GAGE APPLIED TECHNOLOGIES

CompuScope PCI Hardware Manual and Driver Installation Guide

P/N: 0045508
Reorder #: MKT-HWM-PCI03
0505

Third Edition (May 2005)

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: +1-514-633-7447 Fax: +1-514-633-0770

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

Table of Contents

Preface

This manual provides detailed information on the hardware features of CompuScope PCI Analog Input cards and CompuScope PCI Digital Input cards. This information includes specifications, block diagrams, connector descriptions, memory architecture descriptions, etc.

In addition, this guide takes you through the process of installing your CompuScope card(s) and describes available custom features.

Please note that this manual is not intended as a reference for CompactPCI bus CompuScope cards. If you did not receive the correct guide, please contact the factory for a replacement.

It is assumed that the reader is familiar with using PCs, Windows and PCI bus cards. No description is included for these topics. If you are not comfortable with these areas, it is strongly recommended that you refer to the relevant product guides.

To maintain the accuracy of the information contained herein, we reserve the right to make changes to this manual from time to time.

Note: For brevity, in this manual,

"CompuScope 82G" is abbreviated as "CS82G"

"CompuScope 8500" is abbreviated as "CS8500"

"CompuScope 12400" is abbreviated as "CS12400"

"CompuScope 12100" is abbreviated as "CS12100"

"CompuScope 1250" is abbreviated as "CS1250"

"CompuScope 1220" is abbreviated as "CS1220"

"CompuScope 14200" is abbreviated as "CS14200"

"CompuScope 14105" is abbreviated as "CS14105"

"CompuScope 14100" is abbreviated as "CS14100"

"CompuScope 1450" is abbreviated as "CS1450"

"CompuScope 1610" is abbreviated as "CS1610"

"CompuScope 1602" is abbreviated as "CS1602"

"CompuScope 3200" is abbreviated as "CS3200"

Preventing ESD

Before installing or servicing this product, read the ESD information below:

CAUTION. *Static discharge can damage any semiconductor component in this instrument.*

When handling this instrument in any way that requires access to the on-board circuitry, adhere to the following precautions to avoid damaging the circuit components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive circuit boards and components.
2. Transport and store static sensitive modules in their static protected containers or on a metal rail. Label any package that contains static sensitive boards.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules and circuit boards. Perform installation and service of static-sensitive modules only at a static-free work station.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the circuit boards over any surface.
7. Avoid handling circuit boards in areas that have a floor or work-surface covering capable of generating a static charge.

General safety summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Observe all terminal ratings.
To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do not operate with suspected failures.
If you suspect there is damage to this product, have it inspected by qualified service personnel.

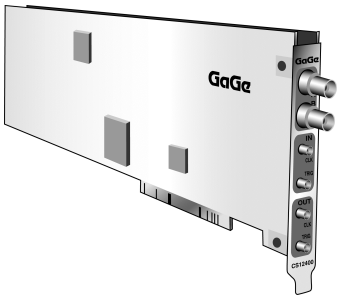
Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

What you should receive with your CompuScope 12400

If you order an independent CompuScope 12400 card, you should receive the following articles:

- CompuScope 12400 card



- You will also receive a number of standard items included with each order:

Hardware Manual and 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.

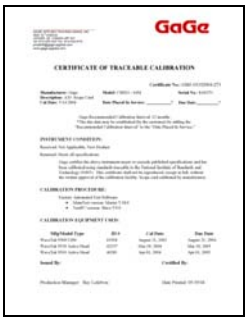
The Hardware Manual is also available in PDF format on the Gage CompuScope CD or you can download card-specific manuals from Gage's Web site.

Gage CompuScope CD (with GageScope Software)

The Gage CompuScope CD, included on the inside-front cover of the Hardware Manual and Installation Guide, contains all of the software drivers you need to operate your CompuScope 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



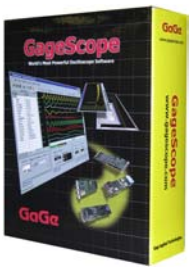
Each CompuScope card is shipped with a Certificate of NIST traceable Calibration. NIST is the National Institute to Standards and Technologies - the US organization that is responsible for the definitions and measurement of metrology standards.

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.

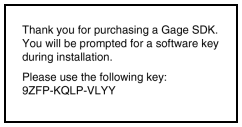
Warranty card

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

GageScope® software and
Standard or Professional edition
Software Key envelope

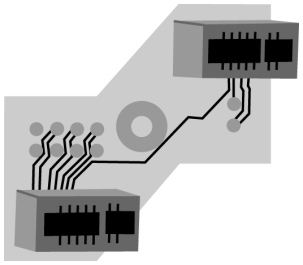


Software Development Kits (SDKs)
You will be provided with a software key
to use for the installation of the SDK.



