

Fieldbus 101

Introduction to FOUNDATION fieldbus

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Overview

Why should I care about FOUNDATION fieldbus?

You wouldn't be reading this if you didn't already suspect that FOUNDATION fieldbus could help you improve process and plant performance.

The fact is, it can. It offers distinct advantages over traditional analog and discrete wiring or even other digital buses — at lower total installed cost and lower ongoing costs.

FOUNDATION fieldbus can deliver these benefits because it's different from traditional communication technologies. That doesn't mean it's harder to learn or to use — just different.

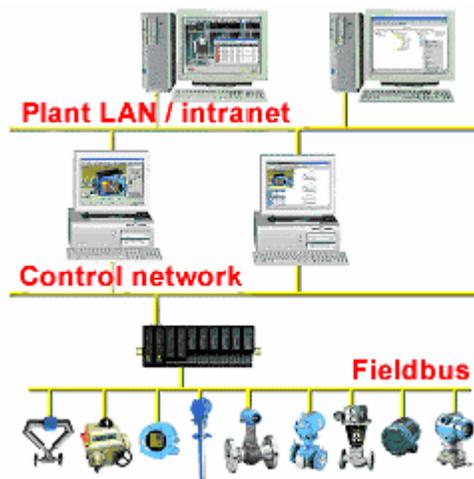
To help you understand those differences, this introductory course offers a brief overview of FOUNDATION fieldbus and some of its advantages. Other courses provide more details about the technology and its benefits, as well as practical tips on putting FOUNDATION fieldbus to work for you.

Hint: As you go through the topics in this introductory course, watch for answers to these questions:

- *How can FOUNDATION fieldbus carry more information than 4-20 mA wiring?*
- *Who controls FOUNDATION fieldbus technology?*
- *For what kind of application was FOUNDATION fieldbus originally designed?*

What is FOUNDATION Fieldbus

FOUNDATION fieldbus is an all-digital, serial, two-way communications system that serves as the base-level network in a plant or factory automation environment.



It's ideal for applications using basic and advanced regulatory control, and for much of the discrete control associated with those functions.

Two related implementations of FOUNDATION fieldbus have been introduced to meet different needs within the process automation environment. These two implementations use different physical media and communication speeds.

- **H1** works at 31.25 Kbit/sec and generally connects to field devices. It provides communication and power over standard twisted-pair wiring. H1 is currently the most common implementation and is therefore the focus of these courses.
- **HSE** (High-speed Ethernet) works at 100 Mbit/sec and generally connects input/output subsystems, host systems, linking devices, gateways, and field devices using standard Ethernet cabling. It doesn't currently provide power over the cable, although work is under way to address this.

The digital bus advantage

Conventional analog and discrete field instruments use point-to-point wiring: one wire pair per device. They're also limited to carrying only one piece of information -- usually a process variable or control output -- over those wires.

As a digital bus, FOUNDATION fieldbus doesn't have those limitations.

Multidrop wiring. FOUNDATION fieldbus will support up to 32 devices on a single pair of wires (called a segment) -- more if repeaters are used. In actual practice, considerations such as power, process modularity, and loop execution speed make 4 to 16 devices per H1 segment more typical.

That means if you have 1000 devices -- which would require 1000 wire pairs with traditional technology -- you only need 60 to 250 wire pairs with FOUNDATION fieldbus. That's a lot of savings in wiring (and wiring installation).

Multivariable instruments. That same wire pair can handle multiple variables from one field device. For example, one temperature transmitter might communicate inputs from as many as eight sensors -- reducing both wiring and instrument costs.

Other benefits of reducing several devices to one can include fewer pipe penetrations (for improved safety and reduced risk of fugitive emissions) and lower engineering costs.

Two-way communication. In addition, the information flow can now be two-way. A valve controller can accept a control output from a host system or other source and send back the actual valve position for more precise control. In an analog world, that would take another pair of wires.

New types of information. Traditional analog and discrete devices have no way to tell you if they're operating correctly, or if the process information they're sending is valid. As a consequence, technicians spend a lot of time verifying device operation.

