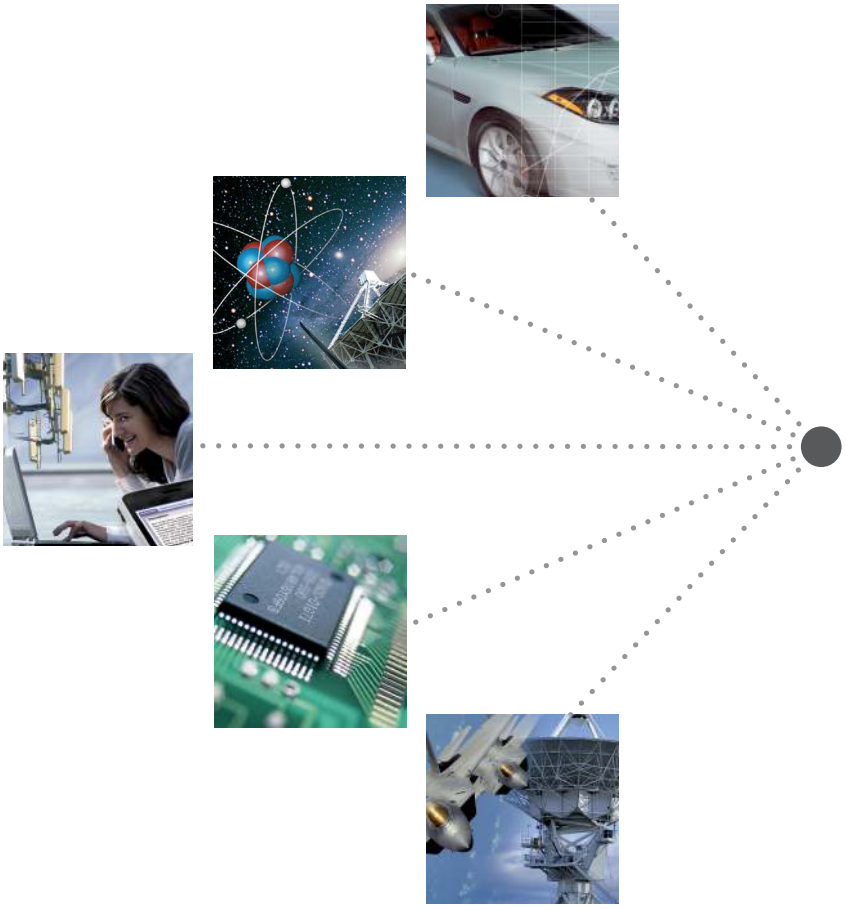
Keysight Technologies
Discover the Alternatives in Automated Measurements and Testing

KEYSIGHT
TECHNOLOGIES

Discover the Alternatives

A single platform is rarely the right answer for every test scenario. That's why the Keysight Technologies, Inc. portfolio includes more than traditional instruments.

Our expanding range of modular products is an extension of Keysight's measurement expertise into PXI and the new AXIe standard. In these modular form factors, we're delivering the measurements you need today, and enabling new capabilities that weren't previously possible across analog, digital, RF, microwave and lightwave technologies.



Addressing a growing range of applications

Whether you create test solutions within a manufacturing company or as a system integrator, Keysight's modular portfolio offers a solid foundation. The bedrock is the testing and verification of electronic components, subsystems and products. These fundamental capabilities support a variety of applications in fields such as aerospace, defense, communications, automotive, research and science.

With our modular instruments—DMMs, digitizers, signal analyzers, arbitrary waveform generators and more—your range of choices is getting bigger and better. Discover the alternatives—with Keysight.

Tracking your needs

The evolving challenges within your products, and your business, flow through to automated test and measurement. As an example, increasingly integrated functionality in your products leaves fewer test points but demands greater test coverage. Shorter product life cycles drive the need for greater flexibility and openness in your test solutions. Tighter cost controls translate into a need for systems that can test more devices in less time — and do so within a smaller physical footprint.

