
VB-8034

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Contents

National Instruments VirtualBench VB-8034 Specifications. 3

National Instruments VirtualBench VB-8034 Specifications

These specifications are for the National Instruments VirtualBench VB-8034 only. These specifications are valid following 30 minutes of warmup and are typical at 25 °C, unless otherwise noted. For feature differences between the VirtualBench application for Windows and iPad, go to ni.com/info and enter vbfeatures.

Mixed Signal Oscilloscope

Analog Channels

Vertical System

Number of channels	4 single-ended, non-isolated
Bandwidth (-3 dB) ^[1]	350 MHz
Resolution	8 bits
Accuracy ^[2]	±2% of input ±1% full scale (V_{pk-pk})
Input coupling	DC, AC
Vertical sensitivity (range)	5 mV/div (40 mV _{pk-pk}) 10 mV/div (100 mV _{pk-pk}) 20 mV/div (200 mV _{pk-pk}) 50 mV/div (400 mV _{pk-pk})

	100 mV/div (1 V _{pk-pk})
	200 mV/div (2 V _{pk-pk})
	500 mV/div (4 V _{pk-pk})
	1 V/div (10 V _{pk-pk})
	2 V/div (20 V _{pk-pk})
	5 V/div (40 V _{pk-pk})
Input impedance (user selectable)	1 M Ω 15 pF or 50 Ω

Range	Programmable Offset Range
5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div	± 5 V
100 mV/div, 200 mV/div, 500 mV/div, 1 V/div, 2 V/div, 5 V/div	± 20 V

Table 1. DC Offset Range

Acquisition modes	Sample, peak detect, averaging
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Horizontal System

Maximum sample rate	1.5 GS/s/channel
Maximum record length	1 MS/channel

Digital Channels/Logic Analyzer

Vertical System

Number of channels	34
Maximum input frequency	100 MHz
Input voltage	0 V to 5 V
Input current	$\leq 50 \mu\text{A}$



Note Mixed signal oscilloscope digital channels are designed to withstand accidental overvoltage from signals on the VB-8034 or similar devices. They are not recommended for use with signals likely to exceed 0 V to 5 V in normal operation.

Input threshold	Programmable, 0 V to 2.0 V
Threshold accuracy	350 mV
Input impedance	100 k Ω 7.5 pF (nominal) pulled to -2.0 V to +6.5 V, varies with the input threshold setting
Additional/internal channels	Digital I/O lines, function generator start, external trigger (TRIG), power line frequency

Horizontal System

Timing mode sample rate ^[3]	1 GS/s (down to ~15 kS/s)
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Maximum external sample clock rate	100 MHz
Record length	
Typical	1 MS
Minimum ^[4]	4 kS
Decimation	External Sample Clock, 1:1, 2:1, and n*4:1 where n is an integer
Maximum sample compression	2 ¹⁵ to 1

Triggering

Trigger modes	Normal, Auto, Single, Force
Trigger sources	Oscilloscope analog channels, oscilloscope digital channels, function generator start, digital I/O lines, external trigger (TRIG), power line frequency
Trigger types	
Analog	Edge with hysteresis
Digital	Edge, glitch ^[5] , level, pattern
Trigger resolution	
Analog/oscilloscope	667 ps
Digital/logic analyzer	1 ns

Trigger export	Available through external trigger (TRIG)
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Waveform Measurements

Oscilloscope time ^[6]	Period, frequency, positive duty cycle, negative duty cycle, positive pulse width, negative pulse width, rise time, fall time, rise rate, fall rate
Oscilloscope voltage ^[6]	High, low, amplitude, maximum, minimum, peak-to-peak, overshoot, undershoot, RMS, mean, cycle RMS, cycle mean
Logic analyzer time ^[6]	Period, frequency, positive duty cycle, negative duty cycle, positive pulse width, negative pulse width

Waveform Math

Operations ^[7]	A + B, A - B, A * B, A/B, FFT
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Function Generator (FGEN)

Waveforms	Sine, square, ramp/triangle, DC, arbitrary ^[8]
Update rate	125 MS/s
Resolution	14 bits
Number of channels	1
Output impedance	50 Ω

