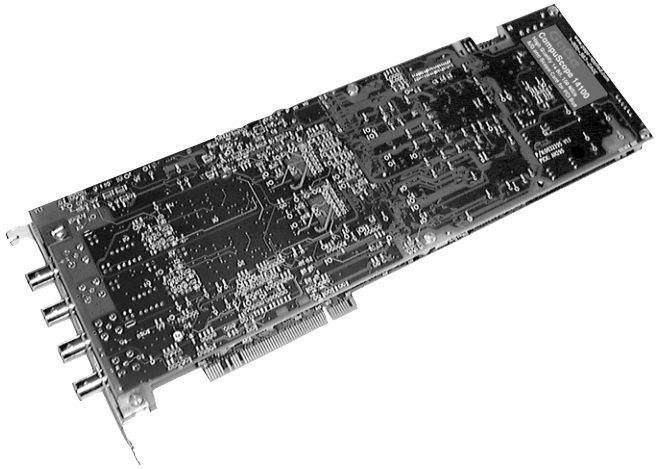
CompuScope 14100

Ultra-fast waveform digitizer card for PCI bus



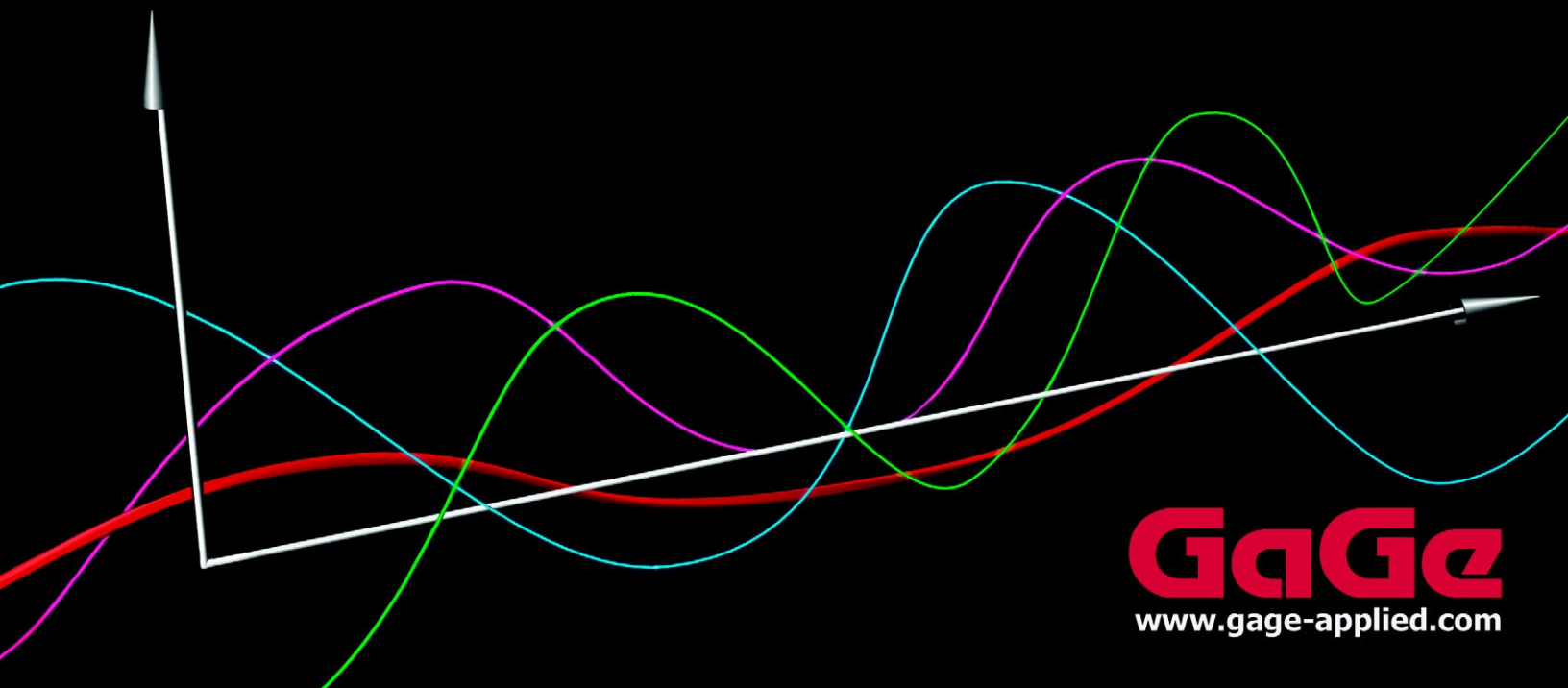
General-purpose digitizer module for high-accuracy synthetic instrumentation, automated test systems, and scientific research.

