

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

Errata

Title & Document Type: 53310A Modulation Domain Analyzer Service Manual

Manual Part Number: 53310-90029

Revision Date: November 1992

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

www.tm.agilent.com

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

SERVICE MANUAL

HP 53310A
Modulation Domain Analyzer

SERIAL NUMBER PREFIX: 3105

This manual applies to instruments with serial numbers prefixed 3105, unless accompanied by a Manual Change Sheet indicating otherwise. For additional information about serial numbers, refer to "Instrument Identifications" in the Preface of this Manual.

© Copyright HEWLETT-PACKARD COMPANY 1991, 1992
5301 Stevens Creek Boulevard • Santa Clara, California 95052-8059

Printed: NOVEMBER 1992

MANUAL PART NUMBER 53310-90029

HEWLETT PACKARD

Certification and Warranty

CERTIFICATION

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

WARRANTY

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

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

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

LIMITATION OF WARRANTY

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

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

EXCLUSIVE REMEDIES

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

ASSISTANCE

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

For any assistance, contact your nearest Hewlett-Packard Sales and Support Office. Addresses are provided at the back of this manual.

Safety Considerations

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed. Refer to instructions in Chapter 1 of this Manual.

SAFETY EARTH GROUND

An uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

Safety Symbols



Instruction manual symbol; the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual.



Indicates hazardous voltages.



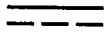
Indicates earth (ground) terminal.



Indicates terminal is connected to chassis when such connection is not apparent.



Alternating current.



Direct current.

WARNING

THIS DENOTES A HAZARD. IT CALLS ATTENTION TO A PROCEDURE, PRACTICE, OR THE LIKE, WHICH, IF NOT CORRECTLY PERFORMED OR ADHERED TO, COULD RESULT IN PERSONAL INJURY. DO NOT PROCEED BEYOND A *WARNING* SIGN UNTIL THE INDICATED CONDITIONS ARE FULLY UNDERSTOOD AND MET.

CAUTION

This denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a *CAUTION* sign until the indicated conditions are fully understood and met.

Safety Information

WARNING

Any interruption of the protective grounding conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection.)

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to the earthed pole terminal (neutral) of the power source.

Instructions for adjustments while covers are removed and for servicing are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform such adjustments or servicing unless qualified to do so.

For continued protection against fire, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay). Do not use repaired fuses or short circuited fuseholders.

When measuring power line signals, be extremely careful and always use a step-down isolation transformer whose output voltage is compatible with the input measurement capabilities of this product. This product's front and rear panels are typically at earth ground, so **NEVER TRY TO MEASURE AC POWER LINE SIGNALS WITHOUT AN ISOLATION TRANSFORMER.**

ACOUSTIC NOISE EMISSION:

LpA 47dB at operator position at normal operation, tested per ISO 7779. All data are the results from type test.

(German) GERAeUSCHEMISSION:

LpA 47dB am Arbeits platz, nomaler Betrie, geprueft nach DIN 45635 Teil 19. Die Angaben beruhen auf Ergebnissen von Typpruefungen.

Table of Contents

PREFACE

200 MHz Modulation Domain Analyzer 1
How to Use This Manual 1
Repair Strategy 1
Instrument Identification 1
Instruments Covered by This Manual 1
Manual Organization 2
How to Order Manuals 2
Options 3
Accessories Supplied 3
Accessories Available 3
The Modulation Domain Analyzer At a Glance 4
System Control 5
Setup 5
Menus 5
Entry 5
Softkeys 5

Chapter 1 PREPARING THE HP 53310A FOR USE

Introduction 1-1
Step 1: Inspect the Product 1-1
Step 2: Set Up the HP 53310A 1-2
Step 3: Turn On the HP 53310A 1-6
Step 4: Perform the Self Tests 1-7
If Power-Up Indicates a Failure 1-8
If Self Test Indicates a Failure 1-8
If the Display is Blank 1-8

Chapter 2 PERFORMANCE TESTS

Introduction 2-1
Operational Verification 2-1
Complete Performance Tests 2-1
HP-IB Verification 2-1
Calibration Cycle 2-1
Test Record 2-2
Messages Displayed on the Screen 2-2
Equipment Required 2-2
Operational Verification Test 2-3
Perform the Power-Up, Calibration, and Self Test 2-3
To Setup the Operational Verification Test 2-7
To Run the Operational Verification Test 2-8
Performance Test Procedures 2-11
Test 1A: Channel A/B Frequency Resolution and Input Noise 2-12
Test 1B/C: Channel C (Option 030/031) Frequency Resolution 2-17
Test 2: Time Interval Resolution 2-22
Test 3: Time Interval Accuracy 2-24
Time Interval Accuracy: A → B Common Mode 2-24
Time Interval Accuracy: A and B Separate Mode 2-26

Chapter 2 PERFORMANCE TESTS (Continued)

Test 4: Minimum Time Interval 2-29
Test 5: Sensitivity 2-31
Sensitivity: Channels A and B 2-31
Sensitivity: Channel C (If Option 030 or 031 is Installed) 2-32
Test 6: Minimum Pulse Width 2-34
Minimum Pulse Width: Channels A and B 2-34
Minimum Pulse Width: External Arm 2-37
Test 7: Threshold Accuracy 2-39
Positive Voltage Threshold Values Test 2-40
Negative Voltage Threshold Values Test 2-41
Zero Voltage Threshold Values Test 2-42
HP-IB Verification 2-45

Chapter 3 ADJUSTMENTS AND CALIBRATION

Introduction 3-1
Equipment Required 3-1
Frequency Reference Calibration Interval 3-1
Instrument Self Calibration 3-2
Adjusting the Hardware 3-2
To Adjust the Power Supply 3-2
To Adjust the Timebase 3-5
Calibrating the Firmware 3-8
Setup for Calibration 3-8
Procedure for Calibration 3-8
Performing Optional Maintenance 3-10
To Adjust the CRT Monitor 3-10
To Clean the Instrument 3-12
To Touch-Up Paint the Instrument 3-12

Chapter 4 SERVICE

Introduction 4-1
Returning the Instrument to Hewlett-Packard for Service 4-2
To Provide Repair Information 4-2
To Pack in the Original Packaging Materials 4-2
To Pack in the Commerically Available Materials 4-3
Pre-Troubleshooting Information 4-4
Safety Considerations 4-4
Recommended Test Equipment 4-4
Repair Considerations 4-5
After Service Considerations 4-5
Service Accessories 4-6
Assembly Identification and Location 4-7
Troubleshooting the HP 53310A 4-8
Introduction 4-8
Using the Troubleshooting Flowcharts and Procedures 4-9
Primary Flowchart Details 4-11
Flowchart 1 Details 4-19
Flowchart 2 Details 4-27
Flowchart 3 Details 4-35
Flowchart 4 Details 4-39
Flowchart 5 Details 4-43

Chapter 4 SERVICE (Continued)

Flowchart 6 Details 4-51
Flowchart 7 Details (Option 031) 4-59
Troubleshooting Theory 4-62

Chapter 5 REPLACING ASSEMBLIES

Introduction 5-1
Tools Required 5-1
Do This First 5-2
To Remove the Cover 5-2
To Remove the Rear Panel Assembly (Std/Opt 010/Opt 031) 5-2
  To Remove Standard Instrument Rear Panel 5-2
  To Remove the Option 010/031 Instrument Rear Panel 5-4
To Remove A7 Power Supply Assembly 5-5
To Remove A3 Cpu Assembly 5-6
To Remove A12 Lo Assembly 5-7
To Remove A4/A5 Keyboard/RPG Assembly 5-8
To Disassemble The A4/A5 Keyboard/RPG Assembly 5-9
To Remove A1 Main Board Assembly 5-10
To Remove A2 Input Board Assembly 5-11
To Remove A6 CRT Monitor Assembly 5-12
  Setup 5-12
  Procedure 5-13
To Remove the Fan 5-14
To Remove the Tilt-Stand Feet 5-14
To Remove the Handle 5-15
To Remove the Nut Plate for the Handle 5-15

Chapter 6 HOW THE HP 53310A WORKS

Introduction 6-1
Theory of Operation 6-1
  Overall Block-Level Theory of Operation 6-1
  A1 Main Board Assembly 6-2
  A2 Input Board Assembly 6-2
  A3 Central Processing Unit (CPU) Assembly 6-2
  A4 Keyboard Assembly 6-2
  A5 Rotary Pulse Generator (RPG) Knob Assembly 6-2
  A6 CRT Monitor Assembly 6-3
  A7 Power Supply Assembly 6-3
  A8 AC Line Filter Circuits (Standard/Option 010) 6-3
  A12 LO Board Assembly (Option 031 only) 6-3

Chapter 7 RETROFITTING OPTIONS

Introduction 7-1
Tools Required 7-1
Do This First 7-1
To Remove the Cover 7-1
To Retrofit Option 001 Expanded Memory 7-2
To Retrofit Option 010 High Stability Oven Timebase 7-4
To Retrofit Option 030 Channel C 7-7
To Retrofit Option 031 Channel C 7-9
  Retrofit Kit Documentation 7-9

Chapter 7 RETROFITTING OPTIONS (Continued)

Sheetmetal and Hardware 7-10
C Channel Boards and EPROMS 7-10
Cables 7-10
Documentation 7-10
Installation Procedures 7-11
Part 1: Overview 7-11
Part 2: Overview 7-15
Part 3: Overview 7-16
Part 4: Overview 7-17

Chapter 8 REPLACEABLE PARTS

Introduction 8-1
Exchange Assemblies 8-1
Reference Designations 8-1
Replaceable Parts 8-2
How To Order A Part 8-2
Parts Identification 8-2
Contacting Hewlett-Packard 8-3
Cabinet Parts and Hardware 8-3

Appendix A SPECIFICATIONS

Introduction A-1
Specifications and Characteristics A-4
Spurious Frequency Modulation A-11

Appendix B MANUAL CHANGES

Introduction B-1
Manual Changes B-1

Appendix C MISCELLANEOUS

General Notes on Performance Test Theory C-1
Servicing the Quick Start Signal Source C-3
Description C-3
Warranty and Determining Warranty Period C-3
Obtaining Service C-4
Test Procedure C-4
Equipment Required C-4
Setup C-4
Procedure C-5
Repair Process C-6
Obtaining a New Quick Start Signal Source C-6
If Quick Start Signal Source is In Warranty C-6
If Quick Start Signal Source is Out of Warranty C-6

1

PREPARING THE HP 53310A FOR USE

INTRODUCTION

This chapter describes how to make sure your HP 53310A Modulation Domain Analyzer is operational. Start by inspecting the HP 53310A for any damage that may have occured during shipment (Step 1 below). Then, you set up the HP 53310A (Step 2). During the setup, pay attention to the environmental conditions and to the voltage selection. Finish by turning on the HP 53310A (Step 3), then making sure the HP 53310A is operating correctly by running the self tests (Step 4).

STEP 1: INSPECT THE PRODUCT

1 **Inspect the shipping container for damage.**

If the shipping container or cushioning material is damaged, keep them until you have checked the contents of the shipment, as well as checked the instrument mechanically and electrically.

2 **Check the list of supplied accessories.**

Check the contents of your shipment against the following list to ensure you have all of the accessories that come with the HP 53310A. In addition to this service manual, your HP 53310A should have come with the following items:

- Power Cord, 2.3 meters, 90°
- Operating Reference Manual
- Programming Reference Manual
- Quick Start Guide
- Programming Quick Reference Guide
- Quick Start Signal Source
- When present, Option 031 User's Guide

If any accessories are missing, contact your nearest Hewlett-Packard Sales Office.

3 **Inspect the product for physical damage.**

Check the instrument and the supplied accessories for obvious physical or mechanical defects. If you find any defects, contact your nearest Hewlett-Packard Sales Office. Arrangements for repair or replacement are made, at Hewlett-Packard's option, without waiting for a claim settlement.

STEP 2: SET UP THE HP 53310A

1 **Verify that the enviromental conditions are within tolerance.**

Make sure that you operate or store the instrument within the following conditions for temperature, humidity, and altitude.

Table 1-1. Environmental Operating Conditions

	OPERATING	NON-OPERATING
Temperature	0°C to +55°C (32°F to +131°F)	–40°C to +70°C (-40°F to +158°F)
Humidity	Up to 95% relative humidity (noncondensing) at +40°C (+104°F)	Up to 90% relative humidity at +65°C (149°F)
Altitude	Up to 4,600 meters (15,000 ft)	Up to 15,300 meters (50,000 ft)

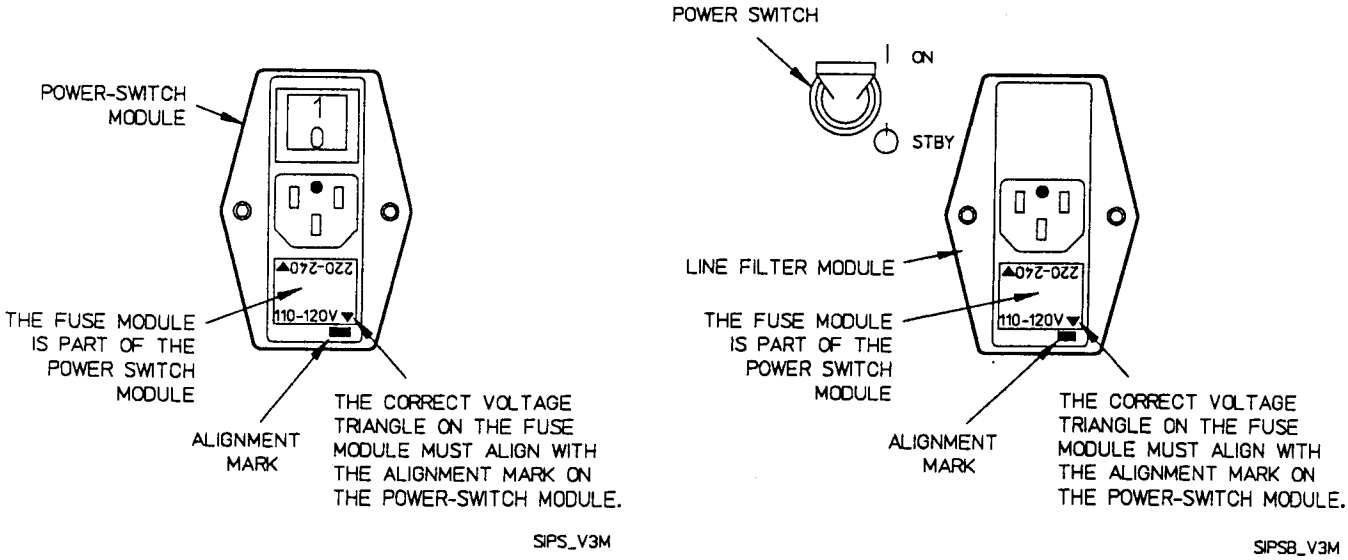
2 **Check the position of the fuse module to make sure it is set to the line voltage in your area.**

CAUTION

Severe damage will occur if the line voltage is not properly set.

The fuse module must be in the correct position for the line voltage in your area. The fuse module is in the power (or line filter) module on the rear panel of the instrument as shown in *Figure 1-1*. The figure shows the rear-panel power modules for both the Standard and Option 010 instruments.

If you need to change the position of the fuse module, carefully pry at the top of the fuse module with a flat-blade screwdriver (as shown in *Figure 1-2*) until you can grasp and pull it out by hand. Align the correct voltage marker with the marker on the power module as shown in *Figure 1-1*. Then, reinsert the fuse module into the power module.



(a) Standard Instrument Power-Switch Module

(b) Option 010 Instrument Power Switch/Line Filter Module
(Also see Figure 1-4 to make sure that the fuse for the Option 010 Oven Oscillator Power Supply is installed and correct.)

Figure 1-1. HP 53310A Input Power Modules

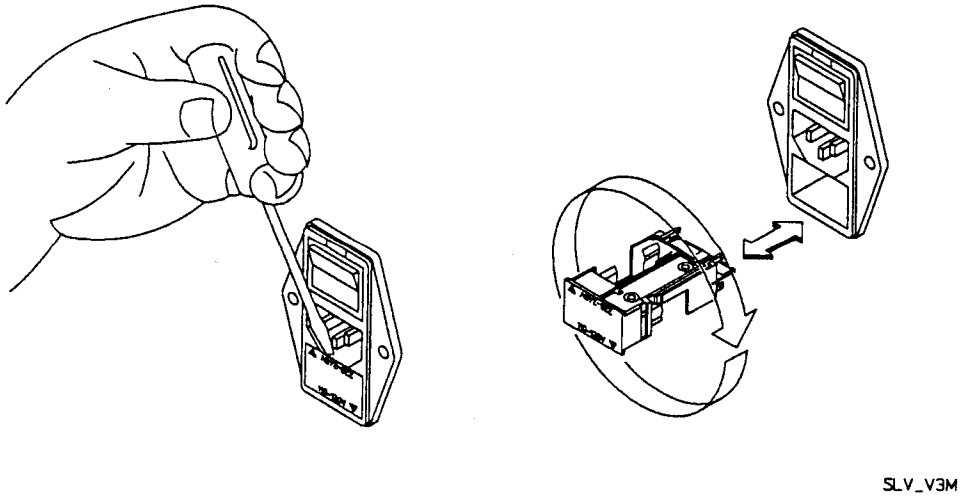


Figure 1-2. Selecting Line Voltage

If you find it necessary to check or change the fuse, remove the fuse module and look at each fuse for its amperage and voltage ratings. See *Figure 1-3.*

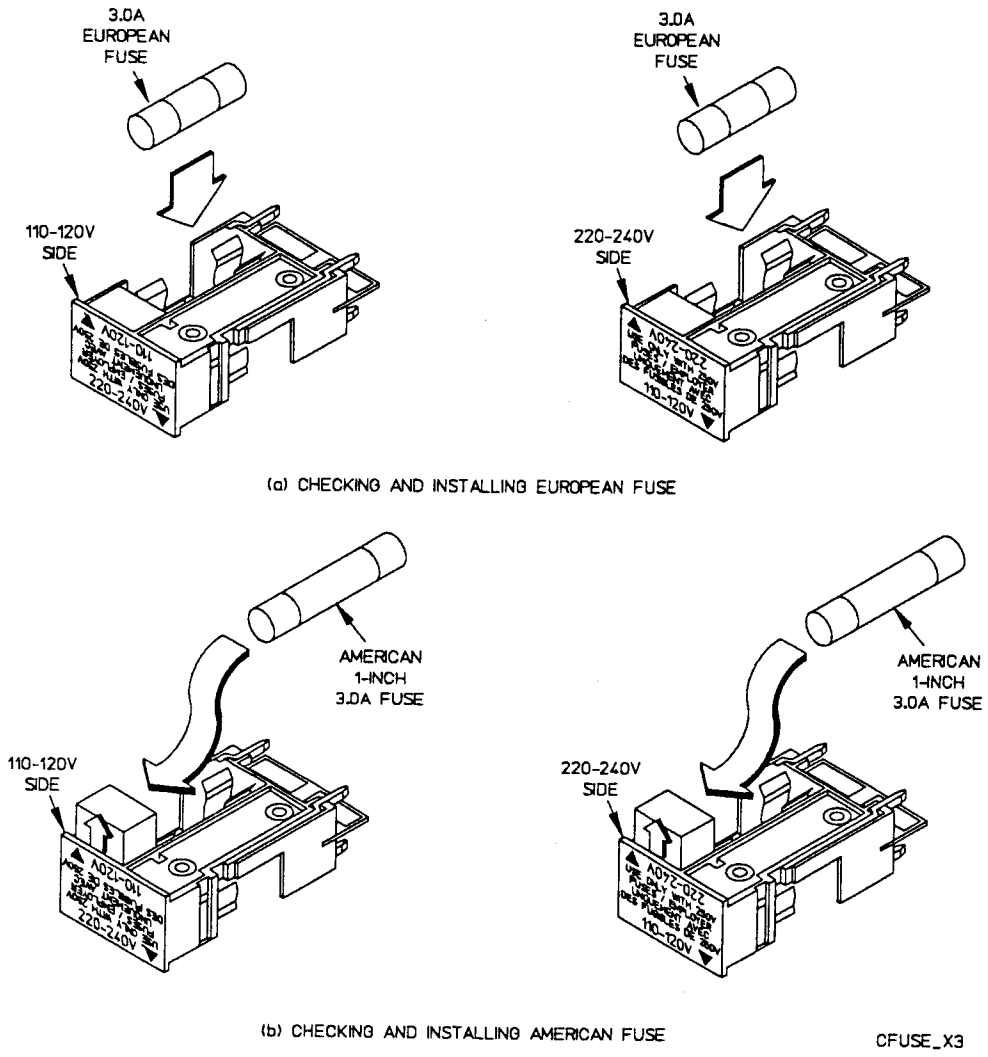


Figure 1-3. Checking for the Correct Fuse

If your instrument contains the Option 010 High Stability Timebase, check the fuse and line voltage selection for the Oven Oscillator Power Supply circuit. *Figure 1-4* shows the oven oscillator fuseholder and line voltage selection switch, which are located on the rear panel. Use a medium size flat-blade screwdriver to remove the fuseholder cap and re-position the line selector switch.

NOTE

If your instrument contains the Option 031 Digital RF Communications Analysis / High Resolution 2.5 GHz Input, the rear-panel appearance will differ from that shown in figure 1-4 and will include three additional coaxial connectors at the lower left-hand corner.

As indicated in the oven oscillator section of the rear panel (see *Figure 1-4*), use a 0.5A fuse for a 115-120V line voltage source, and a 0.25A fuse for a 220-240V line voltage source.

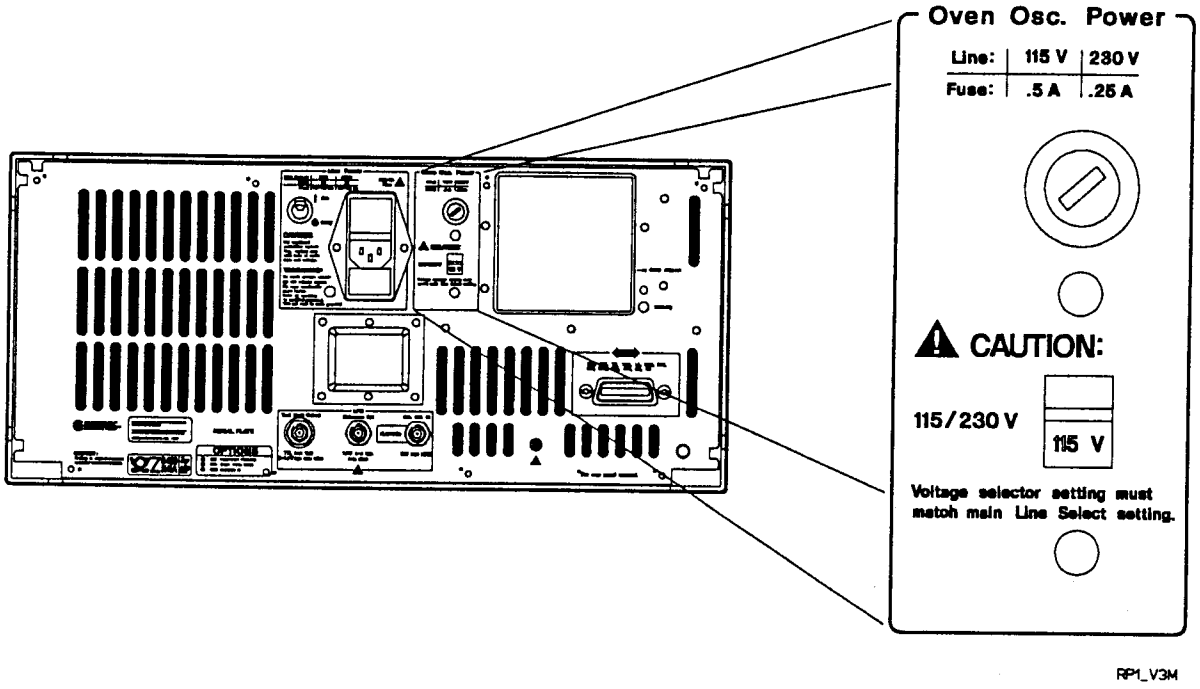


Figure 1-4. Selecting Line Voltage for Option 010 Oven Oscillator Power Supply

STEP 3: TURN ON THE HP 53310A

1 Connect the power cable.

The HP 53310A requires a power source of either 115 or 230 Vac (–25% to +15%), 48 to 66 Hz, and 350 VA maximum.

CAUTION

Before connecting the power cable to the instrument, make sure the correct line voltage is selected with the fuse module.

WARNING

THIS IS A SAFETY CLASS 1 INSTRUMENT. TO MINIMIZE SHOCK HAZARD, THE INSTRUMENT IS EQUIPPED WITH A THREE-CONDUCTOR, AC POWER CABLE. THE POWER CABLE MUST EITHER BE PLUGGED INTO AN APPROVED THREE-CONTACT ELECTRICAL OUTLET, OR USED WITH A THREE-CONTACT TO TWO-CONTACT ADAPTER, WITH THE GREEN GROUNDING WIRE FIRMLY CONNECTED TO AN ELECTRICAL GROUND (OR SAFETY GROUND) AT THE POWER OUTLET.

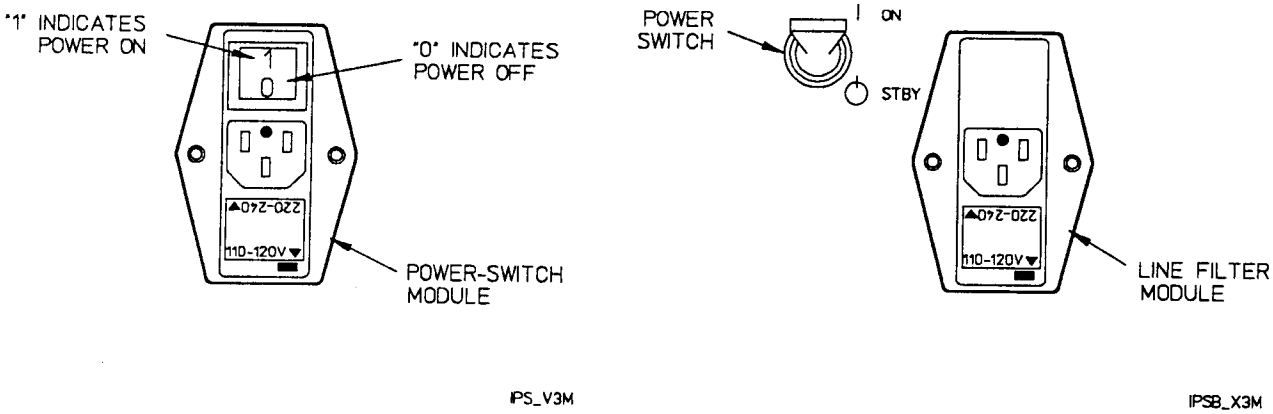
2 Turn on the HP 53310A with the rear panel power switch. See *Figure 1-5.*

A few seconds after the instrument is turned on, the graticules and menus are displayed on the screen. If any faults occurred at power-up, and two softkeys (Ignore and Self Test Menu) appear, see "If Power-Up Indicates a Failure" on page 1-8 in this chapter.

If the display is blank, see "If the Display is Blank" on page 1-8 in this chapter.

With the standard instrument power switch, shown in *Figure 1-5 (a)*, turn on the instrument by pressing the "1" on the rocker switch. The rocker switch is labeled "1" and "0", corresponding to ON and OFF.

Figure 1-5(b) shows the Option 010 instrument power switch. When the power switch is in the "On" position, power is applied to the instrument. The "Stby" position removes operating power from the instrument, but provides power for the Option 010 Oven Oscillator to maintain a constant temperature for the crystal.



(a) Standard Instrument Power Switch

(b) Option 010 Instrument Power Switch

Figure 1-5. ON / OFF Power Switches

STEP 4: PERFORM THE SELF TESTS

1 **Press PRESET hardkey to initialize the instrument.**

Before running the self tests, it is a good practice to initialize the instrument to a default condition.

2 **Press Utility hardkey.**

Pressing this key accesses the calibration, self test, and service functions of the HP 53310A.

3 **Press SELF TEST MENU softkey, and observe that the ALL function is highlighted. If not, press the top softkey until ALL is highlighted.**

4 **Press Start Test softkey. The HP 53310A display will indicate that the "ALL" self-test diagnostic is running. If all tests pass, the selftest menu should appear similar to *Figure 1-6*. Note that a "Timer" bar is displayed on the left side of the display. This bar indicates that the timer self tests are active; the bar goes away after completion of these tests.**

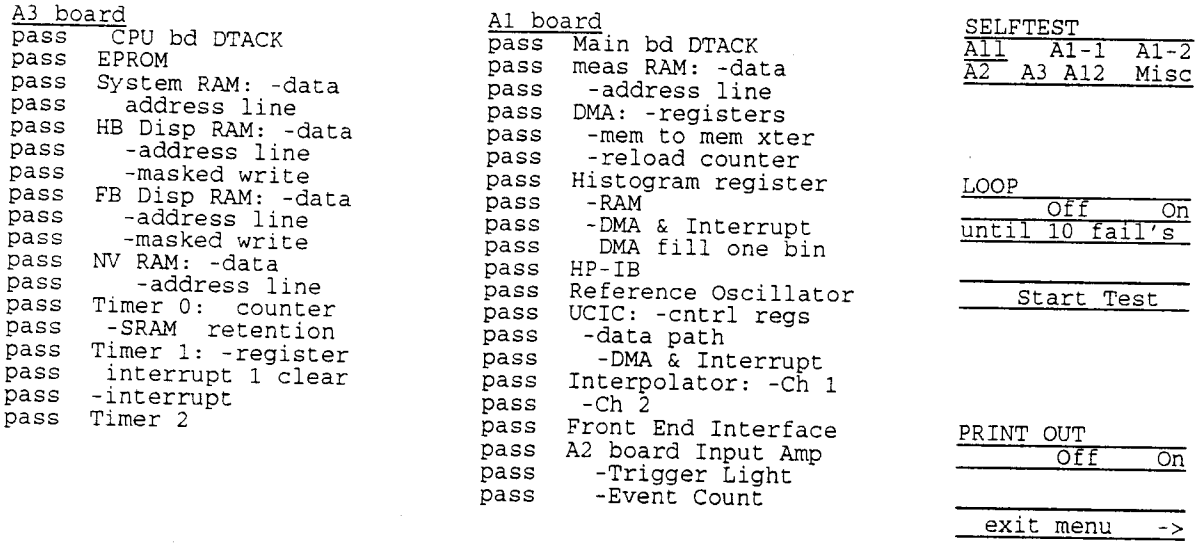


Figure 1-6. The Self Test-ALL Display After Completion of Tests

5 **After all tests are completed as indicated by "pass" or "FAIL" message adjacent to the test, verify that there are no test failures.**

6 **Press exit menu softkey to exit self test menu.**

If a failure is indicated, refer to "If Self Test Indicates a Failure" on page 1-8.

If all tests passed, the HP 53310A is ready to operate.

If Power-Up Indicates a Failure

The instrument will stop its turn-on sequence and display the problem and two softkey choices:

- Ignore — allows you to proceed past the error to complete the power-up sequence at your own risk.
- Self Test Menu — allows you to directly access the diagnostics that can be used to get further details on the problem.

If Self Test Indicates a Failure

If the instrument fails any of the tests in the Self Test-ALL, follow the steps below.

1 **Calibrate the firmware.**

Refer to Chapter 3 (Adjustments and Calibrations).

2 **If the instrument fails the firmware calibration, repair is necessary.**

Refer to Chapter 4 (Service).

If the Display is Blank

A blank display can indicate a problem with the fuse or the power source.

1 **Check the position of the fuse module.**

The correct voltage triangle on the fuse module must align with the alignment mark on the power-switch module. If the fuse module position needs changing, gently pry out the fuse module with a flat-blade screwdriver. Then, reinsert the fuse module into the power-switch module. See *Figures 1-1* to *1-4*.

2 **Check the fuse.**

The fuse is inside the fuse module. To check the fuse, follow these steps:

a. Gently pry out the fuse module with a flat-blade screwdriver.

b. Gently pry out the fuse from the fuse module with a flat-blade screwdriver.

c. Check the fuse rating. The correct fuse rating is 3A at 250 V.

d. Visually inspect the fuse to see if it is blown or damaged. If in doubt, use an ohmmeter to verify there is continuity across the fuse.

e. Reinstall the fuse so that the fuse is on the same side of the fuse module for the voltage at your location.

f. Reinstall the fuse module so that the voltage mark for your area is aligned with the alignment mark on the power-switch module.

3 **Check the power source.**

Check that the outlet that the power cord is plugged into has power, and that the power cord is plugged into the HP 53310A.

If the display is still blank when you turn on the HP 53310A, circuits within the instrument may be defective. Refer to Chapter 4 (Service).

2

PERFORMANCE TESTS

Verifying Operation and Specifications

INTRODUCTION

This chapter provides procedures to test the electrical performance of the HP 53310A Modulation Domain Analyzer, using the specifications listed in *Table A-1* of Appendix A. Three types of testing are provided:

- Operational Verification
- Complete Performance Tests
- HP-IB Verification

If you are unfamiliar with the operation of the HP 53310A, HP recommends you to review the "The Modulation Domain Analyzer at a Glance" section in the Preface of this manual. However, the procedures are written so that little experience is necessary. The procedures should be followed in the order they appear.

OPERATIONAL VERIFICATION

The Operational Verification test is an abbreviated series of checks that may be performed to give a high degree of confidence that the instrument is operating properly without performing the complete Performance Test. An operational verification is useful for incoming inspection, routine maintenance, and after instrument repair.

COMPLETE PERFORMANCE TESTS

The complete Perfomance Tests verify the specifications listed in *Table A-1*. All tests can be performed without access to the inside of the instrument.

HP-IB VERIFICATION

The HP-IB Verification program exercises the instrument via the HP-IB interface. The program is written for a Series 200 or 300 HP 9000 as the controller. If the instrument successfully completes all phases of the verification program, there is a very high probability that the HP-IB interface is working properly. A listing of the HP-IB verification program is provided in *Table 2-14*.

CALIBRATION CYCLE

The HP 53310A requires periodic verification of operation. Depending on the use and environmental conditions, The HP 53310A should be checked using the operational verification procedure at least once every year. A full calibration procedure, including adjustments and a full Performance Test, should also be performed at least once every year. Refer to the "Calibration Cycle" section in Chapter 3 (Adjustments and Calibration) for more information.

TEST RECORD

The results of the Operational Verification, complete Performance Tests, and HP-IB Verification test should be recorded on a copy of the Performance Test Record, located at the end of this chapter.

MESSAGES DISPLAYED ON THE SCREEN

At various times messages will appear on the top portion of the display. Refer to the Operating Reference Manual for full explanations of the messages. Generally, with the continuous wave (CW) input signals used in many of the tests in this chapter, the messages about "modulation rate too low" or "no modulation found" will appear. These are of no concern. These messages are intended as convenience aids and do not affect the specifications or operation of the HP 53310A.

EQUIPMENT REQUIRED

Equipment required for the performance tests in this chapter is listed in *Table 2-1.* Any equipment that satisfies the critical specification listed in the table may be substitued for the recommended model(s).

Table 2-1. Recommended Test Equipment

INSTRUMENT	REQUIRED CHARACTERISTICS	USE	RECOMMENDED MODEL
Digitizing Oscilloscope	100 MHz bandwith	T,A	HP 54501A
Synthesizer	1 Hz to 10 MHz	T,OV,P	HP 3326A
Function Generator	1 Hz to 10 MHz	OV	HP 3312A
Synthesized Signal Generator	10 MHz to 2.5 GHz	T,OV,P	HP 8663A
Pulse Generator	External trigger. 5 nsec minimum pulse width, 60 mV minimum pulse amplitude.	P	HP 8161A
Pulse Generator	2.5 nsec minimum pulse width, 60 mV minimum pulse amplitude.	P	HP 8130A
Digital Multimeter	DC, AC, ohms	T,OV,P,A	HP 3458A
DC Power Supply	Adjustable to 5.000V	T,OV,P	HP 6216C
DC Power Supply	12V, 2A	T	HP 6284A
Service Accessories Kit		T,A	53310-67001
Frequency Standard	Absolute accuracy $>1 \times 10^{-10}$	A	HP 5061B
Step Attenuator	Adjustable in 1 dBm steps from 0	T	HP 355C or equivalent
Power Meter	Measure +3.5 dBm @ 625-1250 MHz	T,A	HP 438A
Frequency Counter	Measure 625-1250 MHz	T,A	HP 5334B (Opt. 030)

T = Troubleshooting
A = Adjustments
OV = Operational Verification tests
P = Full Performance Tests

OPERATIONAL VERIFICATION TEST

Perform the Power-Up, Calibration, and Self Test

PERFORM POWER-UP

1 **Before connecting the power cord and switching on the instrument, be sure that the line voltage selector is properly set, the correct fuse is installed, and all safety precautions have been observed.**

Also, make sure no cables are connected to the input channels of the instrument.

2 **Connect the HP 53310A power cord to the primary power source, making sure the power switch is in its off position.**

3 **Turn on the HP 53310A.**

For standard instruments, press "1" on the power switch to power up the instrument. For Option 010 instruments, set the power switch to the "On" position to power up the instrument.

4 **Verify that the following happens:**

a. After a few seconds, if there are no error or failure messages, graticules and the FUNCTION menu are displayed on the screen.

b. If the HP 53310A displays an ERROR or FAILURE message, refer to Operating Reference Manual for details on the messages. To troubleshoot failures refer to Chapter 4 (Service) in this manual. This completes the power-up.

PERFORM CALIBRATION

1 **Press Preset hardkey to preset the HP 53310A.**

The FUNCTION menu should be displayed with the **Frequency** function highlighted.

2 **Press Utility hardkey, then press SELFCAL MENU softkey.**

Observe that **Offset** of the first softkey and **A** of the **Channel** softkey are highlighted.

Note: no input signals are applied during the offset calibration.

3 **Press Channel softkey until Both is highlighted.**

4 **Press Start Calibration softkey.**

The display should indicate "CALIBRATION PASSED" for both Channel A and B. If "CALIBRATION FAILED" is indicated, refer to Chapter 4 (Service).

5 **Press the top softkey until Gain is highlighted.**

6 Follow the instructions below:

a. Connect a +5V dc source to channel A of the HP 53310A and the voltmeter (or digital multimeter) as shown in *Figure 2-1*.

b. Adjust the dc source to +5.000V by monitoring with the voltmeter.

c. Press **Channel** softkey until A is highlighted.

d. Press **Start Calibration** softkey to compute and update calibration parmeters.

Observe that the display indicates "CALIBRATION PASSED". If there is a failure, refer to Chapter 4 (Service).

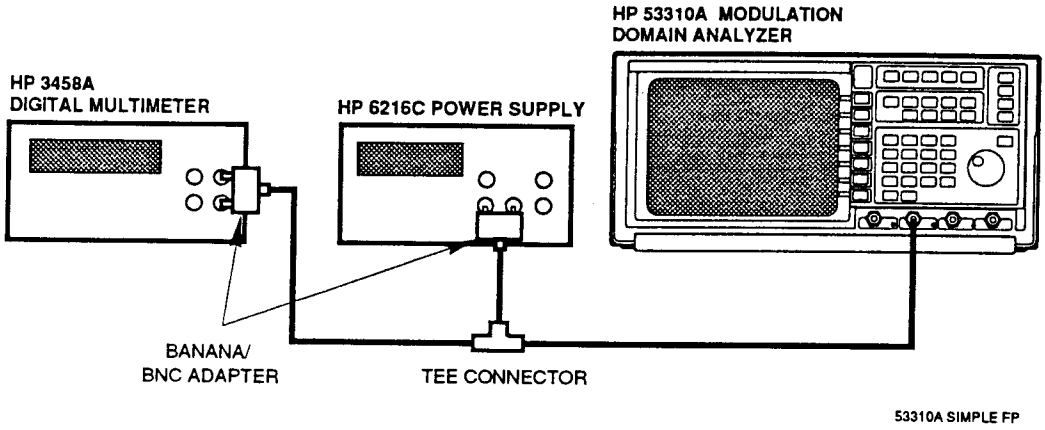


Figure 2-1. Gain Calibration Setup

7 Repeat step 6 for Channel B.

Make sure you disconnect the Channel A cable and connect it to Channel B input. Also, set the **Channel** softkey to its **B** function.

8 Disconnect the +5V dc source from channel B.

9 Press the top softkey until Interpolators is highlighted.

Make sure all inputs to all channels are removed.

10 Press Start Calibration softkey.

Observe that the display indicates the interpolators calibration passed. If the calibration fails, refer to Chapter 4 (Service).

11 Press exit menu softkey to exit the selfcal menu.

RUN SELF TEST

1 **Press Utility hardkey.**

2 **Press SELF TEST MENU softkey.**

The **ALL** function should be highlighted. If it is not, press first softkey until **ALL** is highlighted.

3 **Follow the instructions in the display.**

4 **Press Start Test softkey.**

The HP 53310A will display the "ALL" self-test diagnostic menu, and if all tests in the self test menu pass the screen should appear similar to *Figure 2-2*. Note that a "Timer" bar is displayed on the left side of the display. This bar indicates that the timer self tests are active; the bar goes away after completion of these tests.

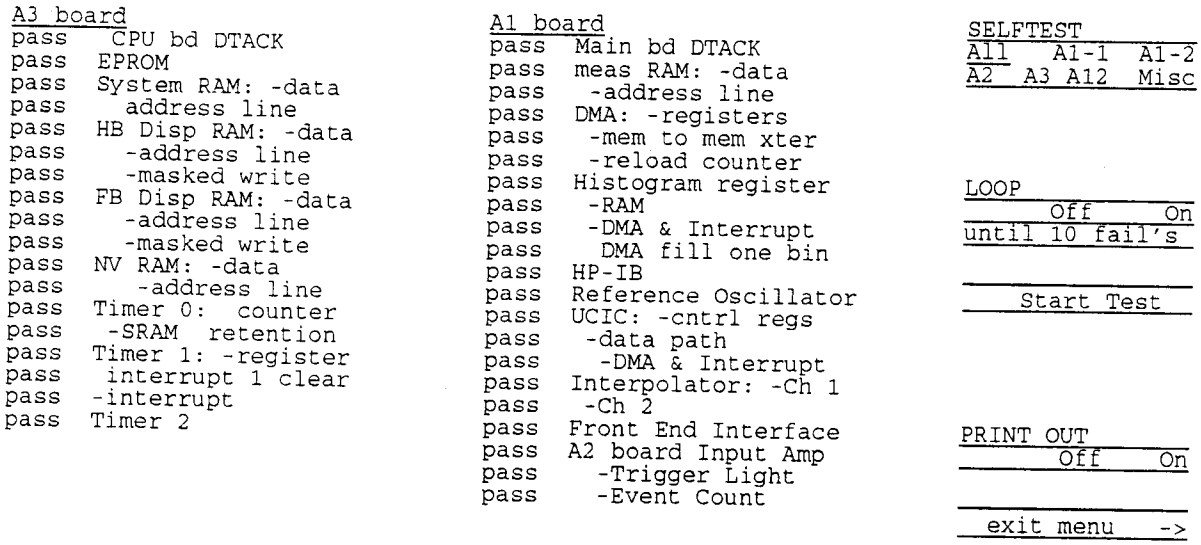


Figure 2-2. The SELF TEST-ALL Display After Completion of Tests

5 **After all tests are completed as indicated by "pass" or "FAIL" message adjacent to the test and the absences of the timer bar, verfiy that there are no test failures.**

If a failure is indicated, refer to the troubleshooting procedures in Chapter 4 (Service).

If all tests passed, go to next step.

6 **Press the top softkey until Misc is highlighted.**

7 **Perform the keyboard self test and note which keys are defective by performing the following:**

a. Press the second softkey until **Keybd** is highlighted.

b. Press **Start Test** softkey and observe that a replica of the keyboard is displayed on the screen.

c. Press any front-panel key and notice that the corresponding square on the screen for that key turns blank.

d. Press the remainder of the front-panel keys and notice that each corresponding square turns blank.

If you press a key and the corresponding square does not go blank, the key is probably defective, but continue to perform the remaining steps of this troubleshooting procedure to verify defective keyboard.

NOTE

Press the Stop / Single hardkey three times as indicated in the replica keyboard on the screen to STOP or EXIT the keyboard selftest.

8 Now, run CRT diagnostic by performing the following steps:

a. Press the second softkey until **CRT** is highlighted.

b. Press **Start Test** softkey.

c. Observe that a CRT test pattern similar to *Figure 2-3* is displayed.

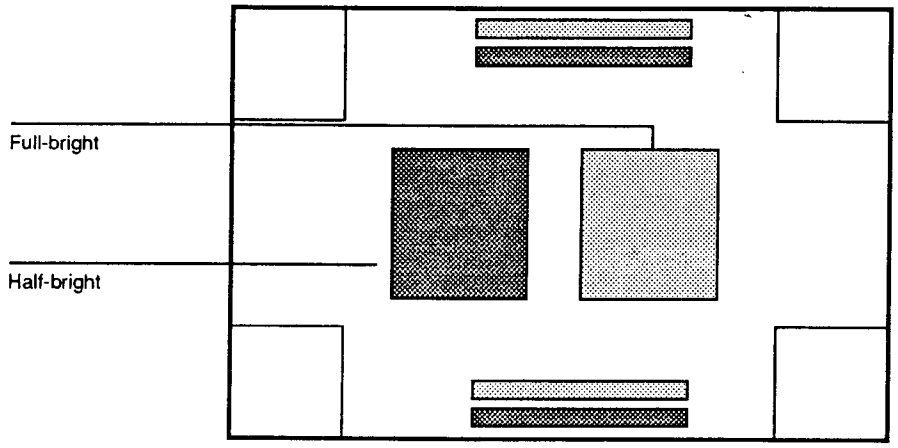


Figure 2-3. CRT Diagnostic Test Pattern

9 Mark Pass or Fail on the Performance Test Record, line 1.

10 Press exit menu softkey.

This completes the self tests.

To Setup the Operational Verification Test

1 **Connect the HP 53310A as shown in *Figure 2-4*; that is, perform the following:**

Connect a BNC cable from the V p-p output of the HP 3312A Function Generator to Chan A of the HP 53310A Modulation Domain Analyzer.

2 **Set HP 3312A Function Generator to output a 10 MHz, 1V p-p sinewave that has a triangular Frequency Modulation (FM).**

Set the HP 3312A controls as follows:

(Use the front panel indications on the HP 3312A. Precise measurement of these settings is not required, as this is only a operational verification test of the HP 53310A.)

FREQUENCY	10 MHz
AMPLITUDE	1 VOLT
VERNIER	center
FUNCTION	Sinewave
OFFSET	CAL
SYM	CAL
MODULATION FM	pushed in (ON)
TRIANGULAR WAVEFORM	pushed in (ON)
RANGE HZ	100
VERNIER	center

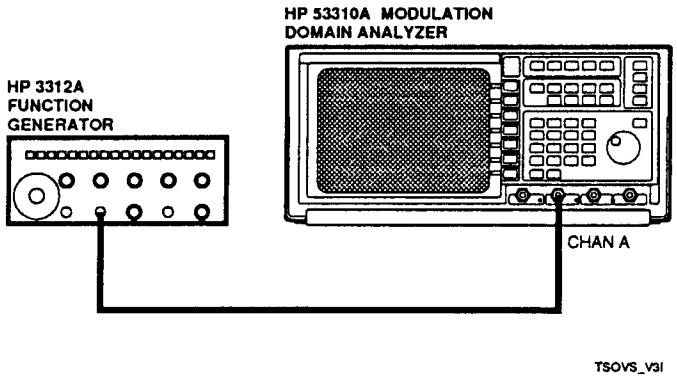


Figure 2-4. HP 53310A Operational Verification Setup

NOTE

If you do not have an HP 3312A Generator, you can use the the Quick Start Signal Source and the procedures in the Quick Start Guide, instead of this operational verification test procedure, to verify operation of the instrument.

To Run the Operational Verification Test

1 **Press Preset hardkey.**

2 **Press Autoscale hardkey.**

Observe a traingular waveform on the display.

RUN, STOP/SINGLE FUNCTIONS

1 **Press Run hardkey.**

The HP 53310A should be in the Run measurment mode as indicated by the "running" message in the upper left corner of the display.

2 **Press Stop/Single hardkey.**

The HP 53310A should be in the Stop measurement mode as indicated by the "stopped" message in the upper left corner of the display.

CLEAR DISPLAY FUNCTION

1 **Press Clear display hardkey.**

Observe the triangular waveform is cleared from the display.

2 **Press Run or Stop/Single key to re-display the waveform.**

FREQUENCY FUNCTION

1 **Press Preset hardkey.**

2 **Press Autoscale hardkey.**

Observe a traingular waveform on the HP 53310A display.

3 **Press Function & Input hardkey.**

Observe that **Frequency** and **A** are highlighted.

4 **Press blue Shift key, and then press Mean key.**

Observe and record the Mean frequency, which is displayed at lower left of display.

Mean frequency _____

5 **Press Markers hardkey.**

6 **Press Freq Markers softkey to turn on the marker function.**

F_1 marker softkey data field should be highlighted.

7 **Press TRACK Off/On softkey to Off.**

8 **Rotate the knob counterclockwise until F_1 marker is lined up with peak amplitude of the bottom part of the waveform.**

Observe at the bottom of the display or in the F_1 softkey a reading **less than** the Mean value recorded in step 4.

9 **Press F_2 softkey and rotate the knob counterclockwise until F_2 marker is lined up with the peak amplitude of the top part of the waveform.**

Observe at the bottom of the display or in the F_2 softkey a reading **greater than** the Mean value recorded in step 4.

Also observe at the bottom of the display the delta frequency reading. It should be equal to the difference between F_1 and F_2.

10 **Press Freq Markers softkey to turn off the marker function.**

11 **Mark Pass or Fail on the Performance Test Record, line 2.**

TIME INTERVAL A→B FUNCTION

1 **Press Preset hardkey.**

2 **Press the top softkey to put the instrument into its Time Interval measurement mode.**

The Time Int A→B function should be highlighted.

3 **Press the second softkey to select the Common input function.**

Observe that green LEDs at both channel A and B inputs are now blinking, indicating that the channels are receiving and detecting the same input signal.

4 **Verify that the both channels A and B are set for rising edge. If not, press the third softkey to select the rising edge for both Channels A and B.**

Observe that the fourth softkey is set for the +TI measurement mode.

5 **Press Autoscale hardkey.**

Observe a triangular waveform on the HP 53310A display.

6 **Press the blue Shift key, and then press Mean key.**

Observe and record the Mean time interval, which is displayed at lower left of display.

Mean time interval _____

7 **Press Markers hardkey.**

8 **Press TI Markers softkey to turn on the marker function.**

I_1 marker softkey data field should be highlighted.

9 **Press TRACK Off/On softkey to Off.**

10 **Rotate the knob counterclockwise until I_1 marker (horizontal dotted line) is lined up with peak amplitude of the bottom part of the waveform.**

Observe at the bottom of the display or in the I_1 softkey a reading less than the Mean value recorded in step 6.

11 **Press I_2 softkey and rotate the knob counterclockwise until I_2 marker is lined up with the peak amplitude of the top part of the waveform.**

Observe at the bottom of the display or in the I_2 softkey a reading **greater than** the Mean value recorded in step 6.

Also observe at the bottom of the display the delta time interval reading. It should be equal to the difference between I_1 and I_2.

12 **Press TI Markers softkey to turn off the marker function.**

13 **Mark Pass or Fail on the Performance Test Record, line 3.**

HISTOGRAM FUNCTION

1 **Press Preset hardkey.**

2 **Press Display Hardkey, and select the following in the DISPLAY menu:**

a. **vs Time/Histogram** to **Histogram**.

b. **Hist Accumulate** to **On**.

3 **Press Histgram hardkey, and select the following in the HISTOGRAM menu:**

a. **Hist From Vs Time/Fast Hist** to **Fast Hist**.

b. **# Of Meas** to 1000. After keying in the value, press **ENTER** key.

4 **Set the HP 3312A Function Generator to output a 10 MHz, 1V p-p sinewave with NO Frequency Modulation.**

That is, remove the FM from the opeartional verification test signal.

5 **Press Autoscale hardkey.**

Observe a histogram on the HP 53310A display. Note that part of the histogram may drift off screen; this is due to the function generators unstable output signal. For this operational verification, it is only important that a histogram is displayed.

6 **Mark Pass or Fail on the Performance Test Record, line 4.**

PERFORMANCE TEST PROCEDURES

Table 2-2 lists a summary of the complete performance tests.

Table 2-2. The Performance Tests

PAGE NO.	TEST DESCRIPTION
2-3	OPERATIONAL VERIFICATION
2-12	TEST 1A: CHANNEL A/B FREQUENCY RESOLUTION AND INPUT NOISE
2-17	TEST 1B/C: CHANNEL C (OPTION 030/031) FREQUENCY RESOLUTION
2-21	TEST 2: TIME INTERVAL RESOLUTION Time Interval Resolution: Time Interval A→B Time Interval Resolution: Time Intervals of Chan A and B Checked Individually
2-23	TEST 3: TIME INTERVAL ACCURACY Time Interval Accuracy: A→B Common Mode Time Interval Accuracy: A and B Separate Mode
2-28	TEST 4: MINIMUM TIME INTERVAL
2-30	TEST 5: SENSITIVITY Sensitivity: Channels A and B Sensitivity: Channel C (If option 030/031 is installed)
2-33	TEST 6: MINIMUM PULSE WIDTH Minimum Pulse Width: Channels A and B Minimum Pulse Width: External Arm
2-38	TEST 7: THRESHOLD ACCURACY
2-44	HP-IB VERIFICATION

TEST 1A: CHANNEL A/B FREQUENCY RESOLUTION AND INPUT NOISE

Description: This test checks the HP 53310A ability to resolve Channel A and B input signals, and the amplifier input noise specifications.

Procedure:

NOTE

Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

1 **Turn on the HP 53310A, HP 8663A Synthesized Signal Generator, and HP 3326A Synthesizer. Allow the instruments to warm up for 30 minutes.**

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the HP 8663A (source) as shown in Figure 2-5.**

Make sure the HP 53310A and the source frequency references are locked. This is accomplished when the source reference is connected to the HP 53310A Ext. Ref. In input as shown in *Figure 2-5*.

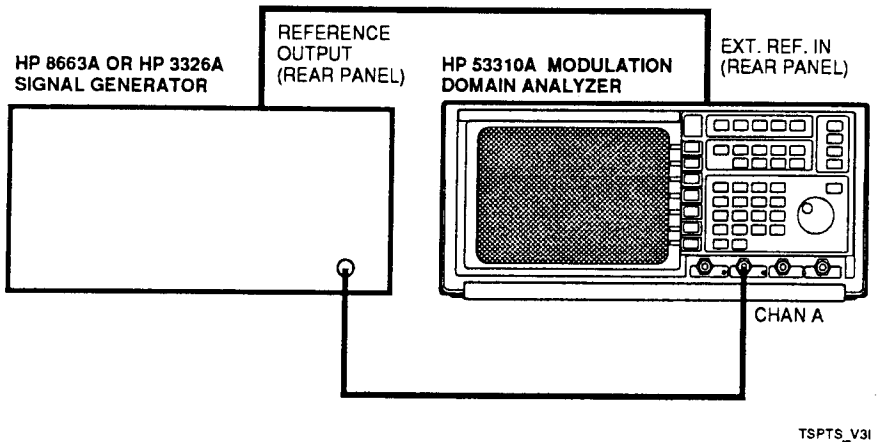


Figure 2-5. HP 53310A Performance Tests Setup

4 **Set source to output 95.12345 MHz, 900 mV rms signal with no modulation or dc offset.**

5 **On the HP 53310A, press Preset hardkey.**

Observe that **Frequency** mode of the top softkey is highlighted, and **A** channel of the second softkey is highlighted.

6 **Press CONFIGURE INPUT softkey to enter the INPUT menu.**

7 **Set the following in the INPUT menu:**

NOTE

The value or state of a menu item can be adjusted or changed when that item is highlighted on the screen. To highlight or make a menu item accessible, press the adjacent front-panel softkey.

a. **Volt Threshold** for Channel A to **0V**.

b. **DC/AC** for Channel A to **DC**.

c. 1 **MΩ/50Ω** for Channel A to **50Ω**.

d. **Hysteresis** to MIN (no "bar" displayed in softkey).

8 **Press Display Hardkey, and select the following in the DISPLAY menu:**

a. **vs Time/Histogram** to **Histogram**.

b. **Linear/Log** to **Log**.

c. **Hist Accumulate** to **On**.

9 **Press Histgram hardkey, and select the following in the HISTOGRAM menu:**

a. **Hist From Vs Time/Fast Hist** to **Fast Hist**.

b. **# Of Meas** to 100. After keying in the value, press **ENTER** key.

10 **Press Autoscale hardkey.**

Observe a histogram on the HP 53310A display.

11 **Press Vertical hardkey.**

NOTE

Use the ENTRY hardkeys, instead of the front-panel knob to adjust or change values for the user-entry items (i.e., Center, Span under the Vertical menu, and Interval At Center under the Sampling menu) in Table 2-4. Use of the ENTRY keys makes it easier to enter the exact values indicated in Table 2-4.

12 **In the Vertical menu, adjust the Center and Span values for the first row of user-entry values listed in *Table 2-4*, (table for Channel A resolution and input noise data).**

For example, to adjust the **Center** frequency value to 95.12345 MHz and the **Span** value to 40 KHz in the first row of *Table 2-4*, perform the following:

a. Press **Center** softkey, and press the following ENTRY keys: **9, 5, ., 1, 2, 3, 4, 5.**

b. Press the **MHz** (or third) **Enter** hardkey.

c. Press **Span** softkey, and press the following ENTRY keys: **4, 0.**

d. Press the **kHz** (or second) **Enter** hardkey.

13 Press Sampling hardkey, and set Interval At Ctr softkey to Manual.

14 Adjust the Interval At Ctr for the value listed in the first row of *Table 2-4*, 1 microseconds (μs), by using the ENTRY keys.

15 Allow at least 2k (2,000) samples to accumulate before performing the next step.

The number of samples are indicated at the bottom of screen. In this case, 2k samples is accumulated very quickly. However, at low values of Interval at Center, it can take a while to accumulate 2k samples.

