CompuScope 14100 product introduction

CompuScope 14100 is 14 bit 100 MS/s single channel and 50 MS/s dual channel waveform digitizer card for the PCI Bus.

Recognizing that until very recently, almost all multi-Megahertz data acquisition was done using Digital Storage Oscilloscopes under GPIB control, GaGe has ported all the features of these DSOs onto the CompuScope card. This means that you do not have to rethink the solution in terms of a completely unknown data acquisition card. You can simply develop the data acquisition system as if an oscilloscope were being used, but instead use a CompuScope card to take advantage of its attractive price and performance.

Of course, CompuScope cards are much more than just another DSO under GPIB control:

- CS14100 features up to 8 million samples of on-board acquisition memory.
- Multi-card Master/Slave systems provide from 2 to 16 channels of simultaneous A/D conversion, something normal DSOs simply cannot do.
- Data transfer rates from CompuScope memory to PC memory run as high as 80 MB/s for the CS14100 as compared to a few hundred KB/s for GPIB.
- CompuScope cards are easier to program, as Software Development Kits are available for C/C#, MATLAB, and LabVIEW. Operation under Visual Basic.NET and LabWindows/CVI is also possible from the C/C# Software Development Kit.
- CompuScope cards are installed inside the PCI bus chassis, so there is no external box such as a DSO.
- CS14100 cards have standard features such as Multiple Record, which help optimize the use of the on-board memory by stacking data from successive bursts.
- You can also write software for a multi-card system in which all the cards are not in a Master/Slave configuration. GaGe drivers support all these multi-card configurations.

Special features of the CompuScope 14100 include:

- Bus Mastering

  CompuScope 14100 cards are fully capable of becoming a bus master in order to transfer data at the maximum rate of 80 MB/s.

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

CompuScope 14100 connectors and headers

CompuScope cards connect to the outside world through connectors, both analog (BNC) and digital (PCI Bus, Master/Slave, etc.). This section describes these connectors for the CS14100 card.

The connectors and headers on the CS14100 card are shown below:

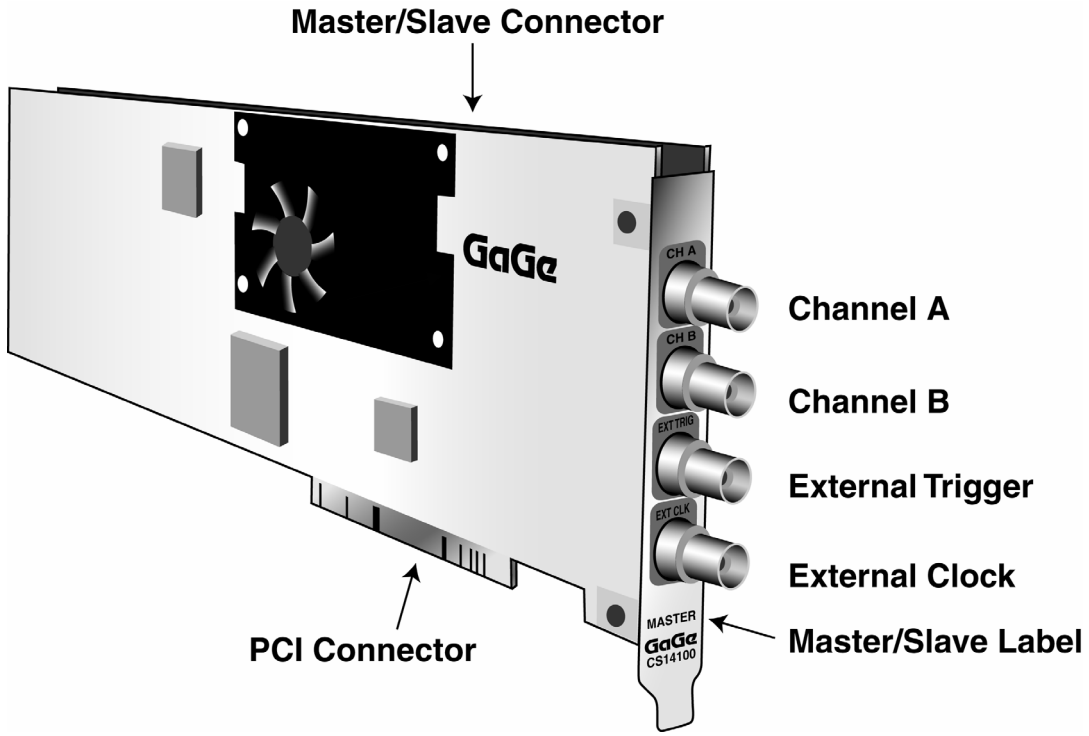

Figure 1: Connectors on CS14100

- **Channel A BNC** connector is the single-ended signal input for Channel 1 on an independent CompuScope card or the Master card in a Master/Slave multi-card system. Refer to the section on CompuScope digitizer channel enumeration for more information on channel enumeration in Master/Slave multi-card systems.
- **Channel B BNC** connector is the single-ended signal input for Channel 2 on an independent CompuScope card or the Master card in a Master/Slave multi-card system. Refer to the section on CompuScope digitizer channel enumeration for more information on channel enumeration in Master/Slave multi-card systems.
- **External Trigger BNC** connector is used to input a signal that is used as an External Trigger. External Trigger is defined exactly as in an oscilloscope. This signal can be used to trigger the system but cannot be viewed or digitized.
- **External Clock** connector is used for the **External Clock Input**, as described in the section labeled *External Clock*.
- **Master/Slave connector.** The Master/Slave connector is located near the top edge of the CompuScope 14100 card. In case of an Independent card (i.e. a card not upgraded to either a Master or a Slave), this connector may not be present.

  The Master/Slave Timing Module is used to pass all the signals necessary to synchronize Slave CompuScope 14100 cards with the Master.

NOTE FOR MULTI-CARD COMPUSCOPE 14100 USERS:
IF Y-CABLES ARE NOT CONNECTED TO THE AUXILIARY POWER CONNECTORS OF YOUR COMPUSCOPE CARDS, THEY WILL NOT FUNCTION PROPERLY

CompuScope 14100 optional Trigger Output

An optional Trigger Output upgrade is available for CompuScope 14100 cards.

Trigger output signal is provided on an Auxiliary Board that can be installed in an adjacent slot and connects to the CompuScope 14100 using a short cable.

The rising edge of this output signifies that a trigger event has been detected on the CompuScope 14100.

In a Master/Slave configuration, only the Master card needs to be upgraded for Trigger Output capability.

For best results, this output should be terminated with a 50 Ω load capable of absorbing 0.5 Watt power.

It should be noted that this output is synchronized to an internal clock, called GCLK, on the CompuScope 14100. This clock is not the same as the sampling clock.

The relationship between GCLK and sampling clock must be understood in order to take full advantage of this powerful feature.

Single channel mode
In single channel mode, GCLK is always one-half the frequency of the sampling clock. Consequently, if the trigger event is asynchronous to the sampling clock, Trigger Out signal will only be activated after one of the two subsequent rising edges of the sampling clock.

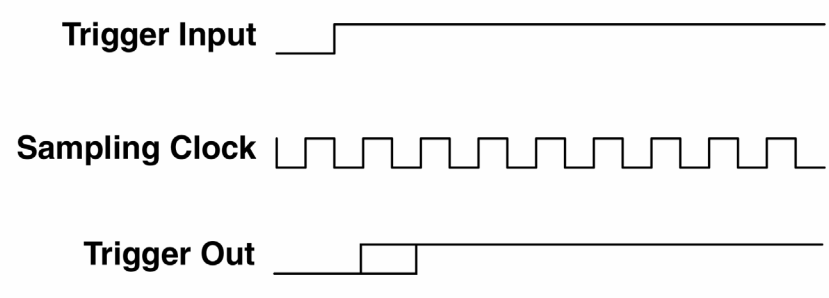

Figure 2: Trigger Out in single channel mode

Dual channel mode
In dual channel mode, GCLK is exactly the same frequency as the sampling clock. Consequently, if the trigger event is asynchronous to the sampling clock, Trigger Out signal will only be activated after the subsequent rising edge of the sampling clock.