Switchable filter ^[9]	36 MHz lowpass, 7-pole, elliptical
Sine	
Maximum frequency	20 MHz
Total Harmonic Distortion (THD)	
1 MHz	-55 dBc
10 MHz	-50 dBc
Spurious Free Dynamic Range (SFDR)	-70 dB at 1 MHz (non-harmonic)
Phase noise (1 MHz)	-125 dBc/Hz at 10 kHz offset
Square	
Maximum frequency	5 MHz
Rise/fall time	<20 ns (10% to 90%)
Overshoot	<5%
Jitter	8 ns cycle-to-cycle
Ramp/triangle maximum frequency	1 MHz
Accuracy (with >10 kΩ load)	
Amplitude (1 kHz sine)	±(1% of output value ± 5 mV)
DC	±(1% of output value ± 5 mV)
Output range	

50 Ω	± 6 V
Hi-Z (>10 k Ω)	± 12 V
DC offset	
50 Ω	± 6 V
Hi-Z (>10 k Ω)	± 12 V



Note The combination of signal amplitude and DC offset cannot exceed the output range specifications. The impedances listed are the loads applied by the user to the FGEN output.

Frequency	
Accuracy	≤ 100 ppm
Resolution	1 μ Hz
Arbitrary waveform	
Points	1 MS
Sample rate	125 MS/s
Flatness	± 0.3 dB to 20 MHz
Protection	Short-circuit protected

Triggering

Trigger types	Start of buffer ^[10]
Trigger resolution	8 ns
Trigger export	Available through external trigger (TRIG)

Digital I/O

Number of channels	8
Direction control	Input or output, software-selectable
Logic level	5 V compatible TTL input, 3.3 V LVTTTL output
Drive strength	4 mA
Input voltage	0 V to 5 V



Note Digital I/O lines are designed to withstand accidental overvoltage from signals on the VB-8034 or similar devices. They are not recommended for use with signals likely to exceed 0 V to 5 V in normal operation.

DIO channel pull resistors	10 k Ω , pull-down on dig/<0..7>, 1.5 k Ω , configurable pull-up to 3.3 V on dig/<6,7>
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External Power

3.3 V output	
Voltage	3.3 V \pm 10%
Current	20 mA

Digital Multimeter

Functions	DC voltage, AC voltage, DC current, AC current, resistance, diode, continuity
Resolution	5½ digits
Sample rate	5 S/s



Caution Do not use this device for connection to signals or for measurements within Measurement Categories III or IV. For more information about Measurement Categories, refer to the [Safety Voltages](#) section.

Input protection

Resistance, diode	Up to 300 V DC
DC and AC voltage	Up to 300 V DC or 265 V AC _{rms} , 400 V AC peak

DC and AC current

DMM A current connector fuse Internal ceramic fuse, 11 A, 1 kV AC, 10.3 × 38 mm, F 11A 1000V (SIBA part number 5019906.11 at www.siba-fuses.com)

DMM mA current
connector fuse

Internal ceramic fuse, 1 A, 500 V AC, 5 × 20 mm, T 1A H 400V
(Littelfuse part number 0477001.MXP at www.littelfuse.com)



Caution Fuses are located on bottom of device underneath door. Use Phillips #1 screwdriver for removal. Ensure all hazardous voltages are disconnected from the device prior to removal of door.

Fuse When this fuse symbol is marked on a device, take proper precautions.

Maximum common-mode voltage

300 V DC or AC_{rms}

DC

Range	Input Impedance	1-Year Accuracy ^[11] ± (% of Reading + % of Range)	Temperature Coefficient ^[11] ± (% of Reading + % of Range)/°C
100 mV*	>10 GΩ, 10 MΩ	0.015 + 0.005	0.001 + 0.0005
1 V	>10 GΩ, 10 MΩ	0.015 + 0.005	0.001 + 0.0005
10 V	>10 GΩ, 10 MΩ	0.015 + 0.005	0.001 + 0.0005
100 V	10 MΩ	0.035 + 0.005	0.005 + 0.0005
300 V	10 MΩ	0.035 + 0.005	0.005 + 0.0005

* Add 15 μV if not immediately following offset null.

Table 5. DC Voltage Accuracy

Range	Burden Voltage	1-Year Accuracy ^[11] ± (% of Reading + % of Range)	Temperature Coefficient ^[11] ± (% of Reading + % of Range)/°C
10 mA	<0.03 V	0.070 + 0.020	0.0035 + 0.0010
100 mA	<0.3 V	0.070 + 0.003	0.0020 + 0.0010
1 A	<0.03 V	0.130 + 0.025	0.0065 + 0.0010
10 A*	<0.3 V	0.130 + 0.004	0.0045 + 0.0010

Range	Burden Voltage	1-Year Accuracy ^[11] ± (% of Reading + % of Range)	Temperature Coefficient ^[11] ± (% of Reading + % of Range)/°C
* 30 seconds on, 30 seconds off. Add 300 ppm/A for currents >2.2 A. After measuring >5 A, wait two minutes to get full accuracy in the 1 A range.			

