Full-Featured E Series Multifunction DAQ
12 or 16-Bit, up to 1.25 MS/s, up to 64 Analog Inputs

E Series – Full-Featured

- 16 or 64 analog inputs at up to 1.25 MS/s, 12 or 16-bit resolution
- 2 analog outputs at up to 1 MS/s, 12 or 16-bit resolution
- 8 digital I/O lines (TTL/CMOS); two 24-bit counter/timers
- Analog and digital triggering
- 14 or 15 analog input signal ranges
- NI-DAQ driver simplifies configuration and measurements

Families
- NI 6071E
- NI 6070E
- NI 6062E
- NI 6052E
- NI 6040E
- NI 6033E
- NI 6032E
- NI 6031E
- NI 6030E
- NI 6020E (only digital triggering)

Operating Systems
- Windows 2000/NT/XP
- Real-time performance with LabVIEW (page 134)
- Others such as Linux and Mac OS X (page 187)

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio
- VI Logger

Other Compatible Software
- Visual Basic, C/C++, and C#

Driver Software (included)
- NI-DAQ 7

Calibration Certificate Included
See page 21.

Family	Bus	Analog Inputs	Input Resolution	Max Sampling Rate	Input Range	Analog Outputs	Output Resolution	Output Rate	Output Range	Digital I/O	Counter/Timers	Triggers
NI 6071E	PCI, PXI	64 SE/32 DI	12 bits	1.25 MS/s	±0.05 to ±10 V	2	12 bits	1 MS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6070E	PCI, PXI, FireWire	16 SE/8 DI	12 bits	1.25 MS/s	±0.05 to ±10 V	2	12 bits	1 MS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6062E	PCMCIA	16 SE/8 DI	12 bits	500 kS/s	±0.05 to ±10 V	2	12 bits	850 kS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6052E	PCI, PXI, FireWire	16 SE/8 DI	16 bits	333 kS/s	±0.05 to ±10 V	2	16 bits	333 kS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6040E	PCI, PXI	16 SE/8 DI	12 bits	500 kS/s	±0.05 to ±10 V	2	12 bits	1 MS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6033E	PCI	64 SE/32 DI	16 bits	100 kS/s	±0.1 to ±10 V	0	-	-	-	8	2, 24-bit	Analog, digital
NI 6032E	PCI	16 SE/8 DI	16 bits	100 kS/s	±0.1 to ±10 V	0	-	-	-	8	2, 24-bit	Analog, digital
NI 6031E	PCI, PXI	64 SE/32 DI	16 bits	100 kS/s	±0.1 to ±10 V	2	16 bits	100 kS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6030E	PCI, PXI	16 SE/8 DI	16 bits	100 kS/s	±0.1 to ±10 V	2	16 bits	100 kS/s	±10 V	8	2, 24-bit	Analog, digital
NI 6020E	NI USB	16 SE/8 DI	12 bits	100 kS/s	±0.05 to ±10 V	2	12 bits	20 S/s	±10 V	8	2, 24-bit	Digital

Table 1. NI Full-Featured E Series Model Guide (See page 228 for detailed specifications.)

Overview and Applications

NI Full-Featured E Series devices are the fastest and the most accurate multiplexed data acquisition devices available. They are ideal for applications ranging from continuous high-speed data logging to control applications to high voltage signal or sensor measurements when used with NI signal conditioning. Synchronize the operations of multiple devices using the RTSI bus or PXI trigger bus and easily integrate other hardware such as motion control and machine vision to create an entire measurement and control system.

Visit ni.com/oem for information on our quantity discounts for OEM customers.

Highly Accurate Hardware Design

NI Full-Featured E Series DAQ devices includethe following features and technologies:

Temperature Drift Protection Circuitry – Designed with components that minimize the effect of temperature changes on measurements to less than 0.0006% of reading per °C.

Resolution-Improvement Technologies – Carefully designed noise floor maximizes resolution.

Onboard Self-Calibration – Precise voltage reference included for calibration and measurement accuracy. Self-calibration is completely software controlled, with no potentiometers to adjust.

NI DAQ-STC – Timing and control ASIC designed to provide more flexibility, lower power consumption, and a higher immunity to noise and jitter than off-the-shelf counter/timer chips.

Full-Featured E Series Multifunction DAQ 12 or 16-Bit, up to 1.25 MS/s, up to 64 Analog Inputs

NI MITE – ASIC designed to optimize data transfer for multiple simultaneous operations using bus mastering with three scatter-gather DMA channels for maximum performance of concurrent I/O operations.

NI PGIA – Measurement and instrument class amplifier that guarantees settling times at all gains. Typical commercial off-the-shelf amplifier components do not meet the settling time requirements for high-gain measurement applications.

PFI Lines – Eight programmable function input (PFI) lines that can be used for software-controlled routing of interboard and intraboard digital and timing signals.

RTSI or PXI Trigger Bus – Used to share timing and control signals between devices and synchronize operations.

RSE Mode – In addition to differential and nonreferenced single-ended modes, NI full-featured E Series devices offer referenced single-ended (RSE) mode for use with floating signal sources in applications with channel counts higher than eight.

Onboard Temperature Sensor – Included for monitoring the operating temperature of the device to ensure that it is operating within the specified range.

