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Agilent Technologies L4532A/ 34A □ 20 MSa/ s Digitizer

Service Guide



Agilent Technologies

Notices

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Software Revision

This guide is valid for the firmware that was installed in the instrument at the time of manufacture. However, upgrading the firmware may add or change product features. For the latest firmware and documentation, go to the product page at:

www.agilent.com/ find/ L4532A

or

www.agilent.com/ find/ L4534A

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Safety Information

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Product manuals are provided with your instrument on CD-ROM and/ or in printed form. Printed manuals are an option. Manuals are also available on the Web. Go to www.agilent.com/ find/ manuals and type in your product number in the Search field.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the instrument's external markings described under "Safety Symbols".

Ground the Instrument

The Agilent L4532A/ 34A is provided with a grounding-type power plug. The instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Fuses

The Agilent L4532A/ 34A is provided with an internal line fuse. This fuse is not user accessible.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes.

Do Not Operate Near Flammable Liquids

Do not operate the instrument in the presence of flammable liquids or near containers of such liquids.

Do Not Remove the Instrument Cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Cleaning

Clean the outside of the instrument with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Agilent Sales and Service Office for service and repair to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Symbols



Earth Ground



Chassis Ground



Risk of electric shock



Refer to manual for additional safety information



Standby Power. Unit is not completely disconnected from AC mains when power switch is in standby position

CAT I — IEC Measurement Category I. Inputs may be connected only to circuits that are isolated from AC mains

Installing the Instrument

Before connecting to power, check the following to ensure it is correct for your application.

- Line Cord

The Agilent L4532A/ 34A power supply operates in the following line-voltage ranges:

~Line:
100-240 V, 50-60 Hz
(240 VA Max)

No line-voltage switch is required and the internal line fuse is appropriate for all voltages within these ranges. This fuse is not user accessible.

Ensure that the front-panel power switch is readily accessible during operations.

The instrument is ventilated from the front, rear, and left side. Do not obstruct the ventilation holes in any of these locations.

Before connecting a load or device under test, read the operating instructions that begin in chapter 1 of the User's Guide.

Intended Use of the Instrument

The Agilent L4532A (2-channel) or L4534A (4-channel) 20 MSa/ s, Isolated/ Floating 250V, 16-bit Digitizer is intended to be used to digitize waveform signals in electronic-test applications. Each input channel provides an isolated, floating input rated for signals of 250 Vpk. The instrument must be connected to the device under test using cables appropriate to the application and voltages present.

The L4532A/ 34A is intended only for IEC Measurement Category I applications, as defined below.

IEC Measurement Category I Overvoltage Protection

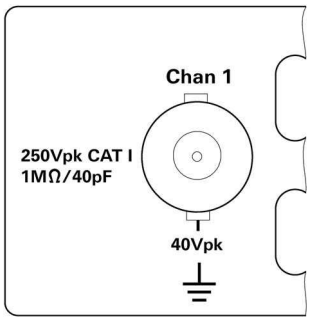
The L4532A/ 34A has IEC Measurement Category I (CAT I) overvoltage protection. IEC Measurement Category I refers to devices that are isolated from line-voltage mains. Do not connect the inputs of a CAT I instrument to AC line-voltage mains.

WARNING

Do not connect the input channels of the L4532A/ 34A to AC line-voltage mains. This instrument must be used in CAT I (isolated from mains) applications. Do not use in other IEC Measurement Category (CAT II, CAT III, or CAT IV) applications. Failure to observe these precautions may result in electric shock and serious personal injury.

Protection Limits

The Agilent L4532A/ 34A provides protection circuitry to prevent damage to the instrument and to protect against the danger of electrical shock, provided the protection limits are not exceeded. To ensure safe operation of the instrument, do not exceed the protection limits shown for each input on the rear panel.



Each input-channel BNC connector (Channel 1 is shown) has the following protection limits:

- The shield of each input-channel BNC connector may float 40 Vpk relative to earth ground. Each channel may float independently.
- The allowable input signal is 250 Vpk (from shield to center pin on the BNC connector) for each input channel.
- The Transient Overvoltage limit is 400 Vpk for each input channel.

The input impedance for each channel is 1 MW and the input capacitance is 40 pF.

In addition:

- The 10 MHz In connector is limited to 3 Vpp.
- The Trig In/ Out connector is limited to +5 V max.

WARNING

Do not exceed any of the specified protection limits to avoid the risk of electric shock or instrument damage.

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1 Specifications

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Specifications

Specifications are subject to change without notice. For the latest specifications, see the product datasheet on the Web. Firmware updates may also be available on the Web. Start at the appropriate product page:

www.agilent.com/ find/ L4532A

www.agilent.com/ find/ L4534A

This ISM device complies with Canadian ICES-001.

Cet appareil ISM est conforme à la norme NMB-001 du Canada.



NOTE The specifications on the following pages are valid for Agilent L4532A/ 34A digitizers with firmware revision 1.00, or later, installed.

General Specifications

Maximum Sample Rate	20 MSa/s
Sample Resolution	16 Bits
Input Configuration	Isolated Inputs (each channel independently isolated)
Isolation voltage (low to chassis)	±40 V
Maximum input (Hi to Low)	±250 V_{pk} [1]
Maximum Input Range	±256 V
Input impedance	1 MΩ || 40 pF
Input coupling	DC or AC
AC cutoff frequency (-3 dB)	< 10 Hz
Input ranges	±256 V, ±128 V, ±64 V, ±32 V, ±16 V, ±8 V, ±4 V, ±2 V, ±1 V, ±500 mV, ±250 mV
Overvoltage protection	Yes
Maximum Overvoltage Transient	±400 V_{pk}
Analog bandwidth (-3dB)	20 MHz typical
Noise Filtering (2-pole Bessel)	200 kHz, 2 MHz typical
Power Requirements	
Line Voltage:	100 to 240 VAC (universal)
Line Frequency:	50 Hz or 60 Hz
Power Consumption:	45 W (240 VA maximum)
EMC Conforms To:	IEC 61326-1:2005-12 (EU) EN 61326-1:2006 ICES-001:2004 (Canada) AS/NZS CISPR 11:2004
Safety Conforms To	IEC/EN 61010-1:2001(EU) CAN/CSA-C22.2 No. 61010-1-04 (Canada) UL 61010-1 (2nd Edition) (US) AS 61010.1:2003 (Australia/New Zealand)

1. CAT 1. IEC measurement category 1. Inputs may be connected only to circuits that are isolated from AC mains.

Arm and Trigger

Each Arm event gates 1 or more trigger events. Each Trigger event causes acquisition of data into a single record at the configured sample rate. The number of data records is configurable from 1 to 1024.

Source	Arm	Trigger	Description
IMMediate	□	□	Trigger or ARM at INIT time
EXTernal[1]	□	□	BNC TTL input edge (selectable rising/ falling edge)
Software	□	□	Instrument commands
Timer	□		0.0 s to 3600.0 s with 50 ns resolution
Channel/ Edge		□	Selectable level, rising/ falling, hysteresis
Channel/ Window		□	Selectable high and low levels, leaving/ entering, hysteresis
OR[2]		□	Logical OR of channel trigger source and EXTernal

1. EXTernal can be used as an ARM source or a Trigger source, but not both at the same time.
2. OR can not be used if the EXTernal source is being used as an ARM source.

Sampling

Programmable sample rates:	1 KSa/ s, 2 KSa/ s, 5 KSa/ s, 10 KSa/ s, 20 KSa/ s,□ 50 KSa/ s, 100 KSa/ s, 200 KSa/ s, 500 KSa/ s,□ 1 MSa/ s, 2 MSa/ s, 5 MSa/ s, 10 MSa/ s, 20 MSa/ s
External event output:	
Event Types:	Trigger, end-of-record, end-of-acquisition
Output Signal:[1,2]	TTL
Impedance:	25 □ or 50 □
Trigger Modes	
Pretrigger	0 to □record length - 4□
Posttrigger	Record length — pretrigger
Timestamp triggered event□	Elapsed time since INIT, or □ Continuous running timestamp
Timestamp resolution	12.5 ns
Trigger delay	0 to 3600 s, with 50 ns resolution
Trigger holdoff	0 to 10 s, with 50 ns resolution
Trigger latency[3]	12.5 ns
Trigger reactive	
Ext input trigger latency	40 ns to 51 ns
Ext output trigger latency	4 ns to 21 ns

1. Pulse width 1 □s (200 ns for records taking <2 □s to complete).
2. TTL output pulse can be configured for either rising or falling edge.
3. Latency between Level/ window trigger detection and first (trigger) sample.

DC Accuracy

Total Specification (% of reading + % of range) [1]

	23 °C ±5 °C		$T_{autozero}$ ±3 °C[2,3]	Temp coefficient outside 18-28 °C	
Range	± % of reading	± % of range	± % of range	± % of reading/ °C	± % of range/ °C
250 mV	0.10	0.30	0.11	0.01	0.015
500 mV	0.10	0.20	0.06	0.01	0.010
4 V, 64 V	0.10	0.30	0.05	0.01	0.015
8 V, 128 V	0.10	0.20	0.04	0.01	0.010
1 V, 2 V, 16 V, 32 V, 256 V	0.10	0.12	0.04	0.01	0.010

1. 100,000 sample average @1 MSa/ s
2. For 1 V range and greater, typical offset with constant temperature is 0.01% of range.
3. Autozero done at room temperature within 24 hours.

Integral nonlinearity	±5 LSB
Differential nonlinearity	± 1 LSB typical, no missing codes
Input bias current	< 10 nA typical

Dynamic Characteristics[1]

Measured using a 65536 point FFT.

	SFDR (dBc)	THD (dBc)	SNR (dB)	SINAD (dB)	ENOB[2]
Input range 980 kHz input (-1 dBFS)					
250 mV	71	-79	67	66.7	10.8
500 mV	77	-83	70	69.8	11.3
1 V	81	-85	73	72.7	11.8
2 V	85	-82	75	74.2	12.0
4 V	70	-80	64	63.9	10.3
8 V	70	-83	65	64.9	10.5
16 V	70	-81	65	64.9	10.5
Input range 9.8 MHz input (-1 dBFS)					
250 mV	71	-71	66	64.8	10.5
500 mV	71	-73	68	66.8	10.8
1 V	69	-68	72	66.5	10.8
2 V	63	-62	72	61.6	9.9

1. External timebase measurements made with 1 Vpp sinewave with <2 ps RMS jitter.

2. ENOB = (SINAD - 1.76)/6.02□

AC flatness (DC-4 MHz)	
250 mV	□0.28 dB relative to 1 kHz
500 mV, 1 V, 2 V, 4 V, 8 V, 16 V, 32 V	□0.20 dB relative to 1 kHz□
64 V, 128,V, 256 V	□0.40 dB (□0.01 dB/ □C Temperature Coefficient outside 18-28□C) relative □ to 1 kHz
Crosstalk (Ch to Ch) R_S = 50 □□	< -90 dB @1 MHz

Timing and synchronization

Internal timebase accuracy	□50 ppm
Internal timebase output (clock out BNC)	
Frequency	10 MHz
Level	TTL
External timebase reference (clock in BNC)	
Lock range	10 MHz □5000 ppm (10 MHz □50 kHz)
Clock skew	□10 ns (typical)
Level	1 V_{pp} sine wave minimum, with < 2 ps RMS jitter.
Input resistance	100 k□ nominal

Waveform memory

Data memory	
Standard[1]	32 MSa/ ch
Extended[1]	128 MSa/ ch
Random access to readings	
Multiple record mode	Capture multiple records from multiple triggers

1. Nominal values. Specific sample max is between 33,554,432 and 134,205,440 samples.

Waveform measurements

Voltage	Peak-to-Peak, minimum, maximum, average, RMS, amplitude, base, top, overshoot, preshoot, upper, middle, lower
Time	Rise, Fall, Period, frequency, positive width, negative width, duty cycle

Utilities

Calibration	
Calibration cycle	1 year
Internal calibration source	0 to □16V typical
Electronic calibration	Requires an external 6.5 digit DMM and PC
Self test	Power on self test. Complete self test performed using *TST?

Hardware

1U Full rack LXI	425.7 mm W x 44.5 mm H x 367.9 mm D
Weight	
L4532A (2 channel)	3.3 kg
L4534A (4 channel)	3.63 kg
Front Panel	Power switch and display
Back panel (connectors)	
Power Input	
Input Channel	BNC
Cal Src out	BNC
10 MHz In	BNC
10 MHz Out	BNC
Trig In/ Out	BNC
I/ O Interface	LAN (Gbit), USB 2.0

Software

Web Interface	Internet Explorer, IE (version 6 & 7), Mozilla Firefox and Netscape. Requires Java-enabled browser (Java 1.6 or greater)
Remote programming language	ASCII commands, IEEE 488.2 compliant
Computer interfaces	
LAN: Standard LAN 10/ 100/ 1000 Base Tx	(VXI-11[1] compliant),
	Sockets (service at port 5025),
	Telnet (Service at port 5024)
USB: Standard USB 2.0	(USBTMC compliant[2])
Programming via direct native command set	
VISA I/ O control (LAN or USB)	Agilent I/ O Libraries Suite 15.0 recommended
LAN sockets control (LAN only)	<Sockets programming>
Programming via software driver	
IVI-COM, IVI-C Driver for Windows 2000/ XP/ Vista	
G-driver for LabVIEW	
Compatible with programming tools and environments:	
Agilent VEE Pro, Microsoft Visual Studio.NET, C/ C++, Visual Basic 6,	
National Instruments Test Stand, Measurements Studio, LabWindows/ CVI, LabVIEW.	

1. VXI-11 allows transfer of IEEE 488.1 and IEEE 488.2 messages over a TCP/ IP network. Supported by Agilent IO Libraries Suite (included).
2. USB Test and Measurement Class (TMC) that communicates over USB, complying with IEEE 488.1 and IEEE 488.2 standards. Supported by Agilent IO Libraries Suite (included).

Minimum system requirements (I/O Libraries and Drivers)

Operating System	Windows XP SP2 (or later) Windows 2000 Pro SP4 (or later)	Windows Vista 32-bit (Home, Basic, Premium, Business, Ultimate, Enterprise)
Processor	450 MHz Pentium II or higher required, 800 MHz recommended	1 GHz 32-bit (x86)
Available Memory	128 MB minimum (256 MB or greater recommended)	512 MB minimum (1 GB recommended)
Available Disk Space	280 MB minimum, 1 GB recommended for MIcrosoft .NET framework 2.0 65 MB for Agilent IO LIbraries Suite	280 MB minimum, 1 GB recommended for Microsoft .NET framework 2.0 65 MB for Agilent IO LIbraries Suite
Video	Super VGA (800 X 600) 256 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 5.01 or greater	Microsoft Internet Explorer 7 or greater

Environmental

Operating environment	Pollution degree 2, indoors
Operating temperature	0 to 55 °C
Storage temperature	-40 to +70 °C
Warm-up period	< 60 minutes to rated specs
Relative humidity (RH)	Maximum relative humidity 80% for temperatures up to 31 °C, decreasing linearly to 50 % RH> at 40 °C
Altitude	2000 M

Data storage/ transfer

Pre trigger data	Up to full record length - 4 samples
Record length	8 samples to 32 MSa/ 128 MSa
Post trigger data	4 samples to 128 MSamples
Maximum number of triggers	Number of records (triggers) configurable to 1024 records
Resolution	One sampling interval
Timestamp rollover	> 1.5 years
Maximum data transfer rate from memory	
USB 2.0	8 MB/ s
Gbit LAN	15.0 MB/ s

To Calculate Total Measurement Error

The digitizer's accuracy specifications are expressed in the form: ± (% of reading + % of range). In addition to the reading error and range error, you may need to add additional errors for certain operating conditions. Make sure you apply the conditions as described in the footnotes on the specification pages.

- If you are operating the digitizer outside the temperature range specified, apply an additional temperature coefficient error.

Understanding the " % of reading " Error The reading error compensates for inaccuracies that are dependent upon the input signal level. The reading error varies according to the input level on the selected range. This error is expressed in percent of reading. The following table shows the reading error applied to the digitizer's ±8 V input range specification for a nominal operating temperature of 23 °C ±5 °C.

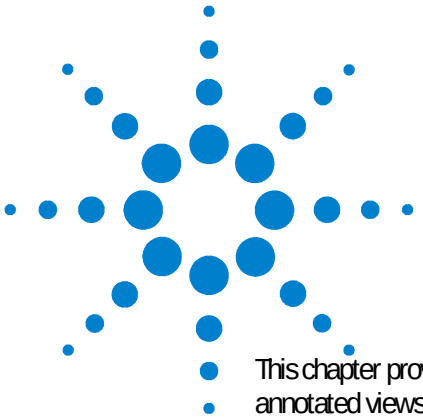
Range	Input Level	Reading Error ± (% of reading)	Reading Error (Voltage)
±8 V	8 VDC	0.1	±8 mV
±8 V	4 VDC	0.1	±4 mV
±8 V	1 VDC	0.1	±1 mV

Understanding the " % of range " Error The range error compensates for inaccuracies that result from the range you select. The range error contributes a constant error, expressed as a percent of range, independent of the input signal level. The following table shows the range error applied to the digitizer's ±8 V input range specification for a nominal operating temperature of 23 °C ±5 °C.

Range	Input Level	Range Error ± (% of range)	Range Error (Voltage)
±8 V	8 VDC	0.20	±16 mV
±8 V	4 VDC	0.20	±16 mV
±8 V	1 VDC	0.20	±16 mV

Temperature Coefficients

Accuracy is usually specified at the calibration temperature 23 °C ±5 °C temperature range. This is a common temperature range for many operating environments. You must add additional temperature coefficient errors to the accuracy specification if you are operating the digitizer outside the ± 5 °C temperature range (the specification is per °C).



2 Introduction

This chapter provides an overview of the basic capabilities of the two digitizer options, with annotated views of the front and rear panels.

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L4532A/ 34A Digitizers - Capabilities

General Capabilities

The L4532A (2-channel) and L4534A (4-channel) are 1U, full-rack (EIA cabinet), LXI (Class-C) digitizers for design validation and functional test applications. Primary features of both models are:

- Maximum Input Voltage: ±250 V
- Minimum Full-Scale Voltage Range: ±250 mV (1000:1 range)
- Isolated/Floating Inputs: two or four differential inputs; can measure high and low voltage signals simultaneously on separate channels
- Maximum Sample Rate: 20 MSa/s
- Vertical Resolution: 16 bits (including sign bit)
- Analog Bandwidth: 20 MHz
- Input Filters: 200 kHz, 2 MHz and 20 MHz
- Power Supply: Universal, 100 V to 240 V
- BNC connectors for:
  - Input channels
  - Bi-directional external trigger In/Out
  - 10 MHz external synchronization source (clock) input and output
  - Calibration source output
- Sample Memory:
  - Standard Memory: 32 MSa/channel (not upgradeable after purchase)
  - Deep Memory Option: 128 MSa/channel
- Instrument Control (PC interface) Options:
  - Gigabit LAN (with auto-IP or user-set parameters)
  - USB 2.0
- Programming Language: ASCII commands, IEEE 488.2 compliant
- Computer Interfaces:
  - Built-in Web Interface (LAN only)
  - LAN: Standard LAN 10/100/1000BaseTx, (VXI-11 Class-C* compliant), Sockets (service at port 5025), Telnet** (service at port 5024)

    * VXI-11 allows transfer of IEEE 488.1 and IEEE 488.2 messages over a TCP/IP network. Supported by Agilent IO Library Suite (included)
    ** Telnet service allows transfer of Agilent digitizer commands and responses over a TCP/IP network.
  - USB: Standard USB 2.0 (USBTMC*** compliant)

    *** USB Test and Measurement Class (TMC) that communicates over USB, complying with IEEE 488.1 and IEEE 488.2 standards. Supported by Agilent IO Libraries Suite (included)
  - IVI-C, IVI-COM, and LabVIEW drivers

Sampling and Measuring Capabilities

The digitizer captures one data record (a selected number of samples) per trigger, and stores it in sample memory. You can query the digitizer to download data from the sample memory, and can specify:

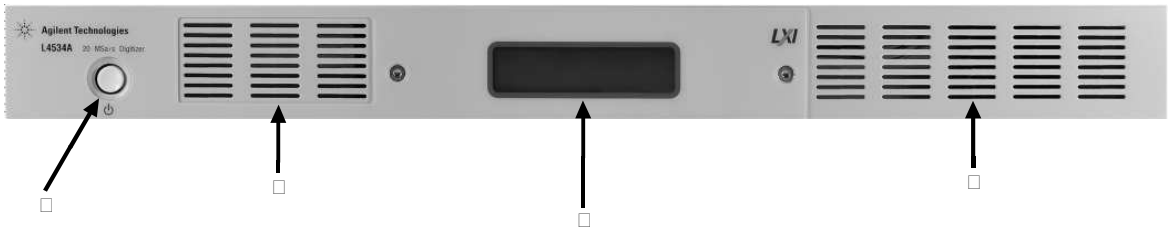
- Individual channels or ranges of (one, two or four) channels; four channels on L4534A only)
- Individual samples or ranges of samples
- Individual records or ranges of records.
- All samples in memory

The digitizer can calculate the following measurements from the sample data:

- Voltage levels
  - Minimum Voltage
  - Maximum Voltage
  - Peak-to-Peak Voltage
  - Base Voltage
  - Top Voltage
  - Amplitude
  - Average Value
  - RMS Average
  - Lower Threshold Level
  - Middle Threshold Level
  - Upper Threshold Level
- Time-based measurements
  - Rise Time
  - Fall Time
  - Pulse Width
  - Period
  - Duty Cycle
  - Frequency
  - Preshoot
  - Overshoot

Detailed instructions on sampling and measurement, with definitions of these measurements, command language syntax and examples, are provided in the Agilent L4532A/34A User's Guide.

L4532A/ L4534A Front Panel At A Glance



1	On/ stand-by button
2	Display
3	Air vents

On/ Stand-by button

The "on/ stand-by" button (⏻) turns the digitizer on if it is in stand-by mode, and returns it to stand-by mode if it is on. Complete details of the button's function are in "Applying Power" on page 30.

Display

The backlit front-panel LCD display provides two lines which can display 16 characters each. The top line displays the instrument state; the bottom line displays LXI/ LAN information, firmware update progress messages, or an LXI error indicator. For details on these messages, see "Display Messages" on page 20. A complete description of display features is in the Agilent L4532A/ 34A User's Guide.

