Summary

Foxboro’s latest I/A Series System release for FOUNDATION Fieldbus has added CIF support capabilities and is in 100% compliance to all mandatory features, including several desirable optional features.

Business Value

Foxboro’s market-leading InFusion I/A Series for FOUNDATION Fieldbus provides a high availability platform solution with superior device management and FOUNDATION Fieldbus control in the field, making it easier to engineer, commission, and startup a plant in a fraction of the time.

INTRODUCTION

Foxboro’s latest I/A Series® System release for FOUNDATION™ Fieldbus has added Control in the Field (CIF) support capabilities. In August 2009, the I/A Series system passed the FOUNDATION’s Version 2.0 Host Interoperability System Test with 100% compliance to all mandatory features, including compliance to several desirable optional features.

While other companies have previously introduced offerings, Invensys has had the luxury of working with a number of their major clients, including Shell and Saudi Aramco, to learn firsthand what those clients’ offerings lacked.

Distinguishing features of this new release includes:

• A highly automated process for downloading database and commissioning devices that gives the fastest commissioning in the industry
• An expert system to automatically create foolproof and accurate fieldbus link schedules
• The most extensive and flexible approach to creating templates for the application specific usage of all blocks within the device
• A unique approach to caching all standard fieldbus parameters within the DCS for rapid response in calling up and interacting with blocks within the devices
• Continued extensions to Invensys’ open and innovative Field Device Manager

KEY FEATURES OF THE INVENSYS CONTROL IN THE FIELD SOLUTION

Invensys’ FOUNDATION Fieldbus solution was introduced in three major steps:

1. High Availability platform solution – Best in Class fault tolerant platform to maximize availability and ensure easy setup and configuration.

2. Superior Device Management – Field Device Manager that was the first to innovatively combined Enhanced Device Description and FDT Device Type Manager technologies. This not only provides a common environment for configuring, commissioning and maintaining any device from any vendor, it allows users to customize the device management user interface screens linked to traditional device descriptions, use the interface screens created by the device manufacturer through enhanced descriptions, and use the DTM user interface created by the device manufacturer for in-depth device diagnostics.

3. FOUNDATION Fieldbus Control in the Field (FF CIF) - 100% compliance to the mandatory aspects of the standard
In addition to complying with the FF Control in the Field standard, Invensys has gone above and beyond to incorporate improvements that make it easier to engineer, commission, and startup a plant using FF technology, and in a fraction of the time.

Some examples of our achievements:

**Enhanced Block Support**

While the FF specification defines a set of standard parameters for block types common to process control, device vendors are free to add their own custom parameters to the standard FF blocks, adding custom features related to bump-less initialization and mode switching, or adding new block types with custom profiles.

Invensys’ solution extends block support to include not only the FOUNDATION Fieldbus standard blocks and parameters, but also custom parameters and custom block types provided by device vendors.

**Faster Response to Operator Changes**

Operators require instantaneous responsiveness when interacting with all function blocks, no matter where they are located.

FOUNDATION Fieldbus Control in the Field places the function blocks directly in the field devices. Operator actions must now pass through additional layers of infrastructure, resulting in the potential for slow operator responsiveness.

To provide the fastest possible operator responsiveness, dynamic variables are continuously cached in the control processor. When a user opens a graphic or faceplate display, the dynamic data from the device is immediately available to the operator.

**Templates to Dramatically Reduce Engineering Time**

The use of templates allows users to configure control loops once and replicate them many times, drastically reducing the overall engineering effort. In the event that changes are required to the master templates, these changes are automatically replicated to all instances. Templates provide a consistency and standardization across the plant and reduce the potential for errors in configuration. Templates can be very generic or application specific, with five levels of nesting possible.

**Easy FOUNDATION Fieldbus Scheduling**

When the loop is constructed, the application engineer is given control over the sequence of execution of each block.

Application engineers no longer need to be experts in the field, as InFusion’s Engineering Environment fully understands the details of H1 link schedules. The user simply sets the loop in the right execution order, and the InFusion Engineering Environment internal algorithm automatically optimizes the execution on the H1 segment for the best performance. Re-sequencing the order of block execution is easily done by touching each block in the sequence of execution desired.