Table 9. DC Current Accuracy

Range	Short-Circuit Current	1-Year Accuracy ^[11] ± (% of Reading + % of Range)	Temperature Coefficient ^[11] ± (% of Reading + % of Range)/°C
100 Ω	170 μA	0.018 + 0.050	0.0010 + 0.0005
1 kΩ	170 μA	0.018 + 0.005	0.0010 + 0.0005
10 kΩ	70 μA	0.018 + 0.005	0.0010 + 0.0005
100 kΩ	10 μA	0.018 + 0.005	0.0010 + 0.0005
1 MΩ	1.1 μA	0.035 + 0.005	0.0040 + 0.0005
10 MΩ	1.1 μA	0.150 + 0.005	0.0100 + 0.0005
100 MΩ	1.1 μA	1.3 + 0.005	0.1000 + 0.0005
* Perform offset nulling.			

Table 4. DC Resistance Accuracy (2-Wire)*, 1 V Open Circuit Voltage



Caution The input terminals of the DMM are not protected for electromagnetic interference. As a result, the DMM may experience reduced measurement accuracy or other temporary performance degradation when connected to unshielded test leads in an environment with radiated or conducted radio frequency electromagnetic interference.

DC continuity accuracy range ^[12]	100 Ω
DC diode test range	2 V
Effective Common-Mode Rejection Ratio (CMRR), 1 kΩ resistance in LO lead	>100 dB
Normal-Mode Rejection Ratio (NMRR), 50/60 Hz ±0.1%	>100 dB

Overrange	105% of range except 300 V
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AC

Range (rms)	Peak Voltage	Frequency	1-Year Accuracy ^[13] ± (% of Reading + % of Range)	Temperature Coefficient ^[13] ± (% of Reading + % of Range)/°C
100 mV, 1 V, 10 V, 100 V, 265 V	±210 mV, ±2.1 V, ±21 V, ±210 V, ±400 V	20 Hz to 45 Hz	0.91 + 0.10	0.01 + 0.005
		45 Hz to 65 Hz	0.30 + 0.05	0.01 + 0.005
		65 Hz to 1 kHz	0.21 + 0.05	0.01 + 0.005
		1 kHz to 5 kHz	0.12 + 0.05	0.01 + 0.005
		5 kHz to 20 kHz	0.35 + 0.05	0.01 + 0.005

Table 5. AC Voltage Accuracy

Range (rms)	Peak Current	Burden Voltage (rms)	Frequency	1-Year Accuracy ^[13] ± (% of Reading + % of Range)	Temperature Coefficient ^[13] ± (% of Reading + % of Range)/°C
5 mA	±10.5 mA	<0.02 V	20 Hz to 1 kHz	0.20 + 0.01	0.01 + 0.005
			1 kHz to 5 kHz	0.60 + 0.01	
50 mA	±105 mA	<0.2 V	20 Hz to 1 kHz	0.20 + 0.01	0.01 + 0.005
			1 kHz to 5 kHz	0.50 + 0.01	
500 mA	±1.05 A	<0.02 V	20 Hz to 1 kHz	0.15 + 0.01	0.01 + 0.005
			1 kHz to 5 kHz	0.50 + 0.01	
5 A	±10.5 A	<0.2 V	20 Hz to 1 kHz	0.25 + 0.03	0.01 + 0.005
			1 kHz to 5 kHz	0.60 + 0.03	

Table 9. AC Current Accuracy



Caution The input terminals of the DMM are not protected for electromagnetic interference. As a result, the DMM may experience reduced measurement accuracy or other temporary performance

degradation when connected to unshielded test leads in an environment with radiated or conducted radio frequency electromagnetic interference.

Input impedance	10 M Ω 200 pF
CMRR, 1 k Ω resistance in LO lead	>70 dB (DC to 60 Hz)

DC Power Supply

Outputs	0 V to +6 V/0 A to 3 A, 0 V to +25 V/0 A to 1 A (isolated), 0 V to -25 V/0 A to 1 A (isolated)
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Note The +25 V and -25 V channels are bank isolated from ground but not from each other.

