

Project Execution Best Practices

Tips & Tricks based on lessons learnt



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Temporary vs. Permanent Communication

Ad-hoc Communication:

- Handheld field communicators used only a few minutes per year
- Just a few transactions
- If communication fails, we wiggle the wires and try again.



Permanent Comms:

- DCS and intelligent device management communication is "always on"
- Must work around the clock
- The expectation is that it shall not fail.



Lessons Learnt from the Past

- Some first generation system, devices, and accessories were unreliable implementations of the technology
- Some systems lacked intelligent device management software
- Difficult user interface
- Discrete device not available (FF small portion)
- Limited Exi power
- Lack of training led to design and installation mistakes
- Lack of test tools
- Use of 4-20 mA practices
- Back then people were not familiar with software

Training

New Competencies



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Training for Successful Outcome

- Training is a critical success factor for Foundation fieldbus projects
- PMC, consultant/EPC, and sub-contractors may have not undergone extensive Foundation fieldbus training
 - Needed for contractors do a good job with fieldbus
- Standard training must be customized to the unique design and requirements of each project
 - Such as the design and components used
- Complement to existing DCS and intelligent device management software courses
 - Task-oriented, project-specific



Fieldbus Training



- Fieldbus is different from 4-20 mA and on/off hardwiring
- New competencies required
- For all persons involved
- At every stage of the project
- Classroom and hands-on
 - Real test tools and equipment
- Customized to project hardware and procedures

Project-Specific, Task-Oriented, Role-Based Training

- Design engineers
 - Wiring rules
 - Function blocks
 - Fieldbus validation software
- Installation technicians
 - Lay, cut, strip, connect cable
 - Check
- Device commissioning technicians
 - Check bus
 - Connect device
- Maintenance technicians
 - Calibration trim, zeroing
 - Add, remove, replace device
 - Configuration, re-range
 - Device diagnostics
- Troubleshooting team
 - Device communication
 - Loop blocks



