



Reliability & Maintainability Engineering System v6
A reliability engineering tool for asset management and designing industrial processes



R-MES™ User Manual, version M-2012-v6.4

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Introduction

R-MES is a Reliability Engineering IT platform , for managing assets in industrial plants and fleets, which complements basic and complex unit analysis using the methodology and analysis of reliability block diagrams (RBD), and that enables historical and probabilistic analysis of key process indicators (KPI's) to be developed. This is done for the purpose of auditing and projecting the overall performance of the assets evaluated. The R-MES system is an integrated, rigorous, and easy to use system that enables assets to be managed and maintained with an engineering vision for any systemic configuration, whether it is simple or complex.

The R-MES system uses Reliability Blocks Diagrams for its modeling methodology – RBD), which consists of integrating diverse logical-functional configurations from basic units to complex systems. The permitted configurations (Series, Parallel, Stand-by, Partial Redundancy and Fractionation) provide a high degree of versatility for modeling practically any productive system, whether it is of an esthetic nature (process plants) or dynamic (mobile equipment fleets).

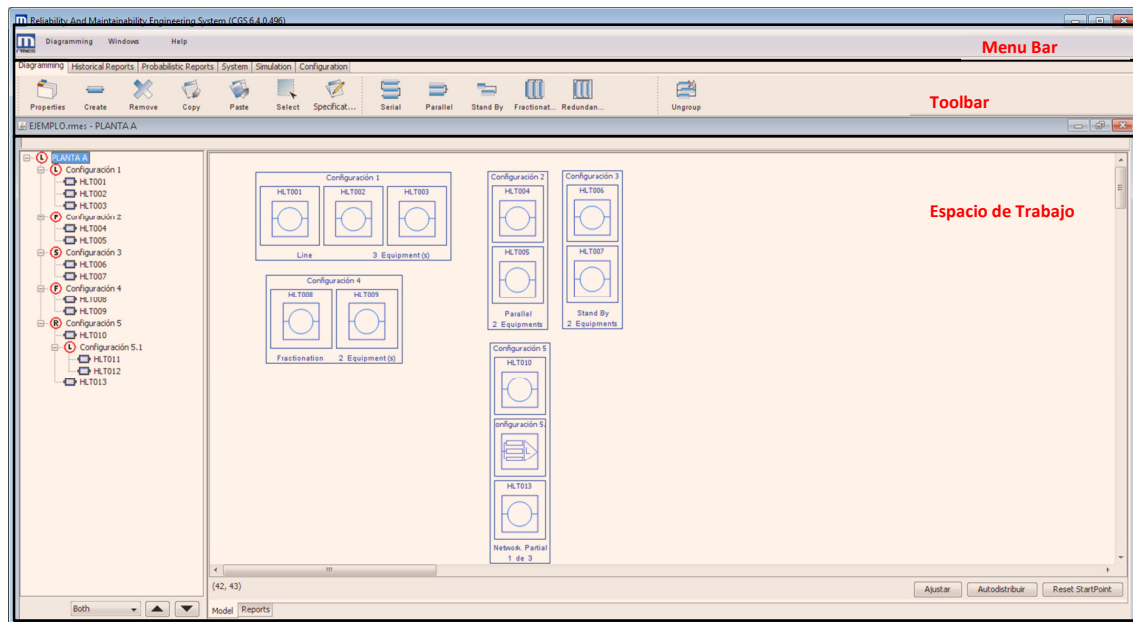
The methodology obtains KPI's at the level desired by the user, from basic units (equipment) to complex systems (lines, areas, and plants). This enables critical equipment and areas of loss to be identified, to develop comparisons in the yield of similar equipment, and ultimately obtain a satisfactory diagnosis of the total yield of the assets.

R-MES: Reliability & Maintainability Engineering System

Starting R-MES

The graphic interface of the R-MES software is made up of 3 main sections:

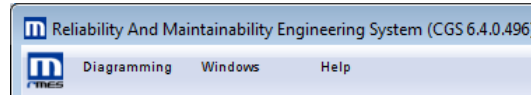
- Menu Bar
- Toolbar
- Workspace



It should be mentioned that when you first open the software there is no **Workspace** loaded, so you will have to create one or open an already existing one in the **R-MES menu** of the **Toolbar**. For more information about creating or opening workspaces go to the section **R-MES menu** of the **Menu Bar** in this manual.

Menu Bar

The **Menu Bar** enables easy access to 4 menus that contain basic options for working with the software. The menus mentioned are the following:

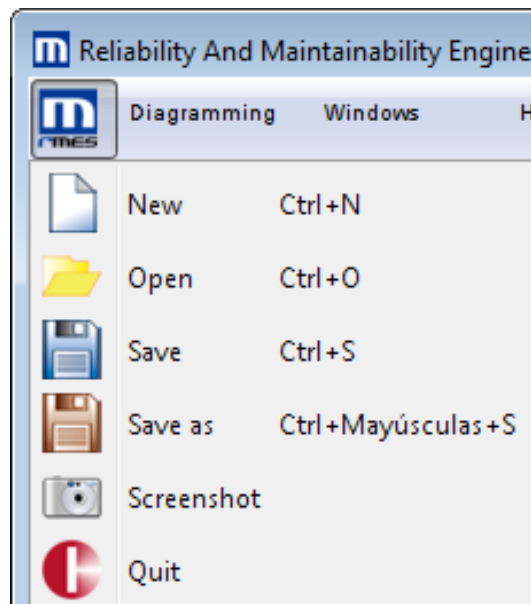


- R-MES Menu
- Diagram Menu
- Windows Menu
- Help Menu

R-MES Menu

The options in this menu are used to create new workspaces and manipulate files.

When you select the icon “R-MES Menu” () , the following options will be displayed:



R-MES Option Menu







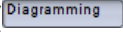
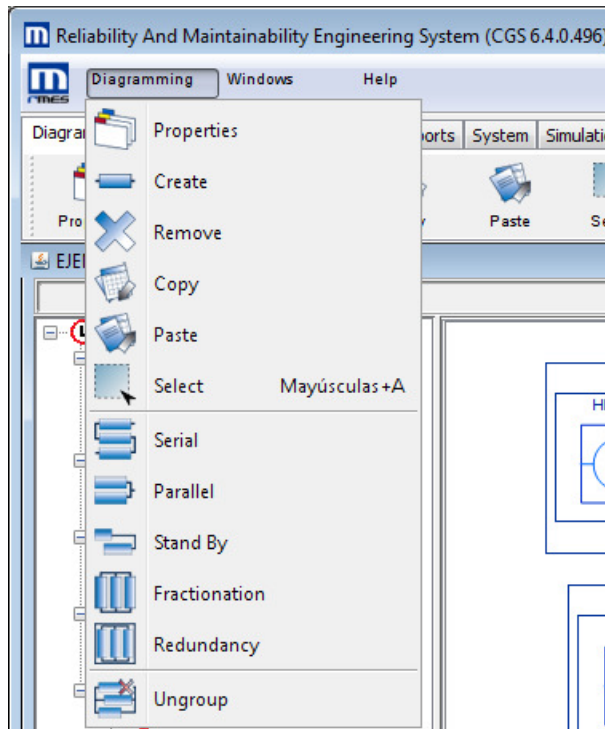
Name	Icon	Direct Access	Function
New		Ctrl + N	Create a new workspace
Open		Ctrl + O	Open an R-MES file
Save		Ctrl + S	Save an R-MES file
Save as		Ctrl + Shift+ S	Save as new R-MES file
Screenshot		-	Save workspace as a JPG image
Quit		-	Close R-MES

Diagram Menu













The **Diagram Menu** contains tools for building a diagram in the workspace.

The options for the **Diagram Menu** can also be found in the **Diagram Toolbar**.

When you click on the “**Diagramming**” () button, the following options will be displayed:



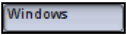
Diagramming Menu Options

Name	Icon	Direct Access	Function
Properties		-	Show properties of the diagram node selected
Create		Insert	Create a piece of equipment in the workspace
Remove		Delete	Eliminate all selected diagram nodes
Copy		Ctrl + C	Copy selected diagram nodes
Paste		Ctrl + V	Paste previously copied diagram nodes
Select		Ctrl + A	Select diagram nodes
Serial		Ctrl + S	Generate a logical-functional configuration Series
Parallel		Ctrl + P	Generate a logical-functional configuration in Parallel
Stand By		Ctrl + B	Generate a logical-functional configuration in Stand-by
Fractionation		Ctrl + F	Generate a logical-functional configuration in Fractionation
Redundancy		Ctrl + R	Generate a logical-functional configuration in Redundancy
Ungroup		Ctrl + D	Ungroup the selected configurations

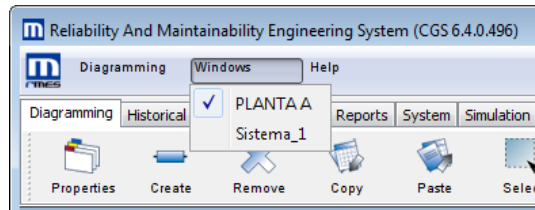
For more information on how to use these options, see the item **Diagramming** under the **Toolbar** section.

Windows Menu

In R-MES multiple workspaces can be manipulated, and in this menu you can select the workspace that you want to view.


When you click on “**Windows**” () , a list of the names of the systems found in each of the workspaces being used by the user is displayed. It should be mentioned that each workspace can only contain one system.

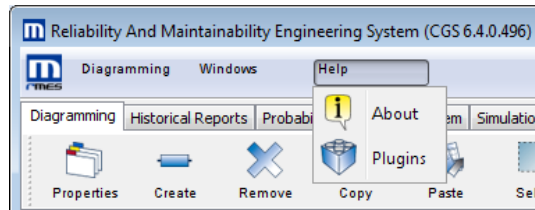
As an example, the following is a list of systems in use:





The ✓ sign means that this is the workspace viewed by the user.

Help Menu

In the help menu () there is information about the use and features of the system.



Menu Options

Name	Icon	Direct Access	Function
About		-	Show the version of R-MES
Plug-ins		-	Show available Plug-ins

Toolbar

The toolbar has 6 tabs that group the software's options in a way that makes using it easier and more intuitive. The tabs are:



- Diagramming
- Historical Reports
- Probabilistic Reports
- System
- Simulation
- Configuration

Take into account that before generating the reports from **Historical Reports**, **Probabilistic Reports**, and **Simulation**, you must first:

- Have created a diagram of the system in the **Diagram** toolbar.
- Have made the necessary modifications in the **Configuration** and the **System Properties** toolbars.
- Have uploaded the data in the **Database** in the **Systems** toolbar.

Diagram Tab

For modeling industrial plants and mobile equipment fleets, the R-MES system is based on the Reliability Blocks Diagram (RBD) methodology, that consists of grouping maintainable units in logical-functional configurations from a bottom-up perspective, meaning that it starts from the piece of equipment up to grouping them based on the process modeled, which represents the dependability of the group. The methodology enables key process indicators (KPI's) to be obtained at the level desired by the user from basic units (equipment) to the behavior of a complex system (plant/fleet), covering dimensions of reliability, maintainability, availability, utilization, and productivity.

Predetermined configurations Series, Parallel, Stand-by, Fractionation and Redundancy are included, to represent the different levels of redundancy and idle capacity in the phases of a productive process in a logical-functional way, considering the design capacity of the equipment and a normal operation system of the process. R-MES can also obtain historical

indicators that consider the presence of a Stockpile, given that these stocking systems are important in order to avoid system shutdowns, directly affecting the reliability of the process. It is important to point out that R-MES contains RBD specific algorithms (Fractionation and Redundancy-Fractionation), developed in-house by their R&D team, which provide great versatility to the system in order to adapt to real processes of different types. At the same time, R-MES has a navigation scheme that is comfortable and simple for the user, which groups together different functions, enabling easy and efficient work.

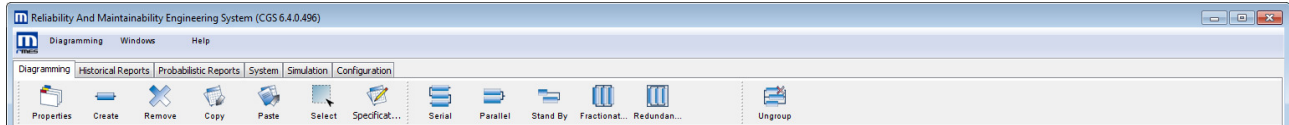


Diagram Tab Options

Name	Icon	Direct Access	Function
Properties		-	Show the properties of the selected diagram node.
Create		Insert	Create a piece of equipment in the workspace.
Remove		Delete	Eliminate equipment and/or configurations selected.
Copy		Ctrl + Shift + C	Copy selected diagram nodes.
Paste		Ctrl + Shift+ V	Paste previously copied diagram nodes.
Select		Shift+ A	Select diagram nodes.
Specifications		-	Enables you to write specifications for a diagram node.
Series		Ctrl + S	Generate a Logical-functional Configuration in Series .
Parallel		Ctrl + P	Generate a Logical-functional Configuration in Parallel.
Stand By		Ctrl + B	Generate a Logical-functional Configuration in Stand-by .
Fractionation		Ctrl + F	Generate a Logical-functional Configuration in Fractionation.
Redundancy		Ctrl + R	Generate a Logical-functional Configuration in Redundancy.
Ungroup		Shift+ D	Ungroup the selected configurations.

Diagram Tab: Properties

Show the properties of the piece of equipment, configurations, or the plant.

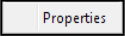
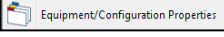

Procedure:

Open the **Properties** window and edit the information if necessary.

There are different options for opening the properties window, depending on whether it is a **Diagram Node** (equipment or a configuration) or **System**. Each of these will be explained below:

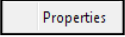



Access properties window of diagram nodes (diagram nodes)

The properties window of a node can be accessed in one of five ways:

- Double click on the node in the **Diagram Space**.
- Right-click on the node in the **Navigation Tree** and select the option “**Properties**” ().
- Right-click on the equipment/configuration in the **Diagram Space** and select the option “**Equipment/Configuration Properties**” ()
- Select the node in the **Diagram Space** or in the **Navigation Tree**, and then select the **Reports** tab, which is located in the lower left-hand side of the **Diagram Space**.
- Select the node in the **Diagram Space** or in the **Navigation Tree**, and then click the “**Properties**” () button on the **Diagram** toolbar.

Access the system’s properties window

The window containing the system’s properties can be observed in one of five ways:

- Right-click on the node in the **Navigation Tree** and select the option “**Properties**” ().
- Right-click on the equipment/configuration in the **Diagram Space** and select the option “**Equipment/Configuration Properties**” ()
- Select the system in the **Navigation Tree** and then select the **Reports** tab, which is located in the lower left-hand side of the **Diagram Space**.
- Select the system in the **Navigation Tree**, and then click the “**Properties**” () button on the **Diagram** toolbar.
- Select the option “**Properties**” () on the **System** toolbar.

Characteristics

- Each properties window shows the characteristics of one single diagram node at a time.
- There are some differences in the characteristics of the configurations depending on their **Logical-Functional Configuration** (Series, Parallel, Stand-by, Fractionation or redundancy). For that reason the windows that show the properties of the configurations are not all the same.
- The properties of the equipment, configurations, and the system are the following:

Equipment Properties

Shown below are all of the characteristics found in the properties window of a piece of equipment.

Equipment Properties

- **Name:** Name of the equipment.
- **Equipment Code:** Unique identifier of the equipment. Nickname with which it is found in the database. The equipment code must not contain accents.
- **Failure Catalog: The Catalog has, Symptoms, failure modes and causes of equipment failure.**
- **Alias:** Virtual codes for the equipment. These are other nicknames for the equipment.
- **Impact:** The impact of the equipment on the configuration it belongs to. The impact by default is 100%, except for equipment found in **Logical-Functional Configuration in**

Equipment Indicators

- **Manual:** This option permits equipment indicators to be entered manually.
- **Imported Data:** The software calculates the equipment's indicators according to the data that was imported.
- **Failure Rate:** The failure rate of the equipment. If you select the checkbox implies that the failure rate is used to calculate the probability MTBF. If it's not selected will be used MTBF for calculating the failure rate (one is the inverse of the other).
- **Mean Time between Failures:** This is the MTBF of the equipment.
- **Mean Time to Repair:** This is the MTTR of the equipment.
- **Mean Time to Intervention:** This is the MTTI of the equipment.
- **Runtime:** The length of time the equipment functioned since the last failure. By default, it is MTBF.
- **Operation Time. This is the operation time of the equipment**



- **Average Intervention Cost:** This is the average cost that maintenance implicates (both corrective and programmed maintenance).
- **Capex:** (Capital Expenditure), investment is associated to equipment and / or process.
- **Fixed Opex:** (Operational Expenditure) operational costs that an equipment and / or process have, does not depend on the amount of production (eg, salaries, rent, etc.).
- **Variable Opex:** (Operational Expenditure) operational costs that an equipment and / or process have, they depend on the amount of production, such as supplies, spare parts, energy, etc.
- **Scaling index:** is the factor that identifies whether or not the presence of economies of scale.
- **Productive Capacity:** is the capacity of work of equipment, measured in units of product per unit of time.

Data Source

- **Node:** This corresponds to the configuration name and represents the selected node in the tree.
- **Current Repository:** This is the database that data is currently being extracted from.
- **Create from CSV:** Upload a new data source from a file in CSV format (comma separated values), to import more data from the equipment. With the button “**Create**” data is imported.
- **Repositories:** Show the databases that are uploaded. In the case that more than one database is uploaded, the software only uses the data from the database visible in the box. To use another database, you must select it and then click “**Use**”. Only one data source may be used at a time.
- **Clean:** Eliminate all data used by the equipment, but without eliminating the uploaded databases.
- **Create:** Import data from the new CSV loaded in **Create from CSV**. In the window that is displayed when you click “**Create**” enter the name of the file to upload.
- **Use:** Enables you to use data from the selected database in **Databases**.
- **Estimate:** When you click this button a new window opens in which the estimations of general **Indicators**, distribution, and goodness of fit are shown.
- **View/Edit:** See all equipment data that is being used. You can manually change the data. Within this option you can also export data (only from the equipment in question).

TBF

- **Weibull Graph:** This is the graph of equipment failure frequency

Properties of the logical-functional configurations in Series, Parallel and Stand-by

The properties of the **logical-functional configurations in Series, Parallel and Stand-by** separated by item are:

Properties

- **Name:** Name of the configuration.
- **Equipment Code:** Unique identifier of the configuration. Nickname with which it is found in the database. The configuration code must not contain accents.
- **Alias:** Virtual codes for the configuration. These are other nicknames for the configuration. Although it is not advisable, it is possible to upload information from the databases directly to the configuration, for which the software searches for the configuration's code or alias in the database to import its data.
- **Impact:** The impact the configuration has on its parent configuration. The impact by default is 100%, except when the configuration is found in **Logical-Functional Configuration in Fractionation**, since in this case the value of the impact can be changed in the properties of the parent configuration that it belongs to.
- **Capex:** (Capital Expenditure), investment is associated to equipment and / or process.
- **Fixed Opex:** (Operational Expenditure) operational costs that an equipment and / or process have, does not depend on the amount of production (eg, salaries, rent, etc.).
- **Variable Opex:** (Operational Expenditure) operational costs that an equipment and / or process have, they depend on the amount of production, such as supplies, spare parts, energy, etc.
- **Scaling Index:** is the factor that identifies whether or not the presence of economies of scale.
- **Productive Capacity:** is the ability of work of equipment, measured in units of output per unit of time.

Data Source

- **Node:** This corresponds to the configuration name and represents the selected node in the tree.
- **Current Repository:** The database that data is currently being extracted from.



- **Create from CSV:** Enables you to upload a new database from a file in CSV format (comma separated values) to import data from the configuration. By clicking “**Create**” data is imported. For data to be imported correctly, the database must contain the code or alias of the configuration. This data corresponds only to the configuration and not to the equipment it is made up of.
- **Repositories:** Shows the databases that are uploaded. If more than one database is uploaded, the software is only using data from the database visible in the box. To use another database, you must select it and then click “**Use**”. Only one data source can be used at a time.
- **Clean:** Eliminates all data used from the configuration, but without eliminating the uploaded databases.
- **Create:** Enables you to import data from the new CSV uploaded in **Create from CSV**. In the window that is displayed when you click “**Create**” enter the name of the file to be uploaded.
- **Use:** Enables you to use the data from the database selected in **Databases**.
- **Estimate:** The estimation of parameters is not available for configurations.
- **View/Edit:** Enables you to see the data from the configuration in the database and manually edit it if desired. This button can only be used when the imported database contains the code or alias of the configuration. If it only has equipment data, it will not be possible to see or edit configuration data. Within this option you can also export data (only from the configuration in question).

TBF

- **Weibull Graph:** This graph is not available for configurations.

Properties of a logical-functional configuration in Fractionation

The **logical-functional configuration in Fractionation** has all the properties listed above for configurations in Series, Parallel, and Stand-by, and also has two more characteristics, which are:

Fractionation Properties

- **MinToWork:** The minimum nodes necessary to fulfill the configuration’s required production. If you enter 0 (zero) this implicates that the **logical-functional configuration** of the nodes is due to **Fractionation**. If another value is entered (between 1 and the

total number of nodes in the configuration) a **Fractionation in Redundancy** is being considered.

- **Configure:** When you click this button, a window opens with the following options:
 - **Fractionation or Fractionation Redundancy:** These options enable you to choose between Fractionation or Fractionation Redundancy. If you previously entered the value zero for the MinToWork, the option **Fractionation** will automatically appear, but if you previously entered a MinToWork value greater than zero, the option **Fractionation Redundancy** will be automatically selected.
 - **Equipment Running:** This option can only be used when you choose the option **Fractionation due to redundancy**. If you previously entered a MinToWork value greater than zero, this value will automatically take the option **Equipment running**. This can be modified in the **Configure** window and when you click , the impact on each node will be changed (impacts that cannot be modified by the user).
 - **Impacts:** Enables you to enter the impact of each node found within the configuration. This item can only be modified when you select the option **Fractionation**, where by default the software calculates the impacts proportionate to the number of nodes found within the configuration in fractionation.
 - **Default:** When you click this button, impacts are calculated proportionate to the number of nodes found within the configuration in **fractionation**.
 - **Close:** Closes the **Configure** window and saves the changes made in it.

Properties of a logical-functional configuration in Redundancy

The **logical-functional configuration in Redundancy** has all of the properties listed above for configurations in Series, Parallel, and Stand-by, but also has one more characteristic, which is:

Redundancy Properties

MinToWork: The minimum pieces of equipment necessary to fulfill the configuration's required production. This number is limited to between 1 and the total number of pieces of equipment in the configuration.

Properties of the System

All of the characteristics found in the properties of the system window are shown below:



Properties of the System

- **Descriptive Name:** Name of the configuration or plant.
- **Nickname:** Unique identifier of the configuration. Code with which it is found in the database. The nickname of the plant must not contain accents.
- **Variable Cost Impact:** The percentage of the annual billing corresponding to variable cost.
- **Annual Billing:** the annual billing of the system or plant.
- **Equipment:** Gives the possibility of working with equipment or fleets in R-MES.
- **Nominal Capacity:** The quantity produced per hour in the plant.

Data Source

- **Node:** The name of the system.
- **Current database:** The database that data is currently being extracted from.
- **Create from CSV:** Enables you to upload a new database from a file in CSV format (comma separated values), to import data from the system. By clicking **“Create”** data is imported. For data to be imported correctly, the database must contain the code or alias of the system. This data corresponds only to the system and not to the equipment and/or configurations it is made up of.
- **Databases:** Shows the databases that are uploaded. If more than one database is uploaded, the software is only using data from the database visible in the box. To use another database, you must select it and then click **“Use”**. Only one data source may be used at a time.
- **Clean:** Eliminates all data used from the system, but without eliminating the uploaded databases.
- **Create:** Enables you to import data from the new CSV uploaded in **Create from CSV**. In the window that is displayed when you click **“Create”** enter the name of the file to upload.
- **Use:** Enables you to use the data from the database selected in **Databases**.
- **Estimate:** The estimation of parameters is not available for configurations.
- **View/Edit:** Enables you to see the data of the system that is in the database and manually edit it if desired. This button can only be used when the database imported contains the code or alias of the system. If it only has the data of the diagram nodes, the

system does not contain its own data, and therefore there is no data that can be seen or edited for the system. Within this option data can also be exported.

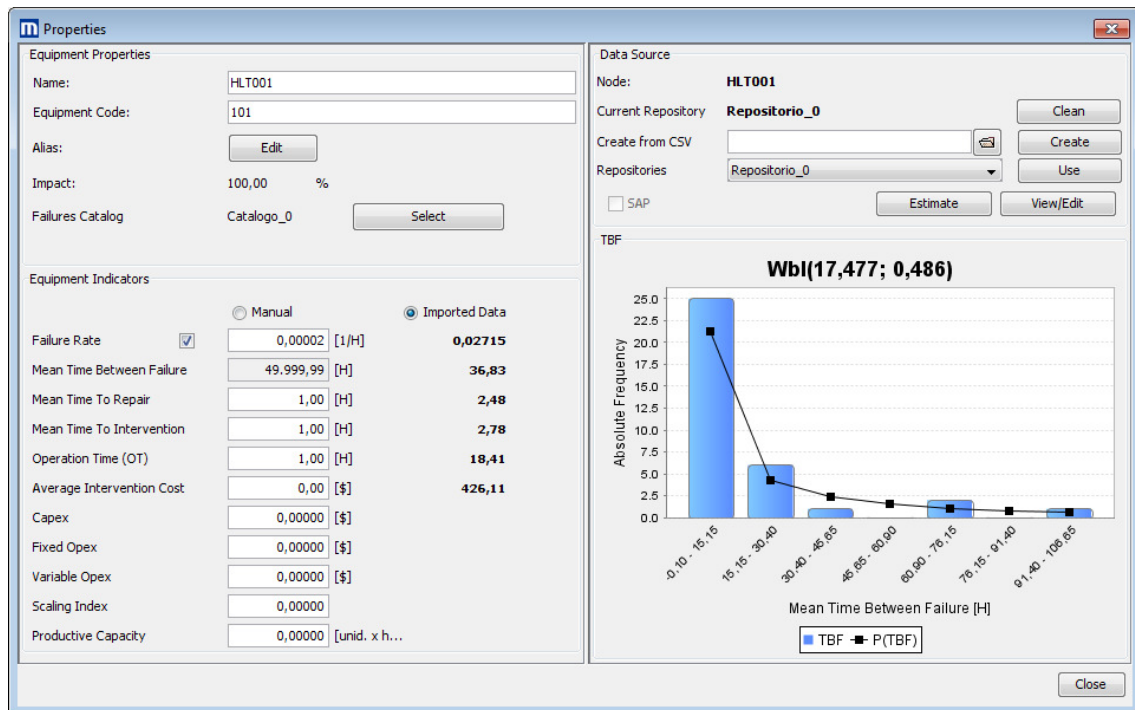
TBF

- **Weibull Graph:** This graph is not available for the system

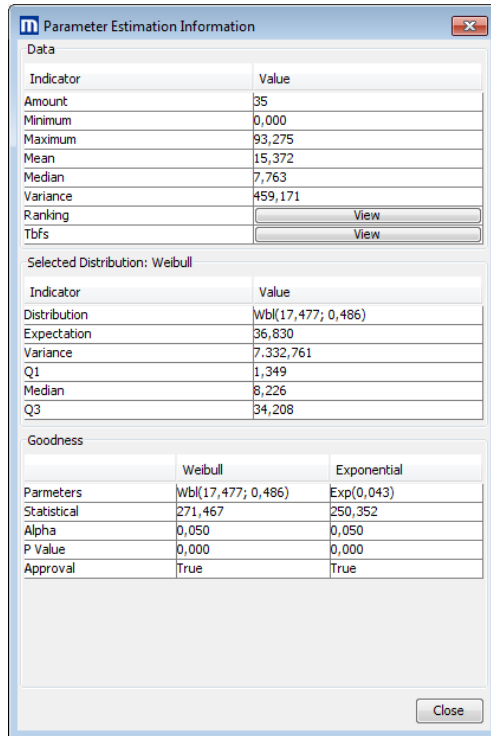
Example

Properties of an equipment

Select the piece of equipment HLT001 and then click the icon “**Properties**” on the **Diagram** toolbar. This will open the following window:



The name of this piece of equipment is HLT001 and its code is 101. The indicators for this piece of equipment are being calculated using imported data. The database that data is being extracted from is called **Repositorio_0**. When you click on “**Estimate**” the following window will open:



Here the indicators for the piece of equipment HLT001 are found.

Properties of a configuration

Logical-Functional Configuration in Series

Select Configuration 1 and then click on the “**Properties**” icon on the **Diagram** toolbar. This will open the following window:

The screenshot shows a software window titled "Properties" with a close button in the top right corner. The window is split into two panes. The left pane, titled "Line Properties", contains a list of fields with their corresponding values or controls:

Line Properties	
Name	Configuración 1
Equipment Code	Configuración 1
Alias	<input type="button" value="Edit"/>
Impact	100,00 %
Capex	<input type="text" value="0,00"/>
Fixed Opex	<input type="text" value="0,00"/>
Variable Opex	<input type="text" value="0,00"/>
Scaling Index	<input type="text" value="0,00"/>
Productive Capacity	<input type="text" value="0,00"/>

The right pane, titled "Data Source", contains the following information and controls:

- Data Source**
- Node:** Configuración 1
- Current Repository:** Repositorio_0 (with a button)
- Create from CSV:** (with a button)
- Repositories:** Repositorio_0 (with a button)
- SAP (with and buttons)
- TBF:** Graph not available for configurations

A button is located at the bottom right of the window.

In this example, the name is the same as the nickname.

In the upper left-hand side of the window the type of **Logical-Functional Configuration** of this node is shown, which is in Line (or in Series).

Configuration 1 is not found within another parent configuration, and therefore is not found within a **Logical-Functional Configuration in fractionation**, and for that reason its impact by default is 100%.

The database that data is extracted from is called **Repositorio_0**.

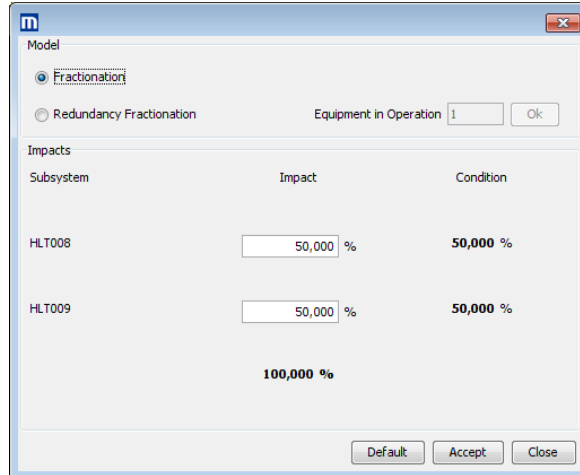
Logical-Functional Configuration in Fractionation

Select Configuration 4 and then click on the **“Properties”** icon on the **Diagram** toolbar. This will open the following window:

In this example the name is the same as the nickname.

In the upper left-hand side of the window, the type of **Logical-Functional Configuration** of this node is detailed. Since the MinToWork is equal to zero it assumes that there is no fractionation in redundancy.

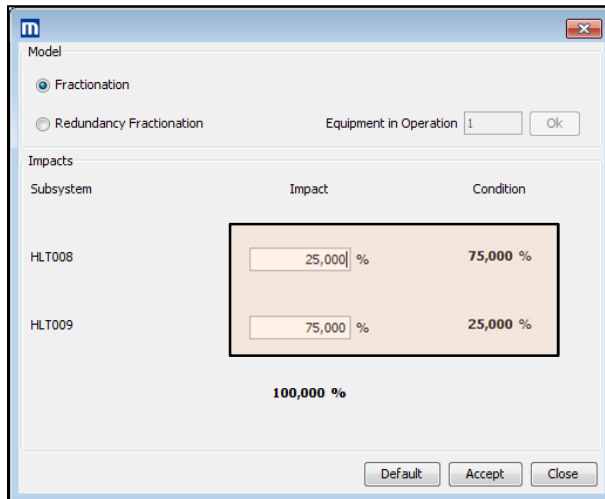
When you click **“Configure”** the following window will open:



Since the MinToWork previously entered was zero, in this window for the item **Model**, the option **Fractionation** is selected.

By default the software calculates impacts proportionately to the number of nodes found within the configuration in fractionation. That is why the two pieces of equipment, HLT008 and HLT009 each have a 50% impact.

To change the equipment's impact, the impact of the HLT008 must have a value of 25% and the impact of the HLT009 must be 75%. Next, close the window. This saves the changes to the impacts.



Logical-Functional Configuration in Redundancy

Select Configuration 5 and then click on the **“Properties”** icon on the **Diagram** toolbar. Doing this will open the following window:

In this example the name is the same as the equipment code

In the upper left-hand side of the window the type of configuration of this node is shown. For this type of configuration the impact by default is 100%. The MinToWork of this configuration is 1.

The database that data is being extracted from is called **Repositorio_0**.

Properties of a System

Select the system, Plant A, and then click on the **“Properties”** icon on the **Diagram** toolbar. This will open the following window:

The screenshot shows the 'Properties' window for a system named 'PLANTA A'. The window is divided into two main sections: 'System Properties' on the left and 'Data Source' on the right.

System Properties:

- Descriptive Name: PLANTA A
- Nickname: PLANTA A
- Variable Cost Impact: 12,00 %
- Annual Billing: 400.000.000,00 [\$]
- Nominal Capacity: 200,00 [unidades] By hour

Utilities:

- View Failures: View Failures
- Exportar_Lista: Export Equipment List
- Export Detentions: Export Plant Detentions
- View Deadlines: View Deadlines
- Equipment Codes: Resolve code conflicts

Data Source:

- Node: PLANTA A
- Current Repository: Repositorio_0
- Create from CSV: [Empty field]
- Repositories: Repositorio_0
- SAP

Buttons: Clean, Create, Use, Estimate, View/Edit, Close.

TBF: Graph not available for configurations


In this example the name is the same as the nickname. The database that data is being extracted from is called **Repositorio_0**.

Enter 12% for the Variable Cost Impact, \$400,000,000 for the Annual Billing, and 200 units for the Nominal Capacity. Next, close the window. Doing this will save the changes.

Diagram Tab: Create

Enables a new piece of equipment to be created in the **Workspace**. A piece of equipment is the fundamental unit for constructing diagrams in R-MES.

Procedure

- In the **Navigation Tree** select the system or configuration in which the piece of equipment must be created.
- Select the icon “**Create**” () on the **Diagram** toolbar or press the “**Insert**” button on the keyboard. This automatically enters a new piece of equipment into the **Workspace**.

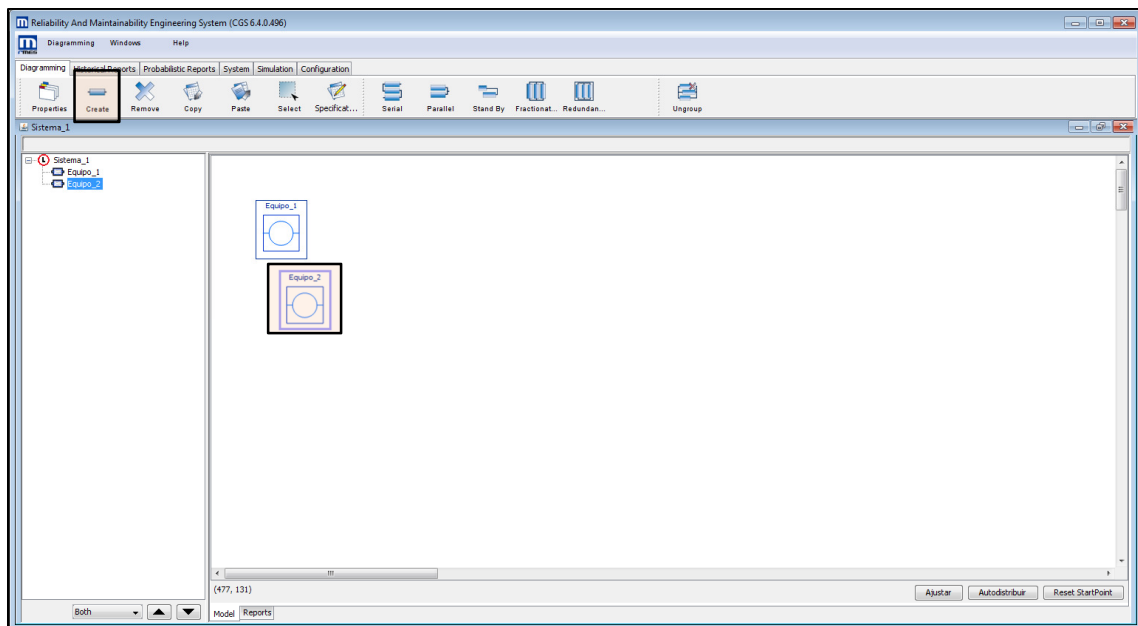
Characteristics

- Only pieces of equipment can be created this way, not configurations.
- Only one piece of equipment can be created at a time. When a piece of equipment is created in an already existing configuration in fractionation, the impact of each diagram node within it changes, calculated proportionately to the new quantity of equipment. If you do not want the impacts to be proportionate, they must be changed in the **Properties** of the **Logical-Functional Configuration in Fractionation**. For more information, go to the item **Properties** in the section **Toolbar** in this manual.

- To change the properties of the new piece of equipment, go to the window **Equipment Properties**. For more information, see the item **Properties** In the section **Diagram** in this document.
- A piece of equipment must be created before uploading it to the database, or rather, if it is already imported it has to be uploaded again, because if not, the new equipment will not contain data.

Example

Click “Create” on the **Diagram** toolbar.



Equipment 2 is created because by default when creating a new workspace is created with equipment incorporated.

Diagram Tab: Eliminate

Eliminate the selected diagram nodes.

Procedure

- First select the diagram node(s) to be eliminated from the **Workspace**.

- Next, select the icon “**Eliminate**” (✕) from the **Diagram** toolbar or press the button “**Delete**” on the keyboard. This will open a new window where you will be asked to confirm the elimination of the selected node(s).

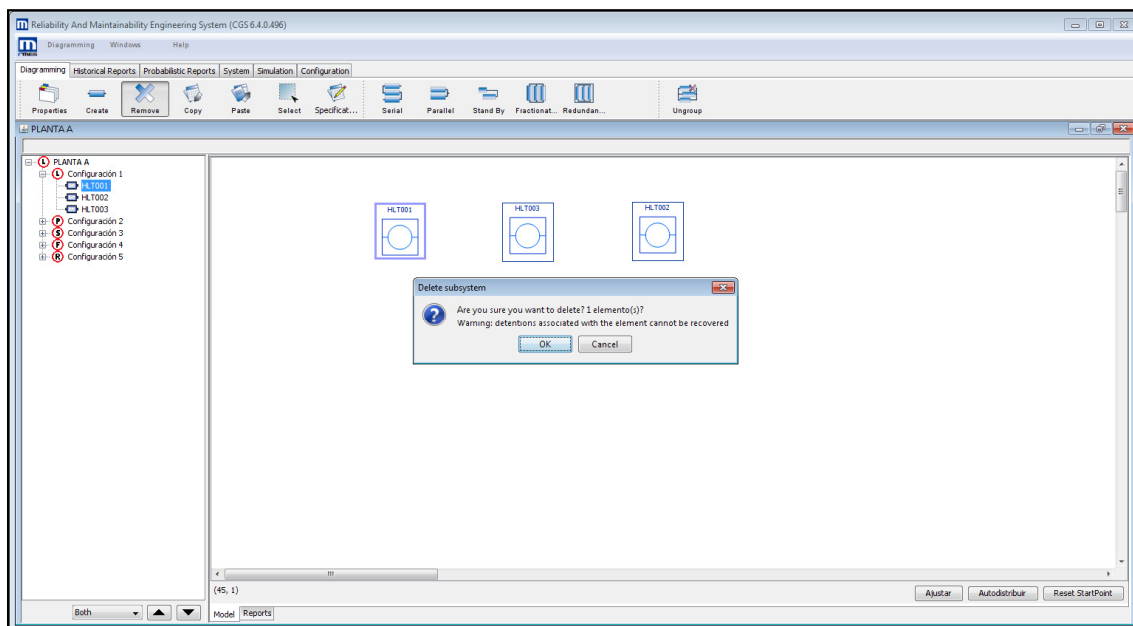
Characteristics

- More than one diagram node can be eliminated at a time.
- It is not possible to eliminate all pieces of equipment of a configuration, since the configuration would not contain the minimum quantity to satisfy it (a configuration must contain at least one piece of equipment, and in some cases two). If you want to eliminate all pieces of equipment from a configuration, but not the configuration itself, it is recommended that you create new pieces of equipment within the configuration first and then eliminate the old ones.

Example

Remove an equipment

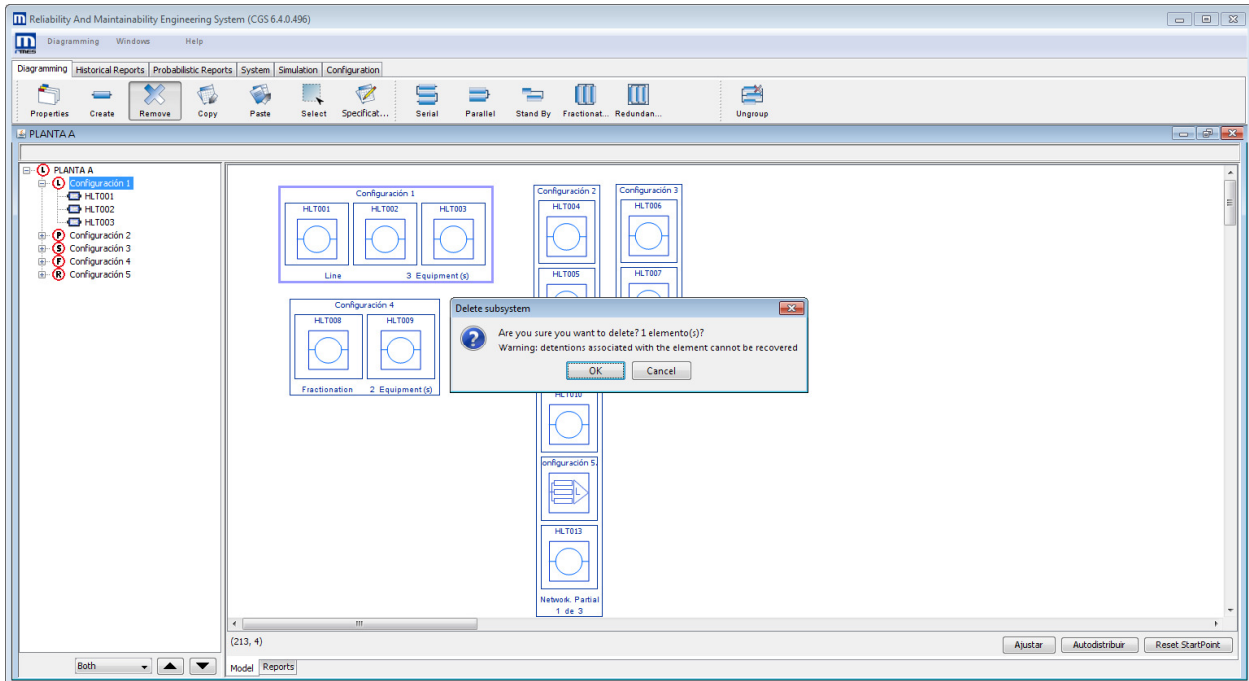
Select the equipment and click the icon “**Remove**” on the **Diagram** toolbar.



In the window that opens click “**Accept**” and the selected piece of equipment will be eliminated.

Remove a configuration

Select a configuration and click the icon “**Remove**” on the **Diagram** toolbar.




In the window that opens click “**Accept**”, which eliminates the selected configuration.

Diagram Tab: Copy

Copy the selected diagram nodes.

Procedure

- Select the diagram node(s) to copy. The equipment can be selected in the **Diagram Space** or in the **Navigation Tree** and the configurations can only be selected in the **Diagram Space**.
- Next, click on the icon “**Copy**” () on the **Diagram** toolbar, or press **Ctrl + Shift + C** on the keyboard.

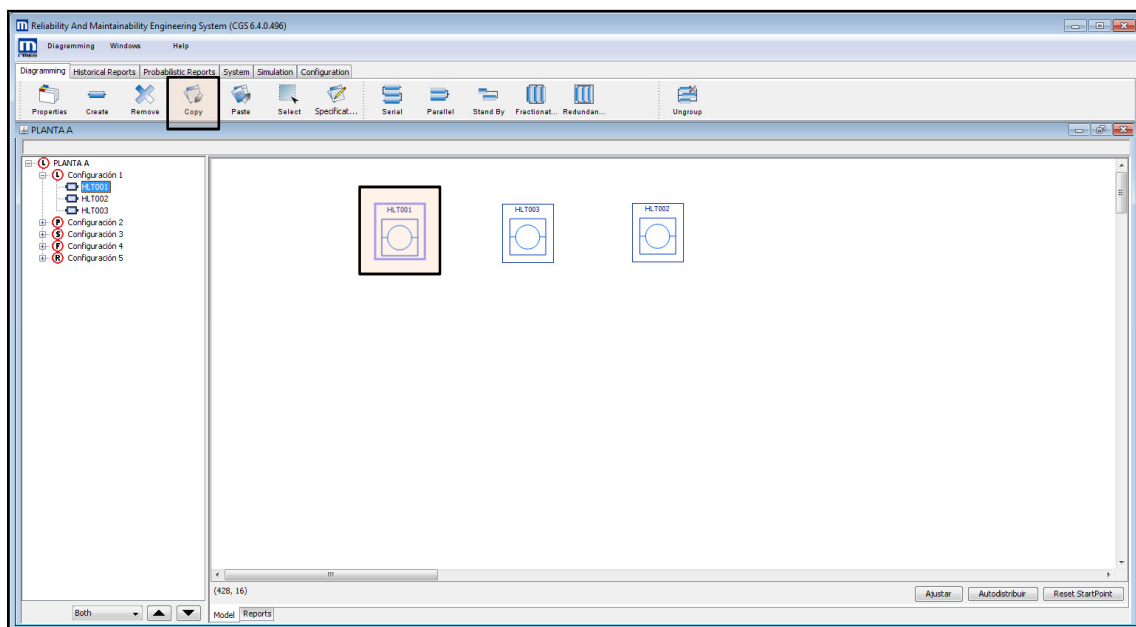
Characteristics

- More than one diagram node can be copied at a time.
- Both the data of the piece of equipment and its properties are copied, except for the name and nickname since the words ***“COPY 1 OF...”*** are put in before the name.

Example

Copy a piece of equipment

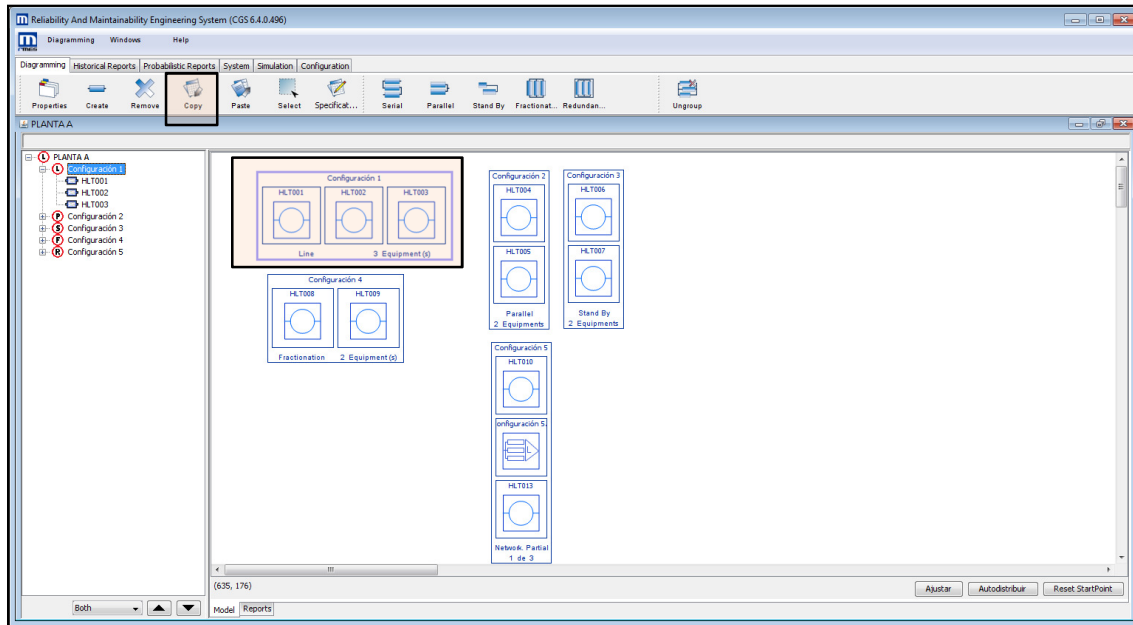
Select the piece of equipment HLT001 and click the icon **“Copy”** on the **Diagram** toolbar.



This will copy the selected piece of equipment. To complete the process and duplicate the item must press the Paste button, which is explained below.

Copy a configuration

Select Configuration 1 and click the icon “Copy” on the **Diagram** toolbar.




This will copy the selected configuration.

Diagram Tab: Paste

Paste the selected diagram nodes.

Procedure

- Before pasting, one or more diagram nodes (equipment and/or configurations) must have been copied.
- In the **Navigation Tree** select the system or configuration the diagram node will be pasted into.
- Select the icon “Paste” () on the **Diagram** toolbar or press **Ctrl + Shift + V** on the keyboard. This will automatically add the copied diagram node(s).

Characteristics

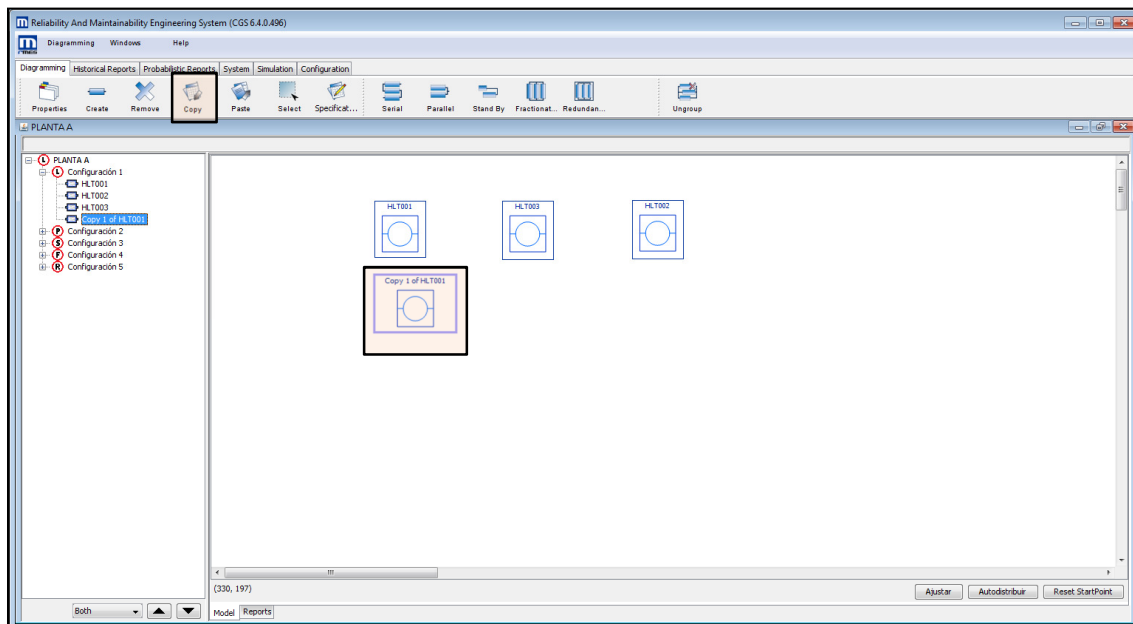
- If more than one diagram node was copied, they will all be pasted when you choose the option **“Paste”**.
- The newly pasted diagram nodes have the same data and properties of the diagram nodes that were copied, except for the name and code, since the words **“COPY OF...”** are put in before the name.
- When one or more diagram nodes are pasted into a configuration in fractionation, the impact of each diagram node within it changes, calculated proportionately to the new quantity of equipment. If you do not want them to be proportionate, change the impacts in the **Properties** of the configuration in fractionation. For more information go to the item **Properties** under the **Diagram** toolbar section in this manual.

Example

Paste a piece of equipment

Select Configuration 4 in the **Navigation Tree** and click the icon **“Paste”** on the **Diagram** toolbar. Previously, the piece of equipment **HLT001** had been copied, so pasting duplicates that node.

The new piece of equipment is called: **Copy 1 of HLT001**.



The new piece of equipment is called: **Copy 1 of HLT001**

The properties of the piece of equipment **Copy 1 of HLT001** are:

The screenshot shows the 'Properties' dialog box for equipment 'Copy 1 of HLT001'. The dialog is divided into two main sections: 'Equipment Properties' and 'Equipment Indicators' on the left, and 'Data Source' and 'TBF' on the right.

Equipment Properties:

- Name: Copy 1 of HLT001
- Equipment Code: Copy 1 of 101
- Alias: Edit
- Impact: 100,00 %
- Failures Catalog: Select

Equipment Indicators:

- Manual (radio button) / Imported Data (radio button, selected)
- Failure Rate: 0,00002 [1/H] / 0,00002
- Mean Time Between Failure: 49.999,99 [H] / 50.000,00
- Mean Time To Repair: 1,00 [H] / 0,00
- Mean Time To Intervention: 1,00 [H] / 0,00
- Operation Time (OT): 1,00 [H] / 25.000,00
- Average Intervention Cost: 0,00 [\$] / 0,00
- Capex: 0,00000 [\$]
- Fixed Opex: 0,00000 [\$]
- Variable Opex: 0,00000 [\$]
- Scaling Index: 0,00000
- Productive Capacity: 0,00000 [unid. x h...]

Data Source:

- Node: Copy 1 of HLT001
- Current Repository: None (Clean)
- Create from CSV: (Create)
- Repositories: Repositorio_0 (Use)
- SAP: (Estimate, View/Edit)

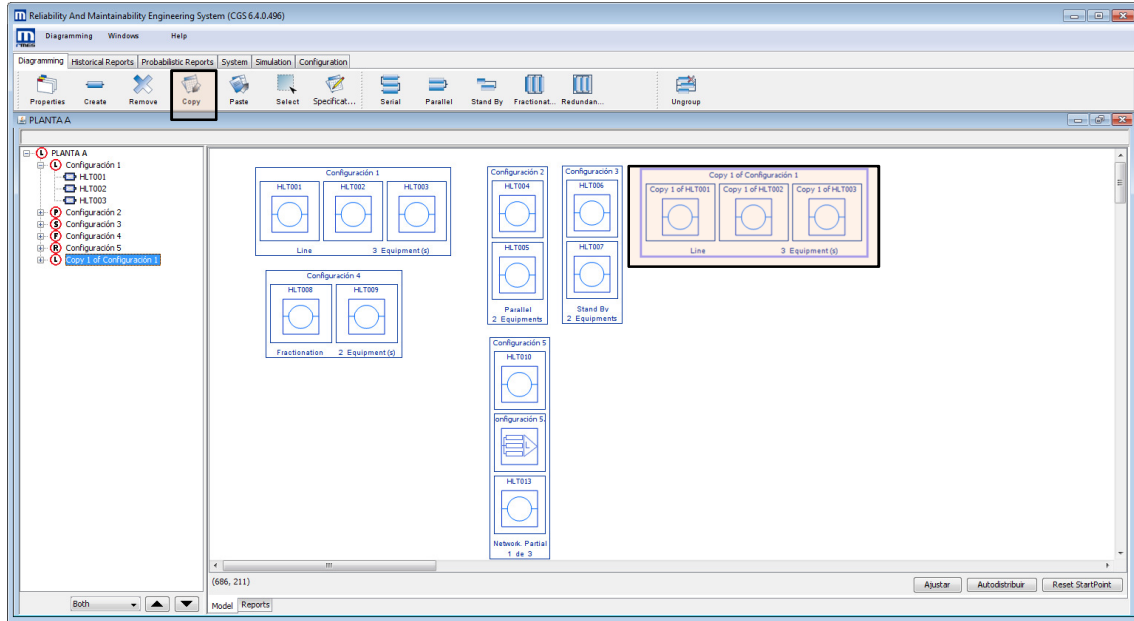
TBF:

A graph showing Absolute Frequency (Y-axis, 0.0 to 1.0) versus Mean Time Between Failure [H] (X-axis). The graph is currently empty.

This piece of equipment acquires all the data of the equipment it is a copy of, except the name, code and the imported data.

Paste a configuration

Select Plant A in the **Navigation Tree** and click the icon **“Paste”** on the **Diagram** toolbar. Previously, Configuration 1 had been copied, so pasting duplicates this configuration. The new diagram node is called: **Copy 1 Configuration 1**.



The properties of the node **Configuration 1** are:

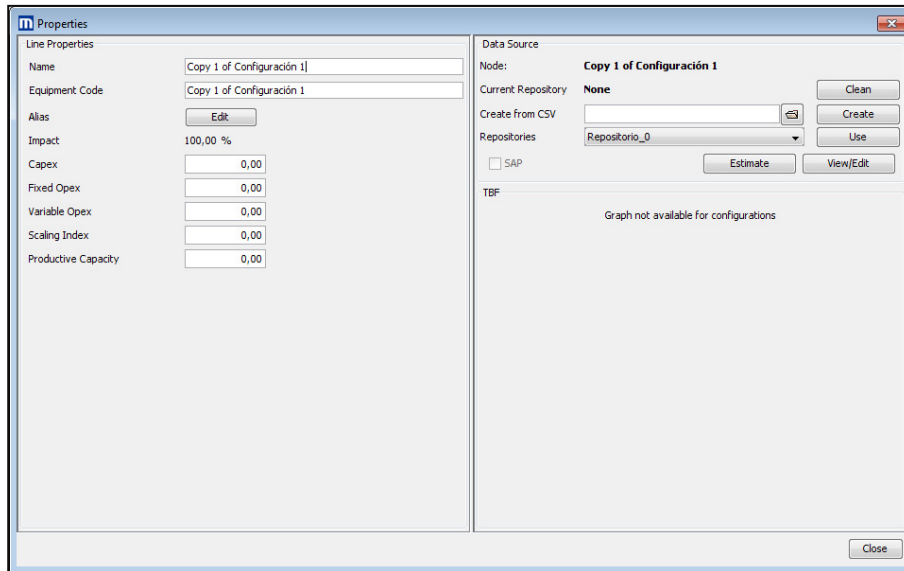



Diagram Tab: Select

Select all of the diagram nodes visible in the **Diagram Space**.

Procedure

- View the nodes to be selected in the **Diagram Space**.

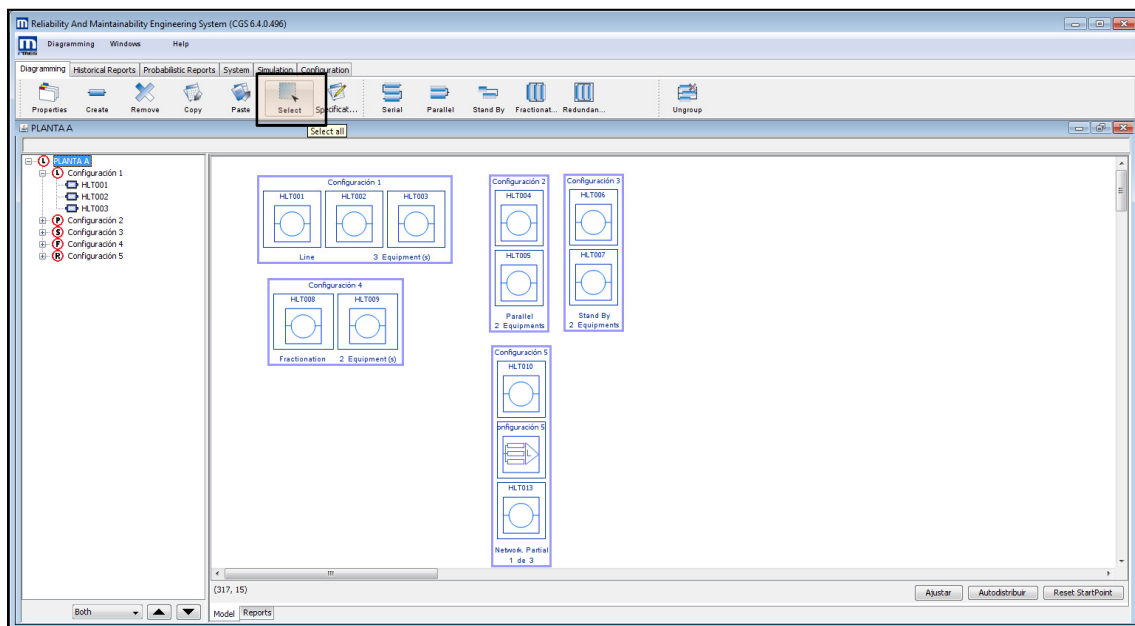
- Click on the icon “**Select**” () on the **Diagram** toolbar or press **Shift + A** on the keyboard.

Characteristics

- When the diagram nodes are selected, the borderlines in the **Diagram Space** will appear thicker.
- When you click the icon “**Select**” all of the nodes visible in the **Diagram Space** will be selected, but if you want to select less diagram nodes than the ones shown, follow these steps:
 - In the **Diagram Space** with the mouse left-click on the upper left-hand corner of the area that contains the diagram nodes to be selected.
 - Drag the arrow diagonally towards the lower right-hand corner of the area that contains the nodes to be selected.
- If you want to select one node, just click on it in the **Diagram Space** or in the **Navigation Tree**.

Example

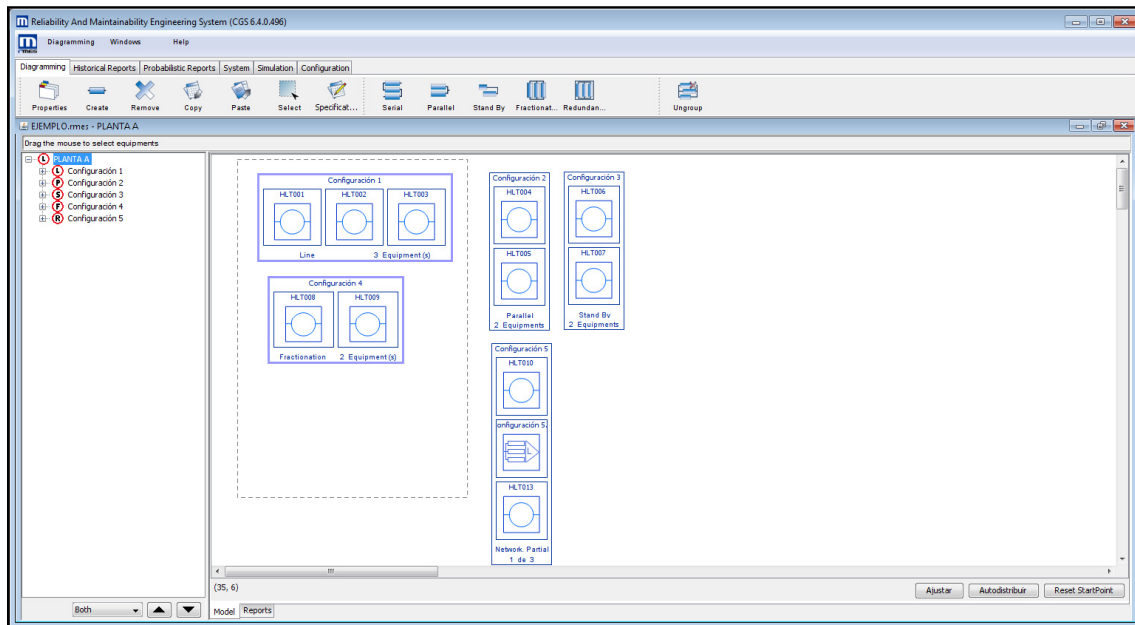
Display the System (Plant A) in the **Diagram Space** and click the icon “**Select**” on the **Diagram** toolbar.



The borderlines of all the configurations will appear thicker, which means that they are selected.

Partial Selection

Drag the mouse from one corner to the opposite corner, leaving all of the diagram nodes to be selected inside.




When you drag the mouse, a dotted line shows the area selected.


Diagram Tab: Specifications

Enables you to write specifications for a diagram node.

Procedure

- Select the icon **“Specifications”** () on the **Diagram** toolbar. This will open a window where you can write the necessary specifications.

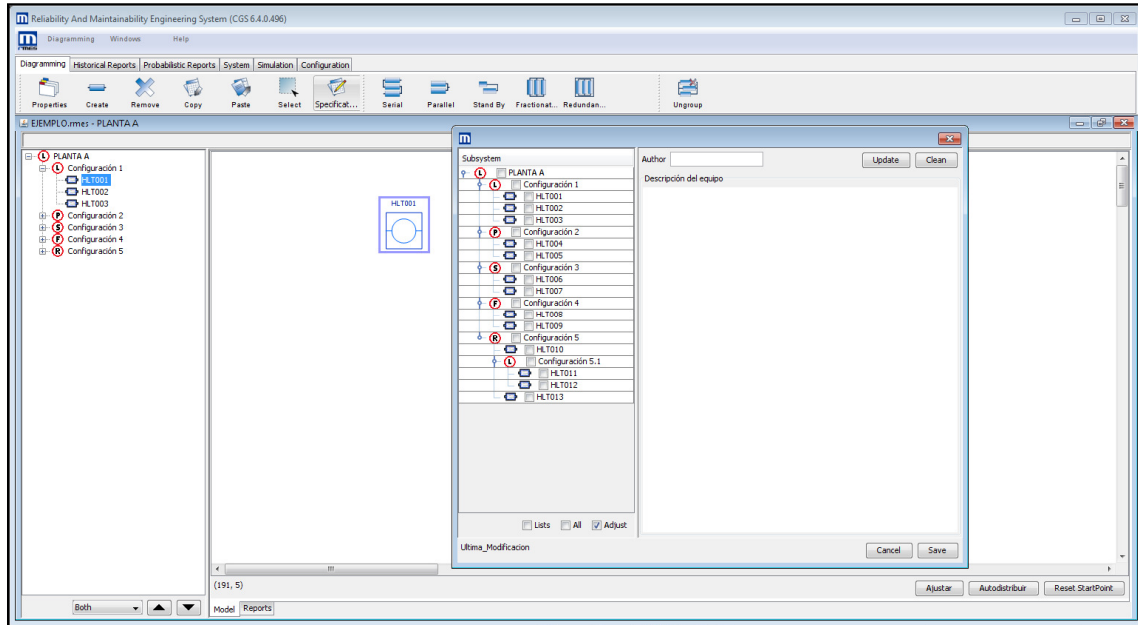
Characteristics

- To review and/or modify specifications that were entered later, select the diagram node and then choose the option **“Specifications”** () on the **Diagram** toolbar.
- The same note can be stored for more than one equipment at a time.

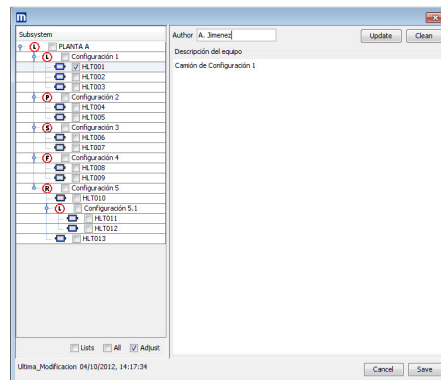
Example

Specifications of equipment

Select the the icon “Specifications” on the **Diagram** toolbar.



Select in the tree the equipment HLT001, Write “Camión de configuración 1”, then press update button and finally the save button.



To specify a configuration the process is the same, but instead of selecting equipment in the tree a configuration is selected.


Diagram Tab: Series

Generate a **logical-functional configuration in Series**


In a **logical-functional configuration in Series** the failure of any diagram node component (equipment and/or configurations) provokes a shutdown of the system it belongs to.

In particular, there is no Redundancy in this configuration, which translates to a 1:1 ratio between the shutdown of the diagram nodes that make up the configuration, as long as there is no nesting or overlap.

Procedure

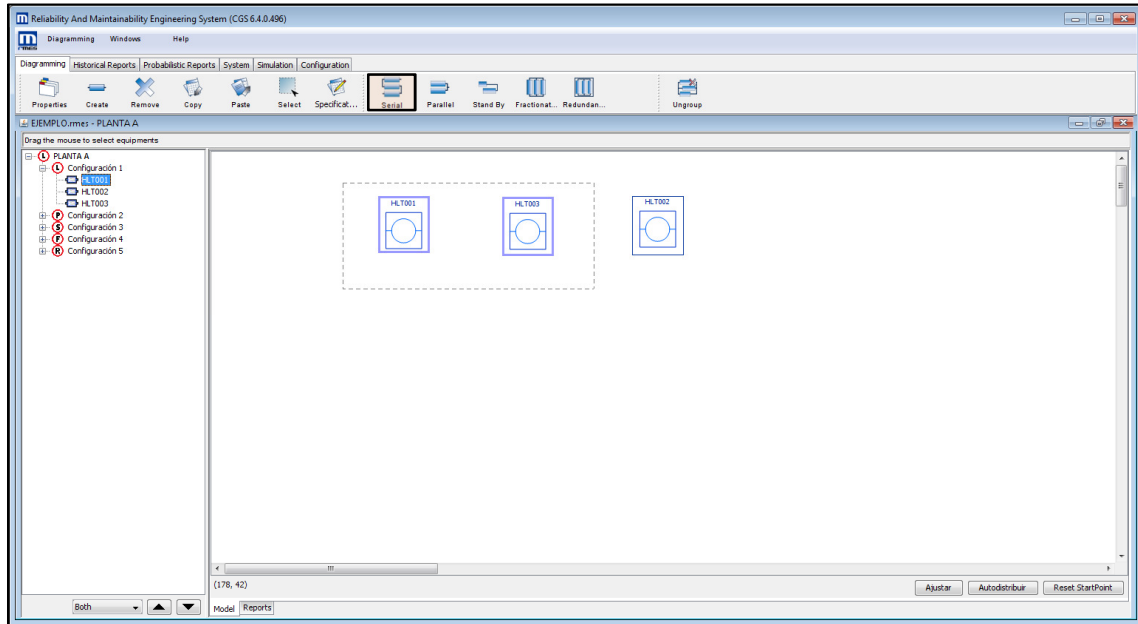
- Select the group of diagram nodes (equipment and/or configurations) in the **Workspace** that will comprise the **Logical-functional Configuration in Series**.
- Next click on the icon “Series” () on the **Diagram** toolbar, or press **Ctrl + L** on the keyboard. This will create a **Logical-functional Configuration in Series**.

Characteristics

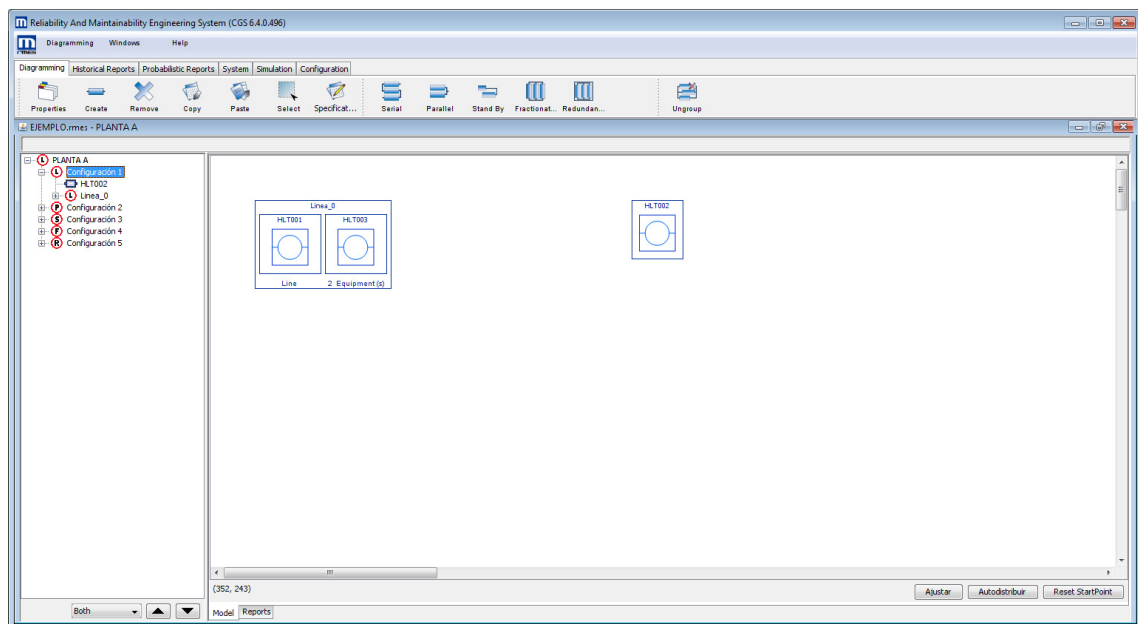
- The minimum number of diagram nodes that a **Logical-functional Configuration in Series** may contain is 1.
- If the **Logical-functional Configuration in Series** is made up of configurations, it is not necessary for them to also be in **Series**.
- The **Logical-functional Configurations in Series** appear in the **Navigation Tree** with the symbol .

