

# SPI meets SIS

## Using SmartPlant Instrumentation to Document Safety Instrumented Systems

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Implementation  
Team



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# Functional safety instrumented systems for the process industry sector

- ◆ **International Electrotechnical Commission (IEC) developed IEC 61511 in 1998**
- ◆ **ISA S84 committee adopted the IEC 61511 standard in 2004 creating ISA 84.01/IEC 61511**
  - These standards called for Safety Instrumented Systems to be designed to automatically respond to potentially dangerous process conditions and take preprogrammed action to mitigate or avoid a dangerous condition
  - The safety-related portion of the Plant Control Systems configuration must remain in place for the lifecycle of the plant
  - Provides a framework for establishing safety integrity levels and hardware fault tolerances
  - Preparation of information and procedures concerning software needed by the user for the operation and maintenance of the SIS



# Safety Instrumented Systems fit to SmartPlant Instrumentation



- ◆ **Basic Plant Control Systems use SmartPlant Instrumentation to Document:**
  - **Indexes**
  - **Spec Sheets**
  - **Field Wiring**
  - **Loop Diagrams**
  - **Integration to DCS systems**
  
- ◆ **IEC 61511 created Need to Document Safety Instrumented Systems:**
  - **Shutdown Systems (ESD),**
  - **Fire and Gas Systems (F&G)**
  - **Burner Management Systems (BMS)**
  - **Safety Interlock (or Instrumented) Systems (SIS)**

# Plant Control Systems Manufactures Offer Solution for Safety Instrumented Systems



- ◆ **IEC 61508 defines a set of standards for functional safety of electrical or programmable electronic safety-related systems equipment**
- ◆ **IEC 61508 was first published in 1998 with the latest revision published in September of 2005**
- ◆ **Manufactures switched from hard wired Safety systems to safety PLC's and safety networks:**
  - **Internationally Certified**
  - **Lower Installed Equipment Costs**
  - **Heightened Flexibility of Configuration**
  - **Reduced Risk of Process Operator Error**
- ◆ **The SmartPlant Instrumentation now has the burden of documenting the Safety Instrumented System and the Basic Process Control System**

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# Safety Instrumented Systems benefit from SmartPlant Instrumentation



- ◆ **Data centric information management**
  - Data is input once and resides only one place and is referenced by other systems with integration.
- ◆ **Reference System data management**
  - Reference System Data for procedures and practices are maintained in the system and readily available to the users
- ◆ **Applying rule bases and data profiles**
  - Rule bases and Data profiles validate data as it is loaded into the databases and govern user input to reduce errors
- ◆ **Automated Document Generation & Management**
  - Documents are controlled for management of Change and automatic report generation from the database

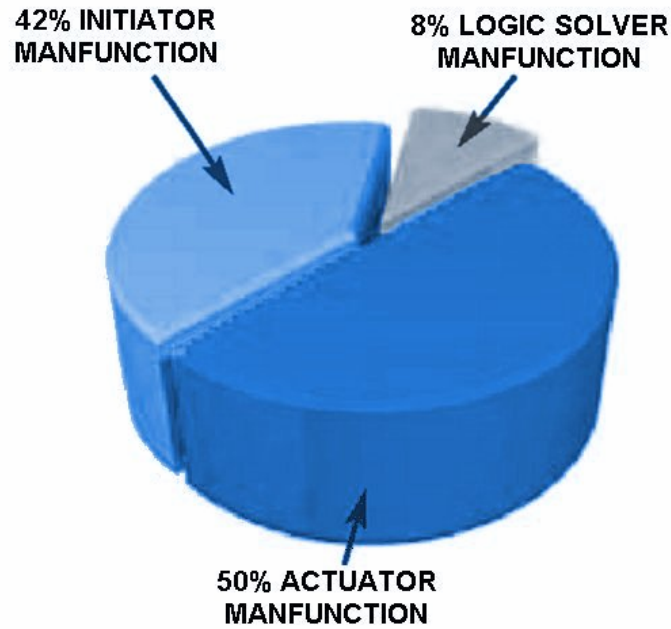
# Basic Parts of a Safety Instrumented Systems



- ◆ **Initiators**
  - **Primary Sensing Elements (Transmitters & Switches)**
- ◆ **Logic Solver**
  - **Programmable Logic Controllers or Switch & Relay Logic**
- ◆ **Actuators**
  - **Final Control Elements (Valves, Motors & Solenoids)**



# Reliability factors for Safety Instrumented Systems



Per OREDA (Offshore REliability DAta)

- ◆ The most common areas of Failure (92%) are the Initiators and Actuators and their associated wiring systems
- ◆ They are also the two areas that SmartPlant Instrumentation interfaces with the Safety Instrumented System!



