PM-ANALYZE

Analysis of Alarms and process values

System Description

PM-ANALYZE Version 9

Edition: 10/01/2020

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1 Overview

1.1 General information

Process alarms, faults, status and operation messages as well as trends recorded from various sources contain a wealth of information which often only becomes visible by means of computer-aided analysis. Reduced downtime and maintenance times, early detection of signs of wear and tear, localization of error sources or weak points are just a few examples.

Problems in production plants that have been recorded as alarms as well as archived trend values are the starting point for evaluations and analyses with PM-ANALYZE.

PM-ANALYZE not only allows the chronological display of messages and trends from different sources, it also provides an optimal overview with its user-friendly filters and analysis options. The excellent performance during evaluation of large amounts of messages is another advantage of PM-ANALYZE.

One of the key benefits from PM-ANALYZE is the possibility to display trends and alarms in parallel in freely configurable workspaces. Workspaces can be either directly integrated into an HMI screen or separately viewed by the PM-ANALYZE client application.

1.2 Characteristics

PM-ANALYZE offers the following functionalities:

- Archiving of process values and alarms from multiple different base HMI systems in chronological order
- Display of current process values from the process value archive in a chart or in tabular form
- Display of archived process values in a chart or table within widely configurable relative or absolute time ranges, based on a shift, a batch[1] or another defined context
- Calculations with the process values and aggregation of the process values are possible
- Monitoring of the most recent alarm from the alarm archives
- Tabular display of archived alarms in freely definable absolute or relative time ranges or in relation to a shift, a batch or another context
    - Definition of complex filters with hierarchical structure if needed to exactly filter for specific alarm contents
    - Combination of multiple filters.
- Easy integration of historical backup archives into the analysis database. No time consuming backup and restore operations necessary
- Configuration of multiple different views (charts and alarms) in parallel within a workspace
- Transfer of the selected time frame from one view to one or multiple other views within a workspace. This allows the parallel display of alarms and trends from the same time range
- Workspaces can be saved under a descriptive name either personalized for the logged in user or made globally available for all users
- Saved workspaces can be easily retrieved later by a single button click
- Personal workspaces can be defined as default view for each individual user and are automatically displayed on startup
- Interactive linkage between views that have been combined into a workspace. E.g. when an alarm table is displayed together with a trend chart, a ruler in the trend indicates the timestamp of the selected alarm
- Comfortable zoom function for charts with a time axis
- Configuration library
  Settings regarding time range, filter options and view type can be stored and managed within the integrated configuration library and made available to either all or individual users
- Statistical Analysis
    - Frequency analysis for the detection of the most frequently occurring alarms. By using a grouping based of the content of the alarms e.g. by location the results provide an excellent basis for spotting problematic aggregates
    - Volume analysis to examine the alarm archive in smaller intervals e.g. a complete month split into single days
    - Flickering analysis to identify alarms that occur in bursts within short timeframes
    - Duration analysis to identify the alarms that have been active for the longest time. (only available for base systems providing the alarm duration like WinCC, PCS 7 and WinCC RT Professional.)

[1] Selection time frames by batch name is only available in conjunction with PM-QUALITY

1 Overview

- Export of data in the formats CSV, XML or directly to Microsoft Excel.

  If installed on the same PC, data is directly transferred to Microsoft Excel from within PM-ANALYZE. There the analysis results are available for arbitrary further processing with standard office tools.
- Support for multiple redundant WinCC Server pairs
- Client/Server – Architecture

  Alarm archives created by the PM-ANALYZE Server are available for decentralized viewing and processing with the PM-ANALYZE Clients.
- Support of a REST API to query the PM SERVER archives

2 System configuration

2.1 Easy connection to base systems

By integrating the PM-SERVER component, PM-ANALYZE is open for an easy connection to different base systems for process visualization. The connection is made either to a local system or via a LAN (TCP/IP).

For the base systems

- SIMATIC WinCC 7 / PCS 7
- SIMATIC WinCC (TIA) Runtime Professional
- SIMATIC WinCC Unified PC-Runtime

the PM-AGENT Unified manages the data transfer to the PM-SERVER. All incoming alarms and process values are passed to the PM-SERVER where they are recorded in the configured alarm or process value archives.
For the base systems

- WinCC (TIA) Comfort/ RT Advanced
- WinCC flexible

the locally created CSV or RDB archives are cyclically transferred to the PM-SERVER where they are imported into a text import station and also added to the configured target alarm or process value archives.
The alarm and process value archives that have been configured in the PM-SERVER form the basis for the analysis taking place in PM-ANALYZE.

2.2 Single station system

PM-ANALYZE Server (System package type S) can be installed on a single station base system like WinCC, PCS7, WinCC RT Professional / RT Advanced / WinCC Unified PC-Runtime and compatible with the operating systems[3)]

- Windows 7/8.1 (32/64Bit) / Windows 10 (64Bit)
- Windows 2008/2012 R2/2016/2019 Server (64Bit)

A PM-ANALYZE single station system can be easily extended to a client server system by installing additional PM-ANALYZE clients on PC's on the network. The single station simply takes over the role of the server in this case.

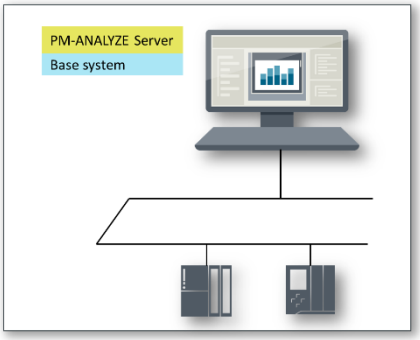


Figure 2: PM-ANALYZE single station system

2.3 Single station system with WinCC Comfort , WinCC flexible

Together with the base systems WinCC Comfort and WinCC flexible the PM-ANALYZE Server is installed on a separate PC under the following operating systems[2]

- Windows 7/8.1 (32/64Bit) / Windows 10 (64 Bit)
- Windows 2008/2012 R2/2016/2019 Server (64Bit)

The systems are connected via a TCP/IP network. The alarms are automatically exported as files in CSV or RDB format from the alarm or process value archives of the HMI and permanently imported via text import into the PM-SERVER. From there the alarms are available for analysis with PM-ANALYZE.

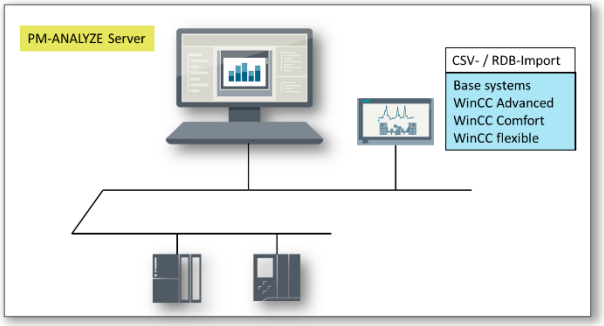


Figure 1: PM-ANALYZE single station system on a separate PC

[2] For the released base system and operating system versions please refer to the release notes of PM-ANALYZE.
[3)]For the released base system and operating system versions please refer to the release notes of PM-ANALYZE.

2 Systemkonfiguration

2.4 PM-ANALYZE multi-user system (Server / Client)

A PM-ANALYZE multi user system consists of:

- One PM-ANALYZE Server (system package type S)
- multiple PM-ANALYZE clients (system packages type C)

The PC's (Server / Clients) are connected via a tcp/ip network.

The PM-ANALYZE server can be installed either locally on the server of the base system or on a separate PC if required. The PM-ANALYZE server utilizes the PM-SERVER for the central archiving from multiple different connected base systems.

The PM-ANALYZE client can be installed either on a base system client or on a separate standalone PC.

The user interface for displaying, filtering and analyzing the archives is equally available on the PM-ANALYZE server and the PM-ANALYZE client installations.

Operating systems[4]:

Server: Windows 2008/2012 R2
Windows 2016/2019 Server (64Bit)

Client: Windows 7/8.1 (32/64Bit)
Windows 10 (64 Bit)
Windows 2008/2012 R2 Server (64 Bit)
Windows 2016/2019 Server (64Bit)

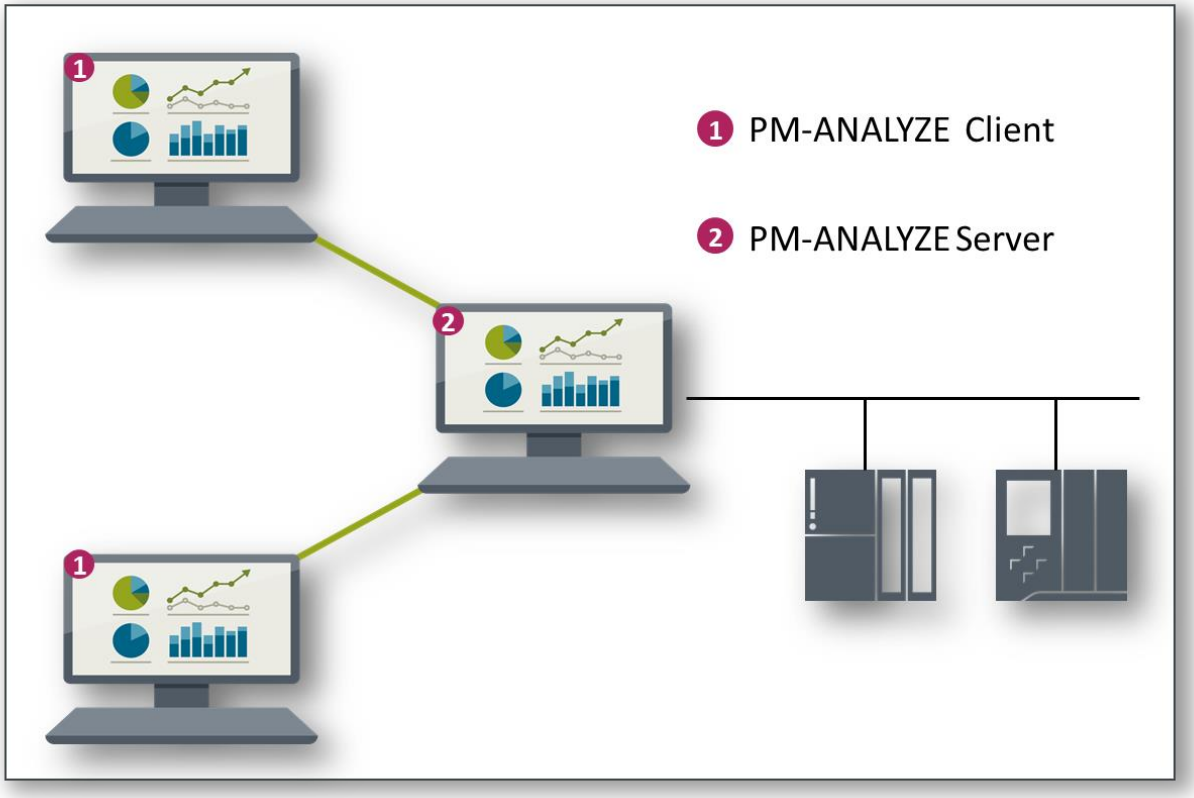


Figure 3: PM-ANALYZE multi-user system

[4] For the released base system and operating system versions please refer to the release notes of PM-ANALYZE.

