



# **SIL Solver® Enterprise**

## **V1.2.5**

# **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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    - [eroche@sis-tech.com](mailto:eroche@sis-tech.com) 713-909-2123
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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

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4. Generating reports
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7. Troubleshooting

# 1. ACCESSING THE APPLICATION

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

# Licensing

- SIL Solver<sup>®</sup> 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 *application's administrator account*.
  - This is addressed in the ADMIN Guide

# Logging In: Username and Password

Companies purchasing a license to a SIL Solver® application will typically have their own server locations.

For training classes provided by SIS-TECH, a link to a training server location will be provided.

Log in with your assigned Username and Password



The image shows a login interface for the SIL SOLVER application. At the top, the text "SIL SOLVER" is displayed in a large, green, 3D-style font, with a green diamond-shaped logo containing a stylized "S" between the words. Below this, the word "LOGIN" is centered in a white, sans-serif font on a green rectangular background. Underneath "LOGIN", there are two white input fields. The first field is preceded by the label "USER NAME" in a small, green, sans-serif font. The second field is preceded by the label "PASSWORD" in the same font style. At the bottom of the green background, there is a white rectangular button with the word "Login" in a green, sans-serif font.

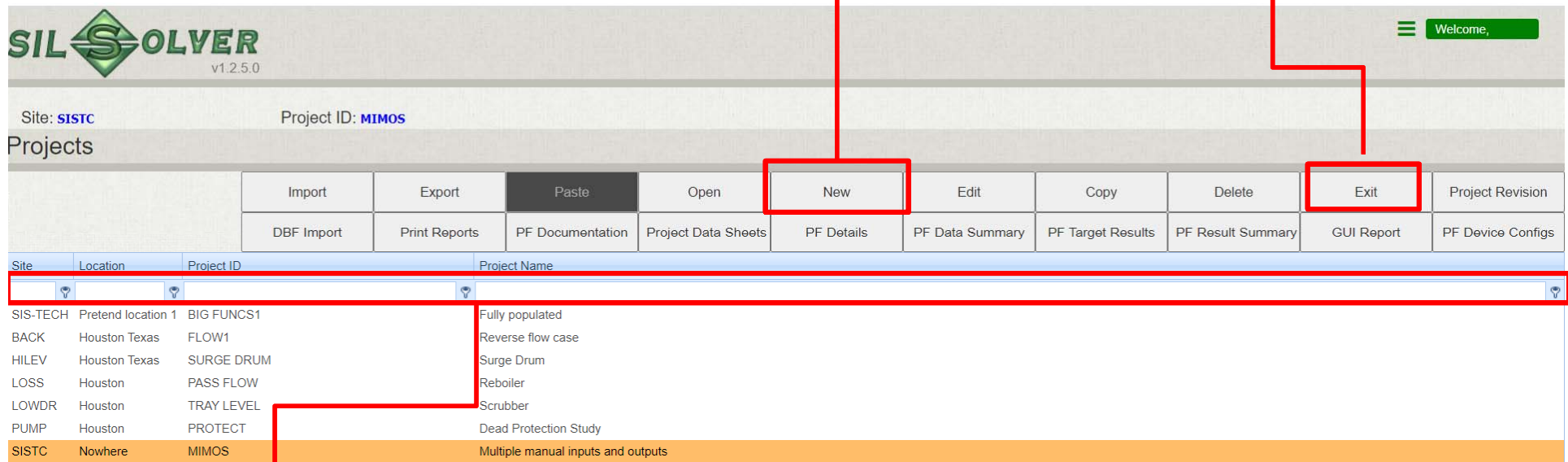


## 2. CREATING A NEW PROJECT

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

Starting a new project

Exit the software



Site: **SISTC** Project ID: **MIMOS**

Projects

Import	Export	Paste	Open	New	Edit	Copy	Delete	Exit	Project Revision
DBF Import	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	BIG FUNCS1	Fully populated
BACK	Houston Texas	FLOW1	Reverse flow case
HILEV	Houston Texas	SURGE DRUM	Surge Drum
LOSS	Houston	PASS FLOW	Reboiler
LOWDR	Houston	TRAY LEVEL	Scrubber
PUMP	Houston	PROTECT	Dead Protection Study
SISTC	Nowhere	MIMOS	Multiple manual inputs and outputs

Project List

Filters may be useful to users with long project lists

Site: **SISTC**

Project ID: **MIMOS**

## Projects

		Import	Export	Paste	Open	New	Edit	Copy	Delete	Exit	Project Revision
		DBF Import	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs
Site	Location	Project ID	Project Name								
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>								
SIS-TECH	Pretend location 1	BIG FUNCS1	Fully populated								
BACK	Houston Texas	FLOW1	Reverse flow case								
HILEV	Houston Texas	SURGE DRUM	Surge Drum								
LOSS	Houston	PASS FLOW	Reboiler								
LOWDR	Houston	TRAY LEVEL	Scrubber								
PUMP	Houston	PROTECT	Dead Protection Study								
SISTC	Nowhere	MIMOS	Multiple manual inputs and outputs								

Click to create a new project

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

Add New Project

Site:

Location:

Project ID:

Name:

Save Close

Add New Project

Site:

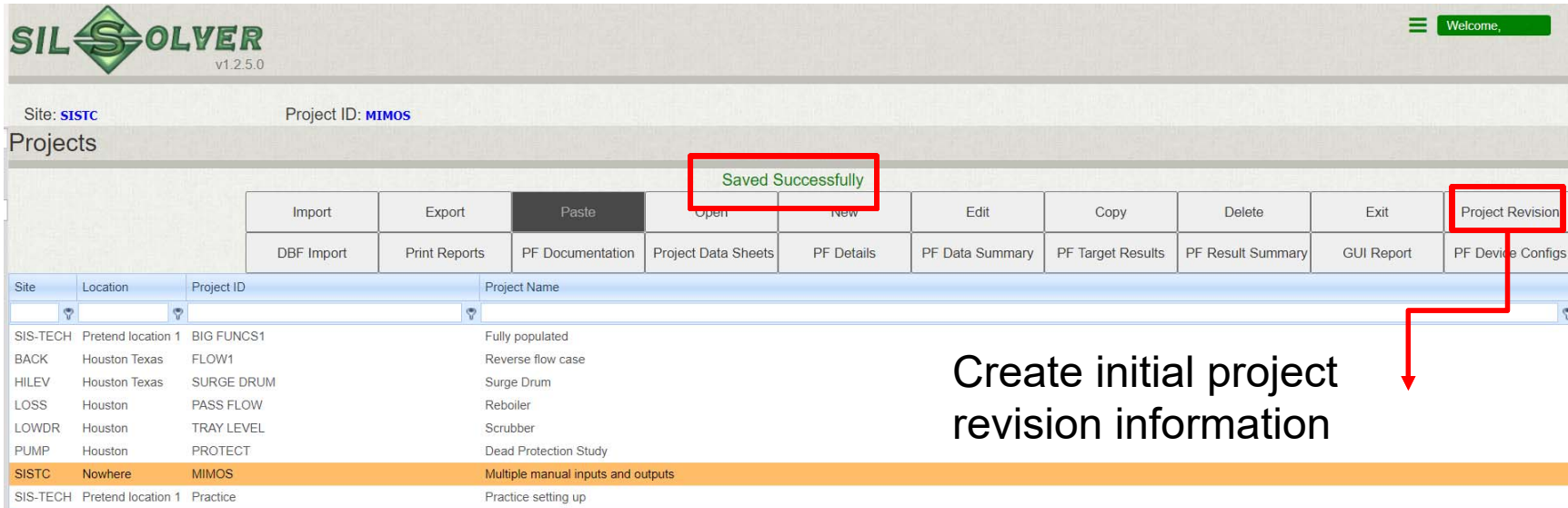
Location:

Project ID:

Name:

Save Close

# Project Revision Data



Site: **SISTC** Project ID: **MIMOS**

**Projects**

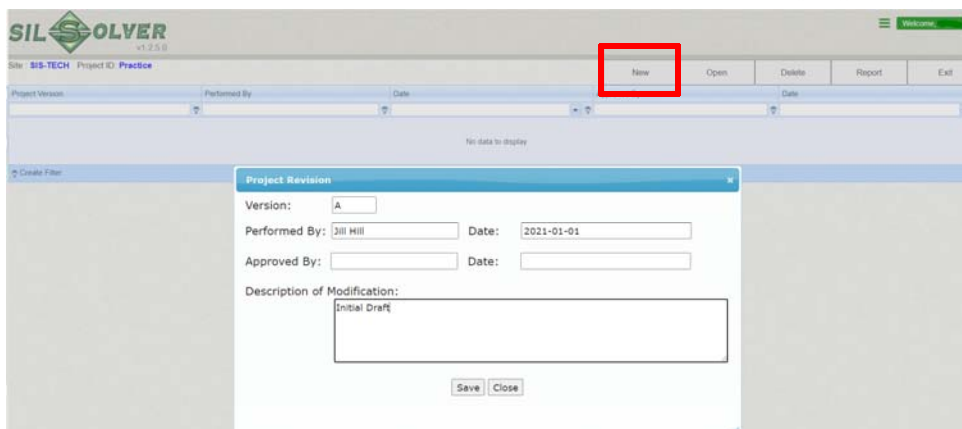
Import Export Paste Open New Edit Copy Delete Exit Project Revision

DBF Import Print Reports PF Documentation Project Data Sheets PF Details PF Data Summary PF Target Results PF Result Summary GUI Report PF Device Configs

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	BIG FUNCS1	Fully populated
BACK	Houston Texas	FLOW1	Reverse flow case
HILEV	Houston Texas	SURGE DRUM	Surge Drum
LOSS	Houston	PASS FLOW	Reboiler
LOWDR	Houston	TRAY LEVEL	Scrubber
PUMP	Houston	PROTECT	Dead Protection Study
<b>SISTC</b>	<b>Nowhere</b>	<b>MIMOS</b>	<b>Multiple manual inputs and outputs</b>
SIS-TECH	Pretend location 1	Practice	Practice setting up

Save Successfully

Create initial project revision information



**Project Revision**

Version:

Performed By:  Date:

Approved By:  Date:

Description of Modification:

Save Close

Click "New" to open dialog box, enter data, and Save

## 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

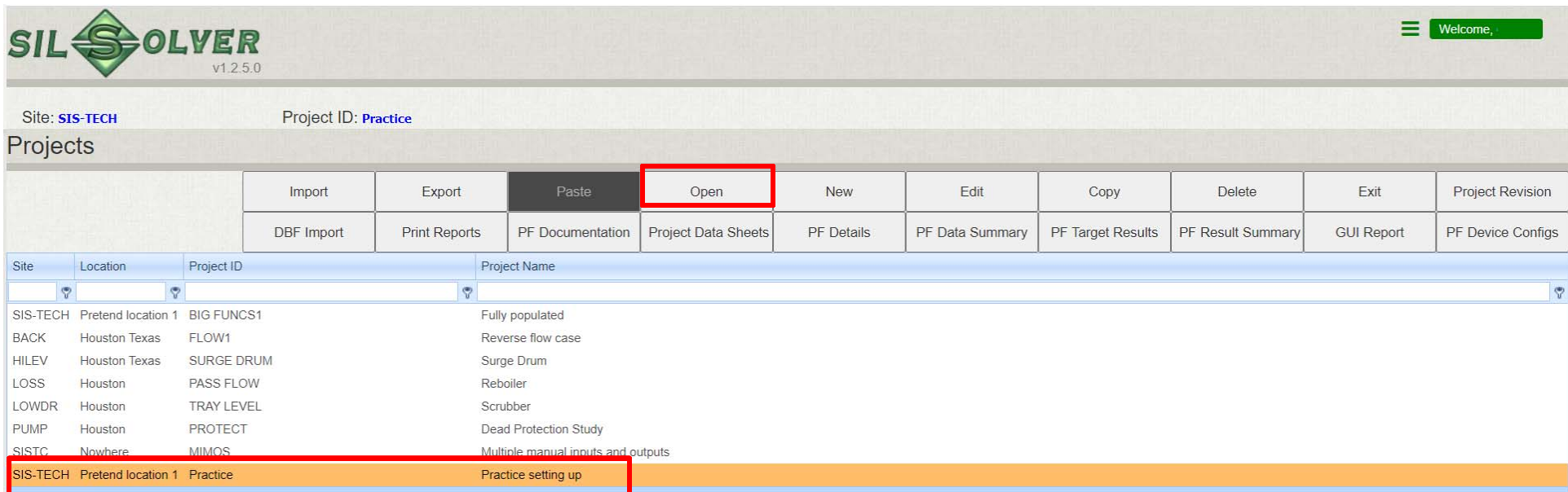
- SIF 01
- SIL-1 (20% design margin)
- Low Demand mode
- Spurious trip target = 20 yrs
- Desired test interval = 5 yrs
- V-101 High DP (2oo3, DP-101A/B/C) trip closes XV-101A and XV-101B (1oo2) ball valves spring loaded to the closed position, each with a single ETT solenoid (XY-101A and XY-101B)
- Power 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
- Assume no sensor diagnostic response will be implemented, so no DC credit should be taken

# Opening the project

Start from Project home page

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

Click Open



Site: [SIS-TECH](#) Project ID: [Practice](#)

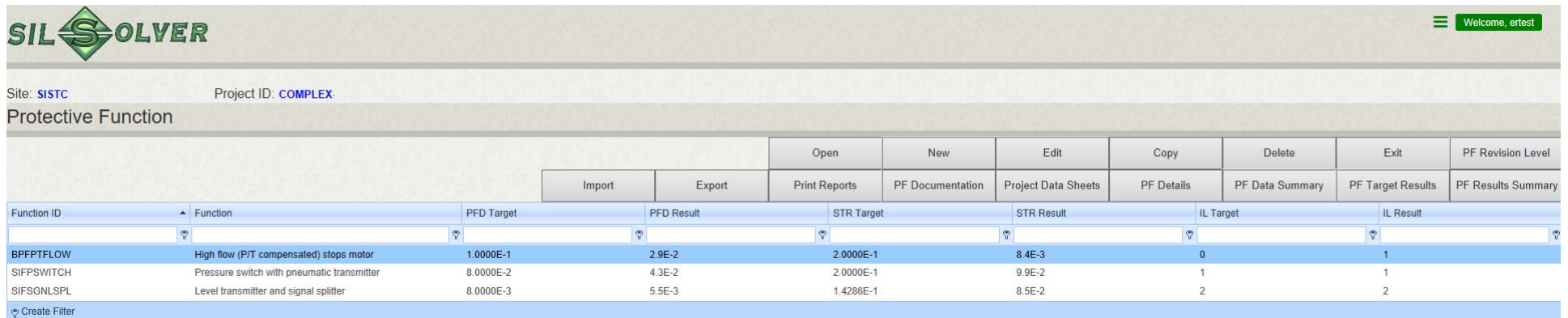
Projects

Import	Export	Paste	<b>Open</b>	New	Edit	Copy	Delete	Exit	Project Revision
DBF Import	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	BIG FUNCS1	Fully populated
BACK	Houston Texas	FLOW1	Reverse flow case
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LOSS	Houston	PASS FLOW	Reboiler
LOWDR	Houston	TRAY LEVEL	Scrubber
PUMP	Houston	PROTECT	Dead Protection Study
SISTC	Nowhere	MIMOS	Multiple manual inputs and outputs
<b>SIS-TECH</b>	<b>Pretend location 1</b>	<b>Practice</b>	<b>Practice setting up</b>

# Protective Function Level

- The general layout is the same as the main page with list of projects



The screenshot shows the SIL SOLVER software interface. At the top, there is a header bar with the SIL SOLVER logo on the left and a 'Welcome, erest' button on the right. Below the header, there is a section for 'Protective Function' with a 'Project ID: COMPLEX' label. The main part of the interface is a table with columns for Function ID, Function, PFD Target, PFD Result, STR Target, STR Result, IL Target, and IL Result. The table contains three rows of data. A red arrow points from the 'Function' column of the first row to the text 'Project information.' below the table.

