CompuScope 82G product introduction

CompuScope 82G is an 8 bit, waveform digitizer card for the PCI Bus, capable of 2 GS/s sampling on one channel and 1 GS/s sampling on two simultaneous channels.

Recognizing that until very recently, almost all multi-Megahertz data acquisition was done using Digital Storage Oscilloscopes under GPIB control, Gage has ported all of 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:

- CS82G features up to 16 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 or extended memory run as high as 80 MB/s for the CS82G 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.
- CS82G cards have standard features such as Multiple Record, which help optimize the use of the on-board memory.
- You can also write software for a multi-card system in which all the cards are not in a Master/Slave configuration. Drivers supplied by Gage support all of these multi-card configurations.
- In case you do not want to program the CompuScope 82G card(s), you can use the powerful GageScope® oscilloscope software to acquire, analyze and archive signals.

Special features of the CompuScope 82G include:

- Bus Mastering

  CompuScope 82G is 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.

- Multiple Record

  Multiple Recording allows CompuScope 82G to capture data on successive triggers and stack it in the on-board memory.

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

- Pre-Trigger Multiple Record

  Pre-Trigger Multiple Recording allows CompuScope 82G to collect pre-trigger data when the card is in Multiple Record mode. Up to 32 K points can be captured as pre-trigger data.

CompuScope 82G 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 CS82G card.

The connectors and headers on the CS82G card are shown below:

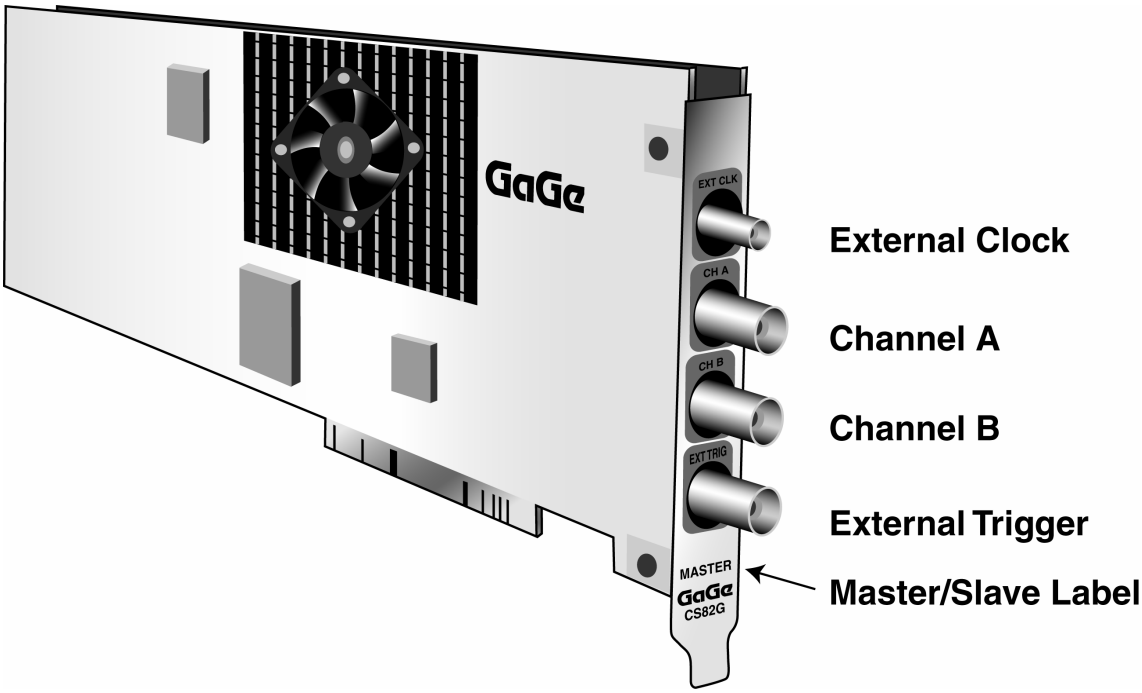

Figure 1: Connectors on CS82G

- **External Clock** connector is used for the External Clock Input, as described in the section labeled *External Clock*.
- **CH 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.
- **CH 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 an analog or digital signal, which may be 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.
- **PCI bus connector** is located at the bottom of the printed circuit board. This is an industry standard connector that complies with all specifications of the PCI bus.

- **Auxiliary power connector.** Power is supplied to the CompuScope 82G via the PCI bus and the Auxiliary Power Connector.

  It is absolutely necessary to connect the Auxiliary Power Connector using the disk drive power cable supplied with your CompuScope.

  If you fail to connect the Auxiliary Power Connector to the chassis power supply, your CompuScope 82G will not work.

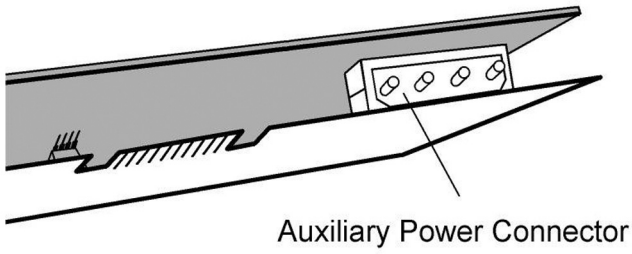

Figure 2: Auxiliary Power Connector

- **Master/Slave Timing Module (MSTM) connector.** The MSTM connector is located near the top-left corner of the CompuScope 82G. 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 of the signals necessary to synchronize Slave CompuScope 82G cards with the Master. The MSTM connector on the CS82G card is shown below:

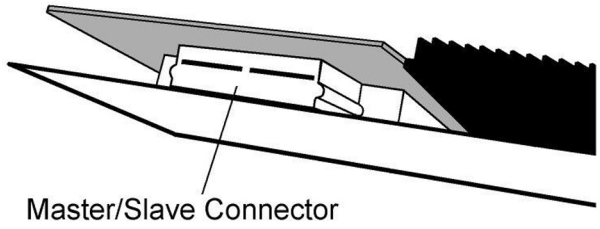

Figure 3: Master/Slave Timing Module connector

CompuScope 82G - 1 GHz Bandwidth version

The CompuScope 82G – 1 GHz is a special member of Gage's high-performance CS82G product family. This section explains the key differences between the standard CS82G and the special 1 GHz bandwidth version.

1. Why is 1 GHz of bandwidth important?

A higher bandwidth increases the precision and widens the range of applications of fast digitizers. By 'precision' we mean "less distortion" of the high frequency components that can be found in the spectrum of very fast transients.

While operating at 2 GS/s, the CompuScope 82G – 1 GHz provides a bandwidth limit that is equal to the Nyquist frequency of 1 GHz.

2. Specifications of the CS82G – 1GHz Bandwidth version

The 1GHz bandwidth version of the CS82G shares most of the specifications of the standard product. However, a few key differences exist. This section will highlight these differences and describe how to best operate the product to perform accurate measurements and prevent damage to the card.

Note that the CS82G – 1 GHz can be ordered with or without Internal Triggering. Only the dynamic performance of the product is affected by this choice.

2.1 – Input Characteristics and Protection

The modification made to the CS82G to give it a 1GHz bandwidth requires the bypassing of most of the protection from high voltages as well as all but 1 input range in each of the operating modes.

The input must be single-ended with an impedance of 50 Ohms, which is protected by diode clamping. Therefore, when operating a CS82G – 1 GHz, users must be cautious to not exceed the absolute maximum input voltage of ± 1V.

Furthermore, the only input ranges available for this product are ± 250mV in Dual Channel Mode, and ± 500mV in Single Channel Mode.

The following table provides the typical bandwidth of the CompuScope 82G – 1 GHz with, and without, Internal Trigger.

	Single Channel	**Dual Channel**
Bandwidth with Internal Trigger	1 GHz	465 MHz
Bandwidth without Internal Trigger	1.2 GHz	850 MHz

2.2 – Dynamic Performance

The following tables provide the typical dynamic performance of the CompuScope 82G – 1 GHz with (and without) Internal Trigger.

Single Channel Mode – sampling at 2 GS/s

Signal Input:	**15 MHz**	**100 MHz**	**200 MHz**
SNR (dB)	43 (43)	42 (42)	41 (42)
SFDR (dB)	52 (52)	50 (55)	49 (54)
SINAD (dB)	43 (43)	41 (43)	40 (42)
THD (dB)	-56 (-56)	-52 (-55)	-47 (-54)
ENOB (bits)	6.8 (6.8)	6.7 (6.7)	6.5 (6.7)

Dual Channel Mode – sampling at 1 GS/s

Signal Input:	**10 MHz**	**100 MHz**	**200 MHz**
SNR (dB)	46 (46)	44 (44)	43 (43)
SFDR (dB)	55 (54)	54 (54)	51 (53)
SINAD (dB)	45 (46)	43 (44)	41 (43)
THD (dB)	-53 (-53)	-50 (-52)	-45 (-50)
ENOB (bits)	7.3 (7.3)	7.0 (7.0)	6.8 (6.8)

3. Software considerations

Users of the CS82G – 1 GHz under Windows 98/ME/NT require a special driver version (3.60.30), which is available as a free download of the Gage website: http://www.gage-applied.com/support/softwares.php.

