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Low-Cost Multifunction I/O – 100 kS/s, 12-Bit, 8 Analog Inputs

1200 Family

PCI-1200
DAQCard-1200
Lab-PC-1200
Lab-PC-1200AI
DAQPad-1200

Analog Inputs
8 single-ended, 4 differential channels
100 kS/s sampling rate
12-bit resolution

Analog Output (not for Lab-PC-1200AI)
2 channels, 12-bit resolution

Digital I/O
24 (5 V/TTL) lines in 8-bit ports

Counter/Timers
Three, 16-bit resolution

Triggering
Digital

Driver Software
NI-DAQ
Windows 2000/NT/9x
*Mac OS**
**not for all hardware, refer to page 192*

Application Software
LabVIEW
LabWindows/CVI
ComponentWorks
VirtualBench
Measure
BridgeVIEW
Lookout

Calibration Certificate Included!
(refer to page 216)



Make sure you consider our new low-cost 12-bit E Series products – refer to page 239.

Bus	Analog Inputs	Resolution	Sampling Rate	Input Range	Analog Outputs	Resolution	Output Rate	Output Range	Digital I/O	Counter/ Timers	Triggers
PCI, PCMCIA, ISA, Parallel Port	8 SE/4 DI	12 bits	100 kS/s	up to ±5 V	2[1]	12 bits[1]	1 kS/s[1]	±5 V[1]	24	3, 16-bit	Digital

[1]No analog outputs on Lab-PC-1200AI

Table 1. 1200 Family Channel, Speed, and Resolution Specifications *(refer to page 314 for more detailed specifications)*

Overview

The 1200 Family devices are low-cost, multifunction I/O devices with up to 100 kS/s, 12-bit performance on 8 single-ended or 4 differential analog inputs. The 1200 Family features digital triggering capability; three 16-bit, 8 MHz counter/timers; two 12-bit analog outputs; and 24 digital I/O lines. The 1200AI does not include the two analog outputs.

Hardware

Analog Input

The 1200 Family has eight single-ended or 4 differential 12-bit analog input channels. The voltage input range is software programmable for 0-10 V (unipolar) or ±5 V (bipolar). A software-programmable gain amplifier has gain selections of 1, 2, 5, 10, 20, 50, or 100.

The single-channel sampling rate of the ADC is 100 kS/s. The PCI, DAQCard, and Lab-PC versions can sustain this rate, but the DAQPad cannot. The sustainable data transfer rate to a standard PC parallel port is 25 kS/s (depending on your computer). If you need an external solution with faster sampling, consider the DAQPad-6020E for USB, (100 kS/s, page 241) and the DAQPad-6070E for IEEE 1394 (1.25 MS/s, page 226). When scanning multiple channels, the maximum sampling rate for all 1200 family products is 83.3 kS/s at a gain of 1.

Data acquisition with the 1200 Family devices is available in three modes: 1) continuous acquisition of a single channel, 2) multichannel acquisition with continuous scanning, or 3) multichannel acquisition with interval scanning with a resolution of 1 µs.

The 1200 Family devices have two hardware triggering modes – pretrigger mode and posttrigger mode. In pretrigger mode, the device collects samples until a trigger is received at the external trigger input, and then continues to collect a specified number of samples. In posttrigger mode, the device collects a specified number of samples after it receives a trigger.

Analog Output

The 1200 Family has two double-buffered 12-bit DACs that are connected to two analog output channels. You can independently configure each channel through software for unipolar (0-10 V) or bipolar (±5 V) operation. The resolution of the 12-bit DAC is 2.44 mV in both polarities.

