



CS1220 Hardware Manual

Reorder #: MKT-HWM-PCI01-CS1220
0408

First Edition (August 2004)

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Please complete the following section and keep it handy when calling Gage for **technical support**:

Owned by: _____
Serial Number(s): _____

Purchase Date: _____
Purchased From: _____

You must also have the following information when you call:

- Software Driver & Application Version
- Software Development Kit, if applicable
- Brand name and type of computer
- Processor and bus speed
- Total memory size
- Information on all other hardware in the computer

How to reach Gage Applied Technologies for Product Support

Toll-free phone: (800) 567-GAGE Toll-free fax: (800) 780-8411

To reach Gage from outside North America

Tel: (514) 633-7447 Fax: (514) 633-0770

Email: prodinfo@gage-applied.com **Website:** www.gage-applied.com

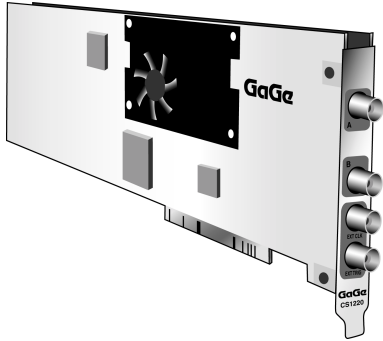
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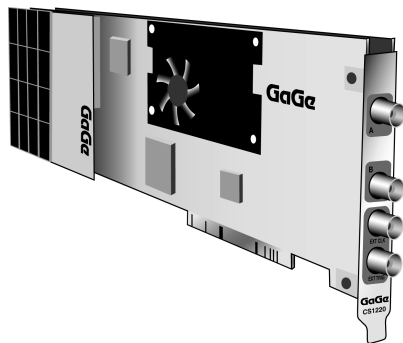
What you should receive with your CompuScope 1220

If you order an independent CompuScope 1220 card, you should receive the following articles:

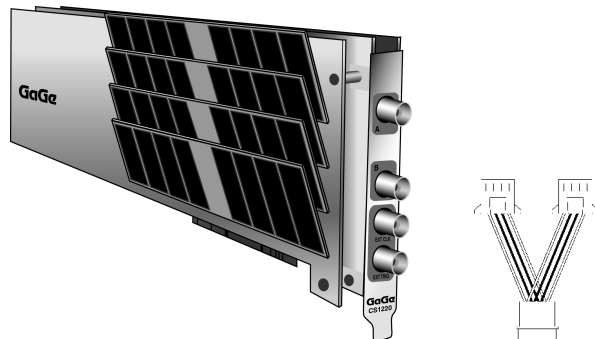
- CompuScope 1220 card. You should notice the configuration of the BNC connectors on the face plate of your CompuScope 1220 card.



If you purchased a CompuScope 1220-4M or CompuScope 1220-8M card, you should see a piggyback memory board attached to the back of the card, as shown below.



If you purchased a CompuScope 1220 card with 64M, 256M, 512M or 1G acquisition memory, you should see a full-length piggyback memory board attached to the back of the card, as shown below. You should also receive one Y-cable for powering the piggyback memory board (also known as Deep Memory Board).



- Standard items included with each independent CompuScope card

Hardware manual, including Driver Installation Guide



Note that you will receive only one copy of the Hardware Manual per order placed with Gage. Additional copies can be requested at order time.

The Hardware Manual is also available in PDF format on the Gage Software Disk or you can download card-specific manuals from Gage's Web site.

Gage Software Disk (with GageScope Software)



The Gage Software Disk, included at the back of the Hardware Manual and Installation Guide, contains all of the software drivers you need to operate your Gage hardware. The CD also contains all of the installers for the application packages provided by Gage, including Lite, Standard and Professional editions of GageScope.

Note that some packages will only be available if you have purchased the software and have a key provided by Gage.

