

NI PXI/PCI-5105 Specifications

12-Bit 60 MS/s Digitizer

Unless otherwise noted, the following conditions were used for each specification:

- All filter settings
- All impedance selections
- Sample clock set to 60 MS/s

Typical values are representative of an average unit operating at room temperature. Specifications are subject to change without notice. For the most recent NI 5105 specifications, visit ni.com/manuals.

To access the NI 5105 documentation, including the *NI High-Speed Digitizers Getting Started Guide*, go to **Start»Programs»National Instruments»NI-SCOPE»Documentation**.



Hot Surface If the NI 5105 has been in use, it may exceed safe handling temperatures and cause burns. Allow the NI 5105 to cool before removing it from the PXI chassis or PC.

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Vertical

Analog Input (Channels 0–7)

Specification	Value		Comments
Number of Channels	Eight (simultaneously sampled)		—
Connectors	SMB		—
Impedance and Coupling			
Input Impedance	50 Ω \pm 2% 1 M Ω \pm 1% in parallel with a typical capacitance of 50 pF		Software selectable.
Input Coupling	AC, DC		AC coupling available on 1 M Ω only.
Voltage Levels			
Full Scale (FS) Input Range	50 Ω Range (V_{pk-pk})	1 M Ω Range (V_{pk-pk})	—
	0.05	0.05	—
	0.2	0.2	—
	1	1	—
	6	6	—
	—	30	—
Maximum Input Overload	50 Ω	1 M Ω	—
	7 V_{rms} with $ Peaks \leq 10$ V	$ Peaks \leq 42$ V	

Specification	Value		Comments
Accuracy			
Resolution	12 bits		—
DC Accuracy	NI PXI-5105		Within ± 5 °C of self-calibration temperature.
	50 Ω	1 M Ω	
	All ranges: $\pm(1\%$ of Input + 0.25% of FS + 600 μ V)	50 mV range: $\pm(1\%$ of Input + 0.25% of FS + 600 μ V)	
		200 mV, 1 V, and 6 V ranges: $\pm(0.65\%$ of Input + 0.25% of FS + 600 μ V)	
		30 V range: $\pm(0.75\%$ of Input + 0.25% of FS + 600 μ V)	
	NI PCI-5105		
	50 Ω	1 M Ω	
	All ranges: $\pm(1\%$ of Input + 0.25% of FS + 1.4 mV)	50 mV range: $\pm(1\%$ of Input + 0.25% of FS + 1.4 mV)	
		200 mV, 1 V, and 6 V ranges: $\pm(0.65\%$ of Input + 0.25% of FS + 1.4 mV)	
		30 V range: $\pm(0.75\%$ of Input + 0.25% of FS + 1.4 mV)	
DC Drift	$\pm(0.05\%$ of Input + 0.02% of FS + 20 μ V) per °C		—

Specification	Value				Comments
AC Amplitude Accuracy	50 Ω		1 M Ω		Within ± 5 °C of self-calibration temperature.
	Range V_{pk-pk}	At 50 kHz, Typical	Range V_{pk-pk}	At 50 kHz, Guaranteed	
	0.05	± 0.1 dB ($\pm 1.2\%$)	0.05	± 0.2 dB ($\pm 2.3\%$)	
	0.2	± 0.1 dB ($\pm 1.2\%$)	0.2	± 0.13 dB ($\pm 1.5\%$)	
	1	± 0.1 dB ($\pm 1.2\%$)	1	± 0.13 dB ($\pm 1.5\%$)	
	6	± 0.1 dB ($\pm 1.2\%$)	6	± 0.4 dB ($\pm 4.7\%$)	
	—		30	± 0.4 dB ($\pm 4.7\%$)	
Crosstalk, Typical	50 Ω		1 M Ω		Channel to nearest channel. Channels in same configuration.
	All ranges: ≤ -80 dB at 1 MHz		50 mV range: ≤ -75 dB at 1 MHz All other ranges: ≤ -80 dB at 1 MHz		
Bandwidth					
Bandwidth (-3 dB), Typical	Range (V_{pk-pk})	50 Ω	1 M Ω		—
	0.05	55 MHz	35 MHz		
	All other ranges	60 MHz	60 MHz		
Bandwidth Limit Filter	24 MHz Antialias Filter				—
AC Coupling* Cutoff (-3 dB), Typical	12 Hz				* AC coupling available on 1 M Ω only
Passband Flatness	Refer to Figure 1				—

