A Dozen Ways to Measure Fluid Level
How They Work

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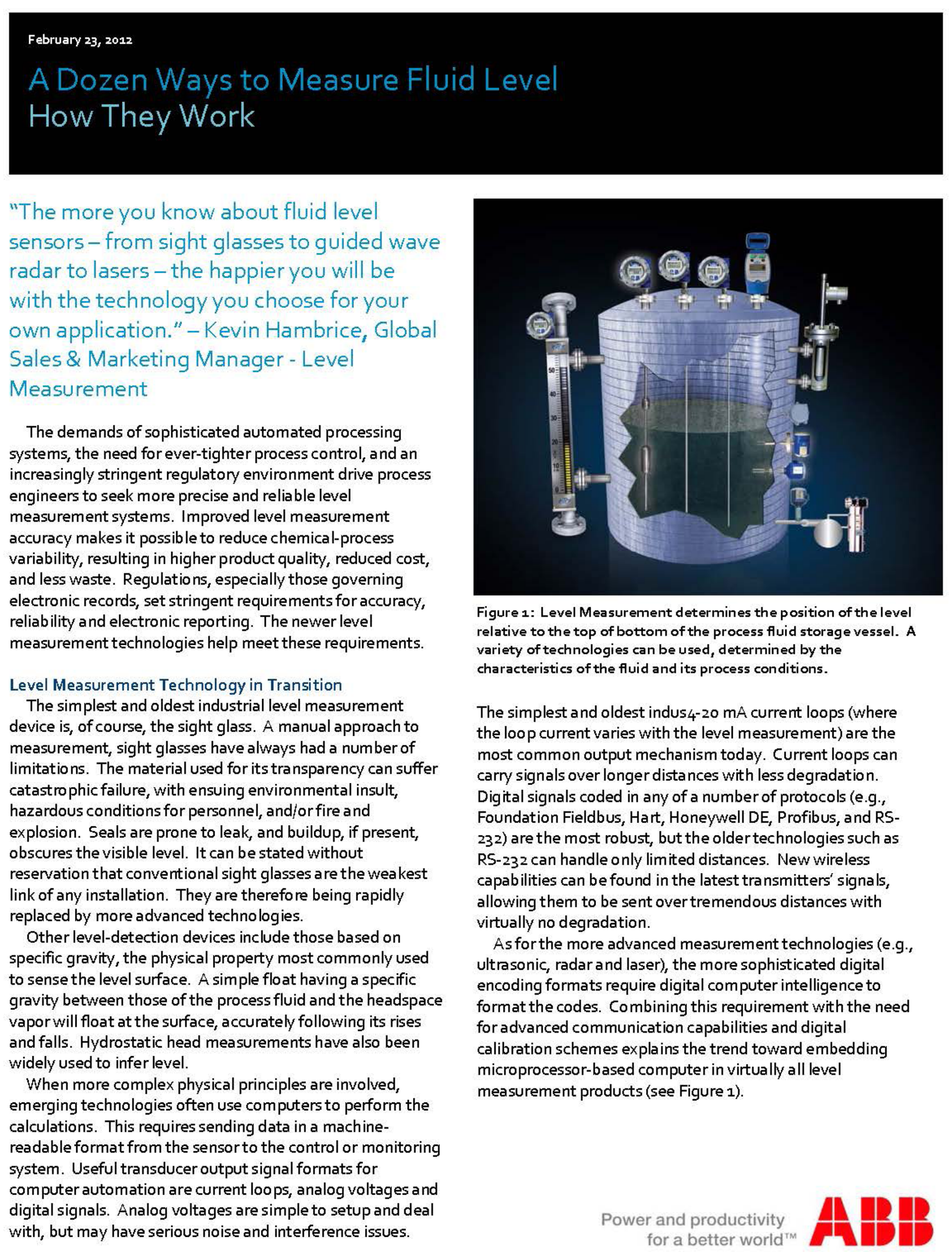

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"The more you know about fluid level sensors – from sight glasses to guided wave radar to lasers – the happier you will be with the technology you choose for your own application." – Kevin Hambrice, Global Sales & Marketing Manager - Level Measurement

The demands of sophisticated automated processing systems, the need for ever-tighter process control, and an increasingly stringent regulatory environment drive process engineers to seek more precise and reliable level measurement systems. Improved level measurement accuracy makes it possible to reduce chemical-process variability, resulting in higher product quality, reduced cost, and less waste. Regulations, especially those governing electronic records, set stringent requirements for accuracy, reliability and electronic reporting. The newer level measurement technologies help meet these requirements.

Level Measurement Technology in Transition

The simplest and oldest industrial level measurement device is, of course, the sight glass. A manual approach to measurement, sight glasses have always had a number of limitations. The material used for its transparency can suffer catastrophic failure, with ensuing environmental insult, hazardous conditions for personnel, and/or fire and explosion. Seals are prone to leak, and buildup, if present, obscures the visible level. It can be stated without reservation that conventional sight glasses are the weakest link of any installation. They are therefore being rapidly replaced by more advanced technologies.

Other level-detection devices include those based on specific gravity, the physical property most commonly used to sense the level surface. A simple float having a specific gravity between those of the process fluid and the headspace vapor will float at the surface, accurately following its rises and falls. Hydrostatic head measurements have also been widely used to infer level.

When more complex physical principles are involved, emerging technologies often use computers to perform the calculations. This requires sending data in a machine-readable format from the sensor to the control or monitoring system. Useful transducer output signal formats for computer automation are current loops, analog voltages and digital signals. Analog voltages are simple to setup and deal with, but may have serious noise and interference issues.

Figure 1: Level Measurement determines the position of the level relative to the top of bottom of the process fluid storage vessel. A variety of technologies can be used, determined by the characteristics of the fluid and its process conditions.

The simplest and oldest indus4-20 mA current loops (where the loop current varies with the level measurement) are the most common output mechanism today. Current loops can carry signals over longer distances with less degradation. Digital signals coded in any of a number of protocols (e.g., Foundation Fieldbus, Hart, Honeywell DE, Profibus, and RS-232) are the most robust, but the older technologies such as RS-232 can handle only limited distances. New wireless capabilities can be found in the latest transmitters' signals, allowing them to be sent over tremendous distances with virtually no degradation.

As for the more advanced measurement technologies (e.g., ultrasonic, radar and laser), the more sophisticated digital encoding formats require digital computer intelligence to format the codes. Combining this requirement with the need for advanced communication capabilities and digital calibration schemes explains the trend toward embedding microprocessor-based computer in virtually all level measurement products (see Figure 1).

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