swan
ANALYTICAL INSTRUMENTS

WHITEPAPER

Smart – An Interpretable Term

The missing definition for smart measuring equipment leads to different expectation between buyers and sellers. This whitepaper assesses the properties most often considered «smart» in online water monitoring and gives a recommendation, which features smart instrumentation should offer.

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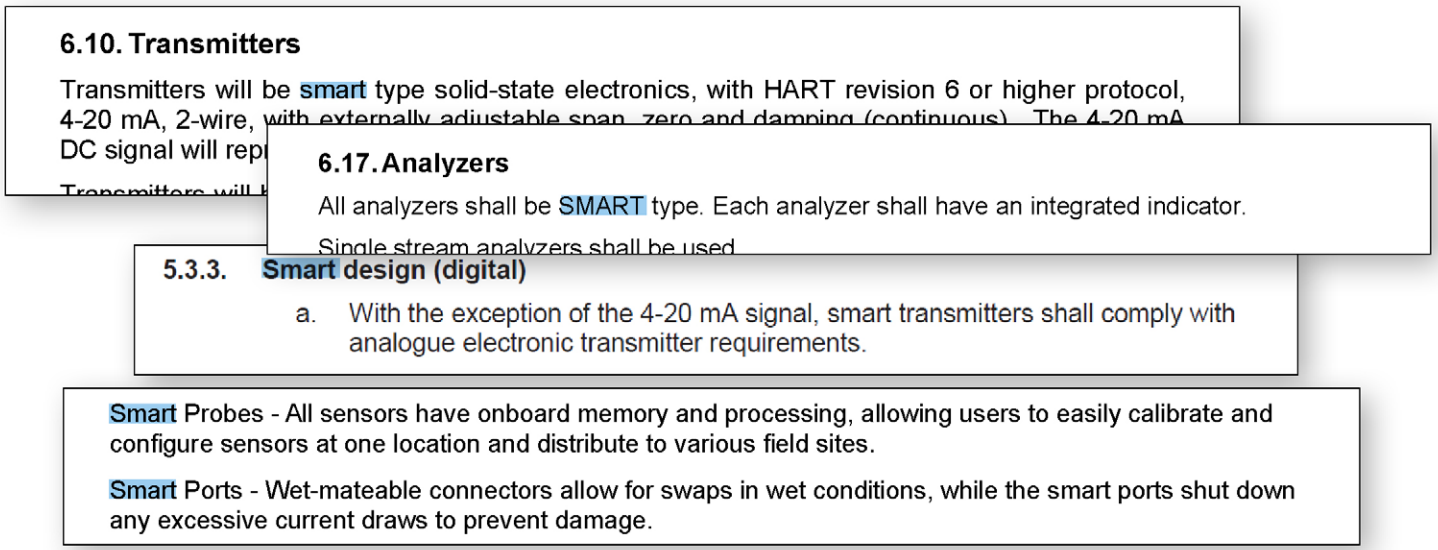
For several years, smart products and solutions have been promoted for online water analytics. But what does "smart" really mean? The interpretation of the term "smart" varies heavily as it is not defined.

Since it is not always easy to distinguish between truly smart solutions and mere marketing expressions, even customers have started to randomly add "smart" to their vocabulary, which leads to unclear expectations.

What can be defined as "smart" depends on individual requirements of customers and their applications. Since the term is used without a standardized definition, it is not binding. This carries the risk of unsatisfactory equipment because there is no common understanding on what smart characteristics a measurement device has to offer. In the following, we analyze the most frequently used smart attributes in connection with online water instruments.

Original extracts from several different customer and product supplier specifications:



Digital Sensor = Smart?

In water analysis, all sensor-generated measurements are of analog origin. However, an analog signal is hard to transport over long distances or to be utilized in a subsequent digital system like the DCS or SCADA. That's why sooner or later it needs to be converted into a digital signal within the measurement chain.

Recently, sensors have been released which include the digital signal conversion on board. This is an interesting set-up, for example in applications where wireless signal communication without transmitter is possible. Other features include in-stored calibration data with ID, allowing to calibrate the sensor outside of the process and use the same sensor in various places or utilize inductive sensor connections. For high range applications (ppm) and in-line sensors (field instruments), these can be very useful features adding benefit for operators. However, digital sensors do not have any effect on the measurement quality.

In trace applications (ppb, ppt), it is not allowed to calibrate sensors outside of the measurement chain and the sensors must remain in-place as part of a sensible measurement chain.

Digital or analog data processing does not influence the sensors primary function of measuring. Benefits in terms of handling may occur from digital sensors but are heavily dependent of the application they are used in.

Transmitters with control functions = Smart?

Some transmitters not only measure local parameters but also act as local controllers, typically for parameters like pressure and flow. Such field-based transmitters are often difficult to access and thus the term "smart transmitters" in such applications means the ability to remotely access and configure them.

In online water measurements, the transmitters are always readily accessible and rarely perform any local control function. State-of-the-art suppliers provide interface cards (e.g. HART or Profibus/Modbus) for those customers interested in remote interaction with a smart transmitter, even though these interfaces are normally not used to remotely configure the transmitters.

Validated Data = Smart?