2 Systemkonfiguration

2.5 PM-ANALYZE in a distributed system

The PM-ANALYZE system software can be installed within a distributed system on any computer..

A PM-ANALYZE multi-user system consists of:

- One PM-ANALYZE server (system package type S)
- Multiple PM-ANALYZE Clients (system packages type C)
- PM-AGENT Unified system package for base systems of type WinCC / PCS 7 / WinCC (TIA) RT Professional / WinCC Unified PC-Runtime

The PC's (Server / Clients) are connected via a tcp/ip network.

The PM-ANALYZE server is installed on a separate standalone server. The PM-ANALYZE server utilizes the PM-SERVER for the central alarm archiving from multiple different connected base systems. For bases systems of type WinCC / PCS7 / WinCC Professional and WinCC Unified PC-Runtime the alarms and process values are transferred by the PM-AGENT to the PM-SERVER.

Alarms from the base systems of type WinCC flexible, WinCC Advanced / Comfort are exported locally as csv or rdb files on the HMIs and imported via text import into the alarm archives of the PM-SERVER. The process values are transferred by the OPC UA/DA interface to the PM-SERVER.

The user interface for displaying, filtering and analyzing the alarm and process value archives is equally available on the PM-ANALYZE server and the PM-ANALYZE client installations.

The PM-ANALYZE client is installed on a base system client or on a separate PC.

Operating systems:

Server: Windows 2008/2012 R2 Server (64Bit)

Windows 2016/2019 Server (64Bit)

Client: Windows 7/8.1 (32/64Bit)
Windows 10 (64 Bit)
Windows 2008/2012 R2 Server (64 Bit)/
Windows 2016/2019 Server (64Bit)

2 Systemkonfiguration

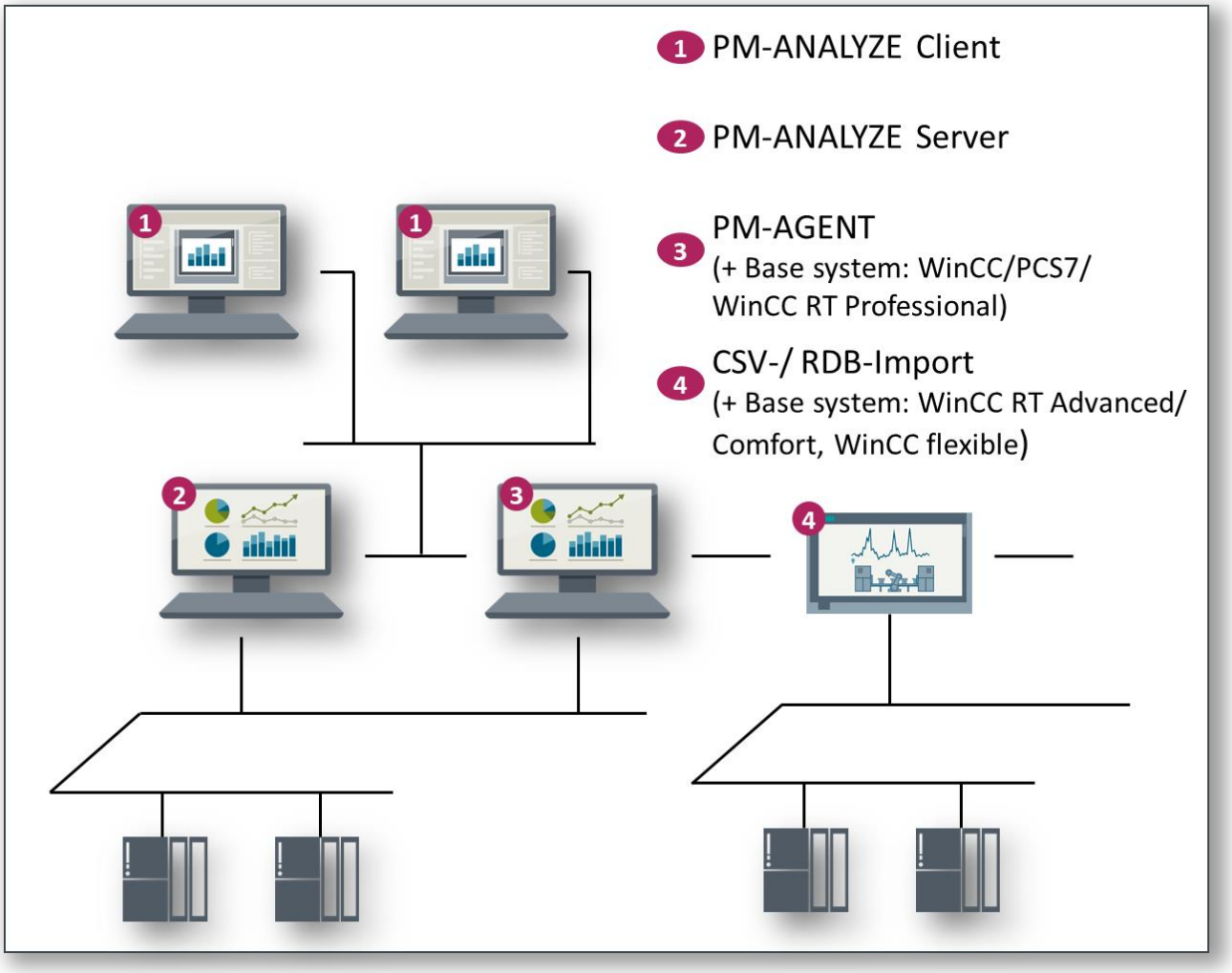


Figure 4: PM-ANALYZE in a distributed system

3 Operation

3.1 General information

The database for displaying, filtering and analyzing of alarms and process values are the alarm and process value archives that have been configured within the PM-SERVER.

All relevant base systems for the collection of process data are configured in the PM-SERVER as a so called station. The station can be either of type PM-AGENT, of type OPC or of type text import. The stations collect the incoming alarms and process values and archive them into the appropriate alarm and process value archives of the PM-SERVER. These archives are made available in PM-ANALYZE within a selection list.

An additional possibility for analysis is offered by the PM-SERVER context archives. A context monitors the content of an arbitrary text tag and records the text together with the begin and end timestamps. Within such a context tag, e.g. a shift number, a batch name or any other text based information can be recorded.

Furthermore, PM-SERVER enables calculations and aggregations to be performed with the process values. The calculation results internally generate a new process variable, which can also be archived and thus visualized in the PM-ANALYZE client.

The functionality in PM-ANALYZE is always related to the currently selected archive. During the configuration of such an archive in PM-SERVER, the decision is made which alarms and process values from which of the connected base systems shall be stored in the archive. PM-SERVER offers the possibility to store the alarms and process values from multiple and even different base systems in a common archive.

The organization of the archives is crucial for the operation of PM-ANALYZE.

PM-ANALYZE offers the following functionalities for the currently selected archive.

Process value archive:

- Display and monitoring of the most recent process values from the archive either in a chart or a table
- Display of archived historical process values as a chart or a table for a selected absolute or relative frame time or based on a shift, a batch or a context

Alarm archive:

- Displaying and monitoring the most recent alarms from the archive.
- Selecting the alarms from the archive in a specified time range or in relation to a batch, shift, or context
- Filtering based on the contents of the archived alarms
- Statistical analysis of the archived alarms by frequency, volume, flickering and duration.

Context archive:

- Displaying and monitoring the most recent contexts from the context archive

Process values when displayed in parallel to alarm statistics as trends in charts provide an comprehensive insight over the underlying process characteristics. Once a view has been configured as required it can be saved under a descriptive name as a workspace. Workspaces are either personalized for each user or globally available. (see also chapter 4 User interface)

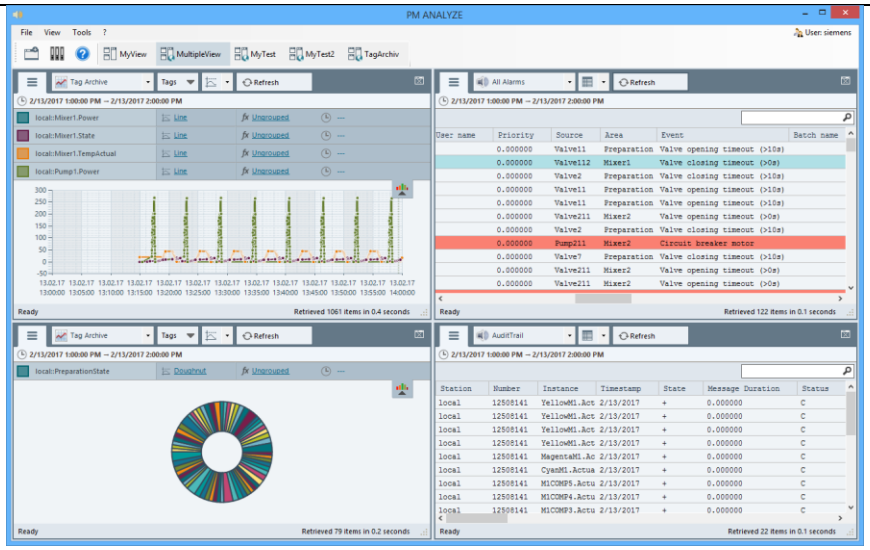


Figure 5: PM-ANALYZE client user interface

3 Operation

3.2 Displaying process values

The graphical display of process values in a chart provides concise and comprehensive information about the process characteristics. This can be based either on the currently executing process or on historical data recordings.

Archive values that are to be displayed in a chart are selected from a drop down menu. The menu lists all tags from the currently selected process value archive.

3.2.1 Chart selection

PM-ANALYZE offers a broad palette of chart types.

