



SIL Solver® Enterprise

User Instructions

SIS-TECH Solutions, LP

We're Proven-in-Use®

Welcome

- Welcome to SIL Solver® Enterprise.
- This presentation is sectioned to make it easier to navigate. You can collapse the slides to the sections using the tool bar.
- **If you need assistance or would like to provide us with feedback, contact:**
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SIL Solver®

We are Proven in Use

- More than 100 companies have chosen SIL Solver® for their functional safety verification since 2002

We Build upon Field Experience

- The built-in SIL Solver® database uses field failure data as a basis, reflecting real-world device performance

We are Internationally Recognized

- SIL Solver® uses internationally recognized methods for PFD and STR calculation
- SIL Solver® is used by companies worldwide

User Instructions

Table of Contents

1. Logging in
2. Creating a new project and functions
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1. LOGGING IN

- Licensing
- Assigning username and password for new user
- Logging in

Licensing

- SIL Solver® is licensed software
 - Each enterprise license includes one administrator account and two user licenses
 - Additional user licenses can be purchased
- To request a quote for a new license, contact SIS-TECH at:
<http://sis-tech.com/applications/sil-solver>

Assigning username and password to new user

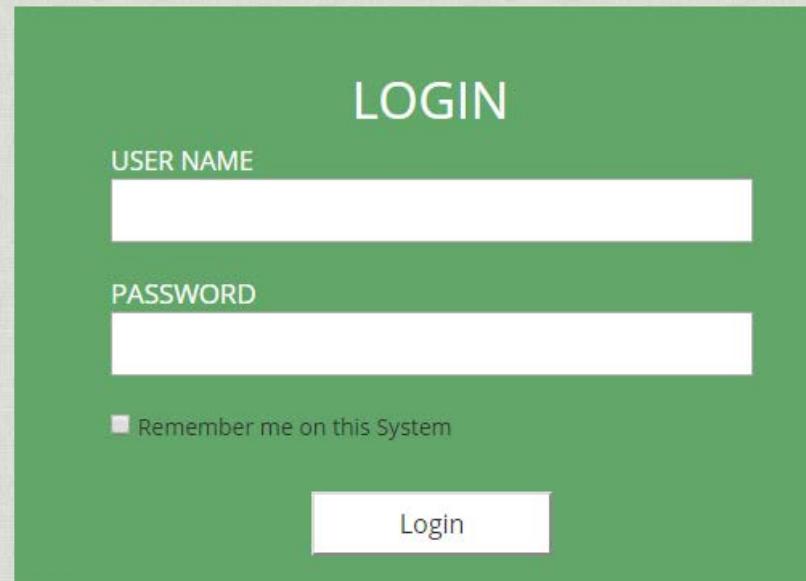
- Assignment/re-assignment of usernames and passwords is performed through the administrator account of the purchasing company

Logging In: User Name and Password

Purchasing companies
will have their own server
locations

For training classes,
in any web browser go to,
[http://silsolver.sis-
tech2.com/](http://silsolver.sis-tech2.com/)

Log in with your assigned
User name and Password

A green rectangular login form with white text and input fields. At the top right, the word "LOGIN" is written in a white, sans-serif font. Below it, the label "USER NAME" is followed by a white input field. Below that, the label "PASSWORD" is followed by another white input field. At the bottom left of the form, there is a small checkbox labeled "Remember me on this System". At the bottom right, a white "Login" button with a black border is centered.

2. CREATING A NEW PROJECT

- Setting up the project information
- Creating a safety function
- Copying a safety function
- Editing a safety function

Starting a new project

Exit the software

SIL SOLVER

Welcome, srtzvi

Site: BOGCI Project ID: SPLPNCwork

Projects

New

Exit

DBF Import Import Export Print Reports PF Documentation Project Data Sheets PF Details PF Data Summary PF Target Results PF Result Summary

Site	Location	Project ID	Project Name

No data to display

Create Filter

Project List
Filters may be useful to users with long project lists

Site: BOGCI

Project ID: SPLPNCwork

Projects

Open **New** Edit Copy Delete Exit Project Revision User Guide

DBF Import Import Export Print Reports PF Documentation Project Data Sheets PF Details PF Data Summary PF Target Results PF Result Summary

Site	Location	Project ID	Project Name

No data to display

→ Click to create a new project

The window below pops up, type in relevant information and click “Save”

Add New Project

Site:	<input type="text"/>
Location:	<input type="text"/>
Project ID:	<input type="text"/>
Name:	<input type="text"/>

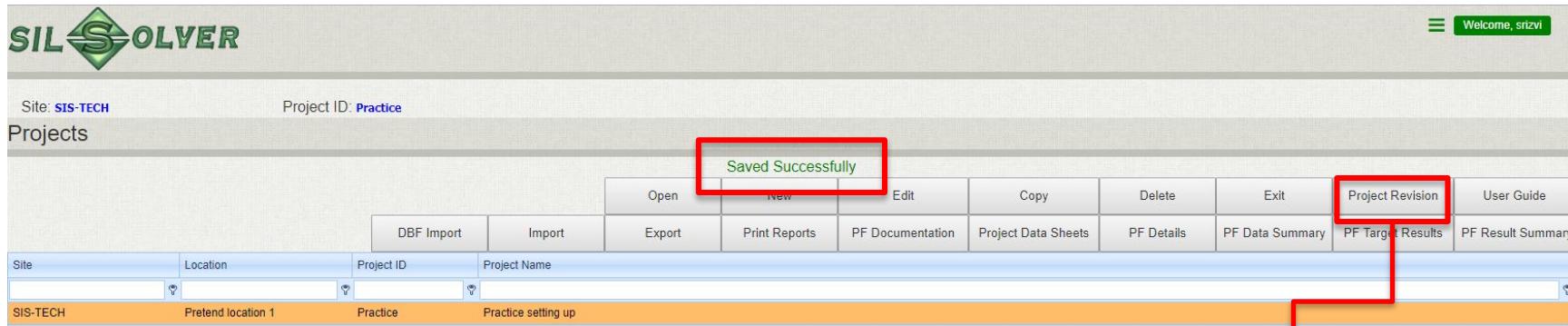
Save **Close**

Add New Project

Site:	<input type="text" value="SIS-TECH"/>
Location:	<input type="text" value="Pretend location 1"/>
Project ID:	<input type="text" value="Practice"/>
Name:	<input type="text" value="Practice setting up"/>

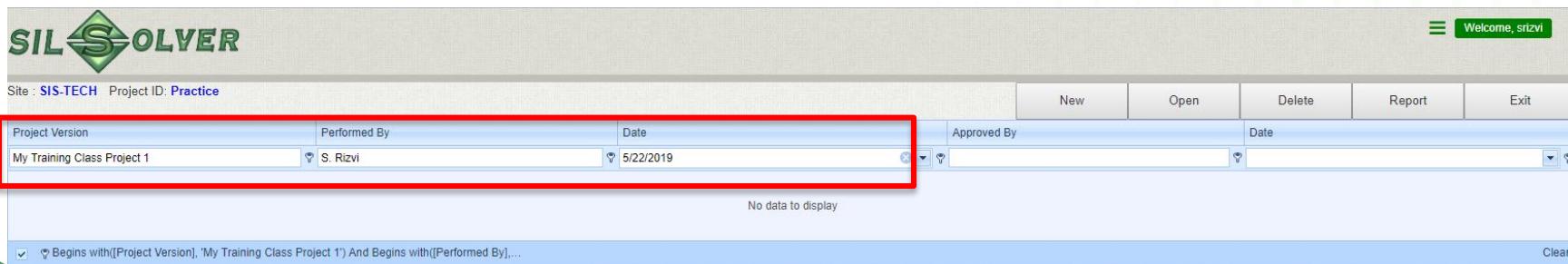
Save **Close**

Success!



The screenshot shows the SIL SOLVER software interface. At the top, there is a navigation bar with the SIS TECH logo, a menu icon, and a 'Welcome, srizvi' message. Below the navigation bar, the main title 'SIL SOLVER' is displayed. The top menu bar includes 'Site: SIS-TECH', 'Project ID: Practice', and a 'Welcome, srizvi' message. The main content area is titled 'Projects'. A red box highlights the 'Saved Successfully' message, and another red box highlights the 'Project Revision' button in the toolbar. A red arrow points from the 'Project Revision' button to the text 'Set initial project revision information' below.

Set initial project
revision
information



The screenshot shows the 'Project Revision' screen of the SIL SOLVER software. The top navigation bar includes 'Site: SIS-TECH', 'Project ID: Practice', and a 'Welcome, srizvi' message. The main content area has a table with columns: 'Project Version', 'Performed By', 'Date', 'Approved By', and 'Date'. A red box highlights the first row of the table, which contains 'My Training Class Project 1', 'S. Rizvi', and '5/22/2019'. Below the table, a message says 'No data to display'. At the bottom, there is a search bar with the placeholder 'Begins with([Project Version], 'My Training Class Project 1') And Begins with([Performed By],...)' and a 'Clear' button.

Steps for adding a safety function

1. Obtain functional description from Hazard and Risk Analysis (H&RA) documentation
2. Open Project
3. Select new function and enter function identification fields
4. Enter performance targets
5. Enter function architecture through GUI interface and populating the architecture with devices
6. Perform calculation
7. Re-iterate with design modifications if necessary to get successful design

Example SIF

Information from H&RA and related process requirement specification (PRS) information

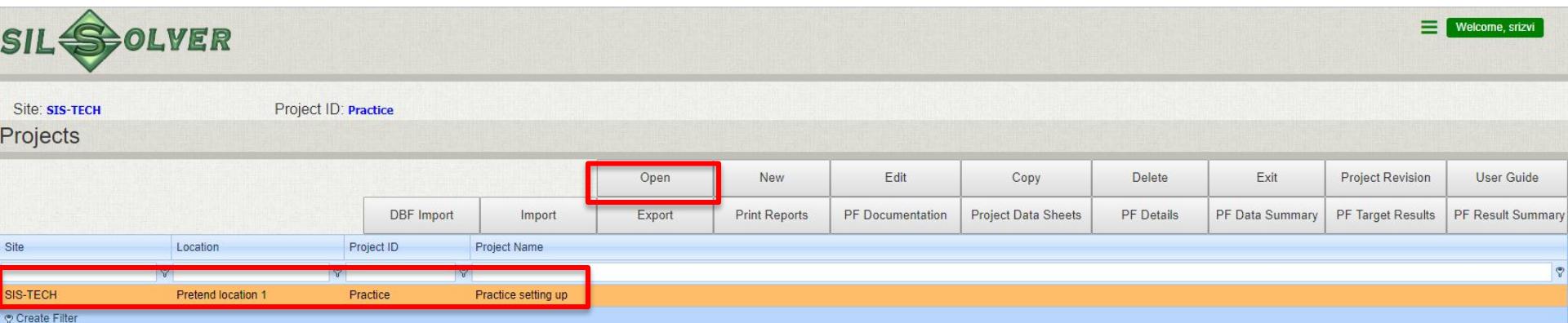
- SIF 01
- SIL-1 (20% design margin)
- Low Demand mode
- Spurious trip target = 20 yrs
- Desired test interval = 5 yrs
- V-101 High DP (2oo3,DP-101A/B/C) trip closes XV-101A and XV-101B (1oo2) ball valves spring loaded to the closed position, each with a single ETT solenoid (XY-101A and XY-101B)
- Power supply is monitored and is tested at 5 yr interval
- Existing logic solver (SIS-A) is safety configured system with 1oo2D CPU and simplex I/O

Opening the project

Start from Project home page

Select the Project by left-click (first project in list is selected by default)

Click Open



Site: SIS-TECH Project ID: Practice

Projects

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	Practice	Practice setting up

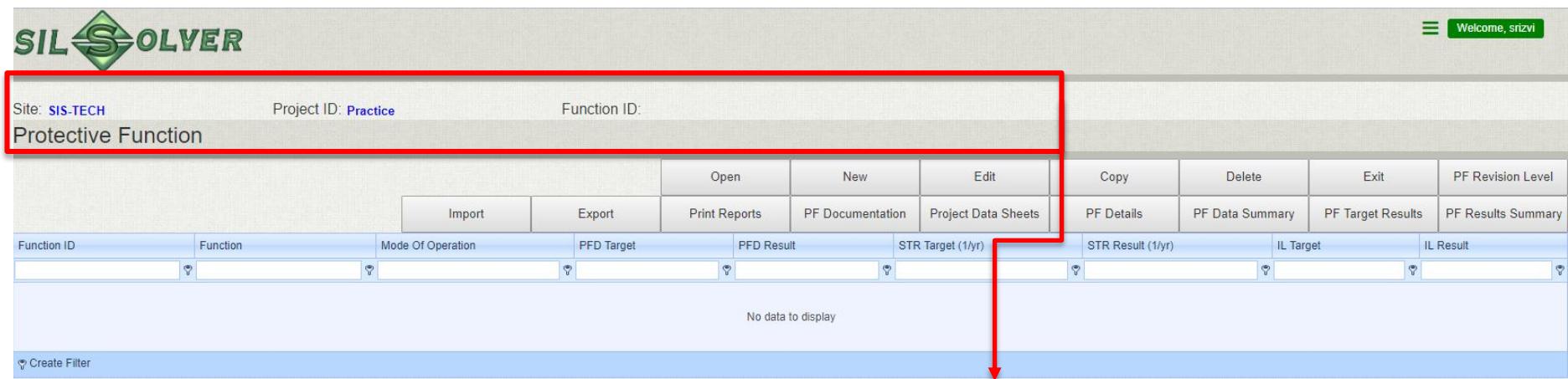
DBF Import Import Export Open New Edit Copy Delete Exit Project Revision User Guide

Print Reports PF Documentation Project Data Sheets PF Details PF Data Summary PF Target Results PF Result Summary

Create Filter

Protective Function Level

- The layout is the same as the main page with list of projects except that on the project level, we have the project information listed and do NOT have the DBF import function



The screenshot shows the SIL SOLVER software interface. At the top, there is a navigation bar with the 'SIL SOLVER' logo, a 'Welcome, srizi' message, and a 'Site: SIS-TECH' dropdown. Below the navigation bar, the 'Project ID: Practice' and 'Function ID:' fields are visible. A red box highlights the 'Protective Function' section. The main area contains a toolbar with buttons for 'Import', 'Export', 'Open', 'New', 'Edit', 'Copy', 'Delete', 'Exit', and 'PF Revision Level'. Below the toolbar is a table with columns for 'Function ID', 'Function', 'Mode Of Operation', 'PFD Target', 'PFD Result', 'STR Target (1/yr)', 'STR Result (1/yr)', 'IL Target', and 'IL Result'. A red arrow points from the 'Project Data Sheets' button in the toolbar to the 'Project information' text below.

Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result

No data to display

[Create Filter](#)

Project information.

Start a new safety function

SIL SOLVER

Site: SIS-TECH Project ID: Practice Function ID:

Protective Function

		Open	New	Edit	Copy	Delete	Exit	PF Revision Level		
		Import	Export	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Results Summary
Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result		

No data to display



- Enter ID, brief version of H&RA description, Mode of Operation, and Save

Protective Function

Function ID:	SIF 01
Function :	V-101 High DP trip
Mode of Operation:	Low Demand ▾

Save Close

Success!

