PXIe-4133 Specifications

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PXIe-4133 Specifications

Definitions

Warranted describes the performance of a model under stated operating conditions and are covered by the model warranty.

Characteristic describes values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- *Typical* describes the performance met by a majority of models.
- **Nominal** describes an attribute that is based on design, conformance testing, or supplemental testing.

Values are *Nominal* unless otherwise noted.

Related information:

• PXIe-4133 User Manual

Conditions

Maximum and **minimum** values describe the performance of the instrument within the recommended calibration interval and under the stated operating conditions. **Maximum** and **minimum** values are subject to production verification or

guaranteed by design.

Specifications are valid under the following conditions unless otherwise noted.

- Ambient temperature¹: 0 °C to 55 °C
- Chassis slot cooling capacity: ≥58 W²
- Calibration interval: 2 years
- 1. The ambient temperature of a PXI system is defined as the temperature at the chassis fan inlet (air intake) or the specified operating temperature of your PXI chassis, whichever is lower.
- 2. The PXIe-4133 must be installed in a chassis with slot cooling capacity \geq 58 W.

Device Capabilities

The PXIe-4133 is intended to test both forward and reverse bias characteristics of diodes. The following tables describe the basic capabilities in each mode of operation.

• **Pulsed Current and Voltage Measurement**—The PXIe-4133 outputs sequences of current pulses, and returns current and voltage measurements for the diode under test.

Current Ranges	10 A, 2.5 A, 0.5 A, 0.1 A
Voltage Range	15 V
Pulse Width	2.5 μs to 655 μs (subject to current amplitude and duty cycle limits)

• **Reverse Current Measurement**—The PXIe-4133 outputs a negative voltage to reverse bias the diode under test, and returns measurements of the applied voltage and leakage current through the diode.

Current Ranges	100 μΑ, 10 μΑ, 1 μΑ
Voltage Range	100 V
Pulse Width	≤ 524 ms

• **Reverse Voltage Measurement**—The PXIe-4133 outputs a negative current to reverse bias the diode under test, and returns a measurement of the breakdown voltage across the diode.

Current Range	10 μΑ
Voltage Range	100 V
Pulse Width	≤ 524 ms

Pulsed Current and Voltage Measurement Operations

Current Range	Output Resolution	Output Accu (% of Currer	tput AccuracyMeasure AccuracyMeasure Accuracyof Current + Offset)(% of Current + Offset)(% of Voltage + Offset)		Measure Accuracy (% of Current + Offset)		Accuracy age +
		Typical	Maximum	Typical	Maximum	Typical	Maximum
10 A	176 µA	±0.4% ±1 mA	±0.7% ±3.5 mA	±0.2% ±1.5 mA	±0.35% ±5 mA		±0.1% ±3.5 mV
2.5 A	44 μΑ	±0.4% ±0.4 mA	±0.7% ±1 mA	±0.2% ±1 mA	±0.35% ±5 mA	±0.05%	
0.5 A	8.8 μΑ	±0.25% ±0.15 mA	±0.4% ±0.3 mA	±0.2% ±0.1 mA	±0.35% ±0.25 mA	±2 mV	
0.1 A	1.8 µA	±0.15% ±0.03 mA	±0.3% ±0.05 mA	±0.15% ±0.02 mA	±0.25% ±0.05 mA		

Accuracy specifications are valid from 0 °C to +55 °C, within 2 years of external calibration.

Output accuracy is valid with output voltages of +0.5 V to +15 V.

Voltage measurement range:0 V to +15 V, remotely sensed.

Voltage measure accuracy is valid with sense voltages relative to Force LO:

- Sense LO to Force LO: 0 V to +2 V (up to 2 V drop across Force LO cable)
- Sense HI to Force LO: 0 V to +15.6 V (combined sense voltage and Force LO cable voltage drop)

Output current rise time	0.8 μs, 10% to 90% of output
Output current overshoot	0.15% of final settled value
Minimum pulse width	2.5 μs
Maximum pulse width	655 μs (subject to current amplitude and duty cycle limits 3)
Maximum pulse period ⁴	20.971 ms
Pulse width resolution	10 ns
Measure sampling rate (waveform mode)	2 MS/s
Measure aperture time (average point per pulse mode)	0 ms to 524.29 ms
Measure start time	-20.971 ms to 20.971 ms (relative to pulse start)

- 3. For information about duty cycle and current amplitude limits, refer to *Pulse Width and Duty Cycle Limitations* in the *PXIe-4133 User Manual*.
- 4. The pulse period includes the pulse width and dead time.

range (immediate pulse trigger ⁵)	
Measure start time range (external pulse trigger)	0 ms to 20.971 ms (relative to pulse start)
Measure start time resolution ⁶	10 ns
Maximum pulse count per sequence	10,000
Output protection	In case of an open circuit or overvoltage (Force HI to Force LO voltage >25 V) for more than 4 μ s after the start of a pulse, the output disconnects and the pulse sequence immediately terminates.

