ibaInCycle

Monitoring and analyzing cyclical or rotating processes

Manual

Issue 1.2

Measurement Systems for Industry and Energy

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The content of this publication has been checked for compliance with the described hardware and software. Nevertheless, discrepancies cannot be ruled out, and we do not provide guarantee for complete conformity. However, the information furnished in this publication is updated regularly. Required corrections are contained in the following regulations or can be downloaded on the Internet.

The current version is available for download on our web site www.iba-ag.com and can be found in the iba help center docs.iba-ag.com.

Version	Date	Revision	Author	Version SW
1.2	08-2026	ONNX module	st	8.14.0

Contents

1 About this documentation

This documentation describes the function and application of the software

ibaInCycle.

1.1 Target group and previous knowledge

This documentation addresses qualified professionals, who are familiar with handling electrical and electronic modules as well as communication and measurement technology. A person is regarded as a professional if he/she is capable of assessing the work assigned to him/her and recognizing possible risks on the basis of his/her specialist training, knowledge and experience and knowledge of the standard regulations.

In particular, this documentation is aimed at people who deal with the acquisition and analysis of process data. Since *ibaInCycle* is an integral part of *ibaPDA*, the following previous knowledge is required to configure *ibaInCycle*:

- Windows operating system
- Basic knowledge of *ibaPDA*

1.2 Notations

In this manual, the following notations are used:

Action	Notation
Menu command	Menu *Logic diagram*
Calling the menu command	*Step 1 – Step 2 – Step 3 – Step x* Example: Select the menu *Logic diagram – Add – New function block*.
Keys	<Key name> Example: <Alt>; <F1>
Press the keys simultaneously	<Key name> + <Key name> Example: <Alt> + <Ctrl>
Buttons	<Key name> Example: <OK>; <Cancel>
Filenames, paths	`Filename`, `Path` Example: `Test.docx`

1.3 Used symbols

If safety instructions or other notes are used in this manual, they mean:

Danger!

The non-observance of this safety information may result in an imminent risk of death or severe injury!

Observe the specified measures.

Warning!

The non-observance of this safety information may result in a potential risk of death or severe injury!

Observe the specified measures.

Caution!

The non-observance of this safety information may result in a potential risk of injury or material damage!

Observe the specified measures.

Note

A note specifies special requirements or actions to be observed.

Tip

Tip or example as a helpful note or insider tip to make the work a little bit easier.

Other documentation

Reference to additional documentation or further reading.

2 Introduction

ibaInCycle monitors all types of cyclically repeating processes, including recurring sequences and rotating components, such as rollers and gears.

Process signals from cyclical processes ideally exhibit similar behavior within a cycle. *ibaInCycle* compares the “learned” or defined good process with the actual process signal and signals deviations immediately, for example via alarm message or e-mail. In addition, a feedback in the plant control can be implemented to automatically adjust the corresponding parameters.

Since *ibaInCycle* is seamlessly integrated in *ibaPDA*, the full *ibaPDA* connectivity is available to acquire all possible process signals in a system and to use them to define the states. *ibaInCycle* provides different modules, which are configured in the I/O manager of *ibaPDA*:

- The InCycle expert module offers a variety of individual configuration options for analyzing the cycles.
- The InCycle auto-adapting module automatically learns the behavior of the cycles in different process conditions and uses this as a reference to automatically identify deviations.
- The InCycle ONNX module can be used to apply an existing ONNX neural network to the sampled values or the band values of each cycle.

2.1 ibaInCycle (ibaPDA)

ibaInCycle is an integrated technology module of the process data recording system *ibaPDA*. *ibaInCycle* offers features to analyze and display cyclical processes, both for recurring process steps as well as for rotating mechanics.

An *ibaInCycle* license allows the use of 4 InCycle modules. If more modules are needed, an additional *ibaInCycle* license can be purchased for each 4 additional modules.

The *ibaInCycle-100* license allows 100 InCycle modules to be used.

Order no.	Product name	Description
30.681215	ibaInCycle	Analysis of cyclical processes, 4 modules
30.681217	ibaInCycle-100	Analysis of cyclical processes, 100 modules

2.2 ibaAnalyzer-InCycle

The InCycle Expert view is available in *ibaAnalyzer* without additional license. With the *ibaAnalyzer-InCycle+* license, the results of the InCycle calculations become available in *ibaAnalyzer* as signals, can be exported to databases and used for further processing in reports or with *ibaDatCoordinator*.

Order no.	Product name	Description
33.010411	ibaAnalyzer-InCycle+	Offline analysis of cyclic processes: Trending and output of InCycle results in *ibaAnalyzer*

2.3 ibaInCycle profiles

All InCycle profiles with configurable calculation rules use profiles for the configuration. These profiles can be used to reuse calculation rules and exchanged between different systems or *ibaPDA* and *ibaAnalyzer*. Profiles without know-how protection can be exported and imported as a file in XML format.

Profile endings
The exported profiles of the individual modules have the following file extensions:

- InCycle-Expert: .inCycleProfile
- InCycle-Auto-Adapting: .inCycleTeachProfile
- InCycle-ONNX: .inCycleAIProfile

3 System requirements

Hardware

- PC, Multicore CPU 2 GHz, 8 GB RAM, 512 GB HDD

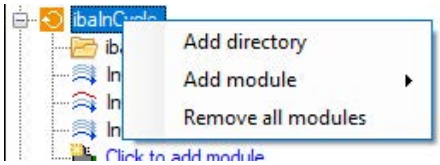
Software

- *ibaPDA*, version 8.14.0 or higher
- *ibaAnalyzer*, version 8.2.0 or higher

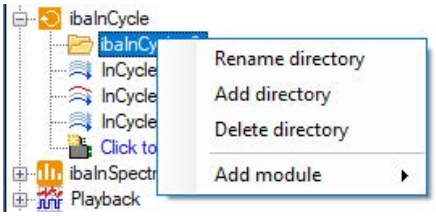
4 The ibaInCycle interface in ibaPDA

4.1 Arranging and structuring ibaInCycle modules

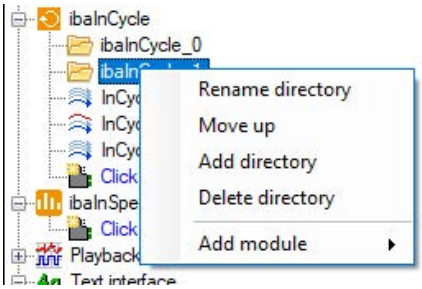
Below the *ibaInCycle* interface in the I/O manager in *ibaPDA*, the user can establish a hierarchic structure, e.g. in accordance with the plant structure, by means of directories. Such folders can be created by right-clicking on the *ibaInCycle* interface or an existing folder.



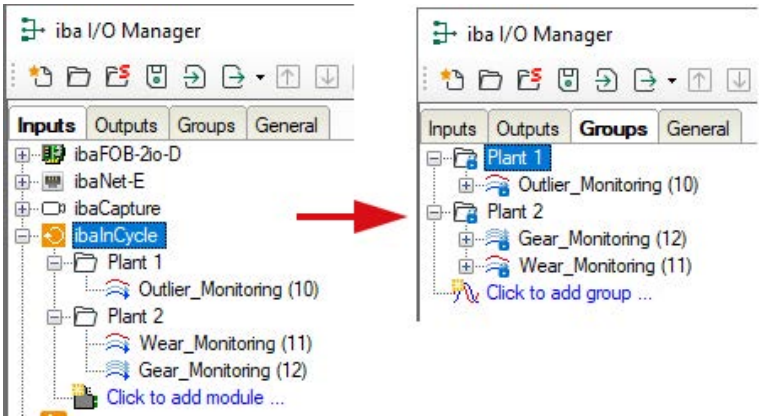
If several folders were created on the same hierarchical level, they can be marked by mouse-click and moved within the level by using the key combination <Ctrl>+<cursor up> or <cursor down> or by drag & drop.



InCycle modules can be moved to directories by drag & drop. New modules can be directly added to a folder via the context menu, too. The folders can be renamed just as you like.



Based on this hierarchic structure, *ibaInCycle* groups are automatically created in the "Groups" section in the I/O manager. These groups are locked and cannot be modified. You cannot add signals to a locked group or its sub-group(s).



4.2 Knowhow protection

The *Knowhow protection* node offers mechanisms for protecting intellectual property associated with certain calculations and/or settings in *ibaPDA*, which are considered as user knowhow worth protecting.

4.2.1 Application range of know-how protection

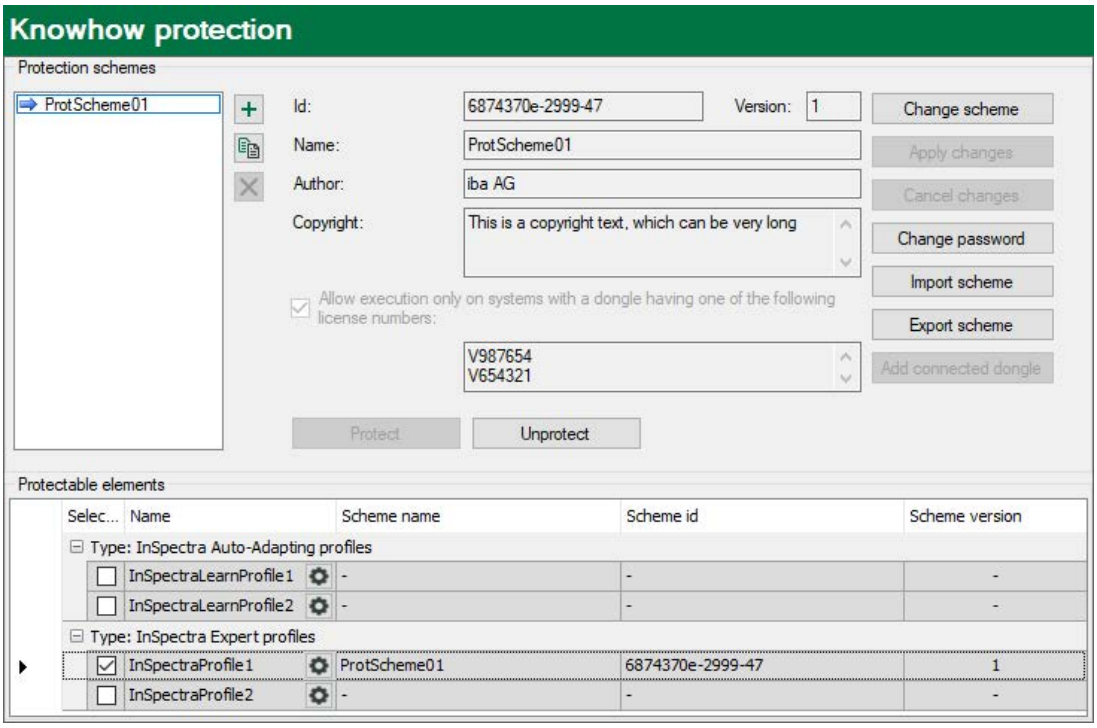
In principle, the know-how protection can be applied to all module types which use profiles, such as

- InSpectra and InCycle modules
- Computation module
- Lookup table
- Parameter set
- Process condition

The following protective functions are realized:

- Protection against change
  The protected elements cannot be changed without entering a password.
- Read protection
  The configuration of the protected elements is not displayed without entering a password.
- License protection
  The protected elements are only executed on systems that run with a previously registered dongle or registered soft license. Several license numbers can be registered.

The protection is realized via so-called protection schemes that, once defined, can always be applied again.



The basic procedure is as follows:

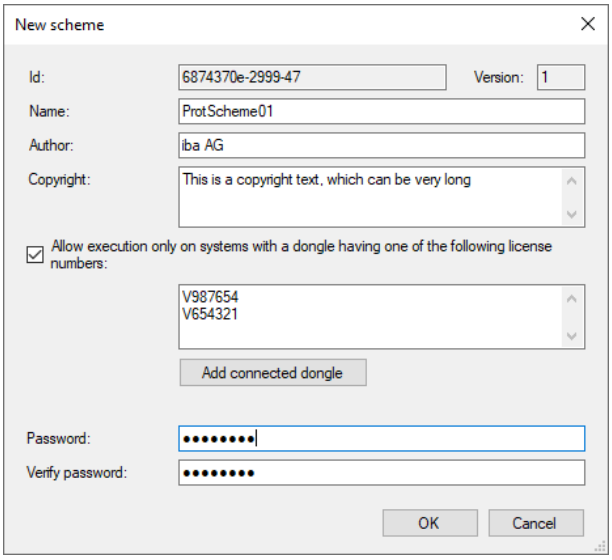
1. Generating a protection scheme
2. Applying a protection scheme to an element

Tip

If you click on the gear icon then you get directly to the configuration dialog of the respective profile.

4.2.2 Creating a protection scheme

1. Open the I/O Manager and highlight the node *Knowhow protection* in the *General* tab.
2. Click the button + to add a new scheme.
   The “New scheme” dialog opens.
   The parameters *ID* and *Version* are automatically generated.



3. Now enter the other parameters and then click on <OK>.

The settings and entries to be made for a protection scheme are specifically as follows:

Author (optional)
Enter the name of the author here.

Copyright (optional)
You can enter a note text here about the copyright of the elements protected by this scheme.

Only permit execution on systems with one of the following license numbers
Enable this option if the elements protected by this scheme are only to be executed on systems with certain license numbers (license protection). Then enter all respective license numbers in the field below. You can easily enter the number of the respective connected dongle or active soft license using the <Add connected dongle> button. If you do not enable this option, there is no execution restriction of the protected elements with respect to the license number.

Password
Enter a password that consists of at least 8 characters. Spaces are not permitted. You will need the password for the following actions:

- Viewing the configuration of a protected element
- Changing the configuration of a protected element
- Changing or removing the protection scheme

Note

What to do, if you don't know the password anymore?

The password of a protection scheme is encrypted and saved in the I/O configuration. Note the password and store it in a save place where you can find it.

If you forgot the password you won't be able to open or edit protected profiles for *ibaInSpectra* or *ibaInCycle*, for instance Because you cannot reset the password by yourself, the only way to fix it is to save the I/O configuration of your system and send the configuration to the iba support desk. You may as well take the project file or simply generate a support file over the *Help* menu and send it to the iba support desk, conjoined with the request for resetting the protection scheme passwords.

iba can only remove the passwords but is not able to retrieve them. iba erases the passwords from the configuration and send it back to you. Then you can load this configuration into your system. Finally, you can define a new password.

4.2.3 Application of a protection scheme

An element can always only be protected by one protection scheme, but a protection scheme can be applied to several elements.

If you have elements in your *ibaPDA* configuration worth protecting, such as InSpectra profiles, then these elements are shown in the table below in the dialog

In order to protect one or more elements, first highlight the desired scheme in the list of the protection schemes (top left).

Then highlight the relevant lines at the bottom by setting a check mark in the selection box and click on the button <Protect>.

Then enter the password for the respective protection scheme and click <OK>.

4.2.4 Removing the protection

In order to remove the protection for one or more elements, highlight the corresponding lines in the table below in the dialog by setting a check mark in the selection box. Then click on the button <Unprotect>.

Then enter the password for the respective protection scheme and click <OK>.

If you want to remove the protection for several elements at the same time that are protected with different schemes, then you have to enter the passwords for all respective schemes in the password dialog.

4.2.5 Importing and exporting protected elements

When elements are protected, they can be exported and imported. The configuration of the elements is encrypted in the export files (*.protectionScheme). You therefore have an easy way of spreading protected know-how to different *ibaPDA* systems.

For an export, highlight the desired element and click <Export scheme>. Then select the desired storage path, enter a file name and close the dialog by pressing <Save>.

If you have highlighted several elements for export, then a prompt dialog appears asking whether all highlighted elements should be saved in the export file or whether you want to select more first.

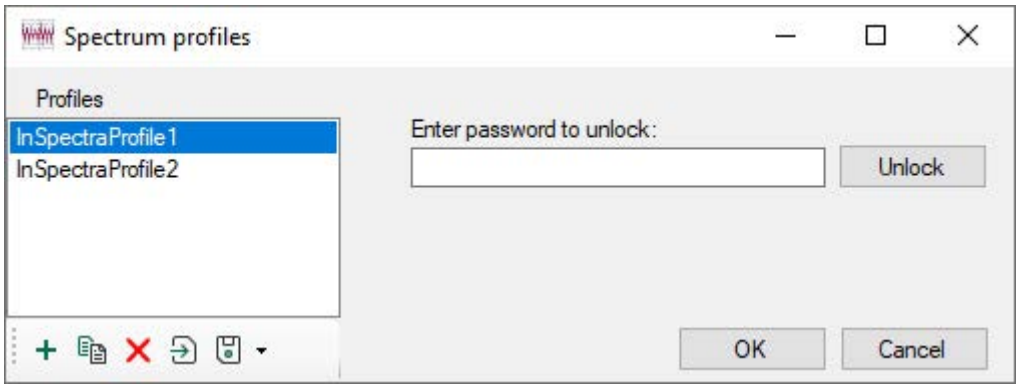
If you want to import a protected element file, click on <Import scheme>, select the desired file (*.protectionScheme) and close the dialog by pressing <Open>.

4.2.6 Unlocking protected items

If you want to access protected items in the application, then you must first unlock the respective item by entering the password for the protective rule.

If, for example, you want to view the configuration of the protected InSpectra profiles, then you must first enter the password in the “Spectrum” dialog and click on <Unlock>.

The access remains protected until the I/O manager is closed again.