- If you ordered Master or Slave upgrades with your CompuScope 12400 cards, you will receive one of the following Master/Slave Timing Modules (actual Master/Slave Timing Module may not be exactly as shown).

2 Card
Master/Slave
Timing Module



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.

Introduction to the CompuScope 12400

The CompuScope 12400 is a 12 bit, 400 MS/s dual channel general-purpose waveform digitizer card for the PCI Bus.

The CompuScope 12400 represents a new generation of digitizers from Gage and has most of the advanced features you would expect from a top performance signal capture card:

- Single-channel maximum sampling speed of 400 MS/s.
- 2 synchronous channels at maximum sampling speed of 200 MS/s.
- Up to a total of 2 billion samples of on-board acquisition memory in a single full-length PCI slot format.
- Data transfer rates from CompuScope memory to PC memory as high as 200 MB/s through Bus Mastering on a 66 MHz, 32 bit PCI bus.
- 200 MHz bandwidth specification.
- Ease of integration with External Clock In and Out, External Trigger In and Out.
- Ease of system development with Software Development Kits (SDKs) for C/C#, MATLAB, LabVIEW, and LabWindows/CVI.
- Pre-Trigger Multiple Record functionality, which help optimize the use of the on-board memory by stacking data from successive acquisitions.
- A nominal resolution of 12 bits, combined to an accuracy of ± 0.5% for precise absolute measurements of fine signal details.
- On-board self-calibration to guarantee consistent accuracy across input ranges and modes of operation; self-calibration can be automatic or user-controlled to minimize down time and ensure availability of the card for measurement in test systems.
- Full-featured front-end, with software control over input ranges, coupling and impedances.
- Excellent frequency response and minimal phase distortion characteristics; designed for optimal cross-channel synchronization and smooth frequency response within a 1 dB band of the ‘ideal’ response for the bandwidth.
- Time-stamping acquired records using an on-board 44 bit counter that is clocked by a 66 MHz crystal oscillator. This is particularly useful in Multiple Record mode. Optionally, the time-stamp counter can use the sample clock as its reference.
- On-board Phase Lock Loop (PLL) circuitry allows an external 10 MHz clock reference to synchronize the on-board oscillator to provide the sampling clock signal.

CompuScope 12400 specifications

PLEASE CHECK THE GAGE WEBSITE FOR THE MOST UP-TO-DATE SPECIFICATIONS.

SYSTEM REQUIREMENT

PCI-based computer with at least 1 free full-length PCI slot, 128 MB RAM, 100 MB hard disk. Minimum Pentium II 500 MHz and SVGA video.

SIZE

Plugs into one full-length PCI slot, 13" x 4.1", for all memory configurations.

POWER

+ 5 Volts	
	Typical
All memory depths	18.0 W
+3.3 Volts	
	Typical
All memory depths	7.9 W
+ 12 Volts	
	Typical
All memory depths	0 W
- 12 Volts	
	Typical
All memory depths	0 W

COOLING SYSTEM

Min. CFM requirement: *Characterization in progress*

A/D SAMPLING

Inputs per card: 2

Resolution: 12 bits

Sampling Rates

Channels A and B simultaneously:
200 MS/s, 100 MS/s, 50 MS/s, 25 MS/s,
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

Channel A only: 400 MS/s, 200 MS/s, 100 MS/s, 50 MS/s, 25 MS/s,
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

Connector: BNC

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

Coupling: AC or DC; software-selectable

AC Coupled Bandwidth: 10 Hz to 200 MHz (see Note 2)

DC Coupled Bandwidth: DC to 200 MHz (50 Ω only, slightly less for 1 MΩ; see Note 2)

Flatness (see Note 2): Within 1 dB of ideal response over 75% of bandwidth

DC Accuracy: ± 0.5%

Input Voltage Ranges: ± 100 mV, ± 200 mV, ±500 mV, ± 1 V, ± 2 V, ±5 V
(±5 V is only available in 50 Ω)

DC Offset: ± 1 time Full Range, except in ± 5 V input range

Protection: 1 MΩ impedance: Diode-clamped
50 Ω impedance: No protection

Absolute Maximum Amplitude:
1 MΩ impedance: ± 15 V (continuous)
50 Ω impedance: ± 5 V (continuous), ± 15 V (for 1 ms duration)

DYNAMIC PARAMETERS

Unless otherwise noted, the dynamic parameters are measured with input amplitude of 95% of Full Scale in Direct-to-ADC mode. Sampling is done at 200 MS/s on both channels. Typical values for either channel are listed below.

