ProSIS-FSE

SILCalc V2.0 User Guide

1 OBJECTIVES

SIL Verification is a formal process that utilizes the conceptual design results to perform a reliability evaluation on that conceptual design. The SIL verification will be performed using the online tool to located at ProSIS-FSE >SIL Calculator. The result of the SIL verification is the Achieved Safety Integrity Level (ASIL) for the specific SIF under consideration. As long as the ASIL (Achieved SIL) is greater than or equal to the TSIL (Target SIL), the conceptual design of the SIF is proven sufficient. If the ASIL is lower than the TSIL, the conceptual design will need to be improved.

The Achieved Safety Integrity Level is obtained from two or three separately determined Safety Integrity Levels (PFD, Architecture, and Systematic Capability). Though it is important for engineers to understand that the final ASIL is based on these two (or three) independently determined Safety Integrity Levels, the actual determination of the Safety Integrity Levels is something that is automatically done through the online SIL Calculator Tool.

Safety Integrity Level (SIL) is the internationally accepted term for defining the required performance of a Safety Instrumented Function (SIF) in terms of maximum probability of failure and minimum level of hardware fault tolerance as protection for random failures and for specifying engineering development process requirements as protection against systematic failures. The SIL Calculator tool evaluates all three concepts as defined by current standards.

The purpose of this guide is to provide guidance on using the SIL Calculator Tool. This document is not intended to provide advice on applying the published industry consensus standards on Functional Safety.

2 REFERENCES

2.1 Referenced Publications

(1) *IEC 61511, Functional Safety: Safety Instrumented Systems for the Process Industry Sector, 2003, International Electrotechnical Committee, Geneva, Switzerland*

(2) *ANSI/ISA 84.00.01-2004 (IEC 61511: Mod), Functional Safety: Safety Instrumented Systems for the Process Industry Sector, 2004, The Instrumentation, Systems, and Automation Society, 67 Alexander Drive, Research Triangle Park, North Carolina, 27709*

(3) *IEC 61508, Functional Safety of Electrical/Electronic/Programmable Electronic Safety-Related Systems, 2000 & 2010, International Electrotechnical Committee, Geneva, Switzerland*

(4) *PDS Method Handbook 2013, Reliability Prediction Method for Safety Instrumented Systems, SINTEF Technology and Society, NO-7465, Trondhein, Norway*

3 ACRONYMNS AND DEFINITIONS

Acronyms

ASIL	*Achieved Safety Integrity Level*
MTTR	*Mean Time to Restoration*
PFDavg	*Average Probability of Failure on Demand*
SIF	*Safety Instrumented Function*
PHA	*Process Hazards Analysis*
SIL	*Safety Integrity Level*
SILpfd	*SIL Based on the Probability of Failure (PFD) Average*
SILarch	*SIL based on Architectural Constraints*
SILcalc	*SIL Calculation on-line tool*
SILsys	*SIL Based on the Systematic Capability*

Definitions

Achieved Safety Integrity Level (ASIL) — *The SIL achieved given the SIF's conceptual design, it is based on the minimum value for SILpfd, SILarch, and SILsys.*

Safety Instrumented Function (SIF) — *A function that is implemented by a Safety Instrumented System which is intended to achieve or maintain a safe state for the process with respect to a specific hazardous event.*

Each SIF should be designed and tested to meet its target SIL.

Safety Integrity Level (SIL) — *Discrete level (one out of a possible four) for specifying the probability of a SIS satisfactorily performing the required SIF under all of the stated conditions within a stated period of time.*

Safety Instrumented Systems (SIS) — *A system consisting of one or more SIFs. Consists of sensors, logic solver(s), and final elements.*

Target Safety Integrity Level (TSIL) — *The SIL required of a SIF such that when this SIF is combined with any non-SIS IPLs, the overall risk associated with the hazardous scenario is adequately reduced.*

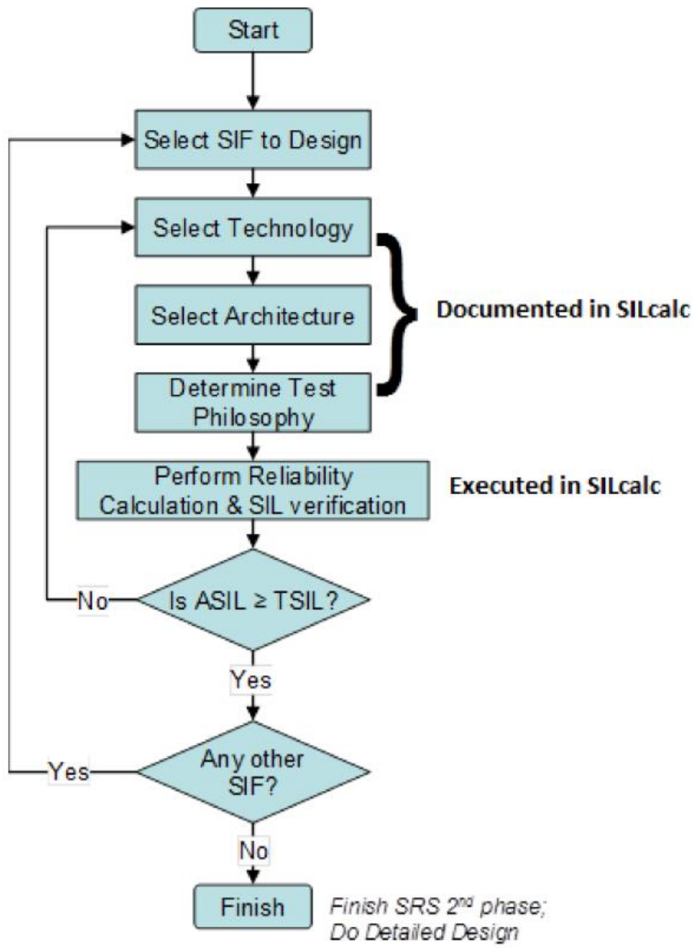
4 SIL VERIFICATION RESPONSIBILITIES

1. *Specify SIF design in SILcalc*
2. *Determine reliability data for components*
3. *Execute reliability calculations using SILcalc*
4. *Document results*
5. *Suggest areas for improvement in case conceptual design does not meet the Target Safety Integrity Level*

5 SIS DESIGN Coupled to SIL VERIFICATION PROCESS

The combined SIF Design and SIL verification process shows an iterative process where a Design is created evaluated, and if deemed sufficient finalized. If the design is not sufficient a re-design of the design needs to take place.

The following flowchart documents the combined Design and SIL Verification process.



5.1 Overview of SIF Design Tasks

For each Safety Instrumented Function (SIF) identified:

1. *Review the Safety Requirements Specification and obtain an understanding of the requirements on the SIF that needs to be designed*
2. *Select equipment to be used in the SIF*
   - *IEC 61508 certified equipment required*
   - *Proven equipment, documented justification needs to be generated for each equipment item.*
3. *Gather and adhere to the Safety Manuals for all equipment items selected*
4. *Create design*
   - *Select Architecture*
   - *Specify Test Philosophy*
   - *Identify potentially SIF level diagnostics*
5. *Document Design*

5.1.2 Unique Design Requirements Required for SIL Verification

Each SIF shall be designed with the specified equipment to meet the target proof test interval as specified in the SIF SRS. Equipment redundancy in fault tolerant voting configurations (e.g. 1oo2, 2oo3, etc.) may be added as necessary to meet the target SIL and the target proof test interval.

