

# 100 MHz, 100 MS/s, 14-Bit Digitizer

NEW

## NI 5122

- 2 channels simultaneously sampled at 14-bit resolution
- 100 MS/s real-time and 2.0 GS/s random interleaved sampling
- 100 MHz bandwidth
- 50  $\Omega$  or 1 M $\Omega$  input impedance, software selectable
- 200 mV to 20 V input range
- 75 dBc SFDR and 62 dB SINAD
- 8, 32, or 256 MB of memory per channel
- Edge, window, hysteresis, video, and digital triggering with 100 ps timestamping

## Models

- NI PCI-5122
- NI PXI-5122

## Operating Systems

- Windows 2000/XP

## Recommended Software

- LabVIEW™
- LabWindows/CVI
- Measurement Studio™

## Other Compatible Software

- Visual Basic
- C/C++

## Application Software (included)

- Spectral Measurements Toolkit (32 and 256 MB/channel models only)

## Driver Software (included)

- NI-SCOPE



## Overview

The National Instruments 5122 high-resolution digitizer features two 100 MS/s simultaneously sampled input channels with 14-bit resolution, 100 MHz bandwidth, and up to 256 MB of memory per channel in a compact, 3U PXI or PCI module. With its high sampling rate and low-distortion front end, the NI 5122 is ideal for a wide range of applications in automotive, communications, scientific research, military/aerospace, and consumer electronics. Using National Instruments new Synchronization and Memory Core (SMC) architecture, you can easily synchronize to other analog and digital instruments to develop high-channel-count or mixed-signal test systems.

## Analog Input Performance

The NI 5122 uses 14-bit analog-to-digital converters (ADCs), low-noise variable-gain amplifiers, and a low-jitter 100 MHz timebase to deliver 75 dBc spurious-free dynamic range and 62 dB signal-to-noise ratio. The 14-bit data converters have 64 times the resolution of traditional 8-bit instruments, providing more accurate time and frequency-domain measurements.

Software selectable 50  $\Omega$  or 1 M $\Omega$  input impedance, input ranges from 200 mV<sub>pp</sub> to 20 V<sub>pp</sub>, seven trigger modes, and antialias and noise filters make the NI 5122 versatile enough to meet the most demanding application requirements. The programmable DC offset feature maximizes the use of the entire 14-bits of vertical resolution. Onboard self-calibration also ensures measurement stability over the entire operating temperature range of 0 to 55 °C.

## Deep Onboard Acquisition Memory

The NI 5122, based on the SMC architecture, comes with either 8, 32 or 256 MB of high-speed memory per channel (4, 32, or 128 million 14-bit samples per channel). The NI 5122 can acquire more

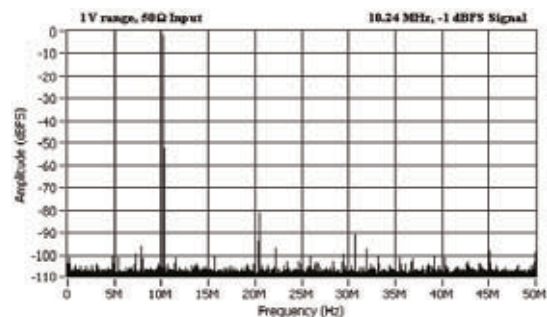


Figure 1. Graph of Dynamic Performance (FFT)

than 1 million triggered waveforms without software intervention in multiple-record acquisition mode, for applications such as RADAR, ultrasound, and event detection, which require short trigger rearm times. In addition, you can timestamp each triggered event with 100 ps resolution in both single-shot and multiple record acquisition modes. The NI 5122 also can stream data continuously from onboard memory to host memory for longer acquisitions and streaming to disk. The high-speed PCI bus and the scatter-gather bus mastering capabilities of the NI MITE ASIC move data to the computer at speeds up to 100 times faster than traditional instrument interfaces, thereby dramatically decreasing overall test time.

## Triggering

The NI 5122 digitizer has three trigger sources – analog, digital, and software control. Compare the input signal on either channel or the external trigger channel to one or two thresholds for edge, hysteresis, or window trigger detection. You can also use line-selectable video triggering for NTSC, PAL, or SECAM broadcast standards. Drive and receive digital triggers to and from the PXI or RTSI trigger bus or the