Note For an illustration of measurement ranges and boundaries, review the *Pulsed Current and Voltage Measurement* topic in the *PXIe-4133 User Manual*.

Repeatability Specifications

Non-linearity, temperature stability, and voltage measurement sensitivity errors are all included in the total accuracy specifications. They are included here to provide a measure of repeatability across variations in operating conditions.

- 5. For an immediate trigger, specify none as the pulse trigger source.
- 6. Measure start time is the time of the first sample in a waveform or the start time of the measurement aperture (in average point per pulse mode). Measure start time is independently programmable for each pulse.

Current	Temperature Stability		Voltage Measurement Sensitivity		
Range	Current Output	Current Measurement	to Output Current (±0.25 mV Maximum over All Currents)	to Common Mode Voltage	
10 A	(±0.006% of output ± 60 μA) per °C	(±0.005% of reading ± 80 μA) per °C	±0.025 mV per A		
2.5 A	(±0.006% of output ± 15 μA) per °C	(±0.005% of reading ± 80 μA) per °C	±0.025 mV per A	±0.5 mV per volt	
0.5 A	(±0.004% of reading ± 5 μA) per °C	(±0.005% of reading ± 5 μA) per °C	±0.5 mV per A	across Force LO cable	
0.1 A	(±0.002% of reading ± 1 μA) per °C	(±0.004% of reading ± 1 μA) per °C	±2.5 mV per A		

Table 1. Temperature Stability and Voltage Measurement Sensitivity

Temperature stability (voltage measurement, 15 V range)	(±0.0012% of reading ± 30 $\mu V)$ per °C
Non-linearity (current output)	±0.006% of range
Non-linearity (current measurement)	±0.003% of range
Non-linearity (voltage measurement)	±0.001% of range

Related information:

- Pulsed Current and Voltage Measurement
- Pulse Width and Duty Cycle Limitations

Reverse Current Measurements

Current Range		Measure Accuracy (% of current + offset)			
	Output Voltage Range	0 V > Vout > -1	0 V	Any Output Voltage	
		Typical	Maximum	Typical	Maximum
-100 μA	-0.1 V to -20 V	±0.1% ±10 nA	±0.15% ±30 nA	±0.1% ±10 nA	±0.15% ±32 nA
-10 μA	-0.1 V to -100 V	±0.1% ±3.0 nA	±0.2% ±10 nA	±0.1% ±3.0 nA	±0.2% ±28 nA
-1 µA	-0.1 V to -100 V	±0.1% ±0.5 nA	±0.3% ±1.5 nA	±0.1% ±0.5 nA	±0.3% ±3.3 nA

Accuracy specifications are valid from 0 to +55 °C, within 2 years of external calibration

Maximum pulse width	524 ms
Output protection	Outputs are protected against open circuits (measured current is within offset error specifications) and short circuits (outputs are current limited).

Voltage Range	Output Resolution	Output Accuracy (% Load Regulation)	of Voltage + Offset +	Measure Accuracy (% of Voltage + Offset)	
		Typical	Maximum	Typical	Maximum
-100 V	1.64 mV	±0.07% ±10mV +0.5 mV/μA	±0.15% ±20 mV +0.5 mV/μA	±0.05% ±10 mV	±0.1% ±30 mV

The reverse voltage output has a 500 Ω output impedance that causes the output voltage to become more positive (closer to zero) with larger load current.

Repeatability Specifications

Non-linearity, temperature stability, and voltage measurement sensitivity errors are all included in the total accuracy specifications. They are included here to provide a

measure of repeatability across variations in operating conditions.

