

DDA

Disk Drive Analyzer

DDA 3000

Disk Drive Analyzer

LEADING FEATURES

- 3 GHz Bandwidth
- 10 GS/s sample rate/channel
- 20 GS/s dual channel mode
- Up to 48 Mpts in dual channel mode
- Intuitive front panel and touch screen interface
- Zoom and Multi-Zoom on Disk Sectors
- One Button Access to Read Channel Emulation, Servo Analysis, Disk Triggers
- Segmented Memory for Sector by Sector parametric measurements
- Built in PWxx, amplitude, pulse shape and acsn parametric measurements
- Customizable with MATLAB scripts of your channel
- Flexible connectivity to networks, peripherals with 100BT Ethernet and USB

X-STREAM



Signal fidelity and disk triggering, combined with long memory and WaveShape analysis are strengths of the DDA products.

LeCroy offers both 5 and 3 GHz Bandwidth Disk Drive Analyzers. The DDA 5005A is designed for signal fidelity, whole track acquisition and analysis for read channel, media noise analysis, head parametrics with the longest acquisition memory standard. The DDA 3000 provides the same measurement capability at a lower bandwidth and memory configuration and with the convenience of selectable 50 ohm and Hi Z inputs.

Excellence in Head, Disk, Track and Noise Analysis

The DDA series analyzers incorporate the tools to make you most efficient. The 100 Mpts capture memory standard in the DDA 5005A XXL provides 5 milliseconds of single shot 20 GS/s capture speed on two channels. On the DDA 3000, 8 Mpts on 2 channels captures multiple drive sectors in a single shot

acquisition. Trigger on index and with the Optional DDA XL memory you can capture a whole track of information and then zoom in on any sector of detail.

Since its inception, DDA Series products have helped data storage design engineers improve the time to market of new products and speed the understanding and failure analysis on existing drives. The DDA 3000 and 5005A continue that tradition with high speed SiGe front end components, fast 10 GS/s Analog to Digital Converters and the longest high-speed memory. Its low noise, high timing precision design accurately captures the sampling points ensuring precise vertical and timing measurements. Each DDA provides an integrated tool designed for ease of setup in acquisition, manipulation and measurement.

LeCroy

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Disk Drive Analyzer



WaveLink high bandwidth differential probes let you capture head signals with best signal to noise ratio and low circuit loading.

Long Memory and Flexibility in Finding Problems

Acquire a head signal up to 3 GHz and then Quick Zoom it from the front panel. The DDA copies and expands the drive signal automatically. Simply scroll horizontally and vertically to examine any sector. Multiple Zooms let you view up to 8 separate areas of the head signal; each Zoom comes with a distinct color. You can measure the time between two events accurately with horizontal and vertical cursors.

Disk drive parameters let an engineer characterize the pulse width variation or signal to noise across a selectable region. Failure Analysis engineers can store and recall golden waveforms and panel setups to compare



problem drives with the known good signals. Analog to Digital Converters running at speeds up to 20 GS/s ensure the right sensitivity to measure today's high speed read channels. In every DDA, you can run your MATLAB scripts to view the captured signal with the filters matched for your channel and media.

Triggers Designed for Drive Analysis

Disk Triggers allow engineers to set up a series of events in the signal that then cause a trigger. For example, qualify the signal on the index signal and then capture all the sectors of information on the track. As memory is increased in the DDA, more sectors can be captured, at up to 50 picosecond/sample time resolution. Up to 20,000 sectors of data can be gathered with the DDA3000 equipped with the DDA option XL.

High Fidelity Connection to the Drive

With the WaveLink high frequency differential probes, design engineers can measure read channel signals up to 3 GHz with the DDA 3000 (5 GHz with the DDA 5005A). The unique design ensures high impedance loading across the full bandwidth. Match the probe bandwidth with your requirement. The 3 GHz DDA 3000 offers the convenience of both Hi Z and 50 ohm inputs that are switchable from the coupling screen.

Flexible Connectivity

All DDA Series analyzers come complete with a 100BT/10BT Ethernet connection for fast connection to network printers and for remote control. In addition, a GPIB option provides remote control through the IEEE-488 interface bus. Built in USB connections, a 3.5" floppy drive and integrated hard disk drive are also available for additional waveform storage and measurement setups. An optional built in graphics printer provides strip chart performance of multiple disk sectors.

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Disk Drive Analyzer Specifications

Vertical System

Analog Bandwidth @ 50 Ω (-3 dB)	3 GHz
Rise Time (Typical)	150 ps
Input Channels	4
Bandwidth Limiters	25 MHz-200 MHz
Input Impedance	50 Ω ; 1 M Ω /11pF typical (using PP005A probe)
Input Coupling	1 M Ω : AC, DC, GND; 50 Ω : DC
Maximum Input Voltage	50 Ω : 5 Vrms, 1 M Ω : 100 Vmax (peak AC; \leq 5 KHz + DC)
Channel-Channel Isolation	250:1 at same V/div setting; 40:1 at 3 GHz
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)
Sensitivity	50 Ω : 2 mV – 1 V/div fully variable; 1 M Ω : 2 mV – 2 V/div fully variable
DC Gain Accuracy	\pm 1.5% of full scale; \pm 1% (typical)
Offset Range	50 Ω : \pm 700 mV @ 2-4.99 mV/div \pm 1.5 V @ 5-100 mV/div \pm 10 V @ .102-1 V/div
	1 M Ω : \pm 700 mV @ 2-4.99 mV/div \pm 1.5 V @ 5-100 mV/div \pm 20 V @ 0.102-2 V/div
Offset Accuracy	\pm (1.5% of full scale + 0.5% of offset value + 2 mV)

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 – 10 s/div
Math & Zoom Traces	8 math/zoom traces standard
Clock Accuracy	\leq 10 ppm @ 0–40 $^{\circ}$ C
Time Internal Accuracy	\leq 0.06 / SR + (10 ppm * Reading) (rms)
Sample Rate & Delay Time Accuracy	\pm 10 ppm \leq 10 s interval
Jitter Noise Floor	2 ps rms @ 100 mV/div (typical)
Trigger & Interpolator Jitter	\leq 2.5 ps (typical)
Channel-Channel Deskew Range	\pm 4.5 ns
External Clock	30 MHz – 1 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 μ s/div
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode; up to 4 channels)
Intersegment Time	\leq 6 μ s
Maximum Acquisition Points/Ch	4 Ch / (2 Ch) Sequence Mode
Standard	4M / 8M 1,000 segments
L – Memory Option	8M / 16M 5,000 segments
VL – Memory Option	16M / 32M 10,000 segments
XL – Memory Option	24M / 48M 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
Interpolation	Linear, Sin x/x

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	DC50 Ω , GND, DC1M Ω , AC1M Ω
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	\pm 5 div from center
Max trigger frequency	3 GHz w/Edge Trigger; 750 MHz w/SMART Trigger

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	(2) PP005A standard; Optional passive and active probes available.
Probe System: Probus	Automatically detects and supports a variety of compatible probes.
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
Real time 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

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Disk Drive Analyzer Specifications (continued)

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 8 Math/Zoom traces

CPU

Processor	Intel 1.7 GHz or better with MS Windows 2000 Platform
Processing Memory	Up to 1 Gbyte

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	Store to the internal hard drive, floppy drive or to a USB-connected peripheral device.
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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 – 1 MHz square wave or DC level; 0.0 to 5.0 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	Selected 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

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Disk Drive Analyzer 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. Trigger 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

Disk Drive Triggers

Sector Trigger on the *n*th sector pulse after index. Index and sector pulse polarity and sector pulse number are selectable.

Servo Gate Trigger on the *n*th servo gate after index and every *m*th thereafter. Index and servo gate pulse polarity are selectable.

PES Trigger Trigger on Position Error Signal (PES) exceeding an adjustable voltage window. Servo gate can be selected as qualifier.

Read Gate Trigger Trigger on any read gate longer than an adjustable Sector ID field length.

Math Tools

Display up to eight math function traces (F1 - F8). 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.

<i>absolute value</i>	<i>negate</i>
<i>average (summed)</i>	<i>product (x)</i>
<i>Average (continuous)</i>	<i>ratio (/)</i>
<i>difference (-)</i>	<i>reciprocal (invert)</i>
<i>differentiate</i>	<i>resample (deskew)</i>
<i>enhanced resolution (to 11 bits vertical)</i>	<i>rescale (with units)</i>
<i>envelope</i>	<i>roof</i>
<i>exp (base e)</i>	<i>sin x/x</i>
<i>exp (base 10)</i>	<i>square</i>
<i>FFT</i>	<i>square root</i>
<i>floor</i>	<i>sum (+)</i>
<i>identity</i>	<i>histogram</i>
<i>integrate</i>	<i>trend (datalog)</i>
<i>log (base e)</i>	<i>Auto-correlation</i>
<i>log (base 10)</i>	

FFT includes: power averaging, power density, real and imaginary components, and frequency domain parameters.

Pass/Fail

Test waveforms by comparing their shape to test templates and simultaneously check multiple parameters versus selectable parameter or mask limits. Pass or fail conditions can initiate actions including document:local or networked files, or email the image of the failure, saving waveforms, or send a GPIB SRQ, or pulse to trigger another device.

Automated Disk Drive Measurements

<i>TAA</i>	<i>lbase</i>	<i>ltmn</i>	<i>msnr</i>
<i>TAA+</i>	<i>lbsep</i>	<i>ltmx</i>	<i>rsnr</i>
<i>TAA-</i>	<i>lmax</i>	<i>ltot</i>	<i>m_to_r</i>
<i>PW50</i>	<i>lmin</i>	<i>ltpt</i>	<i>nbph</i>
<i>PW50+</i>	<i>lnum</i>	<i>lttp</i>	<i>nbpw</i>
<i>PW50-</i>	<i>lpp</i>	<i>ltut</i>	
<i>Resolution</i>	<i>ltbe</i>	<i>NLTS</i>	
<i>Overwrite</i>	<i>ltbp</i>	<i>ACSN</i>	

Standard Automated Measurements

<i>amplitude</i>	<i>first</i>	<i>median</i>
<i>area</i>	<i>maximum</i>	<i>number of points</i>
<i>base</i>	<i>mean</i>	<i>phase</i>
<i>cycles</i>	<i>minimum</i>	<i>time @ minimum (min)</i>
<i>cycle std. deviation</i>	<i>+overshoot</i>	<i>time @ maximum (max)</i>
<i>cycle mean</i>	<i>-overshoot</i>	Δ delay
<i>cycle median</i>	<i>peak-to-peak</i>	Δ time @ level
<i>cycle rms</i>	<i>period</i>	Δ time @ level from trigger
<i>data</i>	<i>risetime</i>	Δ time from clock to data + (setup time)
<i>delay</i>	<i>rms</i>	Δ time from clock to data - (Hold time)
<i>duty cycle</i>	<i>std. deviation</i>	<i>18 Histogram Parameters</i>
<i>duration</i>	<i>top</i>	
<i>falltime</i>	<i>width</i>	
<i>frequency</i>	<i>last</i>	

Jitter measurement for parameters including: period, cycle-cycle, frequency, and edge@lv, with JitterTrack up to 200 edges.

Advanced Drive Analysis

Advance Drive Analysis capabilities of the DDA 3000 include:

- Head Filter/ Equalizer Emulation
- Channel Emulation
- SAM Histograms
- Plot of SAM Values
- PES Runout Analysis
- Analog Compare

Additional Waveshape Analysis capabilities include:

- FFT capability includes: power averaging, power density, real and imaginary components, and frequency domain parameters
- Parameter Math – add, subtract, multiply or divide two different parameters
- User-definable parameter measurements
- User-definable math functions

Ordering Information

Product Code

DDA Disk Drive Analyzer

3 GHz 20 GS/s (2 Ch); 10 GS/s 4 Ch 1 M Ω & 50 Ω Color DSO
8 Mpts/2 Ch; 4 Mpts/Ch Standard

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Included with Standard Configuration

10:1 10 M Ω Passive Probes (Qty 2)

PP005A

Operators Manual; Quick Reference Guide; CD-ROM with OM/RCM and
Utility software and Recovery software

Remote Control Manual

Floppy Disk Drive

CD-ROM Drive

Optical 3 button Wheel Mouse - USB

Standard Ports: 10/100Base-T Ethernet, Parallel, SVGA Video Output, USB

Protective Front Cover

Standard Commercial Calibration and Performance Certificate

3 Year Warranty

Memory Options

16 Mpts/2 Ch, 8 Mpts/Ch

-L

32 Mpts/2 Ch, 16 Mpts/Ch

-VL

48 Mpts/2 Ch, 24 Mpts/Ch

-XL

Hardware Options

IEEE-488 Remote Control Interface

GPIB-1

Removable Hard Drive Option

RHD

Built In B&W Graphics Printer with Strip Chart

GP02

WaveShape Analysis Packages

Jitter and Timing Analysis

JTA2

Digital Filter Package

DFP2

Serial Data Mask Testing Package

SDM

LeCroy M1 Timing Tool

M1/ADV-1

Selected Accessories

10:1 10 M Ω Passive Probes

PP005A

2.5 GHz Active Voltage Probe

HFP2500

WaveLink 4 GHz Differential Probe

D300/D300AT

Differential Probe

AP034

Differential Probe

ADP300 series

Current Probe

CP and AP series

Keyboard

KYBD-1

Oscilloscope Cart

OC1021

Oscilloscope Cart with additional shelf and drawer

OC1024

Rackmount - 25" Slide

RMA-25

Rackmount - 30" Slide

RMA-30

AntiVirus Software

AV

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