



## Brooks Instrument

### Advantages of FOUNDATION fieldbus™ in Thermal Mass Flow Applications | Business White Paper

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## **Advantages of FOUNDATION fieldbus™ in Thermal Mass Flow Applications**

FOUNDATION fieldbus™ is an extremely stable, all digital, two-way communications technology for plant instrumentation and the best technology for utilizing advanced diagnostics. Because of all of its advantages, FOUNDATION fieldbus is gaining worldwide acceptance. In particular, many life sciences and chemical research customers have been seeking a thermal mass flow controller with FOUNDATION fieldbus communications. Brooks Instrument recently introduced the first thermal mass flow controller with FOUNDATION fieldbus technology to allow its customers to take advantage of the full power of this communications protocol.

### **So What is FOUNDATION fieldbus™**

The Fieldbus Foundation™ is a not-for-profit corporation consisting of leading process and manufacturing automation companies worldwide whose major purpose is to provide an automation infrastructure that supports open scalable integration, process integrity and business intelligence. In this environment, end users, manufacturers, universities and research organizations are working together to develop the technology, provide development tools, support and training, coordinate field trials and demonstrations, and enable product interoperability.

From its inception, the Fieldbus Foundation, a trade consortium representing the major process automation industry suppliers and end users worldwide, has taken a leadership role in the development that provides digital communications and an integrated automation infrastructure based on regional and international standards.

The organization's technology, FOUNDATION fieldbus™, is an all-digital, two-way communications technology for plant instrumentation. It offers reduced wiring, easier maintenance, and simpler integration. Due to direct data exchange with field devices, FOUNDATION fieldbus is more robust than other digital protocols, thus avoiding network slowdowns and interrupts. There is direct access over the FOUNDATION fieldbus protocol to device parameters, such as valve tuning. The end result is a decrease in device start-up time and cost.

FOUNDATION fieldbus is open, which means that it can use any control system host rather than a proprietary protocol. The two-way, or bi-directional, communications means that it can be used to communicate among field devices and to the control system.

The FOUNDATION technology consists of the protocol, a Function Block structure for true distributed control, Device Description (DD) technology for parameterization and integration of data, a network hierarchy for subsystem integration and a well-defined system management structure for reliability and determinism of functional execution. There are three different types of blocks in which FOUNDATION fieldbus organizes device data. These different blocks are:

Resource block	Only block required by FOUNDATION fieldbus. Stores high-level device information such as serial number, manufacturer, and diagnostics
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Function block	Process variables such as analog input and output and external (from the device) PID (Proportional, Integral, Derivative) loop parameters
Transducer block	Device-level parameters such as calibration data, full scale values, and internal (to the device) PID loop parameters

FOUNDATION fieldbus is similar to Profibus and DeviceNet in that it is a digital bus protocol used for device I/O communications. However, there are several differences. These are highlighted in the next section.<sup>1</sup>

### **FOUNDATION fieldbus Comparison with other Digital Protocols**

FOUNDATION fieldbus is a digital protocol like DeviceNet or Profibus, but it has some fundamental differences. With DeviceNet and Profibus, the process is contained within the host, or control system. With FOUNDATION fieldbus, the process is contained within the device. This permits device-to-device communication within a network without having to go back to the host which allows closed loop system(s) between field devices (e.g. the user could easily have a mini system between a flow, level, and pressure device.)

The process being in the device with FOUNDATION fieldbus also permits devices to continue running without the host if the host is temporarily interrupted. The device can manage errors, stop the device or other devices, or even stop the process. This makes FOUNDATION fieldbus the ideal protocol to manage diagnostic information. Having the process in the device does slow down data rates going to and from the host. This makes FOUNDATION fieldbus slower from a communications standpoint compared to DeviceNet and Profibus. However, the FOUNDATION fieldbus network is much more robust because of the slower data rates. Unlike DeviceNet, FOUNDATION fieldbus permits electronic tags. An electronic tag gives a live device a name on the network that can exist after device is removed. Conversely, DeviceNet uses a network address that is only live when the device is on the network. Below is a quick summary guide of the differences between FOUNDATION fieldbus, DeviceNet, and Profibus DP.

