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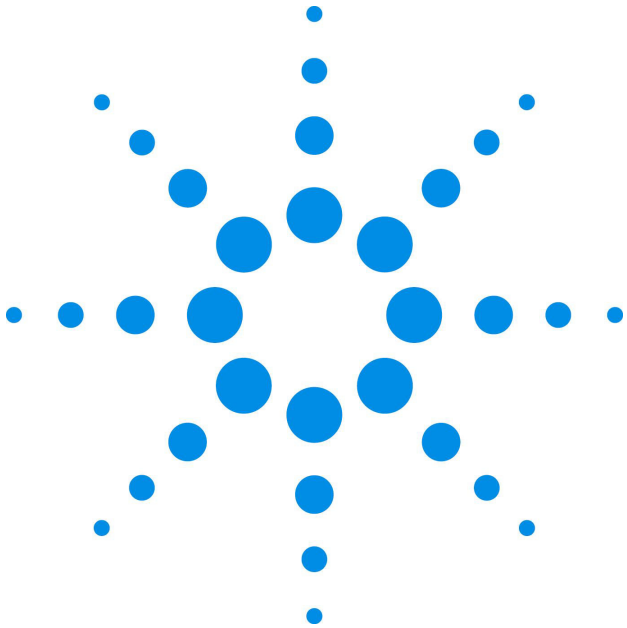
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Agilent 53131A/132A/181A
225 MHz Counters

Assembly-Level
Service Guide



Agilent Technologies

Manual Part Number 53131-90039
Printed in Malaysia

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NOTES

Agilent 53131A/132A/181A Assembly-Level Service Guide

This guide describes how to service the Agilent 53131A and Agilent 53132A Universal Counters, and the Agilent 53181A Frequency Counter.

Agilent 53131A/132A/181A 225 MHz Counter

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March 2009

Printed in Malaysia

Manual part number
53131-90039

Certification and Warranty

Certification

Agilent Technologies certifies that this product met its published specification at the time of shipment from the factory. Agilent Technologies 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 the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

Agilent warrants Agilent hardware, accessories and supplies against defects in materials and workmanship for a period of one year from date of shipment. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.

Agilent warrants that Agilent software will not fail to execute its programming instructions, for the period specified above, due to defects in material and workmanship when properly installed and used. If Agilent receives notice of such defects during the warranty period, Agilent will replace software media which does not execute its programming instructions due to such defects.

For detailed warranty information, see back matter.

Safety Considerations

General

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

Before Cleaning

Disconnect the product from operating power before cleaning.

Warning Symbols That May Be Used In This Book



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.



or



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



Indicates Alternating current.



Indicates Direct current.

Safety Considerations (contd)

WARNING

BODILY INJURY OR DEATH MAY RESULT FROM FAILURE TO HEED A WARNING. DO NOT PROCEED BEYOND A WARNING UNTIL THE INDICATED CONDITIONS ARE FULLY UNDERSTOOD AND MET.

CAUTION

Damage to equipment, or incorrect measurement data, may result from failure to heed a caution. Do not proceed beyond a *CAUTION* until the indicated conditions are fully understood and met.

Safety Earth Ground

An uninterruptible safety earth ground must be maintained from the mains power source to the product's ground circuitry.

WARNING

WHEN MEASURING POWER LINE SIGNALS, BE EXTREMELY CAREFUL AND ALWAYS USE A STEP-DOWN ISOLATION TRANSFORMER WHICH OUTPUT IS COMPATIBLE WITH THE INPUT MEASUREMENT CAPABILITIES OF THIS PRODUCT. THIS PRODUCT'S FRONT AND REAR PANELS ARE TYPCIALLY AT EARTH GROUND. *THUS, NEVER TRY TO MEASURE AC POWER LINE SIGNALS WITHOUT AN ISOLATION TRANSFORMER.*

Agilent Technologies, Inc.
900 South Taft Avenue
Loveland, Colorado 80537 U.S.A.

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Warranty (contd)

Agilent does not warrant that the operation of Agilent products will be uninterrupted or error free. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, customer will be entitled to a refund of the purchase price upon prompt return of the product.

Agilent products may contain remanufactured parts equivalent to new in performance or may have been subjected to incidental use.

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Warranty does not apply to defects resulting from (a) improper or inadequate maintenance or calibration, (b) software, interfacing, parts or supplies not supplied by Agilent, (c) unauthorized modification or misuse, (d) operation outside of the published environmental specifications for the product, or (e) improper site preparation or maintenance.

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For consumer transactions in Australia and New Zealand: the warranty terms contained in this statement, except to the extent lawfully permitted, do not exclude, restrict or modify and are in addition to the mandatory statutory rights applicable to the sale of this product to you.

Assistance

Product maintenance agreements and customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office.

Safety Considerations (contd)

WARNING

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.

WARNING

ANY INTERRUPTION OF THE PROTECTIVE GROUNDING CONDUCTOR (INSIDE OR OUTSIDE THE PRODUCT'S CIRCUITRY) 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 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) of the same current rating and type (for example, normal blow, time delay). Do not use repaired fuses or short circuited fuseholders.

Acoustic Noise Emissions

LpA<47 dB at operator position, at normal operation, tested per EN 27779. All data are the results from type test.

Geräuschemission

LpA<47 dB am Arbeits platz, normaler Betrieb, geprüft nach EN 27779.
Die Angagen beruhen auf Ergebnissen von Typenprüfungen.

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Agilent Technologies	**DECLARATION OF CONFORMITY** According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014	CE

Manufacturer's Name: Agilent Technologies, Incorporated
Manufacturer's Address: Santa Clara Site
5301 Stevens Creek Blvd
Santa Clara, California 95051

Declares, that the product

Product Name: Universal Counter Frequency Counter
Model Number: 53131A, 53132A 53181A
Product Options: *This declaration covers all options of the above product.*

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly.

	Standard	**Limit**
EMC	*IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998*	
	CISPR 11:1990 / EN 55011:1991	*Group 1 Class A [1]*
	IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995	*4kV CD, 8kV AD*
	IEC 61000-4-3:1995 / EN 61000-4-3:1995	*3 V/m, 80-1000 MHz*
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	*0.5kV signal lines, 1kV power lines*
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	*0.5 kV line-line, 1 kV line-ground*
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	*3V, 0.15-80 MHz I cycle, 100%*
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	
Safety	*IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995*	
	Canada: CSA C22.2 No. 1010.1:1992	

Supplemental Information:

[1] The product was tested in a typical configuration with Agilent Technologies test systems.

July 31, 2001
Date

Art Nanawa, Product Regulations Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.
Authorized EU-representative: Agilent Technologies Deutschland GmbH, Herrenberger Straβe 130, D 71034 Böblingen, Germany

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Preface

This guide provides assembly-level service information for the Agilent 53131A and Agilent 53132A Universal Counters, and the Agilent 53181A Frequency Counter.

How to Use This Guide

Repair Strategy

This service guide is designed to isolate failures to the assembly level only.

The Agilent 53131A/132A/181A Counter can be returned to Agilent Technologies for all service work, including troubleshooting, and verifying specifications. Contact your nearest Agilent Technologies Sales and Service Office for more details.

Note: there is an Express Repair/Performance Calibration Service for USA customers if downtime is critical. You can receive your repaired Counter via overnight shipment. Just call 800-403-0801 and ask for Express Repair/Performance Calibration Service. When your Counter is repaired, it will be returned via overnight shipment at no extra charge.

If you decide to service the Counter yourself, use the troubleshooting procedures in Chapter 2 (Service) and the disassembly and reassembly procedures in Chapter 3 (Replacing Assemblies). Then use the calibration instructions in Chapter 2 to calibrate the Counter for peak-performance operation, and finally perform the complete performance tests in Chapter 1 to verify the Counter's specifications.

Instrument Identification

Instrument identification is made from the serial number on the rear panel of the Counter. Agilent 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 Agilent-assigned alpha character between the prefix and suffix identifies the country in which the instrument was manufactured.

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Instruments Covered by this Guide

This guide applies directly to Agilent 53131A, Agilent 53132A, and Agilent 53181A Counters that have the same serial number prefix(es) shown on the title page. If the serial number prefix of your Counter differs from that listed on the title page of this guide, then there may be differences between this guide and your instrument.

Instruments having a higher serial prefix are covered when required by one or more manual-change sheets included with this guide. If a required change sheet is missing, contact your nearest Agilent Technologies Sales Office listed at the back of this guide. Instruments having a serial prefix lower than that listed on the title page are covered in Chapter 6, “Backdating.”

Assembly-Level Service Guide Organization

This assembly-level service guide consists of a table of contents, preface, eight chapters and an index. The page running headers identify the chapters and sections of this manual. The chapter contents are summarized as follows:

Chapter 1, “Performance Tests,” provides procedures that verify the Counter operates properly and meets the Agilent 53131A/132A or Agilent 53181A specifications given in Chapter 7, “Agilent 53131A/132A Specifications,” or Chapter 8, “Agilent 53181A Specifications,” in this guide.

Chapter 2, “Service,” is divided into seven main sections that provide instructions for returning the Counter to Agilent Technologies for service, calibrating the Counter, and troubleshooting the assemblies in the Counter.

Chapter 3, “Replacing Assemblies,” provides procedures for replacing defective assemblies and/or modules in the Counter.

Chapter 4, “Retrofitting Options,” provides field-installation procedures that help you install options into the Counter.

Chapter 5, “Replaceable Parts,” lists the replaceable parts contained in the Counter, and explains how to order replacement parts for your Counter.

Chapter 6, “Backdating,” contains information required to adapt this manual for older instruments.

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Chapter 7, “Agilent 53131A/132A Specifications,” lists all the specifications and operating characteristics for the Agilent 53131A/132A Universal Counter.

Chapter 8, “Agilent 53181A Specifications,” lists all the specifications and operating characteristics for the Agilent 53181A Frequency Counter.

How to Order Guides

The part number for this guide is listed in the *Certification and Warranty* page (located on the back of the title page) and on the rear cover of this guide. Preface will always follow table of contents. Page numbers will be in roman lower case.

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Description of the 225 MHz Counters

The **Agilent 53131A** and **Agilent 53132A** are universal counters capable of measuring frequencies to 225 MHz on Channels 1 and 2. With an optional Channel 3, this frequency is extended to 3.0 GHz (Option 030); 5.0 GHz (Option 050) or 12.4 GHz (Option 124)."

For the Agilent 53131A, frequency and time interval resolutions are 10 digits in one second and 500 picoseconds, respectively. The Agilent 53131A provides users with a GPIB measuring speed of 200 measurements per second, and is suitable for bench-top operation and lower-volume ATE operation. The frequency and time interval resolutions for the Agilent 53132A are up to 12 digits in one second and 150 picoseconds, respectively. The Agilent 53132A provides users with exceptional resolution, and is ideal for ATE systems operation.

The Agilent 53131A/132A basic measurement functions include Frequency, Period, Pulse Width, Duty Cycle, Rise/Fall Time, Time Interval, Frequency Ratio, Totalize, Phase, and Peak Voltage.

The **Agilent 53181A** is a frequency counter capable of measuring frequencies to 225 MHz on Channel 1. Depending on which optional Channel 2 the counter contains, this capability is extended to 1.5 GHz (Option 015) or 3.0 GHz (Option 030). The Agilent 53181A has a frequency resolution of 10 digits in one second.

The Agilent 53181A provides users with a GPIB measuring speed of 200 measurements per second, and is suitable for bench-top and ATE operation.

The Agilent 53181A basic measurement functions include Frequency, Period, Peak Voltage, and Frequency Ratio (if Channel 2 is installed).

The Agilent 53131A/132A/181A include additional measurement functions and features that are designed specifically for manufacturing and service applications:

- 1, 5, 10 MHz external reference capability—to match customer's house standard (however, the Agilent 53132A's external reference capability is 10 MHz only),
- optional ultra-high stability , high stability, or medium stability oven oscillators for high accuracy needs,

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- external gating,
- statistics,
- automatic limit testing,
- SCPI programming capability, and
- analog display mode limit testing

Programmable control is performed via a GPIB. The GPIB and a talk-only RS-232C serial port are standard for the Agilent 53131A/132A/181A. The serial port is for printing measured and analyzed data on serial printers, or for outputting an out-of-limit signal.

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Options

The options available for the Agilent 53131A/132A/181A Counter are listed following this paragraph. Specifications for the options are listed in Chapter 7, “Agilent 53131A/132A Specifications,” and Chapter 8, “Agilent 53181A Specifications.” 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 the “Retrofitting Options” chapter in this guide for instructions on field installation of the options.

NOTE

The “0’s” and “1’s” in the following option numbers are numeric characters (that is, they are not letters).

Hardware

- Medium Stability Oven Timebase, Option 001
- DC Power Input, Option 002
- High Stability Oven Timebase, Option 010
- Ultra-High Stability Oven Timebase, Option 012 (Agilent 53132A and Agilent 53181A Only)
- 1.5 GHz RF Input Channel (Channel 2), Option 015 (Agilent 53181A Only)
- 3.0 GHz RF Input Channel (Channel 3), Option 030
- 5.0 GHz RF Input Channel (Channel 3), Option 050
- 12.4 GHz RF Input Channel (Channel 3), Option 124
- [*]Rear Terminals, Option 060
- Rack Mount Kit, Option 1CM (Agilent part number 5063-9240)

[*] For the Agilent 53131A/132A Option 030, front and rear terminals can exist for Channel 1 and 2. The optional Channel 3 can be configured as rear terminals only or front terminals only. For the Agilent 53181A, front and rear terminals can exist for Channel 1. The optional Channel 2 can be configured as rear terminals only or front terminals only. Option 050 and Option 124 can be configured only as front terminals.

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Support

- 5-year Return to Agilent Technologies for Repair, Option W50
- 5-year Return to Agilent Technologies for Calibration, Option W52

Accessories Supplied and Available

Accessories Supplied

- Power cord, 2.3 meters

Accessories Available

- Agilent 34161A Accessory Pouch
- Printer RS-232 Interface cables, Agilent 24542G or Agilent 24542H
- GPIB cables, Agilent 10833A/B/C/D

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1

Performance Tests

Verifying Specifications

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1

Introduction

This chapter provides procedures to test the electrical performance of the Agilent 53131A/132A Universal Counter and Agilent 53181A Frequency Counter, using the specifications listed in Chapter 7, “Agilent 53131A/132A Specifications,” and Chapter 8, “Agilent 53181A Specifications,” of this guide.

Three types of testing are provided:

- Operational Verification
- Complete Performance Tests
- Optional GPIB Verification

This chapter is organized as follows:

- Introduction page 1-2
- Equipment Required page 1-4
- Agilent 53131A/132A/181A Operational Verification page 1-5
- Agilent 53131A/132A Complete Performance Tests page 1-16
- Agilent 53131A/132A GPIB Verification Program (Optional) page 1-40
- Agilent 53131A/132A Performance Test Record (Page 1 of 6) page 1-41
- Agilent 53181A Complete Performance Tests page 1-47
- Agilent 53181A GPIB Verification Program (Optional) page 1-70
- Agilent 53181A Performance Test Record (Page 1 of 4) page 1-71

Operational Verification

The operational verification 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 tests. An operational verification is useful for incoming inspection, routine maintenance, and after instrument repair.

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Complete Performance Tests

The complete performance tests verify the specifications listed in Chapter 7, “Agilent 53131A/132A Specifications,” and Chapter 8, “Agilent 53181A Specifications.” All tests can be performed without accessing the inside of the instrument.

Optional GPIB Verification

The GPIB verification program, described on page 1-40 (Agilent 53131A/132A) or page 1-70 (Agilent 53181A), exercises the Counter via the GPIB interface. The program is written for an HP 9000 series 200 or 300 Desktop Computer as the controller. If the instrument successfully completes all phases of the verification program, there is a very high probability that the GPIB interface is working properly.

The GPIB program is available on disks as indicated in the following listing:

- **For Agilent 53131A/132A Counters**—Agilent part number 53131-13501 (3 1/2-inch LIF disk) and Agilent part number 53131-13502 (5 1/4-inch LIF disk).
- **For Agilent 53181A Counters**—Agilent part number 53181-13501 (3 1/2-inch LIF disk) and Agilent part number 53131-13502 (5 1/4-inch LIF disk).

Recommended Calibration Cycle

The Counter requires periodic verification of operation. Depending on the use and environmental conditions, aging, and measurement accuracy required, the Counter should be checked using the operational verification procedure *at least* once every year.

Test Record

The results of the operational verification, complete performance tests, and GPIB verification test should be recorded on a copy of the Performance Test Record, located at the end of each (i.e., Agilent 53131A/132A and Agilent 53181A) complete performance tests section in this chapter.

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1

Equipment Required

Table 1-1. Recommended Test Equipment

Instrument	Required Characteristics	Recommended Model	Use
Synthesizer	DC to 13 MHz	Agilent 3325B	OV, P, T
Synthesized Signal Generator	100 kHz to 2560 MHz	Agilent 8663A	OV, P, T
Pulse Generator	5 ns pulse width	Agilent 8130A or equivalent	OV, C
Sweep Oscillator	3.0 GHz	Agilent 8340B	P, T
Primary Frequency Standard (10 MHz House Standard)	Absolute accuracy >1 x 10^{-10}	Agilent 5071A	C
DC Power Supply	Adjustable to 5.000V	Agilent 6234A	C
Digital Voltmeter	Microvolt accuracy	Agilent 3458A	OV, C
Time Interval Calibrator	Effective edge repeatability: <10 ps	Agilent 59992A J06	C
Type N-to-BNC Connector	—	Agilent 1250-0780	OV, P
BNC-to-Dual Banana Plug	BNC(m) to banana plug	Agilent 11001-60001	OV, P, C T
50Ω Feedthrough (3)	—	Agilent 10100C	OV, P, C
50Ω Coaxial Cable with BNC connectors (5)	BNC(m) to BNC(m), 48 inches	Agilent 10503A	OV, P, C, T
Coaxial BNC Tee Connector	—	1250-0781	P, C

P = Performance Tests
OV = Operational Verification
C = Calibration
T = Troubleshooting

Some of this equipment may no longer be available as new. Use an equivalent model number.

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Agilent 53131A/132A/181A Operational Verification

The operational verification 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 tests.

If you are unfamiliar with the operation of the Counter, you should review the Chapter 1, “Getting Started,” in the Operating Guide. However, the procedures in this chapter are written so that little experience is necessary. The procedures should be followed in the order in which they appear.

Power-On Self Tests

1 **Inspect the Counter for any damage.**

2 **Make sure no cables are connected to the input channels (rear and front panels) of the Counter.**

NOTE It is normal for the fan in the Counter to continue to run after the Counter is placed in Standby mode. Power to the timebase is continuous to maintain long term measurement reliability, and the fan helps maintain timebase temperature stability.

NOTE The power supply will automatically sense the input voltage; thus, there is no need to change the ac voltage setting.

3 **Connect the power cord to the Counter, and connect the other end of the power cord to the primary power source.**

4 **Press *POWER* key to turn on the Counter.**

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1

5 Verify that the following happens:

- All segments of the front-panel display light up,
- ***SELFTST: PASS*** is displayed,
- ***GPIB AT n*** is quickly displayed—where "n" represents the GPIB address (Note that some earlier versions of the Counter's firmware did not display the GPIB address at power-up.), and
- dashes are displayed.

The Counter is now ready to measure frequency of a signal applied to CHANNEL 1 input as indicated by illumination of the **Freq** and **Ch1** annunciators.

If a fail message is displayed, refer to the troubleshooting section in Chapter 2, "Service," of this guide.

6 For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 1.

6' For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 1.

7 Connect the Counter's rear-panel *10 MHz Out* as shown in Figure 1-1A or Figure 1-1B, depending on which Counter you are testing.

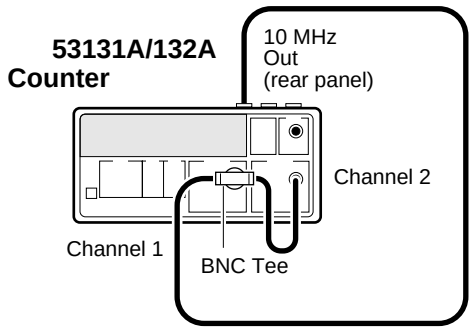


Figure 1-1A. Operational Verification Setup for Agilent 53131A/132A

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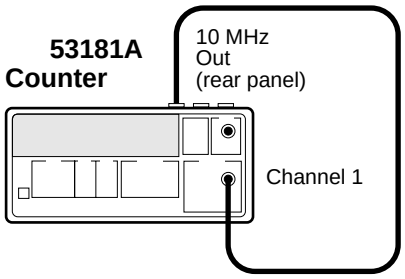


Figure 1-1B. Operational Verification Setup for Agilent 53181A

8 Depending on which Counter you are testing, verify the appropriate reading as shown below:

For Agilent 53131A and Agilent 53181A, verify a reading of 10.000,000,00 MHz.

For the Agilent 53132A, verify a reading of 10.000,000,000 MHz.

9 For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 2.

9’ For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 2.

NOTE **The remaining steps apply to the Agilent 53131A and Agilent 53132A only since the Agilent 53181A does not have a standard Channel 2 input.** For the Agilent 53181A, proceed to the following “Run Self Test” section.

10 Press *Freq & Ratio* key until *FREQUENCY 2* is displayed to select Channel 2 for frequency measurements.

For the Agilent 53131A, verify a reading of 10.000,000,00 MHz.

For the Agilent 53132A, verify a reading of 10.000,000,000 MHz.

11 For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 3.

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Run Self Test

1 Disconnect the input signals from the Counter.

2 Power down (turn off the Counter), press and hold *Recall (Utility)* key, then press *POWER* key.

3 Press *Recall key* until *TEST: ALL ?* is displayed.

4 Press *Enter* key.

Observe that ***ALL: PASS*** is displayed after the self test is completed.

If ***ALL: FAIL*** is displayed or a failure is indicated, refer to the troubleshooting section in Chapter 2, "Service," of this guide.

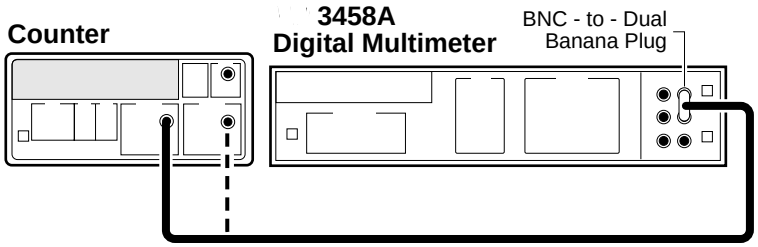
5 For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 4.

5' For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 3.

Termination Check

1 Cycle the *POWER* key to preset the Counter.

2 Connect a digital voltmeter (DVM) to CHANNEL 1 as shown in Figure 1-2, and set it to measure ohms (set DVM to appropriate Ω range).



Agilent 53131A/132A is shown in above figure. This setup for the Agilent 53181A requires a connection to Channel 1 only.

Figure 1-2. Termination Check Setup

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3 P**ress Channel 1 *50Ω/1MΩ* key.**

The LED turns on, indicating a 50Ω input impedance for Channel 1.

4 **Press Channel 1** *DC/AC* **key.**

The LED turns on, indicating DC input coupling for Channel 1.

5 **Verify the DVM reads** 51.1Ω ± 3Ω

6 **For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 5a.**

6' **For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 4a.**

7 **Press Channel 1 *50Ω/1MΩ* key.**

The LED turns off, indicating a 1 MΩ input impedance for Channel 1.

8 **Verify the DVM reads approximately** 1.0000000 MOHM**.**

9 **For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 5b.**

9' **For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 4b.**

10 **Repeat steps 3 through 9 for Channel 2 for the Agilent 53131A/132A Counter ONLY since the Agilent 53181A Counter does not have a standard Channel 2.**

11 **For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Tests 6a and 6b.**

12 **Disconnect the test setup.**

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External Arm Test (Agilent 53131A/132A Only)

This test verifies the External Arm port of the Agilent 53131A and Agilent 53132A Counter is operational.

Equipment

Agilent 8663A Synthesized Signal Generator
Agilent 8130A Pulse Generator (or equivalent)
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cables (2)
Agilent 1250-0780 N-to-BNC Connector

Counter Setup

1 Cycle the *POWER* key to preset the Counter.

2 Set the Counter as follows:

Other Meas, *TOTALIZE 1*
Gate & ExtArm, *GATE: EXTERNL (ENTER)*

3 Set CHANNEL 1 input conditions to:

Trigger/Sensitivity, *AUTO TRG: ON*
Trigger/Sensitivity, *LEVEL: 50 PCT*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuator, Off
100kHz Filter, Off

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Procedure

1 Set the Pulse Generator to the following:

PERIOD: 20 µs
WIDTH: 5 µs
High: 3.00 V Low : 0.8 V
Trailing/Leading : 1.0 ns
Input Mode: TRIG

2 Connect the equipment as shown in Figure 1-3.

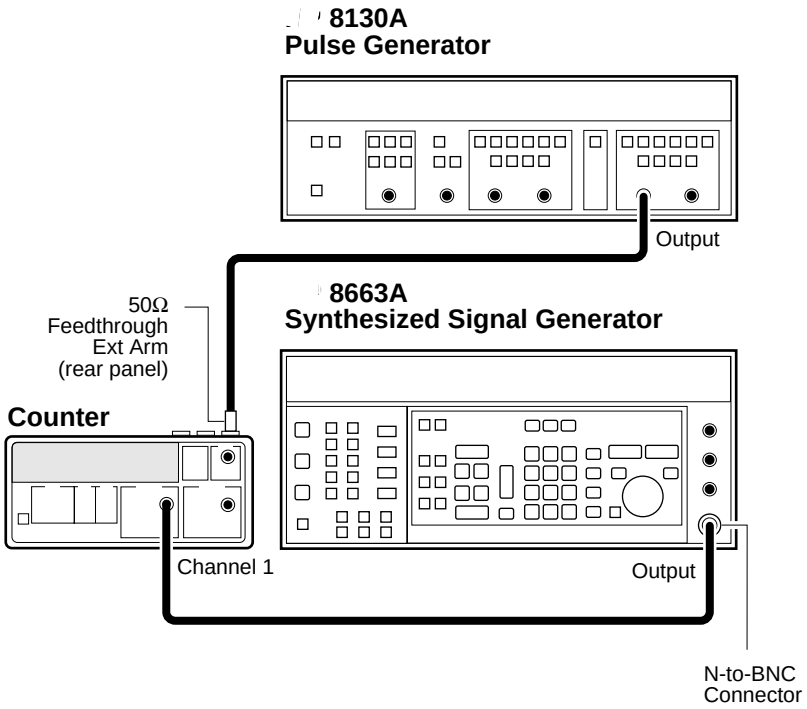


Figure 1-3. External Arm Test Setup (Agilent 53131A/132A Only)

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3 **Set the Agilent 8663A to output a 200 MHz, 100 mV sine wave signal to Channel 1.**

4 **On the Counter, Press *Run* key.**

5 **Send a single pulse by pressing the MAN key on the Agilent 8130A, and observe that with each press the *Gate* annunciator flashes.**

The Counter should display approximately 1000.

6 **For Agilent 53131A/132A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 7.**

7 **Disconnect the test setup.**

External Timebase Tests

These tests verify the External Timebase 1, 5, 10 MHz specifications of the Agilent 53131A and Agilent 53181A Counters by checking that TIMEBASE AUTO allows the Counter to be synchronized to the external reference.

Note that the Agilent 53132A only operates with the 10 MHz external timebase; therefore, perform the procedure in the section titled "10 MHz External Timebase Input for the Agilent 53132A" on page 1-15 to verify that TIMEBASE AUTO allows the Counter to be synchronized to the external reference.

Equipment

Agilent 3325B Synthesizers (2)
Agilent 10100C 50W Feedthrough
Agilent 10503 BNC Cables (2)

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1 MHz External Timebase Input (Agilent 53131A and 53181A Only)

1 Connect the equipment as shown in Figure 1-4.

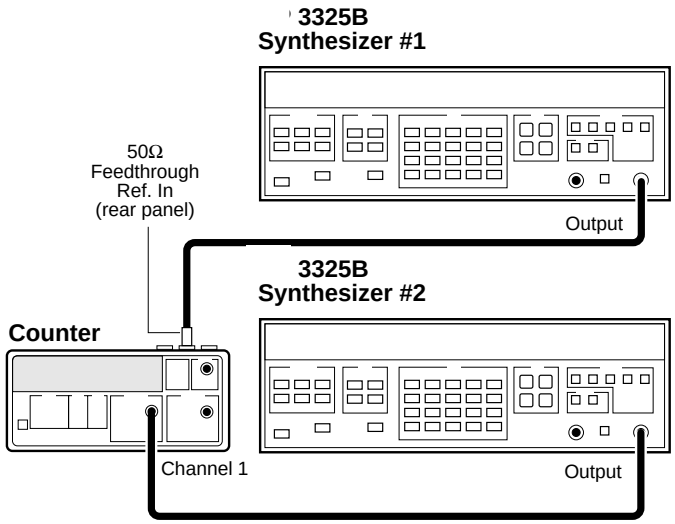


Figure 1-4. External Timebase Test Setup

2 Cycle the *POWER* key to preset the Counter.

3 Set Synthesizer #1 (i.e., the Agilent 3325B connected to the rear-panel *Ref In* input of the Counter via a 50Ωfeedthrough) to output a 1 MHz, 200 mV rms sine wave signal.

4 Set Synthesizer #2 (i.e., the Agilent 3325B connected to Channel 1) to output a 2 MHz, 100 mV rms square wave signal.

Verify the Counter displays a reading of approximately 2 MHz and the **ExtRef** annunciator is lit.

5 For Agilent 53131A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 8a.

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5’ For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 5a.

5 MHz External Timebase Input (Agilent 53131A and 53181A Only)

1 Change the frequency of Synthesizer # 1, which is connected to the Counter’s rear-panel *Ref In* input to 5 MHz.

2 On the Counter, press *Run* key.

Verify the Counter displays a reading of approximately 2 MHz and the **ExtRef** annunciator is lit.

3 For Agilent 53131A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 8b.

3’ For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 5b.

10 MHz External Timebase Input (Agilent 53131A and 53181A Only)

1 Change the frequency of Synthesizer #1, which is connected to the Counter’s rear-panel *Ref In* input to 10 MHz.

2 On the Counter, press *Run* key.

Verify the Counter displays a reading of approximately 2 MHz and the **ExtRef** annunciator is lit.

3 For Agilent 53131A, mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 8c.

3’ For Agilent 53181A, mark Pass or Fail in the Agilent 53181A Performance Test Record on page 1-71, Test 5c.

4 Disconnect the test setup.

This completes the Operational Verification for the Agilent 53131A and Agilent 53181A.

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10 MHz External Timebase Input for the Agilent 53132A

1 **Connect the equipment as shown in Figure 1-4.**

2 **Set Synthesizer #1 (i.e., the Agilent 3325B that is connected to the rear-panel *Ref In* input of the Counter via a 50Ω feedthrough) to output a 10 MHz, 200 mV rms sine wave signal.**

3 **Set Synthesizer #2 (i.e., the Agilent 3325B that is connected to Channel 1) to output a 2 MHz, 100 mV rms square wave signal.**

Verify the Counter displays a reading of approximately 2 MHz and the ExtRef annunciator is lit.

4 **Mark Pass or Fail in the Agilent 53131A/132A Performance Test Record on page 1-41, Test 8d.**

5 **Disconnect the test setup.**

This completes the Operational Verification for the Agilent 53132A.

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1

Agilent 53131A/132A Complete Performance Tests

The specifications of the **Agilent 53131A/132A Universal Counter** can be verified by performing the performance tests provided in this section. Table 1-2 lists a summary of the Agilent 53131A/132A performance tests.

Record the results of the performance tests in the appropriate place on Agilent 53131A/132A Performance Test Record, which starts on page 1-41.

(Note: the complete performance tests for the Agilent 53181A Frequency Counter begin on page 1-47 of this chapter.)

NOTE

To perform valid testing of the specifications, warm up the Counter and test equipment for 30 minutes.

Table 1-2. The Agilent 53131A/132A Performance Tests

Page Number	*Test Description
page 1-17	Test 1: Time Interval (Agilent 53131A/132A Only)
page 1-19	Test 2: Trigger Level (Agilent 53131A/132A Only)
page 1-22	Test 3: Channels 1 and 2 Frequency Sensitivity (Agilent 53131A/132A Only)
page 1-27	Test 4: Channels 1 and 2 Frequency Accuracy (Agilent 53131A/132A Only)
page 1-30	Test 5: Option 030/050/124 Channel 3 Frequency Sensitivity (Agilent 53131A/132A Only)
page 1-35	Test 6: Option 030/050/124 Channel 3 Frequency Accuracy (Agilent 53131A/132A Only)
page 1-37	Test 7: Peak Volts, Channels 1 and 2 (Agilent 53131A/132A Only)
page 1-40	Agilent 53131A/132A GPIB Verification Program (Optional)

* Other Counter measurement functions (e.g., Period) are mathematically derived by the microprocessor from the parameters verified by these performance tests. If the Counter passes the performance tests, the other measurement functions are functioning to specifications.

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Test 1: Time Interval (Agilent 53131A/132A Only)

This test verifies the Time Interval specifications between Channels 1 and 2.

Equipment

Agilent 8130A Pulse Generator (or equivalent)
Agilent 10503A BNC Cable

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Press *Time & Period* key until *TI 1 TO 2* is displayed.**

3 **Set CHANNEL 1 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: .500V (Enter)*
Trigger/Sensitivity, *COMMON 1: ON*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

4 **Set CHANNEL 2 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: .500V (Enter)*
Trigger/Sensitivity, *SLOPE: NEG*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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1

Procedure

1 Connect the pulse generator signal to Channel 1 of the Counter as shown in Figure 1-5.

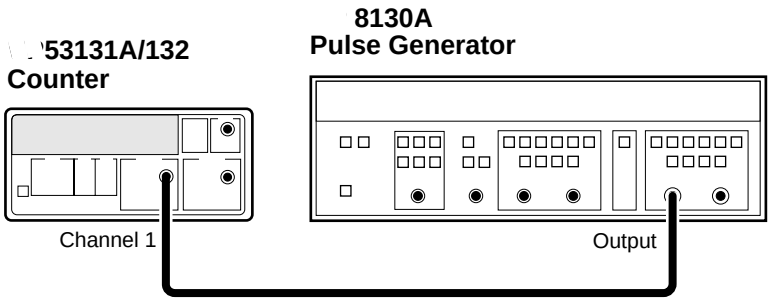


Figure 1-5. Time Interval (Channel 1 TO 2) Test Setup

2 Set the Pulse Generator to the following:

PERIOD: 10 µs
WIDTH: 150 ns
High: 1.00 V Low : 0.00 V
Input Mode: Normal

3 On the Counter, Press *Single/Stop* key.

The Agilent 53131A Counter should display 0.1500 µs ±0.0040 µs.

The Agilent 53132A Counter should display 0.1500 µs ±0.0025 µs.

4 Record this value in the appropriate place in the Performance Test Record (Test 1, Line 1 for Agilent 53131A or Test 1, Line 2 for Agilent 53132A).

5 Disconnect the test setup.

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Test 2: Trigger Level (Agilent 53131A/132A Only)

This test verifies the Trigger Level accuracy of the Agilent 53131A and Agilent 53132A Universal Counters.

Equipment

Agilent 3325B Synthesizer
Agilent 10503A BNC Cable

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Set CHANNEL 1 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

3 **Set CHANNEL 2 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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1

Procedure

1 Connect the output of the Agilent 3325B to Channel 1 of the Counter as shown in Figure 1-6.

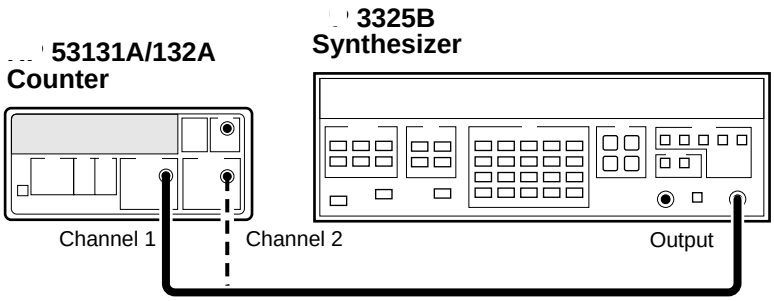


Figure 1-6. Trigger Level Test Setup

2 Set the Agilent 3325B to output a 1 MHz, 80 mVp-p square wave signal.

3 Set the Agilent 3325B DC OFFSET to -60 mV.

4 On the Counter, press *Run* key.

5 Now, increment the dc offset on the Agilent 3325B by +1 mV until the Counter's *Gate* annunciator flashes and continue incrementing until the Counter displays a *stable* reading of approximately 1 MHz.

Observe the offset value on the display of the Agilent 3325B.

Record the dc offset value_____ mV.

6 Add the upper peak voltage (40 mV) of the 80 mV p-p signal to the offset value in step 5 (For example, -24 mV + 40 mV = 16 mV)**.**

This is the upper hysteresis level.

Record the upper hysteresis level_____ mV.

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7 **In the Counter's Channel 1 Trigger/Sensitivity menu, change the SLOPE to NEG.**

8 **Set the Agilent 3325B DC OFFSET to +60 mV.**

9 **On the Counter, press *Run* key.**

10 **Now, decrement the offset on the Agilent 3325B by -1 mV until the Counter's *Gate* annunciator flashes and continue decrementing until the Counter displays a *stable* reading of approximately 1 MHz.**

Observe the offset value on the display of the Agilent 3325B.

Record the value_____ mV.

11 **Add the lower peak voltage (-40mV) of the 80 mVp-p signal to the offset value in step 10 (for example, 21 mV –40 mV = -19 mv.)**

This result is the lower hysteresis level.

Record the lower hysteresis level _____ mV.

12 **Now, add the upper hysteresis value (recorded in step 6) and lower hysteresis value (recorded in step 11).**

This is the trigger level; it should be 0.0 V ±15 mV.

13 **Record the trigger level value in the appropriate place in the Performance Test Record (Test 2, Line 1).**

14 **Repeat steps 1 through 13 for Channel 2.**

15 **Record the trigger level value in the appropriate place in the Performance Test Record (Test 2, Line 2).**

16 **Disconnect the test setup.**

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Test 3: Channels 1 and 2 Frequency Sensitivity (Agilent 53131A/132A Only)

This set of tests verifies frequency sensitivity specifications of the Agilent 53131A and 53132A Universal Counters.

Equipment

Agilent 8663A Synthesized Signal Generator
Agilent 1250-0780 Type N-to-BNC Connector
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cables (2)

Counter Setup

1 Cycle the *POWER* key to preset the Counter.

2 Set CHANNEL 1 input conditions to:

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000 V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

3 Set CHANNEL 2 input conditions to:

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000 V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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100 kHz to 100 MHz Sensitivity for Agilent 53131A/132A

1 Connect the timebase output of the unit with the better timebase to the timebase reference input of the other unit as shown in Figure 1-7.

For this test, make sure you always use the unit (Agilent 53131A/132A or Agilent 8663A) that contains the better 10 MHz timebase as the output source as shown in Figure 1-7.