Insist PMC, consultant, EPC, and sub-contractor provide experienced personnel

KoM

Kick-off Meeting and Project Handover



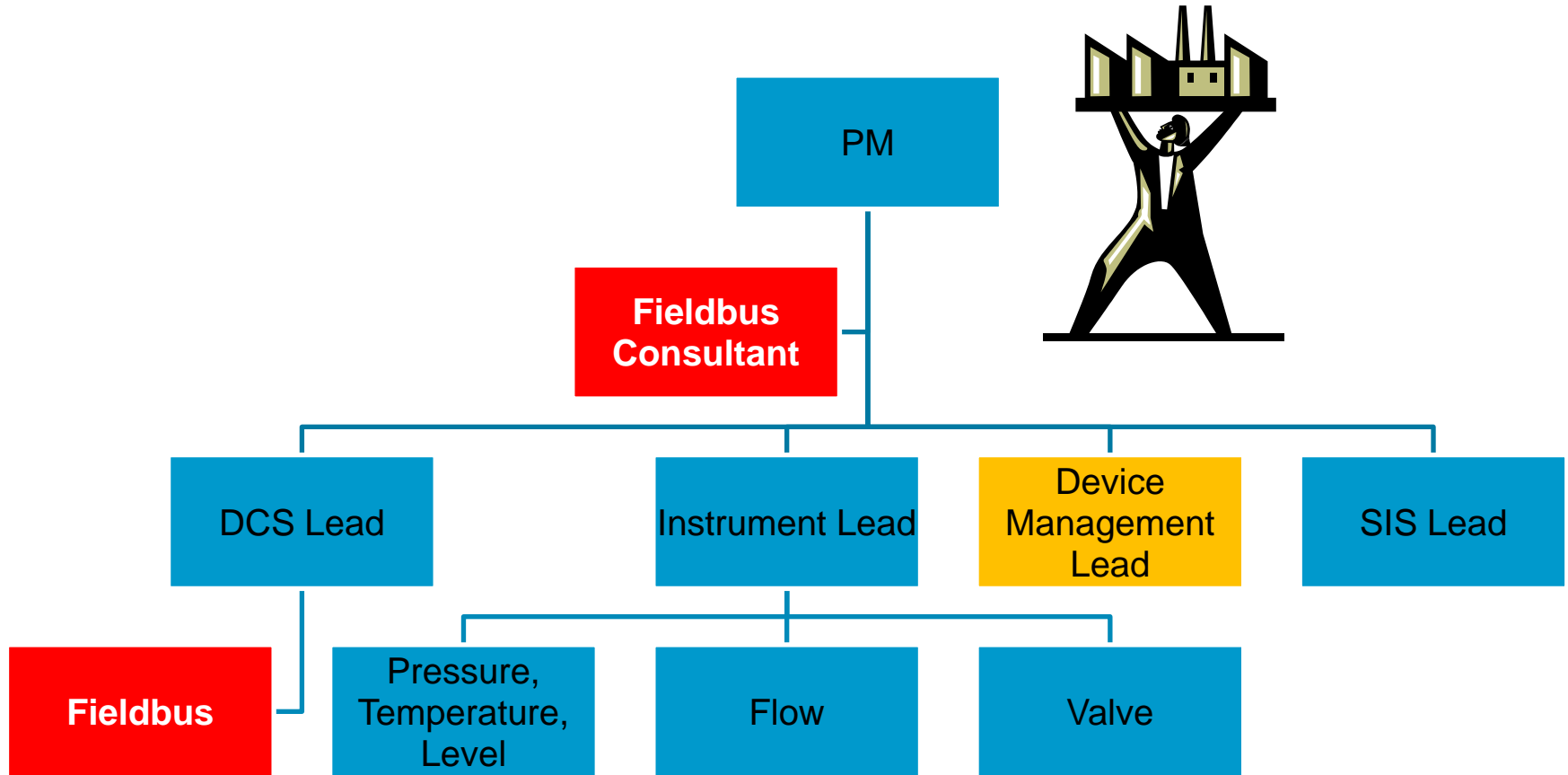
Kick-off Meeting

Reconfirm Project Assumptions

- Are multi-input transmitters fully utilized
 - Temperature profiling
- Have unnecessary discrete-I/O been eliminated
 - Positioner already includes feedback
 - Pressure, temperature, flow, and level switches replaced by transmitters
 - Electric actuators (MOV) can use Fieldbus
 - Variable speed drives and starters can use Profibus
- Is advanced diagnostics used
- Are remote indicators utilized



Project Team Organization Chart



- Insist on personnel experienced with fieldbus and intelligent device management software

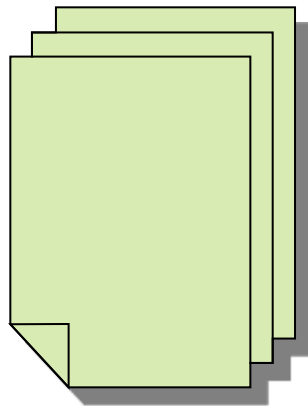
Project MIV Instrument Lead

- Manage Multiple Device Suppliers

- Only devices the DCS is approved for are used, or get DCS integration testing done
- Manage device revision so that the DD for all devices is loaded into intelligent device management software, DCS, and handheld field communicator
- Devices are purchased with tag pre-assigned
- Valve "fault-state" is defined for positioners
- Function block and diagnostics options
- Training on specifics for commissioning the device
- Training on how to use diagnostics in the device in troubleshooting
- Factory valve signatures are provided
- Compatible hazardous area approvals
- Samples are available for FAT interoperability test
- FAT interoperability testing is done

