

LeCroy

DDA 5005A/DDA 5005A XXL/ DDA 3000 DISK DRIVE ANALYZERS



DDA 5005A/DDA 5005A XXL/DDA 3000

Leading Features

- **3 or 5 GHz trigger bandwidth**
- **10 GS/s sample rate/channel**
- **20 GS/s dual-channel mode**
- **Up to 100 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, and Disk Triggers**
- **Head Equalization, Channel Emulation, and SAM Histograms**
- **Segmented Memory for sector-by-sector parametric analysis**
- **Built-in PWxx, amplitude, pulse shape, and ACSN parametric measurements**
- **Customizable with MATLAB, Mathcad, Visual Basic, or Excel scripts**
- **Flexible connectivity to networks, peripherals with 100Base-T Ethernet, and USB**

Maximum Performance

Since their inception, Disk Drive Analysis (DDA) Series oscilloscopes have helped data storage design engineers improve the time to market of new products and accelerated understanding and failure analysis on existing drives. LeCroy continues that tradition with its powerful Disk Drive Analysis toolset, enabling you to capture, view, and analyze the waveshape of high-speed, complex drive signals with speed and integrity. LeCroy's X-Stream architecture integrates SiGe "digitizer on a chip" technology and a specialized high-speed streaming bus design to transfer data from the ADC to a proprietary acquisition memory. The X-Stream architecture enables disk drive engineers to quickly, easily, and accurately measure and analyze disk drive signals.

The DDA 5005A is designed for signal fidelity, whole track acquisition and analysis for read channel, media noise analysis, and head parametrics with the longest acquisition memory standard. The DDA 3000 provides the same measurement capability at a lower bandwidth. This unique product has the convenience of selectable 50 Ω or 1 M Ω inputs.

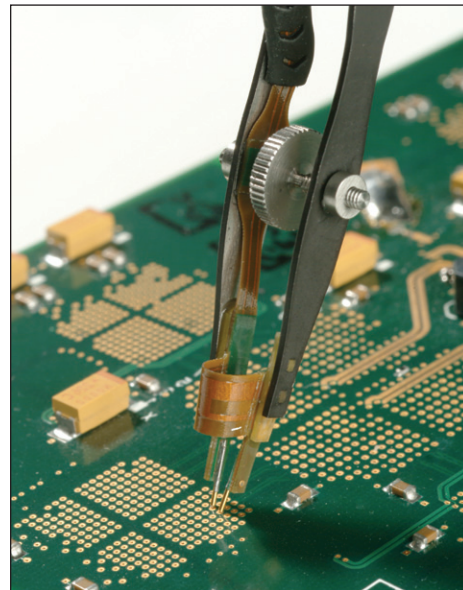
Excellence in Head, Disk, Track, and Noise Analysis

The DDA Series analyzers incorporate the tools to make you the most efficient. The standard 100 Mpts of capture memory in the DDA 3000 (2 channel mode) and DDA 5005A XXL

provides 5 milliseconds of single-shot 20 GS/s capture on two channels, allowing multiple drive sectors to be acquired at once.

Long Memory and Flexibility in Finding Problems

Acquire a head signal up to 5 GHz, and then QuickZoom 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 eight separate areas of the head



High Fidelity Connection to the Drive

With the WaveLink® high frequency differential probes, design engineers can measure read channel signals up to 3 or 5 GHz. The unique design ensures high impedance loading across the full bandwidth, so that you can match the probe bandwidth to your requirement.

signal; each zoom comes in a distinct color. You can measure the time between two events accurately with horizontal and vertical cursors. Disk drive parameters let you characterize the pulse width variation or signal-to-noise ratio across a selectable region. Failure Analysis engineers can store and recall golden waveforms and panel setups to compare problem drives with the known good drives. 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 customer-developed scripts to view the captured signal with the filters matched to your channel and media. Custom user scripts can be created in MATLAB, Mathcad, Visual Basic, or even Excel.

Exceptional Trigger Performance

Disk Triggers allow you 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, with up to 50 picosecond/sample time resolution. Up to 25,000 sectors of data can be gathered with the DDA 3000 or DDA 5005A XXL.

Natural Graphical Interface

One press of the DDA button takes you directly to the Disk Drive Analyzer features. The familiar 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, context-sensitive on-line help gives immediate assistance.



