Splitting the Grid

The Effect Of Multiple Display Grids on Signal Integrity

Modern digitizing oscilloscopes use ADCs to convert real-world signals into discrete digitized values. Most oscilloscopes contain 8-bit ADCs. This corresponds to 256 discrete levels of signal representation per channel. Acquisition accuracy is maximized when using the full dynamic range of the ADC.

When viewing multiple channels simultaneously, a common practice has been to decrease the vertical scaling of each signal to fit them within the same grid as shown in Figure 1. Since each channel uses only one-half of the full dynamic range, only 128 discrete levels are used for digitization, which corresponds to 7-bit accuracy per channel.

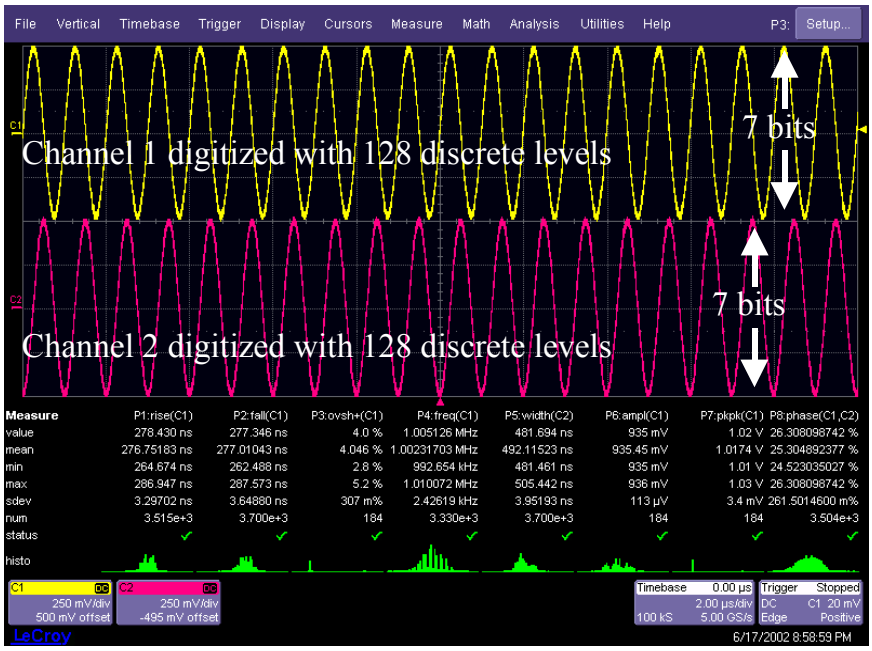

Figure 1: Two traces displayed on the same grid

The feature of multiple display grids offers the capability of splitting the display into multiple grids, each containing the full dynamic range of the digitizer. Figure 2 shows two physically separate grids each containing one input signal at full deflection.

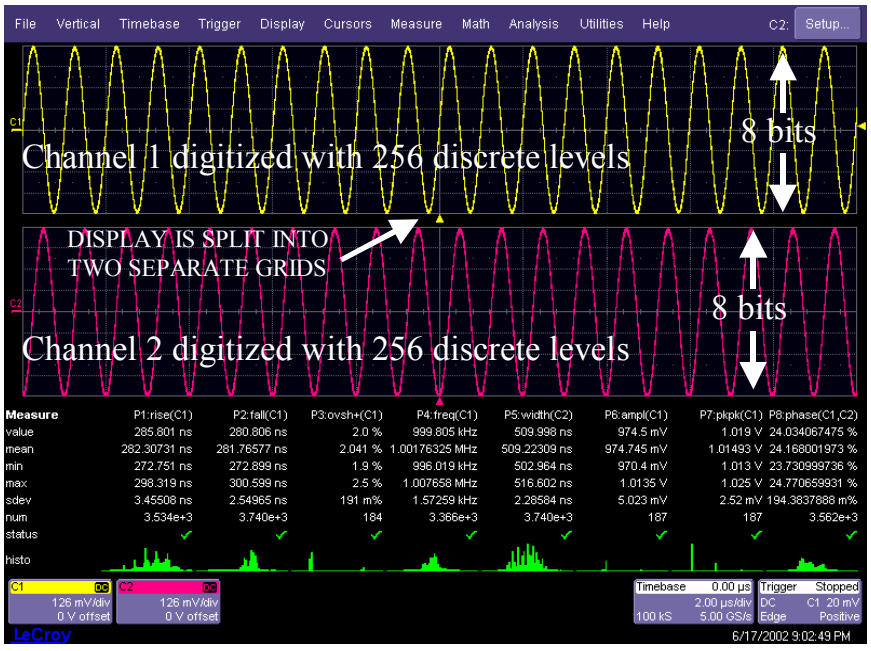

Figure 2: Two traces displayed with dual grid

The added vertical accuracy of splitting the grids carries over into measurement accuracy for both vertical and timing measurements. For example, amplitude and peak to peak readings are 975 mV and 1.015 V in Figure 2 compared with 935 mV and 1.017 V in Figure 1.

The oscilloscope readings in Figure 2 more closely match the expected output of the sine wave signal generator. Data accuracy was increased due to scaling the channels to include a larger portion of the digitizer's dynamic range by using multiple grids.

Standard digitizing oscilloscopes include four input channels. Figure 3 shows an example of displaying four input channels simultaneously on a single grid. Each input channel's vertical scaling is reduced and occupies 25% of its full scale dynamic range. This corresponds to 64 counts of the ADC (6-bit resolution) for each trace. When the same signals from Figure 3 are acquired using quad grid mode, each signal will now have 8-bit accuracy.

The Channel 1 ramp function from Figure 3 is expanded vertically and displayed in Figure 4 alongside a ramp trace acquired using quad grid mode. A detailed view of a signal acquired using only 6 bits of the ADC reveals low accuracy of the acquisition while the signal captured in quad grid mode shows the full eight bit range of the ADC on the acquired signal.

(note: see application notes on averaging and digital filtering for info on further enhancing resolution)

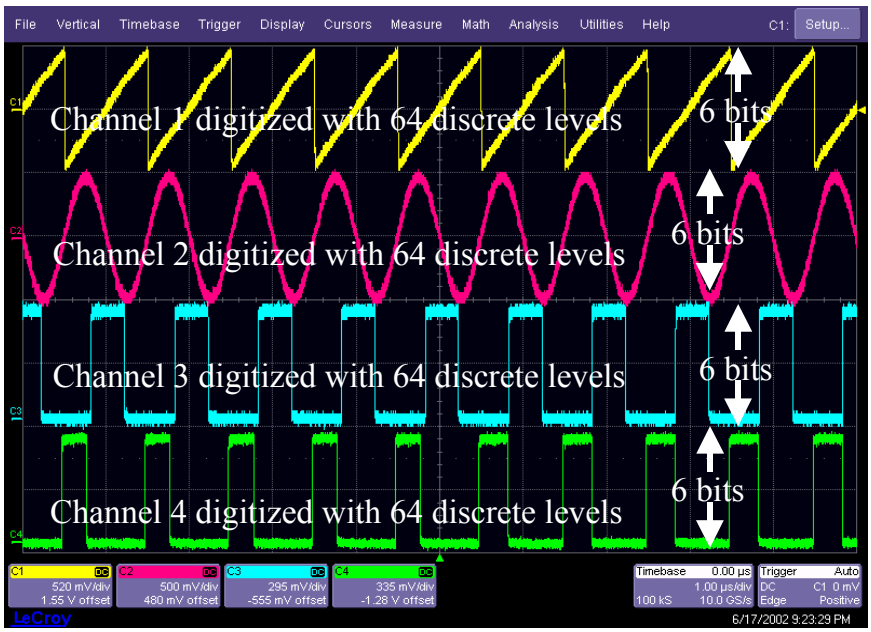

Figure 3: Capturing 4 signals on one grid uses only 6 bits of the ADC

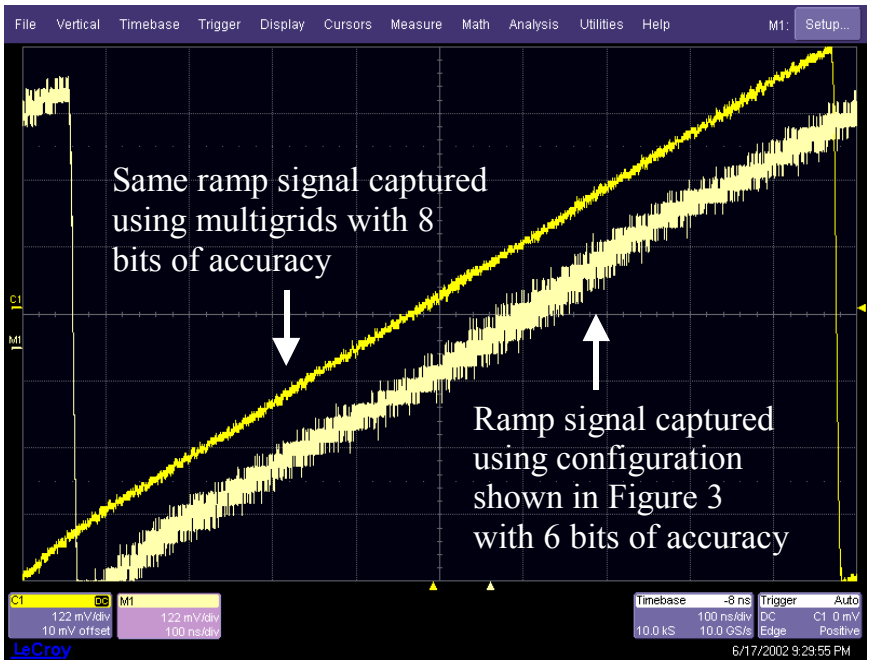

Figure 4: Detailed view of data comparing 8-bit signal result from quad grid compared with 6-bit signal from single grid.