5 ibaInCycle in ibaAnalyzer

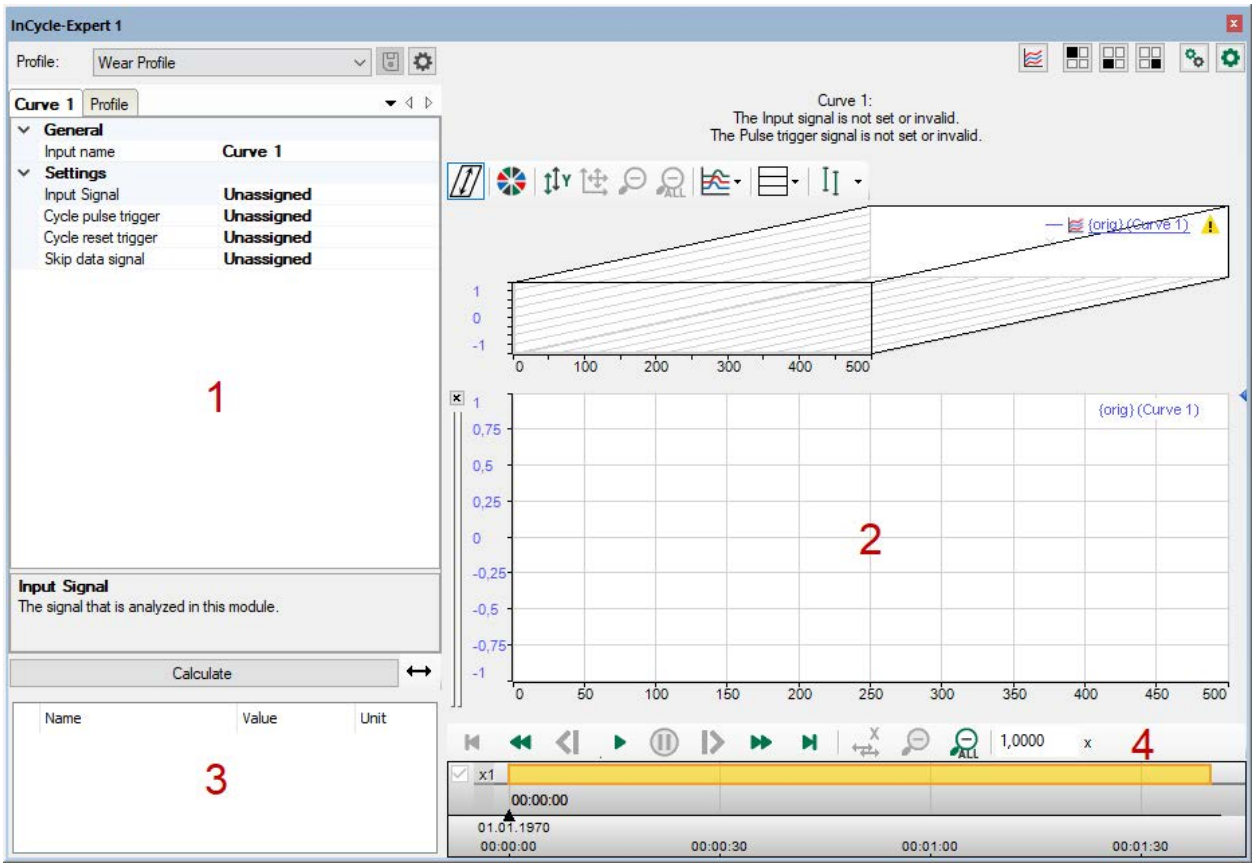
ibaInCycle is integrated in *ibaAnalyzer* with the InCycle Expert view. Here you can create profiles and test calculations offline.

With the *ibaAnalyzer-InCycle+* license, the results of the InCycle calculations become available in *ibaAnalyzer* as signals, can be exported to databases and used for further processing in reports or with *ibaDatCoordinator*.

5.1 The InCycle view in ibaAnalyzer

ibaAnalyzer-InCycle offers the InCycle Expert view for visualization and analysis of InCycle Expert modules. It is possible to switch between cycle view and circle view in the InCycle Expert view.

The InCycle Expert view consists of 4 areas, which are explained in the following sections.



1 Configuration area

2 Visualization area

3 Results area

4 Playback area

There are additional buttons in the top right area of the view for the view settings.

 Toggling between cycle and circle view

 Show/hide the configuration area

 Show/hide the results area

 Show/hide the playback area

 *Preferences* for global settings for all InCycle Expert views

 Settings for the current view

Note

Changes to the preferences are not applied to existing views.

5.1.1 Configuration area

The input signals, triggers and profiles of the respective InCycle module are defined in the configuration area. A detailed description can be found at the InCycle Expert module.

See chapter ↗ *The InCycle Expert module, page 72*

5.1.2 Visualization area

The visualization area of the *ibaAnalyzer-InCycle* view shows the same view that is used in ibaPDA for the InCycle module.

A detailed description of the cycle view can be found in chapter ↗ *The cycle view, page 22*

A detailed description of the circle view can be found in chapter ↗ *The circle view, page 64*

5.1.3 Results area

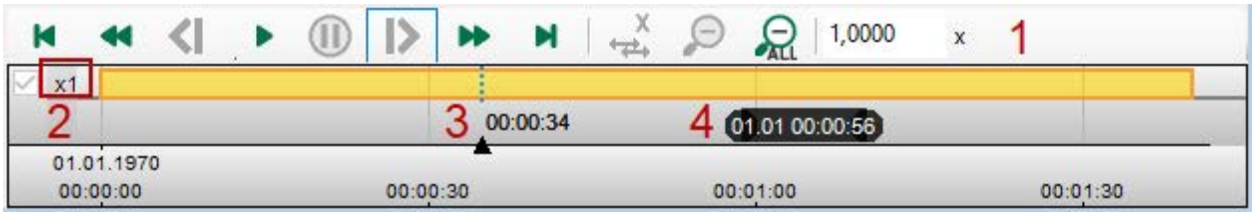
The results of the respective module are shown in ibaAnalyzer-InCycle in the results area at the bottom left.

All characteristic values and output signals of the respective modules are available as results. The results always relate to the current cursor position of the playback area. The calculation that was calculated last before this time is displayed.

You can find the description of the results of the InCycle Expert module in chapter ↗ *Results of the calculations of the Expert module, page 84*

5.1.4 Playback area

In the playback area, you can control the playback of the measurement file (dat format) using the buttons and the slider.



Meaning of buttons:


Start / stop playback


Jump to start / end


Reduce/increase replay speed
(The set replay speed is shown on the left (2))


Jump to the next result in the respective direction


Display the total time period


Remove one/all zoom level(s)

More features:

1 Input of the replay speed
You can enter the factor of the replay speed here. The new speed is adopted by pressing <Enter>.
The replay speed is relative to the normal speed. For example, 2.00x means that the current replay speed is twice the normal speed.

2 Display of the replay speed

3 Time marker
On the timeline, a black triangle represents the current time stamp. If the time marker is moved, the InCycle view jumps to the time stamp of the marker. The time marker can be moved by clicking and dragging it with the mouse. If you click anywhere on the timeline, the marker will jump to this position.

4 Tooltip
If you move the mouse over the timeline, the time stamp of the mouse position will be shown in the tooltip.

The playback area can also be controlled using the keyboard.

Key	Function
<← >	One result backward
< → >	One result forward
< ↑ >	Increase playback speed
< ↓ >	Decrease playback speed
< Space bar >	Play / Pause

Zooming and shifting the time scale

You can zoom in the time scale by drawing a rectangle with the mouse button pressed down on the timeline.

You can shift the time range by clicking the time axis and then dragging the mouse horizontally. The cursor then appears as a double arrow.

6 The cycle view

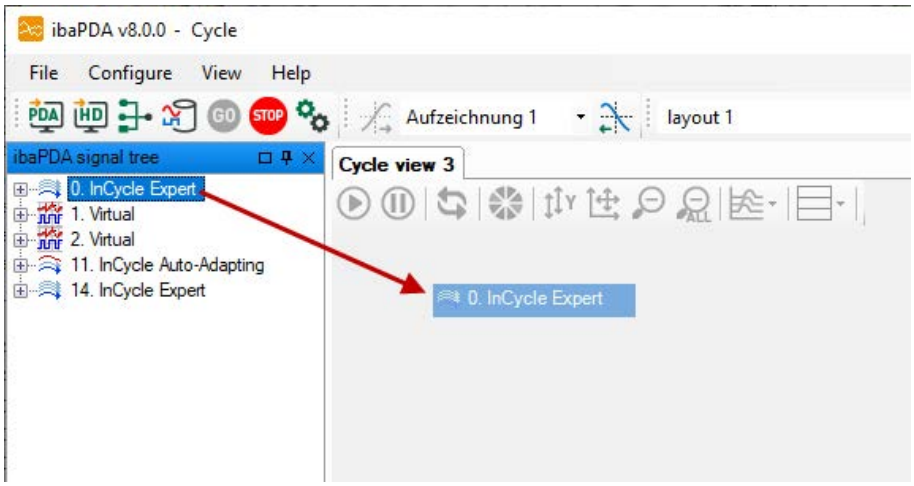
The cycle view is used to visualize the results of the InCycle expert module and the InCycle Auto-Adapting module in *ibaPDA*.

A cycle view may include one or more InCycle modules. The curves can have individual value axes or lie on a common value axis.

6.1 Open a cycle view in ibaPDA

Use the button to add a new cycle view:

You can drag individual or several InCycle Expert or InCycle Auto-Adapting modules from the signal tree to the cycle view main window using drag & drop. In doing so, relevant parameters for the cycle view are copied from the module settings. Individual signals cannot be displayed.

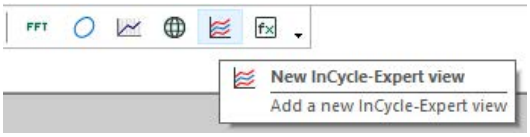


The following hotkey is available to drag new InCycle modules into a cycle view:

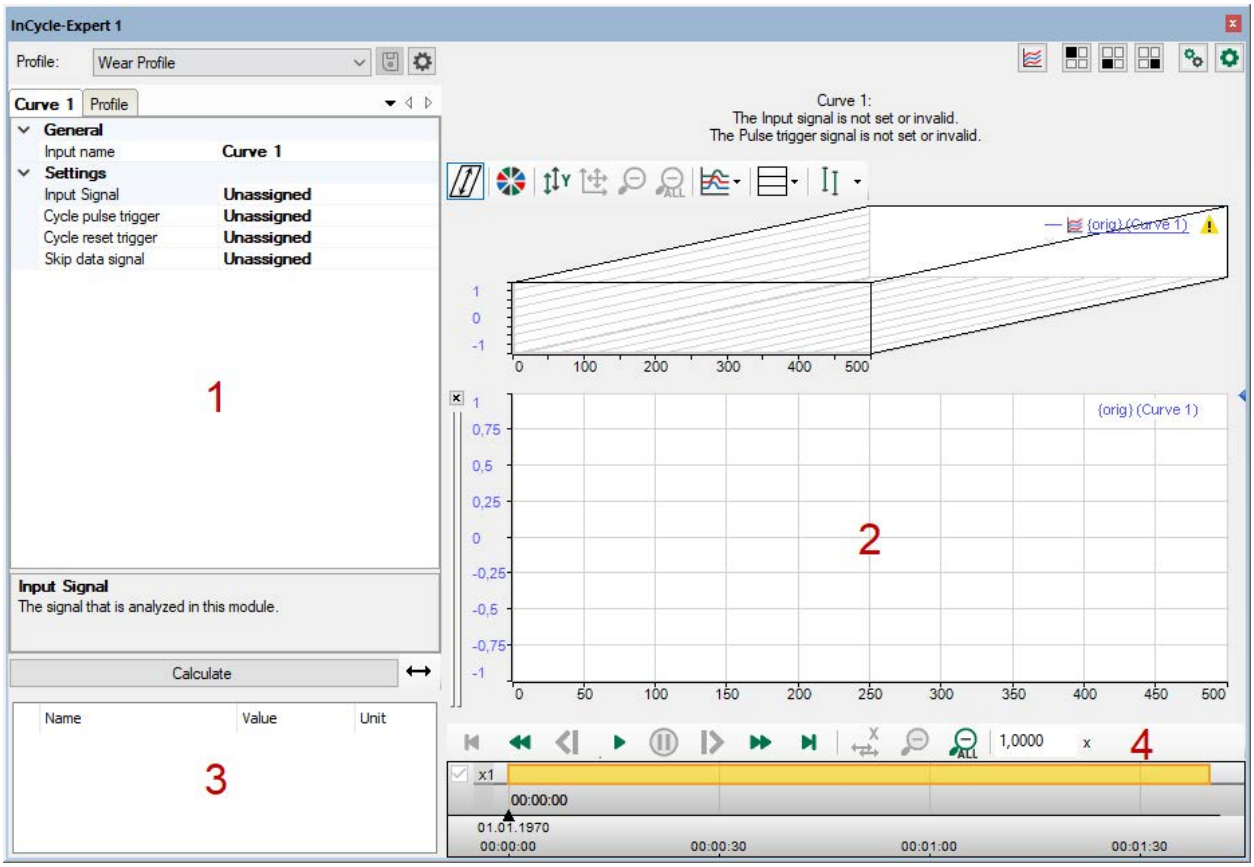
- <Ctrl>: If you hold the control key (Ctrl key) when dragging an InCycle module into the cycle view, the module present is replaced by the new module.

6.2 Opening a cycle view in ibaAnalyzer

Use the button in the toolbar to add a new InCycle Expert view.



The InCycle Expert view in ibaAnalyzer contains additional display areas in addition to the actual cycle view.



1 Configuration area (input signals, profiles) see ↗ *Setting calculation parameters, page 78*

2 Visualization area of the cycle view

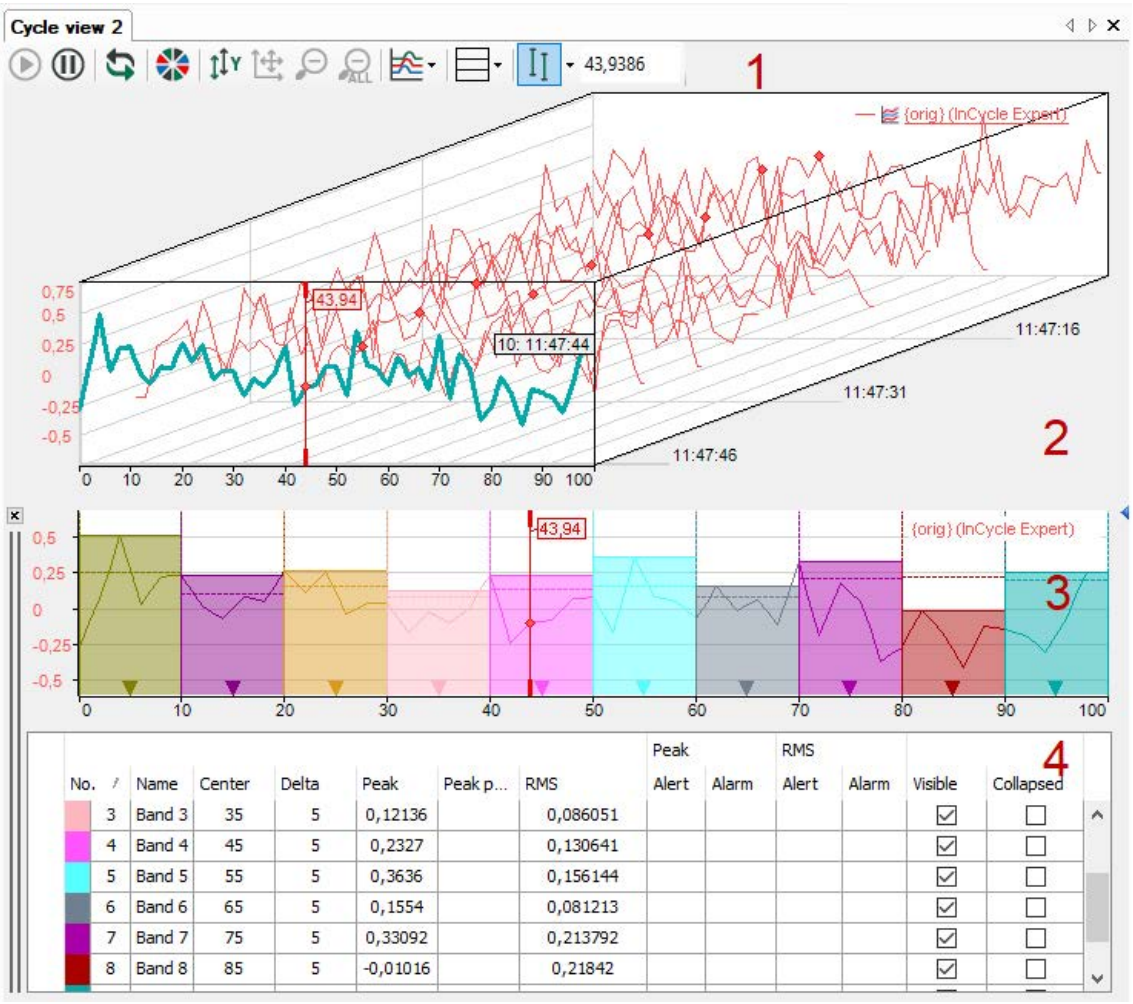
3 Result area, see ↗ *Results of the calculations of the Expert module, page 84*

4 Playback area (playback settings), see ↗ *Playback area*, page 20

The description of the cycle view can be found in chapter ↗ *Overview of the cycle view, page 24*.

6.3 Overview of the cycle view

The cycle view offers a number of special graphs and tables, which can be individually displayed or hidden as needed.



Legend

1	Toolbar
2	Main window
3	Cycle graph
4	Cycle table

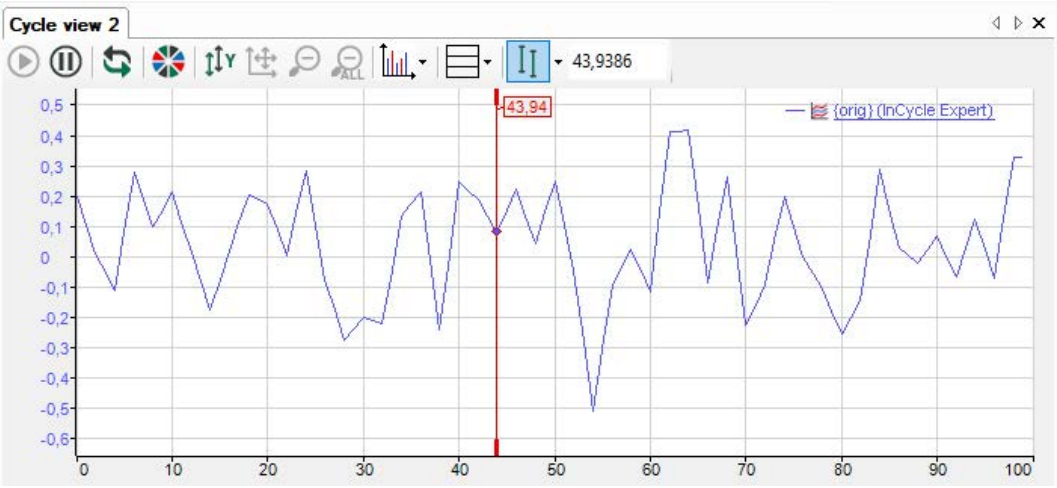
You can display or hide the individual graphs and tables within the cycle view by using the toolbar.

Toolbar

	Start / Pause (only *ibaPDA*) Stop or continue the cycle display update
	Reset all displayed data (only *ibaPDA*) The display is cleared only once and all values are set to zero until the next cycle calculation is completed.
	Determine planecount automatically (only *ibaAnalyzer*)
	Auto color signals
	Auto scale value axes
	Restore manual scale [1]
	Zoom out last step/all steps [1]
	Switching the display type in the main window (single curve / waterfall / contour)
	Open the sub menu for showing/hiding the windows Main window Cycle graph Cycle table
	Show/hide, center, configure interactive marker; No function for configured markers
	[1] acts individually on the main window or cycle graph

6.4 Main window

In the main window, the result of the calculations of the signal to be examined is shown. The standard view for the main window is the single curve.

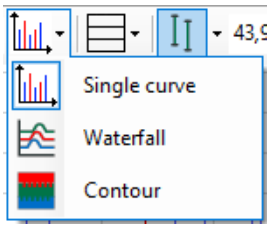


You can enable an interactive marker that you want to use to be able to read the associated results along the X-axis on the individual samples. When switching to the waterfall or contour view, the individual results of the analysis are displayed spatially offset. This provides an overview of the history of the gradient. Detailed information can be found in chapter ↗ *Waterfall, page 26*

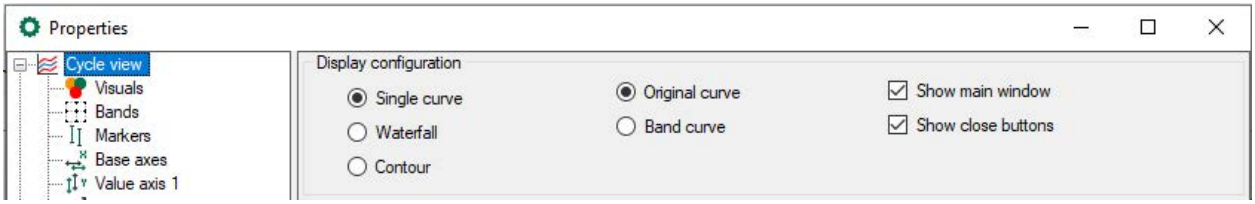
6.4.1 Waterfall

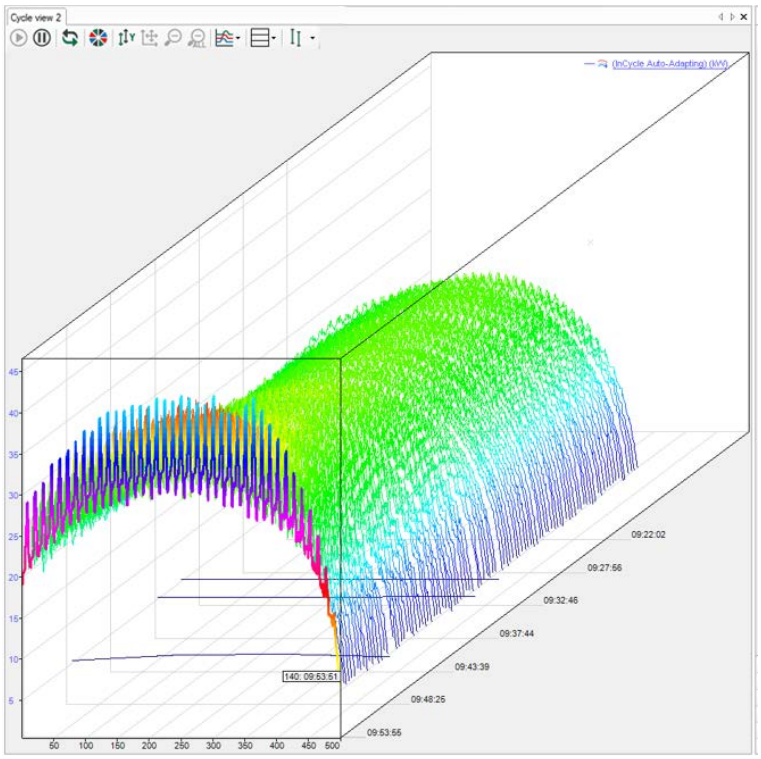
The main window of the cycle view can be converted to an isometric perspective. In this mode, the successive events of a curve are displayed on a Z-axis, with the newest result closest to the axes origin, in order to create a waterfall effect.

However, note that using a waterfall appearance demands greater resource requirements than using a single curve. You can switch to the waterfall perspective via the corresponding button in the toolbar of the cycle view.



Alternatively, you can switch perspectives in the properties dialog of the cycle view as well.





The figure above shows the results of the last 100 calculations. By using the <Up> and <Down> cursor keys or by scrolling with the mouse wheel, you can move through the planes and have displayed the related curves and characteristic values.

When moving the mouse with the <Ctrl> key pressed, you can change the angle and perspective of the view. If you press the <Shift> key at the same time, then the perspective pans to 0 degrees. The axis position settings are overwritten in this mode.

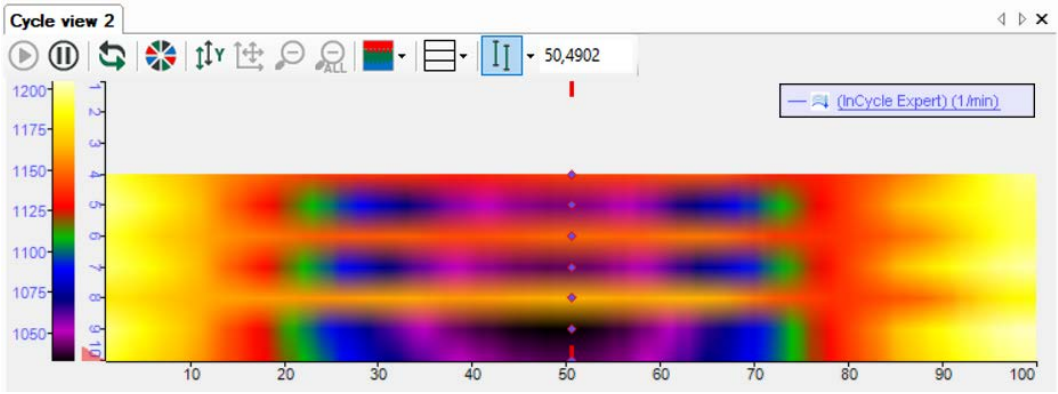
If you have set the desired perspective, you can save it. To do this, select *Save perspective* in the context menu and enter a name. Saved perspectives also appear in the context menu and can be re-enabled at any time. When you select *Front* perspective, the display pans to 0 degrees. Selecting *Default* returns you to the default setting. See chapter ↗ *Settings of the cycle view, page 47*

Scales are always displayed at the side of the cur enot overlapping with the perspective flow direction.

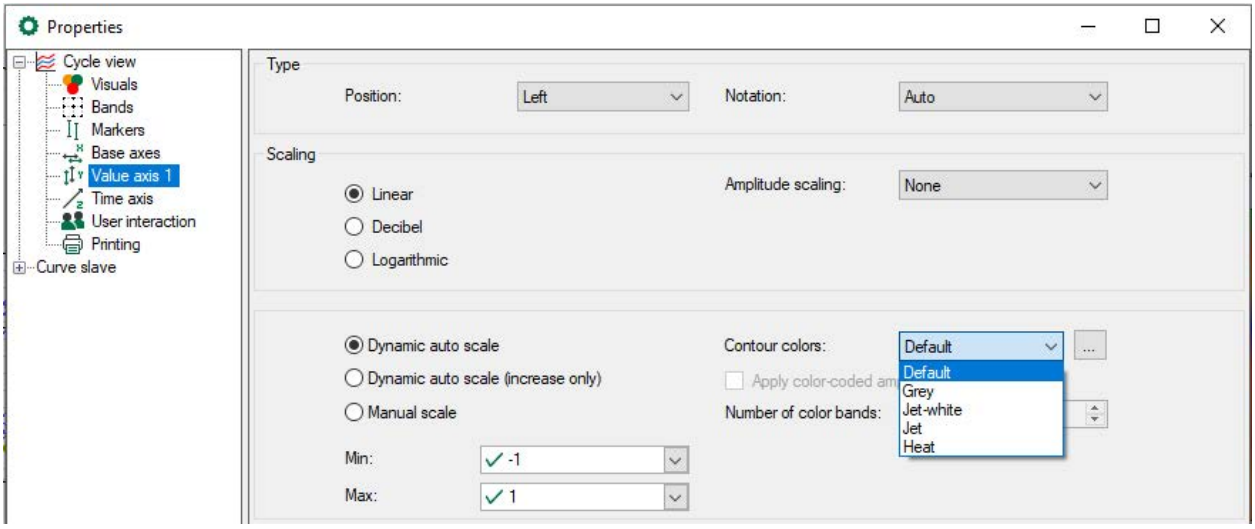
While the waterfall perspective is enabled, the label, marker and zoom rectangle functionality is limited to the foremost plane. The appearance options of the waterfall perspective are determined in the properties window in the node *Time axis*. See chapter ↗ *Z-axis, page 59*

6.4.2 Contour view

The contour view corresponds to a 2D top view of the waterfall, where the value ranges are represented by colors.



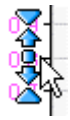
The color scheme can be configured in the properties of the value axis. Both pre-defined schemes can be selected here and separate color schemes can be created.



6.4.3 Zoom

The scale of an axis can be changed in three ways.

- Autoscale
  You can perform an autoscale via the context menu of the axis or by clicking with the middle mouse button on the axis.
- Shift
  You can shift an axis by dragging it with the mouse.
- Zoom
  Using the mouse wheel, you can zoom in and out in the area of the cursor. You can change the scale via the pop-up buttons on the axis too. These buttons appear when you move the mouse over the right side of a horizontal axis or over the top of a vertical axis.



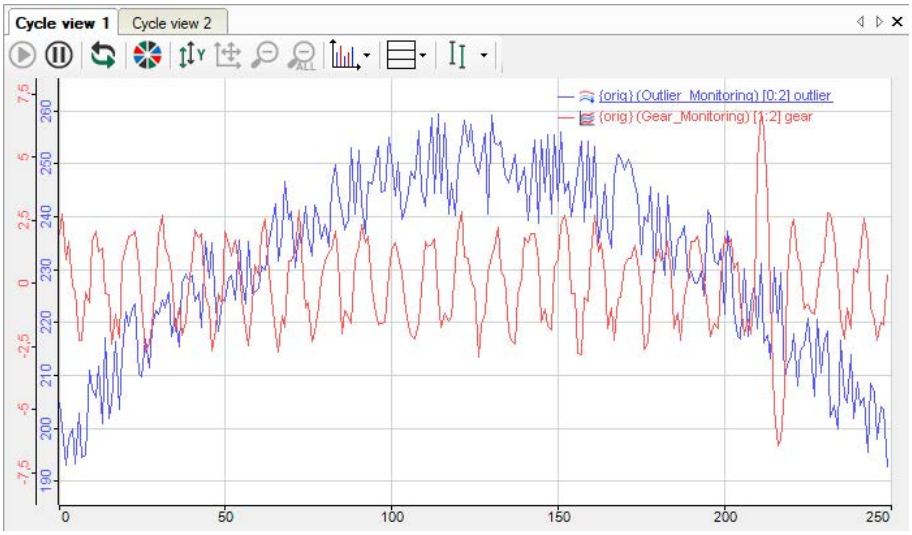
The outermost symbols halve/double the scale range based on the mean value. The arrows have a similar function, but with a smaller zoom factor. The button in the middle autoscales the axis.

In addition, you can zoom into a certain area of the diagram using the zoom rectangle (click with mouse and drag). The zoom rectangle enables the zoom buttons in the view toolbar, which allow you to return to previous zoom levels.

6.4.4 Legend

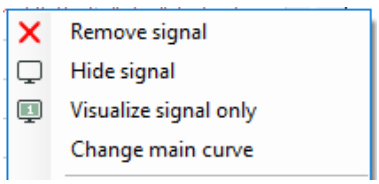
The legend indicates which modules are added to the view. The legend contains the following parts:

- Tree structure of the value axis. This shows which curves are shown on which axis.
- Module type: InCycle Expert or InCycle Auto-Adapting module
- Curve type (band curve or original curve)
- Signal ID and signal name
- unit



The legend has a drag & drop function. This way, a curve can be laid upon different value axes. While dragging the curve, an arrow appears in the value axis tree pointing to the tree that will contain the curve when it is dropped. If a curve is not dropped inside a legend row, the curve will be laid upon a new axis.

Right clicking in a legend row opens the context menu for the legend.



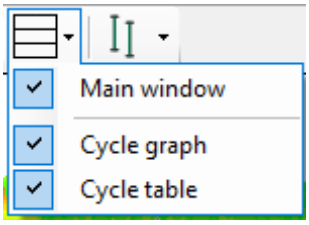
Clicking on *Remove signal* deletes the corresponding signal. Clicking on *Hide signal* hides the signal and shows the signal name transparently. The signal is only temporarily hidden and can always be displayed again.

By clicking on *Visualize signal only* in the context menu, only the selected curve remains in the display and all other curves are hidden. Clicking on *Change main curve* makes the selected curve the main curve.

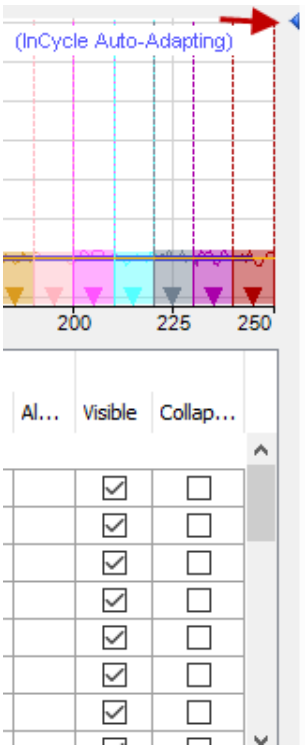
In the context menu under *Properties*, you can display the selected settings for the curves. In the properties of the cycle view (main window), you can also configure and enable a separate legend that contains additional information, such as name, comments and sampling time of the input signal, marker values or any literal text.

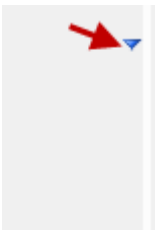
6.5 Cycle graph and cycle table

In addition to the main window, you can open a graphical and/or tabular display of the data of the cycle. Click on the button for the window menu in the toolbar of the cycle view for this purpose.

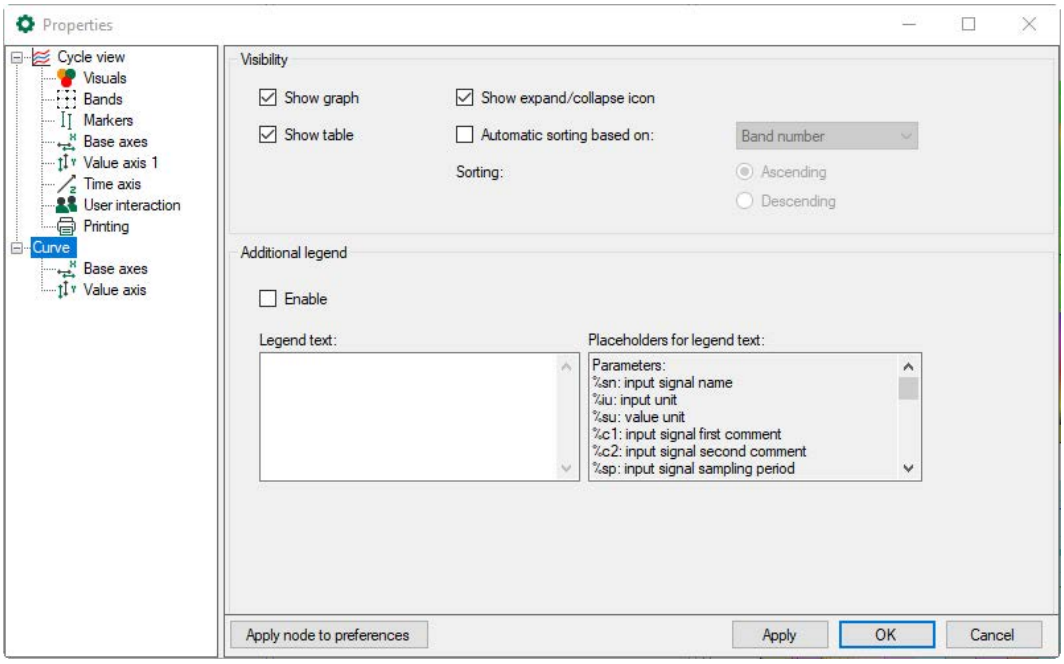


Graphical display and data table form a group, as the table always provides the data suitable for the cycle in the display. However, the display and table can be individually displayed or hidden. In addition, the display and data table can be minimized or displayed together. To do this, simply click on the small triangle on the right margin of the display.





You define general display properties in the properties dialog of the cycle view in node *Curve*.



Visibility

You can define here whether the curve and the data table for the cycle are shown as a standard. Even if a view is disabled here, it can be re-enabled later in the cycle view toolbar. The data table can be sorted automatically. Define the parameter (column) here according to which and in which sequence the table is sorted.

Additional legend

When this option is enabled, another legend is displayed in the cycle window in addition to the normal signal legend. You can define the content of this legend yourself. For example, you can enter a detailed multi-line text, in which placeholders for dynamic information can also be used. The following placeholders are available:

- %sn: Input signal name
- %iu: Input unit
- %su: Value unit
- %c1: Input signal first comment
- %c2: Input signal second comment
- %sp: Input signal sampling time
- %x: X-value at interactive marker
- %y: Y-value at interactive marker
- %xmouse: X-value at mouse cursor
- %ymouse: Y-value at mouse cursor
- %tmouse: Z-value at mouse cursor
- %xmv: X-value of the nearby marker position
- %ymv: Y-value of the nearby marker position
- %tmv: Time value of the nearby marker position
- %nmv: Name of the nearby marker position
- %imn: InCycle module name
- %n: Band name
- %nb: Band number
- %r: RMS value
- %p: Peak value
- %pf: Peak position
- %c: Center position
- %d: Delta position
- %l: Lower position
- %u: Upper position

By default, all signal-dependent placeholders relate to the first curve. To identify another curve, use a colon followed by the word “curve” and the index of the curve, e.g. “%sn:curve1” for the first curve.

Use the optional formatting string “w.p” to specify the format of the numeric parameters, where “w” is the width and “p” is the precision. The width is the minimum number of the characters shown. Precision is the number of decimal places.

