GAGE APPLIED TECHNOLOGIES

PCI Hardware and Driver Installation Guide

Reorder #: MKT-HWM-PCI01-Install
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First Edition (August 2004)

Changes are periodically made to the information herein; these changes will be incorporated into new editions of the publication. Gage Applied Technologies, Inc. may make improvements and/or changes in the products and/or programs described in this publication at any time. The latest copy of this manual can be found on our web page at www.gage-applied.com in the Downloads section, User Manuals.

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
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Table of Contents

Preface

This manual provides detailed information on the hardware features of CompuScope PCI Analog Input cards, CompuScope PCI Digital Input cards and CompuGen Analog and Digital Output 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 and CompuGen 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 85G" is abbreviated as "CS85G"

"CompuScope 82G" is abbreviated as "CS82G"

"CompuScope 8500" is abbreviated as "CS8500"

"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"

"CompuGen 1100" is abbreviated as "CG1100"

"CompuGen 3250" is abbreviated as "CG3250"

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. Do 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.

Identifying your CompuScope card(s)

Please note: if you are installing a CompuGen 1100 or a CompuGen 3250, please refer to the installation instructions within their respective sections.

Your CompuScope cards are composed of a base board and an analog board.

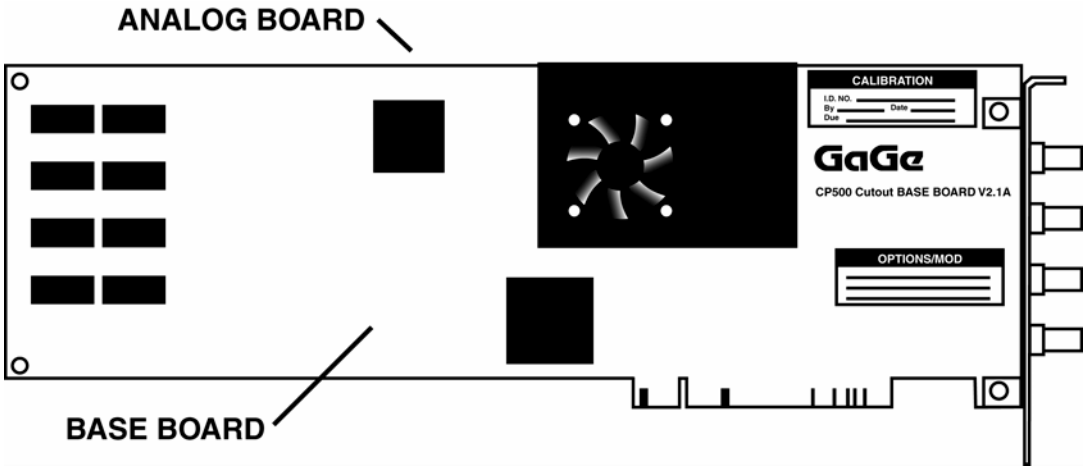


Figure 1: CS12100 and CS1250 base board and analog board

You will find the hardware version number of the base board in the location shown below:

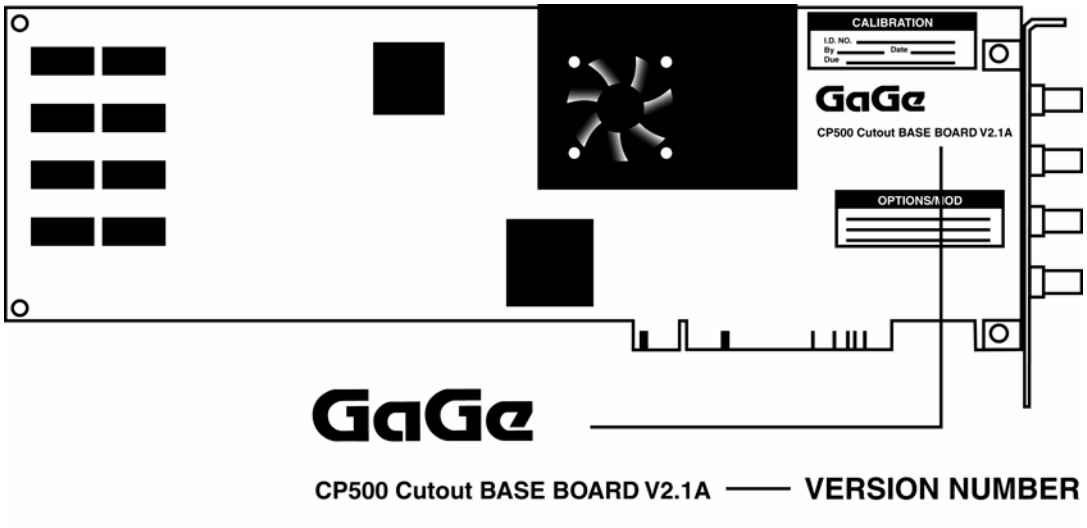


Figure 2: Base board hardware version number

You may also see an "OPTION/MOD" label listing any upgrades or modifications that have been performed on your card. For example, if you have purchased a CompuScope 12100-8M card, the "OPTION/MOD" label will list "8M" as an option.

The location of the calibration label is also shown below. The card serial number is listed on the calibration label.

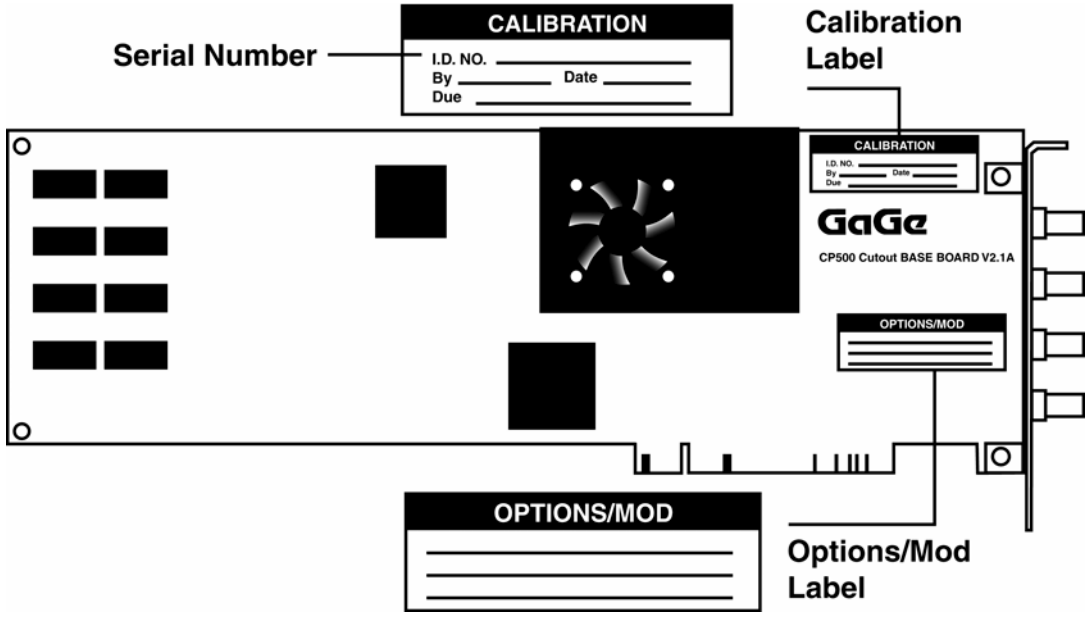


Figure 3: Calibration label and OPTION/MOD label

If you have purchased a multi-card system, you will notice that each of the CompuScope cards is labeled as either “MASTER” or “SLAVE 1”, “SLAVE 2” etc.

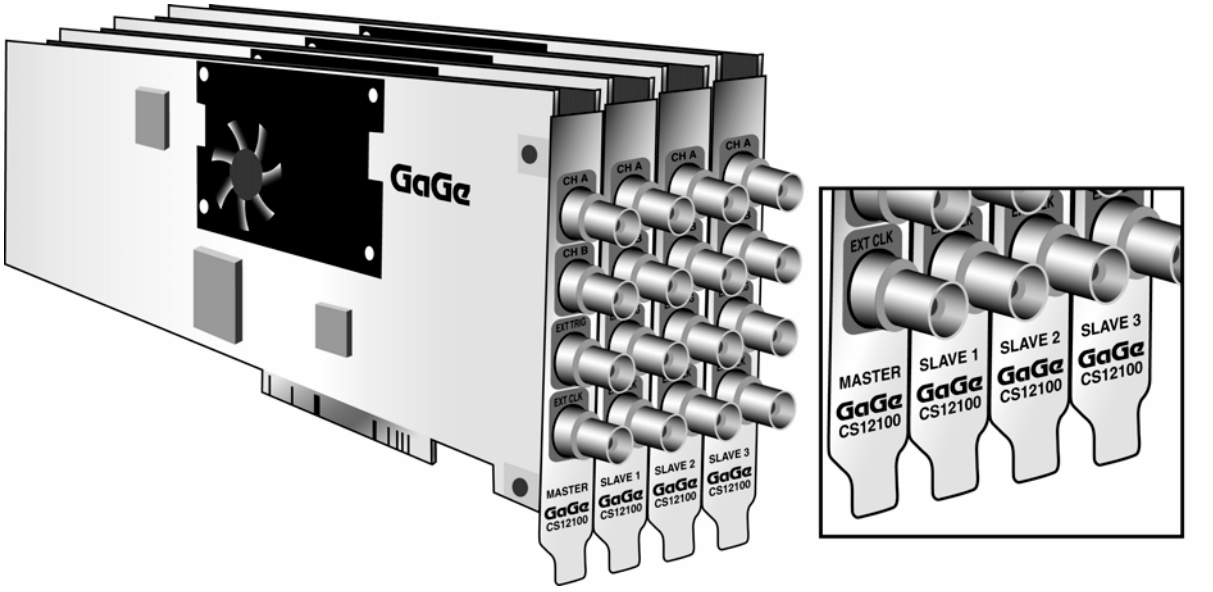


Figure 4: Master/Slave card designation

If you purchased a CompuScope with 4M or 8M on-board acquisition memory, you should also notice an additional piggyback circuit board on the back of the CompuScope card.

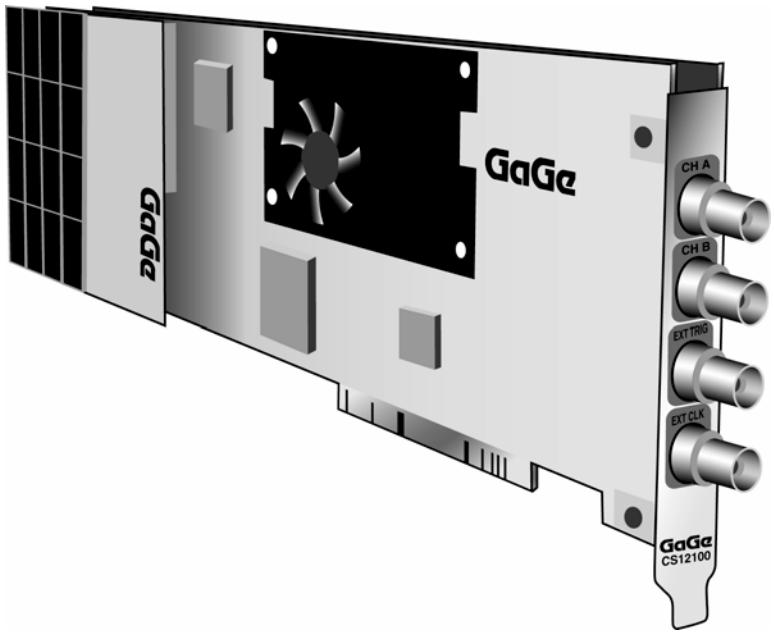


Figure 5: CompuScope card with piggyback extended memory board

If you purchased a CompuScope card with 64M or more on-board acquisition memory, you should notice an additional full-length piggyback circuit board on the back of the CompuScope card. This board is also referred to as a "Deep Memory Board".

The exact amount of on-board acquisition memory is listed on the OPTION/MOD sticker.

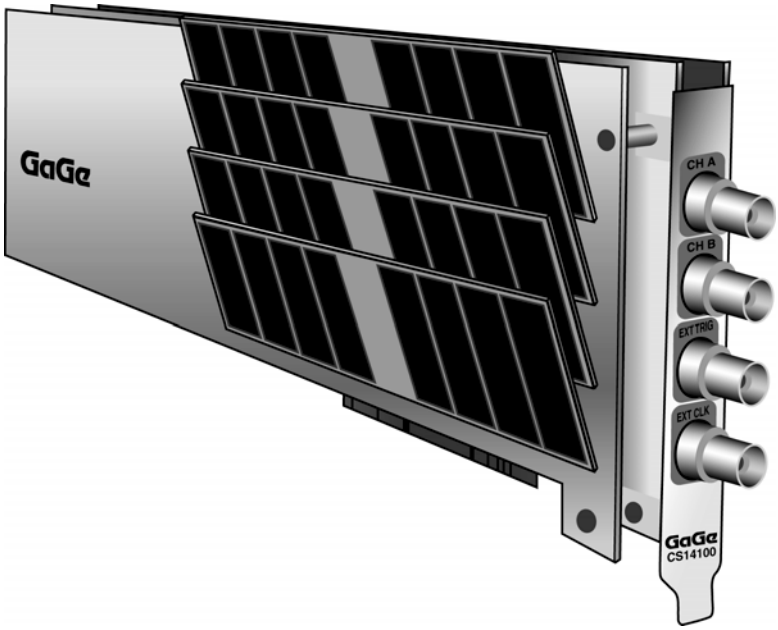


Figure 6: CompuScope card with Deep Memory Board

Notes

Installing a single CompuScope card (does not apply to CompuGen cards)

Please note: If you have a CompuGen 1100 or CompuGen 3250, please see the installation instructions specific to these cards within the individual product's section.

Below, you will find detailed instructions to guide you through the installation process.

Please refer to page ii for Electrostatic Discharge (ESD) handling procedures before installing your CompuScope card(s).

Installing the CompuScope card in Your PC

1 Power off your PC.

2 Open your PC's cover.

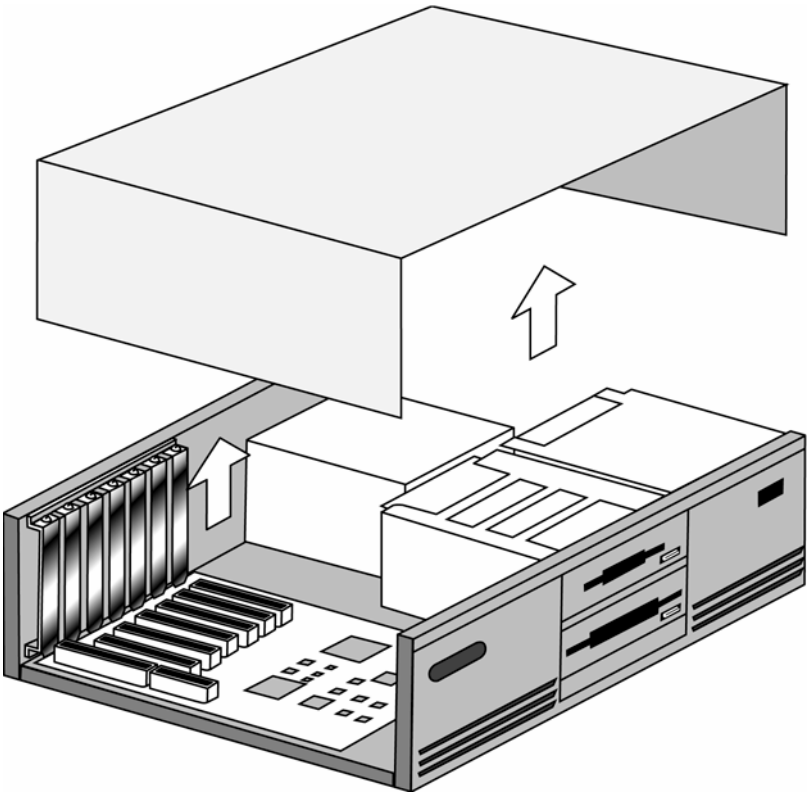


Figure 7: Opening your PC's cover

3 Select the appropriate number of unused full-sized PCI expansion slots. For the CompuScope 85G and CompuScope 82G, you will need 1 slot. For other CompuScope models, you will need 1 slot for 1M models, 2 slots for 4M and 8M models, and 3 slots for 64M, 128M, 256M, 512M, 1G and 2G models.

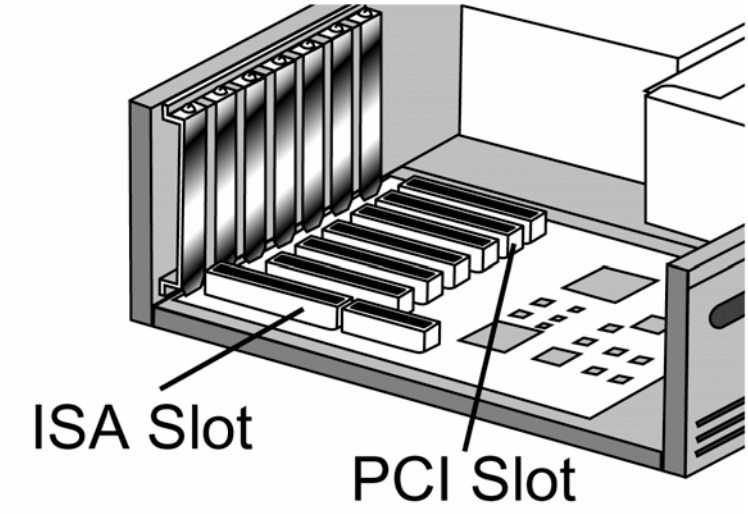


Figure 8: Selecting a PCI slot

4 Unscrew the screw holding the slot's backplate and remove it. Keep the screw, as you will need it in subsequent installation steps.

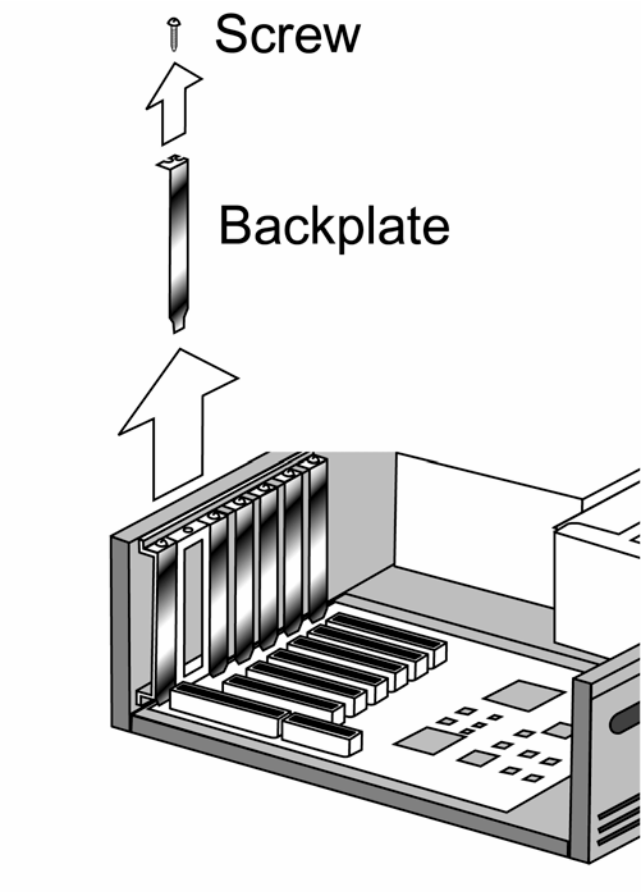


Figure 9: Removing the backplate

5 Insert the CompuScope card into the empty slot.

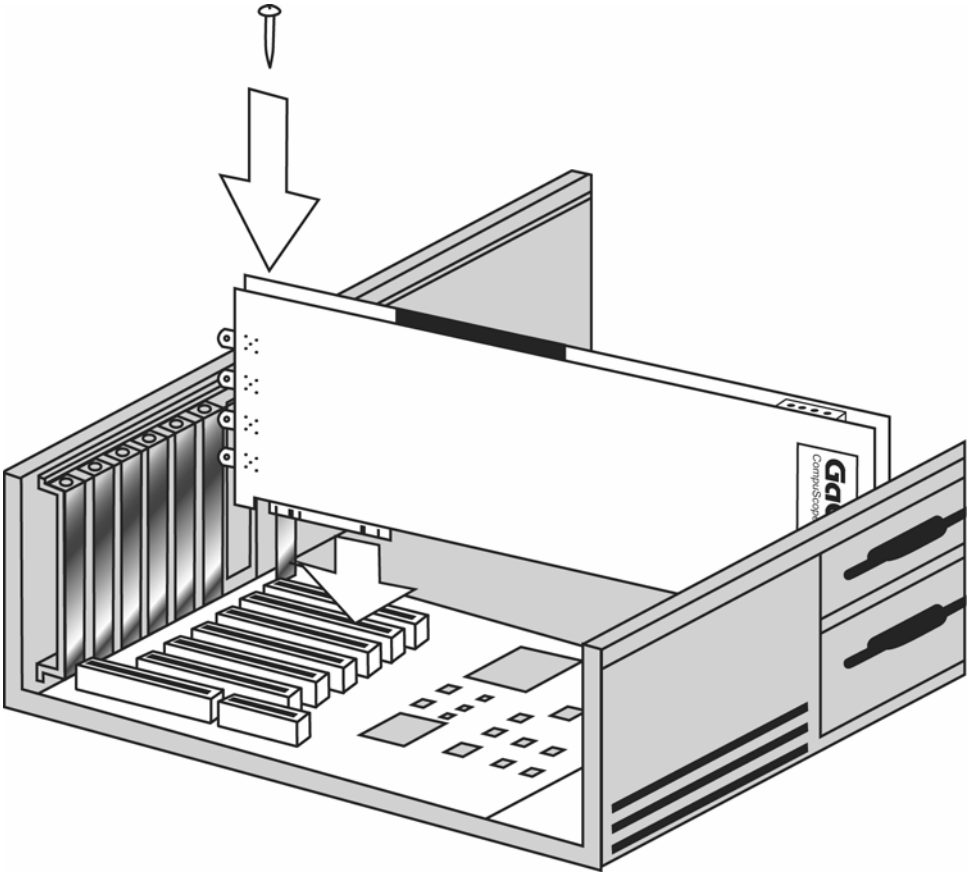


Figure 10: Inserting a single card

6 After making sure that the card is properly seated, screw the card to the chassis.

7 **Step for the CompuScope 82G and CompuScope 8500:**

IMPORTANT NOTE: you must provide auxiliary DC power to your CompuScope card. In some cases, PCI motherboards are not capable of delivering the necessary power to the CompuScope card (power traces are very thin and can be damaged if the current is more than a few amperes).

To accommodate such motherboards, Gage has designed a mezzanine power delivery system whereby +12 volt power can be delivered to the CompuScope add-on board directly from the power supply without having to go through the motherboard.

If your PC has a spare disk drive power connector (attached to your computer's power supply) that will reach the CompuScope power connector, simply plug this cable into the power connector. If it is not long enough, use the Auxiliary Power Cable provided with your card as an extender.

If your PC has no spare power connectors, unplug a used power connector (for example, to your hard drive) and attach the Auxiliary Power Cable. One end of the Y-cable goes to the CompuScope power connector; the other replaces the connector that you unplugged.

The auxiliary power connectors are located in the top right corner of the cards as shown in the figure below.

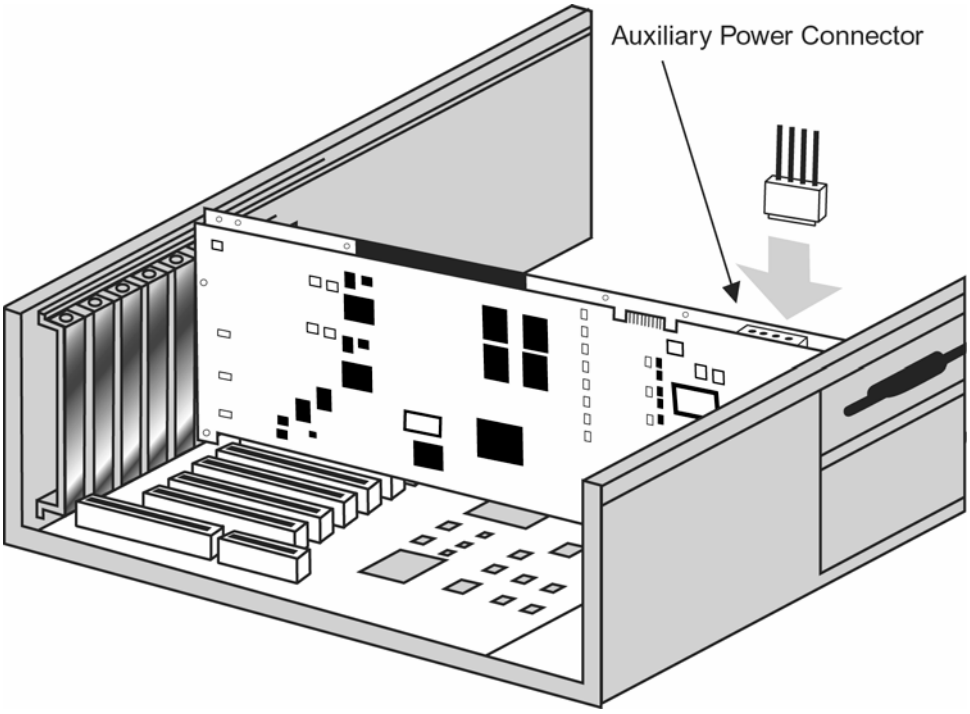


Figure 11: Connecting auxiliary power: single card

8 **Step for all CompuScope cards with a piggyback Deep Memory Board (also known as memory daughter board). This applies to most models with 64M or more memory:**

IMPORTANT NOTE: you must provide auxiliary DC power to your CompuScope card with 64M or higher memory if it has a piggyback Deep Memory Board. The piggyback Deep Memory Board has diagonal memory modules and is on the left if you are looking at the BNC input connectors.

In some cases, PCI motherboards are not capable of delivering the necessary power to the CompuScope card (power traces are very thin and can be damaged if the current is more than a few amperes).

To accommodate even such motherboards, Gage has designed a mezzanine power delivery system whereby +12 Volt power can be delivered to the CompuScope add-on board directly from the power supply without having to go through the motherboard.

If your PC has a spare disk drive power connector (attached to your computer's power supply) that will reach the CompuScope power connector, simply plug this cable into the power connector. If it is not long enough, use the Auxiliary Power Cable provided with your card as an extender.

If your PC has no spare power connectors, unplug a used power connector (for example, to your hard drive) and attach the Auxiliary Power Cable. One end of the Y-cable goes to the CompuScope power connector; the other replaces the connector that you unplugged.

If you are installing a CompuScope card with 64M or higher memory, you will have to connect a Y-cable to the piggyback Deep Memory Board.

PLEASE NOTE: If you are installing a CompuScope 8500 with 128M or higher memory, you must also make sure that you connect a power cable to the connector on the piggyback Deep Memory Board (in addition to the power cable that you have connected as shown in step 7).

The auxiliary power connectors are located in the top right corner of the piggyback Deep Memory Board as shown in the figure below.

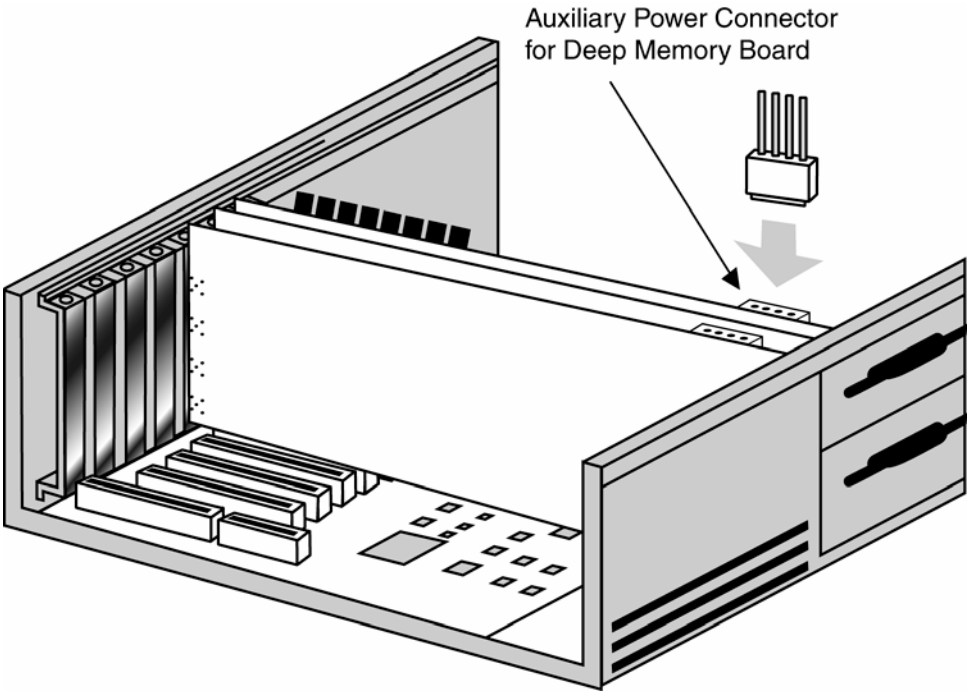


Figure 12: Connecting auxiliary power connector for 64M and higher memory models

9 Close the PC's cover and turn the main power switch back to ON.

10 Refer to the section within this manual called *Driver Installation Guide* for instructions on installing Windows drivers for the CompuScope card. Windows drivers are supplied with the product on CD.

11 Verify the operation of the card using CSTest+ or CSTest. CSTest+ and CSTest are sample programs provided with the CompuScope drivers to ensure proper operation of the CompuScope cards. CSTest+ is provided with the 3.80.xx drivers and CSTest is provided with the 3.60.xx drivers. Please refer to the section within this manual called **Section 3 – Verifying signal acquisition with CSTest+** for details on running CSTest+.

12 Install GageScope software. Follow the instructions provided in the GageScope manual for installing this software.

13 Run GageScope software and start acquiring data.
Follow the instructions provided in the GageScope manual for using this software.

14 **(Optional)** When writing your own program using one of Gage's Software Development Kits (SDKs), please refer to the appropriate Gage SDK manual for information on installation and usage of the Gage SDK.

