

Digital I/O Accessories and Cables

Accessory Selection Process

Step 1. From Tables 1 through 3, locate the table with your digital I/O device.

Step 2. Using the table from Step 1 as a guide, determine which accessories are appropriate for your device. Select an accessory using Table 4 as a reference.

Step 3. Using the table from Step 1, determine the appropriate cable solution for your selected digital I/O device and accessory.

Device	Accessories			SCXI	SSR Series, SC-206x ER-8/16
	SCB-68, CB-68LP, CB-68LPR	Cables	TB-2715		
	TBX-68				
PCI-6534, PCI-DIO-32HS, AT-DIO-32HS	SH68-68-D1 or R6868		N/A	Refer to SCXI Signal Conditioning on page 246 for details	Refer to Digital Signal Conditioning Accessories on page 347 for details
PXI-6534, PXI-6533	SH68-68-D1 or R6868	Connects directly to the device			
DAQCard-6533	PSHR68-68-D1 or PR68-68F		N/A		

Table 1. NI 6534 and NI 6533 Devices – Accessories and Cables

Device	Accessories		
	CB-100 Kit	SCB-100	CA-1000, CB-50, CB-50LP
	Cables		
PCI-6527, PXI-6527	Kit includes R1005050 cable	SH100-100-F	R1005050 (splits into two 50-pin connectors); with this cable, you can use two accessories from this group with one NI 6527 device

Table 2. NI 6527 Devices – Accessories and Cables

Device	Accessories			SCXI	SSR Series, SC-206x ER-8/16
	CB-100 Kit	SCB-100	CA-1000, CB-50, CB-50LP		
	Cables				
PCI-6503, PC-DIO-24	N/A	N/A	SH50-50 or NB1	Refer to SCXI Signal Conditioning on page 246 for details	Refer to Digital Signal Conditioning Accessories on page 347 for details
DAQCard-DIO-24	N/A	N/A	PSH27-50F-D1		
PCI-DIO-96, PXI-6508, DAOPad-6508	Kit includes R1005050 cable	SH100-100-F	R1005050 (Splits into two 50-pin connectors); with this cable, you can use two accessories from this group with each device		
PC-DIO-96	Kit includes NB5 cable	N/A	NB5 (Splits into two 50-pin connectors); with this cable, you can use two accessories from this group with each device		

Table 3. NI 6503 and NI 6508 Devices – Accessories and Cables

Accessory	Description	Page
SCXI	Signal conditioning system	246
SSR Series	Digital signal conditioning modules	347
SC-206x	Digital signal conditioning modules	347
ER-8/16	Electromechanical relays	347
CA-1000	Configurable connector accessory	352
SCB-68	Shielded connector block	385
SCB-100	Shielded connector block	385
TB-2715	Front-mount terminal block for PXI-653x	385
TBX-68	DIN-rail connector block	386
CB-68LP	Low-cost connector block	386
CB-68LPR	Low-cost connector block	386
CB-50	I/O connector block	386
CB-50LP	I/O connector block	386
CB-100 kit	I/O connector block kit; includes cable	386

For complete and up-to-date information about accessories, visit ni.com/catalog

Table 4. Overview of Accessories

Digital I/O Accessories

Accessories for Digital I/O

SCXI – High-Performance Signal Conditioning (see Figure 1)

SCXI is a modular high-performance signal conditioning system that serves as a front end to your digital I/O device. The SCXI modules for digital I/O offer isolation, extended voltage ranges (up to 250 V_{rms}), increased current switching capabilities, and expanded channel counts (up to 3,072 I/O lines). In addition to SCXI modules for digital I/O, your SCXI signal conditioning system can include modules for analog outputs and general-purpose switching when cabled to a digital I/O device. With SCXI, you can create integrated, flexible high-channel-count measurement systems with signal conditioning components tailored to your needs. See page 246 for details on SCXI signal conditioning.



Figure 1. SCXI High-Performance Signal Conditioning

SCC Low-Channel-Count (see Figure 2)

National Instruments offers several options for low-channel-count digital signal conditioning. These accessories, such as SCC, provide a cost-effective solution for low-channel-count digital I/O systems requiring isolated I/O or relays for controlling external devices. Most of these products cable directly to your National Instruments digital I/O device. See page 347 for details on digital signal conditioning accessories.



Figure 2. Digital Signal Conditioning Accessories

CA-1000 (see Figure 3)

Configurable signal connectivity solution for connecting digital I/O devices to different types of standard I/O connectors and for incorporating switches and LED indicators. You can place this connector box under a laptop PC, on a benchtop, or in a 19 in. rack.