FDS

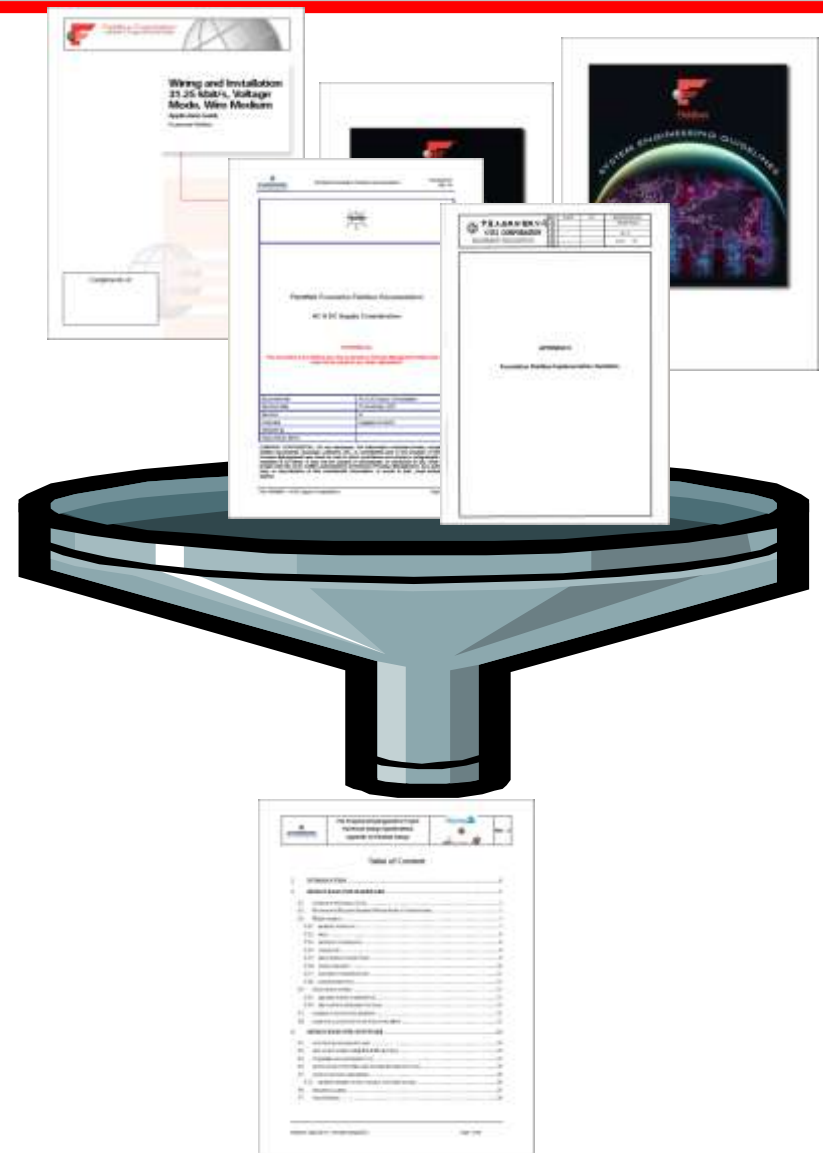
Fieldbus Functional Design Specification



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Fieldbus Functional Design Specification (FDS)

- Generated by project team
- Content:
 - Hazardous area concept
 - Components
 - Wiring
 - Design considerations
 - Control strategy
 - Field Diagnostic Alerts
 - Etc.



FDS Fieldbus Appendix Content

- Discuss and Agree

- Environmental specification
- Area classification
- Protection concept
- FF component selection
 - Field devices
 - Cables
 - Coupler
 - Power supply
- Wiring design
 - Topology
 - Grounding/shielding
- Design
 - Availability (redundancy)
 - Device allocation (grouping)
 - Response time
 - Spare capacity
 - Design rules
- Application configuration (control strategy)
 - Function block assignments (control allocation)
 - Bus macrocycle period
 - Spare capacity
 - Block tag convention
- Diagnostics
 - Field Diagnostics alerts

Physical Design

Bus hardware



Device Selection

- Interoperability Approved Devices

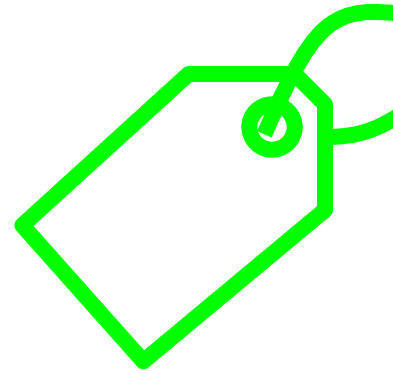
- FF registered
- DCS tested against third-party devices at DCS interoperability lab
 - Make sure all device support files are available



