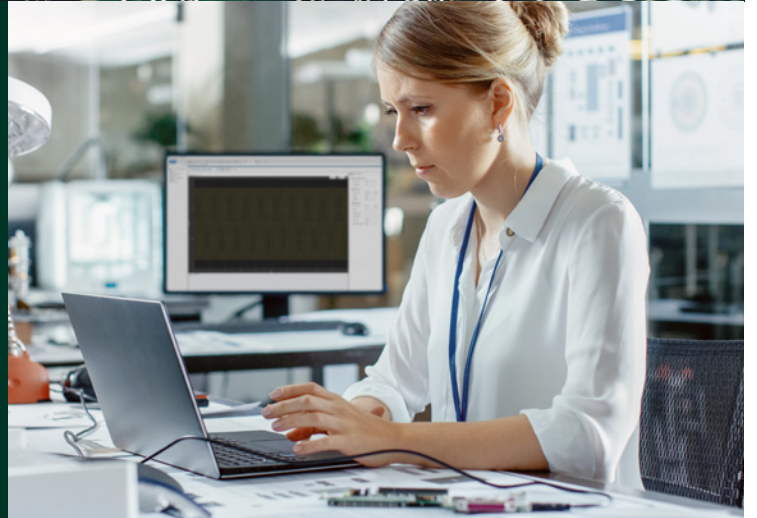
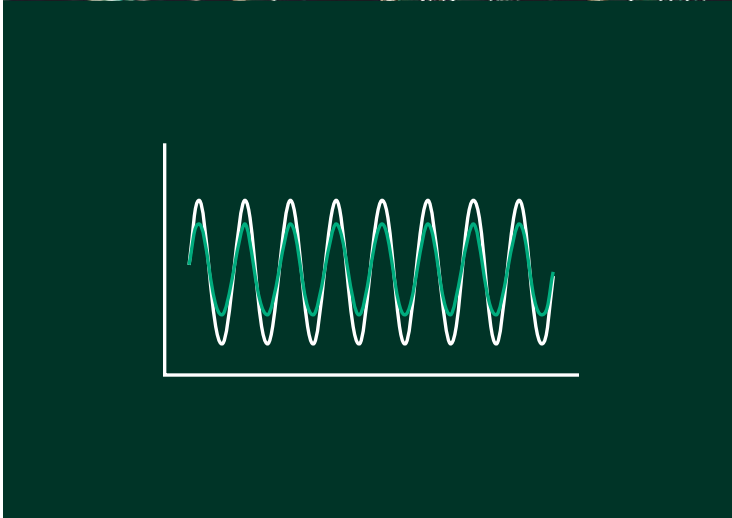
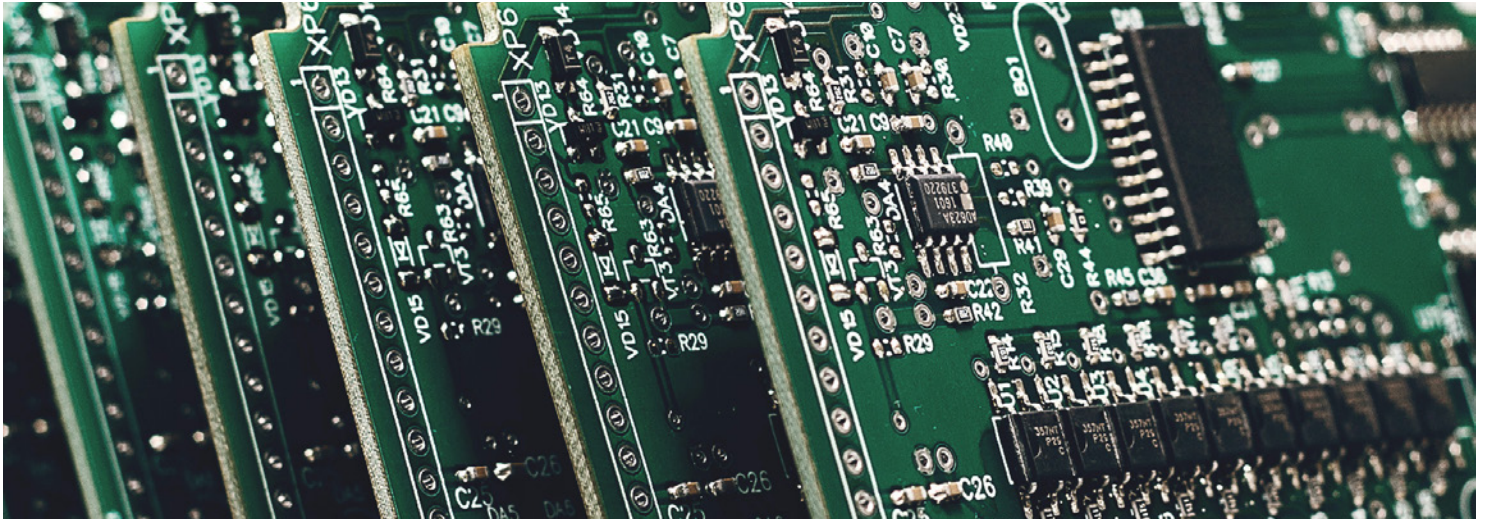