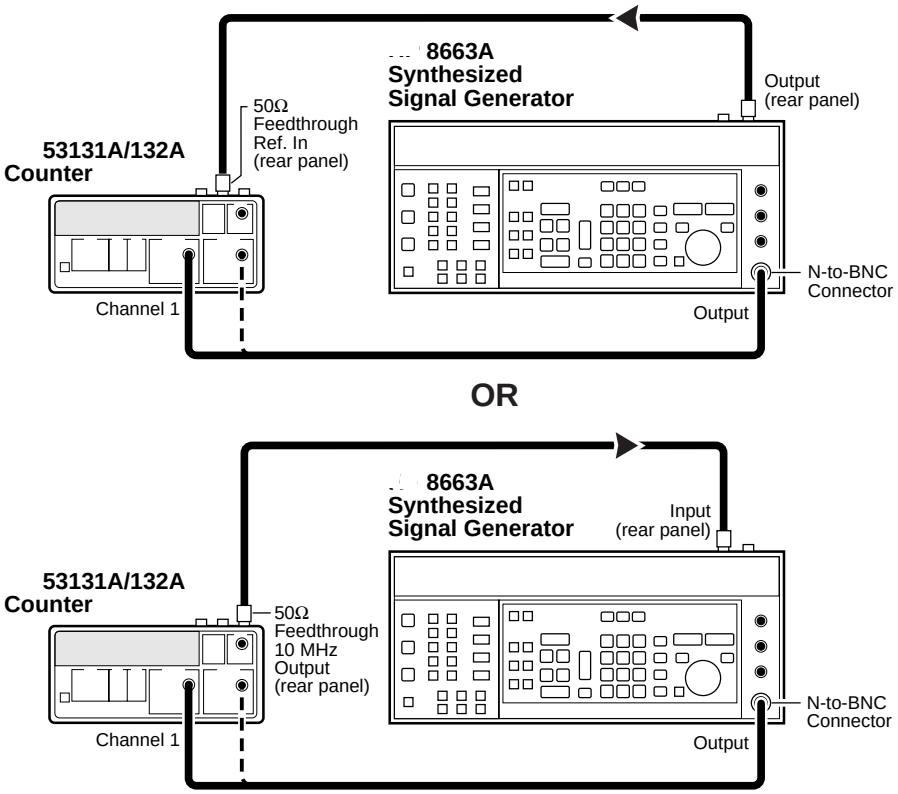


Figure 1-7. Channels 1 and 2 Frequency Sensitivity Test Setup

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2 **Set the Agilent 8663A Signal Generator to output a 100 MHz, −35.0 dBm sine wave signal (−20.0 dBm for Option 060 Rear Terminals) to the Counter's Channel 1 input.**

3 **On the Counter, press *Run* key.**

4 **In 0.1 dB steps, increase the power level until the Counter displays a *stable* reading of 100 MHz.**

The Counter should display 100 MHz when the signal generator level is ≤−21.0 dBm (20 mVrms). **Counters with Option 060 should display 100 MHz when the signal generator level is ≤−9.5 dBm (75 mVrms).**

5 **Sweep the frequency from 100 MHz to 100 kHz. *For Option 060, sweep frequencies from 225 MHz to 100 kHz.***

The Counter should read frequencies from 100 MHz to 100 kHz at an input power level of ≤−21.0 dBm (20 mVrms). **Counters with Option 060 should read frequencies from 225 MHz to 100 kHz at ≤−9.5 dBm (75 mVrms).**

6 **Record the actual reading in the appropriate place in the Performance Test Record (Test 3, Line 1).**

If you are testing a Counter with front-panel terminals (Standard), record the reading on Line 1 of the **Standard** portion of the test record.

If you are testing a Counter with rear terminals (Option 060), record the reading on Line 1 of the **Option 060** portion of the test record.

NOTE

DO NOT test the front terminals if rear terminals are installed. The front terminal performance is not specified when the rear terminals are installed.

7 **Connect the Agilent 8663A to Channel 2 of the Counter.**

8 **On the Counter, press *Freq & Ratio* key until *FREQUENCY 2* is displayed.**

9 **Repeat steps 2 through 5 for Channel 2.**

10 **Record the actual reading in the appropriate place in the Performance Test Record (Test 3, Line 2).**

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If you are testing a Counter with front-panel terminals (Standard), record the reading on Line 2 of the **Standard** portion of the test record.

If you are testing a Counter with rear terminals (Option 060), record the reading on Line 2 of the **Option 060** portion of the test record.

NOTE

The remaining sensitivity procedures are NOT required for Counters that contain Option 060 Rear Terminals; thus, this completes the sensitivity portion of the Frequency Performance Test. Go to the Frequency Accuracy Test on page 1-27.

100 MHz to 200 MHz Sensitivity for Agilent 53131A/132A

1 **Leave the signal generator connected to Channel 2. Change the signal generator settings to 200 MHz at −30 dBm.**

2 **On the Counter, press *Run* key.**

3 **Increase the power level by 0.1 dB steps until the Counter displays a *stable* 200 MHz reading.**

The Counter should display 200 MHz when the input signal level is ≤−17.5 dBm (30 mVrms).

4 **Sweep the signal generator frequency from 200 MHz to 100 MHz.**

The Counter should read frequencies from 200 MHz to 100 MHz when the input signal level is ≤−17.5 dBm (30 mVrms).

5 **Record the actual reading in the Performance Test Record (Test 3, Line 3).**

6 **Connect the signal generator to Channel 1.**

7 **On the Counter, press *Freq & Ratio* key until *Frequency 1* is displayed.**

8 **Repeat steps 1 through 4 for Channel 1.**

9 **Record the actual reading in the Performance Test Record (Test 3, Line 4).**

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200 MHz to 225 MHz Sensitivity for Agilent 53131A/132A

1 **Leave the signal generator connected to Channel 1. Change the signal generator settings to 225 MHz at −30 dBm.**

2 **On the Counter, press *Run* key.**

3 **Increase the power level by 0.1 dB steps until the Counter displays a *stable* reading of 225 MHz.**

The Counter should read 225 MHz when the input signal level is ≤−15.0 dBm (40 mVrms).

4 **Sweep the signal generator frequency from 225 MHz to 200 MHz.**

The Counter should read frequencies from 225 MHz to 200 MHz when the input signal level is ≤−15.0 dBm (40 mVrms).

5 **Record the actual reading in the Performance Test Record (Test 3, Line 5).**

6 **Connect the signal generator to Channel 2.**

7 **On the Counter, press *Freq & Ratio* key until *Frequency 2* is displayed.**

8 **Repeat steps 1 through 4 for Channel 2.**

9 **Record the actual reading in the Performance Test Record (Test 3, Line 6).**

10 **Disconnect the test setup.**

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Test 4: Channels 1 and 2 Frequency Accuracy (Agilent 53131A/132A Only)

This set of tests verifies the frequency accuracy specifications of the Agilent 53131A and Agilent 53132A Universal Counters.

Equipment

Agilent 8663A Synthesized Signal Generator
Agilent 1250-0780 Type N-to-BNC Connector
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cables (2)

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Using the Gate & ExtArm key, set the gate time to *TIME 1.000 s*.**

3 **Set CHANNEL 1 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000 V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

4 **Set CHANNEL 2 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000 V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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1

Procedure

1 Connect the equipment as shown in Figure 1-8 with the signal generator connected to Channel 1 of the Counter.

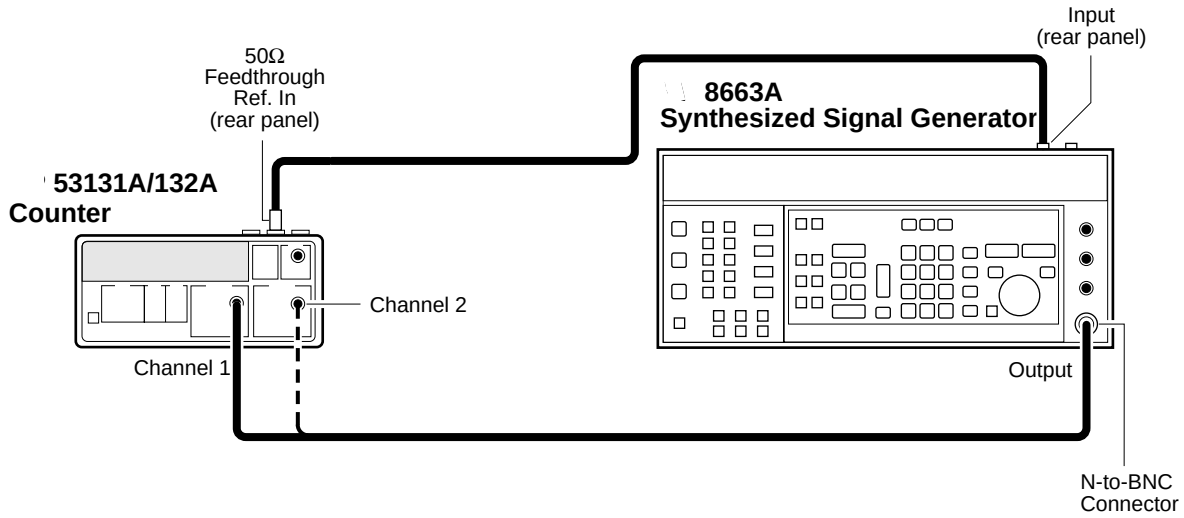


Figure 1-8. Channels 1 and 2 Frequency Accuracy Test Setup

2 Set the Signal Generator to output 1 MHz at -7 dBm.

3 On the Counter, press *Run* key.

Verify the Agilent 53131A Counter reads 1 MHz ±1 mHz.

Verify the Agilent 53132A Counter reads 1 MHz ±200 µHz.

4 Record the actual reading in the appropriate place in the Performance Test Record (Test 4, Line 1 for Agilent 53131A or Test 4, Line 3 for Agilent 53132A.

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5 **Change the signal generator frequency to 100 MHz.**

Verify the Agilent 53131A Counter reads 100 MHz ±70 mHz.

Verify the Agilent 53132A Counter reads 100 MHz ±15 mHz.

6 **Record the actual reading in the appropriate place in the Performance Test Record (Test 4, Line 5 for Agilent 53131A or Test 4, Line 7 for Agilent 53132A).**

7 **Change the signal generator frequency to 200 MHz.**

Verify the Agilent 53131A Counter reads 200 MHz ±130 mHz.

Verify the Agilent 53132A Counter reads 200 MHz ±30 mHz.

8 **Record the actual reading in the appropriate place in Performance Test Record (Test 4, Line 9 for Agilent 53131A or Test 4, Line 11 for Agilent 53132A).**

9 **Change the signal generator frequency to 225 MHz.**

Verify the Agilent 53131A Counter reads 225 MHz ±150 mHz.

Verify the Agilent 53132A Counter reads 225 MHz ±35 mHz.

10 **Record the actual reading in the appropriate place in the Performance Test Record (Test 4, Line 13 for Agilent 53131A or Test 4, Line 15 for Agilent 53132A).**

11 **Connect the signal generator to Channel 2.**

12 **On the Counter, press *Freq & Ratio* key until *Frequency 1* is displayed.**

13 **Repeat steps 2 through 9 for Channel 2.**

14 **Record the actual readings in the appropriate places in the Performance Test Record.**

15 **Disconnect the test setup.**

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Test 5: Option 030/050/124 Channel 3 Frequency Sensitivity (Agilent 53131A/132A Only)

This test verifies the frequency range, and sensitivity of the optional 3-GHz and 5-GHz Channel 3 (Option 030/050/124) for the Agilent 53131A and the Agilent 53132A Universal Counters.

Equipment

Agilent 8663A Synthesized Signal Generator (not needed for Option 050)
Agilent 8340B Sweep Oscillator
Agilent 1250-0780 Type N-to-BNC Connector (not needed for Option 050)
Agilent 10503A BNC Cable(2)
Agilent 10100C 50Ω Feedthrough
Agilent 11500D N-N Cable (Option 050 only)
Agilent 1250-1250 N(M) to SMA(F)
Agilent 1250-0777 N(F) to N(F)

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Set the Counter as follows:**
Freq & Ratio, *FREQUENCY 3*

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100 MHz to 2.5 GHz Sensitivity for Agilent 53131A/132A Option 030 only

1 **Set the Agilent 8663B Synthesized Signal Generator to output a 2500 MHz, -40 dBm sine wave, and connect the signal to Channel 3 of the Counter as shown in Figure 1-9.**

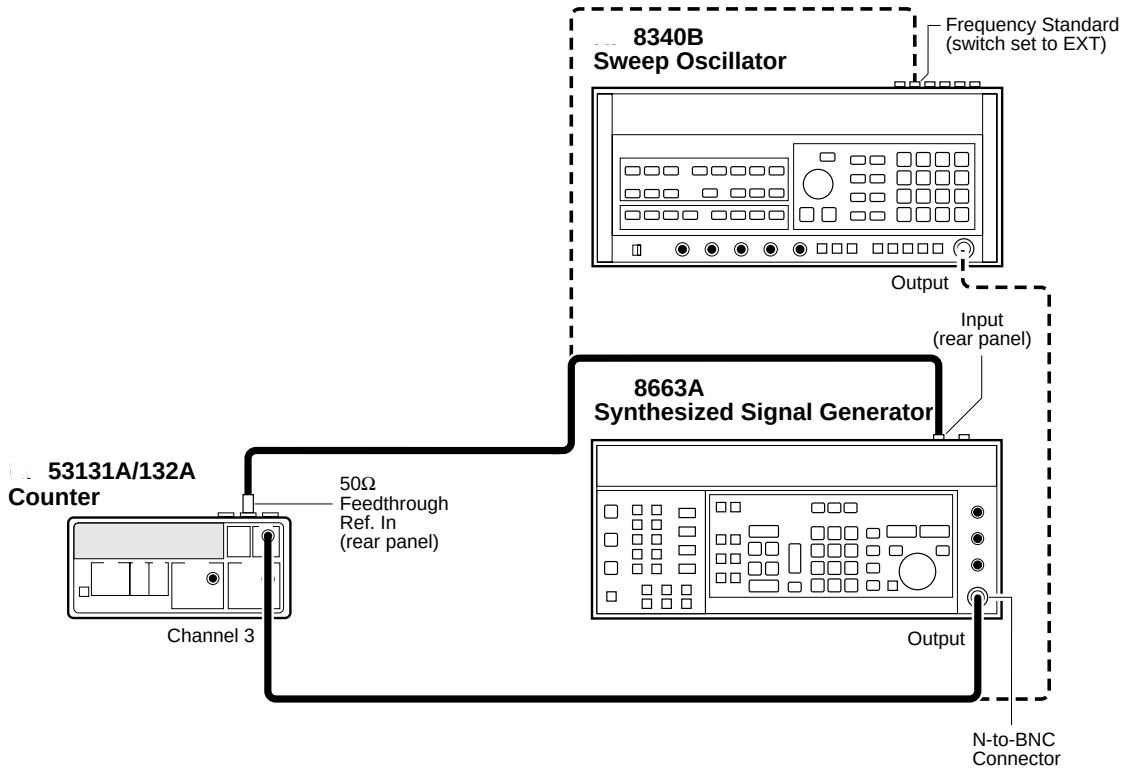


Figure 1-9. Option 030/050/124 Channel 3 Frequency Sensitivity and Accuracy Test Setup

2 **On the Counter, Press *Run* key.**

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3 **Increase the power level in 5 dB steps until the Counter displays a *stable* reading of approximately 2.5 GHz.**

The Counter should display 2.5 GHz at ≤-27.0 dBm (10 mVrms).

4 **Sweep the frequencies from 2.5 GHz to 200 MHz.**

The Counter should read frequencies from 2.5 GHz to 200 MHz at ≤-27.0 dBm (10 mVrms).

5 **Record the actual reading in the Performance Test Record (Test 5, Line 1).**

2.7 to 3.0 GHz Sensitivity for Option 030 only

1 **Disconnect the Agilent 8663A Synthesized Signal Generator from the Counter (see Figure 1-9), and connect the Agilent 8340B Sweep Oscillator to Channel 3 of the Counter.**

2 **Change the settings of the Sweep Oscillator to 3.0 GHz, -40 dBm.**

3 **Increase the power level in 1 dB steps until the Counter displays a *stable* reading of approximately 3.0 GHz.**

The Counter should display 3.0 GHz at ≤-21.0 dBm.

4 **Sweep the frequencies from 3.0 GHz to 2.7 GHz.**

The Counter should read frequencies from 3.0 to 2.7 GHz at ≤-21.0 dBm.

5 **Record the actual reading in the Performance Test Record (Test 5, Line 2).**

6 **Disconnect the test setup.**

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200 MHz to 5.0 GHz Sensitivity for Agilent 53131A/132A (Option 050 only)

1 **Connect the 8340B Sweep Oscillator to Channel 3 of the counter.**

2 **Change the settings of the Sweep Oscillator to 5.0 GHz, -40 dBm.**

3 **Increase the power level in 1 dB steps until the Counter displays a *stable* reading of approximately 5.0 GHz.**

The Counter should display 5.0 GHz at ≤-23 dBm.

NOTE Use a power meter and sensor to ensure the accuracy of the power being input.

4 **Sweep the frequencies from 200 MHz to 5.0 GHz.**

The Counter should read frequencies from 200 MHz to 5.0 GHz at ≤-23 dBm.

5 **Record the actual reading in the Performance Test Record (Test 5, Line 3).**

6 **Disconnect the test setup.**

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200 MHz to 12.4 GHz Sensitivity for Agilent 53131A/132A (Option 124 only)

1 **Connect the 8340B Sweep Oscillator to Channel 3 of the counter.**

2 **Change the settings of the Sweep Oscillator to 12.4 GHz, -40 dBm.**

3 **Increase the power level in 1 dB steps until the Counter displays a *stable* reading of approximately 12.4 GHz.**

The Counter should display 12.4 GHz at ≤-23 dBm.

NOTE Use a power meter and sensor to ensure the accuracy of the power being input.

4 **Sweep the frequencies from 200 MHz to 12.4 GHz.**

The Counter should read frequencies from 200 MHz to 12.4 GHz at ≤-3 dBm.

5 **Record the actual reading in the Performance Test Record (Test 5, Line 4).**

6 **Disconnect the test setup.**

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Test 6: Option 030/050/124 Channel 3 Frequency Accuracy (Agilent 53131A/132A Only)

This test verifies the frequency accuracy of the optional 3-GHz or 5-GHz Channel 3 (Option 030).

Equipment

Agilent 8663A Synthesized Signal Generator (Option 030 only)
Agilent 8340B Sweep Oscillator
Agilent 1250-0780 Type N-to-BNC Connector (Option 030 only)
Agilent 10503A BNC Cable (2)
Agilent 10100C 50Ω Feedthrough
Agilent 11500D N-N Cable (Option 050 only)
Agilent 1250-1250 N(M) to SMA(F)
Agilent 1250-0777 N(F) to N(F)

Counter Setup

1 Cycle the *POWER* key to preset the Counter.

2 Set the Counter as follows:

Freq & Ratio, *FREQUENCY 3*
Gate & ExtArm, *TIME: TIME 1.000 s*

Procedure

1 Connect equipment as shown in Figure 1-9.

(NOTE: For Options 050 and 124, skip steps 2 through 5. Proceed to step 6.)

2 Set the Agilent 8663A Synthesized Signal Generator to output 100 MHz at –17.0 dBm.

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3 On the Counter, press *Run* key.

Verify the Agilent 53131A Counter reads 100 MHz ±70 mHz.

Verify the Agilent 53132A Counter reads 100 MHz ±20 mHz.

4 Record the actual reading in the Performance Test Record (Test 6, Line 1 for Agilent 53131A or Test 6, Line 2 for Agilent 53132A).

5 Disconnect the Agilent 8663A output from Channel 3 of the Counter, and connect the Agilent 8340B Sweep Oscillator output to Channel 3 of the Counter as shown in Figure 1-9.

6 Set the Agilent 8340B to output 3.0 GHz at –17.0 dBm.

Verify the Agilent 53131A Counter reads 3.0 GHz ±2 Hz.

Verify the Agilent 53132A Counter reads 3.0 GHz ±0.4 Hz.

7 Record the actual reading in the Performance Test Record (Test 6, Line 3 for Agilent 53131A or Test 6, Line 4 for Agilent 53132A).

8 Set the Agilent 8340B to output 5.0 GHz at –17 dBm.

Verify the Agilent 53131A Counter reads 5.0 GHz ±3 Hz.

Verify the Agilent 53132A Counter reads 5.0 GHz ±0.7 Hz.

9 Record the actual reading in the Performance Test Record (Test 6, Line 5 for Agilent 53131A or Test 6, Line 6 for Agilent 53132A).

10 Set the Agilent 8340B to output 12.4 GHz at –17 dBm. (This step is for Option 124 only.)

Verify the Agilent 53131A Counter reads 12.4 GHz ±8 Hz.

Verify the Agilent 53132A Counter reads 12.4 GHz ±2 Hz.

11 Record the actual reading in the Performance Test Record (Test 6, Line 7 for Agilent 53131A or Test 6, Line 8 for Agilent 53132A.)

12 Disconnect the test setup.

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Test 7: Peak Volts, Channels 1 and 2 (Agilent 53131A/132A Only)

This test verifies the Peak Volts accuracy specification of the Agilent 53131A and Agilent 53132A Universal Counters.

Equipment

Agilent 3325B Synthesizer
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cable

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Press *Other Meas* key until *VOLT PEAKS 1* is displayed.**

3 **Set CHANNEL 1 input to:**

50Ω/1MΩ, 50Ω
X10 Attenuate, Off
100kHz Filter, Off

4 **Set CHANNEL 2 input to:**

50Ω/1MΩ, 50Ω
X10 Attenuate, Off
100kHz Filter, Off

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1

Volt Peak 1

1 Connect the equipment as shown in Figure 1-10.

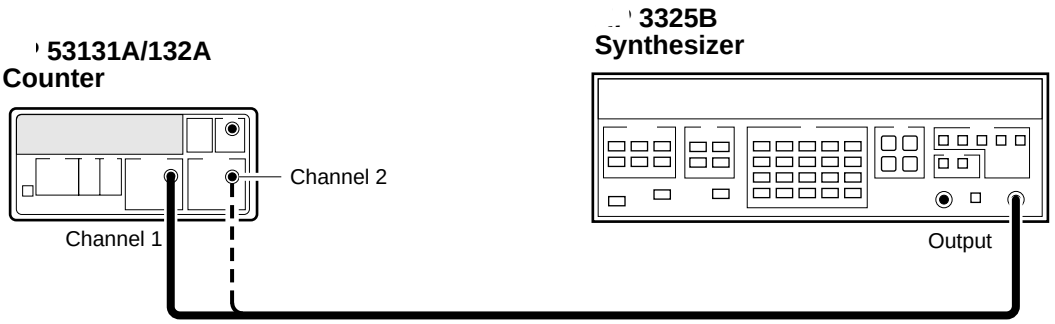


Figure 1-10. Peak Volts Test Setup

2 Set the Agilent 3325B to output a 2 MHz, 2 Vp-p sine wave.

The Counter should display −1.00 ±0.12V for the *negative peak* of the sine wave. This reading is displayed on the left side of the display.

Record the actual reading in the Performance Test Record (Test 7, Line 1a).

Also, the Counter should display +1.00 ±0.12V for the *positive peak* of the sine wave. This reading is displayed on the right side of the display.

Record the actual reading in the Performance Test Record (Test 7, Line 1b).

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Volt Peak 2

1 Remove the signal from Channel 1 of the Counter and connect it to Channel 2.

2 Press *Other Meas* key until *VOLT PEAK 2* is displayed.

The Counter should display -1.00 ±0.12V for the *negative peak* of the sine wave. This reading is displayed on the left side of the display.

Record the actual reading in the Performance Test Record (Test 7, Line 2a).

Also, the Counter should display +1.00 ±0.12V for the *positive peak* of the sine wave. This reading is displayed on the right side of the display.

Record the actual reading in the Performance Test Record (Test 7, Line 2b).

3 Disconnect the test setup.

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Agilent 53131A/132A GPIB Verification Program (Optional)

The GPIB Verification program exercises the Agilent 53131A/132A and through various operating modes via the its GPIB interface. If the Counter successfully completes all phases of the verification program, there is a high probability that the GPIB interface is operating correctly. If the Counter fails the verification program, refer to the troubleshooting section in Chapter 2, “Service,” of this guide.

The GPIB Verification program may be loaded into the HP 9000 series 200 or 300 Desktop Computer from the 3 1/2-inch disk (Agilent P/N 53131-13501) or the 5 1/4-inch disk (Agilent P/N 53131-13502).

1 **To run the program on the disk, insert the disk into the Desktop Computer, load the program by typing *Load “VER31”*, and press *RUN* key on the computer’s keyboard.**

2 **Follow the instructions displayed in the computer’s screen.**

3 **After running this program, record the result (Pass or Fail) on the last page (page 1-46) of the Agilent 53131A/132A Performance Test Record.**

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Agilent 53131A/132A Performance Test Record (Page 1 of 6)

Agilent Technologies Model 53131A/132A Universal Counter

Serial Number: _____ Repair/Work Order No. _____

Test Performed By: _____ Temperature: _____

Date: _____ Relative Humidity: _____

Notes: _____

Test Number	Operational Verification	Test Results Pass	Fail
1	Power on Self Test	❑	❑
2	Channel 1, 10 MHz Test	❑	❑
3	Channel 2, 10 MHz Test	❑	❑
4	Run Self Test	❑	❑
5a	Termination Check Ch 1, 50Ω	❑	❑
5b	Termination Check Ch 1, 1MΩ	❑	❑
6a	Termination Check Ch 2, 50Ω	❑	❑
6b	Termination Check Ch 2, 1MΩ	❑	❑
7	External Arm Test	❑	❑
8a	1 MHz External Timebase Input Test (Agilent 53131A Only)	❑	❑
8b	5 MHz External Timebase Input Test (Agilent 53131A Only)	❑	❑
8c	10 MHz External Timebase Input Test (Agilent 53131A Only)	❑	❑
8d	10 MHz External Timebase Input Test for the Agilent 53132A	❑	❑

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Agilent 53131A/132A Performance Test Record (Page 2 of 6)

Complete Performance Tests				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
1	**Time Interval** (Agilent 53131A/132A Only):			
	For Agilent 53131A	0.1460 µs	1. _____	0.1540 µs
	For Agilent 53132A	0.1475 µs	2. _____	0.1525 µs
2	**Trigger Level:**			
	Channel 1	−15 mV	1. _____	+15 mV
	Channel 2 (Agilent 53131A/132A Only)	−15 mV	2. _____	+15 mV

Test 3: Channels 1 and 2 Frequency Sensitivity (Agilent 53131A/132A Only)		
Standard (Front Panel Terminals)	**Actual Reading**	**Specification**
100 kHz–100 MHz, Channel 1	1. _____	≤−21 dBm (20 mVrms)
100 kHz–100 MHz, Channel 2	2. _____	≤−21 dBm (20 mVrms)
100 MHz–200 MHz, Channel 2	3. _____	≤−17.5 dBm (30 mVrms)
100 MHz–200 MHz, Channel 1	4. _____	≤−17.5 dBm (30 mVrms)
200 MHz–225 MHz, Channel 1	5. _____	≤−15.0 dBm (40 mVrms)
200 MHz–225 MHz, Channel 2	6. _____	≤−15.0 dBm (40 mVrms)
Option 060 Rear Terminals	**Actual Reading**	**Specification**
100 kHz–225 MHz, Channel 1	1. _____	≤−9.5 dBm (75 mVrms)
100 kHz–225 MHz, Channel 2	2. _____	≤−9.5 dBm (75 mVrms)

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Agilent 53131A/132A Performance Test Record (Page 3 of 6)

Complete Performance Tests (Continued)				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
4	**Channels 1 and 2 Frequency Accuracy** (Agilent 53131A/132A Only)			
	1 MHz Test (Agilent 53131A):			
	Channel 1			
	Channel 2	999,999.999 Hz	1. _____	1,000,000.001 Hz
	1 MHz Test (Agilent 53132A):	999,999.999 Hz	2. _____	1,000,000.001 Hz
	Channel 1			
	Channel 2	999,999.9998 Hz	3. _____	1,000,000.0002 Hz
		999,999.9998 Hz	4. _____	1,000,000.0002 Hz
4	**100 MHz Test (Agilent 53131A):**			
	Channel 1	99.999,999,93 MHz	5. _____	100.000,000,07 MHz
	Channel 2	99.999,999,93 MHz	6. _____	100.000,000,07 MHz
	100 MHz Test (Agilent 53132A):			
	Channel 1	99.999,999,980 MHz	7. _____	100.000,000,020 MHz
	Channel 2	99.999,999,980 MHz	8. _____	100.000,000,020 MHz

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Agilent 53131A/132A Performance Test Record (Page 4 of 6)

Complete Performance Tests (Continued)				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
4	**200 MHz Test (Agilent 53131A):**			
	Channel 1	199.999,999,87 MHz	9. _____	200.000,000,13 MHz
	Channel 2	199.999,999,87 MHz	10. _____	200.000,000,13 MHz
	200 MHz Test (Agilent 53132A):			
	Channel 1	199.999,999,970 MHz	11. _____	200.000,000,03 MHz
	Channel 2	199.999,999,970 MHz	12. _____	200.000,000,03 MHz
4	**225 MHz Test (Agilent 53131A):**			
	Channel 1	224.999,999,85 MHz	13. _____	225.000,000,15 MHz
	Channel 2	224.999,999,85 MHz	14. _____	225.000,000,15 MHz
	225 MHz Test (Agilent 53132A):			
	Channel 1	224.999,999,965 MHz	15. _____	225.000,000,035 MHz
	Channel 2	224.999,999,965 MHz	16. _____	225.000,000,035 MHz

Test 5: Option 030/050/124 Channel 3 Frequency Sensitivity (Agilent 53131A/132A Only)

	Actual Reading	**Specification**
100 MHz–2.5 GHz	1. _____	≤-27 dBm 10 mV rms
2.7–3.0 GHz	2. _____	≤-21 dBm 20 mV rms
200 MHz–5.0 GHz	3. _____	≤-23 dBm 16 mV rms
200 MHz–12.4 GHz	4. _____	≤-23 dBm 16 mV rms

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Agilent 53131A/132A Performance Test Record (Page 5 of 6)

Complete Performance Tests (Continued)				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
6	**Option 030 Channel 3 Frequency Accuracy** (Agilent 53131A/132A Only)			
	100 MHz Test (Agilent 53131A): Channel 3	99.999,999,93 MHz	1. _____	100.000,000,07 MHz
	100 MHz Test (Agilent 53132A): Channel 3	99.999, 999,980 MHz	2. _____	100.000,000,020 MHz
6	**3.0 GHz Test (Agilent 53131A):** Channel 3	2,999.999,998 MHz	3. _____	3,000.000,002 MHz
	3.0 GHz Test (Agilent 53132A): Channel 3	2,999.999,999,60 MHz	4. _____	3,000.000, 000,4 MHz
6	**5.0 GHz Test (Agilent 53131A):** Channel 3	4,999.999,997,0 MHz	5. _____	5,000.000,003,0 MHz
	5.0 GHz Test (Agilent 53132A): Channel 3	4,999.999,999,3 MHz	6. _____	5,000.000, 000,7 MHz

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Agilent 53131A/132A Performance Test Record (Page 6 of 6)

Complete Performance Tests (Continued)				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
6	**12.4 GHz Test (Agilent 53131A):**			
	Channel 3	12.399.999 992 MHz	7. _____	12,400.000 008 MHz
	12.4 GHz Test (Agilent 53132A):			
	Channel 3	12,399.999 998 MHz	8. _____	12,400.000 002 MHz
6	**12.4 GHz Test (Agilent 53131A):**			
	Channel 3	12,399.999,982,0 MHz	7. _____	12,400.000 018, MHz
	12.4 GHz Test (Agilent 53132A):			
	Channel 3	12,399.999,992,0 MHz	8. _____	12,400.000, 008,0 MHz
7	**Peak Volts, Channels 1 and 2** (Agilent 53131A/132A Only):			
	Volt Peak 1			
	Channel 1	−1.12 V +0.88 V	1 a._____ b._____	−0.88 V +1.12V
	Volt Peak 2			
	Channel 2	−1.12 V +0.88 V	2 a._____ b._____	−0.88 V +1.12V

Complete Performance Tests (Continued)		
GPIB Verification (Optional)	**Test Results**	
	Pass	**Fail**
	❑	❑

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1

Agilent 53181A Complete Performance Tests

The specifications of the **Agilent 53181A Frequency Counter** can be verified by performing the performance tests provided in this section. Table 1-3 lists a summary of the Agilent 53181A performance tests.

Record the results of the performance tests in the appropriate place on Agilent 53181A Performance Test Record, which starts on page 1-71.

(Note: the complete performance tests for the Agilent 53131A/132A Universal Counter begin on page 1-16 of this chapter.)

NOTE

To perform valid testing of the specifications, warm up the Counter and test equipment for 30 minutes.

Table 1-3. The Agilent 53181A Performance Tests

Page Number	*Test Description
page 1-48	Test 1: Trigger Level (Agilent 53181A Only)
page 1-51	Test 2: Channel 1 Frequency Sensitivity (Agilent 53181A Only)
page 1-55	Test 3: Channel 1 Frequency Accuracy (Agilent 53181A Only)
page 1-58	Test 4: Option 015/030/050/124 Channel 2 Frequency Sensitivity
page 1-63	Test 5: Option 015/030/050/124 Channel 2 Frequency Accuracy (Agilent 53181A Only)
page 1-68	Test 6: Peak Volts, Channel 1 (Agilent 53181A Only)
page 1-70	Agilent 53181A GPIB Verification Program (Optional)

* Other Counter measurement functions (e.g., Period) are mathematically derived by the microprocessor from the parameters verified by these performance tests.

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Test 1: Trigger Level (Agilent 53181A Only)

This test verifies the Trigger Level accuracy of the Agilent 53181A Frequency Counter.

Equipment

Agilent 3325B Synthesizer
Agilent 10503A BNC Cable

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Set CHANNEL 1 input condition to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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Procedure

1 Connect the output of the Agilent 3325B to Channel 1 of the Counter as shown in Figure 1-11.

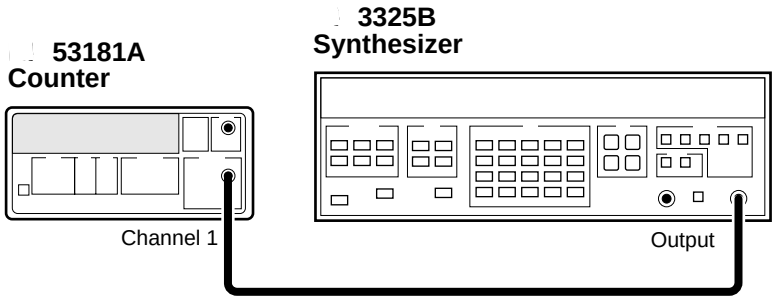


Figure 1-11. Trigger Level Test Setup

2 Set the Agilent 3325B to output a 1 MHz, 80 mVp-p square wave signal.

3 Set the Agilent 3325B DC OFFSET to -60 mV.

4 On the Counter, press *Run* key.

5 Now, increment the dc offset on the Agilent 3325B by +1 mV until the Counter's *Gate* annunciator flashes and continue incrementing until the Counter displays approximately 1 MHz.

Observe the offset value on the display of the Agilent 3325B.

Record the dc offset value_____ mV.

6 Add the upper peak voltage (40 mV) of the 80 mV p-p signal to the offset value in step 5 (For example, -24 mV + 40 mV = 16 mv)**.**

This is the upper hysteresis level.

Record the upper hysteresis level_____ mV.

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7 **In the Counter's Channel 1 Trigger/Sensitivity menu, change the SLOPE to NEG.**

8 **On the Counter, press *Run* key.**

9 **Set the Agilent 3325B DC OFFSET to +60 mV.**

10 **Now, decrement the offset on the Agilent 3325B by –1 mV until the Counter's *Gate* annunciator flashes and continue decrementing until the Counter displays approximately 1 MHz.**

Observe the offset value on the display of the Agilent 3325B.

Record the value_____ mV.

11 **Add the lower peak voltage (-40mV) of the 80 mVp-p signal to the offset value in step 10 (for example, 21 mV –40 mV = –19 mV.)**

This result is the lower hysteresis level.

Record the lower hysteresis level _____ mV.

12 **Now, add the upper hysteresis value (recorded in step 6)and lower hysteresis value (recorded in step 11).**

This is the trigger level; it should be 0.0 V ±15 mV.

13 **Record the trigger level value in the Performance Test Record (Test 1, Line 1).**

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Test 2: Channel 1 Frequency Sensitivity (Agilent 53181A Only)

This set of tests verifies frequency sensitivity specifications of the Agilent 53181A Frequency Counter.

Equipment

Agilent 8663A Synthesized Signal Generator
Agilent 1250-0780 Type N-to-BNC Connector
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cables (2)

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Set CHANNEL 1 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000 V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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100 kHz to 100 MHz Sensitivity for Agilent 53181A

1 Connect the equipment as shown in Figure 1-12 with the signal generator connected to Channel 1 of the Counter.

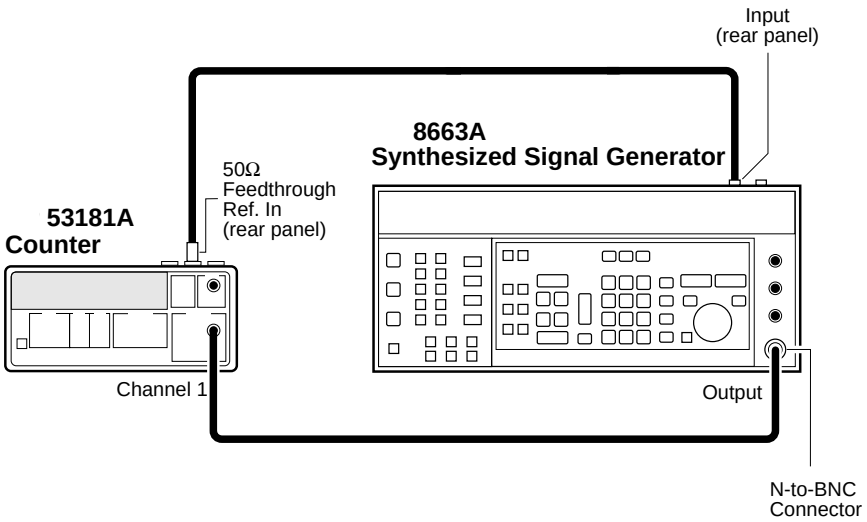


Figure 1-12. Channels 1 Frequency Sensitivity Test Setup

2 Set the Agilent 8663A Signal Generator to output a 100 kHz, −35.0 dBm sine wave signal (−20.0 dBm for Option 060) to the Counter's Channel 1 input.

3 In 0.1 dB steps, increase the power level until the Counter displays a *stable* reading of 100 kHz.

The Counter should display 100 kHz when the signal generator level is ≤−21.0 dBm (20 mVrms). Counters with Option 060 Rear Terminals should display 100 kHz when the signal generator level is ≤−9.5 dBm (75 mVrms).

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4 Sweep the frequency from 100 kHz to 100 MHz. *For Option 060, sweep frequencies from 100 kHz to 225 MHz.*

The Counter should read frequencies from 100 kHz to 100 MHz at an input power level of ≤−21.0 dBm (20 mVrms). Option 060 Counters should read frequencies from 100 kHz to 225 MHz at ≤−9.5 dBm (75 mVrms).

5 Record the actual reading in the Performance Test Record (Test 2, Line 1).

If you are testing a Counter with front-panel terminals (Standard), record the reading on Line 1 of the **Standard** portion of the test record.

If you are testing a Counter with rear terminals (Option 060), record the reading on Line 1 of the **Option 060** portion of the test record.

NOTE DO NOT test the front terminals if rear terminals are installed. The front terminal performance is not specified when the rear terminals are installed.

NOTE The remaining sensitivity procedures are NOT required for Counters that contain Option 060 Rear Terminals; thus, this completes the sensitivity portion of the Frequency Performance Test. Go to the Frequency Accuracy Test on page 1-55.

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100 MHz to 200 MHz Sensitivity for Agilent 53181A

1 **Change the signal generator settings to 110 MHz at −30 dBm.**

2 **Increase the power level by 0.1 dB steps until the Counter displays a *stable* 110 MHz reading.**

The Counter should read 200 MHz when the input signal level is ≤−17.5 dBm (30 mVrms).

3 **Sweep the signal generator frequency from 100 MHz to 200 MHz.**

The Counter should read frequencies from 100 MHz to 200 MHz when the input signal level is ≤−17.5 dBm (30 mVrms).

4 **Record the actual reading in the Performance Test Record (Test 2, Line 2).**

200 MHz to 225 MHz Sensitivity for Agilent 53181A

1 **Change the signal generator settings to 200 MHz at −30 dBm.**

2 **Increase the power level by 0.1 dB steps until the Counter displays a *stable* 200 MHz reading.**

The Counter should read 200 MHz when the input signal level is ≤−15.0 dBm (40 mVrms).

3 **Sweep the signal generator frequency from 200 MHz to 225 MHz.**

The Counter should read frequencies from 200 MHz to 225 MHz when the input signal level is ≤−15.0 dBm (40 mVrms).

4 **Record the actual reading in the Performance Test Record (Test 2, Line 3).**

5 **Disconnect the test setup.**

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Test 3: Channel 1 Frequency Accuracy (Agilent 53181A Only)

This set of tests verifies the frequency accuracy specifications of the Agilent 53181A Frequency Counter.

