waveMASTER™

X-STREAM

WaveMaster 8600A 8500A 8300A

Oscilloscopes

WaveMaster oscilloscopes are the only scopes that include an all SiGe front end, X-Stream technology; and also offer user customization.

LEADING FEATURES

- ***6, 5 or 3 GHz bandwidth***
- ***10 GS/s sample rate/channel***
- ***20 GS/s dual channel mode***
- ***All-SiGe front end for high signal fidelity (up to 75 ps rise time)***
- ***1 ps rms jitter noise floor***
- ***1 ppm internal sample clock***
- ***X-Stream™ technology data transfer is 10 –100X faster than other scopes***
- ***Customizable – add your own measurements or functions*** *(VBScript, MATLAB, Mathcad, or Excel)* ***using the optional XMAP software package***
- ***< 2.5 ps rms trigger jitter***
- ***SiGe trigger circuit (5 GHz bandwidth)***
- ***10.4" TFT SVGA color display with 800 x 600 pixel resolution***
- ***100BaseT Ethernet, standard***
- ***Intuitive graphical user interface makes advanced Waveshape Analysis simple***
- ***Win2000 O/S***

Maximum Performance

The WaveMaster™ oscilloscope is designed to meet next-generation Research and Development needs. It is the only high bandwidth scope to include an all-SiGe front end for highest signal fidelity, to use unique X-Stream technology to provide fast display updates (up to 100X faster) of your analyses, and to provide the ability to customize the scope with your own measurements or functions. Imagine the power this provides to solve your unique problems and to speed product development. In addition, the WaveMaster contains a SiGe trigger circuit for maximum trigger sensitivity at high bandwidths and extremely low (< 2.5 ps) trigger jitter.
A high stability (1 ppm) internal sample clock ensures the most precise timing measurements. Capture up to 1 Mpt with standard memory (4 ch mode), or upgrade to longer memory (up to 48 Mpts in 2 ch mode) to enable debug and design characterization of complex or rare occurrences in long duration signals. LeCroy's extensive measurement and analysis tool sets combined with innovative and intuitive displays make WaveShape Analysis simple.

Maximum Benefits

The high fidelity all-SiGe front end is ideal for use with the fastest, highest bandwidth requirements. Users making timing measurements will appreciate the low trigger jitter and superior timebase stability. The high resolution (800x600 pixel) display and 20% larger viewing area allow for crisp, clear display of signals. Our unique "Histicons" (small images showing live statistical variations in measurements), enable you to find signal problems you weren't even aware of.

Easy to Use

The familiar scope controls on the front panel, coupled with a powerful, efficient, easy-to-use graphical user interface, let you simply and quickly control the scope from the touch screen, front panel, mouse, or any combination of the above. The WaveMaster scope is able to quickly display long, complex signals, processed functions in various domains (time, frequency, and statistical), and measurements (choose from an extensive library).

LeCroy

WaveMaster 8600A/8500A/8300A Oscilloscopes

Unprecedented

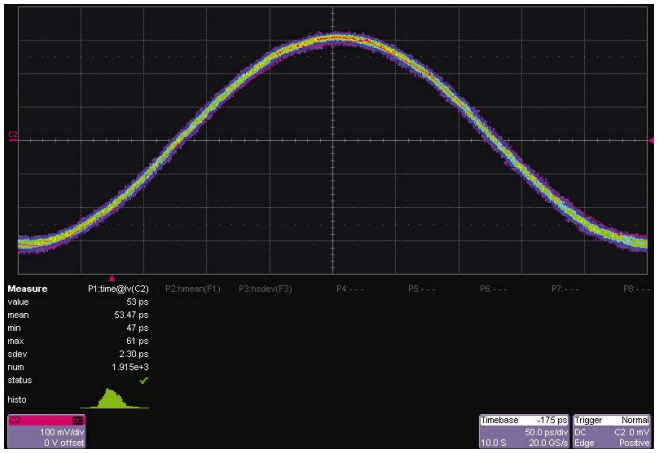
The precision and fidelity of the WaveMaster front end is unprecedented in a real-time oscilloscope. LeCroy has delivered the first product to truly meet the needs of high-speed digital designers with a combination of exceptional front end, trigger, and timebase performance together with long memory, X-Stream technology, and the first true ability to customize your scope to your exact needs.

