

## 9370 Series Digital Oscilloscopes 1 GHz Bandwidth, 2 GS/s

### Main Features

- Up to 8M Point record length
- 8-bit vertical resolution, 11 with ERES option
- Two and Four Channel versions
- Portable Hard Disk (PCMCIA III), Memory Card and DOS Compatible Floppy Disk options
- Innovative Peak Detect
- Glitch, Pattern, Qualified, Interval, Dropout and TV Triggers
- Fully programmable via GPIB and RS-232-C
- Internal Graphics Printer Option
- Automatic PASS/FAIL testing
- Advanced Signal Processing
- 1 GHZ BANDWIDTH

The 9370 series digital storage oscilloscope opens up new horizons for engineers and scientists at the leading edge of technological developments. With 1 GHz bandwidth and long acquisition memories, it is now possible to reveal previously hidden waveform details. Narrow glitches are more accurately defined; risetime measurements below 1 nanosecond are more precise; and high-frequency content, filtered out in lower bandwidth systems, is retained, thereby preserving signal amplitudes and overall signal integrity.

### 2 GS/S SAMPLE RATE

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The two and four channel models of the 9370 series sample simultaneously on all channels at 500 MS/s. Thus, they are ideal for demanding high speed applications. In addition, two channels can be combined to provide a sample rate of

1 GS/s. The 9374 provides 2 GS/s in single channel mode. Finer horizontal resolution and accuracy are guaranteed by high sample rates. This is especially critical in digital design where unpredictable circuit behavior has to be identified and analyzed in detail to be fully understood. Together with this excellent single-shot performance the 9370 series also provides a sample rate equivalent to 10 GS/s for repetitive signals.

### 8M POINTS ACQUISITION MEMORY

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Channel memory lengths of 50k, 250k and 2M are available on the two and four channel 9370 DSOs. The memory power is revealed when the user seeks to sample at the highest speed over many timebase settings. Short memory DSOs may boast a high sample rate for short waveforms, but only a long memory oscilloscope can deliver high sample rates for long waveforms. To exploit this capability to its fullest the LeCroy 9370 series combines its channel acquisition memories to give the user up to 8 million sample points, thereby providing the waveform detail required on long and complex signals.

The combined capabilities of the 9370 series place it in the forefront of DSO capability.

### ACQUISITION SYSTEM

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#### Bandwidth (-3 dB):

@ 50 Ohms: DC to 1 GHz 10 mV/div and above

@ 1 M Ohm DC: DC to 500 MHz typ. at probe tip, with PP004 supplied standard. 1 GHz FET probe optional.

**No. of Channels:** 4 (9374) or 2 (9370)

**No. of Digitizers:** 4 (9374) or 2 (9370)

**Maximum Sample Rate and Acquisition Memories:** See table below.

#### Sensitivity:

2 mV/div to 1 V/div, 50 Ohms, fully variable

2 mV/div to 10 V/div, 1M Ohm, fully variable.

**Scale factors:** A wide choice of probe attenuation factors are selectable.

#### Offset Range:

2.00 - 4.99 mV/div:  $\pm 400$  mV

5.00 - 99 mV/div:  $\pm 1$  V

0.1 - 1.0 V/div:  $\pm 10$  V

1.0 - 10V/div:  $\pm 100$  V (1M Ohm only)

**DC Accuracy:** Typically 1% for DC gain and offset at 0V.

**Vertical Resolution:** 8 bits.

**Bandwidth Limiter:** 20 MHz, 200 MHz.

**Input Coupling:** AC, DC, GND.

**Input Impedance:** 1M Ohm//15 pF or 50 Ohms  $\pm 1\%$ .

#### Max Input:

1 M Ohm: 400 V (DC+peak AC @10 kHz)

50 Ohms:  $\pm 5$  V DC (500 mW) or 5 V RMS

### TIME BASE SYSTEM

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**Timebases:** Main and up to 4 Zoom Traces.

**Time/Div Range:** 1 ns/div to 1,000 s/div.

**Clock Accuracy:** < or equal to 10 ppm

**Interpolator resolution:** 10 ps

**Roll Mode:** Ranges 500 ms to 1,000 s/div.

**For > 50k points:** 10 s to 1,000 s/div.

**External Clock:** < or equal to 100 MHz on EXT input with ECL, TTL or zero crossing levels. Optional 50 MHz to 500 MHz rear panel fixed frequency clock input.

