



FIELDCOMM GROUP™
*Connecting the World of
Process Automation*

101

FOUNDATION Fieldbus

**PROVEN TECHNOLOGY
FOR A DIGITAL FUTURE**





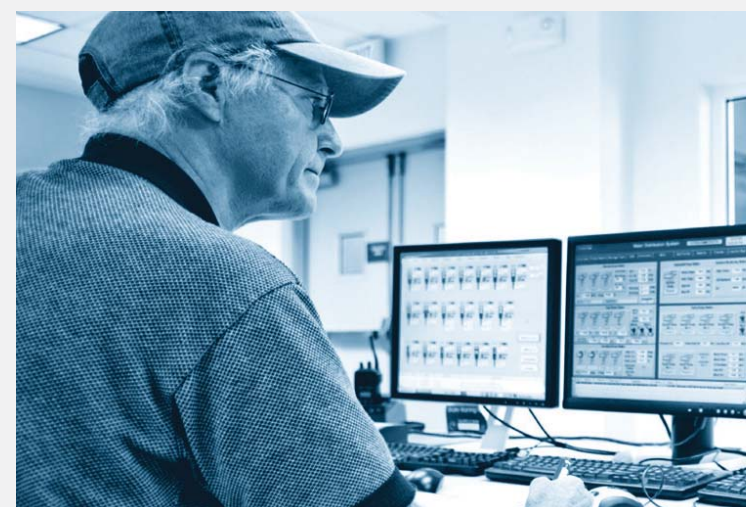
FOUNDATION

INTEGRATED PLATFORM FOR PROCESS AUTOMATION

Driving the Industrial Digital Transformation for Over 20 Years

FOUNDATION™ Fieldbus has 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 technology 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.



What is FOUNDATION Fieldbus?

FOUNDATION Fieldbus is a real-time digital communication network designed specifically for process control applications. It replaces analog 4-20 mA and on/off signals for connecting instruments like transmitters, analyzers, control valve positioners, and on/off valves to distributed control systems (DCS), programmable logic controllers (PLC), remote terminal units (RTU), and other automation systems.

FOUNDATION Fieldbus has the smallest hardware footprint of any technology in process automation. It provides an all-digital solution from the sensor to actuator, completely eliminating the need for analog 4-20 mA signals and significantly reducing the overall amount of equipment needed. It also takes the place of proprietary protocols previously-used with electric actuators/motor-operated valves (MOV), gas chromatographs, and tank gauging systems. Communication is time-synchronized and scheduled to ensure deterministic closed-loop digital control. Multiple devices, each with multiple I/O signals, share the same bus.



FOUNDATION Fieldbus supports long cable lengths to junction boxes far into the field, as well as long spurs for devices. Fieldbus-based control systems employ two-wire twisted pair cable and provide intrinsically safe or non-incendive device power suitable for all hazardous areas. Unrestricted access to field device intelligence enables centralized configuration/setup and diagnostics for all field instruments, including discrete sensors and actuators. This solution also supports temporary masters such as handheld field communicators, laptops/tablets, and documenting calibrators.



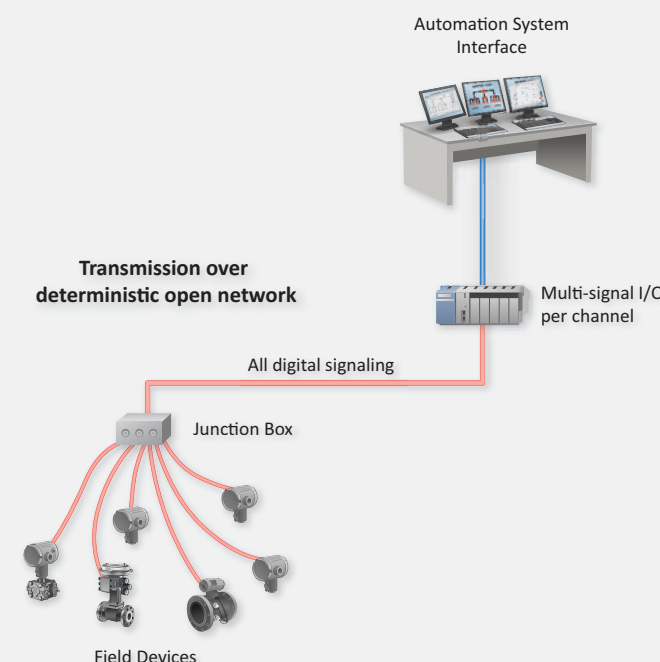
As demonstrated at plants around the world, the benefits of completely digital automation without the limitations of 4-20 mA and on/off signals are enormous.