ENOB:	10.0
SNR:	62.0 dB
SFDR:	72.0 dB
SINAD:	61.4 dB

ACQUISITION MEMORY

Data Storage: In on-board memory

Memory depth per channel:
16 Msamples, 64 Msamples, 256 Msamples, 512 Msamples; 1 Gsample
(12-bit samples in 16-bit words)

One Channel Mode (Channel A only):
Up to full on-board memory

TRIGGERING

Trigger engines:	2 per system
Source:	Ch. A, Ch. B, EXT or Software; software-selectable
Input combination:	1, 2, 1 or 2
Type:	Digital triggering on channels Analog triggering on external trigger
Level Accuracy:	± 5% of Full Scale
Slope:	Positive or Negative, software-selectable
Sensitivity:	± 10% of Full Scale This implies that the signal amplitude must be at least 20% of full scale to cause a trigger to occur. Smaller signals are rejected as noise.
Post Trigger Data:	128 points minimum. Can be defined with a 64 point resolution.
Max. Record Length:	Up to maximum memory

INTERNAL CLOCK

Source:	Clock oscillator
Accuracy:	± 25 ppm for 200 MHz and lower (0 to 50° C ambient) ± 50 ppm for 400 MHz (0 to 50° C ambient)

EXTERNAL TRIGGER

Impedance:	1 MΩ, 35 pF
Amplitude:	Absolute Maximum ± 15 V
Voltage Ranges:	± 1 V and ± 5 V (software-selectable)
Bandwidth:	80 MHz
Coupling:	AC or DC
Connector:	SMA
Type:	Analog Triggering

TRIGGER OUT

Impedance:	50 Ω
Amplitude:	0-2.5 V (TTL)
Connector:	SMA

EXTERNAL CLOCK

Maximum Frequency:	420 MHz
Minimum Frequency:	40 MHz
Signal Level:	Minimum 1 V RMS Maximum 2 V RMS
Impedance:	50 Ω
Sampling Edge:	Rising
Duty Cycle:	50% ± 5%
Connector:	SMA

EXTERNAL REFERENCE (OPTIONAL)

The External Reference timebase is used to synchronize the Internal Sampling Clock

Frequency:	10 MHz; Software-selectable
Signal Level:	Minimum 1 V RMS Maximum 2 V RMS
Impedance:	50 Ω
Sampling Edge:	Rising
Duty Cycle:	50% ± 5%
Connector:	SMA

CLOCK OUT

Maximum Frequency:	200 MHz
Minimum Frequency:	40 MHz (from External Clock) 50 kHz (from Internal Clock)
Output frequency:	Equal to the sample rate when it is ≤ 200 MS/s Equal to half the sample rate when it is > 200 MS/s
Signal Level:	0-2.5 V (TTL)
Impedance:	50 Ω
Duty Cycle:	50% ± 10%
Connector:	SMA

TIMESTAMPING

Resolution:	7.5 ns
Counter turnover:	24 hours continuous

MULTIPLE RECORD

Pre-trigger Data:	Up to virtually full record length
Record Length:	128 points minimum; can be defined with a 64 points resolution
Maximum Number of Triggers:	16,777,216

MULTI-CARD SYSTEMS

A unique feature of the CS12400 is its ability to automatically reconfigure itself to Master/Slave or Independent multi-card system simply by adding or removing the Master/Slave Timing Module.

Operating Mode:	Master/Slave or Multiple/Independent configurations

Maximum Number of Cards

Master/Slave:	2 to 8 cards
Multiple/Independent:	Limited by PC backplane

PCI BUS INTERFACE

Plug-&-Play:	Fully supported
Bus Mastering:	Fully supported
Scatter-Gather:	Fully supported
Bus Width:	32 bits
Bus Speed:	66 MHz or 33 MHz
Bus Throughput:	200 MB/s to PC Memory (66 MHz PCI; dependent on motherboard and number of PCI-PCI bridges)
Compatibility:	PCI-compliant v.2.2 systems Also v.2.1 systems that supply 3.3 V to PCI slot

OPERATING SYSTEMS SUPPORTED

- Windows 2000*/XP CompuScope Driver version 4.00.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#
- CompuScope SDK for MATLAB
- CompuScope SDK for LabVIEW
- CompuScope SDK for LabWindows/CVI

WARRANTY

One year parts and labor.

Notes:

1) Unless otherwise specified, all dynamic performance parameters are measured at input amplitude of 95% of Full Scale in Direct-to-ADC mode and sampling at 80 MS/s.
2) Detailed characterization curves pending and will be available upon request.

