CHAPTER NINE: *Display More*

Chapter 3 showed how to set up the display and use persistence. Now learn how to get more from your display.

In this chapter, see how

Analog Persistence works

To use advanced color management tools

To change your palettes and pick colors

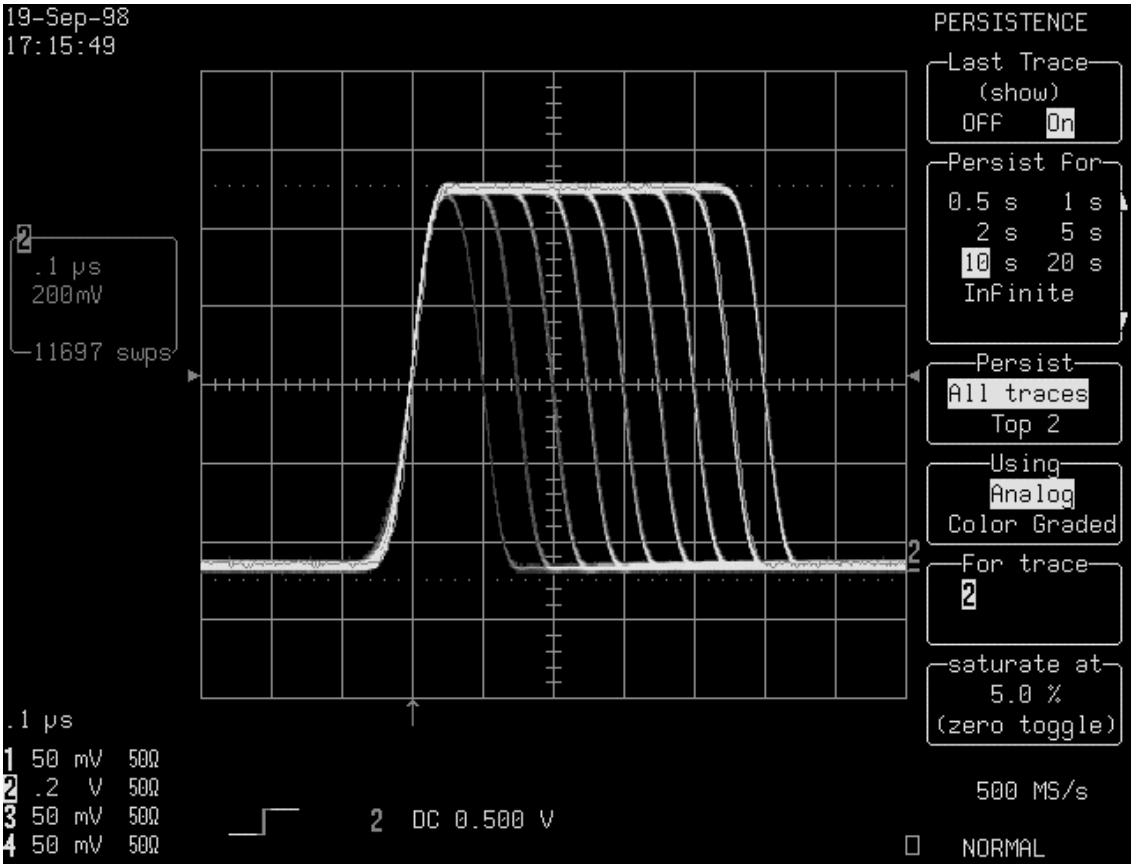
To set up XY display

To use cursors in XY display

Transform Your Vision

ANALOG
PERSIST

Press the green  button and transform your vision of the waveform. With the brightness levels of a single color, the Waverunner Analog Persistence feature shows relative signal intensities "three dimensionally" to reveal signal evolution over time. It offers you an *analog* view of the waveform with all the advantages of a digital oscilloscope. Color Graded persistence works in a similar way using a color spectrum to map signal intensity. Both Waverunner persistence modes are infinite or variable with decay over time.



Analog Persistence display of a signal with elements of a variable frequency of occurrence.

HOW ANALOG PERSISTENCE WORKS

LeCroy's Analog Persistence feature offers the advantages of analog display in a DSO (Digital Storage Oscilloscope). The display looks like analog and is fast, too. But it has the data manipulation, flexibility, and statistical analysis capabilities only found in a digital instrument.

