

LeCroy



Digital Oscilloscopes

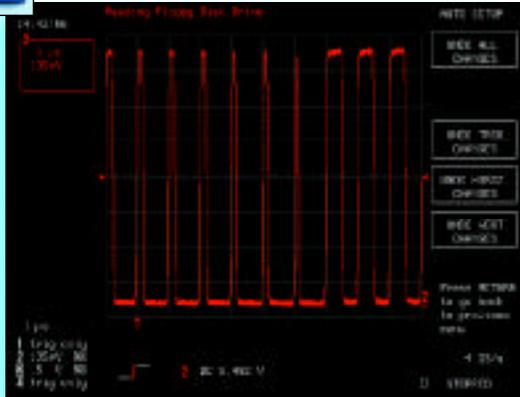


QUICK REFERENCE GUIDE

# Waverunner-2 Quickstart to Signal Viewing



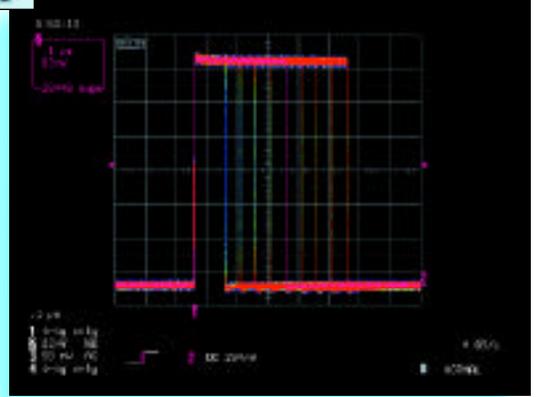
## Quickly Display Signals



1. Connect your signal. When using a probe, ProBus<sup>®</sup> automatically sets the vertical scale factor and HFP probes automatically light-up with the trace color.
2. Press *AUTO SETUP* and view.
3. Press "Undo" to revert back to a previous setting.



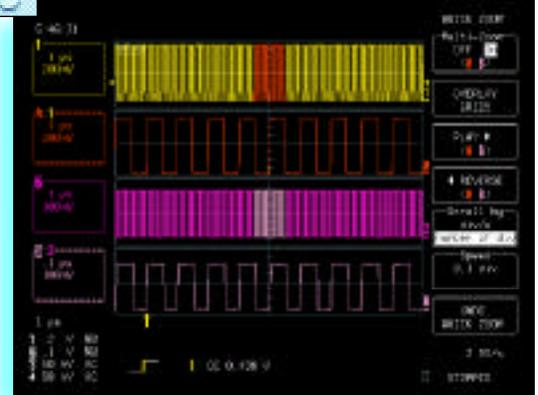
## Analog Persistence™



Press *ANALOG PERSIST* to access the power of Analog Persistence. The three-dimensional view shows variations in a waveform as intensity or color-graded variations. Press *DISPLAY* to customize the display.



## Quick Zoom



Press *Zoom* for a close-up view of signal details. Use the zoom controls to magnify and inspect the signal, the softkeys to change the zoom view, lock the zoom traces with multi-zoom, and to automatically scan the waveform.

Selects a pre- or post-trigger delay. Use to view the signal events prior to the trigger point.

Presets the trigger delay to zero.

Press a *CHANNEL* button to view the menu.

Adjust the *TIME/DIV*, and *SMART Memory* automatically assures the maximum resolution for each time-base setting.

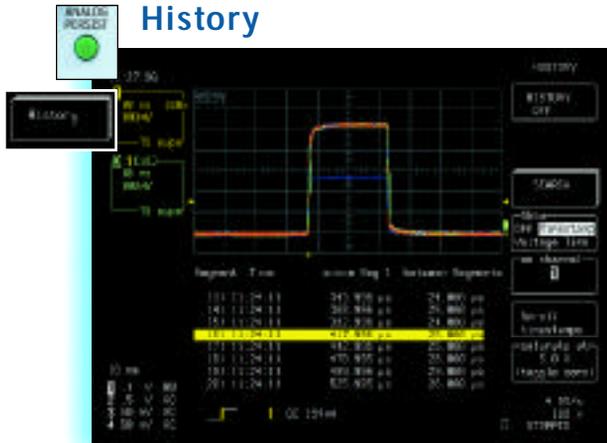
Press *SETUP* and *TIMEBASE* to set up the scope's timebase and acquisition system.

