Ocean Data Systems Ltd.
The Art of Industrial Intelligence

User Documentation

Dream Report 4+

Setpoint Analysis Tool

http://www.dreamreport.net

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Introduction

This document will assist you in using Setpoint Analysis Tool in Dream Report projects and different project object types.

Setpoint Analysis Tool (Overview)

Setpoint Analysis Tool is a special module, which allows smart analyzing of thermal and other processes, where the process is based on the setpoint stability analysis. It allows automatic detection of the stability periods, entry and exit points of those stability periods.

Setpoint Analysis Configuration (Setpoint Definition)

To use **Setpoint Analysis Tool**, user, first, has to create setpoint definitions for the project report(s). Then, the setpoint analysis results can be used in charts and in statistical functions.

You can create setpoint definitions in the **Setpoint analysis configuration** window. To open it, click on the command button *Setpoint analysis configuration* on the **Tools** ribbon icon on the horizontal toolbar either in the Dream Report Logger Studio or Dream Report Designer Studio menu (see pic. below):

Dream Report   **Ocean Data Systems.Ltd**

The following dialog window will be opened:
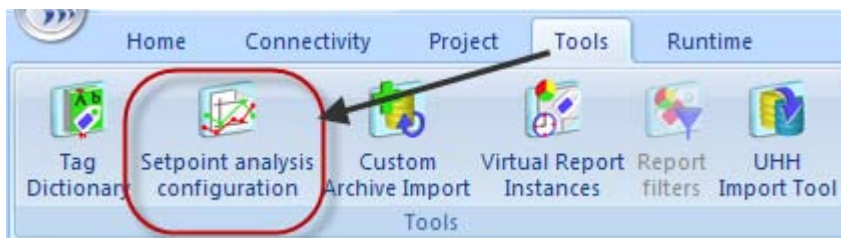
1. Setpoint Data

1.1. Setpoint Data Definition

To define a setpoint, in the **Setpoint data** section enter the following data (please see the picture below):

A - Setpoint **Name** (logical name is unique and can't be the same for different setpoints);

B - Setpoint **Value**;

C - Setpoint **Bandwidth**, which defines high ("**Upper Tolerance**") and low ("**Lower Tolerance**") levels for the stability. It enables to resolve the task when high and low tolerance values are different.

D - **Consider Stable Period if Values are Stable for at Least**: - to define the stability period by setting the time period when the values will remain stable.

1.2. Setpoint Data Dynamic Values

Such parameters as Setpoint **Value**, **Upper Tolerance**, **Lower Tolerance** can be set as a static number (e.g. 10), or can be set as a **real-time** tag value. Double-click on the needed edit box corresponding to one of these parameters and the *Select Data Item* window will be opened (please see the picture below):
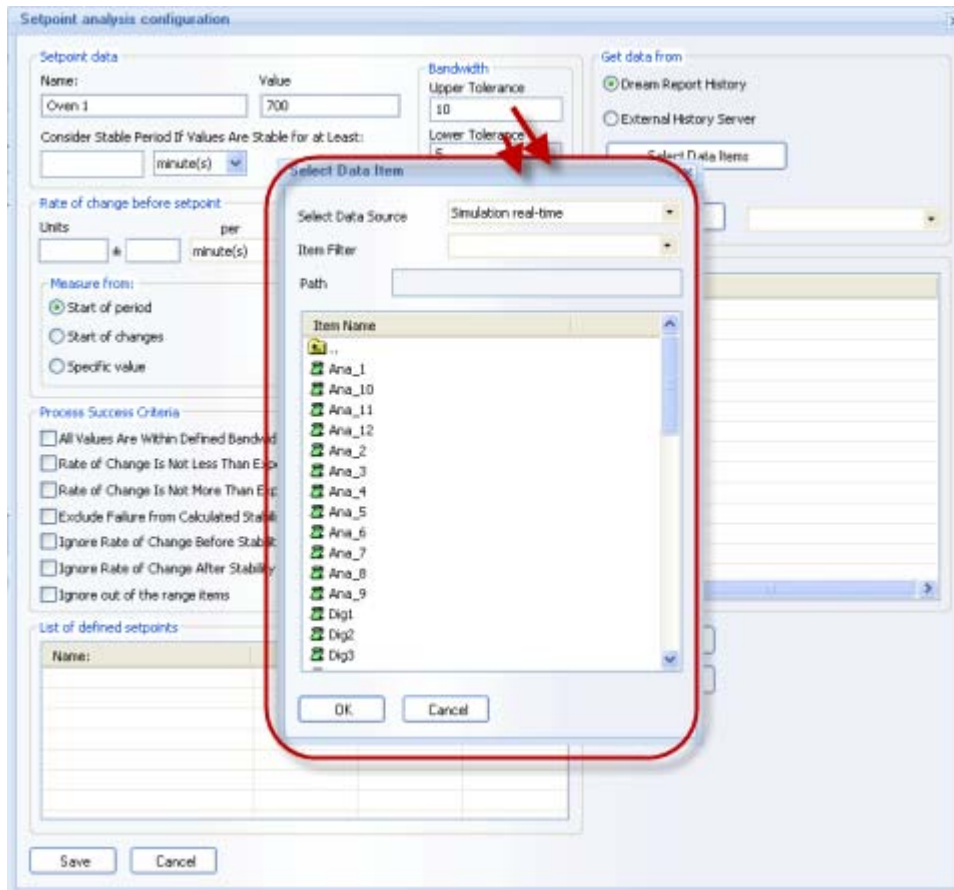
Select any available **REAL-TIME** driver and a tag (required item). Then, in the runtime, when the report is generated, the setpoint module will read the current real-time value of the defined tag, and use its value as a value for that parameter for this specific report generation.

