

# S Series Multifunction DAQ

## 12-Bit, 5 MS/s, 2 or 4 Analog Inputs

### NI PCI-6110, NI PCI-6111

- 2 or 4 analog inputs at 5 MS/s/channel, 12-bit resolution
- 2 analog outputs at 4 MS/s, 16-bit resolution (2.5 MS/s dual-channel)
- 8 digital I/O lines (5 V TTL/CMOS); two 24-bit counter/timers
- Analog and digital triggering
- Pseudodifferential simultaneous sampling inputs
- $\pm 200$  mV to  $\pm 42$  V signal ranges
- NI-DAQ driver simplifies configuration and measurements

#### Models

- NI PCI-6110
- NI PCI-6111

#### Operating Systems

- Windows 2000/NT/XP/Me/9x
- Mac OS 9
- Others such as Linux (page 187)

#### Recommended Software

- LabVIEW
- LabWindows/CVI
- Measurement Studio for Visual Basic
- VI Logger

#### Other Compatible Software

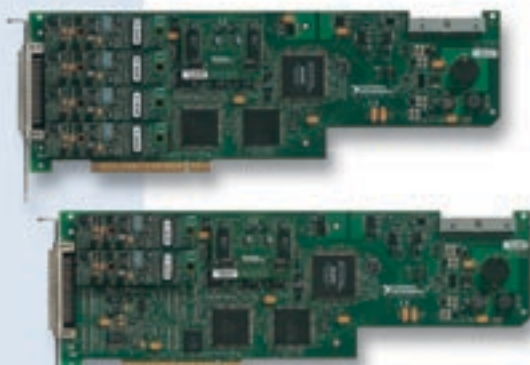
- Visual Basic
- C/C++

#### Driver Software (included)

- NI-DAQ

#### Calibration Certificate Included

See page 21



| Family  | Bus | Analog Inputs | Input Resolution | Sampling Rate | Input Range             | Analog Outputs | Output Resolution | Max Output Rate | Output Range | Digital I/O | Counter/Timers | Triggers           |
|---------|-----|---------------|------------------|---------------|-------------------------|----------------|-------------------|-----------------|--------------|-------------|----------------|--------------------|
| NI 6110 | PCI | 4             | 12 bits          | 5 MS/s        | $\pm 0.2$ to $\pm 42$ V | 2              | 16 bits           | 4 MS/s*         | $\pm 10$ V   | 8           | 2, 24-bit      | Analog and Digital |
| NI 6111 | PCI | 2             | 12 bits          | 5 MS/s        | $\pm 0.2$ to $\pm 42$ V | 2              | 16 bits           | 4 MS/s*         | $\pm 10$ V   | 8           | 2, 24-bit      | Analog and Digital |

\*4 MS/s single channel; 2.5 MS/s on two channels.

Table 1. NI 6110 and NI 6111 Channel, Speed, and Resolution Specifications. (See page 231 for detailed specifications)

## Overview and Applications

The National Instruments PCI-6110 and PCI-6111 devices combine the latest in PC technologies to deliver simultaneous sampling, high-bandwidth capabilities for low and high channel-count data acquisition (DAQ) systems. These devices are used in a broad variety of applications including:

- Continuous high-speed data logging at speeds in excess of 8 MS/s
- Electro-optics
- 42 V automotive applications
- Radar, sonar
- High-energy physics
- Highly accurate time/frequency domain measurements – as little as 35  $\mu$ V of noise, as much as 75 dB spurious-free dynamic range (SFDR)

## Features

The NI PCI-6110 and NI PCI-6111 feature pseudodifferential inputs on each input channel, which minimize groundloops and achieve up to 72 dB common-mode rejection ratio (CMRR). These devices also feature software-selectable AC/DC input coupling to maximize measurement resolution. Simultaneous sampling is possible with these devices, which maintains phase relationships of the incoming signals. In order to ensure accurate measurements, each ADC on

these devices are calibrated at the factory with a NIST-traceable source and can be self-calibrated in the field as the test environment changes.

The PCI-6110 and PCI-6111 feature analog and digital triggering, as well as two 12-bit analog outputs, two 24-bit 20 MHz counter/timers, and eight digital I/O lines.

### INFO CODES

For more information, or to order products online visit [ni.com/info](http://ni.com/info) and enter:

pci6110

pci6111

**BUY ONLINE!**

## Ordering Information

NI PCI-6110 .....777475-01

NI PCI-6111 .....777530-01

Includes NI-DAQ driver software.

For information on extended warranty and value-added services, see page 20.

## Recommended Configurations

| Family  | DAQ Device | Accessory            | Cable                  |
|---------|------------|----------------------|------------------------|
| NI 6110 | PCI-6110   | BNC-2110 (777643-01) | SH68-68-EP (184749-01) |
| NI 6111 | PCI-6111   | BNC-2110 (777643-01) | SH68-68-EP (184749-01) |

See page 221 for accessory and cable options.

# S Series Multifunction DAQ 12-Bit, 5 MS/s, 2 or 4 Analog Inputs

| Nominal Range (V) | Absolute Accuracy |        |             |                           |          |                   | Relative Accuracy                     |                 |          |
|-------------------|-------------------|--------|-------------|---------------------------|----------|-------------------|---------------------------------------|-----------------|----------|
|                   | % of Reading      |        | Offset (mV) | Noise + Quantization (mV) |          | Temp Drift (%/°C) | Absolute Accuracy at Full Scale (±mV) | Resolution (mV) |          |
|                   | 24 Hrs            | 1 Year |             | Single Pt.                | Averaged |                   |                                       | Single Pt.      | Averaged |
| ±42               | 0.507%            | 0.509% | 34.669      | 50.732                    | 4.395    | 0.0005            | 293.56                                | 57.861          | 5.786    |
| ±20               | 0.507%            | 0.509% | 19.871      | 20.293                    | 1.758    | 0.0005            | 123.42                                | 23.145          | 2.314    |
| ±10               | 0.107%            | 0.109% | 5.738       | 10.146                    | 0.879    | 0.0005            | 17.51                                 | 11.572          | 1.157    |
| ±5                | 0.057%            | 0.059% | 2.971       | 5.073                     | 0.439    | 0.0005            | 6.36                                  | 5.786           | 0.579    |
| ±2                | 0.057%            | 0.059% | 1.272       | 2.029                     | 0.176    | 0.0005            | 2.63                                  | 2.314           | 0.231    |
| ±1                | 0.057%            | 0.059% | 0.698       | 1.015                     | 0.088    | 0.0005            | 1.38                                  | 1.157           | 0.116    |
| ±0.5              | 0.057%            | 0.059% | 0.402       | 0.669                     | 0.059    | 0.0005            | 0.76                                  | 0.771           | 0.077    |
| ±0.2              | 0.057%            | 0.059% | 0.204       | 0.390                     | 0.035    | 0.0005            | 0.36                                  | 0.463           | 0.046    |

Note: Accuracies are valid for measurements following an internal calibration. Averaged numbers assume dithering and averaging of 100 single-channel readings. Measurement accuracies are listed for operational temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory-calibration temperature. One-year calibration interval recommended. The Absolute Accuracy at Full Scale calculations were performed for a maximum range input voltage value (for example, 10 V for the ±10 V range) after one year, assuming 100 pt averaging of data. See overview on page 194 for example calculations.

Table 2. PCI-6110 and PCI-6111 Analog Input Accuracy Specifications

| Nominal Range (V) | Absolute Accuracy |        |             |                                       |
|-------------------|-------------------|--------|-------------|---------------------------------------|
|                   | % of Reading      |        | Offset (mV) | Temp Drift (%/°C)                     |
|                   | 24 Hrs            | 1 Year |             |                                       |
| ±10               | 0.018%            | 0.022% | 5.933       | 0.0005                                |
|                   |                   |        |             | Absolute Accuracy at Full Scale (±mV) |
|                   |                   |        |             | 8.133                                 |

Note: Temp Drift applies only if ambient is greater than ±10 °C of previous external calibration. See page 194 for example calculations.