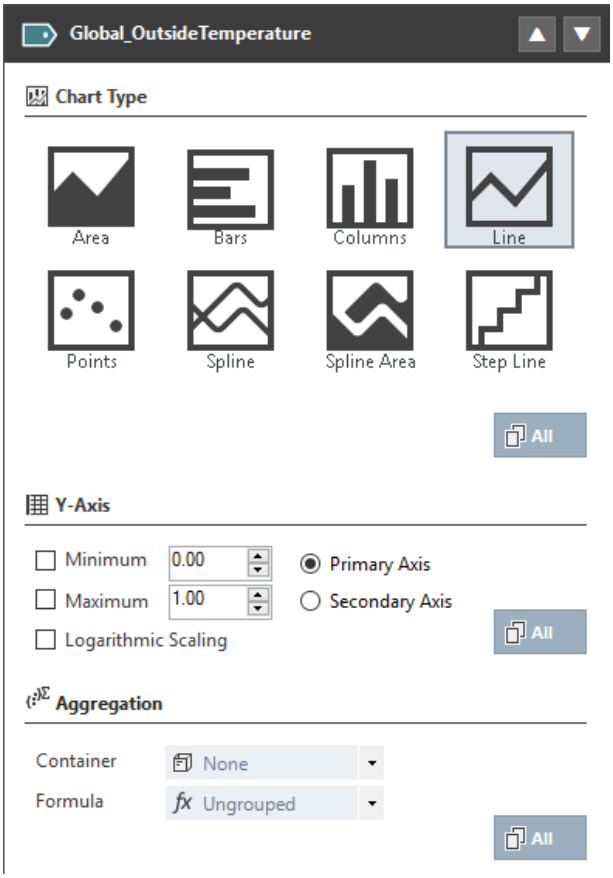


Figure 6: PM-ANALYZE Chart Types 1

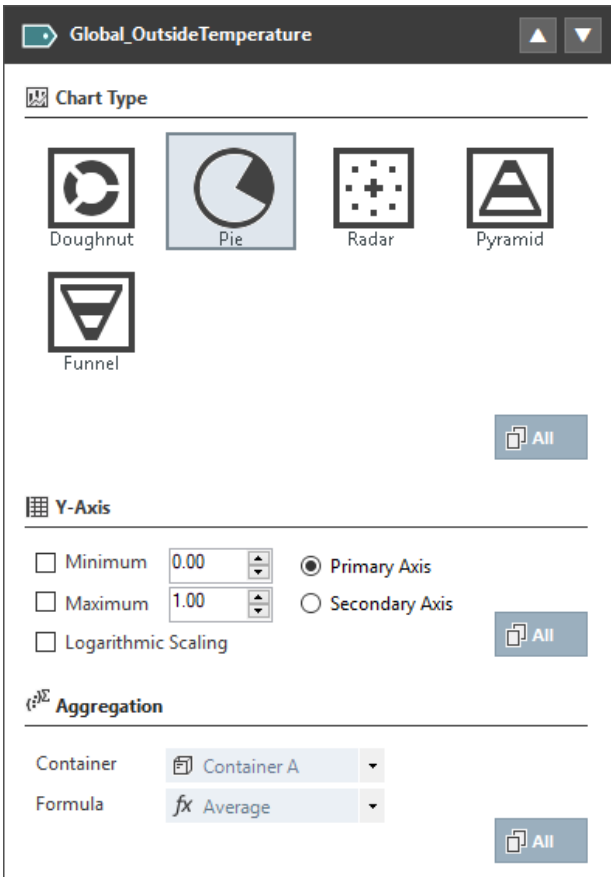


Figure 7: PM-ANALYZE Chart Type 2

Charts that have the same type of time axis for display are shown within the same trend. Otherwise PM-ANALYZE automatically puts the chart into a separate trend.

3 Operation

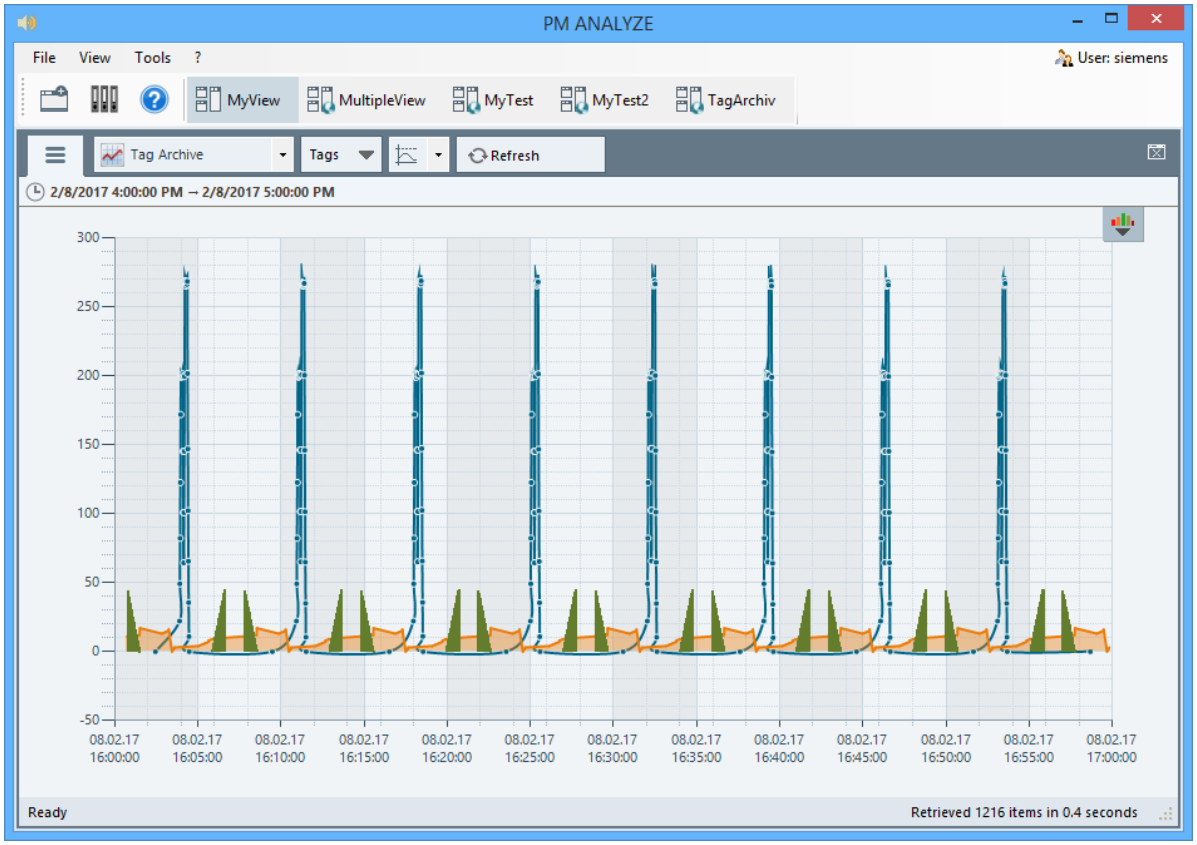


Figure 8: PM-ANALYZE, chart view of selected process values

Figure 9: PM-ANALYZE, Gantt chart for visualization of state tags

3 Operation

3.2.2 Configuration of the process value view

Besides viewing the raw archive values, PM-ANALYZE offers the possibility to aggregate data on the fly for display. The aggregation interval and the aggregation function can be separately defined for each individual trend.

PM-ANALYZE offers the following aggregation functions:

- Minimum
- Maximum
- Average
- Sum
- First value or
- Last value

The aggregation, trend color selection and also the charting type are configured in the legend for the chart. The legend can be expanded or collapsed as needed in order to provide more display space for the chart.

Figure 10: Legend to the configuration of the process value view

3 Operation

3.3 Viewing alarms from the archive

The view for the recent alarms from the selected archive provides clearly organized control over the current alarm situation within the plant. All alarms transferred to the selected archive are listed in a table. The search function allows instant filtering to locate specific alarm messages.

3.3.1 Filtering of archived alarms

For a selected alarm archive a wide variety of configurable filter options is available. The filter values can be automatically generated from the underlying values in the corresponding alarm archive. Filters can also be hierarchical to provide a maximum of support when relevant alarms are to be discovered quickly.

Based on the columns of the alarm archive, the PM-ANALYZE topology manager allows the definition of the filters individual for each archive. Multiple filters can be created as needed and are then displayed as filter tabs in the PM-ANALYZE client.

Each tab shows the distinct contents of each alarm column that has been configured as part of the filter. By default all content values are selected. Irrelevant values can be unchecked in order to focus on the alarms of interest.

Multiple filters spanning over more than one tab are combined and evaluated as an AND operation.

If a filter criterion has been activated within a tab, the  icon is shown in the tab header.

Filters can be saved in the configuration library under a descriptive name either as personal filters for the currently logged in user or as globally available to all PM-ANALYZE users.

Archive segments which have been detached from the database from PM-SERVER can be easily re-attached for analysis form within the PM-ANALYZE client. The time range from which alarms can be selected is then automatically extended to include the re-attached backup segments.

