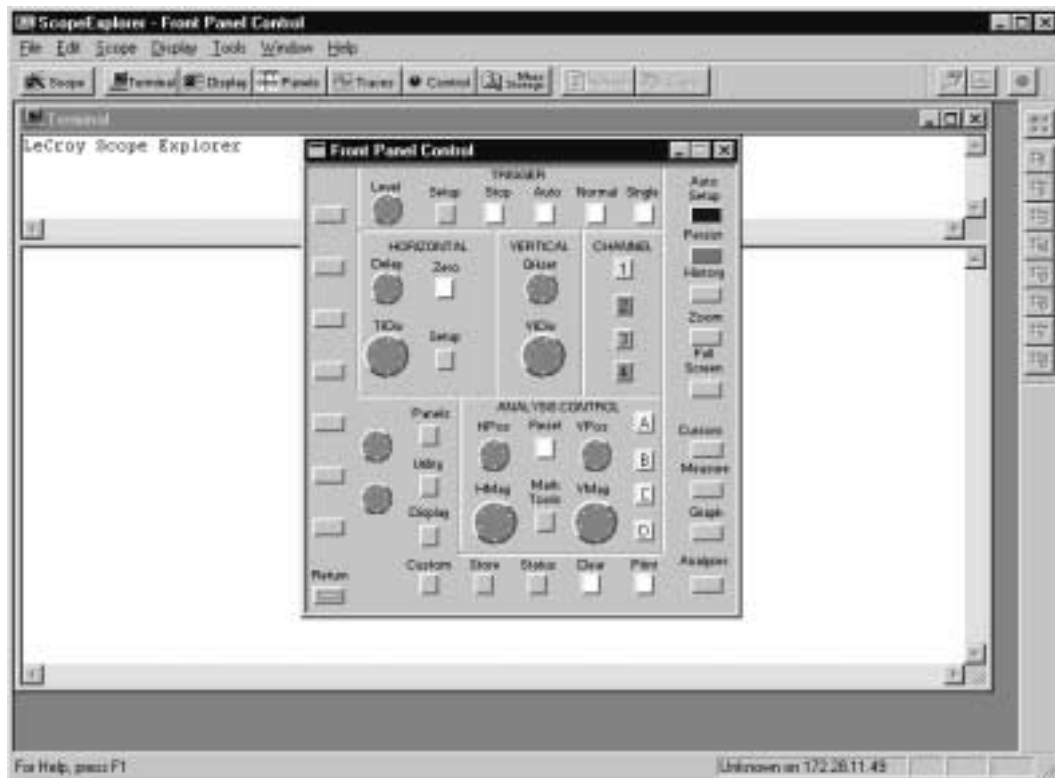


# Introductory Information on Operation of the LeCroy LT342 Waverunner Digital Oscilloscope Selected from the Manuals

*First Things...First*



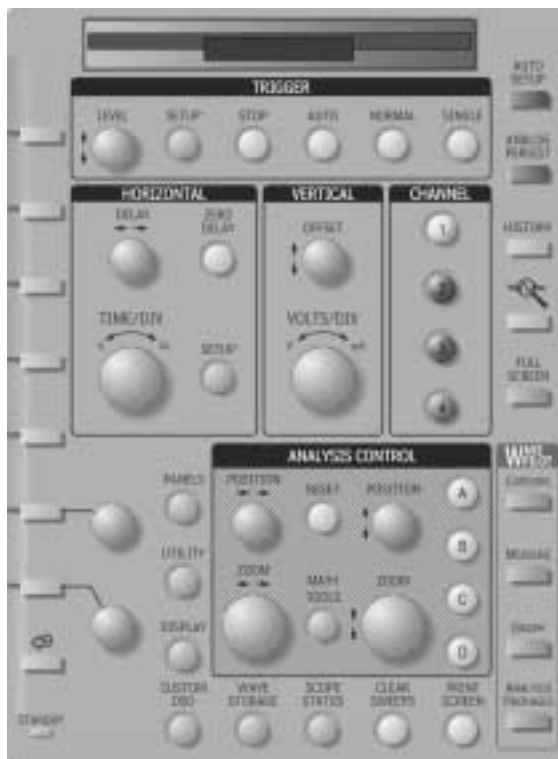
**ScopeExplorer now has a virtual front panel to allow full control of remote scopes.**

**ActiveDSO**, which works on any PC running Windows 95, 98, NT, 2000, or Me, enables you to exchange data with a variety of Windows applications or programming languages that support the ActiveX standard, such as MS Office, Internet Explorer, Visual Basic, Visual C++ and Visual Java. ActiveDSO hides the intricacies of programming for each of these interfaces and provides a simple and consistent interface to the controlling application. You can also visually embed ActiveDSO in any OLE automation compatible client and use it manually without programming. You could, for example, generate a report by importing scope data straight into Excel or Word, analyze your waveforms by bringing them directly into Mathcad, archive measurement results "on the fly" in a Microsoft Access database, and automate tests using Visual Basic, Java, C++, or Excel (VBA).

Visit our web site at <http://www.lecroy.com/software> to download these and other free software applications.

## UP AND RUNNING

### Get to Know Your WavePro DSO – Front Panel



WavePro DSO main front panel controls and features.

### WavePro DSO Controls

#### Trigger Knobs:

**LEVEL** Selects the trigger threshold level. The Level is indicated on the display grid and at the bottom of the screen.

#### Trigger Buttons:

**SETUP** Activates the trigger setup menu to select the trigger type and the trigger conditions. Graphics shown at the bottom of the display indicate the trigger setup.

**STOP** Prevents the scope from triggering on a signal.

**AUTO** Triggers the scope after a selectable time-out, even if the trigger conditions are not met.

## *First Things...First*

**NORMAL** Triggers the scope each time a signal is present that meets the conditions set for the type of trigger selected.

**SINGLE** Arms the scope to trigger once (single-shot acquisition) when the input signal meets the trigger conditions set for the type of trigger selected.

### **Horizontal Knobs:**

**DELAY** Horizontally positions the scope trace on the display so you can observe the signal prior to the trigger time. **DELAY** adjusts the pre- and post-trigger time.

**TIME/DIVISION** Sets the time/division of the scope timebase (acquisition system). LeCroy SMART Memory automatically optimizes the memory and sample rate for maximum resolution.

### **Horizontal Buttons:**

**ZERO DELAY** Sets the horizontal delay to zero. The trigger point is positioned at the start of the display grid.

**SETUP** Activates the TIMEBASE menu to allow you to select acquisition conditions, including the sample mode, maximum memory length, external clocking, etc.