Cursors

Cursors let you measure time and amplitude points on the disk waveforms. You can measure the time between gate and signal across two different channels. Different cursor modes are easily recalled and set. They are easily accessed from the front panel or the graphical user interface. Set up basic time or amplitude cursors on a single waveform, or choose to use independent cursors on different waveforms.



ProLink Signal Inputs (DDA 5005A Analyzer)

ProLink inputs provide a high integrity, high bandwidth interchangeable interface to SMA or BNC cables, probes, and accessories. ProLink supports ProBus for direct, automatic control of LeCroy probes and accessories. The optional AP-1M adapter provides Hi-Z input.

Flexible Connectivity

The DDA Series comes complete with a 100Base-T/10Base-T Ethernet connection and a built-in hard drive for waveform storage. At the press of a button, you can even e-mail the measurement result and waveform display to other engineers or to your notebook. Attach any USB device for extended connectivity for network printing, or for attaching additional storage or pointing devices.



WaveScan Advanced Search

Locate Problems Triggers Won't Find WaveScan is a powerful tool that provides the ability to locate unusual events in a single capture, or scan for an event in many acquisitions over a long period of time using more than 20 different search/scan modes. WaveScan uses measurement-based scanning modes, like frequency, to show statistical distribution of events. It overlays events for a quick and simple visual comparison.

Specifications

Vertical System	DDA 5005A AND DDA 5005A XXL	DDA 3000
Analog Bandwidth @ 50 Ω (-3 dB)	5 GHz	3 GHz
Input Channels	4	4
Bandwidth Limiter	20 MHz; 200 MHz; 1 GHz; 3 GHz; 4 GHz	25 MHz, 200 MHz, 1 GHz
Input Impedance	50 Ω \pm 1.5%	50 Ω or 1 M Ω 15 pF, 10 M Ω 11 pF with PP005A probe
Input Coupling	DC, GND	1 M Ω : AC, DC, GND; 50 Ω : DC
Maximum Input Voltage	2.5 V _{rms} ; \pm 4 V _{peak}	50 Ω : 5 V _{rms} , 1 M Ω : 100 V max. (peak AC: \leq 5 KHz + DC)
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)	
Sensitivity	2 mV–1 V/div fully variable	50 Ω : 2 mV–1 V/div fully variable; 1 M Ω : 2 mV–2 V/div fully variable
Offset Range	\pm 750 mV @ 2 mV–194 mV/div \pm 4 V @ 196 mV–1 V/div	50 Ω : \pm 700 mV @ 2 mV–4.95 mV/div. \pm 1.50 V @ 5 mV–100 mV/div. \pm 10 V @ 102 mV–1 V/div. 1 M Ω : \pm 700 mV @ 2 mV–4.95 mV/div. \pm 1.50 V @ 5 mV–100 mV/div. \pm 20 V @ 102 mV–2 V/div.
DC Gain Accuracy	\pm 1.5% of full scale; \pm 1% (typical)	

Horizontal System

Timebases	Internal timebase common to 4 input channels; An external clock may be applied at the auxiliary input	
Clock Accuracy	\leq 1 ppm	\leq 5 ppm
Time Interval Accuracy	\leq 0.06/SR + (1 ppm * Reading)	\leq 0.06/SR + (5 ppm * Reading)
External Clock Frequency	30 MHz–2 GHz; 50 Ω impedance; applied at the auxiliary input	30 MHz–1 GHz; 50 Ω impedance; applied at the auxiliary input
Roll Mode – Operating Range	N/A	Up to 1000 s/div; lower limit determined by memory length and sample rate

Acquisition System

Single-Shot Sample Rate/Ch	10 GS/s
2 Channel Max.	20 GS/s
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode – up to 4 channels)

Acquisition Memory	Max. Length (Mpts) (2 Ch/4 Ch)	Max. number of Segments; Sequence Mode
DDA 3000, DDA 5005A XXL	100M/48M	25,000
DDA 5005A	48M/24M	20,000

Random Interleaved Sampling (RIS)	200 GS/s for repetitive signals, to 20 ps/div. Upper limit determined by sample rate and memory length settings.
Intersegment Time	6 μ s

Acquisition Processing

Averaging	Summed or continuous averaging up to 1 million sweeps
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope, linear, floor, or roof; for up to 1 million sweeps
Interpolation	Linear or Sin x/x

Triggering System

Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, External, Ext x 10, Ext/10, or line; slope and level unique to each source (except line trigger)
Coupling	DC
Pre-trigger Delay	0–100% of horizontal time scale

Triggering System (continued)

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

	DDA 5005A AND DDA 5005A XXL	DDA 3000
Trigger Sensitivity (edge, typical) (Ch 1-4 & External)	3 div < 5 GHz 2 div < 4 GHz 1.2 div < 3 GHz	2 div < 3 GHz 1 div < 2 GHz

Max. Trigger Frequency, SMART Trigger	750 MHz ≥ 10 mV
External Trigger Input Range	Ext ±0.4 V; Ext x 10 ±0.04 V; Ext/10 ±4 V

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. 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	Triggers on the n'th sector pulse after index. Index and sector pulse polarity and sector pulse number are selectable
Servo Gate	Triggers on the n'th servo gate after index and every m'th thereafter. Index and servo gate pulse polarity are selectable
PES Trigger	Triggers on Position Error Signal (PES) exceeding an adjustable voltage window. Servo gate can be selected as qualifier
Read Gate Trigger	Triggers on any read gate longer than an adjustable Sector ID filed length

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

	DDA 5005A AND DDA 5005A XXL	DDA 3000
Probes	A variety of passive and active probes are optional	(2) PP005A passive probes are standard. A variety of other passive and active probes are available.
Probe System	ProLink: Automatically detects and supports a variety of compatible probes; Supports SMA or ProBus BNC with ProLink adapters (included)	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 panel
Resolution	SVGA; 800 x 600 pixels
Real-time Clock	Dates, hours, minutes, seconds displayed with waveform
Number of Traces	Display a maximum of eight traces. Simultaneously display channel, zoom, memory, and math traces
Grid Styles	Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY
Waveform Styles	Sample dots joined or dots only

Specifications

Analog Persistence Display

Analog and Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory
Persistence Selections	Select Analog or color positive
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 software package)

CPU

Processor	Intel® Pentium® 4 @ 2.54 GHz (or better), with Microsoft Windows® XP Professional
Processing Memory	Up to 2 Gbytes

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 or to a USB connected peripheral device
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Interface

Remote Control	Full command set for all front panel controls and internal functions via GPIB or Ethernet using Windows Automation or LeCroy Remote Command Set
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DDA 5005A AND DDA 5005A XXL

DDA 3000

GPIB Port (IEEE-488.2)	Optional	Standard
Ethernet Port	10/100Base-T Ethernet interface	
USB Ports	6 USB 2.0 ports (2 on front panel), support MS Windows® compatible devices	
External Monitor Port Standard (independent Dual Monitor support available as an option)	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; 0–0.5 V into 50 Ω (0–1.0 V into 1 M Ω)
Control Signals	Trigger ready, trigger out, pass/fail status; TTL logic voltage

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
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Power Requirements

Voltage	100–240 V _{rms} ($\pm 10\%$) at 50 or 60 Hz; 115 V _{rms} ($\pm 10\%$) at 400 Hz; Automatic AC Voltage selection
Max. Power Consumption	650 W/650 VA

Physical Dimensions

Dimensions (HWD)	264 mm x 397 mm x 491 mm; 10.4" x 15.65" x 19.25" (height excludes feet)
Weight	18 kg; 39.5 lbs.
Shipping Weight	24 kg; 53 lbs.

Environmental

Temperature (Operating)	+5 °C to +40 °C including CD-ROM drives
Temperature (Non-Operating)	-20 °C to +60 °C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 °C
Humidity (Non-Operating)	Upper limit derates to 25% relative humidity (non-condensing) at +40 °C
Altitude (Operating)	Up to 10,000 ft. (3,048 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

Certifications

CE Compliant for Safety and EMC, UL and cUL listed; conforms to EN 61326, 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.

Math Tools

Displays 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. Function traces can be chained together to perform math-on-math. Capabilities include:

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

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 to local or networked files, or e-mail the image of the failure, save waveforms, or send a GPIB SRQ, or pulse to trigger another device.

Automated Disk Drive Measurements

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

Standard Automated Measurements

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

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

Advanced Drive Analysis

Capabilities 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 with 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

Description	Product Code
4 Ch; 5 GHz; 10 GS/s; 20 GS/s max.; 100 Mpts Memory (using 1 or 2 Ch)	DDA 5005A XXL
4 Ch; 5 GHz; 10 GS/s; 20 GS/s max.; 48 Mpts Memory (using 1 or 2 Ch)	DDA 5005A
4 Ch; 3 GHz; 10 GS/s; 20 GS/s max.; 100 Mpts Memory (using 1 or 2 Ch) 50 Ω and 1 M Ω Input	DDA 3000

Included with Standard Configuration

CD-ROM Drive	
± 10 , 10 M Ω Passive Probe (Qty 2) (SDA 3000 only)	PP005A
ProLink Adapters (DDA 5005A and DDA 5005A XXL only): SMA (Qty 4); BNC (Qty 2)	
Optical 3-button Wheel Mouse-USB	
Getting Started Manual	
CD-ROM containing Operator's Manual, Remote Control Manual, and Automation Manual	
CD-ROMs containing Utility Software and Norton Antivirus Software (1 year subscription)	
Protective Front Cover	
Remote Control Manual	
Standard Commercial Calibration and Performance Certificate	
Standard Ports; 10/100BaseT Ethernet, Parallel, SVGA Video Output, USB	
3-Year Warranty	

Software Options

Application Specific Test and Analysis Software Packages

Advanced Optical Recording Measurement Software Package	AORM
8B/10B Decoding and Analysis Software Package	SDA-8B10B

Advanced Math and WaveShape Analysis Software Packages

Demodulation Software Package	DMOD
Processing Web Editor Software Package for Functions and Parameters	XWEB
Jitter and Timing Analysis Software Package	JTA2
Digital Filter Software Package	DFP2

Compliance Software Packages

Ethernet Test Software Package	ENET
USB 2.0 Compliance Test Software Package	USB2

Hardware and Software Option

32 Digital Oscilloscope Mixed Signal Option	MS-32-DSA
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Hardware Options and Accessories

Internal Graphics Printer	WM-GP02
IEEE-488 GPIB Interface (standard in DDA 3000)	GPIB-1
Removable Hard Drive Package (including USB, CD-ROM, and spare hard drive)	RHD
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1



1-800-5-LeCroy
www.lecroy.com

Local sales offices are located throughout the world.
To find the most convenient one visit www.lecroy.com

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Description	Product Code
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Hardware Options and Accessories

Rackmount Adapter with 25" (64 cm) Slides	RMA-25
Rackmount Adapter with 30" (76 cm) Slides	RMA-30
Removable Hard Drive Package (includes USB, CD-ROM, Removable Hard Drive, and Spare Hard Drive)	WM-RHD
Additional Removable Hard Drive	WM-RHD-02
Soft Carrying Case	WM-SCC
Hard Transit Case	WM-TC1
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
USB 2.0 Testing Compliance Test Fixture	TF-USB

Probe and Probe Accessories

Set of 4 ZS1500, 1.5 GHz, 0.9 pF, 1 M Ω High Impedance Active Probe	ZS1500-QUADPAK
Set of 4 ZS1000, 1 GHz, 0.9 pF, 1 M Ω High Impedance Active Probe	ZS1000-QUADPAK
WaveLink 7.5 GHz, Differential Probe Adjustable Tip Module (for DDA 5005A only)	D600A-AT*
WaveLink 4 GHz, Differential Probe Adjustable Tip Module (for DDA 3000 only)	D300A-AT*
WaveLink 7 GHz, Differential Probe Small Tip Module (for DDA 5005A only)	D600ST*
WaveLink 4 GHz, 5 V Differential Probe Small Tip Module	D350ST*
WaveLink 6 GHz, Differential Positioner Mounted Probe Tip Module	D500PT*
WaveLink ProLink Probe Body (for DDA 5005A only)	WL600
WaveLink ProBus Probe Body (for DDA 3000 only)	WL300
Optical-to-Electrical Converter, 500–870 nm ProLink BMA Connector	OE525
Optical-to-Electrical Converter, 950–1630 nm ProLink BMA Connector	OE555
1 GHz Active Differential Probe ($\div 1$, ± 10 , ± 20)	AP034
ProLink-to-SMA Adapter	LPA-SMA
ProLink-to-BNC Adapter; 1 each	LPA-BNC
Kit of 4 SMA ProLink Adapters with Case	LPA-SMA-KIT
Kit of 4 ProLink BNC Adapters with Case	LPA-BNC-KIT
1 M Ω Adapter includes PP005A Passive Probe (For DDA 5005A and DDA 5005A XXL only)	AP-1M

*For a complete probe, order a WL300 or WL600 Probe Body with the Probe Tip Module.

Customer Service

LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year.

This warranty includes:

- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge