



CS3200 Hardware Manual

Reorder #: MKT-HWM-PCI01-CS3200
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

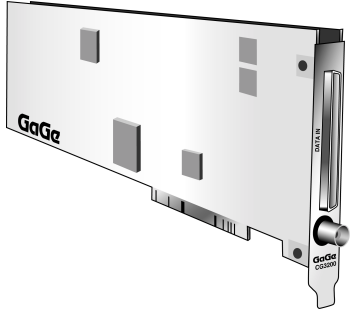
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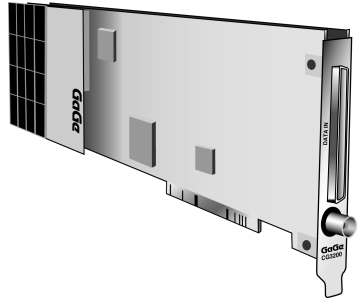
What you should receive with your CompuScope 3200

If you order an independent CompuScope 3200 card, you should receive the following articles:

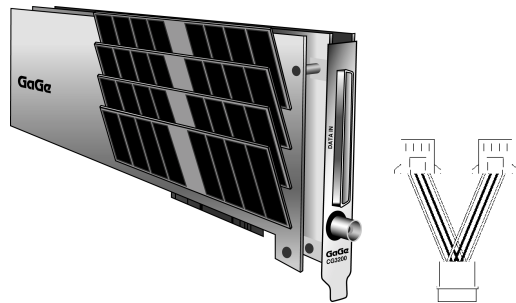
- CompuScope 3200 card



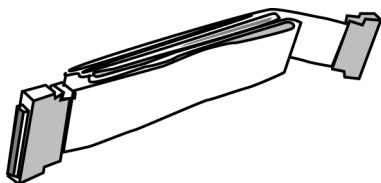
If you purchased a CompuScope 3200-8M or 16M card, you should see a piggyback memory board attached to the back of the card, as shown below.



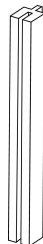
If you purchased a CompuScope 3200 card with 128M, 512M, 1G or 2G acquisition memory, you should see a full-length piggyback memory board attached to the back of the card, as shown below. You should also receive one Y-cable for powering the piggyback memory board (also known as Deep Memory Board).



- One pleated foil cable



- one plastic card guide



- Standard items included with each independent CompuScope 3200 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 GageBit Software)



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

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

GageBit User's Guide



Note that you will receive only one copy of GageBit per order, irrespective of the number of cards you ordered. Additional copies can be requested at order time.

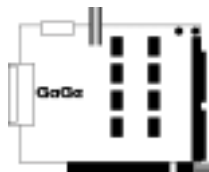
The GageBit User's Guide is also available in PDF format on the Gage Software Disk or you can download it from Gage's Web site.

Warranty card



- Optional items, if purchased

Buffer board



CS32x0: BNC breakout board

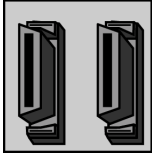


Software Development Kits (SDKs) & applicable manual(s)

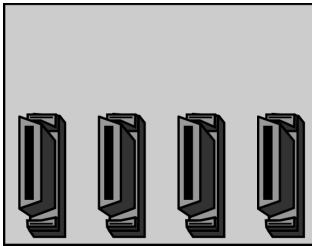


If you ordered Master or Slave upgrades with your CompuScope 3200 cards, you will receive one of the following Master/Slave Timing Modules:

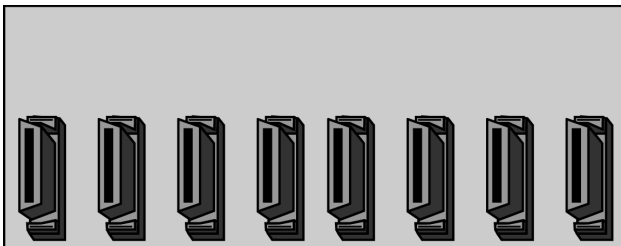
- 2 Slot Master/Slave Timing Module. Used for:
2 card Master/Slave system of CS3200-2M