### **Vertical Knobs:**


**OFFSET** Adjusts the vertical offset of the channel selected by pressing one of the Channels buttons (1, 2, 3, or 4).

**VOLTS/DIV** Adjusts the Volts/Division setting (vertical gain) of the channel selected at the press of one of the "Channel" buttons (1, 2, 3, or 4).


### **Channel Buttons:**


**1, 2, 3, 4** These buttons activate the menu that lets you change the channel's setup conditions including coupling, gain, and offset. They are used also to select multiple grids, to automatically set the gain (FIND), or to automatically display a zoom of the signal. Press twice to toggle the trace on and off.

### **Analysis Control Knobs:**

 **POSITION** Adjusts the horizontal position of a zoom trace on the display. The zoom region is highlighted in color on the source trace.

 **ZOOM** Adjusts the horizontal zoom (magnification factor) of the selected zoom trace.

 **POSITION** Adjusts the vertical position of the selected zoom trace on the display.

 **ZOOM** Adjusts the vertical zoom (magnification factor) of the selected zoom trace on the display.

## Analysis Control

### Buttons:


- A, B, C, D** Activates a setup menu for the selected zoom trace so you can select a source trace for the zoom: either a channel trace or another zoom trace. Press A, B, C, or D to set up signal processing, including averaging, integration, re-scaling, and other math (signal processing) functions. Press a second time to turn the trace off.
- RESET** Resets the zoom factors and clears the results from signal processing (math operations).
- MATH TOOLS** Provides access and an overview of the setup of zooms and signal processing on all zoom traces.

### Wavepilot Buttons:

- CURSORS** Turns on cursors to measure signal details. Select from a wide variety including absolute and relative cursors, with readout in volts or dBm.  
**(toggle switch)**
- MEASURE** Automatically displays up to 26 signal parameters, and it is context sensitive so the parameters on signals, histograms, and FFTs are relative. You can easily set up a group of 5 custom parameters with statistics, or pass/fail tests.  
**(toggle switch)**
- GRAPH** Displays a histogram or trend, or selects a Track View or FFT spectrum.
- ANALYSIS PACKAGES** Directly accesses application-specific solutions. Get immediate access to Jitter and Timing Analysis, telecom mask testing, and other optional signal analysis solutions.

## Special Features

### Buttons:

- AUTO SETUP** Automatically sets the scope's horizontal timebase (acquisition system), vertical gain and offset, as well as trigger conditions, to display a wide variety of signals.
- ANALOG PERSIST** Provides a three dimensional view of the signal: time, voltage, and a third dimension related to the frequency of occurrence, as shown by a color-graded (thermal) or intensity-graded display.
- HISTORY** Maximizes the update rate and stores the history of up to 8000 acquisitions, including trigger time, with 1 ns resolution. Scan through the history and view, measure, and analyze your signal's characteristics.
- QUICKZOOM** Automatically displays magnified views of up to four signal inputs on multiple grids. With four input signals, the signals are displayed along with four zoom traces, each on its own grid.  
  
**(toggle switch)**
- FULL SCREEN** Activates a display mode that maximizes the screen area used to display the signal for easier viewing of signal details.
- CUSTOMDSO** Store your own custom applications in the scope's NVRAM. Create them offline, and load and access them by means of the CustomDSO button.

### General Control

#### Buttons:

- PANELS** Store scope setting files (Panels) to internal non-volatile virtual disk (VDISK) or to PC Cards and diskettes. These Panel files can be recalled to configure the scope to the previously stored settings.
- UTILITY** For setup of scope features including hardcopy devices and formats, date and time, mass storage devices, and remote control interfaces.
- DISPLAY** For setup of a wide variety of display characteristics including, X-Y mode, persistence, custom trace colors, bold data points, etc.
- WAVE STORAGE** Store or recall waveform data to optional PC Cards or to a diskette.
- SCOPE STATUS** Displays the status of the scope including installed options, available memory, serial number, as well as most setup conditions including the acquisition system, and general waveform information.
- CLEAR SWEEPS** Clears data from multiple sweeps (acquisitions) with the exception of the last acquisition including: persistence trace displays, averaged traces, FFT averaging, etc. During waveform readout, cancels readout.
- PRINT SCREEN** Prints the screen displayed to a diskette or to the optional: internal printer, PC Card Hard Drive, memory card, or network printer.

### Soft Keys and

#### Control Knobs:

- Two control knobs linked to display screen** These control knobs are context sensitive controls whose function depends on the feature selected. They are used to control measurement cursors, navigate through menus, and select items and conditions displayed in menus.
- 7 buttons linked to display screen** These buttons are context sensitive buttons whose function depends on the features selected and the menu displayed directly to the left of the buttons.
- 1 button with Return Icon** This button returns the display to the previous menu, or clears the menu from the screen if the top-level menu is being displayed.
- STANDBY Lamp:** The STANDBY lamp indicates when the scope has placed itself in standby (screen saver) mode. In this mode, current settings are retained. The lamp does not indicate the standby mode that is induced when you turn off the power switch.


### Install and Power Up

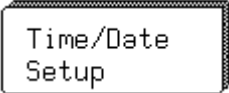


1. Before powering up, check that the local power source corresponds to the *WavePro* DSO's power range (see page xxxvi).
2. Use the cable provided to connect the scope to the power outlet through its rear panel receptacle (see next page).
3. Turn the scope on by pressing the On button at the bottom left-hand corner of the *WavePro* DSO front panel.

