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Find the *DynamicSignals / GaGe CompuScope 1450* at our website: *Click HERE*

GAGE APPLIED TECHNOLOGIES

CS1450 Hardware Manual

Reorder #: MKT-HWM-PCI01-CS1450
0408

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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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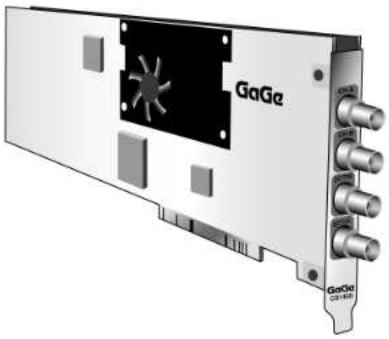
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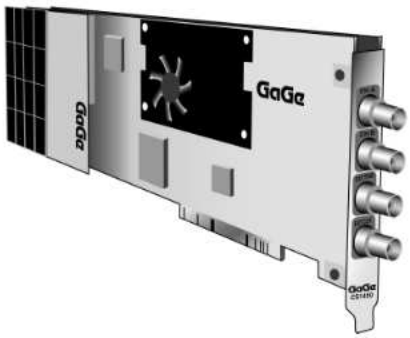
What you should receive with your CompuScope 1450

If you order an independent CompuScope 1450 card, you should receive the following articles:

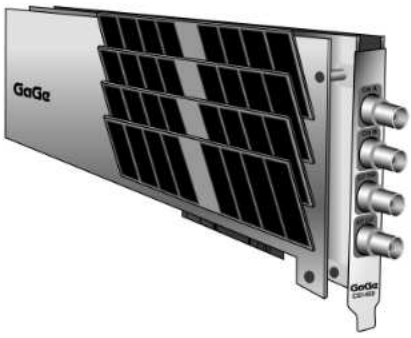
- CompuScope 1450 card

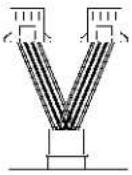


If you purchased a CompuScope 1450-8M card, you should see a piggyback memory board attached to the back of the card, as shown below.



If you purchased a CompuScope 1450 card with 128M, 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).





- Y-Cables for powering CompuScope cards in a multi-card system (Master/Slave or multiple independent). You will receive one Y-cable for each card.



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- 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)



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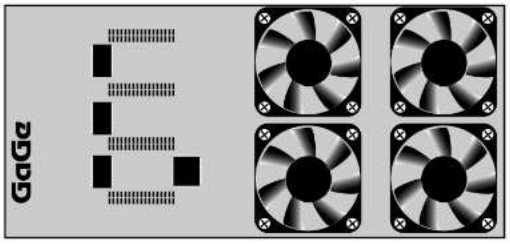
- If you ordered Master or Slave upgrades with your CompuScope 1450 cards, you will receive one of the following Master/Slave Timing Modules:

2 Slot
Master/Slave
Timing Module



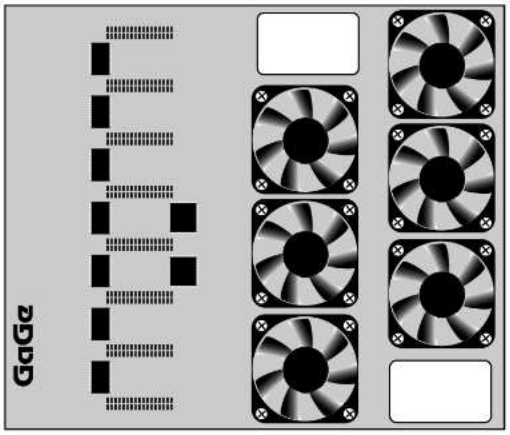
2 Slot Master/Slave Timing Module is used for:
2 card Master/Slave system of CS1450-1M

4 Slot
Master/Slave
Timing Module



4-Slot Master/Slave Timing Module is used for:
4 card Master/Slave systems of CS1450-1M
2 card Master/Slave systems of CS1450-8M

8 Slot
Master/Slave
Timing Module



8-Slot Master/Slave Timing Module is used for:
6 or 8 card Master/Slave systems of CS1450-1M
3 or 4 card Master/Slave systems of CS1450-8M
2 or 3 card Master/Slave systems of CS1450-128M, CS1450-512M or CS1450-1G

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.

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CompuScope 1450 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**

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CompuScope 1450 product introduction

CompuScope 1450 is 14 bit 50 MS/s single channel and 25 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:

- CS1450 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 80 MB/s for the CS1450 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.
- CS1450 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 1450 include:

- Bus Mastering

  CompuScope 1450 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.