**Backup Link Active Scheduling (LAS) Made Easy**

While the FBM serves as the primary scheduler of the segment, the user may assign one or several devices to serve as backup active schedulers in the event both sides of a fault tolerant pair of FBMs have failed.
Fastest at Device Commissioning

Device setup wizards enable the automated setup and configuration of the field devices assigning tags, addresses and system management parameters. Deployment of the control strategies is automatic and in a large parallel fashion, whether control resides in the Control Processor or field devices.

With the device ready to go, the user places the device in an ‘active’ controlling state, which automatically activates the control scheme in the device.

The time associated with Device Commissioning was reported to Invensys as the single biggest issue to resolve.

KEY POINTS TO CONSIDER FOR CONTROL LOCATION

1) Ways to Maximize Loop Performance
   The single most significant advantage of placing the PID control in the field device are delays or lags in moving the output of the AI block to the PID block and moving the PID block output to the AO block are minimized. Therefore, many customers place flow and pressure loops requiring fast response times in the field.
   
   Macronycle periods can be reduced when placing the PID in the field, which is due to a reduction in the number of variables published. For example, if a PID and AO block are in the same device it is not necessary to publish the output of the PID block externally over the H1 segment.

2) Ways to Maximize Operator Responsiveness
   The controllers of the I/A Series system cache the operator view data each time it is read from the field device. This gives the system superior responsiveness to graphic or faceplate call up speed as well as operator manipulation of the blocks within the field devices. Views of both dynamic and static data are cached.

3) How to Minimize Loop Downtime / Maximize Loop Uptime
   With high system fault tolerance through redundancy, the major cause of loop downtime is a failure of any non-redundant elements (such as the valve positioner, transmitter, device coupler or field barrier). System reliability is extremely high, with human error more likely a cause of failure than system failure. Invensys contends that no appreciable reliability is to be gained from Foundation Control in the Field over DCS redundancy.

4) How to Reduce System Cost
   Compared to control in the host, control in the field can be accomplished with fewer published variables on the H1 segment. On average, more devices may be used per segment and the project can be implemented with fewer segments, reducing the number of cabinets, FF power supplies and FF interface cards.
   
   An even larger increase in average devices per segment, whether control is in the host or in the field, can be achieved by setting macronycles at values as long as the control will tolerate. The impact is almost in direct proportion. For example, the number of segments required when using a 1-second macronycle is nearly half that when using a 0.5-second macronycle.
   
   System costs can also be reduced through optimizing the use of the H1 bandwidth, using speed only where necessary. When using multipoint measurement devices, such as eight point temperature transmitters, the I/A Series system can save bus traffic by utilizing client server views to read all 8 points in a single read transaction. The updated speed may be configured for each MAI block to periods slower than the macronycle. The measurements can then be split into individual analog points with unique tags inside our controllers.
5) How to Ease Factory Acceptance Testing
Since device vendors are free to design their own algorithms, and add custom parameters, training is required for the control engineers to ensure they understand the unique characteristics of the blocks in each make and model of device used. Invensys simplifies the task of simulating the behavior of those blocks. SimSci-Esscor's FSIM Plus™ software allows the control engineer to build control strategies and simulate how they will behave in the DCS system. Simulation is included for popular fieldbus function blocks allowing simulation to check out the control loop design for both control in the host and control in the field applications. The DCS is also capable of simulating popular field device function blocks. Operator graphics behavior and historian connections can be validated even during the Factory Acceptance Test.

6) Control Loop Complexity and Sophistication
Compared to the full set of DCS function blocks, the fieldbus block set offered by most device vendors is extremely limited. Most parameters of fieldbus blocks are contained, and typically have only 1 or 2 inputs to each function block, and 1 output. In contrast, I/A Series function blocks allow other blocks to be linked as sources feeds so that output limits, block-operating modes, tuning constants, set point limits and more can be changed through sophisticated control loop designs. The bottom line, very sophisticated loops can be constructed within the I/A Series system, while on any system Control in the Field loops are constrained to basic control loop designs.

SUMMARY
The robust I/A Series fieldbus system excels at automating plants having demanding requirements for uptime, system speed, size and longevity. The largest refinery in the world using fieldbus (Reliance) is running on an I/A Series system. With this latest release, the Invensys system becomes one of the leading fieldbus systems on the market for any vertical industry market looking for a system that makes using fieldbus easy, provides faster plant startups and device commissioning, and provides highly open support to manage any device from any vendor.