Users of the CS82G – 1 GHz under Windows 2000/XP can use the most recent CompuScope Win 2K/XP drivers.

GageScope® and the various SDKs, however, will not perceive the 1GHz version of the CS82G as having only 2 input ranges (one for Dual Channel Mode, one for Single Channel Mode). Users must therefore ensure that they request the correct input ranges when operating the card, or risk seeing their data scaled by the wrong factors (see Section 2 on previous page).

CompuScope 82G 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 82G throughput & maximum PRF

A number of applications require the CompuScope 82G to acquire data based on a rapidly occurring trigger signal. These high Pulse Repeat Frequency (PRF) applications include imaging, radar, ultrasound and lightning test.

Gage has 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 CS82G 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):	***80 MB/s***

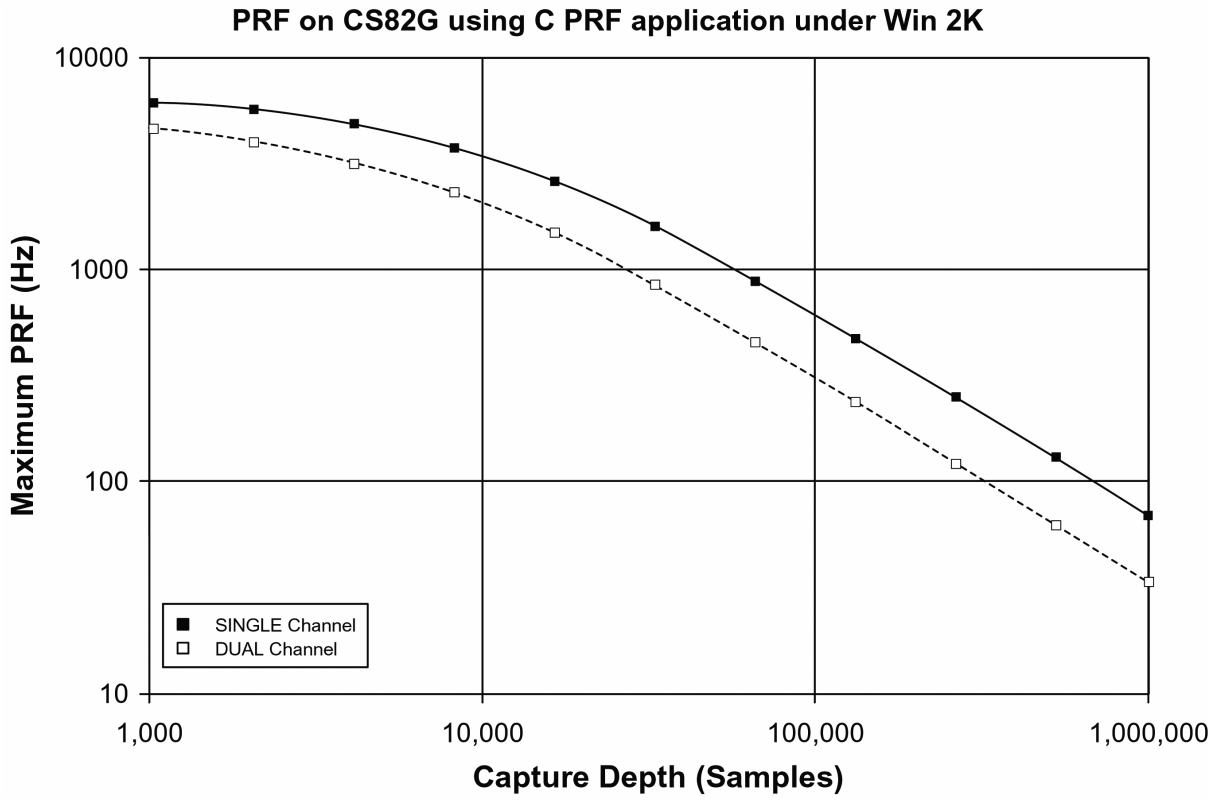

Figure 4: Maximum PRF vs. acquisition length