Function ID	Function	PFD Target	PFD Result	STR Target	STR Result	IL Target	IL Result
BPFPTFLOW	High flow (P/T compensated) stops motor	1.0000E-1	2.9E-2	2.0000E-1	8.4E-3	0	1
SIFPSWITCH	Pressure switch with pneumatic transmitter	8.0000E-2	4.3E-2	2.0000E-1	9.9E-2	1	1
SIFSGNLSPL	Level transmitter and signal splitter	8.0000E-3	5.5E-3	1.4286E-1	8.5E-2	2	2

Project information.

# Start a new safety function

Site: SIS-TECH

Project ID: Practice

Function ID:

Protective Function

		Import	Export	Paste	Open	New	Edit	Copy	Delete	Exit	PF Revision Level
		Update Data	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs
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 Function ID, brief version of function description (e.g., from H&RA), Mode of Operation, and Save

Protective Function

Function ID:

SIF 01

Function :

V-101 High DP trip

Mode of Operation:

Low Demand

Save

Close



# Select and Open Function

**SIL SOLVER** v1.2.5.0 Welcome,

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

Protective Function

Function ID Saved Successfully

Import	Export	Paste	<b>Open</b>	New	Edit	Copy	Delete	Exit	PF Revision Level
Update Data	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs

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 DP 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



# Function GUI Interface

SIF project information

SIF calculation results both numerical and graphical

HFT for Logic Solver

HFT for Inputs(s)

HFT for Action(s)

HFT for Support System 1

HFT for Support System 2

HFT for Manual Input

HFT for Manual Action

The Backward and Forward buttons only have meaning when you have multiple functions in the project

Modelling panel, where you select system configuration and component.

The screenshot shows the SIS-TECH SIL SOLVER GUI. At the top, there's a header bar with 'Site: SIS-TECH Practice', 'Function: V-101 High DP trip', and 'Function ID: SIF 01'. Below this is a table with columns: PFDavg, IL, STR (1/Yr), MTIPS (Yr), and HFT. The table has rows for 'TARGETS', 'RESULTS', and 'HFT?'. To the right of the table is a 'PFD/STR Breakdown' section with two sub-sections: 'PFDavg' and 'STR', both showing 'No data'. Below the table is a 'Calculate and Save' button. On the left side, there's a 'Modelling panel' with a list of system configurations: SRS, LOGIC SOLVER, INPUT CONFIGURATION, INPUT DEVICE, ACTION CONFIGURATION, ACTION DEVICE, SUPPORT CONFIGURATION, SUPPORT SYSTEM, CUSTOMER DEVICE, and MANUAL DEVICE. On the right side, there's a 'HFT for Logic Solver' section with buttons for HFT<sub>IN</sub>, HFT<sub>LS</sub>, and HFT<sub>ACT</sub>. Below this is a 'HFT for Support System 1' section with buttons for HFT<sub>SPT1</sub>, HFT<sub>SPT2</sub>, HFT<sub>MIN</sub>, and HFT<sub>MACT</sub>. At the bottom right, there's a 'HFT for Manual Input' section with buttons for HFT<sub>MAN</sub> and HFT<sub>MACT</sub>. A 'Reset' button is also visible at the bottom right.

# 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  
 Project ID: Practice  
 Function: V-101 High DP trip  
 Function ID: SIF 01

Welcome, User Guide

SIL-SOLVER

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
TARGETS					
RESULTS					
TARGETS MET?					

PFD/STR Breakdown

PFDavg: No data  
 STR: No data

HFTIN HFTLS HFTACT  
 HFTSPT1 HFTSPT2 HFTMIN HFTMACT

+ - Exit Calculate and Save + - Reset

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

Noon Noon

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

# 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, User Guide **SIL SOLVER**

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
<b>TARGETS</b>					
<b>RESULTS</b>					
<b>TARGETS MET?</b>					

PFD/STR Breakdown

PFDavg No data STR No data

HFT<sub>IN</sub> HFT<sub>LS</sub> HFT<sub>ACT</sub>  
 HFT<sub>SPT1</sub> HFT<sub>SPT2</sub> HFT<sub>MIN</sub> HFT<sub>MACT</sub>

Exit Calculate and Save Reset

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

Target Specification

PFDavg 0.08  
 MTTFs (Yr) 20  
 Update

Enter performance targets and update

# HFT Target

HFT target is based on the SIL Target and SIS Mode of Operation, following ANSI/ISA61511-1:2018 requirements. If no PFDavg target has been entered (which would result in no SIL target), HFT target will be set to null.


SILTarget	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**  
Project ID: **Practice**

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

Welcome, .  
User Guide



	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	PFD/STR Breakdown		HFT <sub>IN</sub>	HFT <sub>LS</sub>	HFT <sub>ACT</sub>
TARGETS	8.00E-02	1.00	5.00E-02	20.00	0	PFDavg	STR	HFT <sub>SPT1</sub>	HFT <sub>SPT2</sub>	HFT <sub>MIN</sub>
RESULTS						No data	No data			
TARGETS MET?										

Exit
Calculate and Save
+ - Reset

# Picking Logic Solver (LS)

Select Logic Solver header on left to begin configuration

Left click desired logic solver to copy and then click in middle box to paste.

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

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

Welcome, ...

User Guide

**SIL SOLVER**

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	PFD/STR Breakdown		HFT <sub>IN</sub>	HFT <sub>LS</sub>	HFT <sub>ACT</sub>
TARGETS	8.00E-02	1.00	5.00E-02	20.00	0	PFDavg	STR			
RESULTS										
TARGETS MET?										

← → Exit

Calculate and Save

+ - Reset

SRS

LOGIC SOLVER

GENERIC 2004D DUAL MP, DUAL I/O

GENERIC 1002D DUAL MP, SIMPLEX I/O

NON-SC D/D  
NON SC PES DUAL MP, DUAL I/O

Wrong one?

To delete the logic solver, move the mouse to icon, right click to make the delete option appear, left click on the delete option



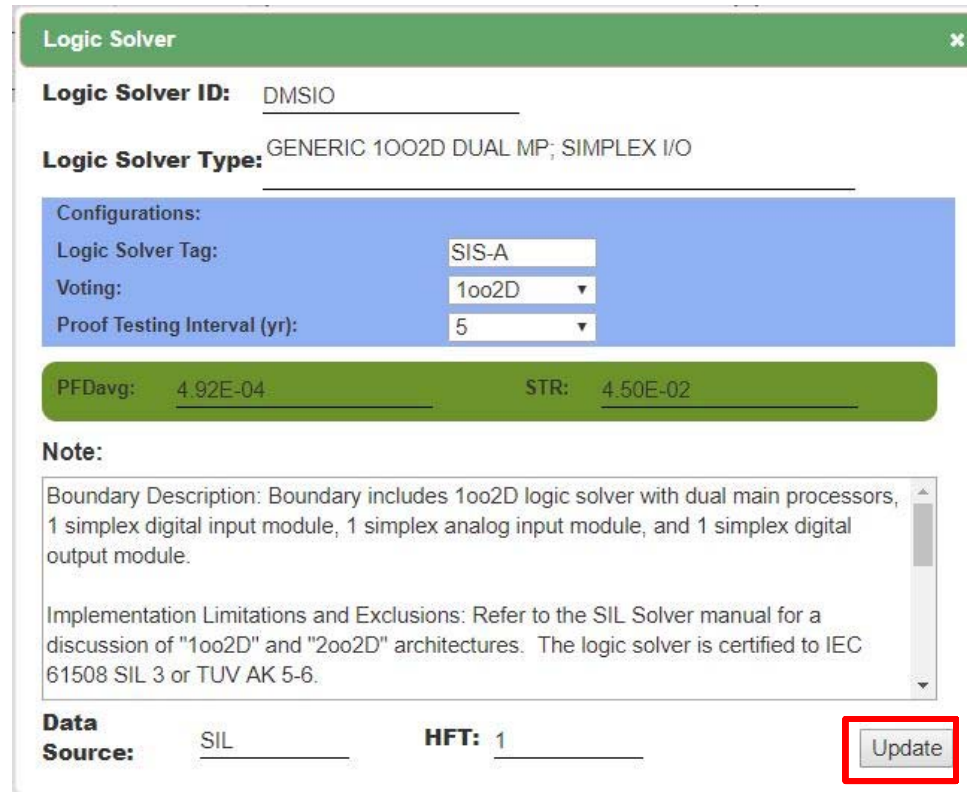
# Adding LS details

Left click the logic solver icon on in the center box. Enter a logic solver tag name, select the voting (may be only one option), 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

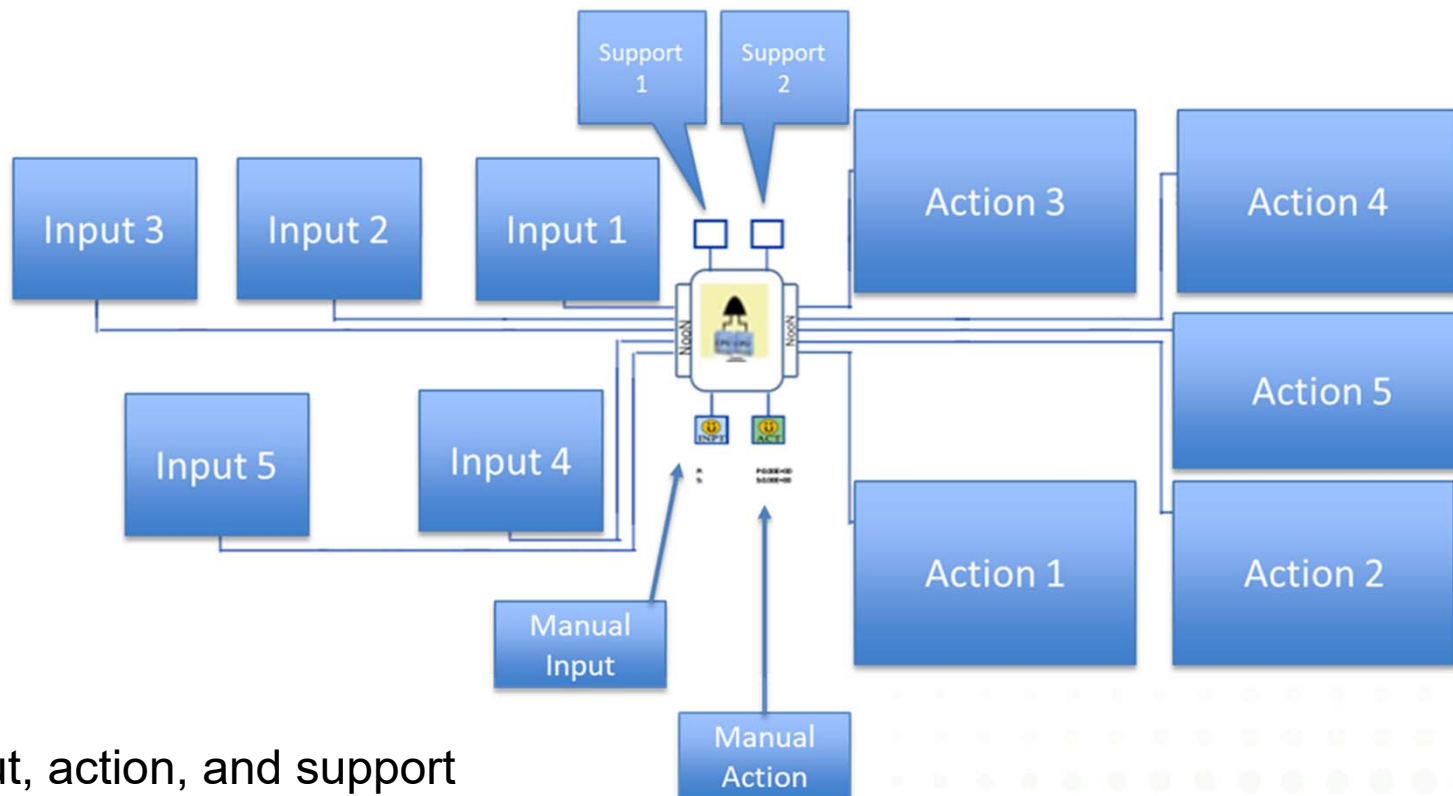
Tool will automatically calculate LS contributions to PFDavg and STR



The screenshot shows a 'Logic Solver' configuration window. It includes fields for 'Logic Solver ID' (DMSIO), 'Logic Solver Type' (GENERIC 1002D DUAL MP; SIMPLEX I/O), and a 'Configurations' section with 'Logic Solver Tag' (SIS-A), 'Voting' (1oo2D), and 'Proof Testing Interval (yr)' (5). Below this, it displays 'PFDavg: 4.92E-04' and 'STR: 4.50E-02'. A 'Note' section contains boundary and implementation details. At the bottom, 'Data Source' is set to 'SIL' and 'HFT' is '1'. An 'Update' button is highlighted with a red box.

Click Update to return to GUI page

# Screen locations of the other subsystems



Input, action, and support system locations are filled in the order entered

## 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 grouping.

Left-click the selected configuration to add to the GUI.

