

NI PXI/PCI-5114 Specifications

8-Bit 250 MS/s Digitizer

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

- All filter settings
- All impedance selections
- Sample clock set to 250 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 5114 specifications, visit ni.com/manuals.

To access the NI 5114 documentation, including the *NI High-Speed Digitizers Getting Started Guide*, which contains functional descriptions of the NI 5114 signals, navigate to **Start»Programs»National Instruments»NI-SCOPE»Documentation**.



Hot Surface If the NI 5114 has been in use, it may exceed safe handling temperatures and cause burns. Allow the NI 5114 to cool before removing it from the PXI chassis.

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Vertical

Analog Input (Channel 0 and Channel 1)

Specification	Value	Comments
Number of Channels	Two (simultaneously sampled)	—
Connector	BNC	—
Impedance and Coupling		
Input Impedance	50 Ω \pm 1.5% 1 M Ω \pm 1% in parallel with a typical capacitance of 26 pF	Software selectable.
Input Coupling	AC, DC, GND	AC coupling available on 1 M Ω only.

Specification	Value				Comments
Voltage Levels					
Full Scale (FS) Input Range and Programmable Vertical Offset	50 Ω		1 M Ω		—
	Range (V _{pk-pk})	Vertical Offset Range (V)	Range (V _{pk-pk})	Vertical Offset Range (V)	
	0.04	± 0.8	0.04	± 0.8	
	0.1	± 0.8	0.1	± 0.8	
	0.2	± 0.8	0.2	± 0.8	
	0.4	± 0.8	0.4	± 0.8	
	1	± 6.5	1.0	± 8.0	
	2	± 6.0	2.0	± 8.0	
	4	± 5.0	4.0	± 8.0	
	10	± 2.0	10	± 30	
	20		± 25		
	40		± 15		
Maximum Input Overload	50 Ω		1 M Ω		—
	7 V _{rms} with Peaks \leq 10 V		Peaks \leq 35 V		
Accuracy					
Resolution	8 bits				—
DC Accuracy (Programmable Vertical Offset = 0 V)	NI PXI-5114: $\pm(1.5\% \text{ of Input} + 0.3\% \text{ of FS} + 200 \mu\text{V})$ NI PCI-5114: $\pm(1.5\% \text{ of Input} + 0.3\% \text{ of FS} + 280 \mu\text{V})$				Within $\pm 5^\circ\text{C}$ of self-calibration temperature.
Programmable Vertical Offset Accuracy	$\pm 2\%$ of offset setting				Within $\pm 5^\circ\text{C}$ of self-calibration temperature.
DC Drift	$\pm(0.03\% \text{ of Input} + 0.06\% \text{ of FS} + 40 \mu\text{V})$ per $^\circ\text{C}$				—
Crosstalk, Typical	$\leq -60 \text{ dB}$ at 10 MHz $\leq -45 \text{ dB}$ at 100 MHz				CH 0 to/from CH 1, External Trigger to CH 0 or CH 1.

Specification	Value			Comments
Bandwidth and Transient Response				
Bandwidth (-3 dB)	Range (V_{pk-pk})	Bandwidth	Rise/Fall Time, Typical	—
	All ranges except 0.04	125 MHz	2.8 ns	
	0.04	100 MHz	3.5 ns	
Bandwidth Limit Filter	20 MHz Noise Filter			—
AC Coupling* Cutoff (-3 dB), Typical	12 Hz			*AC coupling available on 1 M Ω only.
Passband Flatness	± 1 dB up to 50 MHz			Referenced to 50 kHz. Bandwidth limit filter off.

