cleverscope

The Power to Zoom

CS328A-XS
Mixed Signal Oscilloscope

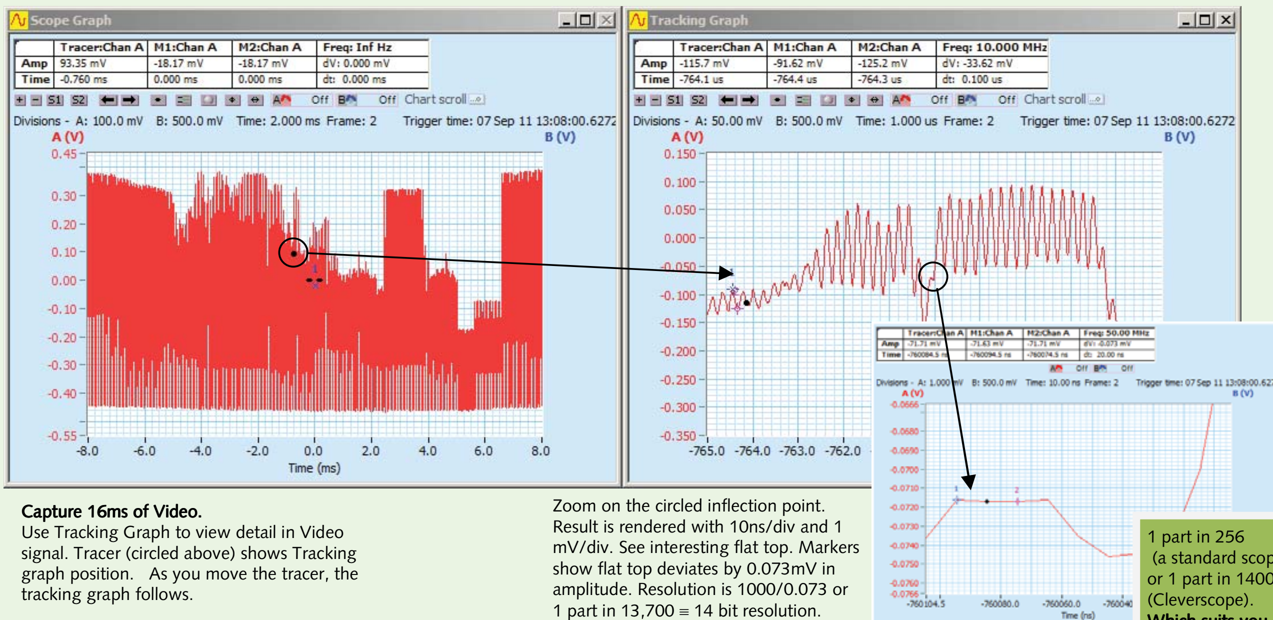
- + Dual 14 bit ADC
- + 8 Digital Inputs
- + 8 MSamples storage
- + 100 MSPS capture
- + 1.5 MSPS streaming
- + 0–10 MHz Signal generator
- + Two mixed signal triggers
- + Protocol decoding
- + Spectrum analysis
- + Symbolic maths
- + Live Matlab and Scilab link
- + Excel export
- + Copy & paste
- + USB or Isolated Ethernet

A massive million to one zoom changes the way you do business. Capture the big picture, and zoom! Look anywhere in the signal, confident 14 bits of vertical resolution reveals the finest detail.

"It has been a fantastic instrument and solved the very difficult waveform observations that I have needed to complete in the last few months." R Dunn, Australia

Zoom Time and Voltage

The scope graph defines the signal captured. The Tracking and Maths graphs track the tracer. Each graph has independent control of time and amplitude. Capture the big signal and zoom on the tiny.

