

# Tutorials

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## About the Tutorials

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

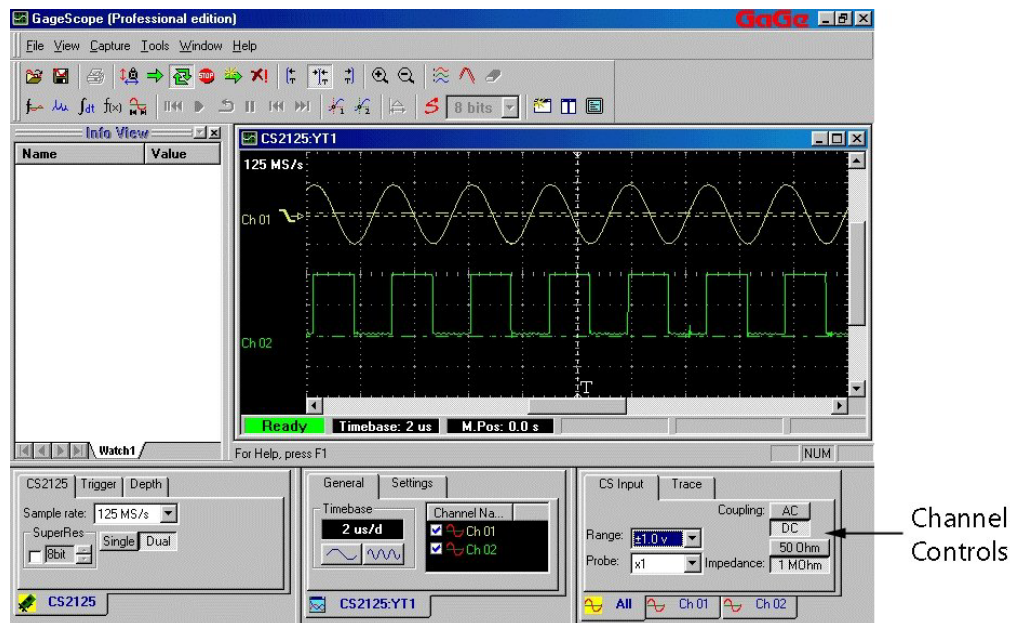
- Tutorial 1 - Fundamentals
- **Tutorial 2 - Working with Channels**
- Tutorial 3 - Triggering
- Tutorial 4 - Working with Special Modes
- Tutorial 5 - Working with Subchannels
- Tutorial 6 - Arbitrary Waveform Generator
- Tutorial 7 - Using the Graphical Waveform Editor

Each section is a self-contained tutorial. If you are new to GageScope<sup>®</sup>, 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.

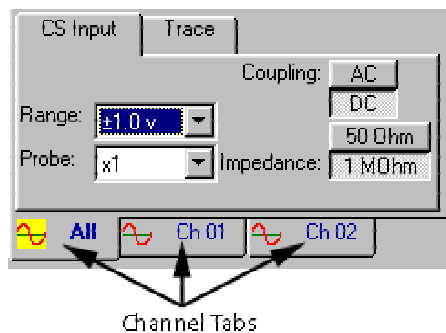
# Tutorial 2: Working with Channels

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A channel can originate from a live signal through a CompuScope card, or it can be loaded from disk. Most channel settings are changed through the Channel Control at the lower right of the screen.

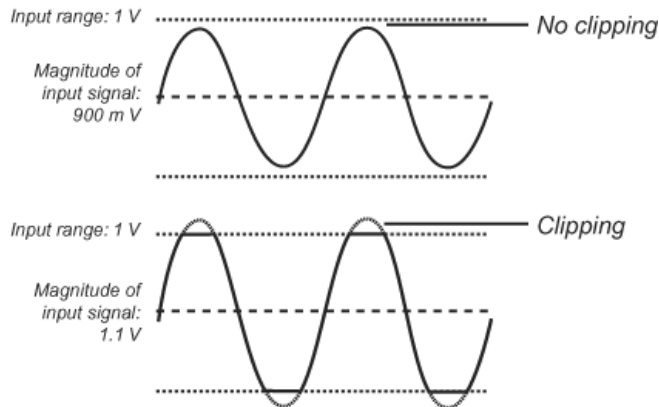


Be sure to verify that you are making changes to the proper channel by first clicking on the Channel tabs at the bottom of the Channel Control. The channel tab that is “in front” is the channel that will be affected by your changes. If the **All** tab is in front, you will be making changes to all current channels.



# Input Range

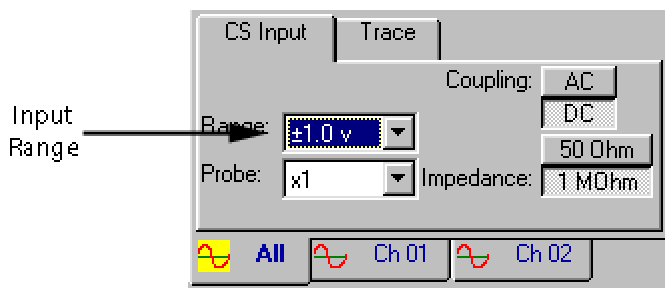
The input range is the range in Volts that GageScope<sup>®</sup> will measure when acquiring data. If the input range is less than the maximum magnitude of an input signal, the peaks of the signal will be cut off.



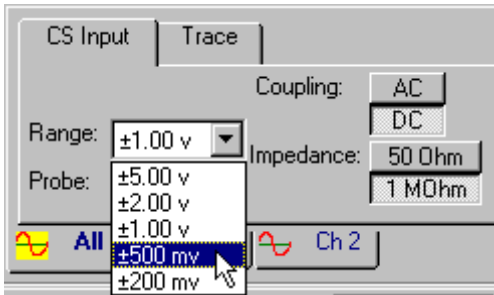
Note: You will not be able to change this setting if you are using a CompuScope 1016, as the input range for this card is fixed at  $\pm 2V$ .

