

General Specification

Safety Function Monitoring



GS GMSCD1001-01E

The Problem

Facilities often contain a large number of SIFs (Safety Instrumented Functions) that require constant monitoring with appropriate data collection, analysis and reporting capabilities when SIF activations occur to compare against HAZOP & LOPA design expectations. This capability is often lacking or difficult to provide in an effective way that satisfies both technical authorities and regulators.

The Solution

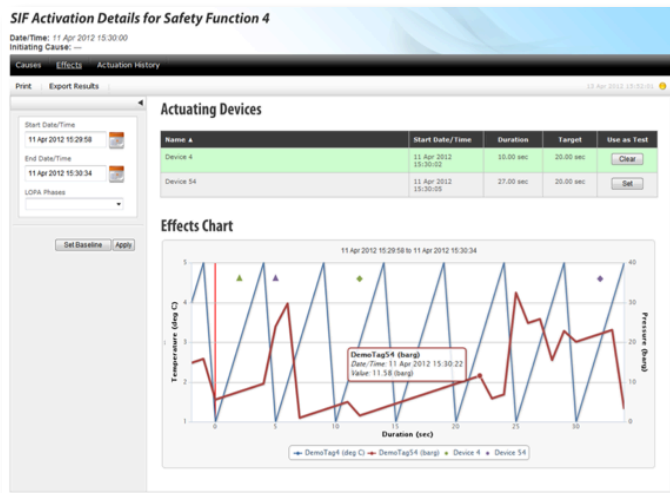
Exaquantum/SFM (hereafter called 'SFM') is Yokogawa's Safety Function Monitoring solution. SFM collects, processes and presents safety data to enable monitoring and analysis of key safety KPIs such as SIF (Safety Instrumented Functions) activations, ILPs (Independent Layers of Protection), initiating causes and overrides. This information assists users to identify safety issues, reduce maintenance activities and improve safety designs.

Benefits

- Quickly identify safety events such as SIF Activations, Overrides/Inhibits and Protection Layer Availability to increase user efficiency and accuracy
- Preventative and improved planning of maintenance activities by identifying SIF Activation test results as replacements for scheduled tests
- Partial Stroke Test (PST) results from Yokogawa's 'PRM' (Plant Resource Manager) can be collected
- Benchmark safety performance against design expectations to highlight variations that may indicate possible safety issues
- Identify issues not originally recognized in the safety design to reduce risk
- Provides regulators and technical authorities with accurate safety design validation information when required
- Improved user capability by providing access to relevant information contained in a single database

Key Features

- Overviews of the key safety KPI information including SIF activations by category, SIF output failures (devices), overridden SIFs and active ILPs
- Verification of LOPA (Layer of Protection Analysis) through mapping SIS (Safety Instrumented Systems) elements against the LOPA 'Initiating Cause' assumptions
- SIF device(s) activation monitoring
- Non-SIF device(s) actuation monitoring
- Override/Inhibit monitoring
- Dynamic reports that can be periodically generated and exported



Introduction

SFM is an integrated, plant-wide solution for Safety Monitoring that:

- Provides an analysis and reporting tool to help users monitor the performance effectiveness of defined SIS (Safety Instrumented Systems) against their design targets
- Integrates data from the safety systems, control systems, and risk analysis from HAZOP, LOPA, etc.
- Displays and reports to identify abnormal events and causes, or safety activations suitable for test replacement, which would not be possible without extensive manual analysis
- Can be used to intelligently monitor and validate the correlated information, independent of system vendor

SIF Overview

IL	Total SIFs	Activations	Output Faults
3	4	0	0
2	15	0	0
1	21	8	2
a	7	0	0
0	3	0	0
Totals	50	8	

ICSS ILP Overview

IL	Currently Inactive	In Period
3	1	1
2	0	2
1	0	8
a	1	1
0	0	0
Totals	2	12

Capabilities

Data Collection

The underlying Exaquantum historian provides SFM with a powerful, integrated, cost-effective platform for collecting and storing data from different sources via OPC DA, OPC A&E and OPC HDA independent of the system vendor. OPC HDA has been expanded within Exaopc (Yokogawa's OPC server) to allow historical Alarms & Events to be recovered following a communications interruption.

