

Digital Industries

USER MANUAL V1.4

Batch Performance Analytics

SIEMENS

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER	indicates that death or severe personal injury **will** result if proper precautions are not taken.
 WARNING	indicates that death or severe personal injury **may** result if proper precautions are not taken.
 CAUTION	indicates that minor personal injury may result if proper precautions are not taken.
NOTICE	indicates that property damage may result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

 WARNING	Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation, and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of the Siemens AG. Third parties using for their own purposes any other names in this document which refer to trademarks might infringe upon the rights of the trademark owners.

Disclaimer of liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

The information given in this document only contains general descriptions and/or performance features which may not always specifically reflect those described, or which may undergo modification in the course of further development of the products. The requested performance features are binding only when they are expressly agreed upon in the concluded contract.

Contents

Legal information	**2**
Welcome	**4**
Safety information	**4**
Getting started	**5**
Managing data upload	**12**
Managing data configuration	**22**
Navigating production overview dashboard	**40**
Exploring batch details in the production overview	**47**
Analyzing batch element details	**51**
Managing batches	**54**
Understanding efficiency measures overview	**55**
Anomaly detection	**59**
Understanding anomaly overview	**75**
Viewing anomaly details	**89**
Managing anomalies	**92**
Understanding cluster analysis	**94**
Glossary	**105**
Support	**108**

Welcome

We warmly welcome you to Batch Performance Analytics. The aim of this document is to enable you to use Batch Performance Analytics both comprehensively and efficiently. Batch Performance Analytics is being continuously improved. This document applies to Batch Performance Analytics Version 1.4.

Safety information

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary, and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit https://www.siemens.com/industrialsecurity.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under https://www.siemens.com/cert.

Notes on protecting administrator accounts

A user with administrator rights has extensive access and manipulation possibilities. Therefore, make sure that the administrator account is adequately protected to prevent unauthorized changes. Use secure passwords and use a standard user account for regular operation. Other measures, such as the use of security policies, should be applied as required.

Export Control Classification

AL: N
ECCN: EAR99

Getting started

This user manual provides guidance on using the **Batch Performance Analytics (BPA)** application, including:

- Accessing the Batch Performance Analytics start page.
- Navigating the user interface and utilizing available controls.
- Understanding the information provided within the app.
- Effectively using BPA insights to improve batch process performance.

Understanding Batch Performance Analytics

In batch processing, maintaining consistent product quality and minimizing downtime due to defects are critical. Continuous monitoring of process conditions helps detect atypical behaviors, allowing operators to take corrective actions early—such as adjusting parameters or scheduling maintenance.

The BPA application enhances decision-making by:

- Providing data-driven insights for improving batch production performance.
- Monitoring running batches for deviations from normal operation (anomalies).
- Enabling proactive interventions to optimize processes and ensure stable product quality.

Data management in BPA

Batch data can be:

- Uploaded manually through the BPA interface.
- Transferred automatically via a data collector installed in your system (refer to the Data collector user manual for details).

Data sources:
BPA integrates with SIMATIC BATCH Report, which logs batch and recipe data:

- Batch Logs: Record process events (e.g., start/end times, setpoints, actual values, operator actions, and fault messages).
- Recipe Logs: Document the structure and setpoints of a basic recipe.

For long-term archiving, SIMATIC Process Historian can be used for storage and evaluation of batch data.

How BPA works:

- BPA applies machine learning and user-defined thresholds to learn and establish normal batch conditions.
- It performs anomaly detection on both archived batch data and real-time production data.
- It helps detect deviations early, allowing operators to intervene quickly and improve process reliability.

Note: A general understanding of automation and batch process control systems is recommended to fully utilize this documentation.

Using Batch Performance Analytics

Using the Batch Performance Analytics app involves a series of steps to effectively monitor, analyze, and optimize batch processes. Here is a comprehensive guide on how to use the app:

1. Setting up the application:

- Create a Process Cell (PCell) within the app.
- Ensure that you have the necessary licenses by accessing the "License management" section.

2. Inputting data:

- Under "Batch Sources", upload batch archives in XML format, which contain essential batch data.
- Upload trend data as CSV files, containing sensor information for batch processes.

3. Mapping data:

- Perform data mapping to connect batch data with trend data for a comprehensive analysis.

4. Batch qualification:

- Categorize batches as 'good' or 'bad' to assess batch quality. Virtual parameters can be used to define custom criteria for this classification.

5. Exploring data:

- Begin by navigating to the "Production overview" section to visualize produced batches over a specified time period in a time chart, along with their qualifications.
- In "Details," explore individual batches in depth. Each batch features a Gantt chart depicting units RUPs, ROPs, and phases. You can also view sensor curves for specific recipe procedure elements.
- The dashboard provides various key performance indicators (KPIs) such as "Batches by cycle time," "Batches by state distribution," "Batches by process message," "Batches by process operator holdups," and "Batches by unit allocation time." A table lists all produced batches, including recipe, product, start and end times, duration, status, and quality.

6. Evaluating unit efficiency:

- Measure unit efficiency in terms of availability, performance, quality, and time losses.
- Analyze specific KPI details for each unit.

7. Performing analysis:

- Define analysis objectives and create a model in Model library.
- Specify the instance type (RUP/ROP/phases), sensors, and settings.
- Train the model successfully before running the analysis.

8. Reviewing results:

- Once your models are trained, you can initiate an analysis. The results are available in a dashboard.
- View the number of detected anomalies over a given period.
- Access detailed anomaly reports for each model.

- The dashboard also provides KPIs related to anomalies, including "Anomalies by model", "Anomalies by units", "Anomalies by deviation type", "Anomalies by time deviation", "Anomalies by batch quality", "Anomalies by sensors", and "Anomalies by instance run".

9. Advanced analysis:

- To further support your analysis, the app offers cluster analyses for instances (to identify variations in sub-processes and meaningful clusters for training), anomalies (to identify patterns for root cause analysis), and training data clustering (to optimize your model).

The app's functionalities are detailed comprehensively in the accompanying document. By following these steps, you can use Batch Performance Analytics to improve batch processes, detect inefficiencies, and enhance overall production performance.

First-time use & logging in

BPA is a cloud-based application requiring a valid username and password for access. User accounts are managed by the app administrator within the application.

System requirements

For an optimal experience, use the following browsers:

- ✅ Google Chrome
- ✅ Microsoft Edge
- ❌ Internet Explorer is not supported.

Logging in to BPA

1. Open the login page via the provided URL.
2. Enter your username or email address.
3. Enter your password.
4. Click "Sign In" to access the BPA home page.

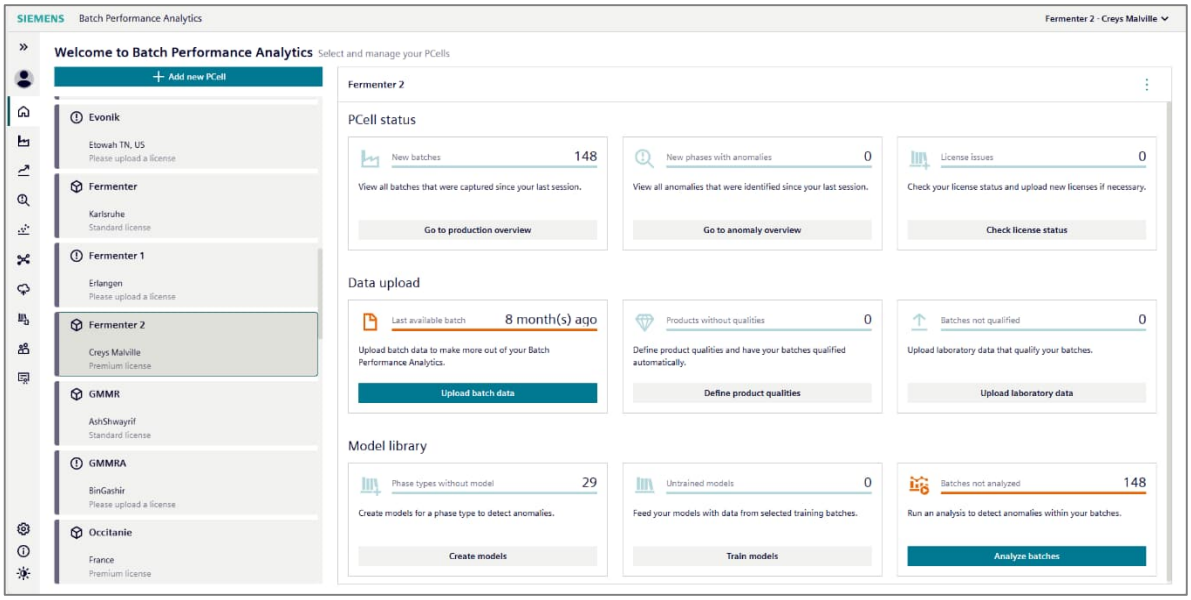
Note For security reasons, the system automatically logs users out after a period of inactivity.

Navigating Batch Performance Analytics

After logging into Batch Performance Analytics (BPA), you will see an overview of all available Process Cells (PCells).

Accessing and selecting PCells

- PCells are displayed in a list on the left-hand side, sorted alphabetically by name.
- A quick-selection dropdown menu in the upper-right corner allows you to switch between PCells easily.
- The right-hand panel provides key details about the selected PCell, including its status, batch sources, and model configuration.
- Actionable tiles highlight areas requiring attention, allowing you to navigate directly to tasks that need to be addressed.

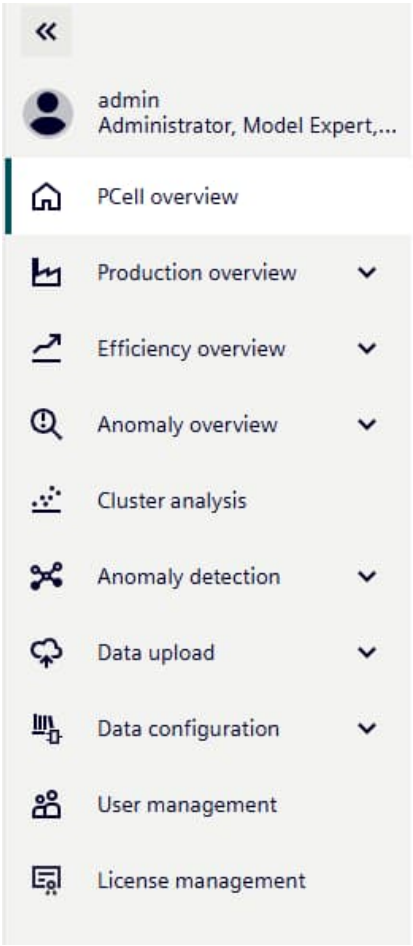


Exploring PCell details

- Click on a PCell's icon in the taskbar (located on the left edge of the screen) to view detailed information.

Navigating the sidebar menu

- To display descriptions of sidebar menu icons, click the Expand Sidebar icon in the upper-left corner.



Managing your user profile

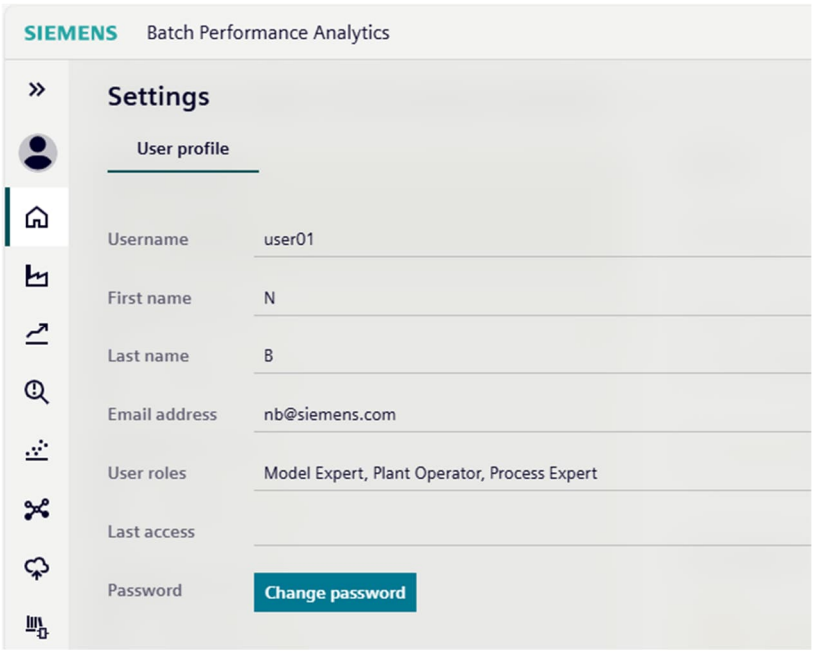
The user profile section in the Batch Performance Analytics (BPA) app allows you to view and manage your account settings. To access the profile, navigate to the sidebar menu and click on the User profile icon. This opens the Settings view, where you can review your personal information.

The profile displays essential details, including your username, registered name, email address, assigned user roles such as Administrator, Model Expert, Plant Operator, or Process Expert, and the date and time of your last login.

You can change your password directly from the profile settings. To do so, select the Change password option, enter your current password, provide a new password, confirm it, and submit the changes. The password must meet the app's security requirements.

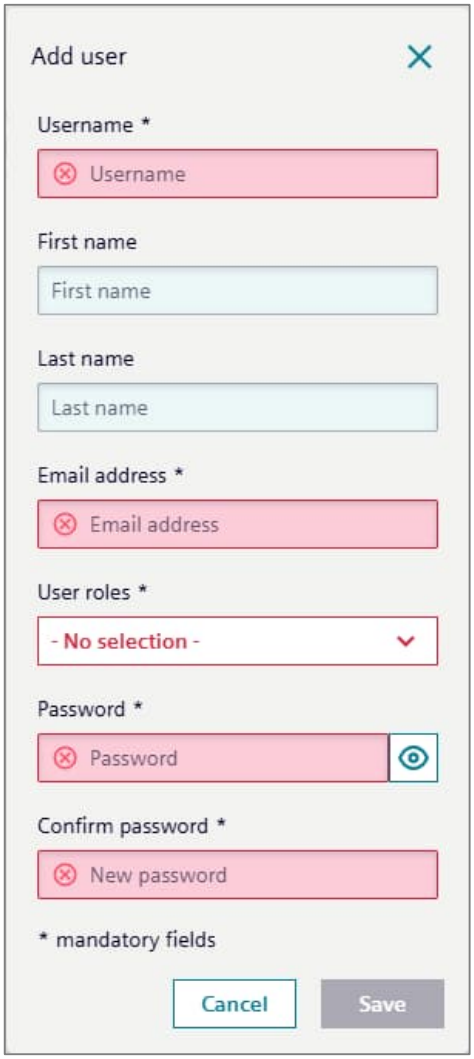
In addition to updating your password, you can log out from this section. However, regular users cannot modify their name or role, as these settings are managed by administrators. Keeping your profile information accurate ensures secure and efficient access to the BPA app.

.

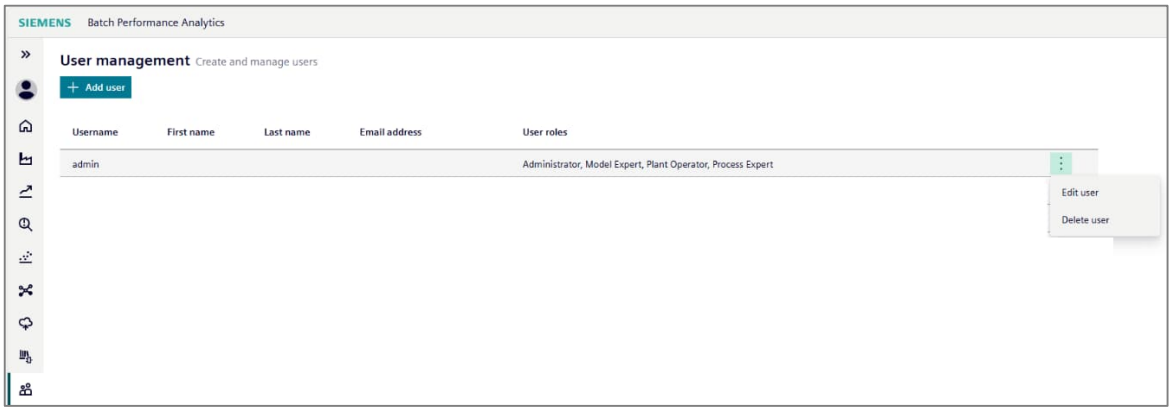


Managing users

User management enables administrators to control user access and facilitate the onboarding and offboarding of users from IT resources. To add a new user, go to "User management" and click on "+ Add New." Required fields are marked with an asterisk (*).

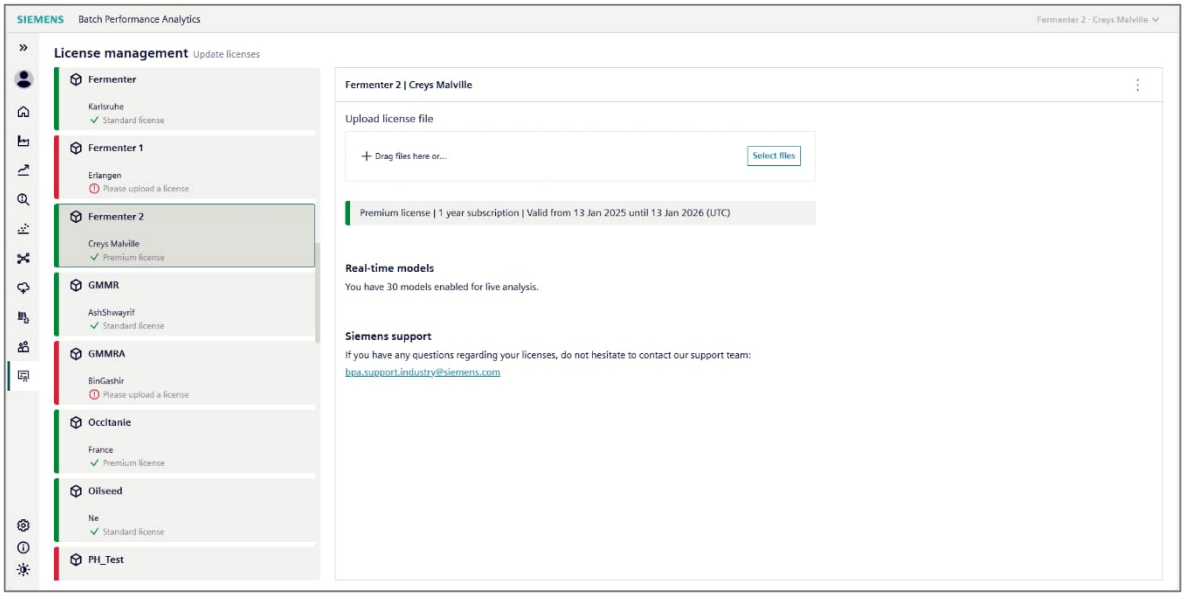


To edit or delete an existing user, click the three-dot icon at the end of the corresponding line.



Managing licenses

The license management section is designed for administrators to upload purchased license files. For any questions or issues related to licenses, please reach out to the support email address.



Managing data upload

The data upload feature allows you to manually import data files into the application, enabling you to consolidate data from various sources. The available data types for uploading include:

1. **Batch archives**
   Batch archives, typically in the form of "SIMATIC BATCH Reports", record recipe details and batch data as logs. These logs contain information needed for tracking the process, such as start and end times, setpoints, actual values, operator interventions, and fault messages. Additionally, recipe logs provide insight into the structure and setpoints of the base recipe used in the batch process.
2. **Trend data**
   This type of data includes information about trends and measurements taken during the batch process. Trend data helps monitor and analyze the behavior of various process parameters over time.
3. **Lab data**
   Lab data includes quality-related measurements and information generated by a Laboratory Information Management System (LIMS). This data typically involves quality control tests, sampling points, and product evaluations that help assess the overall quality of the batch.

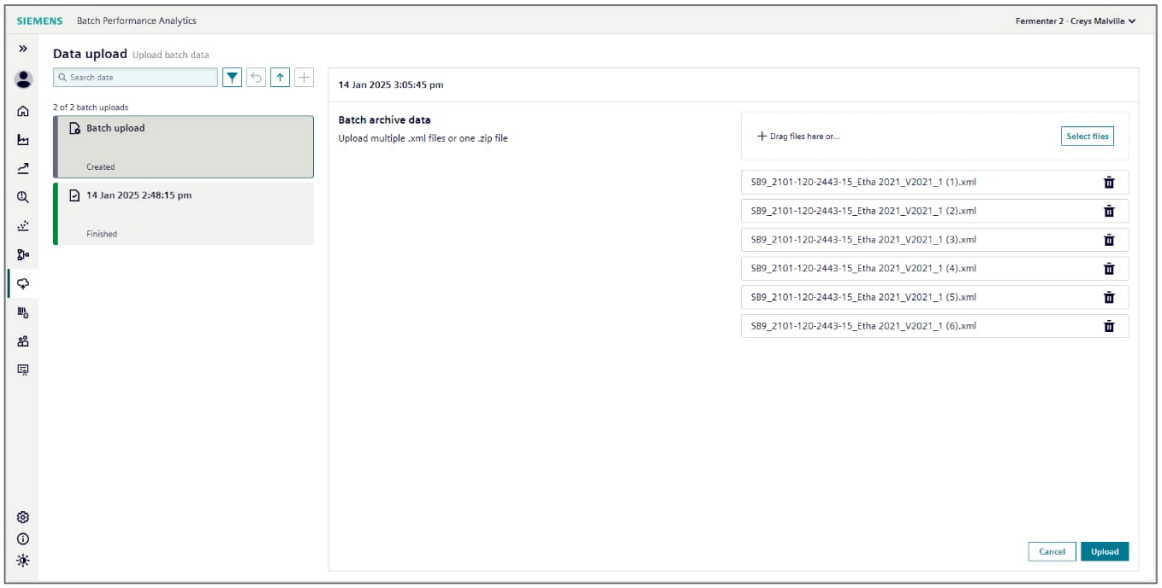
Uploading batch archive data

To upload batch archive data, navigate to the "Data upload" section. Open the sidebar, click on the "Data upload" icon, and select "Batch data" from the dropdown menu.

Starting a new upload task

1. Click the **"+"** icon on the left side, next to the filter and sort options, to create a new batch upload task.
2. A file selection field will appear on the right side of the screen. You can:
   - Click "Select files" to browse and choose your files.
   - Drag and drop files directly into the designated area.
3. Supported file formats include:
   - Individual batch XML files.
   - A ZIP file containing multiple XML files.

The selected files will be listed below the upload field, where you can review them and remove any unnecessary files before proceeding.

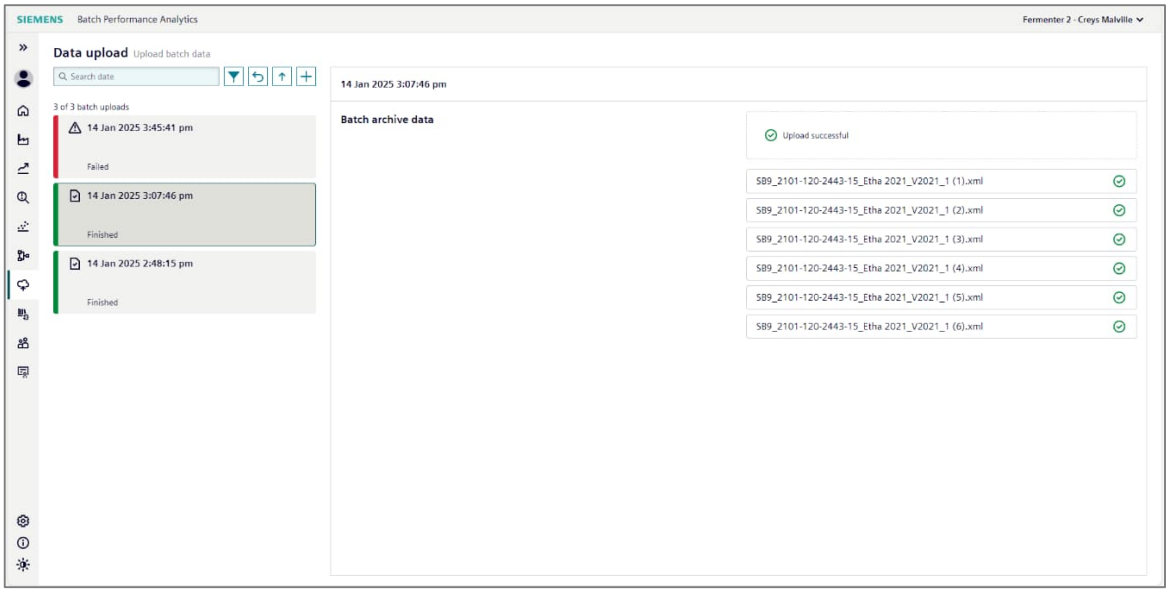


Uploading the files

1. Click "Upload" to begin the process.
2. A progress indicator will appear, displaying the upload status.
3. The status of the upload task will be shown on the left-hand side:
    - "Finished"– All files uploaded successfully.
    - "Warning" – Some files had issues.
    - "Failed" – Upload unsuccessful. Hover over the failure icon for details.

Managing uploaded data

- The most recent upload task appears at the top of the list.
- You can sort tasks in ascending or descending order.
- Use advanced filters to search for specific upload tasks by date or status (Finished, Warning, Failed).



Note Do not close the application or navigate away until the upload is complete. The busy icon will disappear once the process is finalized, and parsing of the uploaded files will begin.

Preparing trend data

In many cases, the required sensor measurement data for analysis may be missing or incomplete in the batch XML files. To address this, measured values can be extracted from PCS 7 archives and exported as CSV files. These CSV files can then be imported into the app, where they can be assigned manually or using a mapping template.

The process consists of three steps:

1. **Configure trend data upload settings** – Adjust the upload settings based on your CSV trend data files.
2. **Upload CSV trend data files** – Import the extracted sensor data into the app.
3. **Map sensors to tags** – Assign the uploaded sensor data to the appropriate tags, either manually or using a predefined mapping template.

The following sections provide detailed instructions for each step. Below is an example of a CSV file containing measured values:

ts	MCM_F0351	MCM_F0384	MCM_P0284	…
01.03.2023 02:00:00	12,2	1,032	9,253	
01.03.2023 02:00:15	12,5	1,014	9,232	
01.03.2023 02:00:30	12,7	1,073	9,244	
…				

Configuring trend data upload settings

To access the Data upload – Trend data, navigate to the sidebar, click on the "Data upload" icon, and select "Trend data" from the dropdown menu.

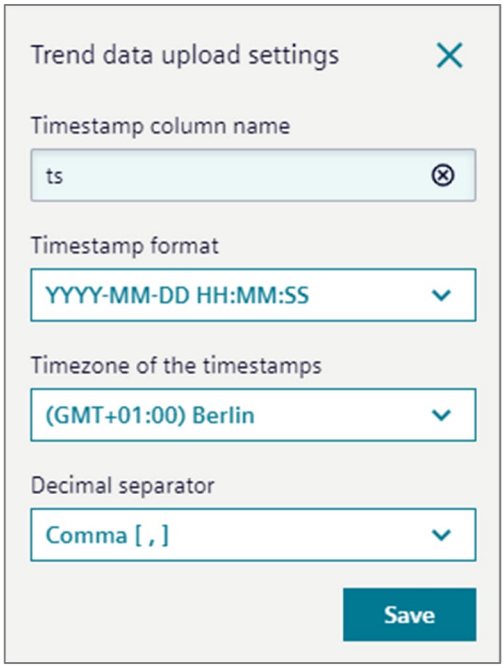
To set up your trend data upload preferences, follow these steps:

1. **Access the settings**:
   In the view, click on the settings wheel icon located in the upper left corner. This opens the "Trend data upload settings" dialog window.



2. **Specify the timestamp column**:
   In the settings dialog, enter the exact name of the timestamp column as it appears in your CSV trend data file. This ensures accurate data mapping during upload.

3. **Select the timestamp format**:
   Choose the appropriate timestamp format from the pull-down menu to match the format used in your CSV file. This step ensures the system correctly interprets the time data.
4. **Set the time zone**:
   If the timestamps in your CSV file do not include time zone information, select the corresponding time zone from the pull-down menu.
5. **Define the decimal separator**:
   Specify the decimal separator (e.g., dot or comma) used for numerical values in your CSV trend data file by selecting it from the pull-down menu.
6. **Save the configuration**:
   Once all the fields are configured correctly, click the "Save" button to confirm your settings. The dialog window will close, and your preferences will be applied for all subsequent trend data uploads.



Uploading trend data

In order to analyze trend data, you need to upload sensor measurement values extracted from external sources in CSV format. The following steps guide you through the process of selecting, uploading, and managing your trend data files within the application.

1. Access the trend data upload section

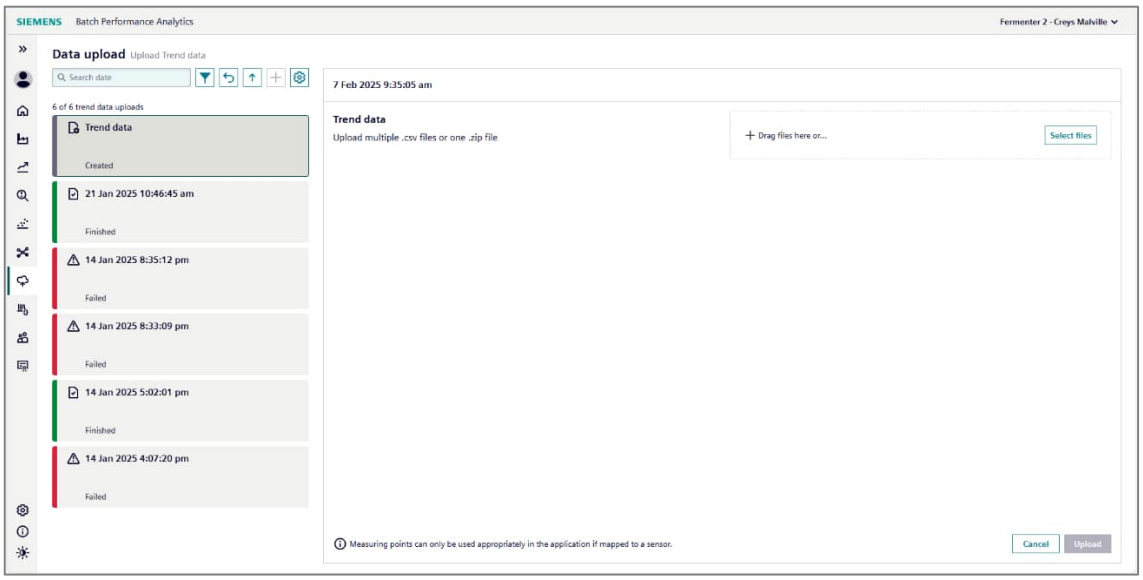
Navigate to the Trend data upload section. Click the **"+"** icon on the left-hand side, next to the sorting and filtering icons. This will create a new trend data upload task, automatically timestamped with the current date and time.

2. Select your CSV trend data file

On the right-hand side of the screen, locate the file selection field. You can:

- Click the "Select files" button to browse and select one or more CSV files (or a single .zip file containing multiple CSVs).

- Drag and drop the file(s) directly into the designated upload area.



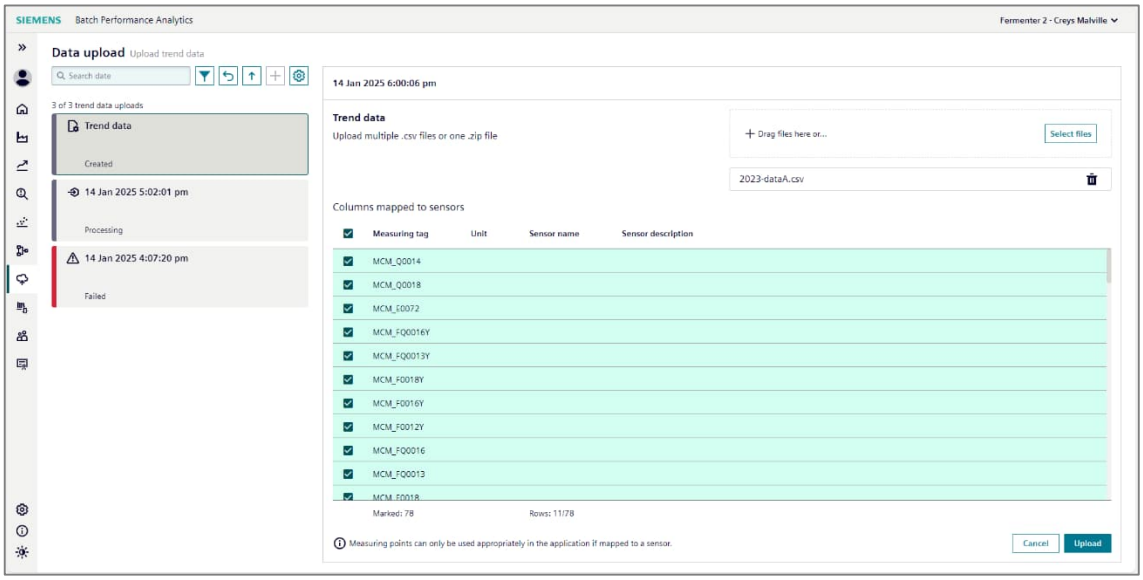
3. Manage selected files

Once your file(s) are selected:

- The file name will appear below the selection area.
- You can remove and replace files if necessary.
- A list of columns mapped to sensors or measuring points from the CSV file will be displayed.
- Mapping can be configured under Data configuration → Trend data mapping (see the "Managing data configuration" section for details).

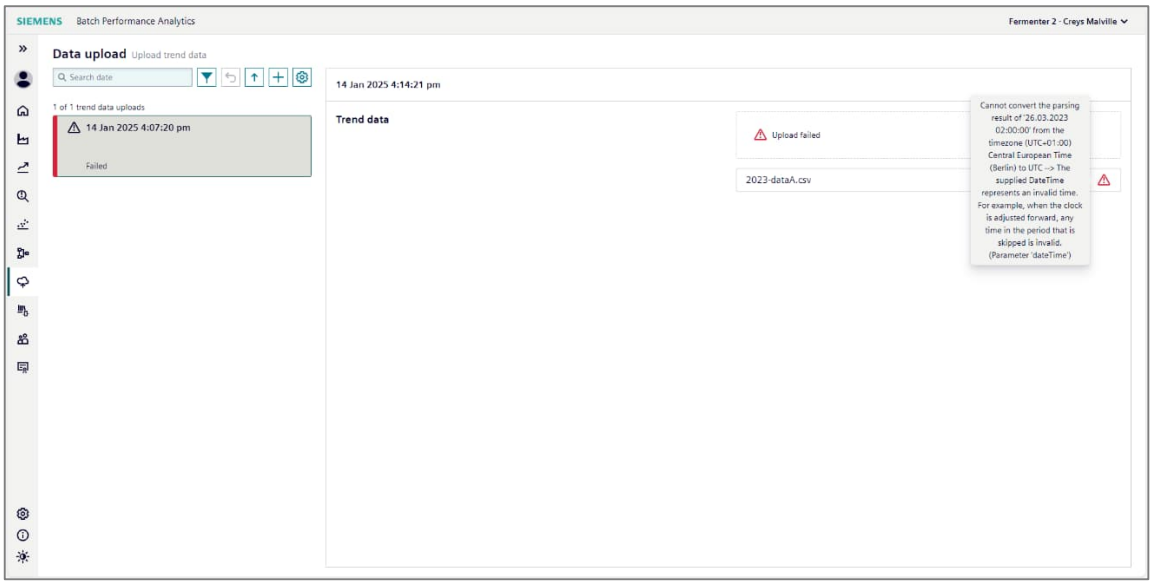
4. Start the upload process

Click the "Upload" button to begin. A progress indicator will appear, showing real-time updates on the upload status.



5. Monitor upload status

1. A progress indicator will appear, displaying the upload status.
2. The status of the upload task will be shown on the left-hand side:
    - "Finished" (Green) – All files uploaded successfully.
    - "Warning" – Some files had issues.
    - "Failed" – Upload unsuccessful. Hover over the failure icon for details.



Note Do not close the application or navigate away until the upload is complete. The busy icon will disappear once the process is finalized, and parsing of the uploaded files will begin.

Uploading lab data for quality assessment

To evaluate the quality of a finished batch, it is essential to define the criteria and characteristics the batch must meet to be deemed acceptable. These quality parameters, often derived from production data, are provided in a structured CSV file format.

Prerequisites for lab data upload

Before uploading lab data, the following foundational steps must be completed (as described in the chapter on Data configuration):

1. **Establishing sampling points**:
    - Assign quality parameters to a specific sampling point.
    - Choose between a batch-specific sampling point or a plant-wide sampling point with a defined reference period, depending on the requirements of your quality control process.
2. **Defining product qualities and tolerance limits**:
    - Specify the acceptable ranges and limits for product quality parameters.
3. **Uploading quality parameter data files**:
    - Prepare and organize your CSV files containing quality parameter data.
    - Select the relevant sampling point to which these files will be associated.

Purpose of lab data upload

The process of uploading lab data culminates in a comprehensive quality assessment of the produced batches. By associating quality parameter data with predefined sampling points, the system enables accurate evaluation and qualification of batches.

This structured approach ensures a seamless integration of lab data into the analytics system, paving the way for reliable quality assessments and effective production monitoring. Detailed instructions for each step are elaborated in subsequent chapters.

