Low-Cost Digital I/O 24 or 96 Lines, 5 V TTL/CMOS

**NI 650x**
- 24 or 96 digital input/output lines
- 5 V TTL/CMOS
- 2-wire handshake capability
- Known power-up states
- Available for PCI, PXI/CompactPCI, ISA, USB, and PCMCIA
- NI-DAQ driver simplifies configuration and measurements

**Models**
- NI 6503
  - PCI-6503
  - DAQCard-DIO-24
  - PC-DIO-24
  - NI 6507/NI 6508
  - PCI-DIO-96
  - PXI-6508
  - DAQPad-6507 for USB
  - DAQPad-6508 for USB
  - PC-DIO-96

USB devices for Windows 2000/Me/98 only

---

**Overview**

The NI 6503 devices are 24-bit parallel digital I/O interfaces for computers with PCI, USB, PCMCIA, or ISA buses. The NI 6507/NI 6508 families are 96-bit parallel digital I/O devices for computers with PCI, PXI/CompactPCI, USB, or ISA buses. All NI 650x devices are for 5 V TTL/CMOS I/O signals. For high-voltage signals, see page 486 for digital signal conditioning solutions or consider the NI 6527 devices on page 334.

---

**Hardware**

**82C55 Parallel Port Interfaces**

The NI 650x digital I/O devices use the 82C55 Parallel Port Interfaces (PPIs). The NI 6503 devices contain one PPI, and the NI 6507/NI 6508 devices contain four PPIs. Each PPI controls 24 bits of digital I/O and has three 8-bit ports (A, B, and C), which you can program as either inputs or outputs. Ports A and B are always used for digital I/O, while port C can be configured for digital data I/O, control, status, or handshake signals.

---

**Real-Time**

See page 142

**NI Application Software**

- LabVIEW
- Measurement Studio

**Operating Systems**

- Windows 2000/NT/Me/9x*
- Mac OS**

**Applications**

- Interface to parallel digital I/O peripherals
- Monitoring and control of switches, relays, actuators, lights, and motors
- BCD-compatible panel meters and test equipment

**Accessories**

See page 338

* Visit ni.com/info and enter winxp for the latest operating system information
**Not for all hardware

---

**Table 1. NI 650x Specifications Overview (see page 344 for detailed specifications)**

<table>
<thead>
<tr>
<th>Family</th>
<th>Bus</th>
<th>Digital I/O Lines</th>
<th>Maximum Rate</th>
<th>Logic Level</th>
<th>Isolation</th>
<th>Handshaking</th>
<th>Pattern I/O</th>
<th>Messaging</th>
<th>Triggering</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI 6503</td>
<td>PCI, PCMCIA, ISA</td>
<td>24</td>
<td>Unstrobed</td>
<td>-</td>
<td>5 V TTL/CMOS</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NI 6507</td>
<td>PCI</td>
<td>96</td>
<td>Unstrobed</td>
<td>-</td>
<td>5 V TTL/CMOS</td>
<td>-</td>
<td>✓</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* Rates may depend on application, computer, software. See page 344 for more information.

---

**Digital I/O Power-Up State Selection**

You can power up the PCI-6503, PC-DIO-24, PC-DIO-96, PXI-6508, and DAQPad-650x digital I/O lines in a user-defined state — either high or low. On these devices, each line is connected to a 100 kΩ resistor and you can use a jumper to select whether the lines of the device power up in the high or low state. The DAQCard-DIO-24 and PCI-DIO-96 have 100 kΩ resistors that always pull high.

---

**Table 2. Digital Connectors**

<table>
<thead>
<tr>
<th>Device</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI-6503</td>
<td>50-pin, see Figure 3</td>
</tr>
<tr>
<td>PC-DIO-24</td>
<td></td>
</tr>
<tr>
<td>DAQCard-DIO-24</td>
<td>27-pin; cable adapts it to the 50-pin connector shown in Figure 3</td>
</tr>
<tr>
<td>NI 6508 devices</td>
<td>100-pin; see Figure 2</td>
</tr>
<tr>
<td>DAQPad-6507</td>
<td>Onboard screw terminals for all I/O signals and strain relief for ruggedized wiring. The DAQPad-6507 does not need additional cables or external termination accessories.</td>
</tr>
</tbody>
</table>
**Low-Cost Digital I/O 24 or 96 Lines, 5 V TTL/CMOS**

### Digital I/O Connector
Digital connectors for the NI 650x devices are described in Table 2. The eight bits in Port A of each PPI are at xPA7 through xPA0 on the digital I/O connector where x represents which PPI is being used. Ports B and C are at xPB7 through xPB0 and xPC7 through xPC0, respectively. Each port is programmed to be input or output. Power from the computer I/O channel or the DAQPad power supply is also available on the digital I/O connector. See page 338 to learn more about connectivity solutions, including direct connectors, electromechanical relay devices, and other signal conditioning solutions.