Physical Design Highlight: Tagging

- Devices shall be ordered with tag pre-assigned in SOFTWARE not just the stainless steel tag
 - If not an MIV project, the consultant/EPC must order it

Pre-tagging is important for speedy device commissioning



Cable and Component Selection

- Approved Components

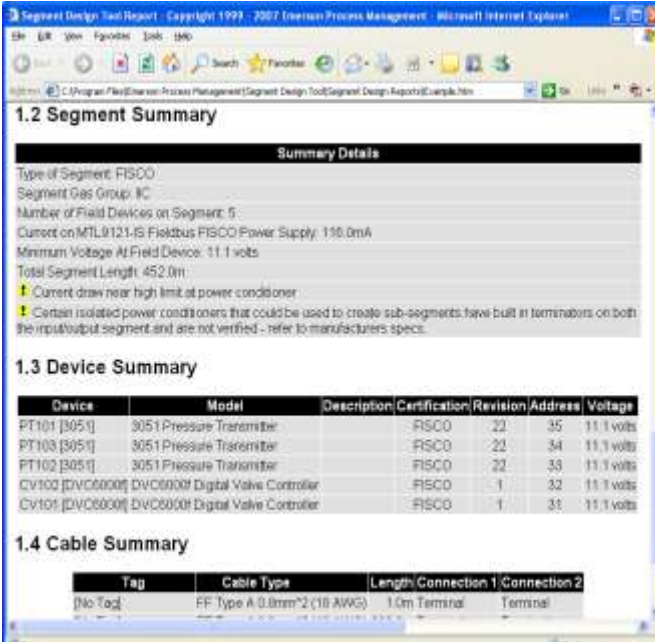
- FF registered
 - Fieldbus Cable
 - Fieldbus Power Supplies
 - Fieldbus Couplers (wiring blocks), Barriers, & Miscellaneous
 - Fieldbus Terminators



Successful Implementation & Improved Operation

Physical Design Highlight: Segment Design Validation

- Review of consultant/EPC segment design ‘typicals’
 - Or segment specific; as the case may be
- Tips & Tricks
 - Device power consumption
 - Normal and firmware download
 - Spur short protection current
 - Not zero
 - Power to field communicator
 - Bus powered
 - Power to testers
 - Bus powered



The screenshot displays a web browser window titled "Segment Design Tool Report - Copyright 1999 - 2007 Invenio Process Management - Microsoft Internet Explorer". The address bar shows the file path: "C:\Program Files\Invenio Process Management\Segment Design Tool\Segment Design Reports\Example.htm".

1.2 Segment Summary

Summary Details

Type of Segment: FISCO
Segment Gas Group: IC
Number of Field Devices on Segment: 5
Current on MTL9121-IS Fieldbus FISCO Power Supply: 150.0mA
Minimum Voltage At Field Device: 11.1 volts
Total Segment Length: 452.0m
⚠ Current draw near high limit at power conditioner.
⚠ Certain isolated power conditioners that could be used to create sub-segments have built in terminators on both the input/output segment and are not verified - refer to manufacturer's specs.

1.3 Device Summary

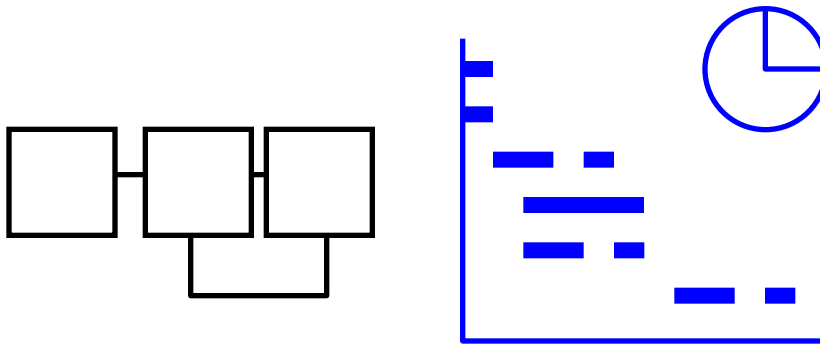
Device	Model	Description	Certification	Revision	Address	Voltage
PT101 [3051]	3051 Pressure Transmitter		FISCO	22	35	11.1 volts
PT103 [3051]	3051 Pressure Transmitter		FISCO	22	34	11.1 volts
PT102 [3051]	3051 Pressure Transmitter		FISCO	22	33	11.1 volts
CV100 [DVC6000]	DVC6000 Digital Valve Controller		FISCO	1	32	11.1 volts
CV101 [DVC6000]	DVC6000 Digital Valve Controller		FISCO	1	31	11.1 volts