Risk Assessment (HAZOP, LOPA)

SFM is configured with the safety design expectations derived from the HAZOP and (if conducted) LOPA risk assessments. This information is compared against the actual operational safety function activity to highlight issues, validate safety design intervals and optimize test scheduling.

Web User Interface

SFM provides secure web based displays and reports for user access from local and remote locations so there is no need to install client software.

SIF KPIs

An overview of user filtered SIF KPIs is provided, allowing users to view the following information:

- SIF Overview by Safety Integrity Level
- Number of SIFs
- Number of SIF activations
- Number of SIF output faults (device failures)
- ICSS (Integrated Control and Safety System) ILP Overview by Integrity Level showing both the number of currently inactive and user filtered date/time inactive ILPs
- MOS (Maintenance Override Switch) Overview by Integrity Level showing both the number of SIFs currently in Maintenance Override and user filtered date/time SIF Maintenance Overrides

Identification of SIF Activations

SFM provides comprehensive A&E monitoring capabilities to identify SIF Activations. These activations are then translated into Reports, Overview screens and SIF Activation lists, all of which provide users with a clear picture as to which SIFs have activated, and more importantly, which activations should be assessed.

Date/Time	SIF Name	Initiating Cause	Parent	IL	ILP	Fail	Verify	Test
1 Feb 2013 17:01:55	FALL-0312366	—	—	1	●	●	●	●
3 Feb 2013 16:19:53	TAHH-0220102	—	—	1	●	●	●	●
3 Feb 2013 15:58:29	TAHH-0320026	—	—	1	●	●	●	●
3 Feb 2013 15:55:07	TAHH-0220102	—	—	1	●	●	●	●

SIF Activation Analysis

When SIF Activations take place, SFM records key associated data that can be used to better understand the effect of the activation.

SFM records the following information:

- Associated safety device transitions and travel times to determine the travel times of the devices when activated versus the expected design times defined in the safety design.
- Related process information (pressure, temperature, etc.) is recorded and trended before, during and following the activation. This process information can be compared against baseline data to show variations in the profile signature to look for process data deviations.
- Actuating device starts and stops are overlaid onto process data trends making it easy to see changes in trends before and during the device transition.

SIF Activation Verification

SIFs which have activated can be verified with SFM. This verification process establishes the SIF Activation reason(s), which is also known as the 'Initiating Cause'. The Initiating Cause(s) are derived from the safety design and imported into SFM. When an Initiating Cause has not been identified in the safety design, SFM allows a new Initiating Cause(s) to be defined that is displayed in various SFM reports to allow the safety design to be improved.

Initiating Causes

SIF Initiating Causes are monitored against the safety design. This provides a valuable understanding as to what the actual demand versus expected demand is. The SFM traffic light system provides early warnings as to Initiating Causes which have exceeded their expected design frequency.

Monitoring Overrides and Inhibits

SFM monitors SIF overrides, inhibits and their protection layers. This provides critical information in the understanding as to whether SIFs have sufficient protection and whether they are maintaining their designed SILs.

Exaquantum/SFM

Safety Function Monitoring

Home

SIFs

SIF Activations

Initiating Causes

Reports

Administration

Reports

Overall SIF Report

27 Jun 2013 11:04:09

View Report

Start Date

27/06/2012

End Date

27/06/2013

Safety Function Search

Safety Function

All

IL Rating

All

Plant

All

Associated Tags Search

Associated Tags

All

Actuating Device Search

Actuating Device

All

Overall SIF Report

27 Jun 2012 to 27 Jun 2013

SIF Details

REGION		SITE	
FACILITY		AREA	
Safety Function	FALL-0550046	Version	1
Associated Tags	_FIT0550046		
IL Rating	a		

Actuating Devices

Device Name	Total Actuations	Total Actuations by SIF	Actuation Failures by SIF
_XZ0550016	1	0	0

Initiating Causes

Description	Total Activations	Design Frequency	Actual Frequency
A Closed open manual isolation valves	0	0.00200	0.00000
B Strainer blocked	0	0.20000	0.00000
C Shuck check valve	0	0.10000	0.00000
D Duty pump trip	0	0.10000	0.00000
E Failure of FIC 0550047 causes FV 0550067 to fully close (water)	0	0.10000	0.00000

