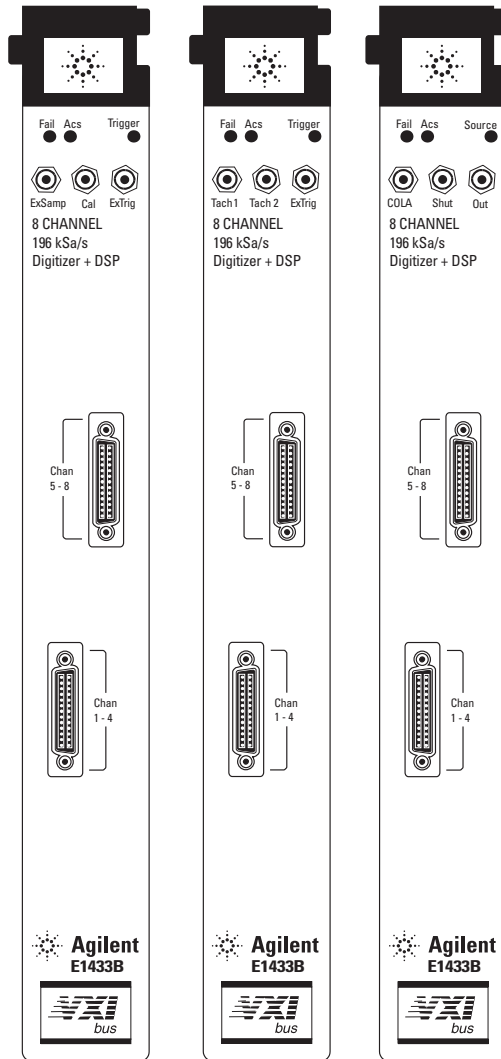
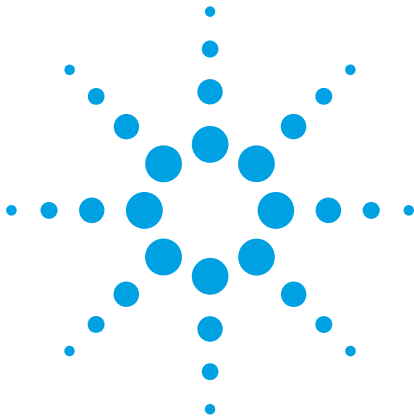


# Agilent E1433B

## 8-Channel 196 kSa/s Digitizer plus DSP

### Technical Specifications



Agilent E1433B

Agilent E1433B  
with Tachometer  
Option AYF

Agilent E1433B  
with Arbitrary Source  
Option 1D4

The Agilent E1433B 8-Channel 196 kSa/s Digitizer plus DSP is a C-size VXI module. "196 kSa/s" refers to the maximum sample rate of 196,608 samples per second per channel.

The E1433B may contain either one or two four-channel input assemblies so that the module may have a total of up to eight inputs.

This module integrates transducer signal conditioning, anti-alias protection, digitization and high speed measurement computation in a single-slot VXI card. Onboard digital signal processing and 32 Mbytes of RAM maximizes total system performance and flexibility.