CompuScope Certificate of NIST Traceable Calibration



Each CompuScope card is shipped with a Certificate of NIST Traceable Calibration. NIST is the National Institute to Standards and Technologies - the US organization that is responsible for the definitions and measurement of metrology standards.

Prior to shipment, Gage runs each CompuScope card through a battery of over 1000 automated performance verification tests using a NIST traceable calibration source. The tested CompuScope is then considered a NIST traceable calibration instrument for a period of one year – the calibration interval that is generally accepted by the Test and Measurement industry.

Warranty card



- You may also receive a number of optional items, if purchased:

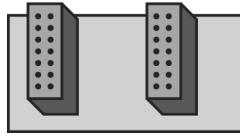
GageScope® software and
Standard or Professional edition
Software Key envelope

Software Development Kits (SDKs)
& applicable manual(s)



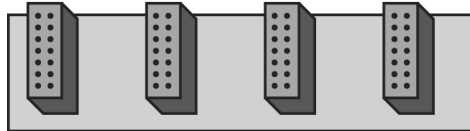
- If you ordered Master or Slave upgrades with your CompuScope 1220 cards, you will receive one of the following Master/Slave Timing Modules (actual Master/Slave Timing Module may not be exactly as shown).

2 Slot
Master/Slave
Timing Module



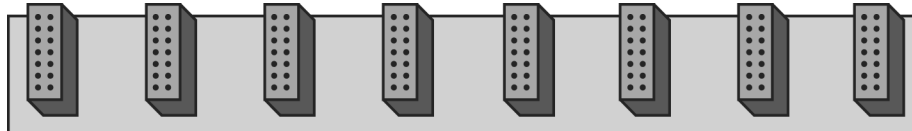
2-Slot Master/Slave Timing Module is used for:
2-Card Master/Slave system of CS1220-1M

4 Slot
Master/Slave
Timing Module



4-Slot Master/Slave Timing Module is used for:
4-Card Master/Slave system of CS1220-1M
2-Card Master/Slave system of CS1220-4M or CS1220-8M

8 Slot
Master/Slave
Timing Module



8-Slot Master/Slave Timing Module is used for:
6-or 8-Card Master/Slave system of CS1220-1M
3-or 4-Card Master/Slave system of CS1220-4M or CS1220-8M
2-or 3-Card Master/Slave system of CS1220-64M, CS1220-256M, CS1220-512M or CS1220-1G

Carefully inspect these articles before proceeding further. If you find any damage caused by transportation, please report it to the organization from which you purchased the CompuScope card.

CompuScope 1220 compliance statement

Category	Standards or description
EC Declaration of Conformity – EMC	<p>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:</p> <p>EN 61326 EMC requirements for Class A electrical equipment for measurement, control and laboratory use. ^{1,2,3}</p> <p>IEC61000-4-2 Electrostatic Discharge (Performance criterion B)</p> <p>IEC61000-4-3 RF Electromagnetic Field (Performance criterion A)</p> <p>IEC61000-4-4 Electrical Fast Transient/Burst Immunity (Performance criterion B)</p> <p>IEC61000-4-5 Power Line Surge Immunity (Performance criterion B)</p> <p>IEC61000-4-6 Conducted RF Immunity (Performance criterion A)</p> <p>IEC61000-4-11 Voltage Dips and Interruptions Immunity (Performance criterion B)</p> <p>EN 61000-3-2 AC Power Line Harmonic Emissions</p>
Australia / New Zealand Declaration of Conformity - EMC	<p>Complies with EMC provision of Radio communications Act per the following standard(s):</p> <p>AS/NZS 2064.1/2 Industrial, Scientific and Medical Equipment: 1992 ^{1,2,3}</p>

- 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 1220 product introduction

CompuScope 1220 is 12 bit dual channel, 20 MS/s 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:

- CS1220 features up to 1 billion 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 50 MB/s for the CS1220 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.
- CompuScope cards are installed inside the PCI bus chassis, so there is no external box such as a DSO.
- CS1220 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. Drivers supplied by Gage support all these multi-card configurations.

