CPCI-DAS1200 & CPCI-DAS1200/JR

High-Speed CompactPCI-bus Compatible, 16-Channel Analog Input Board with Dual Analog Output Channels & 24 Digital I/O bits

Features

- 16 channel SE / 8 channel diff.
- 12-bit A/D resolution
- 330-kHz sample rate
- Burst-Mode SS&H emulation
- 1024 sample FIFO
- Dual 12-bit D/As (no D/As on /JR model)
- Three 16-bit counters
- 24-bits digital I/O
- Fully Plug-and-Play
- Fully Autocalibrating

Block Diagram
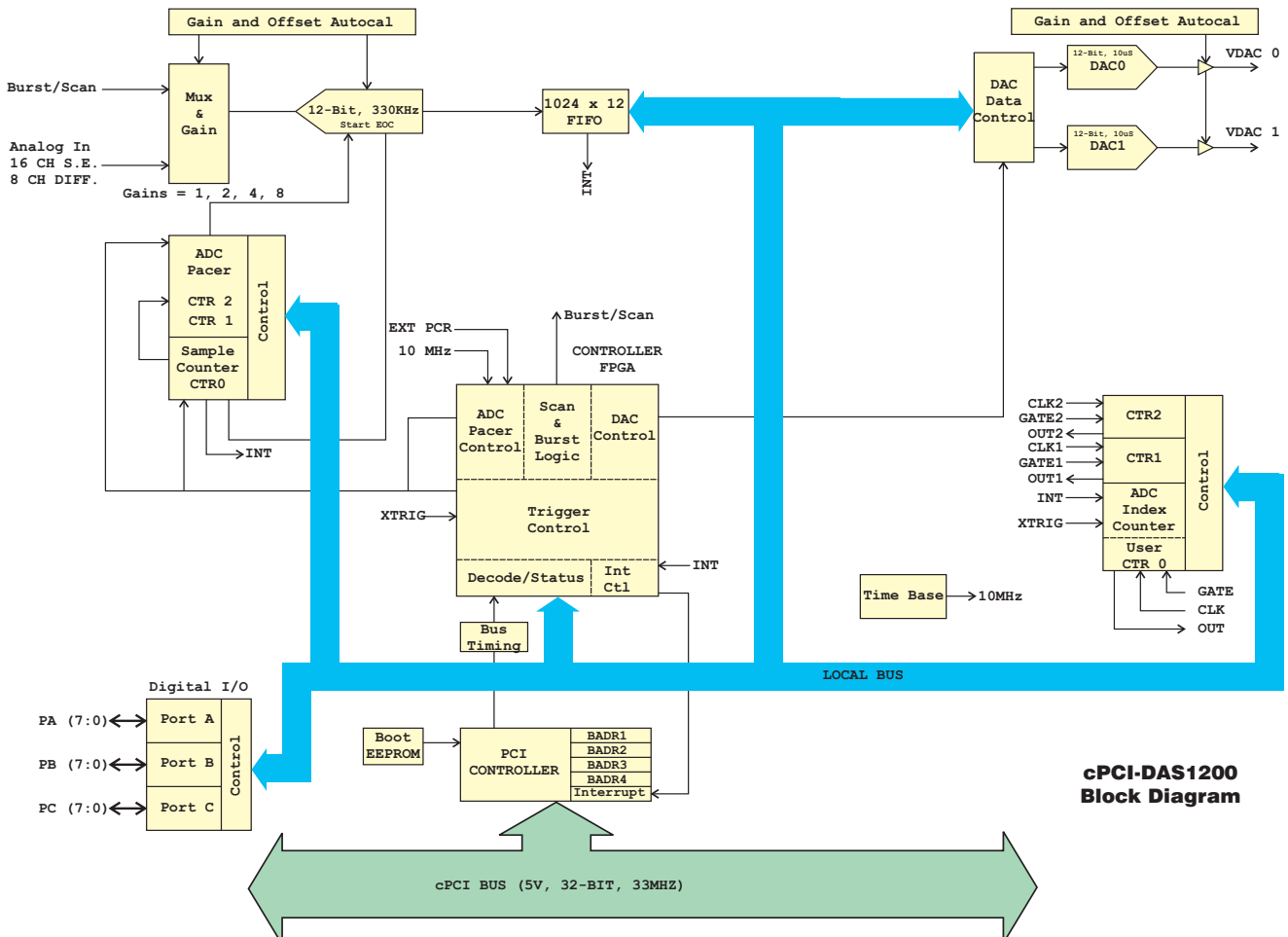
cPCI-DAS1200
Block Diagram