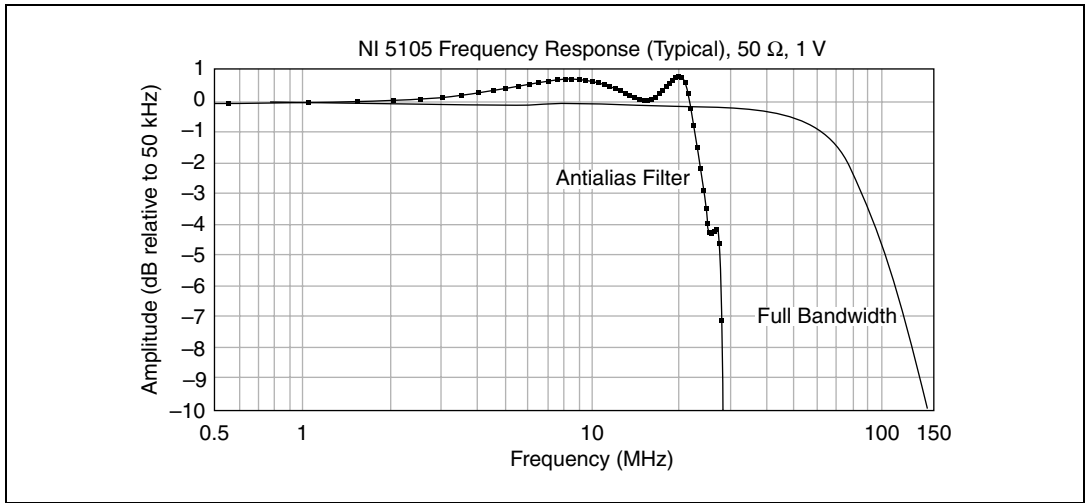


Figure 1. NI 5105 Frequency Response (Typical)

Specification	Value			Comments
Spectral Characteristics				
Spurious Free Dynamic Range with Harmonics (SFDR), Typical	Range (V_{pk-pk})	50 Ω	1 M Ω	5 MHz, -1 dBFS input signal. Includes the 2 nd through the 4 th harmonics. 24 MHz filter on.
	0.2	72 dBc ¹	70 dBc ¹	
	1	72 dBc	65 dBc	
	6	72 dBc	65 dBc	
Total Harmonic Distortion (THD), Typical	Range (V_{pk-pk})	50 Ω	1 M Ω	
	0.05	-75 dBc	-72 dBc	
	0.2	-75 dBc	-75 dBc	
	1	-75 dBc	-65 dBc	
Signal to Noise and Distortion (SINAD), Typical	Range (V_{pk-pk})	50 Ω	1 M Ω	
	0.05	59 dB ¹	50 dB ¹	
	0.2	62 dB	59 dB ¹	
	1	62 dB	61 dB	
	6	62 dB	59 dB	
<p>1. NI PCI-5105 only: Due to high spectral noise content below 5 kHz caused by some computer chassis, spectral performance of the NI PCI-5105 is specified for 5 kHz and above on the indicated ranges. For more information on preventing ground loop noise, refer to the <i>Ground Loop Noise</i> topic in the <i>NI High-Speed Digitizers Help</i>. Note: The specifications listed here apply for all frequencies on the NI PXI-5105.</p>				

