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Strain- and Bridge-Based Measurements

NI USB-9237

- Full-, half-, and quarter-bridge (120/350 Ω) completion[1]
- Bus powered
- Built-in excitation up to 10 V
- Up to 50 kS/s/ch sample rate
- Simultaneous acquisition with four ADCs
- Quick sensor connect with RJ50 connectors
- TEDS (IEEE 1454.1) compatible
- External excitation input through analog bridge (optional)

[1]Quarter bridge requires accessory.

Operating Systems

- Windows Vista/XP/2000

Compatible Software

- LabVIEW
- LabWindows™/CVI
- Measurement Studio
- Visual Basic 6.0
- C# and Visual Basic .NET
- ANSI C/C++

Measurement Services Software (included)

- NI-DAQmx driver software
- Measurement & Automation Explorer configuration utility
- LabVIEW SignalExpress LE data-logging software



Overview

The National Instruments USB-9237 combines performance and portability by making the NI 9237 C Series module compatible with the bus-powered USB carrier for C Series modules. This module is ideal for laptop applications because the USB port on the laptop powers all acquisition and sensor excitation.

High-Speed Measurements

The NI USB-9237 module can take measurements at up to 50 kS/s on four channels simultaneously and continuously stream the data back over a Hi-Speed USB interface to serve applications from static load or fatigue testing to high-speed fracture tests.

Sensor Compatibility

With full-, half-, and quarter-bridge completion, the USB-9237 can measure a variety of load, force, and torque cells as well as some pressure transducers and most strain gages.[1]

Safety Isolation

- 30 V of overvoltage protection
- 60 V of CAT I channel-to-earth ground isolation
- 1000 V of transient withstand isolation

[1]Quarter bridge requires accessory.

Connectivity

The USB-9237 uses four standard RJ50 connectors for rapid sensor connection. You can add an RJ50 connector to any sensor using a crimping tool, making sensor removal and insertion as easy as connecting a PC to a network. For screw-terminal connectivity, the NI 9949 accessory kit converts from RJ50 to 10 screw terminals. RJ50 cable kits are available in quantities of four 2 m cables and one 10 m cable. For custom sensor wiring, cable kits are available with an RJ50 connector on one end and 10 signal wires on the other.

Software

The USB-9237 is shipped with the standard NI-DAQmx bundle that includes Measurement & Automation Explorer (MAX) for configuration and testing; LabVIEW SignalExpress LE for out-of-the-box measurements, logging, and data display; and an API/driver for languages such as LabVIEW, ANSI C, C#, Visual Basic .NET, Visual Basic 6.0, Measurement Studio, and LabWindows/CVI.

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Specifications

>> For complete specifications, see the *NI USB-9237 User Guide and Specifications* manual at **ni.com/manuals**.

Input Characteristics

Number of channels 4
Bridge completion
  Full and half ..... Internal
  Quarter ..... External
  ADC resolution ..... 24 bits
  Type of ADC ..... Delta-sigma (with analog prefiltering)
  Sampling mode ..... Simultaneous
  Data rates (f_s) ..... (50 kS/s)/n, n= 1, 1, …31
Master timebase (internal)
  Frequency ..... 12.8 MHz
  Accuracy ..... ±100 ppm max
  Nominal full-scale range ..... ±25 mV/V
Scaling coefficient ..... 2.9802 nV/V per LSB
Overvoltage protection
  between any two terminals ..... ±30 V
Accuracy

Error[1]	Percent of Reading	Percent of Range[2]
Calibrated max (-40 to 70 °C)	0.20%	0.25%
Calibrated typ (25 °C, ±5 °C)	0.05%	0.05%
Uncalibrated max (-40 to 70 °C)	0.60%	0.35%
Uncalibrated typ (25 °C, ±5 °C)	0.20%	0.1%

[1] Excluding offset null or shunt calibration. [2] Range equals 25 mV/V.

Gain drift ..... 10 ppm/°C max
Offset drift
  2.5 V excitation ..... 0.6 µV/V per °C
  3.3 V excitation ..... 0.5 µV/V per °C
  5 V excitation ..... 0.3 µV/V per °C
  10 V excitation ..... 0.2 µV/V per °C

Safety

Safety Voltages

Connect only voltages that are within these limits.
Between any two terminals ..... ±30 V max

Isolation

Channel-to-channel ..... No isolation between channels
Channel-to-earth ground
  Continuous ..... 60 VDC, Measurement Category I
  Withstand ..... 1,000 V_{rms}, verified by a 5 s dielectric withstand test

Excitation Voltages

Although the sensor industry does not recognize a single standard excitation voltage level, excitation voltage levels of between 2.5 and 10 V are common. You can program the USB-9237 to supply 2.5, 3.3, 5, or 10 V of excitation voltage, and the module can provide up to 150 mW of excitation power. Unless you supply external excitation voltage, National Instruments recommends that you set the excitation voltage to a value that keeps the total power below 150 mW. The USB-9237 automatically reduces internal excitation voltages as needed to stay below 150 mW.

The power consumed by a single bridge is

$$\frac{V_{ex}^{\ 2}}{R}$$

where R is the total resistance of the bridge.

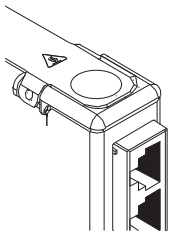
For a full bridge, R is equal to the resistance of each element. For a half or quarter bridge, R is equal to two times the resistance of each element.

With the 150 mW limit, you can power full and half bridges as follows:

- Four 350 Ω half bridges at 5.0 V
- Four 350 Ω full bridges at 3.3 V
- Four 120 Ω half bridges at 2.5 V

If you need an excitation voltage greater than 150 mW, use the four-position external excitation voltage connector to connect an external excitation source to the USB-9237.

Channel Signal Names

RJ50 (10p10c) Modular Plug and Receptacle Pin Numbers	RJ50 Pin	RJ45 Pin	Signal Name	Signal Description
	1	–	SC	Shunt calibration
	2	1	AI+	Positive input signal
	3	2	AI-	Negative input signal
	4	3	RS+	Positive remote sense signal
	5	4	RS-	Negative remote sense signal
	6	5	EX+	Positive excitation signal[1]
	7	6	EX-	Negative excitation signal[1]
	8	7	T+	TEDS DATA
	9	8	T-	TEDS Return[1]
	10	–	SC	Shunt calibration

[1] These signals are shared by all four RJ50 connectors on the USB-9237.

Accessories

There are several options for connecting signals to the USB-9237, as shown in figures 1 and 2.



Figure 1. NI 9237 with RJ50 to 10 m Signal Wire Cable



Figure 2. NI 9237 with RJ50 Cable and Screw-Terminal Accessories

Ordering Information

NI USB-9237 (carrier, module, and USB cable)	780137-01
NI 9945 (1/4 bridge, 350 Ω, qty 4)	194739-01
NI 9944 (1/4 bridge, 120 Ω, qty 4)	194738-01
NI 9949 (RJ50 to screw terminal)	196809-01
NI 9942 (excitation connector)	194611-01
RJ50 cable, 2 m (qty 4)	194612-02
RJ50 cable, 10 m (qty 1)	194612-10
RJ50 to signal wire cable, 2 m (qty 4)	195950-02
RJ50 to signal wire cable, 10 m (qty 1)	195950-10

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351510A-01 2007-9107-301-101-D

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