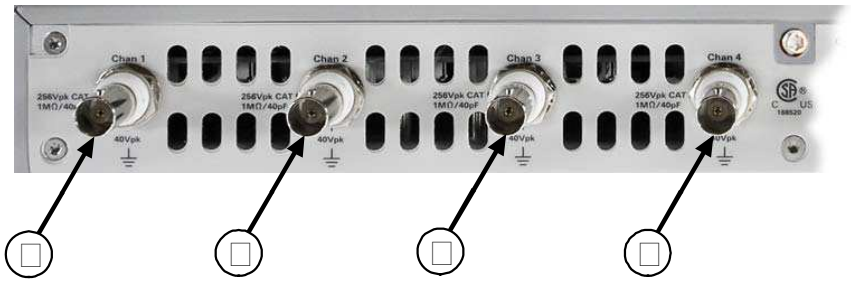
A sequence of instrument ID information is displayed at boot-up, followed by a fixed, idle state message. The complete sequence is illustrated in "Applying Power" on page 30.

L4532A/ L4534A Rear Panel At A Glance

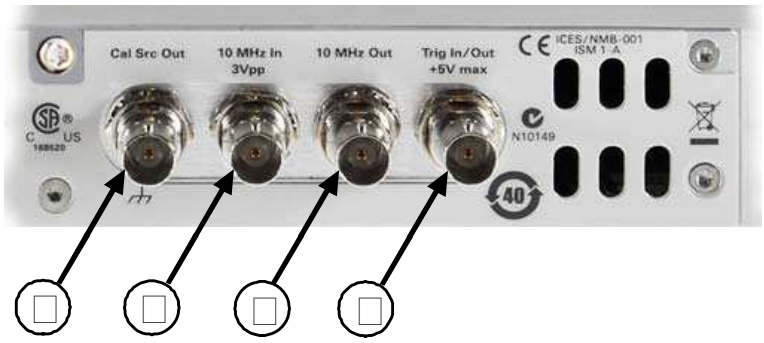
The photos below show the 4-channel model L4534A. The 2-channel model L4532A will only have two BNC connectors for Chan 1 and Chan 2 at left; all other connections are the same on both models.



Channel Connections (left side of panel, 4-channel model)

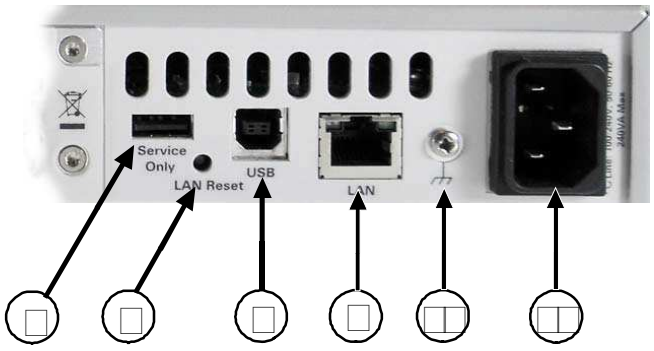


Control Connections (center of panel)



1	BNC connectors for channel inputs
2	BNC connector for calibration source connection
3	BNC connector for sync signal input
4	BNC connector for sync signal output
5	BNC connector for trigger signal
6	Service port
7	LAN reset access port
8	USB port
9	LAN port
10	Chassis ground terminal
11	AC power cable socket

Communications Connections (right side of panel)



Display Messages

The backlit front-panel LCD display provides two lines which can display 16 characters each.

Top Display Line

The top line displays the instrument state:

- **IDLE** – the digitizer is currently not busy.
- **WFA** – The digitizer has been INITiated and is waiting for arm.
- **WFT** – The digitizer is armed and waiting for trigger.
- **ACQUIRING** – The digitizer has seen its trigger event and is currently measuring on one or more if the inputs.
- **Measuring** – The digitizer is evaluating an on-board measurement.
- **DTR** – The digitizer is transferring data.
- **SYSTEM ERROR** – The digitizer detected a hardware error on startup.
- **Testing ...** – A self test is currently being performed.
- **Calibrating** – Calibration is currently being performed.
- **Updating** – A firmware update is in progress.
- **Rebooting** – New firmware has been installed, and the digitizer is rebooting to complete the update.

In normal operation, the rightmost three characters of the top line are reserved for annunciators:

- The last character will be for errors. If there is an error for any of the server applications, the error annunciator ■ will be displayed. When the error is cleared, the ■ will be cleared as well. If a LXI LAN communication error occurs, there will be an asterisk on the bottom display line below the error annunciator, as shown: ■ ⌜
- The second from the last character will be the LAN activity indicator, ■. If there have been LAN commands or queries, the ■ will be displayed for a few seconds and then cleared.
- The third from the last character will be the USB activity indicator, ■. If there have been USB commands or queries, the ■ will be displayed for a few seconds and then cleared.

During firmware updates the top line of the display displays **Updating**, and the bottom line displays progress messages. These provide feedback that the digitizer has not stopped the update process, since firmware updates may take several minutes.

Bottom Display Line

The bottom line displays LXI/LAN information. LXI always has precedence over LAN information. For example if the LXI Identification is sent to an instrument it must be displayed instead of any LAN information.

If LXI information is displayed: these are the possible messages:

- **LXI-Power** - The backlight of the display will indicate that the power is on.
- **LXI-IDENT** - A request for LXI instrument identification has been sent to the digitizer. A subsequent request must be sent to disable this message.
- * - LXI LAN fault indicator.

If LAN information is displayed: it is the current IP Address.

If a firmware update is in progress: progress messages are displayed.

2 Introduction

3
Getting Started

This chapter provides an overview of the L4532A/34A 20 MSa/s 16-bit digitizer. It discusses safety considerations, installation, cable connections, and communication between the digitizer and your PC. It also introduces the digitizer's built-in LAN-based Web Interface.

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Using the Web Interface 35
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Inspecting Contents

Items Supplied

The following accessories are shipped standard with the L4532A/34A digitizer:

- Power cord for country of destination
- Agilent Automation Ready CD (IO Libraries Suite)
- Agilent L4532A/34A Product Reference CD

The following printed (hardcopy) manuals are optionally available with the L4532A/34A:

- Agilent L4532A/34A User's Guide
- Agilent L4532A/34A Service Guide

If the L4532A/34A was ordered with option 0B0 (delete printed manuals), hardcopy manuals are not included with the instrument. However, all manuals, online help, and other documentation are provided in electronic form on the Agilent L4532A/34A Product Reference CD.

Before installing the instrument, verify that you have received these items with your instrument. If anything is missing, please contact your nearest Agilent Sales Office.

Inspecting the Unit

When you receive your digitizer, inspect it for any obvious damage that may have occurred during shipment. If there is damage, notify the shipping carrier and nearest Agilent Sales Office immediately.

Until you have verified that the digitizer is functional, save the shipping carton and packing materials in case the unit has to be returned.

Installing the L4532A/ 34A

Safety Considerations

The digitizer is a Safety Class 1 instrument, which means it has a protective earth terminal (the third terminal safety ground in the power connector). That terminal must be connected to earth ground using the supplied three-wire power cord, which must be connected to a grounded receptacle. Do not defeat the safety ground by removing the power plug's ground prong or by using an ungrounded adapter or cable.

Refer to the Safety Summary page at the beginning of this guide for general safety information. Safety warnings for specific procedures are located at appropriate places throughout this manual.

Environment

WARNING Do not operate the digitizer in the presence of ignitable gases or fumes

The dimensions and environmental conditions for the digitizer are documented in Chapter 1, Specifications. The digitizer should only be operated indoors in a controlled environment.

Fans cool the digitizer by drawing air through the front and exhausting it out the left side and back. Install the digitizer in a location that allows generous space at the front, back, and left side of the unit for adequate air circulation.

Rack Mounting the Digitizer

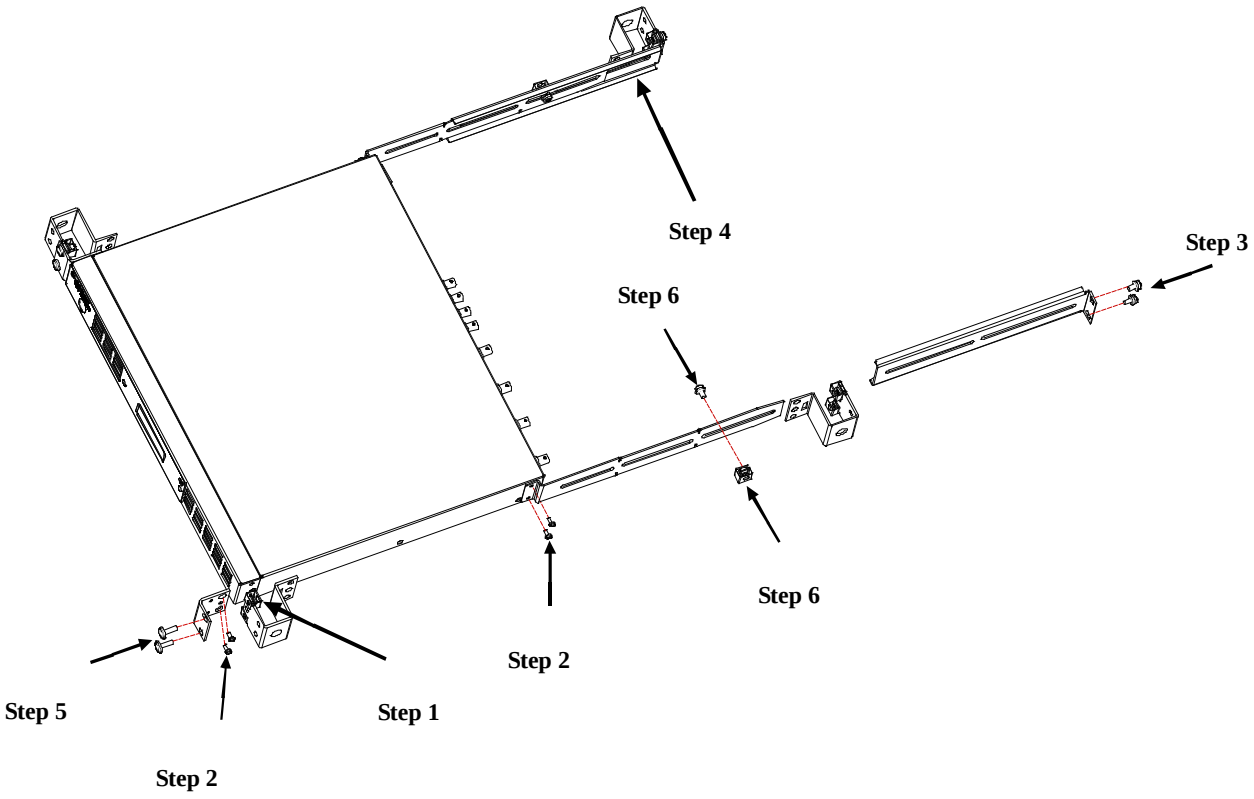
CAUTION Do not block the air intake and exhaust at the front, rear, and left side of the unit. Use the Rack Mount kit (order part # L4532-67001) to rack mount your instrument. Do not use support rails, as these would block air flow.

The Agilent L4532A/34A digitizers can be mounted in a 19-inch EIA rack cabinet. It fits in one rack unit (1U) of space. The optional L4532-67001 rack mount kit includes the following parts:

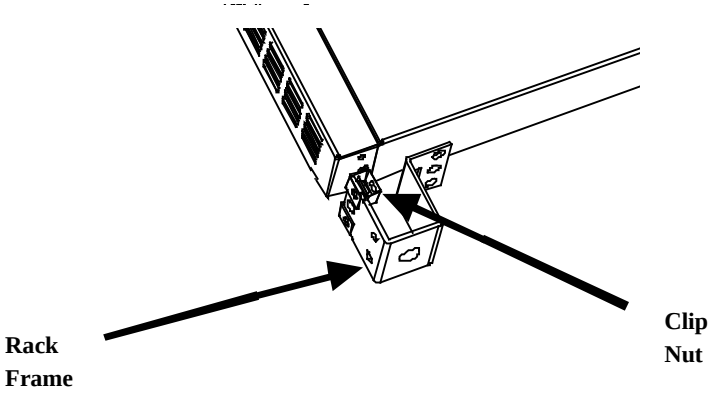
Table 1

Description	Quantity
Clip nut	10 (9 plus 1 spare)
Front Ear	2
Rear Extender Support	2
Rear Ear	2
M3 x 8mm machine screw	10 (8 plus 2 spares)
10-32 Plain Machine Screw	6 (5 plus 1 spare)
10-32 Dress Machine Screw	6 (4 plus 2 spares)

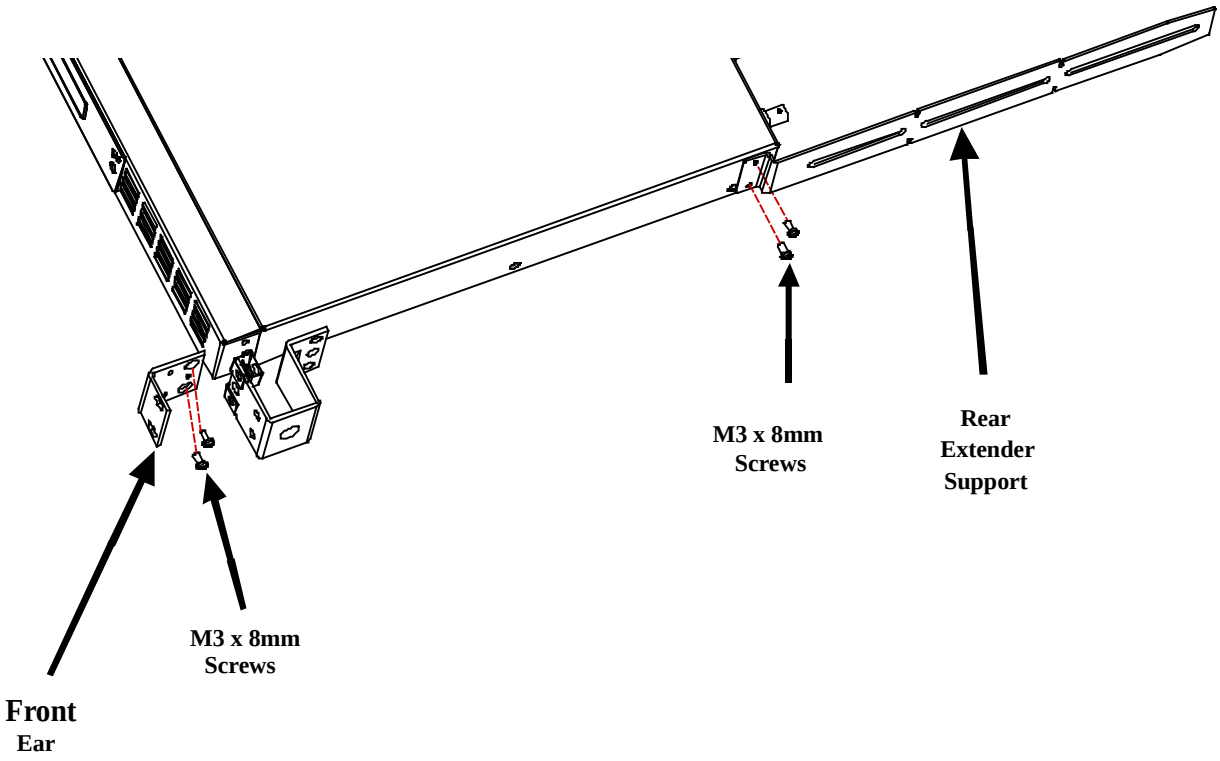
Install the rack mount kit as instructed on the following page. The numbers on the diagram below match the procedure steps.



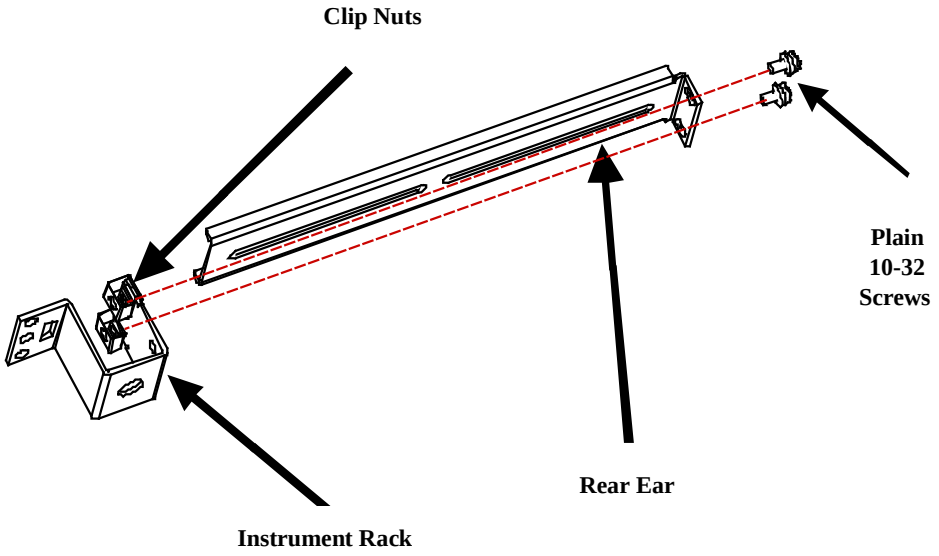
1 Install eight clip nuts on the rack frame (two in each corner) where your instrument will be located.



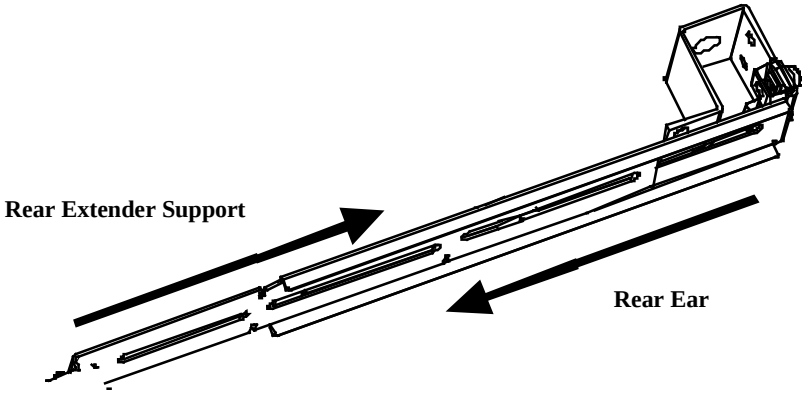
2 Attach the two front ears and the two rear extender supports to the digitizer as shown below. Use four M3 x 8mm screws for the front ears and four M3 x 8mm screws for the extender supports.



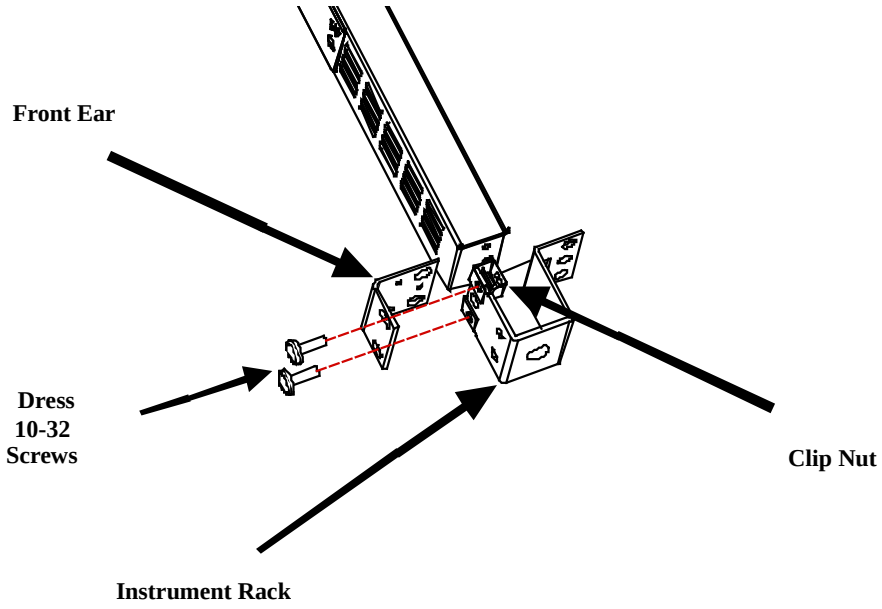
3 Attach the two rear ears to the clip nuts on the back of the instrument rack as shown below. Use the four plain 10-32 screws to install the rear ears.



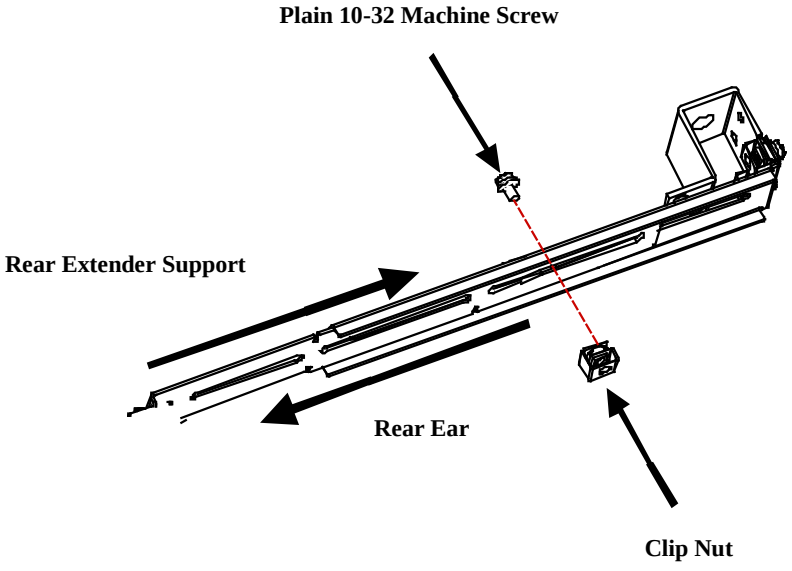
4 Slide the instrument into the rack, making sure that the rear extender supports are aligned inside the rear ears.



5 Attach the front ears to the clip nuts on the front of the instrument rack using the four dress 10-32 screws provided.



6 Optional step: Insert two plain 10-32 screws, one through the slot of each rear ear and extender support. Attach the screws with clip nuts.



This will prevent the unit from sliding out of the front of the rack.

Powering Up

Connecting the Line Cord

WARNING

FIRE HAZARD Use only the power cord that was supplied with your instrument. Using other types of power cords may cause overheating of the power cord, resulting in fire.

SHOCK HAZARD The power cord provides a chassis ground through a third conductor. Be certain that your power outlet is of the three-conductor type with the correct pin connected to earth ground.

Connect the power cord to the power receptacle on the rear of the unit. If the wrong power cord was shipped with your unit, contact your nearest Agilent Sales Office.

The AC input on the back of the digitizer is a universal AC input that accepts nominal line voltages in the range of 100 VAC to 240 VAC at 240 voltamperes. The line frequency may be either 50 Hz or 60 Hz.