# SmartPlant Instrumentation Maintains Safety Instrumented Systems Data



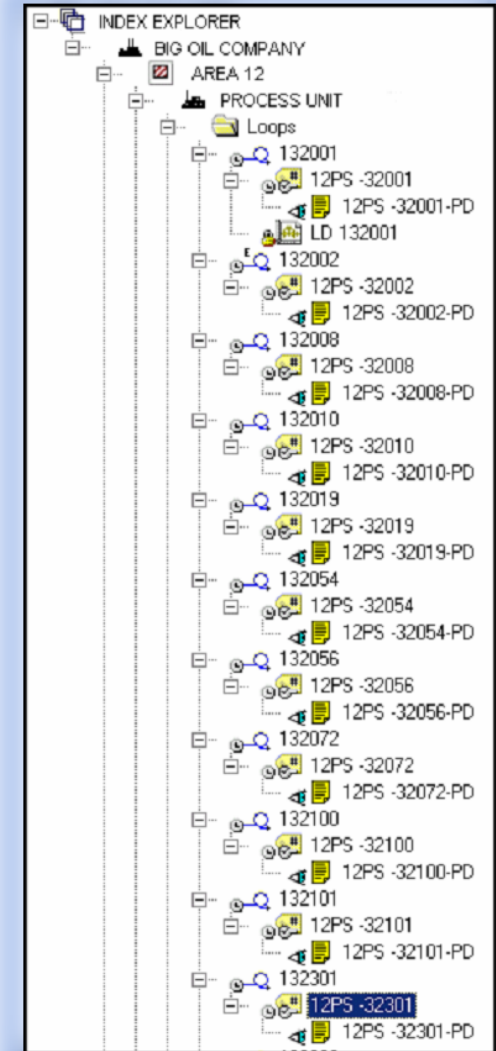
- ◆ **SAFETY INSTRUMENTED SYSTEMS INDEX DATA**
  - All Safety Device Tag Numbers with Related Data
  - Additional Fields of data specific to Safety Devices
- ◆ **SAFETY INSTRUMENTED SYSTEMS SPEC DATA**
  - Specify Safety Devices for Sizing, Selection & Purchase
  - Additional Spec Sheets for Unique Safety Devices
- ◆ **SAFETY INSTRUMENTED SYSTEMS WIRING DATA**
  - All Wiring From Safety Devices to Logic Solver I/O
  - Additional Wiring Requirements for Safety Power System
- ◆ **SAFETY INSTRUMENTED SYSTEMS DOCUMENTS**
  - Reference Document Management System PCS
  - Additional Information Management for Safety Systems
  - Operator Document Retrieval of Safety Information

# SAFETY INSTRUMENTED SYSTEMS INDEX DATA



## ◆ STANDARD BASIC PROCESS CONTROL SYSTEM INDEX DATA

- Plant – Area – Unit Reference
- Instrument Tag Numbers
- Loop association
- Service Description
- Process & Instrument Diagram
- Instrument Function
- Signal Types & I/O Data
- Piping Line Information
- Fabrication Requirements
- Cross References