- 4 Slot Master/Slave Timing Module. Used for:
4 card Master/Slave systems of CS3200-2M
2 card Master/Slave systems of CS3200-8M
2 card Master/Slave systems of CS3200-16M



- 8 Slot Master/Slave Timing Module. Used for:
6 or 8 card Master/Slave systems of CS3200-2M
3 or 4 card Master/Slave systems of CS3200-8M
3 or 4 card Master/Slave systems of CS3200-16M
2 or 3 card Master/Slave systems of CS3200-128M,
CS3200-512M, CS3200-1G and CS3200-2G



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 3200 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 3200 product introduction

CompuScope 3200 is a PCI bus based board-level product that allows the user to capture up to 32 bits of single-ended CMOS/TTL or differential ECL/PECL digital data into on-board memory of up to 2 Gigabytes at clock rates up to 100 MHz.

CS3200 can also be configured, in software, to be 8, 16 or 32 bits wide, thereby allowing the user to maximize the use of acquisition memory for 8 or 16 bit inputs.

Multiple CompuScope 3200 cards can be used in Master/Slave configuration to provide wider input words of up to 256 bits.

INPUT CIRCUITRY

The input stage of the CS3200 consists of 34 high-speed comparators: 32 for data and one each for clock and trigger. The use of high-speed comparators with fully programmable thresholds allows the use of virtually any logic level: 5V TTL/CMOS, 3.3V CMOS, 2.7 V CMOS, ECL, PECL or even custom logic levels.

Inputs need to be driven by a source capable of driving a 50 Ω load. This is necessary in order to maintain good signal integrity.

For CMOS or TTL signal sources not capable of driving 50 Ω loads, a special *CMOS Buffer Board* is available from Gage, which buffers the data with 50 Ω drivers. The input of the *CMOS Buffer Board* is a 68 pin IDC header for data, a BNC connector for Trigger and another BNC for Clock input. All input signals must be 0 to 3.3 V or 0 to 5V CMOS or TTL signals.

The output of the *CMOS Buffer Board* is a 68 pin MDR connector which connects to the CS3200 using a 6 foot long pleated foil cable, supplied with the CompuScope 3200.

Differential ECL or PECL signals are, by definition, capable of driving a 50 Ω load and interface seamlessly with CompuScope 3200.

CONFIGURABLE INPUT

The output of the on-board comparators is fed into an on-board FPGA, which maximizes the use of on-board memory for data from 8, 16 or 32 bits of width.

The presence of this FPGA also makes it possible to build customized digital acquisition systems, including front-end data processing, for specific requirements. Contact the factory for such custom applications.

Customers must decide at the time of placing an order whether they require a differential ECL/PECL input or single-ended CMOS/TTL input CompuScope 3200. This setting must be configured at the factory and cannot be modified in the field.

ON-BOARD MEMORY

CompuScope 3200 stores digital data in on-board acquisition memory, which is addressable through the PCI bus under software control.

The on-board memory is configured as a circular buffer, so it is possible to store both pre and post trigger data. In other words, it is possible to wait indefinitely for a trigger event and then capture digital data from both before and after this event.

The number of data words that can be captured into on-board memory is a function of the size of the memory and input width. For example, a 16 MB model provides 16 million words of storage when the input is 8 bits wide. The same model provides 4 million samples of memory with 32 bit word width.

TRANSFERRING DATA TO PC MEMORY

CompuScope 3200 is fully capable of acting as a bus master to DMA captured data into user buffers.

EXTERNAL CLOCK

CompuScope 3200 allows the use of either internal or External Clocks. External Clock can be very useful in systems that require synchronous data capture. These applications include A/D Testing, Telecommunication, DSP Systems, Video, Ultrasonic Imaging etc.

