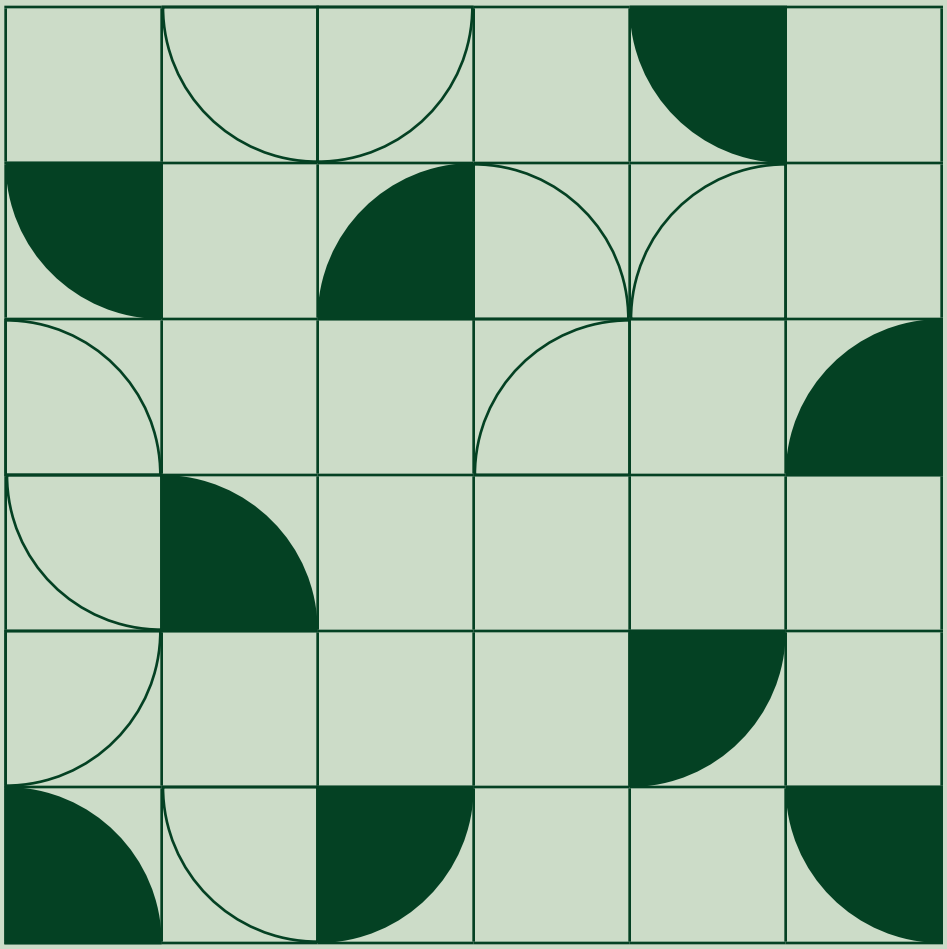
Design Validation Test System Build Guide for CompactDAQ



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Use this guide as your team plans for a new automated test stand for design validation, performance benchmarking, or other iterative tests. The guide covers system elements such as chassis and module selection, mechanical mounting, software development, and system operation. The considerations discussed will reduce development time by catching potential issues early; the chassis and module configuration tables will reduce time spent researching and ordering system components.

Compact DAQ Main System Components

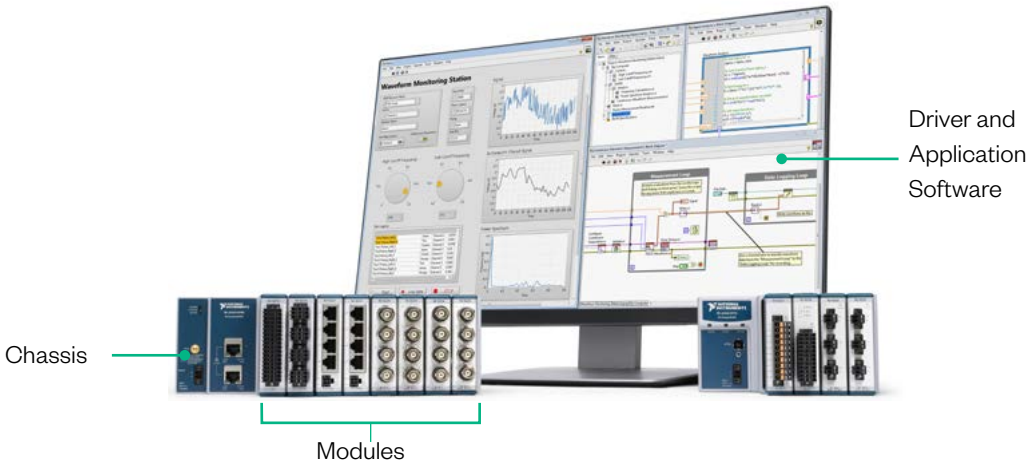


FIG 1 A CompactDAQ system can be as simple as a 1-slot USB chassis with a single module connected to a laptop running FlexLogger configuration-based software, or it can be multiple distributed Ethernet chassis with synchronized measurement channels connected to a custom test application that integrates code from multiple development languages and third-party instrumentation.

Chassis Selection and Considerations

The core technology and module compatibility of CompactDAQ chassis is nearly identical. The chassis differ by communication bus, number of slots, and environmental operating ranges. Use this section to select the best one for your needs.