Additional diagnostics can be considered whenever practical to reduce redundancy requirements or increase proof test intervals. These may include:

a. *Comparison of sensor signals from the same process variable or Deviation alarm credit can be utilized. The assumption is that the deviation alarm is treated as critical and appropriate action taken within the MTTR.*

b. *Partial valve stroke testing (PVST) on final element*

c. *Full (full open to full close or vice versa) on-line stroke test of valves.*

Based on the SIF component safety manual, proof tests recommended by the manufacturer, proof tests conducted in the field an appropriate Diagnostic (proof) Test Coverage (DTC) must be determined.

5.1.3 Documentation of Design through SIL Verification

The design decisions are documented using the through selections made in the SILcalc SIL verification tool.

As part of the design documentation a SIS Identification (System ID), SIF Name, a SIF Tag (SIF ID), should be specified as a minimum.

Instrumented Protective Function PFD_{Avg} & $MTTF_{Spuriously}$ Calculator

Project Name :	SIS200	SIF Name :	Low Steam Drum Level
Company :	PROSIS-FSE	SIF ID/Tag :	SIS100-1
Site Name :	Texas	Target SIL :	SIL3
Status :	Status	Target RRF :	1000
Comments :	Comments		

5.2 SIL Verification Overview

A typical SIS consists of sensors which measure process variables (i.e., level, pressure, flow, temperature, etc.), a logic solver, which is configured to recognize hazardous conditions and initiate Critical Safety Actions, and final elements such as solenoid valves, shutdown valves and motors. These final elements are driven by the logic solver to eliminate the unwanted process condition that, if not corrected, would lead to a hazardous condition. They are the minimum needed to bring the process to the safe state.

Since the design is documented in the SILcalc SIL verification tool, the process of SIL verification is rather trivial, but it will involve the following:

1. *Determine all input information*
   a. *General information, like ISA Architectural Constraints requirements, MTTR, etc.*
   b. *Failure rate data*

2. *Compare Achieved Safety Integrity Level with Target Safety Integrity Level*
3. *Suggest areas for improvement in case conceptual design does not meet the Target Safety Integrity Level*
4. *Document results*

In the Design step, the Safety Instrumented Function is documented in SILcalc, this means that voting arrangements and equipment item selections have already been made. The following provides an overview of required input information.

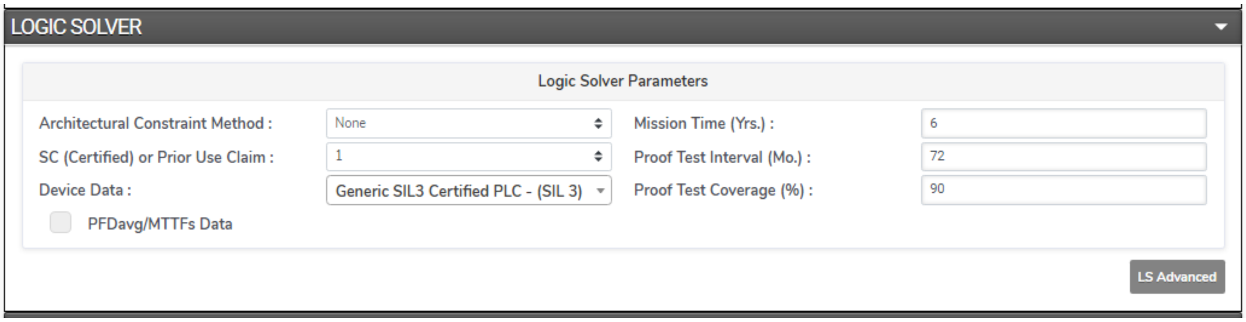
5.2.1 SIL verification SIF Level Selections

This information applies to the entire Safety Instrumented Function

Consider IEC 61508 Systematic Capability	*The Systematic Capability as defined in IEC61508 can be considered. If* ***"Yes"*** *is selected, the final Achieved SIL will reflect the overall SIF Systematic Capabilities. The Achieved SIL will be limited up to the Systematic capability of the SIF. If selected as* ***"Yes",*** *the Sys. Cap. "Prior Use" selection is available for the SIF Parts*
Beta Method	*The Beta that is entered for all the voting configuration is not directly applied in the calculations. IEC61508, ANSI/ISA 84 and SINTEF (4) all have different methods for determining the actual Beta applied in the formulas. The user selects the method you wish to use. We suggest using SINTEF PDS Method as we have determined all the values for all the voting arrangements. The tables in the standards only have values for common voting architectures. The most conservative (Used by many other popular tools) is the IEC61508 method.*
Consider MTTFs	*The Mean Time to Trip Spuriously needs to be considered as defined in the IEC61511 standard. Select "**Yes**" in order to have the tool determine the MTTFs. Otherwise select "**No**"*
MTTR	*The Mean Time To Restoration (MTTR) indicates the average time it will take (In Hours) to repair a diagnosed fault.*

5.2.2 SIL Verification Logic Solver Parts Selections

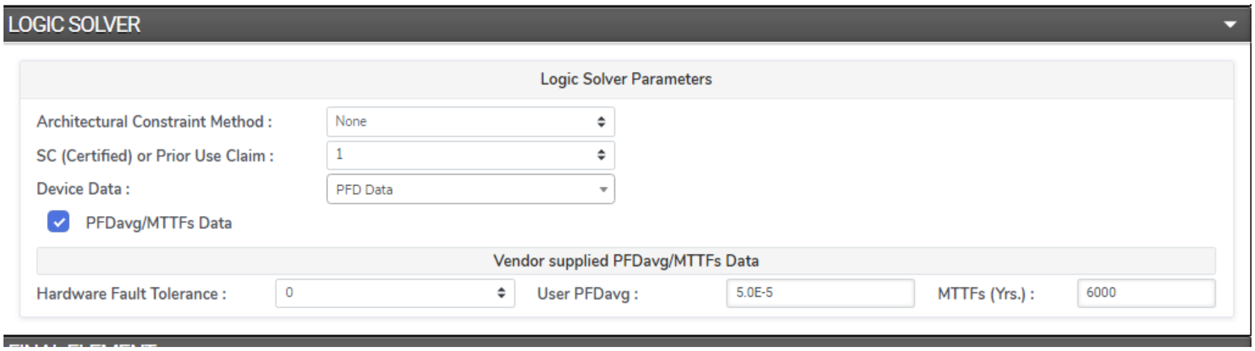
This information applies to selections common to the Logic Solver part, Sensor part and Final Element part. The design will consist of up to four sensor groups and up to four final element groups. The voting between these groups should already have been specified during the *design phase. As part of the SIL verification step the common cause / beta factor between the*



various groups need to be established.

Architectural Constraints Method	Architectural constraints can be considered. **IEC 61508:2010** can be utilize for SIL Certified (designed to IEC61508) sensors, Logic Solvers, and Final Elements as this provides the most appropriate evaluation of hardware redundancy. **IEC 61511:2016** can be considered for SIF components not designed to IEC61508 standards or where SIL Certified devices are not used. The standards allow the practitioner to use either one (IEC61508 or IIEC61511).
Mission Time (Yrs.)	The Mission time is the interval at which the SIF components are brought to a like new (100% PTC) state. This is also considered the period over which the SIF parts will operate.
SC (Certified) or Prior Use Claim	If **Certified Device Claim** is selected, then the SILCalc will automatically determine the SILsys based on the devices Systematic Capabilities and the architecture. For Prior Use Claim: • "1, 2,or 3", selected if you are claiming Prior Use, select the SIL capability of your prior use claim • "1/2", selected if the maximum allowable for a single (simplex) SIF component is SIL1. If the architecture is N+1 (2) or greater the SIL is limited to SIL2. • "2/3", selected if the maximum allowable for a single (simplex) SIF component is SIL2. If the architecture is N+1 (2) or greater, the SIL is limited to SIL3.
Proof Test Coverage (%)	Required to account for imperfect proof testing methods.
Proof Test Interval (Mo.)	Indicating the frequency in Months that the imperfect test DTC % will take place. This test interval cannot exceed the 100% TI.
PFD/MTTFs Data	In many cases the Logic Solver supplier will not provide the failure rate data for the logic solver components. In these cases, the vendor will supply you with the PFDavg and MTTFs values. If this is the case, you will check this selection.