Creating the lab data CSV-file

To create the lab data CSV-file, please follow these guidelines:

1. Start by including a header row that designates the columns in the file. The first column should be reserved for the timestamp (ts) of the recorded values, while the remaining columns can be used for various quality parameters (measuring points).
2. If the data in the file pertains to specific batches, remember to include a "Batch ID" column to uniquely identify each batch.

Here are two illustrative examples:

Example 1: Lab data CSV-file (Without batch ID, Plant sampling point with reference point)

ts	Name Quality parameter 1	Name Quality parameter 2	Name Quality parameter …	
01.03.2023 02:00	787,2	66,72		
01.03.2023 06:00	785,5	64,5		
01.03.2023 10:00	784,3	68,5		
01.03.2023 14:00	788,7	78,8		
…				

Example 2: Lab data CSV-file (With batch ID, Batch specific sampling point)

ts	Name Quality parameter 1	Name Quality parameter 2	Name Quality parameter …	Batch ID
01.03.2023 02:15	487,2	66,72		13585
01.03.2023 04:55	485,5	64,5		13591
01.03.2023 10:08	484,3	68,5		13594
01.03.2023 15:33	488,7	78,8		13599
…				

By following these guidelines and structuring your lab data file accordingly, you can effectively organize and manage your data for further processing.

Configuring lab data upload settings

To access the Data upload – Lab data section, navigate to the sidebar, click on the "Data upload" icon, and select "Lab data" from the dropdown menu.

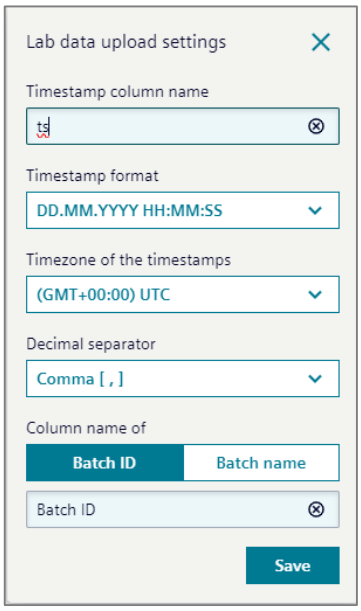
Before uploading your lab data CSV file, it's essential to configure specific settings to ensure compatibility with the file's header. These configurations include:

1. Specifying the name of the timestamp column.
2. Defining the timestamp format.
3. Setting the appropriate time zone.
4. Selecting the decimal separator for numeric values.

If your lab data includes batch-specific quality parameters, you'll also need to specify the Batch ID column name. If not, this field can be left blank.

Step-by-step guide to configure lab data upload settings

1. Click the settings wheel icon. The "Lab data upload settings" dialog window will open.
2. Input the column name for timestamps as it appears in your CSV file.
3. Choose the correct timestamp format from the drop-down menu.
4. Select the appropriate time zone from the available options in the drop-down menu.
5. Specify the decimal separator for numeric values by selecting the appropriate option.
6. If your data includes batch-specific sampling points, enter the Batch ID column name that matches the CSV file. Leave this field blank if not applicable.
7. Ensure you click "Save" to store your configurations.



Initiating lab data upload

After configuring your upload settings, you can proceed with the lab data upload process. Keep in mind that only one file can be uploaded at a time. Follow the steps below to initiate and manage the upload process:

Step-by-step procedure:

1. **Create a new upload task**
   Click on the "+" icon located on the left-hand side, next to the sorting and search field. This action will create a new "upload task."

2. **Select a file for upload**

    - Use the "Select files" button to browse and select your CSV lab data file from your directory.
    - Alternatively, you can drag and drop the file into the upload field.
      Once selected, the file name will appear below the field. If needed, you can remove the file before proceeding.

3. **Start the upload process**
   Click the "Upload" button to initiate the upload process.

4. **Map columns to quality parameters**

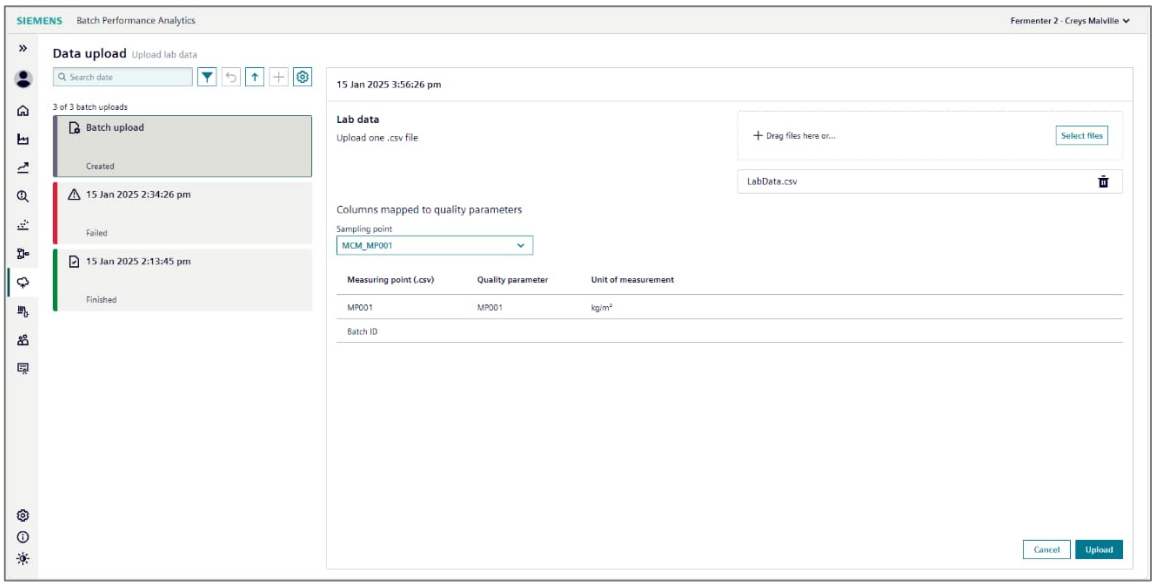
    - After starting the upload, a section titled "Columns mapped to quality parameters" will appear.
    - Use the dropdown menu to select the sampling point to which the data should be mapped.
    - A list of all measuring points and quality parameters from your CSV file will be displayed, showing which parameters will be imported.

5. **Import data**
   Click the "Upload" button again to import the data to the corresponding sampling point.

6. **Monitor the upload status**

    - During the upload, a busy indicator will appear.
    - On the left-hand side, the status of the "Lab data upload" task will be displayed.

        - If the upload is successful, the status will turn green with the message "Finished."
        - If there is an error, a warning or failure message will appear. On the right-hand side, the file will also be marked with either "successful" or "failed." Hover over the "failed" status symbol to see a detailed error description.



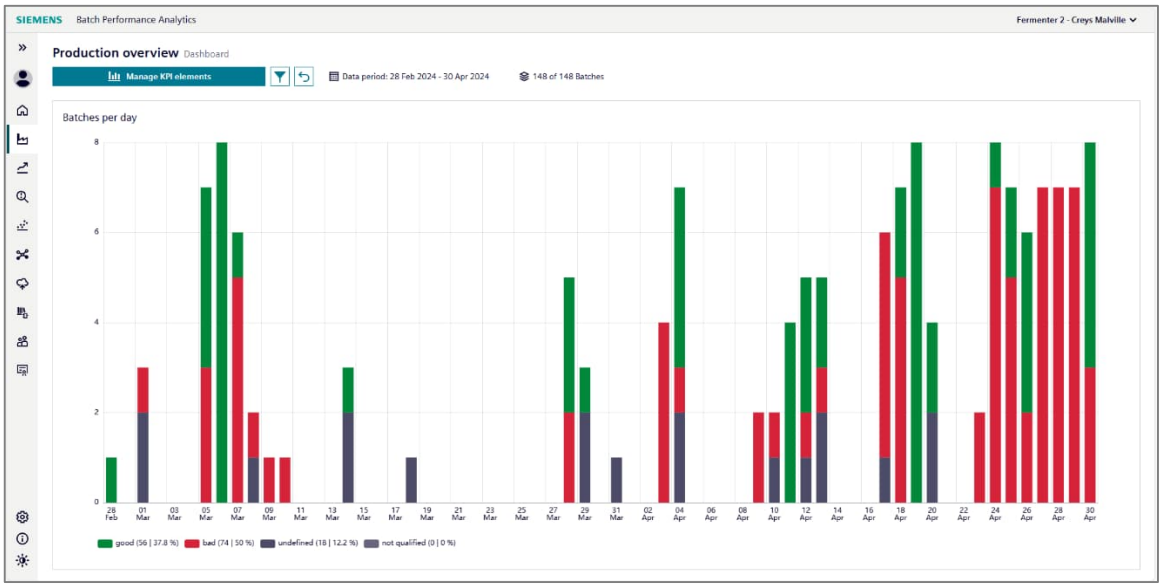
7. **Sort and filter uploaded tasks**

    - The most recent Lab data upload task will appear at the top of the list.

- You can sort the tasks in ascending or descending order.
- Use advanced filtering options to search for specific tasks based on a date range or upload status.

8. **Automatic batch qualification**
   Once the lab data is uploaded, the affected batches will automatically undergo qualification. These batches will be assigned a status such as:

   - Good
   - Bad
   - Undefined
   - Not qualified



Managing data configuration

If no measuring points have been preselected, you can manually select them at this point. To access the trend data mapping, navigate to the sidebar, click on the "Data configuration" icon, and select "Trend data mapping" from the dropdown menu.

Alternatively, you can prepare a mapping template beforehand for easier mapping during the first data import, as described in the next chapter.

Preparing mapping templates

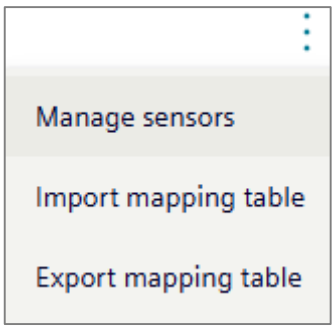
To simplify the process of mapping sensors to your data, it's recommended to prepare a mapping template that can be easily imported into the system. The mapping template is in CSV format. The first line in the CSV file is used to define column names, and it must be structured exactly as in the example provided below. Starting from the second line, you should input the following details for each sensor:

1. **Tag names:** These are the names of the sensors as they appear in the data files.
2. **Assignment to batch unit:** Specify the batch unit to which the sensor is assigned.
3. **Sensor name:** This is the name of the sensor as it's stored and displayed in BPA.
4. **Measuring unit (optional):** Indicate the unit of measurement for the sensor's data.
5. **Description (optional):** You can provide an optional description for the sensor.

MeasuringPoint	Unit	Sensor	UnitOfMeasurement	Description
MCM_F0351	RE01	MCM_F0351	l/s	Inlet Flow
MCM_F0384	RE01	MCM_F0384	m^3/h	Outlet Flow
MCM_P028	RE01	MCM_P0284	bar	Inlet Pressure

Trend data mapping

This section covers essential data management features within the application, including sensor management, trend data mapping, and exporting mapping tables. These features can be accessed by clicking on the three-dot icon in the top-right corner of the screen and selecting the desired option from the dropdown menu. Users can manually add and configure sensors, import and adjust trend data mappings, and export mapping tables for external use. The following chapters provide step-by-step guidance on managing these functions.

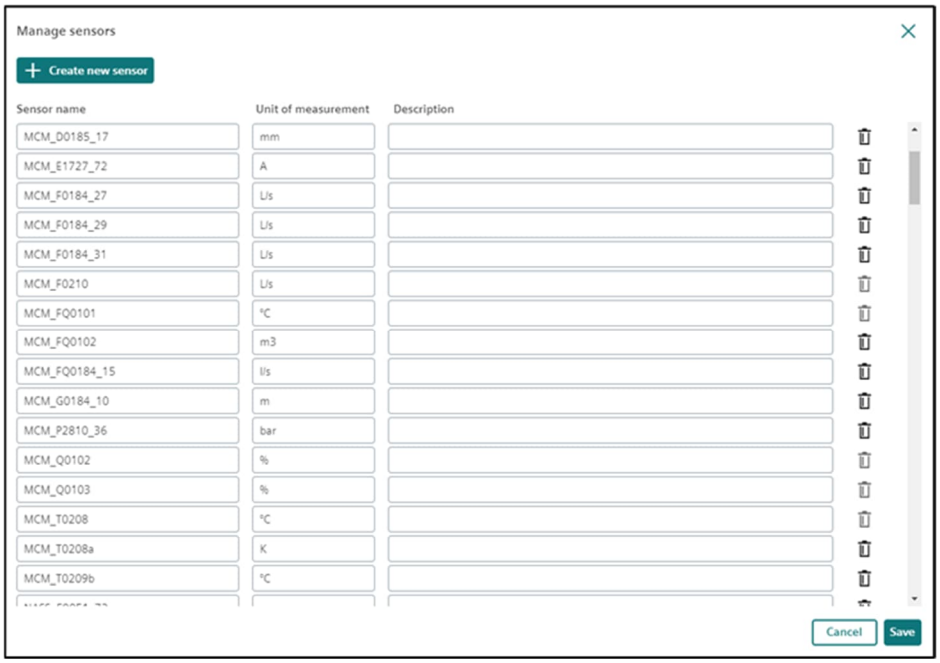


Managing Sensors

The **"Manage sensors"** feature enables you to manually add new sensor groups by entering essential details such as the sensor name, unit of measurement, and an optional description. Follow the steps below to manage sensors:

Procedure for "Manage sensors"

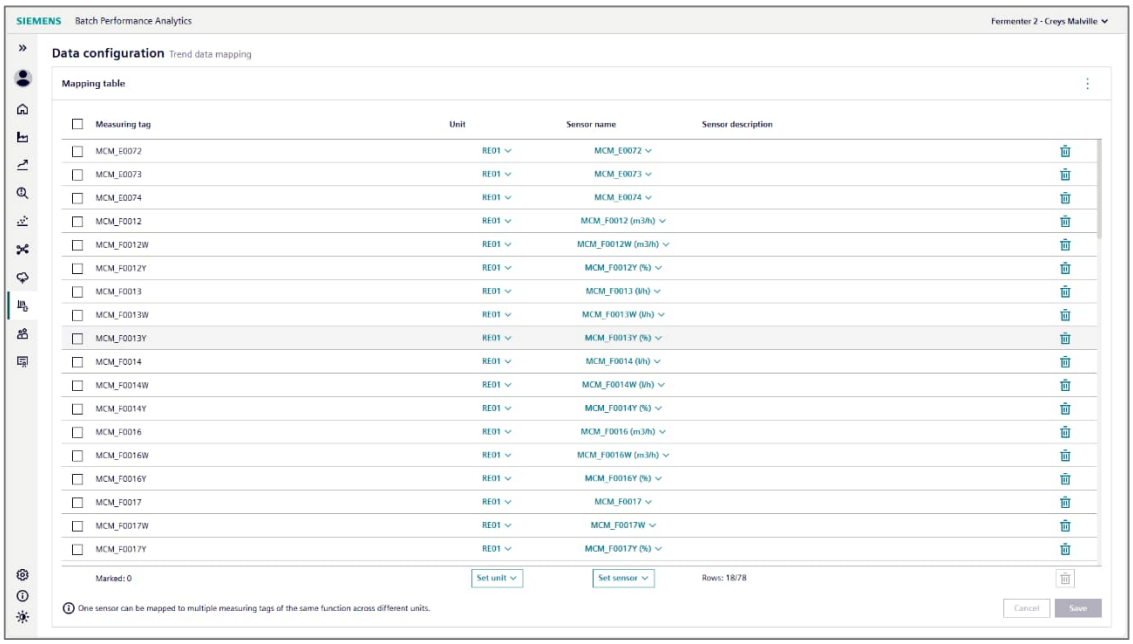
1. Click on the three-dot icon located in the top right corner of the screen.
2. Select "Manage sensors" from the drop-down menu.
3. Click "+ Create new sensor" to generate an empty line for a new sensor entry.
4. Enter the sensor name, unit of measurement, and a description if needed.
5. After entering all necessary details for the new sensors, click "Save" to confirm and store your changes.



Configuring trend data mapping

To configure trend data mapping, follow these steps:

1. To access the trend data mapping section, navigate to the sidebar, click on the "Data configuration" icon, and select "Trend data mapping" from the dropdown menu.
2. Click on the three-dot icon located in the top right corner of the screen.
3. From the dropdown menu, select "Import mapping table."
4. Locate and select your CSV mapping file from your directory.
5. Review the imported mapping table
    - The mapping table will be displayed, reflecting the contents of your imported CSV file.
    - You can make adjustments to the table, including:
        - Editing the "Unit" and "Sensor name."
        - Deleting any measuring tag from the list and database if necessary.
6. Once you've made the required updates, click "Save" to confirm and store your changes.



Exporting mapping table

The "Export mapping table" feature allows you to save and share the mapping table in CSV format. Follow these steps to export the mapping table:

Procedure for exporting mapping table

1. Click on the three-dot icon located in the top-right corner of the screen.
2. Select "Export mapping table" from the drop-down menu.
3. The mapping table will be exported as a CSV file, which you can save and share as needed.

Qualifying batches

In a production plant, products are produced in large quantities based on complex manufacturing specifications. These products must meet numerous general conditions. Quality in manufacturing is controlled, among other things, based on random samples. Production management systems always record all relevant process values.

Defining the quality of a finished batch involves specifying the criteria and characteristics that the products within the batch should meet to be considered of acceptable quality.

The essential quality parameters are provided in a CSV file format.

If lab data is missing, the user can qualify the batch in the UI manually (e.g., in table view on the production overview). In the pursuit of quality, there are two distinct approaches: the first involves dedicating specific quality parameters to each batch of products produced, ensuring a tailored assessment. Alternatively, a more continuous approach involves sampling at fixed intervals within the production facility, often aligned with a predefined reference period.

The following steps are performed. First, the establishment of a sampling point, to which quality parameters are assigned. The choice between a batch-specific sampling point or a plant-wide sampling point with a reference period depends on the specific quality control needs.

Following this, the definition of product qualities and their corresponding tolerance limits is addressed, setting the stage for quality evaluation. Finally, the upload of quality parameter values data files, along with the selection of the intended sampling point, culminates in a quality assessment of the batches.

This step-by-step process is comprehensively elucidated in the forthcoming chapters.

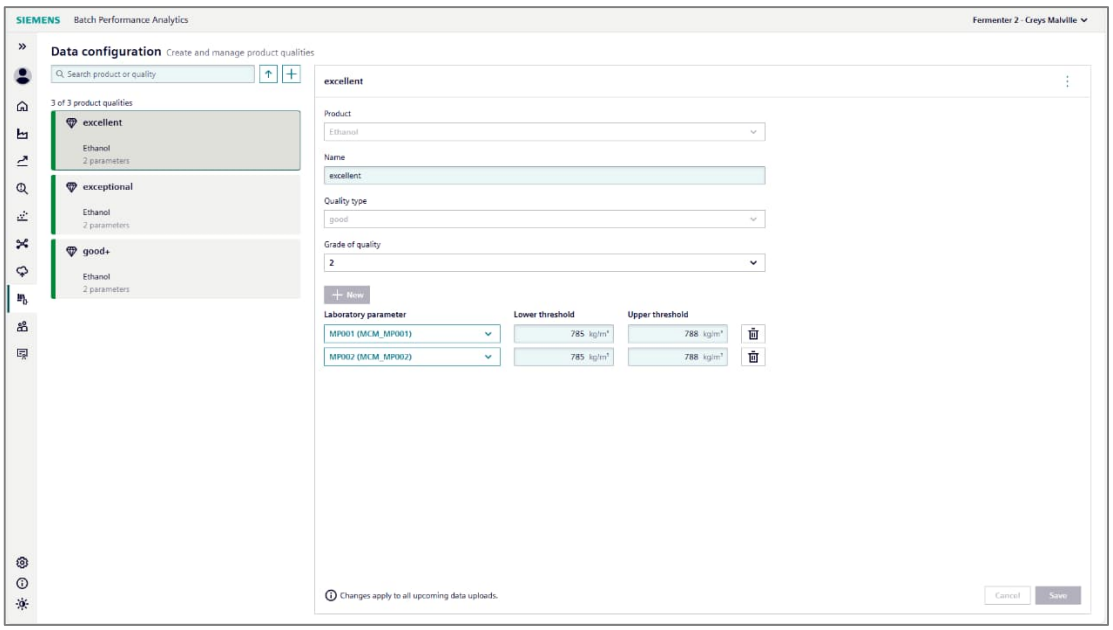
Setting product quality

Defining product quality is essential to ensure consistent grading and quality control for finished batches. This involves creating a grading system that categorizes the quality of batches, with designations such as **"Excellent," "Good,"** or **"Acceptable."**

Each quality parameter is associated with tolerance limits, specifying the acceptable range or values needed to meet a particular quality grade. These limits may vary depending on the parameter's importance in the overall quality assessment.

Procedure for setting product quality

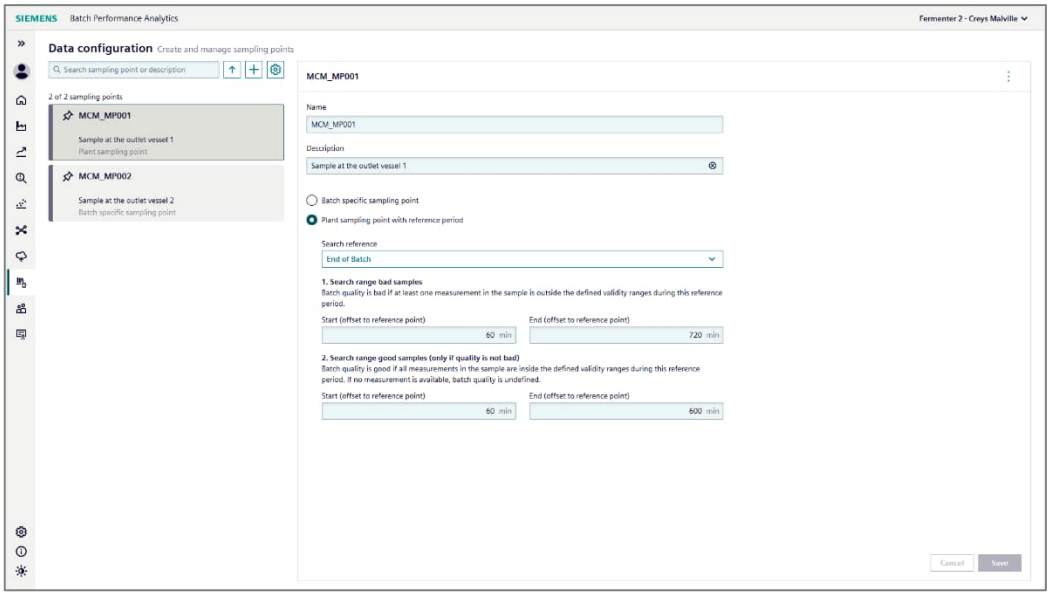
1. Navigate to the sidebar, click on the "Data configuration" icon, and select "Product quality" from the dropdown menu.
2. Click the "+" icon to create a new product quality profile. This action will generate a "Product quality profile" tile.
3. On the right-hand side, select the specific product for which you are defining quality parameters from the dropdown menu.
4. Provide a name for the product quality profile that reflects its quality grade (e.g., "Excellent," "Good," "Acceptable," etc.).
5. Assign a numerical grade to the profile.
    - Grade 1 represents the highest quality.
    - Grade 10 represents lower quality.
6. Click "+ New" to add a quality/laboratory parameter.
7. Select the laboratory measuring point from the dropdown menu.
8. Specify the lower limit and upper limit values. These values define the acceptable range (quality band) for the product to meet the assigned quality grade.
9. Once all parameters are set, click "Save" to finalize your product quality profile.



Setting sampling points

To configure sampling points for your data collection, follow the steps below.

1. Navigate to the sidebar, click on the "Data configuration" icon, and select "Sampling points" from the dropdown menu.
2. Click on the "+" icon to create a new sampling point. This action will generate a tile labeled "New sampling point."
3. Enter a name and description for the sampling point in the designated fields.
4. Choose whether the sampling point is:
    - Batch-specific ("Batch-specific sampling point")
    - Plant-wide with a reference period ("Plant sampling point with reference period")
5. Set Reference period (if applicable)
    a. For Plant sampling points with reference periods, define the search ranges for good and bad samples.
    b. Specify the reference point as either the "Start of Batch" or the "End of Batch."
6. Click "Save" to confirm and save your settings.

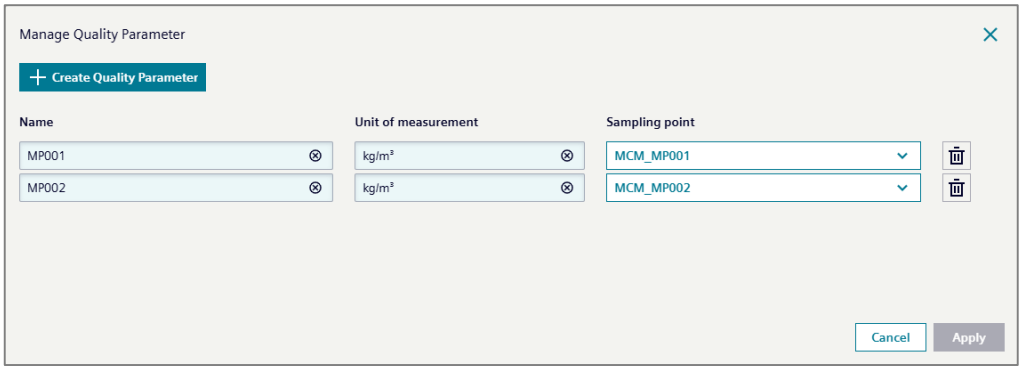


Managing quality parameters

After defining sampling points, you can assign quality parameters from your CSV file to the respective sampling points.

Procedure for assigning quality parameters

1. Click on the settings wheel located to the right of the search box.
2. A dialog window titled "Manage Quality Parameter" will open.
3. Click "+ Create Quality Parameter" in the dialog window.
4. Enter the name of the quality parameter. Ensure this name matches the header name of the column in your CSV file containing lab measurement values.
5. Enter the unit of measurement for the quality parameter.
6. Select the appropriate sampling point from the dropdown menu. This should correspond to the context or location where the quality parameter is defined.
7. If you have multiple quality parameters, repeat the above steps for each one.
8. Click "Apply" to finalize and save your quality parameter assignments.



Configuring virtual parameters

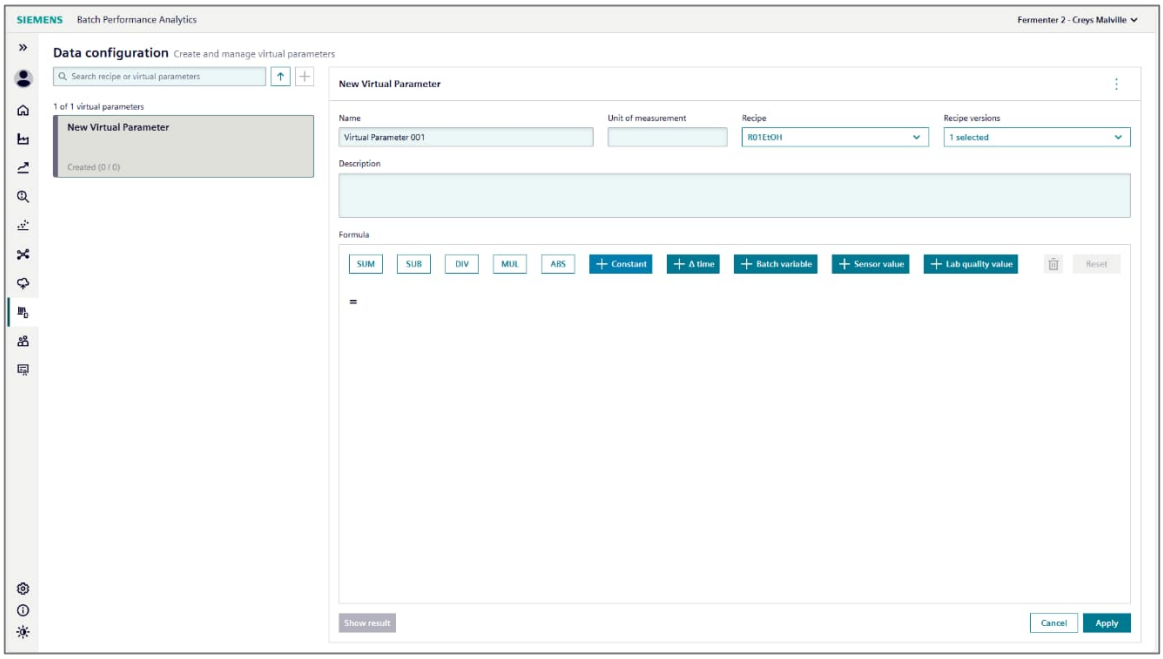
The virtual parameter allows users to utilize available data for identifying optimal batches. This functionality is essential when batch-end quality alone is not enough to identify the best batches for model training. For instance, even if a batch meets the quality standards, specific sub-processes within that batch might not have operated optimally.

Since the models target sub-processes rather than entire batches, it becomes vital to access and utilize all relevant sub-process data. This enables users to combine different data points to identify the most suitable batches for training.

Key features of virtual parameters include a custom formula input field, allowing users to create formulas using arithmetic operations to combine data points. In addition to arithmetic operations, users can incorporate constants, time-intervals, batch variables, sensor values, and lab quality values. The relevant dialogs for configuring these inputs are described in the following chapters.

The batch analysis feature enables the evaluation of sub-process data to identify optimal RUPs, ROPs, and phases. Additionally, various calculation options are available, including statistical operations such as MAX, MIN, AVG, LAST, and FIRST.

When new batches are uploaded or batches come from online sources, the results for all virtual parameters for these batches are automatically triggered and calculated.



Creating a virtual parameter

To create a new virtual parameter, follow these steps:

1. To access the virtual parameters, navigate to the sidebar, click on the "Data configuration" icon, and select "Virtual parameters" from the dropdown menu.
2. Click on the "+" icon located at the top left-hand side of the screen to add a new virtual parameter.
3. On the right-hand side, enter a meaningful name for the virtual parameter. Select a recipe from the dropdown list. If multiple versions of the recipe are available, choose the appropriate one from the dropdown menu. (Optional) Enter a description to provide additional context.
4. Select an arithmetic operator from the following options:

    - SUM (+) – Summation
    - SUB (-) – Subtraction
    - MUL (*) – Multiplication
    - DIV (/) – Division

Note: You can also start your formula with any elements defined under step 5 without first selecting a mathematical operation.

5. Define the operands using one or more of the following:

    - ABS
    - Constant value
    - Time-interval (can be defined in a separate dialog)
    - Batch variables (can be defined in a separate dialog)
    - Sensor values (can be defined in a separate dialog)
    - Lab quality values (can be defined in a separate dialog)

Example workflows:

- Simple variable: Select a sensor value directly to create a simple virtual parameter
- With operation: Click SUM (+), select a batch variable, then select a constant to create a sum
- With ABS: Select ABS function, then choose the variable to get its absolute value

For detailed instructions on how to define the operands, refer to the next sections.

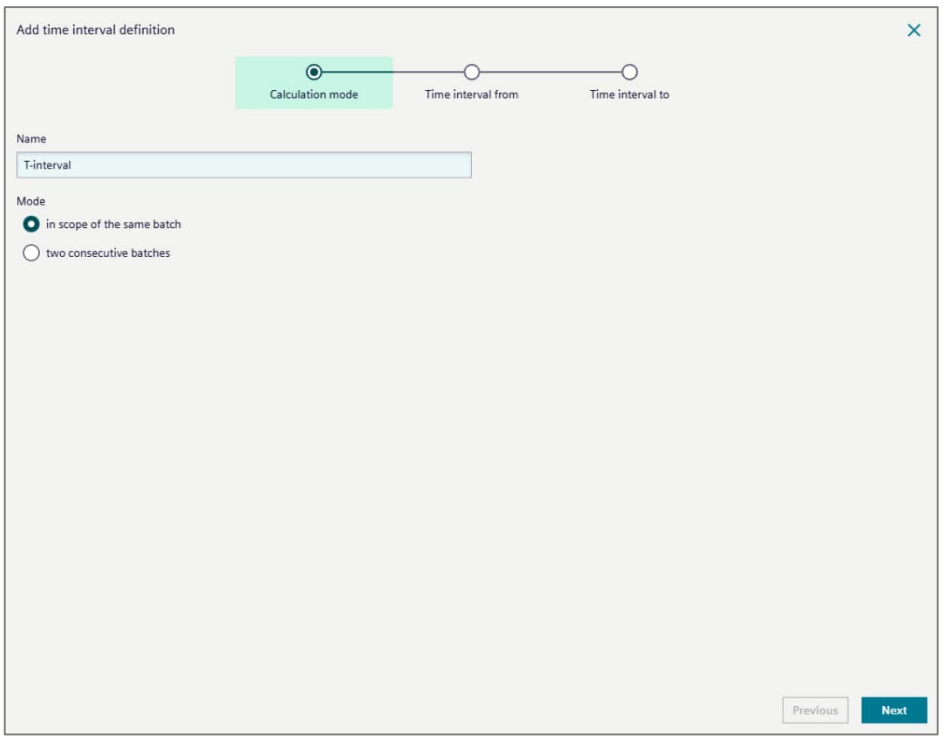
Note: In the formula editor, double-click the variable to replace it. To remove the variable, select it and press Delete.

Virtual parameter using time-intervals

The Time-interval feature allows you to calculate the duration between two points in your production process. This can be done either within a single batch or between consecutive batches.

1. Defining a virtual parameter with time-intervals

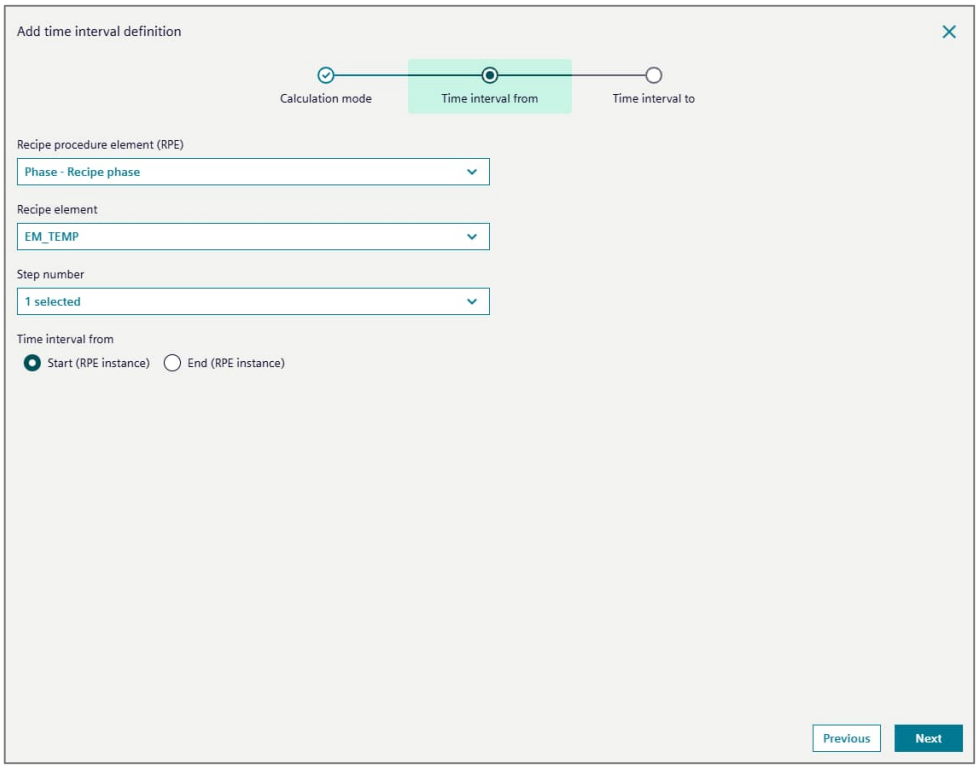
1. Click the "+ Δ Time" button to open the selection dialog.
2. Provide a meaningful name for the time interval
3. Select the calculation mode:
   • Single Batch Mode: Calculate time within the same batch
   • Consecutive Batch Mode: Calculate time between two batches
4. Click Next



5. Configure start point ("FROM")
   Single batch mode options:

   - RUP (Recipe Unit Procedure): Start or End time
   - ROP (Recipe Operation Procedure): Start or End time
   - Phase: Start or End time

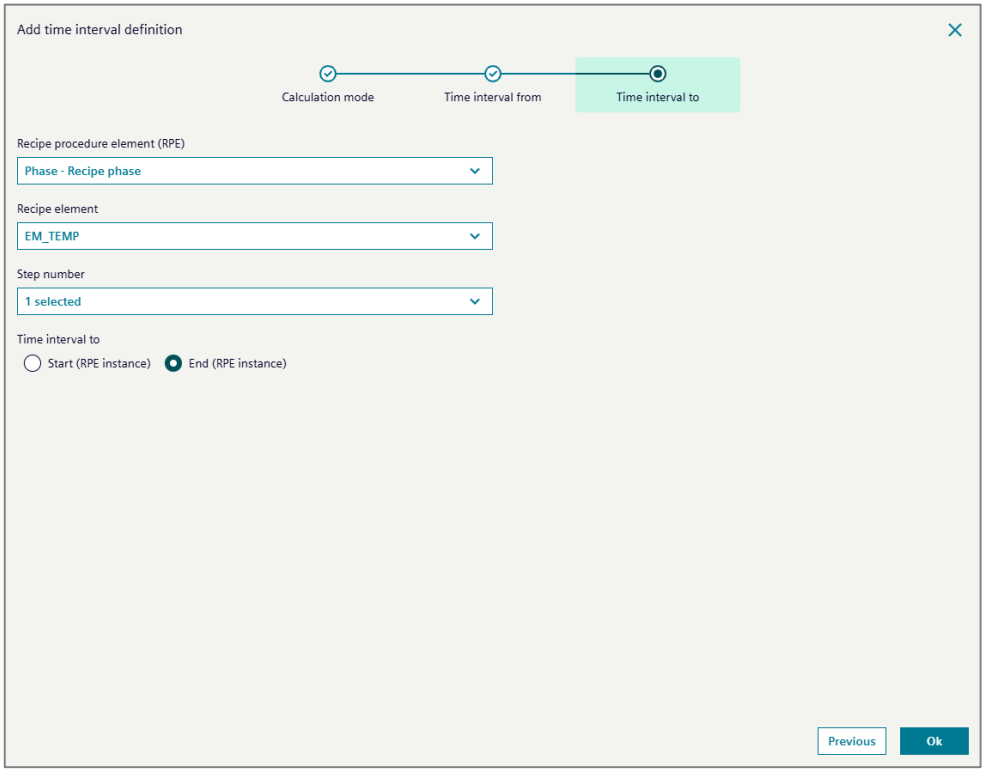
6. Click Next



7. Configure end point ("TO"):

Select the endpoint using the same options as the start point

8. Click Ok



Usage tips:

- For single batch mode: Ensure your selected points exist within the same batch execution
- For consecutive batch mode: Verify that the batches are actually consecutive in your production sequence
- The result will be provided in seconds

Virtual parameters using batch variables

Virtual parameters using batch variables enable you to create custom calculations based on key batch metrics such as duration, quantity, and message counts.