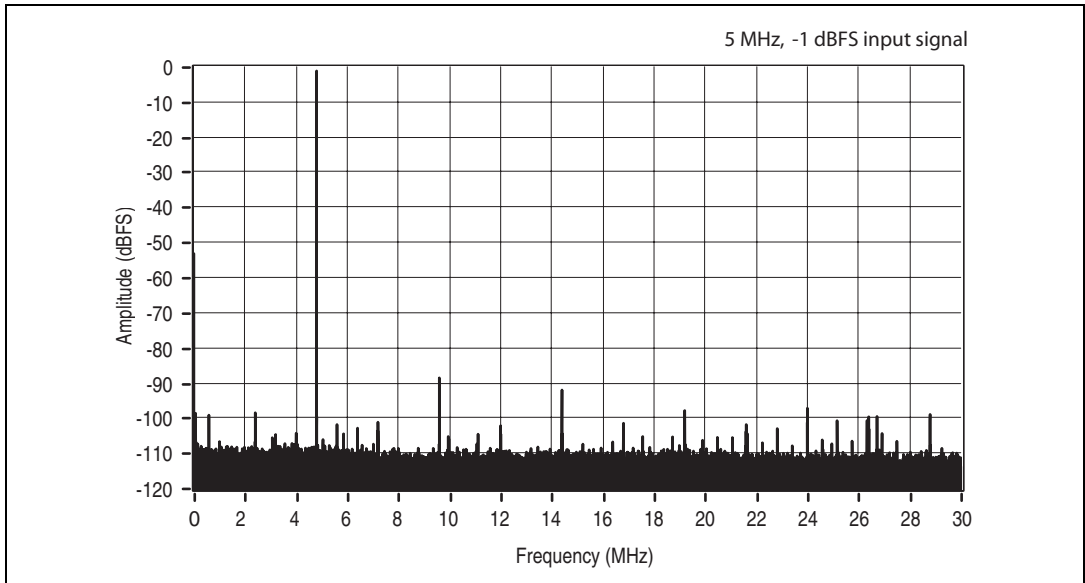


Figure 2. NI PXI/PCI 5105 Dynamic Performance, 50 Ω , 1 V Range, with 24 MHz Filter Enabled.

Specification	Value				Comments	
RMS Noise	Range (V_{pk-pk})	50 Ω		1 M Ω		50 Ω terminator connected to input.
		Full BW	24 MHz Filter On	Full BW	24 MHz Filter On	
	0.05	0.06% FS (30 μ V) ¹	0.038% FS (19 μ V) ¹	0.16% FS (80 μ V) ¹	0.12% FS (60 μ V) ¹	
	0.2	0.035% FS (70 μ V) ¹	0.028% FS (56 μ V) ¹	0.055% FS (110 μ V) ¹	0.036% FS (72 μ V) ¹	
	1	0.03% FS (300 μ V)	0.029% FS (290 μ V)	0.03% FS (300 μ V)	0.03% FS (300 μ V)	
	6	0.03% FS (1.8 mV)	0.028% FS (1.68 mV)	0.055% FS (3.3 mV)	0.036% FS (2.16 mV)	
30	—	—	0.03% FS (9 mV)	0.03% FS (9 mV)		

1. NI PCI-5105 only: Due to high spectral noise content below 5 kHz caused by some computer chassis, spectral performance of the NI PCI-5105 is specified for 5 kHz and above on the indicated ranges. For more information on preventing ground loop noise, refer to the *Ground Loop Noise* topic in the *NI High-Speed Digitizers Help*. Note: The specifications listed here apply for all frequencies on the NI PXI-5105.