CA-1000See page 352



Figure 3. CA-1000 Configurable Signal Connectivity Solution

SCB-68 and SCB-100 (see Figure 4)

Shielded I/O connector blocks for easy connection of I/O signals to 68 or 100-pin digital I/O devices. The screw terminals are housed in a metal enclosure for protection from noise corruption. Combined with shielded cables, the SCB-68 and SCB-100 provide rugged, very low noise signal termination. They also include general breadboard areas – two on the SCB-68 and three on the SCB-100.

SCB-68776844-01

Dimensions – 19.5 by 15.2 by 4.5 cm (7.7 by 6.0 by 1.8 in)

SCB-100776990-01

Dimensions – 19.5 by 15.2 by 4.5 cm (7.7 by 6.0 by 1.8 in)



Figure 4. SCB-68 and SCB-100 Shielded Connector Blocks

TB-2715 (see Figure 5)

With the TB-2715 terminal block for PXI-6534 and PXI-6533 devices, you can connect signals directly without additional cables. The TB-2715 latches to the front of your PXI module with locking screws and provides strain relief as well as easy access to your signals through shielded screw terminals.

TB-2715778242-01

Dimensions – 8.43 by 10.41 by 2.03 cm (3.32 by 4.1 by 0.8 in.)



Figure 5. TB-2715 Terminal Block



Figure 6. TBX-68 I/O Connector Block

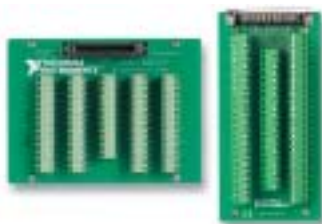


Figure 7. CB-68LP and CB-68LPR I/O Connector Blocks



Figure 8. CB-50 I/O Connector Block



Figure 9. CB-50LP I/O Connector Block



Figure 10. CB-100 I/O Connector Kit

Digital I/O Accessories

TBX-68 I/O Connector Block with DIN-Rail Mounting (See Figure 6)

Termination accessory with 68 screw terminals for easy connection of field I/O signals to NI 653x devices. Includes one 68-pin male connector for direct connection to 68-pin cables. The TBX-68 is mounted in a protective plastic base with hardware for mounting on a standard DIN rail.

TBX-68777141-01

Dimensions – 12.50 by 10.74 cm (4.92 by 4.23 in.)

CB-68LP and CB-68LPR I/O Connector Blocks (See Figure 7)

Low-cost termination accessories with 68 screw terminals for easy connection of field I/O signals to NI 653x devices and one 68-pin male connector for direct connection to 68-pin cables. The connector blocks include standoffs for use on a desktop or mounting in a custom panel. The CB-68LP has a vertically mounted 68-pin connector. The CB-68LPR has a right-angle mounted connector and is used with the CA-1000.

CB-68LP777145-01

Dimensions – 14.35 by 10.74 cm (5.65 by 4.23 in.)

CB-68LPR777145-02

Dimensions – 7.62 by 16.19 cm (3.00 by 6.36 in.)

CB-50 I/O Connector Block with DIN-Rail Mounting (See Figure 8)

Termination accessory with 50 screw terminals for easy connection of field I/O signals to NI 650x and NI 6527 devices. Includes one 50-pin header for direct connection to 50-pin cables. The CB-50 includes a protective plastic base and hardware for mounting on either a standard DIN-rail or flush on a wall or panel.

CB-50776164-90

Dimensions – 13.5 by 7.3 cm (5.3 by 2.9 in.)

CB-50LP I/O Connector Block (See Figure 9)

Termination board with 50 screw terminals for easy connection of field I/O signals to NI 650x and NI 6527 devices. Includes one 50-pin header for direct connection to 50-pin cables. The CB-50LP includes metal standoffs for use on a desktop or for mounting on a custom panel.

CB-50LP777101-01

Dimensions – 13.26 by 7.19 cm (5.22 by 2.83 in.)

CB-100 I/O Connector Kit (See Figure 10)

The first CB-100 kit includes two CB-50 I/O connector blocks and an R1005050 ribbon cable for connecting to a PCI-6527, PXI-6527, PCI-DIO-96, PXI-6508, or DAQPad-6508 device. The second CB-100 kit includes two CB-50 I/O connector blocks and an NB5 ribbon cable for direct connection to a PC-DIO-96 device. Each CB-50 block includes hardware for DIN-rail or panel mounting.

