

FOUNDATION Fieldbus Overview



The FOUNDATION Fieldbus (FF) protocol was created in 1994 by a group of process automation suppliers. Unlike other protocols, FF was developed specifically for the process industries. It is therefore capable of handling all of the complexities of process management, including process variables, real-time deterministic process control, and diagnostics.



FOUNDATION Fieldbus features intrinsic safety, long wiring run length, and delivery of blocks of data over a two-wire system. In intrinsically safe applications, only 83mA of power are available for each segment, so it is important that field devices consume very little power. TopWorx FF products consume less than 17mA of power, so up to five devices can be used on each segment.

FOUNDATION Fieldbus is the ideal digital replacement for the traditional 4-20mA analog standard. Although it is tailor-made for analog instruments, such as control valves and transmitters, it is often appropriate for on/off valves as well. For example, in continuous processes (low discrete population), it is often logical to tie the on/off valves into the FF system rather than use conventional wiring or a completely different bus network for a small number of valves. And in batch operations (high discrete population) that are intrinsically safe, FF is often the only logical choice for networking on/off valves.

TopWorx has recognized these issues and has created several cost-effective ways to extend the benefits of FF to on/off valves and other discrete devices.

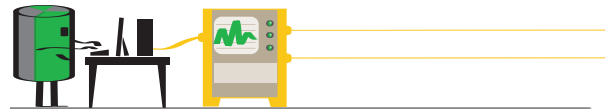
FOUNDATION Fieldbus Network Highlights

Type of Network	Process Control Network
Physical Media	Twisted pair, fiber
Network Topology	Star, Bus
Maximum Devices	32 nodes/segment (16 nodes/segment on some Host systems)
Maximum Devices using Intrinsically Safe wiring	4-6 per repeated segment depending on power requirements of devices and the type of I.S. barrier used.
Maximum Distance	<ul style="list-style-type: none"> - Maximum Distance 1,900 meters - Maximum Distance with repeaters 9,500 meters (max. of 4 repeaters can be used)
Communication Methods	<ul style="list-style-type: none"> - Client/server, Publisher/subscriber, Event - Both scheduled and unscheduled communications
Primary usage	Used for analog and discrete process control devices
Power and Communications on same twisted pair	Requires FF power supply (conditioner) to protect the digital communications
Device Power Supply	Can be supplied from bus (typical)

Wiring Types	(Recommend using Type A cable only for new installations)
Type A:	Shielded Twisted Pair #18AWG (0.8mm) 1900m (6232 ft.)
Type B:	Multi-twisted Pair with shield #22AWG (0.32mm) 1200m (3936 ft.)
Type C:	Multi-twisted Pair without shield #26AWG (0.13mm) 400m (1312 ft.)
Type D:	Multi-core without twisted pairs and having an overall shield #16AWG (1.25mm) 200m (656 ft.)
Grounding aspects	Wiring is ungrounded. If bus wires are grounded or shorted, communication to all devices is interrupted. (short circuit protection is recommended)
Shielding	Shields should be grounded at only one point
Terminators	2 near each end of each bus segment
Hazardous Area Installations	Intrinsically Safe devices available
Device Addressing	Automatic when connected to segment
Governing Body	Fieldbus Foundation
Web Site	www.fieldbus.org

Conventional I/O System vs. FOUNDATION Fieldbus Network

FOUNDATION Fieldbus is the ideal protocol for the process industries.



CONVENTIONAL I/O SYSTEM

Advantages

- Technology is already understood
- Lower device cost
- Independent wiring from devices to the control system means wiring problems with one device don't affect other field devices

Drawbacks

- Higher installed cost
- Point-to-point wiring is expensive
- Many wiring connections:
 - are labor intensive to install
 - create many points of failure
 - increase complexity when troubleshooting
 - require large amounts of cabinet or rack space for installation of terminal blocks
 - create time-consuming initial checkout and startup
- Expansion requires duplicating the entire wiring scheme for each additional point

FOUNDATION Fieldbus can handle process variables, deterministic process control, and diagnostics, and is the ideal protocol for the process industries.

FOUNDATION FIELDBUS NETWORK

Advantages

- Excellent support for analog I/O
- Incorporates discrete devices into same segments
- Provides control in the field capabilities
- Provides redundancy options for power and communications devices
- Available for Intrinsically Safe installations
- Largely supported by process control manufacturers
- Complete digital communications to transmitter microprocessors:
 - Eliminates inaccuracies of A/D and D/A conversions of analog representative signals, such as 4-20mA
 - Eliminates calibration of representative signals to improve accuracy
 - Eliminates setting of upper and lower range limits at the device level
- Devices contain diagnostic information and alarming capabilities
- Interoperability certification ensures that various field devices work with a variety of host systems, regardless of manufacturer

Drawbacks

- Limited power requirements in Intrinsically Safe applications, extended for FISCO installations
- Segment power, grounding, and loading must be considered when designing segments
- Training for commissioning, troubleshooting, and calibration may be required
- Requires proper grounding and power isolation for error free network communications

TopWorx Comments on FOUNDATION Fieldbus

Strengths

FF is made for process control. FF was designed by the world's leading process automation suppliers for the process industries.

FF is proven worldwide. At the time of publication, FF systems have been implemented in over 25 countries.

FF is intrinsically safe. In the processing world, hazardous areas are common. Other bus networks got their start in factory automation before migrating to the process industries, and thus often fall short in hazardous areas. But FF, designed for process automation, incorporates intrinsic safety. TopWorx solutions for discrete valves are intrinsically safe as well.

FF users want on/off solutions. Due to the sophistication of the FF protocol, occasionally a plant's on/off valves become an afterthought in the design of the system.