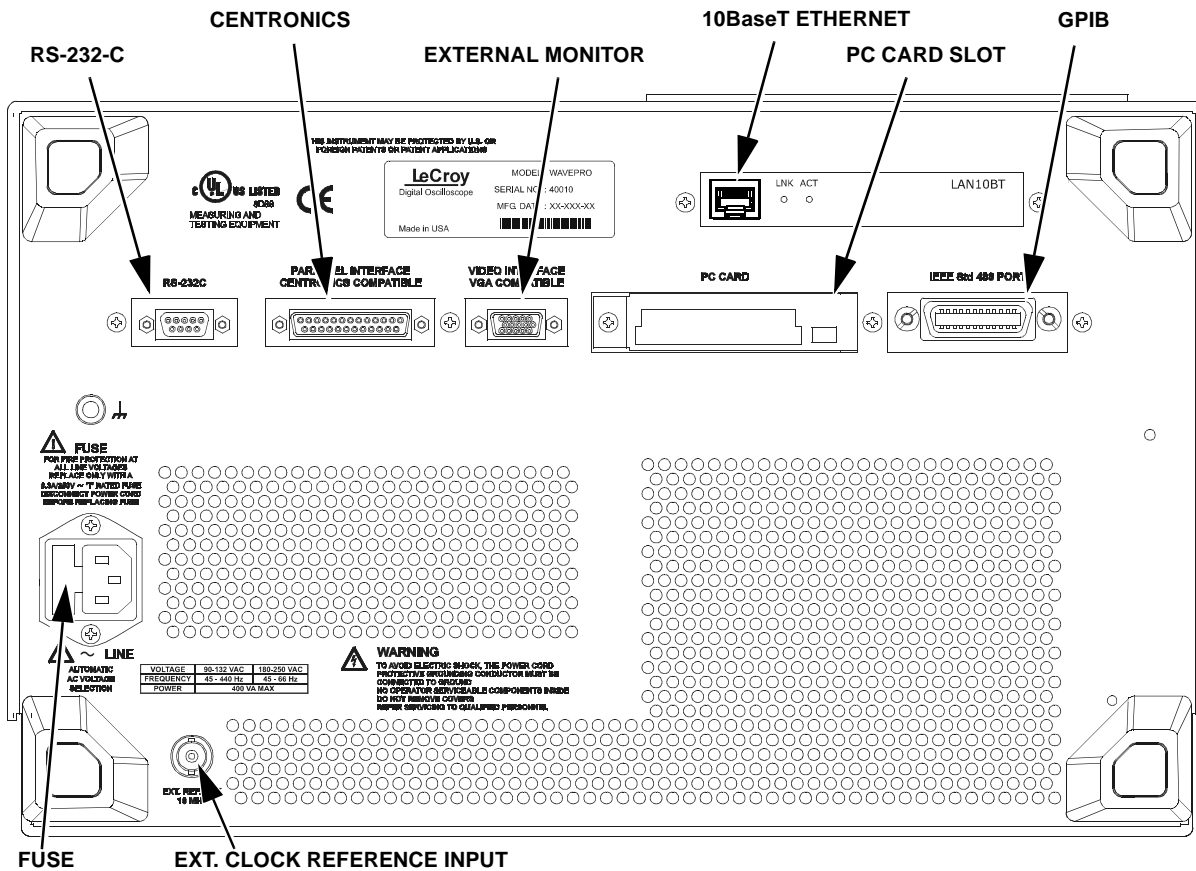
Before a display appears, the instrument will automatically perform hardware and software self-tests, followed by a full system calibration. The front panel STANDBY LED will be lit during this sequence. The full testing procedure will take about 10 seconds, after which a display appears.

UTILITY

4. Press  to display the UTILITIES on-screen menus.

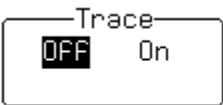
5. Then press the button beside the menu  to set the time and date.

Get to Know Your WavePro DSO – Back Panel



Use the RS-232-C, GPIB, and Ethernet ports to connect your WavePro DSO scope to a computer or terminal, the external monitor port to display your waveforms on another monitor, and the Centronics port to connect compatible printers or other devices. Use the PC Card slot for the PC Memory Card and portable Hard Disk options, and the BNC input for external reference clock signal.

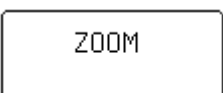
## TO NAVIGATE THROUGH MENUS

Menus such as  enable you to perform actions or adjust settings.



The menu button beside each displayed menu controls that menu.

Longer menus that span the breadth of two buttons are controlled by both buttons.


Capitalized menus —  for example — perform specific actions.


The two menu knobs work together with the two menu buttons beside them.


Combinations of knobs and buttons control continuously adjustable variables. The button selects or changes the variable, while the knob adjusts its value.

Menus are grouped and shown together according to their function. Press a button or turn a knob to select a particular menu or an item on a menu. Travel up or down in the menu list and change the selection. Or change values and settings.

## PANELS

The darker, labeled buttons also play a role in menu selection; for example,  was used to select the menus for initialization. When you press any one of these, it offers access to related menus in its group.

Menus with shadows  lead to other menus: Press their buttons to display those menus.

Press  to return to a shadowed menu. Also use this button whenever you wish to go back to the previous menu display.




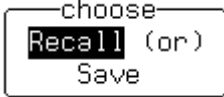
Arrows on the side of a long menu indicate that you can scroll up or down the menu list. Press one or the other of these menus' buttons to move in the desired direction, and to view or select any menu item not displayed. Arrows disappear when you reach the beginning or end of the menu list.

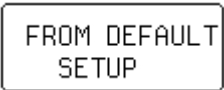
### Initialize

Initialize your WavePro scope to its basic default settings:

PANELS

1. Press  to display the PANEL SETUPS menu group.


2. If **Recall** is not selected, press the button once to select it: 

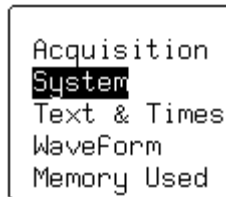
3. Then press the button beside .

Initialize to WavePro DSO default settings whenever you wish to clear your settings and make a fresh start on a new measurement.

### Check Your WavePro DSO System

SCOPE STATUS

1. Press  to show the STATUS menus.



2. Press the top button to highlight and select **System**. The screen will show your WavePro DSO's serial number, the version of software installed and the date of its release, as well as a full list of your currently installed software and hardware.
3. Contact LeCroy customer service immediately if any of the options you ordered have not been installed.





## **PART ONE**

# **GETTING STARTED**

This part of the manual covers the main *WavePro* DSO features and explains, step by step, how to use them. You'll get to know your scope and start working with it quickly and effectively. Capture and view waveforms. Zoom and scroll. Learn the art of display. Use math and measurement tools. Document your work.

## **CHAPTER ONE: *View Your Waveform***


In this chapter, see how


- *To select the input signal channel*
- *To use menus and controls for basic operations*
- *To find your way around the display*
- *To adjust the timebase, gain and position of the signal*
- *To zoom — manually and automatically*
- *To set up the timebase*
- *To set signal coupling*
- *To calibrate and use the passive probe*
- *To set up the CAL and BNC outputs*

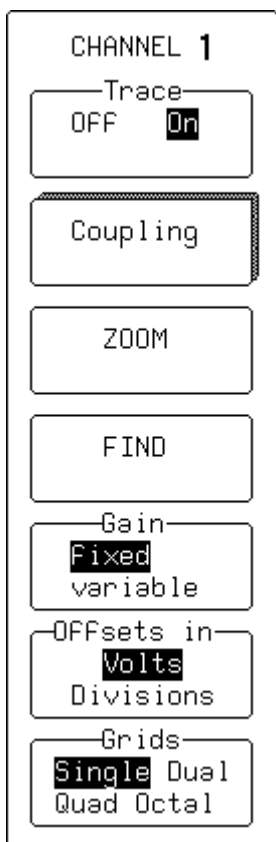
## View Your Waveform

Take these steps to capture and view your signal; set time and volts per division; zoom and auto-scroll:

1. Connect your signal to the *WavePro* DSO (Channel 1 input for this example).

2. Press the blue  button to automatically set the (Edge) trigger level, timebase, and vertical settings for display of the input signal. Press it again to confirm the action.

3. Press  to select CHANNEL 1 and display the basic channel 1 vertical controls.



4. Use these menus in the steps on the following pages to adjust the signal's trace on the screen.



Turns Channel 1 on or off.

**TIP: Press  twice to turn the channel on or off.**



Accesses the CHANNEL Coupling menus. See page 1-9.



Automatically makes a zoomed trace of the signal. Use the vertical POSITION knob to move the trace so that it is clearly visible. Use the vertical ZOOM knob to adjust its expansion vertically. See page 1-7.



Automatically sets gain and offset, and "find" the signal.

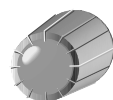


Selects fixed or variable gain. Select "variable" to control the channel's gain continuously. See page 1-4.

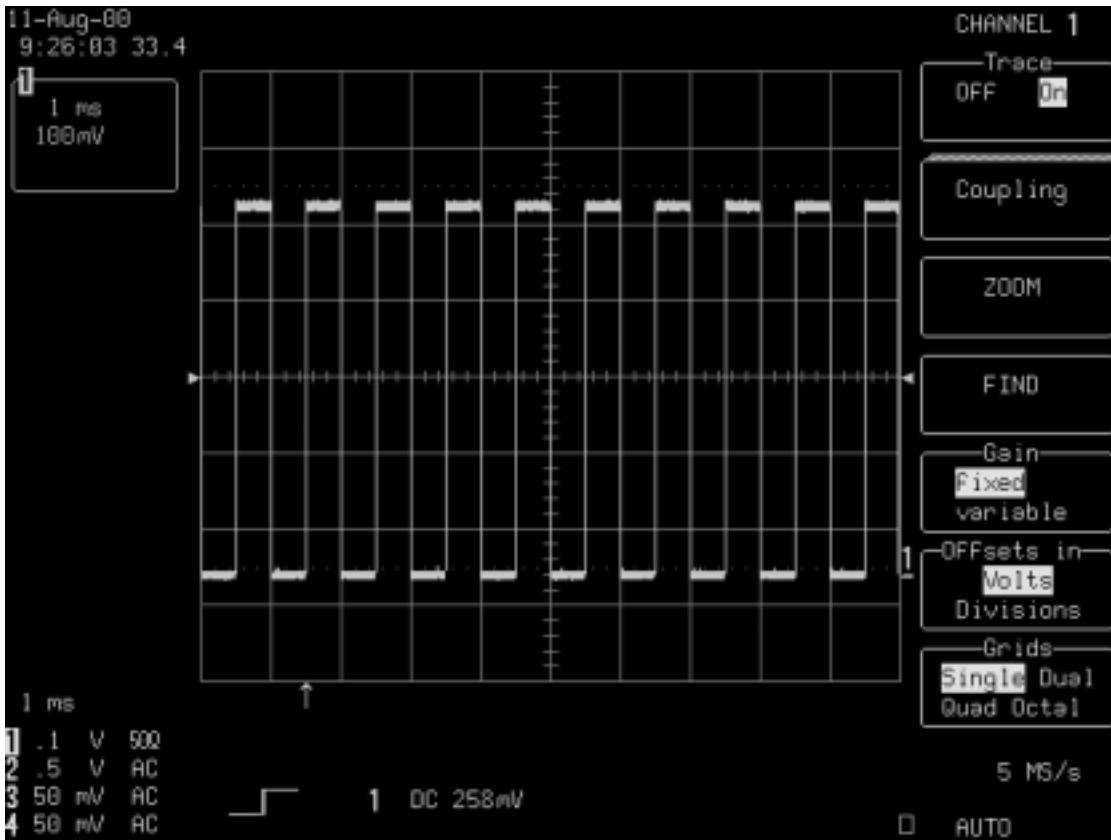


Changes the offset display to volts or divisions.

**TIP: With AUTO SETUP you can automatically set up signals in the 5 mV to 40 V range with a frequency of  $\geq 50$  Hz and a duty cycle as small as 0.1%.**



Selects the grid style and number. See Chapter 3, "Display Persistence."



To Find Your Way around the WavePro DSO Display

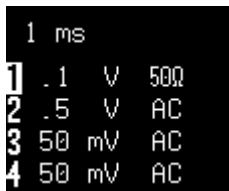
11-Aug-00  
9:37:14 33.2

Real-Time Clock field: powered by a battery-backed real-time clock, it displays the current date and time.

1 ms  
100mV

Displayed Trace Label indicates for each channel displayed the time/div and volts/div settings and cursor readings, where appropriate.

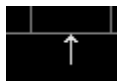
## View Your Waveform



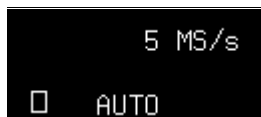
*Acquisition Summary field: timebase, volts/div, probe attenuation, and coupling for each channel, with the selected channel highlighted.*



*Trigger Level arrows on both sides of the grid that mark the trigger voltage level relative to ground level.*



*Trigger point is an arrow indicating the trigger time relative to the trace.*



*Trigger Status field shows sample rate and trigger re-arming status (AUTO, NORMAL, SINGLE, STOPPED). The small square icon flashes to indicate that an acquisition has been made.*



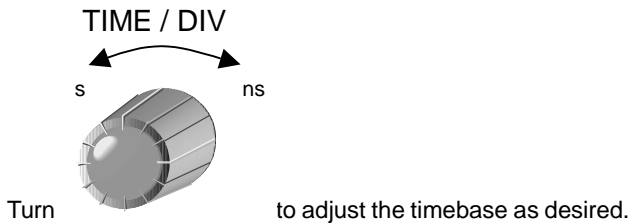
*Trigger Configuration field contains an icon indicating the type of trigger, and information on the trigger's source, slope, level and coupling, and other information when appropriate.*



*Trace and Ground Level shows the trace number and ground level marker.*

- A. Other display areas include the Time and Frequency field, located below the grid and stating time and frequency relative to cursors, and a Message field placed above the grid and reserved for special messages. For more about the display, see Chapter 3, "Display Persistence."

