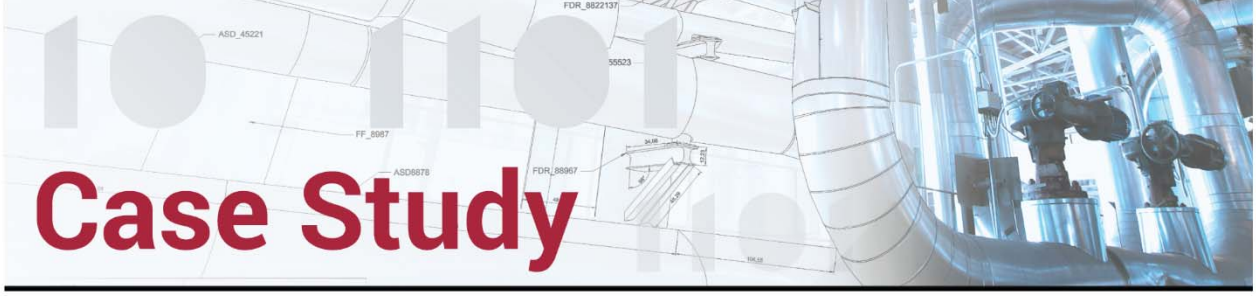

Kaneka Employs FOUNDATION Fieldbus in Demanding Chemical Plant Applications

The open, non-proprietary FOUNDATION™ Fieldbus protocol was first introduced in 1994. The technology has since been applied in a wide range of commercial process applications at thousands of industrial sites worldwide

The following article describes the functional evaluation results observed through Kaneka Corporation's experience with FOUNDATION Fieldbus, including the performance advantages realized through implementation of the technology in its chemical processing plants.

About FOUNDATION Fieldbus Technology

Technologies like FOUNDATION Fieldbus have been driving the digital transformation to smarter plant operations, made popular by terms such as the Industrial Internet of Things (IIoT) and Industry 4.0, for more than two decades. FOUNDATION Fieldbus is embedded in millions of intelligent devices and systems and has enabled end users to make better and faster decisions, increase productivity, reduce costs, and minimize risk while raising the level of awareness of plant operations from instrument technicians all the way to corporate officers.

FOUNDATION Fieldbus allows industrial organizations to unlock the full capabilities of their existing assets. By providing the means to leverage immense amounts of data generated by modern automation systems, the potential uses and benefits are numerous. They range from enhanced data collection and improved remote monitoring, diagnostics and asset management, to reduced configuration and commissioning effort.

FOUNDATION Fieldbus provides an all-digital communication infrastructure for process automation, with powerful multivariable measurement capabilities, robust device diagnostics, and the ability to integrate wireless devices across multiple networks. The block structure of FOUNDATION Fieldbus is unique, enabling true distributed functionality, improved data management, and alarm and alert management.

FOUNDATION Fieldbus' bidirectional communication protocol provides real-time, closed-loop control between intelligent field instruments and host systems. Being a peer-to-peer system, communication can occur directly between two fieldbus-enabled field devices or between field devices and a control or asset management system. Given the all-digital nature of fieldbus, following industry guidelines on proper wiring and termination practices ensures reliable communication.

FOUNDATION Fieldbus is intended to enable information-driven systems, with H1 (31.25 bit/s) technology supporting field-level interface and device integration within the process plant

environment, and High Speed Ethernet (HSE) functioning as a control backbone (100 Mbit/s) with capabilities for device, subsystem and enterprise integration.

A Fieldbus Applications

The following is a list of processes where Kaneka Corporation applied FOUNDATION Fieldbus, including the objectives for its implementation:

Wastewater treatment process (VCM, special resin plant)

Kaneka implemented FOUNDATION Fieldbus on small-scale control and monitoring systems for wastewater treatment, including utility facilities with sophisticated instrumentation used on continuous processes. The technology is expected to provide improvements in facility management that will lower maintenance costs and improve plant safety and stability.

Caustic soda plant

FOUNDATION Fieldbus was used to control the raw material refining process for caustic soda, which was spread over a wide area of the plant. The technology supported remote control of the product loading facility and monitoring of chemical solution leakage.

Pharmaceuticals plant

On pharmaceutical production processes, the operating condition of instrumentation assets must be quantitatively checked. Data must also be maintained in electronic form in order to comply with U.S. Food and Drug Administration (FDA) regulations. Kaneka evaluated FOUNDATION Fieldbus' capabilities for automating asset management in applications such as liquid level measurement on a raw material tank.

