CPCI-DAS64/Mx/16 & CPCI-DAS64/Mx/16/JR family
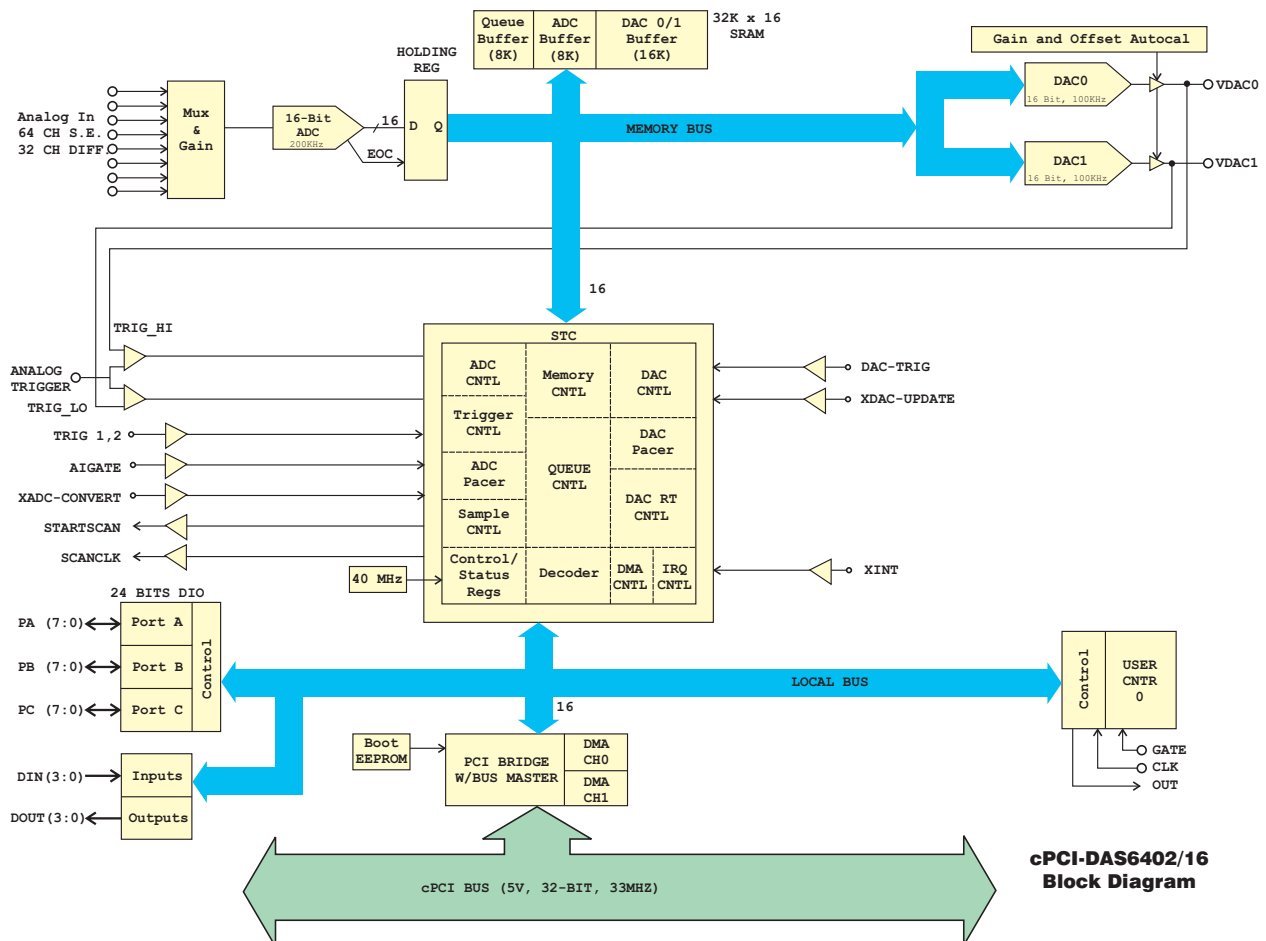
Ultra High-Speed CompactPCI-bus Compatible, 16-bit, 64-Channel Analog Input Board with Dual Analog Output Channels & 32 Digital I/O bits

Block Diagram

cPCI-DAS6402/16
Block Diagram

Functional Description

The CPCI-DAS64/Mx/16 family of analog and digital I/O boards offer an incredible combination of high speed, channel count and resolution on a single CompactPCI-bus data acquisition board. Offering 64 single-ended or 32 differential 16-bit analog inputs with sample rates up to 3 MHz (single-channel, up to 1.5 MHz multi-channel), two 16-bit analog outputs (no outputs on /JR version), 32 bits of digital I/O and one 16-bit down counter. The board offers a variety of analog and digital trigger modes with software selectable trigger levels and direction.