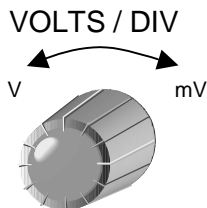
### Use Time/Div to Adjust the Timebase



**NOTE:** AUTO SETUP operates only on channels that are turned on, unless no channels are turned on. Then all channels will be affected. When more than one channel is turned on, the first channel in numerical order with a signal applied to it will be automatically set up for edge triggering.

The time per division is set in a 1-2-5 sequence. The WavePro DSO automatically adapts itself to use the maximum sampling rate whenever the timebase is changed. The selected time/div setting is shown in the trace label at the top left portion of the screen, and the sampling rate in the trigger status field at the bottom right-hand corner.

### Adjust Sensitivity and Position




1. Turn [knob] to reduce the vertical gain sensitivity. The volts/div setting is shown in the Channel 1 trace label.

The next two steps can be taken (if not already) when you wish to fine tune the vertical gain and get a better vertical resolution:

2. Fine tune the vertical gain by selecting "variable" from the Gain menu (see page 1-1).
3. Now turn the VOLTS / DIV knob through several complete rotations, so that the entire signal reaches from top to bottom of the grid. Filling the grid in this way, you can use the full range of available digitizing levels.

4. Use [knob] to center the waveform on the grid.


UTILITY

**TIP:** Press  to select Special Modes. Then select the Channels menu to choose

**In:** Set the offset of a gain (VOLTS/DIV) change in volts or vertical divisions (this is in volts, by default).


**Automatic Recalibration:** Turn this feature on or off (default is "On"). "Off" may speed capture, but time calibration is not certain during the capture period.

**Global BWL:** This controls the global bandwidth limit. When On, the chosen bandwidth applies to all channels. When Off, a bandwidth limit can be set individually for each channel.



## Set Up the Timebase

SETUP

1. Press  in the **HORIZONTAL** control group to access the TIMEBASE menus.

TIMEBASE

T/div 20 ns

800

samples at

4 GS/s

(250 ps/pt)

For 200 ns

---

Sampling

**Single Shot**

RIS

---

Sample Clock

**Internal**

ECL 0V TTL

---

Channel Use

**4** 2 1

Automatic

---

Sequence

**OFF** On

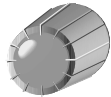
---

Record up to

4M

samples

2. Use these menus to set up the timebase in single-shot mode. See Chapter 7, "A Question of Timebase," for more on the sampling modes.



**Single-Shot** sampling displays data collected during successive single-shot acquisitions from the input channels — it captures nonrecurring, or very low repetition-rate events, simultaneously on all input channels.

Selects **Internal** or external — **ECL, 0V, TTL** — clock modes. Select internal unless using an external clock signal. See Chapter 7, "A Question of Timebase," for external clock. See also "Pairing Channels" in Chapter 8.

Switches sequence mode **On** or **Off**. Use the knob to choose the number of segments. See Chapter 7, "A Question of Timebase," for sequence sampling.

Selects the maximum number of samples to be acquired, using the menu knob; and sets the default 100k, using the menu button.

## Zoom and Scroll Automatically

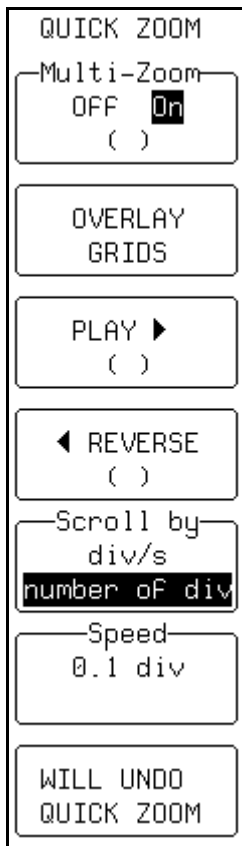
Use ZOOM to see more detail on your signal. The display will show the original signal and its zoomed copy.




1. Press **QUICK ZOOM**  to display the TRACE A menus.


The menu shown on the next page will be displayed.


2. Use these menus to scroll back and forth through the full length of one or all of your zoom copies.





MULTI-ZOOM unifies the control of all zoom traces, while AUTO SCROLL walks the zoom trace or traces across the referenced trace.


- 


When **Off**, only the active zoom trace is controlled. When **On**, all displayed zoom traces (A, B, C, D) are simultaneously controlled (automatically) with Auto Scroll and (manually) with the horizontal **ZOOM** and **POSITION** knobs. See the next page for more on Multi-Zoom.
- 


Press to superimpose one grid over the other.
- 

Scrolls the zoom trace from right to left of screen. When playing, the menu is labeled "STOP (PLAYING)": Press to stop.
- 

Scrolls the zoom trace from left to right of screen. When playing, the menu is labeled "STOP (REVERSING)": Press to stop.
- 

Scrolls by divisions per second or number of divisions. Use **div/s** to scroll continuously for viewing. Use **number of div** for waveform processing, especially Pass/Fail testing.
- 

Turn the knob to set the scroll speed. When scrolling by divisions, "10 div" will step the zoom trace "grid-page" by "grid-page" across the length of the referenced trace.
- 

Press the menu button to cancel quick zoom.
- 

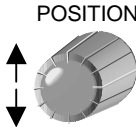
Press to stop scrolling and return to the previous menu displayed.



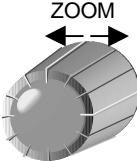
## View Your Waveform

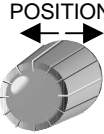
**TIP:** Think of zoom as an extra timebase that offers alternative sweep speeds. You can display as many as four zooms at once.

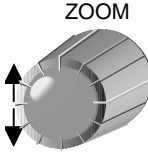
### Use the Position and Zoom Controls

1. Turn  to place Trace A vertically on the grid.

When using more than one grid, turn POSITION to move traces from one grid to another.

2. Turn  to adjust the expansion factor and increase the amount of zoom.

3. Turn  to move the zoomed region of the trace.

4. Turn  to vertically expand, or reduce, the zoom trace.

**TIP:** The smaller *WavePro* DSO knobs are rate sensitive: the faster you rotate them, the greater the resulting change per degree of rotation.