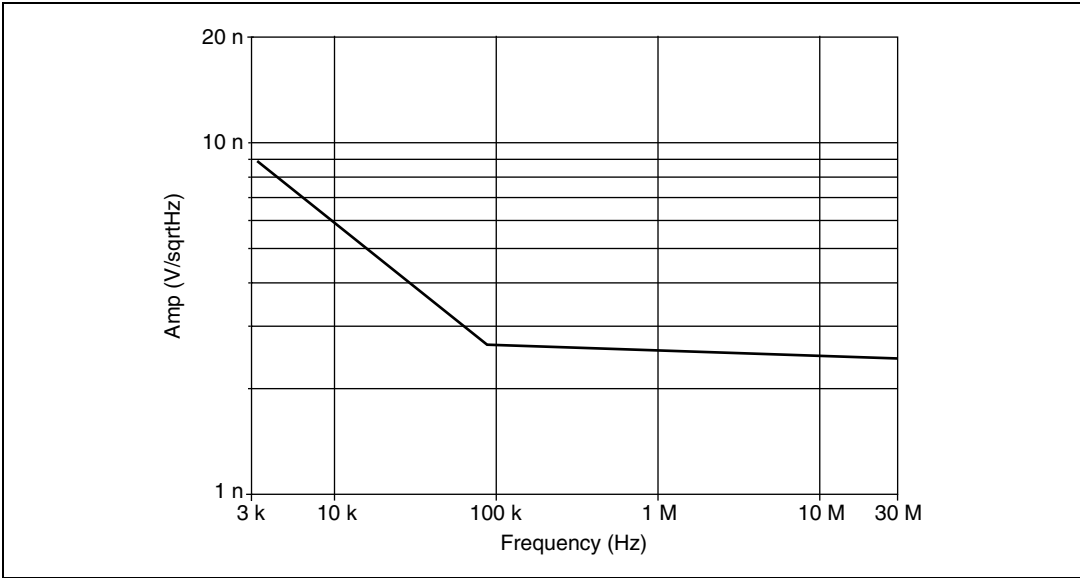


Figure 3. Representation of NI PXI-5105 Spectral Noise Density on 50 mV_{pk-pk} Range, 50 Ω Input Impedance with Antialias Filter Enabled

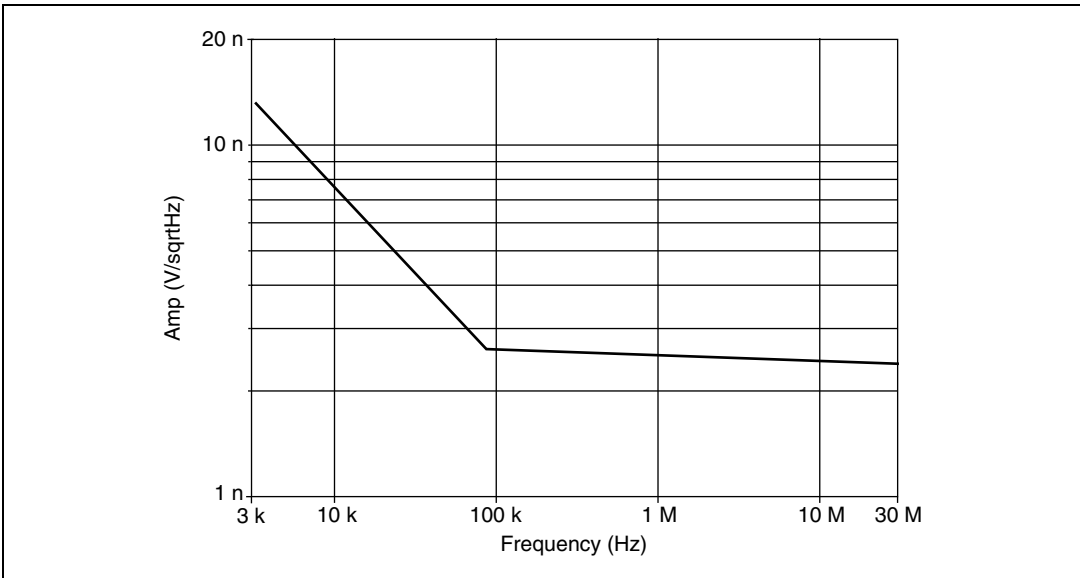


Figure 4. Representation of NI PCI-5105 Spectral Noise Density on 50 mV_{pk-pk} Range, 50 Ω Input Impedance with Antialias Filter Enabled