Site: <b>SIS-TECH</b>		Function: <b>V-101 High DP trip</b>		Welcome,		User Guide		SIL SOLVER	
Project ID: <b>Practice</b>		Function ID: <b>SIF 01</b>							

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT	PFD/STR Breakdown		HFT <sub>IN</sub>	HFT <sub>LS</sub>	HFT <sub>ACT</sub>
TARGETS	8.00E-02	1.00	5.00E-02	20.00	0	<div> <div>PFDavg</div> <div>100%</div> <div>Logic</div> </div>	<div> <div>STR</div> <div>100%</div> <div>Logic</div> </div>			
RESULTS										
TARGETS MET?										

← → Exit

Calculate and Save

+ - Reset

SRS

LOGIC SOLVER

INPUT CONFIGURATION

ONE DEVICE

TWO DEVICES

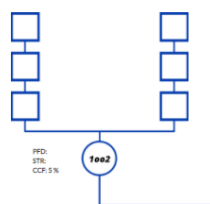
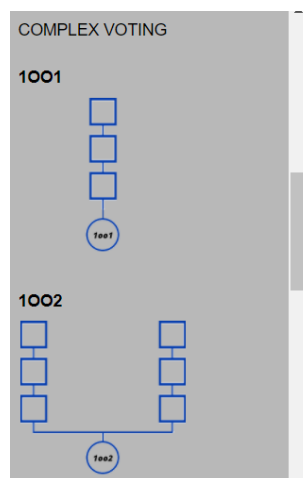
THREE DEVICES

1003

2003

Wrong choice? Hover over that portion of the architecture until grey location field appears, right-click to get option to copy or delete, left-click delete.

# Complex Voting Architectures



- 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

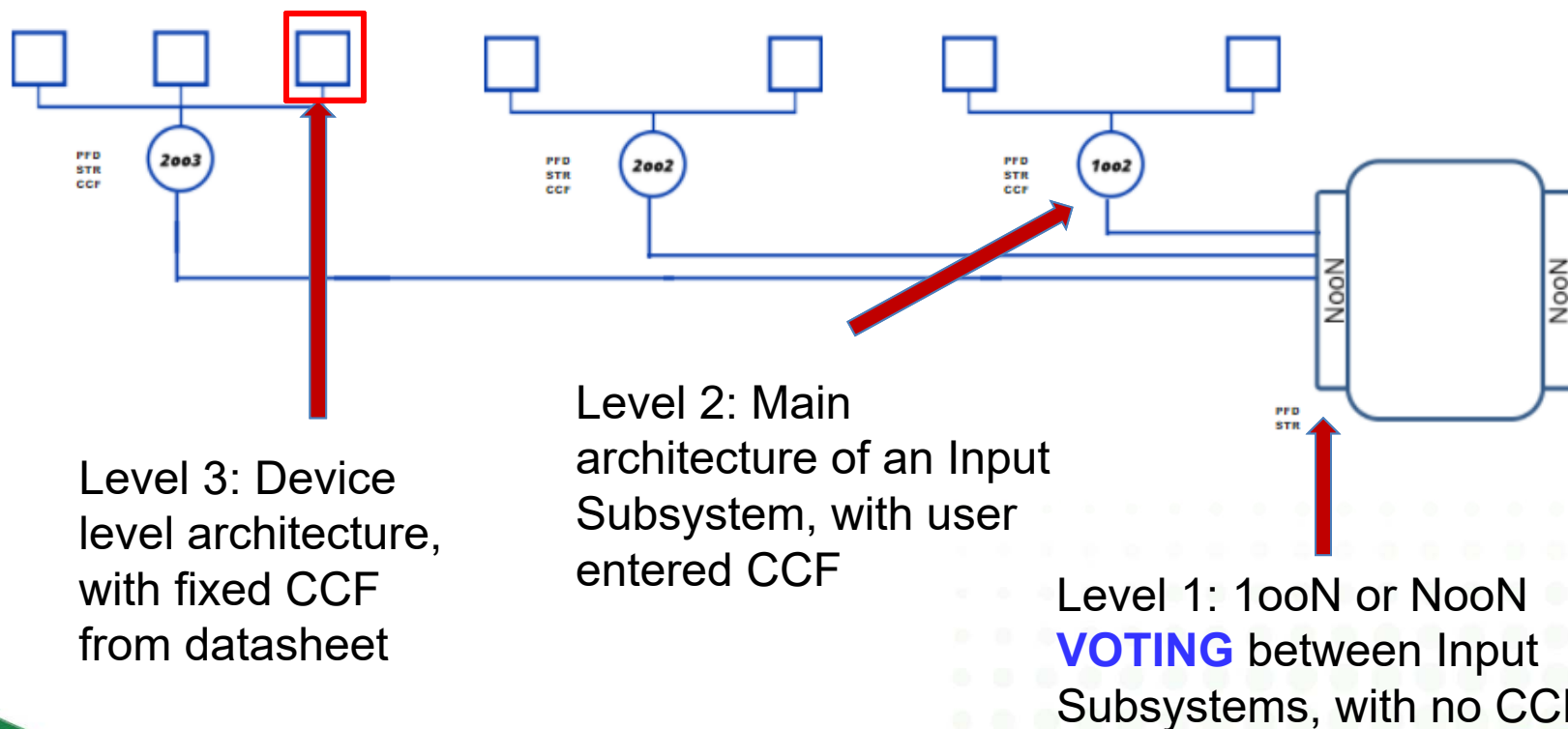
Common examples:

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



# Three levels of Input Architecture

Best Practice: Only use Level 3 if you must for the complexity of the function (some details will not show on the GUI)



# Picking Sensor 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**  
 Project ID: **Practice**

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

Welcome, User Guide

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
<b>TARGETS</b>	8.00E-02	1.00	5.00E-02	20.00	0
<b>RESULTS</b>					
<b>TARGETS MET?</b>					

**PFD/STR Breakdown**

PFDavg

STR

HFT <sub>IN</sub>	HFT <sub>LS</sub>	HFT <sub>ACT</sub>
HFT <sub>SPT1</sub>	HFT <sub>SPT2</sub>	HFT <sub>MIN</sub>
HFT <sub>MACT</sub>	HFT <sub>MACT</sub>	HFT <sub>MACT</sub>

← → Exit
Calculate and Save
+ - Reset

INPUT DEVICE

Search Clear

TRIP AMPLIFIER  
  
 ANALYZER  
  
 PRESSURE  
  

DIFFERENTIAL PRESSURE TRANSMITTER

PNEUMATIC PRESSURE SWITCH

PNEUMATIC PRESSURE TRANSMITTER

# 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**

Welcome, User Guide



	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
<b>TARGETS</b>	8.00E-02	1.00	5.00E-02	20.00	0
<b>RESULTS</b>					
<b>TARGETS MET?</b>					

**PFD/STR Breakdown**

PFDavg

100%

Logic

STR

100%

Logic

HFT <sub>IN</sub>	HFT <sub>LS</sub>	HFT <sub>ACT</sub>
	1	
HFT <sub>SPT1</sub>	HFT <sub>SPT2</sub>	HFT <sub>MIN</sub>

← → Exit
Calculate and Save
+ - Reset


INPUT DEVICE


Clear


TRIP AMPLIFIER

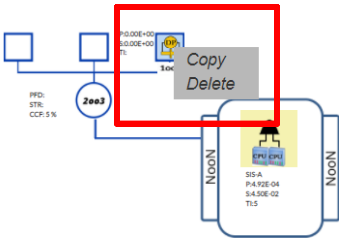
ANALYZER

PRESSURE

 DIFFERENTIAL PRESSURE TRANSMITTER

 PNEUMATIC PRESSURE SWITCH

 PNEUMATIC PRESSURE TRANSMITTER



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

# Adding Device Details

White boxes are editable fields. Some are pre-populated

Device

Device ID: DPTR
Device Type: DIFFERENTIAL PRESSURE TRANSMITTER

Configurations:

Display Tag for Device(s): Individual Tags
Proof Testing Interval (yr):
Voting: 1oo1
Subsystem Diagnostic Level: ? NO DC

Maintenance:
Mean Time to Repair (hr): 72
Diagnostic Interval (hr): 0.5
Overhaul Interval (yr): 20
Proof Testing Coverage (%): ? 100
User Specified

Properties:
Failure Dangerous Failure Rate (1/yr): 8.00E-03
Failure Spurious Failure Rate (1/yr): 1.67E-02
Common Cause Factor CCF Dual (%): 2
Common Cause Factor CCF Triple (%): 2
Diagnostic Coverage Simplex DC1 (1/yr): 60
Diagnostic Coverage Dual DC2 (1/yr): 80
Diagnostic Coverage Triple DC3 (1/yr): 90

PFDavg: 0.00E+00
STR: 0.00E+000

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

Data Source: SIL
Update

32

# Filled In

Test Interval  
is in years

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

Define  
Diagnostic  
Level that will be  
implemented

Default OI is  
20Year

Default PTC is  
100 %

Device

Device ID: DPTR

Device Type: DIFFERENTIAL PRESSURE TRANSMITTER

Configurations:

Display Tag for Device(s)

Individual Tags

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

Common Cause Factor CCF Dual (%):

2

Common Cause Factor CCF Triple (%):

2

Diagnostic Coverage Simplex DC1 (1/yr):

60

Diagnostic Coverage Dual DC2 (1/yr):

80

Diagnostic Coverage Triple DC3 (1/yr):

90

Maintenance:

Mean Time to Repair (hr):

72

Diagnostic Interval (hr):

0.5

Overhaul Interval (yr):

20

Proof Testing Coverage (%): ?

100

User Specified

☐

PFDavg:

0.00E+00

STR:

0.00E+000

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 Guide)

Data Source: SIL

Update

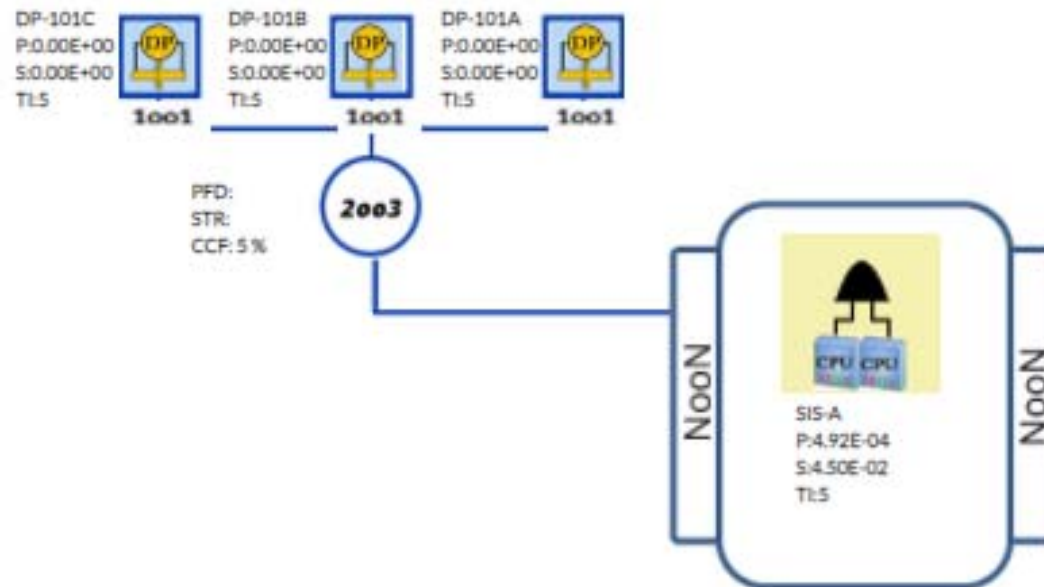
Will updated  
once SIF is  
calculated

Update button will activate once  
minimum date is entered.



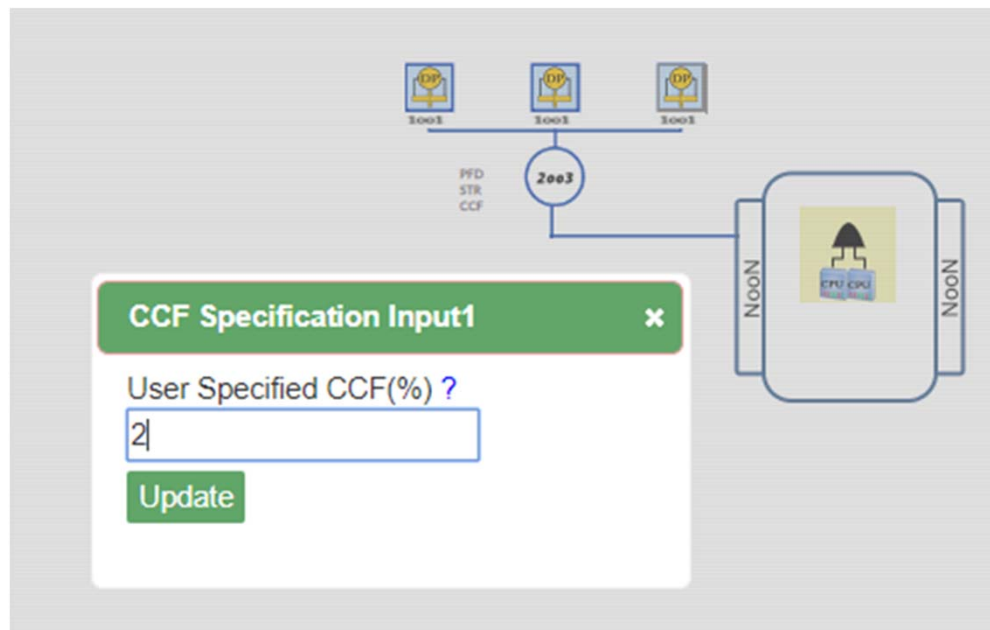
# Completing the subsystem

1. Copy DP-101A Pressure transmitter
2. Paste DP pressure transmitter to each of box in the 2003 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
- Update the default CCF value as needed (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



CCF is not used in non-redundant (i.e., 1oo1 or 2oo2) architectures

Note: When using diverse instrumentation in a redundant architecture, there might still be some CCF. A judgement based on the technology and installation details should be made.