NOTE

The detachable power cord may be used as an emergency disconnect device. In rack installations or other installations with a master power switch for the rack or bench, the master switch may be used as an emergency disconnect device. Do not position the digitizer so that the power cord, master switch or other emergency disconnect device is inaccessible.

Applying Power

With power connected, the unit is in "stand-by" mode. In stand-by mode, line power continues to drive the digitizer's internal power supply; however, no power is provided to its measurement circuitry.

You may already have connected your LAN or USB interface cable; if not, you may do so at this time.

Press the "on/stand-by" button (⏻) on the front panel. The power on sequence is described and illustrated below.

- If the L4532A/34A does not turn on when ⏻ is pressed, verify that AC power is available to the instrument and that the power cord is securely connected. If the instrument still does not turn on, the cooling fan is not audible, or the front panel display is off when power is applied, return the unit to Agilent for repair.
- The L4532A/34A remembers its power state (e.g. "on" or "standby") when unplugged; it will return to that state when plugged in again.

Power-On Sequence

The L4532A/34A may take up to a minute to boot, during which you will see some progress messages on its display. Then the display provides three sets of information, in sequence:

ID and revision message First, the instrument will provide an ID and version info (typical example shown):



The first line displays the model number. The second line is in the form **f.ff-bb-gg-rr**, where:

- **f.ff** is the instrument's installed firmware version.
- **bb** is the FPGA version for the digitizer's digital board.
- **gg** is the FPGA version for the digitizer's channel 1-2 analog board.
- **rr** is the FPGA version for the digitizer's channel 3-4 analog board.

The FPGA versions provide useful information for instrument servicing.

MAC Address Then, the instrument will display its fixed MAC address (a typical example is shown; every LAN instrument has a MAC address uniquely identifying its LAN interface):



Idle State Message Upon completing the power-on sequence, the instrument displays this idle state message. If a LAN connection is established, the instrument also displays the IP address:



In LAN configurations without a DHCP server, allow approximately 60 seconds for the Automatic IP feature to assign an IP address to the digitizer.

A brief power-on self-test occurs automatically during power-on. If this test fails, the ■ annunciator on the right side of the display turns on when the digitizer enters the Idle state. In that case, you may initiate a more complete self test as described in "Self Test Procedures" on page 76.

Should a LAN communication error occur, there will be an asterisk beneath the error annunciator, on the second display line, as follows: ■ ┌

Power-Down Sequence

To return the instrument to stand-by mode, press ⏻.

Input Connections

The L4532A has two input-channel terminals; the L4534A has four (they are shown in "Channel Connections" on page 19.

Input Characteristics and Protection limits

Each input-channel BNC connector has the following characteristics:

- The input resistance is 1 MW.
- The input capacitance is 40 pF.
- The allowable input signal is ±250 Vpk (from shield to center pin on the BNC connector).
- The Transient overvoltage limit is ±400 Vpk for each input channel.
- Each channel may float independently; its BNC connector shield may float ±40 Vpk relative to earth ground.

WARNING The shields of any two channels must be limited to a potential difference of ±42 Vpk (maximum, shield-to-shield) to avoid an electric shock hazard.

Connecting the DUT

Use standard BNC cables to connect your device under test (DUT) to the digitizer's input channels. Such cables have BNC connectors at each end, requiring that the DUT have BNC outputs.

WARNING When connecting the BNC input connectors to the device under test, make sure that the BNC cables used are rated for the expected input voltages. Up to 250 Vpk may be measured on each channel, provided the cables are rated for such voltages.

The Agilent L4532A/34A is designed for IEC Measurement Category I (CAT I) measurements only. The input channels may be connected only to circuitry that is isolated from AC Mains.

WARNING Do not connect the input channels of the L4532A/ 34A to AC line-voltage mains. This instrument must be used in CAT I (isolated from mains) applications. Do not use in other IEC Measurement Category (CAT II, CAT III, or CAT IV) applications. Failure to observe these precautions may result in electric shock and serious personal injury.

When any DUT is connected, it can expose the digitizer's hardware to excessive voltages. The channel protection relays protect the digitizer from these conditions, but only if the digitizer is On. Using the On/Stand-by switch to put the unit in Stand-by mode resets all channels to the ±256 V range and disconnects the input BNCs from the measurement hardware.

CAUTION If you remove line power from the digitizer before putting the digitizer in Stand-by mode, the input channel configuration will remain at the last set range, without benefit of input channel overvoltage protection. Agilent recommends that you issue the `SYSTem:PRESet [SAFE]` command before removing line power.

Fixture Safety Considerations

The information presented below is a guideline and not an absolute rule. The test system designer must take responsibility for making sure that test programs, systems, and fixtures pose no safety hazard to test operators.

Some safety elements to consider before building a fixture are listed below. There may be others to consider based on local statutes and practices, and the nature of the tests being performed.

High Voltage Hazards

Voltage values equal to or exceeding the following levels (with respect to chassis ground) are considered to be shock hazards:

60 VDC□
42 Vpk□
30 Vrms

If a hazardous voltage present on your fixture or DUT is accessible to operators, you should provide a safety shroud. You should also warn operators of the danger with a high-voltage warning label.

For the Agilent L4532A/34A, there are three main considerations regarding high voltage safety:

1 Make sure that all BNC cables being used are rated for the expected voltages.

2 Make sure that the DUT does not have high voltage (greater than 42 Vpk) circuits exposed to the operator.

3 Make sure that floating shields on two or more channels do not float at a shield-to-shield potential exceeding 42 Vpk. Otherwise, a shroud should be used.

WARNING If the shields of two or more channels are expected to float with more than a 42 Vpk potential difference between shields, operators must be protected against the resulting shock hazard. A shroud or cover must be provided to prevent contact with the shields during such operations. Failure to do so may result in electric shock.

Connecting to Your PC

You may connect the digitizer to your PC using a local area network (LAN) or USB interface. Complete connectivity details for Agilent instruments can be found in the Agilent GPIB/USB/LAN Connectivity Guide.

The L4532A/34A has a built-in web server. The LAN connection between the PC and the digitizer provides access to the digitizer through the digitizer's Web Interface. This is the easiest way to access the L4532A/34A as it requires no additional I/O drivers.

NOTE Complete instructions for PC connection, configuration and communication are provided in the Agilent L4532A/ 34A User's Guide. Refer to that section to make and configure your desired connection.

To get started using the digitizer:

- Install the Agilent IO Libraries Suite from the Automation-Ready CD-ROM that is shipped with your instrument.
- Connect and configure a LAN or USB connection.
  - For LAN connection, use a standard Categpry 5 LAN cable.
  - For USB connection, use a USB A-Plug to B-Plug cable.
- Run the Connection Expert utility of the Agilent IO Libraries Suite to verify that the computer automatically recognizes the digitizer. This may take several seconds. If the instrument cannot be found, you can add the instrument using the IP address displayed on the front panel.
- You can now use Interactive IO within the Connection Expert to communicate with your digitizer, you can program it using various programming environments, or you can use the Web Interface (next section).

Using the Web Interface

The web interface is very useful for getting up to speed quickly using the L4532A/34A digitizers. Its main benefits:

- The easy to navigate interface and help screens provide a quick way to familiarize yourself with most digitizer configuration and acquisition options.
- You can make all key configuration settings and install measurements from one page (**Configure Digitizer**).
- You can trigger the digitizer, view data on an oscilloscope-like graphical display, view derived measurements, and fetch data, all from one page (**Acquire Data**).
- You can easily control system functions, such as reading and debugging errors, resetting power-on defaults, executing a device clear, saving configured instrument states, running a self-test and performing device calibration; all from one page (**Utilities**).

The **Command Monitor** window displays the commands which result from each function you select, so that you can learn the commands necessary to build and verify an automated control program for your host application. For convenience, you may even cut and paste commands from the Command Monitor into your programming environment.

This section provides the instructions for accessing the web interface and a quick look at a few of its pages; just enough to connect a signal source to your digitizer and digitize your first samples.

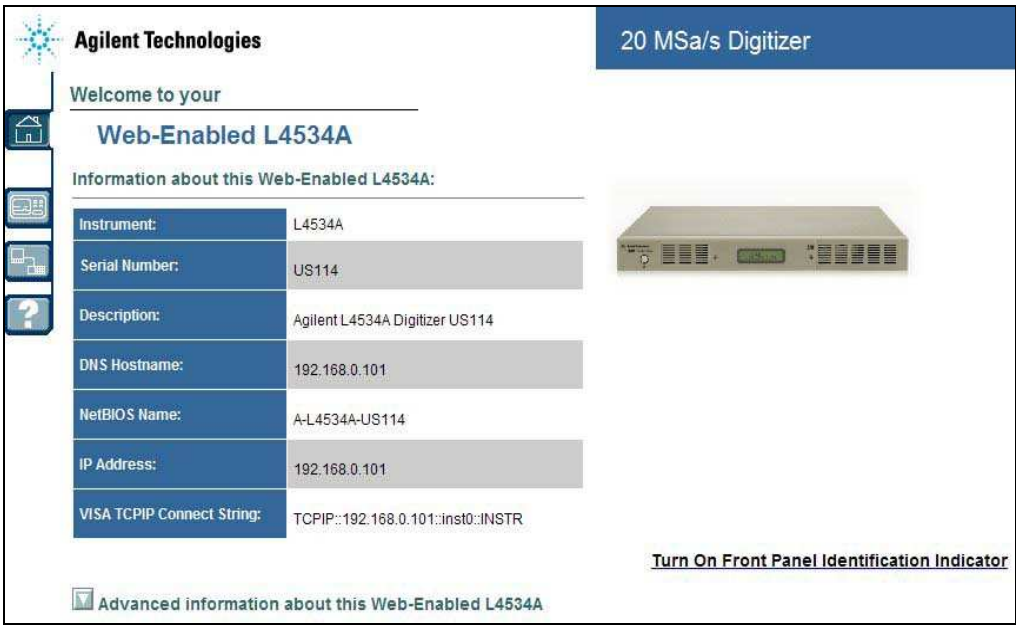
For a more complete look at the Web Interface, explore the built-in Help screens.

Accessing the Web Interface

To use the Web Interface:

1. Make and configure a LAN connection.
2. Turn on the digitizer. Following the power-on sequence note the digitizer's IP address displayed on the front panel at IDLE.
3. Open the Internet browser on your PC. In the browser `Address' window, enter the digitizer's IP address (for example, type `192.168.0.101`).

The Web Interface's `Welcome Page' appears as shown below.



NOTE In order to access the Web Interface's Remote Control Page, you must have a Java-enabled browser. Internet Explorer 6.0 or later is recommended.

The Java applet is signed. You may see a dialog from your browser requesting permission to run this applet, and may have to enable the applet to run.

You do not need to have the Agilent IO Libraries Suite software in order to access the Web Interface. However, if you do have the IO Libraries, you can start the interface from the Agilent Connection Expert program that is provided with the IO Libraries.

NOTE In some network configurations, a proxy server may prevent access to the instrument (i.e. "page cannot be displayed"). In this situation, configure the proxy from the Internet browser such that the proxy is not used for (IP) addresses within the range of those that can be assigned to the L4532A/ 34A.

Navigating the Web Interface

The Web Interface has three main pages (Welcome, Remote Control, and Network Configuration). Click on one of the icons at the left of any screen to get to the desired web page:



Welcome Page
The Welcome page (default when accessing the Web Interface) provides basic information and identification of the Agilent L4532A/ 34A instrument.



Remote Control Page
This page allows you to control the instrument over the LAN. You can configure the instrument, collect and display data, and perform many other tasks without programming.



Network Configuration Page
This page allows you to configure the LAN settings for your instrument on the network.



Help for this Web Page
This page allows you to access extensive Web Page help. Click on this icon for help on the currently selected page.

The Web Interface is self-guiding. The help button provides complete help (in a separate pop-up window) for whichever other page you are viewing (e.g. the top three pages listed above, or one of their tabbed pages).

The Network Configuration Page allows you to easily make changes to LAN settings, using the help button as necessary. Refer to the Agilent L4532A/334A User's Guide for more complete instructions.

The Remote Control Page provides access to most digitizer configuration and control settings, so we will explore it for the remainder of this chapter.

Begin by clicking the (Remote Control page) icon.

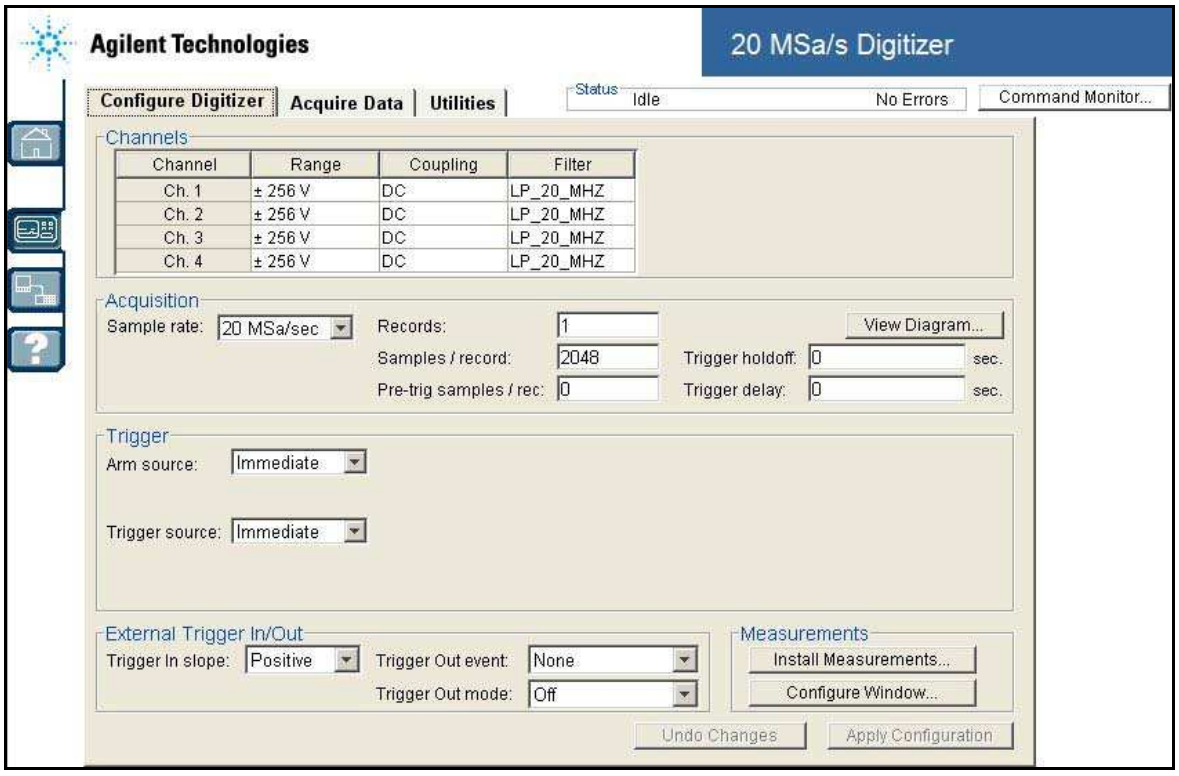
The Remote Control page is not password protected from the factory. If passwords have been enabled, the following screen appears:



Enter the password if necessary; the Remote Control page loads.

Navigating the Remote Control Page

The Remote Control page (below) contains the four main icons at left, a status monitor panel at center with three tabs, and a Command Monitor... button at right which allows you to monitor the commands sent when you configure or operate the digitizer.



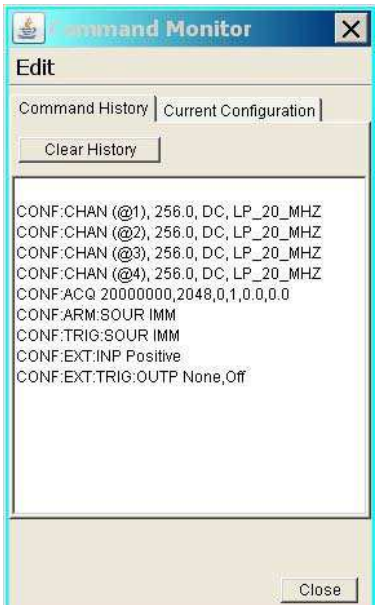
The three tabs are:



- **Configure Digitizer** - This tab appears first. It allows you to configure the digitizer and set up to acquire data.
- **Acquire Data** - This tab allows you to start an acquisition and display data graphically.
- **Utilities** - This tab allows you to access several utility functions, and even to send instrument commands from over the LAN.

Below the tabs are buttons to Apply Configuration or Undo Changes. Any changes you set do not take effect until applied.

The Command Monitor Button Clicking this button from the remote control page opens a second window (with two tabs), where you can view the actual commands sent to the instrument to put it in its current state (click the Current Configuration tab) or a list of commands issued (click the Command History tab). The Command Monitor window listing a typical configuration is illustrated below.



For convenience, you may cut and paste commands from the Command Monitor window into your programming environment.

The Configure Digitizer Tab Under this tab (illustration on previous page), you can configure most acquisition parameters:

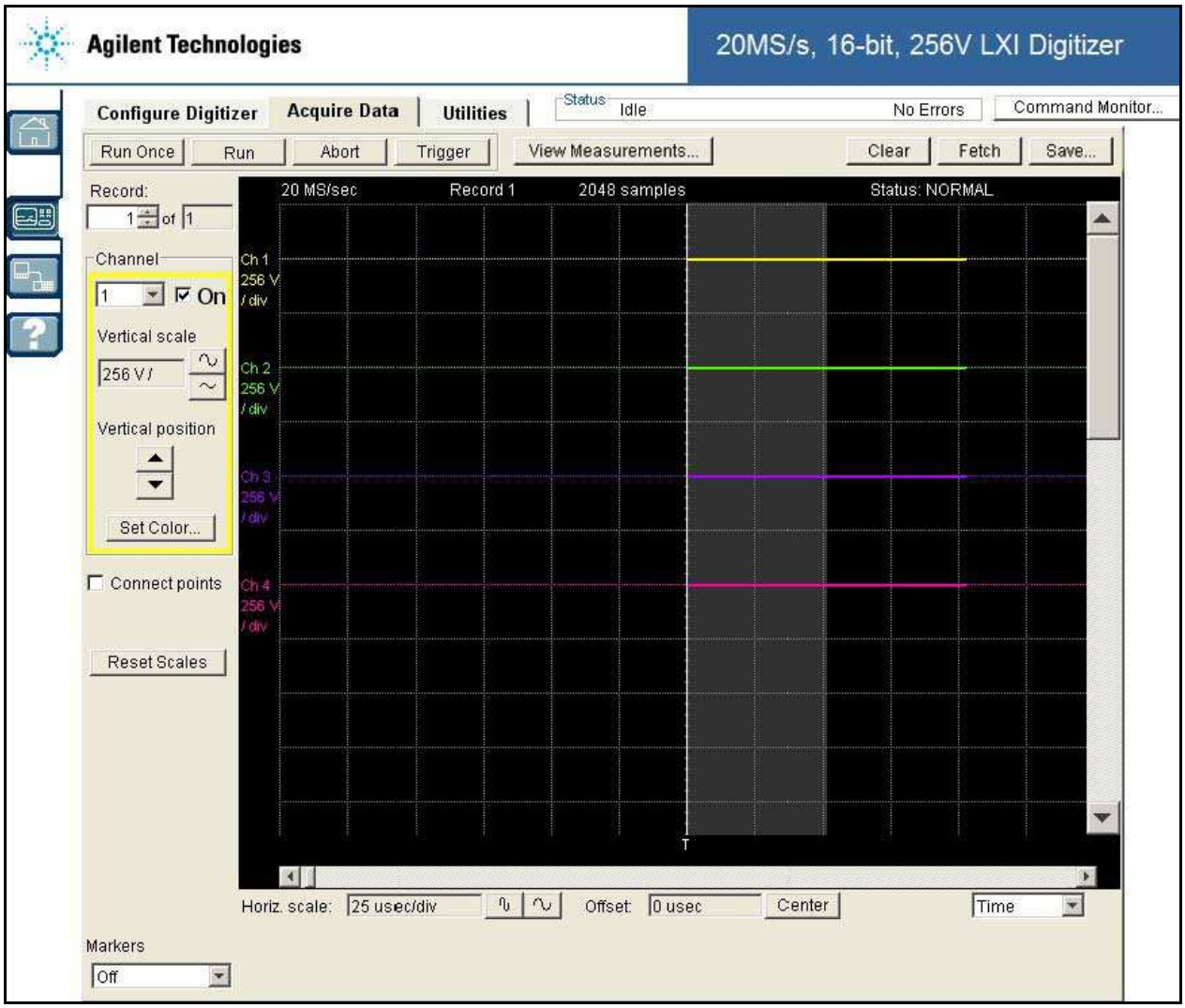
Table 2

In this Section	You can configure these parameters
Channels	input range
	coupling
	low-pass filter settings
Acquisition	sampling rate
	number or records
	record size
	pre-trigger size
	trigger holdoff
	trigger delay
Trigger	arm source
	triggers per arm
	trigger source
	trigger channel parameters (channel number, mode edge or window , edge or window voltage levels, hysteresis)
External Trig Out	trigger-in slope, trigger-out event
	trigger impedance

If you have the Command Monitor window open, you can view the resulting commands sent to the digitizer upon clicking the Apply Configuration button (the button becomes active only if you have made configuration changes).

These settings and the commands you user to set them from a host application are described in detail in the Agilent L4532A/34A User's Guide.

The Acquire Data Tab Under this tab, the Web Interface provides a gtraphical representation of the sampled data in real time, as an aid in setup and troubleshooting. You can adjust the horizontal and vertical scales to selectively view data, and can set measurement markers.