<b>FOUNDATION fieldbus</b>	<b>DeviceNet</b>	<b>Profibus DP</b>
Device-to-device	Communication from host	Communication from host
Electronic tag	Network address	Electronic tag
Process contained within the device	Process contained within the host	Process contained within the host
Slower data rates	Higher data rates	Higher data rates
More robust network	Less robust network	Less robust network

Due to all of the advantages, many life sciences and chemical research customers have been searching for a thermal mass flow controller with FOUNDATION fieldbus communications. **Brooks Instrument is the first to offer a thermal mass flow controller with FOUNDATION fieldbus communications.** Brooks has implemented FOUNDATION fieldbus exclusively on the SLA5800 and SLAMF Series devices and taken

<sup>1</sup> Source: Fieldbus.org

advantage of the full power of the communications protocol. Some of the benefits of the Brooks SLA FOUNDATION fieldbus option are:

**High/Low Alarms**

The function block easily allows the user to set up alarm limits for device flow, temperature, and valve position. (Pressure is available for pressure controllers.) Four levels of alarms can be set (high-high, high, low, and low-low). Through the host (or control system) a user can write rules on these alarms or on the standard deviations of any of these parameters.

**Easy Access to Tuning Parameters**

Via the transducer block, the user has easy access to PID, offset, and span. The transducer block is accessible to the user from any of the hosts' software (DeltaV, Yokogawa, Honeywell, etc.)

**Ultra-fast External PID Loop**

Other devices typically have external PID loops running at 30-40 msec. Because Brooks has external power provided to the device, its external PID loop runs at 8 msec. This allows the Brooks device to run external PID loops for any device in the network at much faster rates.

**“Lightning-proof”**

The FOUNDATION fieldbus connection for the SLAMF series of mass flow instruments has surge protection that makes it ideal for outdoor use.

**Brooks is Interoperable With Any Control System.**

Brooks FOUNDATION fieldbus has been H1 certified by the Fieldbus Foundation. The Brooks interface has passed interoperability testing by the ITK (Interoperability Test Kit) and for all major control hosts, including Delta V, Honeywell, Yokogawa, Invensys, and ABB. No matter what control system you're using, the Brooks SLA Series will be compatible.

**Advanced Diagnostics**

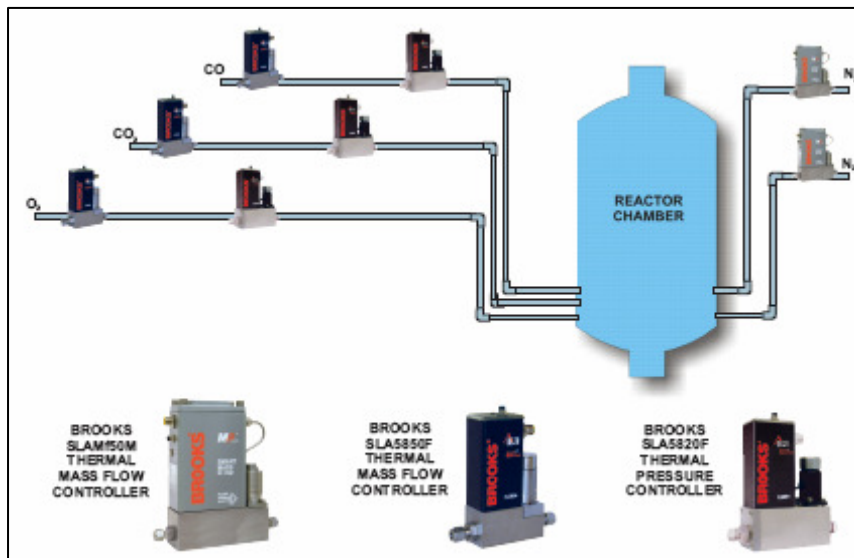
Because the process is contained within the device, FOUNDATION fieldbus is the best protocol for managing advanced diagnostic information. The diagnostic information can be accessed from the resource block within the device description (DD). The Brooks SLA Series FOUNDATION fieldbus devices have a wealth of diagnostic information. Below are some examples of these device diagnostics.

- Zero drift diagnostic
- Valve spring life exceeded
- Reverse and no flow conditions detected
- Calibration due reminder
- Device overhaul due

All of Brooks' diagnostics have detailed descriptions and recommended actions in the product instruction manuals.

The following are some examples in which Brooks Thermal Mass Flow devices with FOUNDATION fieldbus deliver advantages over other protocols.