NI is now part of Emerson.



EMERSON™



Solution Brochure

Signal Chain Validation Solution

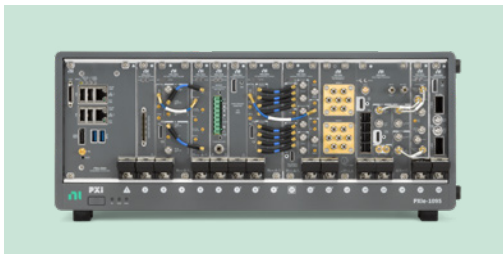
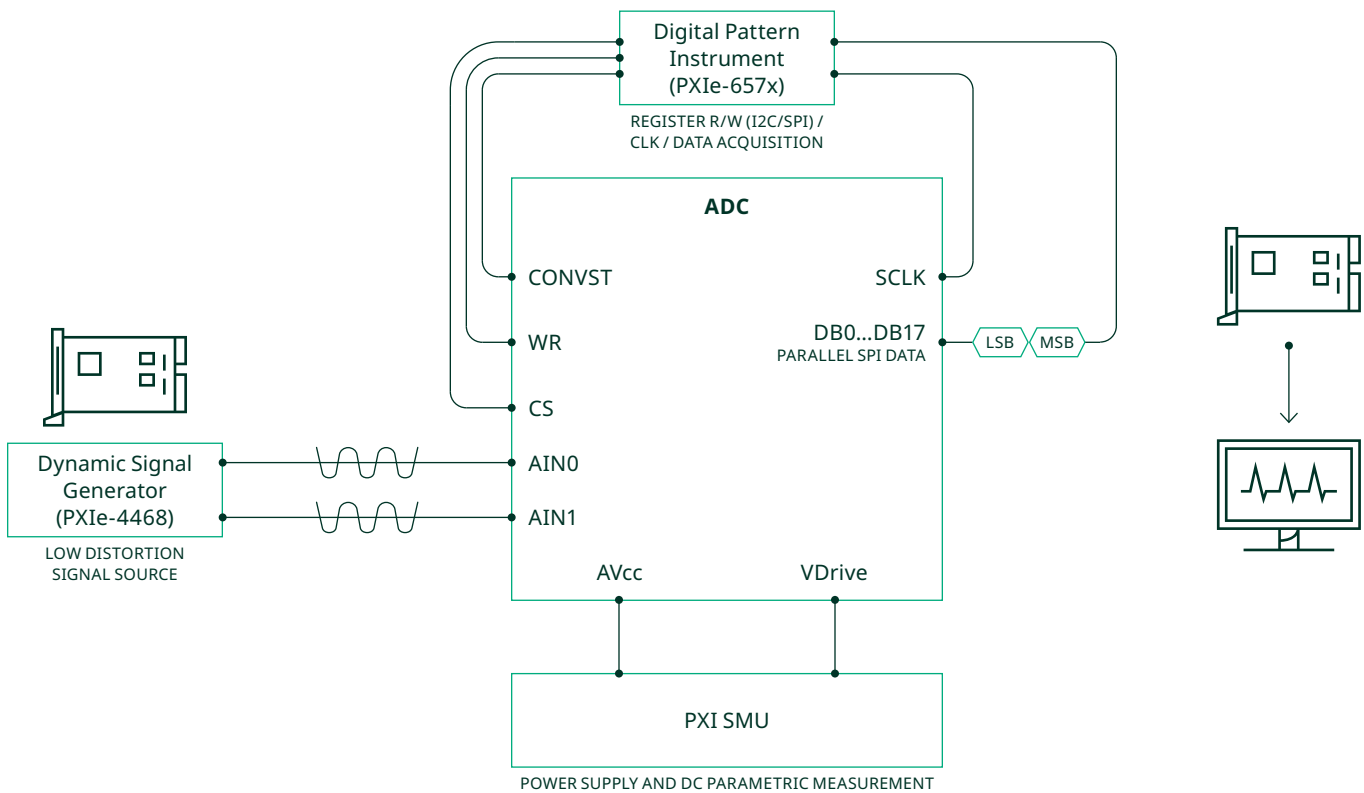
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Introduction