ALL SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

CompuScope 12400 ordering information

Hardware and upgrades

Product	Order No.
CompuScope 12400 – 32M	124-001-002
CompuScope 12400 –128M	124-001-004
CompuScope 12400 –512M	124-001-005
CompuScope 12400 – 1G	124-001-006
CompuScope 12400 – 2G	124-001-007
CS12400: Signal Averaging Firmware Option	124-181-004
CS12400: FIR Filtering Firmware Option	124-181-005
CS12400: External Reference Clock Option	124-181-006
Refer to the Gage website for a list of available upgrades for your CompuScope: www.gage-applied.com	

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 (Manuals in PDF format provided on CD)	200-113-000
Gage SDK Pack (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 SDK for LabWindows/CVI	200-300-100

CompuScope 12400 simplified block diagram

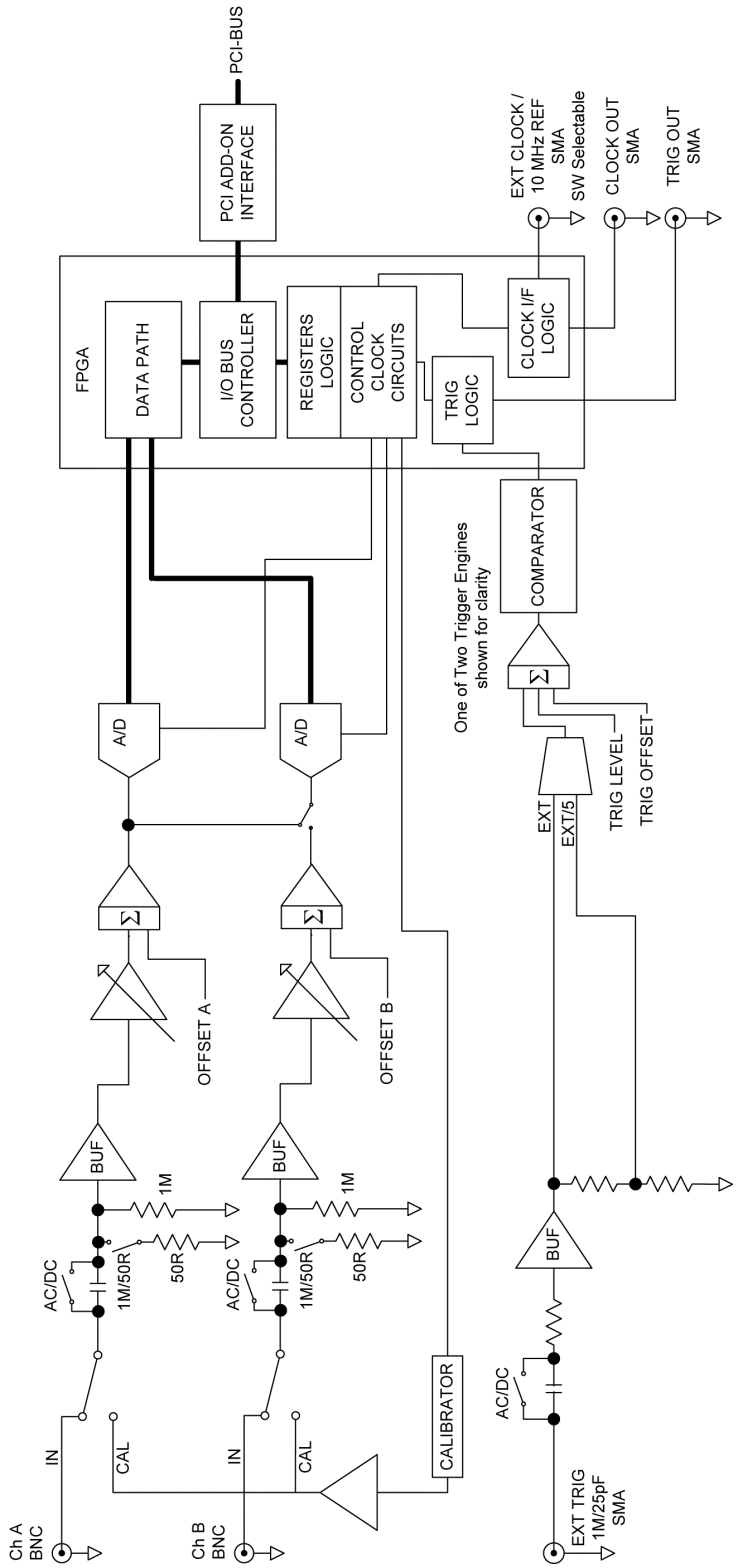


Figure 73: CS12400 simplified block diagram

CompuScope 12400 connectors and headers

CompuScope cards connect to the outside world through connectors, both analog (SMAs or BNCs) and digital (PCI bus). This section describes these connectors for the CS12400 card.

The connectors and headers on the CS12400 card are shown below:

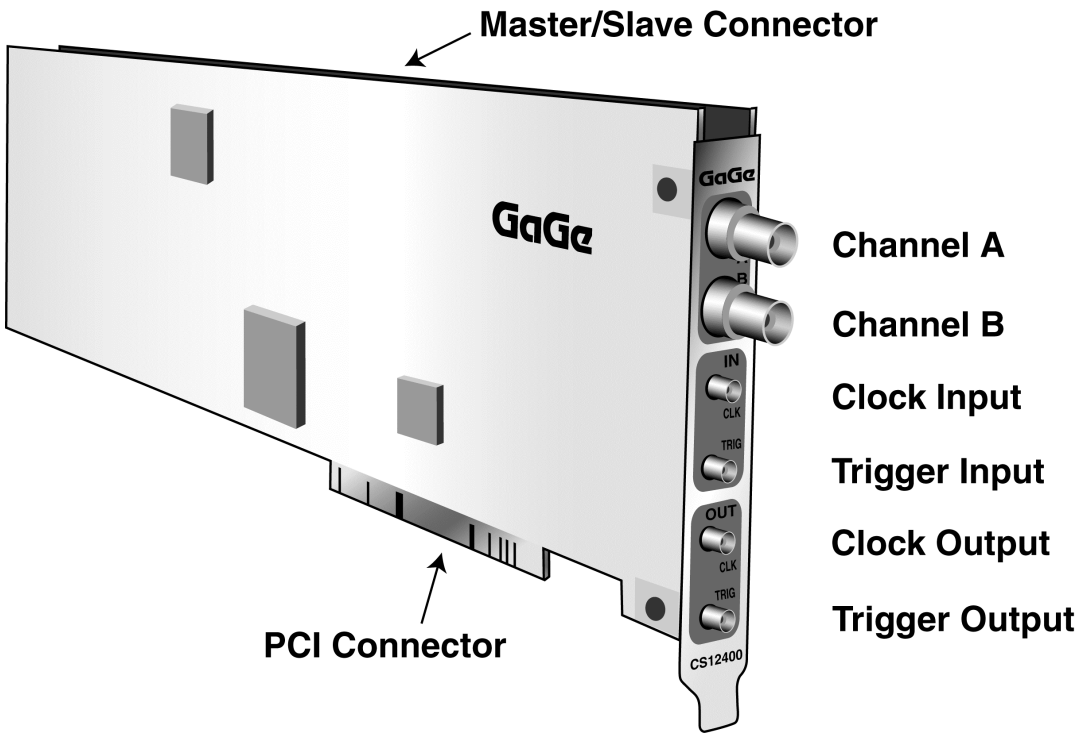


Figure 74: Connectors on CS12400

- **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.
- **Clock Input SMA** connector is used to input a signal to be used as the sampling clock. This signal is referred to as the External Clock signal.
- **Trigger Input SMA** 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.
- **Clock Output SMA** connector is used to supply the clock signal, either from the internal oscillator or from the External Clock Input, to another module of the test system or experimental setup. The characteristics of the Output are detailed in the Specifications section.
- **Trigger Output SMA** connector is used to supply a trigger signal generated by the card to another module of the test system or experimental setup.
- **Master/Slave connector.** The Master/Slave connector is located near the top edge of the CS12400 card.

The Master/Slave Timing Module is used to pass all the signals necessary to synchronize Slave CS12400 cards with the Master. A unique feature of the CS12400 is its ability to automatically reconfigure itself to Master/Slave or Independent multi-card system simply by adding or removing the Master/Slave Timing Module.

Special characteristics and features of the CompuScope 12400

The CompuScope 12400 provides a wide array of advanced digitizer capabilities. This section is a brief review of some of the special characteristics and features offered by the card.

Frequency response

Designed to satisfy a wide range of applications, it is critical that the CS12400 provides frequency measurements as precise and reliable as possible over the analog bandwidth of the card.

The CS12400 has a very flat frequency response, minimizing the attenuation or amplification of frequency components, so that the signals from the BNC connectors to the ADCs are as identical as possible. The paths of clocking signals to the ADCs are also as similar to one another as possible. As such, the frequency responses of both channels fall within a narrow band around the ideal frequency response for the bandwidth.

The figure below illustrates the actual frequency response of the CS12400 using the following acquisition parameters. The sampling rate is 200 MS/s. The input range is ±500mV with AC input coupling and 50 Ω terminating input impedance.