Specification	Value		Comments
Skew			
Channel to Channel Skew, Typical	24 MHz Filter Off	24 MHz Filter On	10 MHz sine input signal.
	≤ 500 ps	≤ 600 ps	

Sample Clock

Specification	Value		Comments
Sources	NI PXI-5105	NI PCI-5105	* Internal Sample Clock is locked to the Reference Clock or derived from the onboard VCXO.
	Internal: Onboard Clock (internal VCXO)* External: PFI 1, PXI Star	Internal: Onboard Clock (internal VCXO)* External: PFI 1	
Onboard Clock (Internal VCXO)			
Sample Rate Range (Real-Time Sampling, Single Shot)	60 MS/s*		* Divide by n decimation used for all rates less than 60 MS/s. For more information about Sample Clock and decimation, refer to the <i>NI High-Speed Digitizers Help</i> .
Timebase Frequency	60 MHz		—
Timebase Accuracy	Not Phase-Locked to Reference Clock	Phase-Locked to Reference Clock	—
	±25 ppm	Equal to the Reference Clock accuracy	
Sample Clock Delay Range	±1 Sample Clock period		—
Sample Clock Delay Resolution	< 10 ps		—

Specification	Value		Comments
External Sample Clock			
Sources	NI PXI-5105	NI PCI-5105	—
	PFI 1, PXI Star	PFI 1	
Frequency Range	8 MHz to 65 MHz (using NI-SCOPE 3.2) 4 MHz to 65 MHz (using NI-SCOPE 3.3 or later)		Divide by n decimation available where $1 \leq n \leq 65,535$. For more information about Sample Clock and decimation, refer to the <i>NI High-Speed Digitizers Help</i> .
Duty Cycle Tolerance	45% to 55%		—
Sample Clock Exporting			
Exported Sample Clock Destinations	Destination	Maximum Frequency	Cannot export decimated Sample Clock.
	PFI 1	65 MHz	

Phase-Locked Loop (PLL) Reference Clock

Specification	Value		Comments
Sources	NI PXI-5105	NI PCI-5105	—
	PXI_CLK10 (backplane connector)	PFI 1 (front panel SMB connector)	
	PFI 1 (front panel SMB connector)	RTSI 7	
Frequency Range	1 MHz to 20 MHz in 1 MHz increments. Default of 10 MHz. The PLL Reference Clock frequency must be accurate to ± 50 ppm.		—
Duty Cycle Tolerance	45% to 55%		—
Exported Reference Clock Destinations	PFI 1		—

Trigger

Reference (Stop) Trigger

Specification	Value		Comments
Trigger Types	Edge, Window, Hysteresis, Digital, Immediate, and Software		Refer to the following sections and to the <i>NI High-Speed Digitizers Help</i> for more information about what sources are available for each trigger type.
Trigger Sources	NI PXI-5105	NI PCI-5105	—
	CH 0–CH 7, PFI 1, PXI_Trig <0..6>, PXI Star Trigger, and Software	CH 0–CH 7, PFI 1, RTSI <0..6>, and Software	
Time Resolution	Sample Clock Timebase Period		—
Rearm Time	Internal Onboard Clock	External Sample Clock	—
	2.4 μ s	144 \times External Clock Period	
Holdoff	From Rearm time up to $[(2^{32} - 1) \times \text{Sample Clock Timebase Period}]$		—
Analog Trigger (Edge, Window, and Hysteresis Trigger Types)			
Sources	CH 0–CH 7 (front panel SMB connectors)		—
Trigger Level Range	100% FS		—
Edge Trigger Sensitivity	2% FS		—
Trigger Jitter	Sample Clock Timebase Period		—

Specification	Value		Comments
Digital Trigger (Digital Trigger Type)			
Sources	NI PXI-5105	NI PCI-5105	—
	PFI 1 (front panel SMB connector)	PFI 1 (front panel SMB connector)	
	PXI_Trig <0..6> (backplane connector)	RTSI <0..6>	
	PXI Star Trigger (backplane connector)		

PFI 1 (Programmable Function Interface, Front Panel Connector)

