

Field instrument data paves the road to autonomous operations

By Chris McNamara

The road to autonomous industrial operations may begin with something process plants already possess in abundance: data trapped inside their field instruments.

During a presentation at YNOW2026, A Yokogawa Users Conference & Exhibition, Peter Kwaspen, Instrumentation Digital Technology Expert at Shell Global Solutions International, outlined how Shell is working to extract more value from smart-instrumentation data to reduce downtime, improve maintenance and make turnarounds more efficient.

But Kwaspen began not with instrumentation or artificial intelligence, but with human decision-making. Drawing on the work of psychologists Daniel Kahneman and Amos Tversky, he described how people tend to rely on fast, intuitive thinking rather than the slower, deliberate reasoning required to analyze large amounts of information.

That matters, particularly as plants give operators and maintenance personnel access to ever-growing quantities of data. Simply providing more information

doesn't necessarily produce better decisions.

The information needs to be easy and clear, understandable and, most importantly, actionable, Kwaspen said. Rather than requiring workers to analyze raw data and determine what to do, systems should increasingly provide recommendations that allow them to act.

That philosophy is reflected in Shell's approach to autonomous operations. The company is concentrating on what it calls the "decision integrator." At that level, data and analytical models

“We need to start leveraging our smart instrumentation data today. If we don't do that, we will be out of tune for a long time.”

—Peter Kwaspen, Instrumentation Digital Technology Expert, Shell Global Solutions International



go beyond providing insights and begin generating recommendations for operators, Kwaspen said.

Unlock the 99%

Field instrumentation presents an enormous opportunity because plants typically use only about 1% of the data available from their instruments, Kwaspen explained.

That 1% is, essentially, the process value—the pressure, temperature, flow or level measurements sent to a control system to operate the process.

The remaining data can include information about device health, performance and diagnostics, process conditions, device identification and configuration. The difference in scale is substantial. Kwaspen estimated that a plant with 1,000 instruments might have 1,000 process values but more than 100,000 additional metadata points available from those devices.

“We have not been using this information rightfully until now,” Kwaspen said.

Shell is working to change that by collecting field-instrument information and routing it through its infrastructure to a real-time data-ingestion platform in the Shell Azure cloud. Once stored there, the information can be processed, presented through dashboards and eventually subjected to more advanced analysis.

One obstacle is a familiar one in industrial automation: standardization. Parameter names and data structures can vary by device, version and manufacturer.

To create greater consistency, Shell is using the Process Automation Device Information Model (PA-DIM) from FieldComm Group to structure instrumentation data. Shell has also been working with Yokogawa on technology to collect and process the information, and is investigating ways to automate

the translation of device parameters into standardized PA-DIM data.

That is particularly important in brownfield facilities filled with existing instrumentation. Eventually, devices may be capable of communicating standardized PA-DIM data themselves, Kwaspen predicted. Until then, plants need a practical way to translate information coming from installed instruments.

From diagnostics to action

Once that data becomes accessible and standardized, the potential applications multiply.

Device-identification information, for example, can help plants investigate obsolescence. Historical data can reveal equipment availability over time. Diagnostics can enable maintenance organizations to respond to developing instrument problems before they affect production.

A smart instrument might report that maintenance is required while continuing to provide a reliable process value. If that warning is ignored for months and the device eventually fails, the problem can escalate from a maintenance issue to a production problem. Using diagnostics effectively can help plants intervene during that window.

Shell is also looking beyond straightforward alarms toward more sophisticated questions. An engineer might want to identify control valves exhibiting increasing friction while another parameter remains low, for example. Finding the answer manually across thousands of instruments could require considerable analysis.

This is where artificial intelligence (AI) could become valuable, but only if the AI understands the data. It needs to know where particular information resides, what individual parameters mean and how those parameters relate to one

another and to the process. Without that context, an AI system could produce unreliable answers or hallucinations, explained Kwaspen.

Consequently, Shell is developing knowledge graphs for field devices. These would establish relationships among device parameters and provide AI systems with the context needed to answer practical questions using factual plant data.

The ultimate goal is not simply to give an engineer a more powerful analytical tool. It is to enable someone to ask a straightforward operational question, such as determining which valves experienced increased problems following maintenance, and receive a useful answer without spending hours finding and analyzing the underlying data.

Build the business case

Shell already has examples in which diagnostics data has helped reduce plant downtime, maintenance costs and turnaround costs, Kwaspen said. The financial implications of avoiding production losses can be particularly large. Potential savings across Shell’s operations could be substantial, he stressed.

Shell is not pursuing the issue alone. WIB, the International Instrument Users Association, an end-user working group, is examining requirements and use cases for field diagnostics and assessing how well products and services address them. The group, which includes Shell, ExxonMobil, Cargill, BP and Aramco, plans to publish a white paper detailing its findings, said Kwaspen.

“We need to start leveraging our smart instrumentation data today,” Kwaspen concluded. “If we don’t do that, we will be out of tune for a long time.” ∞