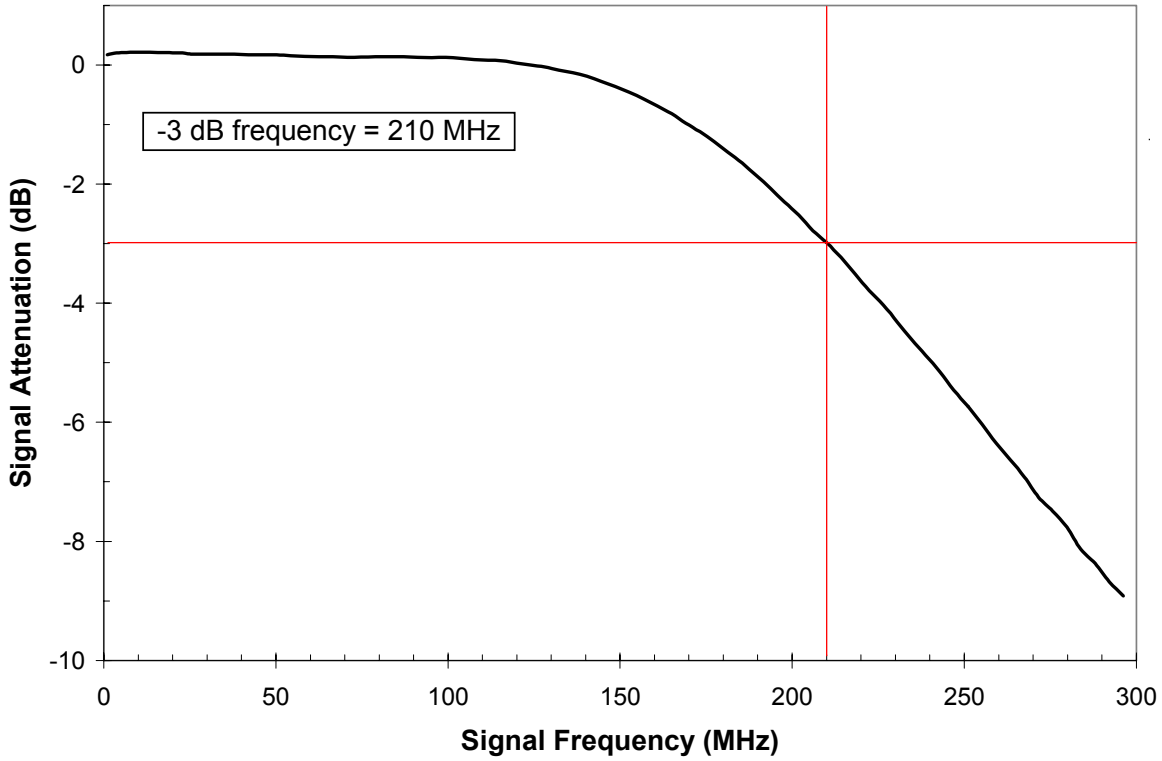


Figure 75: Illustration of the frequency response

Trigger Output signal

The Trigger Output signal provides a mechanism to synchronize other system elements to the trigger event that caused the CS12400 to start acquiring data.

Please note that the trigger signal provided by the CompuScope 12400 is only designed to drive one other device with 50 Ω impedance.

Clock Output signal

The Clock Output signal provides a clock synchronous to the sample clock being used to acquire data on the CS12400. The function is independent of the clock source, that is it functions the same way when the internal oscillator, the external clock, or the external reference clock is active.

Please note that the clock signal provided by the CompuScope 12400 is only designed to drive one other device with 50 Ω impedance.

Clock Input signal

The CompuScope 12400 can be clocked in any of three modes of operation, which are accessible via software commands.

The normal mode of operation consists in using the internally generated clock. This is the mode of operation by default; in this mode, the card ignores any signal present at the Clock Input connector. When developing an application for the CS12400 (in C/C#, LabVIEW, LabWindows/CVI, or MATLAB) you must supply the sampling rate to be used.

The second mode of operation consists in using the externally provided clock. In this mode, the card is instructed to expect a signal at the Clock Input connector, and to use it as the sampling clock. It is not critical to provide the sampling rate for this mode, but it is good practice.

Finally, you can select to use a reference clock, which is an industry standard 10 MHz clock, used to synchronize the card to the rest of the test system or experimental setup. In this mode the card is instructed to expect a signal at the Clock Input connector and to use the signal to control a proprietary phase frequency detector that synchronizes the on-board oscillators to the external reference signal.

The input characteristics detailed in the Specifications section are valid for both the External Clock and for the Reference Clock situations.

Windowed triggering

Using the CompuScope 12400 card's ability to have two independent trigger sources which are ORed together, the user can set up the triggering such that a trigger will occur if the input signal is outside a specified "window," i.e. it is higher than the upper limit or lower than the lower limit.

