
User's Manual for

Sabaton v1.0

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1. Introduction

1.1 About Sabaton

Sabaton is a program for FMEA (Failure Mode and Effects Analysis) and FMECA (Failure Mode, Effects and Criticality Analysis) analysis. The FMEA/FMECA method is widely used in product and system development to reveal possible failures and to assess the potential causes and effects of these failures. The analysis typically results in improvement proposals aimed at eliminating system malfunction or to reduce the effects of the failures, and is also valuable in understanding complex system behaviour.

The Sabaton user is assumed to be familiar with the FMEA/FMECA methodology. Thus the user's manual does not include any description of the method as such. You may, however, refer to the numerous textbooks and standards that are available. Some references to text books as well as standards are found in "List of References" on page 63, see, e.g., refs. [1] and [2].

1.2 About the Manual

Figure and dialog appearance

All figures and program dialogs in this manual are taken from Windows 2000. With Windows 9x/NT/XP the appearance may differ slightly.

Typing conventions

Throughout the guide, menu options for Sabaton appear in **bold** in the following form: **Main menu name | menu command**. E.g., to create a new analysis you must first click on the **File** menu and then select the **New analysis** command from the drop-down list. This command is then described as the **File | New analysis** command.

Shortcuts



Shortcut menu

Shortcuts for menu commands may both be available through keyboard combinations and the toolbar. These shortcuts appear to the left of the text describing the menu command or operation. E.g.:

The **File | New analysis** command has a shortcut in the toolbar.

Many commands are available through a shortcut menu, activated by right-clicking on the mouse. The commands available from the shortcut menu vary depending on where the menu is activated, and offer the most useful commands for the task being conducted (these are normally chosen from the regular command menu). Some commands may, however, only be accessed from the shortcut menu.

1.3 Getting more Information

This user's manual is always the first place to look for help. The User's Manual is also available within Sabaton through the help menu and "Help"-buttons.

If you still need help, please contact your distributor or visit our Web-site:

<http://www.sydvest.com>

1.4 Installing and Uninstalling

1.4.1 System Requirements

- Windows 9x, NT, 2000 or XP
- Pentium 233 MHz processor minimum
- 64 Mb RAM minimum, 128 Mb recommended
- 50 Mb free disk space
- Available on CD

1.4.2 Starting Setup

It is recommended that you close all programs running on your computer before installing.

If your Sabaton installation file is available as, e.g. a downloaded file on your file server, it may have a different name than given below. In this case follow the same

instructions, but change the name and location of the installation file.

Follow the instructions below to install:

1. Place the Sabaton installation CD in your PC's CD-ROM drive.
 - If your CD-ROM has AutoPlay enabled, the Sabaton Setup will start automatically. In this case, skip to step 4.
2. Open the **Run** dialog box by opening the **Start** menu and choose **Run**.
3. Start the Sabaton Setup program by typing **d:setup** (where **d:** is the drive containing the Sabaton CD) and press **Enter**.
4. The Sabaton Setup screen appears. Follow the instructions on your screen.

1.4.3 Uninstalling Sabaton

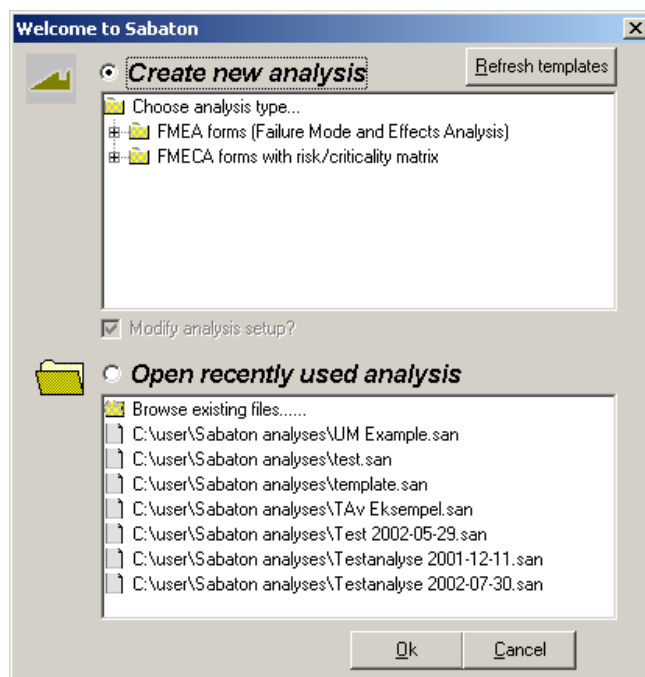
You can use the uninstall feature of Sabaton to remove the program from your system.

1. Click the **Start** button, select **Settings**, and click **Control Panel**. The Control Panel opens.
2. Open the Add/Remove Programs control. The Add/Remove Program Properties dialog box appears.
3. In the list of programs that can be removed, select Sabaton, then click the **Add/Remove** button.
4. Click **Yes** to confirm that you want to remove Sabaton.

2. Getting Started

2.1 Start the Program

The following dialog appears when starting Sabaton:



See “Start a New Analysis” on page 6 if you want to start a new analysis.

To open an existing analysis, either select one of the recently used analyses from the list, or select **Browse existing files....**

Note that if you started the program by double-clicking on a Sabaton file you will go directly to the program window, please see “The Sabaton Program Window” on page 8.

2.2 Start a New Analysis

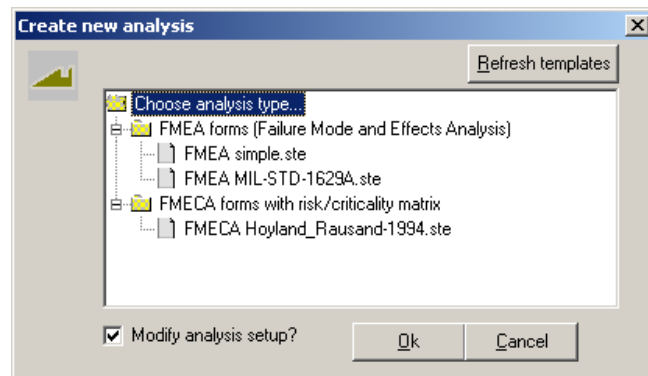
2.2.1 Initiate a new analysis

A new analysis is either started from the File menu or through the program start-up, as described in “Start the Program” on page 5.



Select **File | New analysis** from the File menu to start a new analysis.

When initiating a new analysis, the dialog below appears.



Select analysis type from the dialog, and further, select which of the templates within the selected analysis type you prefer to use in your analysis.

Note that you need to refresh the list of analysis templates if you have copied new templates into your system manually (Please refer to **?????** for a description of this). Then select the **Refresh templates** command from the dialog.

For comments on the **Modify analysis setup** check-box, see “Start analysis without modifying setup” on page 7 and “Modify analysis setup” on page 7.

2.2.2 Analysis types

Currently, there are two different analysis types available, the FMEA and the FMECA:

- *FMEA forms*
Analysis forms for performing Failure Mode and Effects Analysis (FMEA), i.e., without criticality ranking options.
- *FMECA forms*
Analysis forms for performing Failure Mode,

Effects and Criticality Analysis (FMECA). Here, you may include columns with calculated fields in the form, as well as including a criticality/risk matrix.

Whether both analysis types are available or just the former depends on what licence you purchased.

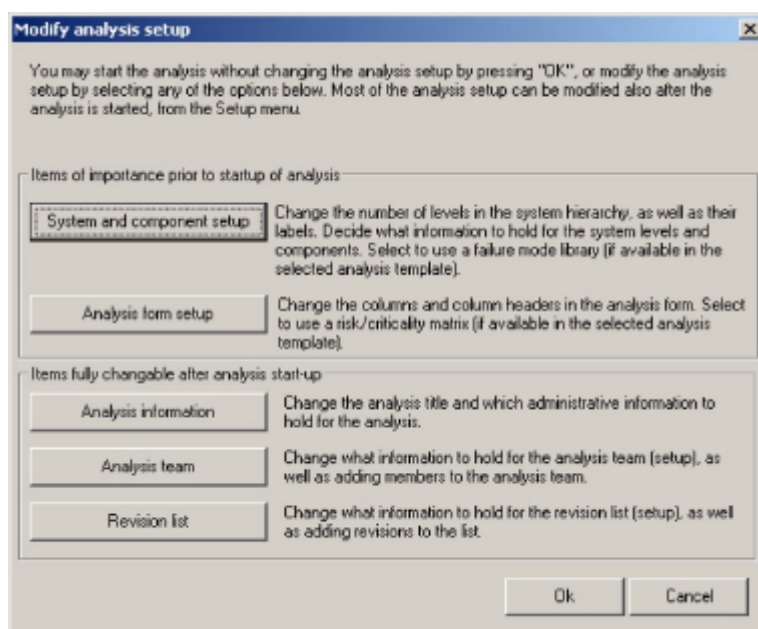
Sabaton have some predefined analysis templates, however, you may also create your own templates, or obtain further templates from Sydvest or colleagues.

2.2.3 Start analysis without modifying setup

If you want to start an analysis without modifying the analysis setup, simply un-check the “Modify analysis setup” check-box before you press **OK**. In this case, you proceed to the regular Sabaton program window. Please refer to “The Sabaton Program Window” on page 8.

2.2.4 Modify analysis setup

If you want to modify the analysis setup before you start the analysis, retain the “Modify analysis setup” check-box checked, and press **OK**. You will now proceed to the **Modify analysis setup and analysis information** dialog, see below:



From the **Modify analysis setup and analysis information** dialog you are able to change the setup for the analysis, like system breakdown and the analysis form columns. You may

also enter analysis information, like analysis title. Please see below. Note that all information and setup can be entered and altered also during the analysis.

The commands available are:

System and component setup

The **System and component setup** command opens a dialog where you specify the hierarchical breakdown of the system as well as what information to hold for both the system levels and the components. For components, also selections for the optional failure mode library are given. Please refer to “System and Component Setup” on page 49.

Analysis form setup

The **Analysis form setup** command opens a dialog where you specify the layout of the analysis form itself, including which columns to include, their headings, etc. Also your selections for the optional risk/criticality matrix is made here, as well as the options for status codes that can be used for highlighting failure modes in the analysis. Please refer to ?? “Analysis Form Setup” on page 53.

Analysis description

The **Analysis description** command opens a dialog where you can define the analysis title, description and similar. This is further described in ?? “Analysis Description” on page 21.

Analysis team

The **Analysis team** opens a dialog where you can enter and manage an overview of all persons involved in the analysis. This is further described in ?? “Analysis Team” on page 23.