But FOUNDATION fieldbus devices can tell you if they're operating correctly, and if the information they're sending is good, bad, or uncertain. This eliminates the need for most routine checks -- and helps you detect failure conditions before they cause a major process problem.

The PlantWeb advantage

In a PlantWeb architecture, Emerson field devices can provide status information that helps reduce maintenance cost by eliminating routine checks of device operation.



Their predictive diagnostics can also help increase plant uptime and performance by detecting or predicting deteriorating performance and failure conditions before they cause problems.

Control in the field. FOUNDATION fieldbus also offers the option of executing some or all control algorithms in field devices rather than a central host system. Depending on the application, control in the field may provide lower costs and better performance -- while enabling automatic control to continue even if there's a host-related failure.

An established standard

FOUNDATION fieldbus is covered by standards from three major organizations:

- ANSI/ISA 50.02
- IEC 61158
- CENELEC EN50170:1996/A1

The technology is managed by the independent, not-for-profit Fieldbus Foundation, whose 150+ member companies include users as well as all major process automation suppliers around the globe.

Some suppliers have even donated fieldbus-related patents to the Fieldbus Foundation to encourage wider use of the technology by all Foundation members.

Interoperability

Interoperability simply means that FOUNDATION fieldbus devices and host systems work together while giving you the full functionality of each component.

How do you know it's interoperable? Instruments can earn "registered" status (and the right to carry a FOUNDATION fieldbus checkmark logo) by passing rigorous tests to demonstrate they meet the requirements for interoperability.



And to ensure that users have a choice of fieldbus products, the Foundation doesn't allow devices to bear the FOUNDATION fieldbus interoperability "checkmark" until at least two products of the same type — from different manufacturers — have passed its tests.

Host interoperability testing. Host systems undergo Foundation-supervised tests to demonstrate their support for specific interoperability features. The features a given host system supports are listed on the Foundation's web site, but host systems aren't registered and don't bear the checkmark logo.

The PlantWeb advantage

Intelligent field devices used in PlantWeb architecture were among the first to earn the Foundation's "checkmark" logo. Our DeltaV™ automation system was also one of the first to successfully undergo host-system testing. And Emerson has been a leading participant in multi-vendor interoperability tests.



As a result, in addition to the performance and reliability our devices and systems are known for, you get the flexibility to put together an interoperable solution that meets your needs.

Interoperable isn't interchangeable. Interchangeable means you can freely substitute one device for another and still get exactly the same functionality. Interoperable, on the other hand, means different devices from different manufacturers can work together -- but individual devices can have different functionality.

For example, you may have two pressure transmitters from different manufacturers. One transmitter may provide only analog input functionality, while the other transmitter also offers PID control and custom diagnostic capabilities. You can't replace the more capable transmitter with the less capable one and still get the same total functionality. But both transmitters can work together on the same fieldbus segment.

Fieldbus 201 covers interoperability in more detail.

Safe and efficient process control

Some communication protocols that were originally designed for factory or office automation are proving useful in specific niche applications in process plants. But none of these protocols was designed with the full requirements of process control in mind. As a result, they are less-than-optimum choices for providing safe and effective process control.

FOUNDATION fieldbus H1, on the other hand, was developed specifically to meet the needs of the process industry.

- It can withstand the harsh and hazardous environment of process plants.
- It delivers power and communications over the same pair of wires.
- It can use existing plant wiring.
- It supports intrinsic safety.

In short, it's designed to operate where your process does.

Control you can count on. FOUNDATION fieldbus also provides deterministic process control: control communications happen on schedule, without delays caused by other traffic on the bus. If a message doesn't get through, it tries again.

Control reliability doesn't stop there. If fieldbus devices lose their connection to the host system, they are capable of maintaining safe and effective control across the bus.

Keeping the user informed. FOUNDATION fieldbus devices always know whether the information they're providing is good and provide this status information with the process variable. For the safest plant operation, both the control strategy and the operator need this status information delivered through the host so they can respond safely and predictably during failure modes.

The bottom line: FOUNDATION fieldbus is designed to deliver the performance and reliability needed for mission-critical process control.