Installing multiple CompuScope cards (does not apply to CompuGen cards)

Please note: If you have a CompuGen 1100 or CompuGen 3250, please see the installation instructions specific to these cards within the individual product's section.

Note that, unlike other types of CompuScope cards, multiple CS85G and CS14105 cards cannot be configured as Master/Slave Multi-Card systems. Multi-Card CS85G and CS14105 systems must be installed and operated as Multiple-Independent Multi-Card systems.

Below, you will find detailed instructions to guide you through the installation process of your multi-card system.

Before installing the CompuScope cards, please refer to page ii for Electrostatic Discharge (ESD) handling procedures.

1 Power off your PC.

2 Open your PC's cover.

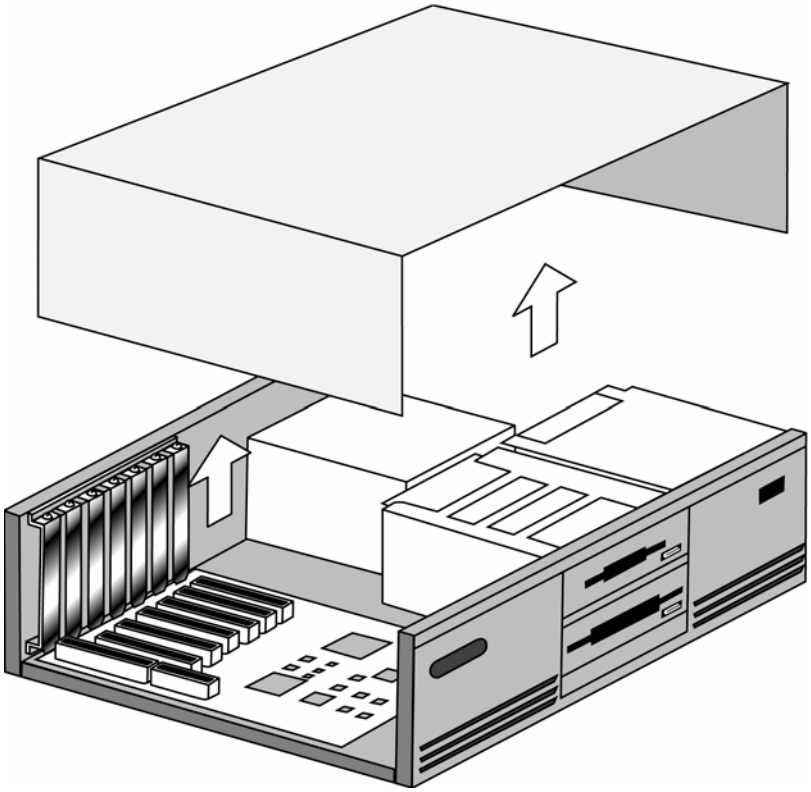


Figure 13: Opening your PC's cover

3 Select the required number of unused full-length PCI expansion slots based on the slot requirements of the CompuScope model you are installing (this information is available in the specification section for your CompuScope card).

The first card you should install is the one designated as Master. After the Master card is installed, proceed to install the cards designated Slave 1, Slave 2, etc. in the correct order.

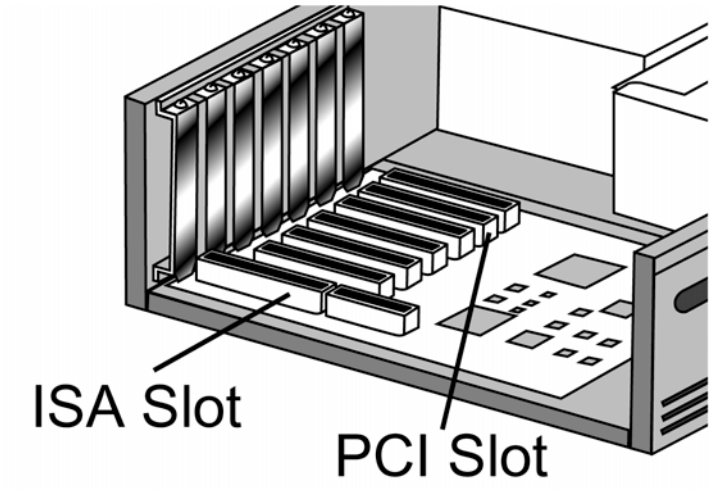


Figure 14: Selecting PCI slots

4 Unscrew the screw holding the slot's backplate and remove it. Keep the screw, as you will need it in subsequent installation steps.

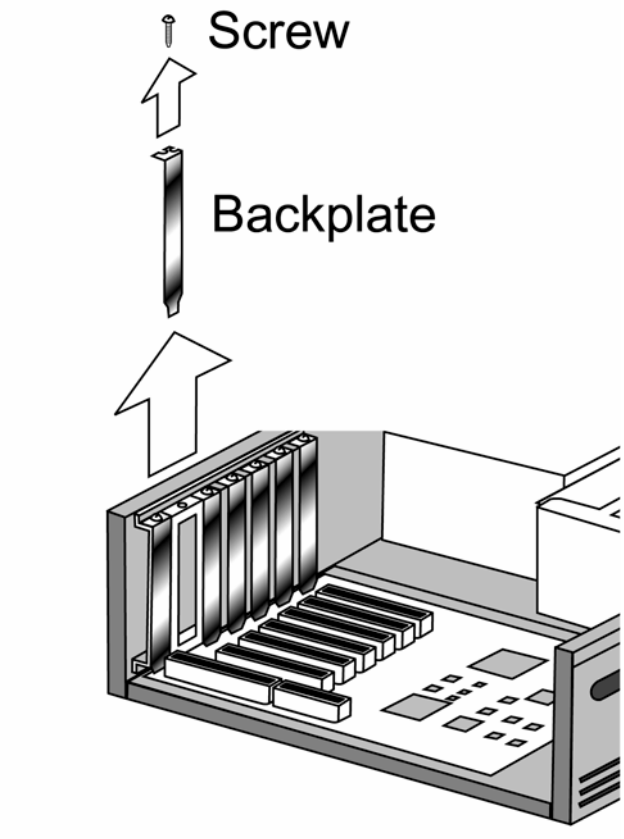


Figure 15: Removing the backplate

5 The first card you install will be the MASTER card. The MASTER card controls the operation of all Slave cards installed in the system. It generates the clock and issues triggers to all cards, controlling the timing for captures for the entire system. You must install a designated Master card as Master, and Slaves as Slaves.

The MASTER card must be installed into a vacant PCI slot in such a way that there are as many adjacent vacant PCI slots to the right (if you are facing the BNC connectors) as required for the Slave cards you will be installing.

If you are installing multiple cards in a multiple-independent configuration, install the first card in the same manner.

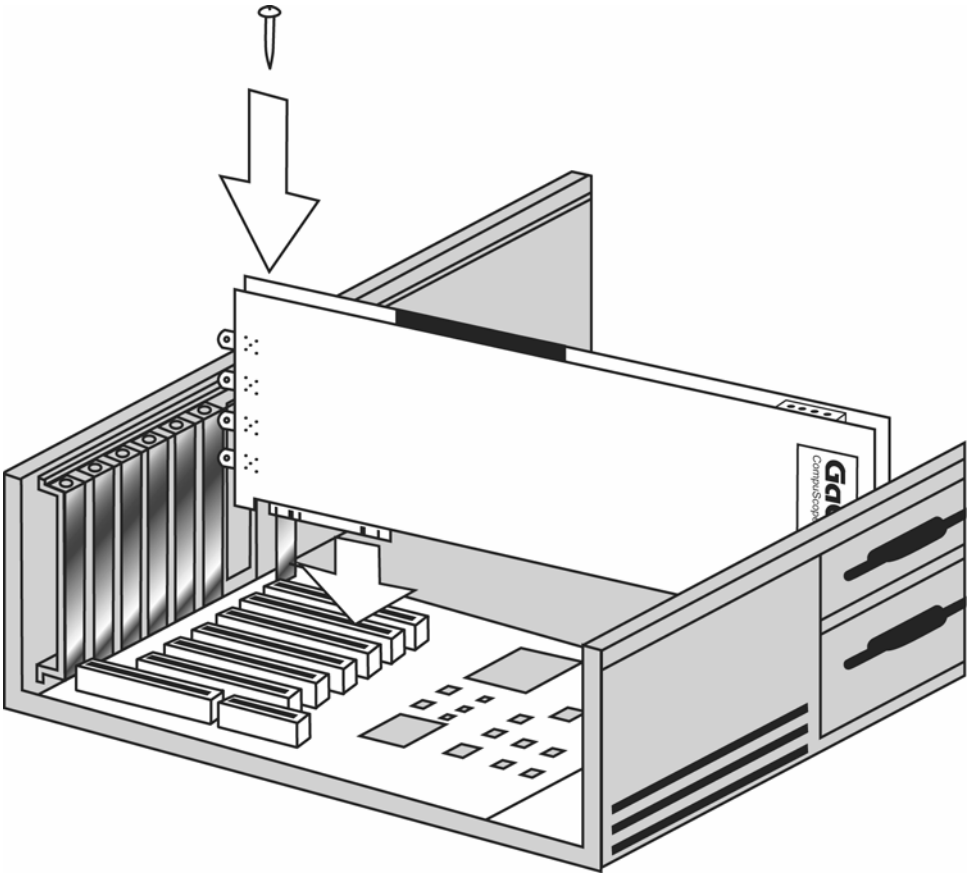


Figure 16: Installing the Master card or the first multiple independent card

6 After installing the Master Card in an appropriate PCI slot, the first Slave Card (labeled Slave 1) should be installed in the next available PCI slot to the right, and so on, as shown in the illustration below.

If installing multiple cards in a multiple-independent configuration: after installing the Independent Card #1 in an appropriate PCI slot, install the subsequent card(s) in the next available PCI slot to the right, and so on, as shown below.

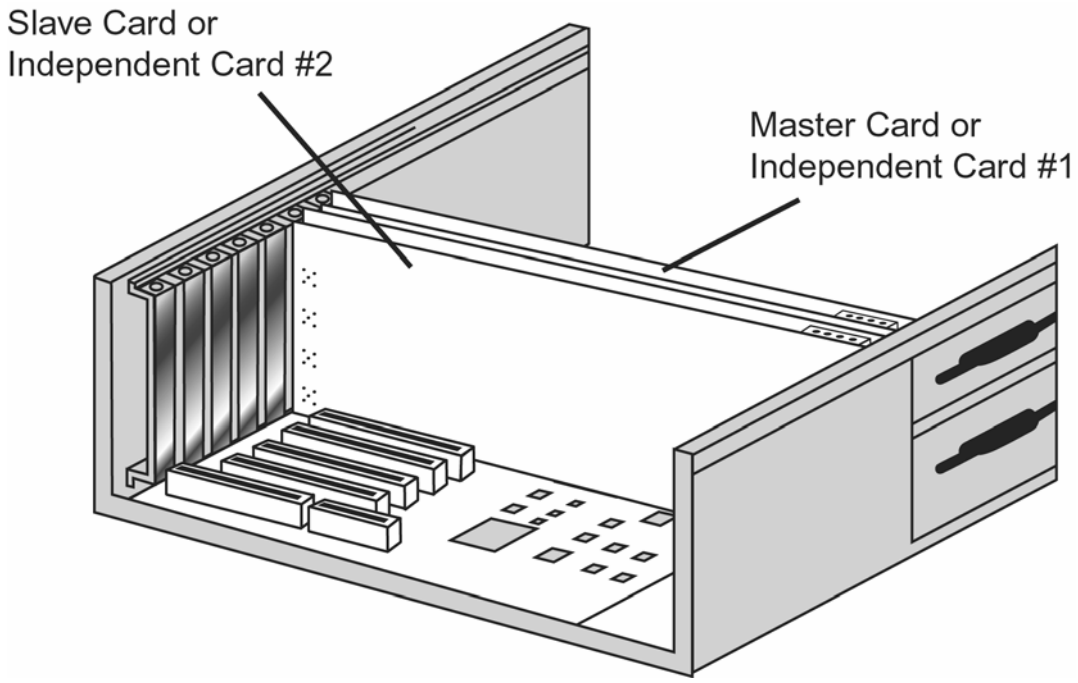


Figure 17: Inserting multiple CompuScope cards

Note that 1M memory models occupy one slot, 4M and 8M models occupy two slots and higher memory models occupy three slots.

7 After making sure that the cards are properly seated in their respective slots, screw all cards to the chassis.

8 Note: skip this step if you are installing cards in a multiple-independent configuration, you should not have received a Master/Slave Timing Module (MSTM) with your shipment.

Attach the appropriate Master/Slave Timing Module to all cards. (MSTM is polarized to avoid incorrect insertion.).

If you have a CompuScope 12100, 1250, 1220, 1602, 1610 or 3200 it should be installed as follows:

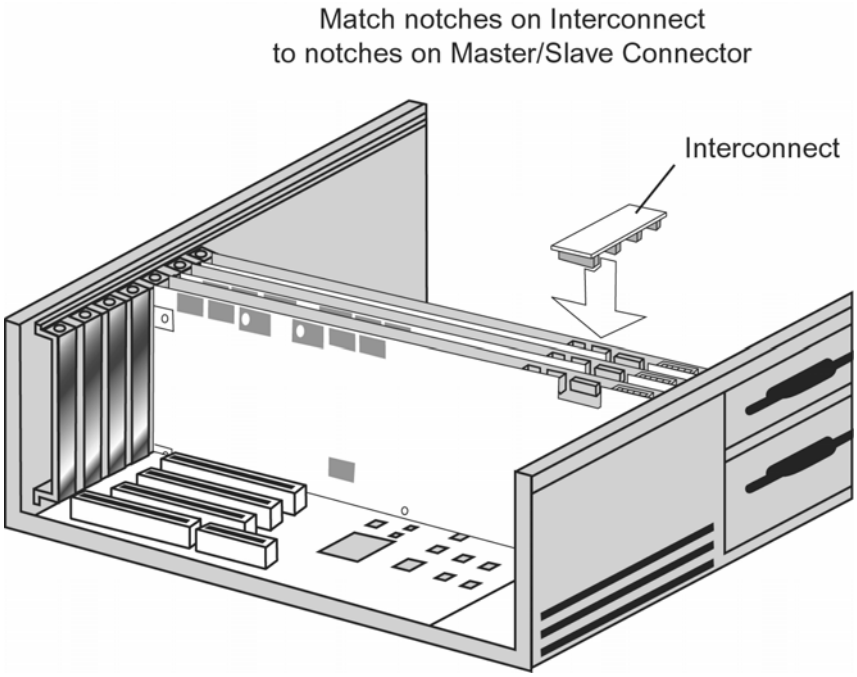


Figure 18: Installing MSTM for CompuScope 12100, 1250, 1220, 1602, 1610 or 3200

If you have a CompuScope 82G, 8500, 14100 or 1450 it should be installed as follows:

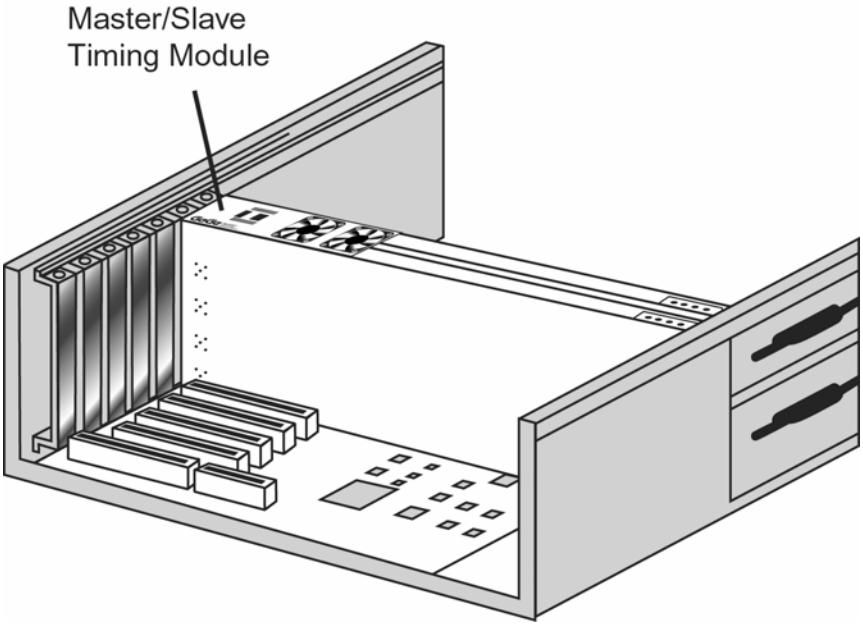


Figure 19: Installing MSTM for CompuScope 82G, 8500, 14100 or 1450

9 IMPORTANT NOTE: you must provide auxiliary DC power to your CompuScope card. In some cases PCI motherboards are not capable of delivering the necessary power to more than one CompuScope card (power traces are very thin and can be damaged if the current is more than a few amperes). To accommodate even such motherboards, Gage has designed a mezzanine power delivery system whereby +12 Volt power can be delivered to the CompuScope add-on board directly from the power supply without having to go through the motherboard.

If your PC has a spare disk drive power connector (attached to your computer's power supply) that will reach the CompuScope power connector, simply plug this cable into the power connector. If it is not long enough, use the Auxiliary Power Cable provided with your card as an extender.

If your PC has no spare power connectors, unplug a used power connector (for example, to your hard drive) and attach the Auxiliary Power Cable. One end of the Y-cable goes to the CompuScope power connector; the other replaces the connector that you unplugged.

Connect the 4-pin Y-cable to the Auxiliary Power Connectors on all the cards starting from the Master card (or the first Independent card). You must make sure that you have as many cables available as the total number of cards.

The auxiliary power connectors are located in the top right corner of the cards as shown in the figures below:

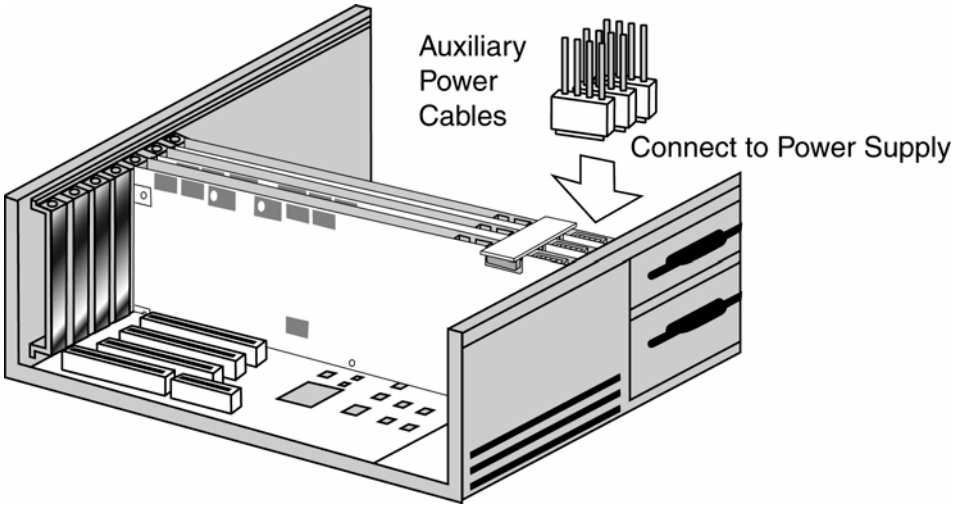


Figure 20: Connecting auxiliary power cable on CS12100, CS1250, CS1220, CS1602 or CS1610 multi-card systems

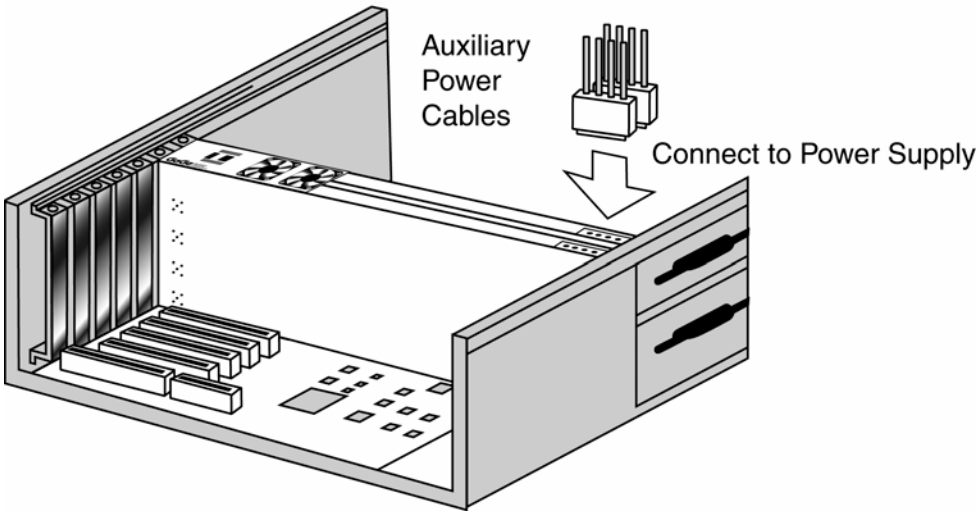


Figure 21: Connecting auxiliary power cable on CS8500, CS14100 or CS1450 multi-card systems

10 **Step for all CompuScope cards with a piggyback Deep Memory Board (also known as memory daughter board). This applies to most models with 64M or more memory:**

IMPORTANT NOTE: you must provide auxiliary DC power to your CompuScope card with 64M or higher memory if it has a piggyback Deep Memory Board. The piggyback Deep Memory Board has diagonal memory modules and is on the left if you are looking at the BNC input connectors. The auxiliary power connectors are located in the top right corner of the piggyback Deep Memory Board as shown in the figure below.

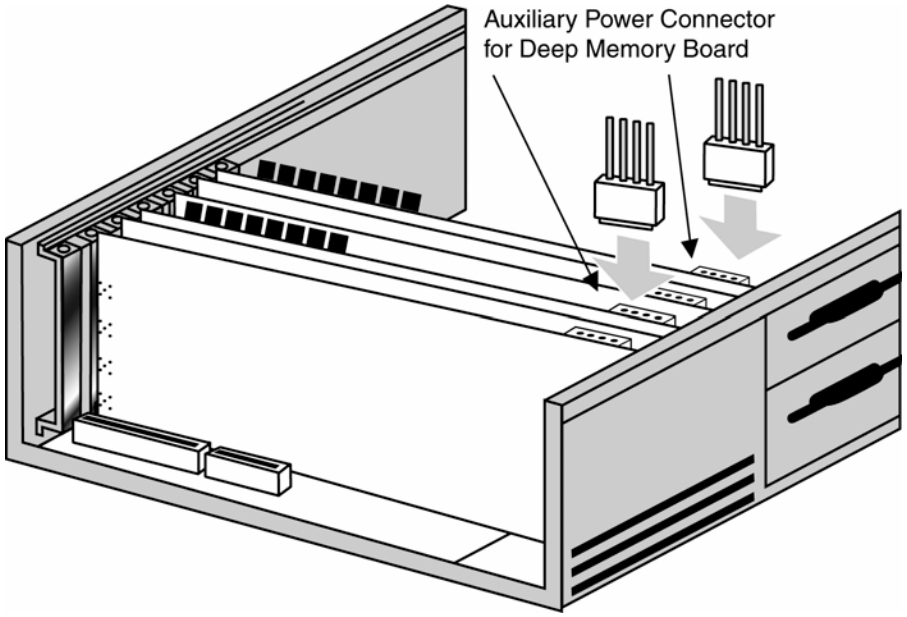


Figure 22: Connecting auxiliary power connector for multi-card systems with 64M and higher memory models

11 After making sure the cards are properly seated in the PC, with the interconnect properly secured, close the PC's cover and turn the main power switch back to ON.

12 Refer to the section within this manual called *Driver Installation Guide* for instructions on installing Windows drivers for the CompuScope cards. Windows drivers are supplied with the product on CD.

13 Verify the operation of the card using CSTest+ or CSTest. CSTest+ and CSTest are sample programs provided with the CompuScope drivers to ensure proper operation of the CompuScope cards. CSTest+ is provided with the 3.80.xx drivers and CSTest is provided with the 3.60.xx drivers. Please refer to the section within this manual called **Section 3 – Verifying signal acquisition with CSTest+** for details on running CSTest+.

14 Install GageScope software. Follow the instructions provided in the GageScope manual for installing this software

15 Run GageScope software and start acquiring data.
Follow the instructions provided in the GageScope manual for using this software

16 **(Optional)** When writing your own program using one of Gage's Software Development Kits (SDKs), please refer to the appropriate Gage SDK manual for information on installation and operation of the Gage SDK.

Note: Once upgraded to the Master/Slave option, the CompuScope Master or Slave cards will not function without the Master/Slave Timing Module. In other words, once configured as a Master/Slave System, the cards will not function independently.

Notes

Triggering on CompuScope digitizers

CompuScope digitizers feature state-of-the-art triggering.

Below is a table of the different software-selectable triggering features available on CompuScope cards:

	Ch A	Ch B	External Trigger	Software Trigger	Trigger Engines	Window Trigger	Ch A, B or Ext. Trigger	Trigger Bus for Master/Slave
CS85G	X	X	X	X	1			
CS82G	X	X	X	X	1			
CS8500	X		X	X	1			
CS12100 CS1250	X	X	X	X	2	X	X	
CS1220	X	X	X	X	2	X	X	X
CS14200 CS14105	X	X	X	X	2	X	X	
CS14100 CS1450	X	X	X	X	2	X	X	
CS1610 CS1602	X	X	X	X	2	X	X	X

The trigger circuit is designed to be similar to an oscilloscope, so the user can easily replace the digital oscilloscope in his or her application with a CompuScope card. A user can select the trigger source, trigger level and trigger slope using software commands.

The selected trigger source is then compared to a trigger level set by an on-board, 8 or 12 bit software-controlled DAC (only the 8 most significant bits are actually used). An on-board, high-speed comparator is used for this function, making it possible to trigger on narrow pulses or glitches that are much shorter than the sample rate.

Each time the selected signal crosses the trigger level, the on-board triggering circuitry monitors it for the slope selected by the user. When the appropriate slope is detected, a trigger signal is generated.

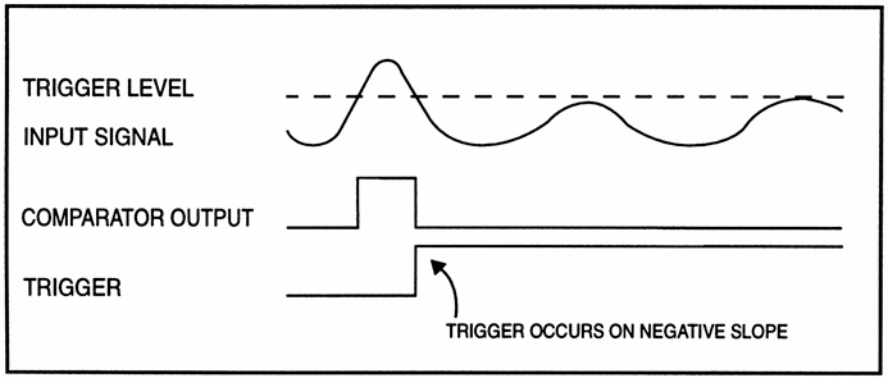


Figure 23: Generation of a trigger signal – negative slope

Windowed Triggering
(for CS12100, CS1250, CS1220, CS14200, CS14105, CS14100, CS1450, CS1610 & CS1602)

Using the CompuScope'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.

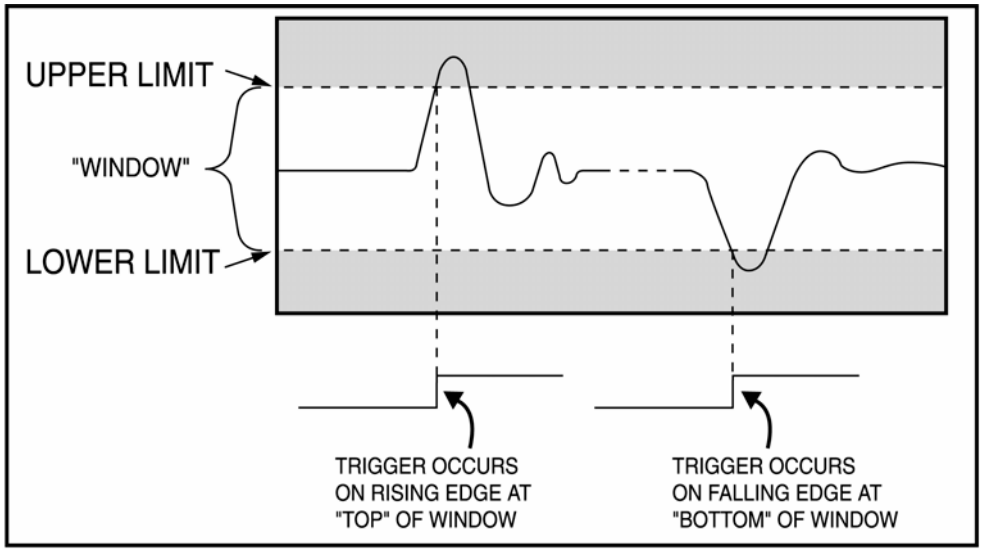


Figure 24: Windowed triggering

Channel A, B or External Triggering
(for CS12100, CS1250, CS1220, CS14200, CS14105, CS14100, CS1450, CS1610 & CS1602)

There are occasions when it is not possible to predict if the trigger is going to occur on Channel A, B or External.

For example, if the CompuScope card is hooked up to two photon detectors that are picking up random or intermittent pulses, the user is not able to select the trigger source. The CompuScope card can be put in a mode in which it will trigger on, for example, the rising edge of a pulse on Channel A or on the rising edge of a pulse on Channel B.

In other words, by selecting two different sources with independent levels and slopes, the user can generate a trigger on the first occurrence of the pulse on either of the two channels.

The External Trigger input can also be used in conjunction with Channel A or B, however, the data is not recorded for this input.

Trigger bus for Master/Slave systems (for CS1220, CS1610 & CS1602)

In a Master/Slave system, any one of the input channels can be used as a trigger source.

This is achieved by having a trigger bus in the Master/Slave interconnect that enables any one of the CompuScope 1220, 1610 or 1602 cards in the system to initiate a trigger.

This powerful feature allows the use of a multi-channel, Master/Slave CompuScope 1220, 1610 or 1602 system for acquiring signals in a system in which the user cannot predict which channel would receive the trigger signal. Examples of these applications are explosion testing and acoustic emission testing.

External Trigger amplifier

Below is a table with the oscilloscope-like external trigger input impedance, trigger comparator operating range, and software-selectable attenuation.

	External Trigger input impedance	Software-selectable attenuation
CompuScope 85G	1 MΩ / 20 pF	± 800mV, ± 8 Volt
CompuScope 82G	1 MΩ / 25 pF	±1 Volt, ±5 Volt
CompuScope 8500	1 MΩ / 30 pF	±1 Volt, ±5 Volt
CompuScope 12100	1 MΩ / 30 pF	±1 Volt, ±5 Volt
CompuScope 1250	1 MΩ / 30 pF	±1 Volt, ±5 Volt
CompuScope 1220	1 MΩ / 30 pF	±1 Volt, ±5 Volt
CompuScope 14200	1 MΩ / 35 pF	±1 Volt, ±5 Volt
CompuScope 14105	50 Ω	±1 Volt, ±5 Volt
CompuScope 14100	1 MΩ / 35 pF	±1 Volt, ±5 Volt
CompuScope 1450	1 MΩ / 35 pF	±1 Volt, ±5 Volt
CompuScope 1610	1 MΩ / 30 pF	±1 Volt, ±5 Volt
CompuScope 1602	1 MΩ / 30 pF	±1 Volt, ±5 Volt

Gage's proprietary input-protection circuitry allows the FET stage to withstand voltages as high as ±15 volts without causing any damage to the inputs.

Multiple Record for all CompuScopes except for the CS85G, CS82G, CS14200 and CS14105

Please note: the CompuScope 85G does not support Multiple Record.

See next section titled: "Multiple Record for the CS82G, CS14200 and CS14105" for details on this feature on the CompuScope 82G, CompuScope 14200 and CompuScope 14105.

Even though the PCI bus allows very fast data throughput to system RAM, there may still be applications in which data bursts cannot be off-loaded either because of very fast trigger repeat frequency or because of software limitations.

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

It should be noted that for all CompuScope digitizers, with the exception of the CompuScope 1602, only post-trigger data can be captured in Multiple Record mode. For the CompuScope 1602, only 20 pre-trigger points can be captured in Multiple Record mode; all other data is post-trigger data.

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

Once the CompuScope card has finished capturing a Multiple Record segment, the trigger circuitry is automatically re-armed within a certain number of sample clock cycles to start looking for the next trigger. No software intervention is required.

The table below shows the number of sample clock cycles required for re-arming the CompuScope cards.

	Re-arm time in sample clock cycles
CompuScope 8500	24
CompuScope 12100	16
CompuScope 1250	16
CompuScope 1220	5

	Re-arm time in sample clock cycles
CompuScope 14100	9 in single channel 18 in dual channel
CompuScope 1450	5 in single channel 10 in dual channel
CompuScope 1610	5
CompuScope 1602	5

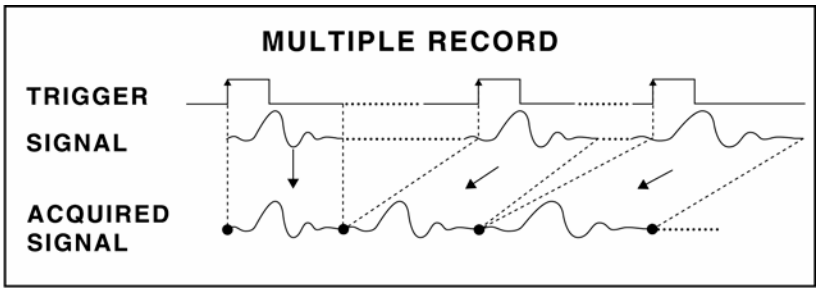


Figure 25: Multiple Record mode

Multiple Recording is useful for applications in which a series of bursts of data have to be captured in quick succession and there is not enough time to off-load the data to the system RAM.

Another situation in which Multiple Recording may be used is when data storage has to be optimized. These are cases in which only certain portions of the incoming signal are of interest and data capture during the dead time between successive portions is not useful.

Examples of these situations are radar pulses, ultrasound data, lightning pulses, imaging signals and explosion testing.

Multiple Record for the CS82G, CS14200 and CS14105

Even though the PCI bus allows very fast data throughput to system RAM, there may still be applications in which data bursts cannot be off-loaded either because of very fast trigger repeat frequency or because of software limitations.

The CS82G, CS14200 and CS14105 are capable of capturing pre-trigger data in Multiple Record (PTM) mode. Software can configure these cards to capture a pre-determined amount of pre-trigger data (see table below).

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

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

Once the CompuScope card has finished capturing a Multiple Record segment, the trigger circuitry is automatically re-armed within a pre-determined amount of time to start looking for the next trigger (see table below). No software intervention is required.

	Pre-trigger data size	**Re-arm**
CompuScope 82G	0 to 32K	Single: 304 Dual: 152
CompuScope 14200	Up to virtually full record length	2.6 μs
CompuScope 14105	Up to virtually full record length	2.6 μs

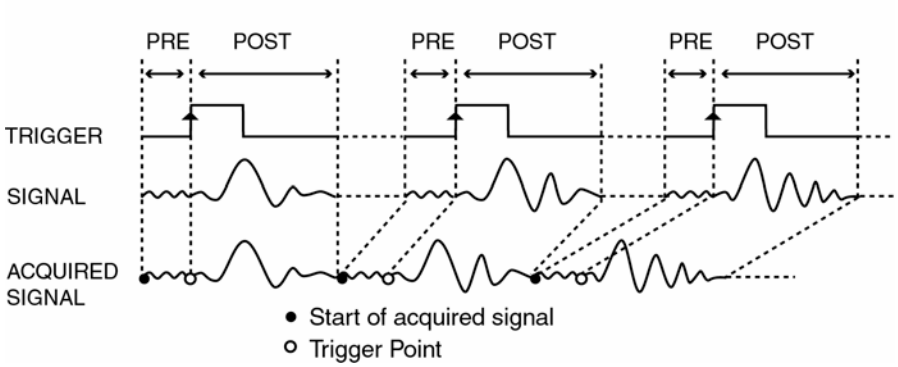


Figure 26: Multiple Record mode with Pre-Trigger data

Multiple Recording is useful for applications in which a series of bursts of data have to be captured in quick succession and there is not enough time to off-load the data to the system RAM.

Another situation in which Multiple Recording may be used is when data storage has to be optimized. These are cases in which only certain portions of the incoming signal are of interest and data capture during the dead time between successive portions is not useful.

Examples of these situations are radar pulses, ultrasound data, lightning pulses, imaging signals and explosion testing.

External Clock on CompuScope digitizers

External Clocking is a very powerful feature in a digitizer. It allows the user to synchronize the digitizer to an external system. Below is a table of available External Clock options for CompuScope digitizers.

	External Clock Input	X1 External Clock Input
CompuScope 85G	Not available	Not available
CompuScope 82G	Optional	Not required
CompuScope 8500	Optional	Not required
CompuScope 12100	Optional	Optional
CompuScope 1250	Optional	Optional
CompuScope 1220	Standard	Not required
CompuScope 14200	Standard	Not required
CompuScope 14105	Standard	Not required
CompuScope 14100	Standard	Not required
CompuScope 1450	Standard	Not required
CompuScope 1610	Standard	Not required
CompuScope 1602	Optional	Not required

Slower clock rates can cause saturation in the on-chip track-and-hold amplifiers and cause substantial signal distortion.

Failure to supply an External Clock with the specified frequency and duty cycle may result in higher distortion on the measured signal.

Note that high resolution and high-speed waveform digitizers are very sensitive to phase noise and duty cycle of the External Clock input. All efforts should be made to minimize jitter and distortion on the External Clock signal.

The **CS1220, CS1610 and CS1602** are dual-channel cards and therefore have dual-channel External Clock. There is no single-channel External Clock on these cards.

The user is allowed to put the **CS82G, CS12100, CS1250, CS14100 or CS1450** card in either single channel mode or dual channel mode while providing an External Clock.

The **CS14200 and CS14105** are dual-channel cards that have a unique operating mode that allows all on-board memory to be used by one channel. All other dual channel properties remain the same.

When the CS12100*, CS1250* and CS1610 perform dual channel acquisitions with an External Clock, samples are taken only on every other edge of the External Clock signal. This can cause one clock trigger jitter even if the trigger signal is perfectly synchronized to the External Clock signal (*see also the section on X1 External Clock on page 30).

When the CS1602 performs dual channel acquisitions with an External Clock, samples are taken only on every eighth edge of the External Clock signal. This can cause an eight clock trigger jitter even if the trigger signal is perfectly synchronized to the External Clock signal.

Please see the next page for a table of External Clock signal levels, impedance, sampling edge, coupling, allowable External Clock frequency range and duty cycle for the different CompuScope digitizers.

PLEASE NOTE:

THE EXTERNAL CLOCK ILLUSTRATIONS IN THIS SECTION DEPICT THE CLOCK SIGNAL AS A SQUARE WAVE FOR CLARITY, PLEASE FOLLOW THE RECOMMENDATIONS IN THE TABLE ON THE NEXT PAGE TO ACHIEVE PROPER OPERATION.

	Signal level	Impedance	Sampling edge	Coupling	External Clock frequency range	Duty cycle
CompuScope 82G	MIN. 225 mV RMS MAX. 500 mV RMS	50 Ω	Dual: Rising only Single: Rising & Falling	AC	10 MHz to 1 GHz	Single/Dual: 50% ± 5 %
CompuScope 8500	500 mV RMS sine wave	50 Ω	Rising	AC	200 MHz to 500 MHz	50% ±30%
CompuScope 12100	0 to +5 Volt TTL	50 Ω	Rising	DC	ExtClk: 10 MHz to 100 MHz X1 ExtClk: 5 MHz to 50 MHz	ExtClk: 50% ±30% X1 ExtClk: 50% ±5%
CompuScope 1250	0 to +5 Volt TTL	50 Ω	Rising	DC	ExtClk: 10 MHz to 50 MHz X1 ExtClk: 5 MHz to 25 MHz	ExtClk: 50% ±30% X1 ExtClk: 50% ±5%
CompuScope 1220	TTL	50 Ω	Rising	DC	1 kHz to 20 MHz	50% +5% at 20 MHz, rise & fall time < 8 ns, pulse width ≥ 22.5 ns
CompuScope 14200	MIN. 1 V RMS MAX. 2 V RMS	50 Ω	Rising	AC	Single/Dual: 1 MHz to 200 MHz	50% ± 5%
CompuScope 14105	MIN. 1 V RMS MAX. 2 V RMS	50 Ω	Rising	AC	Single/Dual: 30 MHz to 105 MHz	50% ± 5%
CompuScope 14100	MIN. 1 V RMS MAX. 2 V RMS	50 Ω	Rising	AC	Single: 40 MHz to 100 MHz Dual: 20 MHz to 50 MHz	Single: 50% ± 30% Dual: 50% ± 5%
CompuScope 1450	MIN. 1 V RMS MAX. 2 V RMS	50 Ω	Rising	AC	Single: 40 MHz to 50 MHz Dual: 20 MHz to 25 MHz	Single: 50% ± 30% Dual: 50% ± 5%
CompuScope 1610	TTL	Per TTL levels	Rising	DC	2 kHz to 20 MHz, maximum using 2x decimation filter	50% +5% at 20 MHz, rise & fall time < 8 ns, pulse width ≥ 22.5 ns
CompuScope 1602	TTL	Per TTL levels	Rising	DC	8 kHz to 20 MHz, maximum using 8x decimation filter	50% ±5% at 20 MHz, rise & fall time < 8 ns, pulse width ≥ 22.5 ns

Single channel External Clocking

Please note: this section does not apply to the CS1220, CS1610 and CS1602.

For information concerning External Clock for these cards, please refer to the next section titled: "Dual-channel External Clocking" on page 29.

The External Clock is designed for use with single channel mode, i.e. when only one input per card needs to be digitized. Sampling occurs on every low-to-high transition of the External Clock. For sine wave clocks, a transition is defined as the zero-crossing of the rising part of the wave.

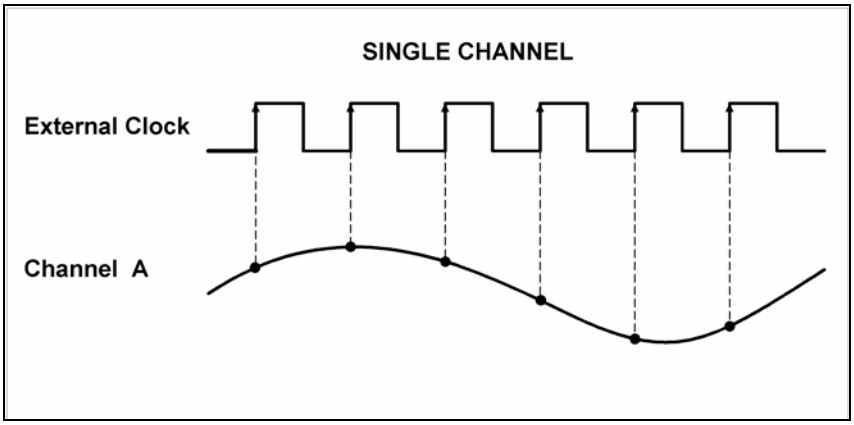


Figure 27: CS8500, CS12100, CS1250, CS14200, CS14105, CS14100, CS1450 External Clock in single channel mode

A new sample is taken on every rising edge of the External Clock.

It is very important that the External Clock signal supplied to the CompuScope card has the proper duty cycle. Failure to supply an External Clock within the specified range may result in higher distortion on the measured signal.

For the CompuScope 82G, in single channel External Clocking mode, sampling occurs on every transition (low-to-high as well as high-to-low) of the External Clock. For sine wave clocks, a transition is defined as the zero-crossing of the rising part of the wave.

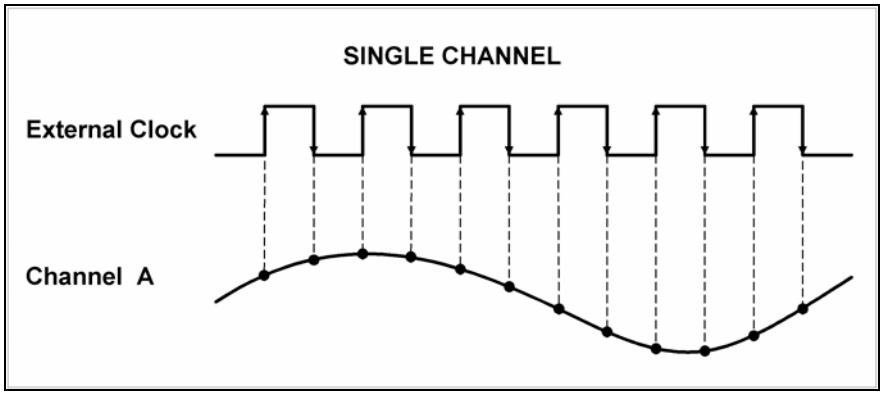


Figure 28: Single channel External Clock on the CompuScope 82G

Dual-channel External Clocking

Please note: this feature is not available on the CS8500.

Dual channel External Clocking is a software selectable feature available on the CS82G, CS12100, CS1250, CS1220, CS14200, CS14105, CS14100, CS1450, CS1610 and CS1602.

This mode configures the on-board clocking circuitry to simultaneously sample both inputs on every low-to-high transition of the External Clock. This is usually essential in wireless, telecom and radar applications that require simultaneous and coherent sampling of I & Q (In-phase & Quadrature) inputs after demodulation.

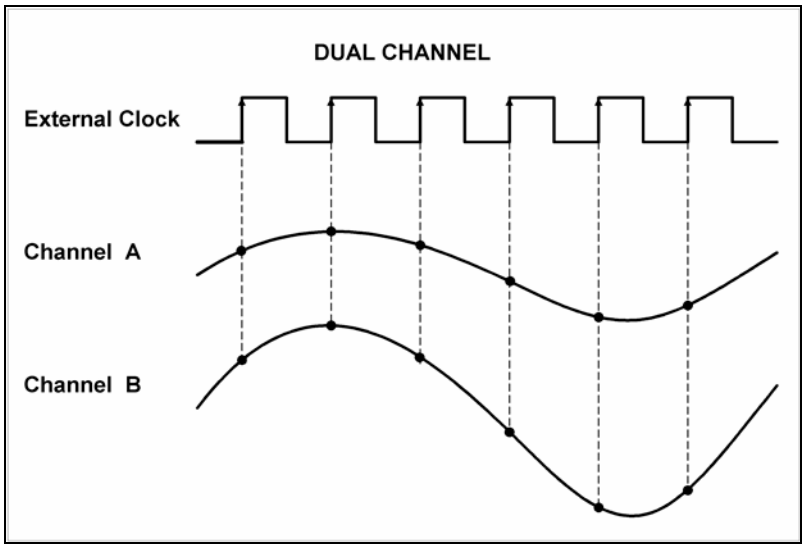


Figure 29: CS82G, CS1220, CS14200, CS14105, CS14100 & CS1450 Dual channel External Clock

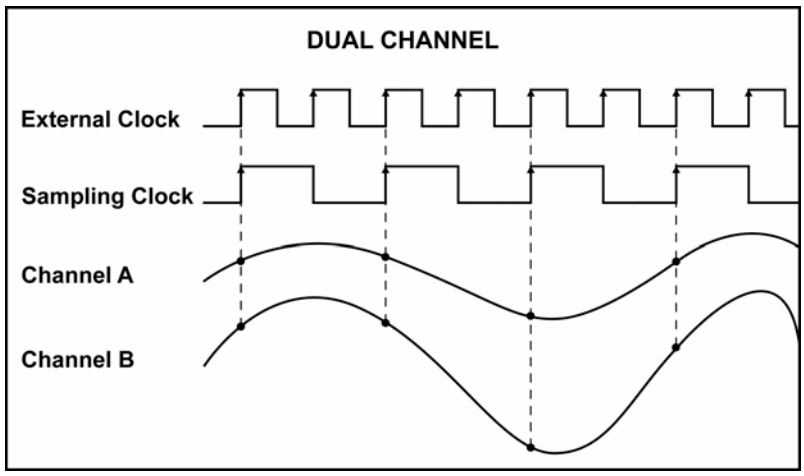


Figure 30: CS12100, CS1250, CS1610, CS1602* Dual channel External Clock

*Figure 30 above illustrates a 2 to 1 ratio between the External Clock and the Sampling Clock. The CS1602 uses and 8 to 1 ratio, that is the clock edges result in one sample conversion.

X1 External Clock (only available with CS12100 or CS1250)

Please note: this feature is only available with the CompuScope 12100 and CompuScope 1250

X1 External Clock Upgrade
X1 External Clock Upgrade is designed strictly for simultaneous, dual channel acquisition applications.

X1 External Clocking is achieved by modifying the CS12100 or CS1250 hardware. Once upgraded with X1 External Clock, a CompuScope 12100 or CompuScope 1250 is not capable of doing any single channel mode acquisition – even with internal clocking.

This mode configures the on-board clocking circuitry to simultaneously sample both inputs on every low-to-high transition of the External Clock. This is usually essential in wireless, telecom and radar applications that require simultaneous and coherent sampling of I & Q (In-phase & Quadrature) inputs after demodulation.

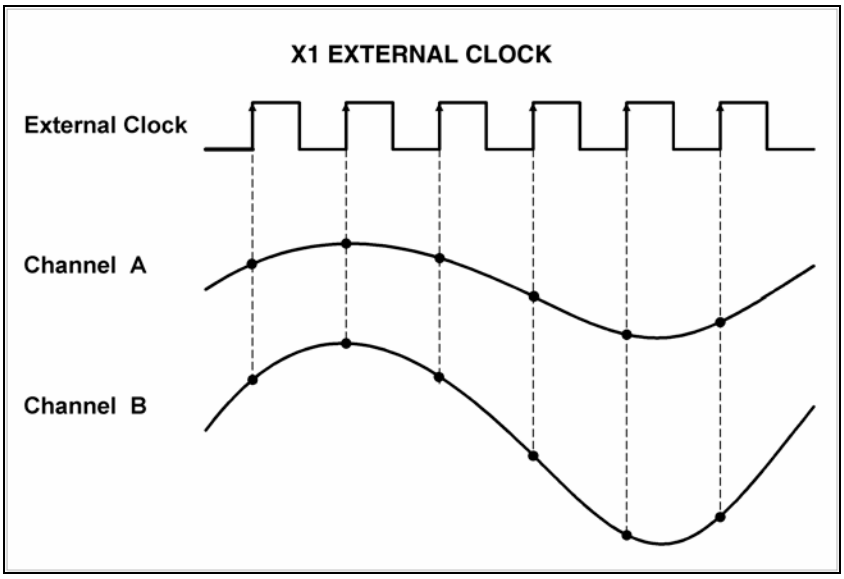


Figure 31: X1 External Clock upgrade in dual channel mode

Memory organization on CompuScopes (except for the CompuScope 85G)

Please note: for memory organization on the CompuScope 85G, please refer to the next section: Memory organization on CompuScope 85G.

Memory architecture

CompuScope cards have high-speed on-board memory to store the digital data for the PCI bus to access it in post-processing mode.

Interface to the PCI bus

In order to allow optimum data transfer rates from the CompuScope card memory to the PC memory, the on-board RAM is mapped into the memory space of the PCI bus.

The PCI bus Plug-and-Play BIOS determines the exact address at which this memory is mapped. This means that the user does not have to set any jumpers or switches to configure the CompuScope card — it really is plug and play.

Bus Mastering

Full Bus Mastering capabilities are provided on CompuScope cards, allowing the fast data transfer to occur as a result of a Direct Memory Access (DMA).

Software loads the start address, destination pointer and number of points to be transferred into the PCI bus controller on the CompuScope card and then asks the card to do a DMA transfer. The PCI bus mastering control circuitry takes over from this point and performs the transfer without any CPU involvement.

Data storage

The data coming out of the A/D converters or digital input is stored in the on-board memory buffer, which is configured as a circular buffer. A circular buffer is used to guarantee that the system will keep on capturing data indefinitely until a trigger event is detected.

The sequence of events is as follows:

- PCI bus instructs the CompuScope to **start_capture** using a register bit.
- BUSY flag is set by the CompuScope. PCI bus is denied any further access to the on-board memory.
- The on-board memory counters initialize to ZERO and start counting up, thereby starting data storage at memory address ZERO.
- The system waits for a trigger event to occur while it is storing data in the on-board memory. This data is called Pre-Trigger data.
- Once the trigger event is received, a specified number of Post-Trigger points are captured. The number of Post-Trigger points can be specified by writing to a register on the CompuScope.
- After storing the specified number of Post-Trigger points subsequent to receiving the trigger event, acquisition is stopped, the BUSY flag is reset and the PC bus is allowed access to the on-board memory.

A graphical representation of the above sequence is as follows:

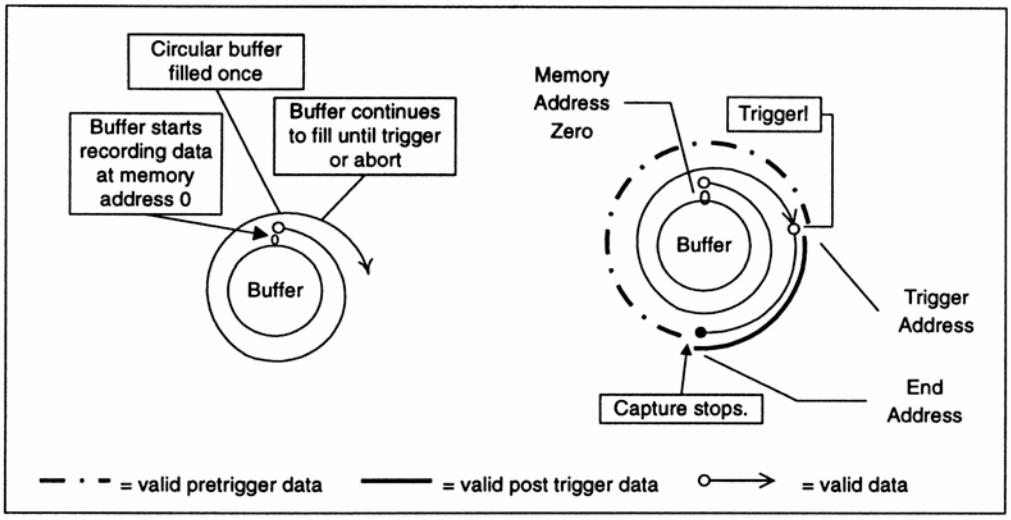


Figure 32: Pre-Trigger: all data points in buffer valid

In the diagram above, the circular memory buffer is shown as an annulus with the physical memory address ZERO at the top. Data storage is shown as a spiraling line going clockwise.

Storage starts at address ZERO and keeps on writing into the memory until it is filled (the spiraling line completes a circle) and then starts overwriting the data stored in addresses ZERO, 1, 2...

Once a trigger event is detected, the address to which the data was being written into is tagged as the Trigger Address, a specified number of Post-Trigger points are captured and then the acquisition is stopped.

The memory address at which the acquisition is stopped is designated as the End Address and the address after that one is called Start Address.

Now, Pre-Trigger data lies between Start Address and Trigger Address, and Post-Trigger data between Trigger Address and End Address.

It is clear from the diagram shown above that memory address ZERO is not necessarily the first point, or Start Address, of the signal being captured. In fact, the physical address ZERO has very little significance in such a system, as the trigger can happen at any time.

One case in which ZERO is the Start Address is when the acquisition is completed before the memory had filled up, i.e. the trigger was received right after the software tells the CompuScope to **start_capture**.

This situation is illustrated below:

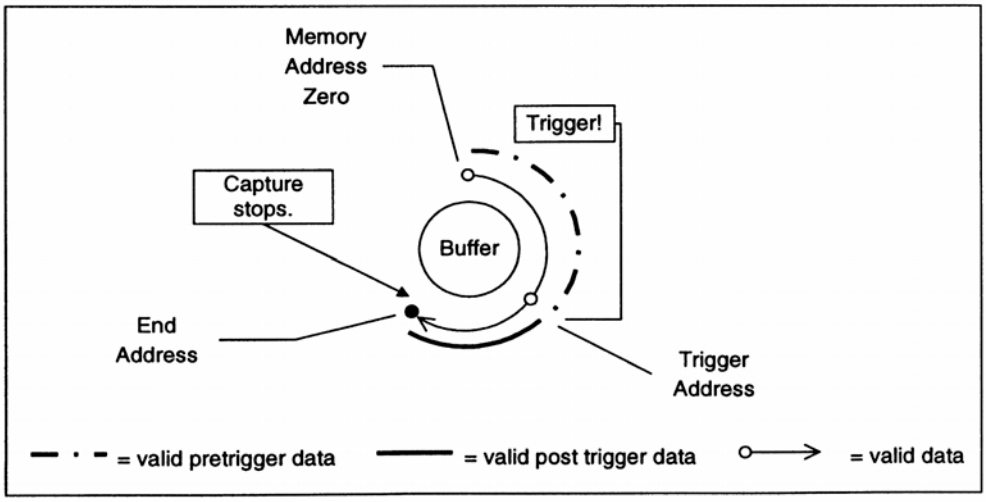


Figure 33: Pre-Trigger: not all data points in buffer valid

This condition can be detected by looking at the RAMFULL bit in the STATUS register. This bit is reset to ZERO when a **start_capture** command is issued and is set to ONE when the memory counters overflow from FFFFF to ZERO, for example.

In this case, Pre-Trigger data lies between ZERO and Trigger Address, and Post-Trigger between Trigger Address and End Address.

The driver and the software development kits handle these issues seamlessly.

Memory organization on CompuScope 85G

CompuScope 85G uses a very unique analog to digital signal conversion technique. Patented by Tektronix, this technique is called FISO (Fast In Slow Out).

The basic concept is very simple and is a three part process:

- Store the signal in "analog memory" at the ultra-fast sampling speed, e.g. 5 GS/s
- Play back the stored signal at a slower speed, e.g. 1 MHz
- Use a slower speed, conventional A/D device to convert the signal to digital code

While the concept is very simple, the implementation required decades of research and development to perfect the data conversion process.

One obvious corollary to having "analog memory" is that the maximum amount of acquisition memory on the CompuScope 85G is limited to the maximum number of analog storage cells in the FISO ASIC. This number is 10,000 points for each of the channels on the CompuScope 85G.

Since the acquisition is done by an on-board 68000 microprocessor, data transfer to PC memory is done as a memory to memory transfer between the 68000 and the host processor, e.g. Pentium III.

Driver installation guide

Installing your Gage hardware in a computer is only one step in setting up your system. You also need to install drivers and application software to operate the instrument card or cards you purchased. This section will describe how to install software and verify the operation of your new hardware.

Please note that due to the various versions of operating systems supported by Gage, the screen captures serving as illustrations in this manual may differ from what you will see on your screen. The discrepancies will not be material when it comes to basic functionalities and operation; however, the look and certain names will be slightly different.

Section 1 – Installing drivers and applications

The product you bought comes with a totally re-designed and vastly improved installation package. This new installer was designed to work the same way on all supported operating systems. It was also designed to be intuitive to most users and easy to follow for anyone familiar with installing software on a computer running Windows. Therefore a certain level of familiarity with the Windows operating system is assumed in this manual.

The basic instructions presented in this section should be sufficient for most installation needs.

The main installation steps are as follows: (you may skip some of the steps if you do not wish or need to install certain drivers or applications)

A – If you have not already done so, insert your Gage Software CD into the CD-ROM drive of your computer. The AutoRun feature of Windows should kick-in and bring up the installer's main screen. If this does not take place, you can start the installer by double-clicking on the gage.exe item that you will find on the CD.

The Gage software disk main screen will appear (see Figure 34 below).