Signal Chain validation solution simplifies validation for critical high-precision data converters, audio codecs (ADC/DAC), audio amplifiers, high-precision amplifiers, and general-purpose amplifiers. With NI LabVIEW and Python examples on GitHub, seamless integration into NI InstrumentStudio™ Professional software, and scalable support for diverse configurations, it streamlines validation process.



AUDIO ADC, CLASS D AMPS: TYPICAL SYSTEM SUPPORTED

- NI PXIe-657x for digital interface and DUT control
- NI PXIe-4468 dynamic sig gen
- Source Measure Units plus NI PXIe-4151 PPS and PXIe-4051 e-load

FIGURE 1

Example Audio Codec Validation Workflow Example

A comprehensive Signal Chain Validation Solution is imperative to address the previously mentioned challenges. Here's why:

01

Streamline Lab Standardization

Facilitating more successful lab standardization initiatives by simplifying processes and ensuring seamless implementation.

02

Simplify Lab Automation

Empowering non-automation experts in the lab environment through an easier path to automation capabilities, fostering efficiency and productivity.

03

Fast-Track Semi Growth

Boosting growth in the validation lab with ready-to-use capabilities for IP measurements, expediting development cycles and enhancing competitiveness.

04

Unleash Unrivaled Performance

NI PXI offers unparalleled instrument performance, data throughout, latency, and synchronization for advanced test and measurement applications.

05

Discover Unparalleled Visuals

Integrated environment for instrument configuration that simplifies quick, interactive measurements and augments automated production test systems.

06

Accelerate Validation

Develop, debug, and deploy test systems and provide full visibility into testing process and results.

Solution Overview

Signal Chain Solution is your key to unlocking peak performance in today's fast-paced technological landscape. With our integrated suite of tools and technologies, we streamline the development, validation, and optimization of high-performance systems.

From audio systems to communication networks, our solution offers seamless integration of industry-leading hardware and software components, ensuring flexibility, scalability, and unmatched reliability. Let's embark on this journey together and elevate your system performance to new heights.

