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High-Speed Voltage Output – up to 1 MS/s/Channel, up to 16 Bits, up to 32 Channels

NI 673x, NI 671x, NI 672x

- Low-cost arbitrary waveform generation
- High-channel density
- Integrated multidevice synchronization bus
- Easy real-time control with LabVIEW Real-Time
- Digital triggering and external clocking
- Simultaneous updates
- 8 digital I/O lines (TTL/CMOS)
- Two 24-bit counter/timers
- Measurement services that simplify configuration and measurements

Operating Systems

- Windows 2000/NT/XP
- Mac OS X
- Linux®

Recommended Software

- LabVIEW 7.x or higher
- LabWindows™/CVI 7.x or higher
- Measurement Studio 7.x or higher
- Analog Waveform Editor

Other Compatible Software

- Visual Studio .NET
- Visual Basic, C/C++, and C#

Measurement Services Software (included)[1]

- NI-DAQmx driver
- Measurement & Automation Explorer configuration utility

[1]Mac OS X and Linux applications must use NI-DAQmx Base driver software.

Calibration Certificate Available



Family	Bus	Analog Outputs	Update Rate per Channel (S/s)[1]	Output Resolution	Output Range (V)	External Voltage Reference	Digital I/O	Counter/Timers	Triggering
NI 6711	PCI, PXI	4	1 M	12	±10	✓	8	2, 24-bit	Digital
NI 6713	PCI, PXI	8	740 k to 1 M	12	±10	✓	8	2, 24-bit	Digital
NI 6715	PCMCIA	8	100 k to 1 M	12	±10	✓	8	2, 24-bit	Digital
NI 6731	PCI	4	1 M	16	±10	✓	8[2]	2, 24-bit	Digital
NI 6733	PCI, PXI	8	740 k to 1 M	16	±10	✓	8[2]	2, 24-bit	Digital
NI 6722	PCI, PXI	8	182 to 800 k	13	±10	–	8	2, 24-bit	Digital
NI 6723	PCI, PXI	32	45 to 800 k	13	±10	–	8	2, 24-bit	Digital

[1]Update rate can vary depending on the number of channels used; [2]Static or hardware-timed pattern generation and acquisition up to 10 MHz

Table 1. High-Speed Voltage Output Product Selection Guide

Overview and Applications

National Instruments high-speed voltage output devices combine the latest in PC technologies to deliver simultaneous, multichannel updates for control and waveform output applications. Use these modules in a variety of applications, including:

- Stimulus/response
- Power supply control
- High-speed, deterministic control
- Sensor/signal simulation

Features

The versatile NI high-speed voltage output devices commonly replace several kinds of instruments including stand-alone PID controllers, low-speed arbitrary waveform generators, and function generators.

Waveform Generation

These devices are capable of updating at rates up to 1 MS/s, giving you the ability to generate waveforms up to 500 kHz. When using these devices, you have complete control of each data point that is updated on the output for each channel. This feature is significant because you can define not only common waveforms such as square, sine, or sawtooth but also complex waveforms. For instance, you are able to create a sine wave that is overlaid with noise in which the amplitude and noise shape are user-defined. In practice, the waveform is defined in a software buffer, within PC memory, and is streamed to the voltage output device using direct memory access (DMA) data transfers. Using DMA transfers, the amount of memory located on board the voltage output device is minimized and is swapped with inexpensive PC memory.

Real-Time Control

You can use NI high-speed voltage output devices with the LabVIEW Real-Time Module to deliver real-time, deterministic control loop execution. Because they are compatible with LabVIEW Real-Time, common control algorithms, such as PID, are simple to implement but, more importantly, you may prototype and implement complex, cutting-edge control algorithms as well. High-performance control, on the order of eight PID loops running in excess of 20 kHz each, is possible with this combination of hardware

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and software. Each high-speed voltage output device offers multichannel simultaneous updates and hardware-timed single-point updates.

Multidevice Synchronization

Each high-speed voltage output device offers the ability to be master or slave of a multidevice timing and triggering system. Use integration technologies such as the RTSI bus, PXI trigger bus, and PFI pins to trigger and synchronize to a wide variety of I/O types. These I/O types range from analog input, image acquisition, motion control, and high-speed digitizers to multifunction data acquisition devices. With these integration infrastructures, you can create powerful, custom test and control systems with ease.