Please see below an example of the setpoint tolerance values defined as tags:
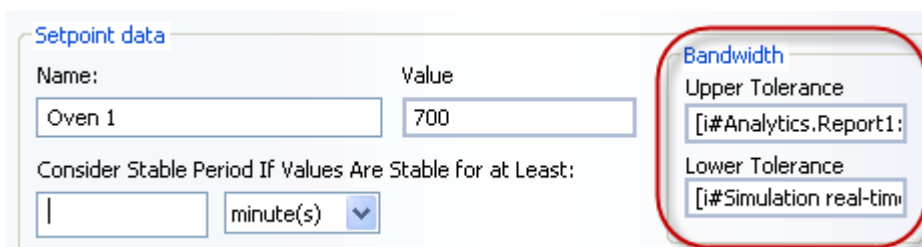
2. *Data Items Selection*

In the right-hand part of the dialog window select one of the sources to obtain data from: *Dream Report History* or *External History Server*. Select data source and data items, which will be used as a source for the data for setpoint analysis (please see the picture below):
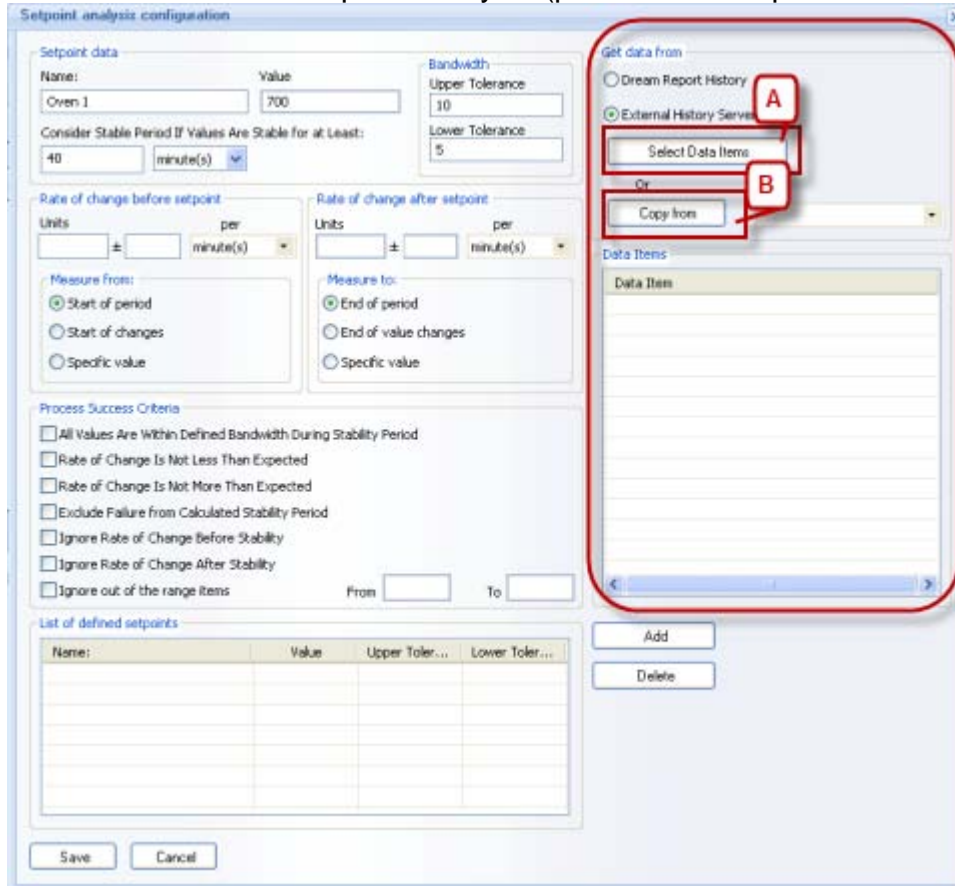
A - Click on the button "*Select Data Items*".

1. The **Select Data Items** dialog window will be opened (please see the picture below):
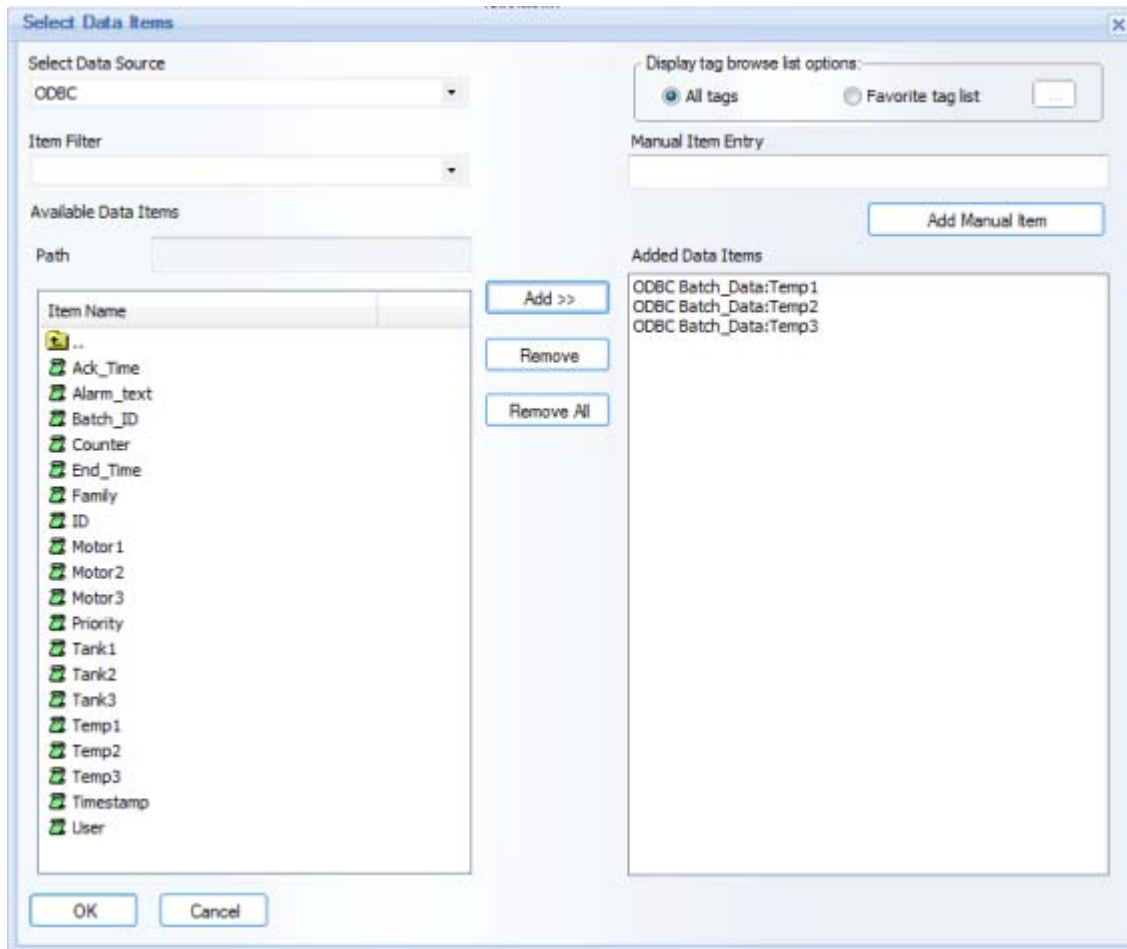
2. Select items/tags which will be used for this setpoint analysis.
   NOTE:
   - If "*Dream Report History*" radio button is enabled, then, the combo box "Select Data Source" will contain a list of data access drivers defined in the project;
   - If "*External History Server*" option is selected, the "Select Data Source" combo box will contain a list of external history access drivers defined in the project.

   In Select Data Source and Available Data Items, select the source and item from which Dream Report will calculate values.

3. Click on the button "*Add*" and in the **List of defined setpoints** section a new setpoint definition will be added to the project. Its **Name**, **Value**, **Upper Tolerance** and **Lower Tolerance** will appear in the table in this section (please see the picture below):

B - If setpoint configuration has already got any setpoint definition with required data source and tags, select such a setpoint from the combo box next to the button "**Copy from**" and click on that button. This new setpoint definition will copy all defined items from the selected setpoint.

3. Rate of Change (ROC)

If you are interested in measuring the rate of change of your values before entering the stability zone and after exiting it, you can set the criteria for the rate of change measurement.

There are 2 sections for ROC measurement settings:
   1 - **Rate of change before setpoint** - contains the criteria for the rate of change measurement before entering the stability zone.
   2 - **Rate of change after setpoint** - contains the criteria after exiting the stability zone.
Both sections have the same configuration parameters and controls (please see the picture below):.

3.1. Rate of Change (ROC) Definition

1 - Rate Of Change (ROC) has 2 sections to be defined (please see the picture below):
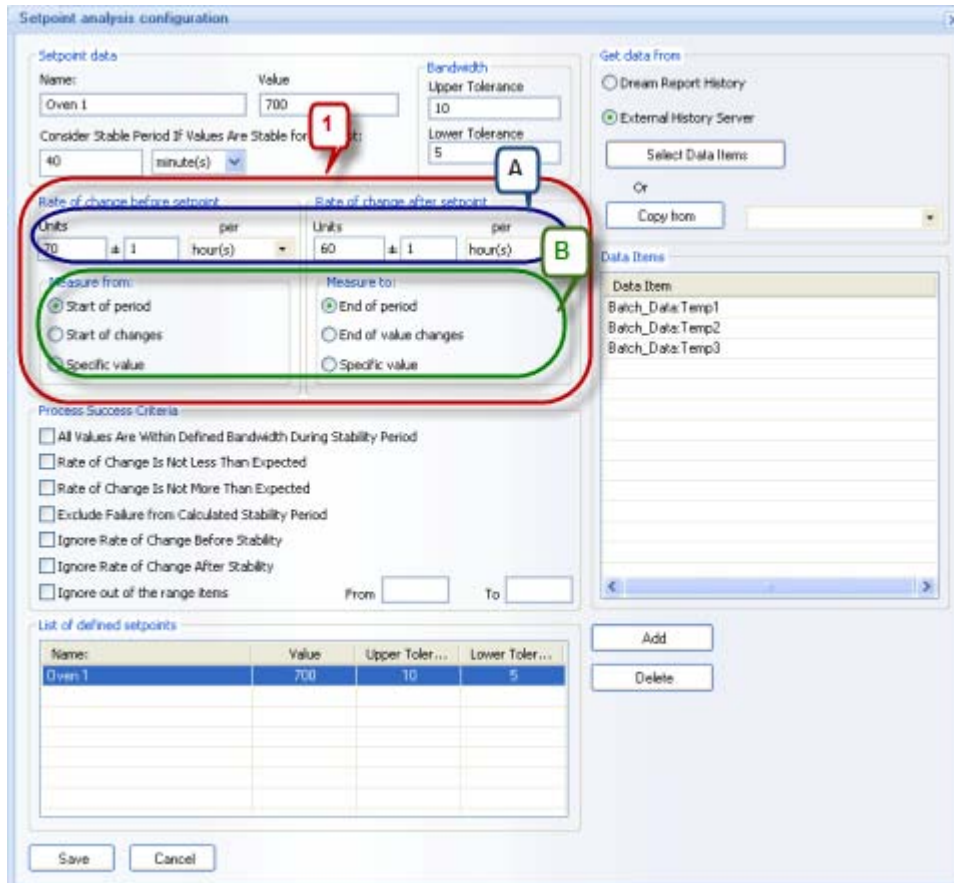
A - Value - you have to specify the expected rate of change (units (e.g. degrees C) per time unit (e.g. per hour, per minute)).