Table 3. PCI-6110 and PCI-6111 Analog Output Accuracy Specifications

## Driver Software

NI-DAQ is the robust driver software included with all National Instruments data acquisition and signal conditioning products. This easy-to-use software tightly integrates the full functionality of your DAQ hardware to LabVIEW, LabWindows/CVI, and Measurement Studio for Visual Basic. High-performance features include multidevice synchronization, networked measurements, and DMA data management. Bundled with NI-DAQ, the Measurement & Automation Explorer utility simplifies the configuration of your measurement hardware with device test panels, interactive measurements, and scaled I/O channels. NI-DAQ also provides numerous example programs for LabVIEW and other application development environments to get you started with your application quickly.

## Services and Support/Training

As a complement to your data acquisition and signal conditioning product, consider:

- Technical Support – Included in hardware/software purchase through Applications Engineers worldwide, Web resources with more than 1000 example programs and more than 7000 KnowledgeBases, and Premier Support – [ni.com/support](http://ni.com/support)
- NI Factory Installation Services (FIS) – Software and hardware installed in PXI and PXI/SCXI systems, tested and ready to use – [ni.com/advisor](http://ni.com/advisor)
- Calibration – Includes NIST-traceable basic calibration certificate, services for ANSI/NCSL-Z540 and periodic calibration – [ni.com/calibration](http://ni.com/calibration)
- Extended Warranty – Meet project life-cycle requirements and maintain optimal performance in a cost-effective way – [ni.com/services](http://ni.com/services)
- Data Acquisition Training – Instructor-led courses – [ni.com/training](http://ni.com/training)
- Professional Services – Feasibility, consulting, and integration through our Alliance Program members – [ni.com/alliance](http://ni.com/alliance)

For more information on NI services and support, visit [ni.com/services](http://ni.com/services)

## Related Products

For related products, please refer to:

- High-Speed Digital I/O – page 378
- High-Speed Digitizers – page 440

See page 221 for connector diagrams.

See page 231 for detailed specifications.

# Multifunction DAQ Overview

Multifunction DAQ Overview

DAQ and Signal Conditioning

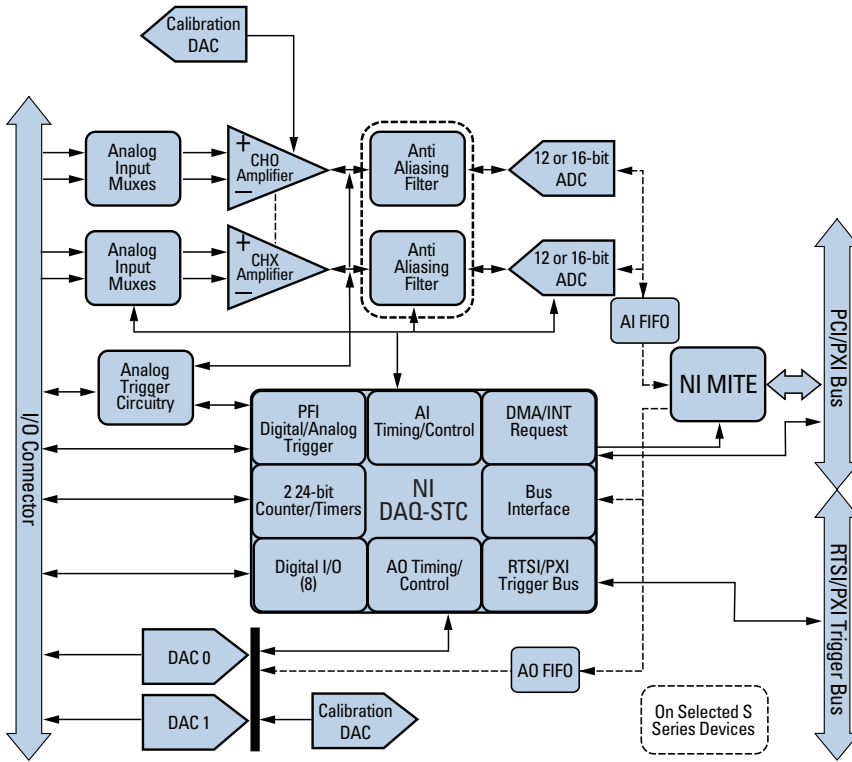


Diagram 1. S Series Diagram

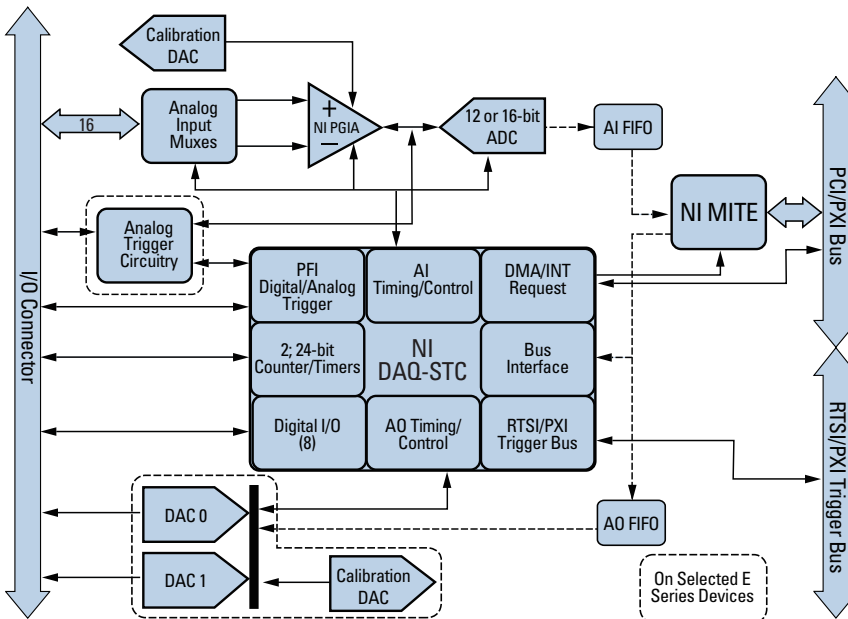


Diagram 2. E Series Diagram

# Driver Software for Data Acquisition and Signal Conditioning

## NI-DAQ

- Driver software for NI data acquisition and signal conditioning hardware
- Short time to first measurement with quick configuration and application-specific example programs
- Named and scaled channels remove configuration complexity
- Multiple-device synchronization and integration with RTSI or PXI trigger bus
- Networking features for remote and distributed measurements
- Robust double-buffered DMA data management routines

## Operating Systems

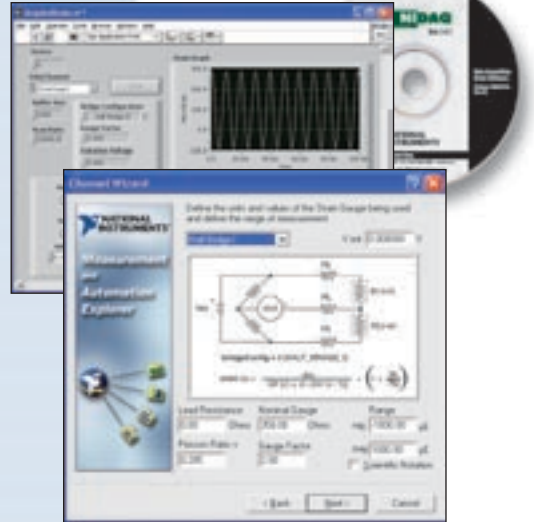
- Windows 2000/NT/XP/Me/9x
- Mac OS 9
- Others such as Linux (see page 187)
- Real-Time performance with LabVIEW (page 134)

## Recommended Software

- LabVIEW
- LabWindows/CVI
- Measurement Studio for Visual Basic
- VI Logger

## Other Compatible Software

- Visual Basic
- C/C++



## Overview

The quality of your configuration and driver software is just as important as the quality of your measurement hardware. NI-DAQ is a robust, time-proven driver for NI data acquisition and signal conditioning hardware. This software helps you quickly install your device and begin taking measurement data. NI-DAQ includes hundreds of application examples to jump-start your application development. NI-DAQ delivers the same ease of use and performance across many development environments, operating systems, and computer buses.

## Integrated Software Framework

Software ties the various pieces of measurement hardware together into a complete measurement system. National Instruments provides an integrated software framework (see Figure 1) to increase development productivity and decrease cost. NI-DAQ is part of the measurement and control services software, which tightly integrates NI measurement hardware with your application development environment. Because NI-DAQ is built in this framework, you can easily integrate and synchronize multiple measurement types, including motion and vision, with your data acquisition system. With this flexible, hardware-independent software, you can achieve interactive configuration, powerful programming, and excellent measurement performance.

