

High-Speed Digitizers – Optimized for Automated Test

NI 5154, NI 5153, NI 5152 **NEW!**

- 2 GS/s maximum real-time sample rate
- 1 GHz, 500 MHz, and 300 MHz bandwidths
- 8-bit resolution
- 8, 64, or 256 MB memory per channel
- Edge, window, hysteresis, digital, immediate, and software triggering
- PXI and PCI versions

Calibration

- Gain, offset, triggering, and timing self-calibration
- 2-year external calibration interval

Operating Systems

- Windows Vista/XP/2000
- LabVIEW Real-Time

Recommended Software

- LabVIEW
- LabWindows™/CVI
- Measurement Studio for Visual Studio
- LabVIEW SignalExpress

Driver Software (included)

- NI-SCOPE driver
- LabVIEW Express VIs
- NI-SCOPE Soft Front Panel



Overview

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

RADAR, SONAR, and LIDAR
Satellite
Signal intelligence

NI 515x high-speed digitizers/PC-based oscilloscopes provide the industry's first gigahertz solutions optimized for automated test. A digitizer optimized for automated test leverages a high-throughput bus to lower test times, provides picosecond-level synchronization between modules, and integrates with the entire suite of NI hardware – including arbitrary waveform generators, high-speed digital I/O, and other digitizers – so you can build and customize a complete mixed-signal

or high-channel-count test system.

Dual 1 GS/s, 8-Bit Input Channels

- 2 GS/s real-time sampling on 1 channel
- 1 GS/s real-time sampling on 2 channels, simultaneously sampled
- 1 GHz (NI 5154), 500 MHz (NI 5153), or 300 MHz (NI 5152) input bandwidth with noise filters
- 20 GS/s equivalent-time sampling (ETS) for repetitive signals
- 2-year calibration interval and 0 to +55 °C operating temperature

Deep Onboard Memory

- Take advantage of 8, 64, or 256 MB of memory per channel
- Capture more than 1 million triggered waveforms in multiple record mode with trigger rearm time as fast as 1 μ s
- Stream data continuously from onboard memory to host memory or disk

Triggering, Clocking, and Synchronization

- Edge, window, hysteresis, and digital triggering with 5 ps timestamping
- Pretrigger and posttrigger acquisition in single- and multiple-record mode
- Internal 1 GHz clock or external clock from 350 MHz to 1 GHz
- Phase lock to PXI 10 MHz reference or external reference from 1 to 20 MHz

Software

- IVI-compliant NI-SCOPE driver for NI LabVIEW, LabWindows/CVI, Microsoft C++, and Visual Basic
- NI-SCOPE Soft Front Panel for interactive control
- More than 50 built-in measurements with NI-SCOPE

Ordering Information

NI PXI-5154	780319-0M ¹
NI PCI-5154	780320-0M ¹
NI PXI-5153	780317-0M ¹
NI PCI-5153	780318-0M ¹
NI PXI-5152	779772-0M ¹
NI PCI-5152	779945-0M ¹

¹M (memory per channel): 1 (8 MB), 2 (64 MB), 3 (256 MB)

Includes NI-SCOPE driver and NI-SCOPE Soft Front Panel

BUY NOW!

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

High-Speed Digitizers – Optimized for Automated Test

NI High-Speed Digitizers: Optimized for Automated Test

Prior to these products, high-bandwidth digitizers and oscilloscopes have incorporated features and functionality best suited for benchtop use. An unaddressed area in this high-bandwidth space has been the automated test use model, where measurement throughput and test system footprint can dramatically affect overall cost of test.

NI high-speed digitizers are the first high-bandwidth digitizers on the market that share three characteristics making them uniquely optimized for automated test: high data throughput, tight synchronization between channels, and ease of integration with other instrumentation.

High Data Throughput

Bus bandwidth and latency, two common considerations for an automated test system, dictate the overall speed of your measurement system. Latency describes the amount of time it takes for an instrument to respond to a remote command, like a measurement query. Bus bandwidth refers primarily to the data throughput capacity of the data bus that connects the measurement instrument with the host PC or controller.

The PXI platform – upon which NI high-speed digitizers are built – provides high speed due to the high-bandwidth and low-latency PCI and PCI Express buses. Both PXI and PXI Express data throughput rates are significantly faster than that of GPIB, USB, or LAN – other popular buses for automating test instrumentation. This translates to lower test times.