FOUNDATION Fieldbus takes automation to the next level by making control loops entirely digital from end-to-end—from transmitter to positioner—without intermediate analog signals, and by communicating multiple signals from multiple devices on the same pairs of wires. Range setting is reduced, if not eliminated, for most transmitters, and there is no signal distortion like traditional analog systems.

The technology also enables new, more powerful devices, including intelligent two-wire on/off devices with predictive diagnostics.

FOUNDATION Fieldbus started with a few simple ideas:

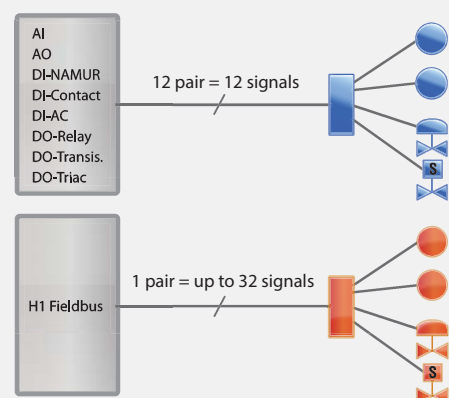
- Reduce cabling
- Simplify marshalling
- Enable real-time digital closed-loop control
- Ensure multi-vendor interoperability
- Expand device intelligence
- Allow diagnostics-based maintenance
- Liberate plants from proprietary protocols



BREAKING THE LIMITS OF ANALOG TECHNOLOGY

VirtualMarshalling™

Some automation projects are adopting various alternatives to traditional I/O and marshalling technology. But why make physical marshalling better when you can eliminate it entirely? Functions provided via physical hardware in conventional control systems are not necessary in a FOUNDATION Fieldbus system since they are handled through software, which is more robust and eliminates failure points.



FOUNDATION technology was developed with *VirtualMarshalling* – software-based distributed I/O connectivity – which provide multiple signals over the same two terminals. No need to rely on custom hardware configurations to accomplish the functions of traditional marshalling. This approach allows late addition of feedback and auxiliary measurement and control signals without the need for additional wiring or switching I/O cards. At design time, it is not necessary to know the exact type and quantity of signal for each device to determine I/O requirements.

VirtualMarshalling makes FOUNDATION Fieldbus particularly well suited for expansions at existing sites with limited additional tray capacity.

An Open Network Standard

Proprietary protocols were eliminated years ago and for many reasons. Devices are therefore able to openly integrate with intelligent device management software for configuration, diagnostics and predictive maintenance all while sharing the same bus infrastructure.

As an open network standard, the technology eliminates single vendor dependency, which limits the ability to interchange or replace existing instruments with third-party solutions. End users can choose the best available instruments for their application and replace them as needed to accommodate the process.

Reduced Installation Time & System Footprint

Rather than use individual wires for each device signal, FOUNDATION Fieldbus connects multiple devices in parallel on the same pair of wires. A single pair provides both power and communication, and can be intrinsically safe or non-incendive if required. This reduces the amount of cable, cable trays, I/O cards, and associated labor for installation, as well as the effort of cutting, stripping, crimping, labeling and connecting at every intermediate point. For example, a bus with 10 instruments—and an average of three signals per device—can take the place of 30 pairs of wires and I/O channels.

Because of its ability to integrate multiple signals on a single wire, FOUNDATION Fieldbus dramatically reduces work required for electric actuators/MOVs



and discrete two-wire intrinsically safe on/off valve actuators. In the past, these devices required one pair of wires and one I/O channel for each signal, meaning as many as 3, 6, 12 or more pairs per device. This results in fewer I/O cabinets, a smaller footprint, less weight and considerably reduced labor. No more “bird’s nest” of wires!

Reduced Device Count

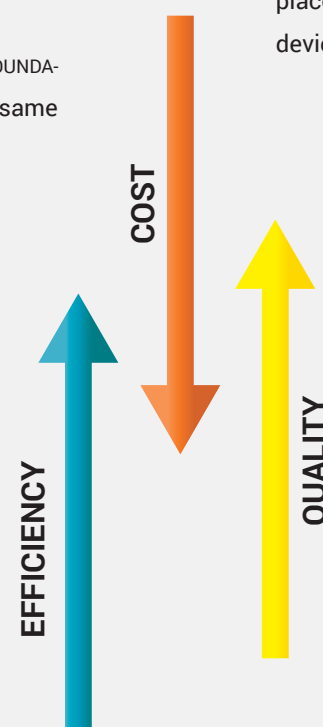
FOUNDATION Fieldbus supports multi-function instruments such as multi-channel temperature transmitters with eight sensor inputs, which are ideal for temperature profiling applications.