B - Criteria - to start/stop measurement of the rate of change (**Measure from**/ **Measure to** sections). For the measurement criteria there are 3 options available:

1. **Start of period/End of period** - the start time (for **Rate of change before setpoint**) or the end time (for **Rate of change after setpoint**) will be either start or end (correspondingly) of the calculation period defined in the statistical object (for details please see **1.1.Setpoint Analysis Result in Statistical Functions** of the **Setpoint Analysis Result in Dream Report Data Objects** section of this manual) (please see the picture below):

2. **Start of changes/End of value changes** - the rate of change measurement will be calculated not from the start (for **Rate of change before setpoint**) or until the end (for **Rate of change after setpoint**) of an object calculation period, but only from the point of time when values started to change (for **Rate of change before setpoint**) or until values are changing (for **Rate of change after setpoint**). If **Start of changes/End of value changes** measurement criteria option is selected, the edit box will appear, where a user can enter the *minimum change of value* (**Min change**) from/until which ROC will be calculated (please see the picture below):

Example: If the minimum change of values for the **Start of changes** option is set as "77" (as in the picture above), then, the rate of change measurement will be calculated from the point of time when values started to change after having reached the value of 77.

3. **Specific value** - sets a specific value, so that the rate of change will start (for **Rate of change before setpoint**) or stop (for **Rate of change after setpoint**) its calculation only when the item value reaches this value. If the **Specific value** option is selected, the edit box will appear, where a user can enter the *control value* for start/stop of ROC calculation (please see the picture below):

Example: If a user sets this option with a specific value of 75 (**ROC before setpoint**), then, the rate of change before setpoint will start its calculation only when the item value (for setpoint) has reached value 75, and will calculate it until the start of the setpoint stability zone (as in the picture above).

3.2. ROC Dynamic Values

Such parameters as **Specific value**, *Min change (Start of Changes)*, *Min change (End of value changes)* can be set as a static number (e.g. 10), or can be set as a **real-time** tag value. Double-click on the needed edit box corresponding to one of these parameters and the *Select Data Item* window will be opened. Select the required item and then, in the runtime, when the report is generated, the setpoint module will read the current real-time value of the defined tag, and use its value as a value for that parameter for this specific report generation (please see the picture below):
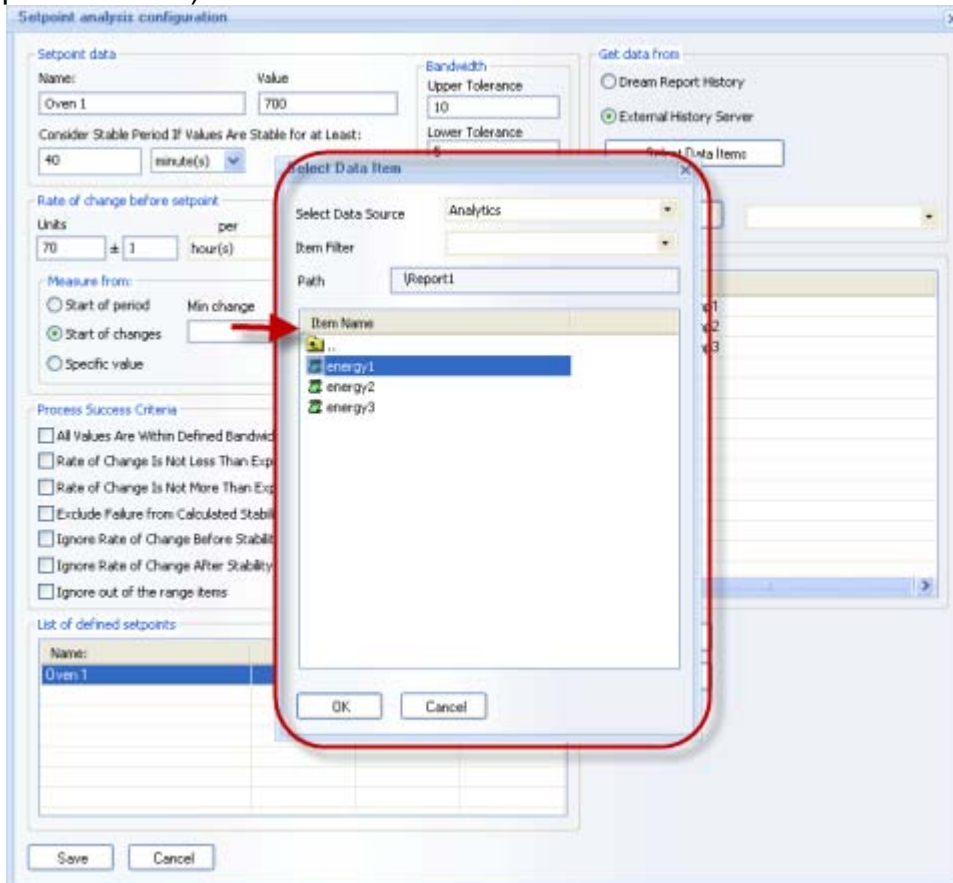
4. Process Success Criteria

