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

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 Ω or 1 MΩ input impedance, software-selectable
- 200 mV to 20 V input range
- 75 dBc SFDR and 62 dB SINAD
- Memory options from 8 to 512 MB per channel
- Edge, window, hysteresis, video, and digital triggering with 100 ps timestamping

Models
- NI PCI-5122
- NI PXI-5122
- NI PXIe-5122

Operating Systems
- Windows Vista/XP/2000

Recommended Software
- LabVIEW
- LabWindows™/CVI
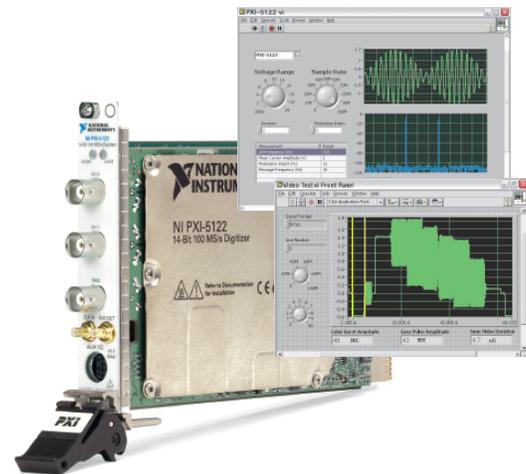- Measurement Studio for Visual Studio

Other Compatible Software
- Visual Basic
- C/C++
- .NET

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

Driver Software (included)
- NI-SCOPE

Overview

National Instruments 5122 high-speed digitizers feature two 100 MS/s simultaneously sampled input channels with 14-bit resolution, 100 MHz bandwidth, and up to 512 MB of memory per channel in a compact, 3U PXI Express, PXI, or PCI device. With its high sampling rate and low-distortion front end, an NI 5122 is ideal for a wide range of applications in automotive, communications, scientific research, military/aerospace, and consumer electronics. Using the National Instruments 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

NI 5122 digitizers use 14-bit analog-to-digital converters (ADCs), low-noise variable-gain amplifiers, and a low-jitter 100 MHz timebase to deliver a 75 dBc spurious-free dynamic range and a 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 Ω or 1 MΩ input impedance, input ranges from 200 mV$_{pp}$ to 20 V$_{pp}$, seven trigger modes, and antialias and noise filters make NI 5122 digitizers versatile enough to meet the most demanding application requirements. The programmable DC offset feature maximizes the use of the entire 14 bits of vertical range. Onboard self-calibration also ensures measurement stability over the entire operating temperature range of 0 to 55 °C.
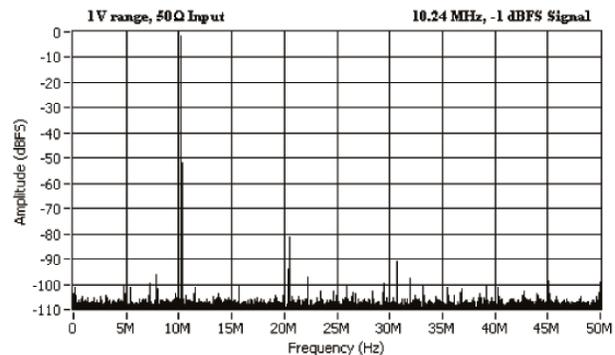
Figure 1. Graph of Dynamic Performance (FFT)

Deep Onboard Acquisition Memory

An NI 5122, based on the SMC architecture, comes with high-speed memory options from 8 to 512 MB per channel (4 to 256 million 14-bit samples per channel). An NI 5122 can acquire more 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. An NI 5122 also can stream data continuously from onboard memory to host memory for longer acquisitions and streaming to disk.