Analog and Digital Triggering – Only full-featured E Series devices provide the ability to set a trigger based on the level of an analog signal, in addition to the ability to trigger off an edge of a digital signal.

More Input Ranges – Up to 15 input ranges for optimal resolution, even for signals smaller than 50 mV.

High-Performance, Easy-to-Use Driver Software

NI-DAQ is the robust driver software that makes it easy to access the functionality of your data acquisition hardware, whether you are a beginning or advanced user. Helpful features include:

Automatic Code Generation – DAQ Assistant is an interactive guide that steps you through configuring, testing, and programming measurement tasks, and generating the necessary code automatically for use in 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 – Software-timed single-point input (typically used in control loops) with NI-DAQ achieves rates of up to 50 kHz. NI-DAQ also delivers maximum I/O system throughput with a multithreaded driver.

Test Panels – With NI-DAQ, you can test all of your device functionality before you begin development.

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

LabVIEW Integration – All NI-DAQ functions use 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.

Worldwide Support and Services

NI provides you with a wealth of resources to help you get your application up and running more quickly, including:

Technical Support – Purchase of NI hardware or software gives you access to application engineers all over the world as well as Web resources with more than 3,000 measurement examples and more than 9,000 KnowledgeBase entries. – ***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***

Calibration – Includes NIST-traceable basic calibration certificates, services for ANSI/NCSL-Z540 and periodic calibration – ***ni.com/calibration***

Extended Warranty – Meet project life-cycle requirements and maintain optimal performance in a cost-effective way – ***ni.com/services***

Data Acquisition Training – Instructor-led courses – ***ni.com/training***

Professional Services – Feasibility, consulting, and integration through our Alliance Partners – ***ni.com/alliance***

For more information on NI services and support, please visit ni.com/services

For information on device support in NI-DAQ 7, visit ni.com/dataacquisition

Full-Featured E Series Multifunction DAQ
12 or 16-Bit, up to 1.25 MS/s, up to 64 Analog Inputs

		Full-Featured E Series				Low-Cost E Series		Basic
Models		NI 6030E, NI 6031E, NI 6032E, NI 6033E	NI 6052E	NI 6070E, NI 6071E	NI 6040E	NI 6034E, NI 6036E	NI 6023E, NI 6024E, NI 6025E	PCI-6013, PCI-6014
Measurement Sensitivity* (mV)		0.0023	0.0025	0.009	0.008	0.0036	0.008	0.004
Nominal Range (V)								
Positive FS	**Negative FS**	**Absolute Accuracy (mV)**						
10	-10	1.147	4.747	14.369	15.373	7.56	16.504	8.984
5	-5	2.077	0.876	5.193	5.697	1.79	5.263	2.003
2.5	-2.5	–	1.190	3.605	3.859	–	–	–
2	-2	0.836	–	–	–	–	–	–
1	-1	0.422	0.479	1.452	1.556	–	–	–
0.5	-0.5	0.215	0.243	0.735	0.789	0.399	0.846	0.471
0.25	-0.25	–	0.137	0.379	0.405	–	–	–
0.2	-0.2	0.102	–	–	–	–	–	–
0.1	-0.1	0.061	0.064	0.163	0.176	–	–	–
0.05	-0.05	–	0.035	0.091	0.100	0.0611	0.106	0.069
10	0	0.976	1.232	6.765	7.269	–	–	–
5	0	1.992	2.119	5.391	5.645	–	–	–
2	0	0.802	0.850	2.167	2.271	–	–	–
1	0	0.405	0.428	1.092	1.146	–	–	–
0.5	0	0.207	0.242	0.558	0.583	–	–	–
0.2	0	0.098	0.111	0.235	0.247	–	–	–
0.1	0	0.059	0.059	0.127	0.135	–	–	–

Note: Accuracies are valid for measurements following an internal calibration. 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 (for example, 10 V for the ±10 V range) after one year, assuming 100 pt averaging of data.*Smallest detectable voltage change in the input signal at the smallest input range.

Table 2. E Series Analog Input Absolute Accuracy Specifications

		Full-Featured E Series				Low-Cost E Series		Basic
Models		NI 6030E, NI 6031E, NI 6032E, NI 6033E	NI 6052E	NI 6070E, NI 6071E	NI 6040E	PCI-6036E	PCI-6024E, NI 6025E,	NI 6013, NI 6014
Nominal Range (V)								
Positive FS	**Negative FS**	**Absolute Accuracy (mV)**						
10	-10	1.43	1.405	8.127	8.127	2.417	8.127	3.835
10	0	1.201	1.176	5.685	5.685	–	–	–

Table 3. E Series Analog Output Absolute Accuracy Specifications

Recommended Accessories

Signal conditioning is required for sensor measurements or voltage inputs greater than 10 V. National Instruments SCXI is a versatile, high-performance signal conditioning platform, intended for high-channel-count applications. NI SCC products provide portable, flexible signal conditioning options on a per-channel basis. Both signal conditioning platforms are designed to increase the performance and reliability of your DAQ System, and are up to 10X more accurate than terminal blocks (please visit ***ni.com/sigcon*** for more details). Refer to the table below for more information:

Sensor/Signals (>10 V)