Equipment

Agilent 8663A Synthesized Signal Generator
Agilent 8340B Sweep Oscillator
Agilent 1250-0780 Type N-to-BNC Connector
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cables (2)

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Using the *Gate & ExtArm* key, set gate time to *TIME 1.000 s*.**

3 **Set CHANNEL 1 input conditions to:**

Trigger/Sensitivity, *AUTO TRG: OFF*
Trigger/Sensitivity, *LEVEL: 0.000 V*
50Ω/1MΩ, 50Ω
DC/AC, DC
X10 Attenuate, Off
100kHz Filter, Off

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Procedure

1 Connect the equipment as shown in Figure 1-13 with the signal generator connected to Channel 1 of the Counter.

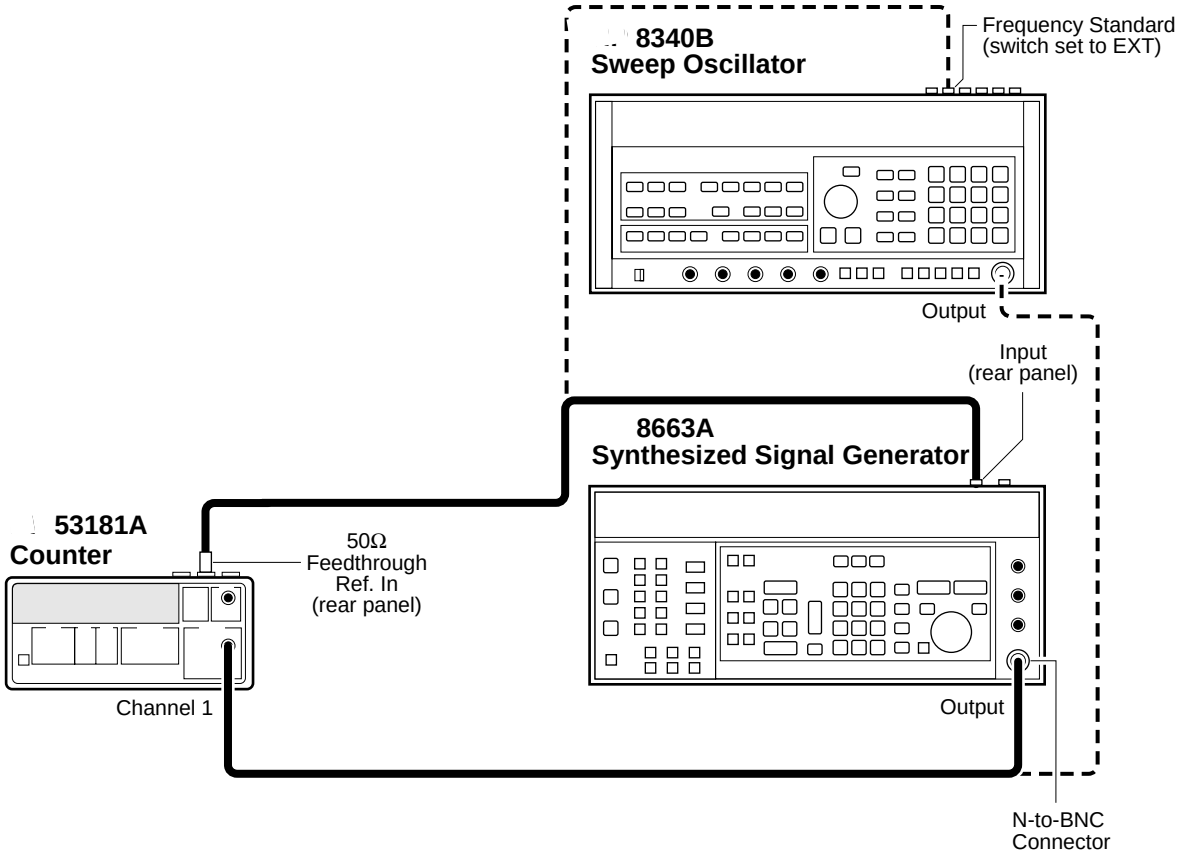


Figure 1-13. Channels 1 Frequency Accuracy Test Setup

2 Set the Agilent 8663A Signal Generator to output 1 MHz at -7 dBm.

3 On the Counter, press *Run* key.

Verify the Counter reads 1 MHz ±1 mHz.

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4 **Record the actual reading in the Performance Test Record (Test 3, Line 1).**

5 **Change the signal generator frequency to 100 MHz.**

Verify the Counter reads 100 MHz ±70 mHz.

6 **Record the actual reading in the Performance Test Record (Test 3, Line 2).**

7 **Change the signal generator frequency to 200 MHz.**

Verify the Counter reads 200 MHz ±130 mHz.

8 **Record the actual reading in the Performance Test Record (Test 3, Line 3).**

9 **Change the signal generator frequency to 225 MHz.**

Verify the Counter reads 225 MHz ±150 mHz.

10 **Record the actual reading in the Performance Test Record (Test 3, Line 4).**

11 **Disconnect the test setup.**

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Test 4: Option 015/030/050/124 Channel 2 Frequency Sensitivity

This test verifies the frequency range and sensitivity of the optional 1.5-GHz (Option 015), 3-GHz (Option 030), 5.0-GHz (Option 050), or 12.4-GHz (Option 124) Channel 2 for the Agilent 53181A Frequency Counter.

Equipment

Agilent 8663A Synthesized Signal Generator (Not needed for Option 050/124)
Agilent 8340B Sweep Oscillator
Agilent 1250-0780 Type N-to-BNC Connector (Not needed for Option 050/124)
Agilent 10503A BNC Cable (2)
Agilent 10100C 50Ω Feedthrough

Counter Setup

1 Cycle the *POWER* key to preset the Counter.

2 Set the Counter as follows:

Freq & Ratio, *FREQUENCY 2*

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100 MHz to 1.5 GHz Sensitivity for Option 015 Only

1 **Set the Agilent 8663B Synthesized Signal Generator to output a 500 MHz, -60 dBm sine wave and connect the signal to Channel 2 of the Counter as shown in Figure 1-14.**

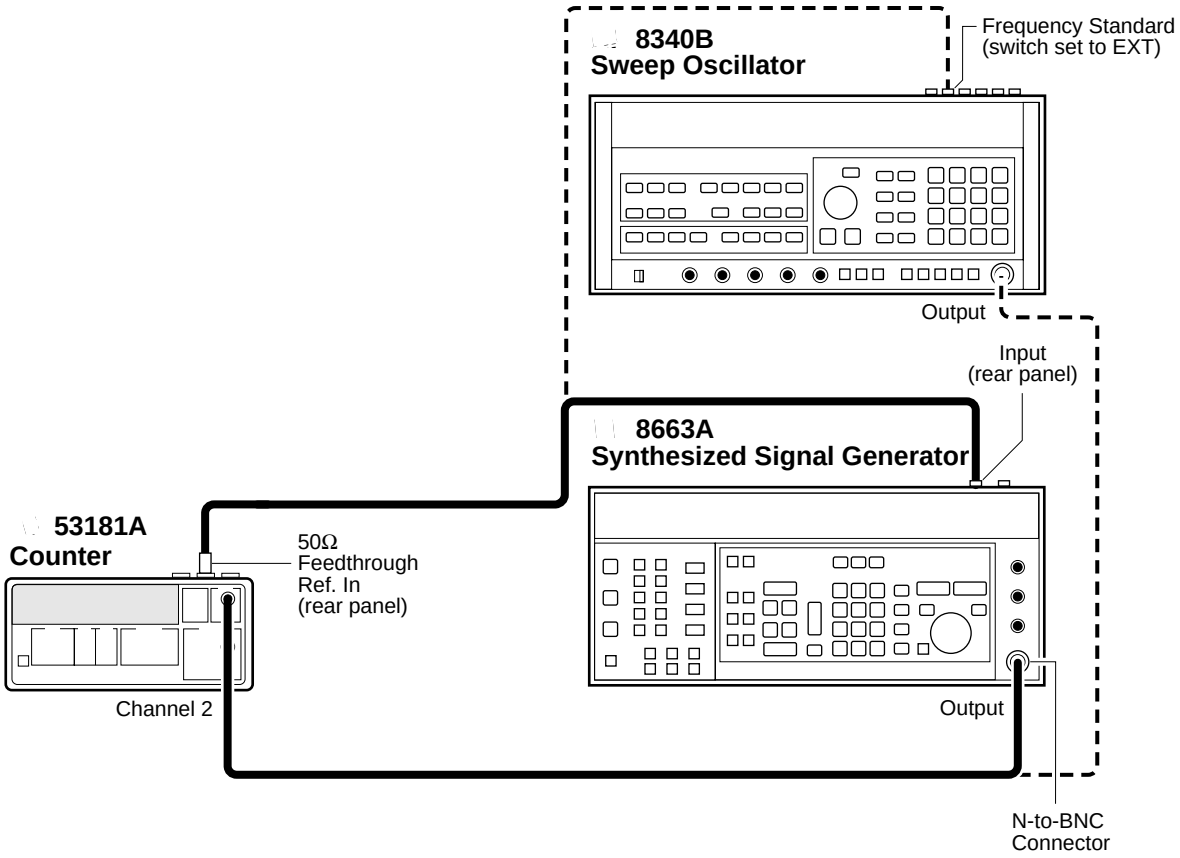


Figure 1-14. Option 015/030/050 Channel 2 Frequency Test

2 **On the Counter, Press *Run* key.**

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3 Increase the power level in 1 dB steps until the Counter reads 500 MHz.

The Counter should display 500 MHz at ≤-27.0 dBm (20 mVrms).

4 Sweep the frequencies from 100 MHz to 1.5 GHz.

The Counter should read frequencies from 100 MHz to 1.5 GHz at ≤-27.0dBm (20 mVrms).

5 Record the actual reading in the Performance Test Record (Test 4, Line 1).

100 MHz to 2.7 GHz Sensitivity for Option 030 Only

1 Set the Agilent 8663B Synthesized Signal Generator to output a 500 MHz, -60 dBm sine wave, and connect the signal to Channel 3 of the Counter as shown in Figure 1-14.

2 On the Counter, Press *Run* key.

3 Increase the power level in 1 dB steps until the Counter reads 500 MHz.

The Counter should display 500 MHz at ≤-27.0 dBm (20 mVrms).

4 Sweep the frequencies from 100 MHz to 2.7 GHz.

The Counter should read frequencies from 100 MHz to 2.7 GHz at ≤-27.0 dBm (20 mVrms).

5 Record the actual reading in the Performance Test Record (Test 4, Line 2).

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2.8 to 3.0 GHz Sensitivity for Option 030 Only

1 **Disconnect the Agilent 8663A Synthesized Signal Generator from the Counter (see Figure 1-14), and connect the Agilent 8340B Sweep Oscillator to Channel 3 of the Counter.**

2 **Change the settings of the Sweep Oscillator to 3.0 GHz, -40 dBm.**

3 **Increase the power level in 1 dB steps until the Counter displays 3.0 GHz.**

The Counter should display 3.0 GHz at ≤-21.0 dBm.

4 **Sweep the frequencies from 3.0 GHz to 2.8 GHz.**

The Counter should read frequencies from 3.0 to 2.8 GHz at ≤-21.0 dBm.

5 **Record the actual reading in the Performance Test Record (Test 4, Line 3).**

6 **Disconnect the test setup.**

200 MHz to 5.0 GHz Sensitivity for Option 050 only

1 **Connect the 8340B Sweep Oscillator to Channel 2 of the counter.**

2 **Change the settings of the Sweep Oscillator to 5.0 GHz, -30 dBm.**

3 **Increase the power level in 1 dB steps until the Counter displays a *stable* reading of approximately 5.0 GHz.**

The Counter should display 5.0 GHz at ≤-23 dBm.

NOTE Use a power meter and sensor to ensure the accuracy of the power being input.

4 **Sweep the frequencies from 200 MHz to 5.0 GHz.**

The Counter should read frequencies from 200 MHz to 5.0 GHz at ≤-23 dBm.

5 **Record the actual reading in the Performance Test Record (Test 4, Line 4).**

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200 MHz to 12.4 GHz Sensitivity for Option 124 only

1 **Connect the 8340B Sweep Oscillator to Channel 2 of the counter.**

2 **Change the settings of the Sweep Oscillator to 12.4 GHz, −30 dBm.**

3 **Increase the power level in 1 dB steps until the Counter displays a *stable* reading of approximately 12.4 GHz.**

The Counter should display 12.4 GHz at ≤−23 dBm.

NOTE Use a power meter and sensor to ensure the accuracy of the power being input.

4 **Sweep the frequencies from 200 MHz to 12.4 GHz.**

The Counter should read frequencies from 200 MHz to 12.4 GHz at ≤−23 dBm.

5 **Record the actual reading in the Performance Test Record (Test 4, Line 5).**

6 **Disconnect the test setup.**

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Test 5: Option 015/030/050/124 Channel 2 Frequency Accuracy (Agilent 53181A Only)

This test verifies the frequency accuracy of the optional 1.5-GHz (Option 015), 3-GHz (Option 030), 5.0 GHz (Option 050), or 12.4 GHz (Option 124) Channel 2 for the Agilent 53181A Frequency Counter.

The tests are organized as follows:

- Option 015 Channel 2 Frequency Accuracy Test, *starts on page 1-63*
- Option 030 Channel 2 Frequency Accuracy Test, *starts on page 1-65*
- Option 050 Channel 2 Frequency Accuracy Test, *starts on page 1-65*
- Option 124 Channel 2 Frequency Accuracy Test, *starts on page 1-67*

100 MHz to 1.5 GHz Accuracy Test for Option 015

Equipment

Agilent 8663A Synthesized Signal Generator
Agilent 8340B Sweep Oscillator
Agilent 1250-0780 Type N-to-BNC Connector
Agilent 10503A BNC Cable (2)
Agilent 10100C 50Ω Feedthrough
Agilent 11500D N-N Cable (Option 050 only)
Agilent 1250-1250 N(M) to SMA(F)
Agilent 1250-0777 N(F) to N(F)

Counter Setup

1 Cycle the *POWER* key to preset the Counter.

2 Set the Counter as follows:

MEASURE/Freq & Ratio, *FREQUENCY 2*
Gate & ExtArm, *TIME: TIME 1.000 s*

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Test 5: Option 015/030/050/124 Channel 2 Frequency Accuracy (Agilent 53181A Only)

Procedure

1 Connect equipment as shown in Figure 1-15.

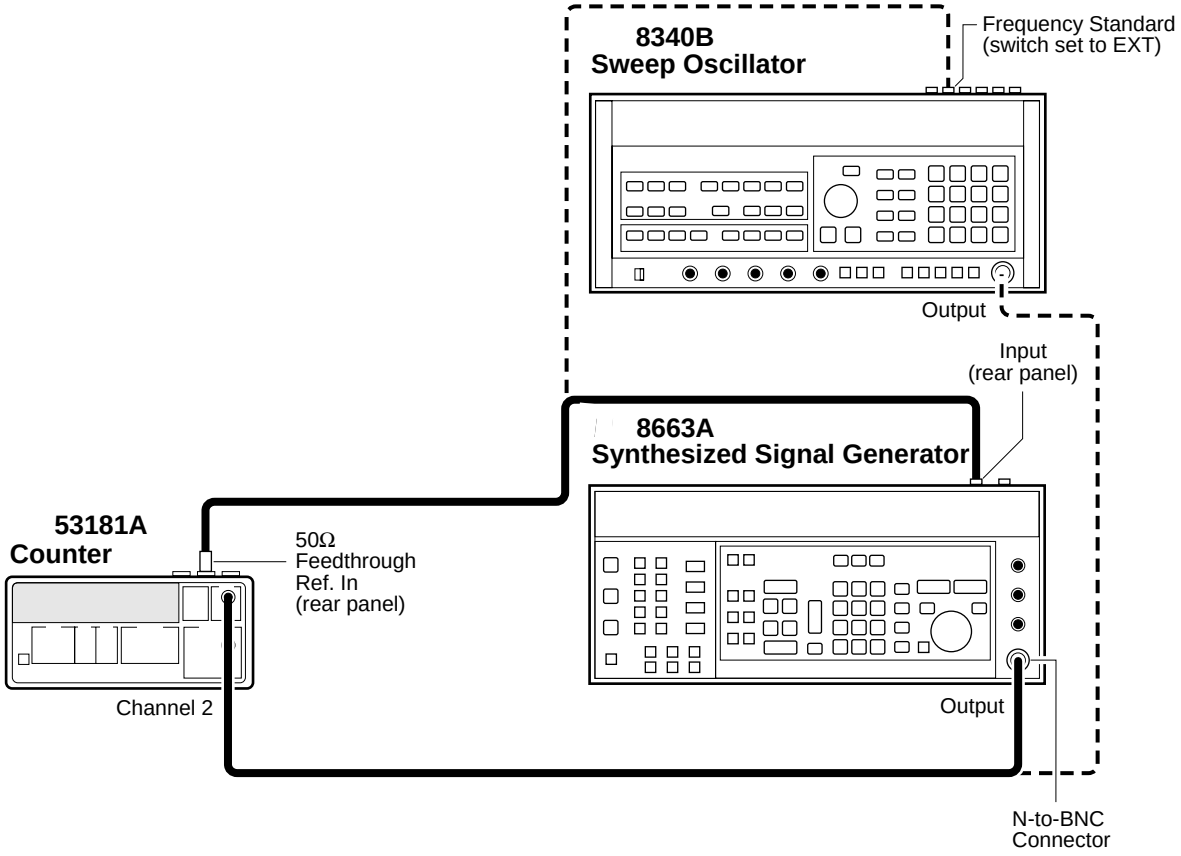


Figure 1-15. Option 015/030/050/124 Channel 2 Frequency Accuracy Test Setup

2 Set the Agilent 8663A Synthesized Signal Generator to output 100 MHz at –17.0 dBm.

Verify the Counter reads 100 MHz ±70 mHz.

3 Record the actual reading in the Performance Test Record (Test 5, Line 1).

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4 Change the synthesized signal generator's frequency to 1.5 GHz.

Verify the Counter reads 1.5 GHz ±1 Hz

5 Record the actual reading in the Performance Test (Test 5, Line 2).

6 Disconnect the test setup.

Minimum to Maximum Accuracy Test for Options 030/050/124

Equipment

Agilent 8663A Synthesized Signal Generator (not needed for Option 050)
Agilent 8340B Sweep Oscillator
Agilent 1250-0780 Type N-to-BNC Connector (not needed for Option 050)
Agilent 10503A BNC Cable (2)
Agilent 10100C 50Ω Feedthrough
Agilent 11500D N-N Cable (Option 050 only)
Agilent 1250-1250 N(M) to SMA(F)
Agilent 1250-0777 N(F) to N(F)

Counter Setup

1 Cycle the *POWER* key to preset the Counter.

2 Set the Counter as follows:

MEASURE/Freq & Ratio, *FREQUENCY 2*
Gate & ExtArm, *TIME: TIME 1.000 s*

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Test 5: Option 015/030/050/124 Channel 2 Frequency Accuracy (Agilent 53181A Only)

Procedure

1 **Connect equipment as shown in Figure 1-15.**

(NOTE: For Option 050/124, skip steps 2 through 7. Proceed to step 8.)

2 **Set the Agilent 8663A Synthesized Signal Generator to output 200 MHz at −17.0 dBm.**

3 **On the Counter, press *Run* key.**

Verify the Agilent 53181A Counter reads 100 MHz ±70 mHz.

4 **Record the actual reading in the Performance Test Record (Test 5, Line 3).**

5 **Disconnect the Agilent 8663A output from Channel 2 of the Counter, and connect the Agilent 8340B Sweep Oscillator output to Channel 2 of the Counter as shown in Figure 1-15.**

6 **Set the Agilent 8340B to output 3.0 GHz at −17.0 dBm.**

Verify the Agilent 53181A Counter reads 3.0 GHz ±2 Hz.

7 **Record the actual reading in the Performance Test Record. (Test 5, Line 4).**

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Test 5: Option 015/030/050/124 Channel 2 Frequency Accuracy (Agilent 53181A Only)

(NOTE: For Options 050/124)

8 **Set the Agilent 8340B to output 5.0 GHz at –17 dBm.**

Verify the Agilent 53181A Counter reads 5.0 GHz ±3 Hz.

9 **Record the actual reading in the Performance Test Record (Test 5, Line 5).**

(NOTE: For Option 124)

10 **Set the Agilent 8340B to output 12.4 GHz at –17 dBm.**

Verify the Agilent 53181A Counter reads 12.4 GHz ±8 Hz.

11 **Record the actual reading in the Performance Test Record (Test 5, Line 6).**

12 **Disconnect the test setup.**

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Test 6: Peak Volts, Channel 1 (Agilent 53181A Only)

This test verifies the Peak Volts accuracy specification of the Agilent 53181A Frequency Counter.

Equipment

Agilent 3325B Synthesizer
Agilent 10100C 50Ω Feedthrough
Agilent 10503A BNC Cable

Counter Setup

1 **Cycle the *POWER* key to preset the Counter.**

2 **Press *Other Meas* key until *VOLT PEAKS 1* is displayed.**

3 **Set CHANNEL 1 and CHANNEL 2 inputs to:**

50Ω/1MΩ, 50Ω
X10 Attenuate, Off
100kHz Filter, Off

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Procedure

1 Connect the equipment as shown in Figure 1-16.

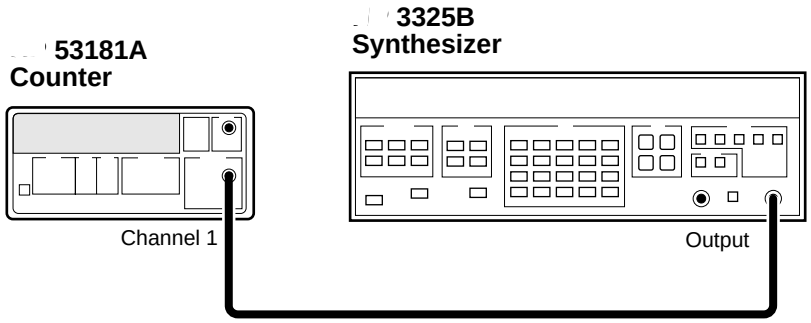


Figure 1-16. Peak Volts Test Setup

2 Set the Agilent 3325B to output a 2 MHz, 2 Vp-p sine wave, and connect the signal to Channel 1 of the Counter.

The Counter should display −1.00 ±0.12V for the *negative peak* of the sine wave. This reading is displayed on the left side of the display.

Record the actual readings in the Performance Test Record (Test 6, Line a).

Also, the Counter should display +1.00 ±0.12V for the *positive peak* of the sine wave. This reading is displayed on the right side of the display.

Record the actual readings in the Performance Test Record (Test 6, Line b).

3 Disconnect the test setup.

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Agilent 53181A GPIB Verification Program (Optional)

The GPIB Verification program exercises the Agilent 53181A through various operating modes via the its GPIB interface. If the Counter successfully completes all phases of the verification program, there is a high probability that the GPIB interface is operating correctly. If the Counter fails the verification program, refer to the troubleshooting section in Chapter 2, “Service,” of this guide.

The GPIB Verification program may be loaded into the HP 9000 series 200 or 300 Desktop Computer from the 3 1/2-inch disk (Agilent P/N 53181-13501) or the 5 1/4-inch disk (Agilent P/N 53181-13501).

1 **To run the program on the disk, insert the disk into the Desktop Computer, load the program by typing *Load “VER81”*, and press *RUN* key on the computer’s keyboard.**

2 **Follow the instructions displayed in the computer’s screen.**

3 **After running this program, record the result (Pass or Fail) on the last page (page 1-74) of the Agilent 53181A Performance Test Record.**

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Agilent 53181A Performance Test Record (Page 1 of 4)

Agilent Technologies Model 53181A Frequency Counter

Serial Number: _____ Repair/Work Order No. _____

Test Performed By: _____ Temperature: _____

Date: _____ Relative Humidity: _____

Notes: _____

Test Number	Operational Verification	Test Results	
		Pass	Fail
1	Power on Self Test	❑	❑
2	Channel 1, 10 MHz Test	❑	❑
3	Run Self Test	❑	❑
4a	Termination Check Ch 1, 50Ω	❑	❑
4b	Termination Check Ch 1, 1MΩ	❑	❑
5a	1 MHz External Timebase Input Test	❑	❑
5b	5 MHz External Timebase Input Test	❑	❑
5c	10 MHz External Timebase Input Test	❑	❑

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Agilent 53181A Performance Test Record (Page 2 of 4)

Complete Performance Tests				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
1	**Trigger Level:**			
	Channel 1	-15 mV	1. _____	+15 mV
		-15 mV	2. _____	+15 mV

Test 2: Channel 1 Frequency Sensitivity (Agilent 53181A Only)

Standard (Front Panel Terminals)	**Actual Reading**	**Specification**
100 kHz–100 MHz, Channel 1	1. _____	≤-21 dBm (20 mVrms)
100 MHz–200 MHz, Channel 1	2. _____	≤-17.5 dBm (30 mVrms)
200 MHz–225 MHz, Channel 1	3. _____	≤-15.0 dBm (40 mVrms)
Option 060 Rear Terminals	**Actual Reading**	**Specification**
100 kHz–225 MHz, Channel 1	1. _____	≤-9.5 dBm (75 mVrms)

Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
3	**Channel 1 Frequency Accuracy** (Agilent 53181A Only)			
	1 MHz Test			
	100 MHz Test	999,999.999 Hz	1. _____	1, 000, 000.001 Hz
	200 MHz Test	99.999,999,93 MHz	2. _____	100.000, 000,07 MHz
	225 MHz Test	199.999,999,87 MHz	3. _____	200.000,000,13 MHz
		224.999,999,85 MHz	4. _____	225.000,000,15 MHz

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Agilent 53181A Performance Test Record (Page 3 of 4)

Complete Performance Tests				
Test 4: Option 015/030/050 Channel 2 Frequency Sensitivity (Agilent 53181A Only)				
		Actual Reading	**Specification**	
100 MHz–1.5 GHz (Option 015 Only)		1. _____	≤27 dBm	
100 MHz–2.7 GHz (Option 030 Only)		2. _____	≤27 dBm	
2.8–3.0 GHz (Option 030 Only)		3. _____	≤21 dBm	
.2–5.0 GHz (Option 050 Only)		4. _____	≤23 dBm	
.2–12.4 GHz (Option 124 only)		5. _____	≤23 dBm	
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
5	**Option 015/030 Channel 2 Frequency Accuracy** (Agilent 53181A Only)			
	100 MHz to 1.5 GHz Test for Option 015 (Agilent 53181A):			
	Channel 2	99.999,999,93 MHz	1. _____	100.000,000,07 MHz
	Channel 2	1, 499.999,999 MHz	2. _____	1,500.000,001 MHz
5	**100 MHz to 3.0 GHz Test for Option 030 (Agilent 53181A):**			
	Channel 2	99.999,999,93 MHz	3. _____	100.000,000,07 MHz
	Channel 2	2,999.999,998 MHz	4. _____	3, 000.000,002 MHz
5	**200 MHz to 5.0 GHz Test for Option 050:**	4,999.999,997 MHz	5. _____	5,000.000,003 MHz
5	**200 MHz to 12.4 GHz Test for Option 124:**	12,399.999,992	6. _____	12.400.000,008 MHz

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Agilent 53181A Performance Test Record (Page 4 of 4)

Complete Performance Tests				
Test Number	**Test Description**	**Minimum**	**Actual Reading**	**Maximum**
6	**Peak Volts, Channel 1** (Agilent 53181A Only)**:**			
	Channel 1	–1.12 V +0.88 V	a. _____ b. _____	–0.88 V +1.12V
GPIB Verification (Optional)			**Test Results** **Pass**	**Fail**
			❑	❑

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2

Service

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Introduction

This chapter provides service information for your Agilent 53131A/132A/181A and is divided into seven major sections:

- **Returning the Instrument to Agilent Technologies for Service** (page 2-3). This section provides you with step-by-step instructions on how to return the instrument for service.
- **About the Agilent 53131A/132A Calibration Menu** (page 2-6). This section contains reference information that gives a complete overview of the calibration menu of the Agilent 53131A/132A.
- **The Agilent 53131A/132A Calibration Procedures** (page 2-15). This section provides step-by-step procedures for calibrating the Agilent 53131A/132A.
- **About the Agilent 53181A Calibration Menu** (page 2-25). This section contains reference information that gives a complete overview of the calibration menu of the Agilent 53181A.
- **The Agilent 53181A Calibration Procedures** (page 2-31). This section provides step-by-step procedures for calibrating the Agilent 53181A.
- **Pre-Troubleshooting Information** (page 2-36). This section provides you with pertinent information such as safety considerations, recommended test equipment, repair and after-service considerations, and assembly identification and location.
- **Troubleshooting the Counter** (page 2-45). This section provides you with troubleshooting procedures that isolate the faulty assembly or module.

If the instrument is under warranty, return the instrument to Agilent Technologies for service. Refer to the first section of this chapter titled “Returning the Instrument to Agilent Technologies for Service.” If you decide to troubleshoot the instrument yourself, refer to the section titled “Troubleshooting the Counter.”

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Returning the Instrument to Agilent Technologies for Service

To Provide Repair Information

If you are shipping the instrument to an Agilent Technologies office for service or repair, call your nearest Agilent Technologies Sales Office to make arrangements. Then tag and package the Agilent 53131A/132A/181A for shipment.

Note there is an Express Repair/Performance Calibration Service for USA customers if downtime is critical. You can receive your repaired Counter via overnight shipment. Just call 800-403-0801 and ask for Express Repair/Performance Calibration Service. When your Counter is repaired, it will be returned via overnight shipment at no extra charge.

1 Write the following information on a tag:

- Owner's 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 "To Pack in the Original Packaging Materials." If the original packaging material are not available, you can order new materials through an Agilent Technologies Sales Office. The new materials are identical to those used by the factory when packaging the instrument. If you want to use commercially available materials, refer to the section titled "To Pack in the Commercially Available Materials."

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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 one of the polystyrene block is in its proper position in the box.**

4 **Place the instrument, front panel end first, on the polystyrene block.**

5 **Place the other polystyrene block on top of the rear end 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.**

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To Pack in the Commercially Available Materials

If the factory packaging materials are not available, you can use commercially 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.**

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About the Agilent 53131A/132A Calibration Menu

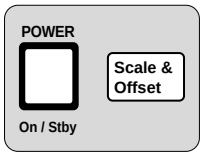
NOTE

If you are familiar with the information provided in this section, proceed to the section titled "The Agilent 53131A/132A Calibration Procedures" on page 2-15 to calibrate your Counter. This section, "About the Agilent 53131A/132A Calibration Menu," can be used as a reference.

NOTE

With the exception of the standard timebase oscillator, no adjustments are required for the Agilent 53131A/132A Counter.

Overview of the Agilent 53131A/132A Calibration Menu



The Calibration menu is accessed by holding the **Scale & Offset** key and cycling the **POWER** key. All of the calibration factors and security settings are stored in *non-volatile* memory, and *do not* change when power has been off or after a remote interface reset.

A calibration security code feature allows you to enter a security code (electronic key) to prevent accidental or unauthorized calibrations of the Counter. The security code is set to 53131 or 53132 (corresponding to the model) when the Counter is shipped from the factory. If you forget your security code, you can reset the security code to the model-number default by resetting all of the non-volatile memory to a default state (Contact Agilent Technologies for this confidential procedure).

NOTE

This menu does not exist in early versions of the Counter. In the early versions (firmware revisions 3317, 3335, and 3402) of the Agilent 53131A/132A, the CAL: menu item resides in the Utility menu, and there is no calibration security capability. See Chapter 6, "Backdating," in this guide for the correct calibration procedures.

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The Calibration menu, illustrated on page 2-8, allows you to:

- view the calibration security status of the Counter (**CAL SECURE** or **CAL UNSECURE**)
- initiate the Counter's calibration routines, which can perform automatic calibration of the voltage offset and gain of the front-end input amplifiers (**CAL: OFFS 1 / 2 ?**, **GAIN 1 / 2?**), of the optional timebase (**CAL: TIMEBAS?**), and of the differences in electrical path-length between channels 1 and 2 (**CAL: TI QUIK?** and **CAL: TI FINE?**)
- secure against calibration by entering the security code while the Counter is unsecured (**CODE:**)
- unsecure for calibration by entering the security code while the Counter is secured (**CODE:**)
- change the security code by entering a new code while the Counter is unsecured (**CODE:**)
- view the calibration count, which indicates the number of times that the Counter has been calibrated (**CAL COUNT?**). The calibration count increments up to a maximum of 32,767 after which it wraps around to 1. A calibration count of 0 indicates that the Counter is completely uncalibrated. (The calibration count is unaffected by interpolator calibration.)
- get Help (**HELP:**) with any of the following:
  - how to calibrate (**CAL?**),
  - how to secure (**SECURE?**), and
  - how to change the code (**CODE?**)

NOTE

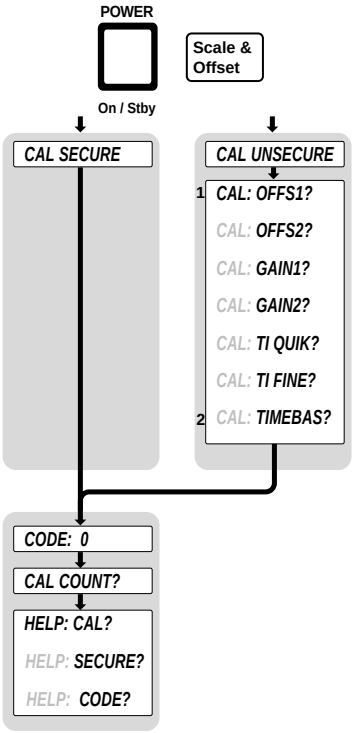
A good precaution is to use a GPIB program (see the programming example titled "To Read and Store Calibration Data" in Chapter 3 of the Programming Guide) to read and store the calibration factors prior to initiating any calibration.

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The Agilent 53131A/132A Calibration Menu Tree

NOTE

Turn power off, press and hold **Scale & Offset** key, then press **POWER** key to access this menu. **This menu does not exist in early versions (firmware revisions 3317, 3335, and 3402) of the Agilent 53131A/132A. In the early versions of the Counter, the CAL: menu item resides in the Utility menu, and there is no calibration security capability. See Chapter 6, "Backdating," in this guide for correct calibration procedures.**



[1] This menu item appears and calibration is permitted only if calibration is unsecure. Enter in the correct code to change calibration to secure.

[2] Timebase can be automatically calibrated only if the timebase option is installed.

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To View the Calibration Menu and Security Status

The Calibration menu is accessed by holding the Scale & Offset key and cycling the POWER key. The first item in the Calibration menu is a message indicating the calibration security status: ***CAL SECURE*** or ***CAL UNSECURE***.

To Unsecure for Calibration

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

CAL SECURE is displayed.

If ***CAL UNSECURE*** is displayed, then the Counter is already unsecured for calibration, and the remaining steps are not applicable.

2 **Press *Scale & Offset* key until *CODE:* is displayed.**

3 **Press the appropriate arrow keys to enter the security code *"53131"*, for example, if 53131 was the security code set at the factory.**

4 **Press *Enter* key.**

CAL UNSECURE is displayed.

NOTE

If "53131" was NOT the correct security code, the Counter would have displayed ***BAD CODE***.

To Initiate the Calibration Routines

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Unsecure for calibration by performing the preceding procedure.**

3 **Press *Scale & Offset* key until *CAL: OFFS1?* is displayed.**

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4 Press any one of the arrow keys until your calibration choice (that is, *CAL: OFFS2?*, *CAL: GAIN 1?*, *CAL: GAIN 2?*, *CAL: TI QUIK?*, *CAL: TI FINE?*, or *CAL: TIMEBAS?*) is displayed.

Note that the timebase choice (CAL: TIMEBAS?) only appears when the Timebase Option is installed.

5 Press *Enter* key.

A scrolling message is displayed.

6 Follow the instructions in the scrolling message, and press *Enter* key to start the calibration.

The Counter momentarily displays ***CALIBRATING***, and then displays the calibration test name and pass/fail status (for example, ***OFFS 1 PASS***).

When the calibration completes, a pass/fail message will be displayed. If the calibration failed, then the calibration factors remain unchanged.

INFORMATION ABOUT CAL:TI QUIK? AND CAL:TI FINE?

CAL:TI QUIK? and CAL:TI FINE? are two different ways to calibrate out the differences in electrical path length between Channel 1 and Channel 2. When you provide the calibration signal, the instrument measures how the difference in path length translates to an average delay between the two channels.

The Quick Time Interval Calibration requires a simple input signal. You provide on Channel 1 a clean square wave with a rapid rise time and an approximate frequency of 10 MHz. The instrument routes the calibration signal in COMMON to both channels 1 and 2, and measures the average delay between the two channels so configured. The advantage of the Quick Calibration is that it is easy, quick, and requires little special equipment. The disadvantage is that the calibration term is best fit for TI measurements configured COMMON and measured from rising to rising edge; it leaves uncorrected a small systematic error for all other configurations. The Fine Time Interval Calibration minimizes systematic error by calibrating the instrument in each configuration.

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The Fine Time Interval Calibration requires a special calibrator signal source to provide input—because it produces eight calibration terms, each tailored to a different combination of input conditions. It requires the synthesizer driving the calibrator to produce a very accurate 10 MHz waveform—because it calibrates the pulse width configuration against the 50-nanosecond pulse width so provided. It minimizes systematic error by calibrating the instrument in each of the eight configurations: falling to falling edges, falling to rising edges, etc., and both SEPARATE and COMMON routing.

Notes Pertaining to CAL: TI QUIK?

Advantage: Calibration signal is simple.

Disadvantage: One correction term for all slope and routing configurations.

Input signal: clean square wave, fast rise time, approximately 10 MHz, 1 volt peak-to-peak, no dc offset (oscillating about 0.0 volts), driving 50Ω

Timebase: Any external timebase you provide is ignored during calibration.

Procedure: From the front-panel calibration menu, one keypress invokes the calibration.

Notes Pertaining to CAL: TI FINE?

Advantage: Calibration minimizes systematic error for any supported combination of input slope and routing.

Disadvantage: Calibration signal is more complex. *If you perform a calibration that you feel is erroneous and do not feel you can perform the fine calibration, perform the CAL: TI QUIK? calibration instead, or restore the calibration factors that you saved prior to starting.*

Equipment: Agilent 8130A Pulse Generator or equivalent.
Agilent 59992A J06 Time Interval Calibrator or equivalent.

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Equipment and Counter Setup: See Figure 2-1.

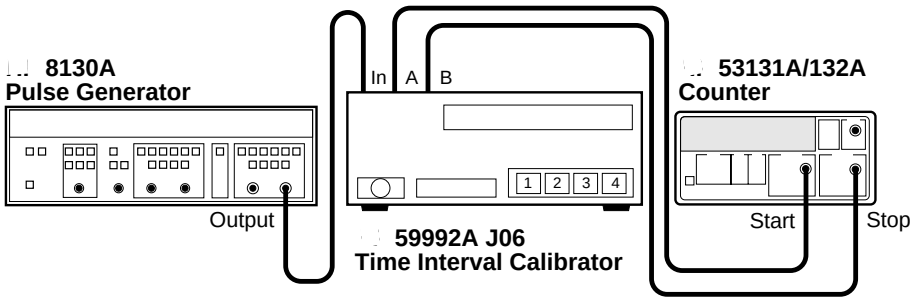


Figure 2-1. Calibration Setup for CAL: TI FINE?

Out of Agilent 8130A, into Agilent 59992A J06 Calibrator Signal:

PERIOD: 100 ns
WIDTH: 50 ns
High: 0.50 V Low: -0.50 V
Input Mode: Normal

Timebase: Any external timebase you provide is ignored during calibration.

Procedure: From the front-panel calibration menu, one keypress invokes the calibration. You are prompted to press buttons on the Agilent 59992A J06 Calibrator for each part of a four-part calibration.

Note that CAL: TI FINE? requires the completion of four steps in order.

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To Secure Against Calibration

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

CAL UNSECURE is displayed. If ***CAL SECURE*** is displayed, then the Counter is already secured against calibration and the remaining steps are not applicable.

2 **Press *Scale & Offset* key until *CODE:* is displayed.**

3 **Press the appropriate arrow keys to enter the security code, then press *Enter* key.**

CAL SECURE is displayed.

To Change to a New Security Code

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Unsecure for calibration by the using the procedure described in the section titled "To Unsecure for Calibration."**

3 **Press *Scale & Offset* key until *CODE:* is displayed.**

4 **Press the appropriate arrow keys to enter the new or customized security code, then press *Enter* key.**

A scrolling message will appear, indicating what the new code is. For example, the Counter displays the ***NEW CODE IS 5*** if you entered "5" as the new code.

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To View the Calibration Count

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Press *Scale & Offset* key until *CAL COUNT?* is displayed.**

3 **Press any one of the entry keys (arrow, +/-, *Enter*) to have a scrolling message appear, indicating what the calibration count is.**

Your Counter was calibrated before it left the factory. When you receive your Counter, read the calibration count to determine its initial value.

To Get Help with the Calibration Menu

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Press *Scale & Offset* key until *HELP: CAL?* is displayed.**

3 **Press any one of the arrow keys until your help choice (that is, *HELP: CAL?*, *HELP: SECURE?*, *HELP: CODE?*) is displayed.**

4 **Press *Enter* key to display the help information.**

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The Agilent 53131A/132A Calibration Procedures

First Determine the Counter Firmware Revision

Press and hold *Recall (Utility)* key, then cycle *POWER* key.