Figure 2. Hardware Block Diagram

Data Streaming up to 400 MB/s

Because of the PCI and PCI Express buses used in PXI, an NI 5122 can continuously stream data to the host computer at rates up to 110 MB/s using PCI/PXI or 400 MB/s using PXI Expre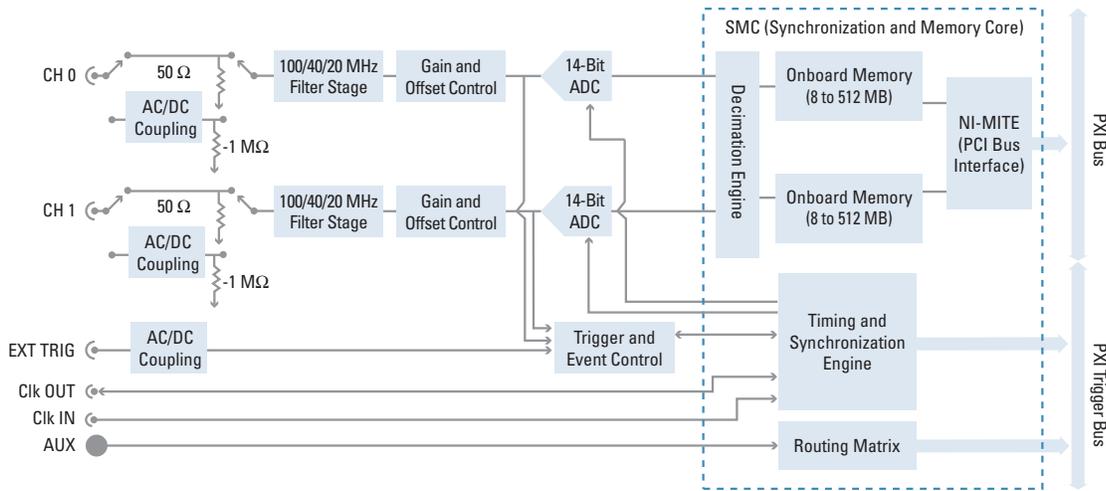ss. At 400 MB/s, an NI 5122 is streaming data on both channels at its maximum data rate. The dedicated per-slot bandwidth available in PXI Express enables multi-module systems to achieve higher aggregate data rates. High-speed data record and playback applications are possible using the host computer's memory or high-end storage solutions such as RAID. Using an 8 x 500 GB drive RAID system with a capacity of 4 TB, you can capture data at 400 MB/s for more than 2.5 hours. Areas that benefit from this capability include RF/IF data streaming in signal intelligence, data record and playback, and scientific applications.

Triggering

NI 5122 digitizers have 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 trigger bus or the 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 100 MHz frequency generator, 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 an 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 PXI-5421 arbitrary waveform generators and NI PXI-655x digital waveform generator/analyzers.

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 for Visual Studio 6.0 and .NET. NI-SCOPE includes more than 50 built-in measurement and analysis functions and an interactive SCOPE Soft Front Panel. The NI Spectral Measurements Toolkit gives you sophisticated frequency-domain measurements, such as power in-band, multiple peak search, and 3D spectrogram, for applications in communications, signal intelligence, and avionics.
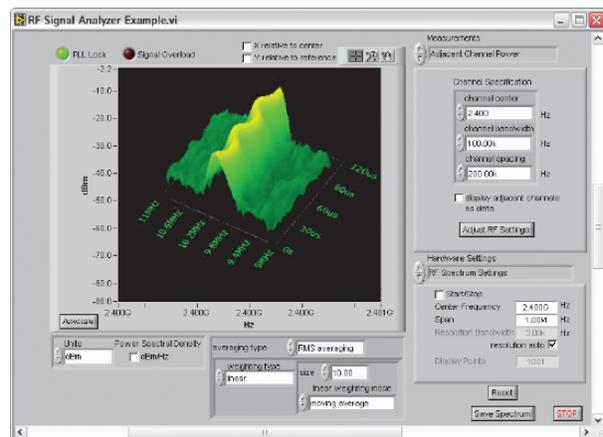

Figure 3. Spectral Measurements Toolkit 3D Spectrogram

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

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

    512 MB/channel..778756-04

NI PXIe-5122

    8 MB/channel..779967-01

    64 MB/channel..779967-02

    256 MB/channel..779967-03

Includes NI 5122 device, NI-SCOPE, and Scope Soft Front Panel. The 32 and 256 MB/channel models also include the NI 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 generators

NI PXI-5404 clock and frequency generator

NI PXI-655x digital waveform generator/analyzers

BUY NOW!

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to **ni.com/digitizers**.

