Low-Cost Industrial Digital I/O – 5 V TTL/CMOS

NI 6509

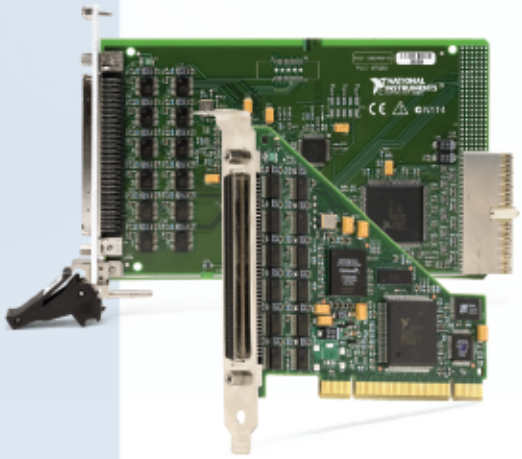
- 96 bidirectional input/output lines (5 V TTL/CMOS)
- High current drive (24 mA sink or source)
- High-reliability industrial feature set-programmable power-up states, digital I/O watchdogs, change detection, programmable input filters
- Low-cost solution with superior features for data acquisition, manufacturing test, and industrial control applications
- Direct connection to 5 V logic devices and most solid-state relays (SSRs)
- NI-DAQmx software for highest productivity and performance (NI-DAQmx version 7.1 and higher)

Operating Systems
- Windows 2000/NT/XP
- LabVIEW Real-Time

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio

Other Compatible Software
- C, C++
- Microsoft Visual Studio .NET 2003

Measurement Services Software (included)
- NI-DAQmx version 7.1 or higher



Product	Bus	Input Lines	Output Lines	Isolation	Max Range	Low Thresh.	High Thresh.	Output Current	Industrial Feature Set
NI 6509	PCI, PXI	96[1]	96[1]	–	-0.5..5.5 V	0.8 V	2.0 V	±24 mA	✓

[1]The PCI-6509 features 96 bidirectional I/O lines. Line direction is selectable on an 8-bit port basis.

Table 1. NI 6509 Specifications Overview

Overview and Applications

National Instruments 6509 devices are industrial 96-channel digital I/O interfaces for PCI and PXI systems. They are compatible with TTL, CMOS, and 5 V digital logic levels. An NI 6509 has 96 bidirectional digital VO lines with high-current-drive capabilities (24 mA), and is completely jumper-free. With an NI 6509, you can input and output at 5 VDC digital levels and directly drive external digital devices such as solid-state relays (SSRs) with current up to 24 mA per channel. Each port can be individually configured for input or output, and no external power supply is required for outputs. An NI 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 module directly to a wide array of 5 V electronic devices, sensors, and actuators.

An NI 6509 offers superior features and high value for industrial control and manufacturing test applications such as factory automation, embedded machine control, and production line verification. NI 6509 devices have been designed from top to bottom to incorporate the latest hardware technologies and provide innovative features for applications requiring ease of use, high reliability, and performance. They take advantage of NI-DAQmx measurement services software (version 7.1 or higher) to speed up application development with many helpful features including DAQ Assistant, automatic code generation, and high-performance multithreaded streaming technology.

Hardware

High-Reliability Industrial Feature Set

NI 6509 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 errors and ensure safe recovery
- Change detection triggers your application and returns I/O data 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

With programmable power-up states, you can configure the initial NI 6509 output states in software to ensure glitch-free operations when connected to industrial actuators such as pumps, valves, motors, and relays. An NI 6509 holds these I/O states after receiving power, so your computer can boot and your software application can begin running. The programmable power-up states are glitch-free, meaning the outputs never go through an incorrect state during power up.

Each individual digital line can be configured as high-impedance input, high output, or low output. The digital I/O module stores the settings in onboard nonvolatile memory and implements the power-up states automatically after power is applied to the device.

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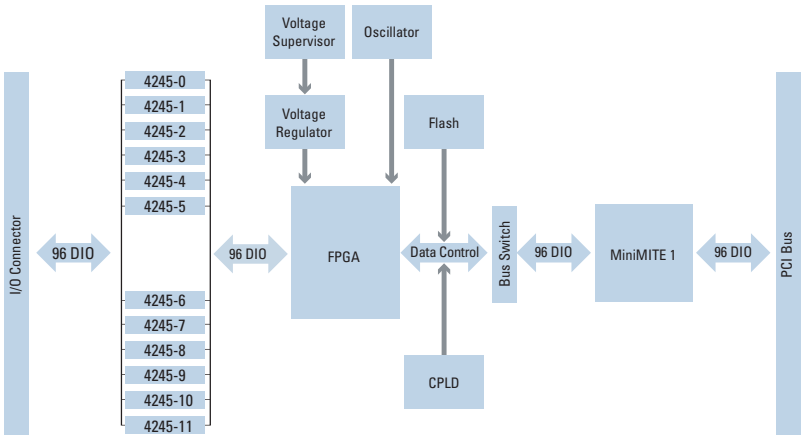

