Application Note #7

More is Better

When dealing with slow rotating machinery, "more is better." This is especially true when dealing with tachometer signals. The more pulses you can acquire from a rotating shaft turning at slow speed, the more accurate your RPM information will be and the better off you are.

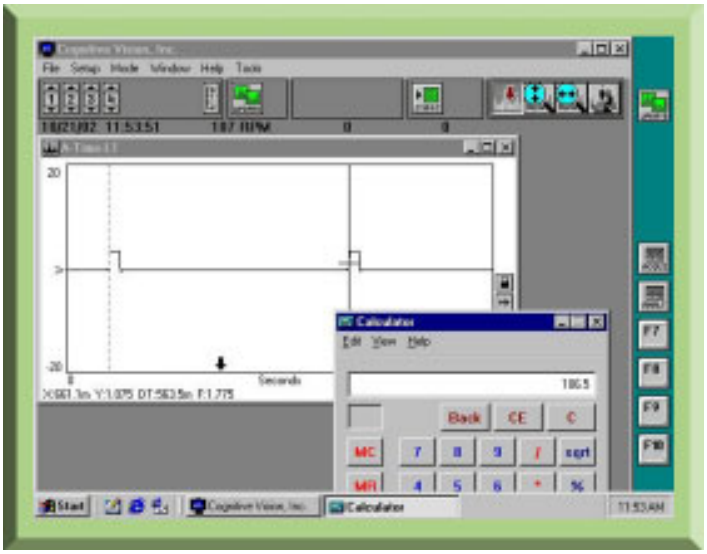

Figure 1. 5% Error?

It all comes down to a question of timing, which is dependent upon the size of the shaft. As an example, let's look at a three-inch diameter shaft turning at100 RPM. The time between pulses is about one-half a second using a once per revolution tachometer signal. Shown in Figure 1 is a time trace of the tachometer ouput. On the left-hand side about two-thirds down the figure is the cursor line readout. The Delta Time (DT) value of the readout shows the time between pulses is 0.5635 seconds. If we calculate the RPM using the frequency value shown on the cursor line (1.775 times 60), the result is 106.5 RPM. However, take note of the RPM readout above the time trace. It's reading 107 RPM! The difference between these two RPM values amounts to less than 0.5%. How do we account for this difference? The answer is simple. Most electronic counter circuits need a number of pulses to compute the RPM. When there is only one pulse per revolution, the counting is on a rotation-by-rotation basis. If we can increase the number of pulses per revolution, we can obtain a better average RPM.

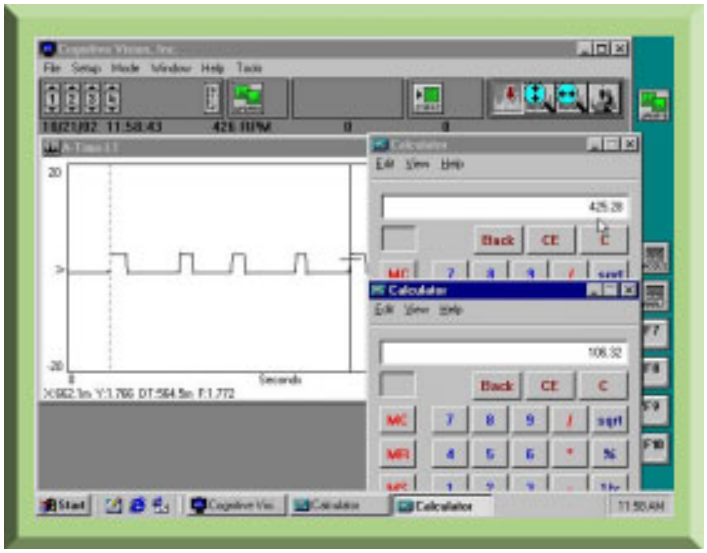

Figure 2. 4 Pulses

This point is illustrated in Figure 2. Looking at the same shaft, we have increased the number of pulses to four by adding three more targets. The tachometer counter is still counting as if there were one pulse per revolution so the speed that is shown is four times the actual speed. If we use the new RPM value located above the time trace and divide by four, the result is 106.32 RPM. The resultant difference is smaller. With more targets per revolution, calculation of average RPM of slow rotating shafts becomes much more accurate.

A down-counter has been added to the new CV435 TachPRO to allow the operator to adjust for the number of targets. Figure 3, on the next page, illustrates the advantage of the CV435 and its down-counter. Here the operator has "dialed" in 004 on the down-counter

and the end result is a more accurate idea of the speed of the shaft. In this case, the CV395 DynamicPRO's tachometer "counter," the triggering of the Channel 1 data and the computation of speed from the Delta Time (DT) marker function (Via the Microsoft Calculator) are in perfect agreement, at the very low speed of 87 RPM.

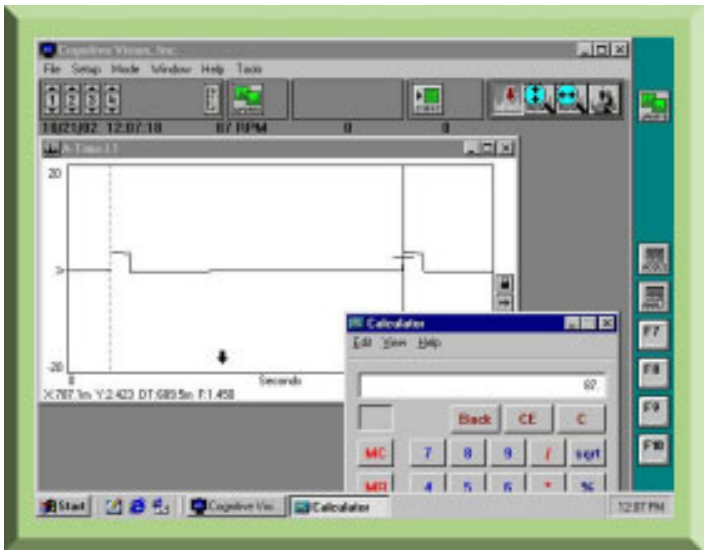

Figure 3. Down-Counter Output

An added benefit of using the CV435 TachPRO and its down-counter is evident in the shape of the pulses. If you examine the traces closely in Figures 2 and 3 you will notice the difference in pulse shapes. In Figure 2, with no down-counter being utilized, the CV435 gives you the exact amount of time the reflection is taking place. The reflective tape for each of the four targets is of different widths. In Figure 3, the CV435 down-counter performs the "counting" of the pulses, and the division "dialed-in" by the operator, the reflective pulse is also converted to an electronic pulse of equal pulse width. This reshaped and well defined pulse width with complete high and low frequency content preserved provides an excellent trigger signal for other instrumentation.

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