The External Clock is carried on the 68 wire input connector. A high-speed comparator converts the input level of the clock to CMOS/TTL levels used by the on-board data latching and demultiplexing circuitry.

The maximum clock frequency of the input clock is 100 MHz. The driving circuitry on the user's circuit must be capable of driving a 50 Ω load.

CLOCK EDGE SELECTION

The user is allowed to select either the rising or falling edge of the input clock to latch the data.

This flexibility allows the user to apply the CompuScope 3200 in situations in which one of the clock edges and input data do not satisfy the timing requirements. In such cases, using the opposite edge of the clock may resolve the timing conflict.

CLOCK AND DATA TIMING

If the customer operates the CompuScope 3200 with an External Clock, it should be kept in mind that the maximum speed of the input clock is 100 MHz with a rise and fall time of 2.5 ns or less. The minimum clock frequency is zero, i.e. the clocks can be started and stopped at will, once the acquisition has started.

The setup and hold times of the data with respect to the active edge of the clock must satisfy the minimum requirements listed in the specifications.

CRYSTAL BASED TIMEBASE

CompuScope 3200 allows the use of both Internal or External Clock under software control.

When the internal clock is selected, the sampling clock is provided by a crystal controlled oscillator, thereby providing very good short and long term timing accuracy.

When an External Clock is used, the timing accuracy depends entirely on the quality of the External Clock supplied by the user.

INPUT CONNECTOR

The data is input to the CompuScope 3200 over a 68 wire *Pleated Foil* cable. The input connector is a 68 pin MDR socket (P/N 3M 10268-55H3VC). The mating connector is a 3M 10168-6000EC. The mating connector hood is a 3M 10368-A230-00.

Each CompuScope 3200 is supplied with a 6 foot *Pleated Foil* cable featuring the 3M 10168-6000EC connector.

TRIGGER

An External Trigger input is provided on the CompuScope 3200. The configuration of this input is set at the factory as either differential ECL/PECL or single-ended CMOS/TTL.

It is possible to trigger either on the rising or falling edge of this trigger input.

TRIGGER OUTPUT

A Trigger Output signal (5 Volt TTL) is also provided by the CompuScope 3200. This signal is synchronized to the internal clock that runs the demultiplexed memory counters. As such, there can be a latency of as much as 8 clock cycles between a trigger input and a trigger output.

This Trigger Output can be used to synchronize an entire system to Gage's internal clock.

BNC BREAKOUT BOARD

One of the popular accessories for CompuScope 3200 is a BNC Breakout Board which connects to the card using the pleated foil cable and allows the user to inject digital data, clock and trigger signals using BNC coaxial connectors.

CompuScope 3200 specifications

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

SYSTEM REQUIREMENTS

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"

2 MB Acquisition Memory	1 slot
8 MB Acquisition Memory	2 slots
16 MB Acquisition Memory	2 slots
128 MB Acquisition Memory	3 slots
512 MB Acquisition Memory	3 slots
1 GB Acquisition Memory	3 slots
2 GB Acquisition Memory	3 slots

POWER

+ 5 Volts		
Acquisition Memory	Worst Case	Typical
2M	28.6 W	26.0 W
8M	31.6 W	29.0 W
16M	31.6 W	29.0 W
128M	33.6 W	30.0 W
512M	36.1 W	32.0 W
1G	36.1 W	32.0 W
2G	38.6 W	34.0 W

INPUT

Input Connector:	68 Pin MDR connector
No. of Data Lines:	32, 16 or 8, software selectable
Input Type:	Single Ended or Differential, factory set. Cannot be modified in the field
Input Levels:	
Single-Ended:	CMOS (0 to 5 Volts), CMOS (0 to 3.3 Volts)
Differential:	ECL or PECL

CLOCK

Internal Clock Rate:	MHz: 100, 50, 20, 10, 5, 2, 1 kHz: 500
External Clock:	Standard
External Clock Type:	Single Ended or Differential, set to the same type as data lines