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# Specifications

## Frequency

Bandwidth (Hz)	Sample Rate (Hz)	Bandwidth (Hz)	Sample Rate (Hz)	Bandwidth (Hz)	Sample Rate (Hz)
88,320.00 <sup>1</sup>	196,608.00	10,000.00	25,600.00	762.94	1,953.13
76,800.00	196,608.00	9,765.63	25,000.00	750.00	1,920.00
86,250.00 <sup>1</sup>	192,000.00	9,600.00	24,576.00	651.04	1,666.67
75,000.00	192,000.00	9,375.00	24,000.00	640.00	1,638.40
73,600.00 <sup>1</sup>	163,840.00	8,000.00	20,480.00	625.00	1,600.00
64,000.00	163,840.00	7,812.50	20,000.00	610.35	1,562.50
70,190.43 <sup>1</sup>	156,250.00	7,680.00	19,660.80	600.00	1,536.00
61,035.16	156,250.00	7,629.39	19,531.25	585.94	1,500.00
69,000.00 <sup>1</sup>	153,600.00	7,500.00	19,200.00	500.00	1,280.00
60,000.00 <sup>1</sup>	153,600.00	6,510.42	16,666.67	488.28	1,250.00
59,895.83 <sup>1</sup>	133,333.33	6,400.00	16,384.00	480.00	1,228.80
52,083.33	133,333.33	6,250.00	16,000.00	476.84	1,220.70
57,500.00 <sup>1</sup>	128,000.00	6,103.52	15,625.00	468.75	1,200.00
50,000.00	128,000.00	6,000.00	15,360.00	406.90	1,041.67
56,152.34 <sup>1</sup>	125,000.00	5,208.33	13,333.33	400.00	1,024.00
48,828.13	125,000.00	5,120.00	13,107.20	390.63	1,000.00
55,200.00 <sup>1</sup>	122,880.00	5,000.00	12,800.00	381.47	976.56
48,000.00	122,880.00	4,882.81	12,500.00	375.00	960.00
46,000.00 <sup>1</sup>	102,400.00	4,800.00	12,288.00	325.52	833.33
40,000.00	102,400.00	4,687.50	12,000.00	320.00	819.20
44,921.88 <sup>1</sup>	100,000.00	4,000.00	10,240.00	312.50	800.00
39,062.50	100,000.00	3,906.25	10,000.00	305.18	781.25
44,160.00 <sup>1</sup>	98,304.00	3,840.00	9,830.40	300.00	768.00
38,400.00	98,304.00	3,814.70	9,765.63	292.97	750.00
43,125.00 <sup>1</sup>	96,000.00	3,750.00	9,600.00	250.00	640.00
37,500.00	96,000.00	3,255.21	8,333.33	244.14	625.00
36,800.00 <sup>1</sup>	81,920.00	3,200.00	8,192.00	240.00	614.40
32,000.00	81,920.00	3,125.00	8,000.00	238.42	610.35
35,095.21 <sup>1</sup>	78,125.00	3,051.76	7,812.50	234.38	600.00
30,517.58	78,125.00	3,000.00	7,680.00	203.45	520.83
34,500.00 <sup>1</sup>	76,800.00	2,604.17	6,666.67	200.00	512.00
30,000.00	76,800.00	2,560.00	6,553.60	195.31	500.00
29,947.92 <sup>1</sup>	66,666.67	2,500.00	6,400.00	190.73	488.28
26,041.67	66,666.67	2,441.41	6,250.00	187.50	480.00
29,440.00	65,536.00	2,400.00	6,144.00	162.76	416.67
25,600.00	65,536.00	2,343.75	6,000.00	160.00	409.60
28,750.00 <sup>1</sup>	64,000.00	2,000.00	5,120.00	156.25	400.00
25,000.00	64,000.00	1,953.13	5,000.00	152.59	390.63
28,076.17 <sup>1</sup>	62,500.00	1,920.00	4,915.20	150.00	384.00
24,414.06	62,500.00	1,907.35	4,882.81	146.48	375.00
27,600.00 <sup>1</sup>	61,440.00	1,875.00	4,800.00	125.00	320.00
24,000.00	61,440.00	1,627.60	4,166.67	122.07	312.50
23,000.00 <sup>1</sup>	51,200.00	1,600.00	4,096.00	120.00	307.20
20,000.00	51,200.00	1,562.50	4,000.00	119.21	305.18
22,460.94 <sup>1</sup>	50,000.00	1,525.88	3,906.25	117.19	300.00
19,531.25	50,000.00	1,500.00	3,840.00	101.73	260.42
22,080.00 <sup>1</sup>	49,152.00	1,302.08	3,333.33	100.00	256.00
19,200.00	49,152.00	1,280.00	3,276.80	97.66	250.00
21,562.50 <sup>1</sup>	48,000.00	1,250.00	3,200.00	95.37	244.14
18,750.00	48,000.00	1,220.70	3,125.00	93.75	240.00
16,000.00	40,960.00	1,200.00	3,072.00	81.38	208.33
15,360.00	39,321.60	1,171.88	3,000.00	80.00	204.80
15,258.79	39,062.50	1,000.00	2,560.00	78.13	200.00
15,000.00	38,400.00	976.56	2,500.00	76.29	195.31
13,020.83	33,333.33	960.00	2,457.60	75.00	192.00
12,800.00	32,768.00	953.67	2,441.41	73.24	187.50
12,500.00	32,000.00	937.50	2,400.00	62.50	160.00
12,207.03	31,250.00	813.80	2,083.33	61.04	156.25
12,000.00	30,720.00	800.00	2,048.00	60.00	153.60
10,416.67	26,666.67	781.25	2,000.00	59.60	152.59