1. Defining a virtual parameter with a batch variable

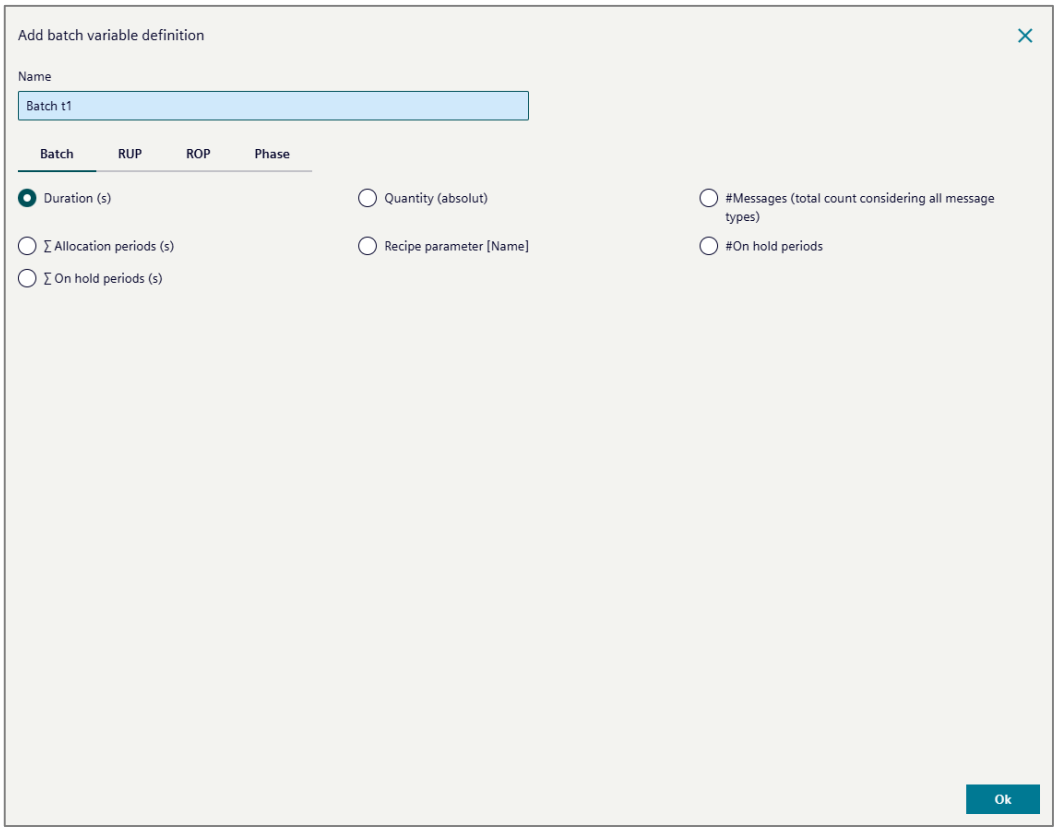
1. Click the "+ Batch variable" button to open the selection dialog.

The dialog presents four tabs: Batch, RUP, ROP, and Phase.

2. Select the Batch tab and choose one of the following variables:

    - Duration (s): Total batch duration.
    - Quantity (absolute): Absolute quantity processed.
    - #Messages (total number): Total number of messages (all message types).
    - ∑Allocation periods (s)
    - Recipe parameter
    - #On hold periods
    - ∑On hold periods (s)

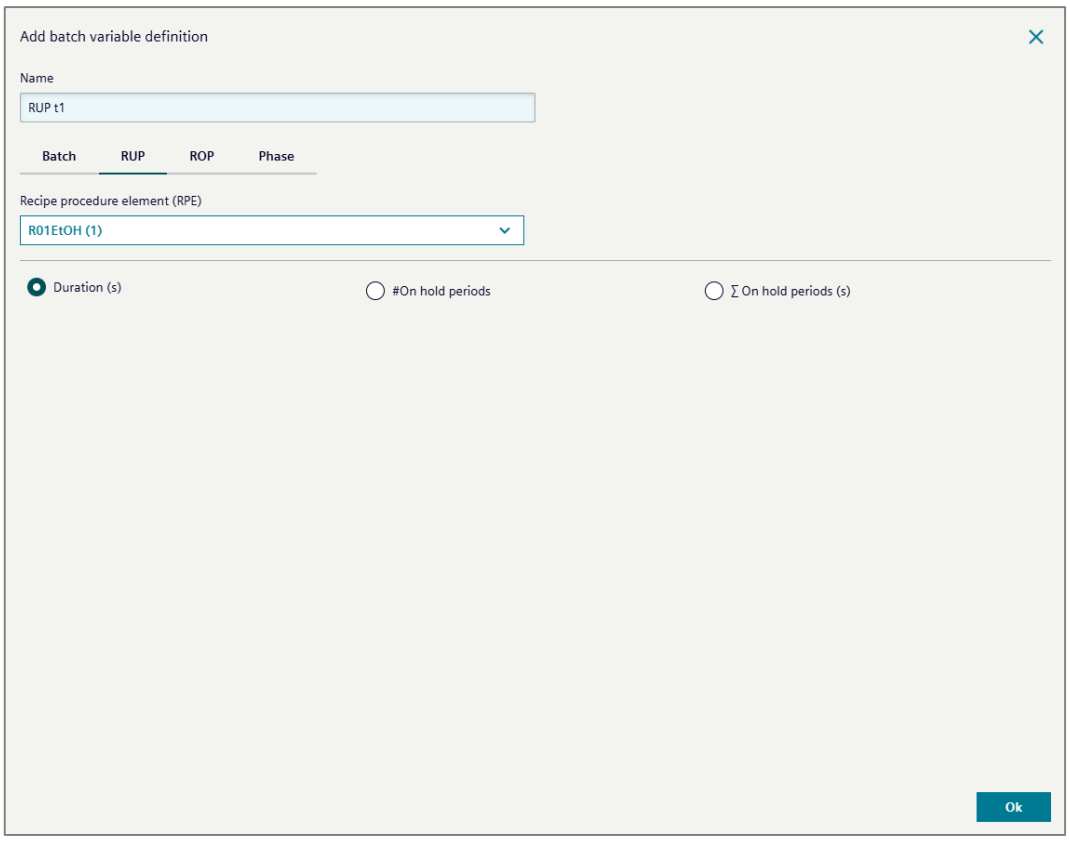
3. Click “Ok” to confirm and return to the formula editor.
4. Click “Apply” to save the changes, calculate the result, and store the virtual parameter for each batch.



2.Defining a virtual parameter with a RUP variable

A virtual parameter can be linked to only one RUP variable.

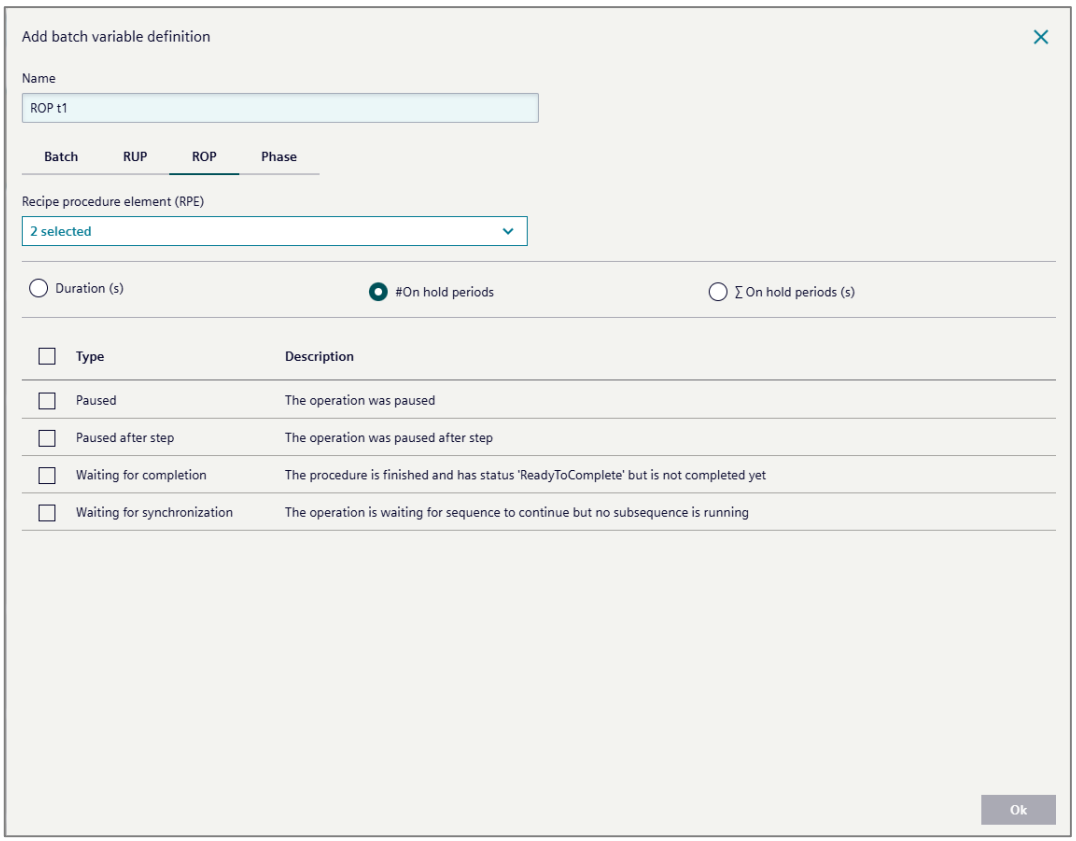
1. Click the “+ Batch variable” button to open the selection dialog.
2. Navigate to the RUP tab and choose from the available options:
    - Select one or multiple RUPs from a dropdown list.
    - Choose a variable:
        - Duration (s)
        - # On hold periods
        - ∑ On-hold Periods (s)
3. Click “Ok” to confirm and return to the formula editor.
4. Click “Apply” to save the changes, calculate the result, and store the virtual parameter for each batch.



3.Defining a virtual parameter with a ROP variable

A virtual parameter can be linked to only one ROP variable.

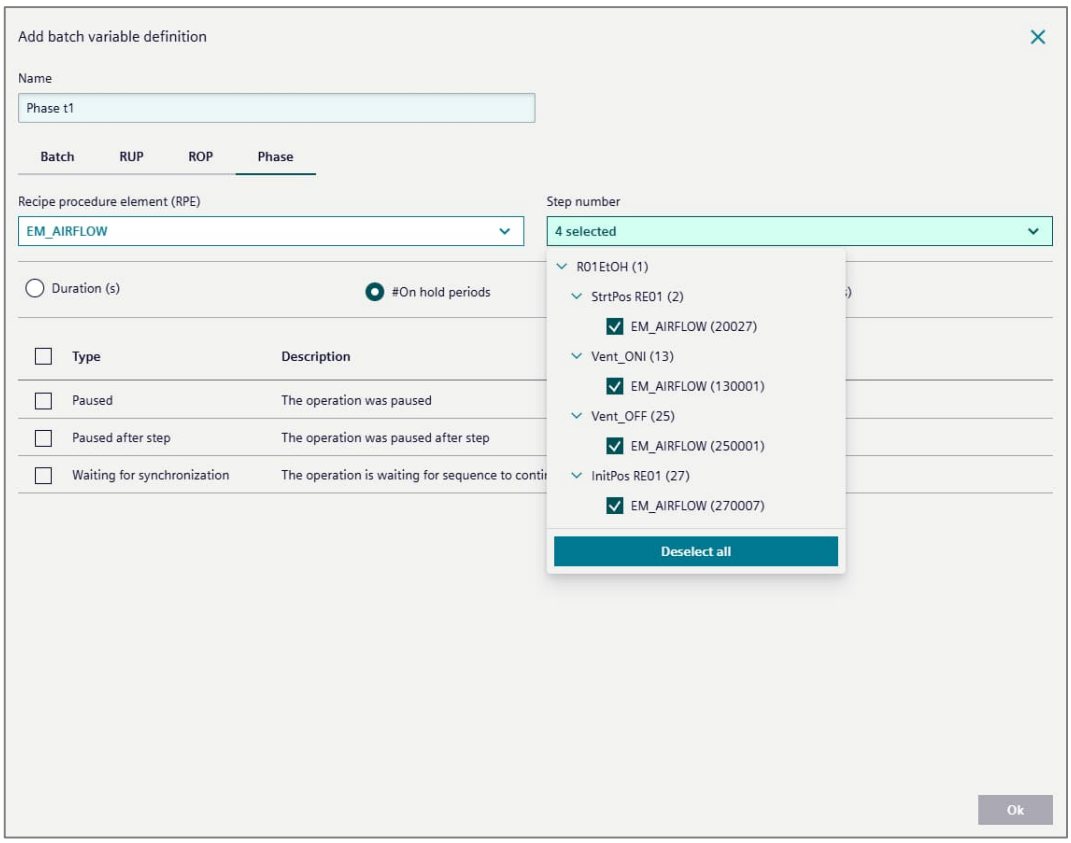
1. Click the "+ Batch variable" button to open the selection dialog.
2. Navigate to the ROP tab and choose from the available options:
    - Select one or multiple ROPs from a dropdown list.
    - Choose a variable:
        - Duration (s)
        - # On hold periods
        - ∑ On-hold Periods (s)
3. Click "Ok" to confirm and return to the formula editor.
4. Click "Apply" to save the changes, calculate the result, and store the virtual parameter for each batch.



4.Defining a virtual parameter with a phase variable

A virtual parameter can be linked to only one phase variable.

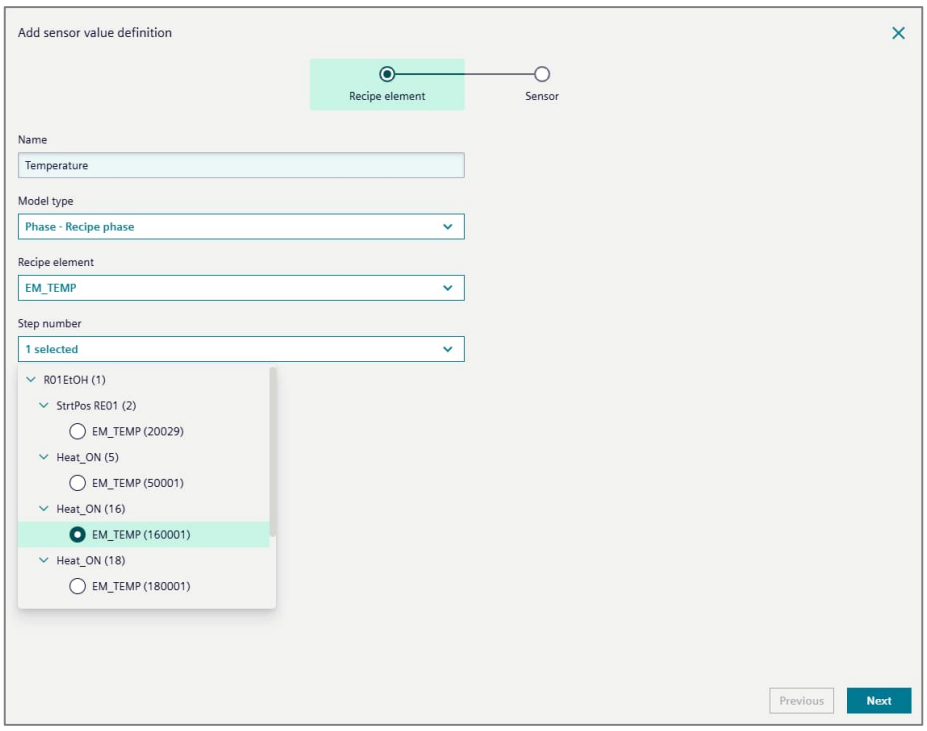
1. Click the "+ Batch variable" button to open the selection dialog.
2. Navigate to the Phase tab and choose from the available options:
    - Select Phase Type.
    - Select one or multiple step numbers from a dropdown list.
    - Choose a variable:
        - Duration (s)
        - # On hold periods
        - ∑ On-hold Periods (s)
3. Click "Select" to confirm and return to the formula editor.
4. Click "Apply" to save the changes, calculate the result, and store the virtual parameter for each batch.

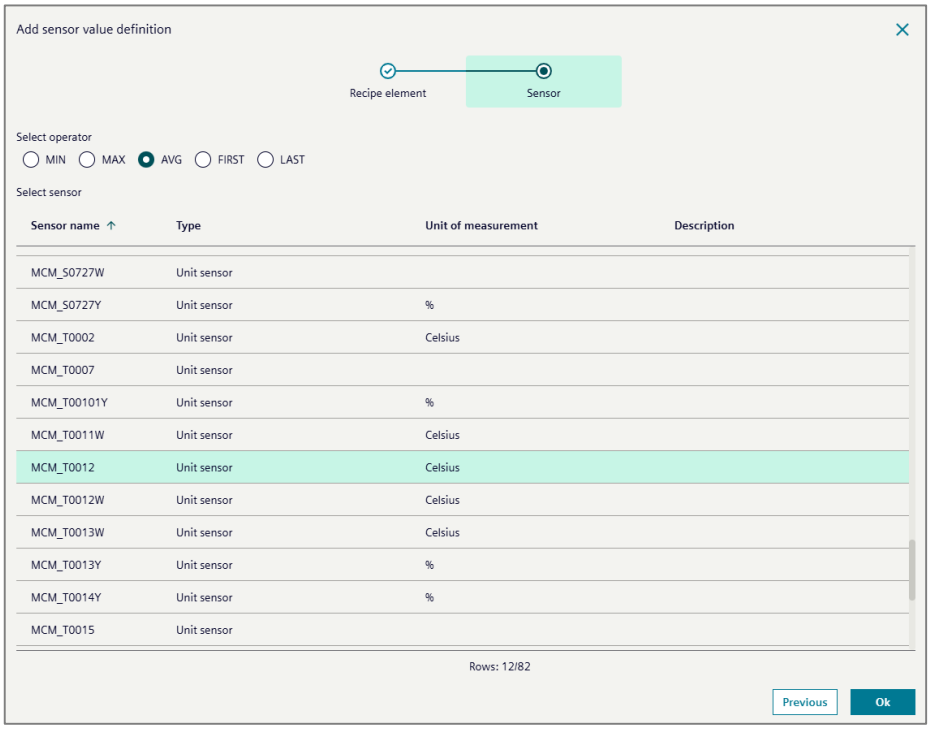


Virtual parameters using sensor values

Users can calculate specific values based on sensor measurements over a defined timeframe, supporting process monitoring, performance evaluation, and data analysis.

1. Open the sensor variable dialog by clicking “+ Sensor value”.
2. Enter a meaningful name for the sensor value variable.
3. Select a model type and recipe element from dropdown menu.
4. Click “Next”.
5. Choose a sensor and an operator (e.g., MIN, MAX, AVG, FIRST, LAST).
6. Click “Ok” to confirm. The selected sensor and operator will be displayed in the Formula Editor.
7. *(Optional)* Click the selected sensor in the Formula Editor to reopen the Sensor Selection Dialog and choose a different sensor if needed.

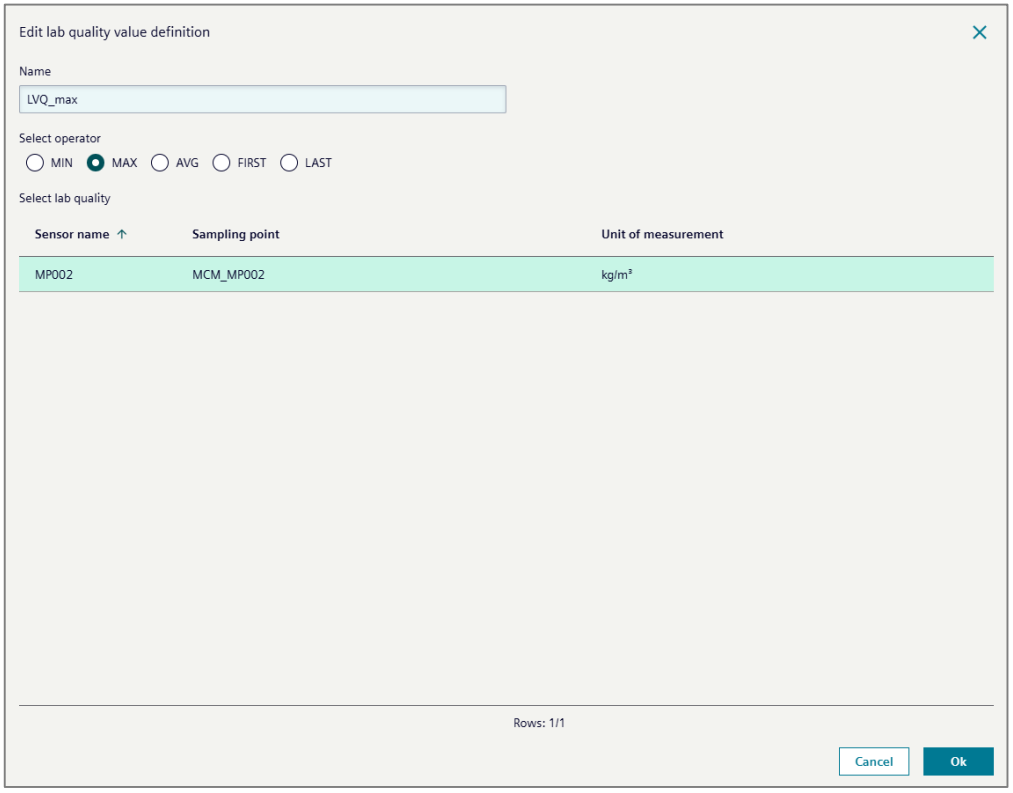

Add sensor value definition
Recipe element
Sensor
Name
Temperature
Model type
Phase · Recipe phase
Recipe element
EM_TEMP
Step number
1 selected
R01EtOH (1)
StrtPos RE01 (2)
EM_TEMP (20029)
Heat_ON (5)
EM_TEMP (50001)
Heat_ON (16)
EM_TEMP (160001)
Heat_ON (18)
EM_TEMP (180001)
Previous
Next


Add sensor value definition
Recipe element
Sensor
Select operator
MIN
MAX
AVG
FIRST
LAST
Select sensor
Sensor name
Type
Unit of measurement
Description
MCM_S0727W Unit sensor
MCM_S0727Y Unit sensor %
MCM_T0002 Unit sensor Celsius
MCM_T0007 Unit sensor
MCM_T00101Y Unit sensor %
MCM_T0011W Unit sensor Celsius
MCM_T0012 Unit sensor Celsius
MCM_T0012W Unit sensor Celsius
MCM_T0013W Unit sensor Celsius
MCM_T0013Y Unit sensor %
MCM_T0014Y Unit sensor %
MCM_T0015 Unit sensor
Rows: 12/82
Previous
Ok

Virtual parameters using lab quality values

Users can define a formula by linking a specific measurement value from a quality parameter to a virtual parameter, ensuring accurate data representation based on a selected operator.

1. Open the lab quality variable dialog by clicking “+ Lab quality value”.
2. Enter a meaningful name for the lab quality value variable.
3. Select a quality parameter from the list and an associated operator (e.g., MIN, MAX, AVG, FIRST, LAST).
4. Click "Ok" to confirm and return to the formula editor.
5. The selected lab quality variable and operator will be displayed in the formula editor.
6. *(Optional)* Click the added parameter to reopen the quality parameter dialog and select a different one. The previous selection will be replaced.



Show result dialog

The "Show result" provides users with access to the calculated values of a virtual parameter for each relevant batch. This allows for validation and further analysis of batch performance.

Accessing the Show result dialog

The "Show result" button becomes available once the virtual parameter has been successfully calculated. If the parameter is still in the "Created" or "Processing" state, the button remains inactive to prevent premature access to incomplete results.

Dialog content

When opened, the dialog presents a structured table displaying batch-specific results. At the top, a header section provides details about the virtual parameter and its associated recipe versions. The table includes batch names, start dates, computed values for each batch, and a "State" column indicating the calculation status (Success, Failed) with corresponding icons.

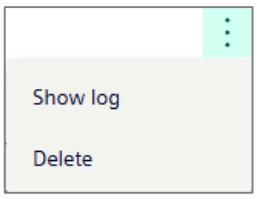
Users can select one or multiple batches they wish to recalculate and trigger a new calculation by clicking the "Recalculate" button at the bottom. The button is only active when at least one batch is selected. Once recalculation is initiated, the dialog automatically closes, and the virtual parameter state updates to "Processing".

Additionally, users can filter the table to display only batches with failed results for easier troubleshooting.



Accessing Show log and delete options

To access the Show log and delete options, click on the three-dot icon. This will open a dropdown menu with both options available for selection.



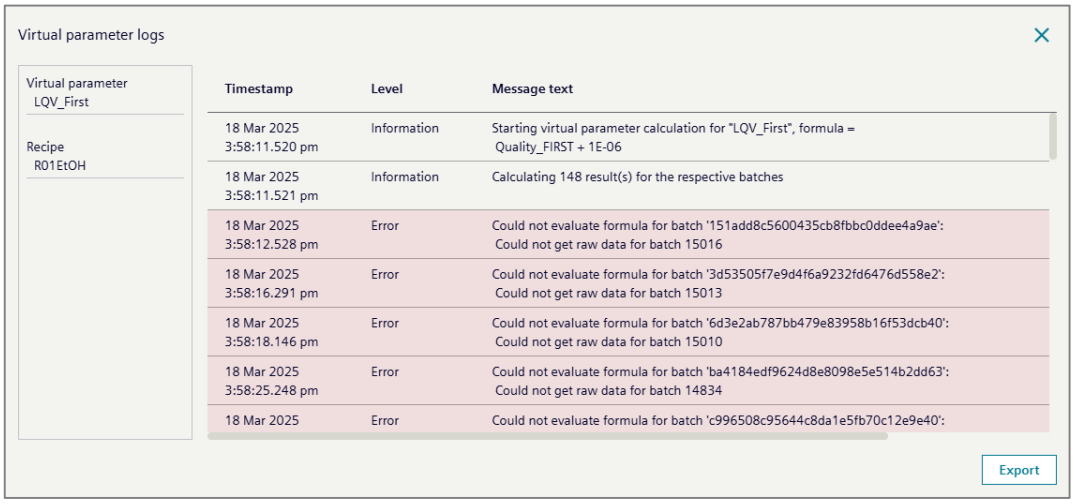
Viewing and managing logs

Once you select Show log, the log file will be displayed, providing detailed information and error details related to each batch. You can review these logs to identify any issues encountered during the calculation process.

- **Export log**: The error log can be exported using the Export button, allowing you to save and share the log data for further analysis.

Deleting the virtual parameter

If you select Delete from the dropdown, you can remove the virtual parameter. This action clears the current configuration of the virtual parameter.



Navigating production overview dashboard

To open the Production overview – Dashboard, navigate to the sidebar, click on the "Production overview" icon, and select "Dashboard" from the dropdown menu.

The dashboard displays the production overview of the selected PCell as a timeline chart showing all batches available each day within the chosen time frame. Batches of good quality are represented in green, while subpar batches are denoted in red. Batches without a defined quality state are depicted in a dark gray shade, and those awaiting qualification appear as light gray.

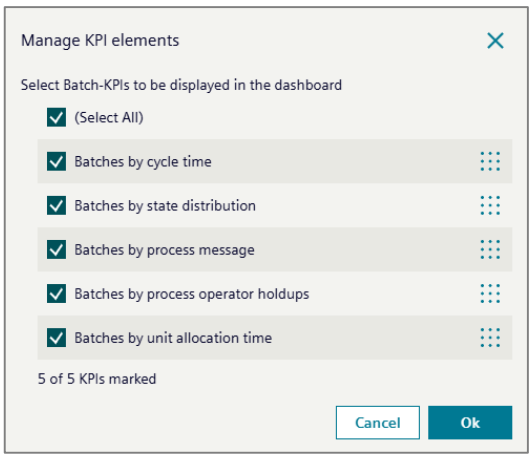
Hovering over a bar reveals a tooltip with details on the date and the number of batches in each quality category for that day. A legend provides both the total count and percentage of batches categorized as good, poor, undefined, or unqualified within the selected period.

The legend also allows users to toggle batch visibility in the chart by clicking the corresponding icons. For a more refined search, advanced filtering options help locate specific batches. Clicking on a bar in the timeline directs you to a detailed batch view for that specific day.



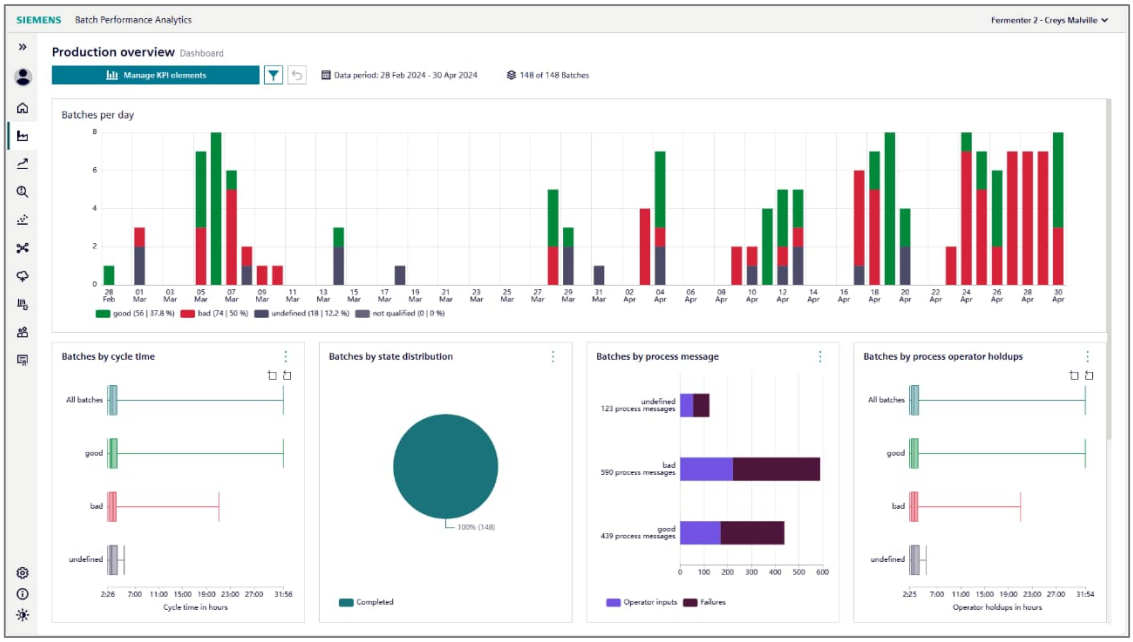
In the Production overview dashboard, click the "Manage KPI elements" button to open a dialog displaying a list of KPIs, with none selected by default. Choose your preferred KPIs by either clicking "Select All" or individually selecting them.

To adjust the display order, use the drag-and-drop function by hovering over the icon at the end of each KPI line. Once finalized, click "OK" to close the dialog. The selected KPIs will then appear beneath the timeline bar chart.



Displaying KPIs

The selected KPIs are displayed below the timeline chart.

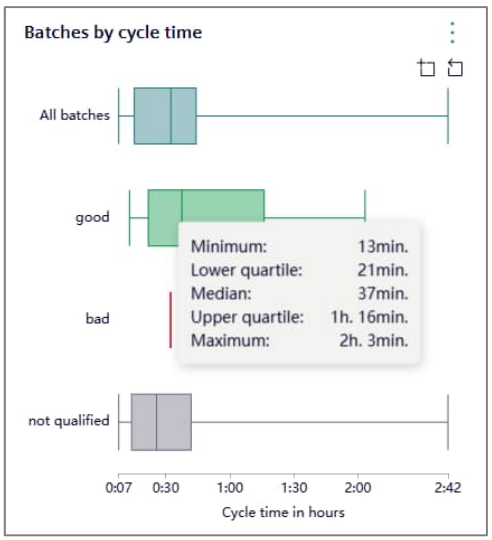


Understanding KPIs in detail

This section provides an in-depth look at KPIs, highlighting their role in accelerating batch data assessment and evaluation. These carefully selected metrics enhance root cause analysis, allowing for a quick and thorough examination of batch performance to support informed decision-making.

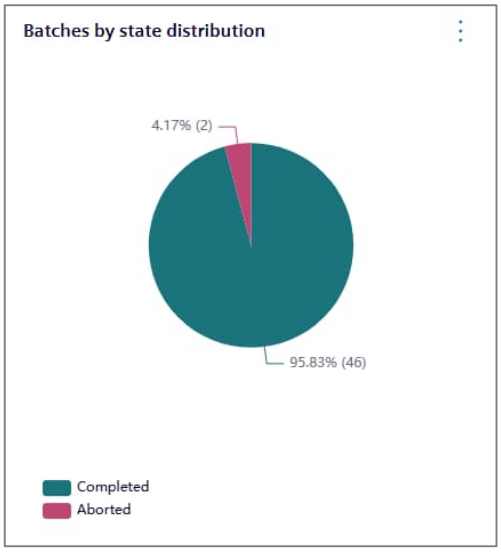
Batches by cycle time

The Batches by cycle time KPI is visualized as a boxplot, offering a graphical representation of cycle time distribution across batches. A tooltip provides key statistical insights, including the minimum, maximum, median, and first and third quartiles, helping you quickly understand the range and variability of cycle times in your batch processes.



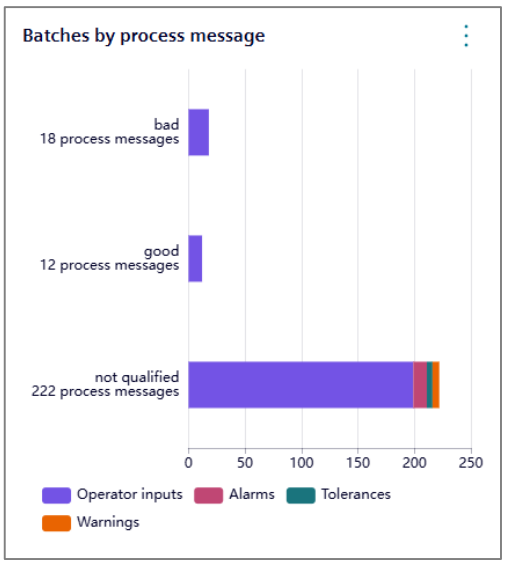
Batches by state distribution

The batches by state distribution KPI provides a visual representation of batch statuses within the selected time period. It enables a quick assessment of how many batches fall into different states, such as completed, aborted, stopped, and others, offering a clear overview of batch progress.



Batches by process message

The batches by process message KPI provides insights into the number of messages generated during batch runs, categorized by alarm class. This helps identify the frequency and types of alarms or messages that occurred throughout the batch processes.



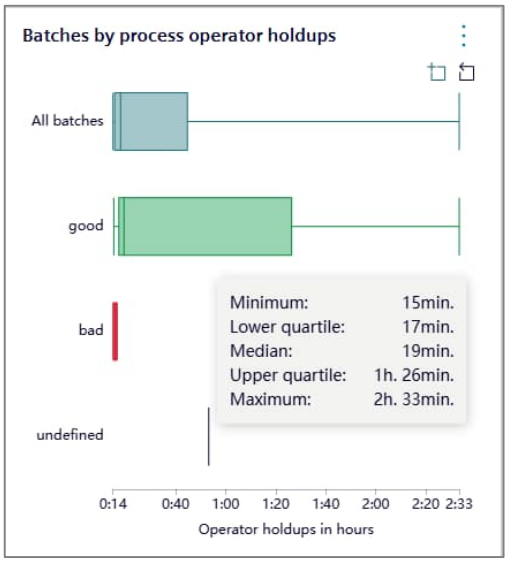
Batches by process operator holdups

The boxplot provides a visual summary of batches that were held by process operators during production. These holds occur when an operator manually pauses the active process phase on a unit. Such interventions can potentially influence both the quality and the duration of batches. The boxplot is designed to help users understand and evaluate these effects more clearly.

