16 Channel Simultaneous High Speed Digitizer ACQ216CPCI

ACQ216CPCI Digitizer Board Specification

16 Channels Simultaneous Input 16 Mega Sample per Second per Channel
25, 50 MSPS 14-bit Flash Converter options, sampling rate to 50MSPS
6U CompactPCI Data Acquisition Board
Flexible Digital I/O Subsystem, PXI backplane clock and trigger routing
Support for multiple board synchronisation
Intel XScale Microprocessor, 1 GByte of sample memory
PCI 2.2 Interface, Target and Initiator, 64bit, 66MHz DMA upload,
Able to operate as CompactPCI peripheral, system board and standalone.
MotherBoard / Mezzanine Design for maximum signal conditioning flexibility plus Rear Transition Module RTM support for additional options.
Dual channel Gigabit Ethernet, PICMG 2.16 Compatible

Description

The ACQ216CPCI board represents the first in a new generation of intelligent high performance Analog Data Acquisition products from D−TACQ Solutions Ltd. The board samples 16 input channels simultaneously with 14 bit resolution at speeds up to 50 MSPS (mega-samples per second) and offers excellent AC performance.

Hardware Architecture

The design uses a leading edge Xilinx Virtex II Pro FPGA to provide the maximum possible bandwidth from ADC to memory and to implement DSP co-processing features for the XScale CPU. This board offers the advanced features of an intelligent board including programmable triggering, flexible clocking and a host of data management functions. Dedicated, high speed Digital I/O allows multiple boards to be synchronized together for high channel count applications. The on board intelligence frees the host processor from complex real time design issues, allowing industry standard operating systems to be used in high performance applications. The board can be configured to acquire data into a large on-board data store of up to 1 GByte or to stream the data to a PCI device. Reduced rate streaming via onboard gigabit Ethernet is an option, as is operation in a self hosted standalone mode.

Analog Front End Customized by Mezzanine.

For a complete data acquisition solution the ACQ216CPCI is coupled to a signal-conditioning Mezzanine board. D−TACQ offers a range of Mezzanines for various input ranges and anti-aliasing options. Additional Mezzanines can be designed and supplied cost-effectively in small quantities.

Software System Support

As a networked appliance ACQ216CPCI may be controlled via standard TCP/IP networking via a published interface. For conventional pci backplane control, D−TACQ supports the Linux Operating System and produces full driver support with source code under GPL. Either control interface provides easy to use, high level ascii commands, ideal for scripting and high performance binary data transfer. The onboard embedded system runs Linux 2.6 tuned for the ARMV5 architecture, and the kernel source code is also available to customers on request. The open source embedded system in combination with the high bandwidth data path offers enormous scope for application customisation.

Support for FPGA DSP functionality available subject to support contract.

Example System Configuration

1U slim box with 2 CPCI slots, conventional 2 x ACQ216CPCI in networkl board mode, 32 Channels, 512 MSPS total.

Part Number	Channels	Max Sample Rates			
ACQ216CPCI-16-50	16	16c x 16M	12c x 22M	8c x 25M	4c x 50M
ACQ216CPCI-08-50T	8			8c x 33M	4c x 50M
ACQ216CPCI-04-80	4				4c x 65M

Full Order Code: ACQ216CPCI-CC-SP-Mx-RTMy
CC- channel code (16/8/4), SP speed code (25/50/80)
Mx – mezzanine (see options below) RTMy – RTM (see options below).

Special builds available on request.
M :MSPS/channel
c : channels

Analog Input Subsystem

Analog Input Performance (Typical)

Number Of Channels	16/8/4	SINAD	74 dB*
Throughput	See Ordering Information	SFDR	85 dBc*
Resolution	14 bits	SNR	75 dB*
Coupling	DC, Differential Input – Mezzanine defines External Interface	THD	>-80 dB
		Full Power BW	20 MHz
		Small Signal BW	40 MHz
Sampling	Simultaneous	Crosstalk (3 dB)	<88 dB **
Input Impedance	500R – Mezzanine defines External Impedance	CMRR	>60dB ***
		Temperature Stability	TBA
Voltage Range	±2.5V – Mezzanine defines External Voltage Range		
Offset Error	0.01%	* 5MHz FS input signal.	
Gain Error	1%, reduce by numeric comp	** 1MHz FS input signal.	
INL	2 lsb	*** 10kHz FS input signal.	
DNL	1 lsb		

Available Mezzanine types:

M1: Front panel 16 x dual pin Lemo connections,
Opto isolated or LVDS single pin Lemo clock and trigger.
Fixed input voltage, ±2.5V, overvoltage protected.