# 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 inter-comparison 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:

Device Tag: DP-101A

Proof Testing Interval (yr): 5

Voting: 1oo1

Subsystem Diagnostic Level: ? DC3

Maintenance:

Mean Time to Repair (hr): 72

Diagnostic Interval (hr): 0.500

Overhaul Interval (yr): 20

Proof Testing Coverage (%): ? 100

User Specified ☐

Properties:

Failure Dangerous Failure Rate (1/yr): 8.00E-03

Failure Spurious Failure Rate (1/yr): 1.67E-02

Common Cause Factor CCF Dual (%): 2

Common Cause Factor CCF Triple (%): 2

Diagnostic Coverage Simplex DC1 (1/yr): 60.00

Diagnostic Coverage Dual DC2 (1/yr): 80.00

Diagnostic Coverage Triple DC3 (1/yr): 90.00

PFDavg: 2.01E-002

STR: 1.67E-002

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

Data Source: SIL

Update

The triplex DC for this device is 90%

# 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.

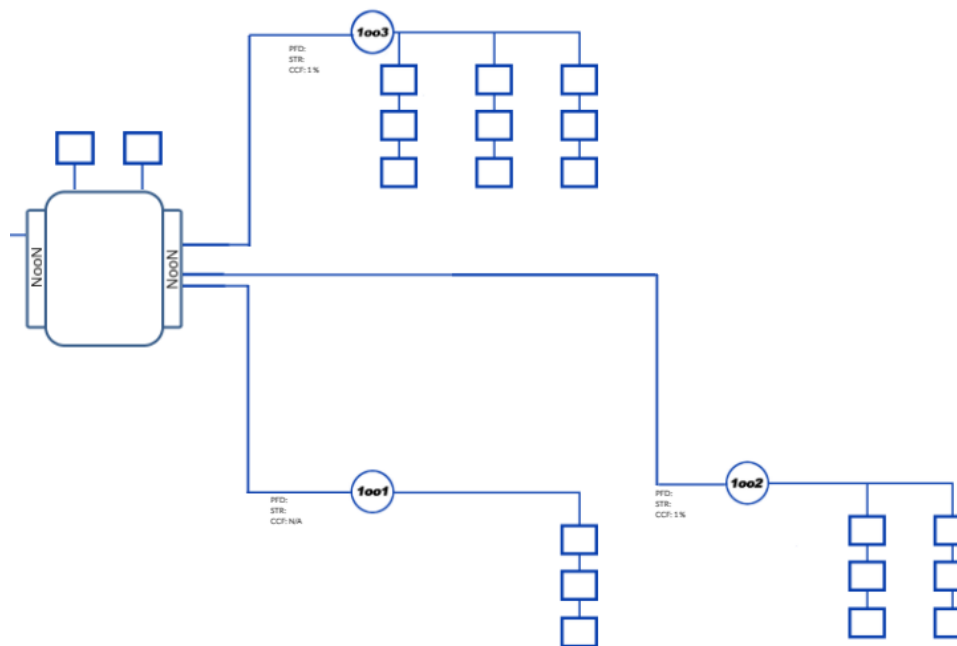
May select a higher DC when an external independent reading can be used for inter-comparison with the SIF sensor.

*Reminder: Credit for diagnostics shouldn't be taken if the diagnostic result isn't going to be used to take prompt safe action, either automatically or manually, to address any risk gap caused by the failure.*

# 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(s)
3. Specify relevant parameters



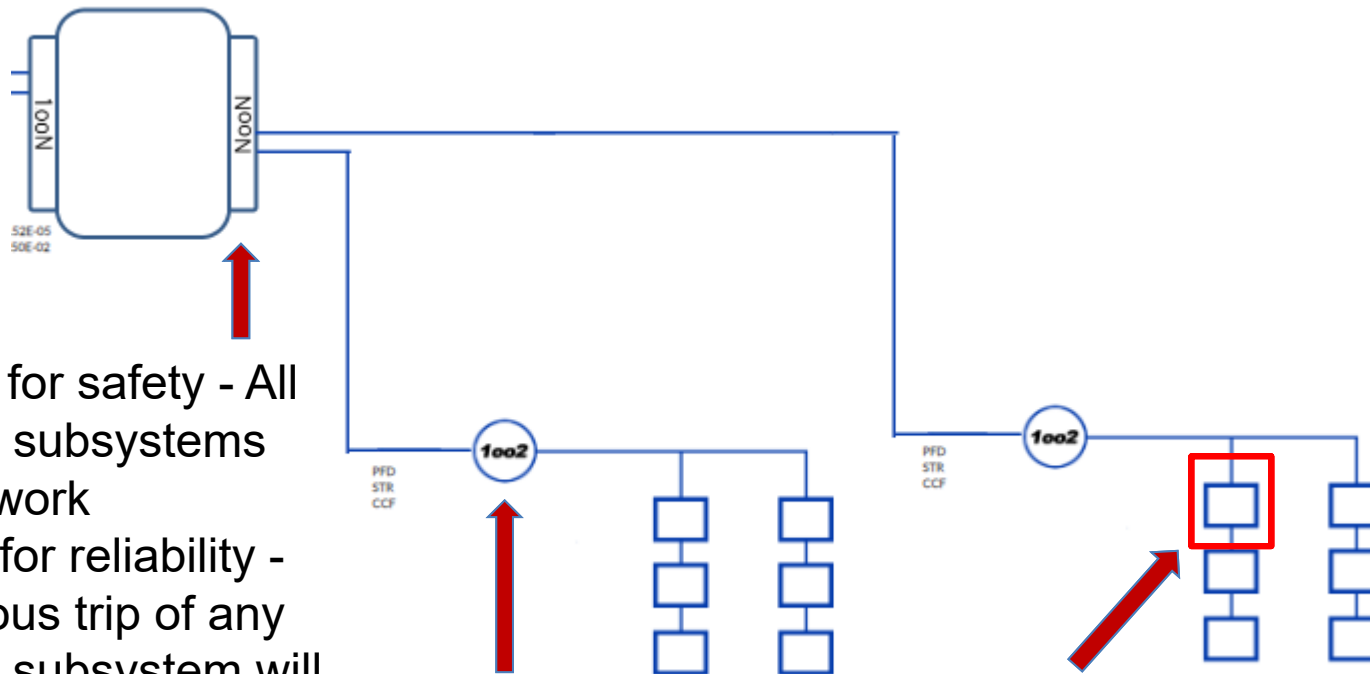


# Two configurable levels of Action Architecture

Best Practice: To show the most information on the GUI, only use Level 2 if you must for the complexity of the function.

## FIXED:

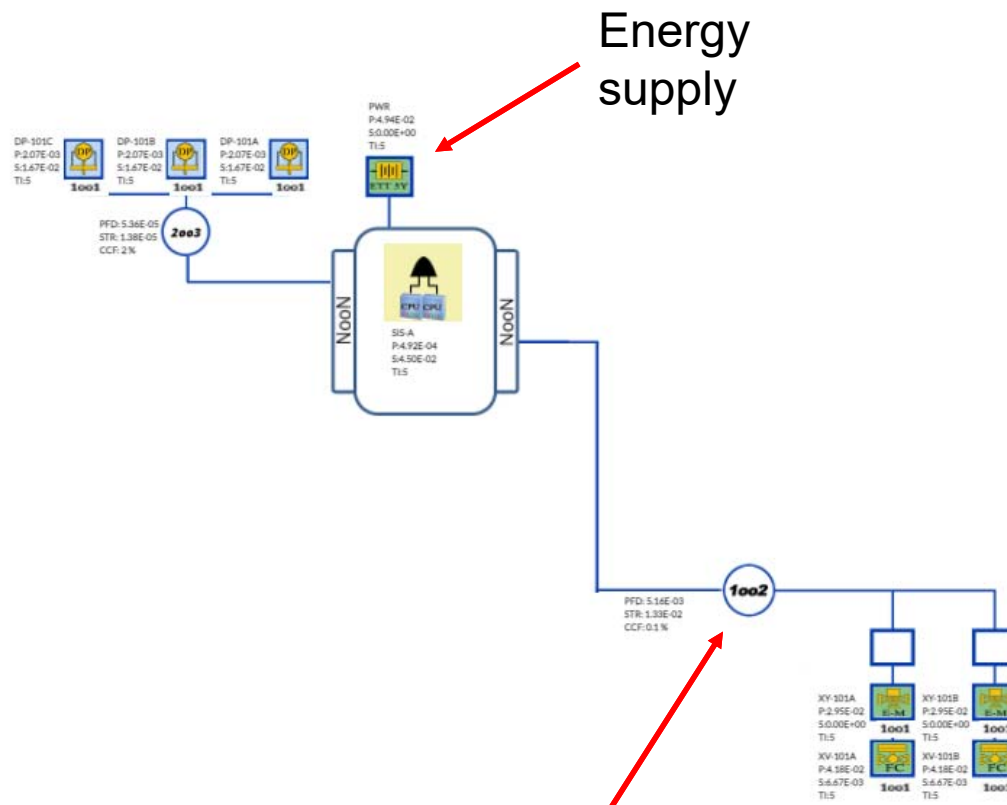
- NooN for safety - All action subsystems must work
- 1ooN for reliability - Spurious trip of any action subsystem will cause an operational problem



Level 1: Main architecture of an Action Subsystem, with user entered CCF

Level 2: Device level architecture, with fixed CCF from datasheet

# Adding valves, solenoids, and support system



**Device**

Device ID: SVETM Device Type: SOLENOID VALVE - ETT - MONITORED

**Configurations:**

Device Tag: XY-101A  
 Proof Testing Interval (yr): 5  
 Voting: 1001  
 Subsystem Diagnostic Level: ? NO DC

**Properties:**

Failure Dangerous Failure Rate (1/yr): 1.18E-02  
 Failure Spurious Failure Rate (1/yr): 0  
 CCF Dual(%): 1  
 CCF Triple(%): 1  
 Diagnostic Coverage Simplex(1/yr): 0.00  
 Diagnostic Coverage Dual(1/yr): 0.00  
 Diagnostic Coverage Triple(1/yr): 0.00

**Maintenance:**

Mean Time to Repair (hr): 72  
 Diagnostic Interval (hr): 0.000  
 Overhaul Interval (yr): 20  
 Proof Testing Coverage (%): ? 100  
 User Specified

**Note:**

Boundary Conditions: Boundary includes solenoid and solenoid wiring up to monitoring device.  
 Process Severity Assumption: N/A  
 Implementation Limitations and Exclusions: Vent port for redundant configurations is unobstructed and protected from debris.

Data Source: SIL Update

**Device**

Device ID: BVFCC Device Type: BLOCK VALVE-BALL-FTC-CLEAN

**Configurations:**

Device Tag: XV-101A  
 Proof Testing Interval (yr): 5  
 Voting: 1001  
 Subsystem Diagnostic Level: ? NO DC

**Properties:**

Failure Dangerous Failure Rate (1/yr): 1.67E-02  
 Failure Spurious Failure Rate (1/yr): 8.67E-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

**Maintenance:**

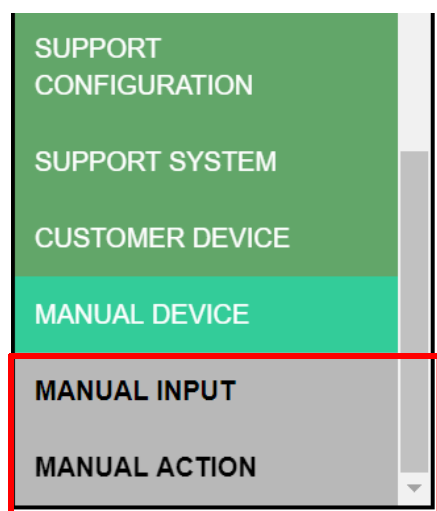
Mean Time to Repair (hr): 72  
 Diagnostic Interval (hr): 0.000  
 Overhaul Interval (yr): 20  
 Proof Testing Coverage (%): ? 100  
 User Specified

**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

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



Click to add  
field to GUI

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**

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

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

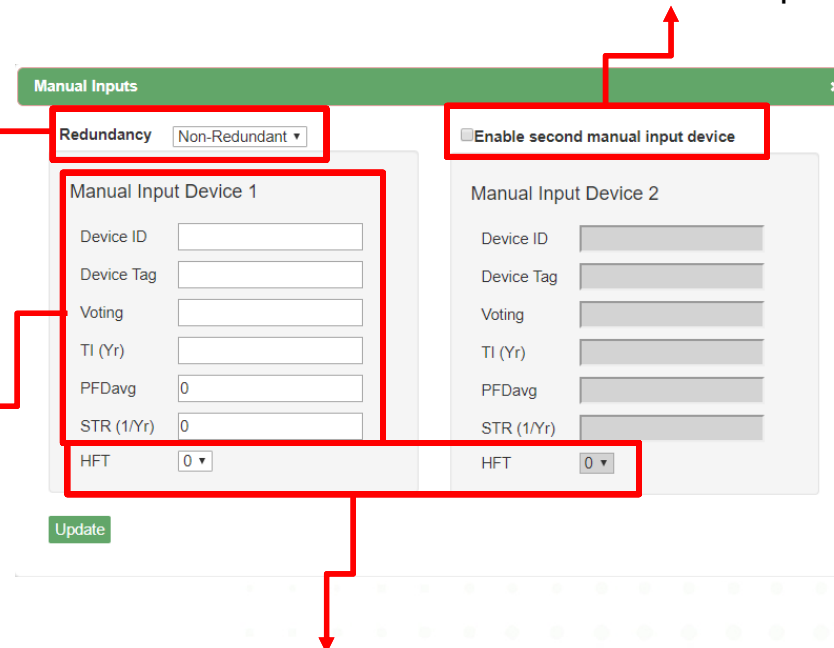
# Manual Inputs

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

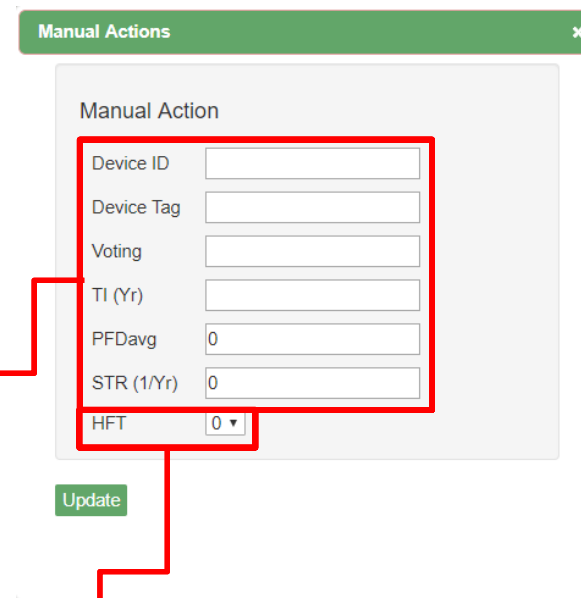
Check to allow entry of the second Manual Input