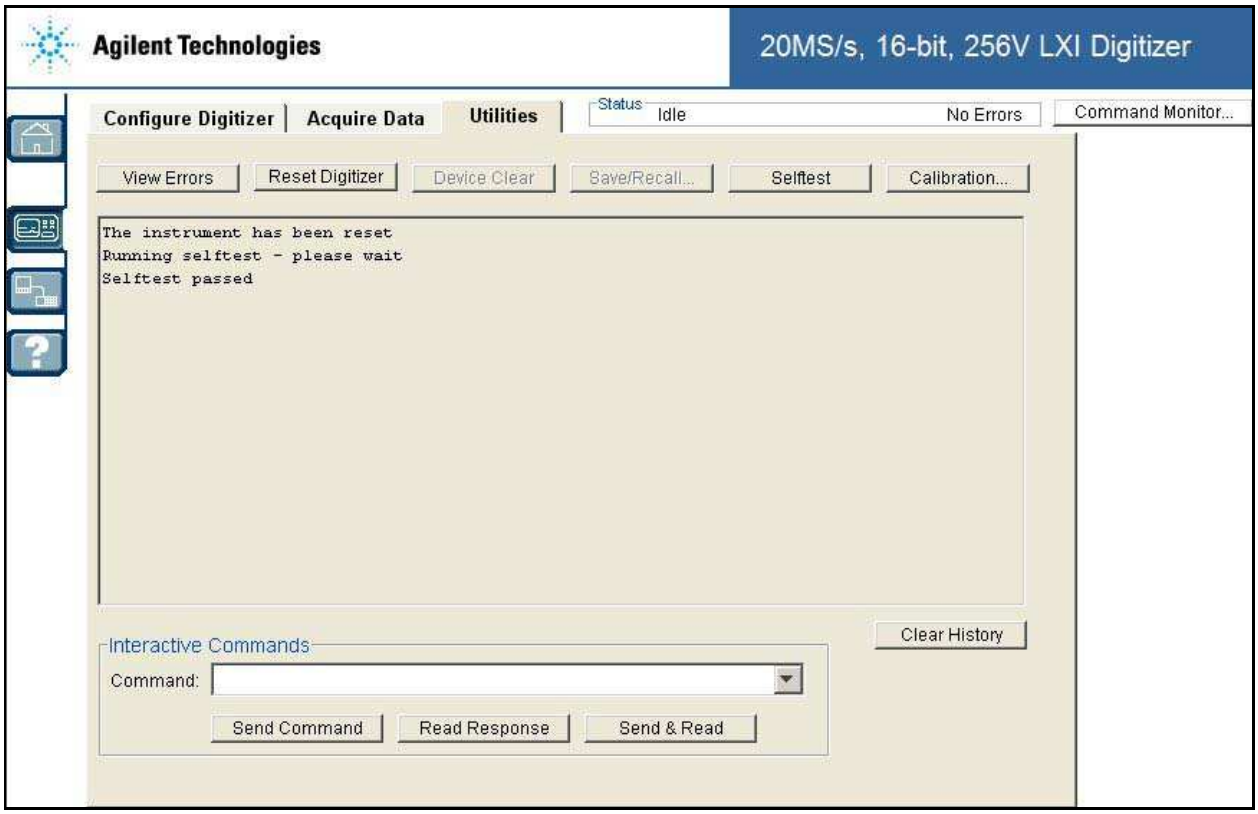


Some useful controls on this page are:

- The Acquisition buttons (**Run Once**, **Run**, **Abort** and **Trigger**) provide you the ability to directly take and view samples.
- The Measurement Data buttons (**Clear**, **Fetch**, **Save**) allow you to fetch select records and output to a file, or clear the displayed data.
- The **Measurements...** button opens a window where you can install measurements and read results.

The Utilities Tab Under this tab, you can:

- View and clear recorded errors
- Reset the digitizer
- Save or recall an instrument state
- Perform an instrument self-test
- Perform digitizer calibration or quick Auto Zero calibration



The Utilities tab also provides an interactive I/O window for sending commands and reading responses.

4
Calibration and Adjustment

This chapter contains procedures for verification of the digitizer's performance and adjustment (calibration).

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Closed-Case Electronic Calibration. The digitizer features closed-case electronic calibration. No internal mechanical adjustments are required. The digitizer calculates correction factors based upon the input reference value you set. The new correction factors are stored in non-volatile memory until the next calibration adjustment is performed. Non-volatile EEPROM calibration memory does not change when power has been off or after a remote interface reset.

Agilent Technologies Calibration Services

Agilent Technologies offers calibration services at competitive prices. When your digitizer is due for calibration, contact your local Agilent Service Center for recalibration. See "Types of Service Available" on page 72 for information on contacting Agilent.

Calibration Interval

The digitizer should be calibrated on a regular interval determined by the measurement accuracy requirements of your application.

A 1-year interval is adequate for most applications. Accuracy specifications will remain valid only if adjustment is made at regular calibration intervals. Accuracy specifications are not valid beyond the 1-year calibration interval. Agilent does not recommend extending calibration intervals beyond 2 years for any application.

Adjustment is Recommended

Specifications are only valid within the period stated from the last adjustment. Whatever calibration interval you select, Agilent recommends that complete re-adjustment always be performed at the calibration interval. This is necessary to ensure that the digitizer will remain within specification for the next calibration interval. This criteria for re-adjustment provides the best long-term stability.

Performance data measured during Performance Verification Tests does not mean that the digitizer will remain within these limits unless the adjustments are performed.

Time Required for Calibration

The digitizer can be automatically calibrated under computer control. With computer control you can perform the verification procedure in less than 45 minutes and the adjustment procedure in less than 10 minutes. Ensure the digitizer is warmed up before beginning any of these procedures (see "Test Considerations" on page 48).

Using the Adjustment Procedures

This chapter provides manual adjustment procedures using the L4532A/34A built-in Web Interface, which provides a Calibration feature. You can also perform these adjustment procedures by sending appropriate digitizer CAL commands over a LAN or USB.

The digitizer must be unsecured prior to initiating the calibration adjustment procedure (see "Calibration Security" on page 65).

You can also automate the complete verification and adjustment procedures outlined in this manual. Refer to the Agilent L4532A/34A Command Reference for information on programming the digitizer. It is also downloadable from the Web. See either product page:

www.agilent.com/find/L4532A

www.agilent.com/find/L4534A

Recommended Test Equipment

The test equipment recommended for the performance verification and adjustment procedures is listed below. If the exact recommended equipment is not available, substitute an instrument with calibration standards of equivalent accuracy.

A suggested alternate method for verification procedures would be to use an Agilent 34410A/11A 6½ digit Digital Multimeter to measure less accurate yet stable sources to determine the exact verification values.

Application	Recommended Equipment	Accuracy Requirements
DC Voltage Verification	Fluke 5700A	<1/5 digitizer accuracy spec
Timebase Verification	Agilent 53132A	12 digit resolution
AC Flatness Verification [1]	Fluke 5700A	<1/5 digitizer accuracy spec
Input Channel Noise [1]	50 Ω BNC Termination (L4532A - 2, L4534A - 4)	
Gain Adjustments	Agilent 34410A/11A	6½ digits

1. Optional Verification Test

Performance Verification Tests

Use the Performance Verification Tests to verify the measurement performance of the digitizer. The performance verification tests use the digitizer's specifications listed in Chapter 1, "Specifications".

You can perform four different levels of performance verification tests:

- Self Test. A series of internal verification tests that give a high confidence that the digitizer is operational.
- Quick Verification. A combination of the internal self-tests and selected verification tests.
- Performance Verification Tests. An extensive set of tests that are recommended as an acceptance test when you first receive the digitizer or after performing adjustments.
- Optional Verification Tests. Tests not performed with every calibration. Perform these tests to verify additional characteristics or functions of the digitizer.

Self Test

A brief power-on self test occurs automatically whenever you turn on the digitizer. This limited test assures that the digitizer is capable of operation. You can initiate a more complete self test as described beginning on page 76.

- During the self test all display segments and annunciators are lit.
- If the self test fails, the **E** annunciator in the display turns on. Use the web interface to determine the source of the error (see "Using the Web Interface" on page 35).
  If repair is required, refer to procedures in Chapter 5, "Service and Repair" or contact an Agilent Service Center.
- If all tests pass, you have a high confidence (>90%) that the digitizer is operational.

Quick Performance Check

The quick performance check is a combination of internal self-test and an abbreviated performance test (specified by the letter Q in the performance verification tests). This test provides a simple method to achieve high confidence in the digitizer's ability to functionally operate and meet specifications. These tests represent the absolute minimum set of performance checks recommended following any service activity. Auditing the digitizer's performance for the quick check points (designated by a Q) verifies performance for "normal" accuracy drift mechanisms. This test does not check for abnormal component failures.

To perform the quick performance check, do the following:

- Perform a self test as described on page 76.
- Perform only the performance verification tests indicated with the letter Q.

If the digitizer fails the quick performance check, adjustment or repair is required.

Performance Verification Tests

The performance verification tests are recommended as acceptance tests when you first receive the digitizer. The acceptance test results should be compared against the nominal temperature test limits. After acceptance, you should repeat the performance verification tests at every calibration interval.

If the digitizer fails performance verification, adjustment or repair is required.

Adjustment is recommended at every calibration interval. If adjustment is not made, you must establish a `guard band', using no more than 80% of the specifications, as the verification limits.

Input Connections

All test connections to the digitizer are made using BNC connectors and cables. The input BNC connector locations are shown on page 19.

Test Considerations

Errors may be induced by ac signals present on the input leads during a self test. Long test leads can also act as an antenna causing pick-up of ac signals.

For optimum performance, all procedures should comply with the following recommendations:

- Assure that the calibration ambient temperature (T_{cal}) is stable and between 18 °C and 28 °C. Ideally the calibration should be performed at 23 °C.
- Assure ambient relative humidity is less than 95%.
- Allow a 60 minute warm-up period.
- Keep the input cables as short as possible.
- Connect the input cable shields to earth ground. Except where noted in the procedures, connect the calibrator LO source to earth ground at the calibrator. It is important that the LO to earth ground connection be made at only one place in the circuit to avoid ground loops.

You must take care to ensure that the calibration standards and test procedures used do not introduce additional errors. Ideally, the standards used to verify and adjust the digitizer should be an order of magnitude more accurate than each digitizer range full scale error specification.

Performance Verification Tests

These performance verification tests verify the digitizer is operating within the specifications shown in Chapter 1. There are two ways these performance tests can be performed:

- Using the Web Interface (as described beginning on page 36).
- Creating your own performance test program using the commands described in the Agilent L4532A/34A Command Reference (provided on the CD with your digitizer).

The procedures in this chapter use the web interface. The same general procedures can be adapted to use either of the other methods described above.

Self Test

A brief power-on self test occurs automatically whenever you cycle power to the digitizer. This limited test assures that the digitizer is capable of operation. If the power-on self test fails, the annunciator on the right side of the display turns on once the digitizer enters the Idle state. In that case, you may initiate a more complete self test as described below.

The complete self-test is an automated procedure that systematically exercises the processor, digital infrastructure, memory, and analog front end subsystems. This procedure attempts to isolate any failing conditions found to a particular assembly, to facilitate troubleshooting and repair. The test takes approximately 60 seconds to complete. Successful execution of the self-test provides a high degree of confidence that the digitizer is operating normally.

During the test the digitizer analog inputs are disconnected internally from the rear panel BNC connectors and are connected to the internal calibration source. This source is then used to stimulate the analog input channels with test signals. All of the internal signal paths are tested for proper operation. As the different signal paths are configured for testing, the activation of the relays used to switch the signal paths is audible. After the test procedure completes, the analog inputs are re-connected to the rear panel BNC connectors.

NOTE Remove all input connections from the digitizer before running the full self test.

Procedure

1. Remove all input connections to the digitizer.
2. Running the test from the remote interface:
   a. Make a connection to the digitizer using the Web Interface (see "Navigating the Web Interface" on page 37).
   b. Enter the Remote Control Page and click the **Utilities** tab.
   c. Clear any errors present in the digitizer error queue, as follows: click the View Errors button and answer YES to view and clear any errors.
   d. Click the Run Self-Test button to begin the self test. The self test will take approximately 60 seconds to complete and you may hear the digitizer internal relays switching during the procedure. The front-panel display and the History dialog box on the control panel page indicate progress of the test. If the self-test is successful, `Self-test Passed` is reported. If any self-test fails, `Self-Test Failed` is reported, and the History dialog box on the control panel page lists error numbers and messages for each failed test. The table on page 77 lists self test error numbers and messages.
   e. As in step 2.c, view, note and clear any errors.
3. Running the test from I/O Libraries:
   a. Make a connection to the digitizer using the Agilent Connection Expert (see "Connecting to Your PC" on page 34).
   b. Click the Interactive IO Button to open the command window.
   c. Read any errors present in the digitizer error queue by sending the `SYSTem:ERRor?` query repeatedly until no errors are reported.
   d. Send the `*TST?` query to begin the self test and return a result. The self test will take approximately 60 seconds to complete and you may hear the digitizer internal relays switching during the procedure. The Instrument Session History dialog box reports test progress, test outcome, error numbers and error messages. The table on page 77 lists self test error numbers and messages.
   e. As in step 3.c, view, note and clear any errors.

If all tests pass, you have a high confidence (> 90%) that the digitizer is operational. The self-test error messages and their meaning are shown beginning on page 77.

DC Voltage Accuracy

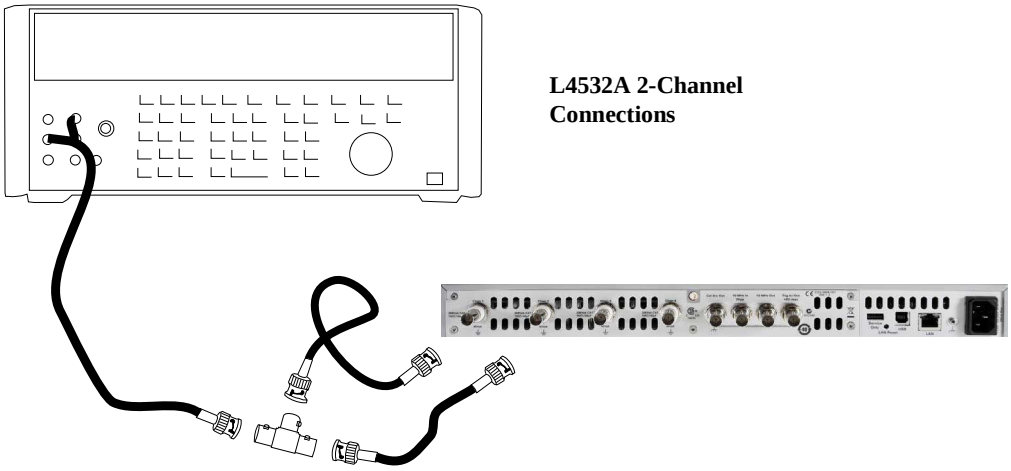
This procedure verifies the DC accuracy specifications of the digitizer. It can be used to determine if the digitizer meets its published specifications for DC accuracy or if it is in need of adjustment. It can also be used to verify that the adjustment procedure was successful in adjusting the digitizer accuracy to meet its published specifications.

The DC accuracy verification procedure uses a calibration standard of known accuracy to generate DC voltage input signals that are measured by the digitizer. The measurement results are then compared to the known values of the inputs to determine the measurement error of the digitizer. Large data records are acquired and averaged in order to reduce the effects of noise on the measurements and to more accurately determine the DC value of the input signals. The On Board Measurement capability of the digitizer is used to perform the data averaging.

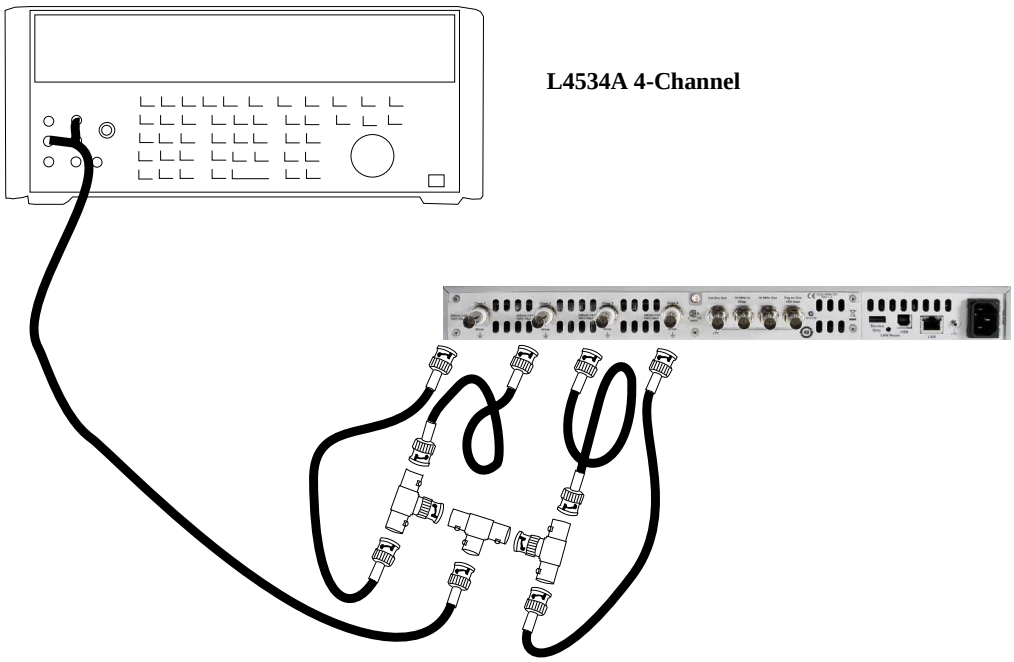
Equipment Setup

1 Read "Test Considerations" on page 48.

2 Connect the Calibrator output to the Channel inputs on the digitizer. All the channels may be connected in parallel to make the measurements easier. Use BNC T-connectors near the channel inputs. The L4532A has two channel inputs and the L4534A has four channel inputs.



L4532A 2-Channel Connections



L4534A 4-Channel

3 Make a connection to the digitizer using the web interface (see page 35).

4 Enter the Remote Control Page and select the **Configure Digitizer** tab. Set the following parameters and click the **Apply Configuration** button.

Channels:
- Range ±250 mV
- Coupling DC
- Filter LP_20_MHz

Acquisition:
- Sample Rate 1 MSa/s
- Records 1
- Samples/record 100000
- Trig Holdoff 0 sec
- Pre-trig Samples/record 0
- Trig delay 0

Trigger:
- Arm source Immediate
- Trigger source Immediate

5 Select the **Acquire Data** tab.

a Click the **View Measurements...** button. Delete any installed measurements.

b Click **New** and select Vave for each digitizer channel. Set the Area to Window. Click the **OK** button.

c Click the **Edit ...** button and set the Starting Offset to 0 and Window Size to 100000. Click the **OK** button.

d Leave the Installed Measurements window open.

Procedure

1 Set the Calibrator to output -235 mVdc.

2 On the **Acquire Data** tab, click the **Run Once** button.

a Note the Vave measurements for all the channels in the Installed Measurements window.

b Compare the measured values to the ones shown in the table below.

3 Set the Calibrator to output each voltage in the following table. Use the **Configure Digitizer** tab to change the Filter or Range as indicated in the table below.

NOTE The table uses the calibrator zero output for ease of connection. A more accurate verification of the zero can be obtained by connecting a 50 □ termination to the input connectors.

4 If any values are out of range, perform the adjustments procedure (beginning on page 64).

WARNING **Shock Hazard. This procedure requires the application of up to 240 Vdc. Ensure all test connections are properly insulated and shielded.**

Input Value	Channel Range	Filter	Quick Check	Error from Input
-235 mV	250 mV	LP_20_MHz		±0.000985 V
0 V				±0.00075 V
+235 mV				±0.000985 V
-235 mV		LP_2_MHz		±0.000985 V
0 V				±0.00075 V
+235 mV				±0.000985 V
-235 mV		LP_200_kHz	Q	±0.000985 V
0 V			Q	±0.00075 V
+235 mV			Q	±0.000985 V
-460 mV	500 mV	LP_20_MHz		±0.00146 V
0 V				±0.0010 V
+460 mV				±0.00146 V
-460 mV		LP_2_MHz		±0.00146 V
0 V				±0.0010 V
+460 mV				±0.00146 V
-460 mV		LP_200_kHz	Q	±0.00146 V
0 V			Q	±0.0010 V
+460 mV			Q	±0.00146 V
-950 mV	1 V	LP_20_MHz		±0.00215 V
0 V				±0.0012 V
+950 mV				±0.00215 V
-950 mV		LP_2_MHz		±0.00215 V
0 V				±0.0012 V
+950 mV				±0.00215 V
-950 mV		LP_200_kHz	Q	±0.00215 V
0 V			Q	±0.0012 V
+950 mV			Q	±0.00215 V

Input Value	Range	Filter	Quick Check	Error from Input
-1.9 V	2 V	LP_20_MHz		±0.0043 V
0 V				±0.0024 V
+1.9 V				±0.0043V
-1.9 V		LP_2_MHz		±0.0043 V
0 V				±0.0024 V
+1.9 V				±0.0043 V
-1.9 V		LP_200_kHz	Q	±0.0043 V
0 V			Q	±0.0024 V
+1.9 V			Q	±0.0043 V
-3.8 V	4 V	LP_20_MHz		±0.0158 V
0 V				±0.012 V
+3.8V				±0.0158 V
-3.8 V		LP_2_MHz		±0.0158 V
0 V				±0.012 V
+3.8 V				±0.0158 V
-3.8 V		LP_200_kHz	Q	±0.0158 V
0 V			Q	±0.012 V
+3.8 V			Q	±0.0158 V
-7.6 V	8 V	LP_20_MHz		±0.0236 V
0 V				±0.016 V
+7.6V				±0.0236 V
-7.6 V		LP_2_MHz		±0.0236 V
0 V				±0.016 V
+7.6 V				±0.0236 V
-7.6 V		LP_200_kHz	Q	±0.0236 V
0 V			Q	±0.016 V
+7.6 V			Q	±0.0236 V

Input Value	Range	Filter	Quick Check	Error from Input
-15.2 V	16 V	LP_20_MHz		±0.0344 V
0 V				±0.0192 V
+15.2V				±0.0344 V
-15.2 V		LP_2_MHz		±0.0344 V
0 V				±0.0192 V
+15.2 V				±0.0344 V
-15.2 V		LP_200_kHz	Q	±0.0344 V
0 V			Q	±0.0192 V
+15.2 V			Q	±0.0344 V
-30.4 V	32 V	LP_20_MHz		±0.0688 V
0 V				±0.0384V
+30.4 V				±0.0688 V
-30.4 V		LP_2_MHz		±0.0688 V
0 V				±0.0384 V
+30.4 V				±0.0688 V
-30.4 V		LP_200_kHz	Q	±0.0688 V
0 V			Q	±0.0384 V
+30.4V			Q	±0.0688 V
-60.8 V	64 V	LP_20_MHz		±0.2528 V
0 V				±0.192 V
+60.8 V				±0.2528 V
-60.8 V		LP_2_MHz		±0.2528 V
0 V				±0.192 V
+60.8 V				±0.2528 V
-60.8 V		LP_200_kHz	Q	±0.2528 V
0 V			Q	±0.192 V
+60.8V			Q	±0.2528 V

Input Value	Range	Filter	Quick Check	Error from Input
-121.6 V	128 V	LP_20_MHz		±0.3776 V
0 V				±0.256 V
+121.6 V				±0.3776 V
-121.6 V		LP_2_MHz		±0.3776 V
0 V				±0.256 V
+121.6 V				±0.3776 V
-121.6 V		LP_200_kHz	Q	±0.3776 V
0 V			Q	±0.256 V
+121.6 V			Q	±0.3776 V
-237.5 V	256 V	LP_20_MHz		±0.5447 V
0 V				±0.3072 V
+237.5 V				±0.5447 V
-237.5 V		LP_2_MHz		±0.5447 V
0 V				±0.3072 V
+237.5 V				±0.5447 V
-237.5 V		LP_200_kHz	Q	±0.5447 V
0 V			Q	±0.3072 V
+237.5 V			Q	±0.5447 V

Timebase Verification

Description

This procedure verifies the correct operating frequency of the digitizers internal timebase.