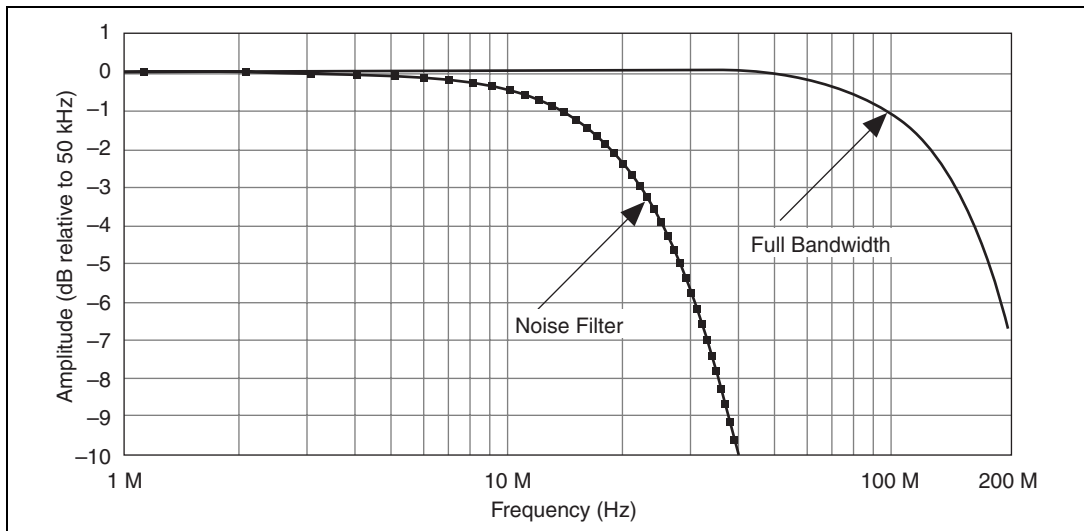


Figure 1. NI 5114 Frequency Response (Typical)

Specification	Value			Comments
Spectral Characteristics				
Spurious Free Dynamic Range with Harmonics (SFDR), Typical	Range (V_{pk-pk})			10 MHz, -1 dBFS input signal. Includes the 2 nd through the 5 th harmonics. Measured from DC to 125 MHz. 20 MHz bandwidth limit filter off.
	All ranges except 0.04	0.04		
	-58 dBc	-58 dBc		
Total Harmonic Distortion (THD), Typical	-58 dBc	-58 dBc		
Effective Number of Bits (ENOB), Calculated*	7.2	6.2		
Signal to Noise and Distortion (SINAD), Typical	44 dB	38 dB		
RMS Noise	Range (V_{pk-pk})	20 MHz Filter On	20 MHz Filter Off	50 Ω terminator connected to input.
	All ranges except 0.04	0.28% FS	0.28% FS	
	0.04	0.28% FS	0.45% FS	
<p>*$ENOB = \log_2(\text{sinad}) - \frac{1}{2}\log_2(1.5) - \log_2(A/V)$ where sinad = the linear representation of SINAD A = amplitude of the supplied sine wave during the test V = (peak) full-scale range of the waveform recorder input</p> <p>Refer to 1057-1994 IEEE Standard for Digitizing Waveform Recorders for information on equation derivation.</p>				

Horizontal

Sample Clock

Specification	Value		Comments
Sources	Internal, Onboard Clock (internal VCXO)* External, CLK IN (front panel SMB connector)		* Internal Sample Clock is locked to the Reference Clock or derived from the onboard VCXO.
Onboard Clock (Internal VCXO)			
Sample Rate Range	Real-Time Sampling (Single Shot)	Random Interleaved Sampling (RIS)	* Divide by n decimation used for all rates less than 250 MS/s. For more information about Sample Clock and decimation, refer to the <i>NI High-Speed Digitizers Help</i> .
	3.815 kS/s to 250MS/s*	250 MS/s to 5 GS/s in increments of 250 MS/s	
Timebase Frequency	250 MHz		When not using External Sample Clock.
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	≤ 20 ps		—

Specification	Value	Comments
External Sample Clock		
Sources	CLK IN (front panel SMB connector)	—
Frequency Range	50 MHz to 250 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%	—

Phase-Locked Loop (PLL) Reference Clock

Specification	Value		Comments
Sources	NI PXI-5114	NI PCI-5114	—
	PXI_CLK10 (backplane connector) CLK IN (front panel SMB connector)	RTSI 7 CLK IN (front panel SMB connector)	
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	NI PXI-5114	NI PCI-5114	—
	PFI <0..1> (front panel 9-pin mini-circular DIN connector) PXI_Trig <0..7> (backplane connector)	PFI <0..1> (front panel 9-pin mini-circular DIN connector) RTSI <0..7>	