SIL SOLVER

Welcome, srizvi

Site: SIS-TECH Project ID: Practice Function ID: **SIF 01**

Protective Function

Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result
SIF 01	V-101	High DR trip	Low Demand					

[Create Filter](#)

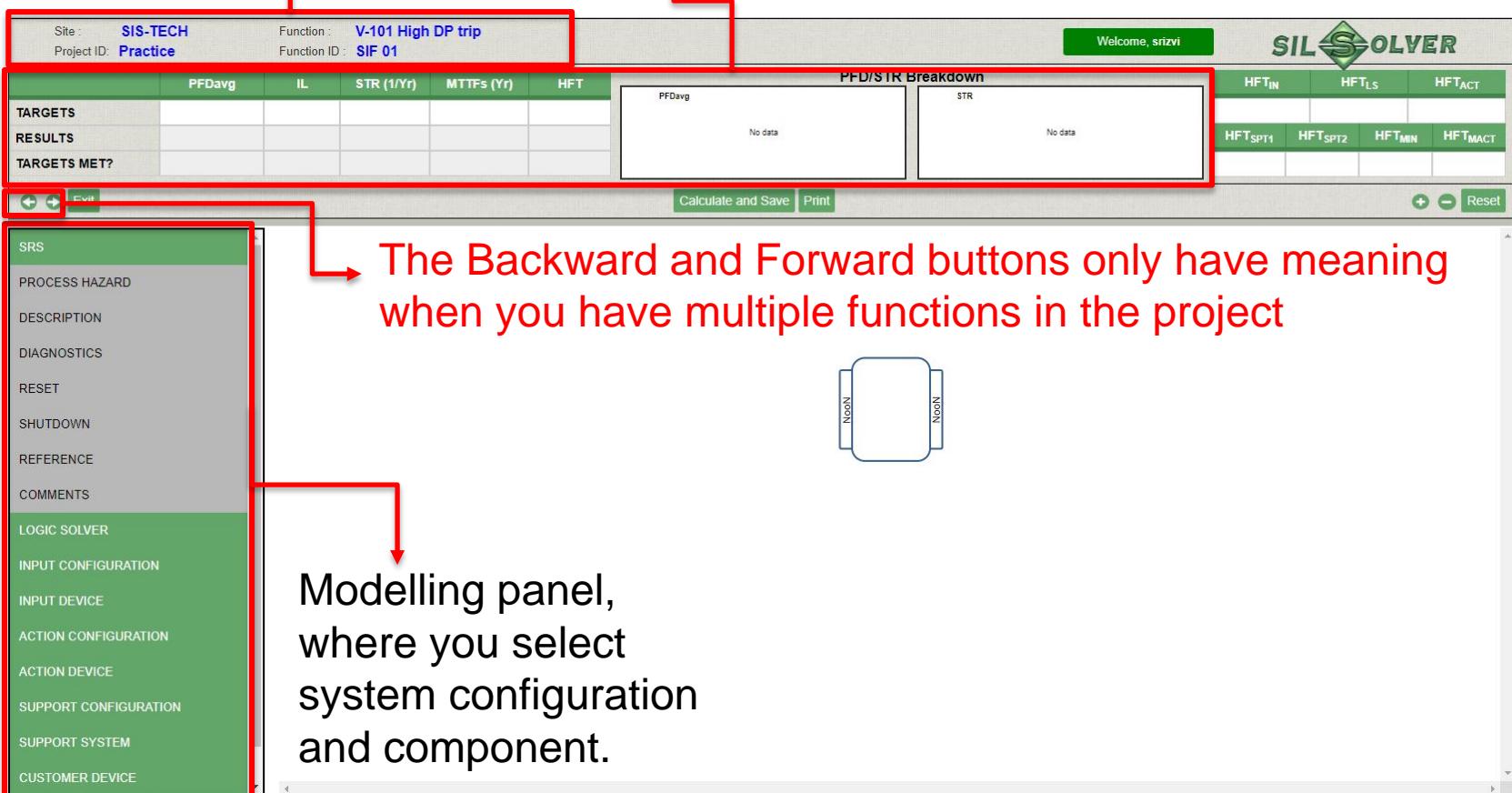
- Select function and click Open to begin configuring SIF

Fields for filtering can be useful for projects with long lists of protective functions

GUI Interface

SIF project information

SIF calculation results both numerical and graphical



The screenshot shows the SIL SOLVER software interface. At the top, there is a header bar with the site and function information: Site: SIS-TECH, Function: V-101 High DP trip, and Project ID: Practice. The main area is divided into several sections:

- SIF project information:** A table with columns for PFDavg, IL, STR (1/Yr), MTTFs (Yr), and HFT. Rows include TARGETS, RESULTS, and TARGETS MET?.
- SIF calculation results:** A section titled "PFD/STR Breakdown" with two sub-sections: PFDavg (No data) and STR (No data). Below this are tables for HFT_{IN}, HFT_{LS}, and HFT_{ACT}, with sub-tables for HFT_{SPT1}, HFT_{SPT2}, HFT_{MIN}, and HFT_{MACT}.
- Navigation and Tools:** A toolbar with Back, Forward, and Exit buttons, and a status bar with Calculate and Save, Print, and Reset buttons.
- Modelling panel:** A sidebar on the left with a green header "SRS" and a list of configuration options: PROCESS HAZARD, DESCRIPTION, DIAGNOSTICS, RESET, SHUTDOWN, REFERENCE, COMMENTS, and LOGIC SOLVER. The LOGIC SOLVER section is expanded, showing INPUT CONFIGURATION, INPUT DEVICE, ACTION CONFIGURATION, ACTION DEVICE, SUPPORT CONFIGURATION, SUPPORT SYSTEM, and CUSTOMER DEVICE.
- Diagram:** A small diagram of a logic component with two vertical ports labeled "NoON" on the left and right.

Annotations with red arrows and text:

- An arrow points from the "SIF project information" text to the top-left table.
- An arrow points from the "SIF calculation results" text to the "PFD/STR Breakdown" section.
- An arrow points from the "Modelling panel" text to the "LOGIC SOLVER" section of the sidebar.
- A large red box highlights the "LOGIC SOLVER" section of the sidebar.
- A red box highlights the "PFD/STR Breakdown" section.
- A red box highlights the "SRS" header of the sidebar.
- A red arrow points from the text "The Backward and Forward buttons only have meaning when you have multiple functions in the project" to the Back and Forward buttons in the toolbar.
- A red arrow points from the text "Modelling panel, where you select system configuration and component." to the "LOGIC SOLVER" section of the sidebar.

Zooming

Use the + and – buttons to zoom in and out on the figure

You cannot interact with certain features in a zoomed state

Site : SIS-TECH Function : V-101 High DP trip
Project ID: Practice Function ID : SIF 01

Welcome, srizvi

SIL SOLVER

PFDAvg IL STR (1/Yr) MTTFs (Yr) HFT

PFDAvg STR

HFT_{IN} HFT_{LS} HFT_{ACT}

HFT_{SPT1} HFT_{SPT2} HFT_{MIN} HFT_{MACT}

PFDAvg

STR

Calculate and Save Print

Targets

Results

Targets Met?

← → Exit

SRS

PROCESS HAZARD

DESCRIPTION

DIAGNOSTICS

RESET

SHUTDOWN

REFERENCE

COMMENTS

LOGIC SOLVER

INPUT CONFIGURATION

INPUT DEVICE

ACTION CONFIGURATION

ACTION DEVICE

SUPPORT CONFIGURATION

SUPPORT SYSTEM

CUSTOMER DEVICE

PFDAvg

STR

Calculate and Save Print

+

-

Reset

NoON

NoON

Use the Reset to return to the base view required for editing

Use the + and – buttons to zoom in and out on the figure

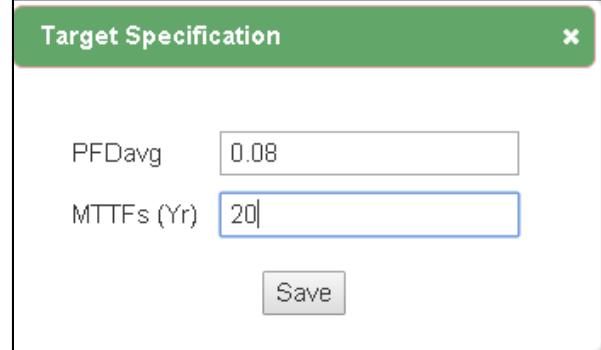
Entering Performance Targets

Click any cell in Targets row of table to open dialog box

Site : SIS-TECH Function : V-101 High DP trip
 Project ID: Practice Function ID : SIF 01

Welcome, srizvi SIL SOLVER

	PFDAvg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	PFD/STR Breakdown		HFT _{IN}	HFT _{LS}	HFT _{ACT}
TARGETS						PFDAvg	No data			
RESULTS						STR	No data			
TARGETS MET?										



Enter performance targets and save

Success!

The screenshot shows the SIL SOLVER software interface. At the top, there is a header with the project details: Site: SIS-TECH Practice, Function: V-101 High DP trip, and Function ID: SIF 01. Below this is a table with columns: TARGETS, PFDavg, IL, STR (1/Yr), MTTFs (Yr), and HFT. The 'TARGETS' row shows values: 8.00E-02, 1, 5.00E-02, 20, and 0. The 'RESULTS' and 'TARGETS MET?' sections are empty. At the bottom of the main window are buttons for 'Calculate and Save' and 'Print'.

A modal dialog box titled 'Silsolver' is displayed, showing the message 'Target saved successfully..!!' with an 'OK' button.

The right side of the interface shows a 'Breakdown' section with a table for 'STR' and a note 'No data'. There are also tabs for 'HFT_{IN}', 'HFT_{LS}', 'HFT_{ACT}', 'HFT_{SPT1}', 'HFT_{SPT2}', 'HFT_{MIN}', and 'HFT_{MACT}'. Below these tabs are 'Add' and 'Reset' buttons.

The left side of the interface features a sidebar with the following sections: SRS, PROCESS HAZARD, DESCRIPTION, DIAGNOSTICS, RESET, SHUTDOWN, REFERENCE, COMMENTS, and LOGIC SOLVER. The 'LOGIC SOLVER' section is highlighted with a red box. Below it are sections for INPUT CONFIGURATION, INPUT DEVICE, ACTION CONFIGURATION, ACTION DEVICE, SUPPORT CONFIGURATION, SUPPORT SYSTEM, and CUSTOMER DEVICE.

In the center of the main window, there is a logic solver configuration area showing a rectangular box with two vertical ports labeled 'NoonN' on each side.

Close dialog box and select Logic Solver on left to begin configuration

HFT Target

HFT target is based on the SIL Target and Mode of. If no PFDavg target has been entered (which would result in no SIL target), HFT target will be set to null.

SIL Target	Mode of Operation	HFT target for each subsystem
1	Low Demand	0
1	High Demand	0
2	Low Demand	0
2	High Demand	1
3	Low Demand	1
3	High Demand	1

HFT Target

Site : SIS-TECH Function : V-102 High DP/P Trip
 Project ID: Practice Function ID : SIF 02 Welcome, srizvi

SIL SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
TARGETS	8.00E-02	1	5.00E-02	20.00	0
RESULTS	5.53E-02	1	5.94E-02	16.84	0
TARGETS MET?					

PFD/STR Breakdown

PFDavg

89.4%

- Action
- Input
- Logic
- Support

STR

50%

- Action
- Input
- Logic
- Support

	HFT _{IN}	HFT _{LS}	HFT _{ACT}
HFT _{SPT1}	1	1	1
HFT _{SPT2}			
HFT _{MIN}			
HFT _{MACT}			

Calculate and Save Print

Exit

+ - Reset

Picking Logic Solver (LS)

Left click desired logic solver to copy
 Move the mouse to the box in the middle and click to paste.

Site : **SIS-TECH** Function : **V-101 High DP trip**
 Project ID: **Practice** Function ID : **SIF 01**

Welcome, srizvi

SIL SOLVER

	PFDAvg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
TARGETS	8.00E-02	1	5.00E-02	20	0
RESULTS					
TARGETS MET?					

PFD/STR Breakdown

PFDAvg	STR
No data	No data

Buttons:

SRS

LOGIC SOLVER

- GENERIC 2004D DUAL MP, DUAL I/O
- GENERIC 1002D DUAL MP, SIMPLEX I/O** (Selected)
- NON SC D/D
- NON SC PES DUAL MP, DUAL I/O
- NON SC D/S
- NON SC PES DUAL MP, SIMPLEX I/O
- NON SC S/S
- NON SC PES SIMPLEX MP, SIMPLEX
- FC
- RELAY - FAIL TO CLOSE**
- FO
- RELAY - FAIL TO OPEN**

HFT_{IN} **HFT_{LS}** **HFT_{ACT}**

HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}	HFT _{MACT}

Wrong one?

To delete the logic solver, move the mouse to icon and right click to delete

24

Adding LS details

Edit the logic solver parameter by left click the logic solver icon on in the box. Where Assign a tag name, select the voting, and enter the test interval (TI)

Note: the voting needs to be selected before test interval.

Caution: Logic Solver test interval may be prescribed in vendor safety manual or prior use justification documentation

Tool will automatically calculate LS contributions to PFDavg and STR

Logic Solver

Logic Solver ID: DMSIO

Logic Solver Type: GENERIC 1002D DUAL MP; SIMPLEX I/O

Configurations:

Logic Solver Tag: SIS-A

Voting: 1oo2D

Proof Testing Interval (yr): 5

PFDavg: 4.92E-04

STR: 4.50E-02

Note:

Boundary Description: Boundary includes 1oo2D logic solver with dual main processors, 1 simplex digital input module, 1 simplex analog input module, and 1 simplex digital output module.

Implementation Limitations and Exclusions: Refer to the SIL Solver manual for a discussion of "1oo2D" and "2oo2D" architectures. The logic solver is certified to IEC 61508 SIL 3 or TUV AK 5-6.

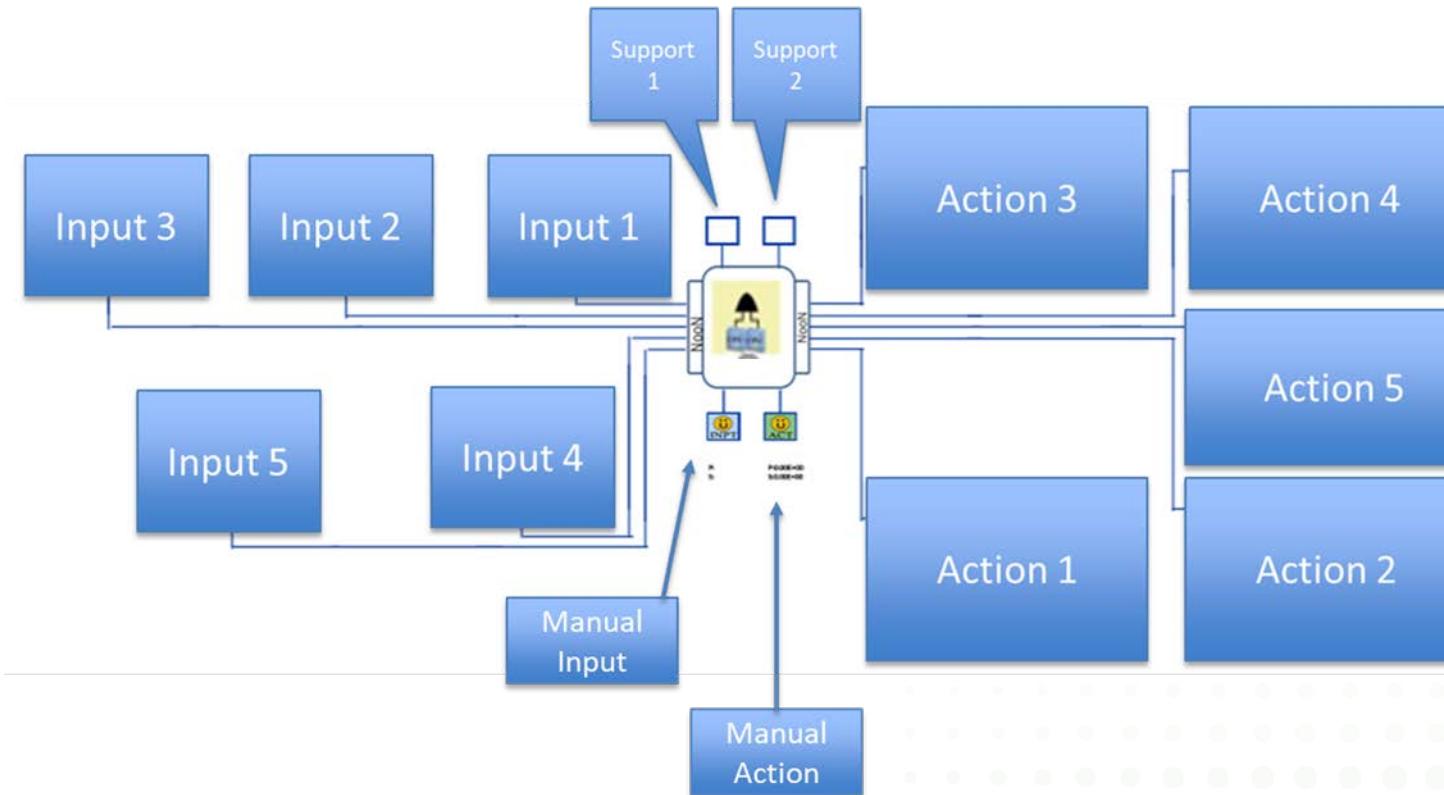
Data Source: SIL

HFT: 1

Update

Click Update to return to GUI page

Other Subsystems are added to the GUI in the order selected



Adding Inputs (aka Sensors)

Adding an input is divided into two steps

1. add the input configuration
2. add each device.