The timebase verification test procedure consists of connecting a frequency counter to the timebase reference signal on the 10 MHz Out BNC connector and measuring the reference signal frequency.

Procedure

1. Connect the rear panel Timebase Output to the counter input.
2. Measure the timebase output frequency.
3. Compare the measured frequency to the value in the table below.
4. If the measured value is out of the specified range, the digitizer requires repair: the Digital Board must be replaced.

Nominal Output	Specification
10 MHz	□ 500 Hz

AC Flatness Functional Test (optional)

Description

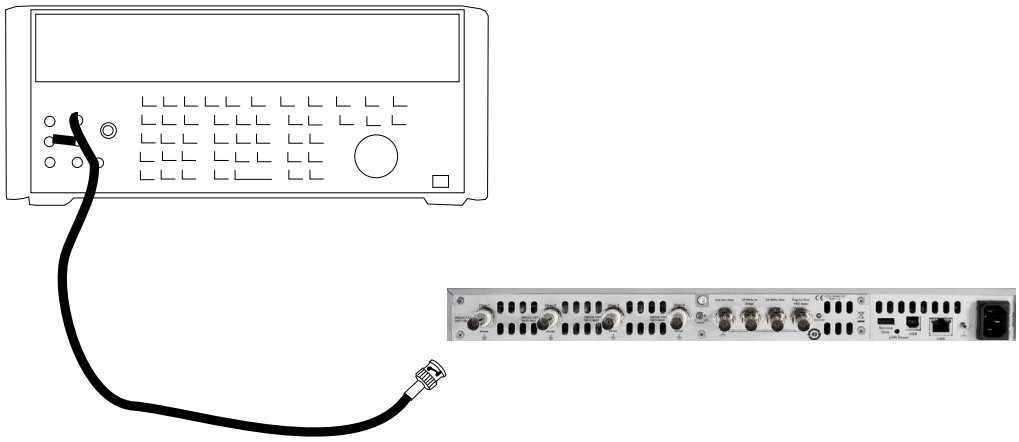
This procedure verifies the AC flatness characteristics of the digitizer. AC Flatness is an optional test because it is a typical characteristic that is not warranted. The AC Flatness was adjusted when the instrument was manufactured and is not normally adjusted again. However, an FAQ on the Agilent web addresses this issue: www.agilent.com/find/L4532A, then select **Technical Support > FAQs**. The AC flatness is specified relative to the AC response at 1 kHz.

The AC flatness test procedure consists of measuring both 1 kHz and 1 MHz input signals on selected ranges and comparing their relative values. The test signals are generated by a calibration standard. The input signals are measured by the digitizer using the On Board Measurement capability to calculate the RMS value of the input signals, and the measured signal amplitudes at the two frequency points are compared to each other.

Equipment Setup

1 Read "Test Considerations" on page 48.

2 Connect the Calibrator output to the Channel 1 input on the digitizer. Do not connect the channels in parallel for this test. The L4532A has two channel inputs and the L4534A has four channel inputs.



3 Make a connection to the digitizer using the web interface (see page 35).

4 Enter the Remote Control Page and select the **Configure Digitizer** tab. Set the following parameters and click the **Apply Configuration** button.

All Channels:
Range ±250 mV
Coupling AC
Filter LP_20_MHz
Acquisition:
Sample Rate 20 kSa/s
Records 1
Samples/record 100000
Trig Holdoff 0 sec
Pre-trig Samples/record 0
Trig delay 0
Trigger:
Arm source Immediate
Trigger source Immediate

5 Select the **Acquire Data** tab.

a Click the **View Measurements...** button. Delete any installed measurements.

b Click **New** and select Vrms for each digitizer channel. Set the Area to Window. Set the Coupling to AC. Click the **OK** button.

c Click the **Edit ...** button and set the Starting Offset to 0 and Window Size to 100000. Click the **OK** button.

d Leave the Measurements window open.

Procedure

1 Set the Calibrator to output 165 mVrms at 1 kHz.

2 On the **Acquire Data** tab, click the **Run Once** button.

a Note the Vrms measurements for the connected channel in the Installed Measurements window.

b Record the measured value as $Vrms_{1kHz}$.

3 Use the **Configure Digitizer** tab to set the Sample Rate to 20 MSa/s. Click the **Apply Configuration** button.

4 Set the Calibrator output to 165 mVrms at 1 MHz (43 Vrms at 300 kHz on the 64 V range).

5 On the **Acquire Data** tab, click the **Run Once** button.

a Note the Vrms measurements for the connected channel in the Installed Measurements window.

b Record the measured value as $Vrms_{1MHz}$.

6 Calculate the flatness result according to the following formula:

$$flatness_error = 20\log\left(\frac{Vrms_{1MHz}}{Vrms_{1kHz}}\right)$$

7 Disable the Calibrator output and connect the Calibrator to the next channel to be verified.

8 Use the **Configure Digitizer** tab to set the Sample Rate to 20 kSa/s. Click the **Apply Configuration** button.

9 Re-enable the Calibrator output and repeat steps 2 to 8.

10 Repeat steps 7 to 9 for each channel to be verified.

11 Use the **Configure Digitizer** tab to change the Range as indicated in the table below. Set the Calibrator to output each voltage in the table below.

12 Repeat steps 2 to 11 until all the channels for all the listed ranges in the following table have been verified.

13 If any values are out of range, repair is required.

Input	Range	Flatness
165 mVrms	250 mV	□ 0.28 dB
335 mVrms	500 mV	□ 0.20 dB
670 mVrms	1 V	□ 0.20 dB
1.34 Vrms	2 V	□ 0.20 dB
2.68 Vrms	4 V	□ 0.20 dB
43 Vrms[1]	64	□ 0.40 dB[2]

1. For this range, set the calibrator output frequency to 300 kHz.□
2. (±0.01 dB/°C Temperature Coefficient outside 18-28°C) relative □ to 1 kHz

Input Channel Noise Functional Test (optional)

Description

This procedure checks the input channel noise of the digitizer. This test does not measure a warranted specification or characteristic. However, it is used to verify that the circuitry in the digitizer is functioning properly.

The input channel noise functional test consists of digitizing a record of data with the input channels terminated with 50Ω terminations and measuring the Vrms value of the channel input noise. The input noise is measured by the digitizer using the On Board Measurement capability to calculate the Vrms value of the record. This measured value is compared to the expected value of the input channel noise functional test limit.

Equipment Setup

1 Read "Test Considerations" on page 48.

2 Connect a 50Ω termination to each channel input on the digitizer. You may also use a single 50Ω termination and repeat this test for each channel. Do not connect the channels in parallel to a single 50Ω termination.



50 Ω Terminations

3 Make a connection to the digitizer using the web interface (see page 35).

4 Enter the Remote Control Page and select the **Configure Digitizer** tab. Set the following parameters and click the **Apply Configuration** button.

Channels:
- Range ±250 mV
- Coupling DC
- Filter LP_20_MHz

Acquisition:
- Sample Rate 20 MSa/s
- Records 1
- Samples/record 40000
- Trig Holdoff 0 sec
- Pre-trig Samples/record 0
- Trig delay 0

Trigger:
- Arm source Immediate
- Trigger source Immediate

5 Select the **Acquire Data** tab.

a Click the **View Measurements...** button. Delete any installed measurements.

b Click **New** and select Vrms for each digitizer channel. Set the Area to Window and choose AC coupling. Click the **OK** button.

c Click the **Edit..** button and set the Starting Offset to 0 and Window Size to 40000. Click the **OK** button.

d Leave the Installed Measurements window open.

Procedure

1 On the **Acquire Data** tab, click the **Run Once** button.

a Note the Vrms measurements for all the channels in the Installed Measurements window.

b Compare the measured values to the ones shown in the table below.

2 Use the **Configure Digitizer** tab to change the Range as indicated in the table below.

3 Repeat steps 1 and 2 for each range in the table.

4 If any values are out of range, repair may be required.

Input	Range	Error from 0
50 □ Termination	250 mV	0.00020 Vrms
	500 mV	0.00024Vrms
	1 V	0.00032Vrms
	2 V	0.00050 Vrms
	4 V	0.0036Vrms
	8V	0.0064 Vrms
	16 V	0.0128 Vrms

Adjustments

These adjustments ensure the digitizer is operating within the specifications shown in Chapter 1. There are two ways these adjustments can be performed:

- Using the Web Interface (as described beginning on page 35).
- Creating your own performance test program using the commands described in the Agilent L4532A/34A Command Reference (provided on the CD with your digitizer).

The procedures in this chapter use the LAN Web Interface. The same general procedures can be adapted to use either of the other methods described above.

NOTE Run a full self test of the digitizer before beginning any adjustment procedures to ensure the digitizer is operating normally (see page 49).

Calibration String

The digitizer allows you to store a message string in calibration memory. For example, you can store such information as the date when the last calibration was performed, the date when the next calibration is due, the digitizer's serial number, or even the name and phone number of the person to contact for a new calibration. The calibration message may contain up to 40 characters.

You can record a calibration message only when the digitizer is unsecured and at the end of the calibration process when new calibration constants are being written to non-volatile memory. You can read the calibration message whether the digitizer is secured or unsecured.

To read the Calibration String using the Remote Control Page:

1. Select the **Utilities** tab.
2. Click the **Calibration...** button. Both the calibration string and calibration count can be read on this screen.

To read the Calibration String using the Agilent Connection Expert, use the `CAL:STR?` command (refer to the L4532A/34A Command Reference).

Calibration Count

You can read the digitizer calibration count to determine how many calibrations have been performed. Note that your digitizer was calibrated before it left the factory. When you receive your digitizer, be sure to read the count to determine its initial value.

The calibration count increments each time the calibration constants are stored (`CAL:STOR` from the remote interface). To read the Calibration Count using the Remote Control Page:

1. Select the **Utilities** tab.
2. Click the **Calibration...** button. Both the calibration string and calibration count can be read on this screen.

NOTE The Calibration Count can be used to indicate that the digitizer calibration has been tampered with. The calibration count is also incremented if the calibration security code has been changed using the security bypass procedure ("To Unsecure the digitizer Without the Security Code" on page 66).

To read the Calibration Count using the Agilent Connection Expert, use the `CAL:COUN?` command (refer to the L4532A/34A Command Reference).

Calibration Security

This feature allows you to enter a security code to prevent accidental or unauthorized adjustments of the digitizer. When you first receive your digitizer, it is secured. Before you can adjust the digitizer, you must unsecure it by entering the correct security code.

NOTE If you forget your security code, you can disable the security feature by following the procedure below.

- The security code is set to ATL4532 or ATL4534 when the digitizer is shipped from the factory (depending on the model). The security code is stored in non-volatile memory, and does not change when power has been off, after a Factory Reset (`*RST` command), or after an digitizer Preset (`SYSTem:PRESet` command).
- The security code may contain up to up to 12 characters. You do not have to use all 12 characters but the first character must always be a letter (A-Z). The remaining 11 characters can be letters, numbers (0-9), or the underscore character ("_"). Blank spaces are not allowed.

During the calibration process using the Remote Access Page, you will be prompted for the calibration security code (if one has been set). At the end of a calibration, the digitizer will be re-secured (if a security code was set).

To secure or unsecure the digitizer using the Agilent Connection Expert, use the `CAL:SEC:STAT` and `CAL:SEC:CODE` commands (refer to the L4532A/34A Command Reference).

To Unsecure the digitizer Without the Security Code

To unsecure the digitizer without the correct security code, you will need a USB Flash drive.

NOTE If you do not have a record of the security code, try the factory default code (ATL4532 or ATL4534 depending on model) before you use the procedure below.

1. Create a 0 byte file named `CalSecureOverride.txt` at the root level of the USB Flash Drive. You can create this file using a program such as Notepad. The file name MUST be `CalSecureOverride.txt` and the file size MUST be 0 bytes. This file will be erased from the USB Flash drive during this procedure.
2. Turn off the digitizer.
3. Install the USB Flash drive in the Service Port on the digitizer rear panel (see page 19).
4. Turn on the digitizer. The digitizer will boot up with the Calibration Override enabled. The file on the USB Flash drive will be erased and an error will be put in the digitizer error queue.
5. You may now unsecure the Calibration mode without providing a password using the `CAL:SEC:STAT OFF` command from the remote interface.
6. Use the `CAL:SEC:CODE <code>` command to set a new security code.
7. Use the `CAL:SEC:STAT ON` command to re-secure the digitizer. Remove the USB Flash drive and reboot the digitizer to eliminate the Calibration Override mode

NOTE When the digitizer is unsecured using this procedure, the Calibration Count is incremented by 1 (see "Calibration Count" on page 65).

Using the Web Interface for Adjustments

All adjustments can be made using the Remote Access Page (see page 35).

Programming the Adjustments

Commands used to perform the adjustments are listed in CALibration subsystem of the L4532A/34A Command Reference. A general sequence for using these commands for a full adjustment is as follows:

```
CAL:SECURE:STATE OFF,<secure_code> // unsecure for calibration
CAL:STATE ON
CAL:RANGE 0.25 // first range
CAL:RANGE:SOURCE UPP // sets high voltage output
// read the output voltage_hi
CAL:RANGE:SOURCE LOW // sets the low voltage output
// read the low voltage_lo
CAL:RANGE:CHAN? (@1:4), <voltage_hi>,<voltage_lo> // sets all channels
CAL:RANGE 0.5 // do the next range
CAL:RANGE:SOURCE UPP // sets high voltage output
// read the output voltage_hi
CAL:RANGE:SOURCE LOW // sets the low voltage output
// read the low voltage_lo
CAL:RANGE:CHAN? (@1:4), <voltage_hi>,<voltage_lo> // sets all channels
// repeat for ranges 1, 2, 4, 8, 16, 32, 64, 128, 256
// on the 32, 64, 128 and 256 ranges, the high and low input is 0
CAL:STORe // put the new calibration constants into memory
CAL:STATE OFF
CAL:SECURE:STATE ON,<secure_code>
```

NOTE Note CAL:RANGE:CHAN? and CAL:STOR commands take several seconds to execute. Be sure to set the remote time-out appropriately

Calibration Process

The following general procedure is the recommended method to complete a full digitizer calibration using the Remote Access Pages.

1. Read "Test Considerations" on page 48.
2. Perform the verification tests to characterize the digitizer (incoming data).
3. On the Remote Access Page, select the **Utilities** tab. Click the **Calibration...** button to begin the adjustments. Note the calibration count for the digitizer's maintenance records.
4. Perform the adjustment procedures ("Adjustment Procedures" on page 68).
5. Secure the digitizer against calibration.
6. Note the security code and calibration count in the digitizer's maintenance records.

Aborting a Calibration in Progress

Sometimes it may be necessary to abort a calibration after the procedure has already been initiated. You can abort a calibration at any time by turning off the power. You can abort a calibration by issuing a remote interface device clear message.

CAUTION If you abort a calibration in progress when the digitizer is attempting to write new calibration constants to EEPROM, you may lose all calibration constants. Typically, upon re-applying power, the digitizer will report an error You should not use the digitizer until a complete re-adjustment has been performed. A list of the possible calibration errors is given on page 79.

Adjustment Procedures

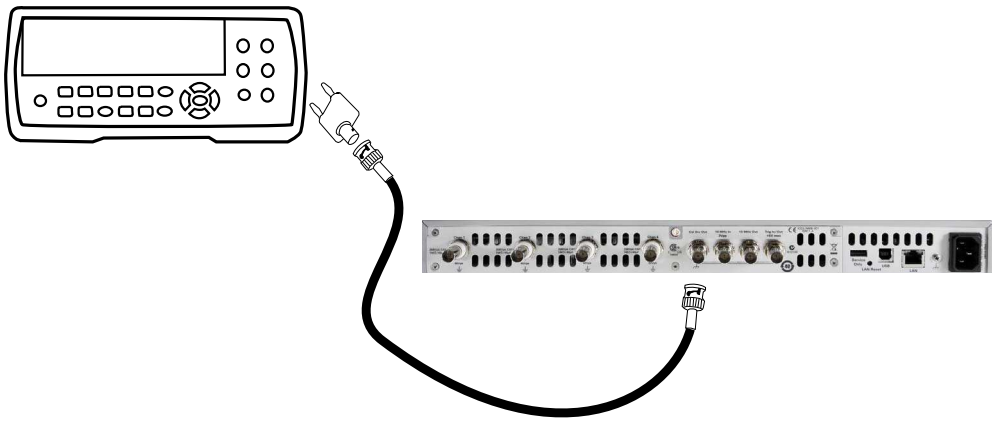
You can adjust both the gain and offset for each range on every channel. Optionally, you can choose to adjust only the offset for each range on each channel. A full adjustment requires you perform both the gain and offset adjustments for every range on every channel.

Gain and Offset Adjustment

1 Read "Test Considerations" on page 48.

2 Connect the DMM to the Calibration Output. Set the DMM as follows:

Hi-Z input
10 NPLC
Autozero Once
Manual Trigger Mode



3 Make a connection to the digitizer using the web interface (see page 35).

4 Enter the Remote Control Page and select the **Utilities** tab.

5 Clear any errors present in the digitizer error queue.

   a Use the **View Errors** button and answer **YES** to view and clear any errors.

6 Click the **Calibration...** button to begin the adjustment procedures.

7 Record the Calibration Count shown in the window.

8 Click the **Perform Calibration Adjustments...** button. Read the messages presented and click the **Next>** button to advance to the Select Calibration Type window.

NOTE If the digitizer is secured for calibration, you will ned to enter the Calibration Security Code when prompted (see page 65).

9 Select the checkbox for **Gain and Offset** calibration and click the **Next>** button.

10 Select the channels to be calibrated and click the **Next>** button. It is recommended that all channel be calibrated and the procedure will step through all the channels selected.

11 Click the **Start** button to begin the calibration.

12 The adjustments begin on the lowest range. It is recommend that you perform the adjustments from the lowest to the highest range in order. For each range the Cal source voltage: High is selected. Read the voltage using the DMM and enter the value in the voltmeter reading box. Select the cal source voltage Low. Read the voltage using the DMM and enter the value in the voltmeter reading box.

   When both the High and Low readings have been entered, click the **Calibrate Range** button.

CAUTION As each range advances, ensure the DMM is set to an appropriate input range to prevent damage to the instrument.

   The status of the adjustment will be indicated and the next range High output is selected.

13 Repeat this process for all ranges up to the 32 volt range.

14 Gain adjustments for ranges above 32 volts are computed using derived parameters from the lower ranges. Offset adjustments are made for all ranges.

15 Check the Store calibration constants into non-volatile memory. If desired, enter a calibration string to be stored (see page 64).

Offset Adjustment

If desired, you may adjust only the offset on a particular range or channel.

NOTE Adjusting only the offset does not ensure the digitizer meets the specifications listed in Chapter 1. A full gain and offset adjustment is recommended.

1. Read "Test Considerations" on page 48.
2. Make a connection to the digitizer using the web interface (see page 35).
3. Enter the Remote Control Page and select the **Utilities** tab.
4. Clear any errors present in the digitizer error queue.
   a. Use the **View Errors** button and answer **YES** to view and clear any errors.
5. Click the **Calibration...** button to begin the adjustment procedures.
6. Record the Calibration Count shown in the window.
7. Click the **Perform Calibration...** button. Read the messages presented and click the **Next>** button to advance to the Select Calibration Type window.

NOTE If the digitizer is secured for calibration, you will need to enter the Calibration Security Code when prompted (see page 65).

8. Select the checkbox for **Offset Only** calibration and click the **Next>** button.
9. Select the channel(s) to be calibrated and click the **Next>** button.
10. Click the **Start** button to begin the calibration.
11. The lowest range is highlighted. Click **Calibrate Range** to begin the offset calibration.
12. Once the offsets have been adjusted, the range will advance to the next range.
13. When all ranges and channels are completed, click **Next >**.
14. Check the "Store calibration constants into non-volatile memory. If desired, enter a calibration string to be stored (see page 64).

5 Service and Repair

This chapter will help you troubleshoot a failing digitizer. It also describes how to obtain repair service and lists replaceable assemblies.

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Service

Operating Checklist

Before returning your digitizer to Agilent for service or repair check the following items:

Is the digitizer inoperative?

- Verify that the power cord is connected to the digitizer and to ac line power.
- Verify the front panel power switch was depressed to toggle to the power on state.

Does the digitizer fail self-test?

- Remove all test connections to the digitizer and run the self-test again.

  Errors may be induced by ac signals present on the digitizer input terminals during self-test. Long test leads can act as an antenna causing pick-up of ac signals.

Types of Service Available

If your digitizer fails during the warranty period, Agilent Technologies will repair or replace it under the terms of your warranty. After your warranty expires, Agilent offers repair services at competitive prices.

Extended Service Contracts

Many Agilent products are available with optional service contracts that extend the covered period after the standard warranty expires. If you have such a service contract and your digitizer fails during the covered period, Agilent Technologies will repair or replace it in accordance with the contract.

Obtaining Repair Service (Worldwide)

To obtain service for your digitizer (in-warranty, under service contract, or post-warranty), contact your nearest Agilent Technologies Service Center. They will arrange to have your unit repaired or replaced, and can provide warranty or repair-cost information where applicable.

To obtain warranty, service, or technical support information you can contact Agilent Technologies at one of the following telephone numbers:

In the United States: (800) 829-4444
In Europe: 31 20 547 2111
In Japan: 0120-421-345

Or use our Web link for information on contacting Agilent worldwide:

www.agilent.com/find/assist

Or contact your Agilent Technologies Representative.

Before shipping your digitizer, ask the Agilent Technologies Service Center to provide shipping instructions, including what components to ship. Agilent recommends that you retain the original shipping carton for use in such shipments.

Repackaging for Shipment

If the unit is to be shipped to Agilent for service or repair, be sure to:

- Attach a tag to the unit identifying the owner and indicating the required service or repair. Include the model number and full serial number.
- Place the unit in its original container with appropriate packaging material for shipping.
- Secure the container with strong tape or metal bands.