The CPCI-DAS1200 and CPCI-DAS1200/JR multifunction analog and digital I/O boards provide a high performance and low cost solution in CompactPCI-bus data acquisition applications. Offering 16 single-ended or 8 differential 12-bit analog inputs with sample rates up to 330 kHz, 24 bits of digital I/O, three 16-bit down counters. In addition, the CPCI-DAS1200 offers two 12-bit analog outputs. The CPCI-DAS1200/JR is identical to the CPCI-DAS1200 except that it does not provide the analog output channels.

The CPCI-DAS1200 is completely plug-and-play. There are no switches, jumpers or potentiometers on the board. All board addresses, interrupt channels etc. are set by your computer's plug-and-play software. Even calibration is performed via software by using on-board digital potentiometers and trim D/A converters. (For more details on our digital calibration techniques, please see our calibration tutorial on page 270).

Analog Inputs

The CPCI-DAS1200 provides 8 fully differential or 16 single-ended analog inputs. The input mode is software selectable, with no switches or jumpers to set. The board offers a 330 kHz maximum sample rate in single and multichannel scans at any gain setting. A 1024 sample FIFO assures data taken from the board is transferred into computer memory without the possibility of missed samples.
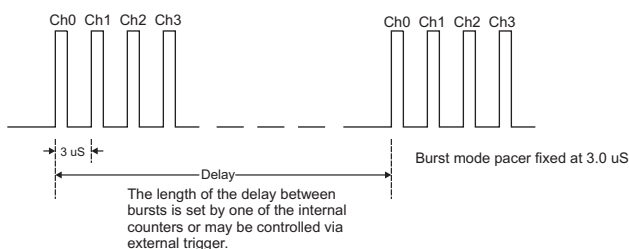
Software also selects the bipolar/unipolar input configuration as well as selecting among the input ranges. The table below details the input ranges and resolutions for the available input configurations and gains.

Bipolar		Unipolar	
Range	Resolution	Range	Resolution
±10V	4.88 mV	0-10V	2.44 mV
±5V	2.44 mV	0-5V	1.22 mV
±2.5V	1.22 mV	0-2.5V	0.61 mV
±1.25V	0.61 mV	0-1.25V	305 uV

Burst Mode

Channel-to-channel skew is the result of multiplexing the A/D inputs and is defined as the time between consecutive samples. For example, if four channels are sampled at a rate of 1 kHz per channel, the channel skew is 250 μs (1 ms/4).

Burst mode minimizes channel-to-channel skew by clocking the A/D at the maximum rate between successive channels. For example, at the 1-ms pulse channel 0 is sampled, channel 1 is sampled 3 μs later, channel 2, 3 μs after that, and channel 3, 3 μs after that. Then no samples are taken until the next 1-ms pulse, when channel 0 is sampled again. In this mode the rate for all channels is 1 kHz, but the channel-to-channel skew (delay) is now 3 μs, or 9 μs total. The minimum burst mode skew/delay on the CPCI-DAS1200 is 3 us.

Ch0 Ch1 Ch2 Ch3 ... Ch0 Ch1 Ch2 Ch3

→ 3 uS ←

Delay

The length of the delay between bursts is set by one of the internal counters or may be controlled via external trigger.

Burst mode pacer fixed at 3.0 uS

Burst Mode Timing Diagram

Analog Outputs

The CPCI-DAS1200 provides two channels of 12-bit analog output. Software selectable output ranges of 0-10V, 0-5V, ±10V and ±5V are provided, and channels may be set at different ranges. The D/A outputs provide rated accuracy to ±5 mA, are short circuit protected (25 mA limit) and are cleared to 0 volts on power up or reset. The analog outputs are controlled via programmed I/O commands.

Parallel Digital I/O

The CPCI-DAS1200 and CPCI-DAS1200/JR provide 24 bits of parallel, digital I/O in the form of two 8-bit ports, and two 4-bit ports. This digital capability is based on an on-board 82C55 PIA chip, which allows each of the ports to be set independently as input or output. On power up or reset, the ports default to the input state (high impedance).