Compact DAQ Main System Components

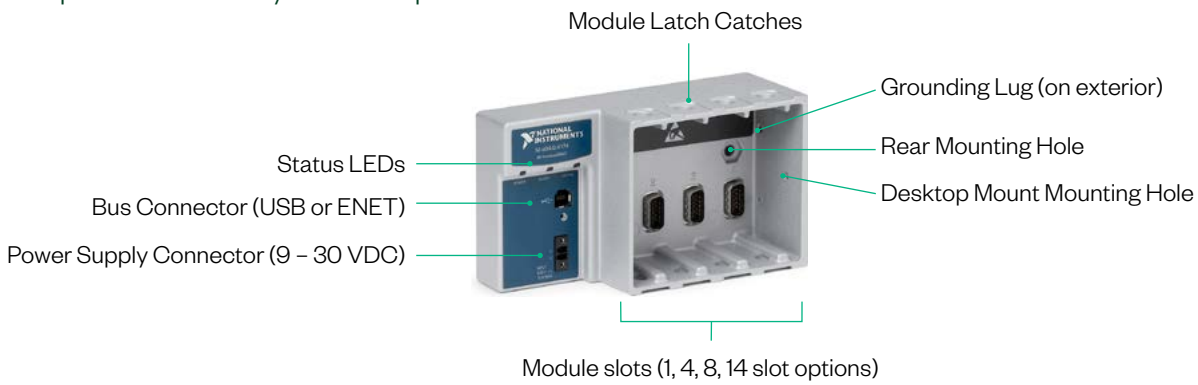


FIG 2 CompactDAQ chassis (cDAQ-9174 shown in image) connect modules to a PC using USB or Ethernet communication and synchronize measurement channels through built-in timing circuitry.

Future Expansion

How often do change requests impact measurement hardware needs?

- Higher-channel count modules will expand an existing system but selecting a chassis with more slots than initially needed leaves room to add new sensors or control signals.
- Select a mounting method where you can drop-in replace a larger chassis when needed.
- Select the appropriate ENET chassis that syncs over Ethernet cables to grow.

Portability

How often does the system move and how far does it travel? Is it moving between labs for different projects every 18 months or is it getting shipped to customer sites for field tests? The 1-slot USB chassis are great for portability because they are USB-powered. No external power supply is needed.

- CompactDAQ USB chassis use the USB Type-A connector. For laptop-based portable systems, consider the available I/O ports. Many laptops have traded out tall ENET ports for more slim designs. ENET cDAQ chassis will work with direct, ad-hoc connections to a laptop through a dongle, but there is the risk that someone in the field doesn't have the right dongle.

Environmental

- Chassis operational temperatures are designed with measurement quality in mind. Not all communication bus options support the maximum operational temperature range. The three ranges include -40 °C to 70 °C, -20 °C to 55 °C, and 0 °C to 55 °C.

Communication Bus

USB connections set the standard for plug-and-play instrumentation and are great connectivity options for portable systems, desktop systems, and stand-alone test rigs.

Ethernet CompactDAQ chassis connect your instrumentation to local area networks or enterprise-wide business networks, so you can run multiple test systems off a single PC. Plug an Ethernet cable directly into your PC (or laptop via dongle if needed) for a chassis cable length of up to the Ethernet standard of 200 m. As with any network, bandwidth should be considered.

The 1-slot Wi-Fi chassis is an ideal option to place instrumentation in locations where cabling or PC placement are difficult. With Wi-Fi, consider network bandwidth from other devices on the network and potential RF interference from your test environment. Antenna selection, network routers, and line-of-sight will all impact connection quality.

Headless Instrumentation Option

Headless operation refers to running a test system, or sub-system without a connected PC for direct operator interface. When operators do need to interface with headless systems, it is typically through remote access over a network or a wired HMI, or a control panel with physical buttons. Consider a CompactRIO chassis to run LabVIEW-built applications (.exe) on the chassis for "headless" operation. See the CompactRIO controller selection page to see which CompactRIO chassis support the NI-DAQmx programming method. CompactRIO with NI-DAQmx support is compatible with the same C Series modules as CompactDAQ and use the same API when programming with LabVIEW.

Chassis Selection Chart

Use the following table to select the right chassis for your test system needs.

MODEL	COMMUNICATION BUS	SLOT COUNT	TSN SYNCHRONIZATION*	EXTERNAL CHASSIS TRIGGER	OPERATING TEMPERATURE
cDAQ-9171	USB	1	No	No	-20 °C to 55 °C
cDAQ-9174	USB	4	No	No	-20 °C to 55 °C
cDAQ-9178	USB	8	No	Yes	-20 °C to 55 °C
cDAQ-9179	USB	14	No	Yes	-20 °C to 55 °C
cDAQ-9181	Ethernet	1	No	No	0 °C to 55 °C
cDAQ-9184	Ethernet	4	No	No	-20 °C to 55 °C
cDAQ-9185	Ethernet	4	Yes	Yes	-40 °C to 70 °C
cDAQ-9188	Ethernet	8	No	Yes	-40 °C to 70 °C
cDAQ-9189	Ethernet	8	Yes	Yes	-40 °C to 70 °C
cDAQ-9191	Wi-Fi	1	No	No	0 °C to 55 °C

*Chassis with tsn synchronization will synchronize channel inputs using the same Ethernet cable used for communication. Read the white paper Designing TSN Ethernet-Based Measurement Systems for more information on the underlying technology.

Module Selection and Considerations

Analog C Series modules are, for the most part, measurement-specific modules with front-end circuitry, analog conversion technology, and signal connectivity designed to create the best digital representation of a signal as possible. Use this section to decide on an approach to wiring, understand different module connector options, and select the right measurement modules for your test system.

FIG 3 Add analog input, analog output, digital input, digital output, and some communication busses such as CAN and LIN to your CompactDAQ-based test system by installing C Series modules in available chassis slots.

Connectivity Options and Considerations

Some modules will have multiple connection options for the same measurement type. For example, the NI 9205 is available with a spring terminal option and a 37-pin D-Sub option. Here are some methodologies you should consider as you select between module connectivity options.

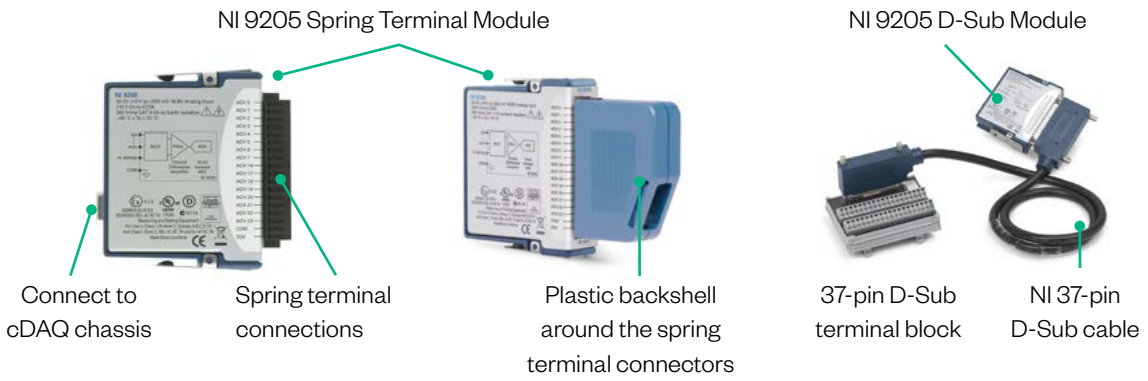


FIG 4 Several modules are available with different connectivity options, such as the NI 9205 pictured above.

Standardize on Common Connectors for Efficiency

Team members building the system will develop a familiarity with the connector and be more efficient with their work if fewer (or a single) connector option is selected. Standard connections also make stocking accessories more convenient. Spring/Screw terminal and D-Sub connection variants are the most common connector types across the family of C Series modules.

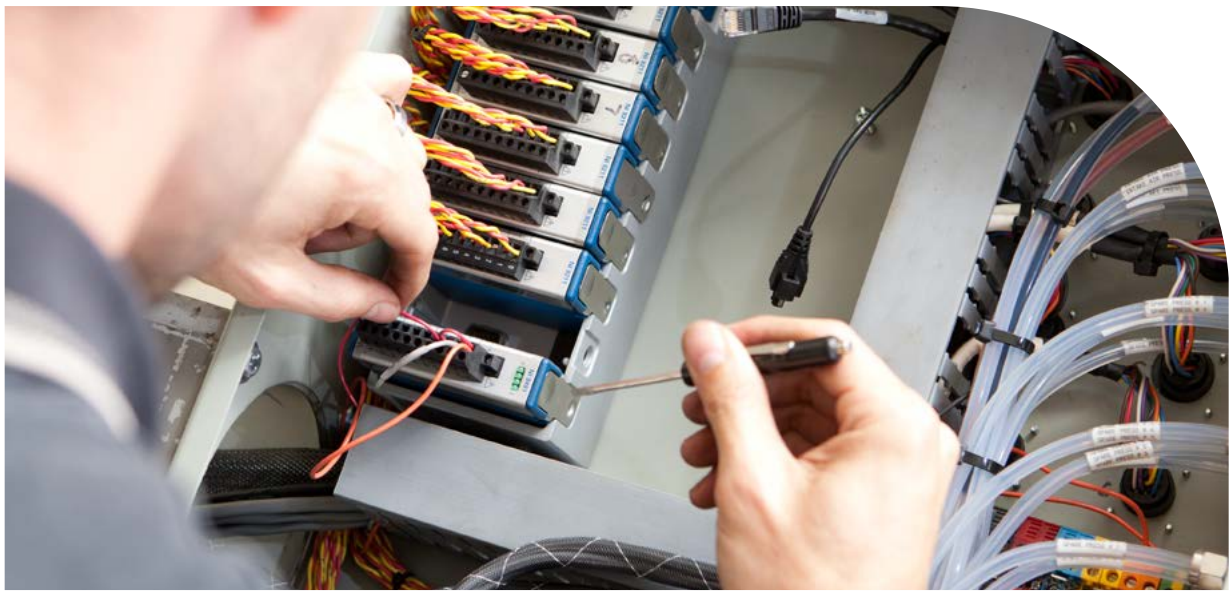


FIG 5 Standardize on a few module connectors (screw terminals shown in image above) for efficient system assembly and support.

Quick Connections Reduce Setup Time

Use modules with a quick connection option for systems that are more portable or for systems that will be subject to frequent setups and changeover. The tradeoff is you will manage multiple types of accessories, need to crimp and terminate sensor wires, and have fewer channels per module (quick connects are less channel-dense). The payback comes from time saved during repetitive test setup. BNC (several modules), RJ-50 (strain/load), LEMO (dynamic universal), and 10-32 coaxial jack (or "Microdot" as seen on the NI 9231 IEPE module) are all quick connect style modules.

NI C Series Module Connector Types

NI-9234

BNC connectors have two signal pins and secure the cable to the module with a quarter-turn coupling nut.

NI-9218

LEMO is a multi-pin push/pull connector that works with several connector standards to offer high-quality connections with a variety of options.

NI-9239

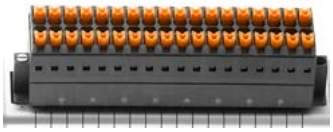
Screw terminal connection options require a flat-bladed screwdriver to close a metal gate that clamps down on exposed signal wire.

NI-9237

RJ50 is a variant of the ubiquitous RJ45 that is used for copper Ethernet connections, but the connector and tools **are not compatible**. The RJ50 has 10 pins. Purchase RJ50 cables and dongles that convert to screw terminals from NI or purchase a crimping tool and use RJ50 connectors to connect sensor wires directly into the module.

NI-9231

The 10-32 coaxial jack, or "Microdot," uses two pins for the connection with a threaded collar to screw the cable in place. This is a common connector for accelerometers and microphones when there are space constraints.



NI-9213

Spring terminal connections use a spring mechanism inside the connector to clamp down on exposed signal wires. Use a small, flat-bladed precision screwdriver to open the cage clamp. Remove the screwdriver after inserting the exposed signal wire.