Batches are categorized by quality outcomes — for example, good, or bad — to reveal potential patterns between operator holds and final product quality. This categorization makes it easier to spot trends or anomalies in operator behavior and their possible consequences.

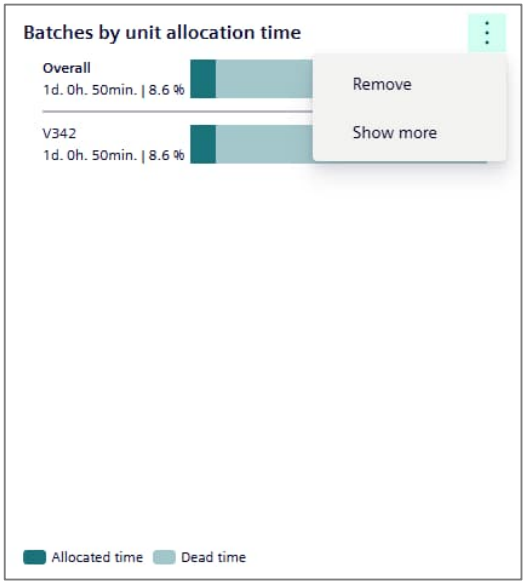
Each boxplot consists of five statistical markers that summarize the distribution of hold impacts: the minimum, first quartile (Q1), median, third quartile (Q3), and maximum. These values reflect the range and concentration of data, giving insight into both the typical and extreme cases of batch delays. The minimum and maximum indicate the lowest and highest hold impacts respectively, while Q1 and Q3 show where the central 50% of the data lies. The median, placed between Q1 and Q3, marks the middle point of the data.

Users can interact with the chart by hovering over parts of the boxplot. Doing so displays a tooltip with the exact values of Min, Q1, Median, Q3, and Max for a given category. This allows for a quick and precise understanding of how operator-induced delays correlate with batch quality or duration.



Batches by unit allocation time

The batches by unit allocation time KPI provides an overview of how long individual units were allocated within the selected period, measured in hours or days.
Clicking on the three-dot menu allows access to additional details by selecting "Show more". For further insights, refer to the chapter "Understanding efficiency measures".



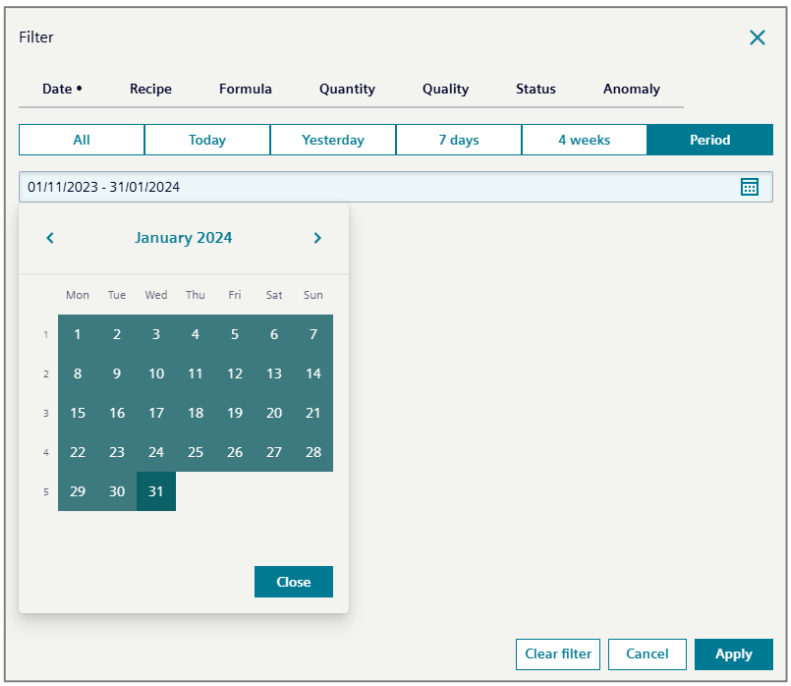
Filtering batches

Use the advanced filtering function to refine batch selection based on specific criteria. You can filter batches by time period, select a particular recipe, define a formula, set quantity parameters, sort by quality, filter by status, and even narrow the search by anomaly types.

Symbol	Action
	Filter inactive. All elements visible.
	Filter active. At least on filter criteria active.
	Undo last filter setting.

Filtering dates

By default, "All" days are selected, offering a full overview of your data. For more focused insights, you can easily switch between pre-defined date ranges such as "Today", "Yesterday", "Last 7 days", and "Last 4 weeks".
For a custom date range, use the "Period" section, which features an intuitive date and time picker. Simply click the calendar icon to open a detailed calendar and select your desired dates and times.



Selecting recipes

Pick a specific recipe from the list of available options. This helps refine your batch search to those linked to a particular production formula or process.



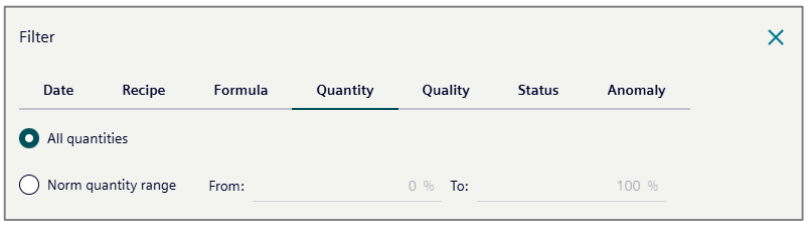
Selecting formulas

Choose a specific formula from the list of available options. This allows you to narrow your focus to batches produced with a particular set of ingredients or parameters.



Defining quantity ranges

Set a specific quantity range to filter batches that fall within the desired percentage range. This is helpful for identifying batches of a particular size or scale.



Selecting specific qualities

Choose specific qualities that interest you. This allows you to filter batches based on predefined quality criteria, ensuring you focus on those that meet certain quality standards.



Filtering batch status

Select batches based on their current status in the production process, such as completed, aborted, stopped, and more. This allows you to sort batches by their stage of completion or any other relevant production status.



Selecting anomaly status

Filter batches by their anomaly status. You can choose to view batches with anomalies or those without, helping you identify any irregularities or exceptions in the production data.



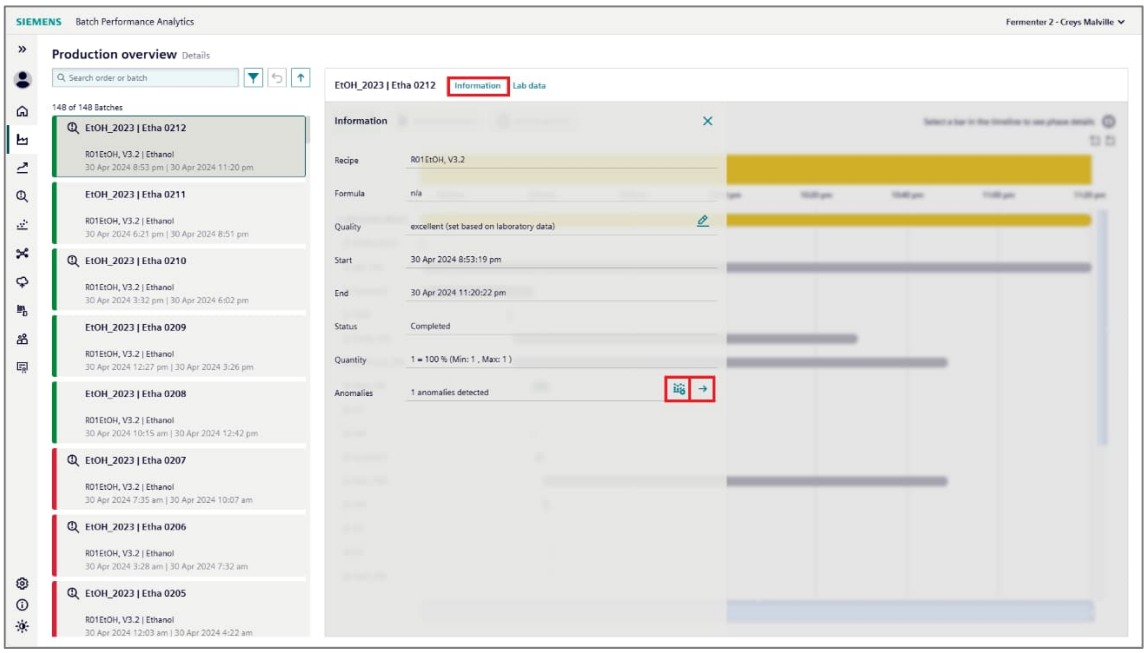
Exploring batch details in the production overview

To access detailed batch information, navigate to the sidebar, click on the "Production overview" icon, and select "Details" from the dropdown menu.
This will open a view displaying a list of all batches on the left-hand side, filtered according to the selected criteria. The batches are arranged chronologically, with the most recent batch appearing at the top. Sorting options include production date, order name, batch name, recipe, and product name. You can also rearrange the list in ascending or descending order to match your preference. For a more targeted search, advanced filtering options allow you to refine the displayed batches based on specific parameters.

Batch information

To access detailed information about a selected batch, click on the "Information" tab on the right-hand side. This section provides a comprehensive breakdown of batch details, including the associated recipe, formula, quality status, start and end times, batch status, total quantity, and the number of detected anomalies.

- Batch quality adjustment: If necessary, you can manually update the quality status of a batch by clicking the pencil icon and selecting the appropriate value.
- Anomalies overview: The "Anomalies" section displays whether any anomalies have been detected in the batch. If at least one anomaly is present, clicking the arrow in this section will direct you to the Anomaly detail's view, where you can examine each anomaly in more depth.
- Initiating anomaly analysis: If further investigation is required, you can start a new anomaly analysis for the selected batch. Clicking the "Start analysis" option opens a dialog box where you can configure and initiate a new analysis. For more details on setting up and running an analysis, refer to the chapter "Starting analysis."



Symbol	Action
	Manually change a batch quality
	Start analysis for the selected batch
	Jump to the anomalies view

Refining batch selection: Searching, filtering and sorting

The application provides an advanced filtering and sorting function, similar to the one used in the dashboard, allowing for precise batch selection and organization. This feature enables users to efficiently search for specific batches, apply detailed filtering criteria, and sort results based on various attributes.
With advanced filtering, you can refine your batch selection by defining specific parameters, ensuring that only relevant data is displayed. The integrated sorting function further enhances data organization, allowing you to arrange batches in ascending or descending order based on key criteria such as production date, order name, batch name, recipe, or product name.

Symbol	Action
	Search for an order name or batch name.
	Filter inactive. All elements are visible.
	Filter active. At least one filter criteria is active.
	Undo last filter setting
	Sort according to date of production – Ascending
	Sort according to date of production – Descending

Viewing batch timelines and phases

The Timeline offers a detailed visualization of batch production, covering Recipe Unit Procedure (RUP), Recipe Operation Procedure (ROP), and individual phases. This timeline helps users track batch progress, analyze statuses, and identify anomalies efficiently.
At the top, the timeline displays the entire batch duration, including the analysis status of each associated instance. Color coding provides quick insights into batch element conditions:

- **Orange** highlights indicate phase, RUP, or ROP instances where anomalies have been detected.
- **Turquoise** represents analyzed instances without anomalies.
- **Gray** denotes instances that have not yet been analyzed.

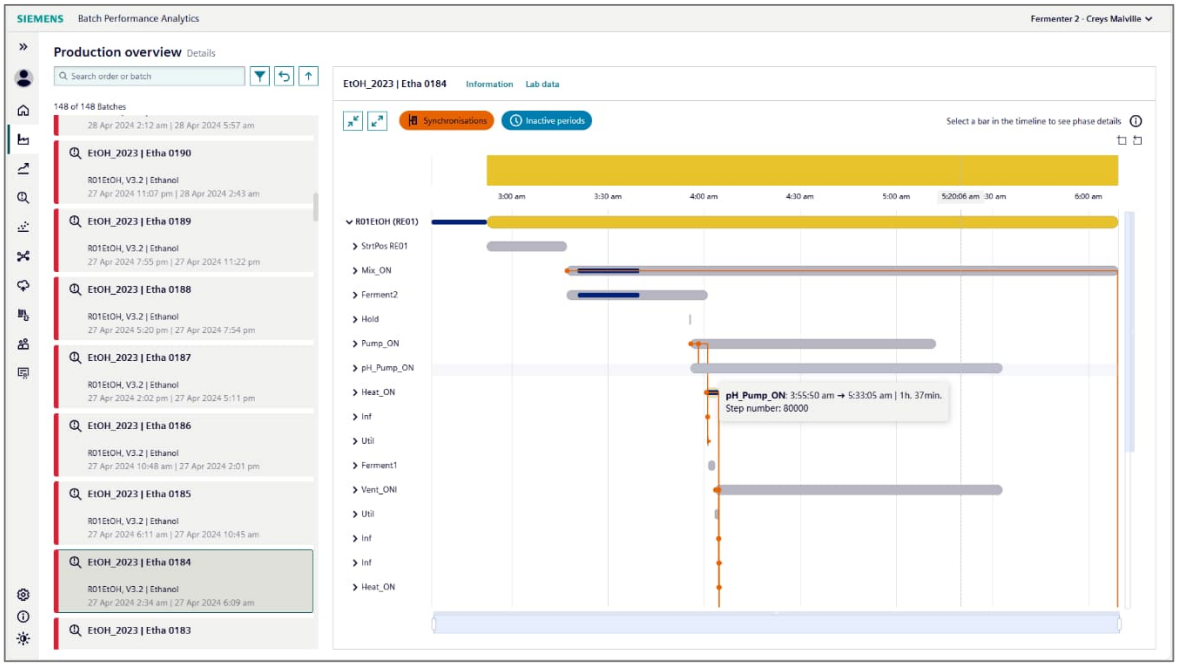
By default, RUP time bars are visible. Users can expand or collapse batch elements using dedicated buttons or by clicking on RUP and ROP names to reveal their underlying components. If an element below a RUP or ROP has been analyzed, a subtle color shift on the parent element serves as a reference, indicating that an analysis has been performed.

Hovering over any bar in the diagram reveals a tooltip containing essential details such as the element name, start and end times, duration, step number, and control strategy (for phases).

The diagram features multiple navigation tools for enhanced usability:

- Zooming: Adjust the zoom level using the slider at the bottom or the "Zoom In" button at the top right. Use the "Reset Zoom" button to revert to the default view.
- Navigation: A ruler helps users move between the start and end of the production timeline.
- Display options: Toggle synchronization lines and inactive periods on or off by clicking the respective icons.

Clicking on any bar within the diagram opens a detailed view of the selected batch element, providing further insights. More details on this functionality can be found in the next chapter, "Analyzing Batch Element Details."

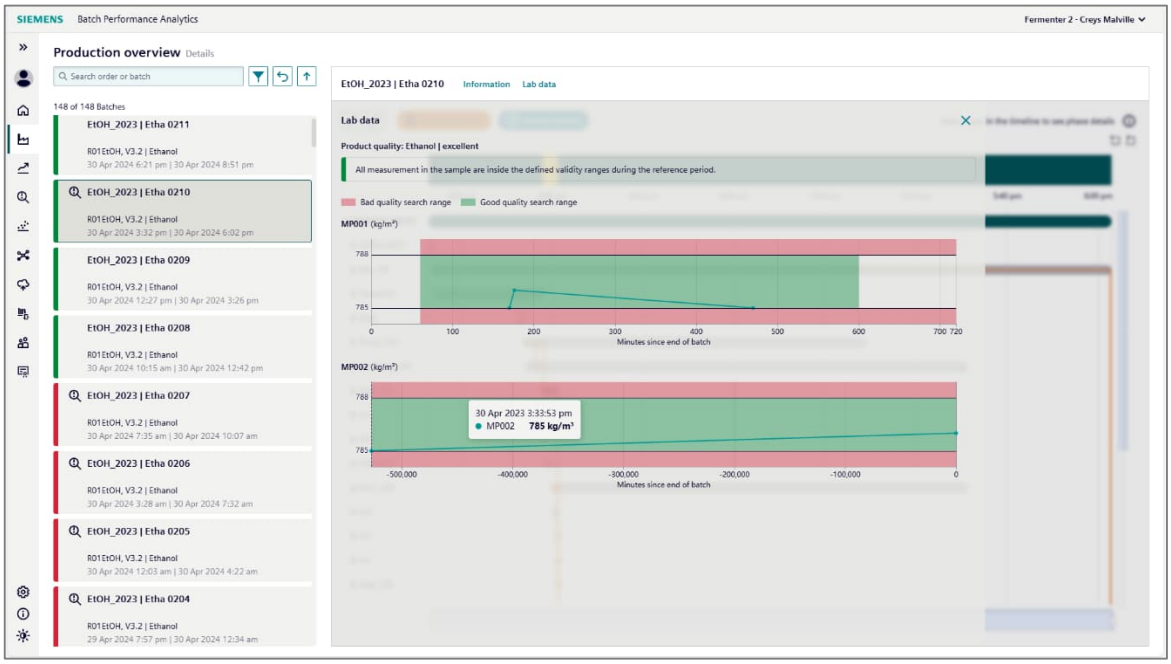


Color coded bars

Color	Description
Light gray	Instance and its children not analyzed
Light turquoise	At least one child of the instance analyzed without anomalies
Light orange	At least one child of the instance analyzed with anomalies
Turquoise	Instance analyzed without anomalies
Orange	Instance analyzed with anomalies
Blue	Inactive periods

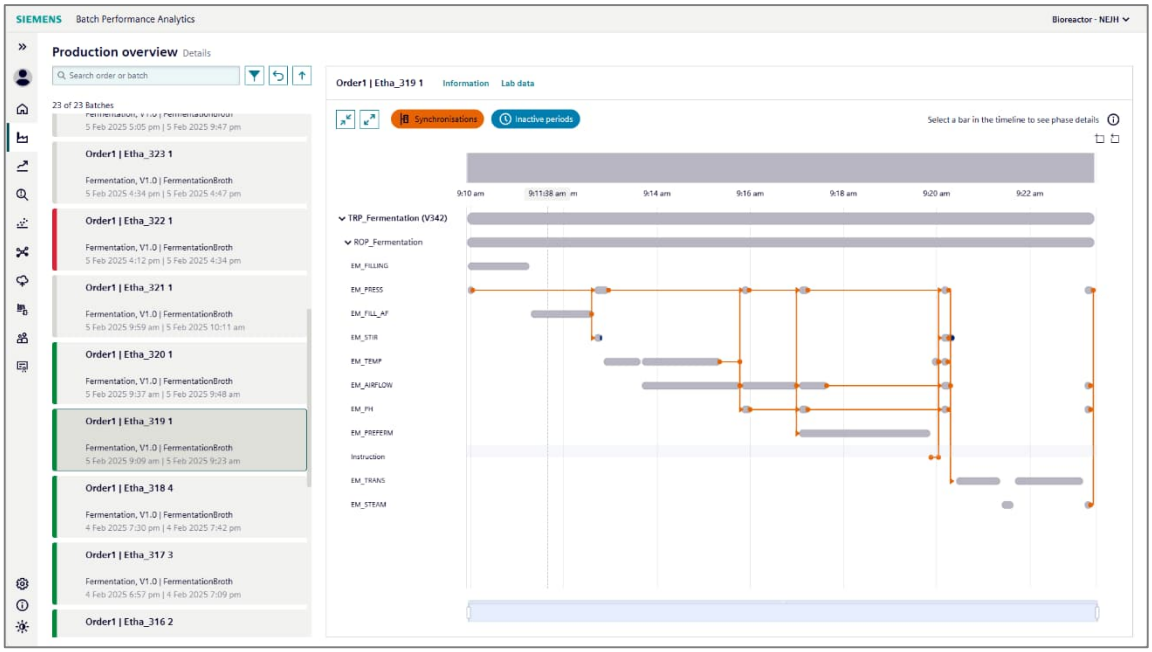
Viewing lab data

The "Lab data" tab provides a visual representation of quality measurements, helping users assess batch quality at a glance. The diagram clearly indicates whether sample values fall within or outside the defined acceptable range, allowing for quick identification of potential quality issues.
Each sampling point is displayed in a separate diagram beneath the main visualization. If multiple sampling points exist, they are presented individually for a more detailed comparison.
A batch is categorized as having poor quality if at least one measured value exceeds the acceptable range. Users can refer to the chapter "Qualifying batches" for more information on configuring acceptable and search ranges to fine-tune quality assessments.



Analyzing batch element details

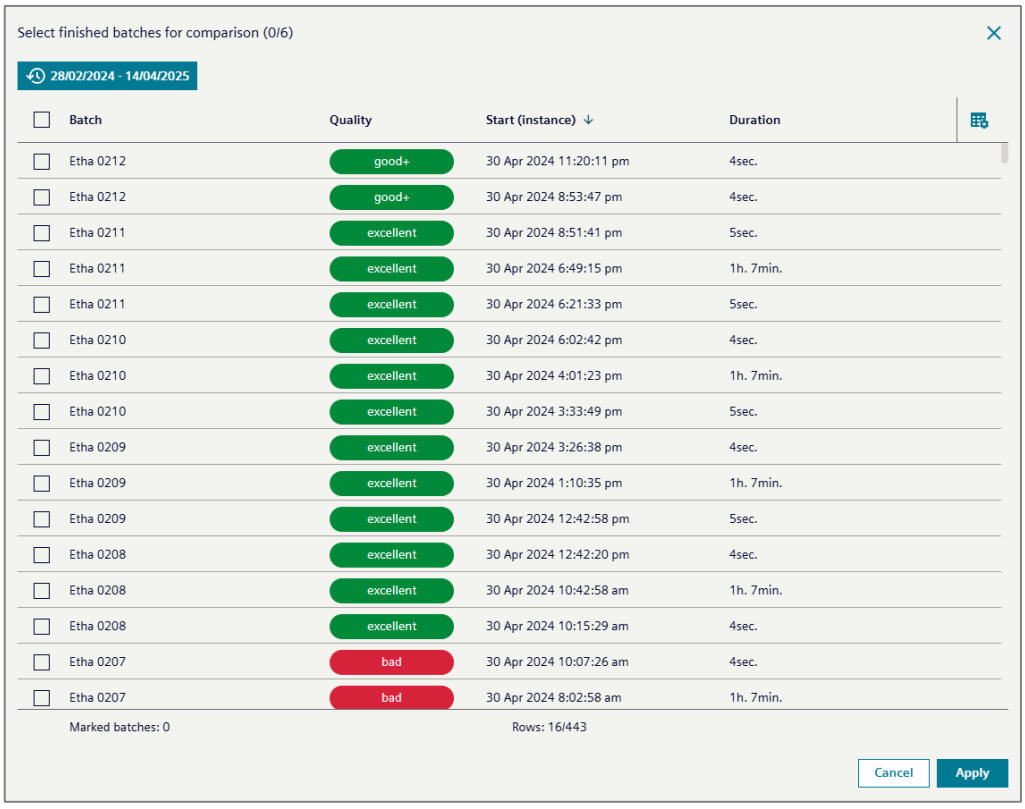
To examine detailed batch element data, click on a Recipe Unit Procedure (RUP) bar, Recipe Operation Procedure (ROP) bar, or a phase bar within the Gantt chart. This will open the corresponding detailed view, providing a comprehensive overview of the selected batch element.



Within the Detail view, you can analyze sensor data by selecting sensors from a drop-down list. The selected sensors will display their trends for the time period of the batch instance, allowing for in-depth monitoring and evaluation.
The system supports the comparison of multiple sensor trends, enabling you to analyze up to 10 trends simultaneously. These trends can be arranged in ascending or descending chronological order based on their tag names. To gain additional insights into measured values, hover your cursor over the trend window to view precise data points. Various zooming options are available, including the slider at the bottom of the chart, the "Area zooming" button on the top right-hand side of the timeline bar, and mouse interactions. If needed, you can reset the zoom level using the "Reset zooming" button.



For cross-batch comparisons, you can utilize the "Compare" button to select up to 6 batches for parallel analysis. Once selected, confirm with "Apply" to display the trends. If you wish to filter batches within a specific time period, use the "Data period" option to define the desired timeframe.



To enhance readability, comparison batches are displayed with gray lines, allowing for a clear distinction between the selected batch and its reference data.

Customizing table columns

To customize the columns displayed in the anomaly table:

1. Click on the table icon located on the right side of the column header.
2. A dropdown menu will appear, allowing you to select or deselect columns such as Batch ID, Start (batch), Duration (batch), End (batch), Order, Quantity, End (instance), Status, and Unit.

Rearranging columns

You can rearrange the order of the columns via drag and drop, except for the first column (Batch name), which is fixed.



Icon	Description
	Return to the Gantt chart
	Area zooming
	Reset zooming

Managing batches

To efficiently manage batches, access the "Table" view by selecting the "Production overview" icon in the sidebar. This view presents a detailed table of all batches based on the selected filter criteria, organized chronologically by production date. The table provides a comprehensive overview of order and batch details. Users can customize the table by rearranging columns through drag-and-drop and access detailed batch information by clicking the Order | Batch link.

Batch table overview

The batch table offers a clear, structured view of batch data with the following features:

- Chronological sorting: Batches are sorted by production date by default.
- Information columns: Each row displays batch name, recipe, product, start time, duration, status, and quality.
- Sorting and filtering: Columns can be sorted and filtered for efficient data management.

Customizing the table view

To customize the table, click the table settings icon in the upper right corner of the column header. This opens a column selection menu, allowing users to choose which columns to display. Additional options include Batch ID, End, Order, Quantity, Formula, number of anomalies, and virtual parameters. In the column selection menu, you also have a button to export the table as a CSV file containing all the currently visible columns.

Sorting and filtering

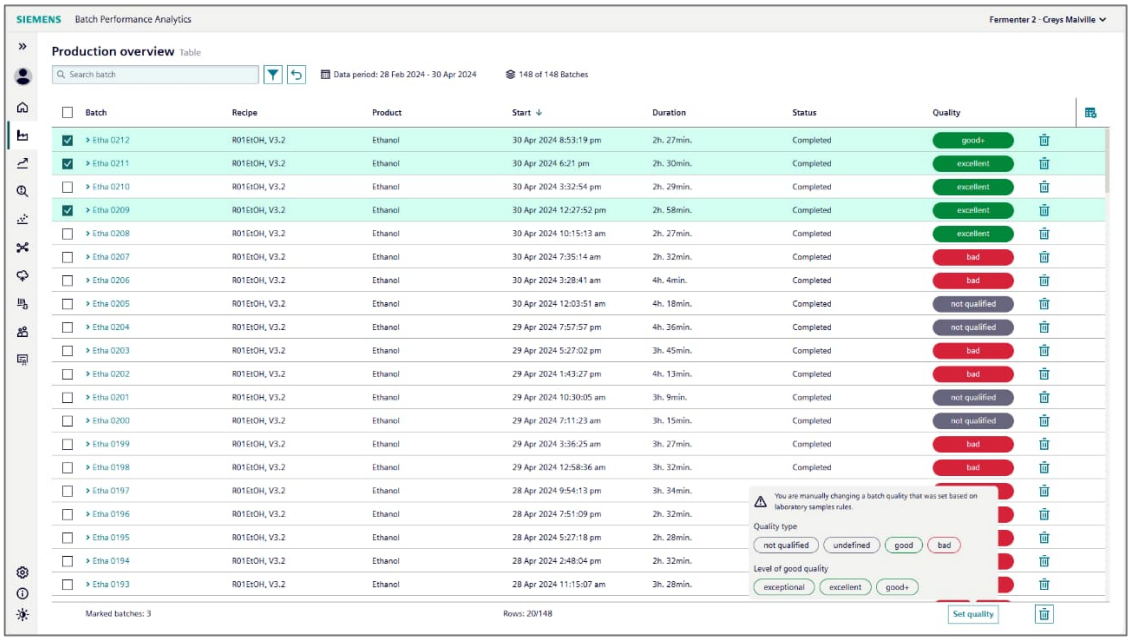
The table supports sorting and filtering, enabling users to organize columns in ascending or descending order. Filtering by specific criteria helps users quickly locate and manage batches.

Batch quality adjustment

Select multiple batches and use the "Set quality" button to update their quality status in bulk.

Batch deletion

To delete a batch, click the delete icon at the end of its row. Deletion removes the batch, existing analyses, and all associated data unless used in training. For multiple deletions, select the desired batches and click the delete icon at the bottom of the table.



Understanding efficiency measures overview

Efficiency is a key factor in optimizing production performance, reducing downtime, and ensuring product quality. The Efficiency measures overview provides a structured approach to analyzing batch operations, identifying inefficiencies, and improving overall manufacturing effectiveness.

This section explores three essential tools for evaluating efficiency:

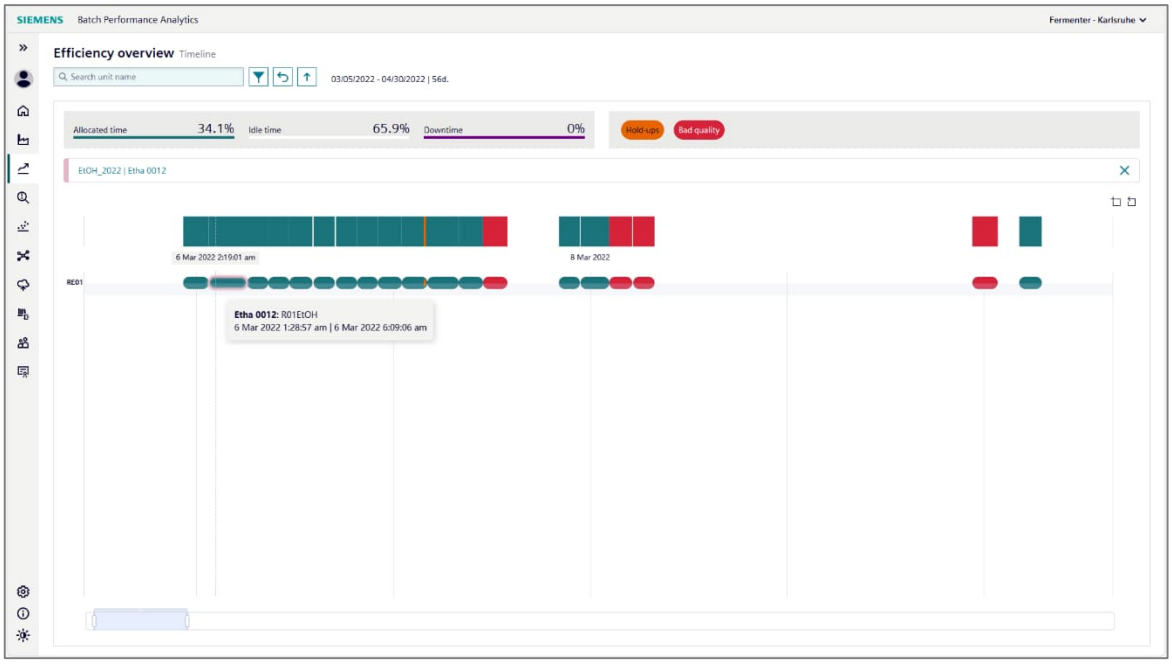
- **Timeline insights** – A visual representation of batch time allocation across different units, highlighting key performance trends and potential inefficiencies.
- **Efficiency details** – A deep dive into time losses and performance metrics, presented through key performance indicators and graphical breakdowns.
- **Efficiency KPIs** – A structured overview of critical performance metrics such as availability, performance, and quality, enabling data-driven decision-making.

Analyzing batch efficiency – Timeline insights

To access the efficiency timeline chart, navigate to the sidebar, click on the “Efficiency overview” icon, and select “Timeline” from the dropdown menu. This timeline visually represents the allocation of batch time to individual units using a bar chart format, providing an intuitive way to analyze efficiency data.

The bar chart includes interactive features for detailed exploration. Zooming in and out is possible using the slider located at the bottom of the chart or the 'Area zooming' button positioned in the top-right corner of the timeline bar. When a specific batch is selected by clicking on its bar within the timeline, it is highlighted in pink, along with all other units that are part of the same batch. The name of the selected batch is displayed at the top of the timeline for reference. When clicking on the batch name, a new tab opens in the browser and the Detail view of that batch in the Production overview is displayed. To undo the selection and return to the original view, click the 'X' icon next to the displayed batch name.

For a more focused analysis, the dashboard provides options to visualize batches with particular characteristics. By using the buttons located at the top of the dashboard, you can highlight batches with poor quality or those that experienced delays or interruptions. These advanced visualization tools allow for a deeper understanding of efficiency measures and help identify areas for improvement.



Evaluating time losses and performance – Efficiency details

To access the efficiency measures details, open the sidebar, click on the “Efficiency measures” icon, and select “Details” from the dropdown menu. This action opens a comprehensive view that includes a detailed list of all units based on the filter criteria selected on the left side of the screen. On the right side, key performance indicators are displayed alongside a pie chart that provides a clear breakdown of time losses.

The pie chart visually categorizes different types of time losses, offering transparency into their causes. These include downtime due to machine-related technical issues or setup and adjustment activities, idle time representing periods of non-allocation, hold-ups where allocation was paused during operations, poor quality batches that failed to meet standards, and allocation time for aborted or stopped processes related to discontinued or halted batches.



To facilitate a deeper understanding of performance, key performance indicators and time losses are presented as daily curves, allowing you to track their progression over a selected timeframe. These curves can be enabled or disabled by clicking on the corresponding elements in the chart legend, giving you control over which data is displayed. This detailed and customizable view provides a comprehensive analysis of unit performance, offering valuable insights to drive continuous improvement.



Analyzing performance metrics – Efficiency KPIs

To access the efficiency measures KPIs, open the sidebar, click on the "Efficiency measures" icon, and select "KPI" from the dropdown menu. This view provides a tool for the continuous evaluation and optimization of a manufacturing plant's performance. It offers a detailed overview of the various plant units, emphasizing key metrics such as availability, performance, quality, and time losses.

Availability is measured as the percentage of time a unit operates relative to its scheduled production time, excluding any downtime. Performance reflects the percentage of net operating time compared to the total operating time, accounting for idle periods and hold-ups. Quality, the third key metric, represents the percentage of effective operating time in relation to net operating time, factoring in losses from defective batches, aborted processes, or halted operations.

The cumulative effect of these losses—availability, performance, and quality—is expressed as a percentage of total production time. This comprehensive depiction of time inefficiencies helps to identify critical areas requiring improvement. The detailed insights provided by this view play an essential role in enhancing overall plant efficiency and optimizing operations.


SIEMENS
Batch Performance Analytics
Blood Fractionation - Karlsruhe
Efficiency overview
KPI
Search unit name
10/21/2022 - 10/21/2022 | 1d.
Unit
Availability
Performance
Quality
Time losses
S112 100% 0.5% 100% 99.5%
S122 100% 0.42% 100% 99.58%
S212 100% 0.54% 100% 99.46%
S222 100% 0.53% 100% 99.47%
S312 100% 0.41% 100% 99.59%
S322 100% 0.41% 100% 99.59%
S412 100% 0.54% 100% 99.46%
S422 100% 0.54% 100% 99.46%
V111 100% 2.78% 100% 97.22%
V121 100% 1.36% 100% 98.64%
V211 100% 5.02% 100% 94.98%
V221 100% 2.88% 100% 97.12%
V311 100% 90.69% 100% 9.31%
V321 100% 3.31% 100% 96.69%
V411 100% 2.86% 100% 97.14%
V421 100% 3.02% 100% 96.98%

Anomaly detection

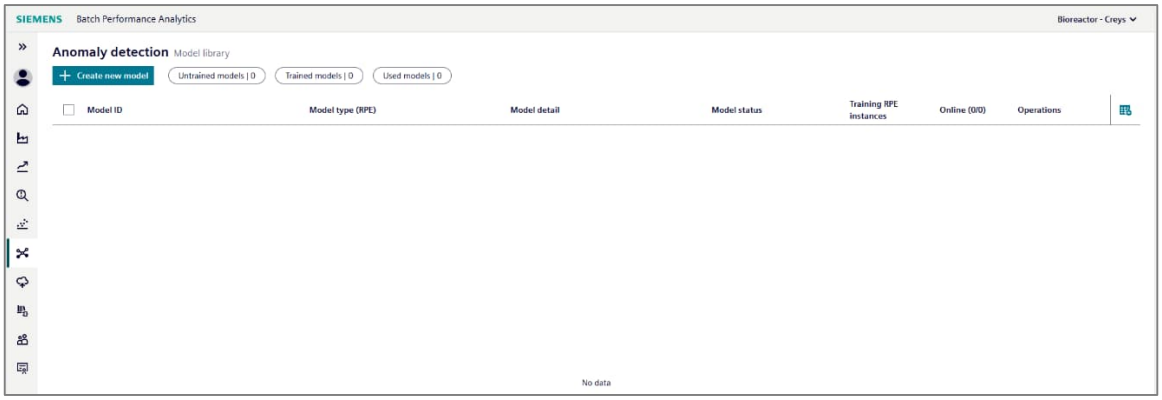
Model library - Defining models and training

The model library allows users to define, configure, and manage models tailored to their specific processes and datasets. These models form the foundation for anomaly detection, enabling users to analyze and identify deviations across various recipe elements, sensors, and phases.
Defining a model involves creating a structured representation of your data and processes by selecting recipes, linking them to relevant sensors, and setting up training instances. With an intuitive interface and step-by-step guidance, the app ensures flexibility in defining models for Recipe Unit Procedures (RUPs), Recipe Operation Procedures (ROPs), or individual phases.
This chapter walks you through the process of creating, configuring, and managing models, helping you streamline your workflow and enhance the precision of your anomaly detection efforts. Whether you're setting up models for the first time or refining existing ones, the model library provides all the tools you need for effective model management.