## Configuration with Measurement & Automation Explorer

Measurement & Automation Explorer simplifies the configuration of your measurement hardware, so you can:

- Quickly detect and configure all hardware

- Use test panels to verify the operation of your hardware (See Figure 4)
- Make simple, interactive measurements
- Name and scale your I/O channels to physical or engineering units (See Figure 3)

## Powerful Programming

NI-DAQ software isolates you from hardware-specific register commands and gives you a simple, yet powerful application programming interface (API) between the complete hardware capabilities and a wide variety of development environments and languages. Because of the consistent API, you can use different DAQ hardware with the same application without modifying your software.

## High-Performance Measurements

NI-DAQ is optimized for measurement performance and ease of use. NI-DAQ software delivers:

- Efficiency and speed through event-driven programming
- Synchronization of measurements across multiple devices
- Seamless integration of measurement accessories
- Flawless buffer and DMA management

# Driver Software for Data Acquisition and Signal Conditioning

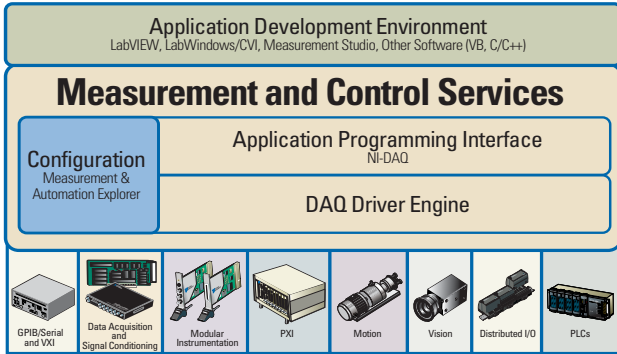


Figure 1. Integrated Software Framework

## LabVIEW and NI-DAQ

Using NI-DAQ, you can easily acquire, analyze, and present your measurements in LabVIEW. Figure 4 shows the block diagram of a typical data acquisition in LabVIEW. With the first set of NI-DAQ VIs, you configure your acquisition and read data from your sensor. Because this VI uses a named channel, most of the signal conditioning and DAQ hardware configuration is handled automatically. Next, you route the waveform from the read VI to the peak detect measurement VI. The waveform data type carries the scaled sensor and time data to the measurement function. Finally, the measurement data can be displayed in an indicator and/or a waveform graph that automatically has the correct time and engineering units.

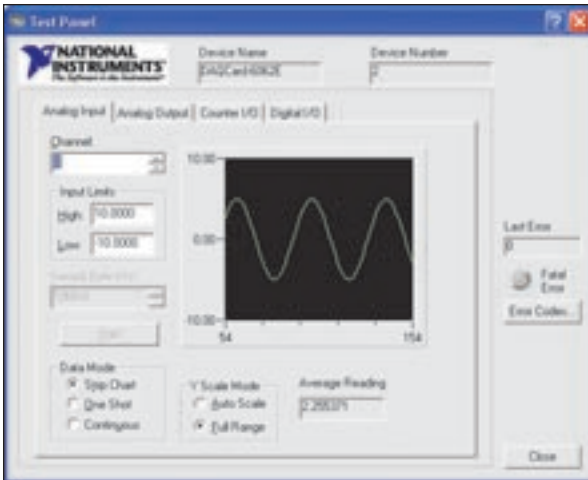


Figure 2. Quickly test your devices with the NI-DAQ test panels.

## Measurement Examples

The NI Developer Zone ([ni.com/zone](http://ni.com/zone)) has more than 2,400 LabVIEW, C, and Visual Basic source code examples written by NI development and application engineers, system integrators, and customers. These free measurement examples cover basic

functional examples such as analog and digital I/O, counter/timer operations, and signal processing and analysis. Plus, you can search on applications ranging from temperature and strain to sound and vibration to machine vision and motion control. With NI's increasing community of virtual instrumentation developers, the number of examples continues to grow quickly.



Figure 3. Measurement & Automation Explorer makes naming, scaling, and accessing I/O channels easy.

## Other Operating Systems

NI-DAQ is built on proven, industry-standard Windows and Mac OS technologies. If your application requires the use of another operating system, you have several options. For information on an open-source, third-party Linux driver, please visit [ni.com/linux](http://ni.com/linux). For other OSs, such as WinCE and QNX, please see the Measurement Hardware DDK on the following page.

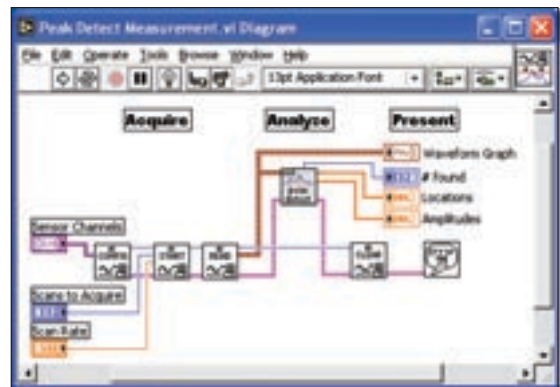


Figure 4. Acquire, analyze, and present with NI-DAQ and LabVIEW.

# Multifunction DAQ Cable and Accessory Selection Guides

## NI Cable Design Advantages

The SH68-68-EP cable is the most commonly used E Series and S Series cable. The cable is designed to work specifically with the NI Multifunction DAQ devices to preserve signal integrity through these technologies:

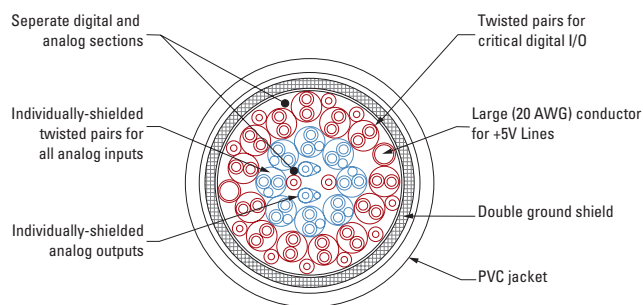


Figure 1. SH68-68-EP Cable

A variety of cabling and accessory options are available for your needs. Use the following tables to choose the most appropriate cables and accessories. To determine which Multifunction DAQ device best fits your needs, please see page 192.