With traditional analog instruments, data manipulation and the direct comparison of acquisitions is practically impossible. Statistical analysis is difficult to perform too. Nevertheless, analog does have certain advantages. Because there is no need for analog-to-digital conversion, the speed of the analog scope is limited only by the bandwidth of its electronics: signals are monitored almost continuously. The standard DSO must capture signals across the time period allowed by the size of its acquisition memory, then process and display their representation. The time needed to process the previous acquisition normally limits DSO speed.

But the Analog Persistence digital oscilloscope is different. It decouples data accumulation from display, accumulating and displaying new data more quickly. Moreover, the persistence is variable.

The display is generated by repeated sampling of the amplitudes of events over time, and the accumulation of the sampled data into three-dimensional display maps. These maps create an analog-style display. User-definable persistence duration can be used to view how the maps evolve proportionally over time. Statistical integrity is preserved because the duration, or decay, is proportional to the persistence population for each amplitude or time combination in the data. In addition, the Analog Persistence scope provides user definable, post-acquisition saturation control of the maps, allowing you to draw detail from the display.

When you select "Analog" from the Using persistence menu, each channel and its associated persistence data map are assigned a single color. As a persistence data map develops, different shades of its color are assigned to the population ranges between a minimum and a maximum population. The maximum population automatically gets the brightest shading, the zero or smallest population gets the darkest shading or the background color, and the population ranges between zero and the maximum population gets the shades in between these.

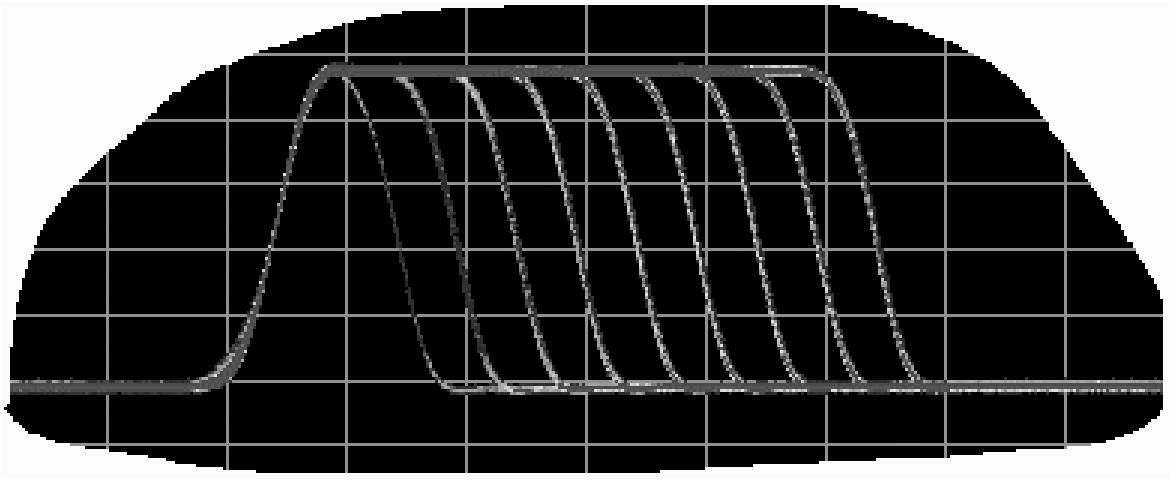
The information in the lower populations, or down at the noise level (random transients rather than dominant signals) could interest you more than the rest. The Analog Persistence view highlights the distribution of data so that you can more easily examine it in detail.

You can select a saturation level or population as a percentage of the maximum population. All populations above the saturation population are then assigned the brightest shade: that is, they are saturated. At the same time, all populations below the saturation level are assigned the remaining shades from brightest down to darkest.

Data populations and their displayed shades are dynamically updated as data from new acquisitions is accumulated.

TO DISPLAY COLOR-GRADED PERSISTENCE

Color-Graded persistence follows the same principles as the Analog Persistence feature, but uses not one, but many, colors to map signal intensity. When you select "Color Graded" from the Using persistence menu, instead of the brightness of a single color as in the Analog Persistence view, the Waverunner uses a color spectrum from red through violet to display persistence.