REV: n is displayed; where "n" represents the numeric firmware revision code.

If **3317**, **3335**, or **3402** is displayed as the firmware revision code, **then perform the calibration procedures in Chapter 6, "Backdating."**

If the Counter's firmware revision code is higher than the ones in the previous paragraph, then perform the following procedures in this section.

NOTE

After completing the instrument calibration, BE SURE to secure the calibration by performing the procedure in the section titled "To Secure Against Calibration" on page 2-13 of this chapter.

To Calibrate the Offset for Channels 1 and 2

1 **To access the Calibration menu, power down, and press and hold the *Scale & Offset* key, then press *POWER* key.**

The first item in the Calibration menu is a message indicating the calibration security status: ***CAL SECURE*** or ***CAL UNSECURE***.

The Counter calibration must be unsecured to perform calibration.
If ***CAL UNSECURE*** is displayed, the Counter is already unsecured for calibration; go to step 5. However, if ***CAL SECURE*** is displayed then perform steps 2 through 4 to unsecure calibration.

2 **Press *Scale & Offset* key until *CODE: 0* is displayed.**

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3 Press the appropriate arrow keys to enter the security code *"53131"*, for example, if 53131 is the security code by performing the following steps:

a. Press g **key four times.**

The Counter should display ***CODE: 00000***.

b. Press d **key five times.**

The Counter should display ***CODE: 50000***.

c. Press g **key once, and then press** d **key three times.**

The Counter should display ***CODE: 53000***.

d. Press g **key once, and then press** d **key once.**

The Counter should display ***CODE: 53100***.

e. Press g **key once, and then press** d **key three times.**

The Counter should display ***CODE: 53130***.

f. Press g **key once, and then press** d **key once.**

The Counter should display ***CODE: 53131***.

g. Finally, press *Enter* key.

CAL UNSECURE is displayed.

NOTE If "53131" is NOT the correct security code, the Counter will display ***BAD CODE***.

4 Press *Scale & Offset* key until *CAL: OFFS 1 ?* is displayed.

5 Press *Enter* key.

A scrolling message on the display will ask you to remove any signals connected to Channel 1. Follow the instruction.

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6 Press *Enter* key.

The Counter momentarily displays ***CALIBRATING***, and then it should display ***OFFS 1 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

7 To calibrate Channel 2, press any one of the arrow keys until *CAL: OFFS 2 ?* is displayed.

8 Press *Enter* key.

A scrolling message on the display will ask you to remove any signals connected to Channel 2. Follow the instruction.

9 Press *Enter* key.

The Counter momentarily displays ***CALIBRATING***, and then it should display ***OFFS 2 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

This completes the Offset Calibration procedure. Proceed to the next procedure to calibrate the gain.

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To Calibrate the Gain for Channels 1 and 2

1 **Press any one of the arrow keys until *CAL: GAIN 1 ?* is displayed.**

2 **Press *Enter* key.**

A scrolling message is displayed. Follow the instruction by performing the following steps.

3 **Connect a BNC tee connector to Channel 1 of the Counter.**

4 **Connect the Counter, dc power supply, and digital multimeter as shown in Figure 2-2.**

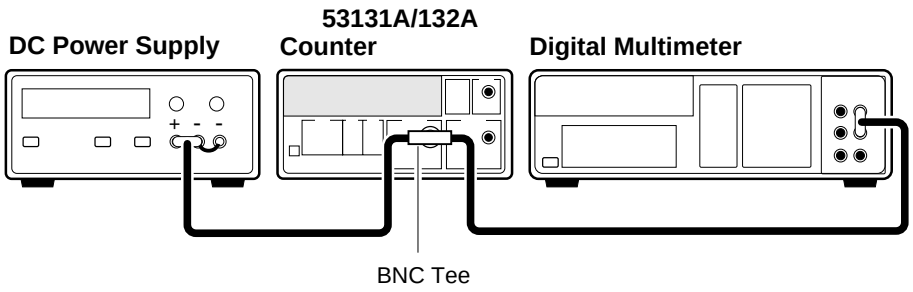


Figure 2-2. Gain Calibration Setup

5 **Adjust the power supply until the digital multimeter displays + 5.000 V ± 0.001 V.**

6 **Disconnect the digital multimeter from the Counter to prevent noise from being introduced into the measurement.**

7 **Press *Enter* key.**

The Counter momentarily displays ***CALIBRATING***, and then it should display ***GAIN 1 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

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8 To calibrate the gain for Channel 2, connect the input or the BNC Tee to Channel 2 of the Counter.

9 Press any one of the arrow keys until *CAL: GAIN 2 ?* is displayed.

10 Press *Enter* key.

A scrolling message is displayed. (The +5V dc supply should already be connected to Channel 2 as you were previously instructed to do this in step 8.)

11 Press *Enter* key again.

The Counter momentarily displays ***CALIBRATING***, and then it should display ***GAIN 2 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

12 Disconnect the calibration setup.

This completes the Gain Calibration procedure. Proceed to the next procedure to calibrate the time interval.

To Calibrate Time Interval

Refer to the section titled **"INFORMATION ABOUT CAL:TI QUIK? AND CAL:TI FINE?"** (page 2-10 and page 2-11) for details on the differences between the two time interval calibrations.

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CAL: TI QUIK? Calibration

1 Press any one of the arrow keys until *CAL: TI QUIK?* is displayed.

2 Press *Enter* key.

A scrolling message with instructions appears. Follow the instruction by performing the following procedure

3 Connect the Agilent 8130A Pulse Generator output to Channel 1 of the Counter as shown in Figure 2-3.

Equipment

Agilent 8130A Pulse Generator (or equivalent)
Agilent 10503A BNC Cable

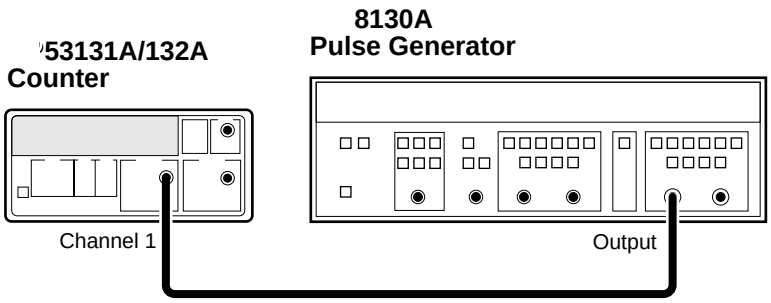


Figure 2-3. Calibration Setup for CAL: TI QUIK?

4 Set the Agilent 8130A as follows:

PERIOD: 100 ns
WIDTH: 50 ns
High: 0.50 V Low : -0.50 V
Input Mode: Normal

NOTE Any external timebase connected to the Counter is ignored during this calibration.

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5 Press *Enter* key.

The Counter displays ***CALIBRATING***, and then it should display ***TI CAL PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

6 Disconnect the calibration setup.

This completes the TI QUIK? calibration procedures.

Depending on which timebase the Counter contains, proceed to the procedure "To Calibrate the Standard Timebase" (page 2-23) or the "To Calibrate the High Stability Timebase Option (Medium, High, or Ultra-High)" procedure (page 2-24) to calibrate the timebase.

CAL: TI FINE? Calibration

1 Connect the Agilent 8130A Pulse Generator, Agilent 59992A J06 Time Interval Calibrator, and Agilent 53131A/123A Counter as shown in Figure 2-4.

Equipment

Agilent 8130A Pulse Generator (or equivalent)
Agilent 59992A J06 Time Interval Calibrator (or equivalent)
Agilent 10503A BNC Cable (3)

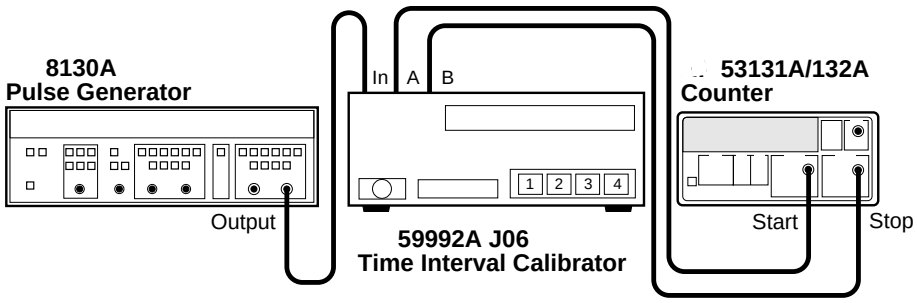


Figure 2-4. Calibration Setup for CAL: TI FINE?

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2 Set the Agilent 8130A as follows:

PERIOD: 100 ns
WIDTH: 50 ns
High: 0.50 V Low : -0.50 V
Input Mode: Normal

NOTE Any external timebase connected to the Counter is ignored during this calibration.

3 Press any one of the arrow keys until *CAL: TI FINE?* is displayed.

4 Press *Enter* key.

A scrolling message with instructions appears. Follow the instruction by performing the following procedure.

Note the Counter display message prompts you to press buttons on the Agilent 59992A J06 Calibrator for each part of a four-part calibration.

Note that CAL: TI FINE? requires the completion of four steps in the proper order.

5 Press *Enter* key after each displayed instruction.

The Counter should display ***CALIBRATING***, and then it should display ***TI CAL PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

This completes the TI FINE? calibration procedures.

Depending on which timebase the Counter contains, proceed to the following procedure “To Calibrate the Standard Timebase” or the “To Calibrate the High Stability Timebase Option (Medium, High, or Ultra-High)” procedure (page 2-24) to calibrate the timebase.

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To Calibrate the Standard Timebase

1 Connect the output of a 10 MHz house standard to Channel 1 of the Counter as shown in Figure 2-5.

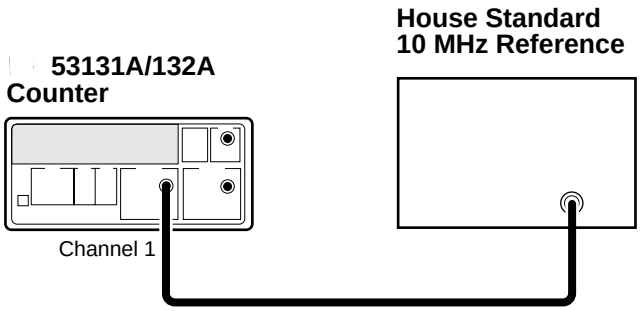


Figure 2-5. Standard Timebase Calibration Setup

2 Cycle the *POWER* key to preset the Counter.

Allow the counter to warm up for approximately 30 minutes.

3 With an insulated tuning tool, turn the *OSC Adjust* potentiometer (located on the rear chassis of the Counter) until the frequency reading in the Counter display is 10.00000000 MHz ± 5 Hz.

The Counter will be calibrated to the house standard.

If you are not able to adjust the frequency correctly, refer to the troubleshooting section in this chapter.

This completes the Standard Timebase Calibration procedure.

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To Calibrate the High Stability Timebase Option (Medium, High, or Ultra-High)

NOTE

Allow the Counter to warm up for approximately 24 hours before performing this calibration. This calibration is unlikely to fail, unless the Counter is not warmed up.

1 **Connect the output of a 10 MHz house standard to Channel 1 of the Counter as shown in Figure 2-5.**

2 **Press any one of the arrow keys until *CAL: TIMEBAS?* is displayed.**

Note that the timebase choice (CAL: TIMEBAS?) only appears when the Timebase Option is installed.

3 **Press *Enter* key and follow the instructions in the scrolling message that appears in the Counter display.**

4 **Press *Enter* key after each instruction.**

The Counter displays ***CALIBRATING***, and then it should display ***TB CAL PASS***.

If the fail message is displayed (even after the Counter has been warmed up for 24 hours), refer to the troubleshooting section in this chapter.

This completes the High Stability Timebase Option Calibration procedure.

If all tests passed, the Counter is now calibrated.

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About the Agilent 53181A Calibration Menu

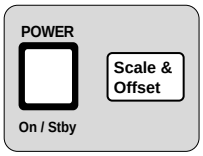
NOTE

If you are familiar with the information provided in this section, proceed to the section titled "The Agilent 53181A Calibration Procedures" (page 2-31) to calibrate your Counter. This section, "About the Agilent 53181A Calibration Menu," can be used as a reference.

NOTE

With the exception of the standard timebase oscillator, no adjustments are required for the Agilent 53181A Counter.

Overview of the Agilent 53181A Calibration Menu



The Calibration menu is accessed by holding the **Scale & Offset** key and cycling the **POWER** key. All of the calibration factors and security settings are stored in *non-volatile* memory, and *do not* change when power has been off or after a remote interface reset.

A calibration security code feature allows you to enter a security code (electronic key) to prevent accidental or unauthorized calibrations of the Counter. The security code is set to 53181 when the Counter is shipped from the factory. If you forget your security code, you can reset the security code to the model-number default by resetting all of the non-volatile memory to a default state.

The Calibration menu, illustrated on page 2-27, allows you to:

- view the calibration security status of the Counter (**CAL SECURE** or **CAL UNSECURE**)
- initiate the Counter's calibration routines, which can perform automatic calibration of the voltage offset and gain of the front-end input amplifiers (**CAL: OFFS 1?, GAIN 1?**), of the optional timebase (**CAL: TIMEBAS?**)
- secure against calibration by entering the security code while the Counter is unsecured (**CODE:**)
- unsecure for calibration by entering the security code while the Counter is secured (**CODE:**)

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- change the security code by entering a new code while the Counter is unsecured (**CODE:**)
- view the calibration count, which indicates the number of times that the Counter has been calibrated (**CAL COUNT?**). The calibration count increments up to a maximum of 32,767 after which it wraps around to 1. A calibration count of 0 indicates that the Counter is completely uncalibrated. (The calibration count is unaffected by interpolator calibration.)
- get Help (**HELP:**) with any of the following:
  - how to calibrate (**CAL?**),
  - how to secure (**SECURE?**), and
  - how to change the code (**CODE?**)

NOTE

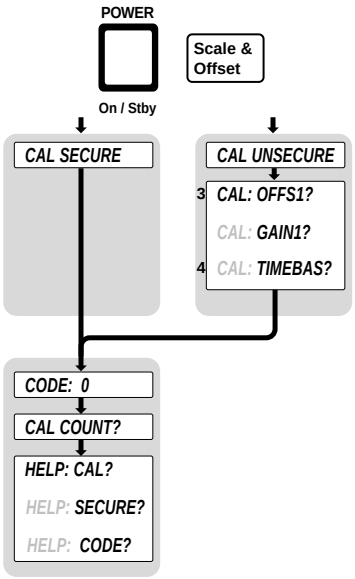
A good precaution is to use a GPIB program (see the programming example titled "To Read and Store Calibration Data" in Chapter 3 of the Programming Guide) to read and store the calibration factors prior to initiating any calibration.

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The Agilent 53181A Calibration Menu Tree

NOTE

Turn power off, press and hold **Scale & Offset** key, then press **POWER** key to access this menu.



[3] This menu item appears and calibration is permitted only if calibration is unsecured. Enter in the correct code to change calibration to secure.

[4] Timebase can be automatically calibrated only if the timebase option is installed.

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To View the Calibration Menu and Security Status

The Calibration menu is accessed by holding the Scale & Offset key and cycling the POWER key. The first item in the Calibration menu is a message indicating the calibration security status: ***CAL SECURE*** or ***CAL UNSECURE***.

To Unsecure for Calibration

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

CAL SECURE is displayed.

If ***CAL UNSECURE*** is displayed, then the Counter is already unsecured for calibration, and the remaining steps are not applicable.

2 **Press *Scale & Offset* key until *CODE:* is displayed.**

3 **Press the appropriate arrow keys to enter the security code *"53181"*, for example, if 53181 was the security code set at the factory.**

4 **Press *Enter* key.**

CAL UNSECURE is displayed.

NOTE If "53181" was NOT the correct security code, the Counter would have displayed **BAD CODE**.

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To Initiate the Calibration Routines

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Unsecure for calibration by performing the preceding procedure.**

3 **Press *Scale & Offset* key until *CAL: OFFS1?* is displayed.**

4 **Press any one of the arrow keys until your calibration choice (that is, *CAL: GAIN 1?*, or *CAL: TIMEBAS?*) is displayed.**

Note that the timebase choice (CAL: TIMEBAS?) only appears when the Timebase Option is installed.

5 **Press *Enter* key.**

A scrolling message is displayed.

6 **Follow the instructions in the scrolling message, and press *Enter* key to start the calibration.**

The Counter momentarily displays ***CALIBRATING***, and then displays the calibration test name and pass/fail status (for example, ***OFFS 1 PASS***).

When the calibration completes, a pass/fail message will be displayed. If the calibration failed, then the calibration factors remain unchanged.

To Secure Against Calibration

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

CAL UNSECURE is displayed. If ***CAL SECURE*** is displayed, then the Counter is already secured against calibration and the remaining steps are not applicable.

2 **Press *Scale & Offset* key until *CODE:* is displayed.**

3 **Press the appropriate arrow keys to enter the security code, then press *Enter* key.**

CAL SECURE is displayed.

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To Change to New the Security Code

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Unsecure for calibration by the using the procedure described in the section titled "To Unsecure for Calibration."**

3 **Press *Scale & Offset* key until *CODE:* is displayed.**

4 **Press the appropriate arrow keys to enter the new or customized security code, then press *Enter* key.**

A scrolling message will appear, indicating what the new code is. For example, the Counter displays the ***NEW CODE IS 5*** if you entered "5" as the new code.

To View the Calibration Count

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Press *Scale & Offset* key until *CAL COUNT?* is displayed.**

3 **Press any one of the entry keys (arrow, +/-, *Enter*) to have a scrolling message appear, indicating what the calibration count is.**

Your Counter was calibrated before it left the factory. When you receive your Counter, read the calibration count to determine its initial value.

To Get Help with the Calibration Menu

1 **Press and hold *Scale & Offset* key, then cycle *POWER* key.**

2 **Press *Scale & Offset* key until *HELP: CAL?* is displayed.**

3 **Press any one of the arrow keys until your help choice (that is, *HELP: CAL?*, *HELP: SECURE?*, *HELP: CODE?*) is displayed.**

4 **Press *Enter* key to display the help information.**

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The Agilent 53181A Calibration Procedures

First Determine the Counter Firmware Revision

Press and hold *Recall (Utility)* key, then cycle *POWER* key.

REV: n is displayed; where "n" represents the numeric firmware revision code.

NOTE

After completing the instrument calibration, BE SURE to secure the calibration by performing the procedure in the section titled "To Secure Against Calibration" on page 2-29 of this chapter.

To Calibrate the Offset for Channel 1

1 **To access the Calibration menu, power down, and press and hold the *Scale & Offset* key, then press *POWER* key.**

The first item in the Calibration menu is a message indicating the calibration security status: ***CAL SECURE*** or ***CAL UNSECURE***.

The Counter calibration must be unsecured to perform calibration.
If ***CAL UNSECURE*** is displayed, the Counter is already unsecured for calibration; go to step 5. However, if ***CAL SECURE*** is displayed then perform steps 2 through 4 to unsecure calibration.

2 **Press *Scale & Offset* key until *CODE: 0* is displayed.**

3 **Press the appropriate arrow keys to enter the security code "*53181*", for example, if 53181 is the security code by performing the following steps:**

a. Press ◀ key four times.

The Counter should display ***CODE: 00000***.

b. Press ▲ key five times.

The Counter should display ***CODE: 50000***.

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c. Press ▶ key once, and then press ▲ key three times.

The Counter should display ***CODE: 53000***.

d. Press ▶ key once, and then press ▲ key once.

The Counter should display ***CODE: 53100***.

e. Press ▶ key once, and then press ▲ key eight times.

The Counter should display ***CODE: 53180***.

f. Press ▶ key once, and then press ▲ key once.

The Counter should display ***CODE: 53181***.

g. Finally, press *Enter* key.

CAL UNSECURE is displayed.

NOTE If "53181" is NOT the correct security code, the Counter will display ***BAD CODE***.

4 Press *Scale & Offset* key until *CAL: OFFS 1 ?* is displayed.

5 Press *Enter* key.

A scrolling message on the display will ask you to remove any signals connected to Channel 1. Follow the instruction.

6 Press *Enter* key.

The Counter momentarily displays ***CALIBRATING***, and then it should display ***OFFS 1 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

This completes the Offset Calibration procedure. Proceed to the next procedure to calibrate the gain.

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To Calibrate the Gain for Channel 1

1 **Press any one of the arrow keys until *CAL: GAIN 1 ?* is displayed.**

2 ***Press Enter* key.**

A scrolling message is displayed. Follow the instruction by performing the following steps.

3 **Connect a BNC tee connector to Channel 1 of the Agilent 53181A.**

4 **Connect the Counter, dc power supply, and digital multimeter shown in Figure 2-6.**

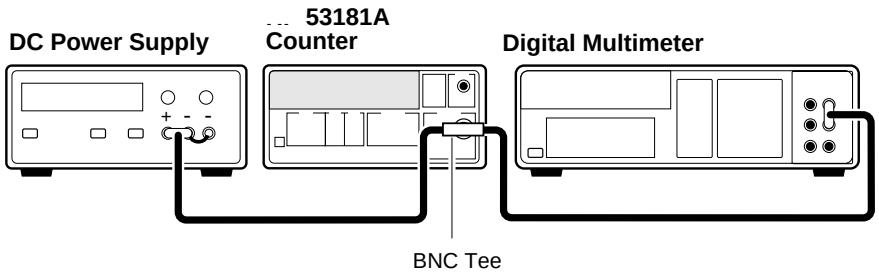


Figure 2-6. Gain Calibration Setup

5 **Adjust the power supply until the digital multimeter + 5.000 V ± 0.001 V.**

6 **Disconnect the digital multimeter from the Counter to prevent noise from being introduced into the measurement.**

7 **Press *Enter* key.**

The Counter momentarily displays ***CALIBRATING***, and then it should display ***GAIN 1 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

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8 Disconnect the calibration setup.

This completes the Gain Calibration procedure.

Depending on which timebase the Counter contains, proceed to either the following procedure “To Calibrate the Standard Timebase” or the “To Calibrate the High Stability Timebase Option (Medium, High, or Ultra-High)”procedure (page 2-35) to calibrate the timebase.

To Calibrate the Standard Timebase

1 Connect the output of a 10 MHz house standard to Channel 1 of the Counter as shown in Figure 2-7.

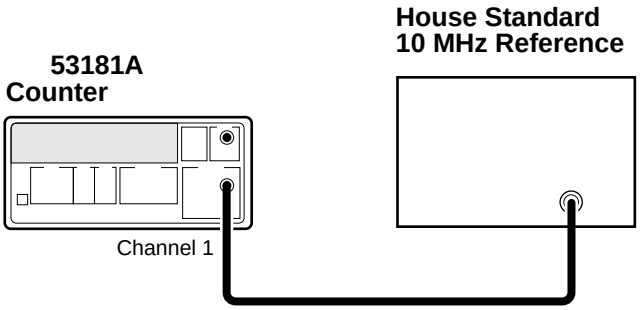


Figure 2-7. Standard Timebase Calibration Setup

2 Cycle the *POWER* key to preset the Counter.

Allow the counter to warm up for approximately 30 minutes.

3 With an insulated tuning tool, turn the *OSC Adjust* potentiometer (located on the rear chassis of the Counter) until the frequency reading in the Counter display is 10.00000000 MHz ± 5 Hz.

The Counter will be calibrated to the house standard.

If you are not able to adjust the frequency correctly, refer to the troubleshooting section in this chapter.

This completes the Standard Timebase Calibration procedure.

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To Calibrate the High Stability Timebase Option (Medium, High, or Ultra-High)

NOTE **Allow the Counter to warm up for approximately 24 hours before performing this calibration.** This calibration is unlikely to fail, unless the Counter is not warmed up.

1 Connect the output of a 10 MHz house standard to Channel 1 of the Counter as shown in Figure 2-7.

2 Press any one of the arrow keys until *CAL: TIMEBAS?* is displayed.

Note that the timebase choice (CAL: TIMEBAS?) only appears when the Timebase Option is installed.

3 Press *Enter* key and follow the instructions in the scrolling message that appears in the Counter display.

4 Press *Enter* key after each instruction.

The Counter displays ***CALIBRATING***, and then it should display ***TB CAL PASS***.

If the fail message is displayed (even after the Counter has been warmed up for 24 hours), refer to the troubleshooting section in this chapter.

This completes the High Stability Timebase Option Calibration procedure.

If all tests passed, the Counter is now calibrated.

NOTE If the counter has been disconnected from line power for over 24 hours, it may take up to 30 days for the daily aging rate to be re-attained.

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Pre-Troubleshooting Information

This section contains the following pertinent troubleshooting information:

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

Safety Considerations

Although this instrument has been designed in accordance with international safety standards, this guide 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.

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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 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).

Recommended Test Equipment

T**est equipment recommended for testing and troubleshooting the Agilent 53131A/132A/181A is listed in Chapter 1, "Performance Tests."** Substitute equipment may be used if it meets or exceeds the required characteristics listed in Table 1-1.

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Repair Considerations

Electrostatic Discharge

Electronic components and assemblies in the Agilent 53131A/132A/181A 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.)**

Surface Mount Repair

Surface mount components should only be removed using soldering irons or desoldering stations *expressly* designed for surface mount components. *Use of conventional solder removal equipment will almost always result in permanent damage to the printed circuit board and will void your Agilent Technologies factory warranty.*

Disassembly and Reassembly Specifics

Refer to the Chapter 3, “Replacing Assemblies,” in this guide for complete disassembly and reassemble details, and Chapter 5, “Replaceable Parts,” for the appropriate exploded view of the instrument parts.

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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 receptacle. (DO NOT connect the instrument to ac power at this time.) Using a suitable ohmmeter, check resistance from the instrument's metallic connection (such as the rear panel or BNC ground collar) to the ground pin on the power cord plug. The reading must be less that 1Ω 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 2 MΩ Replace any component which results in a failure.

Product Performance Checks

After replacement of any assembly or module, perform the operational verification test in Chapter 1, "Performance Tests," of this guide.

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Assembly Identification and Location

The assembly number, name and Agilent Technologies part number of the Agilent 53131A , Agilent 53132A, and Agilent 53181A assemblies are listed in Table 2-1, Table 2-2, and Table 2-3, respectively. Figure 2-8A, Figure 2-8B, and 5-1 illustrate the replaceable assemblies and cables in the Agilent 53131A/132A/181A.

Table 2-1. Agilent 53131A Assembly Identification

Assembly Name	Agilent Part No.	Exchange Part No.*
A1 Motherboard (Series Prefix 3705 and above)	53131-60004**	53131-69004**
A2 Display Board	53131-60002	no exchange
A3 Channel 3 Input Board		
Option 030, 1.5 GHz	n/a	53132-60003
Option 050, 3 GHz	n/a	53132-69211
Option 124, 12.4 GHz	n/a	53132-69212
A4 AC Power Supply		
Standard	0950-2496	no exchange
Option 002	53132-60207	no exchange
Option 010 and 012	53132-60208	no exchange
A5 DC Power Supply		
Option 002	53132-60206	no exchange
A6 Oven Timebase		
(Option 001)	53132-60004 or 53132-60008—Support Bd 1813-0931—Oscillator	no exchange no exchange
(Option 010)	53132-60016—Support Board 10811-60160—Oscillator	no exchange 10811-69160
(Option 012)	53132-60016—Support Board 10811-60260—Oscillator	no exchange 10811-69260

* Exchange part availability subject to change without notice. Contact your local Agilent Technologies Sales Office for current information.
** If the Motherboard needs to be replaced in a unit which contains Options 030, 050, or 124, it must be done at an AgilentTechnologies Service Center.

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Table 2-2. Agilent 53132A Assembly Identification

Assembly Name	Agilent Part No.	Exchange Part No.*
A1 Motherboard (Series Prefix 3705 and above)	53132-60014**	53131-69014**
A2 Display Board	53131-60002	no exchange
A3 Channel 3 Input Board		
Option 030	n/a	53132-60003
Option 050	n/a	53132-69211
Option 124	n/a	53132-69212
A4 AC Power Supply		
Standard	0950-2496	no exchange
Option 002	53132-60207	no exchange
Option 010 and 012	53132-60208	no exchange
A5 DC Power Supply		
Option 002	53132-60206	no exchange
A6 Oven Timebase		
(Option 001)	53132-60008—Support Board 1813-0931—Oscillator	no exchange no exchange
(Option 010)	53132-60016—Support Board 10811-60160—Oscillator	no exchange 10811-69160
(Option 012)	53132-60016—Support Board 10811-60260—Oscillator	no exchange 10811-69260

* Exchange part availability subject to change without notice. Contact your local Agilent Technologies Sales Office for current information.
** If the Motherboard needs to be replaced in a unit which contains Options 030, 050, or 124, it must be done at an Agilent Technologies Service Center.

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Table 2-3. Agilent 53181A Assembly Identification

Assembly Name	Agilent Part No.	Exchange Part No.*
A1 Motherboard (Series Prefix 3705 and above)	53181-60004**	53181-69004**
A2 Display Board	53131-60002	no exchange
A3 Channel 2 Input Board		
Option 015/030	n/a	53132-60003
Option 050	n/a	53132-69211
Option 124	n/a	53132-69212
A4 AC Power Supply		
Standard	0950-2496	no exchange
Option 002	53132-60207	no exchange
Option 010 and 012	53132-60208	no exchange
A5 DC Power Supply		
Option 002	53132-60206	no exchange
A6 Oven Timebase		
(Option 001)	53132-60004 or 53132-60008—Support Board 1813-0931—Oscillator	no exchange no exchange
(Option 010)	53132-60016—Support Board 10811-60160—Oscillator	no exchange 10811-69160
(Option 012)	53132-60016—Support Board 10811-60260—Oscillator	no exchange 10811-69260

* Exchange part availability subject to change without notice. Contact your local Agilent Technologies Sales Office for current information.
** If the Motherboard needs to be replaced in a unit which contains Options 030, 050, or 124, it must be done at an Agilent Technologies Service Center.

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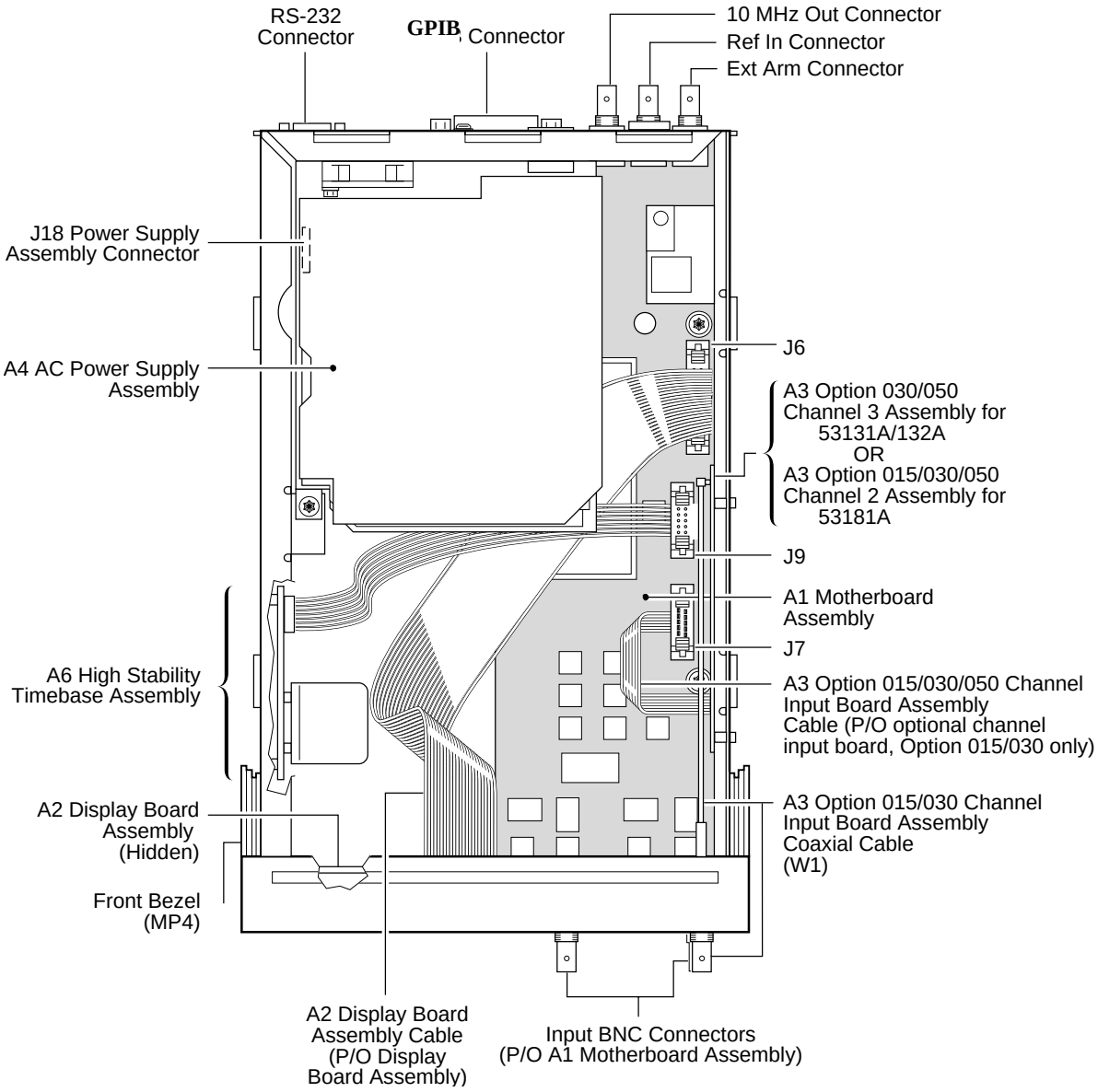


Figure 2-8A. Instrument Top Internal View

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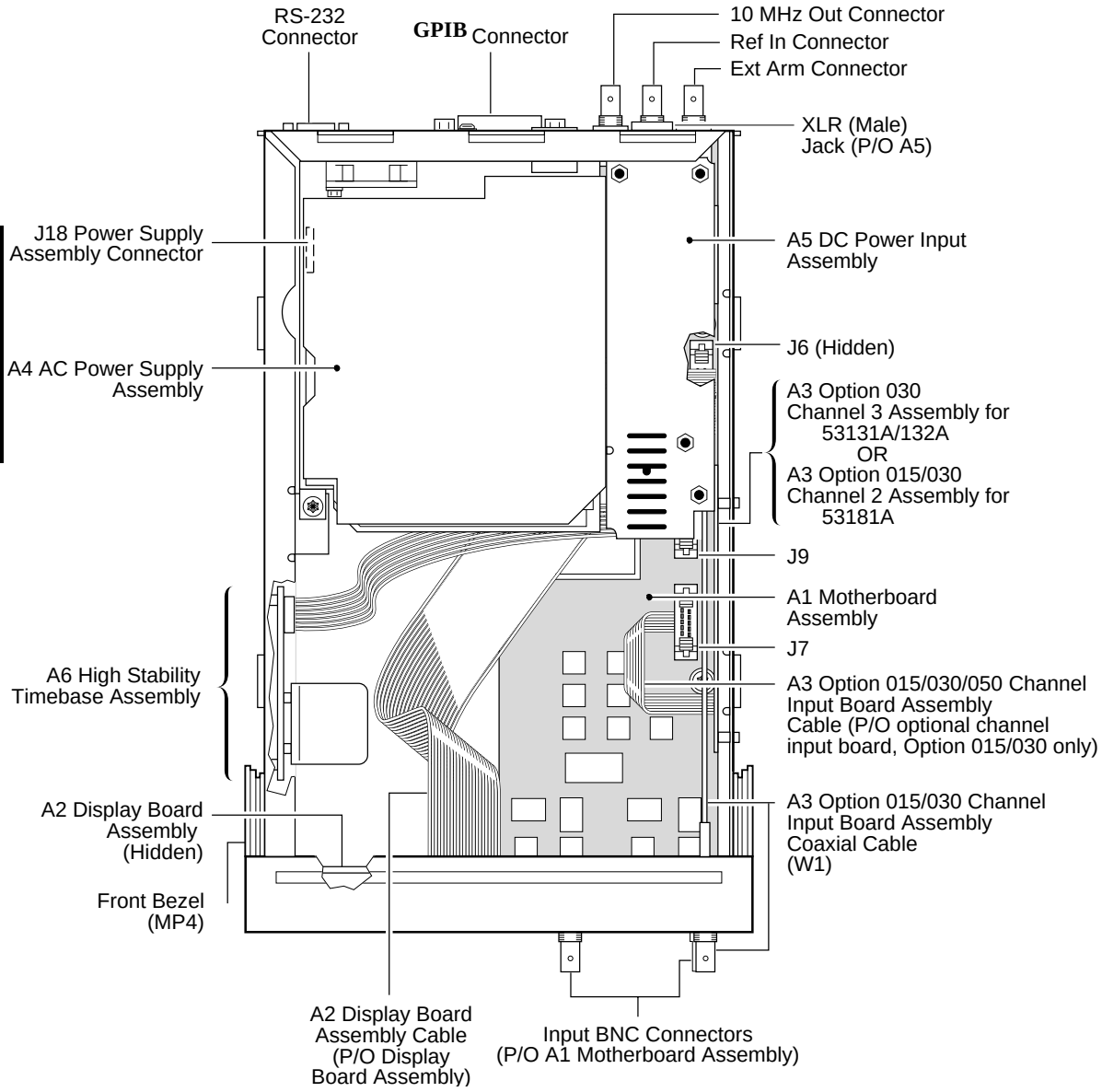


Figure 2-8B. Instrument Top Internal View (Option 002)

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Troubleshooting the Counter

Power Supply Check

WARNING **HAZARDOUS VOLTAGES ARE ON THE POWER SUPPLY ASSEMBLY. ONLY SERVICE TRAINED AND QUALIFIED PERSONNEL SHOULD PERFORM THE FOLLOWING PROCEDURE.**

1 **Remove the power cord from the back of the instrument to disconnect the Counter from the power source.**

2 **Remove the cover as described in Chapter 3.**

NOTE A4 AC Power Supply Assembly is fused for safety reasons. It is assumed that if the fuses are blown, then damage has occurred to the power supply which will make it unreliable. Do not attempt to repair the power supply.

3 **Connect the Counter to the power source.**

The fan should begin to operate as soon as power is supplied. If the fan does not operate, replace A4 AC Power Supply Assembly.

Refer to Chapter 3, “Replacing Assemblies,” in this service guide if you need to remove or replace an assembly.

After replacing the power supply assembly, perform the appropriate calibration procedures in this chapter.

4 **Connect the negative lead of a voltmeter to the chassis and verify that the voltages in Table 2-4 match the voltages measured on connector J18 of A1 Motherboard Assembly. See Figure 2-9 for illustration of J18 viewing from the bottom of the Counter.**

CAUTION BE CAREFUL to NOT short the positive-side lead of the voltmeter to the chassis when probing at the testpoints shown in Figure 2-9.

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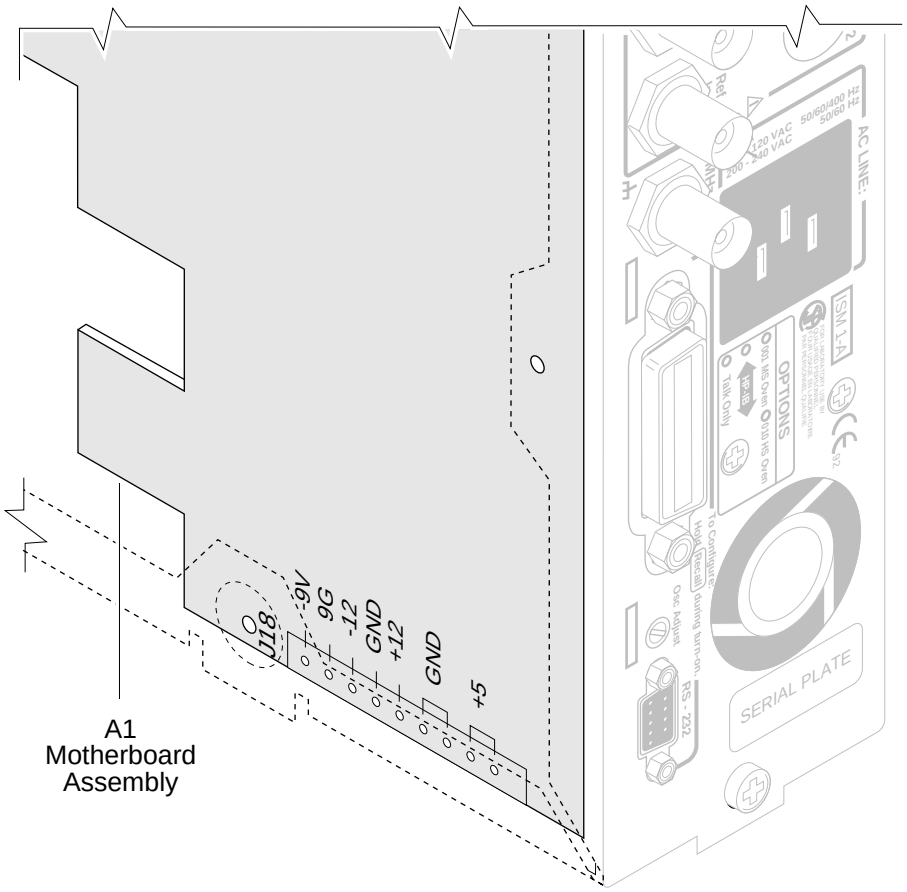


Figure 2-9. A4 AC Power Suppy Testpoint Locations on A1 Motherboard Assembly (Bottom View)

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Table 2-4 lists A4 power supply voltages, the corresponding wire color, and the tolerances.