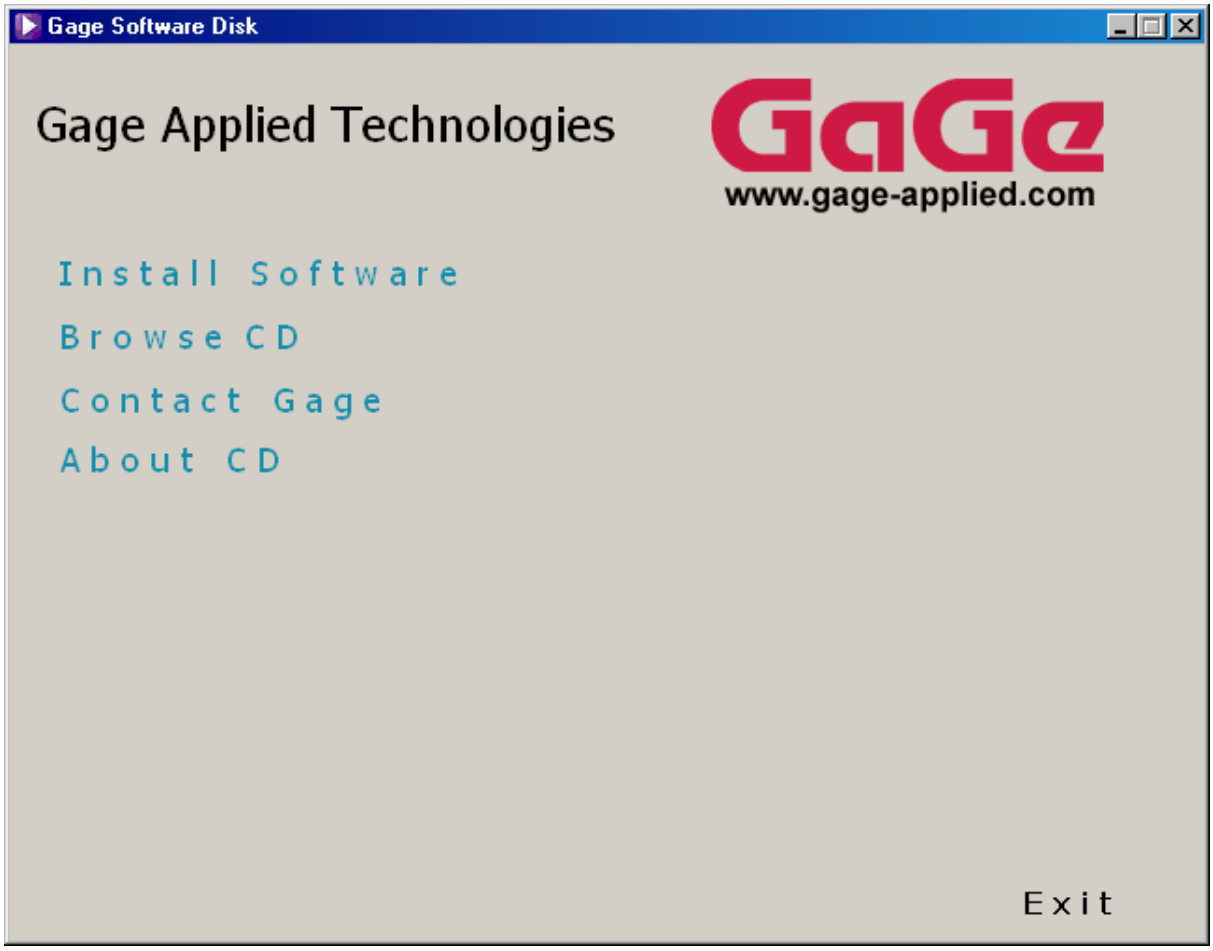


Figure 34: The Gage Software Disk's main screen

This window offers four possible options (not counting the Exit option):

- Install Software
- Browse CD
- Contact Gage
- About CD

The fourth option, About CD, is an important first step whenever troubleshooting the installation or asking for technical support from Gage. It provides valuable information about the various software drivers and application packages available on the CD. Figure 35 gives an example from the first version of this new installation package.

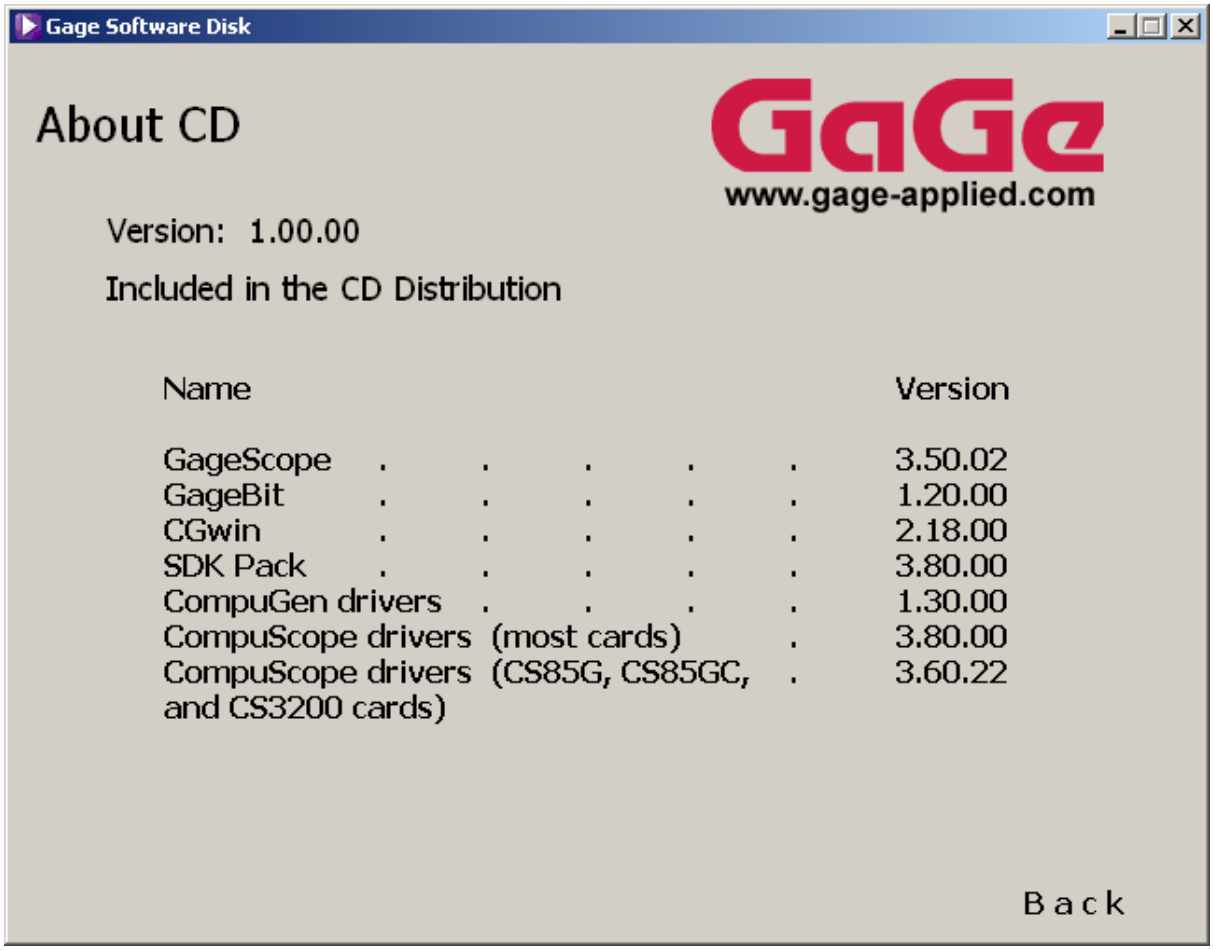


Figure 35: The About CD screen

Whenever navigating the installation software, you can use the Back button at the bottom-right of the screen to return to a previous screen in the installation hierarchy.

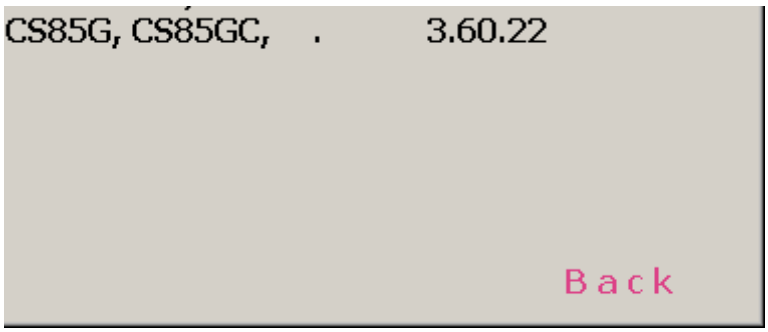


Figure 36: The Back button

Another useful feature of the installer is the Contact Gage option available from the Gage Software Disk's main screen. From this screen, you will find useful contact information for Gage for technical support.

Figure 37: The Contact screen

Also from the Gage Software Disk's main screen, you can directly access Gage's Web site by clicking on the Web address under the Gage logo.

Figure 38: The link to Gage's Web site on the Gage Software Disk's main screen

Finally, as a last exploratory step before installing, you can click on the Browse CD button to open a Windows Explorer window showing the content of the Gage Software Disk (see Figure 39 below).

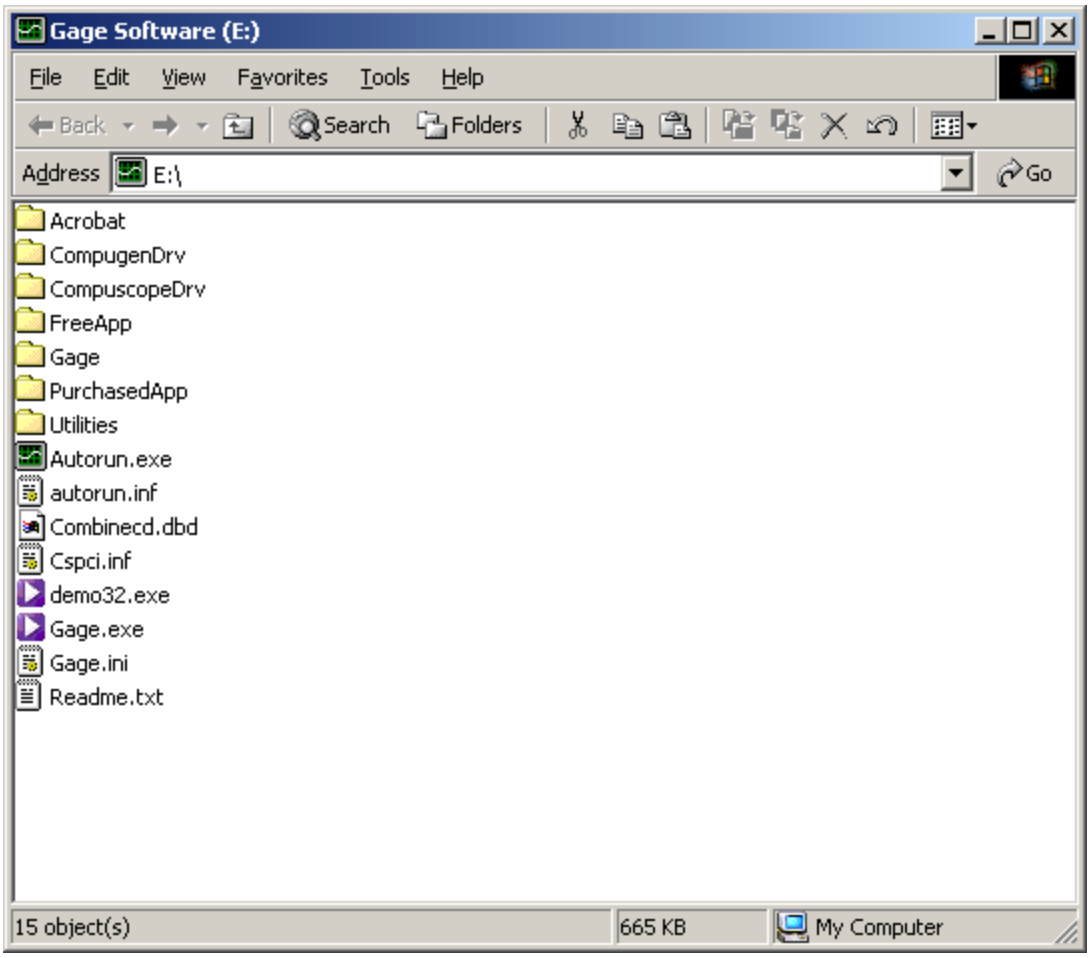


Figure 39: Browsing the CD

Now that you have become familiar with the first level of the installer, we can proceed with the installation proper.

B – Click on the Install Software button to start installing the Gage software.

The Install Software screen (Figure 40) offers four software options to install:

- CompuScope drivers
- CompuGen drivers
- Free applications
- Purchased software

Figure 40: The Install Software screen

As you position the mouse over one of the four menu options, details of each option appear in a text box to the right of the screen (see Figure 41):

Figure 41: Example of information visible when positioning the mouse on a menu item

CompuScope Drivers Installation

Click on the CompuScope drivers button to go to the CompuScope drivers screen (Figure 42). The installer offers two choices of drivers; you must choose according to the type of hardware you purchased.

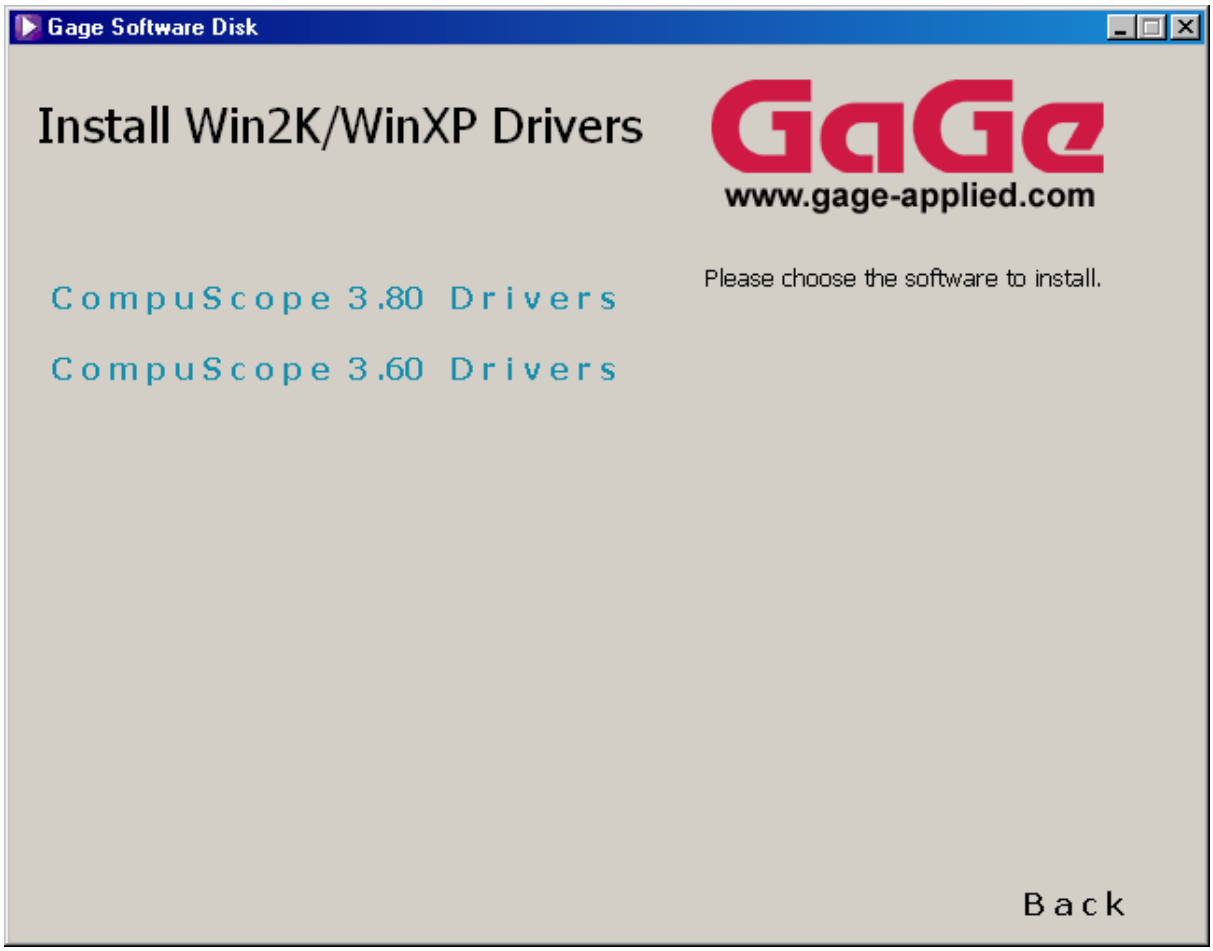


Figure 42: CompuScope Drivers for Win2K/WinXP

Since the CompuScope Windows 98/ME and Windows 2K/XP drivers are plug-and-play, we recommend that you first install your CompuScope hardware and then use the Add New Hardware function of your operating system (if the system does not automatically prompt you for the location of the driver) to install the CompuScope drivers.

CompuScope 3.60 Windows 98/ME or Windows 2K/XP Drivers

For the CompuScope 3.60 Windows 98/ME or Windows 2K/XP drivers, you will actually see the following message (Figure 43) if you try to install from this screen:

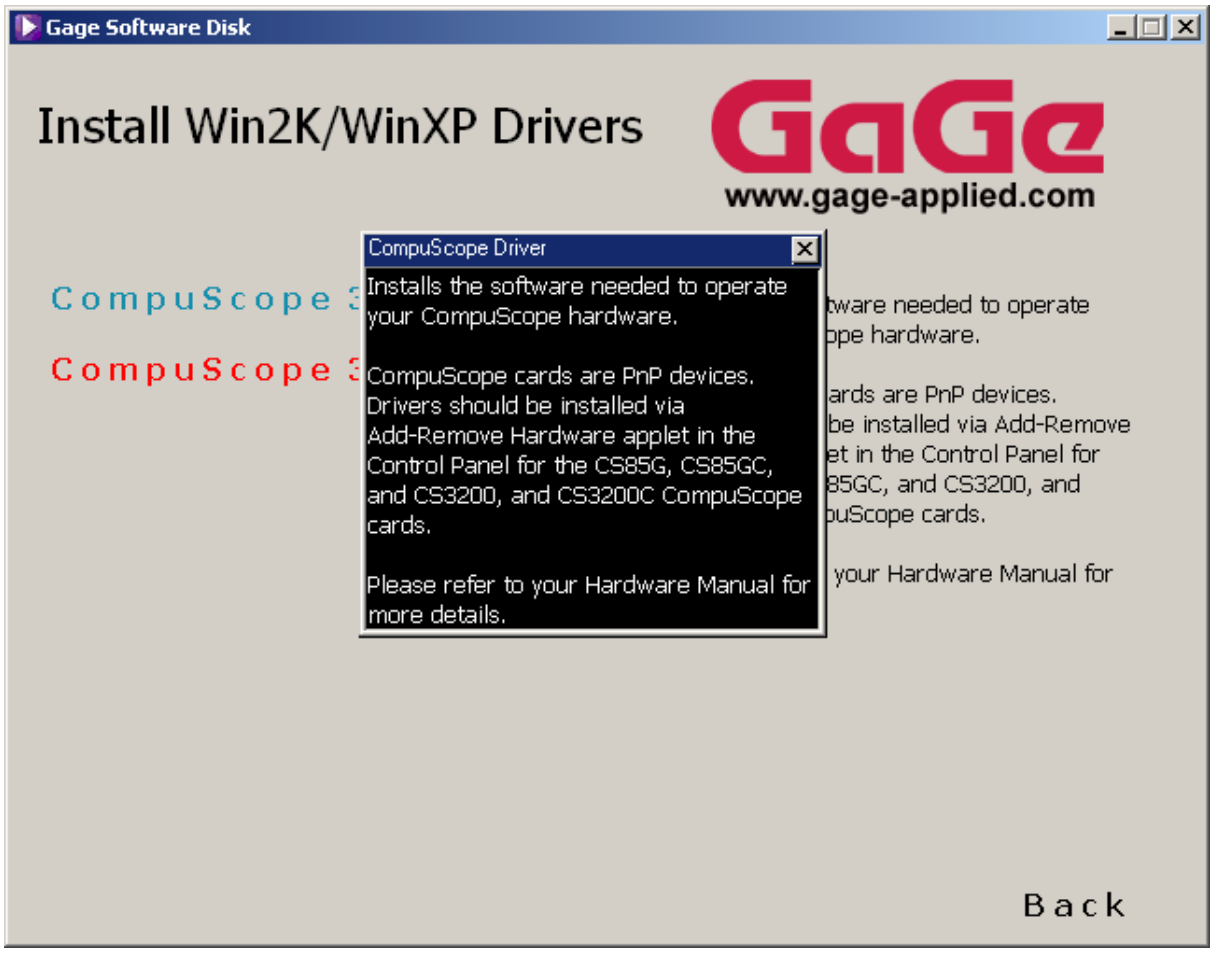


Figure 43: Plug-n-Play CompuScope driver message

The installation of the CompuScope 3.60 Windows 98/ME or Windows 2K/XP drivers should therefore be done from the Add New Hardware function of Windows (note that the CompuScope 3.80 drivers are not available for Windows 98/ME). To complete the installation of CompuScope drivers you will only have to point Windows to the Gage Software Disk and Windows will do the rest of the work.

CompuScope 3.60 Windows NT Driver Installation

Note that if you are using Windows NT, the Add New Hardware function is not available. In order to install the CompuScope 3.60 drivers (note that the CompuScope 3.80 drivers are not available for Windows NT), you must run the Setup.exe file found in the CompuscopeDev/Legacy/WinNT/ directory on the Gage Software Disk:

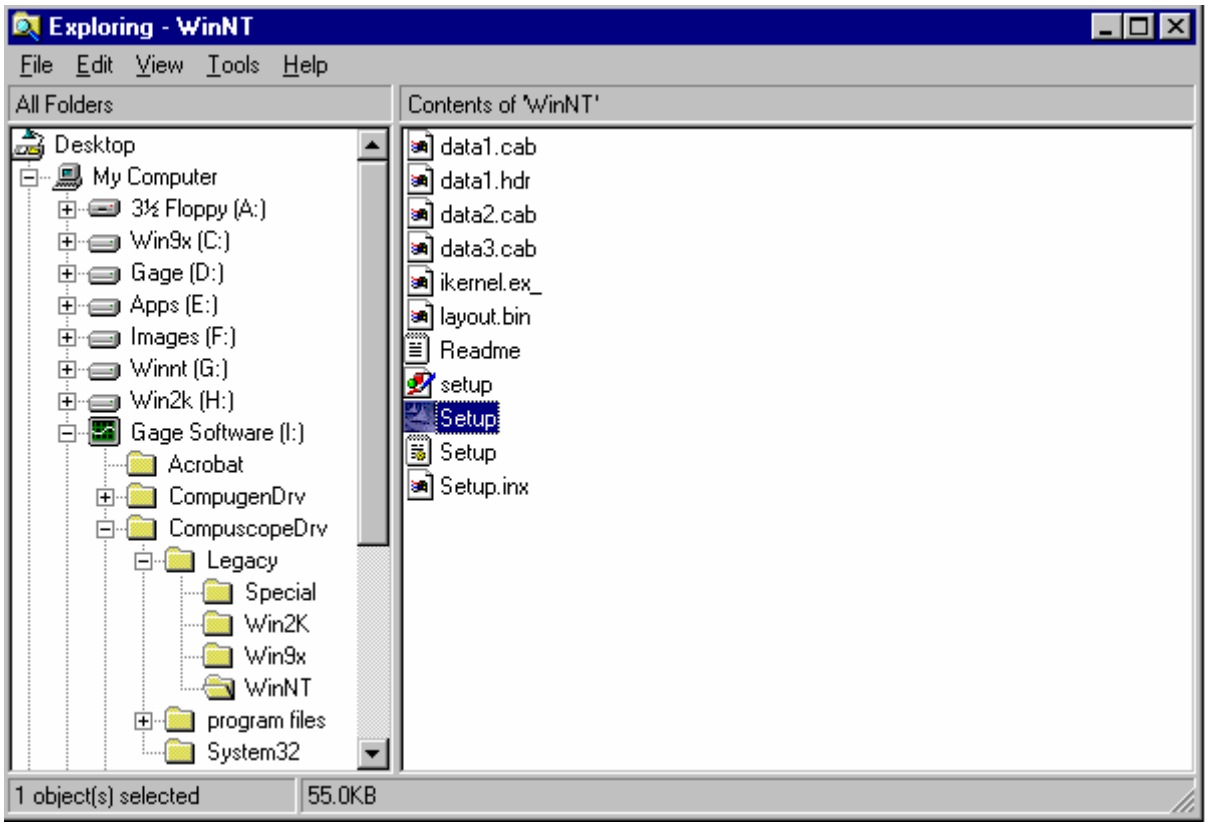


Figure 44: WinNT Explorer window

Running the Setup.exe file will start the InstallShield Wizard for the CompuScope Win NT drivers. Click on Next from the InstallShield Welcome screen to continue with the installation:

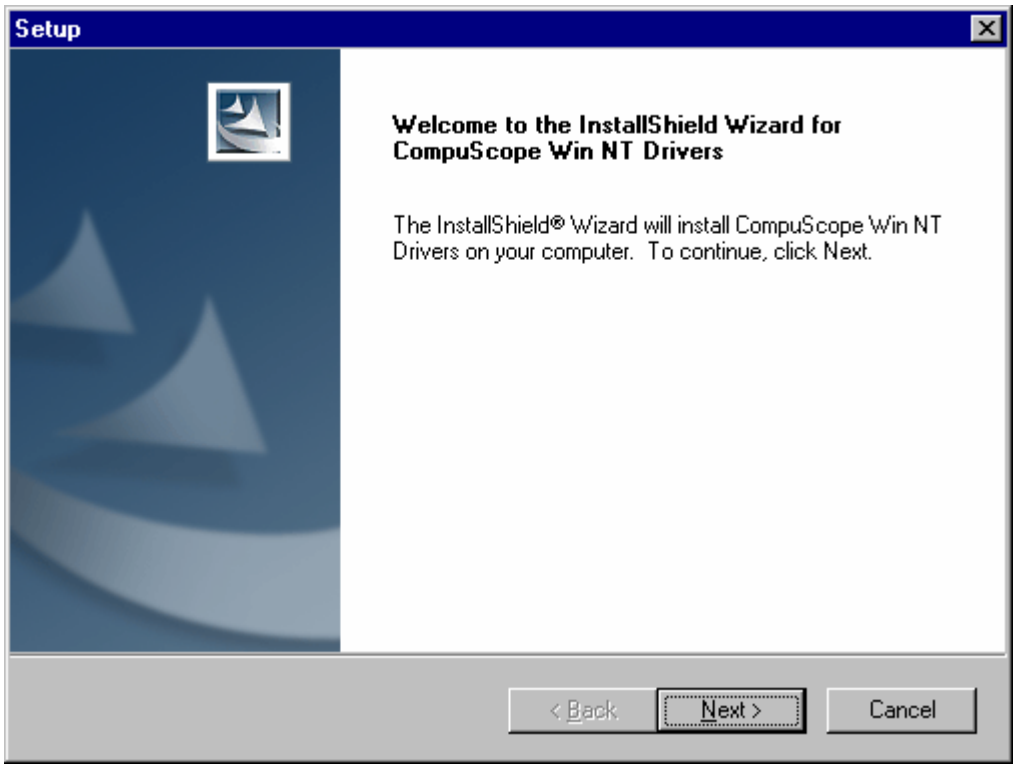


Figure 45: InstallShield Wizard for CompuScope WinNT Drivers

You will then need to choose a destination directory on your computer where you want the drivers to be installed. By default, the drivers will be installed in the G:\Gage\CompuScope SDK for Windows directory. Alternately, you can choose a destination directory of your preference. Click on Next to continue with the installation:

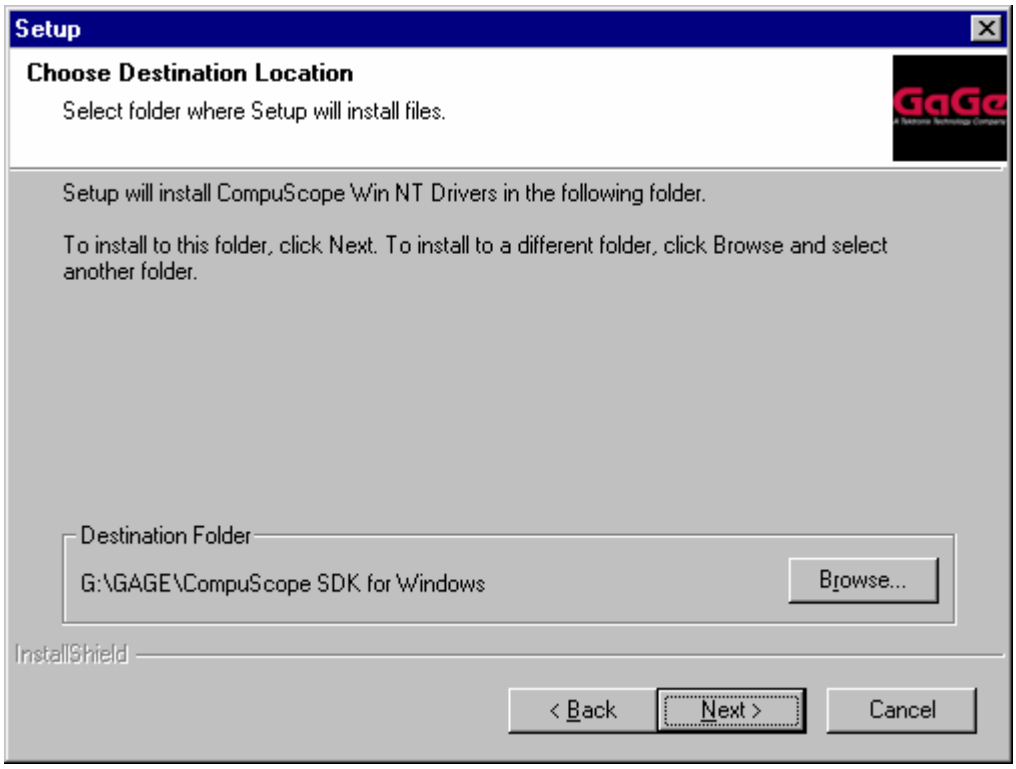


Figure 46: Installation setup

You will be prompted to view the ReadMe file during the installation.