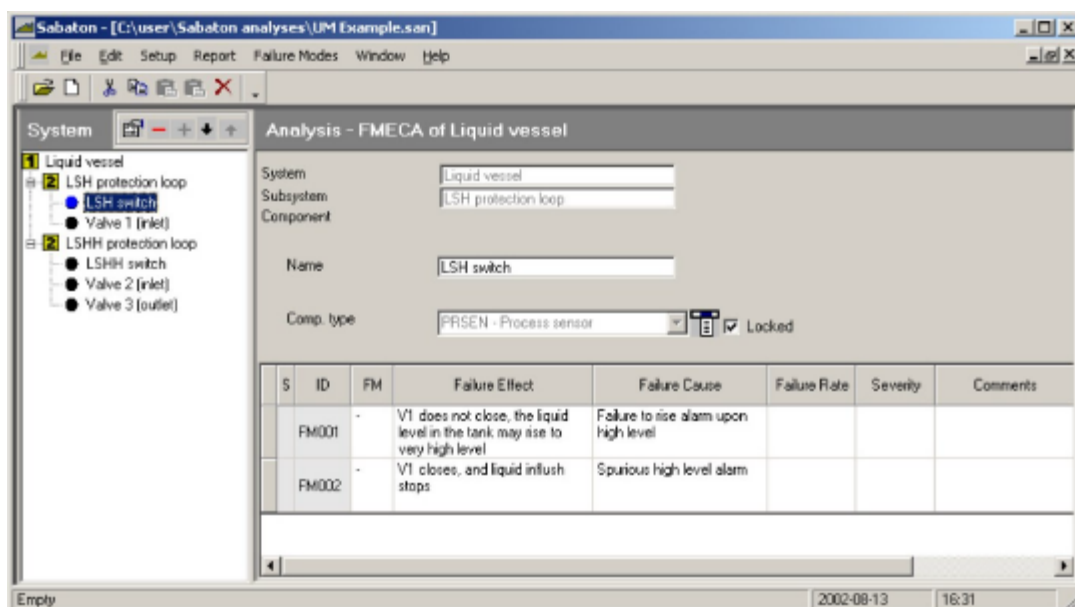
Revision list

The **Revision list** command opens a dialog where you can enter and manage an overview of the revisions of the analysis. The various revisions can also be linked to the analysis team. This is further described in ?? “Revision List” on page 26.

2.3 The Sabaton Program Window

2.3.1 Program Window Layout

The Sabaton program window has a menu, a toolbar for menu shortcuts, two sub-windows where the actual analysis is done, a system hierarchy sub-window, and a status bar at the bottom of the window, see figure below.



External failure mode library

Note! When working with an external failure mode library, the program window will appear somewhat different. This is discussed separately, see “External Failure Mode Libraries” on page 61.

System hierarchy

“View failure modes for components”

In the system hierarchy sub-window (to the left), or system window for short, you construct and move around in the system hierarchy. The analysis window (to the right) displays the failure modes of the component (or lowest indenture level) selected in the system window.

“View failure modes for levels”

Note that you may view failure modes for several components simultaneously by selecting **View failure modes for levels** from the shortcut menu.

System / analysis window dividing line

Note that you may move the dividing line between the system and analysis window by clicking and dragging the divider.

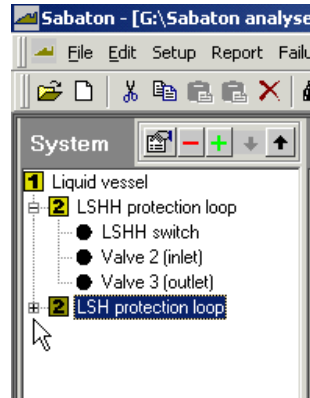
Please refer to “Working with the System Hierarchy” below for further description of the system window. The section “Entering Level and Component Information” on page 12 explains how you can enter descriptive information for levels and components. “Performing the Analysis” on page 31 explains how the analysis is conducted, assuming that the system hierarchy is defined.

2.3.2 Working with the System Hierarchy

*Expand / collapse
system hierarchy*

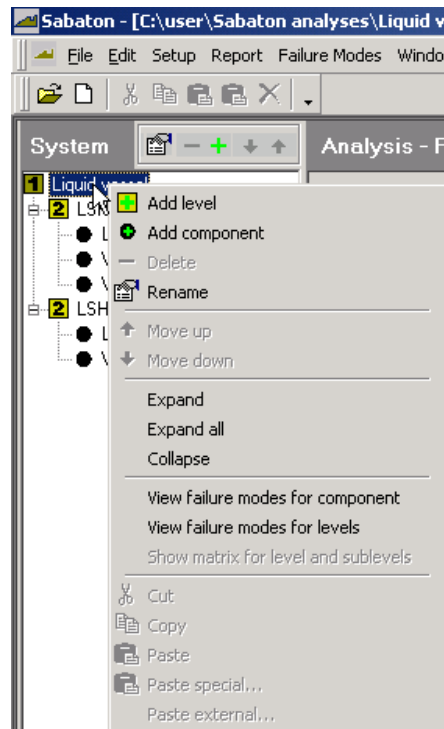
Expand and collapse the system hierarchy by clicking the “+” and “-” signs in the hierarchy, or select one level/component, and choose **Expand** or **Collapse** from the shortcut menu.

Example; by clicking on the “+” sign in figure below, the “LSH protection loop” level expands:



*System window
shortcut menu*

From the shortcut menu you have several additional commands available, see figure and description below.



*Note! Shortcut menu
on selected level or
component only*

*System window
command toolbar*



*Components directly
under higher system
levels*



Note that you need to select the level/component you want to modify before you can activate the shortcut menu. Thus, if you right-click on a level or component different from the current, the level or component will be highlighted, but shortcut menu will not open. Simply right-click once more to activate the shortcut menu.

In the system window heading, a command toolbar is also available. These commands are selected commands from the shortcut menu, and are described below.

Add level / Add component

Select this command to add a level or component below the current level.

Note! In Sabaton you may optionally add components connected to system levels higher than the next-lowest system level. This is, however, a special feature and not the normal situation.

Delete

Deletes the current level or component.

Rename...

Opens the name of the current level or component for editing.

Move up

Moves the current component or level (including sublevels/-components) one step upwards.

Move down

Moves the current component or level (including sublevels/-components) one step downwards.

Expand

Expands the selected level into the next indenture level.

Expand all

Expands all levels below the selected level, all the way down to the component level.

Collapse

Collapses the items of the selected level.

View failure modes for components

The analysis window have two different views. This view shows only the failure modes for the current component. You may add new failure modes (rows) to the component, in addition to editing the existing. See “Analysis window display mode” on page 32 for further details.

View failure modes for levels

This view displays an aggregated list of all failure modes for

all components below the selected level. In this view, you are not allowed to add new failure modes (even if only a single component is selected). See “Analysis window display mode” on page 32 for further details.

Risk or criticality matrix

Show matrix for levels and sublevels / this component

This command is only available if a risk/criticality matrix is defined for the analysis. When selecting this command, a window opens displaying the risk/criticality matrix for the currently selected level or component. See “Working with Risk/Criticality Matrices” on page 45 for further details.

Cut / Copy / Paste / Paste special... / Paste external

Sabaton offers various copy & paste options. For example, the “Paste external” command lets you copy & paste between Sabaton analyses. See “Using the Copy/Paste Features” on page 37.

2.3.3 Entering Level and Component Information

When a component or level is selected in the system window, the upper part of the analysis window displays some descriptive fields linked to the selected component/level. These fields are user definable, although some of them are mandatory. Please refer to “System and Component Setup” on page 49 for help on defining which fields to include as well as the labels to be used for these fields. Also details about the length of the various text fields is given there.

In the figure below, a component have been selected, and the analysis have been set up with the **maximum** of the available descriptive fields.

S	ID	FM	Failure Effect	Failure Cause	Failure Rate	Severity	Comments

You enter the name, description, etc. for the selected component directly in the analysis window. Observe that when you enter the component name, the name is also changed simultaneously in the system window. Observe also that the **System** and **Subsystem** fields in the figure above is a

reference to the system levels for the selected component, and these fields can not be edited when the component is selected.

When a level is selected, only the level name and (if included) the level description is displayed, along with the level names for the above levels.

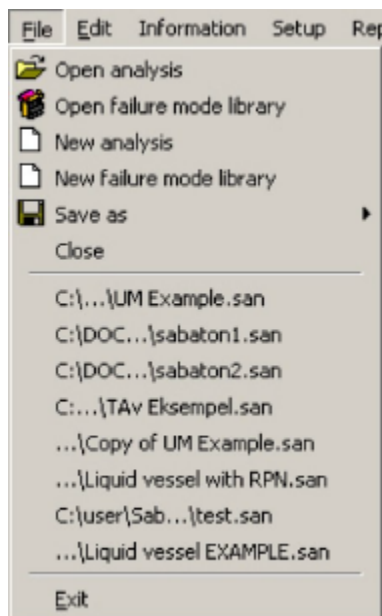
The various descriptive fields for the component and level can also be included in reports, such as the System overview report (please refer to “System Overview Report” on page 58) and in the analysis reports (please refer to “Working with Report Templates” on page 57).

2.4 Overview of Sabaton Menus from an Analysis

First note that the Sabaton menu options will vary depending the active window being an analysis or a failure mode library. The description below explains the menu options available when an analysis is active.

Please refer to “Overview of Failure Mode Library Menus” on page 61 for a description of available menu commands when working with an external failure mode library.

2.4.1 The File Menu



The File menu contains common file-commands for creating, opening and printing analyses. Also available are three different “Save as” commands.

The File menu is given above, and the various commands are briefly described below.

File | Open analysis



Use the **File | Open analysis** command to open an existing analysis. A dialog box for selecting the analysis will be displayed.

File | Open failure mode library



Use the **File | Open failure mode library** to open an existing failure mode library. A dialog box for selecting the failure mode library will be displayed.

File | New analysis



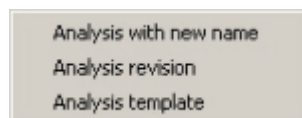
Use the **File | New analysis** command to create a new analysis. Please refer to ?? “Start a New Analysis” on page 6 for further information about starting a new analysis, and to “Modifying the Analysis Setup” on page 49 regarding how to modify the analysis setup.

File | New failure mode library

Use the **File | New failure mode library** to create a new external failure mode library. An external failure mode library is an option you have to define and manage failure mode libraries independent of analyses. These libraries can be imported into an existing analysis, and can also be updated from an ongoing analysis. Please refer to “Failure Mode Libraries” on page 61 for more information about failure mode libraries in general.

File | Save as

When selecting the command **File | Save as**, you may choose between the following options:



The different options works as follows:

- **Analysis with new name**
Saves the analysis with a different file name and/or location. Note that the current analysis will remain the active analysis.
- **Analysis revision**
Saves the analysis for archive purposes. A standard

“Save as” dialog will appear, and the suggested file name will be the existing file name post fixed with the current date and time.

- **Analysis template**

Creates a new analysis template from the setup of the current analysis. Thus, to create new analysis templates, e.g. in order to build up your company specific templates, first modify the analysis setup for a specific analysis, and then use the **File | Save as ... Analysis template** command.

Library of company specific analysis templates

Location of analysis templates

By using the **File | Save as ... Analysis template** command you may build your own library of analysis templates.

You may store the analysis templates in different locations, and switch between different template libraries. Use the **Setup | Sabaton settings...** command to select the location of the analysis templates. Please refer to “The Setup Menu” on page 16 for more information.

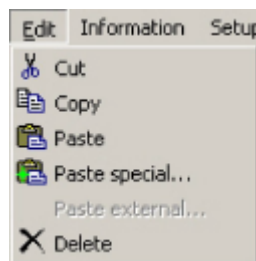
File | Close

Use the **File | Close** command to close the current analysis.

File | Exit

Use the **File | Exit** command to exit from the Sabaton program.

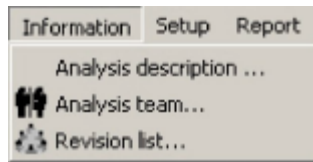
2.4.2 The Edit Menu



The Edit menu contains common commands for editing the system hierarchy and the identified failure modes.

Please refer to “Using the Copy/Paste Features” on page 37 for a description on how to use these commands.

2.4.3 The Information Menu



The **Information** menu offers commands for entering and managing administrative information about the analysis.

Analysis description

The **Information | Analysis description** command opens a dialog where you can define the analysis title, description and similar. This is further described in ?? “Analysis Description” on page 21.