Input Configuration

Click “Input Configuration” to open selection list

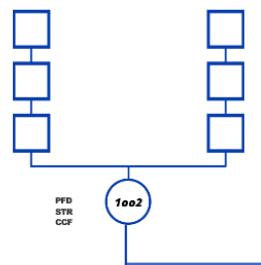
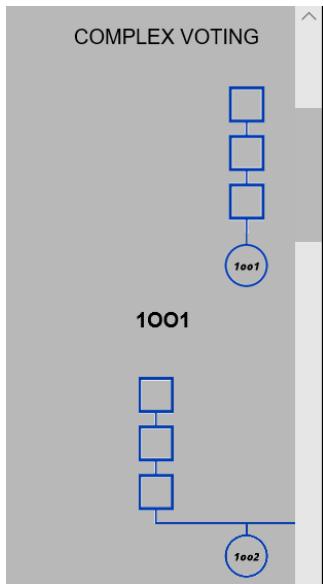
Select the desired voting. Click the selected configuration to add to the GUI.

Wrong choice? Hover over that portion of the architecture until grey selection box appears and right-click to get option to delete.

Site : SIS-TECH Practice Function : V-101 High DP trip Project ID: SIF 01 Welcome, srizvi SIL SOLVER

	PF _{Davg}	IL	STR (1/Yr)	MTTFs (Yr)	HFT	PFD/STR Breakdown			HFT _{IN}	HFT _{L_S}	HFT _{ACT}										
TARGETS	8.00E-02	1	5.00E-02	20.00	0																
RESULTS																					
TARGETS MET?																					
<input type="button" value="←"/> <input type="button" value="→"/> <input type="button" value="Exit"/> <input type="button" value="Calculate and Save"/> <input type="button" value="Print"/> <input type="button" value="+"/> <input type="button" value="-"/> <input type="button" value="Reset"/>																					
<p>SRS</p> <p>LOGIC SOLVER</p> <p>INPUT CONFIGURATION</p> <p>ONE DEVICE</p> <p>TWO DEVICES</p> <p>THREE DEVICES</p> <p>1003</p> <p>2003</p> <p>3003</p> <p>PFD/STR Breakdown</p> <table border="1"> <tr> <td></td> <td></td> </tr> </table> <table border="1"> <tr> <td>HFT_{SPT1}</td> <td>HFT_{SPT2}</td> <td>HFT_{MIN}</td> <td>HFT_{MACT}</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>														HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}	HFT _{MACT}				
HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}	HFT _{MACT}																		

Complex Voting Architectures



Common examples:

- Sensor Transmitter with a Signal Splitter, Trip Amp, or a Relay
- Pressure/Temperature compensated flow

- If a single variable value is made up of multiple devices, use a **Complex Voting Architecture**
- All the devices for each separate value go in a single vertical channel

Picking Technology

Click “input device” to access to the list of device categories
Left-click the relevant category to access the list of devices technology

Site : SIS-TECH Function : V-101 High DP trip
Project ID: Practice Function ID: SIF 01

Welcome, srizvi

SIL SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	PFD/STR Breakdown		HFT _{IN}	HFT _{LS}	HFT _{ACT}
TARGETS	8.00E-02	1	5.00E-02	20.00	0					
RESULTS										
TARGETS MET?										

INPUT DEVICE

- TRIP AMPLIFIER
- ANALYZER
- PRESSURE
- DP** DIFFERENTIAL PRESSURE TRANSMITTER
- P** PNEUMATIC PRESSURE SWITCH
- PT+** PNEUMATIC PRESSURE TRANSMITTER
- P** PRESSURE SWITCH - NORMAL SERVICE
- PT** PRESSURE TRANSMITTER
- DP**

PFD/STR Breakdown

Calculate and Save Print + - Reset

Diagram description: The logic diagram illustrates a safety system configuration. On the left, a 2oo3 voting logic block is connected to three inputs from the left and one output to a final element. The final element is represented by a yellow rectangle containing a black symbol, with two output lines labeled 'Nominally'.

Selecting the Device

Scroll to the desired device

Left click device in list to copy (right-click to open datasheet – more later)

Left click in device box on diagram to add device to the input subsystem

Site : SIS-TECH
Project ID: Practice

Function : V-101 High DP trip
Function ID : SIF 01

Targets

PF Avg	8.00E-02	IL	1	STR (1/Yr)	5.00E-02	MTTFs (Yr)	20.00	HFT	0
--------	----------	----	---	------------	----------	------------	-------	-----	---

Results

Targets Met?									
--------------	--	--	--	--	--	--	--	--	--

PF/STR Breakdown

--	--

HFT_{IN} HFT_{LS} HFT_{ACT}

HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}	HFT _{MACT}

Calculate and Save Print

Reset

INPUT DEVICE

- TRIP AMPLIFIER
- ANALYZER
- PRESSURE
- DP** DIFFERENTIAL PRESSURE TRANSMITTER
- P** PNEUMATIC PRESSURE SWITCH
- PT** PNEUMATIC PRESSURE TRANSMITTER
- P** PRESSURE SWITCH - NORMAL SERVICE
- PT** PRESSURE TRANSMITTER
- DP**

Copy Delete

To delete or copy the device, move the mouse to device icon in function diagram and right click.

Adding Device Details

White boxes are editable fields. Some are pre-populated

Device

Device ID: DPTR **Device Type:** DIFFERENTIAL PRESSURE TRANSMITTER

Configurations:

Device Tag:

Proof Testing Interval (yr):

Voting:

Subsystem Diagnostic Level: ?

Properties:

Failure Dangerous Failure Rate (1/yr):

Failure Spurious Failure Rate (1/yr):

CCF Dual(%):

CCF Triple(%):

Diagnostic Coverage Simplex(1/yr):

Diagnostic Coverage Dual(1/yr):

Diagnostic Coverage Triple(1/yr):

Maintenance:

Mean Time to Repair (hr):

Diagnostic Interval (hr):

Overhaul Interval (yr):

Proof Testing Coverage (%): ?

User Specified

Note:

Boundary Conditions: Boundary includes the electronic transmitter, sensing diaphragm and process connection.

Process Severity Assumption: Clean

Implementation Limitations and Exclusions: No limitations beyond standard assumptions (see SIL Solver Enterprise User Manual).

Data Source: SIL

Filled In

Test Interval is in years

Define Voting of one device. Use 1oo1 most of the time

Define Diagnostic NO DC in this case.

Define OI, default is 20Year

Define PTC, default is 100 %

Device ID: DPTR Device Type: DIFFERENTIAL PRESSURE TRANSMITTER

Configurations:

- Device Tag: DP-101A
- Proof Testing Interval (yr): 5
- Voting: 1oo1
- Subsystem Diagnostic Level: NO DC

Properties:

- Failure Dangerous Failure Rate (1/yr): 8.00E-03
- Failure Spurious Failure Rate (1/yr): 1.67E-02
- CCF Dual(%): 2
- CCF Triple(%): 2
- Diagnostic Coverage Simplex(1/yr): 60.00
- Diagnostic Coverage Dual(1/yr): 80.00
- Diagnostic Coverage Triple(1/yr): 90.00

Maintenance:

- Mean Time to Repair (hr): 72
- Diagnostic Interval (hr): 0.500
- Overhaul Interval (yr): 20
- Proof Testing Coverage (%): 100
- User Specified:

Note:

Boundary Conditions: Boundary includes the electronic transmitter, sensing diaphragm and process connection.

Process Severity Assumption: Clean

Implementation Limitations and Exclusions: No limitations beyond standard assumptions (see SIL Solver Enterprise User Manual).

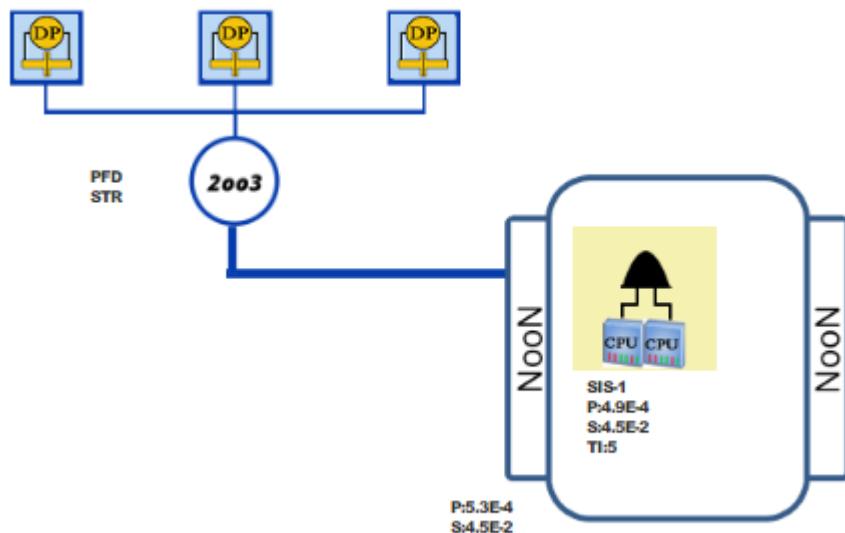
Data Source: SIL

Update

Click Update to save change

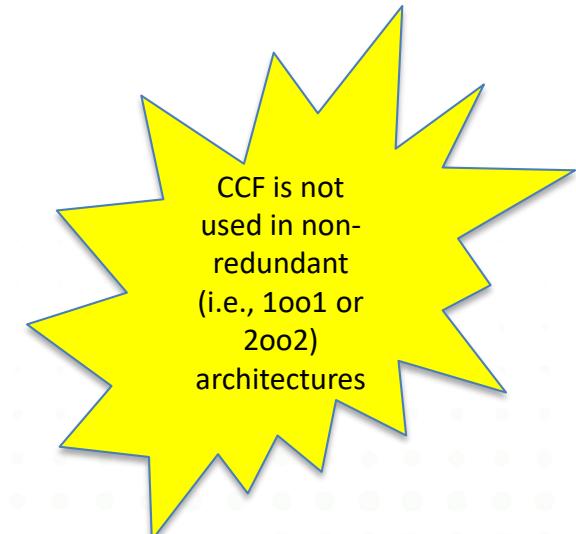
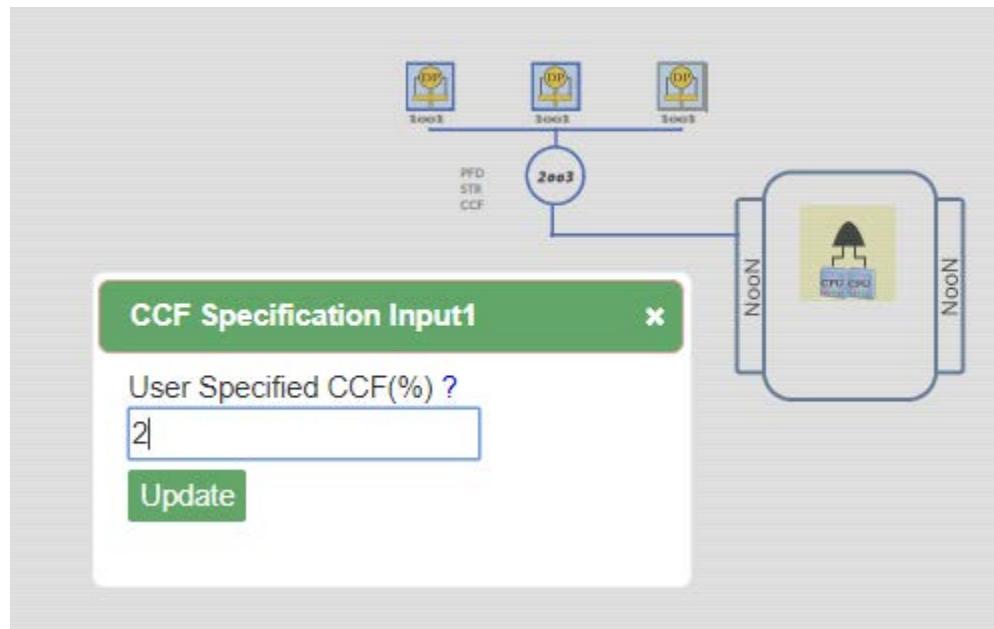
Completing the subsystem

1. Copy DP-101A Pressure transmitter
2. Paste DP pressure transmitter to each of box in the 2oo3 input configuration
3. Update the tags for DP-101B and DP-101C and any other parameters that were modified for DP-101A.



Adding Common Cause

- Left-click on the voting 2oo3 circle
- Put in CCF value as a percentage (for example, 2%)
Note: Recommended values for duplex and triplex architectures are shown in the device datasheet under “Properties”
- Click Update to close the dialog box



Partial Calculation

Click “Calculate and Save”

PFD and STR of the 2oo3 input and LS subsystems will be calculated

Results are displayed graphically and numerically on the GUI

The screenshot shows the SIL-SOLVER software interface. At the top, there are tabs for 'Customer: SIS-TECH' and 'Project: Practice proj 1'. Below these are sections for 'Function: V-101 High DP trip' and 'Function ID: SIF 01'. On the right, there are buttons for 'Welcome, eloiser', 'Reset', 'Exit', 'Calculate and Save', and 'Print'. The main area features a 'PFDavg' and 'STR (1/Yr)' table with data: TARGETS (8E-02, 1, 5E-02, 2E+01), RESULTS (2.05E-3, 2, 4.92E-2, 20.33), and TARGETS MET? (green bar). To the right are two pie charts: 'PFDavg' (76% Input, 24% Logic) and 'STR' (91.5% Input, 8.5% Logic). On the left, there's an 'INPUT CONFIGURATION' sidebar with sections for 'INPUT DEVICE' (ANALYZER, PRESSURE), and icons for 'DIFFERENTIAL PRESSURE TRANSMITTER', 'PNEUMATIC PRESSURE SWITCH', 'PNEUMATIC PRESSURE TRANSMITTER', and 'PRESSURE SWITCH - NORMAL SERVICE'. The central part of the screen shows a process flow diagram with nodes like 'MP-101C', 'P-210B-2', 'P-210B-3', 'T101', 'MP-111B', 'P-210B-2', 'T102', 'MP-101A', 'P-210B-2', 'T103', 'T104', '2003', and a central logic block with 'NoON' and 'NoOFF' outputs. A message box on the right says 'Silsolver' and 'PFD Value get Successfully' with an 'OK' button.