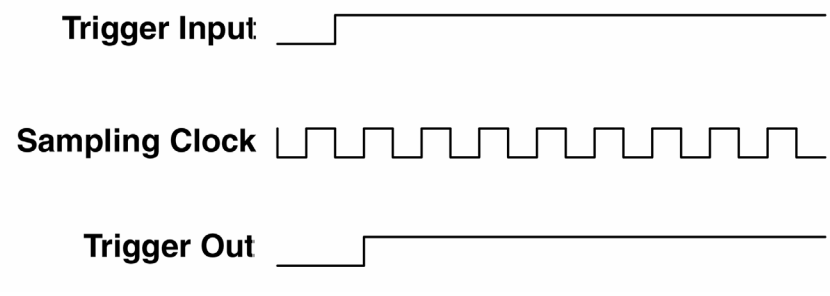

Figure 3: Trigger Out in dual channel mode

Finally, note that there is no output short protection on this signal, so care should be taken not interface it to any output, be it Ground or any other voltage.

CompuScope 14100 with 100 MHz Bandwidth option

This section explains the key differences between the standard CS14100 and the CS14100 with the special 100 MHz bandwidth option.

1. Why is 100 MHz of bandwidth important?

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 CompuScope 14100 with the 100MHz bandwidth option 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 In-phase & Quadrature (I&Q) measurements in communication systems.

2. Specifications of the CS14100 with 100 MHz bandwidth option

The CS14100 with the 100 MHz bandwidth option shares most of the specifications of the standard product. However, a few key differences exist. This section will highlight these differences.

To allow higher frequencies through, including noise, some of the standard CompuScope 14100 specifications are affected when purchasing the 100 MHz bandwidth option. Please refer to the detailed specifications below for more information.

2.2 – Dynamic Performance

Bandwidth (Typical): 120 MHz
Bandwidth (Guaranteed): 100 MHz

The following tables provide the typical dynamic performance of the CompuScope 14100 with the 100 MHz bandwidth option.

Single Channel Mode – sampling at 100 MS/s

Signal Input:	**15 MHz**	**75 MHz**
SNR (dB)	41	48
SFDR (dB)	41	52
SINAD (dB)	41	47
THD (dB)	-63	-54
ENOB (bits)	6.5	7.8

Dual Channel Mode – sampling at 50 MS/s

Signal Input:	**10 MHz**	**75 MHz**
SNR (dB)	56	52
SFDR (dB)	74	67
SINAD (dB)	55	51
THD (dB)	-63	-61
ENOB (bits)	9.0	8.3

CompuScope 14100 compliance statement

Category	Standards or description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 61326 EMC requirements for Class A electrical equipment for measurement, control and laboratory use. [1, 2, 3] IEC61000-4-2 Electrostatic Discharge (Performance criterion B) IEC61000-4-3 RF Electromagnetic Field (Performance criterion A) IEC61000-4-4 Electrical Fast Transient/Burst Immunity (Performance criterion B) IEC61000-4-5 Power Line Surge Immunity (Performance criterion B) IEC61000-4-6 Conducted RF Immunity (Performance criterion A) IEC61000-4-11 Voltage Dips and Interruptions Immunity (Performance criterion B) EN 61000-3-2 AC Power Line Harmonic Emissions
Australia / New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radio communications Act per the following standard(s): AS/NZS 2064.1/2 Industrial, Scientific and Medical Equipment: 1992 [1, 2, 3]

1. **High-quality shielded cables must be used to ensure compliance to the above listed standards**
2. **Compliance demonstrated on a single card configuration**
3. **On the host PC used by the customer, all unused back panel slots must be covered with EMI blocking plates**

CompuScope 14100 throughput & maximum PRF

A number of applications require the CompuScope 14100 to acquire data based on a rapidly occurring trigger signal. These high Pulse Repeat Frequency (PRF) applications include imaging, radar, ultrasound and lightning test.

We have performed extensive repetitive capture benchmarks in Single Record mode. In this mode, the signal is captured into on-board CompuScope memory and the captured data are transferred through the PCI bus using PCI bus mastering to PC RAM.