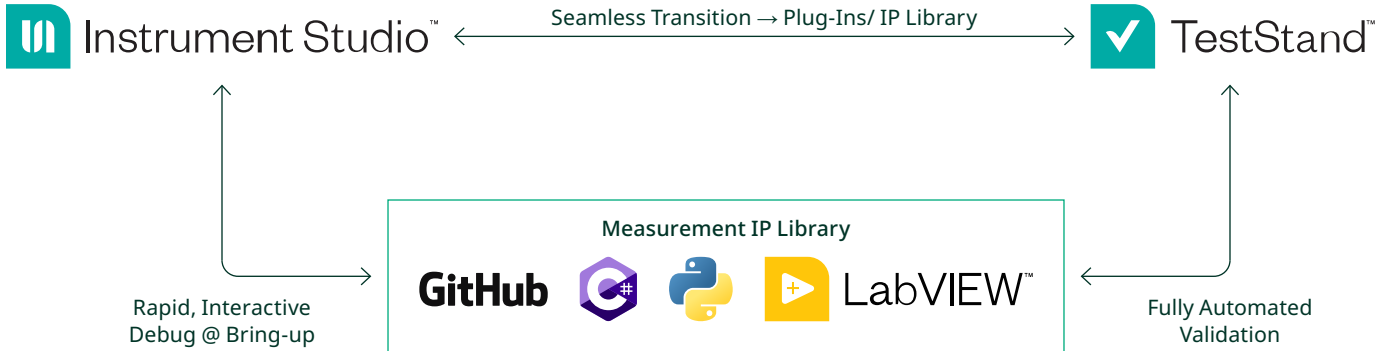
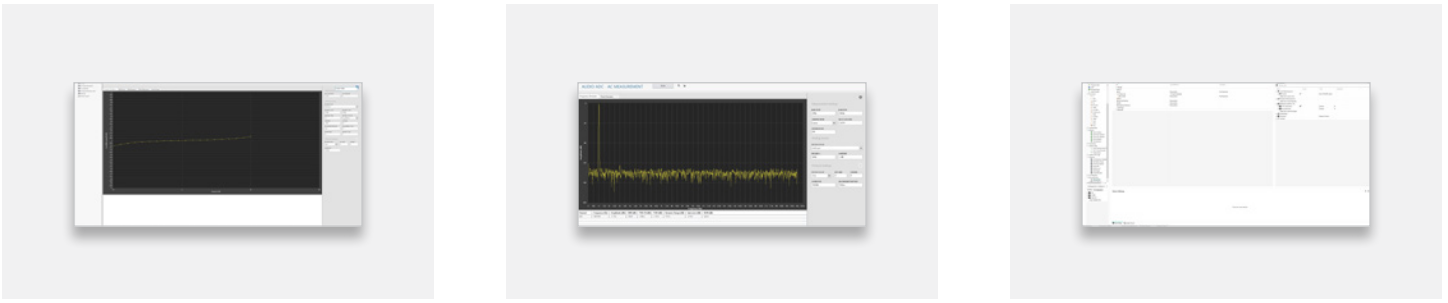


FIGURE 2
Signal Chain Workflow Overview

KEY FEATURES

01

Seamless Integration

Integrate industry-leading hardware and software components effortlessly, including NI PXI hardware, LabVIEW, and Python, ensuring compatibility and ease of use.

02

Flexibility and Scalability

Adapt to varying project requirements with ease, thanks to the solution's flexibility and scalability, allowing for seamless expansion as needed.

03

Streamlined Development

Simplify the development process from concept to deployment, enabling engineers to focus on innovation rather than grappling with technical complexities.

04

Unmatched Performance

Achieve unparalleled performance and reliability in high-performance systems, ensuring optimal functionality even in the most demanding applications.

05

Comprehensive Validation

Validate critical components with ease using signal chain validation tools, including LabVIEW and Python examples, NI PXI hardware, and NI InstrumentStudio Professional software integration, ensuring compliance with industry standards and regulations.

Benefits

01

Enhanced System Performance

Elevate the performance of your systems to new heights, thanks to seamless integration and optimization offered by the Signal Chain Solution.

02

Accelerated Time to Market

Streamline the development and validation process, shortening time to market and allowing you to stay ahead of the competition in today's fast-paced technological landscape.

03

Cost Savings

Minimize development costs and maximize return on investment by leveraging the efficiency and reliability of the Signal Chain Solution.

04

Improved Reliability

Ensure the reliability and robustness of your systems, even in challenging environments, with comprehensive validation tools and industry-leading hardware components.

05

Scalability

Scale your projects seamlessly to meet evolving demands and adapt to changing requirements, ensuring long-term success and sustainability.

06

Simplified Integration

Simplify the integration of hardware and software components, allowing engineers to focus on innovation and problem solving rather than technical hurdles.

Applications

Our signal chain validation solutions cater to a diverse range of applications including high-precision data converters, audio codecs (ADC/DAC), audio amplifiers, high-precision amplifiers, and general-purpose amplifiers. Ensuring accuracy and reliability in signal processing is paramount in today's technology landscape. Our comprehensive validation tools and methodologies empower engineers to achieve optimal performance and fidelity in their designs. Whether verifying dynamic range in audio codecs or precision in data converters, our solutions offer robust testing capabilities to meet the exacting standards of modern electronics. Trust our expertise to validate your signal chain seamlessly and efficiently, ensuring superior performance across every application.