Online water monitoring usually requires a sample to be extracted from a process and conditioned before it reaches the actual instrument. Disturbances upstream of the instrument are highly likely and are a frequent source of bias to process values.

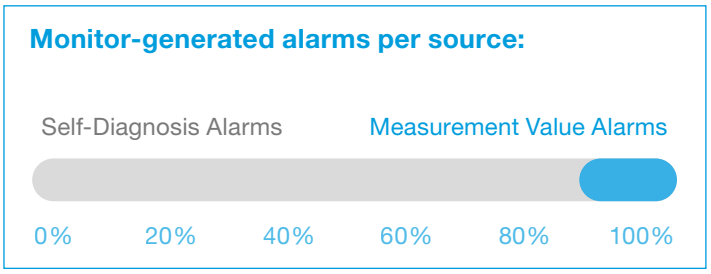
As a consequence of the above, a clear distinction between two types of alarms is required:

Process value alarms
An alarm generated when the measurement value is not within the suitable range defined for the given process. These alarms are typically generated by the DCS, using the process values provided by online water quality monitoring instruments.

Instrument status alarms
An alarm is related to problems with the boundary conditions of an online measurement, independently of the process value. For example a simple pH value might be in a normal range but if the instrument has no sample flow, this condition should be detected and reported along with the process value itself.

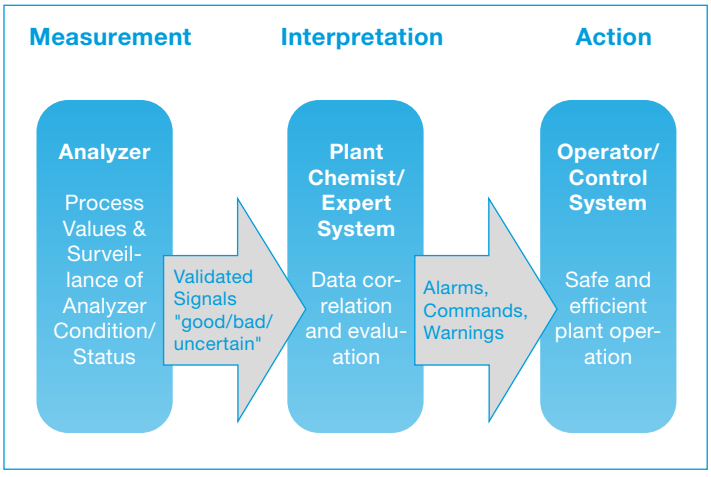
A smart online instrument for water quality monitoring should therefore include self-diagnostic capabilities. More specifically this means:

- the ability to perform the diagnostic measurements (e.g. sample flow, reagent level, temperature etc) and
- the ability to process and translate such diagnostic measurements into summarized status information (e.g. a summary alarm or a status byte of a process value)



This status information generated from instrument self-diagnostics allows a validation of process values (both current and historic process values). Such validated process values greatly increase the trust of operators in the measurements and also provide more reliable data to expert systems.

For those looking for smart instruments and analyzers in the sense of the above definition, Swan has the answer.



Conclusion

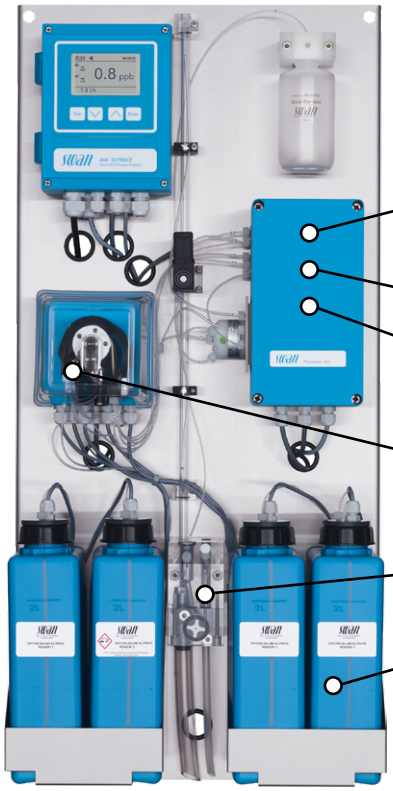
The truly smart approach is to count on high quality analyzers. Smart instrumentation in the context of online water monitoring goes beyond single sensor or transmitter features. Smart online analyzers consider the complete measuring chain. They include self-diagnostic features and provide data for validated measuring values and analyzer status. In summary, the following features are proven and ensure trustworthy water quality process values:

ⓥ Process Values and Status ⓥ QC Values and Status ⓥ Diagnostic Values

Only if all of the above features are available, the collected data provides a reliable foundation for decision-making which ultimately benefits the performance, durability and safety of your process.

Swan Monitor Concept

Our approach to meet above mentioned requirements for smart alarms is summarized in the Swan monitor concept. As such it embodies our vision of an online water analyzer optimized in terms of self-diagnostics, instrument handling and quality assurance.



Swan AMI Silitrace

ⓥ **Process value**

Silica measurement (silica alarm) measurement

ⓥ **Smart Self-diagnostic features**

Sample and reaction chamber temperature measurement

Photometer surveillance and cleaning advice when required

Valve, pump and tube surveillance

Flow monitoring

Reagent level measurement

Validated Data for Smart Decisions - AMI Monitors by Swan

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