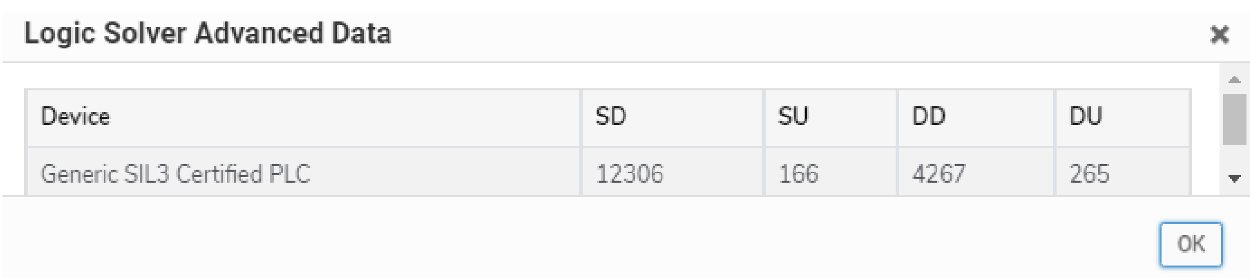
PFDavg/MTTFs Data selected



Architectural Constraints Method	Same as Above
SC (Certified) or Prior Use Claim	Same as above
Device Data	PFD Data (No User selection)
Hardware Fault Tolerance	For a KooN Logic Solver architecture, enter a value = N-K
User PFDavg	Enter the vendor supplied PFDavg
MTTFs	Enter the vendor supplied MTTFs in years

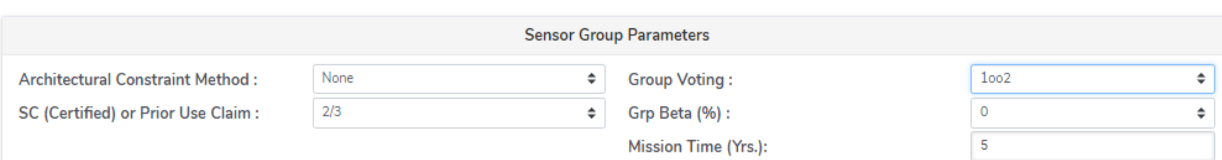
Select the LS Advanced Button 

to view the Failure rate data in FITs.



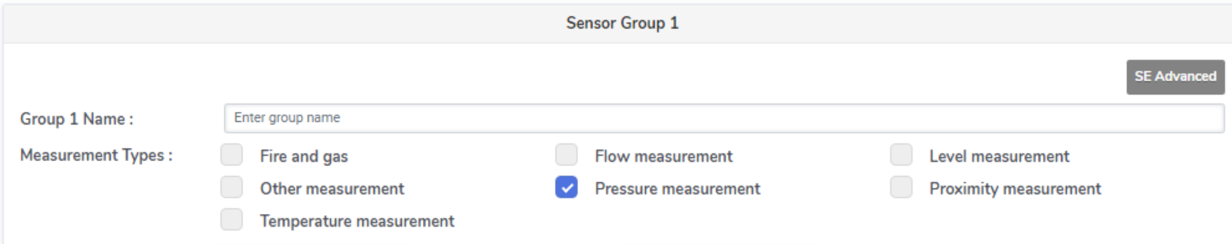
5.2.3 SIL Verification Sensor Component Selections

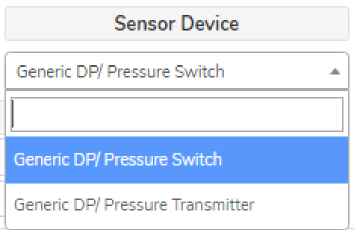
This information applies to the sensor selections. The practitioner will select the SIF components and details specific to the SIS application software and alarming. Selections made here can further improve the PFD results

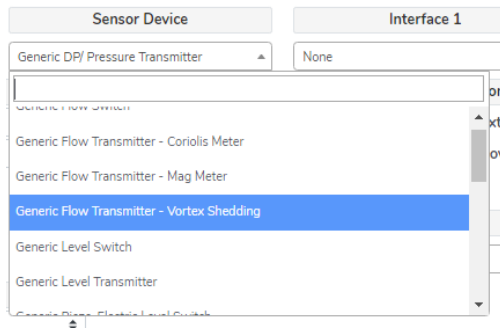


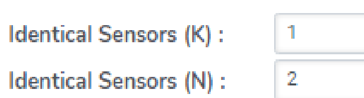
Sensor Group Parameters	
Architectural Constraints Method	*Architectural constraints can be considered.* ***IEC 61508:2010*** *can be utilize for SIL Certified (designed to IEC61508) sensors, Logic Solvers, and Final Elements as this provides the most appropriate evaluation of hardware redundancy.* ***IEC 61511:2016*** *can be considered for SIF components not designed to IEC61508 standards or where SIL Certified devices are not used. The standards allow the practitioner to use either one (IEC61508 or IIEC61511).*
Mission Time (Yrs.)	*The Mission time is the interval at which the SIF components are brought to a like new (100% PTC) state. This is also considered the period over which the SIF parts will operate.*
SC (Certified) or Prior Use Claim	*If* ***Certified Device Claim*** *is selected, then the SILCalc will automatically determine the SILsys based on the devices Systematic Capabilities and the architecture.* *For Prior Use Claim:* • *"1, 2,or 3", selected if you are claiming Prior Use, select the SIL capability of your prior use claim* • *"1/2", selected if the maximum allowable for a single (simplex) SIF component is SIL1. If the architecture is N+1 (2) or greater the SIL is limited to SIL2.* • *"2/3", selected if the maximum allowable for a single (simplex) SIF component is SIL2. If the architecture is N+1 (2) or greater, the SIL is limited to SIL3.*
Group Voting	*Select from the drop down 1oo1, 1oo2, 2oo2, 1oo3, 2oo3, 3oo3, 1oo4, 2oo4, 3oo4, or 4oo4. As your selection changes the additional groups will appear.*
Grp Beta (%)	*This will be visible only if the group voting is ither than 1oo1. Select the Common Cause or Beta factor for the group.*

The user can select one or all device types from the device selection list. The tool will show the device type device that have been selected in the device selection interface. It is recommended that you only select the device type you need. If you have purchased the device addon, this list will be extensive.



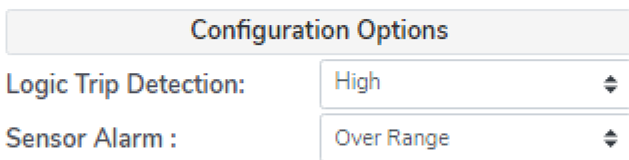




Sensor Device Parameters for up to 4 groups	
Proof Test Interval (Mo.)	*Indicating the frequency in Months that the imperfect test DTC % will take place. This test interval cannot exceed the 100% TI.*
Proof Test Coverage (%)	*Required to account for imperfect proof testing methods.*
Sensor Voting	*Select from the drop down 1oo1, 1oo2, 2oo2, 1oo3, 2oo3, 3oo3, 1oo4, 2oo4, 3oo4,4oo4, or KooN* *Practitioner can input values if KooN is selected on the Solver voting section.* 
Sensor Configuration Options	
Sensor Alarm	*If any of the sensors selected are analog, this will apply if the fail low/high failure rate data is defined. Select "Over Range" if the transmitter failure state is set to High. Select "Under Range" if the*
Proof Test Interval (Mo.)	*Indicating the frequency in Months that the imperfect test DTC % will take place. This test interval cannot exceed the 100% TI.*
PLC Alarm	*If any of the sensors selected are analog, select "Yes" if the logic solver application software is configured to alarm on the above sensor alarm.*
Alarm Vote to Trip	*If the logic solver application program considers the fault as a trip, set to "Yes". Set to "No" if the logic solver application program is not configured to detect a transmitter failure. The fail state direction is*
SIF Trip H/L	*If the SIF is protecting against a high process condition, select "High". If the SIF is protecting against a low process condition, select "Low".*