Later the realization hits that those valves are important, raising the question, "What are we going to do with the discretes?"

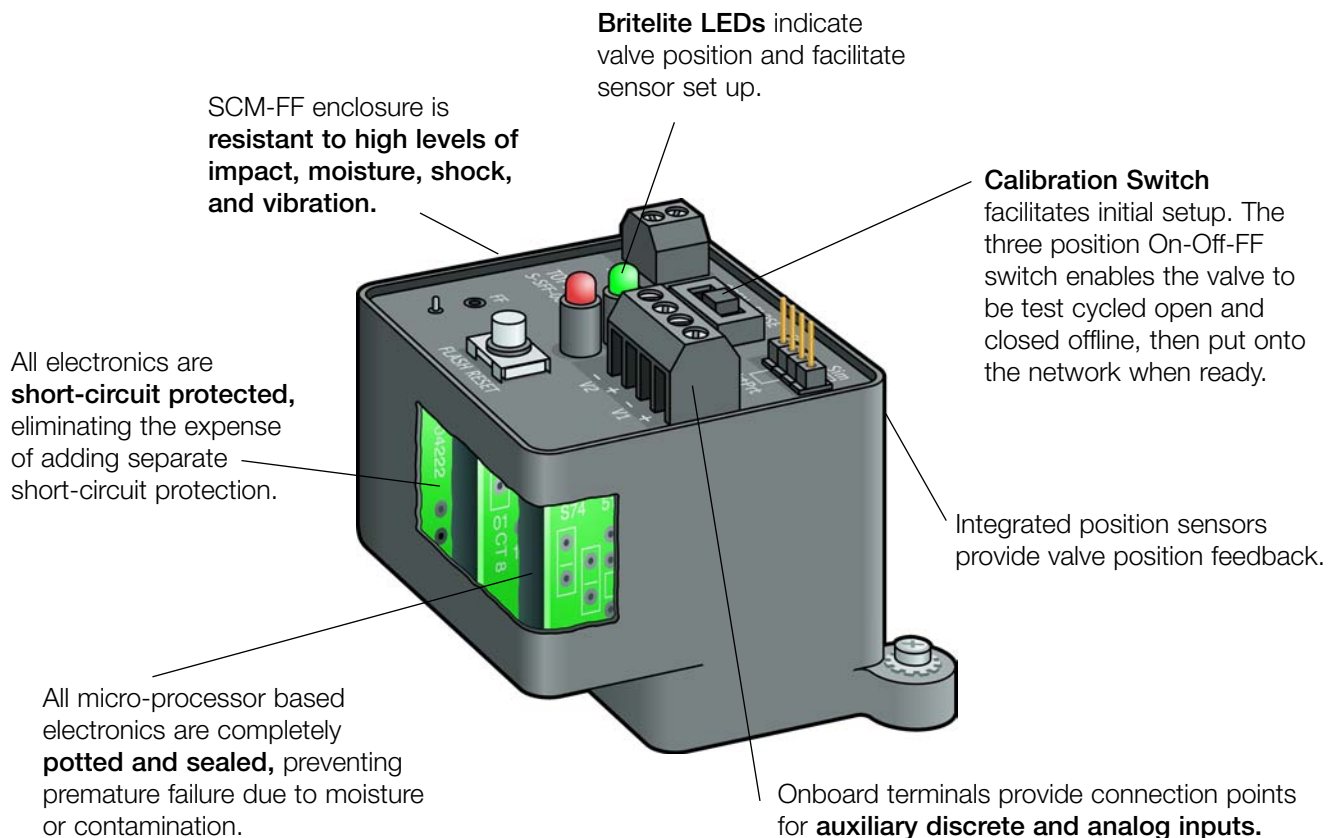
TopWorx has created several long-awaited discrete solutions that are two-wire, intrinsically safe, interoperability certified, and proven to work with process control systems such as Emerson's Delta V.

● Process Control Network

FOUNDATION Fieldbus Sensor-Communications Module



The TopWorx Sensor-Communications Module (SCM) combines position sensors, FF communication, pilot valve outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.



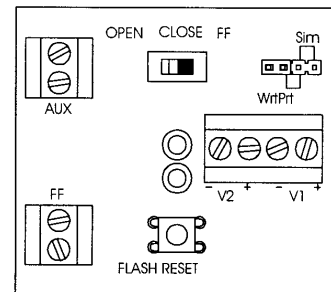
SCM-FF Highlights

The Sensor-Communications Module delivers valve position feedback, communicates directly on the FOUNDATION Fieldbus network, pilots the valve actuator, and provides extra wiring terminals for auxiliary inputs.

The TopWorx SCM-FF is a compact, sealed module that can be used in a variety of enclosures suitable for use in any hazardous or corrosive process environment.

Because of its ultra-low power requirements, the SCM-FF consumes less than 17mA of power; therefore, up to five devices can be loaded onto a single Intrinsically Safe segment.

- 5 Discrete Inputs (DI)** Open/Closed valve position feedback
- 3 Discrete Outputs (DO)** Pilot valve outputs for single or double acting
- Calibration Switch** Open-Close-FF
- Status/Warning LEDs** Open, Closed, Alarm State
- FF Interoperability Tested** Yes
- Emerson Delta V Tested** Yes
- Short Circuit Protection** Yes
- Intrinsically Safe** Yes
- Max Current Consumption** <17mA (22mA with LEDs on full-time)
- Voltage** 9-32 VDC
- Diagnostic Features**
- Cycle Counter** Records number of cycles
- Cycle Time Alarms** User settable values for Open & Close cycle times
- Visual Alarm Indication** Blinking LEDs



SCM-FF Wiring Diagram