System Description	DAQ Device	Signal Conditioning	Page
High performance	PCI-60xxE, PXI-60xxE, DAQPad-60xxE	SCXI	270
Low-cost, portable	PCI-60xxE, PXI-60xxE, DAQPad-60xxE	SCC	251

Signals (<10 V)[1]

System Description	DAQ Device	Terminal Block	Cable	Page
Shielded	PCI-60xxE/DAQPad-60xxE	SCB-68	SH6868-EP	214
Shielded	PXI-60xxE	TB-2705	SH6868-EP	214
Shielded	PCI-6071E/PCI-6033E/PCI-6031E	SCB-100	SH100100	214
Shielded	PXI-6071E/PXI-6031E	Two TBX-68s	SH1006868	214
Shielded	DAQPad-60xxE	SCB-68	SHC6868-EP	214
Low-Cost	PCI-60xxE/PXI-60xxE/DAQPad-60xxE	CB-68LP	R6868	214
Low-Cost	DAQCard-60xxE	CB-68LP	RC6868	214

1Terminal Blocks do not provide signal conditioning (ie. filtering, amplification, isolation, etc.), which may be necessary to increase the accuracy of your measurements.

Table 4. Recommended Accessories

Ordering Information

NI PXI-6071E 777676-01
NI PCI-6071E 777515-01
NI PXI-6070E 777060-01
NI PCI-6070E 777305-01
NI DAQPad-6070E for FireWire .....(See page 207)
NI DAQCard-6062E .....(See page 207)
NI PXI-6052E 777962-01
NI PCI-6052E 777745-01
NI DAQPad-6052E for FireWire .....(See page 207)
NI PXI-6040E 777484-01
NI PCI-6040E 777383-01
NI PCI-6033E 777516-01
NI PCI-6032E 777422-01
NI PXI-6031E 777636-01
NI PCI-6031E 777514-01
NI PXI-6030E 777555-01
NI PCI-6030E 777384-01
NI DAQPad-6020E for USB .....(See page 207)

Includes NI-DAQ driver software and calibration certificate.