Measurement Services Software

National Instruments measurement services software, built around NI-DAQmx driver software, features intuitive application programming interfaces, configuration tools, I/O assistants, and other tools designed to reduce system setup, configuration, and development time. This software, part of your data acquisition purchase, includes helpful features such as:

Automatic Code Generation – DAQ Assistant is an interactive guide that helps you navigate through configuring, testing, and programming analog output tasks and automatically generates the necessary code for NI LabVIEW, LabWindows/CVI, or Measurement Studio.

Cleaner Code Development – Basic and advanced software functions have been combined into one easy-to-use yet powerful set to help you build cleaner code and move from basic to advanced applications without replacing functions.

High-Performance Driver Engine – NI-DAQmx delivers maximum I/O system throughput with a multithreaded driver.

Test Panels – With the Measurement & Automation Explorer configuration utility, you can test all of your module functionality before you begin development.

Scaled Channels – Easily scale your voltage data into the proper engineering units using the NI-DAQmx measurement-ready virtual channels by choosing from a list of common sensors and signals or creating your own custom scale.

LabVIEW Integration – All NI-DAQmx functions create the waveform data type, which carries acquired data and timing information directly into more than 400 LabVIEW built-in analysis routines for display of results in engineering units on a graph.

NI-DAQmx Base Driver

NI-DAQmx Base (available at **ni.com/downloads**) offers Mac OS X and Linux users a programming interface similar to NI-DAQmx. It features ready-to-use LabVIEW VIs and C function features similar to those included in NI-DAQmx driver software.

AO_GND	34	68	NC
NC	33	67	AO_GND
AO_GND	32	66	AO_GND
AO_GND	31	65	AO_7[1]
AO_6[1]	30	64	AO_GND
AO_GND	29	63	AO_GND
AO_5[1]	28	62	NC
AO_GND	27	61	AO_GND
AO_GND	26	60	AO_4
AO_3	25	59	AO_GND
AO_GND	24	58	AOGND
AO_GND	23	57	AO_2
AO_0	22	56	AO_GND
AO_1	21	55	AO_GND
EXTREF	20	54	AO_GND
PO4	19	53	D_GND
D_GND	18	52	DIO0
PO1	17	51	PO5
PO6	16	50	D_GND
D_GND	15	49	DIO2
+5 V	14	48	PO7
D_GND	13	47	PO3
D_GND	12	46	NC
PFI_0	11	45	EXTSTROBE
PFI_1	10	44	D_GND
DBND	9	43	PFI_2
+5 V	8	42	PFI_3/ CTR_1_SOURCE
D_GND	7	41	PFI_4/ CTR_1_GATE
PFI_5/AO_SAMP_CLK	6	40	CTR_1_OUT
PFI_6/AO_START_TRIG	5	39	D_GND
D_GND	4	38	PFI_7
PFI_9/CTR_0_GATE	3	37	PFI_8/CTR_0_SOURCE
CTR_0_OUTT	2	36	D_GND
FREQ_OUT	1	35	D_GND