### USB Devices Power
You can power the DAQPad-6507 and DAQPad-6508 from the USB bus, the optional BP-1 battery pack, or any 9 to 30 VDC supply. With the AC-to-DC adapter unit included, you can power the device from any standard AC source. If you are using several USB devices or drawing more than 50 mA from the onboard 5 V supply, we recommend that you use the AC-to-DC adapter or BP-1 battery pack. A charger unit is included with the BP-1.

---

**Ordering Information**

**NI 6503**
- PCI-6503 ........................................... 777690-01
- DAQCard-DIO-24 .................................. 776912-01
- PC-DIO-24* ...................................... 777368-01

**NI 6507**
- DAQPad-6507 (USB) with built-in screw terminals†
  - U.S. 120 VAC ................................... 777405-01
  - Universal Euro 240 VAC ...................... 777405-04
  - United Kingdom 240 VAC .................... 777405-06
  - Japanese 120 VAC ............................ 777405-01

**NI 6508**
- PCI-DIO-96* ..................................... 777387-01
- PXI-6508 ....................................... 777598-01
- PC-DIO-96* ..................................... 777271-01
- DAQPad-6508 (USB) with 100-pin I/O connector†
  - U.S. 120 VAC ................................... 777661-01
  - Universal Euro 240 VAC ...................... 777661-04
  - United Kingdom 240 VAC .................... 777661-06
  - Japanese 120 VAC ............................ 777661-07

Includes NI-DAQ driver software.
*Windows only
†Windows 2000M/xe98 only; 1 m USB cable included

**BP-1 Rechargeable battery pack**
- 120 VAC charger ................................. 776896-01
- 230 VAC charger ................................. 776896-31

For information on extended warranty and value added services, see page 22.

**Recommended Configurations**

<table>
<thead>
<tr>
<th>Family</th>
<th>Device</th>
<th>Accessory</th>
<th>Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI 6503</td>
<td>PC-6503</td>
<td>CB-50LP</td>
<td>NB1 (180524-10)</td>
</tr>
<tr>
<td></td>
<td>DAQCard-DIO-24</td>
<td>CB-50LP</td>
<td>PSH27-50LP (776899-01)</td>
</tr>
<tr>
<td></td>
<td>PC-DIO-24</td>
<td>CB-50LP</td>
<td>NB1 (180524-10)</td>
</tr>
<tr>
<td>NI 6507</td>
<td>DAQPad-6507</td>
<td>Built-in screw terminals†</td>
<td>N/A</td>
</tr>
<tr>
<td>NI 6508</td>
<td>PCI-DIO-96</td>
<td>SCB-100 (776999-01)</td>
<td>SH100-100F (185095-02)</td>
</tr>
<tr>
<td></td>
<td>PXI-6508</td>
<td>SCB-100 (776999-01)</td>
<td>SH100-100F (185095-02)</td>
</tr>
<tr>
<td></td>
<td>PC-DIO-96</td>
<td>SCB-100 Kit (776455-02)</td>
<td>Included in kit</td>
</tr>
<tr>
<td></td>
<td>DAQPad-6508</td>
<td>SCB-100 Kit (777812-01)</td>
<td>Included in kit</td>
</tr>
</tbody>
</table>

See page 338 for accessory and cable information.
Digital I/O Specifications

Specifications

NI 653x (Continued)

Environment
- Operating temperature: 0 to 55 °C, DAQCard should not exceed 55 °C while in PCMCIA slot
- Storage temperature: -20 to 70 °C
- Relative humidity: 10% to 90%, noncondensing

Certifications and Compliances
- CE Mark Compliance

NI 6527
- These specifications are typical for 25 °C unless otherwise noted.

Digital Input
- Optically isolated input channels: 24, each with its own isolated ground reference
- Maximum input voltage: 28 V DC
- Digital Logic Levels
<table>
<thead>
<tr>
<th>Level</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input low voltage</td>
<td>0 V DC</td>
<td>1 V</td>
</tr>
<tr>
<td>Input high voltage</td>
<td>2 V DC</td>
<td>28 V DC</td>
</tr>
</tbody>
</table>
- Input current
  - 5 V input: 1.5 mA/channel max
  - 24 V input: 8 mA/channel max
- Isolation: 60 V DC, channel-to-channel, and from computer

Digital Switch Output
- Solid-state relay output channels: 24, each with two terminals isolated from other channels
- Relay type: Normally open form A solid-state relays
- Maximum switching voltage
<table>
<thead>
<tr>
<th>AC</th>
<th>DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 V RMS (42 V peak)</td>
<td>60 V DC</td>
</tr>
</tbody>
</table>
- Maximum switching capacity, 25 °C: 120 mA
- Common-mode isolation: 60 V DC or 30 V RMS (42 V peak) channel-to-channel and channel-to-computer
- On resistance: 35 Ω maximum
- Offset leakage current (maximum): 200 nA
- Relay set time (maximum): 3.0 ms
- Relay reset time (maximum): 3.0 ms
- Power-on state: Relays open by default, can be user-defined through software utility
- Overcurrent protection on outputs: 350 mA, typical