## Change the Input Range of Channel 1 to $\pm 500mV$

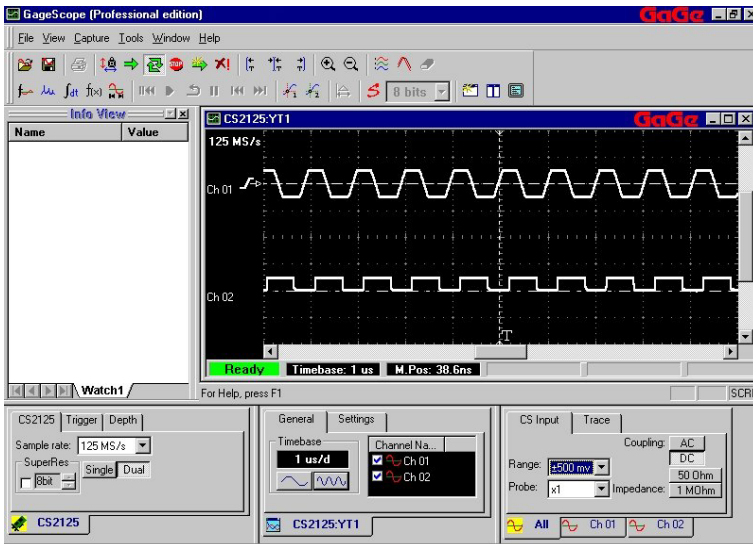
- 1 Click on the **Ch 1** tab in the **Channel Control** (at the bottom of the control).
- 2 Click on the **CS Input** tab. By default the Input Range is set to  $\pm 1V$ .



- 3 Click on the drop-down menu and choose  $\pm 500\text{mV}$  (or a similar small number) from the list.

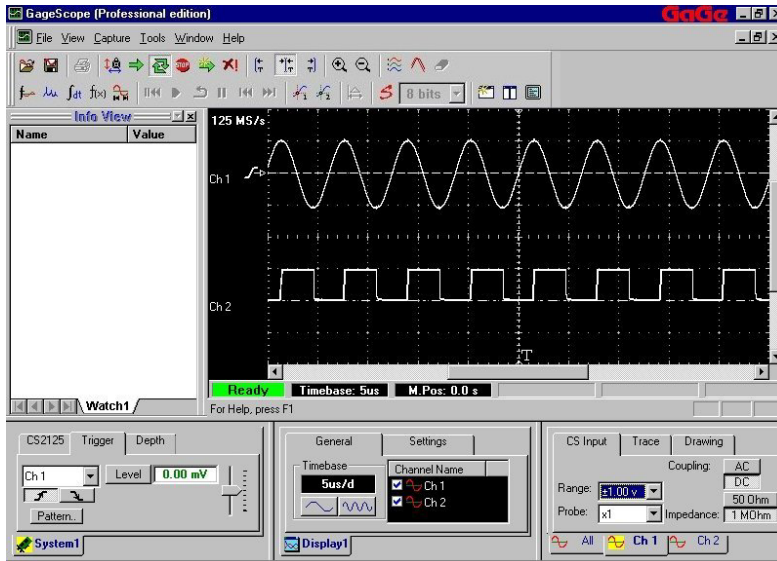


- 4 As  $\pm 500\text{mV}$  is smaller than the peaks of the signal created by the generator (which for these examples is set to about 1.8 V), a significant amount of clipping is seen—the positive and negative peaks are cut off.



## Change the Input Range of Channel 1 back to $\pm 1V$

- 1 Click on the Input range drop-down menu and choose  $\pm 1V$  from the list.



# Coupling

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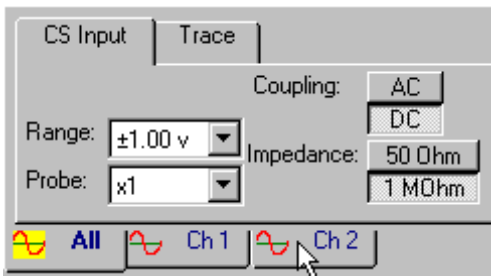
You may have noticed that, in the examples shown so far, channel 2's signal was only visible above its zero line. This is because GageScope® has automatically set all channels to DC coupling.

To see the signal centered around zero, you can change to AC coupling.

Note: You will not be able to change this setting if you are using a CompuScope 1016, as this card is DC only. Also note that only DC coupling is available when Impedance (appearing just below Coupling in the CS Input Tab of the Channel Control) is set to 50  $\Omega$ .

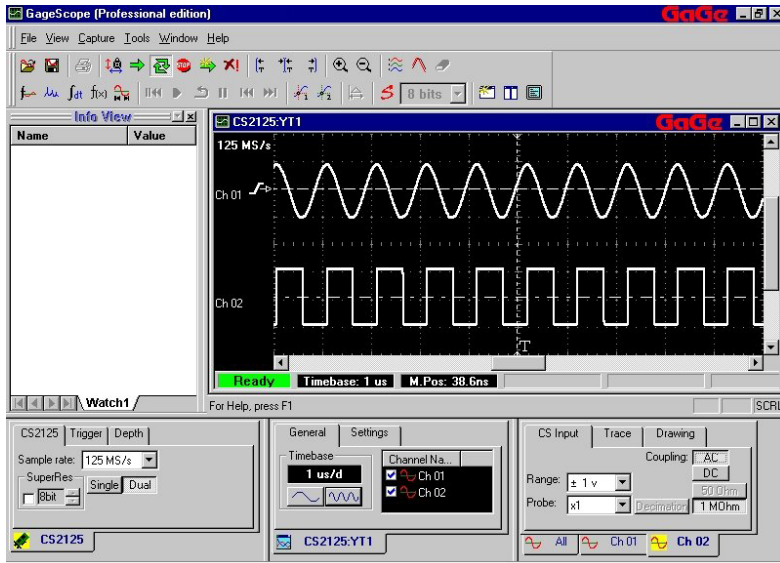
## Change the Coupling of Channel 2 to AC

- 1 Click on the **Ch 2** tab in the Channel control.