Counter/Timer I/O

The CPCI-DAS1200 and CPCI-DAS1200/JR provide three 16-bit down counters. The counters are based on an 82C54 chip, which provides clock, gate and output connections for each counter. The CTR4 clock may be connected to the on-board 10 MHz xtal oscillator or may be left uncommitted for user input.

Installed in any CompactPCI-bus compatible personal computer the CPCI-DAS1200 turns your personal computer into a high speed data acquisition and control station suitable for laboratory data collection, instrumentation, production test, or industrial monitoring.

All CPCI-DAS1200 boards come complete with ComputerBoards' powerful *Insta*Cal™ software package. *Insta*Cal is a complete installation, calibration and test program for ComputerBoards data acquisition and control boards. Complete with extensive error checking, *Insta*Cal guides you through installation and setup of your data acquisition board and creates the board configuration file for use by your program or application software package. *Insta*Cal is described in detail within the software section of this website.

The CPCI-DAS1200 boards are fully supported by ComputerBoards' powerful Universal Library. Universal Library is a complete set of I/O libraries and drivers for all of our boards, for all Windows based languages. When using the Universal Library you can switch boards or even programming languages and the syntax remains constant. Want to change programming languages? The Universal Library requires no relearning. For details on Universal Library, please refer to the software section of this website.

The CPCI-DAS1200 boards are fully supported by a wide variety of applications software packages including SoftWIRE™, DAS-Wizard™, (and DAS-Wizard Pro™), HP VEE®, HP VEE Lab and Lab-VIEW™. For further details on these, as well as a variety of other software packages, please refer to the software section of this website.

SoftWIRE for Visual Basic combines the simplicity of graphical programming with the power and flexibility of programming in VB!

Analog input section

A/D converter type	ADS7800
Resolution	12 bits
Programmable ranges	±10V, ±5V, ±2.5V, ±1.25V,
	0 - 10V, 0 - 5V, 0 - 2.5V, 0 - 1.25V
A/D pacing	
Programmable:	internal counter or external source
	(A/D External Pacer) or sw polled
Burstmode	Software selectable option, rate = 3μs
A/D Trigger sources	External digital (A/D External Trigger)
A/D Triggering Modes	
Digital:	Software enabled, rising edge
Pre-trigger:	Unlimited pre- and post-trigger
	samples. Total samples must be > 512.
Data transfer mode	From 1024 sample FIFO via REPINSW,
	interrupt or software polled
Polarity	Unipolar/Bipolar, software selectable
Number of channels	8 diff. or 16 SE, software selectable
A/D conversion time	3μs
Throughput	330 kHz min
Input settling time	3.0 uS max (to 0.01% at any gain)
Relative Accuracy	±1.5 LSB
Differential Linearity error	±0.75 LSB
Integral Linearity error	±0.5 LSB typ, ±1.5 LSB max
Gain Error	± 0.02% of reading Max
No missing codes	12 bits (guaranteed)
Gain drift (A/D specs)	±6ppm/°C
Zero drift (A/D specs)	±1ppm/°C
Common Mode Range	±10V
CMRR @ 60Hz	70dB
Input leakage current	200nA
Input impedance	10 megohms min
Maximum input voltage	±35V

Analog Output:

D/A type	AD7847AR
Resolution	12 bits
Number of channels	2
Output Ranges	±10V, ±5V, 0-5V, 0-10V. Each
	channel independently programmable.
D/A pacing	Software
Data transfer	Programmed I/O.
Offset error	±600μV max, all ranges (calibrated)
Gain error	±0.02% FSR max (calibrated)
Differential nonlinearity	±1LSB max
Integral nonlinearity	±1LSB max
Monotonicity	12 bits
D/A Gain drift	±2 ppm/°C max
D/A Bipolar offset drift	±5 ppm/°C max
D/A Unipolar offset drift	±5 ppm/°C max
Throughput	PC dependent
Settling time	4μs typ (to .01% of 10V step)
Slew Rate	7V/μS
Current Drive	±5 mA min
Output short-circuit duration	25 mA indefinite
Output Coupling	DC
Amp Output Impedance	0.1 Ohms max
Miscellaneous	DAC's cleared to 0 volts, ±200mV
	on power up or reset