If the original shipping container is not available, place your unit in a container which will ensure at least 4 inches of compressible packaging material around all sides for the digitizer. Use static-free packaging materials to avoid additional damage to your unit.

Agilent suggests that you always insure shipments.

Cleaning

Clean the outside of the digitizer with a soft, lint-free, slightly dampened cloth. Do not use detergent. Disassembly is not required or recommended for cleaning.

Troubleshooting

The digitizer is designed to provide troubleshooting information both during the boot up sequence and in response to a system initiated self-test.

All operations including digitizer I/O begin with the Processor Board and associated Carrier Board. The Digital Board controls all the Channel Analog Boards. The L4532A has a single Analog Board and the L4534A has two Analog Boards. The locations of the major assemblies are shown in the figure on page 84.

In general signal processing flows from the Processor/Carrier Board, to the Digital Board, and finally to the Analog Boards.

A general procedure to begin troubleshooting a failing digitizer is as follows:

1. Disconnect all input cables. Make a remote interface connection to the digitizer (see page 34). Press the power switch.
2. If the display does not light, check if the fans are running. Check if the digitizer responds to the remote interface.
   a. If the display does not light and the fans do not run or the digitizer does not respond to remote commands, test the power supplies as described beginning on page 75
   b. If the display does not light, but the fans are running and digitizer responds to remote commands, the display assembly or cable is likely failing.

NOTE Front Panel Display Lockup or Failure: An ESD (electrostatic discharge) event may cause a temporary failure or lockup of the front-panel display. This has no effect on data integrity, or on the operation of the digitizer other than the display. Cycle the power to restore the front-panel display.

3. If the display lights, observe the display during the digitizer boot sequence.
   a. The circuit assemblies are checked during the boot sequence and are reported in the display with the assembly firmware revision. Failing or missing assemblies can be reported as □**00**□ (see page 31).
   b. If the digitizer does not completely boot, a failure of the Processor/Carrier Board is indicated.
4. If the digitizer completes the boot up sequence, any errors encountered will be indicated by the error annunciator in the display. Read the errors using one of the remote interfaces. Self-test errors are listed in the table on page 77.
5. Run a complete self-test as described beginning on page 76.

Testing the Power Supplies

The main power supply is always active when the ac line power cord is connected to line power. The power switch places the digitizer in standby mode.

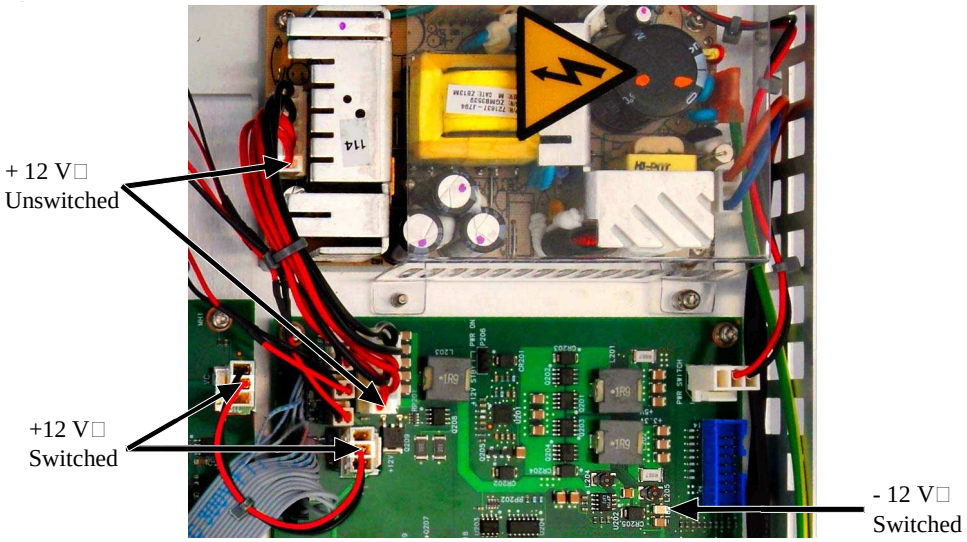
CAUTION To prevent equipment circuit damage, always toggle the line power switch to put the digitizer in standby, remove any input cables, and disconnect the digitizer from the ac mains before removing or replacing any assembly.

To verify the power supplies:

1. Remove the digitizer covers (see page 82).
2. Make sure the ac power line is connected properly.
3. Measure the following voltages using the digitizer chassis as the reference. The test points are shown in the figure on the next page.

Supply	Remarks
+ 12 V Unswitched (□0.1 V)	This supply is active whenever the digitizer is connected to the power line. If the supply is missing, unplug the connector to the Carrier board and retest the supply at the power supply connector. If this supply is still not correct, power supply assembly replacement is indicated. Removing the power supply is described beginning on page 85.
+ 12 V Switched	This supply becomes active when the power switch is pressed. A failure of this supply indicates a failure of the power switch or the Carrier/ Processor Board assemblies. If this supply is missing, unplug the connector from the Digital board and retest the supply at the connector to eliminate a Digital Board loading issue.
- 12 V Switched	This supply is used by the Digital Board assembly. If this supply is not present, a failure of the Carrier/ Processor Board assembly is indicated. A failure of this supply can cause self-test to indicate a failure of the Digital Board. If this supply is missing, remove the Analog Board(s) and retest to eliminate an Analog Board loading issue.

NOTE The power supply contains a built in 3.15 A, 250 VAC protective fuse. This fuse is captive, and is not replaceable. If this fuse blows, replacement of the entire power supply is recommended.



Self Test Procedures

Power On Self Test

Each time the digitizer is powered on, a subset of self tests are performed. These tests check that the minimum set of logic and output hardware are functioning properly.

Full Self Test

The successful execution of the self test procedure provides a high degree of confidence that the digitizer is operating normally. The self test procedure is an automated procedure that systematically exercises the processor, digital infrastructure, memory, and analog front end subsystems. The test procedure attempts to isolate any failing conditions found to a particular assembly to facilitate troubleshooting and repair. The test typically takes approximately 60 seconds to complete.

During the test the digitizer analog inputs are disconnected internally from the rear panel BNC connectors and are connected to the internal calibration source. This source is then used to stimulate the analog input channels with test signals. All of the internal signal paths are tested for proper operation. As the different signal paths are configured for testing, the activation of the relays used to switch the signal paths is audible. After the test procedure completes, the analog inputs are re-connected to the rear panel BNC connectors.

Self-test errors are reported in the following format:

```
-330,"Self-test failed; 631: Channel gain test failed"
```

You should run a full self test before beginning any of the verification or adjustment procedures given in Chapter 4, Calibration and Adjustment

Procedure

1. Remove all input connections to the digitizer. Cycle power to reboot the digitizer and run the power-on self test.
2. Make a connection to the digitizer using the remote interface (see page 35).
3. Enter the Remote Control Page and select the **Utilities** tab.
4. Use the **View Errors** button and answer **YES** to view any power-on self test errors. This also clears all errors.
5. Click the **Run self-test** button to begin the full self test.

   The full self test will take approximately 60 seconds to complete and you may hear the digitizer internal relays switching during the procedure. If the self-test is successful Self-test Passed is reported on the **Utilities** tab. If the self-test is not successful Self-test Failed is reported followed by the self-test error messages. The self-test error messages and their meaning are shown beginning on the next page.

Self Test Error Numbers and Messages

A failure can generate multiple error messages. The earliest messages generated should be considered the primary cause of the failure.

NOTE Some self test messages include a channel number. The channel number, n, will be replaced with a number from 1 to 4 depending upon which channel failed.

NOTE If the same error message occurs on all channels, the Digital Board is the most likely failure. The Digital Board contains the source that is switched to test the Analog Boards.

Error number and message	Probable Cause
602: Internal IO to digitizer failed	Digital Board is most probable cause. Be sure to test for -12 V Switched power on the Carrier/ Processor Board (see page 75)
603: LAN I/ O failure	Carrier/ Processor Board
604: Sample memory test failed	Digital Board
605: Sample memory DMA failed	Digital Board
606: Sample memory DMA address failed	Digital Board
607: Sample memory address line stuck low	Digital Board
608: Sample memory address line stuck high	Digital Board
609: Sample memory addressing failed	Digital Board
610: Sample clock PLL failed	Digital Board
612: External reference clock PLL failed	Digital Board
613: Input channel n: missing	Analog Board for channel n [1]
614: Invalid channel n: for this model	Indicates a mismatch between the Carrier/ Processor Board and the Analog Board(s). Entire unit should be returned for repair.
615: Channel n: calibration gain DAC adjustment failed	Analog Board for channel n
616: Channel n: calibration offset DAC adjustment failed	Analog Board for channel n
618: Channel n: overvoltage protection test failed	Analog Board for channel n [1]
620: Channel n: failed to transmit trigger	Analog Board for channel n [1]
622: Channel n: DC blocking capacitor test failed	Analog Board for channel n [1]
623: Channel n: with no attenuators failed	Analog Board for channel n [1]
624: Channel n: (1:16) attenuator 1 failed	Analog Board for channel n [1]
625: Channel n: (1:16) attenuator 2 failed	Analog Board for channel n [1]
626: Channel n: (1:2) attenuator 3 failed	Analog Board for channel n [1]
628: Channel n: x1.125 gain failed	Analog Board for channel n [1]
629: Channel n: x2.250 gain failed	Analog Board for channel n [1]
630: Channel n: x4.500 gain failed	Analog Board for channel n [1]
631: Channel gain test failed	Analog Board
632: Calibration ground source failed	Digital Board is most probable cause. Be sure to test for -12 V Switched power on the Carrier/ Processor Board (see page 75)[1]
633: Calibration voltage source failed (50 Ohm)	Digital Board
634: Calibration voltage source failed (1 MOhm)	Digital Board[1]
635: Channel n: 20 MHz filter failed	Analog Board for channel n [1]

1. A failure of the Digital Board will cause these failures on all channels.

Error number and message	Probable Cause
636: Channel n: 2 MHz filter failed	Analog Board for channel n [1]
637: Channel n: 200 kHz failed	Analog Board for channel n [1]
639: Channel n: reset test failed	Analog Board for channel n
640: External trigger test failed	Digital Board
641: FPGA memory stuck low	Digital Board
642: FPGA memory stuck high	Digital Board
643: FPGA memory test failed	Digital Board
646: No input channels found	Digital Board (possibly Analog Board)
647: Channel n: input board sync test failed	Analog Board for channel n [1]

1. A failure of the Digital Board will cause these failures on all channels.

Calibration Errors and Messages

These errors may be generated during an adjustment procedure.

Error number and message	Probable Cause
+702, "Cal: secured"	Attempting to begin adjustments on a digitizer that is secured.
+703, "Cal: invalid secure code"	The first character of the security code must be a letter (A-Z), Numbers and Underscores may be used following the letter. Punctuation and spaces are not allowed.
+704, "Cal: secure code too long"	Only 12 characters are allowed in the security code.
+705, "Cal: aborted"	A remote interface Device Clear command was received or power was interrupted during adjustment.
+741,"Cal data lost: string data"	The calibration message string was lost. Run a full self test to ensure the digitizer is operational before attempting to reset.
+747,"Calibration failed;Gain Chan[n] Range[x.x] Coupling[yyy] Filter[zzz]" +747,"Calibration failed;Offset Chan[n] Range[x.x] Coupling[yyy] Filter[zzz]"	A gain or offset adjustment failed. Run a full self test to ensure the digitizer is operational before attempting to re-adjust.
+748,"Cal checksum failed, internal data"	The checksum failed for calibration data. Run a full self test to ensure the digitizer is operational before attempting to re-adjust.

Replaceable Parts List

CAUTION Always use anti-static techniques when assemblies are handled or serviced.

The following table lists the replacement assemblies for the L4532A/34A Digitizers:

Product(s)	Part #	Description
Both L4532A and L4534A	0950-4859	Power Supply
	3101-4118	Power Switch
	3131-0686	Switch Pushbutton Cap
	E5810-00001	Display
	L4532-66705	Processor Board[1]
	L4532-66701	Carrier Board[1]
	L4532-66702	Digital Board
	L4532-66703	Analog Board
	L4532-61602	Power Supply Cable
	L4532-61601	Ground Cable
	L4532-61604	12V Cable
	L4532-61605	Switch Cable
	L4532-68502	Fan
	L4532-61603	Display Cable
	L4532-00102	Top Cover
	L4532-67001	Rack Mount Kit
	L4532-00104	Front Panel
L4532 only	L4532-84302	Front Panel Label
L4534 only	L4534-84302	Front Panel Label

1. The Processor Board and Carrier Board are replaced as a kit: □
L4532-66805 (new) or L4532-69805 (refurbished). □
This repair requires the digitizer to be returned to an Agilent Technologies repair center.

Disassembly

CAUTION To prevent equipment circuit damage, always set the line power switch to off, remove any input cables, and disconnect the digitizer from the ac mains and before removing or replacing any assembly.

Tools You'll Need

- #10 Torx driver for most disassembly
- #8 Torx driver for front panel disassembly
- 14 mm deep socket for BNC connector securing nuts
- 5/16 inch deep socket for the power switch securing nut
- 3/16 inch socket/nut driver for the carrier board standoffs

Electrostatic Discharge (ESD) Precautions

Electrical components can be damaged by electrostatic discharge (ESD) during handling. Component damage can occur at electrostatic discharge voltages as low as 50 volts.

The following guidelines will help prevent ESD damage when servicing the digitizer or any electronic device.

- Disassemble digitizers only in a static-free work area.
- Use a conductive work area to reduce static charges.
- Use a conductive wrist strap to reduce static charge accumulation.
- Minimize handling.
- Keep replacement parts in original static-free packaging.
- Remove all plastic, foam, vinyl, paper, and other static-generating materials from the immediate work area.
- Use only anti-static solder suckers.

Removing the Cover

To remove the cover:

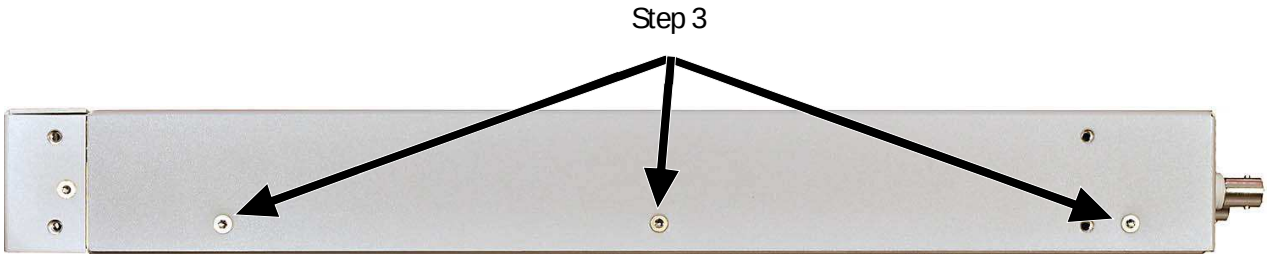
1 Turn off the digitizer and remove the power cord. Remove all cables from the instrument.

WARNING The L4532A/ 34A digitizers do not have an "off" mode. The power supply is always energized when plugged into a live source, even when the unit is in standby mode. Disconnect power and all other connectors before removing the cover.

2 Remove the #10 Torx round head screw holding the cover through the rear panel to the chassis.

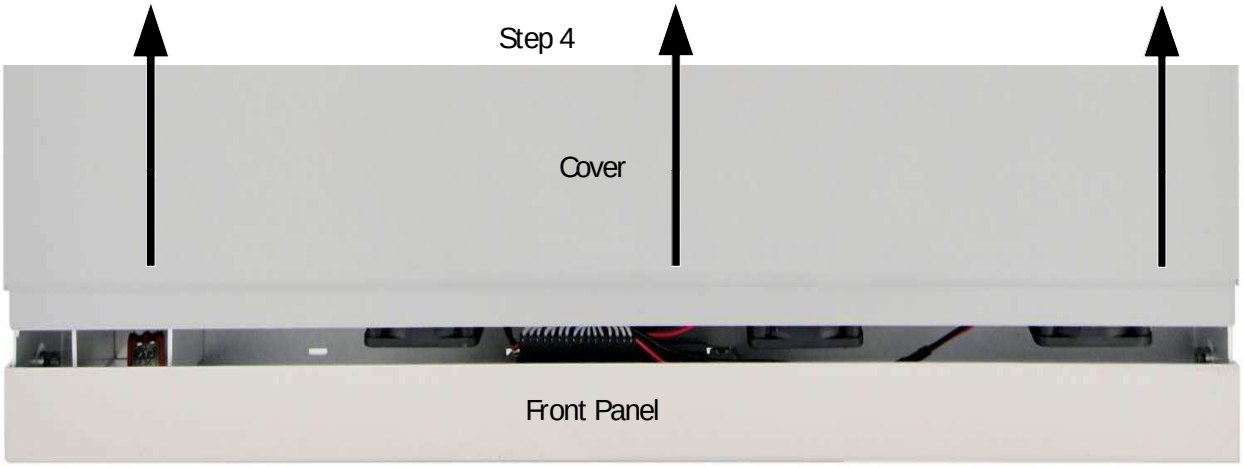


3 Remove the six #10 Torx flat-head screws (three at each side of the digitizer) holding the cover to the chassis.



4 Slide the cover back 1/2 inch (13mm) to disengage it the cover's front lip from beneath the front panel, and lift up to remove.

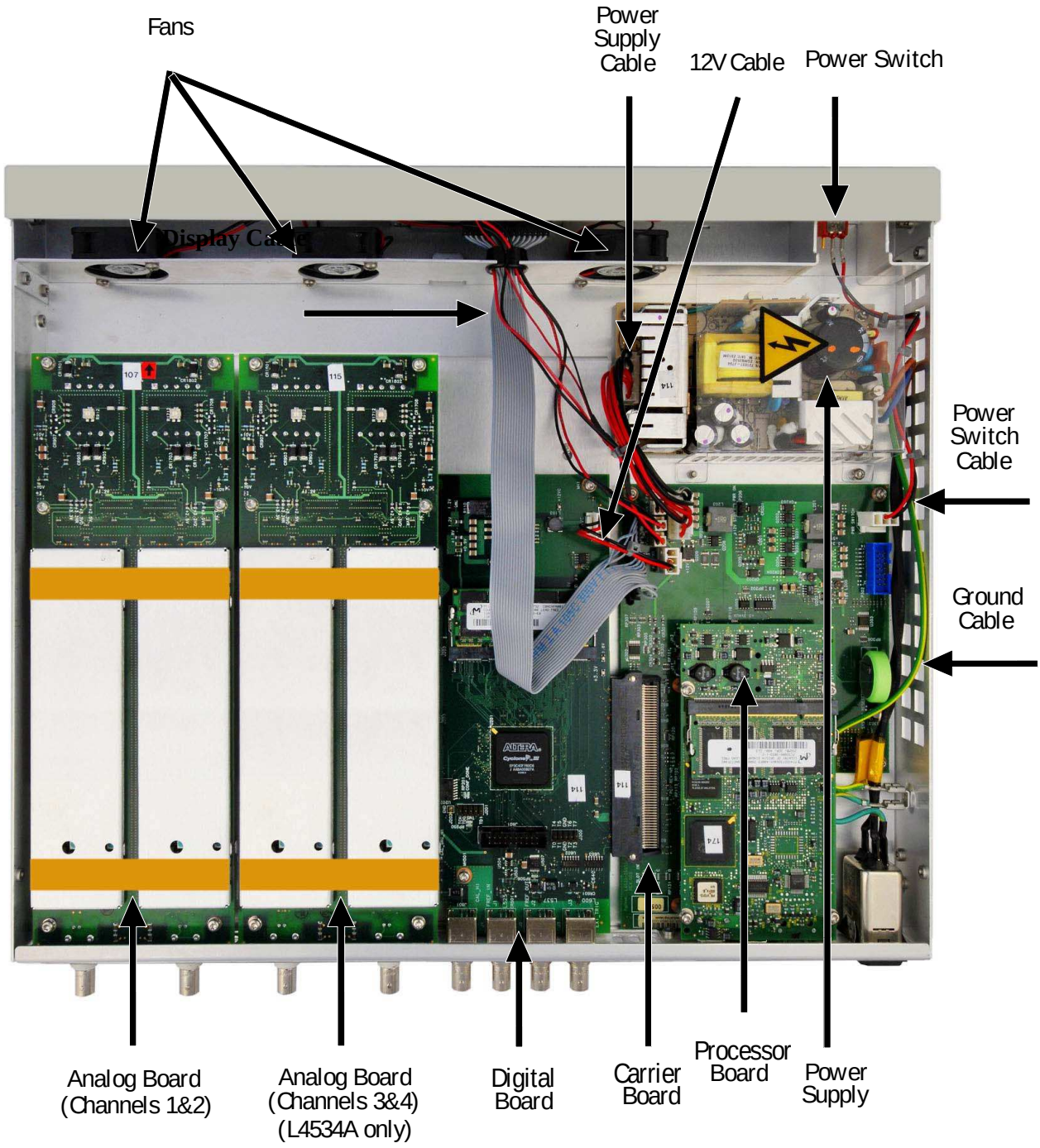
Slide cover back to disengage from front panel



To reinstall the cover, reverse these steps.

