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Find the *National Instruments DAQPad-6020E* at our website: *Click HERE*

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

E Series – Portable

- 16 analog inputs at up to 1.25 MS/s, 12 or 16-bit resolution
- Up to 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
- 4 analog input signal ranges
- NI-DAQ driver simplifies configuration and measurements

Models

- NI DAQCard-6036E for PCMCIA[1]
- NI DAQCard-6062E for PCMCIA
- NI DAQCard-6024E for PCMCIA[1]
- NI DAQPad-6052E for FireWire
- NI DAQPad-6070E for FireWire
- NI DAQPad-6020E for USB[1]

Operating Systems

- Windows 2000/NT/XP
- 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

[1]Digital triggering only

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
DAQCard-6036E	PCMCIA	16 SE/8 DI	16 bits	200 kS/s	±0.05 to ±10 V	2	16 bits	1 kS/s	± 10 V	8	2	Digital
DAQCard-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	Analog, digital
DAQCard-6024E	PCMCIA	16 SE/8 DI	12 bits	200 kS/s	±0.05 to ±10 V	2	12 bits	1 kS/s	± 10 V	8	2	Digital
DAQPad-6052E	IEEE 1394	16 SE/8 DI	16 bits	333 kS/s	±0.05 to ±10 V	2	16 bits	333 kS/s	± 10 V	8	2	Analog, digital
DAQPad-6070E	IEEE 1394	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	Analog, digital
DAQPad-6020E	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	Digital

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

Overview and Applications

National Instruments portable E Series DAQ products deliver the same functionality available in PCI and PXI E Series DAQ devices – in a portable format. The DAQPad devices are hot swappable and available in up to three different configurations. The 15 cm enclosure is ideal for desktop or portable applications and features a 68-pin shielded connector. The 30 cm enclosure with mass termination offers a low-profile package that fits under your laptop computer. It features a 68-pin shielded connector to connect signals from our SCC modular signal conditioning products or from our CA-1000 custom connectivity enclosure. The 30 cm enclosure with BNC connectivity is ideal for applications where portability and quick connectivity are needed, such as in-vehicle automotive or aircraft testing and portable data logging.

NI DAQCards are Type II, PC Card compliant and provide performance equivalent to their PCI or PXI counterparts. However, due to their compact design, they can be used in applications where space constraints are an important concern, such as field service and research.

Highly Accurate Hardware Design

NI portable E Series DAQ devices provide the functionality of E Series data acquisition devices in a portable format:

Temperature Drift Protection Circuitry – Designed with components that minimize the effect of temperature changes on measurements to less than 0.0010% of reading per °C.

Resolution Improvement Technologies – Carefully designed noise floor maximizes the 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.

NI MITE – ASIC designed to optimize data transfer for multiple simultaneous operations using bus mastering with DMA channels, interrupts, or programmed I/O.

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

Models		NI 6052E	NI 6070E	DAQCard-6062E	DAQPad-6020E	DAQCard-6036E,	DAQCard-6024E
Measurement Sensitivity* (mV)		0.0025	0.009	0.010	0.006	0.004	0.009
Nominal Range (V)		Absolute Accuracy (mV)					
Positive FS	Negative FS						
10	-10	4.747	14.369	17.945	14.826	8.653	19.012
5	-5	0.876	5.193	6.983	4.671	2.357	6.517
2.5	-2.5	1.190	3.605	4.502	3.719	–	–
1	-1	0.479	1.452	1.813	1.498	–	–
0.5	-0.5	0.243	0.735	0.917	0.757	0.454	0.0972
0.25	-0.25	0.137	0.379	0.474	0.387	–	–
0.1	-0.1	0.064	0.163	0.203	0.165	–	–
0.05	-0.05	0.035	0.091	0.113	0.091	0.067	0.119
10	0	1.232	6.765	8.55	5.721	–	–
5	0	2.119	5.391	6.288	5.619	–	–
2	0	0.850	2.167	2.528	2.258	–	–
1	0	0.428	1.092	1.274	1.137	–	–
0.5	0	0.242	0.558	0.653	0.577	–	–
0.2	0	0.111	0.235	0.274	0.241	–	–
0.1	0	0.059	0.127	0.149	0.129	–	–