Output	Type	+6 V	+25 V	-25 V
DC output ^[14]	Voltage	0 V to +6 V	0 V to +25 V	0 V to -25 V
	Current ^[15]	3 A	1 A	1 A
Programming accuracy ^{[14],[15]} \pm (% of reading + offset)	Voltage	0.1% + 5 mV	0.1% + 20 mV	0.1% + 20 mV
	Current	0.2% + 10 mA	0.15% + 4 mA	0.15% + 4 mA
Readback accuracy ^{[14],[16]} \pm (% of reading + offset)	Voltage	0.1% + 5 mV	0.1% + 20 mV	0.1% + 20 mV
	Current	0.2% + 10 mA	0.15% + 4 mA	0.15% + 4 mA
Programming resolution	Voltage	1.6 mV	6.6 mV	6.6 mV
	Current	0.90 mA	0.30 mA	0.30 mA
Readback resolution	Voltage	0.40 mV	1.7 mV	1.7 mV
	Current	210 μ A	70 μ A	70 μ A
Load regulation ^[17] \pm (% of reading + offset)	Voltage	0.01% + 25 mV	0.03% + 5 mV	0.03% + 5 mV

Table 9. DC Accuracy/Resolution

Overvoltage protection	30 V (all channels)
Reverse voltage protection	Reverse clamp diode, protected by self-resetting fuse

External Trigger (TRIG)

Direction control	Input or output, software-selectable
Logic level	5 V compatible TTL input, 3.3 V LVTTTL output
Drive strength	4 mA
Input voltage	0 V to 5 V



Note The external trigger line is designed to withstand accidental overvoltage from signals on the VB-8034 or similar devices. It is not recommended for use with signals likely to exceed 0 V to 5 V in normal operation.

Connectivity

Wired USB Interface

USB specification	USB 2.0 Hi-Speed
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Wired Ethernet Interface

Network interface	1000 Base-TX, full-duplex; 100 Base-TX, full-duplex; 100 Base-TX, half-duplex; 10 Base-T, full-duplex; 10 Base-T, half-duplex
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Communication rates	10/100/1000 Mbps, auto-negotiated
Maximum cabling distance	100 m/segment
Network IP configuration	IPv4, DHCP Client

Port	Protocol	Function
Port 80/TCP	HTTP	Device configuration (web, MAX)
Port 443/TCP	HTTP	Device configuration (web, MAX)
Port 3580/TCP	Service locator	Device configuration (web, MAX)
Port 9090/TCP	Configuration only	VirtualBench instrument protocol
Port 5353/UDP	Multicast DNS	Device discovery

Table 9. Network Protocols and Ports Used

Wireless Interface

Port	Protocol	Function
Port 80/TCP	HTTP	Device configuration (web, MAX)
Port 443/TCP	HTTP	Device configuration (web, MAX)
Port 3580/TCP	Service locator	Device configuration (web, MAX)
Port 9090/TCP	Configuration only	VirtualBench instrument protocol
Port 5353/UDP	Multicast DNS	Device discovery

Table 9. Network Protocols and Ports Used

Network IP configuration	IPv4, DHCP Client/Server
Radio mode	IEEE 802.11 b,g,n
Wireless modes	AP mode (default), client mode
Frequency band	2.4 GHz ISM

Channel width	20 MHz
Channels	USA 1-11, International 1-13 (12 and 13 client mode only)
TX power	+10 dBm maximum (10 mW)
Security	Open, WPA, WPA2, WPA2-Enterprise
Enterprise security EAP types	EAP-TLS, EAP-TTLS/MS-CHAPv2, PEAPv0/MS-CHAPv2
Antenna	External RP-SMA omnidirectional dipole

Power Requirements



Caution The protection provided by the VirtualBench hardware can be impaired if it is used in a manner not described in the **NI VB-8034 Safety, Environmental, and Regulatory Information** document.

Voltage input range	100 VAC to 240 VAC, 50/60 Hz
Power consumption	150 W maximum
Power input connector	IEC C13 power connector
Power disconnect	The AC power cable provides main power disconnect. Do not position the equipment so that it is difficult to disconnect the power cable. Depressing the front panel power button does not inhibit the internal power supply.

Calibration

Calibration cycle (digital multimeter, mixed signal oscilloscope, function generator, DC power supply)	1 year
Specified temperature	$T_{\text{cal}} \pm 5\text{ }^{\circ}\text{C}$
Warmup time	30 minutes

Physical Characteristics

Dimensions

Enclosure 30.48 cm × 20.32 cm × 9.40 cm (12.0 in. × 8.0 in. × 3.7 in.)

Enclosure with connectors and antenna 30.48 cm × 25.40 cm × 16.00 cm
(12.0 in. × 10.0 in. × 6.3 in.)