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

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Multifunction DAQ Overview

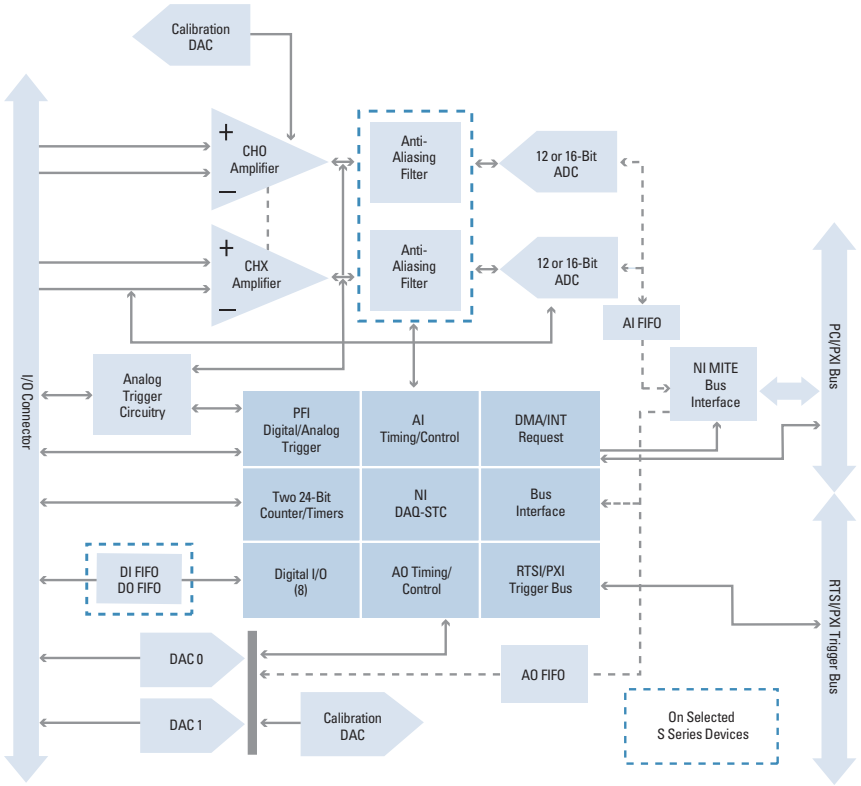

Figure 1. S Series Hardware Block Diagram

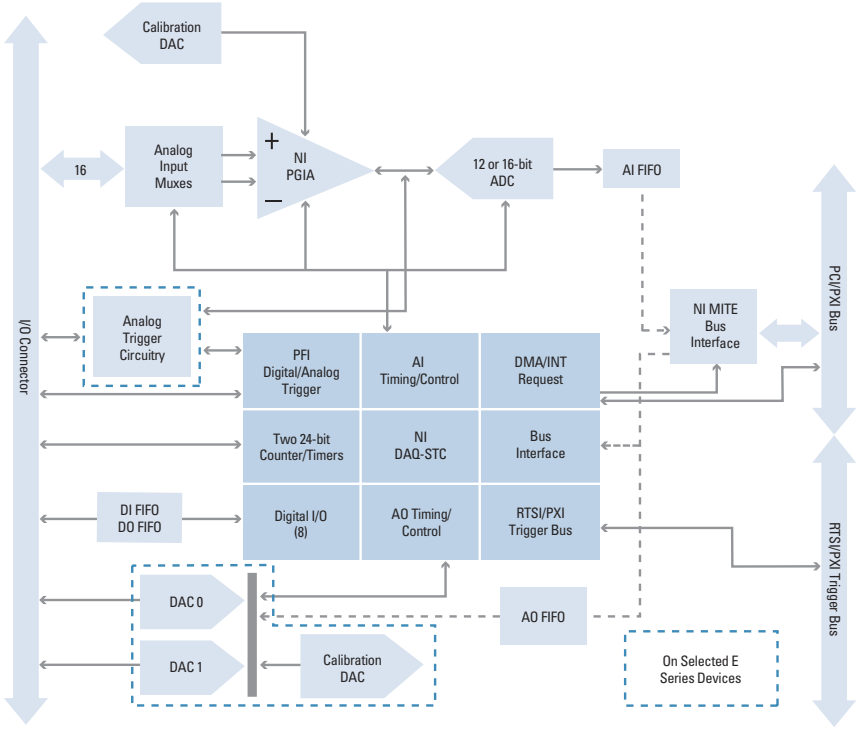

Figure 2. E Series Hardware Block Diagram

16-Bit E Series Multifunction DAQ Specifications

Specifications – NI 6052E and NI 603xE

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

Analog Input

Accuracy specifications ..... See page 228.

Input Characteristics

Number of Channels	
6052E 6030E 6032E 6034E 6036E	16 single-ended or 8 differential (software selectable per channel)
6031E 6033E	64 single-ended or 32 differential (software-selectable per channel)

Resolution..... 16 bits, 1 in 65,536

Maximum Sampling Rate	
6052E 6034E 6036E	333 kS/s 200 kS/s
6030E 6031E 6032E 6033E	100 kS/s

Input signal ranges

Device	Range Software Selectable	Bipolar Input Range	Unipolar Input Range
6052E	20 V	±10 V	–
	10 V	±5 V	0 to 10 V
	5 V	±2.5 V	0 to 5 V
	2 V	±1 V	0 to 2 V
	1 V	±500 mV	0 to 1 V
	500 mV	±250 mV	0 to 500 mV
	200 mV	±100 mV	0 to 200 mV
	100 mV	±50 mV	0 to 100 mV
6030E	20 V	±10 V	–
6031E	10 V	±5 V	0 to 10 V
6032E	5 V	–	0 to 5 V
6033E	4 V	±2 V	–
	2 V	±1 V	0 to 2 V
	1 V	±500 mV	0 to 1 V
	500 mV	–	0 to 500 mV
	400 mV	±200 mV	–
	200 mV	±100 mV	0 to 200 mV
	100 mV	–	0 to 100 mV
6034E	20 V	±10 V	–
6036E	10 V	±5 V	–
	1 V	±500 mV	–
	100 mV	±50 mV	–

Input coupling..... DC
Maximum working voltage
(signal + common mode) ..... Each input should remain within ±11 V of ground
Overvoltage protection
Powered on..... ±25 V
Powered off ..... ±15 V

Inputs Protected	
6052E 6030E 6032E 6034E 6036E	AI<0..15>, AI SENSE
6031E 6033E	AI<0..63>, AI SENSE, AI SENSE2

FIFO buffer size ..... 512 samples, (1024 samples for DAQCard)
Data transfers
PCI, PXI ..... DMA, interrupts, programmed I/O
DAQCard ..... Interrupts, programmed I/O
DMA modes
PCI, PXI ..... Scatter-gather (single transfer, demand transfer)
Configuration memory size ..... 512 words

Transfer Characteristics

Relative accuracy (dithered)

Device	Typical	Maximum
6052E 6034E PCI-6036E	±1.5 LSB	±3 LSB
6030E 6031E 6032E 6033E	±0.75 LSB	±1 LSB
DAQCard-6036E	±3.0 LSB	±6 LSB

DNL

Device	Typical	Maximum
6052E 603xE (except DAQCard-6036E)	±0.5 LSB	±1 LSB
DAQCard-6036E	±1.0 LSB	+4, -2 LSB

No missing codes
DAQCard 6036E..... 15 bits, guaranteed
Others ..... 16 bits, guaranteed

Amplifier Characteristics

Input impedance

Device	Normal Powered On	Powered Off	Overload
6052E 603xE	100 GΩ in parallel with 100 pF	820 Ω	820 Ω

Input bias and offset current

Device	Bias Current	Offset Current
6052E 6034E PCI-6036E	±200 pA	±100 pA
6030E 6031E 6032E 6033E	±1 nA	±2 nA
DAQCard-6036E	±800 pA	±100 pA

16-Bit E Series Multifunction DAQ Specifications

Specifications – NI 6052E and NI 603xE (continued)