|                  |    |    |                    |                      |    |    |                    |
|------------------|----|----|--------------------|----------------------|----|----|--------------------|
| ACH0-            | 34 | 68 | ACH0+              | ACH8                 | 34 | 68 | ACH0               |
| ACH1+            | 33 | 67 | ACH0GND            | ACH1                 | 33 | 67 | AIGND              |
| ACH1GND          | 32 | 66 | ACH1-              | AIGND                | 32 | 66 | ACH9               |
| ACH2+*           | 31 | 65 | ACH2+*             | ACH10                | 31 | 65 | ACH2               |
| ACH3+*           | 30 | 64 | ACH2GND*           | ACH9                 | 30 | 64 | AIGND              |
| ACH3GND*         | 29 | 63 | ACH3-*             | AIGND                | 29 | 63 | ACH11              |
| NC               | 28 | 62 | NC                 | ACH4                 | 28 | 62 | AISENSE            |
| NC               | 27 | 61 | NC                 | AIGND                | 27 | 61 | ACH12              |
| NC               | 26 | 60 | NC                 | ACH13                | 26 | 60 | ACH5               |
| NC               | 25 | 59 | NC                 | ACH6                 | 25 | 59 | AIGND              |
| NC               | 24 | 58 | NC                 | AIGND                | 24 | 58 | ACH14              |
| NC               | 23 | 57 | NC                 | ACH15                | 23 | 57 | ACH7               |
| DAC0OUT          | 22 | 56 | NC                 | DAC0OUT <sup>1</sup> | 22 | 56 | AIGND              |
| DAC1OUT          | 21 | 55 | A0GND              | DAC1OUT <sup>1</sup> | 21 | 55 | A0GND <sup>1</sup> |
| NC               | 20 | 54 | A0GND              | EXTREF <sup>1</sup>  | 20 | 54 | A0GND <sup>1</sup> |
| DIO4             | 19 | 53 | DGND               | DIO4                 | 19 | 53 | DGND               |
| DGND             | 18 | 52 | DIO0               | DGND                 | 18 | 52 | DIO0               |
| DIO1             | 17 | 51 | DIO5               | DIO1                 | 17 | 51 | DIO5               |
| DIO6             | 16 | 50 | DGND               | DIO6                 | 16 | 50 | DGND               |
| DGND             | 15 | 49 | DIO2               | DGND                 | 15 | 49 | DIO2               |
| 5 V Output       | 14 | 48 | DIO7               | +5 V                 | 14 | 48 | DIO7               |
| DGND             | 13 | 47 | DIO3               | DGND                 | 13 | 47 | DIO3               |
| DGND             | 12 | 46 | SCANCLK**          | DGND                 | 12 | 46 | SCANCLK            |
| PFI0/TRIG1       | 11 | 45 | EXTSTROBE**        | PFI0/TRIG1           | 11 | 45 | EXTSTROBE*         |
| PFI1/TRIG2       | 10 | 44 | DGND               | PFI1/TRIG2           | 10 | 44 | DGND               |
| DGND             | 9  | 43 | PF12/CONVERT*      | DGND                 | 9  | 43 | PF12/CONVERT*      |
| 5 V Output       | 8  | 42 | PF13/GPCTR1_SOURCE | +5 V                 | 8  | 42 | PF13/GPCTR1_SOURCE |
| DGND             | 7  | 41 | PF14/GPCTR1_GATE   | DGND                 | 7  | 41 | PF14/GPCTR1_GATE   |
| PF15/UPDATE*     | 6  | 40 | GPCTR1_OUT         | PF15/UPDATE*         | 6  | 40 | GPCTR1_OUT         |
| PF16/WFTRIG      | 5  | 39 | DGND               | PF16/WFTRIG          | 5  | 39 | DGND               |
| DGND             | 4  | 38 | PF17/STARTSCAN     | DGND                 | 4  | 38 | PF17/STARTSCAN     |
| PF19/GPCTR0_GATE | 3  | 37 | PF18/GPCTR0_SOURCE | F19/GPCTR0_GATE      | 3  | 37 | PF18/GPCTR0_SOURCE |
| GPCTR0_OUT       | 2  | 36 | DGND               | GPCTR0_OUT           | 2  | 36 | DGND               |
| FREQ_OUT         | 1  | 35 | DGND               | FREQ_OUT             | 1  | 35 | DGND               |

\*No connect for NI PCI-611E  
\*\*Reserved on the NI PCI-6110, NI PCI-6111

Figure 2. S Series Devices Connector

Figure 3. I/O Connector for 16-channel E Series Devices, except NI 6025E

| Platform             | Shielding        | Connect to ...                               | Cable                                    | Adapter                   | Accessory                                       |
|----------------------|------------------|--|--|---------------------------|---|
| PCI/PXI/USB/FireWire | Shielded         | SCC portable signal conditioning per channel | SH68-68-EP                               | —                         | SC-2345 and modules, p. 320                     |
|                      |                  | SCXI high-performance signal conditioning    | SCXI-1349                                | —                         | SCXI Chassis and Modules, p. 246                |
|                      |                  | Screw terminals <sup>1</sup>                 | SH68-68-EP or SH68-68R1-EP               | —                         | SCB-68  |
|                      |                  | BNC terminal block                           | SH68-68-EP                               | —                         | BNC-2110, BNC-2120, BNC-2090                    |
|                      |                  | 50-pin connector                             | SH6850                                   | —                         | CB50, custom or 3rd party                       |
|                      |                  | Configurable connectivity box                | SH68-68-EP                               | —                         | CA-1000   |
|                      | Unshielded       | Screw terminals <sup>1</sup>                 | R6868                                    | —                         | TBX-68, CB-68LP, CB-68LPP, DAQ Signal Accessory |
|                      | 50-pin connector | R6850  | —  | CB50, custom or 3rd party |   |
| PXI only             | Shielded         | Front-mounted screw terminals                | N/A                                      | —                         | TB-2705   |
| PCMCIA               | Shielded         | Screw terminals <sup>1</sup>                 | SHC68-68-EP or SHC68U-68-EP <sup>2</sup> | —                         | SCB-68, CA-1000                                 |
|                      |                  | 50-pin connector                             | SHC68-68-EP or SHC68U-68-EP <sup>2</sup> | 68M-50F MIO               | CB50, custom or 3rd party                       |
|                      | Unshielded       | Screw terminals <sup>1</sup>                 | RC68-68                                  | —                         | TBX-68, CB-68LP, CB-68LPP, DAQ Signal Accessory |
|                      |                  | 50-pin connector                             | RC68-68                                  | 68M-50F MIO               | CB50, custom or 3rd party                       |

ISA - Visit [ni.com/info](http://ni.com/info) and enter in "legacy" for more information on ISA products

<sup>1</sup> Unshielded Cables can connect to Shielded Accessories and vice-versa.

<sup>2</sup> In adjacent PCMCIA slots, both cables types are required because the same cable would cause mechanical hindrance.

Table 1. Cable Connection Specifications for 16-Channel E Series Devices (except NI 6025E)

# Multifunction DAQ Cable and Accessory Selection Guides

|                      |    |     |          |
|----------------------|----|-----|----------|
| AIGND                | 1  | 51  | ACH16    |
| AIGND                | 2  | 52  | ACH24    |
| ACH0                 | 3  | 53  | ACH17    |
| ACH8                 | 4  | 54  | ACH25    |
| ACH1                 | 5  | 55  | ACH18    |
| ACH9                 | 6  | 56  | ACH26    |
| ACH2                 | 7  | 57  | ACH19    |
| ACH10                | 8  | 58  | ACH27    |
| ACH3                 | 9  | 59  | ACH20    |
| ACH11                | 10 | 60  | ACH28    |
| ACH4                 | 11 | 61  | ACH21    |
| ACH12                | 12 | 62  | ACH29    |
| ACH5                 | 13 | 63  | ACH22    |
| ACH13                | 14 | 64  | ACH30    |
| ACH6                 | 15 | 65  | ACH23    |
| ACH14                | 16 | 66  | ACH31    |
| ACH7                 | 17 | 67  | ACH32    |
| ACH15                | 18 | 68  | ACH40    |
| AISENSE              | 19 | 69  | ACH33    |
| DAC00UT <sup>1</sup> | 20 | 70  | ACH41    |
| DAC10UT <sup>1</sup> | 21 | 71  | ACH34    |
| EXTREF <sup>1</sup>  | 22 | 72  | ACH42    |
| A0GND <sup>1</sup>   | 23 | 73  | ACH35    |
| DGND                 | 24 | 74  | ACH43    |
| DIO0                 | 25 | 75  | AISENSE2 |
| DIO4                 | 26 | 76  | AIGND    |
| DIO1                 | 27 | 77  | ACH36    |
| DIO5                 | 28 | 78  | ACH44    |
| DIO2                 | 29 | 79  | ACH37    |
| DIO6                 | 30 | 80  | ACH45    |
| DIO3                 | 31 | 81  | ACH38    |
| DIO7                 | 32 | 82  | ACH46    |
| DGND                 | 33 | 83  | ACH39    |
| +5 V                 | 34 | 84  | ACH47    |
| +5 V                 | 35 | 85  | ACH48    |
| SCANCLK              | 36 | 86  | ACH56    |
| EXTSTROBE*           | 37 | 87  | ACH49    |
| PFI0/TRIG1           | 38 | 88  | ACH57    |
| PFI1/TRIG2           | 39 | 89  | ACH50    |
| PFI2/CONVERT*        | 40 | 90  | ACH58    |
| PFI3/GPCTR1_SOURCE   | 41 | 91  | ACH51    |
| PFI4/GPCTR1_GATE     | 42 | 92  | ACH59    |
| GPCTR1_OUT           | 43 | 93  | ACH52    |
| PFI5/UPDATE*         | 44 | 94  | ACH80    |
| PFI6/WFTRIG          | 45 | 95  | ACH53    |
| PFI7/STARTSCAN       | 46 | 96  | ACH61    |
| PFI8/GPCTR0_SOURCE   | 47 | 97  | ACH54    |
| PFI9/GPCTR0_GATE     | 48 | 98  | ACH62    |
| GPCTR0_OUT           | 49 | 99  | ACH55    |
| FREQ_OUT             | 50 | 100 | ACH63    |