Example

Select two equipments



And then click the icon “Series” on the **Diagram** toolbar.



In this **Logical-functional Configuration**:

- If one piece of equipment fails, this configuration will stop production.
- If two pieces of equipment fail, there is no production.


Diagram Tab: Parallel

Generate a **Logical-functional Configuration in Parallel**.


The **Logical-functional Configuration in Parallel** relates to two or more diagram nodes (equipment and/or configurations), each one capable of supporting the total load of the phase of the process. Therefore, they are totally redundant systems.

In the **Logical-functional Configuration in Parallel** there is total redundancy in the system, since each diagram node by itself can carry out the function demanded by the system. In other words, a system shutdown is only verified if all the diagram nodes are shutdown.

Procedure

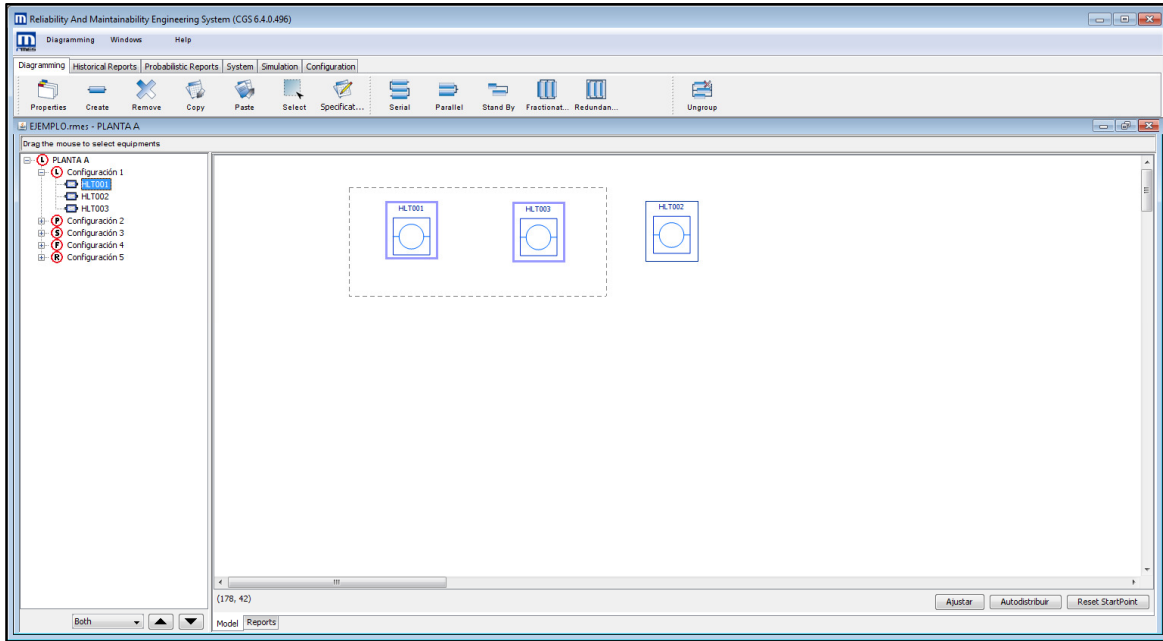
- Select the group of diagram nodes (equipment and/or configurations) in the **Workspace** that will constitute the **Logical-functional Configuration in Parallel**.
- Next select the option “Parallel” () on the **Diagram** toolbar or press **Ctrl + P** on the keyboard. Doing that will create a **Logical-functional Configuration in Parallel**.

Characteristics

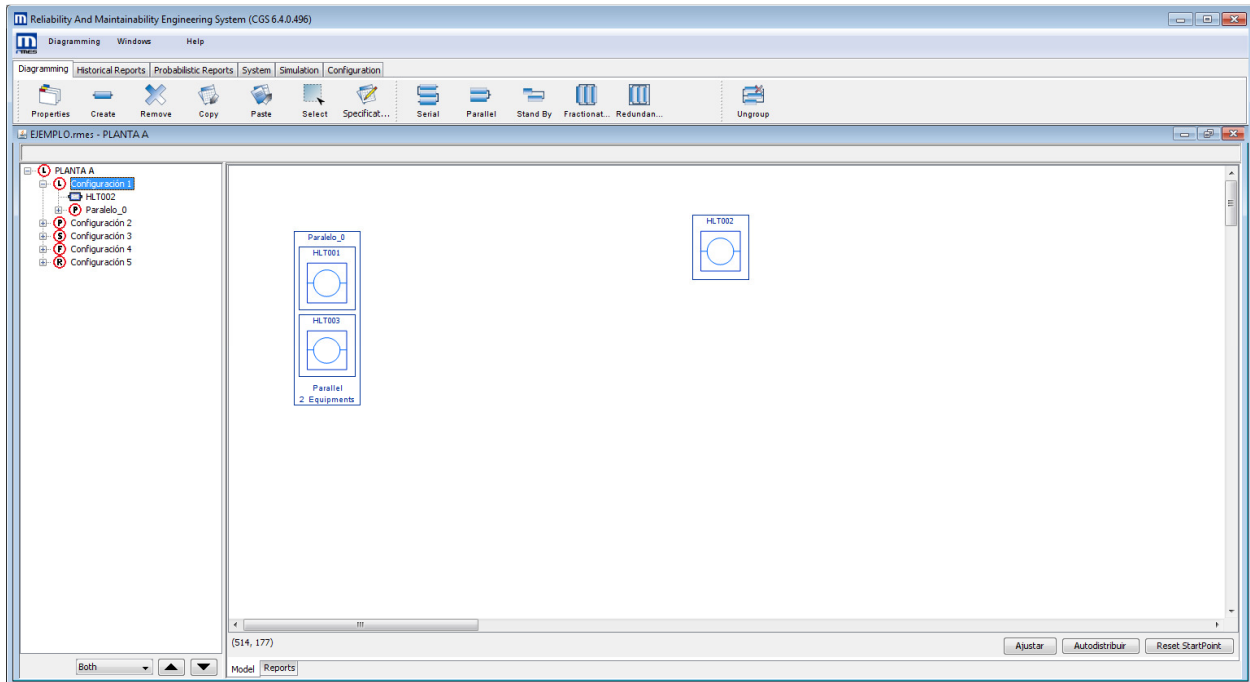
- The minimum number of diagram nodes that a **Logical-functional Configuration** must have is 2 and the maximum is 3.
- If the **Logical-functional Configuration in Parallel** is made up of configurations, it is not necessary for them to also be in **Parallel**.
- The **Logical-functional Configurations in Parallel** cannot contain configurations in **Fractionation**.
- The **Logical-functional Configurations in Parallel** appears in the **Navigation Tree** with the symbol .

Example

Select two equipments.



Then click the icon “Parallel” on the **Diagram** toolbar.



In this **Logical-functional Configuration**:

- If one piece of equipment fails, the productive capacity of the configuration is not affected.
- If two pieces of equipment fail, the production of the configuration is zero.


Diagram Tab: Stand-by

Generate a **Logical-functional Configuration in Stand-by**.


The **Logical-functional Configuration in Stand-by** is composed of two diagram nodes (equipment and/or configurations), one primary and one secondary. The primary node operates until it fails and when it does it is replaced by the second node, which is capable of supporting 100% of the capacity of the first node. The failure in the configuration is verified when the diagram nodes fail simultaneously.

Additionally, the **Logical-Functional Configuration in Stand-by** is similar to the Parallel one, with the difference being that under normal operating conditions, one diagram node is functioning and the other in reserve, which is a more reliable system, but at the same time is running two systems at once.

Procedure

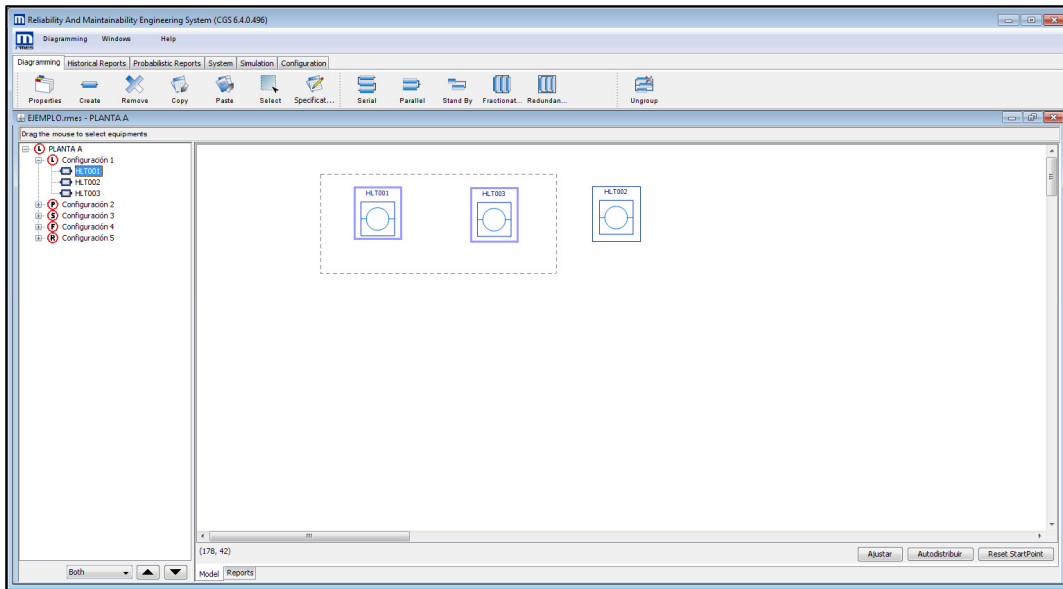
- In the **Workspace**, select the group of diagram nodes (equipment and/or configurations) which will constitute the **Logical-functional Configuration in Stand-by**.
- Next select the option “Stand-by” () or press **Ctrl + B** on the keyboard. Doing this will form a **Logical-functional Configuration in Stand-by**.

Characteristics

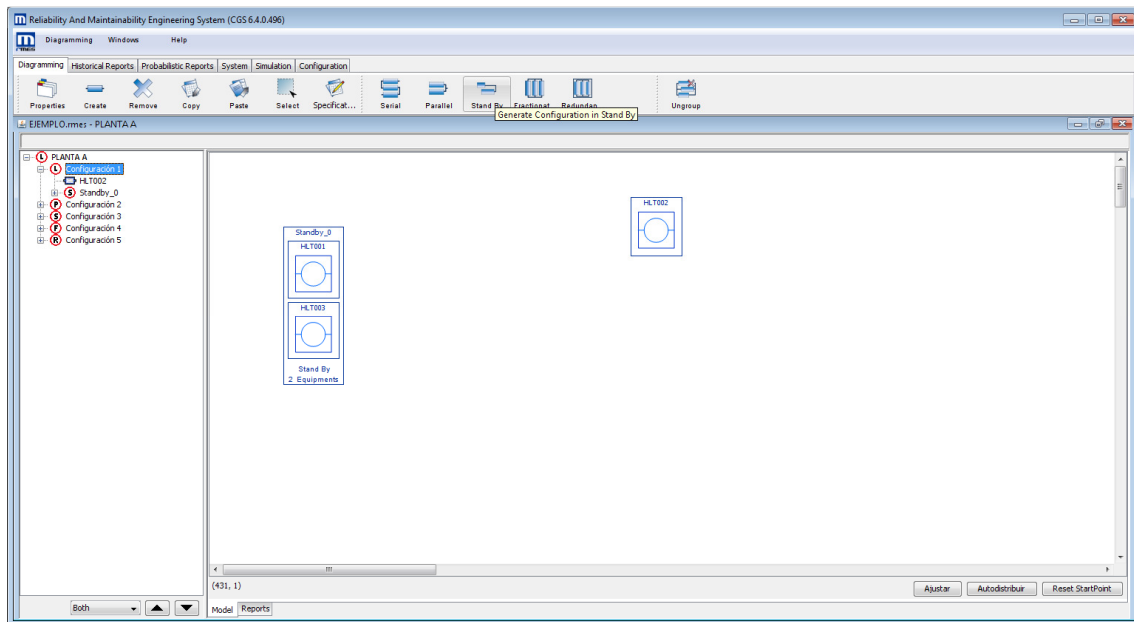
- This **Logical-Functional Configuration** can only be created with two diagram nodes.
- If the **Logical-functional Configuration in Stand-by** is made up of configurations, it is not necessary for them to also be in **Stand-by**.
- **Logical-functional Configurations in Stand-by** cannot contain configurations in **Fractionation**.
- The configurations in **Logical-functional Configurations in Stand-by** in the **Navigation Tree** appear with the symbol  .

Example

Select equipments



Then click the icon “Stand By” on the **Diagram** toolbar.



In this **Logical-Functional Configuration**:

- If the piece of equipment that is running fails, the productive capacity of the configuration is not affected because the other piece of equipment will begin working.

- If both pieces of equipment fail, the production of this configuration will be zero.



Diagram Tab: Fractionation

Generate a **Logical-functional Configuration in Fractionation**.

The **Logical-functional Configuration in Fractionation** represents two or more diagram nodes (equipment and/or configurations) that split the total workload according to a weighting generally associated with the productive capacity of the nodes. The failure of one diagram node provokes a loss of productive capacity in the system proportionate to its level of impact.

It bears mentioning that in a fractionation due to redundancy, more diagram nodes are used than necessary, and each one has an impact within the system. For that reason it is possible for the excess nodes to fail without affecting the capacity demanded by the system.

Procedure


- In the **Workspace**, select the group of diagram nodes (equipment and/or configurations) that will make up the **Logical-functional Configuration in Fractionation**.
- Next, click on the icon “Fractionation” () on the **Diagram** toolbar or press **Ctrl + F** on the keyboard. This will open a window that contains options to create this configuration.
- In this window, you can choose between **Fractionation** or **Redundancy Fractionation**.
 - If you choose **Fractionation**, enter the impact for each diagram node.
 - If you choose **Fractionation Redundancy**, enter the **Equipment Running** (or **MinToWork**, minimum equipment necessary to fulfill the production required for the configuration) and then click “OK” (). The software considers the same impact for all nodes when the option **Fractionation Redundancy** is chosen.

In **Properties** of the configuration you can also enter the number of diagram nodes necessary for production (in the item **MinToWork**). For more information about this, go to the item **Properties** of the **Diagram** toolbar section in this manual.

- When you click “Accept” a **Logical-Functional Configuration in Fractionation** will be created.

Characteristics

- The minimum number of diagram nodes that a **Logical-Functional Configuration in Fractionation** must contain is 2.
- In **Fractionation** (not redundant) the impacts of the diagram nodes can be different.

- If the **Logical-Functional Configuration in Fractionation** is made up of configurations, it is not necessary for them to also be in **Fractionation**.
- The **Logical-Functional Configurations in Fractionation** in the **Navigation Tree** appear with the symbol .

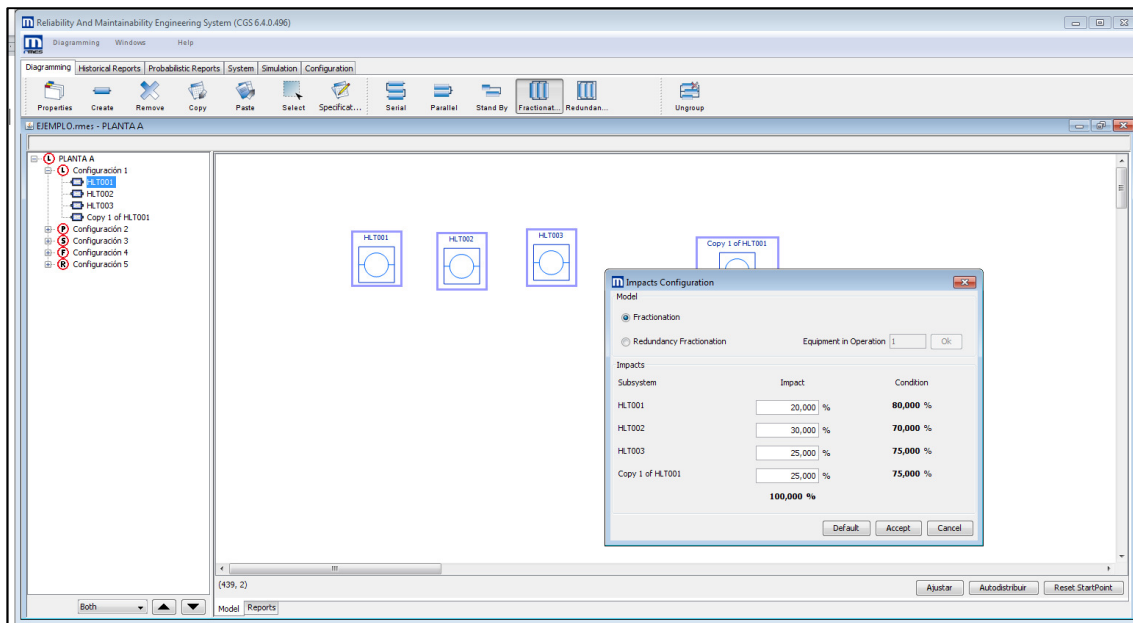
Example

Create a Logical-Functional Configuration in Fractionation

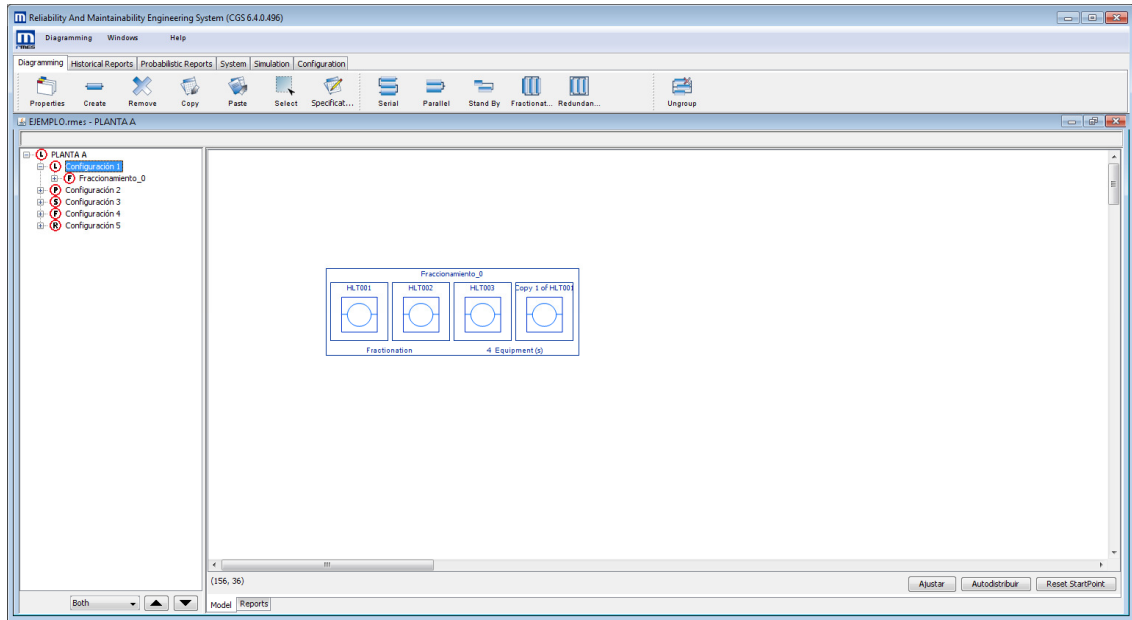
Select four pieces of equipment and click the icon “**Fractionation**” on the **Diagram** toolbar.

In the window that opens, select the option **Fractionation**.

In this case, Equipment HLT001 has an impact of 20% on the configuration (produces 20% of the total production), the impact of Equipment HLT002 is 30%, and HLT003 and Copy of HLT001 are 25%. Enter these impacts.



Click “**Accept**” to create the new configuration.



In this **Logical-Functional Configuration**:

- If Equipment 1 fails, the capacity of the configuration is reduced by 20%, meaning production will be at 80%.
- If Equipment 1 and 2 fail, the capacity of the configuration will be reduced by 50%, meaning production will be at 50%.

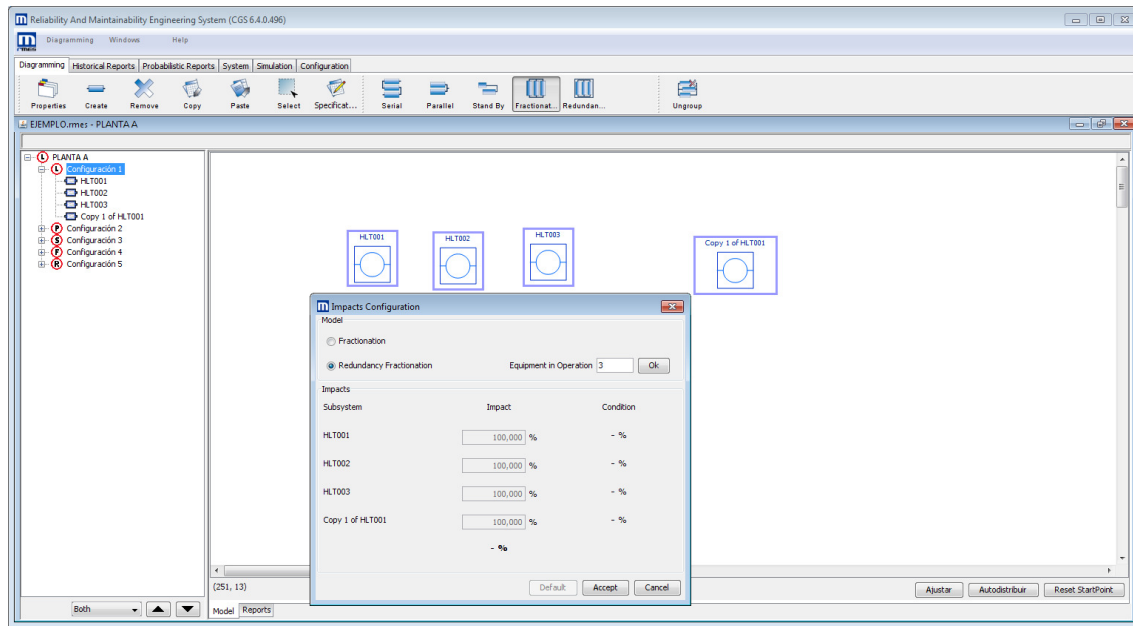
In conclusion, the reduction of the capacity of the configuration is proportionate to the impact of the equipment that fails.

Create a Logical-Functional Configuration in Fractionation with redundancy

Select four equipments and click the icon “**Fractionation**” on the **Diagram** toolbar.

In the window that opens select the option **Fractionation Redundancy** and enter 3 pieces of equipment in **Equipment Running**, and then click “**OK.**”

The number entered in **Equipment Running** means that 3 pieces of equipment are needed in order to produce 100% of production.



Click **“Accept”**, to create the new configuration.

In this **Logical-Functional Configuration**:

- If one piece of equipment fails, the production capacity is not affected (100% total production).
- If two pieces of equipment fail, production will be reduced by 33.33% (66.67% total production).
- If three pieces of equipment fail, production will be reduced by 66.67% (33.33% total production).
- If all pieces of equipment fail, there will be no production.

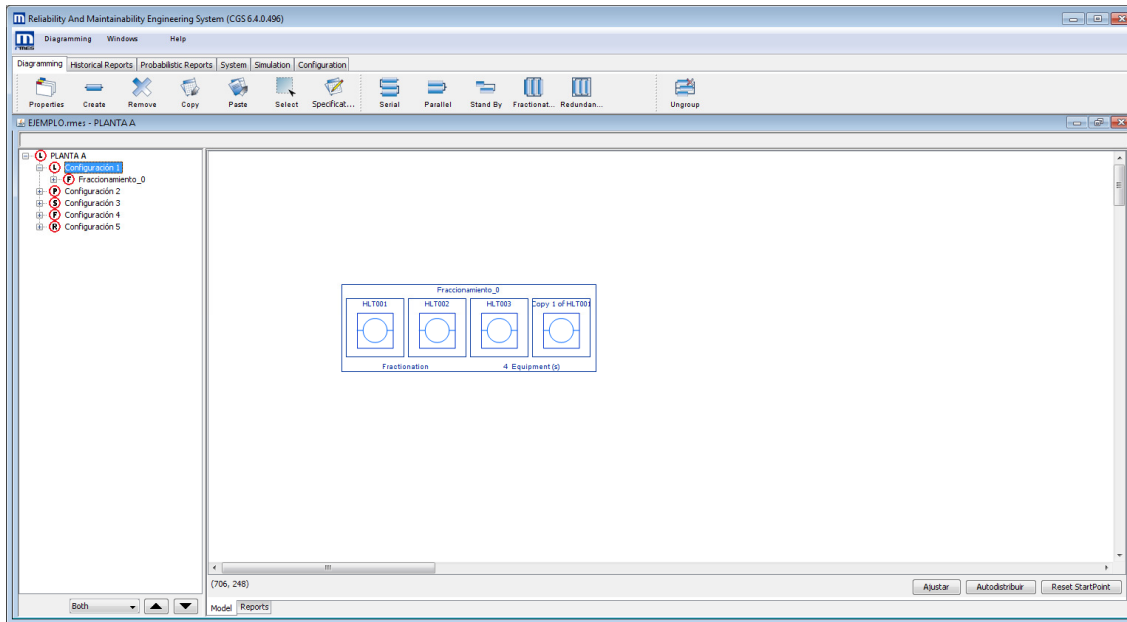


Diagram Tab: Partial Redundancy


Generate a **Logical-Functional Configuration in Partial Redundancy**.

The **Logical-Functional Configuration in Partial Redundancy** represents a system in which more diagram nodes (equipment and/or configurations) than necessary are used in order to fulfill the required production capacity. If the excess nodes fail, the capacity of the system is not affected. But if more diagram nodes fail than the minimum number necessary, the system will stop production. This can be defined as a system in series with redundancy.

Procedure

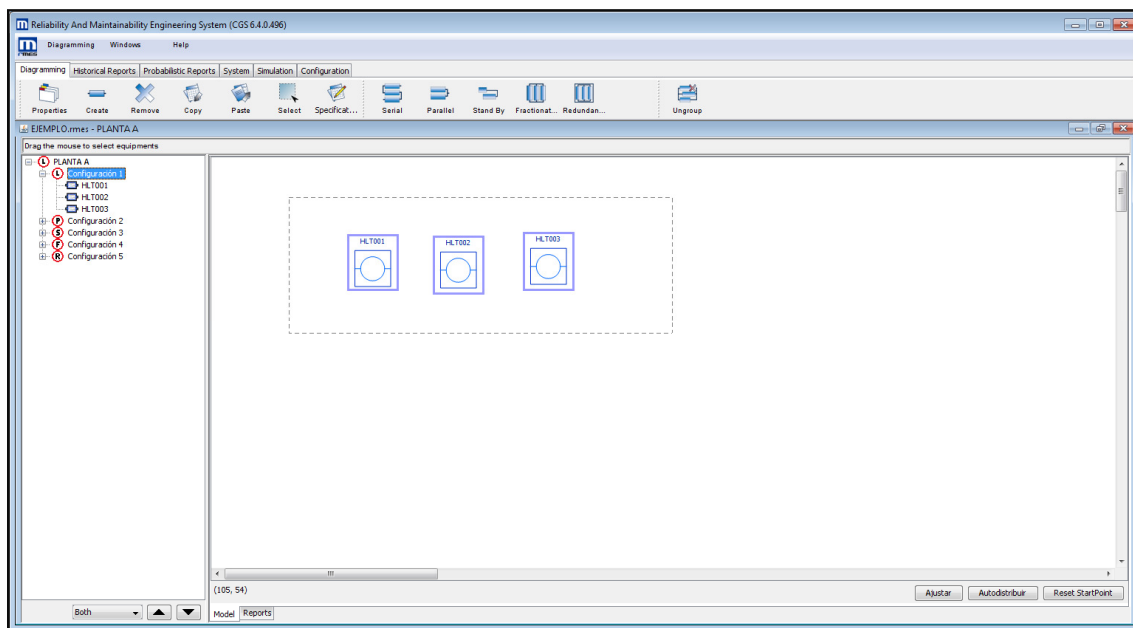
- In the **Workspace** select the group of diagram nodes that will make up the **Logical-Functional Configuration in Partial Redundancy**.
- Next, click the icon “**Partial Redundancy**” (📊) on the **Diagram** toolbar, or press **Ctrl + R** on the keyboard. This will create a **Logical-Functional Configuration in Partial Redundancy**.
- Go to the **Properties** of the recently created configuration to enter the minimum quantity of diagram nodes necessary for production (in the item MinToWork). For more information about this, go to the item **Properties** in the **Diagram** toolbar section in this manual.

Characteristics

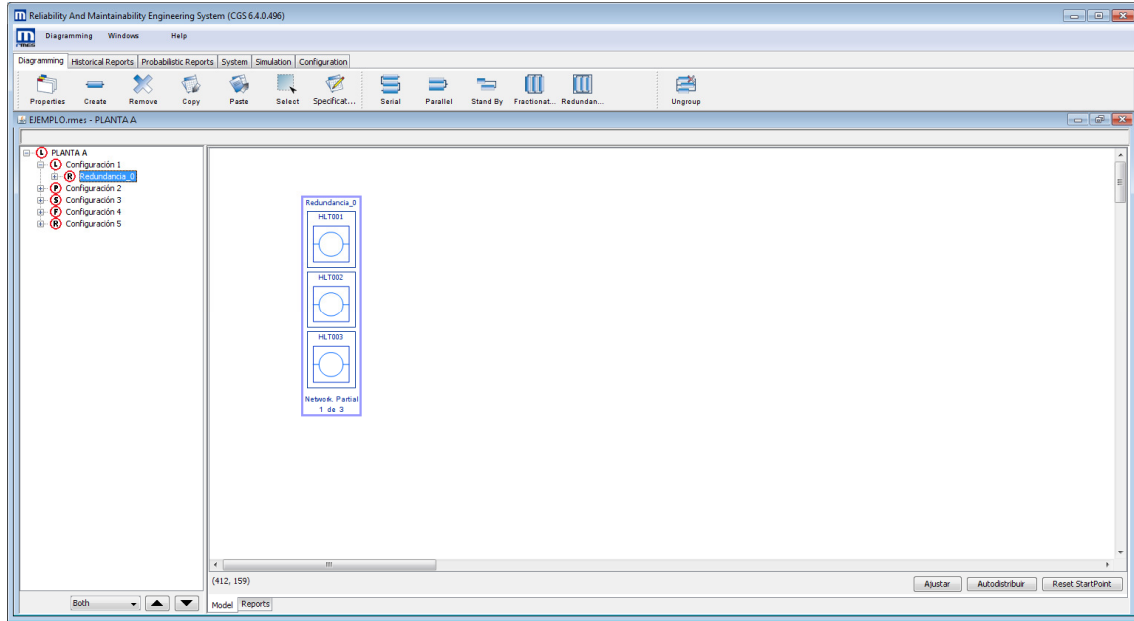
- The minimum number of diagram nodes that a **Logical-Functional Configuration in Partial Redundancy** must contain is 2.
- By default the software sets a **MinToWork** of 1 to create a configuration of this kind. To change this value, go to the window **Properties** of the configuration.
- If the **Logical-Functional Configuration in Partial Redundancy** is made up of configurations, it is not necessary for them to also be in **Partial Redundancy**.
- **Logical-Functional Configurations in Partial Redundancy** cannot contain configurations in **Fractionation**.
- **Logical-Functional Configurations in Partial Redundancy** in the **Navigation Tree** appears with the symbol .

Example

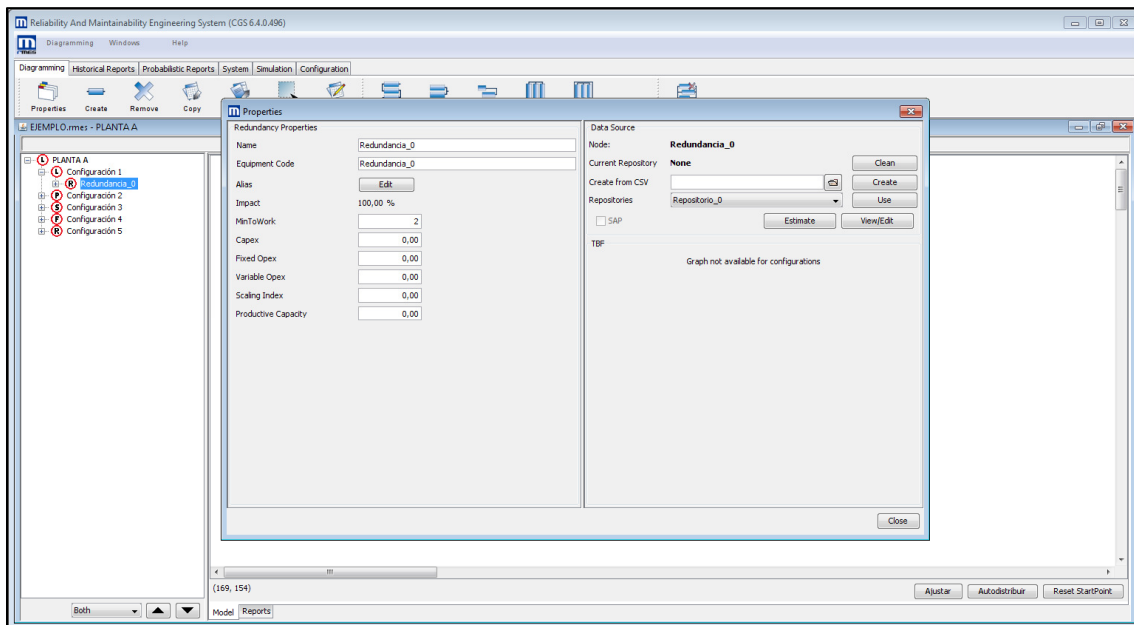
Select three equipments



Then click the icon “**Partial Redundancy**” on the **Diagram** toolbar.



This will create a configuration in **Partial Redundancy**, but in this example two pieces of equipment are necessary for production. This information must be entered in the properties of the configuration in partial redundancy. To do this, open the properties window of the configuration in partial redundancy. To do this, open the properties window of the configuration, go to the item **Properties** in the **Diagram** toolbar section in this manual.




In this **Logical-Functional Configuration**:

- If one piece of equipment fails, the production capacity is not affected.
- If two pieces of equipment fail, there will be no production (since two pieces of equipment need to be working).
- If all of the equipment fails, clearly there will be no production.

Diagram Tab: Ungroup

Ungroup the selected configurations.

Procedure

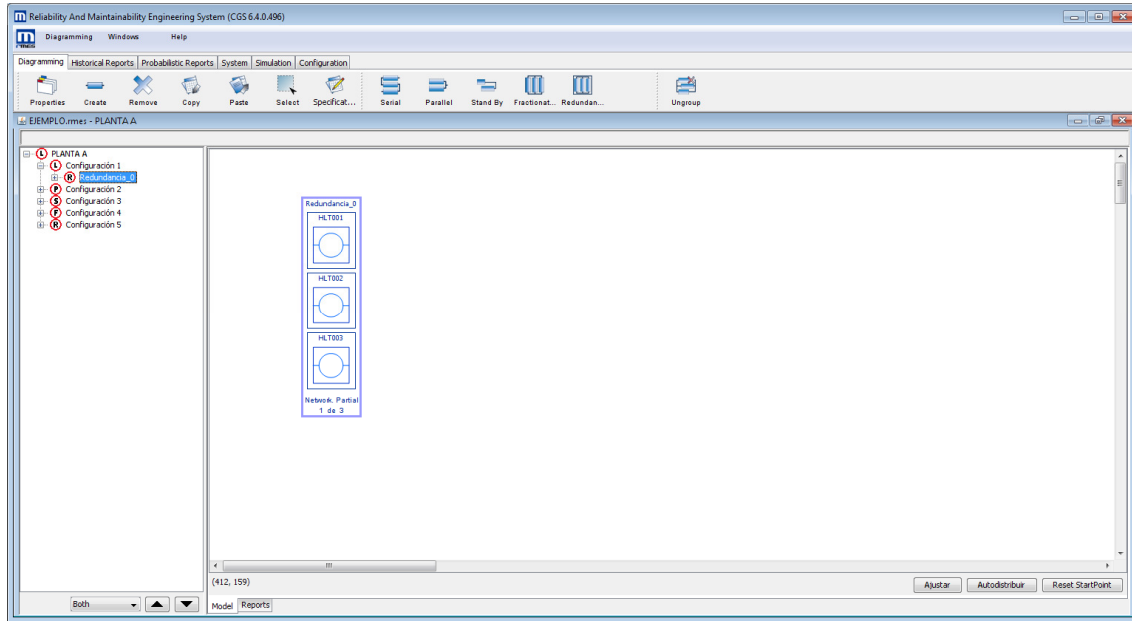
- In the **Workspace**, select the configuration to ungroup.
- Click on the icon “Ungroup” () on the **Diagram** toolbar, or press **Shift + D** on the keyboard.

Characteristics

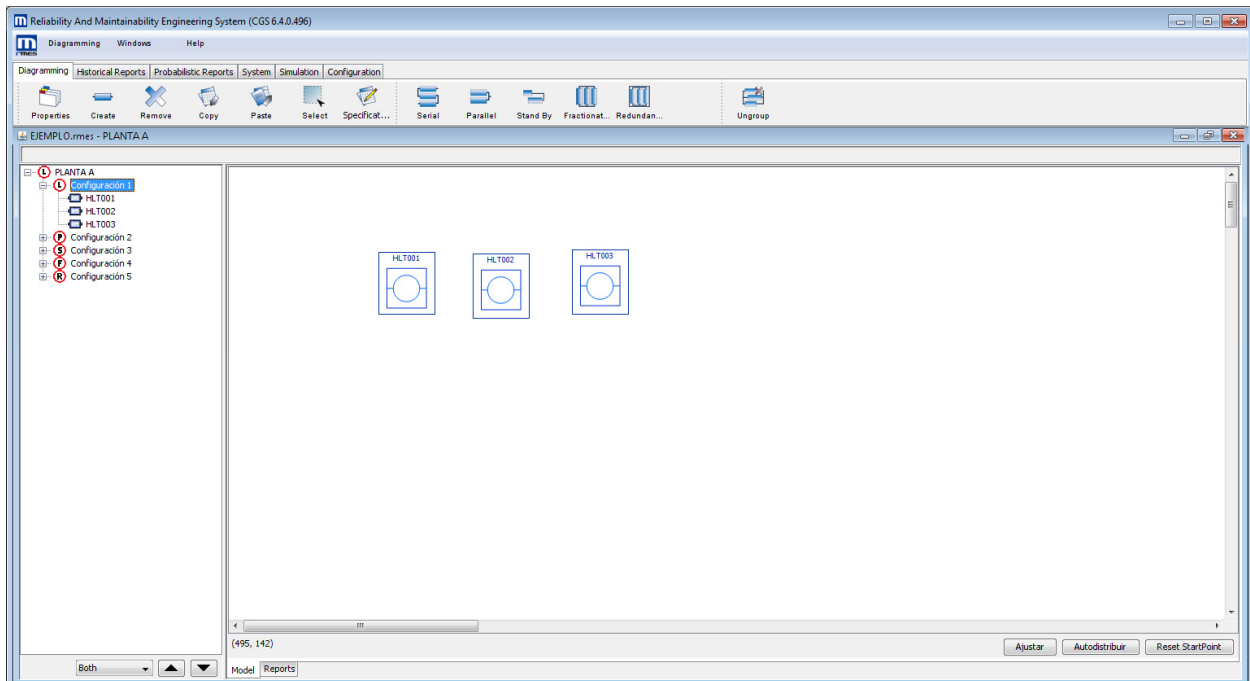
- Only one configuration can be ungrouped at a time.
- All types of configurations can be ungrouped.
- For configuration with fractionation, the impacts of the equipment take the standard value again (100%).
- Ungrouping can only be done in the **Diagram Space**.

Example

Select a configuration in the **Diagram Space**



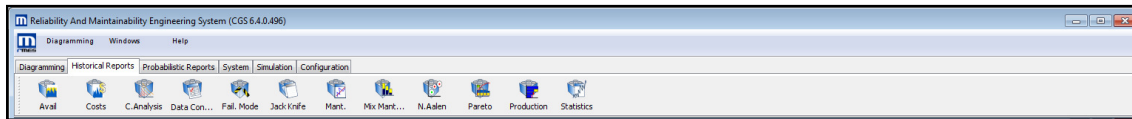
click the icon “Ungroup” on the **Diagram** toolbar.










Historical Reports Tab






This bar enables you to effectively determine the causes for production down time for a plant, configuration, or piece of equipment, defining the causes as operational or maintenance related. It also shows the productivity of a plant measured in units per hour available, identifying periods of overuse or low rate for the process, compared to its nominal capacity.

It should be mentioned that before doing any calculations in this tab, a diagram of the system must have been previously created in R-MES and the database must be uploaded. For information about how to create a diagram, see the item **Diagram** in the **Toolbar** section in this document, and to upload a database go to **Database** on the **System** toolbar.



Historical Reports Tab Options

Report	Icon	Direct Access	Brief Description
Availability		-	Identifies the sources of operation down time of the system and the main causes affecting the cost of the down time through an availability report, use report, and final use report.
Costs		-	The report obtains indicators for indirect cost, cost of the failure and overall cost for each of the diagram nodes.
Criticality Analysis		-	Quantifies the impact of a piece of equipment on the system (cost of the failure).
Verification and control		-	Keeps a record of data imported to the system, which enables a follow-up of maintenance activities to be done, using the work order number.
Failure Modes		-	This is for corrective maintenance activities. For each piece of equipment or component, the cause of the failure is included.
Jack Knife		-	Using Jack-Knife analysis, the dispersion of equipment and/or configurations can be obtained with respect to their mean time to repair and failure frequency.
Maintenance		-	Presents the indicators of Mean Time between Failures (MTBF) and Mean Time to Repair (MTTR) as measures of reliability and maintainability, respectively.

Report	Icon	Direct Access	Brief Description
Maintenance Mix		-	This report shows the structure of work orders carried out on a piece of equipment, defining the percentage of corrective vs. planned activities.
Nelson - Aalen Diagrams		-	Follow-up of the maintenance activities carried out on a piece of equipment as a function of calendar time.
Pareto		-	Equipment that is most relevant in terms of time and frequency of maintenance can be detected.
Production		-	Shows the actual production and target production by interval selected.
Statistics		-	Shows the statistical trends of the equipment and systems with their respective MTBF, MTBS, MTTR, and MTTI.

Historical Reports Tab: Availability


Identifies the sources of operational down time within a process, and the main causes impacting the cost of the failure through an availability, use and effective use report.

Availability and Use indicators are calculated in the following way: for availability indicators, down time attributable to maintenance activities is not counted, and the total calendar time of the period studied is used as a base. For use indicators time associated with operational shutdowns are not counted, and as with the availability indicators calendar time of the period studied is used as a reference. Therefore, these indicators provide a complete view of the impact that maintenance and operational shutdowns have on the process. It is important to consider that R-MES has logical algorithms to identify timely maintenance opportunities, which are done habitually taking advantage of the plant's operational or reserve shutdowns which do not affect the plant's unavailability but rather the utilization of the productive systems. In these cases, it is important to not lose the record of the activities that are considered for obtaining KPI's of the assets worked on.

Finally, the Effective Use indicator considers the time of use of the process, using the time available to operate as a base, providing an indicator isolating the operational effectiveness of the process studied. The analysis of the three indicators combined identifies the sources of operation down time of the process and the main causes affecting the cost of the failure.

The ease of obtaining these indicators is an important factor of the R-MES system, since the user only has to define the time period to be analyzed and the interval calculated (metric period) for the system to deliver the KPI's for the whole logical-functional configuration tree automatically. It is also possible to graph the indicators together and establish a trend analysis of the indicator as a function of time.

Procedure

- Select the icon “**Avail.**” () on the **Historical Reports** toolbar. This will open a window with the **Structural Tree** of the system. In this window are three tabs, one for **Availability**, another for **Use** and a third for **Effective Use**.
- Enter the start and end dates of the study in the items **From** and **Until**.
- Enter the **Period** of calculation: How often you want the indicators to be calculated.
- When you click “**Calculate**” the software delivers the values for **Availability, Use, and Effective Use**, for each piece of equipment, configuration, and the system.
- If desired, the data generated can be exported by clicking “**Export.**”
- If desired, the data generated can be graphed by clicking “**Graph**”.


Characteristics




- Using the option **Adjust**, you can arrange the data calculated in the window so that all of them are visible to the user.
- The indicators are calculated for all equipment and configurations, independently of those selected in the **Structural Tree**.
- When you click “**Calculate**” once, all the indicators are calculated (**Availability, Use, Effective Use**) at the same time.
- The start and end dates must be such that at least once containing the selected metric, eg if I select as the separation metric weeks From-To dates cannot be less than seven days.
- If you are studying only one time period, only dots will be shown on the graphs.

This report also allows the calculation is performed in groups of periods or cycles defined by the user. This option is available when you select the "Configurable" which is located in the "Outline". You can use the administrator to configure the cycle periods.

Options to enter start and end dates for the study

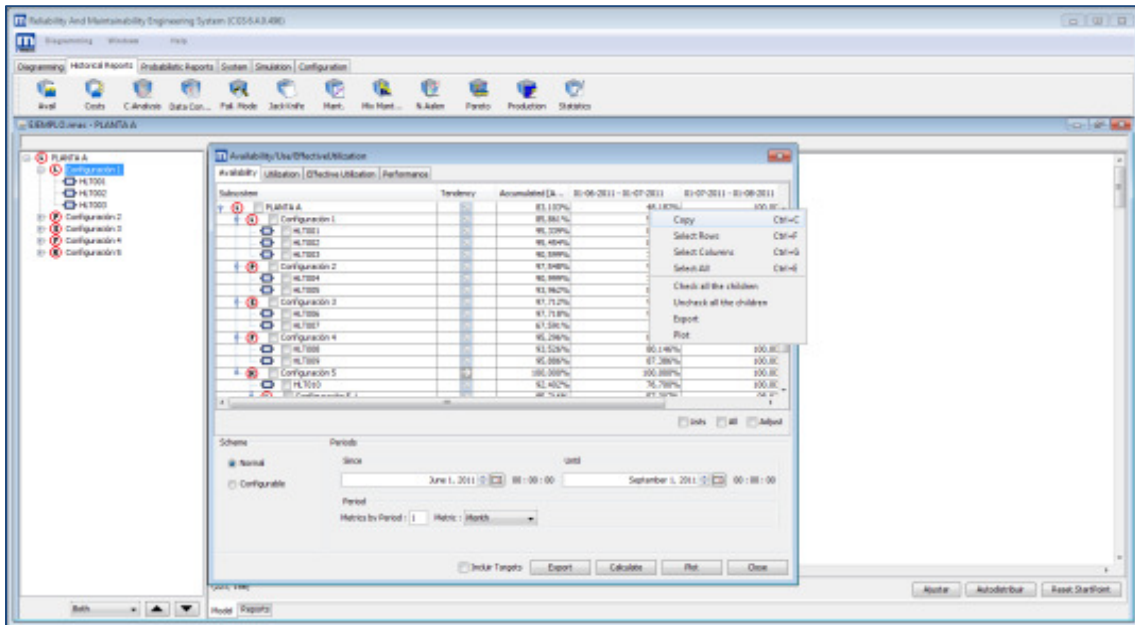
To enter start and end dates for the study, in the items **From** and **Until** there are three alternatives:

- For both the start date (**From**) and the end date (**Until**), click , and in the calendar displayed first select the year, then the month, and lastly the day.
- Another way is to type the dates in each item, in the text boxes, in the format: **MONTH, DAY, YEAR**.

- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard. If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar. For more information about this, go to that item in this document.

Option for selecting data from the data grid

Having generated the data grid, you can perform certain actions with data generated select any or all of them, then press the right button, a menu appears with the following options



Copy: Copy the selected data.

Select Rows: Select the rows of data selected.

Select Columns: Select the columns of data selected.

Select all: Select the whole data grid.

Check all equipment: Check all equipment in the configuration that the selected nodes belong to.

Uncheck all equipment: Uncheck all pieces of equipment in the configuration that the selected nodes belong to.

Export: Exports the failures that generate the KPI in the selected cell.

Graph: Graph failures that generate the KPI in the selected cell.

Options for selecting diagram nodes

To graph or export data, the diagram nodes needed must be selected. To do this, there are the following alternatives:

- They can be selected directly in the **Structural Tree** in the **Availability** window.
- If you want to graph or export all of the diagram nodes, select the option **All** in the **Availability** window.
- When only groups of nodes are needed, select the option **Lists** in the **Availability** window. The lists or groups of diagram nodes must be created previously, in the option **List Adm.** on the **Configuration** toolbar. For more information about this, go to the item **List Adm.** under the **Configuration** toolbar section of this document.

Selecting data must be done in the **Structural Tree** of each one of the three tabs.

Options to export data grid

The exportation window that opens when you click **“Export”**, contains the following options:

- There is an option to export all the reports generated (**Availability, Use, and Effective Use**) or only selected reports.
- It is also possible to export all the diagram nodes or only those previously selected in the **Structural Tree**.
- There is also the option to choose the format for the exported document (Excel, HTML, CSV or XML).

Graph Options

Before clicking **“Graph”**, you can enter target values for the indicators in the following option by the button **“Export”** in the **Availability** window:

- **Include Targets** provides the option to enter the target values for the indicators (**Availability, Use, and Effective Use**) to later be graphed.

Next, select the diagram node(s) to be graphed in one of the ways mentioned previously and click **“Graph”**. The options in the graph window are:

- When you select **Series Manager**, a window will be displayed with the distributions to be graphed, each with the following options:

Visible: With this option, the series will be visible in the graph.

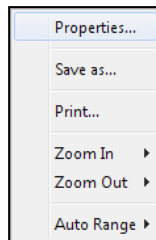
By default, the series of the indicators and the distribution of the target values will be visible when you select the option **“Graph”**.

The **Linear Regression** distributions of the indicators are not visible to be graphed. Therefore, you must select the option **Visible** so that they appear on the graph.

Label: This option is deactivated for this graph.

Color: Enables you to change the color of the series.

- In **Axis Manager**, you can change the minimum and maximum values of the axes of the graph. In **Reset** the values go back to the ones calculated by the software originally.
- With the option **Not Indexed** each of the periods considered is shown on the horizontal axis of the graph.
- With the option **Indexed by Name** the periods are shown on the horizontal axis of the graph numerically (1, 2, 3, 4...) and in an attached table the dates that correspond to each number are shown. Also, in the same table the linear regressions of the indicators are shown for each diagram node selected (displayed by their **Names**).
- With the option **Indexed by nickname** the periods are shown on the graph numerically (1,2,3,4...) on the horizontal axis, and in an attached table the dates that correspond to each number are displayed. The same table also shows the linear regressions of the indicators for each piece of equipment and/or configuration selected (displayed by their **Equipment Code or Nickname**).
- When you right-click on the graph, you have the following options:



Properties: Enables you to change the properties of the graph, such as the color, title, and see tags, among others.

Save as: Save the graphic in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

Zoom out: Gives the option to zoom out on the vertical axis.

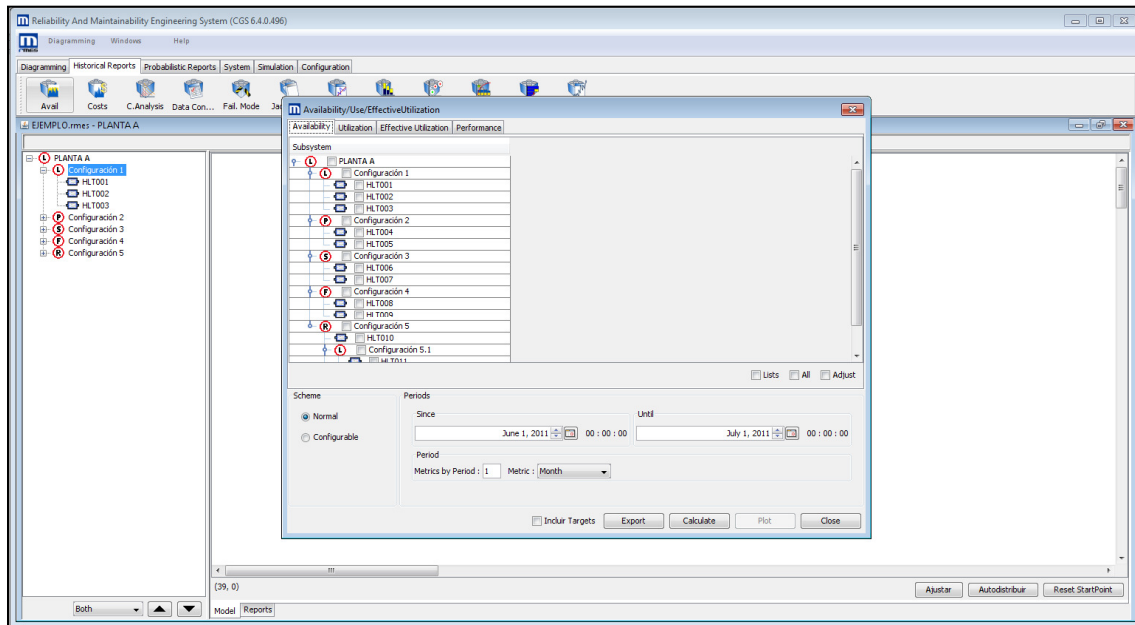
Automatic Range: Gives the option to revert the vertical axis back to its automatic scale.

- The graph can also be exported, selecting **“Export”** in the window of the graph. Graphs can only be exported in Excel and HTML format.


Example

Select the icon **“Availability”** on the **Historical Reports** toolbar.

This will display the following window:



In the upper left-hand side of the window displayed, the tabs for **Availability, Use, Effective Utilization and performance** are located.

Next, enter the start and end dates of the study: from June 1, 2011 at 00:00 to July 1, 2011 at 00:00. To do this, select the  icons and select the dates.

This study is over a total time period of 1 month, but all indicators must be calculated daily. So in the item **Period** enter:

Metrics per Period: 1

Metric: Day.



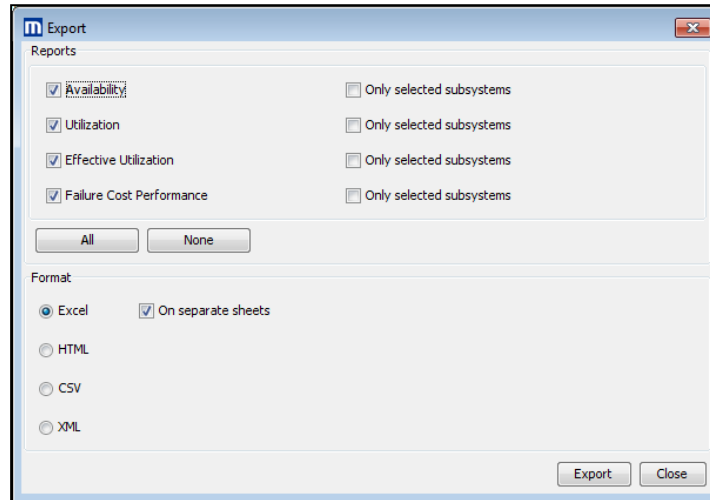
Click **“Calculate”**, which will show the following results:

Subsystem	Tendency	Accumulated [A...]	01-06-2011 - 02-06-2011	02-06-2011 - 03-06-2011	03-06-2011 - 04-06-2011	04-06-2011 - 05-06-2011	05-06-2011 - 06-06-2011	06-06-2011 - 07-06-2011
PLANTA A		48.182%	92.444%	85.660%	48.849%	64.781%	38.232%	57.115%
Configuración 1		56.642%	97.471%	97.289%	86.940%	64.341%	88.554%	57.115%
HLT001		86.708%	97.471%	97.289%	100.000%	87.008%	89.162%	80.364%
HLT002		86.059%	100.000%	100.000%	89.300%	77.333%	99.392%	79.289%
HLT003		71.171%	100.000%	100.000%	97.640%	100.000%	100.000%	70.887%
Configuración 2		92.482%	87.202%	100.000%	99.527%	100.000%	63.561%	98.588%
HLT004		72.388%	84.644%	89.094%	97.440%	14.763%	0.000%	5.549%
HLT005		81.719%	90.002%	99.090%	92.921%	100.000%	63.561%	98.568%
Configuración 3		92.984%	82.796%	98.348%	59.767%	100.000%	96.822%	97.982%
HLT005		93.001%	82.796%	98.348%	59.767%	100.000%	96.822%	97.982%
HLT007		1.725%	37.781%	13.997%	0.000%	0.000%	0.000%	0.000%
Configuración 4		86.576%	92.559%	80.799%	93.329%	100.000%	68.156%	98.774%
HLT008		80.146%	70.238%	52.753%	94.457%	100.000%	100.000%	95.096%
HLT009		87.386%	100.000%	90.148%	92.953%	100.000%	57.541%	100.000%
Configuración 5		100.000%	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%
HLT010		76.700%	33.333%	0.000%	0.000%	0.000%	60.843%	100.000%

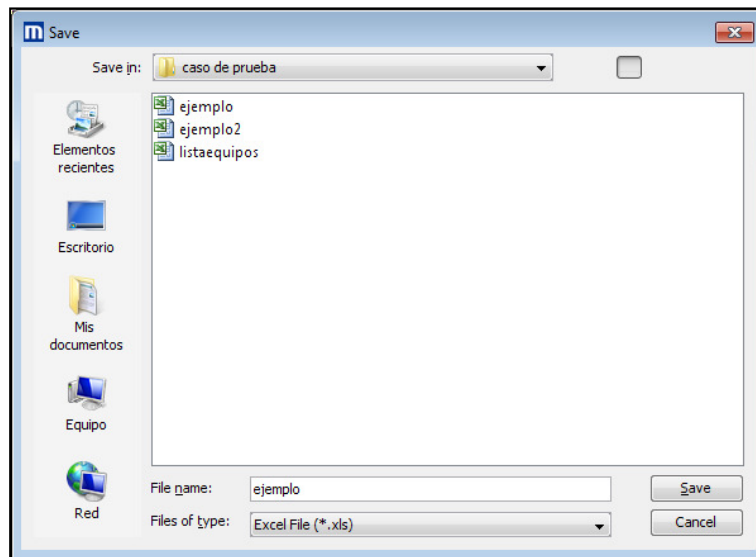
In the results above, the **Trend** column shows the behavior of all the indicators for every day of the study.

The column **Accumulated** provides the value of the indicator for the entire period of study (one month), and the columns to the right of it show the daily values of the indicators. Due to space constraints, only the first 5 days of the study are shown.

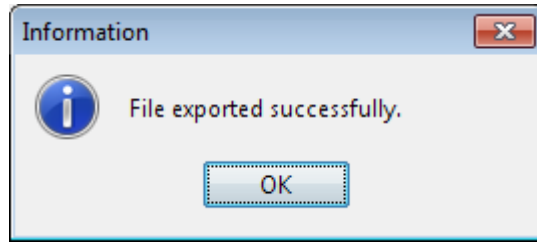
Next click **“Export”** to export the data grid, which will open the following window:



The indicators for each diagram node have to be exported, so the button **All** must be clicked and the option **Only Selected Subsystems** must not be checked. Also, choose the **Format Excel**. Next, click **“Export”**, which will open the window **Save** and in it: Type the file name and Click **“Save”**:

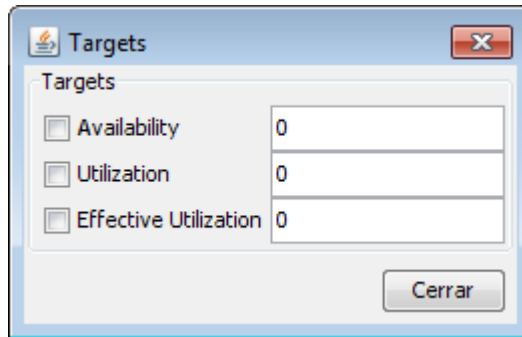


The following message confirms that the file was exported correctly.

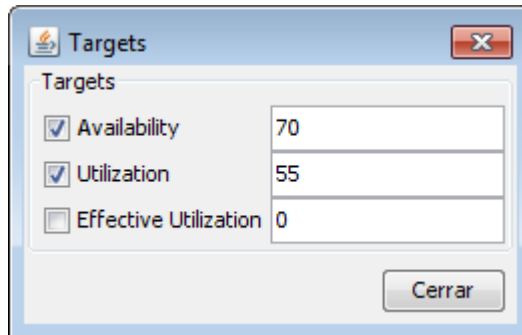


Graphing the **Availability** and **Use** indicators for the piece of equipment HLT001 daily is also required. To do this, take the following steps:

Select the option **Include Targets** (located in the lower part of the **Availability** window), which will open the following window:



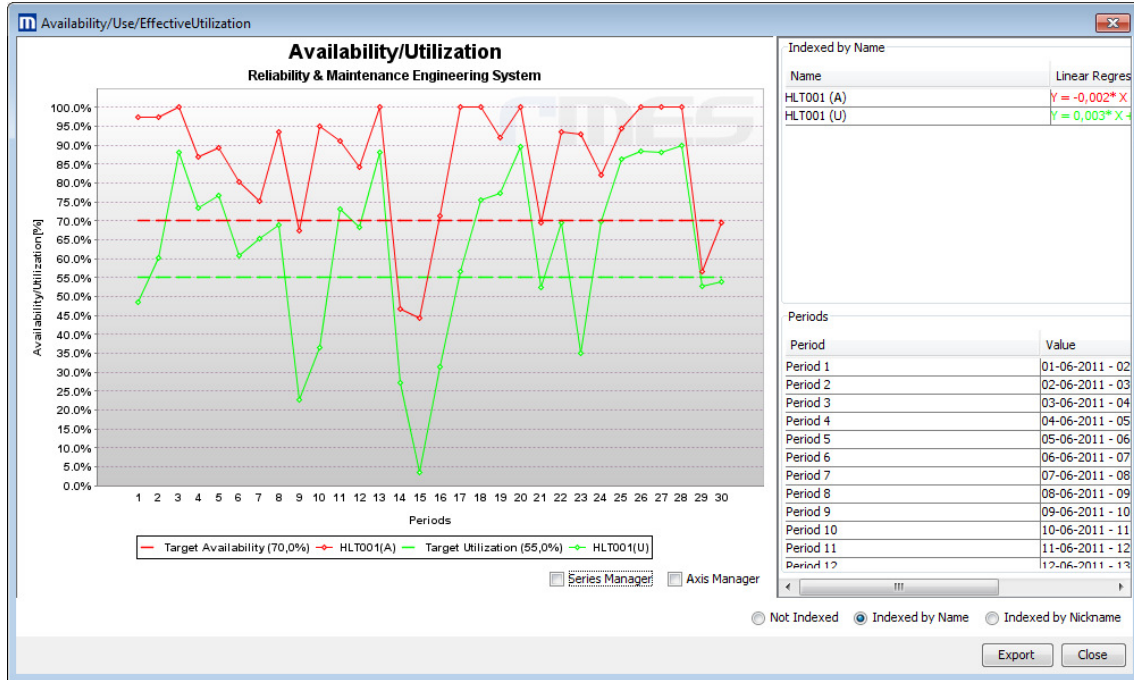
Select the **Availability** and **Use** indicators and enter the respective values 70% and 55%.



Click **“Close”**.

Next, select the piece of equipment HLT001 in the **Availability** and **Use** tabs:

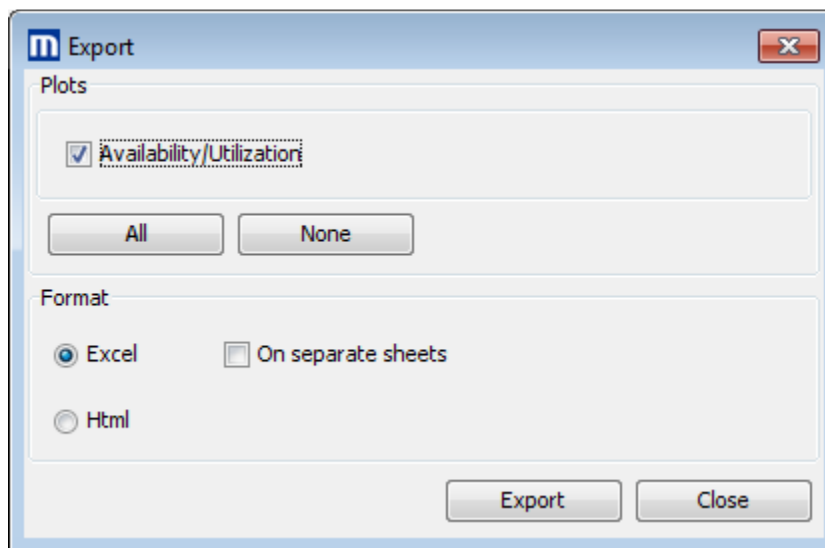
Click **“Graph”** in the **Availability** window, which will generate the following graph:



The option selected to view this graph is **Indexed by Name**: To the right of the graph is the table with the linear regression for each indicator for the piece of equipment HLT001 (this is its name) and in Periods the dates of the periods considered are shown.

In the graph you can see that the majority of the time the indicators were above the targets.

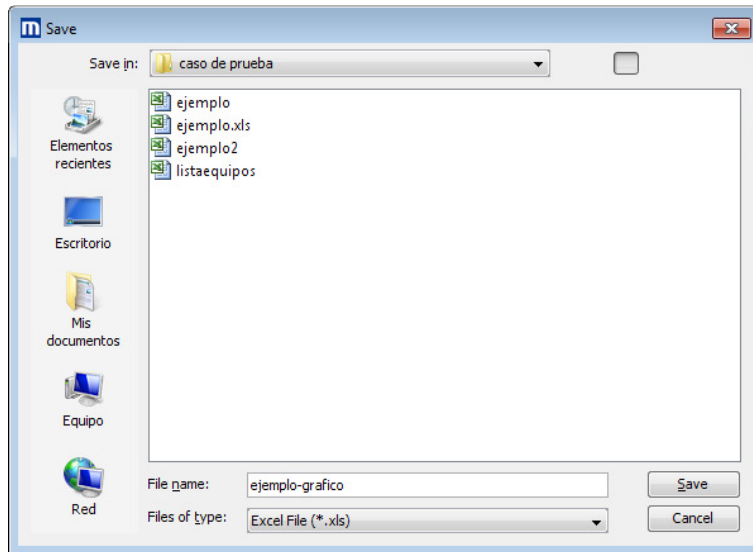
To export the graph click **“Export”**, which will open the following window:



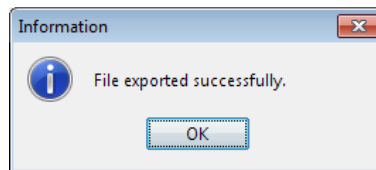
Select the option **Availability, Excel** and click **“Export”**, which will open the window **Save** and in it:

Type the file name: *Availability and Use Indicators Graph for HLT001*.

Click **“Save”**.



The following message confirms that the file was exported correctly:




Historical Reports Tab: Costs

This report presents indicators for direct cost of maintenance, the cost of the failure and the overall cost for each configuration node.

Procedure

- Go to the system **Properties** and enter the **Annual Billing** of the plant and the **Variable Cost Impact**. With this information the software can calculate the variable **Cost of the Failure**.
For more information about the system’s properties, go to the item **Properties** in the **Diagram** toolbar section in this document.





- Select the icon “Costs” () on the **Historical Reports** toolbar. This will open a window with a **Structural Tree** of the system.
- Enter the start and end dates of the study in the items **From** and **Until**.
- Click “**Calculate**”, to generate the report.
- If desired, the data generated can be exported by clicking “**Export**”.
- If desired, the data generated can be graphed by clicking “**Graph**”.

Characteristics

- The indicators are calculated for all equipment and configurations, independently of those selected in the **Structural Tree**.
- The start date and end date must be different, and for the calculation to be correct, both must be within the dates that comprise the database in use.

Options for entering start and end dates for the study

To enter start and end dates for the study, in the items **From** and **Until** there are three options:

- For both the start date (**From**) and the end date (**Until**), click the button , and in the calendar displayed first select the year, then the month, and lastly the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar.

For more information go to that item in this document.

Options to select diagram nodes

To graph or export data, you must select the diagram nodes that you need. To do this there are the following options:

- Select them directly in the **Structural Tree** in the **Costs** window.
- If you want to graph or export all of the diagram nodes, select the option **All** in the **Costs** window.
- When you only need a certain groups of nodes, select the option **Lists** in the **Costs** window. The lists or groups of diagram nodes must have been created previously, in the option **List Adm.** on the **Configuration** toolbar. For more information about this, go to the item **List Adm.** in the **Configuration** toolbar section.

Options to export data grid

The exportation window that opens when you click “**Export**” in the **Costs** window contains the following options:

- The option to export all failure nodes, or only those selected previously in the **Structural Tree**.
- There is also the option to choose the format of the exported document (Excel, HTML, CSV or XML).

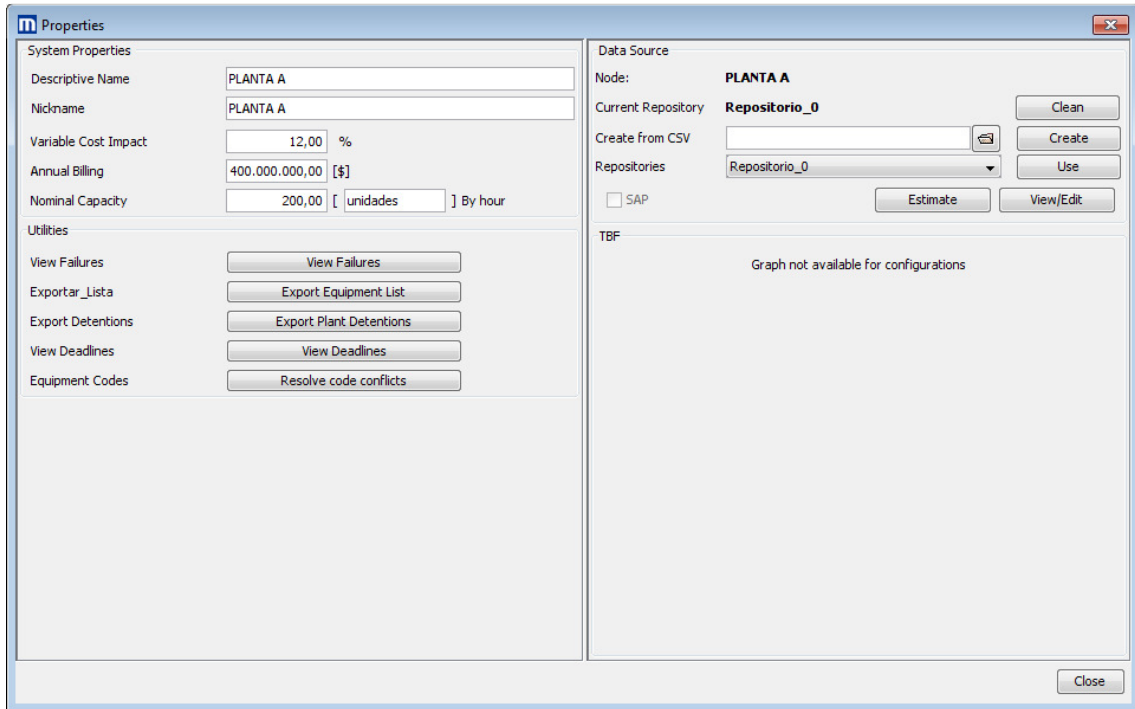
Graph Options

In the graph window that opens when you click “**Graph**”, there are the following options:

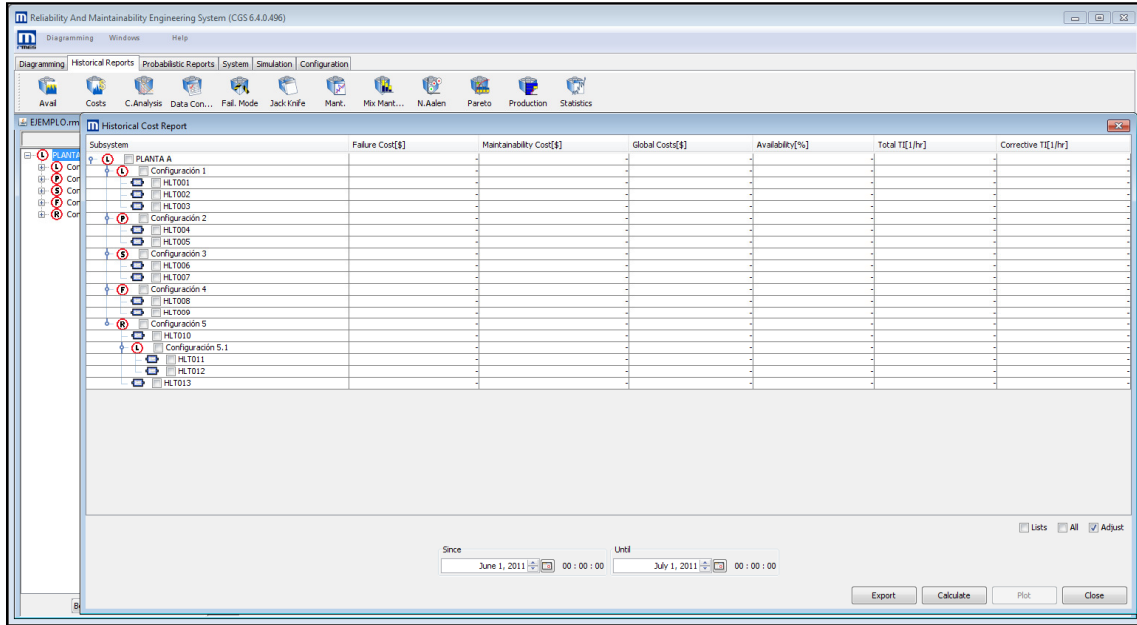
- In **Axis Manager**, you can change the minimum and maximum values of the graph’s axes. In **Reset** the values return to the ones calculated by the software.
- With the option **Default** on the horizontal axis of the graph the names of the selected pieces of equipment are shown.
- With the option **Index**, on the horizontal axis of the graph numerical indexes (1,2,3,4...) are shown, and in an attached table each index is associated with the name of the diagram node that it represents.