At the heart of the board is ComputerBoards' powerful System Timing Controller (STC) chip. The STC chip controls all A/D sampling and D/A update rates as well as controlling the 8K A/D FIFO, the 8K gain/channel queue and the 16K D/A FIFO. This functionality is based on the STC chip's use of an on-board 32K x 16 SRAM. The STC chip assigns functions to various parts of the SRAM (e.g. A/D FIFO) and then provides full speed control and arbitration among the various functions using the various sections of the SRAM buffer.

The STC allows simultaneous full speed A/D sampling, D/A updating and gain/channel queue sequencing (with variable intersample timing if desired). *The STC chip performs these functions up to 5 MHz, and is available as an OEM component for use in your own designs.* The board provides bus-mastering and scatter-gather functionality to assure the desired system timing is maintained.

The CPCI-DAS64/Mx/16 family 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 computers plug-and-play software. Even calibration is performed via software by using on-board trim D/A converters. (For more details on our digital calibration techniques, please see our calibration tutorial on page 268).

Analog Inputs

The CPCI-DAS64/Mx/16 provides 32 fully differential or 64 single-ended analog inputs. The input mode is software selectable, with no switches or jumpers to set. The CPCI-DAS64/M3/16 board offers a 3 MHz maximum sample rate, while the /M2/16 and /M1/16 offer 2 MHz and 1 MHz sample rates. The boards offer full speed acquisition in single channel scans, and will perform full accuracy multichannel scans at 1.5 MHz regardless of gain setting. An 8-k sample gain/channel queue is available making long, complex sample sequencing simple. An 8-k sample FIFO combine with Bus-Master DMA and scatter-gather to assure data taken from the board is transferred into computer memory without the possibility of missed samples.

The table below details the input ranges and resolutions for the available input configurations and gains.

Bipolar Range	Resolution	Unipolar Range	Resolution
±5V	153 uV	0 - 10V	153 uV
±2.5V	76.3 uV	0 - 5V	76.3 uV
±1.25V	38.1 uV	0-2.5V	38.1 uV
±0.625V	19.1 uV	0-1.25V	19.1 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. Burst mode minimizes channel-to-channel skew by clocking the A/D at a high rate between successive samples within a scan, then waiting a specified time before starting an new scan. The CPCI-DAS64/Mx/16 provides burst mode with a 667 nS (1 uS on M1) minimum sample skew/delay.

Analog Outputs *(there are no analog outputs on the/JR version)*

The CPCI-DAS64/Mx/16 boards provide two high speed 16-bit analog outputs. The outputs are updated via on-board 16 K FIFO and provide a 100 kHz max. update rate. Repetitive D/A-based waveforms can be stored in on-board memory and generated without requiring ongoing PCI bus transfers. Software selectable ranges of 0-10V, 0-5V, ±10V and ±5V are provided, and channels may be set at different ranges. The outputs provide rated accuracy to ±20 mA, are short circuit protected (35 mA limit) and are cleared to 0 volts on power up or reset. The board supports simultaneous full speed operation of both the A/D and D/A.

Parallel Digital I/O

The CPCI-DAS64/Mx/16 provides 32 bits of digital I/O. An 82C55 chip provides 24 bits of CMOS compatible I/O at the board's 40-pin auxiliary connector. Four LSTTL compatible digital inputs and four outputs are also provided on the main 100-pin connector. On power up or reset, all I/O ports default to the input state (high impedance).

Counter/Timer I/O

The CPCI-DAS64/Mx/16 provides one 16-bit down counter (1/3 of an 82C54). The counter provides clock, gate and output connections at the user I/O connector.

Installed in any CompactPCI-bus compatible personal computer the CPCI-DAS64/Mx/16 turns your personal computer into a ultra high-speed data acquisition and control station.

Software

All CPCI-DAS64/Mx/16 boards come complete with ComputerBoards' powerful *InstaCal*™ 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-DAS64/Mx/16 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, in all Windows based languages. When using the Universal Library you can switch boards or even programming languages and the syntax remains constant. For details on Universal Library, please refer to the software section of this website.