<sup>1</sup>Not available on NI PCI-6033E

Figure 4. I/O Connector for 64-channel NI devices

|                    |    |     |      |
|--------------------|----|-----|------|
| AIGND              | 1  | 51  | PC7  |
| AIGND              | 2  | 52  | GND  |
| ACH0               | 3  | 53  | PC6  |
| ACH8               | 4  | 54  | GND  |
| ACH1               | 5  | 55  | PC5  |
| ACH9               | 6  | 56  | GND  |
| ACH2               | 7  | 57  | PC4  |
| ACH10              | 8  | 58  | GND  |
| ACH3               | 9  | 59  | PC3  |
| ACH11              | 10 | 60  | GND  |
| ACH4               | 11 | 61  | PC2  |
| ACH12              | 12 | 62  | GND  |
| ACH5               | 13 | 63  | PC1  |
| ACH13              | 14 | 64  | GND  |
| ACH6               | 15 | 65  | PC0  |
| ACH14              | 16 | 66  | GND  |
| ACH7               | 17 | 67  | PB7  |
| ACH15              | 18 | 68  | GND  |
| AISENSE            | 19 | 69  | PB6  |
| DAC00UT            | 20 | 70  | GND  |
| DAC10UT            | 21 | 71  | PB5  |
| RESERVED           | 22 | 72  | GND  |
| A0GND              | 23 | 73  | PB4  |
| DGND               | 24 | 74  | GND  |
| DIO0               | 25 | 75  | PB3  |
| DIO4               | 26 | 76  | GND  |
| DIO1               | 27 | 77  | PB2  |
| DIO5               | 28 | 78  | GND  |
| DIO2               | 29 | 79  | PB1  |
| DIO6               | 30 | 80  | GND  |
| DIO3               | 31 | 81  | PB0  |
| DIO7               | 32 | 82  | GND  |
| DGND               | 33 | 83  | PA7  |
| +5 V               | 34 | 84  | GND  |
| +5 V               | 35 | 85  | PA6  |
| SCANCLK            | 36 | 86  | GND  |
| EXTSTROBE*         | 37 | 87  | PA5  |
| PFI0/TRIG1         | 38 | 88  | GND  |
| PFI1/TRIG2         | 39 | 89  | PA4  |
| PFI2/CONVERT*      | 40 | 90  | GND  |
| PFI3/GPCTR1_SOURCE | 41 | 91  | PA3  |
| PFI4/GPCTR1_GATE   | 42 | 92  | GND  |
| GPCTR1_OUT         | 43 | 93  | PA2  |
| PFI5/UPDATE*       | 44 | 94  | GND  |
| PFI6/WFTRIG        | 45 | 95  | PA1  |
| PFI7/STARTSCAN     | 46 | 96  | GND  |
| GPCTR0_SOURCE      | 47 | 97  | PA0  |
| GPCTR0_GATE        | 48 | 98  | GND  |
| GPCTR0_OUT         | 49 | 99  | +5 V |
| FREQ_OUT           | 50 | 100 | GND  |

Figure 5. I/O Connector for the NI 6025E device

## E Series Devices (NI 6031E, NI 6033E, NI 6071E, NI 6025E)

| Platform | Shielding  | Connect to ...               | Cable     | Cable Leg | Adapter   | Accessory                                       |                     |
|----------|------------|------------------------------|-----------|-----------|-----------|---|---------------------|
| PCI, PXI | Shielded   | Screw Terminals              | SH100100  | —         | —         | SCB-100   |                     |
|          |            | Screw Terminals              | SH1006868 | MIO:      | —         | SCB-68  |                     |
|          |            |                              |           | Extended: | —         | SCB-68  |                     |
|          |            | Screw Terminals <sup>1</sup> | SH1006868 | MIO:      | —         | TBX-68, CB-68LP, CB-68LPR, DAQ Signal Accessory |                     |
|          |            |                              |           | Extended: | —         | TBX-68, CB-68LP, CB-68LPR                       |                     |
|          |            | BNC Terminal Block           | SH1006868 | MIO:      | —         | BNC-2110, BNC-2120, BNC-2090                    |                     |
|          |            |                              | Extended: | —         | BNC-2115  |   |                     |
|          | Unshielded | 50-pin Connectors            |           | SH1006868 | MIO:      | 68M-50F MIO                                     | custom or 3rd party |
|          |            |                              |           |           | Extended: | 68M-50F Extended                                | custom or 3rd party |
|          |            | 50-pin Connector             |           | R1005050  | MIO:      | —   | custom or 3rd party |
|          |            |                              |           | Extended: | —         | custom or 3rd party                             |                     |

ISA - Visit [ni.com/info](http://ni.com/info) and enter in "legacy" for more information on ISA Products.

<sup>1</sup>Shielded cable with unshielded accessories

Table 1. Cable Connection Specifications for 64-Channel E Series Devices and the NI 6025E

# Multifunction DAQ Accessories

## SCXI High-Performance Modular Signal Conditioning (see Figure 1)

SCXI is a high-performance modular signal conditioning platform that you use as a front end to your E Series DAQ device. With the SCXI multiplexing architecture, you can expand your analog inputs to 3,072 channels. Additionally, SCXI offers a variety of modules for connecting to thermocouples, RTDs, strain gauge transducers, LVDT position sensors, ICP-compatible accelerometers/microphones, thermistors, millivolt inputs, voltage inputs up to 1000 V, current inputs (0-20mA), frequency inputs or dynamic signals.

See page 246 for details on SCXI Signal Conditioning.

## SCC Portable Modular Signal Conditioning for Low-Channel-Count Applications (see Figure 2)

The SCC Series portable modular signal conditioning system consists of SCC modules that plug into a low-profile SC-2345 shielded carrier. SCC modules give you single or dual-channel signal conditioning for up to 16 analog input channels and eight digital I/O lines of your E Series or basic multifunction DAQ device. The SCC Series offers signal conditioning for a variety of inputs, including thermocouples, RTDs, strain gauges, ICP-compatible accelerometers, accelerators, analog inputs requiring isolation, high voltage (up to 100 V), current (0-20mA), and optically isolated digital I/O. Lowpass filtering and breadboard modules are also available.

See page 320 for details on SCC Signal Conditioning.

## Connector Blocks

### BNC-2100 Series Connector Blocks (see Figure 3)

The BNC-2100 Series are shielded connector blocks with signal-labeled BNC connectors for easy connectivity of your analog input, analog output, digital I/O and counter/timer signals to your multifunction DAQ device, including analog input devices. The BNC-2110 and BNC-2120 work with all E Series devices. The BNC-2120 also provides a function generator, quadrature encoder, temperature reference, thermocouple connector, and LED so that you can test the functionality of your hardware. The BNC-2115 has 24 BNC inputs for connecting to the extended I/O channels of our 100-pin E Series DAQ devices.

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.....777807-01

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

BNC-2120.....777960-01

Dimensions – 26.7 by 11.2 by 6.0 cm (10.5 by 4.4 by 2.4 in.)

### SC-2075 Breadboard Connector Block (see Figure 4)

The SC-2075 provides breadboard area for prototyping and BNC and spring terminal connectivity for 68-pin E Series DAQ devices. The built-in  $\pm 15$  V or adjustable 0 to 5 V power supply and LEDs for digital lines make the SC-2075 a cost-effective device, ideal for academic laboratories.

SC-2075 .....778147-90

Dimensions – 26.72 by 20.70 by 4.37 cm (10.52 by 8.15 by 1.72 in.)



Figure 1. SCXI High-Performance Signal Conditioning



Figure 2. SCC Portable, Modular Signal Conditioning



Figure 3. BNC-2100 Series Connector Blocks – BNC-2120, BNC-2110, BNC-2115



Figure 4. SC-2075 Breadboard Connector Block

# Multifunction DAQ Accessories



Figure 5. BNC-2090 Shielded BNC Adapter Chassis



Figure 6. CA-1000 Configurable Signal Conditioning Enclosure



Figure 7. TB-2705 Terminal Block



Figure 8. SCB-68 and SCB-100 Shielded I/O Connector Blocks



Figure 9. TBX-68 I/O Connector Block

## BNC-2090 Shielded BNC Adapter Chassis (see Figure 5)

The BNC-2090 is a shielded, rack-mountable adapter with signal-labeled BNC connectors, spring terminal blocks, and component locations for passive signal conditioning. Consists of 22 BNC connectors and 28 spring terminals to simplify connection to your analog, digital, trigger and counter/timer signals. The BNC-2090 has silk-screened component locations that you use to develop simple signal conditioning circuits. For added flexibility, you can connect any E Series DAQ device to the BNC-2090 from the front or rear through dual 68-pin connectors.