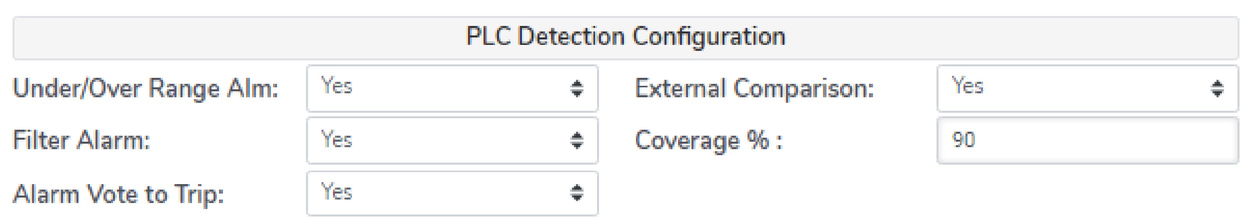
Dev Alarm	*The standard allows additional diagnostic credit for if there are more than one device measuring the process variable. If there is an alarm that is comparing multiple sensors and an alert is annunciated when the sensor values deviate by some amount, select "Yes". If not select "No"*
Deviation Alarm Coverage	*If deviation alarm "Yes" is selected, enter a value between"10 — 100". The value represents the percent of the Dangerous Undetected failures that are detected by the deviation alarm.*

Sensor Configuration Options:
In order to use the Certified device FMEDA failure data, the tool needs to know how the sensor device is configured. Once this is set correctly the toll will automatically select the appropriate failure data



Logic Trip Detection	Some devices have failure data that is specific to the trip direction. For example, some level transmitters have different data for overfill vs run dry detection. You do not need to be concerned with these details. In all cases, select what type of trip the logic is detecting. The tool will take care of all the calculation details concerning this selection.
Sensor Alarm	Smart Analog devices can be set in the transmitter to send a sensor alarm via the 4-20ma. Select the direction the fault alarm is set in the transmitter or the direction of a discrete device.

PLC Detection Configuration:
You have the option to fine tune the failures by selecting how the PLC logic is configured. This is only available for analog sensor devices for obvious reasons.

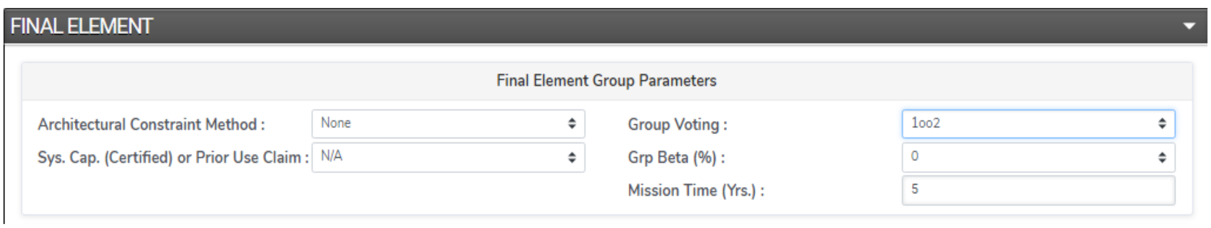


Under/Over Range Alarm	This will tell the software if the PLC logic can detect that the sensor in in fault and will trigger an alarm notifying operator that there is a diagnostic fault. Failure rates will be adjusted accordingly.

Filter Alarm	If the PLC Logic can detect whether the 4-20ma signal is a fault vs a trip condition the set this to “Yes”. This is typically accomplished with a filter and sensor fault detection logic.
Alarm Vote to Trip	If the PLC logic can detect and diagnose a sensor fault, the tool needs to know how the PLC process the fault. Depending on the selection, the tool will adjust the failure rate accordingly.
External Comparison	Finally, if there are another process measuring devices measuring the same process variable and there is a comparison performed, you can take additional credit for this additional diagnostics. The tool will adjust the failure rates to account for this diagnostic.
Coverage %	This is the additional diagnostic credit you are claiming for the external comparison. IEC61508 has additional guidance.

5.2.5 SIL Verification Final Element Selections

This information applies to the final element selections. The practitioner will select the SIF final element components and details specific to the final element. Selections made here can further improve the PFD results

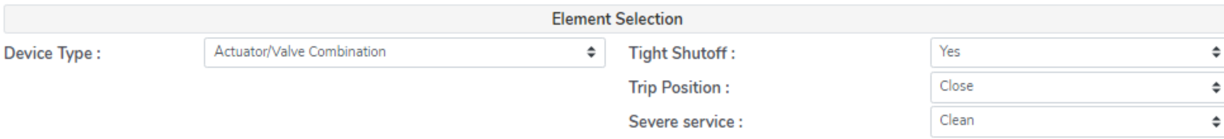


Final Element Group Parameters	
Architectural Constraints Method	*Architectural constraints can be considered. **IEC 61508:2010** can be utilize for SIL Certified (designed to IEC61508) sensors, Logic Solvers, and Final Elements as this provides the most appropriate evaluation of hardware redundancy. **IEC 61511:2016** can be considered for SIF components not designed to IEC61508 standards or where SIL Certified devices are not used. The standards allow the practitioner to use either one (IEC61508 or IIEC61511).*
Mission Time (Yrs.)	*The Mission time is the interval at which the SIF components are brought to a like new (100% PTC) state. This is also considered the period over which the SIF parts will operate.*

SC (Certified) or Prior Use Claim	*If **Certified Device Claim** is selected, then the SILCalc will automatically determine the SILsys based on the devices Systematic Capabilities and the architecture.* *For Prior Use Claim:* • *"1, 2,or 3", selected if you are claiming Prior Use, select the SIL capability of your prior use claim* • *"1/2", selected if the maximum allowable for a single (simplex) SIF component is SIL1. If the architecture is N+1 (2) or greater the SIL is limited to SIL2.* • *"2/3", selected if the maximum allowable for a single (simplex) SIF component is SIL2. If the architecture is N+1 (2) or greater, the SIL is limited to SIL3.*
Group Voting	*Select from the drop down 1oo1, 1oo2, 2oo2, 1oo3, 2oo3, 3oo3, 1oo4, 2oo4, 3oo4, or 4oo4. As your selection changes the additional groups will appear.*
Grp Beta (%)	*This will be visible only if the group voting is ither than 1oo1. Select the Common Cause or Beta factor for the group.*

The user can select the device type from the device selection list. The tool will show the device type device that have been selected in the device selection interface. If you have purchased the device addon, this list will be extensive.

Valve Parameters up to 4 groups	
Proof Test Interval (Mo.)	*Indicating the frequency in Months that the imperfect test DTC % will take place. This test interval cannot exceed the 100% TI.*
Proof Test Coverage (%)	*Required to account for imperfect proof testing methods.*
Final Element Voting	*Select from the drop down 1oo1, 1oo2, 2oo2, 1oo3, 2oo3, 3oo3, 1oo4, 2oo4, 3oo4,4oo4, or KooN* *Practitioner can input values if KooN is selected on the Solver voting section.* 
Grp Beta (%)	*This will be visible only if the group voting is ither than 1oo1. Select the Common Cause or Beta factor for the group.*



For a Valve/Actuator separate or Valve/Actuator Combo

Device Type	*There are three possible selections* • *Other (Motor starters, etc..)* • *Valves/Actuators Separate* • *Valves/Actuators Combination*
Tight Shutoff	Visible for valve only: *Select "Yes" if the hazard will not be mitigated if seat leakage occurs. Select "No" if leakage though the valve will not result in a safety event.*
Trip Position	Visible for valve only: *Select "Close" if the final element trip state is closed. Select "Open" if the final element trip state is open*
Severe Service	Severe service may be considered if the valve will be operating at an upper or lower design limit that can adversely affect the performance of the valve. In this case, select Severe.