Special features of the CompuScope 1220 include:

- **Bus Mastering**
CompuScope 1220 cards are fully capable of becoming a bus master in order to transfer data at the maximum rate of 50 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.
- **External Clock**
CompuScope 1220 comes standard with External Clocking capability that allows synchronization of the digitizers with an external system.

CompuScope 1220 specifications

PLEASE CHECK THE GAGE WEBSITE FOR THE MOST UP-TO-DATE 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" x 4.1".

1 M Acquisition Memory	1 slot
4 M Acquisition Memory	2 slots
8 M Acquisition Memory	2 slots
64 M Acquisition Memory	3 slots
256 M Acquisition Memory	3 slots
512 M Acquisition Memory	3 slots
1 G Acquisition Memory	3 slots

POWER (IN WATTS)

+ 5 Volts		
Acquisition Memory	Worst Case	Typical
1M	25.0 W	17.5 W
4M	28.0 W	20.5 W
8M	28.0 W	20.5 W
64M	32.5 W	23.5 W
256M	32.5 W	23.5 W
512M	32.5 W	23.5 W
1G	32.5 W	23.5 W

Note: Power connector on the deep memory board of 64M, 256M, 512M and 1G models must also be connected using a Y-cable.

CHANNELS A & B

Inputs per card:	2 single-ended inputs
Impedance:	1 M Ω , 35 pF or 50 Ω , software selectable
Coupling:	AC or DC
Connector:	1 BNC per channel
Resolution:	12 bits
A/D Type:	Monolithic, 16 bit oversampling with decimation filter, operating in 12 bit mode
Input Voltage Ranges:	± 50 mV, ± 100 mV, ± 200 mV, ± 500 mV, ± 1 V, ± 2 V, ± 5 V, ± 10 V
Analog Bandwidth:	

Input Range	-3dB Point
± 10 V	5 MHz
± 5 V	5 MHz
± 2 V	10 MHz
± 1 V	10 MHz
± 500 mV	10 MHz
± 200 mV	10 MHz
± 100 mV	10 MHz
± 50 mV	10 MHz

Absolute Max. Amplitude:
 1 M Ω impedance: ± 15 Volts (continuous)
 50 Ω impedance: ± 5 Volts (continuous),
 ± 15 Volts (for 1ms duration)

DC Accuracy

Input Range	Accuracy
± 10 V	$\pm 0.5\%$
± 5 V	$\pm 0.5\%$
± 2 V	$\pm 0.5\%$
± 1 V	$\pm 0.5\%$
± 500 mV	$\pm 0.5\%$
± 200 mV	$\pm 0.5\%$
± 100 mV	$\pm 1\%$
± 50 mV	$\pm 2\%$

Sampling Rates 20 MS/s, 10 MS/s, 5 MS/s, 2 MS/s, 1 MS/s, 500 kS/s, 200 kS/s,
 100 kS/s, 50 kS/s, 20 kS/s, 10 kS/s, 5 kS/s, 2 kS/s, 1 kS/s

Protection

1 M Ω impedance: Diode Clamped
 50 Ω impedance: No protection

DYNAMIC PARAMETERS

Measured using 5 MHz sine wave input at 20 MS/s with amplitude of 95% of full scale on the ± 1 V range.
 Typical values listed below.