Press a *CHANNEL* button, and use the control knobs to select and adjust that channel's Volts/Div and offset settings. Press twice to toggle the channel between On and Off.



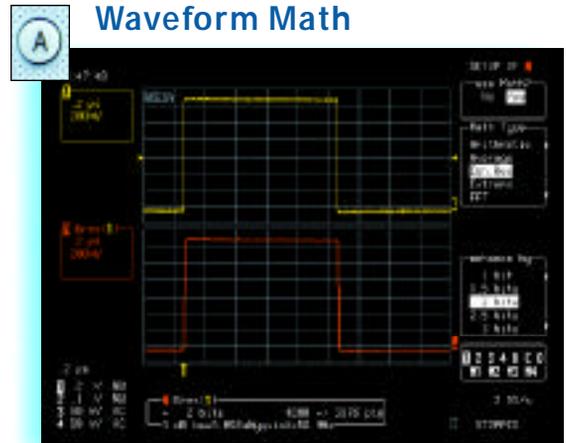
# Measure and Analyze Waveforms

## History



Press *ANALOG PERSIST* and select *HISTORY* to maximize the update rate and to display a signal in Analog Persistence and in sequence mode. Trigger time stamps for up to 4,000 acquisitions are displayed. For further analysis of an acquisition segment, Histogram the full History, then use *PLAY* and *REVERSE* to scan it in sequence.

## Waveform Math



For math processing, Press button A, B, C, or D to set up a zoom trace.

1. Press *SETUP*
2. Select *USE MATH* and choose a function.

Math and analysis can be performed on any trace.  
View the result for trace A, B, C, or D.

### Standard Measurements

ampl	Amplitude	area	Integral of waveform data
base	Lower of two most probable states cycles	cycles	Number of cycles of a periodic waveform
cmean	Cyclic mean: The average of waveform data	crms	Cyclic root mean squar
delay	Time from trigger to transition	dly	Time between 50% level of two sources
duty	Duty cycle: Width as percentage of period	fall	Fall time from 90% to 10%
f80-20%	Fall time from 80% to 20%	maximum	The highest point in a waveform
freq	Frequency	minimum	The lowest point in a waveform
mean	The average of data for time-domain waveform	over+	Overshoot positive
over-	Overshoot negative	pkpk	Peak-to-peak
period	Period of a cyclic signal	r20-80%	Rise time from 20% to 80%
phase	Phase difference between signal analyzed and signal used as a reference	rise	Rise time from 10% to 90%
rms	Root mean square of data between the cursors	sdev	Standard deviation of data between the cursors.
top	Higher of two most probable states	width	Width of cyclic signal: All waveform pulses are averaged then displayed
xamn	Horizontal position of the smallest data value		
xamx	The horizontal position of the largest data value		

### Waverunner-2 Options: WAVA - WaveAnalyzer and EMM - Extended Math and Measurement

csdev	Cyclic standard deviation	c2d±	clock to data ± (setup and hold time)
cmedian	Cyclic median: The average of base and top values over an integral number of cycles	t@lv	The transition time between selected levels on a single trace or between two traces
first	Indicates value of horizontal axis at left cursor	median	The average of base and top values
last	Time from trigger to last (rightmost) cursor	points	Number of points between the cursors
r@level	Rise time between selected voltage levels	f@level	Fall time between selected voltage levels
dur	Time between triggers in segment/history mode	t@level	Time from trigger (t=0) to crossing at a level

**Standard Math Tools (Signal Processing)**

Arithmetic	Sum (add), Difference (subtract), Product (multiply), Ratio (divide)
Averaging	Summed average of up to 4 000 sweeps: Continuous average from 1:1 to 1:1024 weighting
Extrema	Envelope, floor, and roof
FFT	Fast Fourier Transform to 50,000 points:
FFT Types	Power Spectrum, Phase, Magnitude. Windows: Flat Top, Rectangular, Blackman Harris, Von Hann, Hamming
Other Functions	Identity, Negation (Invert), Sine x/x
Resample	To deskew as well as resample signals
Rescale	Assign physical units and rescale
ERES	Enhanced Resolution for up to 11 bits of vertical resolution

**Waverunner-2 Options:****WAVA–WaveAnalyzer**

All standard math, measurement, and signal processing tools plus:

Extended Averaging Summed. Average of up to one million waveforms.

Extended FFT	Continuous average from 1:1 to 1:1024 weighting Fast Fourier Transform to one million points FFT Average, Power Averaging, Real, Power Density, Real + Imaginary
Histograms*	Graphical analysis with Histograms and Histogram Analysis Parameters WAVA: 2 billion events EMM: 200 events

**Histogram Parameters**

avg	average of data values in histogram
fwhm	full width (of largest peak) at half the maximum bin
fwxx	full width (of largest peak) at xx% the maximum bin
hamp1	histogram amplitude between two largest peaks
hbase	histogram base or leftmost of two largest peaks
high	highest data value in histogram
hmedian	median data value of histogram
hrms	rms value of data in histogram
htop	histogram top or rightmost of two largest peaks
low	lowest data value in histogram
maxp	population of most populated bin in histogram
mode	data value of most populated bin in histogram
pctl	data value in histogram for which specified x% of population is smaller
pks	number of peaks in histogram
range	difference between highest and lowest data values
sigma	standard deviation of the data values in histogram
totp	total population in histogram
xapk	x-axis position of specified largest peak
Trending*	Plot a parameter versus time or versus another parameter
Other functions*	Absolute Value, Reciprocal (1/x), Square, Square Root, Derivative, Integral, Exp (base e), Exp (base 10), Log (base e), Log (base 10)

**DFP–Digital Filter Package**

Linear-phase Finite Impulse Response (FIR) filters:

Low Pass, High Pass, Band Pass, Band Stop, Raised Cosine, Raised Root Cosine, Gaussian

Up to 4 filters can be cascaded.

Design a custom filter then download the filter coefficients into the WavePro scope with DSOFILTER utility.

**JTA–Jitter and Timing Analysis**

JitterTrack for a time correlated graphical view of cycle to cycle parameter variation.

**PMA1 – Power Measure Analysis**

Power Measure Analysis provides parametric and graphical analysis of power device modulation and line power analysis.

\* Also included with EMM

# Waverunner-2 Triggering

Level indicators

Horizontal delay (trigger) position indicator

Icons indicate the type and characteristics of the trigger in use.

Select trigger type

Select trigger source

Select coupling

Select pulse type

Setup signal conditions

Flashes when a trigger occurs. The text indicates status.

Accesses the trigger setup menu.

Sets the trigger level.

Prevents the scope from triggering.

Triggers even if a signal is not present.

Triggers whenever the trigger conditions are met.

Arms the trigger. The scope triggers once when the trigger conditions are met and then displays the signal.

## Waverunner-2 Basic Triggers

Name	Description
Edge	Select positive or negative slope and hold-off by time or events.
Window	Set a window around the trigger level. Trigger whenever the signal crosses outside the window in either direction.

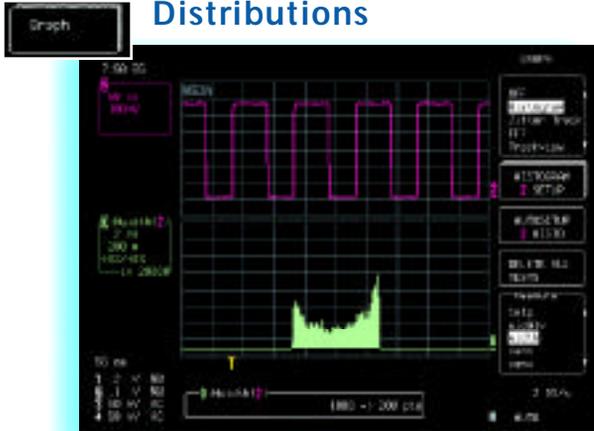
## Waverunner-2 SMART Triggers®

Name	Description
Glitch	Triggers at end of positive or negative pulses down to 2 ns.
Interval	Triggers when pulse is > or < or within a range (< and >) or outside a range. Triggers on intervals between positive or negative edges.
Qualified	Trigger when interval is > or < or within a range (< and >) or outside a range. Qualify by edge or state. Triggers on a selected input after a defined state or edge has occurred on another channel (or a pattern is present or absent). Set a time condition that the second must occur within to trigger, or a wait time or number events before triggering.
Qual First	A single pulse qualifies a sequence of triggers.
Dropout	Triggers if the input signal drops out for longer than selected time.
Pattern (logic)	Trigger on the logical combination of up to 5 inputs. When used in combination with Qualified it is possible to trigger on a selected input when the pattern is present or absent.
TV	Triggers on line (up to 1 500) in odd or even fields for PAL, NTSC, or non-standard video.

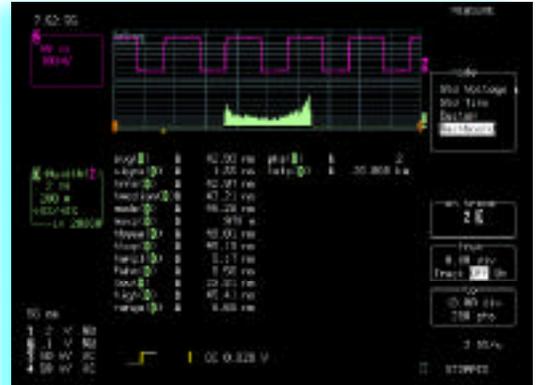
## Waverunner-2 Option: ATP – Advanced Trigger Package

Runt	Define runt conditions including the range of pulse levels, widths, and select the edge.
Slew Rate	Define slew conditions including dV, dT, and slope.

## Graph Parameter Distributions

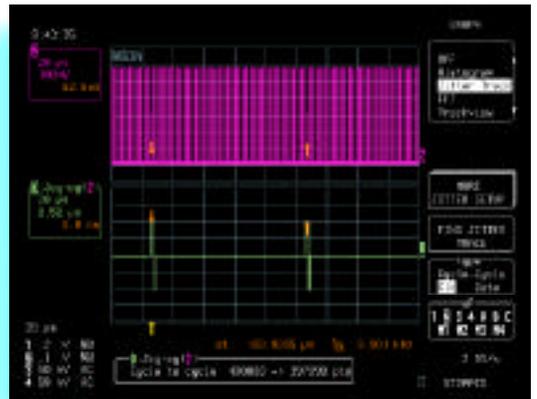


Histograms are fast and simple to set up. Press *WAVEPILOT* and *GRAPH*, dial in the measure parameter, select the Histogram Setup conditions, then press *AUTOSETUP* histogram.



Get measurements that make sense! Press *WAVEPILOT* and *GRAPH*, then *MEASURE*, for a quick, context-sensitive parameter assessment of the characteristics of TrackViews.

## Graph Views



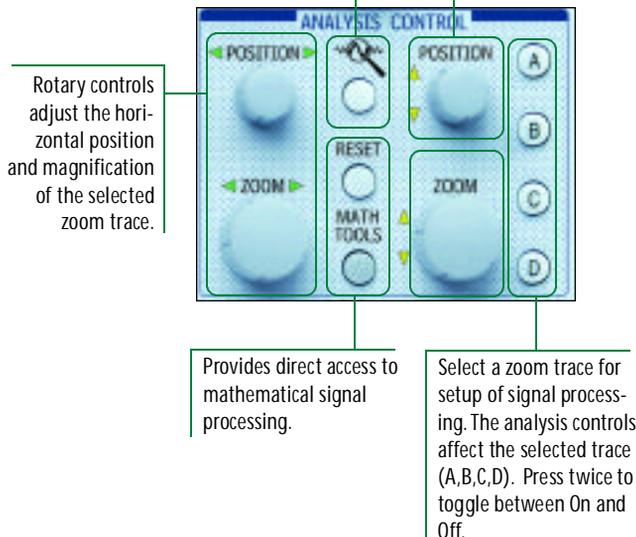
Press *WAVEPILOT* and *GRAPH* for quick access to powerful problem solving features. Quickly identify the problem with special views: Histograms, FFT, TrackView, and JitterTrack.

1. Select the type of view and the parameter or function.
2. Setup the view.
3. Select Graph and TrackView or JitterTrack for a time-correlated view of measurements and you can visually track down signal errors and anomalies.

## Analysis Controls

Quick Zoom automatically displays 10X magnified traces of all signals on multi-grids

Rotary controls adjust the vertical position and magnification of the selected zoom trace.



**Corporate Headquarters**

700 Chestnut Ridge Road  
Chestnut Ridge, NY 10977  
USA  
<http://www.lecr oy.com>

**LeCroy Sales Offices:**

Asia: Hong Kong  
Phone (852) 2834 5630  
Fax (852) 2834 9893

Austria: Markersdorf  
Phone (43) 2749 30050  
Fax (43) 2749 30051

Benelux: The Netherlands  
Phone (31) 40 211 6998  
Fax (31) 40 211 6999

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Phone (33) 1 69 18 83 20  
Fax (33) 1 69 07 40 42

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Phone (49) 6221 827 00  
Fax (49) 6221 834 655

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Phone (39) 41 456 97 00  
Fax (39) 41 456 95 42

Japan: Osaka  
Phone (81) 6 6396 0961  
Fax (81) 6 6396 0962

Japan: Tokyo  
Phone (81) 3 3376 9400  
Fax (81) 3 3376 9587

Japan: Tsukuba  
Phone (81) 298 56 0961  
Fax (81) 298 56 0962

Korea: Seoul  
Phone (82) 2 3452 0400  
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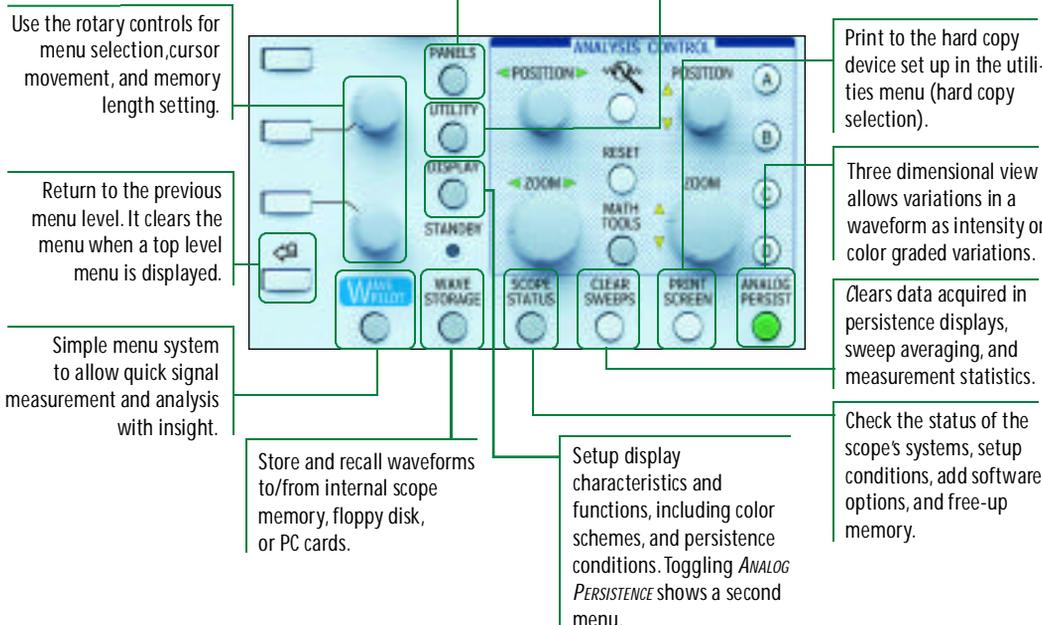
Spain: Madrid  
Phone (34) 91 640 11 34  
Fax (34) 91 640 06 40

Switzerland: Geneva  
Phone (41) 22 719 2111  
Fax (41) 22 719 2230

U.K.: Abingdon  
Phone (44) 1 235 536 973  
Fax (44) 1 235 528796

U.S.A.: Chestnut Ridge  
Phone (1) 845 578 6020  
Fax (1) 845 578 5985

## Waverunner-2 General Controls



## Rear Panel