NI-9205

D-Sub connections—named for the D-shaped metal shell—are a mass termination option that use a pin and socket connection. There are multiple ways to connect to a D-Sub connector including the off-the-shelf cables and terminal blocks, module-mounted terminal blocks with screw terminals, and soldering custom cables using off-the-shelf D-Sub kits with solder cups. All of these options are available from NI as well as most global electronics component distributors.

Connectivity Accessories

Use the available module accessories to route signal wires, add strain relief, and protect operators from hazardous voltage. The NI 9242/44 high-voltage input modules ship with plastic back shells for safety. All other module accessories are sold separately. Consider stocking spare accessories for modules to reduce hazardous situations in the lab and system wiring errors. Easily available accessories improve the chance they are used.

I/O Cable and Accessory Compatibility Guide

CompactDAQ System Accessory Compatibility Guide

Quick Selection Guide

This section lists some of the most popular CompactDAQ modules (C Series Modules) by category so you can quickly match the measurement need (first column) to a model number (third column).

Voltage Input

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose.	±10 V, 16-ch DI, 32-ch SE, 16-bit, 250 kS mux, gain settings	NI-9205	D-Sub, Spring Terminal
Faster rate. Still high-density.	±10 V, 16-ch, 100 kS/s/ch simultaneous. No gain.	NI-9220	D-Sub, Spring Terminal
24-bit resolution. 250 V ch-ch isolation.	±10 V, 4-ch, 50 kS/s/ch	NI-9239	Screw Terminal, BNC
60 V input range	±60 V version of NI-9239	NI-9229	Screw Terminal, BNC
Lowest cost simultaneous sampling	±10 V, 4-ch, 100 kS/s/ch	NI-9215	Screw Terminal, Spring Terminal
Highest-speed simultaneous sampling	±10 V, 4-ch, 1 MS/s/ch	NI-9223	Screw Terminal, BNC
Medium speed. Medium cost.	±10 V, 4-ch, 500 kS/s/ch	NI-9222	Screw Terminal, BNC
Selectable filter, noise rejection	±10 V, 16-ch, 24-bit, 10 kS/s/ch	NI-9202	D-Sub, Spring Terminal
Digitizer functionality	±20 MS/s/ch digitizer. 14-bit.	NI-9775	BNC
Low cost, high-speed 12-bit	±10 V, 8-ch, 12-bit	NI-9201	D-Sub, Screw Terminal, Spring Terminal

TBL 1 All Voltage Input Modules

Voltage Output

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose.	±10 V, 16-ch, 25 kS/s/ch	NI-9264	D-Sub, Spring Terminal
Lower cost and channels. Faster.	±10 V, 4-ch, 100 kS/s/ch	NI-9263	Spring Terminal, Screw Terminal
Ch-ch Isolated Output, 40 V range	±10 V or ±40 V, 4-ch, 100 kS/s/ch	NI-9269	Screw Terminal

TBL 2 All Voltage Output Modules

Thermocouple

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose	16-ch	NI-9213	Spring Terminal
More accuracy (0.37 °C benchmark)	More accurate version of NI-9213	NI-9214	Spring Terminal
Ch-ch Isolation or TC minijack connectors	8-channel, ch-ch iso, mini TC jacks	NI-9212	TC minijacks, screw terminals

TBL 3 All Temperature Input Modules

Accelerometer and Microphone

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here.	4-ch, 51.2 kS/s/ch, ±5 V	NI-9234	BNC
2x Faster Sample Rate. 30 V range	3-ch, 102.4 kS/s/ch, ±30 V	NI-9232	Screw Terminal, BNC
More channels/module	8-ch, 51.2 kS/s/ch, ±5 V	NI-9231	10-32 Coaxial Jack
Lower Cost	12.8 kS/s/ch version of NI-9232	NI-9230	Screw Terminal, BNC

TBL 4 All Sound and Vibration Input Modules

Bridge, Strain, Load, Pressure, Torque

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose.	4-ch, 50 kS/s/ch, 1/4, 1/2, Full-bridge	NI-9237	RJ50, D-Sub*
More than 2x 120 Ohm 1/4 bridge sensors	8-channels	NI-9235	Spring Terminal

TBL 5 All Strain/Bridge Input Modules

RTD (Temperature)

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose	8-Ch, 400 S/s, 0 Ω – 400 Ω, PT100	NI-9216	RJ50, D- Sub*

TBL 6 All Temperature Modules

Universal

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose	4-ch, ch-ch iso, 100 S/s/ch, strain gages, RTD, Thermocouple, Load Cell, 1/2-, 1/4-, Full-bridge completion	NI-9219	Spring Terminals

TBL 7 All Universal Analog Input Modules

Current Input

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Start here. General purpose	±20 mA, 8-ch, 200 kS/s	NI-9203	Spring Terminal, Screw Terminal
More ch/module, 24-bit, 50/60 Hz rejection	±20 mA, 16-ch, 500 S/s	NI-9208	Spring Terminal, D-Sub
Simultaneous sampling and LED indicators	±20 mA, 8-ch, 200 kS/s	NI-9253	Spring Terminal

TBL 8 All Current Input Modules

Digital Input and Output

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
Industrial DIO	32-ch (16I/16O), 12 V/24 V industrial level	NI-9375	D-Sub, Spring Terminal
High Channel-count 24 V DO	32-ch, 12 V/24 V industrial level DO	NI-9476	D-Sub, Spring Terminal
TTL	8-ch, 5 V TTL	NI-9401	D-Sub
High Channel-count TTL	32-ch, 5 V TTL	NI-9403	D-Sub
High Channel-count 24 V DI	32-ch, 12 V/24 V industrial level DI	NI-9425	D-Sub, Spring Terminal
Relay	250 VAC, 60 VDC, 4 relays	NI-9482	Screw Terminal, Spring Terminal
Industrial DI	8-ch, 12 V/24 V DI	NI-9421	D-Sub, Spring Terminal, Screw Terminal
Industrial DO	8-ch, 12 V/24 V DO	NI-9472	D-Sub, Spring Terminal, Screw Terminal