CB-100 with 1 m R1005050 cable777812-01

CB-100 with 1 m NB5 cable.....776455-02

Digital I/O Accessories

RTSI Bus Cables

Use RTSI cables to connect timing and synchronization signals among measurement, vision, motion, and CAN boards for PCI and ISA and external devices such as the DAQPad-6070E for FireWire. For systems using both long and short boards, order the extended RTSI cable.

2 boards	776249-02
3 boards	776249-03
4 boards	776249-04
5 boards	776249-05
Extended, 5 boards	777562-05
3 external devices	186464-01

Shielded Cables

SH68-68-D1 (See Figure 11)

Shielded 68-conductor cable terminated with two 68-pin female 0.050 series D-type connectors for use with NI 653x devices (except DAQCard-6533).

1 m	183432-01
2 m	183432-02



Figure 11. SH68-68-D1 Shielded Cable



Figure 12. SH50-50 Shielded Cable

SH50-50 (See Figure 12)

Shielded 50-conductor cable that connects to a PCI-6503 or PC-DIO-24 device and terminates with a 50-pin connector. The kit includes the shielded cable and a 3 in. ribbon cable for connection flexibility.

1 m	777720-01
2 m	777720-02



Figure 13. SH100-100-F Shielded Cable

SH100-100-F (See Figure 13)

Shielded 100-conductor cable that connects to a PCI-6527, PXI-6527, PCI-DIO-96, PXI-6508, or DAQPad-6508 and terminates with a 100-pin 0.050 series D-type connector that attaches directly to 100-pin accessories.

2 m	185095-02
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PSHR68-68-D1 for DAQCard-6533 (See Figure 14)

Shielded cable kit for use in connecting the DAQCard-6533 to 68-pin accessories. The kit contains the PSHR68-68M, the PCMCIA Strain Relief Adapter, and a 1 m SH68-68-D1 cable.

1 m	777420-01
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Figure 14. PSHR68-68-D1 Shielded Cable Kit

PSHR68-68M for DAQCard-6533 (See Figure 15)

Shielded cable for use in connecting the DAQCard-6533 with custom cables or other 68-pin cable assemblies.

1 m	183569-01
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PSH27-50F-D1 for DAQCard-DIO-24

Shielded cable that connects to the DAQCard-DIO-24 and is terminated with a 50-pin female connector that attaches directly to 50-pin accessories.

0.5 m	776989-0R5
1 m	776989-01



Figure 15. PSHR68-68M Shielded Cable

Digital I/O Accessories



Figure 16. R6868 Ribbon Cable

Ribbon Cables

R6868 (See Figure 16)

68-conductor flat ribbon cable terminated with two 68-pin connectors. Use this cable to connect an NI 653x device (except DAQCard-6533) to 68-pin accessories.

1 m182482-01

R1005050 (See Figure 17)

Ribbon cable that connects to a PCI-6527, PXI-6527, PCI-DIO-96, PXI-6508, or DAQPad-6508 and is terminated with two 50-pin IDC connectors.

1 m182762-01

2 m182762-02



Figure 17. R1005050 Ribbon Cable

PR68-68F for DAQCard-6533 (See Figure 18)

Ribbon cable that connects to the DAQCard-6533 and is terminated with a 68-pin female connector that attaches directly to 68-pin accessories.

0.1 m183646-0R1

1 m183646-01



Figure 18. PR68-68F Ribbon Cable

NB1 (See Figure 19)

50-conductor ribbon cable that connects any device with a 50-pin connector to 50-pin connector accessories.

1 m180524-10

2 m180524-20

NB5 (See Figure 20)

100-conductor ribbon cable that connects to a PC-DIO-96 device (100-pin connector) and is terminated with two 50-pin connectors.

1 m181304-10

2 m181304-20



Figure 19. NB1 Cable



Figure 20. NB5 Cable

Digital I/O Accessories

Custom Connectivity Components

68-Pin Custom Cable Connector/Backshell Kit (See Figure 21)

68-pin female mating connector and backshell kit for use in making custom cables. Solder-cup contacts are available for soldering of cable wires to the connector.

68-pin connector/backshell kit776832-01

PCB Mounting Connectors for Custom Accessories (See Figure 22)

PCB connectors for use in building custom accessories that connect to 68-conductor or 100-conductor shielded and ribbon cables. Two types of connectors are available, one for right-angle and one for vertical mounting on to a PCB.

68-pin, male, right-angle mounting777600-01

68-pin, male, vertical mounting777601-01

100-pin, female, right-angle mounting777778-01

100-pin, female, vertical mounting777779-01

PCMCIA Strain-Relief Accessory (See Figure 23)

Accessory that attaches to the bottom of your notebook computer and provides adjustable strain relief for one or two PCMCIA cables attached to the installed PCMCIA card(s).

