YOKOGAWA

Total Insight Enables Digital Transformation at the Edge for Sustainable, Continuous Business Operations Improvement

White paper - December 4, 2020

Table of Contents

KEY TAKEAWAYS

- ✓ A typical process plant will contain thousands of actuators, analyzers, flowmeters, sensors, transmitters and valves where the physical world first meets the digital world.
- ✓ While digital transformation plans often overlook measurement instruments certain types of instruments could actually be digital transformation enablers.
- ✓ Digital Transformation technologies, like digital twin depend on trustworthy data from edge devices in order to achieve their intended results.
- ✓ The digital twin works in the present but possesses full knowledge of its historical performance and accurate understanding of its future potential.
- ✓ Smart devices, like Yokogawa's line of Total Insight transmitters and flowmeters contribute to Digital Transformation during operations and throughout the lifecycle of the instrument.

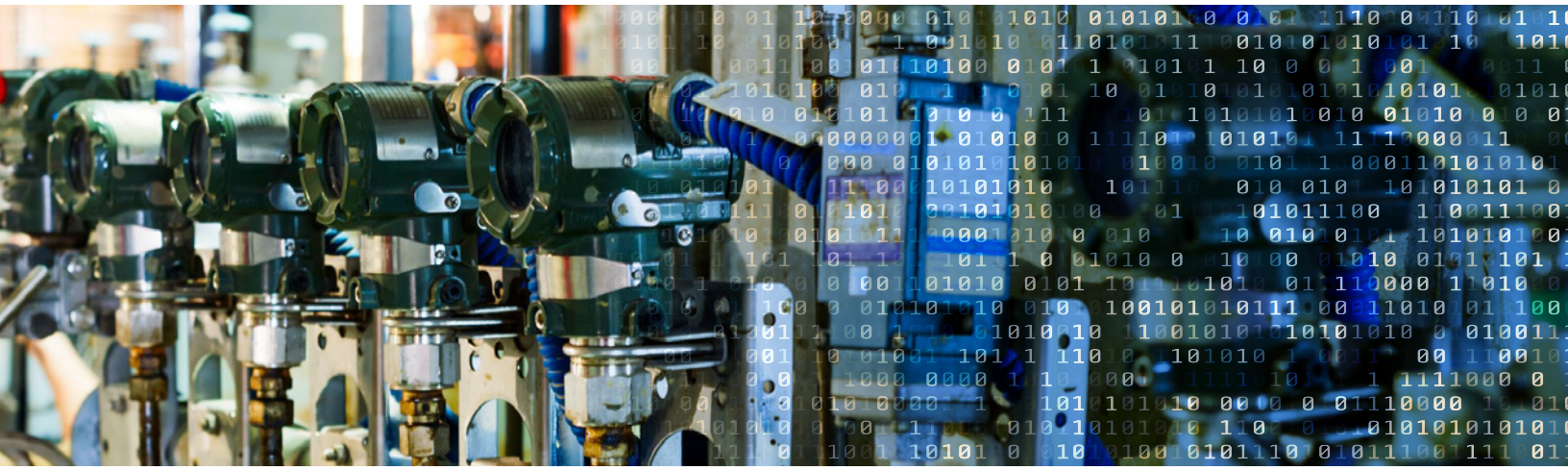
Part 1 Introduction

As companies in the process industries pursue their digital transformation journeys, the collective role of field instruments such as pressure transmitters and flow meters can vary widely. Thousands of them could be deployed in a manufacturing facility. Although they have not moved physically, they have found themselves in a situation now described as “the Edge.”

Where do they fit into the digital transformation strategy? While digital transformation plans often overlook measurement instruments or simply look at them as a number, certain types of instruments could actually be digital transformation enablers.

The transformation program team might be quick to list an analog device such as a pressure transmitter that outputs a 4–20 mA signal as a “non-digital” entity that calls for replacement. However, in a plant in which thousands of them operate, that will not happen very quickly. Although the analog instruments support very little in terms of the needs of a digitally transformed enterprise, they can be enhanced with wireless communications and effective analytics at the Edge or in the Cloud. Those allow the enterprise to realize reasonable value from the limited information that can be derived from the analog instrumentation.

