Fieldbus Foundation
FFIC + ISA Fieldbus Foundation Conference-2010

Date : 6th February, 2010 (Saturday)
Time : from 09:00 am to 05:30 pm.
Venue : IIT Convention Centre
        Gajendra Circle, IIT Campus,
        Adayar, Chennai.

VINU THOMAS
Implementing Foundation Fieldbus Without DCS/PLC
Agenda

- Technology Advances
- FF Architecture Without DCS/PLC
- Key Differentiators
- Application Examples
- Summary
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The Path to Value-Automation Trend

- Centralized DCS Architecture
- Centralized PLC
- Digital Plant Architecture with DCS
- Digital Plant Architecture without DCS

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It is an open, all-digital, two-way communication network (LAN - Local Area Network) for “intelligent” field devices in the process industries.

- It enables several field devices to be connected to the same pair of wires.
- It replaces traditional point-to-point wiring between traditional “dumb” field devices and controllers.
Rethinking Process Control

Using Foundation Fieldbus:

- Divide no longer exists between devices and control system
- Devices and control system engineered together
- Notion of input/output channels disappeared
Agenda

→ Technology Advances
→ **FF Architecture Without DCS/PLC**
→ Key Differentiators
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# The Advanced Technology – Shifting the dividing Line

## Traditional PC-PLC based System TO Fieldbus based Solution

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FF Based System Architecture & Features
Agenda

→ Technology Advances
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Key Differentiators

- Simple & Quick Implementation
- Tighter Process Control
- Magic Of Advance Function Blocks
Key Differentiators

Simple & Quick Implementation
- No AI, AO, DI, DO Cards
- No CPU
- No Marshalling
- Few Terminations
- No configuration software
Key Differentiators

Tighter Process Control

- FF devices offer fastest Function Block execution time.
- The reason for fast execution is:
  - Superior processing power
  - Abundant memory (RAM and Non Volatile)
  - ASICs
- Shorter macro cycle as Function Blocks in different devices can be executed in parallel
- Faster sampling means better access to real process information, much tighter process control reducing variability without host intervention
Control in the field provides loop integrity, increasing control loop availability and reliability.

Control in the field provides better performance than control in the DCS, reducing variability.

Comparison of Control in DeltaV and 3051S Fieldbus Transmitter
(+/- 5% load disturbances at 0.01 Hz)
Less Deviation from Setpoint

Comparison of Control in DCS and in a 3051S Fieldbus Transmitter
(+/- 5% Load Disturbances at 0.01 Hz)

SP: 98.75%
SP: 99.40%

Flow Rate (GPM)

Time (sec)
When to run control in the field

Field devices support the function blocks required for the control strategy.

All the devices are in the same Fieldbus segment (bridges will reduce or eliminate this requirement)

Location of function blocks in the different field devices depend on the control strategy, block execution time and number of messages on the bus.

- Example of strategic location: an input selector should not be located in one of the devices whose measurement is part of the selection.
- When there are several possible locations for a function block, the device with the fastest execution time should be considered.
- Communication among devices should be minimized, in order to reduce macro cycle and to increase bus throughput.
FF Function Blocks Available In FF Devices

- Discrete Input
- Discrete Output
- Analog input
- Analog Output
- Input Selector
- PID Controller
- Manual Loader
- Ratio Block
- Arithmetic
- Integrator
- Signal Characterizer
Agenda

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- **Application Examples**
- Summary
Arithmetic Block has Predefined Algorithms for easy configuration

Flow Compensation Linear
- Mass Flow for Gas

Flow Compensation Square Root
- Mass Flow for Gas

Flow Compensation Approx.
- Mass Flow for Liquid

BTU Flow
- Calculate heat content

HTG compensate Level
- Level Calculation

Multiply and Divide
- Ratio Control, Other Calculations

Summation
- Adding a number of Variables
- Adding flows, temperatures

Average
- Average temperature, pressure for multiple boiler control

4th order polynomial
- Density calculation
- Moisture calculation
Use the Compensated DP Flow Calc in the ARTH Block For Much tighter Control.

Comp Flow Information to PID

FT-100

PT-100

TT-100

Increase Accuracy
Easy Configuration
Execution time = 20 ms
Measure Tank Level without Capillary Systems by using the ARTH Block

Increased Accuracy
No Capillary
Less Maintenance
Use the Input Selector Block to Average or Select Stacked Transmitters

First Good
Maximum Value
Minimum Value
Average
Execution time = 20ms
Use the SGCR to correct for Changing Flow Coefficients

Increased Accuracy
Execution time = 20 ms
Use the Integrator Block to Totalize Flows and Ratio Control

Totalizer
Range 0-SP or SP-0
Set Point Pre Trip
Set Point Trip
Integrate Two Flows

Flow 1
Flow 2

Flow 1*(Mix Ratio) - Flow 2 = 0

Maintain Mix Quality
Execution Time = 20 ms
Use the Integrator Block to Totalize Flows and trip a Discrete Output

Use Integrator Block output to Fine Tune Loading
Changing Paradigm – Implementing FF Solutions Without DCS/PLC

- It is possible to implement FF Solutions for small applications without DCS/PLC

- These Solutions are simple, quick to implement and cost effective

- FF Field Devices now offer Advance Function Blocks which can be used to implement innovative process control solutions