End User Observations

H1 Network Design

Kaneka installed a FOUNDATION H1 (31.25 kbit/s) network taking into consideration factors such as distribution of risk and the layout of instruments. The number of instruments per segment averaged 6 to 8 sets with a maximum of 13 sets. Although the total cable lengths generally fell within the standard FOUNDATION Fieldbus guidelines, they exceeded the maximum total spur cable length (120 m) in several cases, yet operations continued without issue.

Multi-variable Transmissions

Multi-variable transmissions were utilized to meet field requirements. These included: transmission of pH value and fluid temperature with a pH transmitter, transmission of differential pressure and static pressure with a DP cell, and transmission of totalized flow value and velocity with a magnetic flowmeter. By providing multiple measurement capabilities from a single device, Kaneka was able to reduce the number of devices required for their applications.

Control Functions and Function Blocks

Basic loops such as PID control, feed-forward control, ratio control and cascade control were configured using only the function blocks of the field devices. The control cycle was set to a macro cycle of one second. The split range configuration of the control valve and compound control function, such as valve shut-off via an interlock signal, can be configured with a combination of function blocks.

Self-diagnostic Functions

A key advantage of FOUNDATION Fieldbus two-way communications is that self-diagnostics can be performed by the control system in real-time. In the case of a distributed control configuration, the self-diagnostics status and the communication status of a sensor are linked to the PID function block status via the OUT status of the AI function block. That means the system is able to diagnose itself to determine if a fail-safe condition is occurring and move to a safe state.

Another advantage of FOUNDATION Fieldbus, compared to conventional analog instrumentation, is that it enables the control loop to configure the device using data provided by self-diagnostics. The technology also allows operators to monitor the status of each instrument from the control room.

Fieldbus users are not limited to mapping diagnostic functions to a transducer block or function block. This enables the diagnostic functions of current intelligent instruments to be used for Condition-Based Maintenance (CBM), including detection of device problems such as blocked impulse piping and corrosion in trim.

Asset Management Function

Management of remote calibration and maintenance history

Kaneka also verified that zero adjustment or range change for a differential pressure transmitter or magnetic flowmeter could be carried out remotely. Calibration by the production operator not only results in a more efficient workload, but also lower maintenance costs. All maintenance data can be recorded and saved as electronic information in a database where it can be compared or used with actual production data. For pharmaceutical plants, we found that digitizing instrument asset management aided compliance with FDA requirements.

Operator Interface

Among the various components that comprise a plant, including machinery, power facilities, computers, etc., instrumentation systems can be the most complicated. This is because information displayed on the operator screen often cannot be matched with a specific function. FOUNDATION Fieldbus enhances the functionality and reliability of instrumentation systems, and supports an operator interface enabling improved facilities management. Indeed, fieldbus

technology enables CRT-based operation to be carried out in a manner similar to the familiar DCS environment.

Operation History

Kaneka has implemented 14 H1 FOUNDATION Fieldbus segments, approximately 100 sets of fieldbus instruments, and six sets of fieldbus-based hosts. There have been no instrument or communication network problems – even after more than 1 million hours of total operation time (MTBF very seldom reaches 1 million hours). Thus, it considers FOUNDATION Fieldbus' reliability to be equivalent to that of a conventional control system.

Maintenance Tools

To date, there have been no fieldbus instrument failures requiring the use of maintenance tools (i.e., communication monitoring tools or digital oscilloscopes employed for SAT and FAT). Communication-monitoring tools measure communication load and error rate, whereas digital oscilloscopes measure communication signal waves and noise.

Maintenance tools eventually must be incorporated with fieldbus-based host systems so that device or communication errors can be displayed in a way that allows users to respond quickly with troubleshooting measures.

Interoperability

Kaneka's first FOUNDATION Fieldbus application was put into operation in 1997, with system configuration carried out by a single vendor (interoperability tests for the technology had not yet been performed). The company now selects fieldbus devices from multiple suppliers.

Conclusion

Building a better instrumentation system has always been a challenge. The DCS, which became the core of the control architecture, was the result of a lot of hard work by engineers using process computer technology dating back to the 1960s. In the progression from panel to DCS operation, system designers relied on input from production engineers. Fieldbus should be no exception. Although many issues such as reliability, multi-vendor compatibility and integration with existing systems have been resolved, frank and honest feedback from operators and field engineers will help in deploying a fieldbus-based production system that meets the demands of the future.