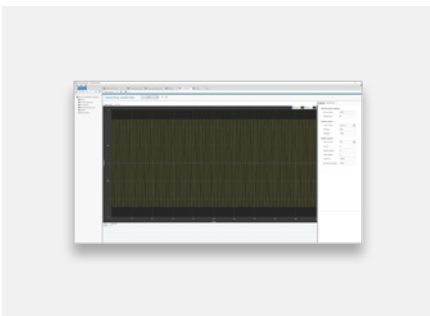
Engineering Workflows

Here's an example engineering workflow for Signal Chain device validation, specifically tailored for the Automotive low power mono audio codec with the given specifications:



DEFINE VALIDATION REQUIREMENTS

Clearly outline the validation criteria based on the device specifications provided. Identify critical parameters such as dynamic range, SNR, sampling rate, and operating temperature range.

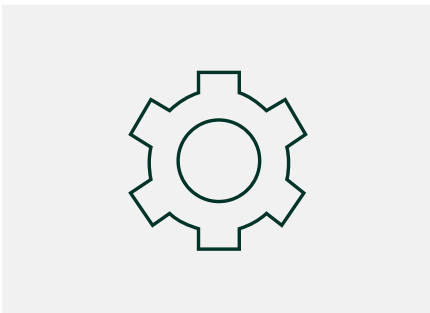


SELECT VALIDATION TOOLS

Utilize the Signal Chain validation solution designed for high-precision data converters, audio codecs, and amplifiers.

Leverage LabVIEW and Python examples that are available on GitHub for seamless integration into InstrumentStudio Professional.

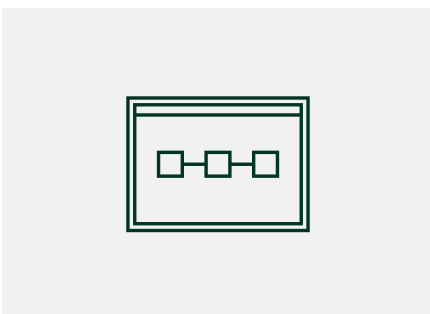
Utilize NI PXI hardware for unparalleled instrument performance, data throughput, and synchronization.



CONFIGURE TEST SETUP

Set up the validation environment using NI PXI hardware along with necessary instrumentation modules.

Configure the test setup to match the specifications of the automotive audio codec, including digital audio interface, sampling rate, and analog I/O channels.



DEVELOP TEST PROCEDURES

Utilize test procedures using LabVIEW and Python for automated validation.

Define test sequences to cover all critical parameters such as SNR, THD, frequency response, and latency.

Incorporate error handling mechanisms to ensure robustness of the validation process.



EXECUTE VALIDATION TESTS

Run the automated test procedures on the configured setup.

Monitor test execution using InstrumentStudio Professional for real-time visualization and analysis.

Record test results for each parameter under varying conditions such as temperature and input signal levels.

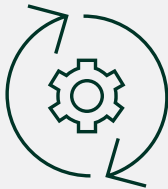


ANALYZE RESULTS

Analyze the collected data to evaluate the performance of the audio codec against the specified requirements.

Compare measured values with datasheet specifications to identify any discrepancies.

Investigate root causes of any failures or deviations from expected behavior.



ITERATIVE OPTIMIZATION

Fine-tune the test procedures and setup based on insights gathered during analysis.

Optimize parameters such as test duration, signal levels, and environmental conditions for improved accuracy and efficiency.

Iterate through the validation process until all requirements are successfully met.



DOCUMENTATION AND REPORTING

Document the validation process, including setup configuration, test procedures, and results.

Generate comprehensive validation reports highlighting the device performance and compliance with automotive standards.

Provide recommendations for further improvements or optimizations if necessary.

By following this workflow, you can effectively validate the Automotive low power mono audio codec and ensure its performance meets the required specifications for automotive applications.

