High-Density Industrial Digital I/O for USB — 96-Channel, 5 V TTL/CMOS

NI USB-6509 *NEW!*

- Portable digital I/O device
- 96 bidirectional I/O channels (5 V TTL/CMOS)
- High-current drive (up to 24 sink or source)
- Optional power supply for additional sourcing current
- Built-in, selectable pull-up/pull-down resistors
- Direct connection to 5 V logic devices and most solid-state relays
- Low-cost solution with superior features for data acquisition, manufacturing test, and industrial control applications

Industrial Features

- Programmable power-up states
- Per-channel selectable debounce filters for digital input lines
- Change-of-state detection
- Watchdog timer

Operating Systems

- Windows Vista/XP/2000

Recommended Software

- LabVIEW
- LabWindows™/CVI
- Measurement Studio

Other Compatible Software

- Visual Studio .NET, C#
- Visual Basic 6.0
- ANSI C/C++
- LabVIEW SignalExpress

Measurement Services Software (included)

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

Product	Digital I/O Lines	Isolation	Max Range	Low Threshold	High Threshold	Output Current	Industrial Feature Set
NI USB-6509	96	–	0...5 V	0.8 V	2.0 V	±24 mA	✓

Overview and Applications

The NI USB-6509 is a portable, industrial data acquisition device with 96 channels of digital I/O. It is compatible with TTL, CMOS, and 5 V digital logic levels. You can individually configure each port of eight lines for input or output. You can drive external digital devices, such as solid-state relays (SSRs), with current up to 24 mA per line using power available over USB. In bus-powered mode, the USB-6509 can source up to 215 mA total across all digital output lines. Use the optional 12 VDC power supply for additional sourcing current. A USB-6509 is ideal for general-purpose data acquisition applications as well as industrial control and automated manufacturing test. With high-current drive, you can connect the digital I/O device directly to a wide array of 5 V electronic devices, sensors, and actuators.

Industrial digital I/O devices are designed to incorporate the latest hardware technologies for applications requiring ease of use, high reliability, and performance. The USB-6509 takes advantage of NI-DAQmx measurement services software to speed up application development with features such as the DAQ Assistant, automatic code generation, and high-performance multithreaded streaming technology.

Hardware

Industrial Feature Set

NI industrial digital I/O devices offer a set of high-reliability features designed to automate even the most demanding applications.

- Programmable power-up states provide safe operation when connected to pumps/valves/motors/relays
- Digital I/O watchdogs detect computer or application crashes and ensure safe recovery
- Change-detection triggers your application and performs a read operation after a digital event with minimal processor usage
- Programmable input filters eliminate glitches/spikes and remove noise

Glitch-Free Startup with Programmable Power-Up States

Using programmable power-up states, you can configure the initial USB-6509 output states in software to ensure consistent, reliable operation when connected to industrial actuators such as pumps, valves, motors, and relays. A USB-6509 holds these output states after receiving power, so your computer can boot and your software application can begin running. Programmable power-up states are glitch-free, meaning the outputs never go through an incorrect state during power up.

You can configure each digital line as high-impedance-input, high-output, or low-output. A USB-6509 stores the settings in onboard nonvolatile memory and implements the power-up states instantaneously after power is applied to the device.

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Detect and Recover with Digital I/O Watchdogs

Digital I/O watchdogs are an innovative technology that can detect a variety of fault conditions such as an application crash and automatically respond by setting the outputs to a user-configured safe state. Watchdogs are important whenever the module is connected to actuators such as pumps, valves, motors, and relays. A USB-6509 monitors the software application; if the application fails to respond within a preset time limit, the device automatically sets the output lines to a user-defined safe state. A USB-6509 remains in the watchdog state until the watchdog timer is disarmed, the device is reset, or the computer is restarted.

Trigger Your Application with Change Detection

With change detection, you can automatically trigger your software application to perform a digital read operation upon a digital change of state. A digital change of state is defined as the rising edge (0 to 1 transition) or falling edge (1 to 0 transition) on one or more digital lines. Using change detection, you can monitor for digital events with minimal processor usage. No polling is necessary because the digital I/O module generates an interrupt to automatically wake up your application.