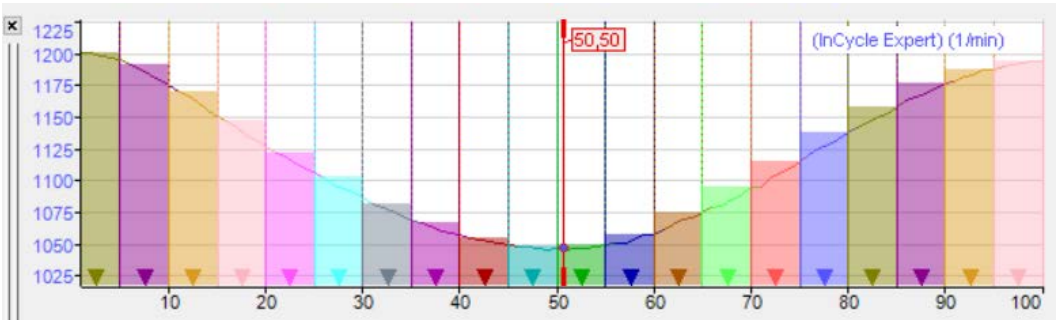
Example: "%5.3y1" indicates the Y-value for marker X1 with a width of 5 characters and a precision of 3.

You can combine most of these techniques: e.g. "%10.5sp:curve1"

6.5.1 Cycle graph

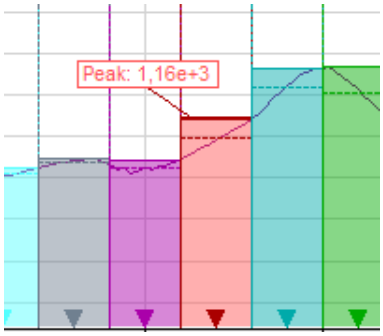
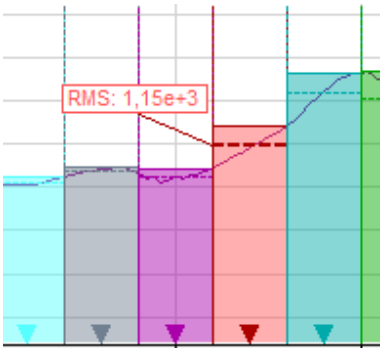
The graphical display of the cycles always shows the last result in two-dimensional appearance or the curve selected in the waterfall or contour plot. (The selected curve in the waterfall view is shown with a different color, marked in the contour plot with a triangle):

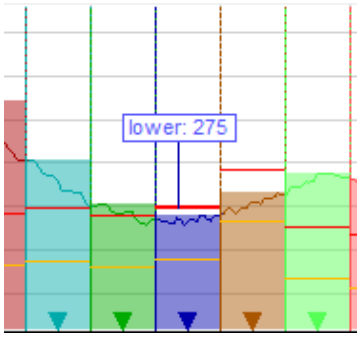
- Curves
- Bands
- Value bands
- Characteristic values of the bands
- Limit values of the bands



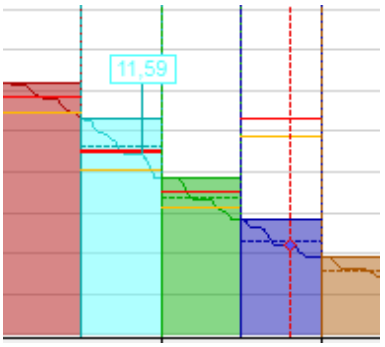
The display shows at least a part of the curves from the main window. You can add additional curves by dragging and dropping them from the main window or from the signal tree via drag & drop. The displays are linked so that all curves in the small cycle display can also be seen in the main window.

The most important parameters of the bands are shown with dotted and colored lines. The respective values are displayed when you position the cursor on the lines (hovering).

 Peak	 RMS

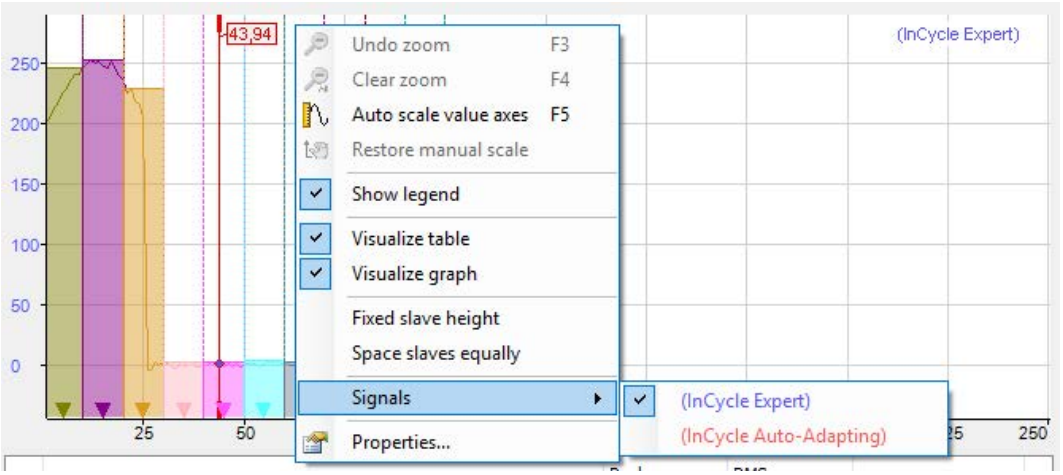


Upper/lower limit



Warning/alarm limit

The configuration of the bands is described in chapter ↗ *Bands, page 51*. You can decide in the bands properties (by using the context menu of the display) which markings and characteristic values are to be displayed (permanently) and whether the curves should change the color when violating the alarm limits.

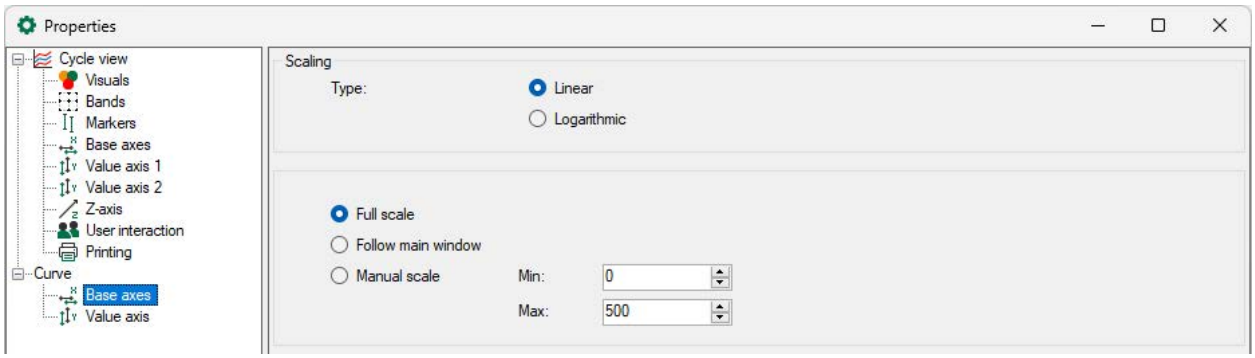


If there are several curves in the display, individual display properties can be assigned to every curve. If the cycle graph has the focus (after a mouse click on the header bar), the tool buttons for zooming out and restoring the manual scale relate to this display and not to the main window. The same applies to the assigned function keys <F3>, <F4> and <F5>.

Base axis

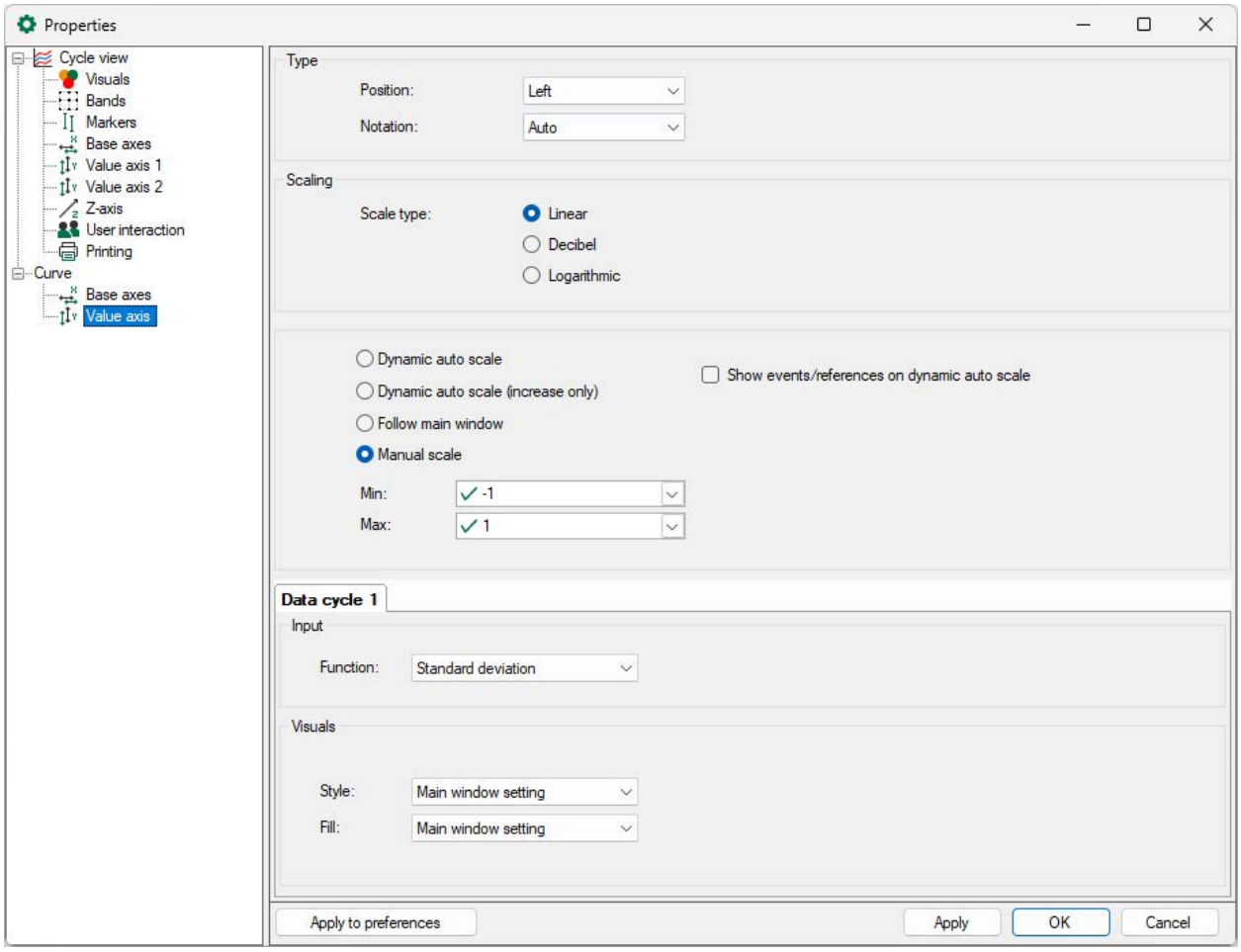
The display has a base axis conforming with that of the main window. You can still modify the settings of the base axis in the display properties to, e.g., choose a logarithmic instead of a linear scaling or a manual scale.

If you zoom in the cycle graph or in the main window, this is usually independent from each other. By using the *Follow main window* option, you can determine that a zoom action in one of the windows also affects the other, but only in horizontal direction.



Value axis

The cycle graph has only one value axis. All curves in the display are displayed on the same scale of values. You can change the settings of the value axis in the properties of the display.



For scaling the value axis, you can choose between linear, decibel and logarithmic.

Select one scaling mode:

- Dynamic auto scale: if you enable this option, the scaling is always adjusted to the highest and lowest signal amplitudes in the graph (in both directions).
- Dynamic auto scale (increase only): When you enable this option, the scaling is continuously adjusted with the highest signal amplitudes. If the amplitudes go beyond the trend view again, the scaling still remains unchanged.

- Follow main window: With this option, a zoom action in the vertical direction in the main window also affects the cycle display.
- Manual scale: if this option is selected, the Min and Max scale values can be manually entered or selected from the field next to it. Beside a static value, you can also use any known measured or virtual analog signal configured in the I/O Manager.
- Show events/references on dynamic auto scale: the scaling is automatically adjusted so that events (such as limit values) and reference values are always displayed.

Data cycle

You can select a function for each cycle display in the *Cycle data x* tabs. You can accept the main window setting or select individual settings from the respective drop-down menu.

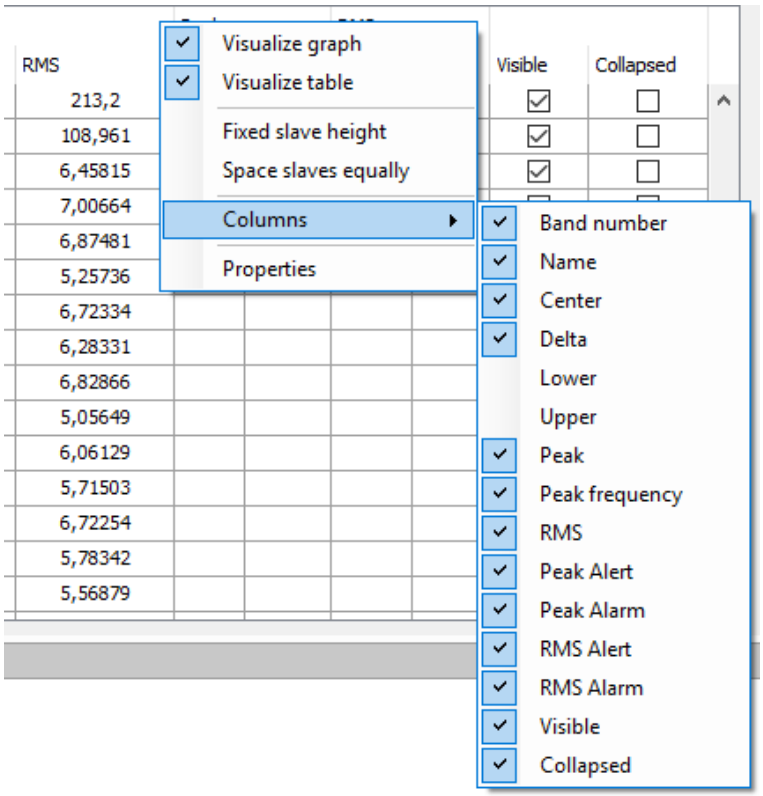
You can also determine the display properties for style and filling for each data cycle separately. You can accept the main window setting or select individual settings from the respective drop-down menu.

6.5.2 Cycle table

A line is automatically created for every defined band of the displayed InCycle module in the data table. The parameters and – if configured – the results are shown for each band.

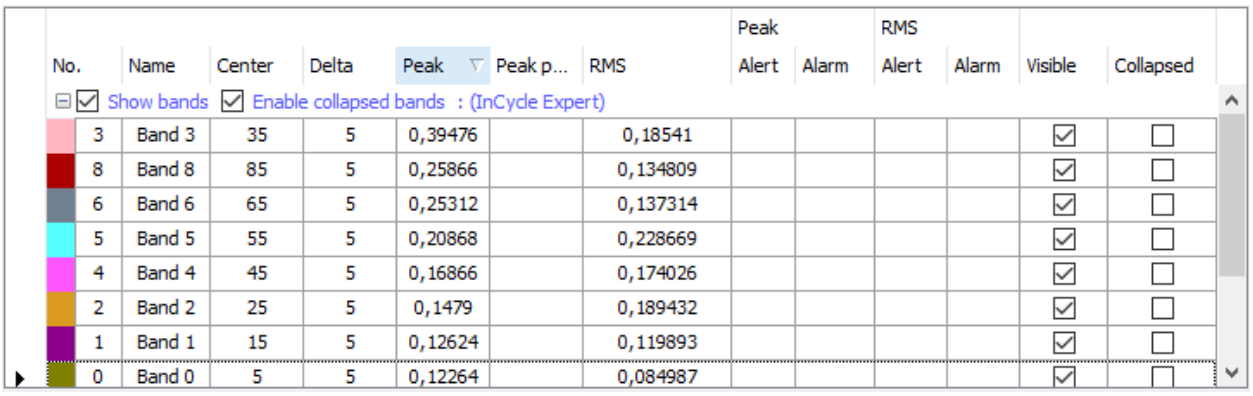
								Peak		RMS			
	No.	Name	Center	Delta	Peak	Peak p...	RMS	Alert	Alarm	Alert	Alarm	Visible	Collapsed
☑ Show bands ☑ Enable collapsed bands : (InCycle Expert)													
	0	Band 0	5	5	0,26704		0,182501					☑	☐
	1	Band 1	15	5	0,37128		0,223071					☑	☐
	2	Band 2	25	5	0,18464		0,133683					☑	☐
	3	Band 3	35	5	0,12651		0,10548					☑	☐
	4	Band 4	45	5	0,39074		0,223938					☑	☐
	5	Band 5	55	5	0,11316		0,180336					☑	☐
	6	Band 6	65	5	0,23246		0,122163					☑	☐
	7	Band 7	75	5	0,03184		0,205376					☑	☐

You can display or hide the characteristic value columns via the context menu (right mouse click in the heading).



In every characteristic value column, the displayed values can be sorted by clicking on the table header. A triangle in the header indicates whether the sorting direction is ascending or descending. The order is automatically re-sorted if the order changes during acquisition.

You define the preference for sorting in the properties dialog of the cycle view in the node *Curve*. See chapter ↗ *Cycle graph and cycle table, page 30*



Show bands / enable collapsed bands
Use this option to globally decide for all bands whether these are displayed in the *Cycle graph* and whether they can be displayed as collapsed bands. If the option *Show bands* is enabled, the display of individual bands in the *Visible* column can be determined separately.

If the option *Enable collapsed bands* is marked, the display of the individual bands in the *Collapsed* column can be determined separately. Collapsed bands are indicated by a triangle at the average.

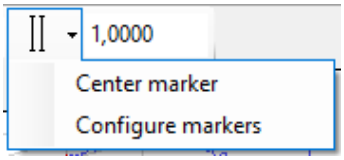
6.6 Markers

For a better evaluation of the cycles analysis, markers can be displayed in the main window and in the *Cycle graph*. The abscissa is divided into the number of samples per cycle. The markers mark individual sample values.

There are several types of markers having different functions:

- Interactive marker
  There is an interactive marker. This marker can be switched on or off and manually moved. The interactive marker differs from the configured markers by 2 thickened ends. See also ↗ *Interactive marker, page 39*
- Configured marker
  Several markers of this type can be used in a display. The marker position can be set to a constant value or controlled by a signal. Also the configured markers can be moved manually. See also ↗ *Configured marker, page 42*
- Tracking marker
  The tracking marker can be used to track the peak value of a curve in the contour plot. See also ↗ *Tracking marker, page 45*

You can enable or disable the display of the interactive marker by clicking the button in the tool bar of the cycle view. The button relates to the main window and the cycle graph.



The markers are configured in the properties of the cycle view (main window).

For all markers, you can set that the factors are shown in the label of the harmonic markers. And it is possible to display sideband labels that show the offset.