1.4 Cable Summary

Tag	Cable Type	Length	Connection 1	Connection 2
[No Tag]	FF Type A 0.8mm ² (18 AWG)	1.0m	Terminal	Terminal

Control Design

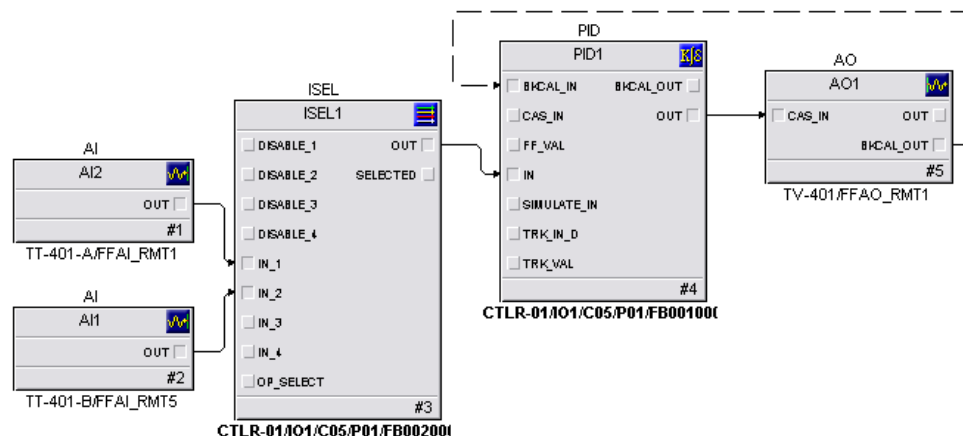
Bus and Function Blocks



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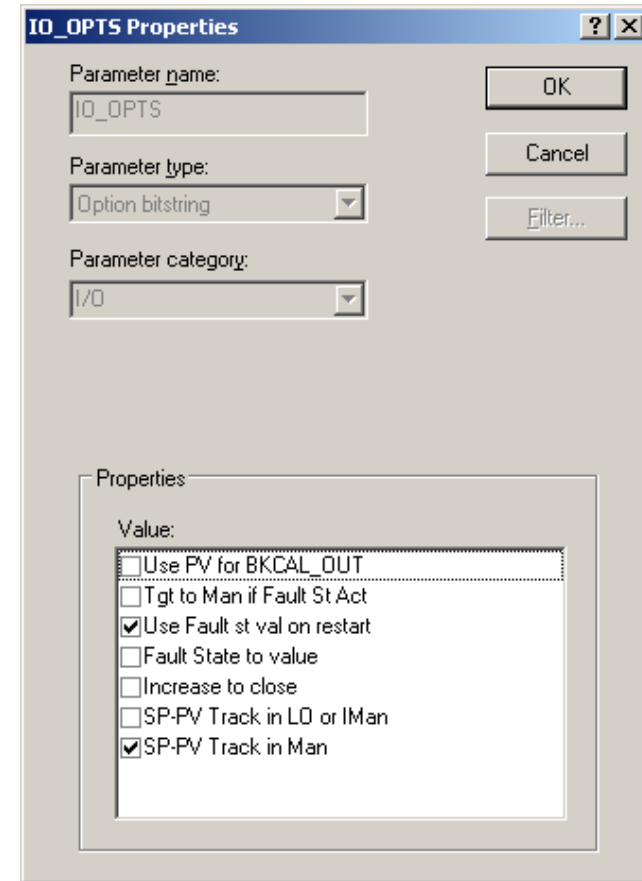
Control Design Highlight: Control Allocation - Loading

- Maximize Control-In-the-Field (CIF)
- Same loop devices ideally on the same bus (but is not a must)
- Tips & Tricks
 - Opt for devices with broad block availability
 - Opt for devices with fast block execution time



Control Design Highlight: Non-Safety-Related Interlocks: Fault-State

- Consultant/EPC to define valve action on loss of communication and sensor failure
 - CHAZOP
- Entered into function blocks at time of configuration:
 - Status options, IO-options (including fault-state), control options, etc.
 - In AI, PID, and AO etc.



