

### Gaining New Ground

#### Reference recorders shake things up in pressure measurement

Within the pressure measurement industry, relentless innovation has become the norm. New technology continually supplants the old. In other technology spheres, PCs pushed aside typewriters. Cell phones drove out telephones. And today, reference recorders are shaking up old standards in the oil & gas industry.

A reference recorder is a new class of instrument that is gaining ground over other common pressure instruments. Chart recorders, deadweight testers, and analog pressure gauges all brought several advantages in their time. Increasingly, reference recorders replace all three with a single instrument.

#### What Is a Reference Recorder?

Reference recorders unify the recording capability of a chart recorder, the high accuracy of a deadweight tester, and the continuous measurements of a pressure gauge into one tool that is easier to use and less expensive.

"On their own, none of these features are unique, but when you put them all in the same device and make it cost-effective, you end up with something really useful," says Jim Pronge, sales manager for Crystal Engineering ([www.crystalengineering.net](http://www.crystalengineering.net)), a San Luis Obispo, Calif.-based company that produces reference recorders and pressure gauges. "Offering reference recorders for both laboratory and field applications is really the icing on the cake for us."

While data logging devices are nothing new, Pronge points out that, "improved microprocessors allow today's reference recorders to read and record faster and more accurately than ever."

Reference recorders detect readings from modules, which may read pressure, temperature, current, or voltage—and store the data in their digital memory. These modules are usually interchangeable and recorders generally accept two inputs at a time. In addition to their compact size, reference recorders offer several improvements to bulky chart recorders.

#### Improving On a Chart Recorder

Chart recorders were originally patented in 1915. They produce a graph on a moving paper chart, and rely on ink pens mounted on mechanical arms, which pivot in response to pressure. Their primary advantage is their ability to record for extended periods in remote locations. Chart recorders may be battery-powered or entirely mechanical (requiring no external power), allowing them to operate in the presence of flammable materials.

An experienced user may provide preliminary analysis on the output

from a chart recorder in the field. Communicating or storing this data electronically becomes possible only after a technician enters or scans the chart into a computer. This process typically takes several days before results become available. Chart recorders typically claim an accuracy ranging from 0.25 percent to 1 percent of span, but that figure depends on changes in ambient temperature and on the thickness of its pens—which can cause an additional error up to 1 percent of the recorded reading.

By contrast, a reference recorder exports digital data and records with higher accuracy. Many reference recorders are also rated Intrinsically Safe for use in the presence of flammable materials.

#### Using Deadweight Testers in the Field

Deadweight testers are used primarily in a laboratory setting. They produce a repeatable reference pressure by balancing calibrated masses on a piston of known area. Operators must use a different set of masses for each engineering unit (i.e., one set of weights for PSI, another for kPa). In an indoor, temperature-regulated environment, deadweight testers can be very accurate—serving as a primary standard for the calibration of other pressure measurement devices. Field versions also exist but, outside the lab, their accuracy depends on a host of factors.

In order to deliver an accurate reading, a field deadweight tester must be perfectly level. Additionally, ambient temperature, humidity, wind, and local gravity will all impact the reading. Without adjusting for these, a field deadweight tester's accuracy may be no better than a common pressure gauge. Even with these compensations, a field deadweight tester cannot actively detect or record changes in pressure—it only offers an accurate reference pressure for comparison.

A reference recorder serves two purposes. First, it stores readings continually, with update rates up to 10 readings per second, and allows the operator to record an entire test from start to finish; second, such a device will provide a consistent, accurate reference for field calibrations. Measurements from modern reference recorders are independent of local gravity or humidity, and produce their accuracy via a proprietary mathematical algorithm that corrects for ambient temperature. Achievable accuracies range from 0.025 percent of the indicated reading at lower pressures, to 0.1 percent of reading up to 15,000 PSI.