CMRR, DC to 60 Hz

		CMRR	
Device	**Range**	**Bipolar (dB)**	**Unipolar (dB)**
6052E	20 V	92	–
	10 V	97	97
	5 V	101	101
	2 V	104	104
	100 mV to 1 V	105	105
6030E	20 V	92	–
6031E	10 V	97	92
6032E	5 V	–	97
6033E	4 V	101	–
	2 V	104	101
	1 V	105	104
	100 mV to 500 mV	105	105
6034E	20 V	85	–
6036E	10 V	85	–
	1 V	96	–
	100 mV	96	–

Dynamic Characteristics

Bandwidth

Device	Range	Small Signal (-3 dB)
6052E	All ranges	480 kHz
6030E, 6031E, 6032E, 6033E	All ranges	255 kHz
6034E, 6036E	All ranges	413 kHz

System noise (LSB_{rms}, including quantization)

Device	Range	Bipolar	Unipolar
6052E	2 to 20 V	0.95	0.95
	1 V	1.1	1.1
	500 mV	1.3	1.3
	200 mV	2.7	2.7
	100 mV	5.0	5.0
6030E	2 to 20 V	0.6	0.8
6031E	1 V	0.7	0.8
6032E	400 to 500 mV	1.1	1.1
6033E	200 mV	2.0	2.0
	100 mV	–	3.8
6034E	10 to 20 V	0.8	–
PCI-6036E	1 V	1.0	–
	100 mV	6.2	–
DAQCard-6036E	10 to 20 V	1.5	–

Settling time to full-scale step

		Accuracy				
Device	**Range**	**±0.00076% (±0.5 LSB)**	**±0.0015% (±1 LSB)**	**±0.0031% (±2 LSB)**	**±0.0061% (±4 LSB)**	**±0.024% (±16 LSB)**
6052E	2 to 20 V	–	10 µs max	5 µs max	4 µs max	3 µs max
	1 V	–	15 µs max	5 µs max	4 µs max	3 µs max
	200 to 500 mV	–	15 µs max	10 µs max	4 µs max	3 µs max
	100 mV	–	15 µs typical	10 µs typical	4 µs max	3 µs max
6030E 6032E	All	40 µs max	20 µs max	–	10 µs max	–
6031E 6033E	All	50 µs max	25 µs max	–	10 µs max	–
6034E	1 to 20 V	–	–	5 µs max	–	–
6036E	100 mV	–	–	–	5 µs typical	–
DAQCard-6036E	10 V	–	–	5 µs max	–	–

Crosstalk

Device	Adjacent Channels	All Other Channels
6052E 603xE	-75 dB	-90 dB

Analog Output

Output Characteristics

Number of Channels	
6052E 6030E 6031E 6036E	2 voltage outputs
6032E, 6033E, 6034E	None

Resolution	
6052E 6036E 6030E 6031E	16 bits, 1 in 65,536

Maximum Update Rate	
6052E	333 kS/s
PCI-6036E	10 kS/s, system dependent
6030E 6031E	100 kS/s
DAQCard-6036	1 kS/s, system dependent

Type of DAC ..... Double buffered, multiplying

FIFO Buffer Size	
6052E, 6030E, 6031E	2,048 samples
6036E	None

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

DMA modes
- PCI, PXI ..... Scatter-gather (single transfer, demand transfer)

Transfer Characteristics

Relative Accuracy	
6052E	±0.35 LSB typical, ±1 LSB maximum
6030E 6031E	±0.5 LSB typical, ±1 LSB maximum
6036E	±2 LSB maximum

DNL ..... ±1.0 LSB maximum

Monotonicity	
6052E 6036E 6030E 6031E	16 bits, guaranteed

Voltage Output

Ranges	
6052E	±10 V, 0 to 10 V, ±EXTREF, 0 to EXTREF; software selectable
6030E 6031E	±10 V, 0 to 10 V; software selectable
6036E	±10 V

Output coupling ..... DC
Output impedance ..... 0.1 Ω maximum
Current drive ..... ±5 mA maximum
Protection ..... Short-circuit to ground

Power-On State	
6052E 6030E 6031E	0 V (±20 mV)
PCI-6036E	0 V (±44 mV)
DAQCard-6036E	0 V (±60 mV)

16-Bit E Series Multifunction DAQ Specifications

Specifications – NI 6052E and NI 603xE (continued)

External reference input (6052E only)
- Range ..... ±11 V
- Overvoltage protection ..... ±25 V powered on, ±15 V powered off
- Input impedance ..... 10 kΩ
- Bandwidth (-3 dB) ..... 3 kHz
- Slew rate ..... 0.3 V/µs

Dynamic Characteristics

Settling time and slew rate

Device	Settling Time For Full-Scale Step	Slew Rate
6052E	3.5 µs to ±1 LSB accuracy	15 V/µs
6030E 6031E	10 µs to ±1 LSB accuracy	5 V/µs
PCI-6036E	5 µs to ±1 LSB accuracy	15 V/µs
DAQCard-6036E	5 µs to ±4.5 LSB accuracy	5 V/µs

	Noise
6052E 6030E 6031E	60 μV_{rms}, DC to 1 MHz
PCI-6036E	110 μV_{rms}, DC to 400 kHz
DAQCard-6036E	160 μV_{rms}, DC to 400 kHz

Glitch energy (at mid-scale transition)