Current Range	Current Measurement Temperature Stability	Current Measurement Sensitivity to Output Voltage
-100 μA	(±0.003% of reading ± 0.2 nA) per $^\circ\text{C}$	±0.2 nA/V
-10 µA	(±0.003% of reading ± 0.1 nA) per $^\circ\text{C}$	±0.2 nA/V
-1 μA	(±0.005% of reading ± 0.02 nA) per $^\circ\text{C}$	±0.02 nA/V

Table 2. Current Measurement Temperature Stability and Sensitivity				

Temperature stability (voltage output)	(±0.0015% of reading ± 0.25 mV) per °C
Temperature stability (voltage measurement)	(±0.0012% of reading ± 0.3 mV) per °C
Non-linearity (voltage output)	±0.003% of range
Non-linearity (voltage measurement)	±0.01% of range
Non-linearity (current measurement)	±0.01% of range

Reverse Voltage Measurements

Output Current Range	Output	Output Accuracy (% of Current + Offset)				Measure	Measure Accuracy	
	Current Resolution	0 V > Vout > -60 V		Any Output Voltage		Voltage Range	(% of voltage + offset)	
		Typical	Maximum	Typical	Maximum	-	Typical	Maximum
-0.1 uA to -10 uA	0.2 nA	±0.1% ±10 nA	±0.2% ±35 nA	±0.1% ±15 nA	±0.2% ±55 nA	0 V to 100 V	±0.05% ±10 mV	±0.1% ±30 mV

Output Current Range	Output Current Resolution	Output Accuracy (% of Current + Offset)			Measure	Measure Accuracy		
		0 V > Vout > -60 V Any Output Voltage		put	Voltage Range	offset)		
		Typical	Maximum	Typical	Maximum		Typical	Maximum

Accuracy specifications are valid from 0 to +55 °C, within 2 years of external calibration

Maximum pulse width	524 ms
Output protection	Programmable output voltage limit (Vclamp). Valid values range from 0 V to -100 V.

Repeatability Specifications

Non-linearity, temperature stability, and voltage measurement sensitivity errors are all included in the total accuracy specifications. They are included here to provide a measure of repeatability across variations in operating conditions.

Non-linearity (current output)	±0.003% of range
Non-linearity (voltage measurement)	±0.01% of range
Temperature stability (current output)	(±0.002% of output ± 0.3 nA) per $^\circ C$
Temperature stability (voltage measurement)	(±0.0012% of reading ± 0.3 mV) per °C
Current output sensitivity to output voltage	±0.5 nA/V

Current output sensitivity to (Vout-Vclamp) difference	±0.3 nA/V (Vout-Vclamp < 70 V)	
	±0.5 nA/V (Vout-Vclamp > 70 V)	

Triggers

Table 3. Supported Triggers

Signal	Action	Source	Supported Delay
Start Trigger	Starts the pulse sequence.	None, PXI trigger lines (PXI_Trig0-7), PFI0, PFI1	None
Pulse Trigger	Generates the next pulse in the pulse sequence.	None, PXI trigger lines (PXI_Trig0-7), PFI0, PFI1	0 s to 5 s
Abort Trigger	Aborts the pulsing within ≤7 µs upon receiving the falling edge.	None, PXI trigger lines (PXI_Trig0-7), PFI0, PFI1	None



Note Setting the trigger source to none produces an immidate trigger.

Note The abort trigger inhibits pulsing while active. For example, if the abort trigger source is set to PXI_Trig0 and the abort trigger edge is rising, the pulser aborts immediately because PXI trigger lines are disconnected by default. If the pulser is waiting for a start trigger, the abort trigger aborts the wait.

Table 4. Supported Signals

Signal	Action	Destination	Supported Delay	Minimum Pulse Width	Notes
Ready for Start Trigger	Asserts when the PXIe-4133 is ready to start the pulse sequence.	None, PXI trigger lines (PXI_Trig0-7),	None	400 ns	The start trigger must be configured with a source other than

Signal	Action	Destination	Supported Delay	Minimum Pulse Width	Notes
Event		PFIO, PFI1			none.
Ready for Pulse Trigger Event	Asserts when the PXIe-4133 is ready to generate the next pulse in the sequence.	None, PXI trigger lines (PXI_Trig0-7), PFI0, PFI1	None	400 ns	The start pulse must be configured with a source other than none.
Pulse Event	Asserts with each pulse.	None, PXI trigger lines (PXI_Trig0-7), PFI0, PFI1	±20.971 ms	400 ns	_

Data clock resolution	10 ns
Timing reference	PXIe_CLK100

Note The data clock controls the resolution of triggers and events.

Note For information about clock timing specifications, including jitter, refer to the PXIe_CLK100 clock timing specifications for your chassis and chassis slots.