This section contains the set of options which will be used to define automatic process validation (please see the picture below):
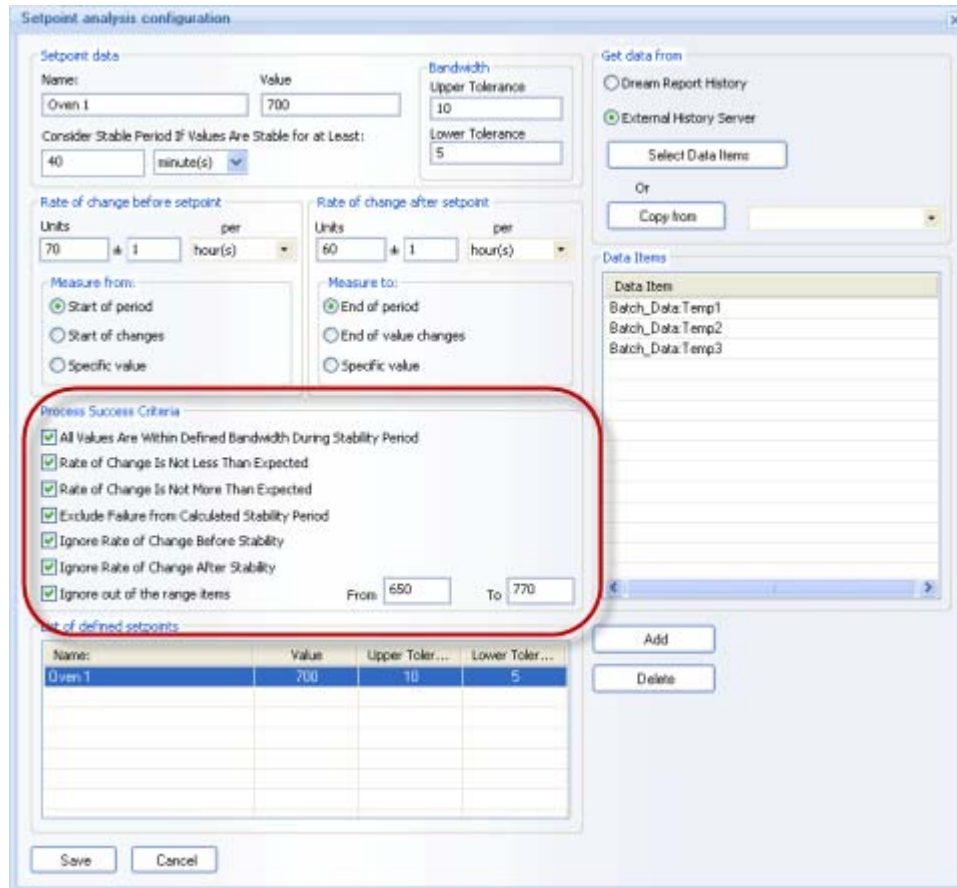
- **All values are within defined bandwidth during stability period** option controls the situation when one or multiple values will fall out of stability bandwidth. If this option is enabled, the process result will be "*Failed*". If this option is disabled, then the process result will be "*Succeeded*" .
- **Rate of change is not less than expected** option controls how rate of change influences the result,i.e., if rate of change is less than expected and the option "**Rate of change is not less than expected**" is enabled - the process will fail. If this option is unchecked, the process will succeed.
- **Rate of change is not more than expected** option controls how rate of change influences the result, i.e.if rate of change is more (faster) than expected and the option "**Rate of change is not more than expected**" is enabled – the process will fail. If this option is unchecked, the process will succeed.
- **Exclude failure from calculated stability period** option influences only calculation of the duration of a stability period. This option controls the situation when, during the stability period, one or multiple points will exit from the stability bandwidth and will then return back

into the stability corridor. If this option is enabled, then the time period, when one or multiple values will be out of range, will be excluded from the calculated duration of the stability. If this option is not checked, the full stability period will be taken for duration calculation.

Example: The stability period started at 10:00 and finished at 11:00. During this period one data item exited from the stability bandwidth at 10:10 and then returned back into the stability corridor at 10:30. If this option is enabled, the duration will be 40 min (from 10:00 to10:10 and from 10:30 to 11:00).If it will be unchecked, the duration will be 1 hour.(from 10:00 to 11:00).

- **Ignore rate of change before stability**/**Ignore rate of change after stability** options define if rate of change should be considered for the process validation ("**Stability result**" function). If any of those check boxes will be checked, the rate of change will be ignored during calculation of the "**Stability result**" function.

- **Ignore out of the range item(s)** option enables to discard from the setpoint calculation the items with the values, which are either higher or lower than the ones defined in the setpoint.

  When this option is selected, a user will be able to set Low (**From**) and High (**To**) limits for the setpoint definition.

  NOTE: Any calculated statistical function or a chart, where the setpoint with such definition is used, will check if the entry value of every item, defined in the setpoint for the specified/selected time period, is in the range. If the item is out of the range, it will be excluded from the calculation. If the item, which is used in the setpoint, has no value available for the specified period, it will also be considered as an item, which is out of the range.

  By default this option will be unchecked. If this option is checked, but no working range has been set, a user will get the warning message asking to define the range.

NOTE: _Setpoint stability zone_ is defined as a time period where all values of all items, defined for that setpoint, are within the corridor of a **setpoint value +/- tolerance**.

Setpoint Analysis Result in Dream Report Data Objects

After setpoint definitions for the project report(s) have been defined (created), the setpoint analysis results can be used in charts and in statistical functions.

1. Setpoint Analysis Result in Statistical Functions

1.1. General Overview

The list of statistical functions in Dream Report data representation objects (**Single Data Objects** and **Automatic Statistical Tables**) has a special group of statistical functions – "**Setpoint Analysis Functions**" - based on setpoint analysis. They are (please see the picture below):

- *Start time of stable period*
- *End time of stable period*
- *Duration of stable period*
- *Setpoint stability result*
- *Counter of stable periods*
- *Rate of change before entering stability zone*
- *Rate of change after exiting stability zone*
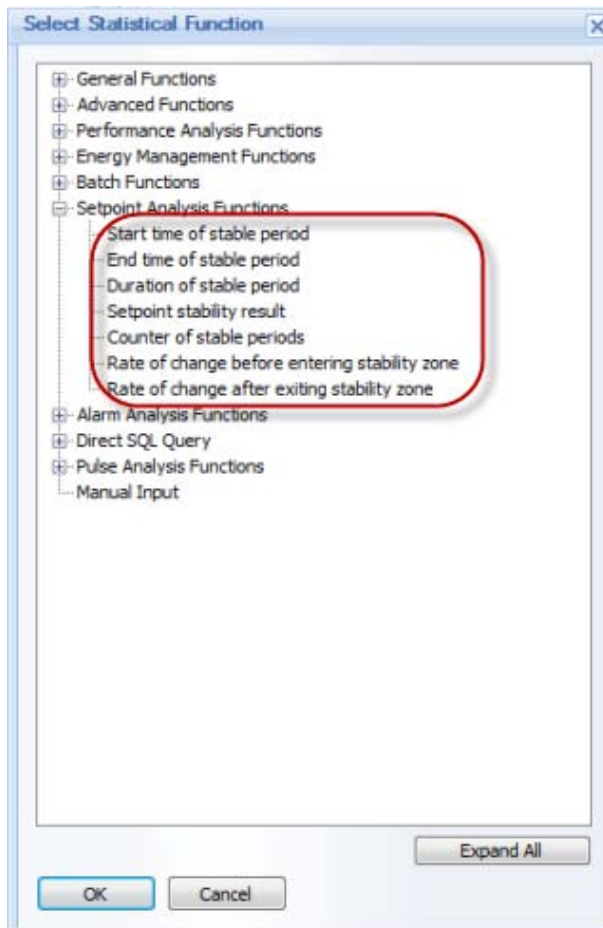
1.2.   Setpoint Selection

If any of these statistical functions is selected, the button "*Select setpoints*" will appear next to the statistical function combo box (please see the picture below):

If you click on the button "*Select setpoints*", the dialog box with setpoint selection will be opened, where you will be able to select one or several setpoints defined in the **Setpoint Analysis Configuration** window (for details, please see the **Setpoint Analysis Configuration** section of this manual):
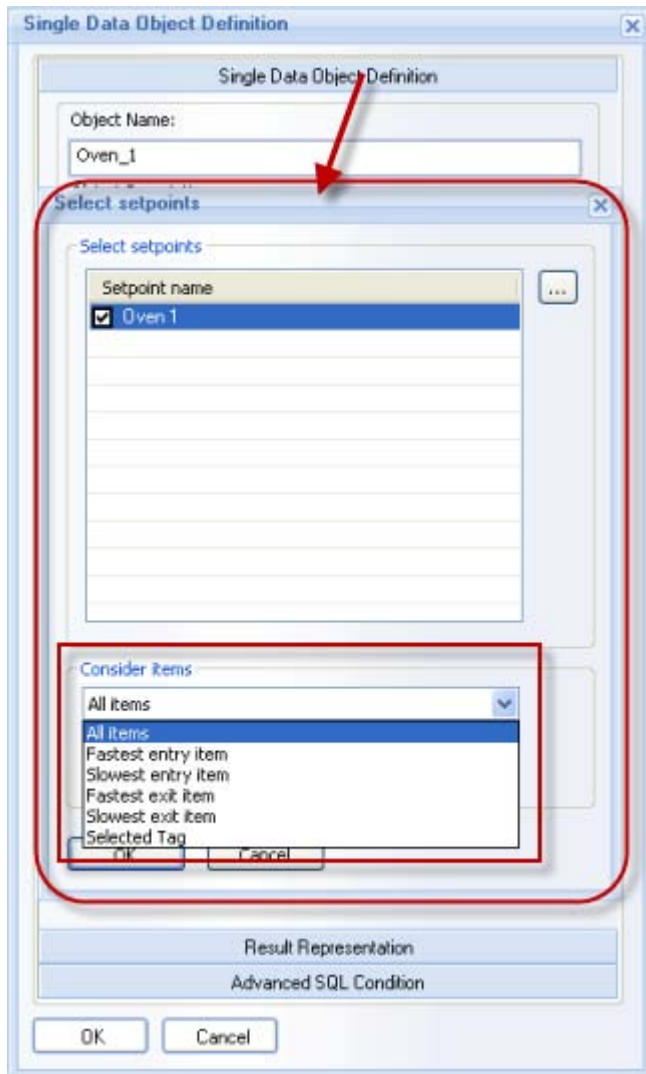
You can select one or more setpoints. Then the check box next to each setpoint will become checked.

If no setpoints have been selected, click on **...** (browse) button on the right. The **Setpoint Analysis Configuration** dialog window will be opened, where you will be able to define setpoints for your project report(s)(for details on how to create setpoint definitions, please go to the **Setpoint Analysis Configuration** section of this manual).

Group box "**Consider items**" has a combo box with 6 entries as shown on the picture above:

- ❖ **All items** - the function will calculate all items/ tags, which have entered and left the stability period. Then the function will do its main calculation for all the items from that setpoint.
- ❖ **Fastest entry item** - the function will calculate the item/ tag, which has first reached the stability period (the one, which has the earliest timestamp of the first value within the stability period). Then the function will do its main calculation only for that item and not for all items from that setpoint.

❖ **Slowest entry item** - the function will calculate the item/tag, which has last reached the stability period (the one, which has the latest timestamp of the first value within the stability period). Then the function will do its main calculation only for that item and not for all items from that setpoint.

❖ **Fastest exit item** - the function will calculate the item/ tag, which has first left the stability period (the one, which has the earliest timestamp of the first value out of the stability range after stability period end time). Then the function will do its main calculation only for that item and not for all items from that setpoint.

❖ **Slowest exit item** - the function will calculate the item/ tag, which has last left the stability period (the one, which has the latest timestamp of the first value out of the stability range after stability period end time). Then the function will do its main calculation only for that item and not for all items from that setpoint.

❖ **Selected Tag** – if this option is selected, the "**Setpoints Tags**" selection box will appear:
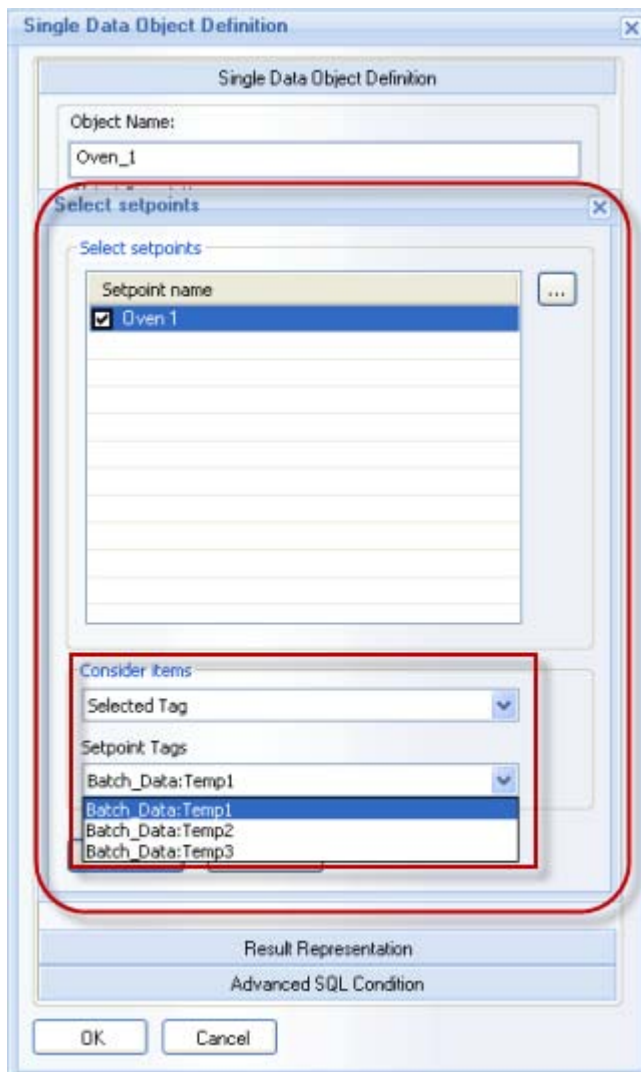
The dropdown menu will include all the items/tags for the setpoint selected.

When you select the item/tag you may need for the calculations, the function will calculate that item/tag which has entered and left the stability period. Then the function will do its main calculation only for this item from that setpoint.

NOTE: The default selection for this combo box is "**All items**".

1.3.   "Setpoint Analysis Functions" Performance

If you select one of the functions from the **Setpoint Analysis Functions** group (please see the list above), then it will perform one of the statistical functions described below:

- **Start time of stable period** calculates the start time of stability period of the selected setpoint. It takes the selected setpoint and gets values of all items/tags defined for that setpoint for the calculation period, defined in that object. This function detects the time, when values of all tags have entered the "stability zone", i.e. are within **setpoint value +/- tolerance**. If more than one setpoint is selected, the function calculates start time for every defined setpoint and then displays the first one between all of them. If during the object calculation period all tag values have never entered together into the stability zone, the object result will be *N/A*.

- **End time of stable period** calculates the end time of stability period of the selected setpoint. End time of stability zone means the timestamp, when last item/tag value has left the stability zone. If it calculates the result for multiple selected setpoints, then it will calculate the result (end time) for each setpoint and then display the last one.