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. NI Portable E Series Analog Input Absolute Accuracy Specifications

Models		NI 6052E	NI 6070E	DAQCard-6062E	DAQPad-6020E	DAQCard-6036E,	DAQCard-6024E
Nominal Range (V)		Absolute Accuracy (mV)					
Positive FS	Negative FS						
10	-10	1.405	8.127	10.568	8.133	2.547	10.568
10	0	1.176	5.685	–	5.691	–	–

Table 3. NI Portable E Series Analog Output Absolute Accuracy Specifications

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 intraboard digital and timing signals.

RSE Mode – In addition to differential and nonreferenced single-ended modes, NI portable 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 – Some portable 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.

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 – The DAQ Assistant is an interactive guide that steps you through configuring, testing, and programming measurement tasks and generates the necessary code automatically for 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 system throughput I/O 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.

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

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*

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*

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

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

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

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	DAQCard-60xxE, DAQPad-60xxE	SCXI	270
Low-Cost, portable	DAQCard-60xxE, DAQPad-60xxE	SCC	251

Signals (<10 V)[1]

System Description	DAQ Device	Terminal Block	Cable	Page
Shielded	DAQPad-60xxE	SCB-68	SH6868-EP	214
Shielded	DAQCard-60xxE	SCB-68	SHC6868-EP	214
Low-Cost	DAQPad-60xxE	CB-68LP	R6868	214
Low-Cost	DAQCard-60xxE	CB-68LP	RC6868	214

[1]Terminal 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 DAQCard-6036E 778561-01
NI DAQCard-6062E 777976-01
NI DAQCard-6024E 778269-01
NI DAQPad-6052E[1] for FireWire (IEEE 1394) with
- Mass termination, AC Adapter[2], and 4 m FireWire cable
  - US 120 VAC 778535-01
  - Universal Euro 240 VAC 778535-04
  - United Kingdom 240 VAC 778535-06
- BNC termination, AC Adapter[2], and 4 m FireWire cable
  - US 120 VAC 778536-01
  - Universal Euro 240 VAC 778536-04
  - United Kingdom 240 VAC 778536-06

NI DAQPad-6070E for FireWire[1] (IEEE 1394) with
- Mass termination, AC Adapter[2], and 4 m FireWire cable
  - US 120 VAC 777867-01
  - Universal Euro 240 VAC 777867-04
  - United Kingdom 240 VAC 777867-06
- BNC termination, AC Adapter[2], and 4 m FireWire cable
  - US 120 VAC 777803-01
  - Universal Euro 240 VAC 777803-04
  - United Kingdom 240 VAC 777803-06

NI DAQPad-6020E for USB[1] in
- 15 cm enclosure with AC Adapter[2], and 1 m USB cable
  - US 120 VAC 777474-01
  - Universal Euro 240 VAC 777474-04
  - United Kingdom 240 VAC 777474-06
  - Japan 120 VAC 777474-07
- 30 cm enclosure with mass termination, AC Adapter[2], and 1 m USB cable
  - US 120 VAC 777704-01
  - Universal Euro 240 VAC 777704-04
  - United Kingdom 240 VAC 777704-06
  - Japan 120 VAC 777704-07
- 30 cm enclosure with BNC termination AC Adapter[2], and 1 m USB cable
  - US 120 VAC 777703-01
  - Universal Euro 240 VAC 777703-04
  - United Kingdom 240 VAC 777703-06
  - Japan 120 VAC 777703-07

Includes NI-DAQ driver software and calibration certificate.
[1]Windows 2000/XP only for DAQPads
[2]The AC Adapter is universal. The difference between these kits is the power cable.