Front Panel Connectors

 Table 5. Force/Sense Connectors

Number of connectors		4 total connectors, 2 connectors per channel (1 force connection and 1 sense connection)
Connector type		TRB (triaxial BNC), 3-lug, 120 degree keying
Terminal Assignments	Center Pin	Н

Middle Ring	LO
Outer Shell	Ground

Table 6. Programmable Function Interface (PFI<0, 1>) Connectors

Number of connectors	2 (PFI<0, 1>)
Connector type	SMB
Direction	Bidirectional
Inputs (Triggers)	Start Trigger, Pulse Trigger, Abort Trigger
Outputs (Events)	Ready for Start Trigger Event, Ready for Pulse Trigger Event, Pulse Event

Rated Voltages

The PXIe-4133 is intended to measure passive devices, such as diodes, in configurations where voltages are either generated by the PXIe-4133 directly or by currents output from the PXIe-4133 which are driven across a device under test.

Notice The protection provided by the PXIe-4133 can be impaired if it is used in a manner not described in the user documentation.

Note The specified values are maximum voltages that the PXIe-4133 outputs and measures back. The user does not apply voltages.

The maximum voltages and currents that the PXIe-4133 can output to a VCSEL device being tested are:

Specification	Value
Forward Bias	+10 A and +15 Vpk
Reverse Bias	-100 μA and -100 Vpk

The maximum voltage levels into the trigger inputs:

Specification	Value
PFI-to-Ground	0 V to +5 V

Measurement Category

This product is rated for Measurement Category I.

Measurement Category I

Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

Attention Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.



Warning Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV, or for measurements on MAINs circuits or on circuits derived from Overvoltage Category II, III, or IV which may have transient overvoltages above what the product can withstand. The product must not be connected to circuits that have a maximum voltage above the continuous working voltage, relative to earth or to other channels, or this could damage and defeat the insulation. The product can only withstand transients up to the transient overvoltage rating without breakdown or damage to the insulation. An analysis of the working voltages, loop impedances, temporary overvoltages, and transient overvoltages in the system must be conducted prior to making measurements.



Mise en garde Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour des mesures dans ces catégories, ou des mesures sur secteur ou sur des circuits dérivés de surtensions de catégorie II, III ou IV pouvant présenter des surtensions transitoires supérieures à ce que le produit peut supporter. Le produit ne doit pas être raccordé à des circuits ayant une tension maximale supérieure à la tension de fonctionnement continu, par rapport à la terre ou à d'autres voies, sous peine d'endommager et de compromettre l'isolation. Le produit peut tomber en panne et son isolation risque d'être endommagée si les tensions transitoires dépassent la surtension transitoire nominale. Une analyse des tensions de fonctionnement, des impédances de boucle, des surtensions temporaires et des surtensions transitoires dans le système doit être effectuée avant de procéder à des mesures.

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as **MAINS** voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Note Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are for other circuits not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Environmental Guidelines

Notice Failure to follow the mounting instructions in the product documentation can cause temperature derating.

Notice This product is intended for use in indoor applications only.

Notice All cabling should be strain-relieved near input connectors. Take care not to directionally bias cable connectors within input connectors when applying strain relief.

Environmental Characteristics

Temperature	Operating	0 °C to 55 °C
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	Storage	-40 °C to 71 °C
Humidity	Operating	10% RH to 90% RH, noncondensing
	Storage	5% RH to 95% RH, noncondensing
Pollution Degree		2
Maximum altitude		2000 m
	Operating vibration	5 Hz to 500 Hz, 0.3 g RMS
Shock and vibration	Non-operating vibration	5 Hz to 500 Hz, 2.4 g RMS
	Operating shock	30 g, half-sine, 11 ms pulse

Note Not all chassis with slot cooling capacity ≥58 W can achieve this ambient temperature range. Refer to PXI chassis specifications to determine the ambient temperature ranges your chassis can achieve.

Calibration Interval

Recommended calibration interval	2 years
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Power Requirements

Specification	Value
Minimum chassis slot power	58 W

Note The PXIe-4133 must be installed in a chassis with slot cooling capacity ≥58 W.

Power Specifications

Specification	Value
+3.3 V load, maximum	1.5 A
+12 V load, maximum	4.5 A (peak), 3.2 A (average)

Specification	Value
Maximum rated power	43 W

Physical Characteristics

Dimensions and Weight

Dimensions	3U, one-slot, PXI Express/CompactPCI Express module 2.0 cm × 13.0 cm × 21.6 cm (0.8 in. × 5.1 in. × 8.5 in.)
Weight	521 g