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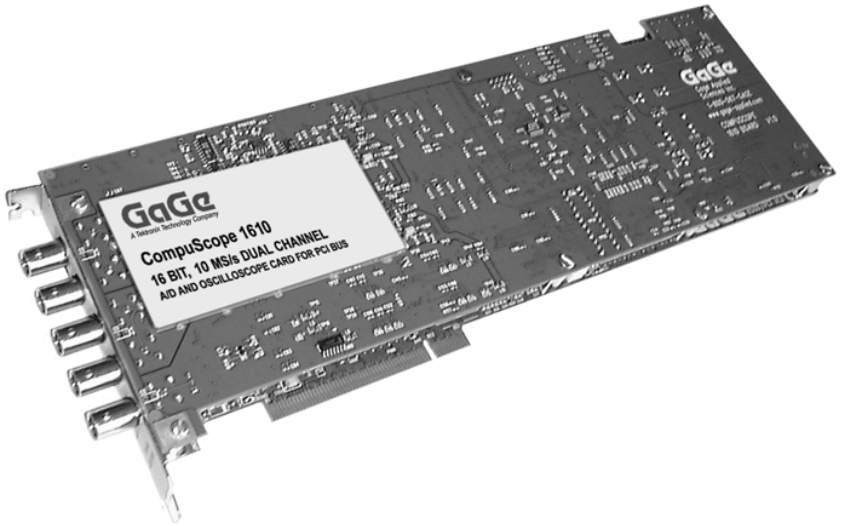
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CompuScope 1610

Ultra-fast waveform digitizer card for PCI bus



High dynamic performance digitizer for high precision measurements.

FEATURES

- 16 bit, 10 MS/s A/D sampling on two simultaneous channels
- Differential or single-ended inputs
- Up to 1 GigaSamples of on-board acquisition memory
- 70 dB signal to noise ratio
- Multi-card systems of up to 16 simultaneous channels at 10 MS/s
- Fast data transfer rate to PC memory
- Compatible with GageScope software
- SDKs for C/C++, MATLAB, LabVIEW under Win 95/98/ME and Win NT/2000/XP

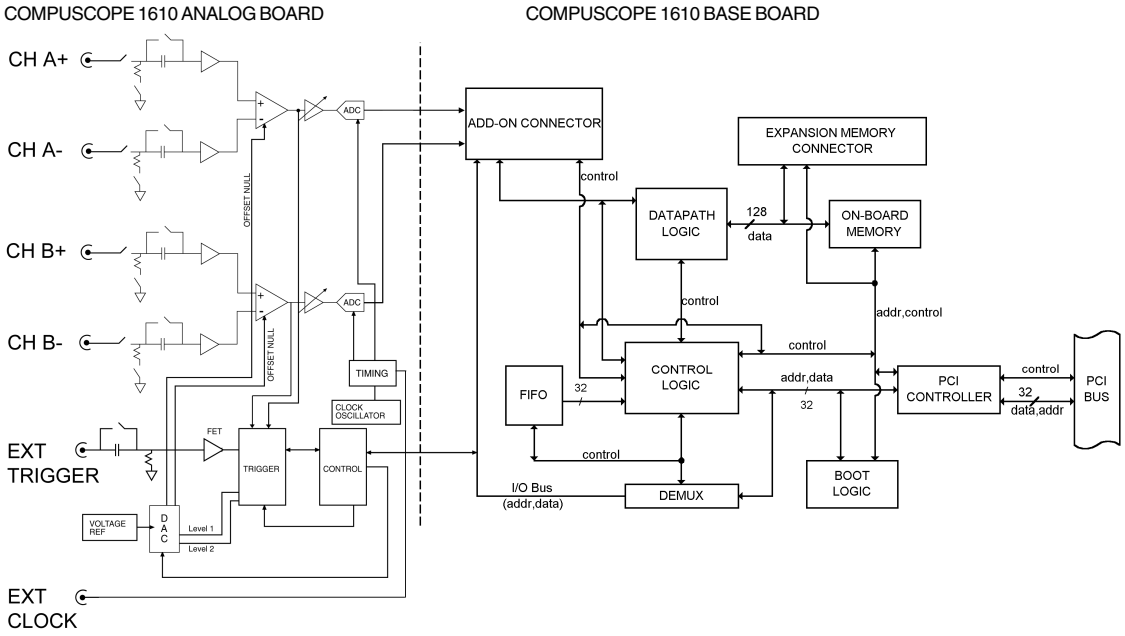
APPLICATIONS

Non-destructive testing
Military & Aerospace
Communications & wireless
Electro-optic
Radar
Laser
High energy physics
Embedded digitizer



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CompuScope 1610 Simplified Block Diagram



COMPUSCOPE 1610

A CompuScope 1610 card for PCI bus can simultaneously sample two analog signals at speeds up to 10 MS/s with 16 bit resolution and store the data in the on-board memory.

