Portable USB-Based DAQ for Thermocouples
NI USB-9211A

- Small, portable device (12.1 by 8.6 by 2.5 cm)
- 4 analog inputs at 24-bit resolution
- 12 S/s sampling rate
- Built-in, removable connectors for easier and more cost effective connectivity
- 250 Vrms channel-to-earth ground isolation
- Plug-and-play connectivity via USB
- Bus-powered

Overview
The National Instruments USB-9211A is a data acquisition module with integrated signal conditioning that provides plug-and-play connectivity via USB for faster setup and measurements. It is designed especially for thermocouple measurements with 24 bits of resolution for superior accuracy and built-in sensors for cold-junction compensation. In addition, this module includes 250 Vrms channel-to-earth ground isolation for safety, noise immunity, and high common-mode voltage range.

Requirements and Compatibility

<table>
<thead>
<tr>
<th>OS Information</th>
<th>Driver Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>NI-DAQmx</td>
</tr>
<tr>
<td>Windows 2000/XP</td>
<td></td>
</tr>
<tr>
<td>Windows 7</td>
<td></td>
</tr>
<tr>
<td>Windows Vista</td>
<td></td>
</tr>
</tbody>
</table>

Comparison Tables

<table>
<thead>
<tr>
<th>Product</th>
<th>Signal Type</th>
<th>Channels (AI)</th>
<th>Input Resolution (bits)</th>
<th>Maximum Sampling Rate (S/s)</th>
<th>Input Range (mV)</th>
<th>Operating System</th>
<th>Driver Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB-9211A</td>
<td>Thermocouple</td>
<td>4</td>
<td>24</td>
<td>12</td>
<td>±80</td>
<td>Windows</td>
<td>NI-DAQmx</td>
</tr>
</tbody>
</table>

Application and Technology

Software
The NI USB-9211A uses NI-DAQmx high-performance, multithreaded driver software for interactive configuration and data acquisition on Windows OSs. All NI data acquisition devices shipped with NI-DAQmx also include NI LabVIEW SignalExpress LE configuration-based data-logging software.
Recommended Accessories

The USB-9211A has built-in screw-terminal connectivity, so no additional accessories are required.

Common Applications

The USB-9211A is ideal for a number of applications where small size and portability are essential, such as:

- Portable data logging – log temperature data quickly and easily
- Academic lab use – obtain academic discounts for quantities of five or more (visit ni.com/academic for details)
- Environmental monitoring – monitor environmental temperature conditions
- Embedded OEM applications
- In-vehicle data acquisition

Information for OEM Customers

For information on special configurations and pricing, please visit ni.com/oem.

Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Software Recommendations

**LabVIEW Professional Development System for Windows**

- Advanced software tools for large project development
- Automatic code generation using DAQ Assistant and Instrument I/O Assistant
- Tight integration with a wide range of hardware
- Advanced measurement analysis and digital signal processing
- Open connectivity with DLLs, ActiveX, and .NET objects
- Capability to build DLLs, executables, and MSI installers

**NI LabWindows™/CVI for Windows**

- Real-time advanced 2D graphs and charts
- Complete hardware compatibility with IVI, VISA, DAQ, GPIB, and serial
- Analysis tools for array manipulation, signal processing statistics, and curve fitting
- Simplified cross-platform communication with network variables
- Measurement Studio .NET tools (included in LabWindows/CVI Full only)
- The mark LabWindows is used under a license from Microsoft Corporation.

**NI Measurement Studio Professional Edition**

- Customizable graphs and charts for WPF, Windows Forms, and ASP.NET Web Forms UI design
- Analysis libraries for array operations, signal generation, windowing, filters, signal processing
- Hardware integration support with native .NET data acquisition and instrument control libraries
- Automatic code generation for all NI-DAQmx data acquisition hardware
- Intelligent and efficient data-logging libraries for streaming measurement data to disk

Support and Services

**System Assurance Programs**

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration
NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.
- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit ni.com/training for more information.

Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit ni.com/warranty.

OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

Detailed Specifications

The following specifications are typical at 25 °C, unless otherwise noted. All voltages are relative to COM unless otherwise noted.