"A good reference recorder's accuracy should not change with temperature across its operating

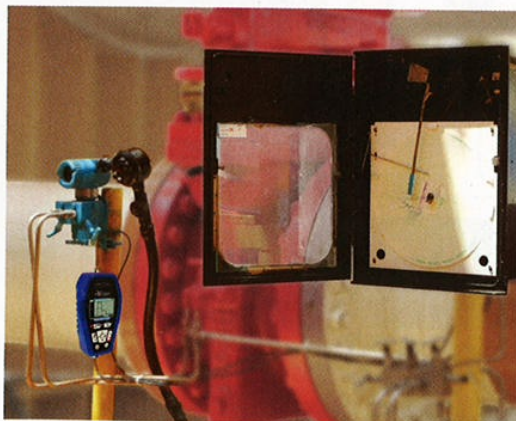


Figure 1. Reference recorders are replacing chart recorders for a variety of applications.



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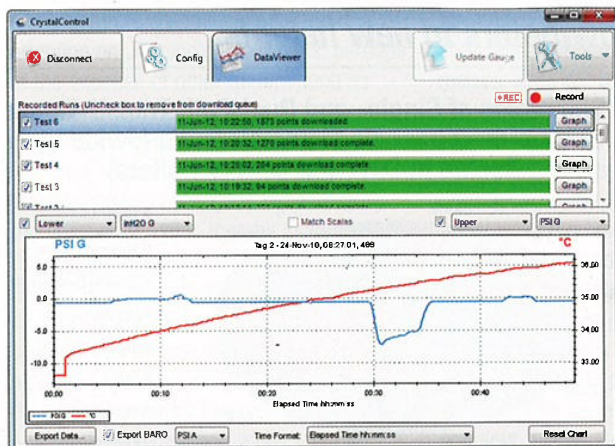
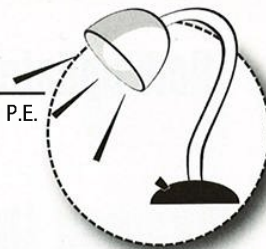


Figure 2. Any PC can download the digital data from a reference recorder.

range,” says Pronge. This is where recorders vary widely. The best manufacturers will provide proof of their accuracy claims, with a calibration certificate from an accredited lab, showing test data at different temperatures.”

### Replacing Multiple Pressure Ranges

Pressure and temperature gauges are widespread and varied in form. Gauges will continue being useful for years, because of their portability, customizability, and affordable cost. In contrast, their drawbacks stem from their inherent fragility and the necessity to carry multiple gauges to cover a given pressure range.

According to Pronge, “Linearity and ruggedness are the two most important features of any pressure gauge. Many pressure

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gauges would be useful across a much larger pressure range if their sensors were more linear and predictable. Also, many gauges continue to display readings that appear accurate, even after their sensors sustained damage.”

To overcome these challenges, reference recorders extend their usability by accepting different modules, each of which covers a wide pressure range. Within each module range, a reference recorder will have superior accuracy and linearity, compared to most pressure gauges. The advanced self-diagnostics in reference recorders prevent the device from displaying an invalid

reading if it sustains damage.

Reference recorders offer a reliable improvement over the decades-old technology commonly seen in the oil & gas industry. Replacing chart recorders, deadweight testers, and older pressure gauges with reference recorders helps companies reduce their equipment costs, training time, and operator error.

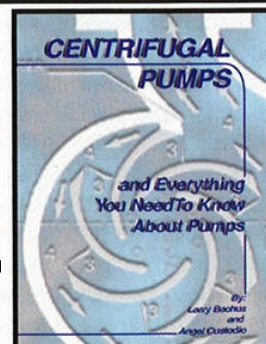
*Patrick Klima is the technical writer at Crystal Engineering. After majoring in Mechanical Engineering at California Polytechnic State University, he wrote technical material and articles for a variety of industries, including energy management and green construction. His articles on pressure measurement solutions and digital pressure gauges have been published in a variety of trade magazines. He can be reached at sales@crystalengineering.net.*

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