A warning will be generated if a function does not have at least one input and one action

2oo3D vs. 2oo3

- What if automated diagnostics is going to be used to take safe action on diagnosed failure?
- Enter each device and change the Diagnostic level to DC3 (diagnostic level for intercomparison of 3 transmitters)
- Click Update to close dialog box

Define Diagnostic DC3 is used since 3 PTs are used for comparison. The DC used in 90% ←

Device			
Device ID:	DPTR	Device Type:	DIFFERENTIAL PRESSURE TRANSMITTER
Configurations: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Device Tag: DP-101A</p> <p>Proof Testing Interval (yr): 5</p> <p>Voting: 1oo1</p> <p>Subsystem Diagnostic Level: ? DC3</p> </div> <div style="width: 45%;"> <p>Properties:</p> <p>Failure Dangerous Failure Rate (1/yr): 8.00E-03</p> <p>Failure Spurious Failure Rate (1/yr): 1.67E-02</p> <p>CCF Dual(%): 2</p> <p>CCF Triple(%): 2</p> <p>Diagnostic Coverage Simplex(1/yr): 60.00</p> <p>Diagnostic Coverage Dual(1/yr): 80.00</p> <p>Diagnostic Coverage Triple(1/yr): 90.00</p> </div> </div>			
Maintenance: <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Mean Time to Repair (hr): 72</p> <p>Diagnostic Interval (hr): 0.500</p> <p>Overhaul Interval (yr): 20</p> <p>Proof Testing Coverage (%): ? 100</p> <p>User Specified <input type="checkbox"/></p> </div> <div style="width: 45%;"> <p>PFDavg: 2.01E-002</p> <p>STR: 1.67E-002</p> </div> </div>			
Note: <p>Boundary Conditions: Boundary includes the electronic transmitter, sensing diaphragm and process connection.</p> <p>Process Severity Assumption: Clean</p> <p>Implementation Limitations and Exclusions: No limitations beyond standard assumptions (see SIL Solver Enterprise User Manual).</p>			
Data Source: SIL <input type="text"/>			
<input type="button" value="Update"/>			

Calculate and Save to Update Partial Results

Site: SIS-TECH Function: V-101
 Project ID: Practice Function ID: SIF 01

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	
TARGETS	8.00E-02	1	5.00E-02	20	0	
RESULTS	2.05E-03	2	4.92E-02	20.33	1	
TARGETS MET?						

[Calculate and Save](#) [Print](#)

Sil solver

Calculation complete

[OK](#)

Welcome, srizvi

SIL SOLVER

STR Breakdown	HFT _{IN}	HFT _{LS}	HFT _{ACT}
STR	1	1	
Action			
Input			
Logic	91.5%		
	HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}
			HFT _{MACT}

[Reset](#)

SRS

PROCESS HAZARD

DESCRIPTION

DIAGNOSTICS

RESET

SHUTDOWN

REFERENCE

COMMENTS

LOGIC SOLVER

INPUT CONFIGURATION

INPUT DEVICE

ACTION CONFIGURATION

ACTION DEVICE

SUPPORT CONFIGURATION

SUPPORT SYSTEM

CUSTOMER DEVICE

Other warnings may occur if some of the required information was left incomplete!

FYI: DC for other architectures

For all other input configurations with safe action on diagnosed failure, the general rule for the selection of Diagnostic level is as below:

1oo1D → DC1 (Diagnostic Coverage Simplex)

1oo2D and 2oo2D → DC2 (Diagnostic Coverage Dual)

1oo3D, 2oo3D and 3oo3D → DC3(Diagnostic Coverage Triplicated)

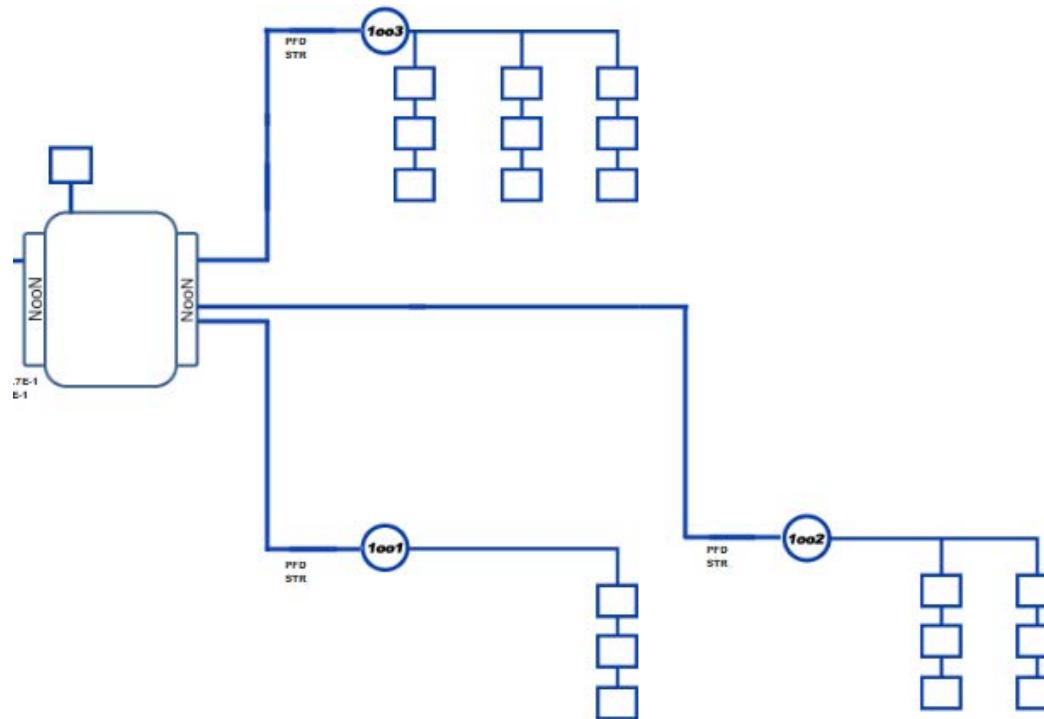
May need to select a lower DC when diverse devices are used in the same voting.

May select a higher DC when an external independent reading can be used for inter-comparison with the SIF sensor.

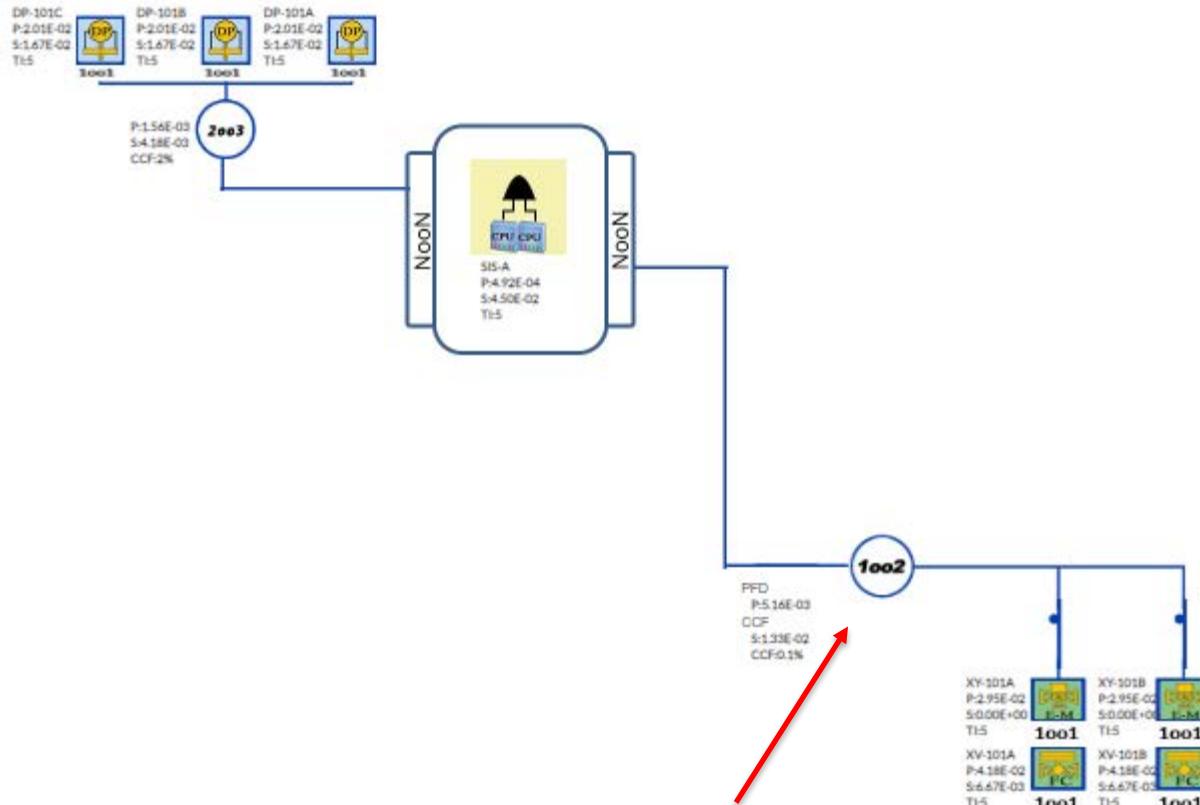
Adding the rest of the system

The support system and final actions are modelled in a similar way as the input.

1. Select the action configuration
2. Select the action device (Identical logic as SIL Solver® V 7.0)
3. Specify relevant parameters



Adding valves and solenoids



Don't forget to enter CCF

Device ID:	SVETHM	Device Type:	SOLENOID VALVE - ETT - MONITORED
Configurations:		Properties:	
Device Tag:	XY-101A	Failure Dangerous Failure Rate (1/yr):	1.18E-02
Proof Testing Interval (yr):	5	Failure Spurious Failure Rate (1/yr):	0
Voting:	1001	CCF Dual(%):	1
Subsystem Diagnostic Level:	NO DC	CCF Triple(%):	1
Maintenance:		Diagnostic Coverage Simplex(1/yr): 0.00	
Mean Time to Repair (hr):	72	Diagnostic Coverage Dual(1/yr): 0.00	Diagnostic Coverage Triple(1/yr): 0.00
Diagnostic Interval (hr):	0.000		
Overhaul Interval (yr):	20		
Proof Testing Coverage (%):	100		
User Specified	<input type="checkbox"/>	PFDavg:	2.00E-002
	<input type="checkbox"/>	STI:	0.00E+000

Device	BLOCK VALVE-BALL-FTC-CLEAN																
Device ID:	BVFCC	Device Type:	BLOCK VALVE-BALL-FTC-CLEAN														
Configurations: <table border="1"> <tr> <td>Device Tag:</td> <td>XV-101A</td> </tr> <tr> <td>Proof Testing Interval (yr):</td> <td>5</td> </tr> <tr> <td>Voting:</td> <td>1oo1</td> </tr> <tr> <td>Subsystem Diagnostic Level:</td> <td>NO DC</td> </tr> </table>				Device Tag:	XV-101A	Proof Testing Interval (yr):	5	Voting:	1oo1	Subsystem Diagnostic Level:	NO DC						
Device Tag:	XV-101A																
Proof Testing Interval (yr):	5																
Voting:	1oo1																
Subsystem Diagnostic Level:	NO DC																
Maintenance: <table border="1"> <tr> <td>Mean Time to Repair (hr):</td> <td>72</td> </tr> <tr> <td>Diagnostic Interval (hr):</td> <td>0.000</td> </tr> <tr> <td>Overhaul Interval (yr):</td> <td>20</td> </tr> <tr> <td>Proof Testing Coverage (%):</td> <td>100</td> </tr> <tr> <td>User Specified</td> <td><input type="checkbox"/></td> </tr> </table>				Mean Time to Repair (hr):	72	Diagnostic Interval (hr):	0.000	Overhaul Interval (yr):	20	Proof Testing Coverage (%):	100	User Specified	<input type="checkbox"/>				
Mean Time to Repair (hr):	72																
Diagnostic Interval (hr):	0.000																
Overhaul Interval (yr):	20																
Proof Testing Coverage (%):	100																
User Specified	<input type="checkbox"/>																
Properties: <table border="1"> <tr> <td>Failure Dangerous Failure Rate (1/yr):</td> <td>1.67E-02</td> </tr> <tr> <td>Failure Spurious Failure Rate (1/yr):</td> <td>6.67E-03</td> </tr> <tr> <td>CCF Dual(%):</td> <td>0.1</td> </tr> <tr> <td>CCF Triple(%):</td> <td>0.1</td> </tr> <tr> <td>Diagnostic Coverage Simplex(1/yr):</td> <td>85.00</td> </tr> <tr> <td>Diagnostic Coverage Dual(1/yr):</td> <td>85.00</td> </tr> <tr> <td>Diagnostic Coverage Triple(1/yr):</td> <td>85.00</td> </tr> </table>				Failure Dangerous Failure Rate (1/yr):	1.67E-02	Failure Spurious Failure Rate (1/yr):	6.67E-03	CCF Dual(%):	0.1	CCF Triple(%):	0.1	Diagnostic Coverage Simplex(1/yr):	85.00	Diagnostic Coverage Dual(1/yr):	85.00	Diagnostic Coverage Triple(1/yr):	85.00
Failure Dangerous Failure Rate (1/yr):	1.67E-02																
Failure Spurious Failure Rate (1/yr):	6.67E-03																
CCF Dual(%):	0.1																
CCF Triple(%):	0.1																
Diagnostic Coverage Simplex(1/yr):	85.00																
Diagnostic Coverage Dual(1/yr):	85.00																
Diagnostic Coverage Triple(1/yr):	85.00																
<table border="1"> <tr> <td>PTD Avg:</td> <td>4.11E-002</td> </tr> <tr> <td>STR:</td> <td>6.67E-003</td> </tr> </table>				PTD Avg:	4.11E-002	STR:	6.67E-003										
PTD Avg:	4.11E-002																
STR:	6.67E-003																
Note: <p>Boundary Conditions: Boundary includes spring return, pneumatically-operated ball valve, operating in a standby (dormant) mode of operation. The solenoid is NOT INCLUDED. Safe-state specified is fail closed.</p>																	
<p>Process Severity Assumption: Clean</p>																	
Data Source: SIL		<input type="button" value="Update"/>															

What if the design has a complicated “black box” subsystem?

