Product Flyer

PXI Waveform Generators

ni.com

Contents

PXI Waveform Generators

PXIe-5413, PXIe-5423, PXIe-5433

- Software: Includes InstrumentStudio™ support for interactive measurements, API support for LabVIEW and text-based languages, shipping examples, and detailed help files
- One or two 16-bit channels updated at 800 MS/s with 20, 40, and 80 MHz bandwidth
- Maximum ±12 V and minimum ±7.75 mV output ranges
- Up to 34 channels to build parallel, high-channel-count systems in a single PXI chassis
- Waveform sequencing and streaming with a PCI Express x4 Gen 1 link

The Right Waveform Generators for Your Automated Test System

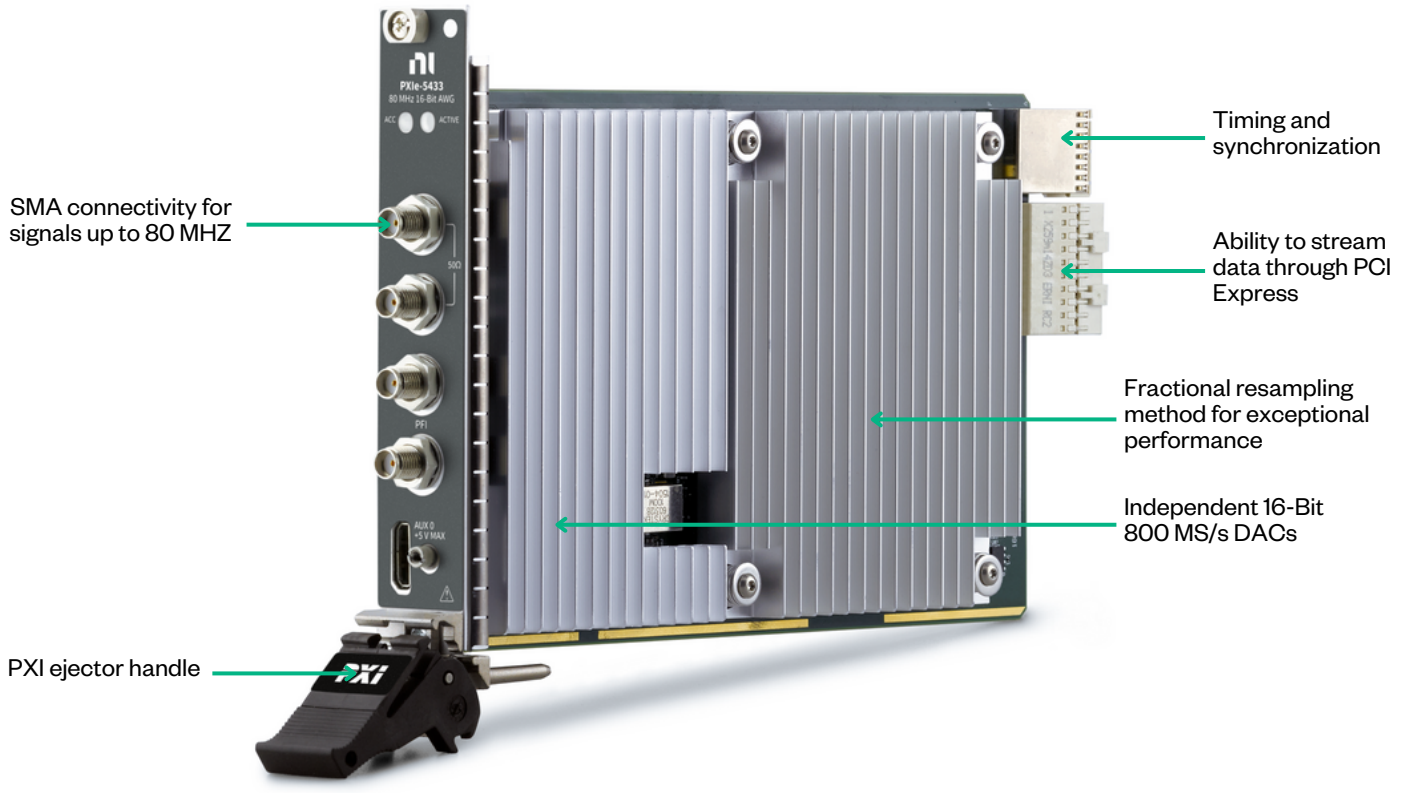
The new PXIe-5413, PXIe-5423, and PXIe-5433 arbitrary waveform generators deliver -92 dB of spurious-free dynamic range and 435 fs integrated system jitter while providing precise waveform adjustment when used with a dedicated standard waveform generation engine. With a new fractional resampling architecture for arbitrary waveform generation, similar dynamic range and jitter performance are available independent of your sample rate. You also benefit from the high-speed waveform streaming capabilities and multiple-instrument synchronization synonymous with PXI.