16 Perform the Std Dev (Standard Deviation) calculation by performing the following:

NOTE

Standard Deviation is equivalent to RMS Resolution.

a. Press blue **Shift** key, then **Std Dev** key.

b. Observe the standard deviation, which is indicated at the bottom of the screen, and record the three most significant digits in *Table 2-4*, Channel A. Note, this standard deviation should be the first entered value for the standard deviation column in the first row of *Table 2-4*.

17 Now, adjust the Interval At Ctr to the next value indicated in *Table 2-4*.

18 Repeat steps 11 to 17 for each appropriate Center and Span value listed in *Table 2-4*, changing the frequency and amplitude of the source input signal as listed in *Table 2-4*.

NOTE: Use an HP 3326A Synthesizer to generate the last two 1 kHz input signals as listed in *Tables 2-4* and *2-5*. The HP 8663A can not output a 1 kHz signal.

19 Repeat for channel B, starting with step 5; but, record values in *Table 2-5*.

20 Compare the recorded values in the *Tables 2-4* and *2-5* against the specified values in the tables.

Refer to the graphical representation of the channel A and B frequency resolution in Appendix A (Specifications).

Failure of this test indicates problems in the input amplifier or interpolator circuits. Refer to Chapter 4 (Service).

Passing the input noise specification is indicated by the fact that the above resolution checks passed. If resolution is correct above 2 MHz but is incorrect below 2 MHz, the input noise is the problem.

21 Record all values in the "MEASURED RESULTS" column in the Performance Test Record.

Table 2-4. Frequency Resolution and Input Noise for Channel A

TEST NUMBER	INPUT TO CHANNEL A	VERTICAL MENU		SAMPLING MENU INTERVAL AT CTR	MEASURED STD DEV (RMS Resolution)	SPECIFIED STD DEV (RMS Resolution)
		CENTER	SPAN			
	HP 8663A:					
1A	95.12345 MHz, 900 mV rms	95.12345 MHz	40 kHz	1 µs	_____	<20.0 kHz
1B	95.12345 MHz 900 mV rms	95.12345 MHz	400 Hz	10 µs	_____	<1.0 kHz
1C	95.12345 MHz, 900 mV rms	95.12345 MHz	10 Hz	100 µs	_____	<50.0 Hz
1D	95.123245 MHz, 900 mV rms	95.12345 MHz	2 Hz	1 ms	_____	<1.0 Hz
1E	95.12345 MHz, 900 mV rms	95.12345 MHz	.1 Hz	10 ms	_____	<100.0 mHz
1F	95.123455 MHz, 900 mV rms	95.12345 MHz	.01 Hz	100 ms	_____	<5.0 mHz
1G	102.3 kHz 900 mV rms	102.3 kHz	50 Hz	100 µs	_____	<5.0 Hz
	HP 3326A:					
1H	1 kHz 1V rms	1 kHz	1 Hz	10 ms	_____	<20.0 mHz
mHz = millihertz						

Table 2-5. Frequency Resolution and Input Noise for Channel B

TEST NUMBER	INPUT TO CHANNEL B	VERTICAL MENU		SAMPLING MENU INTERVAL AT CTR	MEASURED STD DEV (RMS Resolution)	SPECIFIED STD DEV (RMS Resolution)
		CENTER	SPAN			
	HP 8663A:					
1I	95.12345 MHz, 900 mV rms	95.12345 MHz	40 kHz	1 µs	_____	<20.0 kHz
1J	95.12345 MHz 900 mV rms	95.12345 MHz	400 Hz	10 µs	_____	<1.0 kHz
1K	95.12345 MHz, 900 mV rms	95.12345 MHz	10 Hz	100 µs	_____	<50.0 Hz
1L	95.123245 MHz, 900 mV rms	95.12345 MHz	2 Hz	1 ms	_____	<1.0 Hz
1M	95.12345 MHz, 900 mV rms	95.12345 MHz	.1 Hz	10 ms	_____	<100.0 mHz
1N	95.123455 MHz, 900 mV rms	95.12345 MHz	.01 Hz	100 ms	_____	<5.0 mHz
1O	102.3 kHz 900 mV rms	102.3 kHz	50 Hz	100 µs	_____	<5.0 Hz
	HP 3326A:					
1P	1 kHz 1V rms	1 kHz	1 Hz	10 ms	_____	<20.0 mHz
mHz = millihertz						

TEST 1B/C: CHANNEL C (OPTION 030/031) FREQUENCY RESOLUTION

Description: This test checks the HP 53310A ability to resolve Channel C input signals.

Procedure:

NOTE

1. Check the displayed menus and adjust the item called out in the procedure if needed. if a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

2. If option 031 is installed, ensure that the LO jumper cable is present between the LO output and input rear-panel SMA connectors.

1 **Turn on the HP 53310A and HP 8663A Synthesized Signal Generator, and allow the instruments to warm up for 30 minutes.**

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the HP 8663A (source) as shown in *Figure 2-6*.**

Make sure the HP 53310A and the source frequency references are locked. This is accomplished when the source reference is connected to the HP 53310A Ext. Ref. In input as shown in *Figure 2-6*.

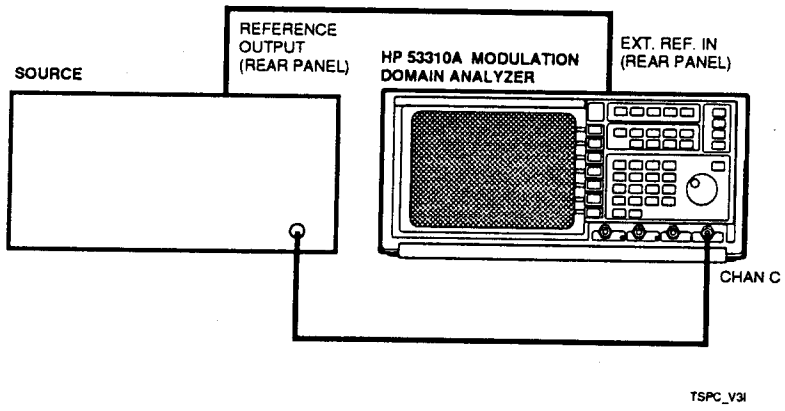


Figure 2-6. HP 53310A Performance Tests Setup (Channel C)

4 **Set source to output 101.123120 MHz, –10 dBm signal with no modulation and dc offset.**

5 **On the HP 53310A, press Preset hardkey.**

Observe that **Frequency** mode of the top softkey is highlighted, and **A** channel of the second softkey is highlighted.

6 **Press the second softkey until C channel is highlighted.**

7 **Press CONFIGURE INPUT softkey to enter the INPUT menu.**

8 **Press the first softkey until C is highlighted.**

Note that no configuration needs to be done.

9 **Press Display Hardkey, and select the following in the DISPLAY menu:**

a. **vs Time/Histogram** to **Histogram**.

b. **Linear/Log** to **Log**.

c. **Hist Accumulate** to **On**.

10 **Press Histgram hardkey, and select the following in the HISTOGRAM menu:**

a. **Hist From Vs Time/Fast Hist** to **Fast Hist**.

b. **# Of Meas** to 1000. After keying in the value, press **ENTER** key.

11 **Press Autoscale hardkey.**

Observe a histogram on the HP 53310A display.

12 **Press Vertical hardkey.**

NOTE

Use the ENTRY hardkeys, instead of the front panel knob to adjust or change values for the user-entry items (i.e., Center, Span under the Vertical menu, and and Interval At Center under the Sampling menu) in Table 2-6. Use of the ENTRY keys makes it easier to enter the exact values indicated in Table 2-6, a or b for either option 030 or 031 respectively.

13 **In the Vertical menu, adjust the Center and Span values for the first row of user-entry values listed in *Table 2-6, a or b: option 030 or 031* (table for Channel C resolution and input noise data).**

For example, to adjust the Center frequency value to 101.12312 MHz and the Span value to 50 kHz in the first row of *Table 2-6, a or b: option 030 or 031*, perform the following:

a. Press **Center** softkey, and press the following ENTRY keys: **1, 0, 1, ., 1, 2, 3, 1, 2.**

b. Press the **MHz** (or third) **Enter** hardkey.

c. Press **Span** softkey, and press the following ENTRY keys: **5, 0.**

d. Press the **kHz** (or second) **Enter** hardkey.

14 **Press Sampling hardkey, and set Interval At Ctr softkey to Manual.**

15 **Adjust the Interval At Ctr for the value listed in the first row of *Table 2-6, a or b: option 030 or 031*, 1 microseconds (μs), by using the ENTRY keys.**

16 **Allow at least 2k (2,000) samples to accumulate before performing the next step.**

The number of samples are indicated at the bottom of screen. In this case, 2k samples is accumulated very quickly. However, at low values of Interval at Center, it can take a while to accumulate 2k samples.

17 **Perform the Std Dev (Standard Deviation) calculation by performing the following:**

NOTE

Standard Deviation is equivalent to RMS Resolution.

a. Press blue **Shift** key, then **Std Dev** key.

b. Observe the standard deviation, which is indicated at the bottom of the screen, and record the three most significant digits in *Table 2-6, a or b: option 030 or 031*, Channel C. Note, this standard deviation should be the first entered value for the standard deviation column in the first row of *Table 2-6*.

18 **Now, adjust the Interval At Ctr to the next value indicated in *Table 2-6, a or b: option 030 or 031*.**

19 **Repeat steps 12 to 18 for each appropriate Center and Span value listed in *Table 2-6, a or b: option 030 or 031*, changing the frequency and amplitude of the source input signal as listed in *Table 2-6, a or b*.**

Note: Adjust CENTER frequency (Vertical Menu) as needed to keep all measurement within the histogram limits.

20 **Compare the recorded Std Dev values in *Table 2-6, a or b: option 030 or 031* against the specified values in the table.**

Refer to the graphical representation of the Channel C frequency resolution in Appendix A (Specifications).

Failure of this test indicates problems in the input amplifier or interpolator circuits. Refer to Chapter 4 (Service).

21 **Record all values in the "MEASURED RESULTS" column in the Performance Test Record.**

Table 2-6a. Frequency Resolution for Channel C (Option 030)

TEST NUMBER	INPUT TO CHANNEL C	VERTICAL MENU		SAMPLING MENU INTERVAL AT CTR	MEASURED STD DEV (RMS Resolution)	SPECIFIED STD DEV (RMS Resolution)
		CENTER	SPAN			
	HP 8663A:					
1Q	101.123120 MHz, −10 dBm	101.123120 MHz	50 kHz	1 µs	_____	<20.0 kHz
1R	101.123120 MHz, −10 dBm	101.123120 MHz	5kHz	10 µs	_____	<2.0 kHz
1S	101.123120 MHz, −10 dBm	101.123120 MHz	50 Hz	100 µs	_____	<20.0 Hz
1T	101.123120 MHz, −10 dBm	101.123120 MHz	5 Hz	1 ms	_____	<1.0 Hz
1U	101.123120 MHz, −10 dBm	101.123120 MHz	.2 Hz	10 ms	_____	<100.0 mHz
1V	101.123120 MHz, −10 dBm	101.123120 MHz	.01 Hz	100 ms	_____	<5.0 mHz
1W	1.0111231 GHz, −10 dBm	1.0111231 GHz	1.5 MHz	1 µs	_____	<200.0 kHz
1X	1.0111231 GHz −10 dBm	1.0111231 GHz	10 kHz	10 µs	_____	<20.0 kHz
1Y	1.0111231 GHz, −10 dBm	1.0111231 GHz	200 Hz	100 µs	_____	<200.0 Hz
1Z	1.0111231 GHz, −10 dBm	1.0111231 GHz	20 Hz	1 ms	_____	<10.0 Hz
1AA	1.0111231 GHz, −10 dBm	1.0111231 GHz	2 Hz	10 ms	_____	<1.0 Hz
1BB	1.0111231 GHz, −10 dBm	1.0111231 GHz	.05 Hz	100 ms	_____	<50.0 mHz
mHz = millihertz						

Table 2-6b. Frequency Resolution for Channel C (Option 031)

TEST NUMBER	INPUT TO CHANNEL C	VERTICAL MENU		SAMPLING MENU INTERVAL AT CTR	MEASURED STD DEV (RMS Resolution)	SPECIFIED STD DEV (RMS Resolution)
		CENTER	SPAN			
	HP 8663A:					
1CC	201.123120 MHz, –5 dBm	201.123120 MHz	10 kHz	1 µs	_____	<1 kHz
1DD	201.123120 MHz, –5 dBm	201.123120 MHz	1kHz	10 µs	_____	<100 Hz
1EE	201.123120 MHz, –5 dBm	201.123120 MHz	100 Hz	100 µs	_____	<20 Hz
1FF	201.123120 MHz, –5 dBm	201.123120 MHz	5 Hz	1 ms	_____	<1.0 Hz
1GG	201.123120 MHz, –5 dBm	201.123120 MHz	0.2 Hz	10 ms	_____	<100 mHz
1HH	201.123120 MHz, –5 dBm	201.123120 MHz	.01 Hz	100 ms	_____	<5 mHz
1II	2.0111231 GHz, –5 dBm	2.0111231 GHz	10 kHz	1 µs	_____	<2 kHz
1JJ	2.0111231 GHz –5 dBm	2.0111231 GHz	10 kHz	10 µs	_____	<1 kHz
1KK	2.0111231 GHz, –5 dBm	2.0111231 GHz	1 kHz	100 µs	_____	<200 Hz
1LL	2.0111231 GHz, –5 dBm	2.0111231 GHz	50 Hz	1 ms	_____	<10.0 Hz
1MM	2.0111231 GHz, –5 dBm	2.0111231 GHz	2 Hz	10 ms	_____	<1.0 Hz
1NN	2.0111231 GHz, –5 dBm	2.0111231 GHz	0.05 Hz	100 ms	_____	<50 mHz
mHz = millihertz						

TEST 2: TIME INTERVAL RESOLUTION

Description: This test is used to check the Time Interval Resolution specifications.

Procedure:

> ***NOTE***
>
> *Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").*

1 **Turn on the HP 53310A and HP 8663A Synthesized Signal Generator, and allow the instruments to warm up for 30 minutes.**

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the HP 8663A (source) as shown in *Figure 2-5*.**

Make sure the HP 53310A and the source frequency references are locked. This is accomplished when the source reference is connected to the HP 53310A Ext. Ref. In input as shown in *Figure 2-5*.

4 **Set source to output 37.12345 MHz, 900 mV rms signal with no modulation and no dc offset.**

5 **On the HP 53310A, press Preset hardkey.**

6 **Press the top softkey to set instrument to Time Int A → B mode.**

7 **Set Common/Separate softkey to Common.**

8 **Set TI to +TI.**

9 **Press CONFIGURE INPUT key, at the bottom of display, to enter the INPUT menu.**

10 **Set the following in the INPUT menu:**

a. **Volt Threshold** for Channel A to **0V**.

b. **Volt Threshold** for Channels B to **0V**. (*Hint:* Press first function key until **B** is highlighted, then enter 0V value.)

c. **DC/AC** for Channels A and B to **DC**.

d. **1 M Ω/50Ω** for Channel A to **50Ω**.

e. **Hysteresis** to **MIN** (no "bar" displayed in softkey).

11 Press Display Hardkey, and select the following in the DISPLAY menu:

a. **vs Time/Histogram** to **Histogram.**

b. **Linear/Log** to **Log.**

c. **Hist Accumulate** to **On.**

12 Press Histgram hardkey, and select the following in the HISTOGRAM menu:

a. **Hist From Vs Time/Fast Hist** to **Fast Hist.**

b. **# Of Meas** to 1,000,000 (Hint: After keying in the value, press **Enter** key.)

13 Press Autoscale hardkey.

Observe a histogram on the HP 53310A display.

14 Press Vertical hardkey, and set Center to 27.3 ns and Span to 2 ns.

15 Perform the Std Dev (Standard Deviation) calculation by performing the following:

a. Press blue **Shift** key, then **Std Dev** key.

b. The HP 53310A should indicate the standard deviation at the bottom of the screen.

16 Allow at least 2,000,000 samples to accumulate.

17 Record the Standard Deviation in *Table 2-7*, and in the Performance Test Record.

Table 2-7. Time Interval Resolution: A→B

TEST NUMBER	INPUT TO CHANNEL A	VERTICAL MENU		MEASURED STD DEV (RMS Resolution)	SPECIFIED STD DEV (RMS Resolution)
		CENTER	SPAN		
2A	37.12345 MHz, 900 mV rms	27.3 ns	2 ns	_____	<200 psec

TEST 3: TIME INTERVAL ACCURACY

Description: Two different tests must be performed to properly check the Time Interval Accuracy specifications:

- Time Interval Accuracy: A → B Common Mode
- Time Interval Accuracy: A and B Separate Mode

The Time Interval Accuracy specification is made up of a number of components:

- Time interval resolution
- Frequency reference error
- Input threshold error
- The systematic error.

These tests measure the systematic error component.

Preliminary Procedure:

NOTE

Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

1 **Turn on the HP 53310A and HP 3326A Synthesizer, and allow the instruments to warm up for 30 minutes.**

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the HP 3326A (source) as shown in *Figure 2-5*.**

Make sure the HP 53310A and the source frequency references are locked. This is accomplished when the source reference is connected to the HP 53310A Ext. Ref. In input as shown in *Figure 2-5*.

4 **Set source to output 2.12345 MHz, 1.7V rms (5V p-p), SQUARE-WAVE signal with no modulation and no dc offset.**

Time Interval Accuracy: A → B Common Mode

1 **Press Preset hardkey.**

2 **Press the top softkey to set instrument to Time Int A → B mode.**

3 **Set Common/Separate softkey to Common.**

4 **Set both A and B to rising edges.**

5 **Set TI to ±TI.**

6 **Press CONFIGURE INPUT key to enter the INPUT menu.**

7 **Set the following in the INPUT menu:**

a. **Volt Threshold** for Channel A to **0V**.

b. **Volt Threshold** for Channel B to **0V**. (Hint: Press first function key until **B** is highlighted, then enter 0V value.)

c. **DC/AC** for both Channels A and B to **DC**.

d. **1 MΩ/50Ω** for Channel A to **50Ω**.

e. **Hysteresis** to MIN (no "bar" displayed in softkey).

8 **Press Display Hardkey, and select the following in the DISPLAY menu:**

a. **vs Time/Histogram** to **Histogram**.

b. **Linear/Log** to **Log**.

c. **Hist Accumulate** to **On**.

9 **Press Histgram hardkey, and select the following in the HISTOGRAM menu:**

a. **Hist From Vs Time/Fast Hist** to **Fast Hist**.

b. **# Of Meas** to 1,000,000. After keying in the value, press **Enter** key.

10 **Press Autoscale hardkey.**

Observe a histogram on the HP 53310A display.

11 **Perform the Mean calculation by performing the following:**

a. Press blue **Shift** key, then **Mean** key.

b. Observe the Mean, which is indicated at the bottom of the screen.

12 **Record the three most significant digits for the rising edge measurement *Table 2-8*.**

13 **Press Function & Input hardkey.**

14 **Set both A and B to falling edges.**

15 **Record the three most significant digits of the Means for the falling edge measurement in *Table 2-8*.**

16 Average the two readings and enter the result in *Table 2-8*; this is the measured systematic error.

Table 2-8. Time Interval Accuracy: Common Mode

TEST NUMBER	SETUP	MEASUREMENT EDGES	MEASURED SYSTEMATIC ERROR	SPECIFIED SYSTEMATIC ERROR
3A	A→B Common	Rising	_____	
		Falling	_____	
		Average	_____	< 1 n sec

Time Interval Accuracy: A and B Separate Mode

1 **Press Function & Input hardkey.**

2 **Set Common/Separate softkey to Separate.**

3 **Set both A and B to rising edges.**

4 **Press CONFIGURE INPUT key to enter the INPUT menu.**

5 **Set the following in the INPUT menu:**

a. **Volt Threshold** for Channel A to **0V**.

b. **Volt Threshold** for Channel B to **0V**. (Hint: Press first function key until **B** is highlighted, then enter 0V value.)

c. **DC/AC** for both Channels A and B to **DC**.

d. **1 MΩ/50Ω** for both Channels A and B to **50Ω**.

e. **Hysteresis** to MIN (no "bar" displayed in softkey) for both channels A and B.

6 **Connect source output to Channels A and B of the HP 53310A as shown in *Figure 2-7*.**

NOTE

In Figure 2-7, the channels A and B cables from the power splitter MUST be the same length.

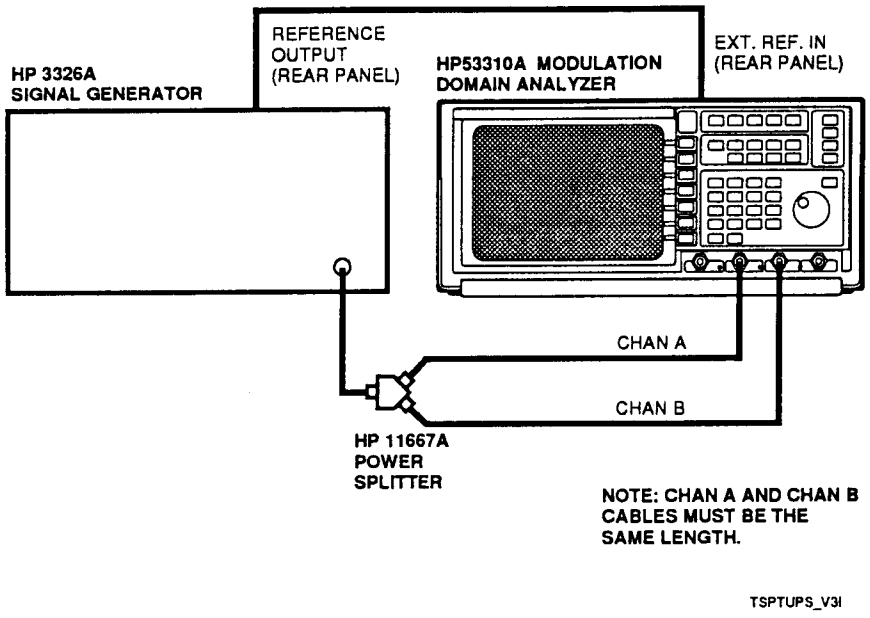


Figure 2-7. Test Setup for Performance Tests Using Power Splitter

NOTE

If the histogram display moves partially off the screen, use the Vertical key and adjust the Center value to return all of the histogram on the screen.

7 **Allow the HP 53310A to accumulate at least 1,000,000 (1M) samples before preforming the next step.**

8 **Perform the Mean calculation by performing the following:**

a. Press blue **Shift** key, then **Mean** key.

b. Observe the Mean, which is indicated at the bottom of the screen.

9 **Record the three most significant digits for the rising edge measurement for Data Set 1 in *Table 2-9*.**

10 **Press Function & Input hardkey.**

11 **Set both A and B to falling edges.**

12 **Record the three most significant digits of the Means for the falling edge measurement for Data Set 2 in *Table 2-9*.**

13 **Reverse the cables to the Chan A and Chan B inputs.**

14 **Press Clear display key, and allow the HP 53310A to accumulate at least 1,000,000 samples.**

15 **Record the Mean of Data Set 4 in *Table 2-9*.**

16 **Press Function & Inputs hardkey, and set A and B to rising edge.**

17 **Allow the HP 53310A to accumulate at least 1,000,000 measurements.**

18 **Record the Mean of Data Set 3 in *Table 2-9*.**

19 **Add the four readings together and divide by four to obtain an average.**

20 **Record the result in step 19 as the Average Systematic Error in *Table 2-9* and the Performance Test Record.**

Table 2-9. Time Interval Accuracy: Separate Mode

TEST NUMBER	SETUP A→B SEPARATE	MEASUREMENT EDGES	POWER SPLITTER POSITION	MEASURED SYSTEMATIC ERROR	SPECIFIED SYSTEMATIC ERROR
3B	Data Set 1	Rising	1	_____	
	Data Set 2	Falling	1	_____	
	Data Set 3	Rising	2	_____	
	Data Set 4	Falling	2	_____	
	Average Systematic Error	—	—	_____	< 1 nsec

TEST 4: MINIMUM TIME INTERVAL

Description: This test checks the ability of the HP 53310A to respond to minimum time interval signals.

Procedure:

NOTE

Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

1 **Turn on the HP 53310A and HP 8663A Synthesized Signal Generator, and allow the instruments to warm up for 30 minutes.**

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the HP 8663A (source) as shown in *Figure 2-5*.**

Make sure the HP 53310A and the source frequency references are locked. This is accomplished when the source reference is connected to the HP 53310A Ext. Ref. In input as shown in *Figure 2-5*.

4 **Set source to output 50 MHz, 900 mV rms signal with no modulation and no dc offset.**

The period of this signal is 20 nanoseconds, which is the minimum time interval the instrument is specified to measure.

5 **Press Preset hardkey.**

6 **Press the top softkey to set instrument to Time Int A → B mode.**

7 **Set Common/Separate softkey to Common.**

8 **Set both A and B to rising edges.**

9 **Set TI to +TI.**

10 **Press CONFIGURE INPUT key to enter the INPUT menu.**

11 **Set the following in the INPUT menu:**

a. **Volt Threshold** for Channel A to **0V**.

b. **Volt Threshold** for Channel B to **0V**. (*Hint:* Press first function key until **B** is highlighted, then enter 0V value.)

c. **DC/AC** for both Channels A and B to **DC**.

d. **1 MΩ/50Ω** for Channel A to **50Ω**.

e. **Hysteresis** to MIN (no "bar" displayed in softkey).

12 Press Display Hardkey, and select the following in the DISPLAY menu:

a. **vs Time/Histogram** to **vs Time**.

b. **Connect** to **On**.

c. **Repetitive/Real Time** to **Real Time**.

d. **Persistence** to **Single**.

13 Press Autoscale hardkey.

14 If the displayed line representing 20 nsec is not centered on the display, press Vertical key and Find Center softkey.

15 Observe a clean display with no dropouts; that is, no display variations going to the extreme top or bottom edges of the display.

16 Observe that the displayed line is very close to 20 nsec.

17 Record the result in *Table 2-10*.

Table 2-10. Minimum Time Interval

TEST NUMBER	INPUT SIGNAL	SPECIFIED MINIMUM TIME INTERVAL	PASS/FAIL
4A	50 MHz, 900 mV rms	20 nsec	_____

TEST 5: SENSITIVITY

Description: Two different tests may have to be performed to check the Sensitivity specifications:

- Sensitivity: Channels A and B
- Sensitivity: Channel C (If Installed)

The first test checks the input amplifiers of Channels A and B performance with specified minimum input signal levels. The second test checks the optional Channel C input amplifier performance.

Preliminary Procedure:

NOTE

Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

1 **Turn on the HP 53310A, HP 3326A Synthesizer, and the HP 8663A Synthesized Signal Generator. Allow the instruments to warm up for 30 minutes.**

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the HP 3326A (source) as shown in *Figure 2-5*.**

Use a source that is appropriate for the frequencies dictated in these test procedures.

Make sure the HP 53310A and the source frequency references are locked. This is accomplished when the source reference is connected to the HP 53310A **Ext. Ref. In** input as shown in *Figure 2-5*.

Sensitivity: Channels A and B

1 **Set source to first frequency and amplitude listed in *Table 2-11*. No modulation or dc offset should be used. Use sine-wave signals.**

2 **Press Preset hardkey.**

Observe the **Frequency** mode of the top softkey is highlighted, and **A** channel of the second key is highlighted.

3 **Press CONFIGURE INPUT key to enter the INPUT menu.**

4 **Set the following Channel A parameters in the INPUT menu:**

a. First softkey to **A**.

b. **Volt Threshold** for Channel A to **0V**.

c. **DC/AC** to **DC**.

d. **1 MΩ/50Ω** to **50Ω**.

e. **Hysteresis** to MIN (no "bar" displayed in softkey).

5 **Press Autoscale hardkey.**

A display should be visible on the screen. (The display may take a few seconds to appear for low input frequencies.)

6 **Press Vertical hardkey.**

7 **In the Vertical menu, adjust Center and Span values for a clear display.**

Observe display for consistent response, with no signal "dropout". A dropout is where the display trace "spikes" toward the top or bottom edge, and occurs as the trace sweeps across the screen.

8 **Repeat steps 1 to 7 for each frequency listed in *Table 2-11*.**

100 MHz and 200 MHz input signs will be required from the HP 8663A.

9 **Connect input signal to Channel B input.**

10 **Repeat this entire procedure for Channel B, and record results for Channel B in *Table 2-11*.**

11 **Record all results in the "MEASURED RESULTS" column in the Performance Test Record.**

Sensitivity: Channel C (If Option 030 or 031 is Installed)

1 **Connect input signal to Channel C input, using the HP 8663A Synthesized Signal Generator.**

Be sure the source frequency references are locked.

2 **Set source to first frequency and amplitude listed in *Table 2-11*. No modulation or dc offset should be used. Use sine-wave signals.**

3 **Press Preset hardkey.**

Observe the **Frequency** mode of the top softkey is highlighted.

4 **Press the second softkey until C is highlighted.**

5 **Press CONFIGURE INPUT key to enter the INPUT menu.**

6 **Press the first softkey until C is highlighted.**

Note that no configuration needs to be done.

7 Press Autoscale hardkey.

A display should be visible on the screen. At 20 Hz, timebase setting will be needed. See *Table 2-11.*

8 Press Vertical hardkey.

9 In the Vertical menu, adjust Center and Span values for a clear display.

For option 030, observe the display for consistent response, with no signal "dropout". A dropout is where the display trace "spikes" toward the top or bottom edge, and occurs as the trace sweeps across the screen.

For option 031, observe a continuously updating display. Adjust the time base to decrease the time per division until both signal and noise are observed. This ensures that display updates are actually occuring.

10 Repeat steps 1 to 9 for each frequency listed for Channel C in *Table 2-11.*

11 Record results in the Performance Test Record.

Table 2-11. Sensitivity Test Results

TEST NUMBER	CHANNEL	INPUT AND CENTER FREQUENCY	INPUT LEVEL AND SPECIFICATION	SPAN	PASS/FAIL
5A	A	20 Hz (HP 3326A)	20 mV rms	10 Hz (Timebase 100 ms)	_____
5B		10 MHz (HP 3326A)	20 mV rms	1 MHz	_____
5C		100 MHz (HP 8663A)	20 mV rms	1 MHz	_____
5D		200 MHz (HP 8663A)	25 mV rms	1 MHz	_____
5E	B	20 Hz (HP 3326A)	20 mV rms	10 Hz (Timebase 100 ms)	_____
5F		10 MHz (HP 3326A)	20 mV rms	1 MHz	_____
5G		100 MHz (HP 8663A)	20 mV rms	20 MHz	_____
5H	C (Option 030)	51 MHz (HP 8663A)	–25 dBm	50 Hz	_____
5I		500 MHz (HP 8663A)	–25 dBm	100 Hz	_____
5J		1 GHz (HP 8663A)	–25 dBm	100 Hz	_____
5K		1.5 GHz (HP 8663A)	–25 dBm	100 Hz	_____
5L		2 GHz (HP 8663A)	–20 dBm	100 Hz	_____
5M		2.5 GHz (HP 8663A)	–15 dBm	100 Hz	_____
5N	C (Option 031)	200 MHz (HP 8663A)	–15 dBm	100 Hz	_____
5O		500 MHz (HP 8663A)	–15 dBm	100 Hz	_____
5P		1 GHz (HP 8663A)	–10 dBm	100 Hz	_____
5Q		1.5 GHz (HP 8663A)	–10 dBm	100 Hz	_____
5R		2.0 GHz (HP 8663A)	–10 dBm	100 Hz	_____
5S		2.5 GHz (HP 8663A)	–10 dBm	100 Hz	_____

TEST 6: MINIMUM PULSE WIDTH

Description: Two different tests may have to be performed to check the Minimum Pulse Width specifications:

- Minimum Pulse Width: Channels A and B
- Minimum Pulse Width: External Arm

The first test checks the ability of input amplifiers of Channels A and B to respond to minumum pulse width inputs. The second test checks the ability of the External Arm input amplifier to respond to a minimum pulse width input, by using an external pulse generator to provide a trigger. The triggered measurement is observed on the HP 53310A display.

Preliminary Procedure:

NOTE

Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

1 **Turn on the HP 53310A and HP 8130A Pulse Generator. Allow the instruments to warm up for 30 minutes.**

NOTE

Depending on the need to test the Absolute Minimum Pulse specification above 50 MHz, the HP 8161A Pulse Generator can be used for this test. The difference between the HP 8130A and HP 8161A and the HP 53310A specifications are compared in the table below. The HP 8082A Pulse Generator may be used as a substitute to the HP 8130A. Its minimum pulse width specification is 2.4 ns.

	MINIMUM PULSE WIDTH	MINIMUM AMPLITUDE	HP 53310A SPECIFICATION	HP 53310A SPECIFICATION
HP 8130A	1.5 nsec	10 mV	> 50 MHz: 2.5 nsec/75 mV	< 50 MHz: 5 nsec/60 mV
HP 8161A	4 nsec	60 mV		< 50 MHz: 5 nsec/60 mV

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

Minimum Pulse Width: Channels A and B

1 **Connect the HP 53310A to the HP 8130A (source) as shown in *Figure 2-8*.**

The HP 53310A timebase output is used to stablize the HP 8130A Pulse Generator by using the timebase signal as a trigger source.

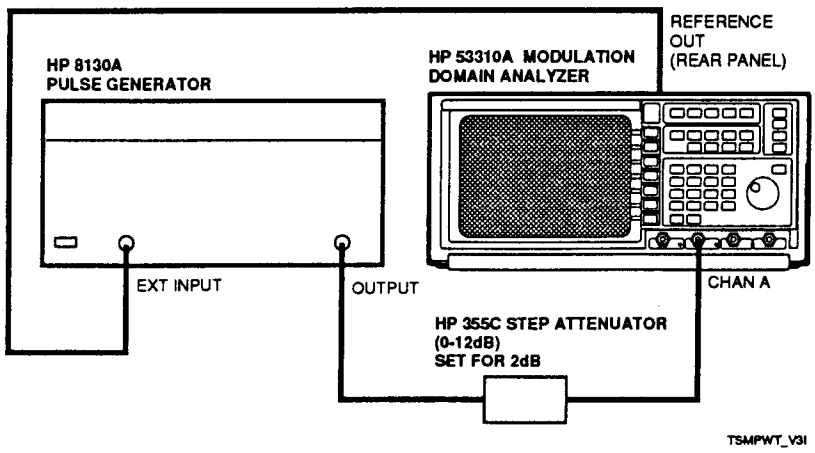


Figure 2-8. Setup for Mininum Pulse Width Tests for Channel A and B

2 Set the HP 8130A Pulse Generator as follows (use channel 1):

Input mode: Trig
Ext input: Consult the generator Operating Manual for detailed settings for external input operation.
Parameter:

Width 2.5 nsec
TRE (trailing edge) 1 nsec
HIGH (high level) +50 mV
LOW (low level) –50 mV

NOTE

If in doubt about settings of the pulse generator, connect it to an oscilloscope and observe setup. For Channel A test, the signal into the HP 53310A should be a 75m Vp-p, 2.5 nsec pulse width signal. Adjust the Step Attenuator as close to 75 mV as possible.

3 Press Preset hardkey.

Observe that the **Frequency** mode of the top softkey and the **A** channel of the second softkey is highlighted.

4 **Press CONFIGURE INPUT key to enter the INPUT menu.**

5 **Set the following Channel A parameters in the INPUT menu:**

a. First softkey to **A**.

b. **Volt** Threshold for Channel A to **0 mV**.

c. **DC/AC** to **DC**.

d. **1 M Ω/50Ω** to **50Ω**.

e. **Hysteresis** to MIN (no "bar" displayed in softkey).

6 **Press Vertical hardkey, and set the following:**

a. *Press **Top** softkey until **Top/Bottom** is highlighted.

b. *Set **Top** softkey to 50 MHz.

c. Set **Bottom** softkey to 7 MHz.

7 **Observe a trace in the lower part of the HP 53310A display.**

This trace represents a 10 MHz pulse repetitious frequency.

8 **Observe that the HP 53310A continues to display the input.**

9 **Record the results for Channel A in *Table 2-12*.**

10 **On the Pulse Generator, set Pulse Width to 5 nsec and output level to 60 mV.**

11 **Repeat this test for Channel B, and record the results for Channel B in *Table 2-12*.**

12 **Record Channel A and B results in the Performance Test Record.**

---

* Since the Channel A minimum pulse width specification is 2.5 nsec ABOVE 50 MHz, setting "Top" to 50 MHz will cause Channel A prescaler to turn on. This is needed so that the HP 53310A will respond to a test signal below 50 MHz.

Minimum Pulse Width: External Arm

1 **Connect the HP 53310A to the source as shown in *Figure 2-9*.**

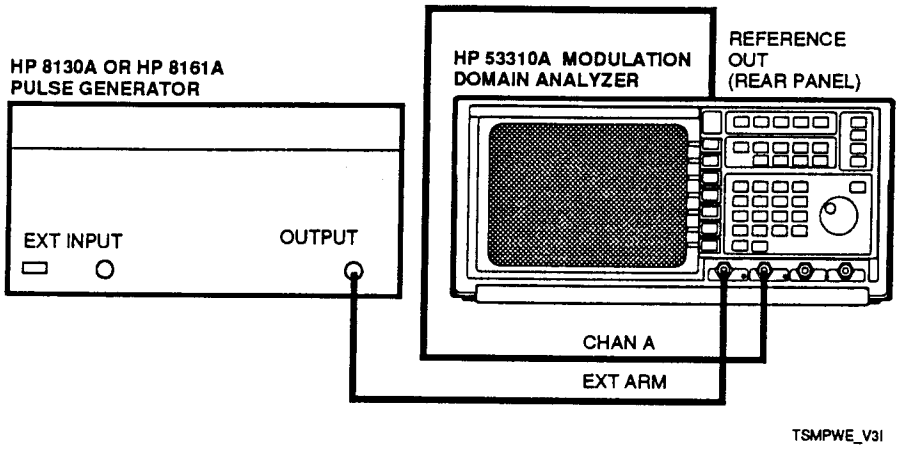


Figure 2-9. Setup for Mininum Pulse Width Tests for External Arm

2 **Set the HP 8161A Pulse Generator as follows:**

Input mode: Norm
Ext input: off
Parameter: Period 100 nsec
Width 5 nsec
LEE (leading edge) 1 nsec
TRE (trailing edge) 1 nsec
HIL (high level) +60 mv
LOL (low level) –60 mv

NOTE

If in doubt about settings of the pulse generator, connect it to an oscilloscope and observe setup.

3 **Press Preset hardkey.**

Observe that the **Frequency** mode of the top softkey and the **A** channel of the second softkey is highlighted.

4 **Press CONFIGURE INPUT key to enter the INPUT menu.**

5 **Set the following parameters in the INPUT menu:**

a. First softkey to **Ext**.

b. **Volt Threshold** for External Arm to **0V**.

c. **Probe** to **1:1**.

6 **Press Autoscale hardkey.**

A trace should be visible on the HP 53310A display.

7 **Observe that the HP 53310A continues to display the input.**

8 **Press Trigger hardkey to enter the TRIGGER menu.**

9 **Set the following parameters in the TRIGGER menu:**

a. **Triggered/Auto** to **Triggered**.

b. **Ext Edge/Freq Value** to **Ext Edge**.

10 **On the Pulse Generator, under the INPUT MODE, select GATE.**

The HP 53310A display should freeze since the instrument is no longer being triggered.

1 **On the Pulse Generator, press SINGLE PULSE key.**

With each press of the SINGLE PULSE key, one display update should occur on the HP 53310A display. Also, the **Ext Arm** front-panel trigger light should flash.

2 **Record the results for External Arm in *Table 2-12*.**

3 **Record Ext Arm results in Performance Test Record.**

Table 2-12. Minimum Pulse Width Test Results

TEST NUMBER	CHANNEL	INPUT PULSE WIDTH/AMPLITUDE	PASS/FAIL
6A	A	2.5 nsec/75 mV	_____
6B	B	5 nsec/60 mV	_____
6C	Ext Arm	5 nsec/60 mV	_____

TEST 7: THRESHOLD ACCURACY

Description: This test checks the Threshold Accuracy specifications of the Channel A and B input amplifiers. This test consists of three sub-tests which are as follows:

- Positive Voltage Threshold Values
- Negative Voltage Threshold Values
- Zero Voltage Threshold Values

Procedure:

NOTE

Check the displayed menus and adjust the item called out in the procedure if needed. If a menu item is NOT mentioned, then its status is not relative to the procedure (i.e., item status is "don't care").

1 **Turn on the HP 53310A, the power supply, and the voltmeter. Allow the instruments to warm up for 30 minutes.**

Be sure that the voltmeter is calibrated.

2 **Perform the self calibrations: Offset, Gain, and Interpolators.**

Refer to "Perform the Power-Up, Calibration, and Self Test" on page 2-3 for details.

3 **Connect the HP 53310A to the source as shown in *Figure 2-10.***

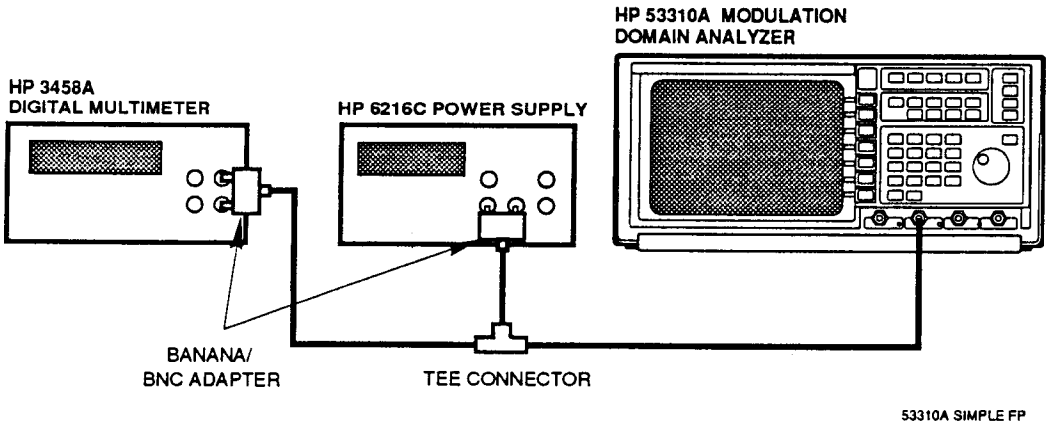


Figure 2-10. Threshold Trigger Accuracy Test Setup

NOTE

Figure 2-11 illustrates what is happening when the three threshold tests are performed.

4 **Set the power supply to output to 5.000V as indicated on the voltmeter.**

Once the power supply is set to output 5.000V, disconnect the voltmeter. This prevents any sampling noise inside the voltmeter from triggering the HP 53310A.

5 **Press Preset hardkey.**

6 **Press the top softkey until Time Int A → B is highlighted.**

Positive Voltage Threshold Values Test

1 **Press CONFIGURE INPUT softkey to enter the INPUT menu.**

2 **Set the following in the INPUT menu:**

a. **Volt Threshold** for Channel A to **5.1V**.

b. **1 MΩ/50Ω** to **1 MΩ**.

c. **Hysteresis** to MIN (no "bar" displayed in softkey).

3 **Press Fine hardkey (near the knob).**

This allows 2.5 mV incremented adjustments of the threshold level (Volt Threshold).

4 **While the Volt Threshold softkey is highlighted (as it should be at this point) carefully adjust the knob counterclockwise to decrease the Volt Threshold value. See *Figure 2-11A*.**

Note that the threshold level moves in 2.5 mV increments and observe the trigger light next to the Channel A input connector.

5 **Continue adjusting the threshold control until the Channel A front-panel trigger light just begins to blink ON or OFF, depending on the initial state of the trigger light.**

Note the reading in the **Volt Threshold** window and record it in *Table 2-13*.

6 **Press FUNCTION MENU softkey at the bottom of the display.**

7 **Set Channel A slope to falling edge.**

8 **Press CONFIGURE INPUT softkey, and adjust Volt Threshold for Channel A to 4.9V.**

Use the ENTRY keys to enter the 4.9V value.

9 **Carefully adjust the knob clockwise to increase the Volt Threshold value. See *Figure 2-11B*.**

Note that the threshold level moves in 2.5 mV increments and observe the trigger light next to the Channel A input connector.

10 **Continue adjusting the threshold control until the Channel A front-panel trigger light just begins to blink ON or OFF, depending on the initial state of the trigger light.**

Note the reading in the **Volt Threshold** window and record it in *Table 2-13*.

Negative Voltage Threshold Values Test

1 **Reverse the polarity at the power supply connection, and check that the power supply is at –5.000V.**

To perform step 1, connect the power supply to the voltmeter and verify –5.000V. Disconnect the voltmeter from the power supply to prevent any sampling noise inside the voltmeter from triggering the HP 53310A.

2 **Adjust the Volt Threshold to –5.1V.**

3 **Carefully adjust the knob clockwise, which will cause the Volt Threshold value to move in a less negative direction. See *Figure 2-11D*.**

Note that the threshold level moves in 2.5 mV increments and observe the trigger light next to the Channel A input connector.

4 **Continue adjusting the threshold control until the Channel A front-panel trigger light just begins to blink ON or OFF.**

Note the reading in the **Volt Threshold** window and record it in *Table 2-13*.

5 **Press FUNCTION MENU softkey at the bottom of the display.**

6 **Set Channel A slope to rising edge.**

7 **Press CONFIGURE INPUT softkey, and adjust Volt Threshold for Channel A to –4.9V.**

Use the ENTRY keys to enter the –4.9V value.

8 **Carefully adjust the knob counterclockwise, which moves the Volt Threshold value more negative. See *Figure 2-11C*.**

Note that the threshold level moves in 2.5 mV increments and observe the trigger light next to the Channel A input connector.

9 **Continue adjusting the threshold control until the Channel A front-panel trigger light just begins to blink ON or OFF, depending on the initial state of the trigger light.**

Note the reading in the Volt Threshold window and record it in *Table 2-13*.

Zero Voltage Threshold Values Test

1 **Set 1 M Ω/50Ω to 50Ω.**

2 **Disconnect all inputs.**

3 **Press FUNCTION MENU softkey at the bottom of the display.**

Channel A should be set to rising edge.

4 **Press CONFIGURE INPUT softkey, and adjust Volt Threshold for Channel A to +25 mV.**

Use the ENTRY keys to enter the +25 mV value.

5 **Carefully adjust the knob counterclockwise to decrease the Volt Threshold value. See *Figure 2-11E*.**

Note that the threshold level moves in 2.5 mV increments and observe the trigger light next to the Channel A input connector.

6 **Continue adjusting the threshold control until the Channel A front-panel trigger light just begins to blink ON or OFF, depending on the initial state of the trigger light.**

Note the reading in the **Volt Threshold** window and record it in *Table 2-13*.

7 **Press FUNCTION MENU softkey at the bottom of the display.**

8 **Set Channel A slope to falling edge.**

9 **Press CONFIGURE INPUT softkey, and adjust Volt Threshold for Channel A to –25 mV.**

Use the ENTRY keys to enter the 25 mV value.

10 **Carefully adjust the knob counterclockwise to decrease the Volt Threshold value. See *Figure 2-11F*.**

Note that the threshold level moves in 2.5 mV increments and observe the trigger light next to the Channel A input connector.

11 **Continue adjusting the threshold control until the Channel A front-panel trigger light just begins to blink ON or OFF, depending on the initial state of the trigger light.**

Note the reading in the **Volt Threshold** window and record it in *Table 2-13*.

12 **Repeat all tests for Channel B, and record results in *Table 2-13*.**

13 Compute the Average of each pair of measurements and record it in *Table 2-13*. Then, compare the Computed Average with the Threshold Setting to obtain the measured Threshold Accuracy.

For example:

TEST NUMBER	CHANNEL	THRESHOLD SETTING	SLOPE	MEASURED RESULTS	COMPUTED AVERAGE	COMPARISON RESULTS (Threshold Setting vs Computed Average)	SPECIFICATIONS
7A	A	+5.0000V	RISING FALLING	5.010V 4.990V	5.000V	0.000V	±75 mV

MEASURED RESULTS FOR RISING SLOPE — 5.010V
MEASURED RESULTS FOR FALLING SLOPE — +4.990V
10.000V

$$\text{Computed Average} = \frac{10.000}{2} = 5.000\text{V}$$

14 Record results in *Table 2-13* and in the Performance Test Record.

Table 2-13. Threshold Accuracy Results

TEST NUMBER	CHANNEL	THRESHOLD SETTING	SLOPE	MEASURED RESULTS	COMPUTED AVERAGE	COMPARISON RESULTS (Threshold Setting vs Computed Average)	SPECIFICATIONS
7A	A	+5.0000V	RISING FALLING				±75 mV
7B	A	–5.0000V	RISING FALLING				±75 mV
7C	A	0.0000V	RISING FALLING				±25 mV
7D	B	+5.0000V	RISING FALLING				±75 mV
7E	B	–5.0000V	RISING FALLING				±75 mV
7F	B	0.0000V	RISING FALLING				±25 mV

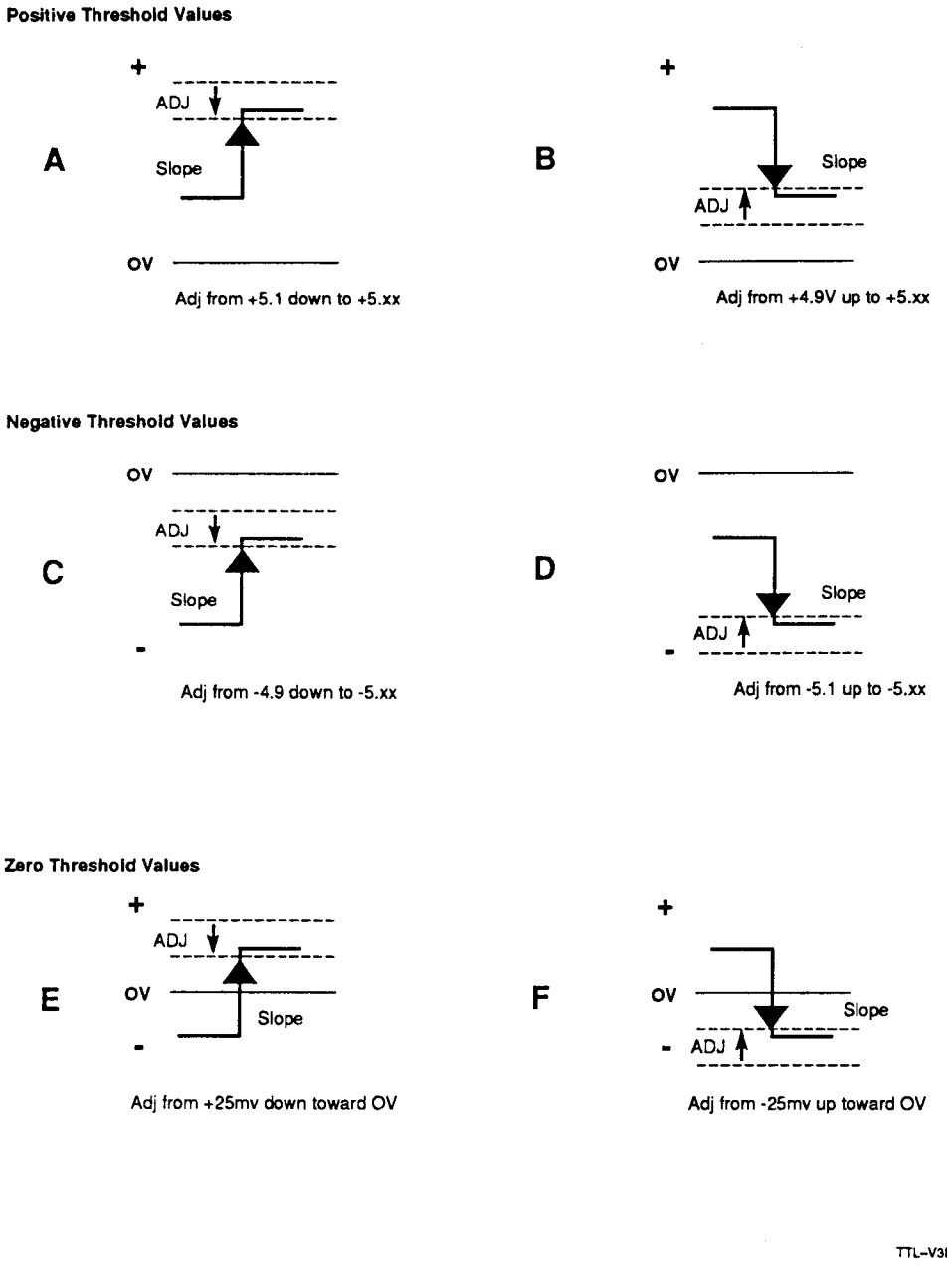


Figure 2-11. Threshold Trigger Levels

HP-IB VERIFICATION

The HP-IB Verification program listed in *Table 2-14* exercises the HP 53310A through various operating modes via the instrument's HP-IB. After running this program, record the result (pass or fail) in the Performance Test Record.

Table 2-14. HP-IB Verification Program Listing

```
10    !   Pa is the primary address for the 53310
20    Pa=12
30    !  Isc is the interface select code
40    Isc=7
50    !  Assign the complete I/O path to the 53310
60    ASSIGN @Hp53310 TO Isc*100+Pa
70    DIM Id$[50]                    !  Id$ used for query response
80    SEND Isc;TALK Pa
90    DISP "Press CONTINUE to proceed, and between each step"
100   PAUSE
110   DISP "You should see 'tlk' on the 53310 display."
120   PAUSE
130   SEND Isc;UNT
140   DISP " 'tlk' should now be gone."
150   PAUSE
160   SEND Isc;LISTEN Pa
170   DISP "You should see 'rmt' and 'lsn' on the 53310 display."
180   PAUSE
190   LOCAL LOCKOUT Isc
200   DISP "Local Lockout mode. Try the local key (it shouldn't work)."
210   PAUSE
220   LOCAL Isc
230   DISP " 'rmt' should be done. Local lockout condition has been removed."
240   PAUSE
250   SEND Isc;UNL
260   DISP " 'lsn' should be done."
270   PAUSE
280   REMOTE @Hp53310
290   DISP " 'rmt' and 'lsn' should appear."
300   PAUSE
310   OUTPUT @Hp53310;"*SRE 16"
320   DISP "SRQ mask has been set to enable SRQ on message available."
330   PAUSE
340   OUTPUT @Hp53310;" *IDN?"
350   DISP "Queried for instrument ID. This should cause 'SRQ' to appear."
360   PAUSE
370   ENTER @Hp53310;Id$
380   DISP " 'SRQ' should be gone. ID response:" ,Id$
390   PAUSE
400   SEND Isc;UNT
410   DISP " 'tlk' should be gone. Try local key, it should remove 'rmt'."
420   PAUSE
430   DISP "END OF HP-IB PROGRAM"
440   END
```

HP 53310A PERFORMANCE TEST RECORD (Page 1 of 3)

HEWLETT-PACKARD MODEL 53310A
MODULATION DOMAIN ANALYZER

Serial Number:_____
Test Performed By:_____
Date:_____
Notes:_____

Repair/Work Order No._____
Temperature:_____
Relative Humidity:_____
Post Calibration Test: ☐
Pre Calibration Test: ☐

TEST NUMBER	OPERATIONAL VERIFICATION TEST	TEST RESULTS PASS	FAIL
1	Self Test	_____	_____
2	Frequency	_____	_____
3	Time Interval	_____	_____
4	Histogram	_____	_____

PERFORMANCE TESTS

TEST NUMBER	CHANNEL	MINIMUM SPECIFICATION	MEASURED RESULTS	MAXIMUM SPECIFICATION	UNCERTAINTY
1A	A	—	_____	20.0 kHz	
1B		—	_____	1.0 kHz	
1C		—	_____	50.0 Hz	
1D		—	_____	1.0 Hz	
1E		—	_____	100.0 mHz	
1F		—	_____	5.0 mHz	
1G		—	_____	5.0 Hz	
1H		—	_____	20.0 mHz	
1I	B	—	_____	20.0 kHz	
1J		—	_____	1.0 kHz	
1K		—	_____	50.0 Hz	
1L		—	_____	1.0 Hz	
1M		—	_____	100.0 mHz	
1N		—	_____	5.0 mHz	
1O		—	_____	5.0 Hz	
1P		—	_____	20.0 mHz	

HP 53310A PERFORMANCE TEST RECORD (Page 2 of 3)

TEST NUMBER	CHANNEL	MINIMUM SPECIFICATION	MEASURED RESULTS	MAXIMUM SPECIFICATION	UNCERTAINTY
1Q	C	—	_____	20.0 kHz	
1R	Opt. 030	—	_____	2.0 kHz	
1S		—	_____	20.0 Hz	
1T		—	_____	1.0 Hz	
1U		—	_____	100.0 mHz	
1V		—	_____	5.0 mHz	
1W		—	_____	200.0 kHz	
1X		—	_____	20.0 kHz	
1Y		—	_____	200.0 Hz	
1Z		—	_____	10.0 Hz	
1AA		—	_____	1.0 Hz	
1BB		—	_____	50.0 mHz	
1CC	C	—	_____	1.0 kHz	
1DD	Opt. 031	—	_____	100.0 Hz	
1EE		—	_____	20.0 Hz	
1FF		—	_____	1.0 Hz	
1GG		—	_____	100.0 mHz	
1HH		—	_____	5.0 mHz	
1II		—	_____	2.0 kHz	
1JJ		—	_____	1.0 kHz	
1KK		—	_____	200.0 Hz	
1LL		—	_____	10.0 Hz	
1MM		—	_____	1.0 Hz	
1NN		—	_____	50.0 mHz	
2A	A	—	_____	<200 psec	
3A	—	—	_____	<1 nsec	
3B	—	—	_____	<1 nsec	
4A	—	20 nsec	_____	—	
5A		20 mV rms	_____	—	
5B		20 mV rms	_____	—	
5C	A	20 mV rms	_____	—	
5D		25 mV rms	_____	—	
5E		20 mV rms	_____	—	

HP 53310A PERFORMANCE TEST RECORD (Page 3 of 3)

TEST NUMBER	CHANNEL	MINIMUM SPECIFICATION	MEASURED RESULTS	MAXIMUM SPECIFICATION	UNCERTAINTY
5F	B	20 mV rms	_____	—	
5G		20 mV rms	_____	—	
5H	C	–25 dBm	_____	—	
5I	Opt. 030	–25 dBm	_____	—	
5J		–25 dBm	_____	—	
5K		–25 dBm	_____	—	
5L		–20 dBm	_____	—	
5M		–15 dBm	_____		
5N	C	–15 dBm	_____	—	
5O	Opt. 031	–15 dBm	_____	—	
5P		–10 dBm	_____	—	
5Q		–10 dBm	_____	—	
5R		–10 dBm	_____	—	
5S		–10 dBm	_____	—	
6A	A	2.5 nsec	_____	—	
6B	B	5 nsec	_____	—	
6C	Ext Arm	5 nsec	_____	—	
7A	A	—	_____	±75 mV	
7B		—	_____	±75 mV	
7C		—	_____	±25 mV	
7D	B	—	_____	±75 mV	
7E		—	_____	±75 mV	
7F		—	_____	±25 mV	
HP-IB VERIFICATION TEST			PASS _____		FAIL _____

3

ADJUSTMENTS AND CALIBRATION

Adjustments, Calibration, and Periodic Maintenance

INTRODUCTION

This chapter explains how to perform the hardware adjustments and firmware calibration to the HP 53310A, as well as how to perform periodic maintenance (such as CRT display adjustments, cabinet and front panel cleaning, and touch-up painting).