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

# Manual Action

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

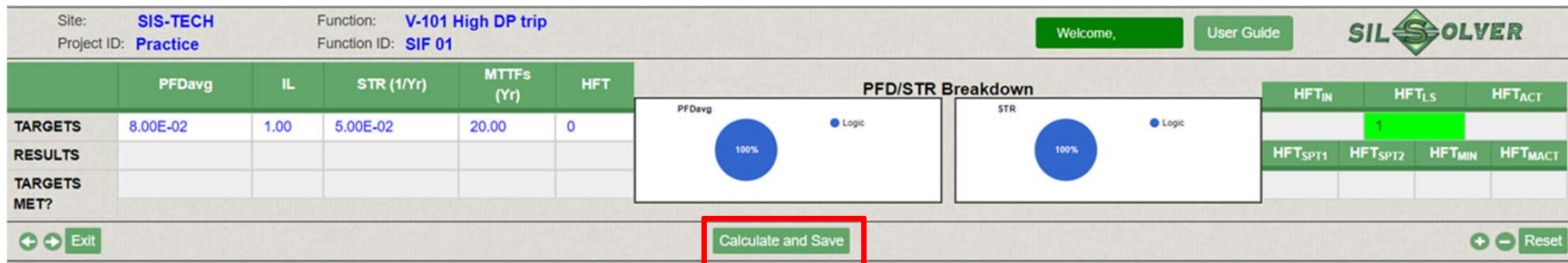


User enters Manual Action HFT Value



# Ready to Calculate?

All devices entered, filled out, and CCF added?  
Click the “Calculate and Save” button



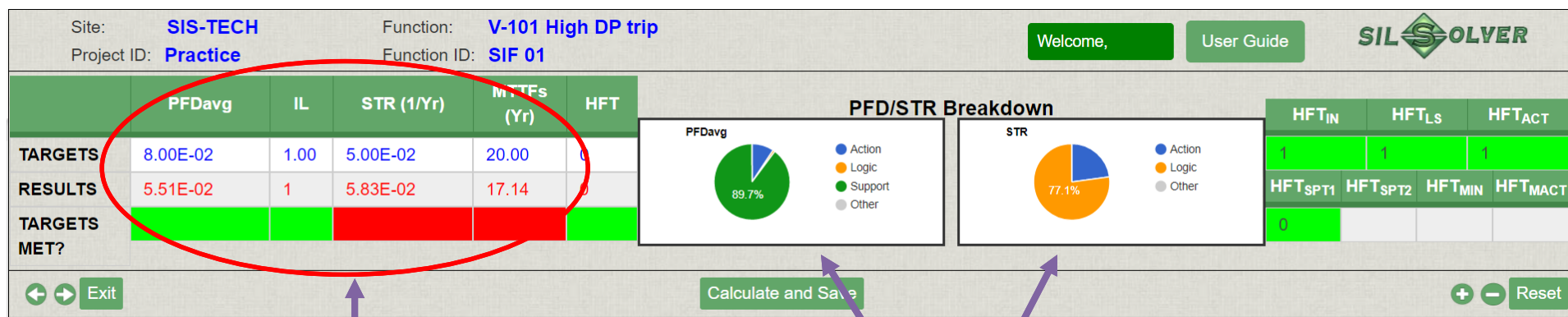
The screenshot shows the SIL SOLVER software interface. At the top, it displays 'Site: SIS-TECH Practice' and 'Function: V-101 High DP trip SIF 01'. Below this is a table with columns for PFDavg, IL, STR (1/Yr), MTTFs (Yr), and HFT. The 'TARGETS' row shows values: 8.00E-02, 1.00, 5.00E-02, 20.00, and 0. The 'RESULTS' row is empty. Below the table, there are two circular progress indicators for PFDavg and STR, both showing 100%. To the right, there are fields for HFT<sub>IN</sub>, HFT<sub>LS</sub>, HFT<sub>ACT</sub>, HFT<sub>SPT1</sub>, HFT<sub>SPT2</sub>, HFT<sub>MIN</sub>, and HFT<sub>MACT</sub>. At the bottom, there is a 'Calculate and Save' button highlighted with a red box, and an 'Exit' button on the left and a 'Reset' button on the right.

Note any **ERRORS** or **Warnings** that are generated during the calculation:

**ERRORS:** A problem exists in GUI or device configuration that will make the calculated results INCORRECT

**Warning:** A value is missing from the configuration that may or may not be a technical issue, depending on the overall design

# 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.

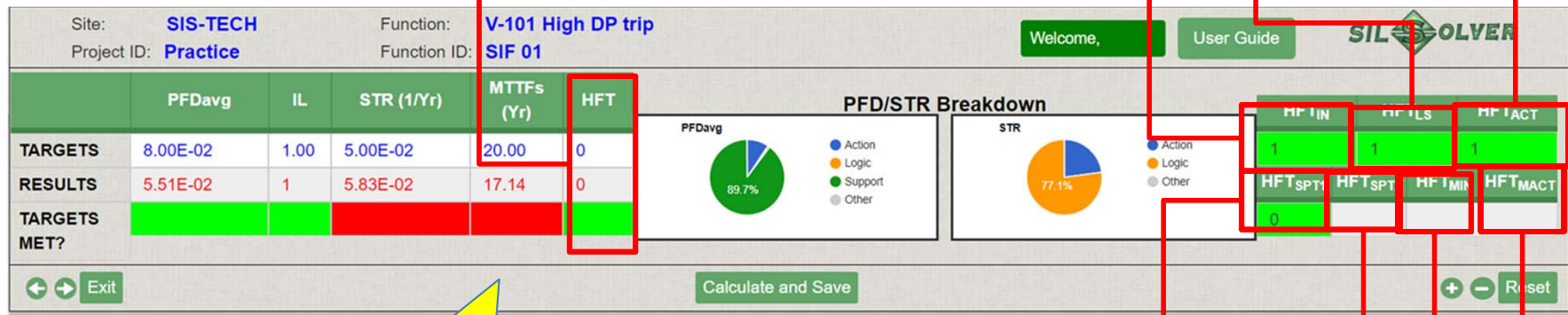
# Don't forget Hardware Fault Tolerance (HFT)

HFT Target and  
Overall HFT  
Result

HFT for Input(s)

HFT for  
Logic  
Solver

HFT for  
Action(s)



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 Input and Action Subsystems

The HFT for each field device box (MooN) is determined by the selected architecture within that box as below.

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

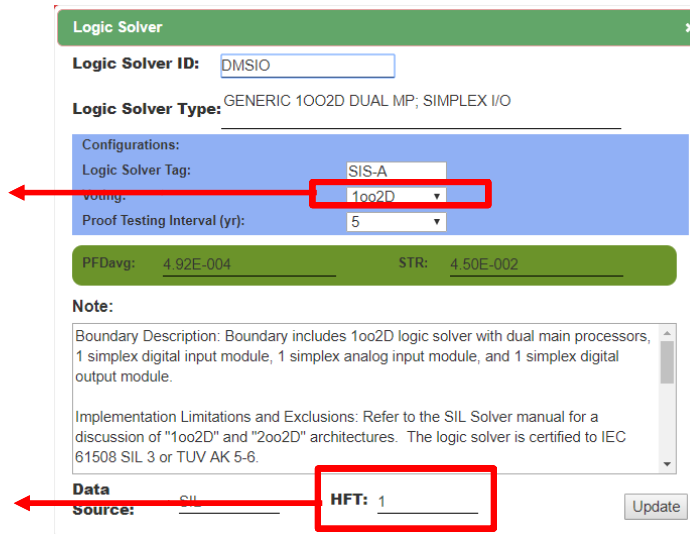
The results of the individual device boxes are combined based on the mid-level architecture.

# HFT for Logic Solver

The HFT value for the logic solver is based on the technology and 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.

In this case,  
architecture is  
1oo2D

Logic Solver  
HFT Value



The screenshot shows the 'Logic Solver' configuration window. Key fields include:

- Logic Solver ID:** DMSIO
- Logic Solver Type:** GENERIC 1OO2D DUAL MP; SIMPLEX I/O
- Configurations:**
  - Logic Solver Tag:** SIS-A
  - Logic Solver Architecture:** 1oo2D (highlighted with a red box and an arrow from the text 'In this case, architecture is 1oo2D')
  - Proof Testing Interval (yr):** 5
- PFDavg:** 4.92E-004
- STR:** 4.50E-002
- 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 (highlighted with a red box and an arrow from the text 'Logic Solver HFT Value')
- Update** button

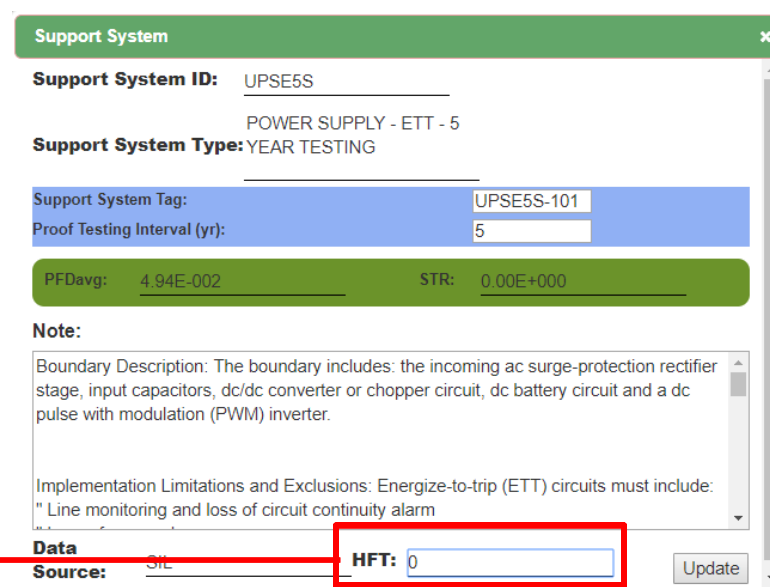
*Default value is 0 when importing a logic solver that is not in the current SIL Solver logic solver datasheet.*



# HFT for Support System

The HFT value for the support system is fixed and shown on the support system data sheet and on the GUI as below.

Support System  
HFT Value



The screenshot shows a 'Support System' window with the following details:

- Support System ID:** UPSE5S
- Support System Type:** POWER SUPPLY - ETT - 5 YEAR TESTING
- 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 (highlighted with a red box)
- Update** button

*Default value is 0 when importing support systems that are not in the current SIL Solver support system datasheet.*

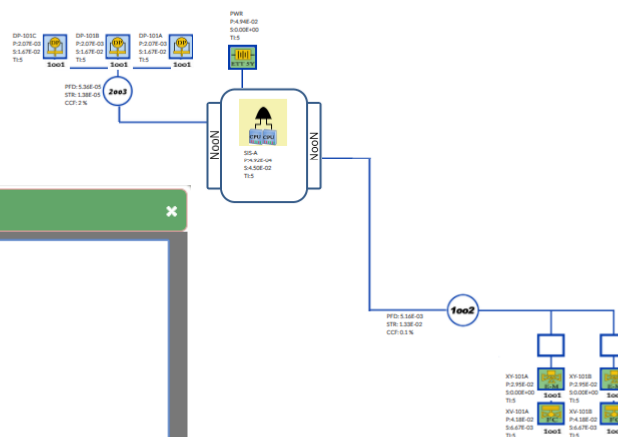


HFT <sub>MIN</sub>	HFT <sub>MACT</sub>

## Is that all?

- The SIL Calculation is performed within a context of standard SIL evaluation assumptions, such as
  - Sufficient independence exists between the SIF and other functions used in the hazard case the SIF is designed for
  - Functional safety management program meets ISA61511-1 requirements
- The documentation of the SIL calculation should include sufficient SRS information to provide this context

- 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**  
 Project ID: **Practice**

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

Welcome, User Guide

	PFDavg	IL	STR (1/Yr)	MTTFs (Yr)	HFT
<b>TARGETS</b>	8.00E-02	1.00	5.00E-02	20.00	0
<b>RESULTS</b>	5.51E-02	1	5.83E-02	17.14	0
<b>TARGETS MET?</b>					

PFDavg

● Action  
● Logic  
● Support  
● Other

STR

● Action  
● Logic  
● Other

HFT <sub>IN</sub>	HFT <sub>LS</sub>	HFT <sub>ACT</sub>
1	1	1
HFT <sub>SPT1</sub>	HFT <sub>SPT2</sub>	HFT <sub>TMIN</sub>
0		

Exit

Calculate and Save

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

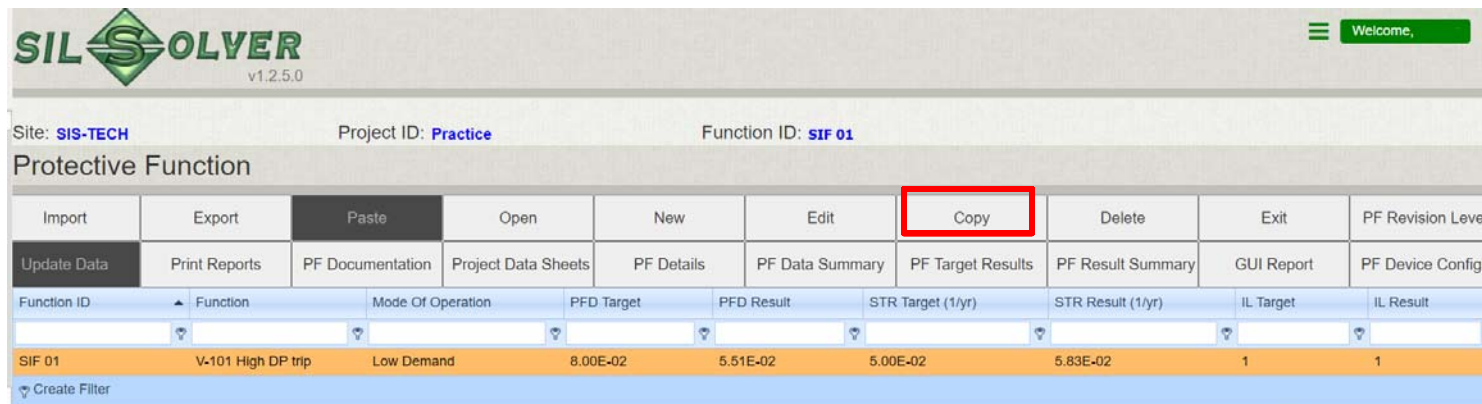
Exit to return to main Protective Function screen for this project



