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Digital Video Basics

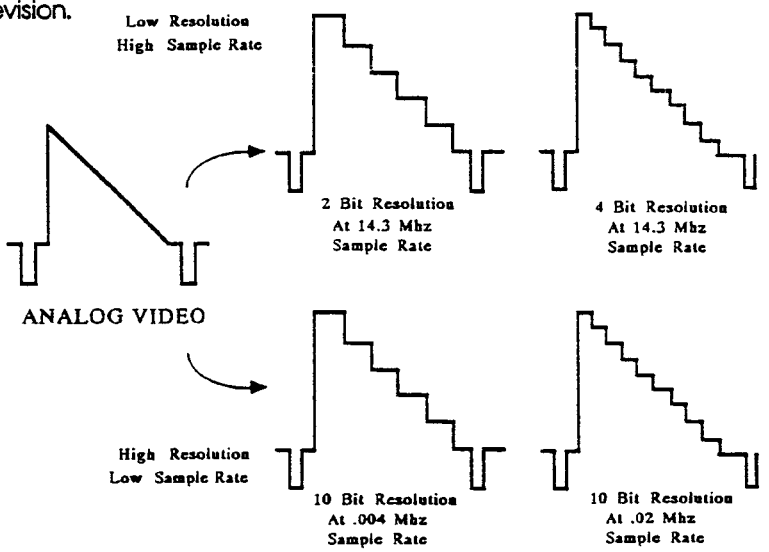
Last month I promised to cover some of the basics of digital video, or at least enough to sort out some of the differences between the families of products. We will cover sampling rate, digital resolution, and what bits have to do with video. I fear that some of this might just get too complicated, but I promise to drop back to the basics next month. A definition of digital video can be related to analog video. If all other factors are ruled out, analog video has infinite resolution and infinite signal clarity. Digital video is automatically limited in its resolution by definition. Digital video is generated by taking limited samples of analog video. Two factors determine the resolution of digital pictures. First is the rate (or how often) these samples are taken. The second is amplitude sampling or how many samples are taken between black and peak white.

Digital Resolution

Lets look at those two factors, one at a time. Amplitude sampling can be considered similar to using a ruler to measure a length. For example, let's assume that a video signal is 1 inch high, from black to white. If we have a ruler divided into ½ inch divisions, then we can locate only black, middle gray and white. Anything which is not at the exact 0, ½ or 1 inch mark is either not recognized or is recorded at the closest mark. Either way, the resulting picture lacks gray scale resolution. Digital 8 bit resolution has 256 evenly spaced marks on our imaginary 1 inch ruler, 9 bit has 512 and 10 bit has 1,024. So a more accurate statement is the amplitude resolution of digital video is primarily determined by the bit sampling of the system.

Horizontal or time rate sampling is the second domain which is required for digital video. Let's use another rough example for this concept. Imagine that you're at a car race. The track is round and it takes about 1 minute to drive a lap. You are allowed to look only once a minute. The race starts, you look, then one car goes 10 feet and dies. A second car does the lap in 55 seconds. You look again as the second car passes the dead car. Your visual information is that they are running even. You speed up your resolution a look every 30 seconds. Now you know that either the first car is dead, or running very fast. Increase your samples to a look every 15 seconds. You still miss the wheel that fell off a car coming out of the third turn. This can go on, but I hope you get the idea. In digital video, the time sampling rate is usually measured in cycles of subcarrier. A cycle of subcarrier is pretty quick, about 3.58 Mega Hertz in NTSC television.

The sample rate is usually 4xfSC or four times the frequency of subcarrier. In NTSC that time is 14.318 Mega Hertz, anything which happens at a rate faster than that might not get noticed. This digital information is then combined, that is the amplitude samples and time samples make up a digital video image. The resulting video image from any digital device is sort of like the "connect the dots" pictures we did when we were kids. The result was usually not quite an accurate representation of the original. It was close, and recognizable, but not as clear. The more dots there were to connect, the better the representation (resolution). We have included a couple of diagrams to help illustrate the concepts presented in this article.



We have received a lot of great requests for future articles from you over the past month. I now have enough suggested subjects to keep "Application" going for the next five years. Keep those requests and questions coming. Phone or mail your message to Mark Everett.