To perform these procedures some knowledge of the operation of the HP 53310A is helpful; however, the procedures are written so that little experience is necessary. The procedures should be followed in the order they appear, except for the CRT display adjustments. The display adjustments are optional and independent of the other procedures.

NOTE

Allow the instrument to warm up for at least 30 minutes before starting the adjustment procedures.

WARNING

READ THE SAFETY CONSIDERATIONS PAGE AT THE FRONT OF THIS MANUAL BEFORE PERFORMING THE ADJUSTMENT PROCEDURES.

CAUTION

The adjustment procedures are performed with the cover of the instrument removed. Take care to avoid shorting or damaging internal parts of the instrument.

EQUIPMENT REQUIRED

Equipment required for the adjustments in this chapter is listed in *Table 2-1*, Recommended Test Equipment, in Chapter 2. Any equipment that satisfies the critical specification listed in the table may be substitued for the recommended model.

FREQUENCY REFERENCE CALIBRATION INTERVAL

The recommended calibration interval for the frequency or timebase reference in the HP 53310A is 1 year; however, this interval depends on your accuracy requirements. Consult the aging curves in Appendix A (Specifications) for the standard timebase or optional high stability oven timebase to determine when you should calibrate the frequency reference.

The timebase adjustment is made at the factory when it is tested. However, adjustment may be necessary after repairs have been made to the instrument. Usually the only assembly that may require adjustment is the assembly that has been replaced.

INSTRUMENT SELF CALIBRATION

The HP 53310A has self-contained calibration procedures. The self-calibration routines execute automatic calibration for voltage offset and gain of both the insterpolators and front end input amplifiers. (The resulting factors are stored to non-volatile memory).

ADJUSTING THE HARDWARE

This section includes instructions on adjusting the hardware. Make sure the instrument is turned on for 30 minutes before you perform the adjustments.

The adjustment procedures in this chapter are for the following assemblies:

- A7 Power Supply
- A1 Main Board Timebase

To Adjust the Power Supply

NOTE

The A7 Power Supply Assembly MUST be loaded to regulate properly. It is loaded by the instrument circuits. DO NOT operate or adjust the power supply without a load.

Required Equipment:

Digital Multimeter . . . . . HP 3458A

1 **Disconnect power cord from the HP 53310A. Refer to *Figure 3-1* for testpoint and adjustment locations.**

2 **Connect the common lead of the voltmeter to A7 Power Supply Assembly chassis.**

3 **Connect the positive lead of the voltmeter to +5.10V on A7 Power Supply Assembly.**

4 **Connect the power cord to the HP 53310A and put power switch in ON position.**

5 **Observe a voltmeter reading within the range of +5.000 to +5.20 V.**

6 **If voltmeter reading is out of this range, adjust +5.10 ADJ on A7 Power Supply Assembly for +5.1 V ± 100 mV.**

The +5.10 ADJ location is shown in *Figure 3-1.*

If there is insufficient adjustment range, the power supply is probably defective. Refer to Chapter 4 (Service).

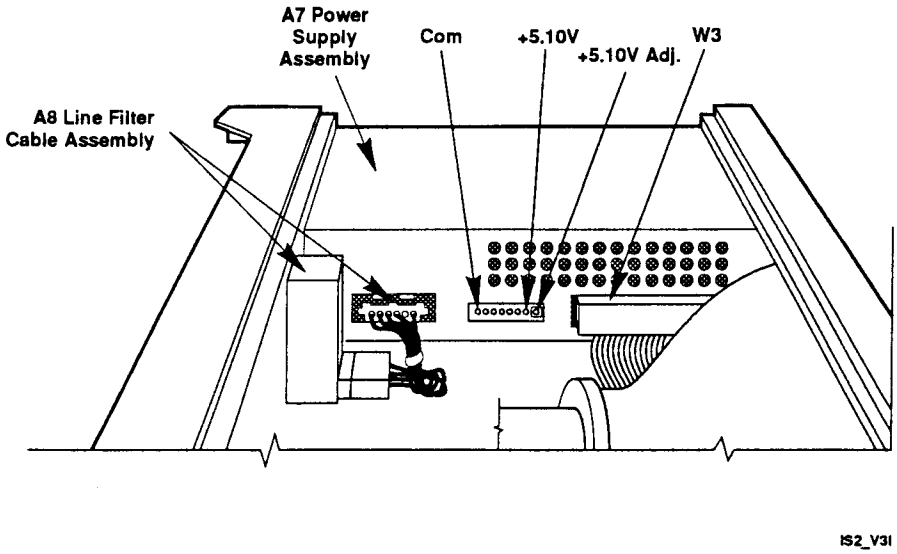


Figure 3-1. A7 Power Supply Assembly Testpoints and Adjustment Location

7 ***For easier access to the power supply adjustment, use the Power Supply Extender Cable (53310-60215) in the Service Accessories Kit (53310-67001). To use the extender cable perform the following (refer to *Figure 3-2* as needed):**

> ***NOTE***
>
> *When A7 Power Supply Assembly is operating outside of the instrument, use an external fan to cool the power supply. This avoids activating the thermal shutdown circuitry in the power supply. However, the supply may operate for several hours without shut down if no forced cooling is provided, depending on the enviromental temperature.*

a. Remove the power cord and the cover from the HP 53310A.

b. Disconnect the A8 Line Filter Cable Assembly from A7 Power Supply Assembly.

c. Disconnect and remove the power supply cable (W3) from A7 Power Supply Assembly and A1 Main Board Assembly.

d. Remove the two locking pins (MP8) from A7 Power Supply Assembly, then slide the power supply out of the cabinet.

e. Connect the Extender Cable (53310-60215) between A7 Power Supply and A1 Main Board assemblies.

---

* This step is optional. Perform this step for easier access to the power supply adjustment.

f. If option 031 is installed, connect the small connector to the A12 board.

g. Reconnect A8 Line Filter Cable Assembly to A7 Power Supply Assembly, and set the power supply on top of the rear part of the cabinet.

h. After doing the above sets, perform steps 2 through 6 in the "To Adjust the Power Supply" procedure on page 3-2.

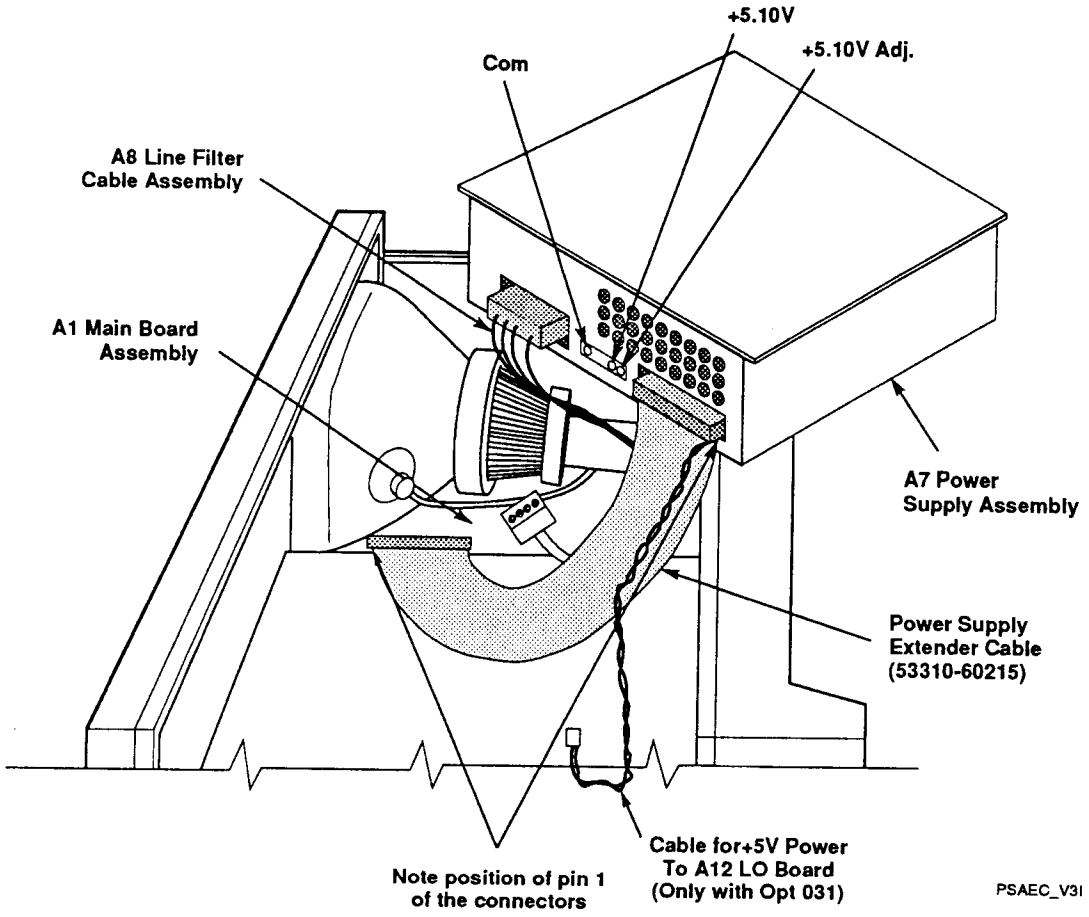


Figure 3-2. A7 Power Supply Assembly and Extender Cable Setup

This completes the power supply adjustment.

To Adjust the Timebase

NOTE

Allow the instrument to warm up for a minimum of 30 minutes before making the A1 Main Board Assembly timebase adjustment. If option 010 is present, this adjustment is not required.

Perform this procedure to adjust the standard timebase circuit on the A1 Main Board Assembly.

TO ADJUST THE STANDARD 10 MHZ OSCILLATOR TIMEBASE

NOTE

One of two timebases may be present in the HP 53310A: Standard or Option 010. All HP 53310A's have the standard timebase installed. When option 010 is present, the standard timebase output is not used.

1 **Connect a house standard (10 MHz reference frequency) to the HP 53310A Channel A input shown in *Figure 3-3*.**

2 **Press the Preset hardkey.**

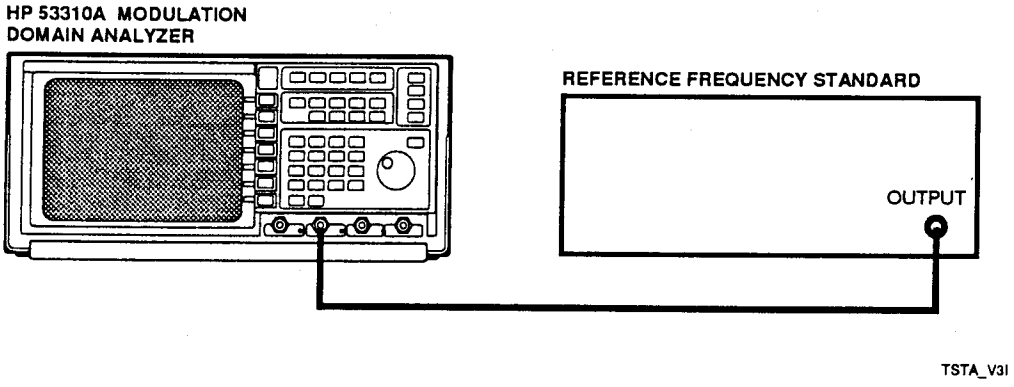


Figure 3-3. Timebase Adjustment Setup

3 **Press CONFIGURE INPUT softkey to enter the INPUT menu.**

4 **Set the following in the INPUT menu:**

a. Set **1MegΩ/50-Ω** for Channel A to **50-Ω**.

5 **Press VERTICAL button.**

a. Set **CENTER** button to **10 MHz** (Enter).

b. Press Blue **SHIFT** key, then **MEAN** key.

c. Press **SPAN** button.

d. Set **SPAN** button to **10 Hz** (Enter).

6 **Press TIMEBASE.**

a. Set Timebase button to **20 ms/div.**

7 **Turn the metallic shaft protuding from the 53310A rear panel slowly to move the display towards the center. If you cannot get an on-screen display, return to step 5e and start with 100 Hz, then go to 10 Hz.**

The mean value at the bottom of the display should be between 9.999995 and 10.000005 MHz.

This completes the adjustment of the standard timebase.

TO ADJUST THE OPTION 010 OVEN OSCILLATOR TIMEBASE

Perform this procedure to adjust timebase circuits driven by the Option 010 Oven Oscillator.

NOTE

The HP 53310A must be connected to ac power for a minimum of 24 hours before making this adjustment. This ensures that the oven is warm and stable. The standard oscillator adjustment is not required when option 010 is installed.

1 **Connect the HP 53310A as shown in *Figure 3-3*.**

2 **Press CONFIGURE INPUT softkey to enter the INPUT menu.**

3 **Set 1MegΩ/50-Ω for Channel A to 50-Ω.**

4 **Press VERTICAL button.**

a. Set **CENTER** button to **10 MHz** (Enter).

b. Press Blue **SHIFT** key, then **MEAN** key.

c. Press **SPAN** button.

d. Set **SPAN** button to **10 Hz** (Enter).

5 **Press TIMEBASE.**

a. Set timebase button to **20 ms/div**.

6 **Insert a non-metallic tuning wand through the OSC ADJUST hole in the side of the rear-panel oven. Turn it slowly to move the trace to the center of the display.**

7 **Press VERTICAL.**

a. Set **SPAN** to **0.5 Hz**.

8 **Press SAMPLING.**

a. Select **MANUAL.**

b. Set sampling time to **10 ms** (Enter).

9 **Insert a non-metallic tuning wand through the OSC ADJUST hole in the side of the rear-panel oven. Turn it slowly to move the trace to the center of the display.**

10 **Press TIMEBASE, and set it to 100 ms/div.**

11 **Press SAMPLING, select MANUAL, and set sampling time to 100 ms.**

The mean value at the bottom of the display should be between 9.999995 and 10.000005 MHz.

This completes the adjustment of the Option 010 timebase.

CALIBRATING THE FIRMWARE

You calibrate the firmware with signals generated in the HP 53310A. The firmware calibration affects channel sensitivity, channel offset, and gain.

The firmware calibration only uses cables and is easy to perform. You should perform the calibration if the ambient temperature changes more than 10°C from the temperature at which a full calibration was performed. You can also perform the firmware calibration to optimize the measurement accuracy of the HP 53310A.

The following equipment is required to perform the firmware calibrations:

Power Supply	HP 6114A (or equivalent power supply)
Digital Multimeter	HP 3458A
Cable (BNC, 50Ω, 4-foot, equal lengths, Qty 2)	HP 10503A
Adapter, BNC tee (m)(f)(f),	HP 1250-0781
Adapter, BANANA/BNC(f)	HP 1251-2277

Setup for Calibration

1 **Perform a key-down Powerup as follows:**

a. Turn off the HP 53310A.

b. Press and hold any front-panel key.

c. Turn on the HP 53310A.

d. After 5 seconds, release the key you are pressing.

e. Observe that graticules and the Function menu are displayed on the screen.

The key-down powerup is used to initialize the instrument to a known operating condition. The key-down powerup prevents setups from interfering with the next test, and it also simplifies the instrument setup procedure.

Procedure for Calibration

1 **Press Utility hardkey, then press SELFCAL MENU softkey.**

Observe that **Offset** of the **CALIBRATE** softkey and **A** of the **Channel** softkey are highlighted.

2 **Press Channel softkey until Both is highlighted.**

3 **Press Start Calibration softkey.**

The display should indicate "CALIBRATION PASSED" for both Channel A and B. If "CALIBRATION FAILED" is indicated, refer to Chapter 4 (Service).

4 **Press SELFCAL softkey at the top of the display until Gain is highlighted.**

5 Follow the instructions below:

a. Connect a +5V dc source to Channel A and the voltmeter (or digital multimeter) as shown in *Figure 3-4*.

b. Adjust the dc source to +5.000V by monitoring with the voltmeter.

c. Press **Channel** softkey until **A** is highlighted.

d. Press **Start Calibration** to compute and update calibration parmeters.

Observe that the display indicates "CALIBRATION PASSED". If there is a failure, refer to Chapter 4 (Service).

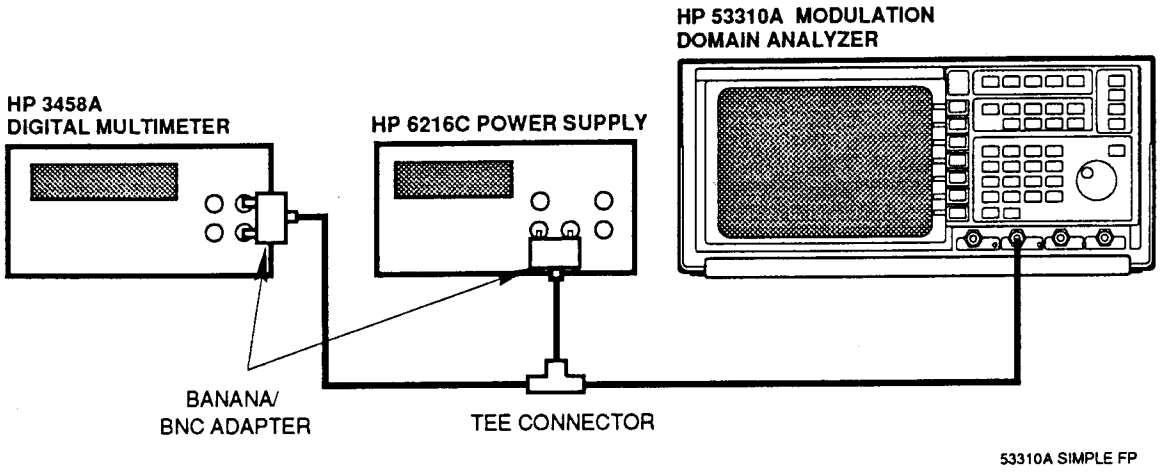


Figure 3-4. Gain Calibration Setup

6 Repeat step 5 for Channel B.

Make sure you disconnect the Channel A cable and connect it to Channel B input. Also, set the **Channel** softkey to its **B** function.

7 Disconnect the +5V dc source from channel B.

8 Press SELFCAL softkey until Interpolators is highlighted.

Make sure all inputs to channels A and B are removed.

9 Press Start Calibration softkey.

Observe that the display indicates the interpolators calibration passed. If the calibration fails, refer to Chapter 4 (Service).

10 Press exit menu softkey to exit the selfcal menu.

This completes the firmware calibration.

PERFORMING OPTIONAL MAINTENANCE

The A6 CRT Monitor Assembly adjustments and cleaning-the-instrument procedures are optional, and are performed only on an as-needed basis.

To Adjust the CRT Monitor

Perform this procedure only when the display has obvious differences from the example in *Figure 3-5*. You can skip parts of the procedure if this display meets the requirement. If the adjustments fail, the A6 CRT Monitor Assembly is probably defective. Refer to Chapter 4 (Service).

The adjustments optimize the characteristics of the CRT display. *Figure 3-5* shows the adjustment locations.

1 **Display the CRT test pattern by performing the following steps:**

a. Press **Utility menu** key.

b. Press **SELF TEST MENU** softkey.

c. Press the top softkey until **Misc** function is highlighted.

d. Press the second softkey until

e. **CRT** function is highlighted.

f. Press **Start Test** softkey.

Observe the CRT test pattern is similiar to *Figure 3-5*.

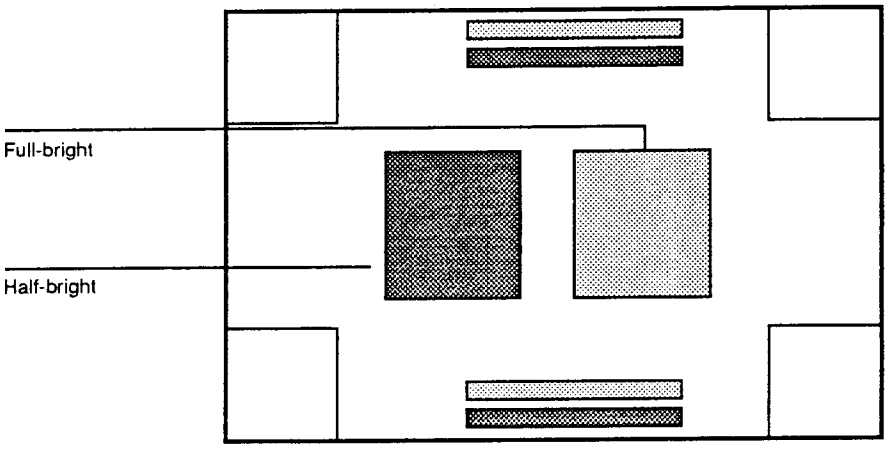


Figure 3-5. HP 53310A CRT Test Display

If the CRT test pattern is incorrect, proceed to the next step (step 2). **Use this test menu for all CRT adjustments.**

2 **Refer to *Figure 3-6* for CRT adjustment locations.**

3 **Adjust driver board V.HOLD (vertical hold) adjustment, if necessary, for vertical synchronization.**

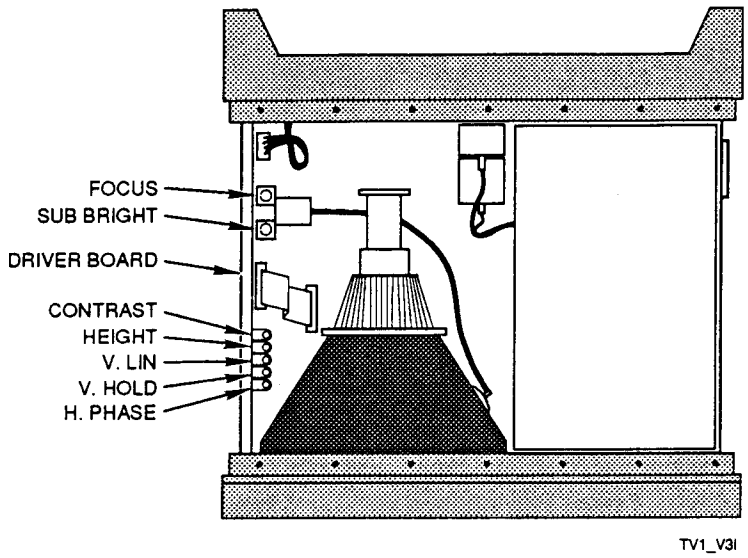


Figure 3-6. HP 53310A CRT Monitor Assembly Adjustment Locations

TO ADJUST INTENSITY, SUB-BRIGHT, AND CONTRAST

1 **Set rear-panel INTENSITY to the mid-range setting.**

2 **Adjust the driver board SUB-BRIGHT control to the lowest setting where the half-bright blocks are visible on the screen.**

3 **Turn rear-panel INTENSITY knob to increase the intensity to a comfortable viewing level.**

The position of the INTENSITY adjustment is usually close to 3/4 of its maximum range.

4 **Adjust CONT for the best contrast between the half-bright and the full-bright blocks on the display.**

Make sure the text is legible in the half-bright blocks.

TO ADJUST THE FOCUS AND HORIZONTAL PHASE

1 **Adjust H.PHASE to center the display horizontally.**

2 **Adjust FOCUS control for a sharp percent symbol (%) on the top and bottom blocks of text.**

TO ADJUST THE VERTICAL LINEARITY AND HEIGHT

3 **Adjust V.LIN for equal height of corner squares.**

The square height should be approximately 25 mm.

4 **Adjust HEIGHT to make the top and bottom borders of the screen approximately 1 cm.**

Adjustments V.LIN and HEIGHT interact. Repeat steps 1 and 2 as necessary for a properly adjusted display.

This completes the CRT Monitor Assembly adjustments.

To Clean the Instrument

You can clean the outer surfaces of the instrument.

1 **Use a mild soap and water to clean the instrument cabinet and the front panel.**

Avoid using harsh soaps that will damage the water-based paint finish of the instrument.

Make sure no water or other cleaners run inside the instrument through any openings.

To Touch-Up Paint the Instrument

You can touch up the cabinet and parts of the front panel of the instrument.

1 **Use touch-up paint HP Part Number 6010-0556 for the moss gray (dark gray) surfaces of the cabinet.**

2 **Use touch-up paint HP Part Number 6010-0849 for the mint gray (very light gray) surfaces of the front panel.**

For information on how to order the above items, refer to "Contacting Hewlett-Packard" in Chapter 8 (Replaceable Parts) of this manual.

4
SERVICE

INTRODUCTION

This chapter provides service information for your HP 53310A, and is divided into four major sections.

- RETURNING THE INSTRUMENT TO HEWLETT-PACKARD FOR SERVICE. This section provides you with step-by-step instructions on how to return the instrument for service.
- PRE-TROUBLESHOOTING INFORMATION. This section provides you with pertinent information such as safety considerations, recommended test equipment, repair and after service considerations, service accessories, and assembly identification and location.
- TROUBLESHOOTING THE HP 53310A. This section provides you with troubleshooting flowcharts and procedures, and diagnostics information that isolate the faulty assembly. (Once you find a faulty assembly, use Chapter 5 (Replacing Assemblies), which instructs you on removing the defective assembly.)
- TROUBLESHOOTING THEORY. This section helps you understand the concepts behind the troubleshooting process in this chapter, which requires isolation of the main assemblies in the instrument to determine the origin of some failures.

If the instrument is under warranty, return the instrument to Hewlett-Packard for service. Refer to the first section of this chapter "RETURNING THE INSTRUMENT TO HEWLETT-PACKARD" on page 4-2. If you decide to troubleshoot the instrument yourself, refer to the "TROUBLESHOOTING THE HP 53310A" section on page 4-8.

RETURNING THE INSTRUMENT TO HEWLETT-PACKARD FOR SERVICE

To Provide Repair Information

If you are shipping the instrument to an HP office for service or repair, call your nearest Hewlett-Packard Sales Office to make the arrangements. Then tag and package the HP 53310A for shipment.

1 **Write the following information on a tag:**

- Owners name and address.
- Instrument model number.
- Complete serial number.
- Description of service required or failure indications.

2 **Attach the tag to the instrument.**

3 **Pack the instrument**

If you have the original packaging materials, refer to the following section titled "Pack in Original Packaging Materials". If the original packaging materials are not available or usable, you can order new materaials through an HP Sales and Service Office. The new materials are identical to those used by the factory when packaging the instrument. If you want to use commerically available materials, refer to "To Pack in Commercially Available Materials" on page 4-3.

To Pack in the Original Packaging Materials

Whenever possible, repack the instrument in its original packaging for shipment. In any correspondence, refer to the instrument by the model number and complete serial number.

1 **Disconnect the power cord, probes, cables, or other accessories attached to the instrument.**

2 **Make sure the folded corrugated spacer (which normally contains the manuals) is in the box to ensure proper fitting.**

3 **Make sure the four polystyrene corner blocks are in their proper positions in the box.**

4 **Place the instrument on the four polystyrene corner blocks with the 3-ply pad at the rear panel end of the instrument.**

5 **Place four more polystyrene corner blocks on top of the instrument to secure it.**

6 **Do not return the manuals with the instrument. Return an accessory only when it is a part of the failure symptoms.**

7 **Seal the shipping container securely.**

To Pack in the Commerically Available Materials

If the factory packaging materials are not available, you can use commerically available materials for shipping.

1 **Wrap the instrument in heavy paper or plastic.**

2 **Place the instrument in a strong shipping container.**

A double-wall carton made of 350-lb test material is adequate.

3 **Protect the control panel with cardboard.**

4 **Add a layer of shock-absorbing material.**

The shock-absorbing material should be 70 to 100 mm (3 to 4 inches) thick around all sides of the instrument to prevent movement inside the container.

5 **Seal the shipping container securely.**

6 **Mark the shipping container FRAGILE.**

PRE-TROUBLESHOOTING INFORMATION

This section contains the following pertinent troubleshooting information:

- Safety Considerations
- Recommended Test Equipment
- Repair Considerations
- After Service Considerations
- Service Accessories
- Assembly Identification and Location

Safety Considerations

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in a safe condition. Service instructions, and adjustment procedures requiring removal of the instrument cover, are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing or make any adjustments with the cover removed, unless qualified to do so.

WARNING

BEFORE APPLYING AC POWER, THE INSTRUMENT AND ALL PROTECTIVE EARTH TERMINALS, EXTENSION CORDS, AUTO-TRANSFORMERS, AND DEVICES CONNECTED TO THE INSTRUMENT SHOULD BE CONNECTED TO A PROTECTIVE EARTH GROUNDED SOCKET.

ANY INTERRUPTION OF THE PROTECTIVE GROUNDING CONDUCTOR INSIDE OR OUTSIDE THE INSTRUMENT OR DISCONNECTION OF THE PROTECTIVE EARTH TERMINAL WILL CAUSE A POTENTIAL SHOCK HAZARD THAT COULD RESULT IN PERSONAL INJURY. INTENTIONAL INTERRUPTION IS PROHIBITED.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, if necessary, should be carried out only by a skilled person who is aware of the hazards involved (for example, fire and electric shock).

Make sure that only fuses with the required current and voltage ratings, and of the specified type (normal blow, time delay, etc.), are used for replacement. DO NOT USE short-circuited fuseholders or repaired fuses.

The safety symbols used on equipment and in the manual are shown in the Safety Consideration page at the front of this manual. Read the Safety Considerations page before servicing the instrument. Before performing any procedure, review it for cautions and warnings.

Recommended Test Equipment

Test equipment recommended for testing and troubleshooting the HP 53310A is listed in *Table 2-1* (Chapter 2). Substitute equipment may be used if it meets or exceeds the required characteristics listed in the table.

Repair Considerations

ELECTROSTATIC DISCHARGE

Electronic components and assemblies in the HP 53310A can be permanently degraded or damaged by electrostatic discharge. Use the following precautions when servicing the instrument:

1 **ENSURE that static sensitive devices or assemblies are serviced at static safe work stations providing proper grounding for service personnel.**

2 **ENSURE that static sensitive devices or assemblies are stored in static shielding bags or containers.**

3 **DO NOT wear clothing subject to static charge buildup, such as wool or synthetic materials.**

4 **DO NOT handle components or assemblies in carpeted areas.**

5 **DO NOT remove an assembly or component from its static shielding protection until you are ready to install it.**

6 **AVOID touching component leads. (Handle by packaging only.)**

POWER SUPPLY COOLING

When the power supply extender cable (53310-60217) or the test cable (53310-60213) are used, the A7 Power Supply Assembly will be operating outside the instrument's cabinet as shown in *Figures 4-10, 4-21* and *4-23*. Thus, the instrument's built-in fan will not be able to keep the power supply assembly cool enough for continous operation. Use an external fan to cool the power supply. A7 Power Supply Assembly may operate for several hours, depending on the environment temperature before shutting itself off.

DISASSEMBLY AND REASSEMBLY SPECIFICS

Refer to Chapter 5 (Replacing Assemblies) for complete disassembly and reassembly details, and to Chapter 8 (Replaceable Parts) for the appropriate exploded views of the instrument parts.

After Service Considerations

PRODUCT SAFETY CHECKS

The following safety checks must be performed after any troubleshooting and repair procedures have been completed to ensure the safe operation of the instrument.

WARNING

RESISTANCE CHECKS DESCRIBED IN THE FOLLOWING TEXT REQUIRE THAT THE POWER CORD BE CONNECTED TO THE INSTRUMENT AND THAT AC POWER BE DISCONNECTED. BE SURE THAT THE POWER CORD IS NOT CONNECTED TO POWER BEFORE PERFORMING ANY SAFETY CHECKS.

1 **VISUAL INSPECTION. Visually inspect the interior of the instrument for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and remedy the cause of any such condition.**

2 **GROUND CONTINUITY TEST. Plug the power cord into the rear panel power module. (DO NOT connect the instrument to ac power.) Using a suitable ohmmeter, check resistance from the instrument's metallic connection (such as the rear panel or BNC ground) to the ground pin on the power cord plug. The reading must be less than 1 Ω. Flex the power cord while making this measurement to determine whether intermittent discontinuities exist.**

3 **Check any indicated front or rear panel ground terminals marked, using the above procedure.**

4 **INSULATION RESISTANCE TEST. Tie the line and neutral pins of the power cord plug together. Measure the resistance from the instrument enclosure (chassis) to the line and neutral pins of the power cord plug. The minimum acceptable resistance is 2MΩ. Replace any component which results in a failure.**

5 **POWER MODULE CHECK. Check the line fuse and voltage selector card in the rear panel power module to verify that the instrument is properly set for the ac power source to be applied. If the Option 010 is installed, also check the fuse and line setting in the Oven Oscillator Power section of the rear panel.**

ADJUSTMENTS

Whenever the A6 CRT Monitor and A9 Oven Oscillator assemblies are replaced, you must perform the appropriate adjustment procedures in Chapter 3, Adjustments and Calibration. If option 031 is present, perform the A12 adjustment and calibration as well.

PRODUCT PERFORMANCE CHECKS

After replacement of any assembly board, perform the Operational Verification Test in Chapter 2 (Performance Tests).

Service Accessories

Service accessories to aid in troubleshooting the HP 53310A are available from Hewlett-Packard. *Table 4-1* lists the items in the HP 53310A Service Accessories Kit. The list includes the name, the HP part number, and a brief description and use of each item.

Table 4-1. Service Accessories Kit (53310-67001) Contents

ACCESSORY	HP PART NO.	DESCRIPTION AND USE
Power Supply Jumper Test Cable	53310-60213	This cable is used when troubleshooting to allow isolation of the A3, A4, A5, and A6 assemblies from the A1 Main Board Assembly.
Power Supply Extender Cable	53310-60217	20-conductor flat ribbon/twisted pair cable that allows operating the A7 Power Supply Assembly outside the instrument, making the A1, A2, A3, A7, and A12 assemblies more accessible for troubleshooting.

Assembly Identification and Location

The assembly number, name and Hewlett-Packard part number of HP 53310A assemblies are listed in *Table 4-2*. Exploded view, *Figure 8-2* (Chapter 8), illustrations the replaceable assemblies and cables in the HP 53310A.

Table 4-2. HP 53310A Assembly Identification

ASSEMBLY	NAME	HP PART NO.	EXCHANGE PART NO.
A1	Main Board Assembly	53310-60001	53310-69001
	or Main Board Assy/w Expanded Memory (Opt. 001)	53310-60007	53310-69007
A2	Input Board Assembly	53310-60002	53310-69002
	or Input Board Assembly/w C-Channel (Opt. 030)	53310-60004	53310-69004
	or Input Board Assembly/w C-Channel (Opt. 031)	53310-60010	53310-69010
A3	CPU Assembly	53310-60003	53310-69003
A4	Keyboard Assembly	54503-66502	—
A5	RPG Assembly	0960-0753	—
A6	CRT Monitor Assembly	2090-0211	—
A7	Power Supply Assembly	0950-1879	—
A8	Line Filter Assembly	53310-60214	—
	or Line Filter Assembly (for Option 010)	53310-60212	—
A9	Oven Oscillator (Option 010 only)	10811-60111	10811-69001
A10	Oscillator Board Assembly (Option 010 only)	53310-60005	—
A11	Oscillator Power Supply Board Assembly (Option 010 only)	53310-60006	—
A12	Local Oscillator Board Assembly (Option 031 only)	53310-60011	53310-69011

TROUBLESHOOTING THE HP 53310A

Introduction

This section can help you locate faulty assemblies in your HP 53310A. The troubleshooting consists of flowcharts, self-test instructions, step-by-step procedures, signal level tables, and diagnostics information.

The repair strategy for this instrument is assembly-level repair. Some assemblies are part of an exchange program with Hewlett-Packard. The exchange program allows you to exchange a faulty assembly with one that has been repaired, calibrated, and performance verified by Hewlett-Packard. Refer to Chapter 8 (Replaceable Parts) for information on how to use the exchange process. Refer to *Table 4-2* for a listing of the exchange assemblies.

The safety symbols used on equipment and in the manual are shown in the Safety Consideration page at the front of this manual. Read the Safety Considerations page before servicing the instrument. Before performing any procedure, review it for cautions and warnings.

WARNING

MAINTENANCE SHOULD BE PERFORMED BY TRAINED SERVICE PERSONNEL AWARE OF THE HAZARDS INVOLVED (FOR EXAMPLE, FIRE AND ELECTRIC SHOCK). WHEN MAINTENANCE CAN BE PERFORMED WITHOUT POWER APPLIED, THE POWER CORD SHOULD BE REMOVED FROM THE INSTRUMENT.

The actions in the Primary Flowchart, *Figure 4-1*, can be performed WITHOUT removing the cover of the instrument. Enough front panel and other indications exist to allow close definition of the problem before removing the cover.

The following instruction are repeated in front of each detailed flowchart section as reminders:

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

Using the Troubleshooting Flowcharts and Procedures

To troubleshoot the HP 53310A perform the following:

1 **Perform tests in the Primary Flowchart in *Figure 4-1* and read the adjacent "PRIMARY FLOWCHART DETAILS" section for detailed explanations of each procedure called out in the Primary Flowchart.**

2 **Go to the subsidiary flowcharts as instructed. The subsidiary flowcharts will help you identify the faulty assembly.**

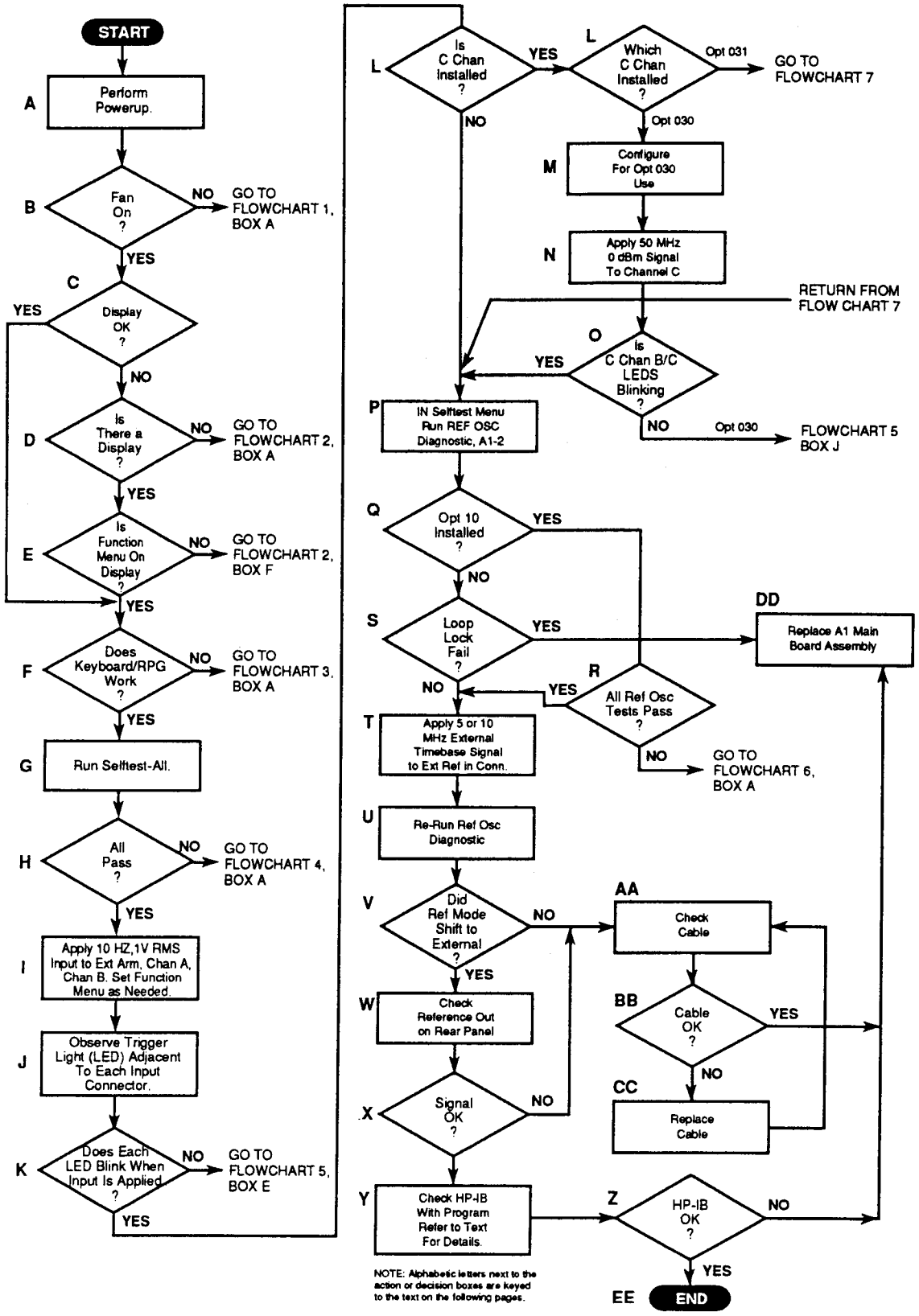


Figure 4-1. HP 53310A Primary Trouble Isolation Flowchart

PRIMARY FLOWCHART DETAILS

The actions in the Primary Flowchart, *Figure 4-1*, can be performed WITHOUT removing the cover of the instrument. Enough front panel and other indications exist to allow close definition of the problem before removing the cover.

An alphabetic letter is assigned to each action box in the flowcharts. The letter corresponds with the instruction line in the troubleshooting procedure that starts with the same letter.

A Perform powerup.

1. Turn on the HP 53310A.

   A few seconds after the HP 53310A is turned on, graticules and the Function menu are displayed on the screen. The screen should look similar to *Figure 4-2*. Note that the items in the two softkeys may vary, depending on the state of the instrument at last power down.

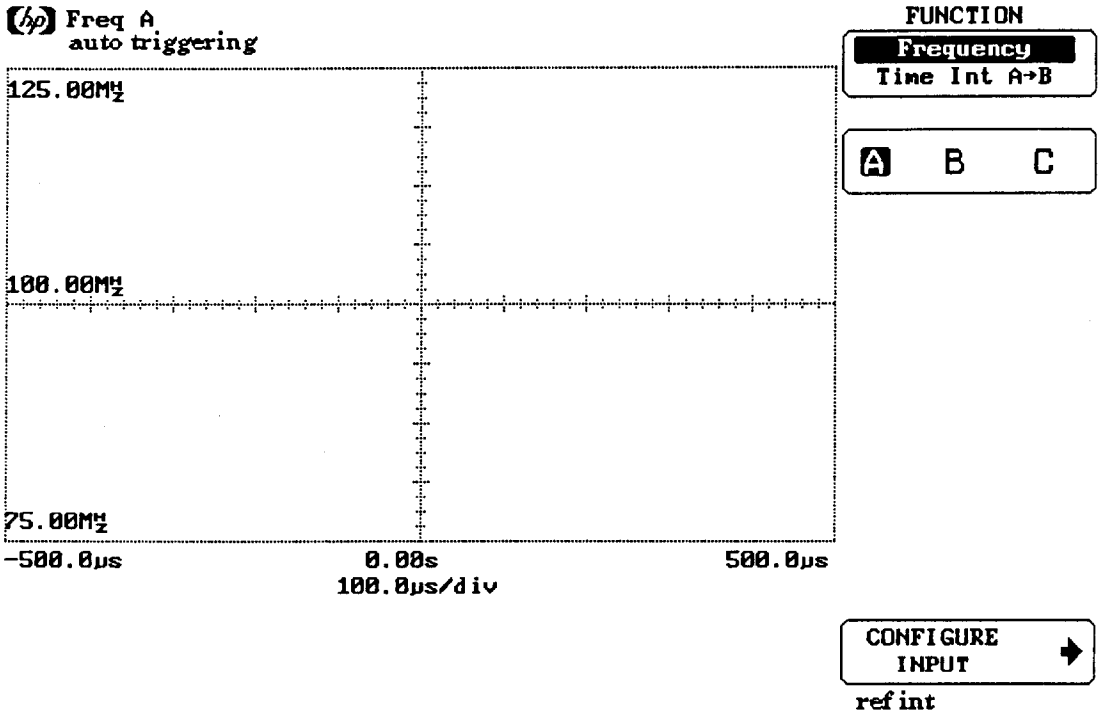


Figure 4-2. Power-Up Display, Function Menu

If any faults occur at power up, the unit will stop its turn-on sequence and display a screen with two softkey choices:

- Ignore
- Self-test menu

IGNORE allows you to proceed past the error to complete the power-up sequence, at your own risk.

SELF-TEST allows you to directly access the diagnostics that can be used to get further details on the problem.

Usually, an error at power up will mean there is a problem with the A3 CPU Assembly, but closer examination of the problem with the diagnostics will help refine this.

2. Press **Preset** hardkey.

   The HP 53310A display should appear like *Figure 4-2*; that is, the **Frequency** and **A** items should be highlighted.

B Fan on?

No? Go to Flowchart 1, box A. See *Figure 4-5.*

Yes? Continue to box C.

Hint: this check provides a quick indication that the instrument is getting power. No fan operation indicates a power problem (A7 Power Supply Assembly), or a fan controller problem (A1 Main Board Assembly), or a faulty fan (B1).

C Display correct? See correct display, *Figure 4-2.*

No? Continue to box D.

Yes? Go to box F.

D ANY display viewable?

No? Go to Flowchart 2, box A. See *Figure 4-11.*

Yes? Continue to box E.

Hint: This provides another indication that instrument is getting power. Lack of display indicates problems with CRT and its driver board, A3 CPU Assembly, or A7 Power Supply Assembly.

E Function Menu displayed?

See *Figure 4-2* for correct menu display.

No? Go to Flowchart 2, box F. See *Figure 4-11.*

Yes? Continue to box F.

Hint: Incorrect display indicates A3 CPU problems. Continue to verify.

F Do keyboard and front panel knob work? Press some keys and turn the knob.

No? Go to Flowchart 3, box A. See *Figure 4-19.*

Yes? Continue to box G.

G Run the SELF TEST-ALL.

NOTE

Key-down powerup may be performed on the HP 53310A before selftests are invoked. If the data stored in non-volatile memory is corrupt as indicated by improper operation, perform the "Key-down Powerup" and the "Calibration" procedures in Chapter 3 (Adjustments and Calibration).

To run the self tests perform the following:

Use the self tests for isolating most problems in the instrument. The self tests verify memories and system functions.

1. Run the self tests by performing the following steps:

> ***NOTE***
>
> *If the firmware calibration is not performed, the Trigger Light test of the A2 Input Amp selftest may fail.*

   a. Press **Utility** hardkey.

   b. Press **SELF TEST MENU** softkey, and observe that the **ALL** function is highligthed. If not, press the top softkey until **ALL** is highlighted.

   c. Press **Start Test** softkey. The HP 53310A display will indicate that the Self test-ALL diagnostic is running. If all the tests pass, the self test menu should appear similar to *Figure 4-3*. Note that a "Timer" bar is displayed on the left side of the display. This bar indicates that the various self tests are active; the bar goes away after completion.

```
A3 board                    A1 board                    SELFTEST
pass   CPU bd DTACK         pass  Main bd DTACK         All   A1-1  A1-2
pass  EPROM                 pass  meas RAM: -data       A2  A3 A12  Misc
pass  System RAM: -data     pass   -address line
pass    address line        pass  DMA: -registers
pass  HB Disp RAM: -data    pass   -mem to mem xter
pass    -address line       pass   -reload counter
pass    -masked write       pass  Histogram register    LOOP
pass  FB Disp RAM: -data    pass   -RAM                      Off    On
pass    -address line       pass   -DMA & Interrupt      until 10 fail's
pass    -masked write       pass    DMA fill one bin
pass  NV RAM: -data         pass  HP-IB                  ------------
pass     -address line      pass  Reference Oscillator      Start Test
pass  Timer 0:  counter     pass  UCIC: -cntrl regs      ------------
pass   -SRAM  retention     pass   -data path
pass  Timer 1: -register    pass    -DMA & Interrupt
pass   interrupt 1 clear    pass  Interpolator: -Ch 1
pass  -interrupt            pass   -Ch 2
pass  Timer 2               pass  Front End Interface    PRINT OUT
                            pass  A2 board Input Amp         Off    On
                            pass    -Trigger Light
                            pass    -Event Count         ------------
                                                           exit menu   ->
```

Figure 4-3. The SELF TEST-ALL Menu

2. After all tests are completed as indicated by "pass" or "FAIL" message adjacent to the test, verify that there are no test failures.

3. Press **exit menu** softkey to exit selftest menu.

H Self tests pass?

No? Go to Flowchart 4, box A. See *Figure 4-20*.

Yes? Continue to box I.

I Apply a 10-Hz, 1 Vrms (or 2.8 Vp-p) sine wave signal to each of the input connectors (Ext Arm, Chan A, and Chan B) while performing the next step, J.

J Observe the blinking trigger light (LED) adjacent to the input connector in use.

Note that no configuration changes are needed from power-up to see this action occur.

Hint: These trigger light actions are the result of a round trip of the input signal from the input connector, through processing on the A2 Input Board Assembly, processing on A1 Main Board Assembly, and a return trigger signal from the A1 board back to the A2 board to cause the light to flash (or blink). The trigger lights may be steady on or off prior to application of input. An input signal in the proper range will cause them to blink.

K Each trigger light blinks when an input is applied?

No? Go to Flowchart 5, box E. See *Figure 4-22.*

Yes? Continue to Box L.

Hint: Blinking action here is based on voltage level. As long as the input is above minimum sensitivity, and the voltage threshold is set below the input level, the light should blink. A blinking trigger light signifies that the input signal's voltage level is high enough for operation. (The voltage threshold in this case is 1 Vrms or 2.8 Vp-p. If the threshold is below this level, the light should blink. The key-down powerup resets the threshold to zero. In the Function/Configuration menu, the threshold voltage may be viewed if desired.) Continue to verify problem.

L Channel C installed?

No? Go to Box P.

Yes? Continue to box M or L: which C channel; option 030 (box M) or 031 (box L)?

M Configure the instrument for Channel C operation via Function & Input hardkey menu:

1. Press second softkey until **C** is highlighted.
2. Press **CONFIGURE INPUT** softkey.
3. Press **INPUT** softkey until **C** is highlighted.

   Note that no configuration needs to be done.

N Apply a 50 MHz, 0 dBm input signal to Chan C.

O Channel B/C trigger lights (LEDs) blinking? (The C-channel LED is shared with the B channel as well.)

No? Go to Flowchart 5, box E. See *Figure 4-22.*

Yes? Continue to box P.

P Run the Reference Oscillator (REF OSC) diagnostic:

1. Press **Utility** hardkey.
2. Press **SELF TEST MENU** softkey.
3. Press the top softkey until **A1-2** is highlighted.
4. Press the second softkey until **RefOsc** is highlighted.
5. Press **Start Test** softkey.
6. Observe the results in the upper left corner of the display, then continue to box Q.

Q Option 010 Oven Oscillator installed?

No? Go to box S.

Yes? Continue to box R.

R All REF OSC tests indicate PASS?

No? Go to Flowchart 6, box A. See Figure 4-27.

Yes? Go to box T.

S Looplock test fail?

No? Go to box T.

Yes? Go to Flowchart 6, box J. See *Figure 4-27.*

Hint: The Looplock fail test here applies to the standard air crystal timebase, installed on A1 Main Board Assembly. **If the Option 010 Oven Oscillator is installed, and the REF OSC tests failed, be sure to go to Flowchart 6 to resolve the problem.**

T Test the EXT TIMEBASE input by applying either a 5 or 10 MHz input into the rear panel connector Ext Ref In.

A 1-Vrms signal of sine, pulse, or square waveshape is adequate for this test.

U Re-run the REF OSC diagnostic test by pressing Start Test softkey.

V Reference mode shift to EXTERNAL?

No? Go to box AA.

Yes? Continue to box W.

W Check the external reference timebase output signal by connecting an oscilloscope to the Reference Out rear panel connector, and verifying that a signal similar to *Figure 4-4* is displayed on the oscilloscope's screen.

Use a BNC cable to make this connection.

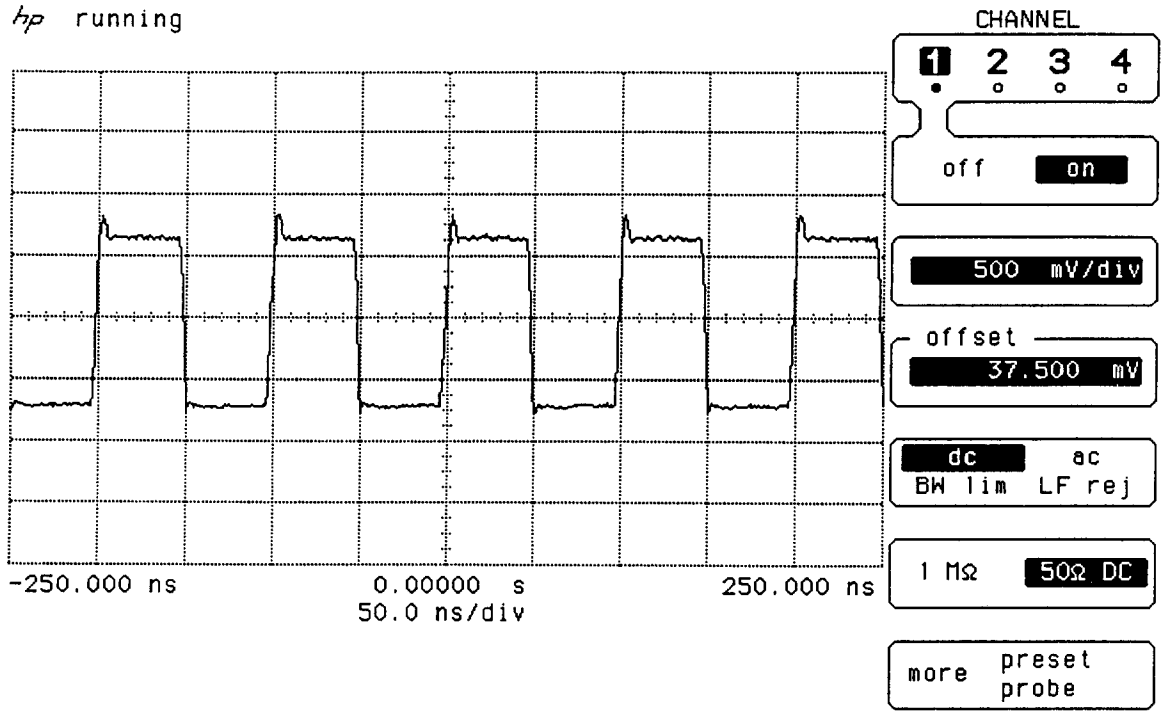


Figure 4-4. External Timebase Reference Signal (Voltage will be 1/2 magnitude for Option 031.)

X Signal correct?

No? Go to box AA.

Yes? Continue to box Y.

Y Connect a controller to the HP-IB connector. Key in the short HP-IB verification program located in *Table 2-14* of Chapter 2 (Performance Tests).

Hint: This program checks the basic HP-IB hardware circuits for continuity and handshaking. If these tests pass, and other problems are evident, a software problem exists either in the user program, or within the instrument. Run another known good program to resolve the problem.

Z HP-IB operating properly?

No? Go to box DD.

Yes? Go to box EE.

AA Check the BNC cable that connects the instrument's Reference Out to the oscilloscope.

BB BNC cable good?

No? Continue to box CC.

Yes? Go to box DD.

CC Replace BNC cable, and repeat steps in boxes AA and BB.

DD Replace A1 Main Board Assembly.

EE End. Instrument should be fully functional at this point.