**External Reference:** Optional 10 MHz rear-panel input.

## TRIGGERING SYSTEM

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**Trigger Modes:** Normal, Auto, Single, Stop.

**Trigger Sources:** CH1, CH2, Line, Ext,

Ext/10 (9374: CH3, CH4). Slope, Level and Coupling for each source can be set independently.

**Slope:** Positive, Negative.

**Coupling:** AC, DC, HF, LFREJ, HFREJ.

**Pre-trigger recording:** 0 to 100% of full scale (adjustable in 1% increments).

**Post-trigger delay:** 0 to 10,000 divisions (adjustable in 0.1 div increments).

**Holdoff by time:** 10 ns to 20 s.

**Holdoff by events:** 0 to 99,999,999 events.

**Internal Trigger Range:**  $\pm 5$  div.

**EXT Trigger Max Input:**

1 M Ohm//15 pF: 250 V (DC + peak AC < or equal to 10 kHz)

50 Ohms  $\pm 1\%$ :  $\pm 5$  V DC (500 mW) or 5 V RMS

**EXT Trigger Range:**  $\pm 0.5$  V ( $\pm 5$  V with Ext/10)

**Trigger Timing:** Trigger Date and Time are listed in the Memory Status Menu.

**Trigger Comparator:** Optional ECL rear panel output.

## SMART TRIGGER TYPES

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**Pattern:** Trigger on the logic AND of 5 inputs - CH1, CH2, CH3, CH4, and EXT Trigger, (9370: 3 inputs - CH1, CH2, EXT) where each source can be defined as High, Low or Don't Care. The Trigger can be defined as the beginning or end of the specified pattern.

**Signal or Pattern Width:** Trigger on width between two limits selectable from 2.5ns to 20s. Will typically trigger on glitches 1ns wide.

**Signal or Pattern Interval:** Trigger on interval between two limits selectable from 10ns to 20s

**Dropout:** Trigger if the input signal drops out for longer than a time-out from 25ns to 20s.

**State/Edge Qualified:** Trigger on any source only if a given state (or transition) has occurred on another source. The delay between these events can be defined as a number of events on the trigger channel or as a time interval.

**TV:** Allows selection of both line (up to 1500) and field number (up to 8) for PAL, SECAM, NTSC or nonstandard video.

## ACQUISITION MODES

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### Random Interleaved Sampling (RIS):

For repetitive signals from 1 ns/div to 5 ms/div.

**Single shot:** For transient and repetitive signals from 10 ns/div (all channels active).

**Peak detect:** Captures and displays 2.5 ns glitches or other high-speed events.

**Sequence:** Stores multiple events in segmented acquisition memories.

### Number of segments available:

9370-9374 .....2-200

9370M-9374M .....2-500

9370L-9374L .....2-2,000

Max. Dead Time between segments: 100  $\mu$ s

## DISPLAY

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**Waveform style:** Vectors connect the individual sample points, which are highlighted as dots. Vectors may be switched off.

**CRT:** 12.5x17.5 cm (9" diagonal) raster.

**Resolution:** 810 x 696 points.

**Modes:** Normal, X-Y, Variable or Infinite Persistence.

**Real-time Clock:** Date, hours, minutes, seconds.

**Graticules:** Internally generated; separate intensity control for grids and waveforms.

**Grids:** 1, 2 or 4 grids.

**Formats:** YT, XY, and both together.

**Vertical Zoom:** Up to 5x Vertical Expansion (50x with averaging, up to 40 mV sensitivity, only with WP01).

### Maximum Horizontal Zoom Factors:

9370-9374 .....2,000x

9370M-9374M .....10,000x

9370L-9374L .....80,000x

Waveforms can be expanded to give

2-2.5 points/division. This provides zoom factors up to 400,000x for the 9374L when channels are combined.

## AUTOMATIC MEASUREMENTS

The following Parametric measurements are available, together with statistics of their Average, Highest, Lowest values and Standard Deviation:

amplitude ? t at level (t=0,abs) overshoot +

area ? t at level (t=0%) overshoot -

base duty cycle peak to peak

cmean falltime period

cmedian f80-20% risetime

crms f@level (abs) r20-80%

csdev f@level (%) r@level (abs)

cycles frequency r@level (%)

delay maximum RMS

? delay mean std dev

? t at level (abs) median top

? t at level (%) minimum width

Parameters are calculated as defined by ANSI/IEEE Std 181-1977 "Standard on Pulse Measurement and Analysis by Objective Techniques". In addition, Rise and Fall times may be measured at 10 % and 90% levels, or 20% and 80% levels, or any other user-specified levels.

? delay provides time between midpoint transition of two sources, for making propagation delay measurements.

? t at level allows the same measurement to be made at any specified level.

Two cursors are used to define the region over which these parameters are calculated.

**Relative Time:** Two cursors provide time measurements with resolution of  $\pm 0.05\%$  full scale for unexpanded traces; up to 10 % of the sampling interval for expanded traces. The corresponding frequency value is also displayed.

**Relative Voltage:** Two horizontal bars measure voltage differences up to  $\pm 0.2\%$  of fullscale in single-grid mode.

**Absolute Time:** A cross hair marker measures time relative to the trigger, and voltage with respect to ground.

**Pass/Fail** testing allow up to five of the listed parameters to be tested against selectable thresholds. Waveform Limit Testing is performed using templates which may be defined inside the instrument.

## INTERNAL MEMORY

**Waveform Memory:** Up to four 16-bit Memories (M1, M2, M3, M4).

**Processing Memory:** Up to four 16-bit Waveform Processing Memories (A, B, C, D).

**Setup Memory:** Four non-volatile memories. Optional Cards or Disks may also be used for high-capacity waveform and setup storage.

## WAVEFORM PROCESSING

Up to four processing functions may be performed simultaneously. Functions available are: Add, Subtract, Multiply, Divide, Negate, Identity, Summation Averaging and Sin (x)/x.

**Average:** Summed averaging of up to 1,000 waveforms in the basic instrument. Up to 106 averages are possible with Option WP01.

**Extrema\*:** Roof, Floor, or Envelope values from 1 to 106 sweeps.

**ERES\*:** Low-Pass digital filter provides up to 11 bits vertical resolution.

Sampled data is always available, even when a trace is turned off.

Any of the above modes can be invoked without destroying the data.

**FFT\*:** Spectral Analysis with five windowing functions and FFT averaging.

\*Extrema and ERES modes are provided in Math Package WP01. FFT is in WP02.

## AUTOSETUP

Pressing Autosetup sets timebase, trigger and sensitivity to display a wide range of repetitive signals. (Frequency above 50Hz; Duty cycle greater than 0.1%).

**Autosetup Time:** Approximately 2 seconds.

**Vertical Find:** Automatically sets sensitivity and offset.

## PROBES

### Model:

One PP004 (10:1, 10 M Ohms // 10 pF) probe supplied per channel. 200 V max input.

The 9370 series is fully compatible with LeCroy's range of FET Probes, which may be purchased separately.

**Probe calibration:** Max 1 V into 1 MW,

500 mV into 50 W, frequency and amplitude programmable, pulse or square wave selectable, rise and fall time 1 ns typical.

Alternatively, the Calibrator output can provide a trigger output or a PASS/FAIL test output.

## INTERFACING

**Remote Control:** Possible by GPIB and RS-232-C for all front-panel controls, as well as all internal functions.

**RS-232-C Port:** Asynchronous up to 19200 baud for computer/terminal control or printer/plotter connection.

**GPIB Port:** (IEEE-488.1) Configurable as talker/listener for computer control and fast data transfer. Command Language complies with requirements of IEEE-488.2.

**Centronics Port:** Optional hardcopy parallel interface is provided with floppy and graphics printer options.

**Hardcopy:** Screen dumps are activated by a front-panel button or via remote control. TIFF and BMP formats are available for importing to Desktop Publishing programs. The following printers and plotters can be used to make hardcopies: HP DeskJet (color or BW), HP ThinkJet, QuietJet, LaserJet, PaintJet and EPSON printers; HP 7470 and 7550 plotters, or similar, and HPGL compatible plotters. An optional internal high resolution graphics printer is also available.

**GENERAL**

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Auto-calibration ensures specified DC and timing accuracy.

**Temperature:**

5° to 40° C (41° to 104° F) rated 0° to 50° C (32° to 122° F) operating.

**Humidity:** <80%.

**Shock & Vibration:** Meets MIL-STD-810C modified to LeCroy design specifications and MIL-T-28800C.

**Power:** 90-250 V AC, 45-66 Hz, 230 W.

**Battery Backup:** Front-panel settings maintained for two years.

**Dimensions:** (HWD) 8.5"x14.5"x16.25", 210mm x 370mm x 410mm.

**Weight:** 13 kg (28.6 lbs) net, 18.5 kg (40.7 lbs) shipping.

**Warranty:** Three years.