DDA
Disk Drive Analyzer

DDA 5005A
DDA 5005A XXL
Disk Drive Analyzer

LEADING FEATURES

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

Accurately capture and analyze many sectors, or a complete track for read channel design or head/media evaluation.

Maximum Performance

The Disk Drive Analyzer 5005A, with 5 GHz bandwidth, includes LeCroy's newest and most powerful Disk Drive Analysis toolset. 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 and easily measure and analyze disk drive signals. With 10 GS/s and 24 Mpts/Ch—up to 20 GS/s and 48 Mpts on two channels—you can be assured drive signals are captured with accuracy and precision.

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 5005A comes standard with enough acquisition memory to capture 2.4 milliseconds of data at 20 GS/s, while the XXL model captures 5 milliseconds with its 100 Mpts per dual-channel memory.

Excellence in Head, Disk, Track, and Noise Analysis

The DDA series analyzers incorporate the tools to make you most efficient. The standard 100 Mpts of capture memory in the DDA 5005A XXL provides 5 milliseconds of single-shot, 20 GS/s capture speed on two channels.

Long Memory and Flexibility in Finding Problems

Acquire a head signal up to 5 GHz and then QuickZoom 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

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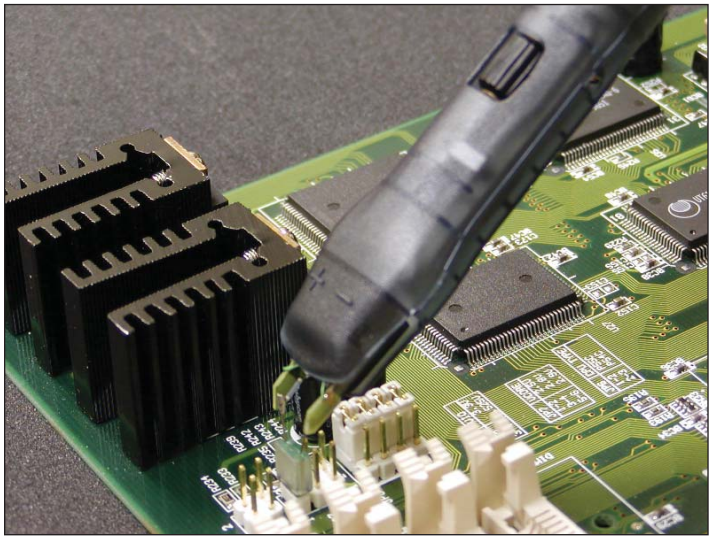

WaveLink high bandwidth differential probes let you capture head signals with best signal to noise ratio.

view up to eight separate areas of the head 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 signals. Analog-to-digital converters running at speeds up to 20 GS/second ensure the right oversampling rate 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 to your channel and media.

Triggers Designed for Drive Analysis

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 50 or 100 picosecond/sample time resolution. Up to 20,000 sectors of data can be gathered with a DDA 5005A equipped with the DDA-XXL option.

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, reacts 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.

Exceptional Trigger Performance

The drive-specific triggers are defined in disk drive terminology, just as they are in the other LeCroy Drive Analyzers. Drive triggers include: Sector, Servo Gate, PES Trigger, and Read Gate Trigger. Setup of trigger conditions is easier then ever.

The standard edge trigger will trigger on signals of up to 5 GHz, and on SMART Triggers®.

ProLink Signal Inputs

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 AP-1M adapter (standard) provides High-Z inputs.

Flexible Connectivity

The DDA 5005A comes complete with a 100Base-T/10Base-T Ethernet connection, a built-in hard drive for waveform storage, and a 3.5" floppy drive. At the press of a button, you can even e-mail the measurement result and scope screen 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. An optional built-in graphics printer provides a strip chart display of multiple disk sectors at one viewing.

DDA 5005A / DDA 50005A XXL

Disk Drive Analyzer Specifications (continued)

Vertical System

Analog Bandwidth @ 50 Ω (-3 dB)	5 GHz
Input Channels	4
Bandwidth Limiter	20 MHz; 200 MHz; 1 GHz; 3 GHz; 4 GHz
Input Impedance	50 Ω ±1.5%
Input Coupling	DC, GND
Maximum Input	2.5 Vrms; ±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 ≥ 10mV
Offset Range	2 mV–99 mV/div: ±750 mV; 100 mV–1 V/div: ±4 V

Horizontal System

Timebases	Internal timebase common to 4 input channels; An external clock may be applied at the Auxilary Input
Math and Zoom Traces	8 math/zoom traces
Clock Accuracy	≤ 1 ppm @ 0–40 degrees C.
Time Interpolator Resolution	1 ps
External Clock Frequency	2 GHz maximum, 50 Ω impedance
Roll Mode – Operating Range	Time/div 500 ms–1000 s/div or sample rate < 100 kS/s max

Acquisition System

Single-Shot Sample Rate/Ch	10 GS/s
2 Channel Max	20 GS/s
Maximum Acquisition Points/Ch	100 Mpts/2 Ch, 50 Mpts/4 Ch

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–10 s/div
Sequence	2–20,000 segments
Intersegment Time	Typically 5 µs

Acquisition Processing

Averaging	Summed averaging; Continuous averaging
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 x 10, 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
Max Trigger Frequency	5 GHz with Edge Trigger; 750 MHz with SMART Trigger
External trigger input range	Ext ±0.4; Ext x 10 ±0.04; Ext / 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

DDA 5005A / DDA 50005A XXL

Disk Drive Analyzer Specifications (continued)

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

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 Master Analysis option)

Rapid Signal Processing

Processor	Intel Pentium with MS Windows Platform
Processing Memory	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	Store to the internal hard drive, floppy drive, or to a USB connected peripheral device

Interface

Remote Control	Full command set for all front panel controls and internal functions via GPIB or Ethernet
GPIB Port (Optional)	Full control via IEEE – 488.2
Ethernet Port	10/100Base-T Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
USB Ports	Minimum of 2 USB ports supports 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	500 Hz – 5 MHz square wave or DC Level 0.0 to +0.5 Volts (Selectable) into 50 Ω
Control Signals	Trigger ready, 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 V AC at 50/60/400 Hz; 200–240 V AC at 50/60 Hz; Power consumption: < 1 kVA , 940 Watts max

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.

Warranty and Service

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

DDA 5005A / DDA 50005A XXL

Disk Drive Analyzer Specifications

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	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

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. Function traces can be chained together to perform math-on-math.

absolute value
average (summed)
Average (continuous)
difference (-)
differentiate
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
FFT
floor
identity
integrate
log (base e)
log (base 10)
negate
product (x)
ratio (/)
reciprocal (invert)
resample (deskew)
rescale (with units)
roof
sin x/x
square
square root
sum (+)
histogram
trend (datalog)
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::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	Resolution	lnum	ltot	msnr
TAA+	Overwrite	lpp	ltpt	rsnr
TAA-	lbase	ltbe	lttp	m_to_r
PW50	lbsep	ltbp	ltut	nbph
PW50+	lmax	ltmn	NLTS	nbpw
PW50-	lmin	ltmx	ACSN	

Standard Automated Measurements

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

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

Advanced Drive Analysis

Advance Drive Analysis capabilities of the DDA 5005A 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 5005A Four Channel Disk Drive Analyzer

5 GHz, 20 GS/s 2 Ch; 10 GS/s Ch, Color DSO 48 Mpts 2 Ch; 24 Mpts/Ch Standard	DDA 5005A

DDA 5005A XXL Four Channel Disk Drive Analyzer

5 GHz, 20 GS/s 2 Ch; 10 GS/s Ch, Color DSO 100 Mpts 2 Ch; 50 Mpts/Ch Standard	DDA 5005A XXL

Included with Standard Configuration

CD-ROM Drive
Floppy Disk Drive
LeCroy ProLink Adapter SMA and BNC
Optical 3-button Wheel Mouse-USB
Operators Manual; Quick Reference Guide; CD-ROM with OM/RCM and Utility Software
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

Hardware Options

LeCroy ProLink Adapter BNC	LPA-BNC

WaveShape Analysis Packages

Digital Filter Package	DFP2
Jitter and Timing Analysis Package	JTA2
Serial Data Mask Testing Package	SDM

Selected Accessories

2.5 GHz Active Voltage Probe	HFP2500
7.5 GHz Passive Probe	PP066
AntiVirus Software	AV
Differential Probe	AP034
1 MΩ Adapter includes PP005A Passive Probe	AP-1M
Keyboard	KYBD-1
LeCroy ProLink Adapter BNC	LPA-BNC
LeCroy ProLink Adapter BNC Kit of 5	LPA-BNC-Kit
Oscilloscope Cart	OC1021
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Rackmount Kit - 25" Slide	RMA-25
Rackmount Kit - 30" Slide	RMA-30
WaveLink 6 GHz Differential Probe	D600AT with D600
WaveLink 4 GHz Differential Probe	D300AT with D300

Warranty and Calibration

MIL STD Calibration Certificate	DDA-CCMIL
NIST Traceable Calibration Certificate	DDA-CCNIST
5-Year Warranty (at time of purchase)	DDA-W5
5-Year Warranty and NIST Calibration (at time of purchase)	DDA-T5
5 Annual NIST Calibrations	DDA-C5
1-Year Extended Warranty	DDA-EW
2-Year Extended Warranty	DDA-EW2

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