

Tutorials

About the Tutorials

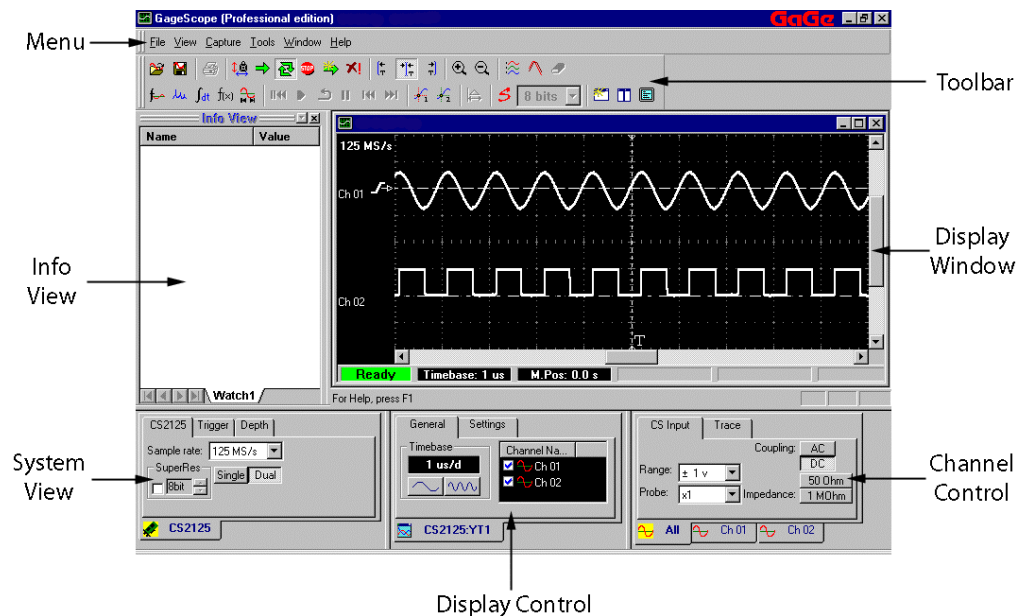
This chapter consists of seven tutorials. You have selected the one that is highlighted in red:

- **Tutorial 1 - Fundamentals**
- Tutorial 2 - Working with Channels
- Tutorial 3 - Triggering
- Tutorial 4 - Working with Special Modes
- Tutorial 5 - Working with Subchannels
- Tutorial 6 - Arbitrary Waveform Generator
- Tutorial 7 - Using the Graphical Waveform Editor

Each section is a self-contained tutorial. If you are new to GageScope[®], it is recommended that you do the tutorials in the order they are presented, as each section assumes you have gone through the previous material.

Tutorial 1: Fundamentals

The GageScope® screen contains menus, a toolbar, a display area, and controls for changing most settings.

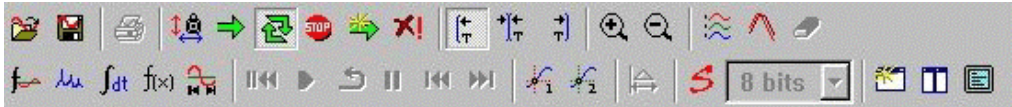


Menu Bar

The menu bar gives you mouse access to many GageScope[®] features, such as opening and saving files. As you will soon see, most features are accessed through easy-to-use on-screen controls.

Toolbar

The Toolbar gives you one-click access to commonly used features such as opening and saving files, cursors, capture controls, SuperRes, trigger alignment, zoom tools, full screen display etc.



If you wish to find out what each button does, position the mouse pointer over a button – a “tool tip” will appear. For more information, see the *Toolbar* in the Reference section of this manual.

Display Window

The Display Window displays live signals being acquired from your CompuScope card as well as signals you load from disk. You can also move signals and change certain settings directly in this window.

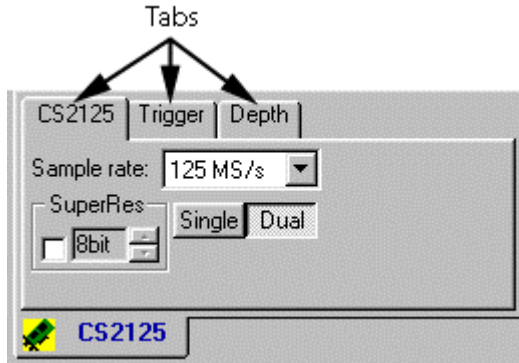
Status Bar

The Status Bar is located at the bottom left of the Display Window. It shows the status of the CompuScope card (triggered, waiting for a trigger, etc.), the current timebase, and the relative position of the trigger (M.Pos).



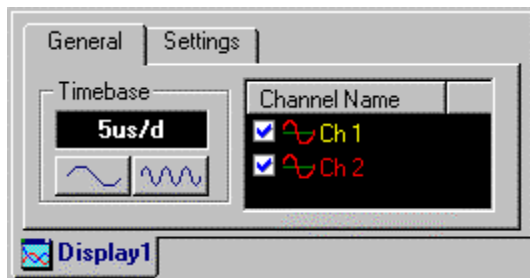
System Control

The System Control contains options for setting the sample rate, the channel mode (single or dual), type and level of trigger, and trigger depth. Related settings are grouped into tabs. For example, settings related to the amount of data captured (pre-trigger depth, post-trigger depth, multiple record, etc.) are in the Depth tab.



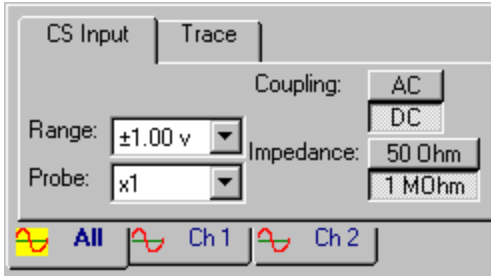
Display Control

The Display Control contains options for changing the look of the current display, such as the timebase and channel visibility, along with display element properties such as grid color. These settings do not affect the captured data.



Channel Control

The Channel Control contains options for changing the settings of individual channels, such as position, vertical scale, input range, and coupling.

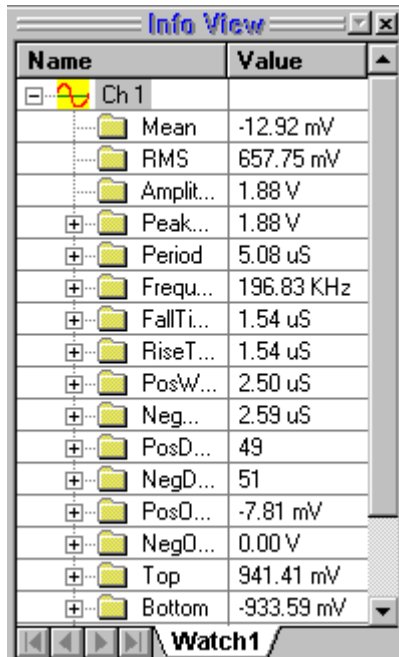


InfoView Palette

The InfoView palette is used to display various measurements being performed on the signal. These capabilities are normally performed through optional advanced analysis tools, which add extra functionality to GageScope®.