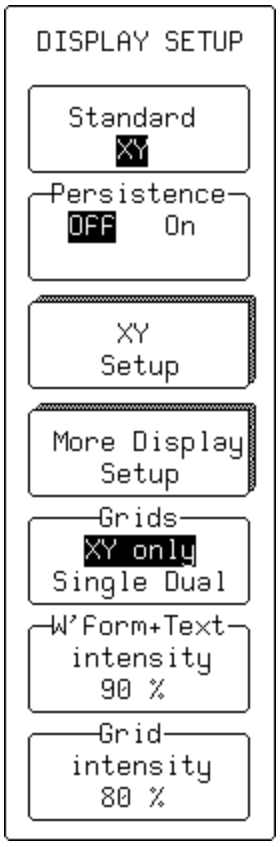


The same waveform as that shown on page 113 displayed using Color-Graded persistence shows the persistence waveform in a spectrum of colors rather than shades of a single color.

"Paint" Your Display

Personalize your Waverunner display — your "canvas" — by choosing from a range of tools, techniques, and color schemes.

1. In the DISPLAY SETUP group (see Chapter 3, "Visualize Your Signal"), press the button for "More Display Setup" to access these menus.



2. Use them to change color schemes and choose advanced color management tools.

To activate the screen saver. See "First Things."

To select either a pre-set, default (**1–6**) or customized (**U1–U4**) color scheme. Choose a custom scheme; the menu below appears. Also selects a scheme for copying to. See next page.

To access the CHANGE COLORS menus. See next page.

To turn Full Screen **On** and expand the grid display to fill the entire screen, **Off** to return to the normal display.

To select **Opaque** or **Transparent** mode, in which objects are always visible. Overlapping regions are distinguished by a new and unique color.

To activate the Measure Gate function. Objects of lesser interest given the color "neutral" will be automatically relegated to the area outside a region. Objects *inside* this measurement-gate region are thus highlighted.

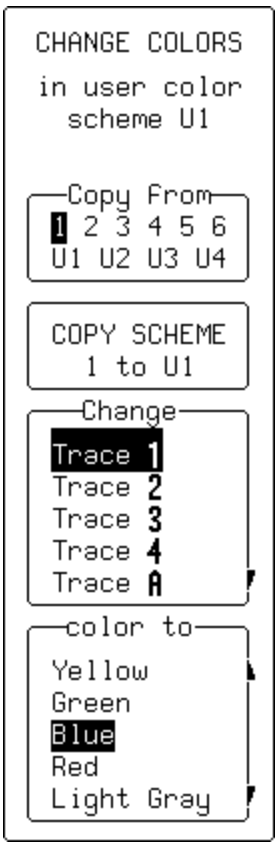
To show data, or sample, points either as **Normal** or **Bold**.

RETURN

In Full Screen, to remove all menus from the screen. The menus will reappear when any darker, labeled, front panel button is pressed.

CHANGE YOUR PALETTE

3. Press the button for "Change Colors" and use these menus to do the following:



Create your own color scheme; assign colors to traces, grids, or any other on-screen object; or copy a default scheme into a custom one to make personalizing quicker and easier.

To select one of the a pre-set, default (**1–6**) or customized (**U1–U4**) color schemes, and copy it to another User scheme. This creates a palette that can then be more easily personalized.

To copy the scheme selected in the menu above to the User color scheme selected in the Color Scheme menu shown on the previous page.

To select the displayed object to be assigned a color using the menu below (see next page).

For selecting the color to be assigned to the object selected in the "Change" menu (see page 119).

RETURN

To return to the MORE DISPLAY menus.

TO ASSIGN COLORS TO ON-SCREEN OBJECTS

Background *— background color of the entire display area*

Trace 1...4 *— color assigned to traces displaying Channel 1, 2, or 3 or 4*

Trace A...D *— color assigned to Trace A, B, C, or D*

Grid *— default color of the grid*

Text *— color assigned to menus, acquisition status and non-single source measurements*

Cursors *— color assigned to cursors*

Warnings *— color assigned to error and warning messages*

Neutral *— color designated as neutral (can be any in user palettes) for measure-gate-region highlighting*

Overlays *— color assigned to the menus overlaid on the grid when in Full Screen mode.*

TO CHOOSE COLORS

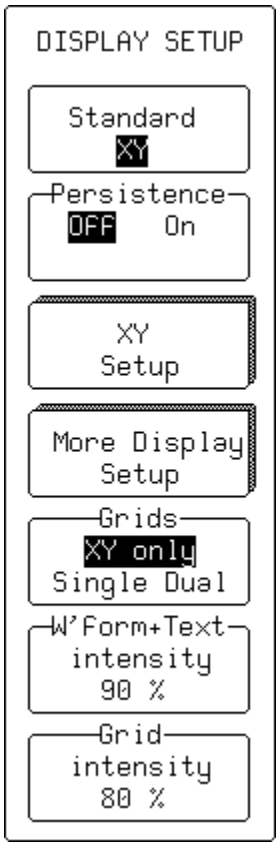
Choose from this gallery of colors for your U1, U2, U3, and U4 custom palettes.

TIP: Personalize your color schemes: for traces, grids, text and menus, cursors, neutral color, background, warnings, and overlays. See the previous page.

Set Up XY Display

XY display is for traces that have the same time- or frequency-span (time/ div), expressed using the same horizontal unit, in seconds or Hertz. The XY display offers three special grid styles: XY only, XY Single and XY Dual, illustrated on the next page.

1. Press DISPLAY for the DISPLAY SETUP menus.
2. Press the button to select **XY** from the top menu.



3. Use these menus to set up your XY display, and to access other display setup menus if desired.

To select "Standard" or **XY**.

To turn persistence on or off. Or press ANALOG PERSIST

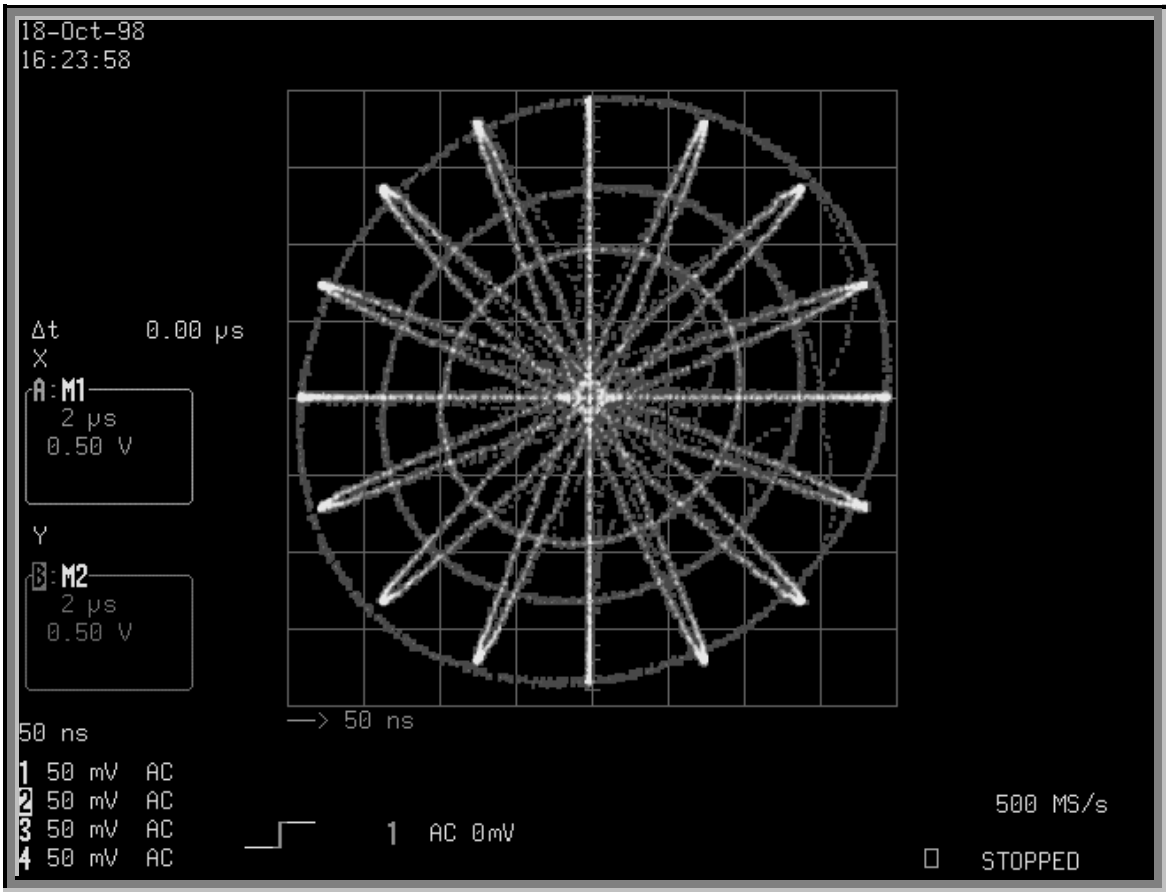
To access XY persistence menus: for choosing Analog or Color-Graded persistence, and persistence saturation in XY display.

To access more display setup menus. See page 116.

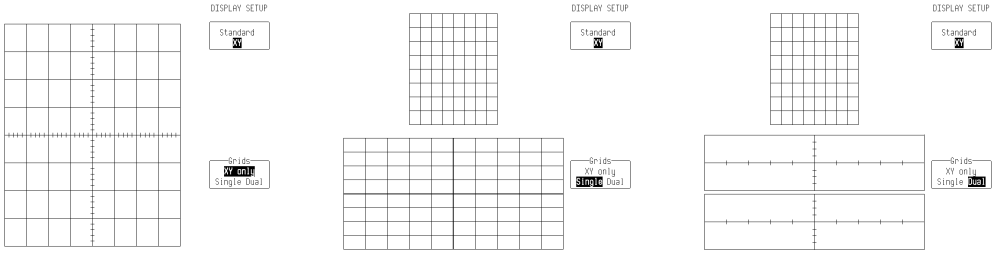
To select grid style and number. See next page.

To adjust waveform and text brightness, using the knob. To return to the default intensity, press the button.

To adjust grid intensity using the knob only. Grids can be brightened, or blended with displayed traces. To return to the default intensity, press the button.



Analog Persistence vector diagram on XY Only grid. Below: XY Only, Single and Dual grids.



TO USE CURSORS IN XY DISPLAY

Cursors are different in XY display (see Chapter 4, "Choose a Measure Tool," for cursors in general).

Absolute Amplitude cursors are horizontal and vertical bars that can be moved up and down and from side to side across the screen. XY Relative Amplitude cursors are pairs of bars that move in the same way.

Absolute and Relative Time cursors behave in XY as they do in Standard display.

Combinations of the amplitude values are shown on the left-hand side of the grid in the following top-to-bottom order:

"*ΔY value / ΔX value*": ***Ratio***

"*20 * log 10 (ratio)*": ***Ratio in dB units***

"*ΔY value * ΔX value*": ***Product***

"*ϕ = arc tan (ΔY / ΔX) range [−180° to +180°]*": ***Angle (polar)***

"*r = sqrt (ΔX * ΔX + ΔY * ΔY)*": ***Radius (distance to origin).***

The definition of ΔX and ΔY depends on which cursor you use. The table below shows how ΔX and ΔY are defined for each type of cursor measurement.

XY CURSORS					
	A_{Abs}	A_{Rel}	T_{Abs}		T_{Rel}
			Org = (0,0)	Org = $V_{XOffset}$ $V_{YOffset}$	
ΔX	$V_{XRef} - 0$	$V_{XDif} - V_{XRef}$	$V_{XRef} - 0$	$V_{XRef} - V_{XOffset}$	$V_{XDif} - V_{XRef}$
ΔY	$V_{YRef} - 0$	$V_{YDif} - V_{YRef}$	$V_{YRef} - 0$	$V_{YRef} - V_{YOffset}$	$V_{YDif} - V_{YRef}$

Where the terms signify:

A_{Abs}: *Absolute Amplitude cursors*

A_{Rel}: *Relative Amplitude cursors*

T_{Abs}: *Absolute Time cursors*

T_{Rel}: *Relative Time cursors*

Org: *Origin*

V_{Xref}: *Voltage of the Reference cursor on the X trace*

V_{Yref}: *Voltage of the Reference cursor on the Y trace*

V_{Xdif}: *Voltage of the Difference cursor on the X trace*

V_{Ydif}: *Voltage of the Difference cursor on the Y trace*