SNR: 55 dB
 SFDR: 57 dB
 ENOB: 8.9 bits

ACQUISITION MEMORY

Data Storage: In on-board memory

Memory sizes: 1 Msamples,
 4 Msamples,
 8 Msamples,
 64 Msamples,
 256 Msamples
 512 Msamples,
 1 Gsamples

Maximum memory depth: Up to half on-board memory per channel

TRIGGERING

Number of Trigger Inputs: 2 per card
 Trigger Source: CH A, CH B, EXT or Software
 Input combination: Wired-OR
 Type: Analog triggering
 Sensitivity: $\pm 20\%$ of full scale
 Level Accuracy: $\pm 10\%$ 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 M Ω , 30 pF
Input Type: Single-ended analog
Amplitude: Absolute Max ± 15 V
Voltage Range: ± 1 V and ± 5 V
Bandwidth: 10 MHz
Connector: BNC

INTERNAL CLOCK

Source: 20 MHz oscillator
Accuracy: ± 50 ppm (0 to 70 degrees Celsius)

EXTERNAL CLOCK

Maximum Frequency: 20 MHz
Minimum Frequency: 1 kHz
Signal Level: TTL
Required Duty Cycle: 50% $\pm 5\%$ at 20 MHz

MULTIPLE RECORD

Pre-trigger Data: None
Record Length: 128 points minimum
Can be defined with a 64 point resolution
Maximum Number of Triggers: 4,194,304

MULTI-CARD SYSTEMS

Operating modes: Master/Slave or Multiple Independent
Maximum Number of Cards
Master/Slave: 2 to 8 cards for 1M memory
2, 3 or 4 cards for 4M or 8M memory
2 or 3 cards for 64M, 256M, 512M and 1G
Multiple/Independent: Limited by the backplane of the PC
Maximum number of Channels
in Master/Slave Mode: 16 at 20 MS/s (for 1M models)

MASTER/SLAVE SYSTEM TRIGGERING

Number of Trigger Inputs: 2 per card
Trigger Source: CH A, CH B, EXT or Software
(Master card only)
Input combination: Wired-OR
Sensitivity: $\pm 20\%$ of full scale
Level Accuracy: $\pm 10\%$ of full scale
Slope: Positive or Negative, software selectable

OPERATING SYSTEMS SUPPORTED

- Windows 98/ME/NT* CompuScope Driver version 3.60.22
* Version 4, SP3 or higher
- Windows 2000**/XP CompuScope Driver version 3.80.xx
** SP1 or higher

APPLICATION SOFTWARE

GageScope[®]: Windows-based software for programming-free operation

- | | |
|-----------------------|---|
| LITE Edition: | Included with purchase, provides basic functionality |
| Standard Edition: | Provides limited functionality of advanced analysis tools, except for Extended Math |
| Professional Edition: | Provides full functionality of all advanced analysis tools |

SOFTWARE DEVELOPMENT KITS (SDK)

- CompuScope SDK for C/C++
For Windows 98/ME/NT/2000/XP
Includes Sample Programs in Visual C++
- CompuScope SDK for MATLAB
For Windows 98/ME/NT/2000/XP
- CompuScope SDK for LabVIEW
For Windows 98/ME/NT/2000/XP

ENVIRONMENTAL

- | | |
|------------------------|---------------------------------------|
| Operating Temperature: | 5 degree Celsius to 40 degree Celsius |
| Relative Humidity: | Less than 80%, non-condensing |
| Maximum Altitude: | 2,000 meters |

WARRANTY

One year parts and labor

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

CompuScope 1220 ordering information

Hardware and upgrades

Product	Order No.
CompuScope 1220 – 1M	122-001-002
CompuScope 1220 – 4M	122-001-003
CompuScope 1220 – 8M	122-001-004
CompuScope 1220 – 64M	122-001-005
CompuScope 1220 – 256M	122-001-006
CompuScope 1220 – 512G	122-001-007
CompuScope 1220 – 1G	122-001-008
CS1220: Memory Upgrade Charge	122-181-200
CS1220: Master Multi-Card Upgrade	122-181-002
CS1220: Slave Multi-Card Upgrade	122-181-003

GageScope Software

Product	Order No.
GageScope Lite Edition	Included
GageScope Standard Edition – purchased with CompuScope hardware	300-100-351
GageScope Standard Edition – purchased independently	300-100-352
GageScope Professional Edition – purchased with CompuScope hardware	300-100-354
GageScope Professional Edition – purchased independently	300-100-355