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[1] (-3 dB).............................	100 MHz
Bandwidth limit filters (software selectable)......................	20 MHz noise (2-pole Bessel) 40 MHz antialias (-6 dB, 6-pole Chebyshev)
Maximum sample rate........................	100 MS/s real-time, 2 GS/s random interleaved sampling
Onboard sample memory....................	8 to 512 MB per channel (4 to 256 million samples)
Pretrigger and posttrigger data points[2]...	0 to 100% of full record length
Input impedance	50 Ω and 1 MΩ || 27 pF(± 2 pF), software selectable
Maximum number of records for multiple-record acquisition[3]	32,768 for 8 MB/ch, 100,000 for all other memory options
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$_{rms}$ with peaks ≤10 V, 1 MΩ: peaks ≤42 V
Input coupling	AC, DC, GND (AC coupling on 1 MΩ only)
AC coupling cutoff frequency (-3 dB)	12 Hz

Maximum Data Streaming Rates[4]	
PCI/PXI	**PXI Express**
110 MB/s	400 MB/s

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 (±2.0 mV for PCI)
4 V, 10 V	±0.65% of input ±8.0 mV
20 V	±0.65% of input ±10.0 mV

Passband Flatness (referenced to 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 to 50 MHz
	200 mV	±0.4 dB DC to 20 MHz ±1 dB 20 to 40 MHz
Antialias filter on	All ranges	±1.2 dB DC to 16 MHz ±1.6 dB 16 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, filters on)

Full Scale Input Range	SFDR (dBc)	THD (dBc)	SNR (dB)	SINAD (dB)
200 mV	75	-75	60	60
400 mV	75	-75	62	62
1 V	75	-75	62	62
2 V	75	-75	62	62
4 V	65	-63	–	–
10 V	65	-63	–	–

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)

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

Dynamic performance (1 MΩ input impedance with 10 MHz, -1 dBFS input signal, filters on)

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)

Intermodulation distortion[5] (IMD)....... <75 dBc
Phase noise density (10 MHz input)... <-100 dBc/Hz at 100 Hz,
<-120 dBc/Hz at 1 kHz,
<-130 dBc/Hz at 10 kHz

Acquisition Modes

Real-time sample rate .... 100 MS/s to 1.526 kS/s sampling rate
Random interleaved 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[6] .... ≤1 ps$_{rms}$

Internal

Internal sample clock frequency......... 100 MS/s sampling rate with decimation by n where $1 \leq n \leq 65{,}535$
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 (to 80 MHz using PXI Star Trigger), variable with decimation by n where $1 \leq n \leq 65{,}535$
External reference clock sources....... CLK IN (SMB connector), PXI backplane 10 MHz
External reference clock range.......... 1 to 20 MHz in 1 MHz increments

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
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.. CH 0 and CH 1: 2.5% FS up to 50 MHz increasing to 5% FS at 100 MHz; TRIG: 2.5% up to 100 MHz increasing to 10% at 200 MHz
Level accuracy..................................... CH 0, CH 1, and TRIG: ±3.5% FS up to 10 MHz
Time resolution .... 100 ps with time-to-digital converter enabled
Holdoff[7] .... 2 μ to 171.79 s, software selectable

External Trigger Channel (TRIG)

Impedance.. 1 MΩ ll 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	1.5 A	110 mA	270 mA	16.7 W
PCI	1.4 A	2.4 A	110 mA	0 A	17.9 W
PXIe	1.6 A	0 A	2.0 A	0A	29.3 W

Environment

Operating temperature[8]..................... 0 to 55 °C (meets IEC-60068-2-1 and IEC-60068-2-2)
Storage temperature........................... -40 to 71 °C (meets IEC-60068-2-1 and 60068-2-2)
Relative humidity .... 10 to 90%, noncondensing (meets 60068-2-56)

Calibration

NIST traceability .... Factory calibrated to verify it meets NIST-traceable standards
Self-calibration.................................... Gain, offset, frequency response, triggering, and timing for all input ranges
External calibration interval................ 2 years
Routine calibration.............................. Return your device to National Instruments or ship to a qualified metrology lab

[1]Bandwidth on 200 mV range is 80 MHz.

[2]NI 5122 also supports continuous acquisition.

[3]0 to 100% pretrigger and posttrigger data.

[4]Rates are for a single NI 5122 device. Dedicated per-slot bandwidth available in PXI Express enables multimodule systems to achieve higher aggregate data rates. Using a 12-drive high-performance RAID system, aggregate data rates up to 600 MB/s to disk are possible.

[5]Measured on ranges up to 2 V on 50 Ω input with two tones at 10.2 and 11.2 MHz, each at -7 dBFS.

[6]Includes effects of converter aperture and clock circuitry jitter from 100 Hz to 100 kHz.

[7]Time-digital-converter disabled.

[8]0 to 45 °C in PXI-101x and 1000/B chassis.

NI Services and Support

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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**.

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