



ABN 43 064 478 842

➤ 231 osborne avenue clayton south, vic 3169  
PO box 1548, clayton south, vic 3169  
t 03 9265 7400 f 03 9558 0875  
freecall 1800 680 680  
[www.tmgtestequipment.com.au](http://www.tmgtestequipment.com.au)

## Test & Measurement

- sales
- rentals
- calibration
- repair
- disposal

## Complimentary Reference Material

This PDF has been made available as a complimentary service for you to assist in evaluating this model for your testing requirements.

TMG offers a wide range of test equipment solutions, from renting short to long term, buying refurbished and purchasing new. Financing options, such as Financial Rental, and Leasing are also available on application.

TMG will assist if you are unsure whether this model will suit your requirements.

Call TMG if you need to organise repair and/or calibrate your unit.

If you click on the “Click-to-Call” logo below, you can call us for FREE!

TMG Corporate Website

TMG Products Website



Click-to-Call  
TMG Now



### Disclaimer:

All trademarks appearing within this PDF are trademarks of their respective owners.



# 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
- Flexible connectivity to networks, peripherals with 100Base-T 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. Our flagship 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, on the other hand, provides the same measurement capability at a lower bandwidth and memory configuration, 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 the most efficient. On the DDA 3000, 8 Mpts on 2 channels captures multiple drive sectors in a single-shot acquisition. Trigger on index and,

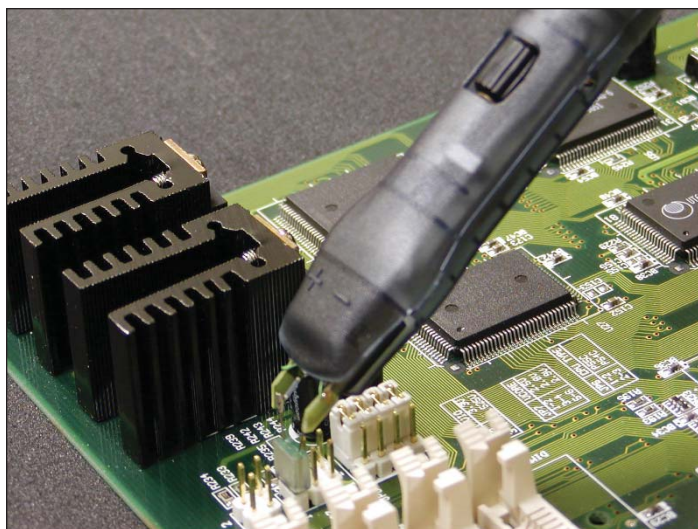
with the optional DDA XL memory, you can capture a whole track of information and then zoom in on any sector.

Since their inception, DDA series scopes have helped data storage design engineers improve the time to market new products and speeded up understanding and failure analysis on existing drives. The DDA 3000 continues 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 is an integrated tool designed for ease of setup in acquisition, manipulation, and measurement modes.

**LeCroy**

# DDA 3000

## Disk Drive Analyzer



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

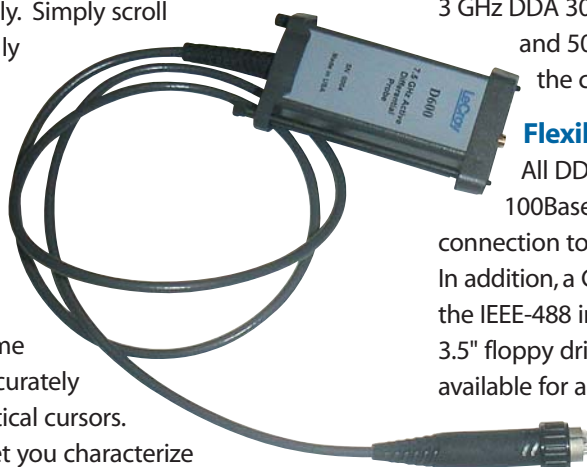
### Long Memory and Flexibility in Finding Problems

Acquire a head signal up to 3 GHz, and then 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 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 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, at up to 50 picosecond/sample time resolution. Up to 20,000 sectors of data can be gathered with a DDA 3000 equipped with the memory 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 on the DDA 3000. The unique design ensures high impedance loading across the full bandwidth. Match the probe bandwidth to 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 100BaseT/10BaseT 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.



# DDA 3000

## Disk Drive Analyzer Specifications (continued)

### Vertical System

Analog Bandwidth @ 50 $\Omega$ (-3 dB)	3 GHz
Rise Time (Typical)	150 ps
Input Channels	4
Bandwidth Limiters	25 MHz; 200 MHz; 1 GHz
Input Impedance	50 $\Omega$ ; 1 M $\Omega$ /11 pF typical (using PP005A probe)
Input Coupling	1 M $\Omega$ : AC, DC, GND; 50 $\Omega$ : DC
Maximum Input Voltage	50 $\Omega$ : 5 Vrms, 1 M $\Omega$ : 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 $\Omega$ : 2 mV – 1 V/div fully variable; 1 M $\Omega$ : 2 mV – 2 V/div fully variable
DC Gain Accuracy	$\pm$ 1.5% of full scale; $\pm$ 1% (typical)
Offset Range	50 $\Omega$ : $\pm$ 700 mV @ 2–4.99 mV/div $\pm$ 1.5 V @ 5–100 mV/div $\pm$ 10 V @ .102–1 V/div  1 M $\Omega$ : $\pm$ 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 + 1.5% 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 and Zoom Traces	8 math/zoom traces standard
Clock Accuracy	$\leq$ 10 ppm @ 0–40 $^{\circ}$ C
Time Interval 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 and Interpolator Jitter	$\leq$ 2.5 ps (typical)
Channel-Channel Deskew Range	$\pm$ 4.5 ns
External Clock	30 MHz – 1 GHz; 50 $\Omega$ 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	4 Ch / (2 Ch)

### 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 $\Omega$ , GND, DC1M $\Omega$ , AC1M $\Omega$
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.

# DDA 3000

## Disk Drive Analyzer Specifications (continued)

### 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

### Analog Persistence Display

Analog and 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.
-----------------------------------	---

### Interface

Remote Control	Via Windows Automation, or via LeCroy Remote Command Set
GPIO 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 $\Omega$ (0-1 V into 1 M $\Omega$ ) 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

### 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

# DDA 3000

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

<i>absolute value</i>	<i>log (base 10)</i>
<i>average (summed)</i>	<i>negate</i>
<i>Average (continuous)</i>	<i>product (x)</i>
<i>difference (-)</i>	<i>ratio (/)</i>
<i>differentiate</i>	<i>reciprocal (invert)</i>
<i>enhanced resolution</i>	<i>resample (deskew)</i>
<i>(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>

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

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

### Standard Automated Measurements

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

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 Disk Drive Analyzer

3 GHz 20 GS/s (2 Ch); 10 GS/s 4 Ch 1 M $\Omega$ & 50 $\Omega$ Color DSO	DDA 3000
8 Mpts/2 Ch; 4 Mpts/Ch Standard	

### Included with Standard Configuration

10:1 10 M $\Omega$ Passive Probes (Qty 2)	PP005A
CD-ROM Drive	
Floppy Disk Drive	
Optical 3-button Wheel Mouse - USB	
Operators Manual; Quick Reference Guide; CD-ROM with OM/RCM and Utility Software and Recovery Software	
Protective Front Cover	
Remote Control Manual	
Standard Commercial Calibration and Performance Certificate	
Standard Ports; 10/100Base-T Ethernet, Parallel, SVGA Video Output, USB	
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

Built In B&W Graphics Printer with Strip Chart	GP02
IEEE-488 Remote Control Interface	GPB-1
Removable Hard Drive Option	RHD

### WaveShape Analysis Packages

Digital Filter Package	DFP2
Jitter and Timing Analysis	JTA2
LeCroy M1 Timing Tool	M1/ADV-1
Serial Data Mask Testing Package	SDM

### Selected Accessories

10:1 10 M $\Omega$ Passive Probes	PP005A
2.5 GHz Active Voltage Probe	HFP2500
AntiVirus Software	AV
Current Probe	CP and AP Series
Differential Probe	AP034
Differential Probe	ADP300 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
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

## Sales and Service Throughout the World

### Corporate Headquarters

700 Chestnut Ridge Road  
Chestnut Ridge, NY 10977  
USA

[www.lecroy.com](http://www.lecroy.com)

### LeCroy Sales Offices:

China: Beijing  
Phone (86) 10 8526 1618  
Fax (86) 10 8526 1619

France: Les Ulis  
Phone (33) 1 6918 8320  
Fax (33) 1 6907 4042

Germany: Heidelberg  
Phone (49) 6221 827 00  
Fax (49) 6221 834 655

Hong Kong  
Phone (852) 2834 5630  
Fax (852) 2834 9893

Italy: Venice  
Phone (39) 041 599 7011  
Fax (39) 041 456 9542

Japan: Osaka  
Phone (81) 6 6396 0961  
Fax (81) 6 6396 0962

Japan: Tokyo  
Phone (81) 3 3376 9400  
Fax (81) 3 3376 9587

Korea: Seoul  
Phone (82) 2 3452 0400  
Fax (82) 2 3452 0490

Singapore  
Phone (65) 6442 4880  
Fax (65) 6442 7811

Sweden: Stockholm  
Phone (46) 8 580 143 45  
Fax (46) 8 580 143 45

Switzerland: Geneva  
Phone (41) 22 719 2228 (North)  
Phone (41) 22 719 2175 (South)  
Fax (41) 22 719 2230

U.K.: Abingdon  
Phone (44) 1 235 536 973  
Fax (44) 1 235 528 796

U.S.A.: Chestnut Ridge  
Phone (1) 845 578 6020  
Fax (1) 845 578 5985

# LeCroy