

WaveMaster 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		
Bandwidth Limiters	25 MHz; 250 MHz; 1 GHz; 3 GHz; 4 GHz		25 MHz; 250 MHz; 1 GHz
Input Impedance	50 Ω ±2.0%		
Input Coupling	DC, GND		
Maximum Input Voltage	±4 V _{peak}		
Channel-Channel Isolation	≥ 100:1 at 2 GHz; ≥ 40:1 at 3 GHz; ≥ 20:1 at 4 GHz;		
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		
DC Gain Accuracy	±1.5% of Full Scale		
Offset Range	2 mV – 194 mV/div: ±750 mV; 195 mV – 1 V/div: ±4 V		
Offset Accuracy	±(1.5% of full scale + 1.5% of offset value + 2mV)		

Horizontal System

Timebases	Internal timebase common to 4 input channels; an external clock may be applied at the auxiliary input
Time/Division Range	20 ps/div – 1000 s/div
Math & Zoom Traces	4 independent zoom and 4 math/zoom traces standard; 8 math/zoom traces available with XMAP (Master Analysis package) or XMATH (Advanced Math package)
Clock Accuracy	≤ 1 ppm @ 0-40 degrees C
Time Internal Accuracy	≤ 0.06 / SR + (1 ppm * Reading) (RMS)
Sample Rate & Delay Time Accuracy	± 1ppm ≤ 10s interval
Jitter Noise Floor	1 ps RMS (Typical)
Trigger & Interpolator Jitter	≤ 2.5 ps (Typical)
Channel-Channel Deskew Range	±4.5 ns
External Timebase Reference	100 MHz; 50 Ω impedance; applied at the rear input
External Clock	30 MHz – 2 GHz; 50 Ω impedance; applied at the auxiliary input

Acquisition System

Single-Shot Sample Rate/Ch	10 GS/s		
2 Channel Max	20 GS/s		
Random Interleaved Sampling (RIS)	200 GS/s for repetitive signals: 20 ps/div – 1 μs/div		
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode, up to 4 channels)		
Intersegment Time	≤ 6 μs		
Maximum Acquisition Points/Ch	(2 Ch) / (4 Ch)	Duration @ 20 GS/s	Segments (Sequence Mode)
Standard	2M / 1M	0.1 ms	500 Segments
M – Memory Option	8M / 4M	0.4 ms	1,000 Segments
L – Memory Option	16M / 8M	0.8 ms	5,000 Segments
VL – Memory Option	32M / 16M	1.6 ms	10,000 Segments
XL – Memory Option	48M / 24M	2.4 ms	20,000 Segments

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	5 GHz w/Edge Trigger; 750 MHz w/SMART Trigger (8300A = 3 GHz w/Edge Trigger, 750 MHz w/SMART Trigger)
External trigger input range	Aux (±0.4 V); Aux X10 (±0.04 V); Aux / 10 (±4 V)
Trigger Sensitivity (Edge)	3 Divisions @ 5 GHz, 2 Divisions @ 4 GHz, 1.2 Divisions @ 3 GHz (Typical)

NOTE: 8600A Bandwidth and rise time specification is for sample rate ≥ 20 GS/s

Basic Triggers

Edge/Slope/Line	Triggers when signal meets slope and level condition.
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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. The High and Low level can be selected independently. 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.

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

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. SNTP 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	Auto, Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY
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 three-dimensional.
Trace Selection	Activate 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) or XMATH (Advanced Math package).
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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.
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Setup Storage

Front Panel and Instrument Status	Store to the internal hard drive, floppy drive or to a USB-connected peripheral device.
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WaveMaster Specifications

Interface

Remote Control	Via Windows Automation, or via LeCroy Remote Command Set.
GPIB Port (Optional)	Supports IEEE – 488.2
Ethernet Port	10/100Base-T 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 V into 50 Ω (0–1 V into 1 M Ω), 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.
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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; Automatic AC Voltage selection. Power consumption: < 800 VA

Environmental

Temperature (Operating)	+5 °C to +40 °C including floppy disk and CD-ROM drives
Temperature (Non-Operating)	–20 °C to +60 °C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 °C. Upper limit derates to 25% relative humidity (non-condensing) at +40 °C.
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF–28800F.
Altitude (Operating)	up to 10,000 ft (3048 m) at or below +25 °C
Altitude (Non-Operating)	Up to 40,000 ft (12,192 m)
Random Vibration (Operating)	0.31 g _{rms} 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 g _{rms} 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Functional Shock	20 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total

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.

Certifications

	CE Approved, UL and cUL listed;
	Conforms to EN 61326-1; EN 61010-1; UL 3111-1; and CSA C22.2 No. 1010.1

Warranty and Service

	3-year warranty; calibration recommended annually.
	Optional service programs include extended warranty, upgrades, and calibration services.

Standard

Math Tools

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, and 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)	(sinx)/x
exp (base 10)	square
fft (power spectrum, magnitude, phase, up to 25 kpts)	square root
floor	sum (+)
histogram of 1000 events	trend (datalog) of 1000 events
integral	zoom (identity)

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 at the front panel auxiliary BNC output, or (with the GPIB option) send a GPIB SRQ.

Optional

Master Analysis Package (XMAP)

This package provides maximum capability and flexibility, and includes all the functionality present in XMATH, XDEV, and JTA2

Advanced Math Package (XMATH)

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

- Intuitive, Graphical Math Setup (Processing Web) with unlimited chaining of functions
- 8 math traces total (4 additional)
- Parameter math – add, subtract, multiply, or divide two different parameters
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million 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
- Sparse function
- Cubic and Quadratic Interpolation function

Advanced Customization Package (XDEV)

This package provides a set of tools to modify the scope and customize it to meet your unique needs. Additional capability provided by XDEV includes

- Creation of 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
 - MATLAB
 - Excel
 - Mathcad
- CustomDSO – create your own user interface in a scope dialog box.
- Add macro keys to run VBScript files
- Support of plug-ins

Measure Tools

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

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

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. JTA2 includes:

- Jitter and timing parameters, with “Track” graphs of
 - Cycle-Cycle Jitter
 - Period
 - Hold
 - N-Cycle
 - Half Period
 - Skew
 - N-Cycle with start selection
 - Width
 - Duty Cycle
 - Time Interval Error
 - Duty Cycle Error
 - Frequency
 - Setup
- Edge@lv parameter (counts edges)
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million events
- Track graphs of all parameters
- Persistence histogram, persistence trace (mean, range, sigma)

Disk Drive Measurements Package (DDM2)

This package provides disk drive parameter measurements and related mathematical functions for performing disk drive WaveShape Analysis.

- Disk Drive Parameters are as follows:

amplitude assymetry	local time trough-peak
local base	local time under threshold
local baseline separation	narrow band phase
local maximum	narrow band power
local minimum	overwrite
local number	pulse width 50
local peak-peak	pulse width 50–
local time between events	pulse width 50+
local time between peaks	resolution
local time between troughs	track average amplitude
local time at minimum	track average amplitude–
local time at maximum	track average amplitude+
local time peak-trough	auto-correlation s/n
local time over threshold	non-linear transition shift
- Correlation function
- Trend (datalog) of up to 1 million events
- Histograms expanded with 18 histogram parameters and up to 2 billion events