For example, InfoView is the window used by the Waveform Parameters analysis tool, which performs measurements such as Mean, Amplitude, Peak-to-peak, and many others on the specified channel of the active display.

Below is a sample of what the Waveform Parameters analysis tool displays.



About Capture Modes

GageScope® has two capture modes: Continuous and One Shot. These modes are represented in the capture portion of the toolbar along with a “Stop” button, an “Abort” button and a “Force Trigger” button.



The “pressed-in” button indicates the current mode. By default, GageScope® sets the capture mode to Continuous upon startup.

Continuous Mode In Continuous Mode, GageScope® repeatedly waits for a trigger event, acquires and displays the data, then waits for another trigger event.

One Shot Mode In One Shot Mode, GageScope® waits for a trigger event, acquires and displays the data, then stops.

When you click on the **One Shot** button, GageScope® automatically disables its timeout feature. In other words, the program will wait forever for a trigger event to occur. This allows for unattended capture of both pre- and post-trigger data.

Stop Button If you are in Continuous or One Shot Capture Mode and click on the **Stop** button, GageScope® finishes the current capture, then stops. If a trigger event has yet to happen, GageScope® acquires and displays the data that existed the moment you pressed the **Stop** button. If the acquisition were to take more than 2 seconds to finish after you press **Stop**, a dialog box will appear with a completion bar which shows how much longer you have to go before the acquisition is to finish.

Abort Button If you are in Continuous or One Shot capture mode and click on the **Abort** button, GageScope® aborts the current acquisition immediately. This is helpful for very long acquisitions. The data you see is that which existed when you clicked on **Abort**.

Force Trigger Button If you want to force a trigger to occur upon manual command, you can click on this button.


To see changes on screen as you make adjustments to your signal, leave GageScope® in Continuous Capture Mode. If you are sure of your settings and are setting up a trigger in order to do a one-time capture of data, use One Shot Mode.

Triggering is discussed in more detail in Tutorial 3.

Capture Mode Exercise

The following exercise will demonstrate the different capture modes and their characteristics. The exercises will only be useful if you have a signal connected to your CompuScope card, and if triggering is left to its default settings. To avoid any problems during this tutorial, do not change any settings other than those demonstrated in the examples.

Set the Capture Mode to Continuous

- 1 Check if GageScope® is set to continuous capture. (The **Continuous** button  in the toolbar should be “pressed in.”)

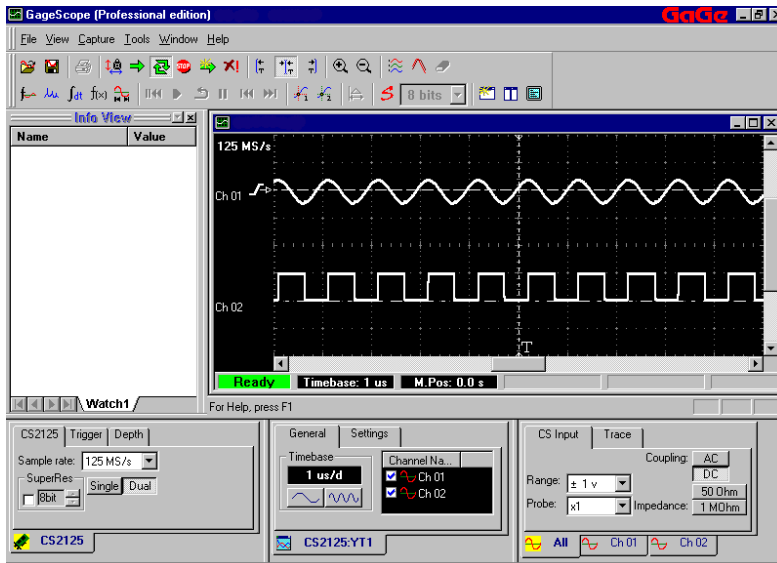
You can also click on the Capture menu—the item that is “pressed in” indicates the current mode.



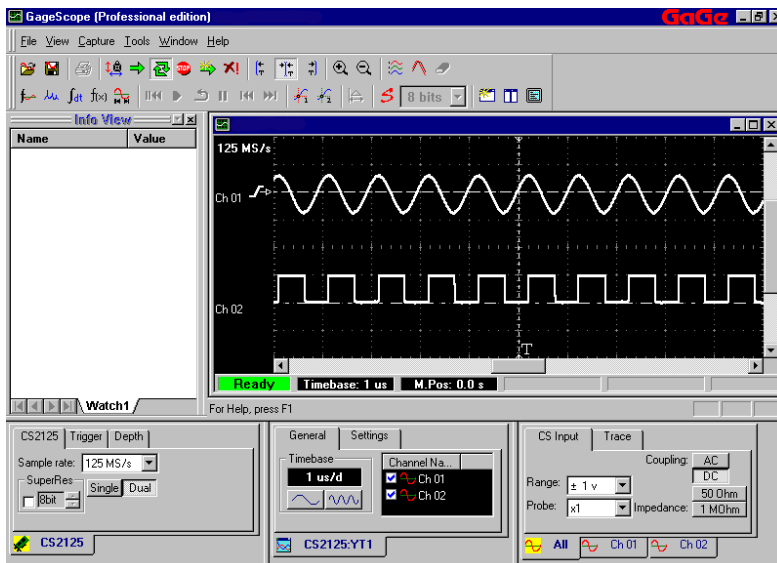
- 2 As GageScope® is set to capture continuously, the signal you are seeing is “live.”

As demonstrated in the next few pages, any adjustments you make to your signal generator are immediately reflected in the Display Window.

- 3 Reduce the amplitude of the signal on your generator. The signal in the Display Window should change accordingly. Note that channel A of the CompuScope card corresponds to channel 1 in GageScope®.

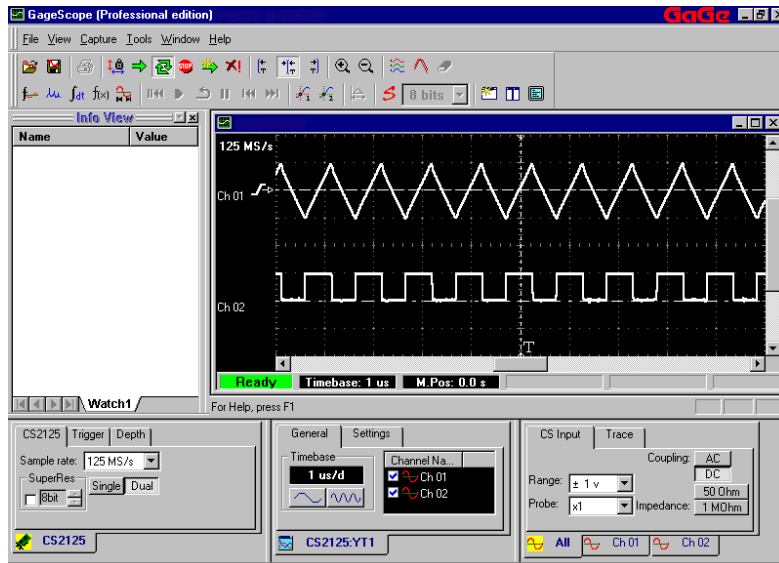


- 4 Increase the amplitude of your signal back to its original setting. The signal in the Display Window should increase accordingly.