PCMCIA Strain-Relief Accessory777550-01

USB Cables (See Figure 24)

Cables for connecting USB DAQPad devices to a USB port. The USB cables have a USB B connector on one end and a USB A connector on the other.

1 m184125-01

2 m184125-02



Figure 21. 68-Pin Custom Cable Kit



Figure 22. PCB Mounting Connectors



Figure 23. PCMCIA Strain-Relief Accessory



Figure 24. USB Cable

Digital I/O Specifications

Specifications – High-Speed Digital I/O – NI 653x

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

Digital I/O

Number of channels	32 input/output 4 dedicated output and control 4 dedicated input and status
Compatibility	5 V TTL/CMOS
Hysteresis	500 mV
Digital logic levels	

Level	Minimum	Maximum
Input low voltage	0 V	0.8 V
Input high voltage	2 V	5 V
Output low voltage ($I_{OL} = 24$ mA)	–	0.4 V
Output high voltage* ($I_{OH} = 24$ mA)	2.4 V	–

*When configured as standard outputs. Drivers configured as wired-OR outputs are tri-stated (high-impedance) when logic is high.

Power-on state for outputs High-impedance, pulled up or down (selectable)

Data transfers	
PCI, PXI, AT	DMA, interrupts, programmed I/O
DAQCard	Interrupts, programmed I/O

Pattern I/O

Direction	Input or output
Modes	Internally or externally timed, change detection

Handshaking I/O

Direction	Input or output
Modes	6 (burst, level-ACK, leading-edge pulse, trailing-edge pulse, long pulse, and 8255 emulation)

Performance Benchmarks

The performance benchmarks were conducted using LabVIEW or LabWindows/CVI programs and with the following computer systems:
 PCI-6534 – Dell Dimension XPS T700r, Pentium II, Windows 98 SE
 PXI-6534 – PXI-8170, Pentium III, Windows 98
 PCI-DIO-32HS – Gateway Pentium III, Win 98 SE
 PXI-6533 – PXI-8170, Pentium III, Windows 98

For pattern I/O, the benchmarks shown are the clock rates. For handshaking I/O, the time interval between transfers is not constant since both the NI 653x and the external device can pause the transfer: the benchmarks shown here present the average transfer rate rather than the sustained transfer rate. To find throughput in Mbytes/s from MHz, use the following formula:

$$\text{Mbytes/s} = \text{transfer rate in MHz} * \text{number of bits} / 8$$

The number of bits must be 8, 16, or 32. For NI 6534 devices, if the data is less than 32 MB, then the transfer rate will be 20 MHz for single-shot pattern I/O or pattern regeneration (looping) from onboard memory. In all other cases, performance depends on the computer hardware, operating system, and other programs running on the computer. Visit ni.com/products to access the most current benchmarks.

Single-Shot Pattern I/O – This benchmark uses the internal clock to control the transfer of finite amount of data (32MB) for a given number of times. If the selected transfer rate is too high, an expected error will occur, and the internal clock rate is decreased until all tests pass without error.

Device	Input Rates (MHz)			Output Rates (MHz)		
	8-bit	16-bit	32-bit	8-bit	16-bit	32-bit
PCI-6534	20.0	20.0	20.0	20.0	20.0	20.0
PXI-6534	20.0	20.0	20.0	20.0	20.0	20.0
PCI-DIO-32HS	10.0	5.0	5.0	5.00	2.5	2.5
PXI-6533	10.0	5.0	5.0	5.00	2.857	2.857

Continuous Pattern I/O – This benchmark uses the internal clock to control the transfer rate of the transfer. If the selected transfer rate is too high, an expected error will occur, and the internal clock rate is decreased. The benchmark executes until 1 GB of data is acquired. If an error occurs before 1 GB of data is acquired, the internal clock rate is decreased and the test starts over.

Device	Input Rates (MHz)			Output Rates (MHz)		
	8-bit	16-bit	32-bit	8-bit	16-bit	32-bit
PCI-6534	20.0	10.0	5	20.0	10.0	5
PXI-6534	20.0	10.0	10	20.0	10.0	6.67
PCI-DIO-32HS	2.5	1.43	1.43	4.00	2.0	2.0
PXI-6533	2.5	1.43	1.43	5.00	2.50	2.5

Continuous Handshaking I/O – This benchmark configures the NI 653x device for burst mode handshaking protocol. The continuous burst mode I/O test calculates the average transfer rate over 1 GB of data transfer. The average transfer rate is calculated as the total data transferred divide by total length of time used for transfer. Single-shot burst mode handshaking I/O performance is as good or better than continuous I/O.

