Vibration Basics—Understanding the X and Y Scales

Understanding the basics of the X & Y scales is very important in the field of vibration analysis. Switching between time and frequency is a common tool used for analysis. Because the frequency spectrum is derived from the data in the time domain, the relationship between time and frequency is very important.

The most common measurements in vibration are in units of acceleration, velocity and displacement. These measurements can be analyzed in 3 different ways: peak-peak, peak, or rms. Good vibration analysts have a solid understanding of each of these fundamental terms and can convert from one measurement to another.

Another important term in vibration is Hertz (Hz). Hertz is the most common term used in vibration analysis to describe the frequency of a disturbance (vibration) in a machine bearing. One Hertz is equal to 1 cycle/second (cps). Traditional vibration

Figure 1– A sine wave composed of four separate discrete frequencies of the same amplitude.

analysis often expresses frequency in terms of cycles/minute (cpm) because many pieces of process equipment have running speeds related to revolutions/minute (rpm). 60 rpm = 60 cpm = 1 cps = 1 Hz.

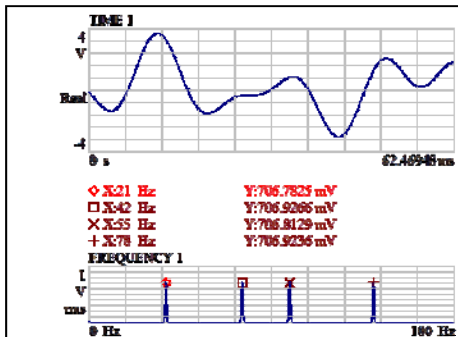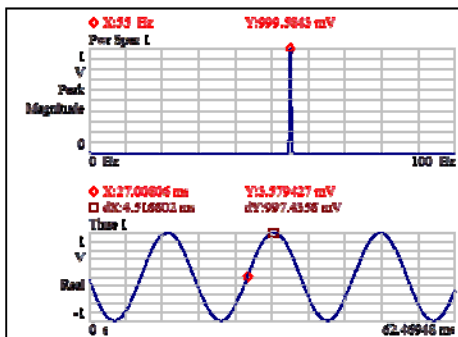The "X" scale is displayed from left to right along the

Figure 2– A single frequency sine wave demonstrating a peak measurement.

graph. In the dual plot in Figure 1, the upper plot is the time waveform and the lower plot is the frequency scale. This is the format used most often in vibration analysis. The time waveform starts at zero seconds at the left side and increases as it moves to the right. The samples shown in this article are taken over about 62.5 milliseconds. The frequency scale starts at 0 Hz on the left and increases in the same manner.
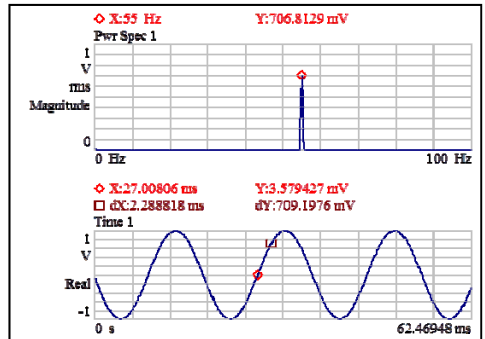

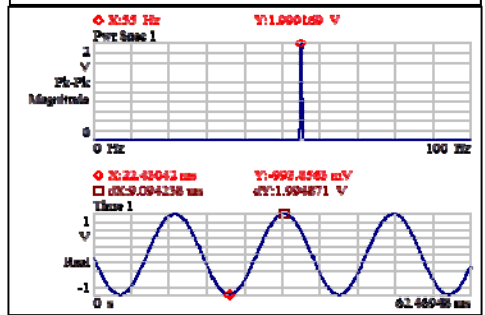Figure 3— Single sine wave demonstrating a RMS measurement.

Fig. 4—The same single frequency sine wave demonstrating peak-to-peak measurement.

The "Y" scale provides the amplitude value for each signal or frequency. Default units for the "Y" scale are **volts RMS**. Volts is an **E**ngineering **U**nit (**EU**). **RMS** is one of three suffixes that explain what portion of the data was actually analyzed. The other two are: (**Peak**) and (**Peak - Peak**). The RMS value is expressed from zero to 70.7% of the peak amplitude. The spectrum value uses the suffix "RMS" to denote this. The Peak - Peak value is expressed from the peak to peak amplitude. The spectrum value uses the suffix "Pk-Pk" to denote this. The time wave has not changed. The Peak value is expressed from zero to the peak amplitude. The spectrum value uses the suffix "Peak" to denote this. The time wave has not changed.

If you have any questions or for further information please feel free to contact CTC directly via Email techsupport@ctconline.com or call 1-800-999-5290 in the US and Canada or +1-585-924-5900 internationally.