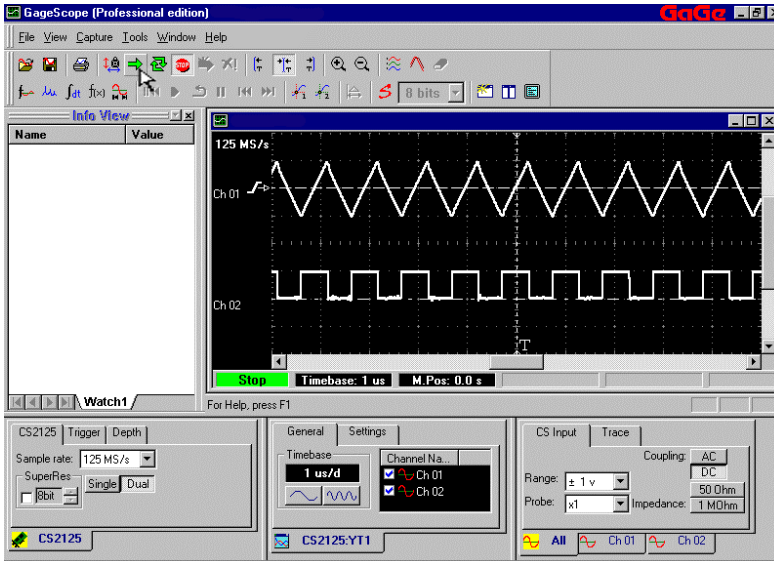
5 Change the signal to a triangle wave.

Again, the signal in the Display Window should change immediately, as GageScope® is set to capture continuously.



Set the Capture Mode to One Shot

- 1 Click on the **One Shot** button  in the Toolbar. You can also choose **One Shot** from the Capture menu.
- 2 Once you click on **One Shot**, the **Stop** button  becomes active.




This is normal. When you clicked on **One Shot**, GageScope[®] waited for a trigger event, acquired and displayed the data. If the trigger settings were not changed since launching GageScope[®], the trigger event occurred immediately.

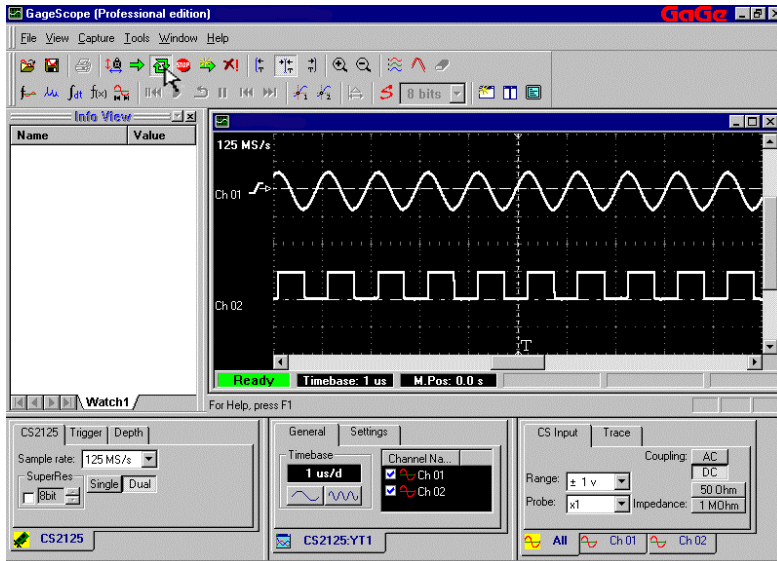
Once the capture was done, instead of looking for a new trigger event, GageScope[®] stopped all trigger-and-capture operations. This is the reason the **Stop** button became enabled.

- 3 Change the signal on your generator to a sine wave.

As GageScope[®] is in Stop Mode, the signal in the Display Window does not change—GageScope[®] is not looking for new trigger events, and no new captures are being performed.

Keep in mind that, although the signal in the Display Window is a triangle wave, the signal supplied by your generator is now a sine wave.

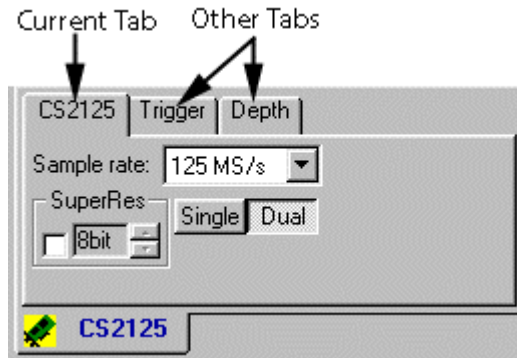
- 4 Click on the **Continuous** button  in the toolbar. The Display should change to a sine wave as soon as you press the **Continuous** button, as GageScope® immediately looks for, then acts on, a trigger event.



Again, as the trigger is set to the same channel that is being acquired, the trigger event and the subsequent change in the display occur immediately.

About Controls and Tabs

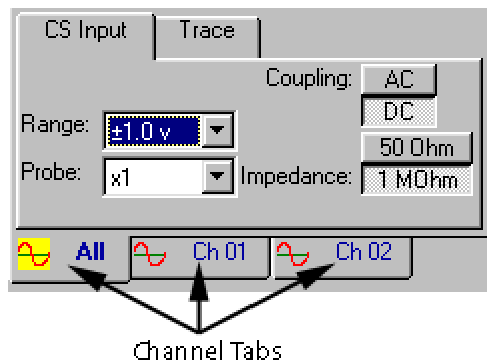
Tabs allow you to quickly switch between the many different parameters found in each control. The current tab is indicated by it being “in front,” as shown below. To switch to a different tab, click on that tab with the left mouse button.



In the System Control, you should have at least one tab with the name of your CompuScope card. As a CompuScope 2125 was used for this tutorial, **CS2125** shows up as a tab in the System Control.

Control-level tabs

Some controls have more than one tab at the bottom of the control. For example, the Channel Control (at the lower right of the screen) has tabs underneath the control, one for each channel.



When making changes to channel settings, always verify that the proper channel tab is in front.

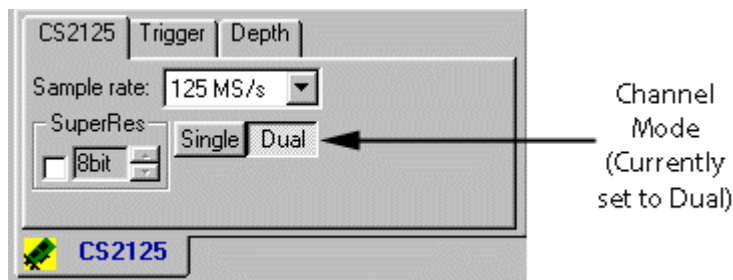
Channel Mode

The Channel Mode setting defines whether the CompuScope card should operate in single or dual channel mode.

- In dual channel mode, both channels A and B on your CompuScope card are available for input.
- In single channel mode, only channel A is available for input.

Note that not all CompuScope cards support this feature; the CompuScope 8500 and CompuScope 1016 are single channel only, for example, while the CompuScope 512 and CompuScope 512/PCI are dual channel only.

Click on the tab that is farthest to the left in the System Control to see this setting. The name of this tab will depend on your CompuScope model. In the case of this tutorial, the tab is titled CS2125.



Effects on Sample Rate

The advantage of single channel over dual channel is that the maximum sample rate in single channel is twice that of dual channel. For example, the maximum sample rate of a CompuScope 2125 in dual channel mode is 125 MS/s, while in single channel mode, it is 250 MS/s.

You can also use the entire memory buffer of your CompuScope for one channel when you are in single-channel mode. In dual-channel mode, the memory buffer is divided equally between the two channels.

Changing the Channel Mode

By default, channel mode is set to Dual. If you do not see the Channel Mode setting, your card does not have the ability to switch channel modes.

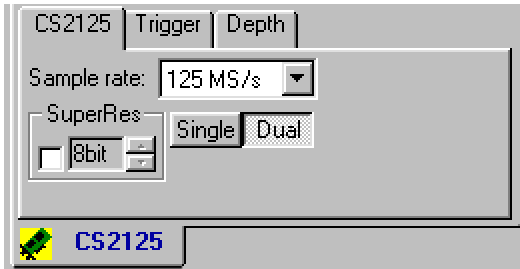
To change to single channel mode, click on the Single button.

Change Back to Dual

Click on the Dual button to change the channel mode back to dual. For the rest of this tutorial, leave this setting in Dual Channel mode. (As the CompuScope 8500 and CompuScope 1016 support single channel mode only, you will have to stay in single channel mode.)

Sample Rate

The sample rate defines how many sample points per second should be acquired by the CompuScope card. The available sample rates will change depending on the CompuScope model and the channel mode.



It is best to set the sample rate to at least twice that of the input frequency. For example, if you are sampling a 1 MHz signal, you should set the sample rate to 2 MS/s or higher.

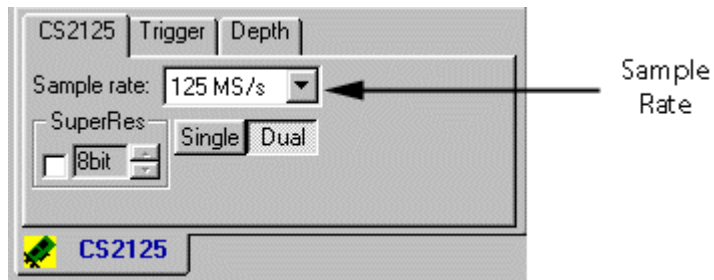
Obviously it is preferable to have as many samples per cycle of the input frequency as possible. The industry standard is to have five to ten samples per cycle. In other words, sample rate should be five to eight times the input frequency to get a good representation of the signal on the screen.

Effect of Channel Mode on Sample Rate

The maximum sample rate in single channel mode is twice that of dual channel mode. For example, the maximum sample rate of a CompuScope 2125 in dual channel mode is 125 MS/s, while in single channel mode, it is 250 MS/s.

Initial Settings

Upon startup, GageScope[®] sets the channel mode to dual and the sample rate to the maximum available. As a CompuScope 2125 was used for this tutorial, the sample rate was set to 125 MS/s, the maximum available in dual channel mode.

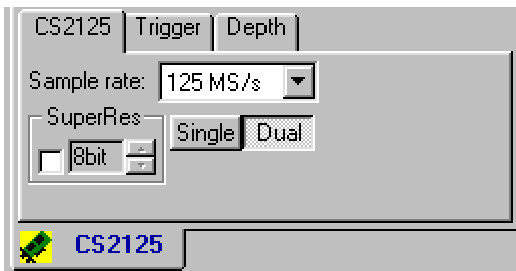


Sample Rate Exercise

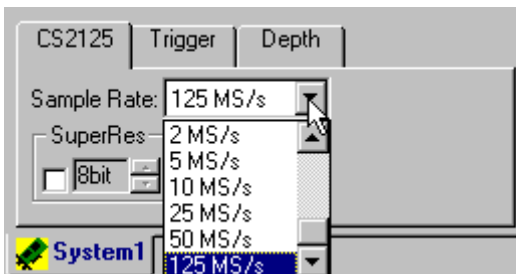
In this short exercise you will change the sample rate to a very low value and then back to a high value.

Change the Sample Rate to a Low Value (5 MS/s for example)

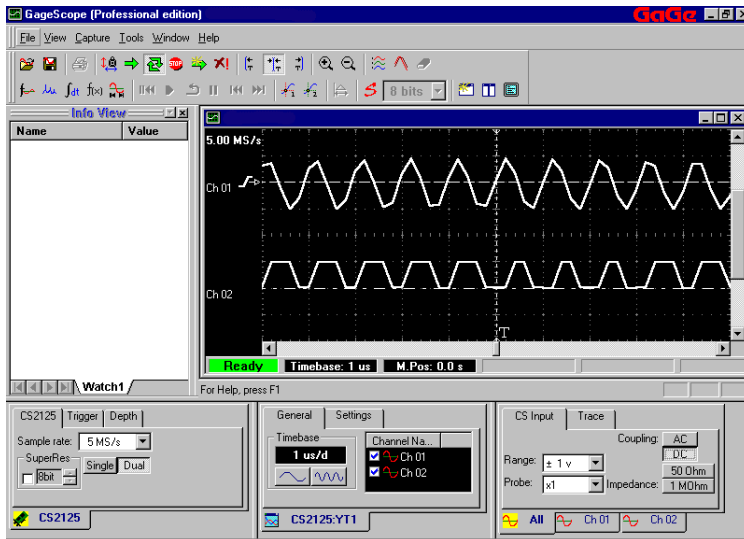
- 1 Verify that you are in dual channel mode and that the Continuous Mode button is active.
- 2 Click on the CS Tab in the System Control. In the case of this tutorial, the tab is titled **CS2125**.



- 3 Click on the Sample Rate drop-down menu to see a list of sample rates.