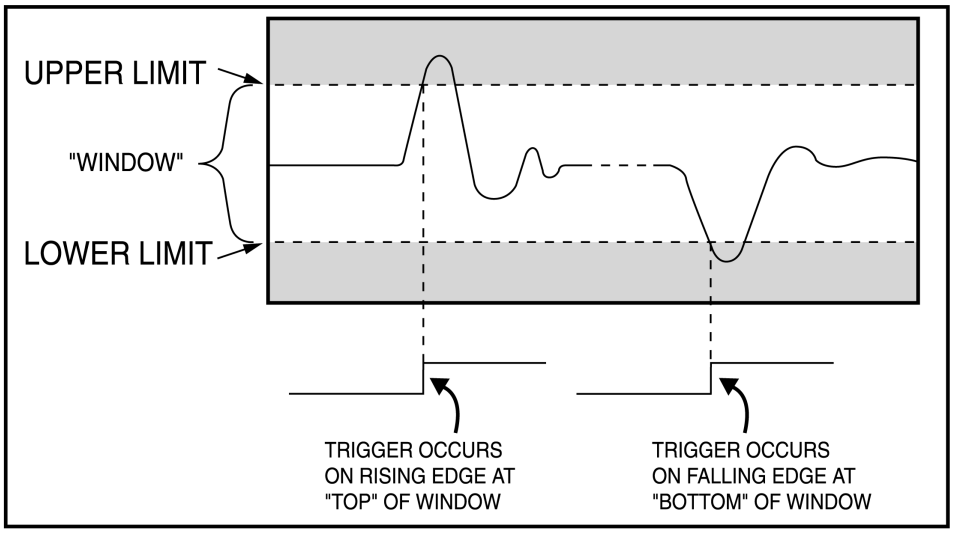


Figure 76: Windowed triggering

CompuScope 12400 throughput & maximum PRF

A number of applications require the CompuScope 12400 to acquire data based on a rapidly occurring trigger signal. These high Pulse Repeat Frequency (PRF) applications include radio, radar and ultrasound signal capture.

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:

- Dual Pentium II, 400 MHz processor,
- L440GX Intel motherboard
- 512 MB RAM
- 20 GB disk drive
- Windows 2000
- NT File System
- 66 MHz, 32 bit PCI bus
- All slots support bus mastering

The application software used for throughput measurements was CSTest.

The CS12400 was operated using CSTest 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.

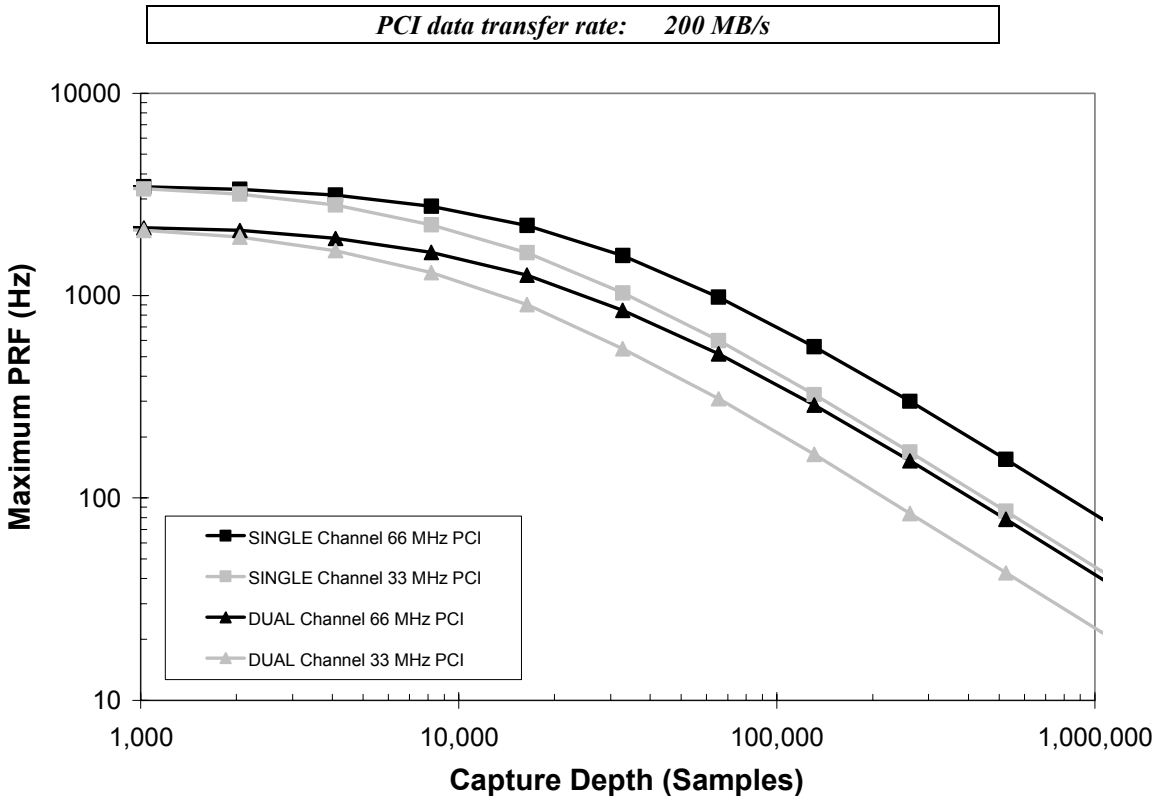


Figure 77: Maximum PRF vs. acquisition length

Notes

Technical Support

Gage Applied Technologies, Inc. offers technical support for all its products.