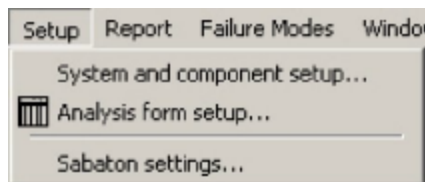
Analysis team

The **Information | Analysis team** opens a dialog where you can enter and manage an overview of all persons involved in the analysis. This is further described in ?? “Analysis Team” on page 23.

Revision list

The **Information | Revision list** command opens a dialog where you can enter and manage an overview of the revisions of the analysis. The various revisions can also be linked to the analysis team. This is further described in ?? “Revision List” on page 26.

2.4.4 The Setup Menu



System and component setup

The **Setup | System and component setup** command opens a dialog where you specify the hierarchical breakdown of the system as well as what information to hold for both the system levels and the components. For components, also selections for the optional failure mode library are given. Please refer to “System and Component Setup” on page 49 for further information.

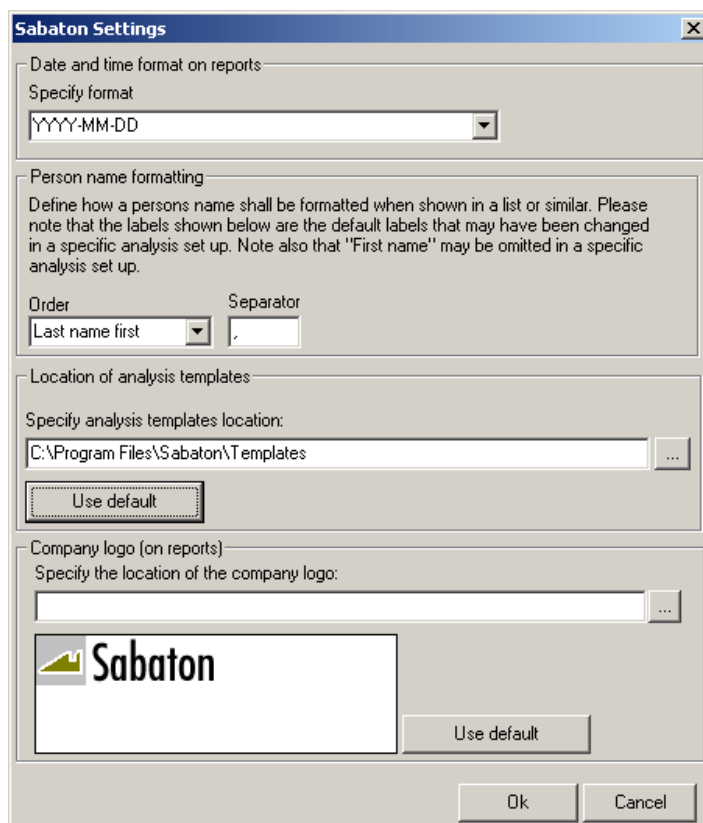
Analysis form setup

The **Setup | Analysis form setup** command opens a dialog where you specify the layout of the analysis form itself, including which columns to include, their headings, etc. Also your selections for the optional risk/criticality matrix is made here, as well as the options for status codes that can be used for highlighting failure modes in the analysis. Please refer to “Analysis Form Setup” on page 53 for further information.

Sabaton settings

The last command opens the Sabaton system settings dialog. This is described below.

From the **Setup | Sabaton settings...** command you open the Sabaton settings dialog (see below). The system settings are stored in the Sabaton ini-file, located in the Sabaton program folder.



Date and time formats on reports

Specify the format of the date and time information printed on the various reports.

Person name formatting

Specify the format of the person names that can be included in the more "administrative" type of reports.

Location of analysis templates

When you start a new analysis in Sabaton, either by selecting the **File | New analysis** or when starting the program, you are asked to select from a list of analysis templates. The analysis

templates are stored in individual files, and the address to the template location is set in the Sabaton setting dialog.

The default analysis template location is the “Templates” folder located directly under the Sabaton program folder.

Relevant information related to analysis templates are:

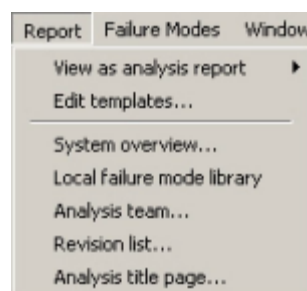
- “Start a New Analysis” on page 6 gives information about starting a new analysis.
- Create new analysis templates by using the **File | Save as** command, see “The File Menu” on page 13.

Company logo (on reports)

A logo/picture is included in the “administrative” type of reports (i.e. other reports than the analysis report). The recommended size of the logo is approximately 100 pixels wide and 32 pixels high (same as the default logo, see the dialog as given above). In case you select a larger logo than 225 pixels wide and 75 pixels high, only a segment of the logo is printed on the reports. The dialog provides a preview of the selected logo/picture.

Note that the Sabaton logo is used as the default logo, as also shown in the dialog above.

2.4.5 The Report Menu



The Report menu contains commands for creating analysis reports as well as the other, more “administrative” type of reports. Different templates may be defined for analysis reports.

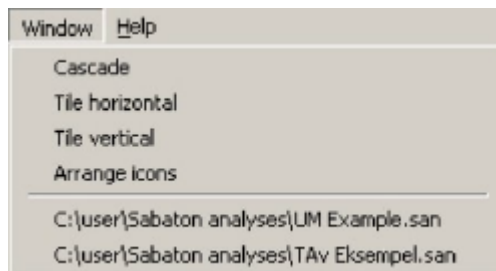
Please refer to “Preparing reports” on page 57 for further description of reports.

2.4.6 The Failure Modes Menu



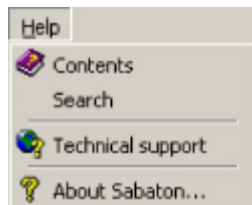
The Failure Modes menu contains commands for working with the internal failure mode library, as well as import from and export to external failure mode libraries. Please refer to “Local Failure Mode Library (in Analysis)” on page 61 for a further description.

2.4.7 The Window menu



The Window menu contains standard Windows commands to arrange windows on the screen, and to toggle between open windows.

2.4.8 The Help Menu



The Help menu contains standard Windows help commands.

*Sabaton licence and
version information*

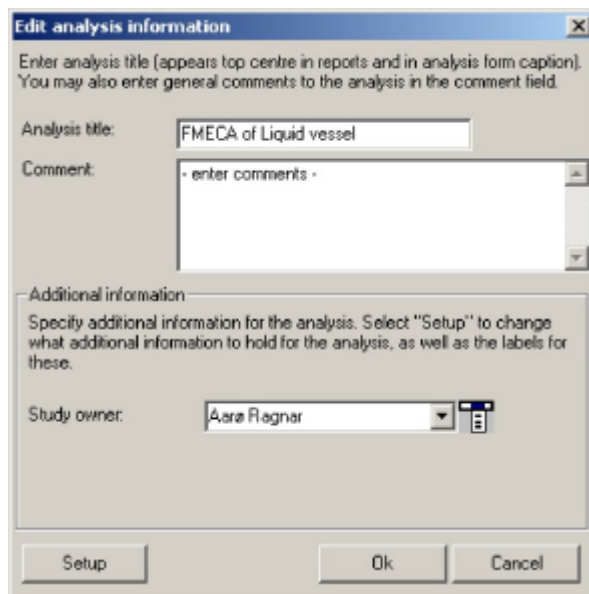
Note that the **Help | About Sabaton...** command opens a dialog where information about your licence (licensee and licence number), as well as the program version and build. This is useful information if you have questions to your Sabaton supplier.

3. Analysis Information

3.1 Analysis Description

Use the **Information | Analysis description** command to open the **Analysis description** dialog. The analysis description includes a number of information fields that describes the analysis, such as the analysis title. This information can be included in various reports, e.g. the analysis reports.

In the figure below, an example of the **Analysis description** dialog is shown. Note that the setup of the analysis description is user definable, and thus that the information fields and labels can vary. This is described below.



Edit analysis information

Enter analysis title (appears top centre in reports and in analysis form caption).
You may also enter general comments to the analysis in the comment field.

Analysis title: FMECA of Liquid vessel

Comment: - enter comments -

Additional information
Specify additional information for the analysis. Select "Setup" to change what additional information to hold for the analysis, as well as the labels for these.

Study owner: Åase Ragnar

Setup Ok Cancel

An overview of the available information fields is given below. Have in mind that the setup is user definable, whereas

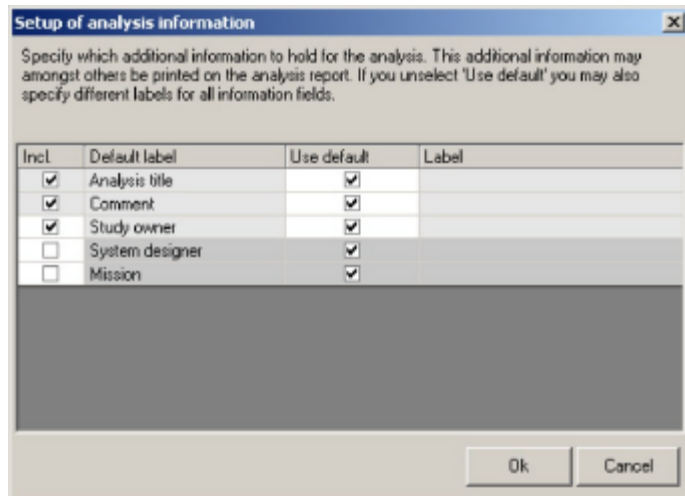
the list below is the maximum number of information fields and assuming default labels. Two of the fields are mandatory, as indicated in the list. Note that also the labels for the mandatory fields can be changed.

The available information fields are:

- **Analysis title** (*mandatory*): A title may be assigned to the analysis. The title is displayed in the Sabaton program window, and also prints among others top centred on the analysis reports.
Maximum 50 characters.
- **Comment** (*mandatory*): A free text field describing the analysis. The field may e.g. be used to describe the scope and objective of the analysis, as well as reference to drawings and limitations etc. In addition to being available online, the comment can be printed on the Analysis title page report (see “Analysis Title Page” on page 59).
Maximum 40 000 characters.
- **Study owner**: Selected from the list of team members. Please refer to “Analysis Team” below.
- **System designer**: Also selected from the list of team members.
- **Mission**: Here you may e.g. enter a mission for the system under analysis. This can among others be included in the heading of the analysis reports.
Maximum 50 characters.

3.1.1 Setup of Analysis Description

Select **Setup** from the **Analysis description** dialog to open the **Setup of analysis description** dialog. The following dialog opens:



Select which information fields to include by checking the “Incl.” column. If you want to enter a different label than the default, uncheck in the “Use default” column and enter the user definable label in the “Label” column.

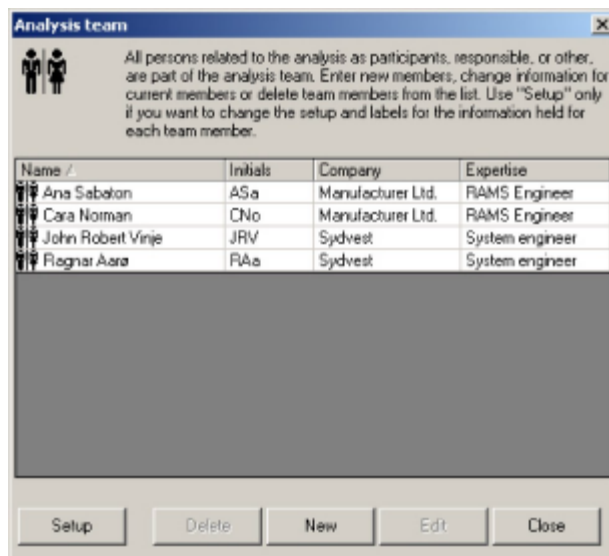
The first two information fields are mandatory (indicated with grey background in the “Incl.” column), however you can specify a different label than the default also for these fields.