Power Requirement
- +5 VDC (±5%): 500 mA, maximum
- Power available at I/O connector: +4.5 to +5.25 VDC, fused at 1 A

Physical
- Dimensions (not including connectors)
  - PCI-6527: 17.5 by 10.7 cm (6.9 by 4.2 in.)
  - PXI-6527: 16 by 10 cm (6.3 by 3.9 in.)
- I/O connector: 100-pin keyed female

Environment
- Operating temperature: 0 to 50 °C
- Storage temperature: -20 to 70 °C
- Relative humidity: 10% to 90%, noncondensing

Certifications and Compliances
- CE Mark Compliance

NI 650x
- These specifications are typical for 25 °C unless otherwise noted.

Digital I/O
- Number of channels
  - NI 6503: 24
  - NI 6507, NI 6508: 96
- Compatibility: 5 V TTL/CMOS
- Power-on state
- Digital logic levels
<table>
<thead>
<tr>
<th>Level</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input low voltage</td>
<td>-0.3 V</td>
<td>0.8 V</td>
</tr>
<tr>
<td>Input high voltage</td>
<td>2.2 V</td>
<td>5.3 V</td>
</tr>
<tr>
<td>Output low voltage (Iout = 2.5 mA)</td>
<td>-</td>
<td>0.4 V</td>
</tr>
<tr>
<td>Output high voltage (Iout = 2.5 mA)</td>
<td>1.7 V</td>
<td></td>
</tr>
</tbody>
</table>

Transfer rates

<table>
<thead>
<tr>
<th>Bus</th>
<th>Maximum with NI-DAQ Software</th>
<th>Typical Sustainable Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCI, PXI, DAQCard, ISA</td>
<td>50 bytes/s</td>
<td>1-10 bytes/s</td>
</tr>
<tr>
<td>DAQPad 250 bytes/s</td>
<td>250 bytes/s</td>
<td></td>
</tr>
</tbody>
</table>

Note: Transfer rate depends on the computer and software. The rates vary due to programming language and code efficiency, CPU utilization, transfer methods, and so on. Please consult the user manual for specifics. The data rate transfer rate is dependent on available CPU bandwidth.

Bus interface
- PCI, PXI, DAQCard, DAQPad, AT: Slave

Power Requirements

<table>
<thead>
<tr>
<th>Device</th>
<th>+5 VDC (+5%)</th>
<th>Power Available at I/O Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>6507/8 and PC+6503</td>
<td>400 mA</td>
<td>+4.65 to +5.25 VDC, 1 A fused</td>
</tr>
<tr>
<td>DAQCard-DIO-24</td>
<td>15 mA</td>
<td>+4.65 to +5.25 VDC, 500 mA</td>
</tr>
<tr>
<td>PC-DIO-24</td>
<td>160 mA</td>
<td>+4.65 to +5.25 VDC, 1 A fused</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Device</th>
<th>+9 to +30 VDC</th>
<th>Power Available at I/O Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAQPad-6507/8</td>
<td>150 mA at 12 VDC</td>
<td>+4.65 to +5.25 VDC, 1 A fused</td>
</tr>
</tbody>
</table>

Physical Dimensions

- PCI-6503: 12.2 by 9.5 cm (4.8 by 3.7 in.)
- Type II PC Card
- PCI-DIO-24: 11.7 by 10.6 cm (4.6 by 4.2 in.)
- PC-DIO-96: 13.7 by 10.7 cm (5.4 by 4.2 in.)
- PXI-6508: 20 by 16 cm (7.9 by 6.3 in.)
- PC-DIO-96: 16.5 by 9.9 cm (6.5 by 3.9 in.)
- DAQPad-6507/8: 14.6 by 21.3 cm (5.8 by 8.4 by 1.5 in.)

I/O Connector
- NI 6503, except DAQCard: 50-pin male
- DAQCard-DIO-24: 25-pin female PCMCIA
- NI 6508, except PC-DIO-96: 100-pin female 0.050 series D-type
- PCI-DIO-96: 100-pin male ribbon cable

Environment
- Operating temperature: 0 to 55 °C, DAQCard should not exceed 55 °C while in PCMCIA slot
- Storage temperature: -20 to 70 °C
- Relative humidity: 10% to 90%, noncondensing

For information on static digital I/O in the VXI form factor, refer to the VXI Solutions Product Guide.

Certifications and Compliances
- CE Mark Compliance