Example

Go to the **Properties** window of the system and enter an **Annual Billing** of \$400,000,000 and a **Variable Cost Impact** of 12%:

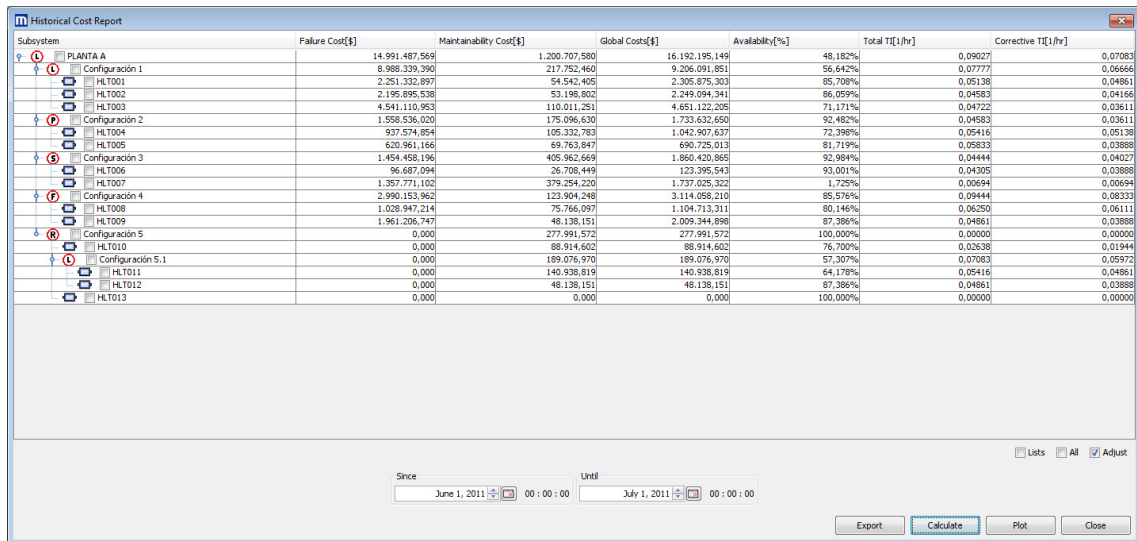


Next, click the icon **“Costs”** on the **Historical Reports** toolbar, which will open the following window:



Enter the start and end dates of the study: from June 1, 2011 at 00:00 to July 1, 2011 at 00:00. To do that, select the  icons and select the dates.

Then click **“Calculate”** to generate the data grid:



The grid must be exported and the data from equipment HLT001, HLT002 and HLT003 must be graphed, so first you need to select those pieces of equipment in the **Structural Tree** and then click **“Export”** in the **Costs** window:

Subsystem	Failure Cost[\$]	Maintainability Cost[\$]	Global Cost[\$]	Availability[%]	Total TtE [1/hr]	Corrective TtE [1/hr]
PLANTA A	14.991.487,569	1.200.707,580	16.192.195,149	48,182%	0,99027	0,07083
Configuración 1	8.988.339,390	217.752,460	9.206.091,851	56,642%	0,07777	0,06666
HLT001	2.251.332,897	54.542,405	2.305.875,303	85,709%	0,05128	0,04861
HLT002	2.195.895,538	53.198,802	2.249.094,341	86,059%	0,04583	0,04166
HLT003	4.541.110,953	110.011,251	4.651.122,205	71,171%	0,04722	0,03611
Configuración 2	1.558.536,020	175.096,630	1.733.632,650	92,482%	0,04583	0,03611
HLT004	937.574,854	105.332,783	1.042.907,637	72,398%	0,05416	0,05138
HLT005	620.961,166	69.763,847	690.725,013	81,719%	0,05833	0,03888
Configuración 3	1.454.458,196	405.962,669	1.860.420,865	92,984%	0,04444	0,04027
HLT006	96.687,094	26.708,449	123.395,543	93,001%	0,04305	0,03888
HLT007	1.357.771,102	379.254,220	1.737.025,322	1,729%	0,00694	0,00694
Configuración 4	2.990.153,962	123.904,248	3.114.058,210	85,576%	0,09444	0,08333
HLT008	1.028.947,214	75.766,097	1.104.713,311	80,146%	0,06250	0,06111
HLT009	1.961.206,747	48.138,151	2.009.344,898	87,386%	0,04861	0,03888
Configuración 5	0,000	277.991,572	277.991,572	100,000%	0,00000	0,00000
HLT010	0,000	88.914,602	88.914,602	76,700%	0,02638	0,01944
Configuración 5.1	0,000	189.076,970	189.076,970	57,300%	0,07083	0,05972
HLT011	0,000	140.938,819	140.938,819	64,178%	0,05416	0,04861
HLT012	0,000	48.138,151	48.138,151	87,386%	0,04861	0,03888
HLT013	0,000	0,000	0,000	100,000%	0,00000	0,00000

This will open the exportation window, where you must select the option **“Historical Costs”**, **Only Selected Subsystems**, and **Excel**.

Export

Reports

Historic Costs Only selected subsystems

Format

Excel On separate sheets

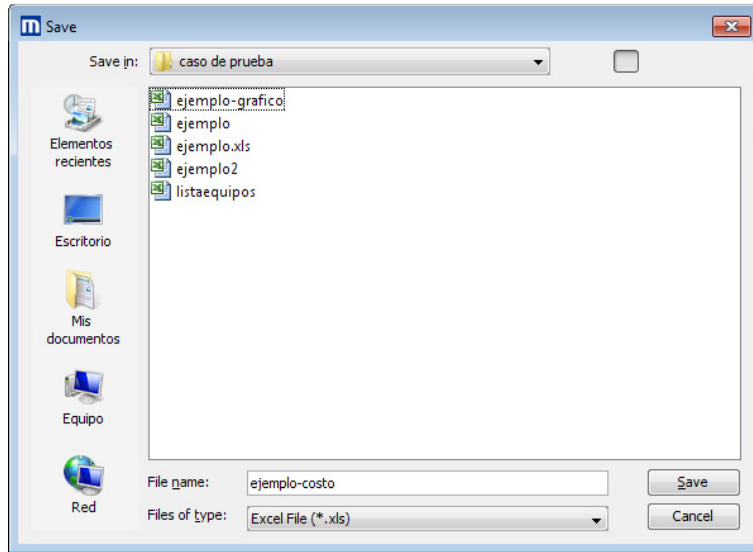
HTML

CSV

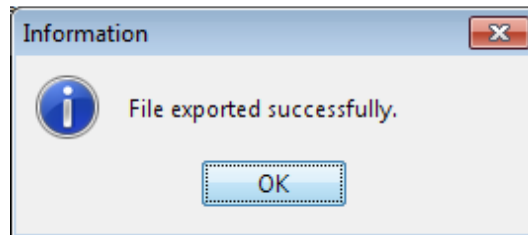
XML

Clicking **“Export”** opens the **Save** window, and in it:

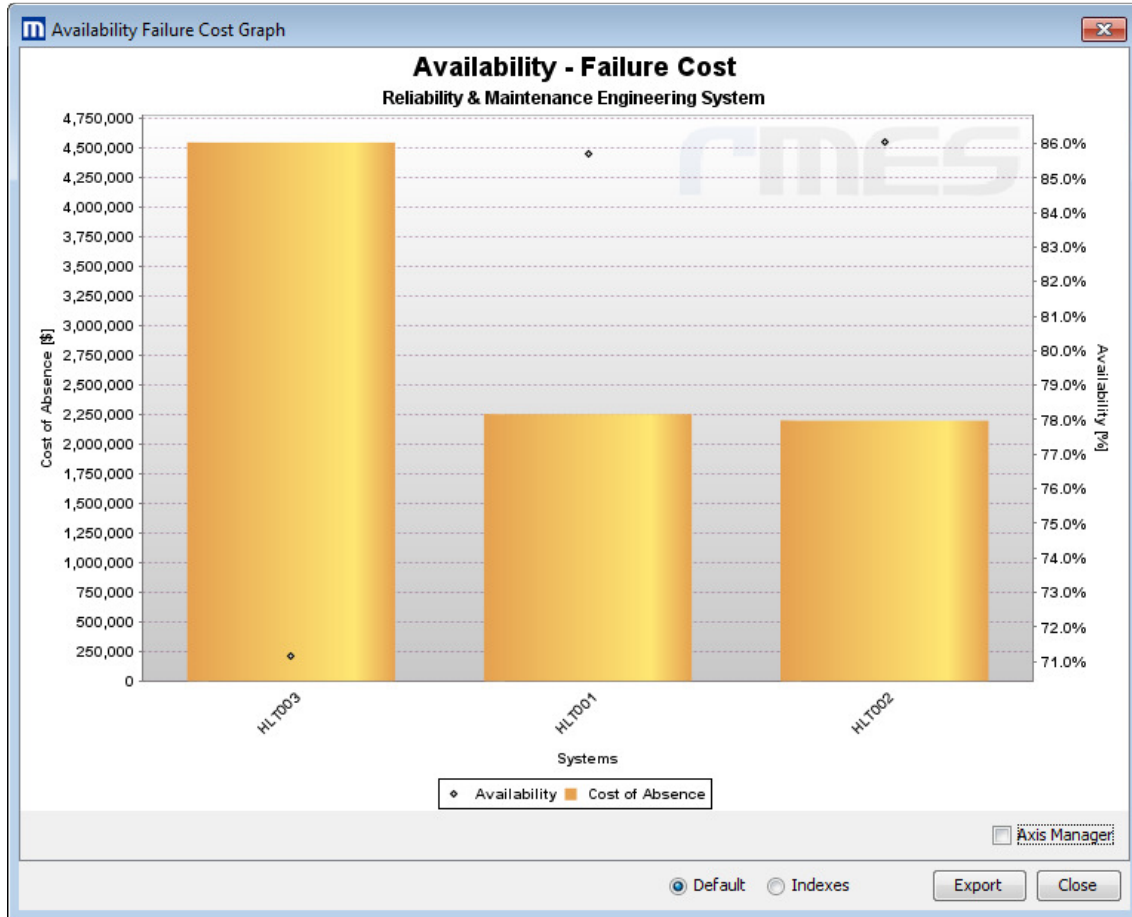
Click **“Save”**:



The following message confirms that the file was exported correctly:



To graph the equipment previously mentioned, go to the **Costs** window and click **“Graph”** (the equipment was already selected previously in the **Structural Tree**) which will generate the following graph:



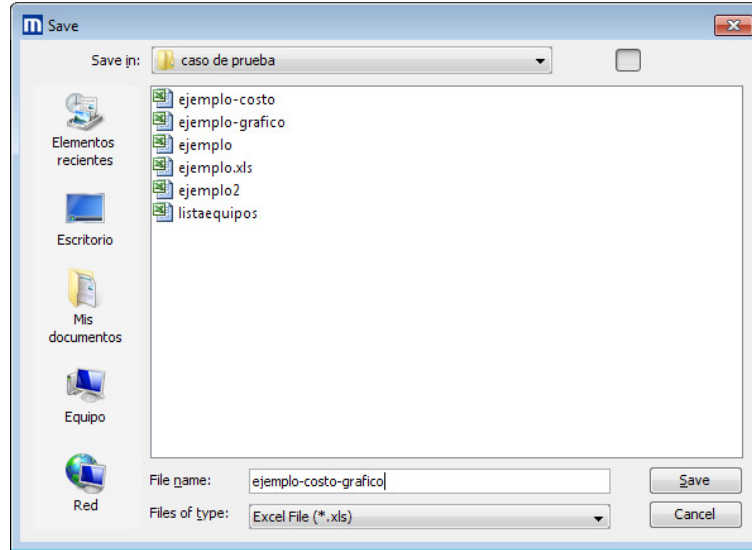
The graph shows that the piece of equipment HLT003 has the highest failure cost of the three pieces of equipment studied and the lowest availability.

To export the graph click **“Export”** in the window of the graph, which will open the window **Save** and in it:

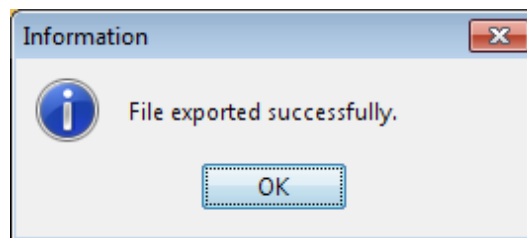
Type the file name: *Configuration 1 Equipment Historical Costs Graph*.

Choose the type of exported file: Excel.

Click **“Save”**.



The following message confirms that the file was exported correctly:




Historical Reports Tab: Criticality Analysis- Unavailability vs. Consequence

The purpose of analyzing critical diagram nodes based on unavailability/consequence is to quantify the impact a piece of equipment has on the system (cost of the failure), taking away two components from it: the time that the piece of equipment was out of service (its unavailability) and its effect on the system's shutdowns (consequence). This enables the effects on the system particular to the piece of equipment and its logical-functional configuration in a system to be separated.

Procedure

- Go to **Properties** of the system and enter the **Annual Billing** of the plant and the **Variable Cost Impact**. With this data, the software can calculate the **Cost of the Failure** variable. For more information on the system's properties, go to the item **Properties** in the **Diagram** toolbar section in this document.





- Select the icon **“Criticality Analysis”** () on the **Historical Reports** toolbar. Doing this will open a window containing a **Structural Tree** of the system.
- Enter the start and end dates of the study in the items **From** and **Until**.
- When you click **“Calculate”** the **Unavailability, Consequence, Incidence, Cost of the Failure, Cost of Repair, and Total Cost** are calculated for each piece of equipment, configuration and the system.
- If desired, you can export all of the data generated by clicking **“Export”**.
- If desired, you can graph all of the data generated. By clicking **“Graph”** only the data corresponding to the Unavailability/Consequence report will be graphed.

Characteristics

- The **Adjust** option enables you to adjust the data calculated in the window so that all of it is visible.
- The indicators are calculated for all equipment, independently of those selected in the **Structural Tree**.
- The start and end dates must be different, and for the calculation to be correct both must be within the dates that comprise the database in use.

Options to enter start and end dates of the study

To enter start and end dates for the study into items **From** and **Until**, there are the following three alternatives:

- For both the start date (**From**) and the end date (**Until**), click the button , and on the calendar that is displayed first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is not correct, you can change it in the option **General** on the **Configuration** toolbar. For more information about this, go to that item in this document.

Options for selecting diagram nodes

To graph or export data, the diagram nodes needed must be selected. To do this there are the following options:

- Select them directly in the **Structural Tree** in the window **Criticality Analysis**.

- If you want to graph or export all of the diagram nodes, select the option **All** in the **Criticality Analysis** window.
- When only groups of nodes are needed, select the option **Lists** in the **Criticality Analysis** window. The lists of groups of diagram nodes must have been previously created, in the action **List Adm.** on the **Configuration** toolbar. For more information about this, go to the item **List Adm.** in the **Configuration** toolbar section in this document.

Options to export data grid

The window that opens when you click “**Export**” in the **Criticality Analysis** window contains the following options:

- You can export all diagram nodes or just those selected previously in the **Structural Tree**.
- There is also the option to choose the format of the exported document (Excel, HTML, CSV or XML).

Graph Options

First select the diagram node(s) to be graphed in one of the formats mentioned above and then click “**Graph**”. The options in the graph window are:

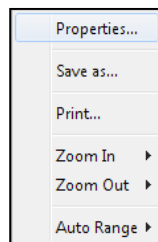
- When you select **Series Manager**, a window will be displayed in which the **Isocriticality** distributions are located, and for each one there are the following options:
 - Visible:** When selected, the distribution becomes visible on the graph.
By default all **Isocriticality** distributions are visible when you click “**Graph**”.
 - Label:** This option enables the value of the **Isocriticality** distribution to be shown on the graph.
To select the **labels** of all the distributions at once, click on the word “**Label**”.
 - Color:** Enables you to change the color of the **Isocriticality** distribution.
- In **Axis Manager** you can change the minimum and maximum values of the axes of the graph. In **Reset** the values of the axes go back to the ones calculated by the software.
- Under the graph, a summary table shows values of each variable for each diagram node. Also, the last columns correspond to:
 - Visible:** When you select this option, the configuration node becomes visible in the graph’s key.
By default, all configuration nodes selected in the **Structural Tree** will be visible in the graph’s key when you click “**Graph**”.
 - Label:** This option enables the selected diagram node to be shown on the graph.

By default, all diagram nodes selected in the **Structural Tree** will be visible on the graph when you click **“Graph”**.

- The item **Organize by** has the following options:
 - Nickname:** Shows all diagram nodes with their nicknames in the graph and the key.
 - Name:** Shows the diagram nodes with their names in the graph and the key.
 These two options are mutually exclusive.
- **Use Images:** Uses colored circles to identify the diagram nodes on the graph. If you want the circle to be accompanied by the name or nickname of the diagram node, choose **“Label”** in the summary table and one of the **Organize by** options.
- **Hours:** Calculates the Isocriticality distributions based on Incidence.
- **Cost:** Calculates the Isocriticality distributions based on the costs of the failure.

The options **Time** and **Cost** are mutually exclusive. To see the values (in hours or cost) of all the Isocriticality distributions, go to **Series Manager** and in the window that is displayed select all of the **Labels**.

- When you right-click on the graph, you will have the following options:



Properties: Enables you to change the properties of the graph, such as the color, title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Prints the graph.

Zoom in: Gives the option to zoom in on both axes, or just the horizontal or vertical one.

Zoom out: Gives the option to zoom out on both axes, or just the horizontal or vertical one.

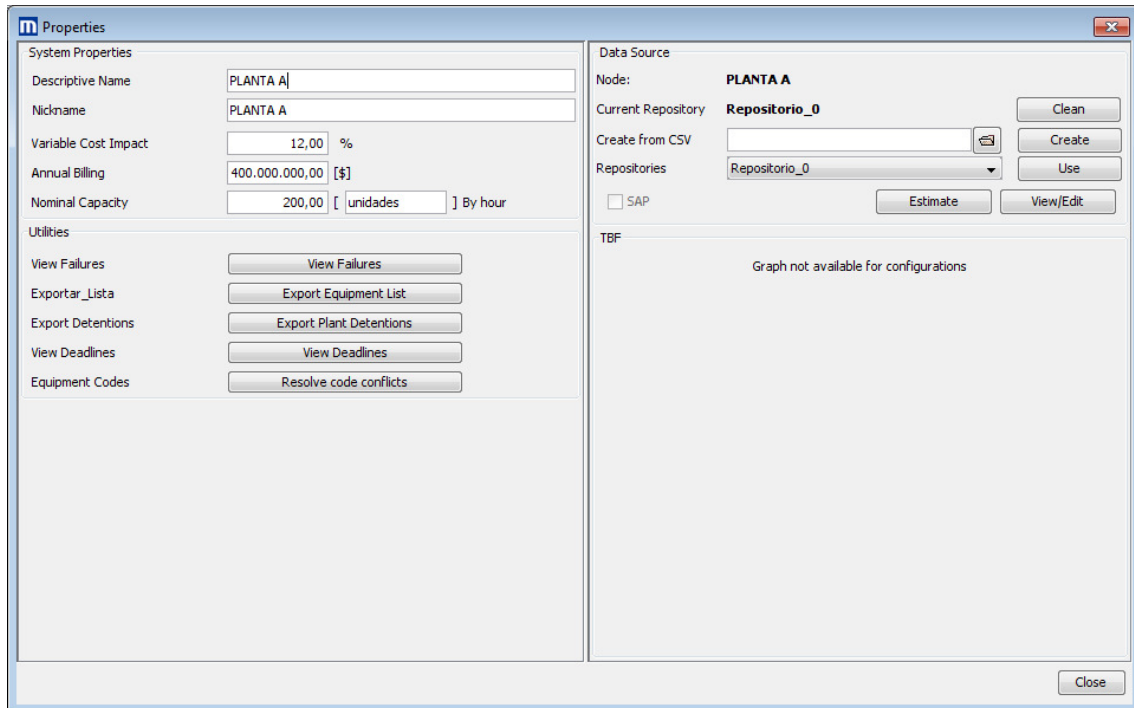
Auto Range: Gives the option to revert back to the automatic scale for both axes, or just the horizontal or vertical axis one.

- The graph can also be exported by clicking **“Export”** in the window of the graph. It can only be exported in Excel or HTML format.

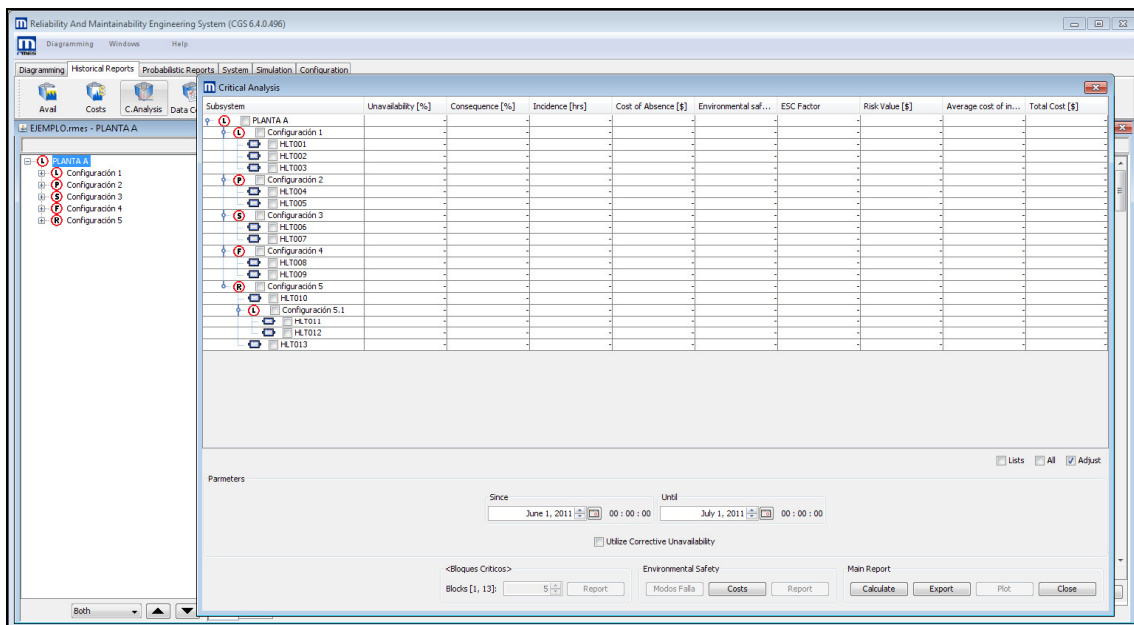
Example




Go to the **Properties** window of the system and enter an **Annual Billing** of \$400,000,000 and a **Variable Cost Impact** of 12%.

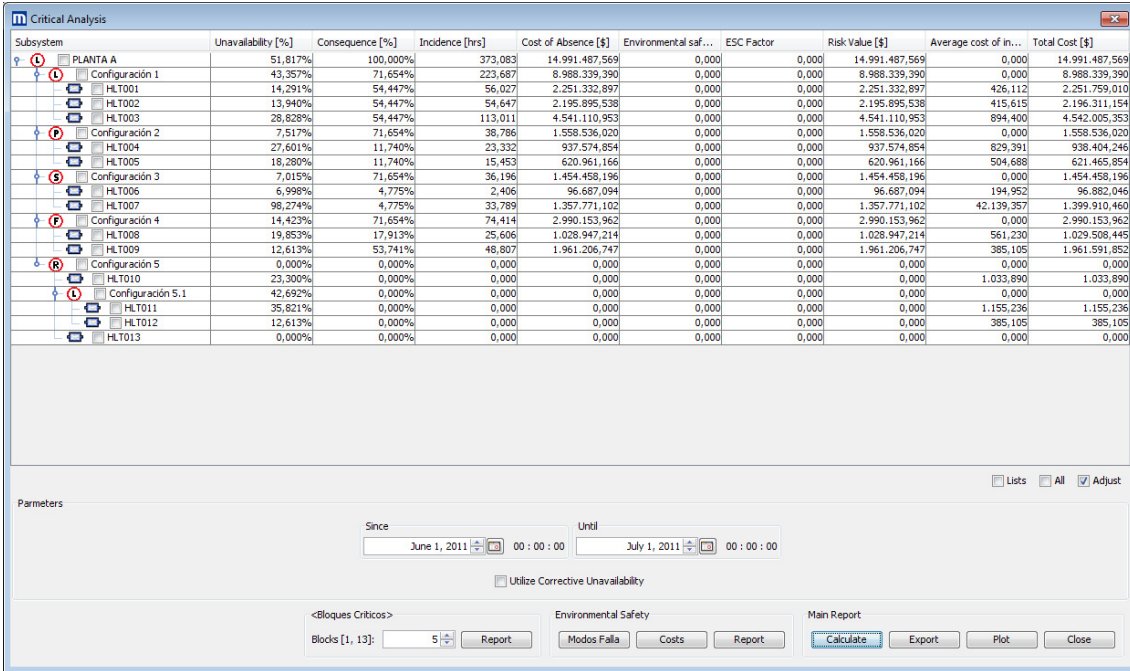


Then select the icon **“Criticality Analysis”** on the **Historical Reports** toolbar, which will open the following window:



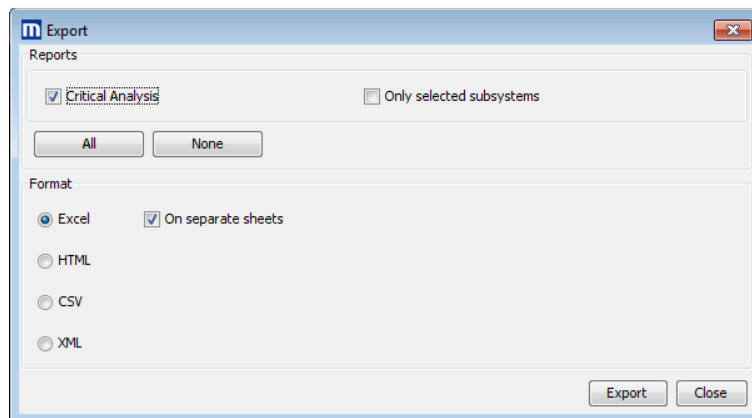
Enter the start and end dates of the study: from June 1, 2011 at 00:00 to July 1, 2011 at 00:00. To do that, select the  icons and select the dates.

Next, in the **Criticality Analysis** window click **“Calculate”** to generate the following data grid:

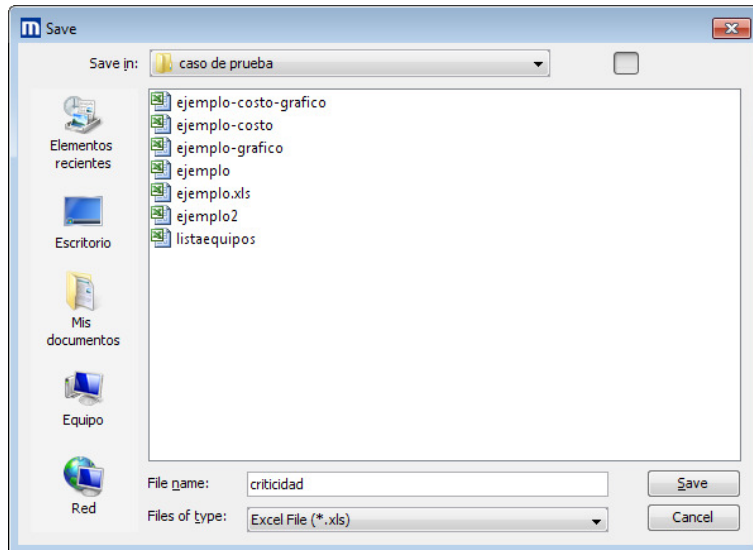


Subsystem	Unavailability [%]	Consequence [%]	Incidence [hrs]	Cost of Absence [\$]	Environmental saf...	ESC Factor	Risk Value [\$]	Average cost of in...	Total Cost [\$]
PLANTA A	51,817%	100,000%	373,083	14.991.487,569	0,000	0,000	14.991.487,569	0,000	14.991.487,569
Configuración 1	43,357%	71,654%	223,687	8.988.339,390	0,000	0,000	8.988.339,390	0,000	8.988.339,390
HLT001	14,291%	54,447%	56,027	2.251.332,897	0,000	0,000	2.251.332,897	426,112	2.251.759,010
HLT002	13,940%	54,447%	54,647	2.195.895,538	0,000	0,000	2.195.895,538	415,615	2.196.311,154
HLT003	28,829%	54,447%	113,011	4.541.110,953	0,000	0,000	4.541.110,953	894,400	4.542.005,353
Configuración 2	7,517%	71,654%	38,796	1.558.536,020	0,000	0,000	1.558.536,020	0,000	1.558.536,020
HLT004	27,601%	11,740%	23,332	937.574,854	0,000	0,000	937.574,854	829,391	938.404,246
HLT005	18,280%	11,740%	15,453	620.961,166	0,000	0,000	620.961,166	504,688	621.465,854
Configuración 3	7,015%	71,654%	36,196	1.454.458,196	0,000	0,000	1.454.458,196	0,000	1.454.458,196
HLT006	6,998%	4,775%	2,406	96.687,094	0,000	0,000	96.687,094	194,952	96.882,046
HLT007	98,274%	4,775%	33,789	1.357.771,102	0,000	0,000	1.357.771,102	42.139,357	1.399.910,460
Configuración 4	14,423%	71,654%	74,414	2.990.153,962	0,000	0,000	2.990.153,962	0,000	2.990.153,962
HLT008	19,853%	17,913%	25,606	1.028.947,214	0,000	0,000	1.028.947,214	561,230	1.029.508,445
HLT009	12,613%	53,741%	48,807	1.961.206,747	0,000	0,000	1.961.206,747	385,105	1.961.591,852
Configuración 5	0,000%	0,000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HLT010	23,309%	0,000%	0,000	0,000	0,000	0,000	0,000	1.033,890	1.033,890
Configuración 5.1	42,892%	0,000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HLT011	35,821%	0,000%	0,000	0,000	0,000	0,000	0,000	1.155,236	1.155,236
HLT012	12,613%	0,000%	0,000	0,000	0,000	0,000	0,000	385,105	385,105
HLT013	0,000%	0,000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000

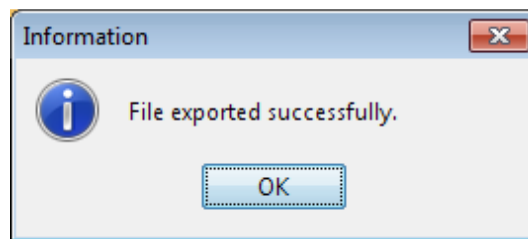
Click **“Export”** in the **Criticality Analysis** window to open the exportation window, and in it select the option **“Criticality Analysis”**. The option **“Only selected subsystems”** must not be checked so that the data for all the diagram nodes will be exported. Also choose the option **“Excel”** and click **“Export”**:



This will open the **Save** window and in it type the file name: *Criticality Analysis- Unavailability vs. Consequence*, and then click **“Save”**:



The following message confirms that the file was exported correctly:

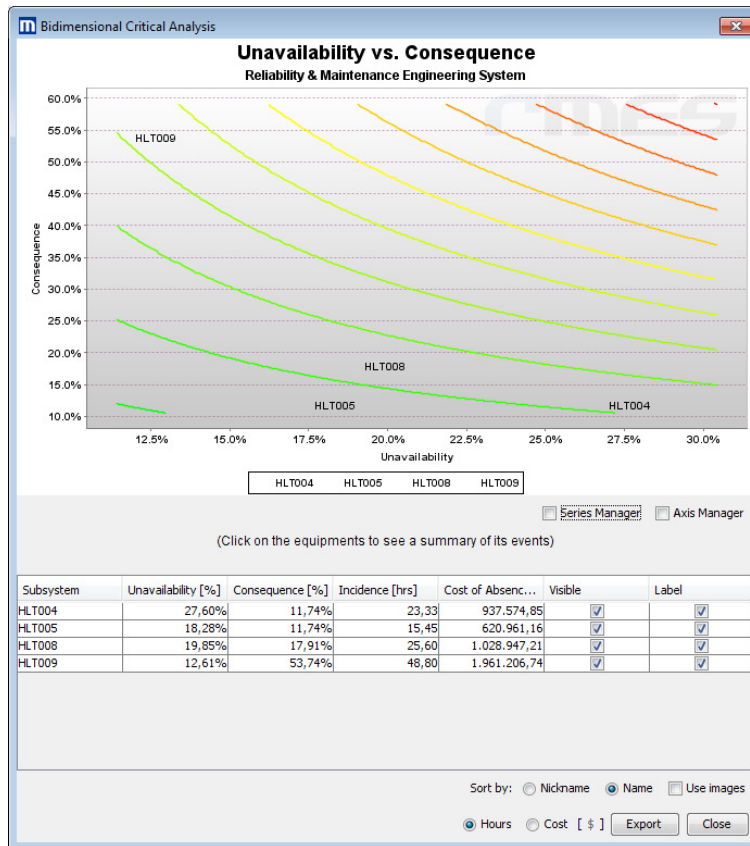


It is also necessary to graph the equipment in configurations 2 and 4, so to do this select them in the **Structural Tree** in the **Criticality Analysis** window and then click **“Graph”**:

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Subsystem	Unavailability [%]	Consequence [%]	Incidence [hrs]	Cost of Absence [\$]	Environmental saf...	ESC Factor	Risk Value [\$]	Average cost of in...	Total Cost [\$]
PLANTA A	51,817%	100,000%	373,083	14.991.487,569	0,000	0,000	14.991.487,569	0,000	14.991.487,569
Configuración 1	43,357%	71,654%	223,687	8.988.339,390	0,000	0,000	8.988.339,390	0,000	8.988.339,390
HLT001	14,291%	54,447%	56,027	2.251.332,897	0,000	0,000	2.251.332,897	426,112	2.251.759,010
HLT002	13,940%	54,447%	54,647	2.195.895,538	0,000	0,000	2.195.895,538	415,615	2.196.311,154
HLT003	28,828%	54,447%	113,011	4.541.110,953	0,000	0,000	4.541.110,953	894,400	4.542.005,353
Configuración 2	7,517%	71,654%	36,786	1.558.536,020	0,000	0,000	1.558.536,020	0,000	1.558.536,020
HLT004	27,601%	11,740%	23,332	937.574,854	0,000	0,000	937.574,854	829,391	938.404,246
HLT005	18,289%	11,740%	15,453	620.961,166	0,000	0,000	620.961,166	504,688	621.465,854
Configuración 3	7,015%	71,654%	36,196	1.454.458,196	0,000	0,000	1.454.458,196	0,000	1.454.458,196
HLT006	6,998%	4,775%	2,406	96.687,094	0,000	0,000	96.687,094	194,952	96.882,046
HLT007	98,274%	4,775%	33,789	1.357.771,102	0,000	0,000	1.357.771,102	42.139,357	1.399.910,460
Configuración 4	14,423%	71,654%	74,414	2.990.153,962	0,000	0,000	2.990.153,962	0,000	2.990.153,962
HLT008	19,853%	17,913%	25,606	1.028.947,214	0,000	0,000	1.028.947,214	561,230	1.029.508,445
HLT009	12,613%	53,741%	48,807	1.961.206,747	0,000	0,000	1.961.206,747	385,105	1.961.591,852
Configuración 5	0,000%	0,000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HLT010	23,300%	0,000%	0,000	0,000	0,000	0,000	0,000	1.033,890	1.033,890
Configuración 5.1	42,692%	0,000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000
HLT011	35,821%	0,000%	0,000	0,000	0,000	0,000	0,000	1.155,236	1.155,236
HLT012	12,813%	0,000%	0,000	0,000	0,000	0,000	0,000	385,105	385,105
HLT013	0,000%	0,000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000

This will generate the following graph:



Choose the graph options **Name**, **Use Images**, and then click the word **Label** so that the graph looks like this:



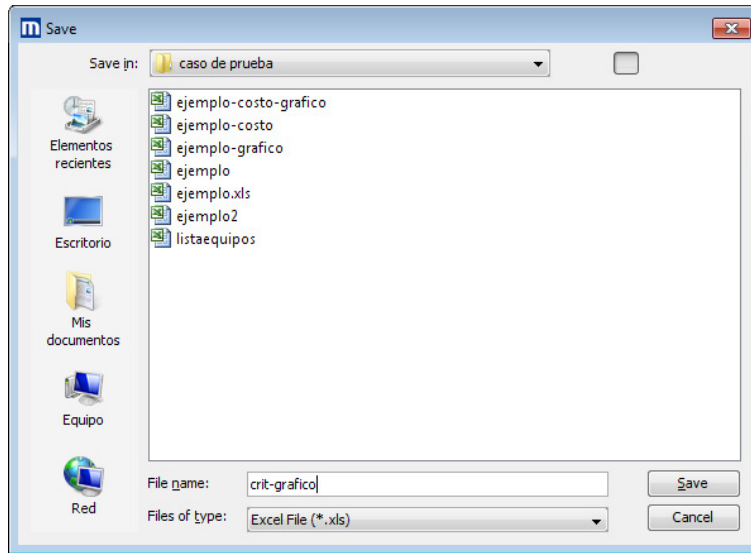
The piece of equipment located in the highest **Iso-Cost** lines is the most critical of the group, which in this case is HLT009

To export the graph click **“Export”** in the graph window, which will open the **Save** window, and in it:

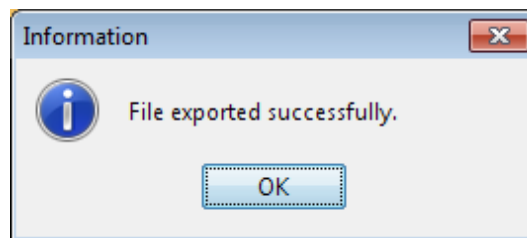
Write the file name: *Iso-Cost of the Equipment in Configurations 2 and 4 Graph.*

Choose the exported file type: *Excel.*

Click **“Save”**.



The following message confirms that the file was exported correctly:




Historical Reports Tab: Criticality Analysis- Analysis of Environmental Safety

In this analysis, two factors are incorporated for the criticality analysis. First is the impact of the failure of a piece of equipment on the environment or safety of the plant, and second is the cost to repair the failure.

It is necessary to mention that to measure the impact the failure of a diagram node has on the environment or safety of the plant, there must be an environmental safety cost (ESC) or an ESC factor with the impact can be valued quantitatively or qualitatively.

Procedure

- Go to the system's **Properties**, and enter the **Annual Billing** of the plant and the **Variable Cost Impact**. With this data the software can calculate the variable **Cost of the Failure**. For more information about the system's properties, go to the item **Properties** in the **Diagram** toolbar section of this document.

- Click the icon “**Criticality Analysis**” () on the **Historical Reports** toolbar. This will open a window with a **Structural Tree** of the system.
- Click the button “**Costs**”. This will display another window with the **Structural Tree** and the **ESC** columns (environmental safety cost) and **ESC Factor**.
- If there are monetary costs for environmental safety when a piece of equipment fails, enter those values in the **ESC** column. If there is not a quantification of the costs but there is a qualitative estimate of the impact generated on the environmental safety due to the failure of a piece of equipment, click on each box in the **ESC Factor** column. This will open another window where specific situations are presented when the piece of equipment in question fails. These situations, according to their risk value, will have a value between 0 and 8. These values correspond to the **ESC Factor** value.
The data in the **ESC** and **ESC Factor** columns are mutually exclusive, but the information from both can be entered, which will generate different reports.
- After entering the values of **ESC** and/or **ESC Factor**, click “**Accept**” in the **Costs** window, which will save the data and close the window.
- Enter the start and end dates of the study in the items **From** and **Until**.
- When you click “**Calculate**” the **Unavailability/consequence** report data is generated, besides the data that belongs exclusively to **Environmental Safety** (ESC, ESC Factor, and Risk Value).
- If desired, all data generated can be exported by clicking “**Export**”.
- If desired, all data generated can be graphed by clicking “**Reports**”.
This will open a window with two tabs, and in each of them a different graph will be generated. The first graph is called: **Quantitative Risk Analysis**. The second graph is the: **Risk Dispersion Graph**.
The **Quantitative Risk Analysis** graph graphs the risk value for each of the diagram nodes selected. The Risk Value = Cost of the failure + QR + ESC.
The **Risk Dispersion** graph graphs the ESC Factor vs. the Cost of the Failure.

Risk of the Failure Mode

Another report that can be generated is a graph of the **Risk Dispersion of failure modes**, which is obtained in the following way:

- Select a single diagram node in the **Structural Tree** in the **Criticality Analysis** window.
- Click on “**Failure Modes**”.
- Enter **ESC** or **ESC Factor** for each one of the failure modes.
- Click “**Accept**”, to generate the graph.





Characteristics



- With the **Adjust** option, you can adjust the calculated data to the window so that all of the data is visible.
- The indicators are calculated for every piece of equipment, independently of those selected in the **Structural Tree** in the **Criticality Analysis** window.
- The start and end dates must be different, and for the calculation to be correct both dates must be within the dates that comprise the database in use.

Options to enter start and end dates for the study

To enter the start and end dates for the study in the items **From** and **Until**, there are three alternatives:

- For both the start date (**From**) and the end date (**Until**), select the button , and on the calendar that is displayed first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is not correct, it can be changed in the option **General** in the **Configuration** toolbar. For more information about that, go to that item in this document.

Options for selecting diagram nodes

To graph or export data, select the diagram nodes needed. To do this, there are the following options:

- Select them directly in the **Structural Tree** in the **Criticality Analysis** window.
- If you want to graph or export all diagram nodes, select the option **All** in the **Criticality Analysis** window.
- When only groups of nodes are needed, select the option **Lists** in the **Criticality Analysis** window. The lists or groups of diagram nodes must have been created previously in the option **List Adm.** on the **Configuration** toolbar. For more information about this, go to the item **List Adm.** in the **Configuration** toolbar section in this document.

Options for exporting data grid

The window that opens when you click “**Export**” in the **Criticality Analysis** window contains the following options:

- It is possible to export all diagram nodes or just those selected previously in the **Structural Tree**.

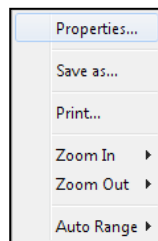
- There is also the option to choose the format of the exported document (Excel, HTML, CSV or XML).

“Reports” Graph Options

The graph window that opens when you click “**Reports**” contains the following options for each of its tabs:

Quantitative Risk Analysis Tab

- When you select **Series Manager** in the **Quantitative Risk Analysis** graph, a window will be displayed with the **Performance** and **Quantitative Risk Analysis**. For each one, there will be the following options:
 - Visible:** When you check this, the selected distribution will be visible in the graph.
By default, the **Performance** distribution and the **Quantitative Risk Analysis** series will be visible when you select “**Reports**”.
 - Label:** This option is not activated for this graph.
 - Color:** Enables you to change the color of the distribution.
- In the **Quantitative Risk Analysis** graph you will also find the options **Default or Indexes:**
 - With the option **Default**, the horizontal axis of the graph shows each of the names of the diagram nodes considered.
 - With the option **Indexes**, the horizontal axis of the graph shows the diagram nodes numerically (1, 2, 3, 4...) and an attached table shows which nodes belong to each of them.
- In the option **Axis Manager**, you can change the minimum and maximum values of the graph’s axes. In **Reset** the values of the axes revert back to the ones calculated by the software.
- When you right-click on the graph, you will have the following options:



Properties: Change the properties of the graph, such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Zoom in on the vertical axis.

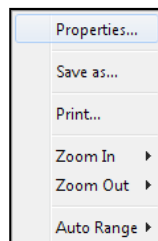
Zoom out: Zoom out on the vertical axis.

Automatic Scale: Return to the vertical axis' automatic scale.

- The graph can also be exported, by clicking **“Export”** in the graph window. It can only be exported in Excel or HTML format.

Risk Dispersion Graph Tab

- When you select **Series Manager**, a window will be displayed showing all diagram nodes previously selected to be graphed, and for each there are the following options:
 - Visible:** When checked, the diagram nodes can be seen on the graph.
By default, all diagram nodes selected in the **Structural Tree** are visible on the graph when you click **“Reports”**.
 - Label:** With this option you can see the diagram node's values for **Failure Cost** and **ESC Factor**.
 - Color:** Change the color of the circle on the graph that represents the diagram node.
- In **Axis Manager**, you can change the minimum and maximum values of the graph's axes. In **Reset**, the values of the axes revert to the ones calculated by the software.
- When you right-click on the graph, you will have the following options:



Properties: Change the properties of the graph, such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Zoom in on both axes, or just the horizontal or vertical one.

Zoom out: Zoom out on both axes, or just the horizontal or vertical one.

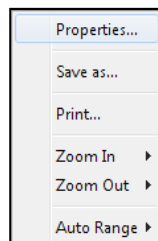
Auto Range: Gives the option to revert back to the automatic scale for both axes, or just the horizontal or vertical one.

- The graph can also be exported by clicking “**Export**” in the graph window. It can only be exported in Excel or HTML format.

“Failure Modes” Graph Options

The **Failure Mode Risk Dispersion** graph that is obtained by clicking “**Failure Mode**” in the **Criticality Analysis** window has the following options:

- When you select **Series Manager**, a window is displayed with the failure modes associated with a diagram node that was selected in the **Structural Tree**. For each one, there are the following options:
 - Visible:** When checked, the failure mode becomes visible on the graph.
By default, all failure modes associated with the diagram node are visible on the graph.
 - Label:** This option makes the **ESC Factor** and **Failure Cost x Weighted Failure Cost** of the failure mode visible.
 - Color:** Change the color of the circle on the graph that represents the failure mode.
- In **Axis Manager**, you can change the minimum and maximum values of the graph’s axes. In **Reset**, the values of the axes revert back to the ones calculated by the software.
- When you right-click on the graph, there will be the following options:



Properties: Change the properties of the graph, such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on both axes, or just the horizontal or vertical one.

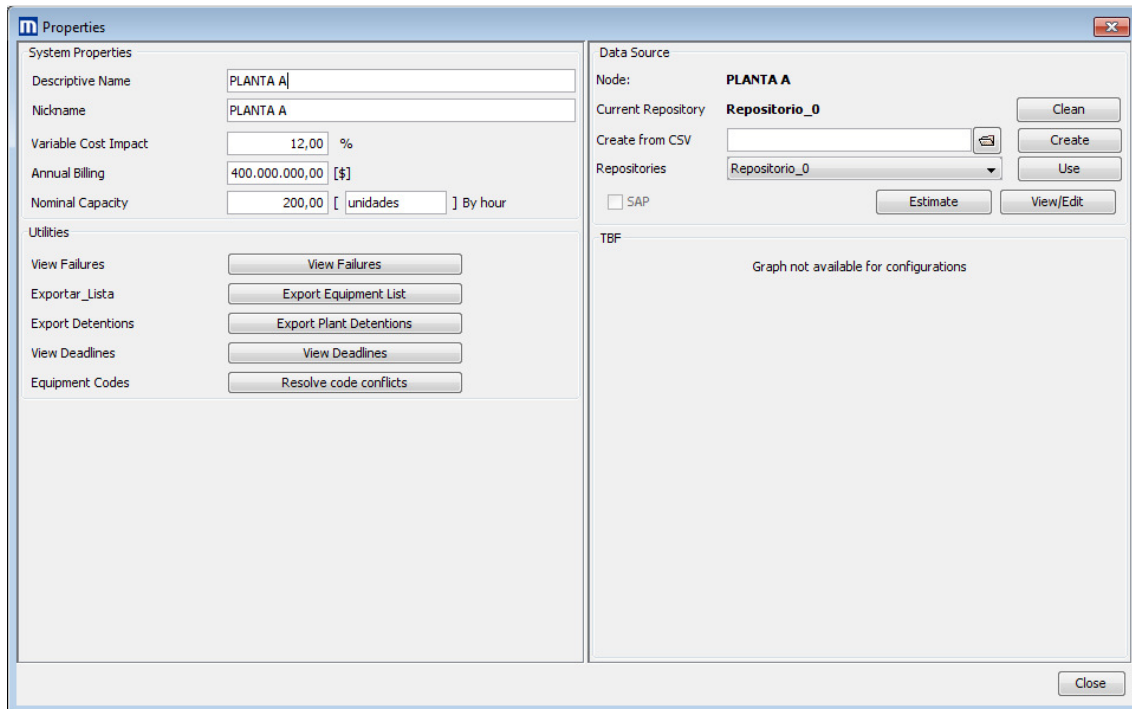
Zoom out: Gives the option to zoom out on both axes, or just the horizontal or vertical one.

Auto Range: Gives the option to revert both axes back to the automatic scale, or just the horizontal or vertical one.

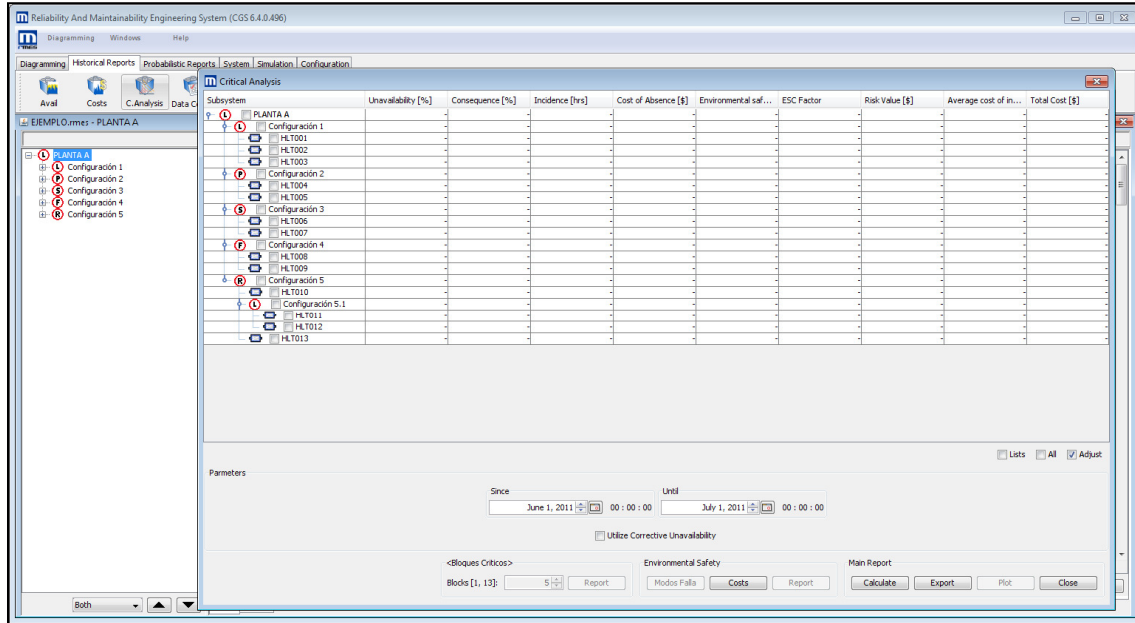
- The graph can also be exported, by clicking **“Export”** in the window of the graph. It can only be exported in Excel or HTML format.


Example

Go to the **Properties** window of the system and enter an **Annual Billing** of \$400,000,000 and a **Variable Cost Impact** of 12%:

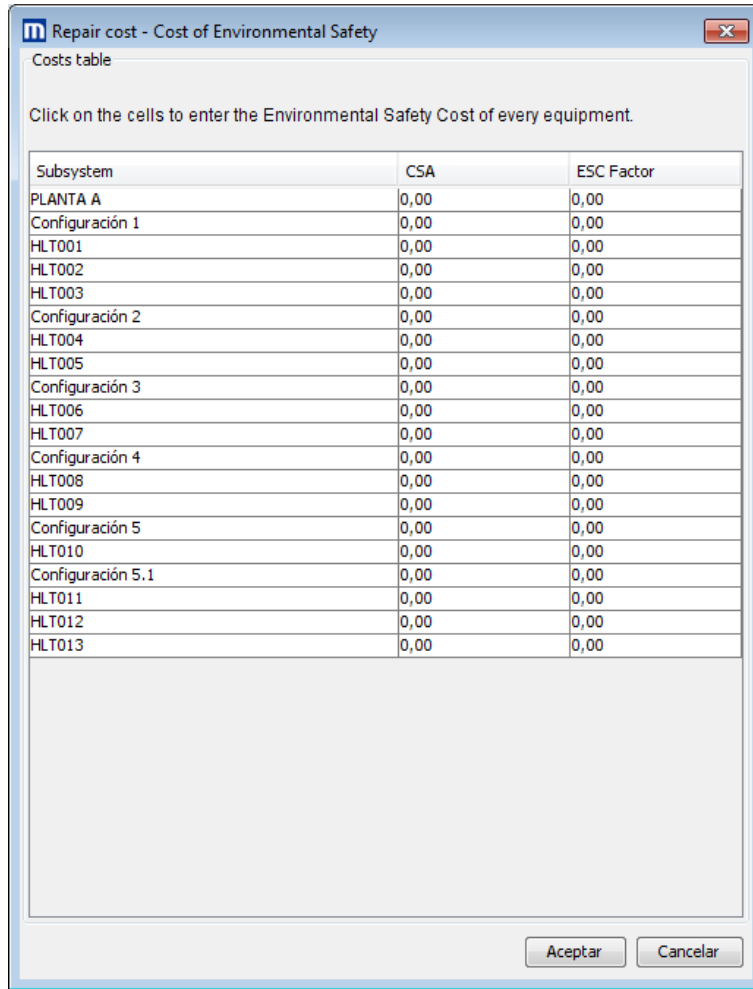


Then click **“Criticality Analysis”** on the **Historical Reports** toolbar, which will open the following window:



Enter the start and end dates of the study: from June 1, 2011 at 00:00 until July 1, 2011 at 00:00. To do that select the  icon and select the dates.

Click on **“Costs”**, which will open the following window:

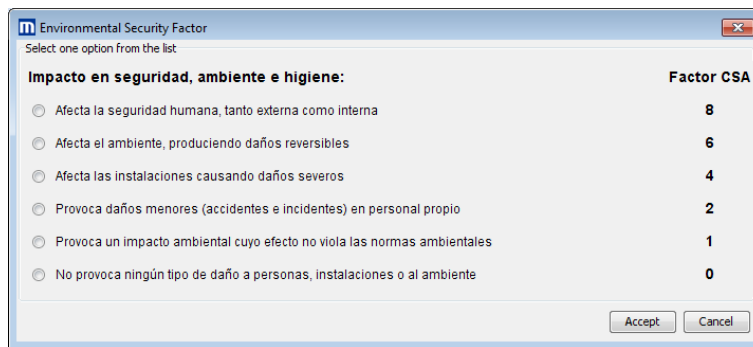


The **ESC Factor** values have to be entered, which are shown in the following table:

PALNTA A	4
Configuración 1	2
HLT001	1
HLT002	2
HLT003	0
Configuración 2	1
HLT004	0
HLT005	1
Configuración 3	4
HLT006	1
HLT007	4
Configuración 4	2

HLT008	1
HLT009	2
Configuración 5	4
HLT010	4
Configuración 5.1	1
HLT011	0
HLT012	0
HLT013	1

To do that click on each box of the **ESC Factor** column which will open a new window. In that window choose an option and then click **“Accept”**:



When you choose an option, an **ESC Factor** value will be generated for each diagram node.

After entering all the data, click **“Accept”** in the **Costs** window to save the data generated:

m Repair cost - Cost of Environmental Safety

Costs table

Click on the cells to enter the Environmental Safety Cost of every equipment.

Subsystem	CSA	ESC Factor
PLANTA A	0,00	4,00
Configuración 1	0,00	2,00
HLT001	0,00	1,00
HLT002	0,00	2,00
HLT003	0,00	0,00
Configuración 2	0,00	1,00
HLT004	0,00	0,00
HLT005	0,00	1,00
Configuración 3	0,00	4,00
HLT006	0,00	1,00
HLT007	0,00	4,00
Configuración 4	0,00	2,00
HLT008	0,00	1,00
HLT009	0,00	2,00
Configuración 5	0,00	4,00
HLT010	0,00	4,00
Configuración 5.1	0,00	1,00
HLT011	0,00	0,00
HLT012	0,00	0,00
HLT013	0,00	1,00

Aceptar Cancelar

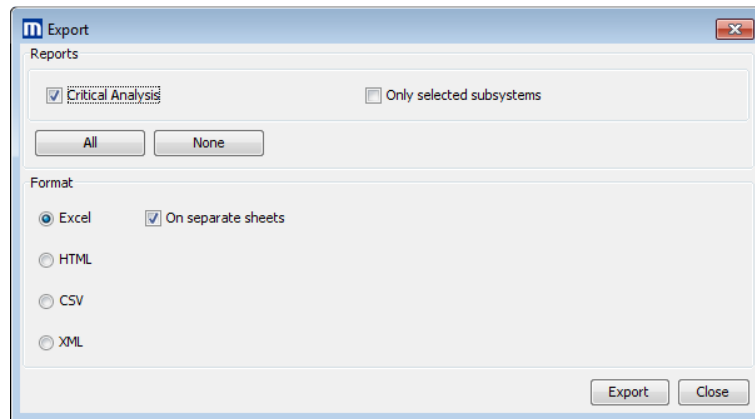
Next, in the main window, click **“Calculate”**:

Subsystem	Unavailability [...]	Consequence ...	Incidence [hrs]	Cost of Absen...	Environmental...	ESC Factor	Risk Value [\$]	Average cost ...	Total Cost [\$]
PLANTA A	-	-	-	-	-	-	-	-	-
Configuración 1	-	-	-	-	-	-	-	-	-
HLT001	-	-	-	-	-	-	-	-	-
HLT002	-	-	-	-	-	-	-	-	-
HLT003	-	-	-	-	-	-	-	-	-
Configuración 2	-	-	-	-	-	-	-	-	-
HLT004	-	-	-	-	-	-	-	-	-
HLT005	-	-	-	-	-	-	-	-	-
Configuración 3	-	-	-	-	-	-	-	-	-
HLT006	-	-	-	-	-	-	-	-	-
HLT007	-	-	-	-	-	-	-	-	-
Configuración 4	-	-	-	-	-	-	-	-	-
HLT008	-	-	-	-	-	-	-	-	-
HLT009	-	-	-	-	-	-	-	-	-
Configuración 5	-	-	-	-	-	-	-	-	-
HLT010	-	-	-	-	-	-	-	-	-
Configurac...	-	-	-	-	-	-	-	-	-
HLT011	-	-	-	-	-	-	-	-	-
HLT012	-	-	-	-	-	-	-	-	-
HLT013	-	-	-	-	-	-	-	-	-

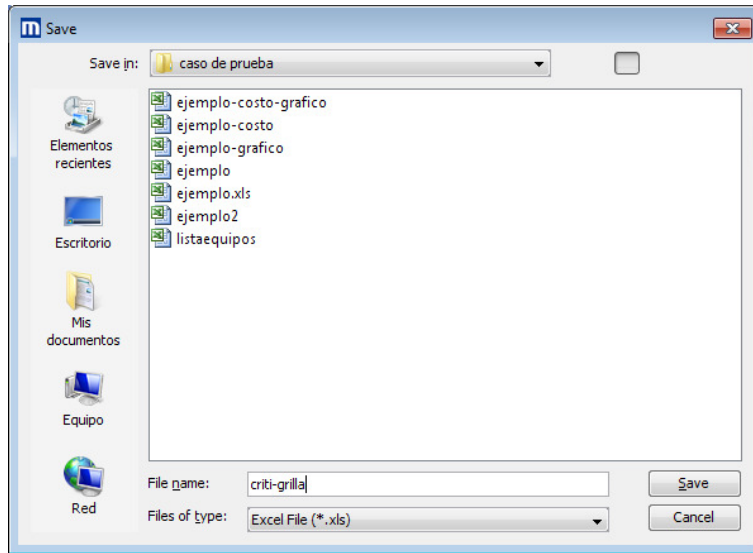
That will generate the following data grid:

Subsystem	Unavailability [...]	Consequence ...	Incidence [hrs]	Cost of Absen...	Environmental...	ESC Factor	Risk Value [\$]	Average cost ...	Total Cost [\$]
PLANTA A	51,817%	100,000%	373,083	14.991.487,569	0,000	4,000	14.991.487,569	0,000	14.991.487,569
Configuración 1	43,357%	71,654%	223,687	8.988.339,390	0,000	2,000	8.988.339,390	0,000	8.988.339,390
HLT001	14,291%	54,447%	56,027	2.251.332,897	0,000	1,000	2.251.332,897	426,112	2.251.759,010
HLT002	13,940%	54,447%	54,647	2.195.895,538	0,000	2,000	2.195.895,538	415,615	2.196.311,154
HLT003	28,828%	54,447%	113,011	4.541.110,953	0,000	0,000	4.541.110,953	894,400	4.542.005,353
Configuración 2	7,517%	71,654%	38,786	1.558.536,020	0,000	1,000	1.558.536,020	0,000	1.558.536,020
HLT004	27,601%	11,740%	23,332	937.574,854	0,000	0,000	937.574,854	829,391	938.404,246
HLT005	18,280%	11,740%	15,453	620.961,166	0,000	1,000	620.961,166	504,688	621.465,854
Configuración 3	7,015%	71,654%	36,196	1.454.458,196	0,000	4,000	1.454.458,196	0,000	1.454.458,196
HLT006	6,998%	4,775%	2,406	96.687,094	0,000	1,000	96.687,094	194,952	96.882,046
HLT007	98,274%	4,775%	33,789	1.357.771,102	0,000	4,000	1.357.771,102	42.139,357	1.399.910,460
Configuración 4	14,423%	71,654%	74,414	2.990.153,962	0,000	2,000	2.990.153,962	0,000	2.990.153,962
HLT008	19,853%	17,913%	25,606	1.028.947,214	0,000	1,000	1.028.947,214	561,230	1.029.508,445
HLT009	12,613%	53,741%	48,807	1.961.206,747	0,000	2,000	1.961.206,747	385,105	1.961.591,852
Configuración 5	0,000%	0,000%	0,000	0,000	0,000	4,000	0,000	0,000	0,000
HLT010	23,300%	0,000%	0,000	0,000	0,000	4,000	0,000	1.033,890	1.033,890
Configurac...	42,692%	0,000%	0,000	0,000	0,000	1,000	0,000	0,000	0,000
HLT011	35,821%	0,000%	0,000	0,000	0,000	0,000	0,000	1.155,236	1.155,236
HLT012	12,613%	0,000%	0,000	0,000	0,000	0,000	0,000	385,105	385,105
HLT013	0,000%	0,000%	0,000	0,000	0,000	1,000	0,000	0,000	0,000

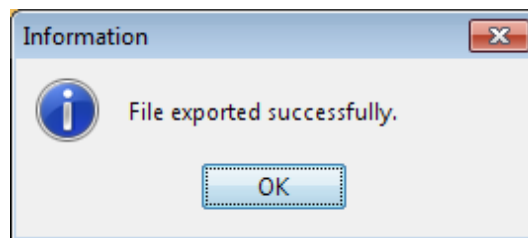
Click **“Export”** in the **Criticality Analysis** window, which will open the exportation window. In that window select the option **“Criticality Analysis”**. The option **Only selected subsystems** must not be checked for all the data from all the diagram nodes to be exported. Also choose the option **“Excel”** and click **“Export”**:



That will open the **Save** window and in it type the file name: *Criticality Analysis- Environmental Safety Analysis*, and then click **“Save”**:



The following message confirms that the file was exported correctly:



Also the pieces of equipment HLT001, HLT002, and HLT003 need to be graphed. Select them in the **Structural Tree** of the **Criticality Analysis** window and then click **“Reports”**:

Subsystem	Unavailability [...]	Consequence ...	Incidence [hrs]	Cost of Absen...	Environmental...	ESC Factor	Risk Value [€]	Average cost ...	Total Cost [€]
PLANTA A	51,817%	100,000%	373,083	14.991.487,569	0,000	4,000	14.991.487,569	0,000	14.991.487,569
Configuración 1	43,357%	71,654%	223,687	8.988.339,390	0,000	2,000	8.988.339,390	0,000	8.988.339,390
HLT001	14,291%	54,447%	56,027	2.251.332,897	0,000	1,000	2.251.332,897	426,112	2.251.759,010
HLT002	13,940%	54,447%	54,647	2.195.895,538	0,000	2,000	2.195.895,538	415,615	2.196.311,154
HLT003	28,828%	54,447%	113,011	4.541.110,953	0,000	0,000	4.541.110,953	894,400	4.542.005,353
Configuración 2	7,517%	71,654%	38,786	1.558.536,020	0,000	1,000	1.558.536,020	0,000	1.558.536,020
HLT004	27,601%	11,740%	23,332	937.574,854	0,000	0,000	937.574,854	829,391	938.404,246
HLT005	18,280%	11,740%	15,453	620.961,166	0,000	1,000	620.961,166	504,688	621.465,854
Configuración 3	7,015%	71,654%	36,196	1.454.458,196	0,000	4,000	1.454.458,196	0,000	1.454.458,196
HLT006	6,998%	4,775%	2,406	96.687,094	0,000	1,000	96.687,094	194,952	96.882,046
HLT007	98,274%	4,775%	33,789	1.357.771,102	0,000	4,000	1.357.771,102	42.139,357	1.399.910,460
Configuración 4	14,423%	71,654%	74,414	2.990.153,962	0,000	2,000	2.990.153,962	0,000	2.990.153,962
HLT008	19,853%	17,913%	25,606	1.028.947,214	0,000	1,000	1.028.947,214	561,230	1.029.508,445
HLT009	12,613%	53,741%	48,807	1.961.206,747	0,000	2,000	1.961.206,747	385,105	1.961.591,852
Configuración 5	0,000%	0,000%	0,000	0,000	0,000	4,000	0,000	0,000	0,000
HLT010	23,300%	0,000%	0,000	0,000	0,000	4,000	0,000	1.033,890	1.033,890
Configurac...	42,692%	0,000%	0,000	0,000	0,000	1,000	0,000	0,000	0,000
HLT011	35,821%	0,000%	0,000	0,000	0,000	0,000	0,000	1.155,236	1.155,236
HLT012	12,613%	0,000%	0,000	0,000	0,000	0,000	0,000	385,105	385,105
HLT013	0,000%	0,000%	0,000	0,000	0,000	1,000	0,000	0,000	0,000

Parameters

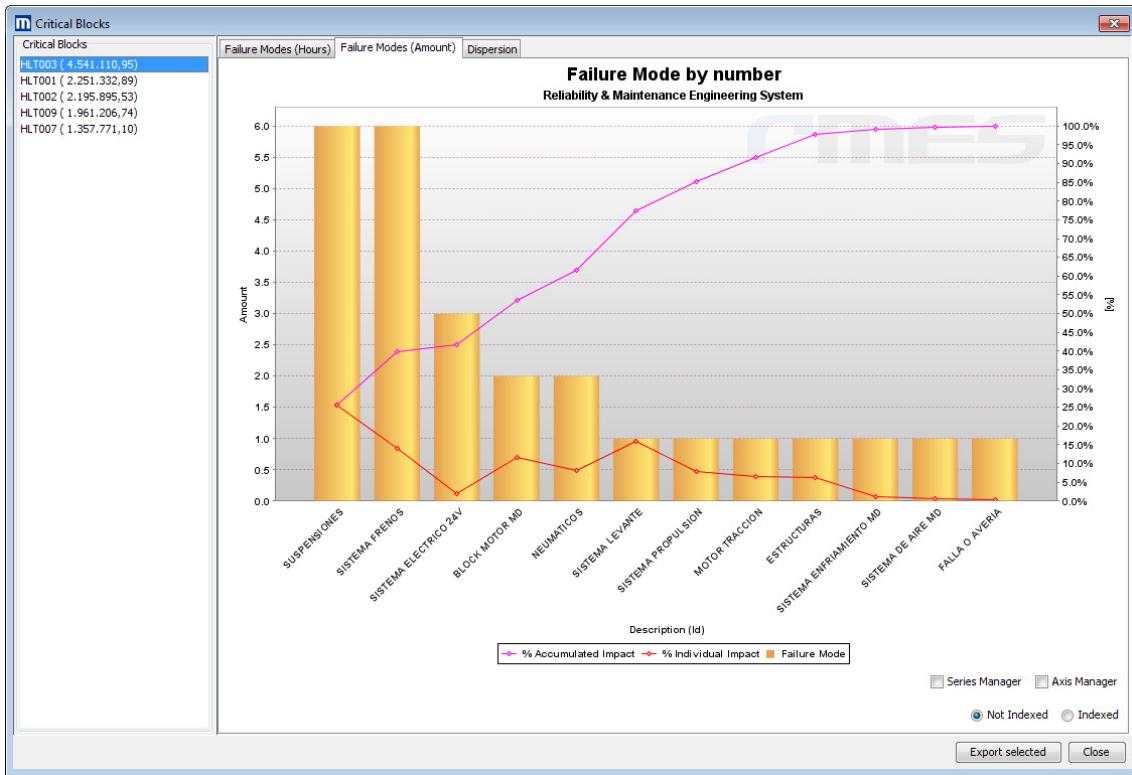
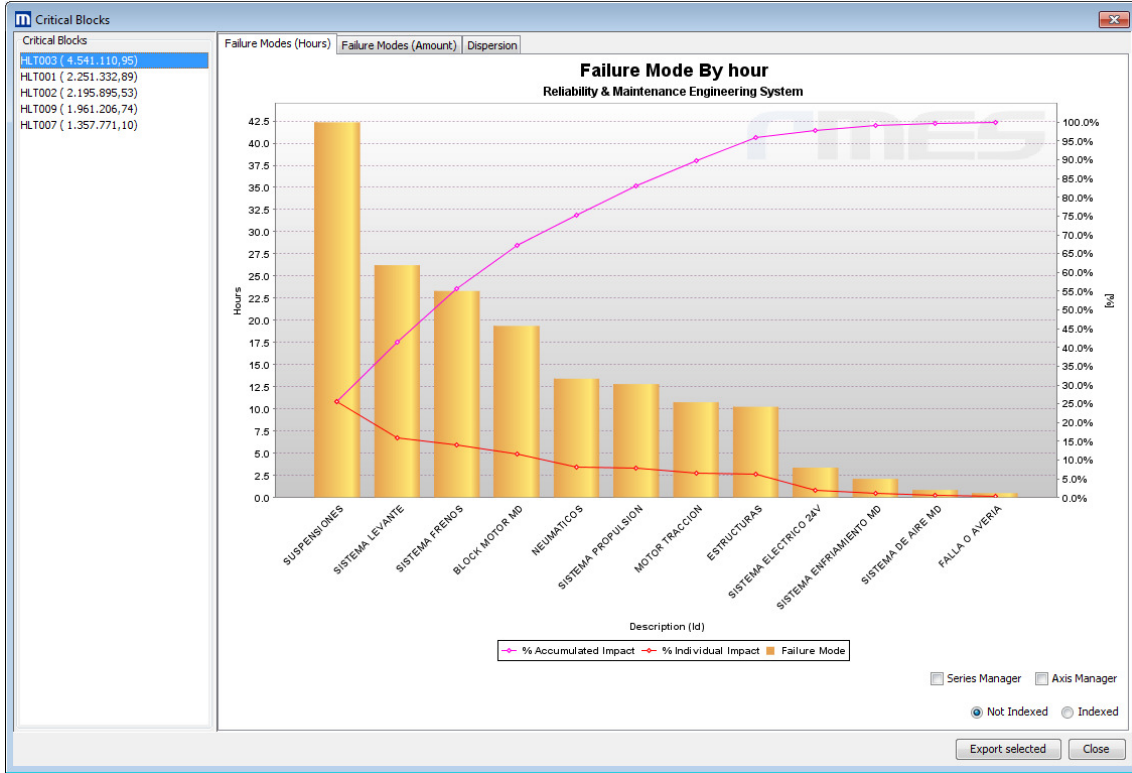
Since: June 1, 2011 00:00:00 Until: July 1, 2011 00:00:00

Utilize Corrective Unavailability

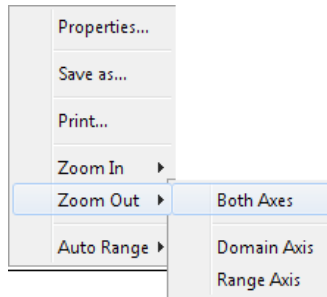
<Bloques Criticos> Environmental Safety Main Report

Blocks [1, 13]: 5 Report Modos Falla Costs Report Calculate Export Plot Close

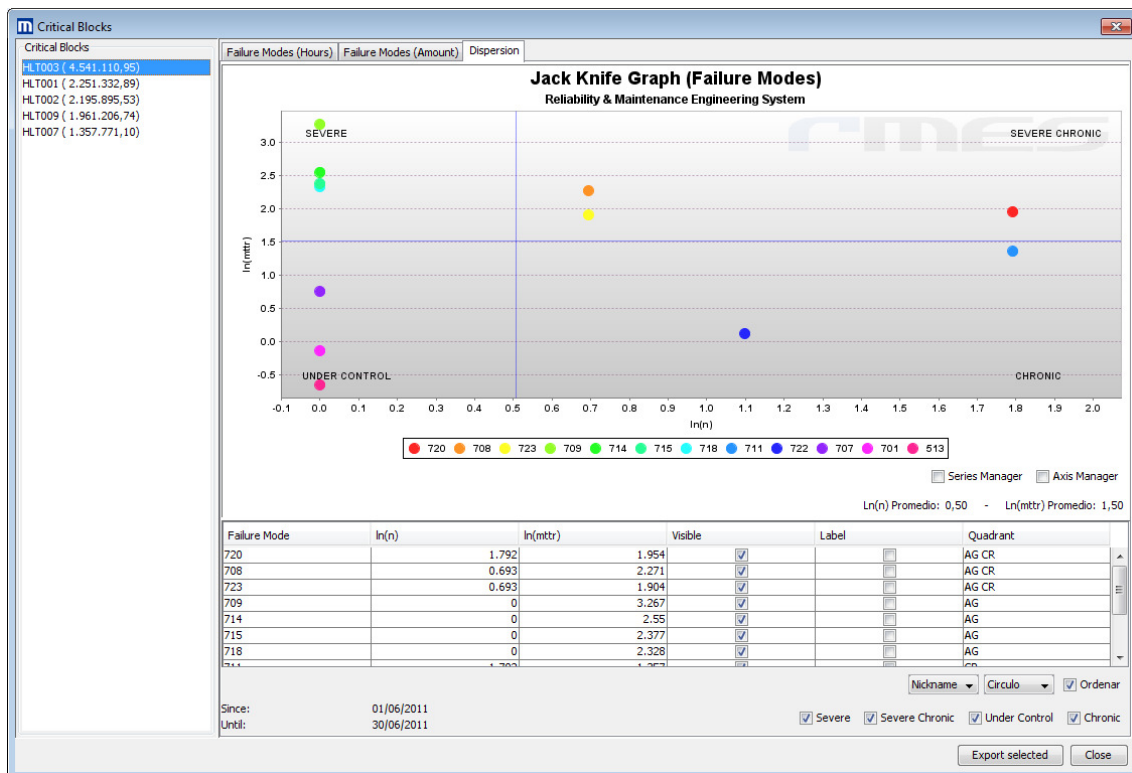
That will generate the following graphs:



In order to get a better perspective of the last graph, right-click on it and choose the option **Zoom out** and then **All axes**:



Do that twice, and the graph will look like this:




As you can see in the graphs, the piece of equipment HLT003 has the highest failure cost but the lowest ESC Factor.