Software Development Kits (SDKs)

Product	Order No.
Gage SDK Pack on CD (No Hardcopy of Manuals included)	200-113-000
Gage SDK Pack on CD (Hardcopy of Manuals included)	200-113-002
CompuScope SDK for C/C++	200-200-101
CompuScope SDK for MATLAB	200-200-102
CompuScope SDK for LabVIEW	200-200-103

CompuScope 1220 simplified block diagram

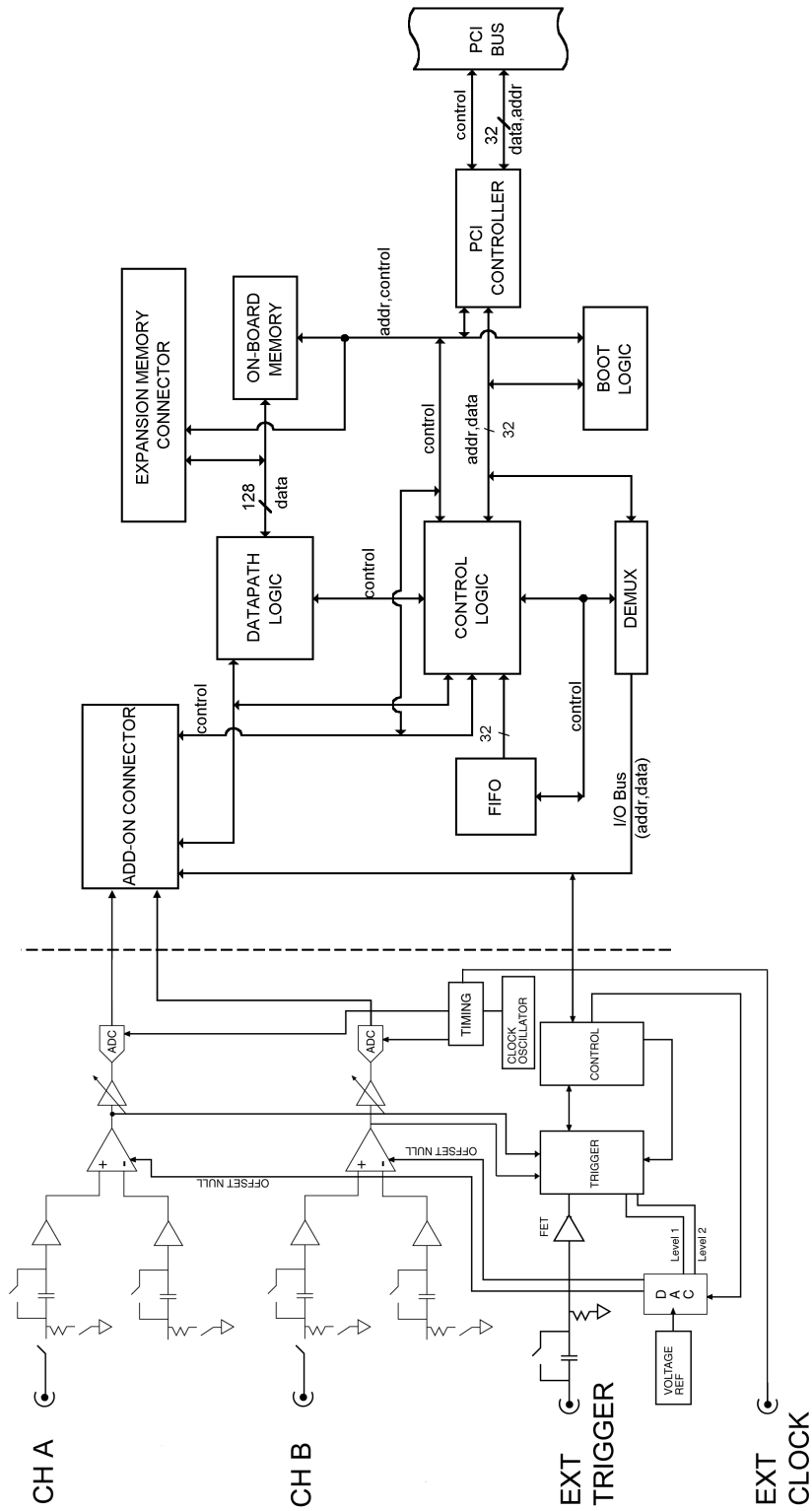


Figure 1: CS1220 simplified block diagram

CompuScope 1220 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 CS1220 card.

The connectors and headers on the CS1220 card are shown below:

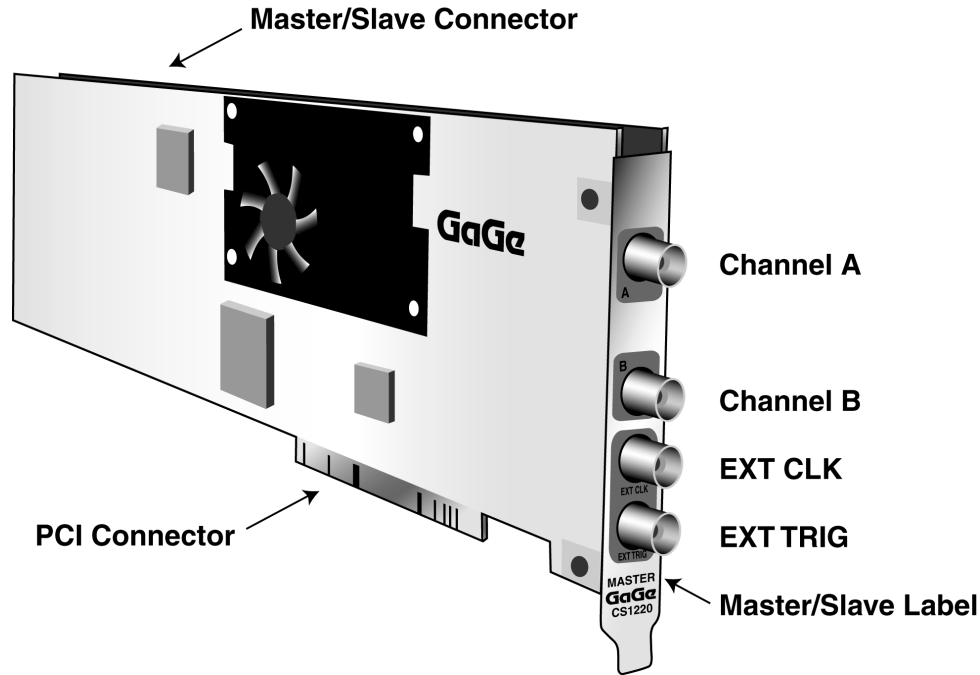


Figure 2: Connectors on CS1220

- **Channel A BNC Connector** for the single-ended input of channel A; used to input an analog signal that is sampled as Channel A.
- **Channel B BNC Connector** for the single-ended input of channel B; used to input an analog signal that is sampled as Channel B.
- **External Clock connector BNC Connector** used to supply a signal that will be used as the sampling clock instead of the CompuScope card's own oscillator.
- **External Trigger BNC Connector** 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.
- **Master/Slave connector** The Master/Slave connector is located near the top edge of the CompuScope 1220 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 1220 cards with the Master.

NOTE FOR COMPUSCOPE 1220 DEEP MEMORY BOARD USERS:

IF Y-CABLES ARE NOT CONNECTED BETWEEN THE POWER CONNECTORS OF YOUR COMPUSCOPE DEEP MEMORY CARD(S) AND THE POWER SUPPLY OF THE CHASSIS, THE DEEP MEMORY CARD(S) WILL NOT FUNCTION PROPERLY.