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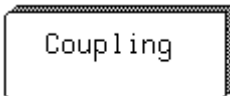
### To ZOOM AND MULTI-ZOOM

- A. You can zoom several traces from a single waveform to obtain precise timing measurements and to improve the time resolution on your displayed waveform. For instance, on a waveform composed of two pulses separated by a long delay, you could make Trace A a zoom of the first pulse, and Trace B a zoom of the second.
- B. **Multi-Zoom** allows you to move the zoomed region of the waveform along two or more different traces, or two or more regions of the same trace, simultaneously. When you activate multi-zoom, the horizontal zoom and position controls apply to all displayed traces — A, B, C, and D — allowing you to view similar sections of different traces at the same time. The vertical sensitivity controls still act individually on the traces.
- C. When trace labels have dotted top and bottom edges, like the one at right, this indicates that their traces are multi-zoomed.



## View Your Waveform

### Set the Coupling

1. Press  and then the button for  to display the coupling menus.



2. Use these menus to set input signal coupling and grounding, the channel bandwidth limit, and the probe attenuation.



Selects the signal coupling.



Moves your selection down the list. When at the bottom, as here, the down arrow disappears and this button becomes inactive.



Select **NORMAL** to set offset, volts/div, and input coupling to display ECL signals. Press again; settings for TTL signals are given. Press a third time; settings will return to those of the last manual setup.



Press to turn the bandwidth limit **Off** or reduce the bandwidth to 200 MHz or 20 MHz. Reduces signal and system noise and prevents high frequency aliasing. Global BWL means that the limit set will apply to all channels. BWL means that a limit can be individually set for each channel. See the TIP on page 1-4 for how to set these using SPECIAL MODES.





Sets the probe attenuation factor for the input channel. The buttons scroll up or down, while the knobs scroll the selector up and down the list. LeCroy's ProBus® system automatically senses probes and sets their attenuation. This menu then changes to indicate the type of probe attached and its attenuation factor. See the upcoming pages for more on probes and ProBus.



#### NOTE:

- **AC position:** signals are coupled capacitively, the input signal's DC component is blocked, and signal frequencies below 10 Hz are limited.
- **DC position:** signal frequency components are allowed to pass through, and an input impedance of either 1 MΩ or 50 Ω can be selected. The maximum dissipation into 50 Ω is 0.5 W. Whenever this is attained, inputs will automatically be grounded. "Grounded" will be highlighted in the "Coupling" menu and an overload message will be displayed in the Acquisition Summary field. Reset by removing the signal from the input and reselecting "DC50Ω."

## Set Up for CAL and BNC Signals

- UTILITY
1. Press .
  2. Press the button to select  and display the CAL BNC OUT menus.

CAL BNC OUT

mode

CAL signal

OFF

Pass/Fail

Trigger Out

Trigger Rdy

SET TO 1 kHz

1 V SQUARE

Shape

Square

Pulse(25 ns)

Amplitude

1.00 V

into 1 MΩ

Frequency

1 kHz

3. Use these menus to choose the type of signal put out at the CAL output. Set the frequency, amplitude, and pulse shape of the calibration signal.



Sets the type of signal from the CAL output.



Resets the CAL output to its default state: a 1 kHz 1 V square wave. The *WavePro* DSO automatically sets the calibration signal to its default when switched on.



Selects the form of the calibration signal.



Sets the pulse level for the CAL output (range: 0.05 to 1.00 V into 1 MΩ), using the knob. If it is connected to an input channel with 50 Ω, the amplitude will be halved.





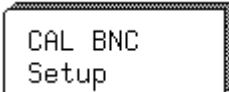
Sets the desired frequency of a CAL signal in the range 1 kHz to 4 MHz, using the knob.

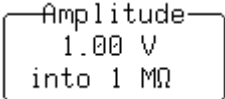
### TO CALIBRATE THE PASSIVE PROBE

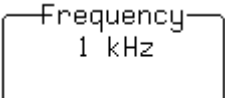


Your WavePro scope comes with a LeCroy passive probe for each channel.

- A. Turn on your WavePro scope.
- B. Insert the probe lead into the Channel 1 input.
- C. Connect the probe tip to the CAL output.
- D. Attach the lead's alligator clip to the ground ring indicated by , located below CAL.
- E. The CAL signal will be a 1 kHz square wave, 1 V p-p.

- F. Press , then the button to select .

- G. Turn the knob alongside  into 1 M $\Omega$  and set the amplitude level. You can press the button to step the voltage in increments of 0.01 V.

- H. Turn the knob alongside  to set the frequency in the range 500 Hz to 2 MHz. Alternatively, press the button to step up the frequency.

- I. Set channel coupling to DC 1 M $\Omega$  using "Coupling" (see page 1-9).

- J. Press  to turn on Channel 1.

- K. Press  twice.

- L. If overshoot or undershoot of the displayed signal occurs, adjust the probe by inserting the small screwdriver, supplied with the probe package, into the potentiometer on the probe head and turning it clockwise or counterclockwise to achieve the optimal square wave contour.

## **CHAPTER TWO: *Simple Triggers***

**In this chapter, see how**

- *To control triggers*
- *To set up an Edge trigger*
- *To re-arm triggering*
- *To determine level, coupling and slope*
- *To use Window trigger*
- *To obtain a summary of your trigger and system status*

### EDGE TRIGGER ON SIMPLE SIGNALS

The WavePro DSO uses many waveform capture techniques that trigger on features and conditions, which you define. These triggers fall into two major categories:

- **Edge** — activated by basic waveform features or conditions such as a positive or negative slope, and holdoff
- **SMART Trigger®** — sophisticated triggers that enable you to use basic and complex conditions for triggering. See Chapter 8, “Trigger Smart.”

Use the Edge trigger type for simple signals, and the SMART Trigger type for signals with rarer features such as glitches.

### Control Triggering

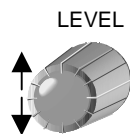
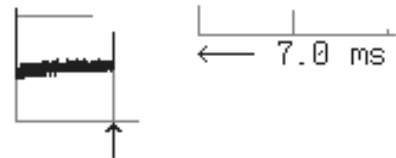


**Horizontal:** Turn in the **HORIZONTAL** group to adjust the trigger's horizontal position.

You can adjust the trigger's position from 0% to 100% pre-trigger, from left to right on the grid. DELAY can also be used for setting the post-trigger, in time units, up to 10 000 divisions, in increments of 0.1 division.

The trigger location is shown by the arrow at the grid bottom, as shown here at near right.

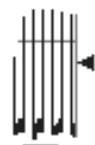
Post-trigger delay is labeled in the trigger delay field, where the arrow becomes horizontal, as shown here at far right.



**Vertical:** Turn in the **TRIGGER** group to adjust the trigger's vertical threshold.

Turn this knob to adjust the level of the trigger source or the highlighted trace. Level defines the source voltage at which the trigger will generate an event — a change in the input signal that satisfies the trigger conditions.

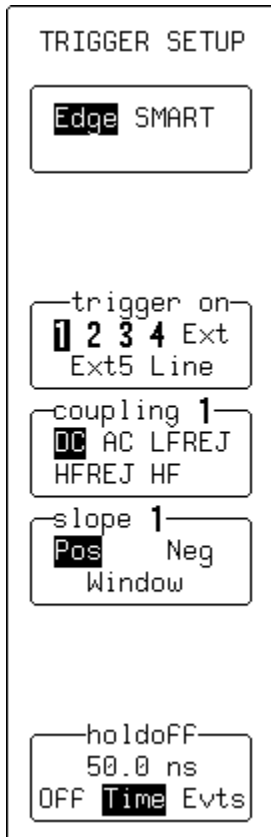
Arrows on both sides of the grid show the threshold position. But these arrows are only visible if the trigger source is displayed and the source signal DC coupled.



## Set Up an Edge Trigger

SETUP

1. Press TRIGGER  to access these menus:



Use them to select the trigger source, the source's coupling, the slope — positive or negative — and the amount of trigger holdoff by time or events

2. Select **Edge** or **SMART**: **Edge** is selected by default.

**TIP: Once set, trigger level and coupling are used for all trigger types.**


3. Select the trigger source. This could be a signal on a channel, the line voltage that powers the WavePro DSO, or the EXT BNC connector.

4. Select the coupling for the trigger source.

5. Place the trigger point on the positive or negative slope of the selected source, or choose to define a window.

When **Window** is selected from the above menu, a menu appears here that allows you to define the window's size. See page 2-5.

Holds off from triggering for a defined time, or number of events, after a trigger event. Use this button to select **Time** or **Events**, and the knob to set the value. **Off** deactivates the holdoff. See Chapter 8, "SMART Trigger."

6. Turn  to adjust the trigger's horizontal position, and the amount of pre-trigger delay.

7. Turn  in the **TRIGGER** group to adjust the trigger voltage level.



### TO DETERMINE TRIGGER LEVEL, COUPLING, AND SLOPE

**Level** defines the source voltage at which the trigger circuit will generate an event: a change in the input signal that satisfies the trigger conditions. The selected trigger level is associated with the chosen trigger source.



Trigger level is specified in volts and normally remains unchanged when you change the vertical gain or offset. The amplitude and range of the trigger level are limited as follows:

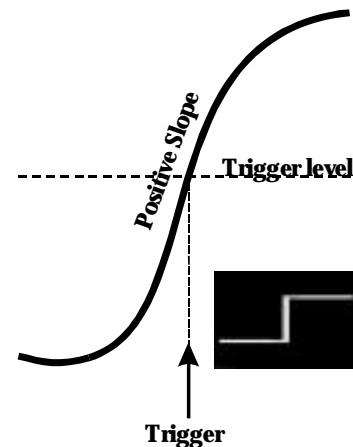
- $\pm 5$  screen divisions with a channel as the trigger source
- $\pm 0.5$  V with EXT as the trigger source
- $\pm 2.5$  V with EXT/5 as the trigger source
- None with LINE as the trigger source (zero crossing is used).

**Coupling** refers to the type of signal coupling at the input of the trigger circuit. As with the trigger level, you can select the coupling independently for each source. Change the trigger source and you can change the coupling. You can choose from these coupling types:

**DC:** All the signal's frequency components are coupled to the trigger circuit for high frequency bursts or where the use of AC coupling would shift the effective trigger level.

- **AC:** The signal is capacitively coupled, DC levels are rejected and frequencies below 10 Hz attenuated.
- **LF REJ:** The signal is coupled through a capacitive high-pass filter network, DC is rejected and signal frequencies below 50 kHz are attenuated. For stable triggering on medium to high frequency signals.
- **HF REJ:** Signals are DC coupled to the trigger circuit, and a low-pass filter network attenuates frequencies above 50 kHz; used for triggering on low frequencies.
- **HF:** Use only when needed for triggering on high-frequency repetitive signals. HF is automatically overridden and set to AC when incompatible with trigger characteristics such as those of SMART Trigger.

**Slope** determines the direction of the trigger voltage transition used for generating a particular trigger event. You can choose a positive or negative slope. Like coupling, the selected slope is associated with the chosen trigger source.




**Figure 2–1.** Edge trigger works on the selected edge at the chosen level. The slope (positive here) is highlighted on the trigger icon.

### TO RE-ARM A TRIGGER


Three trigger re-arming modes — *AUTO*, *NORMAL*, and *SINGLE* — are available for all types of triggers. *STOP* cancels the capture in all three modes.




#### AUTO

Press  to activate *AUTO* mode: the trace will automatically be displayed if no trigger occurs soon after. But if a signal does occur, The WavePro DSO behaves as if in *NORMAL* mode.


#### NORMAL

Press  to enter *NORMAL* mode and continuously update the display while there is a valid trigger. If there is no valid trigger, the last signal is retained and the warning "SLOW TRIGGER" is displayed in the trigger status field.

#### SINGLE

Press  to enter *SINGLE* mode: the WavePro DSO will wait for a single trigger to occur, then display the signal and stop capturing. If no trigger occurs, you can press this button again to manually trigger the scope.

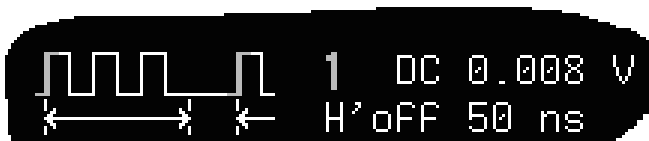
#### STOP

Press  to halt the capture made in *AUTO*, *NORMAL* or *SINGLE* re-arming modes. Press *STOP* to prevent capture of a new signal, or while a single-shot capture is under way to keep the last captured signal.

### TO RECOGNIZE TRIGGER ICONS

Trigger icons allow immediate on-screen recognition of the current trigger conditions. There is an icon for each trigger. The more heavily marked transitions on the icon indicate the slope on which the trigger will be generated. The icons are annotated with information on the trigger settings.


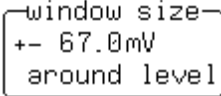
This icon, for example, represents an Edge trigger set up to trigger on the positive slope, at a level of 0.008 V, with a holdoff time of 50 ns.