Historical Reports Tab: Verification and Control

R-MES contains a record of the data imported to the system (DataGrid). This enables a follow-up of the maintenance activities carried out by to be done using the work order number.

Procedure

Select the “**Verification**” () icon on the **Historical Reports** toolbar. That will bring up a window with two tabs, and in each one there is a **Structural Tree** with data about them. The two tabs will be explained separately below:

Verification and Control of Data

- The first tab has information about the number of shutdowns of each piece of equipment, classified according to the failure type.
- Data can be exported by clicking “**Export**”.
- There are 3 graphs that can be made with the data in this tab, found by clicking “**Category**”, “**Duration**”, and “**Interval**”.

Category

- The pieces of equipment to be graphed need to be selected previously in the **Structural Tree**.
- A pie chart is generated with the percentages of each type of maintenance in the selected pieces of equipment.
- The graph can be exported by clicking “**Export**”. (The graph can only be exported in Excel format).

Duration

- The pieces of equipment to be graphed need to be selected previously in the **Structural Tree**.
- In the window of this graph the **Duration Parameter** needs to be entered.
- In the graph, the frequency of all shutdowns of the equipment selected is shown, separated into major and minor shutdowns to the **Duration Parameter** (that must have been entered previously).

Interval

- First select just one piece of equipment in the **Structural Tree** (if more than one is selected, only the first one on the list will be graphed).
- In the window of this graph, the following parameters can be modified: **Minimum Duration, Maximum Duration** and the **Interval** and **Number of Intervals**.
- This graph shows the shutdowns in intervals or levels of shutdown and among types of maintenance.

Data Grid





- Enter the start and end dates of the study in the items **From** and **Until**.
- Select one or more pieces of equipment in the **Structural Tree**.
- When you click **“Update”**, the data grid for the pieces of equipment will be shown.
- Data can be exported by clicking **“Export”**.

Characteristics

- The option **Adjust**, which is found in the two tabs in this report enables you to adjust the data to each window so that it can all be seen.
- The reports are only generated for diagram nodes that contain data, so if there is only information from equipment, reports will not be able to be generated for the configurations or for the plant.
- Only enter the start and end dates in the **Data Grid** tab, which must be different. For the calculation to be correct, both must be within the dates set for the database in use.
- The data grid in the **Verification and control of data** tab is calculated based on all the data found in the database (there is no filter for date).

Options to enter start and end dates for the study

To enter start and end dates for the study in the items **From** and **Until**, there are three options:

- For both the start date (**From**) and the end date (**Until**), select the button , and in the calendar that is displayed first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is incorrect, it can be changed in the option **General** on the **Configuration** toolbar. For more information about that, go to that item in this document.

Options for selecting diagram nodes



To graph or export data from both tabs, you must select the equipment and/or configurations needed. To do that, there are the following options:

- Select them directly in the **Structural Tree** in each tab.
- If you want to graph or export all of the equipment and configurations, select the option **All**.
- When only groups of nodes are needed, select the option **Lists** in each tab. The lists or groups of diagram nodes must have been previously created in the option **List Adm.** on the **Configuration** toolbar. For more information about this, go to the item **List Adm.** in the **Configuration** toolbar section in this document.

Options for exporting a Data Grid

When you click “**Export**”, in each of the tabs an exportation window will open that contains the following options:

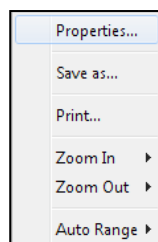
- The exportation window of **Verification and control of data** contains the option to export all the data or just the data from the diagram nodes previously selected in the **Structural Tree**. In the **Data Grid** however, only data from the diagram nodes selected in the **Structural Tree** can be exported.
- In both windows there is the option to choose the format of the document exported (Excel, HTML, CSV or XML).

Graph Options

There are 3 graphs in this report, found in the **Verification and control of data** tab, and their options are described below:

Category

- When you right-click on the graph, you will see the following options:



Properties: Enables you to change the properties of the graph such as color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: This option is not available for this graph.

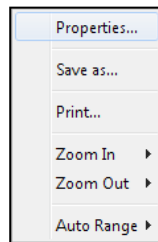
Zoom out: This option is not available for this graph.

Auto Range: This option is not available for this graph.

- The graph can be exported by clicking **“Export”** in the graph’s window. It can only be exported in Excel or HTML format.

Duration and Interval

- When you select **Series Manager**, a window will be displayed containing distributions. Each distribution will have the following options:
 - Visible:** When selected, the distribution will be visible on the graph.
By default, all the distributions are visible when you click graph.
 - Label:** This option is not activated for these graphs.
 - Color:** Changes the color of the distribution.
- When you right-click on one of the graphs you have the following options:



Properties: Enables you to change the properties of the graph such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

Zoom out: Gives the option to zoom out on the vertical axis.

Auto Range: Gives the option to revert the vertical axis back to the automatic scale.

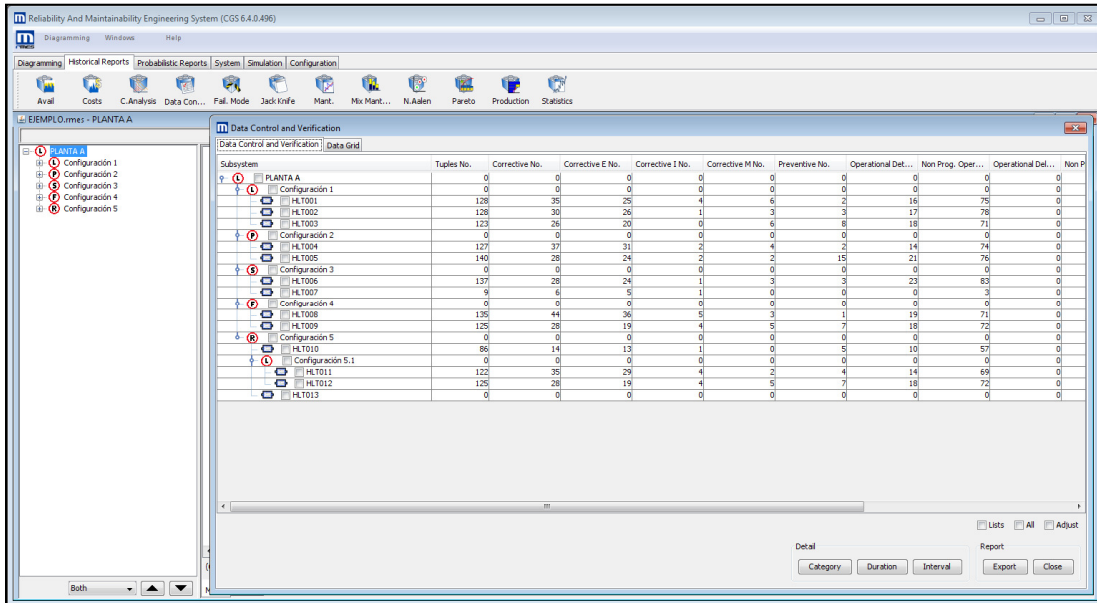
- The graph can also be exported by clicking **“Export”** in the window of the graph. The graph can only be exported in Excel or HTML format.

Example



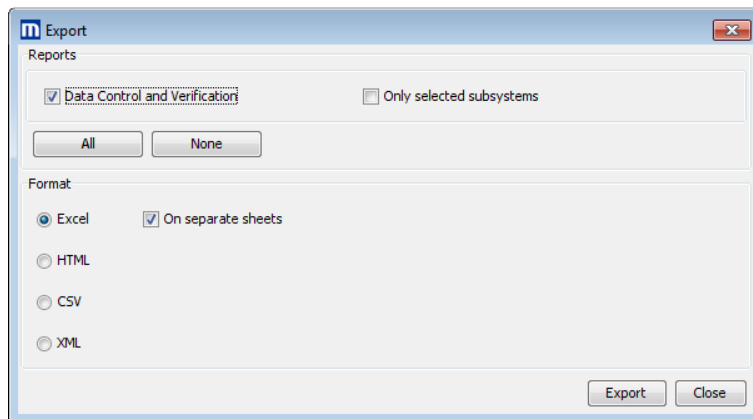
Click **“Verification and control”** which will bring up the following window:

Verification and control of data

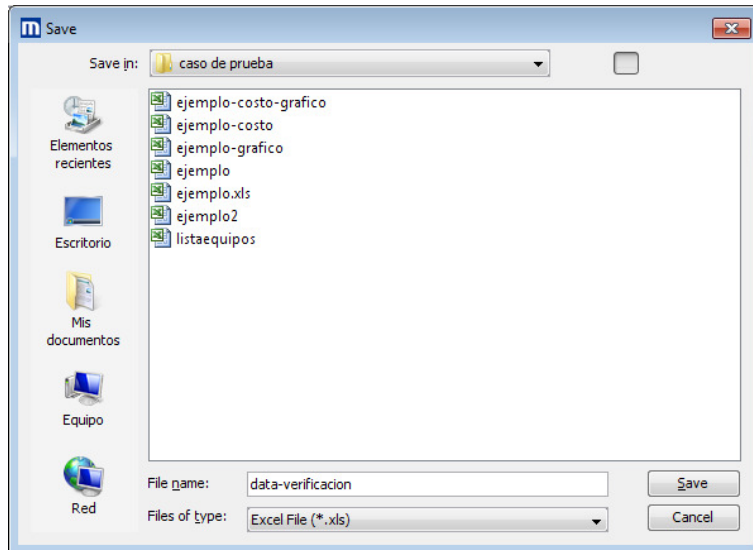


The data grid in the tab **Verification and control of data** is generated immediately when you open the window.

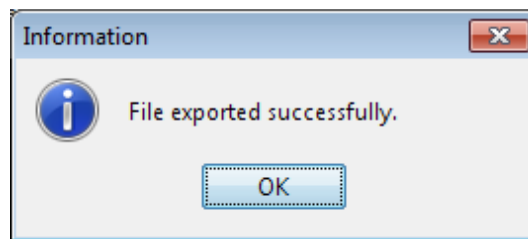
Next click **“Export”** in the **Verification and control of data** tab, which will open the exportation window. In this window select the option **“Verification and control of data.”** The option **Only selected subsystems** must not be checked so that all the diagram nodes will be exported. Also choose the option **Excel** and click **“Export”**:



Doing this will open the **Save** window and in it type the file name: *Plant A Verification and control of data*. Then click **“Save”**:



The following message confirms that the file was exported correctly:



Category

In order to create a graph, you need to select the diagram nodes that you want to be on the graph. In the **Structural Tree** on the **Verification and control of data** tab select the pieces of equipment HLT001, HLT002, and HLT003. Then click **“Category”**:

Data Control and Verification

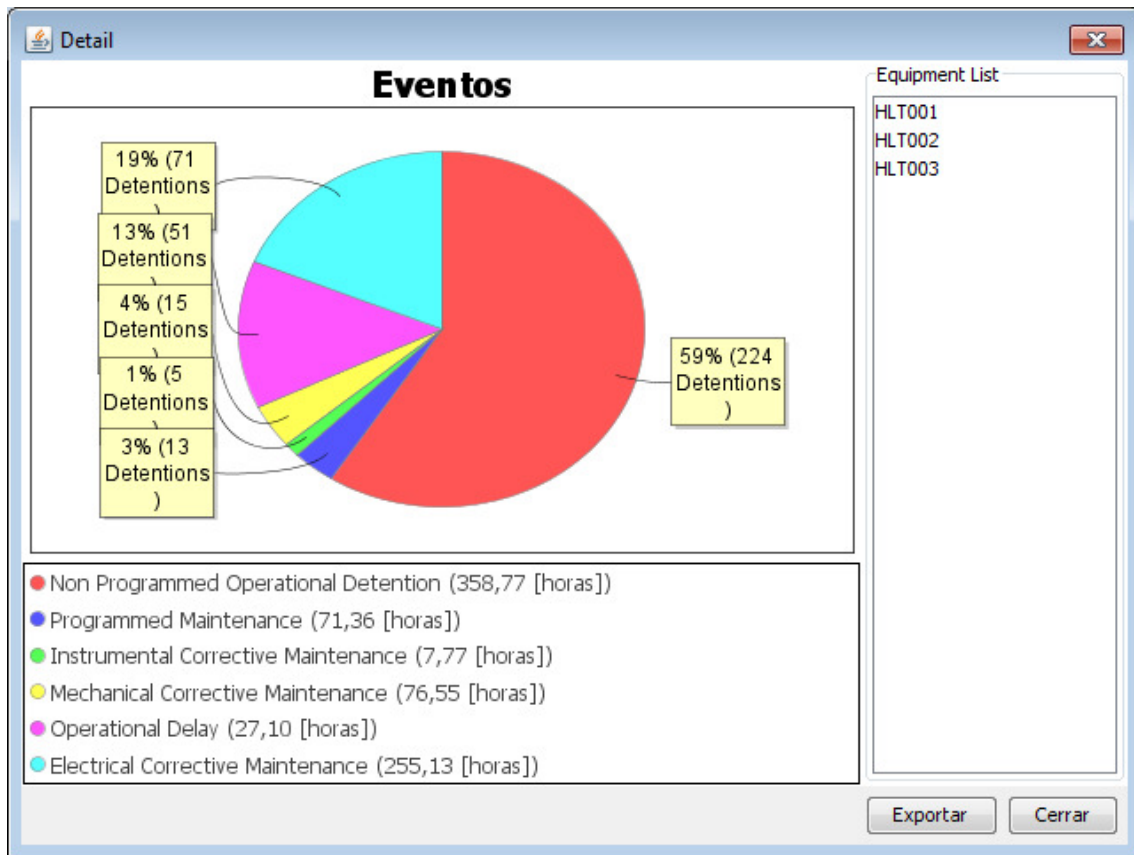
Data Control and Verification | Data Grid

Subsystem	Tuples No.	Corrective No.	Corrective E No.	Corrective I No.	Corrective M No.	Preventive No.	Operational Det...	Non Prog. Oper...	Operational Del...	Non P
PLANTA A	0	0	0	0	0	0	0	0	0	0
Configuración 1	0	0	0	0	0	0	0	0	0	0
HLT001	128	35	25	4	6	2	16	75	0	0
HLT002	128	30	26	1	3	3	17	78	0	0
HLT003	123	26	20	0	6	8	18	71	0	0
Configuración 2	0	0	0	0	0	0	0	0	0	0
HLT004	127	37	31	2	4	2	14	74	0	0
HLT005	140	28	24	2	2	15	21	76	0	0
Configuración 3	0	0	0	0	0	0	0	0	0	0
HLT006	137	28	24	1	3	3	23	83	0	0
HLT007	9	6	5	1	0	0	0	3	0	0
Configuración 4	0	0	0	0	0	0	0	0	0	0
HLT008	135	44	36	5	3	1	19	71	0	0
HLT009	125	28	19	4	5	7	18	72	0	0
Configuración 5	0	0	0	0	0	0	0	0	0	0
HLT010	86	14	13	1	0	5	10	57	0	0
Configuración 5.1	0	0	0	0	0	0	0	0	0	0
HLT011	122	35	29	4	2	4	14	69	0	0
HLT012	125	28	19	4	5	7	18	72	0	0
HLT013	0	0	0	0	0	0	0	0	0	0

Detail

Category Duration Interval Report Export Close

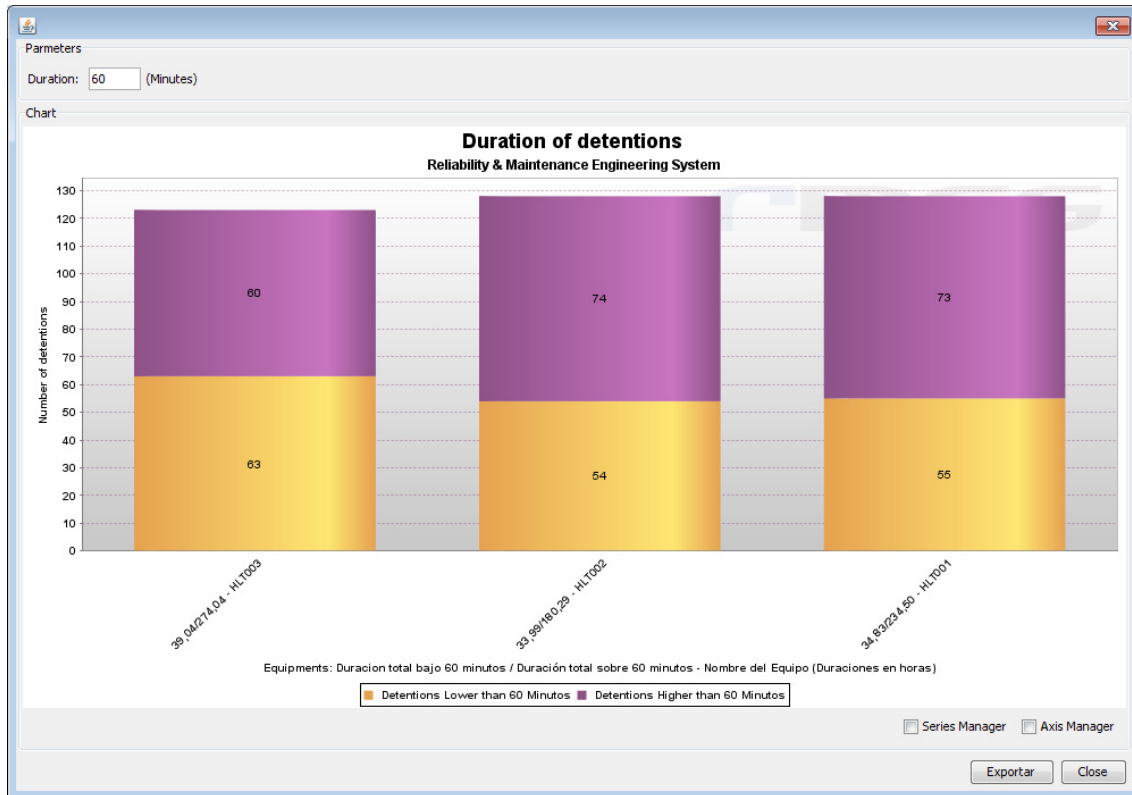
Doing that will generate the following graph:



Click **“Export”** in the previous window and save the graph.

Duration

Later, keeping the pieces of equipment HLT001, HLT002, and HLT003 selected in the **Structural Tree** in the **Verification and control of data** tab, click **“Duration”** in the same tab, and in the graph window that is displayed enter 60 minutes for the item **Duration**:

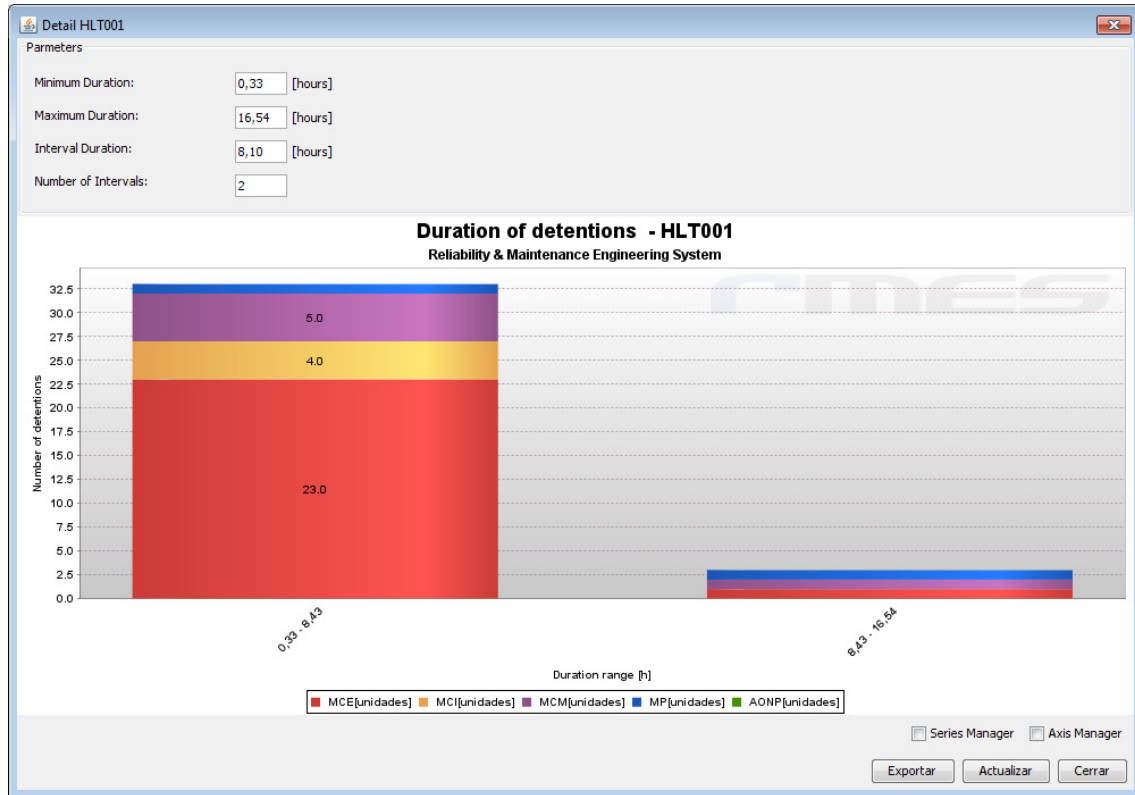


Doing this will automatically generate a graph with the required parameters.

Click **“Export”** in the window above and save the graph.

Interval

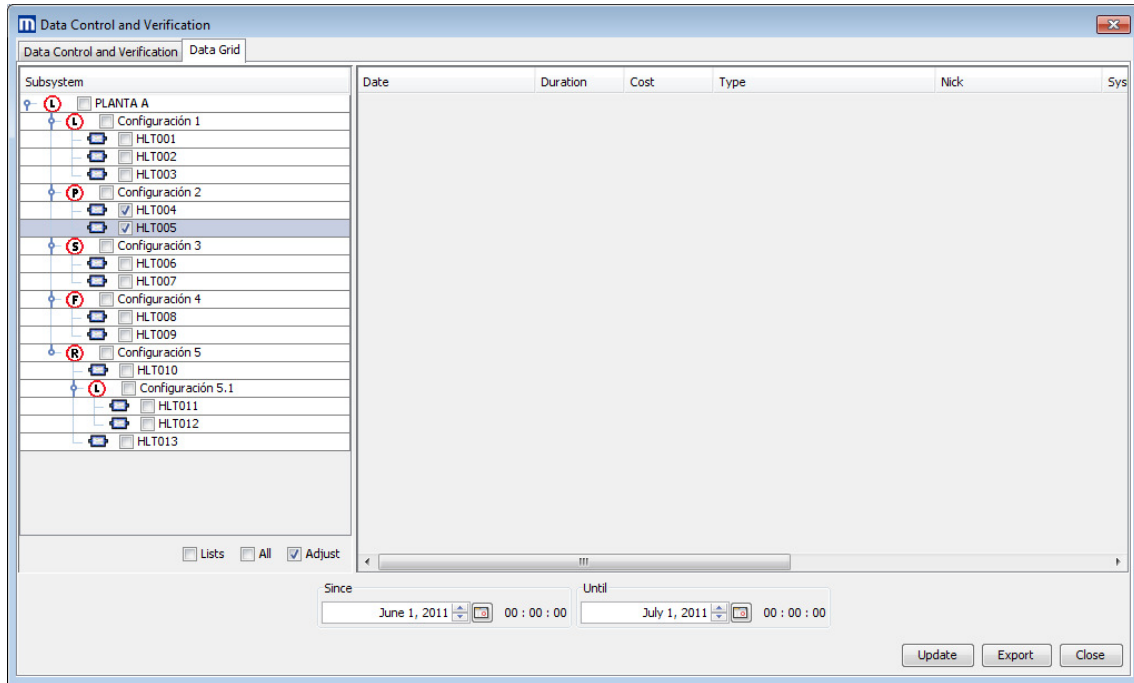
Next, leave just the piece of equipment HLT001 selected in the **Structural Tree** in the **Verification and control of data** tab, and then click **“Interval”** in the same tab, which will generate the following graph:



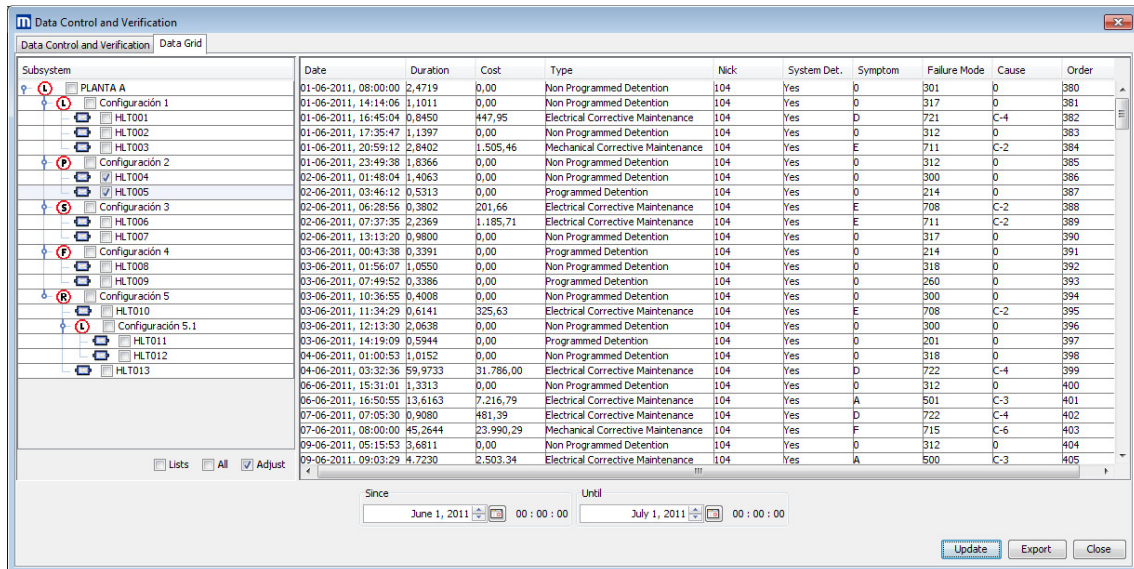
Click **“Export”** in the window above and save the graph.

Data Grid

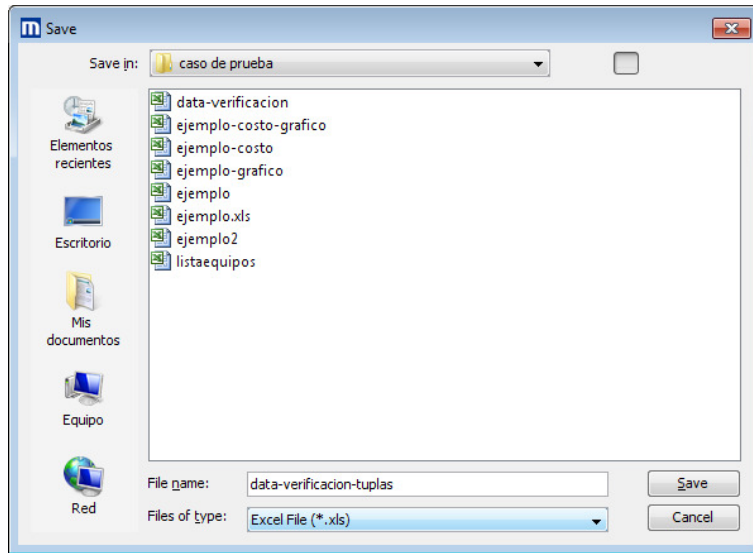
Go to the **Data Grid** tab and select the pieces of equipment HLT004 and HLT005 in the **Structural Tree**. Enter the start and end dates of the report (from June 1, 2011 at 00:00 until July 1, 2011 at 00:00) and then click **“Update”**:



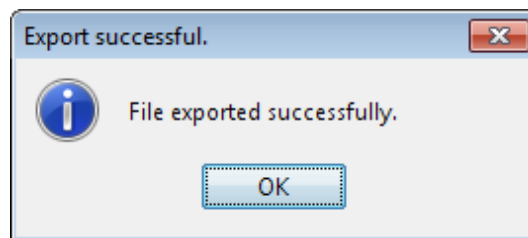
This will generate the following data grid:



Click **“Export”** in the **Data Grid** tab, which will open the **Save** window. In that window type the file name: *Equipment HLT004 and HLT005 Data Grid*, and then click **“Save”**:



The following message confirms that the file was exported correctly:




Historical Reports Tab: Failure Mode

For corrective maintenance activities, the cause of the failure of each piece of equipment or component is included in the database. The information is classified according to a list of failures defined by the client, which is configured in the R-MES system to define the corresponding types.

The Pareto diagram considering the variables number and time separately is presented as a report of this analysis. This enables the most frequent and important causes of unavailability of a particular piece of equipment to be determined to be used as a basis for a more detailed analysis of equipment failures (Root Cause Analysis RCA).

The same method used by R-MES to generate a failure modes report also enables studies of **Elements** and **Causes** to be generated.

Procedure





- Select the icon “**Failure Modes**” () in the **Historical Reports** toolbar.
- Enter the start and end dates of the study in the items **From** and **Until**.
- Select one or more diagram nodes.
- Click “**Calculate**” to generate the report. This will generate a data grid for **Failure Modes**, **Elements** and **Cause**, which are found in their respective tabs.
- The data generated can be exported if desired, by clicking “**Export**” in each of the tabs.
- The data generated can be graphed if desired, by clicking “**Graph**” in each of the tabs.

Characteristics

- Reports are only generated for diagram nodes containing data, so if there is only information for equipment, reports will not be able to be generated for the configurations or the plant.
- A data grid is only calculated for diagram nodes selected in the **Structural Tree**.
- When you select the diagram nodes in the **Structural Tree** and click “**Calculate**”, data grids for the three tabs will be generated simultaneously.
- The start and end dates must be different, and for the calculation to be correct, both must be within the dates that are set for the database in use.

Options to enter start and end dates for the study

To enter start and end dates for the study, in the items **From** and **Until** there are three options:

- For both the start date (**From**) and the end date (**Until**), select the button , and in the calendar that is displayed first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar. For more information about this, go to that item in this document.

Options for selecting diagram nodes

To export or graph data, select the pieces of equipment needed. To do that there are the following options:

- Select them directly in the **Structural Tree**.

- If you want to export or graph all of the diagram nodes, select the option **All** in the **Failure Modes** window.
- When only groups of diagram nodes are needed, select the option **Lists** in the **Failure Modes** window. The lists or groups of equipment must be created previously in the item **List Adm.** on the **Configuration** toolbar. For more information about this, go to the item **List Adm.** in the **Configuration** toolbar section in this document.

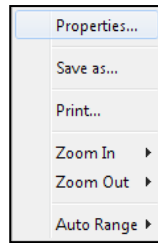
Options for exporting a data grid

- In the **Save** window that opens when you click **“Export”**, in the option **File Type** you can choose to export in Excel, HTML, CSV or XML format.

Graph Options

When you click **“Graph”** in each of the tabs (**Failure Mode**, **Elements**, and **Cause**), a window with two graphs will open, one in each tab. The first one shows the duration (in hours) and the second shows the frequency. The options that they have are:

- When you select **Series Manager**, it will bring up a window containing the graphs of the distributions (failure modes, elements or causes), and for each one there are the following options:
 - **Visible:** This option makes the distribution visible on the graph.
By default, all distributions are visible when you click **“Graph”**.
 - **Label:** This option is not available for these graphs.
 - **Color:** Change the color of the distributions.
- In **Axis Manager** the minimum and maximum values of the graph’s axes can be changed. In **Reset** the values of the axes revert back to the ones calculated by the software.
- With the option **Not Indexed** the names of the distributions of the selected diagram nodes are shown on the horizontal axis of the graphs.
- With the option **Indexed** the codes of the distributions of the selected diagram nodes are shown on the horizontal axis of the graphs. In an attached table the names of the distributions connected to their codes are shown.
- The options **Not Indexed** and **Indexed** are mutually exclusive.
- When you select **Apply to all tabs**, either the option **Not indexed** or **Indexed** selected in one graph will be applied to the other graph.
- When you right-click on one of the graphs, the following options will come up:



Properties: Change the properties of the graph, such as the color or title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

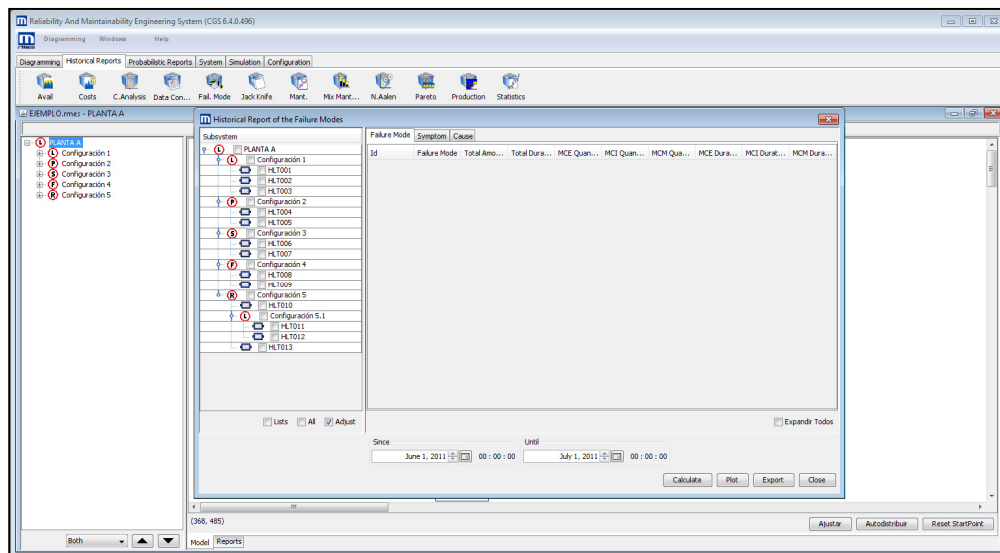
Zoom out: Gives the option to zoom out on the vertical axis.

Auto Range: Gives the option to revert back to the automatic scale on the vertical axis.

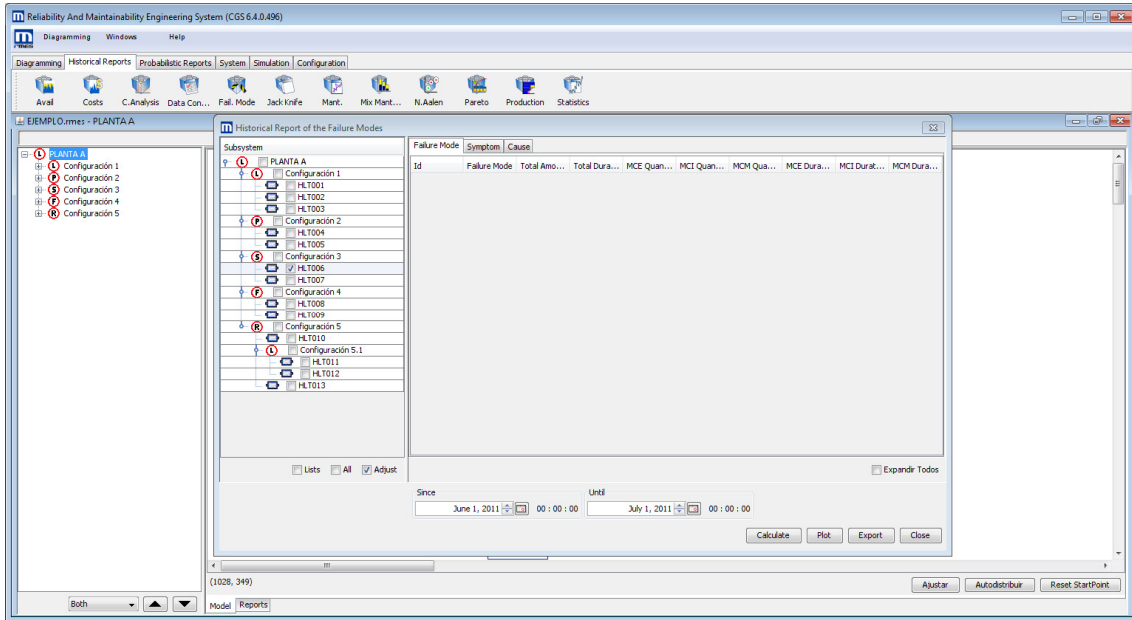
- The graphs can also be exported by clicking **“Export”** in the window of each graph. Graphs can only be exported in Excel or HTML format.

Example

Click **“Failure Mode”** on the **Historical Reports** toolbar, which will display the following window:



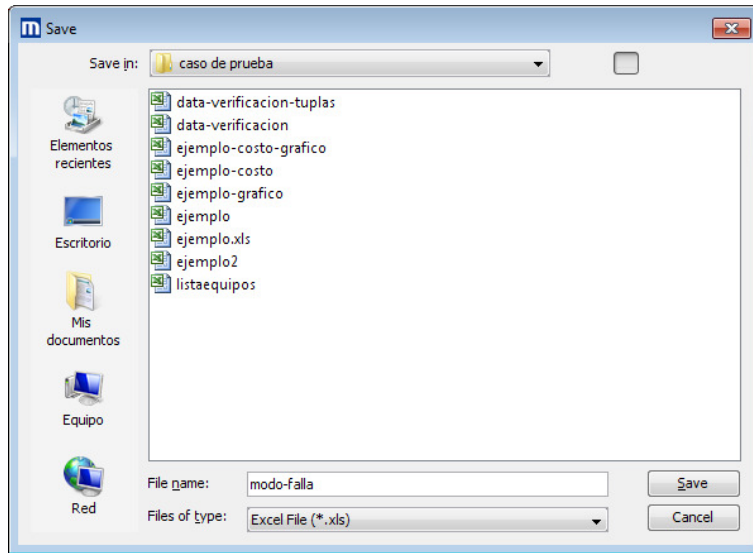
In the window enter the start and end dates of the study (from June 1, 2011 at 00:00 until July 1, 2011 at 00:00), select the piece of equipment HLT006 and then click **“Calculate”**:



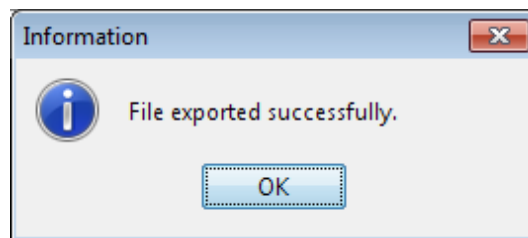
That will generate the following data grid in the **Failure Modes** tab:

Failure Mode	Symptom	Cause	Total Amount	Total Duration[h]	MCE Quantity	MCI Quantity	MCM Quantity	MCE Duration[h]	MCI Duration[h]	MCM Duration[h]
716	SISTEMA STATEX III		1	2,18	0	1	0	0,00	2,18	0,00
719	CABINA Y ACCESORIOS		1	0,35	1	0	0	0,35	0,00	0,00
715	MOTOR TRACCION		2	2,19	1	0	1	0,40	0,00	1,78
714	SISTEMA PROPULSION		6	8,96	6	0	0	8,96	0,00	0,00
723	NEUMATICOS		1	1,38	1	0	0	1,38	0,00	0,00
722	SISTEMA ELECTRICO 24V		9	5,97	9	0	0	5,97	0,00	0,00
701	SISTEMA DE AIRE MD		1	3,65	1	0	0	3,65	0,00	0,00
711	SISTEMA FRENO		3	4,64	2	0	1	4,12	0,00	0,51
710	SISTEMA DIRECCION		1	0,48	1	0	0	0,48	0,00	0,00
501	ESPERA DE REPLUESTO		1	0,52	1	0	0	0,52	0,00	0,00
707	SISTEMA ENFRIAMIENTO MD		1	0,75	0	0	1	0,00	0,00	0,75
708	BLOCK MOTOR MD		1	0,72	1	0	0	0,72	0,00	0,00

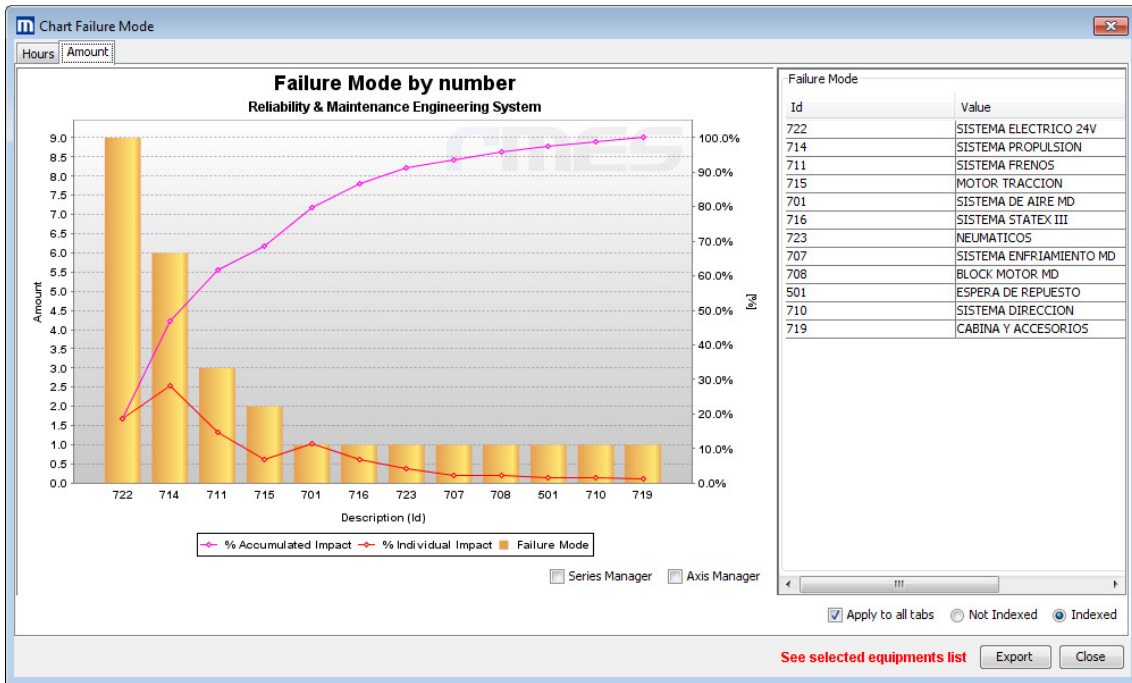
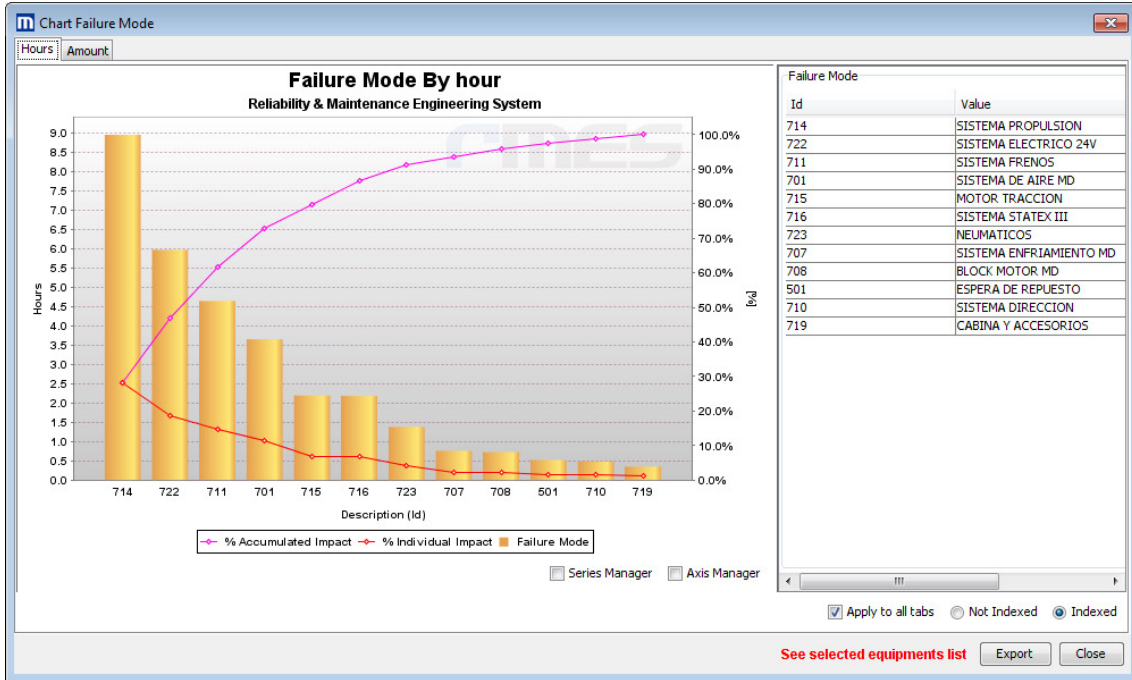
Next, click **“Export”** in the **Failure Modes** tab. This will open the **Save** window and in it type the file name: *Equipment HLT006 Failure Modes*, and then click **“Save”**:



The following message confirms that the file was exported correctly:



To graph the exported data grid click **“Graph”** in the **Failure Modes** tab, which will generate the following graphs:




Finally, export the graphs by clicking **“Export”**.

Historical Reports Tab: Jack-Knife

Using Jack-Knife analysis the dispersion of the equipment and/or configurations can be obtained with respect to its mean time to repair and failure frequency. The dispersion graph is separated into four quadrants, which are: ACUTE (diagram nodes with a high MTTR and low failure frequency), CHRONIC (diagram nodes with low MTTR and high failure frequency) UNDER CONTROL (diagram nodes with a low MTTR value and low frequency) and ACUTE-CHRONIC (diagram nodes with a high MTTR value and high frequency).

In this way the worst diagram nodes in the plant can be located (the ACUTE-CHRONIC ones). At the same time, the dispersion graph of the failure modes of the diagram nodes that the user deems appropriate to analyze can also be obtained. In this case, it is also possible to establish the worst failure codes.

Procedure





- Select the icon “Jack Knife” () on the **Historical Reports** toolbar.
- Enter the start and end dates of the study in the items **From** and **Until**.
- Click “**Calculate**” which will generate the report.
- The data grid can be exported by clicking “**Export**”.
- The data generated can be graphed by clicking “**Dispersion**” for the dispersion of equipment and/or configurations and clicking “**Failure Modes Dispersion**” for the dispersion of failure modes of diagram nodes.

Characteristics

- The graph **Failure Modes Dispersion** is only generated for diagram nodes containing data. So if there is only information from equipment a report will not be able to be generated for the configurations. The **Dispersion** graph can be used for configurations in which the equipment that it is composed of contain data.
- The indicators are calculated for all diagram nodes, independently of those selected in the **Structural Tree**.
- The start date and end date must be different, and for the calculation to be correct both must be within the dates that are set for the database in use.

Options for entering start and end dates for the study

To enter the start and end dates of the study in the items **From** and **Until**, there are three alternatives:

- For both the start date (**From**) and the end date (**Until**), select the button , and in the calendar that comes up first select the year, then the month, and lastly the day.
- Another way is to type the dates of each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar. For more information about this, go to that section in this document.

Options for selecting diagram nodes

To export or graph the data, select the necessary diagrams. To do that, there are the following options:

- Select them directly in the **Structural Tree** in the **Jack-Knife** window.
- If you want to export or graph all of the diagram nodes, select the option **All** in the **Jack-Knife** window.
- When only groups of equipment and or/configurations are necessary, select the option **Lists** in the **Jack-Knife** window. The lists or groups of equipment must be created previously in the option **List Adm.** on the **Configuration** toolbar. For more information about that, go to the item **List Adm.** in the **Configuration** toolbar section in this document.

Options for exporting a data grid

The window that opens when you click “**Export**” in the **Jack-Knife** window contains the following options:

- All the diagram nodes or just the ones selected previously in the **Structural Tree** can be exported.
- The alternative is also given to choose the format of the document exported (Excel, HTML, CSV or XML).

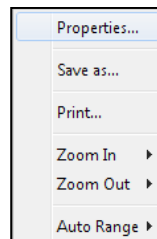
Graph Options

- In this report there are two graphs, in the option “**Dispersion**” for the dispersion of equipment and/or configurations, and the option “**Failure Modes Dispersion**” for the dispersion of failure modes of the nodes.

Diagram Nodes Dispersion Graph Options

In the window of this graph there are the following options:

- When you select **Series Manager**, a window opens with the diagram nodes being graphed, and each one contains the following options:
 - Visible:** When selected the diagram node will be visible on the graph.
By default, all the options **Visible** are selected.
 - Label:** When selected the name or nickname of each diagram node will appear.
 - Color:** Change the color of each diagram node in the graph.
- In **Axis Manager**, the minimum and maximum values of the graph's axes can be changed. In **Reset** the values of the axes revert back to the ones calculated by the software.
- There is an option to choose between **Names** or **Nickname**. With **Nickname**, the name of each diagram node will appear in both the data table and the graph. With **Nickname**, the nickname of each diagram node will appear in both the data table and the graph.
- There is also the option to choose between **Point**, **Circular**, and **Nickname**. With the first three [sic] options each diagram node appears with a specific coloring that represents it. With the last option it is only represented by its Nickname.
- The option **Order** puts the diagram nodes in the table in order, starting from the ones positioned worse on the graph (greater failure frequency and greater MTTR) to the best.
- When you right-click on the graph the following options will appear:



Properties Changes the properties of the graph, such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on all axes, or just the horizontal or vertical one.

Zoom out: Gives the option to zoom out on all axes, or just the horizontal or vertical one.

Auto Range: Gives the option to revert back to the automatic scale on all axes, or just the horizontal or vertical one.

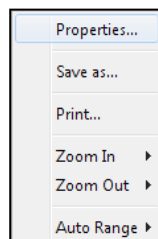
- The graph can also be exported by clicking "**Export**" in the graph's window. The graph can only be exported in Excel or HTML format.

Failure Modes Dispersion of Diagram nodes Graph Options

When you click "**Failure Modes**" a window will open with a list of the failure modes to be graphed. In the window there is the option to take away or add failure modes required.

Within the window of this graph there are the following options:

- When you select **Series Manager**, a window containing failure modes of the diagram nodes previously selected will open (to be graphed). Each of the failure modes have the following options:
 - **Visible:** When selected, failure modes will be visible on the graph.
By default all options **Visible** are selected.
 - **Label:** When selected, the name or nickname of each failure mode appears on the graph.
 - **Color:** Change the color of each failure mode on the graph.
- **In Axis Manager** the minimum and maximum values of the graph's axes can be changed. In **Reset** the values of the axes revert back to the ones calculated by the software.
- There is an option to choose between **Names** or **Nickname**. With **Name**, the name of each failure mode appears in both the data table and the graph. With **Nickname**, the nickname of each failure mode appears in both the data table and the graph.
- There is also the option to choose between **Point**, **Circular**, and **Nickname**. With the first two options each failure mode appears with a specific coloring that represents it. With the last alternative, the failure mode is represented only by its Nickname.
- The option **Order** puts the failure modes in order, starting with the ones positioned worst on the graph (higher failure frequency and higher MTTR) to the ones positioned best.
- When you right-click on the graph there will be the following options:



Properties: Change the properties of the graph such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on all axes, or just the horizontal or vertical one.

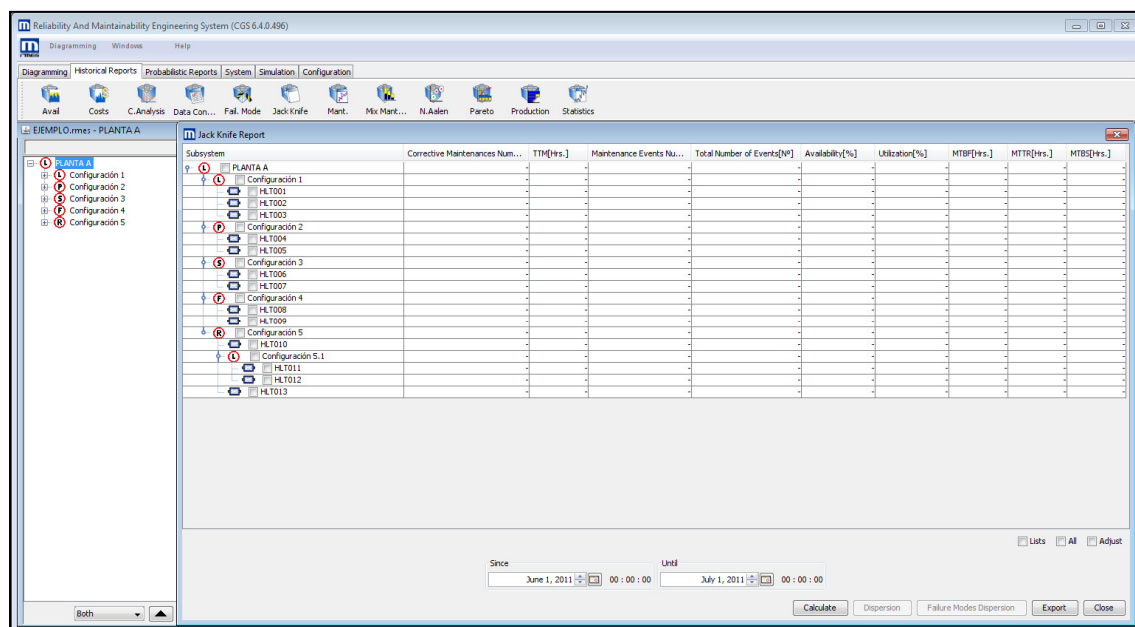
Zoom out: Gives the option to zoom out on all axes, or just the horizontal or vertical one.


Auto Range: Gives the option to revert both axes or just the vertical or horizontal one back to the automatic scale.

- The graph can also be exported by clicking "**Export**" in the graph's window. It can only be exported in Excel or HTML format.

Example

Click "**Jack Knife**", which will open the following window:

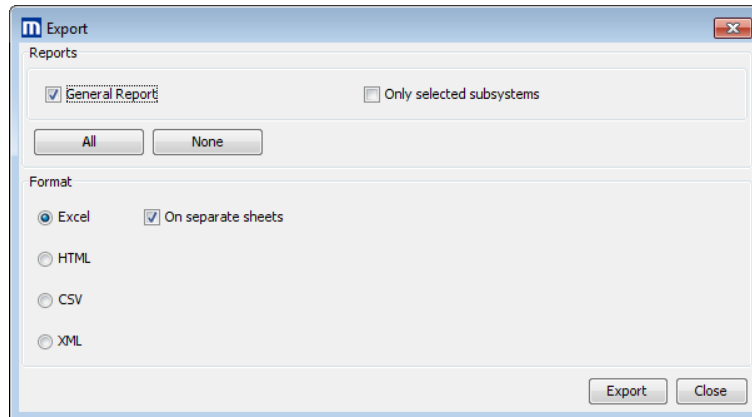


Next enter the start and end dates for the study: from June 1, 2011 at 00:00 until July 1, 2011 at 00:00. To do that, select the icons  and the dates.

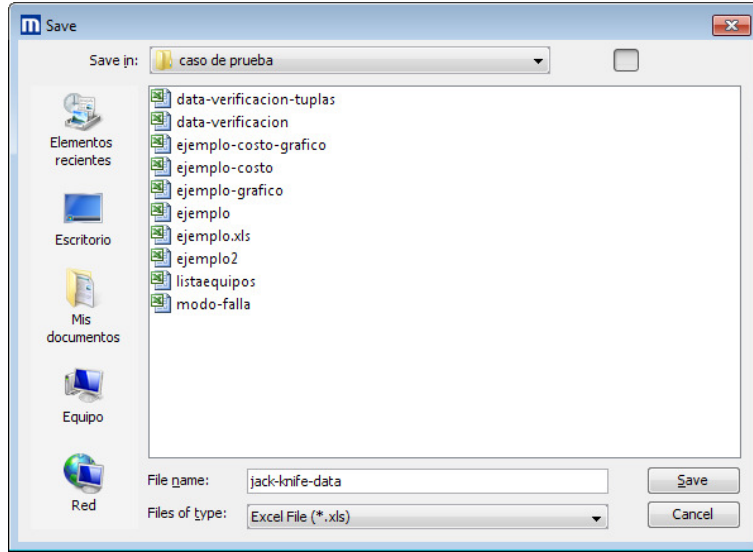
Click "**Calculate**" to generate the following data grid:

Subsystem	Corrective Maintenances Num...	TTM[hrs.]	Maintenance Events Nu...	Total Number of Events[...	Availability[%]	Utilization[%]	MTBF[hrs.]	MTTR[hrs.]	MTBS[hrs.]
PLANTA A	51,000	373,083	65,000	140,000	48,182%	17,779%	2,451	5,794	1,306
Configuración 1	48,000	312,173	56,000	144,000	56,642%	29,978%	4,404	5,436	1,829
HLT001	35,000	102,902	37,000	128,000	85,708%	62,592%	12,518	2,488	4,060
HLT002	30,000	100,368	33,000	126,000	86,059%	70,432%	16,398	2,900	4,695
HLT003	26,000	207,561	34,000	122,000	71,171%	56,674%	15,113	6,363	4,206
Configuración 2	26,000	54,129	33,000	131,000	92,482%	80,407%	21,441	1,349	5,311
HLT004	37,000	198,732	39,000	126,000	72,398%	49,251%	9,331	4,989	3,166
HLT005	28,000	131,621	42,000	139,000	81,719%	62,825%	15,598	2,857	4,308
Configuración 3	29,000	90,514	32,000	138,000	92,884%	77,751%	18,660	1,102	4,954
HLT006	28,000	50,386	31,000	137,000	93,001%	77,751%	19,303	1,137	4,998
HLT007	5,000	707,573	5,000	8,000	1,725%	1,201%	1,441	141,514	0,561
Configuración 4	60,000	103,850	68,000	185,000	85,576%	70,698%	8,344	1,189	3,462
HLT008	44,000	142,945	45,000	135,000	80,146%	65,848%	10,535	2,650	4,087
HLT009	28,000	90,819	35,000	124,000	87,386%	72,314%	17,953	2,010	5,206
Configuración 5	0,000	0,000	0,000	0,000	100,000%	100,000%	720,000	0,000	720,000
HLT010	14,000	167,760	19,000	85,000	76,700%	68,102%	32,689	4,988	6,506
Configuración 5.1	43,000	307,389	51,000	147,000	57,207%	35,627%	5,829	6,233	2,155
HLT011	35,000	257,914	39,000	122,000	64,178%	46,510%	9,302	6,921	3,189
HLT012	28,000	90,819	35,000	124,000	87,386%	72,314%	17,953	2,010	5,206
HLT013	0,000	0,000	0,000	0,000	100,000%	100,000%	720,000	0,000	720,000

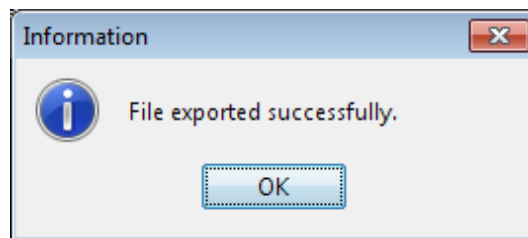
Click "**Export**" in the **Jack-Knife** window which will open the exportation window. In that window select the option "**General Report**". The option **Only selected subsystems** must not be checked so that the data from all the diagram nodes will be exported. Also choose the option **Excel** and click "**Export**":



That will open the **Save** window and in it type the file name: *Jack Knife Plant A*, and then click "**Save**":



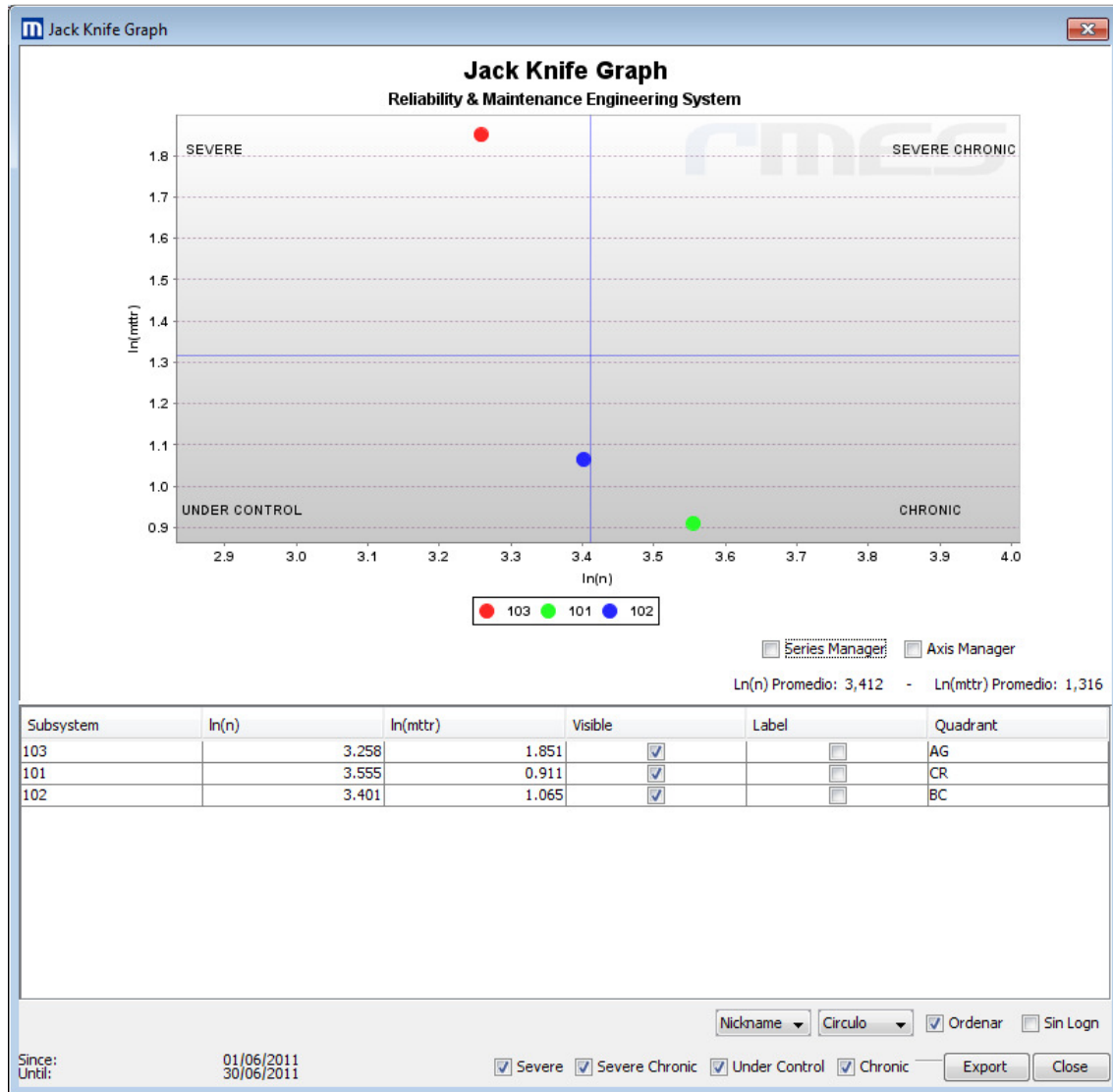
The following message confirms that the file was exported correctly:



To generate a graph, the diagram nodes you want on the graph must be selected. Therefore, select the equipment HLT001, HLT002 and HLT003 in the **Structural Tree**. There are two graphs that can be created:

Equipment Dispersion Graph

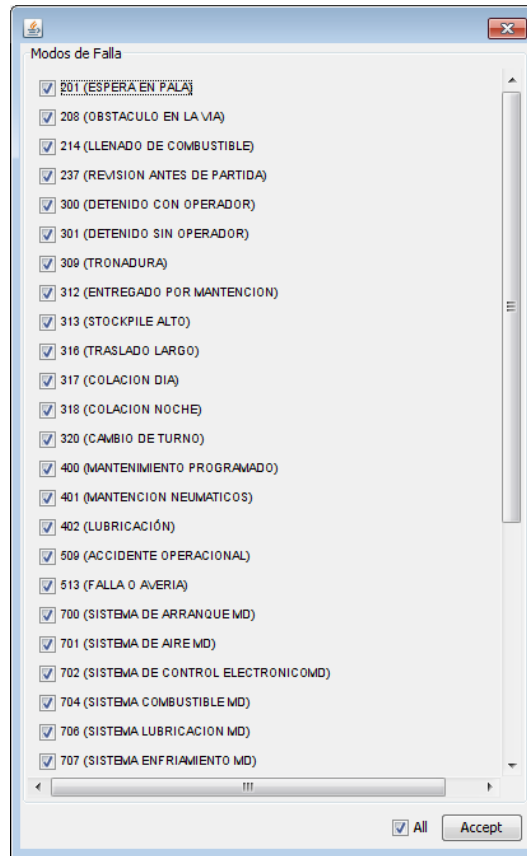
- When you click "**Dispersion**" the following graph will be generated:



Export the graph by clicking "**Export**".

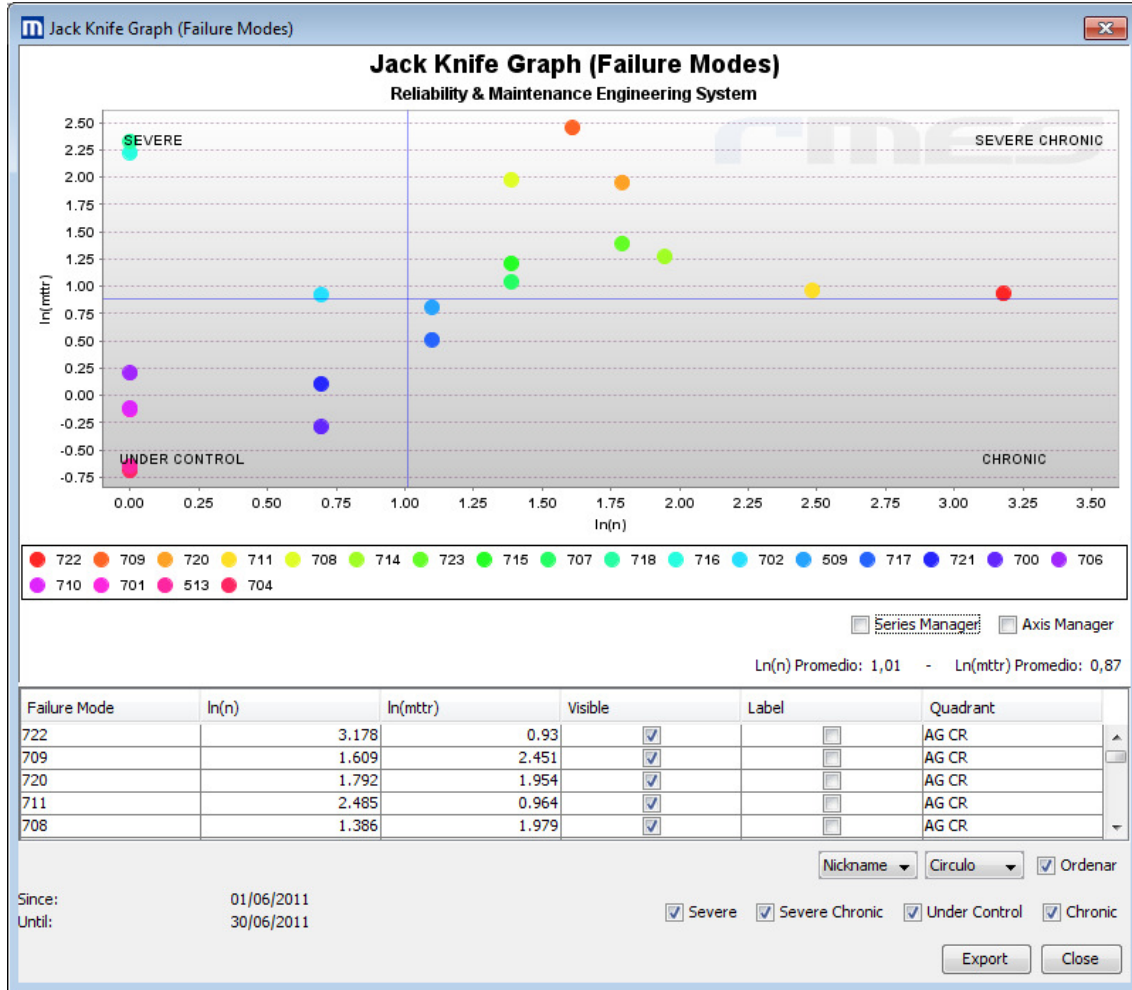
Failure Mode Dispersion Graph

- When you click "**Failure Modes Dispersion**" the following window will open:



This list shows all the failure modes of the selected equipment. This enables you to remove the failure modes that you do not want to be in the study.

Click "**Accept**" in the window with the list of failure modes, which will generate the following graph:



Export the graph by clicking "**Export**".


Historical Reports Tab Maintenance Indicators

This report enables the user to visualize a series of indicators on the equipment level and the configuration level.

- Mix of Planned/Unplanned Activities
- Maintenance/Operation Indicators
- Distribution by category (Electrical, Mechanical, Instrumental) of the number of corrective maintenance activities.
- Total and net available use
- Level of Impact for each type of maintenance

Procedure



- Select the icon "**Maint.**" () on the **Historical Reports** toolbar.
- Enter the start and end dates of the study in the items **From** and **Until**.
- Select a piece of equipment, configuration, or system of the **Structural Tree** within the **Maintenance Indicators** window.

In the upper left-hand side of the same window the name of the name of the selected diagram node is shown.

All the maintenance indicators of a selected diagram node are calculated automatically.

The indicators are presented in five windows.





- The data grid generated can be exported by clicking "**Export**".

Characteristics

- The data grid is only calculated for the diagram nodes selected in the **Structural Tree**.
- When you select a diagram node is selected in the **Structural Tree**, the data grids for all the tabs of the database are calculated automatically.
- The start and end dates must be different and for the calculation to be correct they must both be within the dates that are set for the database in use.
- When you open the **Maintenance Indicators** window, the data shown is from the plant or system.

Options for entering start and end dates for the study.

To enter the start and end dates in the items **From** and **Until**, there are three options:

- For both the start date **From**, and the end date **Until**, select the button , and in the calendar that comes up first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  arrows on your keyboard.

If the time is not correct, it can be changed in the option **General** in the **Configuration** toolbar. For more information about this, go to that item in this document.

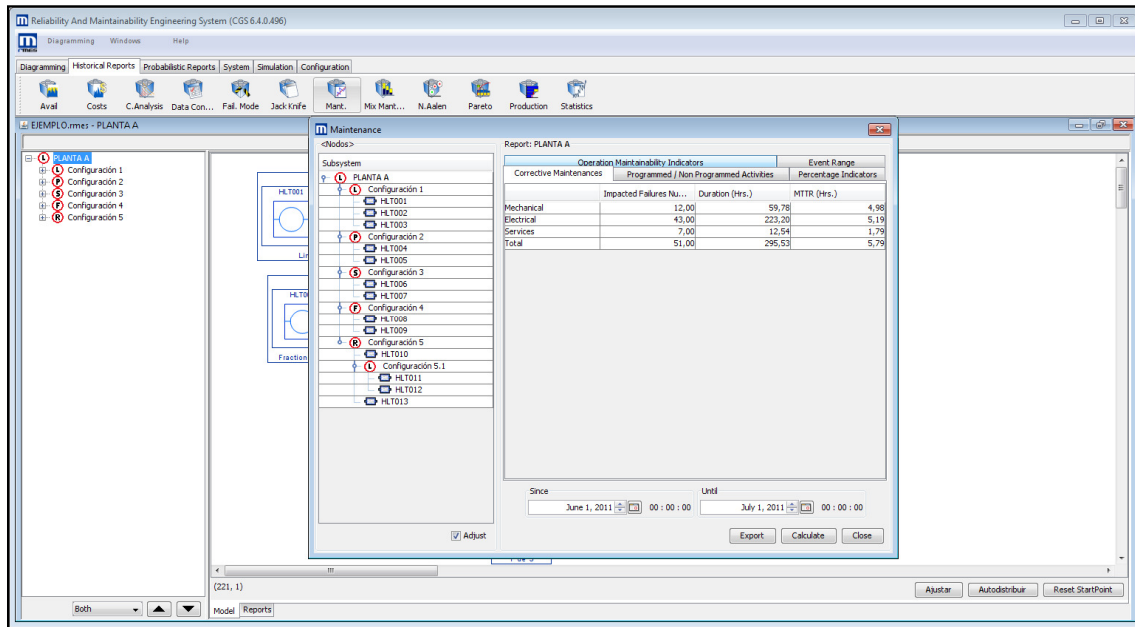
Options for exporting the data grid

- Exportation can only been done for one diagram node at a time.
- When you click "**Export**" once, the data grids for all tabs will be exported.


- In the **Save** window that opens when you click **"Export"**, in the option **File Types**, you can choose to export the data grid in Excel, HTML, CSV or XML format.

Example

Click **"Maintenance Indicators"** on the **Historical Reports** toolbar. This will open the following window:



The data grid visible belongs to Plant A.

Next, enter the start and end dates of the study: from June 1, 2011 at 00:00 to July 1, 2011 at 00:00. To do that, select the icons  and select the dates.

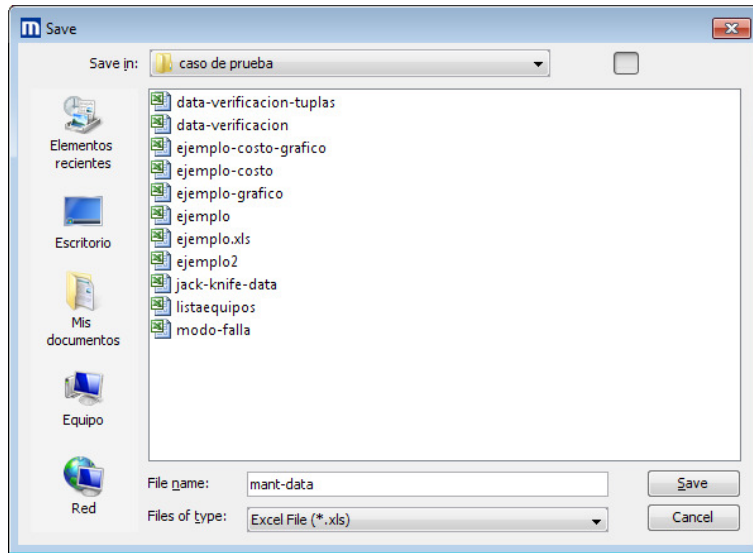
Then select the piece of equipment HLT001 in the **Structural Tree** of the maintenance window. That will generate the data grids of this piece of equipment:

The screenshot shows the 'Maintenance' window with a 'Report: PLANTA A'. On the left, a 'Subsystem' tree lists configurations from 'Configuración 1' to 'Configuración 5.1', with 'Configuración 1' selected. On the right, a data grid displays 'Operation Maintainability Indicators' for HLT001. The grid is divided into 'Corrective Maintenances' and 'Event Range' (Impacted Failures Nu..., Duration (Hrs.), MTTR (Hrs.)).

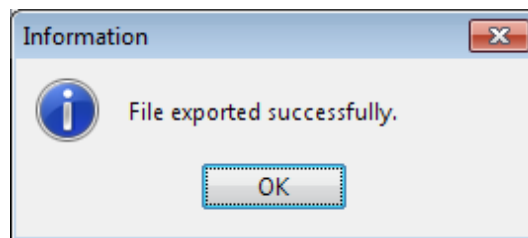
Corrective Maintenances	Operation Maintainability Indicators		Event Range	
	Programmed / Non Programmed Activities	Impacted Failures Nu...	Duration (Hrs.)	MTTR (Hrs.)
Mechanical		12,00	59,78	4,98
Electrical		43,00	223,20	5,19
Services		7,00	12,54	1,79
Total		51,00	295,53	5,79

At the bottom, there are date and time filters: 'Since' (June 1, 2011 00:00:00) and 'Until' (July 1, 2011 00:00:00). Buttons for 'Export', 'Calculate', and 'Close' are visible.

Then click "Export" in the **Failure Modes** tab. This will open the **Save** window and in it type the file name: *Maintenance Indicators for the piece of equipment HLT001* and then click "Save".




The following message confirms that the file has been exported correctly.



Historical Reports Tab: Mix Maintenance

This report shows the structure of the work orders implemented on a piece of equipment, defining the percentage of corrective v/s planned activities. The report considers two values separately: implementation time and number of activities.

Procedure

- Select the icon **“Mix Maint.”** () on the **Historical Reports** toolbar.
- Enter the start and end dates for the study in the items **From** and **Until**.
- Click **“Calculate”** to generate the report.
- Data generated can be exported if desired by clicking **“Export”**.
- Data generated can be graphed by clicking **“Graph”**. This will open a window with two graphs. The first graph shows the Mix Maintenance by time (duration) and the second by number (frequency).





Characteristics



- The data grid is calculated for all equipment, independently of the ones selected in the **Structural Tree**.
- The start and end dates must be different, and for the calculation to be correct both must be within the dates that comprise the database in use.

Options for entering start and end dates for the study

There are three options for entering the start and end dates for the study in the items **From** and **Until**:

- For both the start date (**From**) and the end date (**Until**), select the button , and in the calendar that come up first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar. For more information about this, go to that item in this document.

Options for selecting diagram nodes

To export or graph data, the equipment and/or configuration that you need must be selected. To do that there are the following options:

- Select them directly in the **Structural Tree** in the **Mix Maintenance** window.
- If you want to export or graph all equipment and configurations, select the option **All** in the **Mix Maintenance** window.
- When only groups of equipment are necessary, select the option **Lists** in the **Mix Maintenance** window. The lists or groups of equipment must be previously created in the **List Adm.** option in the **Configuration** toolbar. For more information about that, go to the item **List Adm.** in the **Configuration** toolbar section in this document.

Options for exporting a data grid

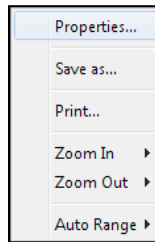
The window that opens when you click **“Export”** in the **Mix Maintenance** window contains the following options:

- You can export all diagram nodes or just those selected previously in the **Structural Tree**.
- There is also the option to choose the format of the exported document (Excel, HTML, CSV, or XML).

Graph Options

The graph window that opens when you click **“Graph”** contains the following options:

- With the option **Names**, the names of all selected diagram nodes are shown on the horizontal axis.
- With the option **Nickname**, the nicknames of the selected diagram nodes are shown and in an attached table the names and nicknames for each one are matched up.
- When you right-click on one of the graphs, the following options will come up:
-



Properties: Change the properties of the graph such as the color or title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

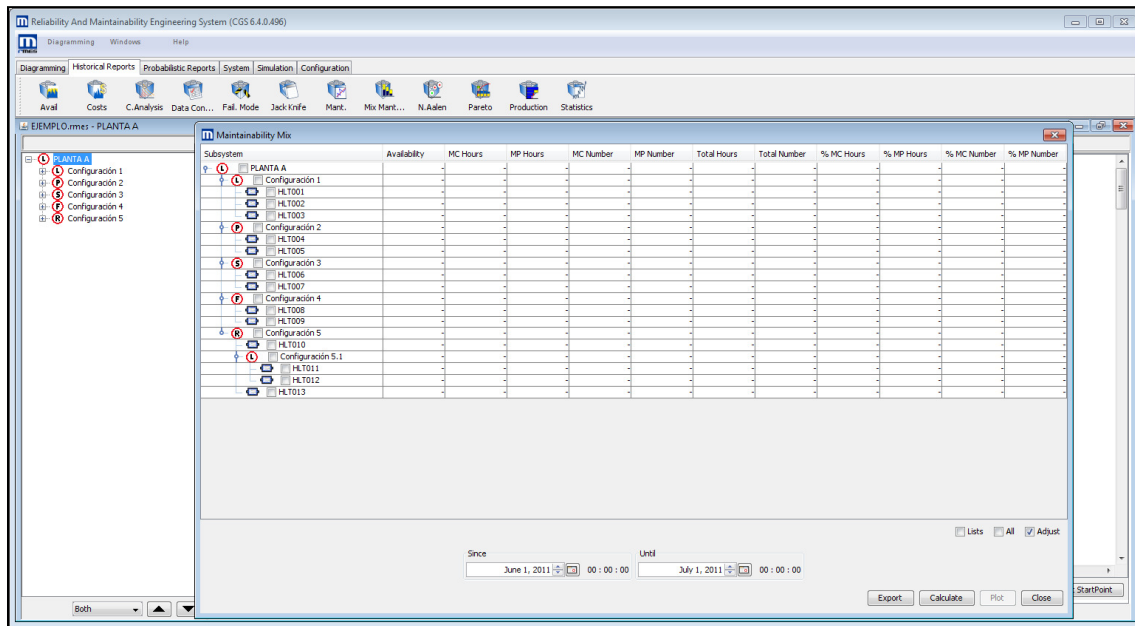
Zoom out: Gives the option to zoom out on the vertical axis.


Auto Range: Gives the option to revert back to the automatic scale on the vertical axis.

- The graphs can also be exported by clicking **“Export”**. They can only be exported in Excel and HTML format.

Example

Click **“Mix Maintenance”** on the **Historical Reports** toolbar, which will open the following window:

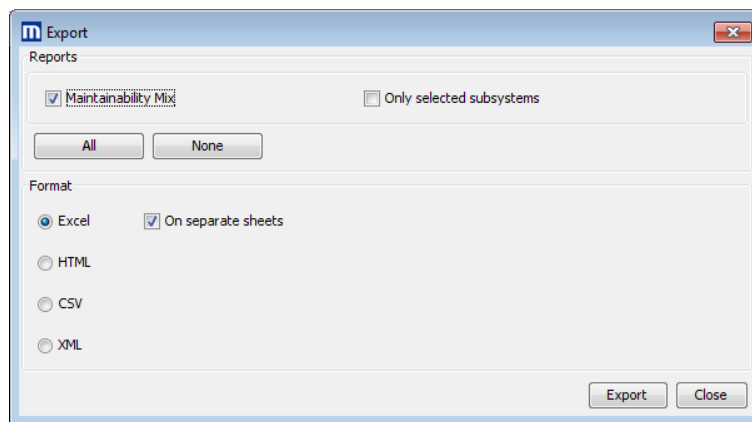


Next enter the start and end dates of the study: from June 1, 2011 at 00:00 until July 1, 2011 at 00:00. To do that, select the icons  and the dates.

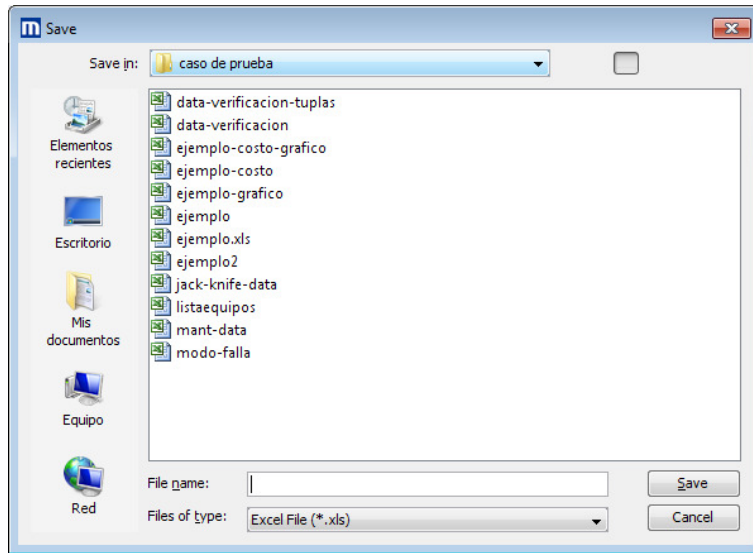
Click **“Calculate”** which will generate the following data grid:

Subsystem	Availability	MC Hours	MP Hours	MC Number	MP Number	Total Hours	Total Number	% MC Hours	% MP Hours	% MC Number	% MP Number
PLANTA A	48.182%	295,537	77,546	62,000	14,000	373,083	76,000	79,214%	20,785%	81,578%	18,421%
Configuración 1	56.642%	260,954	51,218	53,000	8,000	312,173	61,000	83,592%	16,407%	86,885%	13,114%
HLT001	85.708%	87,005	15,896	35,000	2,000	102,902	37,000	84,551%	15,448%	94,594%	5,405%
HLT002	86.059%	87,003	13,365	30,000	3,000	100,368	33,000	86,683%	13,316%	90,909%	9,090%
HLT003	71.171%	165,454	42,106	26,000	8,000	207,561	34,000	79,713%	20,286%	76,470%	23,529%
Configuración 2	92.482%	35,086	19,043	26,000	7,000	54,129	33,000	64,819%	35,180%	78,787%	21,212%
HLT004	72.398%	184,594	14,137	37,000	2,000	198,732	39,000	92,886%	7,113%	94,871%	5,128%
HLT005	81.719%	80,001	51,620	28,000	14,000	131,621	42,000	60,781%	39,218%	66,666%	33,333%
Configuración 3	92.984%	31,969	18,544	29,000	3,000	50,514	32,000	63,287%	36,712%	90,625%	9,375%
HLT006	93.001%	31,841	18,544	28,000	3,000	50,386	31,000	63,194%	36,805%	90,322%	9,677%
HLT007	1.725%	707,573	0,000	6,000	0,000	707,573	6,000	100,000%	0,000%	100,000%	0,000%
Configuración 4	85.576%	71,378	32,472	64,000	8,000	103,850	72,000	68,731%	31,268%	88,888%	11,111%
HLT008	80.146%	116,616	26,328	44,000	1,000	142,945	45,000	81,581%	18,418%	97,777%	2,222%
HLT009	87.386%	56,298	34,520	28,000	7,000	90,819	35,000	61,989%	38,010%	80,000%	20,000%
Configuración 5	100.000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000%	0,000%	0,000%	0,000%
HLT010	76.700%	69,844	97,915	14,000	5,000	167,760	19,000	41,633%	58,366%	73,684%	26,315%
Configuración 5.1	57.307%	268,031	39,357	46,000	8,000	307,389	54,000	87,196%	12,803%	85,185%	14,814%
HLT011	64.178%	242,252	15,661	35,000	4,000	257,914	39,000	93,927%	6,072%	89,743%	10,256%
HLT012	87.386%	56,298	34,520	28,000	7,000	90,819	35,000	61,989%	38,010%	80,000%	20,000%
HLT013	100.000%	0,000	0,000	0,000	0,000	0,000	0,000	0,000%	0,000%	0,000%	0,000%

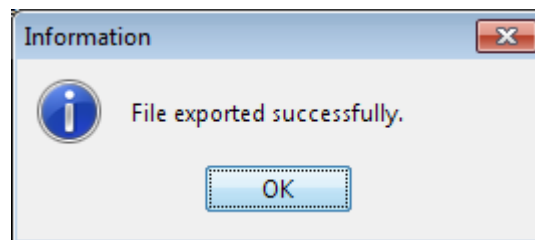
Click **“Export”** in the **Mix Maintenance** window, which will open the exportation window. In that window select the option **“Mix Maintenance”**. The option **Only selected subsystems** must not be checked so that all the data from all diagram nodes will be exported. Also choose the option **Excel** and click **“Export”**:



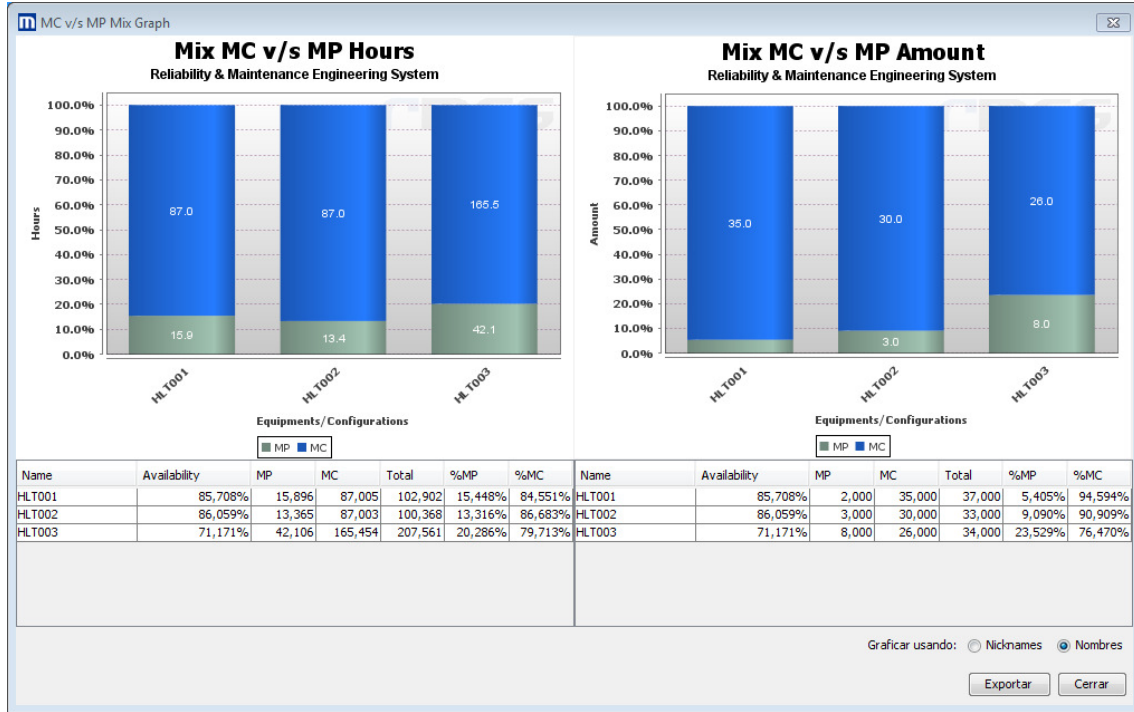
This will open the **Save** window and in it type the file name: *Plant A Mix Maintenance*, then click **“Save”**:



The following message confirms that the file was exported correctly:



To graph, select the diagram nodes that you want to be on the graph. To do that, select the pieces of equipment HLT001, HLT002, and HLT003 in the **Structural Tree** in the **Mix Maintenance** window, and click **“Graph”** which will generate the following graphs:



Export the graph by clicking “Export”.

Historical Reports Tab: Nelson Aalen

The Nelson-Aalen Report enables the user to see all the events that have occurred in a piece of Equipment/Configuration during a determined period of time on a graph. Data such as impact, duration and type of event that occurred can be extracted from the graph.


The functionality of Nelson-Aalen graphs satisfies the need to represent all historical events occurring in a piece of Equipment/Configuration during a period of time in a graph. This graph details the data of the event such as the type of event, if it did or did not cause the System to shutdown, the impact of the event on the System and the duration of the event.

For this situation, a report has been generated so that you can see all of the data of an event in one graph, mixing bubble charts and point graphs. In each graph the size of the bubble indicates the event’s impact on the System, the point indicates the type of event (differentiated by the form) and the color of the point indicates if the System shut down or not (red or green). Additionally, a tag for each point is included indicating the duration of the event and the numerical value of the impact.

Procedure

- Select a diagram node in the **Workspace**.







- Select the icon “**N. Aalen**” () on the **Historical Reports** toolbar.
- Enter the start and end dates for the study in the items **From** and **Until**.
- Click “**Calculate**” to generate the report.
- The data generated can be exported if desired, by clicking “**Export**”.
- The data generated can be graphed if desired, by clicking “**Graph**”.

Characteristics

- A data grid is calculated for one diagram node at a time.
- The data grids for the configurations and the system are calculated based on the overlap of data of the pieces of equipment that each one contains.
- The start and end dates must be different, and for the calculation to be correct, both must be within the dates that are set for the database in use.

Options for entering the start and end dates for the study

There are three options for entering the start and end dates for the study in the items **From** and **Until**:

- For both the start date (**From**) and the end date (**Until**), select the button , and in the calendar that comes up first select the year, then the month, and finally the day.
- Another way is to type the dates of each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the dates desired. You can also use the up  and down  keys on your keyboard.

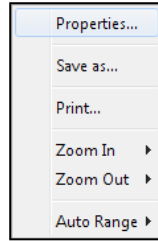
If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar. For more information about that, go to that item in this document.

Options for exporting a data grid

- In the **Save** window that opens when you click “**Export**”, in the option **File Type** you can select to export the data grid in Excel, HTML, CSV or XML format.

Graph Options

- When you right-click on the graph the following options will come up:



Properties: Changes the properties of the graph such as the color or title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on both axes, or just the horizontal or vertical one.

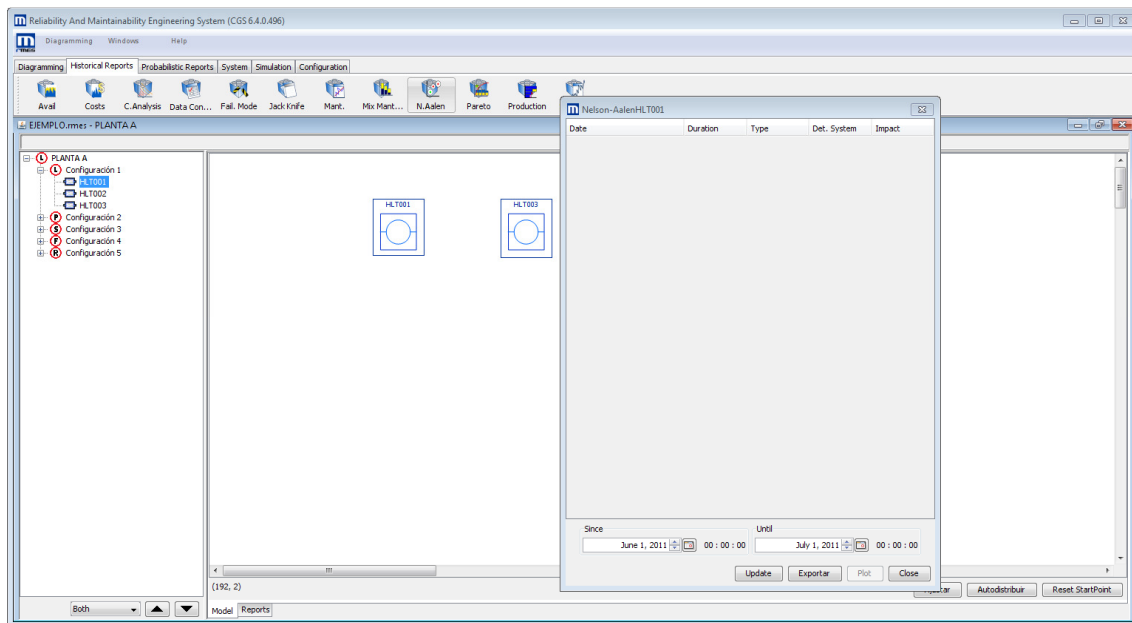
Zoom out: Gives the option to zoom out on both axes, or just the horizontal or vertical one.


Automatic Scale: Gives the option to revert back to the automatic scale for both axes, or just the horizontal or vertical one.

- The graph can also be exported, by clicking “**Export**” on the graph window. It can only be exported in Excel and HTML format.

Example

Select the piece of equipment HLT001 in the **Navigation Tree** and select the option “**Nelson Aalen**” on the **Historical Reports** toolbar, which will display the following window:



Next enter the start and end dates of the study: from June 1, 2011 at 00:00 to July 1, 2011 at 00:00. To do that, select the icons  and the dates.

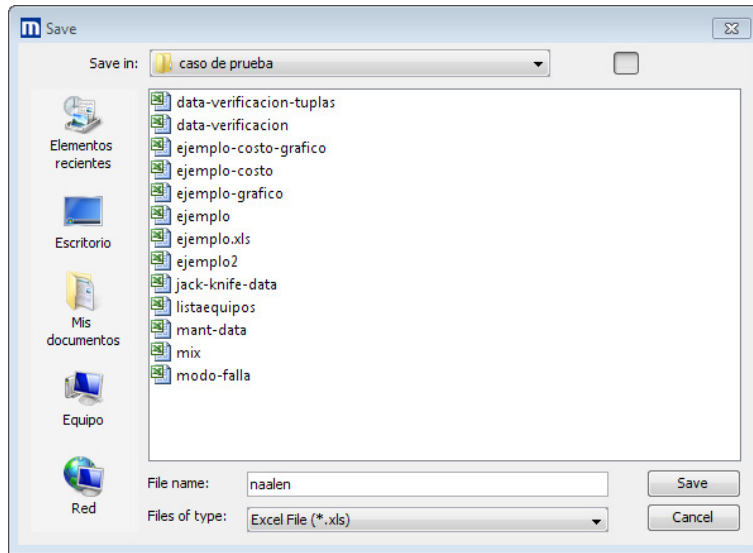
Then click **“Update”** which will generate the following data grid:

Date	Duration	Type	Det. System	Impact
01/06/2011 08:00	10,5833	DONP	SI	1,00
01/06/2011 18:35	0,6069	MCE	SI	1,00
01/06/2011 19:11	0,7300	DONP	SI	1,00
01/06/2011 19:55	0,4683	DONP	SI	1,00
02/06/2011 00:06	0,6505	MCE	SI	1,00
02/06/2011 00:46	6,0875	DONP	SI	1,00
02/06/2011 13:07	1,1111	DONP	SI	1,00
02/06/2011 19:40	0,9605	DO	SI	1,00
02/06/2011 20:38	0,5977	DONP	SI	1,00
02/06/2011 23:53	1,3283	DONP	SI	1,00
03/06/2011 12:30	0,3375	DONP	SI	1,00
03/06/2011 12:50	1,3174	DONP	SI	1,00
04/06/2011 00:04	0,3355	DO	SI	1,00
04/06/2011 00:29	0,6316	DONP	SI	1,00
04/06/2011 07:42	0,3508	DO	SI	1,00
04/06/2011 12:55	1,0886	DONP	SI	1,00
04/06/2011 20:02	3,1180	MCE	SI	1,00
04/06/2011 23:09	0,8944	DONP	SI	1,00
05/06/2011 00:06	0,5022	MCE	SI	1,00
05/06/2011 01:47	0,9686	DONP	SI	1,00
05/06/2011 12:50	1,3700	DONP	SI	1,00
05/06/2011 14:21	2,0988	MP	SI	1,00
05/06/2011 16:27	0,5688	DONP	SI	1,00
06/06/2011 01:10	1,0083	DONP	SI	1,00
06/06/2011 07:36	0,3588	DO	SI	1,00
06/06/2011 13:09	0,9827	DONP	SI	1,00
06/06/2011 15:02	0,4575	MCE	SI	1,00
06/06/2011 16:13	1,4775	MCI	SI	1,00
06/06/2011 18:43	0,6469	MCE	SI	1,00
06/06/2011 19:32	1,8591	MCM	SI	1,00
06/06/2011 21:24	2,3275	DONP	SI	1,00
06/06/2011 23:43	0,8925	MCE	SI	1,00

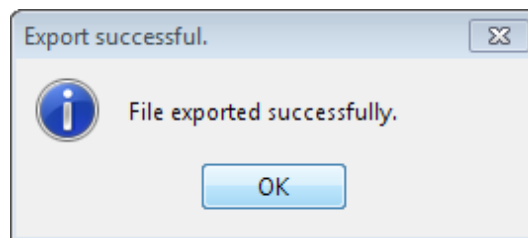
Since: June 1, 2011 00:00:00 Until: July 1, 2011 00:00:00

Buttons: Update, Exportar, Plot, Close

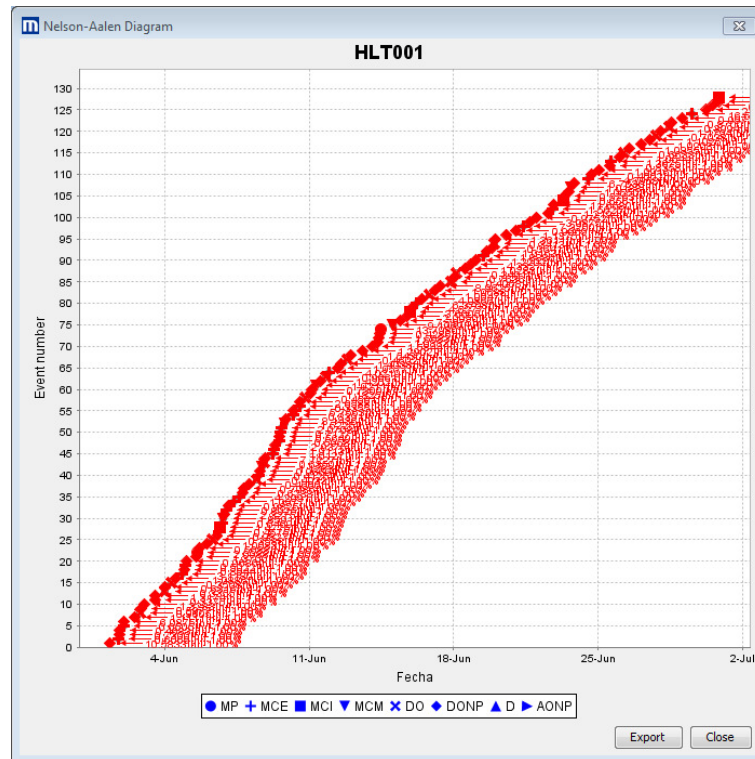
Then click **“Export”** in the **Nelson-Aalen** tab which will open the **Save** window. In that window type the file name: *Nelson-Aalen of Equipment HLT001*, and then click **“Save”**:



The following message confirms that the file was exported correctly:



Then click **“Graph”** in the **Nelson-Aalen** report window, which will generate the following graph:



Finally, export the graph by clicking **“Export”**:


Historical Reports Tab: Pareto

Using the Pareto Diagram, equipment that is more important in regard to time and frequency of maintenance can be detected through the application of the Pareto principle (vital few and trivial many), which states that in general 80% of the total results originate in 20% of the diagram nodes studied.

In this case the R-MES system presents the time and frequency of intervention/shutdowns of equipment and configurations in a hierarchy. Besides showing actual results, it also shows the cumulative percent curve in a secondary scale. The graph is very useful for visually identifying in one single review the minority of vital characteristics that it is important to pay attention to, thus enabling all of the necessary resources to be utilized to carry out a corrective action with a proper allotment of efforts and resources.

It is important to consider that the user can create filters of the types of interventions/shutdowns to be analyzed in the Pareto diagrams; this possibility brings greater flexibility to the application.

Procedure





- Select the icon “Pareto” () on the **Historical Reports** toolbar.
- Select the type of shut down to consider. To select all the types of shut downs, click “**All**” in the **Maintenance Selection** section. By clicking “**None**”, all shut downs will be deselected.
- Enter the start and end dates for the study in the items **From** and **Until**.
- Click “**Calculate**” to generate the report.
- Data generated can be exported if desired, by clicking “**Export**”.
- Data generated can be graphed if desired, by clicking “**Graph**”. When this option is selected, a window with two tabs will open, each containing a graph. The first shows the Pareto analysis by time (duration) and the second by number (frequency).

Characteristics

- A data grid is calculated for all pieces of equipment, independently of the ones selected in the **Structural Tree**.
- The start and end date must be different, and for the calculation to be correct both must be within the dates that comprise the database in use.

Options for entering the start and end dates for the study

There are three options for entering start and end dates of the study in the items **From** and **Until**:

- For both the start date (**From**) and the end date (**Until**), select the button , and in the calendar that comes up first select the year, then the month, and finally the day.
- Another way is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the arrows  until you reach the desired dates. You can also use the up  and down  arrow keys on your keyboard.

If the time is not correct, it can be changed in the option **General** on the **Configuration** toolbar. For more information about this, go to that item in this document.

Options for selecting diagram nodes

To export or graph data, you must select the equipment and/or configuration needed, and to do that there are the following options:

- Select them directly in the **Structural Tree**.

- If you want to export or graph all of the equipment and configurations, select the option **All** in the **Pareto** window.
- When only groups of equipment and/or configurations are necessary, select the option **Lists** in the **Pareto** window. The lists or groups of equipment must be created previously in the option **List Adm.** on the **Configuration** toolbar. For most information about this, go to the option **List Adm.** in the **Configuration** toolbar section of this document.

Options for exporting the data grid

When you click “**Export**” an exportation window will open with the following options:

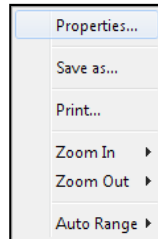
- All of the diagram nodes or just the ones previously selected in the **Structural Tree** can be exported.
- There is also the option to choose the format of the document exported (Excel, HTML, CSV or XML).

Graph Options

The graph window that opens when you click “**Graph**” contains the following options:

- When you select **Series Manager** in each of the graphs, there are the following options:
 - Visible:** When selected each type of shutdown will be visible on the graph.
By default all **Visible** options are selected.
 - Label:** This option is not activated for these graphs.
 - Color:** Change the color of each type of shut down.
- In **Axis Manager** the minimum and maximum values of the graph’s axes can be changed. In **Reset** the axes values revert back to the ones calculated by the software.
- With the option **Names** the names of the diagram nodes selected will be shown on the horizontal axis of the graphs.
- With the option **Nickname** the nicknames of the selected diagram nodes will be shown on the horizontal axis of the graphs.
- With the option **Indexed by Name** the numerical values are shown (from 0, 1, 2, 3...) on the horizontal axis of the graphs and in an attached table the numbers and names of all the diagram nodes they refer to are matched up.
- With the option **Indexed by Nickname**, the numerical values are shown (from 0, 1, 2, 3...) on the horizontal axis of the graphs and in an attached table the numbers and nicknames of the diagram nodes they refer to are matched up.
- When you choose the option **Apply to all tabs**, the option selected between **Names**, **Nickname**, **Indexed by name** or **Indexed by nickname** in one graph will be applied to the other graph.

- When you right-click on one of the graphs there will be the following options:
-



Properties: Enable you to change the properties of the graph such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

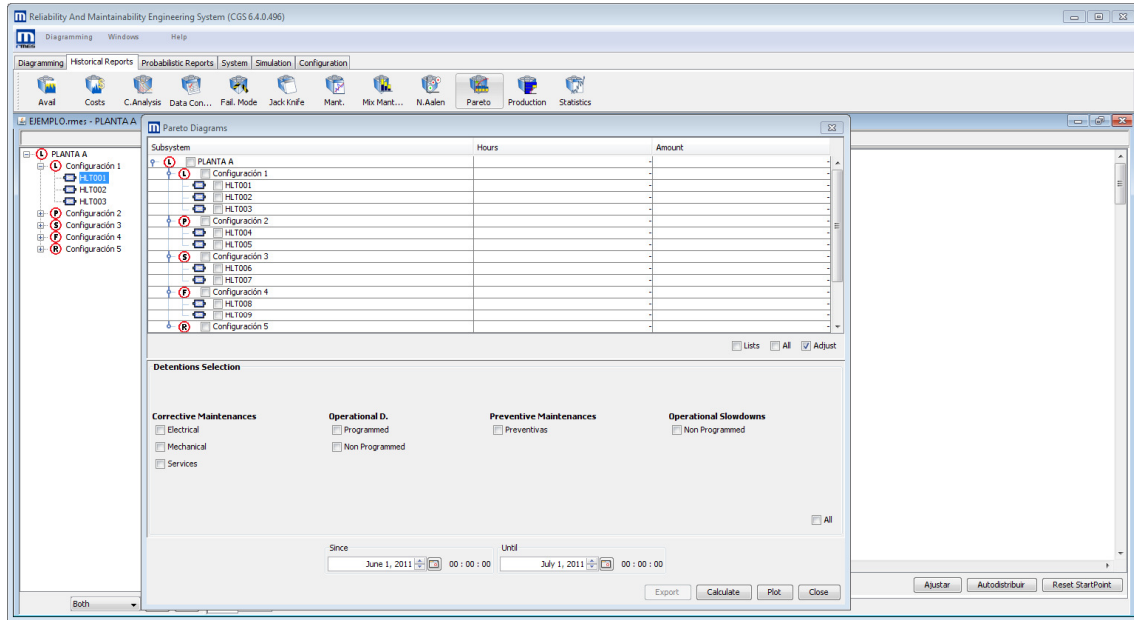
Zoom out: Gives the option to zoom out on the vertical axis.

Auto Range: Gives the option to revert back to the automatic scale on the vertical axis.

- The graphs can also be exported by clicking **“Export”** in the window of either of the graphs. This will display a window with the following options:
 - Export one or both of the graphs at the same time.
 - Export the graph in Excel and HTML format. If exporting both graphs in Excel format there will also be the option to export them into the same worksheet or separate worksheets. To choose this last option, check the option **“In separate worksheets”**.

Example

Click the option **“Pareto”** in the **Historical Reports** toolbar, which will bring up the following window:



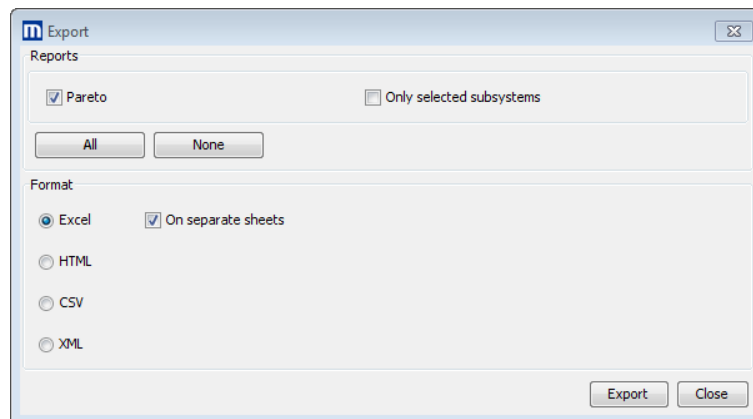
Next, click **“All”** in the item **Selection of Maintenance**.

Next enter the start and end dates for the study: from June 1, 2011 at 00:00 until July 1, 2011 at 00:00. To do that, select the icons  and the dates.

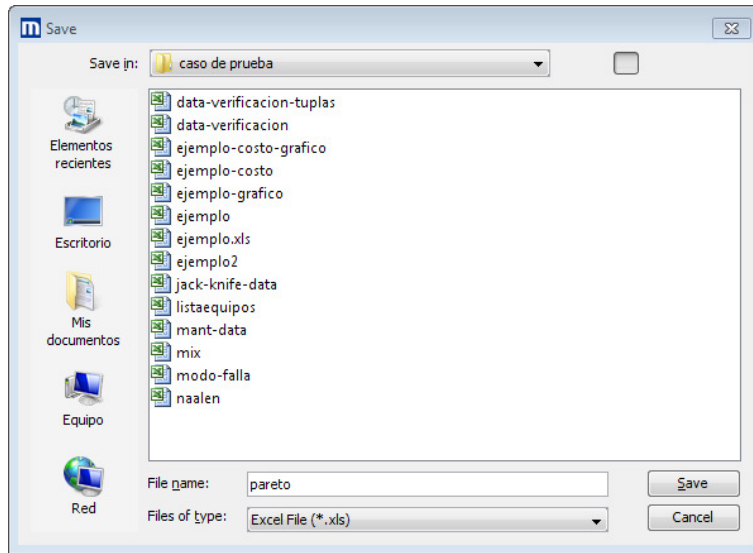
Click **“Calculate”** which will generate the following data grid:

Subsystem	Hours	Amount
PLANTA A	386,059	105,000
Configuración 1	323,066	80,000
HLT001	111,696	53,000
HLT002	109,406	49,000
HLT003	216,391	52,000
Configuración 2	62,845	49,000
HLT004	205,283	52,000
HLT005	142,798	63,000
Configuración 3	62,331	55,000
HLT006	62,202	54,000
HLT007	707,573	6,000
Configuración 4	113,088	103,000
HLT008	154,378	64,000
HLT009	99,325	53,000
Configuración 5	0,000	0,000
HLT010	172,138	29,000
Configuración 5.1	318,681	75,000
HLT011	265,041	53,000
HLT012	99,325	53,000
HLT013	0,000	0,000

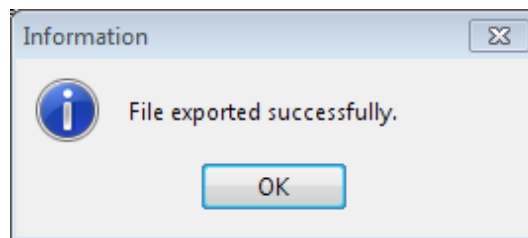
Click **“Export”** in the window above, which will display the exportation window. In this window select the option **“Pareto”**. The option **Only selected subsystems** must not be checked for all the data of all the diagram nodes to be exported. Also choose the option **Excel** and click **“Export”**:



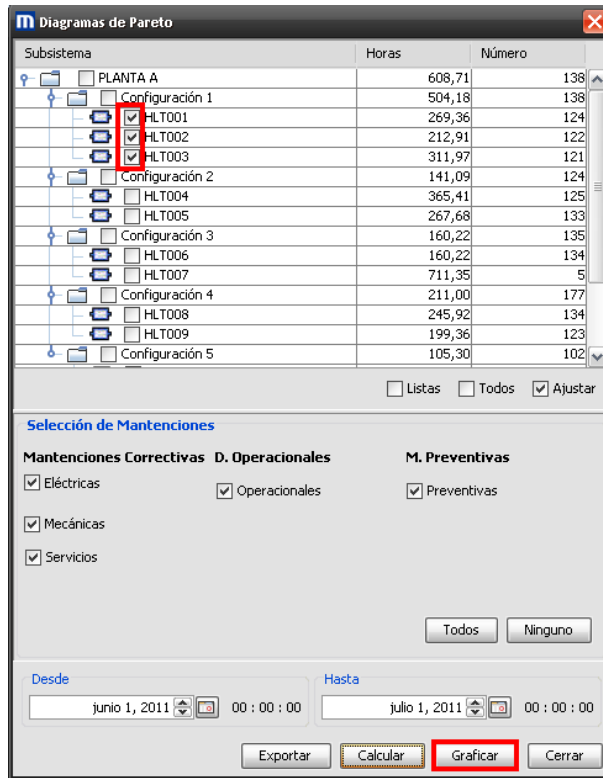
This will open the **Save** window and in it type the file name: *Pareto*. Then click **“Save”**:



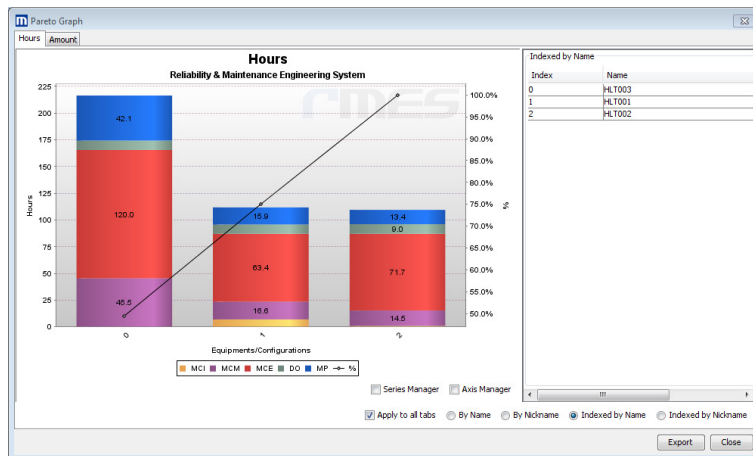
The following message confirms that the file was exported correctly:

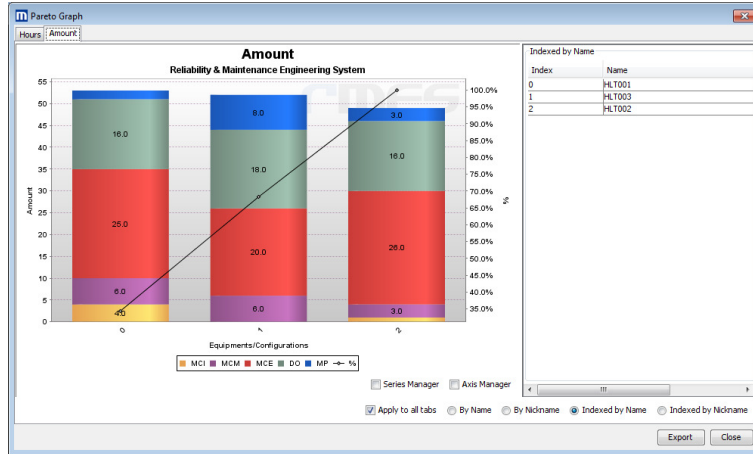


Next select the pieces of equipment HLT001, HLT002, and HLT003 in the **Structural Tree** and click **“Graph”**:



This will generate the following graphs:





Finally, export the graphs by clicking **“Export”**.

Historical Reports Tab: Production

Enables study of actual production and target production per interval of time, providing information regarding system productivity, completion of production plans and effectiveness of the equipment.

With this report you can effectively determine the causes of production downtime of a plant or equipment, defining them as operational or maintenance issues. It also shows the plant’s productivity measured in units per hour available. This identifies periods of overuse or when the process is slow with respect to its nominal capacity.

In the use analysis, the historical report includes a measurement with respect to base time (Total Use), as well as a measurement with respect to time available for operation (Effective Use), isolating the effect of operational shutdowns and maintenance.

Procedure

- Select the **“Production”** (📊) icon on the **Historical Reports** toolbar, which will open a window with two tabs, one for **Actual Production** and the other for **Target Production**.

In the Actual Production tab

- Select the 📁 icon in **Production Database**, which is on the **Actual Production** tab.
- Upload a CSV file containing the actual daily production data. This file must be in the following format:

CSV File Format

The format must be:

Date; Actual Production

Example:

12-01-2011; 10
13-01-2011; 20
14-01-2011; 22

CSV File Format read by Excel

The format must be:

Date	Actual Production
------	-------------------

Example:

12-01-2011	10
13-01-2011	20
14-01-2011	22

The date must be in the format dd/mm/yyyy or dd-mm-yyyy, and the actual production must be in the unit of measurement that has been used.


The file must not contain words.

- After uploading the file, click **“Import”** (). This will extract the data, which are visible in the box to the left on the same tab.
- To export the actual production data, click **“Export”** ().

In the Target Production Tab

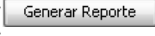

- In the calendar located in the upper right-hand side of the window select the month and year of the study.
- Click on each day on the calendar and enter the value of the production target of the selected day in **Target Production Assignment**. If more than one day has the same production target, drag the mouse over them on the calendar and enter the production

target only once. In the left pane of the tab you can see the production targets entered for each day.

- To export the target production data entered, click “**Export**” ().

In the Actual Production Tab or in the Target Production Tab

Regardless of which tab you are looking at, and after entering the data described above, follow this procedure:





- Enter the start and end dates of the study in the items **From** and **Until**.
- Click “**Generate Report**” () , which will open a new window with the reports generated. This window has 4 tabs, each displaying a graph. These tabs are:
 - Plan Completion
 - Productivity
 - Overall Equipment Effectiveness
 - Actual Production vs. Target Production
- To export the graphs, click “**Export**” () in the window where the graphs are located.

Characteristics

- You need only enter the **Report Interval** and the **Period** once.
- The start date and end date must be different, and for the report to be correct both must be within the dates contained in the database in use, the file imported in **Actual Production**, and the data entered in **Target Production**.
- The calculation **Period (Metrics per period and Metric)** must be equal to or less than the total periods included in both the database in use as well as the imported file in **Actual Production** and the data entered in **Target Production**.

Options for Entering Study Start and End Dates

There are three alternatives for entering the study start and end dates in the items **From** and **Until**:

- For both the start date (**From**) and end date (**Until**), select the  button and in the calendar that is displayed first select the year, then the month, and finally the day.
- An alternative is to type the dates in each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the  arrows until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the times do not coincide with those requested, they can be changed in the **General** option on the **Configuration** toolbar. For more information about this, go to that item in this document.

Options for Exporting the Data Grid

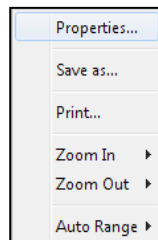
Bring up the tab you want to export data from, and then click **“Export”** ().

- The data grid can only be exported in CSV format.
- Export of **Actual Production** and **Target Production** data must be done separately.

Graph Options

The **Plan Completion**, **Overall**, **Equipment Effectiveness**, and **Actual Production vs. Target Production** graphs have the following options:

- Select **Series Manager** in each of the graphs. In it there are the options:
 - Visible:** When checked, the selected distributions are visible on the graphs.
By default, all distributions are visible when you click **“Graph”**.
 - Label:** This option is not activated for these graphs.
 - Color:** Enables you to change the color of the distributions.
- In **Axis Manager** the minimum and maximum values of the graph axes can be changed. In **Reset**, the values of the axes revert back to the ones calculated by the software.
- When you right-click on one of the graphs, the following options appear:
-



Properties: Change the properties of the graph such as the color and title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

Zoom out: Gives the option to zoom out from the vertical axis.

Auto Range: Gives the option to revert back to the automatic scale on the vertical axis.

- The graphs can also be exported by clicking **“Export”** in the window of each graph. They can only be exported in Excel and HTML format.

Example

The following is the CSV file to be used in the example with **Actual Production**:

```

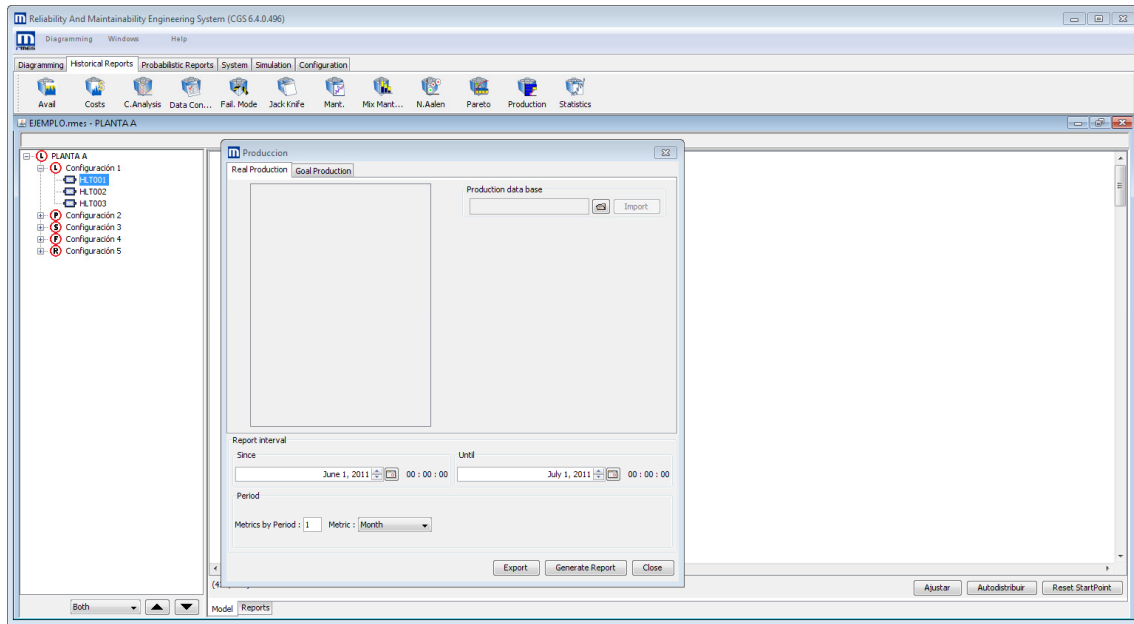
producción real.csv - Bloc de notas
Archivo  Edición  Formato  Ver  Ayuda
01/06/2011;23
02/06/2011;25
03/06/2011;16
04/06/2011;23
05/06/2011;36
06/06/2011;35
07/06/2011;39
08/06/2011;24
09/06/2011;26
10/06/2011;21
11/06/2011;22
12/06/2011;35
13/06/2011;26
14/06/2011;27
15/06/2011;19
16/06/2011;18
17/06/2011;12
18/06/2011;23
19/06/2011;25
20/06/2011;16
21/06/2011;23
22/06/2011;36
23/06/2011;35
24/06/2011;39
25/06/2011;24
26/06/2011;26
27/06/2011;23
28/06/2011;36
29/06/2011;35
30/06/2011;39
Línea 1, columna 1
    
```


This same file read by Excel is:

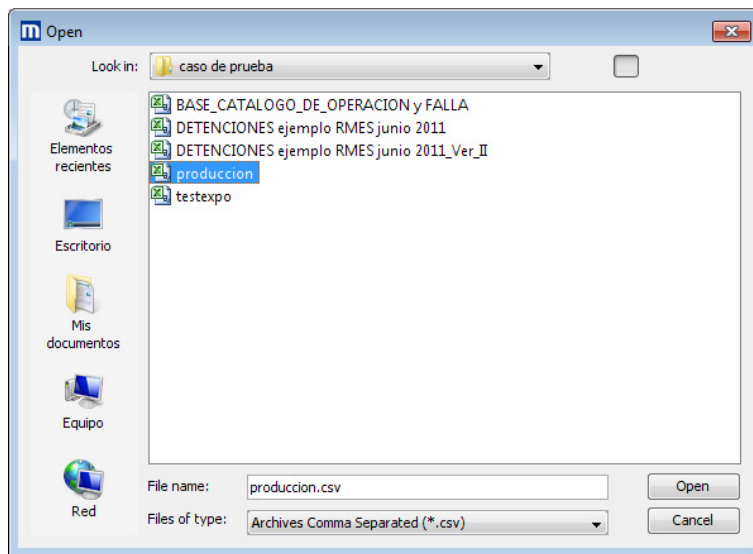
	A	B	C	D	E	F	G
1	01/06/2011	23					
2	02/06/2011	25					
3	03/06/2011	16					
4	04/06/2011	23					
5	05/06/2011	36					
6	06/06/2011	35					
7	07/06/2011	39					
8	08/06/2011	24					
9	09/06/2011	26					
10	10/06/2011	21					
11	11/06/2011	22					
12	12/06/2011	35					
13	13/06/2011	26					
14	14/06/2011	27					
15	15/06/2011	19					
16	16/06/2011	18					
17	17/06/2011	12					
18	18/06/2011	23					
19	19/06/2011	25					
20	20/06/2011	16					
21	21/06/2011	23					
22	22/06/2011	36					

This file can be created by hand in Excel. When saving it, change the extension to CSV.

Click **“Production”**, which will open the following window:

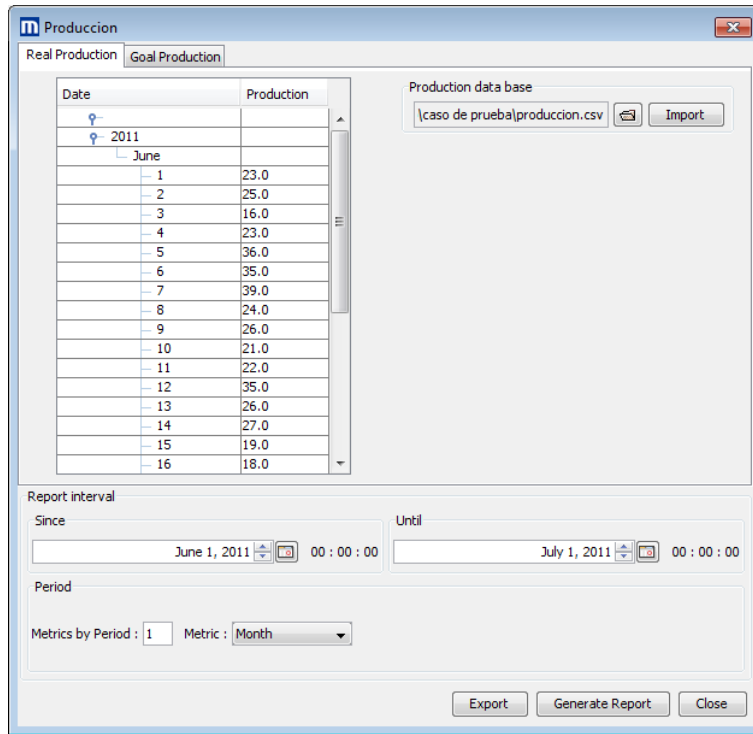


Click the  icon in the upper right-hand side of the window, which opens this window:



Upload the actual production file and click **“Open”**.

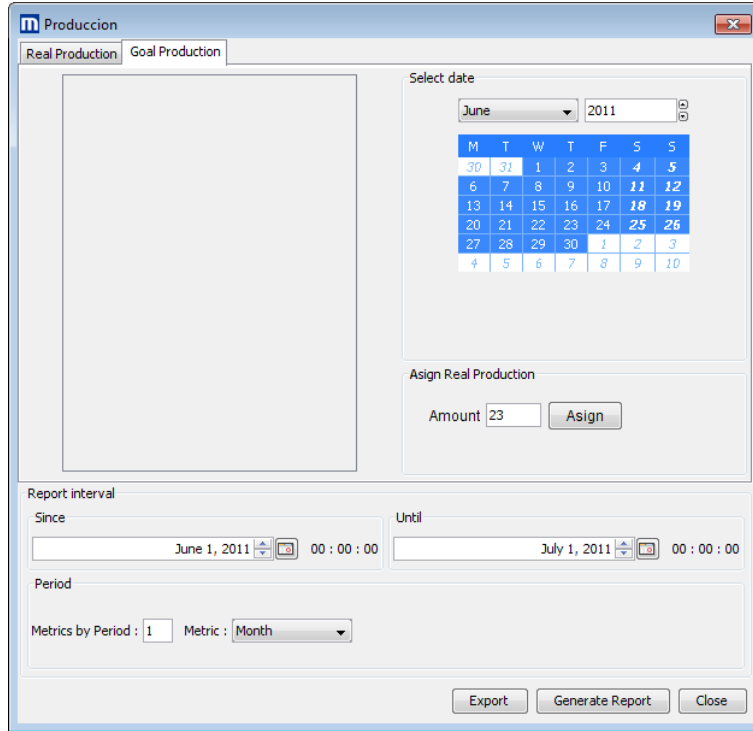
Next, click **“Import”** in the **Production** window, which will make the uploaded data visible:



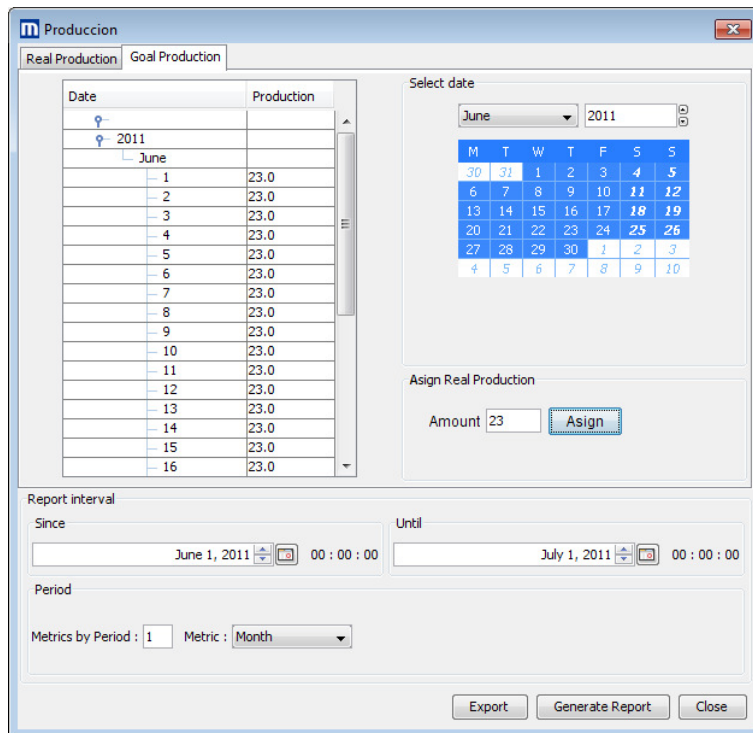
On the left-hand side of the **Actual Production** window you can see the imported database.


The daily target for the entire period studied is 23 tons and to reflect this in the study do the following:

Go to the **Target Production** tab, select the month and year of study on the calendar (June 2011). Then drag the mouse over all the days of the month and enter the number 23 in the space next to the button **“Assign”** and click **“Assign”**.

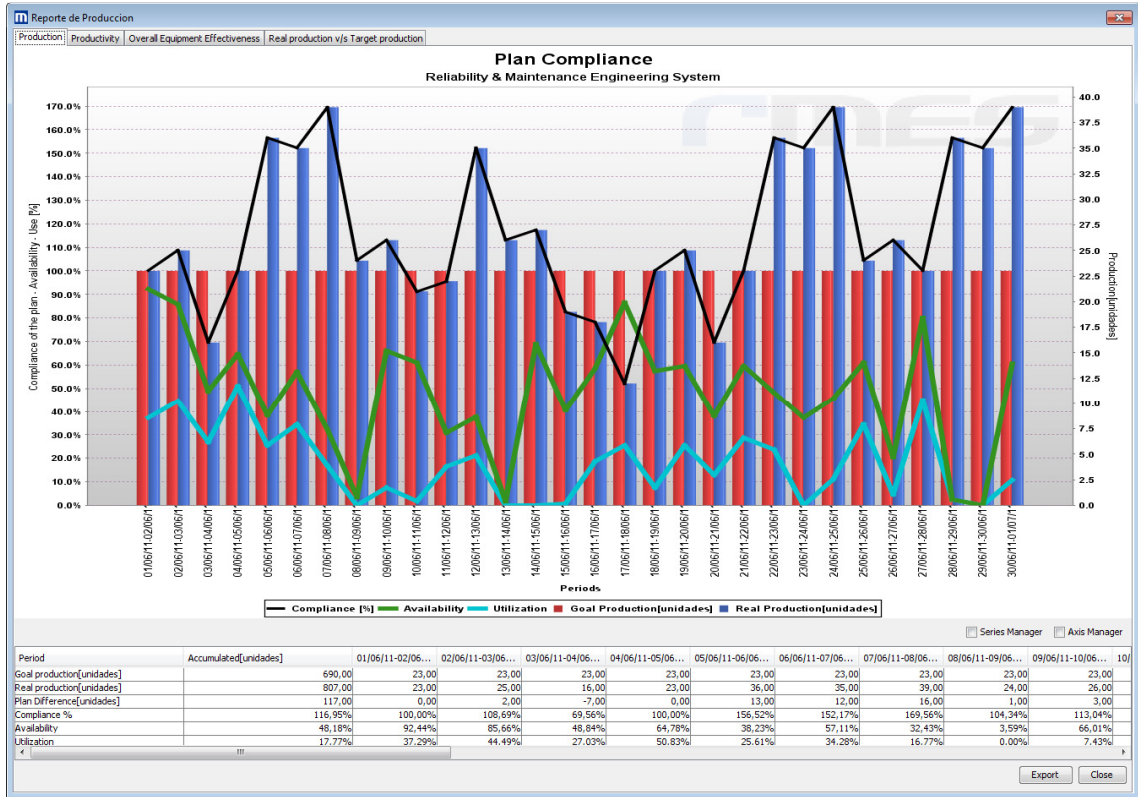


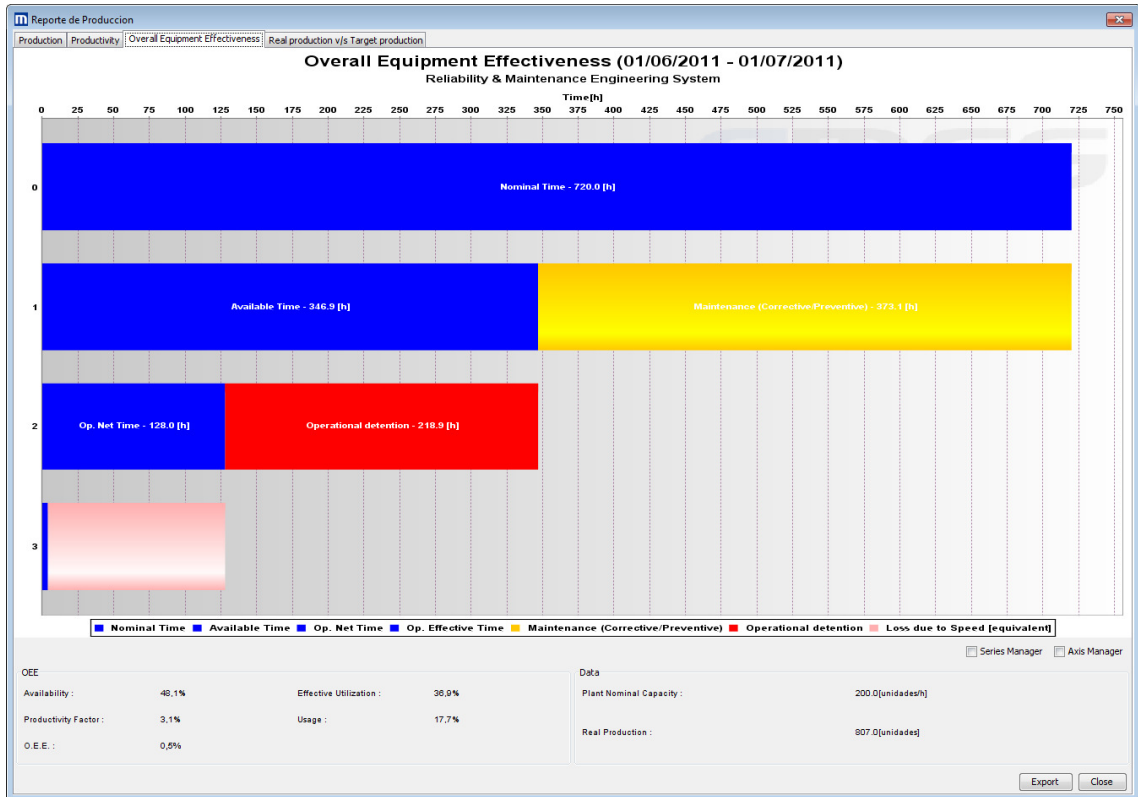
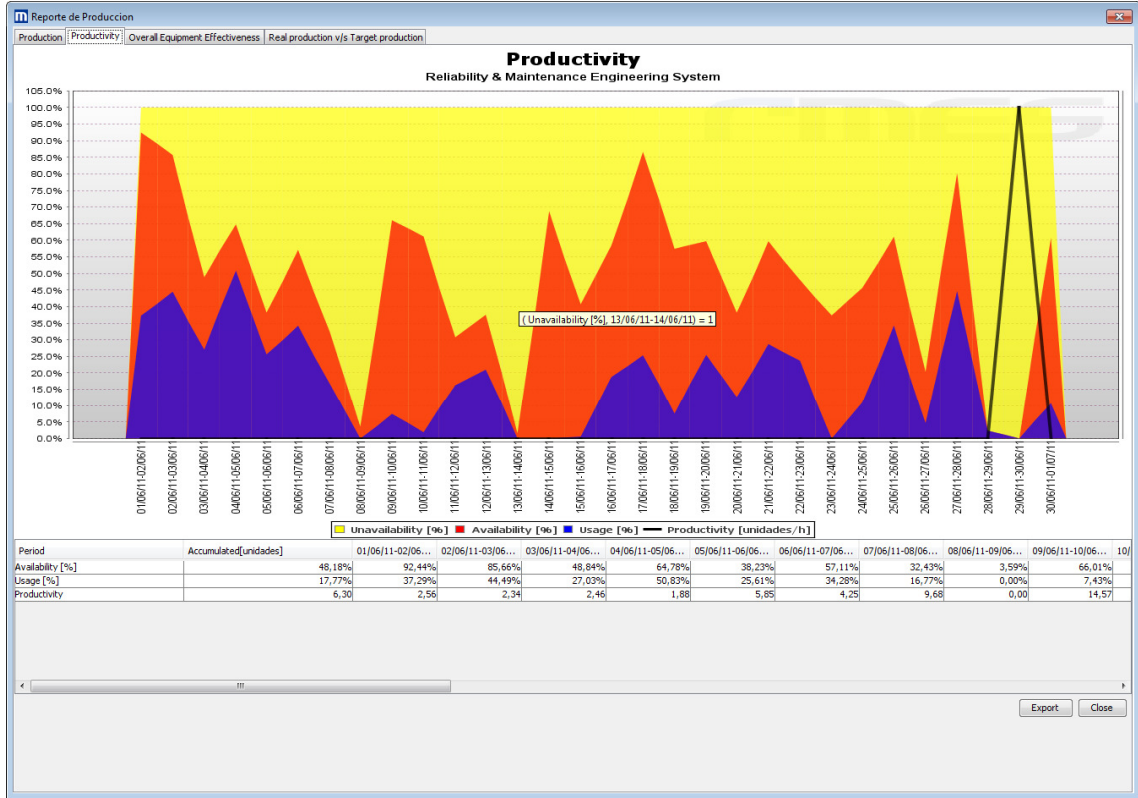
Once this is done, the data entered can be observed in the box located on the left-hand side of the screen:

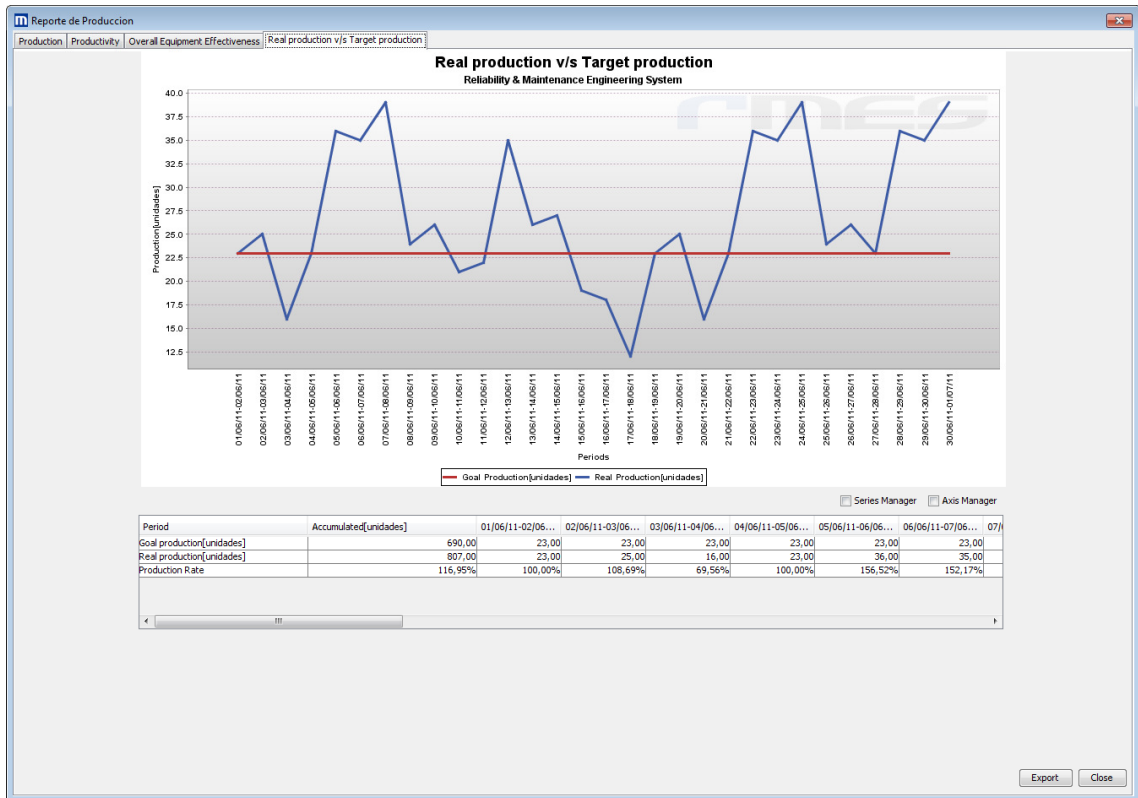


Then enter the start and end dates of the study: from June 1, 2011 at 00:00 to July 1, 2011 at 00:00. To do this, select the  icons and enter the dates. Change metric to Day.