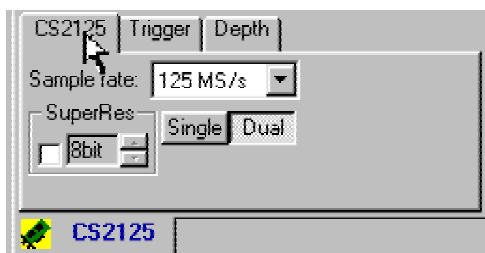
- 4 Scroll up the list and click on **5 MS/s** or similar small number. The low sample rate results in a signal that is not as smooth as before.



When the sample rate is low, the CompuScope card is acquiring fewer sample points per second. In other words, the time resolution of the signal decreases. With fewer points available for building a representation of the signal, the resulting waveform looks jagged.

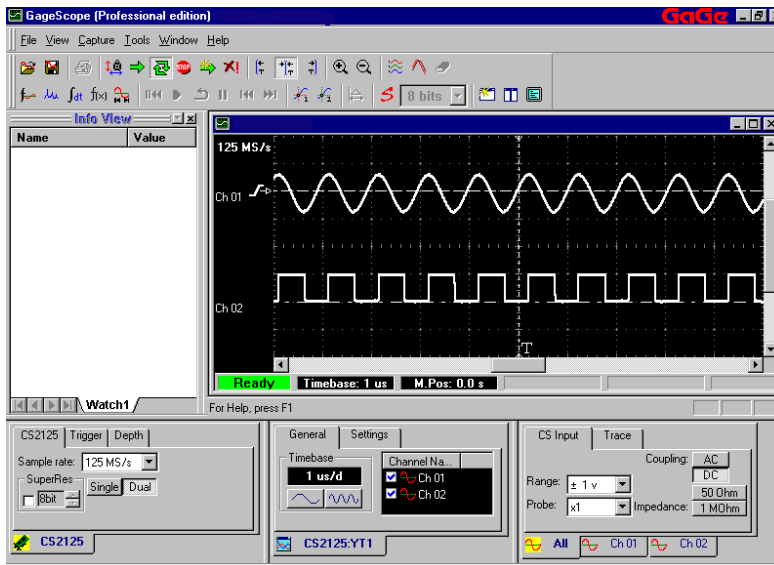
Change the Sample Rate Back to Highest Available

- 1 Click on the CS Tab in the System Control. In the case of this tutorial, the tab is titled **CS2125**.



- 2 Click on the Sample Rate drop-down menu to see a list of sample rates.
- 3 Scroll down to the bottom of the list.

- 4 Click on **125 MS/s** or similar high number. The higher sample rate results in many more acquisitions per second and a much smoother signal.



Note that sample rate is not linked to the timebase setting.

This has been done to allow you to take advantage of the very deep buffer memory on your CompuScopes. You can capture at a very fast sample rate and still view it with a very small timebase.

All digital oscilloscopes on the market control sample rate using the timebase you select, because they have limited memory buffers.

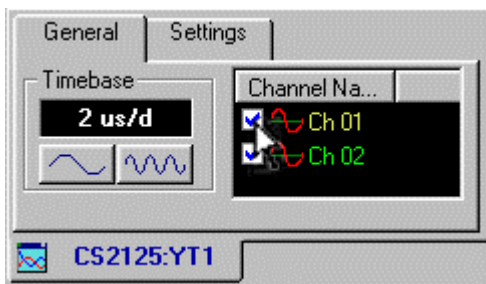
Hiding and Showing Channels

Hiding a channel temporarily removes the channel from the Display Window.

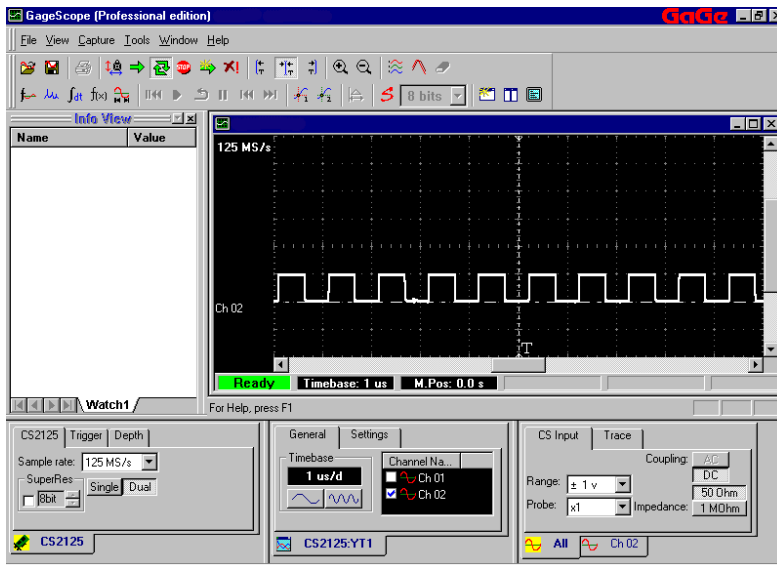
Note that you can also delete channels, but only math and file channels—you cannot delete live signals originating from a CompuScope card. In this exercise, we will merely hide the channel. The **Delete Channel** command is found in the Channel Context menu. Simply click with the right mouse button on a channel's zero line, and then click with the left mouse button on **Delete**.

Hide Channel 1

- 1 In the Display Control (lower middle of the screen), click on the **General** tab.
- 2 Position the mouse pointer on the checkmark next to **Ch 1** in the list.



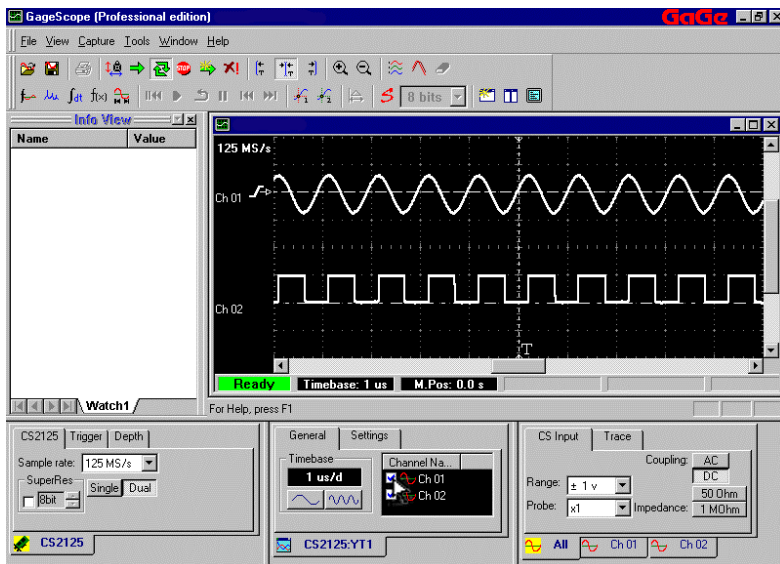
- 3 Click to “unchecked” it. Channel 1 should disappear from view.