- 2 Click on the **CS Input** tab. By default the Coupling is set to **DC**.

### 3 Click the AC button.



***Note that Input Range is not linked to the Vertical Scale setting.***

This has been done to allow you to take advantage of the high resolution offered by CompuScopes. You can capture a signal with  $\pm 1\text{V}$  range and still view it with a vertical scale of 50 mV/div.

All digital oscilloscopes on the market are limited to 8 bit resolution and can digitize the signal with 256 levels only. This way, they can fit all 256 levels on screen. CompuScopes, which offer up to 16 bit resolution, digitize the signal with up to 65,536 levels. There is no screen in the world which can display that many pixels. Hence, the ability to display only a portion of the capture signal's dynamic range is necessary.

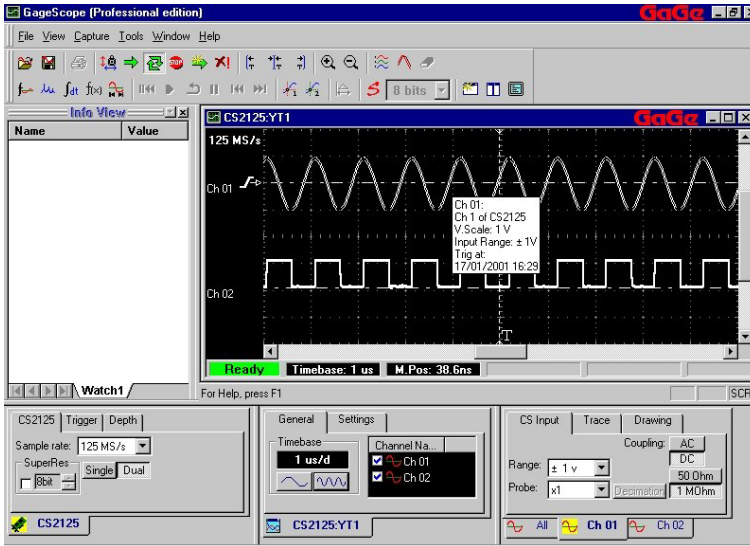


# Channel Position

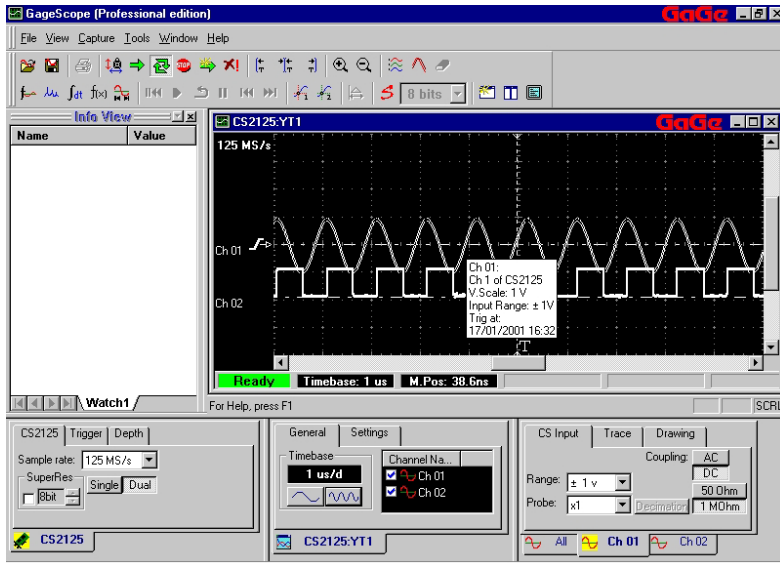
You can change the position of channels by moving them directly in the Display Window or through the position buttons in the Channel Control.

## Move Channel 1 Down via the Display Window

- 1 Position the mouse pointer on the zero line of channel 1. The signal changes to white, and the arrow pointer changes to a drag pointer.



- 2 Hold down the mouse button, then drag the mouse up and down.

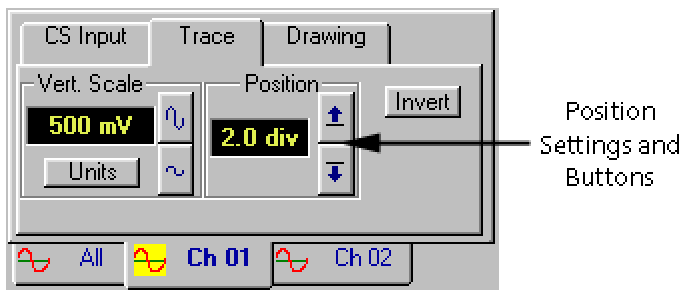



- 3 Before continuing to the next example, move Channel 1 to the Display Window's X Axis (in the middle of the window).

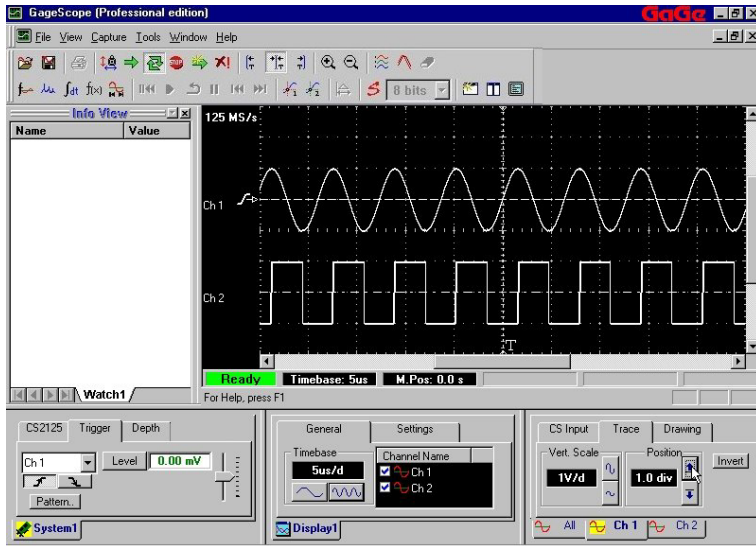
## Raise Channel 1 to 1.0 div using the Position Buttons

The Position Buttons are in the Trace tab of the Channel Control.

- 1 Click on the **Ch 1** tab in the Channel Control.
- 2 Click on the **Trace** tab.



- 3 Click on  repeatedly to raise the channel's position, until it reaches **1.0 div**.



Channel 1 in the Display Window moves as you click on the position buttons.

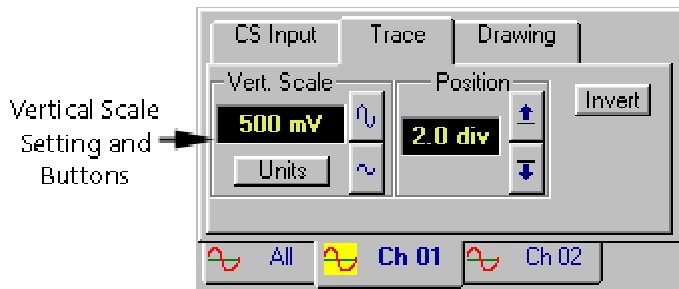
# Vertical Scale

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The Vertical Scale setting is located in the **Trace** tab of the Channel Control.

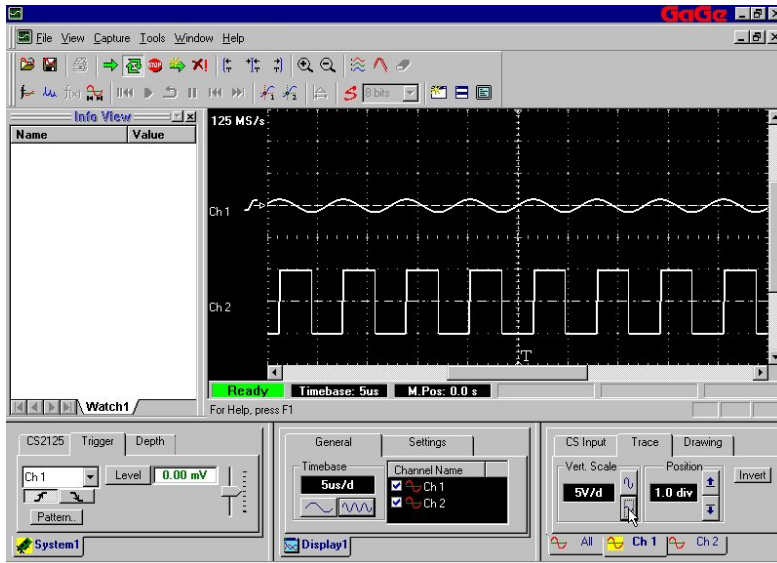
## Change the Vertical Scale of Channel 1 to 5V/div

- 1 Click on the **Ch 1** tab in the Channel control.
- 2 Click on the **Trace** tab.




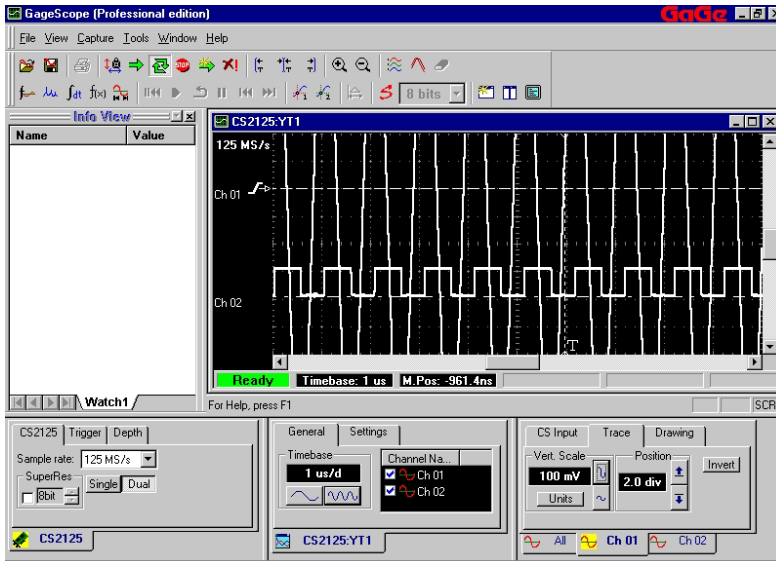
The Vertical Scale is currently set to **1V/d** (1 Volt per division). In other words, a sample point that measures 1V is displayed as 1 division high, a division being one square in the Display Window's grid.

- 3 Click repeatedly on  until the vertical scale is set to **5V/d**.




