CTC AppNotes

A series of technical documents written by members of the CTC community

Dynamic Output Accelerometers VS. 4-20mA Output Accelerometers: Differences and Similarities

One question that comes into the tech support department at CTC from time to time is "Which sensor should I buy to monitor vibration?" The biggest confusion on this point is over whether to buy a dynamic accelerometer or a 4-20 mA output sensor. Many people assume that our dynamic accelerometer is really a 4-20 mA output sensor and vice-versa. This app note will try to explain, in brief, what the basic differences are and why one cannot be used in place of the other.

The first reason behind the confusion may be the fact that the two types of sensors frequently have the identical form factor and electrical connection. The internal sensing elements are also nearly identical. The only real difference between the two sensors is in the way the internal amplifier and processor process and output the vibration affecting the sensor.

Figure 1—CTC's dynamic AC102-1A accelerometer on the left and 4-20 mA output LP202-xxx-1D sensor on the right. The external form factor of both sensors is identical, as is the identical primary sensing element inside. The only difference lies in how the internal amplifier boards process the signal.

Dynamic vibration sensors output an AC voltage riding on a DC bias voltage. The raw output is usually called the time waveform and contains all the information required for a data analyzer or computer to perform a 'Fast Fourier Transform', a mathematical operation that breaks the time waveform down into its frequency based components (see Figure 2) and is output as a spectrum. While valuable as a diagnostic tool, time waveforms and spectra are not used by most PLC, DCS or SCADA type systems and so the dynamic accelerometer is not well suited for use as a continuous monitoring tool without a specialized system or processor unit to modify the signal

4-20mA or "Loop Power" sensors output the same signal sent by the same sensing element in a different way. The 'LP' sensors start by selecting only the portion of the time waveform within a frequency band which is selected at the time of manufacturing. This band will generally eliminate the very high and very low frequencies which are usually less likely to be problem areas. After eliminating the unwanted frequencies the remainder of the data from the time waveform is aggregated into an overall number proportional to the full scale of the sensor, also selected at time of manufacture. As a machine bearing or gear box becomes worn, the surfaces deteriorate and cause vibrations to increase. These increases cause an increase in the overall vibration output of the sensor and a vibration analyst can be sent out to troubleshoot the problem before it causes a shutdown. Unlike a dynamic sensor, LP sensor signals cannot be broken down into their frequency components, as some of the information from the time waveform has been stripped away from the signal prior to its being passed along to the monitoring system

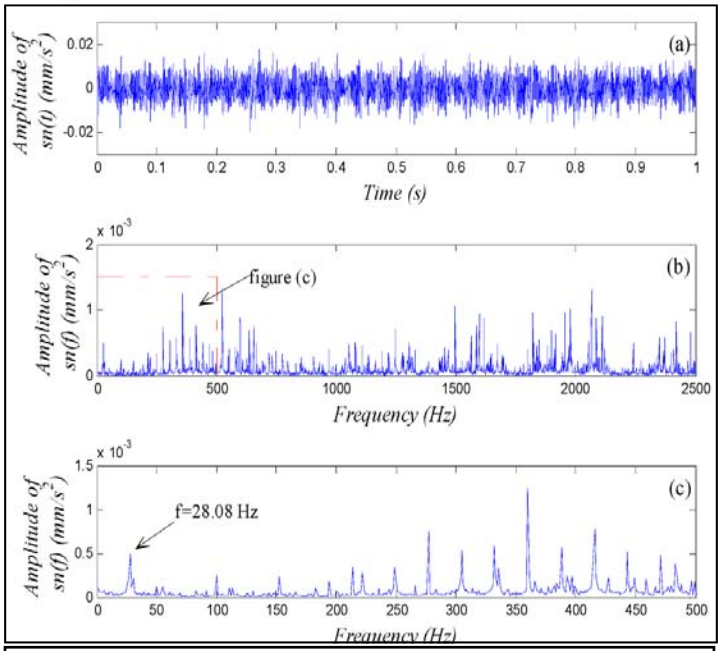

Figure 2– Typical plot from a dynamic analyzer of the output from a dynamic accelerometer. The top plot is the raw out put of the sensor called the time waveform. The middle plot is an FFT spectrum in which the data analyzer has performed a 'Fast Fourier Transform' to break the time waveform into its component frequencies. This information is expanded in the lower plot to focus on frequencies of interest in diagnosing vibration problems which can be used to determine what component of the machine might be deteriorating.

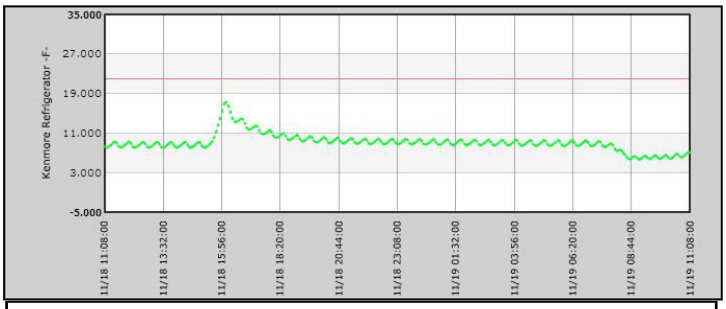

Figure 3– This figure reflects the typical type of information provided by a 4-20 output sensor, with slight fluctuations probably based on the process and larger changes at particular points. Note the red line, which is the alarm point. Once overall vibration levels pass the red lime an alarm or shutdown would be triggered.

If you have any questions or for further information please contact us via email, techsupport@ctconline.com or call 1-800-999-5290 in the US and Canada or +1-585-924-5900 internationally.