Note that you are still in dual channel mode, as hiding a channel does not change the CompuScope card's channel mode. The channel is still available, just hidden from view.


Unhide Channel 1

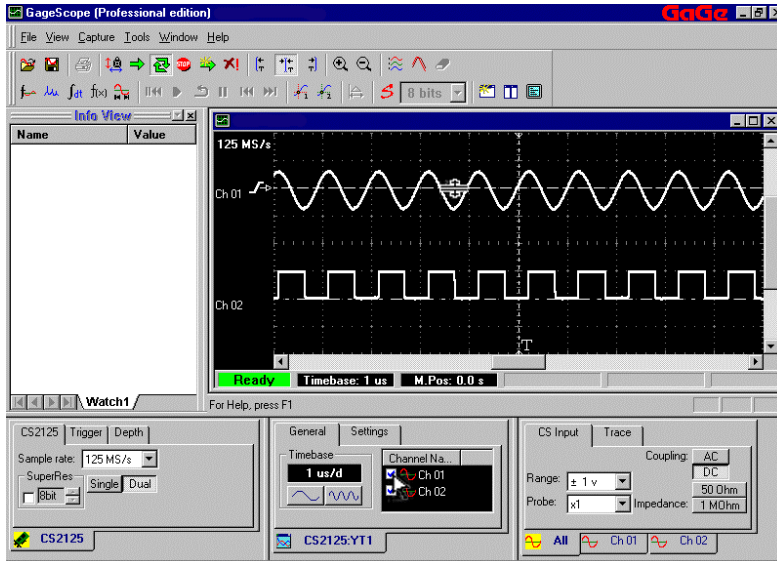
- 1 Click on the empty checkbox next to **Ch 1**. Channel 1 reappears.



Using the Context Menu to Hide and Show Channel 1

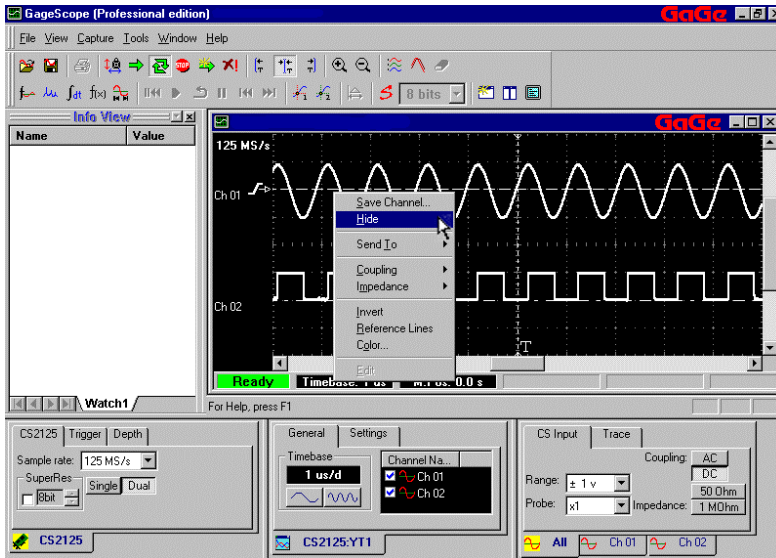
You can also hide channels directly through the Display Window.

- 1 Move the mouse pointer on top of channel 1. In response, channel 1 turns white to indicate it has the current focus. The cursor also changes to a “move”  pointer.



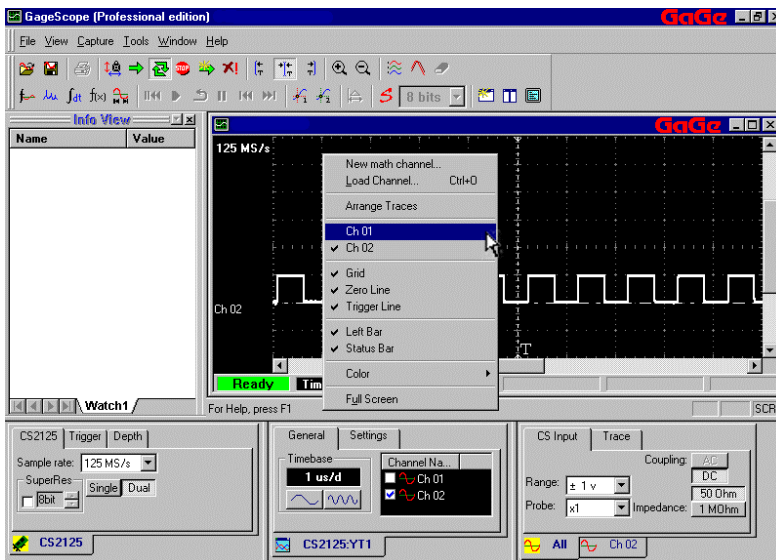
- 2 Click with the **right mouse button** to bring up the channel context menu.

- 3 Click with the **left mouse button** on **Hide**. Channel 1 becomes hidden.



- 4 To bring back channel 1, right-click on an empty area of the Display Window (and not on a channel) to bring up the Display Window context menu.

Notice that **Ch 1** has no checkmark, indicating that it is hidden.



- 5 Left-click on **Ch 1** in the context menu to bring it back.

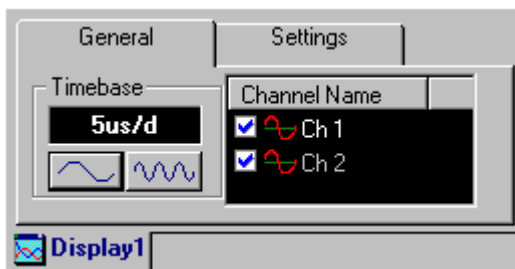
Timebase


The timebase is a display function only and does not affect the data being acquired. Changes to the timebase affect the display of all channels in the Display Window.

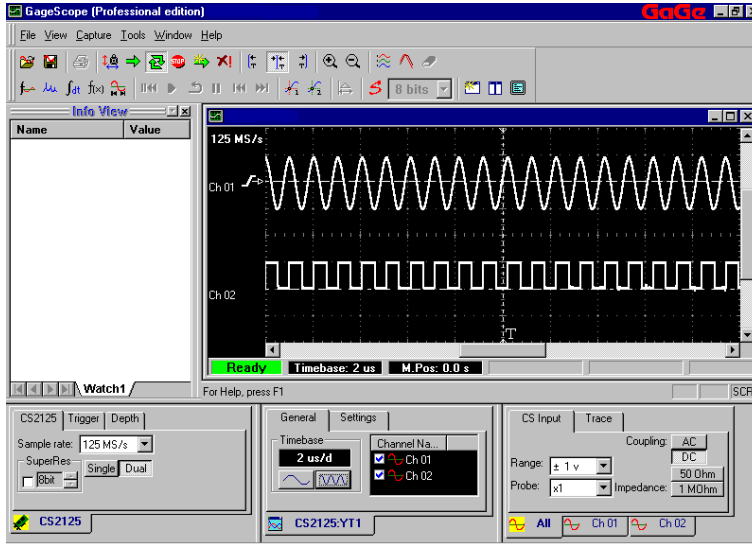
Increase the Timebase

- 1 If not already visible, click on the **General** tab of the Display Control, located in the lower middle of the screen.