## Reduce the Vertical Scale of Channel 1 to 100mV/div

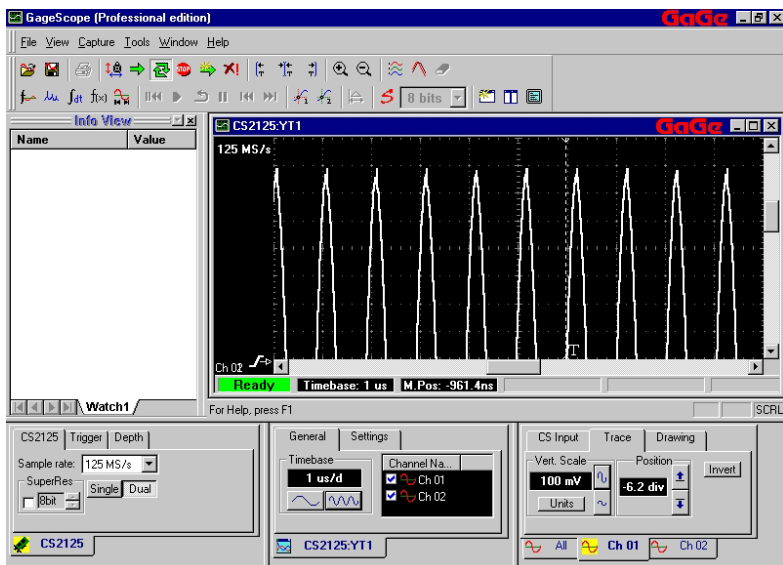
- 1 Click repeatedly on  until the vertical scale is set to 100mV/d.



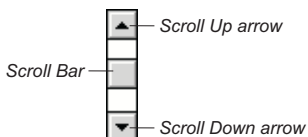
## Scroll to See the Positive and Negative Peaks of Channel 1

When you increased the vertical scale to 100mV/div, the signal peaks became hidden from view. To see the peaks, you can use the vertical scroll bar.

- 1 Click repeatedly on **Scroll Up**  until you see the positive peaks of channel 1.



- 2 Alternatively, instead of clicking the up or down scroll arrow, you can drag the scroll bar itself to bring it to a new location. The Display Window is updated dynamically as you drag the scroll bar.




Drag the scroll bar down until you see the bottom of Channel 1.

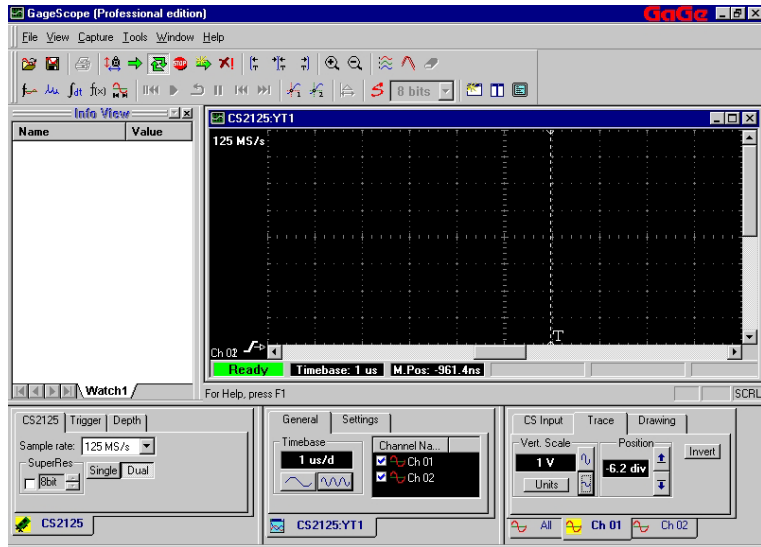
This feature makes your GageScope®/CompuScope combo one of the most powerful oscilloscopes in the world. You are able to capture a signal with very high resolution and view a portion of it.

## Change the Vertical Scale of Channel 1 back to 1V/div

- 1 Click on the **Ch 1** tab in the Channel control.
- 2 Click on the **Trace** tab.

- 3 Click repeatedly on  until the vertical scale is set to **1V/d**.

The signal may seem to disappear.



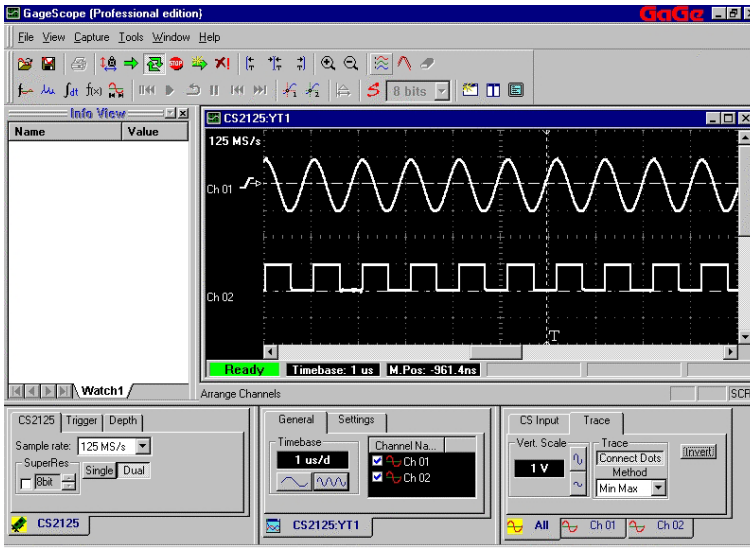
The signal is outside of the visible Display Window area. You can fix this easily with the Arrange Channels command, as demonstrated on the following page.



## Re-arranging Channels Automatically

After returning the vertical scale back to 1V/div, the signals are not positioned nicely for viewing. An easy way to fix this is by using the **Arrange Channels** button, which automatically re-organizes visible channels in order of channel number.

- 1 Click on the **Arrange Channels** button  in the toolbar.