Ultimately, however, the enterprise demands a comprehensive digital infrastructure that extends to the Edge. Otherwise, it cannot fully realize all the benefits digital transformation offers.



“While digital transformation plans often overlook measurement instruments or simply look at them as a number, certain types of instruments could actually be digital transformation enablers.

An enterprise counts heavily on devices at the Edge. Actuators, analyzers, flowmeters, sensors, transmitters and valves are where the physical world first meets the digital world. Sensing devices form the foundation of an operating technology (OT) platform and, collectively, provide an indication of a plant’s vital signs. Sensor data informs and drives the performance of plant operations. Analytical models, artificial intelligence, digital twins, machine learning and many other technologies count on it. A successful digital journey rests on the quality and fidelity of measured data.

Sensor technology is not only changing the way process data is measured, but also the way it is analyzed. Eradicating process errors and improving asset efficiency has never been as important as it is for connected plants of the future. Process operations generate large volumes of data. While in the past, those large amounts of valuable data would be largely unused, a digitally transformed enterprise will take complete advantage of it.

Measurement instrumentation began its digital journey nearly 40 years ago. Microprocessor-based smart transmitters not only improved performance vs. analog instruments, they were able to generate valuable data in addition to the measured variable. As smart instrumentation evolved, it added functionality that was useful to asset management and provided insight into the process.

Recently, a new class of intelligent instrumentation has emerged. It consists of flowmeters and transmitters that integrate seamlessly into a digitally transformed enterprise.

Part 2 Total Insight

The Total Insight portfolio from Yokogawa represents a major step change in technology over today's intelligent instruments. Total Insight operates seamlessly in a digitally transformed enterprise. The instruments possess deep knowledge of their health status for predictive asset management and of the process for use in conjunction with advanced analytics and digital twins at the Edge, in the Cloud and on premise.

Total Insight creates sustainable value throughout the product lifecycle. It fully supports the primary digital transformation focus areas including asset availability and reliability; human effectiveness; safety, sustainability and compliance; and operational performance and productivity.

Across a broad portfolio that includes pressure and temperature transmitters and a variety of flowmeter technologies, all Total Insight instruments provide a common digital technology platform that enables digital transformation:

Simplified product selection and an "Expert Guide" set-up Wizard support human effectiveness goals.

Process Guard feature including data logging, application diagnostics, and NAMUR-compliant alarming supports digital twins for process optimization, operational performance and productivity. In the data logging function, a maximum of four different trends or events from eight different measured variables can be stored on the microSD card at the same time. It is also possible to quickly troubleshoot by exporting recorded trend data and alarm information to a computer system.

By providing considerable information that is related to the process, application diagnostics work in conjunction with digital twins for process optimization and productivity. For example, the ADMAG AXG magnetic flowmeter including the following functionality:

- Detection of flow noise (air bubbles, slurry)
- Detection of coil insulation deterioration
- Detection of electrode insulation deterioration
- Detection of fluid conductivity decrease
- Detection of electrode adhesion (insulator)

Alarming functionality consists of 28 system and process alarms, which are individually classified according to NAMUR Recommendation NE 107, 'Self-Monitoring and Diagnosis of Field Devices,' which has been adopted as a "gold standard" in the process industries. The user can adapt the action of each alarm individually to the process requirements and prevent unnecessary alarms from distracting plant operators. Alarms are classified as "Failure," "Function Check," "Out of Specification" or "Maintenance Required." The alarms work in conjunction with asset management software such as Yokogawa's Plant Resource Manager (PRM) as well as a variety of digital twins.

The Maintenance Manager feature provides verification functionality for measurement integrity to support operational performance, compliance and human effectiveness. Using the characteristics of a healthy meter as a set of baseline conditions and working in conjunction with PRM or with Yokogawa's FieldMate mobile software for calibration and configuration, Maintenance Manager provides an additional asset management function.

