



Foundation™ Fieldbus IEC-61511

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Introduction



- Process Industry Utilisation of IEC61511
- FF Successfully Deployed on BPCS
 - Fast Becoming the Preferred Instrumentation Bus
 - Detailed Design Guides and Specifications
 - Large Selection of HOST and Field Equipment
- FF-SIS in Development Since 2002
 - SROT Working on Formal Release of Specification
 - Manufacturers Developing Host Equipment
 - Control System and Safety Engineers to Utilise Technology in Near Future





FF Milestones



- 1994 – WorldFIP and ISP merge
- 1995 – IRDS and DPS produced
- 1996 – Beta FF Plant Test Completed
- 1998 – ITK and FF checkmark
- 2000 – Flexible Function Block
- 2001&3 – Major Updates to Specifications
- 2003 TÜV Approve FF-SIS Concept
- 200? Formal Release of FF-SIS Standard





FF Technology

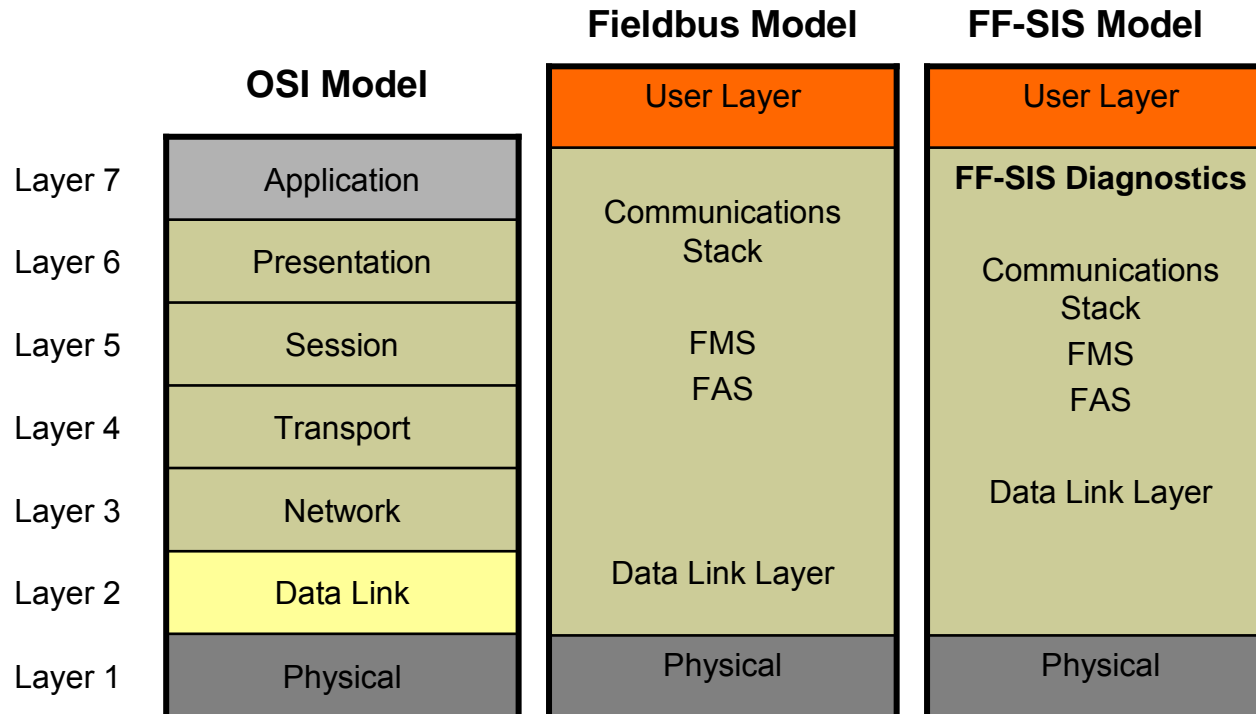


- Physical Layer Implementation of IEC61158
- Communication Stack IEC61158
- Device Description IEC61804
- Manchester-encoded Bus Powered (MBP) System
- 31.25kbps, 9-32 VDC Bus
- No Physical Layer Redundancy





Communication Models





FF-SIS



- IEC61508 SIL 1, 2 and 3
- Safety Protocol Layers to address Communication Errors/Network Faults. Sits at top of the Communication Stack.
 - Error Repetitions
 - Data Corruption
 - Data Insertion/Extension
 - Message Masquerading
- Function Block Diagnostics
 - Specific SIS Blocks AI, AO, DI, DO
- Change Control Mechanism/Security Locks





Safety Buses In Use



- SafetyBUSp
 - IEC61508, SIL 3 Applications
 - 100,000+ Nodes in Operation
- PROFIsafe
 - IEC61508, SIL 3 Applications
 - 190,000+ Nodes in Operation
- SafeEthernet
 - Hima





FF-SIS Benefits



- Increased Diagnostics
 - ↑ Diagnostic Coverage
 - ↓ Redundancy
- Reduced Capital Expenditure
 - Are costs reduced?
- Reduced Operational Expenditure
 - How much do you spend on SIS maintenance and how does that compare to BPCS maintenance metrics?





