DIGITAL DATA ACQUISITION

By Marc Rubino

In order to minimize online vibration measurement error of turbomachinery rotating assemblies, the "glitch" must be reduced to industry accepted threshold values. Glitch refers to all forms of vibration measurement error from an observed rotor surface. Typically, the observed surface is a burnished band on each end of a rotor shaft located adjacent to the radial bearing running surfaces. The observed shaft surfaces are inspected during overhaul or new part manufacture for mechanical and electrical anomalies that would upset the magnetic fields generated by proximity probes, hence glitch is often referred to as "combined electro-mechanical runout". Sources of mechanically induced runout, which are detectable visually or with the aid of a dial indicator (resolution .0001"), include nonconcentric shaft surfaces, a bowed or "kinked" rotor, and shaft surface mars. Sources of electrically induced runout include shaft residual magnetism, metallurgical segregation, and localized stress concentrations. Regardless of the source, rotor glitch must be minimized in the shop to facilitate reliable monitoring in the field.

An archaic method of measuring rotor glitch in the shop is the "manual polar" method. Essentially, an operator measures the voltage output of an Eddy-current proximity probe every ten degrees about the circumference of the observed shaft target area. In other words, the operator rotates the rotor to thirty-six unique positions to find the maximum and minimum voltage values, which is subsequently converted to mils to yield the peak-to-peak electro-mechanical runout. This method does not produce comprehensive results as anomalies between the ten degree locations are missed.

To overcome the pitfalls of the manual polar method, glitch should be recorded continuously over the shaft circumference during rotor slow roll in Vee-blocks. To accomplish this, Rotating Machinery Services utilizes a digital data acquisition system. Digital data acquisition (DAQ) is the process of measuring physical phenomena and converting the measured samples into digital values that can be analyzed and manipulated by a computer. The process begins with using transducers-in this case proximity probes-to convert physical phenomena (pressure, temperature, displacement, etc.) into a measurable electrical signal (voltage), which is analog in nature. Analog signals can exist at any value, vary continuously with time, and are often characterized by their amplitude, frequency, and shape. Through analog-to-digital (A/D) conversion, the analog signal is replaced with a discrete digital representation, which is not a continuous function of time. If the analog signal is sampled at a sufficiently high rate, an accurate digital representation will be produced. The process of A/D conversion is illustrated in the below graph.

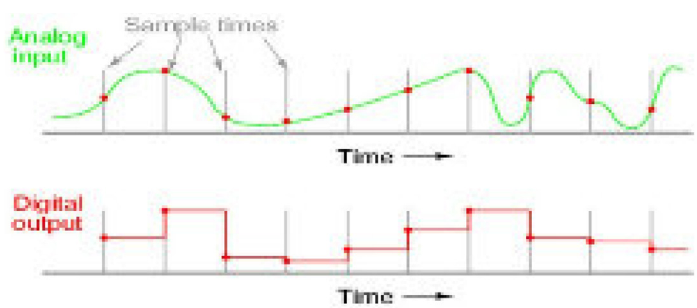

Figure 1: Analog Signal & Its Corresponding Digital Representation

Through digital data acquisition, Rotating Machinery Services can more accurately capture the glitch of rotors. If the glitch is excessive, RMS can quickly rework the rotor in house to produce an acceptable result for the customer. And in the end, a more detailed glitch report can be furnished as part of the rotor quality documentation package. A typical report is shown in Figure 2. This particular report provides electro-mechanical waveforms for two complete revolutions with corresponding peak-to-peak values in mills.

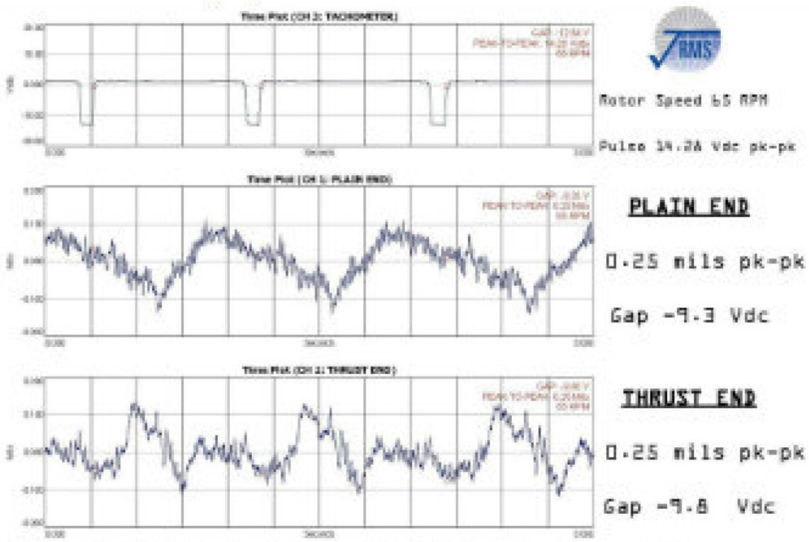

Figure 2: Rotating Machinery Services Electro-Mechanical Runout Plots

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