<sup>1</sup> These sample rates also have available bandwidths that are 1.15 times the bandwidth of this table

**Frequency (continued)**

<b>Bandwidth (Hz)</b>	<b>Sample Rate (Hz)</b>	<b>Bandwidth (Hz)</b>	<b>Sample Rate (Hz)</b>	<b>Bandwidth (Hz)</b>	<b>Sample Rate (Hz)</b>
58.59	150.00	5.09	13.02	0.49	1.25
50.86	130.21	5.00	12.80	0.48	1.22
50.00	128.00	4.88	12.50	0.47	1.20
48.83	125.00	4.77	12.21	0.47	1.19
47.68	122.07	4.69	12.00	0.46	1.17
46.88	120.00	4.58	11.72	0.40	1.02
40.69	104.17	3.91	10.00	0.39	1.00
40.00	102.40	3.81	9.77	0.38	0.98
39.06	100.00	3.75	9.60	0.37	0.95
38.15	97.66	3.73	9.54	0.37	0.94
37.50	96.00	3.66	9.38	0.32	0.81
36.62	93.75	3.18	8.14	0.31	0.80
31.25	80.00	3.13	8.00	0.31	0.78
30.52	78.13	3.05	7.81	0.30	0.76
30.00	76.80	2.98	7.63	0.29	0.75
29.80	76.29	2.93	7.50	0.29	0.73
29.30	75.00	2.54	6.51	0.24	0.63
25.43	65.10	2.50	6.40	0.24	0.61
25.00	64.00	2.44	6.25	0.23	0.60
24.41	62.50	2.38	6.10	0.23	0.59
23.84	61.04	2.34	6.00	0.20	0.50
23.44	60.00	2.29	5.86	0.19	0.48
20.35	52.08	1.95	5.00	0.18	0.47
20.00	51.20	1.91	4.88	0.16	0.41
19.53	50.00	1.88	4.80	0.16	0.40
19.07	48.83	1.86	4.77	0.15	0.39
18.75	48.00	1.83	4.69	0.15	0.38
18.31	46.88	1.59	4.07	0.15	0.38
15.63	40.00	1.56	4.00	0.12	0.31
15.26	39.06	1.53	3.91	0.12	0.30
15.00	38.40	1.49	3.81	0.11	0.29
14.90	38.15	1.46	3.75	0.10	0.25
14.65	37.50	1.27	3.26	0.09	0.24
12.72	32.55	1.25	3.20	0.09	0.23
12.50	32.00	1.22	3.13	0.08	0.20
12.21	31.25	1.19	3.05	0.07	0.19
11.92	30.52	1.17	3.00	0.06	0.16
11.72	30.00	1.14	2.93	0.06	0.15
10.17	26.04	0.98	2.50		
10.00	25.60	0.95	2.44		
9.77	25.00	0.94	2.40		
9.54	24.41	0.93	2.38		
9.38	24.00	0.92	2.34		
9.16	23.44	0.79	2.03		
7.81	20.00	0.78	2.00		
7.63	19.53	0.76	1.95		
7.50	19.20	0.75	1.91		
7.45	19.07	0.73	1.88		
7.32	18.75	0.64	1.63		
6.36	16.28	0.63	1.60		
6.25	16.00	0.61	1.56		
6.10	15.63	0.60	1.53		
5.96	15.26	0.59	1.50		
5.86	15.00	0.57	1.46		