See also to chapter 4.3 Archive settings

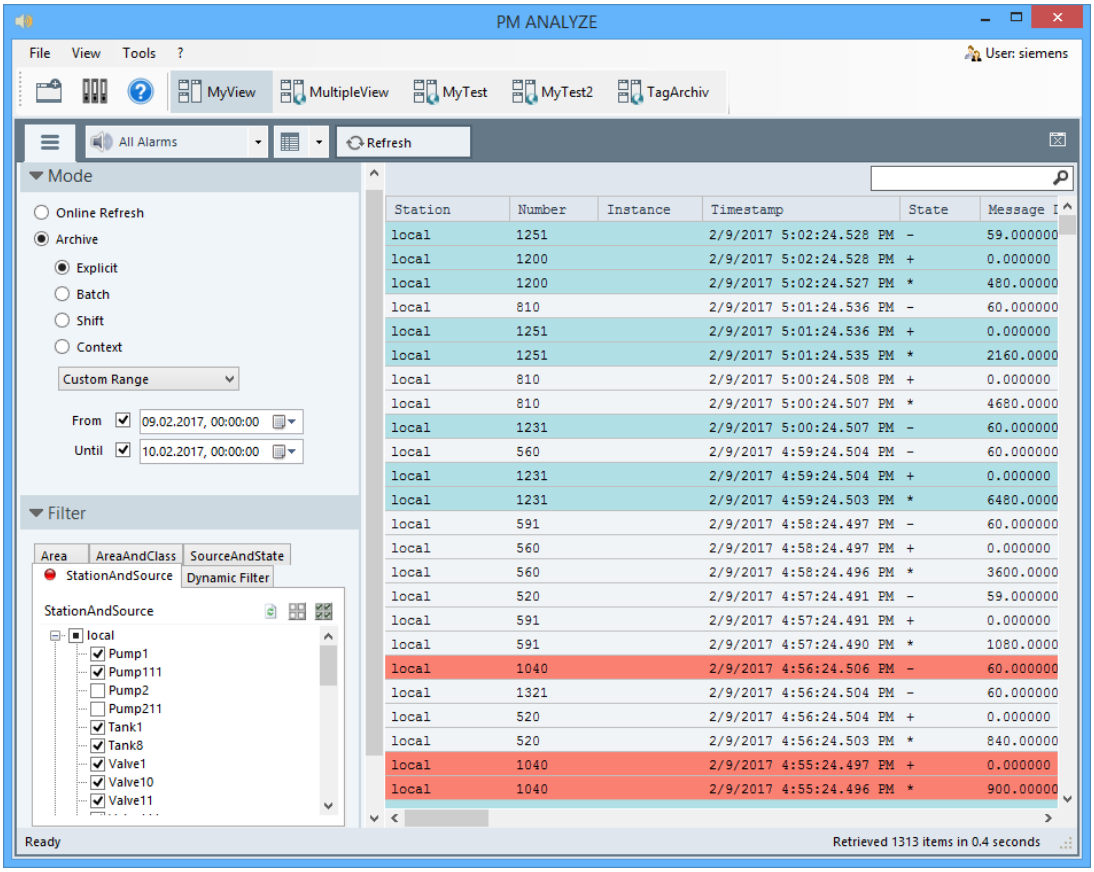


Figure 11: PM-ANALYZE, Alarm view from an alarm archive

3 Operation

3.4 Selecting a time range

As well as for alarms and process values, PM-ANALYZE offers the display of the most recent time frame from the archive or over an configurable historical period.

3.4.1 Most recent data

For this view the filter mode setting is set to *Online Refresh.* By clicking the *refresh* button the most recent 250 alarms or process values that have been entered into the archive are listed. The list is updated every 30s.

The number of alarms and process values to display and the update interval are configurable and default to 250 alarms and 30s.

3.4.2 Archive

For the display of historical values PM-ANALYZE provides several presets to define the scope of the data volume to take into account.

The timeframe can be defined either as absolute from-to values or as a relative time period. When using relative periods a additional distinction can be made between the last period (e.g. last month) or the previous period (e.g. the previous month)

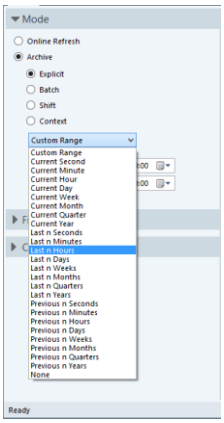


Figure 12: Selection of a relative or absolute time range

Additionally the time period to display can be related to a different criterion as explained in the next paragraphs.

Batch

This option is automatically available when PM-QUALITY is also installed in parallel on the PM-ANALYZE server. By selecting this option, PM-ANALYZE will show all batches that have been recorded by PM-QUALITY in the given time frame by batch name. The timeframe for PM-ANALYZE is then automatically deducted from the production time of the selected batch.

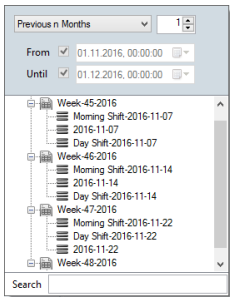


Figure 13: Time range defined by a batch

Shift

The integrated PM-SERVER allows the definition of shift plans that can also be used as a basis for the time range selection within PM-ANALYZE. For a given time period, all shifts are listed by their corresponding name. When a shift is selected from the calendar, it's start and stop time automatically mark the time range for the display in PM-ANALYZE.

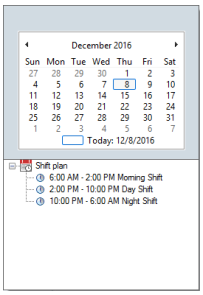


Figure 14: Time range defined by a shift

Context

Another option is the selection of a context tag that has been recorded by the context archive of PM-SERVER. For a given time period, all context time frames that have been recorded with a start and stop time are available for selection. Once a context is selected, this start and stop times are used as the basis for the display in PM-ANALYZE.

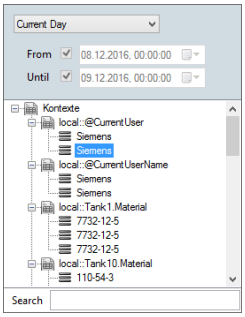


Figure 15: Time range defined by a context

3 Operation

3.5 Statistical analysis

PM-ANALYZE offers four methods for the statistical analysis of alarms from a single alarm archive:

- **Frequency** – Identification of the most frequent alarm sources
- **Flickering** – Identification of alarms that occur in bursts within short timeframes
- **Volume** – Evaluation of the alarms within a defined time range broken down into several smaller time intervals.
- **Duration** – Locating the alarms that have been active for the longest time.

3.5.1 Frequency analysis

The frequency analysis scans the archive and accumulates the frequency of the occurrence. The filter settings for the time range and the alarm columns are taken into account. The result of the analysis shows the resulting alarms ranked by their occurrence where the most frequent occurrence is ranked on number 1.

The grouping functionality organizes the alarms by identifying columns of similar content.. For each ranking the number and also the source alarms that have been used in the grouping are displayed.

See also:

3.5.5 Grouping

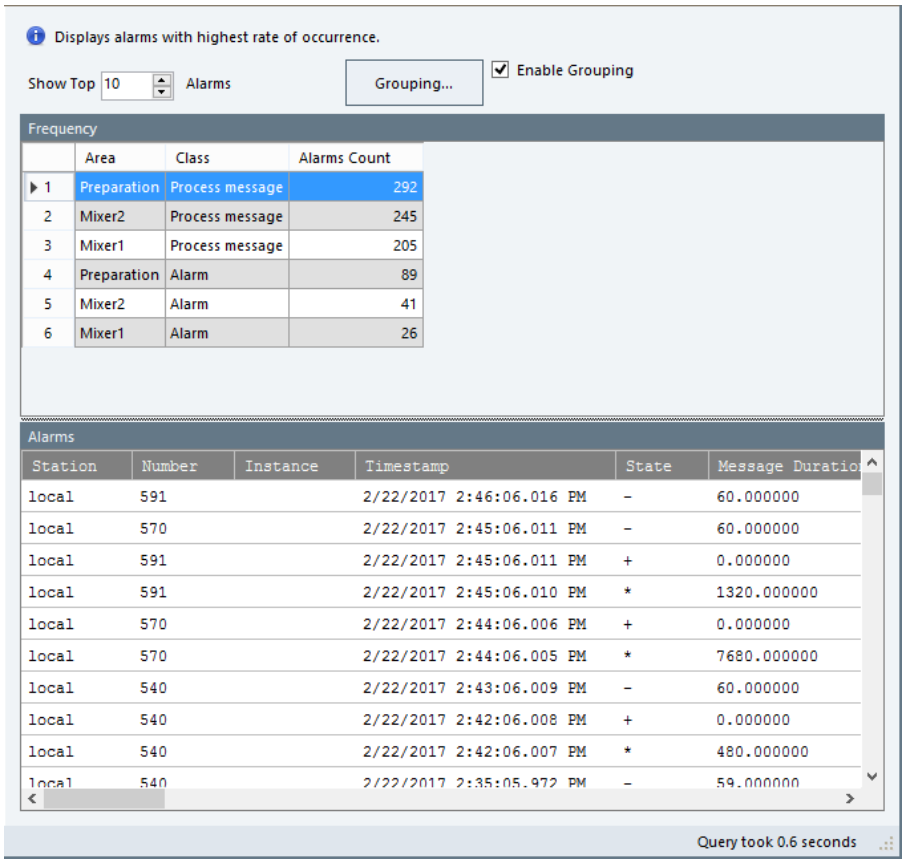


Figure 16: PM-ANALYZE, User interface for the frequency analysis

3 Operation

3.5.2 Flickering analysis

The flickering analysis is used to identify alarms that are occurring in a high frequency within a short time frame. For the analysis a specific time threshold is configured. This threshold defines the time frame from the incoming state of an alarm until the same alarm is reported as incoming again. When the next occurrence of the alarm is below this threshold a so called package is created that accumulates the occurrences i.e. the burst of alarms. All further occurrences of the alarm that also fall into the time frame of the last occurrence plus the threshold are added to this package. If the next alarm is occurs later than this time range, the package is closed and the search for the next package continues. The number of alarms contained in each package and the number of packages found is displayed in the results table.

The analysis is performed over the time range defined by the current filter settings. Within this time range multiple packages can occur for alarms that have been re-occurring within the specified threshold.

PM-ANALYZE lists the found results with the station that delivered the alarm, the alarm number and the number of packages found. For the selected package all alarms that have been identified to belong to the package are displayed in chronological order below in a secondary table.