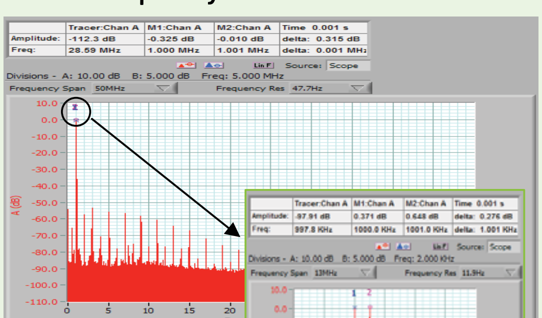


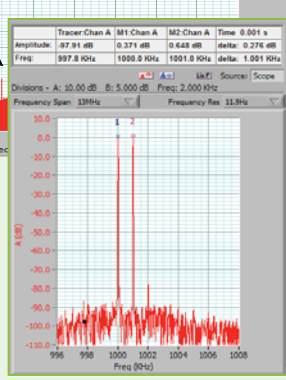
Capture 16ms of Video.
Use Tracking Graph to view detail in Video signal. Tracer (circled above) shows Tracking graph position. As you move the tracer, the tracking graph follows.

Zoom on the circled inflection point. Result is rendered with 10ns/div and 1 mV/div. See interesting flat top. Markers show flat top deviates by 0.073mV in amplitude. Resolution is 1000/0.073 or 1 part in 13,700 ≡ 14 bit resolution.

1 part in 256 (a standard scope) or 1 part in 14000 (Cleverscope). **Which suits you better?**

Zoom Frequency

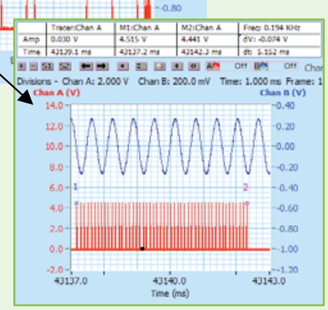




Capture two mixed sine waves of 1.000 and 1.001 MHz with 50 MHz bandwidth. After capture zoom in to see the detail with 50 Hz resolution.

Notice the very low -80dBc intermod distortion! Great for proving mixers, filters and feedback networks.

Zoom Streaming



Continuous stream to disk @1.5MSPS for 200G Samples. Peak capture ensures even 10ns pulse heights are recorded correctly.

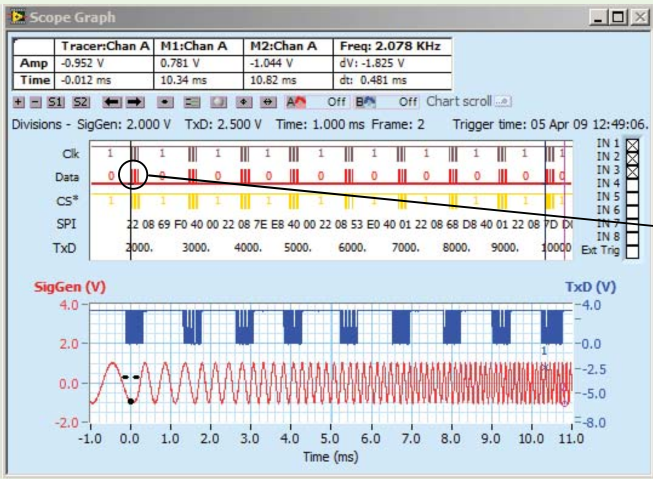
Example Signal: Swept 0.1Hz – 100 kHz, + pulse bursts (30 x 80ns pulses). Capture 180 Million samples, 120 secs duration. Zoom on the tracer. See the pulse burst detail. What other system can do this? Perfect for verifying long term operation.