16 bit 10 MS/s SAMPLING

CompuScope 1610 uses state-of-the-art data conversion technology to provide dual-channel simultaneous sampling rate of 10 MS/s with 16 bit resolution. Each channel has its own ADC chip, eliminating the need for multiplexing the inputs which invariably results in increased noise and lower performance.

DIFFERENTIAL INPUTS

Differential inputs allow the user to fully exploit the 16-bit A/D of the CompuScope 1610. Differential input circuitry automatically eliminates noise picked up by the signal and its reference. With over 80 dB CMRR (Common Mode Rejection Ratio) for low frequency inputs, differential inputs eliminate any ground loop problems.

Single-ended inputs are also available through a simple software command. This command simply connects the negative input of the differential pair to zero volts, allowing single-ended operation.

HIGH IMMUNITY TO DIGITAL NOISE

In order to isolate the high-frequency analog circuitry from PCI bus–related digital electronics, a two-board piggyback configuration is used.

This scheme allows maximum separation of analog and digital grounds, thereby providing high immunity to digital noise.

MEMORY DEPTH

CompuScope 1610 is available with memory depths of 1M, 8M, 128M, 512M and 1G (16-bit samples). This memory can be used as a circular buffer for storage of pre- and post-trigger data.

The memory is divided equally between the two input channels, i.e. a 1 Meg board provides 512 Ksamples of memory per channel.

The data stored in the CompuScope 1610 memory can be transferred to the system RAM for post-processing, display or storage to hard disk without any interface bus (no GPIB bus required).

FAST BUS THROUGHPUT

The high-speed, 32 bit, bus-mastering interface to the PCI bus allows the data from the on-board memory of the CompuScope 1610 to be transferred to the system RAM, or any other PCI destination, at sustained rates of up to 50 MB/s under single-tasking operating systems. Under Windows, this rate depends on the architecture of the user application. Under controlled conditions, it is still possible to achieve 50 MB/s recording speed to the system RAM.

BUS MASTERING

CompuScope 1610 is fully capable of becoming a PCI bus master in order to transfer data at the maximum rate of 50 MB/s.

A PCI bus Master is a card which can take control of the bus and transfer data to any PCI target device such as system RAM without any involvement from the CPU.

FLEXIBLE TRIGGERING

CompuScope 1610 features flexible, oscilloscope-like analog triggering.

An analog comparator provides triggering from any one of the two input channels, from an external signal or from software.

In addition to the trigger source, trigger level and slope are also selectable by software, making the trigger system similar to traditional oscilloscopes.

MULTI-CHANNEL TRIGGERING

A very unique feature of CompuScope 1610 trigger system is the ability to trigger a multi-card Master/Slave system from any one of the input channels.

For example, in a 16 channel system, consisting of 8 Master/Slave CompuScope 1610 cards, the user can set the trigger conditions to be such that the system trigger from any channel.

Trigger level and slope can be defined independently for each channel.

This capability is very powerful for applications in which the trigger signal can come from any one of the sensors being used. Examples are explosion test, material stress analysis, high energy particle detection etc.

BUILT-IN DECIMATION FILTER

CompuScope 1610 uses a unique architecture to provide 16 bit resolution.

The input signal is over-sampled by a factor of 2 and the resulting data stream is fed into an on-chip decimation filter and error-correction circuitry which enhances the effective resolution and dynamic range by eliminating high frequency noise and by providing the lower order bits of the digital output.

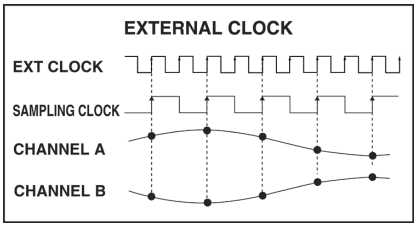
EXTERNAL CLOCK

External clock is a standard feature on the CompuScope 1610. This feature is useful when A/D sampling must be done coherently with the rest of the system.

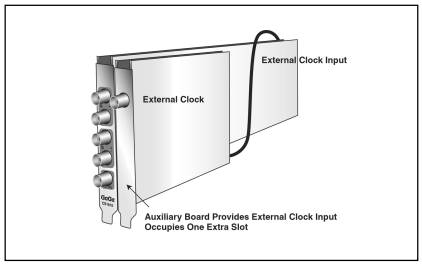
It is important to note, however, that the external clock must be 2 times faster than the required sample rate, i.e. if 1 MS/s sampling is required, the external clock must be 2 MHz.

The External Clock must be a TTL signal with a maximum frequency of 20 MHz and minimum frequency of 2 kHz.