Device	Magnitude	Duration
6052E	±10 mV	1 µs
PCI-6036E	±10 mV	1 µs

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

Digital logic levels

Level	Minimum	Maximum
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	–

Timing I/O

General-Purpose Up/Down Counter/Timers

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

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

- Compatibility ..... 5 VTTL/CMOS

Digital logic levels

Base clocks available
- Up/down counter/timers ..... 20 MHz and 100 kHz
- Frequency Scaler ..... 10 MHz and 100 kHz

- Base clock accuracy ..... ±0.01%

Maximum external source frequency
- Up/down counter/timers ..... 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
- PCI/PXI Up/down counter/timer ..... DMA (scatter-gather), interrupts, programmed I/O
- DAQCard Up/down counter/timer ..... Interrupts, programmed I/O
- Frequency Scaler ..... Programmed I/O

Triggers

Analog Triggers

	Number of Triggers
6052E 6030E 6031E 6032E 6033E	1
6034E 6036E	None

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

	Source
6052E 6030E 6032E	AI<0..15>, PFI 0/AI START TRIG
6031E 6033E	AI<0..63>, PFI 0/AI START TRIG

Level
- Internal source, AI<0..15/63> ..... ±full-scale
- External source, PFI 0/AI START TRIG ..... ±10 V

- Slope ..... Positive or negative; software-selectable
- Resolution ..... 12 bits, 1 in 4,096
- Hysteresis ..... Programmable

Bandwidth (-3 dB)

Device	Internal Source AI<0..15/63>	External Source PFI 0/AI START TRIG
6052E	700 kHz	700 kHz
PCI-6030E, PCI-6031E, 6032E, 6033E	255 kHz	4 MHz
PXI-6030E, PXI-6031E	255 kHz	255 kHz

- Accuracy ..... ±1% of full-scale range maximum

Digital Triggers (all devices)

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>
- Compatibility ..... 5 VTTL
- Response ..... Rising or falling edge
- Pulse width ..... 10 ns minimum

16-Bit E Series Multifunction DAQ Specifications

Specifications – NI 6052E and NI 603xE (continued)

External Input for Digital or Analog Trigger (PFI 0/AI START TRIG)

(6052E, 6033E, 6032E, 6031E, 6030E only)

Impedance ..... 10 kΩ
Coupling ..... DC
Protection
  Digital trigger ..... -0.5 to Vcc + 0.5 V
  Analog trigger
    On/off/disabled ..... ±35 V

Calibration

Recommended warm-up time ..... 15 minutes; 30 minutes for DAQCard
Calibration Interval ..... 1 year
Onboard calibration reference

	DC Level	
6052E, 6030E. 6031E, 6032E, 6033E	5.000 V (±1.0 mV)	Over full operating temperature, actual value stored in EEPROM
6034E, 6036E	5.000 V (±3.5 mV)	

	Temperature Coefficient
6052E, 6030E, 6031E, 6032E, 6033E	±0.6 ppm/°C max
6034E, 6036E	±5.0 ppm/°C max

	Long-Term Stability
6052E, 6030E 6031E, 6032E, 6033E	±6.0 ppm/$\sqrt{1000\ h}$
6034E, 6036E	±15.0 ppm/$\sqrt{1000\ h}$

RTSI

Trigger lines
  PCI 7
  DAQPad 4

PXI Trigger Bus (PXI only)

Trigger lines 6
Star trigger 1

Bus Interface

PCI, PXI ..... Master, slave
DAQCard ..... Slave
DAQPad ..... Master, slave, asynchronous, 400 Mb/s

Power Requirements[1]

Device	+5 VDC (±5%)	Power Available at I/O Connector
PCI-6052E, PXI-6052E	1.3 A	+4.65 to +5.25 VDC, 1 A
6030E, 6031E, 6032E, 6033E	1.5 A	+4.65 to +5.25 VDC, 1 A
6034E PCI-6036E	0.9 A	+4.65 to +5.25 VDC, 1 A
DAQCard-6036E	300 mA	+4.65 to +5.25 VDC, 0.75 A

DAQPad-6052E ..... 20W @ 9-24 VDC

Physical[1]

Dimensions (not including connectors)[1]

PCI ..... 17.5 by 10.6 cm (6.9 by 4.2 in.)
PXI ..... 16.0 by 10.0 cm (6.3 by 3.9 in.)
DAQCard ..... Type II PC Card
DAQPad ..... 30.7 by 25.4 by 4.3 cm (12.1 by 10 by 1.7 in.)

	I/O Connectors
PCI-6052E 6030E 6032E 6034E PCI-6036E	68-pin male SCSI-II type
6031E 6033E	100-pin female 0.050 D-type
DAQCard-6036E	68-position VHDCI female
DAQPad-6052E	68-pin male SCSI-II type, or 15 BNCs and 30 removeable screw terminals

Environment

Operating temperature
6052E, 6036E, 6034E ..... 0 to 55 °C
6030E, 6031E, 6032E, 6033E ..... 0 to 50 °C
Storage temperature ..... -20 to 70 °C
Relative humidity ..... 10 to 90%, noncondensing

Certifications and Compliances

CE Mark Compliance CE

[1]See page 134 for RT Series device power requirements and physical parameters.