ACH0	1	2	ACH1
ACH2	3	4	ACH3
ACH4	5	6	ACH5
ACH6	7	8	ACH7
AISENSE/AIGND	9	10	DAC0OUT[1]
AGND	11	12	DAC1OUT[1]
DGND	13	14	PA0
PA1	15	16	PA2
PA3	17	18	PA4
PA5	19	20	PA6
PA7	21	22	PB0
PB1	23	24	PB2
PB3	25	26	PB4
PB5	27	28	PB6
PB7	29	30	PC0
PC1	31	32	PC2
PC3	33	34	PC4
PC5	35	36	PC6
PC7	37	38	EXTTRIG
EXTUPDATE[1]	39	40	EXTCONV*
OUTB0	41	42	GATB0
OUTB1	43	44	GATB1
CLKB1	45	46	OUTB2
GATB2	47	48	CLKB2
+5 V	49	50	DGND

[1] Not available on Lab-PC-1200AI

Figure 1. 1200 Family I/O Connector

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Low-Cost Multifunction I/O – 100 kS/s, 12-Bit, 8 Analog Inputs

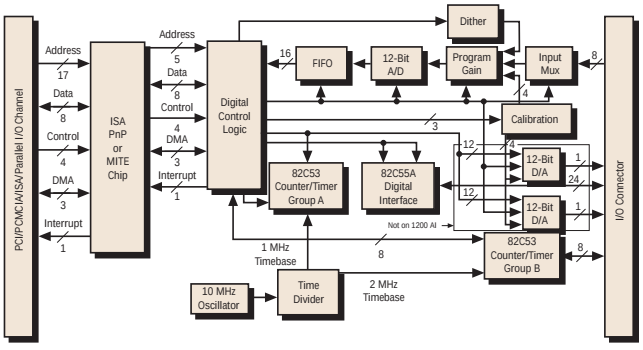


Figure 2. 1200 Family Hardware Block Diagram

Self-Calibration

The analog inputs and outputs of the 1200 Family have self-calibration circuitry to correct for gain and offset errors. You can use the permanently-stored factory calibration constants or store additional sets of constants for different operating conditions in the user-modifiable section of an EEPROM on the device.

Digital I/O

The 1200 Family devices have 24 digital I/O lines that are 5 V/TTL compatible and configurable as three 8-bit ports for input, output, bidirectional, or handshaking modes. The digital output ports of the 1200 series can sink 2.5 mA on each line.

Counter/Timer

The 1200 Family uses two 82C53 counter/timer integrated circuits, each containing three independent 16-bit counter/timers. One 82C53 is dedicated for A/D and D/A timing. The three counters on the other 82C53 are available for general time-related functions, such as clock output, pulse output, and event counting. Of these three counters, one may be required for timing of analog I/O, and one has a built-in 20 MHz source clock.

I/O Connector

The I/O connector is a 50-pin male ribbon cable connector diagrammed in Figure 1. ACH <0..7> are eight analog input channels. DAC0OUT and DAC1OUT are the two analog output channels. EXUPDATE, EXTCONV, and EXTTRIG are TTL lines through which you can externally control analog I/O. CLKB<1..2>, GATB<0..2>, and OUTB<0..2> are the clock, gate, and output of the user-available counters. PA<0..7>, PB<0..7>, and PC<0..7> are the three 8-bit digital I/O ports.

DAQPad-1200 Parallel Port Interface

The DAQPad-1200 includes a 1 m parallel port cable with two 25-pin D-Sub connectors. The DAQPad-1200 rear panel includes two parallel port connectors, Port A for connection to the PC parallel port, and Port B, for transparent pass-through connection to any other standard parallel port device.

DAQPad-1200 Power

The DAQPad-1200 is powered by any 9 to 42 VDC source. With the AC adapter unit included, you can power the DAQPad-1200 from any standard 120 VAC or 230 VAC source.

The optional BP-1 rechargeable battery pack is the same size as the DAQPad-1200 and powers it for 11 hours. The charger unit included with the BP-1 is not CE certified.

BNC and Breadboard Accessories

The BNC-2081 accessory has labeled BNC connections for the analog signals of the 1200 Family. The SC-2071 and SC-2072 are breadboard accessories with labeled and numbered screw terminals, respectively; the 1200 device must be in single-ended mode to use the SC-2071.

Make sure you consider our new low-cost E Series products – refer to page 239.