[1] No Connect on 6711 or 6731

Figure 1. NI 671x and NI 673x I/O Connector

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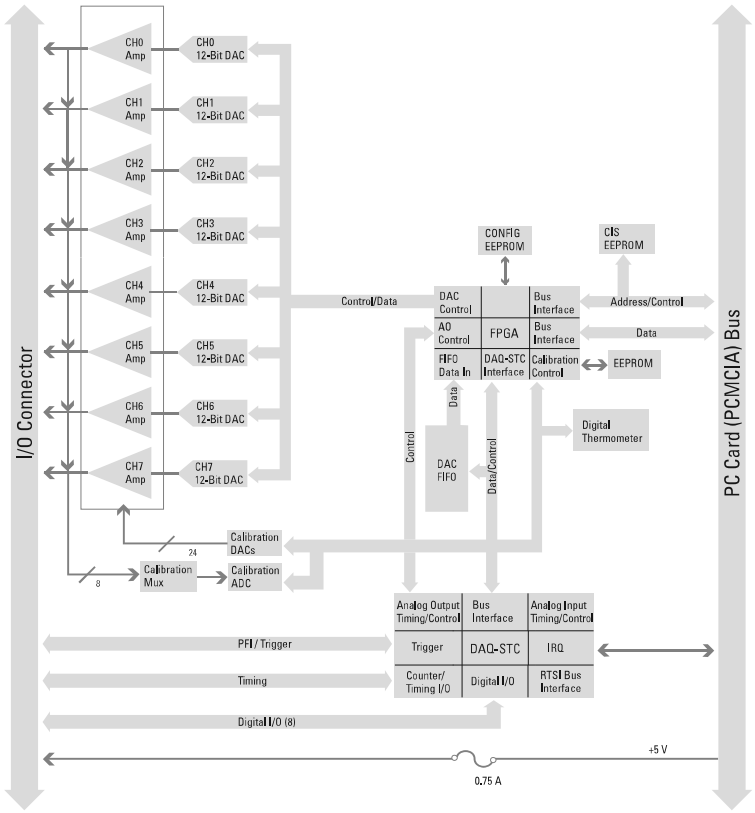


Figure 2. NI DAQCard-6715 Hardware Block Diagram

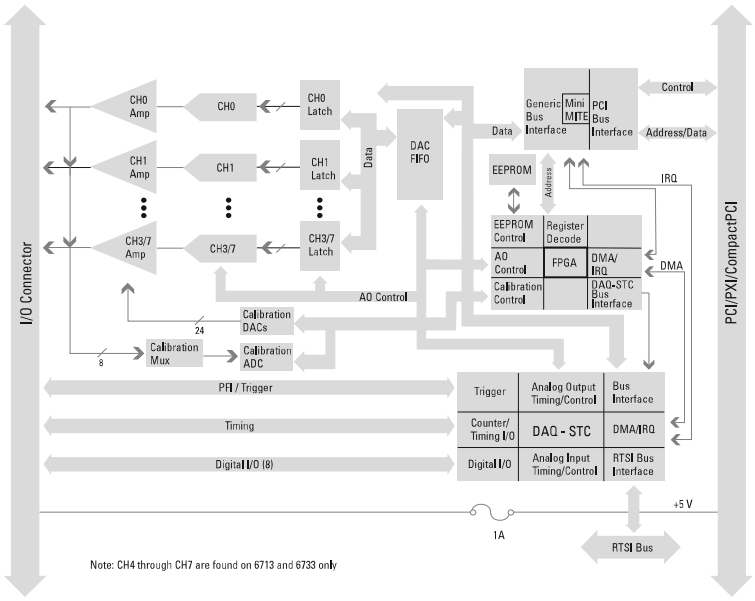


Figure 3. NI 671x and NI 673x Hardware Block Diagram

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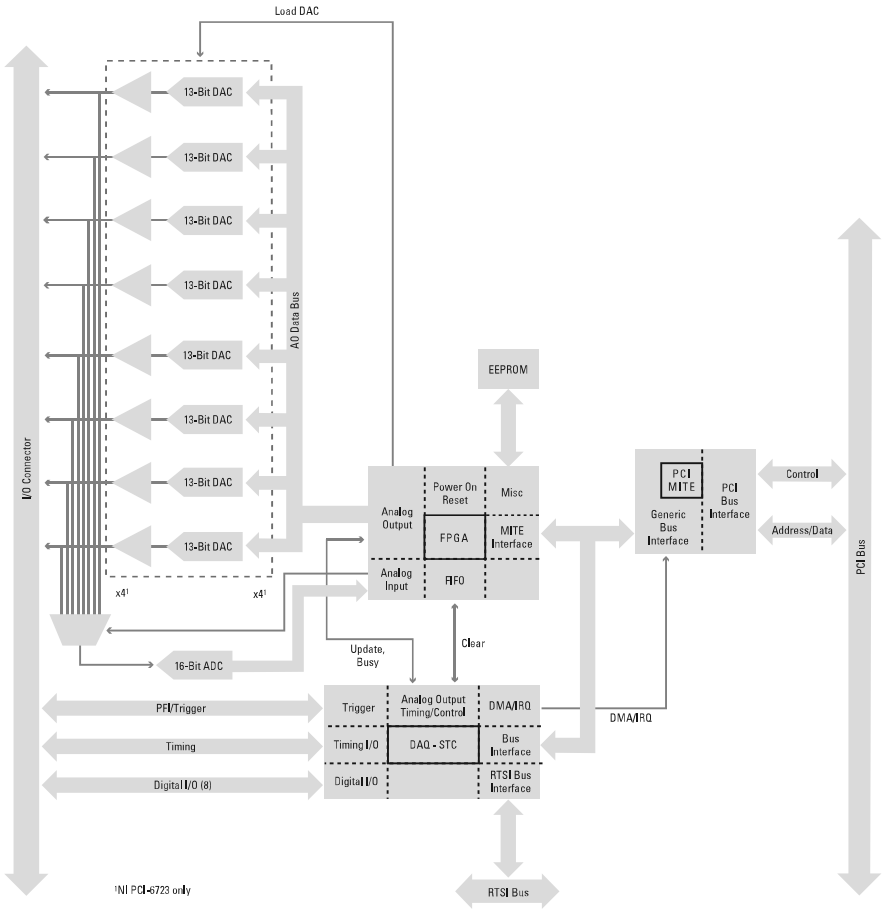