Defining a Model

To access the model configuration, navigate to the sidebar, click on the "Anomaly detection" icon, and select "Model library" from the dropdown menu.
To define a model, begin by creating a new model. Click the "+ Create new model" button, which will open a dialog titled "Model definition."
The model definition dialog contains several elements essential for setting up a model. The Model ID is a unique identifier automatically generated for the model. Associated anomalies display a list of any anomalies linked to the model, while the model status indicates the current stage of the model, such as created. An optional description field is available to add notes or details about the model.
The dialog also includes a visual stepper that outlines the four steps required for model configuration. These steps include selecting a recipe, specifying the recipe procedure element (ROP, RUP, or Phase), defining sensors associated with the model, and specifying training instances to finalize the model setup. This structured approach ensures an organized process for defining models within the model library.

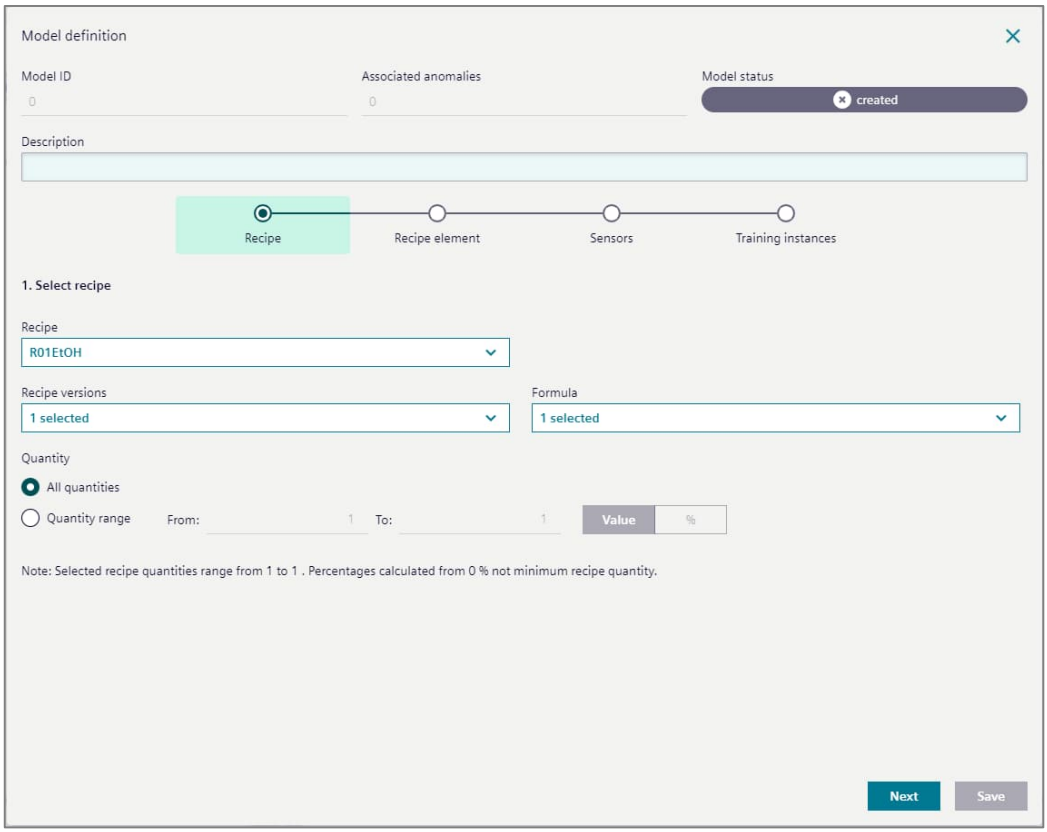
This chapter guides you through the process of defining a model within the model library.



Step 1: Select recipe

This step allows you to choose the recipe and its relevant details for the model.

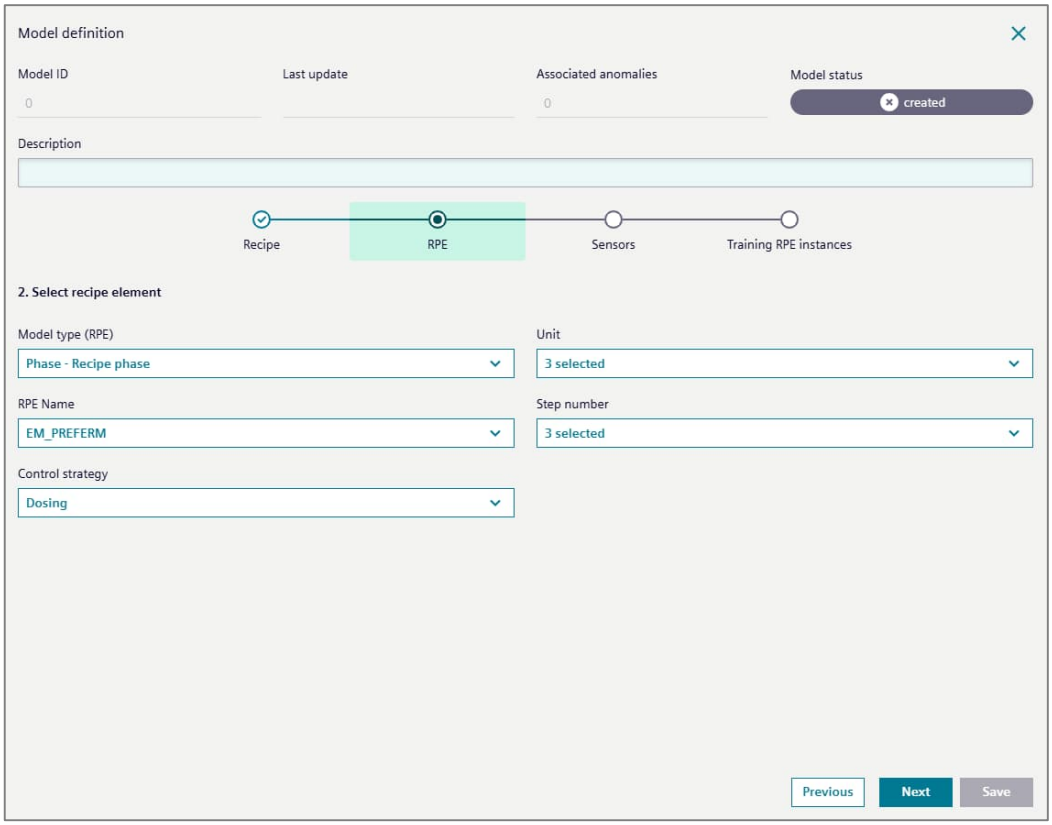
1. Click the "+ Create new model" button. A dialog titled "Model Definition" opens, which serves as the starting point for model creation.
2. Select a recipe from the pulldown menu. Recipes represent the high-level processes or workflows relevant to your data.
3. Choose recipe versions. By default, all versions are selected, ensuring flexibility in applying the model across different iterations of the recipe.
4. Select a formula. Formulas define specific configurations or variants of the recipe, with all formulas selected by default.
5. Define the quantity. You can leave it as "All" (default) to include all data or specify a range to narrow down the model's focus.
6. Click "Next" to proceed to the next step.



Step 2: Select recipe element

This step allows you to specify the recipe element the model will analyze.

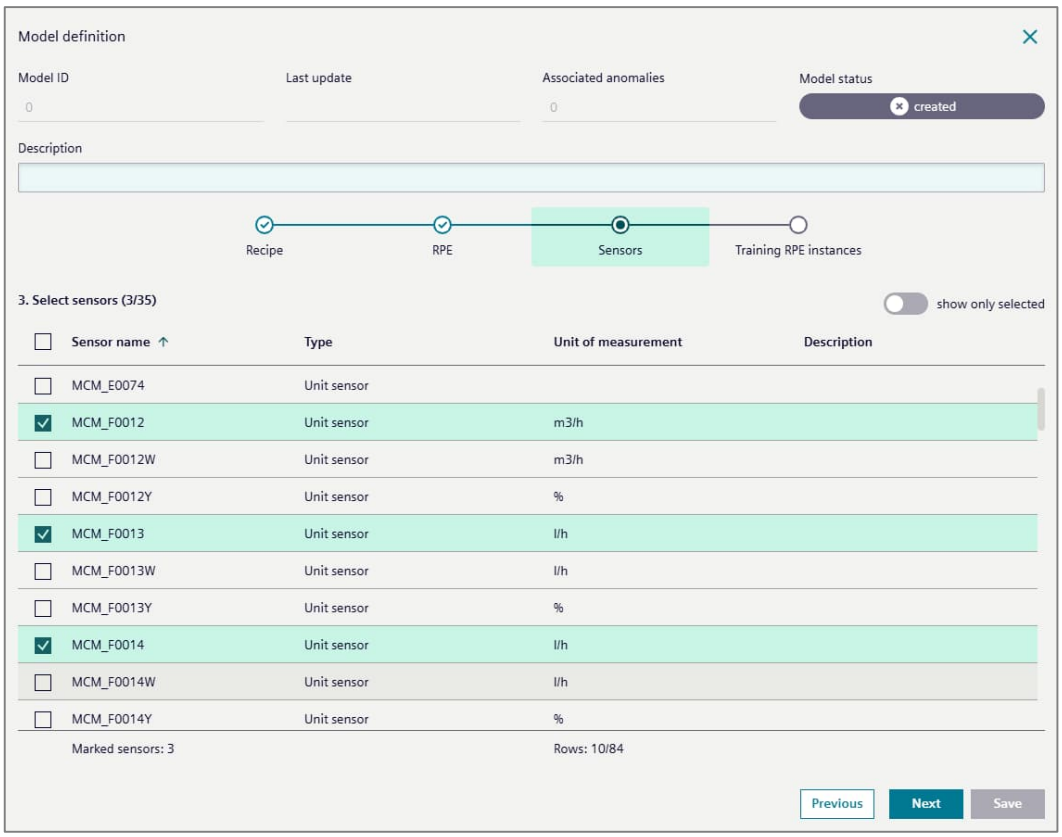
1. Choose the model type from the pulldown menu. The options are:
    - RUP (Recipe Unit Procedure): Focuses on a specific procedure within the recipe.
    - ROP (Recipe Operation Procedure): Targets a smaller operation within the unit procedure.
    - Phase: Analyzes a single phase of the recipe.
2. Select the recipe element from the pulldown menu. For phase-type models, choose one specific phase element.
3. If you are configuring a phase model, select a control strategy from the pulldown menu. The control strategy determines how the phase is managed during execution.
4. Click "Next" to move to the next step.



Step 3: Select sensors

Here, you link sensors to the model to gather data for analysis.

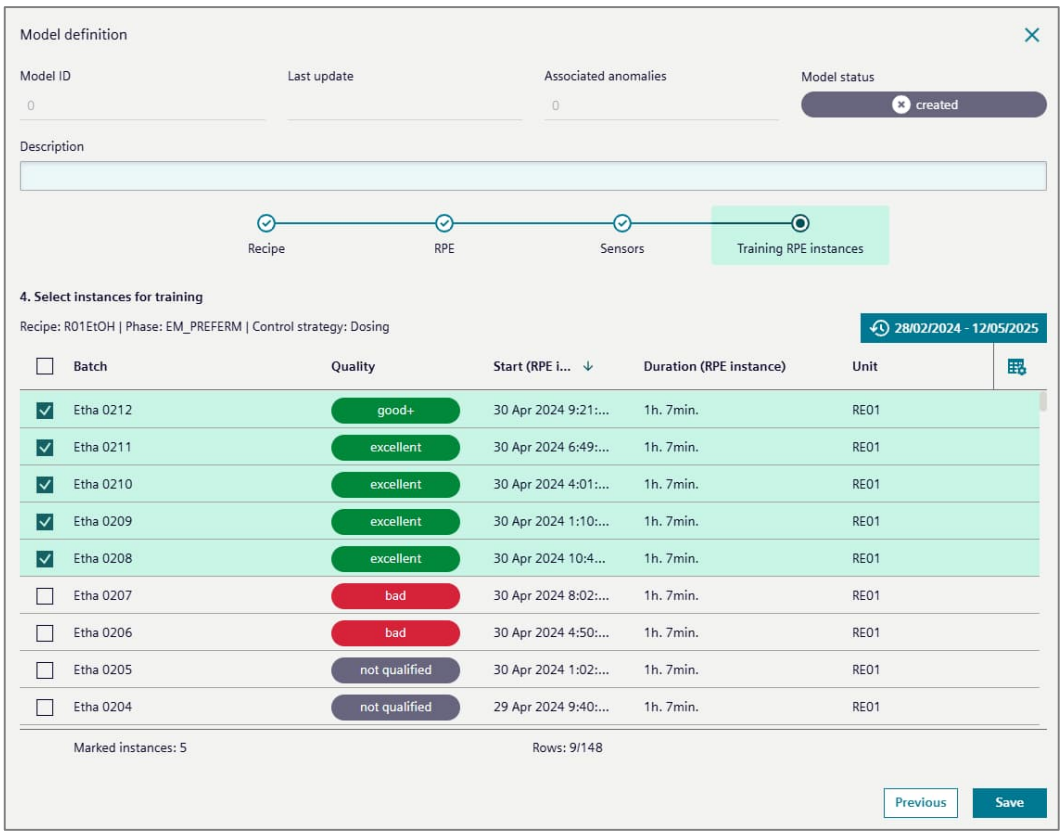
1. A table displays available sensors with details such as:
    - Sensor name: The identifier for the sensor.
    - Type: The sensor's category (e.g., temperature, pressure).
    - Unit of Measurement: The unit in which the sensor readings are recorded.
    - Description: A brief explanation of the sensor's purpose.
2. Choose sensors from the alphabetically sorted list. For ease of use, you can:
    - Sort the list in ascending or descending order.
    - Apply filters to handle large datasets efficiently.
3. To view only the sensors you have selected, enable the "Show only selected" switch.
4. Click "Next" to finalize the sensor selection.



Step 4: Training instances

This final step involves selecting the data instances the model will use for training.

1. Choose the batches or instances to be included in the training from the available list. This step ensures the model learns effectively from relevant data.
2. Click "Save" to complete the model configuration. Once saved, a unique model ID is generated, and the model is added to the model library for further use.



Training a model

The "Train" button, located in the "Operations" column of the model library, starts the training process for the selected model. Training utilizes the batches you previously selected during model configuration, along with the specified model settings. Upon successful training, the model's status changes to "trained", indicated by a green status indicator.

Monitoring training progress

The "Training instances" column shows how many batches were successfully trained out of the total selected. If any batches have data gaps or issues, they are skipped during training. Details about skipped batches and encountered issues can be reviewed in the log file, which provides phase-specific insights into the training process.

Important: At least one batch with valid sensor data is required to successfully train a model.

Using trained models for online analysis

Once trained, a model can be used for online analysis. To enable online monitoring, switch the toggle in the "Online" column to "on". Note that access to online monitoring feature requires a premium license.

Editing and managing models

- **Editing model definitions:**
  To modify a model, click the three-dots icon in the "Operations" column and select "Edit model definition" from the dropdown menu.
- **Reviewing training logs:**
  If training fails or generates warnings, click "Show log" to view detailed information about the errors encountered.

- **Deleting a model:**
  If a model is no longer required, you can delete it by selecting "Delete" from the dropdown menu.

Customizing table columns

To customize the columns displayed in the anomaly table:

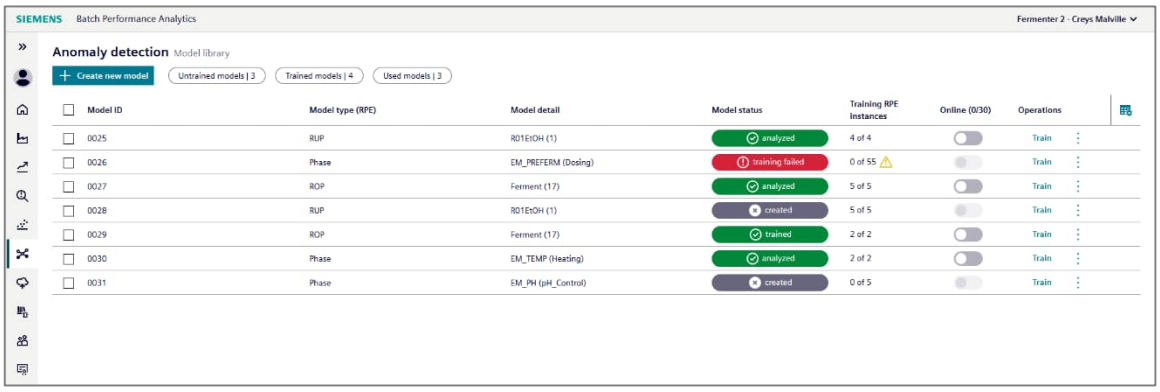
1. Click on the table icon located on the right side of the column header.
2. A dropdown menu will appear, allowing you to select or deselect columns such as Description, Anomalies and Number of sensors.

Rearranging columns

You can rearrange the order of the columns via drag and drop, except for the first column (Batch name) and the 2 last columns, which are fixed.

Notes on changes and deletions

- Changing a model's definition will automatically delete all associated anomalies.
- Deleting a model permanently removes all associated analyses and anomalies from the system.



Model library – Starting analysis

Once models are defined and trained, anomaly detection analysis can be performed for:

- Offline analysis: Manually analyzing archive batches.
- Online analysis: Automatically analyzing running batches.

Offline Analysis

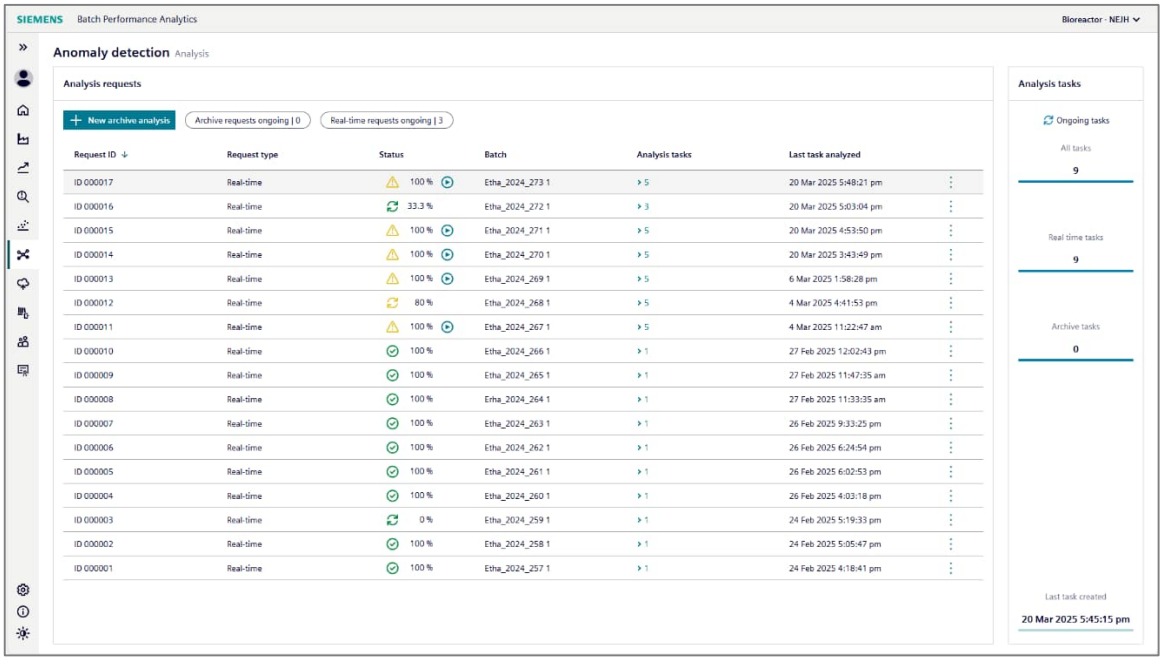
Offline analysis must be manually triggered in the analysis view. Since analyses run sequentially, only one analysis is executed at a time. Additional analyses remain in a "Pending" status until the current analysis is completed.

Accessing and triggering an analysis

1. Navigate to the sidebar, click on the "Anomaly detection" icon, and select "Analysis" from the dropdown menu.
2. Define a new analysis request with your preferred settings.
3. If another analysis is carried out, the new request will remain in "Pending" status.
4. If an analysis does not complete, use the "Stop" button to halt it.
5. Restart an analysis by clicking the "Start" button.

Online Analysis

To enable automatic online analysis, activate the relevant models in the training view. The system then triggers analyses at regular intervals based on data collector notifications. All analyses for a running batch are grouped into one request, with results updating automatically and displayed in the web browser.



Icon	Description
	Analysis ongoing
	Analysis completed. All tasks completed successfully
	Analysis was completed but some tasks failed.

Icon	Description
	Analysis has not yet started
	Analysis stopped
	Start/Restart analysis button
	Stop analysis button

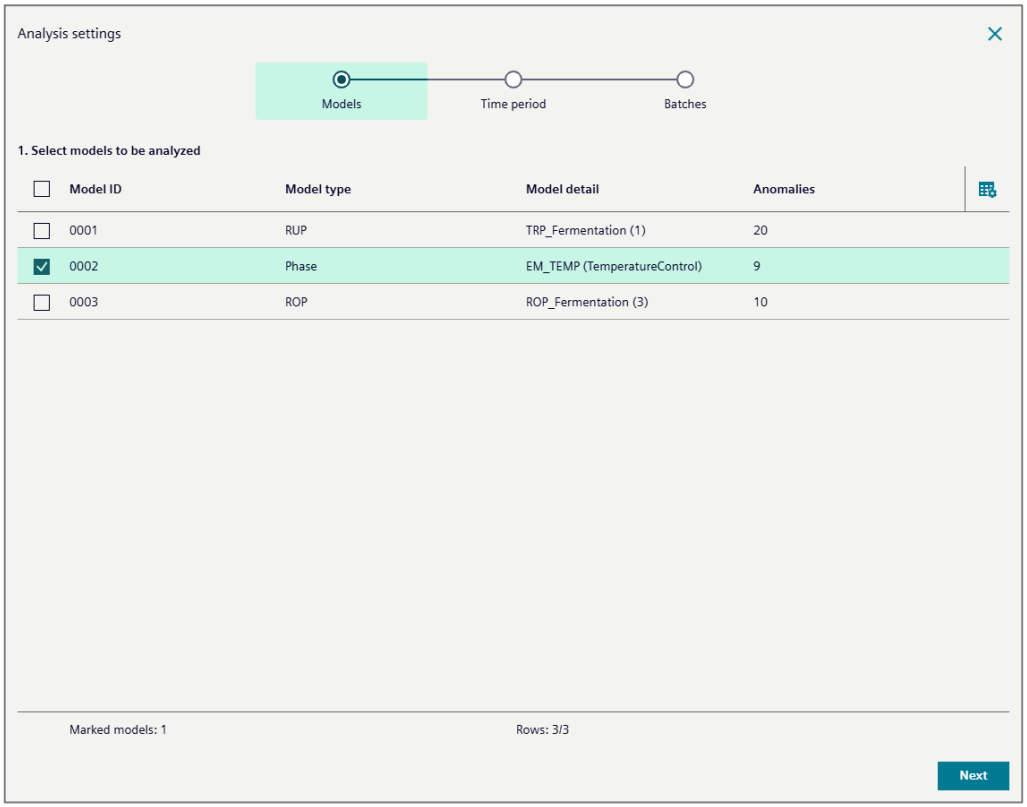
Performing a new offline archive analysis

To start a new offline archive analysis, click "+ New archive analysis." First, select the model for analysis, followed by the desired time period and the batches to be analyzed. Detailed steps are provided in the following chapters.

Analysis settings

Select models for analysis

- Choose one or more models from the list.
- Click "Next".



Customizing table columns

To customize the columns displayed in the anomaly table:

- Click on the table icon located on the right side of the column header.

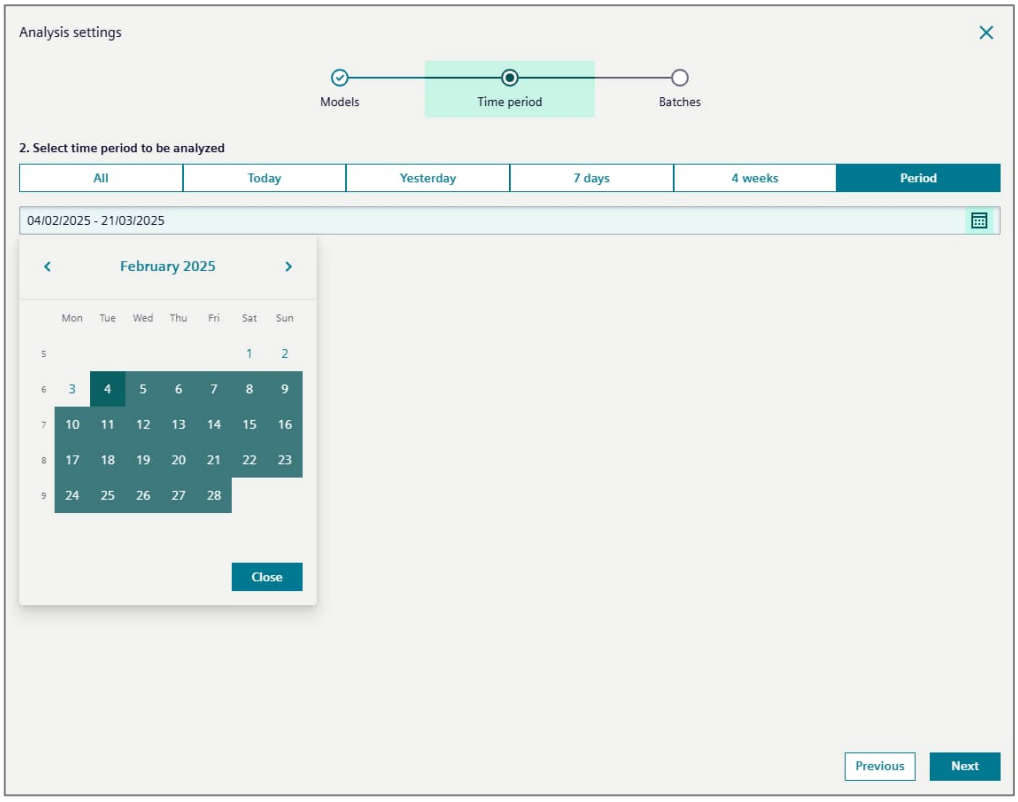
- A dropdown menu will appear, allowing you to select or deselect columns such as Description, Model status, Training instances and Number of sensors.

Rearranging columns

You can rearrange the order of the columns via drag and drop, except for the first column (Batch name) and the 2 last columns, which are fixed.

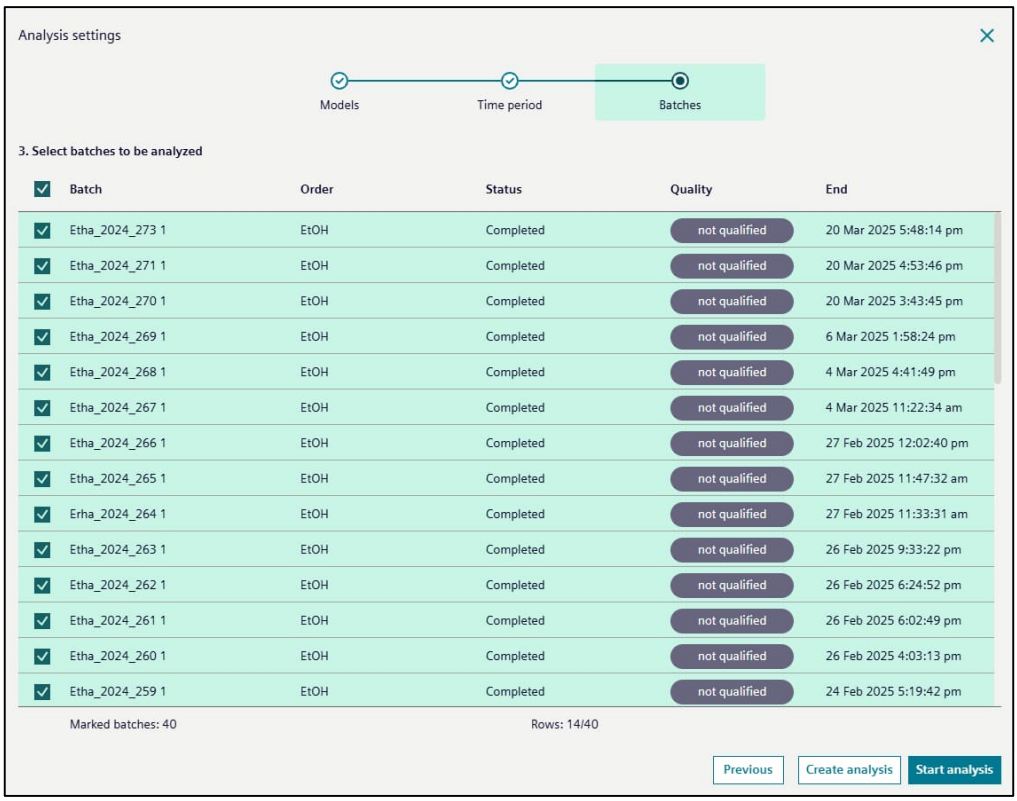
Select time period for analysis

- The default selection is "All". To specify a period, click the calendar icon and select the desired timeframe.
- Click "Next."



Select batches for analysis

- By default, all batches are selected. Deselect any batches that should be excluded.
- Use column sorting and filtering to refine the selection.
- Click "Start analysis".



Note

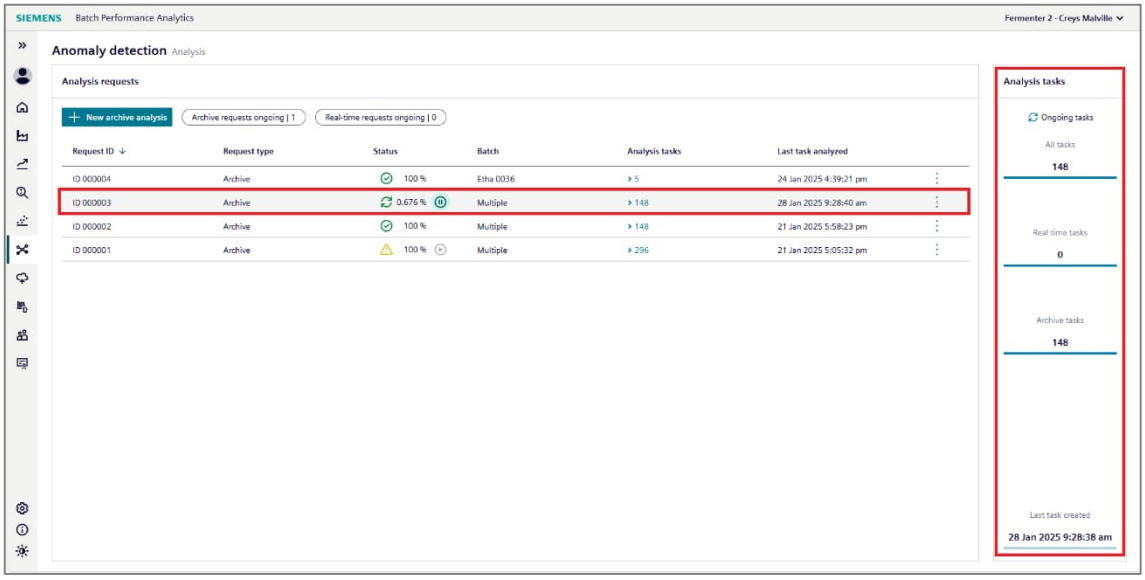
Choosing “Create Analysis” generates an analysis task with a new request ID, which can be started later. Selecting “Start Analysis” initiates the analysis immediately if no other task for archive batch is running at that time. If an analysis task is already running, you can only create a new task.

Understanding the analysis request list

Each analysis request is automatically assigned a unique request ID upon creation. The requests are displayed in a table, sorted by request ID, with the most recent entries appearing at the top.

Overview of the request list:

1. **Sorting and filtering:** The table columns can be sorted alphabetically or filtered to quickly find specific requests.
2. **Progress tracking:**
   - A progress information section on the right side of the table provides an overview of ongoing analysis tasks.
   - Separate indicators show progress for both online analysis and archive data analysis, including the number of active requests.
3. **Managing requests:**
   - The "Status" column allows users to stop or restart a manually initiated analysis.
   - The "Analysis tasks" column displays the total number of tasks created for a request. Clicking on a request provides access to the detailed analysis task view for further examination.
4. **Ensuring task completion:** If all tasks associated with a request are not completed, the request can be restarted to finalize the analysis.



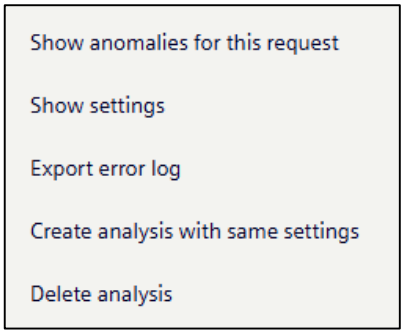
Editing analysis requests

You can take specific actions on each analysis request through the drop-down menu, accessible by clicking the three-dot icon at the end of each row.

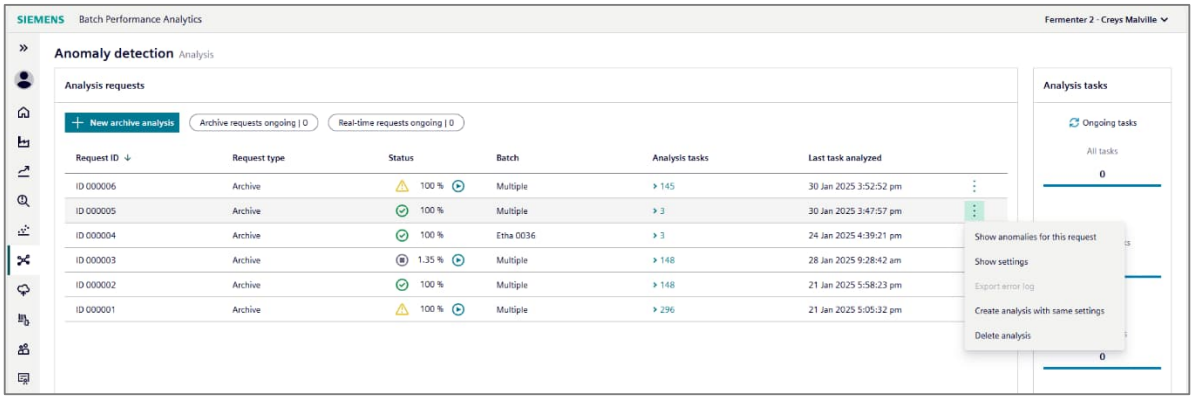
Available actions:

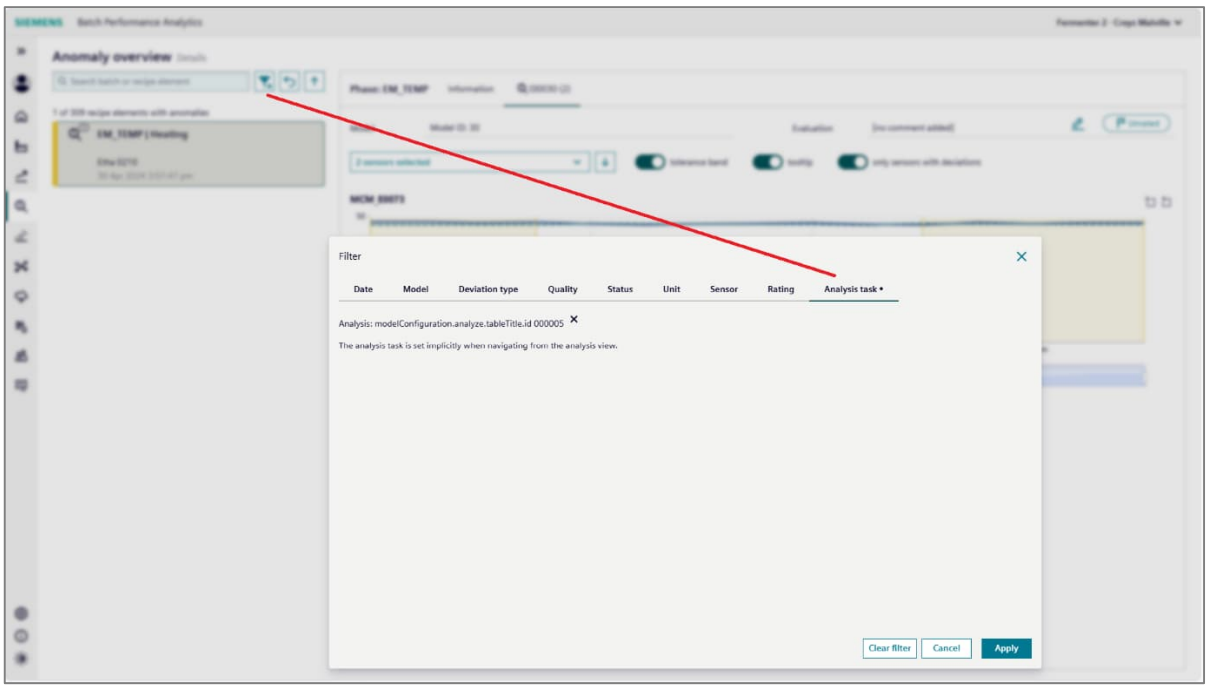
1. **Show anomalies for this request:** Jump directly to the anomaly view for the selected request to review identified issues.
2. **Show settings:** Display the specific settings applied to the analysis task.