Still need mechanical fail-safe and SIS as well!

Control Valves

Fail-Safe vs. Fault-State



Fail-Safe

- In control valve
- Mechanical (spring-return)
- Control valve goes to fail-safe on loss of air or bus power



Consultant/EPC to specify both in instrument specification sheet

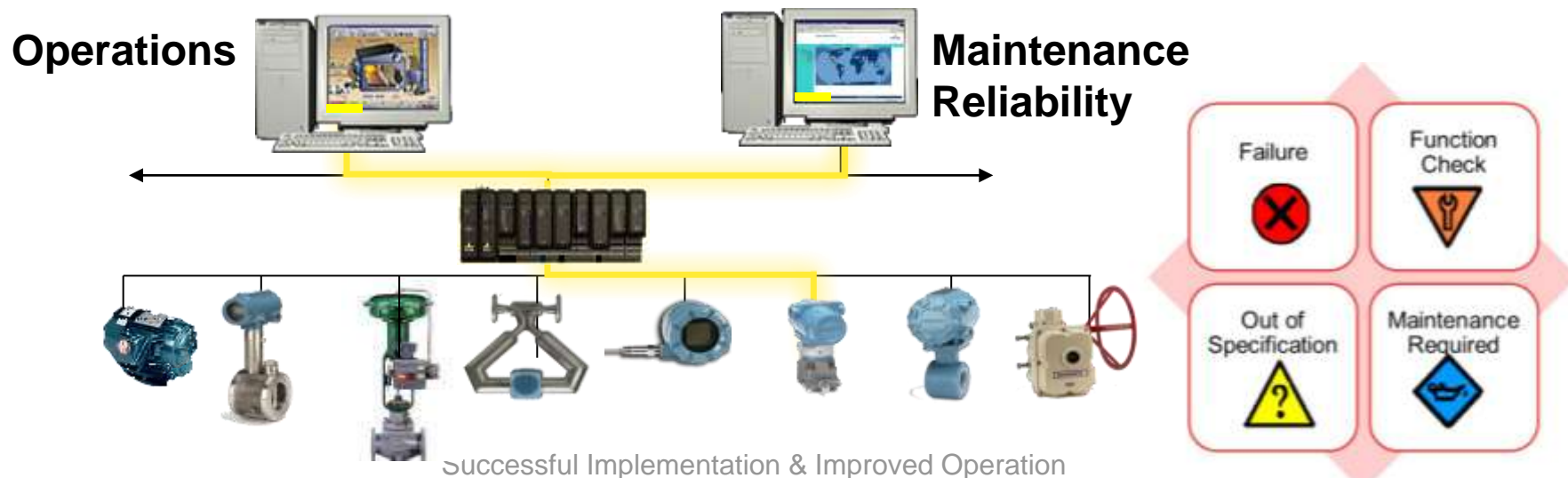
Fault-State

- AO function block
- Configured (from DCS)
- Control valve sent to fault-state on loss of communication or sensor failure etc.