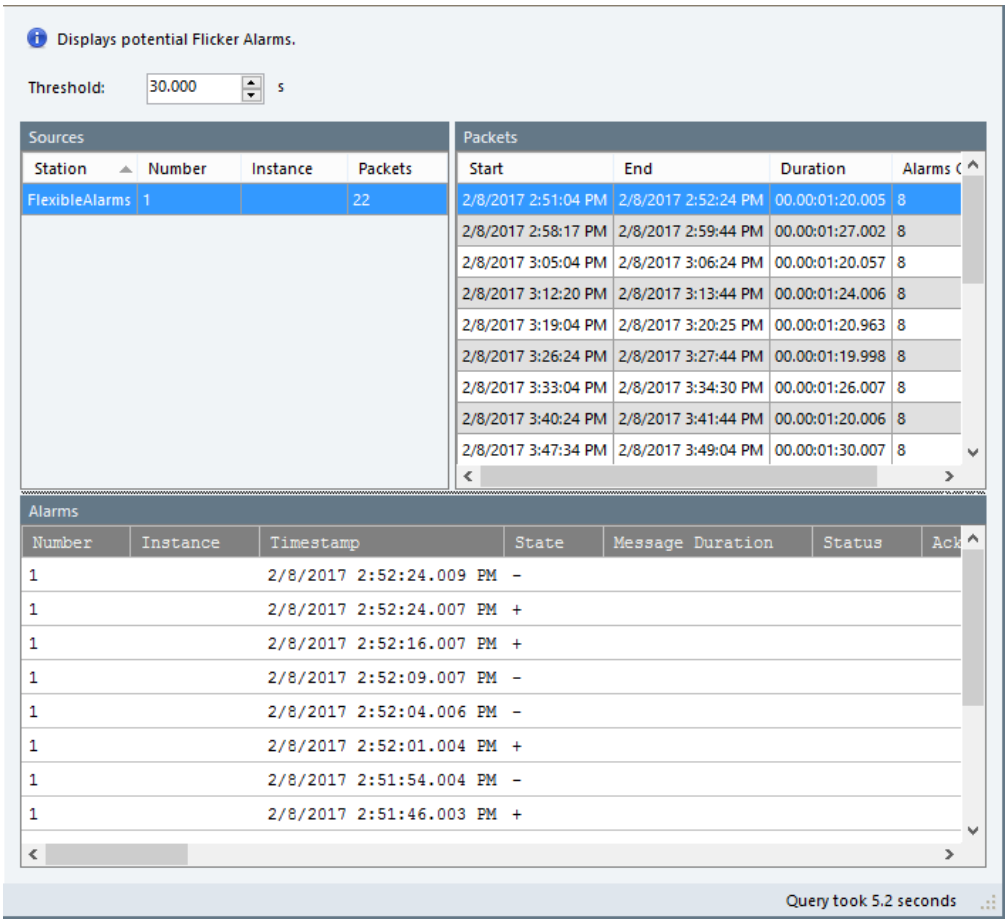


Figure 17: User interface for the flickering analysis

3 Operation

3.5.3 Volume analysis

The volume analysis of PM-ANALYZE aggregates alarms by grouping a larger analysis time range into smaller time intervals. Within these smaller intervals the alarms are accumulated in order to identify times where alarms occur more often compared to other frames. By using this method e.g. a month can be split into individual days in order to see if there are accumulations on weekends.

The available interval settings are hour, day, week, month and year.

Before the analysis is performed, all individually filters that are currently active are applied and the result is used as the basis for the analysis.

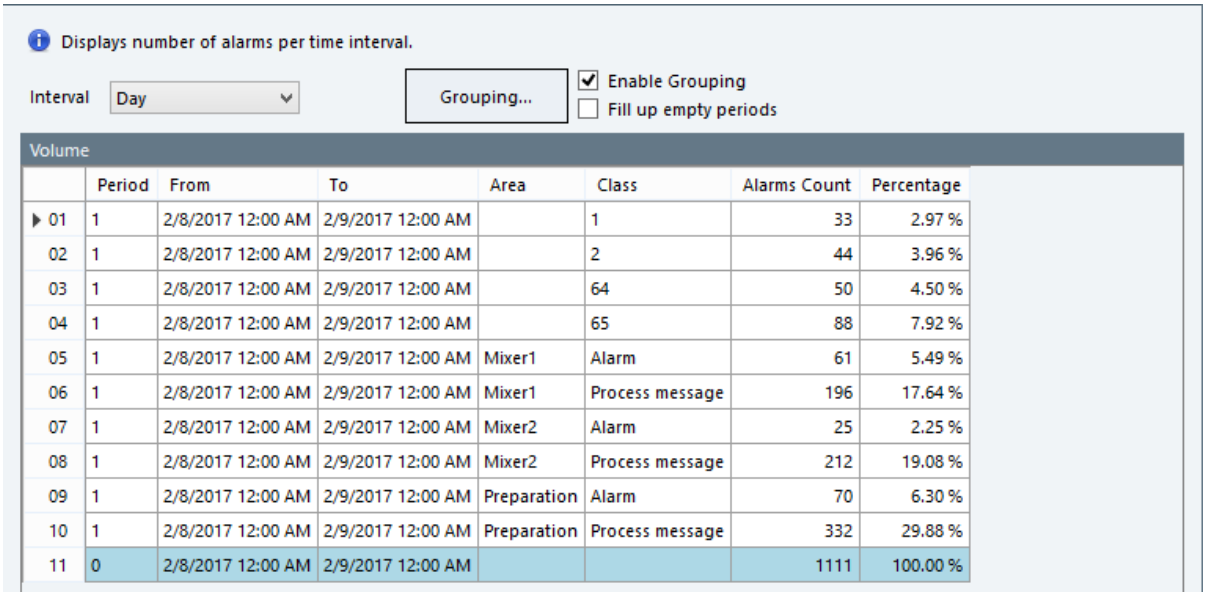
The analysis results are displayed for the configured intervals in a table.

The resulting table can be directly exported into Microsoft Excel. A prerequisite for this function is a installed Microsoft Excel starting from version 2003. During the export operation Microsoft Excel is started and the data is immediately inserted into and newly created workbook.

In order to provide an optimal basis for the powerful pivot table and pivot chart analysis capabilities provided by Microsoft Excel the results display can be configured to also include periods where no alarms have been found.

See also:

3.5.5 Grouping



	Period	From	To	Area	Class	Alarms Count	Percentage
01	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM		1	33	2.97 %
02	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM		2	44	3.96 %
03	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM		64	50	4.50 %
04	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM		65	88	7.92 %
05	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM	Mixer1	Alarm	61	5.49 %
06	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM	Mixer1	Process message	196	17.64 %
07	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM	Mixer2	Alarm	25	2.25 %
08	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM	Mixer2	Process message	212	19.08 %
09	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM	Preparation	Alarm	70	6.30 %
10	1	2/8/2017 12:00 AM	2/9/2017 12:00 AM	Preparation	Process message	332	29.88 %
11	0	2/8/2017 12:00 AM	2/9/2017 12:00 AM			1111	100.00 %

Figure 18: User interface for the volume analysis

3 Operation

3.5.4 Alarm duration analysis

This analysis evaluates the alarms of a specific archive regarding the duration how long the alarms have been in an active state. A precondition for this type of analysis is that the alarm duration has been supplied by the underlying HMI system in a separate alarm column.

By using the grouping functionality, the individual alarm durations can be aggregated to identify the areas or assets that have been in an alarm state for the longest time.

See also:

3.5.5 Grouping

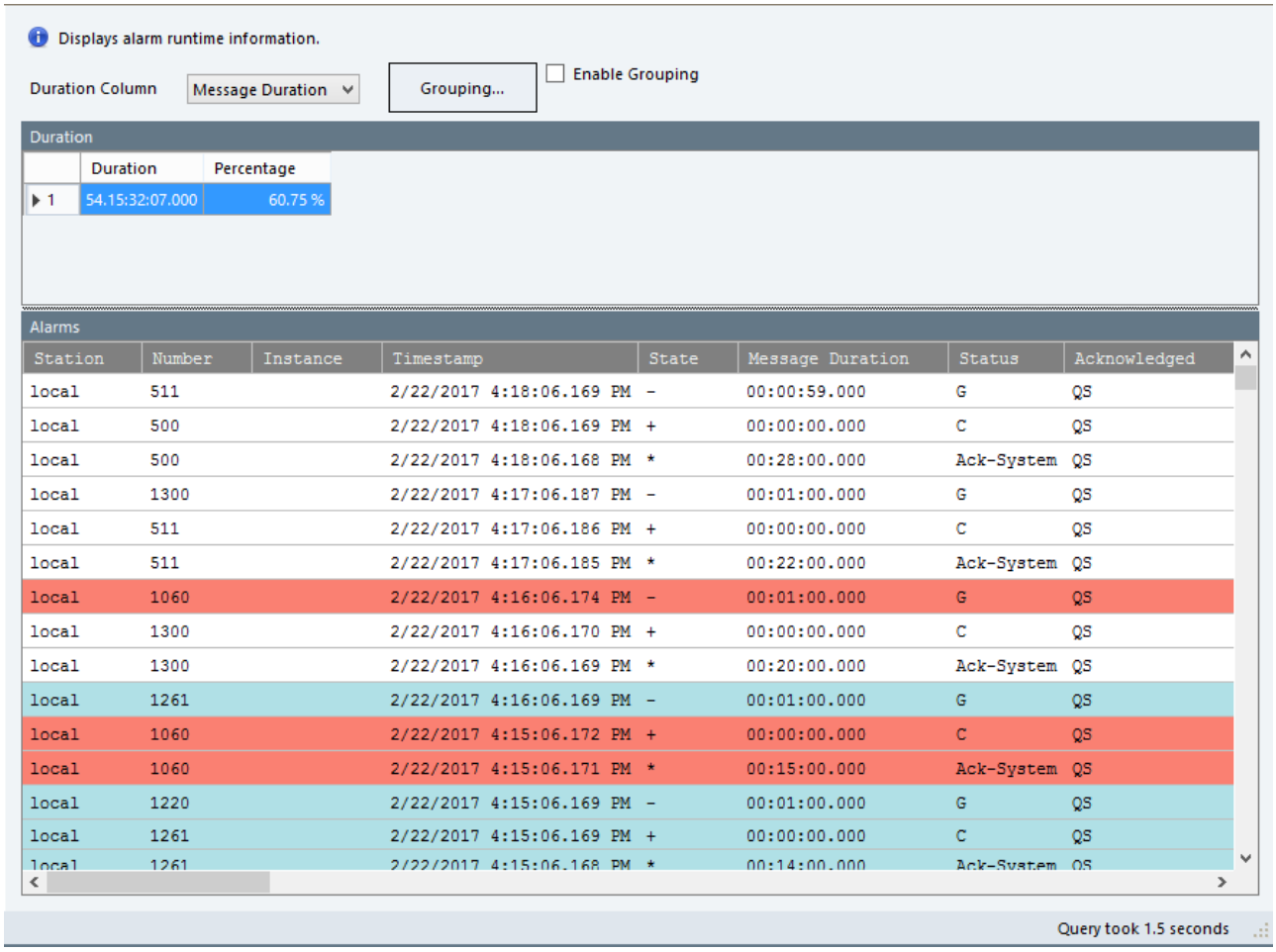


Figure 19: User interface for the message duration analysis

3 Operation

3.5.5 Grouping

In order to provide a better overview on the analysis results, the alarms can be grouped by common content in the alarm columns. This allows e.g. an analysis of the top 10 alarms based on the source of the alarm as opposed to traditional top 10 analysis that are simply base on alarm numbers. The Grouping Settings dialog lists all columns of the currently selected alarm archive. The relevant alarm columns that are to be used can be selected and also brought into the required grouping order via drag and drop.

The grouping functionality is available for the frequency, the volume and the message duration analysis.