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:

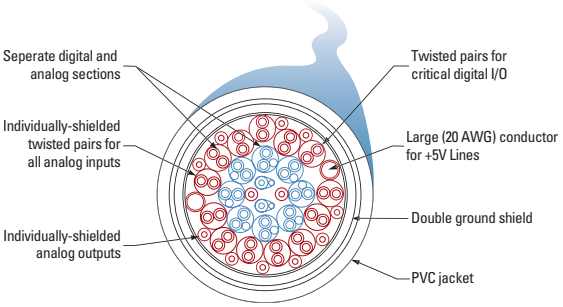

Figure 1. SH68-68-EP Cable

Figure 2. NI offers a wide variety of cable and accessory options, such as the SH68-68-EP cable and the BNC-2110 terminal block.

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 189.

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, page 251
	Shielded	SCXI high-performance signal conditioning	SCXI-1349	–	SCXI Chassis and Modules, page 270
	Shielded	Screw terminals [1]	SH68-68-EP or SH68-68R1-EP	–	SCB-68
	Shielded	BNC terminal block	SH68-68-EP	–	BNC-2110, BNC-2120, BNC-2090
	Shielded	50-pin connector	SH6850	–	CB50, custom or 3rd party
	Shielded	Configurable connectivity box	SH68-68-EP	–	CA-1000, page 351
	Unshielded	Screw terminals [1]	R6868	–	TBX-68, CB-68LP, CB-68LPR, DAQ signal accessory
	Unshielded	50-pin connector	R6850	–	CB50, custom or 3rd party
PXI only					
	Shielded	Front-mounted screw terminals	N/A	–	TB-2705
PCMCIA					
	Shielded	Screw terminals [1]	SHC68-68-EP or SHC68U-68-EP [2]	–	SCB-68, CA-1000
	Shielded	50-pin connector	SHC68-68-EP or SHC68U-68-EP [2]	68M-50F MIO	CB50, custom or 3rd party
	Unshielded	Screw terminals [1]	RC68-68		TBX-68, CB-68LP, CB-68LPR, DAQ signal accessory
	Unshielded	50-pin connector	RC68-68	68M-50F MIO	CB50, custom or 3rd party

[1] Unshielded cables can connect to shielded accessories and vice-versa. [2] 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 and Basic Multifunction DAQ (except NI 6025E, which is on the next page)

Multifunction DAQ Cable and Accessory Selection Guides

AI 0-	34	68	AI 0+
AI 1+	33	67	AI 0 GND
AI 1 GND	32	66	AI 1-
AI 2-	31	65	AI 2+
AI 3+	30	64	AI 2 GND
AI 3 GND	29	63	AI 3-
NC	28	62	NC
NC	27	61	NC
NC	26	60	NC
NC	25	59	NC
NC	24	58	NC
NC	23	57	NC
AO 0	22	56	NC
AO 0	21	55	AO GND
EXT REF	20	54	AO GND
P0.4	19	53	D GND
D GND	18	52	P0.0
P0.1	17	51	P0.5
P0.6	16	50	D GND
D GND	15	49	P0.2
+5 V	14	48	P0.7
D GND	13	47	P0.3
D GND	12	46	AI HOLD
PFI 0/AI START	11	45	EXT STROBE
PFI 1/REF TRIG	10	44	D GND
D GND	9	43	PFI 2/AI CONV
+5 V	8	42	PFI 3/CTR 1 SRC
D GND	7	41	PFI 4/CTR1 GATE
PFI 5/AO SAMP	6	40	CTR 1 OUT
PFI 6/AO START	5	39	D GND
D GND	4	38	PFI 7/AI SAMP
PFI 9/CTR 0 GATE	3	37	PFI 8/CTR 0 SRC
CTR 0 OUT	2	36	D GND
F OUT	1	35	D GND

Figure 2. S Series Devices Connector

[1]No connects for boards that do not support AO or use an external reference with the SH1006868 cable.

AI 8	34	68	AI 0
AI 1	33	67	AI GND
AI GND	32	66	AI 9
AI 10	31	65	AI 2
AI 3	30	64	AI GND
AI GND	29	63	AI 11
AI 4	28	62	AI SENSE
AI GND	27	61	AI 12
ACH13	26	60	AI 5
ACH6	25	59	AI GND
AIGND	24	58	AI 14
ACH15	23	57	AI 7
AO 0[1]	22	56	AI GND
AO 1[1]	21	55	AO GND
EXT REF[1]	20	54	AO GND
P0.4	19	53	D GND
D GND	18	52	P0.0
P0.1	17	51	P0.5
P0.6	16	50	D GND
D GND	15	49	P0.2
+5 V	14	48	P0.7
D GND	13	47	P0.3
D GND	12	46	AI HOLD
PFI 0/AI START	11	45	EXT STROBE
PFI 1/REF TRIG	10	44	D GND
D GND	9	43	PFI 2/AI CONV
+5 V	8	42	PFI 3/AI CTR 1 SRC
D GND	7	41	PFI 4/AI CTR 1 GATE
PFI 5/AO SAMP	6	40	CTR 1 OUT
PFI 6/AO START	5	39	D GND
DGND	4	38	PFI 7/AI SAMP
PFI 9/CTR 0 GATE	3	37	PFI 8/CTR 0 SRC
CTR 0 OUT	2	36	D GND
F OUT	1	35	D GND