The CPCI-DAS-64/Mx/16 boards are fully supported by a wide variety of applications software packages including SoftWIRE™, DAS-Wizard™, (and DAS-Wizard Pro™), HPVEE®, HPVEELab and LabVIEW™. For further details on these, as well as a variety of other software packages, please refer to the software section provided earlier in this website.

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

CPCI-DAS64/M#/16 Specifications

Analog input section
Resolution 16-bit
Number of channels 32 diff/64 SE, Software selectable

A/D Specification	CPCI-DAS 64/M3/16	CPCI-DAS 64/M2/16	CPCI-DAS 64/M1/16
A/D conversion time	333 nS	500 nS	1 uS
Single channel, single input range	3 MHz	2 MHz	1 MHz
Single channel, multiple input gains	500 kHz	500 kHz	500 kHz
Multiple channel, single input range	1.5 MHz	1.5 MHz	1 MHz
Multiple channel, multiple input gains, all samples in the same Unipolar/ Bipolar mode	500 kHz	500 kHz	500 kHz
Multiple channel, switching gains, switching Bipolar/Unipolar mode	500 kHz	500 kHz	500 kHz
Multiple channel, switching Unipolar/ Bipolar mode, single input gain	750 kHz	750 kHz	750 kHz

Data transfer modes   via 8192 sample FIFO and Bus master DMA, interrupt, or software polled
Programmable ranges   ±5V, ±2.5V, ±1.25V, ±0.625, 0 - 10V, 0 - 5V, 0 - 2.5V, 0 - 1.25V

A/D pacing   Programmable: internal counter or external source or software polled
Channel/gain queue   8192 samples.
Burstmode timing   Software selectable option, skew = 667 nS (1 uS on the /M1 board)

A/D Trigger sources   External: analog or digital
A/D Triggering Modes

Digital: SW configurable for Edge (triggered) or level-activated (gated). Programmable polarity (rising/falling edge, high/low gate).

Analog: SW configurable for above/below reference, in/out window and hysteresis. Programmable polarity (rising/falling edge trigger, high/low gate). Trigger levels set by DAC0 and/or DAC1. (Analog triggering is not available on the /JR version)

Pre-trigger: Unlimited pre- and post-trigger sample sizes. Compatible with Digital and Analog trigger modes

Diff. Linearity error   ±1 LSB max
Integral Linearity error   ±1.5 LSB
Gain Error   22.5 ppm typ, 45 max

No missing codes   16- bits guaranteed
Gain drift / Zero drift   ±45ppm/°C / ±45ppm/°C
Input leakage current   2.3 nA (25°C)
Input impedance 10^{11} ohms, typ
Maximum input voltage   ±35 V

Counter section
Configuration   Single 16-bit down counters1/3 82C54
User connections   Clock in, Gate and Output
Clock input frequency   10 MHz max
Min clock pulse width   30 nS high, 50 nS low
Gate width high or low   50 nS min
Input low / high voltage   0.8V max / 2.0V min
Output low / high voltage   0.4V max / 3.0V min

Analog Output:
Resolution   16-bits
Number of channels   2 (not available on /JR version)
Voltage Ranges   ±10V, ±5V, 0-5V, 0-10V. Each channel independently programmable
D/A update rate   100 kHz on each D/A operating in single channel or simultaneous update mode
Data transfer modes   via 16384 sample FIFO and Bus Master DMA or through programmed I/O.
Arbitrary waveform mode   Supports repetitive waveforms to 16 Ksample
D/A pacing   Internal or external clock or software paced
D/A trigger modes   Software or external gate.

Offset error   ±100uV max, all ranges
Gain error   ±30.5ppm max
Differential nonlinearity   ±1LSB max
Integral nonlinearity   ±1LSB max
Monotonicity   16-bits at 25 °C
D/A Gain drift   ±15 ppm/°C max
D/A Bipolar offset drift   ±5 ppm/°C max
D/A Unipolar offset drift   ±3 ppm/°C max

Throughput   100 kHz, 2 channels simultaneous.
Settling time (20 V step to .0008%)   13 μs max
Settling time (10 V step to .0008%)   6μs typ
Slew Rate   10V Ranges   10.7 V/uS
   5V Ranges   10.7 V/uS

Current Drive   ±5 mA min
Short-circuit current   ±35 mA indefinite
Output Coupling / impedance   DC / 0.1 ohms max
Miscellaneous   Power up/reset, all DAC's set to 0 volts

Digital Input / Output
Digital Bits   32
Configuration   24-bit, 82C55 at Aux 40-pin connector 4 dedicated input & 4 dedicated output bits on 100-pin main connector