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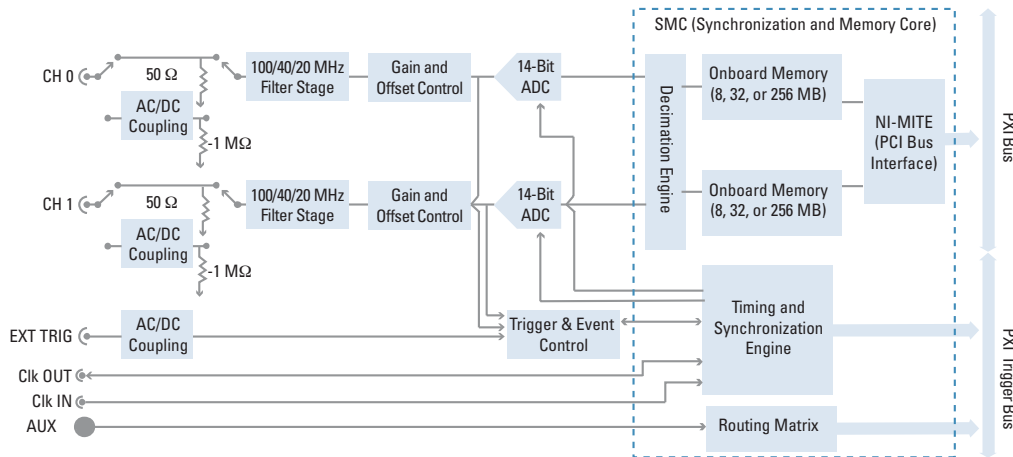


Figure 2. Hardware Block Diagram

external 9-pin AUX connector. You can specify the number of samples to acquire before and after a trigger event occurs. These pretrigger and posttrigger settings also apply when the module is used in multiple-record mode.

## Timing and Synchronization

An advanced 100 MHz clock generator produces the low-jitter, low-phase-skew clock for the precise clocking and stable synchronization necessary for high-speed, high-resolution digitizers. You can also use an external clock source, such as the NI PXI-5404, for applications that require very specific sample frequencies or you can clock directly from the device under test. Synchronize multiple instruments using the PXI backplane 10 MHz reference clock or an external reference ranging from 1 to 20 MHz in 1 MHz increments. Because the NI 5122 is built on the SMC architecture, you can synchronize two or more digitizers for high-channel-count applications, and build mixed-signal test systems using NI 5421 arbitrary waveform generators and NI 655x digital waveform generator/analyzers.

## Calibration

Every NI 5122 is factory calibrated to verify that it meets NIST-traceable standards. The NI 5122 has an onboard calibration circuit that corrects for environmental effects on gain, offset, frequency response, and timing. The NI 5122 also offers a 2-year calibration cycle, reducing your downtime. When you want to calibrate your device externally, return your NI 5122 to National Instruments or ship it to a qualified metrology lab for routine calibration.

## Software

Every National Instruments high-speed digitizer comes with the IVI-compliant NI-SCOPE driver, which is fully compatible with NI LabVIEW, LabWindows/CVI, and Measurement Studio, as well as Microsoft Visual C++ and Visual Basic. NI-SCOPE includes more than 50 built-in measurement and analysis functions, and an interactive SCOPE Soft Front Panel. The Spectral Measurements Toolkit gives you sophisticated frequency-domain measurements such as power in-band, multiple peak search, and 3D spectrogram, for applications such as communications, signal intelligence, and avionics.

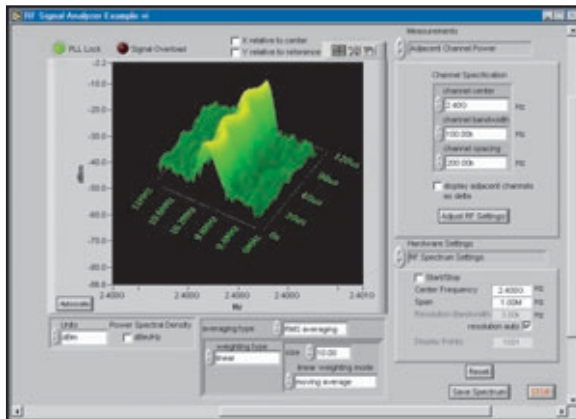


Figure 4. Spectral Measurements Toolkit 3D Spectrogram

## Ordering Information

NI PCI-5122  
 8 MB/channel .....778758-01  
 32 MB/channel .....778758-02  
 256 MB/channel .....778758-03

NI PXI-5122  
 8 MB/channel .....778756-01  
 32 MB/channel .....778756-02  
 256 MB/channel .....778756-03

Includes NI-5122 module, NI-SCOPE, SCOPE Soft Front Panel. The 32 and 256 MB/channel models also include the Spectral Measurements Toolkit.

