

# Tried and true tester goes digital

Farmers who don't want to part with their trusty Motomco 919 grain moisture testers can consider upgrading to digitalized innards

By Ron Lyseng  
Western Producer staff

Thousands of prairie farmers still depend on the venerable Motomco 919 tube-type tester, some of which date back to 1951.

Although the dial-style tester lacks the accuracy of modern digital moisture testers and requires periodic trips to the shop for calibration, many farmers who have bought low-cost imported testers have experienced bad results and have resurrected and retro-fitted their old Motomco testers.

In the past three years, more than 800 of these producers have shown their confidence in the old testers by shipping them to Quantum Electronics in Brandon, where the units undergo a complete digital conversion.

The retrofitted unit is renamed the Quantum 919 Digital.

Bill Fraser, owner of Quantum Electronics and the man who developed the digital system, says a built-in calibration check is standard on all conversions, meaning a farmer may never again need to ship the tester for calibration because it can be done on-farm.

The calibration system eliminates the need to weigh samples or beads and eliminates the need to compare results with other meters.

"The problem with comparing to another meter is the question of accuracy," Fraser said.

"Results from these methods can produce an average error of a half percent moisture, depending on the accuracy of the meter being used as a standard. The built-in check will place the calibration of the meter within .2 percent of an international standard meter and will provide this reference point over a wide temperature range."

Although the digitalized system with built-in calibration is nearly fool-proof, a drop on the floor will still require a trip to the shop for calibration and repair.

## No needle error

Fraser said two chief benefits of a digital display system are the elimination of needle error and eye fatigue.

"There's less eye strain for the operator," he said.

"Part of that is the speed. It goes bang, bang, bang and it's done. It's almost instantaneous. The other thing is that your eyes are no longer constantly searching for that bouncing, jumping needle. That's very hard on the eyes. With digital, you get a readout on the screen in bright red digital display. It's stable. It doesn't move. It saves time."

The basic drawback of the old analog needle display technology is that each point on the dial typically represents 1.5 divisions on the scale.

With digital display, each number represents only .3 divisions on the scale.

Fraser said each half of a division on the scale equals .1 percent. A fuzzy area of 1.5 divisions on the drum dial needle system can easily equal .3 percent.

"If wheat on the drum dial says 40, then we look at the charts and that sample would be 13.1 percent moisture. If the sample went to 40.5 on the drum dial, then the charts tell you it's 13.2 percent moisture."

Fraser said that in the worst case scenario, analog 919 testers have required as much as three whole divisions on the drum dial to register just .1 percent of moisture.

"With a soft response curve like that, three divisions can create a .6 percent reading error."

## Perfect zero

Fraser said the question boils down to how different machines handle the math.

Analog systems have always had an inherent problem handling the digit called "zero". Without a perfect zero as the basis for measurement, it's impossible to register good accuracy with any of the other numbers.

"Zero at null is not an absolute zero with an analog system," he said.

"Zero represents what you can call a minimum reading. But with digital, zero at null is actually an absolute zero."

For example, Fraser said that if he was setting up an analog tester for wheat, the voltage reading would start at one volt at the top of the curve. As he approached the null point at 53, the curve would drop off to no significant voltage and then would go back up to one volt at the top again. The curve never actually drops below the zero voltage line to establish a perfect zero.

With a digital tester, he still starts at one volt, but as he continues to turn the drum dial further, the voltage falls into the minus region.

"The line doesn't come back up. It gives us a downward slope instead of a curve that goes down and then up again. That lets us establish an absolute zero at null. In this case with wheat, we go to null at 53 and we know it's an absolute zero."

He said that if a theoretical horizontal line is drawn where zero should be, the digital crosses the line while the analog dances around just above the horizontal zero. It's this voltage dance that creates eye strain and wastes time.

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— Bill Fraser,  
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An old moisture tester can be retrofitted to digital display, offering a more accurate reading than the analog system.

(WP photos by Ian Bell)

"This is where digital has the distinct advantage. Your eyes are now looking for a fixed point, an absolute point. You're not searching. The analog has this grey area just above the horizontal line and that's where you get the one and a half divisions of error. You can be more than one and a half divisions off and still be fooled to think you've got zero."