Next, select the option **“Generate Report”**. This will generate the following reports:







Finally, export the graphs by clicking “Export” in each tab.

Historical Reports Tab: Statistical Indicators

Besides the historical indicators previously presented in the AVAILABILITY section of HISTORICAL REPORTS, indicators of reliability, maintainability and operational continuity of the assets are emphasized, since the maintenance policies for improvement and implementation are very different depending on the deviations detected in each aspect.


As a historical indicator of reliability, Mean Time between Failures (MTBF) is calculated, which indicates the time of use of equipment or a system between two consecutive failures. Similarly, Mean Time between Shutdowns (MTBS) indicates the time of use of equipment or a system between two shutdowns, regardless of whether such shutdowns are operational or for maintenance.

Regarding maintainability indicators, R-MES provides the Mean Time to Repair (MTTR), which reflects the average time of *corrective intervention* of equipment or a system. Another indicator is Mean Time to Intervene (MTTI), which represents the average time of intervention of equipment considering both preventive and corrective maintenance activities.

The importance of these indicators is that they report the reliability and maintainability status of an industrial asset. This is important for defining the intervention frequencies contained in the maintenance plans, as well as for proper estimation of the time required for shutdowns of production lines to carry out interventions.

Regarding the ease of obtaining these historical indicators, the calculation logic is equivalent to the indicators presented previously (Availability, Total Use, and Effective Use), including the graph applications described previously.

Procedure





- Select the “**Statistics**” () option on the **Historical Reports** toolbar. This will open a window with the **Structural Tree** of the system. In this window there are four tabs, one for MTBF, another for MTBS, followed by MTTR and lastly for MTTI.
- Enter the start and end dates for the study in the items **From** and **Until**.
- Enter the type of metric (Interval of calculation).
- When you click “**Calculate**” the four indicators are calculated for each piece of equipment, configuration and system.
- To export the data generated, click on “**Export**”.
- To graph the data generated, click on “**Graph**”.

Characteristics

- The **Adjust** option fits the data calculated to the screen so that it is all visible to the user.
- The indicators are calculated for all diagram nodes, independently of the ones selected in the **Structural Tree**.
- The start and end dates must be different, and for the calculation to be correct, both must be within the dates that comprise the database in use.
- When you click “**Calculate**” once, all the indicators are calculated at the same time.
- The start and end dates must be different.
- The calculation **Period (Metrics per period and Metric)** must be equal to or less than the total period included in the database in use.
- If just one period is being studied, the graphs will only show dots.
- This report can also calculate different periods at the same time by using the option **Use period administrator**. The periods must have been created previously in the option **Period Administration** on the **Configuration** toolbar.

Options for Entering Start and End Dates for the Study

There are three options for entering the start and end dates of the study in the items **From** and **Until**:

- For both the start date (**From**) and the end date (**Until**), select the  button and in the calendar that appears, first select the year, then the month, and finally the day.
- Another option is to type the dates for each item in the text boxes, in the format: **MONTH, DAY, YEAR**.
- Select the month, day, or year in the text box and click the  arrows until you reach the desired dates. You can also use the up  and down  keys on your keyboard.

If the times do not coincide with those requested, they can be changed in the **General** option on the **Configuration** toolbar. For more information about this, go to that item in this document.

Options for Selecting Data from a Data Grid

After generating a data grid, all or some of the data can be selected. Right-click, and in the window that comes up the following options will appear:

Copy	Ctrl+C
Select Rows	Ctrl+F
Select Columns	Ctrl+G
Select All	Ctrl+E
Check all the children	
Uncheck all the children	

Copy: Copy the selected data.

Select Rows: Select the rows of the selected data.

Select Columns: Select the columns of the selected data.

Select All: Select the whole data grid.

Check all the children: Check all the equipment in the configuration to which the selected nodes belong.

Uncheck all children: Uncheck all equipment in the configuration to which the selected nodes belong.

Options for Selecting Diagram Nodes

To graph or export data, you must select the equipment and/or configurations that are needed. To do that, the following options are available:

- Select them directly in the **Structural Tree**.
- If you want to graph or export all equipment and configurations, select the option **All** in the **Statistics** window.
- When only groups of equipment are necessary, select the **Lists** option in the **Statistics** window. The lists or groups of diagram nodes must have been created previously in the **List Adm.** option on the **Configuration** toolbar. For more information about this, go to the **List Adm.** item in the **Configuration** toolbar section of this document.

Options for Exporting a Data Grid

When you click “**Export**” an export window opens containing the following options:

- The option to export all reports generated or only the reports selected.
- You can export all diagram nodes or only those selected previously in the **Structural Tree**.
- You can also choose the format of the document exported (Excel, HTML, CSV or XML).

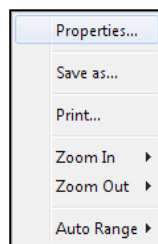
Graph Options

To graph the four indicators of one piece of equipment, select the equipment in the four tabs in the **Structural Tree** and then click “**Graph**”.

In the graph window that opens when you click “**Graph**” the following options appear:

- When **Series Manager** is selected, a window is displayed containing the distributions to be graphed, and each one has the following options:
 - Visible:** When selected, the distribution is visible on the graph.
By default, the distributions of the indicators will be visible when the **Graph** option is selected.
The **Linear Regression** distributions of the indicators are not visible when graphed, so to make them appear on the graph you must select the **Visible** option.
 - Label:** This option is deactivated for this graph.
 - Color:** Enables you to change the color of the distributions.
- In **Axis Manager** the minimum and maximum values of the graph’s axes can be changed. In **Reset** the values revert back to the ones calculated by the software.
- With the **Not Indexed** option, each of the periods considered are shown on the horizontal axis of the graph.

- With the **Indexed by name** option, on the horizontal axis of the graph the periods are shown numerically (1, 2, 3, 4...) and in an attached table the dates are shown that correspond to each number. Also, the same table displays the linear regressions of the indicators for each piece of equipment and/or configuration (indicated by their NAMES).
- With the option **Indexed by nickname** the periods are shown on the horizontal axis of the graph numerically (1, 2, 3, 4...) and in an attached table the dates corresponding to each number are shown. Also, in the same table the linear regressions of the indicators are shown for each piece of equipment and/or configuration selected (indicated by their EQUIPMENT CODE or NICKNAME).
- When you right-click on the graph the following options appear:



Properties: Change the properties of the graph, such as color or title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

Zoom in: Gives the option to zoom in on the vertical axis.

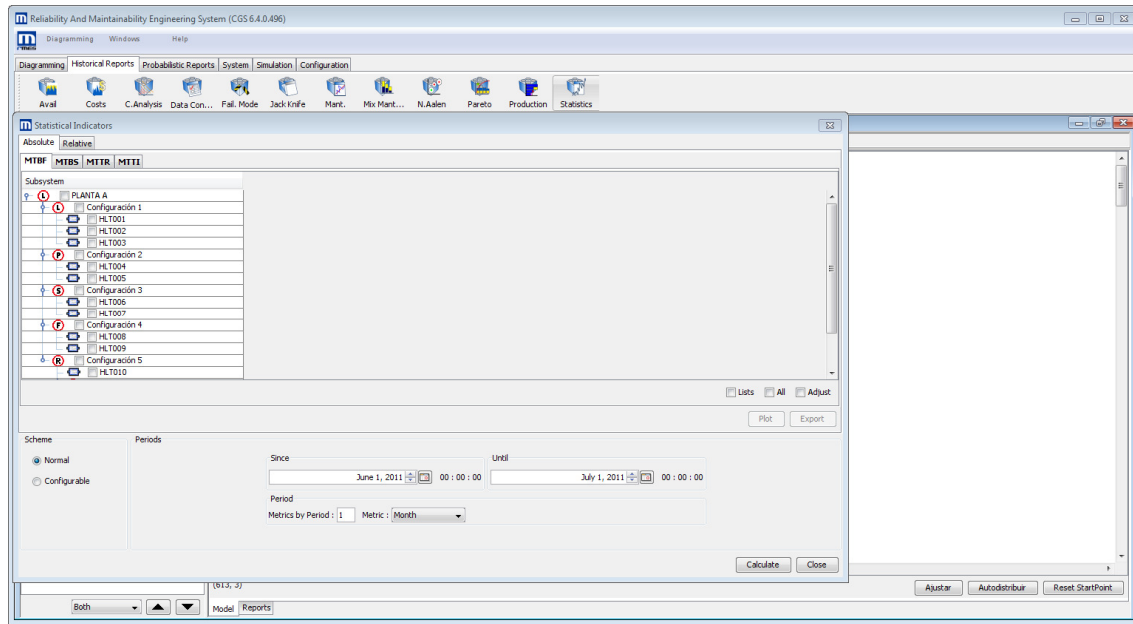
Zoom out: Gives the option to zoom out from the vertical axis.

Auto Range: Gives the option to revert back to the automatic scale on the vertical axis.


- The graph can also be exported by clicking **“Export”** in the graph window. It can only be exported in Excel and HTML format.

Example

Select the option **“Statistics”** on the **Historical Reports** toolbar, which will bring up the following window:



The tabs for **MTBF**, **MTBS**, **MTR** and **MTTI** are displayed in the upper left-hand side of the window that appears.

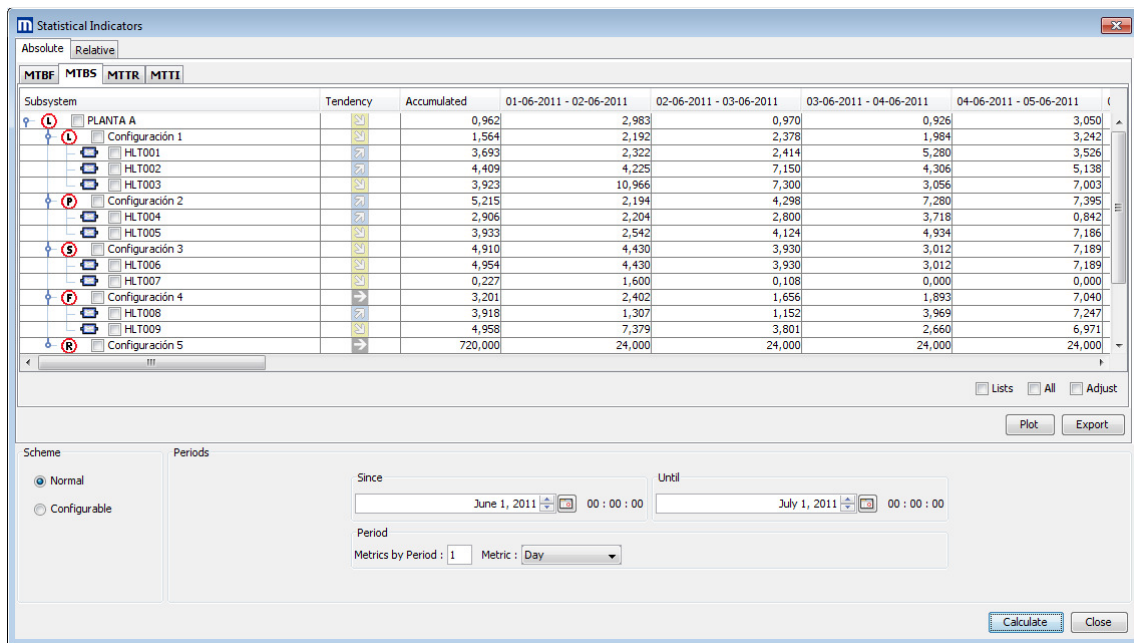
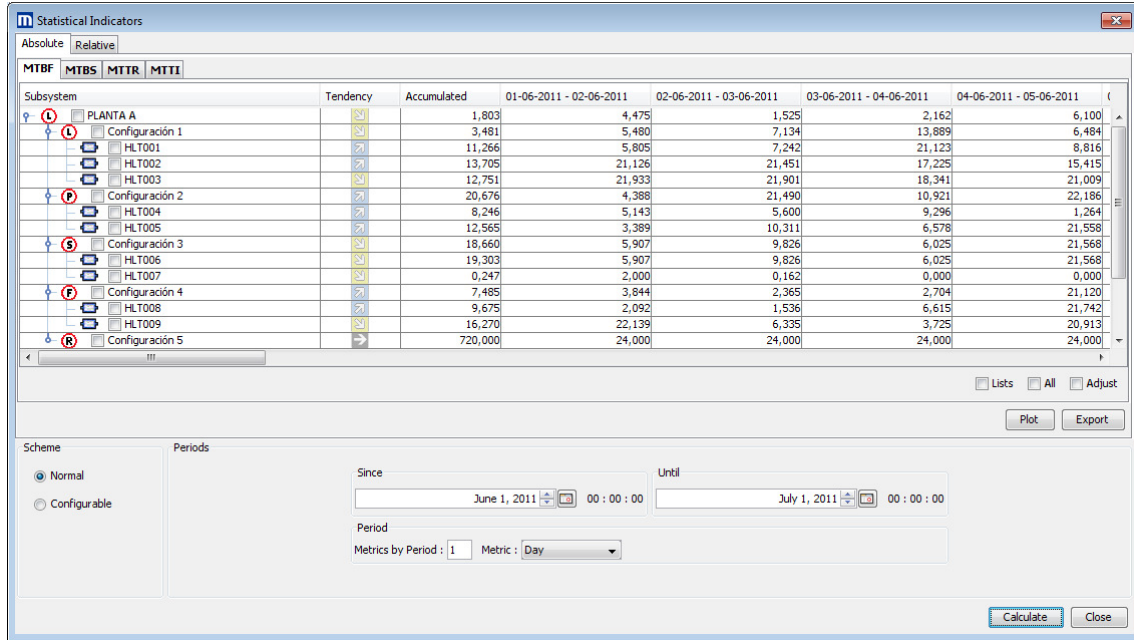
Next, enter the study start and end dates: from June 1, 2011 at 00:00 until July 1, 2011 at 00:00. To do that, select the  icons and the dates.

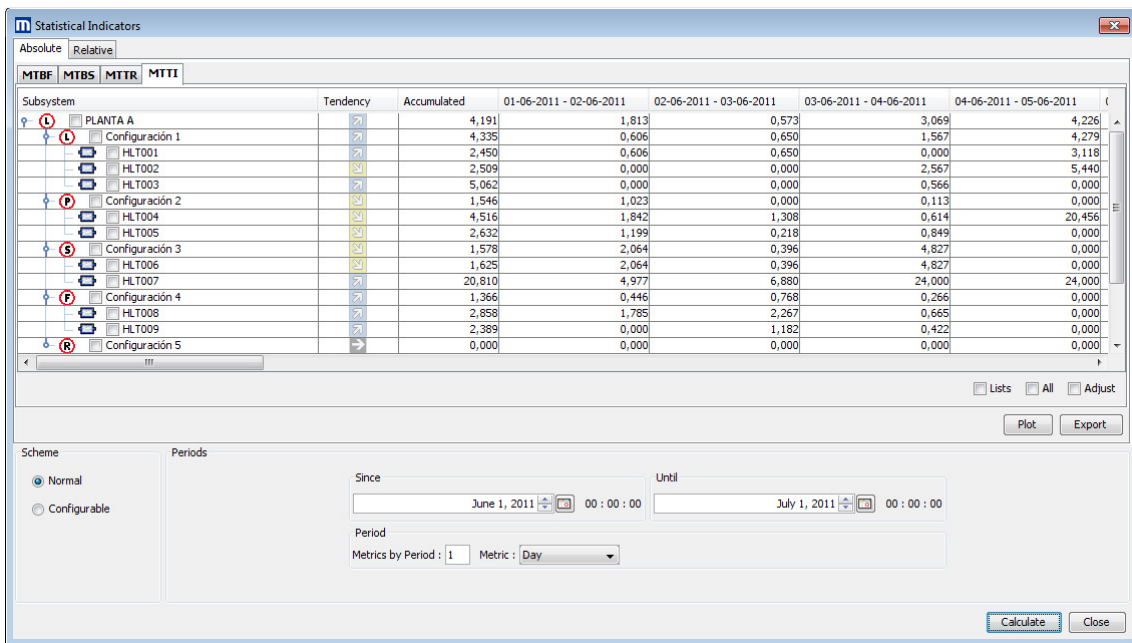
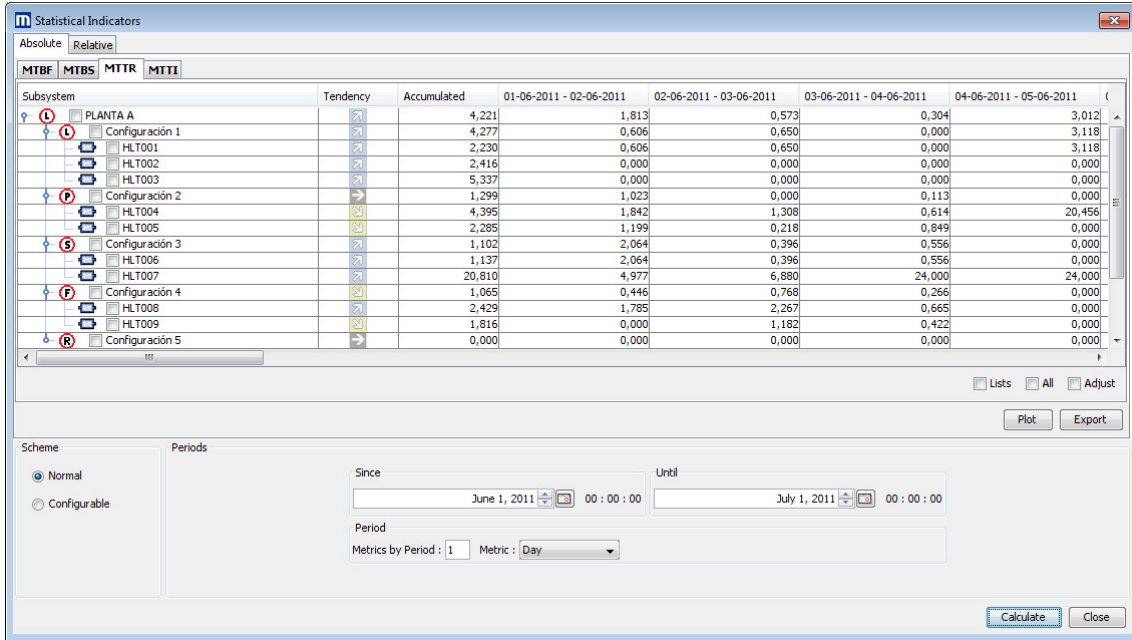
This study is for a time period of 1 month, but the indicators need to be calculated daily, so in the **Period** item, enter:

Metrics per Period: 1

Metric: Day.

Click **“Calculate”**, which will generate the following results:

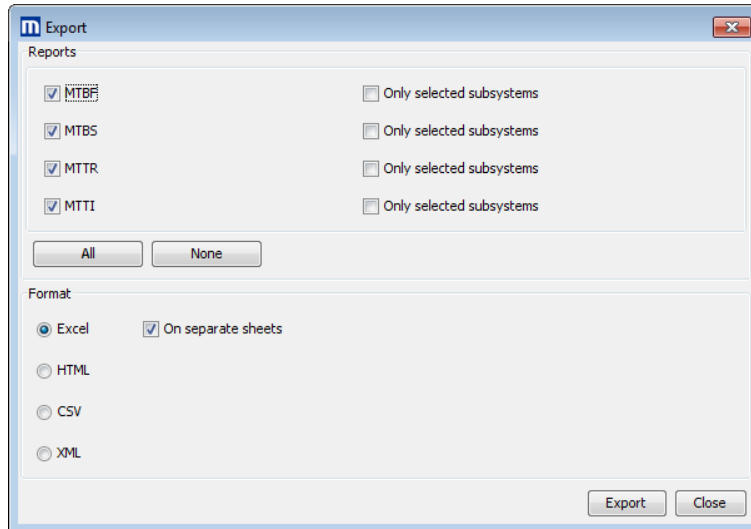




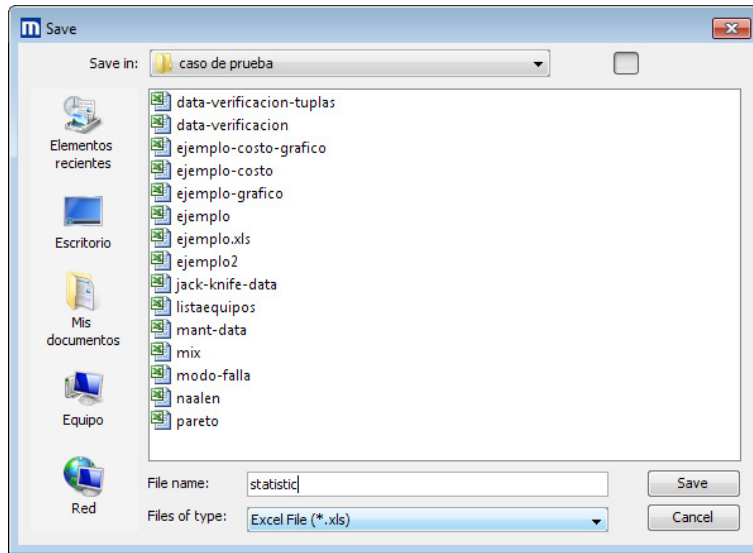
In the results above, the **Trend** column shows the behavior of the indicators for all the days of the study.

The column **Accumulated** provides the value of the indicator during the entire study period (one month), and the columns to the right correspond to the daily values of the indicators. Due to space constraints, the images show only the first 2 days of the study.

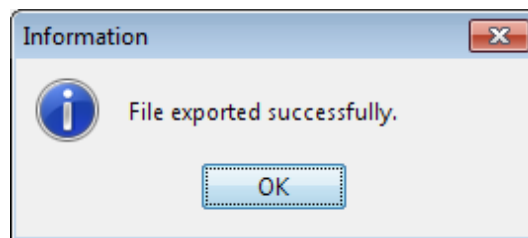
Next, export the data grid by clicking **“Export”** in the **Statistics** window (it doesn’t matter which tab you are viewing). This will display the export window. All indicators for each diagram node must be exported, so the option **All** must be selected, and the option **Only selected subsystems** must not be checked. Also, select Excel as the **Format** and check the option **“In separate worksheets”**. Then click **“Export”**.



This will open the **Save** window and in it type the file name: *Statistical Indicators*. Then click **“Save”**:

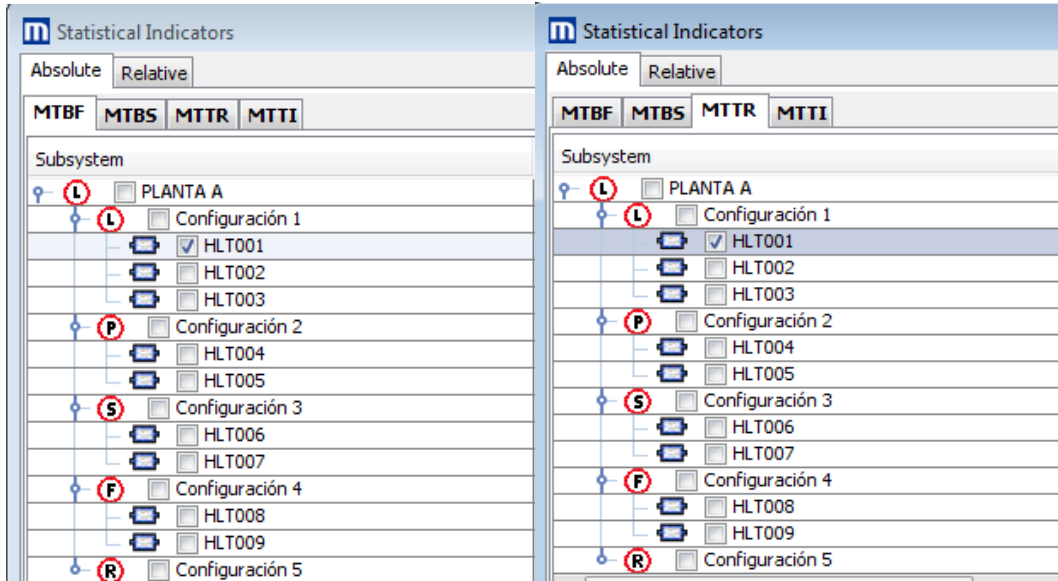


The following message confirms that the file was exported correctly:

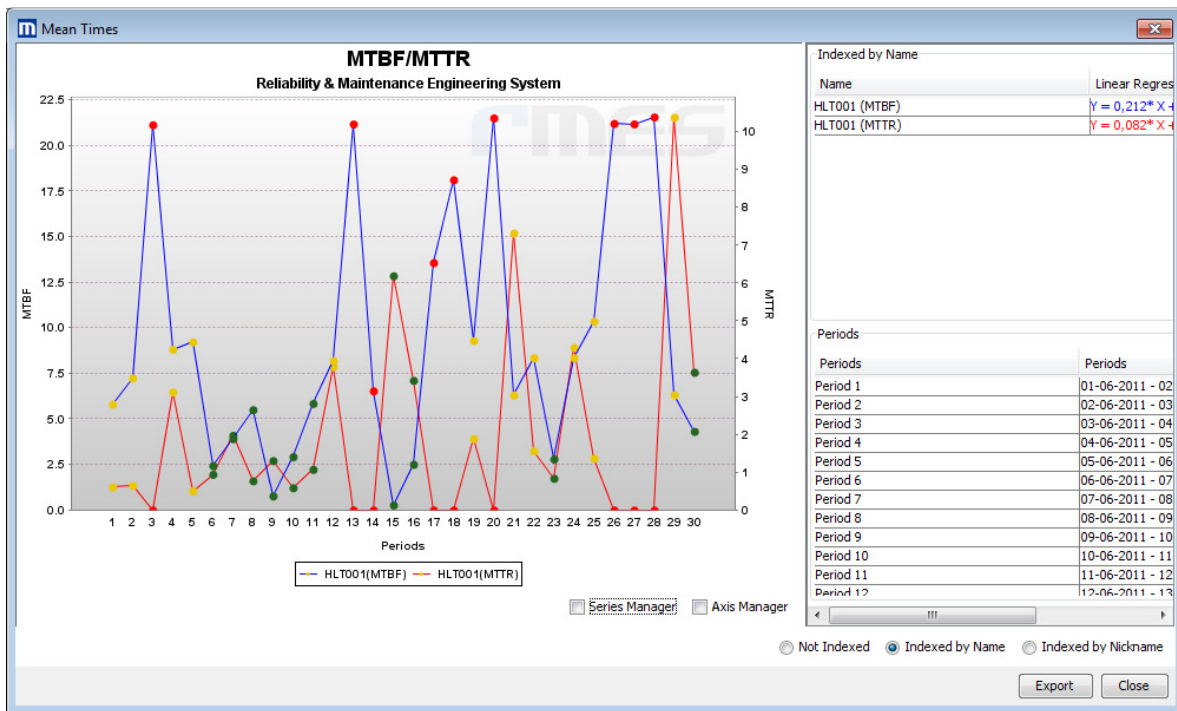


The daily **MTBF** and **MTTR** indicators of the HLT001equipment also need to be graphed . To do that:

Select the HLT001 equipment in the **MTBF** and **MTTR** tabs:



Click **“Graph”** in the **Statistics** window, which will generate the following graph:



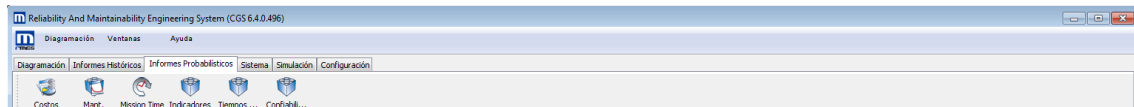
The colors of the points indicate if the point have 0 (red), 1 or less (yellow), 2 or more (green) detentions.

The option selected to view this graph is **Indexed by Name**: To the right of the graph there is a table with the linear regression of each indicator for HLT001 equipment (this is its name) and under periods the dates of the periods are shown.







Finally, export the graph by clicking **“Export”**.

Probabilistic Reports Tab

This toolbar enables you to determine which tools were already seen in previous reports through probability tools.




Toolbar Options

NAME	ICON	DIRECT ACCESS	FUNCTIONALITY
Costs		-	Provides an estimate of the annual maintenance cost.
Maintenance Policies		-	Defines guidelines for the policies applicable to each piece of equipment, and includes Corrective, Cyclical Preventive or Predictive Maintenance as options.
Mission Time		-	Determines the probability that a piece of equipment will reach a programmed shutdown without failing.
Indicators		-	Calculates the Reliability, Availability, and the Failure Cost of equipment and configurations.
Mean Time		-	Shows MTBF, MTTR, MTTI.
Reliability		-	Graphs the distributions of reliability and failure rate of each piece of equipment or configuration.

Probabilistic Report Tab: Costs

This report gives an estimate of annual maintenance costs.

Procedure

- Select the “**Costs**” () icon on the **Probabilistic Reports** toolbar. This will automatically bring up a window with the values of the **Maintenance Cost** per diagram node and per year.
- To export the data generated, click “**Export**”.

Characteristics

- This report can be generated with the equipment's historical data or simply with the data of the following indicators of the equipment.

Mean Time Between Failure
 Mean Time To Repair
 Mean Time To Intervention
 Operation Time (OT)
 Average Intervention Cost

The indicator values can be entered by clicking **Import** on the **Systems** toolbar, or manually in the **Properties** of each piece of equipment.

- Start and end dates of the study cannot be entered because the report is generated with all the imported data.
- The **Adjust** option fits the calculated data to the window so that it is all visible.

Options for Selecting Equipment and/or Configurations

To export data, you must select the equipment and/or configurations needed. The following options can be used to do this:

- Select them directly in the **Structural Tree**.
- To export all of the equipment and configurations, select the **All** option in the **Costs** window.
- When only groups of diagram nodes are needed, select the **Lists** option in the **Costs** window. The lists or groups of diagram nodes must be created previously in the option **List Adm.** on the **Configuration** toolbar.

Options for exporting the data grid

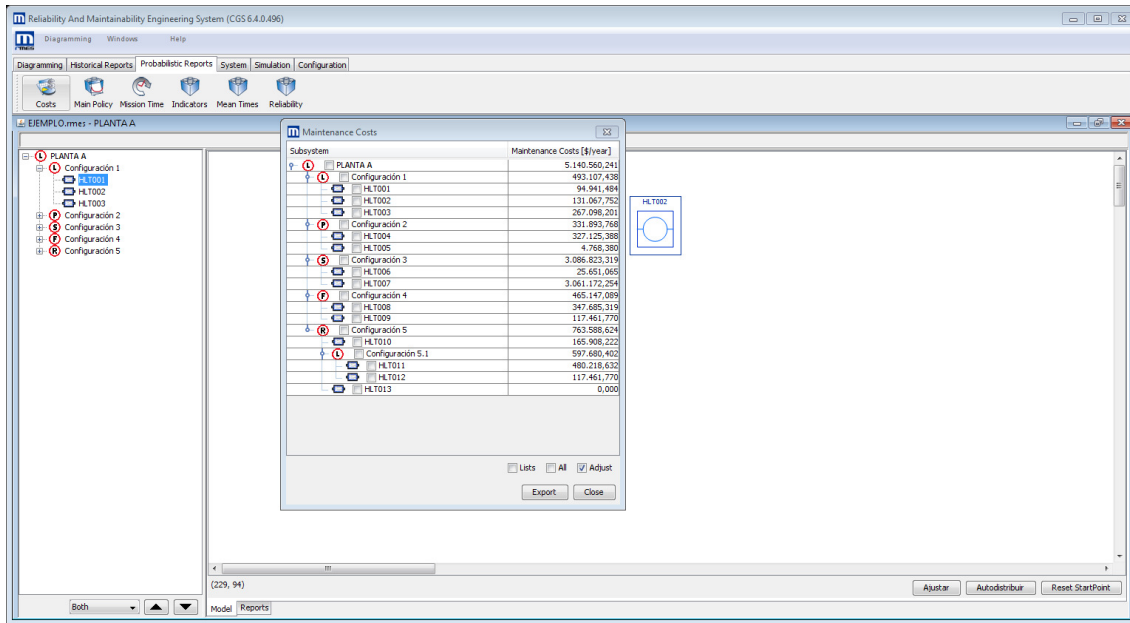
When you click “**Export**” an export window will open containing the following options:



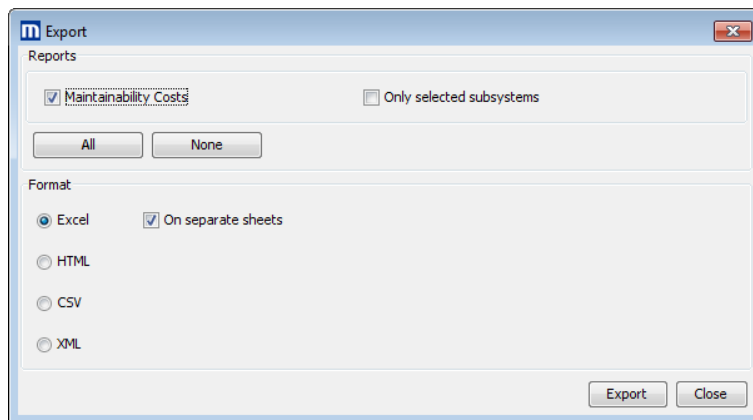
- All of the diagram nodes or only those selected previously in the **Structural Tree** can be exported.
- The format of the exported document can also be chosen (Excel, HTML, CSV or XML).

Example

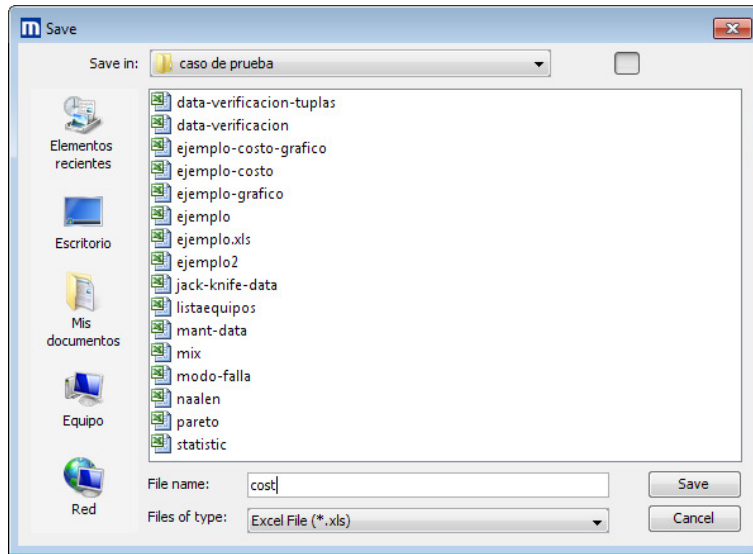
Click **“Costs”** on the **Probabilistic Reports** toolbar, which will display the following window:



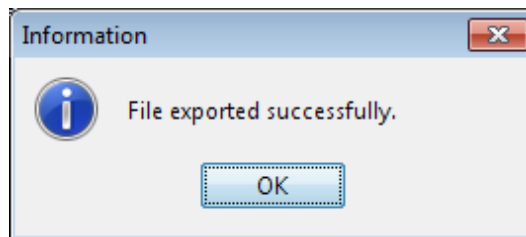
Click **“Export”** in the window above, which will open the export window. In this window select the **“Maintenance Cost”** option. To export the data from all the diagram nodes, make sure the **Only Selected Subsystems** option is not checked. Also choose the option **Excel** and click **“Export”**:



This opens the **Save** window; type in the file name: *Pareto*, and then click **“Save”**:




The following message confirms that the file was exported correctly:



Probabilistic Reports Tab: Maintenance Policies

The **Maintenance Policies** report informs the user about the status of a piece of equipment in a logic diagram in its lifecycle depending on its failure probability function, and suggests recommended maintenance for equipment based on maintenance costs, providing information about the optimal time, minimum cost, and the amount of annual maintenance expected.

Procedure

- First select a piece of equipment in the workspace.
- Next select the **“Maint.”** () icon on the **Probabilistic Reports** toolbar. This will open a window with information about the distribution and its parameters, which represent the reliability distribution of the equipment.
- In that window enter the following costs:

- **Inspection Cost**
- **Preventive Maintenance Cost**
- **Emergency Maintenance Cost**

The software suggests values for the latter two costs, which are displayed immediately when you open the **Maintenance Policies** window in which:

- **Preventive Maintenance Cost:** half of the average intervention cost of the equipment.
- **Emergency Maintenance Cost:** the average intervention cost of the equipment.

It should be kept in mind that for these costs to be suggested they must have been entered previously in **Average Intervention Cost**, by clicking **Import** on the **Systems** toolbar, or manually in the equipment's **Properties**. It is also possible to import them into the database where maintenance costs are entered. The software calculates the average of these costs.

Depending on the values of the parameters of the failure probability function and the costs that the user enters, the equipment is classified in one of the nine squares on the classification grid. For this, the box containing the recommended maintenance policy is highlighted in blue.

- If the suggested policy is in squares 6 or 9:

Corrective	Corrective	Corrective
Corrective	Corrective	Preventive Cyclic
Predictive	Predictive	Preventive Cyclic or Predictive

Click on the square. This will open a window containing information specific to the maintenance policy. Here, the **MTTR** (mean time to repair) and **MTTM** (mean time to maintain) parameters can be modified. The default value that the **MTTR** item provides is the same parameter calculated based on the data imported from the database corresponding to the corrective maintenance of the equipment in question.

- The information generated can be exported by clicking **“Export”**.

Characteristics

- This report can only be generated when there is historical data for the equipment.
- The report is generated with all the data imported from the selected piece of equipment, since it is not filtered by date.
- The report cannot be generated for configurations or systems.
- In the **Configuration Grid** item in the same window as **Maintenance Policies**, the life cycle phase of the equipment is shown (Early Life, Useful Life, or Wearout Life), is displayed after the following phrase:

This piece of equipment is found in...

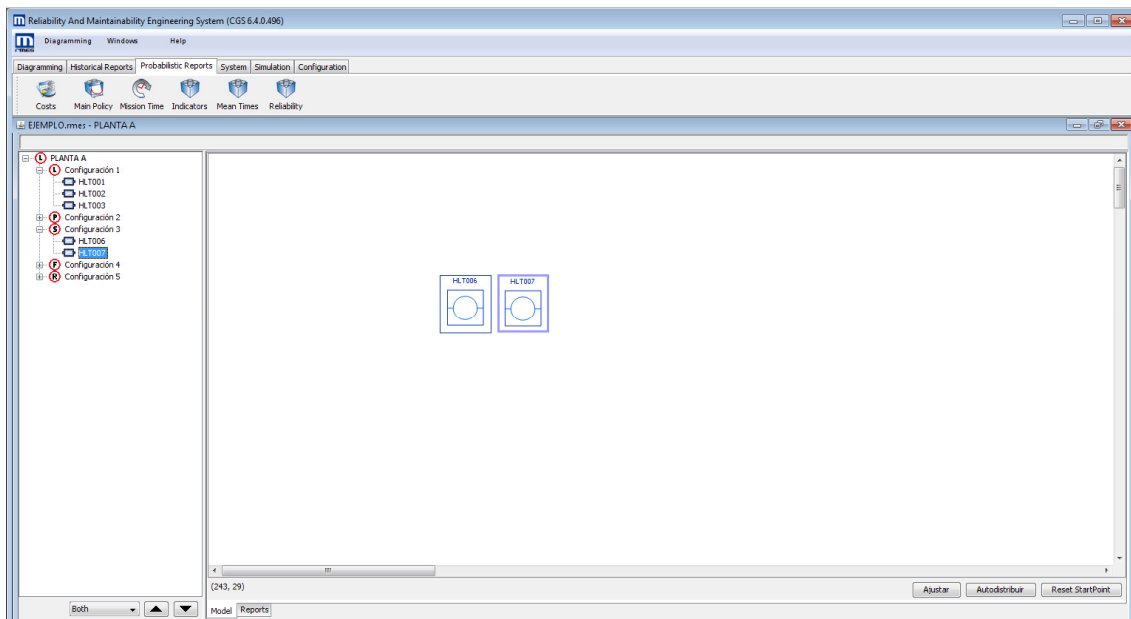
When you click on Early Life, Useful Life, or Wearout Life, the graph of the life cycle and the location of the equipment studied is displayed.

Export Options

- In the **Save** window that opens when you click **“Export”**, in the **File Types** option you can choose to export the file in Excel or HTML format.

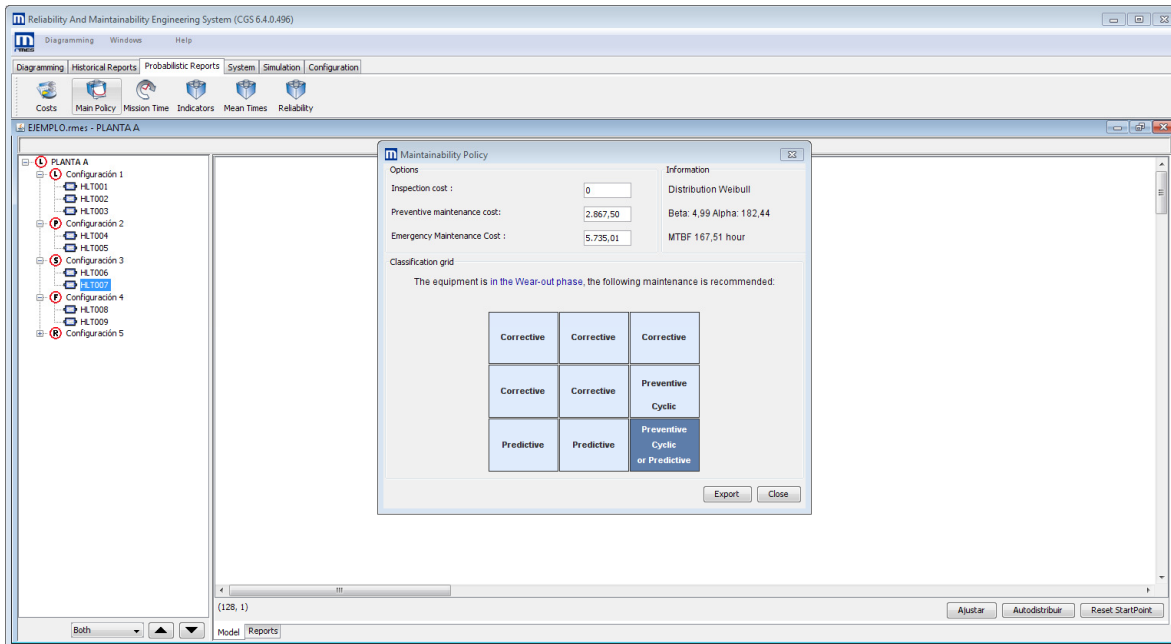
Example

Select the HLT007 equipment in the **Navigation Tree**:

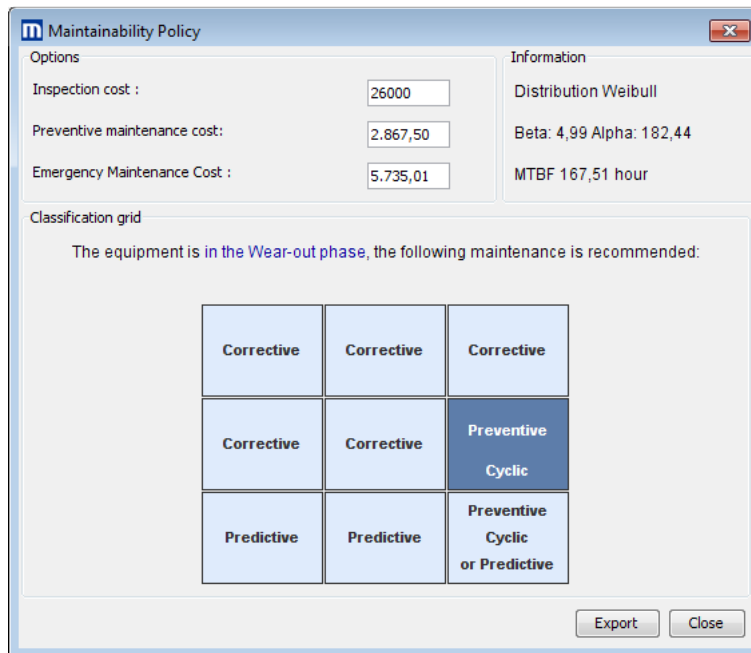


Then when you click **“Maint.”** on the **Probabilistic Reports** toolbar the following window will open:

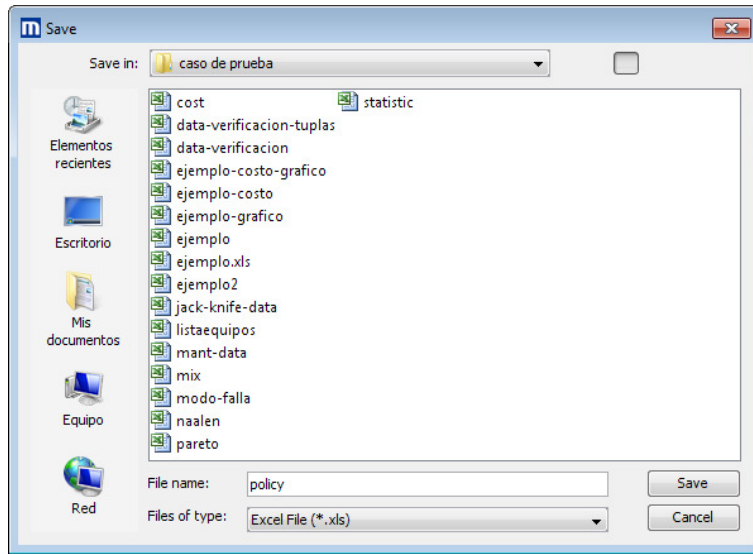




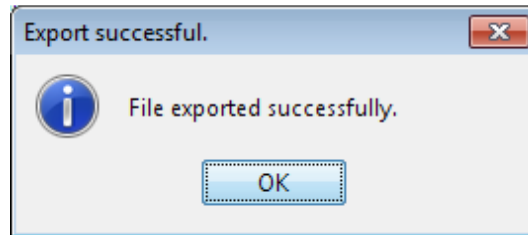
Enter an **Inspection Cost** of 226,000 monetary units, for which the square containing the recommended maintenance policy is number 6.



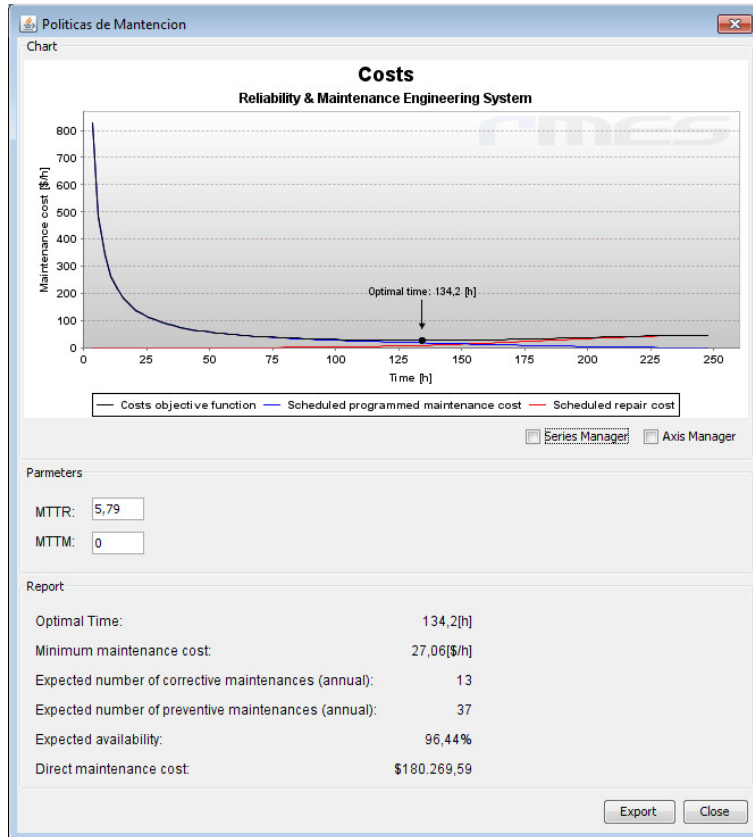
Next, click **“Export”** in the **Maintenance Policies** tab. This will open the **Save** window, and in it type the file name: *HLT007 Equipment Maintenance Policies* and then click **“Save”**:



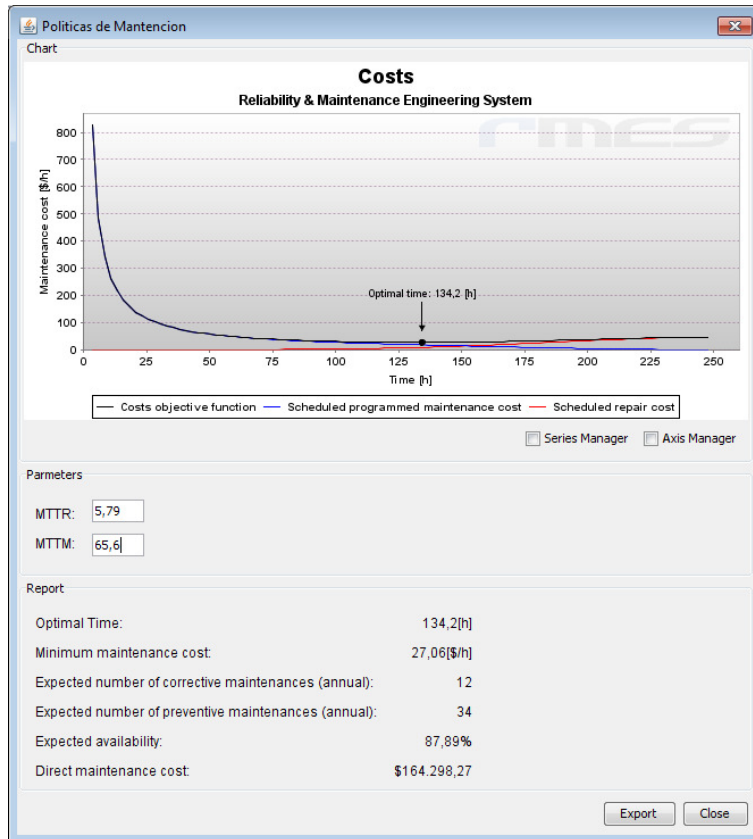
The following message confirms that the file was exported correctly:



Next, click on square number 6, which will display the following window:



Enter an **MTTM** of 65.6. This will generate the following data:



Probabilistic Report Tab: Mission time

This is an application for determining the probability that a piece of equipment will reach a programmed shutdown without failing. This report is a powerful tool for adjusting programmed shutdowns of process lines (short-term analysis) as well as comparatively determining which pieces of equipment have a greater probability of failing, alerting the maintenance units about equipment that is critical in terms of reliability. This tool can also be used in the opposite manner, to postpone programmed maintenance activities if the equipment’s reliability for the programmed maintenance time is assessed as high.

Procedure

- Select the “**Mission time**” (🕒) icon from the **Probabilistic Reports** toolbar. This will display a window with three columns: The first allows you to select the equipment to be studied. The second shows the equipment in the system and the last shows the MTBF.

- Choose the equipment for the report.
- Click **“Report”**. This will open a window with the report.

This window contains reliability graphs of each piece of equipment selected previously, and in which there are options for modifying the parameters. If you make changes, click **“Update”** afterwards so that the changes are saved by the software.

When you deselect the **Overall** option, you can see one graph at a time in the window of the report. In that case, use the option **Go to...** to view the other graphs.
- The data generated can be exported by clicking **“Export”**.

Characteristics

- This report can only be generated when there is existing historical data for the equipment.
- The table located inside the window (the one displayed when you click **Mission time**) can be organized by the name of the equipment or the MTBF of the equipment. To do this, click the headers of the two last columns of the list: or .
- Also in the window that opens when you click **Mission time**, the **“Tree View”** option appears. This shows the list another way, through the **Structural Tree**.
- The graphs show the individual distributions of each piece of equipment, where time zero is the implementation. When the **RT** (runtime) falls within the reliability distribution (this is a date after implementation and before reliability reaches zero) it appears as a vertical line on the graph. The same occurs with the **NSD** (Next Shutdown Date).

Exportation Options

- In the **Save** window that opens when you click **“Export”**, in the **File Type** option, you can choose between Excel, HTML, CSV or XML format.

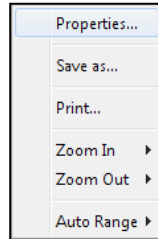
Graph Options

Each graph has the following options:

- When you select **Series Manager** in each of the graphs the following options appear:
 - Visible:** When selected you can see the reliability distribution on the graph.
By default, all the **Visible** options are selected.
 - Label:** This option is not activated for these graphs.
 - Color:** Change the color of the reliability distribution.



- In **Axis Manager** you can change the minimum and maximum values of the graph's axes. In **Reset** the values of the axes revert back to the ones calculated by the software.
- When you right-click on the graph the following options appear:



Properties: Change the properties of the graph such as the color or title, and see tags, among others.

Save as: Save the graph in PNG format.

Print: Print the graph.

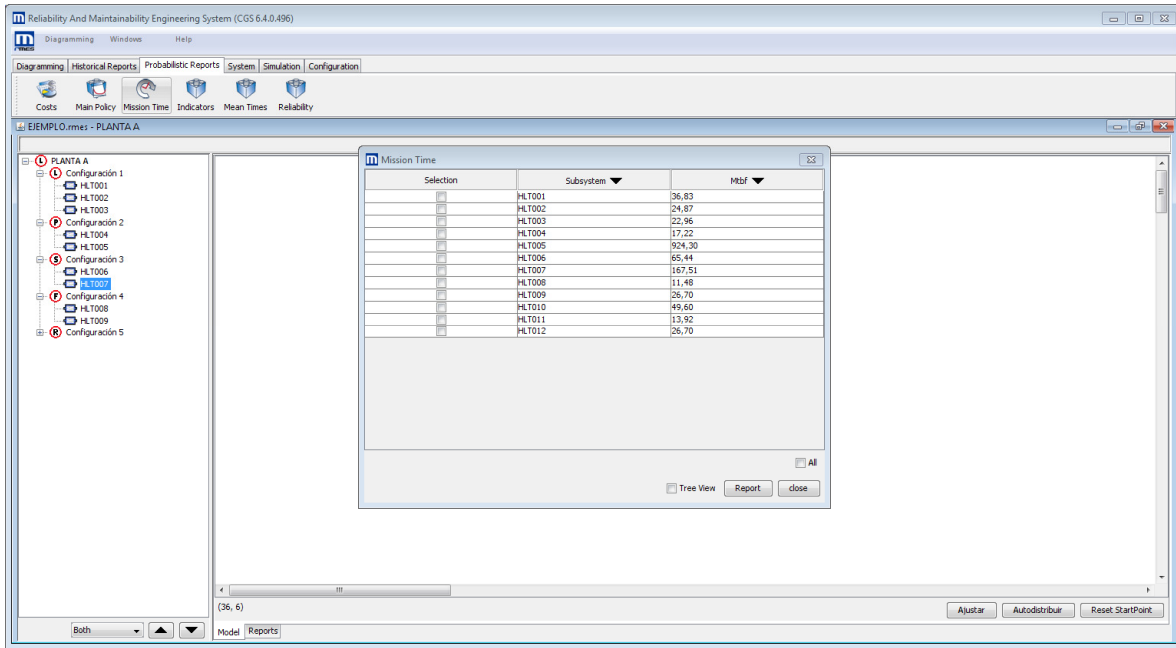
Zoom in: Gives the option to zoom in on both axes, or just the horizontal or vertical one.

Zoom out: Gives the option to zoom out from both axes, or just the horizontal or vertical one.

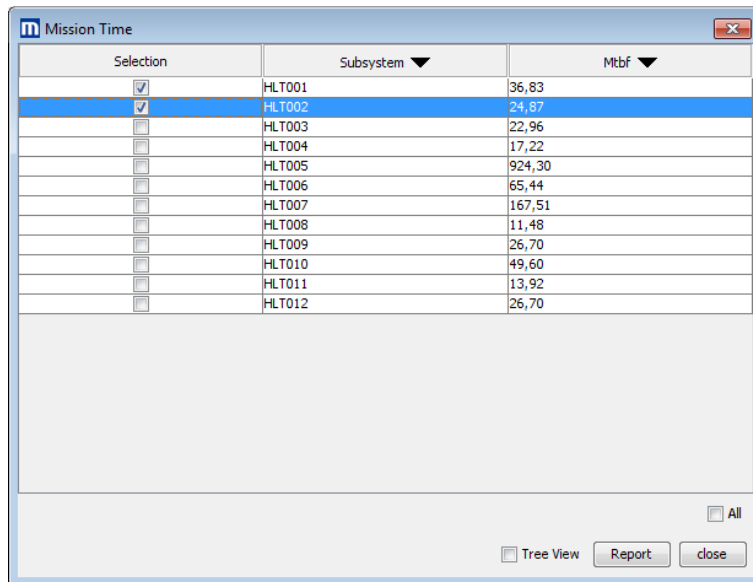
Auto Range: Gives the option to revert back to the automatic scale for both axes, or just the horizontal or vertical one.

Example

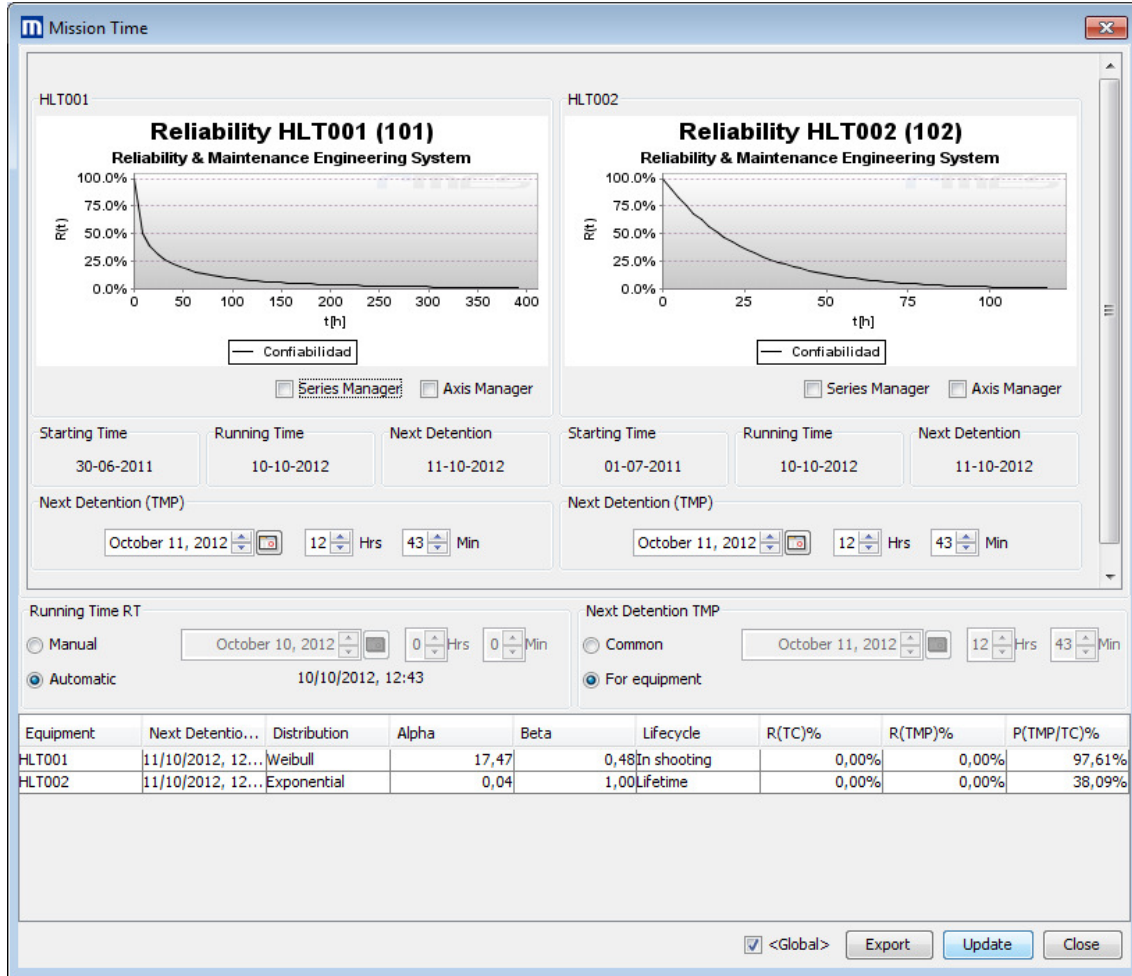
The following window opens after you click “Mission Time”:



Select the HLT001 and HLT002 pieces of equipment and then click “Report”:



That will display the following window:



Since the database used contains data from June 1 until July 1 2011, the software establishes **Implementation** based on that period of time for each piece of equipment: on 06/30/2011 the HLT001 equipment began operating after its last shutdown, while the HLT002 equipment began on 07/01/2011.

This report was generated on 08/23/2011, so that date was designated as the **Runtime** by the software, and the following day is designated as the **Next shutdown**.

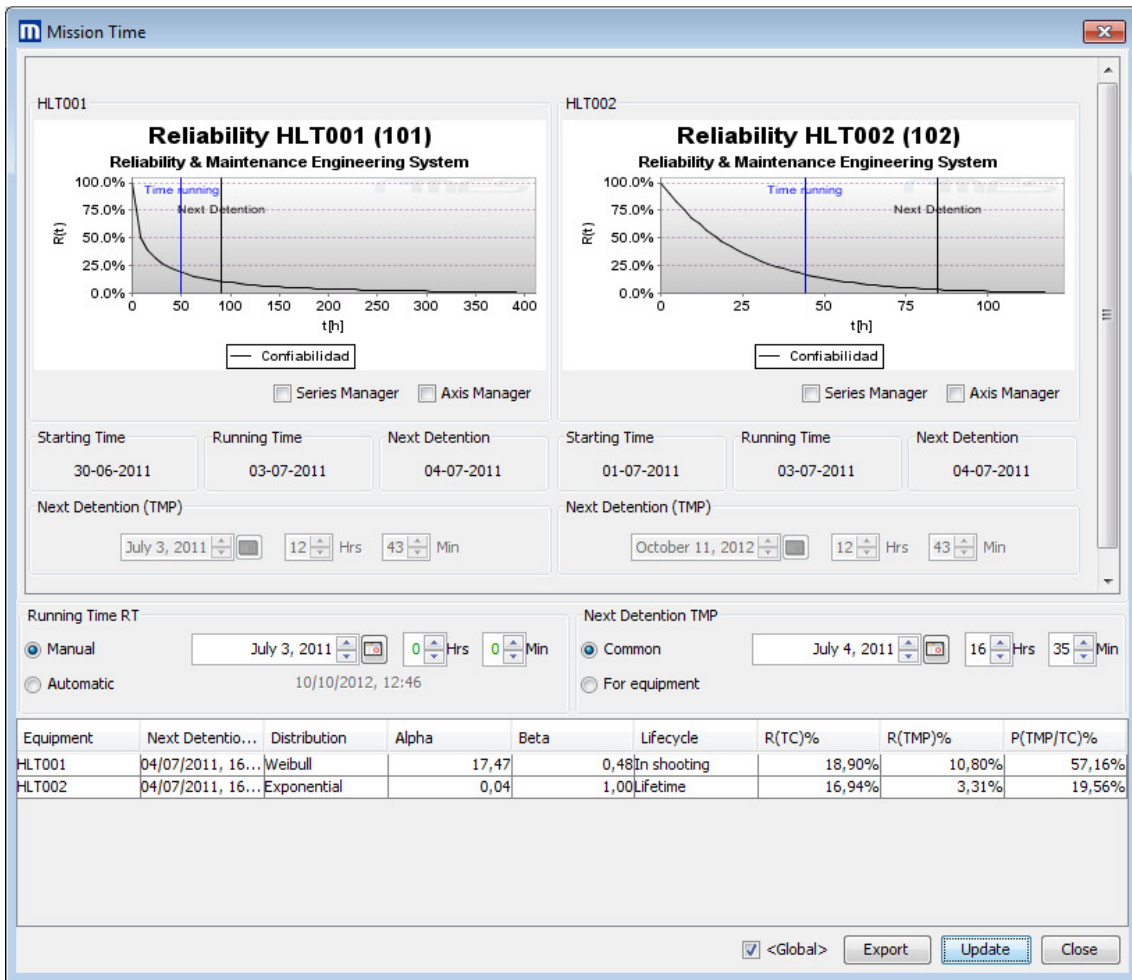
With the values of the reliability distribution parameters (calculated by the software based on data from the database) the probability that each piece of equipment runs without unplanned shutdowns from 08/23/2011 to 08/24/2011 is obtained. The percentage for the HLT001 equipment is 69.6% and for the HLT002 equipment it is 77.84%.

It needs to be taken into consideration that when the **Runtime** is the same as the date the report was generated, the values of the indicators will not be the same when the user attempts to generate the data from this example.

Next, go to the item **Runtime RT**, choose the **Manual** option and enter the date **July 3, 2011** at 00:00. Then go to the **Next Shutdown (NSD)** item, choose the **Common** option and enter the date **July 4, 2011** at 16:35.

Running Time RT <input checked="" type="radio"/> Manual July 3, 2011 0 Hrs 0 Min <input type="radio"/> Automatic 10/10/2012, 12:46		Next Detention TMP <input checked="" type="radio"/> Common July 4, 2011 16 Hrs 35 Min <input type="radio"/> For equipment	
---	--	---	--


Lastly, click **“Update”** to generate the following report:



Probabilistic Reports Tab: Indicators

Calculate the Reliability, Availability, and Failure Cost for equipment and configurations.

Procedure

- Select the “**Indicators**” () icon on the **Probabilistic Reports** toolbar. This will open a window with the **Structural Tree** of the system and four columns, which are:
 - **Reliability:** Reliability of each diagram node.
 - **Availability:** Probabilistic availability of each diagram node.
 - **Availability (MTTI):** Probabilistic availability of each diagram node based on the MTTI.
 - **Failure Cost:** Cost of the failure of each diagram node.
- Click “**Calculate**” to generate the report. The **Adjust** option fits the data calculated to the window so that it is all visible.
- To export the data generated click “**Export.**”

Characteristics

- This report can be generated with historical data of the equipment or with only the values of the following equipment indicators:

Mean Time Between Failure
 Mean Time To Repair
 Mean Time To Intervention
 Operation Time (OT)
 Average Intervention Cost

The indicator values can be entered by clicking **Import** on the **Systems** toolbar or manually in the **Properties** of each piece of equipment.

- The report is generated with all the data imported from the selected piece of equipment, since it is not filtered by date.
- The difference between Availability and Availability (MTTI) is that the first is based on the MTTR and the second on the MTTI.

Options for Selecting Equipment and/or Configurations

To export the data, select the equipment and/or configurations needed. You can use the following options to do this:

- Select them directly in the **Structural Tree**.

- To export or graph all equipment and configurations, select the **All** option in the **Indicators** window.
- When only groups of equipment and/or configurations are necessary, select the **Lists** option in the **Indicators** window. The lists or groups of equipment must be created previously in the **List Adm.** option on the **Configuration** toolbar.

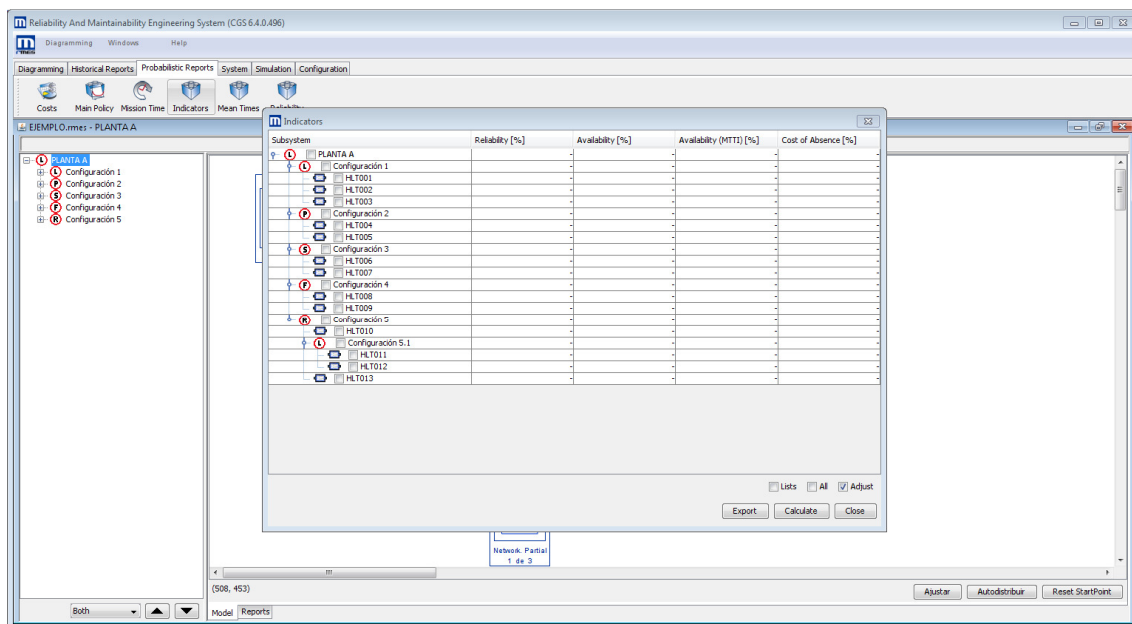
Options for exporting a data grid

The window that opens when you click “**Export**” contains the following options:

- Export only the selected equipment or all equipment.
- Choose the format of the exported document (Excel, HTML, CSV or XML).

Example

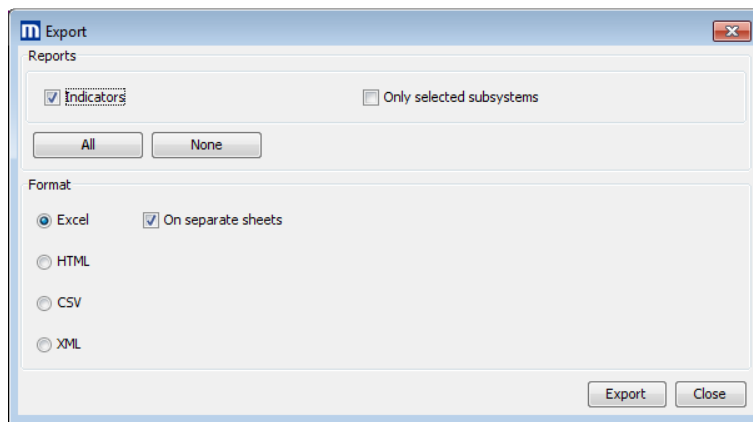
Click “**Indicators**” on the **Probabilistic Reports** toolbar, which will display the following window:



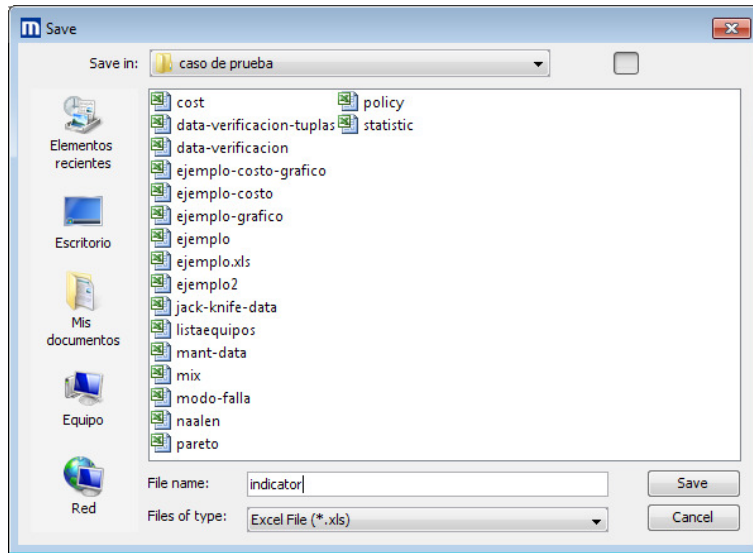
To generate a data grid, click “**Calculate**”:

Subsystem	Reliability [%]	Availability [%]	Availability (MTTI) [%]	Cost of Absence [%]
PLANTA A	37,363%	62,828%	61,409%	130.843.382,000
Configuración 1	40,862%	68,441%	68,327%	94.957.937,847
HLT001	35,853%	93,677%	92,978%	15.612.051,330
HLT002	60,653%	89,559%	89,106%	25.779.110,719
HLT003	60,653%	78,305%	79,003%	53.566.775,798
Configuración 2	17,986%	99,691%	99,665%	926.924,341
HLT004	60,653%	77,536%	77,166%	914.380,181
HLT005	17,988%	99,691%	99,665%	12.544,160
Configuración 3	61,283%	98,325%	97,623%	5.039.094,086
HLT006	33,687%	98,291%	97,576%	85.550,911
HLT007	60,653%	1,099%	1,099%	4.953.543,174
Configuración 4	51,116%	90,063%	87,944%	29.898.051,227
HLT008	50,242%	81,256%	78,341%	21.767.592,102
HLT009	53,485%	92,999%	91,145%	8.130.459,125
Configuración 5	61,451%	99,992%	99,990%	21.374,497
HLT010	47,584%	90,861%	84,888%	4.228,225
Configuración 5.1	55,367%	62,940%	63,017%	17.146,272
HLT011	60,653%	66,070%	67,127%	14.213,497
HLT012	53,485%	92,999%	91,145%	2.932,774
HLT013	60,653%	100,000%	100,000%	0,000

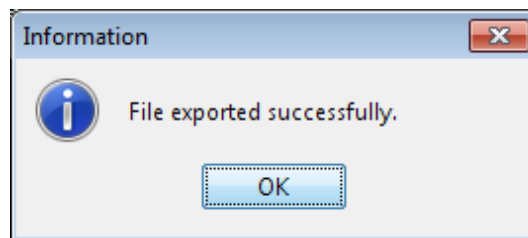
Click **“Export”** in the window above to display the export window. In this window select the **“Indicators”** option. To export the data of all diagram nodes, the **Only Selected Subsystems** option must not be checked. Also, choose the **Excel** option and click **“Export”**:



This will open the **Save** window, and in this window type the file name: *Plant A Probabilistic Indicators*. Then click **“Save”**:




The following message confirms that the file was exported correctly:



Probabilistic Reports Tab: Mean Times

Shows MTBF, MTTR, MTTI, the life cycle stage of the equipment and its reliability distribution.

Procedure

- Select the “**Mean Times**” () icon from the **Probabilistic Reports** toolbar. This will open a window with the **Structural Tree** of the system and five columns, which are:
 - **MTBF:** Mean Time between Failures.
 - **MTTR:** Mean Time to Repair.
 - **MTTI:** Mean Time to Intervene.
 - **Stage:** Life cycle stage of the equipment.
 - **Distribution:** Reliability distribution of equipment.
- Click “**Calculate**” to generate the report. The **Adjust** option fits the data calculated to the window, so that it is all visible.
- To export the data generated, click “**Export**”.

Characteristics

- This report can be generated with historical data of the equipment or with only the values of the following equipment indicators.

Mean Time Between Failure
 Mean Time To Repair
 Mean Time To Intervention
 Operation Time (OT)
 Average Intervention Cost

The indicator values can be entered by clicking **Import** on the **Systems** toolbar, or manually in the **Properties** of each piece of equipment.

- The report is generated with all the data imported from the piece of equipment selected, since it is not filtered by date.
- The **MTBF**, **MTRR**, and **MTTI** indicators are calculated at the equipment, configuration, and system levels, but the **Stage** and **Distribution** can only be calculated for equipment.

Options for Selecting Equipment and/or Configurations

To export data, the required equipment and/or configuration must be selected. You can do this through the following options:

- Select them directly in the **Structural Tree**.
- To export or graph all of the equipment and configurations, select the **All** option in the **Mean Times** window.
- When only groups of equipment and/or configurations are needed, select the **Lists** option in the **Mean Times** window. The lists or groups of equipment must be created previously in the **List Adm.** option on the **Configuration** toolbar.

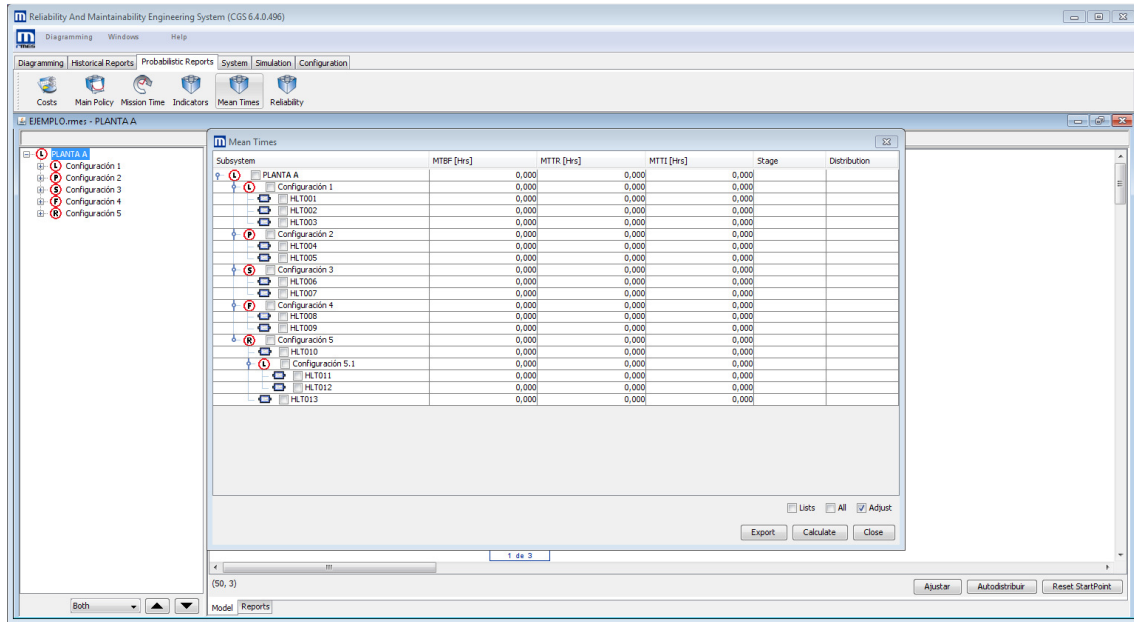
Options for exporting a data grid

In the export window that opens when you click **“Export,”** the following options appear:

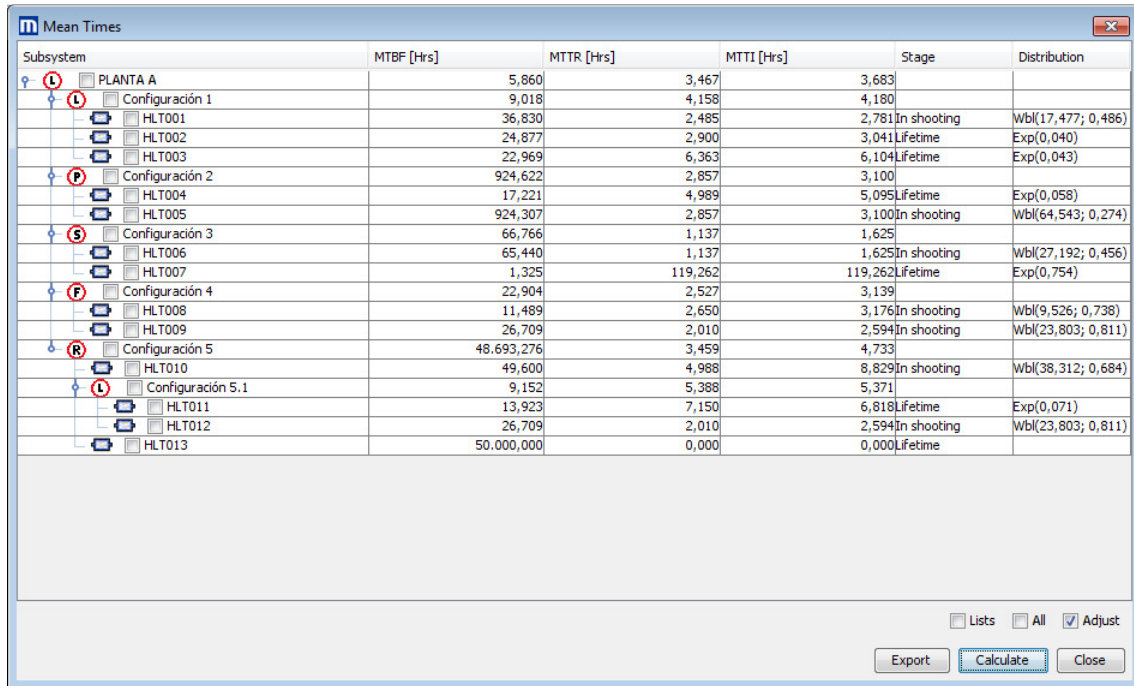
- Export only the equipment selected or all pieces of equipment.
- Choose the format of the document exported (Excel, HTML, CSV or XML).

Example

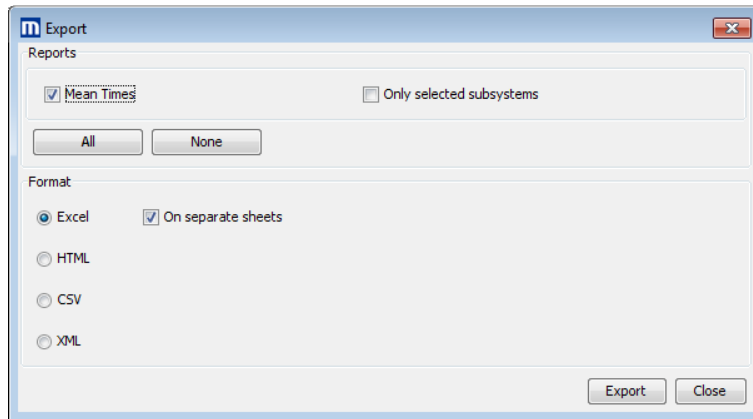
Click **“Mean Times”** on the **Probabilistic Reports** toolbar, which will display the following window:



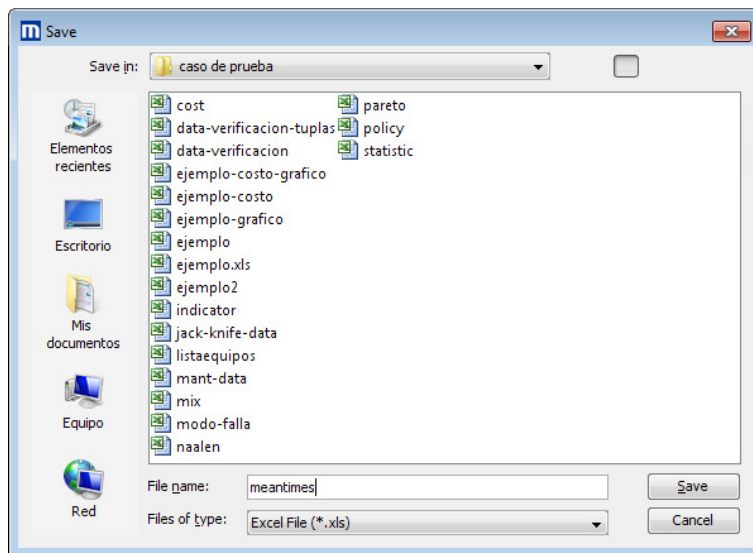
To generate a data grid click **“Calculate”**:



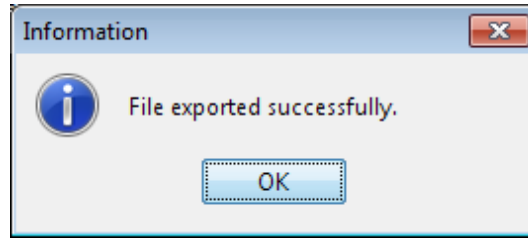
Click **“Export”** in the previous window, which will display the export window. In this window select the **“Mean Times”** option. To export the data of all diagram modes, the **Only Selected Subsystems** option must not be checked. Also, choose the **Excel** option and click **“Export”**:



This will open the **Save** window, and in that window type the file name: *Plant A Mean Times*. Then click **“Save”**:



The following message confirms that the file was exported correctly:



Probabilistic Reports Tab: Reliability

Graphs the reliability distributions and failure rate of each piece of equipment or subsystem.

Procedure

- Select the **Reliability** icon in the **Probabilistic Reports** tab.
- Select a diagram node from the list in the open window.
- Click **“Calculate”**, which will generate two graphs, one in each tab:
 - Reliability
 - Failure Rate

The configuration reports also have the **“Compare”** option, which opens a new window in which the distributions of all diagram nodes in the configuration are shown on the same graph.

Characteristics

- This report can be generated with historical data of the equipment or with only the values of the following equipment indicators.

Mean Time Between Failure
 Mean Time To Repair
 Mean Time To Intervention
 Operation Time (OT)
 Average Intervention Cost

The indicator values can be entered by clicking **Import** on the **Systems** toolbar or manually in the **Properties** of each piece of equipment.

- This report can only be generated when there is existing historical data for the equipment.
- The report is generated with all data imported of the selected piece of equipment, since it does not filter by date.

- After the first report is calculated, when you choose another piece of equipment the report for the new diagram selected will be shown automatically. Thus, you do not need to click “**Calculate**” again.

Graph Options

The options of the graphs are:

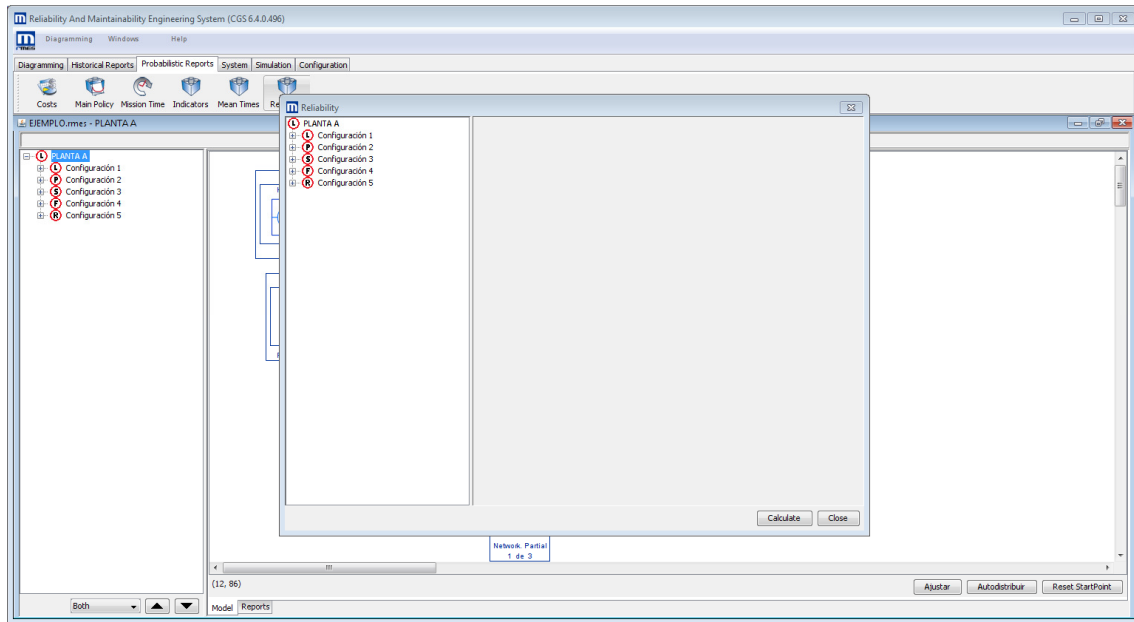
- When you select **Series Manager** in each of the graphs, the following options appear:
 - Visible:** When checked, the selected distributions become visible on the graph.
By default all the distributions are visible.
 - Label:** This option shows the name of the diagram node (for which the report is being produced) on the graph.
 - Color:** Change the color of the distribution.
- In **Axis Manager** you can change the minimum and maximum values of the graph’s axes. In **Reset** the values revert back to the ones calculated by the software.

By right clicking on the graphs, the following options appear:

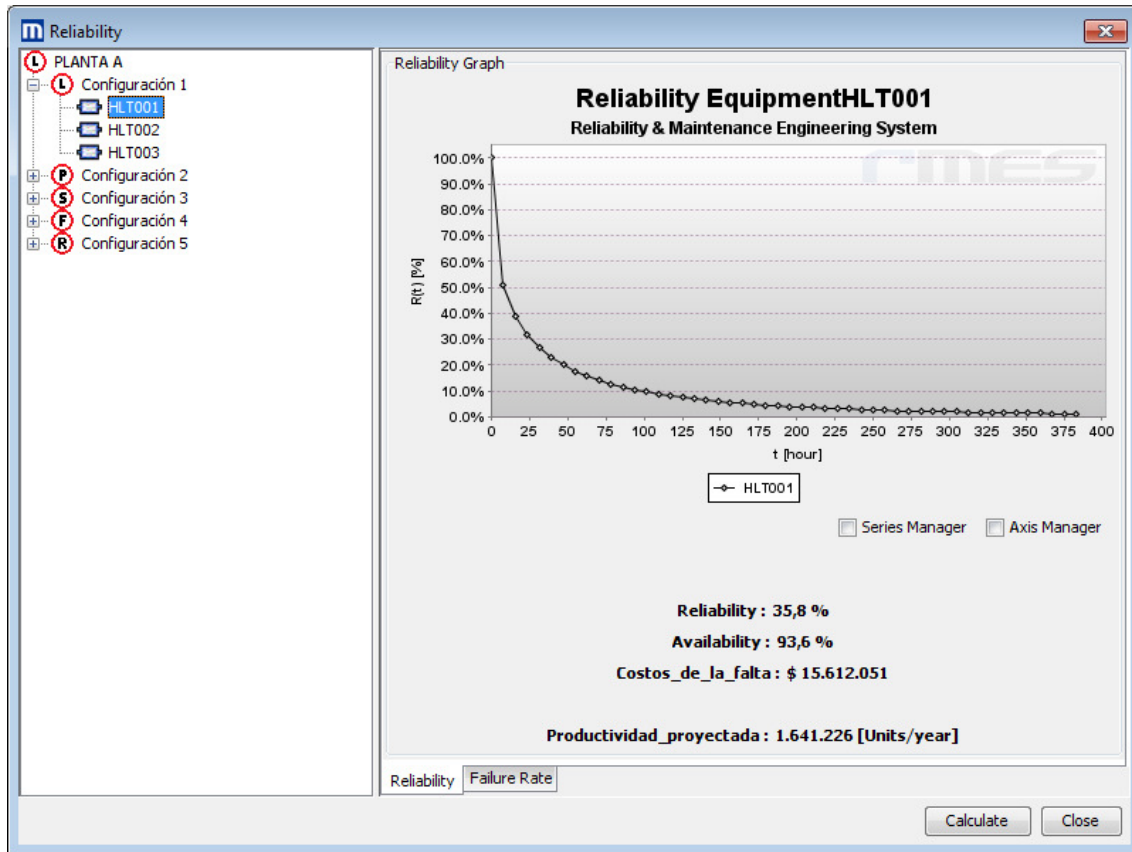
- **Properties:** Change the properties of the title, lines, colors and styles of the graph.
- **Save as:** Save the graph in PNG format.
- **Print:** Print the graph.
- **Zoom in:** Zoom in on both axes, or just the horizontal or vertical one.
- **Zoom out:** Zoom out from both axes, or just the horizontal or vertical one.
- **Automatic Scale:** Revert back to the original scale (calculated by the software) on both axes, or just the horizontal or vertical one.

Example

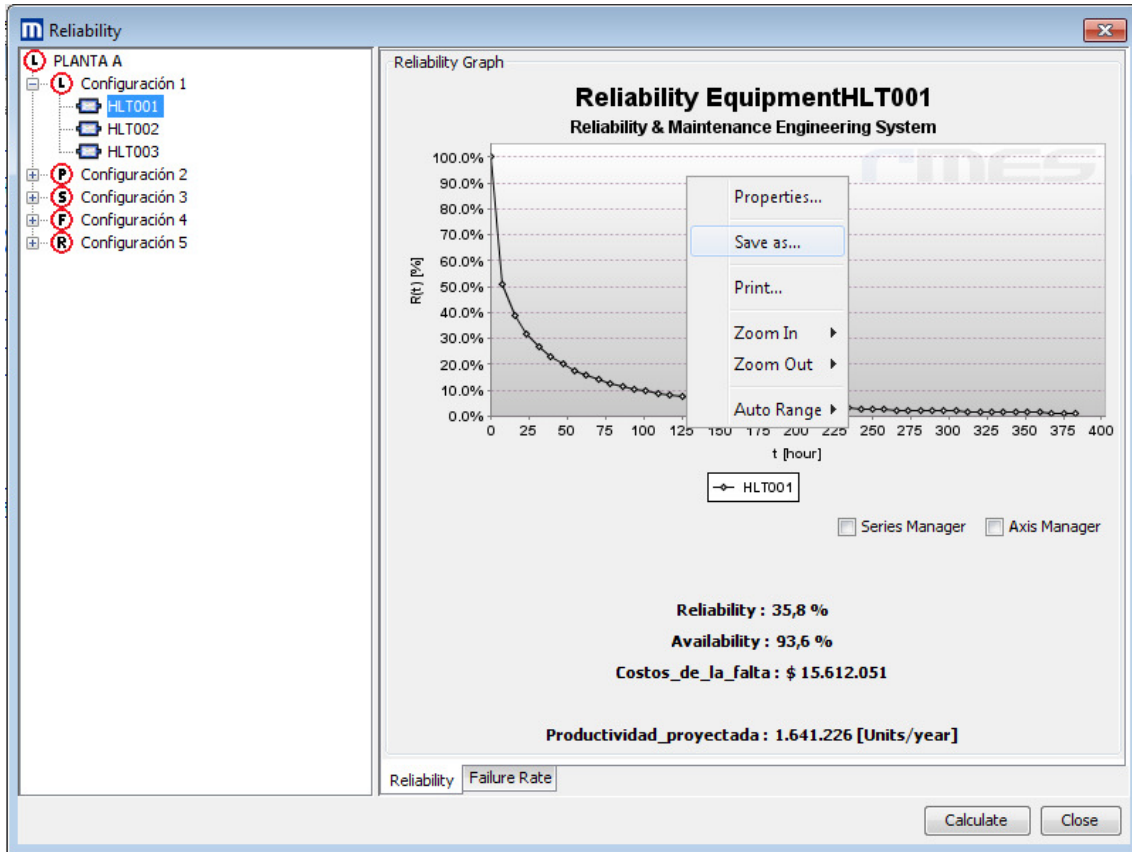
The following window opens when you click “Reliability”:



Select the HLT001 equipment in the *Structural Tree* and click “Calculate”, which will bring up the following report:



Right-click on the graph and in the window that comes up, select the option “Save as”:



Next, in the **Save** window that is displayed, save the graph.


System Tab







This bar enables you to use tools to evaluate and modify the entire system.

In this tab, you can upload databases, which will be used by RMES to make calculations for all reports. Also, there are options for modifying the system properties, entering the investment made, searching for equipment and configurations, and importing or exporting data, among others.



Bar Options

Name	Icon	Direct Access	Functionality
Properties		-	Change the name of the system, variable cost impact, annual billing, etc.

Name	Icon	Direct Access	Functionality
Investment		-	See and modify the amount, interest and years of the investment.
Database		-	Import data from CSV (Comma Separated Values) files and databases.
Update		-	Update imported data.
Count Blocks		-	Visualize the amount of equipment, lines, parallels, fractionations, redundancies, and stand-by in the system.
Search		-	Find equipment, configurations, or systems.
Import and Export Equipment Data		-	Import XLS and CSV files and select the data you want to import. You can also export.




System Tab: Properties

Change the name of the Plant or Fleet diagrammed such as impact, variable costs, and annual billing, among others.

Procedure

Open the **Properties** window of the system and if necessary edit the information in it.

There are different ways to open the system properties window, which are:

- Right clicking on the system in the **Navigation Tree** and in the window displayed select the **“Properties”** () option.
- Selecting the system in the **Navigation Tree** and then selecting the **Reports** tab located in the lower left-hand side of the **Diagram Space**.
- Selecting the system in the **Navigation Tree** to then clicking on **“Properties”** () on the **Diagram** toolbar.
- In the **System** toolbar, selecting the **“Properties”** () option.

System Properties

The Properties window contains the following items:

System Properties

- **Descriptive Name:** Name of the system or plant.

- **Variable Costs Impact:** Corresponds to the percentage of the annual billing corresponding to variable costs.
- **Annual Billing:** The annual billing of the system or plant.
- **Equipment:** Provides the possibility of working with equipment or fleets in RMES.
- **Nominal Capacity:** The quantity produced per hour in the plant.

Utilities

- **View failure:** Provides a grid with data on system failures.
- **Export List:** Exports the list of equipment in the system.
- **Export Shutdowns:** Exports the list of shutdowns within the system.
- **View Dead Lines:** See the start and end dates of the database used.
- **Equipment Codes:** View the repeated equipment codes, so that you can solve the problem.

Data Source

- **Node:** The name of the Plant/Fleet.
- **Current Repository:** The database that data is currently being extracted from.
- **Create from CSV:** Upload a new database to import system data. By clicking “**Create**” the import of data is finalized. To import data correctly, the database must contain the code or alias of the system. This data only corresponds to the system, and not to the equipment and/or configurations of which it is composed.
- **Repositories:** Shows the databases that are uploaded. If there is more than one database uploaded, the software is only using data from the first database. To use another database, you must select it and then click “**Use**”. Only one data source can be used at a time.
- **Clean:** Delete all the system data used, but without deleting the uploaded databases.
- **Create:** Import the data from the new CSV uploaded in **Create from CSV**.
- **Use:** Use the data from the database selected in **Databases**.
- **Estimate:** The estimation of parameters is not available for configurations.
- **View/Edit:** See the system data is in the database and edit it manually if desired. This option can only be used when the imported database contains the code or alias of the system. If it only has data for the diagram nodes it means that there is no data from the system itself. Therefore there is no system data that can be seen or edited. Data can also be exported within this option.

TBF



- **Weibull Graph:** This graph is not available for the system.

Example


Select the system, Plant A, and then click on “**Properties**” on the **System** toolbar. This will open the following window:

The screenshot shows a software window titled 'Properties' with a blue header bar. The window is divided into two main sections. The left section, 'System Properties', contains several input fields: 'Descriptive Name' (PLANTA A), 'Nickname' (PLANTA A), 'Variable Cost Impact' (12,00 %), 'Annual Billing' (400.000.000,00 [\$]), and 'Nominal Capacity' (200,00 [unidades] By hour). Below these are 'Utilities' with buttons for 'View Failures', 'Exportar_Lista', 'Export Detentions', 'View Deadlines', and 'Equipment Codes'. The right section, 'Data Source', shows 'Node: PLANTA A' and 'Current Repository: Repositorio_0'. It includes buttons for 'Clean', 'Create', 'Use', 'Estimate', and 'View/Edit'. A 'Create from CSV' field is also present. At the bottom of the right section, a 'TBF' area contains the text 'Graph not available for configurations'. A 'Close' button is located at the bottom right of the window.

System Tab: Investment

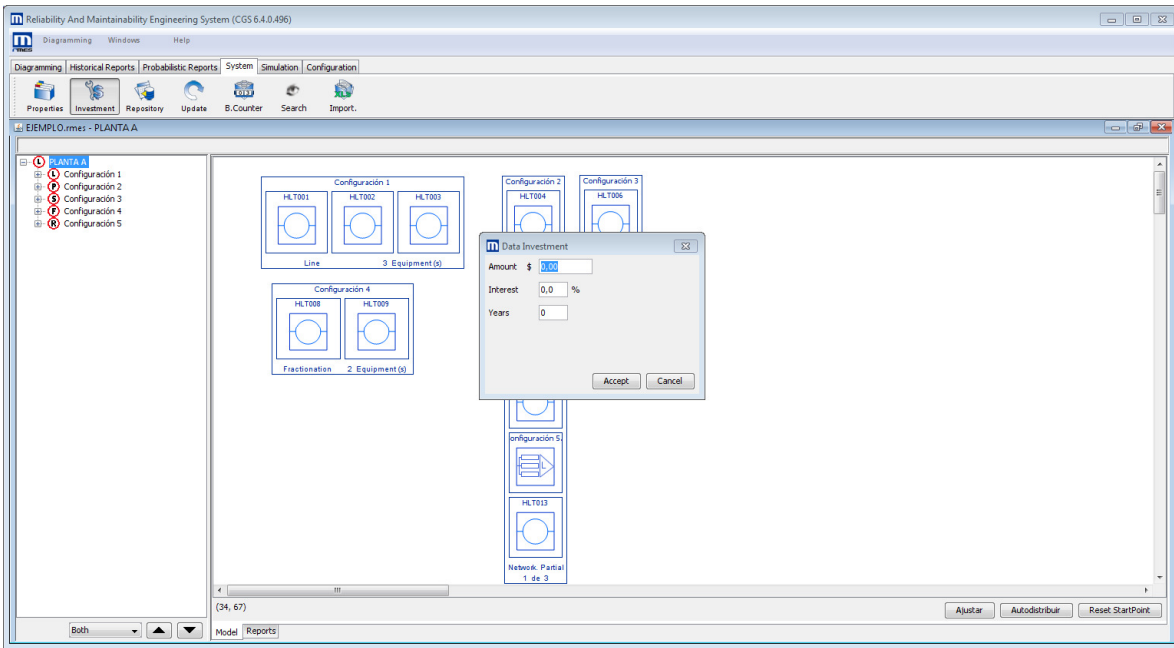
See and modify the amount, interest, and years of the investment.

Procedure:

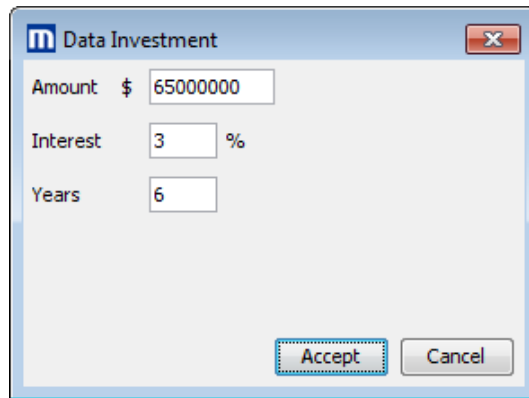
- Select the “**Investment**” () icon on the **System** toolbar, which will open a window where you must enter the following information:
 - **Amount:** Enter the amount of the investment in monetary units.
 - **Interest:** The interest rate of the investment, as a percentage.
 - **Year:** The duration in years of the project to invest in or that was invested in.
- Click “**Accept**” to save the changes entered.

Example

Click **“Investment”** on the **System** toolbar, which will open the following window:



Enter an investment of \$65,000,000, an interest rate of 3% and 6 years. Then click **“Accept”**:





System Tab: Repository

Import data from CSV (comma separated value) files and databases. To upload data from local databases (MS-Excel) or maintenance management systems, the R-MES system enables you to do a mass upload of the diagram nodes contained in a logical-functional diagram. This minimizes the time it takes to obtain results.

Procedure




To upload the database, follow these steps:


- Select the **“Repository”** () icon on the **System** toolbar.
- In the window displayed, click on the  button. This will open another window in which alternatives are given for the source type to be uploaded.
- Choose a source type, either CSV files or databases. The procedure changes depending on the source source chosen. The procedures are explained below:

Add from CSV files

If the source chosen is **Add from CSV files**, use the following procedure:

- Click **“Next>”**.
- In the window that is displayed, type a name to identify the Repository.
- Click on the  button. This will display the **Open** window where you can search for the CSV file(s) to be uploaded.

If you need to upload several files to the same database and they are found in the same location, when the **Open** window is displayed select them all at the same time and click **“Open”**.

If you need to upload several files to the same database and they are found in different locations, click the  button the number of times necessary, searching for and opening each CSV file.

- When the CSV files have finished uploading to the database, click **“Create”**. That will close the **Repository Creation Assistant** window.
- In the **Repository Configuration** window, the new database is uploaded. Select it and click **“Import to Plant”**.
- A message will be sent confirming that the database was imported correctly.

The CSV file must have the following information:

Date;Hour;Duration;Type;GPlan;Cost;Equipmentn;Simptom;FailureMode;Cause;Order;Impact;Sistem Det.

Each row represents a shutdown.

The order must be conserved for the data to be imported correctly.

Example in CSV format:

```
Fecha; Hora; Duración; Tipo; Especialidad; Costo; Equipo; sintoma; m. falla; Causa; Orden; Impacto; Det. Equipo  
01/06/2011; 8:00:00; 10,5836; DONP; 0; 0; 101; 301; 0; 0; 1; 1; 0  
01/06/2011; 18:35:01; 0,6072; MC; E; 321,816; 101; 509; B; C-1; 2; 1; 0  
01/06/2011; 19:11:27; 0,7302; DONP; 0; 0; 101; 312; 0; 0; 3; 1; 0
```


The file can contain the names of each piece of information in the first row.

Add from databases

If the source chosen was **Add from databases**, use the following procedure:

- Click **“Next>”**.
- In the window displayed, select the type of database available and enter the configuration.
- Click **“Create”**.

Characteristics

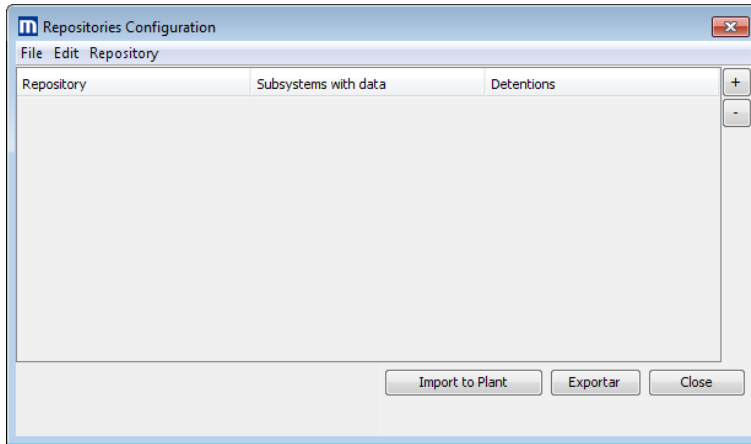
- It is possible to upload more than one document to the same database.
- RMES reports possible errors that the database has when the plant is imported. You have the option of solving the problems or importing anyway.
- It is possible to create various databases (for each one you must have followed the procedures mentioned above), but only one can be imported to the plant at a time.
- Databases no longer needed can be deleted by selecting the database in the **Database Configuration** window and clicking the  button.

Export Options

The data from the database created can be exported by selecting the database in the **Database Configuration** window and clicking **“Export”**.

More Options

This report has additional options located in the **Database Configuration** window, which are:



File

In this item there is the option to:

Close: Close the **Database Configuration** window. This can also be done by clicking **Escape** on the keyboard.

Edit

To use these options, first select a database in the **Database Configuration** window. The options are:

- **View:** Show the data grid uploaded to RMES from the database. This can also be done by clicking **CTRL+O** on your keyboard.
- **View by Subsystem:** Show the data grid uploaded to RMES from the database separated by diagram node. When you select a row of data (that represents a shutdown), in the box on the right the details of the row of data are shown. This can also be done by pressing **CTRL+E** on your keyboard.
- **Rename:** Change the name of the database. This can also be done by pressing **CTRL+R** on your keyboard.
- **Delete:** Delete the database. This can also be done by pressing **Delete** on your keyboard.

Database

- **Create empty:** Create an empty database. After choosing this option, you need to enter the name of the new database. This can also be done when the **Database Configuration** window is open, by pressing **CTRL+N** on your keyboard.
- **Create from CSV:** Create a new database with CSV files. The window displayed is the same one as the **Database Creation Assistant** in the **Database from files** item. This can also be done when the **Database Configuration** window is open, by pressing **CTRL+M** on your keyboard.
- **Create from Wizard:** Create a database. The window displayed is the same one as the **Database Creation Assistant** in the **Selection of Source** item. This can also be done when the **Database Configuration** window is open, by pressing **Insert** on your keyboard.
- **Create from XML:** Create a database with XML files. The window that is displayed is the same one as the **Database Creation Assistant**, except that only files in XML format can be uploaded. This can also be done when the **Database Configuration** window is open, by pressing **CTRL+L** on your keyboard.

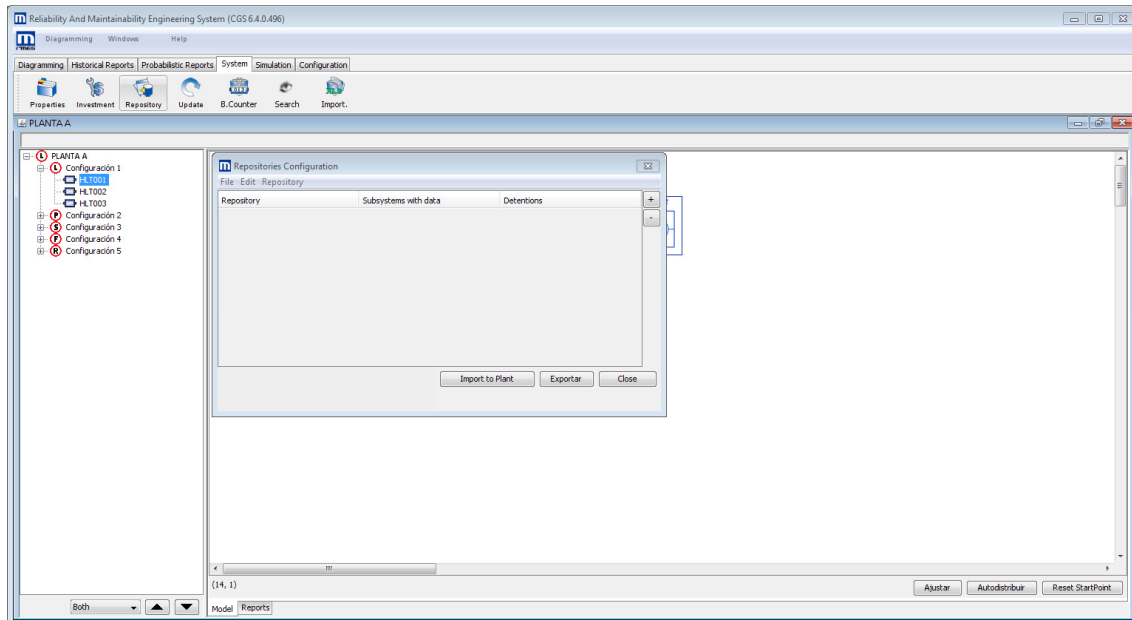
To use these options, a database must be selected first in the **Database Configuration** window. These options are:

- **Add CSV:** Add CSV files to the database. This can also be done by pressing **CTRL+U** on your keyboard.

- **Import to Plant:** Import the database to the plant. This can also be done by pressing **CTRL+I** on your keyboard.
- **View Subsystems:** See the diagram nodes contained in the plant. This can also be done by pressing **CTRL+D** on your keyboard.

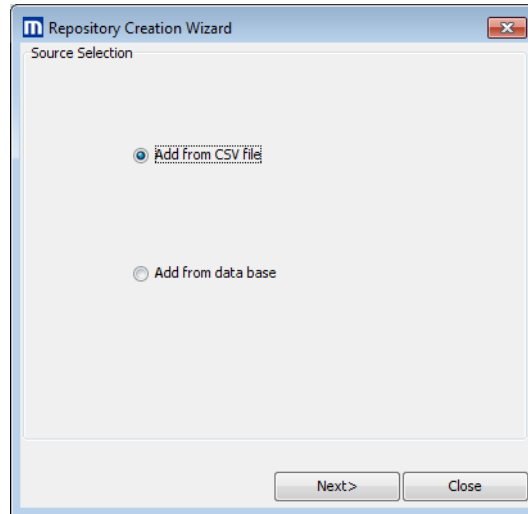
Example

Click **“Database”** on the **System** toolbar, which will display the following window:

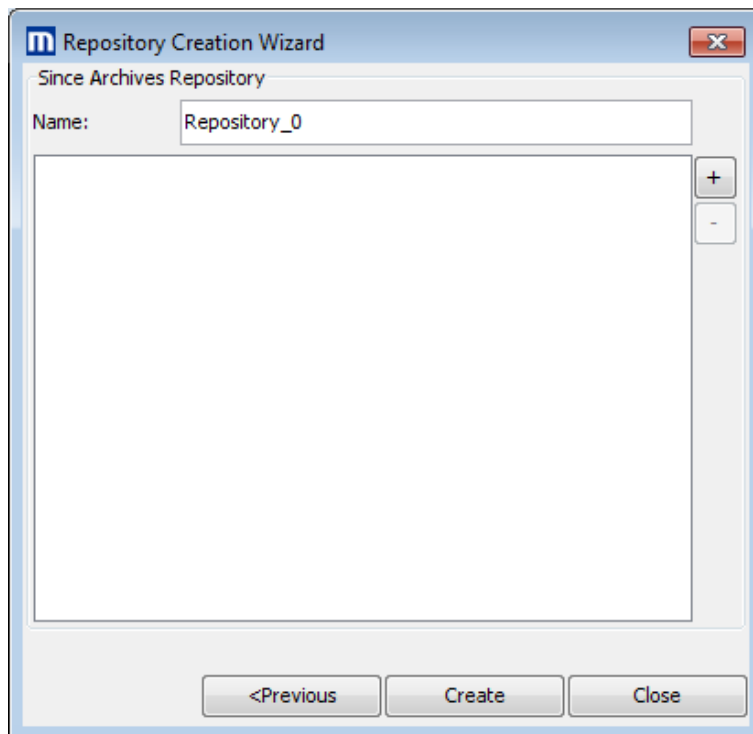


Then click the  button.


This will bring up a new window, and in it select the **“Add from CSV file”** option and then click **“Next”**.

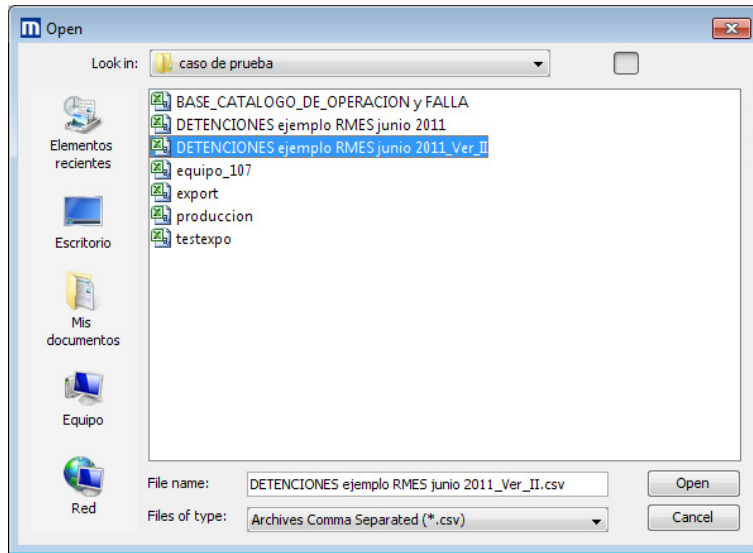


Next, the following window will be displayed:

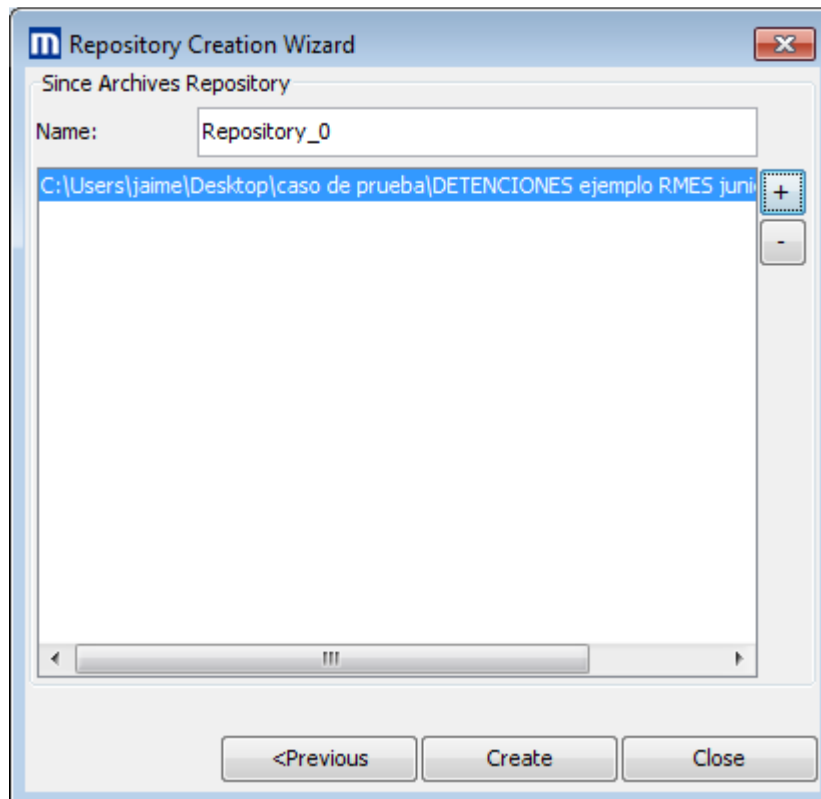


The name **Repository_0** is the default name that RMES provides.

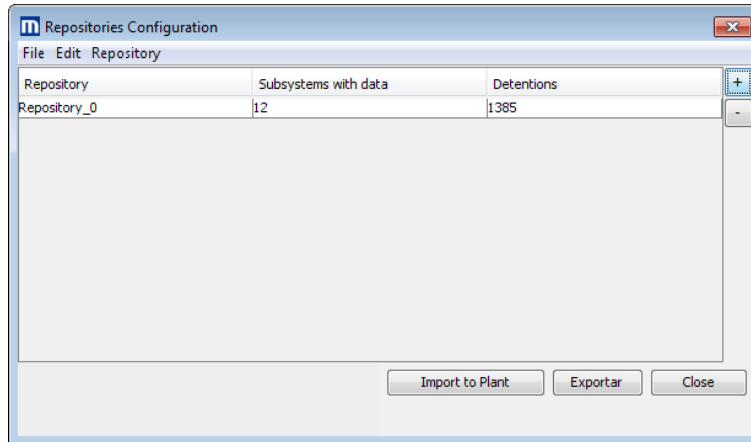
To change the name, just erase the existing one and type another one. Then click the  button and the following window will open:



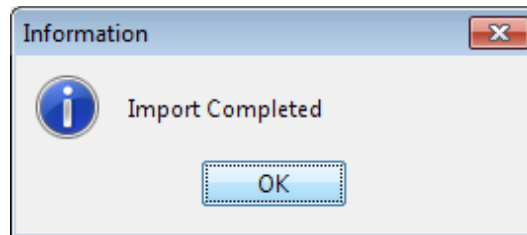
Choose the file ***DETENCIONES ejemplo RMES junio 2011_Ver_II.csv*** and then click **“Open”**. Doing that will take you back to the following window:



When you click **“Create”** the database will be uploaded, as shown in the following screen:



To import to the plant, select the file by clicking on it in the window above and click **“Import to plant”**. The following window confirms the import to the plant:



System Tab: Update

Update is deprecated

System Tab: Block Counter

Visualize the quantity of equipment, lines (Series) parallels, fractionations, redundancies and Stand-by in the system.

Procedure

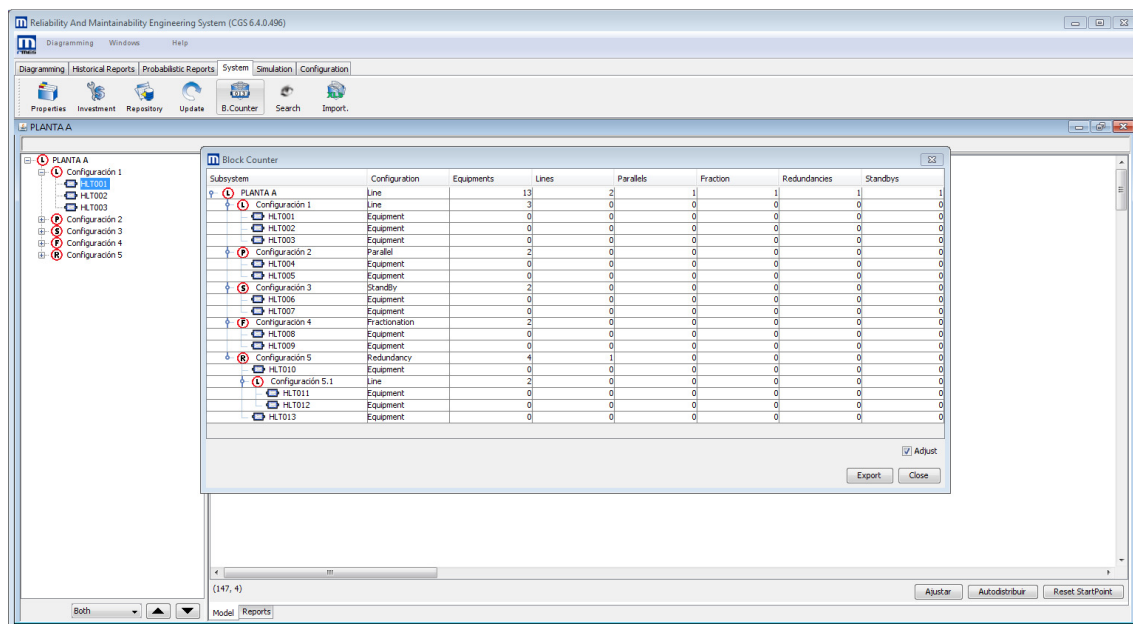
- Click **Block Counter** on the **Systems** toolbar. This will open a window containing a list with the **Structural Tree** of the plant.
For each configuration the following information is presented:
 - Type of configuration.
 - Quantity of equipment it contains.
 - Quantity of configurations in series it contains.
 - Quantity of configurations in parallel it contains.

- Quantity of configurations in fractionation it contains.
- Quantity of configurations in redundancy it contains.
- Quantity of configurations in stand-by it contains.
- By clicking **“Export”** the whole data grid can be exported. You can choose the format of the exported document (Excel, HTML, CSV or XML).

The **Adjust** option fits the data calculated to the screen so that it is all visible.

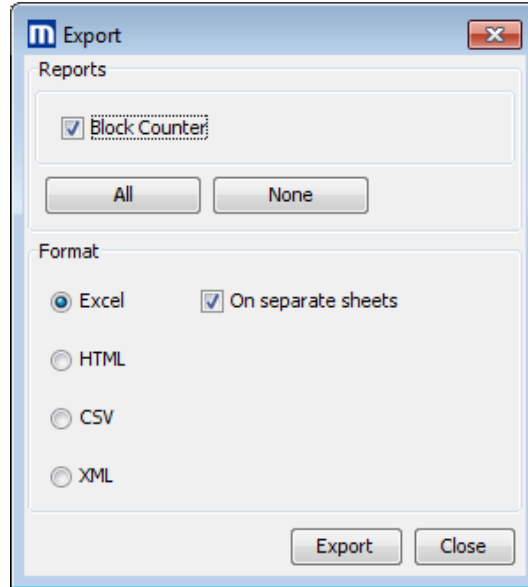
Example

Click **“Block Counter”** on the **System** toolbar, which will display the following window:

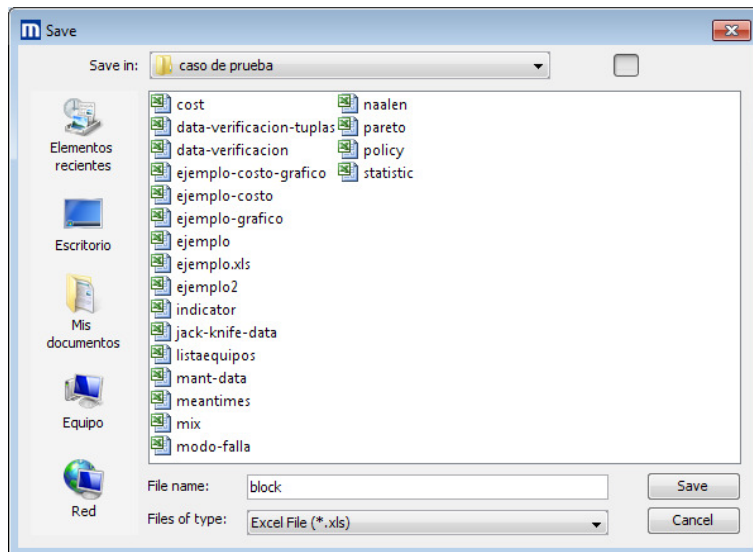


In this example, there is one configuration of each type in the plant. This can be seen in the first row.

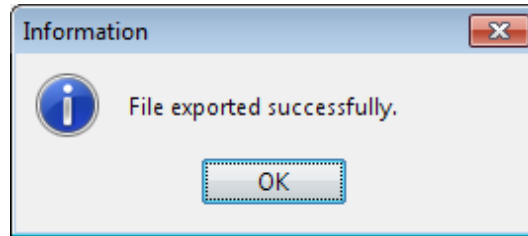
Click **“Export”** in the window above to display the export window. In this window select the **“Block Counter”** option. Also choose the **Excel** option and click **“Export”**:



This will open the **Save** window, and in it type the file name: *Block Counter of Plant A*. Then click **“Save”**:



The following message confirms that the file was exported correctly:



System Tab: Search

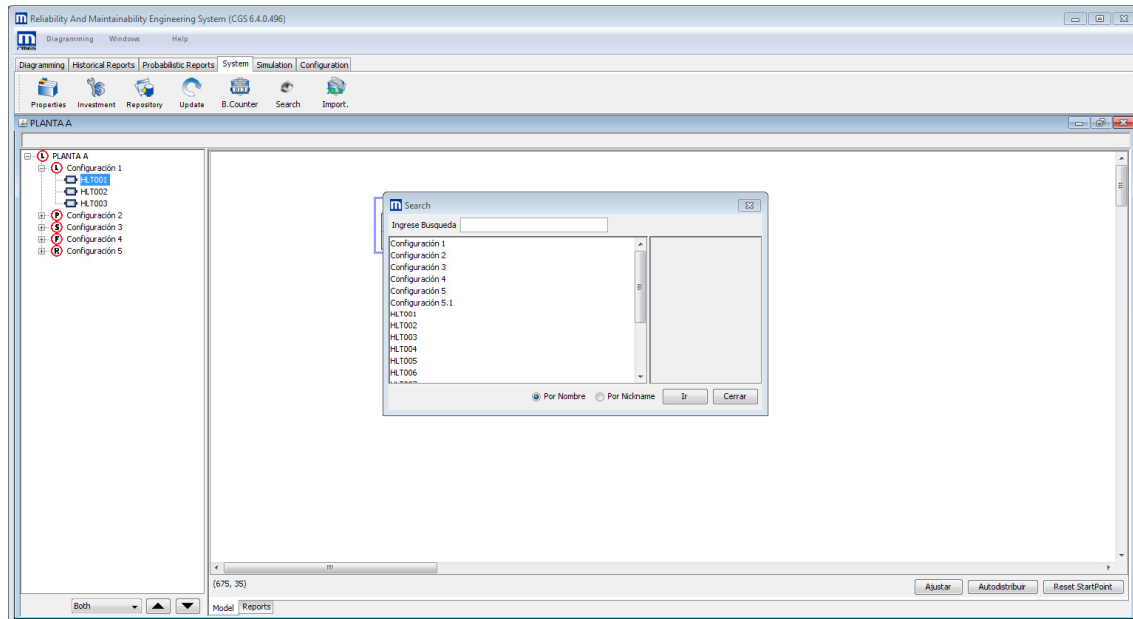
Find equipment, configurations or systems.

Procedure

- Click **Search** on the **Systems** toolbar. This will open a window with a list of the names of the diagram nodes of the plant.
- Choose between either **By Name** or **By Nickname**.
 - By Name:** Shows the list of diagram nodes by their **names**.
 - By Nickname:** Shows the list of diagram nodes by their **nicknames**.
- In **Enter Search**, enter the name or nickname (according to the option previously selected), or search the list for the desired diagram node.
- In the list, select the diagram node you are looking for, and click **Go**. The software will show its location. Another way to find its location is to double click on the diagram node in the list.

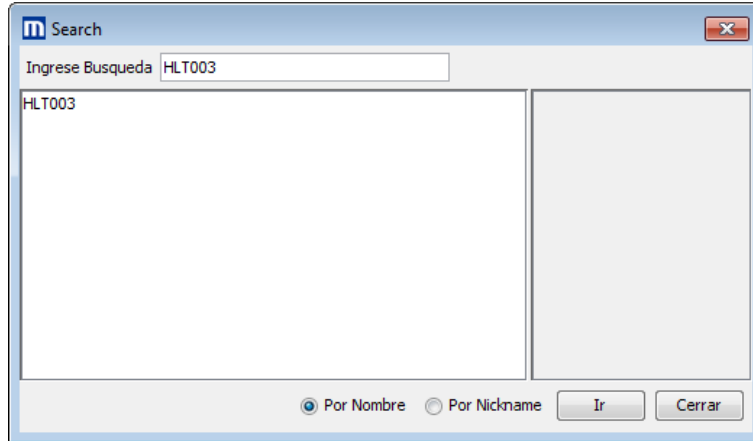
Example

Click “**Search**” in the **System** toolbar, which will display the following window:

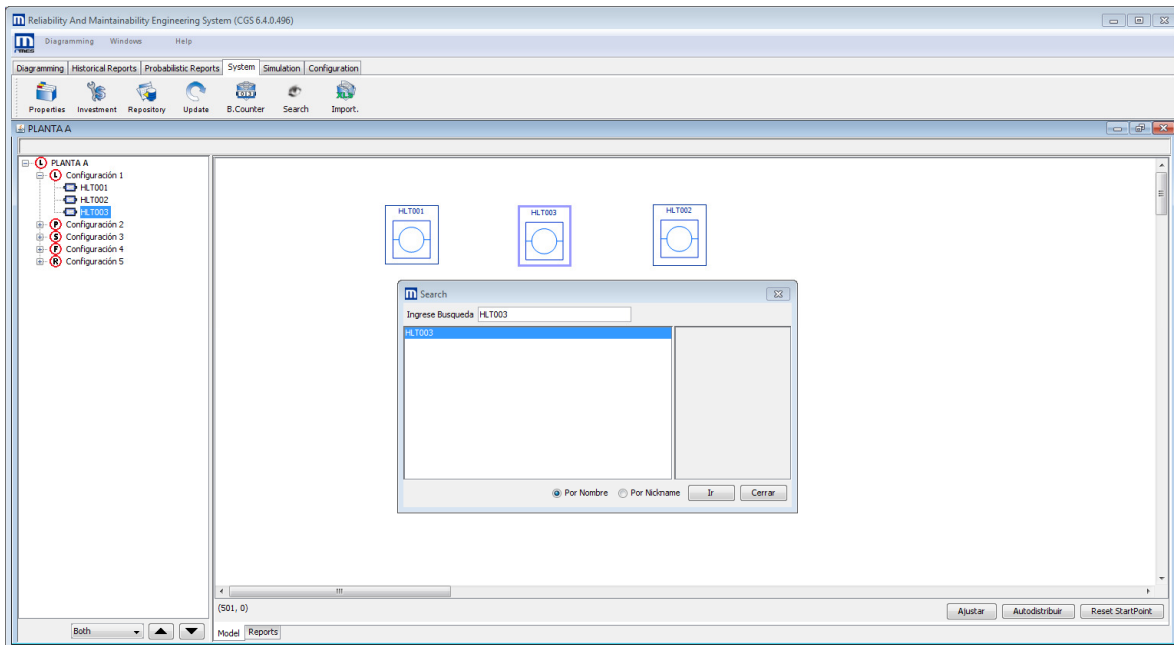


It bears mentioning that in this case it is easy to search for a diagram node, since the plant is small. However, this function is meant for plants with many diagram nodes, making it difficult to search through each one.

Type the name of the HLT003 diagram node in **Enter Search**. You will be able to see the name of the piece of equipment in the search window:



Select the diagram node in the list and click “Go”:




When you do that, and as shown in the image above, in the upper right-hand side of the search window the branch where the HLT003 equipment is located is shown, and this node will be selected automatically in the **Diagram Tree**.

System Tab: Import

Import files (XLS, CSV or XML) with the equipment indicator values (MTTR, MTBF, operation time, among others), making it unnecessary to enter them manually in the properties window of each piece of equipment. There is also the option to export the indicators of the equipment.

Procedure

- Select the configuration in the Workspace containing the equipment from which you need to import or export data. When you select the plant all equipment will be considered.
- Select the “Import” () icon on the **Systems** toolbar. This will open a window with two tabs, one for importing data and the other for exporting.

Importing data

To import data, first you must have created an XLS, CSV, or XML file, which must be in the following formats:

XLS Format

The format that must be followed for the columns is:

Nombre	Nickname	MTBF	MTTR	MTTI	Tiempo de Operación (TO)	Costo de intervención promedio	Capex	Opex fijo	Opex variable	Indice escalamiento	Capacidad Productiva	Rentimientos
--------	----------	------	------	------	--------------------------	--------------------------------	-------	-----------	---------------	---------------------	----------------------	--------------

Example

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	HLT001	101	153	25	27	539	1689	1265000	25699	267490	0,7	265330	0,9	
2	HLT002	102	96	17	25	563	2563	1395000	36500	456300	0,8	392810	0,7	
3														
4														

Each row contains the data of just one piece of equipment.

The file does not have to contain headers with the names of the columns.

CSV Format

The order of the parameters must be the same as the order for XLS files, except that in this type of file the parameter values are separated by a semi-colon.

Example:

	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
HLT001;	101;	153;	25;	27;	539;	1689;	1265000;	25699;	267490;	0,7;	265330;	0,9			
HLT002;	102;	96;	17;	25;	563;	2563;	1395000;	36500;	456300;	0,8;	392810;	0,7			

Each line contains data for only one piece of equipment.

The file does not have to contain headers with the names of the columns.

HTML Format

The order of the parameter values must be the same as the ones above, except that in this case each value must be in quotation marks and preceded by the name of the parameter.

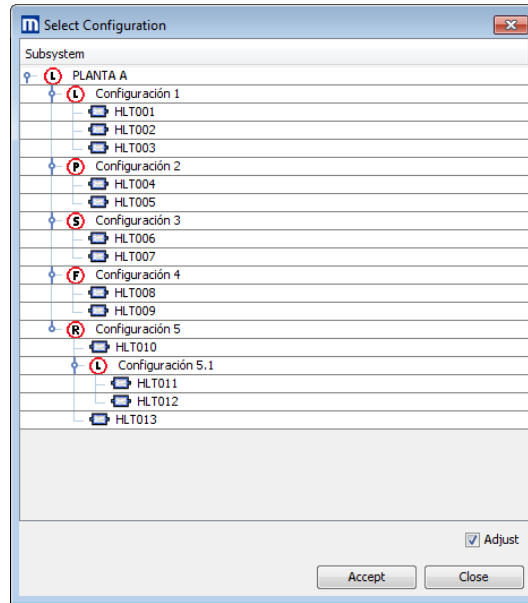
Example:

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<sheetloader xmlns="sheetloader.xml-schema">
  <propiedades>
    <propiedad nombre="HLT001" nickname="101" mtf="153" mtr="25" mti="27" to="539" cip="1689" capex="1265000" opex_fijo="25699"
    opex_variable="267490" indice_escalamiento="0.7" capacidad_productiva="265330" rendimiento="0.9"/>
    <propiedad nombre="HLT002" nickname="102" mtf="96" mtr="17" mti="25" to="563" cip="2563" capex="1395000" opex_fijo="36500"
    opex_variable="456300" indice_escalamiento="0.8" capacidad_productiva="392810" rendimiento="0.7"/>
  </propiedades>
</sheetloader>
```

- Once you have the XLS, CSV, or XML file that you want to import, go to the **Import** tab and select the item **Import Database From** to open the file.
- Next select the parameters to import. This enables you to import selected parameters from the file.
Keep in mind that if the file imported contains equipment not found in the diagram, they must be created and their parameter values will also be imported (according to the parameters selected for import).
- Choose one of the following options:
Do not update data for existing equipment. If you choose this option the software will not upload new data for the existing equipment in the diagram.
Include configurations. If this option is chosen the software will include the equipment found within the sub-configurations that compose the parent configuration (the one previously selected in the Workspace) in the import process.
- Then click **"Import"**.

Export Data:

The selection depends on the export of a configuration. From it, you can export only the equipment that are direct children or all descendants equipment of the configuration. By default, it uses the settings that you selected in the plant. This can be changed by clicking on "Select", which displays a dialog that lets you choose the desired configuration.

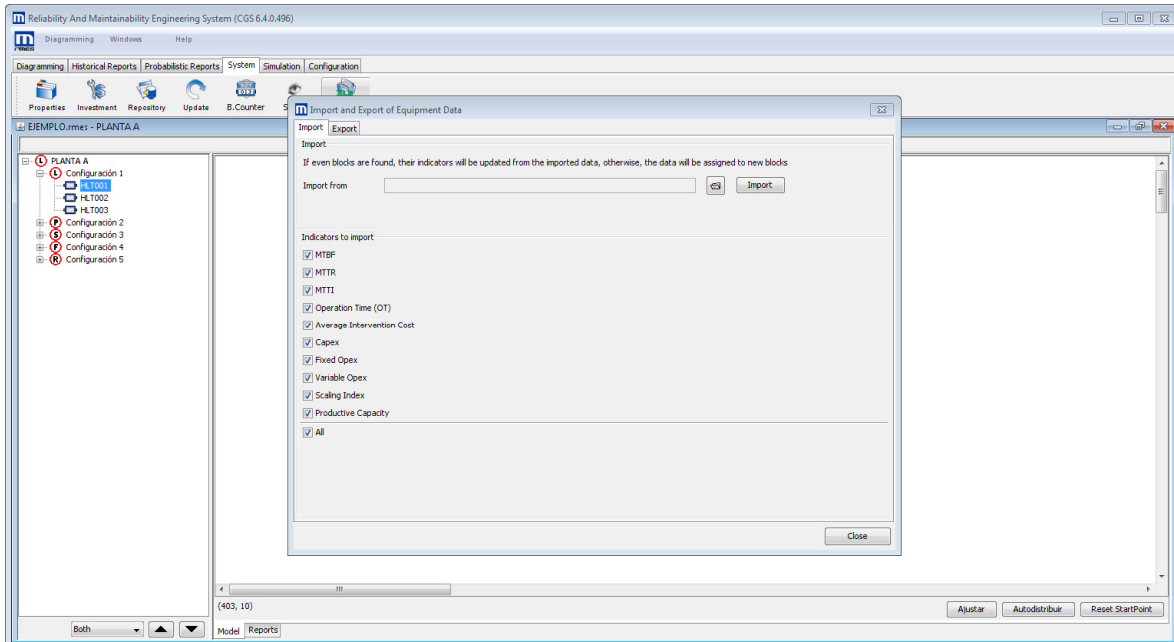



- In the export tab, in **Export to**, click the icon **Folder**.
- Save an Excel or CSV file. The data will be exported to this file later.
- Select the desired setting by pressing the "Select".
- Choose between "direct blocks only" or "All blocks descendants"
- Click **“Export”**.

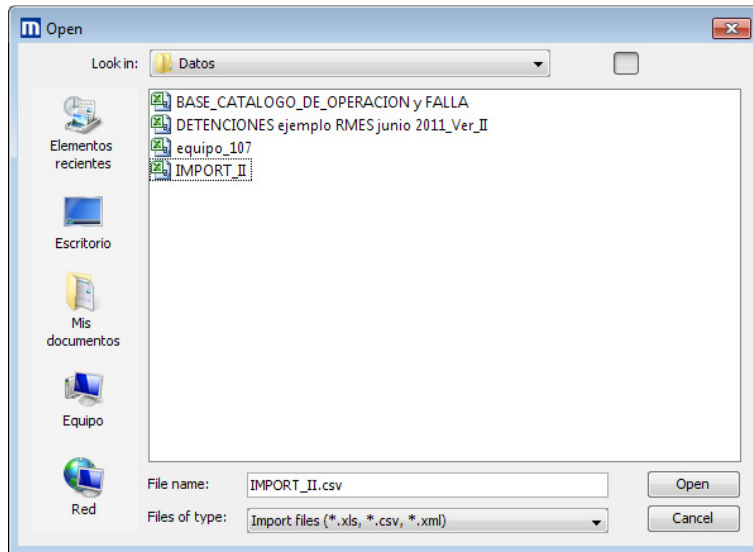
Example

Import Data

The data file to be imported is a CSV file, with data for all the plant equipment, without additional equipment, but only data from Configuration 5 needs to be imported (of all the equipment that comprise it). To do that, first select Configuration 5 in the **Workspace**, and then click **“Import”** on the **System** toolbar. This will display the following window:



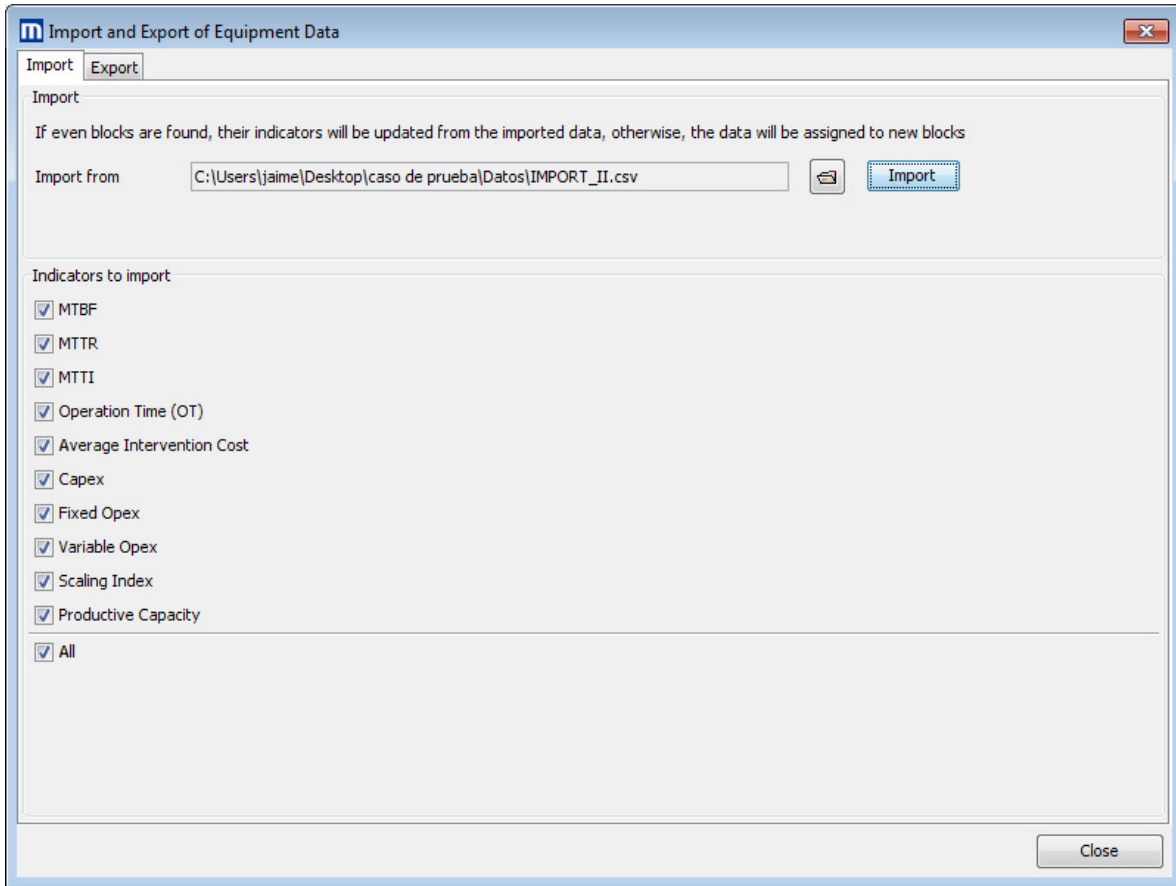
Select the  icon, search for the CSV file and open it:



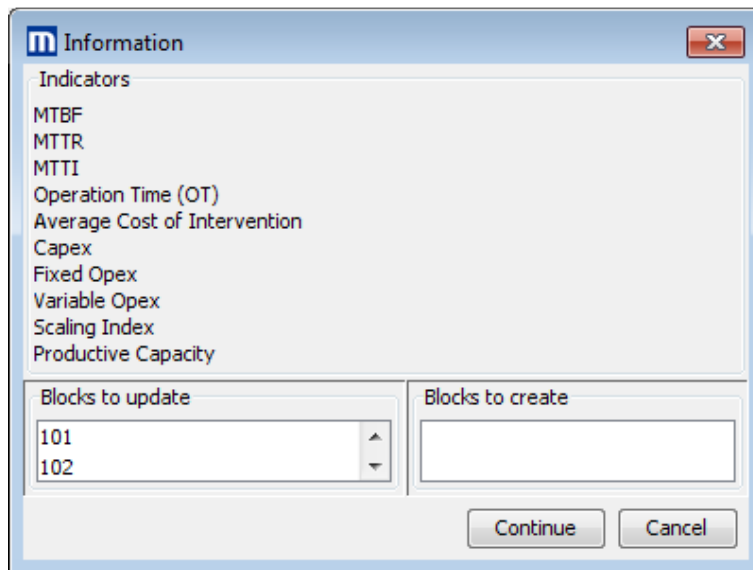
Returning to the import tab, in the **Data to Import** option select **“All”** and in **Options** choose **Include subsystems**. This is selected so that the data entered will replace all the equipment found within Configuration 5, including those from Configuration 5.1.

If the **Include subsystems** option is not selected, only the data for the equipment in Configuration 5 would be imported, but not the data for Configuration 5.1 (meaning the data from the HLT010 and HLT013equipment).

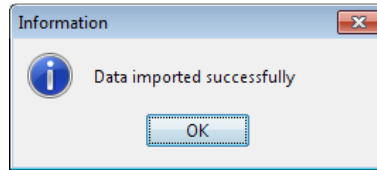
Finally, click **“Import”**.



By clicking "Import" button, the following dialog screen explaining the tasks to be performed.



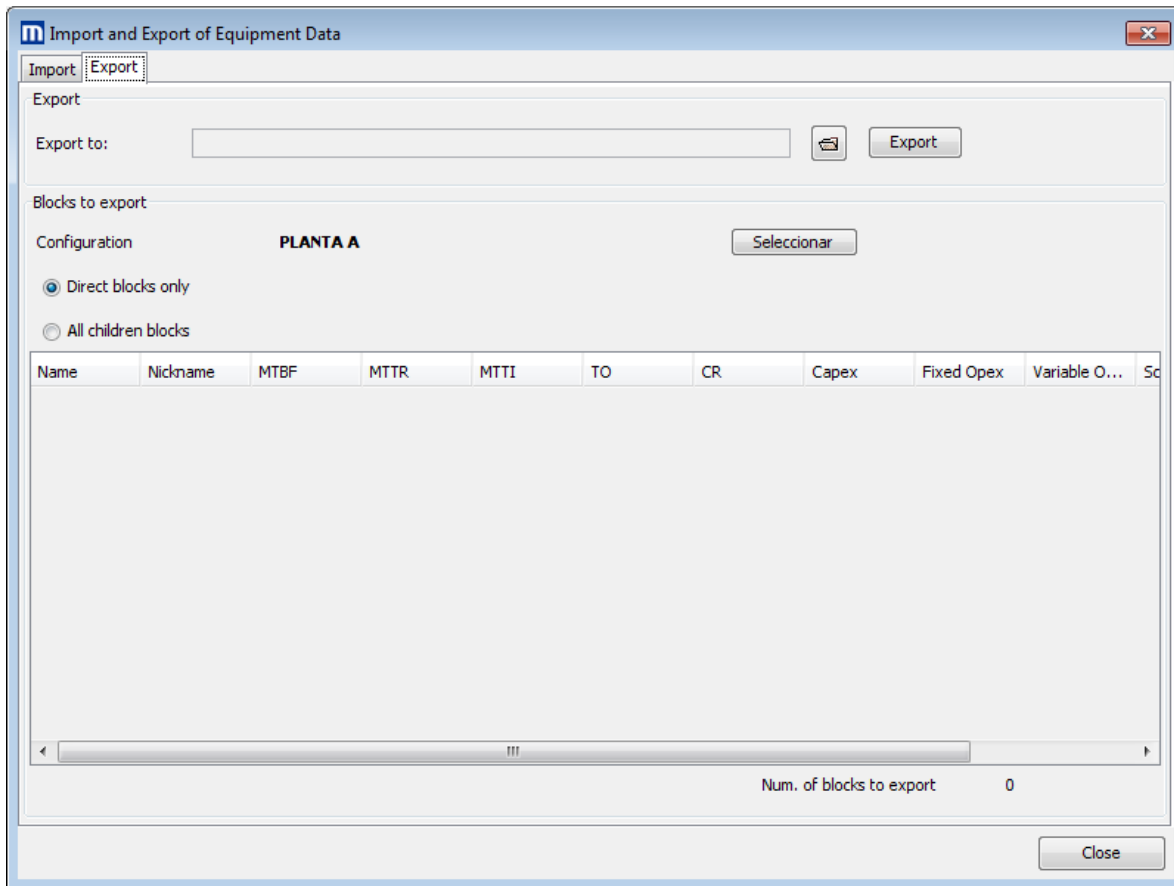
By clicking "Continue" data will be imported to all equipments in the selected configuration. If the equipment exists, its data is replaced. If the equipment does not exist, automatically is created at the level of the plant. To make this more explicit displays a dialog with the actions to be undertaken. The following message confirms that the data was imported correctly:




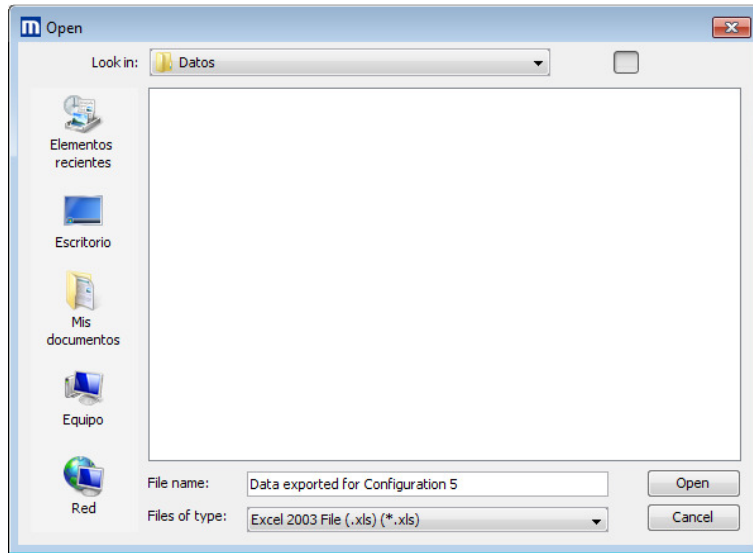
This will import data to for the HLT010, HLT011, HLT012 and HLT0013 equipment belong to "Configuración 1".

Export Data

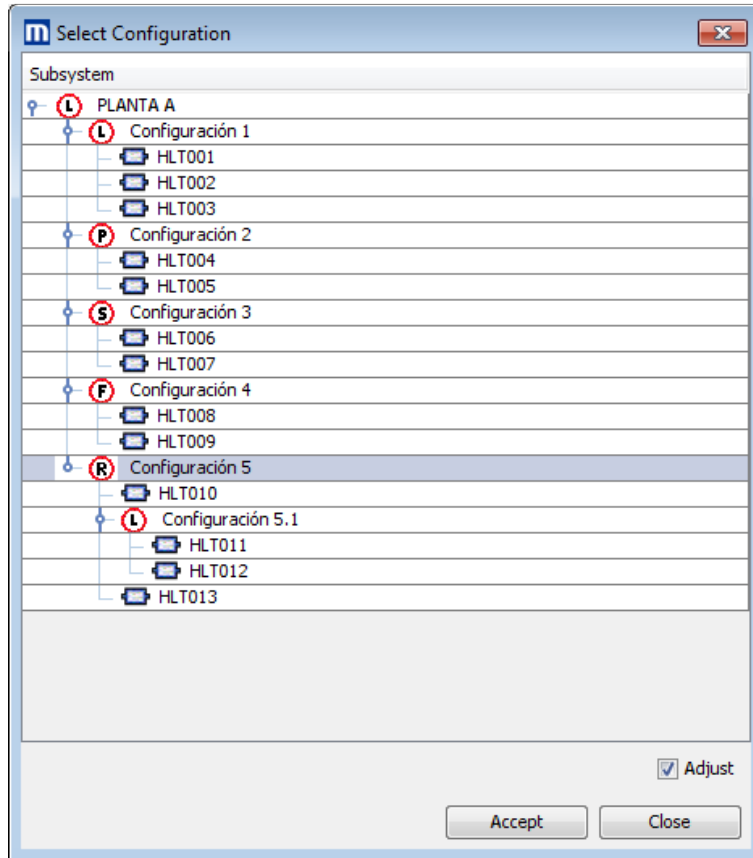
Go to "System" tab of the Workspace and press on "Import.". Then select the "Export".



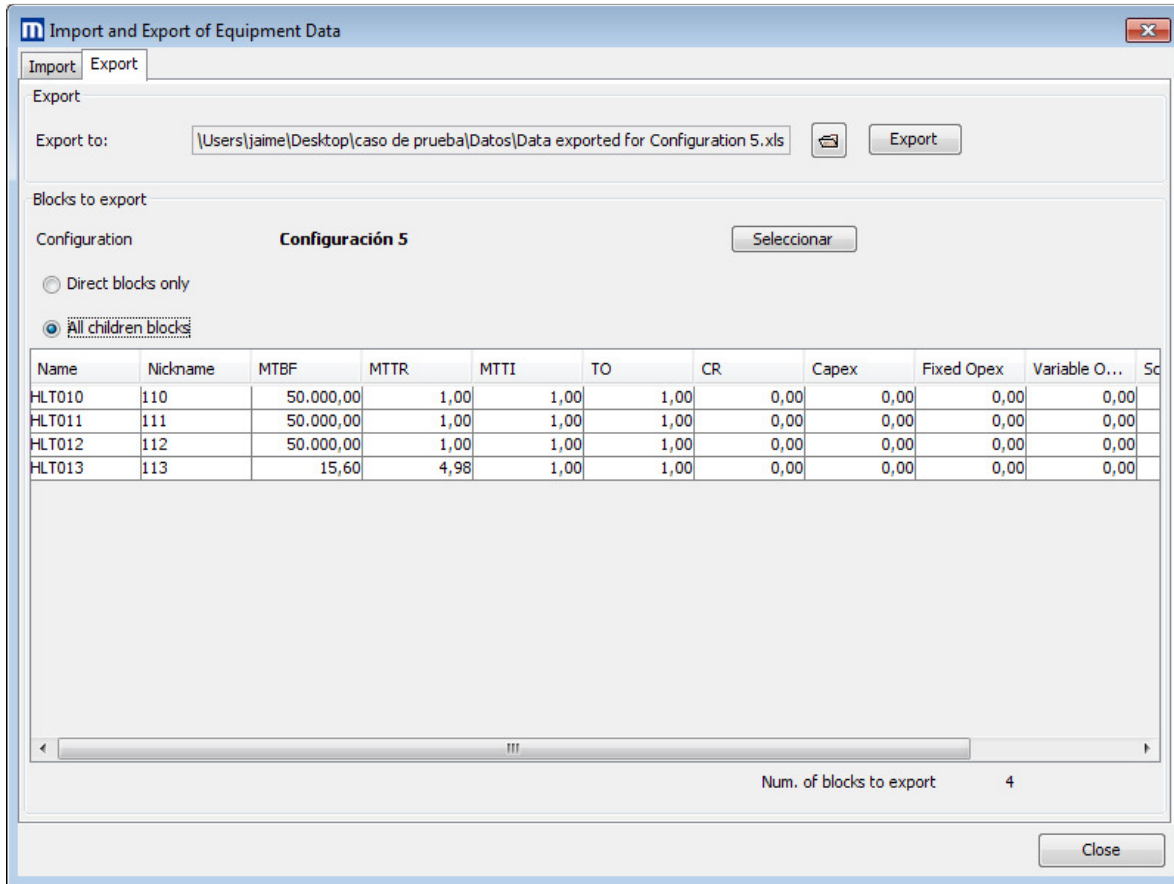
Select the  icon and save a file with the name: *Data exported for Configuration 5*. Then choose the CSV format and click **“Open”**:



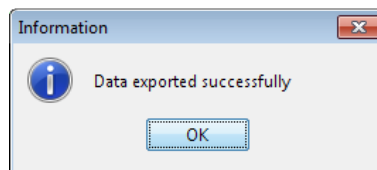
Press the "Select" button. Select the Configuration 5 and press "OK".



Select "All Children blocks ". Then, click "Export".



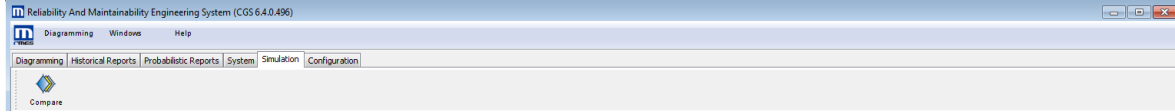
The following message confirms that the data was exported correctly:




Doing this will export the data for the HLT010, HLT011, HLT012 and HLT0013 equipment.

Simulation Tab

This toolbar compares 2 or more systems.




Bar Options

NAME	ICON	DIRECT ACCESS	FUNCTIONALITY
Compare		-	Compare 2 or more systems in regards to their productivity, failure cost, and overall cost.

Simulation Tab: Compare

Compare the failure cost and overall cost values and the productivity of the systems diagrammed.

Procedure

- Select the “**Compare**” () icon on the **Simulation** toolbar. This will open a window with four columns, which are:
 - **System:** Name of the systems found in each open Workspace.
 - **Failure Cost:** Cost of the failure of each system.
 - **Overall:** Overall cost of each system.
 - **Productivity:** Production of units per year of each system.

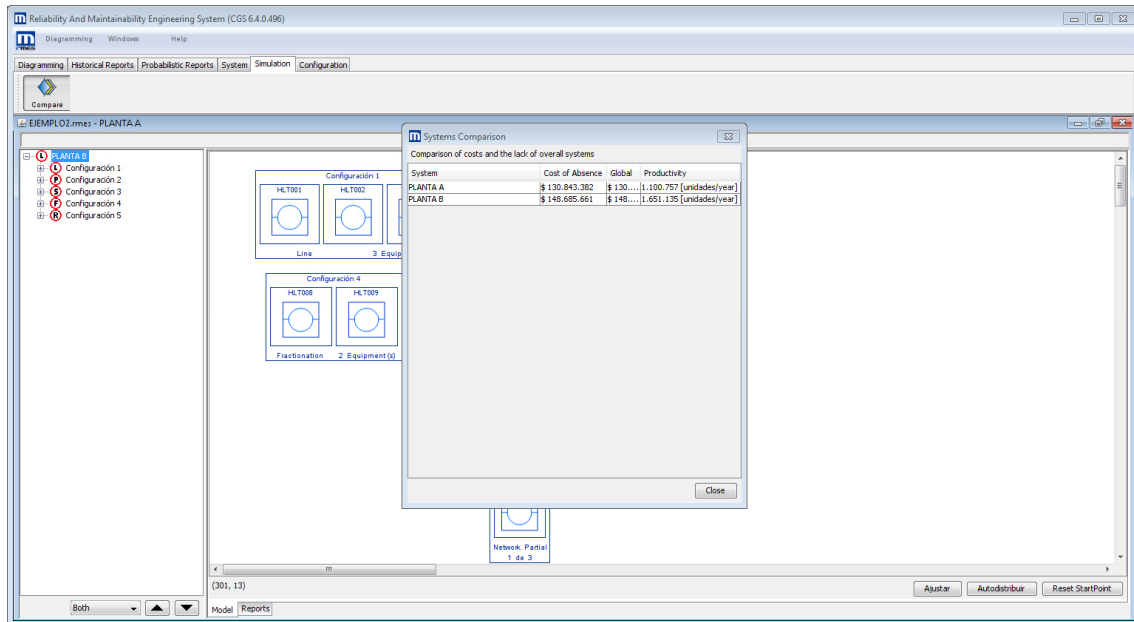
Characteristics

- Any of the plants can be displayed for comparison when you choose the “**Compare**” icon.
- The values of the columns are shown automatically when you open the window.
- For all the columns to have values, you must have previously entered the **Variable Cost Impact, Annual Billing** and **Nominal Capacity data** of each system in **Properties**.

Example

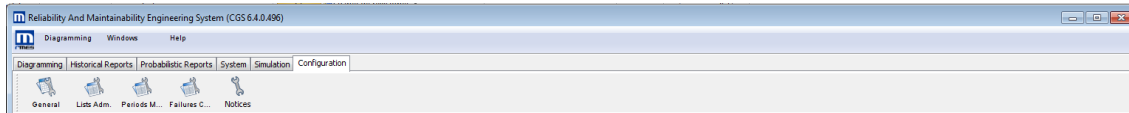
Open Plant A and Plant B on the **RMES menu bar**.

Press **“Compare”** on the **Simulation** toolbar, which will display the following window:






Configuration Tab

This bar enables configuration of the parameters RMS uses to make calculations. It also provides the option of changing the software language.



Menu Options

NAME	ICON	DIRECT ACCESS	FUNCTIONALITY
General		-	Configure the language, capital cost rate, number of operational hours per year, minimum duration of tuples, units of measurement, overlap tolerance, among others.
List Adm.		-	Generate lists of equipment and/or configurations.

Periods Manager		-	Establish date ranges for calculations
Failure Catalog		-	Import catalogs containing codes and names of failure modes, causes and symptoms.
Notices		-	Enter the types and sub-types of maintenance and shutdowns.

Configuration Tab: General

Configure the language, capital cost rate, number of operational hours per year, minimum duration of tuples and units of measurement.

Procedure

- Select the “**General**” () icon on the **Configuration** toolbar.

The window in this option has 5 tabs, which will be explained next:

General

The configurations that can be done in this tab are:

- **Language:** Language the software is translated into. The options are Spanish, English and Italian.
- **Capital Cost Rate:** The cost of capital as a percentage.
- **Annual Operation Time:** The total number of operational hours in a year.
- **Daily Start/End Time:** Corresponds to the start and end time of a workday.
- **Numerical Format:** Choose between the Latin and American format.

For the changes to these configurations to take effect you need to save the “.rmes” file, close the software and then open it again (the changes made will be shown).

In the lower left-hand side of the **General** tab there are two sub-tabs:

- **Configurable Values:** In this sub-tab you can configure the values in the **General** item.
- **Current Values:** Show the values of the **General** item that RMES is utilizing to make the calculations.

Export:

This tab is not used.

Base Configuration

The configurations that can be done in this tab are:

- **Tolerance for Overlap:** If two shutdowns of the same type take the same or less time than the hours entered in **Tolerance for overlap**, these shutdowns will be considered overlaps. This means that the two will be accounted for as a single shutdown.
- **Tolerance for Duration:** For the calculations, only shutdowns with durations equal to or greater than the hours entered in **Duration Tolerance** will be considered. This value acts as a filter of shutdown duration. The **Duration Tolerance** will not be considered for the calculation of **Availability, Use, and Effective Use**, due to the definitions of these metrics, meaning that they consider all shutdowns for their calculations.
- **Correction to the left:** When calculating historical reports, this enables the beginning of the study period to be corrected immediately after the closest corrective maintenance to the left of the date entered by the user as the beginning of the period of study. **Correction to the left** will not be considered for the calculation of **Availability, Use, and Effective Use**.
- There are also the following options:
 - Do not read the lines with durations of less than 1 second.
 - Read the line even if the Failure Mode is null or blank.
 - Read the line even if the Diagram Node is null or blank.
 - Read the line even if the Cause is null or blank.
 - Read the line even if the Order is null or blank.

This is referring to the line or row of data in the database.

For the changes to these configurations take effect, save the “.rmes” file, close the software and then open it again (the changes made will be shown).

In the lower left-hand side of the **Base Configuration** tab there are two sub-tabs:

- **Configurable Values:** Configure the values of the **Base Configuration** item.
- **Current Values:** Show the values of the **Base Configuration** item that RMES is using to make calculations.

Default Properties

This item allows you to enter default values for some variables, such as

- Mean Time Between Failures.
- Mean Time To Repair.
- Intervention Time.



- Operation Time.

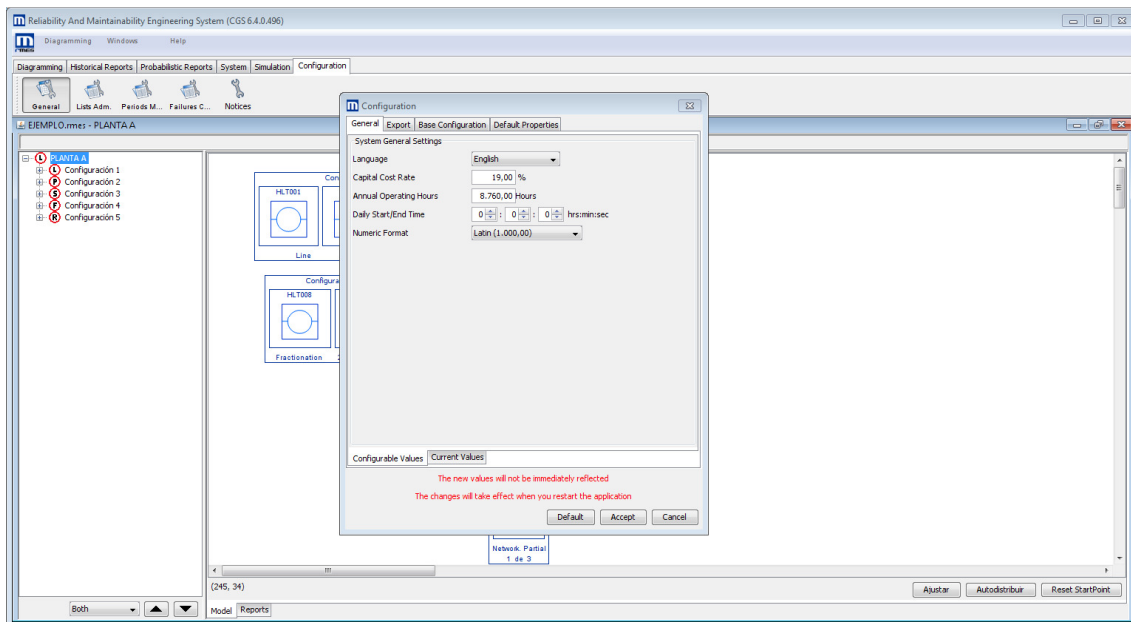
For the changes to these configurations to take effect you need to save the “.rmes” file, close the software and open it again (the changes made will be shown).

In the lower left-hand side of each **Default Properties** tab there are two sub-tabs:

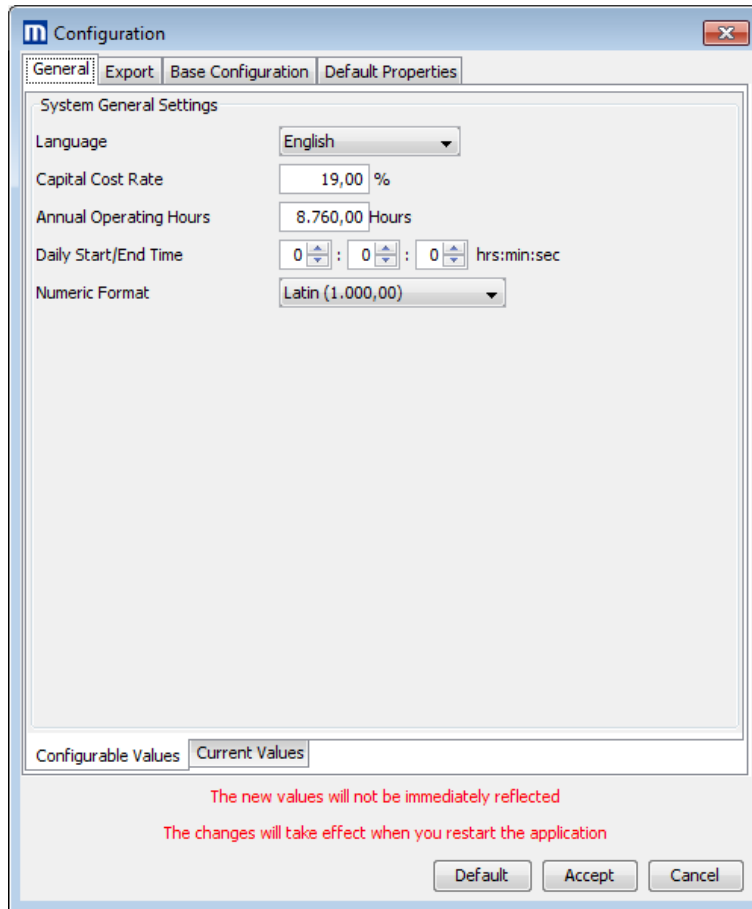
- **Configurable Values:** This item allows you to configure the values of the item **Default Properties**.
- **Current Values:** Show the values of the **Default Properties** item that RMES is utilizing.

Example

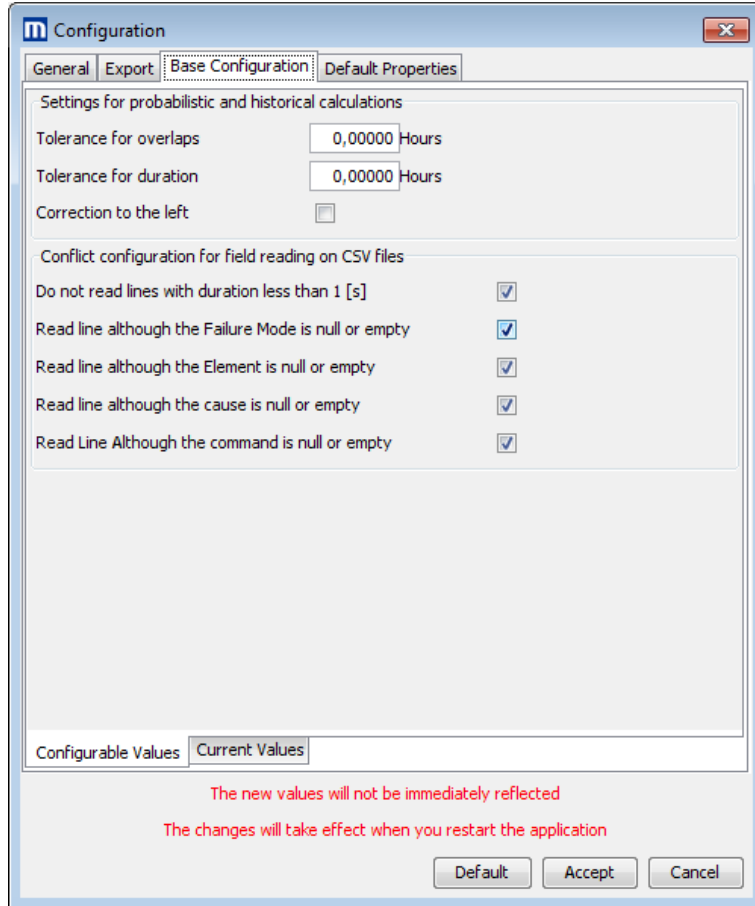
Click “**General**” on the **Configuration** toolbar, which will display the following window:

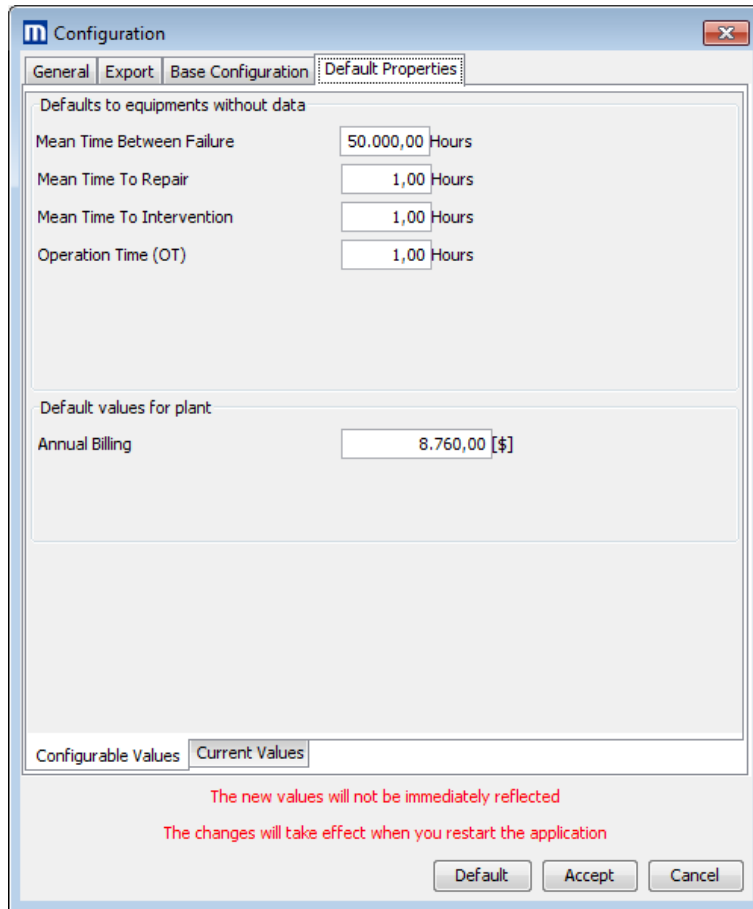


In **Annual Operation Hours** enter 8,760 hours. This implies that the plant operates 24 hours a day. Also, enter a **Capital Cost Rate** of 19%:



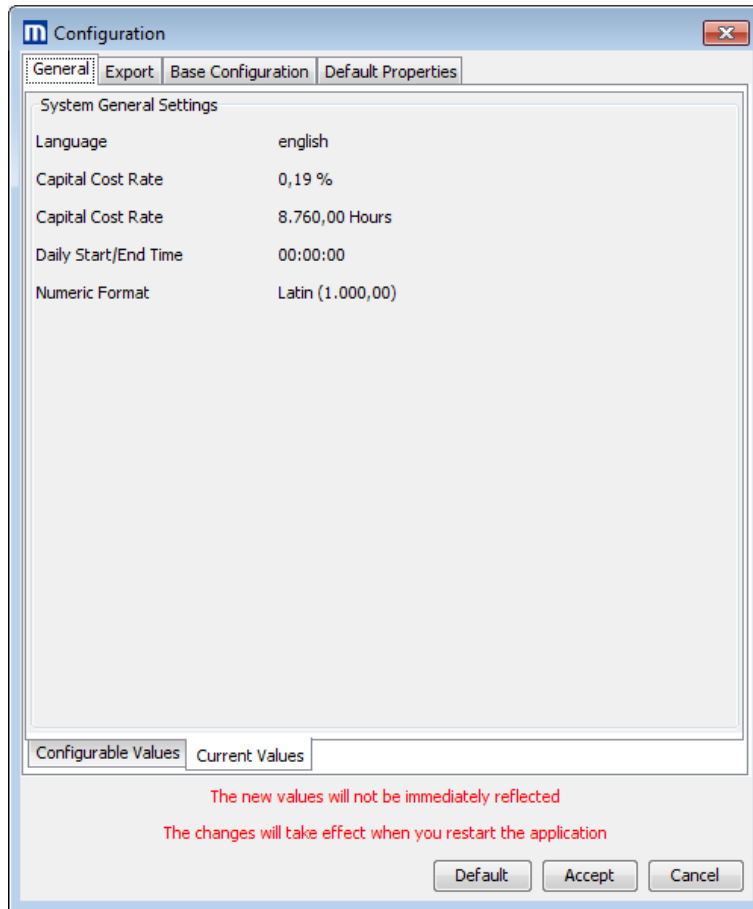
Leave the **Base Configuration** and **Default Properties** tabs just as they are shown in the software:





For the changes to be made effective, click **“Accept”** in the **Configuration** window, save the diagram, close RMES, open it again, and upload the diagram.


In the **Current Values** sub-tab of the **General** tab of the **Configuration** window you can verify that the changes were effectively made:



Configuration Tab: List Administration

R-MES has the capacity to generate lists of equipment and/or configurations that can be used to speed up the equipment and/or configuration selection process in the reports where this option is possible.

Procedure

- Select the “List Adm.” () icon on the **Configuration** toolbar, which will open a window containing the **Structural Tree**.
- From the **Structural Tree**, select the diagram nodes that will form part of one of the lists to be created.
- Click “**Create**”.
- This will display a window in which you must enter the name of the list or group of diagram nodes that will be created.

- Click **“Accept”** in the **Name of the list** window. This will create the list, which is corroborated in the **Available Lists** item of the **List Selector** window, which shows the names of the lists created.

In the same way, create the number of lists necessary.

- When you finish creating the lists, click **“Close”** in the **Lists Selector** window. This will display a window that asks if you want to save the lists created. Click **“Yes”**.

Edit Lists

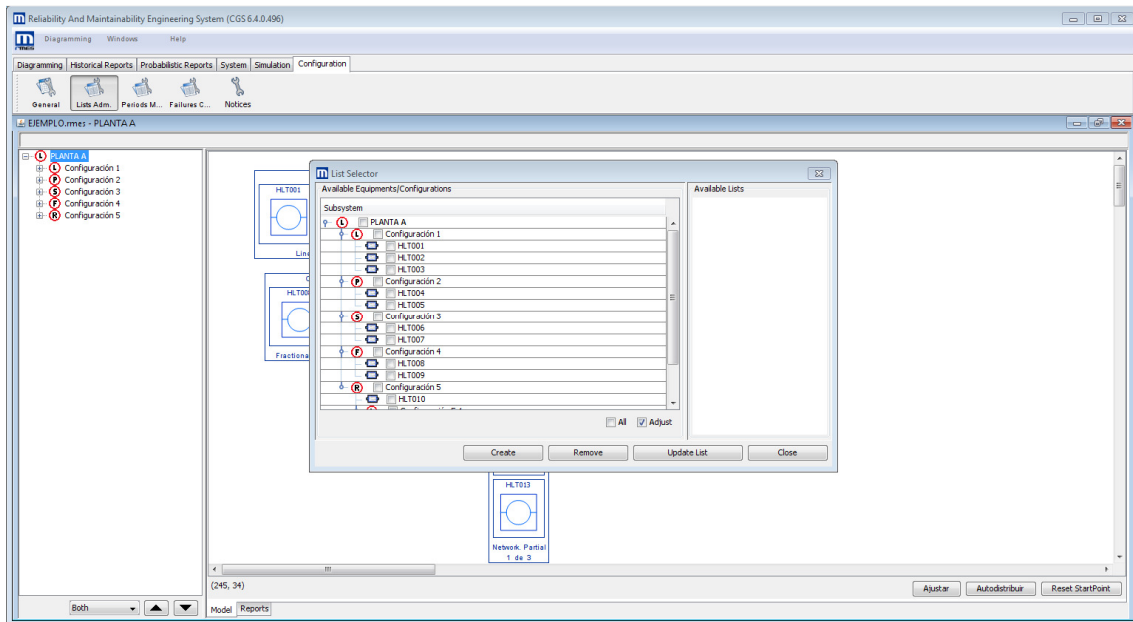
- Select the list to edit in the **Available Lists** item in the **Lists Selector** window. By doing that, the diagram nodes contained in the list will automatically be selected in the **Structural Tree**.
- Select and/or deselect the diagram nodes contained in the list in the **Structural Tree**.
- Click **“Update List”**.
- A window will be displayed asking if you are sure about the update to the list. Click **“Yes”**.

Delete Lists

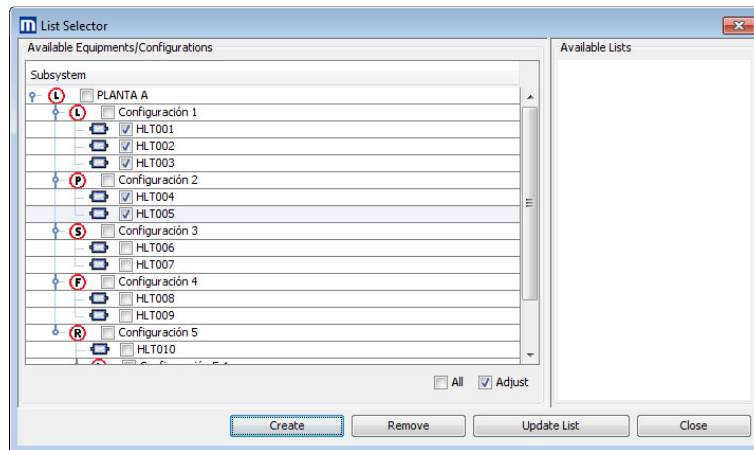
- Select the list to be deleted in the **Available Lists** item in the **Lists Selector** window.
- Click **“Delete”**.
- A window will be displayed asking if you are sure you want to delete the list. Click **“Yes”**.

Example

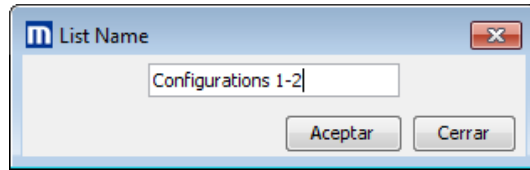
Click **“List Administrator”** on the **Configuration** toolbar, which will display the following window:



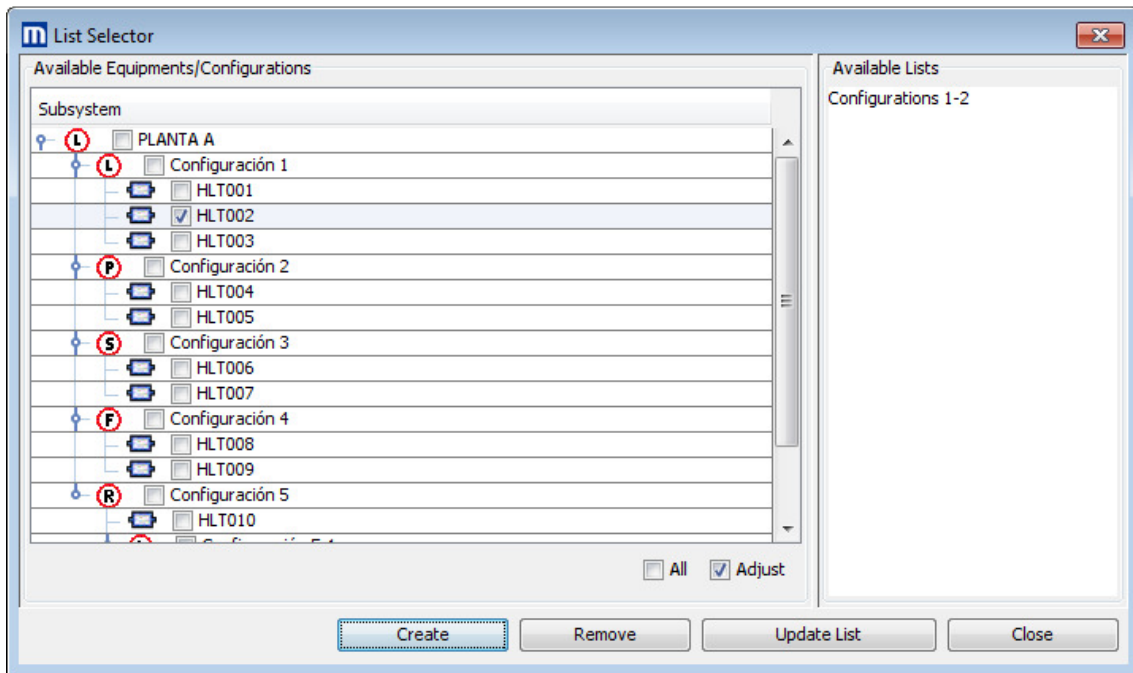
In the **Structural Tree** select the equipment of the first two configurations and click **“Create”**:



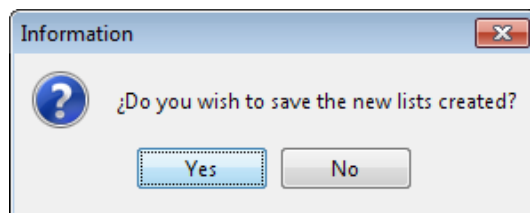
In the window that is displayed, type the name of the list: **Configurations 1-2** and click **“Accept”**:



By doing that, the name of the new list created will be found in the **Available Lists** item. Then click **“Close”**:



Click **“Yes”** in the following message:




Configuration Tab: Period Administrator

Generate ranges of dates to make calculations.

Groups of periods can be created which make it easier to calculate indicators when there are several periods to analyze.





Procedure

- Select the “**Period Administrator**” () icon on the **Configuration** toolbar.
- In the window that is displayed, click “**New**”:
- In the new window that opens, type a name to identify the group of periods, and then click “**Accept**”. By doing that, the name of the new group created will appear in the **Groups of Periods items** of the **Period Administrator** window.
- To assign date ranges to the group of periods created, there are two options: enter the dates manually or import a file with the ranges.

Manual Entry of Periods

- In the **Groups of Periods** option of the **Period Administrator** window select the group of periods that the date ranges will be assigned to.
- Enter a date range in the calendars (in **From** and **Until** of the **New Period** option).

To enter the start and end dates in the items **From** and **Until**, there are three options:

- For both the start date (**From**) and the end date (**Until**), select the  button, and in the calendar that is displayed first select the year, then the month, and finally the day. The time can only be modified as explained in the following points.
 - Another way is to type the dates of each item in the text boxes, in the format **DAY-MONTH-YEAR, HOUR: MINUTES: SECONDS**.
 - Select the month, day, year, hours, minutes, or seconds in the text box and click the  arrows until you reach the desired dates. You can also use the up  and down  keys on your keyboard.
- Click “**Add**”.
- Follow this procedure as many times as necessary to include periods and groups of periods.


The periods created can be seen in the **Periods** item.

File Importation

- The file to be imported must be CSV and have the following format:
Example of two periods:

01-06-2011, 00:00:00; 12-06-2011, 08:00:00; 23-06-2011, 15:22:00; 29-06-2011, 10:05:03;
--

In the box above, each row represents one period (from - to).

- In the **Groups of Periods** option of the **Period Administrator** window, select the group of periods to which the date range will be assigned.
- Select the  icon in the **Database Periods** item. This will display the **Open** window.
- Search for the CSV file, select it and click **“Open”**. This will close the **Open** window and the periods will be uploaded to the group of periods. This can be observed in the **Periods** option in the **Period Administrator** window.

Follow this procedure as many times as needed to incorporate periods and groups of periods.

Characteristics

- Only one group of periods can be selected at a time.
- By clicking **“Select All”** you can select all the periods of just one group of periods.
- When you select a group of periods in the **Groups of Periods** option in the **Period Administrator** window, in the **Periods** option in the same window you can view the periods of which it is comprised.

Deletion Options

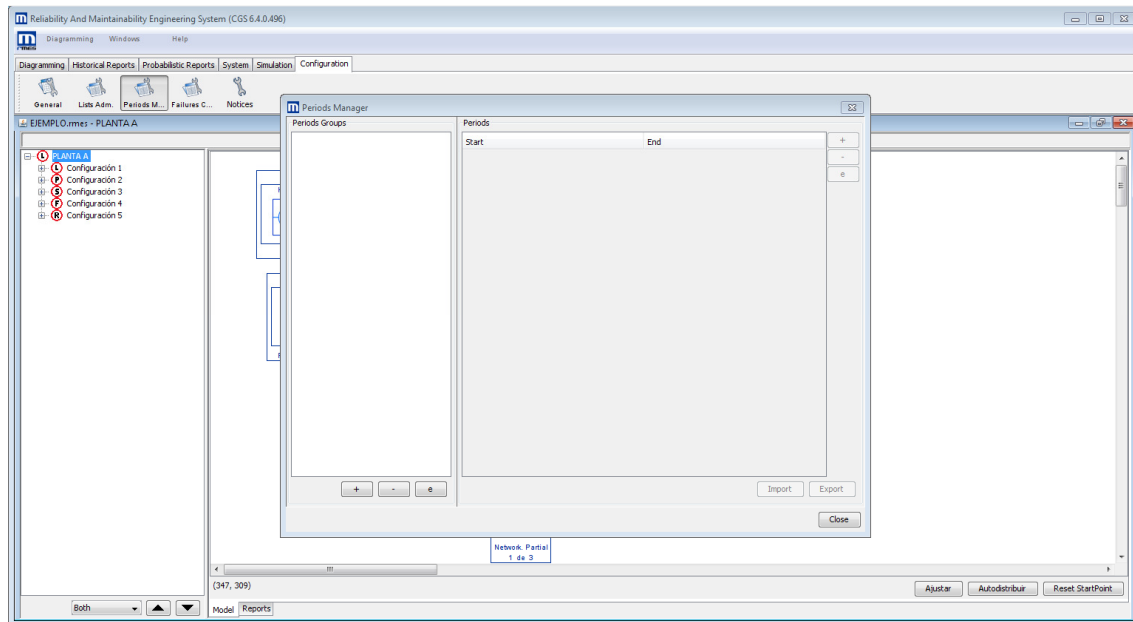
- If you want to delete a group of periods, select it in the **Groups of Periods** option in the **Period Administrator** window and click **“Delete Group”**.
- If you want to delete a period, select it in the **Periods** option in the **Period Administrator** and click **“Delete Period”**.
- Only one group of periods can be deleted at a time, but the periods of one group can all be deleted at the same time. To do that, click **“Select All”** and then **“Delete Period”**.

Exportation Options

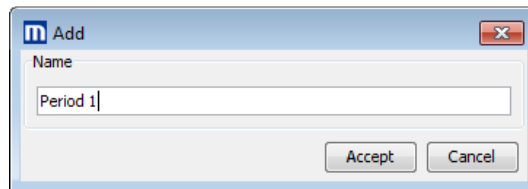
- If you want to export a group of periods, select it in the **Groups of Periods** item in the **Period Administrator** window and click **“Export”**.
- You can only export one group at a time.
- You can only export in CSV format.

Example

Click **“Period Administrator”** on the **Configuration** toolbar. This will display the following window:



Click **“+”** and type the name of the period group: *Period 1*, then click **“Accept”**:

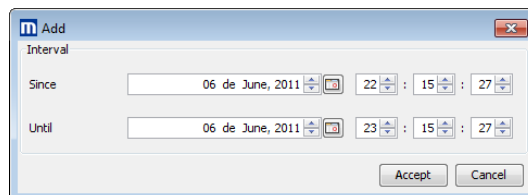


Select *Period 1* in the **Group of Periods** item and type the following dates in the calendars:

From: 01-06-2011, 00:00:00

To: 06-06-2011, 00:00:00

Then click **“+”**, from right:

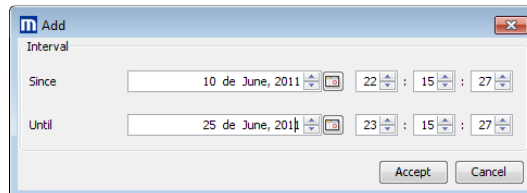


Type another period in the calendars:

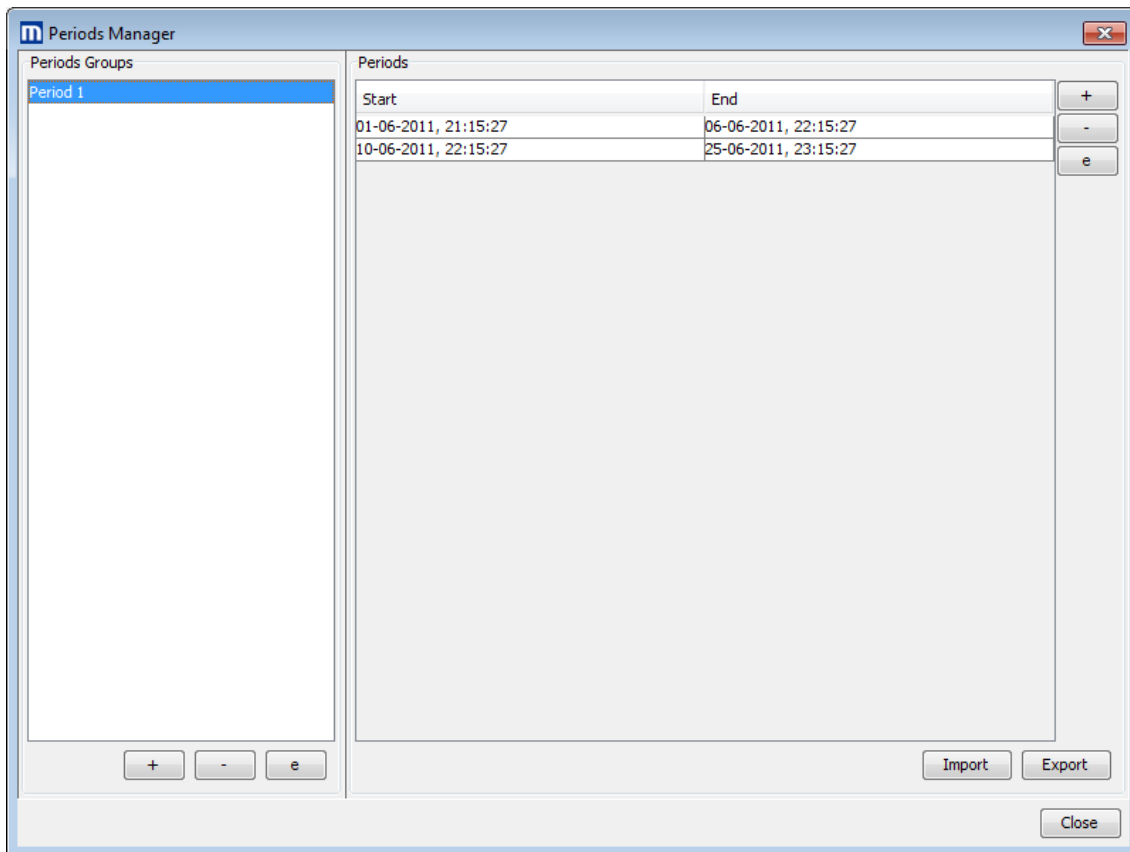
From: 10-06-2011, 08:00:00

To: 25-06-2011, 08:00:00

Then click **“Add”**.



The dates you entered are located in the **Periods** item:



Configuration Tab: Failure Catalogue

Import catalogues, which are made up of the codes and names of failure modes, causes, and symptoms.

Additionally, each catalogue can be associated with different diagram nodes.

Procedure

- First, for each catalogue required, three CSV files (for failure modes, causes, and symptoms) need to be created. All of the CSV files must have the following format:

Example

ID; Name;




475; Failure Mode 1;
476; Failure Mode 2;

When the CSV is read by Excel, it must be in the following format:

ID	NAME
----	------

It must be composed of two columns, one for **ID** and the other for the **Description**. Also, each row must correspond to a failure mode, cause, or symptom, as applicable.

For the import to be done correctly, the order of the columns must be kept exactly the same.

- After you have the files, select the “**Failure Catalogue**” () icon on the **Configuration** toolbar.
- In the lower left-hand side of the **Failure Catalogue** window, enter the name of the catalogue and click . This will create the catalogue.
- To associate failure modes, symptoms and causes to the recently created catalogue, follow this process:
 - In the **Failure Catalogue** window, click the  icon in the **Symptom** item. In the window that is displayed, search for the CSV file that contains the data of the symptoms, select it and click “**Open**”.
 - Repeat the process above for failure modes and causes.
- To associate the recently created catalogue to diagram nodes, follow this process:

- Click “**Associate**”. This will display a window with the **Structural Tree** of the plant.
- Select the diagram nodes that you want to associate with the catalogue.
- Click “**Close**” in the node selection window.
- Create the necessary number of Catalogues.

Characteristics


It is not necessary to upload the three CSV files to create a catalogue (there can be less).

Options for Selecting Diagram Nodes

The diagram nodes selection window has the following options:

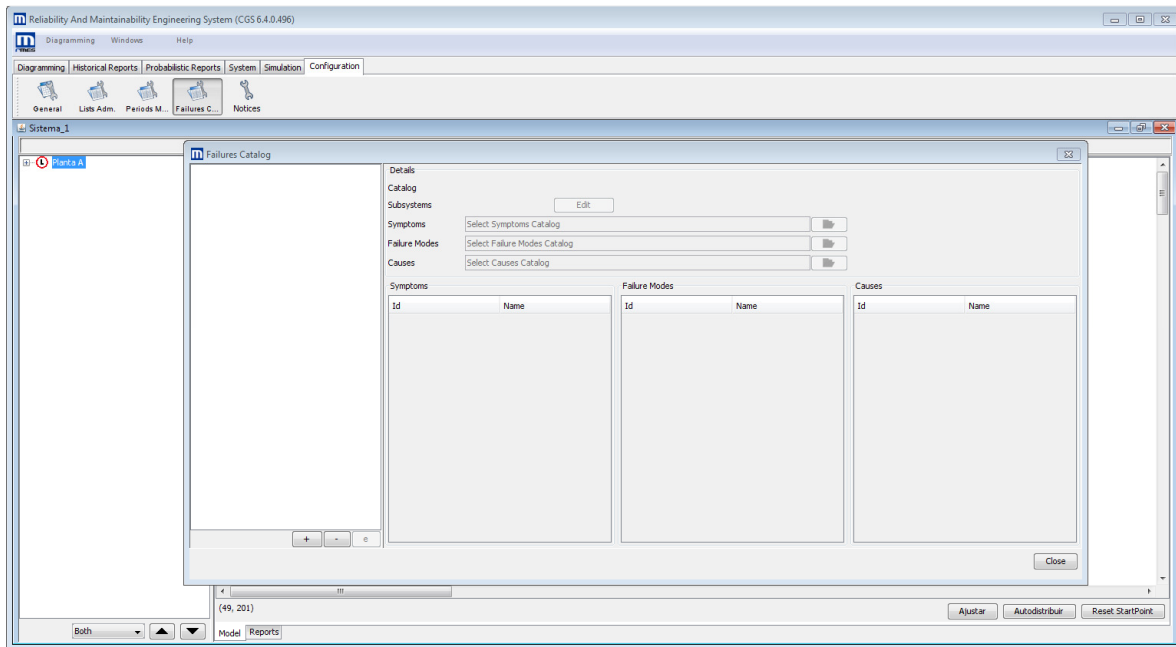
- Select the nodes directly in the **Structural Tree**.
- If you need all of the equipment and configurations, select the option **All**.
- When only groups of equipment and/or configurations are necessary, select the option **Lists**. The lists or groups of equipment must have been created previously in the option **List Adm.** on the **Configuration** toolbar. For more information about that, go to the item **Adm. Lists** in the **Configuration** toolbar section in this document.


Options for Deleting Catalogues

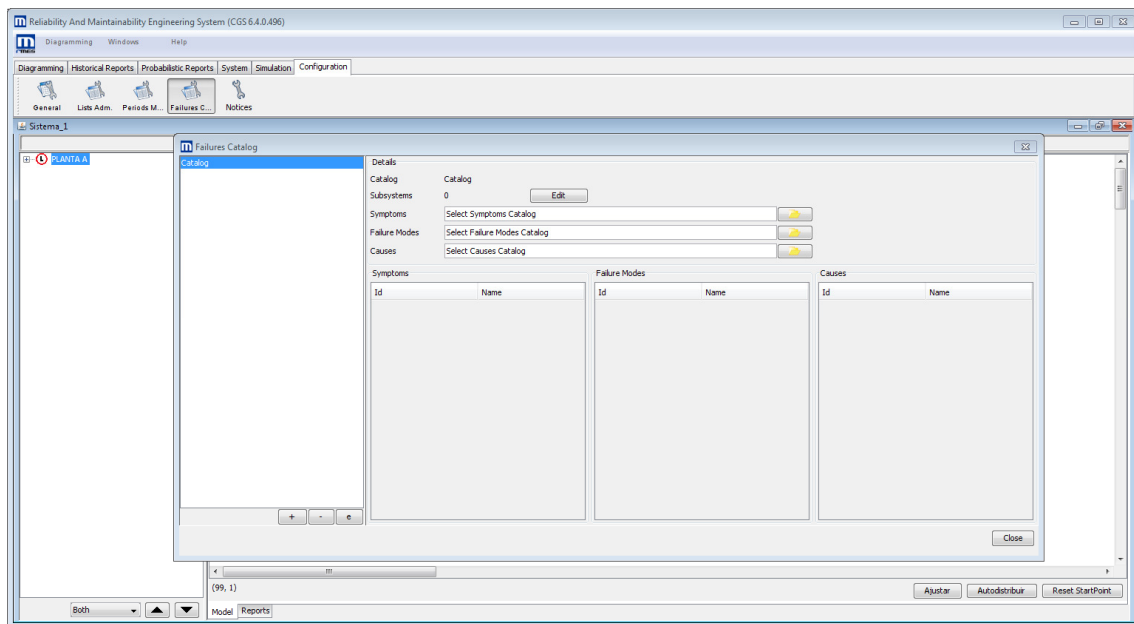
- Select the catalogue to delete in the box on the left of the **Failure Catalogue** window.
- Press .

Example

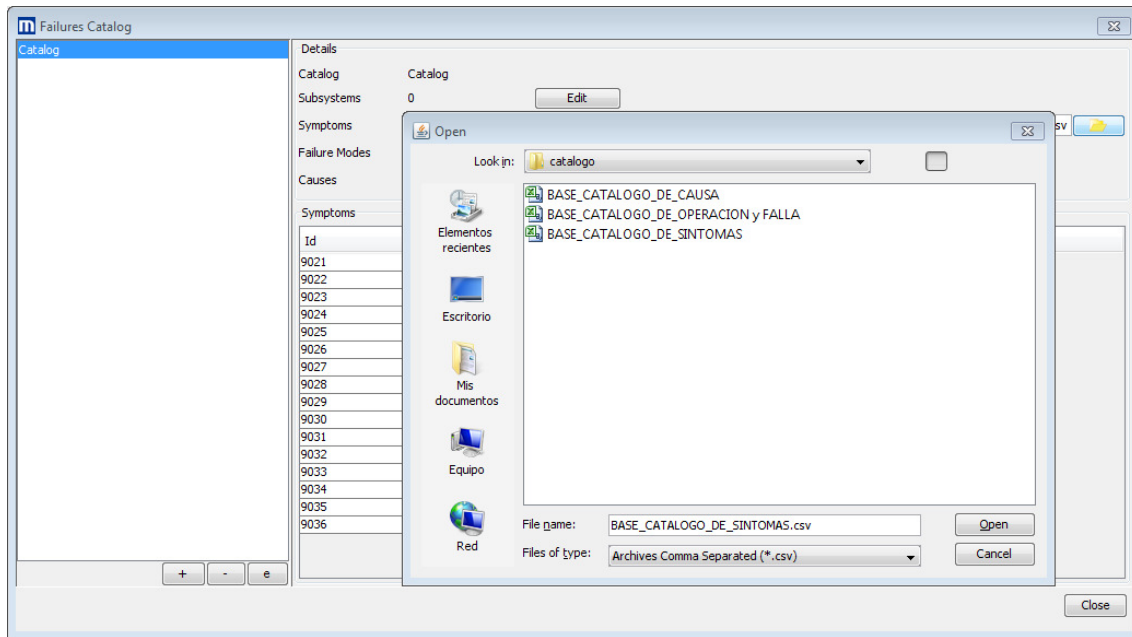
Click **“Failure Catalogue”** on the **Configuration** toolbar, which will display the following window:



Enter the name of the catalogue: click . And write the name “Catalog” That will create the catalogue:

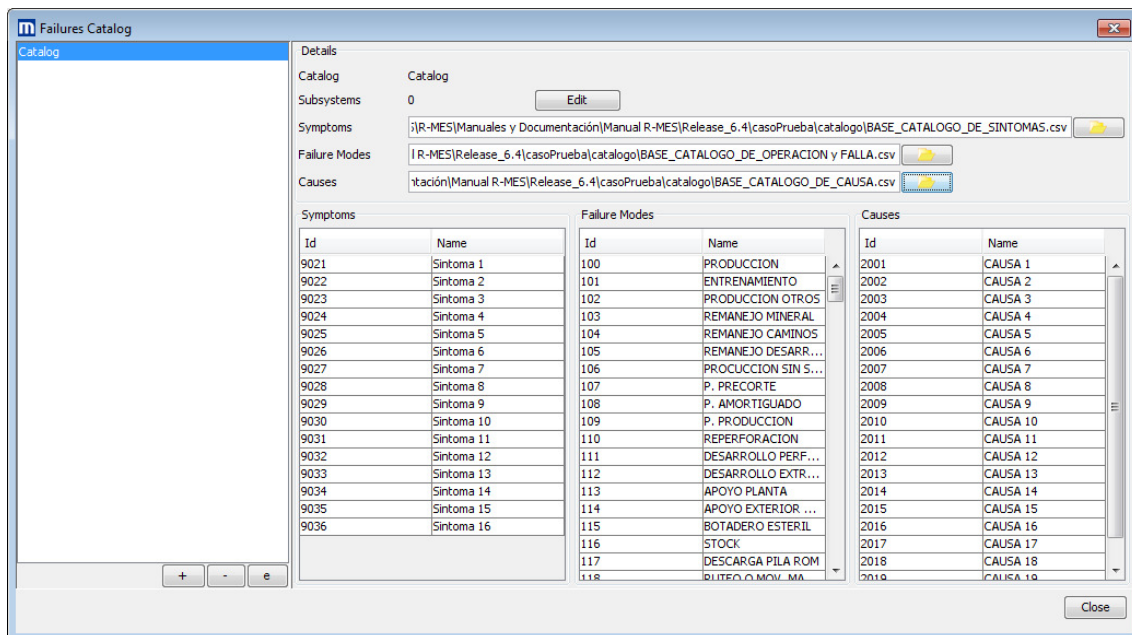


Next click the  icon in the **Symptoms** item. Select the symptoms catalogue file:

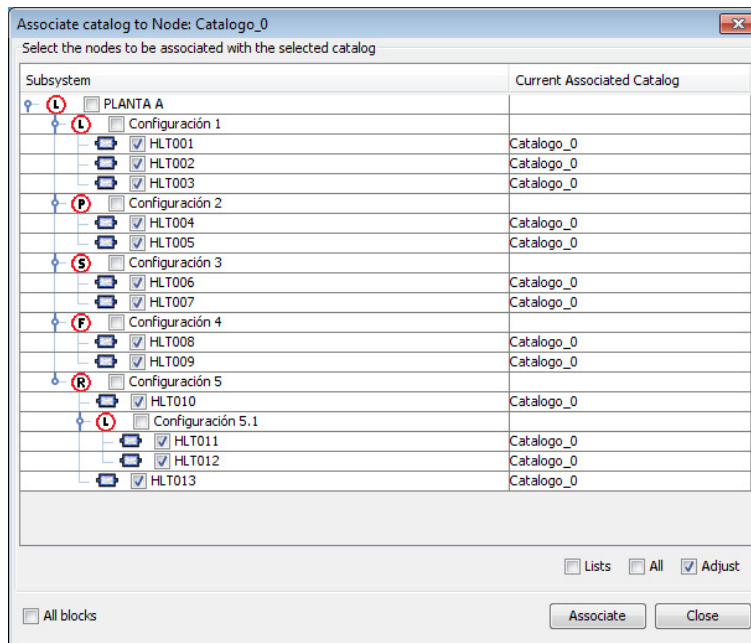


Do the same thing for **Failure Modes** and **Cause**.

The databases uploaded will look like this:




Click **“Edit”** to associate the equipments to the configuration



Configuration Tab: Notices

Enter the types and sub-types of maintenance and shutdowns, which are used to calculate reports that need these classifications.

Procedure:

- Select the **“Notices”** () icon on the **Configuration** toolbar. This will open a window with two tabs, one for entering types of maintenance and shutdowns and the other for entering the sub-types of maintenance.

Types

- Enter the **New Notice Abbreviation** (of the new shutdown or maintenance).
- In **Maintenance**, choose from the options the type of maintenance or shutdown that corresponds to the previously entered abbreviation.
- Click **“Update”**.
- Create the number of notices that needed in the same way.

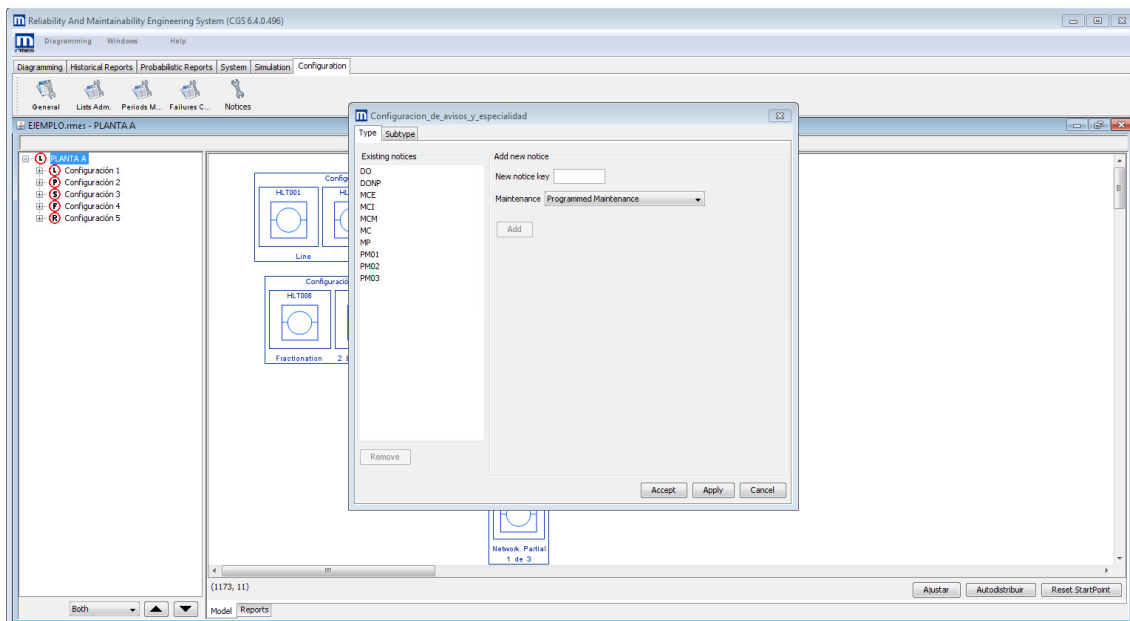
- If you created a type of shutdown or maintenance and want to delete it, select it in the box located on the left side of the window (**Existing Notices**) and click **“Delete”**.

Sub-type

- Enter the **Abbreviation** of the new sub-type.
- In Description, enter a description of the new notice.
- In Sub-type, choose from the options the sub-type that corresponds to the previously entered abbreviation.
- Click **“Add”**.
- Create the number of notices needed in the same way.
- If you created a notice and want to delete it, select it in the table and click **“Delete”**.

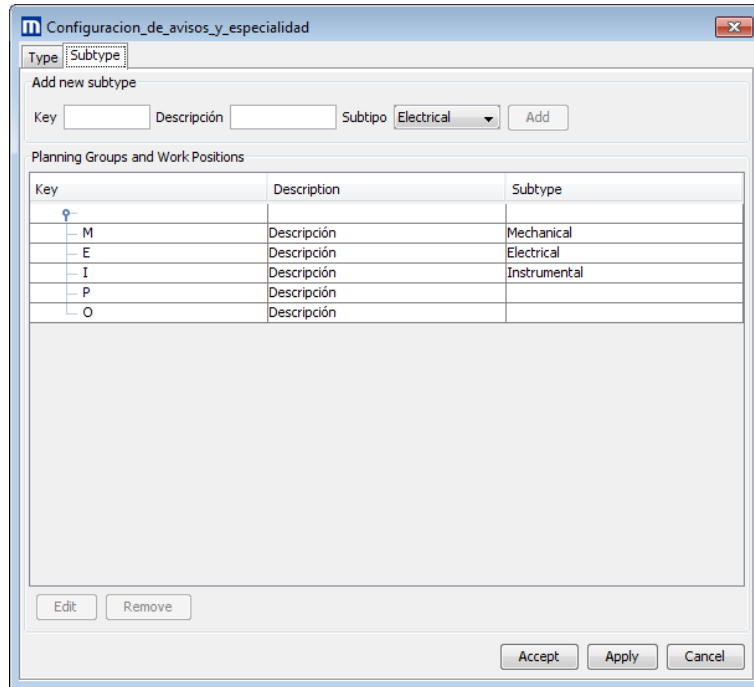
Example

The following window opens when you click **“Notices”**:



As shown in the window, the types of maintenance were already created, so they are shown in the list in the box on the left-hand side of the window. When you click on a maintenance type in the list, its abbreviation and the type of maintenance it is will automatically appear in **Add New Notice**.

Next, enter a new sub-type of maintenance **M**, designated for mechanical maintenance. Enter this information in the sub-type tab in the **Add New Sub-type** item:



When you click “**Accept**” the new sub-type entered will be saved.

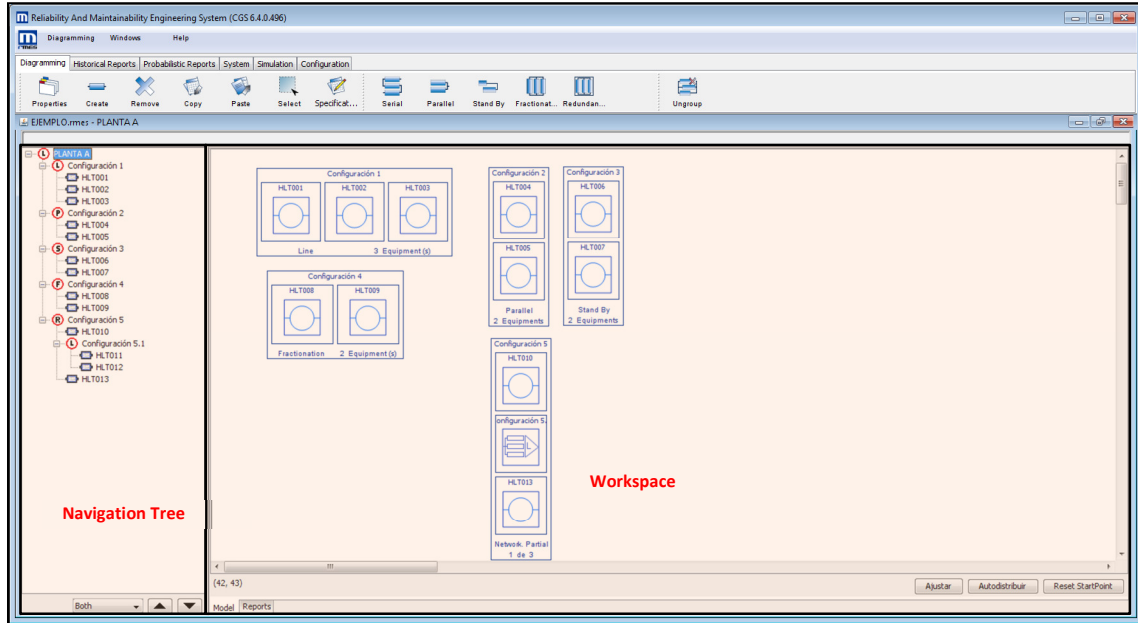
Workspace

In the **Workspace**, the system is diagrammed.

In each **Workspace**, only one system can be diagrammed, but if you need to work with more than one plant, the software allows it. In this way, multiple workspaces can be used at the same time in R-MES.

When you start the software there are no **Workspaces** open, so to begin working you need to open a new workspace in the **R-MES Menu** on the **Menu Bar** under the option **New**, and if you already have a **Workspace** created and saved, use the option **Open** found in the same place.

The **Workspace** is made up of a **Navigation tree** and a **Diagram space**:

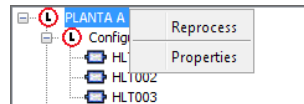


Navigation Tree

In the **Navigation tree** you can see the relationship existing between the configurations and equipment. In this way you can navigate through the system with greater ease.

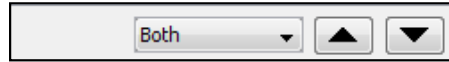
Also, you can identify the types of configurations existing in the system (Series, parallel, Stand-by, Fractionation, or Partial Redundancy), each identified by a letter inside a red circle. For more information about the types of configurations and their symbols, go to the item **Diagram** under the section **Toolbar** in this manual.

When you select and right-click on any of the diagram nodes found in the **Navigation tree**, you have the following options:

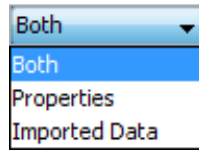


- **Properties:** Show the properties of the selected diagram node.
- **Reprocess:** Enables you to reorder and filter data using overlap criteria.

Under **Navigation tree**, the following options are found:



- When you select the first box, the following options are displayed:



These options enable you to see **Properties**, **Imported Data**, or both in the **Reports** tab (found under the **Diagram Space**)



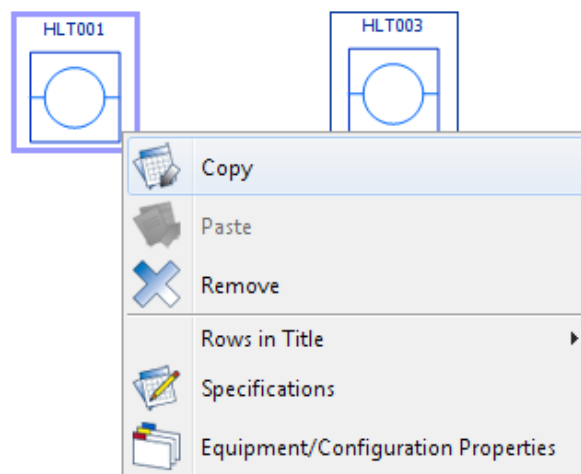
- Using the arrows  , you can move the diagram nodes to the same level through the navigation tree. To do this you must first select the node on the tree and then click the arrows the number of times necessary.

Diagram Space

In the **Diagram space**, you can create, delete, and edit diagrams of the system being studied.

When you select a diagram node in the **Navigation tree**, it is automatically shown in the **Diagram space**.

When you select and right-click on any of the diagram nodes found in the **Diagram space**, you have the following options:



- **Copy:** Copy the selected diagram node.
- **Paste:** Paste the previously copied diagram node.
- **Remove:** Delete the selected diagram node.
- **Rows in Title:** You can distribute the equipment/configuration in one, two or three lines.
- **Specifications:** View, create, and edit the specifications of the selected diagram node.
- **Equipment/Configuration Properties:** Show the properties of the selected diagram node.

Under the *Diagram Space* there are the following tabs:

- **Model:** Shows the space where you can create a diagram of the plant. Here, the boxes or blocks represent diagram nodes.
- **Reports:** Shows the Properties window for each diagram node. For more details about the information in this tab, go to **Properties** in this document under the section **Diagram toolbar**.

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