

300 V_{rms} Analog Input Power Measurement

NI 9225

- 3 channels, simultaneous inputs
- 50 kS/s/ch sample rate
- Channel-to-channel isolation up to 600 V_{rms}
- 24-bit resolution
- Synchronize high-voltage measurements with other modules
- Program for USB with the easy-to-use NI-DAQmx driver

C Series Compatibility

- NI CompactDAQ
- CompactRIO
- R Series expansion chassis

Recommended Software

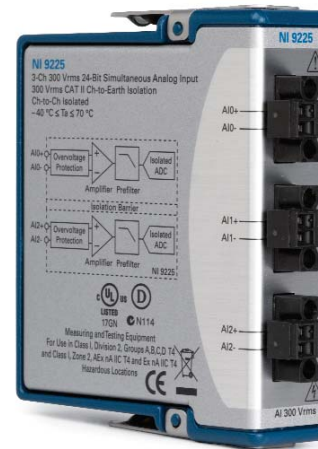
- LabVIEW
- LabWindows™/CVI
- Measurement Studio

NI-DAQmx Compatible Software

- LabVIEW SignalExpress
- Visual Studio .NET
- ANSI C/C++
- C#

Connectivity

- The NI 9225 is shipped with everything needed to connect signals out of the box



Family	C Series Compatibility	Channels	Resolution	Isolation	Max Range	Isolation Level	Sample Rate	Simultaneous
NI 9225	CompactRIO, NI CompactDAQ	3	24	Channel-to-Channel	300 V _{rms}	600 V _{rms}	50 kS/s/ch	✓
NI 9229	CompactRIO, NI CompactDAQ, USB Carrier	4	24	Channel-to-Channel	±60 VDC	250 V _{rms}	50 kS/s/ch	✓
NI 9239	CompactRIO, NI CompactDAQ, USB Carrier	4	24	Channel-to-Channel	±10 VDC	250 V _{rms}	50 kS/s/ch	✓

Table 1. Analog Input Modules for Dynamic Signals

Overview and Applications

The NI 9225 300 V_{rms} C Series analog input module was designed for the waveform measurements of high-voltage signals. The 300 V_{rms} range enables line-to-neutral as well as line-to-line measurements of 110 V power grids and line-to-neutral measurements of 240 V power grids. The three channels on the NI 9225 make the module ideally suited for a three-phase system. Voltage waveform measurements are necessary for monitoring power quality events such as sag, swell, transients, and harmonics. Combine the NI 9225 with the NI 9239 (10 V) and a current transducer to create a customizable power quality monitoring or power metering system.

Safety and Accuracy with Channel-to-Channel Isolation

Isolation is needed for safe operation around high voltages. The NI 9225 has 600 V of continuous channel-to-channel isolation for measurements with differing potentials, as well as 2,300 V_{rms} transient withstand for protection from sudden voltage spikes. In addition to safety, channel-to-channel isolated systems are more accurate and easier to set up due to the elimination of ground loops.

Elimination of Unwanted Signals with Built-In Antialias Filters

For dynamic measurements it is important to filter out unwanted signals. Without some form of filtering, unwanted high-frequency signals can alias the signal you are measuring, causing incorrect readings. To prevent these phenomena, the NI 9225 has built-in antialiasing filters that adjust to the selected sample rate and ensure that the signal you are measuring has no interference from signals beyond the Nyquist frequency.

Synchronous Measurements with Multiple ADCs

The NI 9225 uses four 24-bit analog-to-digital converters (ADCs) for true simultaneous sampling at 50 kS/s. Phase angle is an important factor for power quality measurements, so you must sample all data simultaneously to calculate a true phase offset between phases of voltage and current. For more channels, use multiple modules in an NI C Series chassis, such as NI CompactDAQ or CompactRIO. You can synchronize all channels within the same chassis through the backplane or to external chassis through exported clocks.

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Accessories

The NI 9225 is shipped with everything you need to take it out of the box and begin connecting signal wires. For added safety, you can purchase high-voltage backshells as an accessory kit. Accessory kits are also available for spares or replacements of the 2-pin screw connectors for the module.



Figure 1. High-Voltage Backshells (sold separately in quantities of four as NI 9971)

Ordering Information

NI 9225	780159-01
NI 9971 backshell kit	196375-01
NI 9976 replacement connectors	196739-01

BUY NOW!

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

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C Series Chassis

NI CompactDAQ Platform

NI CompactDAQ delivers the simplicity of USB to sensor and electrical measurements on the benchtop, in the field, and on the production line. By combining the ease of use and low cost of a data logger with the performance and flexibility of modular instrumentation, NI CompactDAQ offers fast, accurate measurements in a small, simple, and affordable system. Flexible software options make it easy to use NI CompactDAQ to log data for simple experiments or to develop a fully automated test or control system. The modular design can measure up to 256 channels of electrical, physical, mechanical, or acoustical signals in a single system. In addition, per-channel ADCs and individually isolated modules ensure fast, accurate, and safe measurements.



Figure 2. NI CompactDAQ Platform

NI CompactRIO Platform

When used with the small, rugged CompactRIO embedded control and data acquisition system, C Series analog input modules connect directly to reconfigurable I/O (RIO) field-programmable gate array (FPGA) hardware to create high-performance embedded systems. The reconfigurable FPGA hardware within CompactRIO provides a variety of options for custom timing, triggering, synchronization, filtering, signal processing, and high-speed decision making for all C Series analog input modules. For instance, with CompactRIO, you can implement custom triggering for any analog sensor type on a per-channel basis using the flexibility and performance of the FPGA and the numerous arithmetic and comparison function blocks built into the NI LabVIEW FPGA Module.



Figure 3. NI CompactRIO Platform

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Specifications and Accuracy

>> For complete specifications, see the *NI 9225 Operating Instructions and Specifications* manual at ni.com/manuals.

Input Characteristics

Number of channels.....	3 analog input channels
ADC resolution.....	24 bits
Type of ADC.....	Delta-sigma (with analog prefiltering)
Sampling mode.....	Simultaneous
Data rate range (f_s)	
Minimum.....	1.613 kS/s
Maximum.....	50 kS/s
Data rate range (f_s).....	50 kS/s, $n = 1, 2, \dots, 31$.
Master timebase (internal)	n
Frequency.....	12.8 MHz
Accuracy.....	± 100 ppm max
Operating voltage ranges ¹	
Nominal.....	300 V _{rms}
Minimum.....	295.1 V _{rms}
Typical scaling coefficient.....	50.66 μ V/LSB
Overvoltage protection.....	450 VDC
Input coupling.....	DC
Input impedance (AI+ to AI-).....	1 M Ω

¹Refer to the *Safety Guidelines* section for more information about safe operating voltages.

Error	Percent of Reading (Gain Error)	Percent of Reading ¹ (Offset Error)
Calibrated max (-40 to 70 °C)	$\pm 0.22\%$	$\pm 0.05\%$
Calibrated typ (25 °C, ± 5 °C)	$\pm 0.03\%$	$\pm 0.008\%$
Uncalibrated max (-40 to 70 °C)	$\pm 1.8\%$	$\pm 0.68\%$
Uncalibrated typ (25 °C, ± 5 °C)	$\pm 0.3\%$	$\pm 0.1\%$

¹Range Equals 426.6 V

Accuracy

Input noise.....	2.2 mV _{rms}
Stability	
Gain drift.....	± 10 ppm/°C
Off-set drift.....	± 1 mV
Post calibration gain match	
(ch-to-ch, 20 kHz).....	0.22 dB max
Crosstalk (1 kHz).....	-130 dB
Phase mismatch (ch-to-ch).....	0.045 deg/kHz max
Phase mismatch	
(module-to-module, max).....	0.045 deg/kHz + 360 deg $\cdot f_{in}/M_{clk}$ ¹
Phase nonlinearity ($f_s = 50$ kS/s).....	0.11 deg max
Input delay.....	38.4/ f_s + 2.6 μ s
Passband	
Frequency.....	0.453 $\cdot f_s$
Flatness ($f_s = 50$ kS/s).....	± 100 mdB max
Stopband	
Frequency.....	0.547 $\cdot f_s$
Rejection.....	100 dB

Aliasfree bandwidth.....	0.453 $\cdot f_s$
-3 dB prefilter bandwidth	
($f_s = 50$ kS/s).....	24.56 kHz
CMRR ($f_{in} = 60$ Hz).....	100 dB
SFDR (1 kHz, -60 dBFS).....	-128 dBFS
Total harmonic distortion (THD).....	-105 dB (1 kHz, -20 dBFS)
MTBF.....	TBD hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method

¹ M_{clk} is the master timebase.

Note: Contact NI for Bellcore MTBF specifications at other temperatures or for MIL-HDBK-217F specifications.

Power Requirements

Power consumption from chassis	
Active mode.....	148 mA max
Sleep mode.....	5 μ A max
Thermal dissipation (at 70 °C)	
Active mode.....	760 mW max
Sleep mode.....	16 mW max

Physical Characteristics

If you need to clean the module, wipe it with a dry towel.	
Screw-terminal wiring.....	16 to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end
Torque for screw terminals.....	0.22 to 0.25 N \cdot m (1.95 to 2.21 lb \cdot in.)
Ferrules.....	0.25 to 0.5 mm ²
Weight.....	147 g (5.2 oz)

Safety

Maximum Voltage

Connect only voltages that are within these limits.
AI+ to AI-300 V_{rms} max

Isolation Voltages

Channel-to-channel	
Continuous.....	600 V _{rms} , Measurement Category II
Withstand.....	2300 V _{rms} , verified by a 5 s dielectric withstand test
Channel-to-earth ground	
Continuous.....	300 V _{rms} , Measurement Category II
Withstand.....	2300 V _{rms} , verified by a 5 s dielectric withstand test

Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example, 115 V for United States or 230 V for Europe. Do not connect the NI 9225 to signals or use for measurements within Measurement Category III or IV.

NI Services and Support



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Hardware Services

NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with ni.com/pxiadvisor.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit ni.com/calibration.

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