Specification	Value
Connector	SMB
Direction	Bidirectional
Coupling	AC, DC
As Sample Clock, Reference Clock	
Input Voltage Range	Sine Wave: 0.65 V _{pk-pk} to 2.8 V _{pk-pk} (0 dBm to 13 dBm) Square Wave: 0.2 V _{pk-pk} to 2.8 V _{pk-pk}
Maximum Input Overload	7 V _{rms} with Peaks ≤ 10 V
Input Impedance	50 Ω
Coupling	AC
As an Input (Digital Trigger)	
Destinations	Start Trigger (Acquisition Arm) Reference (Stop) Trigger Arm Reference Advance Trigger
Input Impedance	150 kΩ
V _{IH}	2.0 V

Specification	Value
V_{IL}	0.8 V
Maximum Input Overload	-0.5 V to 5.5 V
Maximum Frequency	65 MHz
As an Output	
Sources	Start Trigger (Acquisition Arm) Reference (Stop) Trigger End of Record Done (End of Acquisition) Sample Clock Timebase Reference Clock
Output Impedance	50 Ω
Logic Type	3.3 V CMOS
Maximum Drive Current	± 24 mA

TClk Specifications

National Instruments TClk synchronization method and the NI-TClk driver are used to align the sample clocks on any number of SMC-based modules in a chassis. For more information about TClk synchronization, refer to the *NI-TClk Synchronization Help*, which is located within the *NI High-Speed Digitizers Help*.

- Specifications are valid for any number of PXI modules installed in one NI PXI-1042 chassis. These specifications do not apply to PCI modules.
- All parameters set to identical values for each SMC-based module.
- Sample Clock set to 60 MS/s and all filters are disabled.
- For other configurations, including multichassis systems, contact NI Technical Support at ni.com/support.



Note Although you can use NI-TClk to synchronize nonidentical modules, these specifications apply only to synchronizing identical modules.

Specification	Value	Comments
Intermodule SMC Synchronization Using NI-TClk for Identical Modules (Typical)		
Skew	500 ps	Caused by clock and analog path delay differences. No manual adjustment performed.
Skew After Manual Adjustment	< 10 ps	For information about manual adjustment, refer to the <i>Synchronization Repeatability Optimization</i> topic in the <i>NI-TClk Synchronization Help</i> . For additional help with the adjustment process, contact NI Technical Support at ni.com/support .
Sample Clock Adjustment Resolution	< 10 ps	—

Waveform Specifications

Specification	Value	Comments
Onboard Memory Size	16 MB Standard	—
	128 MB Option	
	512 MB Option	
Minimum Record Length	1 Sample	—
Number of Pretrigger Samples	Zero up to full record length	Single-record mode and multiple-record mode.
Number of Posttrigger Samples	Zero up to full record length	Single-record mode and multiple-record mode.
Allocated Onboard Memory per Record	$[(\text{Record length} * 2^\dagger * \text{number of enabled channels}) + 480^\ddagger]$ rounded up to nearest 128 bytes Note: The maximum number of records is 100,000.	* samples † bytes/sample ‡ bytes

Calibration

Specification	Value
Self-Calibration	Self-calibration is done on software command. The calibration corrects for gain, offset, triggering, and timing errors for all input ranges.
External Calibration (Factory Calibration)	The external calibration calibrates the VCXO and the voltage reference. Appropriate constants are stored in nonvolatile memory.
Interval for External Calibration	2 years
Warm-Up Time	15 minutes

Power

Specification	Typical Value	
	NI PXI-5105	NI PCI-5105
+3.3 VDC	1.5 A	1.7 A
+5 VDC	1.7 A	2 A
+12 VDC	200 mA	20 mA
-12 VDC	25 mA	0 A
Total Power	16.15 W	15.85 W