Table 2-4. A4 AC Power Supply Voltages

Wire Color	Voltage	Tolerance
Red	+5.0 V	±0.250 V
Red	+5.0 V	±0.250 V
Black	0.0 V	_____
Black	0.0 V	_____
Yellow	+12.0 V	±0.6 V
Black	0.0 V	_____
Blue	-12.0 V	±1.2 V

5 **After verifying the correct voltage and that all calibrations passed, proceed to the following section.**

Overview of the Self-Test Routines

The Utility menu includes the following three self-test menu items:

- TEST LOOP:
- TST PRINT:
- TEST:

The Counter includes several self-tests. Some self tests are performed at the power-up of the Counter. Some of these self tests can also be invoked from the Utility menu. Other tests can also be invoked from the Utility menu, but a slightly different test is performed. For example, a power-up self test might work regardless of connections to the inputs while a Utility menu self test may require a specific signal to be connected. Some self tests can only be invoked from the Utility menu, for example, the keypad test.

You can specify that the tests should loop forever (***TEST LOOP: ON*** or ***OFF***) or until any key is pressed.

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You can also specify that failure messages be sent to a printer, the RS-232, and the GPIB—if in talk-only (***TST PRINT: ON*** or ***OFF***).

There are 13 choices for the ***TEST:*** menu item. They are listed and described in the following text.

TEST: ***ALL?*** —run all tests, except display, keypad and printer tests.

DISP? —illuminate the indicators and vacuum-fluorescent display (VFD) segments. *Note, this test is not available if* ***TEST LOOP:*** *is ON.* ***TEST LOOP:*** *must be OFF.*

CPU? —test processor(s).

ROM? —checksum the ROM.

RAM? —test RAM.

EEPROM? —checksum the EEPROM, which is used for non-volatile memory.

HP-IB? —test GPIB chip.

QSPI? —test serial hardware control loops.

FPGA? —internally measure the timebase to test count circuitry.

FR END? —check front end circuits, either by swinging trigger levels (during power on test and ALL test) or asking you to connect the timebase output to channels 1 and 2 using a BNC-T connector to split the signal.

MEAS? —make a measurement, either by swinging trigger levels (during power on test and ALL test) or asking you to connect the timebase output to channel 1.

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INTERP? —test interpolators.

KEYPAD? —request user to press all keys. *Note, this test is not available if* ***TEST LOOP:*** *is ON.* ***TEST LOOP:*** *must be OFF.*

PRINT? —send three test lines to a printer via the RS-232. If in talk-only, also send three test lines to a printer via the GPIB.

NOTE

When running the TEST LOOP self-test routine, be sure to connect the Counter to a serial printer via the RS-232 using a RS-232 printer interface cable (Agilent 24542G or Agilent 24542H) to receive more specific failure information. If you run the TEST LOOP test without Counter being connected to a printer, the Counter will only display pass or fail message.

Diagnosing the Faulty Assembly by Using the Self Tests

To Run the Test-All Self Test

1 **Press and hold *Recall (Utility)* key, then cycle *POWER* key.**

2 **Press *Recall (Utility)* key until *TEST: ALL?* is displayed.**

3 **Press *Enter* key to start the test.**

The counter will display the tests as they are being performed. When the tests are completed the display should show ***ALL: PASS***.

If the fail message is displayed, run the appropriate individual test as described in the following sub-section. If the individual test fail, use Table 2-5 to determine which board or assembly you should replace.

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To Run the Individual Self Tests

1 **Press and hold *Recall (Utility)* key, then cycle *POWER* key.**

NOTE

If power does not cycle or the display does not light, go to the section titled “Power Supply Check” on page 2-45 of this chapter.

2 **Press *Recall (Utility)* key until *TEST LOOP:* is displayed.**

3 **Ensure that *TEST LOOP:OFF* is displayed.**

Note that the DISP? and KEYPAD? tests are not available if ***TEST LOOP:*** is ***ON***.

If ***TEST LOOP: ON*** is displayed, press any one of the arrow keys to set ***TEST LOOP*** to ***OFF***.

4 **Press *Recall (Utility)* key until *TEST: ALL?* is displayed.**

5 **Press any one of the arrow keys to select the desired self test (for example, the *DISP?* self test).**

6 **Press *Enter* key to start the test.**

After a test is completed, a pass or fail message will be displayed.

NOTE

After the DISP? (Display) test has cycled through each display segment and annunciator, press the **Enter** key to stop the test and to display the pass or fail message.

7 **If you are asked to do something, press *Enter* key when you have completed the requested task.**

After a test is completed, a pass or fail message will be displayed.

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8 Repeat steps 2 through 5 for each of the self tests.

Note that for the TEST: FR END? test, connect Counter as shown in Figure 2-11A or Figure 2-11B (depending on which Counter you are testing) and press **Enter** key.

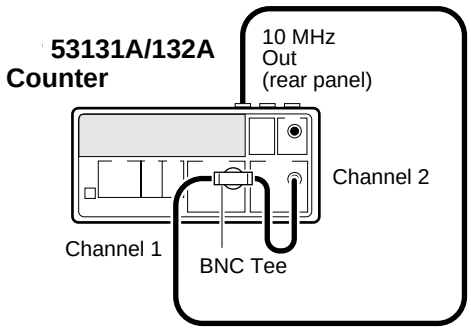


Figure 2-11A. Agilent 53131A/132A Self Test Troubleshooting Setup

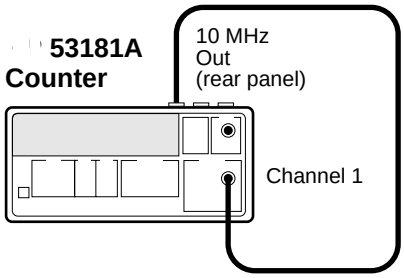


Figure 2-11B. Agilent 53181A Self Test Troubleshooting Setup

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9 If the *FAIL* message is displayed for a test, use Table 2-5 to determine which assembly may need replacing.

Table 2-5. Troubleshooting

Failure Indicator	Assembly at Fault
DISP: FAIL	A2 Display Board Assembly, or A1 Motherboard Assembly
CPU: FAIL	A1 Motherboard Assembly
ROM: FAIL	A1 Motherboard Assembly
RAM: FAIL	A1 Motherboard Assembly
EEPROM: FAIL	A1 Motherboard Assembly
HP-IB: FAIL	A1 Motherboard Assembly
QSPI: FAIL	A1 Motherboard Assembly, or A2 Display Board Assembly
FPGA: FAIL	A1 Motherboard Assembly, or A2 Display Board Assembly
FR END: FAIL	A1 Motherboard Assembly, or A4 AC Power Supply Assembly
MEAS: FAIL	A1 Motherboard Assembly, or A4 AC Power Supply Assembly
INTERP: FAIL	A1 Motherboard Assembly, or A4 AC Power Supply Assembly
KEYPAD: FAIL	Keypad, or Front Panel Assembly, or A1 Motherboard Assembly.
PRINT: FAIL	A1 Motherboard Assembly

10 Refer to Chapter 3, "Replacing Assemblies," in this service guide for dissasembly and reassembly procedures.

NOTE After replacing an assembly, perform the calibration procedures in this chapter.

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3

Replacing Assemblies

Disassembly and Reassembly

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Introduction

This chapter contains the instructions for removing major assemblies in the Agilent 53131A/132A/181A. To install an assembly, reverse the removal instructions.

This chapter provides the following disassembly and reassembly procedures:

- To Remove the Cover page 3-4
- To Remove the Front Bezel page 3-6
- To Remove A1 Motherboard Assembly page 3-9
- To Remove the A2 Display Board, Keypads, and Window page 3-11
- To Remove A3 1.5/3.0/5.0/12.4 GHz Channel Assembly (Option 015/030/050/124) page 3-13
- To Remove A4 AC Power Supply Assembly page 3-15
- To Remove A5 DC Power Input Assembly (Option 002) page 3-17
- To Remove A6 High Stability Timebase Assembly (Options 001, 010, and 012) page 3-19
- To Remove the Rear Terminals (Option 060) page 3-21

WARNING **HAZARDOUS VOLTAGES ARE ON THE POWER SUPPLY ASSEMBLY. UNPLUG THE INSTRUMENT, THEN WAIT AT LEAST SIX MINUTES FOR THE CAPACITORS ON THE POWER SUPPLY ASSEMBLY TO DISCHARGE BEFORE WORKING ON THIS INSTRUMENT.**

CAUTION Do not replace assemblies with the instrument turned on. Damage to components can occur.

Refer to Chapter 5, “Replaceable Parts,” for the part number of the assemblies.

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Tools Required

The following tools are required for these removal and replacement procedures:

- Hand TORX®, 10 screwdriver (T10)
- Hand TORX®, 15 screwdriver (T15)
- 7-mm spin tight
- 14-mm deep-socket spin tight
- Soldering iron—for removing Option 060 Rear Terminals
- Small (1 point) Pozidriv screwdriver—for removing Option 010/012 oven oscillator from A6 Timebase Support Board

Do This First

Before performing any of the removal and replacement procedures, the following steps must be performed.

1 **Turn Counter off.**

2 **Remove ac line power cord from the rear ac line socket.**

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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 INSTRUMENT, LINE VOLTAGES ARE EXPOSED WHICH ARE DANGEROUS AND MAY CAUSE SERIOUS INJURY IF TOUCHED. DISCONNECT POWER.

1 **Turn off the Counter and remove power cord.**

2 **To remove the rear bezel, loosen the captive screws on the sides as shown in Figure 3-1 using the TORX 15 screwdriver.**

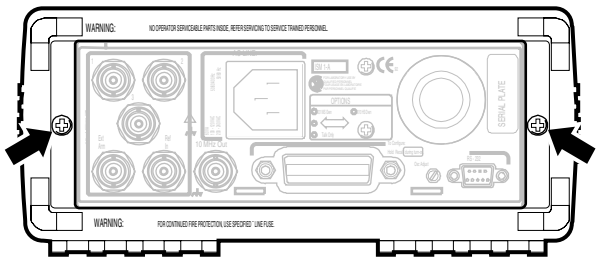


Figure 3-1. Rear Bezel Removal

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3 Remove the screw (H1) located at the bottom near the rear of the cover (MP3) as shown in Figure 3-2.

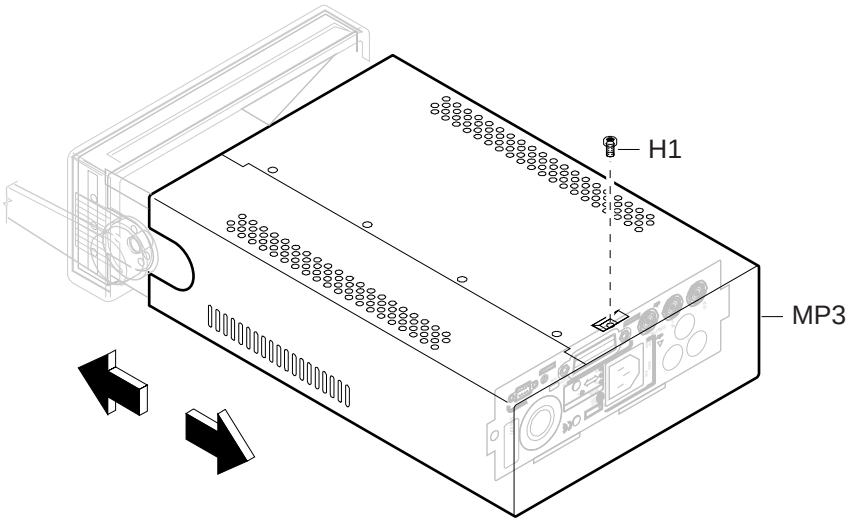


Figure 3-2. Bottom View for Cover Removal

4 With one hand gripping the front bezel, pull the cover off with the other hand by sliding the cover backward.

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To Remove the Front Bezel

1 Remove the cover.

See the section titled “To Remove the Cover” in this chapter.

2 Remove the bail handle (MP7) by rotating it to the vertical position and pull the ends outward as shown in Figure 3-3.

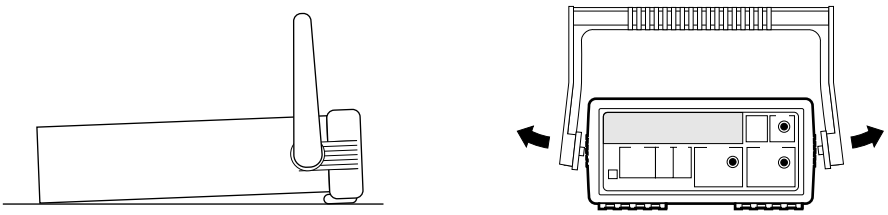


Figure 3-3. Handle Removal

3 Remove the front rubber bumper (part of MP2), stretch a corner and then slide it off as shown in Figure 3-4.

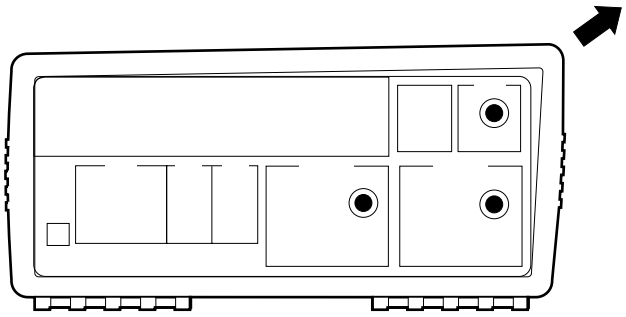


Figure 3-4. Front Rubber Bumper Removal

4 Disconnect the front bezel flat-ribbon cable (which is actually A2 Display Board’s cable) from J6 of A1 Motherboard Assembly as shown in Figure 3-5.

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5 Remove the BNC nuts (H3), shown in Figure 3-5, from the front panel using the 14-mm deep-socket spin tight.

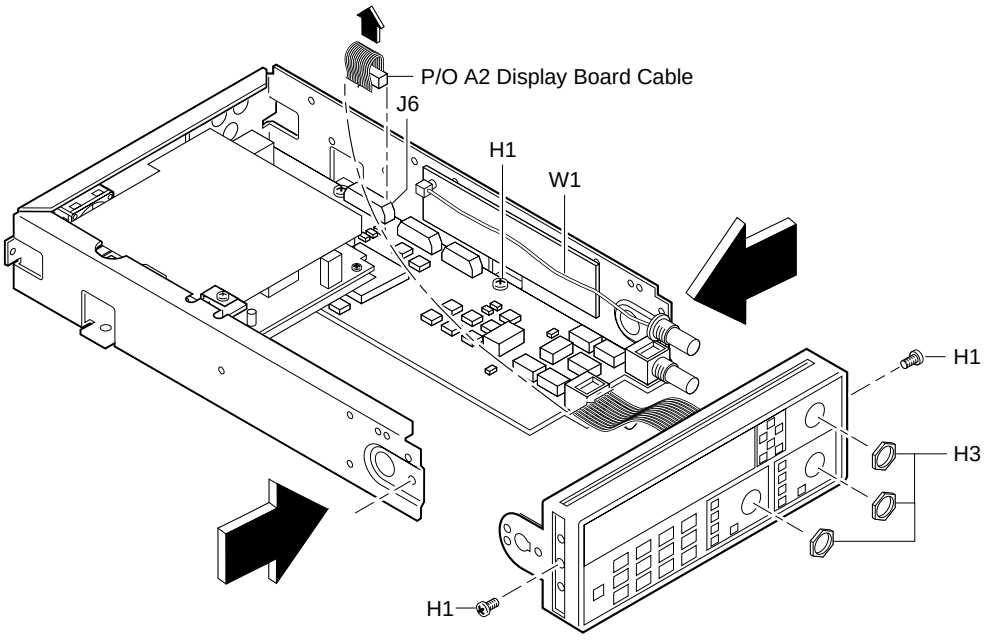


Figure 3-5. Front Bezel Removal

6 For Counters with the optional 1.5 GHz or 3.0 GHz channel (Option 015 or 030), pull cable W1 out of the front bezel as shown in Figure 3-5. For the optional 5.0 or 12.4 GHz channel, remove knurled nut.

CAUTION When reassembling A3 (Option 015/030) Assembly, ensure that cable W1 is not placed or folded on top of the input circuits of A1 Motherboard Assembly or is tucked behind A3 as the Counter may start reading or measuring noise.

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To Remove the Front Bezel

7 Remove the two screws (H1), located in the sides of the front bezel, using the TORX 15 screwdriver as shown in Figure 3-5.

8 Loosen the screw (H1), shown in Figure 3-5, that helps secure A1 Motherboard Assembly to the chassis to make step 9 (the following step) easier.

9 Remove front bezel by pushing inward on the sides of the chassis.

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To Remove A1 Motherboard Assembly

1 **Remove the cover.**

See the section titled “To Remove the Cover” in this chapter.

2 **Remove the Power Supply Assembly.**

See the section titled “To Remove A4 AC Power Supply Assembly” in this chapter.

3 **Remove the front bezel.**

See the section titled “To Remove the Front Bezel” in this chapter.

4 **If the Counter contains Option 015/030/050/124 1.5/3.0/5.0/12.4 GHz Channel, disconnect the optional channel’s flat-ribbon cable from J7 on A1 Motherboard Assembly as shown in Figure 3-6.**

5 **If the Counter contains one of the optional high stability timebase assemblies (Option 001, 010, 012), disconnect the flat-ribbon cable from J6 of A1 Motherboard as shown in Figure 2-8A (See Chapter 2, “Service.”).**

6 **If the Counter contains the Option 002 DC Power Input Assembly, remove it.**

See the section titled “To Remove A5 DC Power Input Assembly (Option 002)” in this chapter.

7 **Remove the two hex screws (H4), shown in Figure 3-6, on the rear-panel GPIB connector using the 7-mm spin tight.**

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To Remove A1 Motherboard Assembly

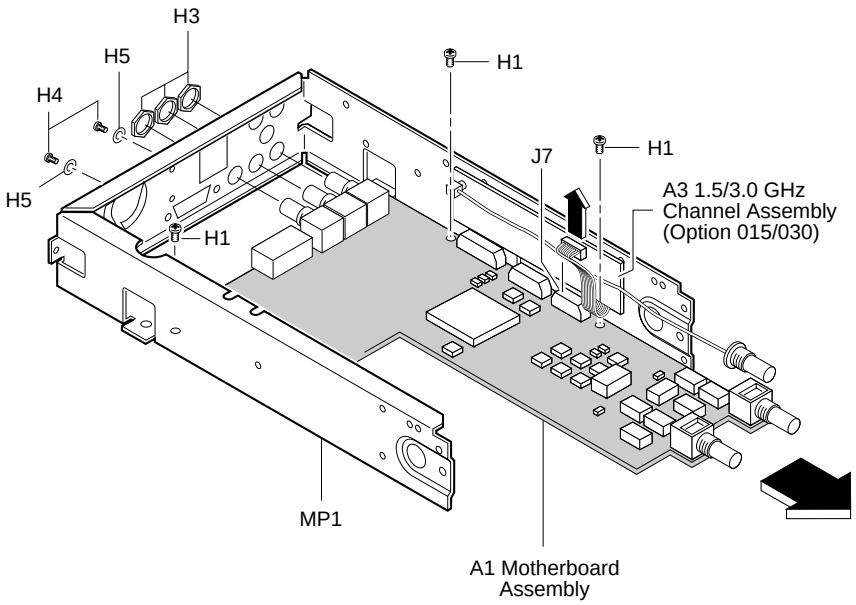


Figure 3-6. A1 Motherboard Assembly Removal

8 Remove the BNC nuts (H3), shown in Figure 3-6, from the rear of the chassis using the 14-mm deep-socket spin tight (Opt 015/030 only). Remove knurled nut for Option 050.

9 Remove the three screws (H1) in A1 Motherboard Assembly as shown in Figure 3-6.

10 Finally, slide the motherboard assembly forward.

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To Remove the A2 Display Board, Keypads, and Window

1 Remove the cover.

See the section titled “To Remove the Cover” in this chapter.

2 Remove the front bezel.

See the section titled “To Remove the Front Bezel” in this chapter.

3 Note that A2 Display Board Assembly, shown in Figure 3-7, is held in place by five tabs (two on top and three on bottom) which are part of the front bezel.

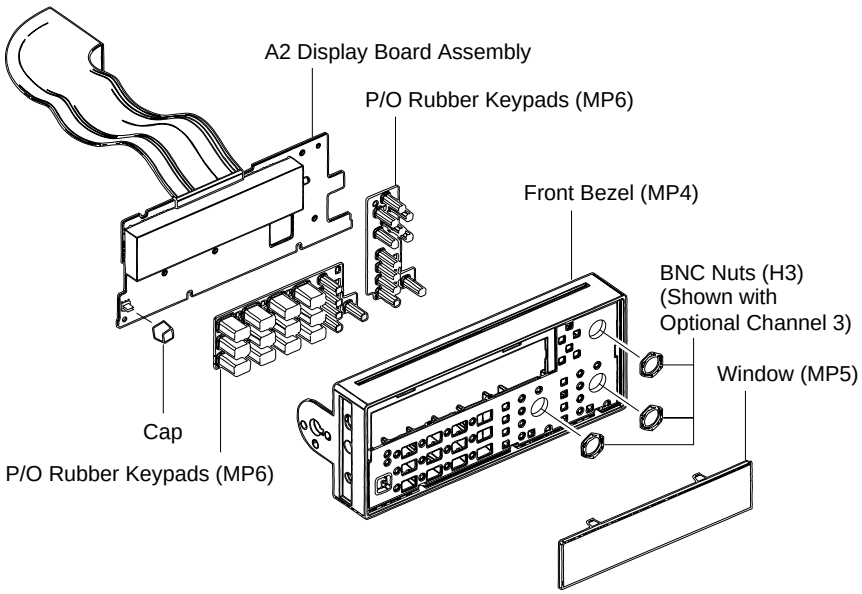


Figure 3-7. A2 Display Board, Keypad, and Window Removal

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4 Pull up on the top portion of the front bezel until the top portion of the display board is free from the top tabs.

5 Pull down on the bottom portion of the front bezel until the display board is free from the bottom tabs.

If the board is still not free, insert a small flat-blade screw driver or object between the bottom of the display board and the bezel to gently pry the board loose from the bottom tabs.

6 Remove A2 Display Assembly from the front bezel.

NOTE

When installing A2 Display Board into the front bezel, pull up on the top portion of the front bezel and press display board into place. Make sure that the board is positioned all the way into the bezel until the two tabs on top and three on bottom are visible.

7 Now, remove the POWER key cap by gripping and pulling it.

NOTE

The cap must be removed to make installation of the A2 Display Board Assembly easier.

8 As shown in Figure 3-7, the rubber keypads (MP6) are now free. Just pull them out of the bezel.

9 Remove the window (MP5), shown in Figure 3-7, by pressing down on the two top tabs and sliding the window forward.

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To Remove A3 1.5/3.0/5.0/12.4 GHz Channel Assembly (Option 015/030/050/124)

NOTE The 1.5 GHz Channel 2 Assembly is available only for the Agilent 53181A Frequency Counter.

1 **Remove the cover.**

See the section titled “To Remove the Cover” in this chapter.

2 **Using the 14-mm deep-socket spin tight, remove the BNC nut (H3) from the optional Channel 3 (or Channel 2 for Agilent 53181A) input connector (Options 015/030 only). For Option 050 or 124 remove the knurled nut using a pair of pliers.**

3 **Pull W1, which is the optional channel assembly cable, out of the Channel 3 (or 2) opening in the front panel assembly as shown in Figure 3-8. For the Option 050 or 124, the connector is part of the Option assembly.**

CAUTION When reassembling A3 (Option 015/030) Assembly, ensure that cable W1 is not placed or folded on top of the input circuits of A1 Motherboard Assembly or is tucked behind A3 as the Counter may start reading or measuring noise.

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To Remove A3 1.5/3.0/5.0/12.4 GHz Channel Assembly (Option 015/030/050/124)

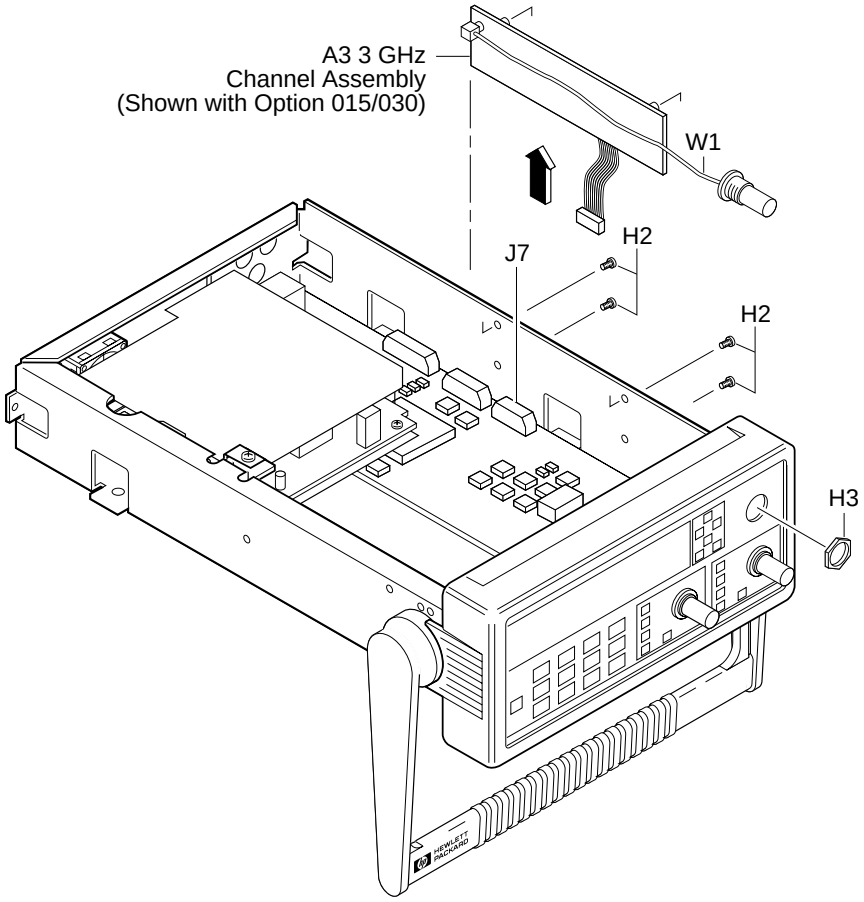


Figure 3-8. Optional Channel Input Assembly Removal

4 Disconnect flat-ribbon cable of the optional channel from connector J7 of A1 Motherboard Assembly as shown in Figure 3-8.

5 Remove the four (two or three for Option 050 or 124) screws (H2) attaching the optional channel to the chassis as shown in Figure 3-8.

6 Remove the optional channel assembly.

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To Remove A4 AC Power Supply Assembly

1 Remove the cover.

See the section titled “To Remove the Cover” in this chapter.

2 Remove the TORX screw (H1) located in the upper-middle of the chassis using the TORX 15 screwdriver as shown in Figure 3-9.

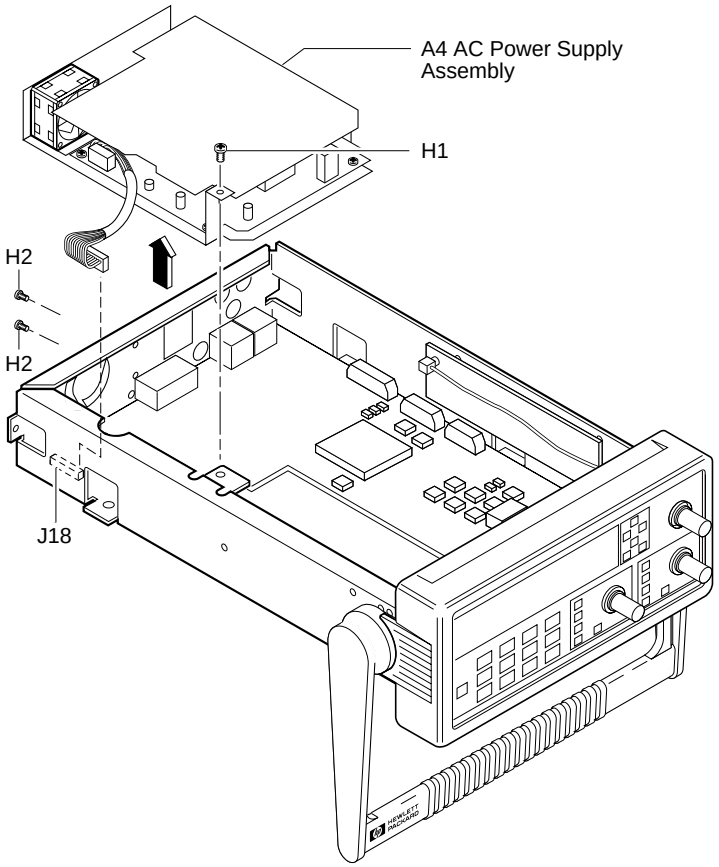


Figure 3-9. A4 AC Power Supply Assembly Removal

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3 Remove the two TORX screws (H2) on the rear panel using the TORX 10 screwdriver as shown in Figure 3-9.

4 Lift up A4 AC Power Supply Assembly and disconnect its cable from J18 on A1 Motherboard Assembly to remove the power supply assembly as shown in Figure 3-9.

NOTE

When replacing the power supply, order the rubber foot (0403-0424). Figure 3-10 shows where the rubber foot is located on the defective assembly.

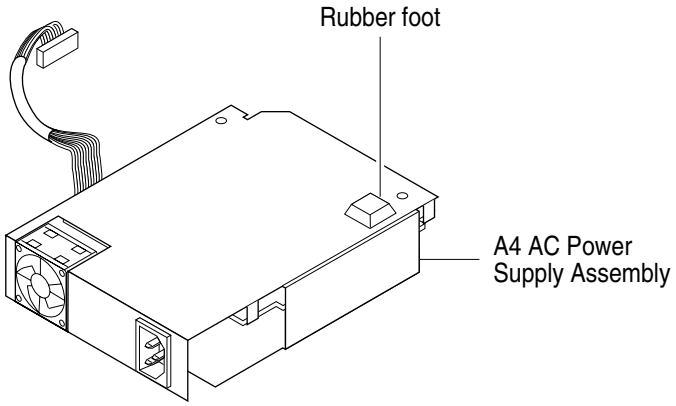


Figure 3-10. Location of the Rubber Foot

5 If the Counter contains the Option 002 DC Power Input Assembly, disconnect A4 AC Power Supply's other cable from Option 002 as shown in Figure 3-11.

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To Remove A5 DC Power Input Assembly (Option 002)

1 **Remove the cover.**

See the section titled “To Remove the Cover” in this chapter.

2 **Remove the four TORX 10 screws (H2) that attach A5 DC Power Input Assembly to the side of the chassis as shown in Figure 3-11.**

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To Remove A5 DC Power Input Assembly (Option 002)

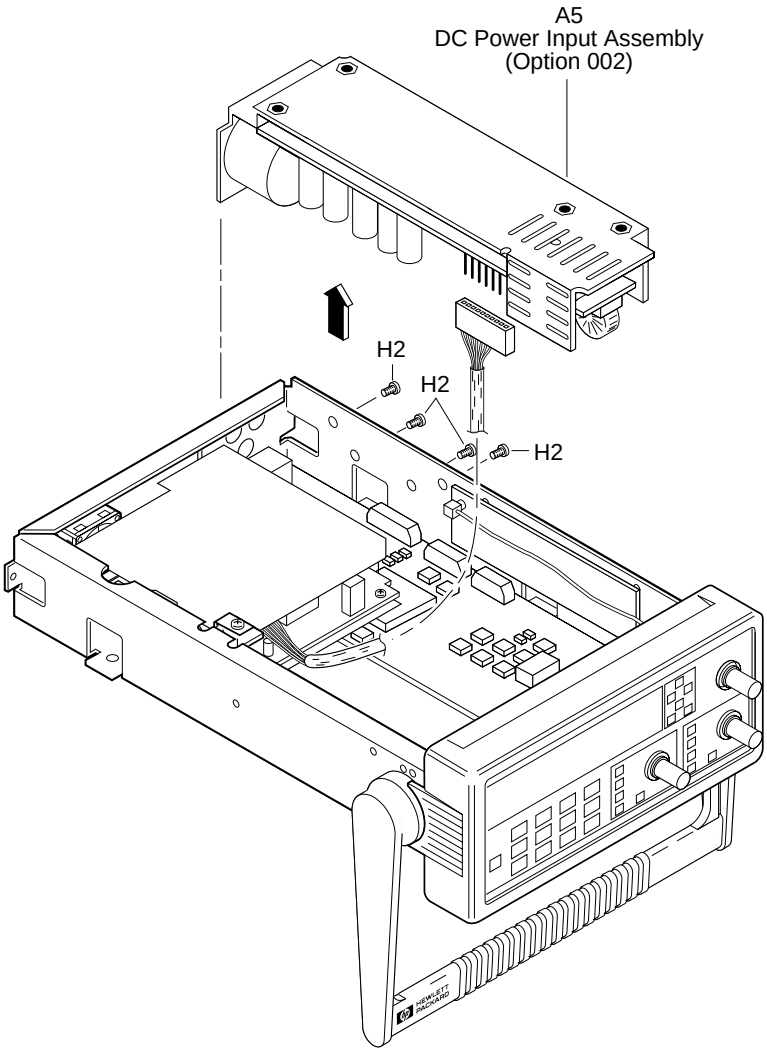


Figure 3-11. DC Power Input Assembly (Option 002) Removal

3 Lift out A5 DC Power Input Assembly and disconnect cable as shown in Figure 3-11.

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To Remove A6 High Stability Timebase Assembly (Options 001, 010, and 012)

1 Remove the cover.

See the section titled “To Remove the Cover” in this chapter.

2 Disconnect A6 High Stability Timebase Assembly cable from the J9 connector on A1 Motherboard Assembly as shown in Figure 3-12.

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To Remove A6 High Stability Timebase Assembly (Options 001, 010, and 012)

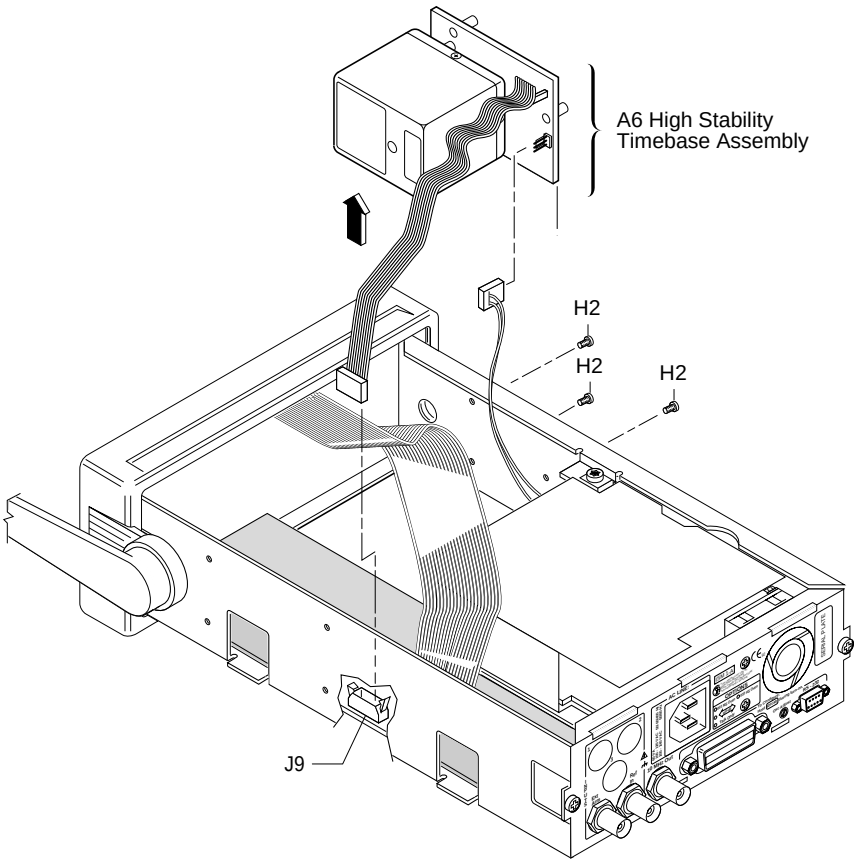


Figure 3-12. Option 001, 010, and 012 A6 High Stability Timebase Assembly Removal

3 **Disconnect the ac power supply's two-wire cable from A6 High Stability Timebase Assembly (if the two-wire cable exists).**

4 **Remove the three TORX 10 screws (H2) attaching the timebase to the chassis as shown in Figure 3-12.**

5 **Remove A6 High Stability Timebase Assembly.**

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To Remove the Rear Terminals (Option 060)

1 Remove the cover.

See the section titled “To Remove the Cover” in this chapter.

2 Unsolder the lead-end of the cables from their appropriate ground and input pads on the A1 Motherboard Assembly (J16, J17) as shown in Figure 3-13.

For the Agilent 53131A/132A unsolder the rear chassis **INPUTS 1** cable to J16 and **INPUTS 2** to J17.

For the Agilent 53181A unsolder the rear chassis **INPUTS 1** cable to J17.

NOTE

If there are upper or lower shields installed on A1 Motherboard Assembly, cut them out and then remove Option 060 Rear Terminal cable(s). Replace the front bezel with the metalized version (53131-40001).

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To Remove the Rear Terminals (Option 060)

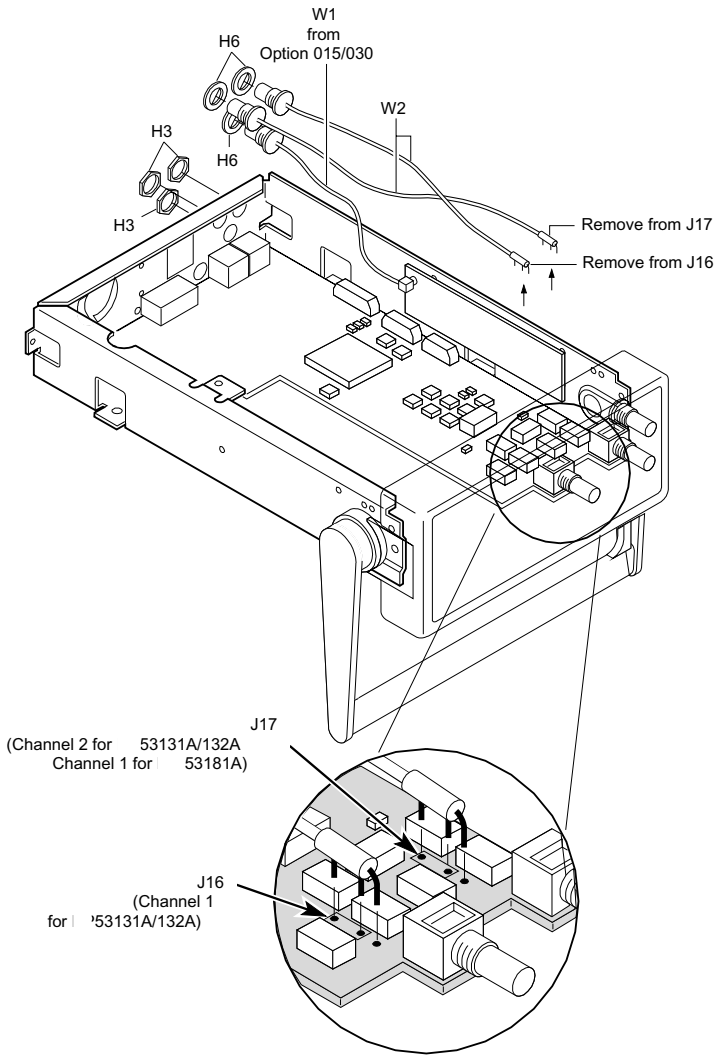


Figure 3-13. Rear Terminals (Option 060) Removal

NOTE Options 050 and 124 (5.0 or 12.4 GHz Input) is front panel only.