DAQPad Accessories

BP-1 rechargeable battery pack
- 120 VAC charger 776896-01
- 230 VAC charger 776896-31

Rack-mount kit 777665-01
Stacking kit 777666-01
PCI-to-IEEE 1394 adapter .....Please call
CardBus-to-IEEE 1394 adapter .....Please call

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Multifunction DAQ Absolute Accuracy Specifications

Specifications (continued)

	Absolute Accuracy						Relative Accuracy	
	% of Reading			Noise + Quantization (mV)			Resolution (mV)	
Nominal Range (V)	24 Hours	1 Year	Offset (mV)	Single Point	Averaged	Temp Drift (%/°C)	Single Point	Averaged
DAQPad-6020E Analog Input Accuracy Specifications – 12-bit, 100 kS/s, 16 Analog Inputs								
-10.0	0.072	0.076	6.380	3.467	0.846	0.0010	5.729	1.114
-5.0	0.019	0.021	3.198	1.733	0.423	0.0005	2.865	0.557
-2.5	0.072	0.076	1.608	0.867	0.211	0.0010	1.432	0.278
-1.0	0.072	0.076	0.653	0.347	0.085	0.0010	0.573	0.111
-0.5	0.072	0.076	0.335	0.173	0.042	0.0010	0.286	0.056
-0.25	0.072	0.076	0.176	0.105	0.021	0.0010	0.151	0.028
-0.1	0.072	0.076	0.081	0.061	0.008	0.0010	0.074	0.011
-0.05	0.072	0.076	0.049	0.049	0.004	0.0010	0.056	0.006
10.0	0.019	0.021	3.198	1.733	0.423	0.0005	2.865	0.557
5.0	0.072	0.076	1.608	0.867	0.211	0.0010	1.432	0.278
2.0	0.072	0.076	0.653	0.347	0.085	0.0010	0.573	0.111
1.0	0.072	0.076	0.335	0.173	0.042	0.0010	0.286	0.056
0.5	0.072	0.076	0.176	0.105	0.021	0.0010	0.151	0.028
0.2	0.072	0.076	0.081	0.061	0.008	0.0010	0.074	0.011
0.1	0.072	0.076	0.049	0.049	0.004	0.0010	0.056	0.006
PCI-6013 and PCI-6014 Analog Input Accuracy Specifications								
-10	0.0658	0.0700	1.8975	0.9330	0.0824	0.0010	1.0849	0.1085
-5	0.0158	0.0200	0.9598	0.4665	0.0412	0.0005	0.5424	0.0542
-0.5	0.0658	0.0700	0.1158	0.0562	0.0050	0.0010	0.0663	0.0066
-0.05	0.0658	0.0700	0.0314	0.0314	0.0031	0.0010	0.0404	0.0040

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 (for example, 10 V for the ±10 V range) after one year, assuming 100 pt averaging of data.