## Simple Triggers

### Use Window Trigger

The Window Trigger (Figure 2–2) allows you to define a window region whose boundaries extend above and below the selected trigger level. A trigger event occurs when the signal leaves this window region in either direction and passes into the upper or lower region. The next trigger will occur if the signal again passes into the window region. For a trigger to occur, the time that the signal spends within the window must be at least 0.5 ns.

1. Select .
2. Then turn the knob alongside  to define the size of the window region.

A bar at the left side of the grid will visually indicate the window's height.

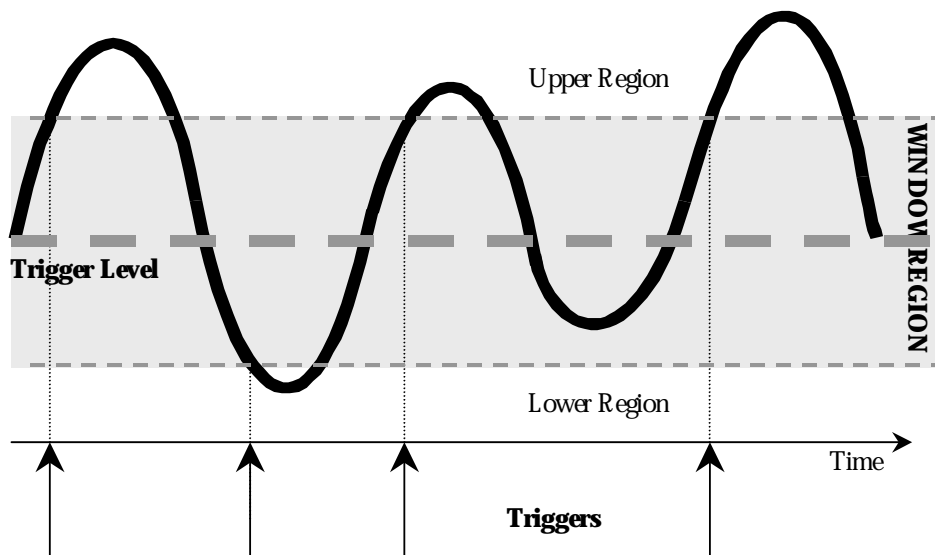


Figure 2–2. Window Trigger: triggers when the signal leaves the window region. The arrows indicate where triggers occur when the signal leaves the window region.

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## Trigger Source

The trigger source may be one of the following:

- *The acquisition channel signal (CH 1, CH 2, CH 3 or CH 4) conditioned for the overall voltage gain, coupling, and bandwidth.*
- *The line voltage that powers the oscilloscope (LINE). This can be used to provide a stable display of signals synchronous with the power line. Coupling and level are not relevant for this selection.*
- *The signal applied to the EXT BNC connector (EXT). This can be used to trigger the oscilloscope within a range of  $\pm 0.5$  V on EXT and  $\pm 2.5$  V with EXT/5 as the trigger source.*

## Level

Level defines the source voltage at which the trigger circuit will generate an event (a change in the input signal that satisfies the trigger conditions). The selected trigger level is associated with the chosen trigger source. Note that the trigger level is specified in volts and normally remains unchanged when the vertical gain or offset is modified.

The Amplitude and Range of the trigger level are limited as follows:

- *$\pm 5$  screen divisions with a channel as the trigger source*
- *$\pm 2.5$  V with EXT/5*
- *none with LINE as the trigger source (zero crossing is used)*


**Note:** *Once specified, Trigger Level and Coupling are the only parameters that pass unchanged from trigger mode to trigger mode for each trigger source.*

## Simple Triggers


### OBTAIN A TRIGGER STATUS SUMMARY

Display a summary of the status of your trigger, as well as timebase, vertical sensitivity, probe attenuation, and offset and coupling for each channel.


SCOPE  
STATUS

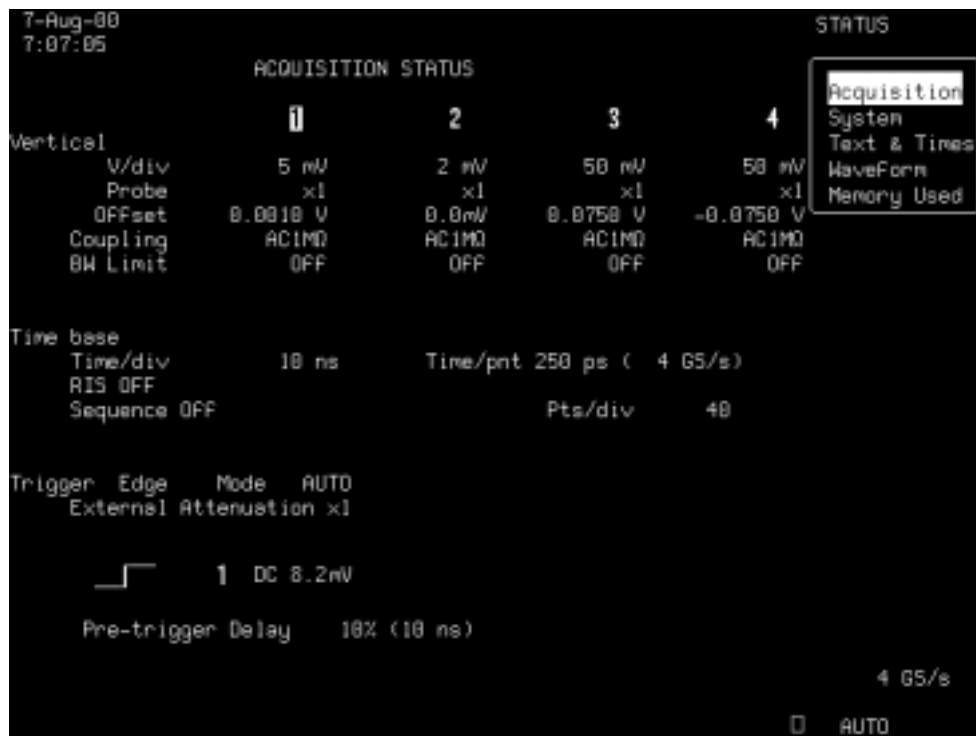
1. Press  to show the STATUS menus.
2. Press the button to select **Acquisition**.

PRINT  
SCREEN

**TIP:** Press  to document your status summary and make a hard copy.

PANELS

Press  when you have a setting you want to reuse (see Chapter 3 for more on this).



Press the SCOPE STATUS button for access to full-screen summaries of your WavePro DSO's system status and other functional status.

See Chapter 8, "SMART Trigger," for more about Edge trigger and all about the SMART Trigger types.

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