3. **Export error logs:** Download logs to review any errors encountered during the analysis.
4. **Create analysis with the same settings:** Initiate a new analysis request using the same settings as the selected request.
5. **Delete analysis:** Remove an analysis task, including all associated anomalies found. Use this action cautiously as it permanently deletes related data.

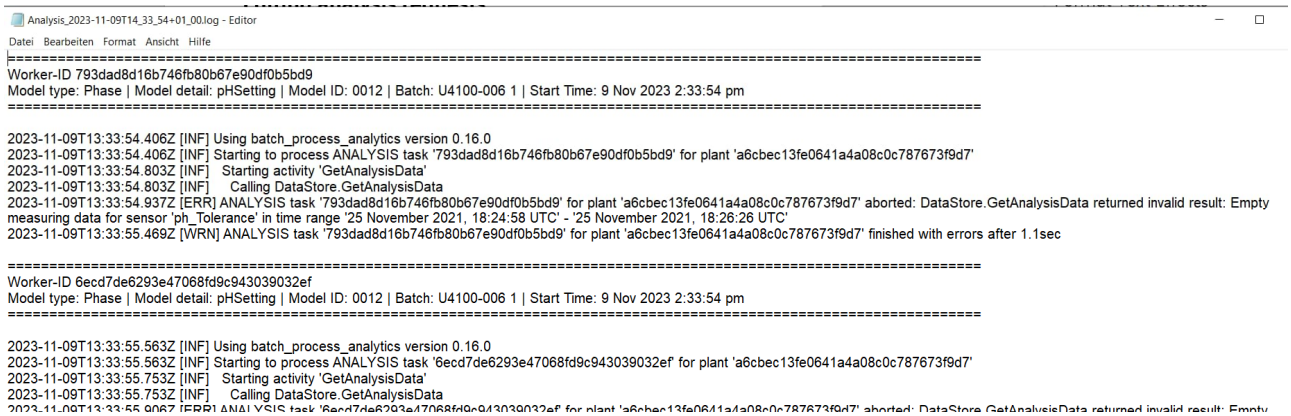


Show anomalies for this request





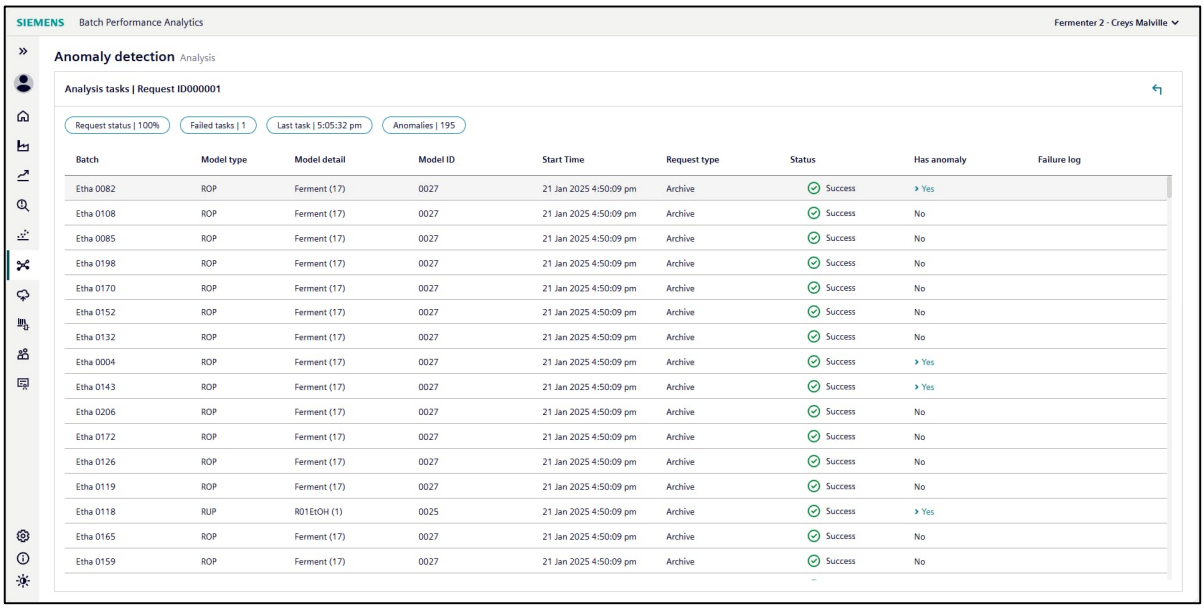
Export error log



Viewing analysis tasks

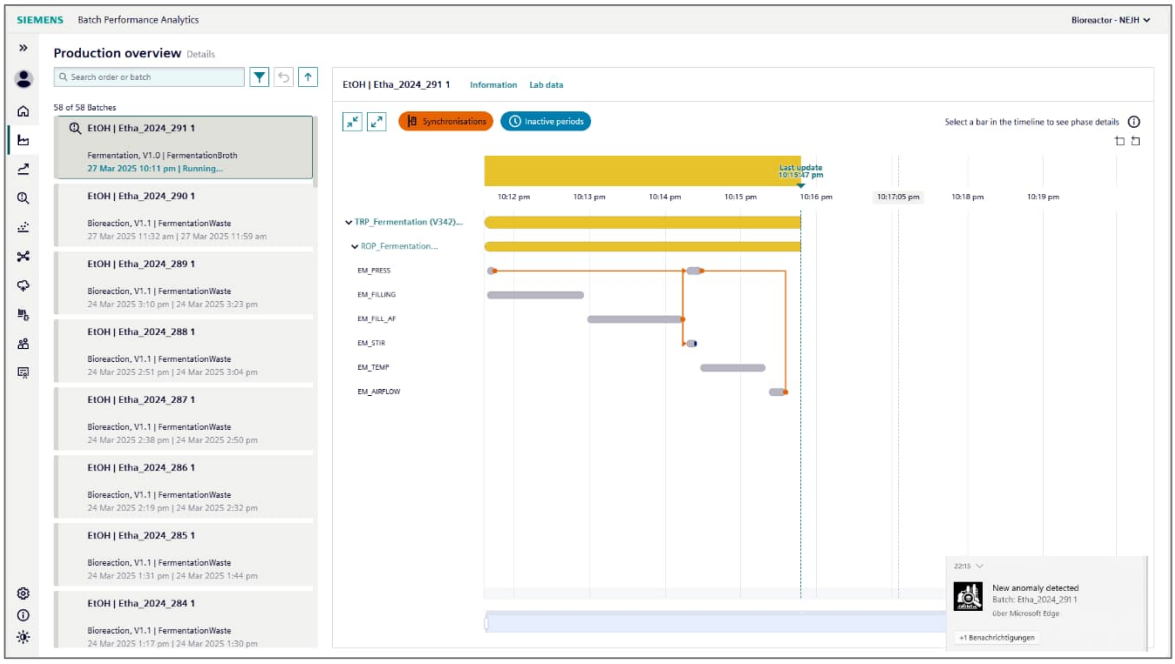
An analysis task involves analyzing a single instance with one model. For each specific analysis request, access a detailed list of all analysis tasks by clicking on the icon in the "Analysis tasks" column. The numbers displayed indicate the quantity of processed tasks. The image below illustrates a list of tasks that can be sorted alphabetically and filtered by columns. Return to the main analysis page by clicking the back button in the top-right corner of the header.





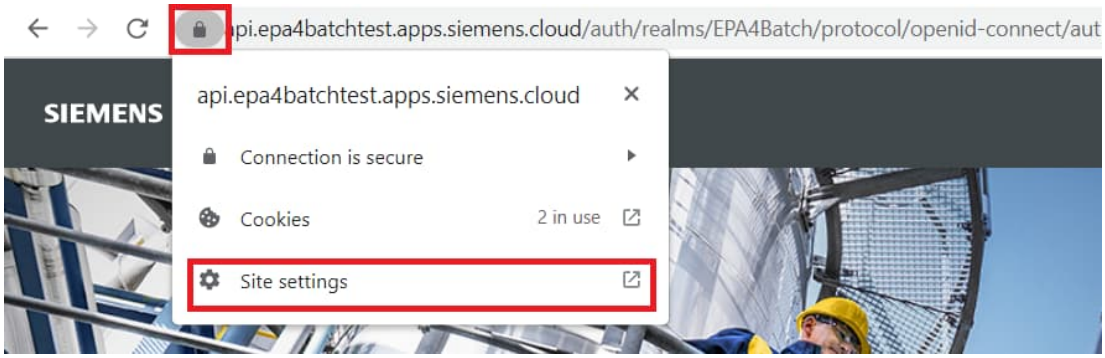
Getting online anomaly notifications

Online anomaly detection is performed automatically for batches currently in production. The progress of running batches can be monitored in the production overview. To receive notifications when an anomaly is detected, you need to set up notifications in your browser. When an anomaly is found during online monitoring, a message will appear on the screen with details about the batch, instance type, model ID, and start time of the instance. Click on the message to display more information.

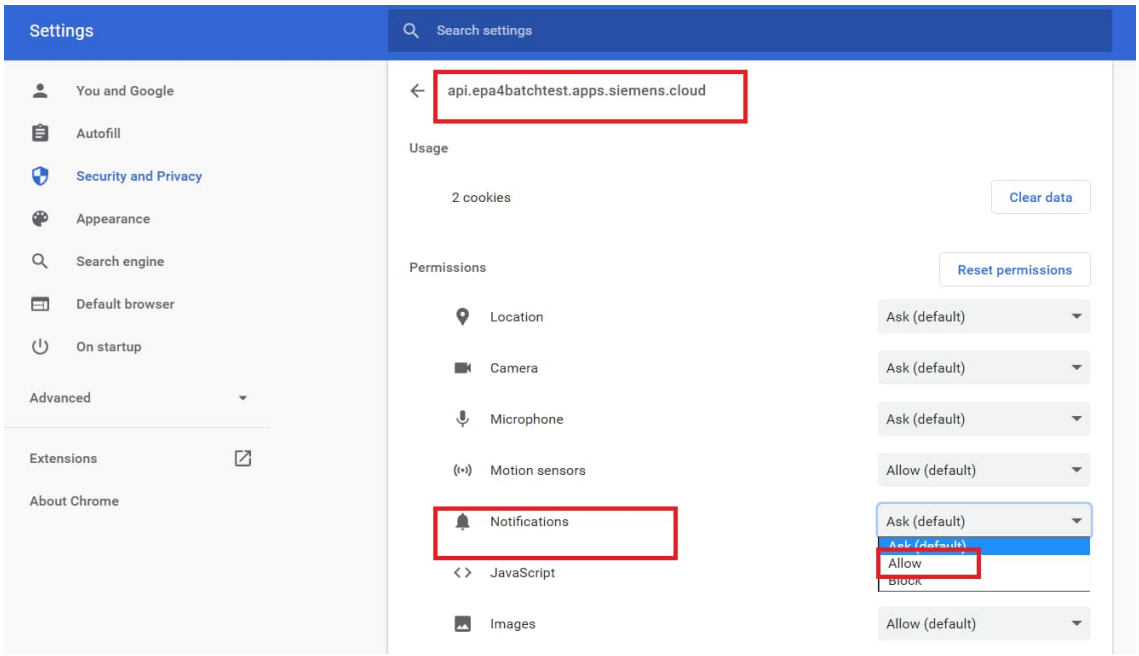


Here are the steps to set up anomaly notifications in your browser:

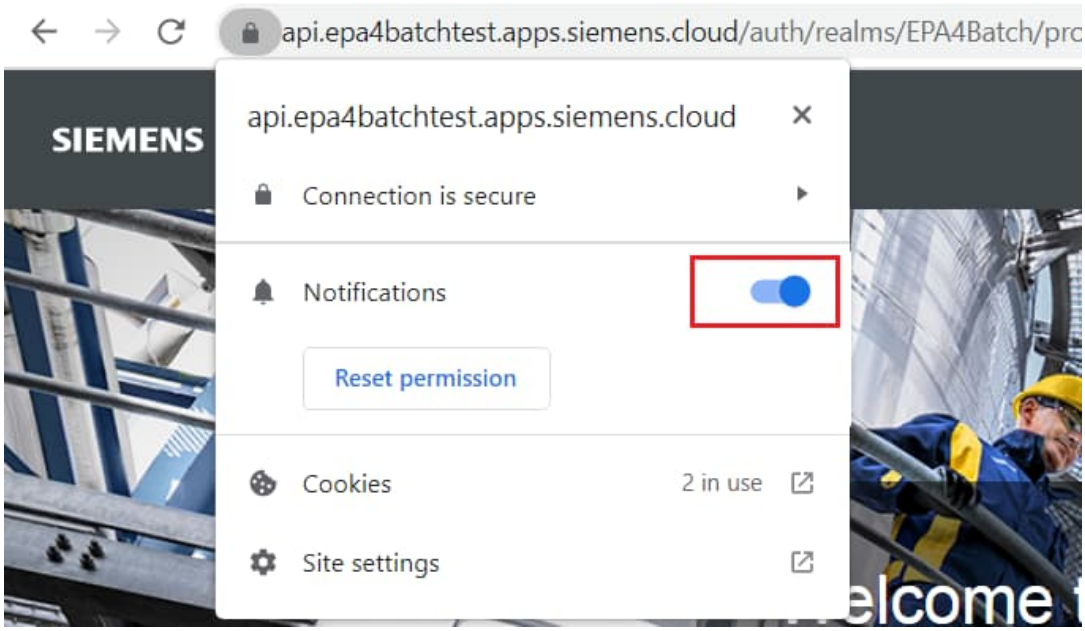
1. Open the application in your browser.



2. Go to Settings > Privacy and Security > Site Settings.
3. Scroll to "Notifications" in the pop-up window.



4. Toggle the "Sites Can Ask to Send Notifications" switch to turn website notification prompts on or off.
5. Ensure that notifications are activated to receive anomaly alerts.



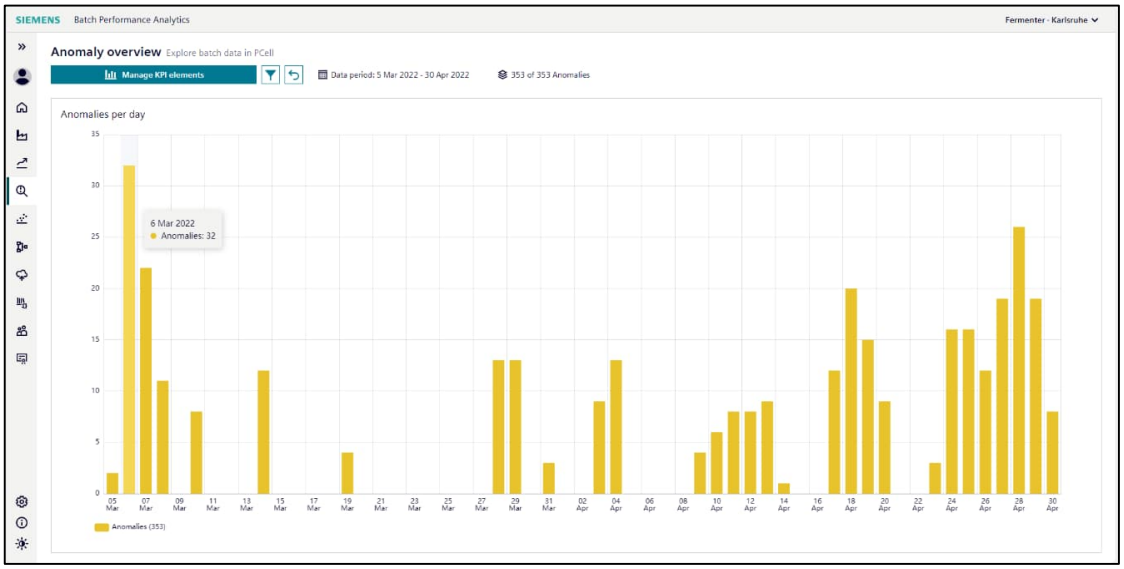
Understanding anomaly overview

Anomaly overview – Dashboard

To access the anomaly overview dashboard, navigate to the sidebar, click on the “Anomaly overview” icon, and select “Dashboard” from the dropdown menu.

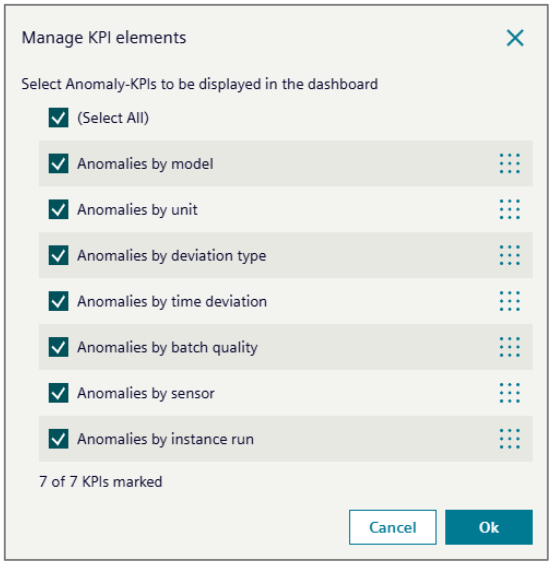
An anomaly represents a deviation or abnormal behavior detected by analyzing data from a specific instance (RUP, ROP or phase) with a particular model. These deviations can be related to sensor data or time-related variations. To review and analyze these anomalies, you can use the "Anomaly overview" dashboard, which provides a comprehensive view of the anomalies detected in your batch system.

1. **Overview dashboard:** The "Anomaly overview" dashboard contains a timeline chart that visualizes the number of anomalies per day. This chart serves to monitor and assess the occurrence of anomalies over time. When you hover over the bars in the chart, a tooltip will appear, displaying the date and the number of anomalies detected on that specific day.



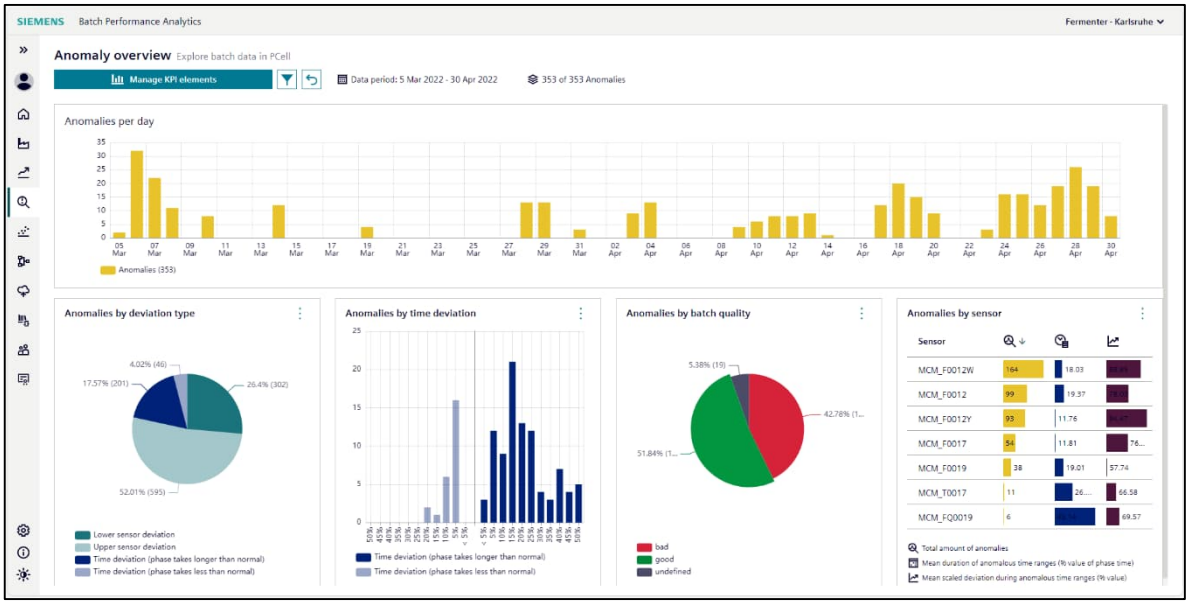
2. **KPI dashboard for root-cause analysis:** The Key Performance Indicator (KPI) dashboard is an essential tool for conducting root-cause analysis. It offers visual representations of various metrics that help identify patterns and data trends related to anomalies in your batch system.
3. **Chart types for data perspective:** The KPI dashboard supports multiple chart types, such as line charts, bar charts, and heat maps, to provide diverse perspectives on the data. These visualizations can be invaluable in gaining insights into your batch processes.
4. **Drill-down capabilities:** To delve deeper into specific performance issues, the dashboard provides drill-down capabilities. This means you can explore the details of individual batches or specific time periods. This in-depth analysis helps you identify the root causes of anomalies and take appropriate actions to enhance batch job performance.

5. **Customizing KPI display:** You have the flexibility to select which KPIs are displayed on the dashboard. By clicking on "Manage KPI elements," you can choose the KPIs most relevant to your analysis needs, either clicking "Select All" or individually ticking the KPIs you want visible. Easily rearrange the order of the KPIs in the view by using the drag-and-drop feature, accessible by pointing to the icon at the end of each KPI line. Once satisfied, click "Ok" to close the dialog, and the selected KPIs will be showcased beneath the timeline bar chart.



Displaying KPIs

The selected KPIs are displayed below the timeline chart.



Understanding KPIs in detail

Key Performance Indicators (KPIs) play a vital role in Batch Performance Analytics by providing insights into anomalies and aiding in root cause analysis. Here, we delve into these KPIs to offer a more detailed understanding of their significance.

Anomalies by model

- Focuses on the number of anomalies detected in each model, offering insights into which models may need further evaluation.
- Percentage of total anomalies within bad batches: Displays the proportion of anomalies occurring within batches considered “bad”.

Interpreting anomalies by model

- **Model performance assessment:** By examining the number of anomalies detected by each model, it becomes evident which models are more sensitive or effective at identifying deviations. This information is invaluable for evaluating model performance.
- **Identification of model strengths and weaknesses:** Understanding the number of anomalies per model sheds light on their strengths and limitations. Models with high anomaly detection rates may excel in specific scenarios but may be prone to false positives.
- **Model optimization:** If certain models consistently detect more anomalies, it may be worthwhile to fine-tune or optimize them further. It's an opportunity to enhance their performance in specific contexts.
- **Proportion of anomalies in bad batches:** The proportion of anomalies within “bad” batches is an essential metric for assessing the models' precision. If a significant percentage of anomalies are found in non-compliant batches, it indicates that the models are effectively identifying issues that can impact product quality.
- **Quality control:** This analysis aids in maintaining quality control by ensuring that models are effectively identifying anomalies in batches that require corrective actions.



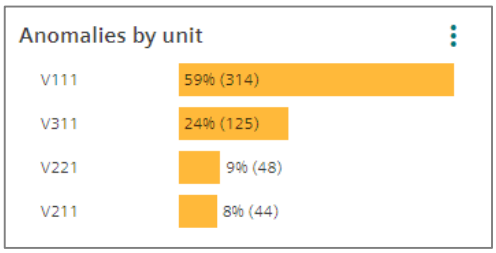
Anomalies by Model analysis is fundamental in maintaining and improving batch performance. It provides a clear picture of how different models are functioning in the context of your industrial process. The data generated from this analysis guides decisions related to model refinement, operational adjustments, and continuous quality assurance, all aimed at enhancing batch outcomes and overall production efficiency.

Anomalies by unit

Analyzes anomalies in relation to batch units, helping to pinpoint which units experience more deviations.

Interpreting anomalies by unit

- **Unit-based comparison:** By analyzing this data, you can easily compare different batch units and their respective anomalies. This helps you identify whether specific units tend to experience more deviations than others.
- **Prioritizing units:** You can prioritize units for investigation and improvement efforts based on the number and severity of anomalies they exhibit. Units with a higher frequency of anomalies may require closer attention.
- **Performance enhancement:** The analysis by unit provides valuable information for optimizing and enhancing the performance of specific batch units. It offers an opportunity to fine-tune processes, calibrate equipment, or address any issues affecting a particular unit.
- **Resource allocation:** When it comes to resource allocation and maintenance planning, understanding which units are more susceptible to anomalies can guide decision-making. It helps in assigning resources efficiently to maintain and improve batch units.



Analyzing anomalies by unit is a strategic step in batch process optimization. It helps in identifying patterns, improving performance, and ensuring consistent product quality. By addressing anomalies at the unit level, you can enhance operational efficiency and the reliability of your industrial batches, ultimately leading to better outcomes and reduced downtime.

Anomalies by deviation type

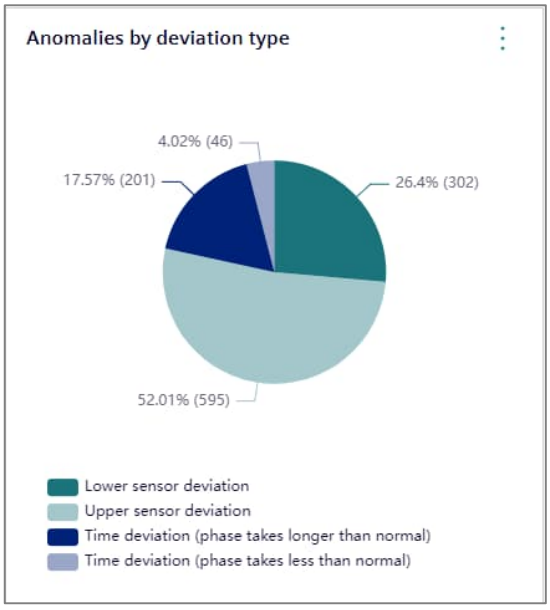
Classifies anomalies based on their type, such as sensor deviations or time deviations, providing insights into the nature of the deviations. A pie chart visualizes the distribution of anomalies by deviation type. The chart's segments represent different deviation types, and their sizes correspond to the proportion of anomalies attributed to each type.

The pie chart includes the following deviation types:

- Lower sensor deviation: Occurs when sensor readings fall below the expected or standard values. This type of deviation suggests that certain sensor measurements are lower than they should be, potentially indicating a problem with equipment or environmental conditions.
- Upper sensor deviation: In contrast, upper sensor deviation happens when sensor readings exceed the expected or standard values. This type of deviation indicates that specific sensor measurements are higher than normal, which can be indicative of another set of issues.
- Time deviation: Time deviations refer to instances where certain phases or events in a batch process take either longer or shorter durations than what is typically expected. Time deviations can impact the overall efficiency and timing of the batch.

Interpreting anomalies by deviation type

- **Pattern identification:** By examining the pie chart, you can quickly identify which deviation types are more prevalent in your batch processes. For instance, you may notice that sensor deviations are more common than time deviations, or vice versa.
- **Focused analysis:** The categorization allows you to focus your analysis efforts on specific types of deviations. For example, if upper sensor deviations are frequent, you can investigate the sensors responsible for these anomalies and address any underlying issues.
- **Root cause analysis:** Understanding the nature of deviations is crucial for root cause analysis. It can help you determine whether deviations are due to sensor malfunctions, environmental factors, or process-related issues.



Analyzing anomalies by deviation type is an essential step in improving batch performance. It helps you target the right areas for corrective action, whether it involves calibrating sensors, adjusting processes, or optimizing timing.

Anomalies by time deviation

The "Anomalies by time deviation" provides a detailed histogram to analyze how often "time deviations" occurred during batch processes. Time deviations refer to discrepancies in the timing of specific events or phases in a batch, and this histogram offers a visual representation of these deviations.

Key elements of the time deviation histogram:

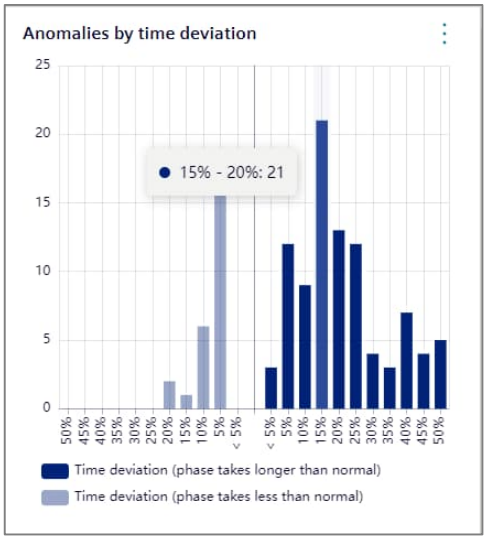
1. X-Axis - Duration of time deviation: The X-axis of the histogram displays the duration of time deviations with a time resolution of 5%. Each bar on this axis represents a specific range of time deviation.
2. Y-Axis - Number of anomalies: The Y-axis shows the number of anomalies with a specific duration of time deviation. This axis provides insights into the frequency of time deviations of various durations.

Time deviation categories:
The histogram includes both positive and negative time deviations:

- Positive time deviation: Refers to instances where a specific event or phase occurs later than expected.
- Negative time deviation: Refers to instances where a specific event or phase occurs earlier than expected.

Interpreting the time deviation histogram

- **Frequency analysis:** The histogram allows you to understand how frequently different durations of time deviations occur. You can observe which ranges of time deviations are more common and which are less frequent.
- **Pattern identification:** By examining the distribution of time deviations, you may identify patterns or recurring issues in your batch processes. For example, you may discover that specific phases frequently experience delays, impacting the overall batch performance.



Understanding time deviations is crucial for optimizing batch processes and ensuring that events occur as planned. Analyzing this data can help identify areas for improvement, reduce the occurrence of time deviations, and enhance the efficiency and predictability of your batches.

Anomalies by batch quality

The "Anomalies by batch quality" provides valuable insights into how anomalies are distributed among different batch quality categories. By visualizing this data with a pie chart, you can easily identify patterns and trends related to batch quality and its impact on anomalies.

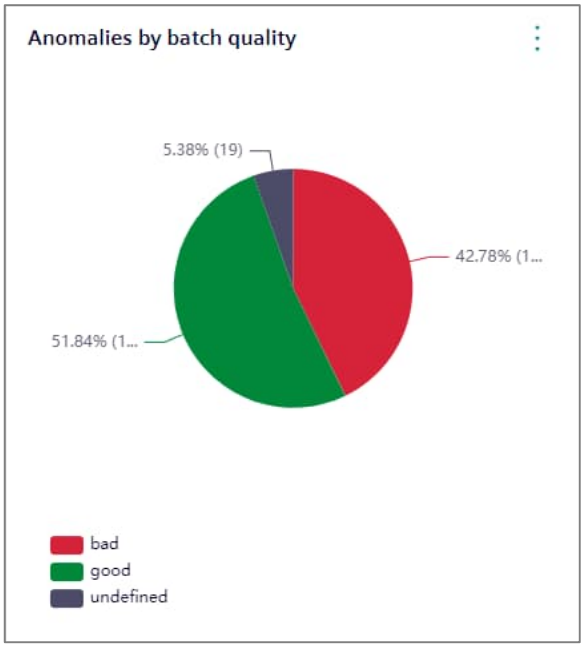
Key elements of the pie chart:
The pie chart segments are color-coded for easy interpretation.

- Green: Represents batches with "good" quality.
- Red: Represents batches with "bad" quality.
- Dark Grey: Represents batches with "undefined" quality.
- Light Grey: Represents batches that are "not qualified.

Understanding the pie chart

The pie chart illustrates the distribution of anomalies across various batch quality categories. This breakdown allows you to grasp the relationship between batch quality and the occurrence of anomalies.

- **Batch quality impact:** The chart highlights whether anomalies are more prevalent in batches with "good," "bad," "undefined," or "not qualified" quality.
- **Quality patterns:** Patterns may emerge, such as whether certain types of anomalies are more common in batches with specific quality categories. For example, "bad" quality batches may exhibit certain types of sensor deviations.



This visual representation of anomaly distribution by batch quality empowers you to make informed decisions and improvements in your batch processes. By identifying patterns, you can develop strategies to enhance batch quality, reduce anomalies, and optimize the overall performance of your batches.

Anomalies by sensor

The "Anomalies by sensor" pinpoints sensors that exhibit the most deviations in your batch processes. It provides detailed metrics for each sensor, offering insights into the extent and impact of these anomalies.

For each sensor, the following key metrics are presented:

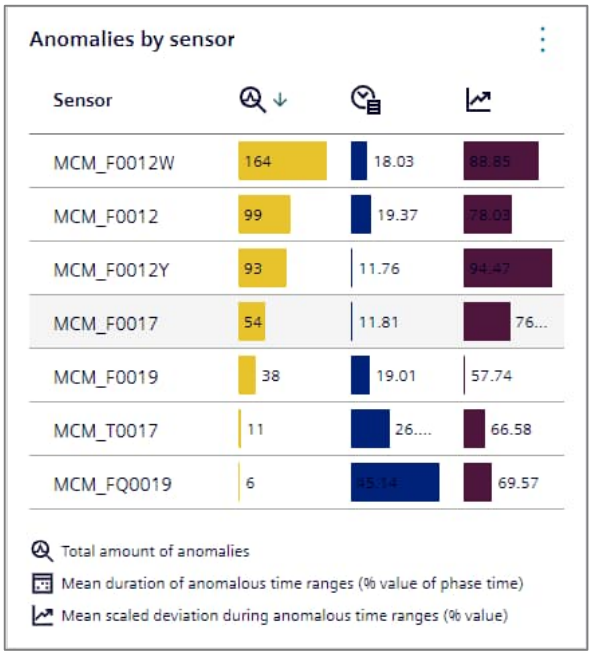
1. Number of anomalies:
    - This metric indicates how many anomalies or deviations have been detected for a specific sensor.
    - A higher number of anomalies may suggest a sensor with recurring issues or deviations.
2. Mean duration of anomalous time ranges (% of phase time):
    - This metric reflects the average duration, expressed as a percentage of the total phase time, during which a sensor deviates from the expected behavior.
    - It provides insight into the temporal extent of sensor anomalies.
3. Mean scaled deviation strength of the sensor during anomalous time ranges (% value):
    - This metric calculates the average scaled deviation strength of the sensor during periods of anomalies, represented as a percentage value.
    - It quantifies the magnitude of sensor deviations during those time ranges.

List sorting

The list of sensors is sorted based on the number of anomalies, with the sensor exhibiting the highest number of anomalies positioned at the top. This sorting helps you quickly identify the sensors that experience the most deviations in your batch processes.

Custom sorting

You have the flexibility to customize the sorting order by clicking on the headers of the KPIs. This allows you to sort the sensors in ascending or descending order based on other metrics, such as mean duration or deviation strength, as needed for your analysis.



The "Anomalies by sensor" section provides essential information to focus your attention on specific sensors in your batch processes that may require further investigation or maintenance. By identifying sensors with a high number of anomalies, you can take targeted actions to address these deviations, leading to improved batch performance and overall process efficiency.

Anomalies by instance run

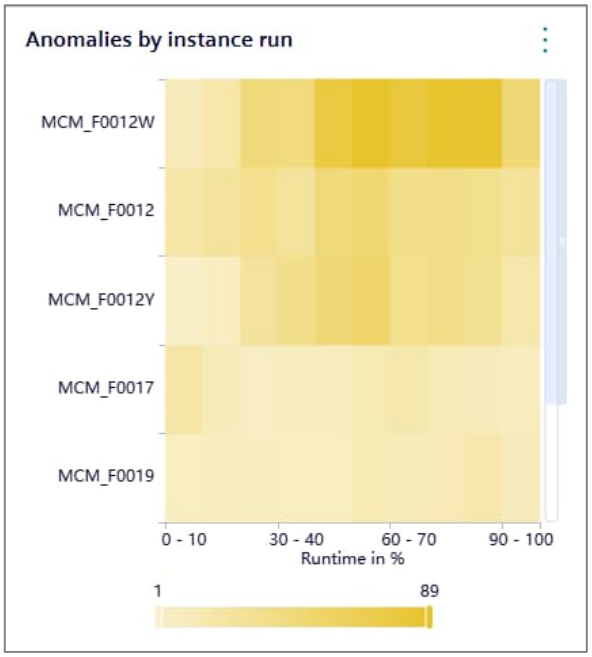
The heatmap is a tool in Batch Performance Analytics for visualizing the intensity of deviations in relation to the runtime of Recipe Procedure Element (RPE) instances. This visualization offers a deeper understanding of when and where sensor deviations occur, enabling you to identify critical points in batch processes.

Key features of the heatmap:

- X-axis: RPE instance runtime
  - The X-axis represents the instance runtime of the RPE with a time resolution of 10%.
  - It provides a time scale showing how far into a RPE instance's execution a particular deviation occurs.
- Y-axis: Top sensors
  - The Y-axis lists the top sensors that have the highest number of deviations detected in the involved instance runs.
  - Sensors are sorted based on the frequency of deviations.
- Color representation
  - Each cell within the heatmap is color-coded to represent the number of deviation occurrences.
  - Darker colors correspond to larger counts of deviations, as indicated by the legend.
  - This color scheme makes it easy to identify the sensors and time slots with the most frequent deviations.

Heatmap use case

In the example below, you can see that the sensor "MCM_F0012W" frequently deviates from the middle of RPE instances. This insight is invaluable for process optimization, as it highlights a specific sensor and time frame where issues consistently arise. By focusing on these critical points in the batch process, you can take targeted actions to improve performance and reduce anomalies. We recommend visualizing the Heatmap for a single Model to focus the analysis on a specific RPE.