Control Design Highlight: Planning Field Diagnostic Alerts

- Field Diagnostics alerts is a new capability
- This new capability has a new engineering task
- Consultant/EPC defines priorities and classification for devices
 - Enable or suppress
 - What affects operations and must be filtered through to operators



FAT

Interoperability testing and FAT



Agree on System FAT Test Plan

- Hardware inspection
 - Approved components
- H1 card port check
 - One device
- Fieldbus power redundancy check
- H1 card redundancy check
- Control strategy/logic check
- Graphics check
- Field Diagnostics alerts check
- Interoperability check
 - One device of each type
- Worst case fully loaded check



Device Revision Management

- Check DD Files at FAT

Protocol	Manufacturer	Model	Description	Device Revision	Remarks
HART	Brand-A	1234	Temperature Transmitter	3	SIS
HART	Brand-B	ABC	Valve Monitor	6	SIS
FF	Brand-C	5678	Gas Chromatograph	3	
FF	Brand-D	DEF	Electric Actuator (MOV)	2	
PROFIBUS-DP	Brand-E	9012	Variable Speed Drive (VSD)	2	MCC
FF	Brand-F	GHI	On/Off valve	1	
FF	Brand-G	3456	Multi-Input Temperature Transmitter	7	
FF	Brand-H	JKL	Radar Level Transmitter	1	Tank gauging system
FF	Brand-J	7890	Multi-Spot Temperature Transmitter	1	Tank gauging system
FF	Brand-K	MNO	Display	1	Tank gauging system

- Verify DD presence by connecting device

FAT Highlight: Fieldbus “Test Panel” for Full FAT



- Simulate fieldbus devices to test control loops and graphics
 - Faceplates
- Configuration checks
 - Scale/range, units, transfer function, channel
 - Fault-state
 - Alarming

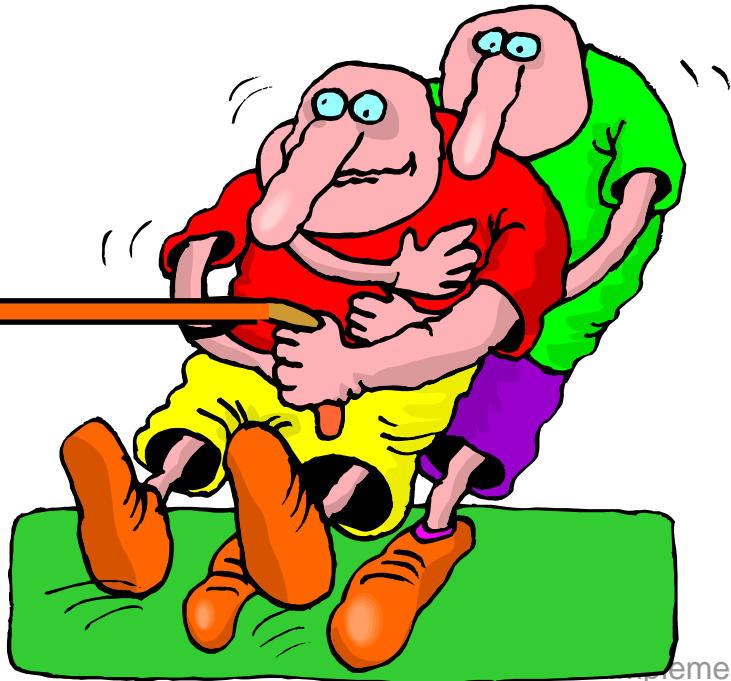
FAT Highlight: Interoperability Testing

- Test one of each device type
- Ensures communication and DD file are OK
- Test configuration download



Installation / Construction

Laying the fieldbus cable and field junction boxes



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Installation Highlight: Test Equipment

- Establish procedure and checklist
- Hands-on training for contractor
- Required test tools are made available in required quantity so as to not delay project
 - Fieldbus power and signal simulator
 - Fieldbus tester
 - Oscilloscope or ADM
 - R and C meter



Device Commissioning

Connecting the Fieldbus Devices



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Device Commissioning Highlight: Digital Way – Not Analog Way

- Transmitters are not calibrated (trim) at site
 - Transmitters are calibrated (trim) in the factory
 - Zeroing for mounting position done as usual
 - Level transmitters scaled to percentage as usual
- There is no five point 0-25-50-75-100 % test
 - (i.e. no 4-8-12-16-20 mA signal)
- If range has to be changed, it is only done from DCS, in a single place
 - From DCS it is downloaded to the transmitter



Device Commissioning Highlight: Test Equipment

- Establish procedure and checklist
- Hands-on training for contractor
- Required test tools are made available in required quantity so as to not delay project
 - Fieldbus tester
 - Oscilloscope or ADM
 - Handheld field communicator



