InstruTECH ITC-1600

16-bit Multi-Channel Data Acquisition System

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Introduction

The ITC-1600 is an expandable 16-bit data acquisition system designed by InstruTECH. The ITC-1600 utilizes the latest fiber-optic and digital signal processing technologies. In addition, to many of the exceptional features of its predecessors, the ITC-16 and ITC-18, the ITC-1600 provides expandability and versatility that will satisfy both current and future needs.

Main Features

ITC-1600 system features

- Expandable fully synchronized data acquisition system
- All synchronous analog and digital channels optically isolated
- Compatible with Windows (2000, XP, Vista), Mac OS X (PPC and Intel), LabVIEW for Windows, and MATLAB

I-1600 rack features

- Eight differential analog input channels
- Two 16-bit 200kHz A/D converters multiplexed into two banks of four input channels
- Simultaneous sampling on two channels (one from each bank) at 200 kHz per channel
- Analog input / output range: ±10.24Volts
- Four pseudo-differential analog output channels
- Four 24-bit D/A converters (16-bit data)
- Sixteen synchronous digital input channels
- Thirty-two synchronous digital output channels
- Four 12-bit asynchronous A/D input channels

PCI-1600 / PCI-1600e features

- Each host interface supports two fully synchronized I-1600 rack units
- Bus Mastering PCI or PCI Express host interface
- PCI-1600 - Universal PCI, 3.3 or 5 Volt bus
- PCI-1600e - PCI Express 1X lane
- Phase Lock Loop In / Out clock for multi-card synchronization

Hardware Configuration

The ITC-1600 system comprises of a PCI-1600 or a PCI-1600e computer interface card and one or two I-1600 analog rack units connected by the InstruLINK fiber optic data cables. Each PCI-1600 or PCI-1600e bus mastering host interface card supports one or two I-1600 rack units. If two rack units are used, then all input and output channels are doubled and fully synchronized. For systems requiring even more channels, multiple PCI-1600 / PCI-1600e and I-1600 units can be installed in the same or in separate computers and again fully synchronized.
This split configuration offers major advantages over traditional data acquisition designs. One advantage is noise performance. Another advantage is the capability to use the analog front end (I-1600 rack unit) with a variety of host interfaces as they become available. Moving the I-1600 from one computer platform to another is a simple matter of using the appropriate host interface and installing compatible software.

Optical Isolation

The analog electronics of the I-1600 rack unit are optically isolated from the digital circuitry of the computer via the InstruLINK fiber optic circuitry. This circuitry provides superb optical isolation, virtually eliminating ground loops, while increasing the distance between the computer and the recording setup to at least five meters. The inter-connecting fiber-optic cables are small, flexible, and, unlike conventional electrical cables, do not emit electromagnetic radiation.

Optical isolation provides complete electrical isolation between the computer and the measuring equipment. Computers contain digital electronics that switch at high speed, producing large electrical transients. The computer ground functions as the return path for these transients resulting in substantial high frequency ground noise. Each I-1600 (rack unit) has a separate analog ground that is isolated from the computer ground.

Optical isolation is essential if low-noise analog outputs are desired.

Analog I/O

Each I-1600 rack unit provides eight differential analog input channels that are separated into two banks of four. Each bank uses one 16-bit 200 kHz A/D converter multiplexed into four inputs. Both A/D converters sample simultaneously and synchronously at the maximum conversion rate resulting in a total throughput of 400 kHz. This unique arrangement allows pairs of channels to be digitized without phase-shift. If the bandwidth of the experiment calls for lower sampling rates, the DSP decimates and / or filters the data. An added benefit of filtering is the reduction of noise.

Each I-1600 rack unit provides four 24-bit D/A converters stripped to 16-bit data. This results to outputs that feature high accuracy. The D/A circuitry used in the I-1600 rack unit is temperature stabilized and "De-glitched" for ideal performance.

In addition, each I-1600 rack unit provides four 12-bit asynchronous "telegraphing" ADC channels which can be used for monitoring slow changing parameters.

Digital I/O

Each I-1600 rack unit has twenty digital inputs and thirty-six digital output channels all sampling synchronously. The digital input channels feature level sensitive or latched modes. For maximum versatility the inputs can be inverted, allowing rising or falling edge triggering.