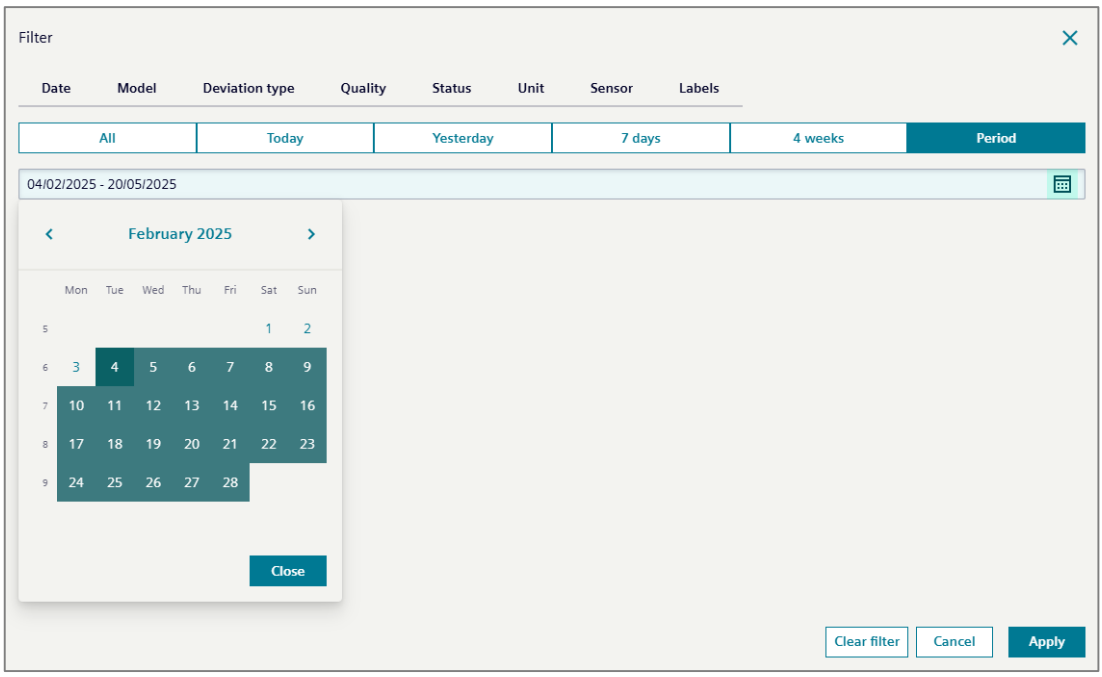
The heatmap provides a powerful visual representation of data trends, aiding in root cause analysis and enabling more efficient decision-making for optimizing batch processes. It serves as a key tool in identifying when and where deviations occur, ultimately leading to enhanced batch performance.

Filtering KPIs

The advanced filtering function allows you to refine your KPI results by specifying various criteria, ensuring that your analysis is targeted and accurate. Here's how you can apply filters to your data.

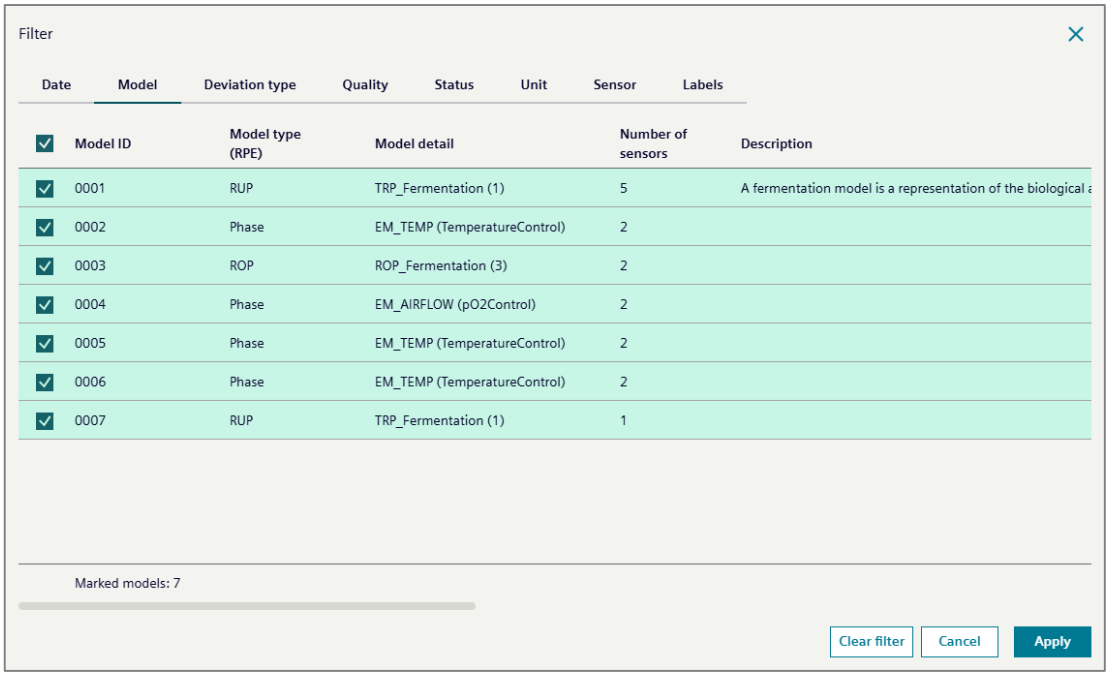
Filtering date

Configure the date filter to specify a particular time range or view data for all days. By default, "All" days are selected, displaying data for all available days. However, you can also define a custom time range by selecting a start date and an end date or choose from predefined time ranges like "Today", "Yesterday", "Last 7 days" and "Last 4 weeks". If you require a custom date range, the "Period" section includes a user-friendly date and time picker. Just click on the calendar icon to access a detailed calendar, enabling you to select specific dates and times.



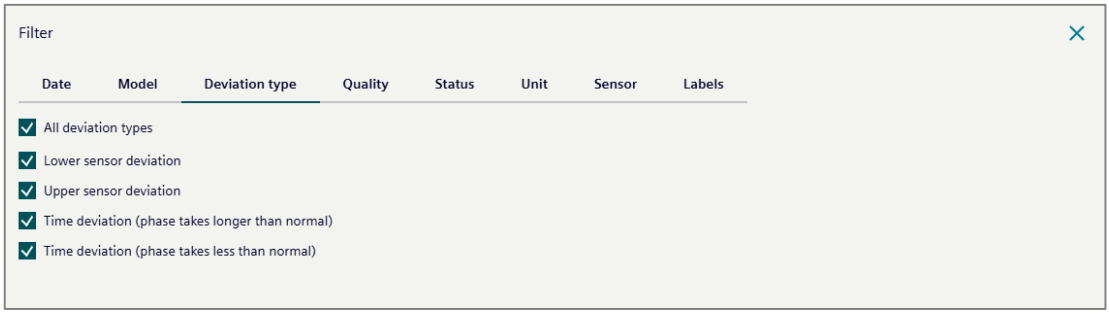
Filtering model

Utilize the sorting and filtering features to select a particular model from the list of available models. Deselect models that you don't want to include in your analysis. This feature is especially valuable when you want to concentrate on specific models.



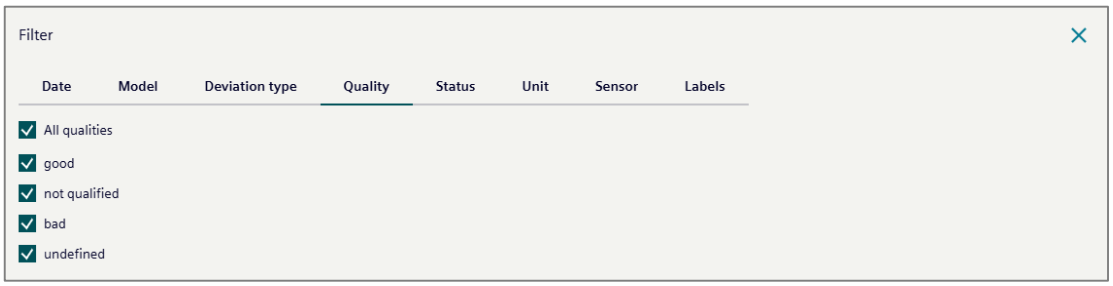
Filtering deviation type

Filter for specific deviation types, such as sensor deviations or time deviations, from the list of available deviation types. Select the deviation type you're interested in and deselect others. This enables you to focus on a specific type of anomaly in your analysis. All deviation types are selected by default.



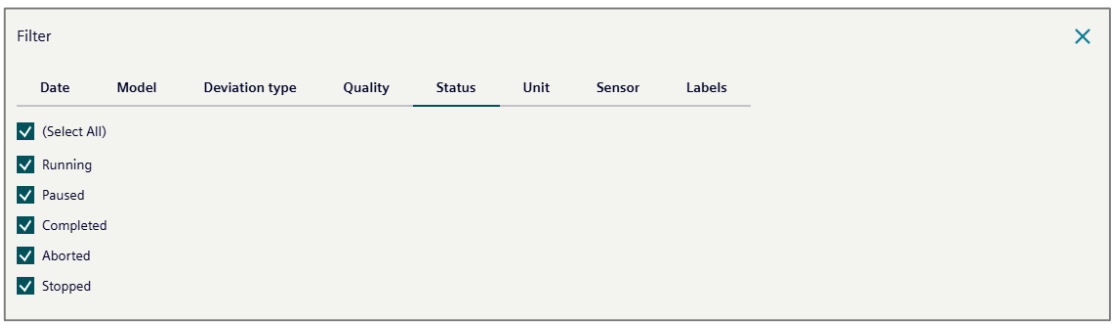
Filtering batch quality

Choose a specific batch quality from the list of all batch qualities. Use the filtering feature to select the quality you want to analyze and deselect others. This allows you to evaluate the impact of batch quality on overall performance. All qualities are selected by default.



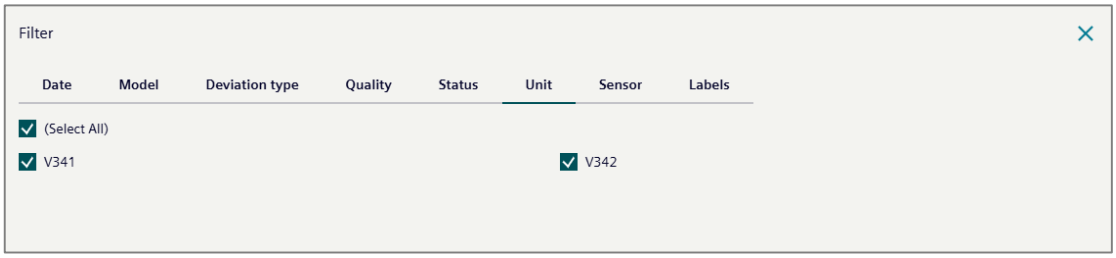
Filtering batch status

To focus on batches with specific statuses, select the relevant status from the list of all available batch statuses. Deselect statuses that you don't wish to consider. This is particularly useful when analyzing batches in different operational states. All statuses are selected by default.



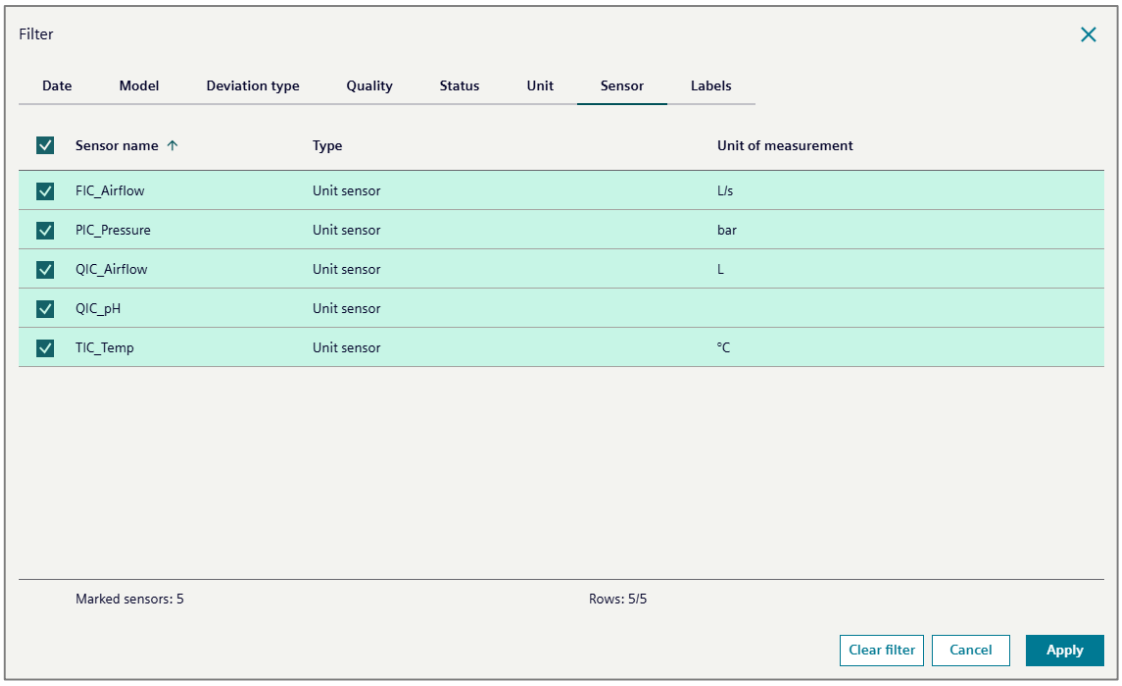
Filtering unit

Utilize the filtering feature to narrow down to a specific batch unit from the list. Choose the desired unit and deselect any others you wish to exclude. This enables focused analysis on the selected batch unit, assessing its influence on overall batch performance. While all batch units are initially selected, you can opt to deselect units not under consideration, ensuring that your analysis is tailored to the specific batch unit of interest. This approach facilitates the identification of batch units that deviate from standard values.



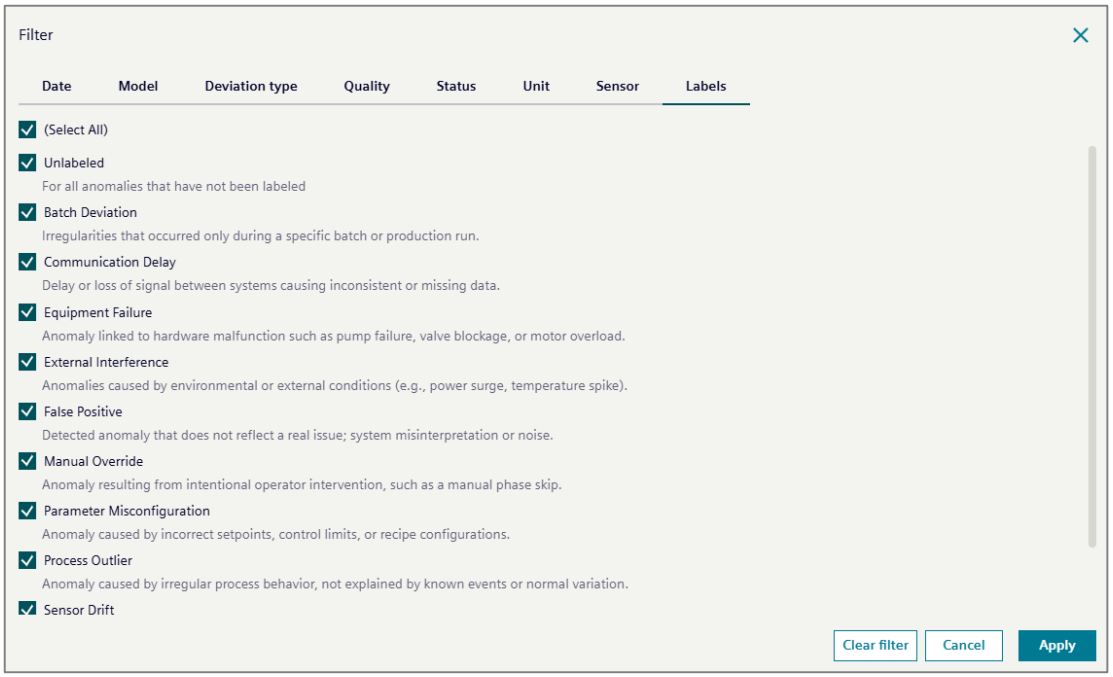
Filtering sensor

To isolate a particular sensor from the list, employ the filtering feature. Choose the specific sensor you desire and deselect any others that are not pertinent to your analysis. This enables concentrated scrutiny of data from the chosen sensor, evaluating its influence on batch performance. While all sensors are initially selected, you have the option to unselect those not under consideration, ensuring a targeted analysis relevant to the sensor of interest. This approach aids in pinpointing sensors that deviate from standard values and can also be instrumental in identifying malfunctioning sensors.



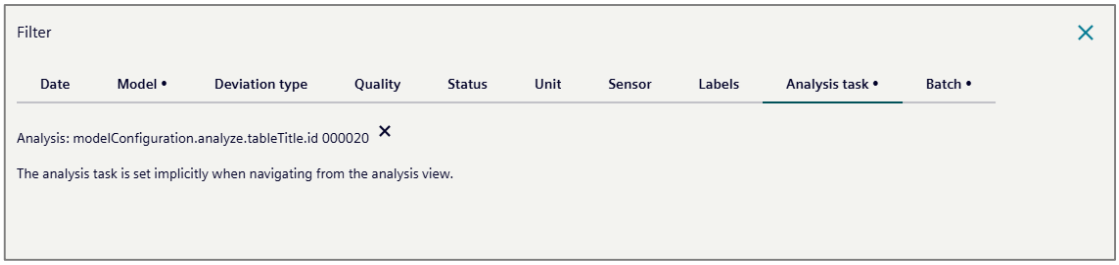
Filtering labels

Utilize the label filter in batch performance analytics to choose anomalies based on their labels.



Viewing analysis task

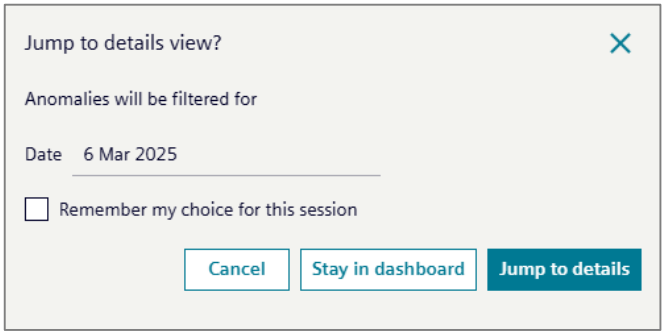
The "Viewing analysis task" filter within batch performance analytics is a system-specific feature enabling you to inspect the outcomes of a designated analysis task. Automatically configured by the system, this filter comes into play when you wish to review results from activities like anomaly detection or other analysis requests. Unalterable by users, the system determines and applies this filter based on the specific analysis task initiated. This functionality streamlines the analysis process, allowing you to focus on the precise results of the analysis task of interest, enhancing overall efficiency. Moreover, it facilitates result comparison by enabling the viewing of outcomes from various analysis tasks.



Using quick filtering

Quick filtering, a feature in batch performance analytics, allows you to swiftly filter data by clicking on a bar in the timeline chart or a name in the KPI tiles. This enables rapid and easy data filtration based on a specific metric or time period. Clicking on a bar in the timeline chart establishes the filter, prompting a confirmation window with the specified

choice. Opt to save the choice for the session by checking the box "Remember my choice for this session," eliminating future prompts when selecting different filters. This enhances the efficiency of the filtering process. Additionally, choose between "Stay in dashboard" to remain on the current dashboard or "Jump to details" to access the filtered data list.



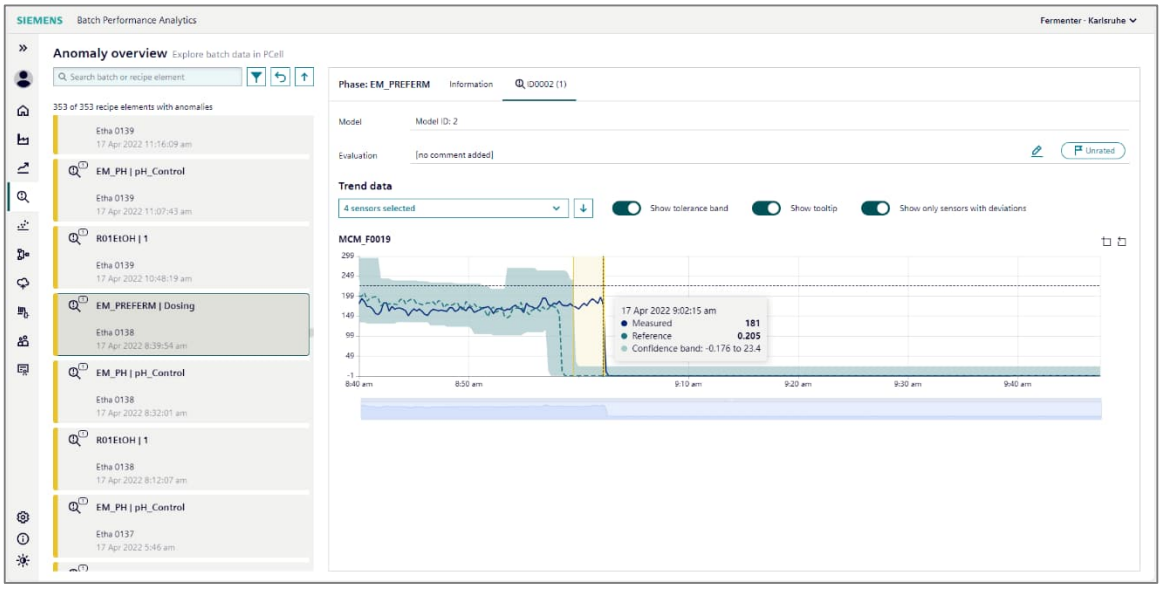
Viewing anomaly details

To access the anomaly overview details, navigate to the sidebar, click on the "Anomaly overview" icon, and select "Details" from the dropdown menu. This dashboard provides a comprehensive tool for monitoring and analyzing anomalies within the batch system.
When opened, the dashboard displays a list of recipe elements—such as RUP, ROP, or phase instances—that have registered anomalies. By default, instances are sorted by occurrence, but users can adjust the sorting order to ascending or descending to suit their analysis needs. Advanced filtering options allow for focused analysis by refining the list based on specific criteria.
Selecting a tile from the list displays the anomaly results associated with the chosen model and its sensors in the main display area. The "Information" tab offers detailed data, enabling effective anomaly analysis and resolution.

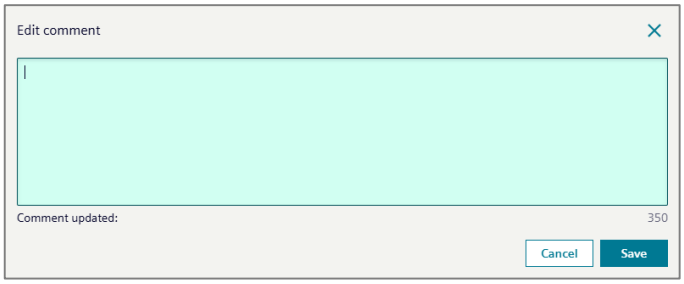
The result area and the information tab are explained in detail hereafter.

Model-based anomaly

Anomalies are distinctly displayed for each model, with the analysis results presented in separate tabs. The count of identified deviations is enclosed within brackets. The view showcases trend data from sensors associated with the model, presenting deviations graphically in diagrams. If multiple sensors were utilized for a single model, they are organized alphabetically under their respective tag names, with the option to arrange them in ascending or descending order.
For a deeper understanding of measured values or to track value evolution, hover the cursor horizontally in the trend window for precise values. Zooming within the chart is facilitated by the slider at the chart's bottom or by selecting "Area zooming" on the top right-hand side of the timeline bar, aided by the mouse. Resetting zoom is conveniently done with the "Reset zooming" button. Additionally, switches such as "Show tolerance band", "Show tooltip" and "Show only sensors with deviations" offer the flexibility to display or hide information in the diagrams, enhancing the analytical capabilities of the anomaly details interface.

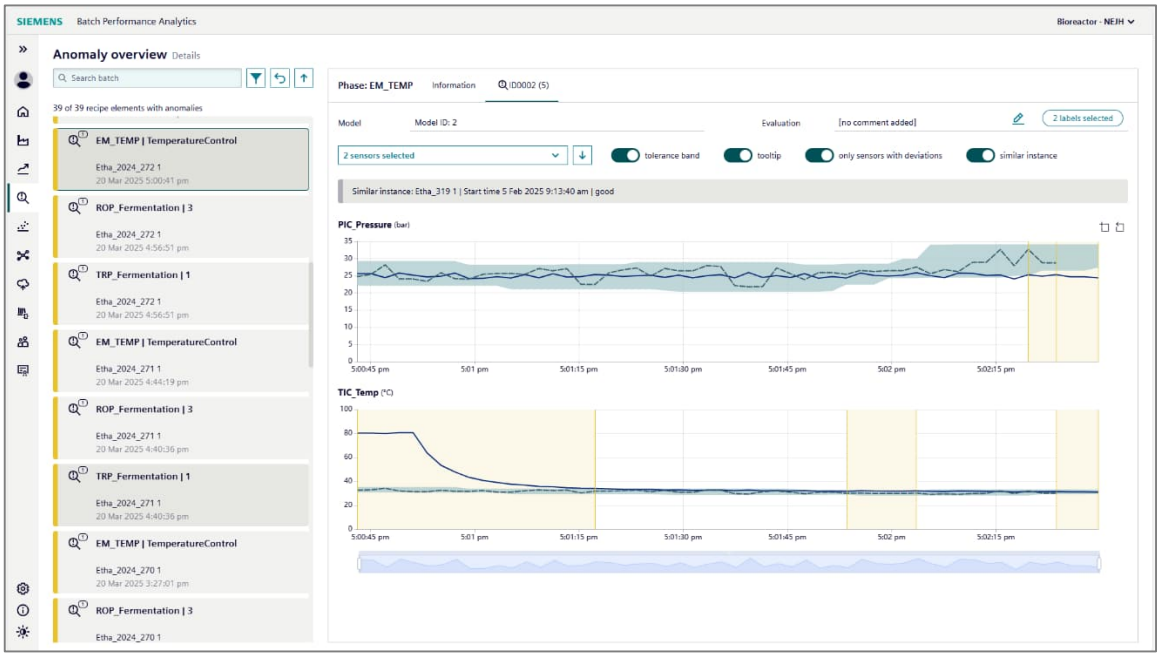


For each anomaly, you have the option to add a comment. Click on the pen icon to open the comment dialog and document your observations or analysis.



Making similarity calculations

Batch Performance Analytics supports you during online monitoring by displaying the most similar instance. During the execution of a recipe procedure element, both anomaly detection and the calculation of a similar instance occur at regular intervals. Visualizing the most similar instance, along with meta-information such as the quality of the associated batch, provides an indicator of the forecast for the ongoing instance. You have the option to toggle the visibility of the trend of the similar instance and its meta-information using the "Show similar instance" button.



Note The calculation of similar phases is only available in online analysis mode. This feature is not applicable during offline analysis.

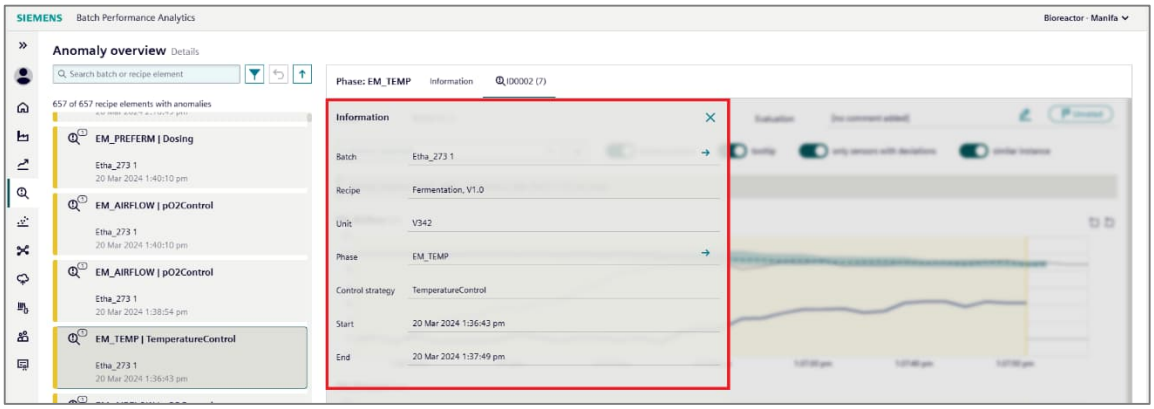
Anomaly labelling

Anomaly labelling allows users to assign descriptive, customizable tags to anomalies. Each anomaly begins with a default label of “Unlabeled,” which can be modified by selecting one or more relevant labels through an intuitive interface. Labels such as “Sensor Drift,” “Process Outlier,” or “False Positive” provide richer context and make it easier to group and prioritize anomalies based on shared characteristics.

Users can create up to 10 labels tailored to their specific analysis needs. Labels can be edited directly from the dialog, and any label can be deleted with a confirmation message that indicates how many anomalies would be affected.

Viewing detailed information

The "Information" tab offers a detailed breakdown of anomaly instances, providing in-depth insights into batch specifics, recipe information, unit details, instance type name, and start and end times of the instance. This structured view enables users to thoroughly understand each anomaly, facilitating effective analysis and resolution. By accessing this information, users can quickly identify the context of detected anomalies, trace their root causes, and make informed decisions to enhance batch performance and minimize future occurrences.



Note: Clicking the arrow on Batch, RUP, ROP, or Phase navigates directly to the Production overview detail view.

Managing anomalies

To access the anomaly overview table, navigate to the sidebar, click on the "Anomaly overview" icon, and select "Table" from the dropdown menu. This will open a dedicated view displaying a comprehensive table of all anomalies based on your selected filter criteria.

Anomaly table overview

The anomaly table provides a structured and organized overview of detected anomalies, facilitating efficient data navigation and analysis.

- Chronological sorting: By default, the table is sorted chronologically based on the production date, allowing you to track anomalies in the order they occurred and understand potential relationships.
- Information columns: Each row in the table provides detailed information about an anomaly, including:
  - Batch and model where the anomaly was detected
  - Model details and ID used in the analysis
  - Anomaly start time and duration
  - Any associated comments or notes
- Sorting and filtering: Columns can be sorted in ascending or descending order, and advanced filtering options allow you to narrow down displayed anomalies based on specific criteria. These features are essential for pinpointing anomalies and understanding their patterns and implications.

Customizing table columns

To customize the columns displayed in the anomaly table:

- Click on the table icon located on the right side of the column header.
- A dropdown menu will appear, allowing you to select or deselect columns such as Batch ID, Start (batch), Duration (batch), Quality, Order, End (RPE instance), Status, Unit, Anomaly metrics, and virtual parameters.
- In the column selection menu, you also have a button to export the table as a CSV file containing all the currently visible columns.

Rearranging columns

You can rearrange the order of the columns via drag and drop, except for the first column (Batch name), which is fixed.

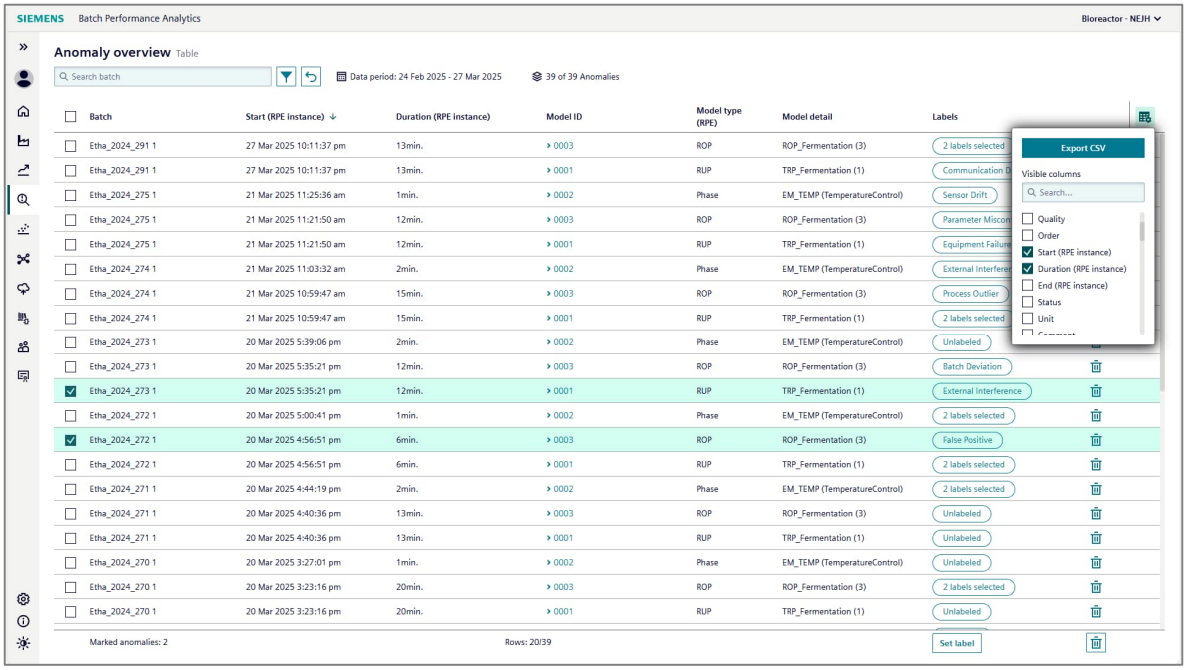
Accessing anomaly details

Clicking on a Model ID link within the table will direct you to the detailed anomaly overview page for that specific model, providing in-depth information and analysis.

Labeling anomalies

You can assign and manage labels for anomalies, supporting both individual and bulk actions to help organize and classify data more effectively. To label a single anomaly, click on the label pill in the corresponding row. This opens a dialog where labels can be added or removed, and any changes made are saved automatically upon closing. For bulk actions, multiple anomalies can be selected using the checkboxes on the left side of each row. Once selected, the “Set label” button becomes active at the bottom of the table. Clicking this button opens a label dialog where labels can be assigned or removed for all selected anomalies at once. The dialog provides visual feedback: labels already applied to some or all of

the selected anomalies are highlighted, and a counter to the right of each label shows how many of the selected anomalies currently have that label.



Anomaly metrics

You can show meaningful anomaly metrics in the anomaly table:

#Deviations: Total number of all process deviations

Min deviation duration: The shortest process deviations, in relation to the RPE instance duration (% value)

Max deviation duration: The longest process deviations, in relation to the RPE instance duration (% value)

Mean scaled deviation: The overall mean scaled process deviation indicates strength of deviation in relation to the tolerance band

Time deviation: Norm time deviation, in relation to the RPE instance duration (% value). A positive value indicates that the instance takes longer than the reference time, while a negative value indicates that the instance takes less time than the reference.

Understanding cluster analysis

Cluster analysis is employed in batch performance analytics to categorize time series data with similar properties or characteristics into distinct groups. The primary emphasis lies in generating graphical representations that reveal patterns and relationships within the data.

Applications of cluster analysis
Cluster analysis finds diverse applications in batch performance analytics, including but not limited to:

1. **Anomaly clustering:**
   - Objective: Identify patterns of anomalies.
   - Use Case: Support root cause analysis by grouping anomalies that share common characteristics.

2. **Model data clustering:**
   - Objective: Identify outliers in training data.
   - Use Case: Optimize machine learning models by isolating and addressing outliers within the training dataset, enhancing model robustness and accuracy.

3. **Recipe procedure element (RPE) clustering (RUP, ROP, or phase):**
   - Objective: Identify variation in sub-processes.
   - Use Case: Discover meaningful clusters within Recipe Unit Procedures (RUP), Recipe Operation Procedures (ROP), or phases for targeted analysis and improvement.

Result and configuration viewing
After creating each cluster analysis, you have the capability to examine both the results and the corresponding configuration. This ensures transparency and allows for a deeper understanding of the insights gained from the analysis.

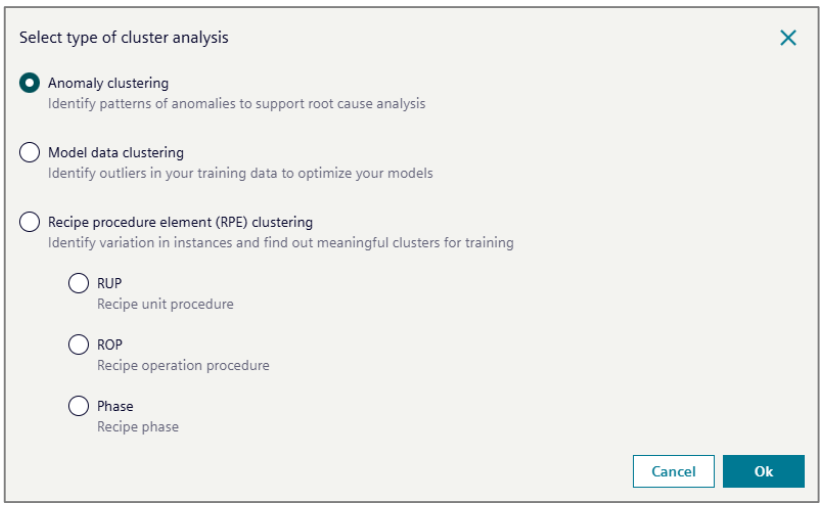
Subsequent sections will guide you through the process of interpreting and utilizing the results and configurations of cluster analyses.

