Dial Versus Digital Indicators, 30 Years Later

George Schuetz, Mahr Federal Inc.

When digital electronic indicators first introduced in the early 1980s, observers expected them to blow mechanical dial indicators out of the water; but despite the clear superiority of electronic indicators in terms of higher resolutions, better accuracy and usefulness in statistical process control and data collection systems. Mechanical indicators retained other advantages and continued to specify by many users. Today however, while neither type is "better" than the other is and the choice depends upon the application and the user's personal preference. Digital finally seems to be gaining the upper hand.

The clearest advantage of digital indicators is in their use for data collection in process control. Digital indicators can output measurements directly usually as an actual value, e.g. 20.00 mm to printers or SPC programs, with no operator errors in reading or recording. The operator only has to position the workpiece and press a button. He needs not to even read the measurement and within the past 5 years or so; this process has gone wireless meaning that the tangle of cables eliminated, and gauges have become much more portable.

With dial indicators, the operator must interpret the pointer's position to read the measurement then he must record it—generally by hand—and finally the data keyed into a computer. That makes three steps during which errors can and frequently do occur. In any situation where data enters into a computer system, digital indicators are the only way to go.

At one point, the cost of digital indicators was significantly higher than dial indicators but today basic digital indicators are very competitive with high quality dial indicators. Providing additional standard features such as auto-zeroing, actual values, in/mm switchable reporting, reversal of measuring direction and data output. A lot of value is now affordable in what was a premium product 30 years ago.

However, even with the cost benefit gone there still something more to mention for mechanical dial indicators. In many ways, the human brain is like an analogue device and it can often gather more information quickly from an analogue readout. I have seen QC inspectors make consistently accurate go/no-go readings with dial indicators even before the pointer has stopped moving! They can tell at a glance approximately where the pointer will stop and in many applications that is close enough. Digital displays does not gives you the option of approximating. When a digital device is flickering between six and seven all of the elements in an LCD display may lit, appearing as an eight.

Skilled operators can also "split grads" with dial indicators i.e., resolve the pointer's position to an accuracy of about one-fifth of the gauges' stated minimum graduation value and analogue dials enable the machinist to observe the direction his process is headed. If reading #1 indicates 1/5 of a grade over zero, reading #2 is precisely zero and reading #3 is 1/5 of a grade below zero. The user may be able to draw valuable conclusions about the condition of his tool. In other words, dials can provide more information than simply the dimensional measurement. An early digital readout would have read zero in all three cases, depriving the user of this additional information.

On the other hand, today's digital indicators are capable of resolutions once reserved for bench amplifiers. Now that "fifth of a grad" is another digit on the indicator and that process change can be observe (assuming, of course, that the gauge is up to the higher resolution of the display). In addition, many of today's digital indicators have some form of supplemental analogue display. These electronic emulations of analogue performance serve to eliminate some of the cognitive disadvantages of digital displays and make digital indicators "user-friendly" in that they start to give the impression of direction and of how far over or under the part tolerance the item be inspected is.

In fact, many digital indicators are becoming so powerful that they are taking on the performance and features of bench amplifiers. It is common to find features such as dynamic measurements, multiple factors, unilateral tolerances, different output formats and micro-inch resolutions in higher end digital indicators. In addition, while they may be high-end for digital indicators, they are still about a quarter of the price of a bench amplifier and probe.

A common serious problem among users of dial indicators is the failure to notice when the pointer makes a full revolution or two. Parts that are grossly out of tolerance may appear to be within tolerances to an inattentive operator. In contrast, digital indicators never come "back to zero", eliminating this problem. In fact, with the ability to display the actual part size, the idea of going back to "0" or reading deviations is fading away. Moreover, all digital indicators made to signal out-of-tolerance dimensions, so the actual decision-making requires to minimal by the user.

In spite of initial doubts, digital indicators have proven to be highly reliable in the shop floor environment. Most have only a single moving part, so they require less frequent cleaning than their mechanical cousins do and many now carry IP ratings that define the environment they can use in, such as dust and water. With proper care, dial indicators can last virtually forever and they never need batteries. However, to find people who can repair dial indicators to repair has become increasing difficult.

Back in the '80s, the marketplace soundly rejected digital speedometers in cars but today, as more people brought up in a digital world; there is a resurgence of digital speedometers, tachometers and other indicators. The same is true for digital indicators and with operators growing use to them; they are taking on more and more applications.

Many of the latest digital indicators are becoming so powerful that they are taking on the performance and features of bench amplifiers. It is common to find features such as dynamic

measurements, multiple factors, unilateral tolerances, different output formats and micro-inch resolutions in higher end digital indicators. In addition, while they may be high-end for digital indicators, they are still about a quarter of the price of a bench amplifier and probe.