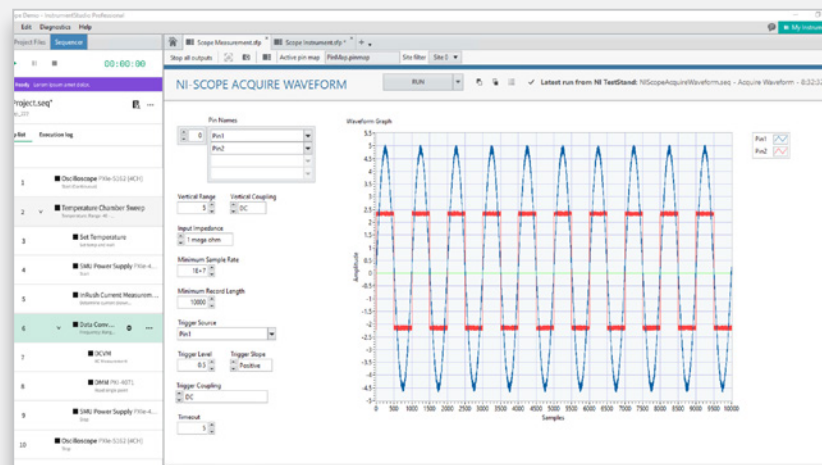
Visual Capabilities with NI InstrumentStudio Professional

InstrumentStudio Professional is application software that provides an integrated approach to interactive PXI measurements, the ability to monitor and debug test systems, and streamlined connections to automated test applications.

Integrated, Interactive Measurements

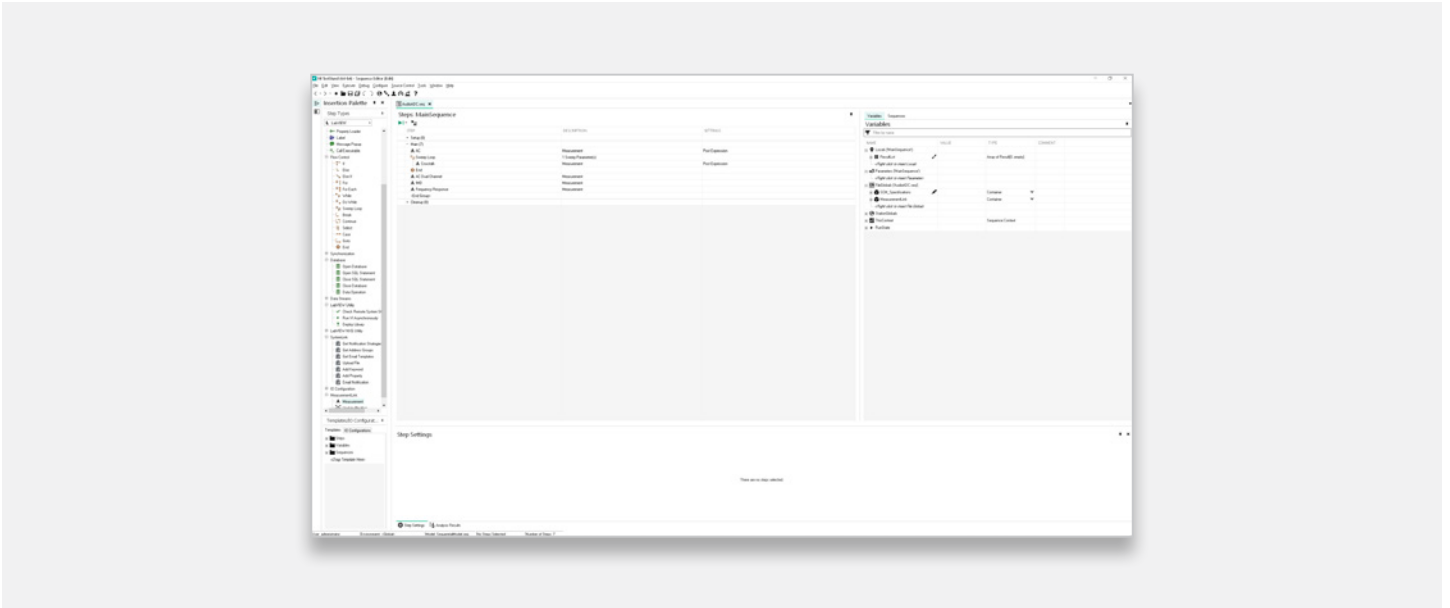
Built to accelerate validation test, InstrumentStudio Professional combines native instrument panels, customizable measurement plug-ins, and in-app automation for a configuration-based approach to test.