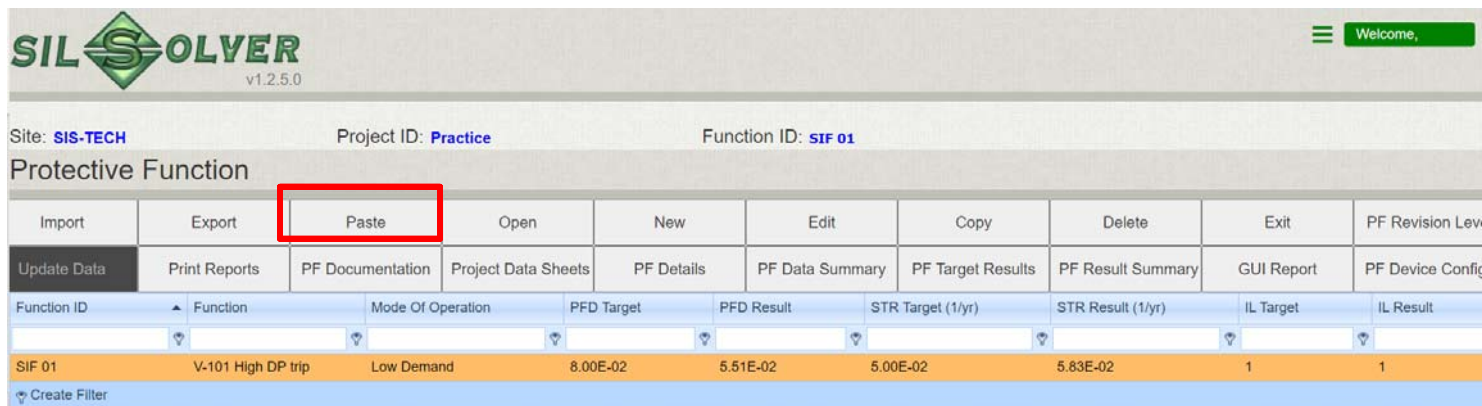
## Second Function

- 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



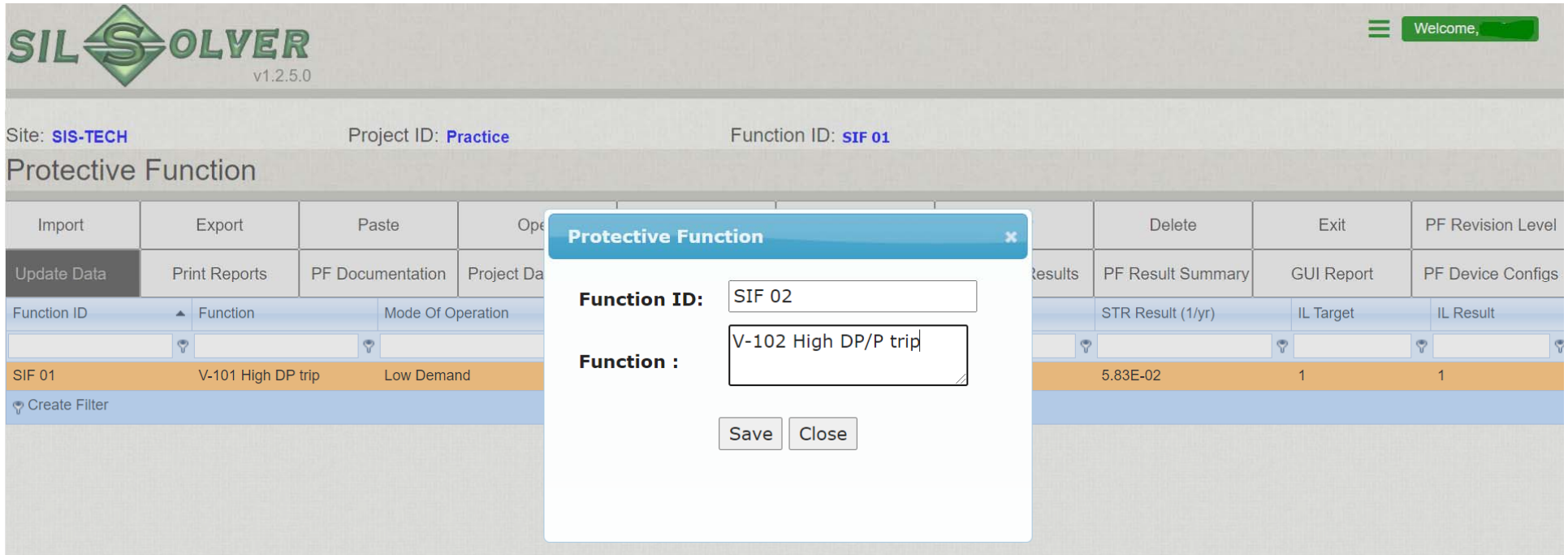
From the main Protective Function page, selecting the function to be copied and clicking the Copy button...



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 v1.2.5.0 software interface. The main window displays the 'Protective Function' section with a table of functions. A 'Protective Function' dialog box is open, allowing the user to enter a new function ID and description.

**Protective Function Dialog Box:**

- Function ID:** SIF 02
- Function :** V-102 High DP/P trip
- Buttons:** Save, Close

**Background Software Interface:**

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

Function ID	Function	Mode Of Operation
SIF 01	V-101 High DP trip	Low Demand
- Buttons:** Import, Export, Paste, Open, Update Data, Print Reports, PF Documentation, Project Data, Delete, Exit, PF Revision Level, PF Result Summary, GUI Report, PF Device Configs, STR Result (1/yr), IL Target, IL Result.

# Address differences in I/O and architecture

**SIL SOLVER** v1.2.5.0 Welcome,

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

**Protective Function**

Import	Export	Paste	Open	New	Edit	Copy	Delete	Exit	PF Revision Level
Update Data	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs
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 DP trip	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1	
SIF 02	V-102 High DP/P trip	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1	

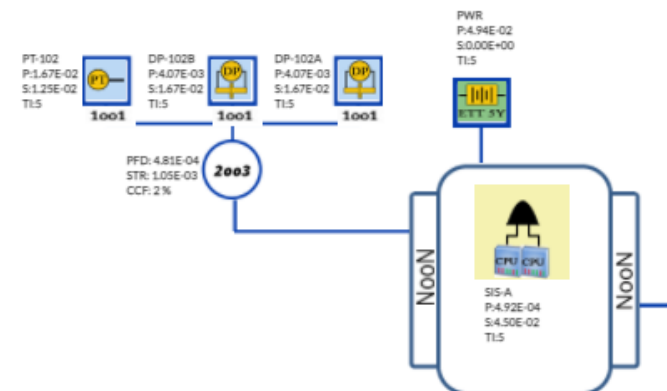
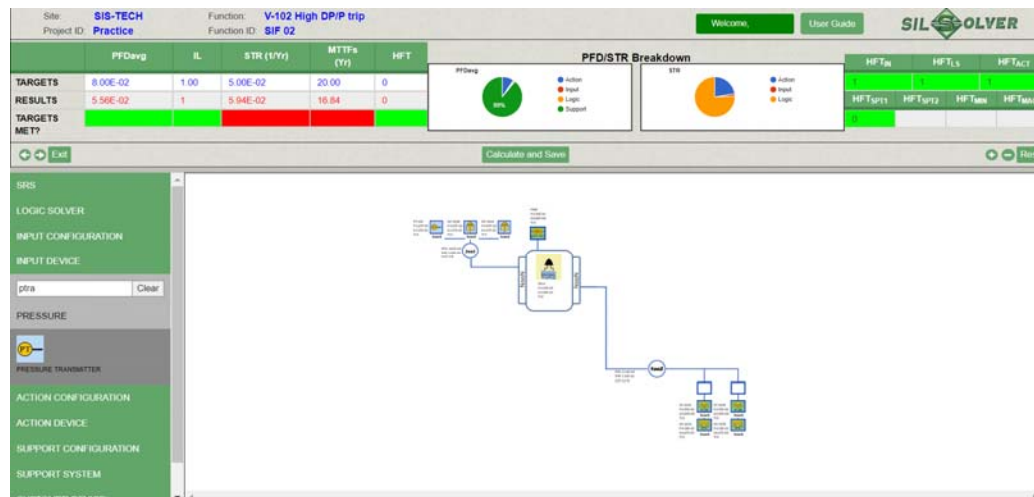
Select and Open the new function

Update tag ID fields for all devices that are the same



# 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).





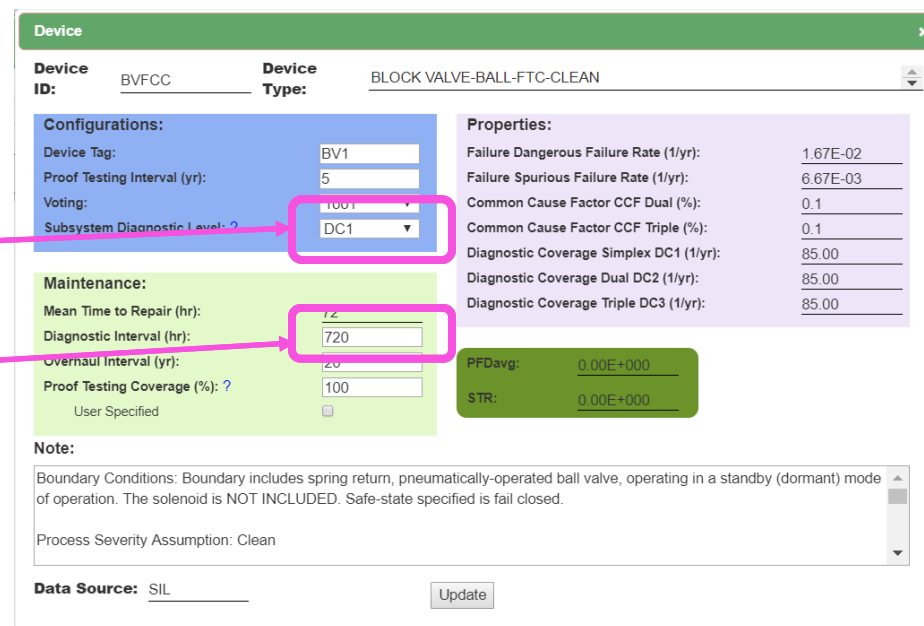
# Partial Stroke Testing of Valves

- 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

Both fields must be configured for correct use of equation



**Device**

Device ID: BVFCC Device Type: BLOCK VALVE-BALL-FTC-CLEAN

**Configurations:**

Device Tag: BV1

Proof Testing Interval (yr): 5

Voting: 1001

Subsystem Diagnostic Level: **DC1**

**Maintenance:**

Mean Time to Repair (hr): 12

Diagnostic Interval (hr): **720**

Overhaul Interval (yr): 20

Proof Testing Coverage (%): 100

User Specified ☐

**Properties:**

Failure Dangerous Failure Rate (1/yr):	1.67E-02
Failure Spurious Failure Rate (1/yr):	6.67E-03
Common Cause Factor CCF Dual (%):	0.1
Common Cause Factor CCF Triple (%):	0.1
Diagnostic Coverage Simplex DC1 (1/yr):	85.00
Diagnostic Coverage Dual DC2 (1/yr):	85.00
Diagnostic Coverage Triple DC3 (1/yr):	85.00

PFDavg: 0.00E+000

STR: 0.00E+000

**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

# 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: 1001

Subsystem Diagnostic Level: ? NO DC

Maintenance:

Mean Time to Repair (hr): 72

Diagnostic Interval (hr): 0.500

Overhaul Interval (yr): 10

Proof Testing Coverage (%): ? 85

User Specified ☒

Properties:

Failure Dangerous Failure Rate (1/yr): 5.00E-03

Failure Spurious Failure Rate (1/yr): 4.00E-02

Common Cause Factor CCF Dual (%): 2

Common Cause Factor CCF Triple (%): 2

Diagnostic Coverage Simplex DC1 (1/yr): 60.00

Diagnostic Coverage Dual DC2 (1/yr): 80.00

Diagnostic Coverage Triple DC3 (1/yr): 90.00

PFDavg: 0.00E+000

STR: 0.00E+000

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

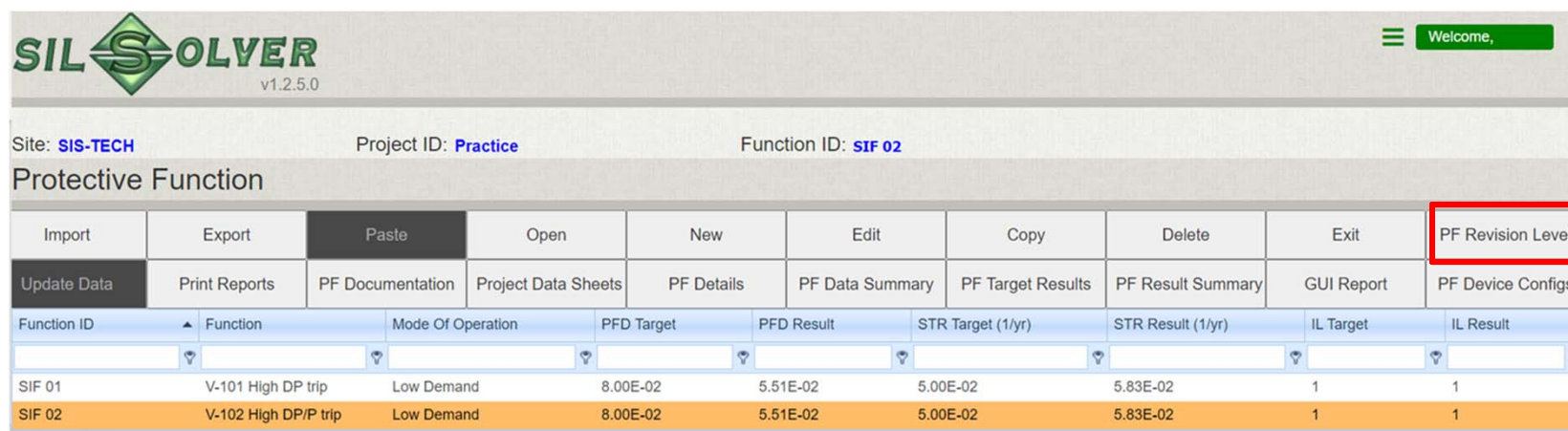
Data Source: SIL

Update

# **3. EDITING, COPYING OR DELETING AN EXISTING PROJECT**

# 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 a new function revision entry, open to edit it, or delete an entry.