Gain four advantages

Keysight answers these needs by offering you advantages in speed, flexibility, openness and size reduction. Speed starts with faster data transfers — and minimized latency — across the entire path between the system controller and instrument memory registers. Flexibility comes from choices of instrumentation that can be quickly configured and reconfigured as needs evolve. Openness follows from the use of industry standards in hardware, interfaces, drivers, software and more. Size reduction comes from fast, flexible, open solutions based on innovations in the modular PXI and AXIe form factors.

Modular architectures are the fastest way for us to bring you our latest innovations — and those advances will migrate into our standalone instruments. In either form factor, you'll be able to complement your knowledge with the measurement expertise embedded in every Keysight product.

Consider the Keysight alternatives

The remaining pages of this brochure cover six key topics:

- A range of approaches to modular
- An overview of our system architecture
- An exploration of our hardware offering
- An outline of our software strategy
- Solution-creation services
- Embedding modules in larger systems

These topics provide an overview of our approach. For more information, please visit us on the Web at www.keysight.com/find/modular.

Examining a range of approaches

Keysight's portfolio for automated testing includes more than traditional GPIB instruments. In recent years we've become a leading provider of LXI-based instruments that leverage LAN as a system backbone. Today, we're expanding our roster of PXI devices and adding a new range of AXIe instruments.

Our lineup spans three different approaches to modular: open, Keysight-proprietary and embedded. Each of these makes different contributions to the speed, flexibility, openness and size of test systems and solutions.

Open modular: PXI and AXIe

When a meaningful degree of openness is achieved across multiple elements—hardware, software, drivers, I/O—the resulting system can deliver the greatest advantages in speed, flexibility and size reduction. The system also has the potential to provide enhanced capability and scalability. When open modular solutions are based on commercial, off-the-shelf (COTS) devices, they also enable choice, flexibility, cost advantages and improved supportability.

Keysight-proprietary modular

Our specialized modular solutions often provide an important advantage in a specific dimension. For example, size is the key attribute of the Keysight 34970 data acquisition mainframe and modules. Another example is the 34980 multifunction switch/measure unit. This cost-effective solution offers excellent flexibility with an eight-slot mainframe, more than 20 plug-in modules, and built-in GPIB, LAN and USB connectivity.

Embedded modular: PCI and PCIe®

Any type of module can become a component within a large, single-purpose solution. Examples include the use of high-performance digitizer modules within research and medical applications, and the use of high-fidelity arbitrary waveform generator (AWG) modules in radar scenario simulations.

Why create a new modular standard?

Advanced TCA Extensions for Instrumentation and Test (AXIe) is an open standard that creates a robust ecosystem of components, products and systems. AXIe leverages existing standards from Advanced Telecom Computing Architecture (ATCA), PXI, LXI and IVI. The standard is broadly applicable to general-purpose instrumentation and semiconductor test.

AXIe has three key attributes. First, it is designed for high-performance instrumentation with a large board size that provides room for module shielding. Next, it is well suited to high-power applications with single-rail power of up to 200 W per slot.

Third, it offers greater scalability and rack-space efficiency than PXI: An AXIe chassis can contain one to 14 slots arranged in a vertical or horizontal configuration, and multiple chassis can be connected to create high-channel-count systems.

Establishing a future-ready architecture

Three key ideas are driving the development and evolution of Keysight's modular portfolio and the associated system architecture:

- Provide powerful, scalable modules, chassis and infrastructure elements.
- Develop architectural components that enable complementary operation of standalone and modular instruments.
- Provide software that enables measurement and analysis capabilities that are independent of the underlying measurement hardware.

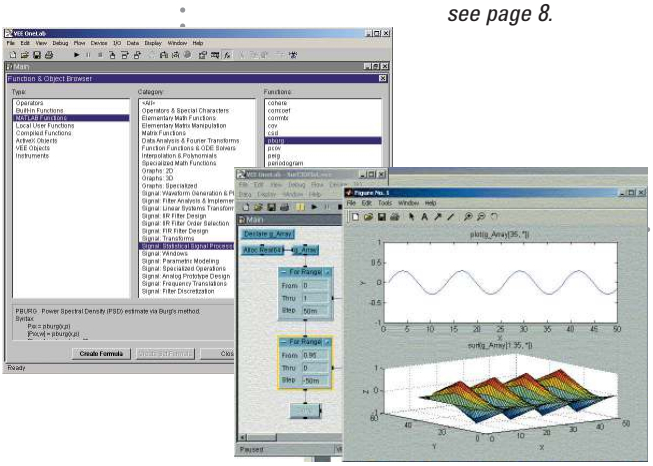
To make this a reality in your day-to-day work, we've been embedding innovative capabilities within our system architecture.

Breaking the performance bottleneck

In defining the Keysight architecture we didn't start with the hardware or software. Instead, we looked for system bottlenecks. In most PXI-based systems, the crucial bottleneck is the I/O chain between the system controller and the individual modules or instruments. The solution is to optimize the speed of every link in that chain.

We use PCI Express® (PCIe) as the unifying element. For maximum speed we recommend a cabled PCIe connection to a PCIe-enabled chassis—PXI or AXIe—because it is memory-mapped to the registers in each instrument.

To wring out even more speed, we hand write every driver. Through a cabled PCIe connection we also enable the use of rack-mountable industrial computers as the system controller. These PCs are faster and more cost-effective than typical embedded controllers.



Architecture: Essential hardware elements

Our next steps were to define the powerful, scalable modules and chassis mentioned earlier—and incorporate both PXI and AXIe. The compatibility of PXI and AXIe makes it possible to mix and match the required capabilities within a single system or solution.

Chassis: We currently offer high-performance PXI and AXIe chassis. The PXI mainframe has 18 slots, 16 of which are hybrid-compatible. It provides a 4 GB/s PCIe data transfer rate (chassis and cabled I/O).

In AXIe we currently offer two-slot (2U) and five-slot (4U) models. These are full rack width and include an embedded system module, which frees up a slot in the chassis. Both units also include inter-chassis synchronization for high-channel-count applications.

Modules: Our goal is to deliver the measurements you need today and enable new capabilities that weren't previously possible. Whether you're addressing analog, digital, RF, microwave or lightwave applications, we'll create modules in the format best suited to each technology.

For more about our hardware, please see page 8.

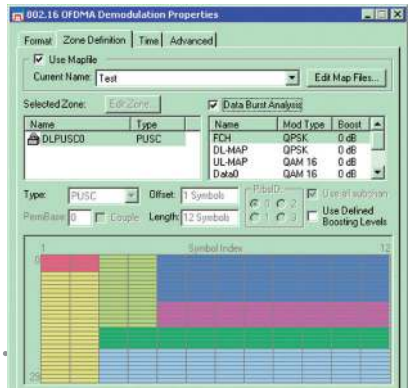
Architecture: Essential software elements

One of the key ideas behind our software strategy is "choice." We make it easy for you to work in your preferred environment: Microsoft Visual Studio .NET, NI LabVIEW, Keysight VEE Pro and so on.

To support your choice, every Keysight module includes the right drivers—IVI-C, IVI-COM or G—for your environment. For faster development, those drivers provide context-sensitive help such as Microsoft IntelliSense and LabVIEW hover-help.

Another important concept is enabling measurement and analysis capabilities that are independent of the underlying hardware. For example, applications such as the Keysight 89600 vector signal analysis (VSA) software and MATLAB from The MathWorks support a wide range of Keysight modular products.

Please see page 9 for more information about our software strategy.



Enhancing and extending your hardware options

Our growing range of modular products is an extension of Keysight's measurement expertise into PXI and AXIe. Going forward, AXIe addresses the growing need for high-performance instrumentation that goes beyond the capabilities of PXI.

Maximizing PXI

PXI is currently the dominant standard for modular instrumentation. It's a mature technology and is widely used.

Over the years, there have been multiple evolutions of the standard—PXIe, PXI-H—designed to boost performance. Unfortunately, there are challenges associated with coexistence of the various form factors. As a result, it can be difficult to optimize performance across an entire system.

Today, Keysight's goal is to maximize the performance of the PXI architecture. We're doing this by leveraging the next generation of wider buses, faster controller links and flexible backplanes.

Moving ahead with AXIe

This new standard is designed for high-performance instrumentation. Its hallmarks are high power, high channel count and RF measurements.

High power: The AXIe standard defines single-rail power at –48 V with 200 W per slot. It also includes robust, dynamically controlled cooling.