<table>
<thead>
<tr>
<th>Input Characteristics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of channels</td>
<td>4 thermocouple channels, 1 internal autozero channel, 1 internal cold-junction compensation channel</td>
</tr>
<tr>
<td>ADC resolution</td>
<td>24 bits</td>
</tr>
<tr>
<td>Type of ADC</td>
<td>Delta-sigma</td>
</tr>
<tr>
<td>Input range</td>
<td>±80 mV (not software selectable)</td>
</tr>
<tr>
<td>Common-mode range</td>
<td></td>
</tr>
<tr>
<td>Channel-to-COM</td>
<td>±1.5 V</td>
</tr>
<tr>
<td>Common-to-earth ground</td>
<td>±250 V</td>
</tr>
<tr>
<td>Common-mode rejection ratio (0 to 60 Hz)</td>
<td></td>
</tr>
<tr>
<td>Channel-to-common</td>
<td>95 dB</td>
</tr>
<tr>
<td>Common-to-earth ground</td>
<td>&gt;170 dB</td>
</tr>
<tr>
<td>Temperature measurement ranges</td>
<td>Works over temperature ranges defined by NIST (J, K, R, S, T, N, E, and B thermocouple types)</td>
</tr>
<tr>
<td>Cold-junction compensation sensor accuracy</td>
<td></td>
</tr>
<tr>
<td>0 to 60 °C</td>
<td>0.6 °C (1.1 °F) typ, 1.3 °C (2.3 °F) max</td>
</tr>
<tr>
<td>Conversion time</td>
<td>70 ms per channel; 420 ms total for all channels including the autozero and cold-junction channels</td>
</tr>
</tbody>
</table>
## Max sampling rate (Hz)

<table>
<thead>
<tr>
<th>Number of Channels in Scan List</th>
<th>Type of Measurement</th>
<th>RAW Analog Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature with CJC and Autozero</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Temperature with Autozero</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Temperature with Autozero</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>RAW Analog Input</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: NI-DAQmx Base always applies autozero.

### Input Characteristics

- **Input bandwidth (–3 dB)**: 15 Hz
- **Noise rejection**: 85 dB min at 50/60 Hz
- **Overvoltage protection**: ±30 V between any input and common
- **Differential input impedance**: 20 MΩ
- **Input current**: 50 nA
- **Input noise**: 1 µV rms
- **Gain error**: 0.05% max at 25 °C, 0.06% typ (over temperature) 0.1% max (over temperature)
- **Offset error (with autozeroing)**: 15 µV typ, 20 µV max
- **Gain error from source impedance**: 0.05 ppm per Ω source impedance due to input impedance
- **Offset error from source impedance**: 0.05 µV typ, 0.07 µV max per Ω source impedance due to input current

### Power Requirements

- **Current consumption from USB**: 500 mA, max
- **Current consumption from USB, suspend mode**: 2.5 mA, max

### Bus Interface

- **USB specification**
  - NI USB-9211: USB 2.0 Full-Speed
  - NI USB-9211A: USB 2.0 Hi-Speed

### Physical Characteristics

- **Dimensions**: 14 cm × 8.6 cm × 2.5 cm (5.51 in. × 3.37 in. × 0.99 in.)
- **Weight**: Approx. 350 g (12.3 oz)
- **Screw-terminal wiring**: 12 to 24 AWG wire with 10 mm (0.39 in.) of insulation stripped from the end
- **Torque for screw terminals**: 0.5–0.6 N · m (4.4–5.3 lb · in.)

### Safety

- **If you need to clean the module, wipe it with a dry towel.**

#### Safety Voltages

- **Channel-to-COM**: ±30 V max, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

- **Isolation**
  - **Channel-to-channel**: No isolation between channels
  - **Channel-to-earth ground**: 2,300 V rms, 5 seconds max
  - **Continuous**: 250 V rms, Measurement Category II

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 U.S. or 230 V for Europe).
Safety Standards
This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to the product label or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Hazardous Locations
This device is not certified for use in hazardous locations.

Environmental
The NI USB-9211/9211A device is intended for indoor use only.

Operating temperature (IEC 60068-2-1 and IEC 60068-2-2) 0 to 60 °C
Storage temperature (IEC 60068-2-1 and IEC 60068-2-2) −40 to 85 °C
Operating humidity (IEC 60068-2-56) 10 to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56) 5 to 95% RH, noncondensing
Maximum altitude 2,000 m (at 25 °C ambient temperature)

Electromagnetic Compatibility
This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note For EMC compliance, operate this device with double-shielded cables.

CE Compliance
This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Note Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit ni.com/certification, search by module number or product line, and click the appropriate link in the Certification column.

Environmental Management
National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the NI and the Environment Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

Note For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit ni.com/environment/weee.htm.

Calibration
You can obtain the calibration certificate for this device at ni.com/calibration.

Calibration interval 1 year
Pinouts/Front Panel Connections

<table>
<thead>
<tr>
<th>Module</th>
<th>Terminal</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>TC0+</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>TC0−</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>TC1+</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>TC1−</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>TC2+</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>TC2−</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>TC3+</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>TC3−</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>No connection</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Common (COM)</td>
</tr>
</tbody>
</table>

NI USB-9211/9211A Terminal Assignments