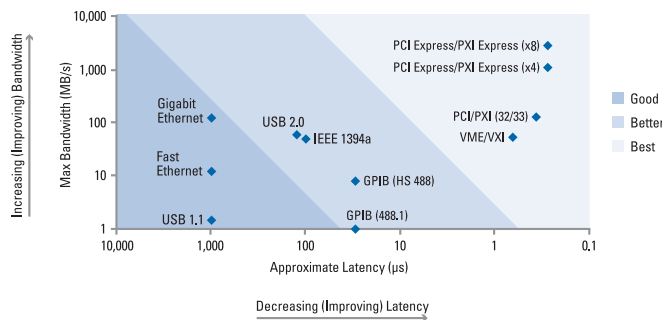


Figure 1. The PXI platform provides the best combination of high-bandwidth and low-latency measurement throughput.

Tight Synchronization between Channels

The PXI backplane offers a built-in common reference clock for synchronization of multiple digitizers in a measurement or control system. Each slot has a 10 MHz TTL clock, transmitted on equal-length traces, providing picosecond-level synchronization between digitizer modules for high-channel-count systems. For example, it is possible to have 34 phase-synchronous 1 GS/s channels in a single PXI chassis, and even scale to higher channel counts.

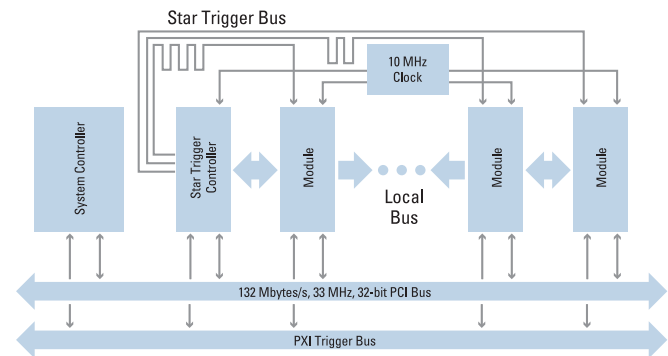


Figure 2. The PXI platform delivers picosecond-level synchronization between instrument modules.

Ease of Integration with Other Instrumentation

Test systems typically contain many instrument types, including signal sources, measurement devices, and switches. The PXI platform has unparalleled breadth, with modules for analog and digital I/O, high-speed instrumentation, vision, motion, and numerous bus interfaces. More than 1,500 PXI modules are available from the more than 70 members of the PXI Systems Alliance (PXISA). So you can not only build a comprehensive test system in a single chassis but also synchronize modules in that chassis to picosecond-level accuracy when using NI modular instrumentation.



Figure 3. The PXI platform supports more than 1,500 instrument modules.

High-Speed Digitizers – Optimized for Automated Test

Achieve Flexible Performance Using NI Software-Defined Instrumentation

NI high-speed digitizers offer several advantages over traditional stand-alone oscilloscopes by delivering an open architecture and flexible software. With an NI digitizer, you can not only perform standard oscilloscope measurements but also easily build other instruments such as spectrum analyzers, transient recorders, and ultrasonic receivers. And NI offers a comprehensive library in LabVIEW of prebuilt functions and example programs geared at getting you up and running quickly.

Open Architecture: NI-SCOPE Driver and the Application Programming Interface (API)

Using the full power of a PC-based measurement device requires the ability to programmatically define and control its behavior. You can programmatically control all NI digitizers using the NI-SCOPE instrument driver, which provides:

- High-level functions for getting started quickly as well as low-level control for accessing all the digitizer features
- More than 50 prewritten example programs that illustrate how to access the full functionality of any NI digitizer
- Programming examples available for LabVIEW, C++, and Visual Basic

Flexible Software: Define Your Instrument

In an automated test environment, there are times when the ability to quickly troubleshoot an issue is crucial. For those occasions, the NI-SCOPE driver offers the measurement features and responsiveness of a traditional benchtop oscilloscope through the NI-SCOPE Soft Front Panel user interface. Take advantage of the more than 50 prebuilt measurement and analysis functions included with the software.

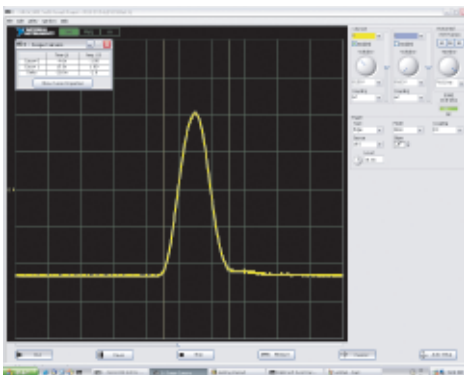


Figure 4. The NI-SCOPE Soft Front Panel provides measurement features and responsiveness comparable to traditional benchtop oscilloscopes.

