Re: Digital Osci and Logic Analyzer

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- *From*: Rich Webb <bbew.ar@xxxxxxxxxxxxxxxxx>
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On Fri, 7 Apr 2006 02:43:39 −0500, "Abstract Dissonance"
<Abstract.Dissonance@xxxxxxxxxxx> wrote:

> How complicated is it to create a simple pc based oscilloscope and logic
> analyzer(excluding the pc software)?
>
> Does it just consist of getting a ADC and interface for sending the data to
> the pc? I'm looking at trying to make one in a similar way to what is done
> on this site:
>
> http://www.fpga4fun.com/digitalscope.html
>
> I figured that the main the parts are the ADC, the probe, and the method of
> sending the information(which I think is the hardest part at high data
> rates?)? I've seen some ADC's that have sample rates of over 100Msps which
> should give me a 50Mhz bandwidth? Although these aren't cheep I've also
> seen some upwards of 1Gsps that would give me a larger bandwidth if I needed
> it.

As a rule of thumb, estimate the useable bandwidth as being limited by one−tenth of the ADC sample rate, not one−half. That lets you recover (more or less) the fifth harmonic of the signal of interest right at Nyquist. For some commercial examples, there's the Fluke 199C: 2.5 Gsps, overall bandwidth 200 MHz; and Tek TDS2012: 1 Gsps and 100 MHz. So for your

> Lets suppose I decide to buy a 1Gsps ADC(which isn't going to happen any
> time soon) and I have a probe that works properly with the ADC. How would I
> go about storing/streaming all those samples? This would require a memory
> chip be able to work down at 1ns or so? I was thinking I could use several
> gigs of pc memory in parallel to reduce the latency and increase total
> sample size to a few seconds... is this possible? What about encoding for a
> digital stream? do something like rle on the bit stream where 01 one would
> store 2 bits as one and its number of repetitions? (need to use 2 bits
> atleast so things like a clock signal are encoded efficiently)

You don't need to capture or store more samples than you need for one display screen.

Assume that your display area is 500 pixels x 500 pixels at ten divisions each for horizontal and vertical. No matter how fast you sample, you've only that area to work with. For each time step (vertical column) you have several choices.

You can decimate your sample rate down to where you grab just one instantaneous sample at that tick