Software

Specification	Value
Driver Software	<p>NI PXI-5105: NI-SCOPE 3.1 or later. NI PCI-5105: NI-SCOPE 3.2 or later.</p> <p>NI-SCOPE is an IVI-compliant driver that allows you to configure, control, and calibrate the NI 5105. NI-SCOPE provides application programming interfaces for many development environments.</p>
Application Software	<p>NI-SCOPE provides programming interfaces, documentation, and examples for the following application development environments:</p> <ul style="list-style-type: none"> • LabVIEW • LabWindows™/CVI™ • Measurement Studio • Microsoft Visual C/C++ • Microsoft Visual Basic
Interactive Soft Front Panel and Configuration	<p>The Scope Soft Front Panel 2.5 or later supports interactive control of the NI 5105. The Scope Soft Front Panel is included on the NI-SCOPE CD.</p> <p>National Instruments Measurement & Automation Explorer (MAX) also provides interactive configuration and test tools for the NI 5105. MAX is included on the NI-SCOPE CD.</p>

Environment

NI PXI-5105



Note To ensure that the NI PXI-5105 cools effectively, follow the guidelines in the *Maintain Forced Air Cooling Note to Users* included in the NI PXI-5105 kit. The NI PXI-5105 is intended for indoor use only.

Specification	Value
Operating Temperature	0 °C to +55 °C in all NI PXI chassis except the following: 0 °C to +45 °C when installed in an NI PXI-1000/B or PXI-101x chassis. Meets IEC-60068-2-1 and IEC-60068-2-2.
Storage Temperature	–40 °C to +71 °C. Meets IEC-60068-2-1 and IEC-60068-2-2.
Operating Relative Humidity	10% to 90%, noncondensing. Meets IEC-60068-2-56.
Storage Relative Humidity	5% to 95%, noncondensing. Meets IEC-60068-2-56.
Operating Shock	30 g, half-sine, 11 ms pulse. Meets IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.
Storage Shock	50 g, half-sine, 11 ms pulse. Meets IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.
Operating Vibration	5 Hz to 500 Hz, 0.31 g _{rms} . Meets IEC-60068-2-64.
Storage Vibration	5 Hz to 500 Hz, 2.46 g _{rms} . Meets IEC-60068-2-64. Test profile exceeds requirements of MIL-PRF-28800F, Class B.
Altitude	2,000 m maximum (at 25 °C ambient temperature)
Pollution Degree	2

NI PCI-5105



Note To ensure that the NI PCI-5105 cools effectively, follow the guidelines in the *Maintain Forced Air Cooling Note to Users* included in the NI PCI-5105 kit. Also, to maximize airflow and extend the life of the device, leave any adjacent PCI slots empty. The NI PCI-5105 is intended for indoor use only.

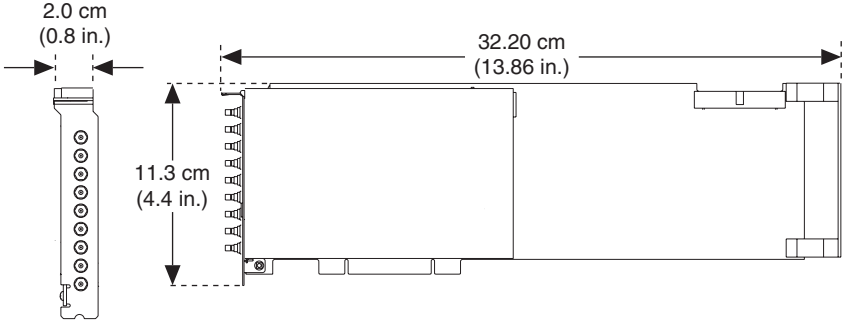
Specification	Value
Operating Temperature	0 °C to +45 °C. Meets IEC-60068-2-1 and IEC-60068-2-2.
Storage Temperature	−40 °C to +71 °C. Meets IEC-60068-2-1 and IEC-60068-2-2.
Operating Relative Humidity	10% to 90%, noncondensing. Meets IEC-60068-2-56.
Storage Relative Humidity	5% to 95%, noncondensing. Meets IEC-60068-2-56.
Storage Shock	50 g, half-sine, 11 ms pulse. Meets IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.
Storage Vibration	5 Hz to 500 Hz, 2.46 g _{rms} . Meets IEC-60068-2-64. Test profile exceeds requirements of MIL-PRF-28800F, Class B.
Altitude	2,000 m maximum (at 25 °C ambient temperature).
Pollution Degree	2