Figure 4. NI 672x Hardware Block Diagram

Ordering Information

PCI

NI PCI-6711 777740-01
NI PCI-6713 777741-01
NI PCI-6722[1] 778705-01
NI PCI-6723[1] 778701-01
NI PCI-6731 778511-01
NI PCI-6733 778510-01

PXI

NI PXI-6711 777794-01
NI PXI-6713 777795-01
NI PXI-6722[1] 778999-01
NI PXI-6723[1] 778998-01
NI PXI-6733 778512-01

PCMCIA

NI DAQCard-6715 778146-01

Includes data acquisition driver software.
[1]Windows only.

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

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Specifications – NI 671x, NI 673x

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

Analog Output

Output Characteristics

Number of channels
- NI 6715/6713/6733 ..... 8 voltage outputs
- NI 6711/6731 ..... 4 voltage outputs

Resolution ..... 12 bits, 1 in 4,096 (NI 671x), 16 bits, 1 in 65,536 (NI 673x)

	Maximum Update Rate (NI 671x/673x)		Max Update Rate (NI 6715)	
Number of Channels	Using Local FIFO (kS/s)[1]	Using Host Memory (kS/s)[2]	Using Local FIFO (kS/s)[1]	Using Host Memory (kS/s)[2]
1	1,000	1,000	1,000	800
2	1,000	1,000	850	400
3	1,000	1,000	750	266
4	1,000	1,000	650	200
5	1,000	1,000	600	160
6	952	1,000	550	133
7	833	869	510	114
8	740	769	480	100

[1]These numbers apply to continuous waveform generation, and do not change irrespective of the number of devices in the system. [2]These numbers may change when using more devices or when other CPU or bus activity is taking place.

FIFO buffer size
- NI 6713/6733 ..... 16,384 samples
- NI 6711/6715/6731 ..... 8,192 samples

Data transfers ..... DMA, interrupts, programmed I/O

DMA modes (PXI/PCI only) ..... Scatter-gather

Voltage Output

Ranges ..... ±10.0 V, ±AO EXT REF

Output coupling ..... DC

Protection ..... Short-circuit to ground

Digital I/O

Number of channels ..... 8 input/output

Compatibility ..... 5 V TTL/CMOS

Power-on state ..... Input (high-impedance)

Data transfers ..... Programmed I/O, DMA (NI 673x), interrupts (NI 673x)

Input buffer ..... 2048 B (NI 673x)

Output buffer ..... 2048 B (NI 673x)

Transfer rate ..... 10 Mwords/s (NI 673x)

Timing I/O

General-Purpose Up/Down Counter/Timers

Number of channels 2

Resolution ..... 24 bits

Compatibility ..... 5 V TTL/CMOS

Level	Minimum	Maximum
Input low voltage	0 V	0.8 V
Input high voltage	2 V	5 V
Output low voltage (I_{out} = 5 mA)	–	0.4 V
Output high voltage (I_{out} = -3.5 mA)	4.35 V	–