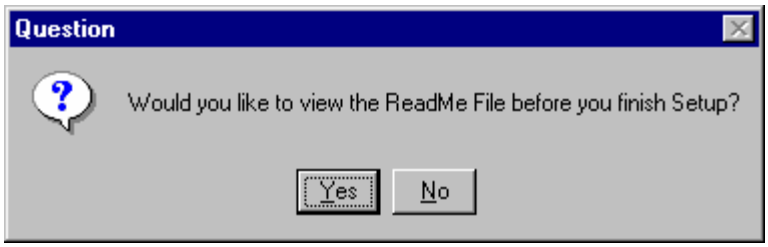


Figure 47: View ReadMe file during installation

The following screen appears if you click Yes to view the ReadMe file:

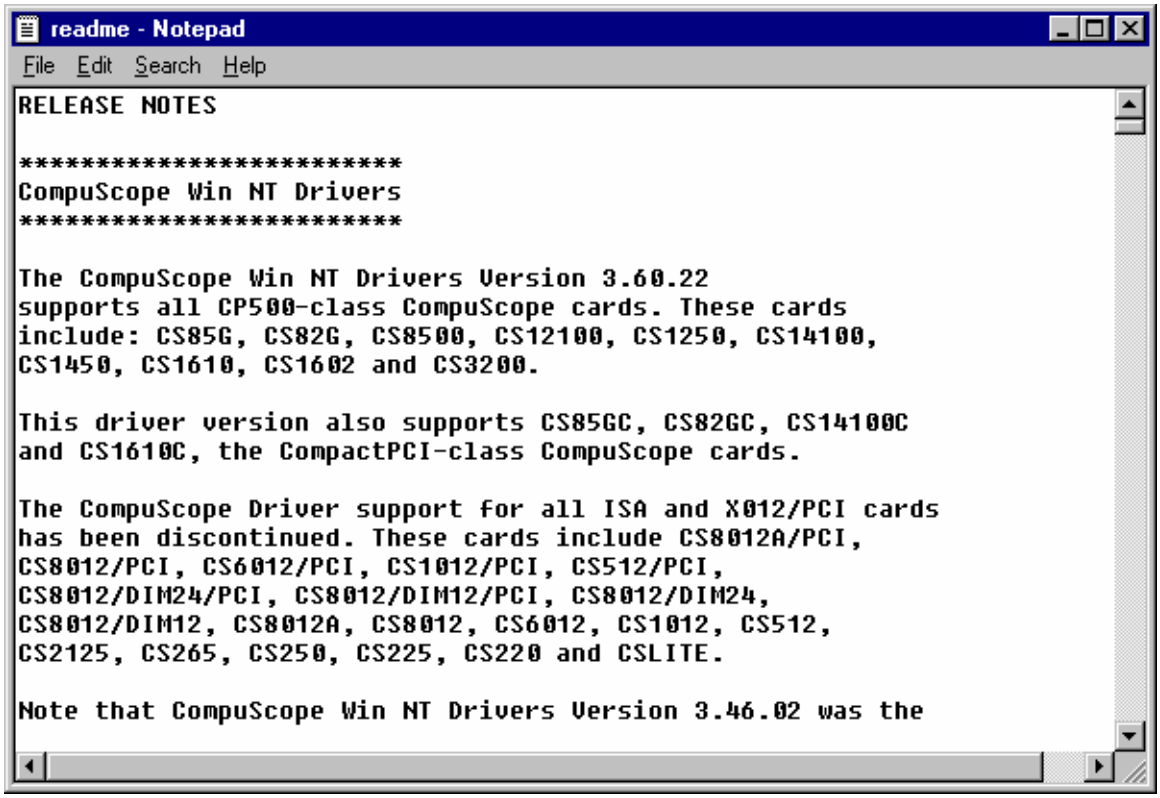


Figure 48: ReadMe file for CompuScope Win NT drivers

If you prefer not to read the ReadMe file, click No and the driver installation completes. In order to use the CompuScope Drivers, you must restart your computer. You will be asked whether or not you want to restart your computer immediately, or you may choose to restart your computer later:

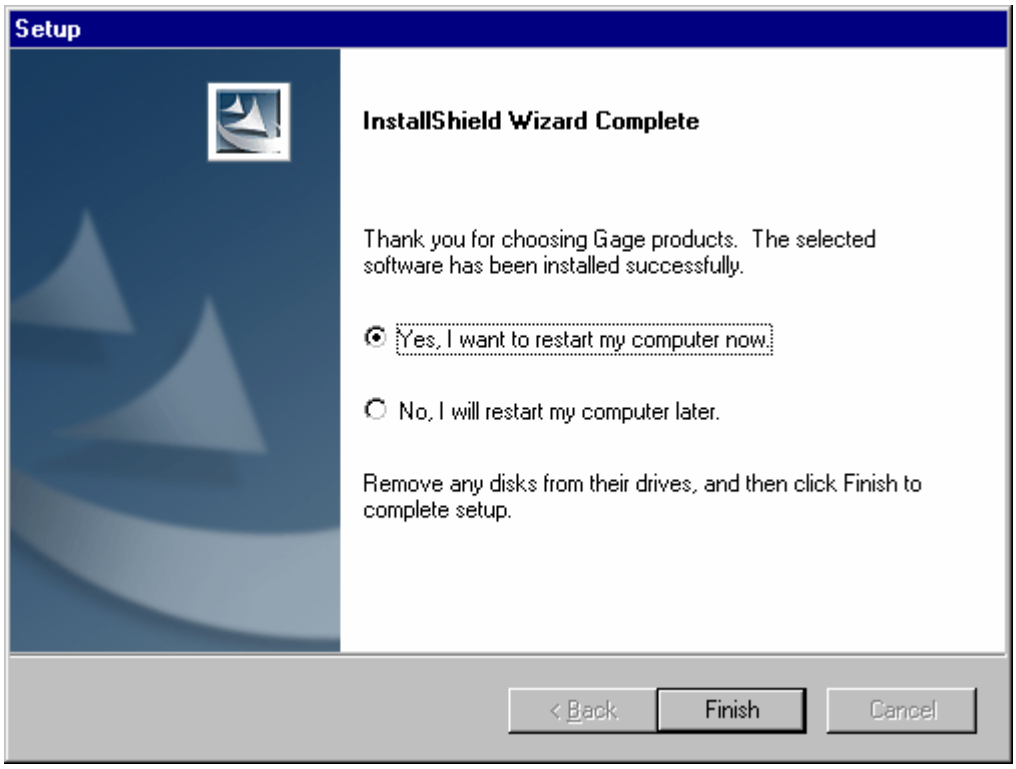


Figure 49: Installation Complete

CompuScope 3.80 Drivers

For the CompuScope 3.80 drivers, it is possible to install directly from the Gage Software disk. To start the installation, click on CompuScope 3.80 Drivers from the Software Install option of the Gage Software Disk:

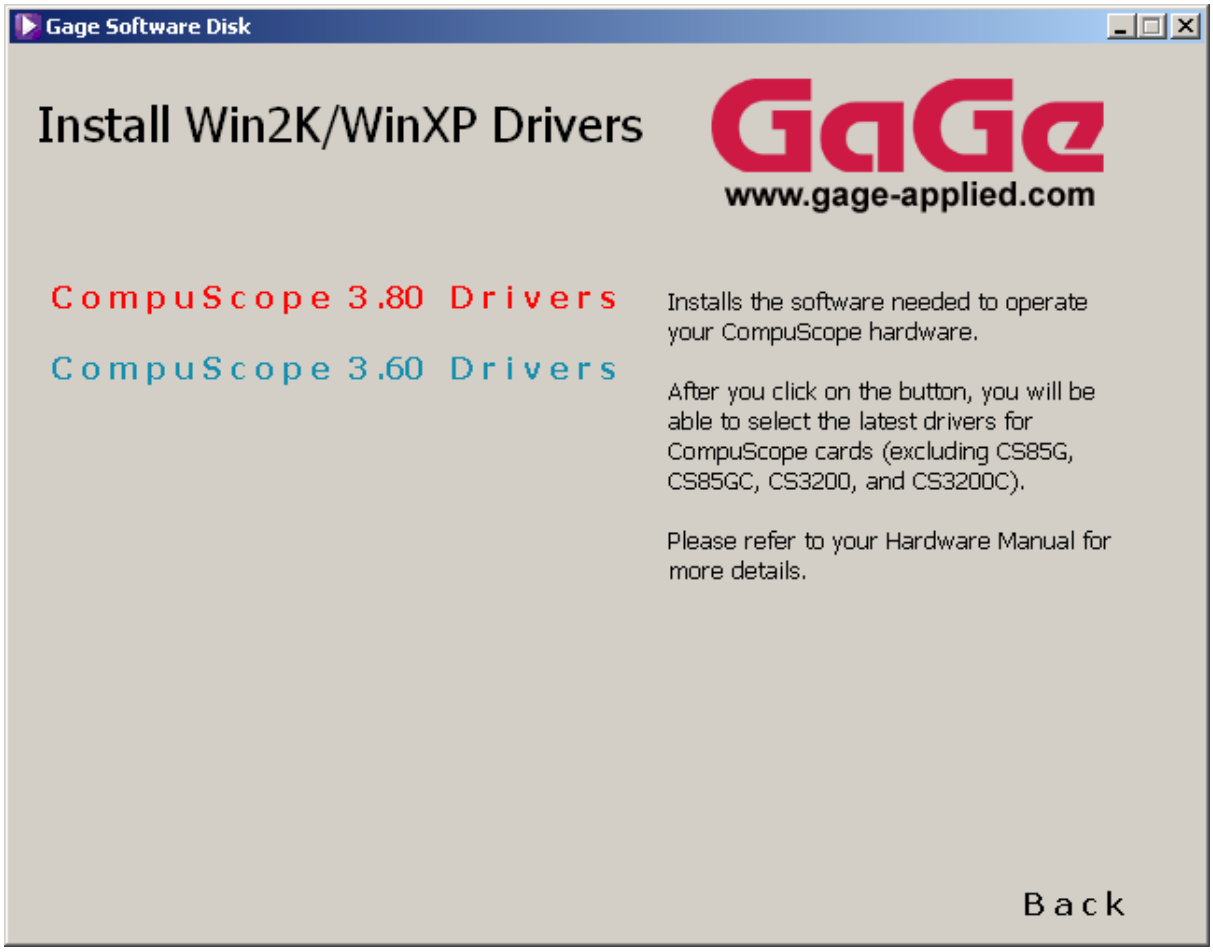


Figure 50: CompuScope Drivers for Win2K/WinXP

The following InstallShield Wizard screen appears:

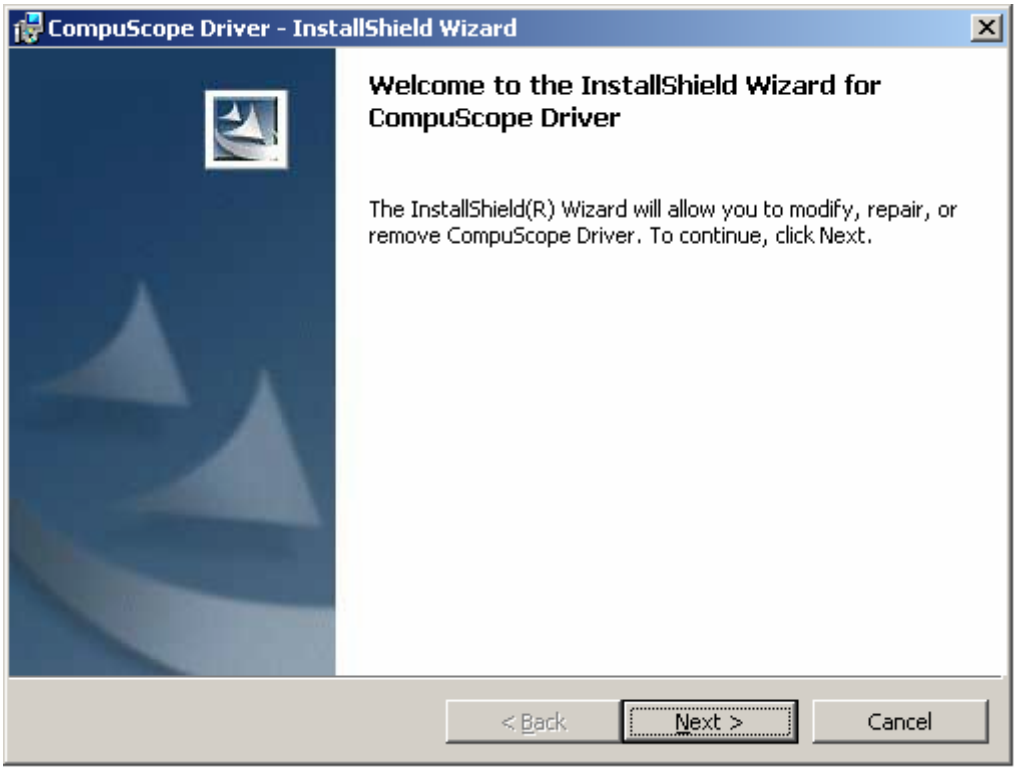


Figure 51: InstallShield wizard

Click Next to continue with the installation of the CompuScope3.80 drivers. Carefully read the Software and Documentation License Agreement text as shown below.

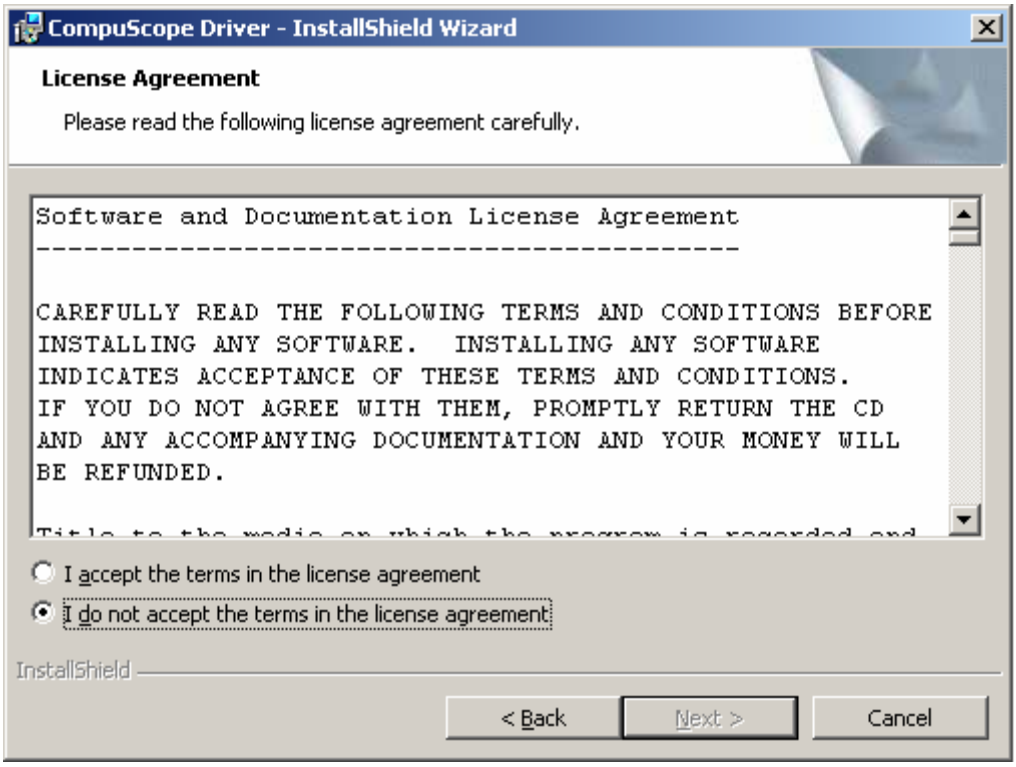


Figure 52: License agreement text

To continue with the installation, you must agree with the terms in the license agreement. Otherwise, the installation will be aborted.

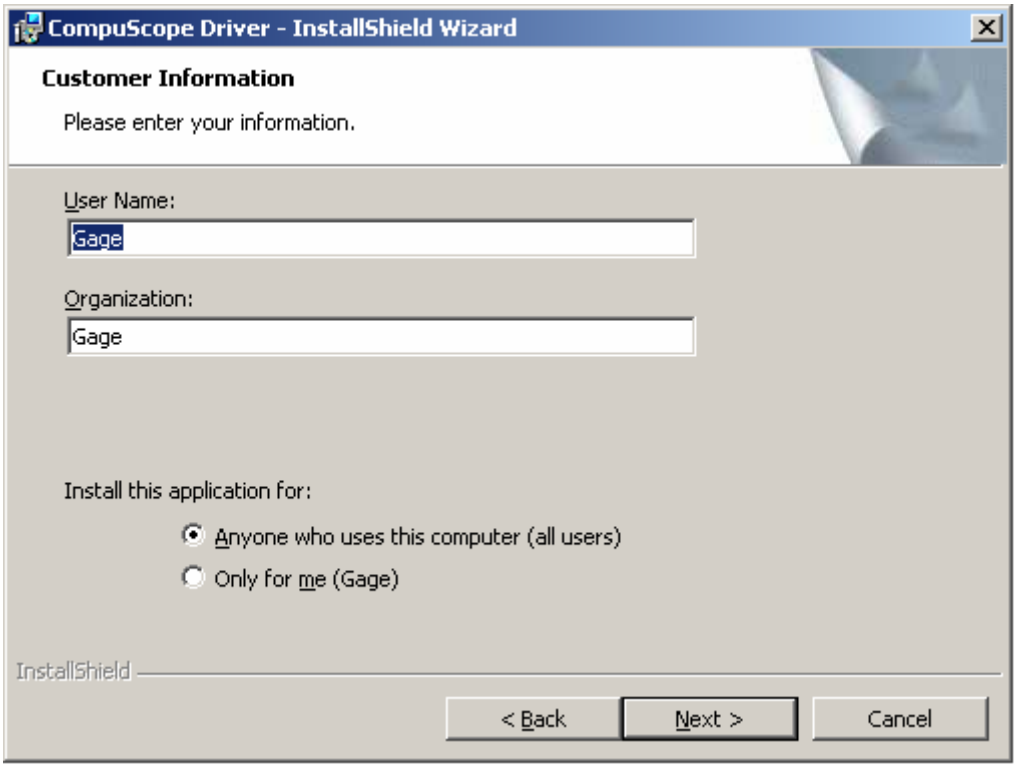


Figure 53: Customer information

Enter your user information in the Customer Information screen. By default, all program features will be installed. Alternately, you can choose the Custom option to install only specific program features.

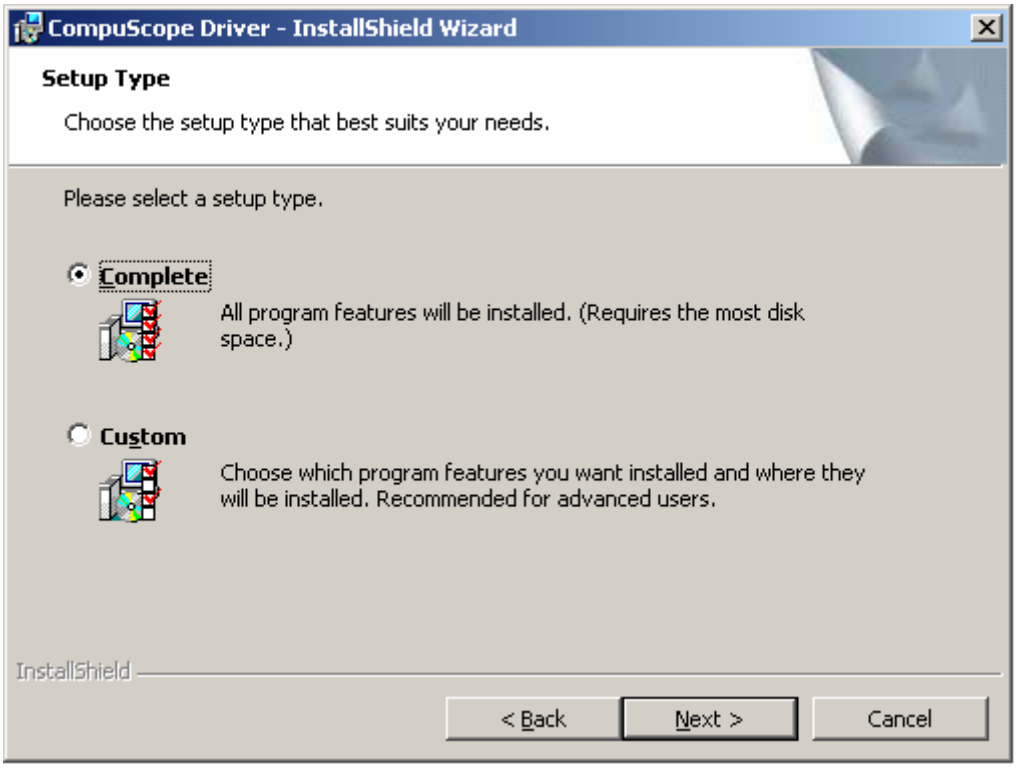


Figure 54: Installation setup

The CompuScope 3.80 drivers will be installed in the C:\Program Files\Gage\CompuScope 3.80 directory by default. You can optionally install the software into a directory of your choice.

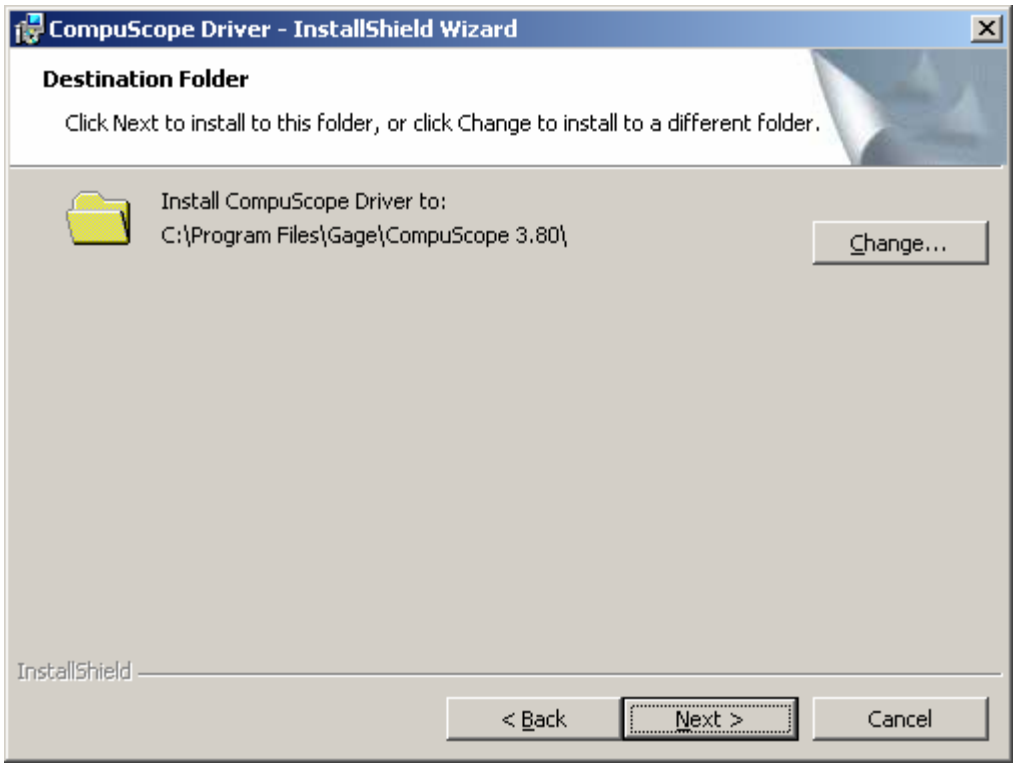


Figure 55: Destination folder for CompuScope 3.80 drivers

Click on Install to begin the installation.

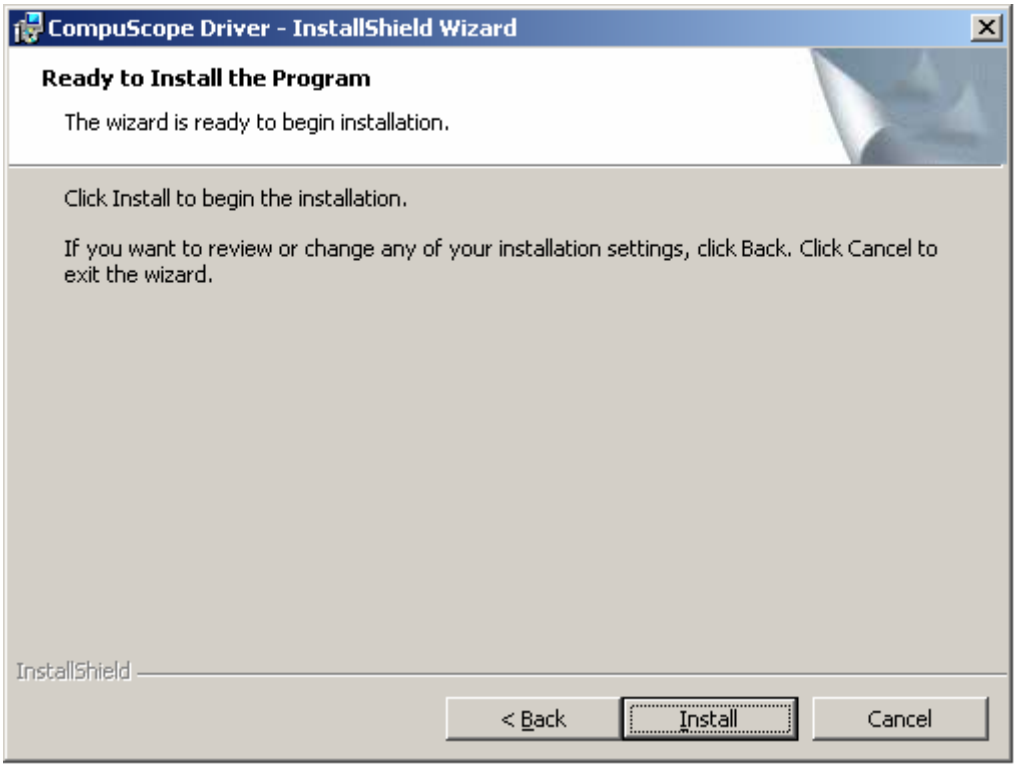


Figure 56: Begin installation

Clicking on Cancel at anytime will abort the driver installation.

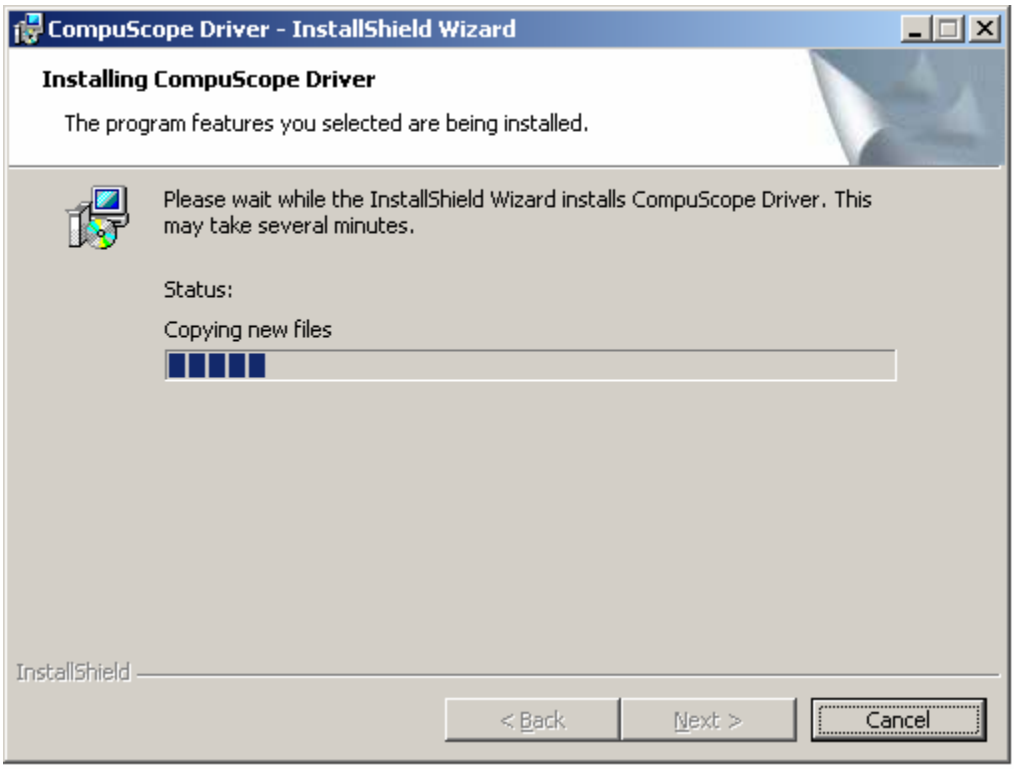


Figure 57: Installing drivers

Click on Finish to complete the installation.

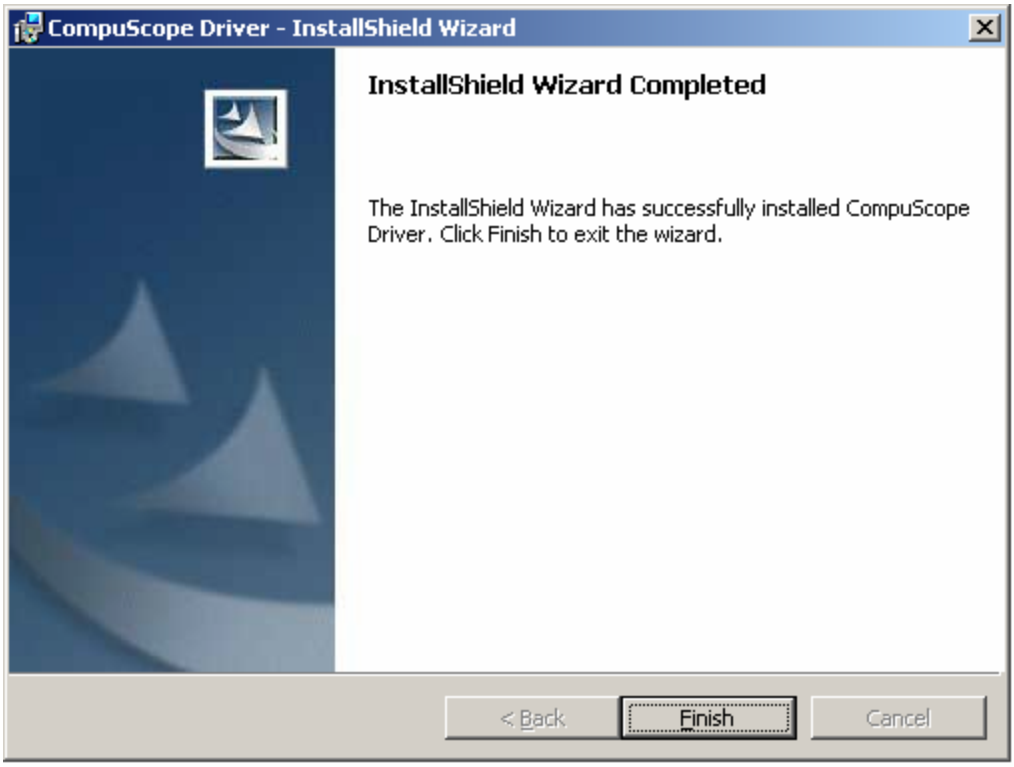
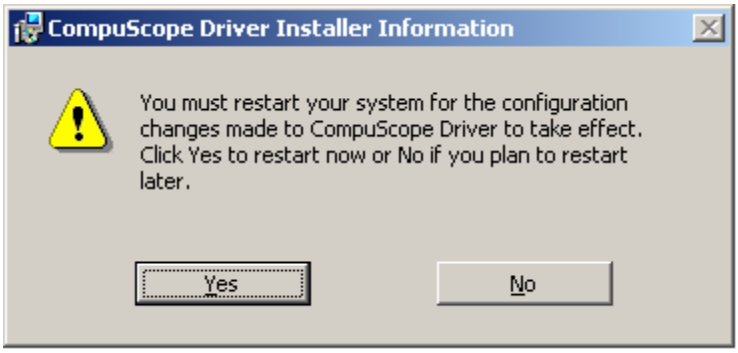


Figure 58: Installation successfully completed

In order to use the CompuScope Drivers, you must restart your computer. You will be asked whether or not you want to restart your computer immediately, or you may choose to restart your computer later.