**Frequency Accuracy** ± 0.012% (120 ppm)

**Input**

<b>Full Scale Input Ranges</b> (in volts peak)	5 mV to 10 V (1,2,5 steps)
<b>Maximum Input Level</b>	42 Vp
<b>Input Impedance</b> (dc coupled or ac coupled above 10 Hz)	
Differential	2 M $\Omega$ nominal
Either side-to-chassis	1 M $\Omega$ nominal
<b>Programmable AC Coupling</b> <b>3 dB Corner Frequency</b> (two-pole, 12 dB/octave)	1 to 100 Hz
<b>Common Mode Rejection Ratio</b>	
ac or dc coupled, 10 Hz to 1 kHz	> 70 dB
Maximum signal, low side to chassis	$\pm 10$ Vpk
Maximum signal, high side to chassis ( $V_T = 0$ )	$\pm 11.5$ Vp
Maximum signal, high side to chassis	$V_T \pm 10$ Vpk (must be $\leq 20$ V) ( $V_T$ = transducer offset cancellation voltage setting)
<b>Amplitude Over-Range Detection</b>	
Common mode overload	$\pm 11.5$ Vp (typical)
Differential mode overload (dc coupled)	105% of full scale
Differential mode overload (ac coupled) for cutoff frequency $\leq 6$ Hz	100% of full scale
for cutoff frequency $> 6$ Hz	50% of full scale, worst case
<b>Residual DC</b>	1% of full scale +2 mV
<b>Amplitude</b>	
<b>Amplitude Accuracy at 1 kHz</b>	$\pm 0.5\%$ of reading, $\pm 0.01\%$ of full scale
<b>Flatness</b> (relative to 1 kHz, at full scale)	
< 29 kHz	$\pm 1\%$ ( $\pm 0.09$ dB)
< 88 kHz	$\pm 2\%$ ( $\pm 0.17$ dB) for $> 100$ mV range
< 88 kHz	$\pm 5\%$ ( $\pm 0.42$ dB) 5 mV to 100 mV range
<b>Amplitude Resolution</b>	16 bits, less 5.5 dB over-range (typical)

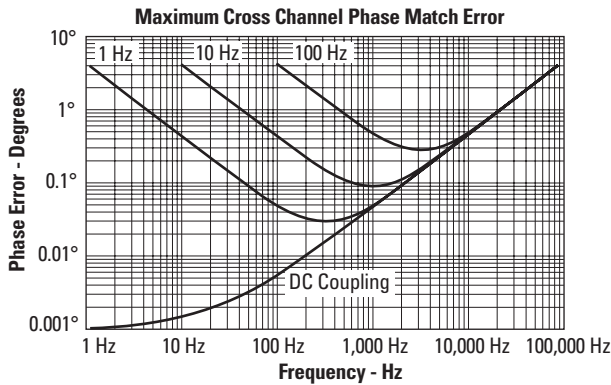
**Cross-Channel Matching** (any E1433B module in the same mainframe)

**Cross-Channel Amplitude Match**

up to 29 kHz  $\pm 0.1$  dB  
 (freq > 2x AC HPF corner freq when AC coupled)  
 29 kHz to 88 kHz  $\pm 0.2$  dB

**Cross-Channel Phase Match**

(full-scale signal, input ranges equal)



**Dynamic Range**

**Resolution** 16 bits

**Spurious-Free Dynamic Range\***

(includes spurs, harmonic distortion, intermodulation distortion, alias products and sidebands > 300 Hz)  
 (source impedance = 50Ω)

51.2 kSa/s Fs,  $\leq 1$  Vpk  $< -90$  dBfs (typical)  
 48 kSa/s to 65.536 Sa/s Fs  $< -80$  dBfs  
 above 65.536 Sa/s Fs  $< -74$  dBfs

**Residual Response with No Input**  $< -76$  dBfs

**Crosstalk**  $< -80$  dBfs (typical)

(receiving channel source impedance = 50Ω, low side grounded, full scale, < 10 kHz signal on other channels, input ranges within 20 dB)

**Noise** (input terminated with 50Ω, 5 mV range)

Noise density above 100 Hz  $< 70$  nVrms/ $\sqrt{\text{Hz}}$   
 Total rms noise, 10 Hz to 10 kHz  $< 7$  μVrms

**Triggering**

**Trigger Detection** Digital

**Trigger Modes** Input, external, source, TTL TRG, software, RPM (requires option AYF)

**Maximum Trigger Delay** (8 channels active)

Pre-trigger delay 2 MSa (32 MB RAM)  
 Post-trigger delay 16 MSa

\* 5 mV range degrades 6 dB.