For rapid initiation of an automated test sequence, use preconfigured Express VIs to quickly set up your digitizer to immediately acquire data. LabVIEW SignalExpress is an interactive environment you can use to acquire, analyze, and log your data with no programming required.

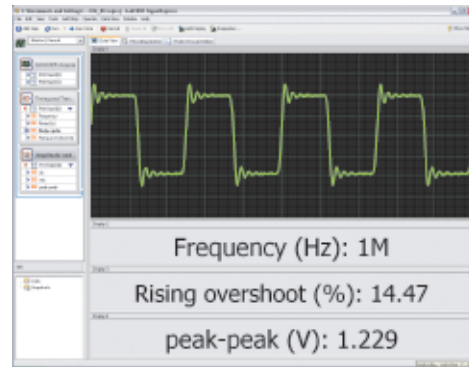


Figure 5. With LabVIEW SignalExpress, you can quickly set up your digitizer to immediately acquire data.

While a quick signal check is valuable at times, other circumstances may call for custom measurements. Stand-alone instrumentation, such as dedicated oscilloscopes and spectrum analyzers, delivers common functions that appeal to the needs of many engineers. As you can imagine, these standard functions do not meet every application need, particularly in automated test applications. But with LabVIEW and the NI-SCOPE API, the digitizer that you use as a general-purpose oscilloscope for one application can be used as a custom instrument for more specialized measurements.



Figure 6. Custom measurements, such as those required for mass spectrometry, are enabled through the combination of LabVIEW and NI modular instruments.

High-Speed Digitizers – Optimized for Automated Test

Specifications

These specifications are valid for 0 to 55 °C unless otherwise stated.

Acquisition System

Number of channels..... 2 simultaneously sampled
 Vertical resolution..... 8 bits
 Bandwidth (-3 dB)
 NI 5154..... 1 GHz minimum
 NI 5153..... 500 MHz minimum
 NI 5152:

Range (V _{pp})	50 Ω	1 MΩ
All except 0.1	340 MHz, typical 300 MHz, minimum	300 MHz, typical 260 MHz, minimum
0.1	165 MHz, typical 135 MHz, minimum	135 MHz, typical 110 MHz, minimum

Bandwidth limit filters
 (software-selectable) 20 MHz noise filter
 Maximum sampling rate..... 1 GS/s (2 ch) or 2 GS/s (1 ch)
 real-time sampling, 20 GS/s
 equivalent-time/random-
 interleaved sampling
 Onboard sample memory 8, 64, or 256 MB per channel
 (8, 64, or 256 million samples)

Multiple Record Acquisition	
Memory/Channel	Maximum Number of Records
8 MB	32,768
64 MB	100,000 ¹
256 MB	100,000 ¹

¹More than 1 million in streaming configuration

Full-scale input ranges
 NI 5154 and NI 5153:

Full-Scale Input Range					
Ranges (V _{pp})					
0.1	0.2	0.5	1	2	5

NI 5152:

Full-Scale Input Range and Programmable Vertical Offset			
50 Ω		1 MΩ	
Range (V _{pp})	Vertical Offset Range (V)	Range (V _{pp})	Vertical Offset Range (V)
0.1	±1	0.1	±1
0.2	±1	0.2	±1
0.4	±1	0.4	±1
1	±1	1	±1
2	±6	2	±10
4	±5	4	±10
10	±2	10	±10

Input impedance
 NI 5154, NI 5153 50 Ω
 NI 5152 50 Ω and 1 MΩ || 22 pF,
 software-selectable
 Maximum input overload..... 50 Ω: 7 V_{rms} with I_{peaks} ≤ 10 V
 1 MΩ: I_{peaks} ≤ 42 V (NI 5152)

Input coupling
 NI 5154, NI 5153 AC, DC
 NI 5152 AC, DC, GND
 AC coupling cutoff frequency (-3 dB)
 NI 5154, NI 5153 114 kHz, 50 Ω
 NI 5152 106 kHz, 50 Ω; 12 Hz, 1 MΩ

Accuracy

DC Accuracy

NI 5154	Typical	0.1 to 1 V _{pp}	±(1.0% of Input + 1.3% of FS)
		2 to 5 V _{pp}	±(1.4% of Input + 1.3% of FS)
NI 5153	Typical	0.1 to 1 V _{pp}	±(1.0% of Input + 1.3% of FS)
		2 to 5 V _{pp}	±(1.4% of Input + 1.3% of FS)
NI 5152	Typical	0.1 to 1 V _{pp}	±(1.26% of Input + 1.0% of FS + 500 μV)
		2 to 5 V _{pp}	±(1.26% of Input + 1.0% of FS + 5 mV)