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3 Loosen and remove the 2940-0256 BNC nuts (H3) that secure the coaxial cable(s) to the rear chassis, using the 14-mm deep-socket spin tight.

4 Pull W2 and washers (H6) out of the rear *INPUTS* opening(s).

5 Pull the connector-end of W1 and washer (H6) out of the rear *INPUTS* opening.

6 Plug opening (s) with MP9 (6960-0159) if you are not going to re-install Option 060.

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To Remove the Rear Terminals (Option 060)

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4

Retrofitting Options

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Introduction

This chapter provides the following retrofit procedures:

- To Retrofit A3 1.5/3.0/5.0/12.4 GHz Channel Assembly (Option 015/030/050/124) page 4-3
- To Retrofit A5 DC Power Input Assembly (Option 002) page 4-4
- To Retrofit A6 High Stability Timebase Assembly (Options 001, 010, and 012) page 4-11
- To Retrofit the Rear Terminals (Option 060) page 4-14

Tools Required

The following tools are required for these retrofitting procedures:

- Hand TORX®, 10 screwdriver (T10)
- Hand TORX®, 15 screwdriver (T15)
- 7-mm spin tight
- 14-mm deep-socket spin tight
- Soldering iron—for retrofitting Option 060 Rear Terminals
- Small (1 point) Pozidriv screwdriver—for securing Option 010/012 oven oscillator to A6 Timebase Support Board
- pliers

Do This First

Before performing any of the retrofit procedures, the following steps must be performed.

1 **Turn Counter off.**

2 **Remove ac line power cord from the rear ac line socket.**

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To Retrofit A3 1.5/3.0/5.0/12.4 GHz Channel Assembly (Option 015/030/050/124)

NOTE

Retrofitting to Option 015 (1.5 GHz), Option 030 (3.0 GHz), Option 050 (5.0 GHz), and Option 124 (12.4 GHz) must be performed by technicians at an Agilent Technologies Service Center.

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To Retrofit A5 DC Power Input Assembly (Option 002)

Option 002 DC Power Input Assembly Parts

	Item	Agilent Part No.	Qty.
•	Chassis (MP10)	53131-00010	1
•	A5 DC Power Input Assembly	53132-60206	1
•	A4 AC Power Supply Assembly	53132-60207	1
•	Rear label (MP11)	53131-80039	1
•	TORX 10 screws (H2)	0515-0430	4

NOTE Option 002 can NOT be installed or combined with Option 060 Rear Terminals.

Preliminary Procedure

1 Remove the cover.

See the section titled “To Remove the Cover” in Chapter 3 of this guide.

2 Remove the front bezel.

See the section titled “To Remove the Front Bezel” in Chapter 3 of this guide.

3 Remove the existing A4 AC Power Supply Assembly.

4 Remove A1 Motherboard Assembly from chassis MP1.

See the section titled “To Remove A1 Motherboard Assembly” in Chapter 3 of this guide.

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Retrofitting Procedure

1 **Slide A1 Motherboard Assembly into the new chassis (MP10) as shown in Figure 4-1A.**

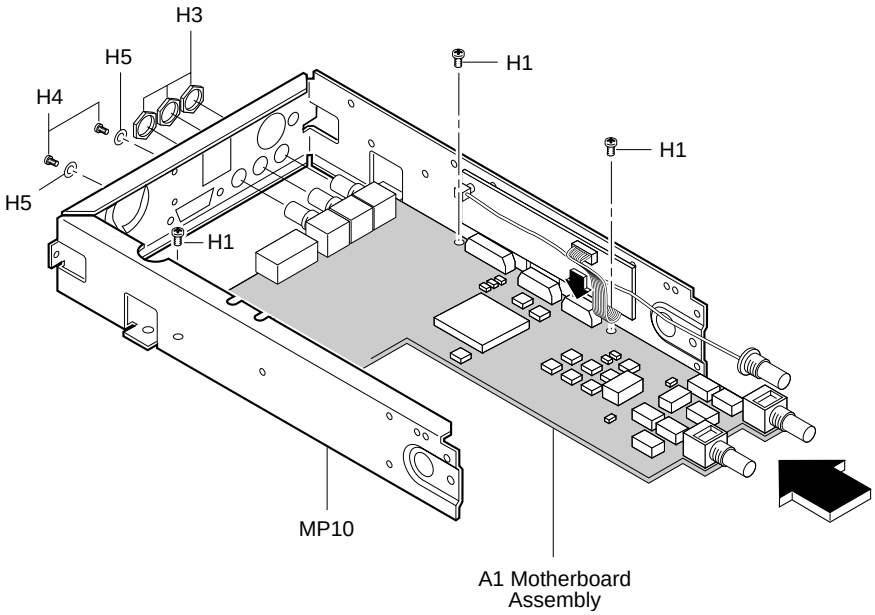


Figure 4-1A. DC Power Input Assembly Retrofitting

2 **Insert but do not tighten the three TORX 15 screws (H1) that attach A1 Motherboard Assembly to the new chassis (MP10) as shown in Figure 4-1A.**

3 **Insert and tighten the three BNC nuts (H3) onto the BNC connectors that protrude from the rear of the chassis using the 14-mm deep-socket spin tight.**

4 **Insert and tighten the two hex screws (H4) and the lock washers (H5) onto the GPIB connector that protrudes from the rear of the chassis using the 7-mm spin tight.**

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5 Now, re-install the front bezel by performing the front bezel removal procedure, in Chapter 3 of this guide, in reverse. Be sure to insert A2 Display Board's cable into connector J6 on A1 Motherboard Assembly.

6 Tighten the three H1 screws, shown in Figure 4-1A, to secure the motherboard to the chassis.

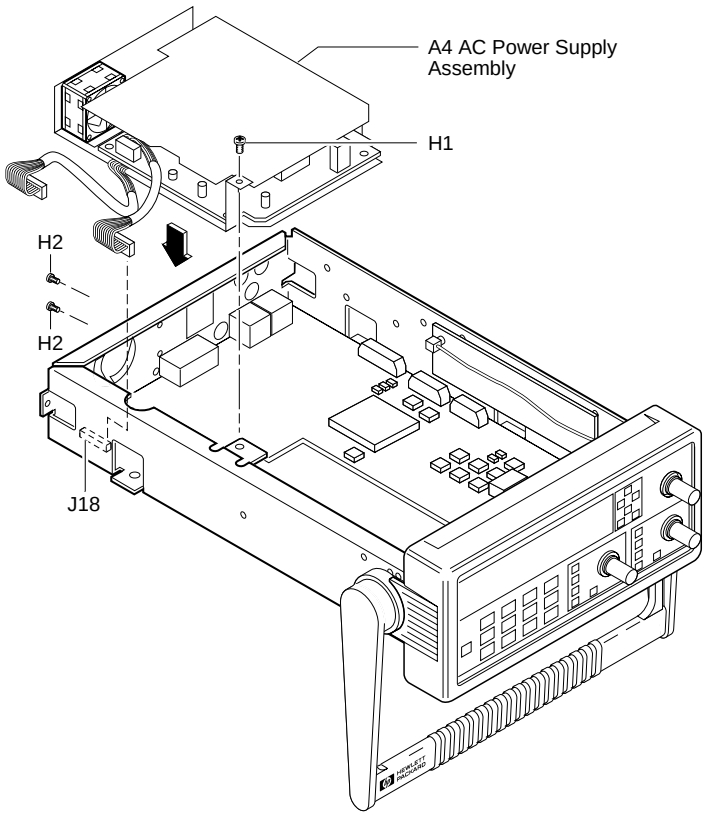


Figure 4-1B. DC Power Input Assembly Retrofitting

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7 To install the new A4 AC Power Supply Assembly (53132-60207), connect the ac power supply's shorter cable to connector J18 on A1 Motherboard Assembly as shown in Figure 4-1B.

8 Insert and tighten the two TORX 10 screws (H2) to attach A4 Power Supply Assembly to the rear of the chassis as shown in Figure 4-1B.

9 Insert and tighten the TORX 15 screw (H1) into the upper-middle of the chassis as shown in Figure 4-1B.

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10 Install A5 DC Power Input Assembly (53132-60206) into the chassis by performing the following:

a. First, connect the other ac power supply cable to the connector on A5 printed-circuit board as shown in Figure 4-1C.

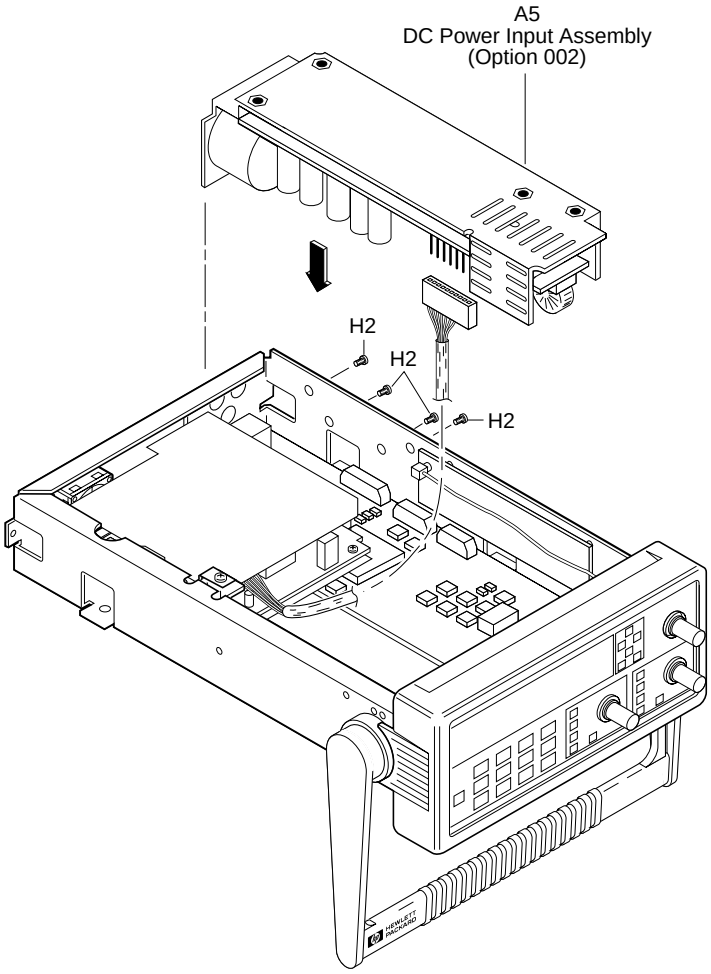


Figure 4-1C. DC Power Input Assembly Retrofitting

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b. Position A5 Power Input Assembly against the rear of the chassis and align it with the two appropriate holes in the rear of the chassis.

c. Using the four TORX 10 screws (H2), secure A5 DC Power Input Assembly to the side of the chassis (MP10) as shown in Figure 4-1C.

11 To install the rear label (MP11), remove the protective seal from the back of it and press into place making sure to properly align the label with the holes in the rear of chassis as shown in Figure 4-1D.

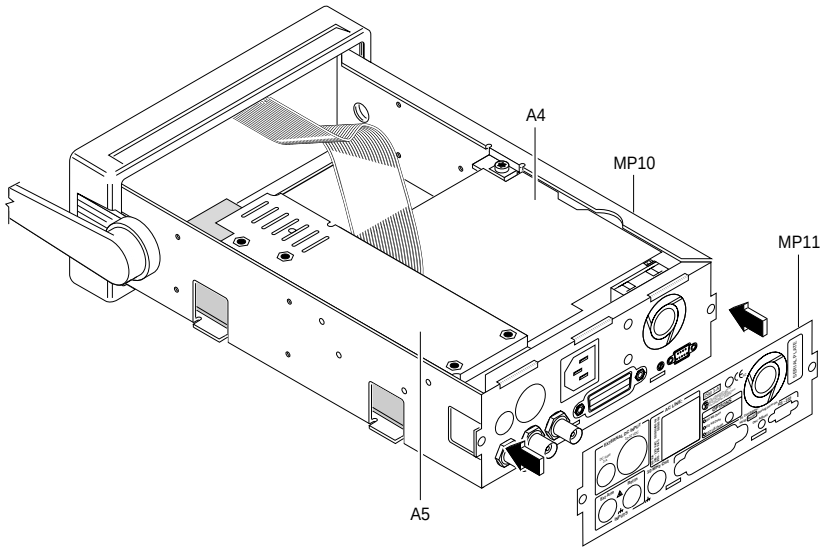


Figure 4-1D. DC Power Input Assembly Retrofitting

12 Re-install the cover by performing the cover removal procedure, in Chapter 3 of this guide, in reverse.

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13 Note that you will have to assemble your own dc power cable using 18 AWG connecting wires and a three-pin Agilent E9640A XLR (female) connector plug, shown in Figure 4-1E.

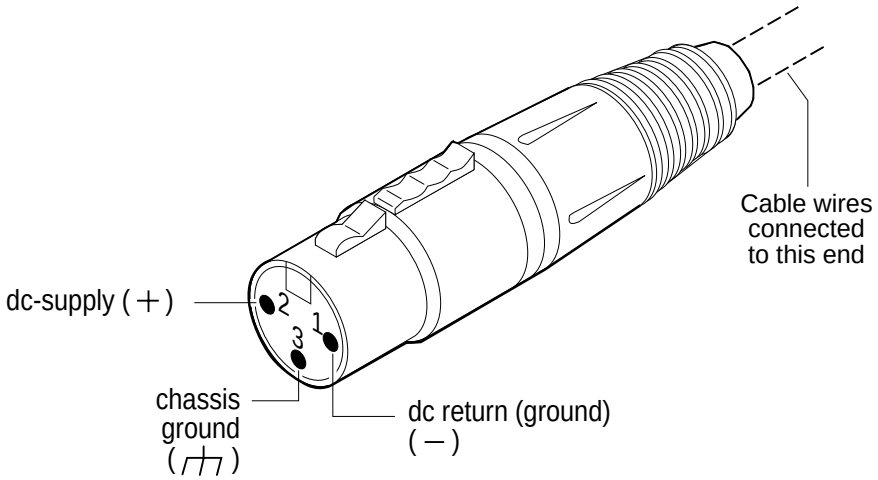


Figure 4-1E. Three-Pin XLR Plug Pinouts (Front View)

14 From the rear of the XLR plug, connect the external power supply's supply-side wire to pin 2 of the XLR plug. Connect the external power supply's return (ground) wire to pin 1, and the chassis ground wire to pin 3 of the XLR plug.

15 Observing the correct polarity, attach the other ends of the wires to a dc source (+10 to +32V dc) to operate the Counter.

This completes the DC Power Input Assembly (Option 002) retrofit procedure.

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To Retrofit A6 High Stability Timebase Assembly (Options 001, 010, and 012)

Option 001 Medium Stability Timebase Assembly Parts

	Item	Agilent Part No.	Qty.
•	A6 Timebase Support Board	53132-60016	1
•	Oven Oscillator	1813-0931	1
•	TORX 10 screws (H2)	0515-0430	3

*Option 010 High Stability Timebase Assembly Parts

	Item	Agilent Part No.	Qty.
•	A6 Timebase Support Board	53132-60016	1
•	Oven Oscillator	10811-60160	1
•	TORX 10 screws (H2)	0515-0430	3
•	Pozidriv screws (H7)	2360-0331	2

*Option 012 Ultra-High Stability Timebase Assembly Parts

	Item	Agilent Part No.	Qty.
•	A6 Timebase Support Board	53132-60016	1
•	Oven Oscillator	10811-60260	1
•	TORX 10 screws (H2)	0515-0430	3
•	Pozidriv screws (H7)	2360-0331	2

* These options can be installed or retrofitted in Counters that have firmware revisions 3402 and greater only. Contact your local Agilent Technologies Service Center for more information.

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To Retrofit A6 High Stability Timebase Assembly (Options 001, 010, and 012)

Procedure

1 **Turn off the Counter and remove power cord.**

2 **Remove the cover.**

See the section titled "To Remove the Cover" in Chapter 3 of this guide.

3 **If you are retrofitting the Option 010 High Stability or Option 012 Ultra-High Stability assembly, go to step 4 below.**

If you are retrofitting the Option 001 Medium Stability Timebase Assembly: Place the oscillator over the outline area of the circuit board and note which holes align with the pins on the bottom side of the oscillator. Use a soldering iron and solder sucker to remove the solder from those holes. Place the oscillator onto the circuit board, with the pins extending through the corresponding holes such that the main body of the oscillator is on the same side as other mounted components. Solder the oscillator in place. **Skip step 4 and go to step 5.**

4 **Plug the oven oscillator into the socket on A6 Timebase Support Board, and secure the oven oscillator to A6 using the two Pozidriv screws (H7) as shown in Figure 4-2.**

5 **If you are retrofitting the Option 001 Medium Stability Timebase, remove the jumper cap on P1 of A6 Timebase Support Board as shown in Figure 4-2.**

If you are retrofitting the Option 010 High Stability and Option 012 Ultra-High Stability timebases, DO NOT remove the jumper cap on P1.

6 **Mount A6 High Stability Timebase Assembly on the left side using three TORX 10 screws (H1) as shown in Figure 4-2.**

7 **Plug the power supply assembly's two-wire cable into the three-prong connector (J2) on the high stability timebase assembly as shown in Figure 4-2 (if the two-wire cable exists).**

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To Retrofit A6 High Stability Timebase Assembly (Options 001, 010, and 012)

8 Connect A6 High Stability Timebase Assembly cable to connector J9 on A1 Motherboard Assembly as shown in Figure 4-2.

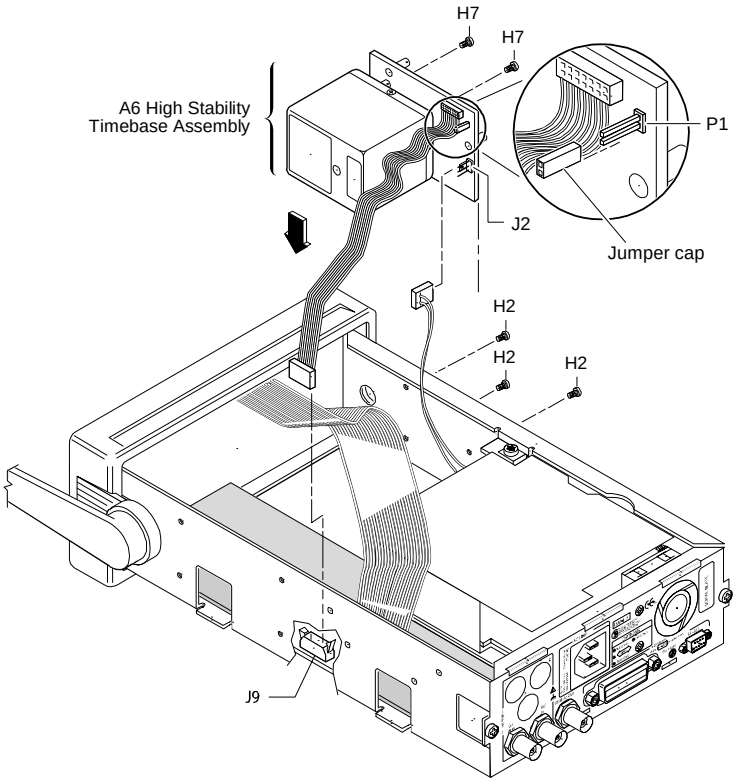


Figure 4-2. High Stability Timebase Retrofitting (Option 001, 010, 012)

9 Re-install the cover by performing the cover removal procedure, in Chapter 3 of this guide, in reverse.

This completes A6 High Stability Timebase Assembly retrofit procedure.

10 Perform the appropriate timebase calibration procedure as found on page 2-23 and page 2-24.

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To Retrofit the Rear Terminals (Option 060)

Option 060 Rear Terminals Parts

Item	Agilent Part No.	Qty.
• Coaxial cable assembly (W2)	8120-6150	2
• BNC washer (H6)	2190-0068	2
• BNC nut (H3)	2940-0256	2

1 Remove the cover.

See the section titled “To Remove the Cover” in Chapter 3 of this guide.

2 For retrofitting the Agilent 53131A or Agilent 53132A that do NOT contain the Optional Channel 3 (Option 030), push out *INPUTS* plugs 1 and 2 (located on rear of chassis) as shown in Figure 4-3A.

For retrofitting the Agilent 53131A or Agilent 53132A that contain the Optional Channel 3 (Option 030), push out *INPUTS* plugs 1, 2, and 3 (located on rear of chassis) as shown in Figure 4-3A.

For retrofitting Agilent 53181As that do NOT contain the optional Channel 2 (Option 015/030), push out *INPUTS* plug 1 (located on rear of chassis) as shown in Figure 4-3A.

For retrofitting the Agilent 53181As that contain the optional Channel 2, push out *INPUTS* plugs 1 and 2 (located on rear of chassis) as shown in Figure 4-3A. See the following NOTE.

NOTE

The Agilent 53131A and 53132A front and rear terminals can be in parallel for inputs 1 and 2. However, the optional Channel 3 input (Option 030) can be configured as **rear terminals only** or **front terminals only**. The optional Channel 3 inputs (Option 050 or 124) can be front terminal only (53131A, 53132A, 53181A).

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NOTE

For the Agilent 53181A, the front and rear terminals can exist for Channel 1. However, Agilent 53181A's optional Channel 2 input (Option 015/030) can be configured as **rear terminals only** or **front terminals only**.

NOTE

If there are upper or lower shields installed on A1 Motherboard Assembly, cut them out and replace the front bezel with the metallized version (53131-40001).

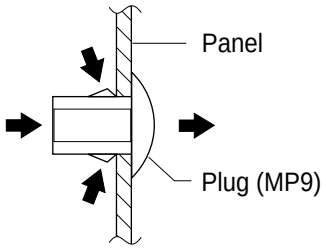


Figure 4-3A. Plug Removal for Rear Terminals Retrofitting

3 **Remove the end of the optional channel (Option 015/030) coaxial cable (W1) that is connected to the front-panel and insert it through the appropriate rear *INPUTS* opening (3 for Agilent 53131A/132A; 2 for Agilent 53181A) as shown in Figure 4-3B.**

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To Retrofit the Rear Terminals (Option 060)

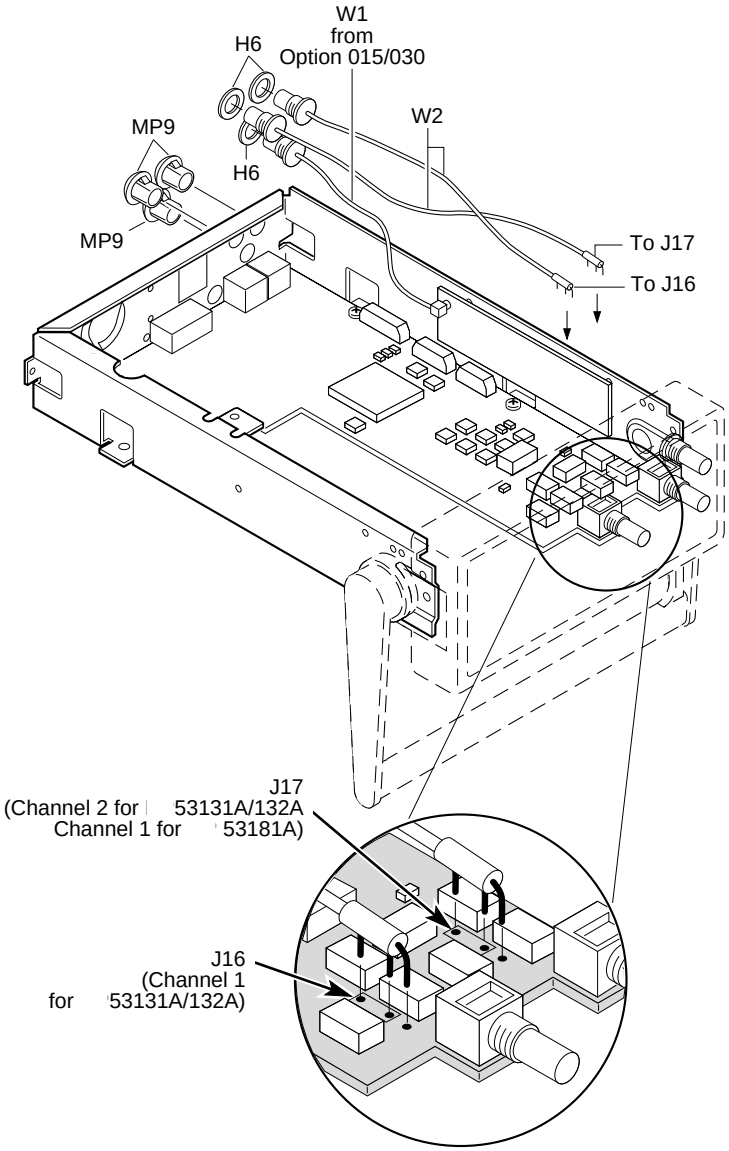


Figure 4-3B. Rear Terminals Retrofitting

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4 Insert the connector-end of the W1, with the washers (H6) in place on the connector, through the appropriate rear *INPUTS* opening.

5 Insert and tighten the BNC nuts (H3) to secure the coaxial cables to the rear of the chassis.

6 Solder the lead-end of the cables to their appropriate ground and input pads on A1 Motherboard Assembly (J16, J17)

For the Agilent 53131A/132A solder the rear chassis **INPUTS 1** cable to J16 and **INPUTS 2** to J17. (See Figure 4-3B.)

For the Agilent 53181A solder the rear chassis **INPUTS 1** cable to J17. (See Figure 4-3B.)

7 Re-install the cover by performing the cover removal procedure, in Chapter 3 of this guide, in reverse.

This completes the Rear Terminals (Option 060) retrofit procedures.

NOTE

When using the front terminals of Inputs 1 and 2, the rear terminals should be terminated with a 50-ohm load (such as part number 1250-0207). When using the rear terminals, these loads should be placed on the front terminals, or the 50-ohm input button selected (but not both).

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5

Replaceable Parts

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Introduction

This chapter contains information for ordering parts. Table 5-1 lists the exchange assemblies. Table 5-2 lists reference designations used in the parts list and throughout the guide, and Table 5-3 lists all replaceable assemblies and parts for the Agilent 53131A/132A/181A Counter. Table 5-4 is a list of manufacturer's code numbers given in the parts list (Table 5-3). It contains the names and addresses corresponding to the code number of the manufacturer. Figure 5-1 is an exploded view of the Agilent 53131A/132A/181A.

Exchange Assemblies

Table 5-1 lists assemblies within the Agilent 53131A/132A/181A that may be replaced on an exchange basis. Factory repaired and tested exchange assemblies are available only on a trade-in basis. Defective assemblies must be returned for credit. (Note that the part numbers for the new and exchange assemblies are also listed in Table 5-3.)

Table 5-1. Exchange Assemblies

Assembly Name	Agilent Part No.	Exchange Part No.*
A1 Motherboard (**Agilent 53131A**)	53131-60004	53131-69004
A1 Motherboard (**Agilent 53132A**)	53132-60014	53132-69014
A1 Motherboard (**Agilent 53181A**)	53181-60004	53181-69004
A3 Channel 3 Input Board		
Option 015, 1.5 GHz	n/a	53132-60003
Option 030, 3 GHz	n/a	53132-60003
Option 050, 5 GHz	n/a	53132-69211
Option 124, 12.4 GHz	n/a	53132-69212
A6 High Stability Oven Timebase (Option 010)	10811-60160	10811-69160
A6 Ultra-High Stability Oven Timebase (Option 012)	10811-60260	10811-69260

* Exchange part availability subject to change without notice. Contact your local Agilent Technologies Sales Office for current information.

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Reference Designations

Table 5-2 lists the reference designations used in the parts lists, block diagrams, and throughout the guide.

Replaceable Parts

Table 5-3 is a list of replaceable parts and is organized as follows:

Electrical assemblies in alphanumerical order by reference designation.

1. Electrical assemblies in alphanumerical order by reference designation.
2. Chassis-mounted electrical parts in alphanumerical order by reference designation.
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. Agilent Technologies part number.
3. Part number check digit (CD).
4. Total quantity (QTY) in instrument. The total quantity is given once and at the first appearance of the part number in the list.
5. Description of the part.
6. Typical manufacturer's part number for the part.

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How To Order A Part

Agilent Technologies wants to keep your parts ordering process as simple and efficient as possible. To order parts perform the following steps:

1 Identify the part and the quantity you want.

2 Determine the ordering method to be used and contact Agilent Technologies.

Parts Identification

To identify the part(s) you want, first refer to the exploded view in Figure 5-1 at the back of this chapter or Figure 2-8A and Figure 2-8B in Chapter 2, “Service.”

When ordering from Agilent Technologies, the important numbers to note from the Parts List are the Agilent 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 guide, you can call on Agilent Technologies for help (see the following section titled “Contacting Agilent Technologies”). Please have the following information at hand when you contact Agilent Technologies for help:

- Instrument Model Number (example, “Agilent 53131A”).
- Complete instrument Serial Number (example, “1234A56789”). Information about where to find the serial number is given in the preface of this guide in the section titled “How to Use This Guide.”
- Description of the part and its use.
- Quantity of the part required.

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Contacting Agilent Technologies

Depending on where you are in the world, there are one or more ways in which you can get parts or parts information from Agilent Technologies.

- Outside the United States, contact your local Agilent Technologies sales office.
- Within the United States, we encourage you to order replacement parts or request parts information directly by telephone or mail from the Agilent Support Materials Organization, using the telephone numbers or address listed on the next page. (You can also contact your local Agilent Technologies sales office. Agilent Technologies sales offices are listed at the back of this package.)

By telephone:

– For Parts Ordering use our toll-free number, (800) 227-8164, Monday through Friday (except Holidays), 6 a.m. to 5 p.m. (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 other times, use (916) 785-8460.

– For Parts Identification Assistance, call us at (916) 783-0804

  Our Parts Identification hours are from Monday through Friday, 6 a.m. to 5 p.m. (Pacific Time).

For mail correspondence, use the address below:

Agilent Technologies
Support Materials Roseville
P. O. Box 1145
Roseville, CA 95661-1145

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Cabinet Parts and Hardware

To locate and identify miscellaneous cabinet and chassis parts and instrument hardware, refer to Figure 2-8A, Figure 2-8B, and Figure 5-1. These figures provide different views of the instrument, with the parts identified by reference designations; the reference designations correspond with the ones in Table 5-3.

Table 5-2. Reference Designation

A	= assembly	P/O	= part of
H	= hardware	S	= switch
J	= electrical connector (stationary portion); jack	T	= transformer
		TP	= test point
MP	= miscellaneous mechanical part	U	= integrated circuit; microcircuit
P	= electrical connector (movable portion); plug	W	= cable; transmission path; wire

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Table 5-3. Agilent 53131A/132A/181A Replaceable Parts

Reference Designation	Agilent Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				EXCHANGE ELECTRONIC ASSEMBLIES		
A1 (Agilent 53131A)	53131-60004	2	1	MOTHERBOARD	28480	53131-60004
	53131-69004	0	1	MOTHERBOARD (EXCHANGE RESTORED)	28480	53131-69004
A1 (Agilent 53132A)	53132-60014	8	1	MOTHERBOARD	28480	53132-60014
	53132-69014	6	1	MOTHERBOARD (EXCHANGE RESTORED)	28480	53132-69014
A1 (Agilent 53181A)	53181-60004	2	1	MOTHERBOARD	28480	53181-60004
	53181-69004	0	1	MOTHERBOARD (EXCHANGE RESTORED)	28480	53181-69004
A3 (Agilent 53181)	53132-60003	5	1	OPTION 015, 1.5 GHz INPUT BOARD (RESTORED)	28480	53132-60003
A3	53132-60003	3	1	OPTION 030, 3 GHz INPUT BOARD (RESTORED)	28480	53132-60003
A3	53132-69211		1	OPTION 050, 5 GHz INPUT BOARD (RESTORED)	28480	53132-69211
A3	53132-69212		1	OPTION 124, 12.4 GHz INPUT BOARD (RESTORD)	28480	53132-69212
				ELECTRONIC ASSEMBLIES		
A2	53131-60002	3	1	DISPLAY BOARD	28480	53131-60002
A4 (Standard)	0950-2496	7	1	AC POWER SUPPLY (STANDARD)	28480	0950-2496
A4 (Option 002)	53132-60207	1	1	OPTIONAL AC POWER SUPPLY (002)	28480	53132-60207
A4 (Option 010/012)	53132-60208	2	1	OPTIONAL AC POWER SUPPLY (010 OR 012)	28480	53132-60208
A5 (Option 002)	53132-60206	0	1	OPTIONAL DC POWER SUPPLY (002)	28480	53132-60206
				CHASSIS PARTS		
H1	0515-0433	6	6	SCREW-MACH TORX 15	00000	ORDER BY DESCRIPTION
H2	0515-0430	3	3	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
H3	2940-0256	4	2	NUT-BNC	00000	ORDER BY DESCRIPTION
H4	0380-1332	7	2	SCREW-STDF, GPIB CONN HEX	00000	ORDER BY DESCRIPTION
H5	2190-0577	1	2	WASKER-LOCK	00000	ORDER BY DESCRIPTION
H6	0590-0505		1	NUT-KNURLED	00000	ORDER BY DESCRIPTION
MP1	53131-00001	6	1	CHASSIS	28480	53131-00001
MP1 (Option 002)	53131-00010	6	1	CHASSIS, OPTION 002	28480	53131-00010
MP2	34401-86010		1	FRONT/REAR RUBBER BUMPER KIT	28480	34401-86010
p/o MP2	34401-86011		1	FRONT RUBBER BUMPER	28480	34401-86011
p/o MP2	34401-86012		1	REAR RUBBER BUMPER	28480	34401-86012
MP3	53131-00012	9	1	COVER	28480	53131-00012
MP4	53131-40009	8	1	FRONT BEZEL	28480	53131-40009
MP5 (Agilent 53131A)	53131-40015	6	1	WINDOW FOR Agilent 53131A	28480	53131-40015
MP5 (Agilent 53132A)	53132-40003	3	1	WINDOW FOR Agilent 53132A	28480	53132-40003
MP5 (Agilent 53181A)	53181-40013	4	1	WINDOW FOR Agilent 53181A	28480	53181-40013
MP6 (Agilent 53131A/132A)	53131-40010	1		KEYPADS FOR Agilent 53131/132A	28480	53131-40010
MP6 (Agilent 53181A)	53181-40012	3		KEYPADS FOR Agilent 53181A	28480	53181-40012
MP7	34401-45011		1	HANDLE	28480	34401-45011
MP8	53131-80038	7	1	REAR LABEL	28480	53131-80038
MP9	6960-0167	2	3	PLUG, HOLE 0.5-IN DIA	28480	6960-0167
	0403-0424	8	1	RUBBER FOOT, BLACK	76381	SJ-5023
	5041-0564	4	1	CAP	28480	5041-0564

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Table 5-3. Agilent 53131A/132A/181A Replaceable Parts (continued)

Reference Designation	Agilent Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	34401-88304	3	1	REAR PLASTIC BEZEL	28480	34401-88304
OPTION 001				**MEDIUM STABILITY TIMEBASE ASSY**		**OPTION 001**
A6	53132-60008	0	1	TIMEBASE SUPPORT BOARD	28480	53131-60008
	1813-0931	2	1	OSCILLATOR-OVEN	28480	1813-0931
H2	0515-0430	3	3	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
OPTION 002				**DC POWER INPUT ASSY**		**OPTION 002**
A5	53132-60206	0	1	DC POWER INPUT ASSY	28480	53132-60206
MP10	53131-00010	7	1	CHASSIS FOR OPT 002	28480	53131-00010
MP11	53131-80039	8	1	REAR LABEL	28480	53131-80039
	0515-0372	3	4	SCREW-MACH TORX 10 8MM LG	00000	ORDER BY DESCRIPTION
	E9640A	6	1	XLR 3-11 CONNECTOR	05276	5109 3-11
OPTION 010				**HIGH STABILITY TIMEBASE ASSY**		**OPTION 010**
A6	53132-60016		3	OSCILLATOR SUPPORT BOARD	28480	53132-60016
	10811-60160		1	OSCILLATOR-OVEN	28480	10811-60160
H2	0515-0430	3	3	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
H7	2360-0331	6	1	SCREW-MACH POZIDR 6-32 0.25-IN-LG	00000	ORDER BY DESCRIPTION
OPTION 012				**ULTRA-HIGH STABILITY TIMEBASE ASSY**		**OPTION 012**
A6	53132-60016		3	OSCILLATOR SUPPORT BOARD	28480	53132-60008
	10811-60260		1	OSCILLATOR-OVEN	28480	10811-60211
H2	0515-0430	3	4	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
H7	2360-0331	6	1	SCREW-MACH POZIDR 6-32 0.25-IN-LG	00000	ORDER BY DESCRIPTION
OPTION 015				**1.5 GHz CHANNEL ASSY**		**OPTION 015**
A3	Exchange only		1	1.5 GHz CHANNEL ASSY	28480	
	8120-6142	7	1	CABLE-COAXIAL INPUT	28480	8120-6142
MP5 (Agilent 53181A only)	53181-40015	6	1	WINDOW, 1.5 GHz, FOR Agilent 53181A ONLY	28480	53181-40015
H2	0515-0430	3	4	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
OPTION 030				**3.0 GHz CHANNEL ASSY**		**OPTION 030**
A3	53132-60003		1	3.0 GHz CHANNEL ASSY	28480	
W1	8120-6142	7	1	CABLE-COAXIAL INPUT	28480	8120-6142
MP5 (Agilent 53181A only)	53181-40014	5	1	WINDOW, 3.0 GHz, FOR Agilent 53181A ONLY	28480	53131-40014
H2	0515-0430	3	4	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
OPTION 050				**5.0 GHz CHANNEL ASSY**		**OPTION 050**
A3	Exchange only		1	5.0 GHz CHANNEL ASSY	28480	
	0515-0430	3	3	SCREW-MACH TORX 10	00000	ORDER BY DESCRIPTION
MP4	53131-40016		1	FRONT PANEL, OPT 050	28480	53131-40016
	0590-0505	1	1	KNURLED NUT	28480	0590-0505
MP5 (Agilent 53181A only)	53181-40017	8	1	WINDOW, 5 GHz, FOR Agilent 53181A ONLY	28480	53181-40017
MP2	53131-40014	5	1	BEZEL	28480	53131-40014

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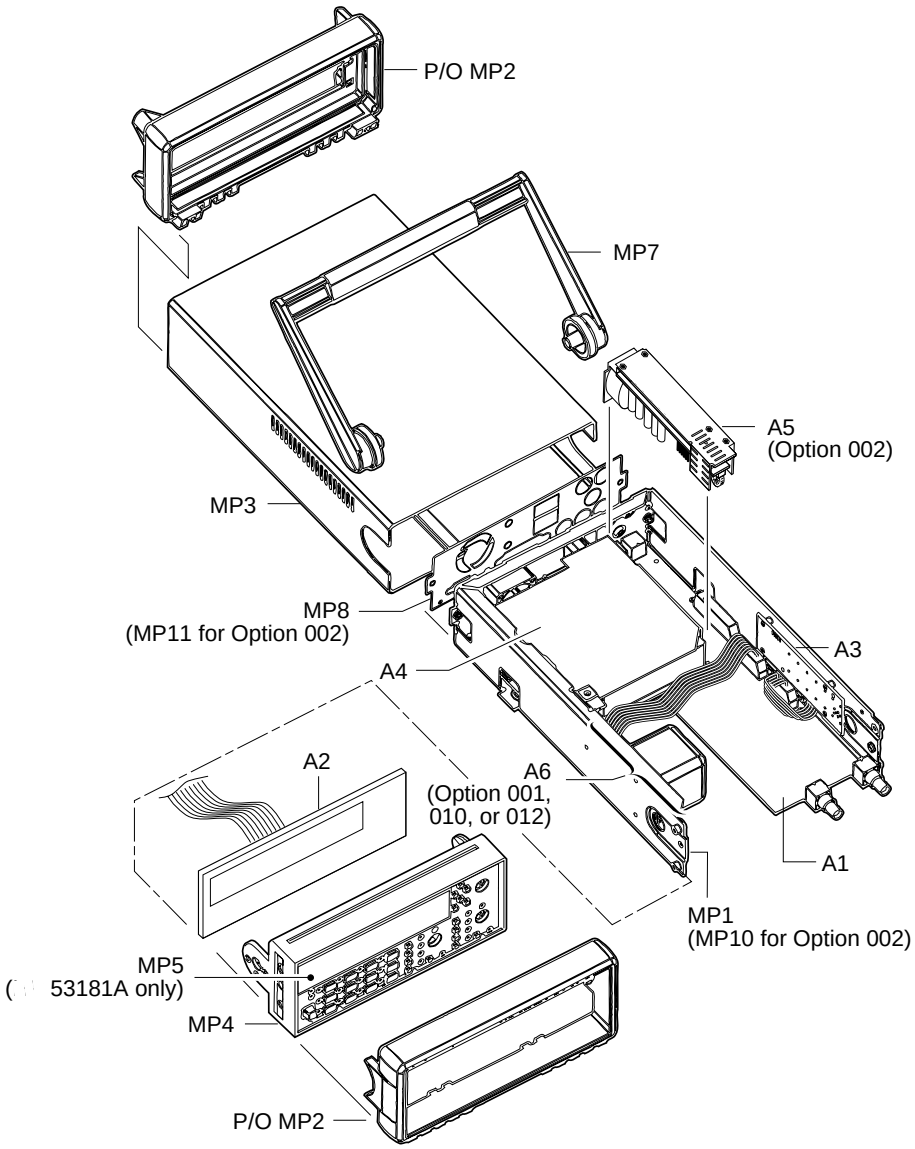


Figure 5-1. Agilent 53131A/132A/181A Exploded View (Chassis Parts and Assemblies)

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Table 5-3. Agilent 53131A/132A/181A Replaceable Parts (Continued)

Reference Designation	Agilent Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
OPTION 060				**REAR TERMINALS**		**OPTION 060**
W2	8120-6150	7	2	CABLE-COAXIAL ASSY (Only one is needed for the Agilent 53131A)	28480	8120-06150
H6	2190-0068	3	2	WASHER-BNC	00000	ORDER BY DESCRIPTION
H3	2940-0256	4	2	NUT-BNC (Only one is needed for 53181A)	00000	ORDER BY DESCRIPTION
OPTION 124				**12.4 GHz CHANNEL ASSY**		**OPTION 124**
A3	Exchange only		1	12.4 GHz CHANNEL 3 ASSY	28480	
H2	0515-0430		2	SCREW-MACH TORX 10	28480	ORDER BY DESCRIPTION
MP4	53131-40008		1	FRONT PANEL, OPT 124	28480	53131-40008
MP5 (Agilent 53181A only)	53181-40009		1	WINDOW, 12.4 GHz, FOR Agilent 53181A ONLY)	28480	53181-40009
H6	0590-0505		1	NUT-KNURLED	28480	0590-0505
MP2	53131-40014		1	BEZEL	28480	53131-40014

Table 5-4. Manufacturer's Code List.