High channel count: AXIe provides tremendous scalability and excellent rack-space efficiency. To enhance flexibility, a chassis can have one to 14 slots arranged in vertical or horizontal configurations. To support large channel counts, multiple chassis can be connected synchronously.

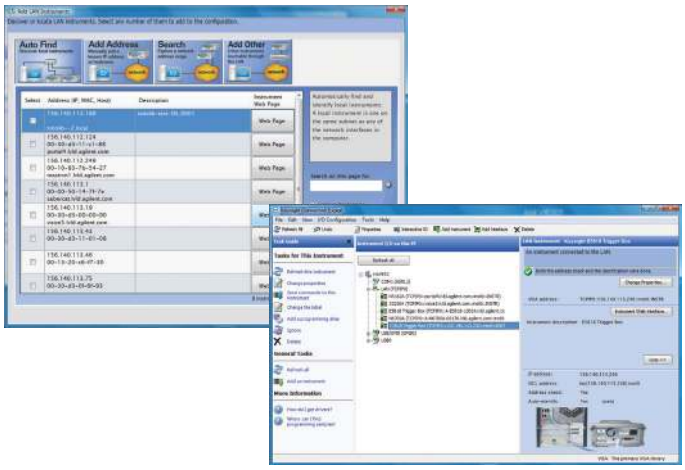
RF measurements: The large board size of an AXIe module provides ample room for shielding, which is crucial for high-quality RF measurements. For fast data transfers, the AXIe standard defines a high-speed local bus (up to 64 differential links) and x 4 PCIe links.

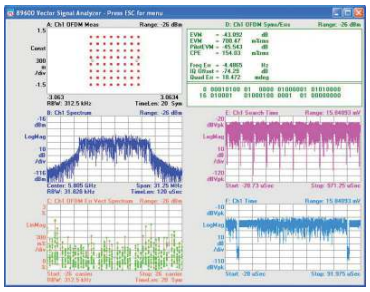
Gaining more advantages with AXIe

To help protect your investment in existing solutions, AXIe is compatible with PXI. With support for LAN and PCIe connectivity, AXIe integrates easily with LXI and PXI instrumentation.

Bringing greater choice to software

As with measurement hardware, a single software platform is rarely the right answer for every test scenario. That's why our modules include a comprehensive set of instrument drivers, documentation, examples and software tools to help you quickly develop a test system in your preferred software platform. This includes development environments such as Microsoft C/C++, C#, or Visual Basic; MATLAB; LabVIEW and LabWindows/CVI; and Keysight VEE Pro.





Gaining flexibility with drivers

In addition to context-sensitive help, we ship our instrument drivers with complete documentation and programming examples that let you get started quickly and complete complex tasks easily. For modules of the same family such as digitizers, the flexibility provided by a driver means that, with few or no software changes, an existing digitizer can be swapped out, replaced or upgraded with the latest high-speed digitizer. During programming, you can use the IO Monitor to trace all modular instrument driver calls to simplify system characterization and debug.

Adding system-level tools

The Keysight IO Libraries Suite will help you display all of the modules in your system—PXI, PXIe, AXIe, or cPCI. You can also view information about the installed software or start a module's soft front panel, which is a graphical interface that lets you easily verify connectivity to a module and explore its functionality.

Our soft front panels also enhance the out-of-the-box experience by letting you make measurements right away. This can be useful during software development and debug, and can be used to perform benchtop measurements with one or more modular devices.

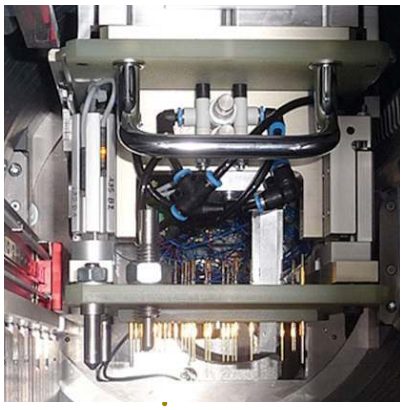
Leveraging the power of .NET

All Keysight modular instruments include IVI-COM drivers that work directly in .NET environments such as C/C++, C# and Visual Basic. We provide .NET assemblies with a complete set of properties and methods arranged in a hierarchy that makes it easy to locate the functions you need.