Data Mobility is also a key function in Total Insight and supports all scenarios for maintenance management standard operating procedures. For plants with limited on-site staffing, Total Insight allows remote operations with complete information access including detailed process analysis. Since manual rounds are not necessary, personnel on-site could perform more important tasks such as initiating performance improvements.

For operations with on-site staffing, Total Insight supports use of a ruggedized mobile personal computer or “PC-less” maintenance using an SD card. Running Yokogawa’s FieldMate software, the ruggedized mobile PC performs verification for transmitters and for the sensing platform in flowmeters.

Figure 1 - A Durabook tablet running FieldMate software

By allowing considerable work to be done off-site, the combination of FieldMate and Total Insight minimizes time on-site. Any configuration, calibration and programming that is required can be done off-site before installation and commissioning. It also ensures that field technicians and maintenance personnel are fully prepared before they travel. Since the ruggedized PC is approved for operation in hazardous areas, a work permit is not necessary. Not only does it make the human aspect more efficient, it enables improved safety.

Further digitalization support by Total Insight includes compatibility with SensPlus™ Buddy, which is a communication support service for providing support to sites from a remote location using a mobile device. Its operation is intuitive and it enables visual transmission by video calls and augmented reality (AR) as well as information sharing by sending images and text. Smooth and accurate communication using SensPlus Buddy improves the efficiency of maintenance work and reduces losses due to mistakes. This tool facilitates safe and worry-free maintenance activities.

Information from FieldMate and Total Insight can also be merged into the company's operations management environment. Complete compatibility with PRM simplifies asset management and predictive asset optimization.

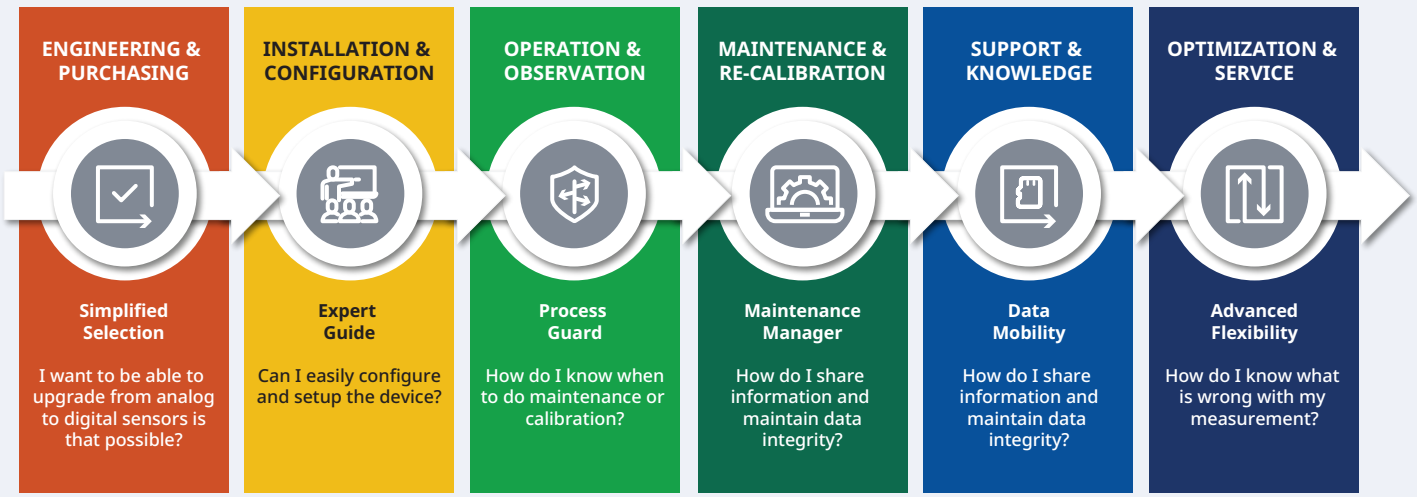


Figure 2 - Total Insight enables digital transformation through the core functionality shown, here.