5.3 Reporting

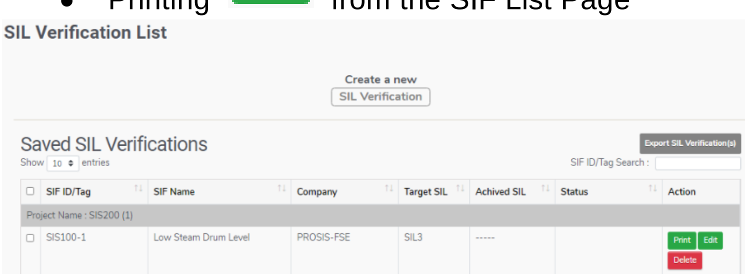
There are two means for reporting the work you have completed. You can print each SIF as well as export SID data.

5.3.1 Printing

- Printing  from the New SIF Calculation page

- Printing 

 from the SIF List Page



Print sample

SIL Verification

RESULT

Instrumented Protective Function PFD_{Avg} & $MTTF_{Spuriously}$ Calculator

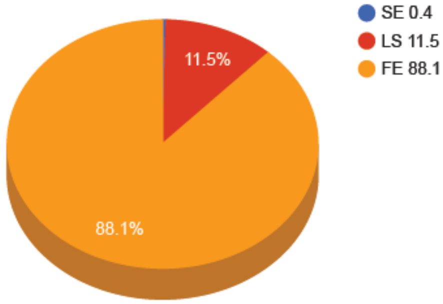
Project Name :	SIS200	SIF Name :	Low Steam Drum Level
Company :	PROSIS-FSE	SIF ID/Tag :	SIS100-1
Site Name :	Texas	Target SIL :	SIL3
Status :	Status	Target RRF :	1000
Comments :	Comments		

Instrumented Protective Function Parameters

Consider IEC61508 Systematic Capability :	Yes	Beta Method :	PDS (SINTEF)
Consider Mean Time to Fail Spuriously :	Yes	Mean Time to Repair (Hrs) :	72

Instrumented Protective Function Results

PFD Distribution



Achieved Safety Integrity Level	SIL1
Safety Integrity Level (PFD_{AVG})	SIL2
Safety Integrity Level (Architectural Constraints)	N/A
Safety Integrity Level (Systematic Capability)	SIL1
Average Probability of Failure on Demand	1.95e-3
Risk Reduction Factor (RRF)	514
Mean Time to Fail Spuriously	13 Yrs.

Instrumented Function Parts Results

Parts	PFD_{AVG}	$MTTF_{Spurious}$	SIL PFD_{AVG}	SIL Limits	
				Arch. Const.	Sys. Cap.
Sensor Part	7.70e-6	47	SIL2	N/A	SIL2
Logic Solver Part	2.25e-4	23		N/A	SIL1
Final Element Part	1.71e-3	73		N/A	N/A

.

SENSOR

Sensor Group Parameters

Architectural Constraint Method:	None	Group Voting:	1oo1
SC (Certified) or Prior Use Claim:	2/3	Mission Time (Yrs.):	5

Sensor Group 1

Group 1 Name: Enter group name

Measurement Types:
- [ ] Fire and gas
- [ ] Flow measurement
- [ ] Level measurement
- [ ] Other measurement
- [ ] Pressure measurement
- [ ] Proximity measurement
- [ ] Temperature measurement

Sensor Voting:	KooN	Proof Test Interval (Mo.):	6
Beta (%):	3	Proof Test Coverage (%):	90
Identical Sensors (K):	1		
Identical Sensors (N):	2		

Process Connection	Sensor Device
None	Generic DP/ Pressure Transmitter

Interface 1	Interface 2
None	None

Configuration Options

Logic Trip Detection:	High
Sensor Alarm:	Over Range

PLC Detection Configuration

Under/Over Range Alm:	Yes	External Comparison:	Yes
Filter Alarm:	Yes	Coverage %:	90
Alarm Vote to Trip:	Yes		

Device Details

LEG1

Process Connection

Device	DD	DU	SD	SU
No Device.				

Input Interface

Device	DD	DU	SD	SU

Device	DD	DU	SD	SU
No Device.				

Sensor Device

Device	DD	DU	SD	SU
Generic DP/ Pressure Transmitter	540	60	700	0

LOGIC SOLVER

Logic Solver Parameters

Architectural Constraint Method :	None	Mission Time (Yrs.) :	6
SC (Certified) or Prior Use Claim :	1	Proof Test Interval (Mo.) :	72
Device Data :	Generic SIL3 Certified PLC - (SIL 3)	Proof Test Coverage (%) :	90

☐ PFDavg/MTTFs Data

Device Details

Device	SD	SU	DD	DU
Generic SIL3 Certified PLC	23598	266	7850	494

FINAL ELEMENT

Final Element Group Parameters

Architectural Constraint Method :	None	Group Voting :	1oo1
Sys. Cap. (Certified) or Prior Use Claim :	N/A	Mission Time (Yrs.) :	5

Final Elements Group 1

Group 1 Name :	Enter group name		
Proof Test Interval (Mo.) :	12	FE Voting :	KooN
Proof Test Coverage (%) :	80	Beta (%) :	3
Identical FE's (K) :	1		
Identical FE's (N) :	2		

Element Selection

Device Type :	Actuator/Valve Combination	Tight Shutoff :	Yes
		Trip Position :	Close
		Service :	Clean

Electrical Interface	FE Interface
None	Generic 2/3 Port, Direct Acting (Poppet) Solenoid

Pneumatic Device 1	Pneumatic Device 2
None	None

FE Valve Combo
Generic Air Operated Ball Valve, Hard Seat

Device Details

FE Electrical Interface

Device	DD	DU	SD	SU
No Device				

FE Interface

Device	DD	DU	SD	SU
Generic 2/3 Port, Direct Acting (Poppet) Solenoid	0	200	0	300

FE Pneumatic

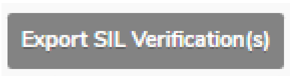
Device	DD	DU	SD	SU

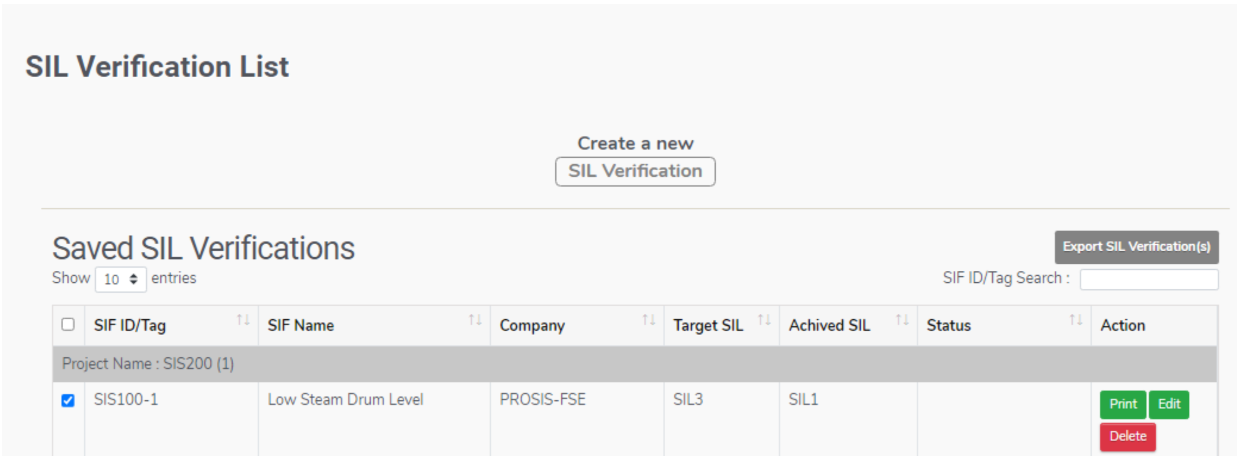
Device	DD	DU	SD	SU
No Device				

FE Valve Combo

Device	DD	DU	SD	SU
Generic Air Operated Ball Valve, Hard Seat	0	3180	0	500

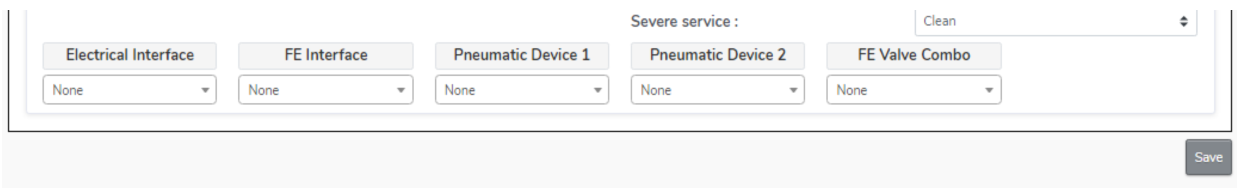
5.3.2 Exporting
From the SIF List page you will be able to export the SIL verification data



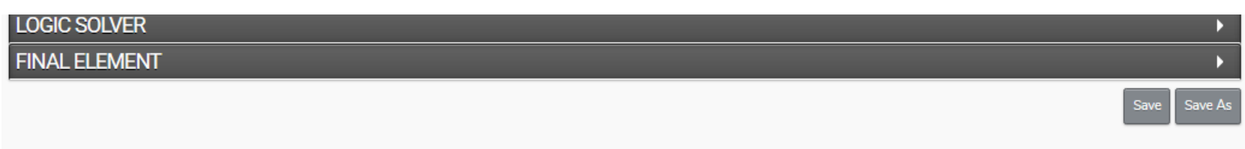


Select all or the SIF to export. The data will be exported in a user friendly Excel file.

5.3 Saving
Depending on your plan you will be able to save all of you SIFs up to your plan limit. From the New SIF page, select the “Save” button on the lower right of the page

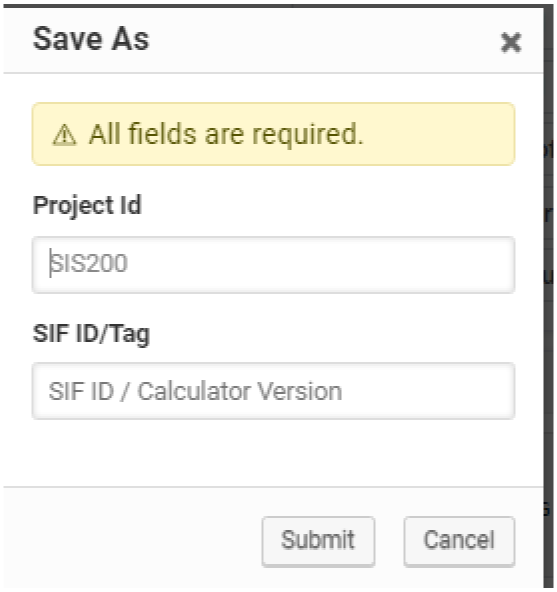


5.4 Copying a SIF design
From the SIF List page, select the SIF to copy by selecting “Edit”. On the bottom of the page, select “Save As’



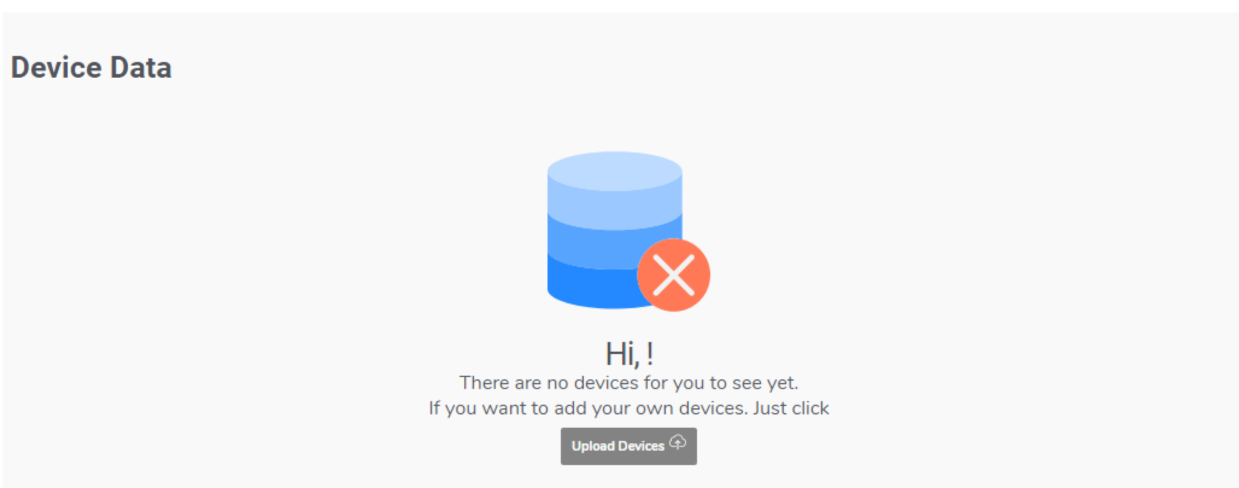
Complete the Required information

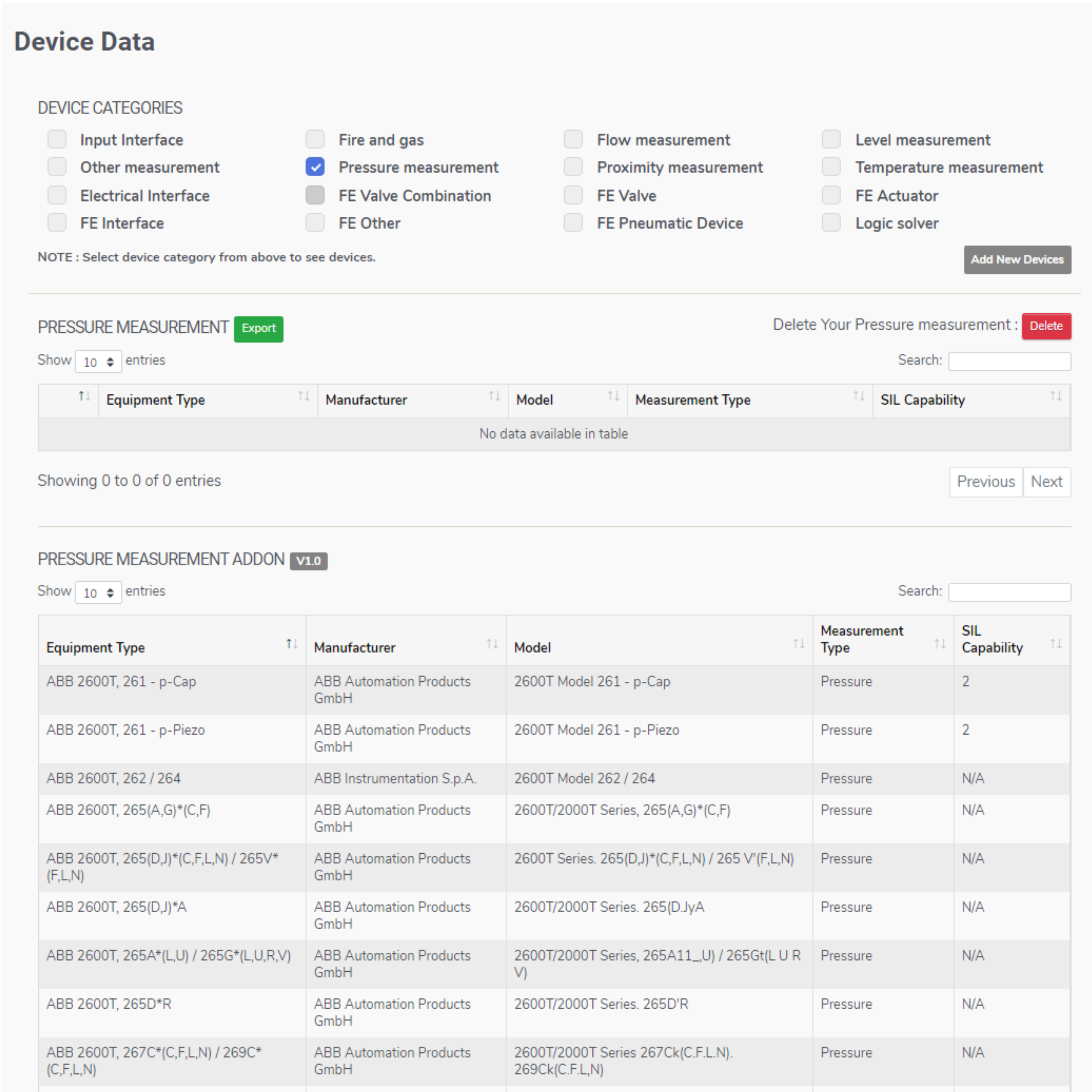
.



5.5 Adding User failure Data

You have the capabilities to save and use your own failure data. From the Failure Data page, select “Upload Devices”. If you have a paid version, you will have the ability to use a comprehensive database of devices. Trial users do not have the capability to view or use this database. Please purchase one of the plans to get access to the data.





Device Data

DEVICE CATEGORIES

- [ ] Input Interface
- [ ] Fire and gas
- [ ] Flow measurement
- [ ] Level measurement
- [ ] Other measurement
- [x] Pressure measurement
- [ ] Proximity measurement
- [ ] Temperature measurement
- [ ] Electrical Interface
- [ ] FE Valve Combination
- [ ] FE Valve
- [ ] FE Actuator
- [ ] FE Interface
- [ ] FE Other
- [ ] FE Pneumatic Device
- [ ] Logic solver

NOTE : Select device category from above to see devices.

Add New Devices

PRESSURE MEASUREMENT Export

Delete Your Pressure measurement : Delete

Show 10 entries

Search:

	Equipment Type	Manufacturer	Model	Measurement Type	SIL Capability
No data available in table					

Showing 0 to 0 of 0 entries

Previous Next

PRESSURE MEASUREMENT ADDON V1.0

Show 10 entries

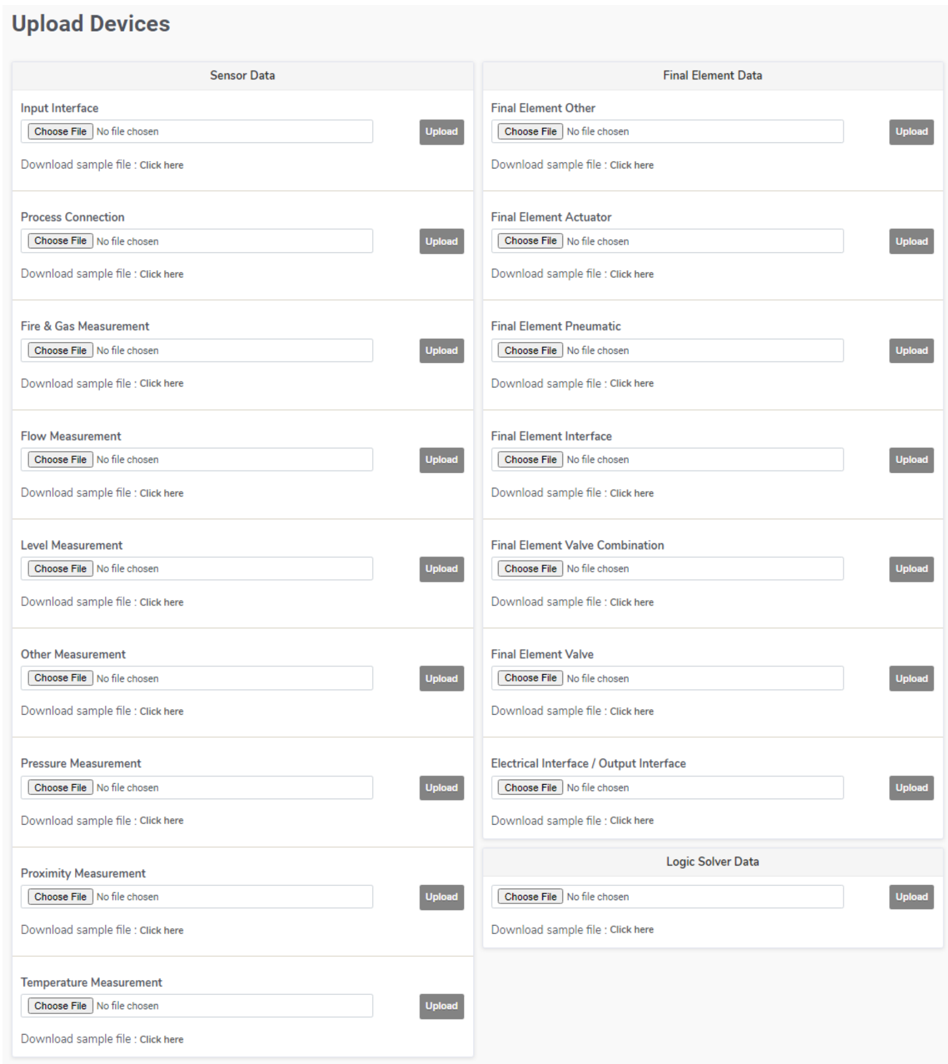
Search:

Equipment Type	Manufacturer	Model	Measurement Type	SIL Capability
ABB 2600T, 261 - p-Cap	ABB Automation Products GmbH	2600T Model 261 - p-Cap	Pressure	2
ABB 2600T, 261 - p-Piezo	ABB Automation Products GmbH	2600T Model 261 - p-Piezo	Pressure	2
ABB 2600T, 262 / 264	ABB Instrumentation S.p.A.	2600T Model 262 / 264	Pressure	N/A
ABB 2600T, 265(A,G)*(C,F)	ABB Automation Products GmbH	2600T/2000T Series, 265(A,G)*(C,F)	Pressure	N/A
ABB 2600T, 265(D,J)*(C,F,L,N) / 265V*(F,L,N)	ABB Automation Products GmbH	2600T Series. 265(D,J)*(C,F,L,N) / 265 V'(F,L,N)	Pressure	N/A
ABB 2600T, 265(D,J)*A	ABB Automation Products GmbH	2600T/2000T Series. 265(D.JyA	Pressure	N/A
ABB 2600T, 265A*(L,U) / 265G*(L,U,R,V)	ABB Automation Products GmbH	2600T/2000T Series, 265A11_,U) / 265Gt(L U R V)	Pressure	N/A
ABB 2600T, 265D*R	ABB Automation Products GmbH	2600T/2000T Series. 265D'R	Pressure	N/A
ABB 2600T, 267C*(C,F,L,N) / 269C*(C,F,L,N)	ABB Automation Products GmbH	2600T/2000T Series 267Ck(C.F.L.N). 269Ck(C.F.L,N)	Pressure	N/A
ABB 2600T, 267C*A / 269C*A	ABB Automation Products	2600T/2000T Series 267C'A / 269CrA	Pressure	N/A

Select the device type you wish to upload. You must use the sample file provided for the upload. You must supply a unique **Item**. The Item name is what will be displayed in the device selection dropdown in the calculator tool. At a minimum, the following data must be populated. You must adhere to the selection indicated below. Some of the device types will not require Analog/Digital. However, some device type may have multiple failure data as in the case of valves where there is different data for trip conditions and PVST. If you need assistance we can load this data for you as a service.