TECHNICAL NOTES

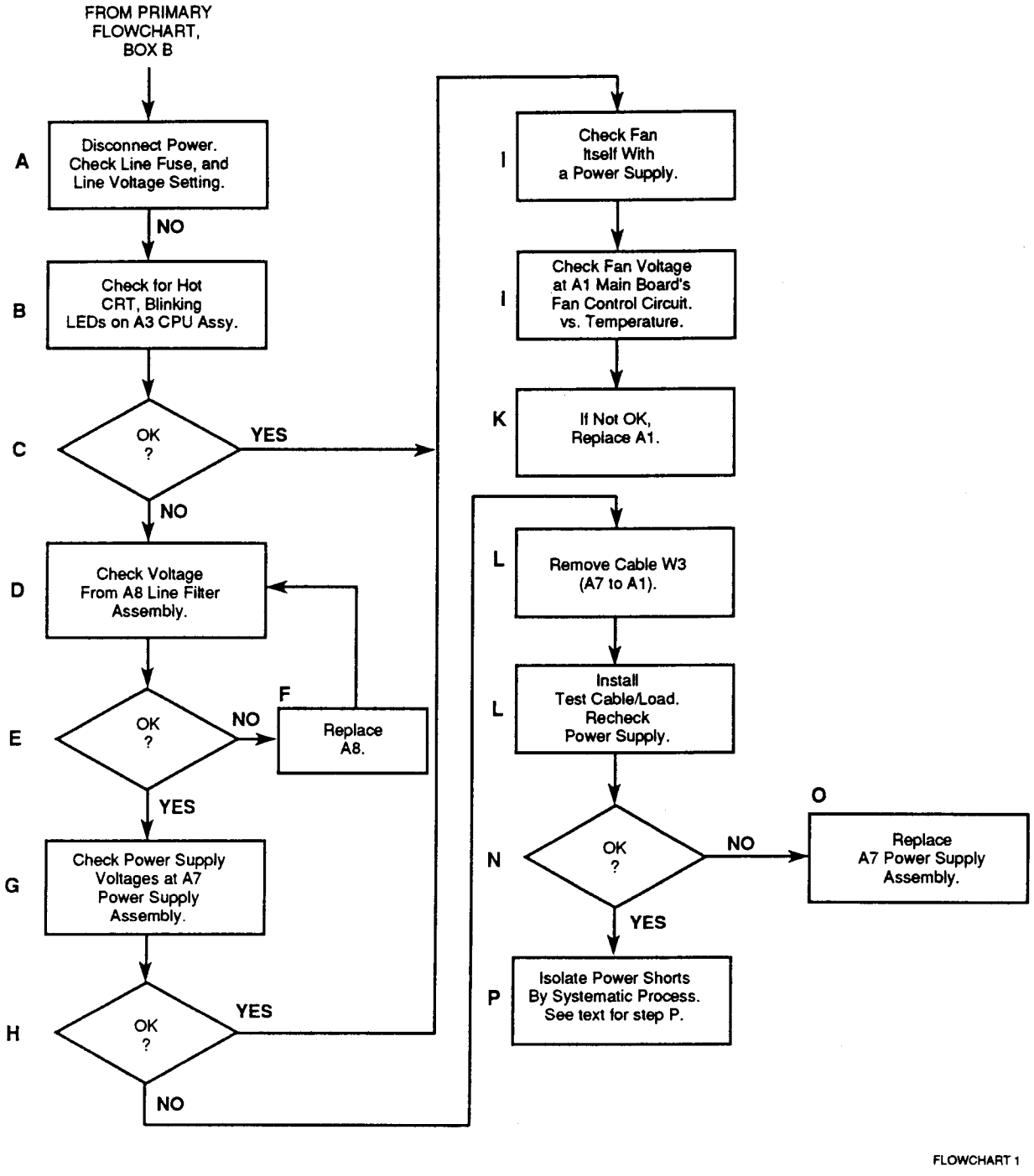


Figure 4-5. Flowchart 1

FLOWCHART 1 DETAILS

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at separating problems with power distribution and fan operation. It begins with output from Primary Flowchart, box B.

Hint: The assumption is made that the power supply mains or internal supply, fan itself, or fan control circuits on A1 Main Board Assembly are bad. If the instrument is totally dead, this is the place to start.

A Check fuse and line voltage settings.

Not okay? Fix as needed.

Okay? Continue to box B.

Hint: If fuse is blown and a new fuse doesn't restore some operation, check the fuse in A7 Power Supply Assembly. The fuse is accessible by removing the supply and looking in the open end, next to the power connector. If this fuse is blown, a major problem exists with the supply, since that fuse is a 5A device, and the line fuse is a 3A device. These fuses are in series with each other. Try a new fuse. If the new fuse opens (or blows), A7 Power Supply Assembly should be replaced. It is non-repairable.

B Check for hot (or glowing) CRT filament and blinking LEDs on A3 CPU Assembly.

The CRT filament and A3 LEDs are shown in *Figure 4-6*.

Hint: The CRT uses 12 volts to heat the filament. Check for a glowing filament by looking in the neck area of the CRT. The A3 LED's use 5 volts and their blinking indicate that the A3 CPU Assembly is receiving power.

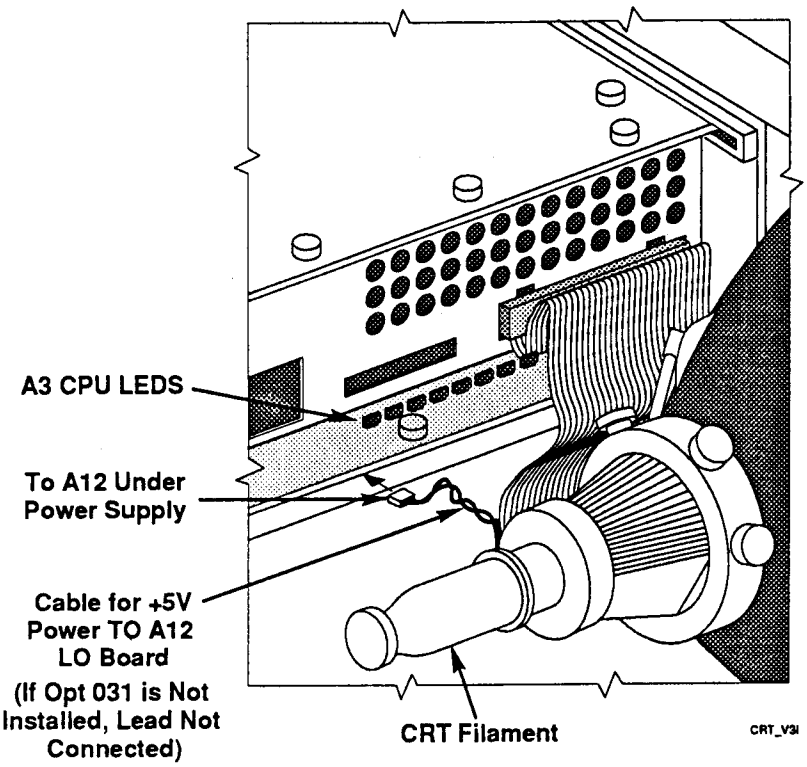


Figure 4-6. CRT Filament and A3 CPU LEDs Locations

C Operating properly?

Yes? Go to box I.

No? Continue to box D.

D Assuming the CRT filament is cold (not glowing), and A3 LEDs are not blinking, check the line voltages at A8 Line Filter Assembly output.

Perform the following steps to measure the signal out of A8:

1. Remove ac power from instrument.
2. Connect the positive lead of a voltmeter to the black/green wire connection of A8 Line Filter Assembly at A8 output connector as shown in *Figure 4-7*, and connect the negative lead to the gray wire connection as shown in *Figure 4-7*. *Figures 4-31* and *4-32* are schematic diagrams of the Standard A8 Line Filter Assembly and the Option 010 A8 Line filter Assembly, respectively.

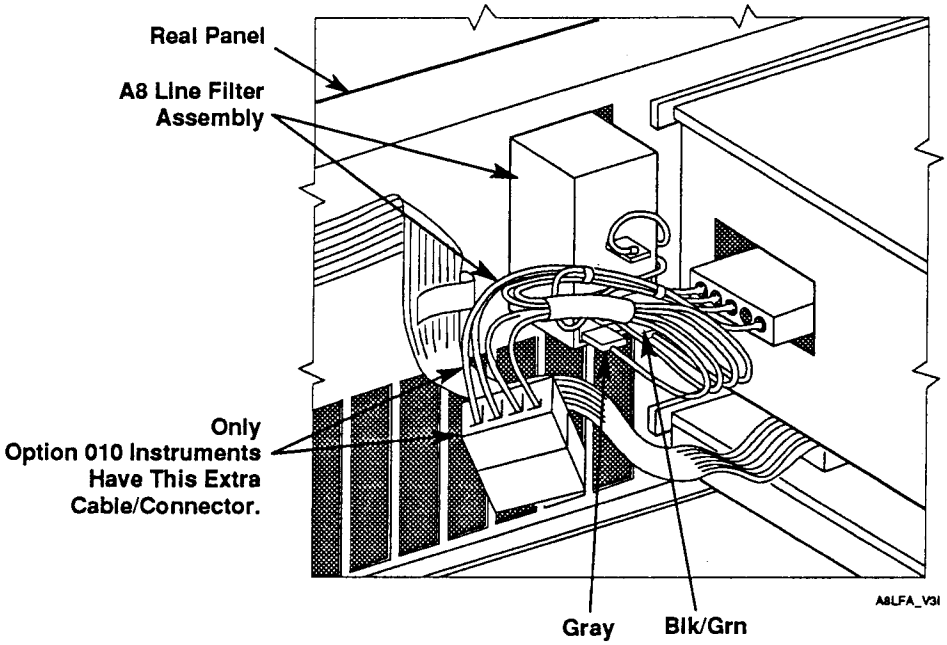


Figure 4-7. A8 Line Filter Assembly Output Location (Standard / Option 010)

3. Apply ac power to instrument, and check for an ac line voltage.

E Signal correct?

Yes? Go to box G.

No? Go to box F.

F Replace A8 Line Filter Assembly and recheck.

G Check A7 Power Supply Assembly itself, using data in *Table 4-3*.

Figure 4-8 shows the location of the dc supply testpoints on the A7 Power Supply Assembly.

Hint: These checks use the instrument circuits as the power supply load. **DO NOT try to check A7 without a load.** It is a switching power supply that requires a minimum 2.5A load on the +5V supply for all of its outputs to regulate properly.

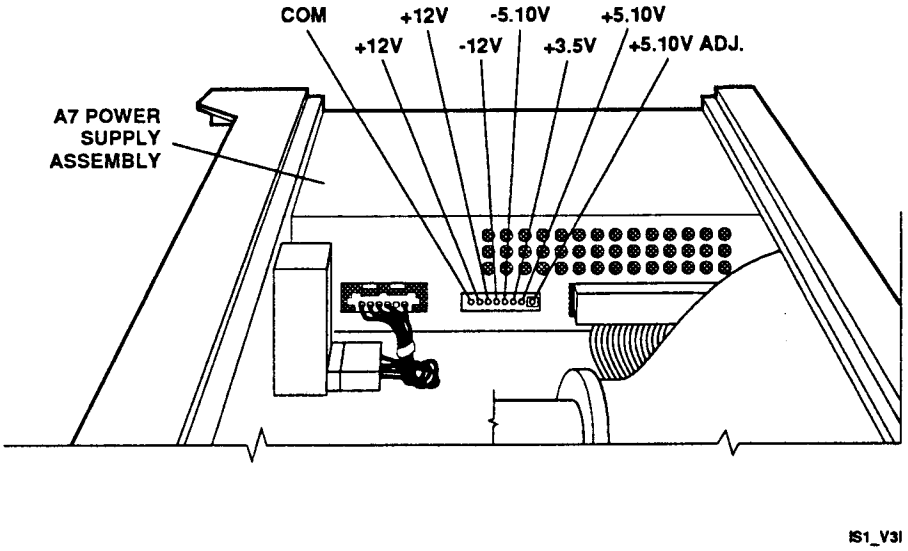


Figure 4-8. A7 Power Supply Assembly Testpoint Locations

Table 4-3. A7 Power Supply Test Points

PIN	SIGNAL DESCRIPTION	PIN	SIGNAL DESCRIPTION
1	+5.10V (ANALOG)	11	-5.1V (ANALOG)
2	+5.10V (ANALOG)	12	GROUND (ANALOG)
3	+5.10V (DIGITAL)	13	+12V (ANALOG)
4	+5.10V (DIGITAL)	14	GROUND (ANALOG)
5	GROUND (DISPLAY)	15	-12V (ANALOG)
6	GROUND (DIGITAL)	16	GROUND (ANALOG)
7	GROUND (DIGITAL)	17	+12V (DISPLAY)
8	GROUND (ANALOG)	18	-5.1V (ANALOG)
9	+3.5V (ANALOG)	19	+15.0V (FAN)
10	GROUND (ANALOG)	20	GROUND (FAN)

NOTE

The ground planes (digital, analog, and display) are at the same potential on the A7 Power Supply Assembly, but at board level the supplies must be measured to the ***respective ground.***

H Power supply voltages correct?

Yes? Go to box I.

No? Go to box L.

I Check fan itself.

Unplug it from A1 Main Board Assembly and apply a +6 to +12V dc level ("+" to red, and "-" to black) and check for fan operation. If not okay, replace fan. If okay, continue. (Do not use an ohmeter; it will not give accurate readings.)

Hint: Remove rear panel to gain access. On units without Option 010, rear panel retaining screws are four accross the top, and 4 across the bottom. On Option 010 rear panels, the screws are marked with an asterisk (*) to aid in choosing the correct screw to remove. CAREFULLY pull the panel back far enough to reach the connections and CAREFULLY take them loose as needed to reach those to be checked. A small bench vise works nicely to support the rear panel.

J At A1 Main Board Assembly, check fan supply voltage.

Voltage will vary with ambient temperature:

70°F = 6.5 to 7.4V
100°F = 9 to 11V

Hint: Use a heat gun pointed at the temperature-controlled thermistor, and observe the voltage change. The thermistor is located next to HP-IB connector on the A1 Main Board Assembly as shown in *Figure 4-9*. Keep the heat gun at least 12 inches away from the thermistor. DO NOT overheat. Note that mini-clips connected to the fan power posts allow you to monitor the voltage with the fan cable plugged in as shown in *Figure 4-9*.

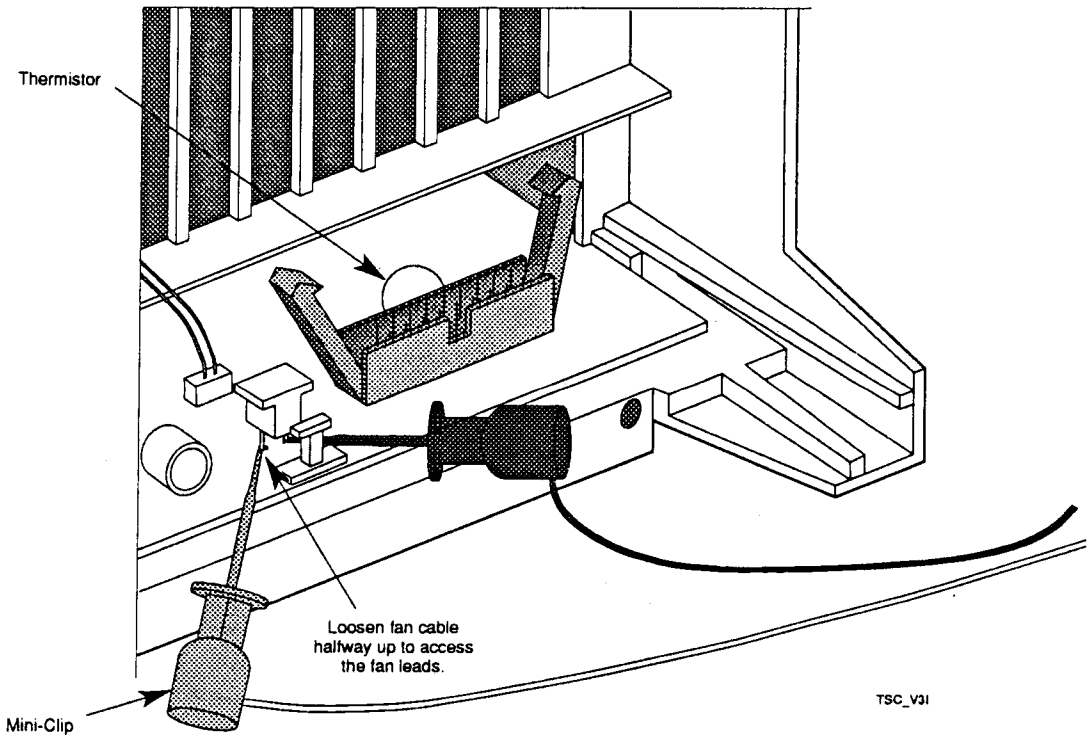


Figure 4-9. Fan Output and Thermistor Locations

K If temperature control action or voltages are not correct, replace A1 Main Board Assembly.

L Remove A1 to A7 cable (W3).

Hint: This action removes the circuits on the A1 Main Board Asssembly as the load for the power supply. The circuits may be loading the supply with a short or partial short.

M Install the Test Cable (53310-60213) into A7 Power Supply Assembly as shown in *Figure 4-10*.

Observe the polarity! The RED +5V wires go toward front of instrument or toward the closed end of the power supply assembly if the supply is positioned out of the instrument as shown in *Figure 4-10*.

NOTE

When A7 Power Supply Assembly is operating outside of the instrument, use an external fan to cool the power supply. This avoids activating the thermal shutdown circuitry in the power supply. However, the supply may operate for several hours without shut down if no forced cooling is provided, depending on the enviromental temperature.

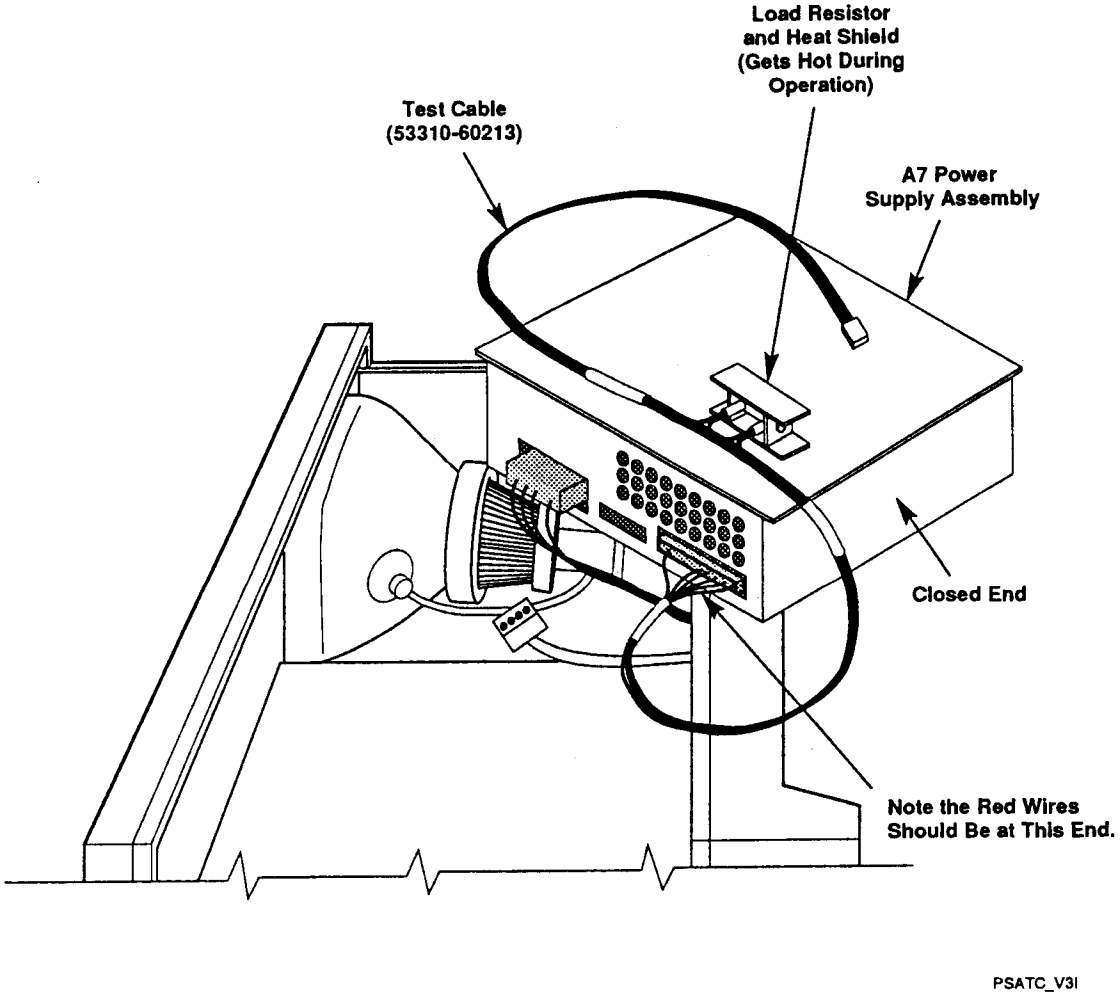


Figure 4-10. A7 Power Supply Assembly and Test Cable Setup

Power up instrument and re-check power supply voltages.

Hint: The load resistor loads the +5V supply. This is needed to be sure that all the supply voltages regulate properly. This load is available as part of test cable (53310-60213). If desired, a 2 ohm, 20-watt resistor can be substituted and connected to the +5V and ground test points, which are visible with the other voltage testpoints shown in *Figure 4-8*.

CAUTION

This resistor gets HOT during operation. Protect yourself and instrument wiring from burns.

N Power supply voltages correct?

Yes? Go to box P.

No? Go to box O.

O Replace A7 Power Supply Assembly.

P A power short is indicated somewhere within the rest of the instrument.

Isolate as follows:

1. Remove all A1 to A3 (opt. 031, A12) ribbon cables. This disconnects all power to the A3 CPU, A4 Keyboard, A5 RPG, and A12 (opt. 031) assemblies.
2. Reconnect the A1 to A7 cable (W3), and reapply power. Check the voltages.
   a. If voltages are correct, problem is in the A3/A4/A5/A6/A12 (opt 031) circuits.

      Isolate further by reconnecting the W9/10/11 ribbon cables to A1 and A3 assemblies, and disconnecting the A6 CRT Monitor Assembly ribbon cable (W13) and A4 Keyboard Assembly ribbon cable (W12) from A3. A6 uses +5 and +12V. A4/A5 assembly uses +5V only. Re-check voltages and isolate and replace the defective assembly.

   b. If voltages are incorrect, the problem is somewhere on A1 Main Board or A2 Input Board assembly. Continue to step 3.
3. Remove A2 Input Board Assembly, and re-check voltages.

   If voltages are correct, the problem is on A2 Input Board Assembly. Replace A2 Input Board Assembly.

   If voltages are incorrect, the problem is on A1 Main Board Assembly. Replace A1 Main Board Assembly.

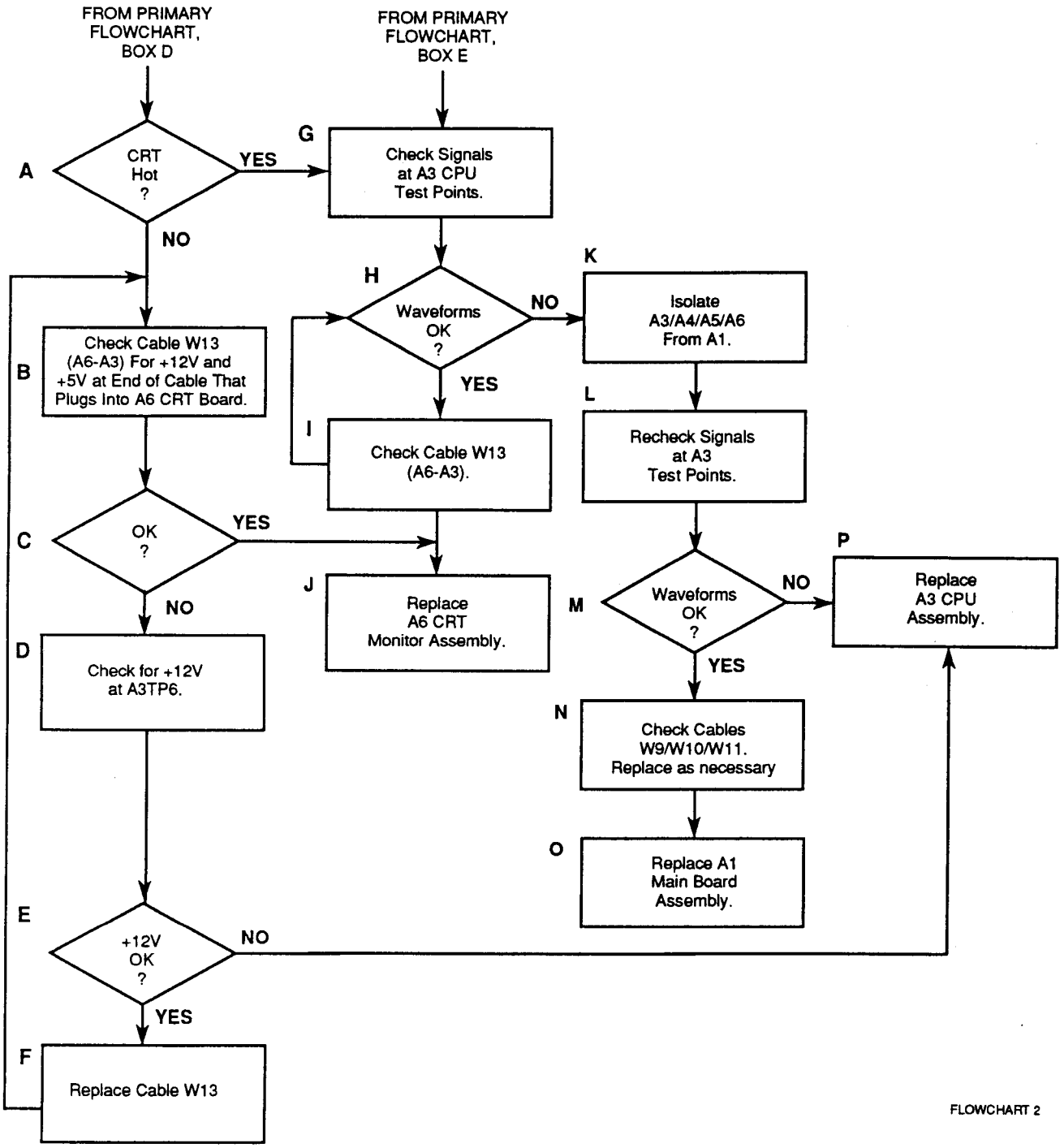


Figure 4-11. Flowchart 2

FLOWCHART 2 DETAILS

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to any troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at the A3 CPU Assembly/A6 CRT Monitor Assembly isolation. It begins with output from Primary Flowchart, box D and E (No display on CRT, and no function menu on display.)

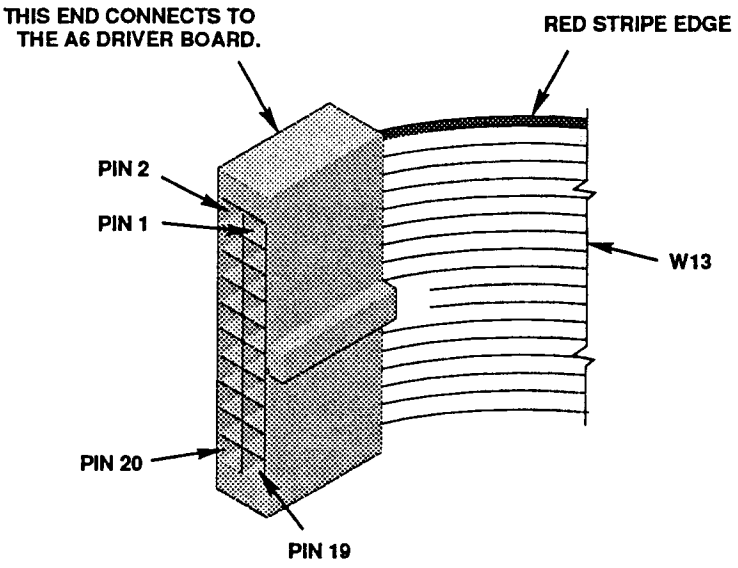
A CRT filament hot?

No? Continue to box B.

Yes? Go to box F.

Hint: The CRT uses 12 volts to heat the filament. Check for a glowing filament by looking in the neck area of the CRT. Also check INTENSITY (on rear panel) and SUBBRIGHT control (on CRT driver board). If SUBBRIGHT control is turned full Counterclockwise (CCW), the CRT will be blacked out. Turn control full Clockwise to insure CRT is full bright. Return to proper setting after check. INTENSITY control has less of an effect.

B If not hot, check for power at end of cable where it plugs into A6 CRT Driver Board. See *Figure 4-12*.



Pin	Signal/Voltage Readings	Pin	Signal/Voltage Readings
1	+5V	11	Vertical (V) Sync Out
2	+12V	12	+12V
3	Gnd	13	Gnd
4	Gnd	14	Gnd
5	+12V	15	Gnd
6	Gnd	16	Full-Bright (FB) Video Signal
7	+12V	17	Gnd
8	Gnd	18	Half-Bright (HB) Video Signal
9	+12V	19	Gnd
10	Horizontal (H) Sync Out	20	+5V

VOLTCON_V3I

Figure 4-12. Connector Pin Out Locations of W13 at A6 Driver Board End

C Cable W13 good?

No? Continue to box D.

Yes? Go to box J.

D check that +12V is good on A3 CPU Assembly at the +12V test point (A3TP6).

E +12V checked good?

No? Go to box Q.

Yes? Continue to box F.

F Replace cable W13.

G Check CRT video and sync signals at test points of A3TP1 (on A3 CPU Assembly) as shown in *Figure 4-13*.

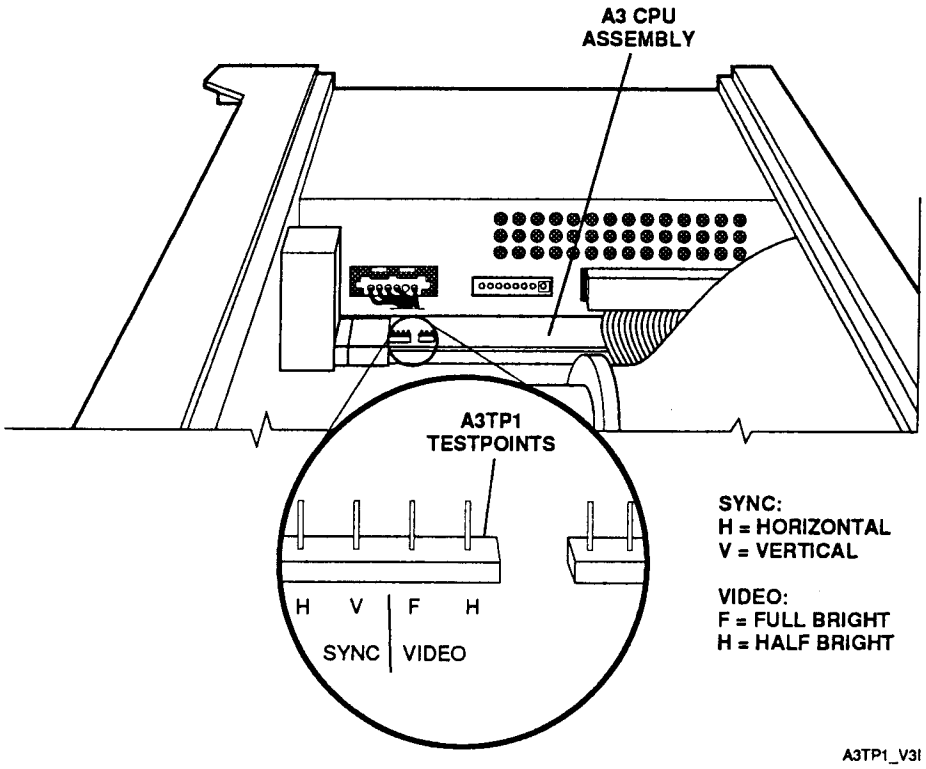


Figure 4-13. A3TP1 Testpoints

To provide stable waveforms for test, run the CRT diagnostic by performing the following steps:

1. Press **Utility** hardkey.
2. Press **SELF TEST MENU** softkey.
3. Press the top softkey until **Misc** is highlighted.
4. Press the second softkey until **CRT** is highlighted.
5. Press **Start Test** softkey.
6. Observe that a CRT test pattern similar to *Figure 4-14* is displayed.

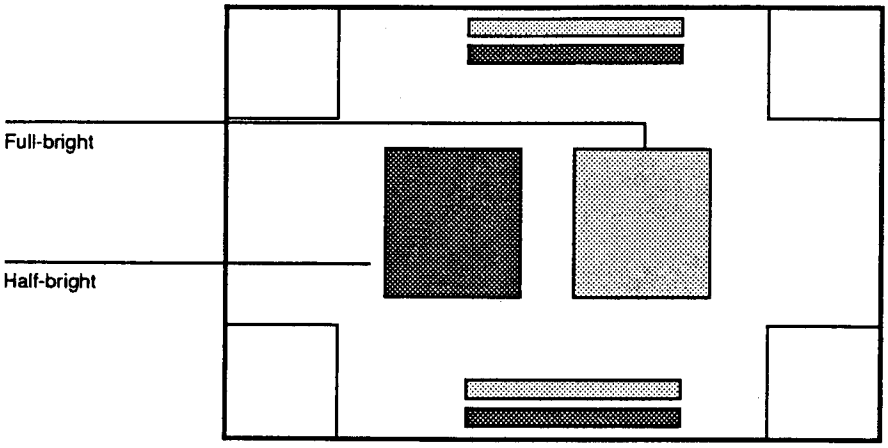


Figure 4-14. CRT Diagnostic Test Pattern

7. Verify that the CRT video signals (Half-bright, Full-bright) are similar to *Figures 4-15* and *4-16*.

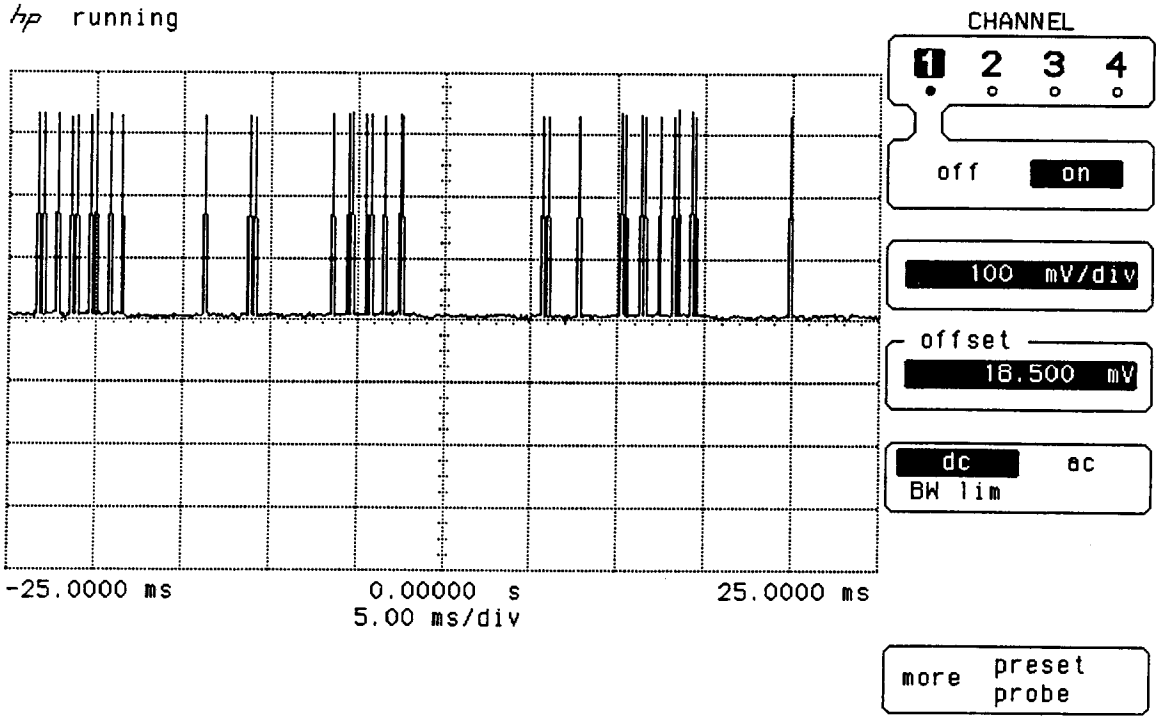


Figure 4-15. Half-Bright Video Signal (With CRT Diagnostic Running)

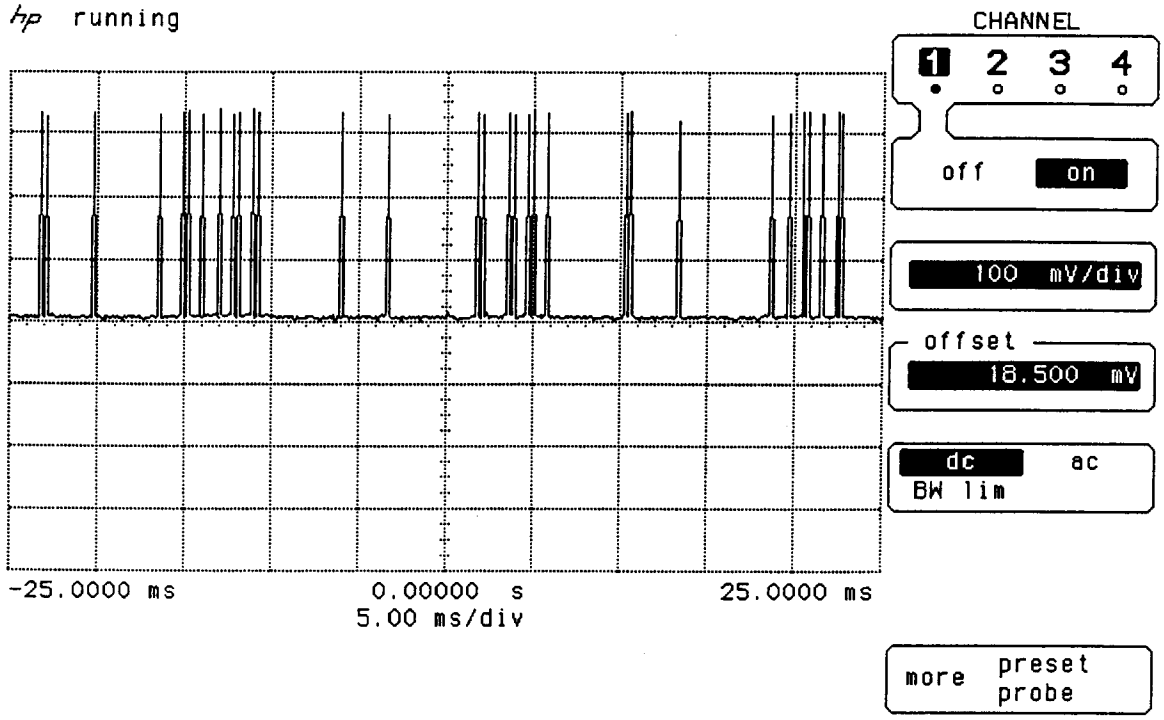


Figure 4-16. Full-Bright Video Signal (With CRT Diagnostic Running)

8. Verify that the CRT sync signals (Horizonal Sync, Vertical Sync) which are generated by A3 CPU Assembly are similar to *Figures 4-17* and *4-18*.

Hint: Half-bright and full-bright video signals will vary in appearance depending on what is being presented to display. Scope picture shown is representative of what it should look like, especially in amplititude with CRT diagnostic running. The horizontal and vertical sync signals are repetitive in nature and should closely match the scope pictures shown.

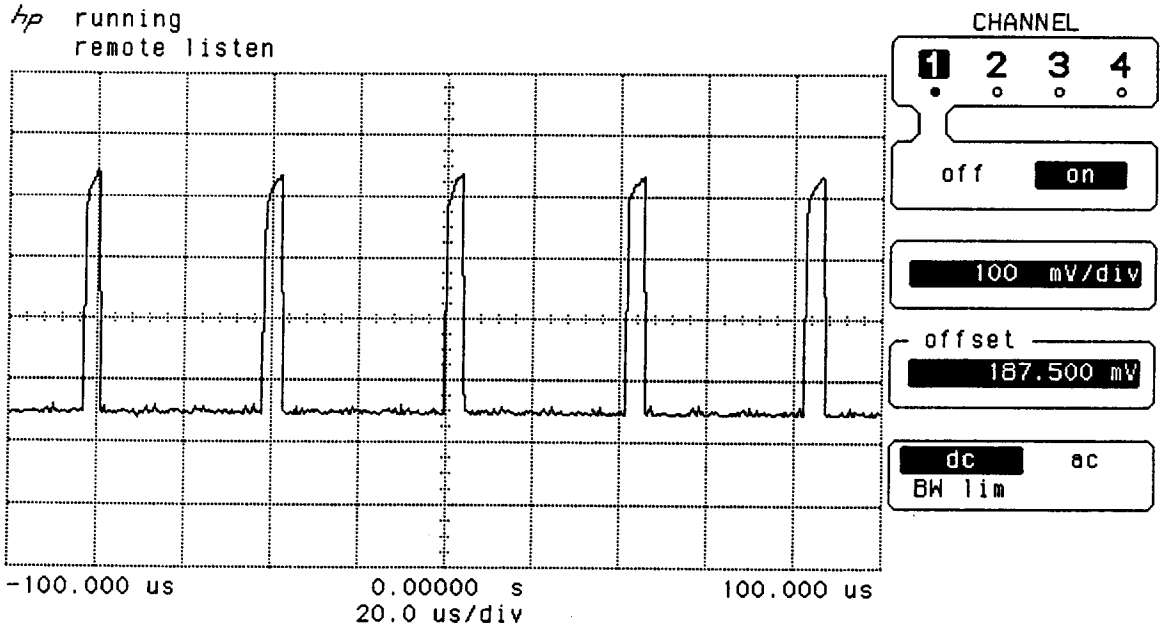


Figure 4-17. Horizontal Sync Signal (Frequency is 24.1 kHz)

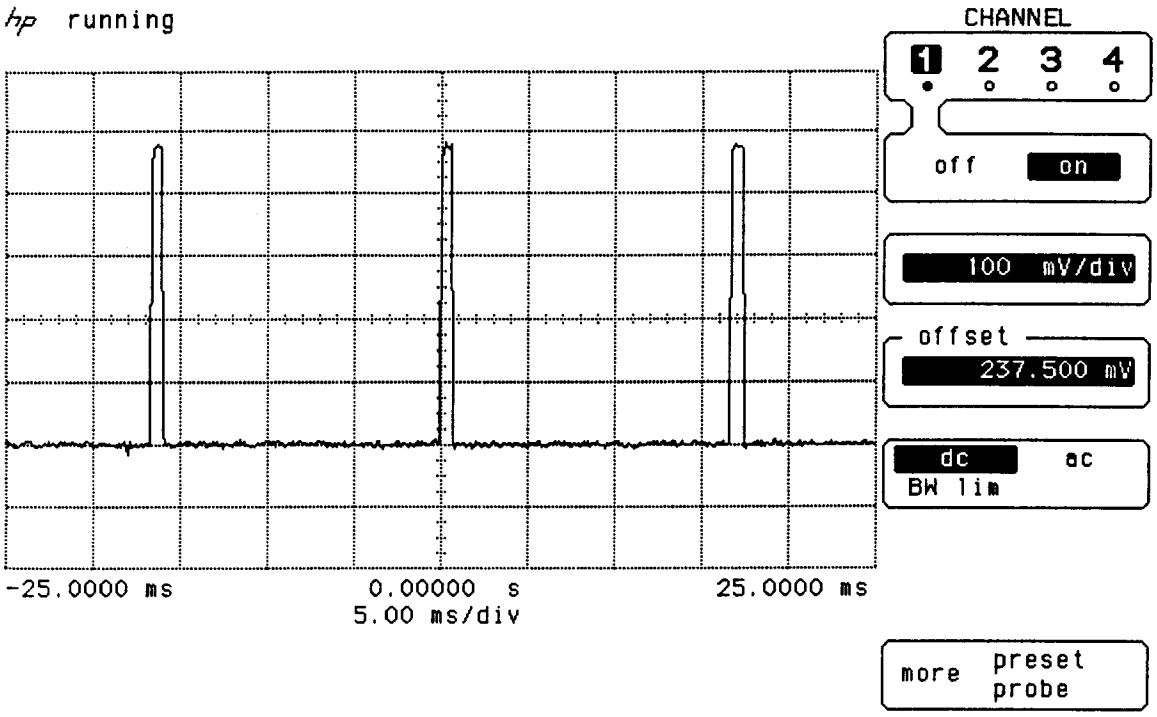


Figure 4-18. Vertical Sync Signal (Frequency is 60 Hz)

9. Press **exit menu** softkey to exit SELF TEST MENU.

H Waveforms correct?

No? Go to box K.

Yes? Continue to box I.

I Check the waveforms at the end of the cable where it plugs into A6 CRT Driver Board. See *Figure 4-12* for connector pin locations.

If waveforms are not okay at this end of cable, replace cable W13.

If waveforms are okay, press any key to exit the CRT diagnostic mode.

J Replace A6 CRT Monitor Assembly. both CRT and driver board are replaced as matched assemblies.

After replacing A6 CRT Monitor Assembly, you must perform the "To Adjust the CRT Monitor" procedure in Chapter 3 (Adjustments and Calibration).

K Isolate A3/A4/A5/A6/A12 (opt. 031) assemblies from A1 Main Board Assembly by performing the following:

1. Unplug and remove ribbon cable W3 (A1 to A7).
2. Unplug and remove ribbon cables W9/W10/W11.

CAUTION

BEFORE PERFORMING THE NEXT STEP, OBSERVE THE POLARITY OF TEST CABLE AT A7! RED wires of the cable go toward front of instrument, or toward the closed end of A7 Power Supply Assembly when the power supply is out of the instrument as shown in Figure 4-21.

3. Install Test Cable (53310-60213) between A7 Power Supply Assembly and A3 CPU Assembly, making sure the polarity of the cable is correct at the A7 power connector as shown in *Figure 4-21.* (The small connector end of the cable which plugs into A3 is keyed.)
4. Leave A6 CRT Monitor cable (W13) and A4 Keyboard cable (W12) plugged into A3 board as shown in *Figure 4-21.*

L Re-check signals at A3 test points (see step or box G).

M Signals correct?

No? Go to box P.

Yes? Continue to box N.

N Check cables W9/W10/W11 and replace cable(s) as necessary.

Try continuity testing, swapping cables, and close visual inspection.

O Replace A1 Main Board Assembly.

P Replace A3 CPU Assembly.

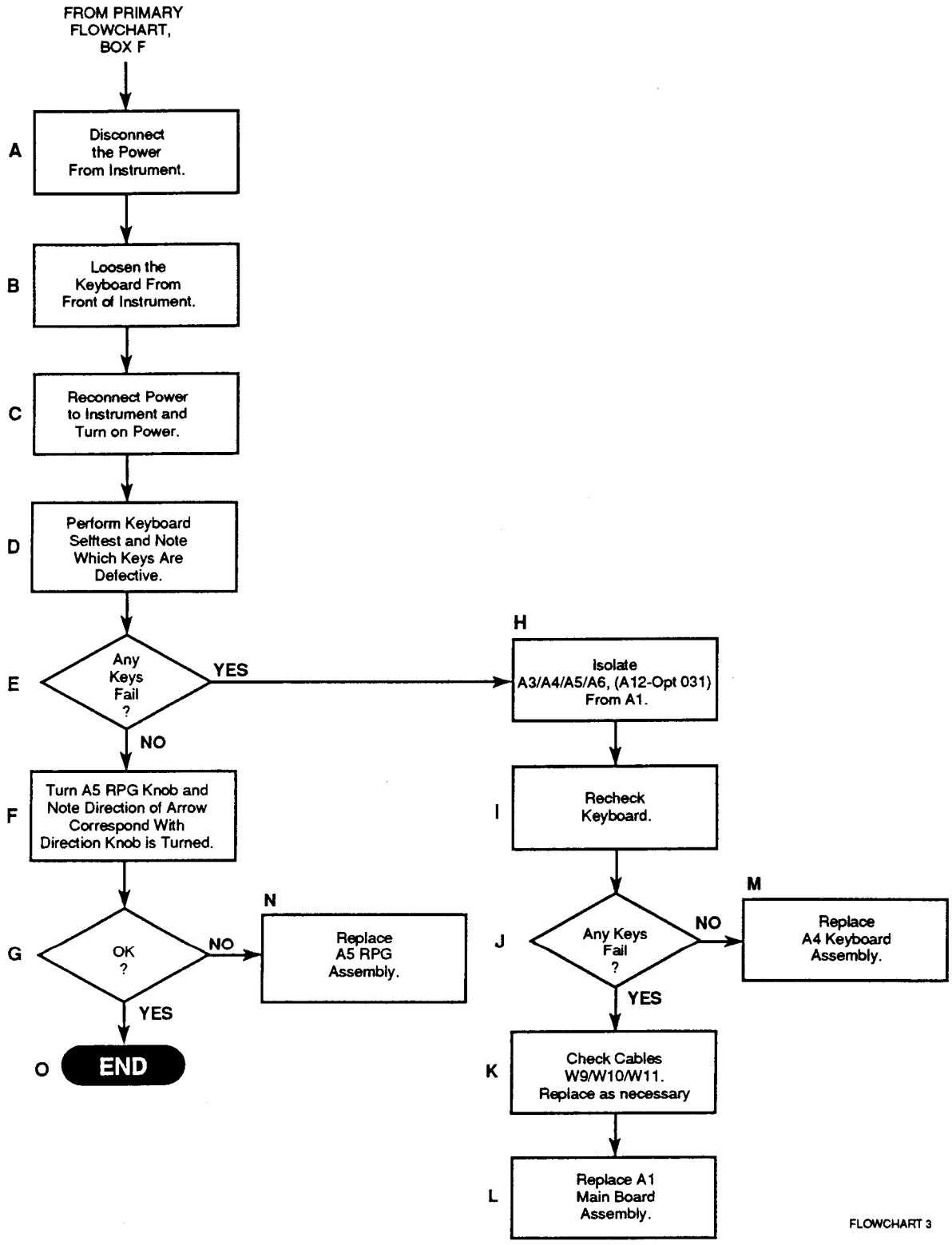


Figure 4-19. Flowchart 3

FLOWCHART 3 DETAILS

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs or A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at the A4 Keyboard Assembly/A5 RPG Assembly isolation. It begins with output from Primary Flowchart, box F. (More specifically, isolation is performed on the elastomeric keypad, printed-circuit keyboard, and the Rotary Pulse Generator, RPG.)

A Disconnect the power cord from the HP 53310A.

B Without disconnecting the keyboard cable (W12), follow the keyboard removal procedure to loosen the keyboard.

See "To Remove the Keyboard Assembly" in Chapter 5 (Replacing Assemblies) for the disassembly and reassembly procedures. As shown in *Figure 8-1* (Chapter 8), leave the keyboard in front of the instrument for the remaining steps.

C Reconnect the power cord to the HP 53310A, and turn on the power.

D Perform the keyboard selftest and note which keys are defective by performing the following:

1. Press **Utility** hardkey.
2. Press **SELF TEST MENU** softkey.
3. Press the top softkey key until **Misc** is highlighted.
4. Press the second softkey until **Keybd** is highlighted.
5. Press **Start Test** softkey and observe that a replica of the keyboard is displayed on the screen.
6. Press any front-panel key and notice that the corresponding square on the screen for that key turns blank.
7. Press the remainder of the front-panel keys and notice that each corresponding square turns blank.

If you press a key and the corresponding square does not go blank, the key is probably defective, but continue to perform the remaining steps of this troubleshooting procedure to verify defective keyboard.

E Any keys fail?

No? Go to box F.

Yes? Go to box H.

F Turn A5 RPG Knob and notice that an arrow appears illustrating which way the knob is turning.

If the arrow turns the same directions as the knob, then the knob is functioning correctly.

NOTE

Press the **Stop/Single** *hardkey three times as indicated in the replica keyboard on the screen to STOP or EXIT the keyboard selftest.*

G RPG operating properly?

No? Go to box N.

Yes? Go to box O.

H Isolate A3/A4/A5/A6/A12 (Opt. 031) assemblies from A1 Main Board Assembly by performing the following:

1. Unplug and remove ribbon cable W3 (A1 to A7).
2. Unplug and remove ribbon cables W9/W10/W11.

CAUTION

BEFORE PERFORMING THE NEXT STEP, OBSERVE THE POLARITY OF TEST CABLE AT A7! RED wires of the cable go toward front of instrument, or toward the closed end of A7 Power Supply Assembly when the power supply is out of the instrument as shown in Figure 4-21.

3. Install Test Cable (53310-60213) between A7 Power Supply Assembly and A3 CPU Assembly, making sure the polarity of the cable is correct at the A7 power connector as shown in *Figure 4-21*. (The small connector end of the cable which plugs into A3 is keyed.)
4. Leave A6 CRT Monitor cable (W13) and A4 Keyboard cable (W12) plugged into A3 board as shown in *Figure 4-21*.

I Recheck keyboard by performing procedure described in step or box D.

J Any keys fail?

No? Go to box M.

Yes? Continued to box K.

K Check out ribbon cables W9/W10/W11 (CPU buses) and replace as needed.

Try continuity testing, swapping cables, and close visual inspection.

L Replace A1 Main Board Assembly.

M Replace A4 Keyboard Assembly.

N Replace A5 RPG Assembly.

O End. The A4 Keyboard and A5 RPG assemblies should be fully functional at this point.

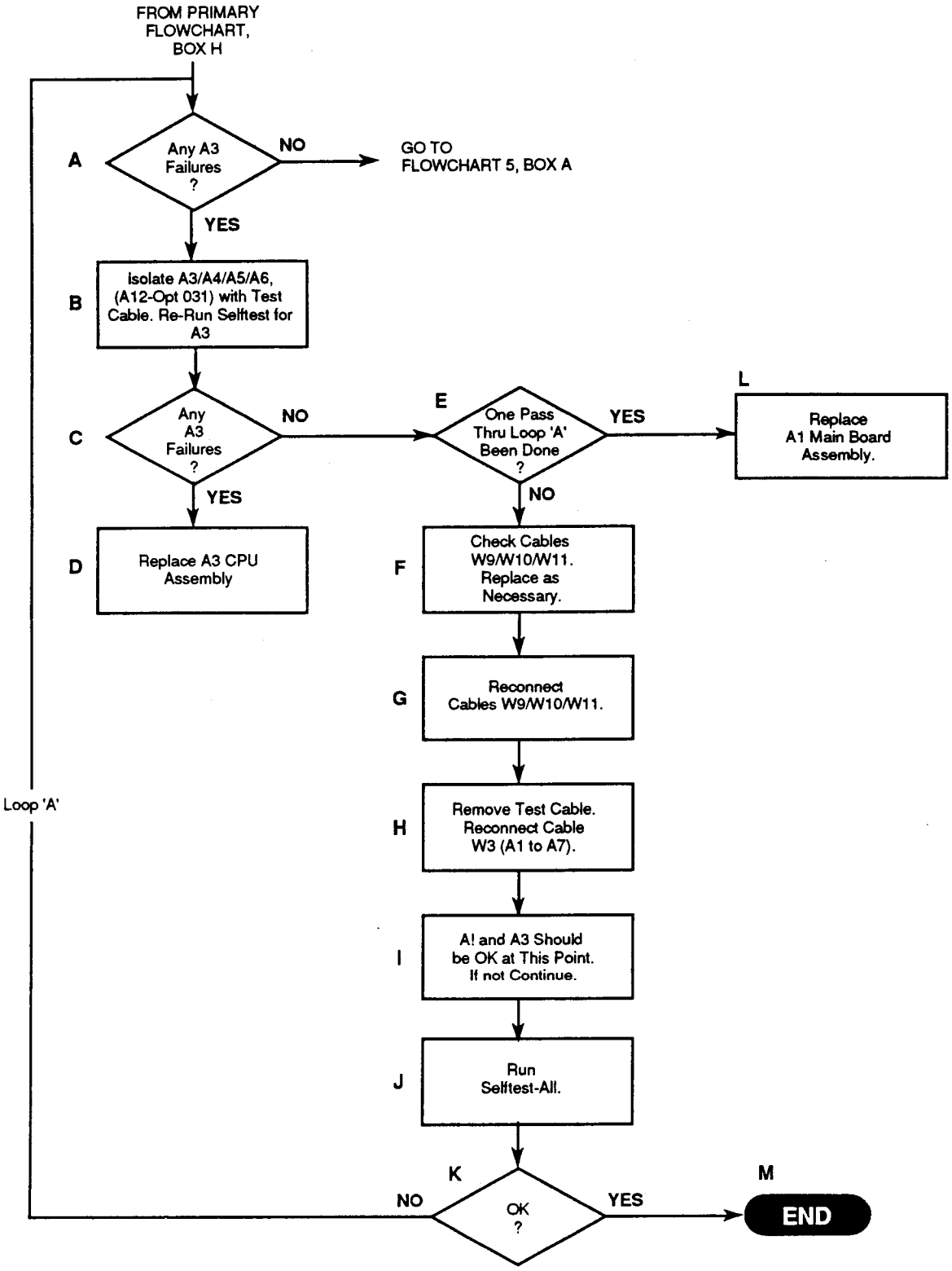


Figure 4-20. Flowchart 4

FLOWCHART 4 DETAILS

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at the A1 Main Board Assembly/A3 CPU Assembly isolation. It begins with output from Primary Flowchart, box H, where an A1 and/or A3 test in the SELFTEST-ALL diagnostic DID fail.

A Any A3 CPU Assembly failures?

No? Go to Flowchart 5, box A. See *Figure 4-22.*

Yes? Continue to box B.

Hint: These tests run in order of importance. A3 CPU is running the instrument, and if it has problems, other failures may occur as well. Also, failures on A1 Main Board may look like A3 failures. The next steps isolate these failures.

B Isolate A1 Main Board Assembly from A3 CPU Assembly by performing the following:

1. Unplug and remove ribbon cable W3 (A1 to A7).
2. Unplug and remove ribbon cables W9/W10/W11.

CAUTION

BEFORE PERFORMING THE NEXT STEP, OBSERVE THE POLARITY OF TEST CABLE AT A7! RED wires of the cable go toward front of instrument, or toward the closed end of A7 Power Supply Assembly when the power supply is out of the instrument as shown in Figure 4-21.

3. Install Test Cable (53310-60213) between A7 Power Supply Assembly and A3 CPU Assembly, making sure the polarity of the cable is correct at the A7 power connector as shown in *Figure 4-21.* (The small connector end of the cable which plugs into A3 is keyed.)

NOTE

When A7 Power Supply Assembly is operating outside of the instrument, use an external fan to cool the power supply. This avoids activating the thermal shutdown circuitry in the power supply. However, the supply may operate for several hours without shut down if no forced cooling is provided, depending on the enviromental temperature.

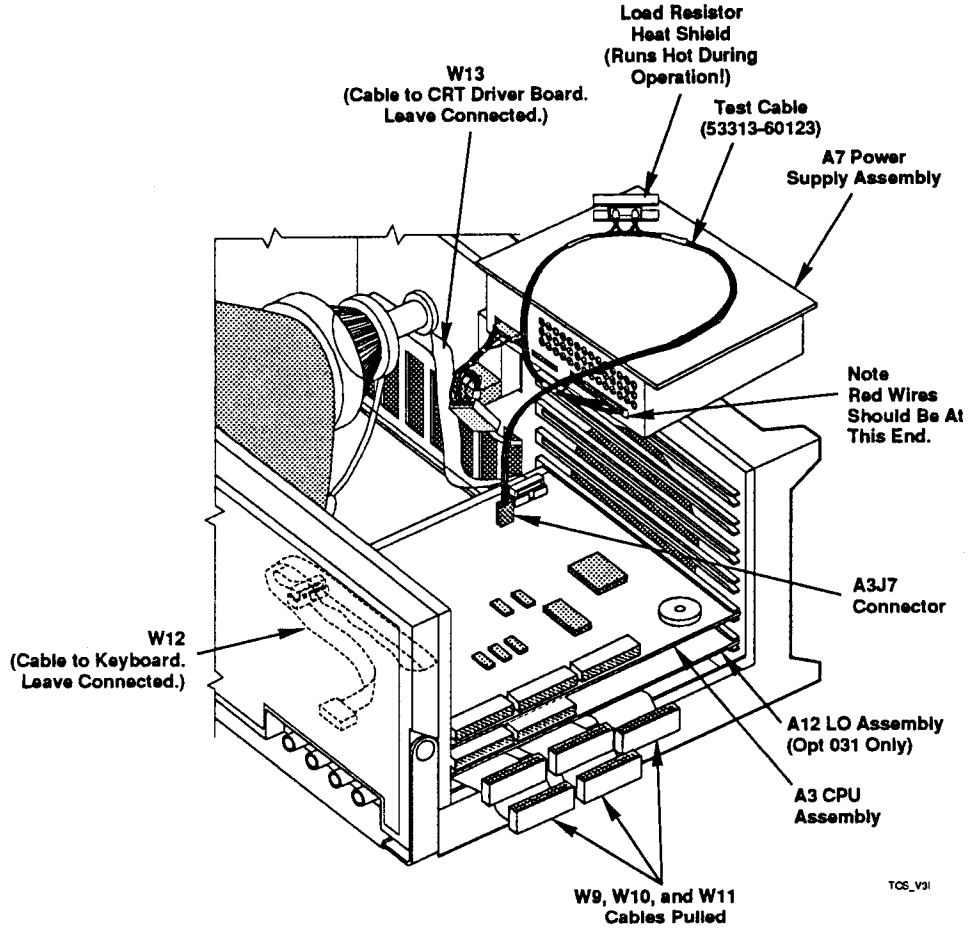


Figure 4-21. Test Cable Setup to Isolate A1 and A3 Assemblies

4. Leave A6 CRT Monitor cable (W13) and A4 Keyboard cable (W12) plugged into A3 board as shown in *Figure 4-21.*
5. Run A3 test diagnostics by performing the following:
   a. Press **Utility** hardkey.
   b. Press **SELF TEST MENU** softkey.
   c. Press the top softkey key until **A3** is highlighted. Observe that the second softkey indicate five circuit tests of A3 CPU Assembly: Dtack, Eprom, Sram, Dram, Vvram, and Timer.

d. Press the second softkey until **DTACK** is highlighted.

e. Press **Start Test** softkey and observe all tests pass.

f. Press the second softkey until **EPROM** is highlighted.

g. Press **Start Test** softkey and observe all tests pass.

h. Press the second softkey until **SRAM** is highlighted.

i. Press **Start Test** softkey and observe all tests pass.

j. Press the second softkey until **DRAM** is highlighted.

k. Press **Start Test** softkey and observe all tests pass.

l. Press the second softkey until **NVRAM** is highlighted.

m. Press **Start Test** softkey and observe all tests pass.

n. Press the second softkey until **TIMER** is highlighted.

o. Press **Start Test** softkey and observe that all tests pass after "Timer" bar on the left side of the display (the bar goes away after completion of the Timer circuit test).

6. Press **exit menu** softkey to exit SELF TEST MENU.

C Any A3 failures?

Yes? Continue to box D.

No? Go to box E.

D Replace A3 CPU Assembly.

E One pass through Loop A been done?

Yes? Go to box L.

No? Go to box F.

Hint: If there are no A3 failures when isolated from A1, A1 or the ribbon cables may have problems. The plan is to check cables first and re-run the self tests in the next steps as portrayed by Loop A.

If one pass through Loop A does not resolve the problem elsewhere, the A1 Main Assembly has a fault.

F Check out ribbon cables W9/W10/W11 (CPU buses) and replace as needed.

Try continuity testing, swapping cables, and close visual inspection.

G Reconnect A3 CPU Assembly to A1 Main Board Assembly via the ribbon cables.

H Remove the Test Cable, and reconnect A1 Main Board Assembly to A7 Power Supply Assembly via cable W3.

I A1 and A3 should be fully functional at this point.

J Run Self Test-ALL.

K All tests pass?

Yes? Go to box M.

No? Go to box A.

L Replace A1 Main Board Assembly.

M End. The A1 Main Board and A3 CPU assemblies should be fully functional at this point.

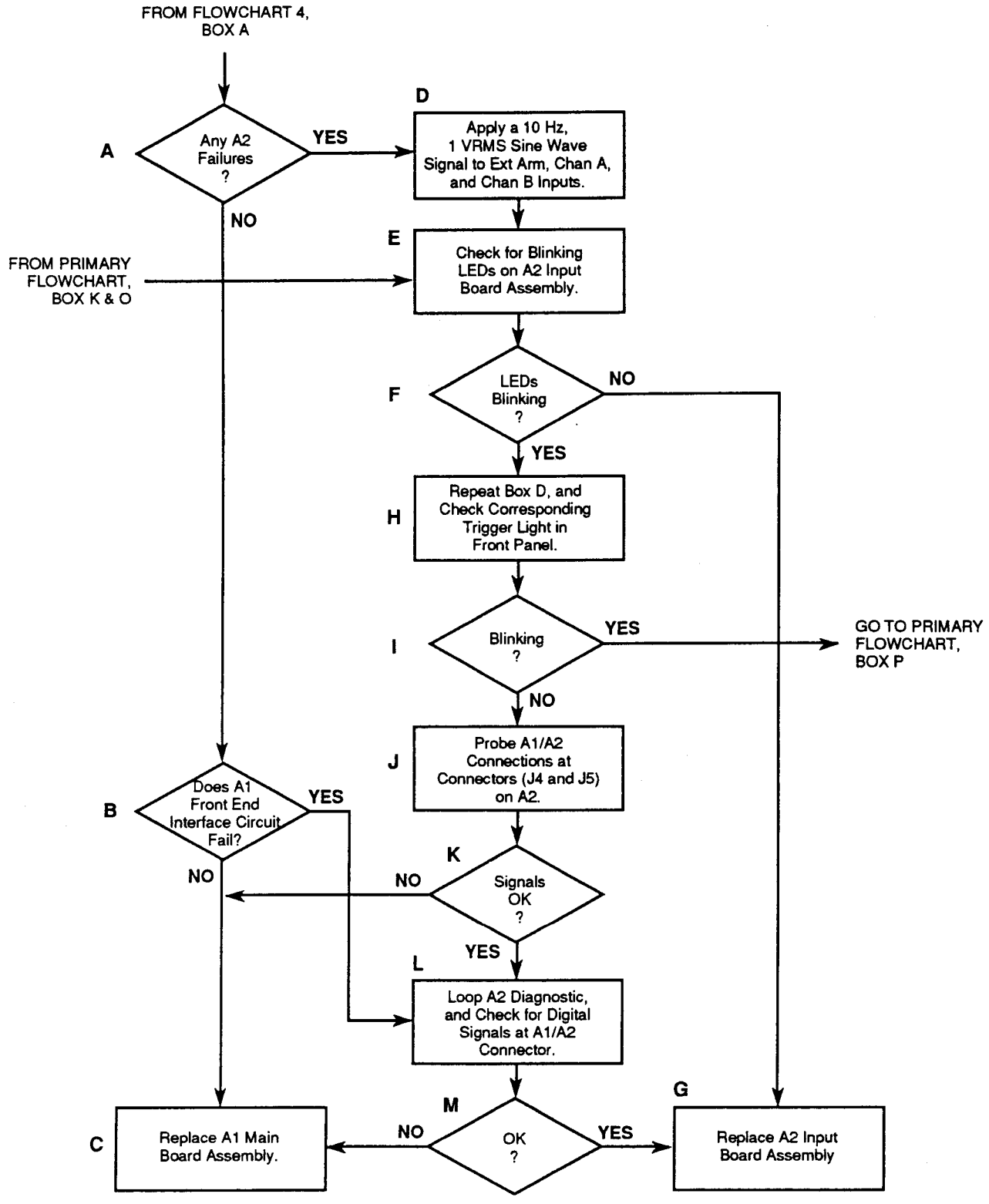


Figure 4-22. Flowchart 5

FLOWCHART 5 DETAILS

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at the A3 CPU Assembly/A1 Main Board Assembly and A2 Input Board Assembly/A1 Main Board Assembly interconnects. It begins with output from Flowchart 4, box A, where no A1 AND A3 failures have occurred after running the SELFTEST-ALL.

CAUTION

If option 031 is installed, the A12 LO assembly must be removed to permit the following checks. DO NOT let the A12 interconnect coaxial-cable heads contact the surface of the A1 Main Board Assembly! These connector shells are at chassis ground and will cause short circuits if care is not used.

A Any A2 Input Board Assemby failures?

Yes? Go to box E.

No? Go to box B.

B Does A1 Front End Interface circuit fail? (Observe SELFTEST-ALL screen.)

This is the last selftest under the A1 board test in the SELFTEST-ALL menu as shown in *Figure 4-3*.

Yes? Go to box D.

No? Go to box C.

Hint: If the A1 Front End Interface fails, the problem may be caused by A2 Input Board Assembly.

C Replace A1 Main Board Assembly.

D **Apply a 10 Hz, 1 Vrms (2.8 Vp-p) sine wave signal to the instrument input channels (Ext Arm, Chan A, and Chan B) and check the A2 Input Board LEDs.**

Using the Power Supply Extender Cable (53310-60217), set up instrument as shown in *Figure 4-23* for testing the A2 Input Board Assembly. This test setup makes LEDs DS4, DS5, and DS6 viewable.

CAUTION

Ensure that the cable polarity is correct by orienting the red lead on the connector (to pin 1 on A1), toward the closed end of the A7 power supply.

Hint: An input of 10 Hz, 1 Vrms will cause the LEDs (DS4 - DS6) on A2 to blink slowly, making it easy to check A2 input processing circuits.

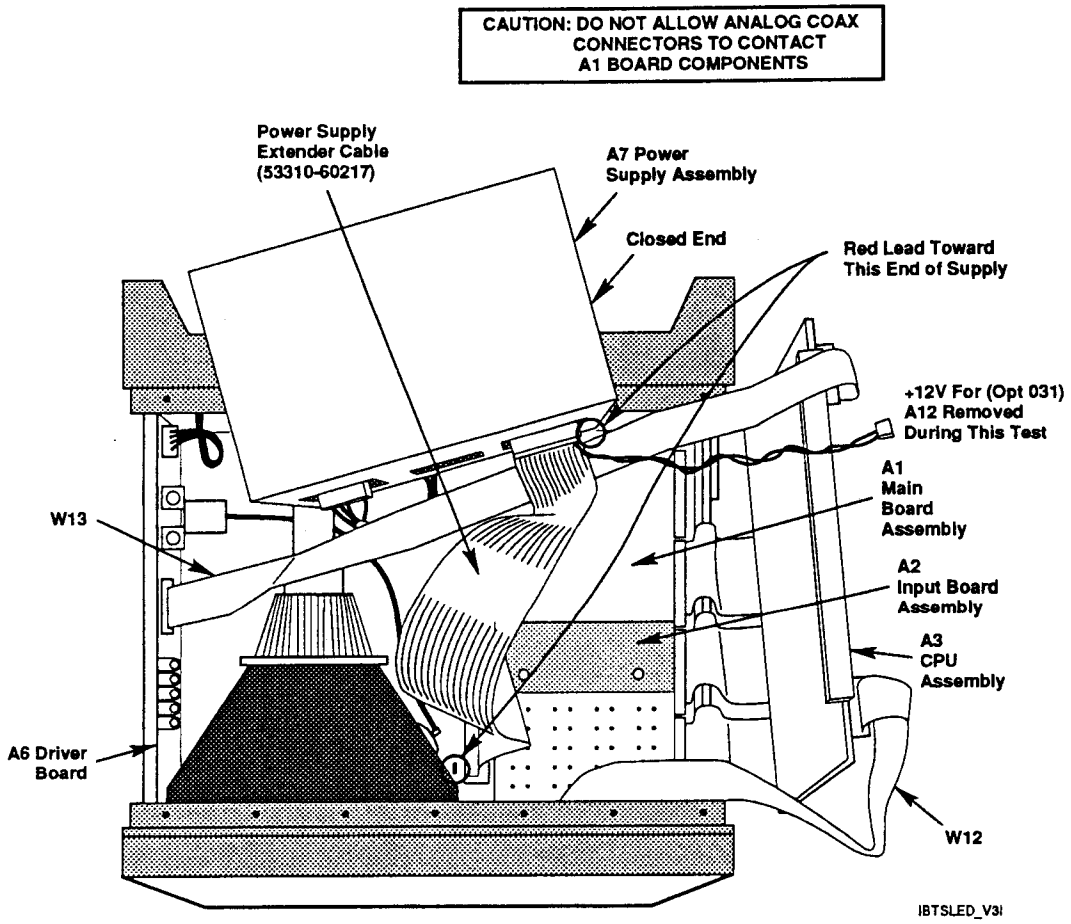


Figure 4-23. A2 Input Board Test Setup for Checking Trigger LEDS (DS4 - DS6)

NOTE

When A7 Power Supply Assembly is operating outside of the instrument, use an external fan to cool the power supply. This avoids activating the thermal shutdown circuitry in the power supply. However, the supply may operate for several hours without shut down if no forced cooling is provided, depending on the enviromental temperature.

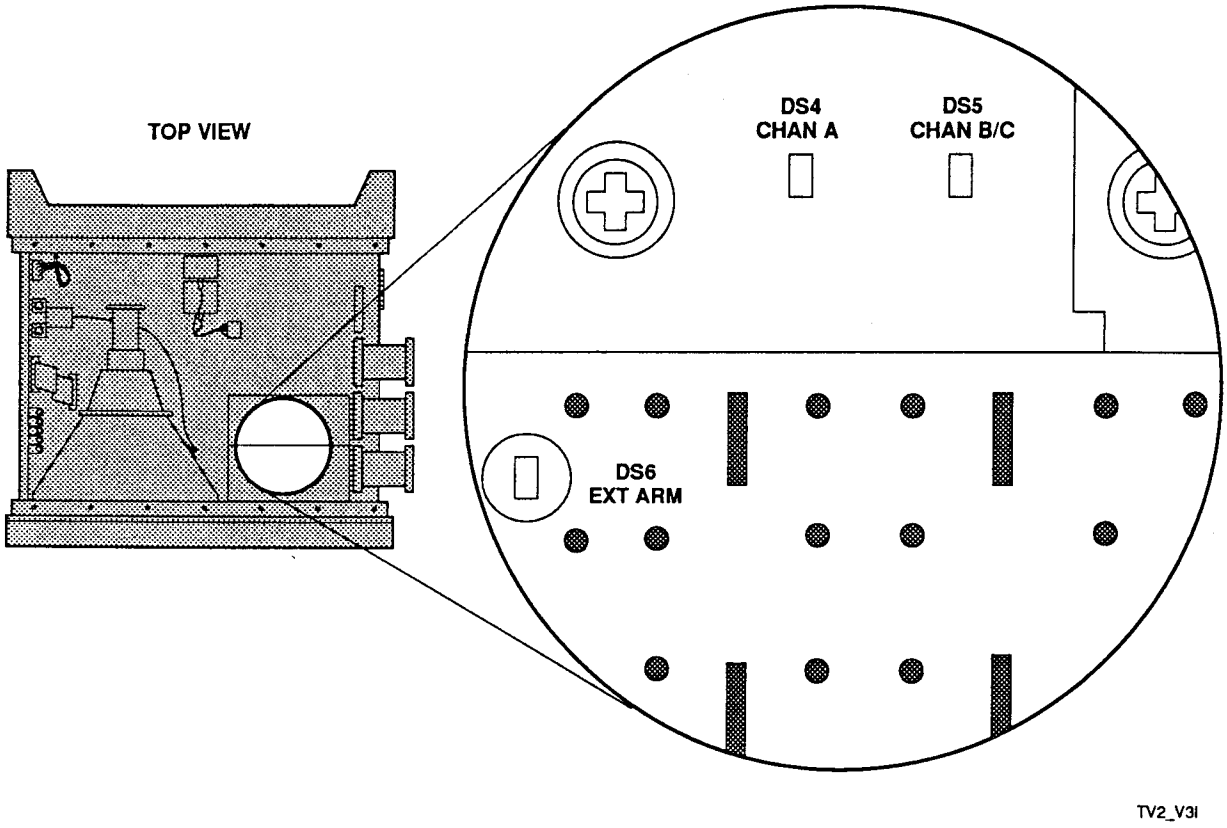


Figure 4-24. A2 Input Board Trigger LEDs

E Apply 10 Hz input to Ext Arm and observe DS6 on the board. See *Figure 4-24*. Apply 10 Hz input to Chan A and observe DS4 on the board. See *Figure 4-24*. Apply 10 Hz input to Chan B and observe DS5 on the board. See *Figure 4-24* (DS5 is also used for Chan C, if installed).

F LEDs show activity (are they blinking)?

No? Go to Box G.

Yes? Go to box H.

Hint: LED activity here indicates that A2 Input Board Assembly is at least processing the input and sending it on to A1 Main Board Assembly for processing.

G Replace A2 Input Board Assembly.

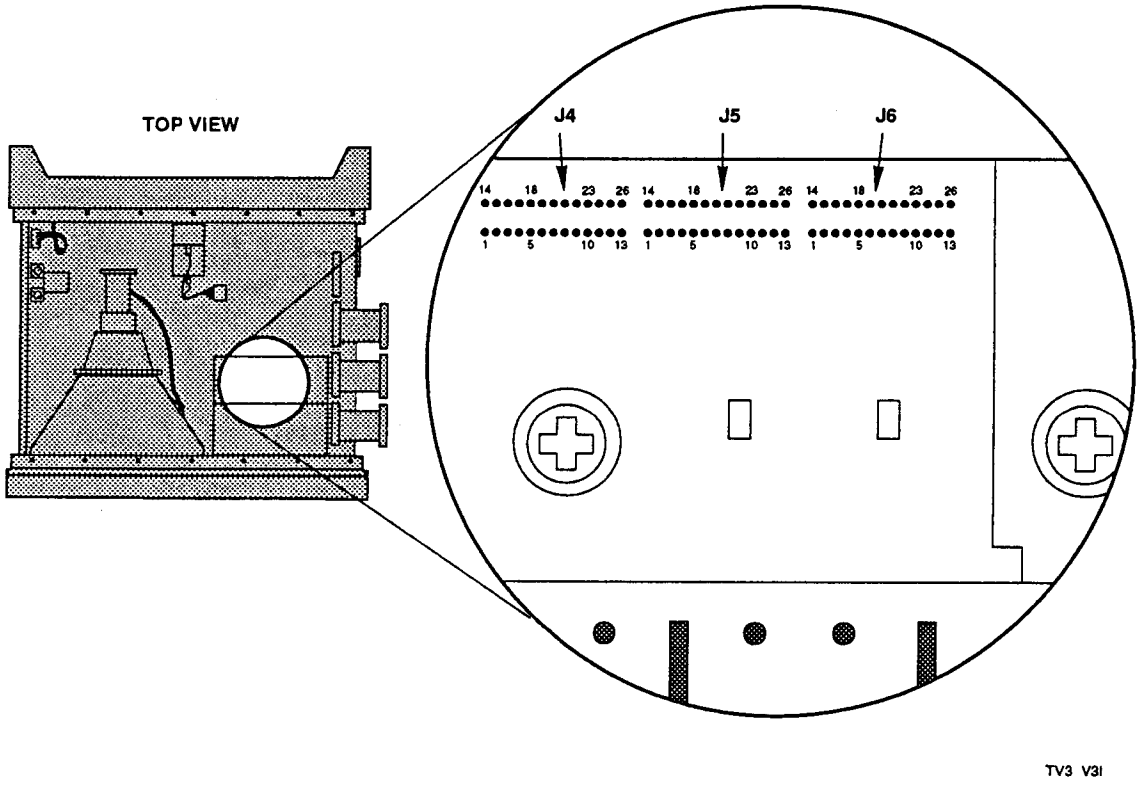


Figure 4-25. A2 / A1 Connector Locations on A2 Input Board Assembly (J4,J5,J6)

H Repeat action in box D, but now observe the corresponding trigger lights in the front panel.

Hint: An input signal gets processed by the A2 circuits and then is sent to the A1 board. The A1 board in turn senses this input and sends a signal to the A2 board to cause the trigger light to flash. Thus, the ability of the instrument to sense an input and flash the trigger light means that the signal-path circuits between A1 and A2 are probably okay. (The above is true as long as the input level is above the minimum sensitivity specification of the instrument, and the voltage threshold is set below the input level — in this check, below 1 Vrms (2.8 Vp-p.)

If the LEDs on the A2 Input Board Assembly work, but the trigger lights in the front panel do not, probing the connector between the two boards will isolates which board is at fault. This will be performed in the following steps. Also, the digital control signals may be at fault. These will also be checked.

I Trigger lights showing activity (blinking)?

Chan B and C share same LED trigger light. The input channel being used drives the trigger light.

No? Go to box J.

Yes? Return to Primary Flowchart, box P.

J Probe A2 connector J4, checking for trigger light blinking voltages coming from the A1 Main Board Assembly.

Check the connector pins that match the input channel being tested. *Figure 4-25* shows where connector J4 is located on the A2 Input Board Assembly.

J4 pin 10 (TRIGGER LIGHT EXT ARM) should indicate activity.
J4 pin 11 (TRIGGER LIGHT CH2) should indicate activity.
J4 pin 12 (TA) should indicate activity.
J4 pin 24 (TRIGGER LIGHT CH1) should indicate activity.

K Correct signals or voltages present?

Yes? Go to box L.

No? Go to box C.

L Loop A2 diagnostic by performing the following:

1. Disconnect all inputs to the instrument.
2. Press **Utility** hardkey.
3. Press **SELF TEST MENU** softkey.
4. Press the top softkey until **A2** is highlighted.
5. Press **Loop** softkey until **On** is highlighted.
6. Press **Start Test** softkey.

7. Observe that the total count of the loops is indicated in the upper right side of the display, indicating that A2 diagnostic is being looped.

   Now, probe the data line connections at the A1/A2 connection (or connectors J4, J5, and J6 of A2). Refer to *Figures 4-25* and *4-26* as needed. Use an oscilloscope or logic probe to check activity and levels of the pins indicated below:

   Using the pinout diagram in *Figure 4-26*, verify that J6 pins 1 - 4 and pins 14 - 17 (BD0 - BD7) are toggling. These signals are TTL levels.

   J6 pins 1 - 4 (BD0-BD3) and pins 14 - 17 (BD4-BD7) should indicate activity.

J6 pins 9 - 13 (BA1-BA5) should indicate activity.
J6 pin 7 (LBLRS — read strobe) should indicate activity.
J6 pin 20 (LBSNLWS — write strobe) should indicate activity.
J6 pin 22 (LRESETA) should be a TTL high.
J6 pin 23 (LMSELECT) should indicate activity.

J5 pins 2 and 3 (XA+, XA– — Ext Arm).
J5 pins 5 and 6 (AA+, AA– — Chan A).
J5 pins 8 and 9 (BA–, BA+ — Chan B).

1. Press **STOP TEST** when you are ready to stop the test. Then, press **exit menu** softkey to exit the diagnostic.

M Signals or voltages at connectors J4 - J6 correct?

Yes? Go to box G.

No? Go to box C.

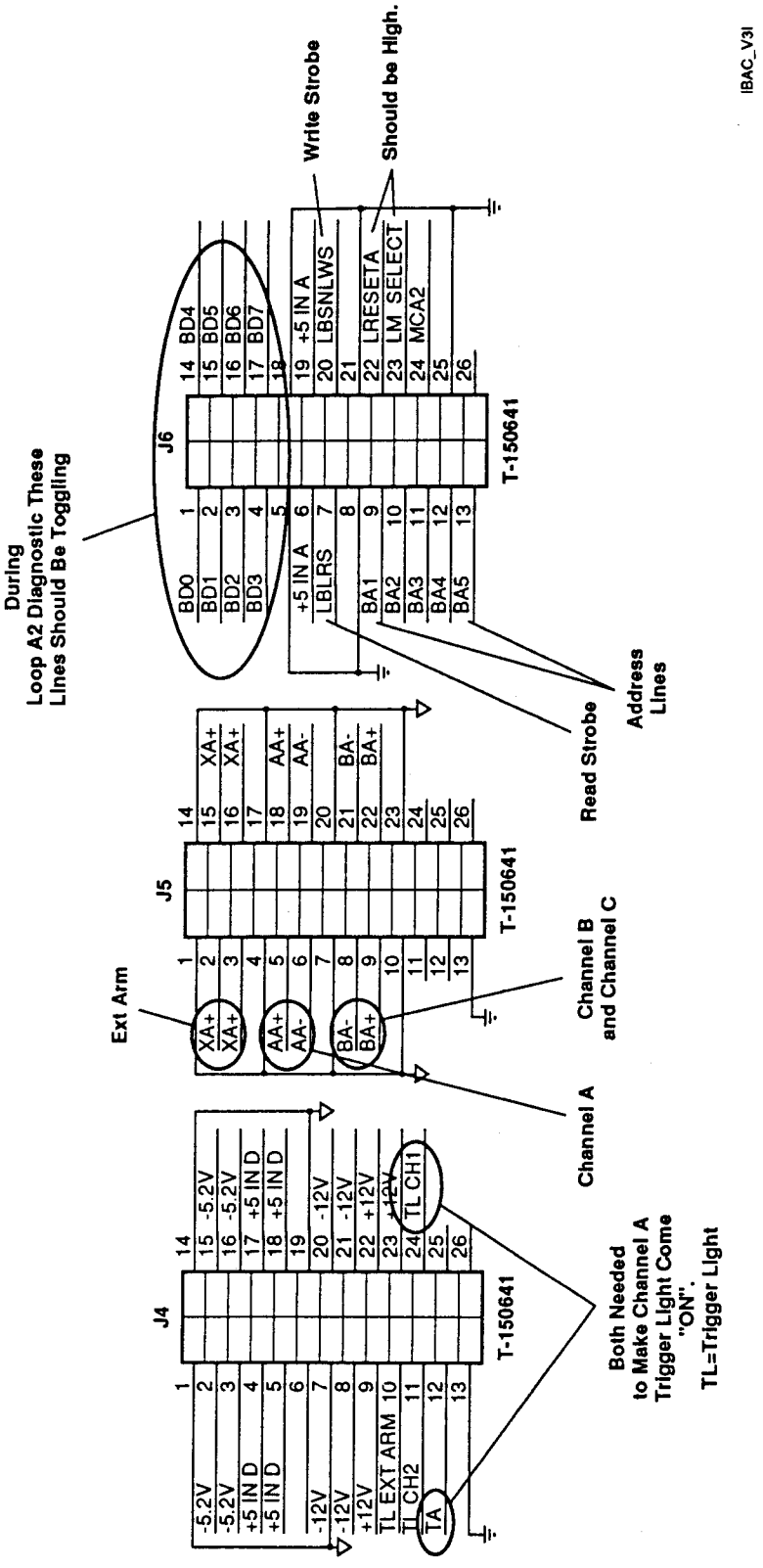


Figure 4-26. A2 Input Board Assembly Connectors (J4,J5, J6) Pinout Diagram

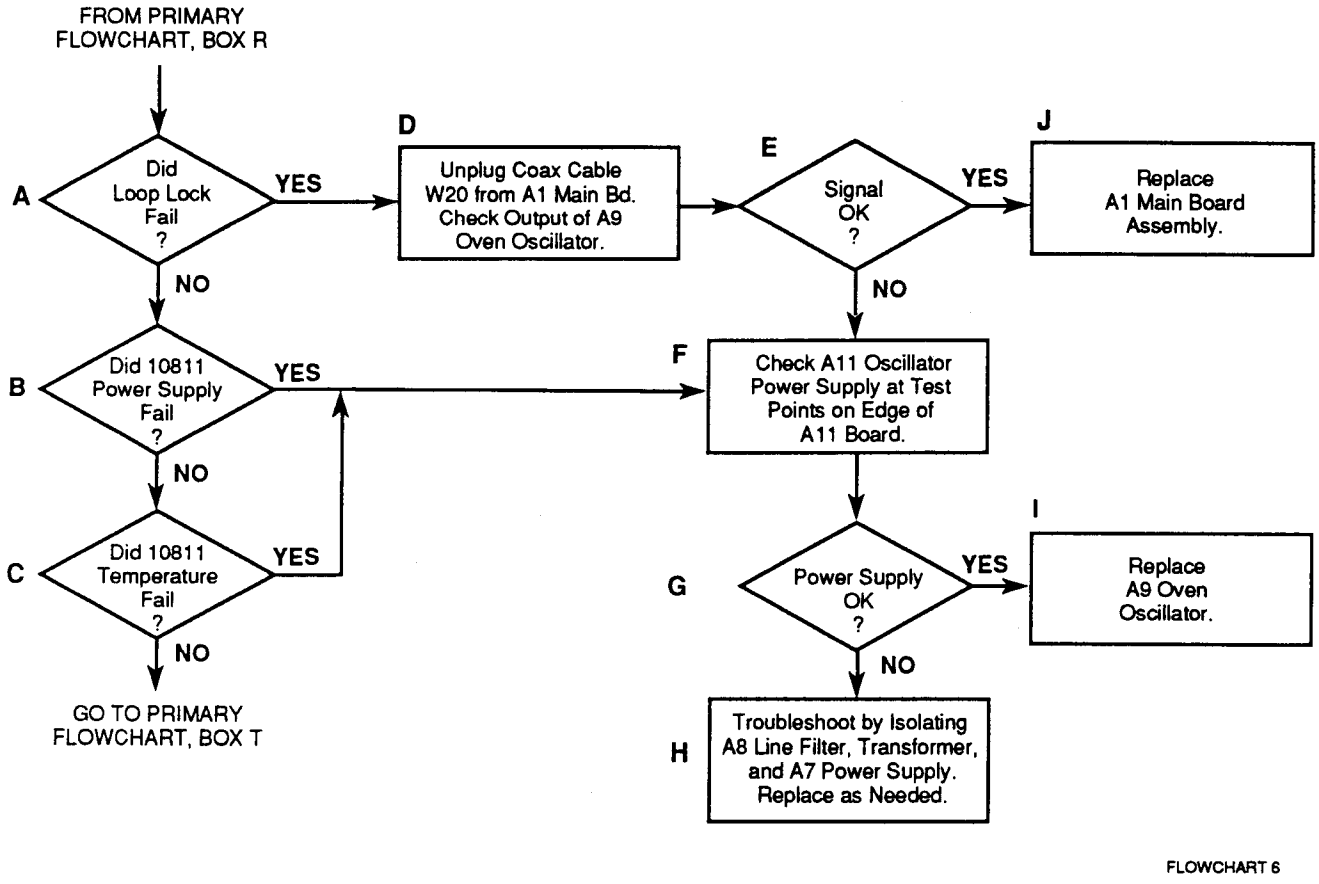


Figure 4-27. Flowchart 6

FLOWCHART 6 DETAILS

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at the Option 010 timebase circuits (i.e., A9 Oven Oscillator, A10 Oscillator printed-circuit board, and A11 Oscillator Power Supply) which are installed on the rear panel assembly. This section begins with output from Primary Flowchart, box R, where a test or tests failed during the Option 010 Reference Oscillator selftest or diagnostic.

A Selftest show a Looplock failure?

Yes? Go to box D.

No? Go to box B.

B Selftest show a 10811 power supply failure?

Yes? Go to box F.

No? Go to box C.

C Selftest show a 10811 oscillator temperature failure?

Yes? Go to box F.

No? Return to Primary Flowchart, box T. See *Figure 4-1.*

Hint: Allow oscillator oven 10 minutes to reach operating temperature from a cold start.

D Unplug coax cable W20 from A1 Main Board Assembly and check output of A9 Oven Oscillator.

To check the output of A9 Oven Oscillator, first perform following step which include safety precautions:

1. Remove power cord.

> ***CAUTION***
>
> ***Be careful around the CRT yoke and neck.***

2. Remove coaxial cable W20 from J22 (OPT 10811) Connector on the A1 Main Board Assembly. **Make sure the cable does not touch the A1 Main Board when power is applied to the instrument** as will be done in the next step.
3. Connect an oscilloscope with 50-ohm input impedance to cable W20.
4. Re-insert power cord and turn on the instrument. Observe a 10 MHz, 1.5 Vp-p signal.

   Hint: At this point, it may be easier to configure the rear panel assembly for troublehooting as described in the following steps. Accessibility will be much easier.

   When access to the Option 010 timebase circuits is needed, perform the following (The Option 010 timebase circuits are installed the rear panel assembly.):

   a. Remove the power cord

   b. Remove the rear panel assembly by performing removal procedure "To Remove the Option 010 Instrument Rear Panel" in Chapter 3 (Replacing Assemblies).

   c. Using a small bench vise, support the rear panel vertically for ease of troubleshooting as shown in *Figure 4-28*.

      Hint: The oscillator will now function as a stand-alone assembly. To actually get the oscillator to produce an output, two jumpers must be inserted into the plug of cable W8 which is normally installed into the A1 Main Board Assembly. These jumpers take the place of the jumper connections made by the A1 Main Board Assembly.

   d. Install these jumpers as shown in *Figure 4-29*. *Figure 4-30* is a complete wiring diagram of cable W8. Refer to it as needed.

   e. Re-insert power cord, and use an oscilloscope to observe a 10-MHz, 1.5V p-p signal out of W20.

   f. If the oscillator now operates, the problem may be on A1 Main Board Assembly.

      Since A1 provides "jumpers" for ground and +12V to the oscillator, check cable W8 against *Figure 4-30* before replacing A1.

   g. If temperature failure was seen, check pin 9 on the connector to A1 board. It should be 3.5V nominal after 10 minutes warm-up time. Note that this is not a TTL signal! When the oven is cold, voltage is between 20 and 30 volts.

   h. If pin 9 is not low, trace through cable W8 as shown in *Figure 4-30* for problem.

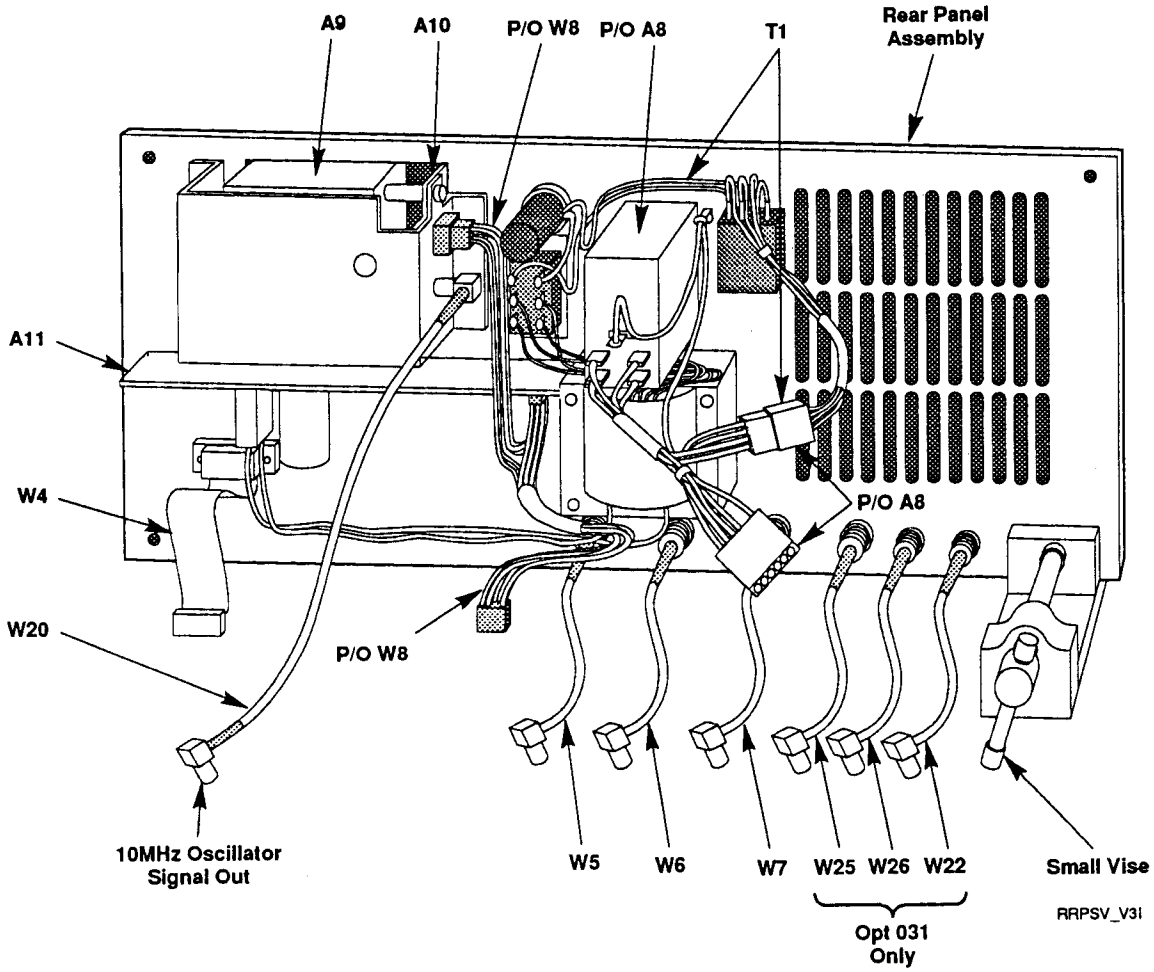


Figure 4-28. Removed Rear Panel Assembly in Small Vice

E Signal correct?

No? Go to box F.

Yes? Go to box J.

F Check A11 Oscillator Power Supply Assembly, at test points on edge of A11 board:

+12V OSC test point
+20-27V OSC OVEN test point.
Ground: use rear panel.

G Oscillator Power Supply voltages correct?

No? Go to box H.

Yes? Go to box I.

H Troubleshoot by isolating all parts of power supply oscillator circuit:

- A8 Line Filter Assembly — check output terminals for proper voltage.
- Transformer — check Oscillator Power Supply Assembly (A11) test points for proper voltage of approximately 30 volts.
- A7 Power Supply Assembly — if voltages at A7 test points are NOT correct and input voltage from transformer is correct, Replace A7 Power Supply Assembly.

I Replace A9 Oven Oscillator.

After replacing the A9 Oven Oscillator, you must perform the "TO ADJUST THE OPTION 010 OVEN OSCILLATOR TIMEBASE" procedure in Chapter 3 (Adjustments and Calibration).

J Replace A1 Main Board Assembly.

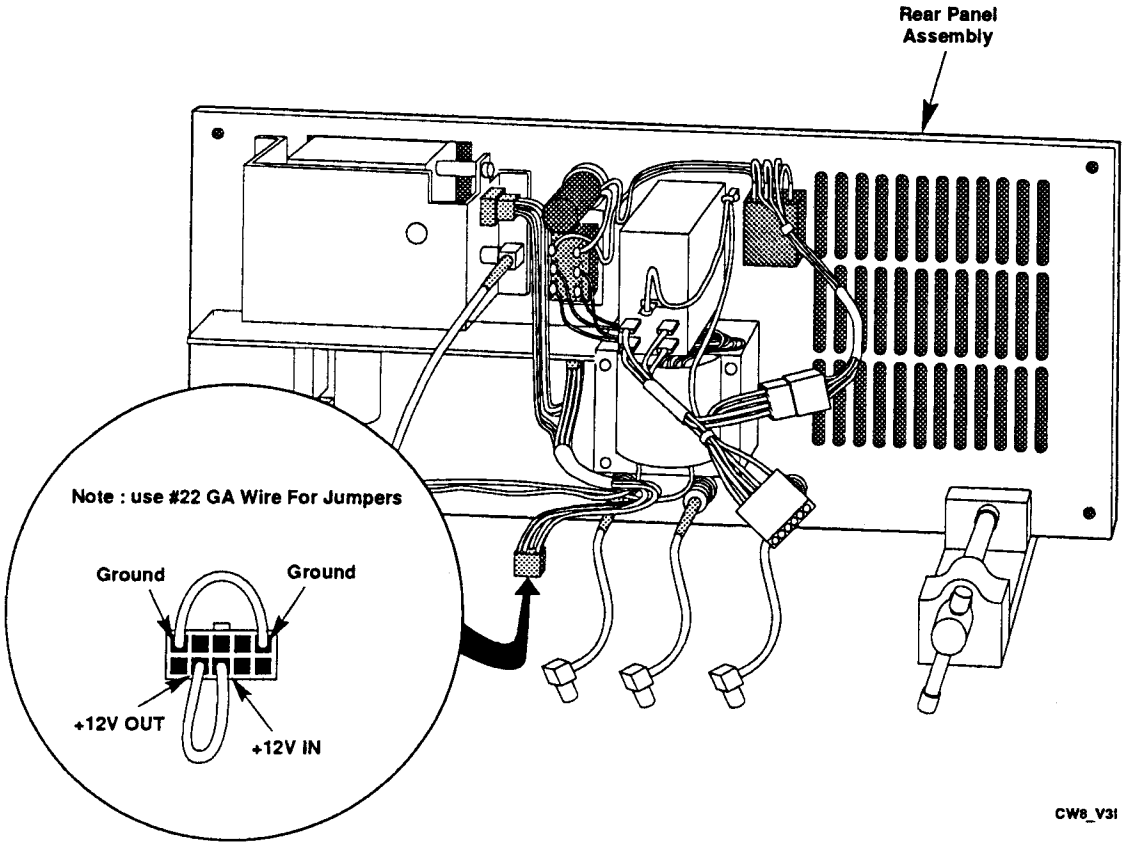


Figure 4-29. Cable W8 Oscillator Power Plug With Jumpers (Option 031 not shown)

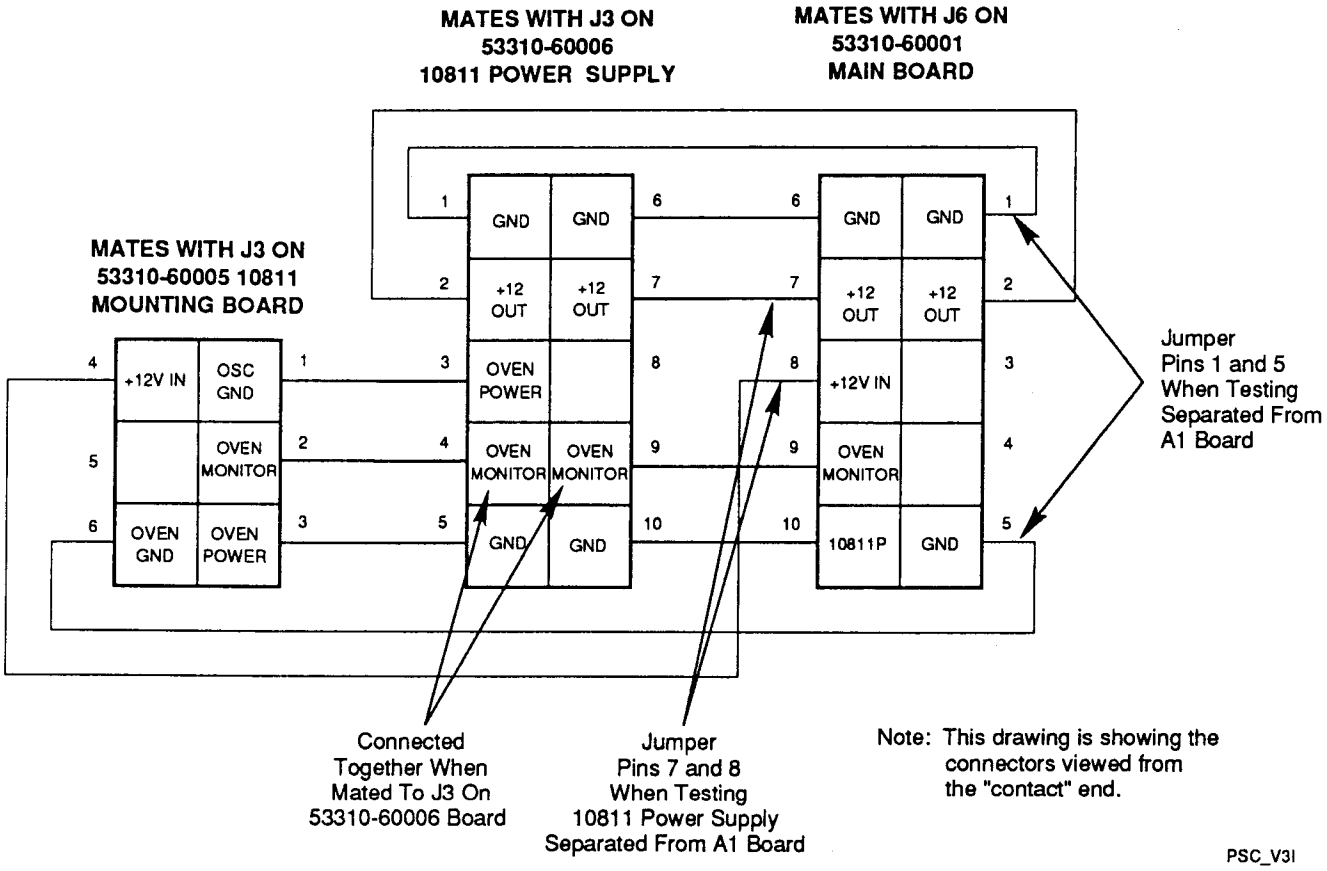


Figure 4-30. Option 010 Oven Oscillator Cable (W8) Wiring Diagram

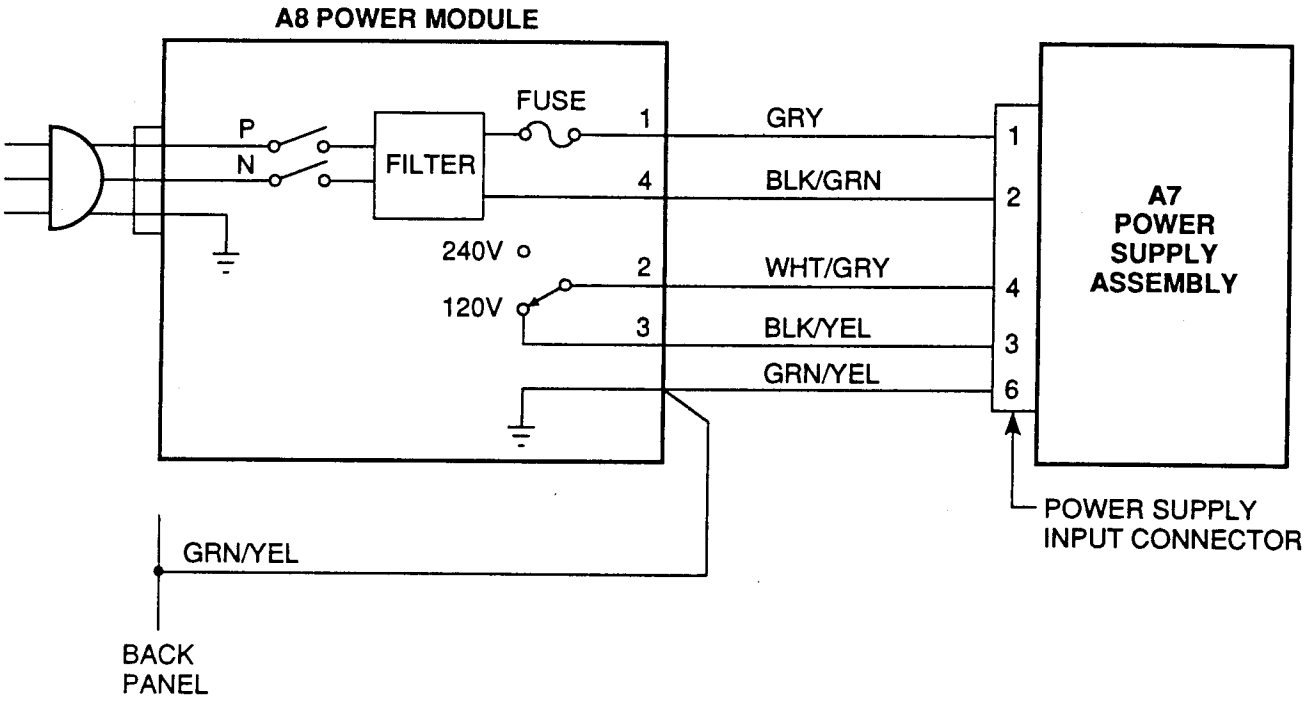


Figure 4-31. AC Power Input Schematic Diagram (Standard)

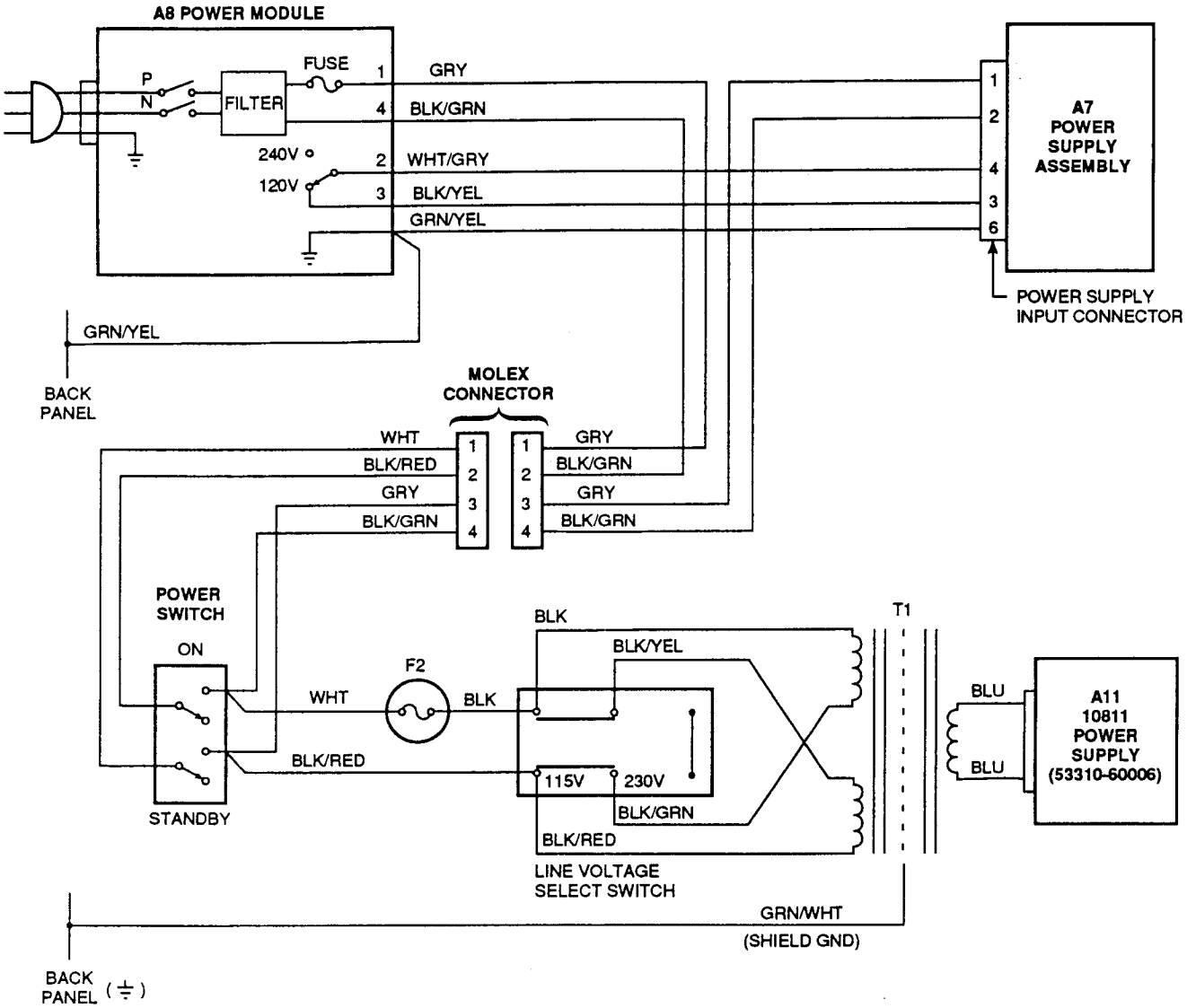


Figure 4-32. AC Power Input Schematic Diagram (Option 010)

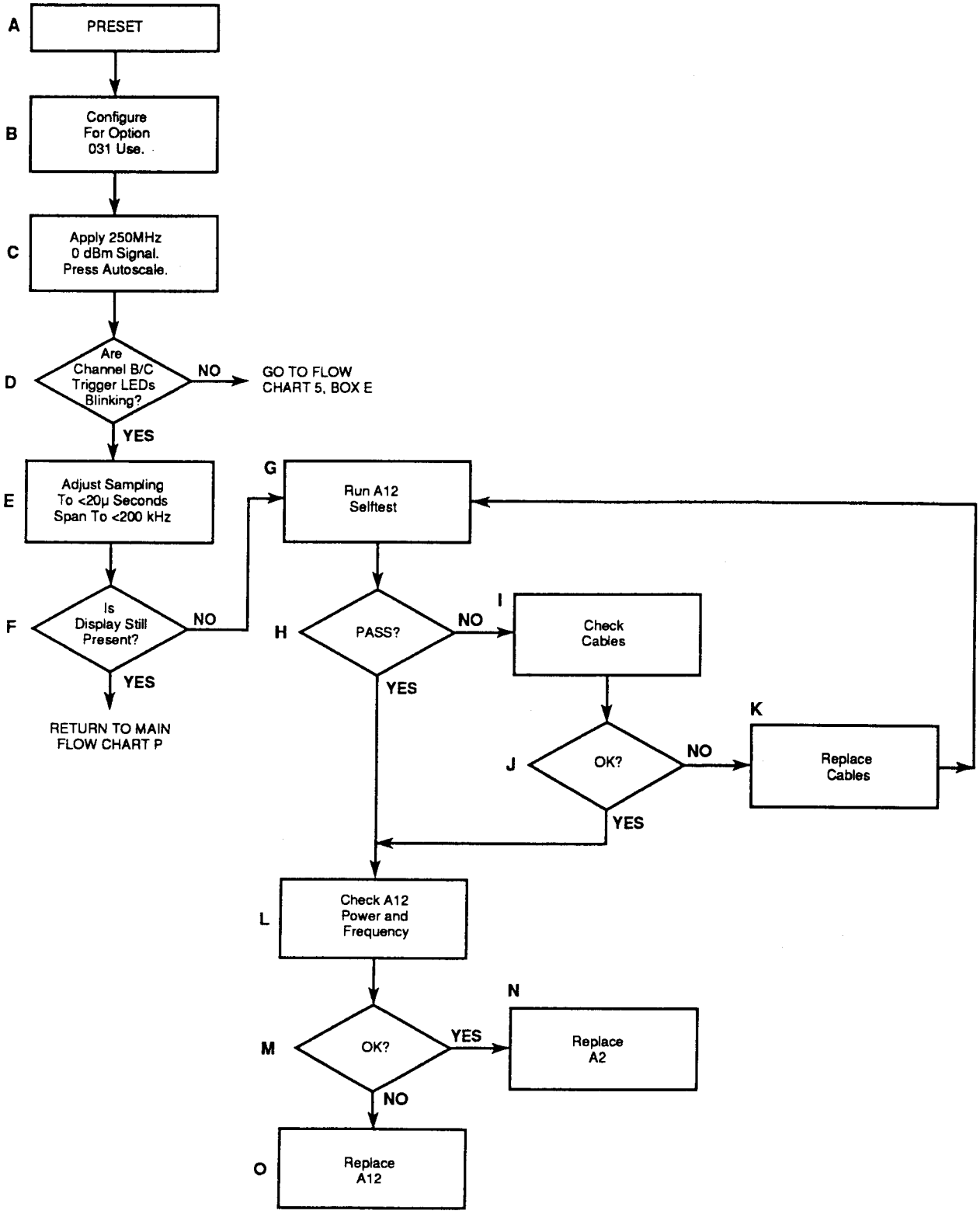


Figure 4-33. Flowchart 7

FLOWCHART 7 DETAILS (Option 031)

1. The cover must be removed to execute these checks.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

2. Prior to **any** troubleshooting, **check all cables!** Some may have partially come loose from their sockets.
3. **Pay particular attention to the installation of the large ribbon cable that connects A7 Power Supply Assembly to A1 Main Board Assembly.** It is very easy to insert the connection at A1 Main Board Assembly one pin offset towards the rear of the instrument (the connector actually touches the bottom frame of the CRT when it is installed correctly). Improperly installing the connector one pin offset shorts all the outputs of A7 Power Supply Assembly. No damage should occur if power is promptly removed.
4. Pay careful attention to the proper orientation of the ribbon cables during reconnection. The red stripe down one edge indicates pin 1 of those cables.

SUMMARY. This troubleshooting section provides a closer look at the A2 input board and A12 LO board and their interactions. This chart begins with output from the Main Flowchart, box L.

Key to understanding the interaction between the A2 and A12 boards is the fact that the 53310 Opt 031 will switch between prescale and downconvert automatically, depending on various settings the user selects. The impact on troubleshooting is that with two signal paths involved, both must be checked out. The following process does this.

In addition, numerous messages are displayed that may point to the cause of an Opt 031 problem. They are fully described in the USERS GUIDE, Chapter 3.

A Press PRESET. This puts the 53310A Opt 031 in a known state.

B Configure the instrument for Opt 031 use via FUNCTION & INPUT hardkey menu:

1. Press second softkey until C is highlighted.
2. Press CONFIGURE INPUT softkey.
3. Press INPUT softkey until C is highlighted. No changes are needed.

C Apply a 250 MHz, 0 dbm Signal to the C channel input connector. Press AUTOSCALE.

D Is the Chan B/Chan C trigger light blinking?

No? go to Flowchart 5, box E

Yes? Continue to box E.

Hint: Up to this point, the Opt 031 is prescaling the input signal. The display should be a straight line across the screen, with little or no movement that is caused by noise. To verify operating mode, press the UTILITY MENU KEY, and then LO MENU. A message above the display will indicate that prescale (or downconversion) is being used.

