

# NI PXI-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](http://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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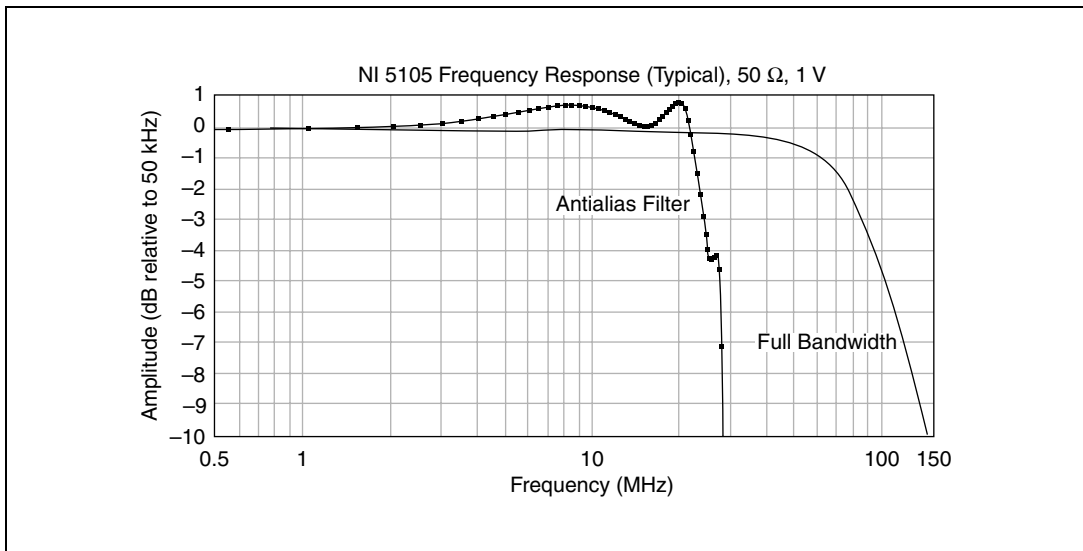
# Vertical

## Analog Input (Channels 0–7)

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

Specification	Value				Comments
<b>Accuracy</b>					
Resolution	12 bits				—
DC Accuracy	50 $\Omega$		1 M $\Omega$		Within $\pm 5$ °C of self-calibration temperature.
	All ranges: $\pm(1\%$ of Input + 0.25% of FS + 600 $\mu$ V)		50 mV range: $\pm(1\%$ of Input + 0.25% of FS + 600 $\mu$ V)		
			200 mV, 1 V, and 6 V ranges: $\pm(0.65\%$ of Input + 0.25% of FS + 600 $\mu$ V)		
			30 V range: $\pm(0.75\%$ of Input + 0.25% of FS + 600 $\mu$ V)		
DC Drift	$\pm(0.05\%$ of Input + 0.02% of FS + 20 $\mu$ V) per °C				—
AC Amplitude Accuracy	50 $\Omega$		1 M $\Omega$		Within $\pm 5$ °C of self-calibration temperature.
	Range $V_{pk-pk}$	At 50 kHz, typical	Range $V_{pk-pk}$	At 50 kHz, guaranteed	
	0.05	$\pm 0.1$ dB ( $\pm 1.2\%$ )	0.05	$\pm 0.2$ dB ( $\pm 2.3\%$ )	
	0.2	$\pm 0.1$ dB ( $\pm 1.2\%$ )	0.2	$\pm 0.13$ dB ( $\pm 1.5\%$ )	
	1	$\pm 0.1$ dB ( $\pm 1.2\%$ )	1	$\pm 0.13$ dB ( $\pm 1.5\%$ )	
	6	$\pm 0.1$ dB ( $\pm 1.2\%$ )	6	$\pm 0.4$ dB ( $\pm 4.7\%$ )	
	—		30	$\pm 0.4$ dB ( $\pm 4.7\%$ )	
Crosstalk, Typical	50 $\Omega$		1 M $\Omega$		Channel to nearest channel.
	All ranges: $\leq -80$ dB at 1 MHz		50 mV range: $\leq -75$ dB at 1 MHz  All other ranges: $\leq -80$ dB at 1 MHz		Channels in same configuration.

Specification	Value			Comments
<b>Bandwidth and Transient Response</b>				
Bandwidth (-3 dB), Typical	Range ( $V_{pk-pk}$ )	50 $\Omega$	1 M $\Omega$	—
	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 $\Omega$ only
Passband Flatness	Refer to Figure 1			—



**Figure 1.** NI 5105 Frequency Response (Typical)

Specification	Value			Comments
<b>Spectral Characteristics</b>				
Spurious Free Dynamic Range with Harmonics (SFDR), Typical	Range $V_{pk-pk}$	50 $\Omega$	1 M $\Omega$	5 MHz, -1 dBFS input signal. Includes the 2 <sup>nd</sup> through the 4 <sup>th</sup> harmonics. 24 MHz filter on.
	0.2	72 dBc	70 dBc	
	1	72 dBc	65 dBc	
	6	72 dBc	65 dBc	
Total Harmonic Distortion (THD), Typical	Range $V_{pk-pk}$	50 $\Omega$	1 M $\Omega$	5 MHz, -1 dBFS input signal. Includes the 2 <sup>nd</sup> through the 4 <sup>th</sup> harmonics. 24 MHz filter on.
	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 $\Omega$	1 M $\Omega$	5 MHz, -1 dBFS input signal. Includes the 2 <sup>nd</sup> through the 4 <sup>th</sup> harmonics. 24 MHz filter on.
	0.05	59 dB	50 dB	
	0.2	62 dB	59 dB	
	1	62 dB	61 dB	
	6	62 dB	59 dB	

Specification	Value				Comments	
RMS Noise	Range (V <sub>pk-pk</sub> )	50 Ω		1 MΩ		50 Ω terminator connected to input.
		Full BW	24 MHz Filter On	Full BW	24 MHz Filter On	
	0.05	0.06% FS (30 μV)	0.038% FS (19 μV)	0.16% FS (80 μV)	0.12% FS (60 μV)	
	0.2	0.035% FS (70 μV)	0.028% FS (56 μV)	0.055% FS (110 μV)	0.036% FS (72 μV)	
	1	0.03% FS (300 μV)	0.029% FS (290 μV)	0.03% FS (300 μV)	0.03% FS (300 μV)	
	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)	
<b>Skew</b>						
Channel to Channel Skew, Typical	24 MHz Filter On		24 MHz Filter Off		10 MHz sine input signal.	
	≤ 600 ps		≤ 500 ps			

# Horizontal

## Sample Clock

Specification	Value		Comments
Sources	Internal: Onboard Clock (internal VCXO)* External: PFI 1, PXI Star		* Internal Sample Clock is locked to the Reference Clock or derived from the onboard VCXO.
<b>Onboard Clock (Internal VCXO)</b>			
Sample Rate Range	Real-Time Sampling (Single Shot)		* 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> .
	60 MS/s*		
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		—
<b>External Sample Clock</b>			
Sources	PFI 1, PXI Star		—

Specification	Value		Comments
Frequency Range	8 MHz to 65 MHz		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%		—
<b>Sample Clock Exporting</b>			
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	PXI_CLK10 (PXI backplane connector) PFI 1	—
Frequency Range	1 MHz to 20 MHz in 1 MHz increments. Default of 10 MHz.  The PLL Reference Clock frequency must be accurate to $\pm 50$ ppm.	—
Duty Cycle Tolerance	45% to 55%	—
Exported Reference Clock Destinations	PFI 1	—

# Trigger

## Reference (Stop) Trigger

Specification	Value		Comments
Trigger Types and Sources	Types	Sources	Refer to the following sections and <i>NI High-Speed Digitizers Help</i> for more information about what sources are available for each trigger type.
	Edge, Window, Hysteresis, Digital, Immediate, and Software	CH 0–CH 7, PFI 1 PXI_Trig <0..6>, PXI Star Trigger, and Software	
Time Resolution	Sample Clock Timebase Period		—
Rearm Time	144 × Sample Clock Period		—
Holdoff	From Rearm time up to $[(2^{32} - 1) \times \text{Sample Clock Timebase Period}]$		—
<b>Analog Trigger (Edge, Window, and Hysteresis Trigger Types)</b>			
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		—
<b>Digital Trigger (Digital Trigger Type)</b>			
Sources	PXI_Trig <0..6> (backplane connector) PFI 1 (front panel SMB connector) PXI Star Trigger (backplane connector)		—

## PFI 1 (Programmable Function Interface, Front Panel Connector)

Specification	Value	Comments
Connector	SMB	—
Direction	Bidirectional	—
Coupling	AC, DC	—
<b>As Sample Clock, Reference Clock</b>		
Input Voltage Range	Sine Wave: 0.65 V <sub>pk-pk</sub> to 2.8 V <sub>pk-pk</sub> (0 dBm to 13 dBm)  Square Wave: 0.2 V <sub>pk-pk</sub> to 2.8 V <sub>pk-pk</sub>	—
Maximum Input Overload	7 V <sub>rms</sub> with  Peaks  ≤ 10 V	—
Input Impedance	50 Ω	—
Coupling	AC	—
<b>As an Input (Digital Trigger)</b>		
Destinations	Start Trigger (Acquisition Arm) Reference (Stop) Trigger Arm Reference Advance Trigger	—
Input Impedance	150 kΩ	—
V <sub>IH</sub>	2.0 V	—
V <sub>IL</sub>	0.8 V	—
Maximum Input Overload	–0.5 V to 5.5 V	—
Maximum Frequency	65 MHz	—