### Accessories

Recommended PXI switch  
 NI PXI-2593 .....778793-01  
 Switchable 1/10x probe  
 SP200B .....763391-01  
 9-pin DIN to BNC for AUX I/O connector  
 Aux110 .....189919-0R5

### Related Products

NI 5421 Arbitrary Waveform Generator  
 NI PXI-5404 Clock and Frequency Generator  
 NI 655x Digital Waveform Generator/Analyzer

## BUY ONLINE!

Visit [ni.com/products](http://ni.com/products) and enter `pxi5122` or `pci5122`

# 100 MHz, 100 MS/s, 14-Bit Digitizer

## Specifications

These specifications are valid for 0° to 55° C for PXI, and 0° to 45° C for PCI, unless otherwise stated.

### Acquisition System

Number of channels.....	2 simultaneously sampled
Vertical resolution.....	14 bits
Bandwidth <sup>1</sup> (-3dB).....	100 MHz
Bandwidth limit filters (software selectable).....	20 MHz noise (2-pole Bessel) 40 MHz antialias (-6dB, 6-pole Chebyshev)
Maximum sample rate.....	100 MS/s real-time, 2 GS/s random interleave sampling
Onboard sample memory.....	8, 32, or 256 MB per channel (4, 16, or 128 million samples)
Pre and post trigger data points <sup>2</sup> .....	0-100% of full record length

### Multiple record acquisition (0-100% pre and post trigger data)

Memory per Channel	Maximum number of records
8 MB	32,768
32 MB	131,072
256 MB	1,048,576

Input impedance.....	50 Ω and 1 MΩ    27 pF(± 2 pF), software selectable
Full scale input range.....	50 Ω: 200 mV, 400 mV, 1 V, 2 V, 4 V, 10 V 1 MΩ: 200 mV, 400 mV, 1 V, 2 V, 4 V, 10 V, 20 V
Vertical offset ranges.....	±50% of full scale input range
Maximum input overload.....	50 Ω: 7 V <sub>rms</sub> with peaks ≤ 10 V, 1 MΩ: peaks ≤ 42 V
Input coupling.....	AC, DC, GND (AC coupling on 1 MΩ only)
AC coupling cutoff frequency (-3dB).....	12 Hz

### Accuracy

#### DC accuracy (0 V offset setting)

Full scale input range	50 Ω and 1 MΩ
200 mV, 400 mV, 1 V, 2 V	±0.65% of Input ±1.0 mV
4 V, 10 V	±0.65% of Input ±8.0 mV
20 V	±0.65% of Input ±10.0 mV

#### Passband Flatness (referenced at 50 kHz)

	Full Scale Input Range	50 Ω and 1 MΩ
Filters off	400 mV, 1 V, 2 V, 5 V, 10 V, 20 V	±0.4 dB DC to 20 MHz ±1 dB 20 MHz to 50 MHz
	200 mV	±0.4 dB DC to 20 MHz ±1 dB 20 MHz to 40 MHz ±1.2 dB DC to 16 MHz ±1.6 dB 16 MHz to 32 MHz
Anti alias filter on	All ranges	±1.6 dB 16 MHz to 32 MHz

AC amplitude accuracy (50 kHz).....	50 Ω: ±0.06 dB, 1 MΩ: ±0.09 dB
Channel to channel crosstalk.....	≤ -100 dB at 10 MHz

### Spectral Characteristics (typical)

#### Dynamic performance (50 Ω input impedance with 10 MHz, -1 dBfs input signal)

Full scale input range	SFDR (dBc)	THD (dBc)	SNR (dB)	SINAD (dB)
200 mV	75	-75	60	62
400 mV	75	-75	62	62
1 V	75	-75	62	62
2 V	75	-73	62	62
4 V	65	-63	—	—
10 V	65	-63	—	—

#### Dynamic performance (1 MΩ input impedance with 10 MHz, -1 dBfs input signal)

Full scale input range	SFDR (dBc)	THD (dBc)	SNR (dB)	SINAD (dB)
200 mV	70	-68	60	59
400 mV	70	-68	62	61
1 V	70	-68	62	61
2 V	70	-68	62	61
4 V	70	-68	62	61
10 V	60	-58	—	—
20 V	60	-58	—	—

SFDR = Spurious-free dynamic range

THD = Total harmonic distortion

SNR = Signal-to-noise ratio, excluding distortion (antialias filter enabled)

SINAD = Signal-to-noise and distortion (antialias filter enabled)

#### Rms Noise (20 MHz filter enabled)<sup>1</sup> Bandwidth on 200 mV range is 80 MHz

Full scale input range	50 Ω	1 MΩ
200 mV	46 μV (*56 μV)	60 μV (*72 μV)
400 mV	92 μV	92 μV
1 V	230 μV	230 μV
2 V	460 μV	460 μV
4 V	920 μV	920 μV
10 V	2.3 mV	2.3 mV
20 V(1 MΩ only)	—	4.6 mV