In the waterfall display, you can connect the marker points between the planes.

The intersections of the markers with the curves are displayed by small diamonds. You can hide these with the option *Hide marker dots*. If *Connect marker dots in waterfall* is also selected, the markers are shown as a line in the waterfall and in the contour view.

The marker front lines can also be hidden in the waterfall display.

For better differentiation, you can assign your own line patterns or bold type to the different markers (first harmonic, harmonic markers and sideband markers).

6.6.1 Interactive marker

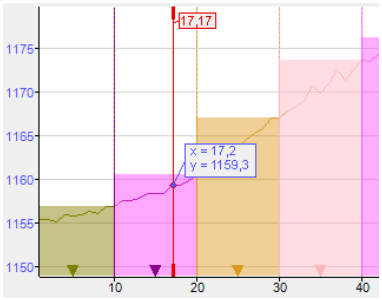
The interactive marker is used for spontaneous reading of X and Y values in a cycle view. It can be shown or hidden at any time.

When activating for the first time, the marker is displayed at the position 0. Every time the marker is switched off and on again, it memorizes the last position.

You can change the marker position either by clicking on the thick ends at the top or at the bottom of the marker or by using the cursor keys:

Keys	Function
<Cursor to the left>/<cursor to the right>	Normal step width
<Shift>+<cursor to the left>/<cursor to the right>	Large steps
<Ctrl>+<cursor to the left>/<cursor to the right>	Small steps

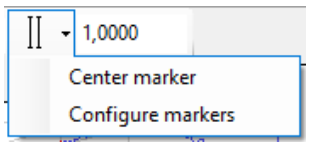
When you move the mouse over the thickened end of the marker, the cursor changes to a double-arrow symbol. You can then move the marker. In the label with the marker color (default: red), the X value is displayed on the base axis. If there are several base axes, you must specify in the settings of the base axes which axis the marker should refer to (marker axis). In addition, X and Y values are displayed at the intersection of the marker with the curve.



Center markers

Since the marker has a certain position on the base axis, it is possible that it is not visible in the image anymore after zooming. Switching the marker off and on to bring it back into the image is useless, as it does not change its position because of that.

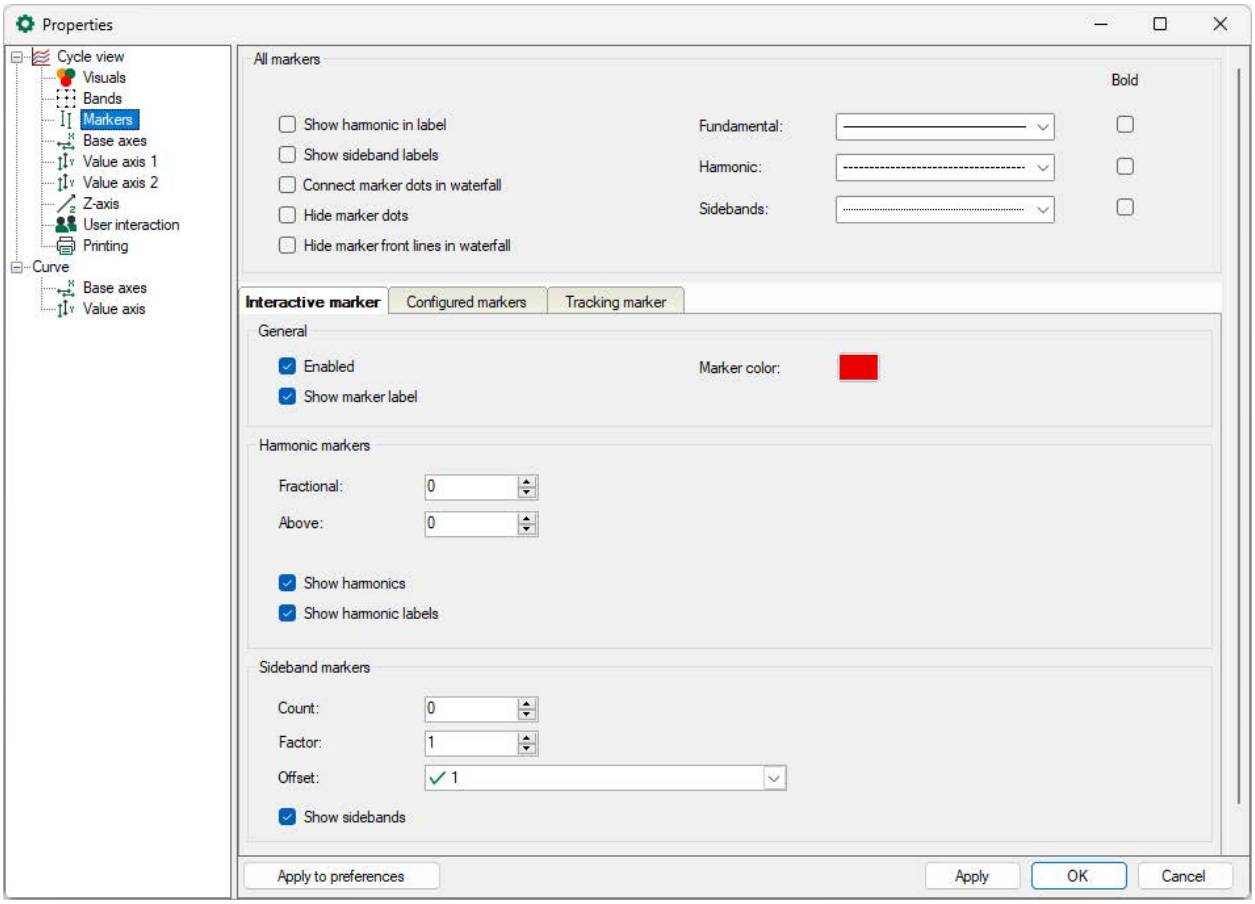
This is what the *Center marker* function is for. With this function, you place the marker in the center of the section currently visible.



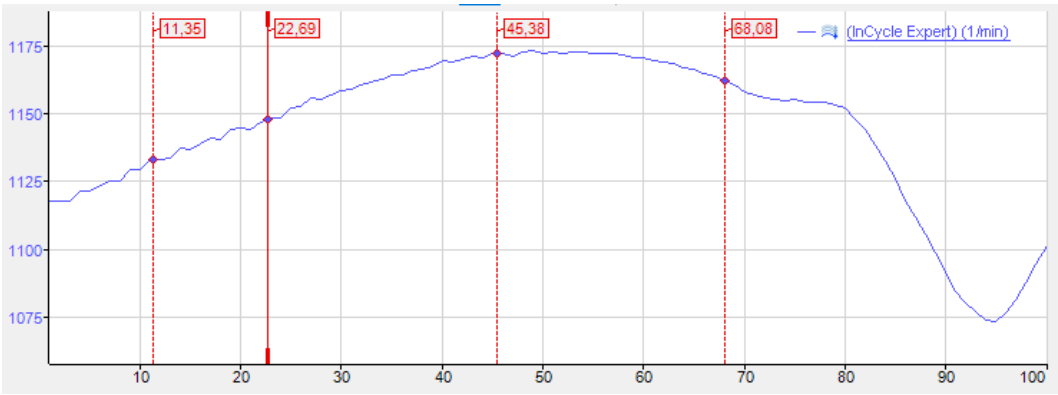
Click on the arrow symbol at the marker button in the tool bar and then on *Center marker*.

Configure markers

In addition to general properties such as color and label, you can also configure harmonic markers and sideband markers in the settings.



Harmonic markers always have a position that corresponds to an integer multiple of the main marker. For the harmonic markers, determine the requested number of the harmonic components below and above the current marker position. For the harmonic positions, further lines are displayed. Additionally, in the *Markers* branch, enable the option *Show harmonic in label* to display the position values on the markers.

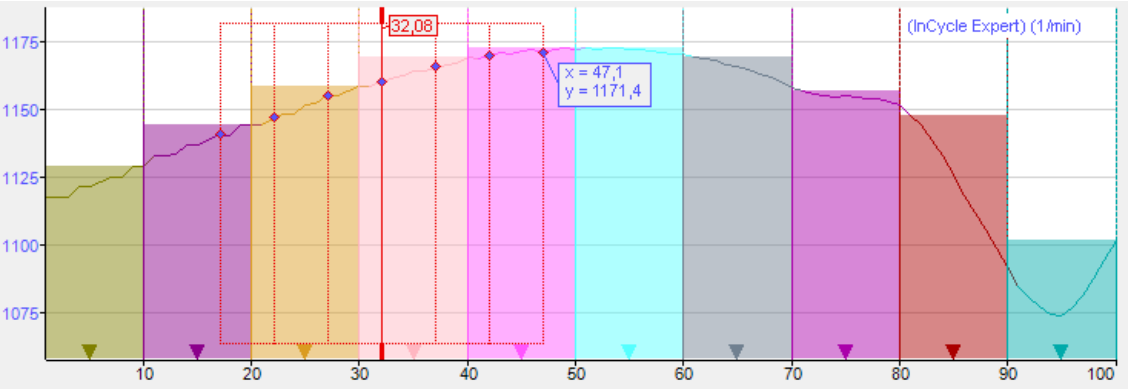


The above figure shows an interactive marker with 1 harmonic component below and 2 harmonic components above the marker position of 22.69.

An adjustable number of sideband markers is added symmetrically right and left of the main marker. The distance to the main marker and the neighboring sidebands is the sideband offset,

represented in units of the base axis. The sideband offset can be a constant value or an analog signal. The offset can also be changed with the mouse by touching one of the outer markers with the cursor and moving it to the left or right with the mouse button pressed down.

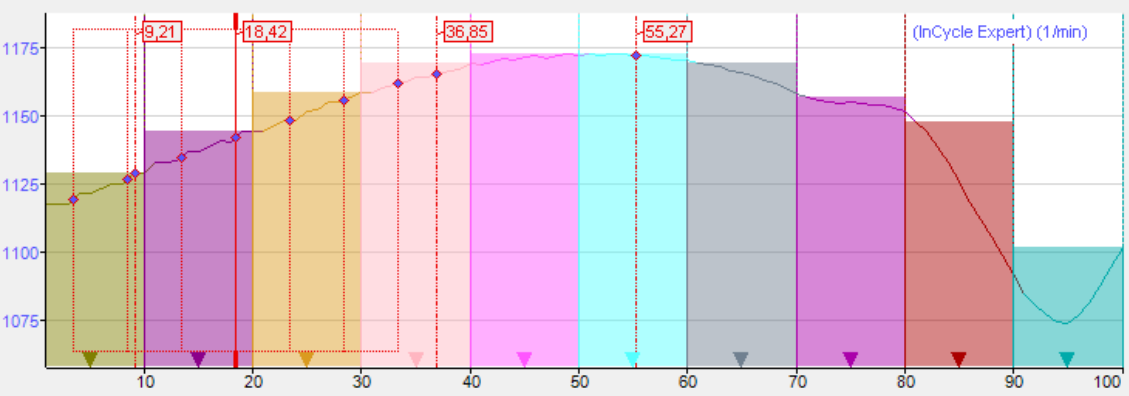
You can enter a factor if the sideband marker is to be at a multiple or fraction of the marker frequency. When the position of the marker in the display is changed by dragging, the factor is updated.



The above figure shows an interactive marker with 3 sidebands and offset of 5 each.

Small diamonds indicate where markers and spectra intersect. If the mouse pointer is moved near a diamond, its coordinates (X and Y values) become visible.

Harmonic component and sideband markers can be displayed in combination, too. The figure below shows a view with a harmonic marker below and two above the main marker. The sideband offset is set to 5.



Note

If the sideband offset is specified by a signal, the value of this signal always has to be >=0. If the value is negative, the offset = 0 and no sideband markers are displayed.

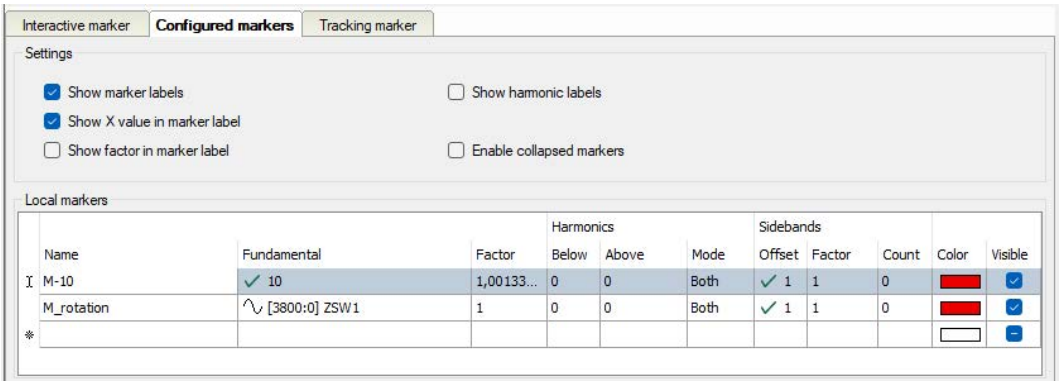
Note

You can make the general settings of the markers in the preferences. You will find individual settings for the curve views in the properties of a view.

6.6.2 Configured marker

The so-called configured markers can either be anchored at certain positions on the base axis with fixed values or moved dynamically along the base axis by means of analog signals.

The markers must first be defined and configured. Configure the markers in the properties dialog of the cycle view, in the *Markers* branch.



Settings

Here you define whether a marker label is displayed and which information is to be displayed additionally: Value on the X-axis and/or factor.

To create a marker, you simply have to enter the required information in the table line. As soon as you click in the empty space below, a new, empty line is added.

Name

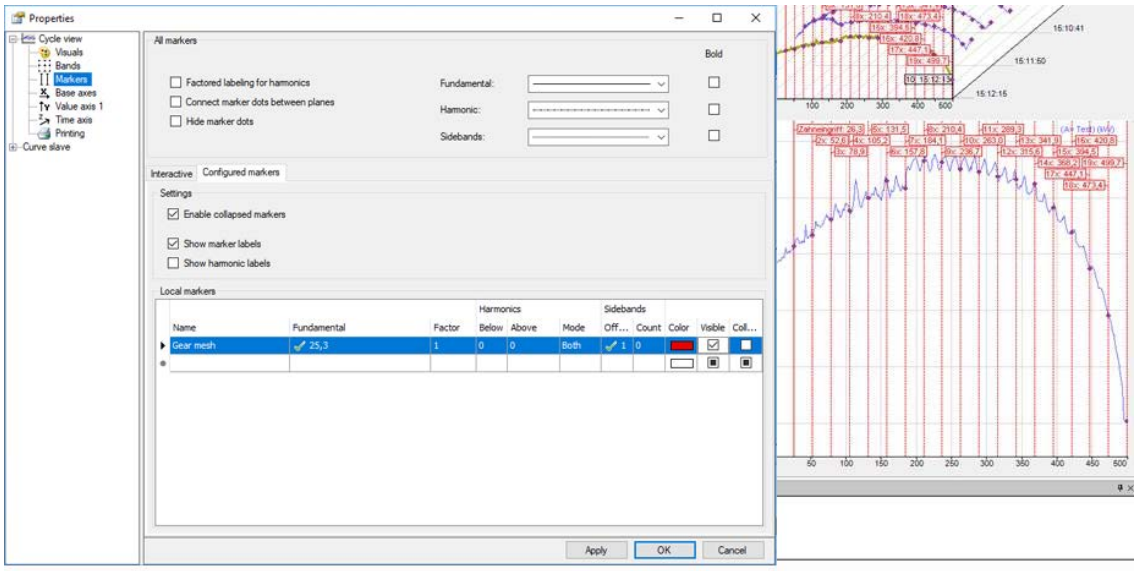
Enter a clear name to be able to easily identify the marker. The name is shown in the display later on, too.

The entries for fundamental/position and factor determine the position of the marker on the base axis. The marker position is calculated by multiplying these two parameters.

Fundamental

For the fundamental, you can enter a fixed value or select a signal. To select a signal, click in the table line and then on the arrow symbol. Select the signal from the signal tree.

If you want to use a signal for controlling the marker position, select a signal complying with the position you want to monitor.



The example in the image above displays a tooth engagement frequency of a saw. The saw, for example, has 19 teeth. 360 data points are acquired per revolution. In other words, every 18.947... data points a gear mesh occurs. With the 18 harmonics above it, 19 equally distributed markers are displayed, which should correlate with the gear mesh in each case.

Note

If the signal for the fundamental/position is negative, the marker is not displayed.

Factor

The default value of the factor is 1. You can enter another factor if, for example, the marker is to be positioned at a multiple or a fractional part of the basic position.

If the position of the configured marker in the display is changed by dragging, the factor is updated.

Harmonics

As with the interactive marker, you can individually determine the number of harmonic markers above or below the marker position for every fixed marker. Additionally, this mode allows you to select whether only the even or odd harmonic components are taken into consideration or both types.

Sidebands

As with the interactive marker, you can individually determine the number of sideband markers and the sideband offset for every marker, static and depending on a signal value. If you drag the sideband markers, the factor is updated during dragging.

Note

If the sideband offset is specified by a signal, the value of this signal always has to be >=0. If the value is negative, the offset = 0 and no sideband markers are displayed.

Color

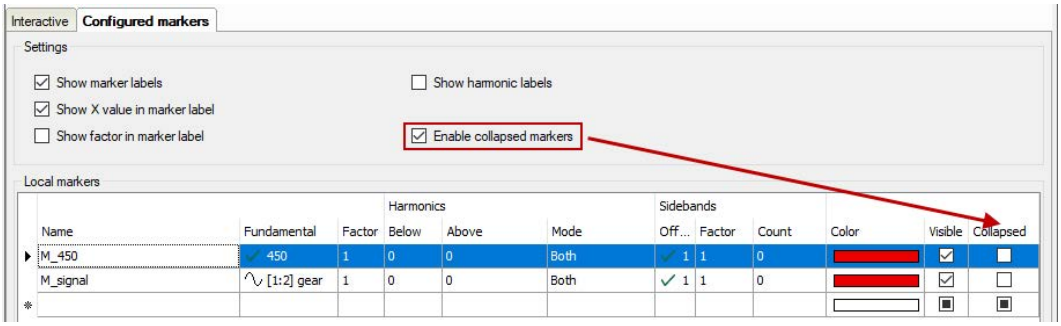
Here, you can allocate an individual color to every static marker

Visible

This option decides whether a configured marker is displayed or not. This is the only possibility of enabling or disabling configured markers for the display. The marker button in the toolbar of the cycle view does not control the configured markers!

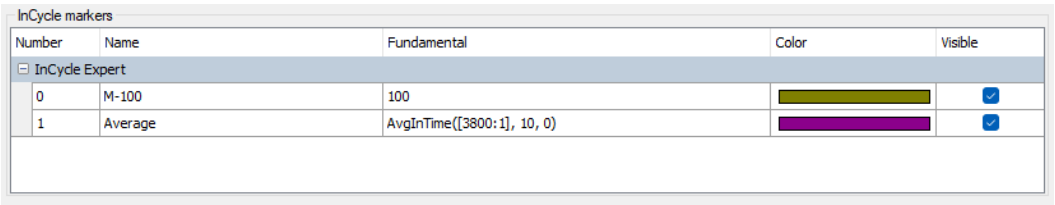
“Enable collapsed markers" option

When you enable this option, an additional column appears in the marker table, in which you can decide for each marker whether it is normal, i.e. it should be displayed as a line and possibly with a label, or only as a triangle based on a base axis.



InCycle markers

The InCycle markers are shown in the table below.



The settings of the InCycle markers can only be changed in the InCycle profile. Only the visibility can be set here.

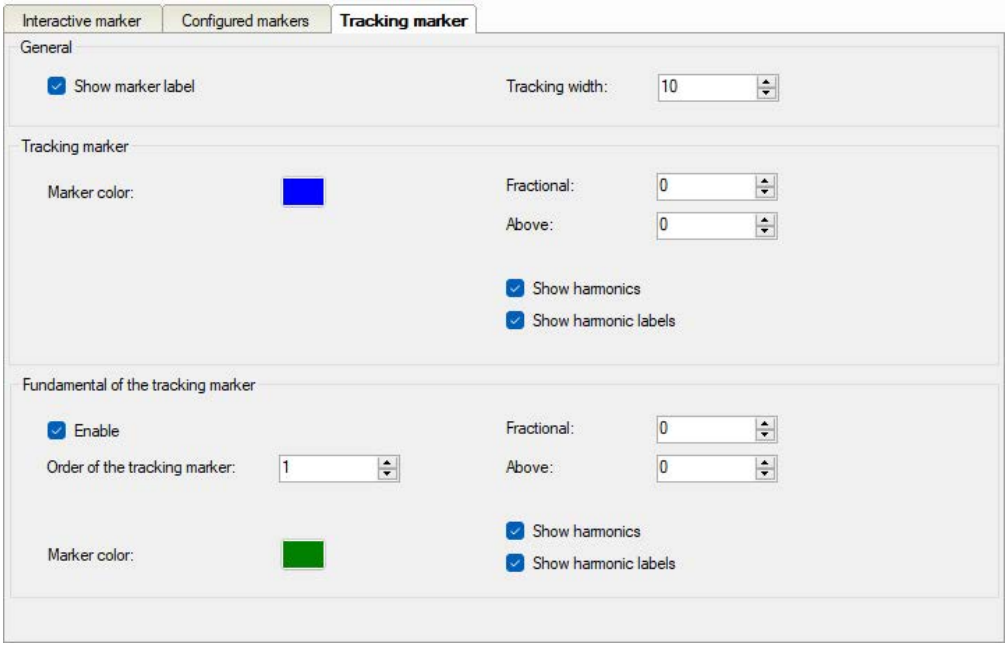
6.6.3 Tracking marker

The tracking marker in the contour view allows tracking a peak value in the curve. To do this, select points in the contour view that lie on a peak of the curve. The system searches for the peaks in the intermediate planes and construct a connecting line (tracking line).

Background:

Often the trend of a process parameter like speed is dominant in contour views. In many cases the speed signal from the PLC is not available or has a bad quality. The tracking line corresponds to the speed signal.

Tracking marker configuration



In addition to general properties such as color and label, you can also configure harmonic markers. See also chapter ↗ *Interactive marker, page 39*.

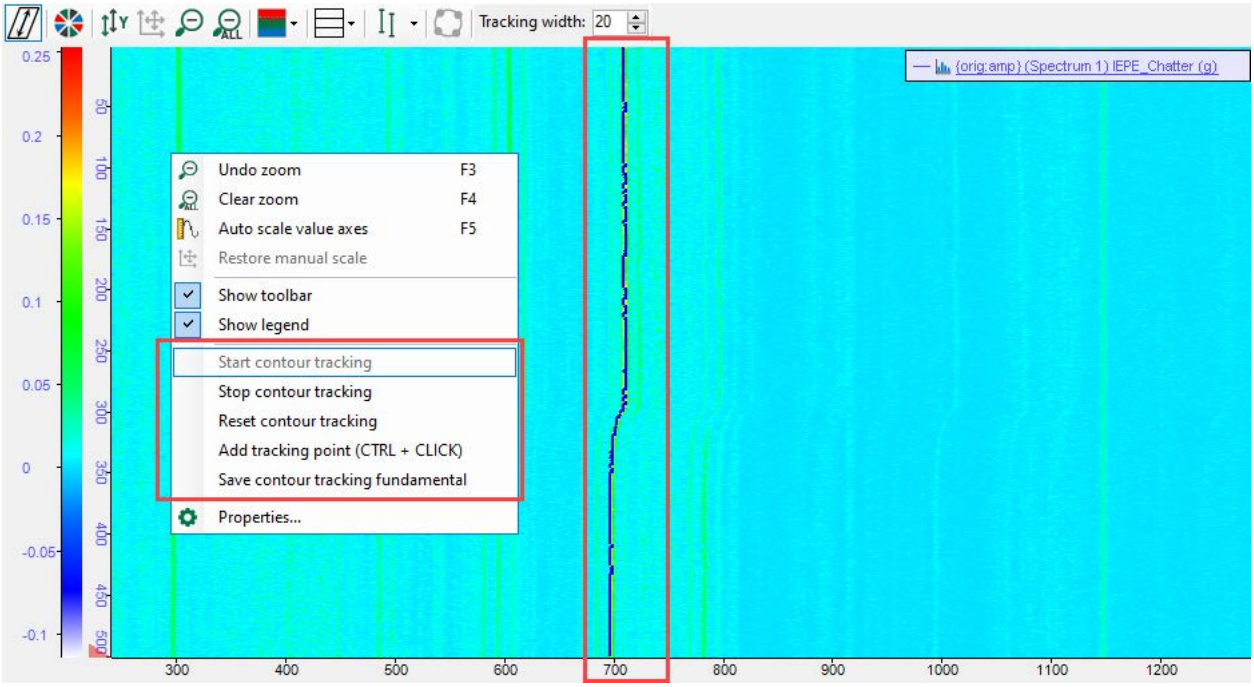
Use the tracking width to set the sensitivity of the contour tracking.

Fundamental of the tracking marker
It is also possible to display the nth fundamental of the tracking marker. Enter the order in the field *Order of the tracking marker*.

You can also configure color and harmonics.

Using the tracking marker in the contour view

The tracking can be started and stopped via the context menu. When contour tracking is started, you can add tracking points. To do this, hold down the <CTRL> key and click in the contour view.

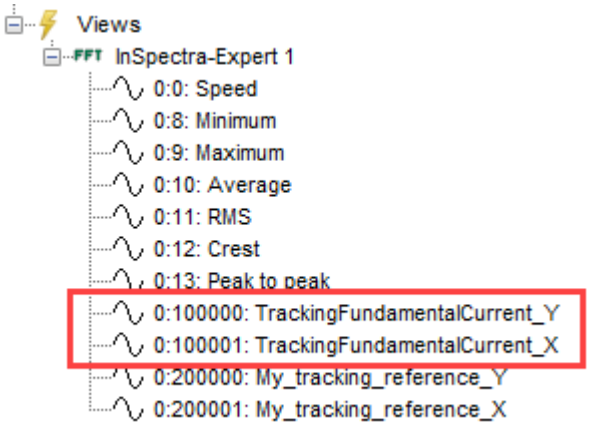


The tracking line runs along the points in the graph which you have selected. The sensitivity of the tracking line selection can be set using the *Tracking width* option in the toolbar. The peak is selected within the tracking width.

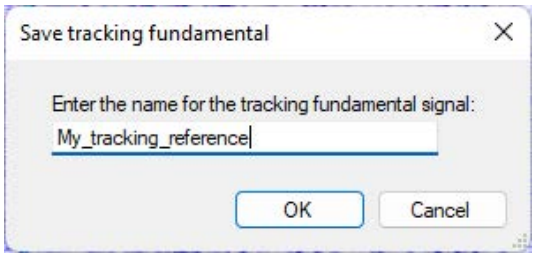
The current tracking line can be reset with the option *Reset contour tracking*. *Contour tracking* remains active and you can set new tracking points.

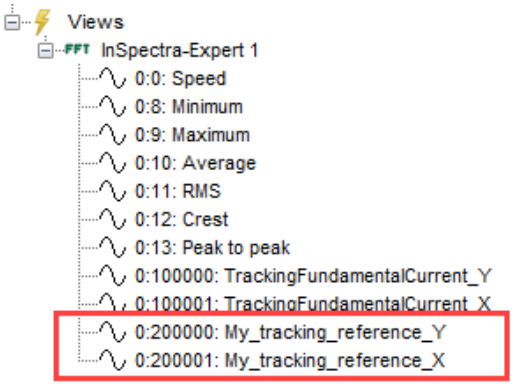
Analysis in ibaAnalyzer

The X- and Y-coordinates of the currently configured tracking line are available as output signals TrackingFundamentalCurrent_Y and TrackingFundamentalCurrent_X of the view in the *ibaAnalyzer* file tree.



A tracking line can be saved as *Tracking Fundamental* by selecting *Save contour tracking fundamental* from the context menu. The name can be freely configured. The X- and Y-coordinates of the saved tracking line are available as two additional output signals of the view with the configured name.

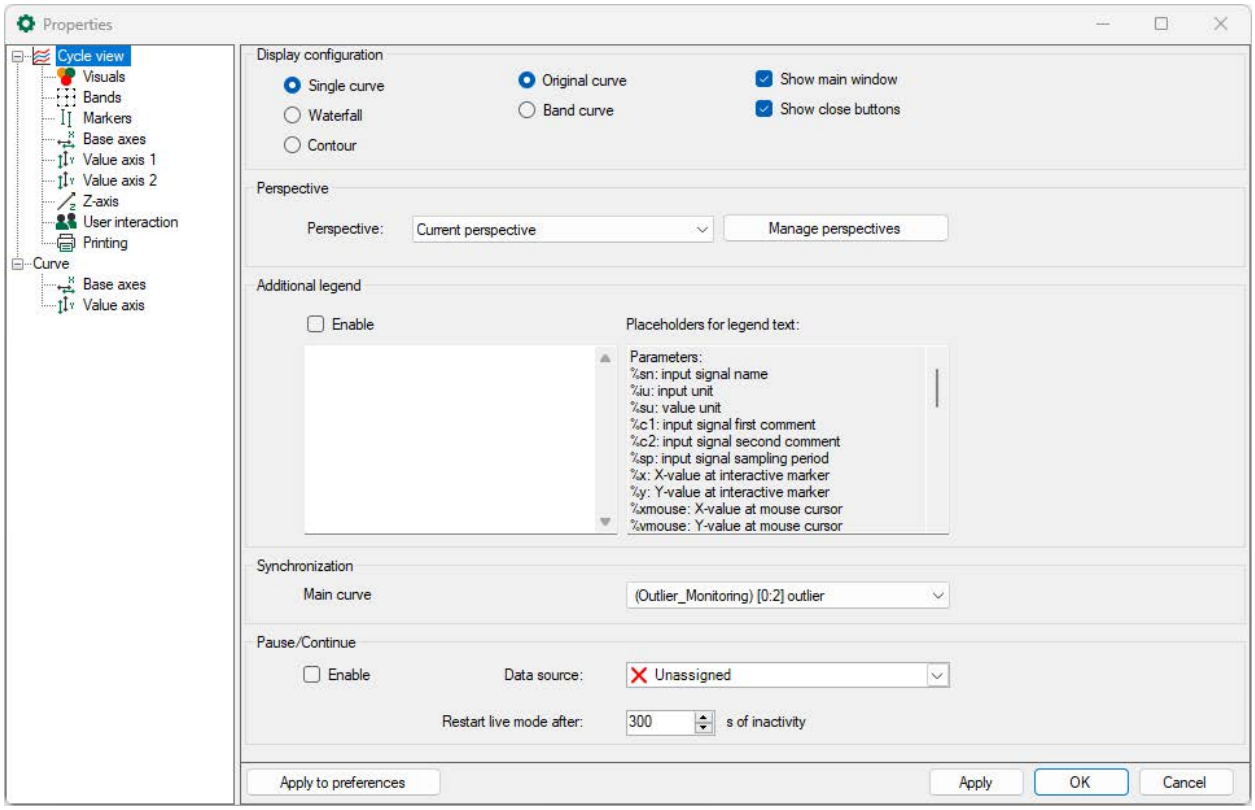




6.7 Settings of the cycle view

In the cycle view, all settings can be adopted node by node in the preferences and are therefore applied to newly opened cycle views. Changes can be saved by pressing the button <Apply node to preferences>. The preferences cannot be viewed separately in *ibaAnalyzer*. A new cycle view must be opened in order to view preferences. In *ibaPDA*, you open the preferences via the menu *Configure - Preferences*.

The node *Cycle view* offers general settings for the display.

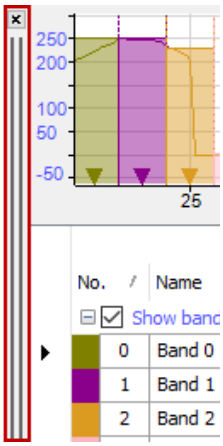


Display configuration

Choose whether you prefer the single curve, the waterfall view or the contour view of the curves. The visibility of the main window can also be set here.

Instead of the *Original curve*, you can select the *Band curve*. Then the results of the individual bands are displayed. You can find settings for this in the node *bands*. See chapter ↗ *Bands, page 51*

Use the *Show close buttons* option to control the visibility of the close buttons and the lines to the left of the display.



Perspective: Drop-down list *Custom perspective*
If you have saved different perspectives for the waterfall (3D) appearance, then you can select one of them. Click the button <Manage Perspectives> to open the dialog for managing perspectives. This lets you delete existing perspectives, copy them to the clipboard or paste them from the clipboard. Since perspectives are always specific to a cycle view, in order to use a perspective in exactly the same way in another cycle view, it must be copied and pasted to the other cycle view.

You can save the perspective in the view. Once you have configured the desired perspective, select *Save Perspectives* in the context menu of the main window. Give the perspective a name and close the dialog via <OK>.

Additional legend
When this option is enabled, another legend is displayed in the main window in addition to the normal signal legend. You can define the content of this legend yourself. For example, you can enter a detailed multi-line text, in which placeholders for dynamic information can also be used. The following placeholders are available:

- %sn: Input signal name
- %iu: Input unit
- %su: Value unit
- %c1: Input signal first comment
- %c2: Input signal second comment
- %sp: Input signal sampling time
- %x: X-value at interactive marker
- %y: Y-value at interactive marker

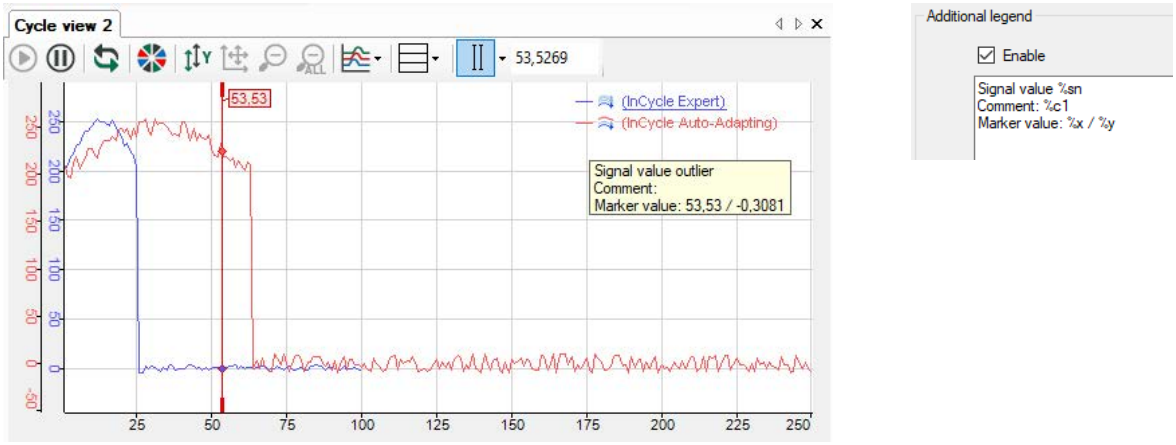
- %xmouse: X-value at mouse cursor
- %ymouse: Y-value at mouse cursor
- %tmouse: Z-value at mouse cursor
- %xmv: X-value of the nearby marker position
- %ymv: Y-value of the nearby marker position
- %tmv: Time value of the nearby marker position
- %nmv: Name of the nearby marker position
- %imn: InCycle module name
- %rms: RMS value of the selected plane (based on input values)

By default, all signal-related placeholders are determined based on the first curve. To identify another curve, use a colon followed by the word “curve” and the index of the curve, e.g. "%sn:curve1", in order to refer to the first curve.

Use the optional formatting string “w.p” to specify the format of the numeric parameters, where “w” is the width and “p” is the precision. The width is the minimum number of the characters shown. Precision is the number of decimal places.

Example: "%5.3y1" indicates the Y-value for marker X1 with a width of 5 characters and a precision of 3.

The following figure shows the definition of the additional legend (right) and the corresponding display (left).



Synchronization
By default, if only one curve is displayed in the cycle view, identifiers and markers are synchronized with this curve and this setting is not available. If multiple curves are displayed in the cycle view, you can define the main curve here which will be used for synchronization.

Pause/Continue
This function is only available in *ibaPDA*. If this option is enabled, the visualization of the curves is controlled by a digital signal. The characteristic value calculation is continued.

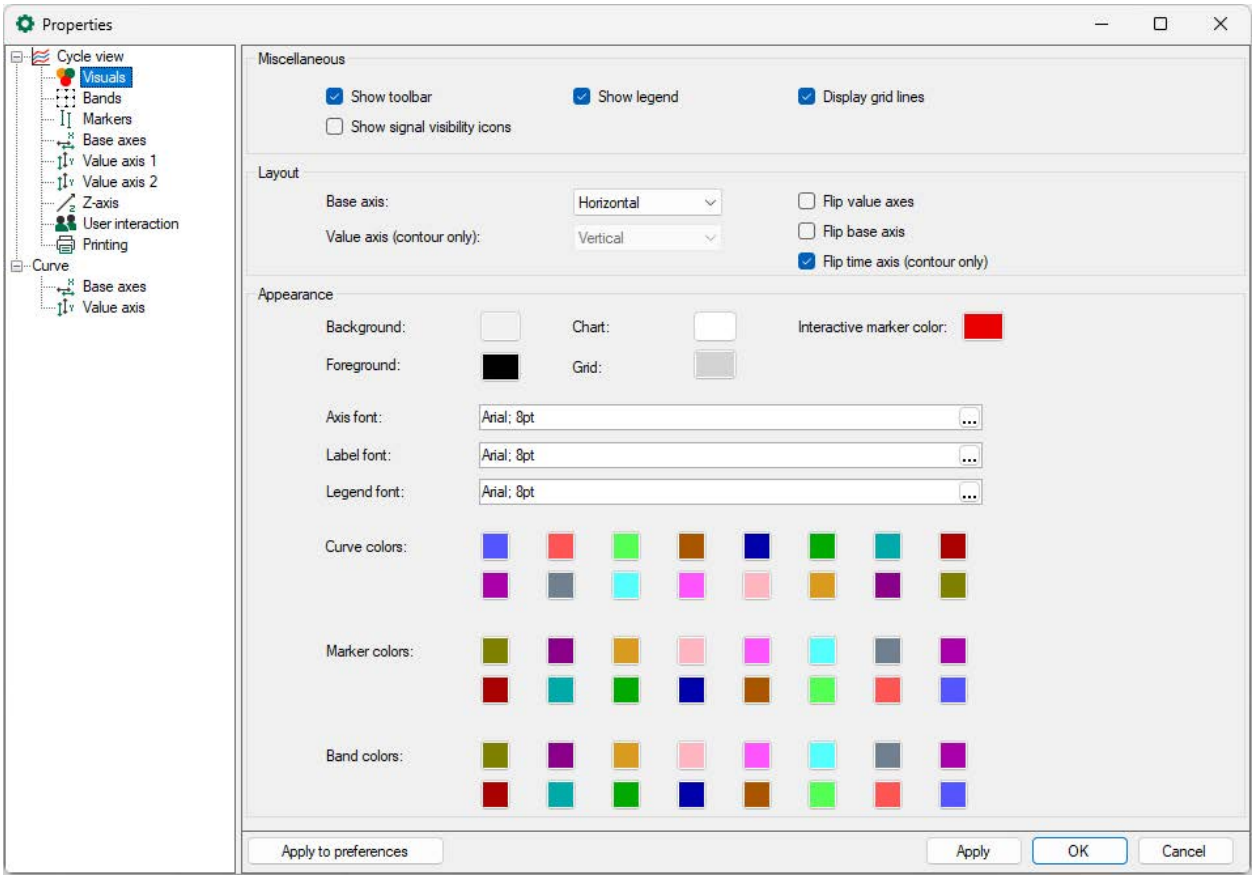
If the digital signal is TRUE (1), the visualization is paused and the display shows the frozen image of the last result.

If the digital signal is FALSE (0), the visualization continues and the display is updated regularly.

You can also enter a time in s after which live mode is automatically continued.

6.7.1 Visuals

In the dialog of the *Visuals* node, you can set the appearance and colors of the cycle view.



Layout

You can change the alignment of the base axes from horizontal to vertical or vice versa by selecting the relevant option from the drop-down menu *Base axis*. You can also flip the individual axes. In the case of a contour view, the value axis (only contour) can be displayed horizontally or vertically next to it.

Appearance

This is where you make the settings for colors and fonts. For the coloring of curves, markers and areas, 16 colors are available, which are automatically assigned to the corresponding items one after the other when they are added in the view.

6.7.2 Bands

The view supports base and value ranges. These bands are used to divide the curves of the cycles and highlight them in color. The bands (horizontal) have a center position and a delta width.

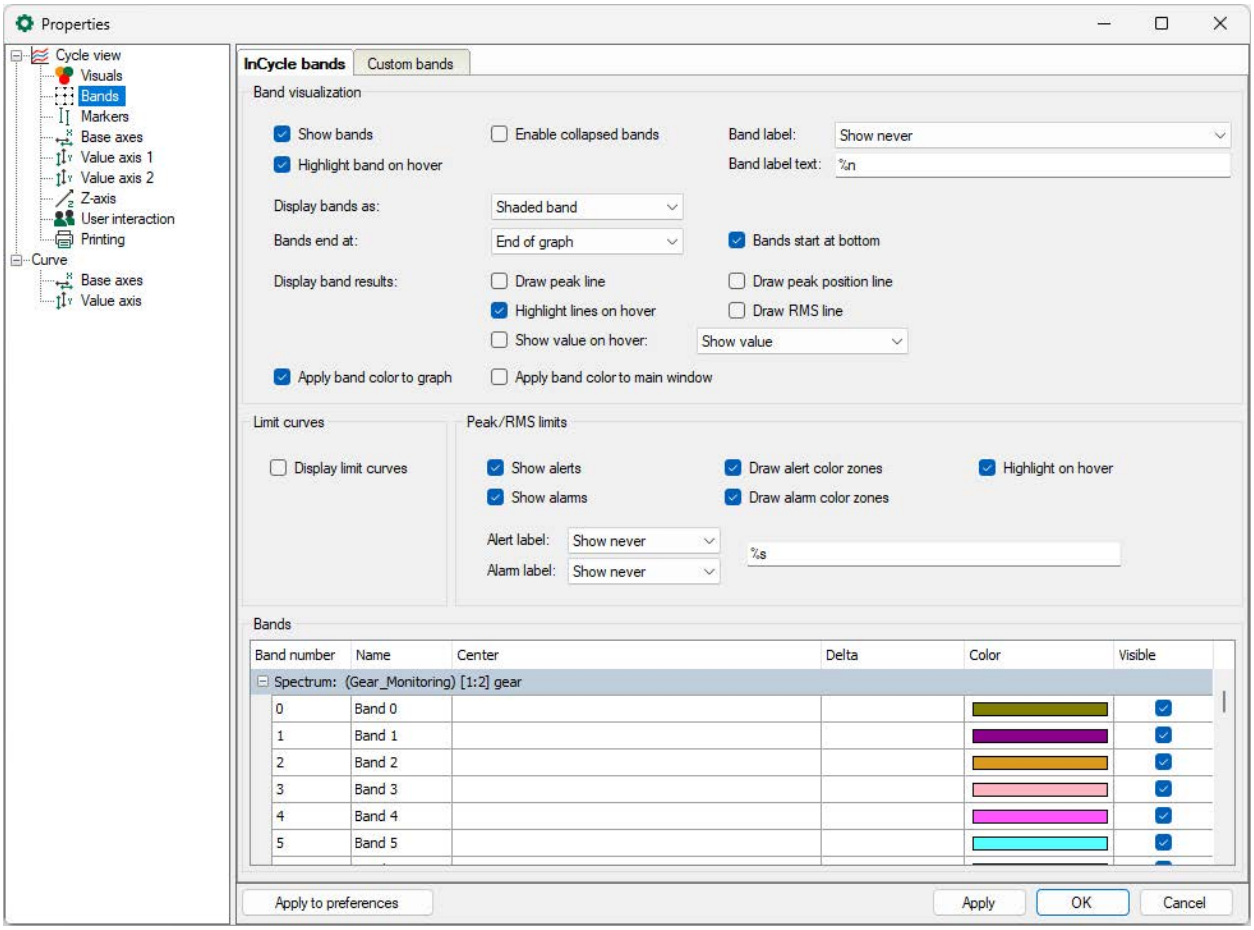
Value bands (vertical) start at a dynamic or static value and either reach upward to the next value band or positive infinity. The base bands can optionally be assigned to individual curves or to all curves. Value bands apply to all curves.

Bands are configured in the properties dialog in the node *Bands*. There are two types of bands:

- *InCycle bands* are bands that have been configured in the calculation profile of an InCycle module.
- *Custom bands* can be assigned to any curve or all curves.

If you have selected *Band curve* (instead of *Original curve*) in the main node cycle view, the tab *Band curve* appears. For the settings, see chapter ↗ *Band curve, page 54*.

InCycle bands

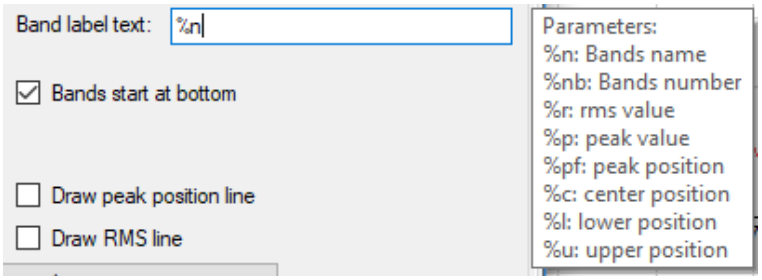


Band visualization

Display properties of the InCycle bands can be determined in the *Band visualization* area. If you enable the minimized display of the bands, the bands are displayed with a triangle. You can display or minimize the bands individually in the cycle table.

If the option *Highlight band on hover* is enabled, the band is highlighted in the curve display and in the data table.

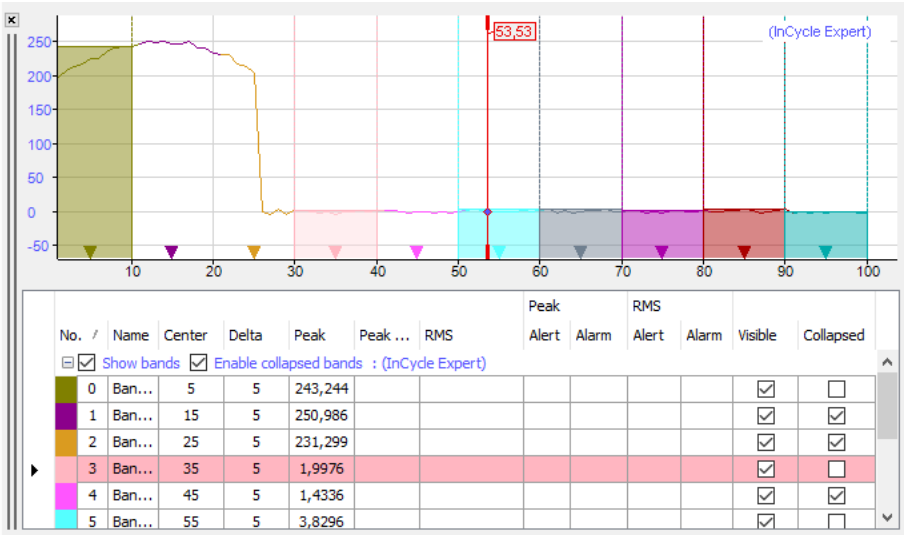
You can determine when the band labels are displayed (never, always or on hover) and what is displayed in the label. If you click the *band label text* field, a list of parameters appears that you can use for dynamic information in the label text.



The following parameters can be used:

- %n: Bands name
- %nb: Bands number
- %r: RMS value
- %p: Peak value
- %pf: Peak position
- %c: Center position
- %l: Lower position
- %u: Upper position

You can determine whether the bands should begin at the lower margin and where they should end (at the end of the curve, at the peak or at the RMS value). The bands can be shown as a shaded band or non-shaded band or only as a line at the center. The characteristic values of the bands can be displayed as lines, which can be highlighted on hover. Collapsed bands are indicated by a triangle. Example:



In addition, the band color can be adopted as a curve color both in the cycle graph as well as in the main window.

Display limit curves
Limit curves can also be displayed for Auto Adapting modules. If “Warning and alarm” is used as the event mode in the profile, the warning limit is displayed in yellow and the alarm limit in red. If “Lower and upper” is used as the event mode, the lower limit is displayed in blue and the upper limit in green.

Peak/RMS limits
Display properties for events (warnings, alarms) can be set in the *Peak/RMS limits* area. Dynamic label texts can also be defined for events.

The following parameters can be used:

- %n: Bands name
- %nb: Bands number
- %r: RMS value
- %p: Peak value
- %pf: Peak position
- %c: Center position
- %l: Lower position
- %u: Upper position

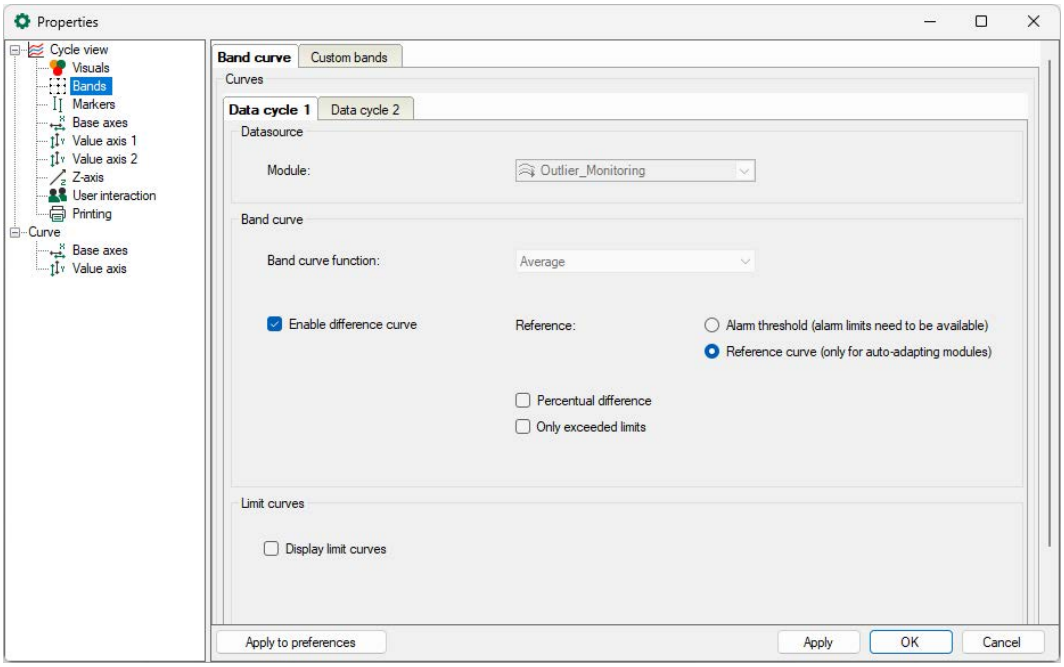
Bands
The ranges configured in an InCycle profile are shown in the table below in the dialog. The name, center position and delta width are already defined in the InCycle profile and can no longer be changed here. The color and visibility can still be changed here.

Custom bands
In the *Custom bands* tab, you define bands with a static or dynamic center and a delta value. You can assign a color and a specific curve or all curves to the band.

You can define the *value bands* in the table below.

6.7.2.1 Band curve

The *Band curve* display mode displays the results (characteristic value) of the individual bands.



Datasource

Module display

Band curve

In the *Band curve function* drop-down menu, you can select the result (characteristic value) to be displayed. The band results configured in the profile under *Calculations* can be selected. Possible values:

- Minimum, minimum position, maximum, maximum position, average, RMS, standard deviation, range, change.

Enable difference curve

If the cycle view shows an auto-adapting module, a difference curve can be displayed. This shows the difference between the reference curve or the *alarm thresholds* for each band.

The *percentual difference* shows all values in percentage to the reference values. If *Only exceeded limits* is enabled, the Y-value will be set to 0 for all bands in which the limit value is not exceeded. *Absolute deviation* shows all of the deviations in the positive Y-direction.

Display limit curves

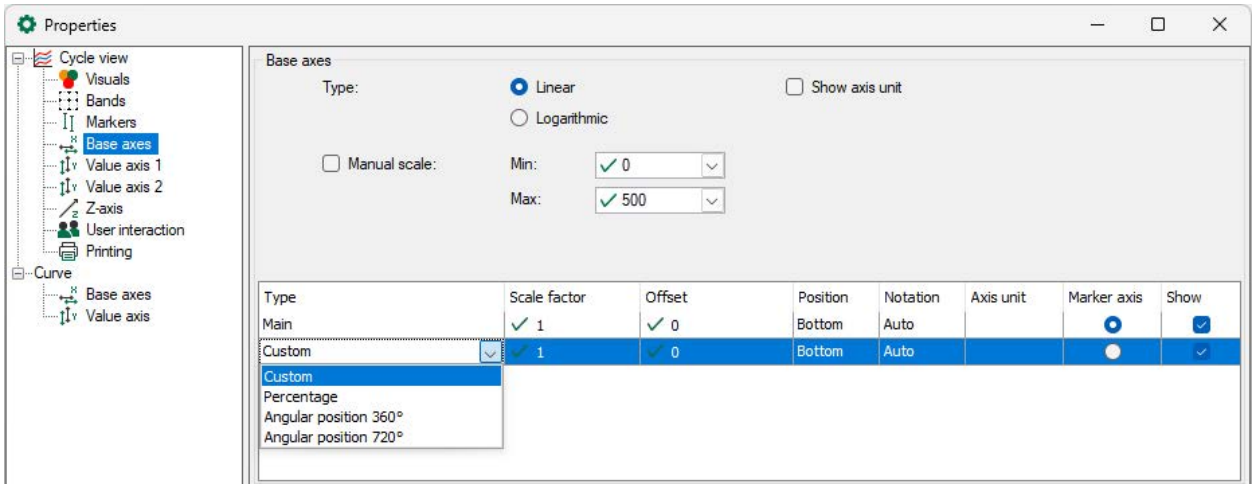
Enable this option to show the limit curves in the cycle view. A limit curve interconnects all band limits of the same type (warning, alarm, lower or upper).

6.7.3 Markers

You will find the description of the marker settings in chapter ↗ *Markers, page 38*

6.7.4 Base axes

You can choose between linear and logarithmic display here and whether the axis unit is displayed or not.