Ordering Information

1200 Family

PCI-1200 *and NI-DAQ for*
Windows 2000/NT/9x.....777386-01
Mac OS 777097-01
DAQCard-1200 *and NI-DAQ for*
Windows 2000/NT/9x.....777087-01
Mac OS 777087-02
Lab-PC-1200 *.....777227-01*
Lab-PC-1200AI *.....777292-01*
DAQPad-1200 *for Parallel Port with AC adapter*
U.S. 120 VAC.....776895-01
Universal Euro 240 VAC.....776895-31
United Kingdom 240 VAC 776895-06

Includes NI-DAQ for Windows 2000/NT/9x on CD unless otherwise noted. See pages 192 and 210 for more details.

BP-1 *rechargeable battery pack with charger*
120 VAC.....776896-01
240 VAC.....776896-31
BNC-2081 *.....776599-90*
SC-2071 *.....776358-91*
SC-2072 *.....776358-92*

Example Configurations

Family	DAQ Board	Cable (page 297)	Accessory (page 292)
1200	PCI-1200	NB1 (180524-10)	CB-50LP (777101-01)
	DAQCard-1200	PR50-50F (182799-01)	CB-50LP (777101-01)
	Lab-PC-1200	NB1 (180524-10)	CB-50LP (777101-01)
	Lab-PC-1200AI	NB1 (180524-10)	CB-50LP (777101-01)
1200AI	DAQPad-1200	NB1 (180524-10)	CB-50LP (777101-01)

For more detailed cable and accessory options, refer to pages 286-299.

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Specifications

1200 Family

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

Analog Input

Input Characteristics

Number of channels ..... *8 single-ended, or 4 differential, software selectable*
Type of ADC ..... *Successive approximation*
Resolution ..... *12 bits, 1 in 4,096*
Maximum sampling rate
PCI, DAQCard, Lab-PC ..... *100 kS/s*
DAQPad ..... *100 kS/s to FIFO; 25 kS/s to PC with standard Centronics port*

Input signal ranges

Gain (Software Selectable)	Range (Software Selectable)	
	Bipolar	Unipolar
1	±5 V	0 to 10 V
2	±2.5 V	0 to 5 V
5	±1 V	0 to 2 V
10	±500 mV	0 to 1 V
20	±250 mV	0 to 500 mV
50	±100 mV	0 to 200 mV
100	±50 mV	0 to 100 mV

Input coupling ..... *DC*
Maximum working voltage
(signal + common mode) ..... *In differential or NRSE mode, the negative input/AISENSE should remain within ±5 V (bipolar) or -5 to 2 V (unipolar) of AGND except for the DAQCard-1200, where the values are ±6 V (bipolar) and -6 to 2 V (unipolar). The positive input should remain within -5 V to +10 V of AGND. For the DAQCard-1200 in RSE mode, the input signal referenced to AGND should remain within ±5 V(bipolar) or 0 to 10 V (unipolar).*

Overvoltage protection
PCI, DAQCard, Lab-PC ..... *±35 V powered on, ±25 V powered off*
DAQPad ..... *±42 V powered on, ±15 V powered off*
Inputs protected ..... *ACH<0..7>*
FIFO buffer size
PCI ..... *4,096 samples*
DAQCard ..... *1,024 samples*
Lab-PC ..... *512 samples*
DAQPad ..... *2,048 samples*
Data transfers
PCI, Lab-PC ..... *DMA, interrupts, programmed I/O*
DAQCard, DAQPad ..... *Interrupts, programmed I/O*
DMA modes
PCI ..... *Scatter-gather*
Lab-PC ..... *Single transfer*
Dither ..... *Available*

Transfer Characteristics

Relative accuracy ..... *±0.5 LSB typical dithered, ±1.5 LSB max undithered*
DNL ..... *±1 LSB max*
No missing codes ..... *12 bits, guaranteed*
Offset error

Error		PCI, DAQCard, Lab-PC	DAQPad
Pregain	After calibration	±10 µV max	±5 µV max
	Before calibration	±20 mV max	±15 mV max
Postgain	After calibration	±1 mV max	±360 µV max
	Before calibration	±200 mV max	±150 mV max