ILPs

Description	Total ILP Unavailable Periods	% Time ILP Unavailable *	Total Time ILP Unavailable
1 FAL 0550047 low seal water flow alarm	0	0.00	0d 0h 0m 0s
2 TAH 0550011 seal water high temperature alarm	0	0.00	0d 0h 0m 0s
3 TAHH 0550039 high high temperature trip also stops the VRU compressor	0	0.00	0d 0h 0m 0s

SIF MO/Fault

Total Time SIF Required (when plant is running)	203d 10h 4m 2s
Total Time SIF not working due to MOS	0d 0h 0m 0s

Safety Reports

SFM provides dynamic reports for all information displayed on the web interface with the ability for the user to select fields and drill into data as well as filtering and sorting by almost all fields being displayed.

Reports contain SIS information for the following areas:

- SIF Activations
- ILP Availability
- Device Actuations
- Overrides and Inhibits
- Initiating Causes
- SIF Masking

Reports can be exported to multiple formats (such as Excel, Word and PDF) and scheduled to be emailed at configurable periods.

Exaquantum/SFM
Safety Function Monitoring

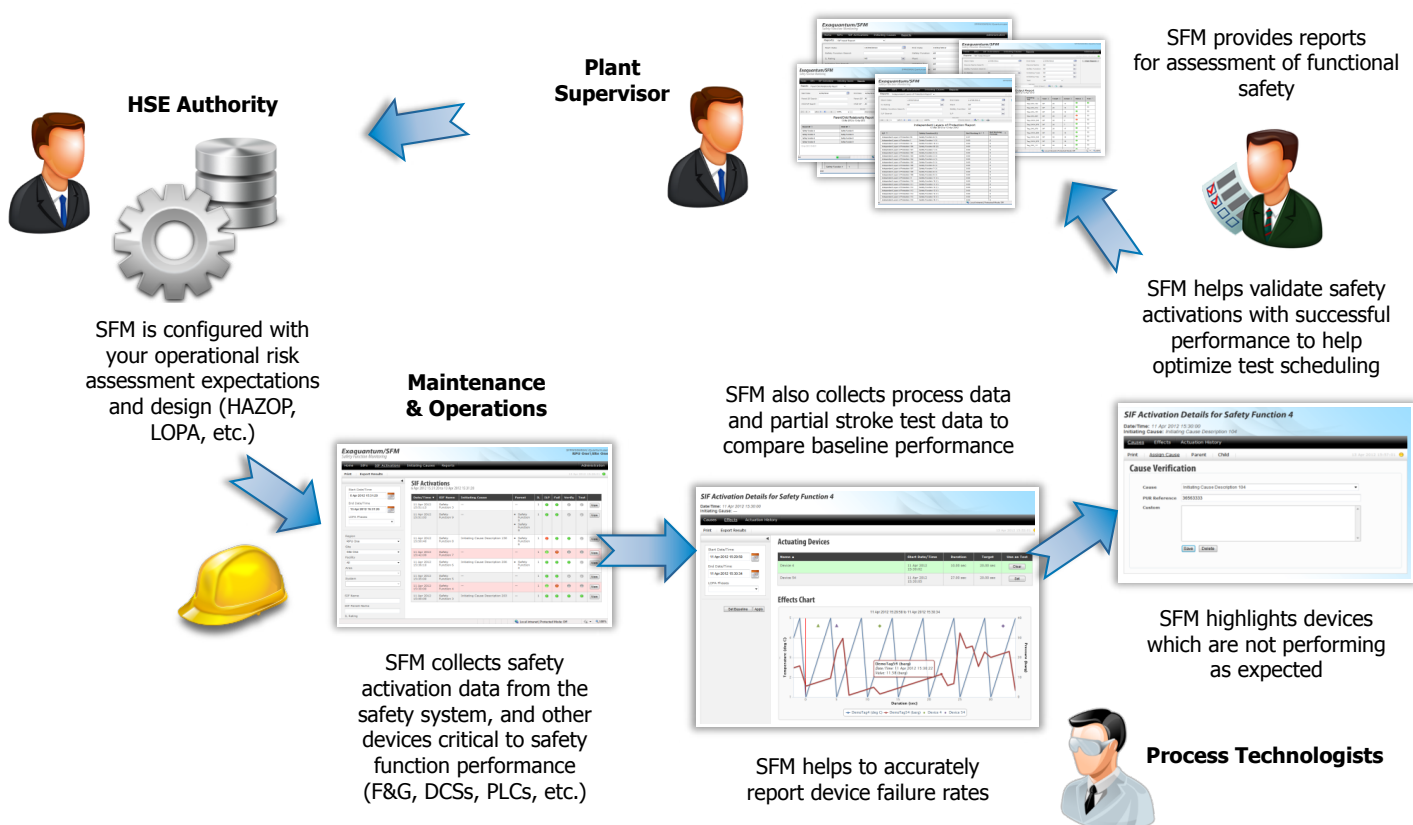
Home SIFs SIF Activations Initiating Causes Reports Administration