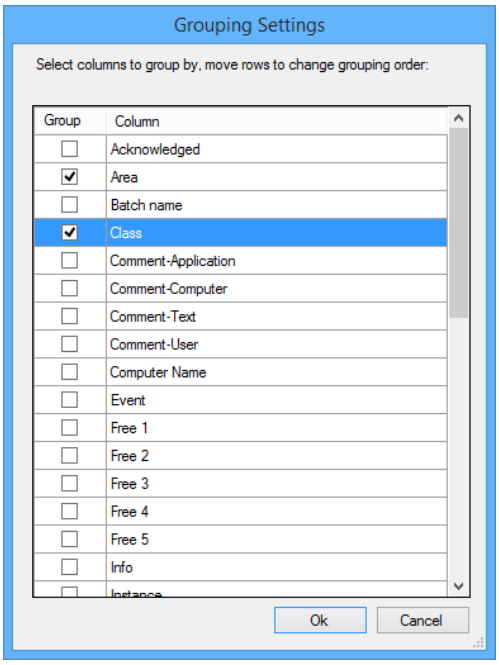


Figure 20: Grouping dialog

4 User interface

4.1 View configuration

One of the key benefits of PM-ANALYZE is the possibility to correlate information by displaying different views in parallel within the same workspace. The content of each individual view can be defined as needed. Within a workspace, process values displayed as trends or tables can be shown side by side with audit trails, alarms or statistical analysis results.

4.1.1 Saving the workspace configuration

The configured views containing all settings regarding time range, type of display, eventual alarm filter settings etc. can be saved under a descriptive name either for an individual user or as a global workspace that is available for all PM-ANALYZE users. For each workspace that is saved, a button on the toolbar of PM-ANALYZE is automatically added. The workspace can then be recalled with all its settings by a single button click.

Each user can also select one workspace as being the default workspace that is automatically opened when this user logs in. If PM-ANALYZE is started without a logged in user, the global workspace that has been marked as the global default is opened.

4.1.2 Comfortable operation

Interactive operation

When data from an alarm archive is displayed in a table together with a chart showing a trend over a time period covering the timestamp of the selected alarm, a ruler marks the position of the selected alarm within the trend.

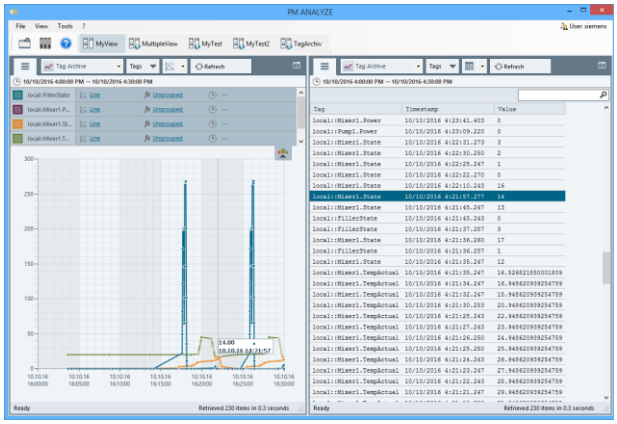


Figure 21: Interactive operation

Tooltip for measured values

The recorded archive value together with the timestamp is shown in an overlay tooltip when hovering with the mouse over the chart..

Derived time frames

The time frame configured for on view can be automatically applied to multiple other views which then become dependent views. Dependent views automatically use the same time range as the master view by default. However a dependent view may also be shifted by a time span in order to allow period comparisons.

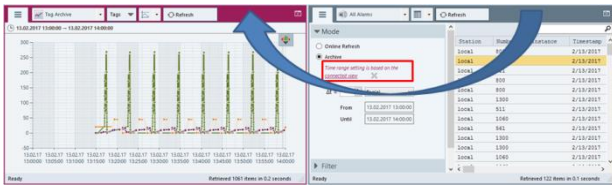


Figure 22: Linked time ranges

Zoom function

PM-ANALYZE has a comfortable zooming function that allows to drill down into charts over the time range.

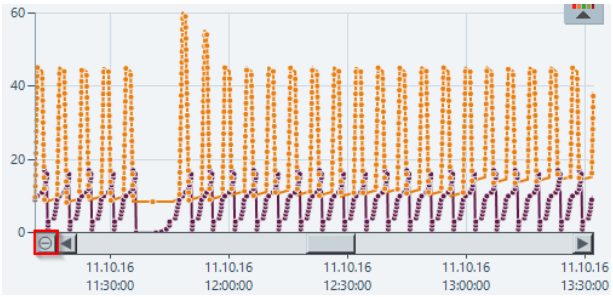


Figure 23: Zoom function

4 User interface

4.2 Configuration library

In order to store frequently used individual settings PM-ANALYZE offers an integrated configuration library.

Within a stored configuration the following settings can be stored:

- Time range
- Filter settings
- View settings

Filters can be arranged and structured into folders that can also contain subfolders in any way. A filter that has been saved in the library can be immediately applied by simply double clicking the filter entry in the library.

Filters can be defined as either global and therefore available to all users or personal which restrict the visibility to the login that created the filter.

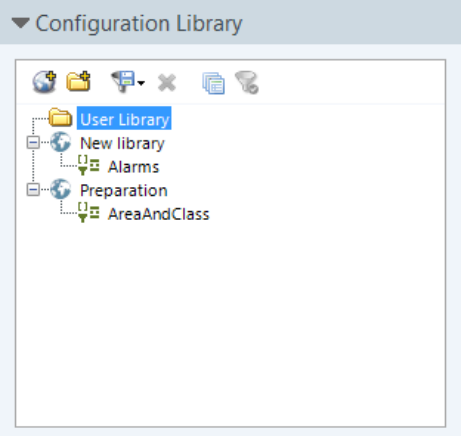


Figure 24: Configuration library

4.3 Archive settings

Archive segments that have been detached from the Microsoft SQL Server database by the PM-SERVER can be re-attached from the archive settings dialog in the PM-ANALYZE client. This includes the time range contained within these historical archives automatically into the time range available for analysis. By default, these historical archive segments stay attached until the end of the current day and will be detached again automatically. If required this time range to keep historical archives attached until being detached again can be configured..

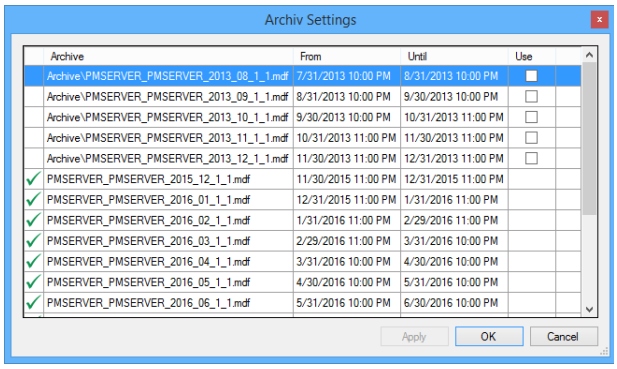


Figure 25: Archive settings dialog

4 User interface

4.4 Export

PM-ANALYZE offers the export of evaluation results in the file formats .csv or .xml and also directly to Microsoft Excel. This applies to the display of currently displayed filtered alarms as well as the analysis results provided by the various analysis methods.. For the transfer to Microsoft Excel the local installation of Excel version 2003 or above is required. The exported data is directly transferred into a new workbook and does not require a file based transfer.

See also:

Chapter 6: Microsoft Excel Add-In

4.5 User login

PM-ANALYZE offers the optional capability to force a user to log on when starting the PM-ANALYZE client. The credentials provided by the user are verified against the logins defined in PM-SERVER. On successful login, the permissions that have been configured the PM-ANALYZE topology are applied.

Operations like

- Modify archive settings
- Modify global filters
- Run statistical analysis

Can be protected against unauthorized access and there be made available to individual operators.

Using PM-ANALYZE with activated logins provides the advantage that both the settings in the configuration library and the view configurations in a workspace can be saved separately for each user and are thereby visible only for the corresponding logged in user.

5 Configuration

5.1 General information

The analysis available in PM-ANALYZE are performed based on the archives that have been configured in the PM-SERVER. The PM-ANALYZE server installation automatically includes the required PM-SERVER infrastructure. If the PM-SERVER has already installed from another PM product like PM-QUALITY, PM-CONTROL or PM-MAINT the existing PM-SERVER installation is also used by PM-ANALYZE. If archives have already been configured from one of the other products they can immediately be reused for PM-ANALYZE. Version compatibility between the different products is documented in the related release notes.

5.1.1 PM-SERVER

PM-SERVER offers a platform that allows the combination of data from different base systems across various performance categories. Based on the connected base systems process values (tags), the permissions, alarm block configurations etc. can be directly imported. If used together with base systems not providing this type of information, the alarm archives can be imported via text files, the process values can be read via OPC connection and the permissions configured within the PM-SERVER directly.