Figure 1. NI 6509 Hardware Block Diagram

Eliminate Noise with Programmable Input Filters

Programmable input filters remove noise, glitches, and spikes on inputs, and also provide debouncing for digital switches and relays. This is important for applications in noisy 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 in seconds. Any digital noise, glitch, or spike that is shorter than half of the specified filter time will be blocked by the digital I/O device, preventing invalid readings and false triggers for change detection events.

Detect and Recover with Digital I/O Watchdogs

NI digital I/O watchdogs are an innovative technology that provides protection against a wide variety of fault conditions:

- Computer crash – total OS crash
- Application crash – software application ceases to respond
- Driver crash – device driver ceases to respond
- PCI bus failure – communications cease to respond

With watchdogs, the digital outputs go to a safe state when a fault condition is detected and the watchdog timer expires for safe recovery. Watchdogs are important whenever the module is connected to actuators such as pumps, valves, motors, and relays. The digital I/O module monitors the software application and, if it fails to respond within the time limit, automatically sets the output lines to a user-defined safe state. The module remains in the watchdog state until the watchdog timer is disarmed by the application and new I/O values are written, the NI 6509 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 NI 6509 notifies the software application when the event is detected, causing the application to automatically perform a read operation. To minimize the effects of noisy input lines, you can use programmable input filters in combination with change detection to eliminate spurious change detection events caused by noise or glitches. NI-DAQmx also includes multithreaded streaming technology so digital change detection events can occur independent of other data acquisition activities such as analog input or output events.

Software

NI-DAQmx Software Technology

NI 6509 devices require NI-DAQmx software version 7.1 or higher. NI-DAQmx software, included FREE with an NI 6509, is available for download from ***ni.com/downloads***. With NI-DAQmx 7.1 or higher, you can use your NI digital I/O device in LabVIEW, ANSI C, Microsoft Visual C++, and the Microsoft .NET languages C# and Visual Basic .NET.

With NI-DAQmx technology, you have access to the full functionality and state-of-the-art hardware technology of your NI 6509 digital I/O devices. NI-DAQmx technology speeds up your development with many features such as automatic code generation to make configuration and programming easy. NI 6509 devices take full advantage of key NI-DAQmx software technologies such as multithreaded streaming technology for dramatic improvements in I/O performance and ease of use.

- Use DAQ Assistant to guide you to fast, accurate measurements with no programming
- Use automatic code generation to create your application in NI LabVIEW, C, Visual Basic .NET, or C#
- Take advantage of multithreaded streaming technology for 1,000X performance improvements
- Use automatic timing, triggering, and synchronization technology to make advanced applications easy
- Visit ***ni.com*** for more than 3,000 FREE software downloads

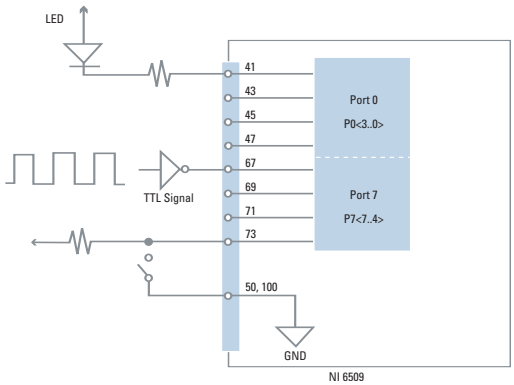

Figure 2. Signal Connections

to jump-start your project
- Use NI-DAQmx functions for jumper-free software configuration of all digital I/O features without hardware switches/jumpers
- Develop your application with easy and open programming in LabVIEW, ANSI C, Microsoft Visual C++, C#, and Visual Basic .NET

Digital I/O Connector

The 100-pin high-density SCSI connector on NI 6509 devices connects to 100-pin ribbon cable 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.

Each 8-bit port on an NI 6509 can be individually programmed to be input or output. The maximum input logic high and output logic high voltages assume a V_{cc} supply voltage of 5 V. The absolute maximum voltage rating is -0.5 to +5.5 V with respect to GND. Pins 49 and 99 on the I/O connector supply +5 V from the computer power supply through a self-resetting fuse.