M2: As M1 + Soft select input voltage ranges, ±10V/±6V/±4V/±2.5V, overvoltage protected.

M5: As M1 + 8 Soft Select input gain ranges

M6: As M2 but with SMA connectors rather than dual pin Lemo for signal.

M7: As M2 but with S68 connector rather than dual pin Lemo for signal.

Available RTM types:

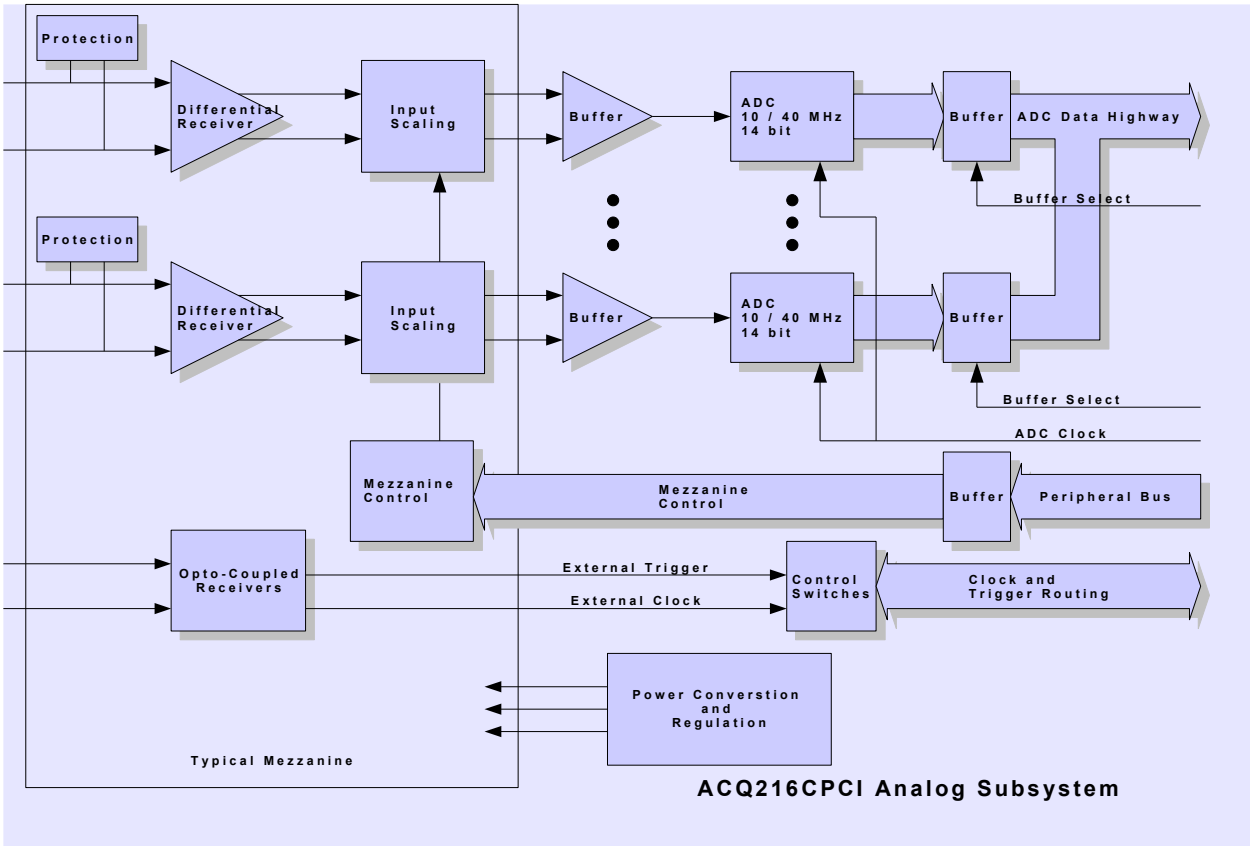
RTM1: Ports for dual Gigabit Ethernet, console, 6 isolated DI, 32 DIO.

RTM-DDS: as RTM1 + DDS clock offering 1Hz resolution over the range 1..100MHz.

RTM5: as RTM-DDS offering extra power for M5 mezzanine.

Analog Input Subsystem Block Diagram:

Digital I/O



ACQ216CPCI Analog Subsystem

Number	6	Digital Expansion Bus
Switching Characteristics	TTL	16 Bit Extension Bus for Low Speed Digital
Maximum Clock Rate	50 MHz	I/O
Minimum High Time for Trigger	100 nS	32 bit programmable Digital IO on RTM
Minimum Low Time for Trigger	100 nS	

The Digital I/Os are used for high-speed control including clocks, triggers and multi-board synchronisation , these are available on the Front Panel (via the Mezzanine Board), Rear Panel (via the RTM) or using PXI compatible P2 backplane routing.

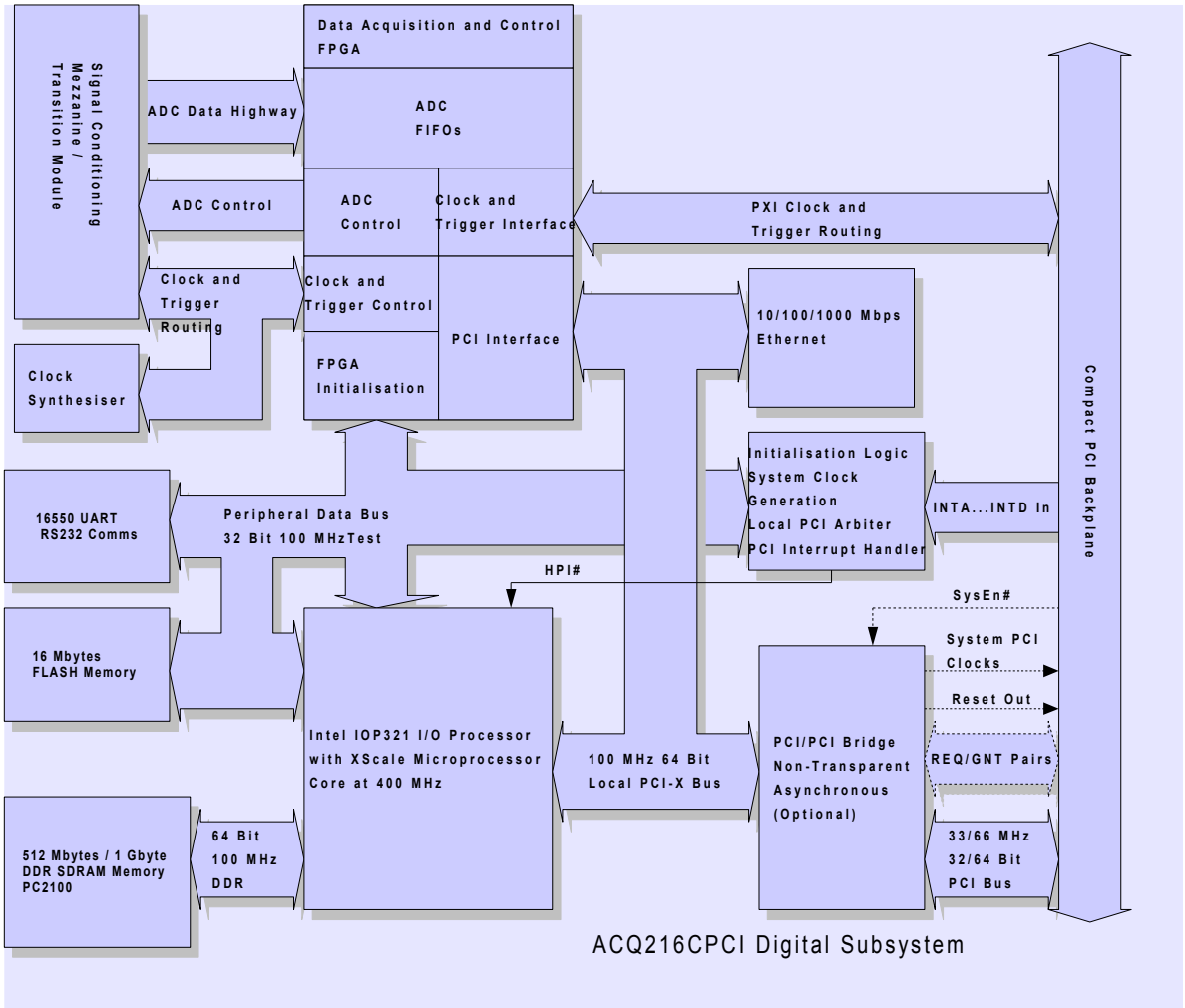
Processor Characteristics

Processor	IOP321 Intel XScale Series I/O Processor
FLASH	16 MBytes
SDRAM	Standard 200 pin DDRSDRAM SODIMM socket for up to 1 GByte of memory
PCI Interface	32/64 bit 33/66 MHz compliant to PICMG CompactPCI Specification 2.0 Rev 3.0

On-Board Peripherals

10/100/1000 Base T Ethernet	Provided through the Rear Transition Module (RTM). Allows standalone operation, remove control and data upload.
Clock Synthesiser	On Board Clock Multiplication / Division for creation of sample clock from External or Internal Clock source, 1..100MHz with ~1kHz resolution.
RS232 Uart	Console function accessed via RTM

Digital Control Subsystem Block Diagram



ACQ216CPCI Digital Subsystem

Main Operating Modes

The following paragraphs discuss many of the functions and features of the ACQ216CPCI board. For a complete discussion on the system capabilities please consult www.D−TACQ.com.

Standard Pre / post capture modes

Digital and analog threshold and edge triggers.

The transient memory is arranged in a circular buffer with data constantly being acquired until the trigger event. Full flexibility of specification of pre-trigger and post trigger data lengths are available for any length up to the full available fitted memory.

Generalised Phase Event Mode for maximum flexibility

This allows the user to select a trigger event that is either

A Digital Event or a Software Event

Either Rising or Falling Edge Digital Event

The user sets up a particular event that initiates the pre-trigger phase, then selects another (or the same) event to move to the post trigger phase. This provides maximum functionality in the data acquisition process including support for initial synchronisation events and for “Gated” trigger behaviour in addition to “Edge” trigger behaviour

Sub-Sample Streaming Mode

In this mode the board acquires data to a circular buffer as per the Standard Modes but here a subsample of the data is passed to the host in real time to allow the host to monitor real time data. This is especially useful for mixed control/diagnostic applications and for more complex “post mortem” evaluation when the decision to move to post capture is determined by the host.

High Throughput Streaming

High Throughput Streaming is available when the system designer can allocate the full PCI bandwidth to the ACQ216CPCI digitizer. In this mode the ACQ216CPCI acting as a Bus Master can continuously stream data at over 200 MBytes/s (64bit 33 MHz PCI), to either host memory or to peripheral storage such as a RAID Disk Array. Reduced Rate Streaming is also possible directly over the local Ethernet.

Low Latency Mode

In this mode the ACQ216CPCI pushes 1 complete sample worth of memory into host memory to minimise sample latency. This is especially useful in control applications where latency is key. For a typical 64 bit 33 MHz PCI system, all data arrives in host memory in a typical time of less than 6 uS (10 MHz conversion rate)

DMA Upload

D−TACQ provides a high performance DMA upload feature for the captured Transient data. This allows Data to be uploaded by channel in addition to the entire dataset, sub-sampling DMA is also available.

In system upgrade

The main logic functions are contained in a FPGA (Field Programmable Gate Array) this is loaded by the Microprocessor at power up from the on-board FLASH Memory. The Microprocessor code is also stored in the FLASH Memory. D−TACQ provides utilities for field upgrade of these FLASH programs allowing feature enhancement to be made in the field without a return to base.

Customisation Potential

As mentioned above most of the main functions of the ACQ216CPCI can be FLASH upgraded in the field; this allows D−TACQ to produce custom enhancements to the board at low cost without extensive NRE development. Potential areas of enhancement are Real Time signal processing with powerful microprocessor / Xilinx co-processor combination, and fast on-board control loops. Please contact D−TACQ if your application requires functionality that is not currently available.

External Connectors

The ACQ216CPCI can be ordered for either front or rear panel connection. Front panel connections are achieved by utilising a mezzanine board which connects to the front panel. This allows a flexible specification of front panel connectors including customer customisation. The mezzanine or rear panel transition module can also be used for signal conditioning, – Contact D−TACQ for further information on available modules.

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