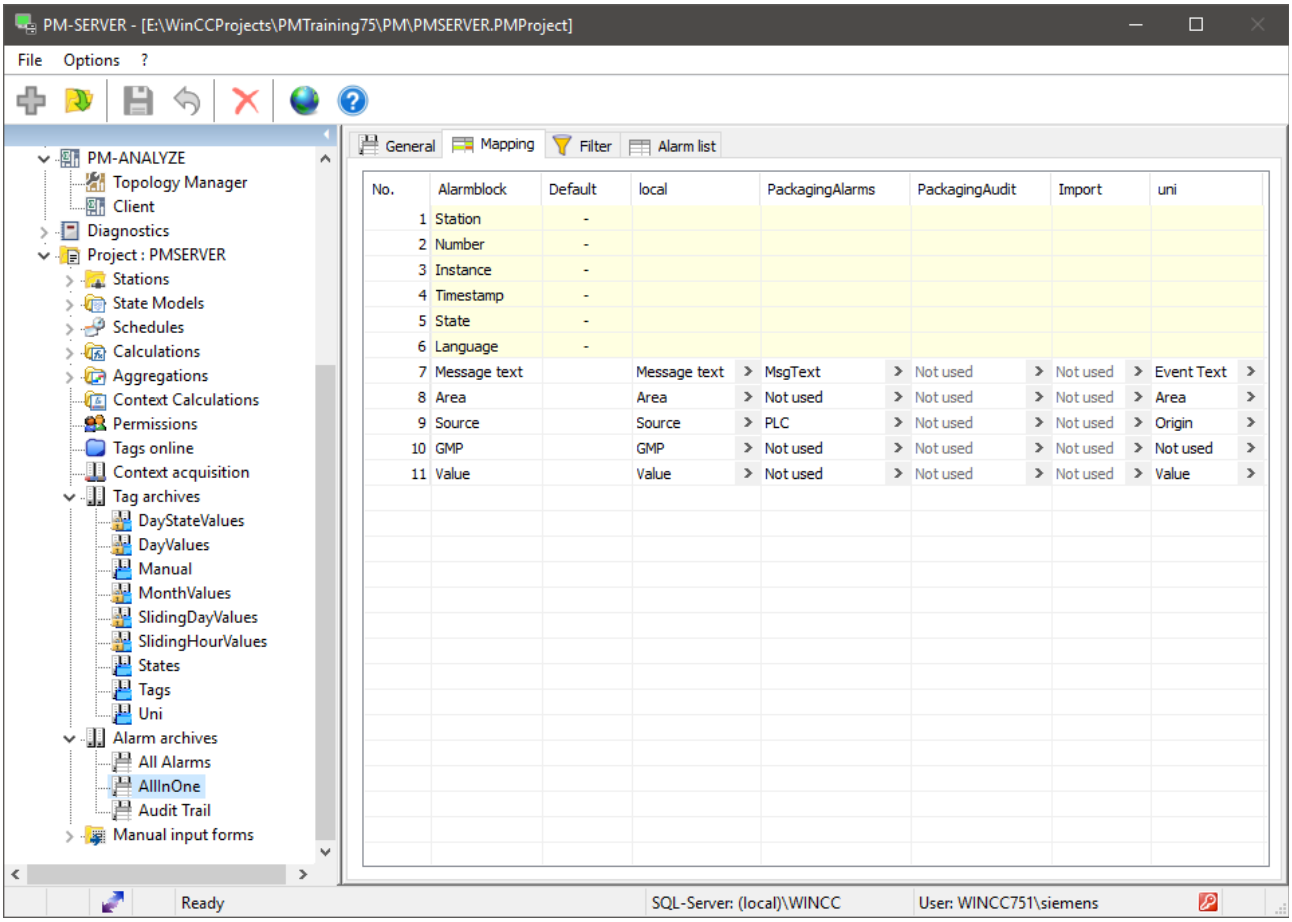


Figure 26: PM-SERVER

5 Configuration

5.1.2 Configurations related to PM-ANALYZE in PM-SERVER

In order to use specific alarm archive columns in individual filters in PM-ANALYZE the related columns must be marked as being “fixed” in PM-SERVER. This prevents the columns to get accidentally deleted when still being used within a filter defined by PM-ANALYZE. Only alarm columns marked with the Icon as being fixed are available for use as filter columns in the PM-ANALYZE Topology Manager.

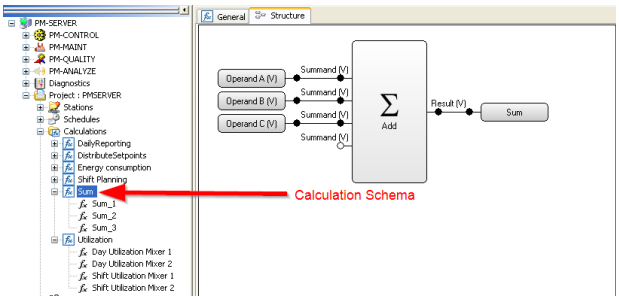


Figure 27: PM-SERVER Calculation Schema

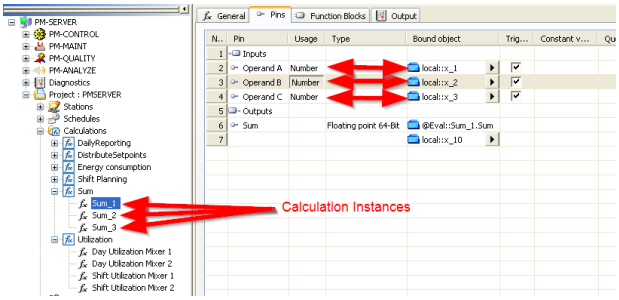


Figure 28: PM-SERVER Calculation instances

5.1.3 Calculations in PM-SERVER

PM-SERVER offers a graphical interface for the definition of algorithms. This allows a simple calculation of complex key figures. The prefabricated set of calculation blocks can be extended by custom functions. The calculation results generate new internal process value variables which can be used for further calculations or for archiving like any other process value.

There are various arithmetic functions available (add, subtract, multiply, divide) as well as bitwise (AND, OR, right shift, ...) and logical binary functions (AND, OR, compare, ...). Furthermore, counters (slope counter, time counter, difference counter) and statistic blocks (average, integral, max, min, ...) can be used.

A calculation consists of a calculation schema and a calculation instance. The algorithm is defined in the calculation schema. The calculation instance provides the calculation schema with the necessary tags and trigger conditions. Several calculation instances can be assigned to one calculation schema. Each instance contains its own connections.

The trigger conditions define when a calculation is executed. There are the following possibilities:

- Change of input value
- Schedules
  - Static schedules (=> Hourly, daily, weekly, monthly, yearly)
  - Dynamic schedules (trigged by start-/stop- signal)
  - Shift schedules with graphical user interface
- Calculation of metrics over schedule timeframes (e.g. daily utilization etc.)
- Reporting and archiving over schedules

5 Configuration

5.1.4 Aggregations in PM-SERVER

PM-SERVER offers the possibility to compress data from series of values by applying a calculation formula. These aggregations can also be hierarchical over multiple levels. A series of measured values can e.g. be aggregated to an hourly average. These averages can then be used as a basis for day averages.

A modification in a lower level leads to a recalculation in the levels above.

Similar to calculations, aggregations are described by an aggregation schema. This schema defines the aggregation intervals (hour, day, month, ...).

Each level creates a new process value archive, in which the generated target values are archived. This way, the source data used for aggregation is preserved.

The source for an aggregation can be either the original data (raw source data) or the data of a lower aggregation level.

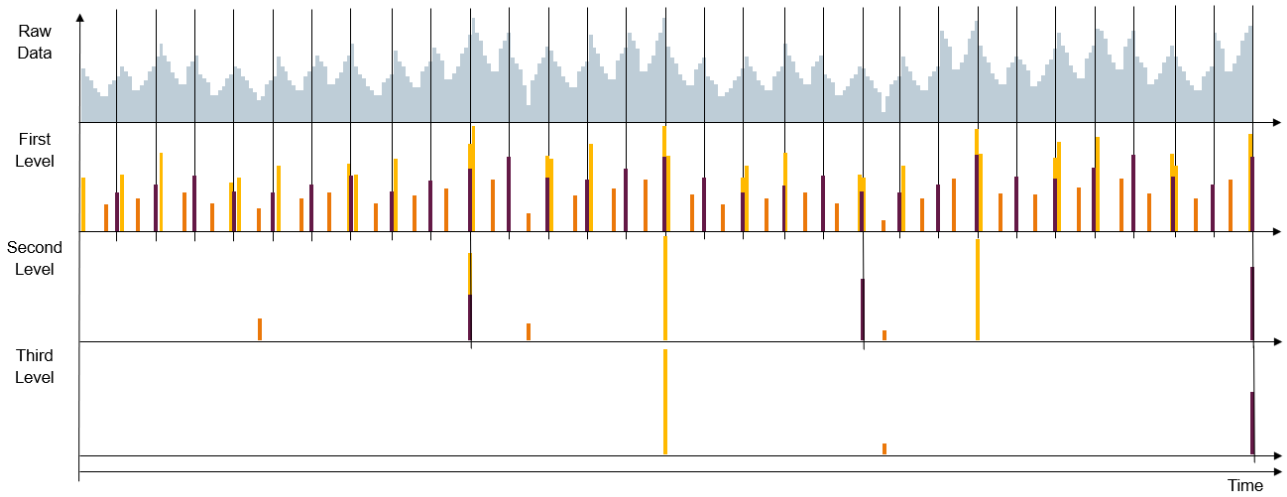


Figure 29: Aggregation of data

5 Configuration

5.2 PM-ANALYZE Topology Manager

5.2.1 General information

The PM-ANALYZE Topology Manager defines basic settings during project setup that control the operation of the connected PM-ANALYZE clients. This include the assignment of permissions to specific user groups and also styling rules for the display of alarms. Furthermore the filters that are to be presented in the PM-ANALYZE client for specific alarm archives are defined here.

5.2.2 Permission settings

Permissions for the PM-ANALYZE client are defined in the Topology Manager. The actions that are subject to permission checking are related to the user groups that hold the permission to execute the action. The execution of the following actions can be protected:

- Modify archive settings
- Modify global filters in the library
- Execute the available analysis methods

5.2.3 Filter definitions

Filters are separately defined for each available alarm archive. The filter definition consists of the name for the filter and the assignment of the alarm columns that are to be evaluated in the filter. All alarm columns that have been marked as being fixed in the PM-SERVER are available as filter candidate columns.

Hierarchical filters are configured by defining multiple filter columns for the same archive name. By additionally providing an index, the hierarchy level in which the column shall be evaluated in the filter can be specified.

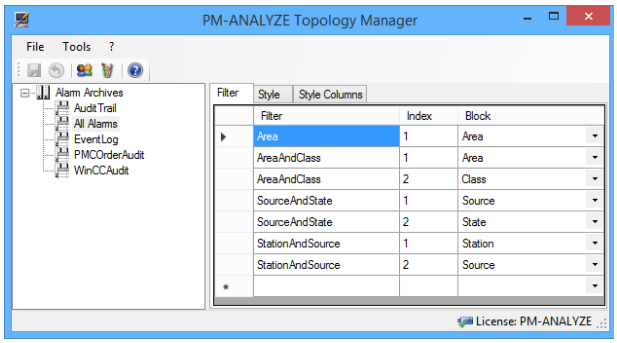


Figure 30: PM-ANALYZE Topology Manager, Filter definition

Each filter that has been defined here is available for the archive in the PM-ANALYZE client as a separate filter page. Each register shows the distinct contents that have been collected in the underlying archive for each filter column.

5.2.4 Global styles / style definition

The global style defines the set of coloring rules that is to be applied when alarms are displayed in the PM-ANALYZE client. The global style applies to all archives that have not defined an individual archive specific style which overrides the global style.

Style columns

In order to selected a individual background and text color combination for alarms meeting specific criterions the controlling alarm columns can be specified. For this purpose a style column name is assigned to an alarm archive column. This style column name can then be used in an xml based rule set that inspects the content of the underlying alarm column in order to apply a specific color combination.