3.2 Analysis Team

Use the **Information | Analysis team** command to open the **Analysis team** dialog. The analysis team is an optional overview of persons (“team member”) involved in the analysis, e.g. participating in work meetings, persons with responsibility for e.g. follow-up of actions, the system responsible, etc.

The team members are available from drop-down lists in the analysis description (see “Analysis Description” on page 21), and you can also link team members to the analysis revision (see “Revision List” on page 26).

In the figure below, an example of the **Analysis team** dialog is shown. Note that the setup of the analysis team is user definable, and thus that the information fields and labels can vary. This is described below.



When you highlight a team member from the list, and select **Edit**, the **Team member** dialog appears:

Team member

Enter data for the team member. Note that you can make changes in the dropdown list by selecting the adjacent icon. Use "Setup" only if you want to change the setup and labels for the information held for each team member.

Name: Ana Sabaton

Initials: ASa

Company: Manufacturer Ltd.

Expertise: System engineer

E-Mail: E.mail@com

Buttons: Ok, Cancel

An overview of the available information fields is given below. Have in mind that the setup is user definable, whereas the list below is the maximum number of information fields and assuming default labels. One of the fields is mandatory, as indicated in the list. Note that also the labels for the mandatory field can be changed.

The available information fields are:

- **First name:** First name of the team member.
Maximum 50 characters.

- **Last name (*mandatory*):** Last name of the team member.
Maximum 50 characters.
- **Initials:** The initials of the team member.
Maximum 4 characters.
- **Title:** The title of the team member. This is picked from a drop-down list. Picked from a fully user-definable drop-down list.
Maximum 30 characters for each drop-down list element.
- **Company:** The organisation where the team member is employed. Picked from a fully user-definable drop-down list.
Maximum 30 characters for each drop-down list element.
- **Expertise:** The expertise of the team member. Picked from a fully user-definable drop-down list.
Maximum 30 characters for each drop-down list element.
- **Phone:** The phone number of the team member.
Maximum 30 characters.
- **E-mail:** The e-mail address of the team member.
Maximum 50 characters.
- **Comment:** Any comment/free text.
Maximum 40 000 characters.

3.2.1 Setup of Analysis Team

Select **Setup** from the **Analysis team** dialog to open the **Setup of analysis team information** dialog. The following dialog opens:

Specify which information to hold for each analysis team member. If you unselect 'Use default' you may also specify different labels for all fields. Note that the 'Last name' information field is mandatory.

Incl.	Default label	Use default	Label
<input type="checkbox"/>	First name	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Last name	<input type="checkbox"/>	Name
<input checked="" type="checkbox"/>	Initials	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	Title	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Organisation	<input type="checkbox"/>	Company
<input checked="" type="checkbox"/>	Expertise	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	Phone	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	E-Mail	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	Comment	<input checked="" type="checkbox"/>	

Ok Cancel

Select which information fields to include by checking the “Incl.” column. If you want to enter a different label than the default, uncheck in the “Use default” column and enter the user definable label in the “Label” column.

The second information field is mandatory (indicated with grey background in the “Incl.” column), however you can specify a different label than the default also for this field.

3.3 Revision List

Use the **Information | Revision list** command to open the **Revision list** dialog. The revision list is an optional overview of revisions of the analysis. Note that the analysis file itself contains one version of the analysis only. Thus the revision list is intended as administrative information only, and helps you in maintaining an overview of the different revisions. You may also link team members to the various revisions, as explained below.

In the figure below, an example of the **Revision list** dialog is shown. Note that the setup of the revision list is user definable, and thus that the information fields and labels can vary. This is described below.

Revision list

A list of revisions defined for the analysis is supported. Please note that the analysis file itself contains one version of the analysis only. Tip: Use the command "File | Save as revision" to file the current revision.

Note! The current revision is defined by the revision start date and is marked with ✓.

Revision name	Rev. date	Rev. appr. by
0	2002-03-30	Cara Norman
1	2002-04-23	Cara Norman
✓ 2	<Ongoing>	Cara Norman

Setup New Edit Delete Close

When you highlight a revision from the list, and select **Edit**, the **Revision** dialog appears:

Revision

Enter data for the analysis revision. All person names are selected from the list of team members. You may select "Edit team members" to change the team directly. Use "Setup" only if you want to change the setup and labels for the information held for each revision.

☒ Current revision

Revision name:

Rev. date: ☒ Ongoing

Rev. appr. by:

Comment:

Participants

Include	Name	Initials	Title	Company	Expertise
<input checked="" type="checkbox"/>	Ragnar Aarø	RAa	-	Sydvest	System engineer
<input checked="" type="checkbox"/>	John Robert Vinj	JRV	-	Sydvest	System engineer
<input checked="" type="checkbox"/>	Ana Sabaton	ASa	-	Manufacturer Ltd	RAMS Engineer
<input type="checkbox"/>	Cara Norman	CNo	-	Manufacturer Ltd	RAMS Engineer

Edit team members Ok Cancel

An overview of the available information fields is given below. Have in mind that the setup is user definable, whereas the list below is the maximum number of information fields and assuming default labels. Four of the fields are mandatory,

as indicated in the list. Note that also the labels for the mandatory fields can be changed.

In addition to the information fields described below, you may also indicate which of the team members that have participated in preparing the revision in the team member list at the bottom of the **Revision** dialog.

The available information fields are:

- **Current revision** (*mandatory*): A status flag that can be set for one (and only one) of the revisions in the list. The revision name for **Current** revision will appear in the analysis report heading.
- **Revision name** (*mandatory*): The revision name or code.
Maximum 10 characters.
- **Start date**: The start date of the revision.
- **Ongoing** (*mandatory*): For the revision that is marked as **Current**, you may indicate that it is still ongoing, instead of giving it an end date.
- **End date** (*mandatory*): The end date of the revision.
- **Responsible**: Selected from the list of team members. Please refer to “Analysis Team” on page 23.
- **Revision approved by**: Also selected from the list of team members.
- **Comment**: Any comment/free text to the revision.
Maximum 40 000 characters.

3.3.1 Setup of Revision List

Select **Setup** from the **Analysis description** dialog to open the **Setup of analysis description** dialog. The following dialog opens:

Setup of revision information

Specify which information to hold for each of the listed analysis revisions. If you unselect 'Use default' you may also specify different labels for all fields. Note that the 'Current revision', 'Revision name' and 'End date' information fields are mandatory.

Incl.	Default label	Use default	Label
<input checked="" type="checkbox"/>	Current revision	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Ongoing	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Revision name	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	Start date	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	End date	<input type="checkbox"/>	Rev. date
<input type="checkbox"/>	Responsible	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Revision approved by	<input type="checkbox"/>	Rev. appr. by
<input checked="" type="checkbox"/>	Comment	<input checked="" type="checkbox"/>	

Ok Cancel

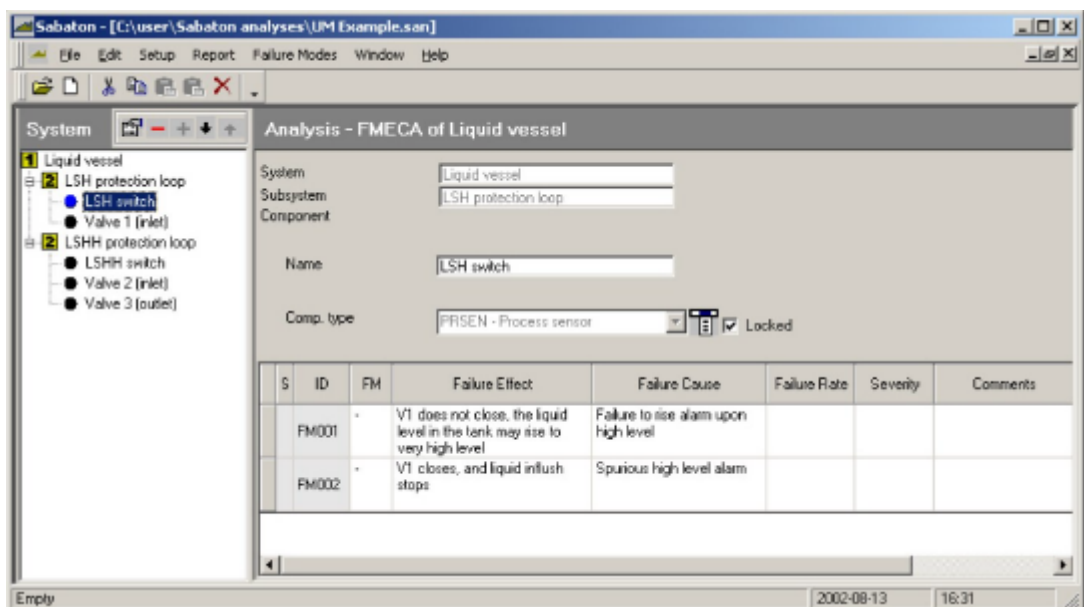
Select which information fields to include by checking the “Incl.” column. If you want to enter a different label than the default, uncheck in the “Use default” column and enter the user definable label in the “Label” column.

The first two information fields are mandatory (indicated with grey background in the “Incl.” column), however you can specify a different label than the default also for these fields.

4. Performing the Analysis

4.1 General

When performing the analysis in Sabaton, you mainly work in the system and analysis sub windows. The system window, to the left in the program window, contains the system hierarchy, and the analysis window, to the right in the program window, contains the identified failure modes. See also the program window in the figure below.



Please refer to “Program Window Layout” on page 8 for a general description of the program window and “Working with the System Hierarchy” on page 10 about the system window.

4.2 The Analysis Window

4.2.1 Analysis window display mode

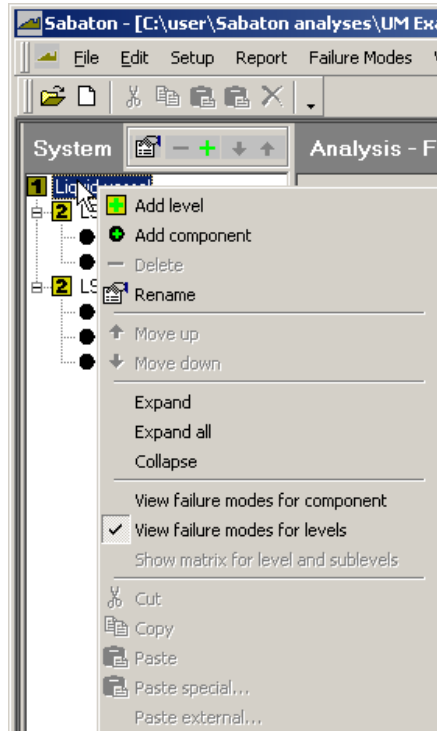
“View failure modes for components”

By default, the analysis window displays the failure modes for the selected component in the system hierarchy. This means that you select a component in the system window, and the identified failure modes for this component is listed in the analysis window. If a level is selected, no failure modes will be listed. This display mode is denoted **View failure modes for components**.