# SAFETY INSTRUMENTED SYSTEMS INDEX DATA



Tag Number	I/O SYSTEM	MAINTENANCE CYCLE	INTERLOCK 1	Service
FT -29407	DCS-DV			K-902 DRY GAS SEAL BUFFER
FT -29480	SIS	6 MONTHS	I-32	MAKE UP & RECYCLE HYDROGEN FEED E-903A
FV -29480	SIS	6 MONTHS	I-32	MAKE UP & RECYCLE HYDROGEN FEED E-903A
FZT -29481	SIS	1 YEAR	I-34	MAKEUP & RECYCLED H2 TO E-903A/B/C
FT -29482	SIS	6 MONTHS	I-30	MAKE UP & RECYCLE HYDROGEN FEED E-903D
FV -29482	SIS	6 MONTHS	I-31	MAKE UP & RECYCLE HYDROGEN FEED E-903D
FZT -29483	SIS	1 YEAR		MAKEUP & RECYCLED H2 TO E-903D/E/F
FT -29485	SIS	6 MONTHS	I-32	MAKE UP & RECYCLE HYDROGEN FEED
FV -29485	SIS	6 MONTHS	I-33	MAKE UP & RECYCLE HYDROGEN FEED
FZT -29486	SIS	1 YEAR	I-34	MAKEUP & RECYCLED H2 TO E-903G/H/I
FT -29487	DCS-DV			FLOW CONTROL OF MAKE UP & RECYCLE HYD
FV -29487	DCS-DV			FLOW CONTROL OF MAKE UP & RECYCLE HYD

- ◆ **Additional Index Data for Safety Instrumented Systems:**
  - **SIL Ratings**
  - **Interlock Numbers**
  - **Maintenance Cycles**
  - **Instrument System Identifiers**
  - **Special Notes for Design Engineering**
  
- ◆ **User Defined Fields and Tables for Safety Data**

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# SAFETY INSTRUMENTED SYSTEMS SPEC SHEETS



- ◆ **STANDARD INSTRUMENT SPEC SHEET DATA**
  - Instrument Tag Numbers
  - Service Description
  - Device sizing Data
  - Design Process Data
  - Operating Process Data
  - Materials of Construction
  - Process Connections Data
  - Signal Connection Data
  - Fabrication Requirements
  - Purchasing Information
  - Revision Control

TAG NO. / SPECIFICATION		DESCRIPTION / TYPE		STATUS / REVISIONS	
ISRA		CONTROL VALVE ASSEMBLY Part 2: Device Specification		Doc No.	Doc Rev
				Issue revision	Issue status
					DNV
<b>VALVE BODY AND BONNET</b>					
11	Body type		80	Disclosure type notation	
12	Bonnet style		81	Digital communication mt	
14	Inlet conn nominal size	[Rating]	82	Signal power source	
15	Outlet conn nominal size	[Rating]	64	Pressure gauge	
16	Inlet conn term-type		65	Cert/Approval type	
17	Flange facing finish	[Style]	66	Mounting location type	
18	Stem seal type		67	Disclosure material	
19	Face-to-face standard		68		
20	Take boss diameter		69	<b>POSITIONER OR CONTROLLER</b>	
21	Body and Bonnet material		70	Configuration type	
22	Living material		71	Input signal type	
23	Body/Bonnet bolting matl		72	Disclosure type notation	
24	Packing lg bolting matl		73	Signal power source	
25	Gasket material		74	Digital communication mt	
26	Packing material		75	Cert/Approval type	
27	Bellows seal material		76	Pressure gauge	
28			77	By-pass manifold	
29			78	Disclosure material	
30			79		
31			80	<b>PERFORMANCE CHARACTERISTICS</b>	
32	Trim style		81	Max press @ design temp	
33	Shutoff characteristic		82	Max working temperature	
34	Flow direction force		83	Max pressure drop	
35	Port/Orifice diameter		84	Rated flow coeff type	
36	Stem diameter	[Rating]	85	Rated factor FI	
37	Closure member material		86	Rated seat leakage class	
38	Seat ring material		87		
39	Stem material		88	<b>ACCESSORIES</b>	
40	Cap material		89	Air set filter style	
41	Guide/Washer material		90	Air set gauges	
42	Guide bushing material		81	Tubing nominal size	
43	Hard facing/coating		82	Tubing and fitting matl	
44			83		
45			84	<b>SPECIAL REQUIREMENTS</b>	
46	Actuator type		85	Custom tag	
47	Acting style		86	Reference specification	
48	Effective area		87	Special preparation	
49	Block set URL	[URL]	88	Compliance standard	
50	Max supply capability		89	Construction code	
51	Handwheel type/posn		90	Software configuration	
52	Casing/linder material		101		
53	Diaphragm/D ring matl		102	<b>PHYSICAL DATA</b>	
54	Trim material		103	Estimated weight	
55			104	Face-to-face dimension	
56			105	Overall height	
57			106	Removal clearance	
58			107	Mfr reference deg	
59			108		
<b>TESTING AND TEST</b>					
111	TAG NO. / FUNCTIONAL IDENT	MANUFACTURER	TEST OR TEST	ACTION	STATUS
112		Block set travel	LRV	URV	
113		Positioner input-travel			
114		Transducer input-output			
115		Test pressure			
116					
117					
<b>COMPONENT EVENTS/EXITS</b>					
118	COMPONENT TYPE	MANUFACTURER	MODEL NUMBER		
119					
120					
121					
122					
123					
124					
125					
<b>REVISIONS</b>					
REV	DATE	REVISION DESCRIPTION	BY	APPROVED/STATUS	REMARKS