FEATURES

- 14 bit, 100 MS/s A/D
- Up to 100 MHz bandwidth
- Up to 1 GigaSamples of on-board acquisition memory
- 63 dB SNR typical
- Multi-card systems of up to 8 channels at 100 MS/s (16 channels at 50 MS/s)
- Fast data transfer rate to system RAM
- Compatible with GageScope software
- SDKs for C/C++, MATLAB, LabVIEW under Win 95/98/ME and Win NT/2000/XP

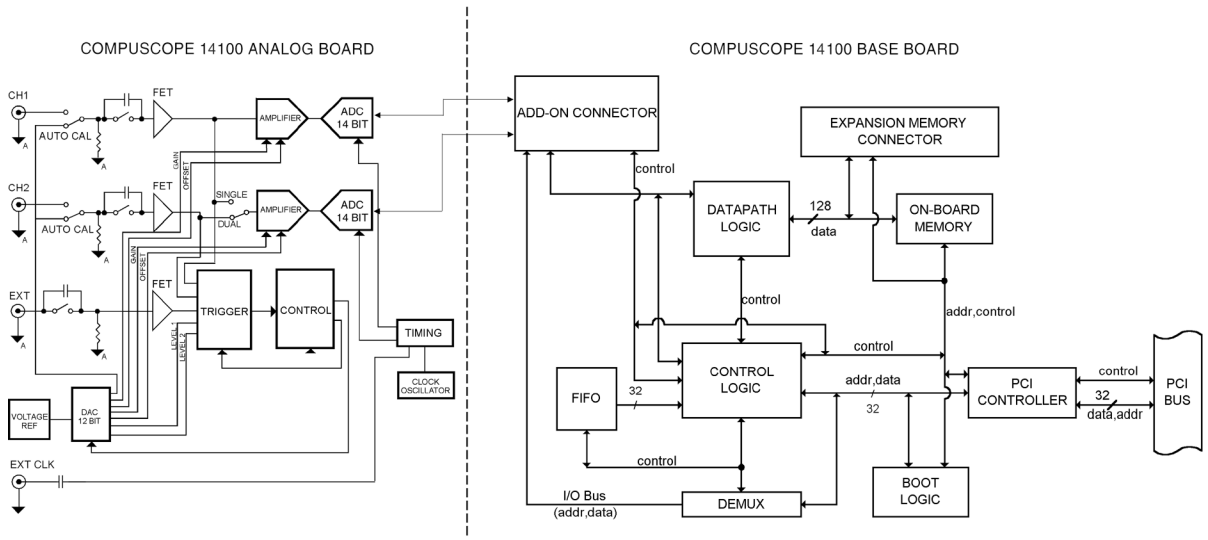
APPLICATIONS

Non-destructive testing
Military & Aerospace
Communications & wireless
Radar, Lidar
High energy physics
Embedded digitizer



GaGe
www.gage-applied.com

CompuScope 14100 Simplified Block Diagram



COMPUSCOPE 14100

CompuScope 14100 can sample analog signals at speeds up to 100 MS/s with 14 bit resolution and store the data in the on-board memory.

100 MS/S SAMPLING

CompuScope 14100 uses two monolithic sub-ranging A/D converters, each running at 50 MS/s, to provide a dual-channel simultaneous real-time sampling rate of 50 MS/s.

In the single-channel mode the two ADCs are clocked in a "ping-pong" mode to achieve up to 100 MS/s sampling. An on-board crystal-controlled timing circuit ensures timebase accuracy and long-term thermal stability.

The on-board auto-calibration circuitry allows the two channels to be matched in order to reduce the image signal.

HIGH IMMUNITY TO DIGITAL NOISE

In order to isolate the high-frequency analog circuitry from PCI bus–related digital electronics, a two-board piggy-back configuration is used. This scheme allows maximum separation of analog and digital grounds, thereby providing high immunity to digital noise.

MEMORY DEPTH

CompuScope 14100 is available with memory depths of 1M, 8M, 128M, 512M and 1G (14-bit samples). This memory can be used as a circular buffer for storage of pre- and post-trigger data.

In the single-channel mode, the maximum number of sample points is equal to the memory depth of the CompuScope 14100 model being used, whereas in the dual-channel mode the maximum number of sample points is half the memory depth.