Using NI-DAQmx software technology, the USB-6509 notifies the software application when it detects an event, causing the application to automatically perform a read operation. To minimize the effects of noisy input lines, use programmable input filters in combination with change detection to eliminate spurious change-detection events caused by noise or glitches.

Eliminate Noise with Programmable Input Filters

Programmable input filters remove noise, glitches, and spikes on inputs as well as provide debouncing for digital switches and relays. These features are important for applications in industrial environments to prevent false readings caused by noise. You can configure the programmable input filter for each digital line by setting the filter time. The USB-6509 blocks any digital noise, glitch, or spike that is shorter than half of the specified filter time, preventing invalid readings and false triggers for change-detection events.

Recommended Software

National Instruments measurement services software, built around NI-DAQmx driver software, includes intuitive application programming interfaces, configuration tools, I/O assistants, and other tools designed to reduce system setup, configuration, and development time. National Instruments recommends using the latest version of NI-DAQmx driver software for application development in NI LabVIEW, LabWindows/CVI, and Measurement Studio. To obtain the latest version of NI-DAQmx, visit **ni.com/support/daq/versions**. NI measurement services software speeds up your development with features including:

- A guide to create fast and accurate measurements with no programming using the DAQ Assistant
- Free LabVIEW SignalExpress LE data-logging software
- Automatic code generation to create your application in LabVIEW; LabWindows/CVI; LabVIEW SignalExpress; and Visual Studio .NET, ANSI C/C++, C#, or Visual Basic 6.0
- Multithreaded technology for 1,000 times performance improvements over basic DAQ driver software
- More than 3,000 free software downloads to jump-start your project at **ni.com/zone**

The USB-6509 is compatible with the following versions (or later) of NI application software: LabVIEW, LabWindows/CVI, or Measurement Studio versions 7.x; or LabVIEW SignalExpress 2.5. The USB-6509 is not compatible with the Traditional NI-DAQ (Legacy) driver.

Digital I/O Cables and Accessories

The 100-pin high-density SCSI connector on the USB-6509 interfaces to 100-pin ribbon cables or shielded cables. For low-cost unshielded connectivity, use the R1005050 ribbon cable with two CB-50LP or CB-50 connector blocks (a CB-100 kit). For shielded connectivity, use the SH100-100-F shielded digital I/O cable with the SCB-100 connector block.

R1005050 – Unshielded ribbon cable that terminates with two 50-pin IDC connectors.
0.5 m 182762-0R5
1 m 182762-01
2 m 182762-02

SH100-100-F – Shielded 100-conductor cable that terminates with a 100-pin 0.050 series D-type connector that attaches to 100-pin accessories.
1 m 185095-01
2 m 185095-02

SCB-100 – Shielded I/O connector block with screw terminals and a general breadboard area for 100-pin digital I/O devices.
SCB-100 776990-01

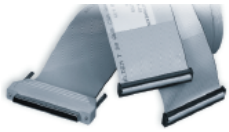
CB-50 – Unshielded I/O connector block with DIN-rail mounting and screw terminals. Includes 50-pin header for direct connection to 50-pin cables.
CB-50 776164-90

CB-50LP – Unshielded termination board with 50 screw terminals. Includes a 50-pin header for direct connection to 50-pin cables.
CB-50LP 777101-01

CB-100 Connector Kit – Includes two CB-50 I/O connector blocks and a 1 m R1005050 ribbon cable.
CB-100 with 1 m R1005050 cable 777812-01

PCB Mounting Connectors – PCB connectors for use in building custom accessories that connect to 100-conductor shielded and ribbon cables.
100-pin, female, right-angle mounting 777778-01
100-pin, female, vertical mounting 777779-01

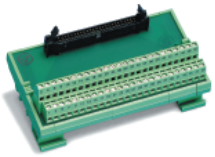
12 VDC Power Supply – Optional 12 VDC, 1.0 A power supply and cable for up to 24 mA current drive per channel.
12 VDC Power Supply 780308-0X



R1005050

SH100-100-F

SCB-100



CB-50

CB-50LP

CB-100

PCB Mounting Connectors

12 VDC Power Supply

Ordering Information

NI USB-6509	779975-01
12 VDC Power Supply (Optional)	
U.S., 120 VAC	780308-01
Switzerland, 220 VAC	780308-02
Australia, 240 VAC	780308-03
Europe, 240 VAC	780308-04
UK, 240 VAC	780308-06
Japan, 100 VAC	780308-07

BUY NOW!