Print Export Results 18 Apr 2013 13:11:01

Initiating Causes

Current LOPA Phase (27 Jun 2013 11:57:46 to 27 Jun 2013 11:57:46)

SIF Name A	IL	Last Initiation	Initiating Cause	Measured Count	Freq. Design	Status
Safety Function 1	1	—	Initiating Cause Description 251	0	0.20000	●
Safety Function 1	1	—	Initiating Cause Description 201	0	0.20000	●
Safety Function 1	1	—	Initiating Cause Description 151	0	0.20000	●
Safety Function 1	1	—	Initiating Cause Description 101	0	0.20000	●
Safety Function 1	1	—	Initiating Cause Description 51	0	0.20000	●
Safety Function 1	1	—	Initiating Cause Description 1	0	0.20000	●
Safety Function 10	1	—	Initiating Cause Description 260	0	0.20000	●
Safety Function 10	1	—	Initiating Cause Description 210	0	0.20000	●
Safety Function 10	1	—	Initiating Cause Description 160	0	0.20000	●
Safety Function 10	1	—	Initiating Cause Description 110	0	0.20000	●



■ Hardware and Software Requirements

Tables: Minimum Hardware and Software Specifications

Component	Hardware Specifications
Combined Exaquantum/SFM Server	<ul style="list-style-type: none"> • 2.2 GHz multi-core processor • 8 GB RAM • 300 GB disk
Exaquantum/SFM Clients	As appropriate for Internet Explorer 8, 9 or 10

Component	Software Specifications
Exaquantum/SFM Server	<p><Operating Systems></p> <ul style="list-style-type: none"> • Windows Server 2012 Standard 64-bit • Windows Server 2008 R2 Standard (SP1) 64-bit • Windows Server 2008 Standard (SP2) 32-bit <p><Other Software></p> <ul style="list-style-type: none"> • Exaquantum PIMS R2.85 Server (Legacy or Standard Security) • Exaquantum/Web R2.85 Server • Interface to 'CAMS for HIS' data via CENTUM R3.08.10 onwards
Exaquantum/SFM Client	<p><Operating Systems></p> <ul style="list-style-type: none"> • Windows Server 2012 Standard 64-bit • Windows Server 2008 R2 Standard (SP1) 64-bit • Windows Server 2008 Standard (SP2) 32-bit • Windows Vista Business Edition (SP2) • Windows 7 Professional (SP1) 32 or 64-bit • Windows 8 Pro 32 or 64-bit <p><Other Software></p> <ul style="list-style-type: none"> • Microsoft Office 2010 or 2013 32-bit • Internet Explorer 8, 9 or 10

■ Models and Suffix Codes

Table: Exaquantum/SFM Server License

	Product Codes	Description
Model	GMSCD10	Exaquantum/SFM Server License
Suffix Codes	-S	Basic Software License
	1	New Order (with Media)
	1	English Version
	-S□□	Enter the number of Exaquantum/SFM Server Licenses in □□ (01 - 99)
	-P□□	Enter the number of additional per-seat Exaquantum/SFM Web Client Licenses in □□ (01 - 99)

An Exaquantum/PIMS and Web Server License must also be provided.

Table: Exaquantum/SFM Maintenance Service

	Product Codes	Description
Model	GMSCD80	Exaquantum/SFM Maintenance Service
Suffix Codes	-S	Basic Maintenance Service
	1	Always 1
	1	English Version
	-10S□□	Enter the number of Exaquantum/SFM Package Server Licenses in □□ (01 - 99)
	-10P□□	Enter the number of per-seat Exaquantum/SFM Web Client Licenses in □□ (01 - 99)

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