For dual sensor temperature transmitters, both channels can be used for control loops. Because of these capabilities, FOUNDATION Fieldbus transmitters can take the place of many hardwired transmitters, thus reducing the overall device count as well as associated wiring and I/O card points.

Reduced Commissioning Time

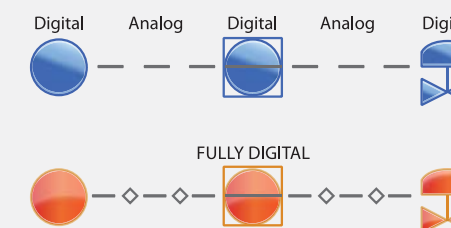
With FOUNDATION Fieldbus, time-consuming manual commissioning tasks and their associated errors are no longer a concern. Traditional five-point loop tests are replaced by a simple plausibility check. Technicians can automatically confirm the correct device type (model and manufacturer) has been installed, and are not required to spend time re-ranging it.

This not only applies to transmitters and positioners, but also discrete devices such as intelligent two-wire on/off valves and electric actuators.



High Signal Integrity

FOUNDATION Fieldbus’ pure digital signals eliminate the digital-to-analog (D/A) and analog-to-digital (A/D) conversion required in devices and systems utilizing 4-20 mA technology. Fewer conversions lead to higher resolution and accuracy. Errors due to current calibration differences between transmitter output and DCS input are also eliminated. This is particularly important in flow and level applications such as tank gauging, where small percentages correspond to significant revenue. Using FOUNDATION Fieldbus, measurement values transmitted digitally cannot be distorted and integrity errors are immediately detected. This compares with often-undetected current skews commonly due to undetected ground loops or improperly separated high voltage lines.



Greater Signal Fidelity

FOUNDATION Fieldbus devices are designed to transmit measurements as a real number in engineering units (not scaled by range), which are received—unaltered—by a control system at the other end. This approach eliminates the process variable value skew that may result from mismatched 4-20 mA range settings between transmitters and control systems. With FOUNDATION Fieldbus, measurement values are also transmitted over the full sensor limit with greater precision and are not limited to a narrow 4-20 mA portion. Readings do not stop at the normal control range, but go beyond, providing valuable information during abnormal conditions.



FOUNDATION

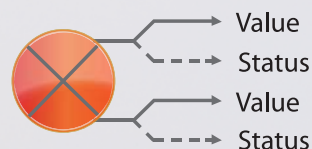
PROVEN BENEFITS IN PROJECTS WORLDWIDE

Tighter Control

Transmitters, controllers, and valve positioners are digital—so it only makes sense to have pure digital signals between them. A digital bus running 25 times faster than earlier hybrids of analog and digital allows a closed loop that is digital and time-synchronized from end to end, from sensor to valve. FOUNDATION Fieldbus communication is deterministic and runs in real-time, offering control response times faster than 150 ms in some cases. Reductions in process variability allow set points to be moved closer to the optimal point of operation.

Real-time Signal Status & Data Quality

FOUNDATION Fieldbus delivers real-time signal validity with each measurement indicating if the value is good for control, uncertain, or bad (fault).



This enables process problems to be distinguished from device problems, thereby minimizing nuisance trips of the control loop on sensor failure and increasing availability.

More Powerful Devices

FOUNDATION Fieldbus-powered instruments are able to consume more power than traditional systems, enabling new and more powerful functionality. Examples of such devices include two-wire eight-channel process temperature transmitters, two-wire tank gauging multi-spot temperature transmitters with water bottom level measurement, and two-wire intelligent on/off valves.

Enhanced Diagnostics

The digital nature of FOUNDATION Fieldbus supports DCS-based device configuration/setup, diagnostics, and viewing of internal variables. The technology also allows two-wire devices to drive more powerful electronics and firmware, ensuring more sophisticated self-diagnostics. This includes statistical process monitoring (SPM) for multiple variables across the bus and continuous valve performance diagnostics not found in 4-20 mA devices. In addition, the technology employs NAMUR NE107-compliant device alarm rationalization to notify the right person without alarm flooding.

Simple Online Upgrades

FOUNDATION Fieldbus instruments not only communicate faster than hybrid analog/digital devices, but they also have the speed necessary to allow firmware download from the system while continuing to run the process. Devices with dual memory banks switch bumplessly to new firmware without any downtime on the segment. Modern FOUNDATION Fieldbus devices are easily upgraded to take advantage of features and other improvements in new versions. These upgrades can be performed without going into the field to replace the entire circuit board or connect a laptop.

Ease of Use

FOUNDATION Fieldbus technology includes NAMUR NE107-compliant role-based and prioritized device diagnostic alarms, backwards compatibility for easy device replacement and soon will include Standard Connection Points (SCP) which will enable true “plug and play” functionality to get users online quickly in the event of a process upset.