Gain error (relative to calibration reference)
After calibration ..... *0.02% of reading max*
Before calibration ..... *±2% of reading max*

Amplifier Characteristics

Input bias current
PCI, DAQCard, Lab-PC ..... *±100 pA*
DAQPad ..... *±200 pA*
Input offset current ..... *±100 pA*
Input impedance
Normal powered on ..... *100 GΩ in parallel with 50 pF*
Powered off ..... *4.7 kΩ min*
Overload ..... *4.7 kΩ min*
CMRR ..... *70 dB typical, DC to 60 Hz*

Dynamic Characteristics

Bandwidth (small signal -3 dB)

Gain	PCI, DAQCard, Lab-PC	DAQPad
1 to 10	250 kHz	400 kHz
20	150 kHz	200 kHz
50	60 kHz	80 kHz
100	30 kHz	40 kHz

Settling time for full-scale step

	Accuracy ±0.024% (±1 LCB)		
	PCI, Lab-PC	DAQCard	DAQPad
Gain	µs typical/µs max	µs typical/µs max	µs max
1	10/14	–/10	25
2 to 10	13/16	–/10	25
20	15/19	12/15	25
50	27/34	25/30	25
100	60/80	60/80	60

System noise (including quantization error) in LSB_{rms}

	PCI, DAQCard, Lab-PC		DAQPad	
Gain	Dither Off	Dither On	Dither Off	Dither On
1 to 50	0.3	0.5	0.3	0.6
100	0.5	0.7	0.6	0.8

Stability

Recommended warm-up time ..... *15 minutes*
Offset temperature coefficient
Pregain ..... *±15 µV/°C*
Postgain ..... *±100 µV/°C*
Gain temperature coefficient
PCI, DAQCard, Lab-PC ..... *±40 ppm/°C*
DAQPad ..... *±50 ppm/°C*

Analog Output *(not for Lab-PC-1200AI)*

Output Characteristics

Number of channels ..... *Two voltage*
Resolution ..... *12 bits, 1 in 4,096*
Typical update rate ..... *1 kS/s (system dependent)*
Type of DAC ..... *Double buffered, multiplying*
Data transfers ..... *Interrupts, programmed I/O*

Transfer Characteristics

Relative accuracy ..... *±0.25 LSB typical, ±0.50 LSB max*
±0.50 LSB typical, ±1.0 LSB max (DAQCard)
DNL ..... *±0.25 LSB typical, ±0.75 LSB max*
±0.50 LSB typical, ±0.90 LSB max (DAQCard)
Monotonicity ..... *12 bits, guaranteed*
Offset error
After calibration ..... *±0.2 mV max; ±0.5 mV max for DAQCard*
Before calibration ..... *±50 mV max; ±75 mV max for DAQCard*
Gain error (relative to internal reference)
After calibration ..... *0.01% of reading max*
0.02% of reading max (DAQCard)
Before calibration ..... *±1% of reading max*
±2% of reading max (DAQCard)

Voltage Output

Ranges ..... *0 to 10 V, ±5 V, software selectable*
Output coupling ..... *DC*
Output impedance ..... *0.2 Ω typical*
0.5 Ω typical (DAQCard)
Current drive ..... *±2 mA*
1 mA max per channel (DAQCard)
Protection ..... *Short circuit to ground*
80 mA momentary short-circuit protection to ground (DAQCard)

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1200 Family *(continued)*

Power-on state
- *PCI, DAQCard, Lab-PC* ..... *0 V*
- *DAQPad* ..... *0 V bipolar mode, 5 V unipolar mode*

Dynamic Characteristics

Settling time to full-scale range (FSR)
- *PCI, Lab-PC* ..... *5 µs to ±1 LSB*
- *DAQCard* ..... *20 µs to ±1 LSB*
- *DAQPad* ..... *6 µs to ±1 LSB*

Stability

Offset temperature coefficient
- *PCI, DAQCard, Lab-PC* ..... *±50 µV/°C*
- *DAQPad* ..... *±60 µV/°C*

Gain temperature coefficient
- *PCI, DAQCard, Lab-PC* ..... *±30 ppm/°C*
- *DAQPad* ..... *±10 ppm/°C*