CompuScope 1220 throughput & maximum PRF

A number of applications require the CompuScope 1220 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 CS1220 was operated using this application for many different capture depths and the results are plotted as points in the graph below. The PCI transfer rate was calculated from the linear portion of the curve at high depths.

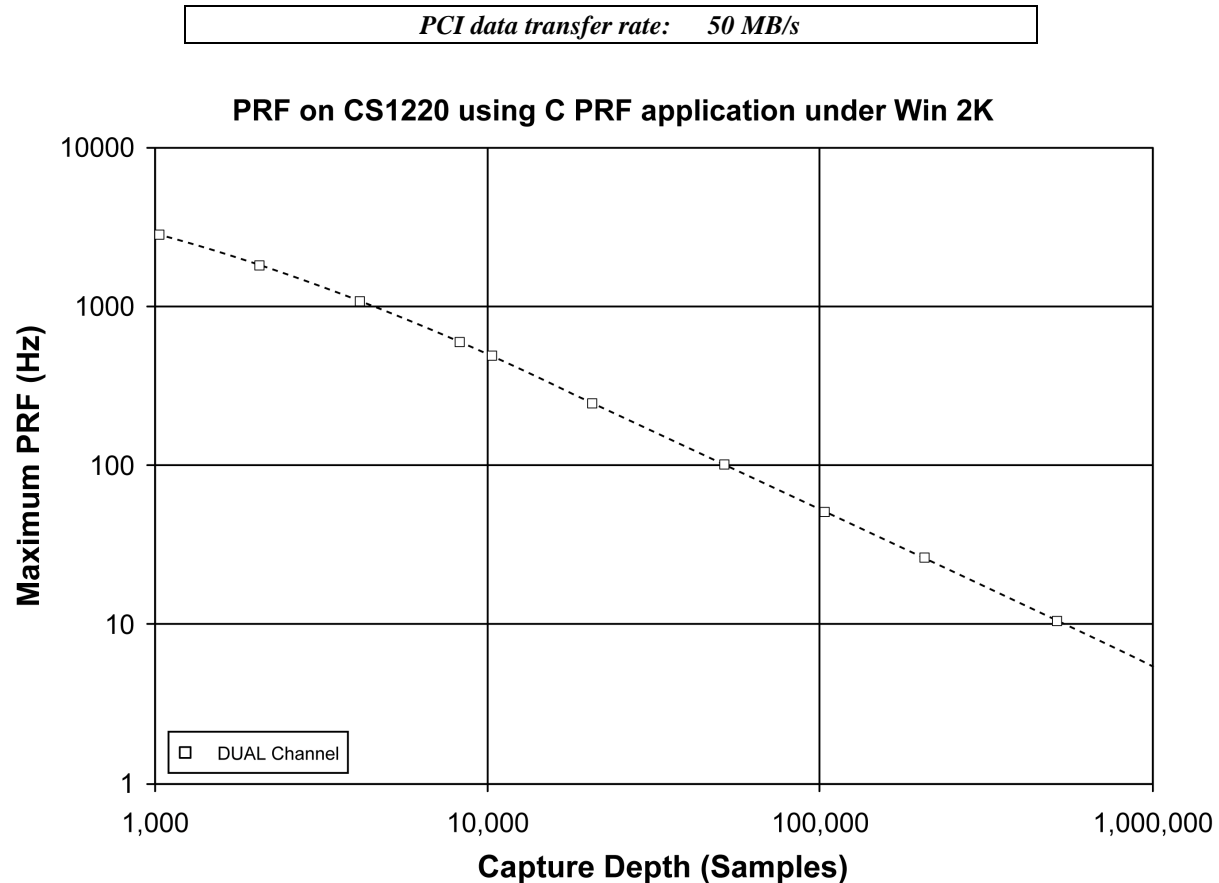


Figure 3: Maximum PRF vs. acquisition length

Notes