The data stored in the CompuScope 14100 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 14100 to be transferred to the system RAM, or any other PCI destination, at sustained rates of up to 80 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 80 MB/s recording speed to the system RAM.

BUS MASTERING

CompuScope 14100 is fully capable of becoming a PCI bus master in order to transfer data at the maximum rate of 80 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 14100 features state-of-the-art analog triggering.

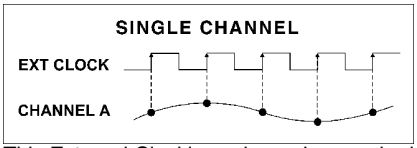
An analog comparator provides triggering from either one of the input channels, or from an external signal or from software.

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

EXTERNAL CLOCK

An external clock input is included as standard on the CS14100 as a BNC input for situations where a special sampling frequency is required.

In both single-channel and dual-channel mode, input signals are sampled at every rising edge of the External Clock.



This External Clocking scheme is a marked improvement over the options available for previous CompuScope models.

The External Clock must be a sine wave with a minimum amplitude of 1 Volt RMS and a maximum amplitude of 2 Volts RMS.

The allowed external clock range is 40 to 100 MHz for single channel mode or 20 to 50 MHz for dual channel mode

The duty cycle of the External Clock signal must be 50% ± 30% for single channel mode and 50% ± 5% for dual channel mode.

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 14100 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.

It should be noted that only post-trigger data can be captured in Multiple Record Mode.

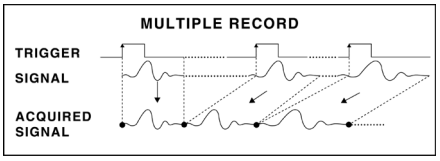
GageScope Software can display the stacked data as individual acquisitions. Software drivers also provide support for accessing Multiple Record data.

Once the CS14100 has finished capturing a Multiple Record segment, the trigger circuitry is automatically re-armed within 18 (9) sample clock cycles in single (dual) channel mode,to start looking for the next trigger. No software intervention is required.

Multiple Recording is useful for applications where 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 system RAM.

Another situation may be 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.



100 MHz Bandwidth Version of CS14100

A version of the CompuScope 14100 is available with 100 MHz enhanced bandwidth.

With 100 MHz bandwidth, the CompuScope 14100 widens the precision and range of applications of fast, high-resolution digitizers. The enhanced bandwidth minimizes the distortion of higher frequency components, improving the characterization of fast pulses from radar signal and high-speed electronic circuitry. While sampling at 100 MS/s, the new CompuScope 14100-100MHz allows undersampling, all the way up to the Nyquist frequency, of continuous periodic signals to extract important spectral information.

A better frequency response also enables more reliable I&Q measurements in communication systems. The CompuScope 14100 is the tool of choice for your critical test and measurements applications.

To allow higher frequencies through, including noise, some of the standard CompuScope 14100 specifications are affected when purchasing the 100 MHz bandwidth version. Please see the detailed specifications on the next page for more information.

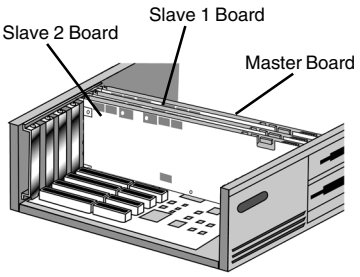
100 MHz Bandwidth Version

Bandwidth(Typical): 120 MHz

Typical Dynamic Parameters: Measured at specified input at 100 MS/s/50 MS/s (Single/ Dual)

	Single Channel		Dual Channel	
	15 MHz	75 MHz	15 MHz	75 MHz
SNR (dB):	41	48	56	52
SFDR (dB):	41	52	74	67
SINAD (dB):	41	47	55	51
THD (dB):	-63	-54	-63	-61
ENOB (bits):	6.5	7.8	9.0	8.3

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 CS14100 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 software can then display all channels from these boards on the same screen. Software drivers also support such Master/Slave systems.

Another class of Multi-Card systems is the Multiple/Independent type. A Multiple/ Independent system does not have common clock and triggering but can consist of CompuScope boards of different types and memory depths.

