SAMPLE RESOLUTION

Another factor to consider when selecting an oscilloscope for an application is the resolution. Bits of resolution refer to the number of unique vertical levels that an oscilloscope can use to represent a signal. One way to understand the concept of resolution is by comparison with a yardstick. Divide a meter yardstick into millimeters; what is the resolution? The smallest tick on the yardstick is the resolution—or 1 out of 1,000.

The resolution of an ADC is a function of how many parts the maximum signal can be divided into. The amplitude resolution is limited by the number of discrete output levels an ADC has. A binary code represents each division; as such, the number of levels can be calculated as follows:

$$\#\ of\ levels = 2^{Resolution}$$

The resolution you need depends on your application; the higher the resolution, the more the oscilloscope costs. Keep in mind that an oscilloscope with high resolution doesn't necessarily mean that it has high accuracy. However, the achievable accuracy of an instrument is limited by the resolution. Resolution limits the precision of a measurement; the higher the resolution (number of bits), the more precise the measurement.

Some oscilloscopes use a method called dithering to help smooth out signals to get the appearance of a higher resolution. Dithering involves the deliberate addition of noise to the input signal. It helps by smearing out the little differences in amplitude resolution. The key is to add random noise in a way that makes the signal bounce back and forth between successive levels. Of course, this in itself just makes the signal noisier. But, the signal smoothes out by averaging this noise digitally once the signal is acquired.

[Source: http://www.ni.com/white-paper/2709/en/]