External Clock Level: Set to the same type as data lines. CMOS/TTL inputs are 3.3 Volt tolerant

 Single-Ended: CMOS (0 to 5 Volts),
 CMOS (0 to 3.3 Volts)
 TTL (0 to 5 Volts)
 Software selectable

 Differential: ECL
 PECL
 Software selectable

Max. Ext Clock Freq: 100 MHz

Min. Ext Clock Freq: DC

Impedance: 50 Ω

TRIGGERING

Source: Ext Trigger or Software

External Trigger: Standard

Trigger Type: Single Ended or Differential, set to the same type as data lines

Trigger Level: Set to the same type as data lines. CMOS/TTL inputs are 3.3 V tolerant

 Single-Ended: CMOS (0 to 5 Volts),
 CMOS (0 to 3.3 Volts)
 TTL (0 to 5 Volts)
 Software selectable

 Differential: ECL
 PECL
 Software selectable

Slope: Positive or Negative

Post-Trigger Depth: 8 bits: 256 point minimum.
 128 point resolution.

 16 bits: 128 point minimum.
 64 point resolution.

 32 bits: 64 point minimum.
 32 point resolution.

MEMORY MODE OPERATION

Data Storage: In on-board memory

Max. On-board Memory: 2MB, 8MB, 16MB, 128MB, 512MB, 1GB or 2GB

8 Bits Width: Sample depth = card memory

16 Bits Width: Sample depth = card memory \div 2

32 Bits Width: Sample depth = card memory \div 4

MULTI-CARD SYSTEMS

Operating Mode: Master/Slave or Multiple/Independent

Maximum Number of Cards:

 Master/Slave: 2 to 8 cards for 2M models
 2, 3 or 4 cards for 8M & 16M models
 2 or 3 cards for 128M, 512M, 1G and 2G models

 Multiple/Independent: Limited by the backplane

PCI BUS INTERFACE

Plug-&-Play:	Fully supported
Bus Mastering:	Fully supported
Bus Width:	32 bit
Bus Throughput:	100 MB/s to PC Memory
Compatibility:	All PCI compliant computers

OPERATING SYSTEMS SUPPORTED

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

APPLICATION SOFTWARE

GageBit Application for Win 98/ME, Win NT/2000/XP

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

OPTIONAL ACCESSORIES

Buffer Board
BNC Breakout Board

WARRANTY

One year parts and labor
All specifications subject to change without notice

CompuScope 3200 ordering information

Hardware and upgrades

Product	Order No.
CompuScope 3200 - 2M (CMOS or TTL)	320-161-001
CompuScope 3200 - 8M (CMOS or TTL)	320-161-002
CompuScope 3200 - 16M (CMOS or TTL)	320-161-003
CompuScope 3200 - 128M (CMOS or TTL)	320-161-004
CompuScope 3200 - 512M (CMOS or TTL)	320-161-005
CompuScope 3200 - 1G (CMOS or TTL)	320-161-006
CompuScope 3200 - 2G (CMOS or TTL)	320-161-007
CompuScope 3200 - 2M (Differential ECL/PECL)	320-161-020
CompuScope 3200 - 8M (Differential ECL/PECL)	320-161-021
CompuScope 3200 - 16M (Differential ECL/PECL)	320-161-022
CompuScope 3200 - 128M (Differential ECL/PECL)	320-161-023
CompuScope 3200 - 512M (Differential ECL/PECL)	320-161-024
CompuScope 3200 - 1G (Differential ECL/PECL)	320-161-025
CompuScope 3200 - 2G (Differential ECL/PECL)	320-161-026
CS3200: Memory Upgrade Charge	320-181-200
CS3200: Master Multi-Card Upgrade	320-181-103
CS3200: Slave Multi-Card Upgrade	320-181-104
CS3200: CMOS Buffer Board	320-181-105
32X0: BNC Breakout Board	325-181-020

