Name – Sandeep Redkar
Title – Technical Consultant
Date – 23rd November 2012
Agenda

- DCS System Readiness
- System Architecture
- System Engineering and Diagnostics
- System Commissioning
- System Maintenance
Host Profile Registration

Class 61 – Integrated Host

Class 62 – Visitor Host

Class 63/64 – Bench Host

Operations

Engineering

Maintenance

Note: Illustrations are examples only.
Host Profile Specification - Key Features

Defines five profiles
- Integrated Host
- Bench Host (for use with on-process devices)
- Bench Host (for use with non-commissioned devices)
- Visitor Host
- FOUNDATION for Safety Instrumented Functions Integrated Host

For each profile, features are marked
- (M)andatory - required for system interoperability
- (O)ptional - useful, but not essential
- (P)rohibited - to prevent interoperability issues

Staged Implementation
- Two stage profile (6Xa, 6Xb) provides time for systems to become compliant
<table>
<thead>
<tr>
<th>Feature</th>
<th>Class 61 Integrated Host</th>
<th>Class 62 Visitor Host (H1)</th>
<th>Class 63 Bench Host (H1) Non-Commissioned Device</th>
<th>Class 64 Bench Host (H1) Commissioned Off-Line Device</th>
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Non-Redundant Architecture
Redundant Architecture

HOST SYSTEM

REDUNDANT PROCESS CONTROLLER

HSE

REDUNDANT LINKING DEVICE

REDUNDANT POWER CONDITIONERS

H1

INSTRUMENTS

H1
Foundation Fieldbus is shifting the process control strategy paradigm.

Traditional methods had the loop closure in the process controller.

Foundation Fieldbus enables you to distribute the loop closure from the process controller to the field instrumentation.
Foundation Fieldbus is much more than a Device Network… it can provide DCS type control functionality

- Single Loop Control
- Feedforward Control
- Cascade Control
- Override Control
- Ratio Control
- Manual Loader
- Lead/Lag Compensation
- Signal Characterization
- Timing and Integration
- Advanced Alarming
- Motor Control
- Math
- Supervisory Data Acquisition
- Sensor bus interfacing
- Coordinated Drives
- Batch Control

Example Applications

Basic Function Blocks
- PID Control, Ratio Control
- Manual Loader, PD Control
- Ratio, Control Selector
- Discrete Input/Output
- Analog Input/Output
- Bias/Gain

Advanced Function Blocks
- Analog Alarm, Arithmetic
- Deadtime, Device Control
- Input Selector, Integrator
- Setpoint Ramp Generator
- Splitter Lead/Lag, Timer
- Signal Characterizer

Flexible Function Blocks
- 8 Channel Analog Input/Output
- 8 Channel Discrete Input/Output
- Application Specific (IEC 61131-3)

Basic and Advanced Process Control Applications

Batch/Discrete/Hybrid/Remote I/O/PLC Applications

H1/HSE
Foundation Fieldbus Synchronizes the Data flow between the Function Blocks

**Function Block Scheduling**
- Scheduled from fraction of 1 millisecond upwards
  [System Management]
- Synchronized Scheduling Between Devices
  [Link Active Schedule]
- Synchronization is Optional

**Trend Support**
- 16 Samples of any Variable
- Floats, Discrete, Bitstrings
- Dynamic Assignment
- Independent Save Period
- Includes a “status” byte per sample
- Automatic Publication
Values are published after the block executes as shown above. No pub is needed for values transferred within a device (assume zero time).
An Input value from one device to another represents one publication.
An Output from one device to another device represents TWO (OUT plus hidden BK_CAL).
To manage the data communications Foundation Fieldbus uses a Link Active Scheduler (LAS)

- “Network Administrator”
  - Manages all the H1 communication and syncs devices
  - “Knows” all devices manages adds / deletions
  - Transmits the compel data message
  - Controller, Linking Device or Instrument can be the LAS
Managing Your FOUNDATION Fieldbus Project

Parts of a Foundation Fieldbus Network

Fieldbus is a bus.

Devices sit in parallel between the wires.

One pair of wires carry all the data from all the devices on that bus.

Five components to an FF network

- 24 Vdc Bulk power supply
- Fieldbus power conditioner
- Two terminators
- Fieldbus cabling
- Smart Instruments
A *network* is a complete fieldbus with devices

- A Foundation Fieldbus network is sometimes called “H1 link” or “bus” or “segment”.