Mfr Code	Manufacturer Name	Address		Zip Code
00000	ANY SATISFACTORY SUPPLIER			
28480	AGILENT TECHNOLOGIES CORPORATE HQ	PALO ALTO	CA	94304
76381	3M CO	ST PAUL	MN	55144
05276	ITT POMONA ELECTRONICS DIV	POMONA	CA	91766

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6

Backdating

Manual Changes

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6

Introduction

This chapter contains information necessary to adapt this guide to apply to older instruments.

The backdating information includes the following:

- Backdating Hardware page 6-3
- Backdating Firmware page 6-8
- Backdating Specifications page 6-16

Manual Changes

This guide applies directly to Counters with the following serial prefixes listed in Table 6-1.

Table 6-1. Instrument this Guide Directly Applies To

Instrument	Serial Prefix Number
Agilent 53131A Universal Counter	3711
Agilent 53132A Universal Counter	3710
Agilent 53181A Frequency Counter	3711

As engineering changes are made, newer instruments may have higher serial prefix numbers than the one shown on the title page of this guide. The guides for these instruments will be supplied with “Manual Updating Changes” package containing the required information. Replace the affected pages or modify existing guide information as directed in the pages of the Manual Updating Changes package. Contact the nearest Agilent Technologies Sales and Support Office.

Older Instruments

To adapt this guide to older Agilent 53131A/132A/181A Counters having a serial prefix lower than 3711, perform the backdating provided in the following sections.

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Backdating Hardware

CHANGE 1 (Below Series Prefix 3711A)

Page 2-40, Table 2-1. Agilent 53131A Assembly Identification:

Change A1 Motherboard part number from 53131-60004 to 53131-60001.

Page 2-42, Table 2-1. Agilent 53181A Assembly Identification:

Change A1 Motherboard part number from 53181-60004 to 53181-60001.

Page 5-7, Table 5-3. Agilent 53131A/132A/181A Replaceable Parts:

53131A—Change A1 Motherboard part number from 53131-60004 to 53131-60001.

53181A—Change A1 Motherboard part number from 53181-60004 to 53181-60001.

CHANGE 2 (New A3 5/12.4 GHz Prescaler Assembly)

Page 2-40/Page 2-42, Table 2-1/Table 2-3. Agilent 53131A/132A/181A Assembly Identification:

Change A3 Channel 3 Input Board (Option 050) part number from 53132-60212 to 53132-60211; exchange part numbers change from 53132-69212 to 53132-69211.

Page 5-7, Table 5-3. Agilent 53131A/132A/181A Replaceable Parts:

Change A3 Channel 3 Input Board (Option 050) part number from 53132-60212 to 53132-60211; exchange part numbers change from 53132-69212 to 53132-69211.

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CHANGE 3 (New TCXO boards)

Page 2-47. Troubleshooting the Counter

Add the following as step 4a:

4a If the Counter under test contains Option 010 or 012 High Stability Timebase, perform the following:

a. Disconnect the power supply's two-wire cable from J2 of A6 High Stability Timebase Assembly as shown in Figure 2-10.

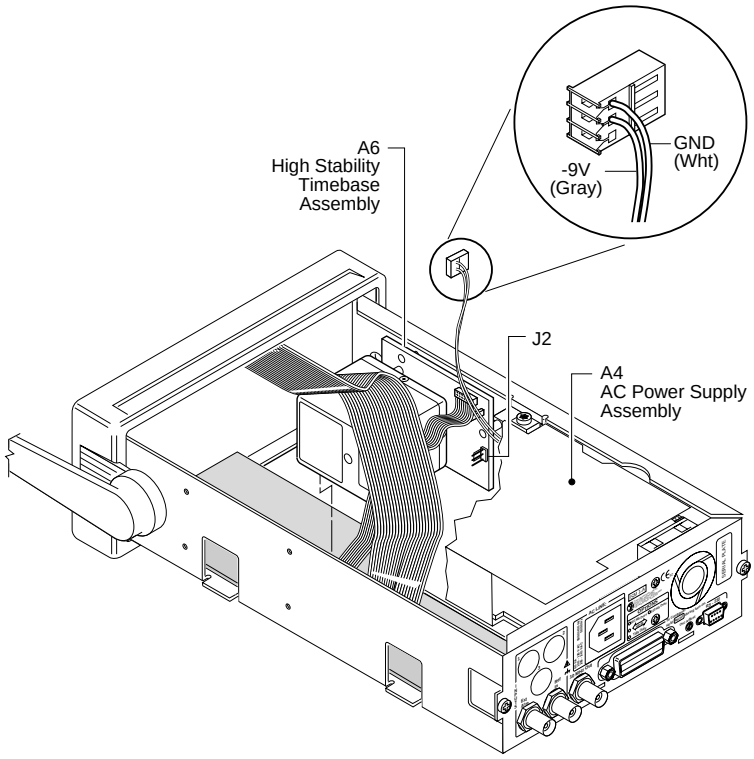


Figure 2-10. A4 AC Power Supply -9V Output Check (Option 010/012 Only)

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b. Connect the negative lead of a voltmeter to the white wire connection (GND) on the connector of the two-wire cable, and connect the positive lead to the gray wire connection (-9V) as shown in Figure 2-10.

Verify a reading of -9.0 ± 0.45 V.

Page 5-7, Table 5-3. Agilent 53131A/132A/181A Replaceable Parts:

Change A6 Options 001, 010, and 012 Timebase Support Board from 53132-60016 to 53132-60008.

Change A6 Option 010 Oscillator-Oven from 10811-60160 to 10811-60111.

Change A6 Option 012 Oscillator-Oven from 10811-60260 to 10811-60211.

CHANGE 4 (Series 3710A to 3705A)

53132A Only (Firmware Revision 3646A to 3546A)

Page 2-41, Table 2-1. Agilent 53132A Assembly Identification:

Change A1 Motherboard part number from 53132-60014 to 53132-60001.

Page 5-7, Table 5-3. Agilent 53131A/132A/181A Replaceable Parts:

Change A1 Motherboard (53132A) part number from 53132-60014 to 53132-60001.

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CHANGE 5 (Series 3705A to 3546A, 3548A)

Chassis color change only.

:Page 5-7/Page 5-10, Table 5-3. Agilent 53131A/132A/181A Replaceable Parts:

Reference Designator/ Description	Series 3705A	Series 3546A (53131A/132A) Series 3548A (53181A)
MP2 Bumper/Cover Kit	34401-86010	34401-86000
MP3 Cover	53131-00012	53131-00002
MP4 Front Bezel (53131/132A) MP4 Front Bezel (53181A)	53131-40009 53181-40011	53131-40001 53181-40001
MP5 Window (53131A) MP5 Window (53132A) MP5 Window (53181A)	53131-40015 53132-40003 53181-40013	53131-40002 53132-40001 53181-40003
MP6 Keypad	53131-40010	53131-40003
MP7 Handle	34401-45011	34401-45001
MP8 Rear Label	53131-80038	53131-80002
Kit-Rack Mount	5063-9240	5062-3972

Option 002

MP10 Option 002 Rear Label	53131-80039	53131-80013

Option 015

MP5 Window 1.5 GHz (53181A)	53181-40015	53181-40005

Option 030

MP5 Window, 3.0 GHz (53181A)	53181-40014	53181-40004

Option 050

Front Panel, 5 GHz (53131/132A)	53131-40012	53131-40006
Front Panel, 5 GHz (53181A)	53181-40016	53181-40006
MP5 Window, 5 GHz (53181A)	53181-40017	53181-40007

CHANGE 6 (Below Series Prefix 3416A)

This change deleted three unnecessary connectors from the A1 (53131-60001) board.

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CHANGE 7 (Below Serial Number 3349A01906)

Page 5-7, Table 5-3. Replaceable Parts, under A1 (for the Agilent 53131A):

[1]Add 53131-00004; 9; 1; SHIELD UPPER; 28480; 53131-00004

[1]Add 53131-00005; 0; 1; SHIELD LOWER; 28480; 53131-00005

[1]Add 53131-00008; 3; 1; SHIELD CHASSIS; 28480; 53131-00008

[1]Add 53131-00009; 4: 1; GROUND CONNECTION 28480; 53131-00009

Change A4 (Standard) Agilent Part Number from 0950-2496 to 0950-2139.

Note: A4 AC Power Supply Assembly 0950-2496 allows 400 Hz operation from 100-120V.

[1] These shields were needed to reduce susceptibility to EMI. However, the shields are not needed on A1 Motherboard Assembly if the metalized front bezel is used in the Counter. Thus, when you order a new A1 Motherboard Assembly (53131-60001, same part number as the old A1) for your Agilent 53131A Counter, you need to order a new metalized front bezel (53131-40003, same part number of the old non-metalized front bezel).

CHANGE 8 (Below Serial Prefix 3404A)

Page 5-7, Table 5-3. Replaceable Parts:

Change, under OPTION 001, A6 Agilent Part Number from 53132-60008 to 53132-60004.

Change, under OPTION 001, 1812-0931; OSCILLATOR-OVEN; to 1812-0932; OSCILLATOR-OVEN.

Change, under OPTION 010, A6 Agilent Part Number from 53132-60008 to 53132-60005.

Change, under OPTION 010, 10811-60111; OSCILLATOR-OVEN; to BLILEY OSCILLATOR-OVEN.

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Backdating Firmware

CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427)

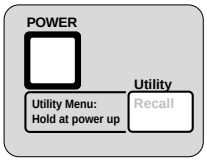
(Note: firmware revision 3413 added the new security menu item and the new Calibration Menu to the Agilent 53131A Counter.)

(Note: firmware revision 3427 was set up to work with the new FPGA [Xilinx 3042A]; and shortens TI delay from 1 ms to 100ms. This revision is backward compatible.

Page 2-6 thru Page 2-15 ("About the Agilent 53131A/132A Calibration Menu," and "The Agilent 53131A/132A Calibration Procedures" sections).

Replace with the following calibration information and procedures:

About the Agilent 53131A Calibration Menu



The Utility menu is accessed by holding the **Recall** key and cycling **POWER** key.

The Utility menu's calibration items, illustrated on the following page, provide you with the functions to:

- initiate the Counter's calibration routines, which can perform automatic calibration of the voltage offset and gain of the front-end input amplifiers, and optional timebase
  (**CAL: OFFS 1 / 2 ?, GAIN 1 / 2 ?, TIMEBAS ?,** and **TI 1→2?**).

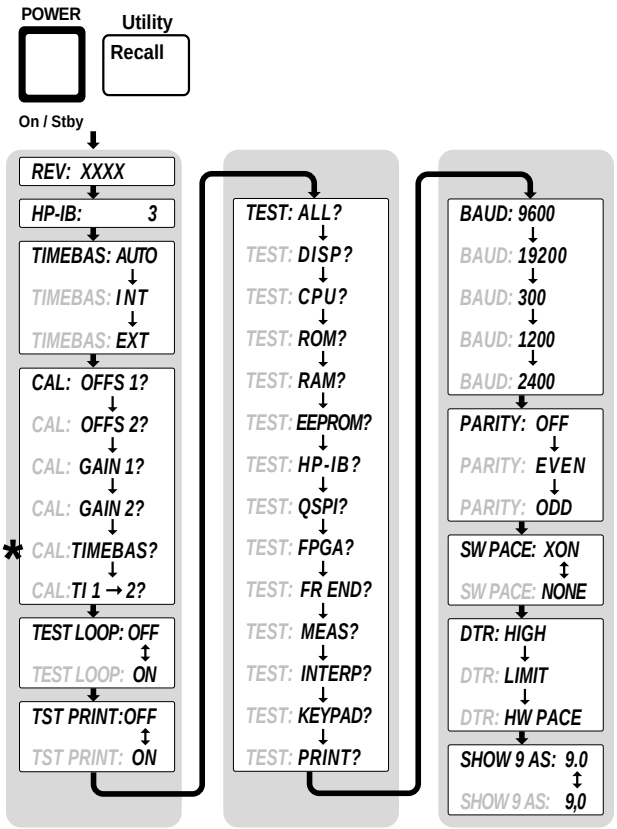
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CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

The Agilent 53131A Utility/Calibration Menu Tree

NOTE

Turn power off, press and hold Recall (**Utility**) key, then press **POWER** key to access this menu.



*Timebase can be automatically calibrated only if the timebase option is installed.

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CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

The Agilent 53131A Calibration Procedures

To Calibrate the Offset for Channels 1 and 2

1 **To access the Utility menu, power down, and press and hold the *Recall (Utility)* key, then press *POWER* key.**

2 **Press *Recall (Utility)* key until *CAL: OFFS 1 ?* is displayed.**

3 **Press *Enter* key.**

The display will ask you to remove any signals connected to Channel 1. Follow the instruction.

4 **Press *Enter* key.**

The Counter momentarily displays ***CALIBRATING***, and then it should display ***OFFS 1 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

5 **To calibrate Channel 2, press any one of the arrow keys until *CAL: OFFS 2 ?* is displayed.**

6 **Press *Enter* key.**

The display will ask you to remove any signals connected to Channel 2. Follow the instruction.

7 **Press *Enter* key.**

The Counter momentarily displays ***CALIBRATING***, and then it should display ***OFFS 2 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

This completes the Offset Calibration procedure. Proceed to the next procedure to calibrate the gain.

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CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

To Calibrate the Gain for Channels 1 and 2

1 **Press any one of the arrow keys until *CAL: GAIN 1 ?* is displayed.**

2 **Press *Enter* key.**

A scrolling message is displayed. Follow the instruction by performing the following steps.

3 **Connect a BNC tee connector to Channel 1 of the Counter.**

4 **Connect the Counter, dc power supply, and multimeter as shown in Figure 2-1.**

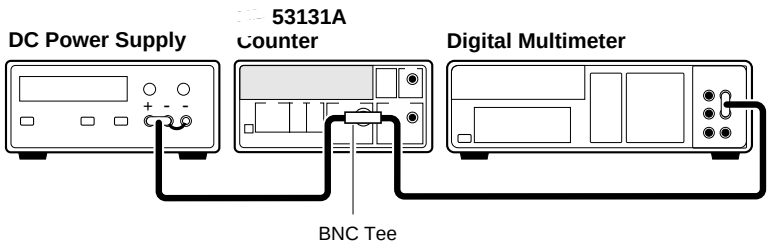


Figure 2-1. Gain Calibration Setup

5 **Adjust the power supply until the multimeter displays + 5.000 V ± 0.001 V.**

6 **Disconnect the digital multimeter from the Counter to prevent noise from being introduced into the measurement.**

7 **Press *Enter* key.**

The Counter momentarily displays ***CALIBRATING***, and then it should display ***GAIN 1 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

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CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

8 To calibrate the gain for Channel 2, connect the input or the BNC Tee to Channel 2 of the Counter.

9 Press any one of the arrow keys until *CAL: GAIN 2 ?* is displayed.

10 Press *Enter* key.

A scrolling message is displayed. (The +5V dc supply should already be connected to Channel 2 as you were previously instructed to do this in step 8.)

11 Press *Enter* key again.

The Counter momentarily displays ***CALIBRATING***, and then it should display ***GAIN 2 PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

12 Disconnect the calibration setup.

This completes the Gain Calibration procedure. Proceed to the next procedure to calibrate the time interval.

To Calibrate Time Interval

1 Press any one of the arrow keys until *CAL: TI → 2?* is displayed.

2 Press *Enter* key.

A scrolling message with instructions appears. Follow the instruction by performing the following procedure.

3 Connect the Agilent 8130A Pulse Generator output to Channel 1 of the Counter as shown in Figure 2-3.

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CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

Equipment

Agilent 8130A Pulse Generator (or equivalent)
Agilent 10503A BNC Cable

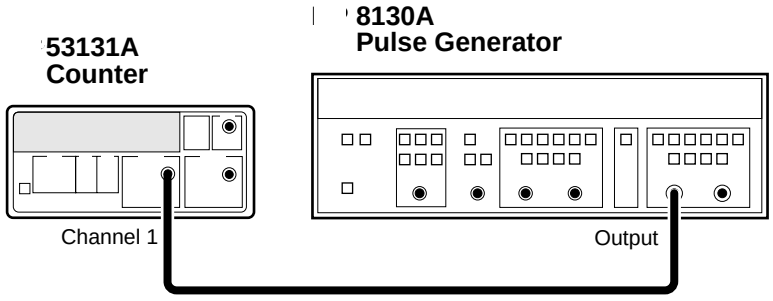


Figure 2-3. TI Calibration Setup

4 Set the Agilent 8130A as follows:

PERIOD: 100 ns
WIDTH: 50 ns
High: 0.50 VLow : -0.50 V
Input Mode: Normal

NOTE Any external timebase connected to the Counter is ignored during this calibration.

5 Press *Enter* key.

The Counter displays ***CALIBRATING***, and then it should display ***TI CAL PASS***.

If the fail message is displayed, refer to the troubleshooting section in this chapter.

CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

6 Disconnect the calibration setup.

This completes the TI QUIK? calibration procedures.

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Depending on which timebase the Counter contains, proceed to the following procedure “To Calibrate the Standard Timebase” or the “To Calibrate the High Stability Timebase Option (Medium or High)” procedure to calibrate the timebase.

To Calibrate the Standard Timebase

1 **Connect the output of a 10 MHz house standard to Channel 1 of the Counter as shown in Figure 2-4.**

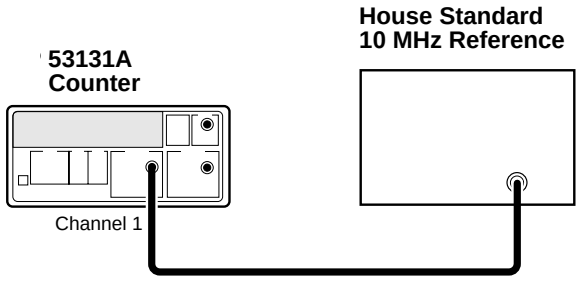


Figure 2-4. Standard Timebase Calibration Setup

2 **Cycle the *POWER* key to preset the Counter.**

3 **With an insulated tuning tool, turn the *OSC Adjust* potentiometer (located on the rear chassis of the Counter) until the frequency reading in the Counter display is 10.00000000 MHz ± 5 Hz.**

The Counter will be calibrated to the house standard.

If you are not able to adjust the frequency correctly, refer to the troubleshooting section in this chapter.

This completes the Standard Timebase Calibration procedure.

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CHANGE 1 (Firmware Revisions 3317, 3335, 3402, 3427) (Continued)

To Calibrate the High Stability Timebase Option (Medium or High)

NOTE

Allow the Counter to warm up for approximately 30 minutes before performing this calibration. This calibration is unlikely to fail, unless the Counter is not warmed up.

1 Connect the output of a 10 MHz house standard to Channel 1 of the Counter as shown in Figure 2-4.

2 Press any one of the arrow keys until CAL: TIMEBAS? is displayed.

Note that the timebase choice (CAL: TIMEBAS?) only appears when the Timebase Option is installed.

3 Press *Enter* key and follow the instructions in the scrolling message that appears in the Counter display.

4 Press *Enter* key after each instruction.

The Counter displays ***CALIBRATING***, and then it should display ***TB CAL PASS***.

If the fail message is displayed (even after the Counter has been warmed up for 30 minutes), refer to the troubleshooting section in this chapter.

This completes the High Stability Timebase Option Calibration procedure.

If all tests passed, the Counter is now calibrated.

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Backdating Specifications

CHANGE 1 (53131A, Serial Prefix 3710A and Below)

Page 7-3, External Arm Input Specifications:

Change the Signal Input Range specification

from:

TTL Compatible

to:

High-Level Input: >3.0 V
Low-Level Input: <1.5 V

CHANGE 2 (53132A, Serial Prefix 3546A and Below)

Page 7-3, External Arm Input Specifications:

Change the Signal Input Range specification

from:

TTL Compatible

to:

High-Level Input: >3.0 V
Low-Level Input: <1.5 V

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CHANGE 3 (53181A, Serial Prefix 3711A02841 and Below)

Page 8-3, External Arm Input Specifications:

Change the Signal Input Range specification

from:

TTL Compatible

to:

High-Level Input: >3.0 V
Low-Level Input: <1.5 V

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Agilent 53131A/132A Specifications

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7

Introduction

The specifications of the Agilent 53131A/132A Universal Counter are provided in this chapter.

Instrument Inputs

Channel 1 & 2 Input Specifications[1]

Frequency Range

DC Coupled:	DC to 225 MHz
AC Coupled:	1 MHz to 225 MHz (50 Ω) 30 Hz to 225 MHz (1 MΩ)
FM Tolerance:	25%

Voltage Range and Sensitivity (Sinusoid)[2]

DC to 100 MHz:	20 mVrms to ±5 V ac + dc (75 mVrms with optional rear connectors)[3]
100 MHz to 200 MHz:	30 mVrms to ±5 V ac + dc (75 mVrms with optional rear connectors)[3]
200 MHz to 225 MHz:	40 mVrms to ±5 V ac + dc (75 mVrms with optional rear connectors)[3]

Voltage Range and Sensitivity (Single-Shot Pulse)[2]

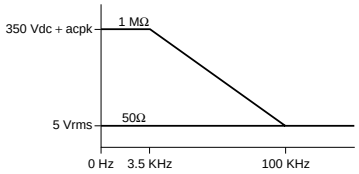
4.5 ns to 10 ns Pulse Width:	100 mVpp to 10 Vpp (150 mVpp with optional rear connectors)[3]
>10 ns Pulse Width:	50 mVpp to 10 Vpp (100 mVpp with optional rear connectors)[3]

Trigger Level[2]

Range:	±5.125 V
Accuracy:	±(15 mV + 1% of trigger level)
Resolution:	5 mV

Damage Level

50 Ω	5 Vrms
0 to 3.5 kHz, 1 MΩ	350 V dc + ac pk
3.5 kHz to 100 kHz, 1 MΩ	350 V dc + ac pk linearly derated to 5 Vrms
>100 kHz, 1 MΩ	5 Vrms



Channel 1 & 2 Input Characteristics[1]

Impedance:	1 MΩ or 50 Ω
1 MΩ Capacitance:	30 pF
Coupling:	AC or DC
Low-Pass Filter:	100 kHz (or disabled) –20 dB at > 1 MHz
Input Sensitivity:	Selectable between Low, Medium, or High (default). Low is approximately 2x High Sensitivity.

Trigger Slope: Positive or Negative

Auto Trigger Level

Range:	0 to 100% in 10% steps
Frequency:	> 100 Hz
Input Amplitude:	> 100 mVpp (No amplitude modulation)

Attenuator

Voltage Range:	x10
Trigger Range:	x10

[1] Specifications and Characteristics for Channels 1 and 2 are identical for both Common and Separate configurations.

[2] Values shown are for X1 attenuator setting. Multiply all values by 10 (nominal) when using the X10 attenuator setting. Note that it may be necessary to recalibrate the input offset in the application environment (especially at high temperature) to achieve maximum sensitivity.

[3] When ordered with optional rear terminals, the Channel 1 and 2 inputs are active on both the front and rear of the universal counter though the specifications provided only apply to the rear terminals. Performance for the front terminals is degraded, but may be improved by terminating the rear terminals into 50 Ω

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Instrument Inputs (Continued)

Channel 3 Input Specifications[4, 5]

Frequency Range

Option 030	100 MHz to 3 GHz
Option 050	200MHz to 5 GHz
Option 124	200 MHz to 12.4 GHz

Power Range and Sensitivity (Sinusoid)

Option 030

100 MHz to 2.7 GHz:	–27 dBm to +19 dBm
2.7 GHz to 3 GHz:	–21 dBm to +13 dBm

Option 050

200MHz to 5 GHz:	–23 dBm to +13 dBm

Option 124

200 MHz to 12.4 GHz	–23 dBm to +13 dBm

Damage Level:

Option 030	5 Vrms
Option 050	+25 dBm
Option 124	+25 dBm

Channel 3 Input Characteristics

Impedance:	50 Ω
Coupling:	AC
VSWR:	< 2.5:1

External Arm Input Specifications

Signal Input Range:

TTL compatible

Timing Restrictions:

Pulse Width:	> 50 ns
Transition Time:	< 250 ns
Start-to-Stop Time:	> 50 ns

Damage Level: 10 Vrms

External Arm Input Characteristics

Impedance:	1 kΩ
Input Capacitance:	17 pF
Start Slope:	Positive or Negative
Stop Slope:	Positive or Negative

Notes:
External Arm is available for all measurements except Peak Volts.

External Arm is referred to as External Gate for some measurements.

[4] Channel 3 is available as an option.

[5] When ordered with optional rear terminals, the Channel 3 connector on the front panel for Option 030 will be routed to the rear panel (rear panel only). There is no degradation in specifications for this input. Option 050 and Option 124 input connectors are available on the front panel only.

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Time Base

Internal Time Base Stability

		Standard (0° to 50°C)	Medium Stability Oven (Option 001)	High Stability Oven (Option 010)	Ultra High Stability Oven (Option 012)
Temperature Stability: (referenced to 25°C)		$< 5 \times 10^{-6}$	$< 2 \times 10^{-7}$	$< 2.5 \times 10^{-9}$	$< 2.5 \times 10^{-9}$
Aging Rate (after 30 days)	Per Day: Per Month: Per Year:	$< 3 \times 10^{-7}$	$< 4 \times 10^{-8}$ $< 2 \times 10^{-7}$	$< 5 \times 10^{-10}$ $< 1.5 \times 10^{-8}$	$< 1 \times 10^{-10}$ $< 3 \times 10^{-9}$ $< 2 \times 10^{-8}$
Turn-on stability vs. time: (in 30 minutes)			$< 2 \times 10^{-7}$ (referenced to 2 hours)	$< 5 \times 10^{-9}$ (referenced to 24 hours)	$< 5 \times 10^{-9}$ (referenced to 24 hours)
Calibration:		Manual Adjust	Electronic	Electronic	Electronic

Note that power to the time base is maintained when the counter is placed in standby via the front panel switch. The internal fan will continue to operate under this condition, to maintain long-term instrument reliability.

External Time Base Input Specifications

Voltage Range: 200 mVrms to 10 Vrms
Damage Level: 10 Vrms

External Time Base Input Characteristics

Threshold: 0 V
Impedance: 1 kΩ
Input Capacitance: 23 pF
Frequency (53131A): 1 MHz, 5 MHz or 10 MHz (automatic selection)
Frequency (53132A): 10 MHz

Internal vs. External Time Base Selection:

Manual: Select Internal or External
Automatic: Internal used when External not present (default)

Time Base Output Specifications

Output Frequency: 10 MHz
Voltage: > 1 Vpp into 50 Ω (centered around 0 V)

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Measurement Specifications

Frequency, Period

Channel 1 and 2 Range: 0.1 Hz to 225 MHz 4.44 ns to 10 s

Channel 3 Range:

Option 030	100 MHz to 3 GHz	0.33 ns to 10 ns
Option 050	200 MHz to 5 GHz	0.2 ns to 5 ns
Option 124	200 MHz to 12.4 GHz	80 ps to 5 ns

(Period 2 or 3 selectable only via the GPIB interface)

For Automatic or External Arming:

(and signals < 100 Hz using Timed Arming)

LSD Displayed:

$$\left(\frac{t_{res}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

RMS Resolution:

$$\left(\frac{\sqrt{t_{res}^2+(2\times Trigger\ Error^2)}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

	Agilent 53131A t_{res}	Agilent 53132A t_{res}
typical	650 ps	200 ps

see graphs for worst case resolution performance

For Automatic Arming: $Gate\ Time = \frac{N}{Frequency}$

where N = 1 for Ch1 or Ch2 Frequency < 1 MHz
4 for Ch1 or Ch2 Frequency > 1 MHz
128 for Ch3

Systematic Uncertainty: $\left(\pm Time\ Base\ Error \pm \frac{t_{acc}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$

	Agilent 53131A t_{acc}	Agilent 53132A t_{acc}
typical	350 ps	100 ps
worst case	1.25 ns	500 ps

Trigger: Default setting is Auto Trigger at 50%

For Time or Digits Arming:

LSD Displayed:

$$\left(\frac{2\sqrt{2}\times t_{res}}{Gate\ Time\times\sqrt{Number\ or\ Samples}}+\frac{t_{jitter}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

RMS Resolution:

$$\left(\frac{4\times\sqrt{t_{res}^2+2\times Trigger\ Error^2}}{Gate\ Time\times\sqrt{Number\ or\ Samples}}+\frac{t_{jitter}}{Gate\ Time}\right)x \begin{matrix}Frequency\\or\\Period\end{matrix}$$

	Agilent 53131A t_{res}	Agilent 53131A t_{jitter}	Agilent 53132A t_{res}	Agilent 53132A t_{jitter}
typical	500 ps	50 ps	225 ps	3 ps

see graphs for worst case resolution performance

Number of Samples =
Gate Time x Frequency (Frequency < 200 kHz)
Gate Time x 200,000 (Frequency > 200 kHz)

Systematic Uncertainty: $\left(\pm Time\ Base\ Error \pm \frac{t_{acc}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$

	Agilent 53131A t_{acc}	Agilent 53132A t_{acc}
typical	100 ps	10 ps
worst case	300 ps	100 ps

Trigger: Default setting is Auto Trigger at 50%

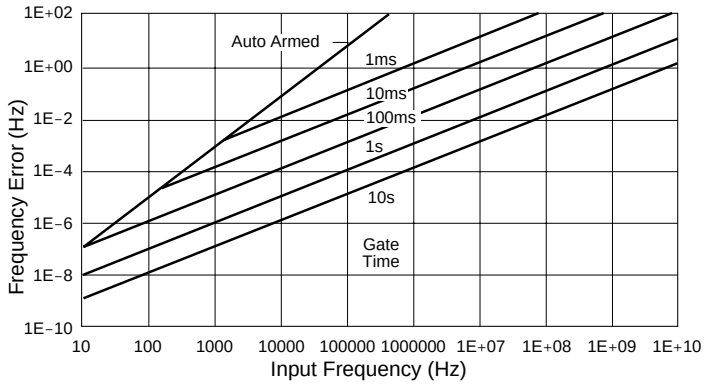
The following graphs may also be used to compute errors for Period Measurements. To find the Period error (ΔP), calculate the frequency of the input signal ($F = \frac{1}{P}$) and find the frequency error (ΔF) from the chart. Then, calculate the period error as: $\Delta P = \left(\frac{\Delta F}{F}\right)\times P$

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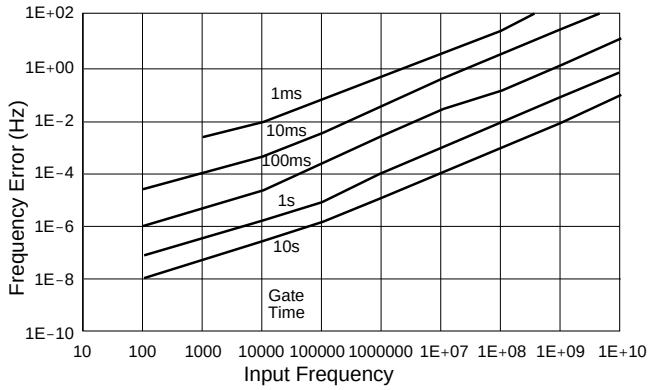
Measurement Specifications (Continued)

Agilent 53131A—Worst Case RMS Resolution

Automatic or External Arming:



Time or Digit Arming:



The preceding graphs do not reflect the effects of trigger error. To place an upper bound on the added effect of this error term, determine the frequency error from the appropriate graph and add a trigger error term as follows:

Automatic or External Arming

$$\text{Frequency Error} + \left(\frac{\sqrt{2} \times \text{Trigger Error}}{\text{Gate Time}}\right) \times \begin{matrix}\text{Frequency}\\ \text{or}\\ \text{Period}\end{matrix}$$

Time or Digit Arming

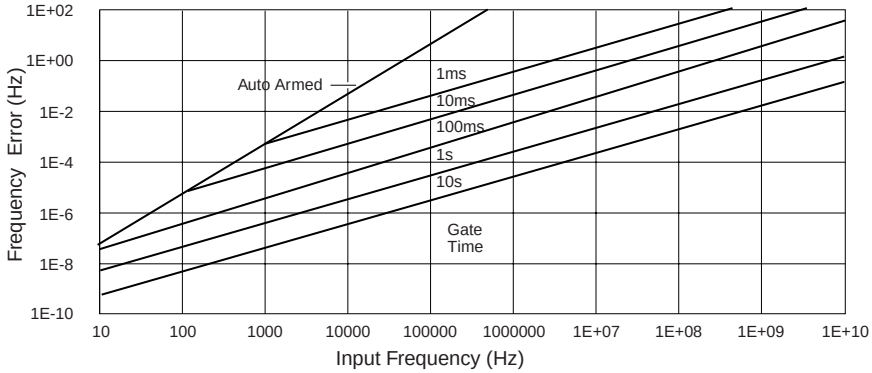
$$\text{Frequency Error} + \left(\frac{4 \times \sqrt{2} \times \text{Trigger Error}}{\text{Gate Time} \times \sqrt{\text{Number of Samples}}}\right) \times \begin{matrix}\text{Frequency}\\ \text{or}\\ \text{Period}\end{matrix}$$

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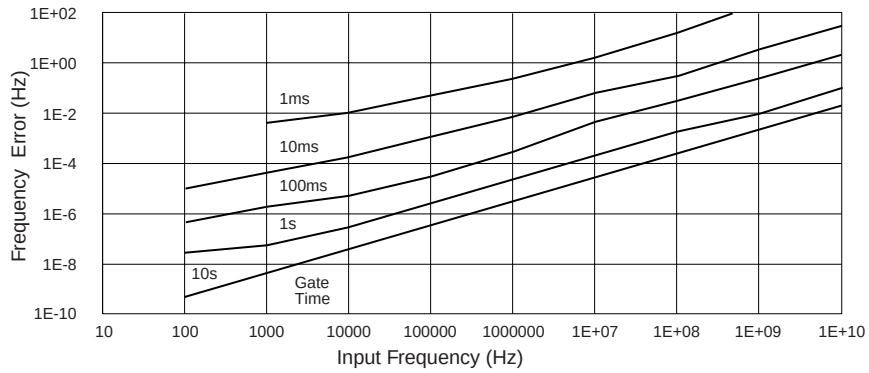
Measurement Specifications (Continued)

Agilent 53132A—Worst Case RMS Resolution

Automatic or External Arming:



Time or Digit Arming:



The preceding graphs do not reflect the effects of trigger error. To place an upper bound on the added effect of this error term, determine the frequency error from the appropriate graph and add a trigger error term as follows:

Time or Digit Arming

$$\text{Frequency Error} + \left(\frac{4 \times \sqrt{2} \times \text{Trigger Error}}{\text{Gate Time} \times \sqrt{\text{Number of Samples}}}\right) \times \begin{matrix}\text{Frequency}\\ \text{or}\\ \text{Period}\end{matrix}$$

Automatic or External Arming

$$\text{Frequency Error} + \left(\frac{\sqrt{2} \times \text{Trigger Error}}{\text{Gate Time}}\right) \times \begin{matrix}\text{Frequency}\\ \text{or}\\ \text{Period}\end{matrix}$$

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Measurement Specifications (Continued)

Frequency Measurement Example:

Given an Agilent 53132A with a High Stability Oven that was calibrated 3 days ago, measure a 15 MHz square wave signal (which has negligible trigger error) with a 1 second gate time. Compute the measurement error to within 2-sigma confidence.

$$\text{Measurement Error} = \text{Systematic Uncertainty} \pm 2 \times \text{RMS Resolution}$$

$$= \left(\left(\pm \text{Time Base Error} \pm \frac{t_{acc}}{\text{Gate Time}} \right) \pm 2 \times \left(\frac{4 \times \sqrt{t_{res}^2 + (2 \times \text{Trigger Error}^2)}}{\text{Gate Time} \times \sqrt{\text{Number of Samples}}} + \frac{t_{jitter}}{\text{Gate Time}} \right) \right) \times \text{Frequency}$$

$$\text{Number of Samples} = \text{200,000 since Frequency is greater than 200kHz and gate time equals 1 second}$$

$$\text{Time Base Error} = \text{Temperature Stability} + 3 \text{ Days} \times \text{Daily Aging Rate}$$

$$= 2.5 \times 10^{-9} + 3 \times (5 \times 10^{-10})$$

$$= 4.0 \times 10^{-9}$$

$$\text{Measurement Error} = \left(\left(\pm 4.0 \times 10^{-9} \pm \frac{1 \times 10^{-11} s}{1 s} \right) \pm 2 \times \left(\frac{4 \times \sqrt{(225 \times 10^{-12} s)^2 + (2 \times 0)}}{1 s \times \sqrt{200,\ 000}} + \frac{3 \times 10^{-12} s}{1 s} \right) \right) \times 15 MHz$$

$$= (\pm 4.0 \times 10^{-9} \pm 2 \times (2.01 \times 10^{-12} + 3 \times 10^{-12})) \times 15 MHz$$

$$= (\pm 4.0 \times 10^{-9} \pm 1 \times 10^{-11}) \times 15 MHz$$

$$= \pm 60.2 \text{ mHz}$$

Which is to say that the Agilent 53132A would display results in the range 15 MHz ±60.2 mHz. Note however that the dominant error is the Time Base Error. If an even higher stability time base is available or if the instrument can be source locked to the 15 MHz signal, then this error term can be substantially reduced. The measurement resolution under these conditions is ±75 µHz (1 sigma) which determines the number of digits displayed.

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Measurement Specifications (Continued)

Time Interval

Measurement is specified over the full signal ranges[7] of Channels 1 and 2.

Results Range: –1 ns to 10^5 s

LSD:

53131A	53132A
500 ps	150 ps

RMS Resolution: $\sqrt{t_{res}^2 + \text{Start Trigger Error}^2 + \text{Stop Trigger Error}^2}$

t_{res}

53131A	53132A
750 ps	300 ps

Systematic Uncertainty: ±*(Time Base Error* × *TI)* ± *Trigger Level Timing Error* ± *1.5 ns Differential Channel Error (Agilent 53131A)* ± *900 ps Differential Channel Error (Agilent 53132A)*

Time Interval Delay

After a Time Interval Measurement has begun by satisfying the trigger conditions on Channel 1, the instrument will wait for the user-entered delay time to elapse before the end-of-measurement trigger will be accepted on Channel 2. Please refer to Measurement Arming for additional information.