Specification	Value	Comments
<b>As an Output</b>		
Sources	Start Trigger (Acquisition Arm) Reference (Stop) Trigger End of Record Done (End of Acquisition) Sample Clock Timebase Reference Clock	—
Output Impedance	50 $\Omega$	—
Logic Type	3.3 V CMOS	—
Maximum Drive Current	$\pm 24$ 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 modules installed in one NI PXI-1042 chassis.
- 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](http://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
<b>Intermodule SMC Synchronization Using NI-TClk for Identical Modules (Typical)</b>		
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 <a href="http://ni.com/support">ni.com/support</a> .
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	$[(\text{Record length} \times 2 \text{ bytes/s} + 480 \text{ bytes}) \text{ rounded up to nearest } 128 \text{ bytes}] \times (\# \text{ of enabled channels})$ <b>Note:</b> Max. records in a multirecord acquisition = Size of memory option / (512 bytes $\times$ # enabled channels)	—

## Calibration

Specification	Value	Comments
Self-Calibration	Self-calibration is done on software command. The calibration corrects for gain, offset, triggering, and timing adjustment 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	Comments
+3.3 VDC	1.5 A	—
+5 VDC	1.7 A	
+12 VDC	.20 A	
–12 VDC	.025 A	
Total Power	16.15 W	

# Software

Specification	Value	Comments
Driver Software	NI-SCOPE 3.1 or later. 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.	—
Application Software	NI-SCOPE provides programming interfaces, documentation, and examples for the following application development environments: <ul style="list-style-type: none"><li>• LabVIEW</li><li>• LabWindows™/CVI™</li><li>• Measurement Studio</li><li>• Microsoft Visual C/C++</li><li>• Microsoft Visual Basic</li></ul>	—
Interactive Soft Front Panel and Configuration	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. 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.	—

# Environment



**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	Comments
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 <sub>rms</sub> . Meets IEC-60068-2-64.	—
Storage Vibration	5 Hz to 500 Hz, 2.46 g <sub>rms</sub> . 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	Comments
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"> <li>• IEC 61010-1, EN 61010-1</li> <li>• UL 61010-1, CAN/CSA-C22.2 No. 61010-1</li> </ul>	—
<p>For UL and other safety certifications, refer to the product label or visit <a href="http://ni.com/certification">ni.com/certification</a>, search by model number or product line, and click the appropriate link in the Certification column.</p>		
Emissions	EN 55011 Class A at 10 m FCC Part 15A above 1 GHz	—
Immunity	EN 61326 EMC requirements; Minimum Immunity	—
EMC/EMI	<p>CE, C-Tick, and FCC Part 15 (Class A) Compliant</p> <p><b>Note:</b> 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)	73/23/EEC	—
Electro-magnetic Compatibility Directive (EMC)	89/336/EEC	—
<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 <a href="http://ni.com/certification">ni.com/certification</a>, search by model number or product line, and click the appropriate link in the Certification column.</p>		
Waste Electrical and Electronic Equipment (WEEE)	<p><b>EU Customers:</b> 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 <a href="http://ni.com/environment/weee.htm">ni.com/environment/weee.htm</a>.</p>	

# Physical

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Specification	Value	Comments
Dimensions	3U, One slot, PXI/cPCI Module 21.6 × 2.0 × 13.0 cm (8.5 × 0.8 × 5.1 in.)	—
Weight	474 g (16.7 oz)	—
<b>Front Panel Connectors</b>		
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

# Where to Go for Support

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The National Instruments Web site is your complete resource for technical support. At [ni.com/support](http://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](http://ni.com/certification). If your product supports calibration, you can obtain the calibration certificate for your product at [ni.com/calibration](http://ni.com/calibration).

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world to help address your support needs. For telephone support in the United States, create your service request at [ni.com/support](http://ni.com/support) and follow the calling instructions or dial 512 795 8248. For telephone support outside the United States, contact your local branch office:

Australia 1800 300 800, Austria 43 0 662 45 79 90 0,  
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Czech Republic 420 224 235 774, Denmark 45 45 76 26 00,  
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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