Introduction to LeCroy Digital Oscilloscopes

Digital scopes are key tools used in the diagnosis, test, and evaluation of electronic circuits and systems. LeCroy DSOs provide the ease of use, reliability, and performance required by engineers to quickly solve electronics problems. LeCroy’s digital scopes integrate advanced digital signal processing technology and a powerful processor with software solutions to save you valuable time in solving problems. LeCroy DSOs provide the power needed to capture, view, and analyze signals while keeping the instrument easy to use.

**Capture**
Capturing signals over a wide range of timebase settings at high sample rates while maintaining fast front-panel responsiveness is made possible by LeCroy’s long record lengths and a high-speed RISC microprocessor based system, which includes up to 64 Mbytes of RAM. LeCroy scopes offer the longest record length in the industry – 2 Mbytes of data acquisition memory per channel, which can be combined to 8 Mbytes on a single signal. The LeCroy SMARTMemory system provides total memory management which:
- Dynamically assigns maximum acquisition memory to each active trace to keep sampling rate high
- Applies a patented min/max sorting algorithm to data records to quickly create a display which shows the important signal features
- Assigns resources of computational/ram to the tasks selected

LeCroy technology has been used to achieve the fastest DSO single-shot sampling rate on the market. The model 9362C at 10 GS/s can display the finest details on short, fast signals. Capturing a signal at the appropriate timebase setting with the best accuracy coupled with rapid data resource assignment and processing enables you to solve problems faster.

**View**
The bright 9” display provided on all LeCroy DSOs offers you a large viewing area where you can really see the details in a signal. The 9300C series offers a high resolution amber display, while the LC series has both traditional color-graded persistence display and a new “analog persistence” intensity-graded color display mode. Engineers who spend much of their day in front of an oscilloscope appreciate the larger view of the signal, and with a choice of 1, 2, 4 or 8 grids, it is easy to separate waveforms and numerical measurements. Seeing more details in a set of signals on the large viewing area of a LeCroy DSO helps you quickly gain insight into the source of a problem.

**Analyze**
LeCroy DSOs have the most advanced set of signal diagnostic, troubleshooting and documentation tools available, and in many cases, they can eliminate the need to transfer captured signals for analysis off-line. This includes the measurement of over 40 signal parameters, worst case analysis (maximum, minimum, average and standard deviation) on those parameters, an FFT package with the capability to resolve 4 million time domain samples into the frequency domain, the ability to daisy chain math functions (such as squaring a waveform and then integrating). LeCroy offers an unmatched advanced math package with integration, differentiation, square root, absolute value, ratio, exponential, log and a set of six selectable digital filters. An optional histogramming and trend capability helps you fully characterize signal instabilities such as timing jitter or amplitude fluctuations. The Pass/Fail test package includes the ability to test each of the four input channels against separate test masks and to combine mask testing with go/no-go testing of key signal

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parameters. Documentation tools include the ability to save data to floppy disk, GPIB, RS-232-C, internal memory, PC memory card, 170 Mbyte PCMCIA portable hard drive or an internal, high-speed graphics printer.

**POWER TOOLS FOR ENGINEERS**

Engineers who use a scope for troubleshooting and have not used a LeCroy DSO will find substantial benefits in LeCroy’s tool set. For example, LeCroy’s FFT package differs from those available from other manufacturers by offering the ability to compute frequency spectra based on up to 4 million time domain sample points. This translates directly into better frequency resolution and more insight into the frequency characteristics of the signal. Worst case parameter tracking offers you the chance to monitor key signal characteristics and display the average, maximum and minimum values of those parameters. This enables you to quickly identify worst case performance of pulse widths, amplitudes, timing jitter, or any other of over 40 signal characteristics. The large display of a LeCroy scope can show single, dual, quad, or octal grids. You can zoom in to see details on any part(s) of the signal, perform a math operation on any segment or the complete waveform, and even perform diagnostics that require “math-on-math” (such as squaring a waveform and then integrating it to find the total power). When searching for intermittents, the Exclusion Trigger allows LeCroy DSOs to avoid the deadlock inherent in other scopes which spend most of their time triggering on the normal signal. Engineers familiar with the aliasing problems caused by short memory will appreciate that all display/triggering modes of LeCroy DSOs take advantage of the full power of the data acquisition memory rather than limiting the acquisition to 500 points as found in the specialized view modes of some digital scopes.

**THE POWER OF THE LeCROY SCOPE**

**ARCHITECTURE**

LeCroy’s high-performance lines (LC594A, LC574A, LC534A, LC374A, LC334A, 9394C, 9374C and 9394C) offer four channels of simultaneous sampling with up to 2 Mbytes of memory per channel. This may be combined to provide two channels at twice the sampling rate and 4 Mbytes of acquisition memory or one channel with four times the sample rate and 8 Mbytes record length. Long memories allow the digital storage oscilloscope to operate at the highest sampling rate over a wide range of baseline settings. To complement the long acquisition memories, these scopes can be fitted with up to 84 Mbytes of processing RAM for your most demanding analysis needs. The scope is thus capable of performing extensive waveform math and processing while still maintaining fast screen update rate and lively front panel controls. This capability is achieved through the integrated use of a 96 MHz PowerPC processor in the LC series, or a 32 MHz 68030/68882 combination in all 9300 series DSOs. Competing DSOs that lack LeCroy’s integrated processing power and memory capacity are unable to effectively deliver this capability. Another vendor’s DSOs might capture 500 kpoints of data but only be able to perform an FFT on 10 kpoints, high resolution computations on 50 kpoints, integrate 130 kpoints or store 250 kpoints to memory. Those types of barrens are eliminated in LeCroy digital scopes.

**MASS STORAGE FOR DSOs**

A PCCIA Type III Hard Disk capability is optionally available for any LeCroy DSO. A removable hard disk of 170 Mbytes provides great capacity and flexibility for fast storage and retrieval of waveforms and instrument settings. This slot also supports ATA Flash memory cards. This facility is an integral part of a powerful and exceptional combination of available documentation features that include DO-S-compatible 3.5” Floppy disk and optional PC memory card interface (PCMCIA Type II port) and a built-in, high-speed graphics printer. These tools permit a gain in productivity by making the data captured by a LeCroy scope easily accessible and transferrable. GPIB, Centronics and RS-232-C interfaces are available for programming or printing/ploting. The optional internal graphics printer produces full-resolution screen dumps in under 10 seconds. In landscape mode, the printer can produce fully detailed hard copies of long waveforms by making printouts up to 160 feet long.

**PROBES**

All LeCroy scopes are supplied with LeCroy’s PrinBus Intelligent Probe Interface. This unique feature permits them to be used with a range of FET probes, controlling the probe from the scope’s front panel. The FET probes provide extremely low (1 MΩ, 2 pF) circuit loading and up to 1 GHz bandwidth at the probe tip. Passive probes are provided as standard accessories with most models. FET probes with bandwidths up to 2.5 GHz are available. A wide range of optional probes are available including differential amplifiers with comparators, and differential probes with gain to 1000, CMRR to 100,000:1, and bandwidth to 250 MHz. A new DC-50MHz current probe (model AP015) is effective for measurements of DC, AC and pulsed currents. The PFE series of high-voltage probes provides a selection of models ranging from 100 to 300 MHz and 600 to 20 kV.

**INNOVATIVE PEAK-DETECT CIRCUIT**

Peak-detect is a common feature among high-end DSOs, because it allows them to show fast phenomena that might otherwise be missed due to undersampling. One undesirable effect of most peak-detect systems, however, is a severe loss of horizontal (time) precision. This happens because detected peaks are known to have occurred during a certain interval, but the specific time at which they occurred is not known. Signals acquired with other manufacturers’ peak-detect techniques therefore may
not be successfully used for further analysis or processing.

LeCroy solves this problem by maintaining both peak-detected and normally sampled waveforms for each signal. So you get all the benefits of peak-detection without any loss of time precision. LeCroy in the only scope manufacturer to use this innovative technique.

SMART Trigger® and Waveform Processing

Some DSO vendors put their best troubleshooting trigger only in their most expensive scopes. But many who use 200 - 400 MHz DSO's would prefer state-of-the-art triggering tools. All LeCroy DSO's include SMART Trigger capability. In addition to Edge and Window Trigger, the SMART Trigger offers glitch, Pulse Width, Interval Width, State and Edge Qualified, Dropout, and TV triggers. Time and Events Holdoff are also provided. The scopes include LeCroy's Exclusion Trigger mode which allows you to set the oscilloscope to trigger only when an abnormal signal width or period occurs.

Optional Analysis Packages

An optional Parameter Analysis Package, option WP03, provides extensive statistical analysis capabilities. Detailed measurements can be easily performed on difficult to characterize waveform phenomena such as amplitude fluctuation and timing jitter. Live histogram displays represent the statistical distribution of selected waveform parameter measurements. The trend function draws line graphs to track the value of measured parameters. You can even use math functions such as differentiation to process the trend data.

The DDM and PRML disk drive packages are powerful firmware options that provide a unique integrated tool for engineers developing and testing high-density storage media. The Disk Drive Measurement (DDM) package, developed specifically for those who design and test disk drives and magnetic tape, is based on the IDEMA Standard Measurements for Magnetic Media and includes calculations of Time Average Amplitude (TAA), Pulse Width at 50%, Pulse Width at 90%, Resolution, and Overwrite. The Partial Response Maximum Likelihood (PRML) package is also for magnetic media testing and allows the calculation of Auto Correlation, Non-linear Transition Shifts and Auto Correlated Signal to Noise. The advanced analysis can be displayed in histograms and as worst case parameters.

The new disk drive package from LeCroy, DDRA, adds powerful PRML signal failure detection and isolation capabilities to LeCroy oscilloscopes. DDRA provides several tools that can be used to automatically determine when a PRML signal failure occurs. In addition, once failures are detected, the corresponding head signal locations where the errors occur, can be directly selected for display and analysis. DDRA also enhances the view of the head signal, through performing PRML drive channel emulation. An emulation of the drive channel noise and equalization filter is performed to display a more easily analyzed head signal. The head signal is annotated with markers that display the ideal PRML target points that displayed the ideal PRML target points when the filtered signal should intersect. The difference between the head signal and the ideal target points provides a clear visual indication of PRML signal quality. The ORM Optical Recording Measurements package allows engineers engaged in the design or test of optical recording media (CD-ROM, magneto-optical or DVD) to make measurements which are specific to that media. Data can be displayed as parametric measurements, histograms or trend lines.

Telecommunications Mask Test packages, with balanced and coax adaptors, are available for ITU G.703 and ANSI T1.102 standards. These telecommunications packages transform LeCroy oscilloscopes into dedicated telecommunications mask testers. The input signal is automatically scaled and aligned within the mask, and our exclusive Finder search engine isolates pulses and patterns even in random-bit streams.

Upgrade Your DSO

Digital scopes are capital equipment with a cost ranging from $5K to $35K. To protect the value of your investment, LeCroy offers an upgrade path to keep up with the latest technology. You can upgrade your DSO’s hardware or software, or add analysis packages as your needs change or as new packages are offered. Suppose your next project involves longer, more complex signals. You will need more acquisition memory in your digital scope. Perhaps the application is driven by the need for really fast measurement results. You can add up to 64 Mbytes of RAM and add an analysis package. LeCroy is the only scope vendor that will upgrade DSO’s to add more acquisition or processing memory. Maybe you would like to transfer a scope to manufacturing where I/O throughput for ISO9000 documentation is critical. LeCroy can add a PCMCIA portable hard drive, fast internal printer or IC memory card.

Summary

If the ability to use a DSO to solve problems quickly is important to you, then a LeCroy DSO should be on your list. LeCroy scopes offer outstanding performance in their abilities to capture, view and diagnose electronic problems. The measurement and documentation tools available for these scopes improve productivity and help companies get new products to market faster.

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