TBL 9 All Digital Modules

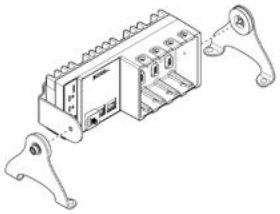
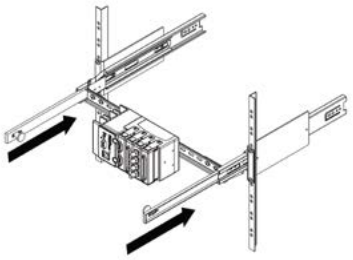
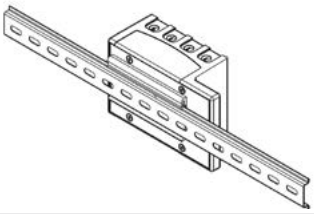
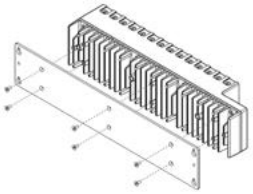
Power (Current and 120+ VAC)

NEED	MODULE DESCRIPTION	MODEL NUMBER	CONNECTOR OPTIONS
VOLTAGE: start here	3-ph 250 VAC L-N (400 VAC L-L) 50 kS/s/ch	NI-9242	Screw Terminal
VOLTAGE: 480 VAC	3-ph 400 VAC L-N (800 VAC L-L) 50 kS/s/ch	NI-9244	Screw Terminal
VOLTAGE: ch-ch iso Voltage	3 channels, 300 V Pk, 50 kS/s/ch	NI-9225	Screw Terminal
Current Low Voltage Transformer input	Voltage module that connects to 0.33 V CTs	NI-9238	Screw Terminal
Current 5A Secondary CT input	Connects to 5 A CTs (20 A range)	NI-9246	Screw Terminal
Current high accuracy, low range	Built-in shunt, 5 A RMS input	NI-9227	Screw Terminal

TBL 10 Voltage and Current Modules for Power Measurement

Mounting Considerations

Mechanical mounting and fixturing is a critical element of a design validation test system. Use the following table as you work through the physical design of your system.

MOUNTING CONFIGURATION	CONSIDERATIONS	IMAGE
Desktop	▪ Use the NI 9901 mounting kit (blue feet) with your chassis for easier access to I/O terminals when working on a desk or workbench.	
Rack mount	▪ I/O cables for cDAQ systems all come out the same direction. ▪ DIN rail can be used in conjunction with rack mount. ▪ Consider space for terminal blocks, power supplies, and cable management.	
DIN	▪ Industrial power supplies have DIN mounting options. ▪ Don't ship systems on DIN rail without considering shock impacts of traditional shipping methods.	
Panel	▪ Consider chassis replacements and upgrades. Can you use the same mounting plate for multiple chassis types? ▪ Some chassis have the same mounting hole configuration, others do not. ▪ Some chassis mount threads access from the front, and some from the back.	
Portable plastic case	▪ Consider patch panels for a cleaner install of power and communication cables. ▪ Plastic cases with closed lids don't dissipate heat as well as those with the lid open. ▪ NI does not sell plastic cases for portable systems, but many case manufacturers have panel kits and cable patch-panels to build suitcase-style portable systems.	

TBL 11 Mounting Considerations

See the white paper CompactDAQ Controller and Chassis Mounting Accessories for more information and images related to mounting CompactDAQ systems.

Use the CompactDAQ advisor to match the right mounting accessories to your chassis. See the Configuring and Buying a System Online section.

2D Drawings and 2D CAD Files

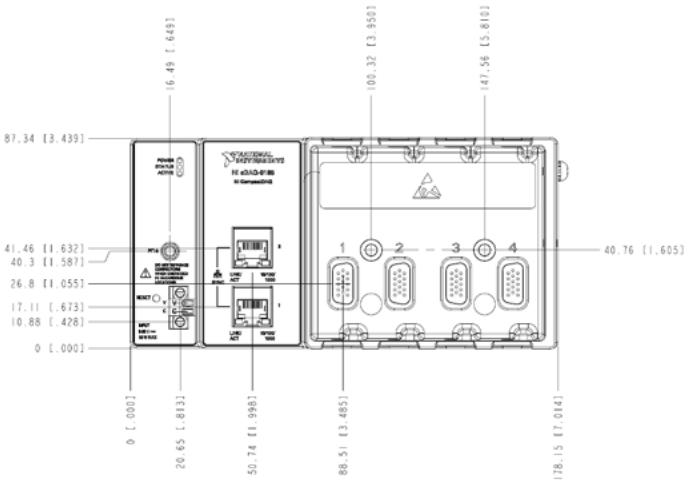


FIG 6 2D dimensional drawings and 3D models are available on ni.com. Available file formats for the cDAQ-9185 (2D drawing shown in image) include PDF, DXF, PRT, STP, and IGS.

See the Dimensional Drawings support page and enter the product model number, for example, "cDAQ-9185," to access 2D drawings and CAD model files.

Powering CompactDAQ Systems

CompactDAQ chassis need a power supply with a 9 – 30 VDC output. A desktop power supply that will power a fully loaded chassis is included in the chassis shipping kit. AC power cords are region specific and sold separately.

See the power consumption specs in your chassis datasheet for power (watts) used. Power use is typically relevant when sizing multiple loads on a single power supply or when planning to use a battery pack. Installed modules add up to 1 watt each to the system power requirements.

FIG 7 NI CompactDAQ chassis ship with a desktop power supply (image above) in the box. The AC power cord is sold separately.

The desktop power supply as seen in Figure 7 arrives ready to connect to the chassis. For alternate power supplies, purchase extra 2-position screw terminals and connect with standard red/black wires from the DC power supply.

Note: The 2-position screw terminal for the power supply is the same form factor as those found on the modules, but is labeled for power supply inputs (V+/V-) instead of channel inputs (0/1).

FIG 8 Use NI industrial power supplies for mounted applications or for consolidating multiple chassis onto a single power supply.

Shop for NI industrial power supplies.

Grounding and Isolation

Safety and Instrument Protection

CompactDAQ modules are independently certified to be safe when used within specifications. Most modules feature hazardous location certifications and/or isolation. Each module is categorized into the following NI-defined isolation levels:

- 60 VDC continuous / 1000 V_{RMS} withstand
- 250 V_{RMS} continuous / 2300 V_{RMS} withstand
- 300 V_{RMS} continuous / 2300 V_{RMS} withstand

Field Wiring and Grounding

Knowing the nature of the signal source and relevant grounding configurations is required to produce accurate and noise-free measurements. Signal sources are broadly classified into two types:

- Grounded or ground-referenced signal source
- Ungrounded or nonreferenced (floating) signal source

A grounded signal source is best measured with a differential or nonreferenced measurement system. In a differential architecture, neither of the inputs is tied to a fixed reference such as Earth of building ground. This is useful in rejecting noise including the unwanted noise often introduced in the circuit that makes up the cabling system as common-mode voltage. One drawback to this approach is that you need twice the number of input channels as signals in your DAQ system. Alternatively, you can use a nonreferenced single-ended (NRSE) architecture that uses one channel per signal and measures each to the same pin usually labeled as AI Sense.

Grounding Resources

For more information, see the following resources:

Understanding and Trusting Isolation Specifications

Grounding Considerations—Intermediate Analog Concepts

Isolation from the Chassis Ground for NI DAQ Hardware

Different Types of Isolation

Helpful Tools for Your Toolbox

Consider these tools when planning CompactDAQ based test systems. These tools are not available from NI.

TOOL	USE FOR	SEARCH FOR
Precision screwdriver with 2.3 mm blade	Connecting wires to spring terminal modules such as the NI 9213	Screwdriver with 2.3 mm x 1 mm blade
Ferrule crimper and ferrules	Crimping the ends of stranded wires for screw terminal modules. Needed for high vibration environments and for connecting dual wires into a single terminal for some applications.	Ferrule crimper
Rivet nuts and rivet nut tool	Mounting the chassis to a metal panel that's in an enclosure. Thru-hole mounting with nut/bolt combination also works, but rivet nuts make it easier to service an installed panel. Use in combination with a chassis panel mount kit.	Rivet nuts
Hand crimp tool	Crimping 4-terminal connector on external excitation plug for NI 9237 module	Molex part number: 0638190000
RJ50 crimp tool and RJ50 connectors	Crimping sensor cables to turn wire leads into an RJ50 connection. (RJ50-RJ50 cable available as an accessory from NI)	RJ50 crimp tool
Standard Phillips head screwdriver	Ground lug on chassis and some of the strain-relief mounts on the modules	Phillips head screwdriver
Small-blade screwdriver	Connecting to module screw-terminals	Small-blade screwdriver
Wire cutting, splicing tools. Needle-nose pliers	Working with signal wires (typically gage 14–26)	Wire strippers and pliers
Electrical heat-shrink tubing	Creating clean wire connections. Available for a variety of conditions and environments.	Heat-shrink tubing
Soldering station (iron, solder, flux)	Creating custom mass-term connectors and cables for D-Sub or LEMO modules.	Soldering equipment
Small plastic zip ties	Strain relief on wiring and cable clean-up	Zip ties
Wire nuts or other form of temporary connectors	Testing connections or creating removable wire junctions to multiple wires without a terminal block.	WAGO LEVER-NUTS or generic wire nuts

TBL 12 | Helpful Tools

Software Development and Operator Interface Considerations

Software is core to the cost, capability, and flexibility of test systems. Use the following considerations to design the right software technologies into your test system.

Available Programming Experience

Efficiently build your test system by aligning software technologies to team software capabilities. Consider the development skills on the team now, how easy those skills are to learn, and how quickly those skills could be contracted on short notice. It may make sense to contract a sub-component for a project if it's well scoped and not likely to need maintenance in the future. On the other hand, it may make sense to add developer skills training to the team for foundational projects that future test rigs will leverage.

If you are looking at LabVIEW, use the NI Partner Network to help with everything from architectural consulting to turn-key product delivery. Or improve your team's in-house development knowledge and ensure best practices with NI's Education Courses and certification programs.

If you're not looking to develop with LabVIEW, NI has one of the largest selections of programming language support for data acquisition, so you can find the support you need for Python, C, C++, Visual Basic 6.0, VB.NET, or C#. (See the Software Support Resources section.)

No programming experience on the team? No problem. FlexLogger data acquisition software covers key feature requirements for data acquisition, including a customizable user interface and alarms, so you can get the data you need to improve product quality without any programming.

Existing Code

Call existing code from LabVIEW-developed applications. Use LabVIEW for data acquisition, instrument control, UI development, and test automation. Use LabVIEW functions to call DLLs, Python script, or .m files from MathWorks MATLAB® software. Leveraging code saves time and this approach lets you use the right tool for the job. For more information on integrating your existing IP into LabVIEW-designed applications, see the following support documentation:

- Overview of Accessing DLLs or Shared Libraries from LabVIEW
- Connecting LabVIEW to 3rd Party Software Packages
- Integrating Python Code in LabVIEW
- Call Perl and Python Scripts from LabVIEW

Designing a Custom Application vs. Buying an Application

Developing a custom system in-house will meet 100% of test software requirements and let you control the system investment roadmap. In-house systems are not without cost though; be sure to factor in maintenance, training, and upgrades when investigating total cost of system ownership.

Benefits of buying off-the-shelf tools include vendor support, maintenance, and official training or an ecosystem of supporting content. But platform investments, the feature roadmap, and support are controlled by the vendor and could be deprecated.

FlexLogger is an off-the-shelf application that covers data acquisition and logging so teams can save developer resources for tasks better aligned to the team's mission.

Use the NI-DAQmx API to develop a custom system in-house system with the programming language that best suits the needs of your system and capabilities of the team.

Data File Formats

One very important consideration for file formats is open standard versus custom format. An example of a common, open format is the .csv file which is human readable and great for sharing data because Excel and other .csv-compatible applications are ubiquitous. The downside is file I/O performance, especially for high channel-count systems or measurements with acquisition rates in the 10 kHz+ range.

In-house binary formats are common because, they are tailored to the needs of the system for maximum optimization. The downside is limited ability to share raw data from the system without writing conversion programs, along with the risk of losing access if file documentation is lost. "Jane was the only one that knew the file schema and she just won the lottery and left the company."

NI recommends the .tdms format for logging dynamic waveform data to disk. A .tdms file uses an open binary format so your system has the performance of binary and the documented benefits of an open-source format. Several vendors advertise support for .tdms file formats, though many label support as "DIAdem file support" after the analysis package that originated the file format. See The NI TDMS File Format for more information on .tdms files.

Operator Interface

User interface features have an impact on application development and required software technologies. Does the operator just push a button and sit back waiting for the file? Are there live data updates on the screen? What about web access? LabVIEW is known for UI functionality in data acquisition systems, and the G Web Development Software makes test stations accessible anywhere in the world. These features add development time and cost but can improve test coverage (product quality) and reduce test time.

FIG 9 Demand for remote access to test systems is increasing. Use the G Web Development Software with LabVIEW to build viewers that run in standard web browsers so design teams and test teams can collaborate faster.

For the non-programming option, operators can configure FlexLogger UIs while the project is running to adjust to what is happening during the test. This manages variances in test setup criteria that may not have been considered—or couldn't have been considered—before the DUT was connected. By contrast, for a simplified experience, the UI panels can be pre-built and locked down.

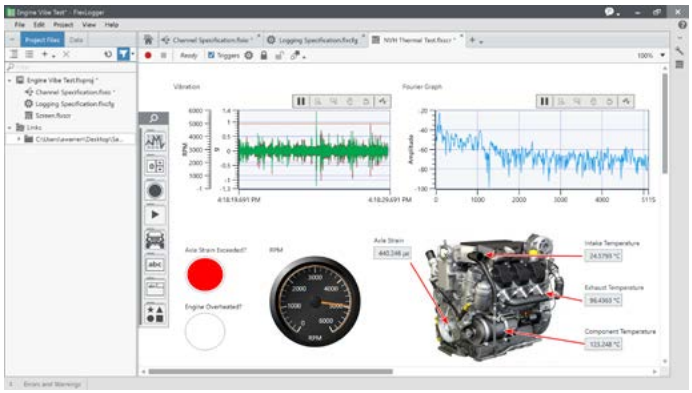


FIG 10 Configure flexible UIs with FlexLogger that are useful and intuitive to operators.

Software Support Resources

Use this section to prepare the PC you're connecting to CompactDAQ. Install the latest NI-DAQmx driver for programming support in LabVIEW, C, C++, Visual Basic 6.0, VB.NET, C# and Python. Contact MathWorks for MATLAB support using Data Acquisition Toolbox™.

API Support Resources

For programming with LabVIEW, see the Getting Started with CompactDAQ Hardware and LabVIEW tutorial for links to LabVIEW development software, how-to videos for taking a measurement, and links to other helpful resources.

For programming with Python, see the NI-DAQmx Python Documentation and associated link to GitHub for the latest source.

For programming with C and .NET, see the NI-DAQmx in Text Based Programming Environments supplemental documentation.

FlexLogger Getting Started Resources

For configuring a data acquisition system without programming, see the Getting Started with CompactDAQ Hardware and FlexLogger tutorial.

For help scripting FlexLogger with Python, see niflexlogger-automation-python on GitHub for an API and examples.

Configuring and Buying a System Online

Use this section for help using NI's online tools for configuring, quoting, and ordering a system.

Starter Configurations

The following system configurations contain a chassis, popular measurement modules, hardware accessories, and FlexLogger data acquisition software. Use these configurations as a starting point for a test system or for a discussion with a technical expert from NI or authorized NI distributor.

- Expandable Thermocouple Data Acquisition System
- Sound and Vibration Data Acquisition System
- Load, Pressure, Force, and Strain Test System
- Mixed-Sensor Electromechanical Test System (voltage, current, thermocouple, DIO)

Using the CompactDAQ System Advisor

Use the CompactDAQ system advisor to find the right accessories for your chassis and modules. Start from one of the previous configurations.

FIG 11 In order to see accessories designed to work with a particular connector type, click the [edit] link as depicted in this screenshot once you have selected the correct module.

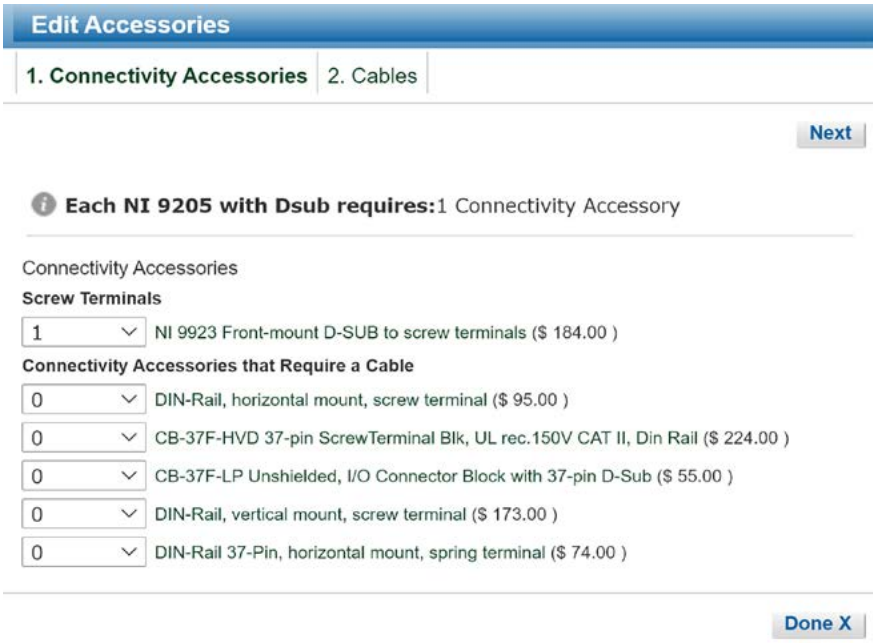


FIG 12 The Edit Accessories window shown in this screenshot lists the types of accessories needed along with the available options for that specific module. For example, the NI 9205 with D-Sub has several terminal block options that require a cable. Select cables on the tab labeled "2. Cables." Many of the accessories listed are links to model pages with images of the accessory.