**Fieldbus Device Types** defined by spec:

- **Host** - server that configures the network and function blocks
- **Bridge** - connects two or more networks
- **Basic** - not capable of scheduling a network
- **Link Master** - capable of scheduling (controlling communications) on a network
- **LAS** - Link Active Scheduler, the LM that is actually scheduling a network
System Engineering and Diagnostics
Linking Device Configuration

- Topology
- Linking Device Node Address
- Max Scan Address
- Macro Cycle
  - Manual
  - Automatic
- Download
On-line Device Configuration

Config Tree

Live List

Visitor List
Field Device Configuration

- New Devices automatically shown in Live List
- Graphical User Interface
  - Blocks – Set Parameters
  - Connectors – VCRs
    - To/From Controller
    - To/From Other Field Devices
  - Wires – Link Block I/O & Connectors

![Device 1 Diagram]

![Device 2 Diagram]
Diagnostics

• Linking Device and Network Diagnostics
• Field Device Diagnostics
  • Process Variables
  • Status
  • Communication Statistics
  • H1 Diagnostics

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<td>Publish VCR Used</td>
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<td>Live Data</td>
<td>True</td>
<td>Subscribe VCR Used</td>
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Oscilloscope Trace

- Field device specific.
- Useful for determining noise, bad termination, etc.
- Zoom function.
- Transmission statistics, signal level, slew rate etc.
H1 Topologies

- Multiple Topologies including:
  - Simple
  - Split Trunk
  - Dual Bus
  - Ring Bus
  - Multi-Master
Protection

- Protect bus from field device or line faults.
- Including trunk open- and short-circuit
- Re-routing of data and power

• Short-circuit
• Open-circuit

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Redundant Masters

- Two masters on same H1 segment
- Token passing on H1 Layer
- Single or Dual Media
System Commissioning
Managing Your FOUNDATION Fieldbus Project
Power and Grounding

Symptoms of **Power and Grounding** problems are:

1. **Erratic behavior**
2. **Devices falling off the Live list**
3. **Devices not showing up in the live list**
4. **The Linking Device gets Watch Dog time outs.**
5. **Downloads fail**
6. **The Linking Device log shows Frame Errors**

**Almost all FF problems can be traced back to power and grounding problems.**
SITE INSTALLATION GUIDELINES
Commissioning the network

Procedures for commissioning of a FOUNDATION fieldbus system include:

• Cable continuity, grounding, and insulation tests.
• Field device (physical installation).
• Device coupler
• Fieldbus power supply
• Field device connection and signal analysis.
• Device download/software checks (data reconciliation).
• Optional bus monitor capture.
• Optional scope waveform capture.
SITE INSTALLATION GUIDELINES

Verifying the network

A5.1 Fieldbus Segment Commissioning Form

Table A5.1. FOUNDATION fieldbus segment commissioning form for non-isolated coupler or trunks only on segments with isolated couplers (for spurs on segments with isolated couplers repeat test for each spur).

Company: 
Location: 
Unit: 
Segment No.: 
Date: 

**Step 1:** This testing is performed before the segment is plugged into the power conditioner.

| (+) to (-)  | Expected > 50K ohm | Actual = | 
| (+) to shield | Expected > 20M ohm | Actual = | 
| (-) to shield | Expected > 20M ohm | Actual = | 
| (+) to ground | Expected > 20M ohm | Actual = | 
| shield to ground | Expected > 20M ohm | Actual = | 

**Step 2:** Plug the segment into the power conditioner.

Shield to ground | Expected < 1 ohm | Actual = |

**Step 3:** Clip a FBT-6 or P&F tester onto the segment and capture the segment diagnostics file.

Segment Diagnostics File: 
Date: 

Technician: 

**Step 4:** Optionally capture a segment trace file with an oscilloscope.

Segment Trace File: 
Date: 

Technician: 

Revision 3.1 - 126 - March 2010
Managing Your FOUNDATION Fieldbus Project
Things to look for – Troubleshooting

What to do when:

- Works on the bench but not on the network
- Open Trunk
- Devices fall off the network
- Handheld works at one end of the network but not the other
- Network suddenly stops

Get the right test equipment
Questions?