“View failure modes for levels”

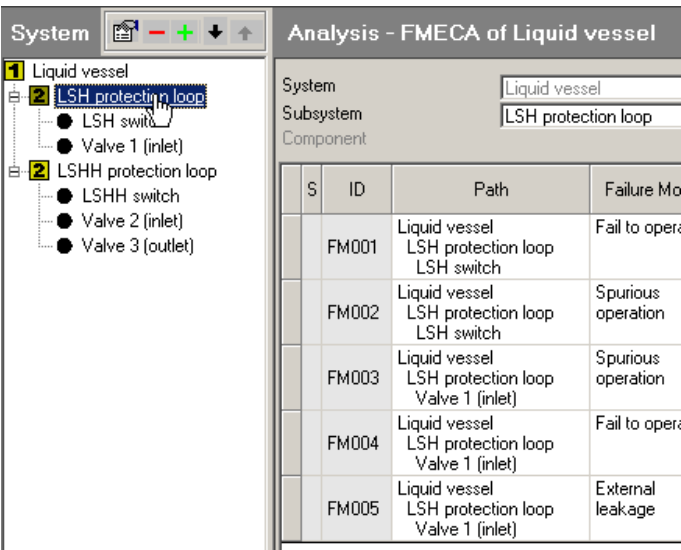
You may also view identified failure modes for more than one component simultaneously. This is done using the **View failure modes for levels**.

You toggle between **View failure modes for components** and **View failure modes for levels** from the shortcut menu in the system window, see figure below.



Viewing failure modes for levels

When viewing failure modes for levels, and aggregated list of all failure modes for all components under the selected level is displayed. In this mode, one column is added in the analysis window, denoted “Path”, showing the level that the component is connected to. In the figure below, a level just under the top level is selected, and the analysis window shows all failure modes identified for the two components connected to this level.



4.2.2 Basic analysis window operations

To edit an identified failure mode, simply activate the column you want to edit by clicking or double-clicking inside the column (or cell, to be precise). If the column is a drop-down list, click once and the drop-down selection is displayed, and you make your selection. If the column is a text or numeric field, double-click to open for edit.

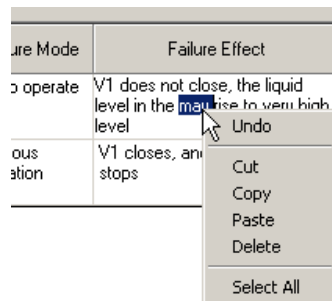
Esc or Ctrl+z recovers from unintentional text/number replacement

Note! If you click only once on a text or numeric field, and start typing, the current cell content will be replaced. Use the Esc button to exit from edit mode without saving. Alternatively, you may use the Ctrl+z command to undo the typing, and continue in edit mode. See also below about editing commands.

Basic Commands when Editing Text or Number Fields

When a text or number field is opened for edit as described above, you may use the standard Windows commands for copy, paste, etc. The commands are available from the shortcut menu from within the cell (cell must be opened for

edit as described above), see figure below. You may also use the keyboard shortcuts to access some of these commands, as described below.



Copy

Use the **Copy (Ctrl+c)** command to copy selected text to the Windows clipboard.

Cut

Use the **Cut (Ctrl+x)** command to cut selected text to the Windows clipboard.

Paste

Use the **Paste (Ctrl+v)** command to paste the content of the Windows clipboard into the field.

Undo

Use the **Undo (Ctrl+z)** command to undo the last change. Note that only one step undo is available.

Select all

Use the **Select All** command to select all text in the cell.

Exit field without saving using Esc

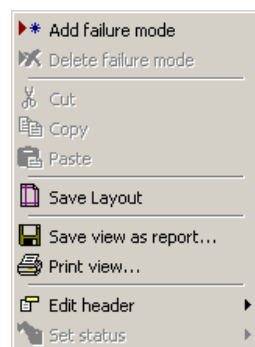
If you press the **ESC** button while editing a text or numeric field, you exit the edit mode without saving.

Copy/paste text between Windows programs

Note that the above copy/paste commands uses the Windows clipboard. Thus, you may copy/paste text between different Windows programs using these commands.

Basic Analysis Window Commands

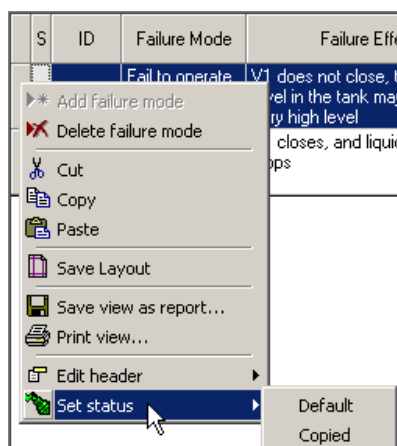
The basic analysis window commands are available from the shortcut menu within the analysis window, see figure and description below.



<i>Add failure mode</i>	To add a failure mode use the Add failure mode command from the shortcut menu.
<i>Edit commands</i>	The delete and copy/paste commands are described in “Using the Copy/Paste Features” on page 37.
<i>Adjust column width / Save layout</i>	<p>The Save layout command saves the current column widths of the analysis form. The column widths are adjusted by dragging the dividers in the column headings. Note that if you adjust the column widths without saving the layout, the layout will be reset when a new level/component is selected.</p> <p>Note that the column widths saved with the layout will also be used when analysis reports are printed.</p>
<i>Save view as report...</i>	The Save view as report... command saves the current failure mode listing to file. Available file types are, among others, Portable Document Format (PDF) and Rich Text Format (RTF).
<i>Print view...</i>	<p>The Print view... command prints the current failure mode listing.</p> <p>It may be useful to have a print (or saving to a report file) of the current listing as a support when performing the analysis. Reports of the final analysis are better obtained using the Report function, see “Preparing reports” on page 57.</p>
<i>Edit header</i>	The Edit header command lets you edit the column heading for the current column. If the column also has a main header, this can also be edited. The Edit header command is a subset of the functions available for defining the analysis form setup. Please refer to “Analysis Form Setup” on page 53 for more information about defining the analysis form.
<i>Set status (highlight failure mode)</i>	<p>Use the Set status command to highlight the failure mode in different ways. The column to the left of the ID, “S”, shows the selected status code, and the background colour of the failure mode row may vary depending on the setup of the status codes. You may also easily sort failure modes by status as described below.</p> <p>To activate the Set status command, first mark the failure mode row by clicking to the left of the failure mode row as indicated in the figure below. Multiple failure modes can be selected by clicking on the first failure mode and by moving the cursor over the other failure modes while keeping the mouse button pressed down.</p>

S	ID	Failure Mode	Failure Effect	Fa
	FM001	Fail to operate	V1 does not close, the liquid level in the tank may rise to very high level	Failure to rise
	FM002	Spurious operation	V1 closes, and liquid inflush stops	Spurious high

When one or multiple failure modes are marked, access the Set status command from the shortcut menu, and select the status code from the list, see figure below.



The status codes are user definable as a part of the analysis form setup, see “Analysis Form Setup” on page 53. There are totally ten different status codes available, of which the two indicated will always be activated (although the label of these may also be changed). See the reference above for further description.

Sort failure modes

Sort ascending or descending

By clicking once on a column heading, the failure mode listing is sorted descending by this field. Clicking once more on the same column heading sorts ascending. This is especially useful when a long failure mode listing is viewed, e.g. using **View failure modes for levels**. Have also in mind that the current listing can be printed or saved to file (see above).

Adjust height of failure mode row

Note that the height of the failure mode row is not adjusted automatically. This means that the text in a cell may not be visible, depending on the row height. The row height is adjusted by dragging the row divider at the bottom of the failure mode, see below.

S	ID	Failure Mode	Failure Effect	
	FM001	Fail to operate	V1 does not close, the liquid level in the tank may rise to very high level	Failure to rise
	FM002	Spurious operation	V1 closes, and liquid inflush stops	Spurious high

The adjusted row heights are stored automatically and individually per failure mode, and the row heights will also be used when printing analysis reports.

4.3 Using the Copy/Paste Features

Marking system hierarchy elements for editing

To select elements from the system hierarchy for editing (i.e. copy, cut or delete), simply make them active by clicking on them. Note that only one element at a time can be selected.

Marking failure modes for editing

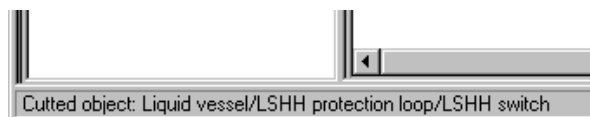
To select a failure mode, mark it by clicking to the left of the failure mode row as indicated in the figure below. A range of failure modes can be selected by clicking on the first failure mode and by moving the cursor over the other failure modes while keeping the mouse button pressed down.

S	ID	Failure Mode	Failure Effect	Fa
	FM001	Fail to operate	V1 does not close, the liquid level in the tank may rise to very high level	Failure to rise
	FM002	Spurious operation	V1 closes, and liquid inflush stops	Spurious high

4.3.1 Edit | Cut



Use the **Edit | Cut** command to cut the selected level, component or failure modes to the internal Sabaton clipboard. Observe that the status bar at the bottom of the program window displays the content of the Sabaton clipboard, see figure below.





4.3.2 Edit | Copy

Use the **Edit | Copy** command to copy the selected level, component or failure modes to the internal Sabaton clipboard. Also here, the content of the Sabaton clipboard is displayed on the status bar, see figure below.



4.3.3 Edit | Paste

The **Edit | Paste** command works different depending on if it is failure modes or system hierarchy elements that have been put on the Sabaton clipboard, see below.

Pasting Failure Modes

If one or more individual failure modes have been put on the Sabaton clipboard, select the component where you want the failure modes to be pasted, and make the analysis window active by clicking somewhere inside it. Now, applying the **Edit | Paste** command (or select it from the shortcut menu), a copy of the clipboard content is pasted as new failure modes on the current component.

S	ID	Failure Mode	Failure Effect	F
	FM001	Fail to operate	V1 does not close, the liquid level in the tank may rise to very high level	Failure to rise
	FM002	Spurious operation	V1 closes, and liquid inflush stops	Spurious high
9	FM014	Fail to operate	V1 does not close, the liquid level in the tank may rise to very high level	Failure to rise

Note that the status code of the copied failure modes will be set to “9”, and the background colour of the failure mode row is set to yellow, see above. The colour background for the various status codes can be altered, thus for a specific analysis the colour background may be different than above.

Please refer to “Analysis Form Setup” on page 53 for information about how to define status codes.

Pasting System Hierarchy Elements

To paste a level or component, you must first select a valid level to paste into (under). Valid level means that it must be allowed to add the clipboard content below the selected level. As an example, a component may be pasted into any selected level, however a sublevel can only be pasted into a level

higher up in the hierarchy. This is controlled by Sabaton, and the **Paste** command is available only if a paste is allowed.

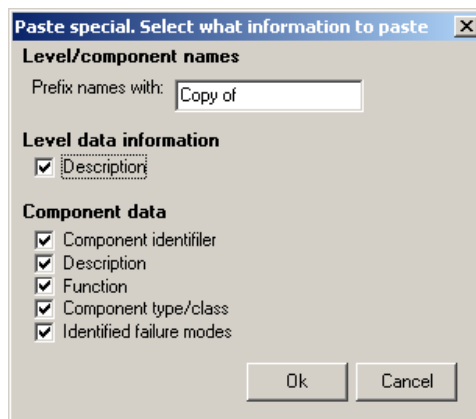
Now, selecting the **Paste** command, a copy of the system hierarchy of the sub tree will be pasted from the clipboard into the current level. All names of levels/components will be prefixed with “*Copy of ...*”. Note that only the system hierarchy of the sub tree will be pasted. That is, even if a component have identified failure modes, these failure modes are not included in the paste. Please see “**Edit | Paste special...**” below on how to include failure modes when pasting.