Other Connectivity Options and High-Voltage Signal Conditioning

Visit ***ni.com/dataacquisition*** to learn more about connectivity solutions, including high-voltage signal conditioning and isolation, electromechanical relay devices, and other solutions.

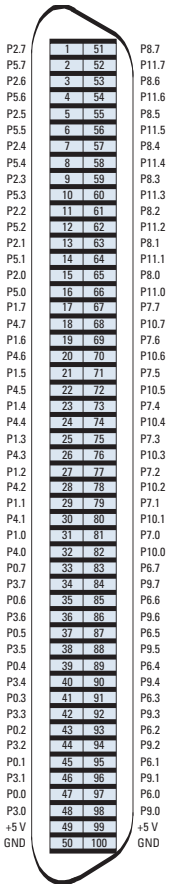

Figure 3. NI 6509 100-Pin SCSI I/O Connector

Ordering Information

NI PCI-6509 778792-01
NI PXI-6509 778858-01
Includes NI-DAQmx software

For information on extended warranty and value-added services, see ***ni.com/services***.

Recommended Configurations

Family	Accessory	Cable
NI 6509	SCB-100 (776990-01)	SH100-100-F (185095-02)
	CB-100 kit (777812-01)	R1005050 included in kit
	PCI-6509 bundle (778936-01)	Cable and connector blocks included

BUY NOW!

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

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Specifications

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

Digital I/O

Number of channels ..... 96 I/O
Compatibility ..... TTL/CMOS
Power-on state ..... Inputs high-Z (default), user-selectable input, output 1 or 0
Data transfers ..... Interrupts, programmed I/O
I/O connector ..... 100-pin female 0.050 series SCSI

Digital Logic Levels

Input signals

Level	Min	Max
Input voltage (V_I)	0 V	V_{CC}
Input logic low-voltage (V_{IL})	–	0.8 V
Input logic high-voltage (V_{IH})	2 V	–

The maximum input logic high and output logic high voltages assume a V_{CC} supply voltage of 5.0 V. Given a V_{CC} supply voltage of 5.0 V, the absolute maximum voltage rating for each I/O line is -0.5 to 5.5 V with respect to GND.

Output signals (V_{CC} =5 V)

Pins 49 and 99 (at +5 V) ..... 1.0 A, maximum (combined or individually)

Level	Min	Max
High-level output current (I_{OH})	–	-24 mA
Low-level output current (I_{OL})	–	24 mA
Output voltage (V_O)	0	V_{CC}
Output low voltage (V_{OL}), at 24 mA	–	0.55 V
Output high voltage (V_{OH}), at -24 mA	3.7 V	–

Power Requirements

+3.3 VDC ..... 375 mA, typical

Use the following equation to determine the power consumption on a 5 V rail. In the equation,

$$148\ \text{mA} + \sum_{i=1}^{j} (\text{current sourced on channel i})$$

j is the number of channels you are using to source current.

Power available at I/O connector ..... 1 A (fused), maximum

Note: The voltage at the I/O connector is dependent upon the amount of current drawn from the NI 6509.

Physical

Dimensions

PCI ..... 14.1 by 11.4 cm (5.54 by 4.47 in.)
PXI ..... 10.0 by 16.0 cm (6.3 by 3.9 in.)

Environmental

The NI 6509 is intended for indoor use only.

Operating temperature ..... 0 to 55 °C
Storage temperature ..... -20 to 70 °C
Relative humidity ..... 10% to 90%, noncondensing
Pollution degree 2

Safety

The NI 6509 meets the requirements of the following standards for safety and electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 3111-1, UL 61010B-1
- CAN/CSA C22.2 No. 1010.1

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

Electromagnetic Compatibility

Emissions ..... EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz
Immunity ..... EN 61326:1997 + A2: 2001, Table 1
EMC/EMI ..... CE, C-Tick and FCC Part 15 (Class A) Compliant

Note: For full EMC compliance, you must operate this device with shielded cabling.

CE Compliance CE

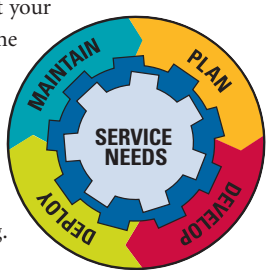
This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety) 73/23/EEC
Electromagnetic Compatibility Directive (EMC) 89/336/EEC

*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/hardref.nsf** and search by model number or product line, and click the appropriate link in the Certification column.*

NI Services and Support

NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit *ni.com/services*.



Training and Certification

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*.

Professional Services

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide NI 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*.

Local Sales and Technical Support

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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