**Note that Input Range is not linked to the Vertical Scale setting.**

This has been done to allow you to take advantage of the high resolution offered by CompuScopes. You can capture a signal with  $\pm 1\text{V}$  range and still view it with a vertical scale of 50 mV/div.

All digital oscilloscopes on the market are limited to 8 bit resolution and can digitize the signal with 256 levels only. This way, they can fit all 256 levels on screen. CompuScopes, which offer up to 16 bit resolution, digitize the signal with up to 65,536 levels. There is no screen in the world which can display that many pixels. Hence, the ability to display only a portion of the capture signal's dynamic range is necessary.

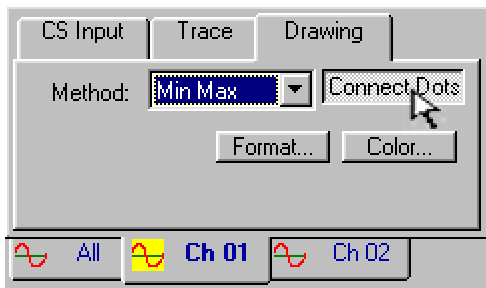
# Connect Dots

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By default GageScope® draws a line between each sample point in order to display a continuous waveform. To have GageScope® display the acquired data as only points, you can toggle the **Connect Dots** button in the **Drawing** tab of the Channel Control.

## Turn off the Connect Dots Setting of Channel 1

- 1 Click on the **Ch 1** tab in the Channel control.
- 2 Click on the **Drawing** tab. By default the **Connect Dots** button is on.
- 3 Click on **Connect Dots** to turn it off. Instead of a single line, channel 1 is displayed as points.



## Turn Connect Dots Back On

- 1 Click on **Connect Dots** once again to turn this option back on.

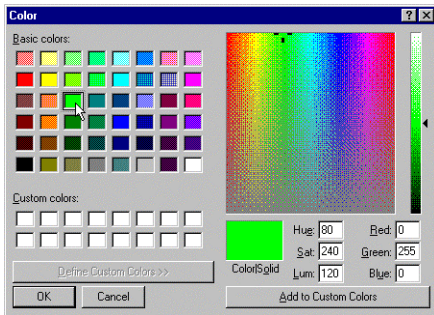
# Channel Color

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The **Color** button changes the channel color via the standard Windows color dialog.

## Change the Color of Channel 1 to Green

- 1 Click on the **Ch 1** tab in the Channel Control (at the bottom of the control).
- 2 Click on the **Drawing** tab.
- 3 Click on the **Color** button. The standard Windows color dialog appears.



- 4 Click on the green color that is in the third row, third column.
- 5 Click the **OK** button.

## Change the Color of Channel 1 back to Yellow


- 1 Click on the **Color** button in the Drawing tab of the Channel Control.
- 2 Choose the yellow that is in the second row, second column.

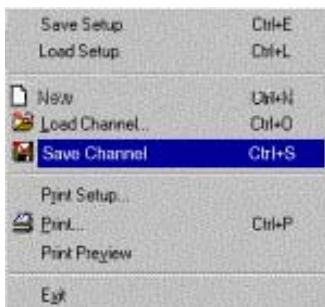
# Saving and Loading Channels

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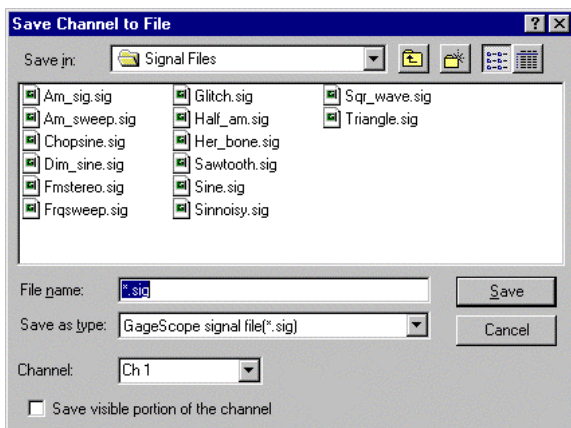
GageScope® allows you to save waveforms to disk in the GageScope® SIG file format. In the following exercise, you will save channel 1 to the Signal Files folder of your GageScope® directory, then load the saved channel.

## Save Channel 1 to Disk

- 1 Choose **Save Channel** from the File Menu, or click on **Save Channel**  in the toolbar.



- 2 The “Save Channel to File” dialog appears.



- 3 At the bottom of the dialog, next to “Channel,” GageScope® gives you the option to choose which channel you want to save. In this example, **Ch 1** is listed.


If you wish, you can choose another channel to save by clicking on the Channel drop-down menu. Note that you can also save all visible channels at once by selecting **All** in the Channel list.

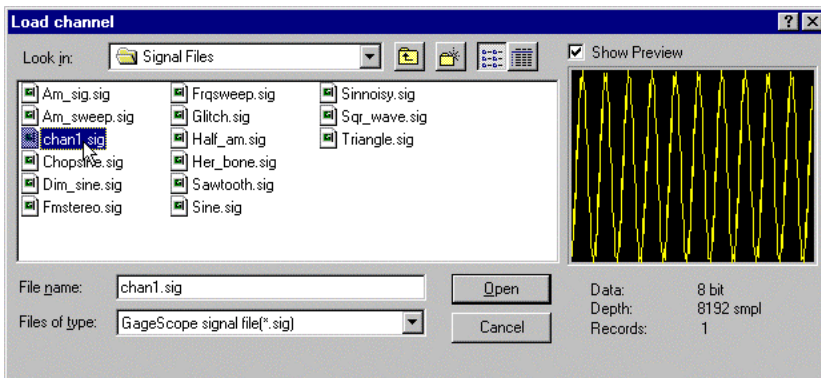
- 4 You can also specify that only the visible portion of the file be saved. To do this, click on the checkbox:

☐ Save visible portion of the channel

- 5 Enter the name **chan1.sig** in the “File name” section of the dialog box.
- 6 By default, GageScope® will save your files in the **Signal Files** folder. This folder contains sample signal files.
- 7 Click **Save**.