4.3.4 Edit | Paste special...



The **Edit | Paste special...** command works only on system hierarchy elements, and is used when you want to include e.g. the failure modes of components in the paste operation. The same restriction as to selecting a valid level to paste into as was described for the **Edit | Paste** command applies, see “**Edit | Paste**” above.

Using the **Edit | Paste special...** command, the following dialog will open:

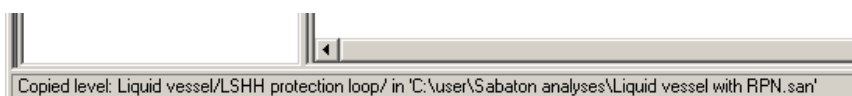


From the dialog, you can tailor the paste operation, and among others select that you want to include also the identified failure modes in the paste operation. Note also that you may control the names of the levels/components.

Note also that all parameters given in the dialog are not necessarily available, as this depends on the system and component setup (see “**System and Component Setup**” on page 49).

4.3.5 Edit | Paste external...

Use the **Edit | Paste external...** command to copy and paste between Sabaton analyses. If you have placed a copy of a system hierarchy element (level or component) on the Sabaton clipboard, you may paste the clipboard content into a different analysis by opening it in a separate window (move between the open analyses using the **Window** commands). When you have moved to a different analysis, you will see that the status bar have added some more information about the clipboard content, see example in the figure below:



The **Paste external** command works somewhat like pasting system hierarchy elements within the same analysis, and is activated from the level where you want to paste the clipboard content into. However, when you select **Paste external...**, two consecutive dialogs opens to let you specify how the paste should be performed.

In the first dialog (see figure below), you specify what information to include in the paste operation, as well as if the pasted level/component names shall have a prefix.

Paste external

You have selected to paste the information from analysis 'C:\user\Sabaton analyses\Liquid vessel with RPN.san' into the current analysis. In case you also want to paste the identified failure modes, you also need to specify the link between the analysis form columns in the two different analysis.

Level/component names and description

Prefix names with:

☒ Include description

Component and analysis information

☒ Component identifier

☒ Description

☒ Function

☒ Include component class/type and failure modes

☒ Append non-existing component classes/types and failure modes

☐ Do not append (set to blank)

Cancel <- Previous Next >

Pressing **Next**, the second dialog opens, from where you select whether to include identified failure modes for the components, see figure and description below. Note that in the example below, the analysis form setup are identical in the source and destination analyses.

Paste external

☒ **Include identified failure modes**

Available columns to paste from

- Potential Failure Mode {Failure mode}
- Potential Effect(s) of Failure {Text memo}
- Sev {Integer (numeric)}
- Class {Text}
- Potential Cause(s)/ Mechanisms of Failure {Text memo}
- Occur {Integer (numeric)}
- Current controls (Prev./Det.) {Text memo}
- Detec {Integer (numeric)}
- RPN {Calculated (equation)}
- Recommended Action(s) {Text memo}
- Responsibility & Target Completion Date {Text memo}
- Action Results {Main header}**

Select which source columns to paste from by drag and drop from the list of available columns. To drag and drop, select column to paste from, and drag down to the current analysis columns. You will then see a + sign on the allowed columns and a stop sign when not allowed.

A default selection is made, but this can be altered. You may also reset to the default selection or remove all column selections with the buttons to the left.

Remove all column selections

Reset to default column selections

Columns in current analysis

Selected source columns {field type}	Paste into {field type}	Comment(s)
Potential Failure Mode {Failure mode}	Potential Failure Mode {Failure mode}	
Potential Effect(s) of Failure {Text memo}	Potential Effect(s) of Failure {Text memo}	
Sev {Integer (numeric)}	Sev {Integer (numeric)}	
Class {Text}	Class {Text}	
Potential Cause(s)/ Mechanisms of Failure {Text memo}	Potential Cause(s)/ Mechanisms of Failure {Text memo}	
Occur {Integer (numeric)}	Occur {Integer (numeric)}	
Current controls (Prev./Det.) {Text memo}	Current controls (Prev./Det.) {Text memo}	
Detec {Integer (numeric)}	Detec {Integer (numeric)}	
	RPN {Calculated (equation)}	
Recommended Action(s) {Text memo}	Recommended Action(s) {Text memo}	
Responsibility & Target Completion Date {Text memo}	Responsibility & Target Completion Date {Text memo}	

Cancel <- Previous Finish

Check the “Include identified failure modes” check box if you want to include the failure modes identified for the components on the clipboard. If this is selected, you need to specify, for each column in the current analysis, the source column in the source analysis.

If the two analyses have identical setup, Sabaton presents a default selection that should represent a more or less full match. If this is not the case, Sabaton will suggest a column selection that will link fields of the same type between the two analyses.

You may alter the selections by drag the available columns in the source analysis (list in the top of dialog) and drop it into the chosen destination column (list in the bottom of the dialog). You may reset to default or remove all selections using the **Remove all column selections** and **Reset to default column selections** buttons in the dialog.

4.3.6 Edit | Delete

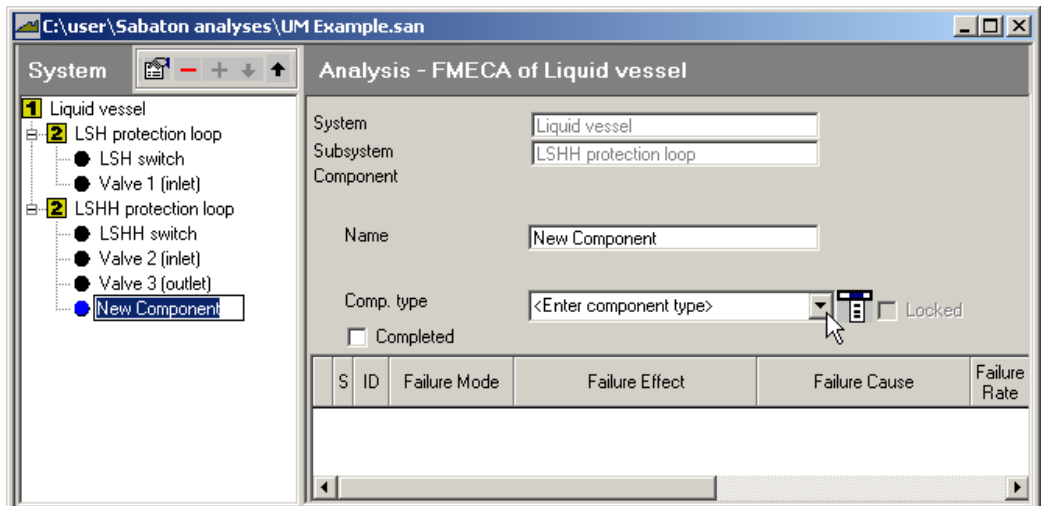


Use the **Edit | Delete** command to delete the selected level, component or failure modes. A warning will be displayed, so that you do not unintentionally delete information.

4.4 Using Failure Mode Library in the Analysis

The analysis may be set up applying failure mode libraries. This is specified in the system and component setup, see “System and Component Setup” on page 49. A general description of failure mode libraries is given in “Failure Mode Libraries” on page 61, however this section presents how to add and edit components and failure modes if a failure mode library is used.

In the figure below, a new component has been added in an analysis applying a failure mode library. Here, it is specified that the failure mode library has two levels, so that a component type must be selected for each component. This is done by selecting from the component type dropdown list in the upper part of the analysis window, see also below.



Select component type from the dropdown list, or select **<add new>** or **<edit list>** to add new/edit the current list, see figure below:

Analysis - FMECA of Liquid vessel

System: Liquid vessel
 Subsystem: LSHH protection loop
 Component:

Name: New Component

Comp. type: <Enter component type>

☐ Completed

S	ID	Failure Mode

PROSE - Process sensor
 PRSEN - Process sensor
 PRVLV - Process valve
 <add new>
 <edit list>

The list of component types may also be edited using the **Failure Modes | Edit local library...** command, see “Local Failure Mode Library (in Analysis)” on page 61.

You may use the **Add failure mode** command from the shortcut menu, as explained in “Basic analysis window operations” on page 33 to add failure modes. However until the component type is selected (and also the component class, if this is included in the setup), the failure mode dropdown list in the analysis will not be available.

Having selected component type and/or class, the failure mode dropdown list will be available, see example below. This will present the list of currently defined failure modes for the selected component type/class. As for the component type explained above, you may also select **<add new>** or **<edit list>** to add new/edit the current list.

Analysis - FMECA of Liquid vessel

System: Liquid vessel
 Subsystem: LSHH protection loop
 Component:

Name: New Component

Comp. type: PROSE - Process sensor

☐ Completed

S	ID	Failure Mode	Failure Effect	Failure Cause
	FM011	-		

FTO
 SPD
 <add new>
 <edit list>

Fail to operate
 Spurious operation

The list of failure modes may also be edited using the **Failure Modes | Edit local library...** command, see “Local Failure Mode Library (in Analysis)” on page 61.

Having added a component, selected component type and/or class, added a failure mode row to the analysis, and also selected a failure mode from the dropdown list, the “Locked” check box to the right of the component type (and same for the component class if included) is checked, see figure below.

S	ID	Failure Mode	Failure Effect	Failure Cause
	FM011	Fail to operate		

This is to indicate that you cannot change the component type due to the link to the selected failure mode. The component type selection may be reset by un-checking the “Locked” check box, however you will then get a warning that all failure mode selections also will be reset.

4.5 Working with Risk/Criticality Matrices

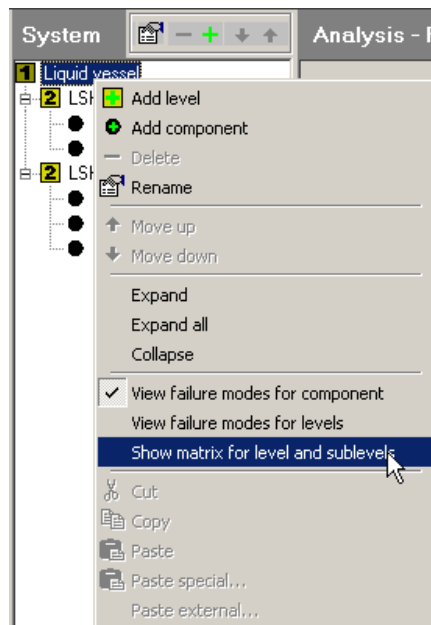
The analysis may be set up using a so-called risk or criticality matrix. This is specified in the analysis form setup, see “Analysis Form Setup” on page 53. This section presents how to work with risk/criticality matrices when performing the analysis. It is assumed that the reader has general knowledge about risk/criticality matrices, and is familiar with how to set up an analysis form with such a matrix.

When an analysis uses risk/criticality matrix, two columns in the analysis form is linked to the matrix, denoted the x- and y-axis of the matrix, respectively. These columns are dropdown list fields, with values specified in the matrix setup.

When a new failure mode row is added, the values for the x- and y-axis of the matrix are selected just as if they were a regular dropdown list field.