## Option 1D4 Arbitrary Source Specifications

### General

<b>Output Modes</b>	Sine and pseudo random with burst; arbitrary waveform with continuous output
<b>Frequency Bands</b>	
<b>Sine, Noise Modes</b>	
Reconstruction filter bandwidth	0 to 25.6 kHz
DSP data rate (Fs)	48.00 kHz to 65.536 kHz
Data word size	16 bits
<b>Arb Modes</b>	
Reconstruction filter bandwidth	0 to 6.4 kHz
Data word size	20 bits
<b>Frequency Accuracy</b>	± 0.012% (120 ppm)
<b>Signal Output</b>	
<b>Number of Output Channels</b>	1
<b>Maximum Amplitude</b>	10 V <sub>p</sub> nominal
<b>Output Impedance</b>	< 0.5Ω (typical)
<b>Maximum Output Current</b>	100 mA (typical)
<b>Maximum Capacitive Load</b>	0.01 μF (typical)
<b>Amplitude Control</b> (signal amplitude = range × scale factor)	
Maximum amplitude	10 V <sub>p</sub> nominal
Amplitude ranges	79 mV <sub>p</sub> to 10 V <sub>p</sub> in 0.375 dB steps
Amplitude scale factor	0.0 to 1.0, with 20-bit resolution
<b>Residual Output Noise Voltage</b> (Freq > 500 Hz)	< 500 nV/√Hz
<b>Residual DC Offset</b>	
Offset after autozero	± 2 mV
Offset after shutdown	± 20 mV
Zeroing resolution	100 μV
<b>Output Overload Trip</b>	> 17V
<b>Amplitude Ramp-down Time</b> (Programmable)	0 to 30 seconds
<b>Shutdown</b>	
Shutdown input	TTL levels
Shutdown time	< 5s
Shutdown time, ac fail	< 4 ms

**Sine Output Mode****Sine Frequency** (65536 Hz Fs)

Frequency range	0 to 25.6 kHz
Frequency resolution	244 $\mu$ Hz

**Amplitude Accuracy**  
(1 kHz sine wave, into  $\geq 200\Omega$ )

10 Vp to 0.158 Vp ranges	$\pm 0.20$ dB (2.3%)
0.152 Vp to 79 mVp ranges	$\pm 0.40$ dB (4.7%)

<b>Flatness</b> (relative to 1 kHz)	$\pm 0.5$ dB
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**Harmonic and Aliased-harmonic Distortion**  
( $\geq 1$  k $\Omega$  load)

1 Vp range, 1.0 scale factor, 0 to 6.4 kHz	< -80 dBc
2 to 10 Vp range, 0.05 to 1.0 scale factor, 0 to 25.6 kHz	< -70 dBc

<b>Spurious Responses</b>	< -60 dBVp
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**Constant-Level Output**

<b>Output Level at 1 kHz</b> (after 1 second settling, amplitude scale factor > 0.001)	1 Vp (nominal)
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<b>Output Impedance</b>	1.2 k $\Omega$ (typical)
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**Flatness**

25 Hz to 5 kHz, amplitude scale factor 0.001 to 1.0	1.13 Vp to 0.50 Vp (+10, -6.0 dB) (typical)
5 Hz to 20 kHz, amplitude scale factor 0.01 to 1.0	1.13 Vp to 0.44 Vp (+10, -7.0 dB) (typical)
5 Hz to 20 kHz, amplitude scale factor 0.1 to 1.0	1.13 Vp to 0.88 Vp ( $\pm 1.0$ dB) (typical)

<b>Sine Wave Distortion</b> (at 1 kHz, amplitude scale factor 0.1 to 1.0)	-40 dBc (typical)
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<b>Residual DC Offset</b>	< 5 mV (typical)
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**Summer Input**

