150 MHz, 200 MS/s, 12-Bit Digitizers

NI 5124

- 2 channels simultaneously sampled at 12-bit resolution
- 200 MS/s real-time and 4.0 GS/s random interleaved sampling
- 150 MHz bandwidth
- 200 mV_{pp} to 20 V_{pp} input ranges
- >75dBc SFDR
- 8, 32, 256, or 512 MB of memory per channel
- Edge, window, hysteresis, video, and digital triggering with 50 ps timestamping

Operating Systems
- Windows 2000/NT/XP

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio

Driver Software (included)
- NI-SCOPE
- LabVIEW Express VIs
- Scope Soft Front Panel
- NI Spectral Measurements Toolkit (with 32, 256 and 512 MB models)

Overview

National Instruments 5124 high-resolution digitizers feature two 200 MS/s simultaneously sampled input channels with 12-bit resolution, 150 MHz bandwidth, and up to 512 MB of memory per channel in a 3U PXI or PCI module. NI 5124 devices use the high-speed PCI bus and the scatter-gather bus mastering of the NI MITE ASIC to move data to the computer at speeds up to 100 times faster than traditional instrument interfaces, thereby dramatically decreasing overall test time. With the Synchronization and Memory Core (SMC) architecture of an NI 5124, you can create mixed-signal systems using signal generators and digital waveform generators/analyzers or build a high-channel-count digitizer with sub-nanosecond synchronization between channels.

Dual 200 MS/s, 12-Bit Input Channels for Time and Frequency Analysis

- 150 MHz input bandwidth with antialias and noise filters
- >75 dBc spurious-free dynamic range (SFDR)
- 4.0 GS/s equivalent time sampling for repetitive signals
- Independent channel selectable 200 mV_{pp} to 20 V_{pp} input ranges
- Independent channel selectable 50 Ω or 1 MΩ input impedance
- 2-year calibration cycle and 0 to 55 ˚C operating temperature

Deep Onboard Memory

- 8, 32, 256, or 512 MB of memory per channel
- Capture more than 1 million triggered waveforms with multiple record hardware rearm
- Stream data continuously from onboard memory to host memory or disk

Triggering, Clocking, and Synchronization

- Edge, window, hysteresis, video, digital, triggering with 50 ps timestamping
- Pre and posttrigger acquisition in single and multiple-record mode
- Internal 200 MHz clock or external clock from 50 to 210 MHz
- Phase lock to PXI 10 MHz reference or external reference from 1 to 20 MHz

Software

- IVI-compliant NI-SCOPE driver for LabVIEW, LabWindows/CVI, and Microsoft C++ and Visual Basic with more than 50 built-in measurements
- Scope Soft Front Panel for interactive control
- Spectral Measurements Toolkit for sophisticated frequency-domain measurements in communications, signal intelligence, and avionics applications

Applications
Communications
xDSL
Wireless communications
Baseband I & Q
Consumer Electronics
DVD, DVD-R, and PVR
Set top box
Gaming console
Biomedical and Scientific Research
Ultrasonic medical imaging
Mass spectrometry
Particle physics
Aerospace/Defense
Emulation of IC communications
Consumer Electronics
RADAR, SONAR, and LIDAR
Satellite
Signal intelligence

Ordering Information

NI PCI-5124 .....779171-0M[1]
NI PXI-5124 .....778757-0M[2]
Includes NI-SCOPE driver and Scope Soft Front Panel. 32, 256, and 512 MB models include NI Spectral Measurements Toolkit.
[1]M (memory per channel): 1 (8 MB), 2 (32 MB), 3 (256 MB)
[2]M (memory per channel): 1 (8 MB), 2 (32 MB), 3 (256 MB), 4 (512 MB)

Recommended PXI Switch
NI PXI-2593 778793-01

NATIONAL INSTRUMENTS™

150 MHz, 200 MS/s, 12-Bit 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
Resolution ..... 12 bits
Bandwidth (-3 dB)

Full Scale Input Range	50 Ω	1 MΩ
400 mV, 1 V, 2 V, 5 V, 10 V, 20 V	150 MHz	145 MHz[1]
200 mV	85 MHz	75 MHz

Bandwidth limit filters
(software selectable) ..... 20 MHz noise (2-pole Bessel)
60 MHz antialias (4-pole elliptical)
Maximum sampling rate ..... 200 MS/s real-time, 4 GS/s random interleaved sampling
Onboard sample memory ..... 8, 32, 256, or 512 MB per channel
(4, 16, 128, 256 million samples)
Pre and posttrigger data points[2] ..... 0 to 100% of full record length

	Memory per channel (MB)	Maximum number of records
Multiple records acquisition (0 to 100% pre and posttrigger data)	8	32,768
	32	131,072
	256	1,048,576
	512	2,097,152

Input impedance ..... 50 Ω and 1 M Ω ll 25 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_{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

[1]Bandwidth on the 1 MΩ input is 145 MHz for 0 to 40 °C and 135 MHz for 40 to 55 °C
[2]NI 5124 is also capable of continuous acquisition

Accuracy

DC accuracy (0 V offset setting)