SUPPORT
CONFIGURATION
SUPPORT SYSTEM
CUSTOMER DEVICE
MANUAL DEVICE
MANUAL INPUT
MANUAL ACTION

Most commonly used for complex designs where there is a complicated subsystem in the design that is evaluated using an advanced method such as FTA

SIL Solver® allows for a MANUAL ACTION subsystem and a MANUAL INPUT subsystem

THESE ARE NOT POPULATED LIKE NORMAL DEVICES



Click to add field to GUI

The PFDavg and STR contributions for these subsystems are entered directly into the tool

These performance of these subsystems are additive to the overall PFD and STR analysis

Manual Inputs

The user can enter two parts of a Manual Input analysis:

If two are used, the user must define whether they are redundant to each other (i.e., EITHER subsystem working will allow the overall Manual Input to work) or non-redundant (i.e., BOTH parts must work for the overall Manual Input to work)

DeviceID, Tag, voting architecture and TI are entered for completeness of reporting. The PFDavg and STR are entered directly for each portion of the Manual Input

Check to allow entry of the second Manual Input

Manual Inputs	
Redundancy	Non-Redundant
Manual Input Device 1	
Device ID	<input type="text"/>
Device Tag	<input type="text"/>
Voting	<input type="text"/>
TI (Yr)	<input type="text"/>
PFDavg	0
STR (1/Yr)	0
HFT	0
Manual Input Device 2	
Device ID	<input type="text"/>
Device Tag	<input type="text"/>
Voting	<input type="text"/>
TI (Yr)	<input type="text"/>
PFDavg	<input type="text"/>
STR (1/Yr)	<input type="text"/>
HFT	0

Update

The user selects the Hardware Fault Tolerance value appropriate for each part of the Manual Input

Manual Action

Manual Actions

Manual Action

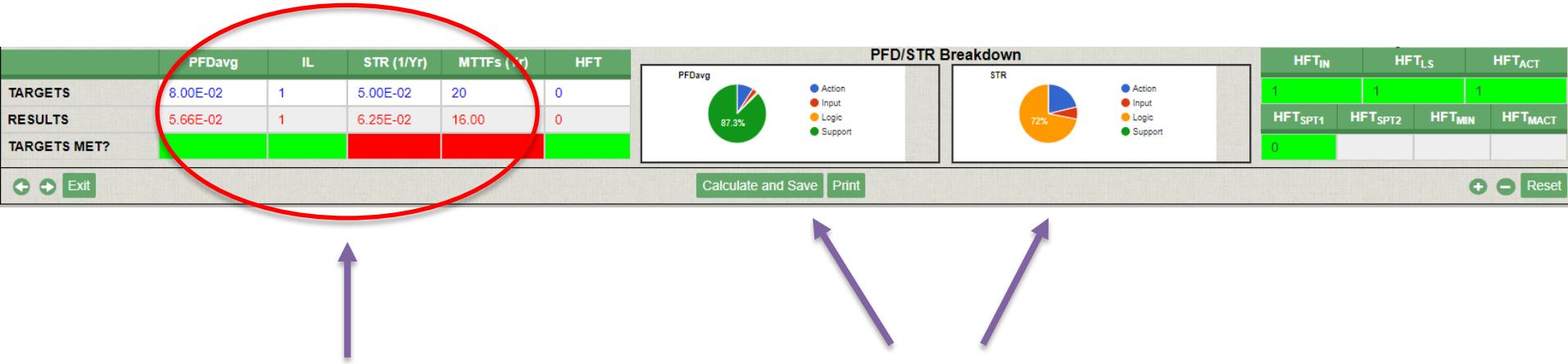
Device ID	<input type="text"/>
Device Tag	<input type="text"/>
Voting	<input type="text"/>
TI (Yr)	<input type="text"/>
PFDavg	0
STR (1/Yr)	0
HFT	0 <input type="button" value="▼"/>

Update

DeviceID, Tag, voting architecture and TI are entered for completeness of reporting. The PFDavg and STR are entered directly for each portion of the Manual Input

User enters Manual Action HFT Value

Are PFDavg and STR good enough?



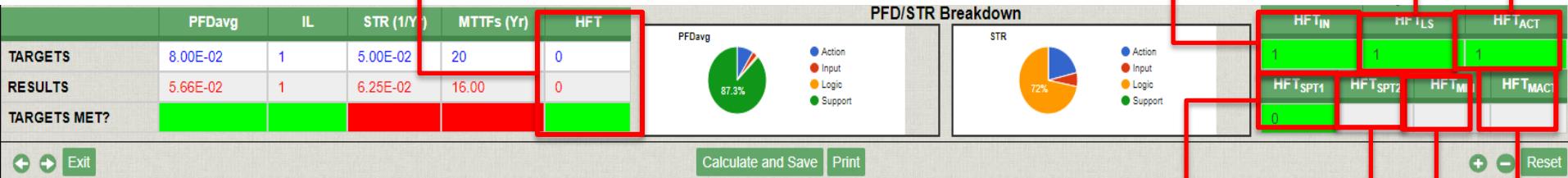
Numerical results and red-green pass-fail indicator on top left of GUI and most SIF reports

Graphical Charts provide information on which components are dominating PFDavg and STR

If necessary, modify design until performance targets are achieved.

Don't forget Hardware Fault Tolerance (HFT)

HFT Target and
Overall HFT
Result



Overall HFT result is the minimum HFT out of the seven main subsystems (see far right side of GUI) for those subsystems that are configured for use in that architecture

HFT for Support
System 1

HFT for Support
System 2

HFT for Manual
Input

HFT for Manual
Action

HFT for
Logic
Solver

HFT for
Action(s)

HFT for Device

The HFT for each field device box (MooN) is determined by the selected architecture within that box as below. The resulting HFT value for each field device is not shown on the GUI, except for logic solver, support system, manual input, and manual action in their respective data sheets.

Architecture(s)	HFT = N - M
1oo1, 1oo1D	0
1oo2, 1oo2D	1
2oo2, 2oo2D	0
1oo3, 1oo3D	2
2oo3, 2oo3D	1
3oo3, 3oo3D	0
2oo4, 2oo4D	2
HFAT/HPATD (unused for LS, but used for some action devices)	1

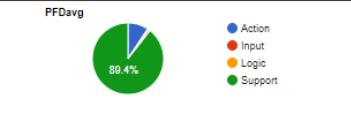
Site : SIS-TECH Function : V-102 High DP/P Trip
Project ID: Practice Function ID : SIF 02

Welcome, srizvi

SIL SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	HFT _{IN}	HFT _{LS}	HFT _{ACT}
TARGETS	8.00E-02	1	5.00E-02	20.00	0	1	1	1
RESULTS	5.53E-02	1	5.94E-02	16.84	0	HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}
TARGETS MET?						0		HFT _{MACT}

PFD/STR Breakdown



PFDavg
89.4%

- Action
- Input
- Logic
- Support



STR
30% Action, 50% Input, 20% Logic

- Action
- Input
- Logic
- Support

Calculate and Save Print

Exit

Reset

HFT for Logic Solver

The HFT value for the logic solver (MooN) is determined by the selected architecture. The resulting HFT value for the logic solver is shown on the logic solver data sheet and on the GUI as below. Default value is 0 when importing a logic solver that is not in the current SIL Solver logic solver datasheet.

In this case,
MooN is 1002D
2-1=1

Logic Solver
HFT Value

Logic Solver

Logic Solver ID: DMSIO

Logic Solver Type: GENERIC 1002D DUAL MP; SIMPLEX I/O

Configurations:

Logic Solver Tag: SIS-A

Voltage: 1002D

Proof Testing Interval (yr): 5

PFDavg: 4.92E-004 STR: 4.50E-002

Note:

Boundary Description: Boundary includes 1002D logic solver with dual main processors, 1 simplex digital input module, 1 simplex analog input module, and 1 simplex digital output module.

Implementation Limitations and Exclusions: Refer to the SIL Solver manual for a discussion of "1002D" and "2002D" architectures. The logic solver is certified to IEC 61508 SIL 3 or TUV AK 5-6.

Data Source: SIL HFT: 1

Update

HFT for
Logic
Solver

Site: SIS-TECH Function: V-102 High DP/P Trip
Project ID: Practice Function ID: SIF 02

Welcome, srizvi

SIL SOLVER

	HFT _{IN}	HFT _{LS}	HFT _{ACT}
HFT _{SPT1}	1	1	1
HFT _{SPT2}	0	0	0
HFT _{MIN}	0	0	0
HFT _{MACT}	0	0	0

PFDavg 89.4% Action
STR 89.4% Input
Logic Support

Calculate and Save Print

HFT for Support System

The HFT value for the support system is shown on the support system data sheet and on the GUI as below. Default value is 0 when importing support systems that are not in the current SIL Solver support system datasheet.

Support System

Support System ID: UPSE5S

Support System Type: POWER SUPPLY - ETT - 5

Support System Tag: UPSE5S-101

Proof Testing Interval (yr): 5

PFDavg: 4.94E-002 **STR:** 0.00E+000

Note:

Boundary Description: The boundary includes: the incoming ac surge-protection rectifier stage, input capacitors, dc/dc converter or chopper circuit, dc battery circuit and a dc pulse with modulation (PWM) inverter.

Implementation Limitations and Exclusions: Energize-to-trip (ETT) circuits must include: "Line monitoring and loss of circuit continuity alarm"

Data **Source:** SIL **HFT:** 0 **Update**

Support System
HFT Value

HFT for Support
System 1 and
Support System 2

Site: SIS-TECH Function: V-102 High DP/P Trip
Project ID: Practice Function ID: SIF 02 Welcome, srizvi

SIL SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	HFT _{IN}	HFT _{LS}	HFT _{ACT}
TARGETS	8.00E-02	1	5.00E-02	20.00	0	1	1	1
RESULTS	5.53E-02	1	5.94E-02	16.84	0	HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN} HFT _{MACT}
TARGETS MET?						0		

PFD/STR Breakdown

PFDavg: 89.4% **STR:** 89.4%

Action: 1% **Input:** 1% **Logic:** 1% **Support:** 89.4%

Calculate and Save **Print** **Exit** **Reset**

HFT Results for Manual Input and Manual Action

HFT Results for Manual Input and Manual Action

←

Site : SIS-TECH
Project ID: Practice

Function : V-102 High DP/P Trip
Function ID : SIF 02

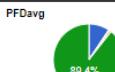
Welcome, srizvi

SIL SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
TARGETS	8.00E-02	1	5.00E-02	20.00	0
RESULTS	5.53E-02	1	5.94E-02	16.84	0
TARGETS MET?	Green	Green	Red	Red	Green

PFD/STR Breakdown

PFDavg



- Action
- Input
- Logic
- Support

STR



- Action
- Input
- Logic
- Support

HFT _{IN}	HFT _{LS}	HFT _{ACT}
1	1	Green
HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}
0		HFT _{MACT}

Calculate and Save **Print**

Reset

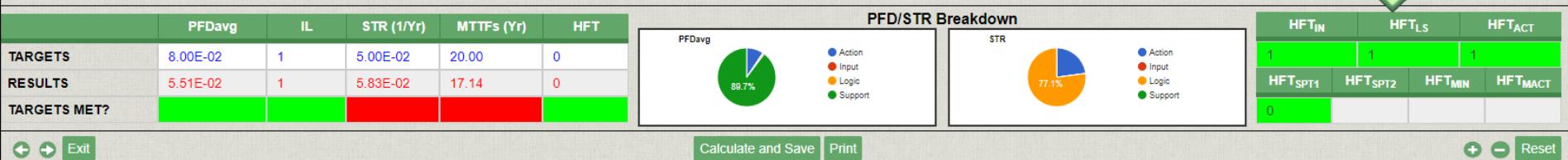
Is that all?

- The SIL Calculation is performed within a context of performance assumptions and other SIL evaluations (e.g., independence of SIF from other functions in the hazard case the SIF is designed for)
- The documentation of the SIL calculation should include sufficient SRS information to provide this context

SRS Info

Site : **SIS-TECH** Function : **V-101**
Project ID: **Practice** Function ID : **SIF 01**

Welcome, srizv

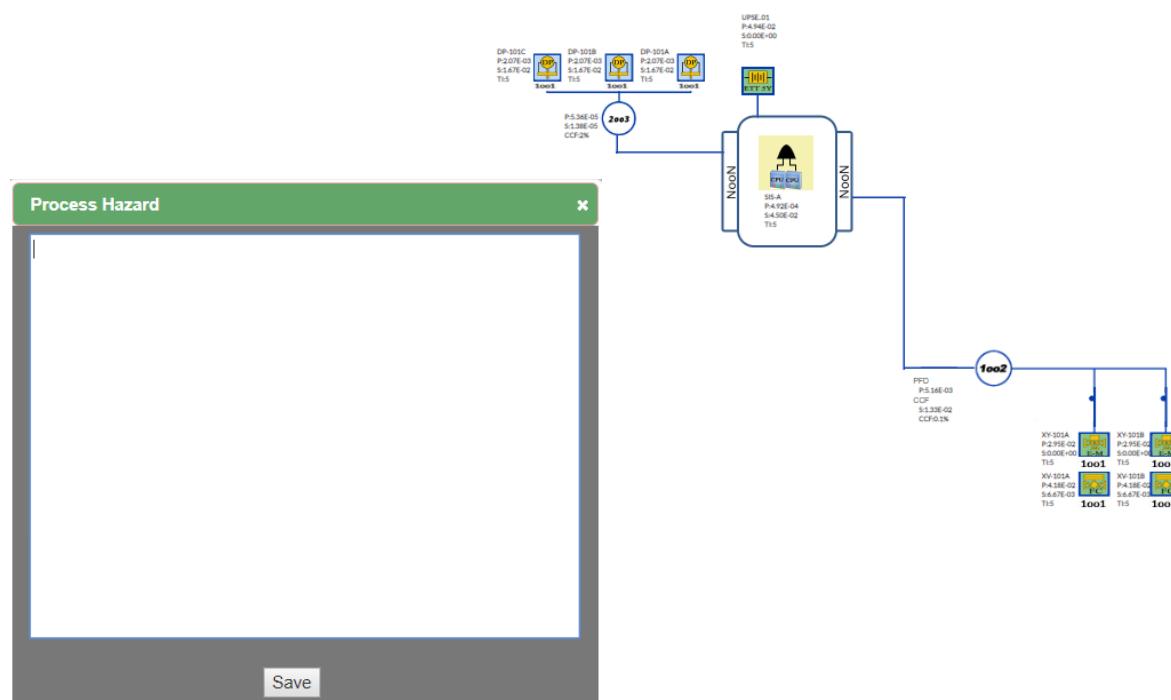


Calculate and Save [Print](#)

Reset

- PROCESS HAZARD
- DESCRIPTION
- DIAGNOSTICS
- RESET
- SHUTDOWN
- REFERENCE
- COMMENTS

- LOGIC SOLVER
- INPUT CONFIGURATION
- INPUT DEVICE
- ACTION CONFIGURATION
- ACTION DEVICE
- SUPPORT CONFIGURATION
- SUPPORT SYSTEM
- CUSTOMER DEVICE
- MANUAL DEVICE



Done with SIF 01

Site : SIS-TECH Function : V-101
Project ID: Practice Function ID : SIF 01

Welcome, srizvi

SIL SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT		HFT _{IN}	HFT _{LS}	HFT _{ACT}	
TARGETS	8.00E-02	1	5.00E-02	20.00	0					
RESULTS	5.51E-02	1	5.83E-02	17.14	0					
TARGETS MET?	Met						1	1	1	
							HFT _{SPT1}	HFT _{SPT2}	HFT _{MIN}	HFT _{MACT}
							0			

PFD/STR Breakdown

PFDavg
89.7%

Action
Input
Logic
Support

STR
77.1%

Action
Input

Exit Exit to return to main Protective Function screen for this project

Calculate and Save **Print** **Reset**

SRS

PROCESS HAZARD

DESCRIPTION

DIAGNOSTICS

RESET

SHUTDOWN

REFERENCE

COMMENTS

LOGIC SOLVER

INPUT CONFIGURATION

INPUT DEVICE

ACTION CONFIGURATION

ACTION DEVICE

SUPPORT CONFIGURATION

SUPPORT SYSTEM

CUSTOMER DEVICE

MANUAL DEVICE

Process Flow Diagram (PFD) and SIF Configuration

Final Elements (1oo2):

- XV-501A: P-2.15E-02, S-0.00E+00, T15
- XV-501B: P-2.15E-02, S-0.00E+00, T15

Second Function

- This project includes V-102 as well
- V-102 has an analogous protective function, SIF 02
- Key difference, SIF 02 uses a single pressure transmitter as the third device, instead of a DP
- Tags: DP-102A/B, PT-102, XV/XY-102A/B

Copy SIF 01

Site: SIS-TECH Project ID: Practice Function ID: SIF 01

Protective Function

			Import	Export	Print Reports	PF Documentation	Project Data Sheets	PF Details	Copy	Delete	Exit	PF Revision Level
Function ID	Function	Mode Of Operation	PFD Target		PFD Result		STR Target (1/yr)		STR Result (1/yr)		IL Target	IL Result
SIF 01	V-101	Low Demand	8.00E-02		7.21E-03		5.00E-02		6.25E-02		1	2

[Create Filter](#)

From the main Protective Function page, selecting the function to be copied and clicking the Copy button...