Frequency Ratio: Ch2/Ch1, Ch1/Ch3, Ch2/Ch1, Ch3/Ch1

Measurement is specified over the full signal range of each input.

Results Range: 10^{-10} to 10^{11}

'Auto' Gate Time: 100 ms (or sufficient cycles on Channel 2 or 3 to make a valid measurement, whichever is longer)

LSD:

$$\text{Ratio } {}^{1}\!/_{2}: \frac{1}{\text{Ch2 Freq} \times \text{Gate Time}}$$

$$\text{Ratio } {}^{1}\!/_{3}: \frac{1}{\text{Ch3 Freq} \times \text{Gate Time}}$$

$$\text{Ratio } {}^{2}\!/_{1}: \frac{\text{Ch2 Freq}}{(\text{Ch1 Freq})^2 \times \text{Gate Time}}$$

$$\text{Ratio } {}^{3}\!/_{1}: \frac{\text{Ch3 Freq}}{(\text{Ch1 Freq})^2 \times \text{Gate Time}}$$

RMS Resolution:

$$\text{Ratio } {}^{1}\!/_{2}: \frac{2 \times \sqrt{1 + (\text{Ch1 Freq} \times \text{Ch2 Trigger Error})^2}}{\text{Ch2 Freq} \times \text{Gate Time}}$$

$$\text{Ratio } {}^{1}\!/_{3}: \frac{2 \times \sqrt{1 + (\text{Ch1 Freq} \times \text{Ch3 Trigger Error})^2}}{\text{Ch3 Freq} \times \text{Gate Time}}$$

$$\text{Ratio } {}^{2}\!/_{1}: \frac{2 \times \text{Ch2 Freq} \times \sqrt{1 + (\text{Ch1 Freq} \times \text{Ch2 Trigger Error})^2}}{(\text{Ch1 Freq})^2 \times \text{Gate Time}}$$

$$\text{Ratio } {}^{3}\!/_{1}: \frac{2 \times \text{Ch3 Freq} \times \sqrt{1 + (\text{Ch1 Freq} \times \text{Ch3 Trigger Error})^2}}{(\text{Ch1 Freq})^2 \times \text{Gate Time}}$$

To minimize relative phase measurement error, connect the higher frequency signal to Channel 1 when possible.

[7] See Specifications for Pulse Width and Rise/Fall Time measurements for additional restrictions on signal timing characteristics.

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Measurement Specifications (Continued)

Pulse Width

Measurement is specified over the full signal range of Channel 1. The width of the opposing pulse must be greater than 4 ns (e.g., when measuring the positive pulse width, the negative pulse width must be greater than 4 ns).

Pulse Selection: Positive or Negative

Trigger: Default setting is Auto Trigger[8] at 50%

Results Range: 5 ns to 10^5 s

LSD:

53131A	53132A
500 ps	150 ps

RMS Resolution: $\sqrt{t_{res}^2 + Start\ Trigger\ Error^2 + Stop\ Trigger\ Error^2}$

t_{res}

53131A	53132A
750 ps	300 ps

Systematic Uncertainty:

± (Time Base Error × Pulse Width) ± Trigger Level Timing Error ± 1.5 ns Differential Channel Error (Agilent 53131A)
± 900 ps Differential Channel Error (Agilent 53132A)

Rise/Fall Time

Measurement is specified over the full signal ranges of Channel 1. The interval between the end of one edge and start of a similar edge must be greater than 4 ns. (e.g., when measuring a rising edge, 4 ns must elapse between the 90% point of one rising edge and the 10% point of the next rising edge).

Edge Selection: Positive or Negative

Trigger: Default setting is Auto Trigger[8] at 10% and 90%

Results Range: 5 ns to 10^5 s

LSD:

53131A	53132A
500 ps	150 ps

RMS Resolution: $\sqrt{t_{res}^2 + Start\ Trigger\ Error^2 + Stop\ Trigger\ Error^2}$

t_{res}

53131A	53132A
750 ps	300 ps

Systematic Uncertainty:

± (Time Base Error × Transition Time) ± Trigger Level Timing Error ± 1.5 ns Differential Channel Error (Agilent 53131A)
± 900 ps Differential Channel Error (Agilent 53132A)

Phase

Measurement is specified over the full signal range of Channels 1 and 2.

Results Range: –180° to +360°

RMS Resolution: $\sqrt{((t_{res}^2 + (2 \times Trigger\ Error^2)) \times \left(1 + \left(\frac{Phase}{360°}\right)^2\right)} \times Frequency \times 360°$

t_{res}

53131A	53132A
750 ps	300 ps

Systematic Uncertainty: *(± Trigger Level Timing Error ± 1.5 ns Differential Channel Error) × Frequency × 360° (Agilent 53131A)*
(± Trigger Level Timing Error ± 900 ps Differential Channel Error) × Frequency × 360° (Agilent 53132A)

[8] Restrictions noted on page 7-2 for Auto Trigger apply to the proper operation of these measurements. The Peak Volts measurement is used to determine the signal amplitude and inaccuracies from this, noted on page 7-11, should be included in calculating the Trigger Level Timing Error.

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Measurement Specifications (Continued)

Duty Cycle

Measurement is specified over the full signal range of Channel 1. However, both the positive and negative pulse widths must be greater than 4 ns.

Results Range: 0 to 1 (e.g. 50% duty cycle would be displayed as .5)

RMS Resolution: $\sqrt{(t_{res}^2 + (2 \times Trigger\ Error^2)) \times (1 + Duty\ Cycle^2)} \times Frequency$

t_{res}	**53131A**	**53132A**
	750 ps	300 ps

Totalize

Measurement is specified over the full signal range of Channel 1.

Results Range: 0 to 10^{15}

Resolution: ± 1 count

Peak Volts

Measurement is specified on Channels 1 and 2 for DC signals; or for AC signals of frequencies between 100 Hz and 30 MHz with peak-to-peak amplitude greater than 100 mV. (The measurement will continue to operate up to 225 MHz, though results are for indication only.)

Results Range: –5.1 V to +5.1 V

Resolution: 10 mV

Systematic Uncertainty for AC signals: 25 mV + 10% of V

for DC signals: 25 mV + 2% of V

Use of the input attenuator multiplies all voltage specifications (input range, results range, resolution and systematic uncertainty) by a nominal factor of 10. For example with AC signals, the Systematic Uncertainty becomes: 250 mV + 10% of V.

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Measurement Definitions

Definitions of Systematic Uncertainty Terms

- **Trigger Error**

External source and input amplifier noise may advance or delay the trigger points that define the beginning and end of a measurement. The resulting timing uncertainty is a function of the slew rate of the signal and the amplitude of spurious noise spikes (relative to the input hysteresis band).

The (rms) trigger error associated with a single trigger point is:

$$\text{Trigger Error} = \frac{\sqrt{(E_{input})^2 + (E_{signal})^2}}{\textit{Input Signal Slew Rate at Trigger Point}} \text{(in seconds)}$$

where

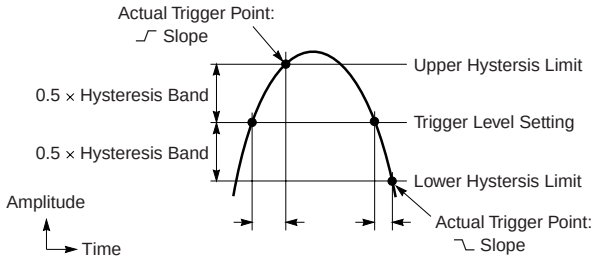
E_{input} = RMS noise of the input amplifier: 1 mVrms (350 µVrms typical). Note that the internal measurement algorithms significantly reduce the contribution of this term.

E_{signal} = RMS noise of the input signal over a 225 MHz bandwidth (100 kHz bandwidth when the low-pass filter is enabled). Note that the filter may substantially degrade the signal's slew rate at the input of the trigger comparator.

For two-trigger-point measurements (e.g. Rise Time, Pulse Width), the Trigger Errors will be referred to independently as Start Trigger Error and Stop Trigger Error.

- **Trigger Level Timing Error**

Trigger level timing error results from a deviation of the actual trigger level from the specified (indicated) level. The magnitude of the measurement timing error depends on several factors, primarily: resolution and accuracy of the trigger level circuit, fidelity of the input amplifier, slew rate of the input signal at the trigger point, and width of the input hysteresis band (see illustration).



Trigger Level Timing Errors

Trigger level timing error is associated with Time Interval, Pulse Width, Rise Time, Fall Time, Phase, and Duty Cycle measurements. The following equations define the general interpretation of its component error terms for a measurement. These should be summed together to obtain the overall Trigger Level Timing Error.

$$\text{Input Hysteresis:} \frac{0.5 \times \textit{Hysteresis Band}}{\textit{Input Signal Slew Rate at Start Trigger Point}} - \frac{0.5 \times \textit{Hysteresis Band}}{\textit{Input Signal Slew Rate at Stop Trigger Point}}$$

$$\text{Trigger Level Setting:} \pm\frac{15\ mV \pm (1\% \times \textit{Start Trigger Level Setting})}{\textit{Input Signal Slew Rate at Start Trigger Point}} \pm \frac{15\ mV \pm (1\% \times \textit{Stop Trigger Level Setting})}{\textit{Input Signal Slew Rate at Stop Trigger Point}}$$

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Measurement Definitions (Continued)

- **Fractional Time Base Error**

  Time base error is the maximum fractional frequency variation of the time base due to aging or fluctuations in ambient temperature or line voltage:

  $$\text{Time Base Error} = \left(\frac{\Delta f}{f}\Big|_{\text{aging rate}} + \frac{\Delta f}{f}\Big|_{\text{temperature}} + \frac{\Delta f}{f}\Big|_{\text{line voltage}}\right)$$

  Multiply this quantity by the measurement result to yield the absolute error for that measurement. Averaging measurements will not reduce (fractional) time base error. The Agilent 53131A/132A universal counters exhibit negligible sensitivity to line voltage; consequently this term may be ignored.

- **Differential Channel Error**

  The Differential Channel Error term included in many of the Systematic Uncertainty equations accounts for channel-to-channel mismatch and internal noise. This error can be substantially reduced by performing the TI Calibration in the temperature environment in which future measurements are to be made and by careful measurement technique. Calibration is accessible via the Calibration Menu during power-up.

7

Typical Versus Worst Case Specifications

Specifications identified as "Typical" represent performance of the instrument that the majority of users will perceive under a wide variety of conditions and signals. The specifications identified as "Worst Case" should be used when the instrument is under extreme environmental conditions or when the accuracy of the measurement results are critically important.

Time Interval Measurement LSD Definition

For the Time Interval, Pulse Width, and Rise/Fall Time measurements, the LSD is the measurement quantization error. " t_{res}" is the LSD plus the effects of certain internal error producing sources.

Additional Considerations for Digits and Time Arming Modes

For sample rates defined below, resolution will be reduced by up to 1 decade. The instruments display detects this condition and displays a reduced-resolution result. Resolution is reduced in a band about f_s, such that

$$x.y = \frac{10MHz}{f_s}$$

where x is any integer, and y is any fraction in the set:

$$1/3,\ 2/3,\ 1/4,\ 2/4,\ 3/4,\ 1/5,\ 2/5,\ 3/5,$$

For Example:

$$25.25 = \frac{10MHz}{396,039.6}$$

$$x = 25$$

$$y = 0.25 = 1/4$$

The width of the band is at most:

$$\pm\frac{6\times 10^{-7}\times f_{input}}{\text{Gate Time}}$$

The value of f_s is not available to the user, but the instrument can be queried over GPIB to determine if this condition exists. After the measurement completes, use the query :DIAGnostic:MEASure:PRESolution? The response is an ASCII text formatted string "Ø" for normal resolution and "1" for reduced resolution. This command is valid only when making frequency measurements in time or digits arming and the input frequency is greater than 100 Hz.

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Measurement Arming and Processing

Gate Time

Auto Mode, or 1 ms to 1000 s

Measurement Throughput

GPIB ASCII: 200 Measurements/s (maximum)
(See examples in the Programming Guide for ways to optimize measurement throughput)

Measurement Arming

Start Measurement: Free Run, Manual, or External
Stop Measurement: Continuous, Single, External, or Timed
Arming Modes:
(Note that not all arming modes are available for every measurement function.)

Auto Arming: Measurements are initiated immediately and acquired as fast as possible, using a minimum number of signal edges. Auto arming offers the highest measurement throughput, though measurement resolution may be reduced.

Timed Arming: The duration of the measurement is internally timed to a user-specified value (also known as the "gate time"). This mode should be used when the length of the measurement time must be controlled.

Digits Arming: Measurements are performed to the requested resolution (number of digits) through automatic selection of the acquisition time. This is the most convenient mode for when a specific measurement resolution is desired.

External Arming: An edge on the External Arm Input enables the start of each measurement. Depending on the measurement function, Auto Arming, Timed arming modes or another edge on the External Arm Input may be used to complete the measurement.

Time Interval Arming Modes:

Agilent 53131A

Time Interval Stop Delay Arming: The Stop Measurement condition on Channel 2 is inhibited (trigger hold-off) for a user specified time following the Start Measurement on Channel 1.

Time Interval Delay Range:	100 µs to 10 s*
Time Interval Delay Resolution:	10 µs from 100 µs to 100 ms 1 ms from 100 ms to 10 s

Agilent 53132A

Time Interval Start Delay Arming: The start of a Time Interval measurement is delayed for a user-specified amount of time, or number of Channel 2 events, from the Start External Arming edge.

Start Delay TimeRange:	100 ns to 999.9999 ms
Start Delay Time Resolution:	100 ns
Start Delay Event Range:	1 to 99,999,999 Channel 2 events
Start Delay Event Rate:	5 MHz maximum
Start Delay Event Setup Time:	30 ns minimum

Time Interval Stop Delay Arming: The Stop Measurement condition on Channel 2 is inhibited (trigger hold-off) for a user-specified amount of time, or number of Channel 2 stop events, following the Start Measurement on Channel 1, or, if enabled, the Stop External Arming edge.

Stop Delay Time Range:	100 ns to 10 s**
Stop Delay Time Resolution:	100 ns from 100 ns to 1 s 1 ms from 1 s to 10 s
Stop Delay Event Range:	1 to 99,999,999 Channel 2 events
Stop Delay Event Rate:	5 MHz maximum
Stop Delay Event Setup Time:	30 ns minimum

* For firmware revisions below 3427 the valid range of delay is 1 ms to 10 s.
** For firmware revisions below 3646 the valid range of delay is 1 ms to 10 s.

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Measurement Arming and Processing (Continued)

Measurement Statistics

Available Statistics: Mean, Minimum, Maximum, Standard Deviation

Number of Measurements: 2 to 1,000,000. Statistics may be collected on all measurements or on only those which are between the limit bands. When the Limits function is used in conjunction with Statistics, N (number of measurements) refers to the number of in-limit measurements. In general, measurement resolution will improve in proportion to $\sqrt{N}$, up to the numerical processing limits of the instrument.

Measurements: Statistics may be collected for all measurements except Peak Volts and Totalize.

Measurement Limits

Limit Checking: The measurement value is checked against user-specified limits at the end of each measurement.

Display Modes: The measurement result may be displayed as either the traditional numeric value or graphically as an asterisk moving between two vertical bars. These bars define the upper and lower limits, and the asterisk represents the current measurement result relative to these limits.

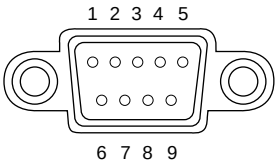
Out-of-Limits Indication: The out-of-limits condition can be indicated by any of the following methods:

- The limits annunciator will light on the front panel display.
- The instrument will generate an SRQ if enabled via GPIB.
- The limits hardware signal provided via the RS-232 connector will go low for the duration of the out-of-limit condition (see the description of this connector under the General Information section of this specifications table).
- If the Analog Display mode is enabled, the asterisk appears outside the vertical bars, which define the upper and lower limits.

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General Information

Save and Recall:	Up to 20 complete instrument setups may be saved and recalled later. These setups are retained when power is removed from the universal counter.	
Rack Dimensions (HxWxD):	88.5 mm x 212.6 mm x 348.3 mm	
Weight:	3.5 kg maximum	
	AC Line Supply	DC Supply (Option 002 Only)
Power Supply Voltage:	100 to 120 VAC ±10% - 50, 60 or 400 Hz ±10% 220 to 240 VAC ±10% - 50 or 60 Hz ±10% AC Line Voltage Selection: Automatic	10 to 32 VDC, 3-pin male XLR connector Option 002 may not be ordered with Option 060
Power Requirements:	170 VA maximum (30 W typical)	4A initial inrush at 10 VDC 3A max, once stabilized
Operating Environment:	0° C to 55° C	
Storage Environment:	–40° C to 71° C	
Remote Interface:	GPIB (IEEE 488.1-1987, IEEE 488.2-1987)	
GPIB Interface Capabilities:	SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E2	
Remote Programming Language:	SCPI-1992.0 (Standard Commands for Programmable Instruments)	
Safety:	Designed in compliance with IEC 1010-1, UL 3111-1 (draft), CAN/CSA 1010.1	
EMC:	CISPR-11, EN50082-1, IEC 801-2, -3, -4	
	Electrostatic Discharge and Fast Transient/Burst Immunity Testing: When the product is operated at maximum sensitivity (20 mVrms) and tested with 8kV AD according to IEC801-2 or with 1kV power line transients according to IEC 801-4, frequency miscounts may occur that will affect measurement data made during these disturbances.	
	Radiated Immunity Testing: When the product is operated at maximum sensitivity (20 mVrms) and tested at 3 V/m according to IEC 801-3, external 100 to 200 MHz electric fields may cause frequency miscounts.	
RS-232C:	The rear-panel RS-232 connector is a 9-pin connector (DB-9, male). You can connect the universal counter to any terminal or printer with a properly configured DTE connector (DB-25). You can use a standard interface cable (Agilent part number 24542G or 24542H). Data is “output only”; the instrument cannot be programmed via the RS-232 interface.	
Note on Pin 4:	May be used as either a DTR signal or an indication of measurement in-limit as configured by the Utility menu. When used as an in-limit indicator, the signal will be high for every measurement within the user set limits.	



Pin Number	Type	Description
2	Input	Receive Data (RxD) (for Xon/Xoff only)
3	Output	Transmit Data (TxD)
4	Output	Data Terminal Ready (DTR) Measurement In-Limit Signal
5	—	Signal Ground
6	Input	Data Set Ready (DSR)
*	All other pins: no connection	

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8

Agilent 53181A Specifications

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Introduction

The specifications of the Agilent 53181A Frequency Counter are provided in this chapter.

Instrument Inputs

Channel 1 Input Specifications

Frequency Range

DC Coupled:	DC to 225 MHz
AC Coupled:	1 MHz to 225 MHz (50 Ω) 30 Hz to 225 MHz (1 MΩ)
FM Tolerance:	25%

Voltage Range and Sensitivity (Sinusoid)[1]

DC to 100 MHz:	20 mVrms to ±5 V ac + dc (75 mVrms with optional rear connectors)[2]
100 MHz to 200 MHz:	30 mVrms to ±5 V ac + dc (75 mVrms with optional rear connectors)[2]
200 MHz to 225 MHz:	40 mVrms to ±5 V ac + dc (75 mVrms with optional rear connectors)[2]

Voltage Range and Sensitivity (Single-Shot Pulse)[1]

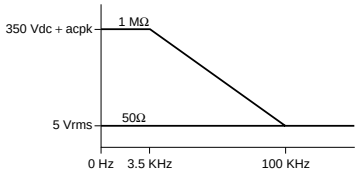
4.5 ns to 10 ns Pulse Width:	100 mVpp to 10 Vpp (150 mVpp with optional rear connectors)[2]
>10 ns Pulse Width:	50 mVpp to 10 Vpp (100 mVpp with optional rear connectors)[2]

Trigger Level[2]

Range:	±5.125 V
Accuracy:	±(15 mV + 1% of trigger level)
Resolution:	5 mV

Damage Level

50 Ω	5 Vrms
0 to 3.5 kHz, 1 MΩ	350 V dc + ac pk
3.5 kHz to 100 kHz, 1 MΩ	350 V dc + ac pk linearly derated to 5 Vrms
>100 kHz, 1 MΩ	5 Vrms



Channel 1 Input Characteristics

Impedance:	1 MΩ or 50 Ω
1 MΩ Capacitance:	30 pF
Coupling:	AC or DC
Low-Pass Filter:	100 kHz (or disabled) –20 dB at > 1 MHz
Input Sensitivity:	Selectable between Low, Medium, or High (default). Low is approximately 2x High Sensitivity.

Trigger Slope: Positive or Negative

Auto Trigger Level

Range:	0 to 100% in 10% steps
Frequency:	> 100 Hz
Input Amplitude:	> 100 mVpp (No amplitude modulation)

Attenuator

Voltage Range:	x10
Trigger Range:	x10

[1] Values shown are for X1 attenuator setting. Multiply all values by 10 (nominal) when using the X10 attenuator setting. Note that it may be necessary to recalibrate the input offset in the application environment (especially at high temperature) to achieve maximum sensitivity.

[2] When ordered with optional rear terminals, the Channel 1 input is active on both the front and rear of the counter though the specifications provided only apply to the rear terminal. Performance for the front terminal is degraded, but may be improved by terminating the rear terminal into 50 Ω

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Instrument Inputs (Continued)

Channel 2 Input Specifications[3, 4]

Frequency Range

Opt. 015	100 Mhz to 1.5 Ghz
Opt. 030	100 MHz to 3 GHz
Opt. 050	200MHz to 5 GHz
Opt. 124	200 MHz to 12.4 GHz

Power Range and Sensitivity (Sinusoid)

Option 015
100 MHz to 1.5 GHz: –27 dBm to +19 dBm
Option 030
100 MHz to 2.7 GHz: –27 dBm to +19 dBm
2.7 GHz to 3 GHz: –21 dBm to +13 dBm
Option 050
200MHz to 5 GHz: –23 dBm to +13 dBm
Option 124
200MHz to 12.4 GHz: –23 dBm to +13 dBm

Damage Level:

Option 015, 030	5 Vrms
Option 050, 124	+25 dBm

Channel 2 Input Characteristics

Impedance:	50 Ω
Coupling:	AC
VSWR:	< 2.5:1

External Arm Input Specifications

Signal Input Range:

TTL compatible

Timing Restrictions:

Pulse Width:	> 50 ns
Transition Time:	< 250 ns
Start-to-Stop Time:	> 50 ns

Damage Level: 10 Vrms

External Arm Input Characteristics

Impedance:	1 kΩ
Input Capacitance:	17 pF
Start Slope:	Positive or Negative
Stop Slope:	Positive or Negative

Notes:
External Arm available for all measurements except Peak Volts.

External Arm is referred to as External Gate for some measurements.

[3] Channel 2 is available as an option.

[4] When ordered with optional rear terminals, the Channel 2 connector on the front panel for Options 015 or 030 will be removed. There is no degradation in specifications for this input. Option 050 and Option 124 input connectors are available on the front panel only.

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Time Base

Internal Time Base Stability

		Standard (0° to 50°C)	Medium Stability Oven (Option 001)	High Stability Oven (Option 010)	Ultra High Stability Oven (Option 012)
Temperature Stability: (referenced to 25°C)		< 5 x 10^{-6}	< 2 x 10^{-7}	< 2.5 x 10^{-9}	< 2.5 x 10^{-9}
Aging Rate (after 30 days)	Per Day: Per Month: Per Year:	< 3 x 10^{-7}	< 4 x 10^{-8} < 2 x 10^{-7}	< 5 x 10^{-10} < 1.5 x 10^{-8}	< 1 x 10^{-10} < 3 x 10^{-9} < 2 x 10^{-8}
Turn-on stability vs. time: (in 30 minutes)			< 2 x 10^{-7} (referenced to 2 hours)	< 5 x 10^{-9} (referenced to 24 hours)	< 5 x 10^{-9} (referenced to 24 hours)
Calibration:		Manual Adjust	Electronic	Electronic	Electronic

Note that power to the time base is maintained when the counter is placed in standby via the front panel switch. The internal fan will continue to operate under this condition, to maintain long-term instrument reliability.

External Time Base Input Specifications

Voltage Range: 200 mVrms to 10 Vrms
Damage Level: 10 Vrms

External Time Base Input Characteristics

Threshold: 0 V
Impedance: 1 kΩ
Input Capacitance: 23 pF
Frequency: 1 MHz, 5 MHz or 10 MHz (automatic selection)

Internal vs. External Time Base Selection:

Manual: Select Internal or External
Automatic: Internal used when External not present (default)

Time Base Output Specifications

Output Frequency: 10 MHz
Voltage: > 1 Vpp into 50 Ω (centered around 0 V)

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Measurement Specifications

Frequency, Period

Channel 1 Range: 0.1 Hz to 225 MHz 4.44 ns to 10 s

Channel 2 Range:

Option 015	100 Mhz to 1.5 Ghz	0.67 ns to 10 ns
Option 030	100 MHz to 3 GHz	0.33 ns to 10 ns
Option 050	200 MHz to 5 GHz	0.2 ns to 5 ns
Option 124	200 MHz to 12.4 GHz	80 ps to 5 ns

(Period 2 selectable only via the GPIB interface)

For Automatic or External Arming:

(and signals < 100 Hz using Timed Arming)

LSD Displayed:

$$\left(\frac{t_{res}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

RMS Resolution:

$$\left(\frac{\sqrt{t_{res}^2+(2\times Trigger\ Error^2)}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

t_{res}: 650 ps typical[5]

For Automatic Arming: $Gate\ Time = \frac{N}{Frequency}$

where N = 1 for Ch1 Frequency < 1 MHz
4 for Ch1 Frequency > 1 MHz
128 for Ch2

Systematic Uncertainty: $\left(\pm Time\ Base\ Error \pm \frac{t_{acc}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$

t_{acc}: 350 ps typical
1.25 ns worst case

Trigger: Default setting is Auto Trigger at 50%

For Time or Digits Arming:

LSD Displayed:

$$\left(\frac{2\sqrt{2}\times t_{res}}{Gate\ Time\times\sqrt{Number\ or\ Samples}}+\frac{t_{jitter}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

RMS Resolution:

$$\left(\frac{4\times\sqrt{t_{res}^2+(2\times Trigger\ Error^2)}}{Gate\ Time\times\sqrt{Number\ or\ Samples}}+\frac{t_{jitter}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$$

t_{res}: 500 ps typical[5]
t_{jitter}: 50 ps typical[5]

Number of Samples =
Gate Time x Frequency (Frequency < 200 kHz)
Gate Time x 200,000 (Frequency > 200 kHz)

Systematic Uncertainty: $\left(\pm Time\ Base\ Error \pm \frac{t_{acc}}{Gate\ Time}\right)\times \begin{matrix}Frequency\\or\\Period\end{matrix}$

t_{acc}: 100 ps typical
300 ps worst case

Trigger: Default setting is Auto Trigger at 50%

The following graphs may also be used to compute errors for Period Measurements. To find the Period error (ΔP), calculate the frequency of the input signal ($F = \frac{1}{P}$) and find the frequency error (ΔF) from the chart. Then, calculate the period error as: $\Delta P = \left(\frac{\Delta F}{F}\right)\times P$

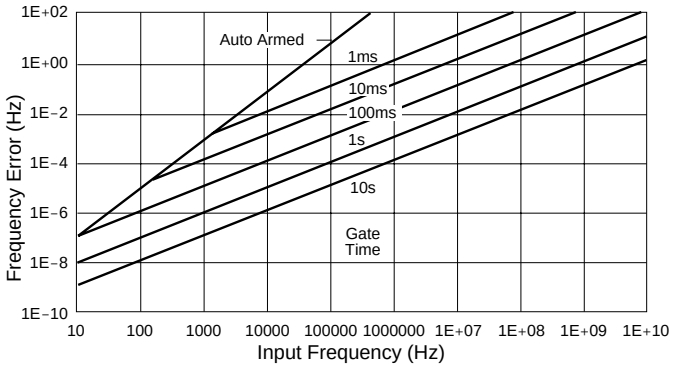
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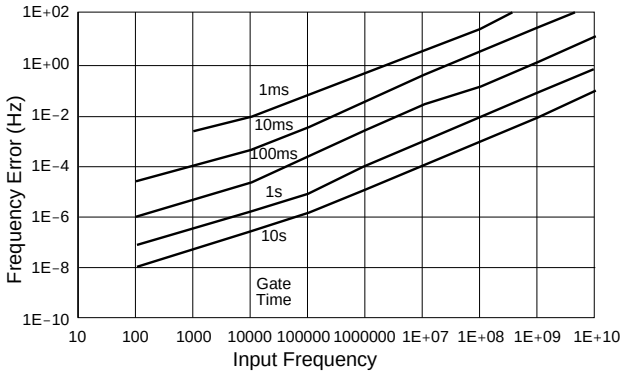
Measurement Specifications (Continued)

Worst Case RMS Resolution

Automatic or External Arming:



Time or Digit Arming:



The preceding graphs do not reflect the effects of trigger error. To place an upper bound on the added effect of this error term, determine the frequency error from the appropriate graph and add a trigger error term as follows:

Automatic or External Arming

$$\text{Frequency Error} + \left(\frac{\sqrt{2} \times \text{Trigger Error}}{\text{Gate Time}}\right) \times \text{Frequency or Period}$$

Time or Digit Arming

$$\text{Frequency Error} + \left(\frac{4 \times \sqrt{2} \times \text{Trigger Error}}{\text{Gate Time} \times \sqrt{\text{Number of Samples}}}\right) \times \text{Frequency or Period}$$

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Measurement Specifications (Continued)

Frequency Measurement Example:

Given an Agilent 53181A with a High Stability Oven that was calibrated 3 days ago, measure a 15 MHz square wave signal (which has negligible trigger error) with a 1 second gate time. Compute the measurement error to within 2-sigma confidence.

$$\text{Measurement Error} = \text{Systematic Uncertainty} \pm 2 \times \text{RMS Resolution}$$

$$= \left(\left(\pm \text{Time Base Error} \pm \frac{t_{acc}}{\text{Gate Time}} \right) \pm 2 \times \left(\frac{4 \times \sqrt{t_{res}^2 + (2 \times \text{Trigger Error}^2)}}{\text{Gate Time} \times \sqrt{\text{Number of Samples}}} + \frac{t_{jitter}}{\text{Gate Time}} \right) \right) \times \text{Frequency}$$

$$\text{Number of Samples} = \text{200,000 since Frequency is greater than 200kHz and gate time equals 1 second}$$

$$\text{Time Base Error} = \text{Temperature Stability} + 3 \text{ Days} \times \text{Daily Aging Rate}$$

$$= 2.5 \times 10^{-9} + 3 \times (5 \times 10^{-10})$$

$$= 4.0 \times 10^{-9}$$

$$\text{Measurement Error} = \left(\left(\pm 4.0 \times 10^{-9} \pm \frac{1 \times 10^{-10} s}{1s} \right) \pm 2 \times \left(\frac{4 \times \sqrt{(500 \times 10^{-12} s)^2 + (2 \times 0)}}{1s \times \sqrt{200,\ 000}} + \frac{50 \times 10^{-12} s}{1s} \right) \right) \times 15MHz$$

$$= (\pm 4.1 \times 10^{-9} \pm 2 \times (4.47 \times 10^{-12} + 50 \times 10^{-12})) \times 15MHz$$

$$= (\pm 4.1 \times 10^{-9} \pm 1.09 \times 10^{-10}) \times 15MHz$$

$$= \pm 63.1 \text{ mHz}$$

Which is to say that the Agilent 53181A would display results in the range 15 MHz ±63.1 mHz. Note however that the dominant error is the Time Base Error. If an even higher stability time base is available to the instrument or if the instrument can be source locked to the 15 MHz signal, then this error term can be substantially reduced. The measurement resolution under these conditions is ±0.8 MHz (1 sigma) which determines the number of digits displayed.

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Measurement Specifications (Continued)

Frequency Ratio: $^{1}/_{Ch2}$ $^{Ch2}/_{C}$

Measurement is specified over the full signal range of each input.

Results Range: 10^{-10} to 10^{11}
'Auto' Gate Time: 100 ms (or sufficient cycles on Channel 1 to make a valid measurement, whichever is longer)
LSD:

$$Ratio\ {}^{1}/_{2}: \frac{1}{Ch2\ Freq \times Gate\ Time}$$

$$Ratio\ {}^{2}/_{1}: \frac{Ch2\ Freq}{(Ch1\ Freq)^2 \times Gate\ Time}$$

RMS Resolution:

$$Ratio\ {}^{1}/_{2}: \frac{2 \times \sqrt{1 + (Ch1\ Freq \times Ch2\ Trigger\ Error)^2}}{Ch2\ Freq \times Gate\ Time}$$

$$Ratio\ {}^{2}/_{1}: \frac{2 \times Ch2\ Freq \times \sqrt{1 + (Ch1\ Freq \times Ch2\ Trigger\ Error)^2}}{(Ch1\ Freq)^2 \times Gate\ Time}$$

To minimize relative phase measurement error, connect the higher frequency signal to Channel 1 when possible.

Peak Volts

Measurement is specified on Channels 1 for DC signals; or for AC signals of frequencies between 100 Hz and 30 MHz with peak-to-peak amplitude greater than 100 mV. (The measurement will continue to operate up to 225 MHz, though results are for indication only.)

Results Range: –5.1 V to +5.1 V
Resolution: 10 mV
Systematic Uncertainty for AC signals: 25 mV + 10% of V
for DC signals: 25 mV + 2% of V

Use of the input attenuator multiplies all voltage specifications (input range, results range, resolution and systematic uncertainty) by a nominal factor of 10. For example with AC signals, the Systematic Uncertainty becomes: 250 mV + 10% of V.

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Measurement Definitions

Definitions of Systematic Uncertainty Terms

- **Trigger Error**

  External source and input amplifier noise may advance or delay the trigger points that define the beginning and end of a measurement. The resulting timing uncertainty is a function of the slew rate of the signal and the amplitude of spurious noise spikes (relative to the input hysteresis band).

  The (rms) trigger error associated with a single trigger point is:

  $$\text{Trigger Error} = \frac{\sqrt{(E_{input})^2 + (E_{signal})^2}}{\textit{Input Signal Slew Rate at Trigger Point}} \text{(in seconds)}$$

  where

  E_{input} = RMS noise of the input amplifier: 1 mVrms (350 µVrms typical). Note that the internal measurement algorithms significantly reduce the contribution of this term.

  E_{signal} = RMS noise of the input signal over a 225 MHz bandwidth (100 kHz bandwidth when the low-pass filter is enabled). Note that the filter may substantially degrade the signal's slew rate at the input of the trigger comparator.

- **Fractional Time Base Error**

  Time base error is the maximum fractional frequency variation of the time base due to aging or fluctuations in ambient temperature or line voltage:

  $$\text{Time Base Error} = \left(\frac{\Delta f}{f}\Big|_{aging\ rate} + \frac{\Delta f}{f}\Big|_{temperature} + \frac{\Delta f}{f}\Big|_{line\ voltage}\right)$$

  Multiply this quantity by the measurement result to yield the absolute error for that measurement. Averaging measurements will not reduce (fractional) time base error. The Agilent 53181A counters exhibits negligible sensitivity to line voltage; consequently this term may be ignored.

8

Typical Versus Worst Case Specifications

Specifications identified as "Typical" represent performance of the instrument that the majority of users will perceive under a wide variety of conditions and signals. The specifications identified as "Worst Case" should be used when the instrument is under extreme environmental conditions or when the accuracy of the measurement results are critically important.

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Measurement Arming and Processing

Gate Time

Auto Mode, or 1 ms to 1000 s

Measurement Throughput

GPIB ASCII: 200 Measurements/s (maximum)
(See examples in the Programming Guide for ways to optimize measurement throughput)

Measurement Arming

Start Measurement: Free Run, Manual, or External
Stop Measurement: Continuous, Single, External, or Timed
Arming Modes:
(Note: auto arming is the only mode available for the Peak Volts function.)

- Auto Arming: Measurements are initiated immediately and acquired as fast as possible, using a minimum number of signal edges. Auto arming offers the highest measurement throughput, though measurement resolution may be reduced.
- Timed Arming: The duration of the measurement is internally timed to a user-specified value (also known as the "gate time"). This mode should be used when the length of the measurement time must be controlled.
- Digits Arming: Measurements are performed to the requested resolution (number of digits) through automatic selection of the acquisition time. This is the most convenient mode when a specific measurement resolution is desired.
- External Arming: An edge on the External Arm Input enables the start of each measurement. Auto Arming, Timed arming modes or another edge on the External Arm Input may be used to complete the measurement.

Measurement Statistics

Available Statistics: Mean, Minimum, Maximum, Standard Deviation

Number of Measurements: 2 to 1,000,000. Statistics may be collected on all measurements or on only those which are between the limit bands. When the Limits function is used in conjunction with Statistics, N (number of measurements) refers to the number of in-limit measurements. In general, measurement resolution will improve in proportion to $\sqrt{N}$, up to the numerical processing limits of the instrument.

Measurements: Statistics may be collected for all measurements except Peak Volts.

Measurement Limits

Limit Checking: The measurement value is checked against user-specified limits at the end of each measurement.

Display Modes: The measurement result may be displayed as either the traditional numeric value or graphically as an asterisk moving between two vertical bars. These bars define the upper and lower limits, and the asterisk represents the current measurement result relative to these limits.

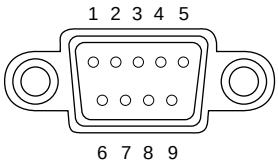
Out-of-Limits Indication: The out-of-limits condition can be indicated by any of the following methods:

- The limits annunciator will light on the front panel display.
- The instrument will generate an SRQ if enabled via GPIB.
- The limits hardware signal provided via the RS-232 connector will go low for the duration of the out-of-limit condition (see the description of this connector under the General Information section of this specifications table).
- If the Analog Display mode is enabled, the asterisk appears outside the vertical bars, which define the upper and lower limits.

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General Information

Save and Recall:	Up to 20 complete instrument setups may be saved and recalled later. These setups are retained when power is removed from the counter.	
Rack Dimensions (HxWxD):	88.5 mm x 212.6 mm x 348.3 mm	
Weight:	3.5 kg maximum	
	AC Line Supply	DC Supply (Option 002 Only)
Power Supply Voltage:	100 to 120 VAC ±10% - 50, 60 or 400 Hz ±10% 220 to 240 VAC ±10% - 50 or 60 Hz ±10% AC Line Voltage Selection: Automatic	10 to 32 VDC, 3-pin male XLR connector Option 002 may not be ordered with Option 060
Power Requirements:	170 VA maximum (30 W typical)	4A initial inrush at 10 VDC 3A max, once stabilized
Operating Environment:	0° C to 55° C	
Storage Environment:	–40° C to 71° C	
Remote Interface:	GPIB (IEEE 488.1-1987, IEEE 488.2-1987)	
GPIB Interface Capabilities:	SH1, AH1, T5, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E2	
Remote Programming Language:	SCPI-1992.0 (Standard Commands for Programmable Instruments)	
Safety:	Designed in compliance with IEC 1010-1, UL 3111-1 (draft), CAN/CSA 1010.1	
EMC:	CISPR-11, EN50082-1, IEC 801-2, -3, -4	
	Electrostatic Discharge and Fast Transient/Burst Immunity Testing: When the product is operated at maximum sensitivity (20 mVrms) and tested with 8kV AD according to IEC801-2 or with 1kV power line transients according to IEC 801-4, frequency miscounts may occur that will affect measurement data made during these disturbances.	
	Radiated Immunity Testing: When the product is operated at maximum sensitivity (20 mVrms) and tested at 3 V/m according to IEC 801-3, external 100 to 200 MHz electric fields may cause frequency miscounts.	
RS-232C:	The rear-panel RS-232 connector is a 9-pin connector (DB-9, male). You can connect the universal counter to any terminal or printer with a properly configured DTE connector (DB-25). You can use a standard interface cable (Agilent part number 24542G or 24542H). Data is “output only”; the instrument can not be programmed via the RS-232 interface.	
Note on Pin 4:	May be used as either a DTR signal or an indication of measurement in-limit as configured by the Utility menu. When used as an in-limit indicator, the signal will be high for every measurement within the user set limits.	



Pin Number	Type	Description
2	Input	Receive Data (RxD) (for Xon/Xoff only)
3	Output	Transmit Data (TxD)
4	Output	Data Terminal Ready (DTR) Measurement In-Limit Signal
5	—	Signal Ground
6	Input	Data Set Ready (DSR)
*	All other pins: no connection	

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