Device	Input Rates (MHz)			Output Rates (MHz)		
	8-bit	16-bit	32-bit	8-bit	16-bit	32-bit
PCI-6534	20	20	18	19.9	19.8	13.0
PXI-6534	19.9	19.9	14.1	19.9	18.0	9.17
PCI-DIO-32HS	19.9	19.7	19.9	19.9	18.0	13.0

Memory

NI 6533	16-sample FIFO
NI 6534	64 MB, 32 MB per I/O group

Start and Stop Triggers

Compatibility	5 V TTL/CMOS
Trigger types	Rising or falling edge, digital pattern
Pulse width for edge triggers	10 ns minimum
Pattern triggers detection capabilities	Detect pattern match or mismatch on user-selected bits

RTSI Bus (PCI and AT only)

Trigger lines	7
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PXI Trigger Bus (PXI only)

Trigger lines	7
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Bus Interfaces

PCI, PXI	Master, slave
DAQCard	PCMCIA slave
AT	AT slave with dual DMA

Power Requirements

Device	+5 VDC (±5%)*
PCI-DIO-32HS, PXI-6533, AT-DIO-32HS	1.3
PCI-6534, PXI-6534	2 A
DAQCard-6533	500 mA

*Excludes power consumed through I/O connector

Physical

Dimensions, not including connectors

PCI, AT	17.5 by 10.7 cm (6.9 by 4.2 in.)
PXI	10 by 16 cm (3.9 by 6.3 in.)
DAQCard	Type II PC Card

I/O Connector

PCI, AT	68-pin male SCSI-II type
DAQCard	68-pin female PCMCIA

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 

Digital I/O Specifications

Specifications – 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 VDC

Digital Logic Levels

Level	Minimum	Maximum
Input low voltage	0 VDC	1 V
Input high voltage	2 VDC	28 VDC

Input current

5 V input 1.5 mA/channel max

24 V input 8 mA/channel max

Isolation 60 VDC 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

AC 30 V_{rms} (42 V peak)

DC 60 VDC

Maximum switching capacity, 25 °C 120 mA

Common-mode isolation 60 VDC or 30 V_{rms} (42 V peak) channel-to-channel and channel-to-computer

On resistance 35 Ω maximum

Off 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 260 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 **CE**

Specifications – 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 Input

Digital logic levels

Level	Minimum	Maximum
Input low voltage	-0.3 V	0.8 V
Input high voltage	2.2 V	5.3 V
Output low voltage (I _{out} = 2.5 mA)	–	0.4 V
Output high voltage (I _{out} = 2.5 mA)	3.7 V	–

Transfer rate

Bus	Maximum with NI-DAQ Software	Typical Sustainable Rate
PCI, PXI, DAQCard, ISA	50 kbytes/s	1-10 kbytes/s
DAQPad	250 bytes/s	175 bytes/s

Note: Transfer rate depends on the computer and software. The rates may vary due to programming language and code efficiency, CPU utilization, transfer methods, and so on. Please consult the user manual for specifics. The DAQPad-650x transfer rate is dependent upon available USB bandwidth.

Handshaking 2-wire

Data transfers Interrupts, programmed I/O

Bus interface

PCI, PXI, DAQCard, DAQPad, AT Slave

Power Requirements

Device	+5 VDC (±5%)	Power Available at I/O Connector
6507/8 and PCI-6503	400 mA	+4.65 to +5.25 VDC, 1 A fused
DAQCard-DIO-24	15 mA	+4.65 to +5.25 VDC, 500 mA
PC-DIO-24	160 mA	+4.65 to +5.25 VDC, 1 A fused

Device	+9 to +30 VDC	Power Available at I/O Connector
DAQPad-6507/8	150 mA at 12 VDC typical; 1 A max	+4.65 to +5.25 VDC, 1 A fused

Physical

Dimensions

PCI-6503 12.2 by 9.5 cm (4.8 by 3.7 in.)

DAQCard-DIO-24 Type II PC Card

PC-DIO-24 11.7 by 10.6 cm (4.6 by 4.2 in.)

PCI-DIO-96 13.7 by 10.7 cm (5.4 by 4.2 in.)

PXI-6508 10 by 16 cm (3.9 by 6.3 in.)

PC-DIO-96 16.5 by 9.9 cm (6.3 by 3.9 in.)

DAQPad-6507/8 14.6 by 21.3 by 3.8 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

PC-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 **CE**