PXI Waveform Generators

	PXIe-5413	PXIe-5423	PXIe-5433
Bandwidth	20 MHz	40 MHz	80 MHz
DAC Resolution; Update Rate	16-Bit; 800 MS/s	16-Bit; 800 MS/s	16-Bit; 800 MS/s
Maximum User-Programmable Arbitrary Waveform	200 MS/s	200 MS/s	400 MS/s Filter On 250 MS/s Filter Off
Channels	1 or 2	1 or 2	1 or 2
Memory	128 MB or 256 MB	128 MB or 256 MB	512 MB or 1 GB
Maximum Voltage	±6 V into 50 Ω ±12 V into High-Z	±6 V into 50 Ω ±12 V into High-Z	±6 V into 50 Ω ±12 V into High-Z
Scripting	No	Yes	Yes
Streaming	No	Yes	Yes

Table 1: NI offers waveform generators ranging from standard function generators to powerful arbitrary waveform generators capable of waveform streaming.

Detailed View of PXIe-5433 Arbitrary Waveform Generator



Key Features

PXI Express Waveform Generator Analog Performance

Modern engineering challenges require increasing signal fidelity and accuracy. PXIe-54x3 instruments use one or two independent, 16-bit digital-to-analog converters (DACs) to generate signals with excellent sine wave flatness throughout the passband. The built-in digital filtering of these waveform generators provides pure, smooth signals with an option to forgo frequency-domain purity for faster rise times and time-domain signal behavior.

Sine Wave Flatness Performance

PXI Waveform Generators include flatness calibration that results in accurate sine wave performance to the full bandwidth of the device. Whereas traditional devices often have a characteristic roll-off approaching the stated instrument bandwidth, PXIe-54x3 arbitrary waveform generators correct for the roll-off to provide consistent performance over frequency.

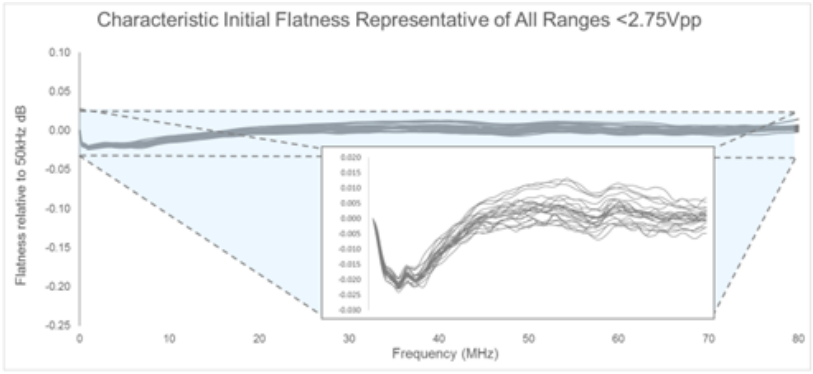


FIGURE 1

PXI Express waveform generators are designed to generate sine signals with very flat amplitude throughout the instruments' passband.

Digital Filtering

The data path of PXI-54x3 arbitrary waveform generators features digital filtering designed to remove unwanted frequency images from the generated signal in arbitrary generation mode that is not available in other modes. With many arbitrary waveform generators, frequency images of the generated signal occur at multiples of the programmed sample rate. When the filter is enabled, the bandwidth of the output signal is limited and the images are removed, which results in purer, cleaner output signals. The only drawback is that the slew rate of any substantial changes in signal amplitude is reduced because high-frequency components of the signal are removed. You can disable the filtering so the high-frequency contents are included in the signal, which results in the output voltage changing as fast as possible between samples in user-programmed waveforms.