82C55 Specifications
Configuration   2 banks of 8, 2 banks of 4, programmable by bank as input or output
Default/Reset State   Input, High Impedance
Output High   2.4 volts @ -2.5 mA min
Output Low   0.5 volts @ 2.5 mA min
Input High   2.0 volts min, 7 volts absolute max
Input Low   0.8 volts max, -0.5 volts absolute min

Dedicated I/O bits (4 input, 4 output)
Input / Output device: 74LS175
Default/Reset State   All 4 outputs to logic low
Output High   2.4 volts @ -0.4 mA min
Output Low   0.5 volts @ 8.0 mA min
Input High   2.0 volts min, 7 volts absolute max
Input Low   0.8 volts max, -0.5 volts absolute min

Interrupts   INTA# - mapped to IRQn via cPCI BIOS at boot-time
Interrupt enable   Software programmable
Interrupt sources   External (rising TTL edge event) or a variety of internal FIFO status sources

Power consumption
+5V Operating   3.0 A typical, 3.7 A max

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

Digital Signal Conditioning (requires C40-37F-2 or BP40-37)

CIO-ERB08[*]   8 channel relay rack with 6 Amp, Form C relays
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-RACK08[*]   8 channel solid state I/O module rack.
SSR-RACK24[*]   24 channel solid state I/O module rack.

BNC Connector Interface Boxes

BNC-16SE   BNC interface box for single-ended mode. Four are required to connect all 64 channels.
BNC-16DI   BNC interface box for differential mode. Four are required to connect to all 32 channels.

Screw Terminal Accessory Boards and Boxes

SCB-Series & CIO-MINI series
The main 100-pin connector is compatible with the C100HD-03 cable and the SCB-50 (1 required) or CIO-MINI50 (2 required). The C100HDS-03 series shielded cable provides maximum noise immunity and is compatible with the SCB-100 screw terminal interface box. The auxilliary digital connector is compatible with the CIO-MINI40 using the C40FF-2 cable.
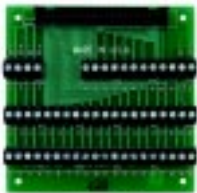
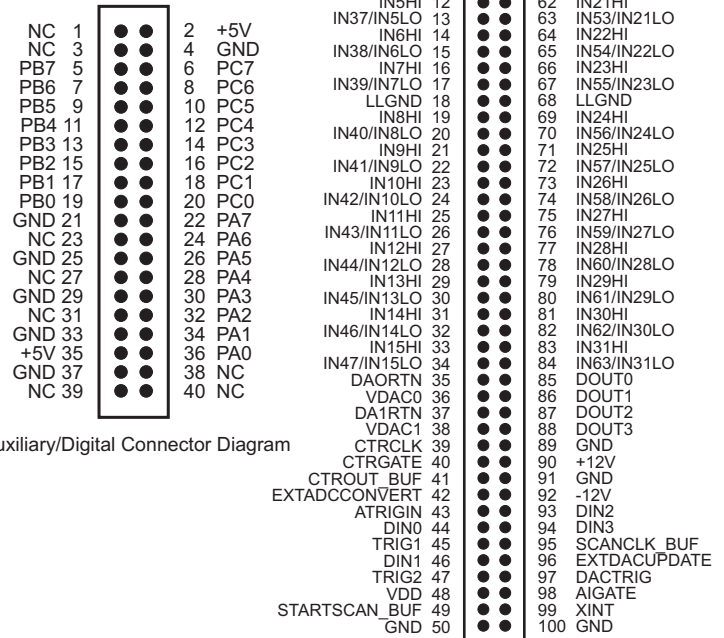[*] Items denoted with an asterisk are available with detachable screw terminals.

In keeping with general plug-and-play standards, the CPCI-DAS64/Mx/16 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 CPCI-DAS64/Mx/16 board's data is accurate when written into your computer's memory. The calibration factors that control the digital trim components are stored in EEPROM on the board. You can remove the board from one computer, install it in another, and it will still provide calibrated data.

The CPCI-DAS64/Mx/16 board is also self calibrating. The CPCI-DAS64/Mx/16 provides on-board circuitry that grounds the inputs for offset calibration, and connects the inputs to an ultra-stable, on-board voltage reference for gain calibration. A complete CPCI-DAS64/Mx/16 calibration is as simple as issuing a single software command.