- **Item** – Must be unique to your list
- **Analog/Digital**: Digital, Digital High, Digital Low, Analog, HART, N/A
- **Architecture Type**: A or B
- **Hardware Tolerance**: 0, 1, 2, 3, 4, 5, N/A
- **SIL Capability**: 0, 1, 2, 3, 1/2, 2/3, N/A

- **Fail Low**: If provided in FITs
- **Fail High**: If provided in FITs
- **Fail Dangerous Detected**: If provided in FITs
- **Fail Safe Detected**: If provided in FITs
- **Fail Annunciated Detected**: If provided in FITs
- **Fail Annunciated Undetected**: If provided in FITs



5.6 Adding Users

Depending on the plan you will be able to add additional users. This may be required if you want to others to review and approve the work. You may need to add additional users of you team that may be working on another project. Whatever the need you will be able to add additional users to the main account from the main menu select “Add User”

Child Users

Show 10 entries | Add New User | Search :

Username	First Name	Last Name	Email	Last Login Date	Action
No data available in table					

Showing 0 to 0 of 0 entries | Previous | Next

The new user must have a valid email address. The page will display all of the users and display the remaining users that can be added. You will be able to add/edit/delete users from this page.

5.6 Proof Test Coverage estimator - FREE

From the main menu select “PTC Calculator”

Sensor Element		
Overall Proof Test Coverage		Normal
		61.27%
Element	DU	PTC
Process Connection	30.0	10%
Sensor Device	37.0	92%
Interface 1	52.8	57%
Interface2	16.6	99%

Final Element			
Overall Proof Test Coverage		Full Stroke	PVST
		74.81%	**48.25%**
Element	DU Normal	DU PVST	PTC Normal
Electrical Interface	40.0	40.0	99%
FE Interface/FE Other	166.0	2.0	99%
Pneumatic Device 1			97%
Pneumatic Device 2			97%
FE Actuator/Valve Combo	338.0	179.0	90%
FE Valve	486.0	312.0	54%

From the tool you will enter all of the vendor PTC and the Dangerous Undetected (DU) found in the certificates. You will only need to ender the devices that you are using. If there is not a device like shown above Pneumatic device 1/2, simply leave these blank as shown above. The value in “Green” is the value you would enter in the SILCalc tool.

5.7 Beta Estimator - FREE

Common Cause Factor Estimator - Sensor/Final Element			
Item	Sensors and final elements		Technique
	X_{SF}	Y_{SF}	Applied?
Separation			
Are all signal cables for the channels routed separately at all positions?	1	2	Yes (selected) / No
If the sensors/final elements have dedicated control electronics, is the electronics for each channel on separate printed-circuit boards?	2.5	1.5	Yes (selected) / No
If the sensors/final elements have dedicated control electronics, is the electronics for each channel indoors and in separate cabinets?	2.5	0.5	Yes (selected) / No
Diversity/Redundancy			
Do the devices employ different physical principles for the sensing elements, e.g., pressure and temperature, vane anemometer and Doppler transducer, etc?	7.5		Yes (selected) / No
Do the devices employ different electrical principles/designs, e.g., digital and analogue, different manufacturer (not re-badged) or different technology?	5.5		Yes (selected) / No
Do the channels employ enhanced redundancy with MooN architecture, where N > M + 2 ?	2	0.5	Yes (selected) / No
Do the channels employ enhanced redundancy with MooN architecture, where N = M + 2 ?	1	0.5	Yes (selected) / No
Are separate test methods and people used for each channel during commissioning?	1	1	Yes (selected) / No
Is maintenance on each channel carried out by different people at different times?	2.5		Yes (selected) / No
Complexity/design/application/maturity/experience			
Does cross-connection between channels preclude the exchange of any information other than that used for diagnostic testing or voting purposes?	0.5	0.5	Yes (selected) / No
Is the design based on techniques used in equipment that has been used successfully in the field for > 5 years?	1	1	Yes (selected) / No
Is there more than 5 years experience with the same hardware used in similar environments?	1.5	1.5	Yes (selected) / No
Are inputs and outputs protected from potential levels of over-voltage and over-current?	1.5	0.5	Yes (selected) / No
Are all devices/components conservatively rated (for example, by a factor of 2 or more)?	2		Yes (selected) / No
Assessment/analysis and feedback of data			
Have the results of the FMEA or FTA been examined to establish sources of CCF and have predetermined sources of CCF been eliminated by design?		3	Yes (selected) / No
Were CC failures considered in design reviews with the results fed back into the design? (Documentary evidence of the design review activity is required.)		3	Yes (selected) / No
Are all field failures fully analysed with feedback into the design? (Documentary evidence of the procedure is required.)	0.5	3.5	Yes (selected) / No
Procedures/human interface			
Is there a written system of work to ensure that all component failures (or degradations) are detected, the root causes established and other similar items inspected for similar potential causes of failure?	0.5	1.5	Yes (selected) / No
Are procedures in place to ensure that: maintenance (including adjustment or calibration) of any part of the independent channels is staggered, and, in addition to the manual checks carried out following maintenance, the diagnostic tests are allowed to run satisfactorily between the completion of maintenance on one channel and the start of maintenance on another?	2	1	Yes (selected) / No
Do the documented maintenance procedures specify that all parts of redundant systems (for example, cables, etc.), intended to be independent of each other, are not to be relocated?	0.5	0.5	Yes (selected) / No
Is all maintenance of printed-circuit boards, etc. carried out off site at a qualified repair centre and have all the repaired items gone through a full pre-installation testing?	0.5	1.5	Yes (selected) / No
Does the system diagnostic tests report failures to the level of a field-replaceable module?	1	1	Yes (selected) / No
Competence/training/safety culture			
Have designers been trained (with training documentation) to understand the causes and consequences of common cause failures?	2	3	Yes (selected) / No
Have maintainers been trained (with training documentation) to understand the causes and consequences of common cause failures?	0.5	4.5	Yes (selected) / No
Environmental control			
Is personnel access limited (for example locked cabinets, inaccessible position)?	0.5	2.5	Yes (selected) / No
Is the system likely to operate always within the range of temperature, humidity, corrosion, dust, vibration, etc., over which it has been tested, without the use of external environmental control?	3	1	Yes (selected) / No
Are all signal and power cables separate at all positions?	2	1	Yes (selected) / No
Environmental testing			
Has the system been tested for immunity to all relevant environmental influences (for example EMC, temperature, vibration, shock, humidity) to an appropriate level as specified in recognised standards?	10	10	Yes (selected) / No
Results			
Sensors and final elements	55	46.5	
Beta	101.5	2%	

To assist with the selection of the common cause (Beta factor), we have added an ANSI/ISA, IEC61511 estimator.

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