- Customizable panels for instruments
- Multi-instrument and multi-measurement views
- Run measurement plug-ins like Power Management and Signal Chain
- In-app sequencing
- Out-of-the-box control for NI instruments
- NI shipping examples
- Automatically detect published plug-ins
- Build repositories
- Develop measurements plug-ins with LabVIEW or Python templates
- Copy-paste functionality with TestStand for advanced automation



Automation Capabilities with NI TestStand

TestStand is a test executive software that accelerates system development and deployment for engineers in validation and production.



Validation and Production Test Automation

TestStand automates, accelerates, and standardizes the overall test process across all of your testers with native functionality for:

- Calling and executing tests written in LabVIEW, Python, C/C++, or .NET
- Complex tasks, such as parallel testing, sweeping, looping, and synchronization
- Creating custom operator interfaces and robust tools for deployment and debugging
- Unit tracking, creating automated reports, and storing results to local or network databases

What Can I Do with TestStand?

Develop test and deploy to your systems. Standardize and streamline your workflows. Learn how TestStand empowers test engineers to outpace time-to-market restrictions through efficiency.



DO MORE WITH THE NI LABVIEW+ SUITE

The LabVIEW+ Suite includes LabVIEW plus TestStand to assist with measurement, analysis, and test. Get NI's test executive software, data acquisition software, measurement data analytics software, and more in the LabVIEW+ Suite.

Testimonials

"Streamlined Validation Made Easy!"

"As an automotive engineer, ensuring the performance of our audio codecs is crucial. With the Signal Chain validation solution, we've simplified our validation process significantly. The seamless integration with LabVIEW and Python, along with NI PXI hardware, has allowed us to automate tests effortlessly. Now, we can validate our audio codecs with confidence, knowing that we're delivering high-quality products to our customers."

Hardware Design Engineer
Leading Semiconductor Company

"Signal Chain solution has transformed our device validation process for our 12-bit, 3.3-kSPS four-channel delta-sigma ADC. With built-in support for PGA, comparator, and 1.8 V I²C bus voltage, this solution seamlessly integrates with our testing environment. Leveraging LabVIEW and Python examples, along with NI PXI hardware, we've achieved unparalleled accuracy and efficiency in our validation tasks. From automated test development to real-time visualization, Signal Chain has empowered us to validate our ADCs with precision, ensuring top-notch performance and reliability for our customers."

Analog IC Design Engineer
Leading Semiconductor Company

Technical Specifications

NI hardware offers I/O and components to create high-quality custom systems. Products include application- and measurement-specific modules, protocol support, FPGA-enabled hardware, and options for industrial and rugged locations. The following modules are recommended for Signal Chain Validation. See the Example Configurations section for a full list of products and specifications with detailed features.

NI PXIe-4468

Features
2-Ch analog Input and 2-Ch analog output
“Pure-Tone” sine wave generation output
Exceptional distortion and noise performance in audio bandwidth (compare to Audio Precision 2700, 58x, 52x)
Software support
NI-DAQmx driver support for LabVIEW, C, C# .NET, Python
Sound and Vibration Toolkit for audio and acoustic measurements
Soft Front Panels for simple to use, interactive experience

See [NI.com](https://www.ni.com) for more information.

NI PXIe-6571 Features

For the full specifications, visit [NI.com](https://www.ni.com).