Digital Input / Output

Digital Type	82C55A
Configuration	2 banks of 8, 2 banks of 4,
	programmable by bank as input or output
Number of channels	24 I/O
Logic Levels	
Output High	3.0 volts @ -2.5mA min
Output Low	0.4 volts @ 2.5 mA max
Input High	2.0 volts min, Vcc+0.5 volts abs max
Input Low	0.8 volts max, GND-0.5 volts abs min
Power-up / reset state	Input mode (high impedance)
Interrupts	INTA# - mapped to IRQn via cPCI BIOS
Interrupt enable	Programmable
Interrupt sources	Residual counter, End-of-channel-scan,
	AD-FIFO-not-empty, AD-FIFO-half-full

Counter section

Configuration Two 82C54s with three 16-bit down counters per 82C54

82C54A:

Counter 0 - ADC residual sample counter
Source:	ADC Clock
Gate:	Internal programmable sourc.
Output:	End-of-Acquisition interrupt

Counter 1 - ADC Pacer Lower Divider
Source:	10 MHz oscillator
Gate:	Tied to Counter 2 gate, programmable source
Output:	Chained to Counter 2 Clock.

Counter 2 - ADC Pacer Upper Divider
Source:	Counter 1 Output
Gate:	Tied to Counter 1 gate, programmable source.
Output:	ADC Pacer clock (if software selected),
	available at user connector

82C54B:

Counter 0 - Pretrigger Mode
Source:	ADC Clock.
Gate:	External trigger
Output:	End-of-Acquisition interrupt.

Counter 0 - User Counter 4 (when in non-Pretrigger Mode)
Source:	User input at 100pin connector (CLK4) or
	internal 10MHz (software selectable)
Gate:	User input at 100pin connector (GATE4)
Output:	Available at 100pin connector (OUT4)

Counter 1 - User Counter 5
Source:	User input at 100pin connector (CLK5)
Gate:	User input at 100pin connector (GATE5)
Output:	Available at 100pin connector (OUT5)

Counter 2 - User Counter 6
Source:	User input at 100pin connector (CLK6)
Gate:	User input at 100pin connector (GATE6)
Output:	Available at 100pin connector (OUT6)

Clock input frequency	10Mhz max
High pulse width (clk input)	30ns min
Low pulse width (clk input)	50ns min
Gate width high or low	50ns min
Input low voltage	0.8V max
Input high voltage	2.0V min
Output low voltage	0.4V max
Output high voltage	3.0V min

Power consumption

+5V Operating	0.8A typical, 1.0A max

Environmental

Operating temp range	0 to 70°C
Storage temp range	-40 to 100°C
Humidity	0 to 90% non-condensing

I/O Connector & Cables

All I/O signals are brought through a 100-pin high-density connector. The (optional) C100FF-XX series cable splits the 100 pins into two separate 50-pin cables. The first 50-pin cable contains the signals from pins 1-50, while the second carries pins 51-100 and keeps the analog signals in one cable and the digital in another. This configuration minimizes noise in the analog signal lines and greatly simplifies field wiring as well as connections to external signal conditioning products.