<b>Maximum Input Level</b>	10 Vp
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<b>Gain, Summer Input to Signal Output</b>	$0 \pm 0.5$ dB at 1 kHz
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<b>Input Impedance</b>	> 10 k $\Omega$ (typical)
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<b>Flatness, dc to 25.6 kHz</b>	$\pm 0.5$ dB (typical)
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<b>Sine Wave Distortion</b>	-80 dBc (typical)
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<b>Residual DC Offset</b>	1 mV (typical)
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## Option AYF Tachometer Input Specifications

Option AYF, Tachometer Input, provides two tachometer inputs. When this option is installed, two of the three SMB connectors on the VXI module are used for tachometer inputs. When this option is not installed, these connectors are normally used for “External Sample” and “Trigger.”

Each tachometer input has a programmable trigger level. Each tach pulse causes a “Tach Edge Time” to be recorded in a 16384-word FIFO. A “Tach Edge Time” is the instantaneous value of the 32-bit “Tach Counter.” A “Decimate” number can be set to ignore a

number of tach pulses before recording each Tach Edge Time. A “Holdoff” time can be set to avoid false triggering due to ringing.

One of the tachometer inputs can be programmed for use as a trigger input rather than a tachometer input. In this mode, the tachometer option can trigger the system and measure the time between the trigger and the next sample clock edge.

The analog signal from either of the tachometer inputs can be routed to an input channel using the internal calibration path.

### General

<b>Tach Counter</b>	32-bit counter with roll-over detector bit
<b>Decimate Counter</b>	16-bit counter
<b>Input Signal Trigger Level (typical)</b>	
Voltage Range	-25V to +25V
Resolution, levels < ± 5V	40 mV
Resolution, levels > ± 5V	200 mV
Hysteresis, levels < ± 5V	0 to 250 mV
Hysteresis, levels > ± 5V	0 to 1.25 mV
Slope	Programmable, positive or negative
<b>Input Signal Timing</b>	
Minimum pulse width	5 µs
Maximum pulse rate	100 kHz
Trigger holdoff	1 to 65536 clock periods
<b>Input Impedance</b>	20 kΩ (typical)



# VXI System Level Specifications

## Features

<b>VXI Standard Information</b>	
	<p>Conforms to VXI Revision 1.4</p> <p>C-size, single slot width</p> <p>Register-based programming</p> <p>“Slave” Data Transfer Bus functionality</p> <p>A24 address capability</p> <p>D32 data capability</p> <p>Optional Local Bus capability</p> <p>SUMBUS driver and receiver</p> <p>Requires two or four TTLTRG_ lines for multi-module synchronization</p>
<b>Signal Processing</b>	
	<p>33 MHz Motorola 96002 DSP</p> <p>Two banks of 128 Kword static RAM</p> <p>32 Mbytes dynamic RAM</p> <p>128 Kbytes Flash ROM</p> <p>Direct Memory Access (DMA) data transfer</p>
<b>Software Drivers</b>	
<b>Driver Type</b>	C libraries with source code
<b>Supported Operating Systems</b>	MS Windows 95 <sup>®</sup> and NT <sup>®</sup> , and HP-UX 10.20
<b>Supply Media</b>	CD-ROM
<b>VXI Plug &amp; Play Compliance</b>	C libraries support MS Windows 95 and NT, and HP-UX.
<b>Regulatory Compliance</b>	
<b>Safety Standards</b>	<p>Designed for compliance to:</p> <p>UL 1244, 4th Edition</p> <p>IEC 348, 2nd Edition, 1978</p> <p>CSA C22.2, No. 231</p>
<b>Radiated Emissions</b> (tested in a “typical” system configuration, consisting of an E1401B Mainframe, V743 Controller, and E1432A module with option 1D4 or AYF)	<p>CISPR 11: 1990, Group 1, Class A (requires connector shields E1400-80920 or E1421-80920)</p> <p>Tested for compliance to the European Economic Area’s EMC directive</p>
<b>Electrostatic Discharge</b>	Tested for compliance to the European Economic Area’s EMC directive
<b>Radiated Immunity</b>	Tested for compliance to the European Economic Area’s EMC directive
<b>Environmental</b>	
<b>Operating Restrictions</b>	
Ambient Temperature	0° to 50 °C
Humidity, Non-condensing	20% RH to 90% RH at 40 °C
Maximum Altitude	4600 meters (15,000 feet)
<b>Storage and Transport Restrictions</b>	
Ambient Temperature	-20° to 65 °C
Humidity, Non-condensing	20% RH to 90% RH at 40 °C
Maximum Altitude	4600 meters (15,000 feet)