CompuGen Drivers Installation

For CompuGen drivers, simply click on the CompuGen drivers button from the initial Install Software screen and follow the instructions of the Install Wizard.

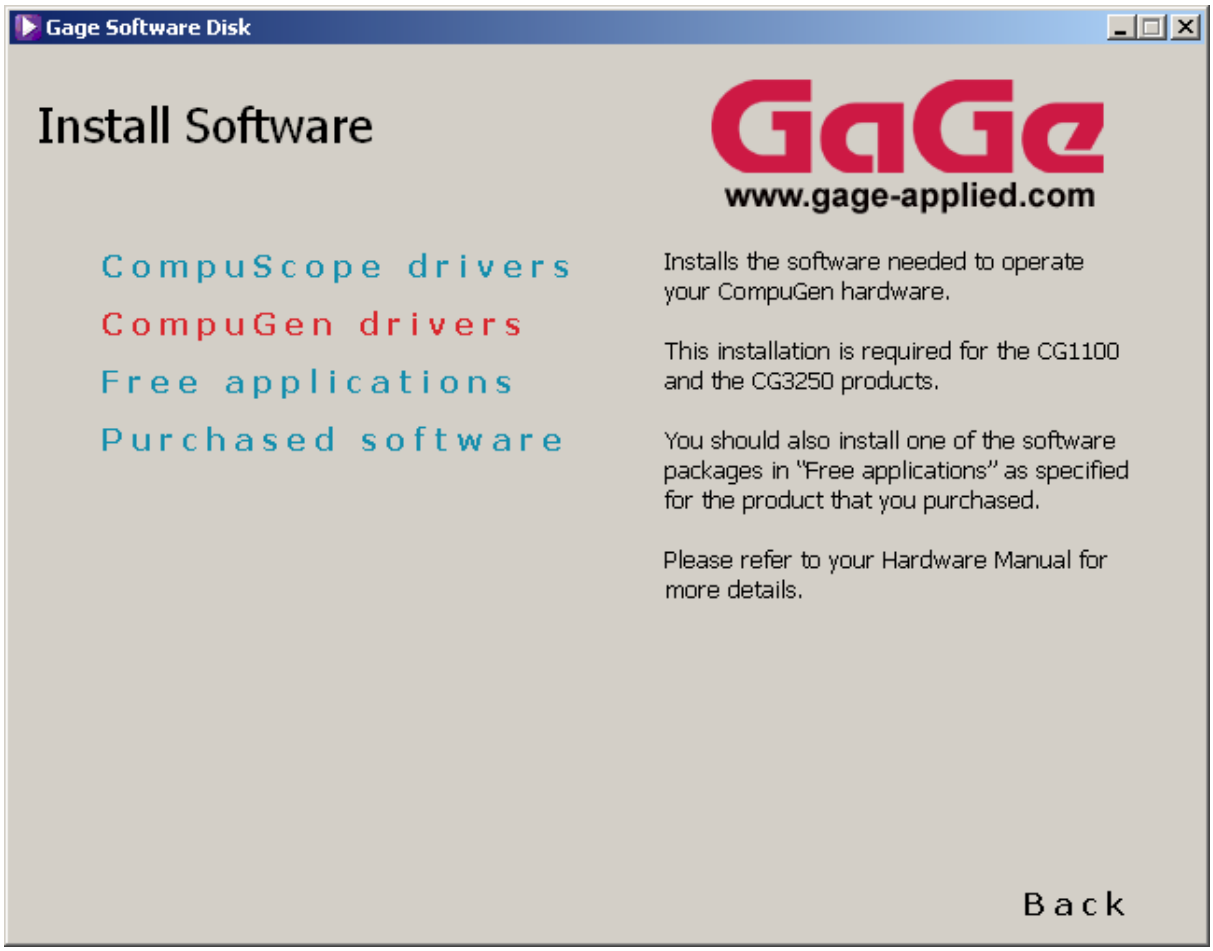


Figure 59: Selecting theCompuGen drivers from the Install Software screen

The first two screens of the CompuGen Install Wizard are shown below (Figure 60 and Figure 61):

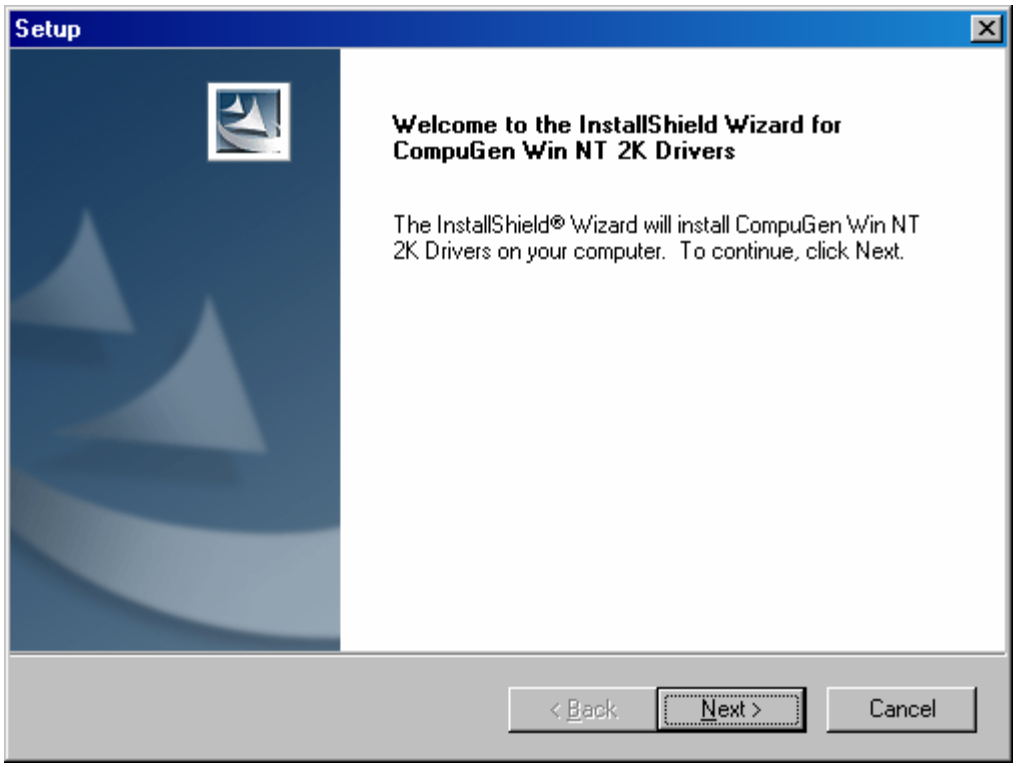


Figure 60: First screen of the CompuGen Install Wizard

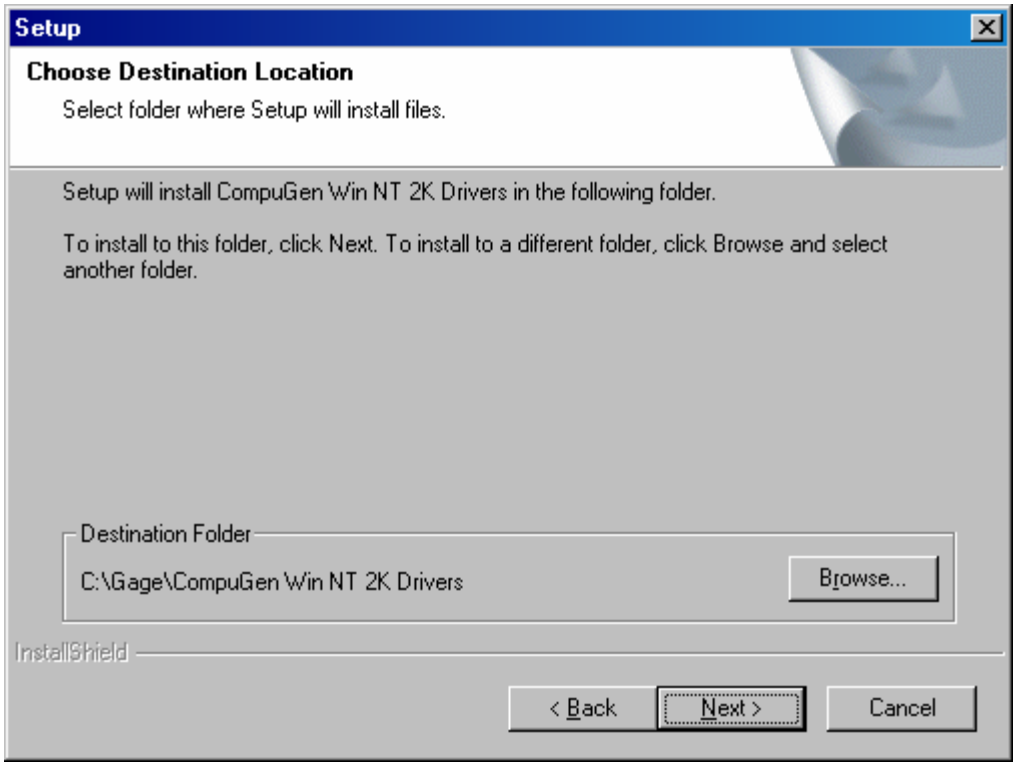


Figure 61: Second screen of the CompuGen Install Wizard

After installing the drivers, go to the Install Software screen to begin installing application software.

Free Applications

You can install Free Applications by clicking on the Free Applications button from the Install Software screen. Depending on the type of hardware you purchased from Gage, you may need some of these free applications to operate your card or cards.

Figure 62: Selection of free applications from Gage

If you have bought an Analog CompuGen product from Gage, you should install the CompuGen software. To do so, simply click on the appropriate button on the screen shown in Figure 62 above and follow the instructions of the CompuGen Install Wizard.

If you have bought a digital capture or digital generator product from Gage, you should install the GageBit software. To do so, simply click on the appropriate button on the screen shown in Figure 62 above and follow the instructions of the GageBit Install Wizard.

Go back to the Install Software screen for the last step of the installation.

Purchased Software

Purchased Software is similarly accessed from the Install Software screen by clicking on the Purchased Software button. There are two main categories of Purchased Software available from the Gage Software Disk: GageScope and Software Development Kits (see Figure 63 below).

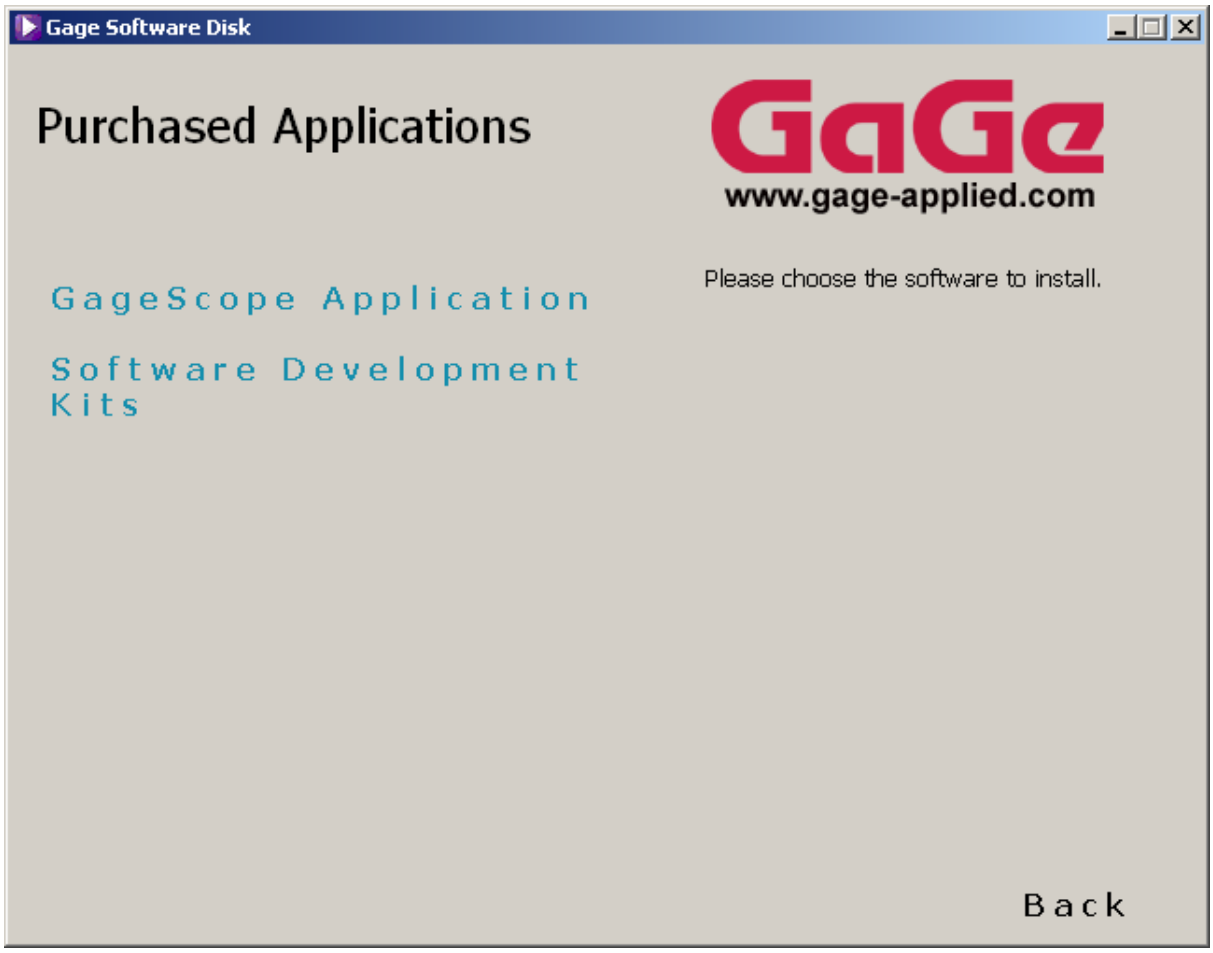


Figure 63: Selection of free applications from Gage

Clicking to install one of the software packages will bring up an install Wizard as usual; simply follow the instructions on screen to install your software. Make sure you have your software key or keys handy as you begin the installation process for GageScope or one of the Software Development Kits.

GageScope

Figure 64 shows the first screen of the GageScope Install Wizard.

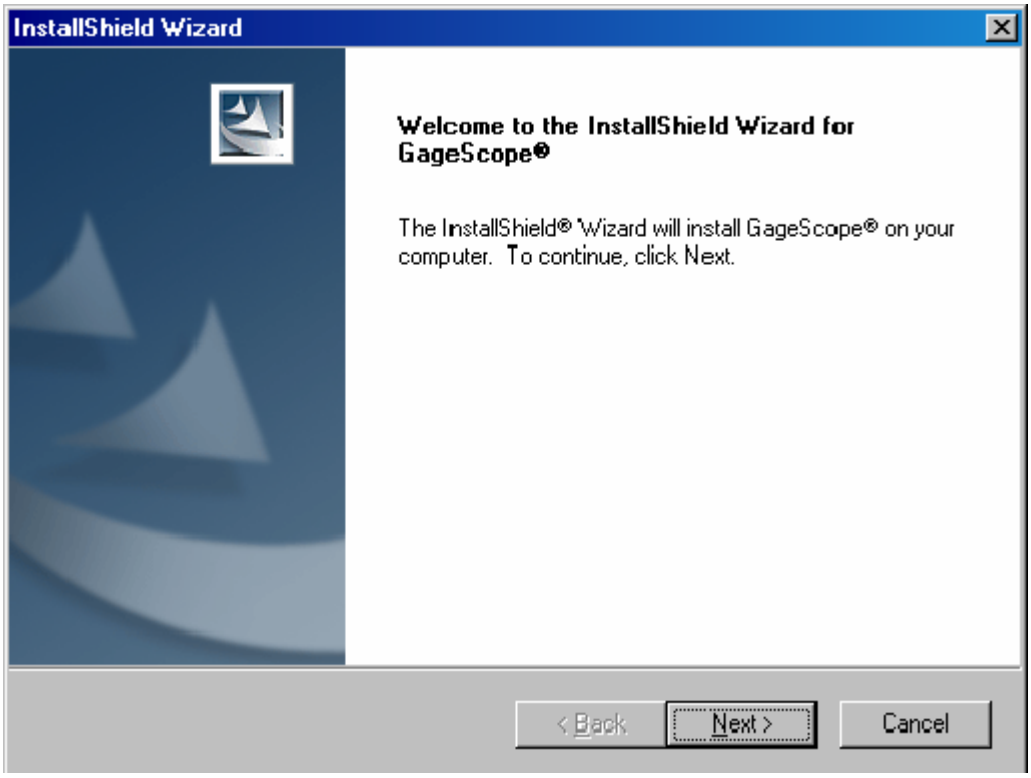


Figure 64: GageScope Install Wizard

For more details on the GageScope installation, please refer to the GageScope Manual that was included in the shipment of your order from Gage.

Software Development Kits (SDKs)

The Software Development Kits (SDKs) also have standardized installation procedures and therefore will not be covered in detail in this manual. Note that all SDKs from Gage are available from the Gage Software CD: C/C++, MATLAB, LabVIEW and LabWindows/CVI.

The first two screens of the SDK Install Wizard are shown below.

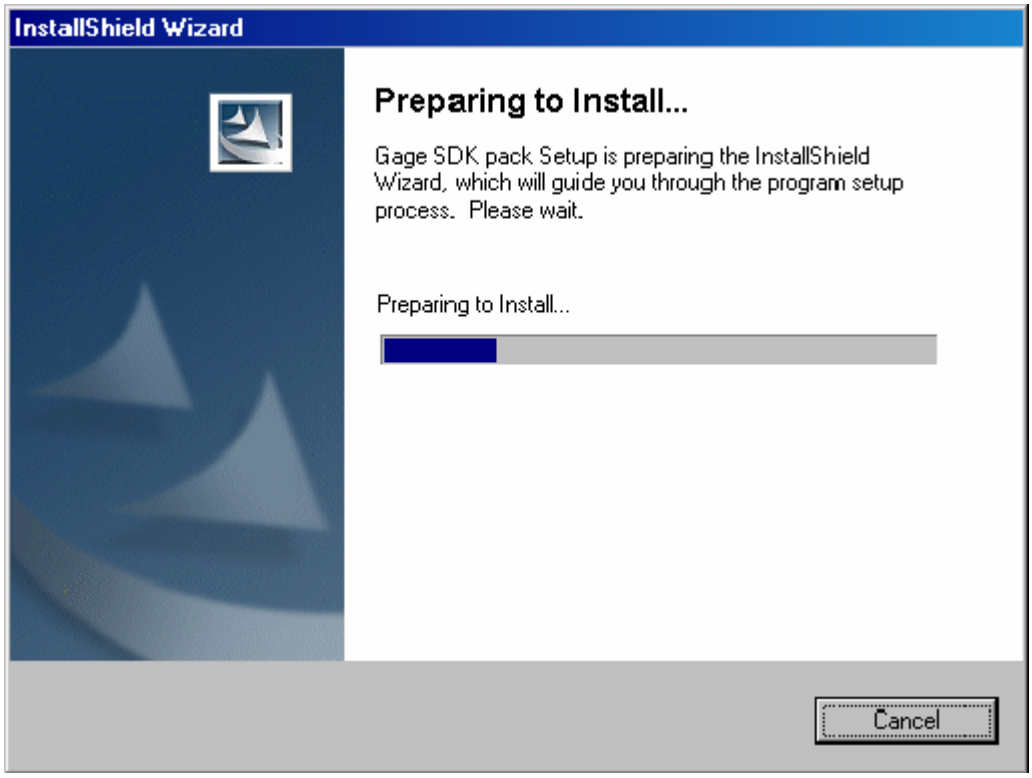


Figure 65: First screen of the SDK Install Wizard

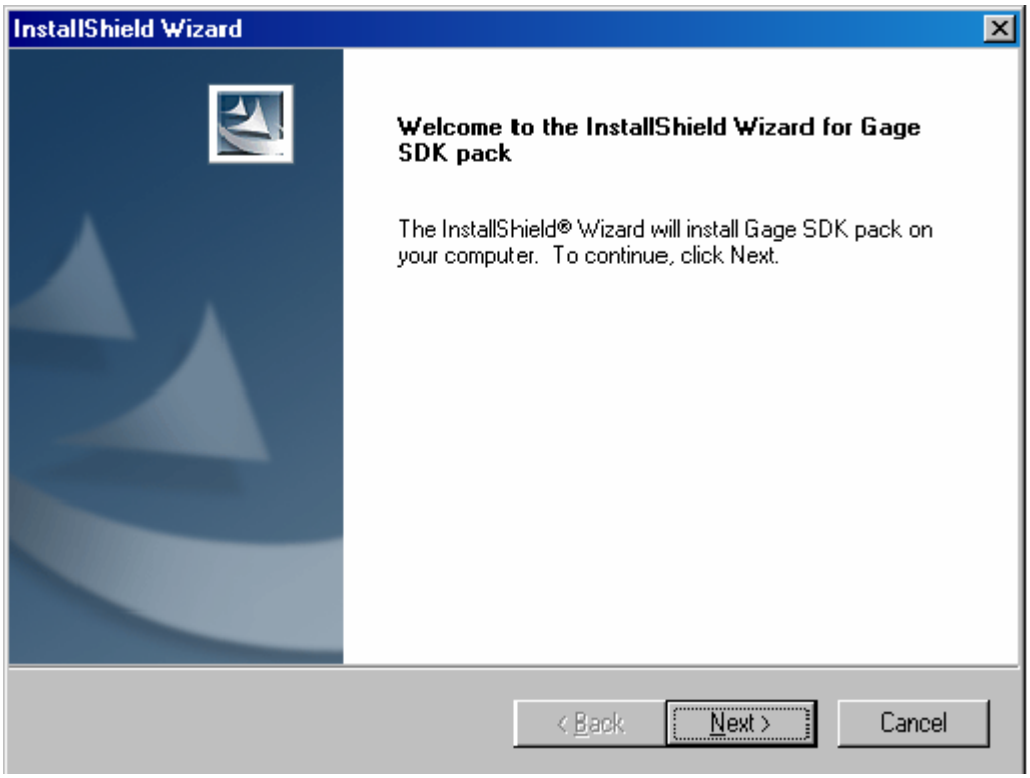


Figure 66: Second screen of the SDK Install Wizard

IMPORTANT NOTE:
If you have purchased a Software Development Kit, or if you are trying to install GageScope, you must first install the drivers for your hardware in order to use the software. If you do not install the drivers, the sample programs will not work properly and GageScope will only function in Demo Mode.

If you wish to leave the Install Software screen without installing any software, simply click the Back button to go back to the Gage Applied Technologies screen.

Once you are back to the main Gage Software Disk screen, click on the Exit button located at the bottom right of the screen. The last screen you will see upon exiting is shown below (Figure 67).

Figure 67: Splash screen seen upon exiting the installer

Section 2 – Verifying the operation of your hardware

Please note: If you wish to verify the operation of your CompuGen hardware, please see the sections pertaining to your CompuGen card "*Error! Reference source not found.***" or "***Error! Reference source not found.***"**

Verifying installation and configuration with the CompuScope Manager

Gage provides a very practical and powerful utility to help you manage your hardware and verify its configuration: CompuScope Manager.

The CompuScope Manager utility is installed at the same time as the drivers and you do not need to do anything special to get it. You can access the CompuScope Manager from the Gage folder in the Programs category of the Start Menu of Windows.

Using the CompuScope Manager is fairly straightforward and will not be discussed in much detail here. The main screen you should refer to is the Resource Manager tab of the CompuScope Manager (see Figure 68 below):

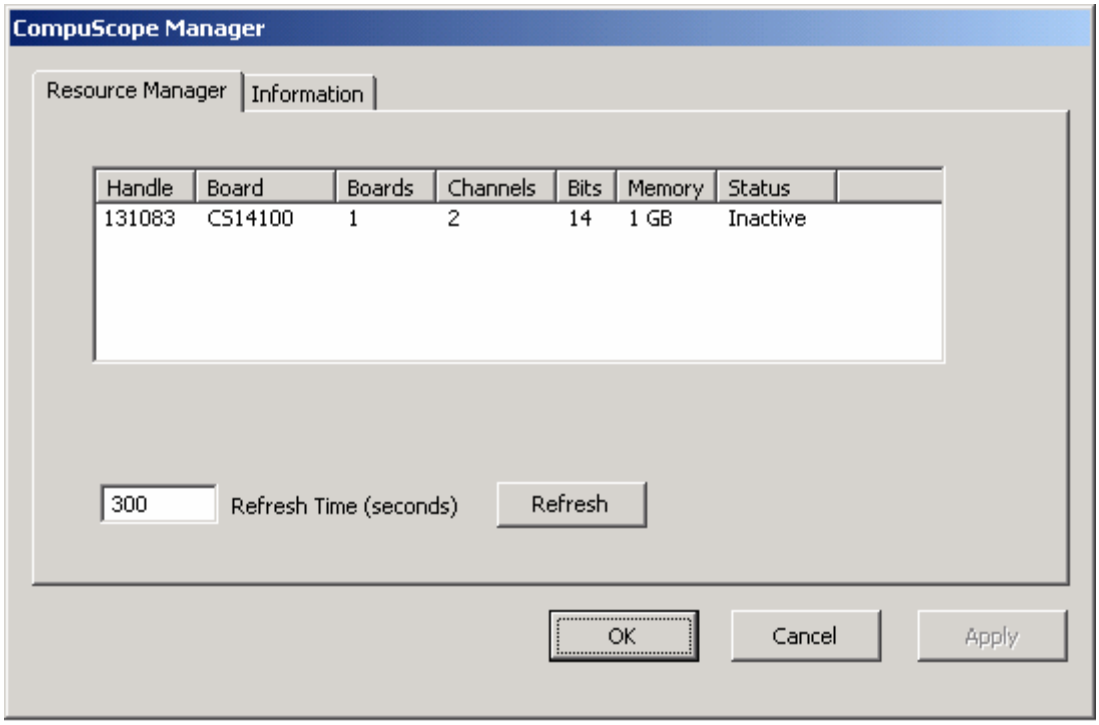


Figure 68: Card information from the Resource Manager tab of the CompuScope Manager

This screen provides you information about the Gage card or cards installed in your system. You can see the type of card, the number of cards in the system, the number of channels on the card, the nominal resolution of the card, the on-board memory, whether the card is active or inactive, and even the handle that the system has to control the card from software (through the driver).

Verifying signal acquisition of a CompuScope with GageScope and CSTest

Gage strongly recommends that you become familiar with GageScope as a powerful tool for capturing and analyzing signals, even if you will eventually develop your own application to control your hardware. Since it embodies all the knowledge required to operate the wide array of CompuScope cards and all their functionalities, GageScope is the ideal tool to verify the operation of your hardware and to troubleshoot applications you may develop on your own. GageScope Lite is provided for free to all users of CompuScope cards for precisely this purpose.

You can find extremely detailed instructions on how to use GageScope in the GageScope manual that came with your order from Gage.

However, if you have not already installed GageScope, or if you do not wish to install it at this point, Gage provides a simple application, CSTest+ for CompuScope 3.80 drivers (or CSTest for CompuScope 3.60 drivers) that allows you to capture signals and verify the correct operation of your new CompuScope card. Note that the following section details the CSTest+ functionality only, but CSTest has a slightly different interface.

Section 3 – Verifying signal acquisition with CSTest+

CSTest+ is a utility program that allows acquisition and display of data from a CompuScope card using CompuScope 3.80 drivers. It acts as a test to ensure that your CompuScope card(s) is fully functional.