E Adjust the SAMPLING to microsec, span to Mhz:

1. Press SAMPLING MENU hardkey.

2. Set INTERVAL AT CENTER to MANUAL

3. Using keyboard, enter 20 Microseconds, or lower.

4. Press VERTICAL MENU hardkey.

5. Press SPAN softkey.

6. Using keyboard, enter 200 kHz, or lower.

Hint: This action causes the Opt 031 to switch to downconvert.

F Still have a display?

Yes? Return to the main flow chart, box P. Both the prescale and downconvert signal paths, and the A12 LO board, are working.

No? Continue to box G.

G Run 12 self-test, as follows:

1. Press UTILITY MENU key. 2. Press SELF TEST softkey 3. Cycle through SELFTEST selections until A12 is highlighted. 4. Press START TEST

H All Pass?

No? Continue to box I

Yes? Go to box L

I Check cables

Carefully check all cables related to Opt 031. Make sure they are seated properly in their connectors. Use an ohmmeter as needed to insure continuity. The cables involved are W21, W22, W23, W24, W26, and W27. See the block diagram on Page 4-2 for their interconnection.

J Cables OK?

No? Continue to box K

Yes? Continue to box L

K Repair/replace cables as needed. Re-run A12 self test.

L Check A12 power and frequency.

Hint: The A12 board is a synthesizer designed to produce frequencies between 200 and 2500 MHz. This signal is used by the A2 board mixer circuit to downconvert the input signal. Checking its frequency and power output will ensure that it is operating properly.

1. At the rear panel LO out connector, connect a power meter/sensor, using adapters as needed. Expect a power level of approx +3 dbm.

2. The A12 LO will produce an output only when certain measurement parameters are called for, and downconversion is needed to increase the measurement resolution. To make sure the A12 LO is producing a signal, set the 53310 as follows:

1. Press SAMPLING MENU hardkey.
2. Set INTERVAL AT CENTER to MANUAL
3. Using keyboard, enter 20 Microseconds, or lower.
4. Press VERTICAL MENU hardkey.
5. Press CENTER SOFTKEY. Using keyboard, enter 1 GHz.
6. Press SPAN softkey.
7. Using keyboard, enter 200 kHz, or lower.

Hint: This action causes the Opt 031 to switch to downconvert. To verify the operating mode, press the UTILITY MENU KEY, and then LO MENU. A message above the display will indicate that prescale or downconversion is being used.

3. Observe the power meter. Power should be +3 dbm nominal. If it is less than 0 dbm, A12 is bad. If the power is greater than +6 dbm, A12 is also bad. Go to Box O.

4. To check the frequency, connect a frequency counter capable of measuring ~200 to 2500 MHz to the LO out jack on the rear panel. The synthesizer frequency will be 7 MHz lower than the center frequency as set on the Vertical menu if span is less than 200 kHz. Proceed as follows: a. Press the VERTICAL MENU hardkey. b. Press the CENTER softkey.

5. Observe the frequency counter as the CENTER frequency is adjusted. It should track 7 MHz lower than the indicated CENTER frequency, in increments of 1 MHz. If it does not, A12 is bad. Go to box O.

If power and frequency checks are OK, proceed to Box N.

N Replace A2

If the A12 synthesizer, and all the cables check out OK, and a measurement cannot be made, then the mixer on A2 is bad.

Replace A2.

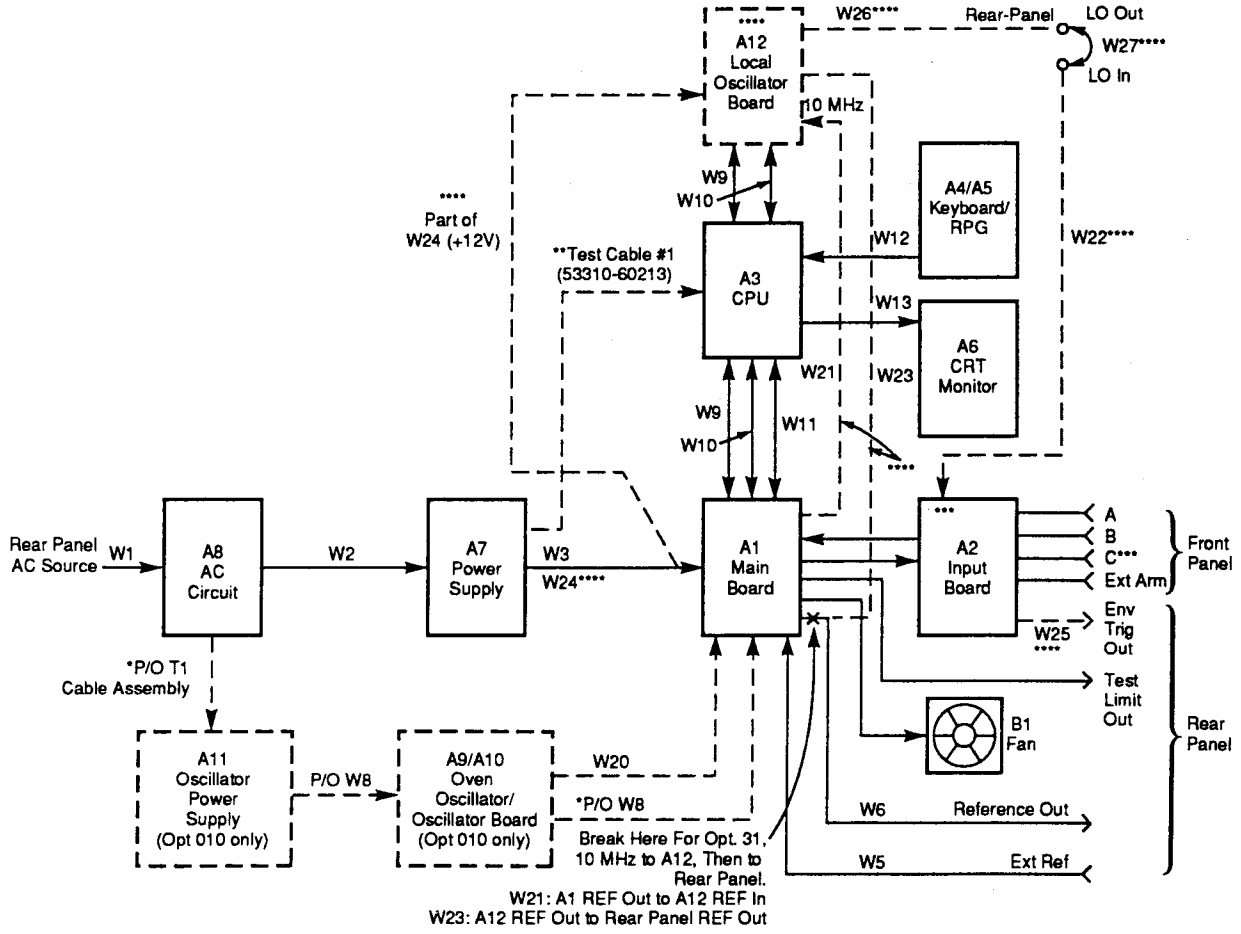
O Replace A12

If the power and frequency checks do not verify A12 operation, then A12 is bad. Replace it.

TROUBLESHOOTING THEORY

This section helps you to understand the concepts behind the troubleshooting process in this chapter which requires isolation of the three main assemblies (i.e., A1 Main Board, A2 Input Board , and A3 CPU) to determine the origin of some failures. The isolation of A3 CPU Assembly from A1 Main Board Assembly is necessary because A3 receives its power supplies and some interface signals from A1. Thus, a faulty A1 assembly may cause a failure indication in A3 assembly. Also, the isolation of A1 Main Board Assembly from A2 Input Board Assembly is necessary because the A2 assembly is installed directly on top of the A1 assembly, connected via the A1/A2 connectors (J4, J5, J6).

Figure 4-34 is a model showing all of the replaceable assembly boards and cables and how they interconnect. This figure also shows the direction of signal flow, and how the A3 CPU, A4/A5 Keyboard/RPG, and the A6 CRT Monitor assemblies are dependent on the A1 Main Board Assembly. Note that the power supplies, and the interface inputs to and from A3 are via A1. Hence, to be able to determine the status of assemblies A3 through A6, you must determine if the A1 assembly is operating properly by taking it out of the loop.



*Cable Assemblies T1 and W8 Exist Only In Instruments That Contain The Option 010 High Stability Time Base.

**Cables W3, (W24 Option 031) W9, W10, and W11 Must be Removed When The Test Cable Is Being Used.

*** C Channel Only For Option 30 or 31.

**** Option 31 Only.

CPUI_V3I

Figure 4-34. A1 Main Board and A3 CPU Isolation Diagram

A power supply jumper test cable (53310-60213) is supplied in the Service Accessories Kit (HP P/N 53310-67001) that allows you to isolate the A3, A4, A5, A6, (Opt. 031 A12), assemblies from the A1 assembly by enabling the connection of +5 and +12 volts (assemblies A3 - A6 operate off +5 and +12V) directly from the A7 Power Supply instead via the A1 assembly. By removing the CPU Bus cables (W9/10/11), the A3 assembly can operate the "kernal" and perform kernal diagnostics on A3 (itself), A4, A5, and A6.

Knowing how the A1 Main Board and A2 Input Board assemblies interact makes isolating A1/A2 problems easier to understand. The following paragraphs describes the interaction between the A1 and A2 assemblies.

The A2 Input Board Assembly receives input signals from its external arm, channel A, channel B, or optional channel C inputs and performs basic signal conditioning. These signals are then sent to the A1 Main Board Assembly where the Universal Counter Integrated Circuit (UCIC) performs further processing. The UCIC in turn sends back signals to A2 Input Board Assembly which causes the front-panel trigger lights to flash, provided the signals met the minimum sensitivity level requirements and the threshold voltages were less than the input signal level.

If the Option 030 Channel C is installed, it shares both the B channel front-panel trigger light and the LED (DS5) on the A2 Input Board Assembly.

If the option 031 Channel C is installed, it also shares the B channel front-panel trigger light and the LED (DS5) on the A2 Input Board Assembly, and includes the following additional capabilities and hardware:

The option 031 A2 Input Board Assembly operates as does option 030 but has available high-resolution downconversion in addition to prescaling. The downconverter is controlled by software and requires a local oscillator signal provided by the A12 LO Board Assembly which is present when option 031 is installed. An external LO can also be connected.

The option 031 A12 LO Board Assembly provides a stable signal for hetrodyne downconversion to the mixer/downconverter present on the option 031 A2 Input Board Assembly. A12 is controlled by software.

A3 CPU Assembly provides digital information to A2 Input Board Assembly via the CPU Bus connections (cables W9, W10, and W11) on A1 Main Board Assembly. These digital signals set trigger levels and relays for dc and ac coupling, input impedance, and separate/common inputs.

When troubleshooting the A1/A2 combination, recognizing the following will provide a clue to where the problem is.

1. If the front-panel trigger lights blink (or flash) when a proper input is applied, all circuits are operating properly as described above.
2. If the front-panel trigger lights DO NOT blink, but the LEDs on A2 blink, then A2 input circuits are operating properly, and the trouble lies in either the interconnection or on A1 Main Board Assembly. Probing the A1/A2 connection (connectors J4, J5, and J6), and using the troubleshooting information will determine which assembly (A1 or A2) is faulty.
3. If the LEDs on A2 do not blink, then either the input circuits on A2 are faulty, or the digital information needed to set the trigger levels is not getting to the A2 assembly. Probing the A1/A2 connectors and using the troubleshooting information will determine which assembly is faulty.

PREFACE

200 MHZ MODULATION DOMAIN ANALYZER

The HP 53310A is a two-channel Modulation Domain Analyzer with an overall measurement range of 200 MHz. An optional third channel (Option 030 Channel C or Option 031 Digital RF Communications Analysis/High Resolution 2.5 GHz Input) extends the instrument overall measurement range to 2.5 GHz.

The channels A and B have switchable input impedance of 1 MΩ and 50Ω. The optional channel C has an input impedance of 50Ω. Also, an external arm or trigger input with 1 MΩ input impedance can be used for triggering measurements. The HP 53310A has auto-scale and auto-trigger features, which make it easy to measure the frequency or time interval of the modulation on input signals. Two analysis modes are provided which can produce three types of output modes: frequency versus time, time interval versus time, and histogram. The frequency and time interval measurements are displayed on the CRT graphically as a series of points versus time like an osilloscope. The histograms can be provided up to the full measurement range. A rear panel HP-IB port is provided that can be used to control the instrument and read out data. Continuous streams of measurement data can be sent to the histogram without locking up the front panel.

When using the HP 53310A, keep in mind that although the display looks similar to an oscilloscope's display, the information being displayed is frequency (or time interval) versus time. This is quite different from an oscilloscope which displays voltage versus time.

HOW TO USE THIS MANUAL

Repair Strategy

The Hewlett-Packard 53310A Modulation Domain Analyzer (Analyzer) can be returned to Hewlett-Packard (HP) for all service work, including troubleshooting, adjusting, calibration, or verifying specifications. Contact your nearest HP Sales and Service Office for more details.

If you decide to service the Analyzer yourself, use the operational verification tests in Chapter 2 (Performance Tests) to define the nature of the problem. For more complete tests, use the performance test procedures in Chapter 2. After a repair, use the instructions in Chapter 3 (Adjustments and Calibration) to calibrate the Analyzer for peak-performance operation.

This service manual is designed to isolate failures to the assembly level only. If a failure occurs, you can isolate the faulty assembly by following the instructions in Chapter 4 (Service). The instructions in Chapter 5 (Replacing Assemblies) help you to remove and replace any defective assemblies.

Instrument Identification

Instrument identification is by a serial number located on the rear panel of the HP 53310A. Hewlett-Packard uses a two-part serial number with the first part (prefix) identifying a series of instruments and the second part (suffix) identifying a particular instrument within a series. An HP assigned alpha character between the prefix and suffix identifies the country in which the HP 53310A was manufactured.

Instruments Covered by This Manual

This manual applies directly to HP 53310A Modulation Domain Analyzers that have the same serial number prefix(s) shown on the title page. If the serial prefix of your instrument differs from that listed on the title page of this manual, there may be differences between this manual and your instrument. Instruments having a higher serial prefix are covered when necessary with "Manual

Changes" sheets included with this manual. If a required change sheet is missing, contact the nearest Hewlett-Packard Sales and Support Office listed at the back of this manual. Instruments having a lower serial prefix than that listed on the title page are covered in Appendix B (Manual Changes).

Manual Organization

This assembly-level service manual consists of a table of contents, eight chapters, and three appendices. Tabs divide the chapters and appendices of this manual.

The Table of Contents at the front of the manual lists the beginning of each chapter and appendices in the manual, helping you to locate information.

Chapter 1, Preparing the HP 53310A for Use, tells you how to make sure your instrument was not damaged in shipment, and that it is operating correctly. Use Chapter 1 when you first receive the Analyzer.

Chapter 2, Performance Tests, contains procedures that verify the Analyzer operates properly and meets the HP 53310A specifications given in Appendix A.

Chapter 3, Adjustments and Calibration, gives instructions on how to adjust the hardware, and to perform the firmware calibrations that can bring the Analyzer to peak operating performance.

Chapter 4, Service, is divided into four parts. Part 1 contains instructions on how to return the Analyzer to Hewlett-Packard for service. Part 2 contains pre-troubleshooting information, and part 3 contains flowcharts, procedures, and diagnostics information that guide you in troubleshooting the Analyzer to the defective assembly. Part 4 contains the theory behind the troubleshooting process used in part 3.

Chapter 5, Replacing Assemblies, contains instructions on how to replace defective assemblies in the Analyzer.

Chapter 6, How the HP 53310A Works, contains the block-level theory of operation for the Analyzer. This chapter can help you better understand how the Analyzer operates.

Chapter 7, Retrofitting Options, contains field-installation instructions that help you to install options into the Analyzer.

Chapter 8, Replaceable Parts, lists the replaceable parts contained in the Analyzer, and explains how to order replacement parts for your Analyzer.

Appendix A, Specifications, lists all the specifications and operating characteristics for the Analyzer.

Appendix B, Manual Changes, contains information necessary to adapt this manual to older instruments (Analyzers).

Appendix C, Miscellaneous, contains a section that describes the theory behind the performance tests and a section with information on how to test and determine if the circuit of the Quick Start Signal Source is functioning properly before requesting a replacement.

HOW TO ORDER MANUALS

A manual part number is listed on the title page of this manual. Use it to order extra copies of this manual.

See Chapter 8 (Replaceable Parts) for a complete list of documentation and ordering numbers.

OPTIONS

The options available for the HP 53310A Modulation Domain Analyzer are listed following this paragraph. Specifications for the options are listed in Appendix A. If you've purchased an option with the initial order, it will be installed at the factory and ready for operation at delivery. Refer to Chapter 7 (Retrofitting Options) for instructions on field installation of the options.

- Expanded Memory, Option 001
- High Stability Oven Time Base, Option 010
- Channel C, Option 030
- Digital RF Communications Analysis/High Resolution 2.5 GHz Channel C Input, Option 031 (includes Option 031 User's Guide)
- Additional set of User Documentation, Option 910 (includes Quick Start Kit)
- Additional set of Service Documentation, Option 915
- Additional set of User Documentation without Quick Start Kit, Option 916
- Three-year customer return repair coverage, Option W30
- Three-year customer return calibration coverage, Option W32

ACCESSORIES SUPPLIED

The HP 53310A is supplied with the following accessories:

- Power cord, 2.3 meters, 90 degrees*
- Operating Reference Manual
- Programming Reference Manual
- Service Manual
- Quick Start Guide
- Programming Quick Reference Guide
- Quick Start Signal Source

ACCESSORIES AVAILABLE

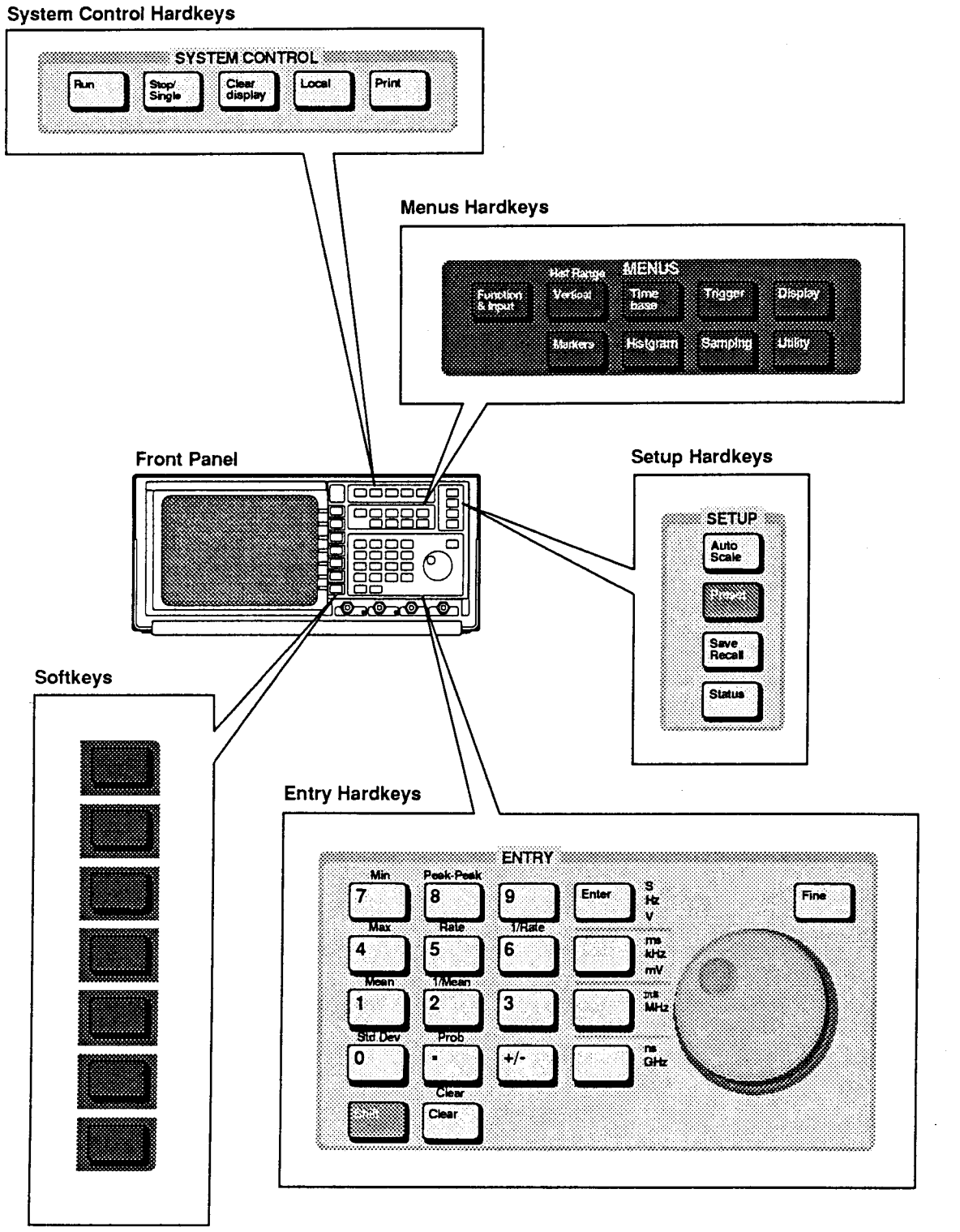
The accessories available for the HP 53310A are as follows:

- Service Accessories Kit (HP P/N 53310-67001)
- Soft Carrying Case (HP P/N 1540-1066)
- Transit Case (HP P/N 9211-1645)
- Rack Mount Kit (HP P/N 5061-6175)
- Rack Mount Slide Kit (HP P/N 1494-0015)

---

* The line power cord will have one of six possible line (mains) connectors, depending on the country of destination. Refer to the table in Appendix A (Installation) of the Operating Reference Manual that lists the available ac power cord (or cable) for the part number of the appropriate cord.

THE MODULATION DOMAIN ANALYZER AT A GLANCE



System Control

- **Run** and **Stop/Single** keys start and stop data acquisition.
- **Clear display** key erases measurement data from the screen.
- **Local** key restores local (front panel) control when the Analyzer is operating under remote control (unless **Local** key is locked out).
- **Print** key copies the current displayed data to a compatible graphics printer.

Setup

- **Autoscale** key automatically sets the vertical and horizontal scale settings for the display of the input signal data.
- **Recall/Save** key retrieves previously saved instrument setups from the non-volatile memory setup registers, and stores the current Analyzer setup in non-volatile memory.
- **Preset** key resets the Analyzer to default (known) conditions.
- **Status** key displays a summary of the Analyzer's settings.

Menus

- **Function & Input** key selects the measurement functions and input signal conditioning.
- **Vertical** key sets the limits for the measurement values to be collected and displayed.
- **Timebase** key sets the length of time for the measurement acquistion.
- **Trigger** key sets the conditions that cause a data sweep to occur.
- **Display** key sets the graphic mode to use in displaying measurement results.
- **Markers** key controls the markers.
- **Histgram** key selects between the histogram of the Versus Time data and a Fast Histogram function.
- **Sampling** key sets the sampling requirements for individual measurements within the data sweep.
- **Utility** key sets the HP-IB settings, self-test functions, diagnostics, and clicker.

Entry*

- Use the numeric keypad to enter numeric data when terminated with a units key selection.
- Use the blue **Shift** key to enable the analysis functions, which are labeled in blue above the numeric keys.
- Use the **Clear** key to end a numeric entry once you have made an error in entering a value into a numeric field. The previous value is restored.
- The *knob* can be used to change value in any numeric field once the field is selected (the field appears in full-bright inverse video).
- The **Fine** key changes the increment and decrement resolution of the knob action on the numeric entry fields to the finest resolution available.

*NOTE: When present, option 031 adds three additional function labels that appear over the top three keys of the rightmost entry key column not shown on the previous page.

Softkeys

The function of these keys varies, depending on the current function menu displayed.

5

REPLACING ASSEMBLIES

Disassembly and Reassembly Procedures

INTRODUCTION

This chapter contains the instructions for removing major assemblies in the HP 53310A. To install an assembly, reverse the removal instructions. Before working on the instrument, read the Safety Considerations page at the front of the manual.

WARNING

HAZARDOUS VOLTAGES ARE ON THE CRT MONITOR AND POWER SUPPLY ASSEMBLIES. TO AVOID ELECTRICAL SHOCK, DISCONNECT THE POWER CORD. WAIT AT LEAST THREE MINUTES FOR THE CAPACITORS ON THE POWER SUPPLY AND MAIN BOARD ASSEMBLIES TO DISCHARGE BEFORE WORKING ON THIS INSTRUMENT.

CAUTION

Do not replace assemblies with the instrument turned on. Damage to components can occur.

Figures 5-1 and *5-2* are provided to complement the removal and replacement procedures for the Standard and Option 010 rear panel assemblies. Refer to the exploded views, *Figures 8-1* and *8-2*, in Chapter 8 (Replaceable Parts) when performing the removal and replacement procedures for the other assemblies.

TOOLS REQUIRED

The following tools are required for these removal and replacement procedures:

- Hand TORX® 10 screwdriver (T10)
- Hand TORX® 10 screwdriver narrow-end shaft (modified tool — see "TO REMOVE THE FAN", page 5-13)
- Hand TORX® 15 screwdriver (T15) — for CRT Monitor screws
- Hand TORX® 25 screwdriver (T25) — for the two shoulder screws in the handle of the instrument
- Small flat-blade screwdriver
- 7 mm extended-shaft spin tight (modified tool for CRT Monitor nuts)
- 9/16-inch spin tight
- 1/2-inch spin tight
- Small long-nose plier

NOTE

The TORX® 10 screwdriver is required for removing all the other screws mentioned in the procedures of this chapter.

DO THIS FIRST

Before performing any of the removal and replacement procedures, the following steps must be performed:

1 **Turn the HP 53310A off.**

2 **Remove ac line power cord from the rear panel line filter assembly.**

TO REMOVE THE COVER

The following steps are for removing the cover. The cover is removed to access the board and cable assemblies, and all other internal parts.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Unscrew the ten flat-head TORX screws (H1) that hold the cover (MP2) to the cabinet (MP1), using the TORX® 10 screwdriver.**

Two screws are located on each side of the cover and six screws are located on the top of the cover.

TO REMOVE THE REAR PANEL ASSEMBLY (STD/OPT 010/OPT 031)

This section contains procedures for removing the standard and Option 010/031 rear panel. The rear panel is also removed when you replace the A1 Main Board Assembly, or the fan (B1).

To Remove Standard Instrument Rear Panel

The following steps are for removing the standard rear panel.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 5-2.

3 **Detach the A8 Line Filter Cable Assembly from A7 Power Supply Assembly.**

4 **Remove eight pan-head TORX® screws (H4) at the edges of the rear panel (MP2).**

Note that there are 4 screws in a row along the top edge of the rear panel and 4 screws in a row along the bottom edge of the rear panel.

5 Pull the rear panel about three inches away from the instrument. (See *Figure 5-1.*)

Notice the banana-plug connector (P1) at the bottom corner of the rear panel. During reassembly, be sure the banana connector inserts into the clip on A1 Main Board Assembly. (This provides safety grounding of the rear panel to the A1 Main Board Assembly's input BNCs.)

6 Remove the HP-IB ribbon cable (W4) from A1 Main Board Assembly by spreading the side retainers of the HP-IB connector on the A1 Main Board Assembly.

7 Remove the Ext. Ref. In, Reference Out, and Test Limit Output cables (W5, W6, and W7, respectively).

Notice where each cable connects to the connectors on A1 Main Board Assembly for later reassembly. The cables connection locations are:

External Reference In cable connects to A1J20

Reference Out cable connects to A1J19

Test Limit Output cable connects to A1J21

NOTE

When reassembling the rear panel, make sure all cables are carefully positioned to prevent crimping against the fan, cabinet parts, and electrical parts.

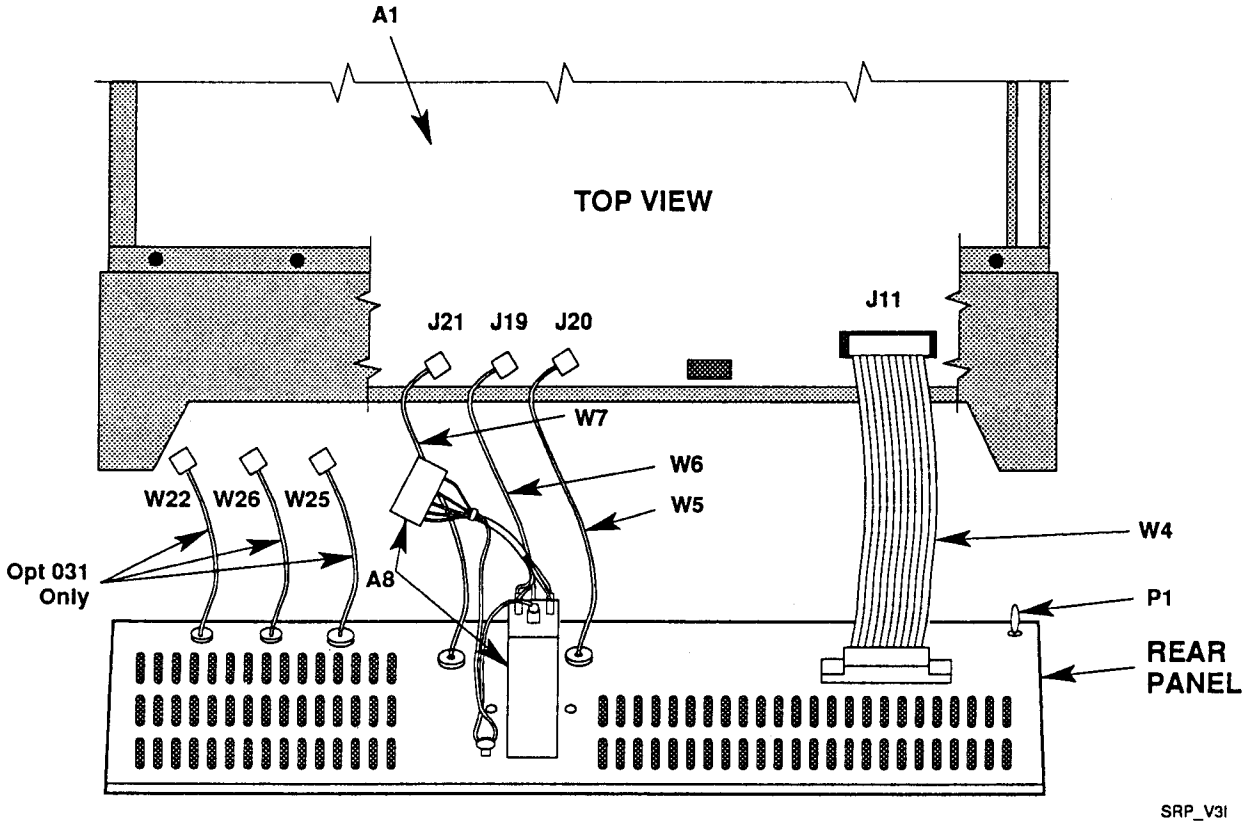


Figure 5-1. Standard Rear Panel Replacement

To Remove the Option 010/031 Instrument Rear Panel

The following steps are for removing the Option 010/031 rear panel.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 5-2.

3 **Detach the the Transformer/Power Switch Cable Assembly (T1) from the A7 Power Supply Assembly.**

4 **Remove eight pan-head TORX® screws (H4) at the edges of the rear panel (MP2).**

Note that there are 4 screws in a row along the top edge of the rear panel and 4 screws in a row along the bottom edge of the rear panel. These screws are marked with an asterisk (*) to assist in removing the correct screw.

5 **Pull the rear panel about three inches away from the instrument. (See *Figure 5-2.*)**

Notice the banana-plug connector (P1) at the bottom corner of the rear panel. During reassembly, be sure the banana connector inserts into the clip on A1 Main Board Assembly. (This provides safety grounding of the rear panel to the A1 Main Board Assembly.)

6 **Remove the HP-IB ribbon cable (W4) from A1 Main Board Assembly by spreading the side retainers of the HP-IB connector on the A1 Main Board Assembly.**

7 **Remove the end of the three-way oscillator power cable (W8) that connects to J6 on the A1 Main Board Assembly.**

8 **Remove the coaxial cable (W20) that connects to J22 on the A1 Main Board Assembly.**

9 **Disconnect the end of T1 cable assembly that connects to A8 Line Filter Cable Assembly, and carefully pull the cable's connectors through the cabinet openings.**

10 **Remove the Ext. Ref. In, Reference Out, and Test Limit Output cables (W5, W6, and W7, respectively).**

Notice where each cable connects to the connectors on A1 Main Board Assembly for later reassembly. The cables connection locations are:

External Reference In cable connects to A1J20
Time Base Out cable connects to A1J19
Test Limit Output cable connects to A1J21

1 **If option 031 is installed, remove the LO Input, LO Output, and Env Trig Out cables (W22, W26, and W25, respectively).**

Notice where each cable connects to the connectors on A1 Main Board Assembly for later reassembly. The cables connection locations are:

LO Output cable connects to A12J2
LO Input cable connects to A2J8
Env Trig Output cable connects to A2J9

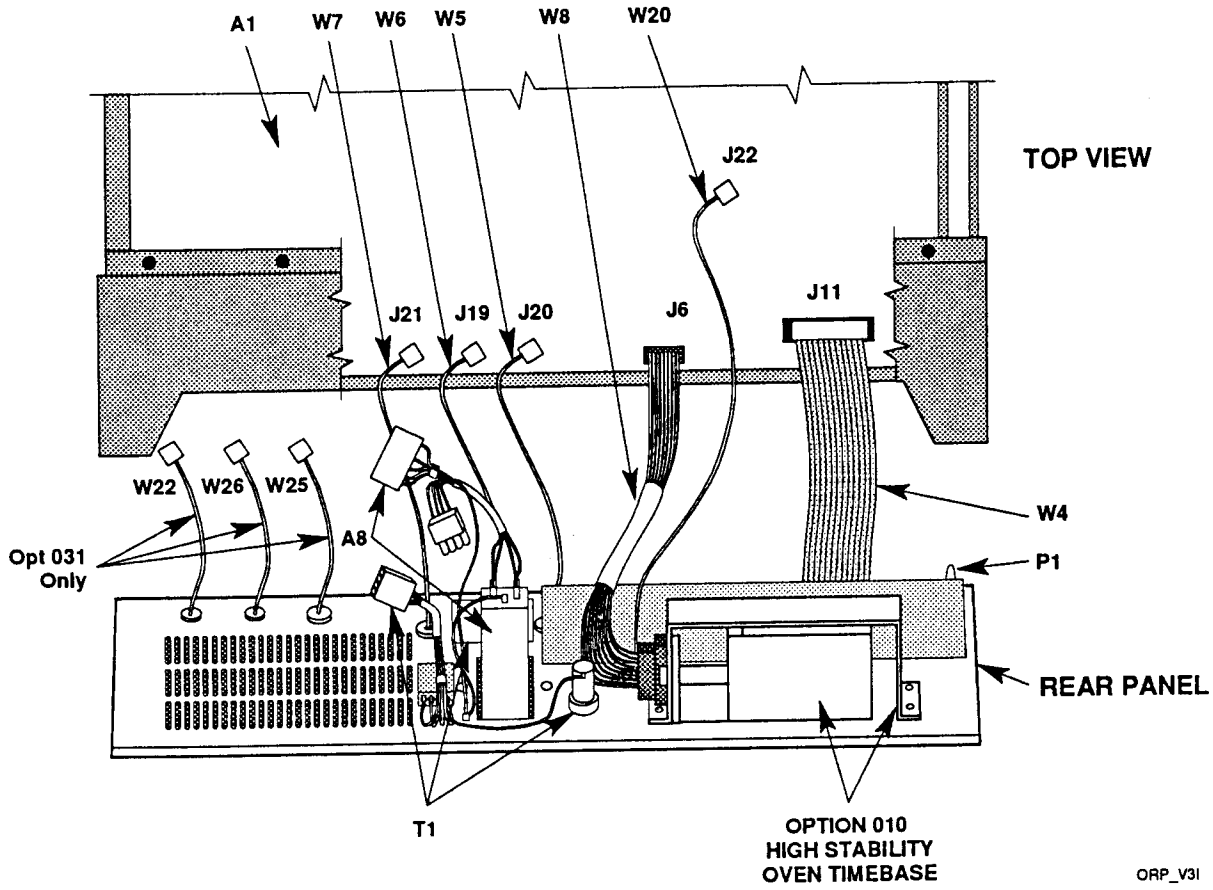


Figure 5-2. Option 010 Rear Panel Replacement

NOTE

When reassembling the rear panel, make sure all cables are carefully positioned to prevent crimping against the fan, cabinet parts, and electrical parts.

TO REMOVE A7 POWER SUPPLY ASSEMBLY

The following steps are for removing the A7 Power Supply Assembly. The power supply is also removed when you replace the A1 Main Board, A2 Input Board, (Opt 031, A12) and A3 CPU assemblies.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 5-2.

3 **Disconnect cable W3 which connects the A7 Power Supply Assembly to A1 Main Board Assembly.**

4 **Disconnect A8 Line Filter Cable Assembly from A7 Power Supply Assembly.**

5 **Remove the two locking pins, MP8, (by rotating and pulling them up) that secure the power supply at the right front and rear corners of the instrument cabinet.**

6 **Slide A7 Power Supply Assembly out through the side of the cabinet.**

Note that the power supply assembly is positioned in the top slide grooves.

TO REMOVE A3 CPU ASSEMBLY

The following steps are for removing the A3 CPU Assembly. The CPU assembly is also removed when you replace the A1 Main Board and A2 Input Board assemblies.

CAUTION

Electrostatic discharge can damage the electronic components on A3 CPU Assembly. Make sure you use a grounded wriststrap and mat when working on A3 CPU Assembly. The Hewlett- Packard part number for grounded wriststrap and mat is 9300-1484.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 5-2.

3 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER SUPPLY ASSEMBLY" on page 5-5.

4 **Disconnect cables W12 and W13 from the A3 CPU Assembly.**

5 **Disconnect cables W9, W10, and W11 from A3 CPU Assembly.**

Gently pry loose these cables from the CPU assembly.

6 **Now, slide A3 CPU Assembly out through the side of the cabinet.**

Note that the CPU assembly is positioned in the slide grooves that are second from the bottom of the cabinet.

Note that the cables (W9, W10, and W11) polarity (or pin 1) is indicated by the red strip edge of the cable.

TO REMOVE A12 LO ASSEMBLY

The following steps are for removing the A12 LO Assembly. The LO assembly is also removed when you replace the A1 Main Board and A2 Input Board assemblies.

CAUTION

Electrostatic discharge can damage the electronic components on A3 CPU Assembly. Make sure you use a grounded wriststrap and mat when working on A3 CPU Assembly. The Hewlett- Packard part number for grounded wriststrap and mat is 9300-1484.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 5-2.

3 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

4 **Disconnect cables W9, W10, and W11 from the A3 and A12 LO Assembly.**

5 **Disconnect cables W21, W23, W26, and +12V twisted leads part of W24 from A12 LO Assembly.**

Gently loosen these cables from the LO assembly; use wrenches as needed.

6 **Now, slide A12 LO Assembly out through the side of the cabinet.**

CAUTION

Do not allow backside parts of A12 LO Assembly to scratch W9, W10, and W11 cables while performing step 6.

Note that the A12 assembly is positioned in the slides that are six groves from the top of the cabinet.

Note that the cables (W9 and W10) polarity (or pin 1) is indicated by the red strip edge of the cable.

TO REMOVE A4/A5 KEYBOARD/RPG ASSEMBLY

The A4/A5 Keyboard/RPG Assembly consists of the keyboard label, the keyboard panel, the elastomeric keypad, the A4 printed circuit (PC) keyboard, the A5 Rotary Pulse Generator (RPG), and the knob. If you need to disassemble the keyboard assembly, see "TO DISASSEMBLE THE A4/A5 KEYBOARD/RPG ASSEMBLY" on page 5-8.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER SUPPLY ASSEMBLY" on page 5-5.

3 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

4 **Remove A12 LO Assembly.**

See "TO REMOVE A12 LO ASSEMBLY" on page 5-7.

5 **Remove the four flat-head TORX® screws (H9) from the back side of the front panel.**

6 **Gently pull on the knob to remove the keyboard/RPG assembly from the front of the instrument, making sure the cable slips through the cable opening in the front of the instrument.**

TO DISASSEMBLE THE A4/A5 KEYBOARD/RPG ASSEMBLY

You can use these instructions to disassemble the keyboard into these parts: keyboard label/panel assembly (MP11), elastomeric keypad, printed circuit (PC) keyboard (A4), RPG (A5), and knob. Follow only those steps that apply to your task. For example, if you are replacing a defective RPG, you do not need to completely remove the keyboard label/panel or PC keyboard.

1 **Remove the keyboard.**

See "TO REMOVE THE A4/A5 KEYBOARD/RPG ASSEMBLY" on page 5-7.

2 **Disconnect the RPG cable from the PC keyboard by first slightly separating the keyboard from the elastomeric keypad, then disconnecting the cable.**

3 **Separate the PC keyboard, keypad, and keyboard panel/label.**

4 **Remove the knob by pulling it straight off the RPG (A5) shaft.**

The knob is force-fitted onto the RPG shaft, so there may be some resistance to removal.

5 **Remove the nut (H15) from the RPG, then remove the RPG from the keyboard panel.**

Use a 1/2-inch spin tight to remove the nut.

If you are only replacing a defective RPG, you do not need to do steps 6 and 7.

6 **If you are replacing the PC keyboard, remove the keyboard/keyboard cable (W12), making sure that the cable slips through the cable opening in the front of the instrument.**

7 **If you are replacing the keyboard label, you need to replace the keyboard label/panel assembly (MP11), 53310-80001, as a unit.**

8 **Keep fingers, dust, and dirt away and off the keypad connection areas on the elastomeric keypad and the PC keyboard.**

TO REMOVE A1 MAIN BOARD ASSEMBLY

Use this procedure to replace a defective A1 Main Board Assembly. You will also remove A7 Power Supply Assembly, A3 CPU Assembly, cables W9, W10, and W11, and the rear panel before you remove A1 Main Board Assembly.

CAUTION

Electrostatic discharge can damage the electronic components on A1 Main Board Assembly. Make sure you use a grounded wriststrap and mat when working on A1 Main Board Assembly. The Hewlett-Packard part number for grounded wriststrap and mat is 9300-1484.

1 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER SUPPLY ASSEMBLY" on page 5-5.

2 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

3 **If Option 031 is installed, remove A12 LO Assembly.**

See "TO REMOVE A12 LO ASSEMBLY" on page 5-7.

4 **Remove the dc power supply cable (W3) from A1 Main Board Assembly.**

5 **Remove the rear panel.**

See to "REMOVE THE REAR PANEL ASSEMBLY" on pages 5-2 through 5-4.

6 **Disconnect Fan (B1) cable from connector J5 at the back of A1 Main Board Assembly.**

7 **Carefully place the HP 53310A on its side.**

8 **From the bottom of the instrument, remove the eight pan-head TORX® screws (H4) that secure A1 Main Board Assembly to the cabinet.**

9 **Set the instrument back to its original position.**

10 **Remove the three CPU bus cables (W9, W10, and W11) and the fan cable from A1 Main Board Assembly.**

11 **Remove the three fancy BNC nuts, H8, (four of these BNC nuts are present on Option 030/031, C-Channel instrument) that secure the A2 Input Assembly to the front panel.**

Use a 9/16-inch spin tight.

12 **Slowly slide A1 Main Board Assembly out of the cabinet and towards the rear of the instrument.**

Note that there is just enough room or space for the UCIC (U39) to clear the rear cabinet opening.

To remove the A2 Input Board Assembly from A1 Main Board assembly, see "TO REMOVE A2 INPUT ASSEMBLY" on page 5-10.

TO REMOVE A2 INPUT BOARD ASSEMBLY

Use this procedure to remove A2 Input Board Assembly from A1 Main Board Assembly. At the rear of and inside the A2 Input Board there are three 26-pin connectors that connect A2 to A1.

CAUTION

Electrostatic discharge can damage the electronic components on A2 Input Board Assembly. Make sure you use a grounded wriststrap and mat when working on A2 Input Board Assembly. The Hewlett-Packard part number for grounded wriststrap and mat is 9300-1484.

NOTE

A2 Input Board Assembly can be removed WITHOUT pulling the A1/A2 (Main/Input Board) assembly set from the instrument.

1 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER ASSEMBLY" on page 5-5.

2 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

3 **Remove the three BNC nuts (H8) that secure the A2 Input Board Assembly to the front panel.**

Note that a fourth BNC nut is present on instruments that contain the optional 030 or 031 C Channel.

4 **Remove the two pan-head TORX® screws (H2) in A2 Input Board Assembly.**

5 **With a gentle rocking or prying motion, lift A2 Input Board Assembly from A1 Main Board Assembly.**

You can use a small flat-blade screwdriver to pry between A2 Input Board and A1 Main board connectors. DO NOT force the screw driver up-against any parts.

If option 031 is installed, unplug the W25 coaxial line.

6 **Guide A2 assembly up and out so that the BNC connectors clear their mounting holes.**

7 **If option 031 is installed, carefully turn the board over and unplug the remaining coaxial cable, W22.**

TO REMOVE A6 CRT MONITOR ASSEMBLY

The A6 CRT Monitor Assembly consists of the driver (or sweep) board, CRT yoke, and CRT. They are adjusted as a unit and are replaced as a unit, rather than individually. Do not remove the yoke from the CRT.

Make sure you perform the following steps in the order shown before you remove the CRT monitor assembly.

Setup

1 **Remove the rear panel.**

See "TO REMOVE THE REAR PANEL ASSEMBLY" on pages 5-2 through 5-4.

2 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER SUPPLY ASSEMBLY" on page 5-4.

3 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

4 **If option 031 is installed, remove A12 LO Assembly.**

See "TO REMOVE A12 LO ASSEMBLY" on page 5-7.

5 **Remove A1 Main Board Assembly.**

See "TO REMOVE A1 MAIN BOARD ASSEMBLY" on page 5-9.

6 **Discharge the high-voltage cable to the CRT mounting band as follows:**

CAUTION

Components can be damaged if the high-voltage cable is discharged to other areas.

a. Connect a jumper wire (clip lead) between the mounting band of the CRT and the shaft of a screwdriver.

b. Discharge the CRT by placing the grounded screwdriver under the protective rubber cap of the high-voltage cable. Then, momentarily touch the screwdriver to the metal clip of the high-voltage cable.

CAUTION

The CRT may charge itself even while disconnected. Make sure you discharge the CRT each time before you handle it.

c. Disconnect the high-voltage cable from the CRT by firmly squeezing the rubber cap until the metal clip disengages from the CRT.

Procedure

Make sure you perform the setup steps first. See above.

1 **Disconnect the intensity cable (W14), the CRT ribbon cable (W13), the two CRT yoke cables, and the CRT base cable from the driver board or the CRT.**

2 **Slide the driver board up and out of the cabinet slot.**

When installing the driver board, it may not clear the cabinet support rib. Press on the center of the outer shield of the driver board to allow the board to bend slightly.

3 **Carefully place the instrument with the front panel facing down.**

BE SURE to place foam cushions in such an arrangement that will prevent the full weight of the instrument from bearing against the RPG knob.

4 **Remove the three nuts (H7) securing the CRT to the front panel.**

Use a 7 mm, extended-shaft spin tight.

5 **Remove the pan-head screw (H5) securing the CRT to the front panel.**

Use TORX® 15 screwdriver.

6 **Remove the driver board guide.**

7 **Discharge the CRT before handling it.**

Use a jumper lead to short the CRT high-voltage terminal to the CRT mounting band.

8 **Remove the CRT.**

9 **Install the new CRT in reverse order.**

When reinstalling the CRT, place the CRT with the high-voltage terminal toward the inside of the instrument, away from the driver board.

10 **Check A6 Monitor Assembly adjustments.**

BE SURE to perform the CRT Monitor adjustments whenever the CRT is replaced; see "To Adjust The CRT Monitor" in Chapter 3 (Adjustments and Calibration).

TO REMOVE THE FAN

When you replace the fan, check the air flow arrows on the fan. Make sure that the air flows into the instrument when the HP 53310A is turned on.

1 **Remove the rear panel.**

See "TO REMOVE THE REAR PANEL ASSEMBLY" on pages 5-2 through 5-4.

2 **Remove the fan (B1) by removing the four screws (H4) securing the fan to the cabinet, and disconnecting the cable from J5 (fan connector) on A1 Main Board Assembly.**

Use a modified TORX® 10 narrow-end shaft screwdriver, or if not obtainable, enlarge the four outside holes on the fan with a drill for tool clearance.

Notice the orientation of the fan cable for later reassembly.

TO REMOVE THE TILT-STAND FEET

Use this procedure to remove damaged tilt-stand feet.

1 **Remove the rear panel.**

See "TO REMOVE THE REAR PANEL ASSEMBLY" on pages 5-2 through 5-4.

2 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER SUPPLY ASSEMBLY" on page 5-5.

3 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

4 **If option 031 is installed, remove A12 LO Assembly.**

See "TO REMOVE A12 LO ASSEMBLY" on page 5-7.

5 **Remove A1 Main Board Assembly.**

See "TO REMOVE A1 MAIN BOARD ASSEMBLY" on page 5-9.

6 **Remove the three screws (H1) securing each tilt-stand and molded foot (MP6) to the bottom of the cabinet (MP1).**

To remove the tilt-stand and molded foot that is located near the CRT monitor assembly, you must remove the CRT. See "TO REMOVE A6 CRT MONITOR ASSEMBLY" on page 5-11.

TO REMOVE THE HANDLE

Use this procedure to remove damaged handle.

1 **Remove the shoulder screw (H17) from each side of the handle (MP12).**

Use the TORX® 25 screwdriver.

TO REMOVE THE NUT PLATE FOR THE HANDLE

Use this procedure to remove damaged nut plates. To access the nut plates, you must remove the cover, A7 Power Supply Assembly, and A3 CPU Assembly. The sweep board assembly must also be removed to access the nut plate that is on the right side (viewing from the rear of the instrument) of the cabinet.

1 **Remove the handle.**

See "TO REMOVE THE HANDLE" on page 5-13.

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 5-2.

3 **Remove A7 Power Supply Assembly.**

See "TO REMOVE A7 POWER SUPPLY ASSEMBLY" on page 5-5.

4 **Remove A3 CPU Assembly.**

See "TO REMOVE A3 CPU ASSEMBLY" on page 5-6.

5 **If option 031 is installed, remove A12 LO Assembly.**

See "TO REMOVE A12 LO ASSEMBLY" on page 5-7.

The left-side nut plate is near the keyboard in the "well" of the cabinet.

6 **Using a small long-nose plier, pull out the nut plate (H18).**

7 **Remove sweep board, which is part of the A6 CRT Monitor Assembly.**

See "TO REMOVE A6 MONITOR ASSEMBLY" on page 5-11.

The right-side nut plate is near the CRT in the "well" of the cabinet.

8 **Using a small long-nose plier, pull out the nut plate (H18).**

When installing new nut plates, use a hammer and small flat-blade screwdriver to gently drive the nut plates into the wells in the cabinet.

6

HOW THE HP 53310A WORKS

Block-Level Theory of Operation

INTRODUCTION

This chapter provides block or assembly-level theory of operation of the HP 53310A.

THEORY OF OPERATION

Overall Block-Level Theory of Operation

The HP 53310A is a two-channel Modulation Domain Analyzer with an overall measurement range of 200 MHz. An optional third channel (Option 030 or 031 Channel C) extends the instrument overall measurement range to 2.5 GHz.

The channels A and B have switchable input impedance of 1 MΩ and 50Ω. The optional Channel C has an input impedance of 50Ω. Also, an external arm or trigger input with 1 MΩ input impedance can be use for triggering measurements.

The human interface is a front-panel knob and keypad for instrument control and a 9-inch (diagonal) CRT for information display. The HP 53310A can measure modulation on input signals, providing three modes of output: frequency versus time, time interval versus time, and histogram. The frequency and time interval measurements are displayed on the CRT graphically as a series of points versus time like an oscilloscope. A rear panel HP-IB port is provided that can be used to control the instrument and readout or printout data. Continuous streams of measurement data can be sent to the histogram without locking up the front panel.

Figure 6-1 is an overall block diagram of the HP 53310A Modulation Domain Analyzer that shows all the assemblies in the instrument. The three main assemblies are:

- A1 Main Board (Std, Opt 001 Versions)
- A2 Input Board (Std, Opt 030, Opt 031 Versions)
- A3 CPU

The auxiliary assemblies include:

- A4 Keyboard and A5 Rotary Pulse Generator (Front Panel section)
- A6 CRT Monitor
- A7 Power Supply
- A8 AC Line Filter Circuits
- A9/A10 Oscillator (Option 010 only)
- A11 Oscillator Power Supply Board (Option 010 only)
- A12 LO Board Assemby (Opt 031 only)

Most of the instrument's circuitry is contained on the three main assemblies. The following paragraphs will described the function and operation of each individual assembly.

A1 Main Board Assembly

The A1 Main Board Assembly contains all the measurement related circuitry, including the custom counter UCIC (Universal Counter Integrated Circuit), the interpolators, timebase, measurement RAM, histogram, DMA controller, HP-IB, HP-IB port, and microprocessor ports to control the measurement circuitry.

The A1 Main Board also provides interfaces for the Power Supply Assembly. The input to the Main Board Assembly can be from any or all three (if instrument contains the Option 030 Channel C) channels located at the front panel BNCs. The user interface is from the front-panel keyboard or with a controller via the HP-IB connector located on the rear panel. Option 001 expanded memory is installed on this board.

A2 Input Board Assembly

The A2 Input Board Assembly connects to the A1 Main Board. As shown in *Figure 6-1*, the A2 Input Board consists of three standard input connectors, an input amplifier circuit, a multiplexer/divider circuit, and an optional connector for C-Channel input amplifier (Option 030 and 031). Both Channels A and B can be selected for 50Ωor 1MΩ input impedance; Channel A measures frequencies from 10 Hz to 200 MHz, and the Channel B input measures frequencies from 10 Hz to 100 MHz. The optional (030 or 031) Channel C input, with a 50Ω input impedance only, extends the frequency range of the HP 53310A to 2.5 GHz. Option 030 uses prescaling for frequency extension. Option 031 has prescaling and mixer circuits to provide either prescaling or down conversion, and operates with the A12 LO Assembly in the down converter mode. The External Arm input is similar to the other channels, but provides only 1 MΩ of input impedance.

A3 Central Processing Unit (CPU) Assembly

The A3 CPU Assembly contains the microprocessor, system RAM, EPROM, keyboard interface, CRT interface, and a counter timer.

The CPU for the HP 53310A is the 68000 microprocessor that has addressing capability of 16 Megabytes (23 address lines and 16 data lines). The CPU receives its clock from the TCL (Timing Control Logic) at the rate of 9.8304 MHz. The CPU drives the read/write line and the address and data strobes.

A4 Keyboard Assembly

The front-panel keyboard (A4 Keyboard Assembly) of the HP 53310A is elastomeric and has 44 keys. Twenty of the keys are single-function, ten are dual-function, and the remaining seven are display softkeys with variable functions depending on the displayed menu. The keyboard rows are continually scanned at a frequency of 60 Hz and when a key is pressed, the 68000 microprocessor scans the keyboard looking for the depressed key.

A5 Rotary Pulse Generator (RPG) Knob Assembly

The RPG is controlled by the front-panel knob and supplies pulses to the 68000 microprocessor when the knob is turned. The RPG is used to dial in values for various settings of the displayed menu. The RPG will normally be set in coarse mode but may be used in fine mode by pressing the front-panel toggle key labeled FINE.

A6 CRT Monitor Assembly

The A6 CRT Monitor Assembly consists of the sweep or driver board circuitry, a 9-inch CRT, and the CRT yoke. The assembly requires +5V and +12V from the power supply via the A3 CPU Assembly.

The CRT is a non-interlacing raster display which is controlled by the A3 CPU Assembly. The A1 Main Board Assembly provides synchronization and pixel information.

A7 Power Supply Assembly

The A7 Power Supply Assembly is a 120 W switching power supply. It has a dc output power connector and cable that connects to the A1 Main Board Assembly. The ac input range to the power supply is 115V or 230V and has maximum power of 200 W when operating at 48 – 66 Hz.

The Power Supply Assembly provides all voltages necessary to operate the HP 53310A through the Main Board Assembly. Filtered voltages of +15V, +12V, –12V, +5.1V, –5.1V, and +3.5V are supplied to the A1 board where they are distributed throughout the board and to the A2 Input Board Assembly and A3 CPU Assembly.

The +5.1V supply is adjustable. The adjustment procedure is in Chapter 3 (Adjustments and Calibration).

A8 AC Line Filter Circuits (Standard/Option 010)

A8 LINE FILTER CIRCUITRY FOR STANDARD INSTRUMENT

For standard instruments, the A8 AC Line Filter circuitry consists of only the A8 Line Filter/Power Switch/Cable Assembly (53310-60214), which provides the ac source to drive the A7 Power Supply Assembly.

A8 LINE FILTER CIRCUITRY FOR OPTION 010 INSTRUMENT

For instruments that contain the Option 010 High Stability Timebase, the A8 AC Line Filter circuitry consists of the A8 Line Filter Cable Assembly (53310-60212) and T1 Power Transformer/Switch Cable Assembly (HP P/N 53310-60207), which provide the ac source to drive the A7 Power Supply and A11 Oven Oscillator Power Supply assemblies. The A11 Oven Oscillator Power Supply Assembly provides regulated power for the A9 Oven Oscillator/A10 Oscillator assemblies.

A12 LO Board Assembly (Option 031 only)

For instruments equiped with option 031 C channel, the A12 board generates the local oscillator signal that is mixed with the C channel input signal on the A2 board. The A12 output is routed to A2 via two rear-panel connections that allow the user to supply an alternate LO signal. The A12 nominal output is 200 MHz to 2.5 GHz at +3.0 dBm.