FF-SIS Risks



- New Application of Existing Technology.
- Competent Engineers/Technicians
- Certified Equipment
- SIF Response Time
- ↑ Diagnostics ↓ Reliability
- Any other risks?





Strategy and Plan



- Overall Strategy
 - Phased Approach
 - Roles and Responsibilities
 - Schedule
 - Justification
- Implementation Schedule
 - Training
 - Technology Review
 - Alignment with Recognised Bodies
 - Existing SIS Systems
 - Product Review and Selection
 - Criteria/Standards/Design Guides
 - 3rd Party Vendors





Management of Safety



IEC-61511 Clause 5

- Review/Update Existing Functional Safety Documentation
- Review Required Competencies and Update Training Plans
- Expand Configuration Management to Include FF Specifics
- SIF Performance Evaluation Procedures





Safety Lifecycle



IEC-61511 Clause 6

- Review/Modify Safety Lifecycle Systems Utilised.
 - Alterations to FAT
 - Alterations to SIF/SIS Validation
 - Training





SIS Design and Engineering



IEC-61511 Clause 11

- Conceptual Engineering
- Redundancy in FF-SIS
- Architectures
- Fault Tolerance
- Equipment Selection
 - IEC61508 Assessment
 - Prior Use
 - ITK and HIST
- Proof Testing Requirements

How much 'prior use' credit can be taken for FF BPCS Instruments and Common Components of 4-20mA and FF Instruments?





SIS Design and Engineering



IEC-61511 Clause 11 cont.

- Segment Design
 - Wiring Schemes
 - Power Supplies
 - Hardware Usage
 - SIF to Segment Allocations
 - Response Time Considerations
- Redundancy Models
- Control in the Field
 - Potential to Distribute Logic Solver Functionality
 - Will there be reluctance to this?
- Testing, Bypasses, Resets, Manual Actuation
 - Integration with FF Instrumentation.





SIS Design and Engineering



IEC-61511 Clause 11 cont.

Hardware Specification

- Interoperability of Equipment
 - ITK/HIST
- Handling of Diagnostics
 - Diagnostic Coverage
 - Segment Communication Diagnostics
- Equipment Diversity
 - Utilising FF with 4-20mA for Diversity?
- Power Supplies and Conditioners
- M/E Interface





SIS Design and Engineering



IEC-61511 Clause 11 cont.

Programming Guidelines

- LVL and FF-SIS
- FF Function Blocks
- Configuration Tools/Software
- Segment Communications
- Control Logic Solver in the Field
- Password Protection/Access Restrictions





SIS Design and Engineering



IEC-61511 Clause 11 cont.

Physical Design

- BPCS Design
 - Knowledge Gained from BPCS
 - Shared Buses
- Segment Constraints
 - Physical Limitations
 - Macrocycle
 - #Devices
- Savings?
- Hardwired and Fieldbus Wiring





Factory Acceptance Testing



- *IEC-61511 Clause 13*
- Segment Testing
 - Test all Segment Permutations
 - Test all Instrument - Instrument Permutations
 - Test all Instrument - Host Permutations
- Host – Sensor Testing
 - ITK and HIST
 - Testing and Documentation
- FAT and Validation Tests
 - Identify Scope for Each
 - Minimise Overlap/Rework

What Validity can you attribute to Testing a Partially Loaded Segment?





Installation and Commissioning



IEC-61511 Clause 14

- Segment Testing
 - Testing and Benchmarking Physical Layer
 - Macrocycle Performance
 - Security
 - Safety Diagnostics
 - Alarms
- Pre-Commissioning Savings
 - Only Realised through Proper Planning and Design
 - Up to 80% Time Reduction Achieved on FF BPCS Projects





SIS Safety Validation



IEC-61511 Clause 15

- SIF Response Time
- Abnormal Situations
- Diagnostic Alarms
 - Simulating Problems to Justify Instrument Diagnostic Coverage Claimed During Design





Operation and Maintenance



IEC-61511 Clause 16

- Training
 - FF
 - Logic Solver
 - FF Diagnostic/Configuration Tools
- Handover from Design Team
 - Design Intent
 - SRS
 - SIF
 - Proof Testing Scope/Procedures
 - Tagging, Lockout, Energisation of System at Handover





SIS Modifications



IEC-61511 Clause 17

- Document unique feature of FF-SIS
 - Change Workflows and Check Sheets.
 - Re-verification and Validation Steps.
 - Software Configuration Management:
- Documentation Management.





Questions Raised.



- Reduced Capital Expenditure. Are costs reduced?
- Reduced Operational Expenditure. How much do you spend on SIS maintenance and how does that compare to BPCS maintenance metrics?
- FF-SIS Risks. Any other risks?
- SIS Design. Will there be reluctance to use CITF?
- SIS Design. Utilising FF with 4-20mA for Diversity?
- How much 'prior use' credit can be taken for FF BPCS Instruments and Common Components of 4-20mA and FF Instruments?
- What Validity can you attribute to Testing a Partially Loaded Segment?





Conclusions



- Investment in Training.
- Prepare Strategy/Plan.
- Document Success on BPCS.
- Alignment with Manufacturers.
- Shared Knowledge and Lessons Learned.





Thank You

QUESTIONS



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