Creating a cluster analysis task

To open the cluster analysis view, go to the sidebar and click on "Cluster analysis."
To create a new cluster analysis task, follow these steps:

1. Click the "+" (Add) button to start a new cluster analysis.
2. Choose the type of cluster analysis that matches your analytical goal.
3. Click "OK" to confirm your selection and continue to the next step.

For detailed instructions and guidance on each step of the process, please refer to the following chapters.

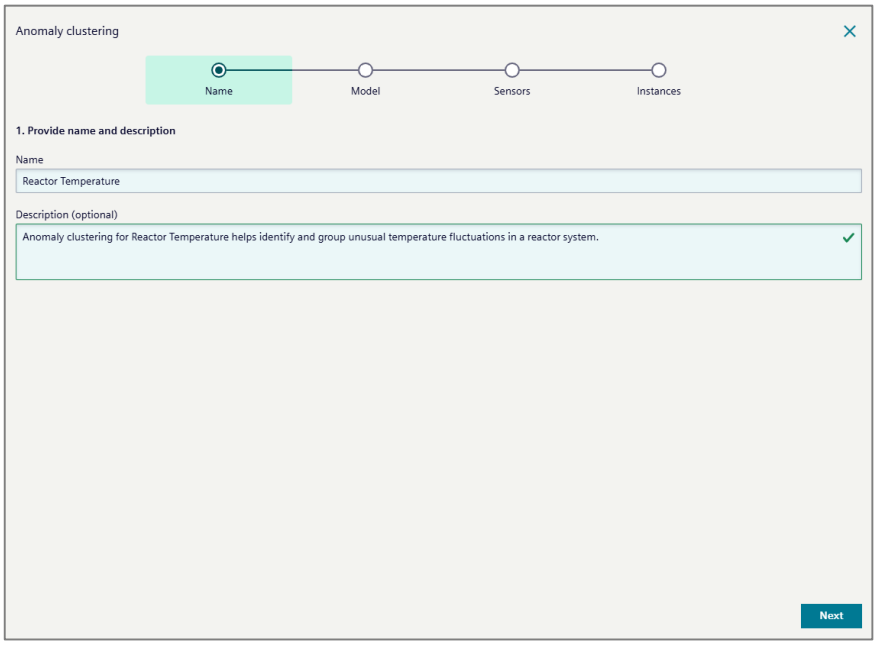


Anomaly clustering

Anomaly clustering is a form of cluster analysis focused on detecting and grouping patterns of anomalies in process data. It supports effective root cause analysis by highlighting unusual or unexpected behaviors that may signal process deviations or malfunctions.

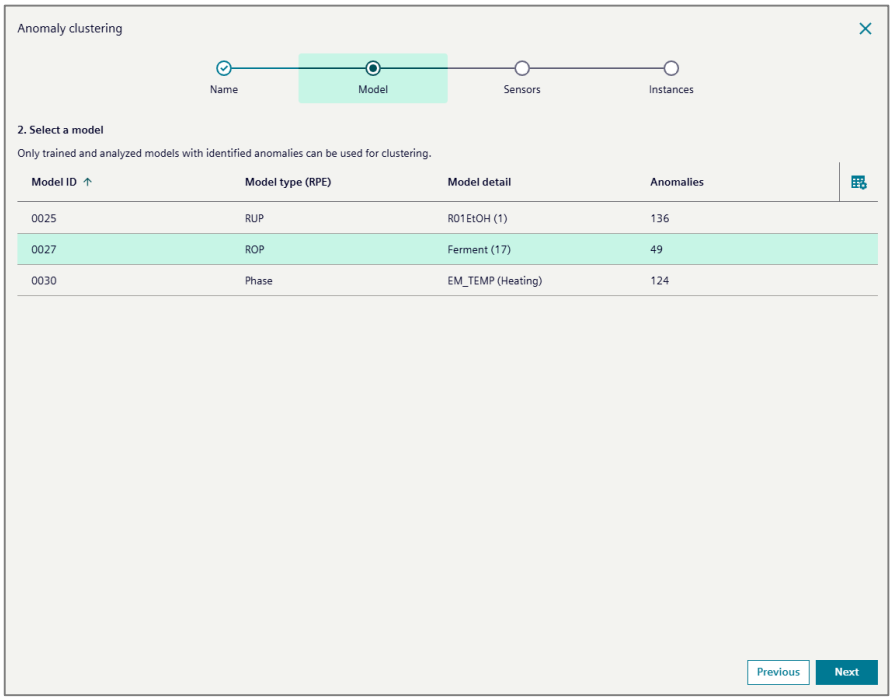
Procedure for anomaly clustering

1. Enter a meaningful name for the anomaly clustering analysis.
2. Optionally, add a description to provide context for the analysis.
3. Click “Next” to proceed to model selection.

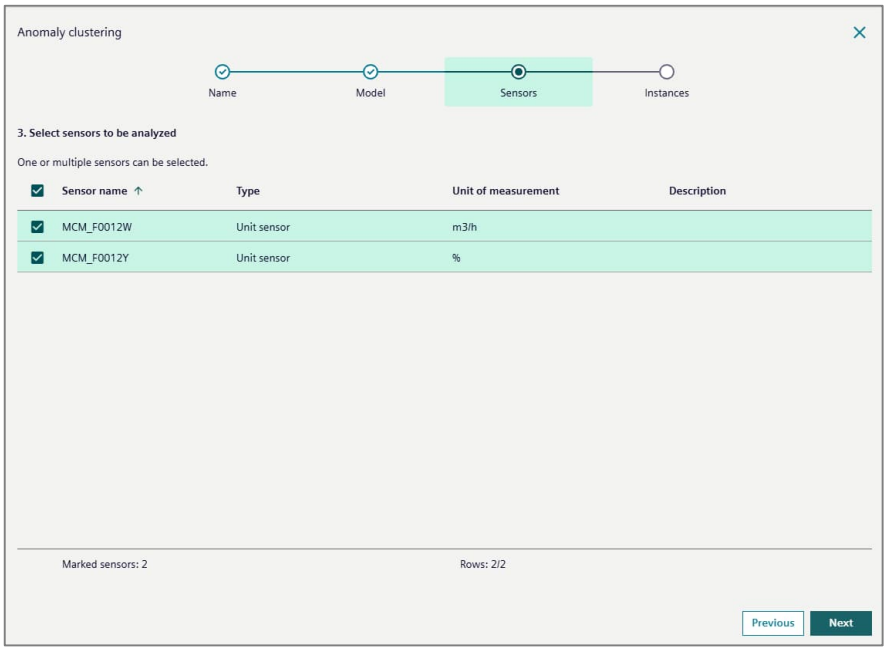


4. Choose a model from the list. Only models that have been successfully trained and analyzed are available for selection.

5. Click “Next” to proceed to sensor selection.



6. Choose one or more sensors from the list. These define the data sources that will be used for anomaly detection and clustering.
7. Click “Next” to proceed to the instances to be analyzed.



8. Choose at least **10 instances** from the list. These instances form the basis for the clustering analysis.
9. Click "Start" to initiate the anomaly clustering analysis.

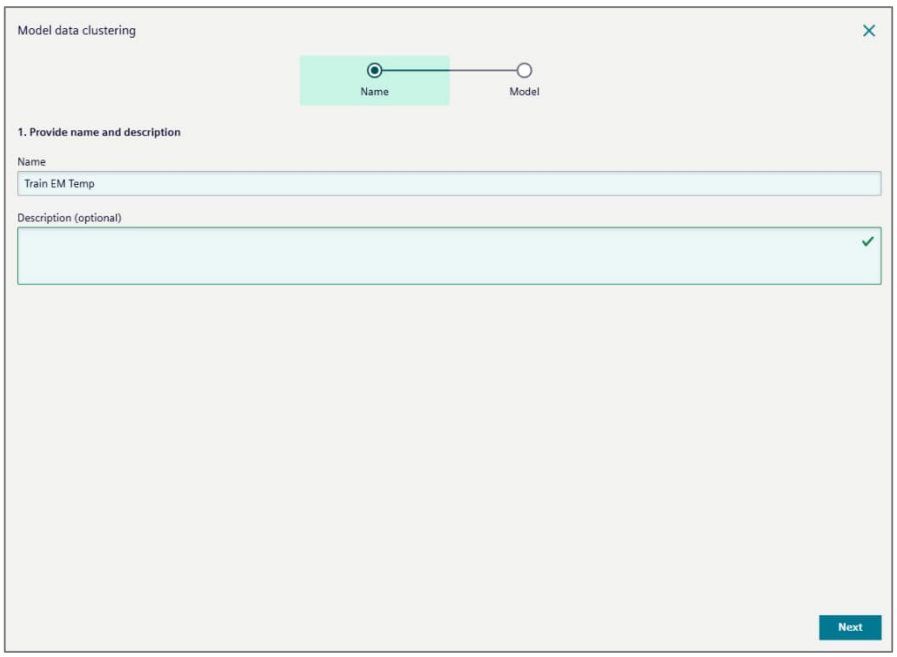


Model data clustering

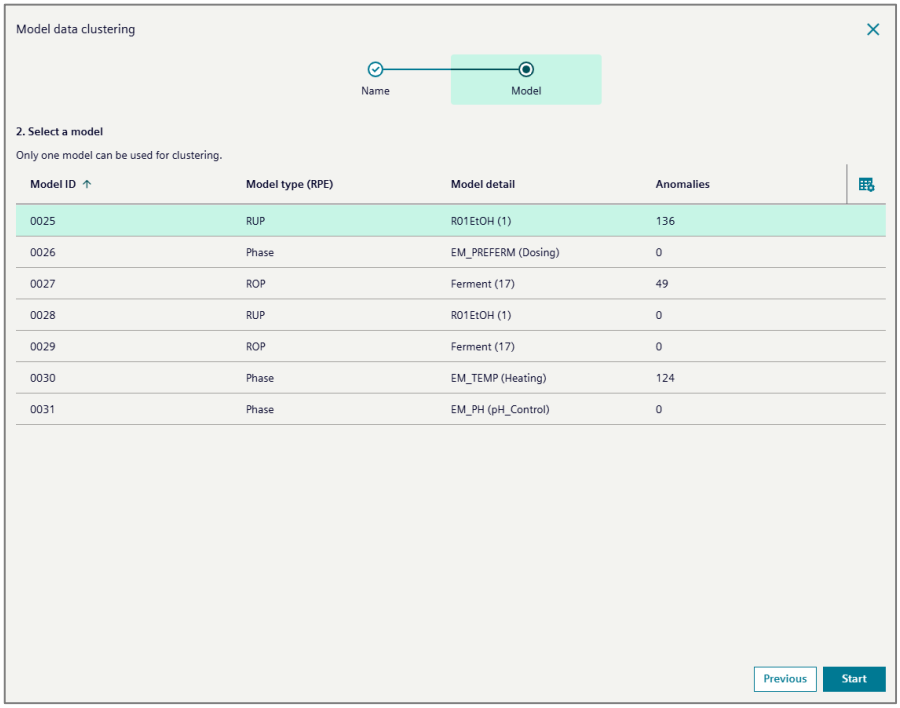
Model data clustering is a type of cluster analysis used to detect outliers within training data. Outliers can significantly affect the performance of machine learning models, often leading to inaccurate results. Identifying and addressing these anomalies early in the process helps improve model reliability and accuracy.

Procedure for model data clustering

1. Enter a meaningful name for the clustering task to identify it easily later.
2. Optionally, provide a brief description to add context to your analysis.
3. Click “Next” to proceed model selection.



4. Choose one model from the list. This model defines the structure for analyzing and clustering the training data.
5. Click "Start" to initiate the training data clustering analysis.



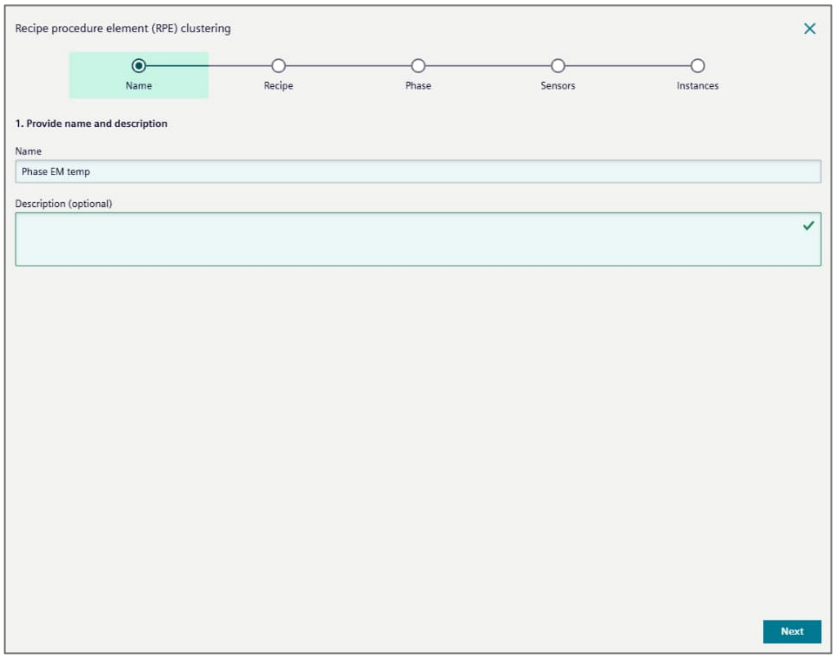
Recipe procedure element (RPE) clustering

Recipe procedure element (RPE) clustering, whether applied to Recipe Unit Procedure (RUP), Recipe Operation Procedure (ROP), or phase clustering, represents a specific form of cluster analysis designed to detect variations in sub-processes and

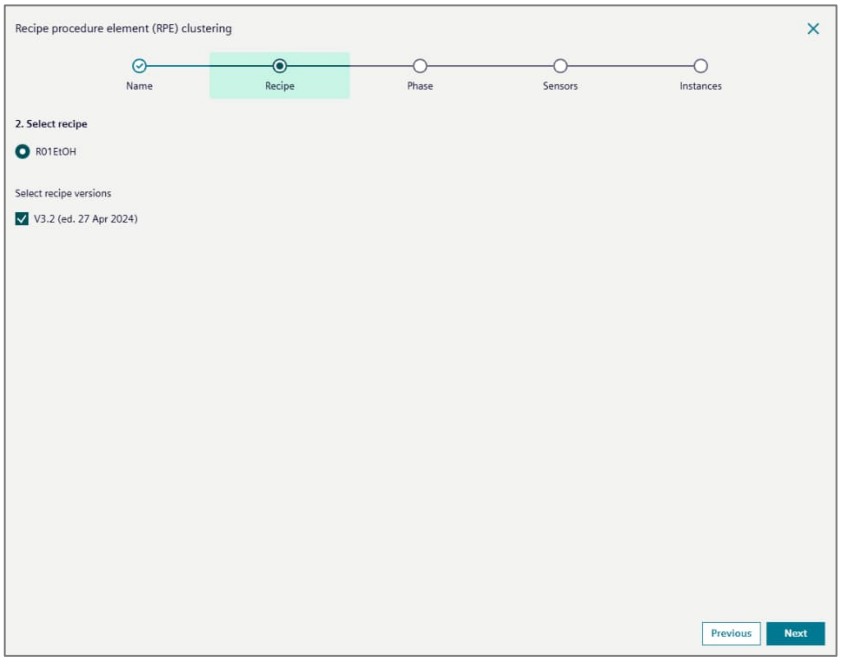
create significant clusters for further training. This type of clustering is particularly invaluable for discerning and understanding distinct instances within an industrial process.

Procedure for recipe procedure element (RPE) clustering

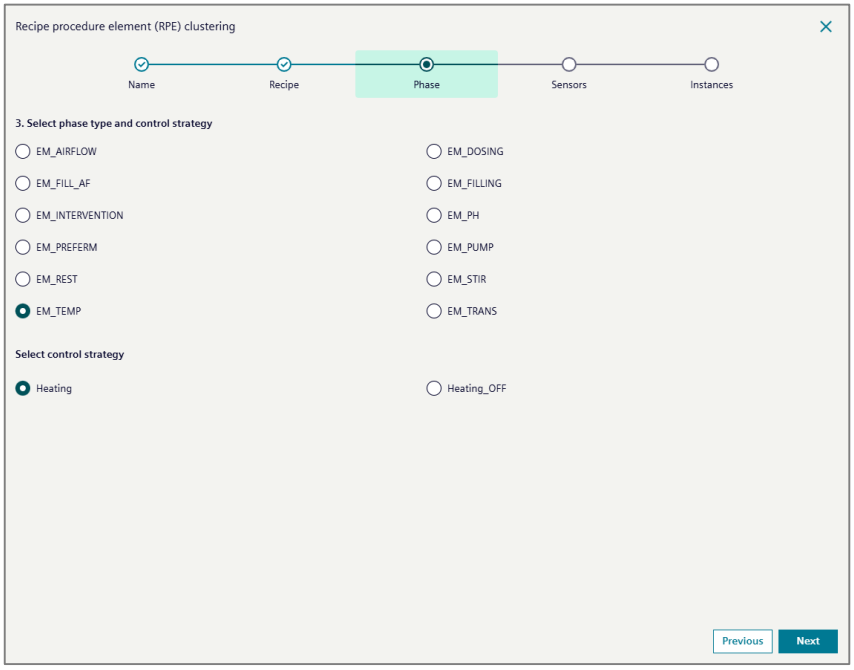
1. Enter a meaningful name for your recipe element clustering analysis.
2. Optionally, offer a brief description to provide context for your analysis.
3. Click “Next” to proceed to recipe selection.



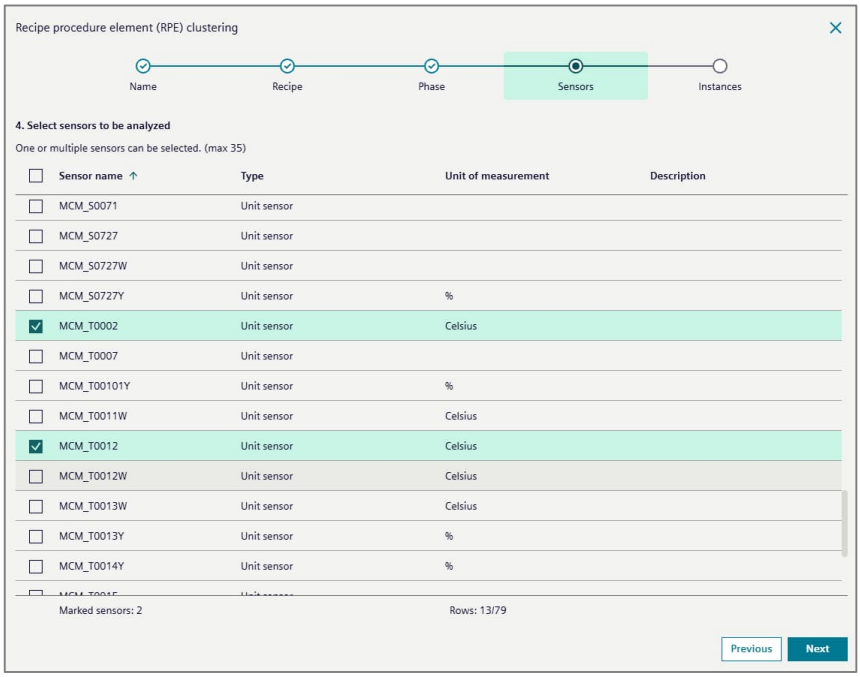
4. Choose a specific recipe and version that align with the sub-processes you wish to analyze.
5. Click “Next” to proceed to recipe element type selection.



6. Select the relevant recipe element type, and if applicable for phases, specify the control strategy for the analysis.
7. Click “Next” to proceed to sensor selection.

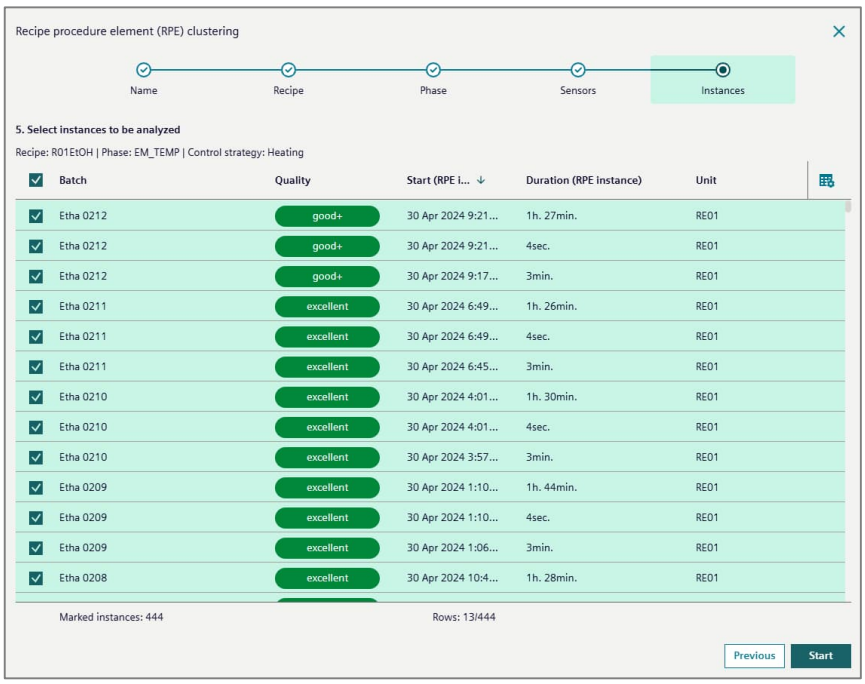


8. Opt for one or more sensors from the available list (up to a maximum of 35). These sensors will serve as the data sources for the analysis.
9. Click “Next” to proceed to select instances to be analyzed.



10. Pick a minimum of 10 instances from the list. These instances will be instrumental in contextualizing the data analysis.

11. Click "Start" to kickstart the recipe elements clustering analysis.



Result overview

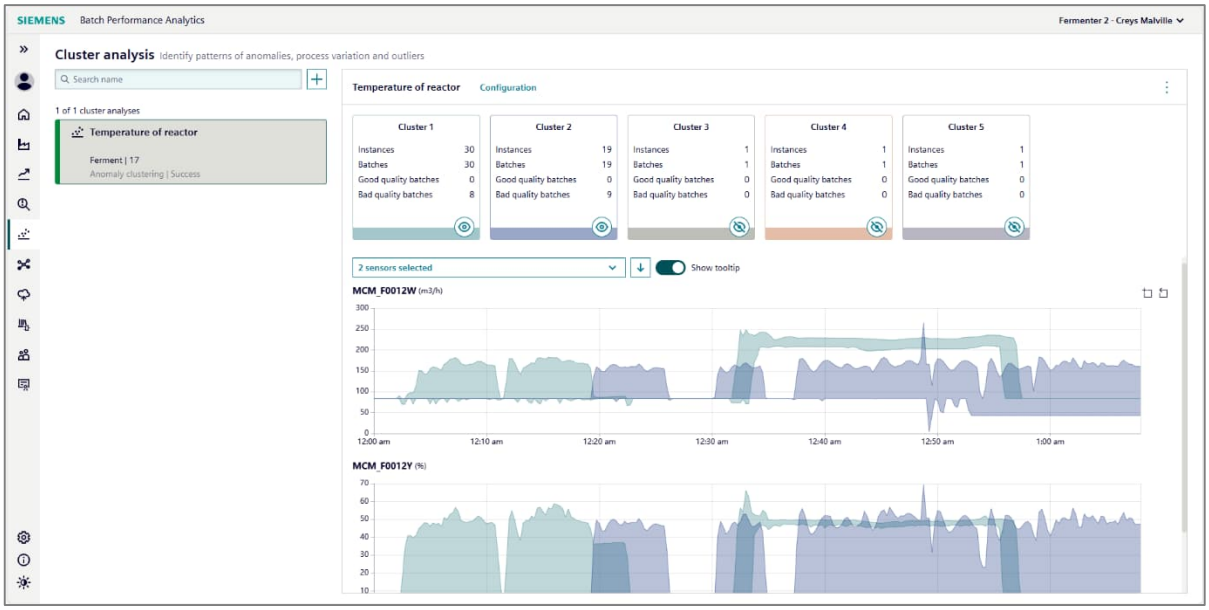
The cluster analysis feature provides a robust method for grouping time series data with shared properties or characteristics.

User interface overview

On the left-hand side, a list of all created cluster analyses is presented, with the latest analysis positioned at the top and pre-selected by default. The right-hand side displays the analysis result, showcasing cluster groups at the top and the graphical representation of individual measurement points below.

Visualization and customization

- Default selection: The first two clusters are selected and displayed due to having the largest number of instances.
- Cluster visibility: Activation or deactivation of the eye icon in each cluster tile controls the visibility of additional clusters, allowing a tailored focus on specific cluster groups.
- Sensor selection: While all sensors are initially selected, users have the flexibility to deselect sensors based on specific requirements.



Navigating results

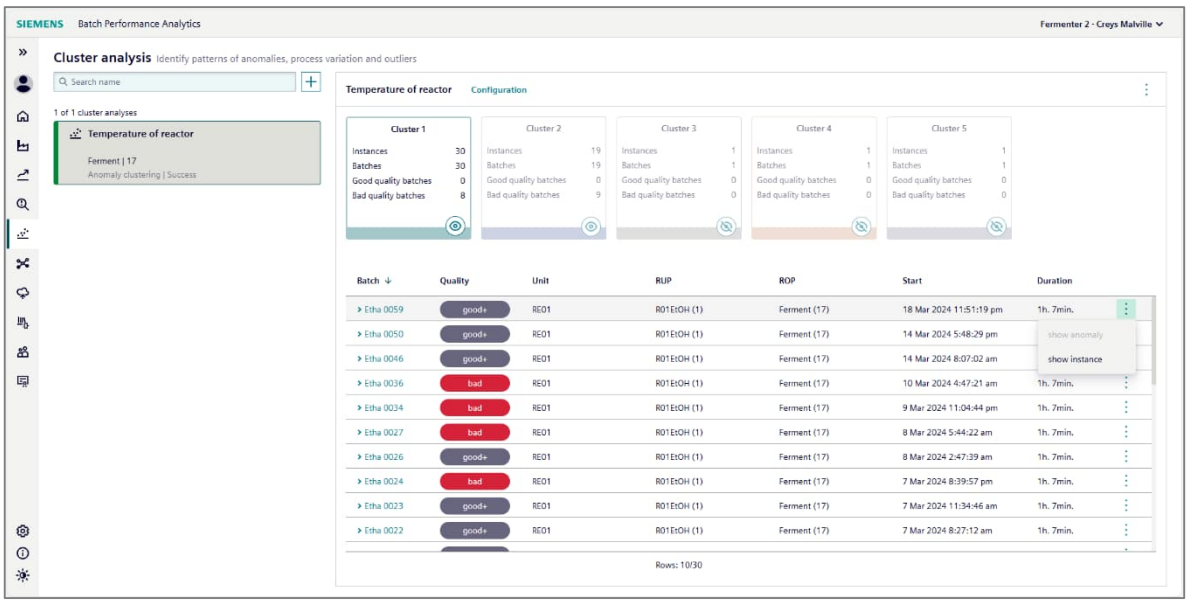
- Batch grouping: You can switch to a list of batches grouped for a selected cluster by clicking on a cluster tile.
- Toggle function: Returning to the chart view is seamless through a toggle function, initiated by clicking on the cluster tile again.
- Detailed batch view: Click on a batch name in the list to jump to the detailed view of that specific batch in a new browser tab.

Context menu functionality

- Quick access: The three dots icon beside each line opens a context menu.
- Anomaly or instance link: You can jump directly to the corresponding anomaly or instance, based on the specific use case.
- In-depth exploration: Clicking opens a new browser tab displaying detailed information about the anomaly or phase, offering a deep dive into the data.

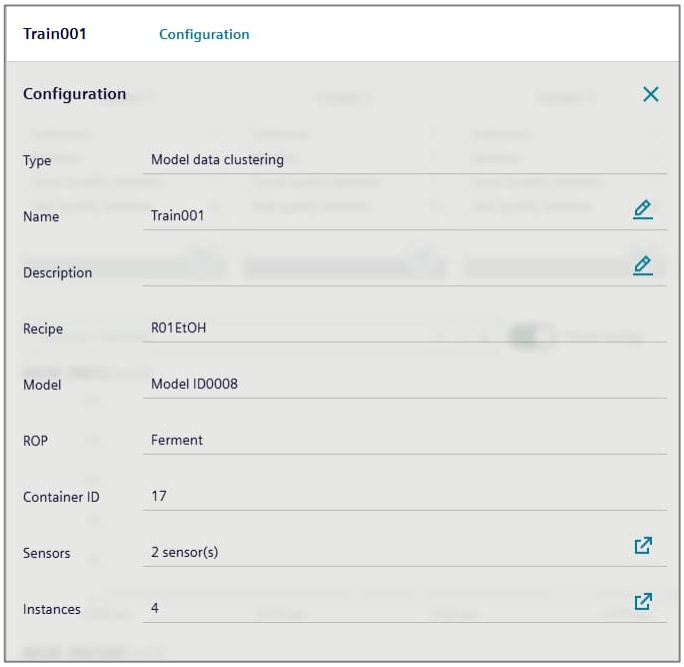
Advanced functionality for recipe element and model data clustering

- Recipe element clustering (RUP, ROP, or phase): You can build a new model using data of a selected cluster via the context menu entry "Create model with cluster data."
- Model data clustering: The context menu entry "Duplicate model with cluster data" allows duplicating the source model using data of a selected cluster.



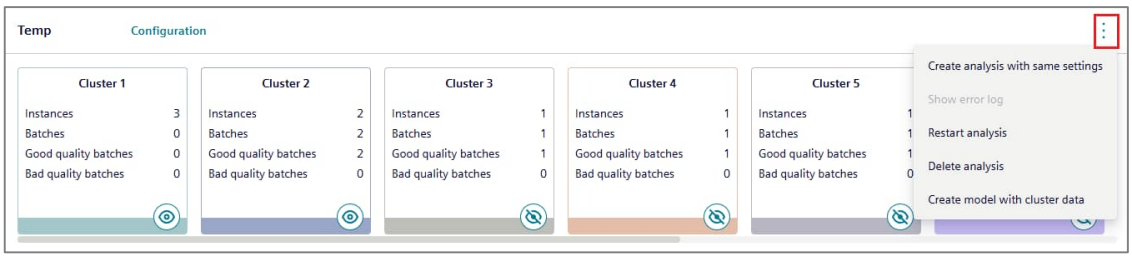
Configuration

The configuration view provides an overview of the cluster analysis setup, summarizing key parameters that define the task. It displays the name and description of the analysis, the selected recipe and model, and the specific type of clustering being performed—whether based on Recipe Unit Procedure (RUP), Recipe Operation Procedure (ROP), or phase with its associated control strategy. Additionally, it shows the sensors and recipe elements included in the analysis. A detailed list of sensors and instances used can be accessed via an icon on the right-hand side.



Using the advanced analysis menu

The advanced analysis menu, accessible via the three-dot icon in the top right-hand corner of the application, provides essential tools for managing, refining, and troubleshooting data analyses and model creation. This section outlines the purpose and functionality of each available menu option.



Create analysis with same settings

Allows duplication of an existing analysis using identical configuration parameters. This feature supports quick replication for comparative studies or iterations without reconfiguring the input data or settings.

Show error log

Displays a detailed log of errors and warnings associated with the current analysis. This feature is for diagnosing issues and understanding anomalies during the analysis execution process.

Restart analysis

Restarts a selected analysis from the beginning, clearing any previous errors or incomplete states. It provides a clean slate for rerunning failed or interrupted analyses.

Delete analysis

Permanently removes an existing analysis from the system. This action cannot be undone and should be used with caution to maintain data integrity and avoid accidental loss.

Create model with cluster data

Enables the creation of a new model using only the data instances from selected clusters. This functionality refines the modeling process by excluding irrelevant or outlier data, resulting in more accurate and focused models.

Glossary

Administrators / App Operators
Administrators are part of the Operations Team and monitor and administrate the application.

Data Analysts
Data Analysts acquire plant data, develop and implement data analyses to drive decisions for optimization.

System engineers
DCS / Batch system engineers provide expert knowledge about the plant instrumentation.

Process engineers
Experts on the process. One of their tasks is the definition of batch recipes.

Process Operators
Monitor and control the process using the DCS and batch operator screens. Need to know the process and how to act in case of process failures.

Batch
- Material that is being produced or that has been produced by a single execution of a batch process.
- An "imaginary" object representing the procedure for producing material at any point within the process.

Note: Batch means both the material created by and during the process as well as the unit that represents the manufacturing procedure for this material. Batch is used as an abstract contraction of the words "the production of a batch".

Batch process
A discontinuous process in which a required product is manufactured in a chronological sequence of production tasks involving one or more batches according to a set of rules (recipe).

Batch report
A selection of data relating to one or more batches. A batch report documents the production of a batch and contains selected recipe data, process data and events.

Control recipe
A type of recipe which, through its execution, defines the manufacture of a single batch of a specific product.
The control recipe is a copy of a particular version of the master recipe that is then modified as necessary with information for planning and execution making it specific to a single batch.

Control strategy
Different equipment phases that are mutually exclusive in terms of simultaneous operation belonging to the same equipment module are known as the control strategies of this equipment module, for example,
Equipment module: Ventilation in level 1 for control strategy 1, ventilation in level 2 for control strategy 2
Control strategy 1: Pressure overlay
Control strategy 2: Rinsing

Equipment module

A functional grouping of equipment that can execute a limited number of specific smaller processing activities.

Equipment phase
The smallest element of a procedural control that can execute a process-oriented task.

Formula
Material and production data: components of the recipe, which contains the following recipe information:
- Process inputs (resources for manufacture of products)
- Process outputs (expected results)
- Process parameters (global recipe parameters)

Input material
Raw material or other resource required to manufacture a product.
The name and quantity of a raw material or other resource required to manufacture a product.

Output material
The name and amount of material or energy expected as the result of executing a recipe.
A material (product, by-product, or waste product) expected as the result of executing a recipe.

Procedure
The strategy according to which a process is executed. This can refer to the production of a batch or to a non-production process, such as a cleaning operation.

Process cell
A logical grouping of facilities/devices that includes the equipment for creating one or more batches. The process cell determines the spectrum of logical control options for a set of process equipment within a process cell complex.
Within the plant hierarchy, the process cell is the highest level. This is followed by units and equipment modules.

Production order
A production order contains information on the product, quantity, required quality and deadline.

Recipe
The required amount of information necessary to define the production requirements for a specific product. A recipe is a set of rules and information required to define how a product is manufactured. There are the following recipes: general recipe, site recipe, master recipe and control recipe.
In SIMATIC BATCH, the following recipe types are used:
- Master recipe
- Control recipe

Recipe control strategy
In a recipe control strategy, the sequence of production steps for making a product can vary from one batch to the next.
The essential aspect of a genuine recipe control strategy is that new recipes can be specified and executed ...
- by the chemist or process technician (not a programmer or control system specialist)
- using a user interface adapted to his/her needs (not using the programming/configuration user interface of the control system)
- without interventions in the software structure of the control system (in other words, without the risk of changing interlocks or validated structures)
- during operation (without reloading/restarting) of the control system

... specify and execute new production processes (= recipes). Such changes, nevertheless, mean changes in the sequences of the process steps and not simply changes to parameter values.

Recipe operation
An operation that is part of a recipe procedure in a master or control recipe. Depending on the recipe type, this becomes the master recipe operation or the control recipe operation.
Abbreviation: ROP

Recipe phase
A phase that is part of a recipe procedure in a master or control recipe. Depending on the recipe type, this becomes the master phase or the control phase.
Abbreviation: RPH

Recipe procedure
The part of a recipe that describes the strategy for producing a batch.
Abbreviation: RP

Recipe procedure element
A collective term encompassing Recipe Unit Procedures (RUP), Recipe Operation Procedures (ROP), and Recipe Phases (RPH), within SIMATIC BATCH. These elements form the hierarchical building blocks of batch process recipes.
Abbreviation: RPE

Recipe unit procedure
A unit procedure that is part of a recipe procedure in a master or control recipe.
Abbreviation: RUP

Unit
A grouping of related control modules and/or equipment modules and their equipment in which one or more larger processing activities can be performed.
Only one batch is ever processed at any one time in a unit. Units generally operate independent of each other. Examples of larger units include caustic soda, carbene addition, extraction, distillation.

Unit of measure
The unit of measure is a dimension or quantity with a specific value. Examples of units of measure: 1 m, 1 kg, 1 bar.

Unit procedure
A strategy for executing a related process within a unit. It consists of a sequence of operations and the required algorithms for triggering, organizing, and controlling these operations.

Unit recipe
A part of a (control) recipe that uniquely specifies the sequence of production requirements for a unit. The unit recipe contains the unit procedure and the corresponding material and production parameters, recipe header, requirements of the equipment and other information.

Support

Technical Support

For all technical requests, please send inquiries to Technical Support via the following email address:

mailto:bpa.support.industry@siemens.com

Contact person

If you would like to request on-site service or need spare parts, please get in touch with your local Siemens representative, they will put you in contact with the responsible service center. You can find your contact person in the contact database:
www.siemens.com/yourcontact

Siemens AG
Digital Industries
Process Automation
Östliche Rheinbrückenstr. 50
76187 Karlsruhe,
Germany

Subject to changes and errors. All rights reserved.

The trademarks mentioned in this document and trademarks are the property of Siemens AG or its affiliates or their respective owners.