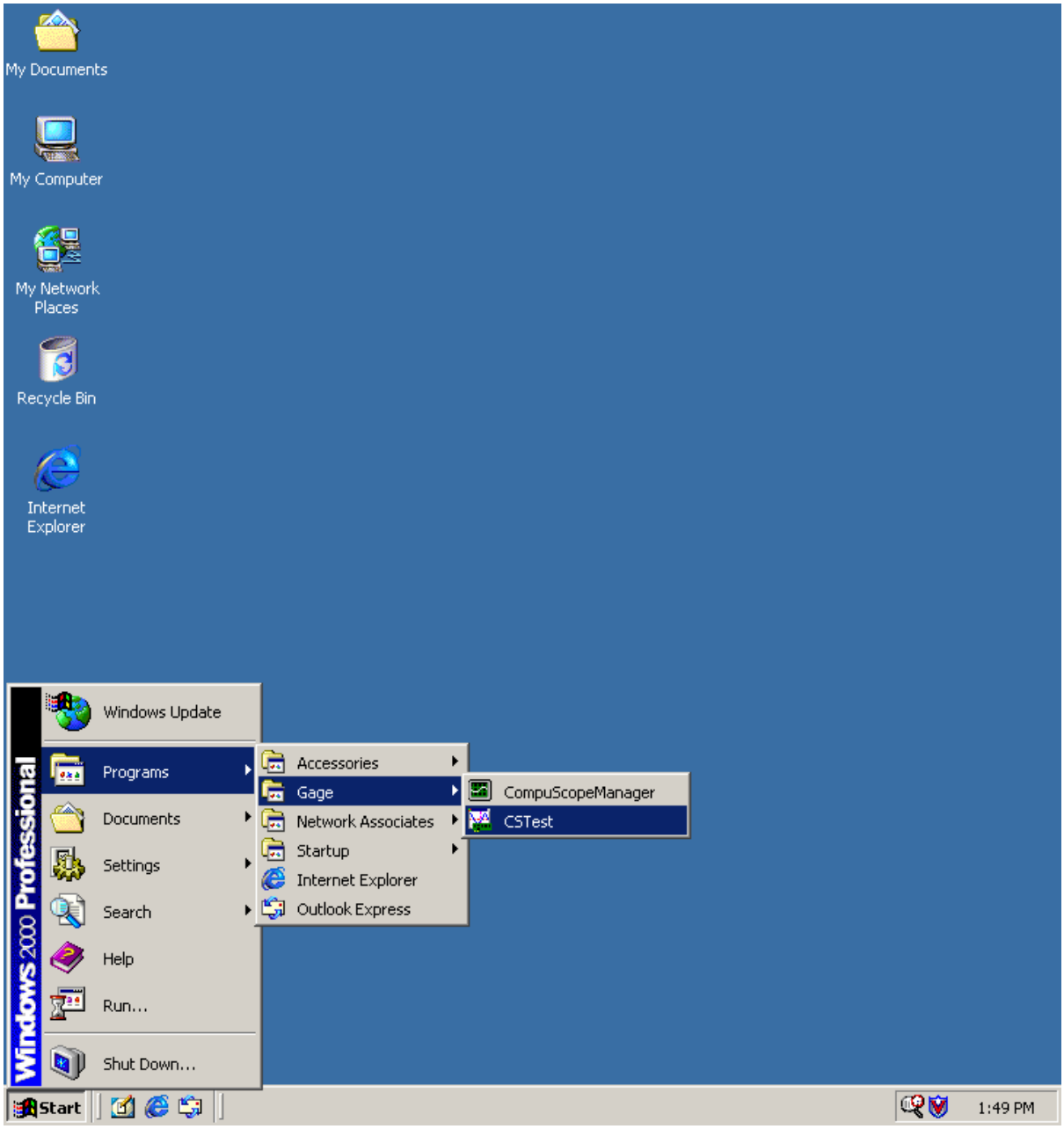
Now that you have successfully installed the CompuScope drivers and have tested driver installation with the CompuScope Manager utility, you can run CSTest+ to verify that these drivers are properly communicating with your CompuScope card(s).

Setting-up your Hardware

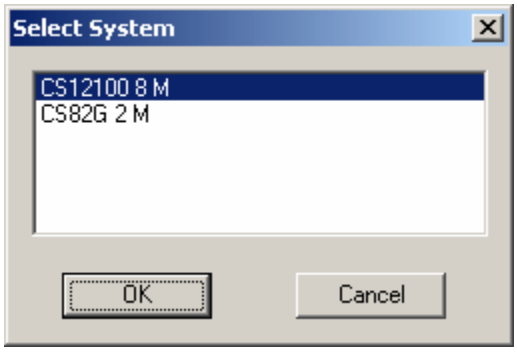
Using a function (signal) generator, generate a 1 MHz sine wave signal and connect it to the CH1 input of your CompuScope card. If you have installed a CompuScope 8500 card, use the 1 MΩ input instead.

Running CSTest+

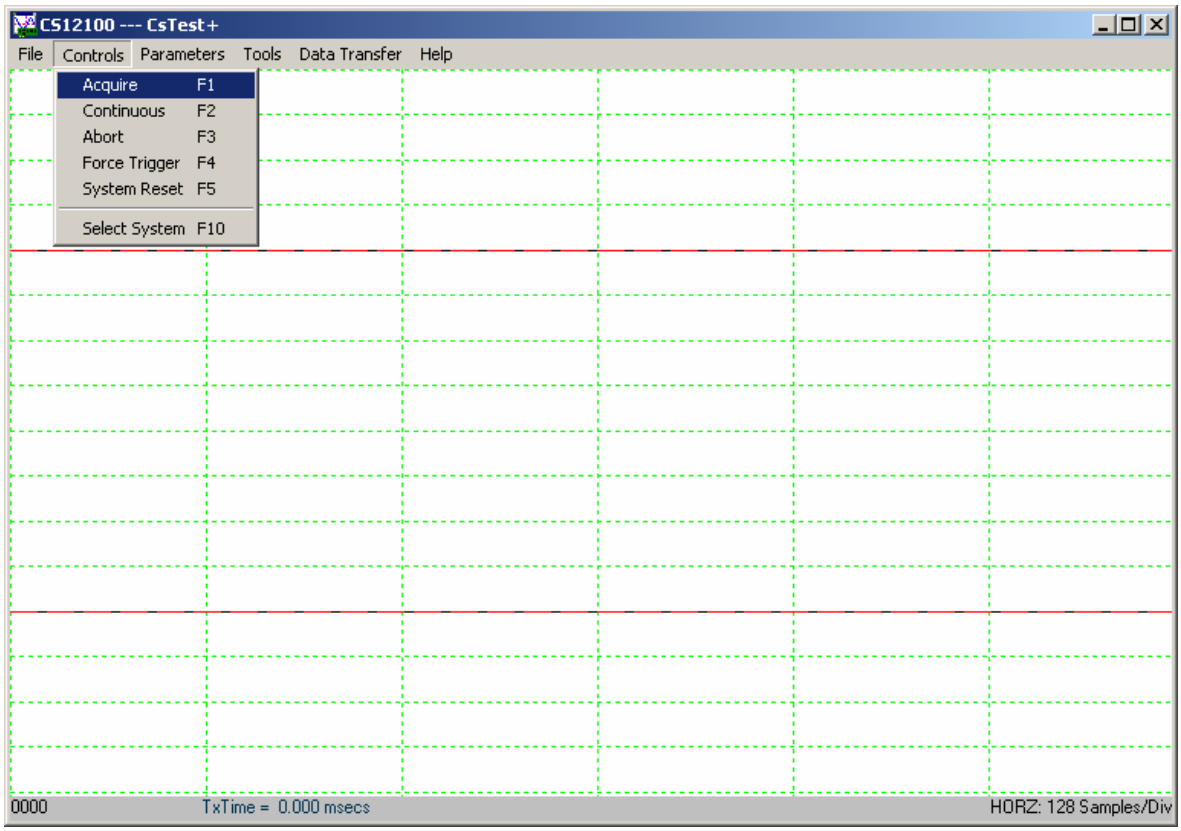
You can run CSTest+ from the Windows Start Menu:



If there is more than one acquisition system installed on the same computer, you should see the **Select System** dialog pop-up. Select the acquisition system you want to test then click OK. You will not see this dialog if there is only one acquisition system installed in the computer.



You should now see a window labeled **CsTest +**. You can view the sine wave that you have generated using the function generator that you have previously connected by selecting **Acquire** from the **Controls** menu:



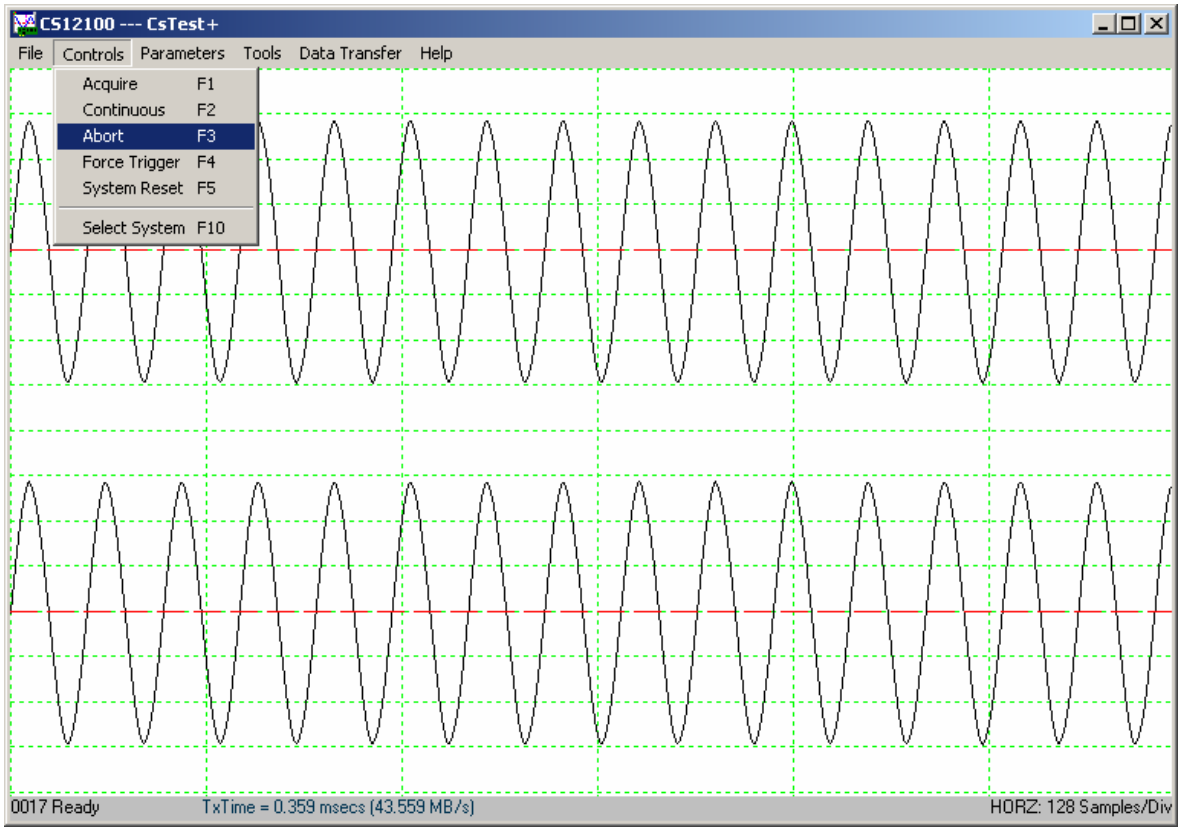
To view the sine wave continuously in time, go to the **Controls** menu and click on **Continuous**. Note that the sine wave on the screen starts from the positive slope. As you change the frequency of the sine wave on your function generator, you will see a corresponding change in the sine wave displayed in CSTest+.

Note: You may have noticed the four-digit number in the bottom left corner of the CSTest+ window. This is a counter. Every time CSTest+ acquires data, the counter is incremented by 1.

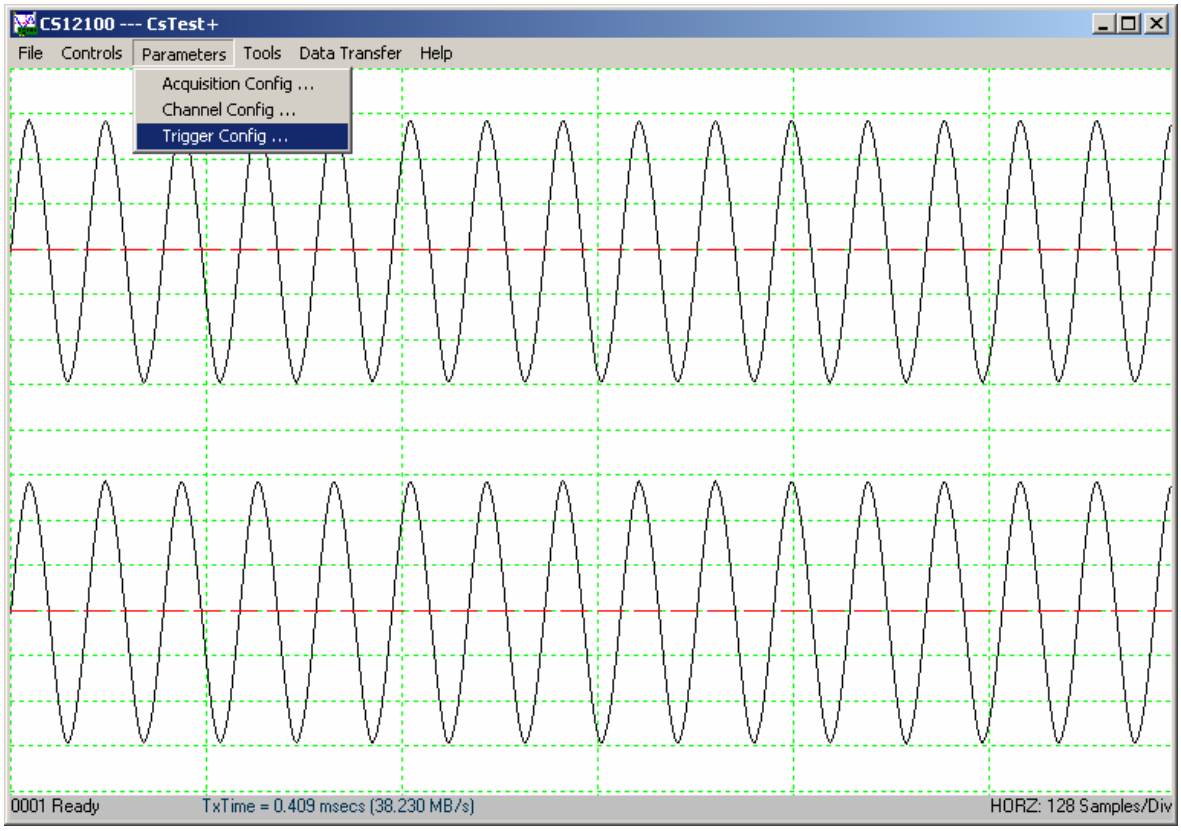
On the right of the counter is the acquisition status. The acquisition status can be one of the following:

Ready	Ready for another data acquisition.
Waiting For Trigger	Data acquisition is in progress, the trigger condition has not been met.
Triggered…	Data acquisition is in progress.
Data Transfer…	Data transfer from on-board memory to PC memory is in progress.

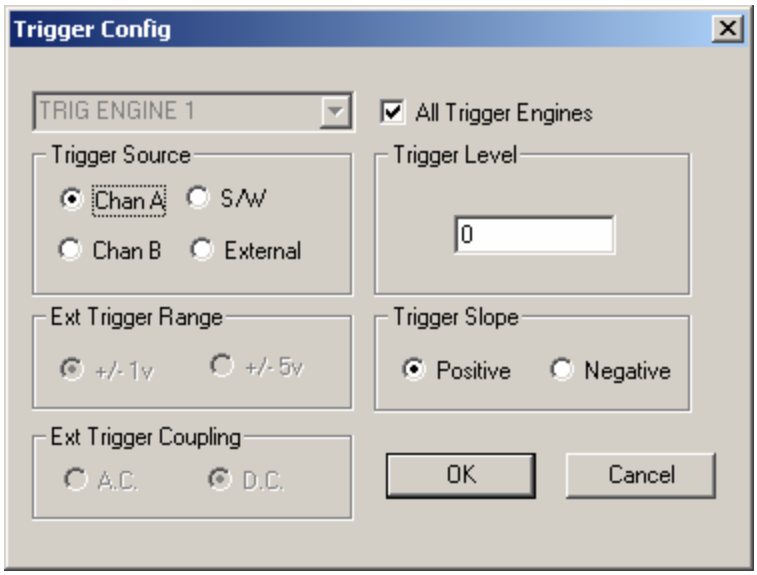
Now, go back to the **Controls** menu and click on **Abort**. This will stop any further acquisition.



We will now change a trigger parameter such as **Trigger Slope** to verify that all controls for the card are working as they should. Go to the **Parameters** menu and select **Trigger Config**.



You should see a new dialog box: (Depending on the version of drivers you have installed, the dialog may look slightly different)

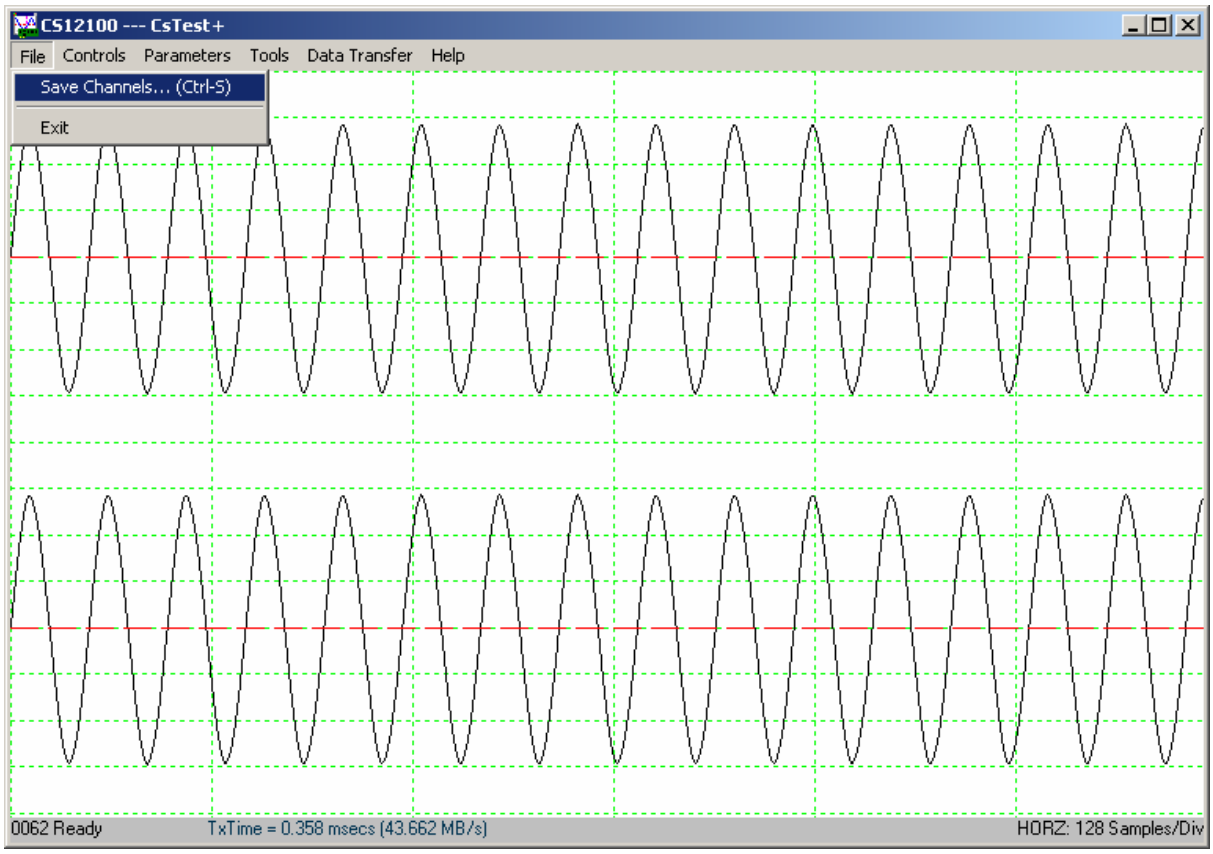


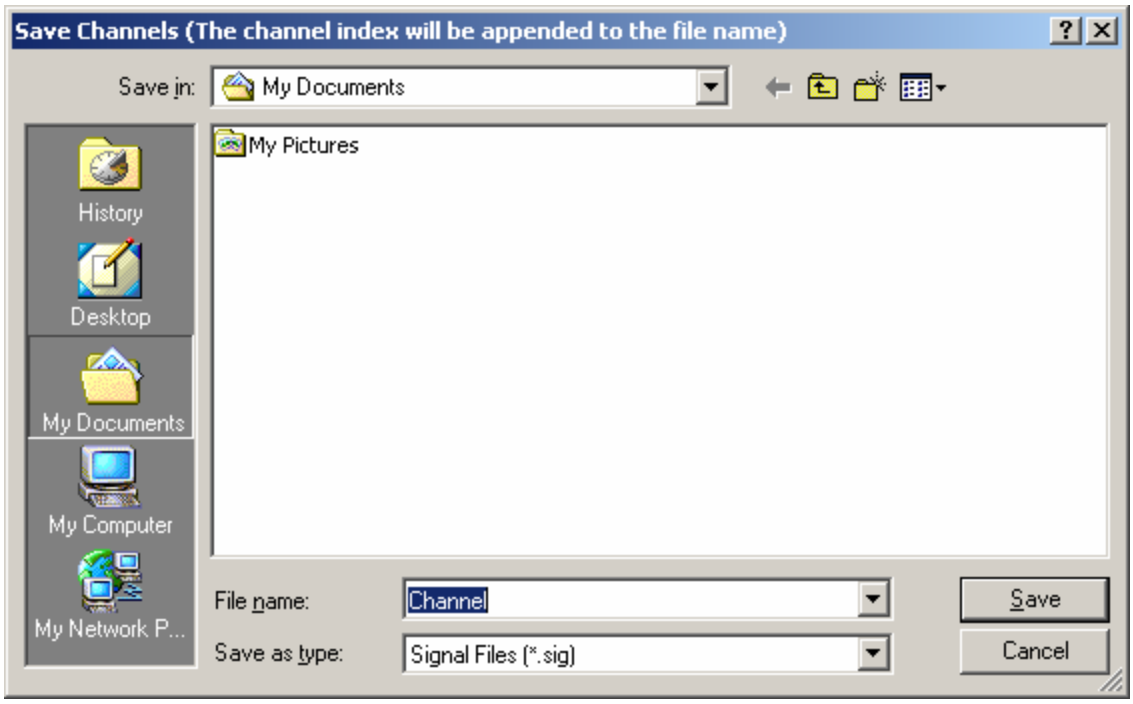
Click on the radio button next to **Negative** in the **Trigger Slope** panel to change the trigger slope from positive to negative. Click on **OK** for this change to be registered and to close the dialog box.

When you go back to the **Controls** menu and click on **Continuous**, you should see the same sine wave, but starting from a negative slope.

This short experiment proves that communication between a utility program, CSTest+, the CompuScope drivers and a CompuScope card has been successfully established. The following screens describe the other functionalities available with CSTest+:

File – Save Channels

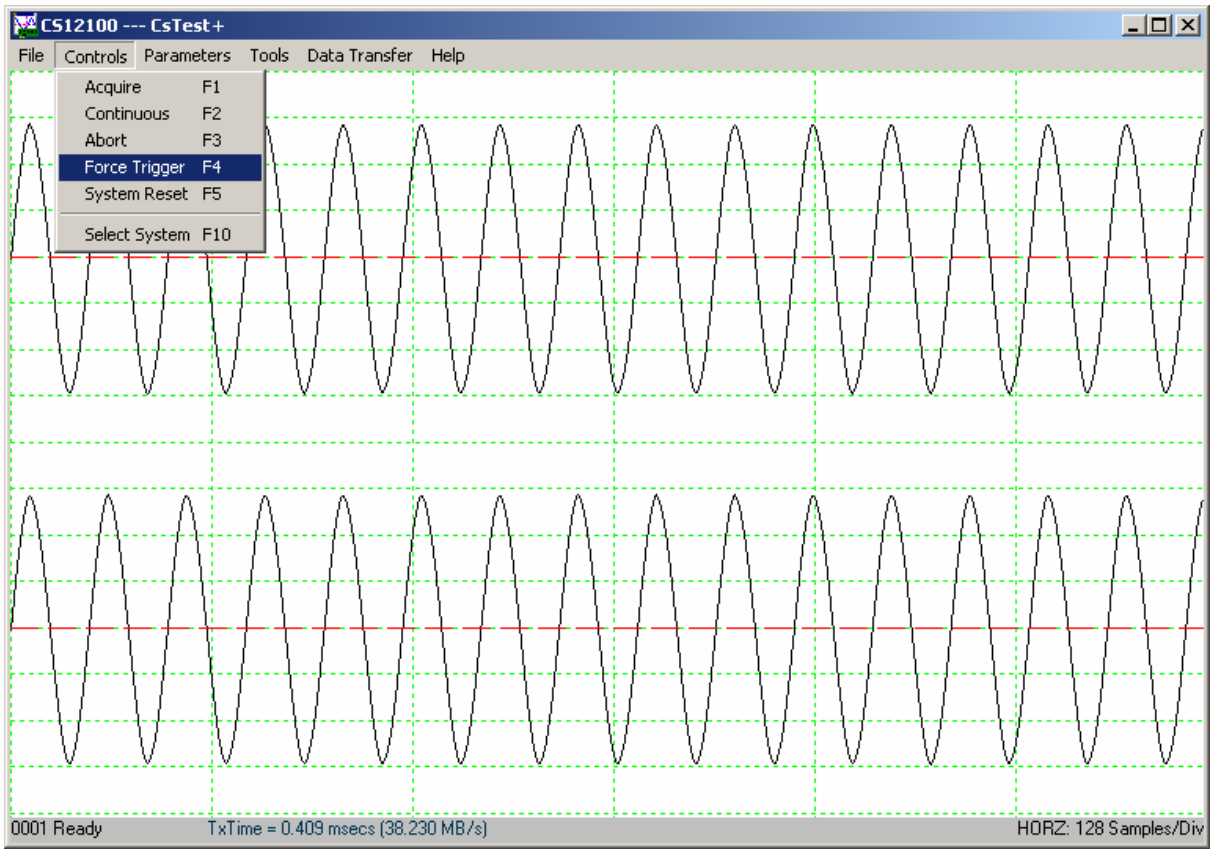




Save Channels saves data captured from different channels into different files in Gage's SIG file format. The Gage SIG file can be read from applications that support Gage's SIG file such as GageScope.

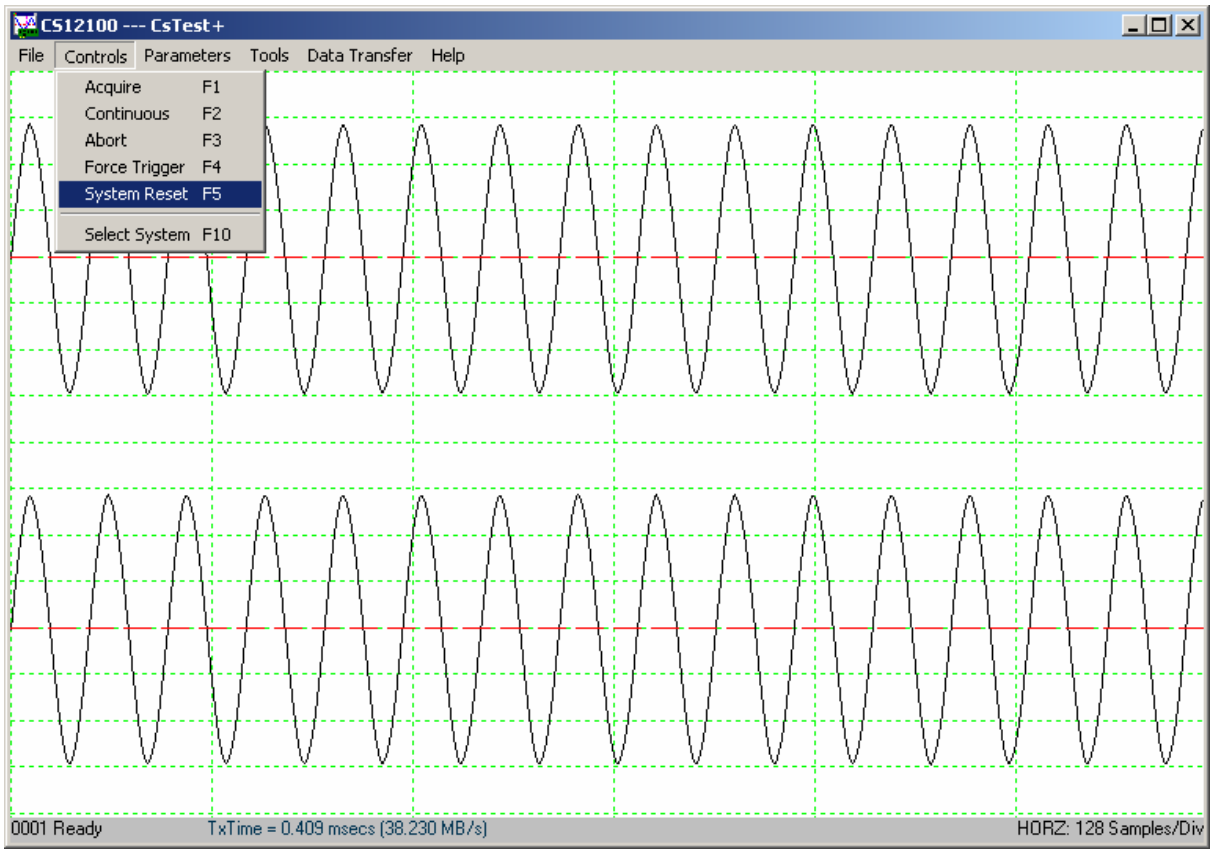
To exit CSTest+, select **Exit** from the **Controls** menu.