Use Auto-Commissioning

- Purchase devices pre-tagged
- Just connect the device to the bus
- Fully automatic commissioning without touching the DCS software
 - Automatic address assignment
 - Automatic configuration download

DeltaV_System Properties

Object type: Database

System Name: DVPROPLUS_S

Zone name for this system: THISZONE

System ID: {4479e74d-6d64-43ab-b1e4-688f3679acdf}

Database Path: D:\DeltaV\DVDData\Databases\DeltaV_System\configdb.hdb

Company Name:

Enable Fieldbus Device Auto-commissioning

Device data is master

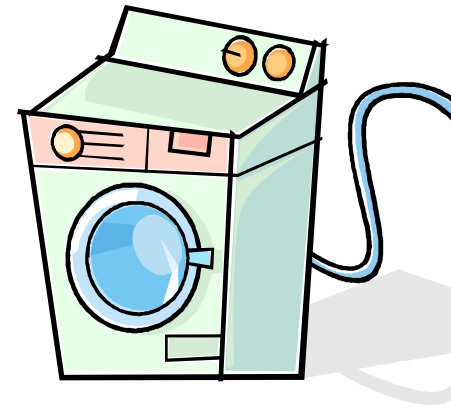
Enable Fieldbus Device Auto-replacement

Device data is master

Order devices with tag pre-assigned

Use of Express and Batch Download

- If loops are not running, use express download
 - Utilizes full bandwidth
- Use batch download
 - Multiple ports downloaded unattended



Express Fieldbus Download

Express Download temporarily disables scheduled communications on the fieldbus and is intended only for plants that are starting up and commissioning fieldbus segments. It is not intended for use with a fieldbus segment currently controlling the process.

Expand the nodes and click the checkbox next to the objects you want to download.

Express Download (Suspends Control)
 Accept all system-selected items for download

Filtering

Exclude decommissioned devices
 Exclude ports and devices which do not need to be downloaded

Path	Type	Needs Downloading	Commissioned
Control Network	Control Network		
CTRL1	Controller		
I/O	I/O		
C01	Fieldbus H1 Card, 2 Ports, Redundant		
P01	Fieldbus Port	No	
C01P120-3242R01	Fieldbus Device	No	Yes
C01P121-3242R01	Fieldbus Device	No	Yes
C01P122-3242R01	Fieldbus Device	No	Yes
C01P123-3242R01	Fieldbus Device	No	Yes
C01P124-3242R01	Fieldbus Device	No	Yes
C01P125-3242R01	Fieldbus Device	No	Yes
C01P126-3242R01	Fieldbus Device	No	Yes
C01P127-3242R01	Fieldbus Device	No	Yes
C01P128-3242R01	Fieldbus Device	No	Yes
C01P133-FFVCTR02	Fieldbus Device	No	Yes
C01P135-DPLOTR01	Fieldbus Device	No	Yes
P02	Fieldbus Port	No	
C03	Fieldbus H1 Card, 2 Ports, Redundant		
C05	Fieldbus H1 Card, 2 Ports, Redundant		
C07	Fieldbus H1 Card, 2 Ports, Redundant		
C09	Fieldbus H1 Card, 2 Ports, Redundant		

Buttons: Download, Cancel, Print, Expand All, Check All, Uncheck All

Operational: Test Equipment

- What test tools will be available on site for daily troubleshooting after project team is disbanded?
 - Fieldbus tester
 - Oscilloscope or ADM
 - Handheld field communicator
 - Fieldbus calibrator



Summary

- Evaluate system and device ease of use
- Task-oriented training
- Specialized tools
- Digital procedures, not analog
- Maximize FF use
- Fieldbus experience
- MIV lead
- FDS
- Pre-tag devices
- Device interoperability certification
- Maximize CIF
- Fast devices with broad block library
- Engineer Field Diagnostics
- FAT test plan
- Manage DD files
- Full FAT with interoperability test
- Installation & commissioning procedures and check lists
- Auto-commissioning
- Express and batch download