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 3200 simplified block diagram

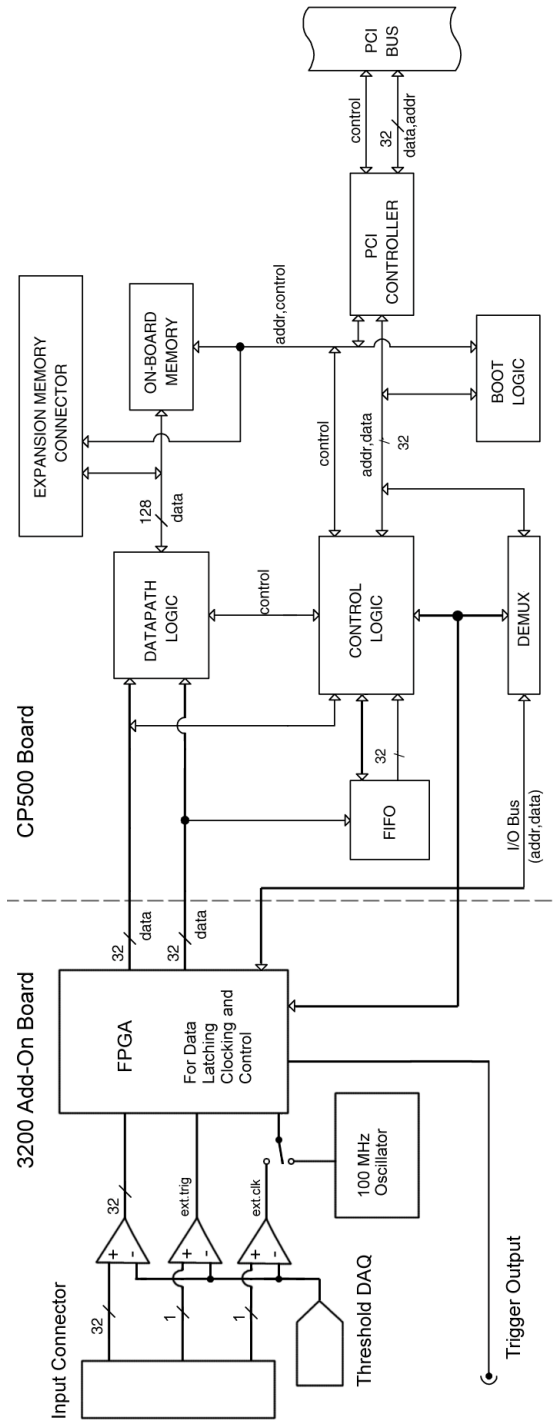


Figure 1: CompuScope 3200 simplified block diagram

CompuScope 3200 connectors and headers

CompuScope 3200 accepts digital data using a connector designed specially for ultra-fast digital signal transmission.

A Trigger Out signal is also available on a BNC connector in order to synchronize CS3200 to the rest of the test system.

The connectors and headers on the CS3200 card are shown below:

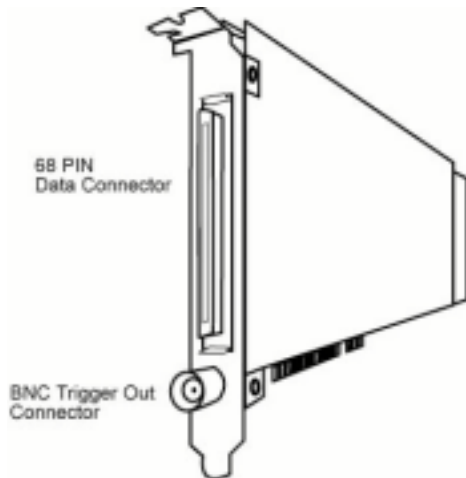


Figure 2a: CS3200 connectors

*Figure 2b: Master/Slave connector**

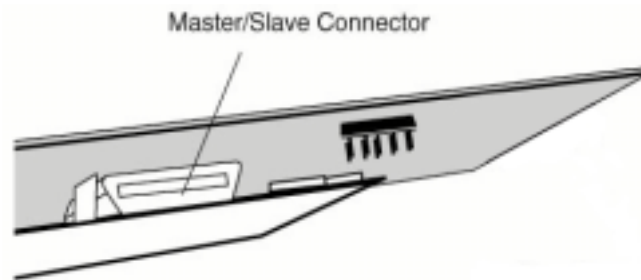


Figure 2: Connectors on CS3200

- **Digital input MDR** connector is used to input up to 32 bits of single-ended or differential digital data lines, one clock input and one trigger input, all with 50 Ω characteristic impedance. This connector is designed to provide “equivalent to coax” performance by using copper conductors encapsulated in a specially formulated Teflon to provide the appropriate dielectric constant. This assembly is wrapped in a pleated copper foil, resulting in a 50 Ω transmission line impedance for each of the 68 conductors in the cable. For more information on the technology used in this connector, please visit www.mmm.com.
- **Trigger Out BNC** connector is used to output a 0 to 5 Volt, TTL signal which signifies that a trigger event has occurred on the CS3200.

Master/Slave Pinout

The Master/Slave connector on the top-left corner of the card is used to pass all the signals necessary to synchronize the Slave cards with the Master.

Clock Output connector

In some select cases, a user may want to drive the rest of the test system with the internal clock of the CS3200. A Clock Output Upgrade must be purchased in order to have access to this signal.

A small, RF co-axial connector is available on the card, to which a 50 Ω cable can be attached to bring out a 5 Volt CMOS clock signal capable of driving a 50 Ω load.

This upgrade is supplied with a cable that connects to the on-board RF connector on one end and a BNC connector mounted on a card bracket on the other.

- Note that in Master/Slave systems, the Clock Output signal is output from the Master card only.

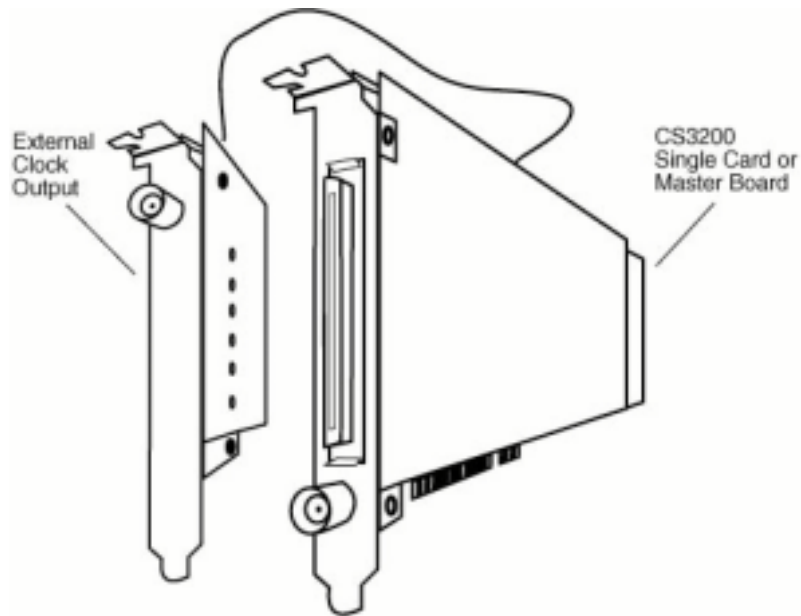
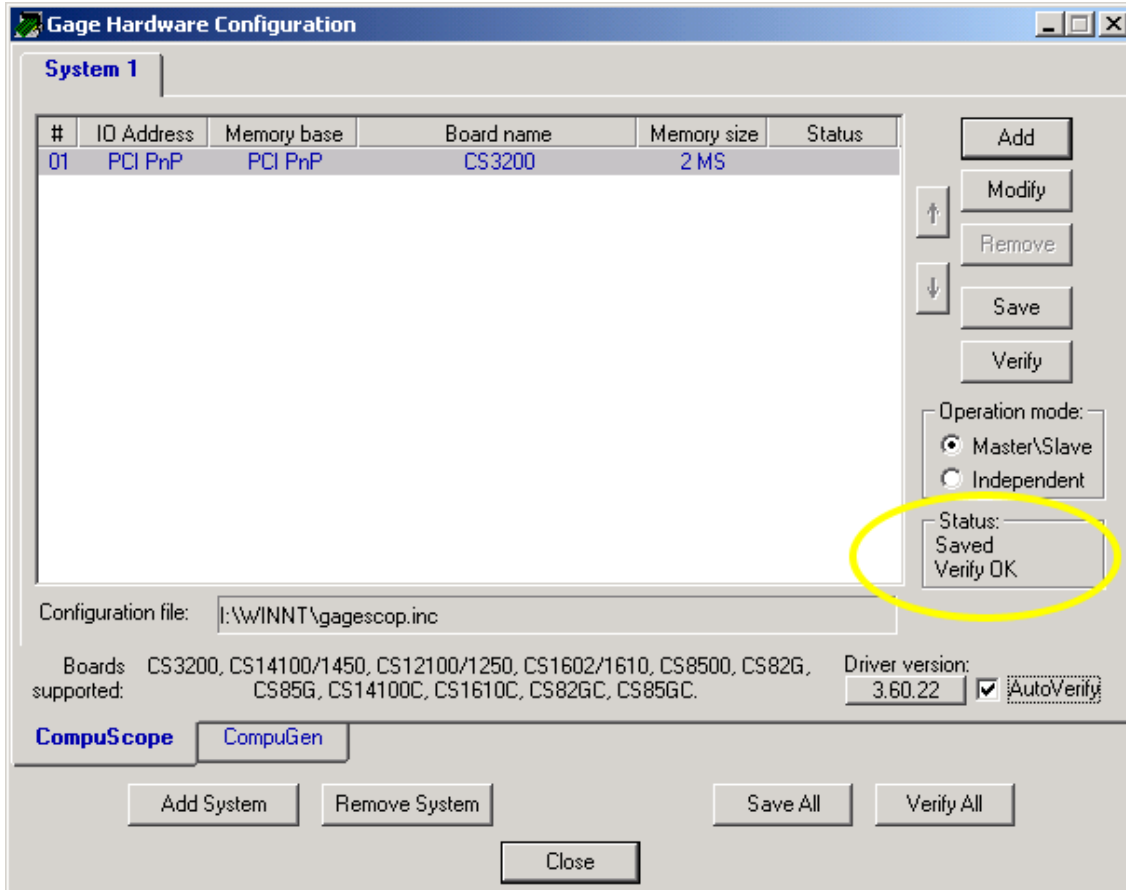
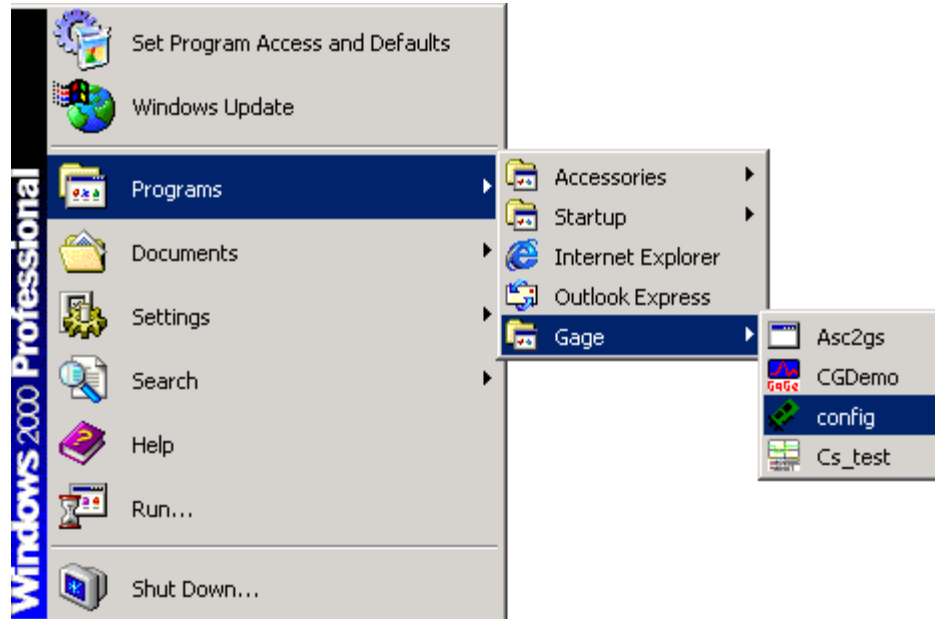