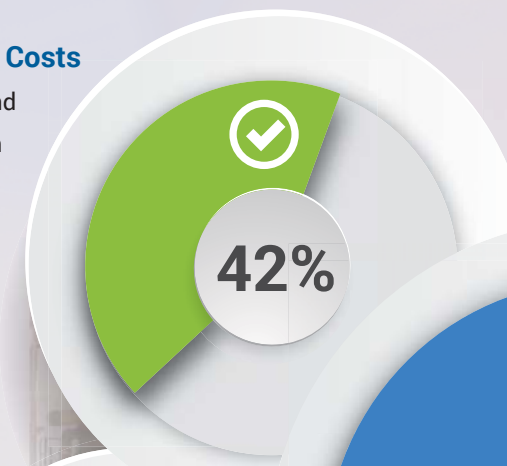
Real-World Examples

Companies around the world benefit by choosing FOUNDATION Fieldbus technology. Here are a few real-world examples. TotalFina Elf is a multinational energy company committed to leveraging innovation and initiative to provide a sustainable response to the growing energy demand. Tecnimont is an engineering, procurement and construction company headquartered in Mumbai, India.

Tecnimont Reduces Installation Costs

Tecnimont reduced installation time and costs - termination, cabinet installation and cable pulling by 42%, compared to that of 4-20mA installation.

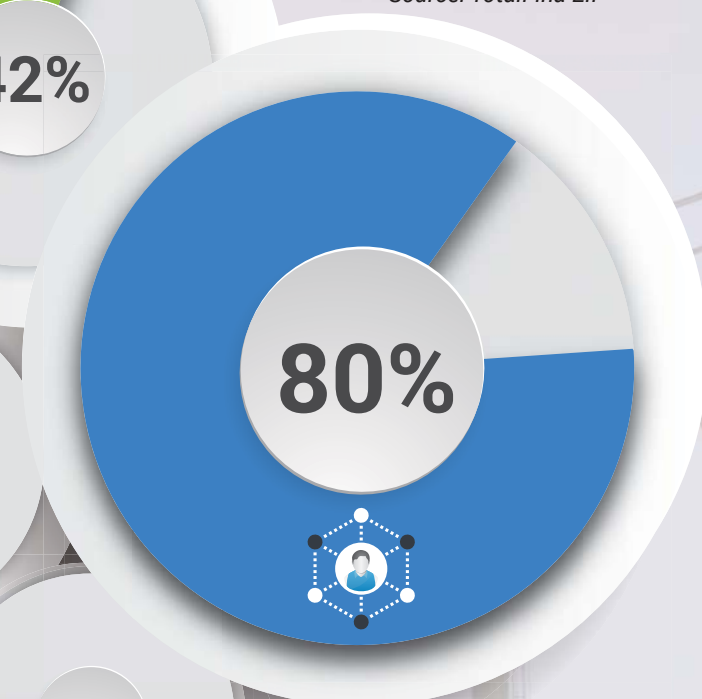
Source: Tecnimont



TotalFina Elf Saves Big!

TotalFina Elf reduced overall engineering costs of a project by 80%.

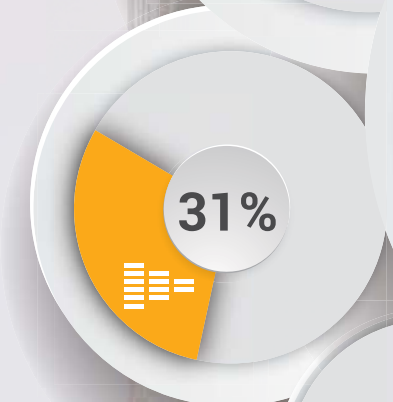
Source: TotalFina Elf



Tecnimont Reduces Commissioning Costs

Tecnimont reduced commissioning costs by 31% compared to 4-20mA system loop checking and commissioning.

Source: Tecnimont



TotalFina Elf Reduces Wiring and Instrumentation Costs

TotalFina Elf reduced wiring and instrumentation costs by 15% by choosing FOUNDATION Fieldbus technology.

Source: TotalFina Elf



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FDI unifies device drivers, configuration tools, diagnostics and documentation regardless of operating system with an independent and downloadable software package compatible with any FDI registered host system.



FOUNDATION Fieldbus provides an all-digital infrastructure, with powerful multivariable measurement capabilities, robust device diagnostics, and the ability to integrate wireless devices across multiple networks.



With over 30 million supported field instruments installed worldwide, HART technology offers a reliable, long-term solution for leveraging benefits of intelligent devices through digital communication.



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