Site: SIS-TECH Project ID: Practice Function ID: SIF 01

Protective Function

			Paste	Import	Export	Print Reports	PF Documentation	Project Data Sheets	PF Details	Copy	Delete	Exit	PF Revision Level
Function ID	Function	Mode Of Operation	PFD Target		PFD Result		STR Target (1/yr)		STR Result (1/yr)		IL Target	IL Result	
SIF 01	V-101	Low Demand	8.00E-02		7.21E-03		5.00E-02		6.25E-02		1	2	

[Create Filter](#)

Causes the Paste button to activate...

Create SIF 02

Clicking the Paste button opens the dialog box to enter the new function ID and description

The screenshot shows the SIL SOLVER software interface for creating a Protective Function. The main window displays a table of existing Protective Functions, including columns for Function ID, Function, Mode Of Operation, PFD Target, PFD Result, STR Target (1/yr), STR Result (1/yr), IL Target, and IL Result. A new row is being created for 'SIF 02', with 'V-102 High DP/P Trip' listed in the Function column. A modal dialog box titled 'Protective Function' is open, prompting for the 'Function ID' (set to 'SIF 02') and 'Function' (set to 'V-102 High DP/P Trip'). The 'Save' button is visible at the bottom of the dialog.

Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result
SIF 01	V-101	Low Demand	8.00E-02	7.21E-03	5.00E-02	6.25E-02	1	2
<input type="button" value="Create Filter"/>								

Protective Function

Function ID: SIF 02

Function : V-102 High DP/P Trip

Save Close

Success!



Welcome, sriziwi

Site: SIS-TECH

Project ID: Practice

Function ID: SIF 01

Protective Function

Function ID Saved Successfully

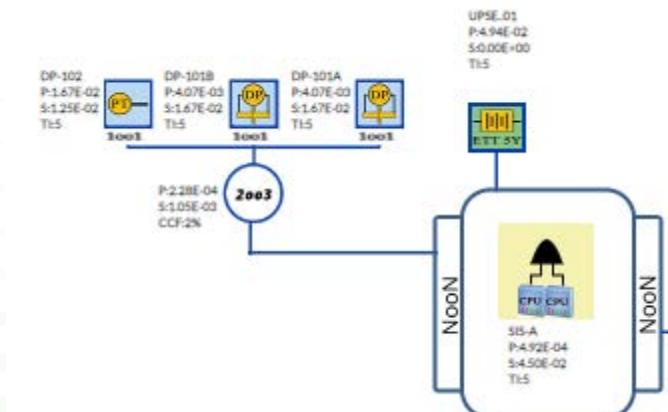
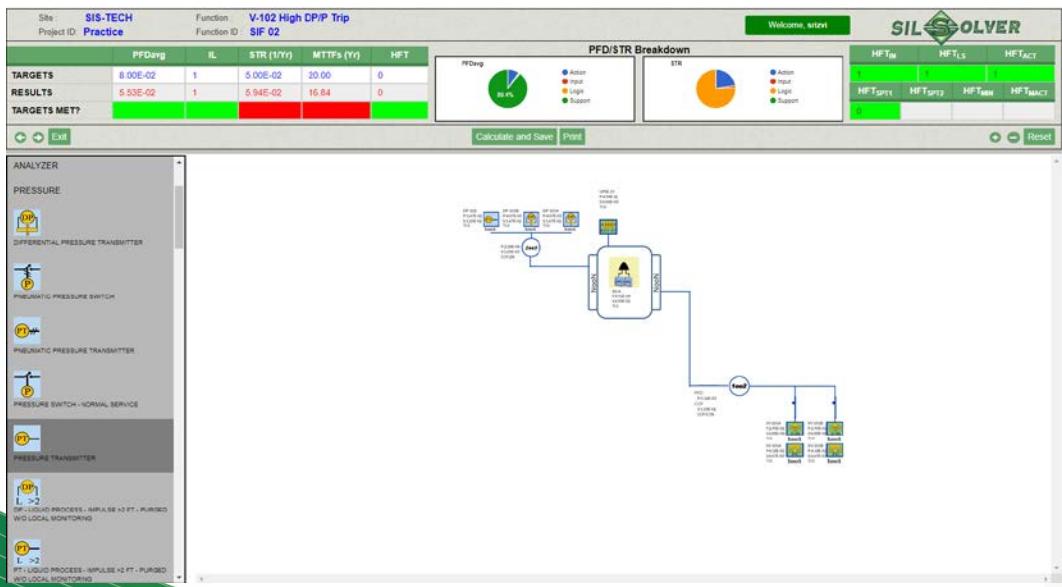
			Import	Export	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Results Summary
Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result			
SIF 01	V-101	Low Demand	8.00E-02	7.21E-03	5.00E-02	6.25E-02	1	2			
SIF 02	V-102 High DP/P Trip	Low Demand	8.00E-02	7.21E-03	5.00E-02	6.25E-02	1	2			

Create Filter

Select the new function and Open
Update tag ID fields for all devices

Modeling diverse sensors

1. Delete the third DP sensor
2. Copy General Pressure transmitter
3. Paste General pressure transmitter to the last box in the 2oo3 input configuration
4. Change Diagnostic level to DC2 for the two DP pressure transmitters and keep the General PT Diagnostic level as NO DC (no device to compare with).



Partial Stroke Testing of Valves

- For valves, the DC selection can be used to model partial stroke testing.

1. Set the diagnostic level to DC1

2. Set the diagnostic interval to partial stroke testing interval

Device	
Device ID:	BVFCC
Device Type:	BLOCK VALVE-BALL-FTC-CLEAN
Configurations:	
Device Tag:	BV1
Proof Testing Interval (yr):	5
Voting:	1oo1
Subsystem Diagnostic Level:	DC1
Maintenance:	
Mean Time to Repair (hr):	72
Diagnostic Interval (hr):	720
Overhaul Interval (yr):	20
Proof Testing Coverage (%):	100
Properties:	
Failure Dangerous Failure Rate (1/yr):	1.67E-02
Failure Spurious Failure Rate (1/yr):	6.67E-03
CCF Dual(%):	0.1
CCF Triple(%):	0.1
Diagnostic Coverage Simplex(1/yr):	85.00
Diagnostic Coverage Dual(1/yr):	85.00
Diagnostic Coverage Triple(1/yr):	85.00
PFAvg:	4.18E-002
STR:	6.67E-003
Note:	
Boundary Conditions: Boundary includes spring return, pneumatically-operated ball valve, operating in a standby (dormant) mode of operation. The solenoid is NOT INCLUDED. Safe-state specified is fail closed.	
Process Severity Assumption: Clean	
Data Source:	SIL
Update	

Both fields must be configured for correct use of equation.

Partial Interim Testing of Sensors

- Sometimes an imperfect test is performed on a sensor at a shorter interval, with a 100% proof test (or complete replacement) performed at a longer interval
- Use the Proof Test coverage and Overhaul interval to model this

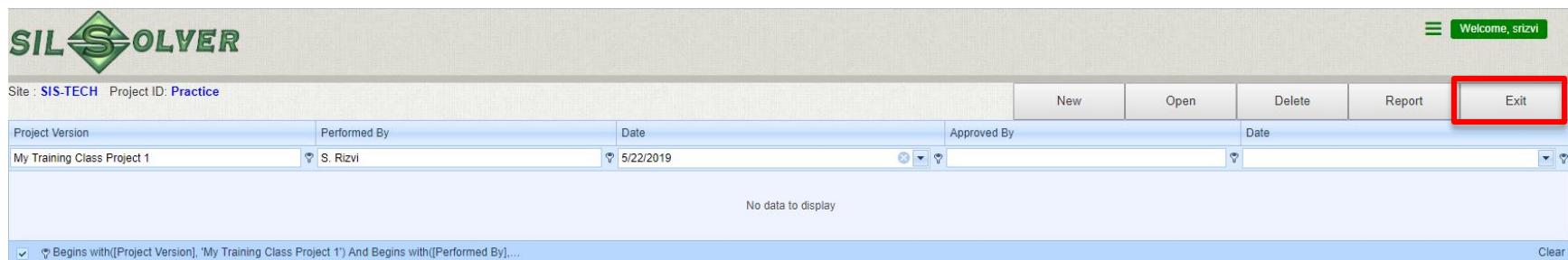
Example:
Sensor installation
with an 85% test
performed
annually with
100% test or full
replacement done
every 10 years

Both fields must be
configured for correct use
of equation.

Device	
Device ID:	THMLS
Device Type:	THERMOCOUPLE - LOW STRESS ENVIRONMENT
Configurations:	
Device Tag:	TT1
Proof Testing Interval (yr):	1
Voting:	1oo1
Subsystem Diagnostic Level:	NO DC
Properties:	
Failure Dangerous Failure Rate (1/yr):	5.00E-03
Failure Spurious Failure Rate (1/yr):	4.00E-02
CCF Dual(%):	2
CCF Triple(%):	2
Diagnostic Coverage Simplex(1/yr):	60.00
Diagnostic Coverage Dual(1/yr):	80.00
Diagnostic Coverage Triple(1/yr):	90.00
Maintenance:	
Mean Time to Repair (hr):	72
Diagnostic Interval (hr):	0.500
Overhaul Interval (yr):	10
Proof Testing Coverage (%):	85
User Specified	<input checked="" type="checkbox"/>
Note:	
Boundary Conditions: Boundary includes thermocouple element and insulators, terminal head and protecting tube or thermowell.	
Process Severity Assumption: Clean	
Implementation Limitations and Exclusions: A low stress environment does not include the following: high vibration application.	
Data Source:	SIL
Update	

Getting back to Project Home

2 WAYS



SIL SOLVER

Welcome, srizvi

Site : SIS-TECH Project ID: Practice

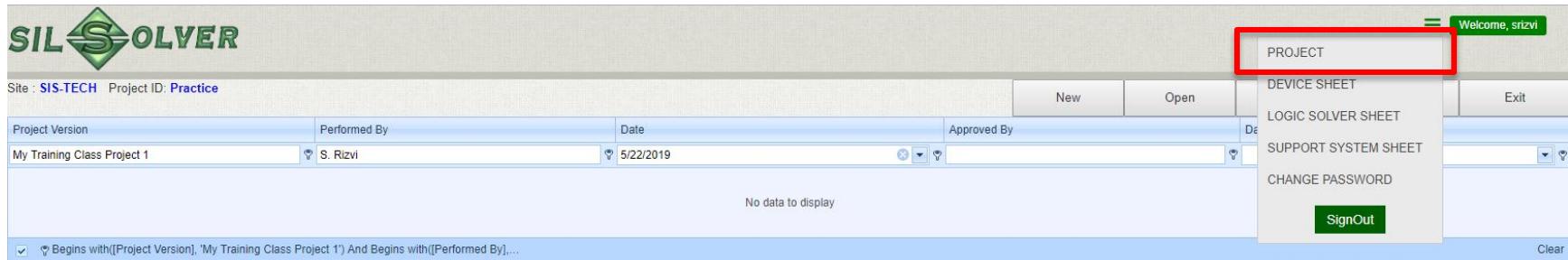
Project Version	Performed By	Date	Approved By	Date
My Training Class Project 1	S. Rizvi	5/22/2019		

No data to display

Begins with([Project Version], 'My Training Class Project 1') And Begins with([Performed By],...)

Clear

New Open Delete Report Exit



SIL SOLVER

Welcome, srizvi

Site : SIS-TECH Project ID: Practice

Project Version	Performed By	Date	Approved By	Date
My Training Class Project 1	S. Rizvi	5/22/2019		

No data to display

Begins with([Project Version], 'My Training Class Project 1') And Begins with([Performed By],...)

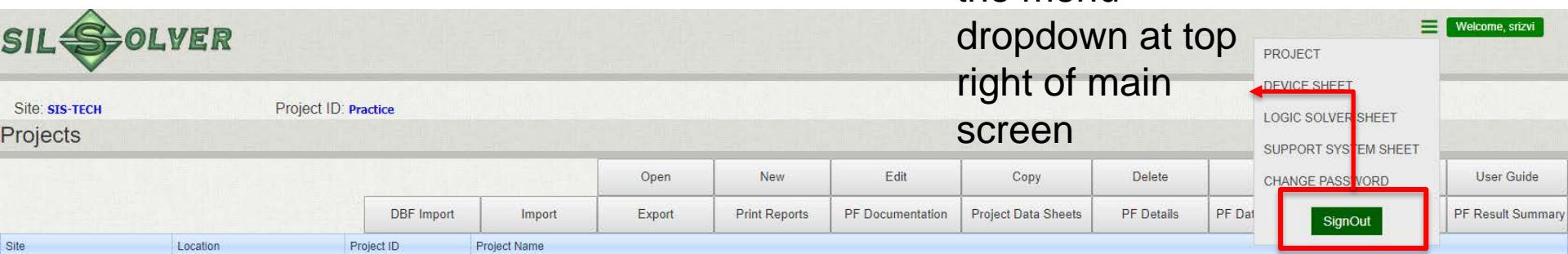
Clear

PROJECT DEVICE SHEET LOGIC SOLVER SHEET SUPPORT SYSTEM SHEET CHANGE PASSWORD SignOut

Exiting SIL Solver®?



Exit the software
from the main
screen



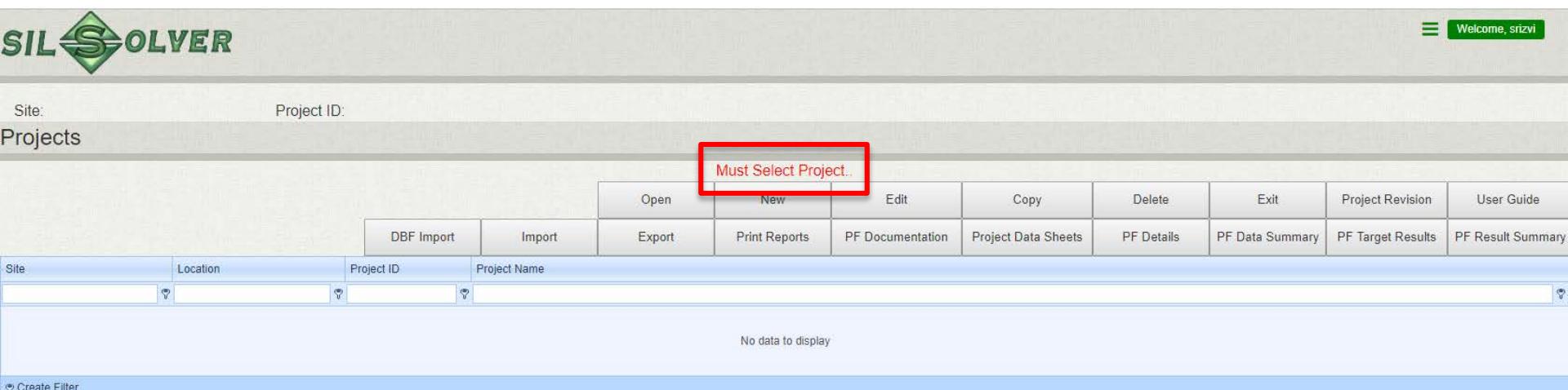
SignOut from
the menu
dropdown at top
right of main
screen

3. EDITING, COPYING OR DELETING AN EXISTING PROJECT

If click Edit on main screen when there are No projects...

By default, the first project in the project list is selected.

Error text will pop up if user attempts a feature (e.g., Edit) that requires a project to be selected and there are no projects in the list.



The screenshot shows the SIL SOLVER software interface. At the top, there is a navigation bar with 'SIL SOLVER' on the left and 'Welcome, srizvi' on the right. Below the navigation bar, there are fields for 'Site:' and 'Project ID:' and a 'Projects' button. The main area is a table with columns: Site, Location, Project ID, and Project Name. The 'Edit' button in the header of this table is highlighted with a red box and contains the text 'Must Select Project..'. Below the table, a message says 'No data to display'. At the bottom, there is a 'Create Filter' button.