Figure 3: External Clock connector, single-card system or Master card

CompuScope 3200: running GageConfig

GageConfig is configuration utility used by Gage's Windows drivers to configure your CS3200 card(s) as well as any other Gage card(s) present in the system.

GageConfig creates a binary file called GAGESCOP.INC that contains the information necessary for the driver to recognize the CompuScope card(s). This file is kept in the **Windows\System** folder of your computer.



Please note that CS3200 is a plug-and-play device, so you do not need to specify an I/O or a memory address, as you would have had to for ISA products.

It is, however, necessary to declare the I/O and Memory addresses as “PnP” in the appropriate section of GageConfig. This would tell GageConfig that we are trying to locate a Plug-n-Play device.

If I/O and Memory Base addresses are not specified to “PnP”, GageConfig will not recognize your CS3200.

CompuScope 3200 triggering

Triggering allows the CompuScope 3200 to capture digital data just before or after an external event or a software command. CS3200 supports both pre- and post-trigger data capture.

CompuScope 3200 allows the user to trigger the system on:

- External Trigger
- Software Trigger

The user can also specify whether to trigger on the rising or falling edge of the External Trigger signal.

Trigger Bus for Master/Slave systems

In a Master/Slave system, a trigger signal on the Master card forces all Slave cards to trigger as well.

A CompuScope 3200 Master/Slave system cannot trigger off of the External Trigger input of a Slave card.

CompuScope 3200 digital input

CompuScope 3200 is available with two different input configurations:

- Single-Ended, TTL/CMOS Inputs
- Differential, ECL Inputs

Users must specify one or the other at the time of placing an order. The two configurations cannot be changed via software commands and require considerable changes to the input circuitry. As such, this change cannot be made in the field and must be done at the factory.

Input comparators

The input stage for all inputs of the CS3200 is an EMI filter followed by a 50 Ω terminating resistor network wide bandwidth analog comparator.

For single-ended input models, one of the inputs to the comparator is the input signal and the other is a programmable voltage level generated by an on-board DAC (Digital to Analog Converter). This enables the input stage to handle different voltage level CMOS signals, e.g. 3.3 Volt, 5 Volt etc.

For differential input models, both inputs of the comparator are fed by the two differential signals corresponding to a particular input. For example, D0+ and D0- are fed into the inputs of the same comparator.

Front-end FPGA

At the heart of the CS3200 is a high-speed FPGA: all data lines, trigger and clock signals received from the outside world are injected into it; all data demultiplexing is done inside it; all acquisition control state machines exist in it; all sampling clock selection circuitry resides in it; all triggering is done within it; and all Master/Slave controls are handled inside it.

This design allows for tremendous flexibility in adapting the CS3200 for a number of customized applications that require not only fast digital data acquisition, but also some data manipulation. Contact the factory with your custom requirement.

This FPGA also allows the CS3200 to work in one of three input word widths of 32, 16 or 8 bits by demultiplexing (DMUX) the data.

Notes