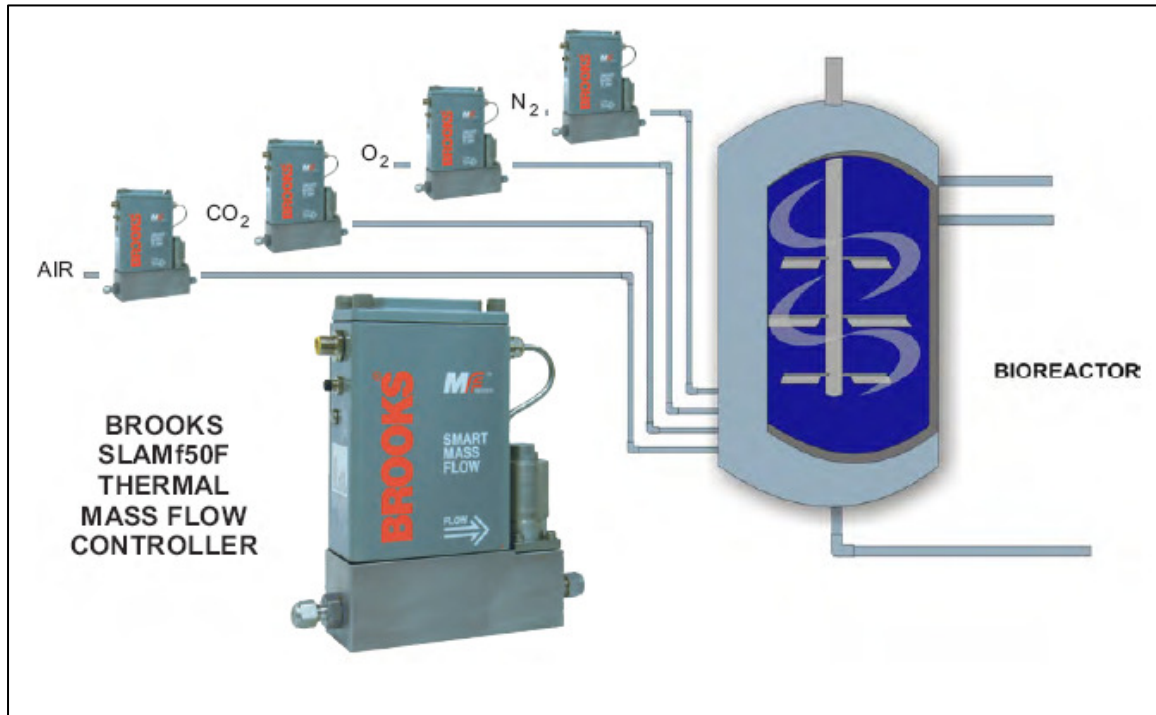
### 1) Customer application: Petrochemical Research



#### Application summary:

- Class 1, Div 2 area classification due to flammable gases in environment
- NEMA 4X / IP65 enclosure for outdoor usage necessary
- Accuracy, repeatability, long-term sensor drift are major concerns
- FOUNDATION fieldbus selected for thermal mass flow because many other components in facility are already FOUNDATION fieldbus

## 2) Customer application: Open frame bioreactor



### Application summary:

- Weatherproof housing is a must for wash-down environment
- Repeatability, response time, and accuracy are vital
- Turndown can lead to big cost savings due to needing fewer devices for application
- FOUNDATION fieldbus preferred to take full advantage of diagnostics

### Conclusion

FOUNDATION fieldbus is an open, all digital two-way communications technology for plant instrumentation. Because of its structure FOUNDATION fieldbus is extremely stable and the best technology for utilizing advanced diagnostics. Due to all its advantages FOUNDATION fieldbus is gaining worldwide acceptance. A recent study conducted by the ARC Advisory Group indicated that 80% of automation end users, system integrators and OEMs have implemented, or plan to implement, fieldbus technology in the process and hybrid industries.

In the past, there was never a FOUNDATION fieldbus option available for thermal mass flow controllers. Brooks Instrument has introduced the first thermal mass flow controller with the FOUNDATION fieldbus protocol. This implementation marries the benefits of Brooks' superior thermal mass flow devices with the advantages inherent in the FOUNDATION fieldbus protocol.