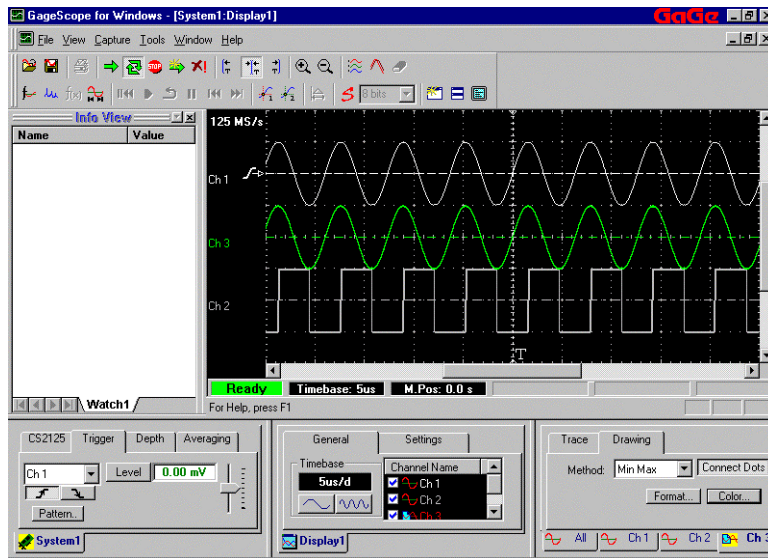
## Load “chan1.sig” from Disk

- 1 Choose **Load Channel** from the File menu; or, click on **Load Channel**  in the toolbar. The Load Channel dialog appears.
- 2 If you are not already in the Signal Files folder in C:\Gage\GageScope\Signal Files, move to the folder now.
- 3 Click on the file **chan1.sig**.



#### 4 Click **Open**.

The channel you loaded should appear at the zero line of the Display Window, with a channel number of 3.

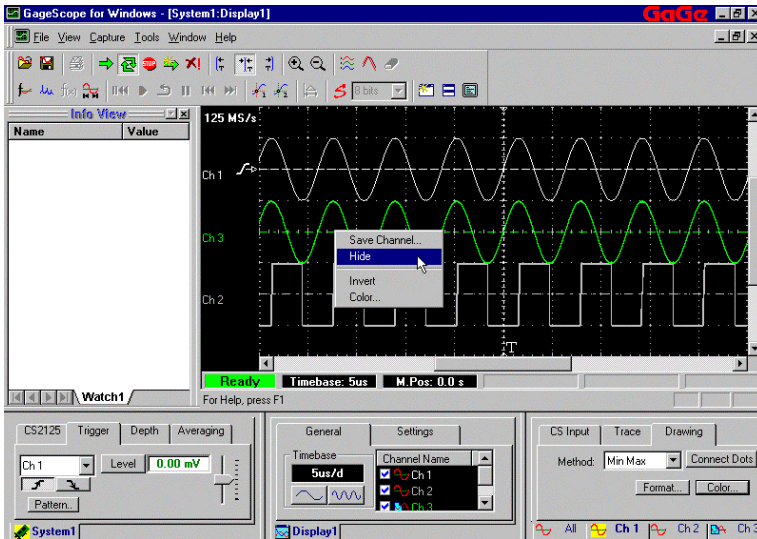


Once a channel is loaded, you can change many of its settings just like any other channel. Note, however, that this channel is not “live,” in that it is not linked to any live signal source via a CompuScope card.

### Hide Channel 3

- 1 Position the mouse pointer on the zero line of channel 3.
- 2 Click with the **right mouse button** to bring up the channel context menu.

- 3 Choose **Hide** from the context menu.



- 4 Channel 3 disappears from the display window. While channel 3 remains in the list of channels in the Display Control (unchecked), it no longer appears as a tab in the Channel Control.

## Note

You can also delete channels, but only math and file channels—you cannot delete live signals originating from a CompuScope card. 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**.

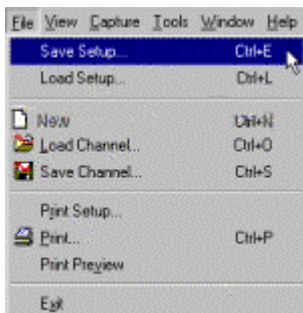
# Saving and Loading Setups

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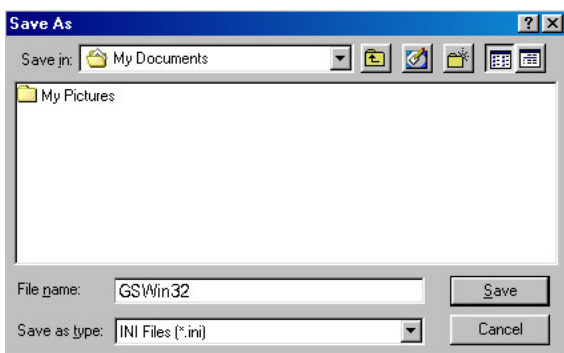
GageScope® allows you to save your current setup to so that you can load it again later. A Setup file contains all of the GageScope® settings which were current at time of saving. The Setup file has the extension .INI. In the following exercise, you will save the current GageScope® setup, make a change to the current setup, and then load the previously saved setup file.

## Save the Current Setup

- 1 Choose **Save Setup** from the File Menu.



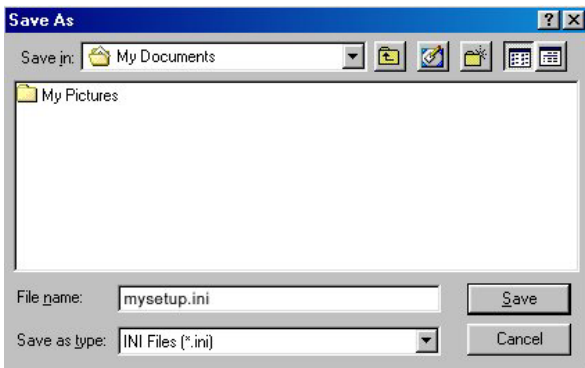
- 2 The Save Setup dialog appears.



The default file name is GSWin32.



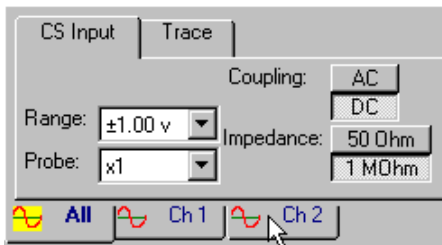
- 3 In the “File name” field, type in **mysetup.ini**.



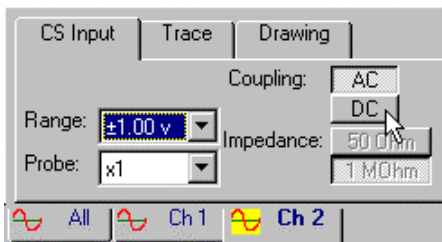
- 4 Go to the folder where you would like to save your Setup file.
- 5 Click **Save** to save the Setup file.

## Make a Change to the Current Setup

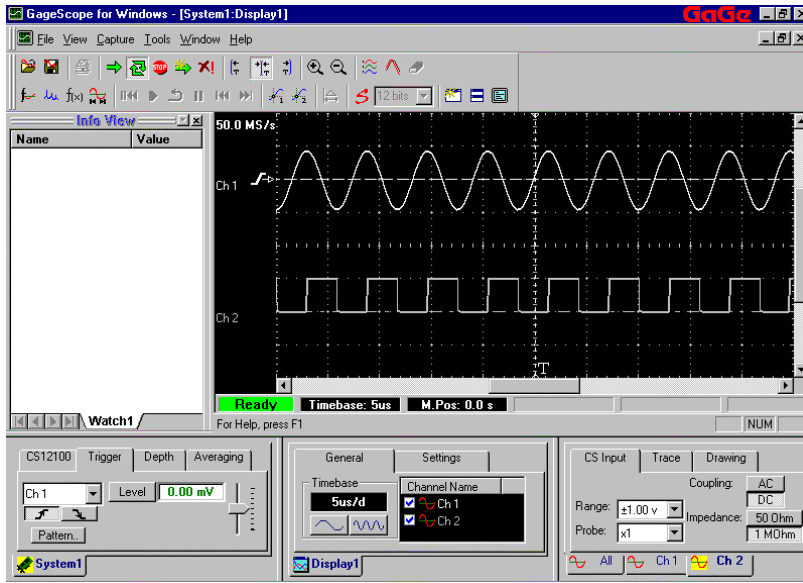
- 1 Click on the **Ch 2** tab in the Channel control.



- 2 Click on the **CS Input** tab. The Coupling should be set to **AC** from one of the previous exercises.
- 3 Click the **DC** button.



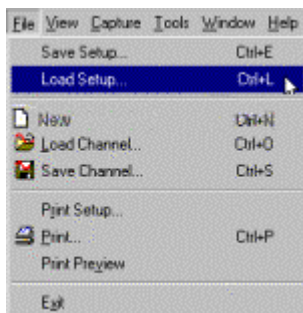
- 4 The coupling on Ch 2 is now DC.



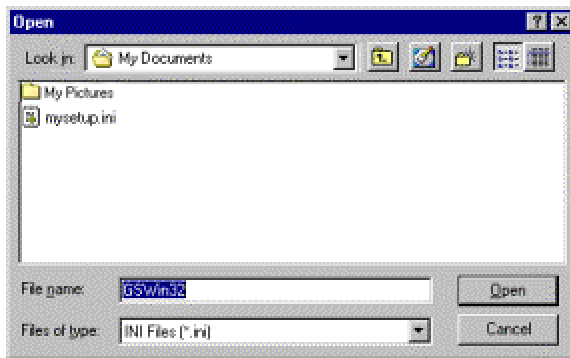
- 5 Click **Stop**  in the Toolbar or in the Capture Menu.

## Load the Previously Saved Setup File

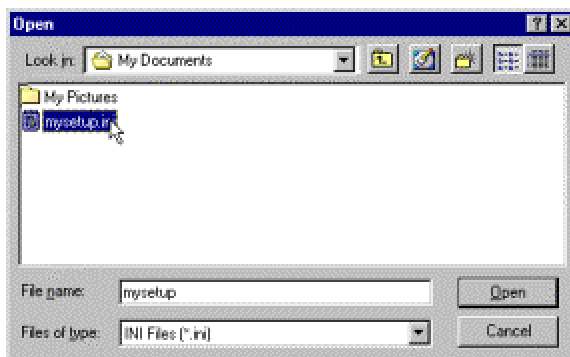
- 1 Choose **Load Setup** from the File menu.




- 2 The Load Setup dialog appears.



- 3 Go to the folder where you saved your Setup file and choose **mysetup.ini** from the list.



- 4 Click **Open** to load the Setup file.

- 5 Click the Continuous Capture button  in the Toolbar. Your previous settings are back—Channel 2's coupling is again set to AC.