BNC-2090 .....777270-01  
Dimensions – 48.3 by 4.4 by 18.8 cm (19.0 by 1.7 by 7.4 in.)

## CA-1000 Configurable Signal Conditioning Enclosure (see Figure 6)

The CA-1000 is a configurable enclosure that gives you maximum user-defined connectivity and flexibility through customized panelettes. Each enclosure can accommodate up to nine panelettes.

Dimensions – 30.7 by 25.4 by 4.3 cm (21.1 by 10 by 1.7 in.)

**See page 352 for more information about the CA-1000.**

## TB-2705 Terminal Block for 68-pin PXI E Series Devices (see Figure 7)

The TB-2705 is a screw terminal block for PXI that works with your PXI E Series DAQ module. It latches to the front of your PXI module with locking screws and provides strain relief and easy access to your analog, digital, trigger and counter/timer signals through screw terminals.

TB-2705 .....778241-01  
Dimensions – 8.43 by 10.41 by 2.03 cm (3.32 by 4.1 by 0.8 in.)

## SCB-68 and SCB-100 Shielded I/O Connector Blocks (see Figure 8)

The SCB-68 and SCB-100 are shielded I/O connector blocks for rugged, very low-noise signal termination for connecting to 68-pin or 100-pin E Series DAQ devices, respectively. Silk-screened component locations for easy addition of simple signal-conditioning circuitry for your analog input channels. They also include general-purpose breadboard areas (two on the SCB-68; three on the SCB-100) as well as an IC temperature sensor for cold-junction compensation in temperature measurements.

SCB-68 .....776844-01  
Dimensions – 19.5 by 15.2 by 4.5 cm (7.7 by 6.0 by 1.8 in.)  
SCB-100 .....776990-01  
Dimensions – 19.5 by 15.2 by 4.5 cm (7.7 by 6.0 by 1.8 in.)

## TBX-68 I/O Connector Block with DIN-Rail Mounting (see Figure 9)

The TBX-68 is a termination accessory with 68 screw terminals for easy connection of field I/O 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.)

# Multifunction DAQ Accessories

## CB-68LP and CB-68LPR I/O Connector Blocks (see Figure 10)

The CB-68LP and CB-68LPR are low-cost termination accessories with 68 screw terminals for easy connection of field I/O signals to 68-pin E Series DAQ 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 it is used with the CA-1000 (see page 352).

|   |           |
|---|-----------|
| CB-68LP .....                                     | 777145-01 |
| Dimensions – 14.35 by 10.74 cm (5.65 by 4.23 in.) |           |
| CB-68LPR .....                                    | 777145-02 |
| Dimensions – 7.62 by 16.19 cm (3.00 by 6.36 in.)  |           |

## DAQ Signal Accessory (see Figure 11)

The DAQ Signal Accessory demonstrates and tests the use of analog, digital, and counter/timer functions of DAQ devices. You can connect the DAQ Signal Accessory directly to your DAQ device. It features a built-in function generator, quadrature encoder, solid-state relay, IC temperature sensor, noise generator, microphone jack, thermocouple jack, four LEDs, and a digital trigger button. The DAQ Signal Accessory works with all E Series DAQ devices.

|   |           |
|---|-----------|
| DAQ Signal Accessory.....                     | 777382-01 |
| Dimensions – 12.7 by 12.7 cm (5.0 by 5.0 in.) |           |

## RTSI Bus Cables (see Figure 12)

Use RTSI bus cables to connect timing and synchronization signals among Measurement, Vision, Motion, and CAN boards for PCI, and FireWire DAQPad devices. For systems using 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 FireWire DAQ Pads ..... | 186464-01 |

## Shielded I/O Cables

### SH68-68-EP Shielded Cable (see Figure 13)

The SH68-68-EP is a shielded 68-conductor cable terminated with two 68-pin female 0.050 series D-type connectors. It features individually-shielded analog twisted pairs for reduced crosstalk with high-speed devices. This cable connects to all 68-pin E Series devices (except DAQCards). If you need a right-angle connector, the SH68-68R1-EP shielded cable is electrically equivalent.

|                                       |           |
|---------------------------------------|-----------|
| 1 m.....                              | 184749-01 |
| 2 m.....                              | 184749-02 |
| Please call for other length options. |           |

### SH68-68R1-EP Shielded Cable (see Figure 14)

The SH68-68R1-EP is a shielded 68-conductor cable. One end terminates with a 68-pin female 0.050 series D-type connector and the other end terminates with a right-angle 68-pin female 0.050 series D-type connector.

|          |           |
|----------|-----------|
| 1 m..... | 187051-01 |
|----------|-----------|

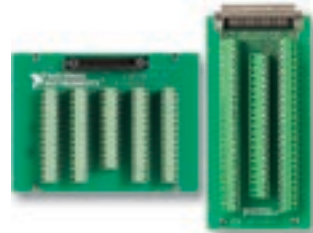


Figure 10. CB-68LP and CB-68LPR I/O Connector Blocks



Figure 11. DAQ Signal Accessory

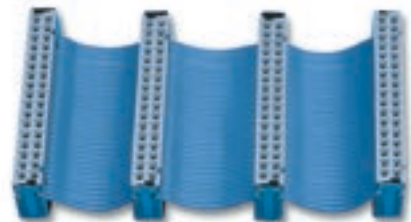


Figure 12. RTSI Bus Cable



Figure 13. SH68-68-EP Shielded Cable



Figure 14. SH68-68R1-EP Shielded Cable

# Multifunction DAQ Accessories



Figure 15. SH100100 Shielded Cable



Figure 16. 68M-50F Cable Adapters



Figure 17. SH1006868 Shielded Cable



Figure 18. SHC68-68-EP and SHC68U-68-EP Shielded Cables



Figure 19. SH6850 Shielded Cable

## SH100100 Shielded Cable (see Figure 15)

The SH100100 is a shielded 100-conductor cable terminated with 100-pin male 0.050 series D-type connectors. This cable connects the 100-pin E Series devices to 100-pin accessories.

|          |           |
|----------|-----------|
| 1 m..... | 182853-01 |
| 2 m..... | 182853-02 |

## 68M-50F S Series Cable Adapters (see Figure 16)

The 68M-50F cable adapter connects a 68-pin NI cable to a standard 0.1 by 0.1 in. 50-pin connector on third-party or custom accessories. The 68M-50F MIO should be used with the SH68-68-EP, SHC68-68-EP, SHC68U-68-EP, or the MIO leg of the SH1006868. The 68M-50F Extended I/O cable adapter should be used for the extended I/O leg of the SH1006868.

|                            |           |
|----------------------------|-----------|
| 68M-50F MIO .....          | 184670-01 |
| 68M-50F Extended I/O ..... | 184670-02 |

## SH1006868 Shielded Cable (see Figure 17)

The SH1006868 is a shielded cable that connects to 100-pin E Series devices and terminates with two female 68-pin 0.050 series D-type connectors. See Table 2 on page 256 for accessories compatible with each 68-pin connector.

|          |           |
|----------|-----------|
| 1 m..... | 182849-01 |
| 2 m..... | 182849-02 |

## SHC68-68-EP and SHC68U-68-EP Shielded Cables for DAQCards (see Figure 18)

These cables connect DAQCards to standard 68-pin accessories. Latching screws secure the shielded connector to the PCMCIA DAQCard. The SHC68-68-EP is a shielded 68-conductor cable terminated with a VHDCI 68-pin male connector at one end and a 68-pin female 0.050 series D-type connector at the other. The SHC68U-68-EP is identical to the SHC68-68-EP except it uses an inverted VHDCI 68-pin male connector. Use the SHC68-68-EP cable with a DAQCard inserted in the lower PCMCIA slot in your laptop or when using only one DAQCard. Use the SH68U-68-EP for a DAQCard located in the upper PCMCIA slot in your laptop. When using two E Series DAQCard PCMCIA devices in adjacent slots, use one SHC68-68-EP and one SHC68U-68-EP.

|              |            |
|--------------|------------|
| SHC68-68-EP  |            |
| 0.5 m .....  | 186838-0R5 |
| 1 m .....    | 186838-01  |
| SHC68U-68-EP |            |
| 0.5 m .....  | 187406-0R5 |
| 1 m .....    | 187406-01  |

## SH6850 Shielded Cable (see Figure 19)

The SH6850 connects a standard 68-pin E Series or S Series product to a 3rd party or custom standard 50-pin accessory. The cable provides a screw-latching 68-pin female connector on one side and a standard 50-pin female connector on the other side.

|           |           |
|-----------|-----------|
| 1 m ..... | 776784-01 |
| 2 m ..... | 776784-02 |

# Multifunction DAQ Accessories

## Ribbon I/O Cables

### R6868 Ribbon Cable for E Series Devices (see Figure 20)

The R6868 is a 68-conductor flat ribbon cable terminated with two 68-pin connectors. Use this cable to connect a 68-pin E Series device to 68-pin accessories.

1 m .....182482-01

### RC68-68 Ribbon Cable for DAQCards (see Figure 21)

The RC68-68 ribbon cable connects DAQCards directly to 68-pin accessories. Two RC68-68 cables can be used together in adjacent PCMCIA slots.

0.25 m .....187252-0R25

1 m .....187252-01

### R1005050 Ribbon Cable (see Figure 22)

This cable connects 100-pin E Series devices, including the NI 6071E, NI 6033E, NI 6031E, and NI 6025E to standard 50-pin 3rd party or custom connectors.

1 m .....182762-01

2 m .....182762-02

### R6850 Ribbon Cable Kit (see Figure 23)

This cable kit combines a 68F-50M cable adapter and a standard 50-pin cable with female connectors on both ends. The cable kit is designed to adapt an E Series, S Series, or PCI-6013/6014 product to a third-party or custom 50-pin accessory.

1 m .....776842-01

## Custom Connectivity Components

### 68-Pin Custom Cable Connector/Backshell Kit (see Figure 24)

The 68-pin female mating connector and backshell kit is used to make custom cables. Solder-cup contacts are available for soldering cable wires to the connector.

68-pin connector/backshell kit .....776832-01



Figure 20. R6868 Ribbon Cable



Figure 21. RC68-68 Ribbon Cable



Figure 22. R1005050 Ribbon Cable



Figure 23. R6850 Ribbon Cable Kit

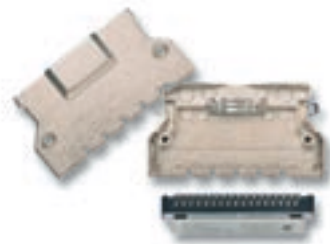


Figure 24. 68-Pin Custom Cable Connector/Backshell Kit

# Multifunction DAQ Accessories



Figure 25. PCB Mounting Connectors for Custom Accessories



Figure 26. PCMCIA Strain-Relief Accessory

## PCB Mounting Connectors for Custom Accessories (see Figure 25)

PCB mounting connectors are used to build custom accessories that connect to 68-conductor or 100-conductor shielded and ribbon cables. Two connectors are available, one for right-angle and one for vertical mounting onto a PCB.

|   |           |
|---|-----------|
| 68-pin, male, right-angle mounting .....    | 777600-01 |
| 68-pin, male, vertical mounting .....       | 777601-01 |
| 100-pin, female, right-angle mounting ..... | 777778-01 |
| 100-pin, female, vertical mounting .....    | 777779-01 |

## PCMCIA Strain-Relief Accessory (see Figure 26)

The PCMCIA Strain-Relief accessory 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 Accessory ..... | 777550-01 |
|--------------------------------------|-----------|



Figure 28. Use the interactive configuration tool in the NI online catalog to select and purchase multifunction DAQ solutions.

## Use Interactive Online Catalog Configurator for Quick Product Selection

You can now easily configure NI multifunction data acquisition (DAQ) measurement systems using a new, interactive feature of our online catalog. The interactive online catalog offers a better, easier way to select and purchase measurement solutions from National Instruments. Based on user input, the interactive online catalog suggests products and then lists the appropriate cables and accessories for those products. This new automated tool helps eliminate ordering mistakes and product-compatibility errors.

To take advantage of the online catalog for multifunction DAQ devices, visit [ni.com/catalog](http://ni.com/catalog)

From the Products and Services menu, select Data Acquisition, then select Multifunction I/O. The online catalog prompts you with a series of questions regarding preferences for operating system, computer bus, number of channels, and maximum sampling rate. The online catalog then recommends several appropriate DAQ devices. You can then review specifications for each device and select your preferred product. Next, the catalog suggests the preferred accessory and cable solution designed to work with the selected DAQ device. You have the option of choosing the preferred configuration or choosing from a separate list of accessories and cables that also work with the selected DAQ device. You can purchase the selected items online.

# S Series Multifunction DAQ Specifications

## Specifications – PCI-6110, PCI-6111

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

### Analog Input

Accuracy specifications ..... See Table 2, page 199

### Input Characteristics

Number of pseudodifferential inputs:

|  |                          |
|--|--------------------------|
| PCI-6110 .....                         | 4                        |
| PCI-6111 .....                         | 2                        |
| Resolution .....                       | 12 bits, 1 in 4,096      |
| Maximum Sampling Rate                  |                          |
| 6110/6111 .....                        | 5 MS/s                   |
| Minimum sampling rate .....            | 1 kS/s                   |
| Streaming-to-disk rate 6110/6111 ..... | 8 MS/s, system dependent |
| Input signal ranges                    |                          |

| Input Range<br>(Software, Selectable per Channel) | Bandwidth (MHz) |
|---|-----------------|
| ±42 V   | 5.5             |
| ±20 V   | 4.4             |
| ±10 V   | 7.2             |
| ±5 V  | 4.8             |
| ±2 V  | 4.8             |
| ±1 V  | 4.4             |
| ±500 mV   | 4.4             |
| ±200 mV   | 4.1             |

Input coupling ..... DC or AC (software selectable)  
Maximum working voltage for all analog input channels

| Input Channels | Range                        | Maximum Working Voltage<br>(Signal + Common Mode)                            |
|----------------|------------------------------|--|
| ACH<0..3>+     | 200 mV to 10 V<br>20 to 50 V | Should remain within ±11 V of ground<br>Should remain within ±42 V of ground |
| ACH<0..3>-     | All                          | Should remain within ±11 V of ground   |

### Overvoltage protection

On/Off..... ±50 V  
Inputs protected ..... ACH<0..3>+, ACH<0..3>-  
FIFO Buffer Size

6110/6111 ..... 8,192 Samples  
Data transfers ..... DMA, interrupts, programmed I/O  
DMA modes ..... Scatter-gather (single transfer,  
demand transfer)

### Transfer Characteristics

Relative accuracy ..... ±0.5 LSB typical, ±1 LSB maximum  
DNL..... ±0.3 LSB typical, ±0.75 LSB maximum  
No missing codes ..... 12 bits, guaranteed  
Spurious free dynamic range (SFDR), DC to 100 kHz

| Range          | SFDR (dB) |
|----------------|-----------|
| 200 mV to 10 V | 75        |
| 20 to 42 V     | 70        |

Effective number of bits (ENOB) ..... 11.0 bits, DC to 100 kHz

### Amplifier Characteristics

Input impedance  
ACH<0..3>+ to ACH <0..3> -  
Normal powered on ..... 1 MΩ in parallel with 100 pF  
Powered off ..... 1 MΩ minimum  
Overload..... 1 MΩ  
Impedance to ground  
ACH<0..3>- to ground ..... 10 nF  
Input bias current..... ±200 pA  
Input offset current..... ±100 pA

CMRR, DC to 60 Hz

| Range      | CMRR (dB) |
|------------|-----------|
| 200 mV     | 72        |
| 500 mV     | 70        |
| 1 V        | 67        |
| 2 V        | 62        |
| 5 V        | 56        |
| 10 V       | 50        |
| 20 to 42 V | 35        |

### Dynamic Characteristics

Interchannel skew ..... 1 ns typical;  $f_{in} = 100$  kHz, 10 V range  
System noise (LSB<sub>rms</sub>, not including quantization)

| Range     | Noise |
|-----------|-------|
| 200 mV    | 1.0   |
| 500 mV    | 0.6   |
| 1 to 50 V | .05   |

Crosstalk ..... -80 dB, DC to 100 kHz

### Analog Output

#### Output Characteristics

Number of channels ..... 2 voltage outputs  
Resolution  
6110/6111..... 16 bits, 1 in 65,536  
Maximum update rate  
1 channel..... 4 MS/s, system dependent  
2 channel..... 2.5 MS/s, system dependent  
Type of DAC..... Double buffered, multiplying  
FIFO Buffer Size  
6110/6111..... 2,048 Samples  
Data transfers ..... DMA, interrupts, programmed I/O  
DMA modes ..... Scatter-gather (single transfer,  
demand transfer)

### Transfer Characteristics

Relative accuracy ..... ±4 LSB typical, ±8 LSB maximum  
DNL ..... ±2 LSB typical, ±8 LSB maximum

### Voltage Output

Ranges ..... ±10 V  
Output coupling ..... DC  
Output impedance ..... 50 Ω ±5%  
Short circuit current ..... ±27 mA typical  
Output stability ..... Any passive load  
Protection..... Short-circuit to ground  
Power-on state..... 0 V, ±400 mV

### Dynamic Characteristics

Settling time and slew rate

| Setting Time for Full-Scale Step | Slew Rate |
|----------------------------------|-----------|
| 300 ns to ±0.01%                 | 300 V/μs  |

Noise..... 1 mV<sub>rms</sub>, DC to 5 MHz  
Glitch energy (at mid-scale transition)  
Magnitude ..... 350 pV

### Digital I/O

Number of channels ..... 8 input/output  
Compatibility ..... 5 V TTL/CMOS  
Power-on state..... Input (high impedance)  
Data Transfers  
6110/6111..... Programmed I/O

# S Series Multifunction DAQ Specifications

## Specifications – PCI-6110, PCI-6111 (continued)

### Digital logic levels

| Level  | Minimum (V) | Maximum (V) |
|--|-------------|-------------|
| Input low voltage                              | 0           | 0.8         |
| Input high voltage                             | 2.0         | 5.0         |
| Output low voltage (I <sub>out</sub> = 24 mA)  | –           | 0.4         |
| Output high voltage (I <sub>out</sub> = 13 mA) | 4.35        | –           |

### Timing I/O

#### General-Purpose Up/Down Counter/Timers

|                    |              |
|--------------------|--------------|
| Number of channels | 2            |
| Resolution         | 24 bits      |
| Compatibility      | 5 V TTL/CMOS |

### Digital logic levels

| Level   | Minimum (V) | Maximum (V) |
|---|-------------|-------------|
| Input low voltage                               | 0           | 0.8         |
| Input high voltage                              | 2.0         | 5.0         |
| Output low voltage (I <sub>out</sub> = 5 mA)    | –           | 0.4         |
| Output high voltage (I <sub>out</sub> = 3.5 mA) | 4.35        | –           |

|                               |  |
|-------------------------------|--|
| Base clocks available         | 20 MHz and 100 kHz   |
| Base clock accuracy           | ±0.01%   |
| Maximum source frequency      | 20 MHz   |
| External source selections    | PFI <0..9>, RTSI <0..6>, analog trigger; software selectable |
| External gate selections      | PFI <0..9>, RTSI <0..6>, analog trigger; software selectable |
| Minimum source pulse duration | 10 ns, edge-detect mode                                      |
| Minimum gate pulse duration   | 10 ns, edge-detect mode                                      |
| Data transfers                | DMA, interrupts, programmed I/O                              |
| DMA modes                     | Scatter-gather (single transfer, demand transfer)            |

### Frequency Scaler

|                    |         |
|--------------------|---------|
| Number of channels | 1       |
| Resolution         | 4 bits  |
| Compatibility      | 5 V/TTL |

### Digital logic levels

| Level   | Minimum (V) | Maximum (V) |
|---|-------------|-------------|
| Input low voltage                               | 0           | 0.8         |
| Input high voltage                              | 2.0         | 5.0         |
| Output low voltage (I <sub>out</sub> = 5 mA)    | –           | 0.4         |
| Output high voltage (I <sub>out</sub> = 3.5 mA) | 4.35        | –           |

|                       |                 |
|-----------------------|-----------------|
| Base clocks available | 10 MHz, 100 kHz |
| Base clock accuracy   | ±0.01%          |
| Data transfers        | Programmed I/O  |

### Triggers

#### Analog Triggers

|                                |                                     |
|--------------------------------|-------------------------------------|
| Number of triggers             | 1                                   |
| Purpose                        |                                     |
| Analog input                   | Start and stop trigger, gate, clock |
| Analog output                  | Start trigger, gate, clock          |
| General-purpose counter/timers | Source, gate                        |

#### Source

|          |                       |
|----------|-----------------------|
| PCI-6110 | ACH<0..3>, PFI0/TRIG1 |
| PCI-6111 | ACH<0..1>, PFI0/TRIG1 |

#### Level

|                             |   |
|-----------------------------|---|
| Internal source, ACH<0..3>  | ±Full-scale                               |
| External source, PFI0/TRIG1 | ±10 V                                     |
| Slope                       | Positive or negative; software-selectable |
| Resolution                  | 8 bits, 1 in 256                          |
| Hysteresis                  | Programmable Bandwidth (-3 dB)            |
| Internal source, ACH<0..3>  | 5 MHz                                     |
| External source, PFI0/TRIG1 | 5 MHz                                     |

### Digital Triggers

|                                |   |
|--------------------------------|---|
| Number of triggers             | 2   |
| Purpose                        |   |
| Analog input                   | Start and stop trigger, gate, clock       |
| Analog output                  | Start trigger, gate, clock                |
| General-purpose counter/timers | Source, gate                              |
| Source                         | PFI<0..9>, RTSI<0..6>                     |
| Slope                          | Positive or negative; software selectable |
| Compatibility                  | 5 V TTL                                   |
| Response                       | Rising or falling edge                    |
| Pulse width                    | 10 ns minimum                             |

### External input for digital or analog trigger (PFI0/TRIG1)

|                 |                                 |
|-----------------|---------------------------------|
| Impedance       | 10 kΩ                           |
| Coupling        | DC or AC                        |
| Protection      |                                 |
| Digital trigger | -0.5 to V <sub>CC</sub> + 0.5 V |
| Analog trigger  |                                 |
| On/off/disabled | ±35 V                           |

### Calibration

|                               |  |
|-------------------------------|--|
| Recommended warm-up time      | 15 minutes                                       |
| Calibration Interval          | 1 year   |
| Onboard calibration reference |  |
| DC Level                      | 5.000 V (±3.5 mV); actual value stored in EEPROM |
| Temperature coefficient       | ±0.6 ppm/°C maximum                              |
| Long-term stability           | ±6 ppm/√1,000h                                   |

### RTSI

|               |   |
|---------------|---|
| Trigger lines | 7 |
|---------------|---|

### Bus Interface

|     |               |
|-----|---------------|
| PCI | Master, slave |
|-----|---------------|

### Power Requirements

| Device   | +5 VDC (±5%) | Power Available at I/O Connector |
|----------|--------------|----------------------------------|
| PCI-6110 | 3.0 A        | +4.65 to 5.25 VDC, 1 A           |
| PCI-6111 | 2.5 A        | +4.65 to 5.25 VDC, 1 A           |

### Physical

#### Dimensions

|                          |                                   |
|--------------------------|-----------------------------------|
| Not including connectors | 31.2 by 10.6 cm (12.3 by 4.2 in.) |
| I/O connector            | 68-pin male SCSI type             |

### Environment

|                       |                          |
|-----------------------|--------------------------|
| Operating temperature | 0 to 45 °C               |
| Storage temperature   | -20 to 70 °C             |
| Relative humidity     | 10 to 90%, noncondensing |

### Certifications and Compliances

#### CE Mark Compliance

<sup>1</sup> Bandwidth specifications are for signals on the (+) input with the (-) input at DC ground. The (-) input is slew rate limited to 24 V/μsec and has an additional 10 nF capacitance to ground.