

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	333 kS/s
6034E 6036E	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	–
		10 V	±5 V	0 to 10 V
5 V		–	0 to 5 V	
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	–	
	10 V	±5 V	–	
	1 V	±500 mV	–	
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

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

CMRR, DC to 60 Hz

Device	Range	CMRR	
		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

Device	Range	Accuracy				
		±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	All	40 µs max	20 µs max	–	10 µs max	–
6032E	All	50 µs max	25 µs max	–	10 µs max	–
6031E	All	50 µs max	25 µs max	–	10 µs max	–
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	-75 dB	-90 dB
603xE		

Analog Output

Output Characteristics

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

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

Maximum Update Rate	
6052E	333 kS/s
PCI-6036E	10 kS/s, system dependent
6030E	100 kS/s
6031E	
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	±0.5 LSB typical, ±1 LSB maximum
6031E	
6036E	±2 LSB maximum

DNL..... ±1.0 LSB maximum

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

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

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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	10 μs to ±1 LSB accuracy	5 V/μs
6031E		
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	60 μV _{rms} , DC to 1 MHz
6030E	
6031E	
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

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	1
6030E	
6031E	
6032E	
6033E	
6034E	None
6036E	

Purpose

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

Source

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

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	External Source
	AI<0..15/63>	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 k Ω
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/ $^{\circ}$ C max
6034E, 6036E	± 5.0 ppm/ $^{\circ}$ 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 Requirements¹

Device	+5 VDC ($\pm 5\%$)	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

Physical¹

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 DAQPad-6052E	68-position VHDCI female 68-pin male SCSI-II type, or 15 BNCs and 30 removable screw terminals

Environment

Operating temperature	
6052E, 6036E, 6034E	0 to 55 $^{\circ}$ C
6030E, 6031E, 6032E, 6033E	0 to 50 $^{\circ}$ C
Storage temperature	-20 to 70 $^{\circ}$ C
Relative humidity	10 to 90%, noncondensing

Certifications and Compliances

CE Mark Compliance CE

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

