waverunner

LeCroy
Digital Oscilloscopes

Get the Complete Picture

LeCroy

EASY AS 1-2-3
for high productivity

FULLY LOADED
for outstanding performance

ANALOG PERSISTENCE™
standard with each model

UNCOMMON VALUE
in a mid-range scope

Why Walk When You Can Run?

CATCH THE FRESH WAVE OF THINKING IN OSCILLOSCOPE DESIGN – THE NEW LECROY *WAVERUNNER*. UNLIKE ANY OTHER SCOPE IN ITS CLASS, IT PUTS COMPLETE FUNCTIONALITY WITH MAXIMUM POWER ON YOUR DESK OR WORKBENCH. AND ALL OF THIS CAPABILITY IS AVAILABLE IN ONE REMARKABLY EASY-TO-USE PACKAGE. FROM TROUBLESHOOTING TO TIMING ANALYSIS TO PRODUCTION TESTING, THE LECROY *WAVERUNNER* SERIES IS UNIQUELY QUALIFIED TO MEET YOUR REQUIREMENTS.

Because There's No Such Thing as a Perfect Wave.

NO MATTER WHAT YOUR CHALLENGE, THE *WAVERUNNER* SCOPE WILL HELP YOU SOLVE IT FASTER. THIS NEW SCOPE IS DESIGNED FOR TECHNICIANS AND ENGINEERS WORKING IN TEST, DESIGN, AND SERVICE, INCLUDING:

- POWER CONVERSION
- ELECTRO-MECHANICAL
- GENERAL ELECTRONICS
- AUTOMOTIVE

… AND MANY MORE

FOR SIGNAL CAPTURE AND VIEWING, THE *WAVERUNNER* SCOPE IS SIMPLY BRILLIANT. ITS EXCEPTIONALLY STRONG FEATURE SET AND COMPLETE RANGE OF ADD-ONS, INCLUDING MATH TOOLS AND PROBES, BRING YOU TO SOLUTIONS FASTER AND EASIER.

The *Waverunner* Series

Document your work using Strip Chart mode on the graphics printer (optional) or print to the standard Centronics™ interface.

The color, 8.4" TFT display is large, bright, and crisp, so it's easy to recognize signal features. Connect an external VGA monitor for remote viewing.

Icons show trigger conditions.

Intelligent ProBus® interface automatically configures the scope for compatible current, voltage, and differential probes.

Compact footprint provides more space on your bench to do your work.

Autosetup adjusts the scope to automatically display the signal.

SMART Trigger® lets you see hard-to-catch glitches, dropouts, and timing errors.

Easy to navigate with an optimized set of knobs, buttons, and simple menus.

Math Tools include FFTs, averaging high resolution, and more…so you:
- see the signal
- see the spectrum
- measure the result

with the most complete set of waveform analysis tools available.

Analog Persistence™ lets you see your signal using the best of both analog and digital scope methods.

Measure Tools – one press of the button gives you control of automatic measurements and cursors.

ALSO AVAILABLE ON THE REAR PANEL
- GPIB, RS-232-C
- Logic signal output, so you can trigger another test instrument or use Pass/Fail for test system control.
- PC Card Slot option

waverunner

Unusually Capable, Remarkably Effortless

CATCH THESE SPECS

The *Waverunner* oscilloscopes provide all you need to quickly view, measure, and evaluate your signals -- accurately and reliably:

- 500 MHz bandwidth
- 500 MS/s single-shot sample rate and 25 GS/s for repetitive signals
- Up to one million data points to view signals with high resolution over longer time intervals

Its powerful, integrated processors provide rapid response. Turn a knob or press a button – *Waverunner* scopes respond instantly.

ANALOG PERSISTENCE FOR A FRESH VIEW

This affordable new class of scopes brings you the power of LeCroy Analog Persistence. All it takes is one touch of the green button to get an analog-like view of your waveforms and explore the full depth of signal information. Then the 8.4" color display lets you clearly see the information you might have missed.

EASY TO USE

The *Waverunner* series is designed to quickly get you up and running. Its color-coded front panel and simple menu system are quick to understand, so your focus is on the work not the tool. Common tasks are automatic. Navigation is logical and intuitive. You'll quickly master its powerful operations.

THE RIGHT PRICE

The *Waverunner* scope raises the bar when it comes to value – you get more for your money than with any other scope in this class. And because *Waverunner* can be upgraded, you can extend its life to meet future needs.

INCREASE YOUR PRODUCTIVITY

Expand the vertical resolution, view the spectrum of a signal with an FFT, average to reduce noise, and more. Two optional measurement packages give you additional capabilities to datalog, integrate, and more. LeCroy's signal diagnostic and troubleshooting tools provide a complete solution for jitter and timing analysis and power measurement.

GETTING STARTED

Waverunner scopes give you three quick ways to find the information you need:

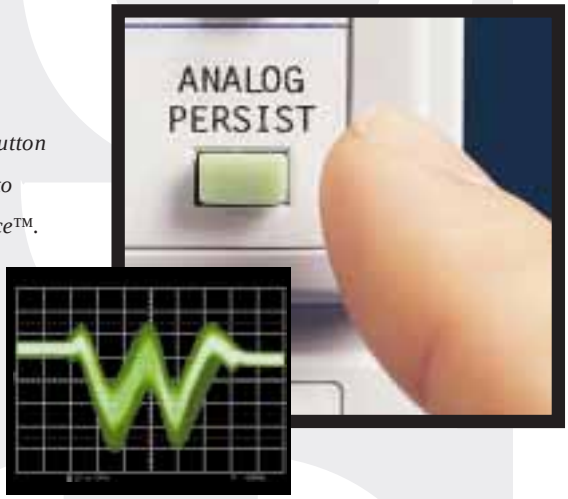
- Quick Reference Guide
- In-depth Operator's Manual organized both for first-time and experienced users
- HTML Manual on CD-ROM

Waverunner COLOR DIGITAL OSCILLOSCOPE SPECIFICATIONS

Model	Bandwidth	Channels	Sample Rate	Acquisition Memory	Analog Persistence
LT342	500 MHz	Two	500 MS/s	250 kpts/Ch	Yes
LT342L	500 MHz	Two	500 MS/s	1 Mpts/Ch	Yes
LT344	500 MHz	Four	500 MS/s	250 kpts/Ch	Yes
LT344L	500 MHz	Four	500 MS/s	1 Mpts/Ch	Yes

See the Third Dimension

Scopes are great tools that help technicians and engineers understand the operation of electrical and electronic systems. With Analog Persistence, you see a third dimension. Are you concerned with intermittent runts or timing problems? Just press the green button and see infrequent signal anomalies such as slow edges, pulse width variations, runts, and glitches. The intensity and color variation indicate the relative rate, such as a clock's period varying once every 100 cycles. Analog Persistence gives you insight into what is happening in your system.



Press the green button for direct access to Analog Persistence™.

SMART TRIGGER

Another touch of a button expands your ability to lock onto a problem signal. The SMART Trigger function uses an icon display and menu control, so you can set trigger conditions like timing intervals, edges, and TV formats. *Waverunner* oscilloscopes can trigger on hard-to-find glitches down to 2 ns, catch signal dropouts, or trigger when the signal falls within a window. You can even set up an exclusion trigger to find events that differ from the nominal signal.

MEASURE ON THE SCREEN

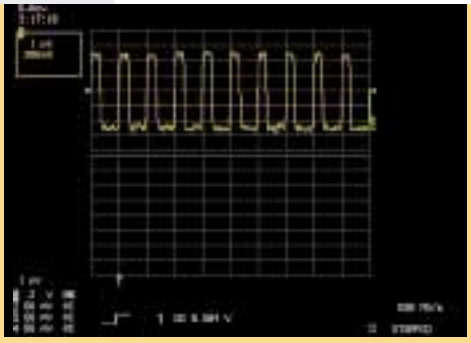
Cursor measurements let you dial into a specific section of your waveform to measure the peak voltage or the time between signal features, such as glitches on two different channels. The user interface and large display let you quickly perform basic measurements. Cursors work in XY display mode so you can read the angle in degrees and the radius in volts for CDMA signals.

MANY WAYS TO ACQUIRE YOUR SIGNAL

Waverunner scopes capture and display waveforms in several ways. Capturing and viewing the signal is as easy as 1-2-3. The scope can also record signals in a segmented memory to take snapshots of a fast-changing event. For slower signals, Roll Mode uses the high-resolution display to give a strip chart view of up to four channels. These capabilities make this scope unique for a wide variety of applications, from electronic devices and sensors to electro-mechanical systems.

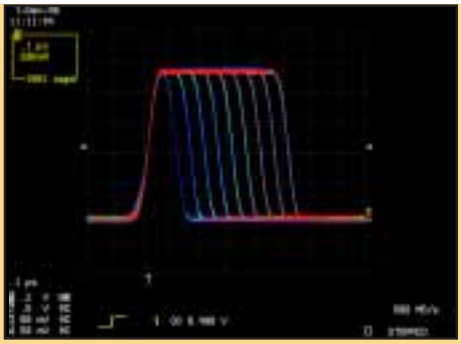
EASY STEPS

Using your Waverunner scope is as easy as 1-2-3!



Waverunner has a powerful interface. Simply connect your signal, press AUTO SETUP, and view.

LeCroy SMARTMemory ensures the highest time resolution for the time window displayed.



Press the green button and you have the power of Analog Persistence. This three-dimensional view shows variations in pulse width.

The Scope with Solutions

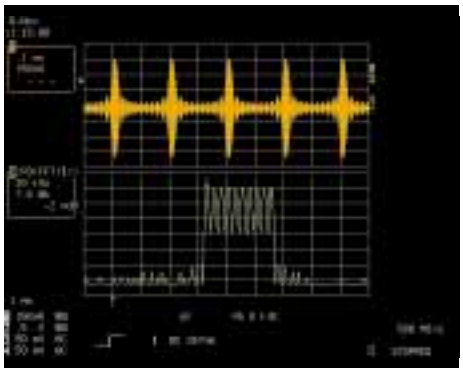
The *Waverunner* series provides the best set of troubleshooting and analysis tools available. It gives you maximum power to measure and analyze in the time domain and in the frequency domain with FFTs.

MEASURE & MATH TOOLS

Choose from 25 automatic measurements that update with your waveform – live, on-screen. Turn on statistics for the parameters average and standard deviation to fully characterize or troubleshoot your circuit. Math Tools let you average (1000 sweeps) to reduce random noise or increase vertical resolution (to 11 bits). Select an optional analysis package for even more power using the same, easy-to-navigate menu system.

SPECTRUM ANALYSIS WITH FFTS

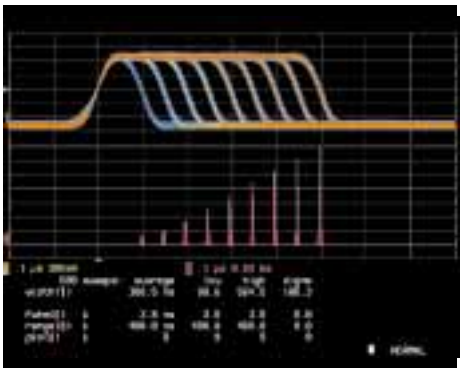
View the FFT of a 50 kpoint waveform while the signal trace updates on the screen. Simultaneously see both the time and frequency domains, even on transient signals. Use cursors to measure the frequency of peaks in the FFT. Perform Pass/Fail testing of the spectra to a tolerance mask.



See transient signals with the time waveform and the frequency spectrum in different colors.

EXTENDED MATH & MEASUREMENTS

This option gives you over 40 measurement parameters and additional math tools to increase your productivity (integrate, differentiate, square, log). You can even datalog measurements with the trend function.

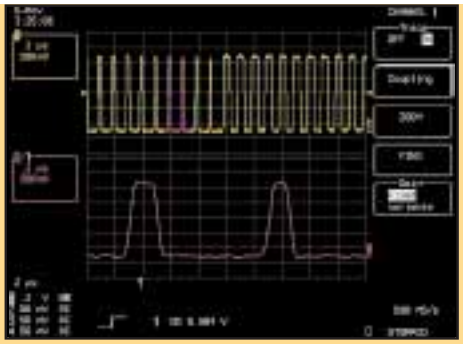


Automatic measurements and histograms help characterize circuits.

Only *Waverunner* lets you perform math-on-math. Deskew the channels, measure current and voltage, multiply for power, then integrate for energy.

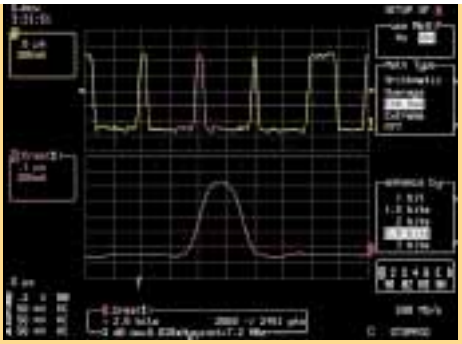
THE COMPREHENSIVE WAVE ANALYZER

The WaveAnalyzer™ option is the ultimate tool for characterization and troubleshooting in time, frequency, and statistical domains for design and research applications. Waveform averaging increases to one million sweeps and FFT spectrum analysis to one million points. Histogram analysis lets you view and measure statistical variations.



To zoom in on the signal, select CHANNEL 1, press ZOOM, and view.

Use the zoom controls to magnify and inspect. Press Auto Scroll to search and scan.



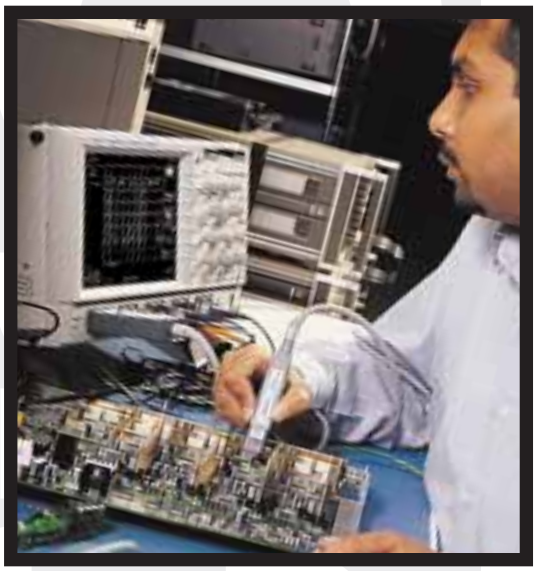
Press MATH TOOLS to choose from a wide variety of waveform math and analysis tools.

Use enhanced resolution (ERES) to filter noise and increase vertical resolution.

Press MEASURE TOOLS to choose from a wide range of time and voltage measurements to characterize your signal.

Powerful Applications

The *Waverunner* oscilloscope acquires signals with high fidelity and integrity. A variety of measurement and analysis tools, as well as probes and accessories, are available. And it's easy to upgrade.



Whether you are troubleshooting, debugging, characterizing circuits and systems, or testing in production, *Waverunner* scopes get the job done. Standard features include Analog Persistence, SMART Trigger, FFTs, automatic measurements, waveform math, and Pass/Fail test.

Use the standard passive probes for 500 MHz bandwidth at the probe tip. Choose an active FET probe to minimize loading on your circuit, or for differential measurements, select the active 500 MHz differential probe. ProBus automatically controls and configures your LeCroy probes.

WORLD-CLASS POWER MEASUREMENT TOOLS

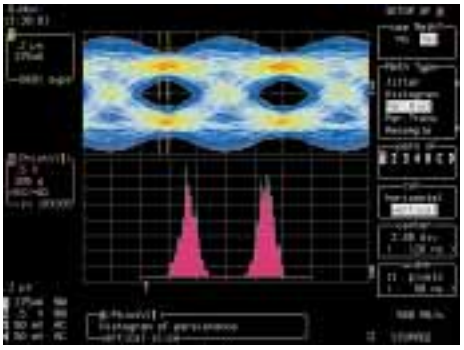
Waverunner and PowerMeasure™ tools provide a complete solution for easily and accurately performing difficult power-related measurements. You can measure instantaneous power, characterize devices and circuits, and perform loop stability measurements, as well as harmonic analysis (FFT). Or deskew timing of current and voltage waveforms, integrate, rescale, and assign electrical units such as amps, watts, and coulombs.

PowerMeasure and precision differential voltage and current measurement probes give the power conversion engineer unprecedented measurement capability.

A TIME ANALYZER IN A SCOPE

Jitter and Timing Analysis (JTA) with second-generation persistence technology (patent pending) enables precise measurements with enhanced timing resolution.

JTA lets you display the jitter function as well as its source signal. Both are perfectly time-correlated, so anomalies can be directly observed on the source trace. Use the JitterTrack™ feature to plot cycle-to-cycle jitter, interval error, period, pulse width, or duty cycle versus time. Use persistence trace histograms to measure jitter and noise on eye diagrams.

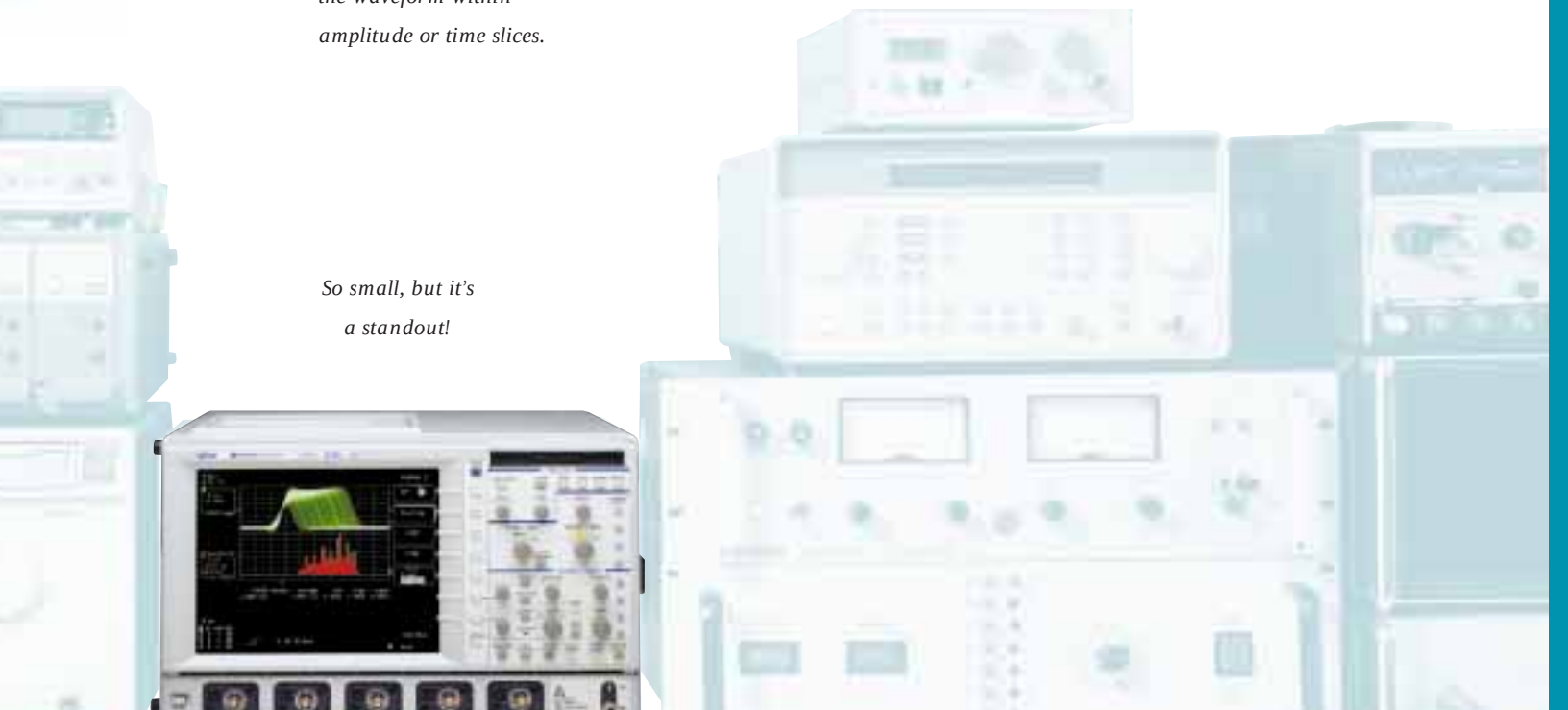


The JTA persistence histogram shows the variation of the waveform within amplitude or time slices.

SOFTWARE TO ENHANCE PRODUCTIVITY

ScopeExplorer™ and ActiveDSO™ are Microsoft Windows (95, 98, or NT) PC-based connectivity tools that make it easy to interface your *Waverunner* scope with a PC via RS-232-C or GPIB. It's easy to integrate scope data with Windows applications as well as to control the scope from your PC. Both tools and the interfaces are standard.

All it takes is a PC with Windows 95, 98, or NT and a GPIB or RS-232-C connection.



So small, but it's a standout!

LT342/LT344 Technical Specifications

Acquisition System

BANDWIDTH (-3DB): 500 MHz @ 50 Ω and at probe tip with PP006; select bandwidth limit (25 or 200 MHz) independently by channel.

INPUT IMPEDANCE: 50 Ω ±1.0%; 1 MΩ // 12 pF typical (using PP006 probe)

INPUT COUPLING: 1 MΩ: AC, DC, GND; 50 Ω: DC, GND

MAX INPUT: 50 Ω: 5 Vrms; 1 MΩ: 400 Vmax (peak AC <-5kHz + DC)

SINGLE-SHOT SAMPLING RATE: 500 MS/s max

ACQUISITION MEMORY: 250 kpts/Ch, 1 Mpoint/Ch on L models

VERTICAL RESOLUTION: 8 bits

SENSITIVITY: 2 mV–5 V/div fully variable; 10 V/div

DC ACCURACY: ±1.5% (0.5% of full scale)

OFFSET RANGE:

2 mV–50 mV/div: ±1 V

100 mV–500 mV/div: ±10 V

1 V–10 V/div: ±100 V

Timebase System

TIMEBASES: Main and up to four zoom traces simultaneously

TIME/DIV RANGE: 1 ns/div to 1000 s/div

CLOCK ACCURACY: ≤10 ppm

INTERPOLATOR RESOLUTION: 5 ps

EXTERNAL CLOCK: ≤500 MHz, 50 Ω, or 1 MΩ impedance

Triggering System

MODES: Normal, Auto, Single, and Stop

SOURCES: Any input channel, external, Ext/10 or line; slope, level, and coupling are unique to each source (except line trigger).

COUPLING MODES: DC, AC, HF, HFREJ, LFREJ (reject frequency 50 kHz typ)

PRE-TRIGGER RECORDING: 0–100% of horizontal time scale

POST-TRIGGER DELAY: 0–10,000 divisions

HOLDOFF BY TIME OR EVENTS: Up to 20 s or from 1 to 99,999,999 events

INTERNAL TRIGGER RANGE: ±5 div

MAXIMUM TRIGGER FREQUENCY: Up to 500 MHz with HF coupling

EXTERNAL TRIGGER INPUT: ±.5 V, ±5 V with Ext/10; max input same as input channels

Autosetup

Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals; vertical find automatically sets sensitivity for the selected input signal.

ACQUISITION MODES

Mode	Time Base Setting	Maximum Rate	Description
Single Shot	10 ns/div to 1000 s/div	500 MS/s	One ADC each channel
Repetitive	1 ns/div to 5 µsec/div	25 GS/s	Random Interleaved Sampling (RIS)
Roll Mode	≤500 kpts: 500 ms–1000 s/div	100 ks/s	Waveform slowly rolls across display
	≥500 kpts: 1 s–1000 s/div	100 ks/s	Slow timebases
Sequence Mode: 2–1000 segments (4000 with L models)		500 MS/s	Stores multiple events with time stamp in segmented acquisition memories

WAVERUNNER TRIGGERS

Name	Description	Edge or SMART Trigger®
Edge/Slope/Window/Line	Triggers when signal meets slope and level condition.	Edge
Signal pulse width	Triggers on glitches down to 2 ns. Width selectable from <2.5 ns to 20 s or on intermittent faults.	SMART
Signal interval	Triggers on intervals selectable between 10 ns and 20 s.	SMART
State or edge qualified	Triggers on input only after a defined state or edge occurred on another channel. Delay between sources is selectable by time or events.	SMART
Dropout	Triggers if the input signal drops out for longer than selected time between 25 ns and 20 s.	SMART
TV	Triggers on line (up to 1500) in odd or even fields for PAL, NTSC, or nonstandard video.	SMART

Technical Specifications

Probes

MODEL PP006: 10:1, 10 MΩ with autodetect (one per channel)

PROBE SYSTEM: ProBus Intelligent Probe System supports differential amplifiers and active, high-voltage, current, and differential probes.

Color Waveform Display

TYPE: Color 8.4" flat panel TFT-LCD with VGA

SCREEN SAVER: Display blanks after 10 minutes.

REAL TIME CLOCK: Date, hours, minutes, and seconds displayed with waveform

NUMBER OF TRACES: Maximum eight on LT344, six on LT342; simultaneously display channel, zoom, memory, and math traces

GRID STYLES: Single, Dual, Quad, Octal, XY, Single+XY, Dual+XY; Full Screen gives enlarged view of each style.

WAVEFORM STYLES: Sample dots joined or dots only -- regular or bold

Analog Persistence Display

ANALOG AND COLOR-GRADED PERSISTENCE: Variable saturation levels; stores each trace's persistence data in memory

TRACE DISPLAY: Opaque or transparent overlap

Zoom Expansion Traces

STYLE: Display up to four zoom traces

VERTICAL ZOOM: Up to 5x expansion, 50x with averaging

HORIZONTAL ZOOM: Expand to 2 pts/div, magnify to 50,000x

AUTO SCROLL: Automatically scan and display a captured signal

Rapid Signal Processing

PROCESSOR: 96 MHz PowerPC

LT342	LT344	LT342L	LT344L
16 Mbytes	16 Mbytes	32 Mbytes	32 Mbytes

64 Mbyte system memory optional for all models.

Internal Waveform Memory

WAVEFORM: M1, M2, M3, M4*

ZOOM AND MATH: A, B, C, D*

*Store full-length waveforms with 16 bits/data point.

Setup Storage

FOR FRONT PANEL AND INSTRUMENT STATUS: Four non-volatile memories and floppy drive are standard. Hard drive and memory card are optional.

Math Tools

Simultaneously perform up to four math processing functions; traces can be chained together to perform math on math.

STANDARD MATH TOOLS:

average (summed to 1000 sweeps)
difference
enhanced resolution (to 11 bits vertical)
FFT of 50 kpoint waveforms
identity
product
resample (deskew)
rescale (with units)
sin x/x
sum

CURSOR MEASUREMENTS

Type	Symbol	From	To
Relative time		first point on waveform	any other point on waveform
Relative voltage		select voltage level	any other voltage level
Absolute time		time and voltage relative to	ground and trigger
Absolute voltage		voltage	ground

Measure Tools

AUTOMATED MEASUREMENTS: Display any five parameters together with their average, high, low, and standard deviations.

STANDARD MEASURE TOOLS:

amplitude
area
base
cycle mean
cycle rms
cycles
delay
Δ delay
duty cycle
fall
fall 80-20
frequency
maximum
mean
minimum
rms
+overshoot
-overshoot
peak-to-peak
period
phase
rise
rise 20-80
top
width

PASS/FAIL: Test any five parameters against selectable thresholds. Limit testing is performed using masks created on the scope or on a PC. Setup a pass or fail condition to initiate actions such as hardcopy output, save waveform to

Technical Specifications

memory, GPIB SRQ, or pulse out.

Extended Math and Measurements Option

Adds math and advanced measurements for general purpose applications. Includes all standard math and measurement tools, plus:

EXTENDED MATH TOOLS:

absolute value
differentiate
exp (base e)
exp (base 10)
log (base e)
log (base 10)
integrate
reciprocal (invert)
square
square root
trend (datalog)

EXTENDED MEASURE TOOLS:

cycles median
cycles std. deviation
Δ time @ level % and volts
Δ time @ level from trigger
Δ time from clock to data + and -
duration
fall @ level; % and volts
first point
last point
median
number of points
rise @ level; % and volts
std. deviation

WaveAnalyzer

Includes the Extended Math and Measure Tools as well as expanded capabilities for performing FFTs, averaging, histograms, and histogram parameters.

WAVE ANALYZER TOOLS

Histograms with 18 Histogram Parameters
Summed Averaging to 1 Million Sweeps
Continuous Weighted Averaging
FFT (up to 1 Mpoint Waveforms)
FFT Power Averaging
FFT Power Density, Real, and Imaginary

Other Application Solutions

JITTER AND TIMING ANALYSIS (JTA)

POWERMEASURE TOOLS

Interface

REMOTE CONTROL: Full control via GPIB and RS-232-C

FLOPPY DRIVE: Internal, DOS-format, 3.5" high-density

PCMCIA TYPE III SLOT (OPTIONAL): Supports memory and hard drive cards.

EXTERNAL MONITOR PORT: 15-pin D-Type VGA-compatible

CENTRONICS PORT: Parallel printer interface

INTERNAL GRAPHICS PRINTER (OPTIONAL): Provides hardcopy output in <10 seconds.

Outputs

CALIBRATOR SIGNAL: 500 Hz–1 MHz square wave, -1.0 to +1.0, test point and ground lug on front panel

CONTROL SIGNALS: Choice of trigger ready, trigger out, or pass/fail status; TTL levels into 1 MΩ at rear panel BNC (output resistance 300 Ω ±10%)

General

OPERATING CONDITIONS: Temperature 5–40°C; humidity 80% non-condensing at 40°C; altitude ≤2,000 meters

SHOCK AND VIBRATION: Conforms to MIL-PRF-28800P; Class C

POWER REQUIREMENTS: 90–132 V AC and 180–250 V AC; 45–66 Hz; maximum power dissipation: 150 VA–230 VA, depending on model

CERTIFICATIONS: CE, UL and cUL

DIMENSIONS (HWD): 210 mm x 350 mm x 300 mm; 8.3" x 13.8" x 11.8" (height excludes feet)

WEIGHT: 8 kg; 18 lbs

WARRANTY AND CALIBRATION: Three years; calibration recommended yearly

Ordering Information

WAVERUNNER DIGITAL OSCILLOSCOPES:	PRODUCT CODE
Two-Channel Color, 500 MHz, 500 MS/s, 250 kpts/ch	LT342
Two-Channel Color, 500 MHz, 500 MS/s, 1 Mpts/ch	LT342L
Four-Channel Color, 500 MHz, 500 MS/s, 250 kpts/ch	LT344
Four-Channel Color, 500 MHz, 500 MS/s, 1 Mpts/ch	LT344L

INCLUDED WITH STANDARD CONFIGURATION:	
10:1 10 MΩ Passive Probe (1 per channel)	PP006
Operator's Manual and HTML Manual on CD-ROM	LTXXX-OM
Remote Control Manual	LTXXX-RCM
Quick Reference Guide	LTXXX-QRG
Math Analysis with FFT	
Floppy Disk Drive	
GPIB, RS-232-C, Centronics Interfaces and VGA Output Port	
Performance Certificate	
Three-Year Warranty	

SELECTED PROBES & ACCESSORIES:	
50 MHz/30 amp (50 amp peak) Current Probe	AP015
120 kHz/150 amp Current Probe	AP011
10 MHz Differential Amplifiers	DA1820/DA1822
100 MHz Differential Amplifiers	DA1850/DA1855
250 MHz, 100:1 or 10:1 Selectable, Passive Differential Probe Pair	DXC100
1 GHz 10:1 FET Probe with SMD Kit	AP020
DC-500 MHz Active Differential Probe	AP033
ProBus 75 to 50 Ω Adapter	PP090
Graphics Printer Paper/10 rolls	GPR10

SOFTWARE OPTIONS:	
Extended Math and Measurement Package	LTXXX-EMM
WaveAnalyzer Package including Histograms	LTXXX-WAVA
Jitter and Timing Analysis Package	LTXXX-JTA
Power Measurement Tools	LTXXX-PMT1

HARDWARE OPTIONS:	
Internal Graphics Printer	LTXXX-GP02
PC Card Slot	LTXXX-PCSLOT
PC Card Hard Disk (520 Mbytes)	LTXXX-HD02
PC Card Slot with HD02 and MC04	LTXXX-PCMEDIA
512 kbytes SRAM Memory Card	MC04
64 Mbytes System Memory	LTXXX-64MBSM

MANUALS:	
Service Manual for LT34X Series	LT34X-SM

WARRANTY & CALIBRATION:	
Swiss OFMET Standard	CCOFMET
US NIST Standard	CCNIST
US Military Standard	CCMIL

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ICA 15M 12/98

Sales and Service Throughout the World

Corporate Headquarters

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA
http://www.lecroy.com

LeCroy Sales Offices:

Asia: Hong Kong
Phone (852) 2836 7361
Fax (852) 2836 7007

France: Les Ulis
Phone (33) 1 69 18 83 20
Fax (33) 1 69 07 40 42

Germany: Heidelberg
Phone (49) 6221 827 00
Fax (49) 6221 834 655

Italy: Venice
Phone (39) 41 456 97 00
Fax (39) 41 456 95 42

Japan: Osaka
Phone (81) 6 396 0961
Fax (81) 6 396 0962

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

Japan: Tsukuba
Phone (81) 298 41 5810
Fax (81) 298 41 5830

Korea: Seoul
Phone (82) 2 3452 0400
Fax (82) 2 3452 0490

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

U.K.: Abingdon
Phone (44) 1235 536 973
Fax (44) 1235 528 796

USA: Chestnut Ridge, NY
Phone (1) 914 578 6020
Fax (1) 914 578 5985

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