	Absolute Accuracy				
Nominal Range (V)	Percent of Reading			Temp	
	24 Hours	90 Days	1 Year	Offset (mV)	Drift (%/°C)
NI 6120 Analog Output DC Accuracy – 16-bit, 2.5 MS/s, 2 Analog Outputs					
±10	0.0511	0.0519	0.0528	1.9	0.0006
NI 6115 Analog Output DC Accuracy – 12-bit, 2.5 MS/s, 2 Analog Outputs					
±10	0.0437	–	0.0454	8.9	0.0006
PCI-6110 and PCI-6111 Analog Output Accuracy – 12-bit, 2.5 MS/s, 2 Analog Outputs					
±10	0.018	–	0.022	5.933	0.0005
NI 6052E Analog Output Accuracy – 16-bit, 333 kS/s, 2 Analog Outputs					
±10	0.0044	0.0052	0.0061	0.798	0.0001
10 to 0	0.0044	0.0052	0.0061	0.569	0.0001
NI 6030E, NI 6031E Analog Output Accuracy – 16-bit, 100 kS/s, 2 Analog Outputs					
±10	0.0045	0.0053	0.0062	0.813	0.0001
10 to 0	0.0045	0.0053	0.0062	0.584	0.0001
NI 607xE Analog Output Accuracy – 12-bit, 1 MS/s, 2 Analog Outputs					
±10	0.0177	0.0197	0.0219	5.93	0.0005
10 to 0	0.0177	0.0197	0.0219	3.49	0.0005
NI 6040E Analog Output Accuracy – 12-bit, 1 MS/s, 2 Analog Outputs					
±10	0.0177	0.0197	0.0219	5.93	0.0005
10 to 0	0.0177	0.0197	0.0219	3.49	0.0005
NI PCI-6036E Analog Output Accuracy – 16-bit, 10 kS/s, 2 Analog Outputs					
±10	0.009	0.011	0.013	1.1	0.0005
NI DAQCard-6036E Analog Output Accuracy – 16-bit, 10 kS/s, 2 Analog Outputs					
±10	0.009	0.011	0.013	1.22	0.0005
PCI-6024E, and NI 6025E Analog Output Accuracy					
±10	0.0177	0.0197	0.0219	5.93	0.0005
DAQCard-6024E Analog Output Accuracy – 12-bit, 10 kS/s, 2 Analog Outputs					
±10	0.0177	0.0197	0.0219	8.37	0.0005
DAQCard-6062E Analog Output Accuracy – 12-bit, 850 kS/s, 2 Analog Outputs					
±10	0.0177	0.0197	0.0219	8.37	0.0005
DAQPad-6020E Analog Output Accuracy – 12-bit, 20 S/s, 2 Analog Outputs					
±10	0.018	0.020	0.022	5.93	0.0005
PCI-6014 Analog Output Accuracy – 16-bit, 10 kS/s, 2 Analog Outputs					
±10	0.0154	0.0174	0.0196	1.568	0.0005

Note: Temp Drift applies only if ambient is greater than ±10 °C of previous external calibration.

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12-Bit E Series Multifunction DAQ Specifications

Specifications – NI 607xE, NI 6062E, NI 6040E, NI 602xE

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

Analog Input

Accuracy specifications ..... See page 228.

Input Characteristics

	Number of Channels
6070E 6062E 6040E 602xE	16 single-ended or 8 differential (software selectable per channel)
6071E	64 single-ended or 32 differential (software selectable per channel)

Resolution..... 12 bits, 1 in 4,096

	Maximum Sampling Rate
607xE	1.25 MS/s
6062E	500 kS/s
6040E	500 kS/s single-channel scanning 250 kS/s multichannel scanning
6023E 6024E 6025E	200 kS/s
6020E	100 kS/s

Input Signal Ranges

Device	Range (Software Selectable)	Bipolar Input Range	Unipolar Input Range
607xE	20 V	±10 V	–
6062E	10 V	±5 V	0 to 10 V
6040E	5 V	±2.5 V	0 to 5 V
6020E	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
6023E	20 V	±10 V	–
6024E	10 V	±5 V	–
6025E	1 V	±500 mV	–
	100 mV	±50 mV	–

Input coupling..... DC

Maximum working voltage

(signal + common mode)..... Input should remain within ±11 V of ground

Overvoltage Protection

Device	Powered On	Powered Off
607xE 6062E 6040E	±25 V	±15 V
6023E 6024E 6025E	±40 V	±25 V
6020E	±35 V	±25 V

Inputs Protected

6070E 6062E, 6040E 602xE	AI <0..15>, AI SENSE
6071E	AI <0..63>, AI SENSE, AI SENSE2

FIFO Buffer Size

DAQCard-6062E	8,192 samples
DAQPad-6020E	4,096 samples
DAQPad-6070E DAQCard-6024E	2,048 samples
PCI/PXI-6070E 6071E, 6040E PCI-6023E, NI 6025E, PCI-6024E	512 samples