Controls – Force Trigger



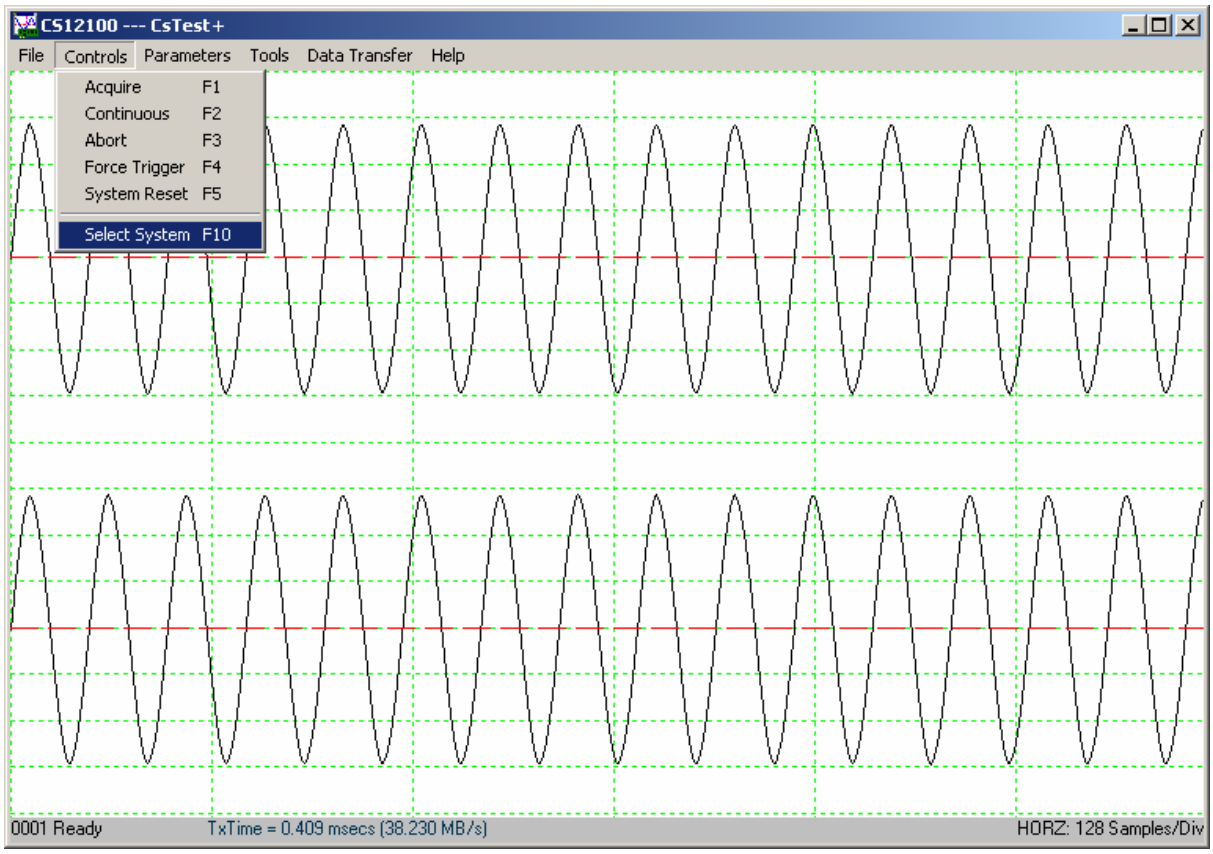
Force Trigger causes the acquisition system to be triggered immediately, no matter what the trigger configuration parameters are.

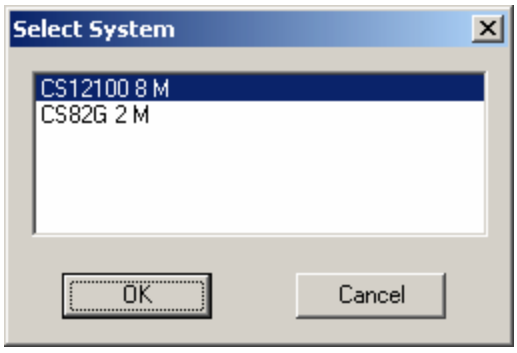
Controls – System Reset



System Reset resets the acquisition system to the default state. The current data acquisition will be aborted and all configuration parameters (Acquisition, Channels and Triggers configurations) will be reset to the default settings.

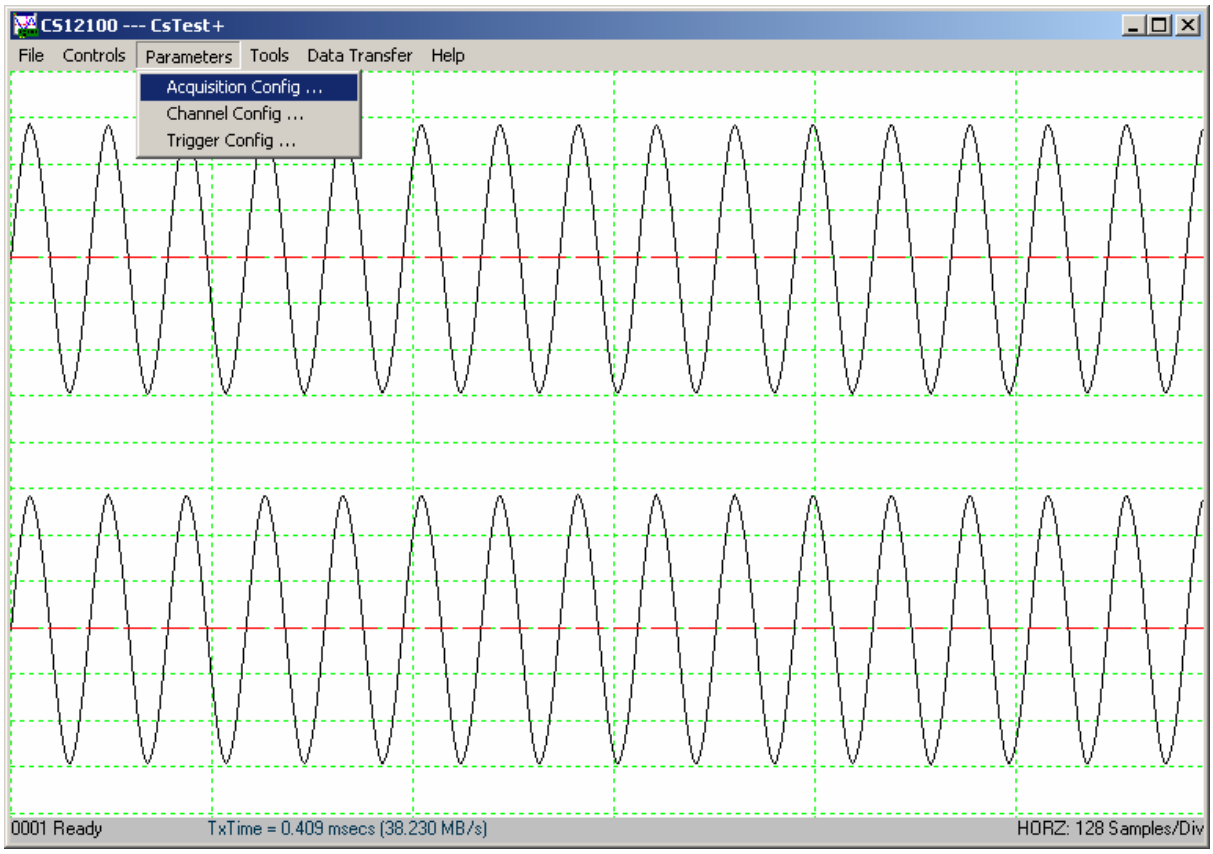
Controls - Select System





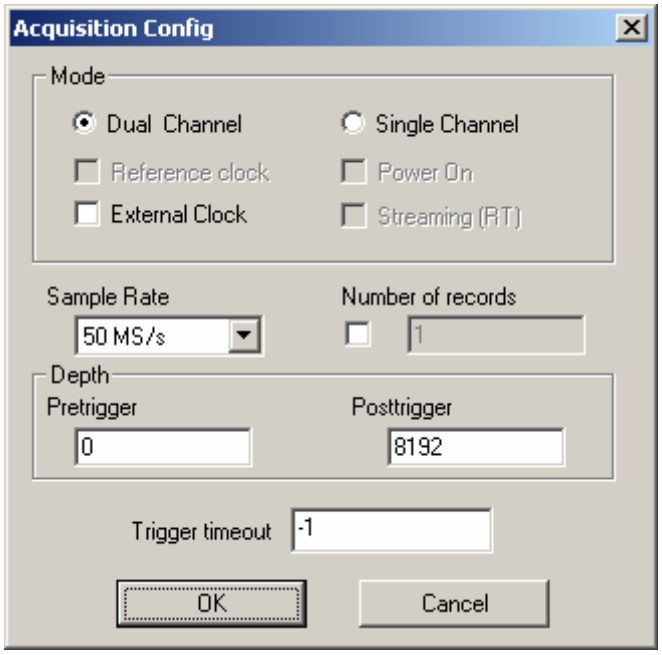
If there is more than one acquisition system installed in the same computer, **Select System** allows the user to select another acquisition system and make it the active acquisition system in CsTest+.

Parameters – Acquisition Config

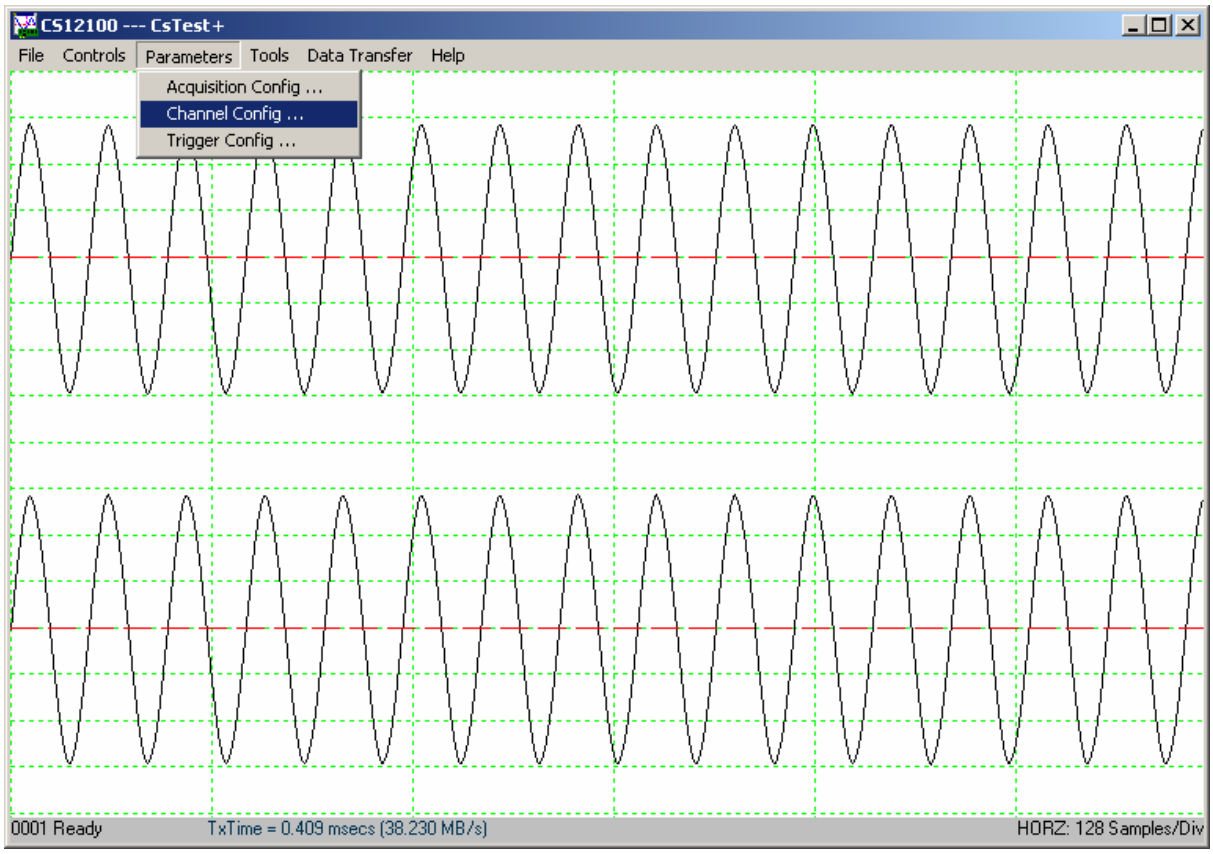


(Depending on the CompuScope card(s) and version of drivers you have installed, the dialog may look slightly different)

Acquisition Config allows users to modify different acquisition configuration parameters such as Pre-Trigger and Post-Trigger depth, Multiple Recording, Sample Rate, Trigger Timeout…



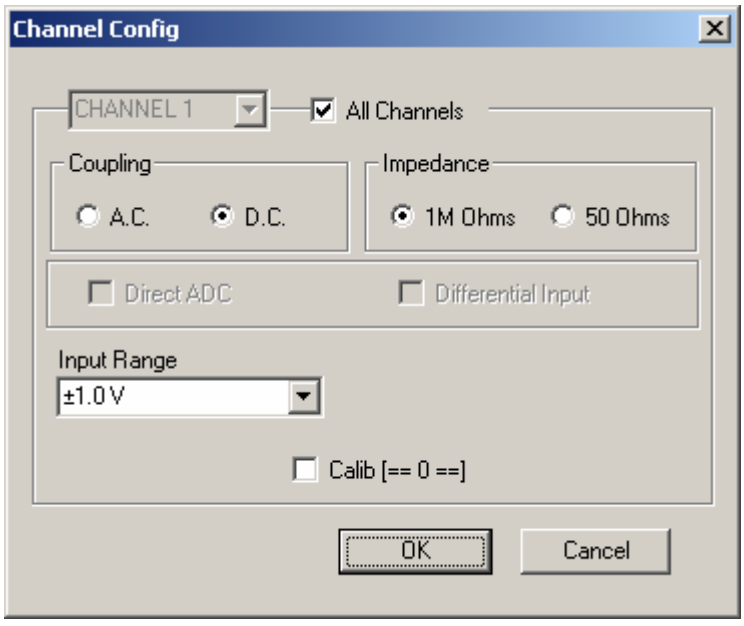
Parameters – Channel Config



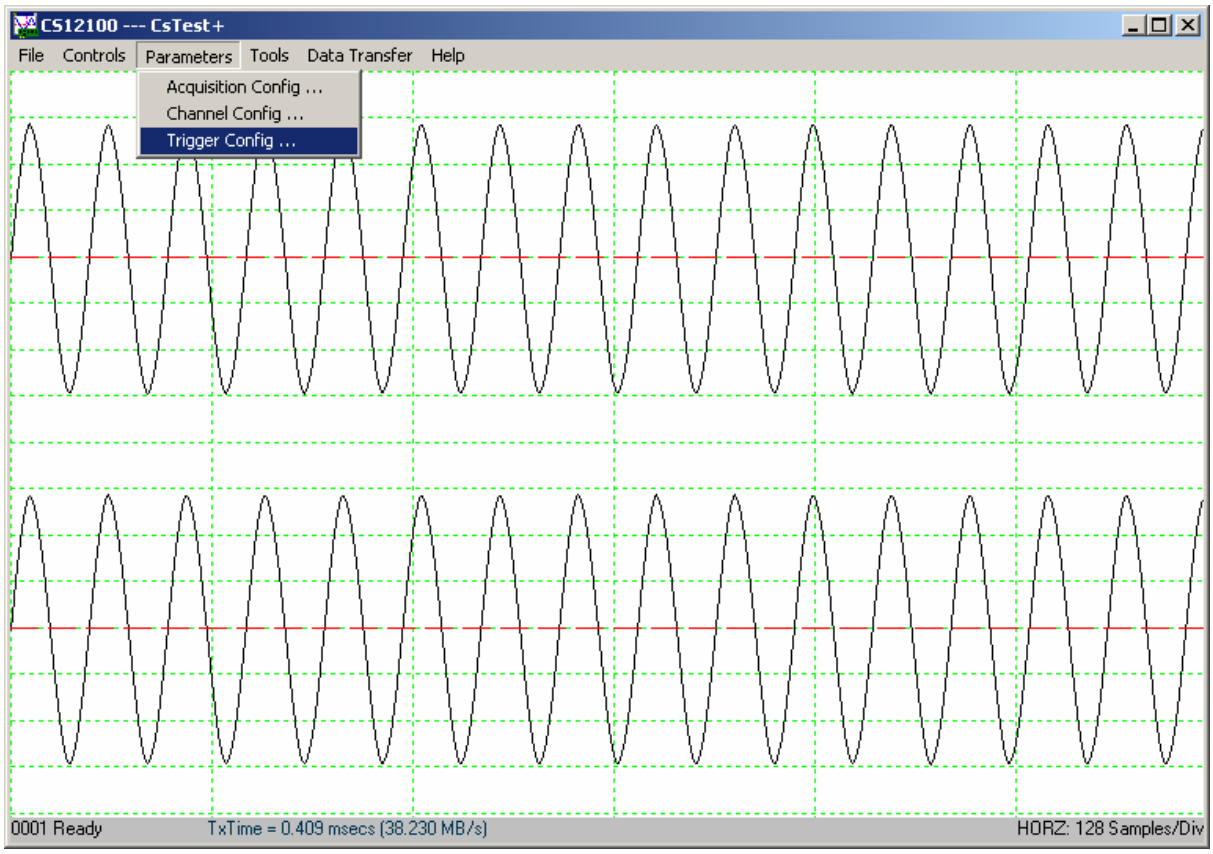
(Depending on the CompuScope card(s) and version of drivers you have installed, the dialog may look slightly different)

Channel Config allows users to modify signal conditioning parameters such as Coupling, Impedance and Gain….

Calib [==0==] is Null Channel Input, which will force the recalibration of the hardware, taking the average value of the current input as a new reference for the zero level.

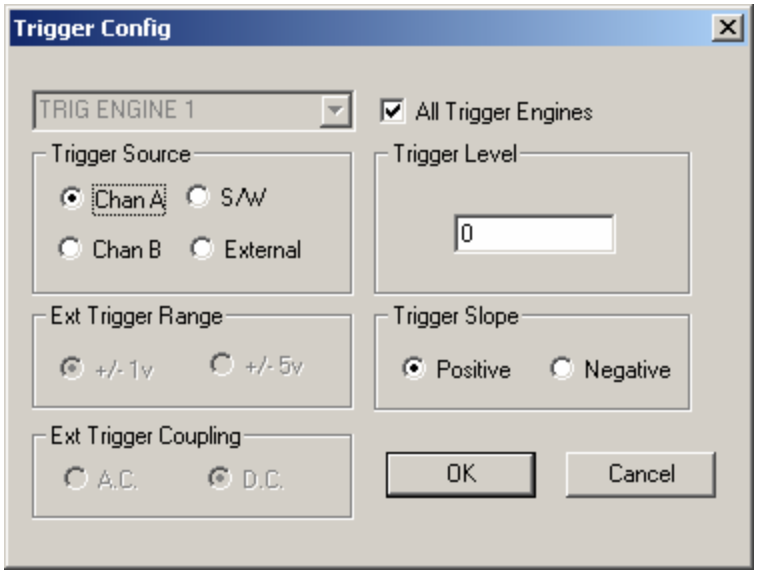


Parameters – Trigger Config

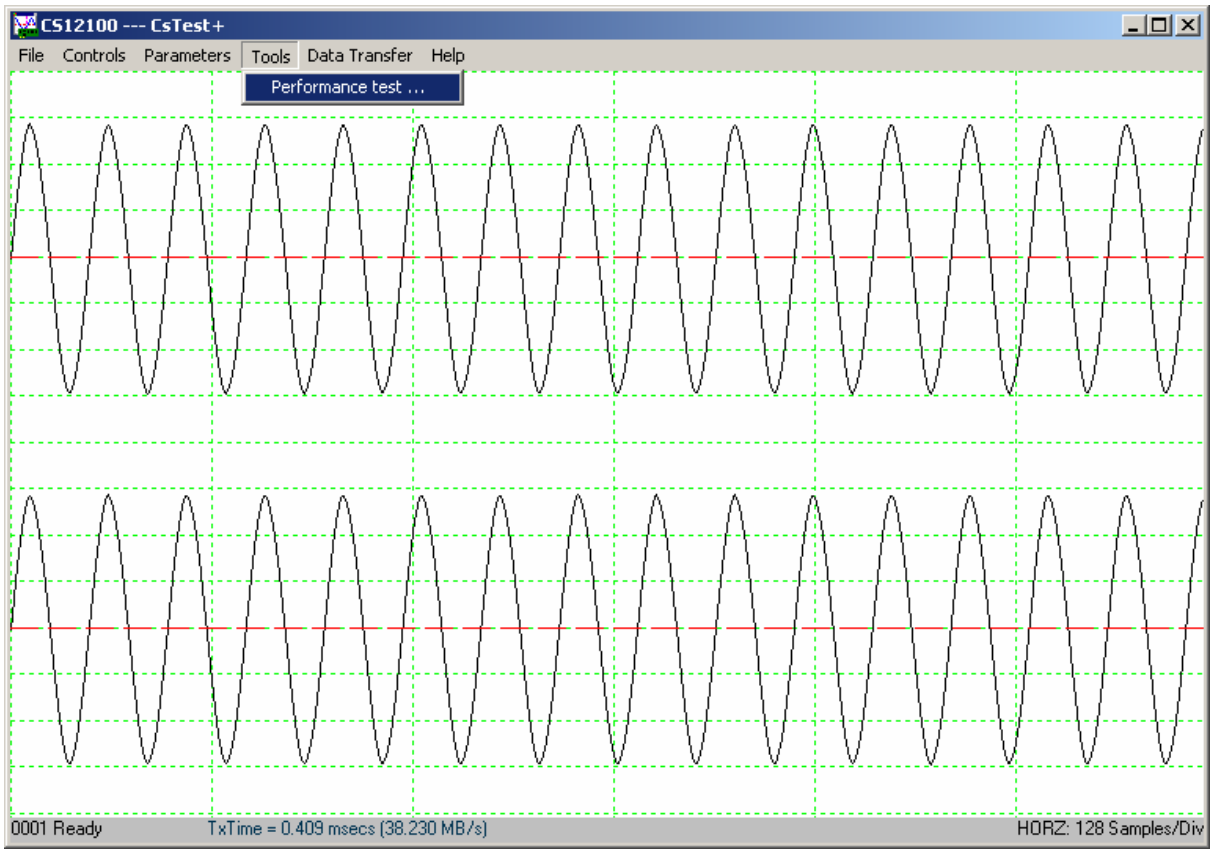


(Depending on the CompuScope card(s) and version of drivers you have installed, the dialog may look slightly different)

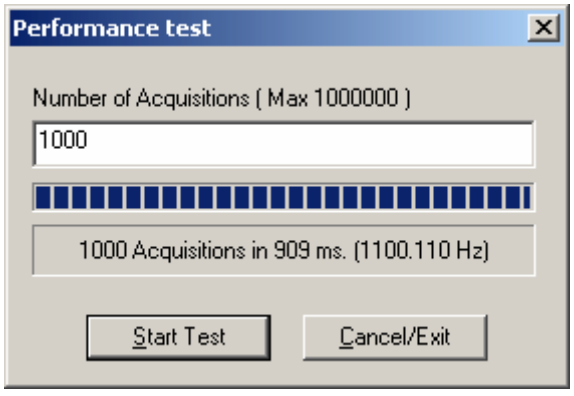
Trigger Config allows users to modify different trigger configuration parameters such as trigger source, level and slope…



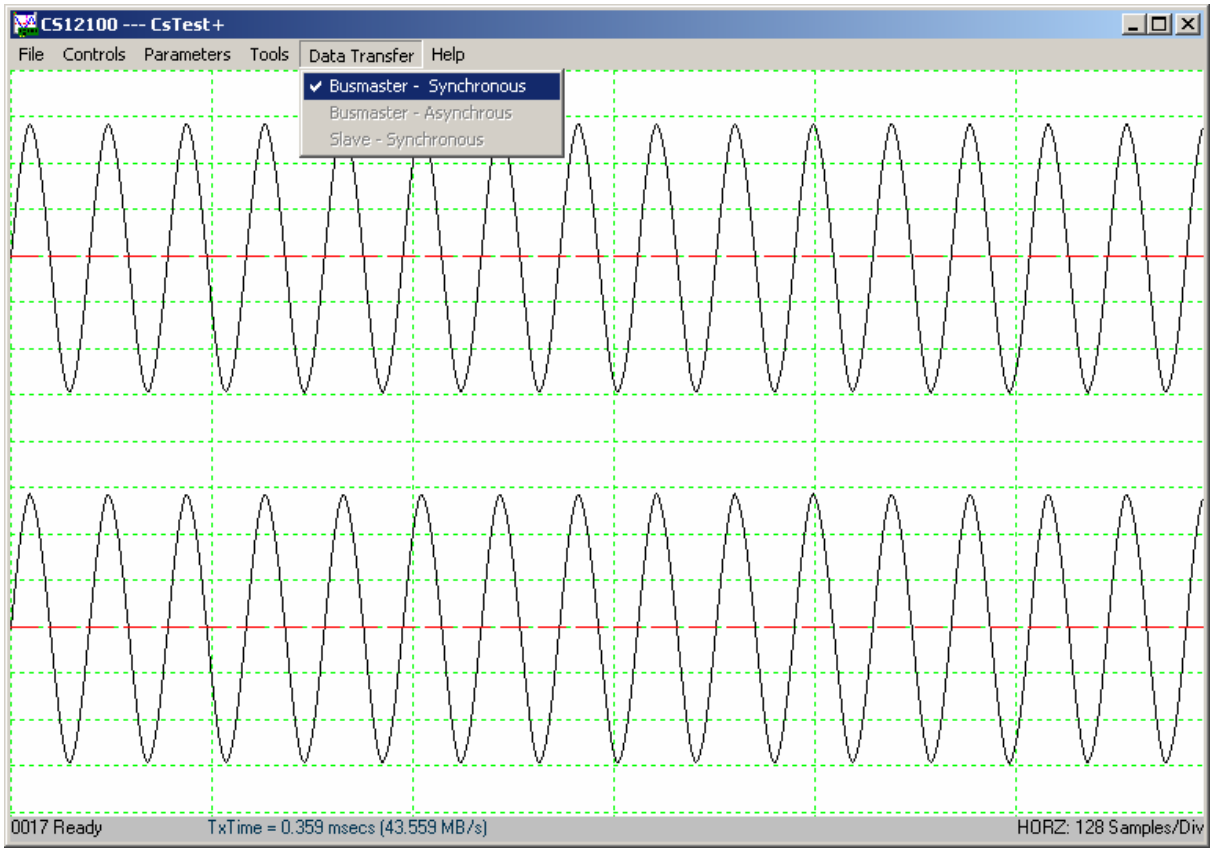
Tools – Performance



Performance tests the PRF performance of the acquisition system using the current configuration parameters.

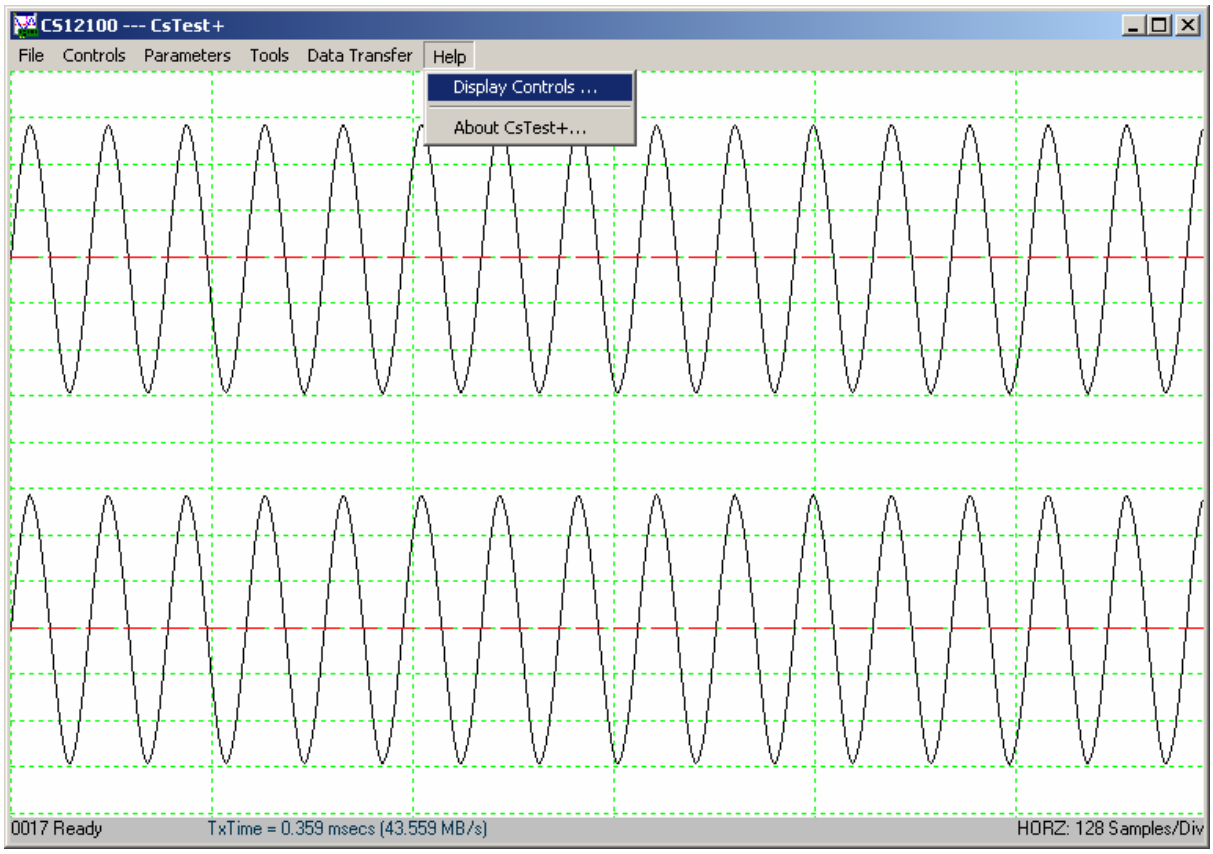


Data Transfer – Busmaster Synchronous

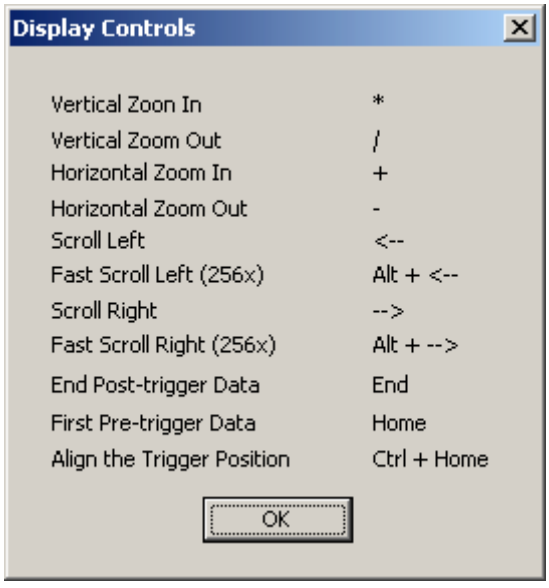


The current version of the Gage drivers only supports synchronous data transfer. Please refer to the CompuScope SDK manual for more information about synchronous and asynchronous data transfer.

Help – Display Controls



Display Controls shows different shortcuts to control the display of the captured data.



Help – About CsTest+