Interior Layout

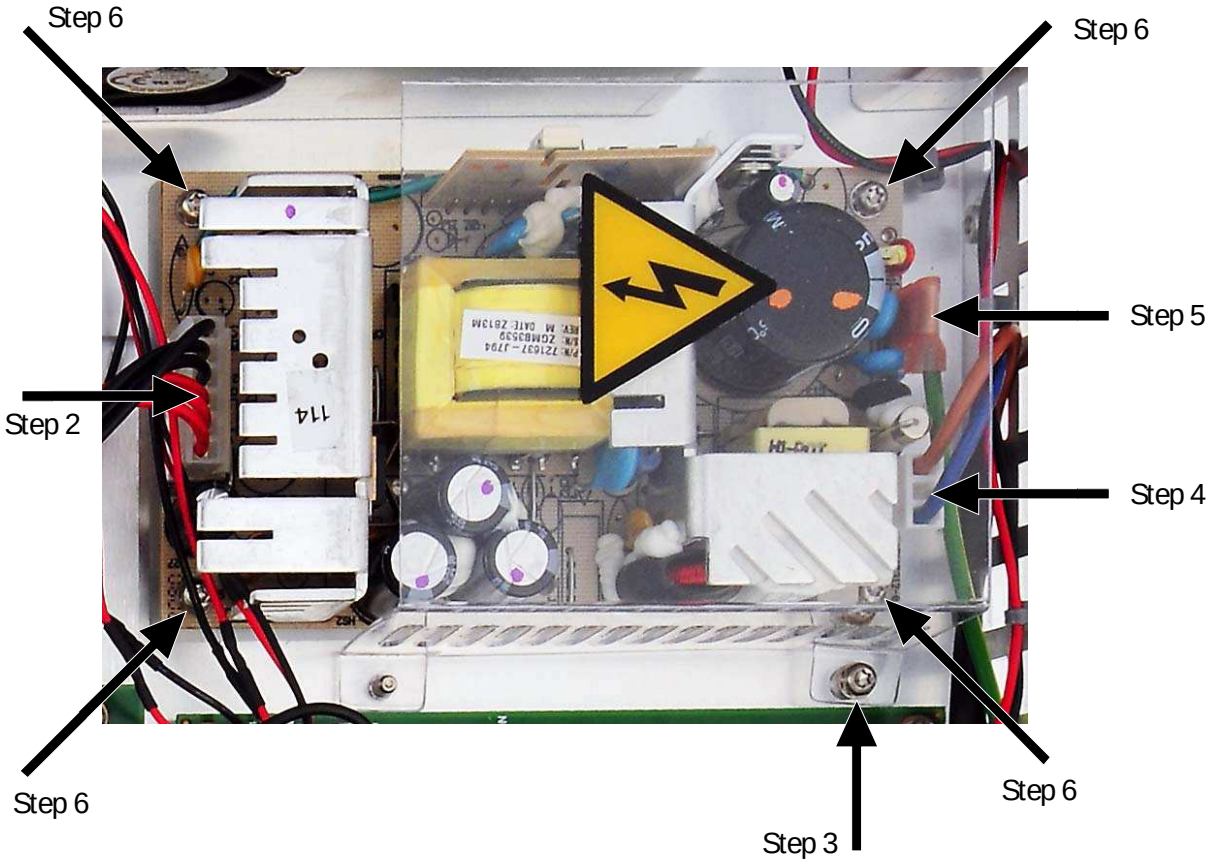
With the cover removed, the location of interior replaceable assemblies is identified below. The L4534A is shown; both models use the same layout, but the L4532A contains only one analog (input) board.



Replacing the Power Supply

The power supply can be removed with all other interior assemblies in place. To remove it:

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Disconnect the power supply cable (6-pin red & black-wired connector) from the power supply.
3. Remove the #10 Torx round head screw holding the power supply shield to the chassis, and remove the shield.
4. Disconnect the AC cable (3-pin blue and brown-wired connector) from the power supply.
5. Disconnect the ground cable (insulated connector on green/yellow wire) from the power supply.
6. Remove the four #10 Torx round head screws (one at each corner of the power supply) holding the power supply assembly to the chassis.
7. Lift the power supply up and out.

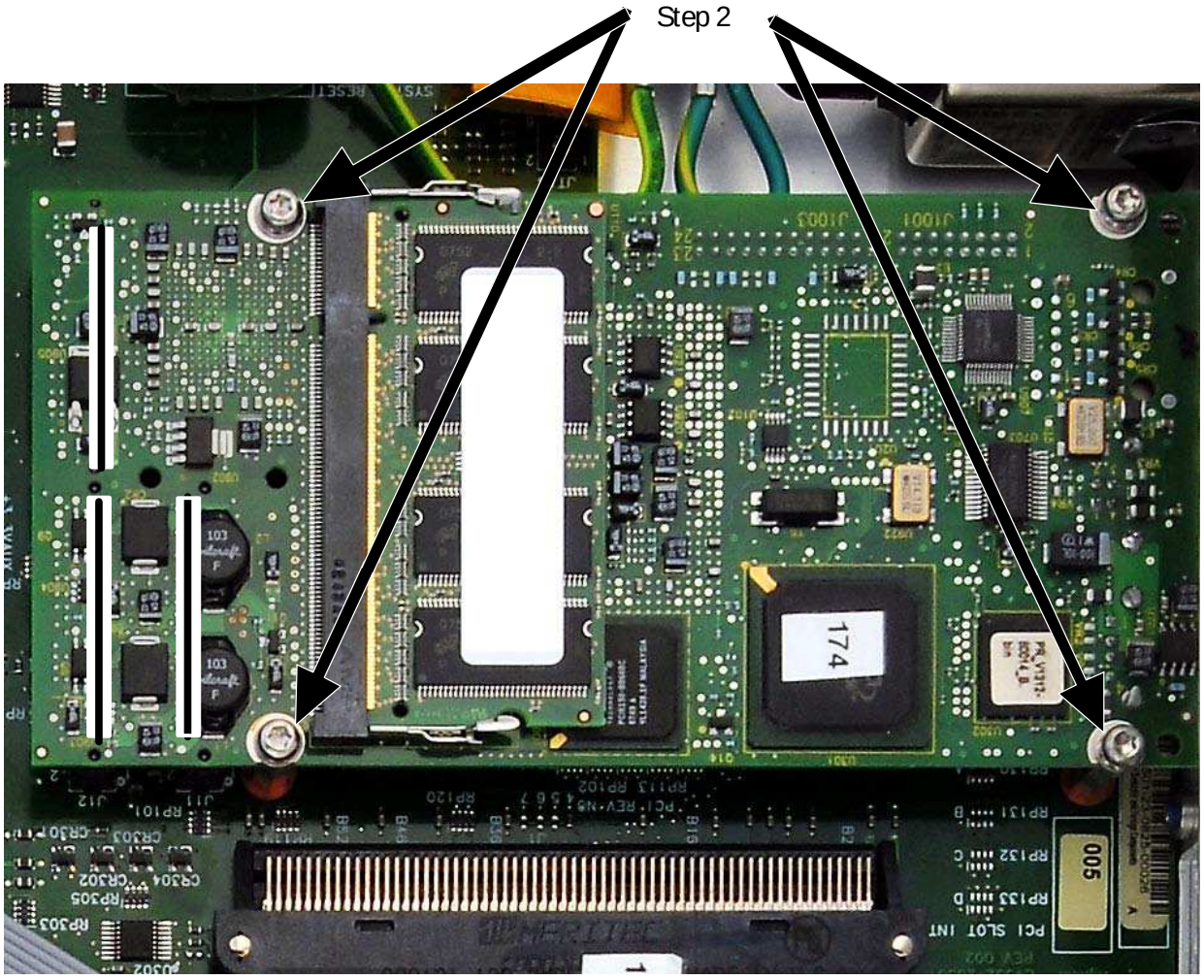


To reinstall the power supply, reverse these steps.

Replacing the Processor Board

The processor board can be removed with all other interior assemblies in place. To remove it:

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the four #10 Torx round head screws holding the processor board to risers on the carrier board.
3. Grasp the carrier board by the edges, avoiding touching electrical components or traces on the board. Carefully pull up, disengaging the three connectors on the rear of the processor board (below thick black and white bars drawn on the photo) from their mating connectors on the carrier board.

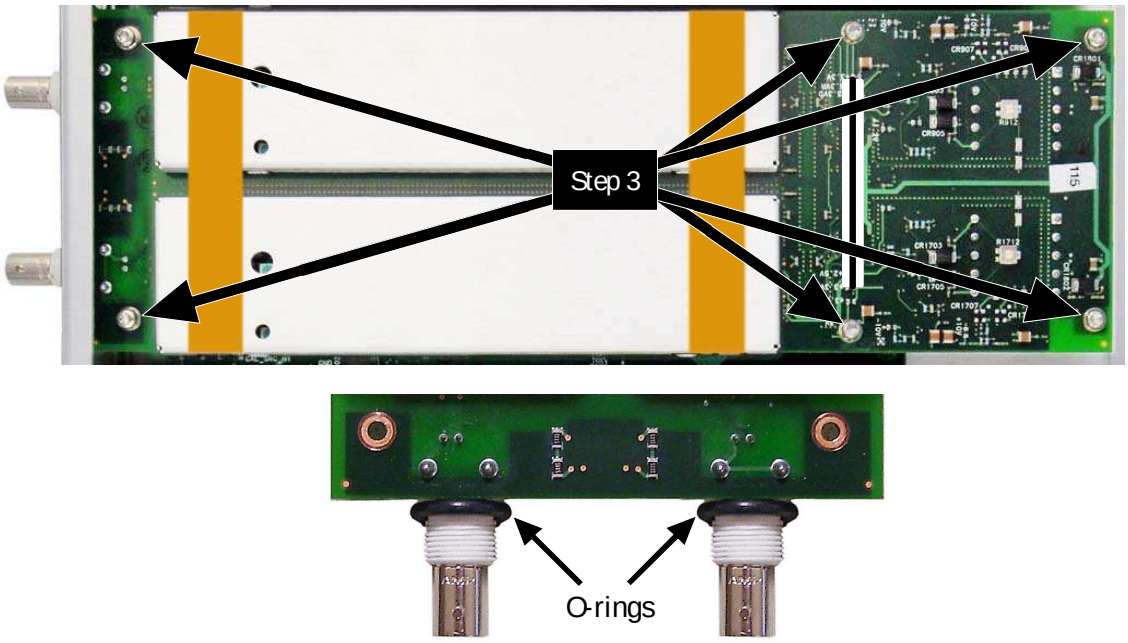


To reinstall the processor board, reverse these steps. Take care to re-engage the connectors to the carrier board securely; align the USB connector with the rear panel, then reinstall the four screws.

Replacing an Analog (Input) Board

The analog board (L4532A) or boards (L4534A) can be removed with all other interior assemblies in place, and without removing the rear panel. To remove the analog board:

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the two 14 mm nuts (with serrated metal grommets) from the analog board's BNC connectors.
3. Remove the six #10 Torx round head screws holding the analog board to risers on the chassis and digital board.
4. Grasp the analog board by the edges, avoiding touching electrical components or traces on the board. Carefully pull up, disengaging the connector on the backside of the board (below thick black and white bar drawn on the photo) from its mating connector on the digital board. Slide the board toward the front panel so that the BNC connectors (with rubber O-rings) clear, and lift out.



End of Removed Analog Board, with O-Rings Seated on BNC Connectors

To reinstall an analog board, reverse these steps.

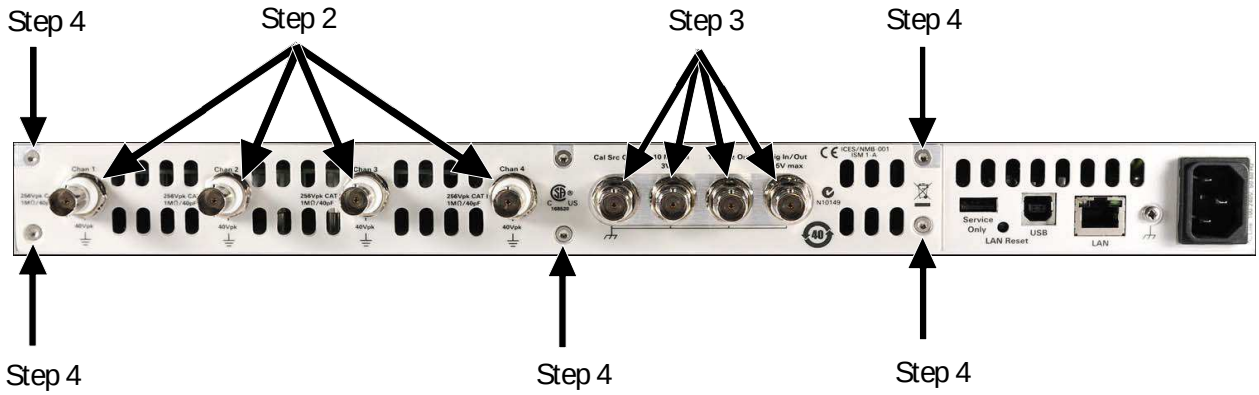
NOTE Remove the O-rings from the old analog channel board and transfer them to the new analog board. The O-rings are installed on the BNC connectors such that the O-rings will be inside the instrument rear panel.

Take care to seat the BNC connectors (with O-rings) in the rear panel and engage the connector to the digital board securely; then reinstall the six screws and secure the BNCs with the nuts and serrated grommets.

Removing the Rear Panel

The rear panel must be removed before you can remove either the digital or carrier board. To remove it:

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the two 14 mm nuts (with serrated metal grommets) from the analog board BNC connectors.
3. Remove the four 14 mm nuts (with serrated metal grommets) from the digital board BNC connectors.
4. Remove the five #10 Torx flat-head screws holding the rear panel to the chassis, and remove the panel.



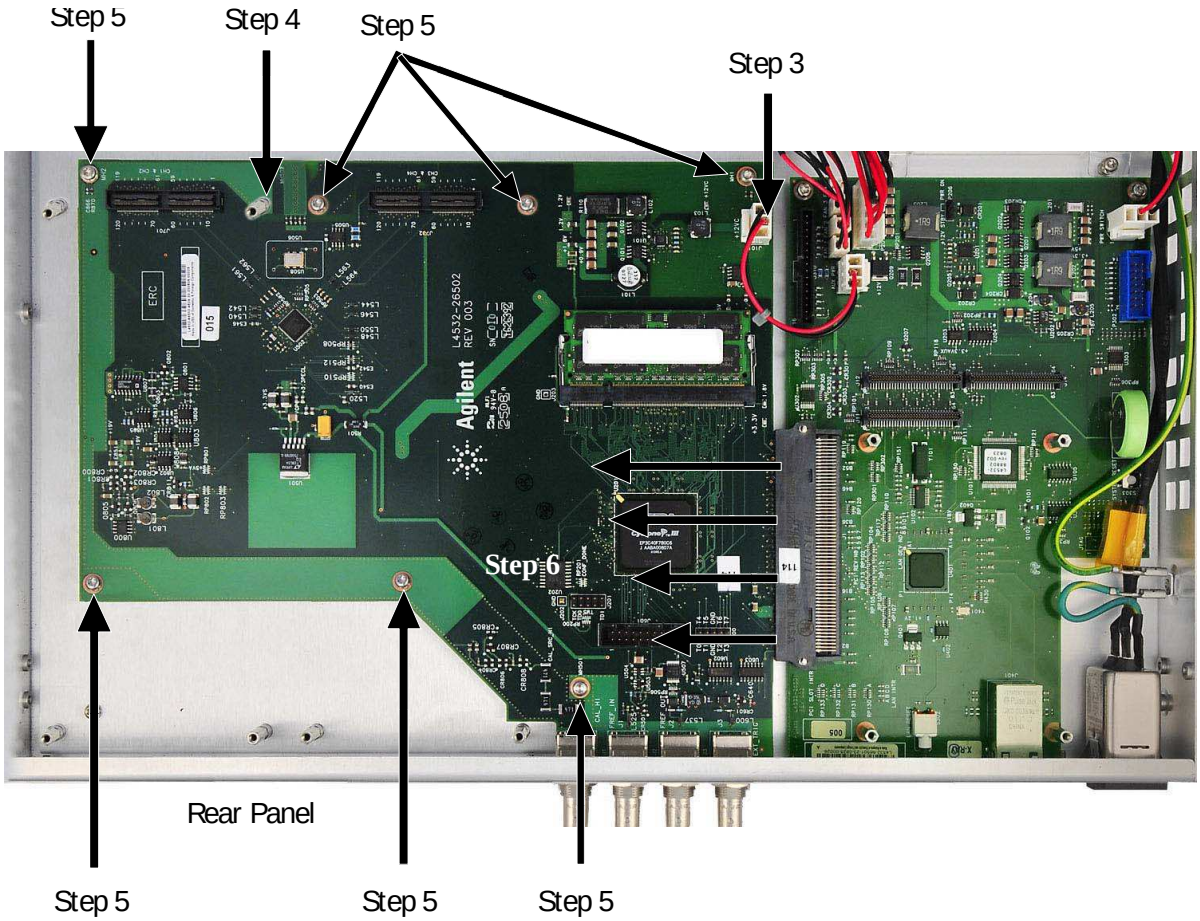
To reinstall the rear panel, reverse these steps.

Replacing the Digital Board (L4532A only)

The analog board and rear panel must be removed before you can remove the digital board. To remove it:

1. Remove the analog board (see "Replacing an Analog (Input) Board" on page 87.
2. Remove the rear panel (see "Removing the Rear Panel" on page 88).
3. Disconnect the 12 V cable from the digital board.
4. Remove the 3/16 inch analog board standoff and flat metal washer from the digital board.
5. Remove the seven #10 Torx round head screws holding the digital board to the chassis.
6. Grasp the digital board by the edges, avoiding touching electrical components or traces on the board. Pull the digital board to the left (oriented as shown below) to disengage the board's end connector

from the carrier board socket. Slide the digital board inward so that the BNC connectors clear the chassis, and lift the board out.



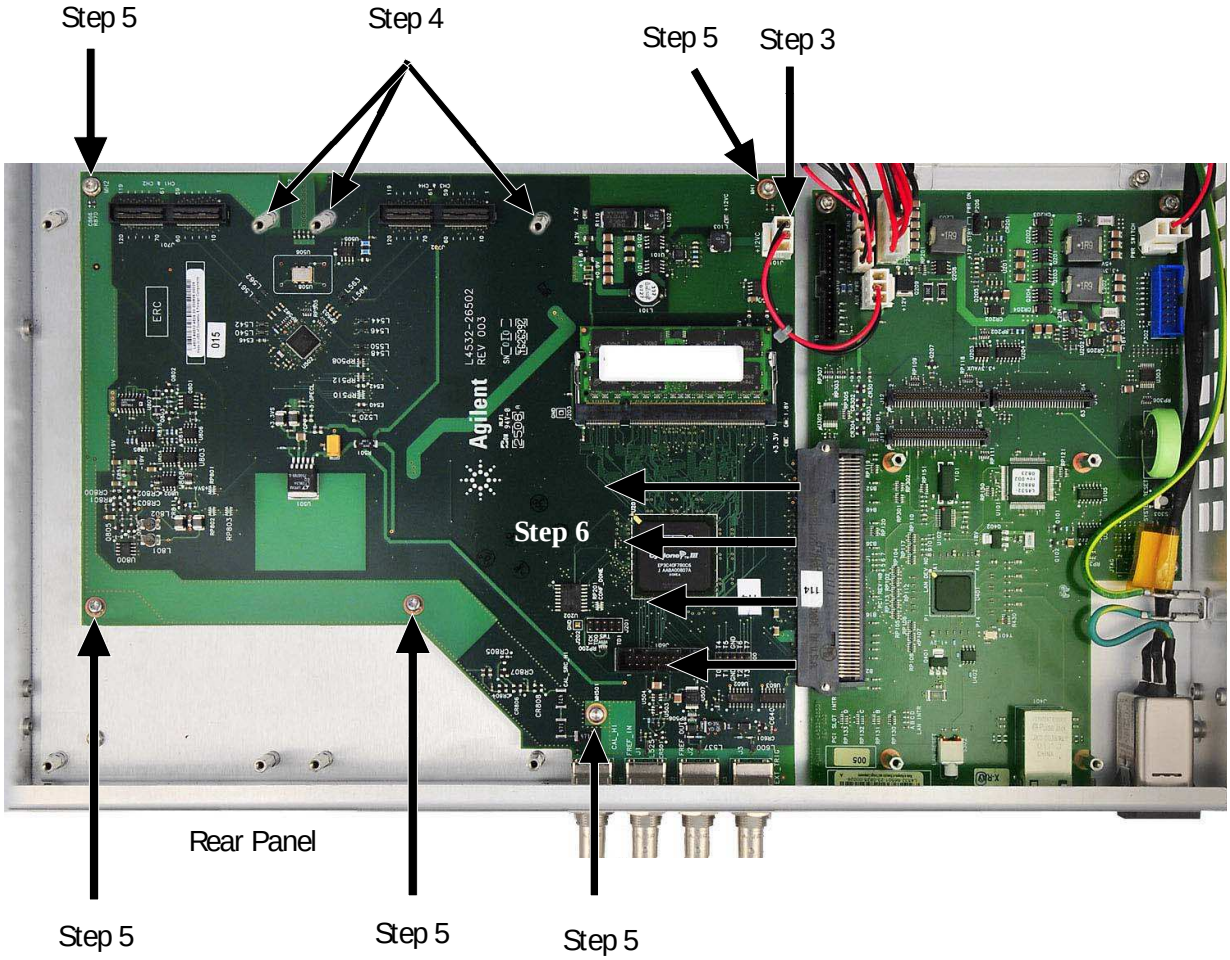
To reinstall the digital board, reverse these steps. Take care to guide the BNC connectors through the chassis and fully reinsert the end connector in the carrier board socket; then reinstall the seven screws and one riser, then reconnect the 12V cable.

Replacing the Digital Board (L4534A only)

The two analog boards and rear panel must be removed before you can remove the digital board. To remove it:

1. Remove both analog boards (see "Replacing an Analog (Input) Board" on page 87.
2. Remove the rear panel (see "Removing the Rear Panel" on page 88).
3. Disconnect the 12 V cable from the digital board.
4. Remove the three 3/16 inch analog board standoffs and flat metal washers from the digital board.
5. Remove the five #10 Torx round head screws holding the digital board to the chassis.

6 Grasp the digital board by the edges, avoiding touching electrical components or traces on the board. Pull the digital board to the left (oriented as shown below) to disengage the board's end connector from the carrier board socket. Slide the digital board inward so that the BNC connectors clear the chassis, and lift the board out.

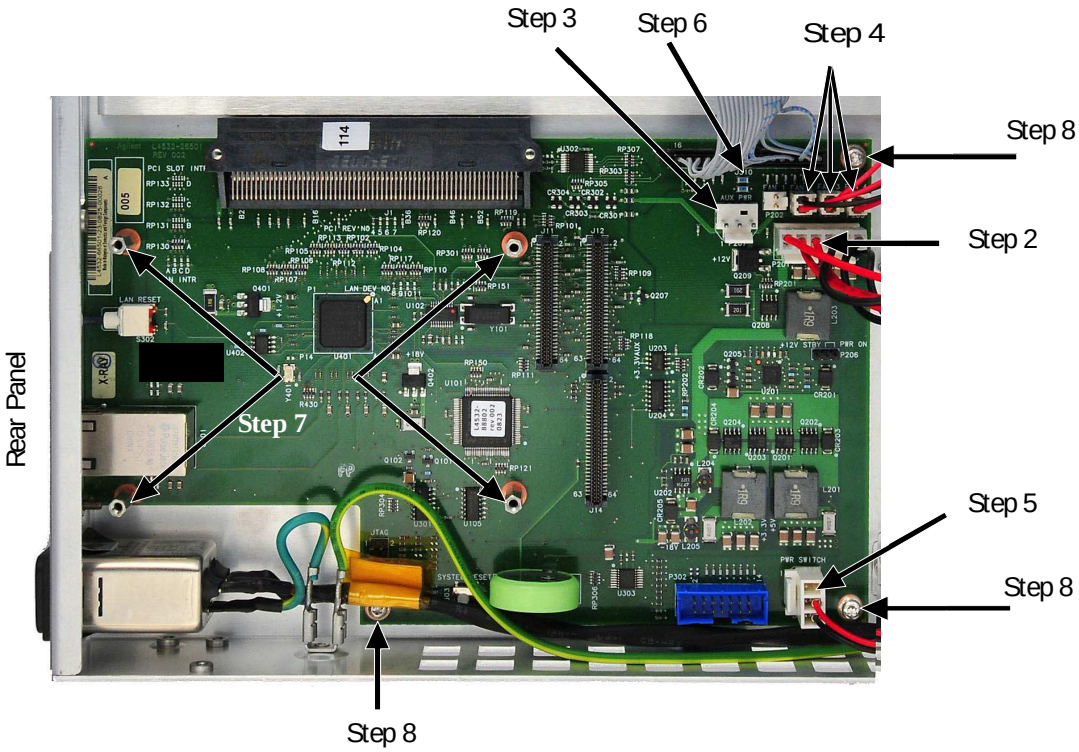


To reinstall the digital board, reverse these steps. Take care to guide the BNC connectors through the chassis and fully reinsert the end connector in the carrier board socket; then reinstall the five screws and three standoffs, then reconnect the 12V cable.