Signal	Pin		Pin	Signal
Analog Ground	1	● ●	51	Digital A0
Analog Input Ch 0 High	2	● ●	52	Digital A1
Analog Input Ch 0 Low / 8 High	3	● ●	53	Digital A2
Analog Input Ch 1 High	4	● ●	54	Digital A3
Analog Input Ch 1 Low / 9 High	5	● ●	55	Digital A4
Analog Input Ch 2 High	6	● ●	56	Digital A5
Analog Input Ch 2 Low / 10 High	7	● ●	57	Digital A6
Analog Input Ch 3 High	8	● ●	58	Digital A7
Analog Input Ch 3 Low / 11 High	9	● ●	59	Digital B0
Analog Input Ch 4 High	10	● ●	60	Digital B1
Analog Input Ch 4 Low / 12 High	11	● ●	61	Digital B2
Analog Input Ch 5 High	12	● ●	62	Digital B3
Analog Input Ch 5 Low / 13 High	13	● ●	63	Digital B4
Analog Input Ch 6High	14	● ●	64	Digital B5
Analog Input Ch 6 Low / 14 High	15	● ●	65	Digital B6
Analog Input Ch 7 High	16	● ●	66	Digital B7
Analog Input Ch 7 Low / 15 High	17	● ●	67	Digital C0
Analog Ground	18	● ●	68	Digital C1
NC	19	● ●	69	Digital C2
NC	20	● ●	70	Digital C3
NC	21	● ●	71	Digital C4
NC	22	● ●	72	Digital C5
NC	23	● ●	73	Digital C6
NC	24	● ●	74	Digital C7
NC	25	● ●	75	NC
NC	26	● ●	76	NC
NC	27	● ●	77	10 Mhz OUT
NC	28	● ●	78	NC
NC	29	● ●	79	NC
NC	30	● ●	80	CLK 6
NC	31	● ●	81	GATE 6
NC	32	● ●	82	OUT 6
NC	33	● ●	83	NC
NC	34	● ●	84	NC
D/A GND 0	35	● ●	85	CLK 5
D/A OUT 0	36	● ●	86	GATE 5
D/A GND 1	37	● ●	87	OUT 5
D/A OUT 1	38	● ●	88	NC
CLK 4	39	● ●	89	PC Ground
GATE 4	40	● ●	90	PC +12V
OUT 4	41	● ●	91	PC Ground
A/D External Pacer	42	● ●	92	PC -12V
NC	43	● ●	93	NC
NC	44	● ●	94	NC
A/D External Trigger	45	● ●	95	A/D Internal Pacer Output
NC	46	● ●	96	NC
NC	47	● ●	97	NC
PC +5V	48	● ●	98	NC
NC	49	● ●	99	NC
PC Ground	50	● ●	100	PC Ground

Auto-Calibration / Self-Calibration

In keeping with general plug-and-play standards, the CPCI-DAS1200 boards have no switches, jumpers or potentiometers. *Auto-calibration* is performed with digital potentiometers and/or trim D/A converters. Unlike some boards that use software lookup tables for post-acquisition error correction, the PCI-DAS1200 boards' data is accurate when written into your computer's memory.

The calibration factors that control the digital trim components are stored in EEROM on the board. You can remove the board from one computer, install it in another, and it will still provide calibrated data.

In addition to being auto-calibrating, the CPCI-DAS1200 boards are also self-calibrating. Standard calibration techniques require a channel to be calibrated with zero volts input (offset calibration) and with a known input voltage (gain calibration). The CPCI-DAS1200 provides on-board circuitry that will short the inputs allowing offset calibration, and then connect the inputs to an ultra-stable, on-board voltage reference for the gain calibration. A complete CPCI-DAS1200 calibration is as simple as issuing a single software command.

Signal Conditioning & Accessories

Analog Signal Conditioning

ISO-RACK16/P[*]	16-channel ISO-5B module rack connects an ISO-5B module to each analog input channel.
ISO-DA02/P[*]	2-channel ISO-5B module rack connects a ISO-5B module to each analog output channel.

Digital Signal Conditioning (requires DADP-5037 adaptor)

CIO-ERB24[*]	24 channel relay rack with 6 Amp, Form C relays
CIO-SERB24[*]	24 channel relay rack with 10 Amp, socketed and field replaceable Form C relays.
SSR-RACK24[*]	24 channel solid state I/O module rack.

BNC Connector Interface Boxes

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BNC-16SE	BNC interface box for 16 channel single-ended mode. Brings each channel out to a BNC connector.
BNC-16DI	BNC interface box for 8 channel differential mode. Each channel has a separate + and - BNC connector.

Screw Terminal Accessory Boards and Boxes

SCB-Series & CIO-MINI-Series
The main 100-pin connector is compatible with C100FF-03 series cables and the SCB-50 screw connection box (1 required for all 100 connections) or CIO-MINI50 screw terminal board (2 required).

[*] Items denoted with an asterisk are available with detachable screw terminals. These terminals simplify field wiring and board replacements. To specify detachable screw terminals simply add a /DST suffix to the part number (e.g. CIO-MINI50/DST or CIO-ERB24/DST).
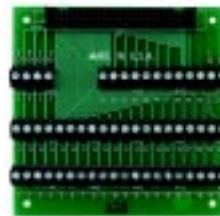
Ordering Guide

CPCI-DAS1200	16-channel, 330kHz, 12-bit A/D, D/A & digital I/O board for cPCI-bus computers.
CPCI-DAS1200/JR	16-channel, 330kHz, 12-bit A/D & digital I/O board for cPCI-bus computers.