All analog, triggering and counter/timer connections are through a 100-pin high-density connector. The C100HD50-03 series cable splits the 100 pins into separate 50-pin cables. The first 50-pin cable contains the signals from pins 1-50, while the second carries pins 51-100. These 50-pin connectors are compatible with the SCB-50, CIO-MINI50, and BNC-series of interconnects. To minimize noise pickup, use the C100HDS-03 series shielded cable along with the SCB-100 shileded interconnection box. The 24-bits of high current digital I/O are available on an 40 pin header. From the 40-pin header the user connect to the optional BP40-37 which brings these pins out to the standard 37-pin connector and installs in any unused slot. This 37-pin connector is then pin compatible with all DIO24 series boards (and all of our 8 and 24-bit digital signal conditioning boards). Alternatively, the 40-pin header may be brought out directly with the C40FF-2 cable and connected directly to a CIO-MINI40 screw terminal board.

LLGND	1		51	LLGND
IN0HI	2		52	IN16HI
IN32/IN0LO	3		53	IN48/IN16LO
IN1HI	4		54	IN17HI
IN33/IN1LO	5		55	IN49/IN17LO
IN2HI	6		56	IN18HI
IN34/IN2LO	7		57	IN50/IN18LO
IN3HI	8		58	IN19HI
IN35/IN3LO	9		59	IN51/IN19LO
IN4HI	10		60	IN20HI
IN36/IN4LO	11		61	IN52/IN20LO
IN5HI	12		62	IN21HI
IN37/IN5LO	13		63	IN53/IN21LO
IN6HI	14		64	IN22HI
IN38/IN6LO	15		65	IN54/IN22LO
IN7HI	16		66	IN23HI
IN39/IN7LO	17		67	IN55/IN23LO
LLGND	18		68	LLGND
IN8HI	19		69	IN24HI
IN40/IN8LO	20		70	IN56/IN24LO
IN9HI	21		71	IN25HI
IN41/IN9LO	22		72	IN57/IN25LO
IN10HI	23		73	IN26HI
IN42/IN10LO	24		74	IN58/IN26LO
IN11HI	25		75	IN27HI
IN43/IN11LO	26		76	IN59/IN27LO
IN12HI	27		77	IN28HI
IN44/IN12LO	28		78	IN60/IN28LO
IN13HI	29		79	IN29HI
IN45/IN13LO	30		80	IN61/IN29LO
IN14HI	31		81	IN30HI
IN46/IN14LO	32		82	IN62/IN30LO
IN15HI	33		83	IN31HI
IN47/IN15LO	34		84	IN63/IN31LO
DAORTN	35		85	DOUT0
VDAC0	36		86	DOUT1
DA1RTN	37		87	DOUT2
VDAC1	38		88	DOUT3
CTRCLK	39		89	GND
CTRGATE	40		90	+12V
CTROUT_BUF	41		91	GND
EXTADCCONVERT	42		92	-12V
ATRIGIN	43		93	DIN2
DIN0	44		94	DIN3
TRIG1	45		95	SCANCLK_BUF
DIN1	46		96	EXTDACUPDATE
TRIG2	47		97	DACTRIG
VDD	48		98	AIGATE
STARTSCAN_BUF	49		99	XINT
GND	50		100	GND

Auxiliary/Digital Connector Diagram

NC	1		2	+5V
NC	3		4	GND
PB7	5		6	PC7
PB6	7		8	PC6
PB5	9		10	PC5
PB4	11		12	PC4
PB3	13		14	PC3
PB2	15		16	PC2
PB1	17		18	PC1
PB0	19		20	PC0
GND	21		22	PA7
NC	23		24	PA6
GND	25		26	PA5
NC	27		28	PA4
GND	29		30	PA3
NC	31		32	PA2
GND	33		34	PA1
+5V	35		36	PA0
GND	37		38	NC
NC	39		40	NC

CPCI-DAS64/M3/16   64-channel, 3MHz, 16-bit analog & digital I/O board for PCI-bus computers.
CPCI-DAS64/M3/16/JR   64-channel, 3MHz, 16-bit A/D & digital I/O board for PCI-bus computers.
CPCI-DAS64/M2/16   64-channel, 2MHz, 16-bit analog & digital I/O board for PCI-bus computers.
CPCI-DAS64/M2/16/JR   64-channel, 2MHz, 16-bit A/D & digital I/O board for PCI-bus computers.
CPCI-DAS64/M1/16   64-channel, 1MHz, 16-bit analog & digital I/O board for PCI-bus computers.
CPCI-DAS64/M1/16/JR   64-channel, 1MHz, 16-bit A/D & digital I/O board for PCI-bus computers.