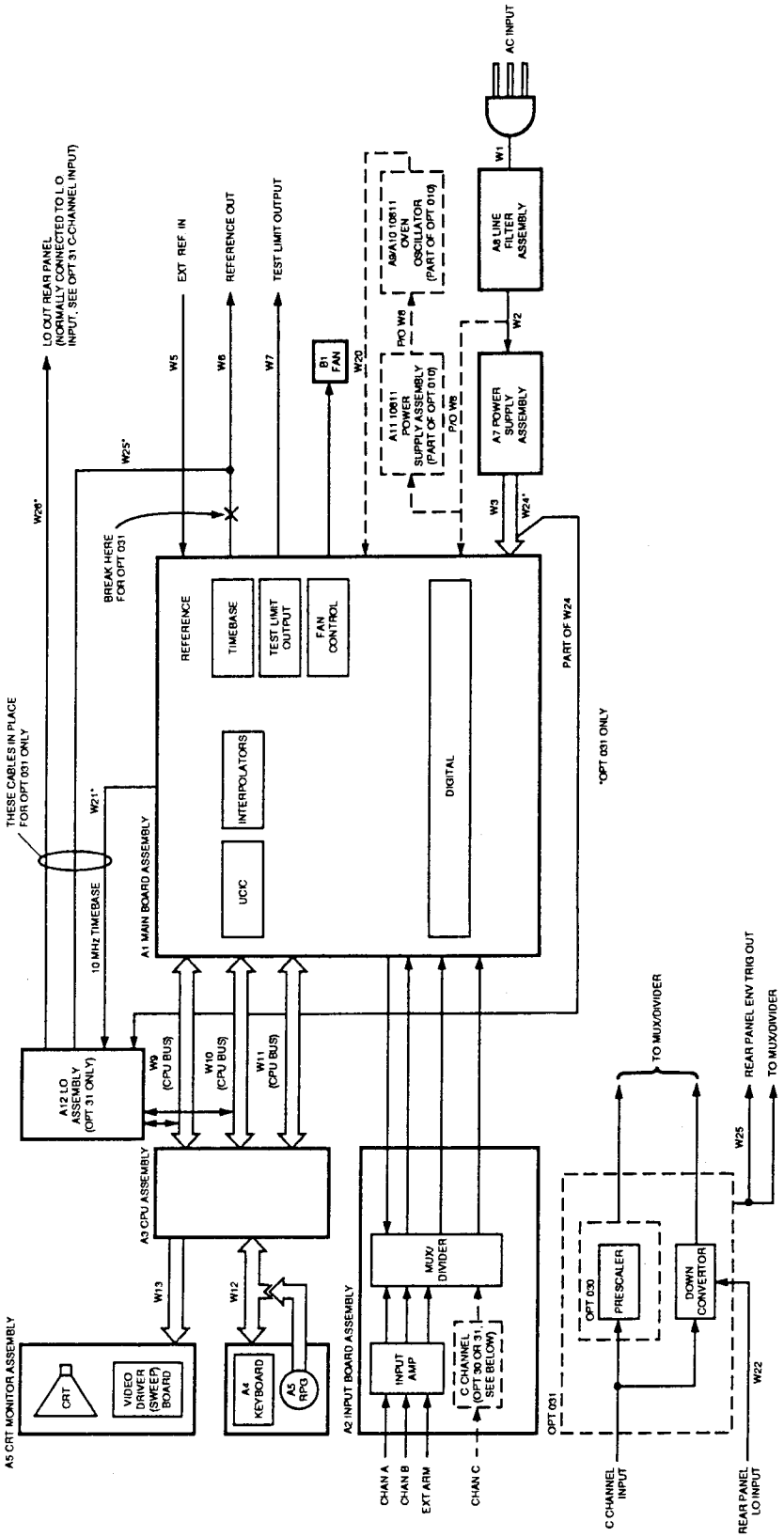


Figure 6-1. HP 53310A Simplified Overall Block Diagram

7

RETROFITTING OPTIONS

INTRODUCTION

This chapter provides procedures that enable you to retrofit your instrument for the following options:

- Option 001 Expanded Memory
- Option 010 High Stability Oven Timebase
- Option 030 Channel C
- Option 031 Channel C

Before working on the instrument, read the Safety Considerations page at the front of the manual.

TOOLS REQUIRED

The following tools are required for the retrofit procedures:

- Hand TORX® 10 and 8 screwdrivers (T10 and T8)
- Small flat-blade screwdriver
- 9/16-inch spin tight
- 1/2-inch spin tight
- Small long-nose plier
- Pozidriv® screwdriver (1PT)

DO THIS FIRST

Before performing any of the retrofit procedures, the following steps must be performed:

1 **Turn the HP 53310A off.**

2 **Remove ac line power cord from the rear panel line filter assembly.**

TO REMOVE THE COVER

The following steps are for removing the cover. The cover is removed to access the board and cable assemblies, and all other internal parts.

WARNING

WHEN THE COVER IS REMOVED FROM THE HP 53310A, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

1 **Turn off the HP 53310A and remove power cord (W1).**

E1667A

2 **Unscrew the ten flat-head TORX screws (H1) that hold the cover (MP2) to the cabinet (MP1), using the TORX® 10 screwdriver.**

Two screws are located on each side of the cover and six screws are located on the top of the cover.

TO RETROFIT OPTION 001 EXPANDED MEMORY

To retrofit the Option 001 Expanded Memory, the A7 Power Supply, A3 CPU, A2 Input Board, and rear panel assemblies must be removed. The existing standard A1 Main Board Assembly (53310-60001) must be removed and replaced by the Option 001 Expanded Memory, which is the 53310-60007 A1 Main Board Assembly. Order part number 53310-60007 to install Option 001.

Refer to the exploded views in *Figure 8-1* and *8-2* in Chapter 8 (Replaceable Parts) as necessary.

CAUTION

Electrostatic discharge can damage the electronic components on the assemblies. Make sure you use a grounded wriststrap and mat when working on the assemblies. The Hewlett-Packard part number for grounded wriststrap and mat is 9300-1484.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 7-1.

3 **Remove A7 Power Supply Assembly by performing the following:**

a. Disconnect cable W3 which connects the A7 Power Supply Assembly to A1 Main Board Assembly.

b. Disconnect A8 Line Filter Cable Assembly from A7 Power Supply Assembly.

c. Remove the two locking pins, MP8, (by pulling them up) that secure the power supply at the right front and rear corners of the instrument cabinet.

d. Slide A7 Power Supply Assembly out through the side of the cabinet.

Note that the power supply assembly is positioned in the top slide grooves.

4 **Remove A3 CPU Assembly by performing the following:**

a. Disconnect cables W12 and W13 from the A3 CPU Assembly.

b. Disconnect cables W9, W10, and W11 from A3 CPU Assembly (and A12 if option 031 is installed).

c. Gently pry loose these cables from the CPU assembly.

d. Now, slide A3 CPU Assembly out through the side of the cabinet.

Note that the CPU assembly is positioned in the slide grooves that are second from the bottom of the cabinet.

5 If option 031 is installed, remove A12 LO Assembly.

a. Disconnect the coaxial cables.

b. Slide A12 LO Assembly out through the side of the cabinet.

6 Remove A2 Input Board Assembly by performing the following:

a. Remove the three BNC nuts (H8) that secure the standard A2 Input Board Assembly to the front panel.

Note that a fourth BNC nut is present on instruments that contain the optional 030 or 031 C Channel.

b. Remove the two pan-head TORX® screws (H2) in A2 Input Board Assembly.

c. With a gentle rocking or prying motion, lift A2 Input Board Assembly from A1 Main Board Assembly.

d. You can use a small flat-blade screwdriver to pry between A2 Input Board and A1 Main board.

e. Unplug the option 031 coaxial cables as required.

f. Guide A2 assembly up and out so that the BNC connectors clear their mounting holes.

7 Remove the dc power supply cable (W3) from A1 Main Board Assembly.

8 Remove the rear panel.

See "TO REMOVE THE REAR PANEL ASSEMBLY (STD/OPT 010)" in Chapter 5 (Replacing Assemblies).

9 Carefully place the HP 53310A on its side.

10 From the bottom of the instrument, remove the eight pan-head TORX® screws (H4) that secure A1 Main Board Assembly to the cabinet.

11 Remove the three CPU bus cables (W9, W10, and W11) and the fan cable from A1 Main Board Assembly.

12 Set the instrument back to its original position.

13 Slowly slide A1 Main Board Assembly out of the cabinet and towards the rear of the instrument.

Note that there is just enough room or space for the UCIC (U39) to clear the rear cabinet opening.

14 Now, install the new Option 001 A1 Main Board Assembly by performing the steps of this procedure in reverse order.

TO RETROFIT OPTION 010 HIGH STABILITY OVEN TIMEBASE

Order part number 53310-60215 for the Option 010 Retrofit Kit.

NOTE

When retrofitting or installing the Option 010 rear panel, make sure all cables are carefully positioned to prevent crimping against the fan, cabinet parts, and electrical parts.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 7-1.

3 **Remove existing standard instrument rear panel by performing the following:**

a. Detach the A8 Line Filter Cable Assembly from A7 Power Supply Assembly.

b. Remove eight pan-head TORX® screws (H4) at the edges of the rear panel (MP2).

Note that there are 4 screws in a row along the top edge of the rear panel and 4 screws in a row along the bottom edge of the rear panel.

c. Pull the rear panel about three inches away from the instrument. (See *Figure 7-1* on page 7-6).

Notice the banana-plug connector (P1) at the bottom corner of the rear panel. During retrofitting of the Option 010 rear panel, be sure the banana connector inserts into the clip on A1 Main Board Assembly. (This provides safety grounding of the rear panel to the A1 Main Board Assembly's input BNCs.)

d. Remove the HP-IB ribbon cable (W4) from A1 Main Board Assembly by spreading the side retainers of the HP-IB connector on the A1 Main Board Assembly.

e. Remove the Ext. Ref. In, Reference Out, and Test Limit Output cables (W5, W6, and W7, respectively). These cables are shown in *Figure 7-1.*

4 **Now, to install the Option 010 High Stability Oven Timebase, which is a rear panel assembly as shown in *Figure 7-2* on page 7-6, perform the following:**

a. Insert the power switch's wire/white connector of T1 Transformer/Switch Cable Assembly through the first bottom cabinet opening from the left side of the cabinet, viewing the instrument from the rear.

b. Insert the wire/white connector of A8 Line Filter Cable Assembly through the first top cabinet opening from the left side of the cabinet, viewing the instrument from the rear.

c. Now, connect the white connectors of T1 and A8 together.

d. Connect the Test Limit Output cable (W7), Reference Out cable (W6), and Ext. Ref. In. cable (W5) of the Option 010 rear panel to the corresponding connector jacks on the A1 Main Board Assembly as shown in *Figure 7-2*.

The cables and corresponding connector jacks are:

Test Limit Output cable (W7) connects to A1J21
Reference Out cable (W6) connects to A1J19
Ext. Ref. In. cable (W5) connects to A1J20

e. Connect cable W8 of the Option 010 rear panel to J6 on the A1 Main Board Assembly as shown in *Figure 7-2*.

f. Connect the coaxial cable (W20) to J22 on the A1 Main Board Assembly as shown *Figure 7-2*.

g. Connect the HP-IB ribbon cable (W4) of the Option 010 rear panel to J11 on the A1 Main Board Assembly as shown in *Figure 7-2*.

h. Place the Option rear panel against the cabinet of the instrument.

Notice the banana-plug connector (P1) at the bottom corner of the Option 010 rear panel. Be sure the banana connector inserts into the clip on A1 Main Board Assembly. (This provides safety grounding of the rear panel to the A1 Main Board Assembly.)

i. Insert and tighten the eight pan-head TORX® screws (H4) at the edges of the Option 010 rear panel.

Note that there are 4 screws in a row along the top edge of the rear panel and 4 screws in a row along the bottom edge of the rear panel. These screws are marked with an asterisk (*) to indicate the correct screw holes.

This completes the retrofitting of the Option 010 High Stability Oven Timebase.

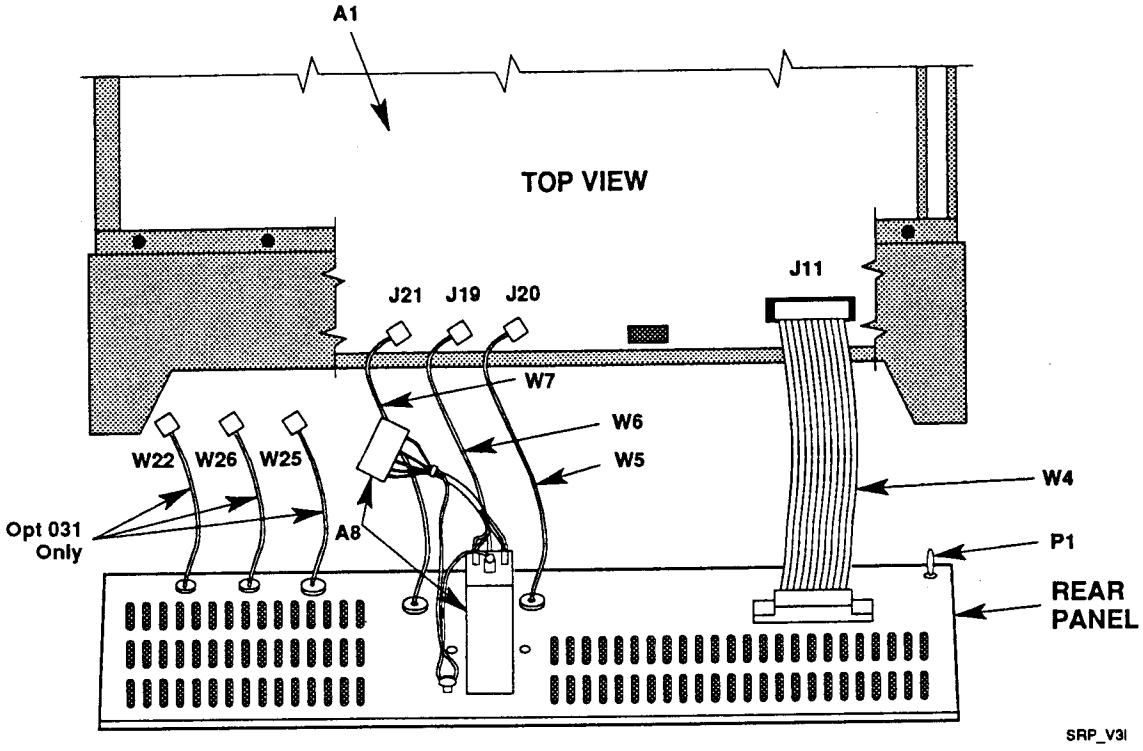


Figure 7-1. Standard Rear Panel Replacement

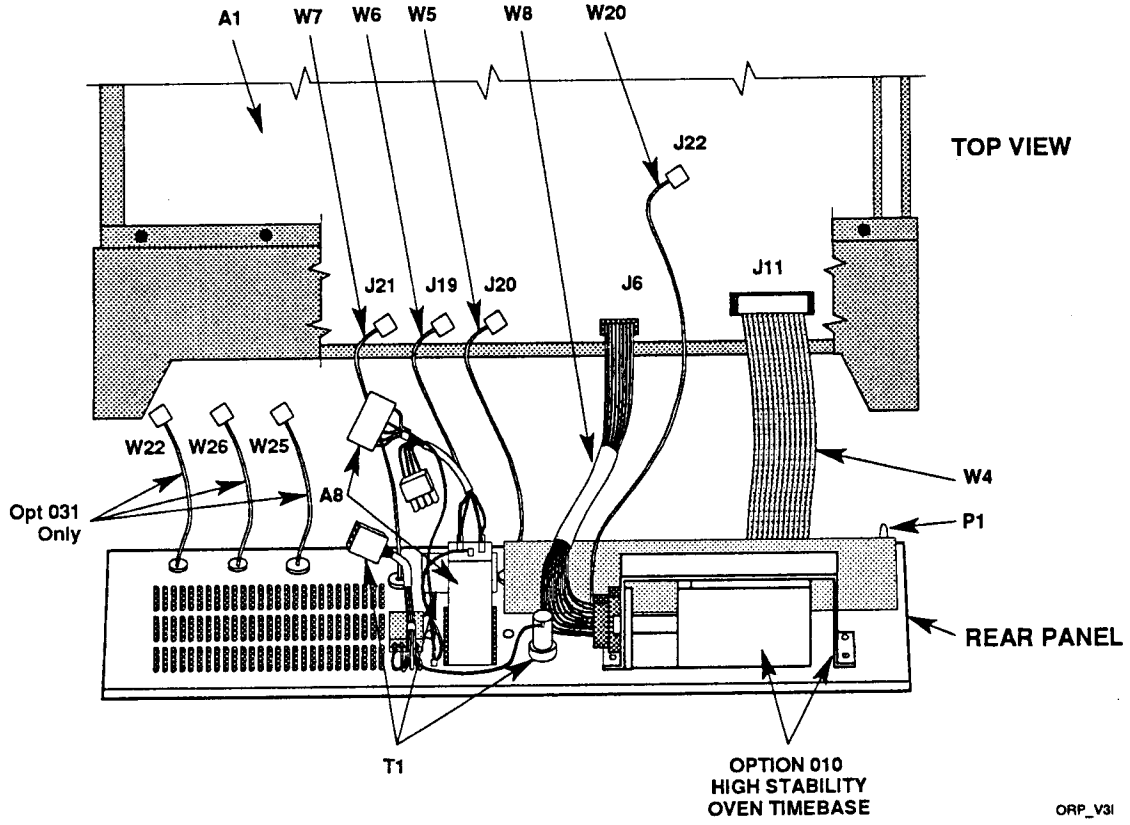


Figure 7-2. Option 010 Rear Panel Replacement

TO RETROFIT OPTION 030 CHANNEL C

To retrofit the Option 030 Channel C, the A7 Power Supply and A3 CPU assemblies must be removed. The existing standard A2 Input Board Assembly (53310-60002) must be removed and replaced by the Option 030 Channel C, which is the 53310-60004 A2 Input Board Assembly. Order part number 53310-60216 for the Option 030 Retrofit Kit.

Refer to the exploded views in *Figure 8-1* and *8-2* in Chapter 8 (Replaceable Parts) as necessary.

1 **Turn off the HP 53310A and remove power cord (W1).**

2 **Remove the cover.**

See "TO REMOVE THE COVER" on page 7-1.

3 **Remove A7 Power Supply Assembly by performing the following :**

a. Disconnect cable W3 which connects the A7 Power Supply Assembly to A1 Main Board Assembly.

b. Disconnect the A8 Line Filter Cable Assembly and pull it through the cabinet openings.

c. Remove the two locking pins, MP8, (by rotating and pulling them up) that secure the power supply at the right front and rear corners of the instrument cabinet.

d. Slide A7 Power Supply Assembly out through the side of the cabinet.

Note that the power supply assembly is positioned in the top slide grooves.

4 **Remove A3 CPU Assembly by performing the following:**

CAUTION

Electrostatic discharge can damage the electronic components on the assemblies. Make sure you use a grounded wriststrap and mat when working on the assemblies. The Hewlett-Packard part number for grounded wriststrap and mat is 9300-1484.

a. Disconnect cables W12 and W13 from the A3 CPU Assembly.

b. Disconnect cables W9, W10, and W11 from A3 CPU Assembly.

c. Gently pry loose these cables from the CPU assembly.

d. Now, slide A3 CPU Assembly out through the side of the cabinet.

Note that the CPU assembly is positioned in the slide grooves that are second from the bottom of the cabinet.

5 Remove existing standard A2 Input Board Assembly by performing the following:

> ***NOTE***
>
> *A2 Input Board Assembly can be removed and re-installed WITHOUT pulling the A1/A2 (Main/Input Board) assembly set from the instrument.*

a. Remove the three BNC nuts (H8) that secure the standard A2 Input Board Assembly to the front panel.

Remove the old label (MP14), 53310-00015, which is held on by the BNC nuts.

b. Remove the two pan-head TORX® screws (H2) in A2 Input Board Assembly.

c. With a gentle rocking or prying motion, lift A2 Input Board Assembly from A1 Main Board Assembly.

d. You can use a small flat-blade screwdriver to pry between A2 Input Board and A1 Main board. Perform this CAREFULLY so as not to damage any components!

e. Guide A2 assembly up and out so that the BNC connectors clear their mounting holes.

6 Now, install the Option 030 A2 Input Board Assembly, which contains the Channel C, by performing the the following:

a. Guide the Option 030 A2 Input Board down and in so that the four BNCs on it protrude through the front-panel mounting holes.

b. Carefully align the connectors J4, J5, and J6 of the A2 board so that they are correctly positioned over the corresponding connectors on the A1 Main Board Assembly.

c. Gently press the A2 assembly onto the A1 assembly.

d. Install the new label (MP25), 53310-00016, over the BNC connectors BEFORE installing nuts.

7 Reassemble the other assemblies to complete the retrofit by performing the procedures in reverse order.

TO RETROFIT OPTION 031 CHANNEL C

General Information and Option 031 Retro-fit Kit Considerations. (Also covers special 59992-J50.)

1 **Only one kit is needed to accomplish the retrofit of Opt 031, in ANY HP 53310. Order part number 53310-67004.**

2 **ALL installation and service information is contained in the service manual.**

3 **These instructions are written in four parts:**

Part 1: For 53310's withOUT Opt 010 shipped with a non-Opt.031 compatible rear panel.
Part 2: For 53310's WITH Opt 010 shipped with a non-Opt.031 compatible rear panel.
Part 3: For 53310's withOUT Opt 010 shipped with an Opt.031 compatible rear panel.
Part 4: For 53310's WITH Opt 010 shipped with an Opt.031 compatible rear panel.

NOTE: See the overview for each procedure to identify the Opt.031 rear panel.

4 **Any other retrofit kit installation requires the ordering and installation of that kit.**

5 **Opt 001 Extended memory option impact: opt 031 has no impact.**

6 **Opt 010 oven oscillator impact: opt 031 impacts this option due to rear panel variations.**

7 **If opt 010 is to be retrofitted along with opt 031, BOTH kits will be needed. Use the assembled rear panel with the Opt 010 kit during retrofit of Opt 031.**

8 **Opt 030 C channel option impact: opt 031 involves input board replacement, and installs the C channel option in the process.**

9 **Option 030 and 031 are mutually exclusive.**

Retrofit Kit Documentation

1 **For instruments shipped with Operating Reference manual (53310-90001) and Programming Reference manual (53310-90003): Install the enclosed 53310-90033 documentation upgrade package.**

2 **For instruments shipped with Operating Reference manual (53310-90037) and Programming Reference manual (53310-90038): No upgrade is needed. These manuals contain the content of the 53310-90033 package. It may be discarded.**

NOTE

Since this kit is designed for ANY 53310 ever produced, there are more parts than may be needed, depending on the exact manufacture date and option configuration of the unit being retrofitted. Also, some spare parts to cover items prone to breakage during disassembly are also included. The excess material may be discarded when the retrofit is completed. Don't be concerned that you may have parts left over.

NOTE

All parts are quantity one (1) unless otherwise indicated.

Sheetmetal and Hardware

Panel, BNC (MP25)	53310-00027
Rear panel - standard (MP3)	53310-00021
Rear panel - Opt 010 (MP26)	53310-60221
Keyboard label/subpanel (MP11)	53310-80032
Bumper, A3 Assy (H28) (qty 2)	0403-0179
Nut, BNC dress (H8) (qty 4)	0590-1251
Washer, 15/32 int lock (H12)	2190-0102
Fuseholder (MP20)	2110-0564
Nut, fuseholder (MP22)	2110-0569
Nut, BNC (H16)	2950-0035

C Channel Boards and EPROMS

53310-60010	A2 Input board
53310-60011	A12 LO board
53310-80028	EPROM A3U24
53310-80029	EPROM A3U25
53310-80030	EPROM A3U23
53310-80031	EPROM A3U20

Cables

Cable W9, W10:	A1/A12/A3CPU buss ribbon cable - (qty 2)	53310-60226
Cable W21:	A1 "Reference Out" to A12 LO board "Reference In"	05340-60111
Cable W22:	A2 input board "LO in" to rear panel "LO in"	53310-60220
Cable W23:	A12 LO board "Reference out" to rear panel "Reference out"	53310-60219
Cable W24:	A7 power supply to A1 main board to A12 LO board	53310-60224
Cable W25:	A2 Input board "Env Trig Out" to rear panel "Env Trig Out"	8120-5055
Cable W26:	A12 LO board "LO Out" to rear panel "LO out"	53310-60222
Cable W27:	Rear panel "LO out" to rear panel "LO in" coax jumper	85660-20101

Documentation

Users Guide	53310-90025
Service manual	53310-90029
Packing list	53310-90031
Upgrade Documentation Package	53310-90033
Programming Quick Reference	53310-90034

INSTALLATION PROCEDURES

CAUTION

Use Appropriate ESD procedures to prevent dammage to electronic items.

PART 1: OVERVIEW

For 53310's withOUT Opt 010 shipped with a non-Opt.031 compatible rear panel.

These units are identifiable by the ABSENCE of three connector holes below the fan opening. The Opt 010 option checkbox on the rear panel will also be blank. For instruments WITHOUT the three connector holes below the fan opening, a new rear panel is fitted as part of the retrofit. Components from the old rear panel will be reused, as well as much of the hardware, so don't actually discard anything until the retrofit is complete and verified.

STEP BY STEP DISASSEMBLY

1 **Remove AC power cord and all other connections.**

2 **Remove top cover. Torx 10 driver needed.**

3 **Remove the two retention pegs that hold the A7 power supply and A3 CPU board in place. Set aside for reuse later.**

4 **Slide A7 out slightly and remove cable W3 between A7 power supply and A1 main board. Discard W3.**

5 **Unplug the power input cable to A7. Remove A7 and set aside.**

6 **Remove 3 CPU ribbon cables W9, W10, and W11. Discard 2 of them.**

7 **Pull loose the other cables going to the A3 CPU board: display and keyboard.**

8 **Remove A3 CPU board and set aside.**

9 **Remove all front panel BNC nuts. Remove BNC panel/label.**

10 **Remove screws that hold A2 to A1. Save hardware.**

11 **Remove A2 input board. Discard.**

12 **Remove keyboard legend panel. The keyboard assy is held on by four screws reached from behind. The knob pulls off. Save all hardware. Discard only the legend panel. See Chapter 5 for details.**

13 **Remove rear panel. Caution: gently pull rear panel straight back. Ground clip behind lower right corner may break if panel is removed at an angle.**

REAR PANEL DIS-ASSEMBLY/RE-ASSEMBLY

In this operation, it is easiest to transfer the components from the old to the new rear panel one at a time. This saves confusion over hardware and minimizes the chance of losing something.

NOTE

Use NEW rear panel 53310-60021.

1 **One at a time, remove and reinstall all components NOT riveted on. Reuse the hardware. Tag any unsoldered wires as needed for re-connection to the proper place on the new panel.**

2 **The items transferred should be: the HP-IB connector, the ground banana plug, the AC input connector, the serial plate, and the following cables:**

3 **W5 "Ext Ref In" (51085-60210) cable/connector from A1 to rear panel.**

4 **W6 "Reference Out" (51085-60210) cable/connector from A1 to rear panel. This cable will be replaced with a new one. Discard.**

5 **W7 "Test Limit Out" (51085-60210) from A1 to rear panel.**

6 **Continuing on rear panel:**

a. Install W22 (53310-60220) cable into "LO in" hole, with SMA at rear panel.

b. Install W23 (53310-60219) cable into "Reference Out" hole, with BNC end at rear panel. Reuse existing BNC nut and washer.

c. Install W25 (8120-5055) cable into "Env Trig Out" hole, with BNC at rear panel. Use washer 2190-0102 and nut 2950-0035 to secure.

d. Install W26 (53310-60222) cable into "LO out" hole, with SMA at rear panel. Use 5/16" socket.

e. Mount W27 coax jumper bewteen "LO out" and "LO In" connectors, on outside of rear panel.

f. Set aside the rear-panel assembly temporarily.

MAIN CHASSIS RE-ASSEMBLY

1 **Install new keyboard legend panel 53310-80032, re-using existing hardware. See Chapter 5 for details.**

2 **Install SMB end of W21 (05340-60111) to J19 on A1 board. Feed other end toward input board area of instrument.**

3 **Carefully re-assemble rear panel onto instrument. Feed cables into the instrument, keeping wires clear of fan. Make sure all connections stay seated as rear panel is positioned into place.**

4 **Attach cable W5 from "Ext Ref In" to A1 main board J20.**

5 **Attach cable W7 from "Test Limit Out" to A1 main board J21.**

6 **Ensure that the following cables are present:**

W21 (long) SMC end from A1 J19. W22 MCX end from rear panel "LO In". W23 (short) SMC end from rear panel "Ref Out". W25 SMB end from rear panel "Env Trig Out". W26 SMA end from rear panel "LO Out".

NOTE

W24 will be installed later.

7 **Install Opt 031 A2 board 53310-60010:**

a. Holding the board in approximate position with components up, attach the MCX connector on W22 to the "LO In" jack on the board.

b. Carefully turn the board over and position the cable near the outside edge, near the ribbon cable connectors. Twist the the cable as little as possible.

c. Insert the front panel connectors into their holes and CAREFULLY position the A2 board onto its mating A1 connectors.

d. Use the OLD BNC label and nuts as a "puller" to help align the A2 to A1 connectors as follows: Install the old BNC label and all four nuts and tighten each a turn at a time, for about 2 turns. This step will pull A2 toward the front panel slightly and allow the A2-to-A1 connectors to be mated more easily.

e. Check W22 once more to be sure it is not pinched under any components.

f. CAREFULLY seat A2 into its connectors. Check W22 one more time.

g. Install the previously removed hardware through A2 into the threaded inserts in A1. Do not overtighten.

h. Remove the old BNC label and nuts and install a new BNC label 53310-00016. Use new dress nuts 0590-1251 for the all the BNC's. Exercise care with the tools so as not to scratch the label/panel or the nuts.

i. Attach SMB end of W25 to connector on top side of A2.

8 Install new power ribbon cable W24 (53310-60224) onto A1 with twisted pair branch connection positioned at A1 end.

9 Install two new ribbon cables W9 and W10 (53310-60026) on the two FRONT most connectors at the left edge of A1. Install one older ribbon cable - it will have only two connectors on it - at the third connector

10 Slide the A12 LO board into the lowest slot. Hold the ribbon cables down and out of way. Use care that no sharp component leads or edges tear those cables.

11 Feed the twisted pair line from W24 up through cut-out in A12 and plug it into the 3 pin receptacle on the A12 board.

12 Install SMC plug on the end of W21 to the "Ref In" SMC connector on A12. This connector is the one closest to the CRT.

13 Install the SMC plug on the end of W23 to the "Ref Out" SMC connector on A12.

14 Install the SMA plug on the end of W26 to the "LO Out" SMA connector on A12.

15 Check the position of A12 in the cabinet. See that all cables are in place and dressed clear of other parts.

NOTE

DO NOT install the ribbon cables onto A12 yet. They will interfere in a following step.

16 Perform the following on the A3 board (instruments with SN 3121A00780 and lower):

a. Remove the stiffener and relocate it to the component side of the board. Re-use the existing hardware. This is needed to provide clearance for the A12 board that mounts under it.

b. Remove the four EPROM's U20, U23, U24, and U25. Use an IC puller, or a long thin screwdriver to gently pry the IC's from their sockets. These IC's can be discarded.

c. Install the new EPROM's in their respective locations matching the locator information on the label with the PC board. USE CARE THAT NO PINS ARE BENT UNDER THE IC! INSPECT THIS AREA CAREFULLY!

d. On the backside of A3, install two rubber bumpers (part number 0403-0179) under ICs U21 and U22. Carefully clean the area with alcohol to ensure good adhesion. (These bumpers prevent A3 and A12 from touching each other and causing a short.)

17 **Install the A3 CPU board in the slot above A12 board.**

18 **Install the W9, W10, and W11 ribbon cables onto A12 and A3.**

19 **Install the other ribbon cables onto A3, from the keyboard, and from the CRT driver board. Dress the cables as required to clear other parts.**

20 **Seat the A3 board fully into its slot, checking that all cables are secure and not binding against other parts.**

21 **Slide the A7 power supply into the top slot. Connect the W24 ribbon cable, insuring that the connector is not offset one pin. Connect the ac power input cable at the rear of A7.**

22 **Slide in the retaining pegs, adjusting slightly the positions of A7, A3 and A12 so that the pegs seat fully down.**

23 **Move serial plate to new rear panel.**

24 **Check option box on new rear panel as needed.**

25 **Perform operational verification test.**

26 **Re-install cover.**

PART 2: OVERVIEW

For 53310's WITH Opt 010 shipped with a non-Opt.031 compatible rear panel.

These units are identifiable by the ABSENCE of three connector holes below the fan opening. The Opt 010 option checkbox on the rear panel will be filled in, and the square aluminum cover over the oven oscillator will be visible. For instruments WITHOUT the three connector holes below the fan opening, a new rear panel is fitted as part of the retrofit. Components from the old rear panel will be transferred to the new panel, using the existing hardware. Don't throw anything away until the retrofit is completed.

Execute Part 1, and items shown below.

REAR PANEL STEP BY STEP DISASSEMBLY/REASSEMBLY: Differences from part 1

NOTE

Use NEW rear panel 53310-60221.

1 **In addition to the items described in Part 1, the following items must be transferred to the new rear panel: oven power supply fuse holder, oven power line voltage selector, power switch, oven oscillator, oven oscillator power supply board, and all associated wiring.**

2 **The only wires that should need unsoldering is the black wire at the oven power supply fuse holder, and the two green ground leads. All the other components connected to soldered wiring can remain connected and may be moved as an assembly.**

3 **Wiring using plug-in connections can be pulled loose and moved easily.**

4 **Carefully inspect the plastic fuseholder and the plastic retaining nut for any damage. Replace it with the one included (2110-0564) and secure with the plastic nut 2110-0569 as needed.**

5 **Re-install components in same orientation as removed. Note position of wires and hardware. These orientations are needed to provide clearance for other items.**

6 **Carefully check all wiring for clearance. Tie-wrap as needed, using shop furnished tie-wraps.**

PART 3: OVERVIEW

For 53310's withOUT Opt 010 shipped with an Opt.031 compatible rear panel.

These units are identifiable by the PRESENCE of three connector holes below the fan opening. The Opt 010 option checkbox on the rear panel will be BLANK. For instruments WITH the three connector holes below the fan opening, the existing rear panel is used, and new cables are installed in the holes.

Execute Part 1, with these differences:

STEP BY STEP DISASSEMBLY: Differences from part 1

1 **Remove dress plug at rear panel for new Opt 031 BNC connector.**

2 **DO NOT remove any other components from the rear panel.**

STEP BY STEP RE-ASSEMBLY: Differences from part 1

3 **1. The only new parts installed on the rear panel are the cables called for.**

PART 4: OVERVIEW

For 53310's WITH Opt 010 shipped with an Opt.031 compatible rear panel.

These units are identifiable by the PRESENCE of three connector holes below the fan opening. The Opt 010 option checkbox on the rear panel will be filled in, and the square aluminum cover over the oven oscillator will be visible.

Execute Part 1, with these differences:

STEP BY STEP DISASSEMBLY: Differences from part 1

1 **Remove dress plug at rear panel for new Opt 031 BNC connector.**

2 **DO NOT remove any other components from the rear panel.**

STEP BY STEP RE-ASSEMBLY: Differences from part 1

1 **The only new parts installed on the rear panel are the cables called for.**

8

REPLACEABLE PARTS

INTRODUCTION

This chapter contains information for ordering parts. *Table 8-1* is a list of exchange assemblies, and *Table 8-2* is a list of reference designations used in the parts list and throughout the manual. *Table 8-3* lists all replaceable assemblies and parts for the Standard HP 53310A. *Table 8-4* lists all replaceable parts for Options. Table 8-5 is a list of the manufacturer's code numbers given in the parts list. It contains the names and addresses corresponding to the code number of the manufacturer. *Figures 8-1* through *8-4* are various exploded views of the HP 53310A.

EXCHANGE ASSEMBLIES

Table 8-1 lists assemblies within the instrument that may be replaced on an exhange basis. Factory repaired and tested exchange assemblies are available only on a trade-in basis. Defective assemblies must be returned for credit. (Note: Part numbers for the new and exchange assemblies are also listed in *Table 8-3*.)

Table 8-1. Exchange Assemblies

ASSEMBLY	NEW ASSEMBLY HP PART NO.	EXCHANGE ASSEMBLY HP PART NO.
A1 Main Board	53310-60001	53310-69001
A1 Main Board (Opt. 001, Expanded Memory)	53310-60007	53310-69007
A2 Input Board	53310-60002	53310-69002
A2 Input Board		
(Opt. 030, C-Channel)	53310-60004	53310-69004
(Opt. 031, C-Channel)	53310-60010	53310-69010
A3 CPU Board	53310-60003	53310-69003
A9 Oven Oscillator (Opt. 010, High Stability Timebase)	10811-60111	10811-69001
A12 L.O. Board (Option 031 only)	53310-60011	53310-69011

REFERENCE DESIGNATIONS

Table 8-2 lists the reference designations used in the parts lists, block diagrams, and throughout the manual.

REPLACEABLE PARTS

Table 8-3 is a list of replaceable parts and is organized as follows:

1. 1. Electrical assemblies in alphanumerical order by reference designation.
2. 2. Chassis-mounted electrical parts in alphanumerical order by reference designation.
3. 3. Chassis-mounted mechanical parts in alphanumerical order by reference designation.

The information given for each part consists of the following:

1. Reference designation.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity (QTY) in instrument. The total quantity is given once and at the firsts appearance of the part number in the list.
5. Description of the part.
6. Typical manufacturer's part number for the part.

HOW TO ORDER A PART

Hewlett-Packard wants to keep your parts ordering process as simple and efficient as possible. Think of the process as having the following steps:

- Identifying the part and the quantity you want.
- Determining the ordering method to be used and contacting Hewlett-Packard.

Parts Identification

To identify the part(s) you want, first refer to the exploded views (*Figures 8-1* through *8-4*) at the back of this chapter.

When ordering from Hewlett-Packard, the important numbers to note from the Parts List are the HP Part Number and part-number check digit (in the "CD" column), and the quantity of the part you want.

If the part you want is NOT identified in the manual, you can call on Hewlett-Packard for help (see the following section "Contacting Hewlett-Packard"). Please have the following information at hand when you contact HP for help:

- Instrument Model Number (example "HP 53310A").
- Complete instrument Serial Number (example "1234A56789"). Information about where to find the serial number is given in the preface of this manual in the "HOW TO USE THIS MANUAL" section.
- Description of the part and its use.
- Quantity of the part required.

Contacting Hewlett-Packard

Depending on where you are in the world, there are one or more ways in which you can get parts or parts information from Hewlett-Packard.

- Outside the United States, contact your local HP sales office. HP sales offices are listed at the back of this manual.
- Within the United States, we encourage you to order replacement parts or request parts information directly by telephone or mail from the HP Support Materials Organization, using the telephone numbers or address listed below. (You can also contact your local HP sales office. HP sales offices are listed at the back of this manual.)

  By telephone:

  – For Parts Ordering, use our toll-free number, (800) 227-8164, Monday through Friday (except Holidays), 6 am to 5 pm (Pacific Time).

    If you need a part in a hurry, an extra-cost Hotline phone ordering service is available, 24 hours a day. Use the toll-free number above at the times indicated; at the other times, use (415) 968-2347.

  – For Parts Identification Assistance, call us at (916) 783-0804. Our Parts Identification hours are from Monday through Friday, 6 am to 5 pm (Pacific Time).

  For mail correspondence, use the address below:

  Hewlett-Packard
  Support Materials Roseville
  P.O. Box 1145
  Roseville, CA 95661-1145

CABINET PARTS AND HARDWARE

To locate and identify miscellaneous cabinet and chassis parts and instrument hardware, refer to *Figures 8-1* through *8-4*. These figures provide various exploded views of the instrument, with the parts identified by reference designations; the reference designations correspond with the ones in *Tables 8-3* and *8-4*.

Table 8-2. Reference Designations

REFERENCE DESIGNATIONS

A = assembly	DS = annunciator; signaling device (audible or visual) lamp; LED	K = relay	TB = terminal board
AT = attenuator; isolator; termination	E = miscellaneous electrical part	L = coil; inductor	TC = thermocouple
B = fan; motor	F = fuse	M = metre	TP = test point
BT = battery	FL = filter	MP = miscellaneous mechanical part	U = integrated circuit; microcircuit
C = capacitor	H = hardware	P = electrical connector (movable portion); plug	V = electron tube
CP = coupler	HY = circulator	Q = transistor; SCR; triode thyristor	VR = voltage regulator; breakdown diode
CR = diode; diode thyristor; varactor	J = electrical connector (stationary portion); jack	R = resistor	W = cable; transmission path; wire
DC = directional coupler		RT = thermistor	X = socket
DL = delay line		S = switch	Y = crystal unit — piezo-electric
		T = transformer	Z = tuned cavity; tuned circuit

Table 8-3. HP 53310A Standard Instrument Replaceable Parts

Reference Designation	HP Part	CD	Qty	Description	Mfr Code	Mfr Part Number
EXCHANGE ASSEMBLIES						
A1	53310-60001	9	1	MAIN BOARD ASSEMBLY	28480	53310-60001
A1	53310-69001	7	1	MAIN BOARD ASSEMBLY (RESTORED-EXCHANGE)	28480	53310-69001
A2	53310-60002	0	1	INPUT BOARD ASSEMBLY	28480	53310-60002
A2	53310-69002	8	1	INPUT BOARD ASSEMBLY (RESTORED-EXCHANGE)	28480	53310-69002
A3	53310-60003	1	1	CPU ASSEMBLY	28480	53310-60003
A3	53310-69003	9	1	CPU ASSEMBLY (RESTORED-EXCHANGE)	28480	53310-69003
ELECTRICAL ASSEMBLIES						
A4	54503-66502	2	1	KEYBOARD ASSEMBLY; PC BOARD & KEYBD CABLE	28480	54503-66502
A5	0960-0753	6	1	RPG ASSEMBLY	28480	0960-0753
A6	2090-0211	8	1	CRT MONITOR ASSEMBLY	28480	2090-0211
A7	0950-1879	8	1	POWER SUPPLY ASSEMBLY	09899	0950-1879
A8	53310-60214	6	1	LINE FILTER/POWER SWITCH & CABLE ASSEMBLY	11855	53310-60214
CHASSIS PARTS						
A1H1	0515-2032	5	4	SCREW FOR BOTTOM RF SCHIELD	00000	ORDER BY DESCRIPTION
A1H2	0515-0430	3	4	SCREW FOR TOP RF SCHIELD	00000	ORDER BY DESCRIPTION
A7F1	2110-0030	3	1	FUSE 5 AMP F-BLO, IN A7 POWER SUPPLY ASSY	75915	312 005
B1	3160-0521	3	1	FAN, TUBEAXIAL	11045	3160-0521
F1	2110-0003	0	1	FUSE, 3 AMP F-BLO, IN A8 LINE FILTER ASSY	75915	312 003
H1	0515-1035	6	18	SCREW FOR FT (6), COVER (10), LINE FILT (2);	00000	ORDER BY DESCRIPTION
H2	0515-0430	3	7	SCREW FOR CPU STIFFNER (3), A2 INPUT BD (2)	00000	ORDER BY DESCRIPTION
H3				NOT ASSIGNED		
H4	0515-0374	4	20	SCREW FOR FAN (4), BOTTOM A1 (8), REAR PNL (8)	00000	ORDER BY DESCRIPTION
H5	0515-0380	2	1	CRT FOR CORNER SCREW; MAX.7PANTRXL	00000	ORDER BY DESCRIPTION
H6	0590-1826	1	1	CRT CHASSIS INSERT; THREADED M4X0.7	00000	ORDER BY DESCRIPTION
H7	0535-0056	1	3	CRT LOCKNUT-HEX; M4X.77MMA/F	00000	ORDER BY DESCRIPTION
H8	0590-1251	6	3	NUT, SPCLY 15/32-32 THD .1-IN-THK .562WDS	00000	ORDER BY DESCRIPTION
H9	0515-1134	6	4	SCREW FOR KEYBOARD; M3X.5X18FLTTX	00000	ORDER BY DESCRIPTION
H10	0515-0113	9	10	CABINET NUT, TOP & SIDES; TINNERMAN M3X.5	00000	ORDER BY DESCRIPTION
H11	0380-1482	0	2	HP-IB CONN. STANDOFF-HEX; 4-40X.34HX	00000	ORDER BY DESCRIPTION
H12	2190-0102	8	3	WSHR 1/2 IN-LOK FOR EXT REF IN CONNECTOR	78189	1924-02
H13	2190-0027	6	1	INTENSITY ADJ. WASHER; 1/4 IN-LOK	00000	ORDER BY DESCRIPTION
H14	2950-0072	3	1	INTENSITY ADJ. NUT; HEX.25-32THD	00000	ORDER BY DESCRIPTION
H15	2950-0001	8	1	RPG NUT; 3/8-32 0.093-THK	00000	ORDER BY DESCRIPTION

Table 8-3. HP 53310A Standard Instrument Replaceable Parts (Continued)

Reference Designation	HP Part	CD	Qty	Description	Mfr Code	Mfr Part Number
H16	2950-0035	8	3	NUT-HEXL CHAM FOR EXT REF IN CONNECTOR	00000	ORDER BY DESCRIPTION
H17	01650-82401	1	2	SCREW FOR HANDLE-SHOULDER	28480	01650-82401
H18	01650-00203	9	2	NUT PLATE FOR HANDLE		
H19	2190-0017	8	2	WASHER, SPLIT-LOCK FOR HPIB CONNECTOR	00000	ORDER BY DESCRIPTION
H28	0403-0179		2	BUMPER ADHESIVE MTG. FOR A3 ASSEMBLY		
MP1	54503-60001	4	1	CABINET (HOUSING ASSEMBLY)	28480	54503-60001
MP2	53310-00006	8	1	COVER-TOP	28480	53310-00006
MP3	53310-00021	3	1	PANEL-REAR (FOR STD INSTRUMENT)	28480	53310-00021
MP4	53310-00011	5	1	PLATE-BLANK (FOR SERIAL NUMBER)	28480	53310-00011
MP5				NOT ASSIGNED		
MP6	01650-47701	0	2	FOOT MOLDED	28480	01650-47701
MP7	01460-1345	9	2	STAND-TILT	28480	01460-1345
MP8	01650-46101	2	2	LOCKING PINS FOR POWER SUPPLY & CPU ASSY	28480	01650-46101
MP9	01650-01202	0	1	BRACKET-GND AND CRT DRIVER BD GUIDE	28480	01650-01202
MP10	53310-40001	7	1	KEYPAD	28480	53310-4000
MP11	53310-80001	1	1	KEYPAD LABEL/SUBPANEL	28480	53310-80001
MP12	01650-04901	2	1	CABINET HANDLE-BAIL	28480	01650-04901
MP13	01650-47401	7	1	KNOB FOR RPG	28480	01650-47401
MP14	53310-00015	9	1	LABEL-BNC (FOR STD INSTRUMENT)	28480	53310-00015
MP15	53310-80003	3	1	LABEL-ID	28480	53310-80003
MP16	1400-1102	6	2	CLAMP-HOLDS CRT CABLE (W13) TO REAR PANEL	16956	1400-1102
MP17	6960-0002		1	DRESS PLUG		
MP18				NOT ASSIGNED		
MP19				NOT ASSIGNED		
P1	54503-87601	6	1	PLUG-BANANA; REAR PANEL/A1 MAIN BD GROUND	28480	54503-87601
W1	08120-1521	6	1	POWER CORD SET 18-AWG 3-COND 90-IN-LG	08452	P34-SVT-C25 3X 18 AWG
W2				NOT ASSIGNED		
W3	54503-61606	7	1	CBL: A7 PWR SUP TO A1 MAIN BD (DC TP A1)	28480	54503-61606
W4	54503-61602	3	1	CBL: A1 MAIN BD TO REAR PNL HP-IB CONN	28480	54503-61602
W5	51085-60210	4	1	CBL: A1 MAIN BD TO REAR PNL EXT REF IN CONN	28480	08120-5305
W6	51085-60210	4	1	CBL: A1 MAIN BD TO REAR PNL TIME BASE OUT	28480	08120-5305
W7	51085-60210	4	1	CBL: A1 MAIN BD TO REAR PNL TEST LIMIT OUT	28480	08120-5305
W8				NOT ASSIGNED IN STD INSTRUMENT; SEE OPT 010		
W9	53310-60201	1	1	CBL: A1 MAIN BD TO A3 CPU (CPU BUS)	28480	53310-60201
W10	53310-60201	1	1	CBL: A1 MAIN BD TO A3 CPU (CPU BUS)	28480	53310-60201
W11	53310-60201	1	1	CBL: A1 MAIN BD TO A3 CPU (CPU BUS)	28480	53310-60201
W12				NOT A REPLACEABLE PART; P/O OF A4 KEYBOARD	28480	53310-60201
W13	53310-60202	2	1	CBL: A3 CPU TO A6 DRIVER BD (P/O CRT ASSY)	28480	53310-60202
W14	1650-61614	6	1	CBL: A6 DRIVER BD INTENSITY CABLE ASSY	28480	1650-61614
W15				NOT ASSIGNED		
W16				NOT ASSIGNED		
W17				NOT ASSIGNED		
W18				NOT ASSIGNED		
W19				NOT ASSIGNED		

Table 8-3. HP 53310A Standard Instrument Replaceable Parts (Continued)

Reference Designation	HP Part	CD	Qty	Description	Mfr Code	Mfr Part Number
W20				See Option 010 (Page 8-7)		
W21				See Option 031 (Page 8-8)		
W22				See Option 031 (Page 8-8)		
W23				See Option 031 (Page 8-8)		
W24				See Option 031 (Page 8-8)		
W25				See Option 031 (Page 8-8)		
W26				See Option 031 (Page 8-8)		
W27				See Option 031 (Page 8-8)		
				EXTRA MANUALS		
	53310-90001	2	1	OPERATING REFERENCE MANUAL	28480	53310-90001
	53310-90003	4	1	PROGRAMMING REFERENCE MANUAL	28480	53310-90003
	53310-90029	6	1	SERVICE MANUAL	28480	53310-90029
	53310-90034	8	1	QUICK REFERENCE PROGRAMMING GUIDE	28480	53310-90034
	53310-90008	9	1	QUICK START GUIDE	28480	53310-90008
	53310-90025		1	OPTION 031 USER'S GUIDE	28480	53310-90025
	53310-90033		1	UPGRADE DOCUMENTATION PACKAGE	28480	53310-90033
	53310-90037		1	OPERATING REFERENCE MANUAL (INCLUDES 53310-90033 CHANGES AVAILABLE AFTER 1/93)	28480	53310-90037
	53310-90038		1	PROGRAMMING REFERENCE MANUAL (INCLUDES 53310-90033 CHANGES AVAILABLE AFTER 1/93)	28480	53310-90038

Table 8-4. HP 53310A Replaceable Parts for Options

Reference Designation	HP Part	CD	Qty	Description	Mfr Code	Mfr Part Number
53310A OPT001				**EXPANDED MEMORY**		**53310A OPT001**
A1	53310-60007	5	1	MAIN BOARD ASSEMBLY WITH EXPANDED MEMORY	28480	53310-60007
A1	53310-69007	3	1	MAIN BD ASSY/W EXPD MEM (RESTORED-EXCHANGE)	28480	53310-69007
53310A OPT010				**HIGH STABILITY OVEN TIMEBASE**		**53310A OPT010**
A8	53310-60212	4	1	LINE FILTER/POWER CABLE ASSEMBLY	11855	53310-60212
A9	10811-60111	8	1	OVEN OSCILLATOR	28480	10811-60111
A9	10811-69001	3	1	OVEN OSCILLATOR (RESTORED-EXCHANGE)	28480	10811-69001
A10	53310-60005	3	1	OSCILLATOR BOARD ASSEMBLY	28480	53310-60005
A11	53310-60006	4	1	OSC POWER SUPPLY BOARD ASSEMBLY	28480	53310-60006
F2	2110-0012	1	1	FUSE (OPT 010); .5 A F-BLO FOR A11 OSC P.S.	75915	312 500
	2110-0004	1	1	FUSE (OPT 010); .25 A F-BLO FOR A11 OSC P.S.	75915	312 250
H4	0515-0374	4	6	SCREW FOR LINE SELECTOR (2), OSC BRKT (4)	00000	ORDER BY DESCRIPTION
H20	0460-1750	5	1	INSULATOR FOR OVEN OSC CAN; TAPE 3/16TK OPCL	00000	ORDER BY DESCRIPTION
H21	0515-0367	5	3	SCREW FOR REAR PNL STDOFFS; M2.5LK8.0L TX	00000	ORDER BY DESCRIPTION
H22	0515-1038	9	4	SCREW FOR TRANSFORMER (T1); M3.0LK30L TX	00000	ORDER BY DESCRIPTION
H23	0515-1969	5	3	SCR FOR STDOFF TO A10/A11 ASSY; M2.5LK10L TX	00000	ORDER BY DESCRIPTION
H24	2360-0195	0	2	SCR FOR OVEN OSC BRACKET; MACH 6-32	00000	ORDER BY DESCRIPTION
H25	0050-2199	9	3	BRACKET-OSC PWR SUPP BD STANDOFFS	85471	0050-2199
H26	53310-00007	9	1	NUT FOR TRANSFORMER (T1)	28480	53310-00007
H27	53310-00008	0	1	NUT PLATE FOR LINE SELECTOR SWITCH	28480	53310-00008
MP17	6960-0002		1	DRESS PLUG		
MP20	2110-0564	5	1	FUSEHOLDER	H9027	2110-0564
MP21	2110-0565	9	1	FUSE CARRIER: 3AG	H9027	2110-0565
MP22	2110-0569	3	1	NUT FOR FUSEHOLDER	H9027	2110-0569
MP23	53310-00004	6	1	BRACKET-OSCILLATOR	28480	53310-00004
MP24	7100-0389	9	1	TRANSFORMER COVER, BELL 7/8	28480	7100-0389
MP26	53310-60221		1	PANEL - REAR-OPT010	28480	53310-60221
T1	53310-60207	7	1	XFMR & SW CBL ASSY; A11 OSC P.S. -TO-XFMR	28480	53310-60207
W8	53310-60211	3	1	CBL: A9 OVEN OSC/A10 OSC BD-TO-A11 OSC PWR	28480	53310-60211
W20	8120-5253	9	1	CBL: A9 OVEN OSC/A10 OSC BD-TO-A1 MAIN BD.	28480	8120-5253
53310A OPT030				**CHANNEL C**		**53310A OPT030**
A2	53310-60004	2	1	INPUT BOARD ASSEMBLY WITH C CHANNEL	28480	53310-60004
A2	53310-69004	0	1	INPUT BD ASSY/W C CHAN (RESTORED-EXCHANGE)	28480	53310-69004
H8	2950-0035	8	1	NUT, HEX DBL CHAM 15/32-32 THO-056200	00000	ORDER BY DESCRIPTION
MP25	53310-00016	0	1	LABEL-BNC (FOR OPTION 030, 031 INSTRUMENT)	28480	53310-00027

Table 8-4. HP 53310A Replaceable Parts for Options

Reference Designation	HP Part	CD	Qty	Description	Mfr Code	Mfr Part Number
53310A OPT031				**CHANNEL C - HI RES**		**53310 OPT031**
A2	53310-60010		1	INPUT BOARD ASSY WITH HI-RES C CHANNEL	28480	53310-60010
A2	53310-69010		1	INPUT BOARD ASSY WITH HI-RES C CHANNEL (RESTORED-EXCHANGE	28480	53310-69010
A3U20	53310-80028		1	EPROM	28480	53310-80028
A3U23	53310-80029		1	EPROM	28480	53310-80029
A3U24	53310-80030		1	EPROM	28480	53310-80030
A3U25	53310-80031		1	EPROM	28480	53310-80031
A12	53310-60011		1	L. O. BOARD	28480	53310-60011
A12	53310-69011		1	L. O. BOARD (RESTORED-EXCHANGE)	28480	53310-69011
H8	0590-1251		1	NUT, BNC DRESS FOR CHAN C CONN	00000	ORDER BY DESCRIPTION
H12	2190-0102		1	WASHER, 1/2 IN-LOK FOR ENV TRIG OUT CONN	78189	1924-02
H16	2950-0035		1	NUT, BNC FOR ENV TRIG OUT CONN	00000	ORDER BY DESCRIPTION
H28	0403-0179		2	BUMPER-ADHESIVE MGT. FOR A3 ASSEMBLY	00000	ORDER BY DESCRIPTION
MP11	53310-80032		1	KEYBOARD LABEL/SUB PANEL	28480	53310-80032
MP25	53310-00027		1	PANEL, BNC	28480	53310-00027
W9	53310-60226		1	CBL: A1/A12/A3 CPU BUSS	28480	53310-60226
W10	53310-60226		1	CBL: A1/A12/A3 CPU BUSS	28480	53310-60226
W21	05340-60111		1	CBL: A1 "REF OUT" TO A12 "REF IN"	28480	05340-60111
W22	53310-60220		1	CBL: A2 "LO IN" TO REAR PANEL "LO IN"	28480	53310-60220
W23	53310-60219		1	CBL: A12 "REF OUT" TO REAR PANEL "REF OUT"	28480	53310-60219
W24	53310-60224		1	CBL: A7/A1/A12 POWER	28480	53310-60224
W25	8120-5055		1	CBL: A2 "ENV TRIG OUT" TO REAR PANEL "ENV TRIG OUT"	28480	8120-5055
W26	53310-60222		1	CBL: A12 "LO OUT" TO REAR PANEL "LO OUT"	28480	53310-60222
W27	85660-20101		1	CBL: REAR PANEL "LO OUT" TO "LO IN"	28480	85660-20101