CLK IN (Sample Clock and Reference Clock Input, Front Panel Connector)

Specification	Value	Comments
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 \leq 10 V$	—
Impedance	50Ω	—
Coupling	AC	—

Trigger

Reference (Stop) Trigger

Specification	Value		Comments	
Trigger Types and Sources	Types		Refer to the following sections and to <i>NI High-Speed Digitizers Help</i> for more information.	
	Sources			
Time Resolution	Edge, Window, Hysteresis, Video, Digital, Immediate, and Software	CH 0, CH 1, TRIG, PXI_Trig<0..6>, PFI <0..1>, PXI Star Trigger, RTSI<0..6>, and Software	TDC = Time to Digital Conversion Circuit.	
	TDC	Onboard Clock		External Clock
	On	40 ps		N/A
	Off	4 ns	External Clock Period	
Rearm Time	TDC		Holdoff set to 0	
	On			10 μ s
	Off			2 μ s
Holdoff	From Rearm Time up to $[(2^{35} - 1) \times (\text{Sample Clock Period})]$		—	
Trigger Delay	From 0 up to $[(2^{35} - 1) - \text{posttrigger samples}] \times (1/\text{sample rate})$, in seconds		—	

Specification	Value		Comments
Analog Trigger (Edge, Window, and Hysteresis Trigger Types)			
Sources	CH 0 (front panel BNC connector) CH 1 (front panel BNC connector) TRIG (front panel BNC connector)		—
Trigger Level Resolution	8 bits (1 in 256)		
Trigger Level Range	CH 0, CH 1	TRIG (External Trigger)	—
	100% FS	±5 V	
Edge Trigger Sensitivity	5% FS up to 100 MHz	0.5 V _{pk-pk} up to 100 MHz	
Level Accuracy, Typical	±5% FS up to 10 MHz	±0.5 V up to 10 MHz	
Jitter	≤ 65 ps rms		—
Trigger Filters	Low Frequency (LF) Reject	High Frequency (HF) Reject	—
	50 kHz	50 kHz	
Digital Trigger (Digital Trigger Type)			
Sources	NI PXI-5114	NI PCI-5114	—
	PXI_Trig <0..6> (backplane connector) PFI <0..1> (front panel SMB connector) PXI Star Trigger (backplane connector)	RTSI <0..6> PFI <0..1> (front panel SMB connector)	
Video Trigger (Video Trigger Type)			
Sources	CH 0 (front panel BNC connector) CH 1 (front panel BNC connector) TRIG (front panel BNC connector)		—

Specification	Value	Comments
Types	Specific Line Any Line Specific Field	—
Standards	SDTV: M-NTSC, B/G-PAL, SECAM, M-PAL EDTV: 480i/59.94 fps, 480i/60 fps, 480p/59.94 Fps, 480p/60 Fps, 576i/50 fps, 576p/50 Fps HDTV: 720p/50 Fps, 720p/59.94 Fps, 720p/60 Fps, 1080i/50 fps, 1080i/59.94 fps, 1080i/60 fps, 1080p/24 Fps	fps = fields per second; Fps = Frames per second

TRIG (External Trigger, Front Panel Connector)

Specification	Value	Comments
Connector	BNC	—
Impedance	1 M Ω in parallel with 22 pF	—
Coupling	AC, DC	—
AC-Coupling Cutoff (-3 dB)	12 Hz	—
Input Voltage Range	± 5 V	—
Maximum Input Overload	Peaks ≤ 42 V	—

PFI 0 and PFI 1 (Programmable Function Interface, AUX Front Panel Connectors)

Specification	Value	Comments
Connector	9-pin mini-circular DIN	—
Direction	Bi-directional	—