In order to serve you better, we have created a web-based technical support system that is available to you 24 hours a day.

By utilizing the internet to the fullest, we are able to provide you better than ever technical support without increasing our costs, thereby allowing us to provide you the ***best possible product at the lowest possible price.***

To obtain technical support, simply visit:

www.gage-applied.com/support/support_form.php

Please complete this form and submit it. Our form processing system will intelligently route your request to the Technical Support Specialist (TSS) most familiar with the intricacies of your product. This TSS will be in contact with you within 24 hours of form submittal.

In the odd case that you have problems submitting the form on our web site, please e-mail us at

tech-support@gage-applied.com

As opposed to automatic routing of technical support requests originating from the Gage web site, support requests received via e-mail or telephone calls are routed manually by our staff. Providing you with high-quality support may take an average of 2 to 3 days if you do not use the web-based technical support system.

Please note that Technical Support Requests received

via e-mail or by telephone will take an average of 2 to 3 days to process.

It is faster to use the web site!

When calling for support we ask that you have the following information available:

1. Version and type of your CompuScope SDK and drivers.
   (The version numbers are indicated in the About CD screen of the CompuScope CD. Version numbers can also be obtained by looking in the appropriate README.TXT files)

2. Type, version and memory depth of your CompuScope card.

3. Type and version of your operating system.

4. Type and speed of your computer and bus.

5. If possible, the file saved from the Information tab of the CompuScope Manager utility.

6. Any extra hardware peripherals (i.e. CD-ROM, joystick, network card, etc.)

7. Were you able to reproduce the problem with standalone Gage Software (e.g. GageScope, GageBit)?

Gage products

For ordering information, see Gage's Product Catalog or visit our web site at www.gage-applied.com

CompactPCI/PXI Bus Products	CompuScope 1610C	16 bit, 10 MS/s A/D card
	CompuScope 14100C	14 bit, 100 MS/s A/D card
	CompuScope 82GC	8 bit, 2 GS/s A/D card
	CompuScope 3200C	32 bit, 100 MHz Digital Input Card
PCI Bus Products	CompuScope 1610	16 bit, 10 MS/s A/D card
	CompuScope 1602	16 bit, 2.5 MS/s A/D card
	CompuScope 14200	14 bit, 200 MS/s A/D card
	CompuScope 14105	14 bit, 105 MS/s A/D card
	CompuScope 14100	14 bit, 100 MS/s A/D card
	CompuScope 1450	14 bit, 50 MS/s A/D card
	CompuScope 12400	12 bit, 400 MS/s A/D card
	CompuScope 12100	12 bit, 100 MS/s A/D card
	CompuScope 1250	12 bit, 50 MS/s A/D card
	CompuScope 82G	8 bit, 2 GS/s A/D card
	CompuScope 8500	8 bit, 500 MS/s A/D card
	CompuScope 3200	32 bit, 100 MHz Digital Input Card
CompuGen PCI	CompuGen 4300	12 bit, 4-channel, 300 MHz Analog Output Card
	CompuGen 8150	12 bit, 8-channel, 150 MHz Analog Output Card
	CompuGen 11G	12 bit, 1 GHz Analog Output Card
CompuGen ISA	CompuGen 1100	12 bit, 80 MS/s D/A card
	CompuGen 3250	32 bit, 50 MHz Digital Output Card
Application Software	GageScope Software	World's Most Powerful Oscilloscope Software
	GageBit Software	Digital Input/Digital Output Software
	CompuGen for Windows	Arbitrary Waveform Generator Software for Windows
Software Development Kits	CompuGen SDK for C/C++	CompuScope SDK for C/C#
	CompuGen SDK for LabVIEW	CompuScope SDK for MATLAB
	CompuGen SDK for MATLAB	CompuScope SDK for LabVIEW
		CompuScope SDK for LabWindows/CVI
Instrument Mainframes	Instrument Mainframe 7500	Instrument Mainframes for Housing CompuScope PCI bus and CompuGen ISA bus Products
	Instrument Mainframe 2000	
	Instrument Mainframe 8000C	Instrument Mainframes for Housing CompuScope CompactPCI/PXI bus products