Please note that much higher PRFs will be achieved using CompuScope Multiple Record mode.

The following test results were obtained using a computer configured as follows:

- Pentium III, 1 GHz processor
- 512 MB RAM
- 20 GB disk drive
- Windows 2000
- NT File System
- 33 MHz, 32 bit PCI bus
- All slots support bus mastering

A C application program optimized for fast repetitive capture in single record mode was used for throughput measurements. The CS14100 was operated using this application in both single and dual channel mode for many different capture depths and the results are plotted as points in the graph below. The PCI transfer rates were calculated from the linear portion of the curves at high depths.

PCI data transfer rate (single channel):	***80 MB/s***
PCI data transfer rate (dual channel):	***50 MB/s***

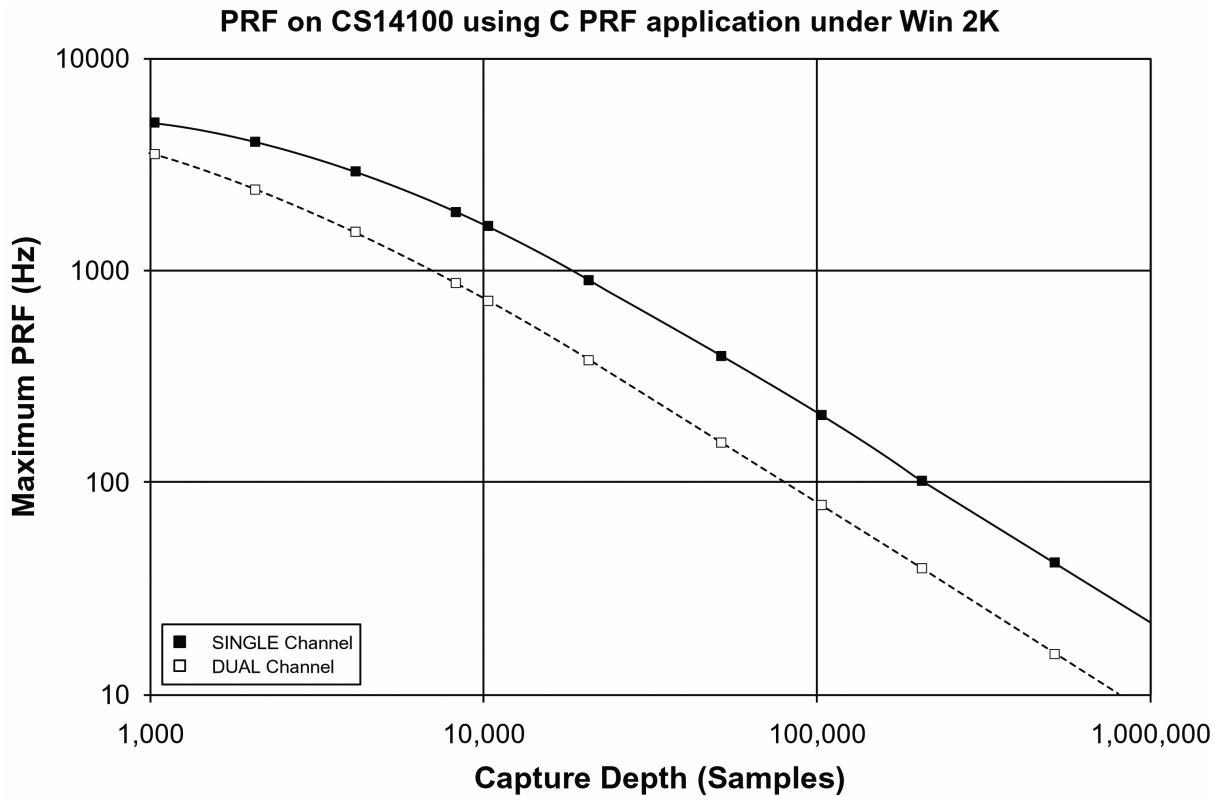

Figure 4: Maximum PRF vs. acquisition length