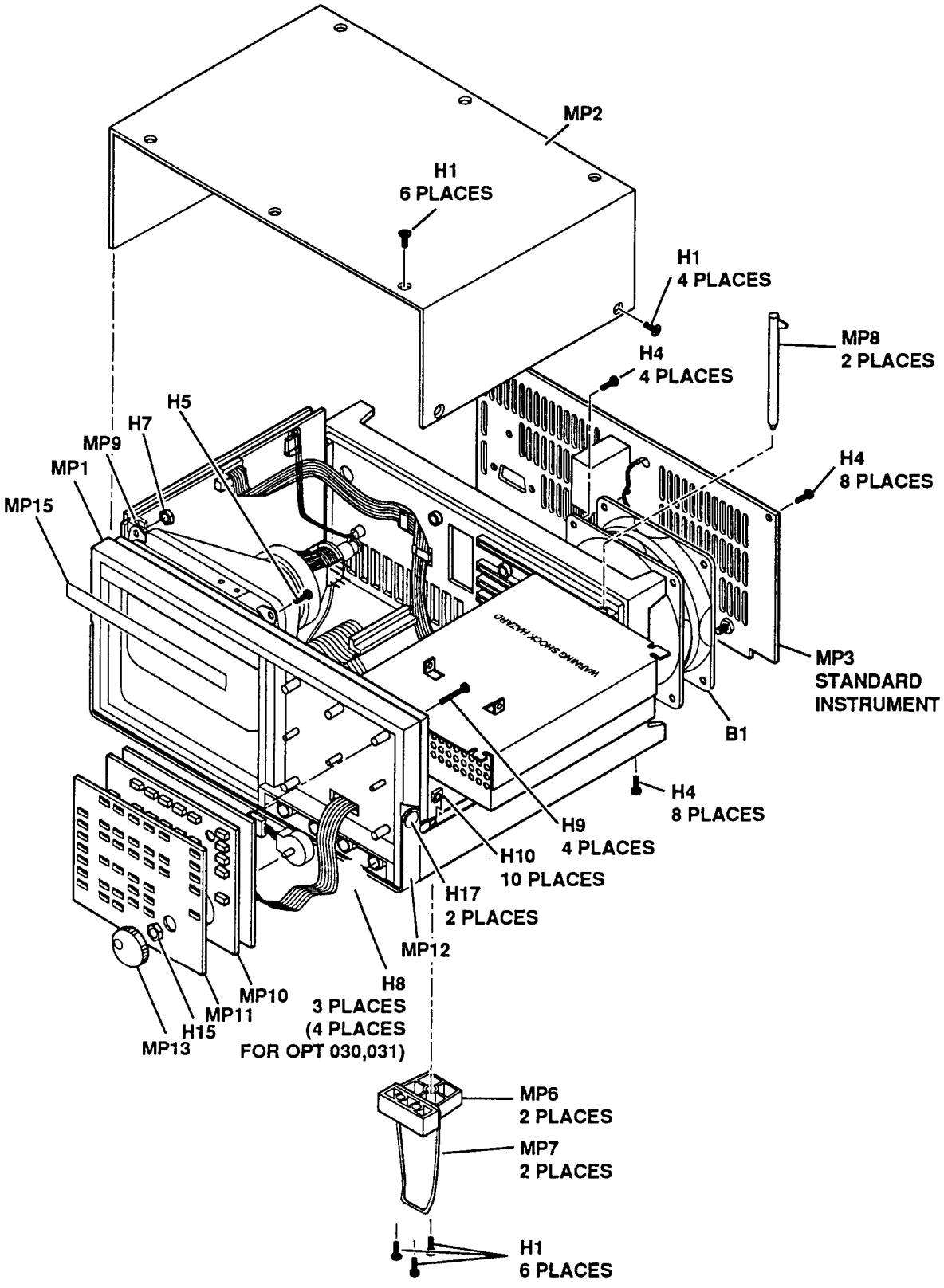


Figure 8-1. HP 53310A Exploded View (Chassis Parts)

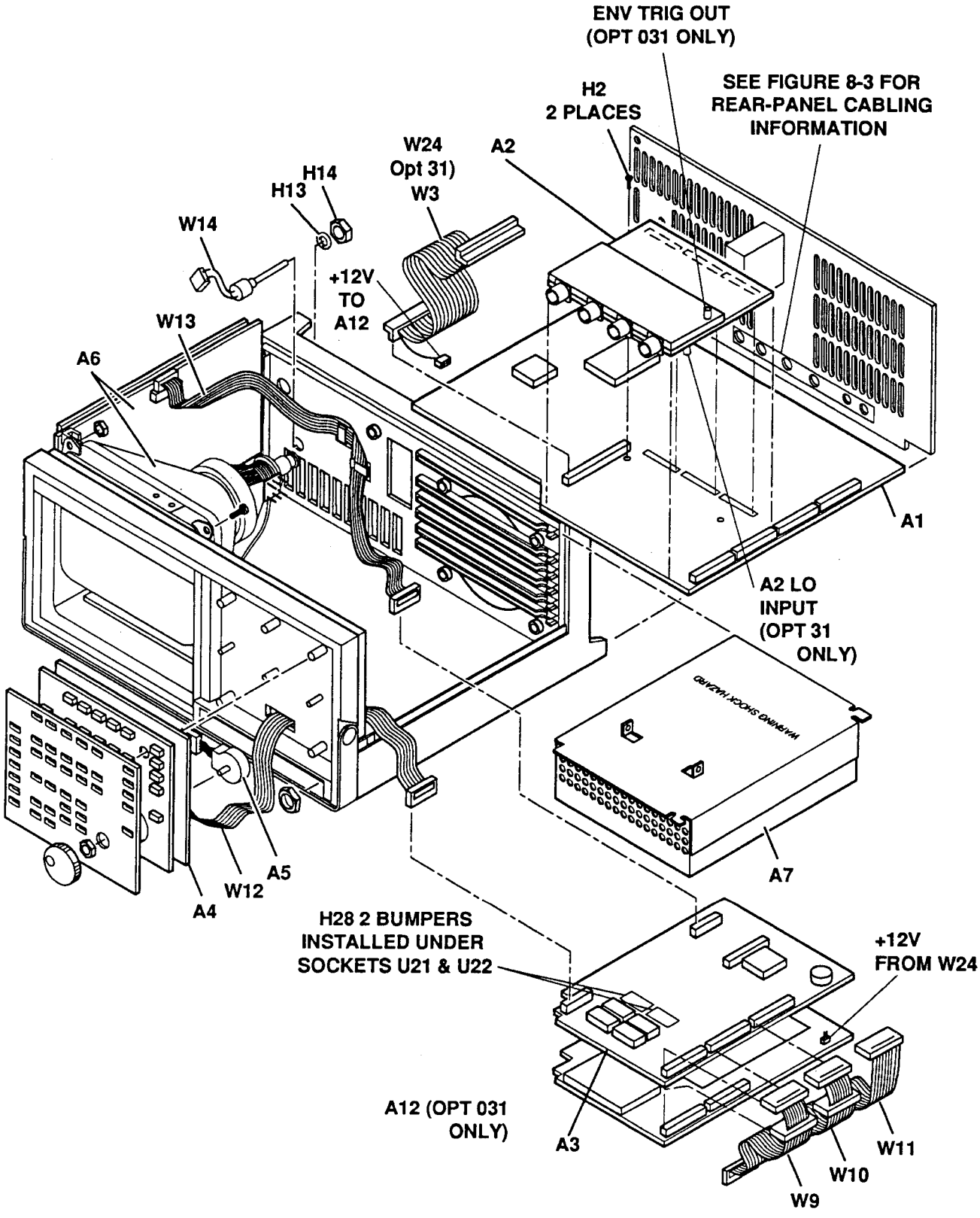


Figure 8-2. HP 53310A Exploded View (PC Boards and Cables)

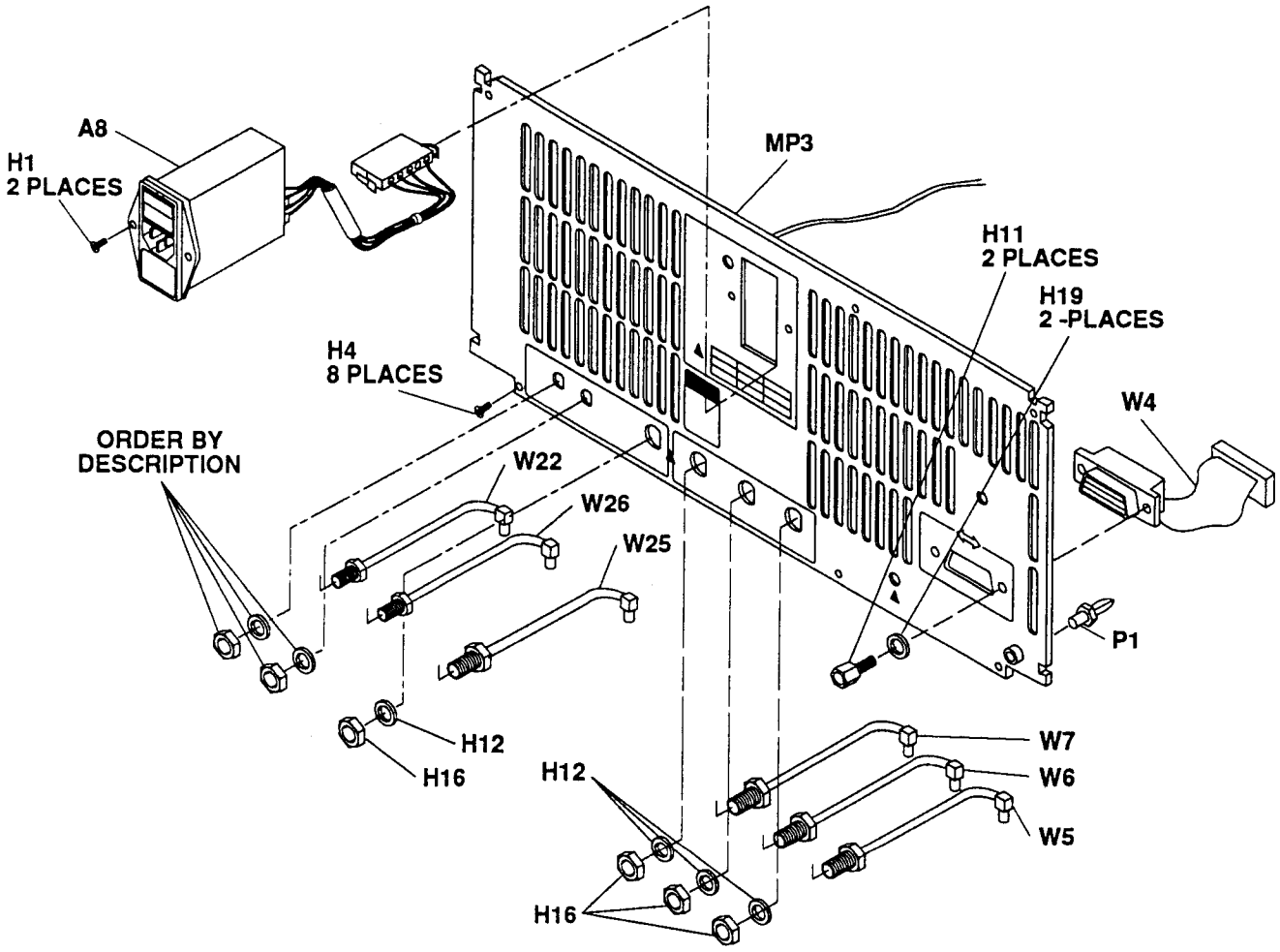


Figure 8-3. Standard Rear Panel Exploded View

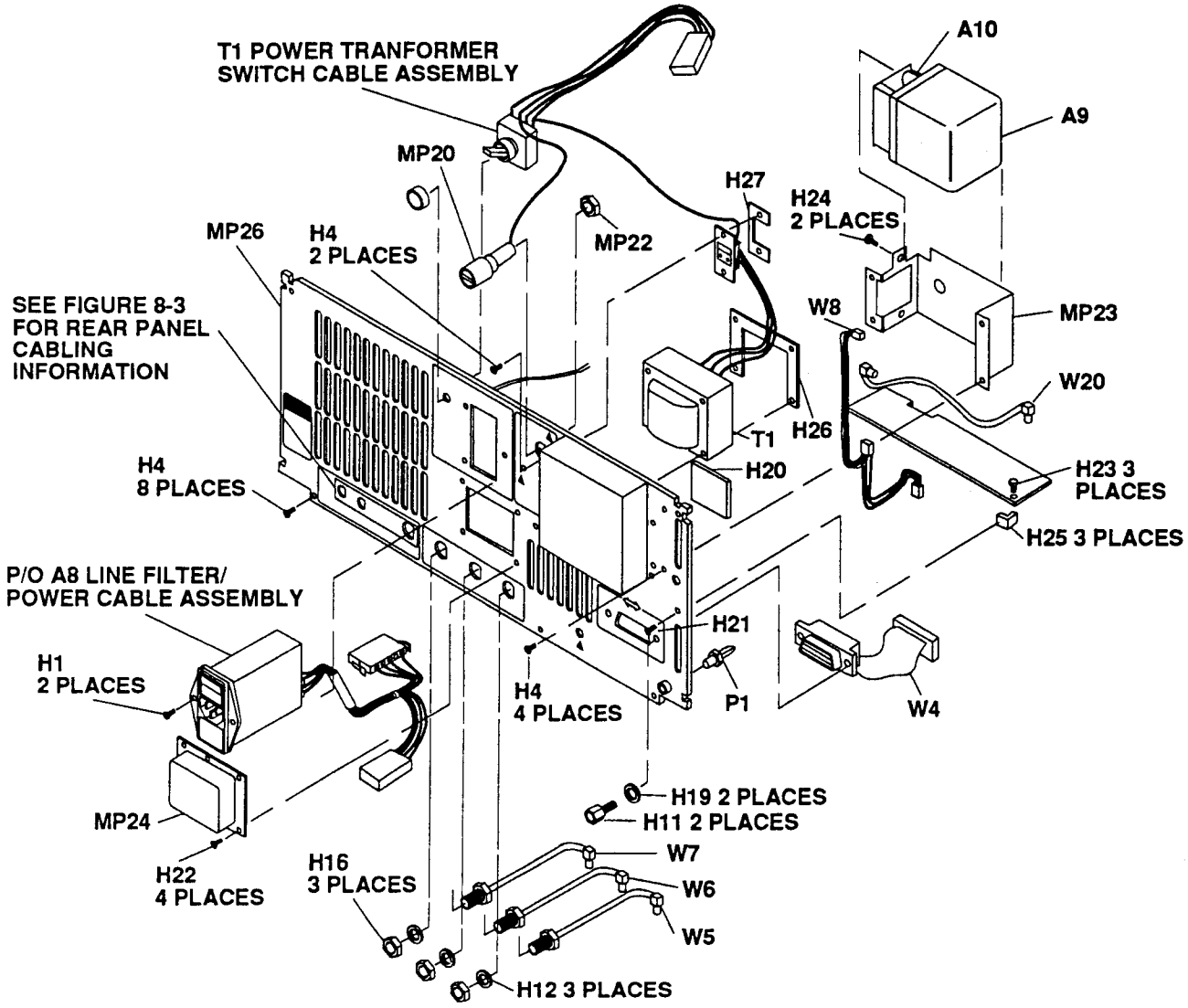


Figure 8-4. Option 010 Oscillator Rear Panel Exploded View

Table 8-5. Manufacturer's Code List

Mfr Code	Manufacturer Name	Address		Zip Code
H9027	SCHURTER AG	LUZERN	SW	CH-60
00000	ANY SATISFACTORY SUPPLIER			
11045	GWRL GRACE WR LIMITED	LONDON	EG	
11855	DELTA ELECTRONIC INDUSTRIES CO	TAIPEI	TN	
16956	DENNISON MFG CO	FRAMINGHAM	MA US	01701
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
75915	LITTLEFUSE INC	DES PLAINES	IL US	60016
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF	ELGIN	IL	60126

A
SPECIFICATIONS

INTRODUCTION

The specifications of the HP 53310A Modulation Domain Analyzer are shown in *Table A-1. Table A-2* is a tabular reference for the frequency resolution specifications of the Channel A/B and Channel C, respectively. Specifications for option 031 can be found on pages A13 and A14.

Table A-1. HP 53310A Specifications

This appendix consists of two parts: 1) Description of the HP 53310A, and 2) Specifications and Characteristics.

Description

This section offers a brief description of the HP 53310A. It follows the menu structure of the product and describes its operation.

Function

Frequency

Channel: A, B, or C (Option 030 or 031)

Time Interval

Measurement: + TI or ± TI
Channel: A & B (Separate) or A only (Common)
Start: ⨍ or ⨍
Stop: ⨍ or ⨍

Input

Channels A and B

Voltage Threshold Range
Manual: +10 V to –10 V, settable in 2.5 mV steps.
Auto: Find 50% Threshold
Coupling: AC or DC
Impedance: 1 MΩ or 50Ω
Hysteresis: Min to Max, settable in ten steps

Channel C (Option 030 or 031: See pages A-13/14)

Voltage Threshold: 0 volts
Coupling: AC
Impedance: 50Ω
Hysteresis: Min

External Arm

Voltage Threshold: 0V, TTL (1.5 Volts), or ECL (–1.3 Volts).

Table A-1. HP 53310A Specifications (Continued)

Vertical/Histogram Display Range

Display measurement range is settable as Center and Span, or Minimum and Maximum. For Frequency measurements, the maximum display value can be selected no larger than eight times the minimum display value.

Timebase

Main Timebase

Range
Panorama Off: 1 µs/div to 1 s/div
Panorama On: 1 to 20 times the window timebase setting (Standard)
1 to 80 times the window timebase (Option 001)

Window Timebase

Range: 1 µs/div to 1s/div
Position: Adjustable throughout the Panorama

Trigger

Display Position: Left, Center, or Right
Delay: Adjustable

Trigger

Mode: Auto or Triggered
Triggered
Edge Trigger
Slope: ⨍ or ⨍ of External
Value Trigger
Source: Frequency or Time Interval measurements, depending on measurement function
Range
Frequency: 80% of minimum display value to 120% of maximum display value
Time Interval: full measurement range
Slope: ⨍ or ⨍
HF Reject: On or Off

Display

Type: "vs Time" or Histogram
Frame type: Frame, Axes, Grid, or Off

vs Time

Acquisition Mode: Real Time or Repetitive
Real Time Persistence: Single or Infinite
Repetitive Averaging: On or Off

Histogram

Probability Scale (percent): Log or Linear
Probability Scaling: Auto or Manual
Accumulate: On or Off

Table A-1. HP 53310A Specifications (Continued)

Markers	Horizontal and vertical markers are available in "vs Time", and Histogram displays. Markers can be used in conjuction with automated analysis. They may also be used to delimit a portion of the measurement data for detailed analysis.
Histogram	**Histogram Type:** Histogram from "vs Time" or Fast Histogram Accumulate: On or Off Fast Histogram Acquire Start: Auto, or External Start on ⌐ or ¬ edge Number of Measurements: 1 to 16 million per acquisition
Sampling Menu	**Modes:** Auto, Edge, or Time Auto: Constant event sampling based on Timebase settings Edge Channel A or B: Every 1 to 256 events External: Every event Time: 400 ns - 1 second
Utility	***HP-IB/Print set up*** Mode: Addressed or Talk Only **Clicker:** On or Off **Screen Saver:** On or Off **Calibration and Diagnostic routines**
Autoscale	Setup parameters are automatically determined to display the dynamics of the input signal. Measurement function and input conditioning should be selected prior to pressing Autoscale.
Automated Analysis	Built-in analysis functions include: Minimum, Maximum, Peak to Peak, Mean, 1/Mean, Standard Deviation, (Modulation) Rate, 1/Rate, and Probability.
Save/Recall	Ten measurement setups can be stored and recalled.

Table A-1. HP 53310A Specifications (Continued)

Specifications and Characteristics

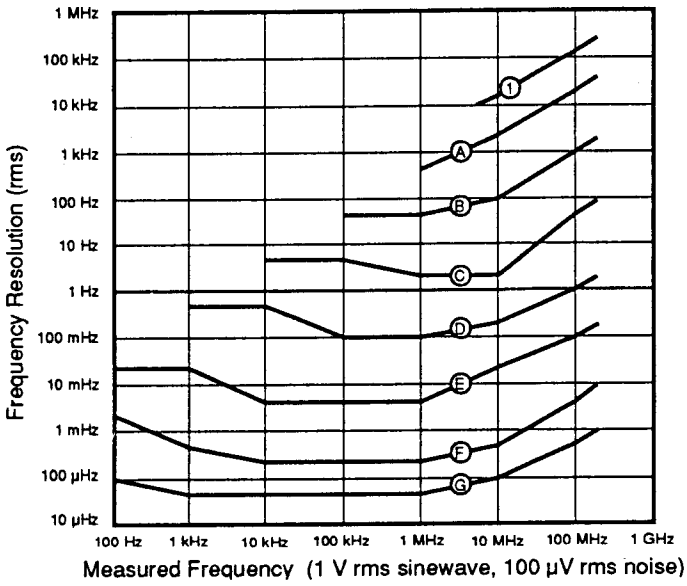
Both warranted specifications and operating characteristics of the HP 53310A are discussed in this section. To distinguish warranted specifications from operating characteristics, *specifications are highlighted throughout in italics.*

Frequency Measurements

Range
Channel A: *10 Hz to 200 MHz*
Channel B: *10 Hz to 100 MHz*
Channel C: *50 MHz to 2.5 GHz* (See pages A-13/14 for Opt. 031)
Maximum Measurement Rate
Fast Histogram: 1.5 MHz
Other Modes: 1.0 MHz
Resolution: *Maximum Available Measurement Resolution or Display Resolution, whichever is greater*
Maximum Available Measurement Resolution (Auto Sampling):
See Graph 1 for Channels A & B
See Graph 2 for Channel C

Graph 1
Maximum Available Frequency Resolution for Channels A & B. Larger Timebase settings and averaging will reduce the effects of random noise and improve resolution.

Additional considerations regarding resolution are discussed at the end of this appendix.

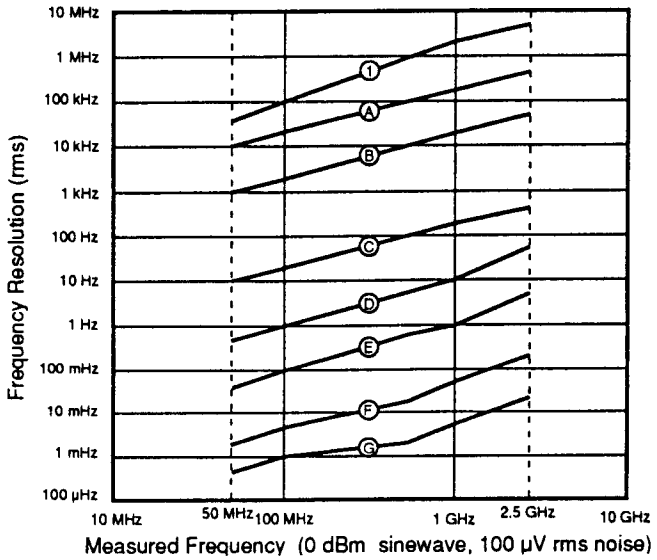


Legend for Graphs 1 & 2

	Timebase Setting (Interval at Center: Auto)	Interval at Center Setting (Interval at Center: Manual)
(1)		125 ns†
(A)	20 µs/Div	1 µs
(B)	200 µs/Div	10 µs
(C)	2 ms/Div	100 µs
(D)	20 ms/Div	1 ms
(E)	200 ms/Div	10 ms
(F)		100 ms
(G)		0.5 s

† Fast sampling mode

Table A-1. HP 53310A Specifications (Continued)



Graph 2
Maximum Available Frequency Resolution for Channel C. Larger Timebase settings and averaging will reduce the effects of random noise and improve resolution.

Additional considerations regarding resolution are discussed at the end of this appendix.

Display Resolution
vs Time, or Histogram of vs Time
Panorama Off: Display Span/256
Panorama On: Display Span/224
Fast Histogram: Display Span/450
Accuracy: ± *(Resolution + (Frequency × Reference Error)*[†]*)*

[†]Refer to Graph 3

Time Interval Measurements

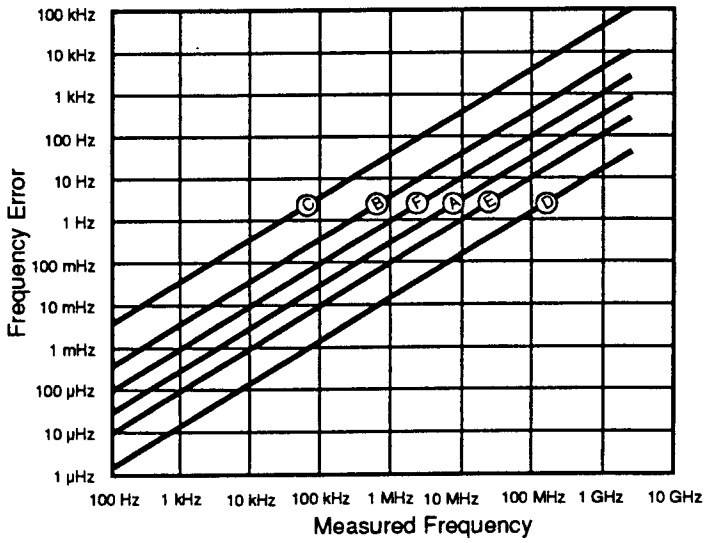
+ Time Interval
Range: *+ 20 ns to + 1 second*
Maximum Measurement Rate
Fast Histogram: 2.5 MHz
Other Modes: 1.25 MHz

± Time Interval
Range: *–0.5 s to +0.5 second*
Maximum Measurement Rate
Fast Histogram: 2.0 MHz
Other Modes: 1.25 MHz

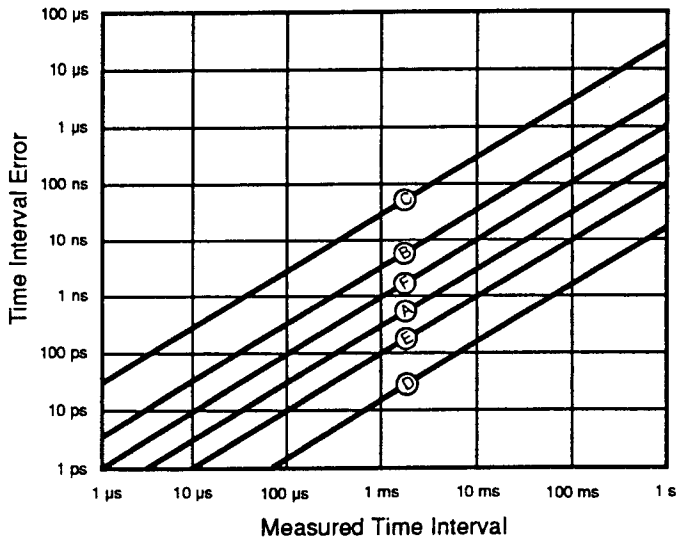
Resolution: *Maximum Available Measurement Resolution or Display Resolution, whichever is greater*

Table A-1. HP 53310A Specifications (Continued)

Graph 3
Frequency Reference Error. Crystal aging will affect your Frequency accuracy.



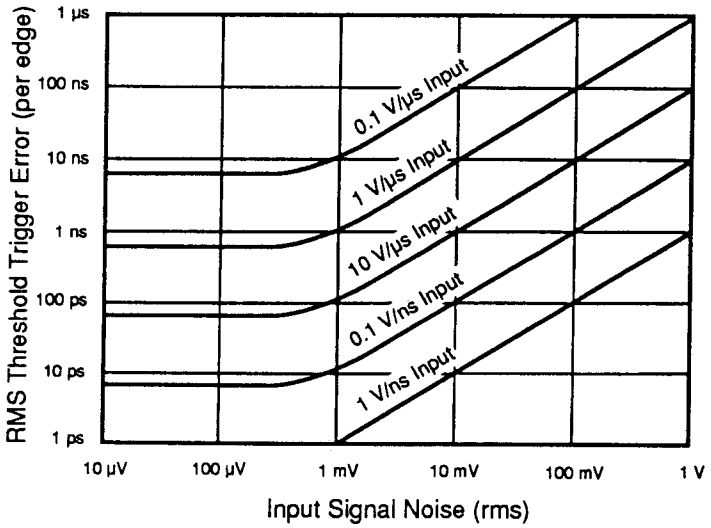
Graph 4
Time Interval Reference Error. Crystal aging will affect your Time Interval accuracy.



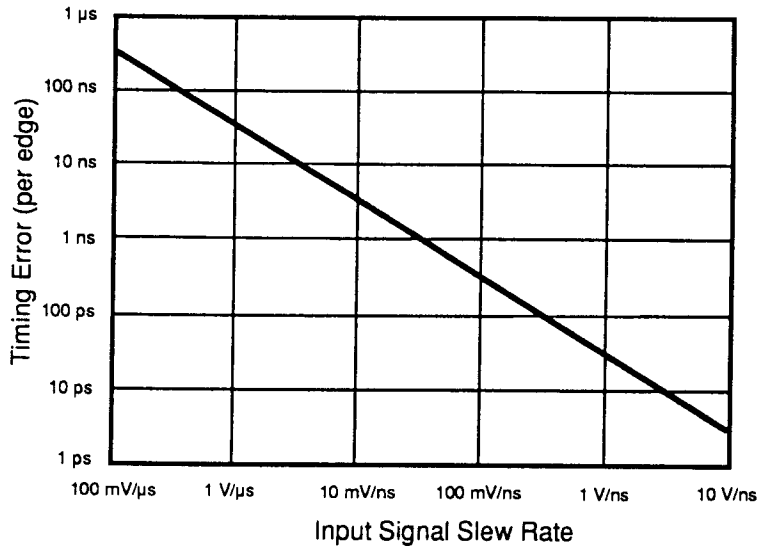
Legend for Graphs 3 & 4

Time Since Last Calibration	Standard Reference	Option 010 Reference
1 Month	(A)	(D)
1 Year	(B)	(E)
10 Years	(C)	(F)

Table A-1. HP 53310A Specifications (Continued)



Graph 5
Noise on the input signal will add error to time interval measurements. Error is associated with both start and stop edges.



Graph 6
Voltage Threshold Level Timing Error varies with input slew rate. Error is associated with both start and stop edges.

Table A-1. HP 53310A Specifications (Continued)

Maximum Available Measurement Resolution:

$$\sqrt{(200\ ps\ rms^{*})^2 + (Threshold\ Trigger\ Errors^{\dagger\dagger\dagger})^2}$$

* 125 ps rms typical

Note: 1) Threshold Trigger Errors are usually negligible for input slew rates > 5V/µs.
2) Through averaging, Maximum Available Measurement Resolution can be significantly improved.

Display Resolution
vs Time, or Histogram of vs Time
Panorama Off: Display Span/256
Panorama On: Display Span/224
Fast Histogram: Display Span/450

Accuracy: ± *Resolution*
± *(Time Interval × Reference Error)*††
± *Start Threshold Level Timing Error*‡
± *Stop Threshold Level Timing Error*‡
± *1 ns Systematic Error*

†† Refer to Graph 4
††† Refer to Graph 5
‡ Refer to Graph 6

Time Axis in vs Time

Resolution:
Main Timebase Setting / 45, with panorama off
Window Timebase Setting/ 45, with panorama on
Accuracy: Resolution

Note: Time aliasing can occur when time between measurements exceeds 360 divisions.

Inputs

Channel A and B

Sensitivity (minimum hysteresis):
20 mV rms sinewave to 100 MHz
(25 mV rms sinewave for Freq A from 100 MHz to 200 MHz)

Minimum Pulse Width: *5 ns at 60 mV p-p*
(2.5 ns at 75 mV p-p for Frequency A measurements above 50 MHz)

Input Amplifier Noise: 600 µV rms

Threshold Drift: ± 3 mV after warm-up at 25°C

Voltage Threshold Accuracy: ± *(25 mV + 1% of Threshold Value)*
Maximum Hysteresis: Increases the minimum input signal amplitude required by a factor of three, providing additional noise immunity.

Impedance: 50Ω or 1 MΩ (500 kΩ in common)

Table A-1. HP 53310A Specifications (Continued)

AC Coupling: 100 Hz cutoff frequency

Capacitance (1 MΩ): < 20 pF (< 30 pF in common)

Dynamic Range (ac): *60 mV p-p to 5 V p-p*

Signal Operating Range (dc)

1 MΩ: ± *10 volts*
50Ω: ± *5 volts*

Damage Level

1 MΩ: *40 V rms for < 5 kHz, 5 V rms for > 5 kHz*
50Ω: 5 V rms

Channel C (Option 030: See pages A-13/14 for Opt. 031)

Sensitivity:–*25 dBm to 1.5 GHz,*
–20 dBm from >1.5 GHz to 2.0 GHz,
–15 dBm from >2.0 GHz to 2.5 GHz

Maximum Input Level: + *7 dBm*

Damage Level: + *15 dBm*

External Arm

Impedance: 1 MΩ
Delay: < 10 ns

Note: Sensitivity, Minimum Pulse Width, Signal Operating Range, and Damage Level of the External input are the same as that of Channel B.

Frequency Reference

Standard Crystal
Temperature Stability: < 8×10^{-6}, *referenced to 25°C*
Short Term Stability: < 4×10^{-9} *for 1 second average*
Aging Rate: < 3×10^{-7} */month*

Option 010 High Stability Oven Reference

Temperature Stability: < 7×10^{-9}, *referenced to 25°C*
Short Term Stability: < 4×10^{-11} *for 1 second average*
Aging Rate: < 5×10^{-10} */day*, < 1×10^{-7} */year*
Warm-up: *Within* 5×10^{-9} *of final value*, 10 minutes after turn-on**.*
When:
1) HP 53310A is operated in a 25°C environment
2) Oscillator off-time** was less than 24 hours
3) Oscillator aging rate was < 5 × 10–10 per day prior to turnoff**

* "Final value" is defined as oscillator frequency 24 hours after turn-on. (See ** note below.)

** "Turn-off","turn-on", and "off-time" apply to periods when power is disconnected from the HP 53310A rear panel.

Table A-1. HP 53310A Specifications (Continued)

Rear Panel Connectors

HP-IB

Controls: The HP 53310A provides full programmability. All instrument settings and operating modes, except specific self test routines, may be remotely programmed via HP-IB (IEEE Std 488.1-1987). The programming codes and formats comply with IEEE Standard Codes, Formats, Protocols, and Common Commands (IEEE Std 488.2-1987), and SCPI (Standard Commands for Programmable Instruments) Standard, Version 1990.0.

Data Acquisition and Transfer Rate: A 450 point data record can be acquired and transferred to a computer at a rate ~ 17 times per second, as tested with an HP 9000, Series 300 controller. For this test, a 1 MHz carrier was applied to the analyzer with a Timebase setting of 40 µs /division.

Data Transfer Rates: ~ 175 kByte/second

Interface Capabilities: SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E2

Test Limit Output

The Test Limit Output will go high when measurements fall outside the display range of the Fast Histogram. In "vs Time" mode, it will indicate each time the Value Trigger condition is met following the pre-trigger delay.
Operating Range:
Low < 0.6 V and High > 1.5 V into 50Ω

Frequency Standard Input

Frequency: 5 MHz or 10 MHz (Opt. 031: 10 MHz only)
Operating Range: 1 V p-p to 5 V p-p, into 1 kΩ
Damage Level: 10 V rms

Frequency Standard Output

Frequency: 10 MHz, or the External Reference if the Frequency Standard Input is used.
Operating Range (ac coupled)
50Ω: > 1 V p-p square wave (Opt. 031: 0.75 V)
1 MΩ: > 2 V p-p square wave (Opt. 031: 1.0 V)

Power Requirements

Voltage: 115/230 V ac (–25% to + 15%)
Frequency: 48 to 66 Hz
Maximum Power: 300 VA

General

Operating Temperature: 0 to 55°C
Weight: 10 kg net, 18 kg shipping
Dimensions: 425 mm W × 194 mm H × 363 mm D
(440 mm D with handle extended)

Table A-1. HP 53310A Specifications (Continued)

Spurious Frequency Modulation

When the HP 53310A measures the frequency of a very stable signal, such as a crystal oscillator or synthesized signal generator, for certain combinations of signal frequency and Interval At Center (as derived below), AND very small vertical span or histogram range, it may show a spurious modulation. This typically appears as a noisy and distorted periodic modulation.

If all three of the above conditions are met, the Analyzer will display the message, "Spurious modulation possible with this setup". In this unlikely situation, the Interval At Center value can be manually changed, as described below, to greatly reduce any spurious modulation.

Technical Explanation

When the HP 53310A measures frequency, very slight nonlinearities in the phase digitizing of the input signal can cause spurious mixing products from interactions between a very stable input signal, the Analyzer's internal clock and the sampling rate. In the Auto sampling mode, the Analyzer uses a digital low-pass modulation filter to greatly improve frequency resolution. The Interval At Center control on the Sampling menu controls the bandwidth of this modulation filter, as well as the measurement rate.

In the majority of situations, the spurious mixing products fall far outside the passband of the modulation filter, and therefore have no effect on the measurement. However, it is possible for a spurious mixing product to fall in the passband of the Analyzer in certain situations.

The frequency resolution specification when the spurious mixing products fall completely within the passband is:

$$\frac{\text{Time Interval Resolution} \times F}{2 \times T}$$

where Time Interval Resolution = 200 ps rms, F is the input frequency and T is the Interval At Center value on the Sampling menu. Note that even with a worst-case spurious modulation in the passband, the resolution is still better than most frequency counters.

Determining If Spurious Modulation May Occur

The Analyzer displays an advisory message if a spurious in-band modulation is possible (and if the span is narrow enough to display it), so the easiest way to determine if the effect of spurious modulation could be significant is to configure a setup and see if the message appears. However, you can perform the same analysis as the Analyzer to check for possible spurious in-band modulation using the following formulas:

$$N = \text{ceil}\left(\frac{1.2 \times F}{7\ \text{MHz}}\right)$$

$$F_{sp} = \text{minfrac}\left(\frac{N \times 200\ \text{MHz}}{F}\right) \times \frac{F}{2 \times N}$$

where F_{sp} is the frequency of the spurious modulation, F is the input frequency, N is an intermediate variable, ceil(x) is the smallest integer

Table A-1. HP 53310A Specifications (Continued)

greater than x, minfrac(x) is | x - rnd(x) |, and rnd(x) is the integer nearest to x. For the C channel, F/64 is used instead of F for calculating Fsp, and for an input signal on the A channel above 50 MHz, F/2 is used instead of F.

The modulation is filtered by a 2-pole digital low-pass filter, having a –3dB bandwidth of approximately:

$$BW_{-3\ dB} = \frac{1}{5 \times T}$$

where T is the Interval At Center value on the Sampling menu. As the Interval At Center value is increased (typically done by increasing the time/div value on the Timebase menu), the Analyzer's modulation bandwidth decreases, making a spurious in-band response increasingly unlikely.
If there is a spurious in-band modulation, the Interval At Center parameter on the Sampling menu can be manually changed to put a null of the digital filter at F_{sp}. The first null is at 1/(2T) so if T is set to $1/(2 \times F_{sp})$, the magnitude of the spurious response will be greatly reduced (typically by an order of magnitude).

Example Computation

To estimate if spurious modulation will be significant, you can apply the above formulas as shown in this example (the Analyzer is always performing this analysis and will advise you when significant spurious modulation is possible). Suppose your input is at 100.1 MHz on Channel A, and the Interval At Center is 10 µs. The worst-case resolution (if all mixing products fell in the passband) would be:

$$\frac{\text{Time Interval Resolution} \times 100.1\ \text{MHz}}{2 \times 10\ \mu\text{s}} = \sim 1\ \text{kHz rms}$$

At this point, you could check this against the appropriate frequency resolution graph in this appendix. For this case, Graph 1 shows that the frequency resolution should be about 1 kHz for this example setup. Since the worst-case computation still lies within the graph specification, you might choose not to complete the computation of the actual effect of spurious modulation. For this example, the analysis will be continued.

To continue the analysis, compute N:

$$N = \text{ceil}\left(\frac{1.2 \times 50.05\ \text{MHz}}{7\ \text{MHz}}\right) = \text{ceil}\,(8.58) = 9$$

Note that F/2 is used (50.05 MHz) because the input signal is above 50 MHz on channel A.
Then compute the spurious modulation frequency:

$$F_{sp} = \text{minfrac}\left(\frac{9 \times 200\ \text{MHz}}{50.05\ \text{MHz}}\right) \times \frac{50.05\ \text{MHz}}{2 \times 9}$$

$$= \text{minfrac}\,(35.964) \times 2.78\ \text{MHz}$$

$$= |35.964 - 36| \times 2.78\ \text{MHz} = \text{approximately } 100\ \text{kHz}$$

Table A-1. HP 53310A Specifications (Continued)

The modulation filter –3dB bandwidth for this example will be:

$$BW_{-3\ dB} = \frac{1}{5 \times 10\ \mu s} = 20\ kHz$$

Since the spurious modulation frequency for this example (100 kHz) is well beyond the passband of the modulation filter (20 kHz), the effect of spurious modulation can be ignored.

Table A-2. HP 53310A Frequency Resolution Tabular Reference

FREQUENCY RESOLUTION (IN HZ)							
Channel A and B							
Input Frequency	**Interval at Center**						
	1 µs	**10 µs**	**100 µs**	**1 ms**	**10 ms**	**100 ms**	**0.5 s**
100					2.E-02	2.E-03	1.E-04
1,000				5.E-01	2.E-02	5.E-04	5.E-05
10,000			5.E+00	5.E-01	5.E-03	2.E-04	5.E-05
100,000		5.E+01	5.E+00	1.E-01	5.E-03	2.E-04	5.E-05
1,000,000	5.E+02	5.E+01	2.E+00	1.E-01	5.E-03	2.E-04	5.E-05
10,000,000	2.E+03	1.E+02	2.E+00	2.E-01	2.E-02	5.E-04	1.E-04
100,000,000	2.E+04	1.E+03	5.E+01	1.E+00	1.E-01	5.E-03	5.E-04
200,000,000	5.E+04	2.E+03	1.E+02	2.E+00	2.E-01	1.E-02	1.E-03
Channel C (Option 030)							
Input Frequency	**Interval at Center**						
	1 µs	**10 µs**	**100 µs**	**1 ms**	**10 ms**	**100 ms**	**0.5 s**
50 MHz	1.E+04	1.E+03	1.E+01	5.E-01	5.E-02	2.E-03	5.E-04
100 MHz	2.E+04	2.E+03	2.E+01	1.E+00	1.E-01	5.E-03	1.E-03
500 MHz	1.E+05	1.E+04	1.E+02	5.E+00	5.E-01	2.E-02	2.E-03
1,000 MHz	2.E+05	2.E+04	2.E+02	1.E+01	1.E+00	5.E-02	5.E-03
2,500 MHz	5.E+05	5.E+04	5.E+02	5.E+01	5.E+00	2.E-01	2.E-02
Channel C (Option 031)							
Input Frequency	**Interval at Center**						
	1 µs	**10 µs**	**100 µs**	**1 ms**	**10 ms**	**100 ms**	**0.5 s**
200 MHz	1.E+03	1.E+02	2.E+01	1.E+00	1.E-01	5.E-03	1.E-03
500 MHz	1.E+03	3.E+02	1.E+02	5.E+00	5.E-01	2.E-02	2.E-03
1,000 MHz	3.E+03	7.E+02	2.E+02	1.E+01	1.E+00	5.E-02	5.E-03
2,500 MHz	3.E+03	1.E+03	5.E+02	5.E+01	5.E+00	2.E-01	2.E-02

Specifications* - Option 031

Both warranted specifications and operating characteristics of the HP 53310A are discussed in this section. To distinguish warranted specifications from operating characteristics, *specifications are highlighted throughout in italics.*

Input Conditions

Range: *50 MHz to 2.5 GHz*
Sensitivity:
–13 dBm 50 MHz to 200 MHz
–17 dBm 200 MHz to 2 GHz
–12 dBm 2 GHz to 2.5 GHz
Maximum Input Level:
+20 dBm
Damage Level:*+23 dBm*
Impedance: 50 Ω
Coupling: ac
RF Burst Width: 50 µs to CW

Maximum Measurement Rate

Fast Histogram: 1.5 MHz
Other Modes: 1 MHz
Fast Sampling: 8 MHz
(repetitive)

External Local Oscillator Input

Level: +6dBm (±1dB)
Impedance: 50 Ω
Frequency Range: 150 MHz to 2.5 GHz

Resolution

Maximum available measurement resolution or display resolution, whichever is greater.

Maximum Available Measurement Resolution (Auto Sampling): *see graph A*

Display Resolution:
vs Time or Histogram of vs Time
Window Off: Display Span/256
Window On: Display Span/224
Fast Histogram:
Display Span/450

Accuracy: ± *[Resolution + (Frequency × Reference Error*)]*

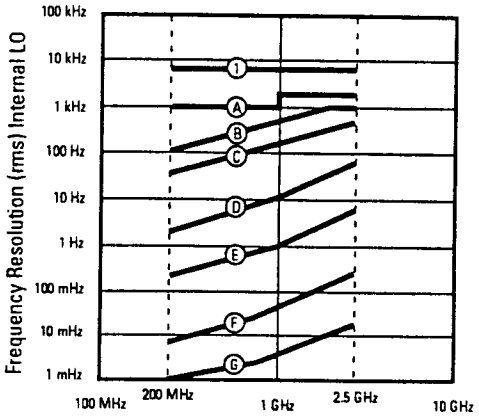
RF Envelope Trigger

Level: Adjustable in 100 steps (e.g., –25 dBm to 0 dBm @1 GHz)

Output: 0 to 0.4 volt into 50 Ω or TTL level into high impedance

*** Consult the HP 53310A Technical Data Sheet (pub# 5091-2596E) for further product information and specifications.**

Maximum Available Frequency Resolution



Measured Frequency
(0 dBm sinewave, 100µV rms noise)

	Timebase Setting Interval @ center: Auto	Interval @ Center Setting (Interval @ Center: Manual	Frequency Resolution (Ext. LO)†
1		125 ns††	7 kHz
A	≤ 20 µs/Div	1 µs	1 kHz
B	200 µs/Div	10 µs	20 Hz
C	2 ms/Div	100 µs	5 Hz
D	20 ms/Div	1 ms	2 Hz
E	200 ms/Div	10 ms	50 mHz
F		100 ms	5 mHz
G		0.5 s	2 mHz

† Typical resolution over the 200 MHz to 2.5 GHz range using an HP 8663A Synthesizer as an external LO.
†† Fast Sampling mode

Graph A

Maximum available frequency resolution for Option 031 Channel C. Larger timebase setting and averaging will reduce the effects of random noise and improve resolution. Please refer to graph 2 of the HP 53310A Technical Data Sheet for resolution over the 50 MHz - 200 MHz band.

B
MANUAL CHANGES

INTRODUCTION

This appendix contains information necessary to adapt this manual to apply to older instruments.

MANUAL CHANGES

This manual applies directly to HP 53310A Modulation Domain Analyzer with the serial prefix 3105 and up.

As engineering changes are made, newer instruments may have higher serial prefix numbers than the one shown on the title page of this manual. The manuals for these instruments will be supplied with MANUAL CHANGES sheets containing the required information. Replace the affected pages or modify existing manual information as directed in the MANUAL CHANGES pages. Contact the nearest Hewlett-Packard Sales and Support Office (listed at the back of this manual) if the change information is missing.

C
MISCELLANEOUS

GENERAL NOTES ON PERFORMANCE TEST THEORY

The HP 53310A contains several interrelated controls that can cause confusion for the occasional user. All tests are designed to run from a PRESET condition, which sets the 53310A to a known state. However, experienced users may arrive at the correct setup and get correct results without doing a PRESET every time, provided that the user understands what is involved. The number of controls and settings makes it impossible to document every possible path to the correct settings; therefore, for simplicity, the PRESET method is used, and a complete description of all control settings that affect the outcome of the measurement is given with each test.

Calibration of the instrument is crucial to correct performance. Full calibration must be performed after a key-down powerup, and may be performed at any time desired via the UTILITY menu. If deviations from expected performance occur, check the interpolator calibration. Also check offset calibration. These are described in the "PERFORM CALIBRATION" section in Chapter 2 (Performance Tests).

Timebase and Interval at Center (located in the Sampling menu) are interrelated when Interval at Center is set to Auto.

The Interval At Center is similar to "gate time" in a frequency counter. This controls the instrument's resolution, noise, responsiveness to modulation, etc.

Operationally, the longer the timebase, the better the ability of the HP 53310A to resolve differences in frequency. The tradeoff is that it will take the instrument longer to do this, just as it takes longer for a frequency counter to display a result with a 1 second gate time compared to a 1 millisecond gate time.

However, as the timebase is made longer, Interval at Center is also made longer. The effect of this is that the instrument is less responsive to fast changes in frequency (bad), and less responsive to noise (good). Long Interval At Center implies a narrow bandwidth response, and conversely, a short Interval At Center implies a wide band response. Wide band response allows fast frequency transitions to be seen, as well as allows noise to have a larger impact. However, the resolution is decreased; that is, the ability to resolve small frequency changes. Again, think of the frequency counter analogy. Short gate times allow fast response to input frequency changes, but the resolution of the answers will not be as good.

The tradeoff is to get the display that tells you the user what you want to know, without having the measurement being cluttered with a lot of noise. When the Interval at Center is left in Auto, the instrument will provide a reasonable value for the user. Manual adjustment is available for user optimization, if desired.

The computational ability of the HP 53310A is used to help determine its performance by using it to calculate standard deviation of an input signal. *A statistics refresher:* The RMS (root-mean-square) error value of the deviations of a series of measurements from their mean value is 1 standard deviation, or 1σ. The Frequency Resolution as an RMS value can be expressed in parts in ten to the X. This figure can read off the display when Standard Deviation is done via the blue "Shift" key and Std Dev key. Standard Deviation figures will be recorded in the Performance Test procedures (Chapter 2).

The primary specifications tested are those related to the "analog" portions of the instrument. Thus, resolution and accuracy come under close inspection. These are affected by input amplifier and interpolator performance, as well as by the frequency. Input sensitivity and minimum pulse width response is also of importance, and is largely determined by the input reference amplifiers. These are also tested.

The remainder of the specification are largely controlled by the firmware built into the HP 53310A, and are termed "Characteristics".

Low frequency (< 2 MHz) signals typically cause the most difficulty for the 53310A in terms of triggering and accurate display, since the slew rate of the signal goes down, as does the sampling rate. Low frequency sine-wave inputs are the worst, since any noise at trigger level crossing will cause time jitter and affect the measurement. Resolution will be affected.

Low amplititude signals will also cause the same effects. Thus, clean, stable sources are critical to checking these specifications. The sources specified are more than adequate to allow the 53310A performance to be measured.

SERVICING THE QUICK START SIGNAL SOURCE

This section contains service information necessary to verify proper operation of the Quick Start Signal Source. The service items discussed in this appendix are:

- Description
- Warranty and Determining Warranty Period
- Obtaining Service
- Test Procedure
- Repair Process
- Obtaining a New Quick Start Signal Source (In or Out of Warranty)
- Option 031 Users see Note on page C-6.

DESCRIPTION

The Quick Start Signal Source (QSSS) is a ROM-based signal generator containing four test signals. The signals are stored in digital form and regenerated via a D/A converter. Power is provided by an internal 9V battery. To operate, the QSSS requires a 10 MHz input signal as its clock source. The required specifications of this clock source are:

- Square wave
- Amplitude of 3.0 Vp-p ±100 mV (terminated in 1 M Ohm)
- AC coupled

During typical use, the QSSS obtains the 10 MHz signal from the 10 MHz reference output connector (Reference Output) on the rear panel of the HP 53310A, but any source will work as long as it meets the required specifications.

The Quick Start Signal Source outputs the following four signals:

- Frequency Modulation
- VCO Step Response
- Data-to-Clock Jitter
- Pulse Width Modulation

The Quick Start Signal Source is intended for use solely as a convenient source of signals for learning how to use the HP 53310A Modulation Domain Analyzer.

WARRANTY AND DETERMINING WARRANTY PERIOD

The warranty for the Quick Start Signal Source is 1 year from date of manufacture. The warranty period is set by the manufacturing date code inprinted on the circuit board inside the unit. To check this date, remove the four screws that hold the case together for access to the circuit board. While the case is opened, check the condition of the battery wires where they connect to the printed-circuit board. Make sure the wires are not broken.

OBTAINING SERVICE

Service is obtained as for any other HP product, via the HP service center. There, technicians will check the Quick Start Signal Source for the proper output as described in the following "Test Procedure" section.

TEST PROCEDURE

The Quick Start Signal Source may be easily tested by viewing waveforms on the HP 53310A as described in the Quick Start Guide. If the HP 53310A is not available, the following procedure may be used to verify performance. In this procedure, only one of the four signals (Frequency Modulation) of the Quick Start Signal Source (QSSS) need to be checked to determine if the QSSS is properly working.

Equipment Required

Source of 10 MHz signal .....HP 53310A, or HP 3325A Function Generator
Digitizing Oscilloscope .....HP 54501A

Setup

CAUTION

BE SURE to set the QSSS On/Off power switch to its "Off" position when the QSSS is not being used.

CAUTION

In step 1, below, set the source to output a 3.0V p-p signal. DO NOT set the amplitude on the source and assume it is outputting 3.0 Vp-p. Most synthesizers and generators are designed to drive 50-Ohm loads, and have their output levels specified accordingly. The 10 MHz input to the QSSS presents a high impedance load; thus, the synthesizers/generators output level needs to be adjusted while loaded with a high impedance.

1 **If using an HP 3325A, set the function generator to output a 10 MHz, square-wave signal with an amplitude of 3.0 V p-p ±100 mV (terminated in 1 MΩ).**

2 **Open the battery compartment lid on the bottom side of the QSSS to ensure that the battery is properly connected, then close the battery compartment lid.**

NOTE

The power source for the QSSS is a standard 9-Volt transistor battery. The HP part number for the battery is 1420-0082.

3 **Using a BNC cable, connect the 10 MHz clock signal from the HP 3325A or HP 53310A to the "Reference" input of the QSSS.**

4 **Using a BNC cable, connect the Channel A output of the QSSS to Channel A of the digitizing oscilloscope.**

Procedure

1 **On the QSSS, set the On/Off power switch to On.**

2 **On the QSSS, set the "SIGNAL SELECT" switch to "Frequency Modulation".**

3 **Verify that the Channel A output of the QSSS is similar to *Figure D-1*.**

a. If the waveform is not similar to *Figure D-1*, then the QSSS is not functioning properly. Go to step 4.

b. If no waveform is present or if waveform is intermittently present, the battery wires inside the QSSS may be faulty. Remove the four screws that hold the case of the QSSS together. Open case and visually check the condition of the battery wires where they connect to the printed-circuit board. Make sure no strands of the wires are broken.

c. If the waveform is correct then the QSSS is operating correctly. Continue with step 5.

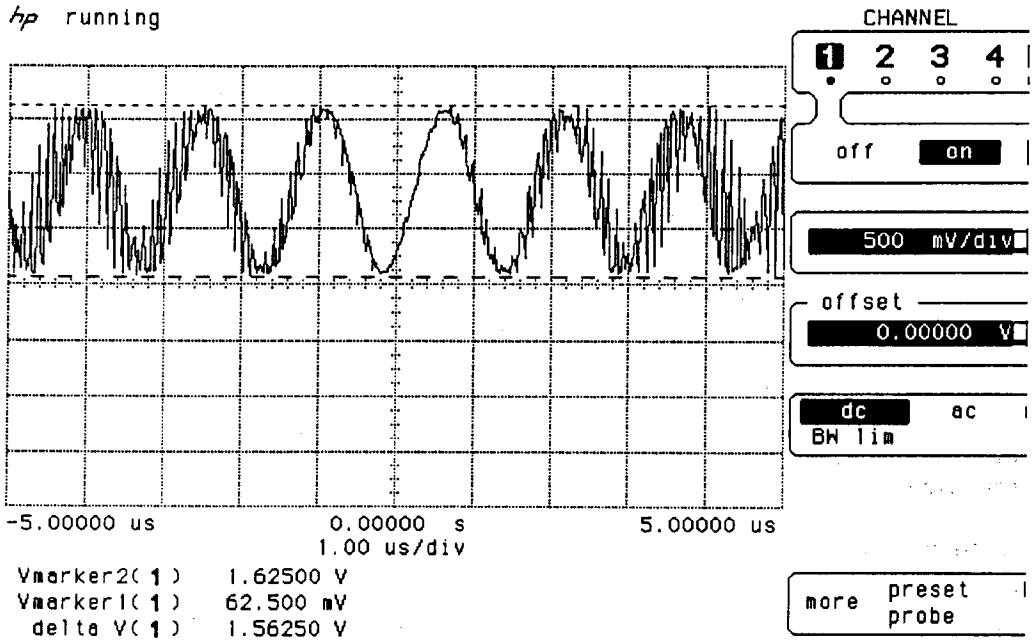


Figure D-1. Frequency Modulation Waveform

4 **Replace the battery and repeat step 3, or use a bench-top power supply, set at 9 Volts, and perform step 3 (the larger battery terminal is the +9 volt connection point).**

If the QSSS still fails this test, then replace the QSSS. Refer to the following "REPAIR PROCESS" section for information on how to obtain a replacement QSSS.

5 **On the QSSS, set the On/Off power switch to Off.**

REPAIR PROCESS

If a failure is indicated in the test procedure, the entire unit (or QSSS) must be replaced. No individual electronic parts are available for replacement. The only replaceable part is the battery, a standard 9V transistor battery (HP part number is 1420-0082).

OBTAINING A NEW QUICK START SIGNAL SOURCE*

If Quick Start Signal Source is In Warranty

If the QSSS is in warranty, contact your nearest HP Service Center. They will give you instructions on how to return the unit. Upon service center verification of a failure, HP will provide a new Quick Start Signal Source.

If Quick Start Signal Source is Out of Warranty

If the QSSS is out of warranty, then you should order HP part number 53310-67002 from either your local HP sales office or in the U.S. from HP Support Materials Organization (SMO). Refer to Chapter 8 (Replaceable Parts) for information on how to order from SMO.

*NOTE: The original Quick Start Signal Source (QSSS) was not designed to work with the Opt 031 HP 53310A. The 10 MHz reference output from Opt 031 units is lower by design than the non-Opt 031 units. When this lower level signal is applied to the QSSS, these units may experience erratic operation, or none at all.

All QSSS's shipped with HP 53310A's with Serial Number 3121A00781 and after have been modified to operate properly with any HP 53310A with any option. This includes all HP 53310A's with Opt 031.

These updated QSSS's are identified by an "Opt. 31 compatible" legend in the lower left corner of the label.

If problems are experienced with an older QSSS when used with an Opt 031 instrument, order a new one, part number 53310-67002. Information for modifying older units is not currently available.

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP