Guidance – Vibration Sensor

The "value" of the vibration signal is an un-calibrated output, the magnitude of which changes as the operator changes the gain of the triggering amplifier, like turning the volume up and down on your radio or television.

We could data log it, but the magnitude of the signal is meaningless, as it will go up and down, depending on how the operator trims the trigger level. So, the sensor provides no more than an adjustable trigger level, for shutting down the test; we are effectively using the sensor as an alarm device, not for making an analytical measurement.

If we want to measure vibration in a meaningful way, we would need to use a properly calibrated and non-adjustable output accelerometer, with high speed data acquisition of the dynamic signal, as opposed to low speed, time smoothed and damped measurement. The former gives you the equivalent of the music, the latter, just a measure of the total noise, with no information about the content of that noise.

Having acquired the signal, for it to be of any use at all, we would then need to process and analyse the output, in order to interpret the raw data into meaningful content.

Frequency Analysis

Frequency analysis is the most commonly used method for analysing a vibration signal. The most basic type of frequency analysis is an FFT, which converts a signal from the time domain into the frequency domain, allowing a power spectrum to be generated, showing the energy contained in specific frequencies of the overall signal. This is useful for analysing stationary signals, whose frequency components do not change over time; it is not suitable for signals whose frequencies vary over time. If we have something like a bearing rotating at a given speed, it will generate a signature frequency or frequencies; we might sensibly decide to focus on this specific frequency, for monitoring and analysis purposes.

Order Analysis

Order analysis is used to analyse systems where the excitation frequency varies, for example, changes in running speed of a motor, so it is geared specifically towards the analysis of rotating machinery and how vibration levels and frequencies change, as the rotational speed of the machine changes.

Wavelet Analysis

Wavelet analysis is used for characterizing machine vibration signatures with narrow band-width frequencies. In essence, we pick a given frequency that we wish to monitor and use that as your measured parameter. This is a bit like saying: "I am not interested in the overall volume of the music; I am only interested in monitoring the volume of noise at Middle C (256 Hz if you are a mathematician and 261 Hz if you are a musician!).

Then there are more complicated forms of analysis, such as model based analysis.

So, we really need to decide what it is we want or think we need to measure, when it comes to vibration measurement and analysis, then choose an appropriate bandwidth sensor, then choose an appropriate analysis system.

The reason why we prefer not to data log the vibration sensor on machines like TE 92 is that we end up with silly questions, such as:

> "The measured vibration level I'm data logging is too high/too low, but the test is still running smoothly"
>
> "Have you adjusted the trigger level on the vibration cut-out circuit?"
>
> "Yes"
>
> "Well, that's why the magnitude of the signal has gone up/down!"

It is not enough just to data log some parameter; you really need to know what the signal means and how you are going to interpret it.