Fractional Resampling

PXIe-54x3 arbitrary waveform generators output all waveforms, including standard and arbitrary waveforms, with a DAC update rate of 800 MS/s. An algorithm implemented on the Xilinx Kintex-7 FPGA is used to up sample user-defined arbitrary waveforms. The maximum rate allowed for arbitrary waveforms uploaded to the PXIe-5413 and PXIe-5423 is 200 MS/s. The PXIe-5433 can accept user-defined waveforms up to 400 MS/s when the digital filter is enabled and 250 MS/s when it is disabled. Increasing the sample rate in an arbitrary waveform can improve the time-domain performance by delivering faster slew rates and smoother waveform behavior. Additional samples can significantly improve frequency-domain purity by smoothing point-to-point transitions and eliminating frequency images.

Frequency List Output Mode

You can use Frequency List output mode to quickly step through a predefined list of frequency values of the standard function mode and create frequency hopping and sweeping. This helps you take the host software out of the process and allows you to advance the list by using digital triggers or hardware-timed internal counters. The Frequency List output mode engine adjusts the frequency in a phase-continuous manner. Because of this phase continuity, you can put together a sweep by creating a series of small steps with hardware counter timing. Using this feature, you can significantly reduce the time of tests involving a series of standard function generations without having to create arbitrary waveform sequences.

Independent Generation Engines and Sequencing

When using PXI-54x3 arbitrary waveform generators, note that each channel has a separate generation engine producing the output signal. This provides a distinct advantage over other 2-channel instruments that may have only one engine.

If an instrument has only one engine, its channels must share much of their configuration and execution. For example, the two channels of a waveform generator with one engine would potentially need to share triggers, markers, and engine events. By having two separate engines in the waveform generator, each channel can have its own configuration for triggers and markers and even waveform scripts. With the PXIe-54x3 arbitrary waveform generators, only the reference clock source and specific hardware resources must be shared. For example, the two engines must share the only external PFI trigger input, but PXI offers many internal system triggers, so engines don't have to share those.

Most importantly, the channels of a waveform generator with two separate generation engines can start and stop generating signals completely independently of one another. This feature can ultimately result in higher channel density or fewer PXI slots being used in a test system. Some applications require multiple, independently operating channels. If your waveform generator does not have independent generation engines, your application may require two devices and, therefore, two PXI slots.

Automated Test Features

The PXI instrumentation platform was created to provide automated test with fast data buses and multi-instrument triggering. The PXIe-54x3 waveform generators expand on these built-in PXI features with independent generation engines in each multichannel instrument and the Frequency List output mode for fast execution of frequency sweeps.

FIGURE 2

You can couple PXIe-54x3 waveform generators with any of NI's 600 PXI modules or the 1,500 PXI modules available from nearly 60 vendors to make smarter test systems.

Synchronization and Integration

NI oscilloscopes use the inherent timing and synchronization capabilities of the PXI platform to communicate with switches and other instruments within the PXI chassis. Using the timing features of the PXI chassis and additional timing software, you can achieve synchronization of <10 ps between channels of multiple oscilloscopes. NI oscilloscopes can also "handshake" with NI waveform generators by sending and receiving hardware-timed triggers over the PXI backplane, scanning through a list of frequencies in a scan list stored in memory onboard the waveform generator. This method of scanning removes the software overhead associated with traditional scan lists and helps you create a deterministic scan list for faster test execution with more repeatable timing.

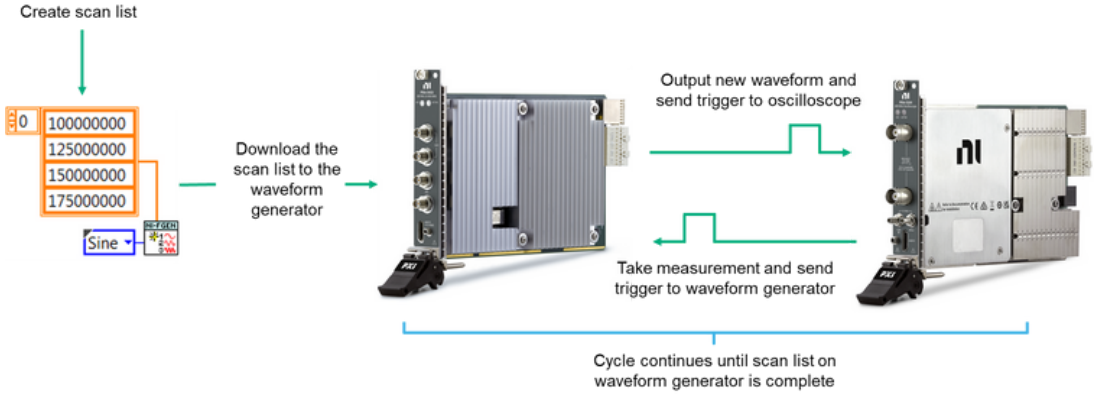


FIGURE 3

Timing and synchronization between a waveform generator and oscilloscope.

You also can implement the timing and synchronization of multiple instruments through NI-TClk. It aligns the sample clocks of multiple instruments in a single chassis or across multiple chassis using a timing and control module to distribute the 10 MHz reference clock and triggers from a master chassis to all worker chassis. Learn more about NI-TClk timing and synchronization.

Self-Calibration and Two-Year Guarenteed Specifications

NI waveform generators offer self-calibration, which is a unique feature that corrects for all DC gain and offset drifts within the instrument using a precision analog-to-digital converter internal to the instrument. By using the self-calibration feature, you can make NI waveform generators highly accurate and stable at any operating temperature.

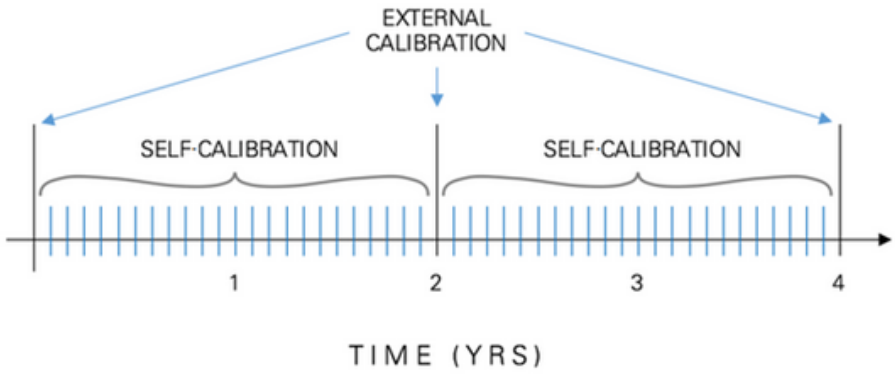


FIGURE 4

NI Self-Calibration

Performing self-calibration takes only a few minutes and requires no external calibrator, which minimizes the maintenance burden of deployed systems. Visit ni.com to learn more about NI's calibration services.

Software Overview

NI-FGEN Driver and Application Programming Interface (API)

In addition to the soft front panel, the NI-FGEN driver includes a best-in-class API that works with a variety of development options such as LabVIEW, C, C#, and others. To ensure long-term interoperability of waveform generators, the NI-FGEN driver API is the same API used for all past and current NI waveform generators. The driver also provides access to help files, documentation, and dozens of ready-to-run shipping examples you can use as a starting point for your application.

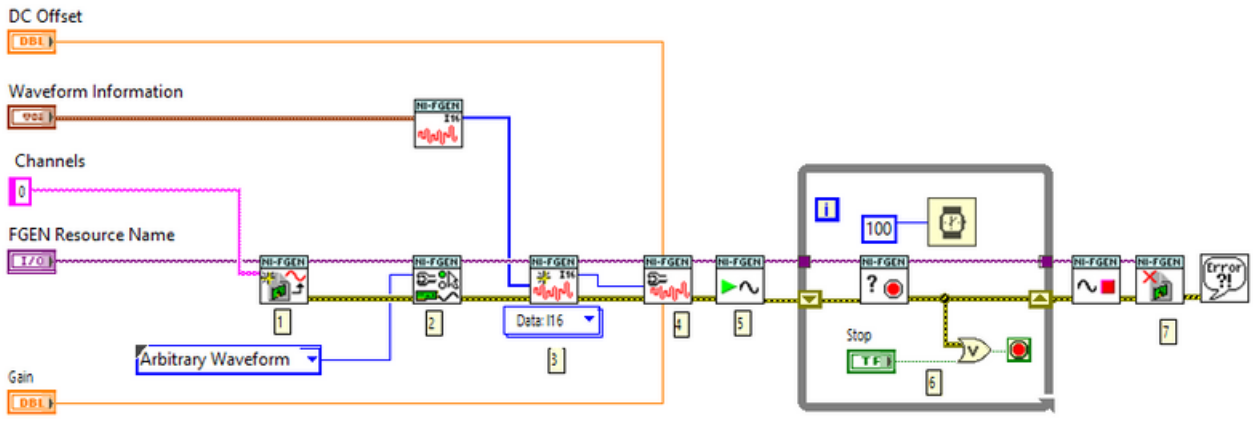


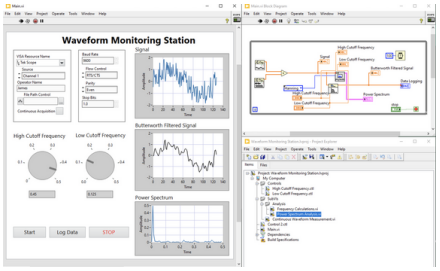
FIGURE 5

Simple LabVIEW code helps you get started taking measurements using NI-FGEN.

NI Software-The Right Tool for the Job

NI has a variety of software for engineers working on research, validation, and production test applications. Learn about our software that helps engineers perform quick ad-hoc tests, build an automated test system, automate data analysis and reporting, develop test sequences, and more.

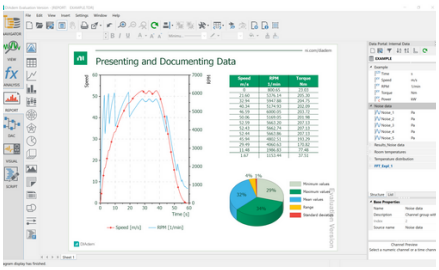
LabVIEW



Graphical programming environment that engineers use to develop automated research, validation, and production test systems.

- Acquire data from NI and third-party hardware and communicate using industry protocols
- Use configurable, interactive display elements
- Take advantage of available analysis functions

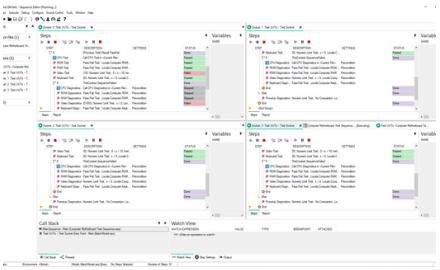
DIAdem



Data analytics software for measurement data search, inspection, analysis, and automated reporting.

- Display data in multiple 2D-axis systems
- Perform calculations with a simple point-and-click interface
- Automate your measurement data analysis workflow, from import to analysis

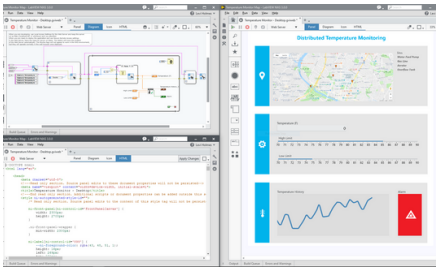
TestStand



Test executive software that accelerates system development for engineers in validation and production.

- Call and execute tests in LabVIEW, Python, C/C++, or .NET
- Conduct complex tasks, such as parallel testing
- Create customer operator interfaces and robust tools for deployment and debugging

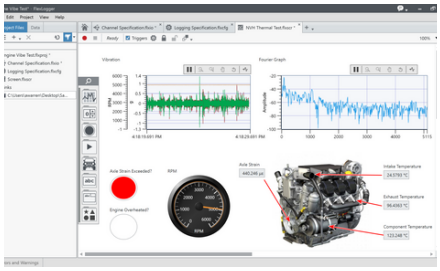
G Web



Development software that helps engineers create web-based user interfaces wihtout the need for traditional web development skills.