Data transfers

PCI, PXI, DAQPad for FireWire..... DMA, interrupts, programmed I/O

DAQCard, DAQPad for USB..... Interrupts, programmed I/O

DMA modes

PCI, PXI, DAQPad for FireWire..... Scatter-gather (single-transfer, demand transfer)

Configuration memory size..... 512 words

Transfer Characteristics

Relative Accuracy

Device	Typical Dithered	Maximum Undithered
607xE 6062E 6040E 6023E 6024E 6025E	±0.5 LSB	±1.5 LSB
6020E	±0.2 LSB	±1.5 LSB

DNL

Device	Typical	Maximum
607xE 6040E 6023E PCI-6024E 6025E	±0.5 LSB	±1.0 LSB
6020E	±0.2 LSB	±1.0 LSB
6062E DAQCard-6024E	±0.75 LSB	-0.9, +1.5 LSB

No missing codes..... 12 bits, guaranteed

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12-Bit E Series Multifunction DAQ Specifications

Specifications – NI 607xE, NI 606xE, NI 6040E, NI 602xE (continued)

Amplifier Characteristics

Input Impedance

Device	Normal Powered On	Powered Off	Overload
6070E	100 GΩ in parallel	820 Ω	820 Ω
6062E	with 100 pF		
6040E			
PCI-6071E			
PXI-6071E			
6023E, 6024E, 6025E	100 GΩ in parallel with 100 pF	4.7 kΩ	4.7 kΩ
6020E	100 GΩ in parallel with 50 pF	3 kΩ	3 kΩ

Input bias current ..... ±200 pA
Input offset current ..... ±100 pA

CMRR, DC to 60 Hz

Device	Range	CMRR (dB)
607xE	20 V	95
	10 V	100
	100 mV to 5 V	106
6040E	10 to 20 V	85
6062E	5 V	95
	100 mV to 2 V	100
6023E	10 to 20 V	85
6024E	100 mV to 1 V	90
6025E		
6020E	100 mV to 20 V	90

Dynamic Characteristics

Bandwidth

Device	Small Signal (-3 dB)	Large Signal (1% THD)
607xE	1.6 MHz	1 MHz
6062E	1.3 MHz	250 kHz
6040E	600 kHz	350 kHz
6023E	500 kHz	225 kHz
PCI-6024E		
6025E		
DAQCard-6024E	500 kHz	265 kHz
DAQPad-6020E	150 kHz	200 kHz

Settling Time to Full-Scale Step

		Accuracy		
Device	Range	±0.012% (±0.5 LSB)	±0.024% (±1 LSB)	±0.098% (±4 LSB)
6070E	20 V	2 µs typical	1.5 µs typical	1.5 µs typical
		3 µs maximum	2 µs maximum	2 µs maximum
	10 V	2 µs typical	1.5 µs typical	1.3 µs typical
		3 µs maximum	2 µs maximum	1.5 µs maximum
	200 mV to 5 V	2 µs typical	1.5 µs typical	0.9 µs typical
		3 µs maximum	2 µs maximum	1 µs maximum
	100 mV	2 µs typical	1.5 µs typical	1 µs typical
		3 µs maximum	2 µs maximum	1.5 µs maximum
6071E	20 V	3 µs typical	1.9 µs typical	1.9 µs typical
		5 µs max	2.5 µs maximum	2 µs maximum
	10 V	3 µs typical	1.9 µs typical	1.2 µs typical
		5 µs maximum	2.5 µs maximum	1.5 µs maximum
	200 mV to 5 V	3 µs typical	1.9 µs typical	1.2 µs typical
		5 µs maximum	2.5 µs maximum	1.3 µs maximum
	100 mV	3 µs typical	1.9 µs typical	1.2 µs typical
		5 µs maximum	2.5 µs maximum	1.5 µs maximum
6062E	All	2.5 µs typical	2.5 µs typical	2 µs typical
		4 µs maximum	3 µs maximum	2.5 µs maximum
	All	4 µs typical	4 µs maximum	4 µs maximum
		8 µs maximum		
	All	5 µs typical	5 µs maximum	5 µs maximum
	All	10 µs maximum	10 µs maximum	10 µs maximum