	NI PXIe-6570	PXIe-6571 ¹	PXIe-6571 8-ch ¹
Module Width	2 slots	1 slot	1 slot
Active Load	24 mA	16 mA	16 mA
Channels	32 per module		8 per module
	256 maximum in a synchronized subsystem	512 maximum in a synchronized subsystem	Optimized for low channel-count bench use
Pin Electronics	Digital: -2 V to +6 V, 32 mA PPMU measure voltage: -2 V to +6 V, 32 mA PPMU force voltage: -2 V to +7 V, 32 mA		
Maximum Vector Rate	100 MHz (10 ns minimum vector period)		
Maximum Data Rate	200 Mb/s		
Maximum Clock Generation	160 MHz ²		
Pattern Timing	31 time sets 39.0625 ps edge placement resolution		
Drive Formats	Non-return (NR), return to low (RL), return to high (RH) (100 MHz max), surround by complement (SBC) (50 MHz max)		
Vector Memory Depth	128 M/Channel		
Opcode Support	Flow control, sequencer flags and registers, signal, source and capture, subroutine		
Source and Capture Engines	Broadcast or site-unique Serial or parallel 8 per instrument		
Source and Capture Memory	256 Mbit source memory, 1 MSample capture memory		
Frequency Counters	5 kHz to 200 MHz, 2.5 ns minimum pulse width		
History RAM	(8,192/N sites) -1 cycles		
SCAN Support	Flattened SCAN patterns, up to 128 M		
Timing Specifications	Warranted		Typical
Calibration ³	Factory Traceable Compliant ISO 17025		

¹ Note that the PXIe-6571 requires a chassis with 82 W slot cooling capacity, such as the PXIe-1095. The PXIe-6571 8-ch. variant can be used in a 58 W and/or 82 W slot cooling capacity chassis. For more on PXI power and cooling, see this white paper.

² Clock rates >133 MHz will have a non-50% duty cycle.

³ ONLY FOR PXIe-6571 8-ch: Calibration will include all DC performance parameters that are warranted. Calibration will not include timing parameters because they are typical, not warranted.

Example Configurations

Chassis and Controllers	Ship Kit PN	Quantity
NI PXIe-8881 Controller	786636-01	1
NI PXIe-1092 Chassis	784781-01	1
Instrumentation		
NI PXIe-4468 Sound and Vibration Instrument	788512-01	1
NI PXIe-7820 FPGA Instrument	783484-01	1
NI PXIe-6571 Digital Pattern Instrument	786320-02	Optional
NI PXIe-4139 Source Measurement Unit	782856-03	Optional
NI PXIe-4081 Digital Multimeter	783130-01	Optional
Accessories		
BNCM-MXLRF Cable	140150-0R46	4
SHC68-C68-RDIO2 Cable	156166-01	Optional
SCB-68 HSDIO		Optional
SHC68-H1X38 High-Speed Digital Flying-Leads Cable Accessory, 1.5 M	192681-1R5	Optional
Power Cord, AC, US, 120 VAC, 2.3 meters	763000-01	1
Software		
InstrumentStudio Professional	789987-35	1
TestStand	788372-35	1
LabVIEW+ Suite	788509-35	Optional

How to Get Started

To get started with the Signal Chain Validation Solution:

- **Understand the solution:** Familiarize yourself with the Signal Chain Validation Solution, which verifies signal integrity, mitigates interference, and optimizes power management to enhance reliability and compliance.
- **Explore NI PXI:** Utilize NI PXI for simplified lab standardization, superior instrument performance, and accelerated validation processes.
- **Access software resources:** Take advantage of [open-source software examples](#) tailored for data converters in InstrumentStudio Professional, facilitating quick measurements. [Watch the How-To-Video Series on YouTube.](#) [Read Setting Up ADC Measurements with NI's Data Converter Reference Architecture App Note.](#)
- **Streamline validation:** Leverage the [powerful NI PXI hardware platform](#) along with [TestStand sequencer](#) software to streamline validation processes, from silicon bring-up to automated testing.
- **Reduce costs and time:** Benefit from reduced test time and costs while ensuring robust validation and compliance across signal chains.



System Integration on Your Terms

NI offers a variety of solution integration options customized to your application-specific requirements. You can use your own internal integration teams for full system control or leverage the expertise of our worldwide network of NI Partners to obtain a turnkey system.

Contact your account manager or call or email us to learn more about how NI can help you increase product quality and accelerate test timelines at (888) 280-7645 or info@ni.com.

NI Services and Support



Consulting and Integration



Global Support



Turnkey Solution Delivery and Support



Prototyping and Feasibility Analysis



Repair and Calibration



Training and Certification

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