Specification	Value	Comments
As an Input (Trigger)		
Destinations	Start Trigger (Acquisition Arm) Reference (Stop) Trigger Arm Reference Advance Trigger	—
Input Impedance	150 k Ω	—
V _{IH}	2.0 V	—
V _{IL}	0.8 V	—
Maximum Input Overload	-0.5 V to 5.5 V	—
Maximum Frequency	25 MHz	—
As an Output (Event)		
Sources	Start Trigger (Acquisition Arm) Reference (Stop) Trigger End of Record Done (End of Acquisition) Probe Compensation (1 kHz, 50% duty cycle square wave, PFI 1 only)	—
Output Impedance	50 Ω	—
Logic Type	3.3 V CMOS	—
Maximum Drive Current	± 24 mA	—
Maximum Frequency	25 MHz	—

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 250 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	< 20 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	< 20 ps	—

Waveform Specifications

Specification	Value		Comments
Onboard Memory Size	8 MB per Channel Standard	8 megasamples per channel	—
	64 MB per Channel Option	64 megasamples per channel	
	256 MB per Channel Option	256 megasamples per channel	
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.
Maximum Number of Records in Onboard Memory	8 MB/channel	32,768	—
	32 MB/channel	262,144	
	256 MB/channel	1,048,576	
Allocated Onboard Memory per Record	$(Record\ Length \times 1\ byte/S) + 240\ bytes$, rounded up to next multiple of 128 bytes or 256 bytes, whichever is greater		—

Calibration

Specification	Value	Comments
Self-Calibration	Self-calibration is done on software command. The calibration corrects for gain, offset, compensated 1 M Ω attenuator, triggering, and timing adjustment errors for all input ranges.	—
External Calibration (Factory Calibration)	The external calibration calibrates the VCXO, gain, 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	NI PXI-5114	NI PCI-5114	—
	840 mA	1.6 A	
+5 VDC	1.1 A	1.7 A	
+12 VDC	250 mA	45 mA	
-12 VDC	170 mA	—	
Total Power	13.32 W	14.32 W	

Software

Specification	Value	Comments
Driver Software	<p>NI PXI-5114: NI-SCOPE 2.9 or later.</p> <p>NI PCI-5114: NI-SCOPE 3.1 or later.</p> <p>NI-SCOPE is an IVI-compliant driver that allows you to configure, control, and calibrate the NI 5114. 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 2.3 or later supports interactive control of the NI 5114. 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 5114. MAX is included on the NI-SCOPE CD.</p>	—

Environment

NI PXI-5114



Note To ensure that the NI PXI-5114 cools effectively, follow the guidelines in the *Maintain Forced Air Cooling Note to Users* included in the NI PXI-5114 kit. The NI PXI-5114 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 _{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-5114



Note To ensure that the NI PCI-5114 cools effectively, follow the guidelines in the *Maintain Forced Air Cooling Note to Users* included in the NI PCI-5114 kit. Also, to maximize airflow and extend the life of the device, leave any adjacent PCI slots empty. The NI PCI-5114 is intended for indoor use only.

Specification	Value	Comments
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	Comments
Safety	<p>The NI 5114 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	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>Note: For EMC compliance, you <i>must</i> 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 full EMC compliance, you must 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		Comments
Dimensions	NI PXI-5114	NI PCI-5114	—
	3U, One slot, PXI/cPCI Module 21.6 × 2.0 × 13.0 cm (8.5 × 0.8 × 5.1 in.)	35.5 × 2.0 × 11.3 cm (13.4 × 0.8 × 4.4 in.)	
Weight	455 g (16 oz)	421 g (14.8 oz)	—
Front Panel Connectors			
Label	Function	Connector Type	—
CH 0	Analog Input	BNC female	
CH 1	Analog Input	BNC female	
TRIG	External Trigger	BNC female	
CLK IN	Sample Clock Input and Reference Clock Input	SMB jack	
AUX I/O	PFI 0, PFI 1	9-pin mini-circular DIN	
NI PXI-5114 Front Panel Indicators			
Label	Function	For more information, refer to the <i>NI High-Speed Digitizers Help</i> .	
ACCESS	The ACCESS LED indicates the status of the PCI bus and the interface from the NI PXI-5114 to the controller.		
ACTIVE	The ACTIVE LED indicates the status of the onboard acquisition hardware of the NI PXI-5114.		

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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