It is very important to maintain the duty cycle of the external clock of 50% ± 5%. Failure to supply a clock with duty cycle in this range can result in invalid data.



The external clock is provided through a BNC connector which is housed on an auxiliary board attached to the CompuScope 1610 via a cable. The auxiliary board occupies an additional slot adjacent to the CS1610.



MULTIPLE RECORD

Even though the PCI bus allows very fast data throughput to system RAM, there may still be applications in which data bursts cannot be off-loaded either because of very fast trigger repeat frequency or because of software limitations.

Multiple Recording allows CompuScope 1610 to capture data on successive triggers and stack it in the on-board memory. Up to 4,194,304 triggers can be captured in multiple record mode.

GageScope Software can display the stacked data as individual acquisitions. Software drivers also provide support for accessing Multiple Record data.

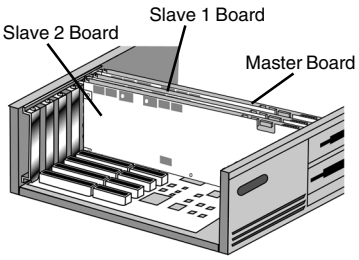
Once the CompuScope 1610 has finished capturing a Multiple Record segment, the trigger circuitry is automatically re-armed within 5 sample clock cycles to start looking for the next trigger. No software intervention is required.

Multiple Recording is useful for applications in which a series of bursts of data have to be captured in quick succession and there is not enough time to off-load the data to the PC memory.

Another situation in which Multiple Recording may be used is when data storage has to be optimized. These are cases in which only certain portions of the incoming signal are of interest and data capture during the dead-time between successive portions is not useful.

Examples of these situations are radar pulses, ultrasound data, lightning pulses, imaging signals and explosion testing.

MULTI-CARD SYSTEMS



One of the most unique features of the CompuScope cards is the Multi-Card system that can be configured.

A Multi-Card system, comprised of one Master and up to 7 Slave CS1610 boards, can be ordered from the factory if the user wants to capture more than two channels with a common clock and trigger. A board-to-board interconnect is supplied with the system. This interconnect carries all the signals needed for proper synchronization.

The following Master/Slave systems can be configured.

- For 1M Memory Models: 2, 4, 6 or 8 cards can be configured
- For 8M Memory Models: 2, 3 or 4 cards can be configured
- For 128M and higher Memory Models: 2 or 3 cards can be configured

GageScope can then display all channels from these boards on the same screen. Software drivers also support such Master/Slave systems.

ORDERING INFORMATION

Hardware & Upgrades

CompuScope 1610-1M	161-001-002
CompuScope 1610-8M	161-001-003
CompuScope 1610-128M	161-001-004
CompuScope 1610-512M	161-001-005
CompuScope 1610-1G	161-001-006
CS1610 Memory Upgrade Charge	161-181-200
Master Multi-Card Upgrade	161-181-002
Slave Multi-Card Upgrade	161-181-003

GageScope Software

GageScope: Lite Edition	included
GageScope: Standard Edition *(with Purchase of CompuScope Hardware)*	300-100-351
GageScope: Professional Edition *(with Purchase of CompuScope Hardware)*	300-100-354

Software Development Kits (SDKs)

Gage SDK Pack on CD	200-113-000
CompuScope SDK for C/C++	200-200-101
CompuScope SDK for MATLAB	200-200-102
CompuScope SDK for LabVIEW	200-200-103

All Upgrades performed at the factory.

COMPUSCOPE 1610 SPECIFICATIONS

SYSTEM REQUIREMENT

PCI-based computer with at least one free full length PCI slot, 128 MB RAM, 50 MB hard disk and SVGA video.

SIZE

Plugs into one full length PCI Slot, 13 inch x 4.1 inch. External Clock is supplied on an Auxiliary board, which plugs into an adjacent PCI slot and connects to the CS1610 card using the cable supplied with it.

Memory Depth	Independent or Master Card	Slave Card
1M	2 slots	1 slot
8M	3 slots	2 slots
128M	4 slots	3 slots
512M	4 slots	3 slots
1G	4 slots	3 slots

POWER (IN WATTS)

+5 V		
Memory	Worst	Typical
1 M	25.0	17.5
8 M	28.0	20.5
128 M	32.5	23.5
512 M	32.5	23.5
1 G	32.5	23.5

Note 1: Power connector on 128M, 512M and 1 G models must be connected using a Y-cable

CHANNELS A & B

Inputs per card: 2 differential inputs

Impedance: 1 MΩ, 35 pF or 50 Ω, software selectable

Coupling: AC or DC

Resolution: 16 bits

A/D Type: Monolithic, 16 bit oversampling with decimation filter

Analog Bandwidth: DC to 4 MHz (DC)
10 Hz to 4 MHz (AC)
DSP FIR filter limits the signal bandwidth to Nyquist Frequency