System Noise (LSB_{rms}, Not Including Quantization)

Device	Range	Dither Off	Dither On
6070E	1 to 20 V	0.25	0.5
6071E	500 mV	0.4	0.6
	200 mV	0.5	0.7
	100 mV	0.8	0.9
6062E	1 to 20 V	0.25	0.6
	500 mV	0.4	0.75
	200 mV	0.5	0.8
	100 mV	0.8	1.0
6040E	1 to 20 V	0.2	0.5
	500 mV	0.25	0.5
	200 mV	0.5	0.7
	100 mV	0.9	1.0
6023E	1 to 20 V	0.1	0.6
PCI-6024E, 6025E	100 mV	0.7	0.8
DAQCard-6024E	10 to 20 V	0.1	0.65
	1 V	0.45	0.65
	100 mV	0.70	0.90
6020E	1 to 20 V	0.07	0.5
	500 mV	0.12	0.5
	200 mV	0.25	0.6
	100 mV	0.5	0.7

Crosstalk, DC to 100 KHz

Device	Adjacent Channels	All Other Channels
607xE, 6062E, 6040E	-75 dB	-90 dB
602xE	-60 dB	-80 dB

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12-Bit E Series Multifunction DAQ Specifications

Specifications – NI 607xE, NI 606xE, NI 6040E, NI 602xE (continued)

Analog Output

Output Characteristics

Number of Channels	
607xE	2 voltage outputs
6062E	
6040E	
6020E	
6024E	
6025E	
6023E	None

Resolution ..... 12 bits, 1 in 4,096

Maximum update rate

Waveform Generation

	FIFO Mode		Non-FIFO Mode	
Device	Internally Timed	Externally Timed	1 Channel	2 Channels
607xE	1 MS/s	950 kS/s	800 kS/s, system dependent	400 kS/s, system dependent
6040E				
6062E	850 kS/s	850 kS/s	800 kS/s, system dependent	400 kS/s, system dependent
6023E	N/A	N/A	10 kS/s with DMA 1 kS/s with interrupts system dependent	10 kS/s with DMA 1 kS/s with interrupts system dependent
PCI-6024E				
6025E				
DAQCard-6024E	N/A	N/A	1 kS/s with interrupts system dependent	1 kS/s with interrupts system dependent
DAQPad-6020E	N/A	N/A	20 S/s, system dependent	20 S/s, system dependent

FIFO Buffer Size	
607xE, 6062E	2,048 samples
6040E	512 samples
602xE	None

Data transfers

- PCI, PXI, DAQPad for IEEE 1394 ..... DMA, interrupts, programmed I/O
- DAQCard, DAQPad for USB ..... Interrupts, programmed I/O

DMA modes

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

Transfer Characteristics

Relative accuracy

- After calibration
  - 6062E, DAQCard-6024E ..... ±0.5 LSB typical, ±1.0 LSB maximum
  - All others ..... ±0.3 LSB typical, ±0.5 LSB maximum
- Before calibration ..... ±4 LSB maximum

DNL

- After calibration
  - 6062E, DAQCard-6024E ..... ±0.5 LSB typical, ±1.0 LSB maximum
  - All others ..... ±0.3 LSB typical, ±1.0 LSB maximum
- Before calibration ..... ±3 LSB maximum

Monotonicity ..... 12 bits, guaranteed after calibration

Gain error (relative to external reference)

- 6062E, 6020E ..... ±0.5% of output maximum, not adjustable
- 607xE, 6040E ..... 0 to 0.67% of output maximum, not adjustable

Voltage Output

Output coupling ..... DC

Output impedance ..... 0.1 Ω maximum

Ranges	
607xE, 6040E, 6020E	±10 V, 0 to 10 V, ±EXT REF, 0 to EXT REF; software selectable
6062E	±10 V, ±EXT REF, software selectable
6024E, 6025E	±10 V

Current drive ..... ±5 mA maximum

Protection ..... Short-circuit to ground

Power-on state ..... 0 V (±200 mV)

External Reference Input

Range ..... 11 V

Overvoltage protection

- 607xE, 6062E, 6040E ..... ±25 V powered on, ±15 V powered off
- 6020E ..... ±35 V powered on, ±25 V powered off

Input impedance ..... 10 kΩ

Bandwidth (-3 dB)

- 607xE, 6040E ..... 1 MHz
- 6062E ..... 50 kHz
- 6020E ..... 300 kHz

Dynamic Characteristics

Device	Settling Time for Full-Scale Step	Slew Rate
607xE	3 µs to ±0.5 LSB accuracy	20 V/µs
6062E		
6040E		
602xE	10 µs to ±0.5 LSB accuracy	10 V/µs

Device	Reglitching Disabled	Reglitching Enabled
607xE, 604xE	±20 mV	±4 mV
PCI-6024E	±42 mV	N/A
6025E		
DAQCard-6024E	±13 mV	N/A
6020E	±100 mV	N/A
6062E	±80 mV	±30 mV

Glitch Duration (At Mid-Scale Transition)	
607xE	1.5 µs
6040E	
6024E	2 µs
6025E	
6020E	3 µs
6062E	

Noise ..... 200 μV_{rms}, DC to 1 MHz

Glitch energy magnitude (at mid-scale transition)

Stability

Gain temperature coefficient (except 6024E, 6025E)

- External reference ..... ±25 ppm/°C

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12-Bit E Series Multifunction DAQ Specifications

Specifications – NI 607xE, NI 606xE, NI 6040E, NI 602xE (continued)

Digital I/O

Number of Channels	
6025E	32 input/output
All others	8 input/output

Compatibility ..... 5 V TTL
Power-on state ..... Input; (high-impedance)
Digital logic levels
P0.<0..7>

Level	Minimum (V)	Maximum (V)
Input low voltage	0	0.8
Input high voltage	2.0	5.0
Output low voltage (I_{out} = 24 mA)	–	0.4
Output high voltage (I_{out} = -13 mA)	4.35	–

P1.<0..7>, P2.<0..7>, P3.<0..7>

Level	Minimum (V)	Maximum (V)
Input low voltage	0	0.8
Input high voltage	2.2	5.0
Output low voltage (Iout = 2.5 mA)	–	0.4
Output high voltage (Iout = -2.5 mA)	3.7	–

Data Transfers	
6025E	Interrupts, programmed I/O
All others	Programmed I/O

Transfer rate (1 word = 8 bits)
Maximum with NI-DAQ, system dependent

Transfer Rate	
DAQPad-6070E	5 kwords/s
All others	50 kwords/s

Constant sustainable rate ..... 1 to 10 kwords/s, system dependent

Timing I/O

Number of channels
Up/down counter/timers 2
Frequency scaler 1
Resolution
Up/down counter/timers ..... 24 bits
Frequency scaler ..... 4 bits
Compatibility ..... 5 V/TTL
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 source frequency
Up/down counter/timers ..... 20 MHz
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

*Except DAQCard and USB DAQPad

Triggers

Analog Triggers

Number of Triggers	
607xE 6062E 6040E	1
602xE	None

Purpose
Analog input ..... Start and stop trigger, gate, clock
Analog output ..... Start trigger, gate, clock
General-purpose counter/timers ..... Source, gate
Source ..... All analog input channels, 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 ..... 8 bits, 1 in 256
Bandwidth (-3 dB)

Device	Internal Source	External Source
607xE	2 MHz	7 MHz
6062E	500 kHz	2.5 MHz
6040E	650 kHz	3 MHz

Hysteresis ..... Programmable

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 V/TTL
Response ..... Rising or falling edge
Pulse width ..... 10 ns minimum

External Input For Digital Or Analog Trigger (PFI0/TRIG1)

Impedance
6062E ..... 12 kΩ
607xE, 6040E ..... 10 kΩ
Coupling ..... DC
Protection
Digital trigger ..... -0.5 to V_{cc} + 0.5 V

Calibration

Recommended warm-up time ..... 15 minutes; 30 minutes for DAQCard and DAQPad
Calibration interval ..... 1 year
Onboard calibration reference
DC level ..... 5.000 V (±3.5 mV) over full operating temperature, actual value stored in EEPROM
Temperature coefficient ..... ±5 ppm/°C maximum
Long-term stability ..... ±15 ppm/$\sqrt{1000\ h}$

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12-Bit E Series Multifunction DAQ Specifications

Specifications – NI 607xE, NI 606xE, NI 6040E, NI 602xE (continued)

RTSI Bus (PCI and FireWire only)

Trigger lines[1]
- PCI 7
- FireWire (DAQPad) 4

PXI Trigger Bus (PXI only)

Trigger lines 6
Star trigger 1

Bus Interface

PCI, PXI, FireWire (DAQPad) ..... Master, slave
USB (DAQPad) ..... Slave
PCMCIA (DAQCard) ..... Slave

Power Requirements[2]

Device	+5 VDC (±5%)*	Power Available at I/O Connector
PCI-607xE, PXI-607xE	1.1 A	+4.65 to +5.25 VDC, 1 A
6040E	1.0 A	+4.65 to +5.25 VDC, 1 A
DAQCard-6062E	340 mA typical 750 mA maximum	+4.65 to +5.25 VDC, 250 mA
DAQCard-6024E	270 mA typical 750 mA maximum	+4.65 to +5.25 VDC, 250 mA
6023E, 6025E, PCI-6024E	0.7 A	+4.65 to +5.25 VDC, 1 A

Device	Power*	Power Available at I/O Connector
DAQPad-6020E	15 W, +9 to +30 VDC	+4.65 to +5.25 VDC, 1 A
DAQPad-6070E	17 W, +9 to +25 VDC	+4.65 to +5.25 VDC, 1 A

*Excludes power consumed through I/O connector

Discharge time with BP-1 battery pack
FireWire (DAQPad) ..... 2.5 hours, typical
USB (DAQPad) ..... 3 hours, typical

Physical[2]

Dimensions (Not Including Connectors)

PCI ..... 17.5 by 10.7 cm (6.9 by 4.2 in.)
PXI ..... 16.0 by 10.0 cm (6.3 by 3.9 in.)
DAQPad (30 cm enclosure) ..... 25.4 by 30.7 by 4.3 cm (10 by 12.1 by 1.7 in.)
DAQPad (15 cm enclosure) ..... 14.6 by 21.3 by 3.8 cm (5.8 by 8.4 by 1.5 in.)
DAQCard ..... Type II PC Card

I/O Connector	
6070E 6040E 6020E 6023E PCI-6024E	68-pin male 0.050 D-type
DAQCard-6062E, DAQCard-6024E	68-pin female VHDCI
6071E 6025E	100-pin female 0.050 D-type

Environment

Operating temperature ..... 0 to 55 °C
0 to 40 °C for DAQCard-6062E and DAQCard-6024E with a maximum internal temperature of 70 °C as measured by onboard temperature sensor; case temperature should not exceed 55 °C for any DAQCard
Storage temperature ..... -20 to 70 °C
Relative humidity ..... 10 to 90%, noncondensing

Certifications and Compliances

CE Mark Compliance CE

[1]Refer to RTSI specifications for available RTSI trigger lines. RTSI not available on DAQCards.
[2]See page 134 for RT Series devices, power requirements and physical parameters.

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