Software Control

Mac OS X (PPC & Intel)
- Driver and Framework Library
- WaveMetrics IGOR Pro XOPs
- PATCHMASTER, CHARTMASTER
- AxoGraphX
- InstruTECH AcquireT

2000, XP, Vista
- Kernel Driver and DLL Library
- WaveMetrics IGOR Pro XOPs
- National Instruments LabVIEW
- PATCHMASTER, CHARTMASTER
- InstruTECH AcquireT and Ecell
- Strathclyde WinWCP
- AxoGraphX

Host Interfaces

PCI-1600	short, 32-bit, 33 MHz, 3.3 or 5 Volt PCI bus mastering
PCI-1600e	PCI Express 1X lane
Cable	1- 5 meter fiber-optic per I-1600
Connectors	2 pair InstruLINK fiber (TX/RX), non-isolated Trigger IN and Trigger OUT, PLL Clock-IN and Clock-OUT

A note about Power Mac G5 computers: Apple has once again changed the PCI expansion slots on their G5 desktop computers. The latest release, as of November 2005, has PCI Express bus architecture. This is also true for the Intel-based Mac Pro desktop computers. The PCI-1600 host interface IS NOT compatible with the PCI Express bus. For these computers, please order the PCI-1600e instead.
Power Mac G5 computers before November 2005 used PCI-X expansion slots. These systems are compatible with PCI-1600's built after April 2004.

Product Content

ITC-1600	**ITC-1600 DUAL**	**Extension**
• One rack mounted interface I-1600 unit	• Two rack mounted interface I-1600 units	• One rack mounted interface I-1600 unit
• One host interface (choice of PCI-1600 or PCI-1600e)	• One host interface (choice of PCI-1600 or PCI-1600e)	• One pair of InstruLINK fiber optical cables
• One pair of InstruLINK fiber optical cables	• Two pairs of InstruLINK fiber optical cables	• Cable to connect the I-1600 to power line
• Cable to connect the I-1600 to power line	• Cables to connect the I-1600 to power line	• One printed manual
• One printed manual	• One printed manual	
Item No.: • *ITC-1600* • *ITC-1600e*	*Item No.:* • *ITC-1600/2* • *ITC-1600e/2*	*Item No.:* • *I-1600*

Technical Specifications

Analog inputs:

Number of channels	8, 2 ADC MUX A channels 0-3 MUX B channels 4-7
Input type	differential, optically isolated
Type of ADC	successive approximation
Input connector	BNC on front panel
Resolution	16-bit, 1 in 65536
Acquisition rate	400 kHz aggregate 200 kHz per ADC
Input range	-10.24 to +10.239 Volts
Conversion speed	software selectable minimum 5 µs per ADC
Differential nonlinearity	±0.002% of FSR
Drift	±2 ppm/°C
Input impedance	1M_
Signal-to-noise ratio	86 dB at DC-160 kHz < 1mV PP
No missing codes	16-bit
Crosstalk between ADC	not measurable
Crosstalk between MUX	-110 dB 20 Volt 1 kHz sine wave
Maximum over voltage	±40 Volts

Analog outputs:

Number of channels	4, individual D/A converters
Output type	pseudo-differential optically isolated
Type of DAC	double buffered, multiplying
Output connector	BNC
Resolution	24-bit converter 16-bit data (1 in 65536)
Output range	-10.24 to +10.239 Volts
Conversion speed	software selectable minimum 5 µs each
Settling time	<4 µs to 0.001%
Gain error	0.2% of FSR
Gain linearity	<2 dB
Drift	±4 ppm/°C, after warm up
Signal-to-noise ratio	116 dB
Output impedance	10 _ (for overload protection)
Short circuit to ground	indefinite
Current output	20 mA maximum
Capacitance drive	200 pF

Asynchronous "telegraphing" inputs:

Number of channels	4, single-ended
Input connector	BNC on rear panel
Resolution	12-bit
Acquisition rate	5 kHz aggregate
Input range	±10 Volts
Max. Input over voltage	±40 Volts

Digital inputs:

Number of inputs	20, logic level optically isolated
Input type	3.3 and 5 Volt logic
Operational mode	software selectable, level or latching, active high or low
Minimum pulse width	150 ns
Input connector	4 front panel BNC, 16 on rear panel DB-37
Maximum over voltage	±30 Volts D.C.

Trigger In:

Number of inputs	1, optically isolated
Input type	3.3 and 5 Volt logic
Operational mode	software selectable, edge, level, active high or low
Minimum pulse width	150 ns
Input connector	BNC on front panel
Maximum over voltage	±30 Volts D.C.

Digital outputs:

Number	36, optically isolated
Output driver	3.3 Volt, TTL, LS, ACT, and HCT
Output connectors	4 on front panel BNC with LED indicators, 32 on rear panel DB-37
Output current	6.4 mA (front panel) sink or source 3.2 mA (rear panel) sink or source
Power-on state	logic low

Trigger Out:

Number of outputs	1, optically isolated
Output driver	3.3 Volt, TTL, LS, ACT, and HCT
Output connector	BNC on front panel
Output current	6.4 mA sink or source

Dimensions:

Width	19" (47.5cm)
Height	1.75" (4.375cm),
Depth	6" (15 cm)
Weight	8 pounds (3.6 kg)

Power Requirements:

Input voltage	85-264 VAC
Input frequency	47-440 Hz
Maximum power	15 Watts

Warranty:

Duration	One year parts and labor

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