Look for the word “Timebase.” By default the timebase is set to **5us/d** (5 microseconds per division).




- 2 Click on  once to increase the timebase to **10us/d**.




Increasing the timebase increases the segment of time shown per division in the Display Window. Thus, when you increase the timebase, the signal peaks get closer together.

Note that your signal may look a bit different from the examples presented here.

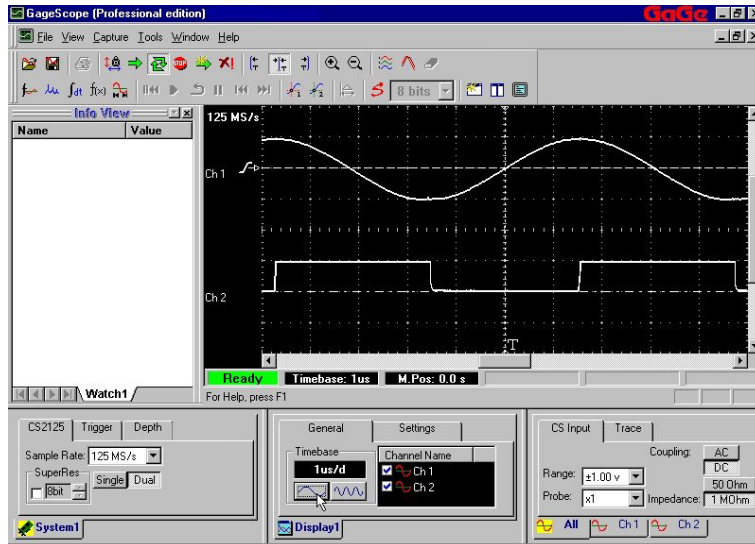
Decrease the Timebase to 1us/d

Use  to decrease the timebase.

- 1 If not already visible, click on the General Tab of the Display Control. The timebase is currently set to **10us/d**.
- 2 Click on  once to decrease the timebase to **5us/d**.


- 3 Keep clicking until the timebase reaches **1 μ s/d**.

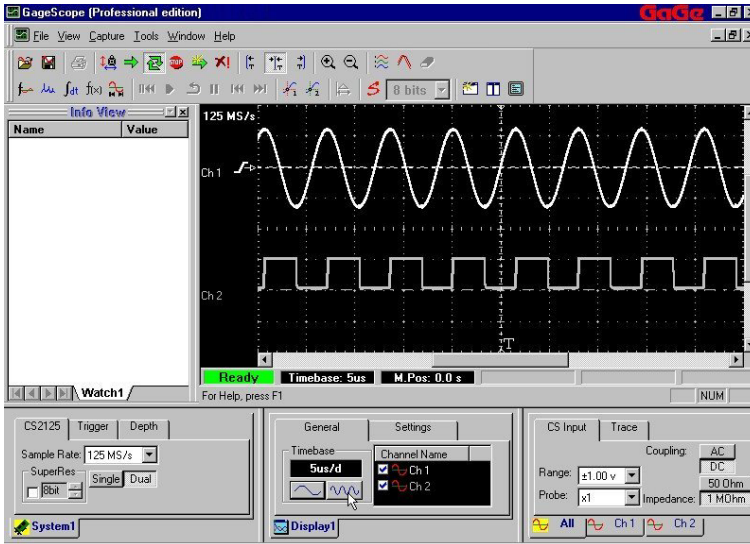
Your display should look something like this:



Decreasing the timebase decreases the segment of time shown per division in the Display Window. Thus, when you decrease the timebase, the signal peaks get farther apart.

Change the Timebase back to 5 μ s/d

- 1 If not already visible, click on the **General** tab of the **Display Control**. The timebase should currently be 1 μ s/d.
- 2 Click on  repeatedly until the timebase comes back to 5 μ s/d.





Note that sample rate is not linked to the timebase setting.


This has been done to allow you to take advantage of the very deep buffer memory on your CompuScopes. You can capture at a very fast sample rate and still view it with a very large timebase.

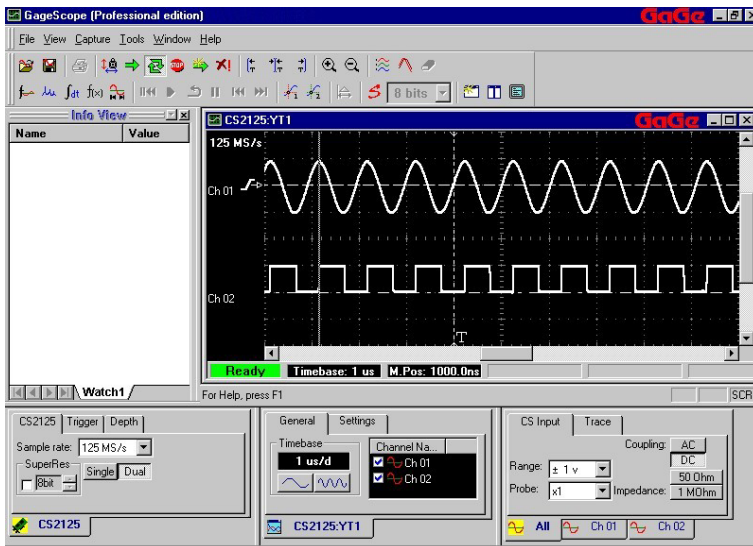
All digital oscilloscopes on the market control sample rate using the timebase you select, because they have limited memory buffers.

The Zoom Tools

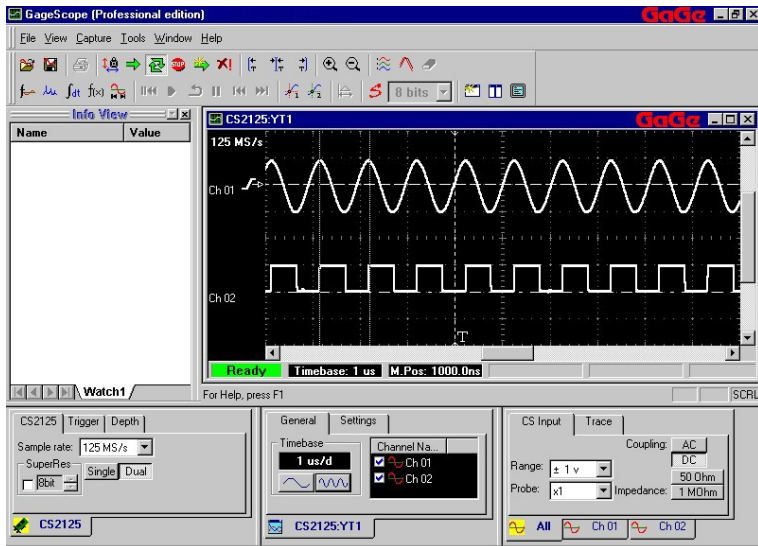
The **Zoom In** tool  magnifies the area you select, allowing for closer inspection of a particular part of a signal. The **Zoom Out** tool  reduces the magnification. In the following example, you will zoom in on the second and third positive peaks of the sine wave signal.