Show matrix

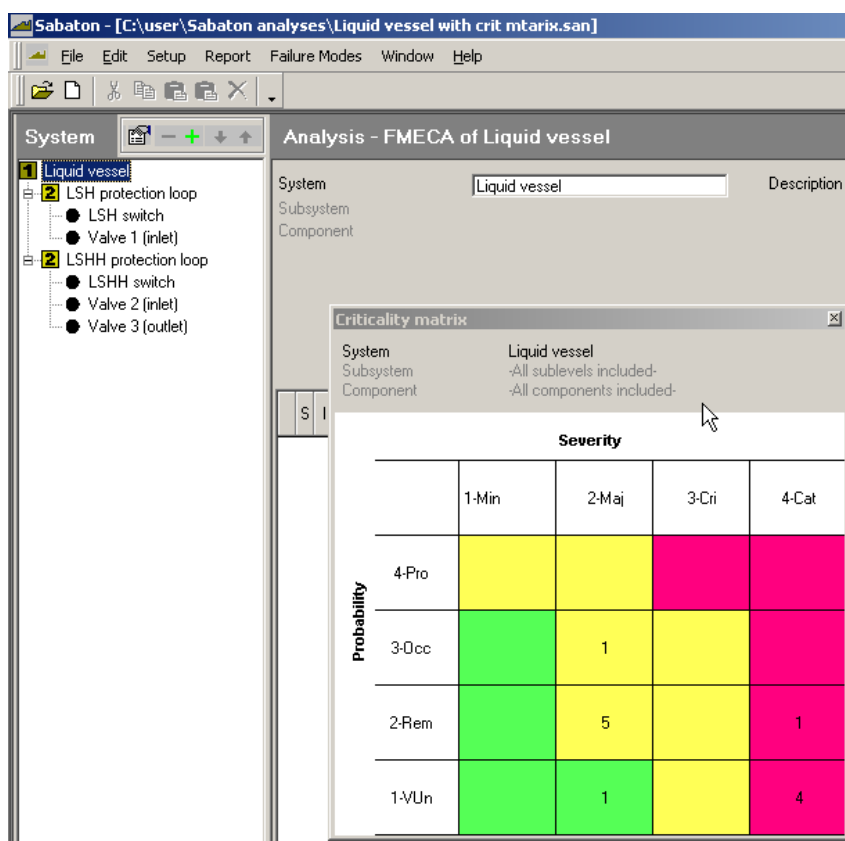
The difference between regular dropdown list fields and the matrix fields appears if you select the **Show matrix** command from the shortcut menu in the system window, see below:



The **Show matrix** command activates a window that will float over the analysis until it is closed. The window contains a view of the defined risk/criticality matrix, with the aggregated number of identified failure modes falling into the different cells of the matrix for the currently selected level or component in the system window.

That is, if a component is selected, only the identified failure modes for this component is counted, however if a level is selected, all failure modes identified for all the components below the selected level is counted.

An example is shown in the figure below, where the top level is selected. Note that the matrix window also shows for which part of the system the failure modes are counted (upper part of the window).



The risk/criticality matrix may also be included in the analysis report, please refer to “Working with Report Templates” on page 57 for more information about this.

5. Modifying the Analysis Setup

5.1 System and Component Setup

Use the **Setup | System and component setup** command to open the **System and component setup** dialog. The dialog have two tabs, **System** and **Component**.

The **Setup | System and component setup** command opens a dialog where you specify the hierarchical breakdown of the system as well as what information to hold for both the system levels and the components. For components, also selections for the optional failure mode library are given.

5.1.1 The System tab

In the **System** tab, you specify what descriptive information to hold for each level, as well as how the hierarchical breakdown of the system shall be done, see description below. In the figure below, an example of the **System** tab is shown.

System and component setup

System | Component

Description for each level
Select if a description field shall be included for each system level and component. If you unselect "Use default" you may also specify a different label.

Incl.	Default	Use default	Specify label
<input type="checkbox"/>	Description	<input checked="" type="checkbox"/>	

System hierarchy setup
Select the number of levels in the system hierarchy, as well as their labels. If you unselect "Use default" you may also specify a different label.

Number of levels in system hierarchy: 3 (2-8)

System level labels

Level	Default label	Use default label	Specify label
1	System	<input checked="" type="checkbox"/>	
2	Subsystem	<input checked="" type="checkbox"/>	
3	Component	<input checked="" type="checkbox"/>	

Ok Cancel

Description for each level

You may specify whether or not to include a description field for each system level (including the components). Also the label for this field, if included, can be set.

The maximum number of characters that can be entered for the description field is ___ characters. The label can be maximum ___ characters.

This information field will be available in the analysis window when a level or component is selected. The description field can also be included in the System overview report (see "System Overview Report" on page 58). For components, the description field can also be included in the analysis reports, see "Working with Report Templates" on page 57.

System hierarchy setup

You may specify the number of levels to be used in the hierarchical system breakdown; from two to eight levels.

Note that, for an ongoing analysis, you are not allowed to reduce the number of levels below the number you have applied in the system.

For the selected number of levels, you can specify the label to use, or select the default label.

5.1.2 The Component tab

In the **Component** tab, you specify what descriptive information to hold for the components, as well as your selections for the optional failure mode library, see below. In the figure below, an example of the **Component** tab is shown.

System and component setup

System **Component**

— Component information —

Select which additional information to hold for the components. If you unselect "Use default" you may also specify different labels for all information fields.

Incl.	Default	Use default	Specify label
<input type="checkbox"/>	Identifier	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Name	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/>	Completed	<input checked="" type="checkbox"/>	
<input type="checkbox"/>	Function	<input checked="" type="checkbox"/>	

☒ Use Failure mode library

Select "Use failure mode library" if you want to use the failure mode library functionality. When the library is selected, you also select how many levels you want to use in the library breakdown. If you unselect "Use default" you may also specify different labels for the library levels.

Number of levels in Failure mode library

Level	Default label	Use default	Specify label
1	Comp. type	<input checked="" type="checkbox"/>	
2	Failure mode	<input checked="" type="checkbox"/>	

Ok Cancel

Component information

You may specify whether or not to include various component descriptive fields. Note that the description field included on the **System** tab comes in addition. Similar to the **System** tab, also the label for the component descriptive fields can be set.

The available component descriptive fields are:

- **Identifier:** An optional identifier for the component.
Maximum __ characters.
Label is maximum __ characters.
- **Name (mandatory):** The component name.
Maximum __ characters.
Label is maximum __ characters.
- **Completed:** A logical field (check box in the analysis window), that you e.g. can use to indicate whether or not you have completed the analysis for the selected component.
Label is maximum __ characters.
- **Function:** A free text field that you e.g. can use to give a description of the component function.
Maximum __ characters.
Label is maximum __ characters.

The component information fields will be available in the analysis window when a component is selected (e.g. see “Entering Level and Component Information” on page 12). The fields can also be included in the System overview report (see “System Overview Report” on page 58) as well as in the analysis reports, see “Working with Report Templates” on page 57.

Use Failure mode library

On the **Component** tab (see dialog in figure above) you also specify whether or not to use the failure mode library. If failure mode library is selected, you may also specify the number of levels (from one to three) to use in the library breakdown, as well as the labels for these levels.

Having selected to use the failure mode library, you also need to include the failure mode field in the analysis form. This is done in the analysis form setup, please refer to “Analysis Form Setup” on page 53.

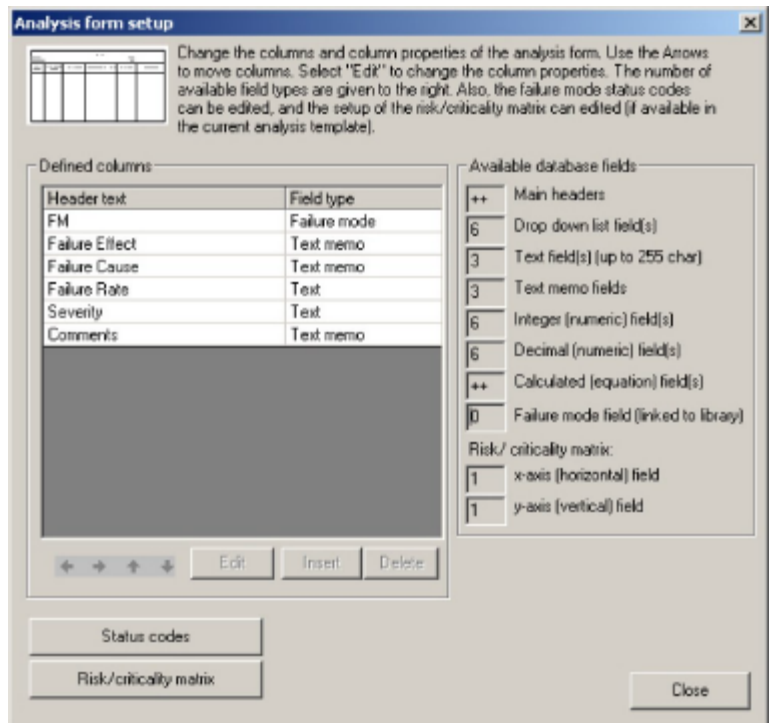
A brief introduction to how the failure mode library is used is given in “Using Failure Mode Library in the Analysis” on page 43. A more thorough description about failure mode libraries is found in “Failure Mode Libraries” on page 61.

Restriction for ongoing analyses

Note that, for an ongoing analysis, the failure mode library can be unselected only if the failure mode library field is not in use. If this field is in use you must therefore first change the analysis form setup, please refer to ?? “Analysis Form Setup” on page 53.

5.2 Analysis Form Setup

The **Setup | Analysis form setup** command opens a dialog where you specify the layout of the analysis form itself, including which columns to include, their headings, etc. Also your selections for the optional risk/criticality matrix is made here, as well as the options for status codes that can be used for highlighting failure modes in the analysis.



The **Analysis form setup** dialog box allows users to configure the layout and properties of the analysis form. It includes a preview of the form layout, a list of defined columns with their field types, and a list of available database fields. The dialog also includes buttons for editing, inserting, and deleting columns, as well as buttons for setting status codes and the risk/criticality matrix.

Change the columns and column properties of the analysis form. Use the Arrows to move columns. Select "Edit" to change the column properties. The number of available field types are given to the right. Also, the failure mode status codes can be edited, and the setup of the risk/criticality matrix can edited (if available in the current analysis template).

Defined columns	Field type
Header text	
FM	Failure mode
Failure Effect	Text memo
Failure Cause	Text memo
Failure Rate	Text
Severity	Text
Comments	Text memo

Available database fields:

- ++ Main headers
- 6 Drop down list field(s)
- 3 Text field(s) (up to 255 char)
- 3 Text memo fields
- 6 Integer (numeric) field(s)
- 6 Decimal (numeric) field(s)
- ++ Calculated (equation) field(s)
- 0 Failure mode field (linked to library)

Risk/ criticality matrix:

- 1 x-axis (horizontal) field
- 1 y-axis (vertical) field

Buttons: Edit, Insert, Delete, Status codes, Risk/criticality matrix, Close

Component status code setup

Define which status codes that shall be available for the identified failure modes. For the included status codes, you may specify what colours shall be used as background for the rows in the analysis form window. If you unselect "Use default" you may also specify different labels for the status codes.

Include	Code	Default label	Use default label	Specify label	Colour
<input checked="" type="checkbox"/>	0	Default	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	1	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	2	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	3	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	4	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	5	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	6	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	7	<Not defined>	<input checked="" type="checkbox"/>		
<input type="checkbox"/>	8	<Not defined>	<input checked="" type="checkbox"/>		
<input checked="" type="checkbox"/>	9	Copied	<input checked="" type="checkbox"/>		

Ok Cancel

5.2.1 Risk/Criticality Matrix Setup

Risk/criticality matrix setup

Risk/criticality matrix label
Specify the name to use for the risk/criticality matrix.

Default label	Use default	Label
Criticality matrix	<input checked="" type="checkbox"/>	

Risk/criticality levels
The defined risk/criticality levels to be used in the matrix are listed below. Select "Define risk/criticality levels" to change the levels.