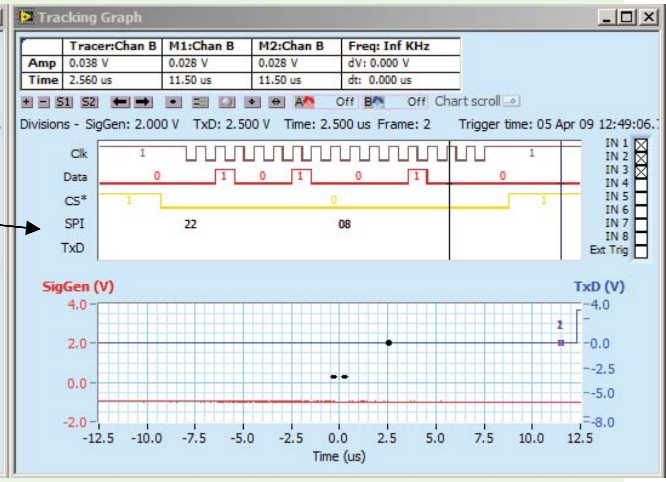
The Power to Trigger

Two independent mixed signal triggers - each can trigger on analog, digital pattern, and count. Combine them to trigger on combinations you want or don't want - brilliant for proving your design!

Mixed Signal Triggering and Protocol decoding

We capture a Uart controlled signal generator frequency command (TxD), and display the stepped signal, and internal SPI bus (Clk, Data,CS*)

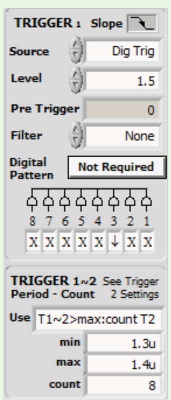


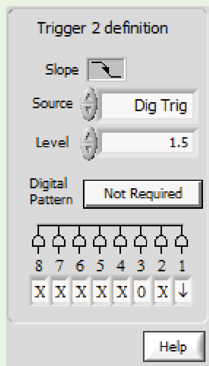


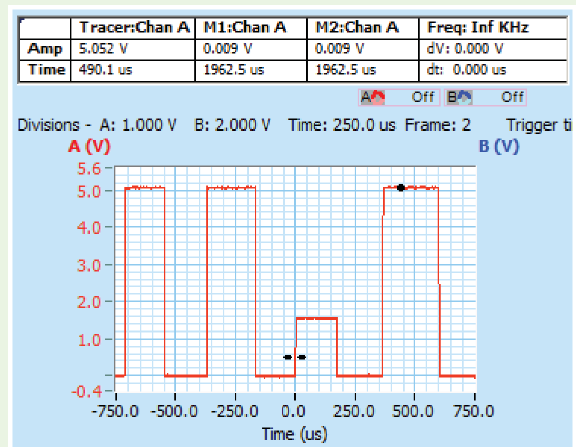
Two mixed signal triggers

Here we trigger on the CS* line going low for more than 1.4us followed by 8 falling edge Clk pulses – the second byte of the SPI message. The Protocol decoder decodes the analog TxD Uart, and the digital SPI signals. Note that Trigger 1 and 2 are different.

Cleverscope can optionally qualify analog triggers with a digital pattern, and digital triggers can include patterns as well (eg In 3 = CS* being 0 in the Trig 2 definition).



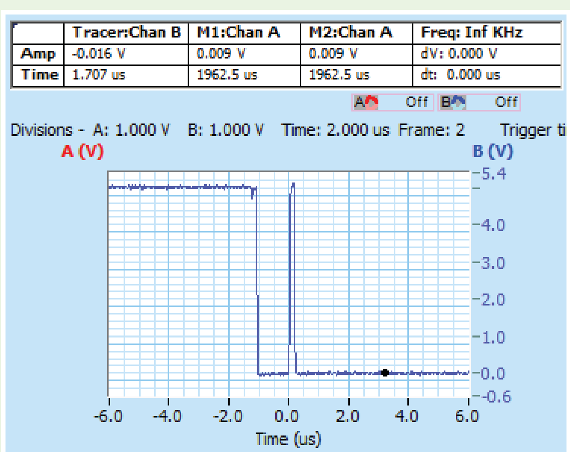




Bus Contention

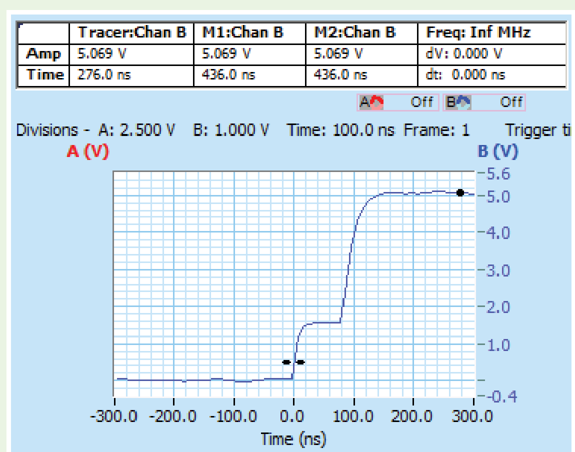
Bus contention can generate runt pulses. With two triggers, Cleverscope can find any pulse that does **not** meet an amplitude/duration specification.

Finding Faults



Poor FPGA logic

Poor FPGA logic can generate glitches. With two triggers, Cleverscope can find any pulse that does **not** meet a duration specification.



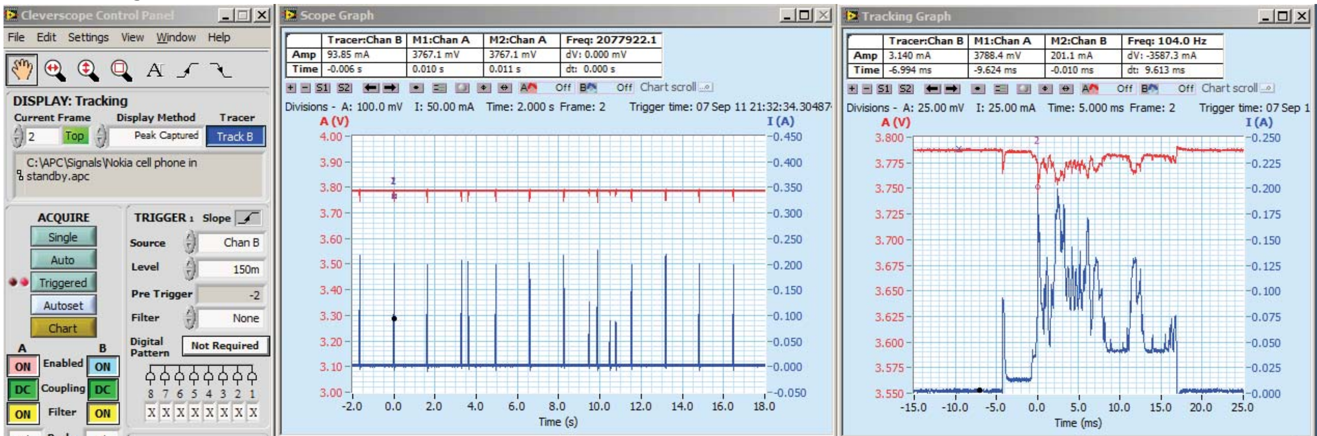
Low current drive

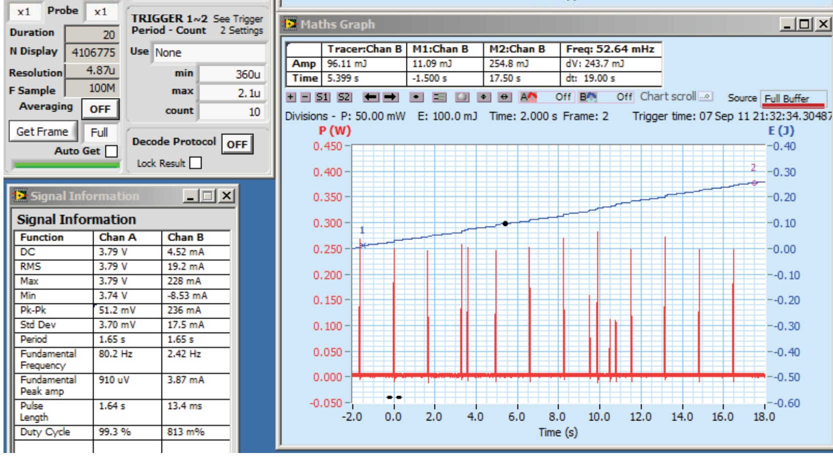
Low current drive can generate slow rise time pulses. With two triggers, Cleverscope can find any pulse that does **not** meet the amplitude/ rise time specification.

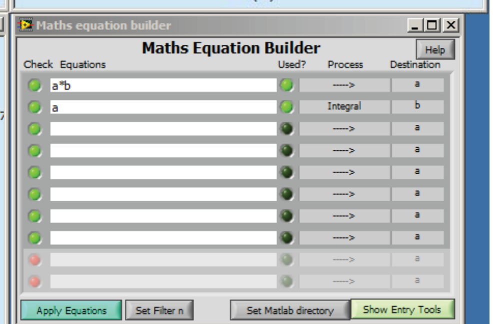
The Power to Analyze

Use the Cleverscope toolset to analyse the response of your system – and solve real-world problems. The application does FFT Spectral Analysis, Maths, Protocol Analysis, Charting, Streaming to disk, Copy and Paste, and live export to Excel, Matlab and Scilab.

Maths, Signal Information and User Units







Finding Energy Use.
The radio draws significant current, and as seen in the Tracking Graph, current is not constant. By using real integration we can come up with an accurate energy use. The Maths Graph is used to do this.

The Maths Equation Builder contains the equations. The first calculates power, which is sent to Chan A. The second integrates the power over time, resulting in energy – sent to Channel B. We plot in engineering units. The markers can be used to measure energy used: 244 mJ in 19 secs, or 12.8 mJ/s, or 12.8 mW.

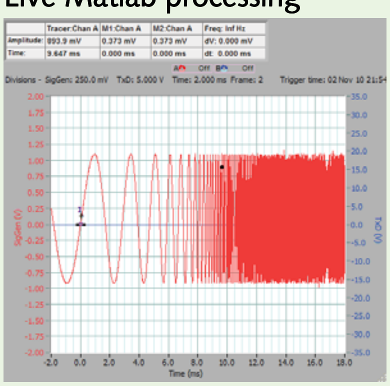
Analyze Cell Phone standby power use
This Nokia cell phone is in standby. It has a 3.8V, 830mAHr battery. How long will it last?

We captured 20 seconds to get a representative sample. Chan B probed a 0.33 ohm current sense resistor, while Chan A probed the battery supply. Note that User Units have been used to display the current in Amps. Note that the A channel voltage is measured between 3 and 4V.
Signal Information gives the DC voltage as 3.79V, and the average DC as 4.52mA. The maximum is 228mA.
Every 1.65 s (on average) the radio is energized.

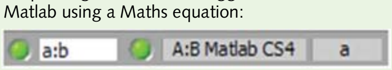
To calculate battery life on standby we need battery capacity and average energy used. The battery capacity is 830 mA Hr. Using E = Pt, Energy is 3.8 x 0.83 x 3600 = 11.4 kJ. We measure 12.8mW average power. Thus the cell phone should last 11400/0.0128 = 890,600 sec = 247 hours.

The same method can be used to estimate lifetime while talking or pressing keys.

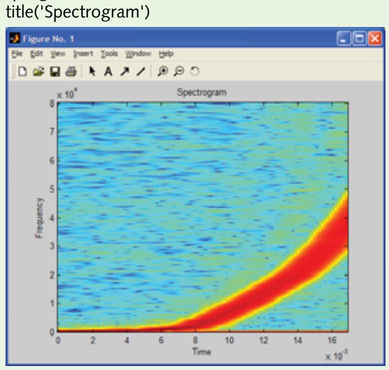
Live Matlab processing



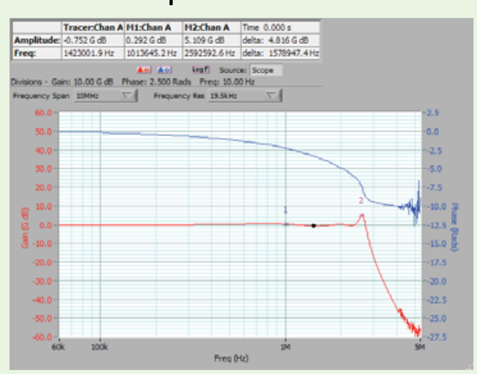
Use Matlab for further analysis. Here we capture a chirp, using the advanced trigger, and send it to Matlab using a Maths equation:



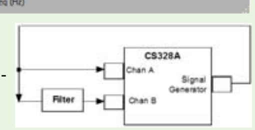
Maths executes one of 4 Matlab functions, live.
Example: Cscope4.m – plots a spectrogram
function y = cscope(a,b,n,T0,dt)
y = a
figure (1)   % Plot data to fig 1
specgram(a,512,1/dt,500,475)
title('Spectrogram')



Gain/Phase plots



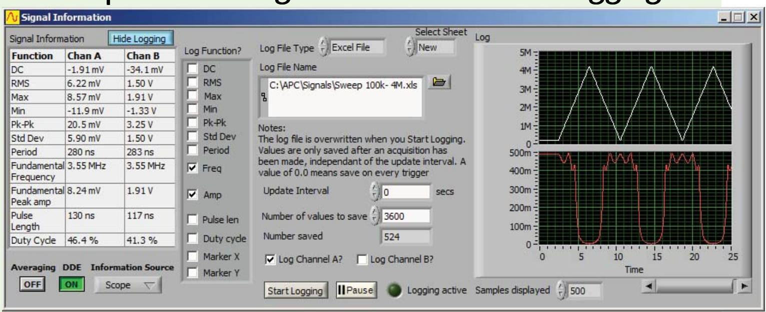
Use the signal generator to build gain/phase plots. Here we plot a Mini-Circuits® BLP-1.9 Low pass filter response, using dB/log F axes.



The Power to Record and Control

Use Cleverscope to Save sample data in binary, text or cleverscope, in response to triggers, time and user need. Save Signal Information to a text file or Excel. Export cell values live to Excel. Copy and Paste results into Word. Recording your results means they are not wasted.

Comprehensive Signal Information and Logging



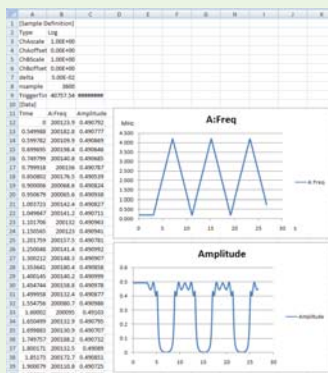
Log to a text file or live to Excel

Signal Information displays many signal derived values such as Freq, RMS amplitude and THD. Log derived values to disk or Excel at up to 20Hz indefinitely, viewing the signal chart in real time.

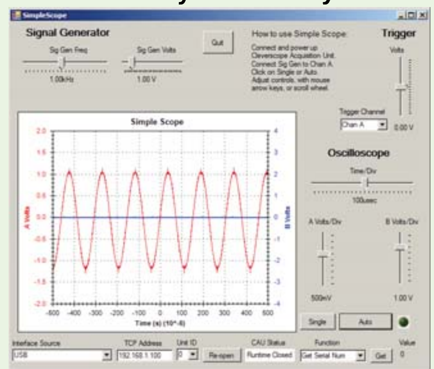
Use Maths to pre-process and extract important signal information.

This example displays a frequency sweep through a filter.

You can also use DDE to send any signal information value live to an Excel cell.



Control your own system



We supply driver software for Microsoft Visual Studio C++, C#, Basic, and Labview, Labwindows, Delphi and C Builder.

We include examples such as SimpleScope which implements a scope with sig gen control. Using our tools, build your own test system.

CS328A-XS Short Specification

- Two 14 bit analog channels sampling simultaneously at 100 MSa/sec. AC or DC coupled. 80dB dynamic range.
- Eight Digital Inputs, threshold adjustable from 0 to 8V.
- One External Trigger input, threshold adjustable from -8 to +20V.
- Each channel - Channel A, Channel B, External Trigger, and Digital Inputs 1-8 have 8M storage each.
- All channels are captured synchronous to a common 100 MHz clock. The clock has 1ps rms jitter. An external clock option (CS810) is available. The external clock range is 1-120 MHz.
- 1x analog input range is from ±20mV to ±20V. User defined scaling and preset probe attenuation values allow display in engineering units for all types of probes.
- Offset automatically set from 0 to ±20V by choosing graph view. The ADC digitizes only the displayed amplitude range. E.g. range is 2.01 V to 2.05V. The digitizer 14 bits applies across the 40mV range 2.01-2.05V.
- Two Mixed Signal Triggers. Each trigger uses an analog transition + digital pattern, or digital transition + pattern. Patterns maybe AND, OR or don't care. Trigger when Trigger 1 AND/OR Trigger 2 occur while meeting a duration and/or count specification. For example you can trigger on the Trigger 1 to Trigger 2 duration being in the range 840ns to 1.24us, followed by 236 Trigger 2 transitions. The analog trigger may be conditioned with a low pass, high pass or noise filter. The digital inputs are Inputs 1 – 8, and the External Trigger.
- A DDS signal generator output, 0-10 MHz, sine, square , triangle, swept DC. Output is ±200mV to ±5V. The output maybe offset over ±5V. The Signal Generator can sweep synchronous with sampling, linear or log.
- USB 2.0 or isolated Ethernet Interface to the PC
- A rear panel Link connector with Trigger bus for unit expansion, and two spare outputs. A four channel unit can be achieved by linking two units, and using the Cleverscope 4 channel software.
- The sample storage may be allocated as between 2 to 3000 frames varying in size from 4M to 4000 samples. These may be used as a history store for reviewing previously captured signals, or to capture up to 3000 trigger events with a minimal 20 µs inter-frame delay, while maintaining time relative to the first trigger for all succeeding frames. All frames are time stamped with a 64 bit 10ns resolution value.
- The analog input signal chain includes optional 20 MHz low pass filter, and moving average filter with 40ns – 1.28us time constant. The moving average filter improves noise and dynamic range - at 1.28us, ENOB is 16 bits.
- The analog signal chain includes a real-time peak capture option, which records the minimum and maximum amplitude in the given time interval. For example, with 2 frames, 8M storage, and a capture period of 10 seconds, each sample interval is 10/4M = 2.5us. With peak capture turned on, samples alternate minimum value, maximum value. Values are ordered for the signal direction. Thus even with 10 second displays, 10ns duration pulses can be displayed.
- The application includes Scope graph, Tracking graph for tracked zoomed view, Maths graph, X-Y graph, Spectrum Graph, Signal Information, Protocol Display, and variable persistence on the time graphs.
- Driver software, including examples, for Labview, Labwindows, Visual Studio C#, C++, Basic, Delphi, Builder.

Some University Users:

Harvard - USA
MIT - USA
Stanford - USA
California Institute of Technology
California at Berkeley - USA
California at San Francisco -USA
California at San Diego - USA
Washington State -USA
Rice - USA
Georgia Tech- USA
Iowa- USA
Hawaii- USA
Colorado- USA
Rpi - USA
Conseil National De Recherches Canada
TU Clausthalle - Germany
TEC Institüt - Germany
Mainz - Germany
Unibw - Germany
Uni-due – Germany
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Auckland - NZ
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