Figure 3. I/O Connector for 16-Channel E Series and Basic Multifunction DAQ Devices, except NI 6025E

AI GND	1	51	AI 16
AI GND	2	52	AI 24
AI 0	3	53	AI 17
AI 8	4	54	AI 25
AI 1	5	55	AI 18
AI 9	6	56	AI 26
AI 2	7	57	AI 19
AI 10	8	58	AI 27
AI 3	9	59	AI 20
AI 11	10	60	AI 28
AI 4	11	61	AI 21
AI 12	12	62	AI 29
AI 5	13	63	AI 22
AI 13	14	64	AI 30
AI 6	15	65	AI 23
AI 14	16	66	AI 31
AI 7	17	67	AI 32
AI 15	18	68	AI 40
AI SENSE	19	69	AI 33
AO 0	20	70	AI 41
AO 1	21	71	AI 34
EXT REF	22	72	AI 42
AO GND	23	73	AI 35
D GND	24	74	AI 43
P0.0	25	75	AI SENSE 2
P0.4	26	76	AI GND
P0.1	27	77	AI 36
P0.5	28	78	AI 44
P0.2	29	79	AI 37
P0.6	30	80	AI 45
P0.3	31	81	AI 38
P0.7	32	82	AI 46
D GND	33	83	AI 39
+5 V	34	84	AI 47
+5 V	35	85	AI 48
AI HOLD	36	86	AI 56
EXT STROBE	37	87	AI 49
PFI 0/AI START	38	88	AI 57
PFI 1/REF TRIG	39	89	AI 50
PFI 2/AI CONV	40	90	AI 58
PFI 3/CTR 1 SRC	41	91	AI 51
PFI 4/CTR 1 GATE	42	92	AI 59
CTR 1 OUT	43	93	AI 52
PFI 5/AO SAMP	44	94	AI 60
PFI 6/AO START	45	95	AI 53
PFI 7/AI SAMP	46	96	AI 61
PFI 8/CTR 0 SRC	47	97	AI 54
PFI 9/CTR 0 GATE	48	98	AI 62
CTR 0 OUT	49	99	AI 55
F OUT	50	100	AI 63

Figure 4. I/O Connector for 64-Channel E Series Devices

AI GND	1	51	P2.7
AI GND	2	52	GND
AI 0	3	53	P2.6
AI 8	4	54	GND
AI 1	5	55	P2.5
AI 9	6	56	GND
AI 2	7	57	P2.4
AI 10	8	58	GND
AI 3	9	59	P2.3
AI 11	10	60	GND
AI 4	11	61	P2.2
AI 12	12	62	GND
AI 5	13	63	P2.1
AI 13	14	64	GND
AI 6	15	65	P2.0
AI 14	16	66	GND
AI 7	17	67	P1.7
AI 15	18	68	GND
AI SENSE	19	69	P1.6
AO 0	20	70	GND
AO 1	21	71	P1.5
NC	22	72	GND
AO GND	23	73	P1.4
D GND	24	74	GND
P0.0	25	75	P1.3
P0.4	26	76	GND
P0.1	27	77	P1.2
P0.5	28	78	GND
P0.2	29	79	P1.1
P0.6	30	80	GND
P0.3	31	81	P1.0
P0.7	32	82	GND
D GND	33	83	P0.7
+5 V	34	84	GND
+5 V	35	85	P0.6
AI HOLD	36	86	GND
EXT STROBE	37	87	P0.5
PFI 0/AI START	38	88	GND
PFI 1/REF TRIG	39	89	P0.4
PFI 2/AI CONV	40	90	GND
PFI 3/CTR 1 SRC	41	91	P0.3
PFI 4/CTR 1 GATE	42	92	GND
CTR 1 OUT	43	93	P0.2
PFI 5/AO SAMP	44	94	GND
PFI 6/AO START	45	95	P0.1
PFI 7/AI SAMP	46	96	GND
PFI 8/CTR 0 SRC	47	97	P0.0
PFI 9/CTR 0 GATE	48	98	GND
CTR 0 OUT	49	99	+5 V
F 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
	Shielded	Screw terminals	SH1006868	MIO:	–	SCB-68
	Shielded		SH1006868	Extended:	–	SCB-68
	Shielded	Screw terminals[1]	SH1006868	MIO:	–	TBX-68, CB-68LP, CB-68LPR, DAQ signal accessory
	Shielded	Screw terminals[1]	SH1006868	Extended:	–	TBX-68, CB-68LP, CB-68LPR
	Shielded	BNC terminal block	SH1006868	MIO:	–	BNC-2110, BNC-2120, BNC-2090
	Shielded		SH1006868	Extended:	–	BNC-2115
	Shielded	50-pin connectors	SH1006868	MIO:	68M-50F MIO	Custom or 3rd party
	Shielded		SH1006868	Extended:	68M-50F Extended	Custom or 3rd party
	Unshielded	50-pin connector	R1005050	MIO:	–	Custom or 3rd party
	Unshielded		R1005050	Extended:	–	Custom or 3rd party

[1]Shielded cable with unshielded accessories

Table 2. Cable Connection Specifications for 64-Channel E Series Devices and the NI 6025E