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**General Characteristics**

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<b>VXI Power Requirements</b>	<b>DC Current</b>
No options installed	
+5.0V	5.50A
+12.0V	0.56A
-12.0V	0.05A
+24.0V	0.44A
-24.0V	0.42A
-5.2V	0.95A
-2.0V	0.03A
Tachometer option installed (AYF)	
+5.0V	0.14A
+12.0V	0.00A
-12.0V	0.00A
+24.0V	0.10A
-24.0V	0.06A
-5.2V	0.00A
-2.0V	0.00A
Source option installed (1D4)	
+5.0V	0.60A
+12.0V	0.19A
-12.0V	0.18A
+24.0V	0.03A
-24.0V	0.03A
-5.2V	0.00A
-2.0V	0.00A
Dynamic Current +12.0 V	
+5.0V	0.20A
+12.0V	0.02A
-12.0V	0.01A
+24.0V	0.01A
-24.0V	0.01A
-5.2V	0.02A
-2.0V	0.01A
<b>VXI Cooling Requirements</b>	5.08 liters/second 0.51 mm H <sub>2</sub> O
<b>Warm-up Time</b>	15 minutes

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## Performance Benchmarks

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Because these performance benchmarks depend on the software and hardware configuration, they are included as supplemental, non-warranted characteristics.

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### VXI Data Transfer Rate (P1 connector)

From E1433B DRAM to VXI V743 Controller	6.5 MB/s
From E1433B DRAM to MXI to external Series 700 Controller	1.5 MB/s
From E1433B DRAM to VXLink interface	345 KB/s
From E1433B DRAM to E6233B Pentium Controller	1.6 MB/s
From E1433B DRAM to National MXI-2 to external 200 MHz Pentium® Pro	1.2 MB/s

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### Local Bus Data Transfer Rate

From E1433B DRAM, one block, during continuous acquisition.	15.7 MB/s
From E1433B's DRAM to E1562D	5 MB/s to 7.8 MB/s
From E1433B's DRAM to E1562E	10 MB/s to 15.7 MB/s
Maximum number of input channels for continuous throughput at 196 kSa/s sample rate	40 channels

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### FIFO Memory

(Maximum FIFO size, 32 MB DRAM installed)	16 MSa/number active channels (opt. ANC)
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Pentium is a U.S. registered trademark of Intel Corporation.

## Specification Note

Specifications describe warranted performance over the temperature range of 0° to 50 °C, after a 15-minute warm-up from ambient conditions. Supplemental characteristics identified as “typical” provide useful information by giving non-warranted performance parameters. Typical performance is applicable from 20° to 30 °C.

## Abbreviations

**F<sub>s</sub>** = sample rate of ADC.

**F<sub>c</sub>** = cut off frequency of high pass or low pass filters.

**dB<sub>fs</sub>** = dB relative to full scale amplitude range.

**dB<sub>c</sub>** = dB relative to carrier amplitude.

**Typical** = typical, non-warranted, performance specification included to provide general product information.

## Warranty Information

This product is distributed, warranted, and supported by Agilent Technologies. The E1432A comes with a three year warranty. During that period, the unit will either be replaced or repaired, at Agilent Technologies' option, and returned to the customer without charge.

## Related Agilent Literature

Agilent E1432A/33B/34A  
Product Overview  
5965-9834E

[http://www.tm.agilent.com/tmo/pia/data\\_acq/PIATop/English/index.html](http://www.tm.agilent.com/tmo/pia/data_acq/PIATop/English/index.html)

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