# SAFETY INSTRUMENTED SYSTEMS SPEC SHEETS



1	Tag Number	SEE LIST	
2	Fire Protection Plan DWG No.		
3	Service	Area Name	SEE LIST
4	Detector Type	EMI Shielding Hz	Infrared Point HC Gas Detector
5	Safety Integrity Level	Approvals	IEC 61508 (SIL Level 2)
6	Area Classification	Zone 2 CENELEC	
7	Output	Range	0 - 100% LEL
8	Gas to be Detected - LPG	BUTANE/PROPANE	
9			
10			

- ◆ **Additional Spec Sheet Data for Safety Instrumented Systems:**
  - Safety Integrity Level Ratings
  - Approvals and Testing Requirements
  - Certifications and Approvals
  - Redundancy or Conditioning Requirements
  - Special Notes for Design Engineering
  - Partial Stroke Testing Requirements (for Valves)
- ◆ **New Spec Sheets May Need to be Added for Safety Devices**

# SAFETY INSTRUMENTED SYSTEMS WIRING DATA



## ◆ SMARTPLANT INSTRUMENTATION STANDARD WIRING DATA

- Wiring of Field Devices
- Signal from Field Devices
- Wiring of Field Junction Boxes
- Home Run Cables and Connectors
- Marshalling Panels and Terminals
- Connections to DCS I/O Cards
- Power Distribution at DCS
- Jumpers and Bus Wiring
- Field Power Wiring
- Grounding Wiring

Connection - SCCB-FGS-01, C251

Terminal strip:  
SCCB-FGS-01, 2, 1, C251, C251

Cable	Set	Wire	1	2	3	4	5	6	7	8	9	10	11	12	13		
C251-FGSM-01/FGS-01F	89AFG -5050A	89AFG -5050A	A1	B1	C1	A2	B2	C2	A3	B3	C3	A4	B4	C4	A5	B5	C5
C251-FGSM-01/FGS-01F	89AFG -5030A	89AFG -5030A	A6	B6	C6	A7	B7	C7	A8	B8	C8	A9	B9	C9	A10	B10	C10
C251-FGSM-01/FGS-01F	89AFG -5040A	89AFG -5040A	A11	B11	C11	A12	B12	C12	A13	B13	C13	A14	B14	C14	A15	B15	C15
C251-FGSM-01/FGS-01F	SPARE	SPARE															
C251-FGSM-01/FGS-01F	89AFG -5040F	89AFG -5040F															
C251-FGSM-01/FGS-01F	89OFD -5040E	89OFD -5040E															
C251-FGSM-01/FGS-01F	89AFG -5030E	89AFG -5030E															
C251-FGSM-01/FGS-01F	89AFG -5030H	89AFG -5030H															
C251-FGSM-01/FGS-01F	89PT -5030B	89PT -5030B															
C251-FGSM-01/FGS-01F	89PT -5131B	89PT -5131B															
C251-FGSM-01/FGS-01F	89AFG -5066A	89AFG -5066A															
C251-FGSM-01/FGS-01F	SPARE	SPARE															