- Data transfer APIs for connecting to systems written in LabVIEW, Python, or C#
- Pre-built objects for data display and user input
- Included hosting on SystemLink™ Cloud

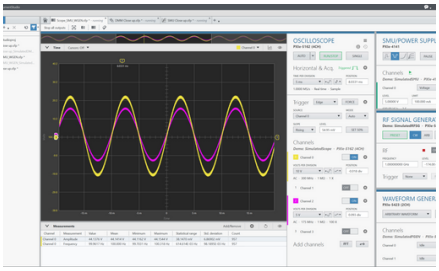
FlexLogger™



No-code data acquisition software engineers use to build validation and verification test applications.

- Interactive visualization tools for monitoring tests with drag-and-drop charts, graphs, and controls
- Ability to set alarms that monitor single channels or groups for unexpected behavior

InstrumentStudio™



Application software that simplifies setup and configuration of NI PXI hardware

- Customizable layouts for monitoring multiple instruments at once
- Interactively debug in tandem with code
- TDMS file export containing instrument settings, measurements, and raw data

What Is PXI?

A Platform Approach to Test and Measurement

Powered by software, PXI is a rugged PC-based platform for measurement and automation systems. PXI combines PCI electrical-bus features with the modular, Eurocard packaging of CompactPCI and then adds specialized synchronization buses and key software features. PXI is both a high-performance and low-cost deployment platform for applications such as manufacturing test, military and aerospace, machine monitoring, automotive, and industrial test. Developed in 1997 and launched in 1998, PXI is an open industry standard governed by the PXI Systems Alliance (PXISA), a group of more than 70 companies chartered to promote the PXI standard, ensure interoperability, and maintain the PXI specification.

Software

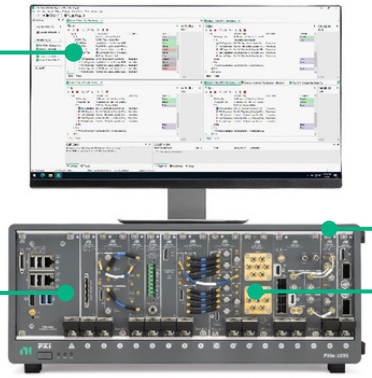
Test Management and Code Development

Code sequencing, database reporting, user management, operator interface, parallel execution, signal processing. LabVIEW, C/C++, .NET, Python

Computer

PXI Embedded Controller

Windows and Real-Time OS options, Intel Xeon processing, peripheral ports, display output, integrated hard drive



Timing and Synchronization

PXI Chassis

PCI Express Gen 3 throughput up to 24 GB/s sub-nanosecond latency, P2P streaming, integrated triggering

Instrumentation

PXI Modules

DC to mmWave, oscilloscope, programmable power supply, switch/MUX, DMM, VSA, VSG, VST, AWG, SMU, DAQ

Integrated with the Latest Commercial Technology

By leveraging the latest commercial technology for our products, we can continually deliver high performance and high-quality products to our users at a competitive price. The latest PCI Express Gen 3 switches deliver higher data throughput, the latest Intel multicore processors facilitate faster and more efficient parallel (multisite) testing, the latest FPGAs from Xilinx help to push signal processing algorithms to the edge to accelerate measurements, and the latest data converters from TI and ADI continually increase the measurement range and performance of our instrumentation.

HIGHER DATA THROUGHPUT

PCI Express Gen 3

PARALLEL TEST EXECUTION

Multicore Processors

MEASUREMENT ACCELERATION

FPGAs

INCREASED MEASUREMENT RANGE

Data Converters

PXI Instrumentation

NI offers more than 600 different PXI modules ranging from DC to mmWave. Because PXI is an open industry standard, nearly 1,500 products are available from more than 70 different instrument vendors. With standard processing and control functions designated to a controller, PXI instruments need to contain only the actual instrumentation circuitry, which provides effective performance in a small footprint. Combined with a chassis and controller, PXI systems feature high-throughput data movement using PCI Express bus interfaces and sub-nanosecond synchronization with integrated timing and triggering.