Order	Code	Description	Colour
1	1-Low	Description, low ...	
2	2-Medium	Description, medium ...	
3	3-High	Description, high ...	

Setup

Risk/criticality matrix
Define the content of the risk/criticality matrix by specifying what risk level that shall be associated with each cell. This is done by clicking and selecting from the drop-down list. Select "Define axes" to change the number and/or description of levels used for the x-axis (horizontal) and y-axis (vertical), as well as the x- and y-axis headers.

		Severity			
		1-Min	2-Maj	3-Cri	4-Cat
Probability	4-Pro	2-Medium	2-Medium	3-High	3-High
	3-Occ	1-Low	2-Medium	2-Medium	3-High
	2-Rem	1-Low	2-Medium	2-Medium	3-High
	1-VUn	1-Low	1-Low	2-Medium	3-High

Define axis ->

Close

2-Hem	1-Low	2-Medium	2-Medium	3-High
1-VUn	1-Low	1-Low	2-Medium	3-High

Define axis ->

x-axis (horizontal) field setup
y-axis (vertical) field setup

Close

Define x-axis (horizontal) field

Enter/edit the x-axis title.

Note that the title should correspond to the header for the x-axis field defined for the analysis form, see below.

Default label	Use default	Label
Consequence	<input type="checkbox"/>	Severity

Corresponding header in analysis form is defined to:

Severity

Select number of levels to use from the drop-down list. Enter/edit code and description for each level directly in the list.

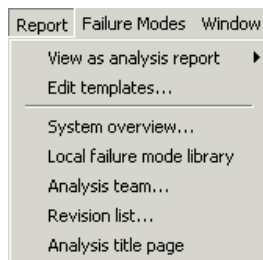
Select number of levels to use: 4

Rank	Code	Name	Description
1	1-Min	1-Minor	1-Minor
2	2-Maj	2-Major	2-Major
3	3-Cri	3-Critical	3-Critical
4	4-Cat	4-Catastrophic	4-Catastrophic

Ok Cancel

6. Preparing reports

6.1 Generally about Reports



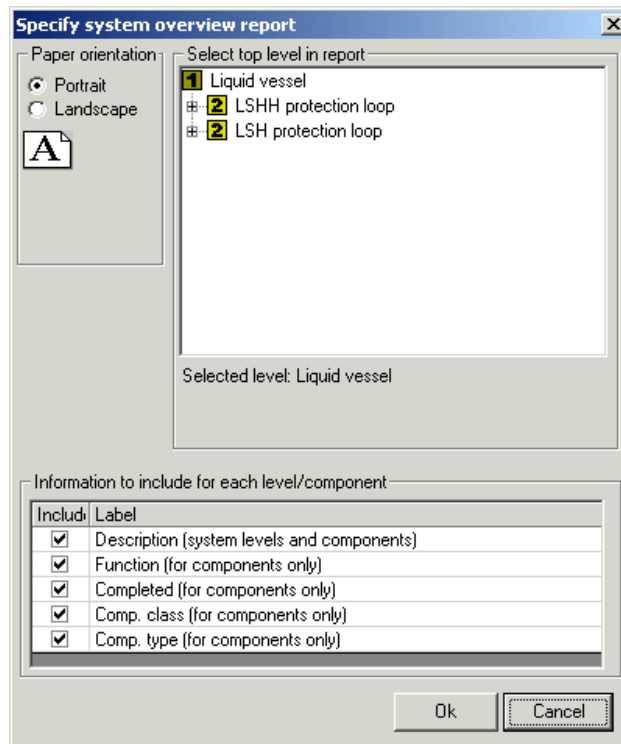
6.2 Analysis reports

6.2.1 The Standard Report

6.2.2 Working with Report Templates

6.3 Other (administrative) reports

6.3.1 System Overview Report



6.3.2 Local Failure Mode Library Report

6.3.3 Analysis Team Report


Specify analysis team report

Information to include

Include	Label
<input checked="" type="checkbox"/>	First name
<input checked="" type="checkbox"/>	Last name
<input checked="" type="checkbox"/>	Initials
<input checked="" type="checkbox"/>	Title
<input checked="" type="checkbox"/>	Organisation
<input checked="" type="checkbox"/>	Expertise
<input checked="" type="checkbox"/>	Phone
<input checked="" type="checkbox"/>	E-Mail
<input checked="" type="checkbox"/>	Comment

Sort list on:
 Last name ☒ Ascending ☐ Descending

Overview of participants vs. analysis revisions
☒ Include participants vs. revisions cross table
 Sort analysis revisions on
 Start date ☒ Ascending ☐ Descending

Paper orientation
☒ Portrait ☐ Landscape


Ok Cancel

6.3.4 Revision List Report


Specify revision list report

Information to include

Include	Label
<input checked="" type="checkbox"/>	Revision name
<input checked="" type="checkbox"/>	Start date
<input checked="" type="checkbox"/>	End date
<input checked="" type="checkbox"/>	Responsible
<input checked="" type="checkbox"/>	Revision approved by
<input checked="" type="checkbox"/>	Comment
<input checked="" type="checkbox"/>	Participants

Sort analysis revisions on
 Revision name ☒ Ascending ☐ Descending

Overview of participants vs. analysis revisions
☒ Include participants vs. revisions cross table
 Sort participants on
 Last name ☒ Ascending ☐ Descending

Paper orientation
☒ Portrait ☐ Landscape


Ok Cancel

6.3.5 Analysis Title Page


Specify analysis title page report

Analysis and system information to include

Include	Label
<input checked="" type="checkbox"/>	Analysis title
<input checked="" type="checkbox"/>	Analysis remarks
<input checked="" type="checkbox"/>	System name
<input checked="" type="checkbox"/>	Study owner
<input checked="" type="checkbox"/>	Printed date

Paper orientation

☒ Portrait
 ☐ Landscape



☒ Include analysis revision information

Include	Label
<input checked="" type="checkbox"/>	Revision name
<input checked="" type="checkbox"/>	Comment
<input checked="" type="checkbox"/>	Start date
<input checked="" type="checkbox"/>	End date
<input checked="" type="checkbox"/>	Responsible (Initials)
<input checked="" type="checkbox"/>	Revision approved by (Initials)
<input checked="" type="checkbox"/>	Participants (Initials)

Ok

Cancel

7. Failure Mode Libraries

7.1 Generally about Failure Mode Libraries

7.2 Local Failure Mode Library (in Analysis)

7.3 External Failure Mode Libraries

7.4 Overview of Failure Mode Library Menus

8. References

8.1 List of References

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- [2] SAE ARP5580: “Recommended Failure Modes and Effects Analysis (FMEA) Practices for Non-Automobile Applications”, SAE International (The Engineering Society for Advancing Mobility Land, Sea, Air and Space), Warrendale, PA, USA, Aerospace Recommended Practice (ARP) 5580, Issued 2001-07.
- [3] SAE J1739: “Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA), and Potential Failure Mode and Effects Analysis for Machinery (Machinery FMEA)”, SAE International (The Engineering Society for Advancing Mobility Land, Sea, Air and Space), Warrendale, PA, USA, Surface Vehicle Recommended Practice J1739, Issued 1994-07, Revised 2001-07.
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- [5] Smith, David J.: “Reliability, Maintainability and Risk – Practical Methods for Engineers”, Butterworth-Heinemann Ltd., Oxford, England, Fourth Edition, 1993.
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- [7] OREDA Handbook: “Offshore Reliability Data Handbook”, publ. by the OREDA Participants, prep. by SINTEF Industrial Management, distr. by Det Norske Veritas, Høvik, Norway, 3rd edition, 1997.
- [8] MIL-STD-1629A: “Procedures for Performing a Failure Mode, Effects and Criticality Analysis”, U.S. Department of Defense, Washington, DC, 1980.

9. Glossary of Terms

Criticality

A relative measure of the impact of a failure mode on the required function. Criticality combines the frequency or probability of occurrence and the level of severity of a failure mode.

Criticality Analysis

A procedure by which each potential failure mode is ranked according to the combined influence of its severity and frequency or probability of occurrence.

Dependability

The collective term used to describe the availability performance and its influencing factors; reliability performance, maintainability performance, and maintenance support.

Design review

A formal, documented, comprehensive, and systematic examination of a design to evaluate the design requirements and the capability of the design to meet these requirements and to identify problems and propose solutions.

End Level Effect

The impact or consequence of a failure mode on the operation, function, or status of the end-item.

Fail Safe

A design property of an item that prevents its failures being critical failures.

Failure Cause

The physical or chemical process, design defects, quality defects, part misapplication, or other processes

Failure Effect

The consequence(s) a failure mode has on the operation, function, or status of an item.

Failure Mode

The effect by which a failure is observed on the failed item.

Failure Mode and Effect Analysis (FMEA)

A procedure by which each potential failure mode in a system is analysed to determine the results or effects thereof on the system, to classify each potential failure mode according to its severity, and to recommend actions to eliminate, or compensate for, unacceptable effects.

Failure Mode, Effect and Criticality Analysis (FMECA)

An extension of the FMEA procedure to include assessment of the failure mode severity and frequency or probability of occurrence.

Failure Symptom

An identifiable physical condition by which a potential failure can be recognised.

Gradual Failure

Failure that could be anticipated by prior examination or monitoring.

Hidden Failure

A failure not evident to the crew or operator during the performance of normal duties.

Inspection

Activities such as measuring, examining, testing, and gauging one or more characteristics of a product or service and comparing these with specified requirements to determine conformity.

Intermittent Failure

Failure of an item for a limited period of time, after which the item restores its required function without being subjected to any external corrective action.

Maintainability

The ability of an item, under stated conditions of use, to be retained in, or restored to, a state in which it can perform its required functions, when maintenance is performed under stated conditions and using prescribed procedures and resources.

Maintenance

The combination of all technical and corresponding administrative actions, including supervision actions, intended to retain an entity in, or restore it to, a state in which it can perform its required function.

Maintenance Support Performance

The ability of a maintenance organisation, under given conditions, to provide upon demand, the resources required to maintain an entity, under a given maintenance policy.

Preventive Maintenance

The maintenance carried out at predetermined intervals or corresponding to prescribed criteria and intended to reduce the probability of failure or the performance degradation of an item.

Quality

The totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs.

Redundancy

In an entity the existence of more than one means for performing a required function.

Reliability

The ability of an item to perform a required function, under given environmental and operational conditions and for a stated period of time.

Reliability Centred Maintenance (RCM)

A disciplined logic or methodology used to identify preventive maintenance tasks to realize the inherent reliability of equipment at least expenditure of resources.

Repair

The part of corrective maintenance in which manual actions are performed on the entity.

Required Function

A function or combination of functions, of an entity, that is considered necessary to provide a given service.

Risk

Risk designates the danger that undesired events represents for humans, the environment or material values. Risk is expressed in the frequency or probability of the undesired events and their corresponding consequences.

Safety

Freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property.

Security

Dependability with respect to the prevention of unauthorized access and/or handling of information.

Severity

The consequences of a failure mode as determined by the degree of injury, property damage, or system damage that could ultimately occur. Severity considers the worst potential consequence of a failure.

Severity Classifications

Severity classifications are assigned to provide a qualitative measure of the worst potential consequences resulting from design error or item failure.

Single Failure Point

A failure of an item that is not compensated for by redundancy or alternative operational procedure that results in adverse end level effects.

Sudden Failure

A failure that could not be anticipated by prior examination or monitoring,

Test Frequency

The number of tests of the same type per unit time interval; the inverse of the test interval.

Test Interval

The elapsed time between the initiation of identical tests on the same sensor, channel, and so forth.

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