Safety, Electromagnetic Compatibility, and CE Compliance

Specification	Value
Safety	<p>The NI 5105 meets the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:</p> <ul style="list-style-type: none"> • IEC 61010-1, EN 61010-1 • UL 61010-1, CAN/CSA-C22.2 No. 61010-1
<p>For UL and other safety certifications, refer to the product label or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.</p>	
Emissions	<p>EN 55011 Class A at 10 m FCC Part 15A above 1 GHz</p>
Immunity	<p>EN 61326 EMC requirements; Minimum Immunity</p>
EMC/EMI	<p>CE, C-Tick, and FCC Part 15 (Class A) Compliant</p> <p>Note: For EMC compliance, operate this device with shielded cabling.</p>
<p>This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:</p>	
Low-Voltage Directive (safety)	<p>73/23/EEC</p>
Electro- magnetic Compatibility Directive (EMC)	<p>89/336/EEC</p>
<p>For EMC compliance, operate this device with shielded cabling. Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain 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.</p>	
Waste Electrical and Electronic Equipment (WEEE)	<p>EU Customers: At the end of their life cycle, all products <i>must</i> be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit ni.com/environment/weee.htm.</p>

Physical

Specification	Value	
Front Panel Connectors		
Label	Function	Connector Type
CH 0–CH 7	Analog input	SMB jack
PFI 1	Trigger input/output, external clock in, reference clock input/output, and timebase out	SMB jack
Dimensions and Weight		
Dimensions	NI PXI-5105	
	3U, One slot, PXI/cPCI Module 21.6 × 2.0 × 13.0 cm (8.5 × 0.8 × 5.1 in.)	
	<p>The diagram illustrates the physical dimensions of the NI PXI-5105 module. It shows a side view of the module with a width of 2.0 cm (0.8 in.) and a height of 13.0 cm (5.1 in.). A top-down view shows the module's length as 21.6 cm (8.5 in.). The front panel features a series of connectors, including a 16-pin connector and a 15-pin connector.</p>	

Specification	Value	
Dimensions	NI PCI-5105	
	<p data-bbox="356 187 579 244">35.5 × 2.0 × 11.3 cm (13.4 × 0.8 × 4.4 in.)</p>  <p>The diagram shows a side view of the NI PCI-5105 module. It is a long, thin rectangular component. On the left side, there is a vertical connector strip with 16 pins. The width of this strip is labeled as 2.0 cm (0.8 in.). The height of the main module body is labeled as 11.3 cm (4.4 in.). The total length of the module is labeled as 32.20 cm (13.86 in.).</p>	
Weight	NI PXI-5105	NI PCI-5105
	474 g (16.7 oz)	433 g (15.2 oz.)

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At ni.com/support you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electronic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting ni.com/certification. If your product supports calibration, you can obtain the calibration certificate for your product at ni.com/calibration.

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Finland 385 0 9 725 725 11, France 33 0 1 48 14 24 24,
Germany 49 0 89 741 31 30, India 91 80 41190000,
Israel 972 0 3 6393737, Italy 39 02 413091, Japan 81 3 5472 2970,
Korea 82 02 3451 3400, Lebanon 961 0 1 33 28 28,
Malaysia 1800 887710, Mexico 01 800 010 0793,
Netherlands 31 0 348 433 466, New Zealand 0800 553 322,
Norway 47 0 66 90 76 60, Poland 48 22 3390150,
Portugal 351 210 311 210, Russia 7 095 783 68 51,
Singapore 1800 226 5886, Slovenia 386 3 425 4200,
South Africa 27 0 11 805 8197, Spain 34 91 640 0085,
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