Oscilloscopes

Sample at speeds up to 12.5 GS/s with 5 GHz of analog bandwidth, featuring numerous triggering modes and deep onboard memory

Digital Multimeters

Perform voltage (up to 1000 V), current (up to 3A), resistance, inductance, capacitance, and frequency/period measurements, as well as diode tests

Digital Instruments

Perform characterization and production test of semiconductor devices with timing sets and per channel pin parametric measurement unit (PPMU)

Waveform Generators

Generate standard functions including sine, square, triangle, and ramp as well as user-defined, arbitrary waveforms

Frequency Counters

Perform counter timer tasks such as event counting and encoder position, period, pulse, and frequency measurements

Source Measure Units

Combine high-precision source and measure capability with high channel density, deterministic hardware sequencing, and SourceAdapt transient optimization

Power Supplies & Loads

Supply programmable DC power, with some modules including isolated channels, output disconnect functionality, and remote sense

FlexRIO Custom Instruments & Processing

Provide high-performance I/O and powerful FPGAs for applications that require more than standard instruments can offer

Switches (Matrix & MUX)

Feature a variety of relay types and row/column configurations to simplify wiring in automated test systems

Vector Signal Transceivers

Combine a vector signal generator and vector signal analyzer with FPGA-based, real-time signal processing and control

GPIB, Serial, & Ethernet

Integrate non-PXI instruments into a PXI system through various instrument control interfaces

Data Acquisition Modules

Provide a mix of analog I/O, digital I/O, counter/timer, and trigger functionality for measuring electrical or physical phenomena

Supporting Documentation

Table 2. PXI Waveform Generators Documentation

Document Type	Model
Getting Started Guide	PXIe-5413, PXIe-5423, PXIe-5433
Specifications	PXIe-5413, PXIe-5423, PXIe-5433

Configure a Custom NI System

NI's online system advisors help you create a custom system based on your specific requirements. Use the advisor to choose compatible hardware, software, accessories, and services and then save your selections as configurations for easy quoting and purchasing later. Visit ni.com/advisor to learn more.

NI Hardware Services

All NI hardware includes a one-year warranty for basic repair coverage and calibration in adherence to NI specifications prior to shipment. PXI systems also include basic assembly and a functional test. NI offers additional entitlements to improve uptime and lower maintenance costs with service programs for hardware. Learn more at ni.com/services/hardware.

	Hardware	Standard	Premium	Description
Duration at Point of Sale	1 year; included	3 years; optional	3 years; optional	NI enhances warranty coverage with additional service benefits provided with a hardware service program.
Maximum Duration with Renewal	≤3 years with service program	≤3 years	≤3 years	NI maintains the high performance and availability of your hardware for up to three years with a hardware service program.
Extended Repair Coverage	•	•	•	NI restores your device's functionality and includes firmware updates and factory calibration; <10 working days[4] + standard shipping.
System Configuration, Assembly, and Test[1]		•	•	NI technicians assemble, install software in, and test your system per your custom configuration prior to shipment.
Advanced Replacement [2]			•	NI stocks replacement hardware that can be shipped immediately if a repair is needed.
System Return Material Authorization (RMA)[1]			•	NI accepts the delivery of fully assembled systems when performing repair services.
Technical Support	•	•	•	NI provides access to support resources for your hardware.
Calibration Plan (Optional)		Standard	Expedited[3]	NI performs the requested level of calibration at the specified calibration interval for the duration of the service program.

1 This option is only available for PXI, CompactRIO, and CompactDAQ systems.
2 This option is not available for all products in all countries. Contact your local NI sales engineer to confirm availability.
3 Expedited calibration is only available for the Traceable calibration level.
4 This applies to non-RF products only. Standard extended repair coverage for RF products is <15 working days + standard shipping.

PremiumPlus Service Program

NI can customize the offerings listed above or offer additional entitlements such as on-site calibration, custom sparing, and lifecycle services through a PremiumPlus Service Program. Contact your NI sales representative to learn more.

Technical Support

NI hardware service programs and warranty include access to technical support provided by NI support agents during local business hours. Service requests can be managed online. Additionally, take advantage of NI's award-winning online resources and communities.