Digital logic levels

Base clocks available ..... 20 MHz and 100 kHz

Data transfers ..... DMA (except DAQCard-6715), interrupts, programmed I/O

DMA modes ..... Scatter-gather

Digital Trigger

Purpose
- Analog output ..... Start trigger, gate, clock
- General-purpose counter/timers ..... Source, gate

Source ..... (except NI 6715)
- PCI ..... RTSI <0...6>
- PXI ..... PFI <0...9>

Slope ..... Positive or negative; software-selectable

Compatibility ..... 5 V TTL/CMOS

Specifications – NI 672x

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

Analog Output

Output Characteristics

Number of channels
- NI 6722 ..... 8 voltage outputs

	Max Update Rate (kS/s)	
Number of Channels	Using Local FIFO[1]	Using Host PC Memory[2]
1	800	800
2	714	714
8	476	182
16	333	90.9
24	253	60
32	204	45

[1]These numbers apply to continuous waveform generation, which allows for the time it takes to reset the FIFO to the beginning when cycling through it. This additional time is not incurred when using host PC memory for waveform generation. The max update rate in FIFO mode does not change regardless of the number of devices in the system.

[2]These results were measured using an NI 6722/6723 device with a 550 MHz Pentium III machine. These numbers may change when using more devices or when other CPU or bus activity occurs.

- NI 6723 ..... 32 voltage outputs

Resolution ..... 13 bits, 1 in 8,192

Max update rate

FIFO buffer size ..... 2,048 samples

Data transfers ..... DMA, interrupts, programmed I/O

DMA modes ..... Scatter gather

Voltage Output

Ranges ..... ±10 V

Output coupling ..... DC

Protection ..... Short-circuit to ground

Digital I/O

Number of channels ..... 8 input/output

Compatibility ..... TTL/CMOS

Power-on state ..... Input (high-impedance)

Data transfers ..... Programmed I/O

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Timing I/O

Number of channels
- Up/down counter/timers 2
- Frequency scaler 1

Resolution
- Up/down counter/timers ..... 24 bits
- Frequency scaler ..... 4 bits

Compatibility ..... 5 V TTL/CMOS

Digital logic levels

Level	Min	Max
Input low voltage	0.0 V	0.8 V
Input high voltage	2.0 V	5.0 V
Output low voltage (I_{out} = 5 mA)	–	0.4 V
Output high voltage (I_{out} = -3.5 mA)	4.35 V	–

Data transfers
- Up/down counter/timers ..... DMA (scatter-gather), interrupts, programmed I/O
- Frequency scaler ..... Programmed I/O

Digital Trigger

Purpose
- Analog output ..... Start trigger, gate, clock
- Counter/timers ..... Source, gate

Source ..... PFI <0...9>

Compatibility ..... 5 V TTL

Response ..... Rising or falling edge

For more detailed specifications, please refer to the product manual.

High-Speed Voltage Output Cables and Accessories

Recommended Configurations

- Shielded options for minimal noise interference
- Direct connectivity options such as BNC
- Low-cost options for OEM
- Front-mount terminal block for PXI
- Custom connectivity with the CA-1000

Model	Shielding	Connect to …	Cable	Accessory
NI 673x, NI 671x	Shielded	BNC	SH68-68-EP	BNC-2110
	Shielded	Screw terminals	SH68-68-EP	SCB-68 or TBX-68
	Shielded	Screw terminals	–	TB-2705 (PXI)
	Shielded	Custom	SH68-68-EP	CA-1000
	Unshielded	Screw terminals	R6868	CB-68LP or CB-68LPR
NI 6723	Shielded	BNC	2 SH68-C68-S	BNC-2110 and BNC-2115
	Shielded	Screw terminals	2 SH68-C68-S	2 SCB-68 or TBX-68
	Shielded	Custom	2 SH68-C68-S	2 CA-1000
NI 6722	Shielded	BNC	SH68-C68-S	BNC-2110
	Shielded	Screw terminals	SH68-C68-S	SCB-68
	Shielded	Custom	SH68-C68-S	CA-1000
	Unshielded	Screw terminals	RC68-68	CB-68LP or CB-68LPR
DAQCard-6715	Shielded	BNC	SHC68-68-EPM	BNC-2110
	Shielded	Screw terminals	SHC68-68-EPM	SCB-68
	Shielded	Custom	SHC68-68-EPM	CA-1000
	Unshielded	Screw terminals	RC68-68	CB-68LP or CB-68LPR

I/O Connector Blocks

BNC-2110 – Shielded I/O connector block with signal-labeled BNC connectors for easy connectivity of your analog output (AO), digital I/O (DIO), and counter/timer signals.