Measurement Accuracy – Stable and Precise

The WaveMaster oscilloscope delivers superior timebase performance and the lowest jitter noise floor of any DSO. The most advanced jitter characterization and analysis is possible with the WaveMaster scope's 1 ps rms jitter noise floor and exceptional timebase stability (+/-1 ppm clock accuracy) for short and long record lengths. In addition, very low trigger jitter (< 2.5 ps) contributes to the ease and accuracy of acquiring high-speed signals. A front end which supports a rise time as fast as 75 ps, enables measurement of the fastest signal edges, with high signal fidelity.

Exceptional Trigger Performance

The WaveMaster SiGe trigger circuit delivers the fastest trigger capability on the market with a 5 GHz edge trigger bandwidth for capturing fast signals, and superior trigger sensitivity at high bandwidths. The versatile SMART Trigger® captures a variety of signals, including glitches and pulse widths down to 600 ps. The logic trigger makes it easy to trigger on a pattern of up to 5 inputs, or to qualify on 4 signal inputs and trigger on the 5th.



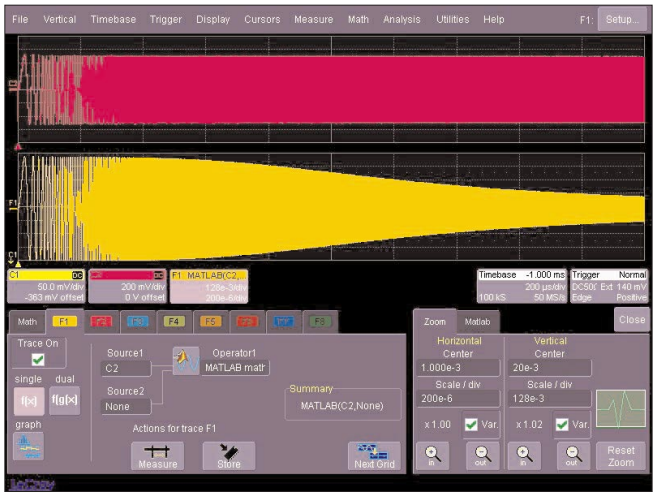
A 2 GHz sine wave input with persistence "on" demonstrates the exceptionally low trigger jitter on WaveMaster scopes.

X-Stream Technology

X-Stream should be a standard feature in every DSO, but it is only available in WaveMaster. X-Stream makes processing of waveform records up to 100X faster than other scopes. Imagine having the ability to see deep memory calculations updated quickly on the screen, and getting fast insight into the source of problems. Innovative views like "Histicons" help you identify signal problems without slowing down your display update. Why would you accept anything less? Leave outdated "viewing" technologies behind and upgrade to X-Stream.

True Customization

Only WaveMaster provides the ability to create your own parameter measurements or math functions in the scope's user interface. Unique or proprietary MATLAB, Mathcad, VBScript, or even Excel calculations can be simply selected like any other LeCroy-installed parameter or math function, and the results displayed on the scope screen. It's that easy! Since the resulting waveform is inserted back into the X-Stream processing flow, cursors, measurements, and math can be performed on it, giving much more power and flexibility than a simple export of data to a third party program. LeCroy's advanced features also provide the ability to program the scope using ActiveX Automation language, embedded scripts, and other open Windows features, to create a scope that meets your specific needs. Why accept only connectivity when you can have true customization?



A user-created MATLAB low-pass filter is easily inserted as function F1 in the WaveMaster user interface.

Cursors

LeCroy has responded to demand from oscilloscope users for dedicated cursor knobs and a very flexible selection of cursors. Different cursor modes are easily recalled and set. You can access them from the front panel or the graphical user interface.

User Interface

The familiar scope controls on the front panel, coupled with a natural, context-sensitive graphical user interface, react quickly to your commands. Functionality is exactly where you expect it to be. If you have questions, the context-sensitive on-line help gives immediate assistance.

WaveMaster 8600A/8500A/8300A Oscilloscopes
Specifications

Vertical System	WaveMaster 8600A	WaveMaster 8500A	WaveMaster 8300A
Analog Bandwidth @ 50 Ω (-3 dB)	6 GHz	5 GHz	3 GHz
Rise Time (Typical)	75 ps	90 ps	150 ps
Input Channels	4	4	4
Bandwidth Limiters	25 MHz; 250 MHz; 1 GHz, 3 GHz, 4 GHz	25 MHz; 250 MHz; 1 GHz, 3 GHz, 4 GHz	25 MHz, 250 MHz, 1 GHz
Input Impedance	50 Ω ±2%		
Input Coupling	DC, GND		
Maximum Input	±4 Vpeak		
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)		
Sensitivity	2 mV – 1 V/div fully variable; Full bandwidth at ≥ 10 mV/div		
Offset Range	2 mV – 194 mV/div: ±750 mV; 195 mV – 1 V/div: ±4 V		

Horizontal System	
Timebases	Internal timebase common to 4 input channels; an external clock may be applied at the Auxiliary Input
Math & Zoom Traces	4 independent zoom and 4 math/zoom traces standard; 8 math/zoom traces available with XMAP (Master Analysis Package)
Clock Accuracy	≤ 1 ppm @ 0–40 degrees C
Time Interval Accuracy	≤ 0.06/SR + (1 ppm + Reading) (RMS)
Sample Rate + Delay Time Accuracy	+/- 1 ppm ≤ 10s interval
Jitter Noise Floor	1 ps rms (typical)
External Clock Frequency	2 GHz maximum / 50 Ω impedance / applied at the auxiliary input

Acquisition System	
Single-Shot Sample Rate/Ch	10 GS/s
2 Channel Max	20 GS/s
Maximum Acquisition Points/Ch	(2 Ch) / (4 Ch)
Standard	2M / 1M
M – Memory Option	8M / 4M
L – Memory Option	16M / 8M
VL – Memory Option	32M / 16M
XL – Memory Option	48M / 24M

Acquisition Modes	
Random Interleaved Sampling (RIS)	200 GS/s for repetitive signals: 20 ps/div – 1 µs/div
Single-Shot	For transient and repetitive signals: 20 ps/div – 1000 s/div
Sequence	2 – 20,000 segments (number of segments depends upon memory options)
Intersegment Time	Typically 6 µs

Acquisition Processing	
Averaging	Summed averaging to 1 million sweeps. Continuous averaging to 1 million sweeps
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope, floor, roof for up to 1 million sweeps

Triggering System	
Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, External, EXT X10, EXT/10, or line; slope and level unique to each source (except line trigger)
Coupling mode	DC
Pre-trigger delay	0 – 100% of horizontal time scale
Post-trigger delay	0 – 10,000 divisions
Hold-off by time or events	Up to 20 s or from 1 to 99 999 999 events
Internal trigger range	±5 div from center
Max trigger frequency	Up to 5 GHz with Edge Trigger; 750 MHz with SMART Trigger
External trigger input range	AUX (±0.4 V); AUX X10 (±0.04 V); AUX/10 (±4 V)

Automatic setup	
Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals.
Vertical Find Scale	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range.

Probes	
Probes	A variety of passive and active probes is optional
Probe System: ProLink with Probus	Automatically detects and supports a variety of compatible probes; Supports ProLink SMA or BNC input adapters.
Scale Factors	Automatically or manually selected depending on probe used.

8600A bandwidth and rise time specification is for sample speed ≥ 20 GS/s

WaveMaster 8600A/8500A/8300A Oscilloscopes

Specifications (continued)

Color Waveform Display	
Type	Color 10.4" flat-panel TFT-LCD with high resolution touch screen
Resolution	SVGA; 800 x 600 pixels
Realtime Clock	Dates, hours, minutes, seconds displayed with waveform, SMTP support to synchronize to precision internet clocks
Number of Traces	Display a maximum of 8 traces. Simultaneously display channel, zoom, memory, and math traces.
Grid Styles	Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY, or Auto
Waveform Styles	Sample dots joined or dots only
Analog Persistence Display	
Analog & Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory.
Persistence Selections	Select analog, color, or 3D
Trace Selection	Activate Analog Persistence on all or any combination of traces.
Persistence Aging Time	Select from 500 ms to infinity.
Sweeps Displayed	All accumulated, or all accumulated with last trace, highlighted.
Zoom Expansion Traces	
	Display up to 4 Zoom and 4 Math/Zoom traces (8 Math/Zoom traces available with XMAP Master Analysis Package option).
CPU	
Processor	Intel Pentium III (or better) with MS Windows 2000 Platform
Processing Memory	Up to 512 MBytes
Internal Waveform Memory	
	M1, M2, M3, M4 Internal Waveform Memory (Store full-length waveforms with 16 bits/data point)
	Or store to any number of files limited only by data storage media.
Setup Storage	
Front Panel and Instrument Status	Save to the internal hard drive, floppy drive or to a USB connected peripheral device.
Interface	
Remote Control	Via Windows automation, or via LeCroy GPIB command set
GPIB Port (Optional)	Supports IEEE – 488.2
Ethernet Port	10/100BaseT Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
USB Ports	4 USB ports support Windows compatible devices.
External Monitor Port Standard	15-pin D-Type SVGA-compatible
Parallel Port	1 standard
Auxiliary Output	
Signal Types	Select from calibrator or control signals output on front panel.
Calibrator Signal	5 Hz – 5 MHz square wave or DC Level; 0.0 to +0.5 Volts into 50 Ω (0 - 1 V into 1 MΩ), or TTL Volts (selectable)
Control Signals	Trigger enabled, trigger out, pass/fail status
Auxiliary Input	
Signal Types	Select from External Trigger or External Clock input on front panel.
General	
Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum.
Power Requirements	100–120 VAC at 50/60/400 Hz; 200–240 VAC at 50/60 Hz; Power consumption: 800 VA , 800 Watts max.
Environmental	5 to 40 °C operating temperature, -20 to 60 °C storage temperature
EMC and Safety Certifications	CE approved, UL and cUL listed; Conforms to EN61326-1; EN61010-1, UL3111, and CSA C22.2 No. 1010.1
Physical Dimensions	
Dimensions (HWD)	264 mm x 397 mm x 491 mm; 10.4" x 15.6" x 19.3" (height excludes feet)
Weight	18 kg; 39 lbs.
Shipping Weight	24 kg; 53 lbs.
Warranty and Service	
	3-year warranty; calibration recommended annually
	Optional service programs include extended warranty, upgrades, and calibration services.

Specifications are subject to change.

WaveMaster 8600A/8500A/8300A Oscilloscopes

Specifications (continued)

Basic Triggers

Edge/Slope/Line	Triggers when signal meets slope and level condition.

SMART Triggers

State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s.
Pattern	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input) Each source can be high, low, or don't care. Triggers at start or end of the pattern.

SMART Triggers with Exclusion Technology

Glitch	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Width	Triggers on positive or negative pulse widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.

Math Tools (Standard)

Display up to four math function traces (F1 – F4). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace. Function traces can be chained together to perform math-on-math.

absolute value	invert (negate)
average (summed)	log (base e)
average (continuous)	log (base 10)
derivative	product (x)
deskew (resample)	ratio (/)
difference (–)	reciprocal
enhanced resolution (to 11 bits vertical)	rescale (with units)
envelope	roof
exp (base e)	(sin x)/x
exp (base 10)	square
fft (power spectrum, magnitude phase up to 25 kpts)	square root
floor	sum (+)
histogram of 1,000 events	trend (datalog) of 1,000 events
integral	zoom (identity)

Automated Measure Tools (Standard)

Displays any 8 parameters together with statistics, including their average, high, low, and standard deviations. Histicons provide a fast, dynamic view of parameters and wave shape characteristics.

amplitude	last	risetime (10-90%, 20-80%, @ level)
area	level @ x	rms
base	maximum	std. deviation
cycles	mean	top
data	median	width
delay	minimum	time @ minimum (min.)
Δ delay	number of points	time @ maximum (max.)
duty cycle	+overshoot	Δ time @ level
duration	–overshoot	Δ time @ level from trigger
falltime (90-10%, 80-20%, @ level)	peak-to-peak	x @ max
frequency	period	x @ min
first	phase	

Pass/Fail Testing

Simultaneously test multiple parameters against selectable parameter limits or pre-defined masks. Pass or fail conditions can initiate actions including document to local or networked files, email the image of the failure, save waveforms, send a pulse out of the front panel auxiliary BNC output, or (with the GPIB option) send a GPIB SRQ.

Master Analysis Package (XMAP)

This package provides a comprehensive set of signal WaveShape Analysis Tools providing insight into the waveshape of complex signals. Additional capability provided by XMAP includes

- 8 math traces total (4 additional)
- Parameter math – add, subtract, multiply, or divide two different parameters
- Create your own measurement parameter or math function using third-party software packages and display the result in the scope. Supported third-party software packages include:
  VBScript(VisualBasic) Excel MATLAB Mathcad
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 20,000 events
- Track graphs of any measurement parameter
- FFT capability added to include: power averaging, power density, real and imaginary components, frequency domain parameters, and FFT on up to 25 Mpts.
- Narrow-band power measurements
- Auto-correlation function
- Persistence histogram, persistence trace (mean range, sigma)
- All parameters in the JTA2 package

Jitter and Timing Analysis Package (JTA2)

This package provides jitter timing and analysis using time, frequency, and statistical views for common timing parameters, and also includes other useful tools.

- Jitter and timing parameters, with "Track" graphs of

Cycle-Cycle Jitter	Period	Time Interval Error	Skew
N-Cycle	Half Period	Setup	Duty Cycle
N-Cycle w/ start selection	Width	Hold	Duty Cycle Error
Frequency			

- Edge@lv parameter (counts edges)
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 20,000 events
- Track graphs of all parameters
- Persistence histogram, persistence trace (mean, range, sigma)

Ordering Information

WaveMaster 8600A Four Channel Digital Oscilloscope	Product Code
6 GHz, 20 GS/s 2 Ch (10 GS/s, 4 ch), 2 Mpts/2Ch; 1 Mpt/Ch Standard	WAVEMASTER 8600A

WaveMaster 8500A Four Channel Digital Oscilloscope	Product Code
5 GHz, 20 GS/s 2 Ch (10 GS/s, 4 ch), 2 Mpts/2Ch; 1 Mpt/Ch Standard	WAVEMASTER 8500A

WaveMaster 8300A Four Channel Digital Oscilloscope	Product Code
3 GHz, 20 GS/s 2 Ch (10 GS/s, 4 ch), 2 Mpts/2Ch; 1 Mpt/Ch Standard	WAVEMASTER 8300A

Included with Standard 8600A and 8500A Configurations:

ProLink Adapter SMA; 4 each
ProLink Adapter BNC; 2 each
Operator's Manual; Quick Reference Guide; CD-ROM with OM/ RCM, Utility Software and Recovery Software
Remote Control Manual
Floppy Disk Drive
CD ROM Drive
Optical 3 button Wheel Mouse-USB
Standard Ports; 10/100BaseT Ethernet, Parallel, SVGA Video Output, USB
Protective Front Cover
Standard Commercial Calibration and Performance Certificate
3 Year Warranty

Included with Standard 8300A Configuration:

ProLink Adapter BNC; 5 each
Operator's Manual; Quick Reference Guide; CD-ROM with OM/ RCM, Utility software and Recovery Software
Remote Control Manual
Floppy Disk Drive
CD ROM Drive
Optical 3 button Wheel Mouse-USB
Standard Ports; 10/100BaseT Ethernet, Parallel, SVGA Video Output, USB
Protective Front Cover
Standard Commercial Calibration and Performance Certificate
3 Year Warranty

Memory Options

8 Mpts/2 Ch, 4 Mpts/ch	-M
16 Mpts/2 Ch, 8 Mpts/ch	-L
32 Mpts/2 Ch, 16 Mpts/ch	-VL
48 Mpts/2 Ch, 24 Mpts/ch	-XL

Software Options

Master Analysis Package	XMAP
Jitter and Timing Analysis	JTA2
Disk Drive Measurement Package	DDM2

Selected Accessories

ProLink Adapter BNC; 1 each	LPA-BNC
ProLink Adapter BNC kit of 4	LPA-BNC-Kit
Keyboard	KYBD-1
3.5 GHz Active Voltage Probe	HFP3500
7.5 GHz Low Capacitance Passive Probe	PP066
1.0 GHz Differential Probe	AP034
1 MΩ Adapter	AP-1M
Norton Anti-Virus	WM-AV
Oscilloscope Cart	OC1021
Oscilloscope Cart with additional shelf and drawer	OC1024
Rackmount Kit - 25" Slide	RMA-25
Rackmount Kit - 30" Slide	RMA-30
WaveMaster Soft Carrying Case	WMSCC
WaveMaster Hard Shell Transit Case	WMTC1

Warranty & Calibration

A variety of extended warranty, certification, and calibration services are available.
Contact LeCroy Sales and Service for details

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