Channel-to-channel crosstalk <-80 dB at 10 MHz,
 <-60 dB at 100 MHz

Spectral Characteristics

		Noise Filter ON	Noise Filter OFF
NI 5154	ENOB	7.3	6.7
	Signal-to-noise-and-distortion (SINAD) ratio, typical	45 dB	41 dB
NI 5153	ENOB	7.3	6.7
	Signal-to-noise-and-distortion (SINAD) ratio, typical	45 dB	41 dB
NI 5152	ENOB	7.3	7.1
	Signal-to-noise-and-distortion (SINAD) ratio, typical	45 dB	43 dB

Timebase System

Timebase options Internal, external (PFI 0)

Internal

Internal sample clock frequency 1 GS/s sampling rate with
 decimation by n, 1 ≤ n ≤ 65,535
 Timebase accuracy² ±25 ppm (±0.0025%)
 if phase-locked to 10 MHz
 backplane clock

²Accuracy will improve when phase-locking to a more accurate reference, such as an NI PXI-665x timing and synchronization module, which can provide timebase accuracy down to ±50 ppb.

External

External clock sources PFI 0 (SMB connector)
 External clock range..... 350 MHz to 1 GHz, variable
 with decimation by n where
 1 ≤ n ≤ 65,535
 External reference sources PXI_CLK10 (backplane connector);
 PFI 0 (front panel SMB connector)
 External reference range 1 to 20 MHz in 1 MHz increments;
 default to 10 MHz
 External clock/reference amplitude Sine wave: 0.65 to 2.8 V_{pp}
 (0 to 13 dBm)
 External clock/reference impedance.... 50 Ω, AC coupled

High-Speed Digitizers – Optimized for Automated Test

Trigger System

Modes	Edge, hysteresis, window, digital, immediate, software
Sources.....	CH 0, CH 1, TRIG, PFI <0..1> PXI_Trig <0..6>, PXI Star Trigger, and Software
Slope	Rising or falling
Hysteresis.....	Fully programmable
High-frequency reject filter.....	50 kHz software-selectable
Low-frequency reject filter	50 kHz software-selectable
Sensitivity	
CH 0 and CH 1	
NI 5154.....	15% FS
NI 5152, NI 5153.....	10% FS
TRIG	
NI 5154.....	15% FS
NI 5153.....	10% FS
NI 5152.....	5% FS
Level accuracy	
CH 0, CH 1	±5% FS up to 10 MHz
TRIG	±1 V up to 10 MHz
Time resolution	5 ps with time-to-digital converter enabled
Holdoff.....	From Rearm Time up to $[(2^{32} - 1) \times \text{Sample Clock Period}]$

External Trigger Channel (TRIG)

Impedance	
NI 5154, NI 5153	2.25 k Ω
NI 5152	1 M Ω 22 pF
Vertical range.....	±5 V
Coupling	
NI 5154, NI 5153	DC
NI 5152	AC, DC

Intermodule SMC Synchronization Using NI-TClk (typical)

Skew.....	500 ps, ≤5 ps after manual adjustment
-----------	---------------------------------------

Power Requirements (typical)

		+3.3 VDC (A)	+5 VDC (A)	+12 VDC (mA)	-12 VDC (mA)	Total Power (W)
NI 5154	PXI	1.7	1.8	520	200	23.25
	PCI	2.3	2.3	214	0	21.66
NI 5153	PXI	1.7	1.8	520	200	23.25
	PCI	2.3	2.3	214	0	21.66
NI 5152	PXI	1.1	1.9	500	210	21.65
	PCI	2.5	2.4	200	0	22.65

Environment

Operating temperature	0 to +55 °C in all NI PXI chassis except the following: 0 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 to +71 °C (meets IEC 60068-2-1 and IEC 60068-2-2)
Relative humidity	10 to 90%, noncondensing (meets IEC 60068-2-56)

Calibration

Self-calibration.....	Gain, offset, triggering, and timing for all input ranges; 1 M Ω attenuator (NI 5152 only)
External calibration interval.....	2 years

Certification and Compliances

CE Mark Compliance
For detailed specifications, visit ni.com/manuals.
For certifications, marks, and DoCs, visit ni.com/certification.

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.

Training and Certification

NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit ni.com/training.

Professional Services

Our Professional Services Team is composed of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and

integrators. Services range from start-up assistance to turnkey system integration.

Visit ni.com/alliance.



OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Local Sales and Technical Support

In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at ni.com/support.

We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit 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.

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.

Repair and Extended Warranty

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit ni.com/services.



ni.com • 800 813 3693

National Instruments • info@ni.com