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

Protective Function

Import	Export	Paste	Open	New	Edit	Copy	Delete	Exit	PF Revision Level
Update Data	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs

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 DP trip	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1
SIF 02	V-102 High DP/P trip	Low Demand	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1



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

New	Open	Delete	Report	Exit
-----	------	--------	--------	------

Function Version	Performed By	Date	Approved By	Date

No data to display

Create Filter

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

**SIL SOLVER** v1.2.5.0 Welcome,

Site: **SIS-TECH** Project ID: **BIG FUNCS1**

**Projects**

Activates when a project is copied

Import	Export	Paste	Open	New	Edit	Copy	Delete	Exit	Project Revision
DBF Import	Print Reports	PF Documentation	Project Data Sheets	PF Details	PF Data Summary	PF Target Results	PF Result Summary	GUI Report	PF Device Configs

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	BIG FUNCS1	Fully populated
TEST	Pretend site 2	CASE 4	Case 3 for testing import-export
SISTC	Pretend location 1	COMPLEX	Complex Architectures
BACK	Houston Texas	FLOW1	Reverse flow case

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



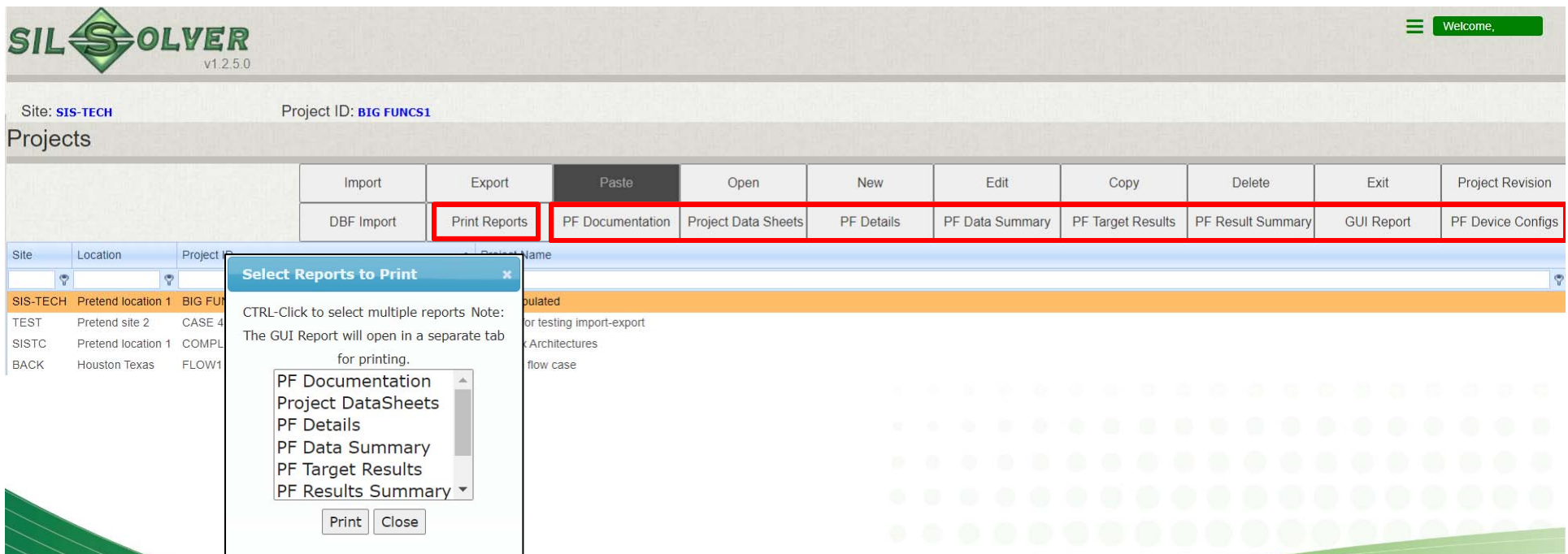
## 4. GENERATING REPORTS

# Project Report generation

Print a single report for a whole project by selecting project and click relevant report tab...

or use “Print Reports” and select multiple reports at once

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



The screenshot displays the SIL SOLVER v1.2.5.0 software interface. The top bar shows the site as 'SIS-TECH' and the project ID as 'BIG FUNCS1'. Below this, a 'Projects' table lists various projects. A 'Print Reports' dialog box is open, allowing the user to select multiple reports for printing. The dialog box includes a list of reports: PF Documentation, Project Data Sheets, PF Details, PF Data Summary, PF Target Results, and PF Results Summary. The 'Print' button is highlighted.

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	BIG FUNCS1	...
TEST	Pretend site 2	CASE 4	...
SISTC	Pretend location 1	COMPL	...
BACK	Houston Texas	FLOW1	...

**Select Reports to Print**

CTRL-Click to select multiple reports. Note:  
The GUI Report will open in a separate tab for printing.

- PF Documentation
- Project Data Sheets
- PF Details
- PF Data Summary
- PF Target Results
- PF Results Summary

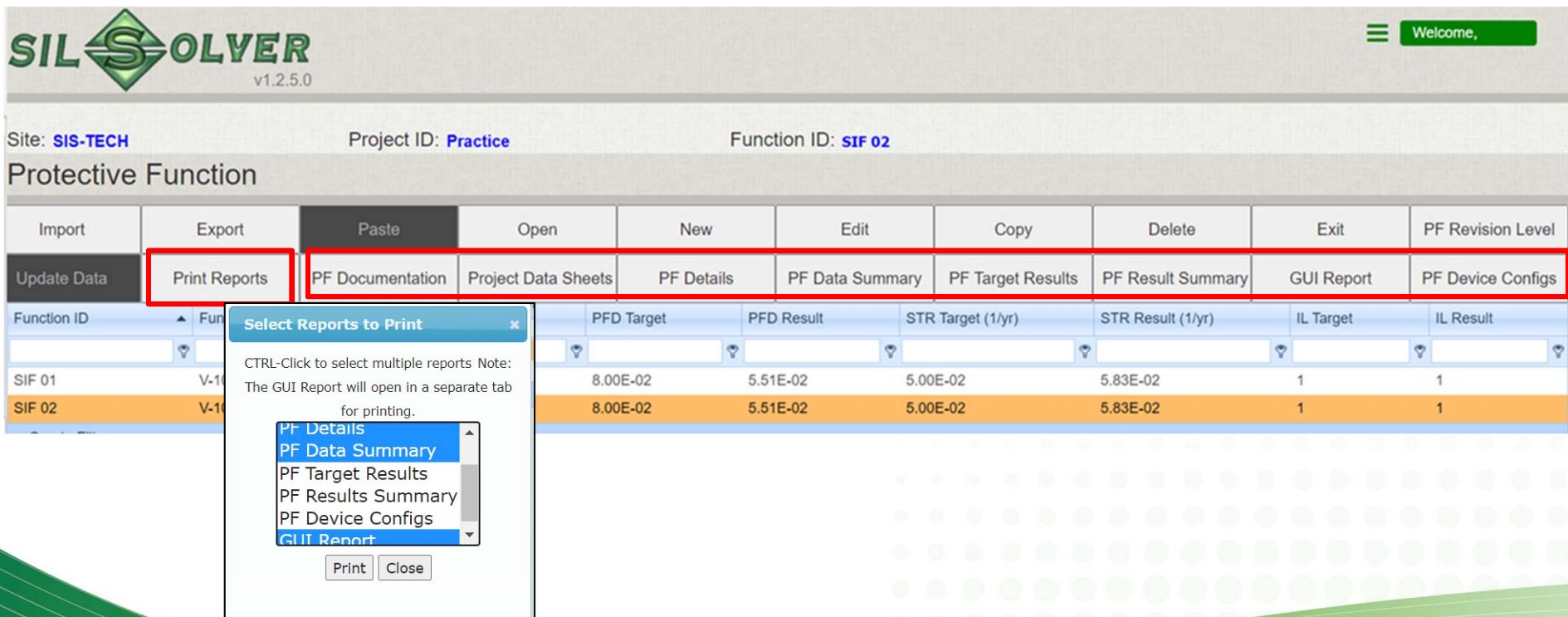
Print Close

# Function Report generation

Print a report for an individual function by going to the function list for that project, select a function and click relevant report tab ...

or use "Print Reports" and select multiple reports at once

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



The screenshot displays the SIL SOLVER v1.2.5.0 interface. At the top, the site is identified as SIS-TECH, the project as Practice, and the function as SIF 02. The main section is titled 'Protective Function'. Below this, a menu bar includes options like Import, Export, Paste, Open, New, Edit, Copy, Delete, Exit, and PF Revision Level. A secondary menu bar highlights 'Print Reports', 'PF Documentation', 'Project Data Sheets', 'PF Details', 'PF Data Summary', 'PF Target Results', 'PF Result Summary', 'GUI Report', and 'PF Device Configs'. A 'Select Reports to Print' dialog box is open, showing a list of reports: PF Details, PF Data Summary, PF Target Results, PF Results Summary, PF Device Configs, and GUI Report. The 'GUI Report' is selected. The background shows a table with columns for PFD Target, PFD Result, STR Target (1/yr), STR Result (1/yr), IL Target, and IL Result, with data for SIF 01 and SIF 02.

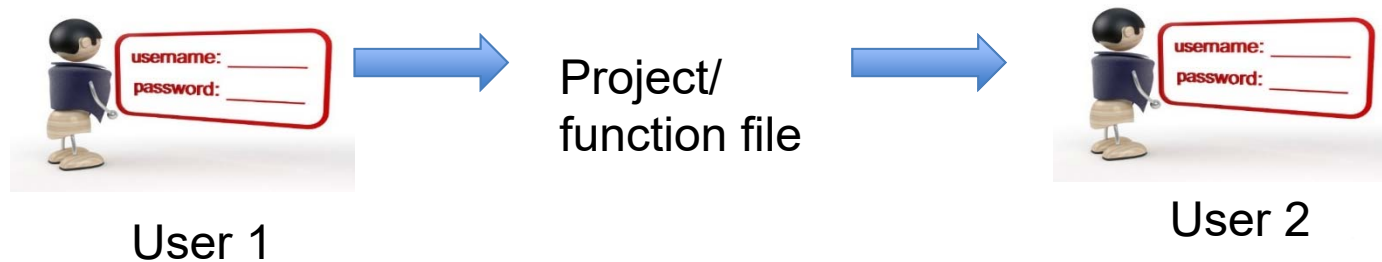
Function ID	PFD Target	PFD Result	STR Target (1/yr)	STR Result (1/yr)	IL Target	IL Result
SIF 01	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1
SIF 02	8.00E-02	5.51E-02	5.00E-02	5.83E-02	1	1

## 5. IMPORTING/EXPORTING

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

# Import and export

- The way to share a project/function between **SIL Solver<sup>®</sup> Enterprise** users



## DBF Import

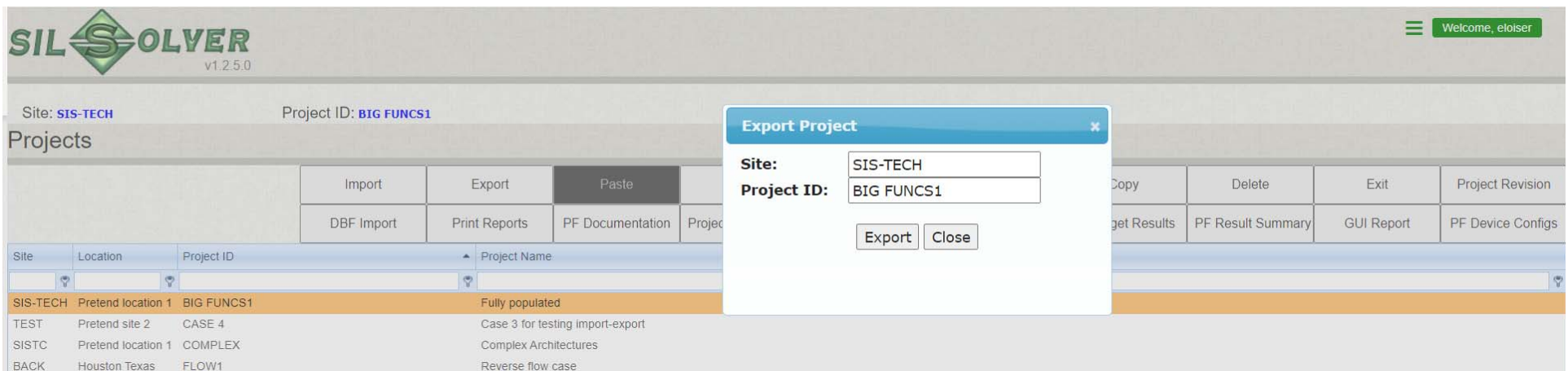
- The way to transfer a project from a SIL Solver<sup>®</sup> desktop program into SIL Solver<sup>®</sup> Enterprise



# Project export

To export a project:

1. Go to the project page
2. Select the project
3. Click “Export” – confirm the Site and ProjectID and click Export in dialog
4. A \*.sifprj file of the project will be created in the download folder



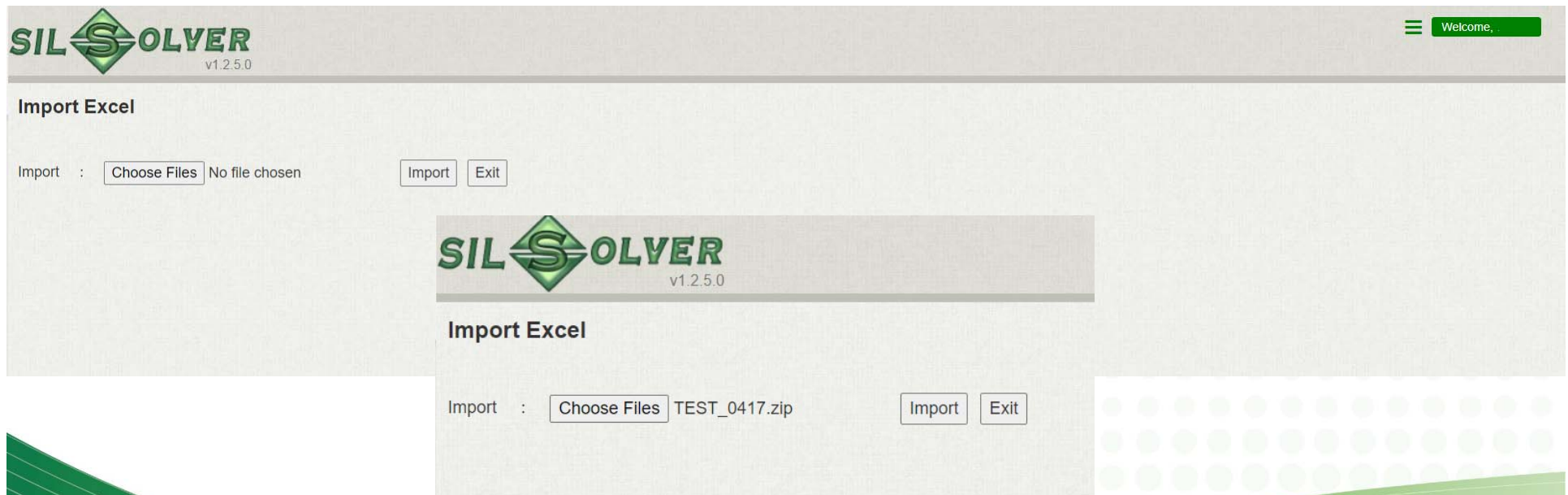
The screenshot shows the SIL SOLVER v1.2.5.0 interface. At the top, the site is 'SIS-TECH' and the project ID is 'BIG FUNCS1'. The 'Export Project' dialog box is open, showing the same site and project ID. The dialog has 'Export' and 'Close' buttons. In the background, a table lists projects:

Site	Location	Project ID	Project Name
SIS-TECH	Pretend location 1	BIG FUNCS1	Fully populated
TEST	Pretend site 2	CASE 4	Case 3 for testing import-export
SISTC	Pretend location 1	COMPLEX	Complex Architectures
BACK	Houston Texas	FLOW1	Reverse flow case

# Project import

To import a previously exported SIL Solver® Enterprise project:

1. Go to the project page
2. Click “Import”, which will open the import page
3. Click “choose files”, then change the directory to the project (\*.silprj)) file you want to import
4. Click Import and the tool will attempt to import the file



# SIL Solver® Enterprise

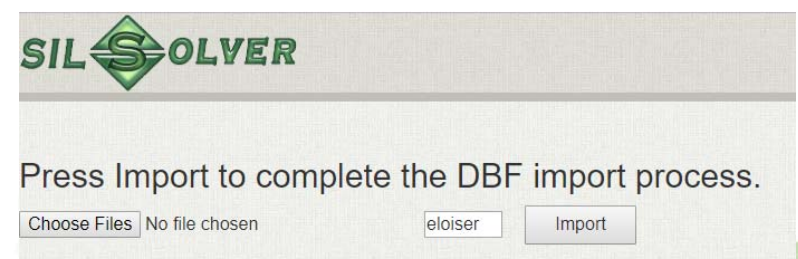
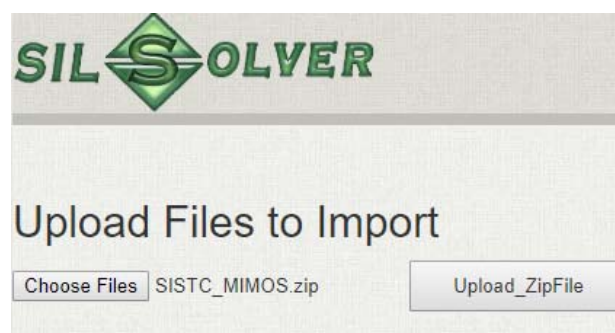
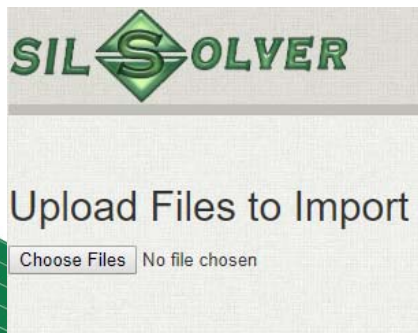
## Function export/import

To export/import an Enterprise function is the same as for a project, the only difference is that the operations are on the function level page and the exported file extension is \*.silsif

# DBF import to Enterprise

To import a **project** from SIL Solver<sup>®</sup> **desktop** versions into SIL SOLVER<sup>®</sup> Enterprise

1. Go to the folder where you saved the desktop software project
  - For example the default directory: C:\SILSolver\_Projects
2. Make sure the project folder name is correct, the files in the folder have not been modified, and no additional files have been added to the folder
3. Zip the project folder that you want to import to SIL Solver<sup>®</sup> Enterprise
4. Go to the SIL Solver<sup>®</sup> Enterprise project page
5. Click “DBF import” button to open the DBF import page
6. Click Choose Files to browse to the Zipped project folder
7. Click “Upload\_ZipFile”
8. When the upload is ready, click import
9. A message will pop up when the import is done, including any warnings



## CAUTION: Know the version the work needs to be performed in!

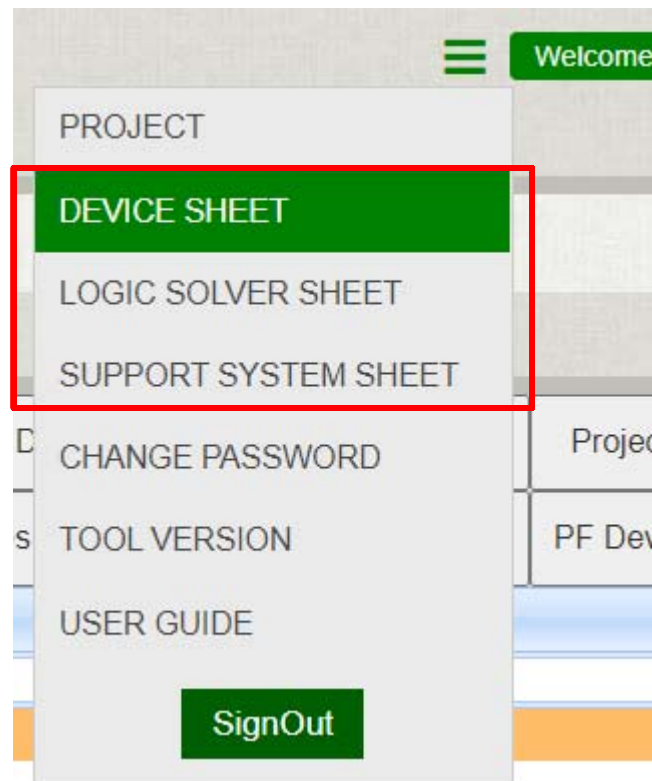
- Projects/functions from older versions **can** be imported into a newer version of SIL Solver® Enterprise.
- However, projects and functions from a newer version **cannot** be imported back into an older version of SIL Solver® Enterprise or into the desktop application.



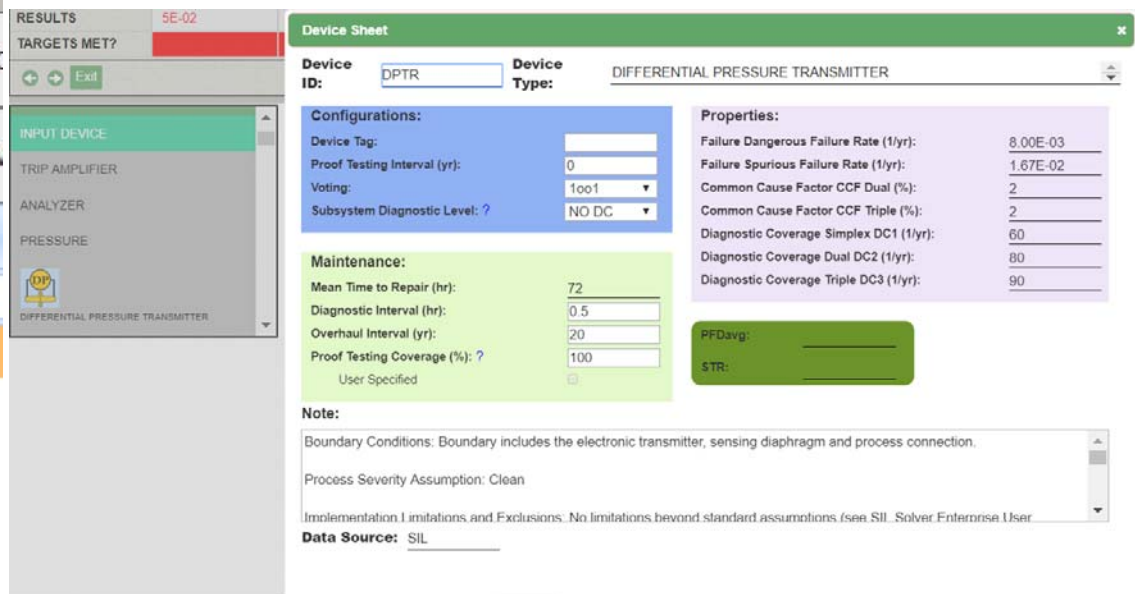
## 6. DATASHEETS

- 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



A screenshot of the 'Device Sheet' window for a 'DIFFERENTIAL PRESSURE TRANSMITTER'. The window is divided into several sections:

- Device ID:** DPTR
- Device Type:** DIFFERENTIAL PRESSURE TRANSMITTER
- Configurations:**
  - Device Tag: [Empty]
  - Proof Testing Interval (yr): 0
  - Voting: 1001
  - Subsystem Diagnostic Level: ? NO DC
- Maintenance:**
  - Mean Time to Repair (hr): 72
  - Diagnostic Interval (hr): 0.5
  - Overhaul Interval (yr): 20
  - Proof Testing Coverage (%): ? 100
  - User Specified: ☐
- Properties:**

Failure Dangerous Failure Rate (1/yr):	8.00E-03
Failure Spurious Failure Rate (1/yr):	1.67E-02
Common Cause Factor CCF Dual (%):	2
Common Cause Factor CCF Triple (%):	2
Diagnostic Coverage Simplex DC1 (1/yr):	60
Diagnostic Coverage Dual DC2 (1/yr):	80
Diagnostic Coverage Triple DC3 (1/yr):	90
- PF Davg:** [Empty]
- STR:** [Empty]
- 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

**Data Source:** SIL







# Device datasheet list

**SIL SOLVER** v1.2.5.0 Welcome, [User]

SIL Solver Data Sheet

Back Version History Data ID List

Page 1 of 5 (248 items) [1] 2 3 4 5

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

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

# Device Datasheet

## SIL Solver Data Sheet

[DATA SHEET](#)
[Back](#)

DataSource

SIL

Device Id

ACC



Device Type

ACCELERATION MONITOR

Fail Dangerous Failure Rate(1/yr)

1.25E-02

Fail Spurious Failure Rate(1/yr)

1.13E-01

Mean Time to Repair(hrs)

72

Common Cause Factor Dual Mode(%)

2.00

Common Cause Factor Triple Mode(%)

2.00

Diagnostic Interval(hrs)

0.00

Diagnostic Coverage in Simplex Mode(%)

0

Diagnostic Coverage in Dual Mode(%)

0

Diagnostic Coverage in Triplicated Mode(%)

0

### Notes

Boundary Conditions: Boundary includes probe/cable assembly and monitor with alarm relay or analog output.

Process Severity Assumption: N/A

Implementation Limitations and Exclusions: For redundant configurations, separate probes and mounting brackets must be used for each monitor. If dual channel monitors are used, the appropriate output voting should be selected from the table.

"D" configuration assumes that each monitor circuit is provided with a means to detect spurious activation of a circuit. "D" configurations can be used when the analog outputs from the monitor are connected to the SIS, providing signal deviation alarming, OR when the relay output from the monitor is used to generate a fault alarm to the operator HMI. This diagnostic does not benefit the PFD so no diagnostic coverage credit is taken in the analysis.










# Same for Logic Solvers and Support Systems

**SIL SOLVER** v1.2.5.0 Welcome

SIL Solver Logic Solver Sheet






Back Version History Logic ID List

Open	Data Version	Source	Logic Solver ID	Logic Solver Image	Logic Solver Description
Open	8	SIL	DMDIO		GENERIC 2004D DUAL MP, DUAL I/O
Open	8	SIL	DMSIO		GENERIC 1002D 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	RELPCCL		RELAY - FAIL TO CLOSE
Open	8	SIL	RELPCOL		RELAY - FAIL TO OPEN

**SIL SOLVER** v1.2.5.0 Welcome

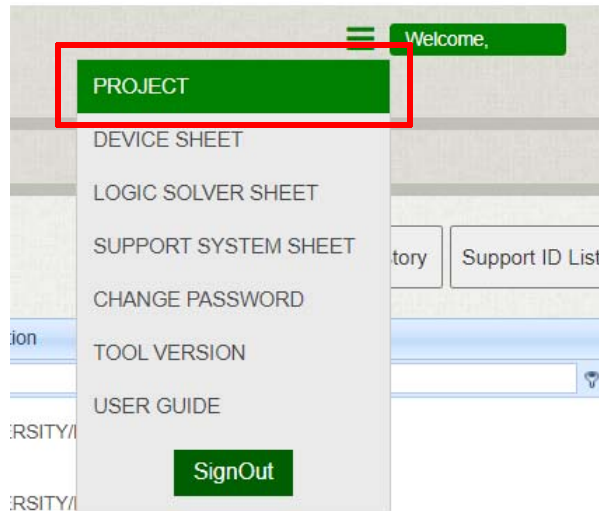
SIL Solver Support System Data Sheet

Back Version History Support ID List

Open	Data Version	Source	Support System ID	Support System Image	Support System Description
Open	8	SIL	IAD RMS		INSTRUMENT AIR-DIVERSITY/MONITORED RECEIVER
Open	8	SIL	IAD RS		INSTRUMENT AIR-DIVERSITY/RECEIVER
Open	8	SIL	IAD S		INSTRUMENT AIR-COMPRESSOR DIVERSITY
Open	8	SIL	IAD IVS		INSTRUMENT AIR-NO DIVERSITY
Open	8	SIL	IAD RCS		INSTRUMENT AIR-RECEIVER



# Returning to Project View



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



# 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 to be created
- Enter the data for the new custom device and Save
  - Do not use special characters or spaces in the Data Source or Device ID fields
  - If desired, browse to a new image for this device to replace the default

The screenshot shows the SIL-SOLVER software interface. On the left, a sidebar lists various configuration options: SRS, LOGIC SOLVER, INPUT CONFIGURATION, INPUT DEVICE, ACTION CONFIGURATION, ACTION DEVICE, SUPPORT CONFIGURATION, SUPPORT SYSTEM, and CUSTOMER DEVICE. The 'CUSTOMER DEVICE' option is highlighted with a red circle. The main window displays the 'Customer Device' form, which includes the following fields:

- Data Source:
- Device ID:
- Device Type:
- Failure Dangerous Failure Rate(1/yr):
- Failure Spurious Failure Rate(1/yr):
- Mean Time to repair(hrs):
- CCF Dual(%):
- CCF Triple(%):
- Diagnostic Interval(hr):
- Diagnostic Coverage Simplex(%):
- Diagnostic Coverage Dual(%):
- Diagnostic Coverage Triplicated(%):
- Notes:
- Select Alternate User Image File (optional):  No file chosen
- Select the image file to represent this custom device.
- Data Source is required.
- 

Once created, custom datasheets cannot be edited!

# 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
- If warnings are generated during the import, there is an import log file that can be downloaded
- For DBF Import, use the Windows native “Send to” “Compressed (zipped) folder” feature, not any other zip application

# Troubleshooting: Disconnects/Timing Out

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