- **Duration of stable period** calculates start and end time for one or several setpoints, and then displays the period (duration) between start and end time.

- **Setpoint stability result** calculates the result, which is true or false. The function gets all values of each item/tag of the setpoint for the interval between start and end time of every setpoint, and checks if all values of all tags are within the **setpoint value +/- tolerance**. If multiple setpoints have been selected, this analysis will be executed separately for every setpoint. The result of this function will be **TRUE** if all values of all tags during a stable period of each zone are within the **setpoint value +/ tolerance**, and will be **FALSE** if any value is out of range during the stability periods.

- **Counter of stable periods** calculates and then displays the number of the stable periods for one or several setpoints selected.

- **Rate of change before entering stability zone** calculates rate of change of item/tag values of the setpoint before entering the stability zone (for details on how to configure the criteria for this statistical function calculations, please see **Rate of Change** of the **Setpoint Analysis Configuration** section of this manual).

- **Rate of change after exiting stability zone** calculates rate of change of item/tag values of the setpoint after exiting stability zone for details on how to configure the criteria for this statistical function calculations, please see **Rate of Change** of the **Setpoint Analysis Configuration** section of this manual).

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2. Setpoint Analysis Result in Charts

The **Process Value** section in **Charts** enables to select the "**Setpoint Analysis**" statistical function for the chart object.

If the "**Setpoint Analysis"** statistical function is selected, then the button "**...**" (browse) will appear next to the combo box with the statistical function. Click this button and in the "Select setpoints" dialog box (for details, please see **1.2. Setpoint Selection** paragraph of the "**Setpoint Analysis Result in Statistical Functions**" section of this manual), please select:

- setpoints that sould be analyzed and displayed on the chart;
- data items that should be displayed on the chart.
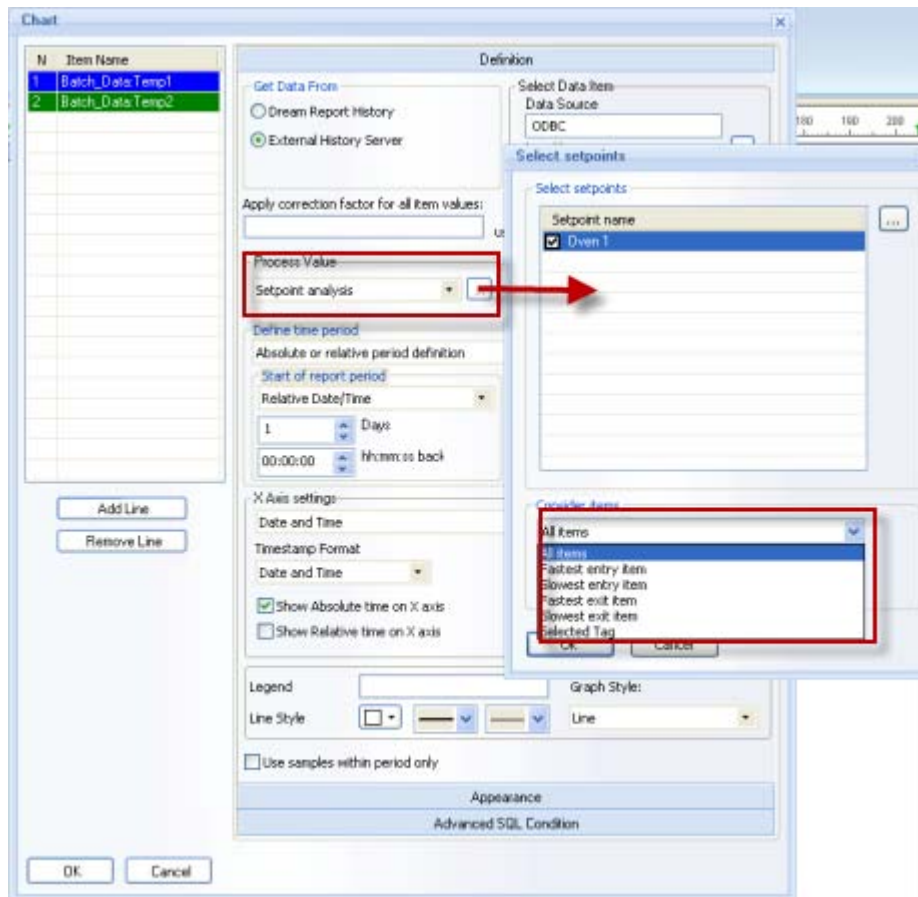
There are the following options available:

- ❖ **All items** - the chart will display all items defined for the selected setpoint;
- ❖ **Fastest entry item** - the chart will display only one item (out of those defined in the selected setpoint), which was the first to enter the stability zone of the setpoint;
- ❖ **Slowest entry item** - the chart will display only one item (out of those defined in the selected setpoint), which was the last to enter the stability zone of the setpoint;
- ❖ **Fastest exit item** - the chart will display only one item (out of those defined in the selected setpoint), which was the first to exit from the stability zone of the setpoint

❖ **Slowest exit item** - the chart will display only one item (out of those defined in the selected setpoint), which was the first to exit from the stability zone of the setpoint;

❖ **Selected Tag** – the chart will display only the selected item/tag, which has entered and left the stability zone of the setpoint.

NOTE: When displaying the setpoint analysis results, the chart will display a dash line to display a setpoint value and two horizontal dash lines to display **min** and **max** of tolerance. Stability zones will be marked with two small triangles and also there will be put two vertical dash lines, which will help to detect start and stop of the stability zone.