Full Scale Input Range	50 Ω and 1 MΩ	
	PXI	PCI
200 mV, 400 mV	±0.65% of Input ±1.3 mV	±0.65% of Input ±1.8 mV
1 V, 2 V	±0.65% of Input ±1.5 mV	±0.65% of Input ±2.1 mV
4 V, 10 V, 20 V	±0.65% of Input ±10.0 mV	±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	±0.5 dB, DC to 20 MHz ±1 dB, 20 MHz to 50 MHz ±1.7 dB, 50 MHz to 100 MHz
	200 mV	±0.6 dB, DC to 20 MHz ±1.5 dB, 20 MHz to 40 MHz
Antialias Filter On	All ranges	-1 dB to +2 dB, DC to 55 MHz

AC amplitude accuracy (50 kHz) ..... 50 Ω: ±0.06 dB
1 MΩ: ±0.09 dB
Channel-to-channel crosstalk ..... ≤-85 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	THD	SNR	SINAD
200 mV	75 dB	-74 dBc	57 dB	57 dB
400 mV	75 dB	-74 dBc	58 dB	58 dB
1 V	72 dB	-72 dBc	58 dB	58 dB
2 V	72 dB	-72 dBc	58 dB	58 dB
4 V	65 dB	-63 dBc	–	–
10 V	65 dB	-63 dBc	–	–

Dynamic Performance (1 MΩ input impedance with 10 MHz, -1 dBFS input signal)

Full Scale Input Range	SFDR	THD	SNR	SINAD
200 mV	70 dB	-68 dBc	53 dB	53 dB
400 mV	70 dB	-68 dBc	55 dB	55 dB
1 V	70 dB	-68 dBc	57 dB	57 dB
2 V	70 dB	-67 dBc	57 dB	57 dB
4 V	67 dB	-66 dBc	56 dB	56 dB
10 V	60 dB	-58 dBc	–	–
20 V	60 dB	-58 dBc	–	–

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 (Noise filter enabled)

Full Scale Input Range	50 Ω	1 MΩ
200 mV	PXI 94 μV_{rms}, PCI 106 μV_{rms}	PXI 104 μV_{rms}, PCI 116 μV_{rms}
400 mV	188 μV_{rms}	192 μV_{rms}
1 V	470 μV_{rms}	480 μV_{rms}
2 V	940 μV_{rms}	960 μV_{rms}
4 V	1.88 mV_{rms}	1.92 mV_{rms}
10 V	4.7 mV_{rms}	4.8 mV_{rms}
20 V (1 MΩ only)	–	9.4 mV_{rms}

Intermodulation distortion[3] (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

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

Acquisition Modes

Real-time sampling rate ..... 200 MS/s to 3.052 kS/s sample rate
Random interleave sampling (RIS) ..... 4 GS/s to 400 MS/s sample rate (repetitive signals only)

Timebase System

Total sample clock jitter[4] ..... ≤1 ps_{rms}

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

Internal

Internal sample clock frequency ..... 200 MS/s sampling rate with
decimation by n where 1≤ n ≤ 65,535
Timebase accuracy ..... ±25 ppm (±0.0025%)

External

External clock sources ..... CLK IN (SMB connector), PXI star
External clock range ..... 50 to 210 MHz, variable with
decimation by n where 1≤ n ≤ 65,535
External reference sources ..... CLK IN (SMB connector), PXI backplane 10 MHz, RTSI 7
External reference range ..... 1 to 20 MHz in 1 MHz increments
External clock/reference amplitude ..... Sine wave: 0.65 to 2.8 Vpp (0 to 13 dBm)
Square wave: 0.2 to 2.8 Vpp
External clock/reference impedance ..... 50 Ω, AC coupled

Trigger System

Modes ..... Edge, Hysteresis, Window, Video, Digital, Immediate, Software
Source ..... CH 0, CH 1, TRIG, PXI_Trig <0:6>, PFI <0:1>, PXI Star, Software RTSI <0...6>
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
decreasing to 10% FS at 150 MHz
TRIG: 2.5% up to 100 MHz decreasing to 10% at 200 MHz
Level accuracy ..... CH0, CH1: ±4.7% FS up to 10 MHz
TRIG: ±3.5% FS up to 10 MHz
Time resolution ..... 50 ps with time-to-digital converter enabled
Holdoff[5] ..... 2 µs to 85.899 s, software selectable

[5]Time-digital converter disabled

External Trigger Channel (TRIG)

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

Power Requirements (typical)

	+3.3 VDC	+5 VDC	+12 VDC	-12 VDC	Total Power (W)
PXI	1.3	1.7	0.13	0.27	17.6
PCI	1.3	2.7	0.13	0	19.4

Environment

Operating temperature[6] ..... PXI: 0 to 55 °C (Meets IEC-60068-2-1 and IEC-60068-2-2)
PCI: 0 to 45 °C (Meets IEC-600680-2-1 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)

[6]0 to 45 °C in PXI-101x and 1000/B chassis

Calibration

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

Certification and Compliances CE

CE Mark compliance
For detailed specifications on power, environmental, safety, and physical dimensions see PXI-5124 or PCI-5124 detailed specifications.

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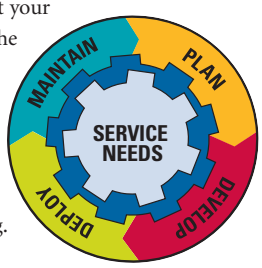

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