Innovative field instrumentation for process automation applications
Over recent years, the kinds of devices used for process instrumentation have undergone continuous advances and improvements in terms of their performance and functionality. Nevertheless, the only ones capable of managing the complicated operating concepts and complex functions associated with such devices are, in the vast majority of cases, device specialists. In this sense, nothing has changed. Within the context of the food and beverages industry in particular, instrumentation and control engineers have to contend with a whole host of equipment such as pumps with frequency converters, flowmeters, temperature sensors, and control systems. Due to the scarcity of resources, it is not possible to have specialized personnel dedicated to each individual item of equipment. Against this backdrop, it is clear that having an intuitive, universally comprehensible operating concept that is common to all products can help to cut down on resources and avoid errors.

Not only that, but it can provide access to the full capabilities of modern instrumentation. These are the very requirements that ABB has managed to implement when developing its instrumentation products, resulting, amongst other things, in a uniform operating concept that is common to all its product lines. For example, the input keyboard allows intuitive operation because its keys resemble those of a standard cell phone. And the diagnostics are very user-friendly in the way that they provide information about sources of error in text format.

The uniform operating concept has been consistently adopted across all the company’s temperature, pressure, and flow measuring technology, as well as the videographic recorders and analyzers. In addition to support for functions based on the HART and fieldbus protocols, key information can also be accessed directly on the display at a local level.

The 261 pressure transmitter, which is specifically designed for hygienic applications and features the operating concept described above, was unveiled as long ago as 2005. More recently, the functions of devices for detecting low-pressure and low fill levels have been enhanced. Temperature adjustment has been implemented for the complete transmitter (optimized for a sensor temperature of –10 to +60 °C) and there is now no need for an internal separating diaphragm. Specially designed process connections ensure that the range is not exceeded even if the process temperature is considerably higher. The result is a measuring instrument that can even provide precise measurement results with a maximum measuring range of 40 mbar (40 cm water). Temperature variations affect the measurement only slightly.

Thanks to the display, with its plain text menu, and the user guidance described, local configuration of the transmitter can be carried out quickly and easily. The diagnostics information makes it really easy to pinpoint errors, should they occur. The display can either be attached directly to the transmitter or installed separately at a remote location. If installed separately, the transmitter is fitted with a dummy cover.

The TTH300 temperature transmitter from ABB also features the operating concept referred to above. Because it is implemented across all products, it naturally follows that there is a corresponding reduction in the level of personnel training required. Two temperature sensors can be connected to the TTH300 using a redundant configuration. The transmitter then monitors these.

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sensors for wire breaks and for drift. In the event of an error, it signals the measured value differential and, where applicable, switches over to the other sensor.

Diagnostics can be read out using the HART protocol. Alternatively, a periodically recurring, brief jump in the measured value can be switched to the transmitter’s 4 to 20 mA output. In addition, error messages are shown on the display, along with the operational status of the transmitter and the connected sensors.

Online diagnostics functions increase availability

The HygienicMaster comes with a diagnostics package that is designed to provide operators with maximum support when attempting to locate faults. The diagnostics package is capable of identifying both process-related and device-related faults. Diagnostic messages are classified in accordance with Namur Recommendation NE107. On the basis of the symbols specified in this recommendation, the diagnostic messages indicate whether device maintenance is required, whether the device is not being operated in accordance with specifications, whether a functional check needs to be performed or whether the device has failed as a result of internal errors. Operators also receive information about potential sources of the error in the form of text messages.

Examples of the kinds of process failures that can be detected include empty pipelines, electrode deposits and poor conductivity of the medium. What’s more, the diagnostics tool even suggests ways of resolving the fault.

CoriolisMaster mass flowmeter

One member of the FlowMaster family of products has been updated and expanded so that the transmitter and flowmeter sensor are coordinated. There is no need for maintenance personnel to change memory modules or make entries.

CoriolisMaster featuring a variable connection concept that has been designed specifically for the food industry.

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information can be accessed at a local level, directly on the device’s display. Using HART communication or the fieldbus communication, it can also be exported to control systems for processing with Plant Access Management or Maintenance software packages.

The CoriolisMaster has already been implemented for several media. For example, sugar matrices (Brix), alcohol tables, and starch/sodium hydroxide solution matrices have already been integrated. All the user has to do is select the relevant value and connect it to the required output.

The benefits are particularly apparent with open-air installations, where extremely stringent requirements are imposed on the accuracy of the density measurement. As part of its range, ABB has been offering a feature for calculating concentrations of 2-phase substances for several years. This DensiMass function has now been completely revised and updated. In addition to the high-precision density measurements referred to above, concentrations can now be calculated directly in units such as Brix.

Calculations are based on concentration-temperature-density matrices, which have already been implemented for some media. For example, sugar matrices (Brix), alcohol tables, and starch/sodium hydroxide solution matrices have already been integrated. All the user has to do is select the relevant value and connect it to the required output.

Many other calculations of this kind rely on cryptic polynomials and formulas. The advantage here is that the same matrix that is used by the laboratories can be entered directly into the software. If individual values need to be modified at a later date just these values can be specified directly, rather than having to replace the information in its entirety. The matrix does not even have to be complete, as missing values can either be interpolated or extrapolated. The matrices take account of temperature effects directly so users no longer need to correct them manually or by means of factors.

Thus, the concentration measurement function is able to perform a calculation for any mixture involving two different liquids. This new solution from ABB represents the best that commercially available Coriolis devices have to offer in terms of concentration calculations. Typical applications include filling operations or blending processes. It can, for example, be used to determine alcohol content or the Brix content of fruit juices. Primary ingredients and flavorings can be mixed together and their quality checked “online” during the mixing process itself.
SM500F videographic recorder

The idea of having a common operating structure was deemed to be just as important for the new control room devices as for the field devices. In the case of the SM500F videographic recorder, this uniform interface is used for both operating and configuration tasks. Alternatively, the recorder can be configured using a PC-based emulator. This alternative method is also incredibly easy to follow. Both mathematical and Boolean relationships can be entered as formulas via input masks and as part of this process, inputs, constants, and virtual variables can be interlinked at will.

The configuration and data can be protected against unauthorized access or manipulation by means of hardware switches, passwords or a combination of the two. The SM500F videographic recorder is located inside a field-mount housing, allowing it to be mounted on the wall, on pipes, and in control panels. The housing is hoseproof in accordance with the IP66 and NEMA 4X protection classes. If mounted in a control panel, a depth of just 67 mm is required behind the panel. The device features eight recording channels.

Up to four analog/digital inputs can be connected to the SM500F and assigned to a software recording channel. The remaining software recording channels can be used for displaying internally generated virtual variables. The process data is graphically displayed for the operator in a variety of formats at a local level, e.g., as a waterfall chart, bar chart, or digital view. In addition, the process data gets safely archived on the exchangeable memory card. Ethernet communication provides a convenient means of monitoring the process remotely and accessing the recorded data.

For situations where data is frequently recorded on the process control system directly, the videographic recorder provides a clear and easy alternative for monitoring and documenting critical points (e.g., when it comes to monitoring heating and pasteurization processes).