Digital I/O

Number of channels ..... *24 I/O (three 8-bit ports; uses the 82C55A PPI)*

Compatibility ..... *5 V/TTL*

Digital logic levels

Level	Minimum	Maximum
Input low voltage	-0.3 V	0.8 V
Input high voltage	2.2 V	5.3 V
Output low voltage (I_{out} = 2.5 mA)	–	0.4 V
Output high voltage (I_{out} = 2.5 mA)	3.7 V	–

Handshaking ..... *2-wire, 2 ports*

Power-on state ..... *Input*

Protection ..... *-0.5 to 5.5 V powered on, ±0.5 V powered off*

Data transfers ..... *Interrupts, programmed I/O*

Timing I/O

Number of channels ..... *3 counter/timers (uses two 82C53 STCs)*

Protection ..... *-0.5 V to 5.5 V powered on, ±0.5 V powered off*

Resolution ..... *16 bits*

Compatibility ..... *5 V/TTL, counter gate and clock inputs are pulled up with 100 kΩ onboard resistors*

Base clock available ..... *2 MHz*

Base clock accuracy ..... *±50 ppm max, ±0.01%*

Maximum source frequency ..... *8 MHz*

Minimum source pulse duration ..... *60 ns*

Minimum gate pulse duration ..... *50 ns*

Digital logic levels

Level	Minimum	Maximum
Input low voltage	-0.3 V	0.8 V
Input high voltage	2.2 V	5.3 V
Output low voltage (I_{out} = 2.1 mA for PCI, Lab-PC) (I_{out} = 4 mA for DAQCard, DAQPad)	–	0.45 V
Output high voltage (I_{out} = 0.92 mA for PCI, Lab-PC) (I_{out} = 1 mA for DAQCard, DAQPad)	3.7 V	–

Data transfer ..... *Interrupts, programmed I/O*

Digital Trigger

Compatibility ..... *5 V/TTL*

Response ..... *Rising edge*

Pulse width ..... *50 ns min*

Bus Interface

PCI ..... *Master, slave*

DAQCard, Lab-PC, DAQPad ..... *Slave*

Power Requirements

+5 VDC (±5%)
- *PCI* ..... *425 mA*
- *DAQCard* ..... *150 mA, 50 mA power-down mode*
- *Lab-PC* ..... *185 mA*
- *Lab-PC-1200AI* ..... *150 mA*

+12 VDC
- *DAQPad* ..... *250 mA*

Power available at I/O connector ..... *+4.65 to +5.25 V, 400 mA fused +5 VDC, 500 mA (DAQCard)*

Physical

Dimensions
- *PCI, Lab-PC* ..... *17.5 x 10.6 cm (6.9 by 4.2 in.)*
- *DAQCard* ..... *Type II PC Card*
- *DAQPad* ..... *14.6 by 21.3 by 3.8 cm (5.8 by 8.4 by 1.5 in.)*

Weight
- *DAQPad* ..... *0.77 kg (1.7 lb)*

I/O connectors ..... *50-pin male*

Paralle port connector
- *Type* ..... *2 female 25-pin D-Sub, EPP and SPP (Centronics)*
- *Throughput* ..... *180 kbytes/s (EPP), 41 kbytes/s (Centronics)*

Environment

Operating temperature ..... *0 to 50 °C, DAQCard should not exceed 50 °C while in PCMCIA slot*

Storage temperature ..... *-20 to 70 °C*

Relative humidity ..... *5% to 90% noncondensing*

BP-1 Rechargeable Battery Pack

Output ..... *12 VDC, 3.2 Ah*

Run time with DAQPad ..... *5 h loaded at 350 mA from +5 V I/O; 11 h unloaded*

Dimensions ..... *14.6 by 21.3 by 3.8 cm (5.8 by 8.4 by 1.5 in.)*

Weight ..... *1.92 kg (4.2 lb)*

Certifications and Compliances[1]

CE Mark Compliance CE

[1] *The charger included with the BP-1 is not CE compliant.*

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