Function Revision Info

To create/edit function revision information, select the function and click “function Revision level” to get to the editing page, where you can create/edit and delete the function revision information

SIL SOLVER Welcome, srizvi

Site: SIS-TECH Project ID: Practice Function ID: SIF 02

Protective Function

			Import	Export	Print Reports	PFD Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Results Summary	PF Revision Level
Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result				
SIF 02	V-102 High DP/P Trip	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1				
SIF 01	V-101	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1				

Create Filter

SIL SOLVER Welcome, srizvi

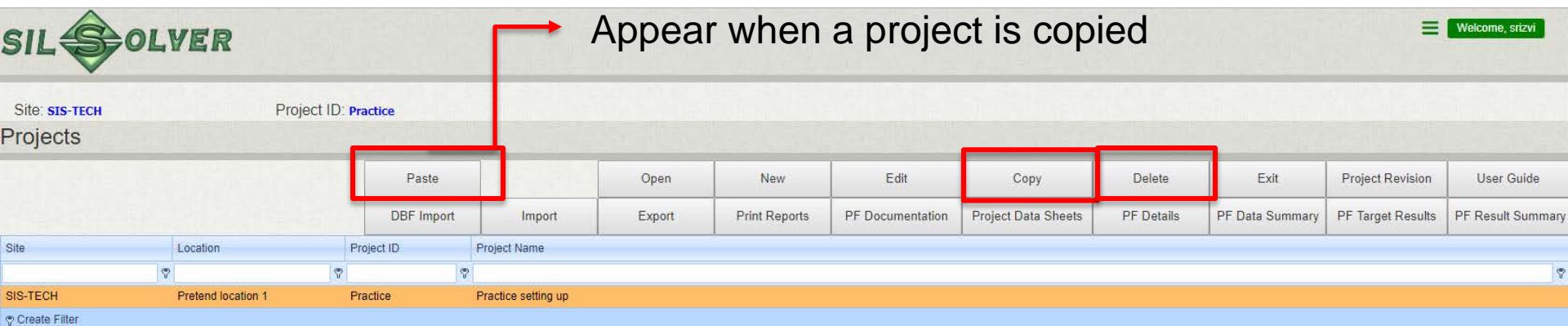
Site : SIS-TECH Project ID: Practice Function : SIF 02

Function Version	Performed By	Date	Approved By	Date	New	Open	Delete	Report	Exit

No data to display

Create Filter

Copying or deleting a project works like copying or deleting a function



Appear when a project is copied

SIL SOLVER

Site: SIS-TECH Project ID: Practice

Projects

Paste

DBF Import Import Export Print Reports PF Documentation Project Data Sheets PF Details PF Data Summary PF Target Results PF Result Summary

Site Location Project ID Project Name

SIS-TECH Pretend location 1 Practice Practice setting up

Create Filter

Select the project

Copy → Make a copy of the selected project and after that a paste button will appear, when “paste” is click a window will pop up for you to enter new project designation.

Delete → Delete the selected project

4. GENERATING REPORTS

- Project Reports
- Function Reports

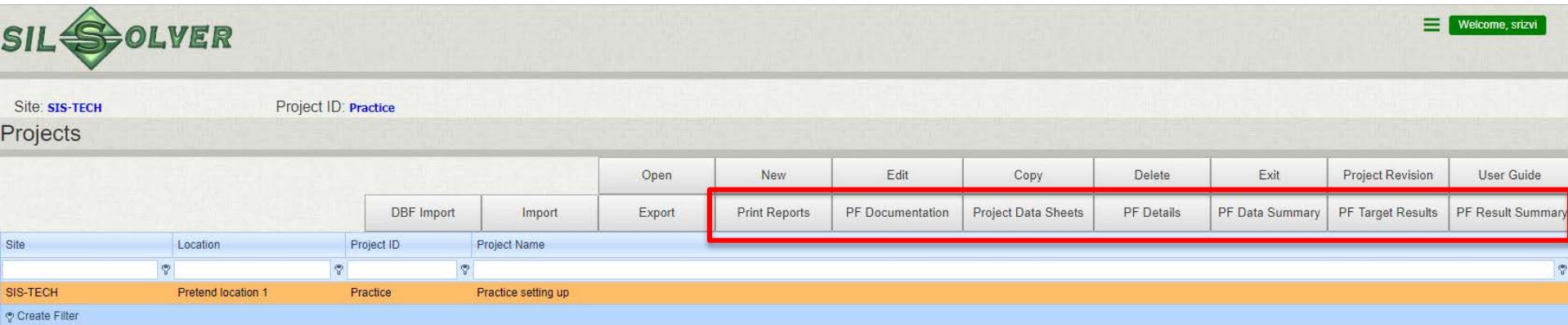
Same Reports

- The reports from SIL Solver® V7.1 have been replicated in SIL Solver® Enterprise

Project Report generation

Print the reports for the whole project by selecting project and click relevant report tab.

When the project reports are printed, the report will include project revision information

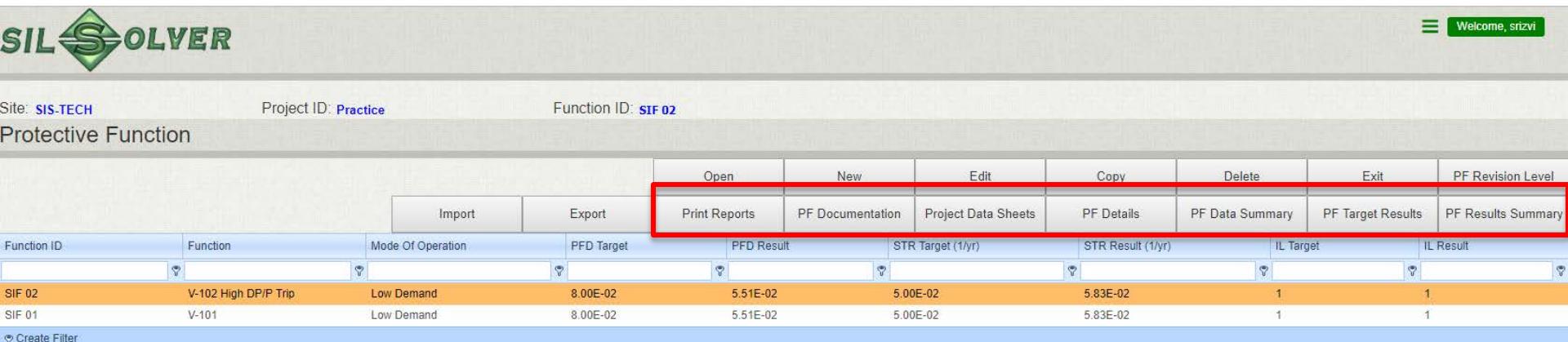


The screenshot shows the SIL-SOLVER software interface. At the top, there is a navigation bar with the 'SIL-SOLVER' logo, a user welcome message 'Welcome, sruvi', and a menu icon. Below the navigation bar, the main title 'Projects' is displayed. The main content area shows a table with columns for 'Site', 'Location', 'Project ID', and 'Project Name'. The 'Project Name' column for the first row contains the value 'Practice'. Below the table, there is a status bar with the text 'SIS-TECH', 'Prefend location 1', 'Practice', and 'Practice setting up'. At the bottom of the status bar, there is a 'Create Filter' button. The top menu bar is highlighted with a red box, showing various options like 'Open', 'New', 'Edit', 'Copy', 'Delete', 'Exit', 'Project Revision', and 'User Guide'. The 'Print Reports' option is specifically highlighted within this menu bar.

Function Report generation

Print the reports for a function by going to the function list, select a function and click relevant report tab.

When the function level reports are printed, the report will include function revision information



The screenshot shows the SIL SOLVER software interface. At the top, there is a navigation bar with the SIS TECH logo, a search bar, and a user welcome message 'Welcome, srizvi'. Below the navigation bar, the main title 'Protective Function' is displayed. The central part of the screen shows a table of functions with columns for Function ID, Function, Mode Of Operation, PFD Target, PFD Result, STR Target (1/yr), STR Result (1/yr), IL Target, and IL Result. The 'Function ID' column shows 'SIF 02' and 'SIF 01'. The 'Function' column shows 'V-102 High DP/P Trip' and 'V-101'. The 'Mode Of Operation' column shows 'Low Demand' for both. The 'PFD Target' column shows '8.00E-02' for SIF 02 and '8.00E-02' for SIF 01. The 'PFD Result' column shows '5.51E-02' for SIF 02 and '5.51E-02' for SIF 01. The 'STR Target (1/yr)' column shows '5.00E-02' for both. The 'STR Result (1/yr)' column shows '5.83E-02' for SIF 02 and '5.83E-02' for SIF 01. The 'IL Target' column shows '1' for both. The 'IL Result' column shows '1' for both. At the top of the table, there is a toolbar with various buttons: Import, Export, Open, New, Edit, Copy, Delete, Exit, and PF Revision Level. The 'Print Reports' button is highlighted with a red box. The 'Function ID: SIF 02' is also highlighted in the table header.

Function ID	Function	Mode Of Operation	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result
SIF 02	V-102 High DP/P Trip	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1
SIF 01	V-101	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1

5. IMPORTING/EXPORTING

- Project export from SIL Solver® Enterprise
- SIL Solver® Enterprise project import
- Function Export/Import
- Importing SIL Solver® V7.1 files into SIL Solver® Enterprise (DBF Import)

Import and export

- The way to share a project/function between users



- The way to transfer information between SIL Solver® V7.1 and SIL Solver® Enterprise



Site: SIS-TECH

Project ID: Practice

Projects

The screenshot shows the SIL SOLVER software interface. At the top, there is a menu bar with various options like Open, New, Edit, Copy, Delete, Exit, Project Revision, and User Guide. Below the menu bar, there is a toolbar with buttons for DBF Import, Import, Export, Print Reports, PF Documentation, Project Data Sheets, PF Details, PF Data Summary, PF Target Results, and PF Result Summary. The main area is titled 'Projects' and shows a table with columns for Site, Location, Project ID, and Project Name. A row is selected for 'SIS-TECH' with the values 'Pretend location 1', 'Practice', and 'Practice setting up'. A red box highlights the 'Import' button in the toolbar, and a red arrow points from this button to the 'Import' section of the main content area.

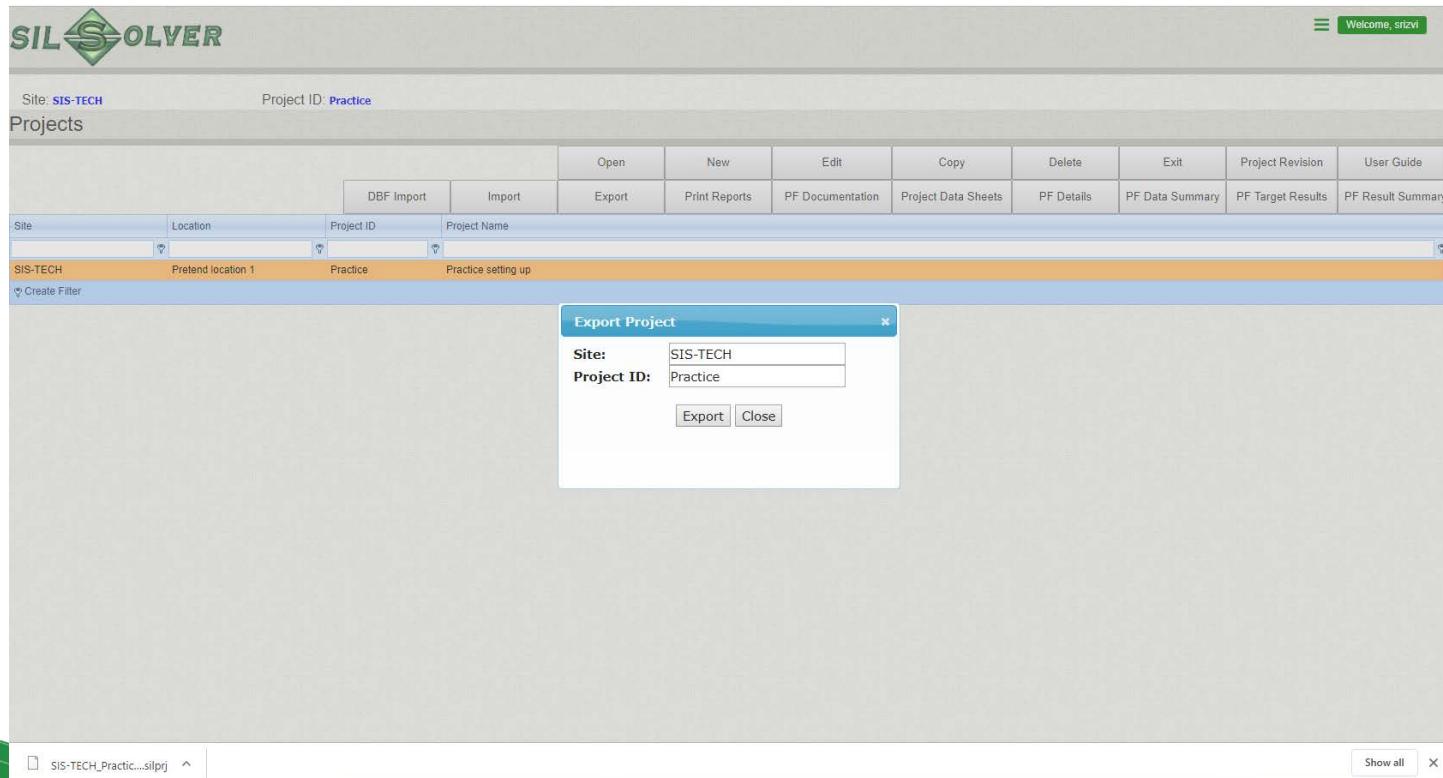
Used to transfer information

- between people
- between SIL SOLVER® tool versions

Project export

To export a project:

1. Go to the project page
2. Select the project
3. Click export
4. A zip file of the project will be created in the download folder

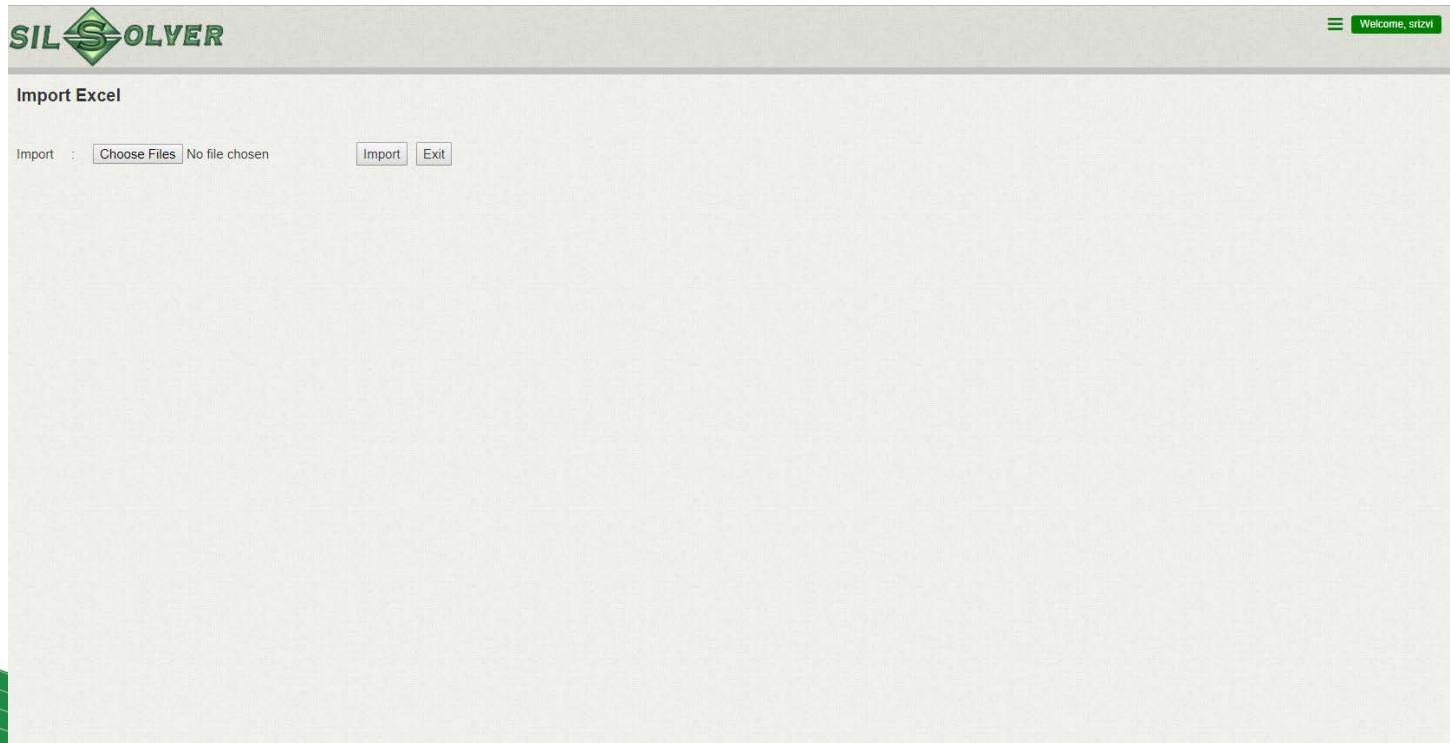


The screenshot shows the SIL-SOLVER software interface. At the top, there is a header with the SIS-TECH logo and a 'Welcome, srujan' message. Below the header, the main menu bar includes 'File', 'Edit', 'View', 'Project', 'Tools', 'Help', and 'About'. The 'Project' menu is currently selected. The main workspace is titled 'Projects' and displays a table with columns: Site, Location, Project ID, and Project Name. A row is selected for 'SIS-TECH' with 'Pretend location 1', 'Practice', and 'Practice setting up'. Below the table, there is a 'Create Filter' button. A modal dialog box titled 'Export Project' is open in the center. It contains two input fields: 'Site:' with 'SIS-TECH' and 'Project ID:' with 'Practice'. At the bottom of the dialog are 'Export' and 'Close' buttons. At the bottom of the main window, there is a navigation bar with icons for 'File', 'Edit', 'View', 'Project', 'Tools', 'Help', and 'About', and a status bar showing 'SIS-TECH_Practic...silprj' and 'Show all'.

