

# LeCroy



Digital Oscilloscopes



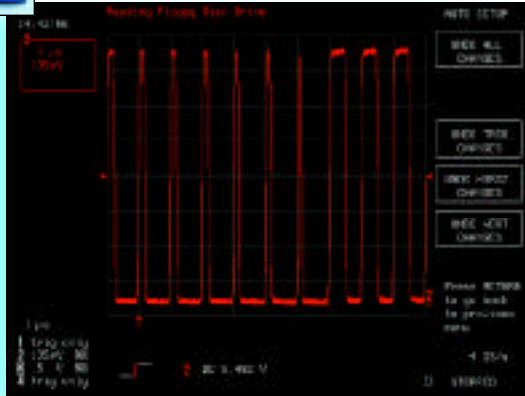
QUICK REFERENCE GUIDE



# Waverunner-2 Quickstart to Signal Viewing



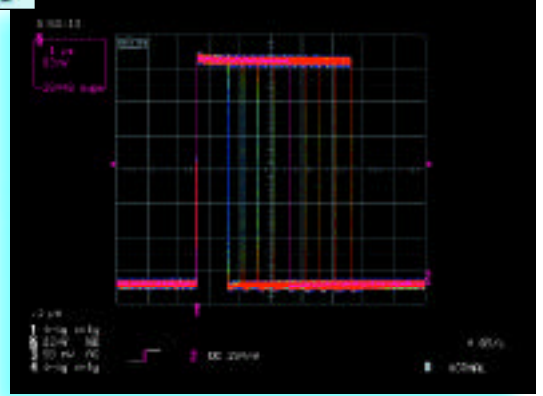
## Quickly Display Signals



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.



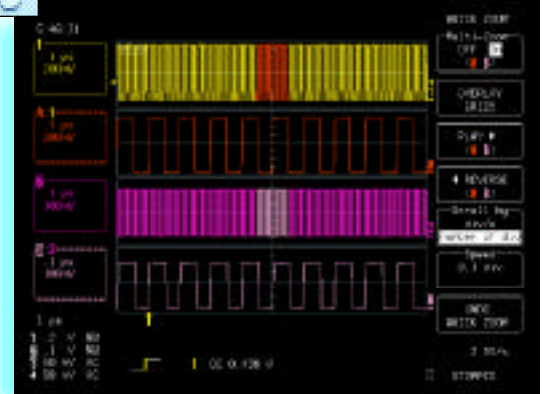
## Analog Persistence™



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.

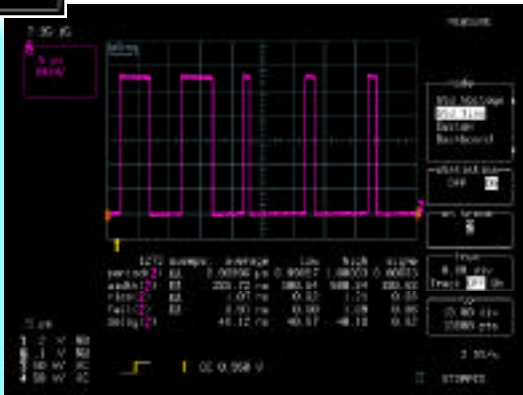
Press a *CHANNEL* button, and use the control knobs to select and adjust that channel's Volts/Div and offset settings. Press twice to toggle the channel between On and Off.

# Wavepilot™ for Quick Measurements and Analysis with Insight



Wavepilot provides a simple menu system that makes it easy to quickly explore the signal with powerful tools that help identify signal problems, characterize them, and track them to the source.

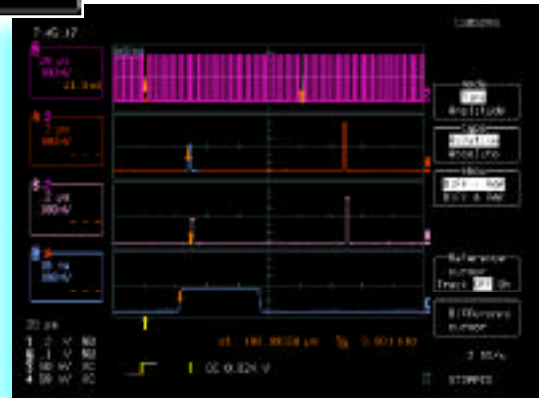
## Measure Statistical Measurements



Press *WAVEPILOT* and *MEASURE* to select automatic parameter measurements with statistics for multiple acquisitions.

1. Select Standard Time or Voltage measurements. Turn parameter statistics On or Off.
2. Select *CUSTOM* to establish your own set of measurements.
3. Setup pass/fail testing on parameters.

## Cursors Measurements



Press *WAVEPILOT* and *CURSORS* for access to a variety of measurement cursors. Read the measurement results on the scope display.

## Measure Parameter Measurements



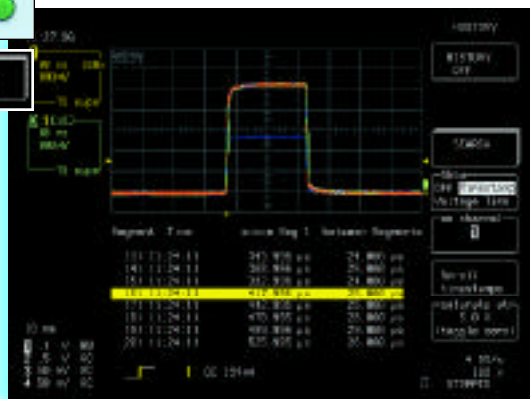
Press *WAVEPILOT* and *MEASURE* for a quick view of up to 26 standard parameters, to set up a custom parameter, or a pass/fail test. Select parameter measurements with statistics for multiple sweeps.

1. Select *DASHBOARD* for an extensive parameter set, or select standard Time or Voltage measurements.
2. The *DASHBOARD* view is context sensitive so when you view a signal, histogram, or TrackView the measurements are relevant.
3. *CUSTOM* turns parameter statistics On or Off and allows you to define your own set of measurements.

# Measure and Analyze Waveforms



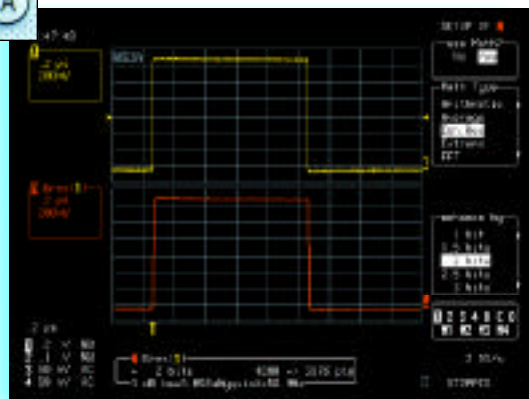
## History



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
Histograms*	FFT Average, Power Averaging, Real, Power Density, Real + Imaginary 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

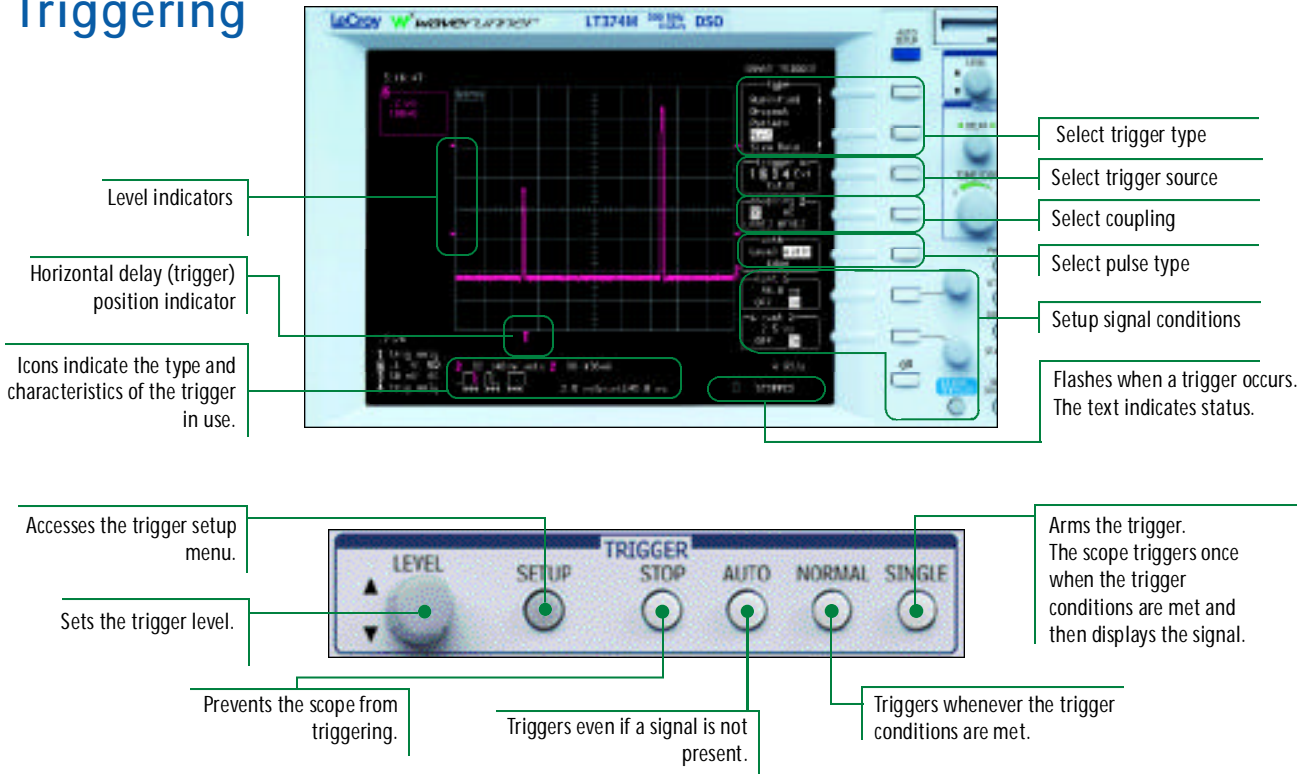
JitterTrack for a time correlated graphical view of cycle to cycle parameter variation.

### 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



## 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.

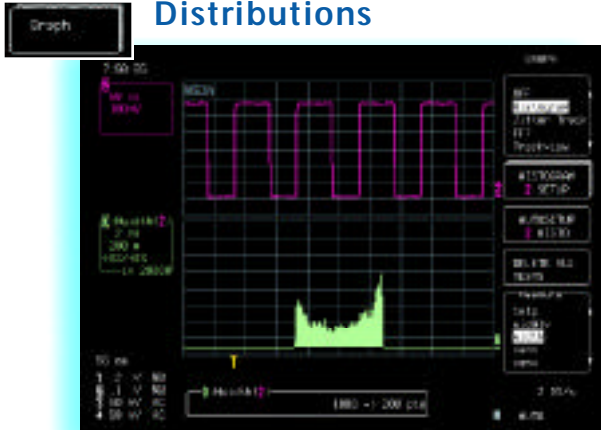
## Waverunner-2 SMART Triggers®

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.

## Graph and Measurements



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

## 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.

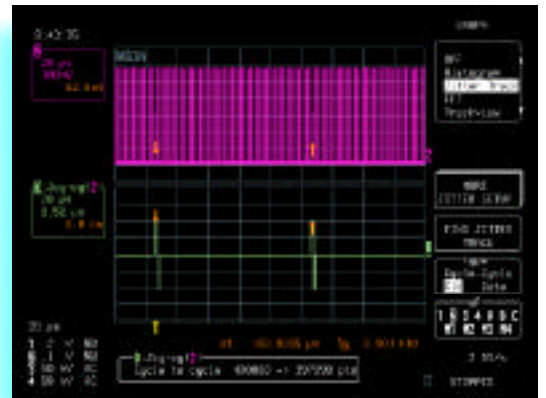


Rotary controls adjust the horizontal position and magnification of the selected zoom trace.

Provides direct access to mathematical signal processing.

Select a zoom trace for setup of signal processing. The analysis controls affect the selected trace (A,B,C,D). Press twice to toggle between On and Off.

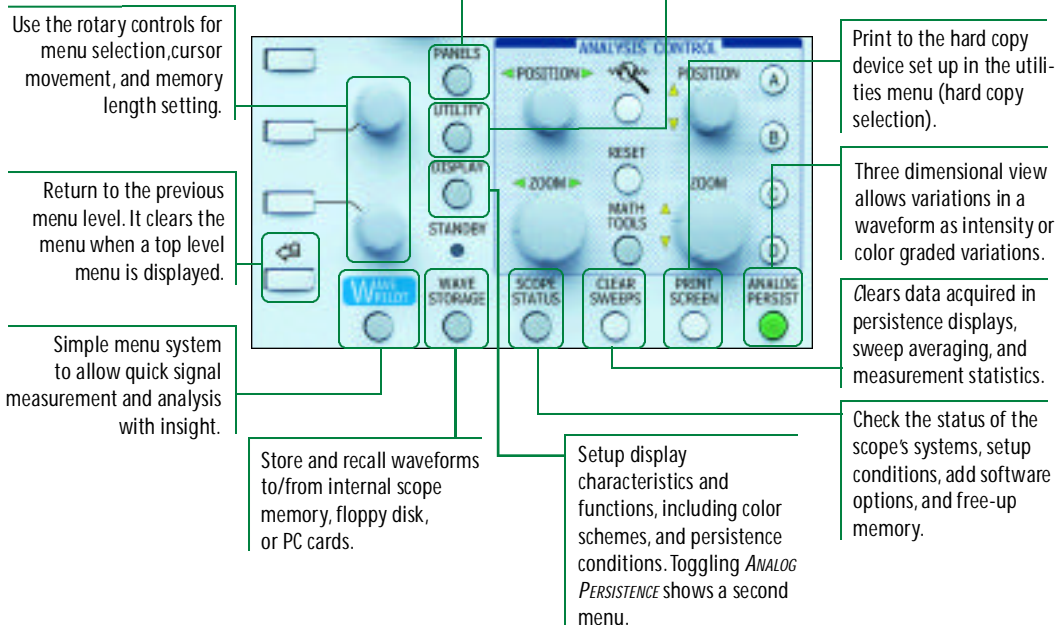
## Graph Views



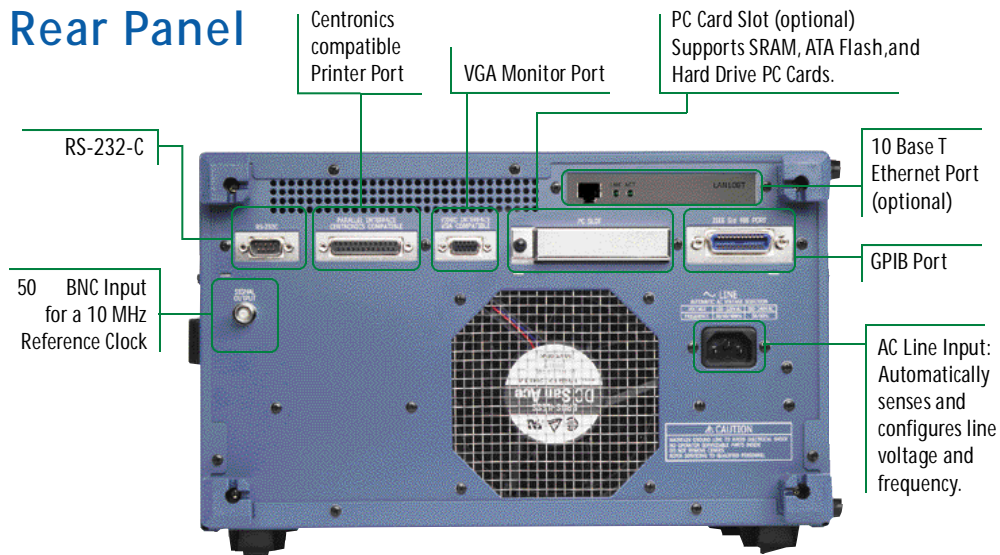
Press *WAVEPILOT* and *GRAPH* for quick access to powerful problem solving features. Quickly identify the problem with special views: Histograms, FFT, TrackView, and JitterTrack.

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.

# Waverunner-2 General Controls



## Rear Panel



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