BNC-2110 777643-01

Dimensions – 20.3 by 11.2 by 5.5 cm (8.0 by 4.4 by 2.2 in.)

BNC-2115 – Shielded I/O connector block with signal-labeled BNC connectors for easy connectivity of your extended analog output on NI 6723 devices.

BNC-2115 777807-01

Dimensions – 20.3 by 11.2 by 5.5 cm (8.0 by 4.4 by 2.2 in.)

SCB-68 – Shielded I/O connector blocks giving you rugged, very low-noise signal termination. The SCB-68 also houses silk-screened component locations for easy addition of simple signal conditioning circuitry for your AO channels.

SCB-68 776844-01

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

CA-1000 – Configurable enclosure that gives you user-defined connectivity and flexibility through customized panelettes.

CA-1000 777664-01

Dimensions – 30.7 by 25.4 by 4.3 cm (12.1 by 10 by 1.7 in.)

TBX-68 – 68 screw terminals for easy connection of field signals to 68-pin DAQ devices. It 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-68 777141-01

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

CB-68LP, CB-68LPR – 68 screw terminals for easy connection of field signals to AO devices. They include one 68-pin male connector for direct connection to 68-pin cables. The connector blocks include standoffs for use on a desktop or for mounting in a custom panel. The CB-68LP has a vertical mounted 68-pin connector. The CB-68LPR has a right-angle mounted connector and can also be used with the CA-1000.

CB-68LP 777145-01

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

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

TB-2705 – 68-pin screw-terminal block for PXI-671x and PXI-673x modules. Latches to the front of your PXI module with locking screws and provides strain relief as well as easy access to your analog, digital,

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trigger, and counter/timer signals through screw terminals. Does not work with NI 6703 or NI 6704 devices.

TB-2705 778241-01

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

Synchronization Cables

RTSI Bus Cables – Used to connect timing and synchronization signals among measurement, vision, motion, and CAN boards for PCI. For systems with long and short boards, use 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

Shielded I/O Cables

SH68-68-EP – Shielded 68-conductor cable terminated with two 68-pin female 0.050 series D-type connectors, featuring individually shielded analog twisted pairs for reduced crosstalk with high-speed devices. This cable works with all NI 671x and NI 673x devices.

1 m 184749-01

SHC68-68-EP – Shielded cable for connecting and latching the NI DAQCard-6715, NI 6722, and NI 6723 to standard 68-pin accessories. Latching screws secure the shielded connector to the device itself for stability. Use this cable for a DAQCard located in the bottom PCMCIA slot of a laptop.

0.5 m 186838-0R5
1 m 186838-01

SHC68U-68-EP – Identical to the SHC68-68-EP, except that the DAQCard connector is inverted so you can use two latching DAQCard devices in adjacent slots. Use this cable with a DAQCard inserted in the upper PCMCIA slot of a laptop.

0.5 m 187406-0R5
1 m 187406-01

SH68-C68-S – Shielded cable for connecting and latching NI 672x devices to standard 68-pin accessories.

2 m 186381-02

Ribbon I/O Cables

R6868 – 68-conductor flat ribbon cable terminated with two 68-pin connectors. Use this cable to connect the NI 670x, NI 671x, and NI 673x devices to low-cost 68-pin accessories.

1 m 182482-01

RC68-68 – 68-conductor flat ribbon cable terminated with one VHDCI 68-pin connector and one 68-pin SCSI II connector. Use this cable to connect the NI 6722 devices and DAQCard-6715 with standard 68-pin accessories.

1 m 187252-01



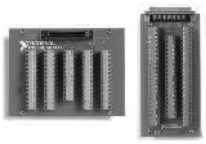
BNC-2110



SCB-68



CA-1000



CB-68LP I/O and CB-68LPR



TB-2705



RTSI Bus Cable



SH68-68-EP Shielded Cable



SHC68-68-EP



R6868 Ribbon Cable



RC68-68 Ribbon Cable

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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

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