Mounting for CompactDAQ		Price Per Unit
	0 Module Immobilization Accessory for the cDAQ-9133 and cDAQ-9135	$ 35.00
	0 Module Immobilization Accessory For 8-Slot cRIO-905x/906x/907x, NI-914x, and cDAQ-918x	$ 73.00
	0 Module Immobilization Accessory for the cDAQ-9132 and cDAQ-9134	$ 27.00
	0 Carrying Handle for CDAQ and CRio	$ 54.00
	0 NI 9901 Desktop Mounting Kit	$ 70.00
	0 NI 9903 Horizontal Panel Mounting Kit for 9181/91 Chassis	$ 42.00
	0 NI 9904 Horizontal Panel Mounting Kit for 4-slot Chassis	$ 80.00
	0 NI 9905 Horizontal Panel Mounting Kit for 8-slot Chassis	$ 42.00
	0 Industrial Rack Mount Kit for CompactRIO and CompactDAQ	$ 142.00
	0 NI 9912: DIN Rail Kit for 4-slot Chassis	$ 42.00
	0 NI 9913 DIN Rail Kit for NI 9181/9191 Chassis	$ 41.00
	0 NI 9915: DIN Rail Kit for 8-slot Chassis	$ 42.00
	0 NI 9918 Industrial Enclosure, windowed door, with panel	$ 577.00
	0 Desktop Mounting Kit for CompactRIO 908x & CompactDAQ 913x	$ 80.00
	0 Panel Mounting Kit NI cDAQ-913x (4 Slot)	$ 81.00
	0 DIN Rail Mounting Kit NI cDAQ-913x (4 Slot)	$ 42.00
	0 DIN Rail Mounting Kit for CompactRIO 908x & CompactDAQ 913x	$ 42.00
	0 Rack Mount Kit	$ 596.00
	0 NI Desktop Mounting Kit for 14 Slot Chassis	$ 70.00
	0 NI Horizontal Panel Mounting Kit for 14 Slot Chassis	$ 78.00
	0 NI 9916 DIN Rail Mounting Kit for 14 Slot Chassis	$ 55.00

FIG 13 The system accessories tab in the advisor includes part lists for AC power cords, industrial power supplies, Ethernet cables, mounting accessories (shown in screenshot), and more.

	A	B	C	D	E
1	**Your Configuration ID is: CD6360068**				
2					
3	**Modules**				
4	**Part Number**	**Model**	**Description**	**Quantity**	**Price**
5	779357-01	NI 9205 with Dsub	NI 9205 32-Ch ±10 V, 250 kS/s, 16-Bit AI Module w/ DSUB	1	xxxx
6	781503-01	NI 9923 Front-mount D-SUB to screw terminals	NI 9923 Front-mount terminal block for 37-pin D-Sub Modules	1	xxxx
7	779357-01	NI 9205 with Dsub	NI 9205 32-Ch ±10 V, 250 kS/s, 16-Bit AI Module w/ DSUB	1	xxxx
8	781503-01	NI 9923 Front-mount D-SUB to screw terminals	NI 9923 Front-mount terminal block for 37-pin D-Sub Modules	1	xxxx
9	779357-01	NI 9205 with Dsub	NI 9205 32-Ch ±10 V, 250 kS/s, 16-Bit AI Module w/ DSUB	1	xxxx
10	781503-01	NI 9923 Front-mount D-SUB to screw terminals	NI 9923 Front-mount terminal block for 37-pin D-Sub Modules	1	xxxx
11	779357-01	NI 9205 with Dsub	NI 9205 32-Ch ±10 V, 250 kS/s, 16-Bit AI Module w/ DSUB	1	xxxx
12	781503-01	NI 9923 Front-mount D-SUB to screw terminals	NI 9923 Front-mount terminal block for 37-pin D-Sub Modules	1	xxxx
13				**Subtotal:**	xxxx
14	**Chassis**				
15	785064-01	cDAQ-9185	NI cDAQ-9185 CompactDAQ Chassis (4-Slot Ethernet)	1	xxxx
16				**Subtotal:**	xxxx
17	**System Accessories**				
18	763000-01	United States 120VAC	Power Cord, AC, U.S., 120 VAC, 2.3 meters	1	xxxx
19				**Subtotal:**	xxxx
20	**Services**				
21	SRV-CD6360068	Standard Services	STANDARD SERVICE PROGRAM FOR COMPACTDAQ SYSTEMS FOR 3 YEARS	1	xxxx
22				**Subtotal:**	xxxx
23				**Total:**	xxxx
24					
25	National Instruments				
26	11500 N Mopac Expwy				
27	Austin, TX 78759-3504				
28					
29	Phone: (800) 531-5066				
30	Fax: 512-683-8411				
31					
32					
33					

FIG 14 You can export your entire system configuration to a Microsoft® Excel® file from the advisor, including software, services, and accessories. Note: the chassis system image shown in this image was also created from the advisor but required copy/paste addition to Excel spreadsheet.

Need Help? Contact Us

Want to discuss product recommendations, quote products, or place an order? See the Purchase and Quote section of our contact page for a toll-free number, NI phone routing menu, and some self-service links for generating a quote online or online purchases and quoting.