Replacing the Carrier Board

The analog board(s), digital board and processor board must be removed before you can remove the carrier board. To remove it:

1. Remove the processor and digital boards (see "Replacing the Processor Board" on page 86, "Replacing the Digital Board (L4532A only)" on page 88 and "Replacing the Digital Board (L4534A only)" on page 89.
2. Disconnect the power supply (6-pin) cable from the carrier board.
3. Disconnect the 12 V cable from the carrier board if still attached (it is shown disconnected in the photo below, as it was removed when removing the digital board).
4. Disconnect the three fan cables from the carrier board.
5. Disconnect the power switch cable from the carrier board.
6. Disconnect the display cable from the carrier board.
7. Remove the four 3/16 inch processor board standoffs from the carrier board.
8. Remove the three #10 Torx round head screws holding the carrier board to the chassis. Grasp the carrier board by the edges, avoiding touching electrical components or traces on the board, and lift the carrier board up and out.

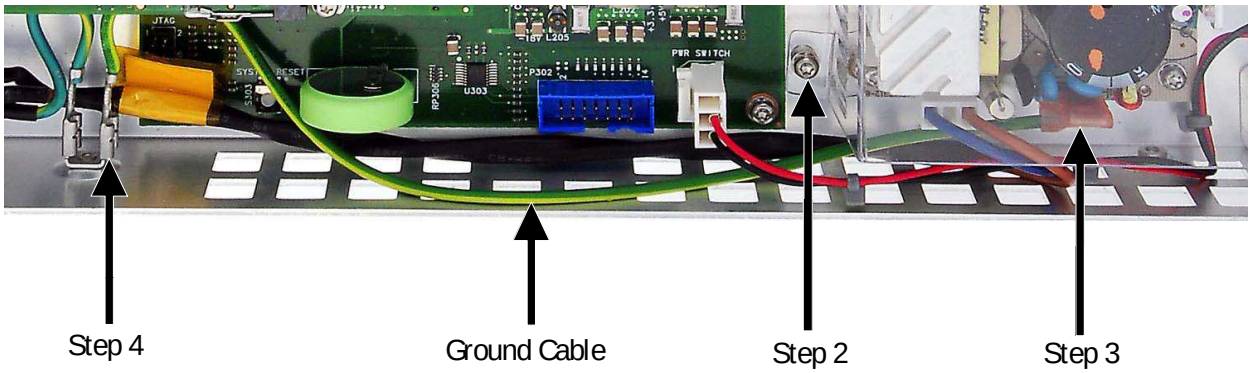


To reinstall the digital board, reverse these steps. When setting the carrier board back in the chassis, first align the USB receptacle with the chassis, then reinstall the standoffs, screws and cables.

Replacing the Ground Cable

The ground cable (green/yellow) can be removed with all other interior assemblies in place. To remove it:

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the #10 Torx round head screw holding the power supply shield to the chassis, and remove the shield.
3. Disconnect the ground cable's insulated connector from the power supply.
4. Disconnect the ground cable's non-insulated connector from the chassis.
5. Route the ground cable past the power supply and power switch cable and remove it.



To reinstall the ground cable, reverse these steps.

Removing the Front Panel

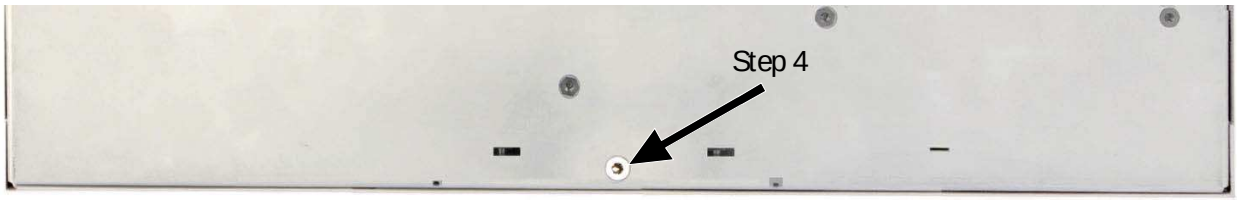
The front panel must be removed before you can remove the power switch (and/or its pushbutton cap), the display, or any of the exhaust fans. To remove it:

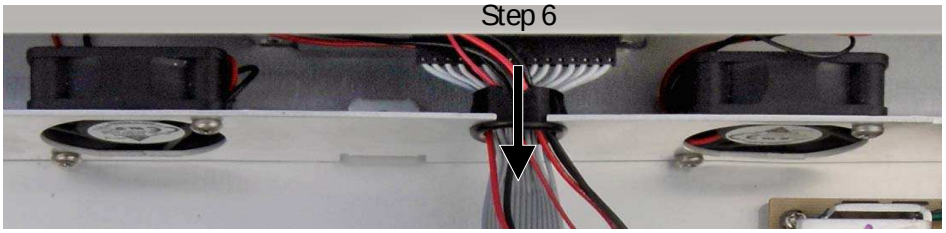
1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the two #10 Torx flat-head screws (one at each side of the digitizer) holding the front panel to the chassis.
3. Remove the two #10 Torx flat-head screws (at the front panel of the digitizer) holding the front panel to the chassis.
4. Remove the #10 Torx flat-head screw (at the center-front of the bottom side of the digitizer) holding the front panel to the chassis.
5. Remove the panel, but support it if the display cable is still connected between the carrier board and display.

6 Disconnect the display cable from the display (this cable has a center locking tab at both ends; squeeze to release). The photo shows the front panel still in place and illustrates why it is easier to disconnect the display cable after the front panel is removed.









To reinstall the front panel, reverse these steps. Remember to reconnect the display cable to the front panel before reattaching the panel.

Replacing the Power Switch and Switch Cable

The cover and front panel must be removed before you can remove the power switch or its cable. To remove them:

1 Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).

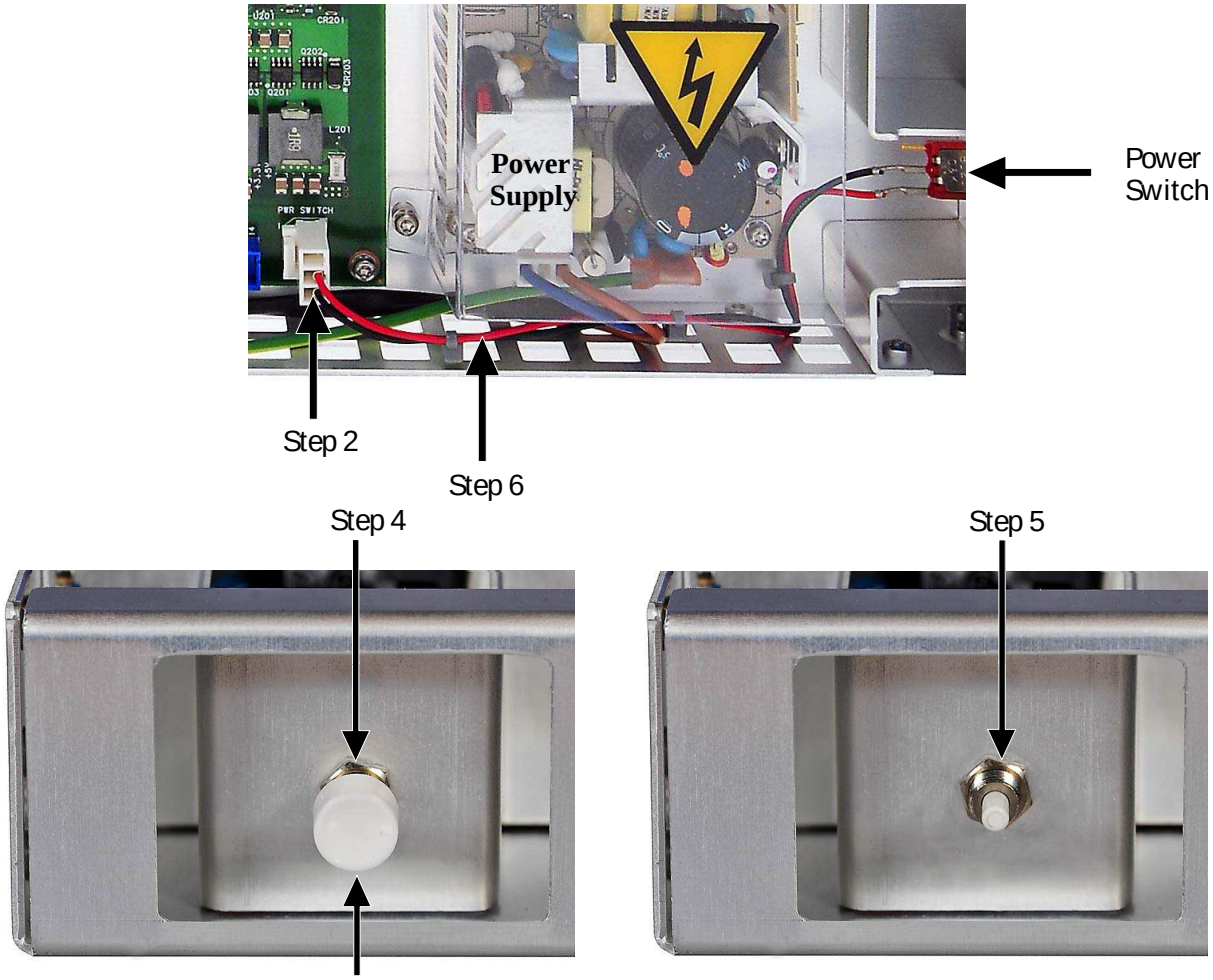
2 Disconnect the power switch cable from the carrier board.

3 Remove the front panel (see "Removing the Front Panel" on page 92).

4 Remove the switch pushbutton cap, by pulling it straight off the power switch shaft (friction fit, not keyed).

5 Remove the 5/16 inch nut securing the power switch, and disengage the switch (slide backwards) into the chassis.

6 Route the switch cable (switch attached) past the power supply and lift out. Then disconnect the switch cable from the switch.



View of power switch, with front panel and cover removed

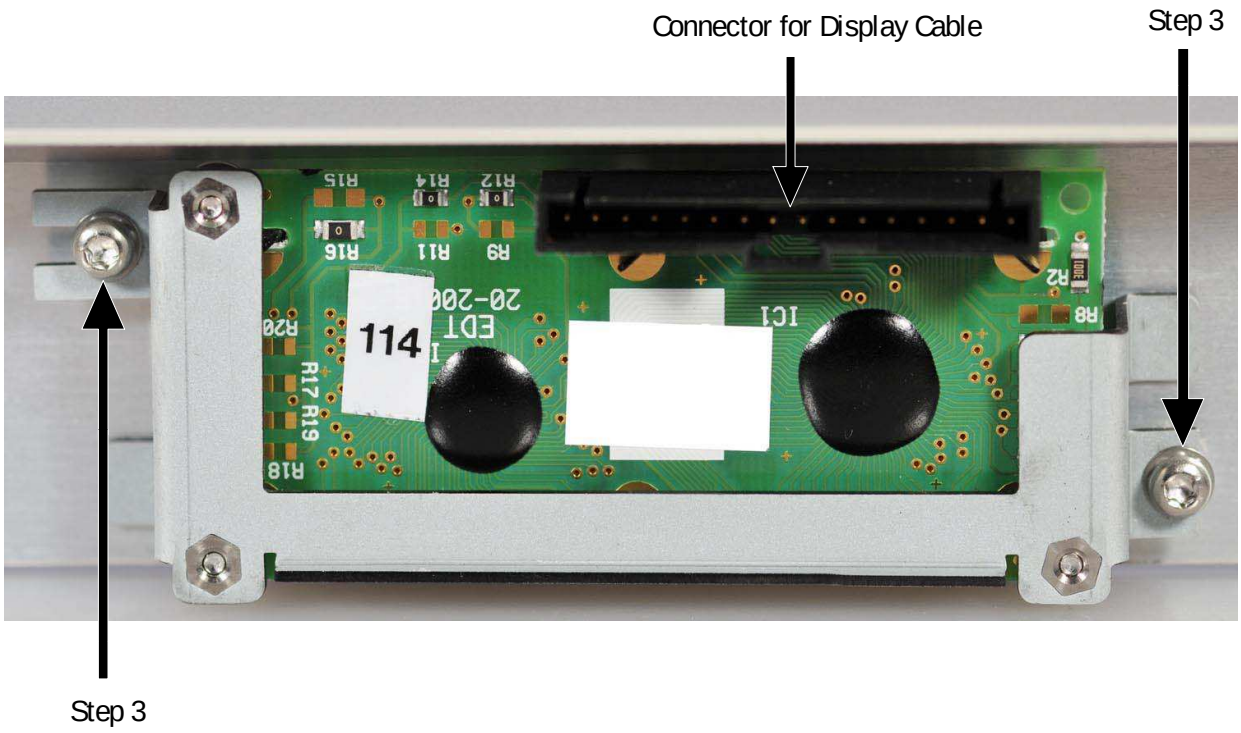
To reinstall the power switch and cap, reverse these steps.

Replacing the Display

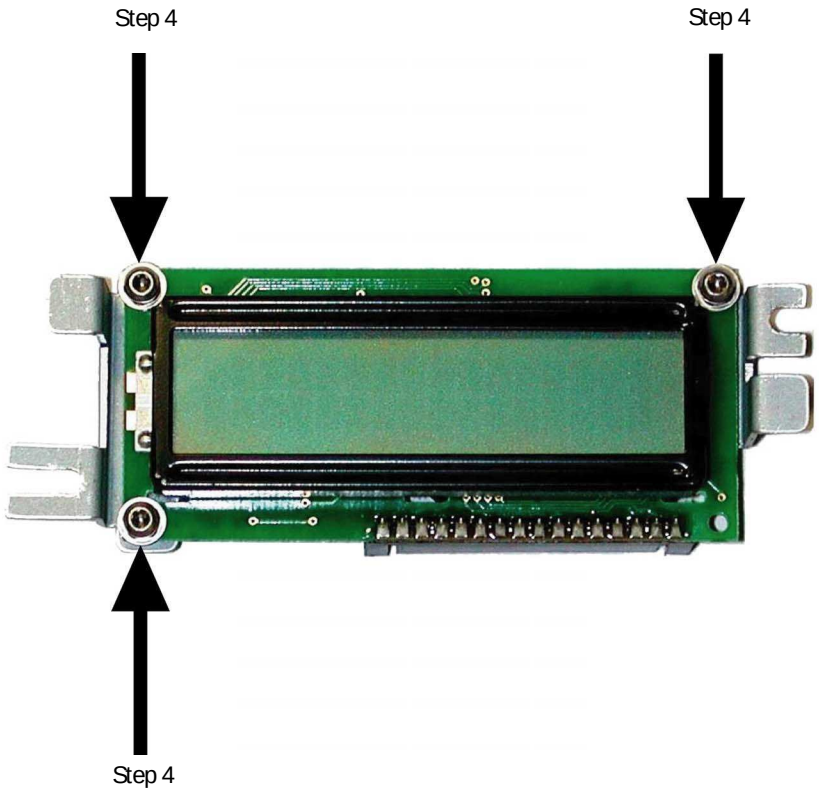
The cover and front panel must be removed before you can remove the display. To remove it:

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the front panel (see "Removing the Front Panel" on page 92).

   In step 6 of that procedure you disconnect the display cable from the display, so the cable is not shown below.
3. Remove the two #10 Torx round head screws holding the display bracket to the front panel.



4 Turn over the display bracket and remove the three #8 Torx round head screws holding the display assembly to the bracket.



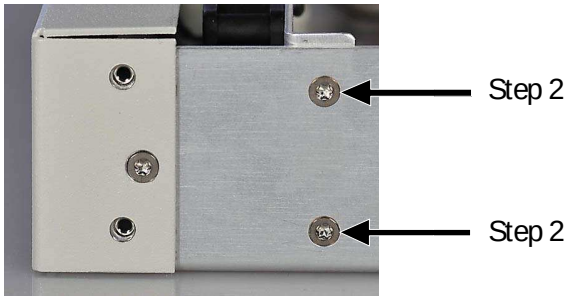
To reinstall the display, reverse these steps.

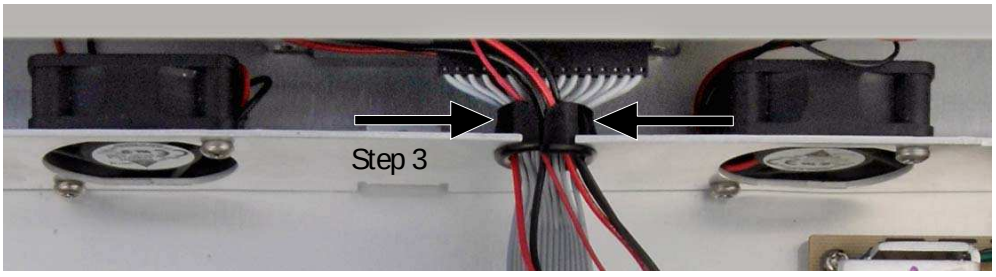
Replacing a Fan

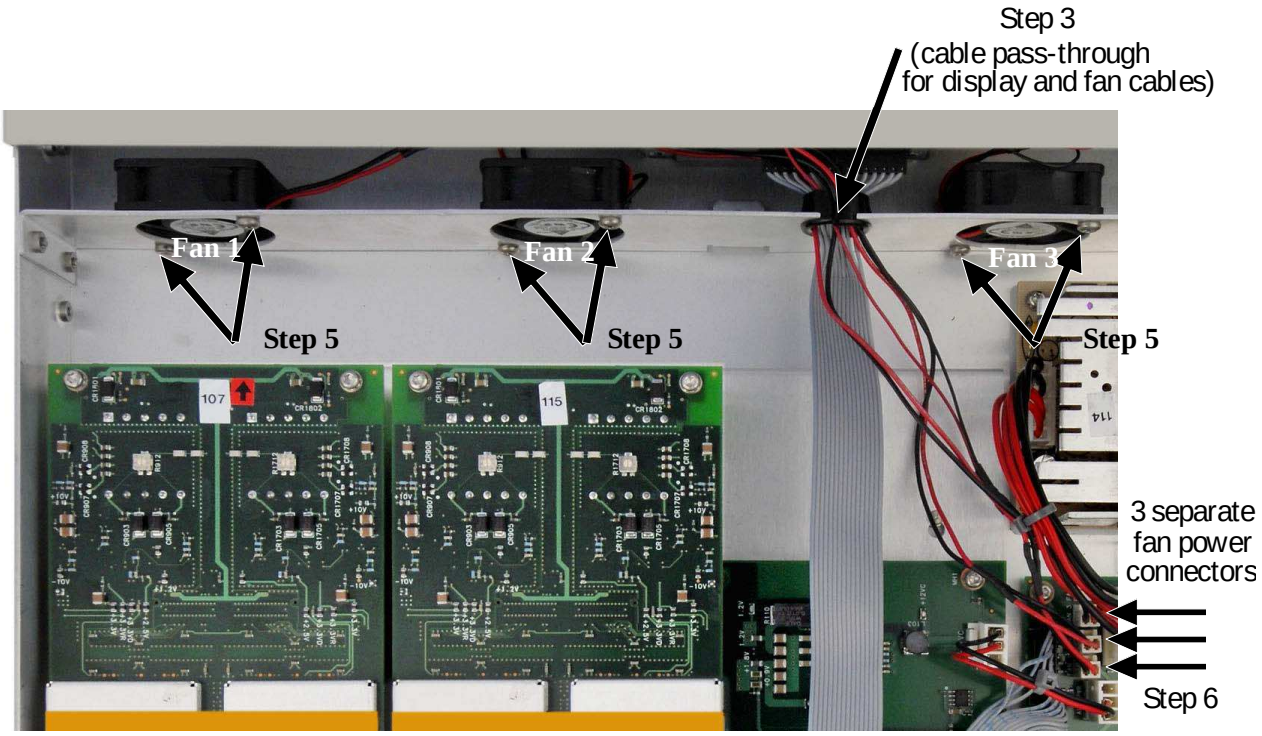
Each of the three exhaust fans can be replaced independently, with most other interior assemblies in place, but you must first remove the fan bracket to easily access the lower fan screws.

1. Remove all cables from the exterior of the instrument, and remove the cover (see "Removing the Cover" on page 82).
2. Remove the four #10 Torx flat head screws (two on each side) holding the fan bracket to the chassis. One side is shown in the illustration.
3. All three fan cables pass through a grommet on the fan bracket. Pinch the sides of the grommet to disengage it from the fan bracket, and slide toward the back of the unit to free the fan cables and display cable.
4. Remove the #10 Torx round head screw at the center of the fan bracket near the display, holding the fan bracket to the chassis. The screw is under the display cable, near where it connects to the display—you may have to move the cable slightly to the side to access the screw.

   Carefully free the fan bracket from the chassis, high enough to access both screws holding the fan you wish to remove from the fan bracket. The last illustration (following page) shows the grommet and fan bracket still in place, but you will have freed the cables in Step 3 and the bracket in this step.
5. Remove the two #10 Torx screws holding the fan to the fan bracket.
6. Disconnect the fan's power cable from the carrier board. Remove the fan.







To reinstall a fan, reverse these steps. Ensure the fan is oriented so that the air flow is in the correct direction.

6 Backdating

This chapter contains information necessary to adapt this manual to instruments not directly covered by the current content. At this printing, however, the manual applies to all instruments. Therefore, no information is included in this chapter.

6 Backdating

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