Part 3 Digital Twin

A digital twin is a virtual, digital copy of a device, system, human or process that accurately mimics actual performance in real-time...

Total Insight supports digital transformation strategies through digital twin technology. The instruments, themselves, incorporate asset management digital twin technology internally. For example, meter verification uses an internal reference to compare with real-world flowtube characteristics. They can also work in conjunction with practically any digital twin on the market including Yokogawa's broad portfolio. That portfolio includes digital twins for instrumentation and process equipment productivity, advanced chemistry, predictive maintenance, process optimization, value chain optimization and enterprise-wide insight.

A digital twin is a virtual, digital copy of a device, system, human or process that accurately mimics actual performance in real-time, is executable and configurable, allowing a better future to be developed.

Digital twins work in the present, mirroring the actual human, device, system or process in simulated mode, but with full knowledge of its historical performance and an accurate understanding of its potential in the future. In this way, the digital twin delivers the full scope of hindsight,

insight, foresight and oversight. As an advanced decision support tool, a digital twin enables improved safety, reliability and profitability in design or operations through forecasting (what's next?), prediction (what if?) and optimization (what's best?).

> *...unlike a simulator, the digital twin is an accurate representation of the asset, not just in a particular operating case but over its full range of operation, all the time.*

Digital twins replicate real-world events and actions by combining live sensor inputs from their physical counterparts with historical-performance data. Digital twin technology relies on a first-principle model, which simulates the performance of an asset; the physical process feeds input into the algorithm, which then uses that data to generate an accurate digital representation of the real-life event. The first principle model is the same as those used in process simulators.

However, unlike a simulator, the digital twin is an accurate representation of the asset, not just in a particular operating case but over its full range of operation, all the time. Instead of a static provision of a snapshot in time, the digital twin captures the full history and future of an asset. The digital twin operates in an automated manner, making regular model runs that are built-in to business workflows. It provides a centralized, single version of the truth, used by everyone, with outputs delivered directly to the business.

Digital twins operate at multiple levels and perform a variety of functions ranging from asset management, predictive maintenance, production optimization and value chain optimization:

- **Instrumentation And Equipment Productivity:** Real-time and predictive data that digital twins collect reduces the risk of equipment breakdown by improving predictive maintenance outcomes. For example, data drift could be an early problem indication. Stakeholders can reduce operational expenditures through online monitoring and prediction of field device health.
- **Advanced Chemistry:** Pumps, flowmeters, transmitters, and chemical analyzers are highly intelligent devices that provide asset performance information and live process information to process and maintenance-purpose digital twins. The digital twins recommend ongoing performance optimizations for the process and instrument operations and add adaptability to changing duty requirements throughout the intelligent device life cycle

- **Increased Production And Predictive Maintenance:** Breakdowns in any manufacturing system can result in delays along the supply chain. Digital twins make it possible to run an AI/ML model with a first principle–based process simulator to identify predictive maintenance and keep downtime to a minimum.
- **Plant Process Optimization:** Operators can use digital twins to create high-fidelity models that they can then use for performance monitoring, simulation, and optimization to deliver enhanced yield performance, flow assurance, energy-efficiency improvement, enhanced reliability, and operator-capability assurance.
- **Value-Chain Optimization:** Understanding when and where products are in demand allows companies to adjust production and labor needs while exploiting market opportunities. Data analytics that operators derive from digital twin applications is invaluable when predicting market demand.
- **Asset Life Cycle:** Operators can use data this digital twin captures to determine real-time performance across the entire life cycle of an asset for optimization.
- **Enterprise Insight:** Digital twins can set up a simulation based on existing company key performance indicators. Given a dashboard with information that a simulator-based digital twin provides, operators can use the model in real time and run multiple hypothetical scenarios or predict the future course of a business based on existing data.

Working in conjunction with Total Insight, the digital twins facilitate information flows across organizational boundaries and enable faster identification and resolution of unit issues. With improved performance gap visibility, second-guessing of decisions is minimized and the organization can more quickly realize benefits and outcomes. Ultimately, Total Insight enables digital transformation benefits including enhanced profitability, improved reliability, improved safety, extended asset performance, reduced asset failure, higher return on investments, and vastly improved productivity.

Part 4 Digital Transformation

> *...forward-looking industry leaders are investing in digital transformation to adapt, achieve operational excellence and outperform peers.*

For process manufacturing industries, digital transformation has moved to center stage. At the highest levels in practically all organizations, it is no longer viewed as a matter of investigation and experimentation, but a strategic imperative linked to the company's survival.

While digital transformation means different things to different people, its concept can become a mantra for earning relevance and establishing leadership in a digital economy. Rather than reacting to change or allowing themselves to be disrupted by it, forward-looking industry leaders are investing in digital transformation to adapt, achieve operational excellence and outperform peers.

There is no "one size fits all" approach to operational excellence. A company's approach could vary broadly depending on its industry, company size, and digital maturity. For instance, a smaller plant may view operational excellence to mean consistently producing a product at export quality, expanding plant capacity, or expanding regional and global business. On the other hand, a digitally savvy operation could be pursuing remote, unmanned or autonomous operations.

Benefits in common to all approaches to digital transformation are as follows:

- **Updated Company Vision**
  The company vision is modernized and earns support from customers who have digitally transformed or are in the digital transformation process.
- **Thriving Culture Of Innovation**
  This effort creates buzz within the organization and inspires a company culture and ability to innovate in product and service development.
- **Deeper Data Analysis**
  Better understanding of what/where data is across the organization, which translates into the ability to infer insights and deepen customer analysis to prove ROI.

- **Increased Customer Value**
  A true 360-degree, seamless customer experience contributes to increased conversions and customer loyalty.
- **Improved Customer Journey**
  Customers naturally continue every step of their journey, improving conversions and outcomes.
- **Increased Internal Collaboration**
  Collaboration significantly improves between business functions to unlock greater business value and efficiency.
- **Empowered Workforce**
  Leadership and employees feel empowered through greater knowledge and information.
- **Improved Efficiency**
  Decision-making and processes become more efficient across departments.
- **Sustainable Continuous Improvement**
  In a survival-of-the-fittest environment, businesses that can continue to adapt and lead will thrive in a dynamic business climate.

For process manufacturing operations, the primary focus areas are asset availability and reliability; human effectiveness; safety, sustainability and compliance; and operational performance and productivity.

Asset availability and reliability goals call for no unplanned outages, flawless startups, shutdowns and transitions, obsolescence management and predictive maintenance. Human effectiveness goals include a skilled, motivated and informed workforce and rigorous adherence to operating plans.

Safety, sustainability and compliance goals address functional safety, physical and cyber security, environmental stewardship and regulatory compliance. Operational performance and productivity measures target maximizing revenue, capital expense management, and operating cost containment. It will also provide for an agile response to market changes and a culture of profitability.

Operating at the Edge, Total Insight instruments seamlessly mesh with digital transformation implementations in a manner that supports all company goals and objectives.

Part 5 Conclusion

Measurement instrumentation began its digital journey many years ago. As smart instrumentation evolved, it added asset management functionality and provided insight into the process. Today, smart instrumentation must integrate seamlessly into a digitally transformed enterprise. The Total Insight portfolio from Yokogawa is a major step change in technology over smart instrumentation and enables digital transformation.

Total Insight creates sustainable value throughout the product lifecycle. It fully supports the primary digital transformation focus areas including asset availability and reliability; human effectiveness; safety, sustainability and compliance; and operational performance and productivity.

Total Insight supports digital transformation strategies through digital twin technology. Together, these technologies facilitate information flows across organizational boundaries and enable faster identification and resolution of unit issues. With improved performance gap visibility, second-guessing of decisions is minimized and the organization can more quickly realize benefits and outcomes.

> *“Total Insight supports digital transformation strategies through digital twin technology.*

Ultimately, Total Insight enables digital transformation benefits including enhanced profitability, improved reliability, improved safety, extended asset performance, reduced asset failure, higher return on investments, and vastly improved productivity.

WP-P-20201110-01