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CompuScope 1450 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
8 M Acquisition Memory	2 slots
128 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	24.8 W	22.5 W
8M	30.3 W	27.5 W
128M	33.6 W	30.5 W
512M	33.6 W	30.5 W
1G	33.6 W	30.5W
- 5 Volts		
	Worst Case	**Typical**
All models	0.0	0.0
+ 12 Volts		
	Worst Case	**Typical**
All models	1.7 W	1.5 W
- 12 Volts		
	Worst Case	**Typical**
All models	0.6 W	0.5 W

Notes:

1. Auxiliary Power Cable must be connected if more than one CS1450 cards are installed.
2. Power connector on the deep memory board of 128M, 512M and 1G models 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
Analog Bandwidth:	DC to 25 MHz (DC coupled) 10 Hz to 25 MHz (AC coupled)
Input Voltage Ranges:	±100mV, ±200mV, ±500mV, ±1V, ±2V, ±5V

Absolute Max. Amplitude:

1 MΩ impedance:	±15 Volts (continuous)
50 Ω impedance:	±5 Volts (continuous)

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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%

Sampling Rate

Single Channel (Channel A only)

MS/s: 50, 25, 10, 5, 2, 1

kS/s: 500, 200, 100, 50, 20, 10, 5, 2, 1

Dual Channel (Channel A and B simultaneously)

MS/s: 25, 10, 5, 2, 1

kS/s: 500, 200, 100, 50, 20, 10, 5, 2, 1

Protection

1 MΩ impedance: Diode Clamped

50 Ω impedance: No protection

Connector: BNC

DYNAMIC PARAMETERS

Measured using 1 MHz sine wave input at 25 MS/s 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: 1 Msamples,
8 Msamples,
128 Msamples
512 Msamples,
1 Gsamples
(14 bit samples)

Maximum memory depth:

Single Channel: Full on-board memory

Dual Channel: Half on-board memory per channel

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TRIGGERING

Number of Trigger Inputs:	2 per system
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, software selectable
Post Trigger Data:	64 (*128*) points minimum. Can be defined with a 64 (*128*) point resolution in dual (*single*) channel mode

EXTERNAL TRIGGER

Impedance:	1 MΩ, 35 pF
Amplitude:	Absolute Max ±15V
Voltage Range:	±1V and ±5V
Bandwidth:	25 MHz
Coupling:	AC or DC
Connector:	BNC

INTERNAL CLOCK

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

EXTERNAL CLOCK

Maximum Frequency:	50 MHz in single channel 25 MHz in dual channel
Minimum Frequency:	40 MHz in single channel 20 MHz in dual channel
Signal Level:	MIN 1V RMS MAX 2 V RMS
Impedance:	50 Ω
Sampling Edge:	Rising
Required Duty Cycle:	50% ± 30% in single channel 50% ± 5% in dual channel

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
Maximum Number of Triggers:	4,194,304

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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 8M memory 2 or 3 cards for 128M, 512M and 1G
Multiple/Independent:	Limited by the backplane
Maximum number of Channels in Master/Slave Mode:	16 at 25 MS/s (for 1M models) 8 at 50 MS/s (for 1M models)

MASTER/SLAVE SYSTEM TRIGGERING

Number of Trigger Inputs:	2 per system
Trigger Source:	CH A, CH B, EXT or Software (Master card only)
Sensitivity:	± 10% of full scale
Level Accuracy:	± 5% 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

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CompuScope 1450 ordering information

Hardware and upgrades

Product	Order No.
CompuScope 1450 – 1M	145-001-002
CompuScope 1450 – 8M	145-001-003
CompuScope 1450 –128M	145-001-004
CompuScope 1450 – 512M	145-001-005
CompuScope 1450 – 1G	145-001-006
CS1450: Memory Upgrade Charge	145-181-200
CS1450: Master Multi-Card Upgrade	145-181-003
CS1450: Slave Multi-Card Upgrade	145-181-004
CS1450: Internal BNC Modification	145-181-020

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

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CompuScope 1450 simplified block diagram

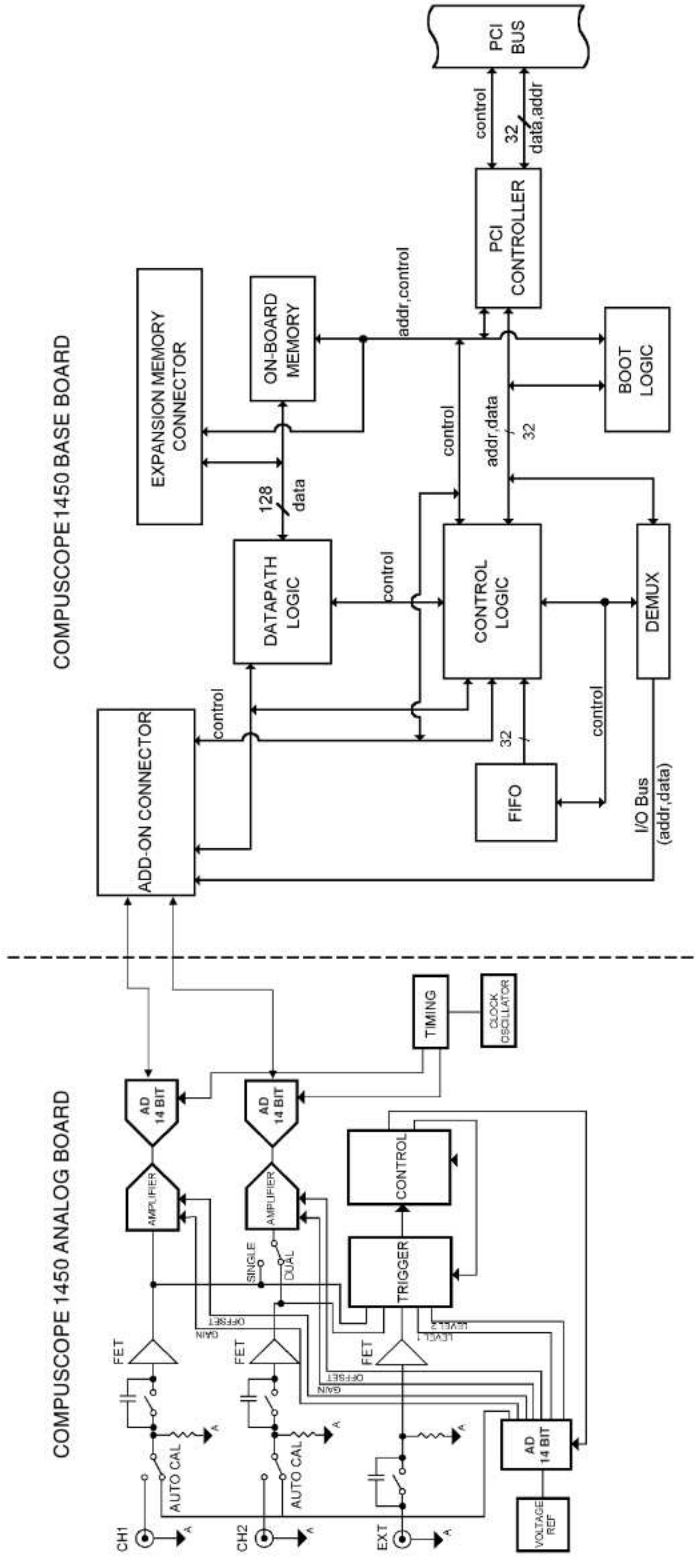


Figure 1: CS1450 simplified block diagram

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CompuScope 1450 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 CS1450 card.

The connectors and headers on the CS1450 card are shown below:

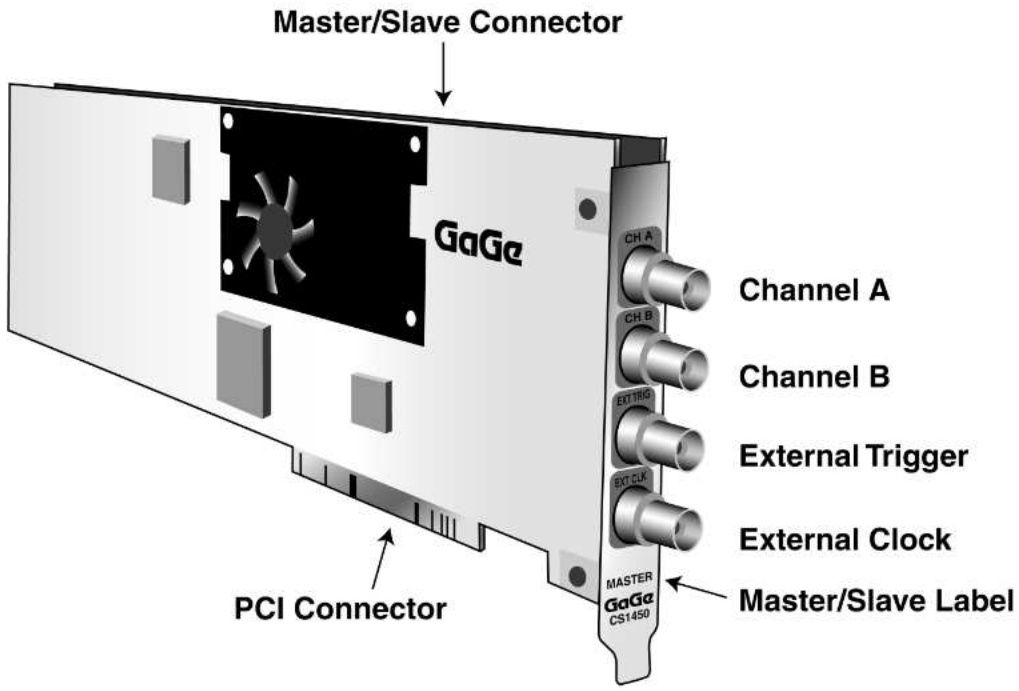


Figure 2: Connectors on CS1450

- **Channel A BNC** connector is used to input an analog signal that is sampled as Channel A.
- **Channel B BNC** connector is used to input an analog signal that is sampled as Channel B.
- **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 1450 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 1450 cards with the Master.

NOTE FOR MULTI-CARD COMPUSCOPE 1450 USERS:
IF Y-CABLES ARE NOT CONNECTED TO THE AUXILIARY POWER CONNECTORS OF YOUR COMPUSCOPE CARDS, THEY WILL NOT FUNCTION PROPERLY

NOTE FOR COMPUSCOPE 1450 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.

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CompuScope 1450 throughput & maximum PRF

A number of applications require the CompuScope 1450 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 CS1450 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***

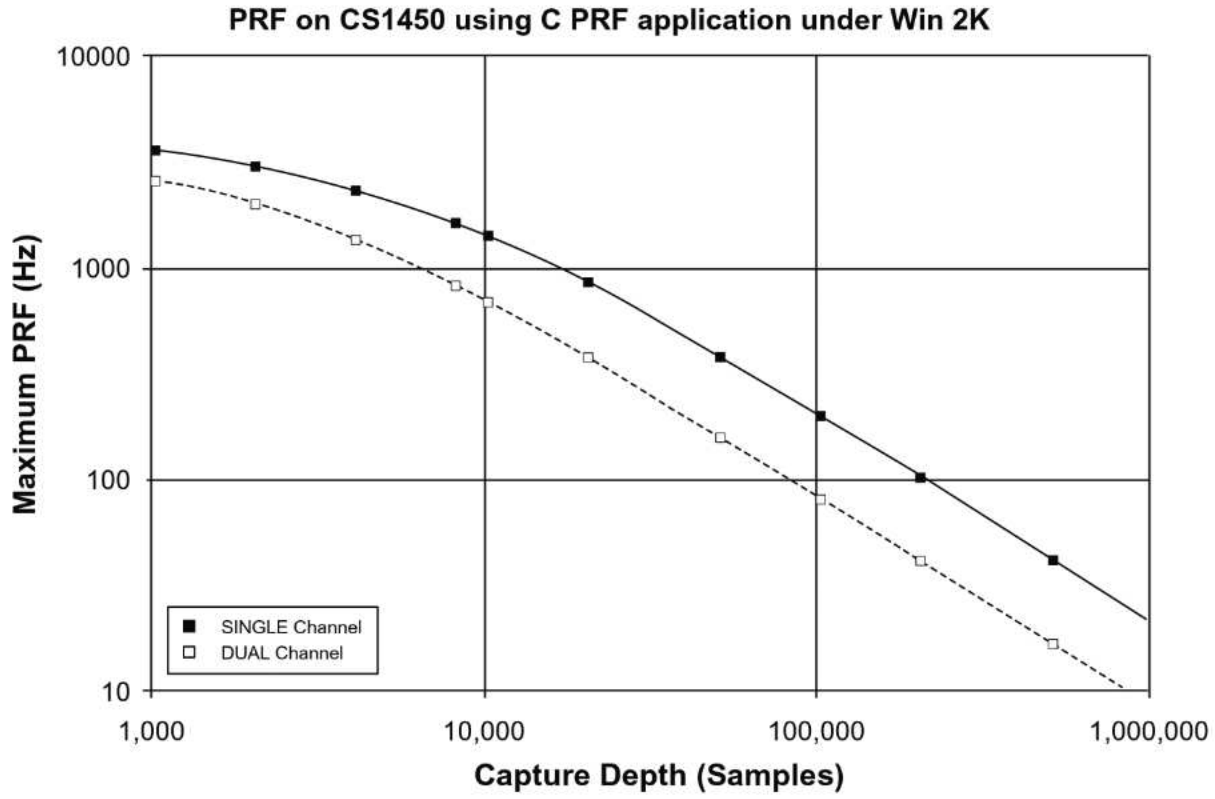


Figure 3: Maximum PRF vs. acquisition length

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Notes

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