Integrated IntelliSense and "F1-help" capabilities simplify the processes of learning and using an instrument driver: When you place the cursor on a driver API and press F1, you are taken directly to the help article that describes that API.

Creating the solution you need

As you seek solutions to evolving test challenges, an outside perspective may be useful. Keysight is ready to help by sharing our expertise in benchtop measurements, modular instrumentation and test automation. In specialized applications, our Solutions Partners are ready to work with you—and us—to define and integrate your next-generation test solution.



Keysight Application Engineering Services

You can rely on the technical experts from Keysight. We know your instruments, and we understand test and measurement. Our services include software development, which can reduce test time and improve repeatability through test automation. We also offer technology training, product training and startup assistance to ensure that you'll maximize your success with your hardware or software purchase.

Areas of focus include test automation; digital design and test; network analysis; wireless communications; and technology refresh, including instrument migration and planning.

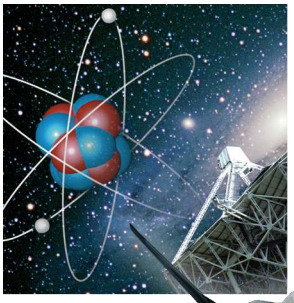
Solutions Partners

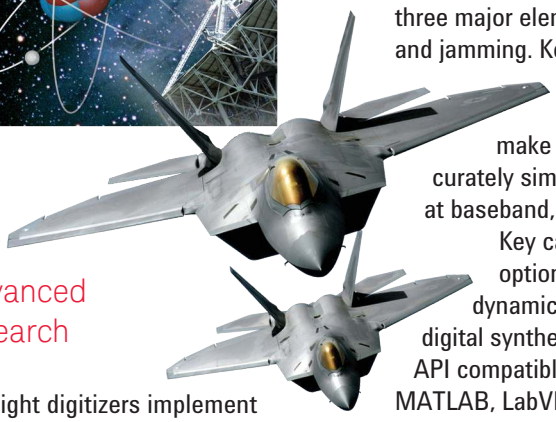
Whether you're looking for help with the development of a turnkey solution, the re-engineering of an existing platform, or the worldwide deployment of a manufacturing test strategy, our Solutions Partners are ready to help address your unique challenges. Areas of specialization include antennas, automotive, communications, electronics manufacturing, environmental, high-speed digital, materials, medical and signal integrity.

A list of Solution Partners is available online at www.keysight.com/find/partners. The list is searchable by geography, industry, application or key word.

Embedding modules in larger systems

In applications around the world, Keysight instrumentation has become an integral part of advanced systems. Even when used as "components" in a larger system, our dependable measurement devices provide exceptional performance that ensures confidence in results—even at the extremes of science.





Advanced research

Keysight digitizers implement innovative techniques that maximize data bandwidth and ensure rapid measurements. Today, these capabilities are providing superior throughput in applications such as the control and monitoring of particle and electron beams in physics research, and in real-time processing for microwave spectrometry in atmospheric research.

Aerospace and defense

The radar signal environment includes three major elements: targets, clutter and jamming. Keysight arbitrary waveform generator (AWG) modules make it possible to accurately simulate this environment at baseband, IF and RF frequencies. Key capabilities include two optional playback modes—dynamic sequencing and direct digital synthesis—and a standard API compatible with C/C++/C#, MATLAB, LabVIEW and more.

Medical

Precise control of the power and size of particle beams has enabled applications in radiotherapy, which is a form of cancer treatment. One approach is to direct a proton beam within the volume of a cancerous tumor and destroy the DNA inside tumor cell nuclei. In one such system, high-performance Keysight digitizers are being used for beam-diagnostic measurements that ensure precise control of the radiotherapy beam.

Enhance your application

If your project or system would benefit from improvements in speed, flexibility, openness or size, we'd like to discuss the possibilities. Please contact your local Keysight representative or visit us on the Web at www.keysight.com/find/advanced-research.

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www.axiestandard.org
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www.lxistandard.org
LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.

www.pxisa.org
PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

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Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

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www.keysight.com/find/modular

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
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