# SAFETY INSTRUMENTED SYSTEMS DOCUMENTATION



## ◆ STANDARD AUTOMATION SYSTEM DELIVERABLES

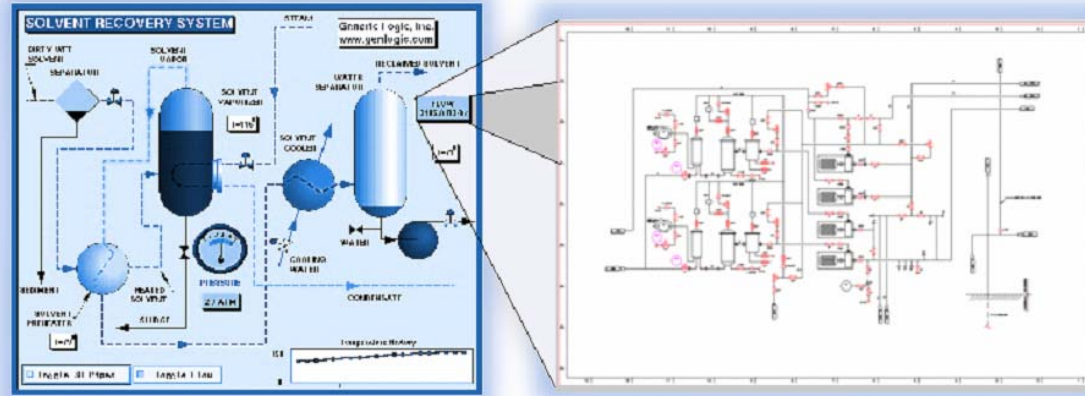
- Instrument Indexes
- Instrument Spec Sheets
- Process Data Sheets
- Sizing Calculation Sheets
- Field Wiring Diagrams
- Junction Box Wiring Schedules
- Instrument Cable Schedules
- Instrument Loop Diagrams
- Maintenance Schedules
- Maintenance Reports
- Instrument Calibration Reports



- ◆ **Not all SIS deliverables can be easily produced or generated with SmartPlant Instrumentation**

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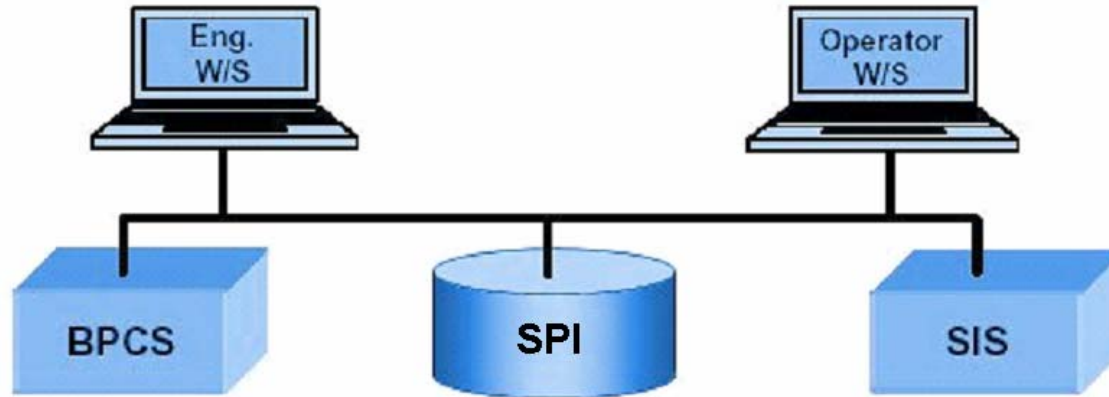
# SAFETY INSTRUMENTED SYSTEMS DOCUMENT MANAGEMENT



- ◆ **Dynamic Document Management of Electronic Safety Documents:**
  - Safety Plan
  - Hazard Reviews
  - Pre-Start-up Acceptance Test
  - Safety Requirements Specification
  - Safety Instrumented System Design
  - Operation and Maintenance Procedures
- ◆ **SmartPlant Instrumentation and Safety Documents may be Integrated to provide Operators with another layer of Safety to overall Plant Operations by providing facilities for quick disaster recovery**

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# Safety Instrumented Systems Integration To SmartPlant Instrumentation



- ◆ **Documenting and Integrating Safety Instrumented Systems with SmartPlant Instrumentation Results:**
  - Integrity of the Data Centric Environment Provides for Maintaining and Accessing the Safety Instrumented Systems Information
  - Automatic Change Management Updates Reports and Display Screens as Configuration Changes, Helps Meet Regulatory Requirements
  - Controlled Access, and Electronic Records Keeping Needed for the Operation and Maintenance of the Safety Systems
  - Real Time Access to Process Control System and Safety Instrumented Systems Data Provides Facilities for Quick Disaster Recovery

# Questions?

## ASCII stupid question

## Get a stupid ANSI

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