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

Specifications

These specifications are typical at 25 °C, unless otherwise noted.

Digital Input/Output

Number of channels 96
Compatibility ..... TTL/CMOS, single-ended GND referenced
Power-on state ..... Configured as inputs (default), pull-up/pull-down (selectable)
Pull-up/pull-down resistors ..... 100 kΩ ±5%
Data transfers ..... Programmed I/O

Digital Input Characteristics

Level	Min	Max
Input voltage	0 V	5.0 V
V_{IL} input low voltage	–	0.8 V
V_{IH} input high voltage	2.0 V	–
I_{IL} input low current (V_{in} = 0 V)	–	-91.0 µA
I_{IH} input high current (V_{in} = 5 V)	–	91.0 µA

Digital Output Characteristics

Level	Min	Typ	Max
Low-level output current (I_{OL})	–	–	24 mA
High-level output current (I_{OH})	–	–	-24 mA
Output low voltage (V_{OL}), at 100 µA	–	0.0 V	0.2 V
at 2 mA	–	0.1 V	–
at 12 mA	–	0.5 V	–
at 24 mA	–	1.0 V	1.4 V
Output high voltage (V_{OH}), at -100 µA	4.3 V	5.0 V	–
at -2 mA	–	4.9 V	–
at -12 mA	–	4.5 V	–
at -24 mA	2.8 V	4.0 V	–

The total current sinking/sourcing from one port cannot exceed 100 mA. Total current sourced by all digital output lines simultaneously should not exceed 215 mA for bus-powered configuration. If more sourcing current is required, use the optional power supply.

+5 V power available at I/O connector (pins 49 and 99) ..... +4.1 to +5.2 V; 215 mA, maximum (bus-powered); 0.5 A, maximum (with external power supply)

Power Requirements

USB
- Input voltage ..... 4.5 to 5.25 V in configured state
- No load current ..... 150 mA, max
- Maximum load current ..... 500 mA, max
- Suspend current ..... 250 µA, typical (no external supply)

External DC supply
- Input voltage range ..... +12 V ±20%
- Maximum input current ..... 1 A

Physical

Dimensions ..... 17.78 by 10.30 by 3.34 cm (7.0 by 4.1 by 1.3 in.)
I/O connector ..... 100-pin female 0.050 series SCSI
Weight ..... 239 g (8.4 oz)

Environment

The USB-6509 is intended for indoor use only.
Operating temperature ..... 0 to 55 °C
Operating humidity ..... 10 to 90% RH, noncondensing
Maximum altitude ..... 2,000 m at 25 °C ambient temperature
Storage temperature ..... -40 to 85 °C
Storage humidity ..... 5 to 90% RH, noncondensing (tested in accordance with IEC-60068-2-1, IEC-60068-2-2, and IEC-60068-2-56)
Pollution degree (60664) 2

Safety and Compliance

Safety

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.

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 according to product documentation.

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 model number or product line, and click the appropriate link in the Certification column.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit **ni.com/environment/weee.htm**.

Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation (China RoHS)

电子信息产品污染控制管理办法（中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

NI Services and Support

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NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit **ni.com/training**.

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Our NI Professional Services team is composed of NI applications and systems engineers and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit **ni.com/alliance**.

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OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit **ni.com/oem**.

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In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at **ni.com/support**.

We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit **ni.com/ssp**.

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**.

Repair and Extended Warranty

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit **ni.com/services**.

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351580A-01 2008-9288-301-101-D