"This error follows you through everything you do so when you drop the sample and go over to operate and do it all over again, you double your error."

Fraser said not all 919 testers are as bad as 1.5 divisions. On the other hand, some are worse. On the better ones, the voltage drop curve is sharper.

"When the curve is sharp, the needle comes right back. It's a bit more touchy defining the low point. That's because there's not as much grey area to work with."

"Some operators complain about having a hard time holding the needle down at the bottom. It doesn't want to stay down there. It's all because some 919s have a gradual curve where the needle settles at the bottom and stays. Others have a sharp curve where the needle goes back fast."

## Radio technology

Fraser said these variations are caused by the different components used over the years in the 919 assembly. The technology was similar to the radio technology of the 1940s, he added.

Like the old radios, the original 919 had variable capacitors with sets of

overlapping tuning plates. Tuning a 919 was the same as tuning an old tube-type radio. Producers would turn the knob to rotate the plates to get the perfect frequency — the perfect match-up between the sets of plates. However, anyone who ever tried to achieve a perfect sound out of a tube-type radio knows that such perfection is impossible.

In the same way that a person has to keep fiddling with the old radio dial to keep the radio station in tune, an operator has to keep fiddling with an analog 919 to keep the readings in tune.

"We zero the analog meter at 53 for wheat, drop the sample, go to operate, flip the dump-over, set the grain back in again, go back to 53 and null it again to make sure it hasn't moved."

"Now, we do that three times over. It takes 30 seconds to a minute, depending on whether or not we need to re-calibrate each time."

"We always have those two oscillators trying to compare each other's frequency."

"With digital, I've eliminated one of the oscillators. That eliminated the needle drift. When the oscillator hits the certain frequency it's tuned for, that's it. It stays there. When I come back for my next test, it's still zeroed at 53 for me. There's no reason for me to turn the drum dial."

Fraser said the Quantum 919 Digital retrofit costs \$395, which includes a tune-up and servicing, plus a 12 volt connection so the tester can be used in the field.

Fraser also has used, converted units available for \$795.

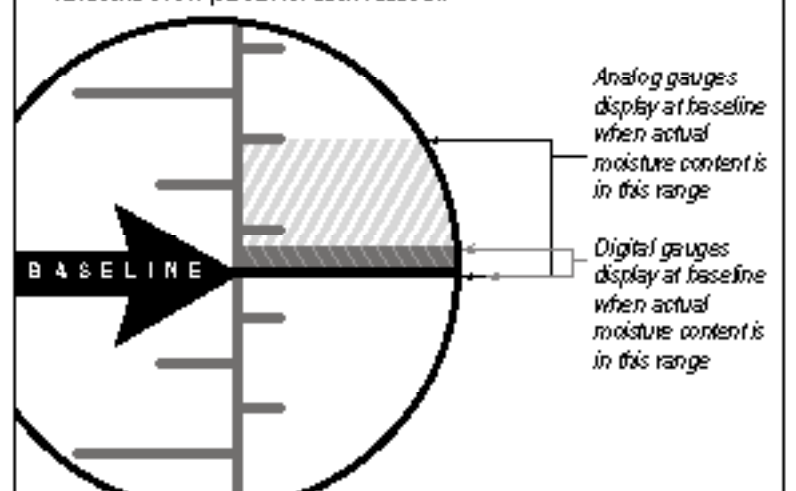
For more information, contact Bill Fraser at 866-919-4919 or 204-727-7828 or visit [www.919.ca](http://www.919.ca).



Bill Fraser of Quantum Electronics in Brandon says the digitalized moisture tester with built-in calibration has a digital display that eliminates eye strain and errors in reading.

## Analog vs. digital testers

Most analog drum systems won't register a noticeable change on the dial until grain moisture changes by more than 0.3 percent; some models allow variations of up to 0.6 percent. Digital systems are more precise, allowing variations of 0.1 percent in each readout.



Source: Quantum Electronics

WP graphic by Michelle Houlden