ORDERING INFORMATION

Hardware & Upgrades

CompuScope 14100-1M	141-001-002
CompuScope 14100-8M	141-001-003
CompuScope 14100-128M	141-001-004
CompuScope 14100-512M	141-001-005
CompuScope 14100-1G	141-001-006
CS14100 Memory Upgrade Charge	141-181-200
Master Multi-Card Upgrade	141-181-003
Slave Multi-Card Upgrade	141-181-004
CompuScope 14100-100MHz Option	141-001-100

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 14100 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

Full-length PCI, 13 inch x 4.1 inch

Memory Depth:	The board occupies:
1M	1 full length slot
8M	2 full length slots
128M - 1G	3 full length slots

POWER (IN WATTS)

+5V		
Memory	Worst	Typical
1 M	24.8	22.5
8 M	30.3	27.5
128 M	33.6	30.5
512 M	33.6	30.5
1 G	33.6	30.5
-5V		
	Worst	Typical
All Models	0.0	0.0
+12V		
	Worst	Typical
All Models	1.7	1.5
-12V		
	Worst	Typical
All Models	0.6	0.5

NOTE: Auxiliary Power Cable must be connected if more than one CS14100 cards are installed. Power connector on models of 128M and higher memory must also be connected using a Y cable.

CHANNELS A & B

Inputs per card: 2

Impedance: 1 MΩ, 40 pF or 50 Ω, software selectable

Coupling: AC or DC

Resolution: 14 bits

Bandwidth: DC to 50 MHz (DC)
10 Hz to 50 MHz (AC)

Full Scale Input Range:
±100mV, ±200mV, ±500mV, ±1V, ±2V, ±5V

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

DC Accuracy relative to full scale input:

Input Range	Accuracy
± 5V	0.5%
± 2V	0.5%
± 1V	0.5%
± 500 mV	0.5%
± 200 mV	1%
± 100 mV	2%

INTERNAL CLOCK

Source: Clock Oscillator
Accuracy: ±50 ppm (0 to 70 deg C)
Sampling Rate
Single-channel (Channel A only):
MS/s: 100, 50, 25,10, 5, 2, 1
kS/s: 500, 200,100, 50, 20, 10, 5, 2, 1
Dual-Channel Mode (Channels A and B simultaneously):
MS/s: 50, 25,10, 5, 2, 1
kS/s: 500, 200,100, 50, 20, 10, 5, 2, 1
Protection: 1 MΩ Impedance: Diode Clamped
50Ω Impedance: No Protection
Connector: BNC

DYNAMIC PARAMETERS

Measured using 1 MHz sine wave input at 50 MS/s, dual channel mode with amplitude of 95% of full scale on the ±1V range. Typical values listed below.

SNR: 63 dB
SFDR: 70 dB
SINAD: 60 dB
THD: -72 dB
ENOB: 10.2 bits

ACQUISITION MEMORY

Data Storage: In on-board memory
Memory Sizes: 1M, 8M, 128M, 512M, 1G (14 bit samples)
Maximum Memory Depth:
Single Channel: Full on-board memory
Dual-Channel: Half on-board memory per channel

TRIGGERING

Source: CH A, CH B, Ext or Software
Type: Analog triggering
Sensitivity: ±10% of Full Scale
Level Accuracy: ±5% of Full Scale
Slope: Positive or Negative
Post Trigger Data: 64 *(128)* points minimum. Can be defined with a 64 *(128)* point resolution in dual*(single)* channel mode

MULTIPLE RECORD

Pre-trigger Data: None
Record Length: 128 *(256)* points minimum. Can be defined with a 64 *(128)* point resolution in dual *(single)* channel mode
Max. # Triggers: 4,194,304

MULTI-CARD SYSTEMS

Operating Mode: 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 50 MS/s
8 at 100 MS/s
(1M models)

EXTERNAL TRIGGER

Impedance: 1 MΩ, 35 pF
Amplitude: Absolute Max ±15V
Voltage Range: ±1V and ±5V
Bandwidth: 30 MHz
Coupling: AC or DC
Connector: BNC

EXTERNAL CLOCK

Max. Frequency: 100 MHz in Single
50 MHz in Dual
Min. Frequency: 40 MHz in Single
20 MHz in Dual
Signal Level: MIN 1 V RMS
MAX 2 V RMS
Impedance: 50Ω
Sampling Edge: Rising
Duty Cycle: 50% ± 30% in Single
50% ± 5% in Dual

MASTER/SLAVE SYSTEM TRIGGERING

of Trigger Input: 2 per system
Trigger Source: CHA, CHB, EXT or Software
(Master card only)
Sensitivity: ±10% of full scale
Level Accuracy: ±5% of full scale
Slope: Positive or Negative

OPERATING SYSTEMS

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

ELECTROMAGNETIC COMPATIBILITY

EC Council Directive 89/336/EEC
EN 61326 Class A, AS/NZS 2064
Compliance demonstrated on a single card configuration

MATERIALS SUPPLIED

One CompuScope 14100 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: October 2003