Project import

To import a project:

1. Go to the project page
2. Click import, the following project will pop up
3. Click “choose files”, then changed the directory to the project (zip) file you want to import
4. The file will be imported



SIL Solver® Enterprise

Function export/import

To import a function is the same as for a project, the only difference is that the operations are on the function level page.

DBF import

To import a **project** from SIL Solver® V7.1

1. Go to the folder where you saved the project. For example the default directory: C:\SILSolver_Projects
2. Zip the project that you want to import to SIL Solver® Enterprise
3. Go to the SIL Solver® Enterprise project page
4. Click “DBF import” tab, the following page will pop up
5. Click “Choose files”, pointing to the Zipped project file
6. Click “Upload_zip File”
7. When the upload is ready, click import
8. A message will pop up when the import is done.

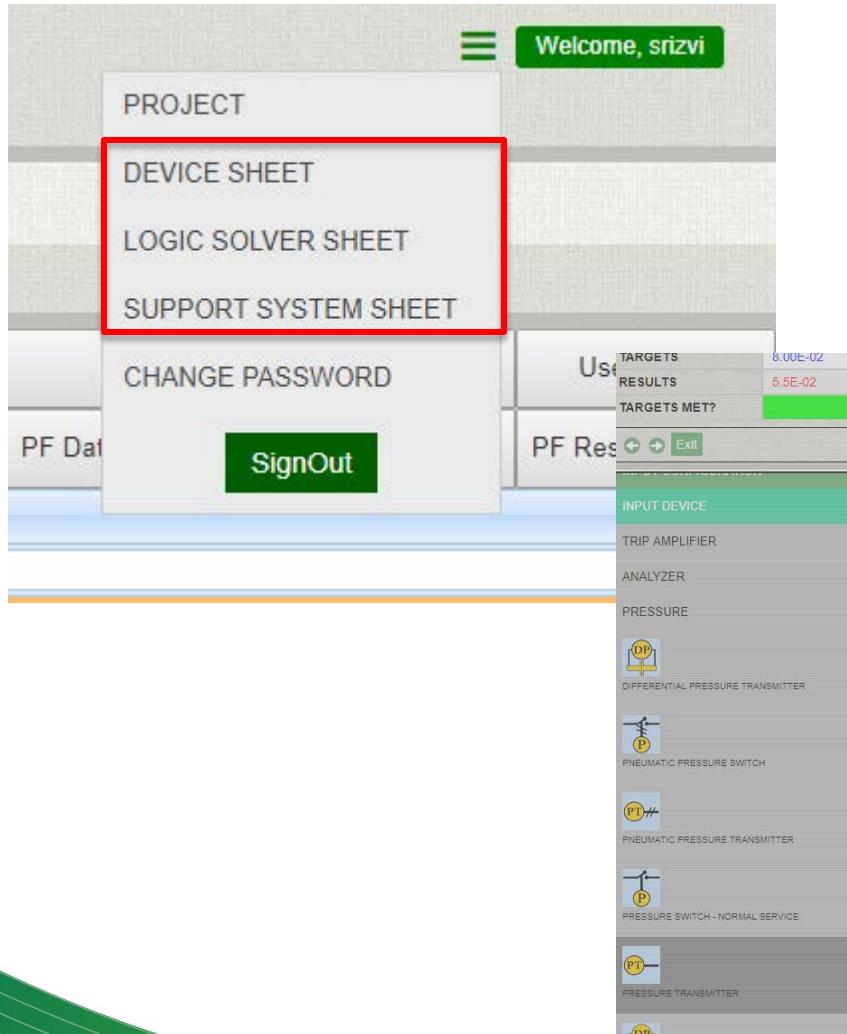


The screenshot shows the 'Upload Files to Import' section of the SIL Solver® Enterprise software. At the top, there is a 'Welcome, srizvi' message with a user icon. Below it, the 'SIL SOLVER' logo is on the left. In the center, there is a 'Choose Files' button with the path 'BOGCI_SPLPNC.zip' displayed. To its right is an 'Upload_ZipFile' button. At the bottom of the section, the user name 'srizvi' is shown. The background of the slide features a green decorative pattern at the top and bottom.

6. DATASHEETS

- Device
- Logic Solver
- Support System

Accessing Datasheets



Access from main page dropdown menu or for individual devices right-click when in device list on GUI

Device datasheet list

Open	Data Version	Source	Device ID	Device Image	Device Description	Fail_Dangerous	Fail_Spurious
Open	8	SIL	ACC		ACCELERATION MONITOR	1.25E-02	1.13E-01
Open	8	SIL	ALANN		ALARM ANNUNCIATOR	1.33E-02	1.33E-02
Open	8	SIL	ANBTU		BTU ANALYZER	6.67E-02	1.00E-01
Open	8	SIL	ANCLR		CHLORINE ANALYZER	6.67E-02	1.00E-01
Open	8	SIL	ANCMO		CARBON MONOXIDE ANALYZER	6.67E-02	1.00E-01
Open	8	SIL	ANCO2		CARBON DIOXIDE ANALYZER	6.67E-02	1.00E-01
Open	8	SIL	ANCON		CONDUCTIVITY ANALYZER	2.00E-01	2.00E-01
Open	8	SIL	ANDO2		DISSOLVED OXYGEN ANALYZER	2.00E-01	2.00E+00
Open	8	SIL	ANH2S		HYDROGEN SULFIDE ANALYZER	3.33E-02	5.00E-02
Open	8	SIL	ANHCT		HYDROCARBON ANALYZER-CATALYTIC	2.00E-02	2.00E-02
Open	8	SIL	ANHIR		HYDROCARBON ANALYZER-INFRARED	2.00E-02	2.00E-02

- Click open (far left) to look at the datasheet for that device

Device Datasheet



SIL Solver Data Sheet

Welcome, srizvi

DATA SHEET

Back

DataSource

Device Id



Device Type

Fail Dangerous Failure Rate(1/yr)

Fail Spurious Failure Rate(1/yr)

Mean Time to Repair(hrs)

Common Cause Factor Dual Mode(%)

Common Cause Factor Triple Mode(%)

Diagnostic Interval(hrs)

Diagnostic Coverage in Simplex Mode(%)

Diagnostic Coverage in Dual Mode(%)

Diagnostic Coverage in Triplicated Mode(%)

Notes

Boundary Conditions: Boundary includes process connection, sampling system and analyzer.

Process Severity Assumption: Clean

Implementation Limitations and Exclusions: Calculation assumes the sampling system is monitored and alarmed. Calibration may be required more frequently than the calculation indicates due to sensor degradation and replacement.

Diagnostic coverage and common cause factors are based on common sampling system. If sampling system is separate for each analyzer, the use of these values will result in a conservative PFDavg.

Data Sources:

Same for LS and Support Systems

SIL SOLVER

SIL Solver Logic Solver Sheet

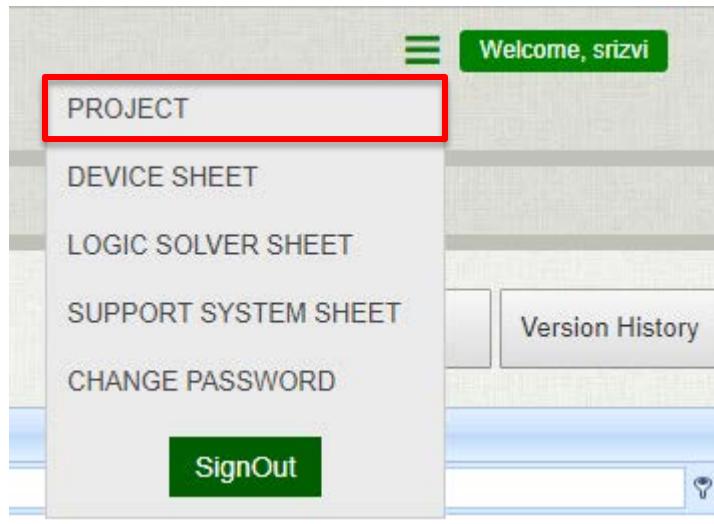
Open	Data Version	Source	Logic Solver ID	Logic Solver Image	Logic Solver Description
Open	8	SIL	DMDIO		GENERIC 200AD DUAL MP: DUAL I/O
Open	8	SIL	DMSIO		GENERIC 100DD DUAL MP: SIMPLEX I/O
Open	8	SIL	NSDD		NON SC PES DUAL MP: DUAL I/O
Open	8	SIL	NSDS		NON SC PES DUAL MP: SIMPLEX I/O
Open	8	SIL	NSSS		NON SC PES SIMPLEX MP: SIMPLEX
Open	8	SIL	RELFL		RELAY - FAIL TO CLOSE

SIL SOLVER

SIL Solver Support System Data Sheet

Open	Data Version	Source	Support System ID	Support System Image	Support System Description
Open	8	SIL	IADMRS		INSTRUMENT AIR-DIVERSITY/MONITORED RECEIVER
Open	8	SIL	IADRS		INSTRUMENT AIR-DIVERSITY RECEIVER
Open	8	SIL	IADS		INSTRUMENT AIR-COMPRESSOR DIVERSITY
Open	8	SIL	IANDVS		INSTRUMENT AIR-NO DIVERSITY
Open	8	SIL	IARWCS		INSTRUMENT AIR-REC/VER
Open	8	SIL	IARWRMS		INSTRUMENT AIR-MONITORED RECEIVER
Open	8	SIL	UPSDOMS		UPS - POWER SUPPLY - DTT - MONITORED
Open	8	SIL	UPSDTS		POWER SUPPLY - DTT
Open	8	SIL	UPSE1S		POWER SUPPLY - ETT - 1 YEAR TESTING
Open	8	SIL	UPSE2S		POWER SUPPLY - ETT - 2 YEAR TESTING
Open	8	SIL	UPSE3S		POWER SUPPLY - ETT - 3 YEAR TESTING
Open	8	SIL	UPSE4S		POWER SUPPLY - ETT - 4 YEAR TESTING

Returning to Project View



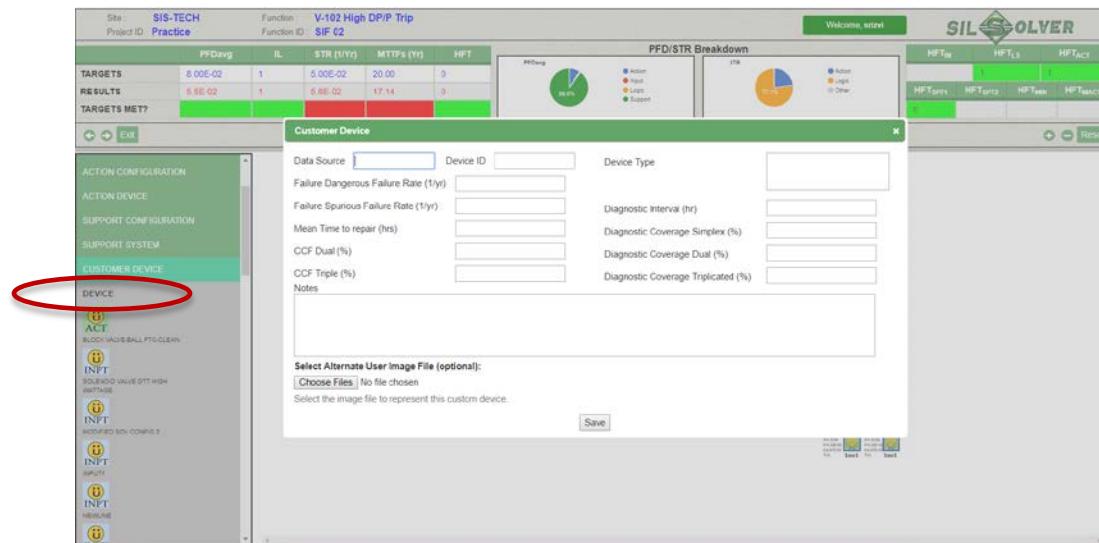
Click Project on the dropdown menu or use Back buttons on the datasheet pages

A screenshot of a software interface titled 'SIL SOLVER'. At the top right, it says 'Welcome, srizvi'. Below that is a 'Back' button (highlighted with a red box) and a 'Version History' button. At the bottom left is a 'SignOut' button. The main area is titled 'SIL Solver Support System Data Sheet'. Below that is a table with the following columns: Open, Data Version, Source, Support System ID, Support System Image, and Support System Description. The 'Back' button is located at the bottom right of the table area.

Open	Data Version	Source	Support System ID	Support System Image	Support System Description

Adding a Custom Datasheet

- From GUI page, go to bottom of lists to the Customer Device section
- Left-click the **header** for the type of sheet this will be
- Enter the data for the new custom device and Save
 - Do not use special characters in the Data Source or Device ID fields
 - If desired, browse to a new image for this device to replace the default



Once created, custom datasheets are available to anyone on the server!

7. TROUBLESHOOTING

- Lost passwords
- Screen settings
- Import challenges
- Disconnects/timing out

Troubleshooting: Lost Username or Password

- Individual username and password assignment is performed by the company that purchases the license through the ADMIN account for that license

Troubleshooting: Screen Settings

- Some SIL Solver® Enterprise application screen content may be obscured if
 - Window is not maximized
 - Zoom >100% is used on the window

Troubleshooting: Import Challenges

- When importing, confirm the final function successfully transferred into SIL Solver® Enterprise

Troubleshooting: Disconnects/Timing Out

- Do not delay too long before saving.
- SIL Solver® Enterprise will time out after **90 minutes** of inactivity.
- A warning screen will pop up during the last minute.
 - Click “Yes” to extend the session