Note Use the VirtualBench instrument in a horizontal orientation. Allow at least 10.16 cm (4.0 in.) of clearance in front, on the sides, and behind the VirtualBench instrument for airflow clearances, and USB, power, and common connector cabling.

Weight	3.130 kg (6 lb 4.4 oz)
Connectivity	
Mixed signal oscilloscope	4, BNC
Logic analyzer	1, 2x20 shrouded IDC header
External trigger	1, BNC

Function generator	1, BNC
Digital I/O	
Type	1, pluggable screw terminal, 3.5 mm (14 position)
Screw terminal wiring	0.1 mm ² to 2.0 mm ² (30 AWG to 14 AWG)
Torque	0.25 N · m (2.2 lb · in.)
Digital multimeter	4, 4 mm banana jacks
DC power supply	6, 4 mm binding posts
Security cable slot	1, complies with Kensington security slot dimensions

If you need to clean the device, wipe it with a dry towel.

Safety Voltages

Connect only voltages that are within these limits.

DMM Isolation Voltages

Hazardous Voltage This icon denotes a warning advising you to take precautions to avoid electrical shock.

Channel-to-earth ground

Continuous 300 V, Measurement Category II

Withstand 3,000 V_{RMS}, verified by a 5 s dielectric withstand test

Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example, 115 V for U.S. or 230 V for Europe.



Caution Do not connect the VirtualBench hardware to signals or use for measurements within Measurement Categories III or IV.

DC Power Supply Isolation Voltages

+25 V and -25 V-to-earth ground continuous	60 VDC, Measurement Category I
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Note Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Environmental

Operating temperature	0 °C to 40 °C
Storage temperature	-20 °C to 70 °C
Operating humidity	10% to 90% RH, noncondensing DMM full accuracy at 10% to 80%
Storage humidity	5% to 95% RH, noncondensing
Cooling	Forced air circulation (negative pressurization) through a fan. Fan speed automatically adjusts according to operating conditions. Intake locations are on the sides of device. Exhaust location is on the rear of device. Ensure that the intake and exhaust locations are not obstructed.

Pollution Degree	2
Maximum altitude	2,000 m

Indoor use only.

Shock and Vibration

Operational shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)
<p>Random vibration</p> <p>Operating 5 to 500 Hz, 0.3 g_{rms}</p> <p>Nonoperating 5 to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)</p>	

Safety

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1



Note For UL and other safety certifications, refer to the product label or the [Online Product Certification](#) section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use; for radio equipment; and for telecommunication terminal equipment:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



Note Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



Note For EMC declarations and certifications, and additional information, refer to the [Online Product Certification](#) section.

CE Compliance

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)

- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2014/53/EU; Radio Equipment Directive (RED)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the **Minimize Our Environmental Impact** web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

电子信息产品污染控制管理办法 (中国 RoHS)

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

- 1 Bandwidth using 50 Ω mode or 1 M Ω mode with the accessory oscilloscope probe.
- 2 Indicates warranted specifications valid at $T_{\text{cal}} \pm 5$ °C. Temperature coefficients are calculated using the temperature change from last external calibration.
- 3 Indicates warranted specifications valid at $T_{\text{cal}} \pm 5$ °C. Temperature coefficients are calculated using the temperature change from last external calibration.
- 4 Under most conditions, the logic analyzer can acquire 1 MS of data. Under some conditions with very high sustained activity on multiple inputs, the logic analyzer may only capture 4 kS of data.
- 5 Glitch triggers are only available with the NI VirtualBench driver.
- 6 Waveform measurements are only available in the VirtualBench application.
- 7 Waveform math is only available in the VirtualBench application.
- 8 Arbitrary waveforms are only available with the NI VirtualBench driver.
- 9 Switchable filters are only available with the NI VirtualBench driver. The VirtualBench application automatically enables the lowpass filter in sine mode.
- 10 The function generator can only produce a trigger.
- 11 Indicates warranted specifications valid at $T_{\text{cal}} \pm 5$ °C. Temperature coefficients are calculated using the temperature change from last external calibration.
- 12 DC continuity is only available in the VirtualBench application.
- 13 Indicates warranted specifications valid at $T_{\text{cal}} \pm 5$ °C. Temperature coefficients are calculated using the temperature change from last external calibration.
- 14 Indicates warranted specifications valid at $T_{\text{cal}} \pm 5$ °C. Temperature coefficients are calculated using the temperature change from last external calibration.
- 15 Minimum programmable current limit is 1% of range.

16 Programming and readback accuracy specified at no load.

17 Change in output voltage for any load within range.