\* PCI-5122

Phase noise density (10 MHz input).....	<-100 dBc/Hz at 100 Hz, <-120 dBc/Hz at 1 kHz, <-130 dBc/Hz at 10 kHz
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### Acquisition Modes

Real-time sample rate.....	100 MS/s to 1.526 kS/s sampling rate
Random interleave sampling (RIS).....	2 GS/s to 200 MS/s sampling rate (repetitive signals only)

### Timebase System

Timebase options.....	Internal, PXI star, external (CLK IN)
Total sample clock jitter <sup>4</sup> .....	≤1 ps <sub>rms</sub>

### Internal

Internal sample clock frequency.....	100 MS/s sampling rate with decimation by n where 1 ≤ n ≤ 65,535
Timebase accuracy.....	±25 ppm (±0.0025%)

### External

External sample clock sources.....	CLK IN (SMB connector), PXI star
External sample clock range.....	30 to 105 MHz. Variable with decimation by n where 1 ≤ n ≤ 65,535

External reference clock sources.....	CLK IN (SMB connector), PXI backplane 10 MHz
External reference clock range.....	1 to 20 MHz in 1 MHz increments
External clock amplitude.....	Sine wave: 0.65 V <sub>pp</sub> to 2.8 V <sub>pp</sub> (0 dBm to 13 dBm) Square wave: 0.2 V <sub>pp</sub> to 2.8 V <sub>pp</sub>

External clock impedance.....	50 Ω, AC coupled
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### Trigger System

Modes.....	Edge, hysteresis, window, video, digital, immediate, software
Sources.....	CH 0, CH 1, TRIG, PXI_Trig <0:6>, PFI <0:1>, PXI Star, Software
Slope.....	Rising or falling
Hysteresis.....	Fully programmable
Video trigger.....	Negative sync of NTSC, PAL, and SECAM standards
Video trigger types.....	Any line, specific line, specific field
High-frequency reject filter.....	50 kHz software selectable
Low-frequency reject filter.....	50 kHz software selectable
Sensitivity.....	CH0 and CH1: 2.5% FS up to 50 MHz increasing to 5% FS at 100 MHz; TRIG: 2.5% up to 100 MHz decreasing to 10% at 200 MHz
Level accuracy.....	CH0, CH1 and TRIG: ±3.5% FS up to 10 MHz
Time resolution.....	100 ps with time-to-digital converter enabled
Holdoff <sup>5</sup> .....	2 μ to 171.79 s, software selectable

### External Trigger Channel (TRIG)

Impedance.....	1 MΩ    22 pF
Range.....	±5 V
Coupling.....	AC, DC

### Power

Typical	+3.3 VDC	+5 VDC	+12 VDC	-12 VDC	Total Power
PXI	1.4 A	1.6 A	0.1 A	0.27 A	17.1 W
PCI	1.4 A	2.4 A	110 mA	0 A	17.9 W

### Environment

Operating temperature <sup>6</sup> .....	PXI: 0 to 55 °C (Meets IEC-60068-2-1 and IEC-60068-2-2) PCI: 0 to 45 °C (Meets IEC-60068-2-1 and IEC-60068-2-2)
Storage temperature.....	-40 to 70 °C (Meets IEC-60068-2-1 and 60068-2-2)
Relative Humidity.....	10 to 90%, noncondensing (Meets 60068-2-56)

### Calibration

Self-Calibration.....	Gain, offset, frequency response, triggering, and timing for all input ranges
External Calibration Interval.....	2 years

### Certification and Compliances

CE Mark Compliance **CE**

For detailed specifications on power, environmental, safety, and physical dimensions, please visit [ni.com/products](http://ni.com/products) and enter express code: **pxi5122**

### Notes

<sup>1</sup> Bandwidth on 200 mV range is 80 MHz

<sup>2</sup> NI PXI-5122 also supports continuous acquisition

<sup>3</sup> Measured on ranges up to 2 V on 50 Ω input with two tones at 10.2 and 11.2 MHz, each at -7dBFS

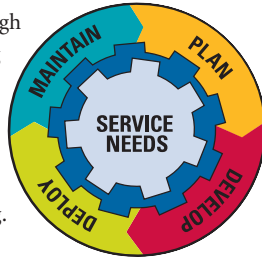
<sup>4</sup> Includes effects of converter aperture and clock circuitry jitter from 100 Hz to 100 kHz

<sup>5</sup> Time-digital-converter disabled

<sup>6</sup> 0-45° C in PXI-101x and 1000/B chassis

# NI Services and Support

NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit [ni.com/services](http://ni.com/services).



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We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit [ni.com/ssp](http://ni.com/ssp).

## Hardware Services

### NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI™ combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with [ni.com/pxiadvisor](http://ni.com/pxiadvisor).

### Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit [ni.com/calibration](http://ni.com/calibration).

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