Zoom In the Second Negative Peak of the Sine Wave

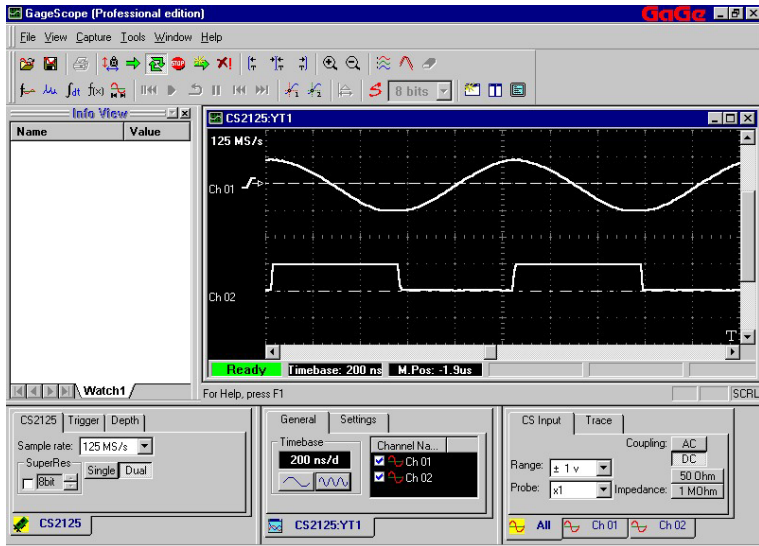
- 1 Click on the “zoom in” icon  in the toolbar.
- 2 Press and hold down the mouse button on the second peak of the signal in the Display Window. A vertical line will appear where you first click.



- 3 Drag the mouse to the third peak in the Display Window. A second line will follow the movement of the mouse.



- 4 Let go of the mouse button. The area you selected is magnified.




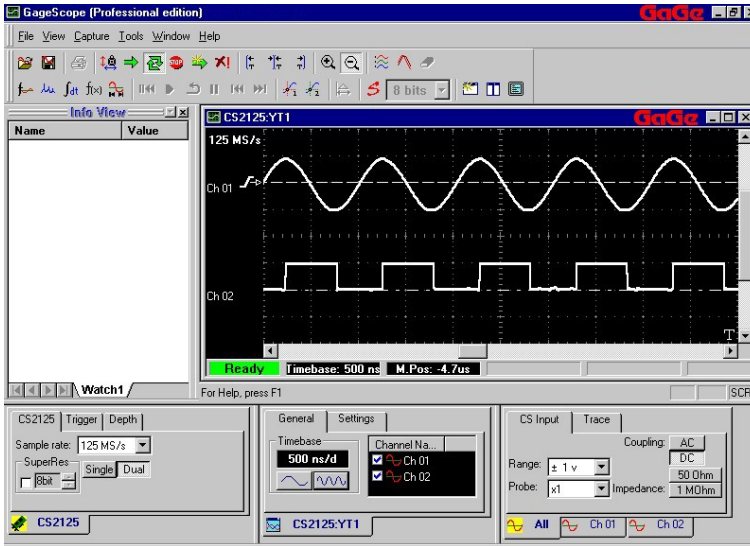
When magnifying a particular area, the zoom tool actually changes the timebase based on the width of your selection, then centers the area in the Display Window.


In this example, GageScope[®] adjusted the timebase to **200 ns/d** in order to magnify the Display Window the amount you specified.

Note that zooming changes the horizontal scale only—it does not affect the vertical scale of the channels.

Zoom Out to 5us/d

- 1 Click on the **Zoom Out** icon .
- 2 Click the mouse somewhere in the Display Window to zoom out (increase the timebase) one increment. The timebase changes to 500 ns/d.



- 3 Once you click with the **Zoom Out** tool, the pointer changes to an arrow again. To return to 5us/d, use the **Zoom Out** tool once more. You can also use the  button.

Customizing the Display

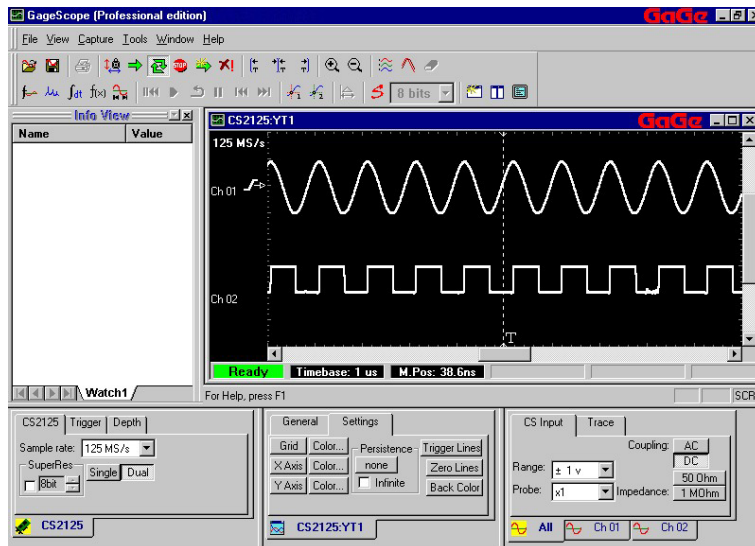
Many Display Window elements (Grid, X Axis, Y Axis, Trigger Line, and Zero Lines) can be turned off using the Settings tab of the Display Control.

Hide All Window Elements

In the following example, you will hide all Display Window elements.

- 1 Click on the **Settings** tab of the **Display Control** to bring it to the front. A Display element whose button is “pressed in” is visible. All Display elements are on by default.
- 2 Click on the buttons **Grid**, **X Axis**, **Y Axis**, **Trigger Level**, and **Zero Lines** to turn each of these Display Window elements off.

As you click each button, notice how the Display Window changes. In the example below, all elements have been turned off.



Show All Window Elements

- 3 Click on the buttons **Grid**, **X Axis**, **Y Axis**, **Trigger Level**, and **Zero Lines**. As you click each button, the corresponding Display element reappears.

About the Other Buttons in the Settings Tab

The **Color** buttons next to **Grid**, **X Axis** and **Y Axis** allow you to change the color of these Display Window elements. The **Back Color** button allows you to change the background color of the Display Window.