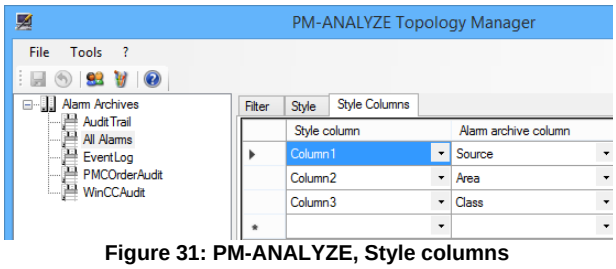


Figure 31: PM-ANALYZE, Style columns

6 Microsoft Excel Add-In

6.1 General Information

With the Microsoft Excel Add-In, PM-ANALYZE offers the option to create arbitrary protocols with the tools provided by Microsoft Excel.

PM-ANALYZE comes with the installation files for the PM-ANALYZE Excel Add-In. The Add-In is not automatically integrated into Microsoft Excel, and can be activated as required by the user.

After successful activation, the user interface of Microsoft Excel displays the PM ANALYZE tab.

6.2 Configuration

The Microsoft Excel Add-In provides access to all process value and aggregation archives of PM-SERVER, to calculated values and key figures as well as to messages and operator actions.

Within the PM-ANALYZE tab in Microsoft Excel, the values to be output depending on a time range are defined. Depending on the application, this data can be provided as unformatted raw data for further processing or directly in a desired report format.

6.3 Automatic Reporting

Individual Excel files can be used as templates for different reports.

Like for example:

- Daily report
- Monthly report
- Annual report
- Event report (e.g. basin overflow)

For this purpose, static or dynamic schedules are created in PM-SERVER, which are used to define the time range of the report.

To generate automatic reports, a function block is used in PM-SERVER. This block defines the schedule, the report template and the output directory. Each time the function block is called by the schedule, a copy of the report template is created and filled with data.

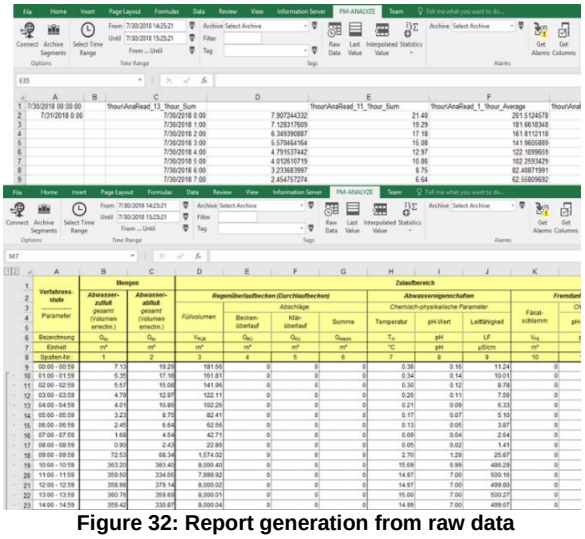


Figure 32: Report generation from raw data

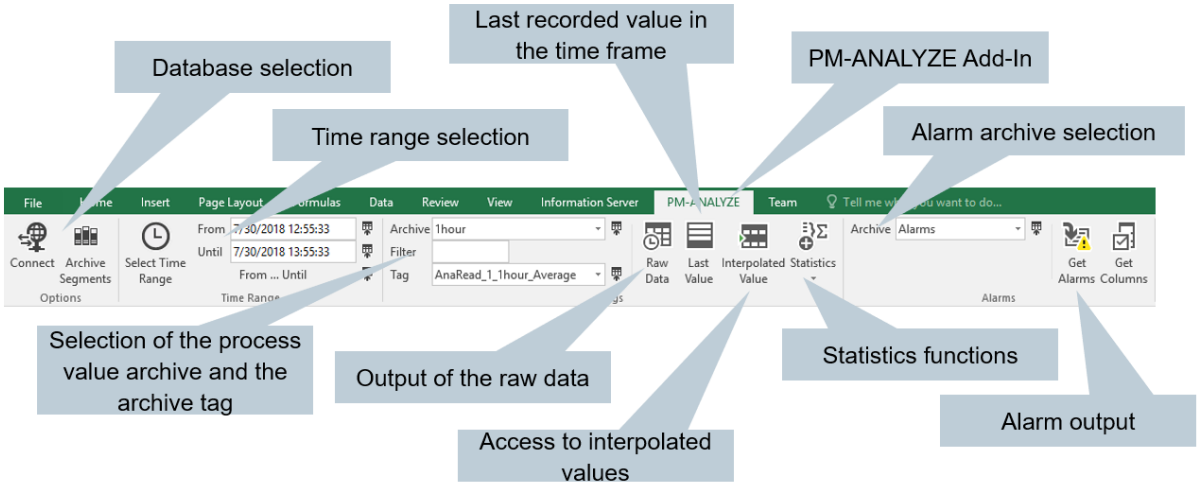


Figure 33: PM-ANALYZE Microsoft Excel Add-In, Toolbar

7 Programming Interface

7.1 General Information about REST API

In addition to the installation of the PM Server, a PM-API is also provided. This REST API enables the data exchange between different systems, especially with web services. In the PM environment, the various PM SERVER archives can be accessed. This supports a simple integration of process values and messages into external tools (such as Microsoft Power BI).

7.2 Supported Services

With the help of the PM-API, the process value and message archives of PM SERVER can be accessed.

The following data can be queried:

- Tag archive
  - List of process value archives
  - Properties of a process value archive
  - List of archived variables
  - Properties of the archived variables
  - Value of an archived variable
  - values of several archived variables
  - Aggregated values of a variable
- Alarm archive
  - List of message archives
  - Properties of a message archive
  - Message blocks
  - Alarms

Endpoint URLs are used to retrieve the data from the archives.

The more specific the query becomes, the more the URL is extended. The query for the list of process value archives is therefore made via ***/api/pmserver/tagarchives***.

If the properties of a process value archive are to be queried instead, the ***/{archiveId}*** addition is added to the above URL. Of course, the archiveID of the desired process value archive is used.

Similarly, the variables within a process value archive can be queried. The URL for this is: ***/api/pmserver/tagarchives/{archiveId}/tags***
The properties of one of these variables are retrieved via the URL addition ***/{tagId}***.

The values of a defined variable can be determined by the query ***/api/pmserver/tagarchives/{archiveId}/tags/{tagId}/values***. The values of several variables can also be retrieved by adding the different TagIds.

The URL:

/api/pmserver/tagarchives/{archiveId}/tags/{tagId}/aggregatedValues
represents a query for aggregated values of a variable.

Similarly, the query takes place within the message archives:

/api/pmserver/alarmarchives/

/api/pmserver/alarmarchives/{archiveId}

/api/pmserver/alarmarchives/{archiveId}/blocks

/api/pmserver/alarmarchives/{archiveId}/alarms

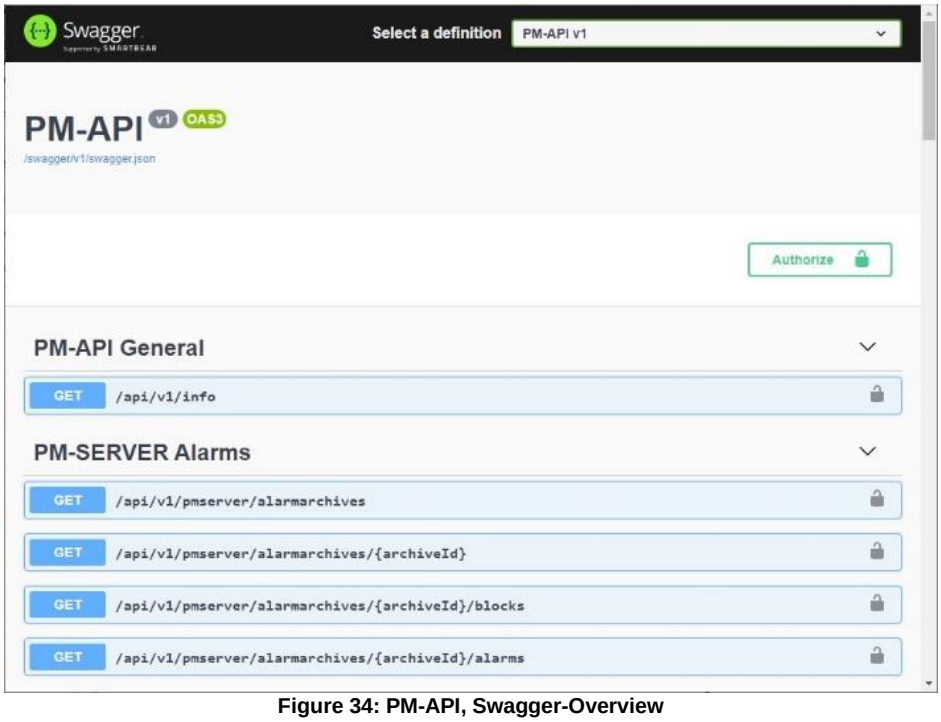
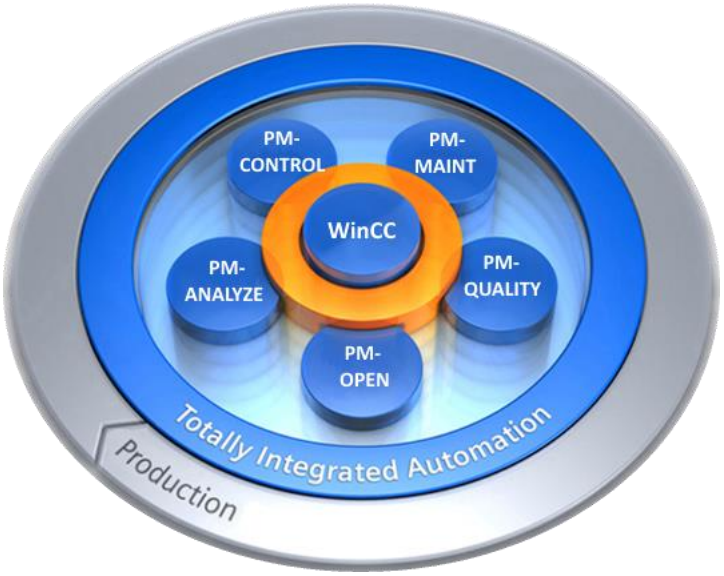


Figure 34: PM-API, Swagger-Overview

Figure reference:

Process Management System

Economical Automation with Standard Software



PM-CONTROL
Recipe/Product Data Management, Job Control

PM-QUALITY
Job/Batch-oriented Archiving and Recording

PM-MAINT
Intelligent Maintenance Management System

PM-ANALYZE
Analysis of Alarms and Process Data

PM-OPEN
Solutions for Communication and Integration

Further technical information?

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