Full Scale Single-Ended Input Range:
±500mV, ±1V, ±2V, ±5V, ±10V

Common Mode Input Voltage:
±7.5 V (DC + peak AC), maximum

Common Mode Rejection Ratio:
80 dB at 60 Hz

Absolute Max.Amplitude:
1 MΩ Impedance:
±15 Volts (continuous)
50 Ω Impedance:
±5 Volts (continuous)
±15 Volts (for 1 ms duration)

DC Accuracy relative to full scale input:
± 0.5% of full scale

Sampling Rate
MS/s: 10, 5, 2.5, 1
kS/s: 500, 200, 100, 50, 20, 10, 5, 2, 1

Protection: 1 MΩ Impedance:
Diode Clamped
50 Ω Impedance:
No protection

Connector: 2 BNCs per channel

DYNAMIC PARAMETERS

Measured using 1 MHz sine wave input at 10 MS/s with amplitude of 95% of full scale on the ±1V range. Typical values listed.

SNR: 70 dB
SFDR: 71 dB
SINAD: 66 dB
THD: -68 dB
ENOB: 11.5 bits

ACQUISITION MEMORY

Data Storage: In on-board memory

Memory Sizes: 1M, 8M, 128M, 512M, 1G (16 bit samples)

Max. Depth: Up to half on-board memory per channel

TRIGGERING

of Trigger Inputs: 2 per card

Trigger Source: CH A, CH B, Ext or Software

Input combination: Wired-OR

Type: Analog triggering

Sensitivity: ± 20% of full scale

Level Accuracy: ± 10% of full scale

Slope: Positive or Negative, software selectable

Post Trigger Data: 64 points minimum in single record acquisition. 128 points minimum in multiple record acquisition. Can be defined with a 64 point resolution

EXTERNAL TRIGGER

Impedance: 1 MΩ, 30 pF

Input Type: Single-ended analog

Amplitude: Absolute Max ±15V

Voltage Range: ±1V and ±5V

Bandwidth: 10 MHz

Connector: BNC

INTERNAL CLOCK

Source: 20 MHz Clock Oscillator

Accuracy: ±50 ppm (0 to 70 deg C)

EXTERNAL CLOCK

Max. Frequency: 20 MHz, maximum using 2x decimation filter.

Min. Frequency: 2 kHz

Signal Level: TTL

Required Duty Cycle:
50% +5% at 20 MHz

MULTIPLE RECORD

Pre-Trigger Data: None

Record Length: 128 points minimum. Can be defined with a 64 point resolution

Max. # of Triggers: 4,194,304

MULTI-CARD SYSTEMS

Operating Modes: Master/Slave or Multiple Independent

Number of Cards in:
- Master/Slave Mode:
  1M models: 2, 4, 6 or 8 cards
  8M models: 2, 3 or 4 cards
  128M, 512M & 1G models: 2 or 3 cards
- Multiple Ind.: Limited by backplane

Max. # Channels: 16 at 10 MS/s (1M models)

MASTER/SLAVE SYSTEM TRIGGERING

of Trigger Inputs: 2 per card

Trigger Source: Ch A, Ch B, EXT or Software

Input Combination: Wired OR

Sensitivity: ± 20% of full scale

Level Accuracy: ± 10% of full scale

Slope: Positive or Negative Software selectable

OPERATING SYSTEMS

Windows 95/98/ME/NT*/2000/XP
*version 4, SP3 or higher

ELECTROMAGNETIC COMPATIBILITY

CE Compliant

EC Council Directive 89/336/EEC

EN 61326 Class A
- IEC 61000-4-2 Electrostatic Discharge (Perf.Crit.B)
- IEC 61000-4-3 RF Electromagnetic Field (Perf.Crit.A)
- IEC 61000-4-4 Electrical Fast Transient/Burst (Perf. Crit. B)
- IEC 61000-4-5 Power Surge (Perf.Crit.B)
- IEC 61000-4-6 Conducted RF (Perf.Crit.A)
- IEC 61000-4-11 Voltage Dips and Interruptions (Perf.Crit B)
- EN 61000-3-2 AC Power Line Harmonics Emissions

AS/NZS 2064
- Australian emissions standard for Industrial, Scientific and Medical Equipment

Compliance demonstrated on a single card configuration

MATERIALS SUPPLIED

One CompuScope 1610 card
One Hardware Manual
One Gage Software Disk on CD
One GageScope Lite Edition Software

WARRANTY

One year parts and labor

All specifications subject to change without notice

Specification Last Updated: February 2003

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