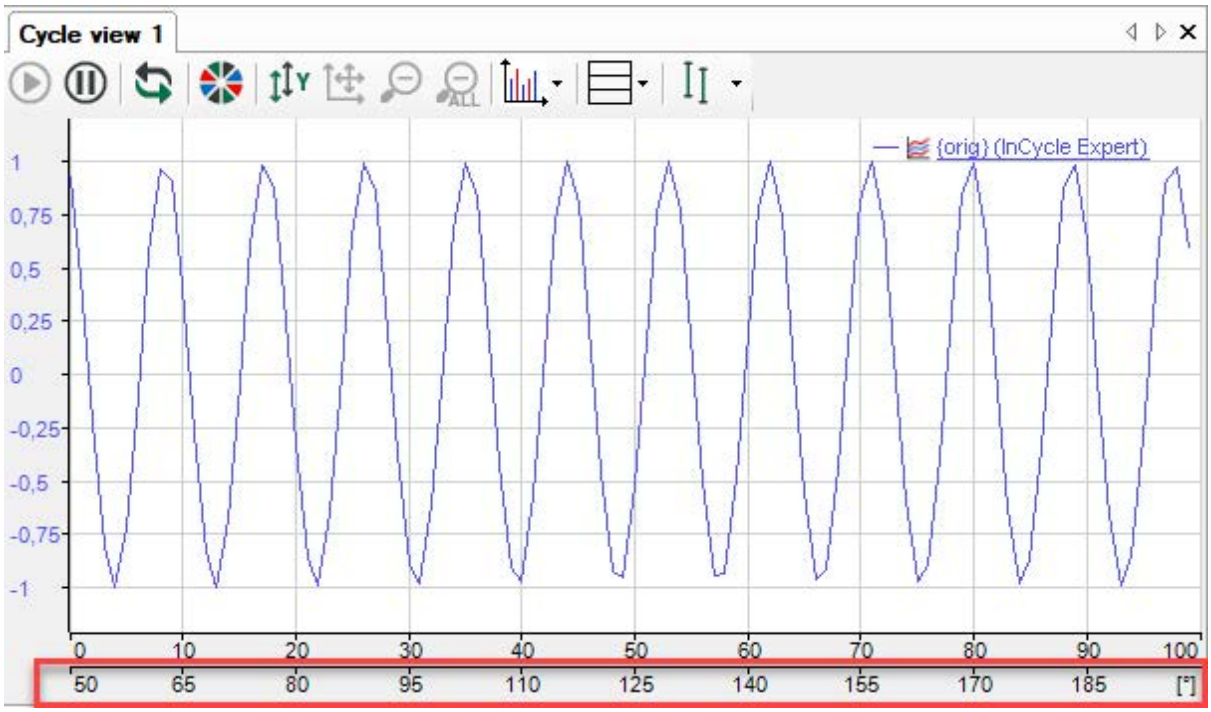


By default, the scaling values are automatically determined. However, you can also make a manual specification.

The basic axis in the cycle view additionally provides three preconfigured alternative axes. While the existing *Main* axis displays the number of the samples from the time-synchronous-averaging, the new axes options do an automatic scaling to the most common representations of cyclic processes:

- Percentage: Shows the cycle in percentage from 0 % to 100 %. This is a common representation for most repeating processes for non-rotating applications.
- Angular position 360°: This is the most common representation for rotating machinery, showing the angular position in degree per rotation.
- Angular position 720°: This is a special representation mainly used for combustion engines. Since each cylinder fires every second revolution a display of the cycle over two revolutions is required to get reproducible results. (Hint: For triggering these cycles correctly, two subcycles with a trigger that occurs once per revolution can be used.)
- Custom: An individual scale factor and an offset can be configured.

  Example: An InCycle Expert module samples with 100 samples per cycle, with a start trigger at 50° and a stop trigger at 200°. To display a range of 150°, a scaling factor of 0.66666 is used. As the scale should start at 50°, an offset of 50 is configured. The displayed range of the user-defined base axis is then [50°..200°[.



It is also possible to configure a dynamic offset, i.e. an offset that depends on a signal value.

If you want to change the settings for Position (Bottom/Top), Notation (Auto/Standard/Scientific) and Axis unit, click on the corresponding cell and select from the drop-down list. In addition, an offset can be configured for the custom base axes.

If you have defined several base axes, select in the column *Marker axis*, to which base axis the markers in the display should refer. Use the *Show* option to control whether the base axis is displayed or not.

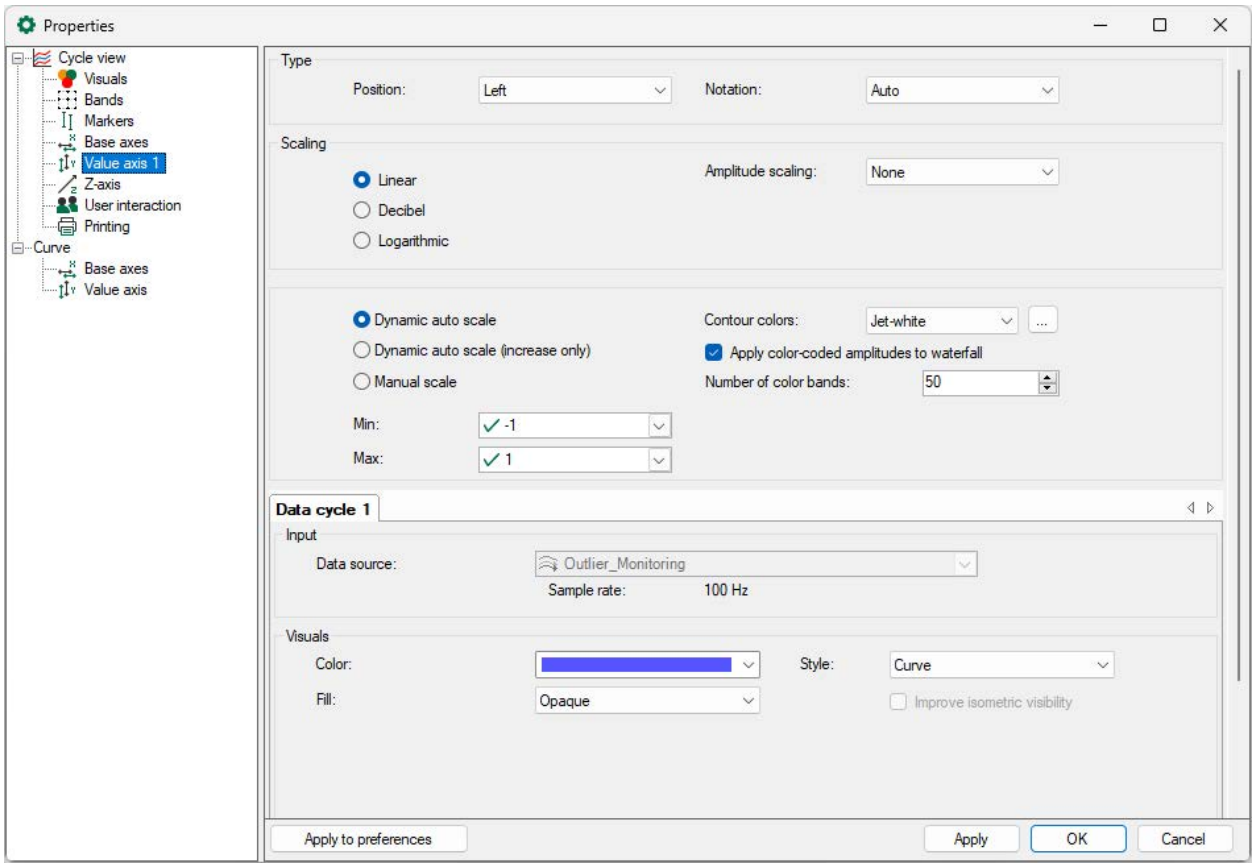
The settings automatically apply to the main window and the cycle graph.

Note

The maximum displayed area of the base axis of the curve view is limited to the area configured in the main window.

6.7.5 Value axes

A value axis can contain several curves. Using the legend, you can change the value axis used by a curve by changing the sequence of the signals. A value axis can be deleted via its context menu. This also deletes all curves on this axis. You can also display the settings for the value axis via the context menu.



The settings for type, scaling, and view correspond to the usual settings in *ibaPDA* and are self-explanatory.

Scaling

Linear, decibel or logarithmic can be set as the scaling. This scaling is applied to the appearance of the single curve, waterfall and contour.

Amplitude scaling

Depending on the requirements for the visualization, it may be useful to either emphasize or suppress the amplitudes for the display. The following methods are available:

- Peak-to-peak
  Amplitude values are practically multiplied by a factor of two
- RMS
  Amplitude values are practically divided by the root 2, thus moving closer to the RMS value.
- Percentage of signal
  The scaling of the amplitude values is defined as a percentage of a signal. Select the signal in the Reference signal for percentage field.
- Percentage of band peak
  The scaling of the amplitude values are based on the peak in a specific band. Enter the band number in the *Band number for percentage* field.

Scaling mode

- Dynamic auto scale: if you enable this option, the scaling is always adjusted to the highest and lowest signal amplitudes in the graph (in both directions).
- Dynamic auto scale (only for enlarging): When you enable this option, the scaling is continuously adjusted with the highest signal amplitudes. If the amplitudes go beyond the trend view again, the scaling still remains unchanged.
- Manual scale: if this option is selected, the Min and Max scale values can be manually entered or selected from the field next to it. Beside a static value, you can also use any known measured or virtual analog signal configured in the I/O Manager.

Color settings

You can choose one of the prepared color schemes for the contour colors (default, grey, jet-white, jet or heat). If you do not like any of the offered color schemes, you can design your own color schemes. To do this, click on the <...> button and the *Manage perspectives* dialog opens. Here you can define new color schemes or change existing ones.

In addition, the colors of the contour view can also be applied to the waterfall view. To do this, enable the *Apply color-coded amplitudes to waterfall* option. The number of color bands defines the color resolution. A maximum of 50 color bands is possible.

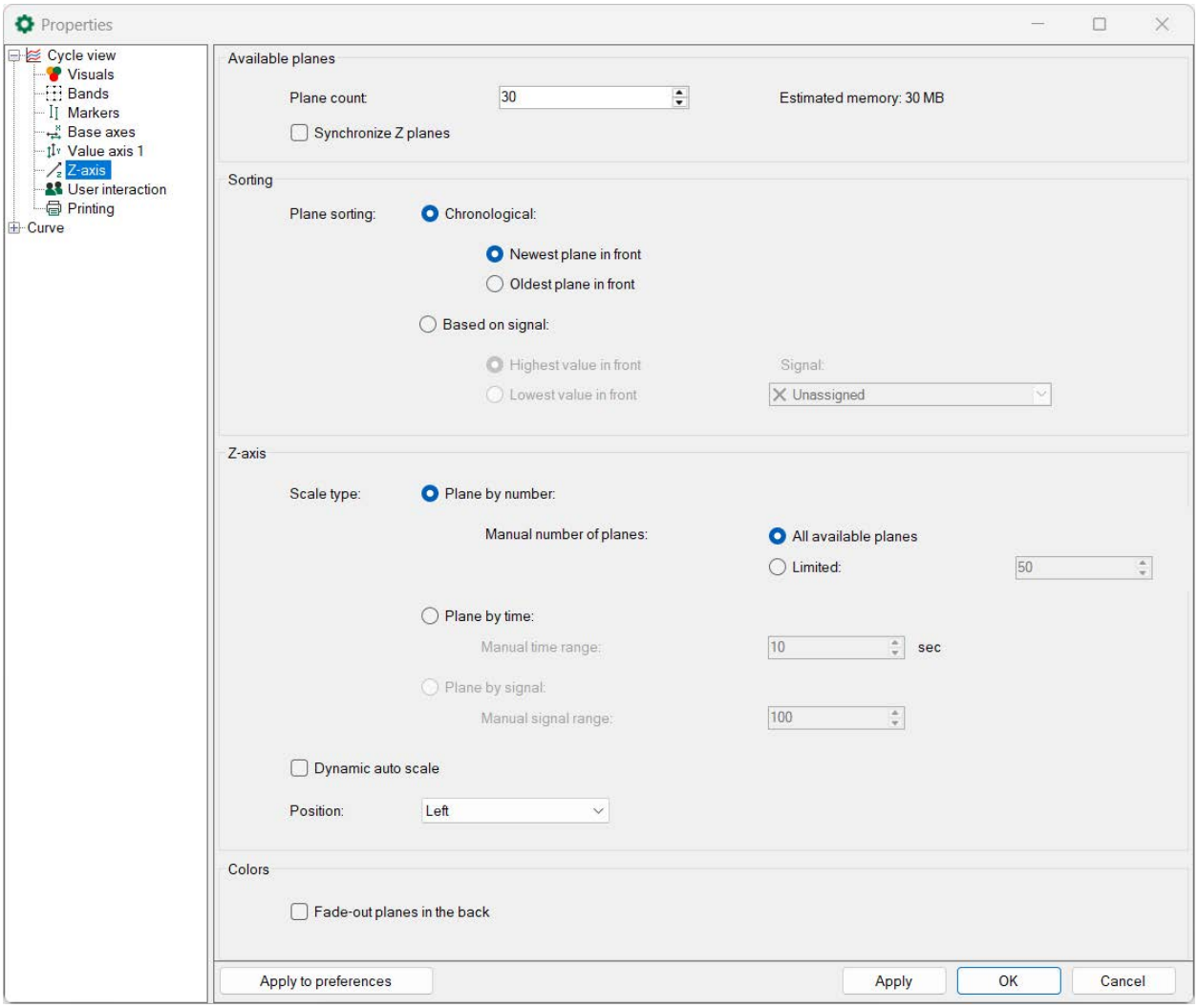
Data cycle x

By default, a *Data cycle 1* tab is available. These settings are used to process a new signal, which is dragged into the cycle display. You can drag multiple signals into a cycle view. If the signals share the same value axis, you will find a separate tab for each signal. The settings for each data cycle can be changed in the properties individually. If each signal has its own value axis in the display, each signal in the tree structure on the left receives its own node for the value axis.

The option *Improve isometric visibility* is used to make curves opaque. This makes some effects in the waterfall view more visible.

6.7.6 Z-axis

In the *Z-axis* node you can define the display options for the waterfall view.



Available planes

- Plane count
  Set the number of planes you wish to be displayed in the Z direction.
- Synchronize Z-planes (option only in *ibaPDA*)
  If you use several curves in a cycle view, then the curves advance at their own pace by default, depending on their sample rate.
  With this option you can synchronize the advance rates of the Z planes across multiple curves. With this option enabled, the cycle view will not allow a curve to advance over the Z planes until all curves have generated a new result. While the view is waiting for certain curves to generate results, the other curves keep showing their newest results on the front plane.
- Automatically set plane count (option only in *ibaAnalyzer*) The number of curves (data cycles) is detected automatically (max = 500)

Sorting
Here, you can select how the planes should be sorted:

- When choosing the chronological plane sorting you can select whether the the newest (default) or oldest plane is in the foreground.
- The cycles can also be sorted according to an external signal. You can select whether the plane with the highest or lowest value should be in front. The sorting happens on the fly: Each time a new curve comes in, all the planes are sorted again. This applies to the contour plot and the waterfall. You can select the desired signal in the field nearby.

  Application: Visualization of dependencies between signals. For example, the frequency spectrum can be sorted by speed.

Z-axis
Specify here the distance at which the planes are to be arranged:

- Plane by number
  The distance between the planes in the contour view is fixed. You can choose between a manually defined number of planes or display all available planes.
- Plane by time
  A new plane is displayed after a defined time. The distance corresponds to the time difference between the planes.
- Plane by signal
  This option can only be used if the plane sorting is *Based on signal*. The distance between the planes depends on the value of the process signal. The *Custom signal range* is the default range displayed in the contour plot. In the context menu of the Z-axis, there is an option *Auto scale* to scale the Z-axis so that all planes of that moment are shown.

Dynamic auto scale
Dynamic auto scale automatically adjusts the Z-axis of the contour view to the available range. Automatic scaling is performed with each new plane.

Position
Specify the position (left or right) of the Z-axis.

Colors
With this option, the waterfall view can be configured to fade-out the colors of the older planes.

6.8 Live visualization

With InCycle modules, it is possible to display a cycle in real time as it gradually builds up. To do this, the following settings are required in the profile:

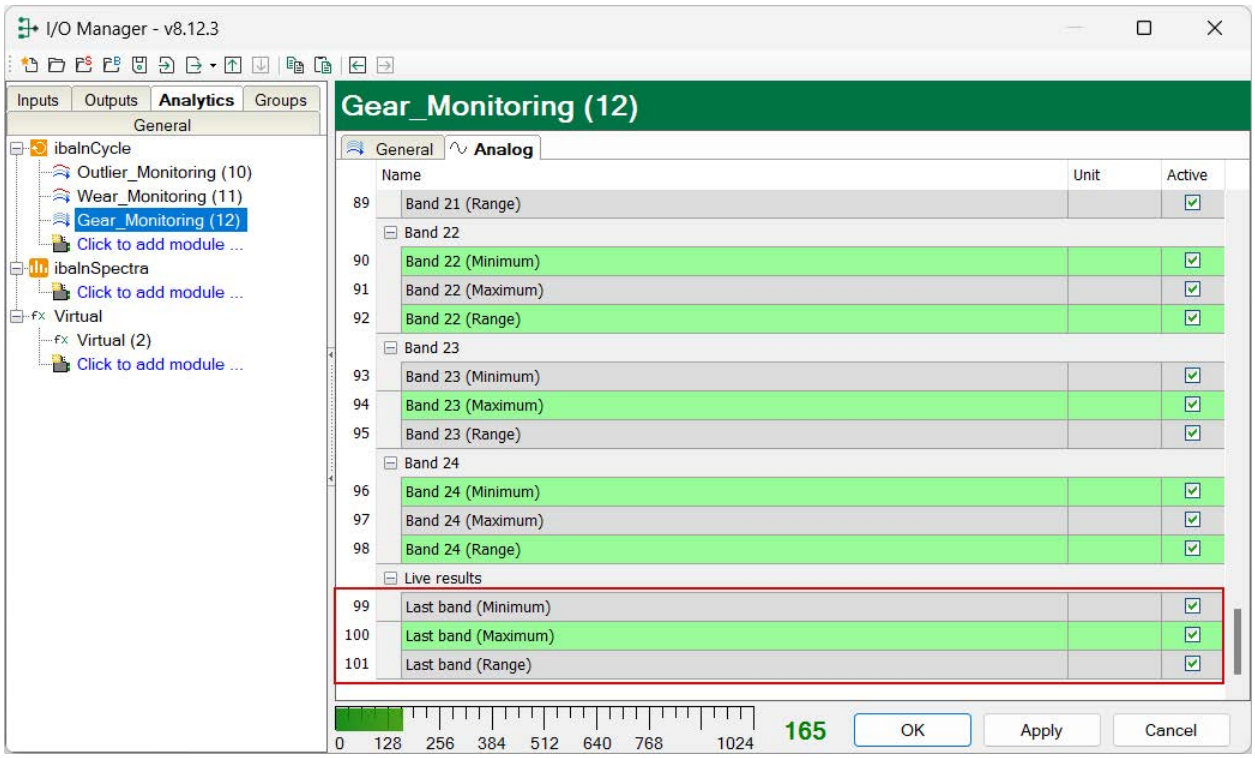
- Mode: Time synchronous averaging
- Averaging is disabled, i.e., number of cycles = 1
- Trigger mode: Progress trigger

The description of the profile settings can be found in chapter ↗ *Setting calculation parameters, page 78*.

Live visualization is supported in the cycle view and the circle view.

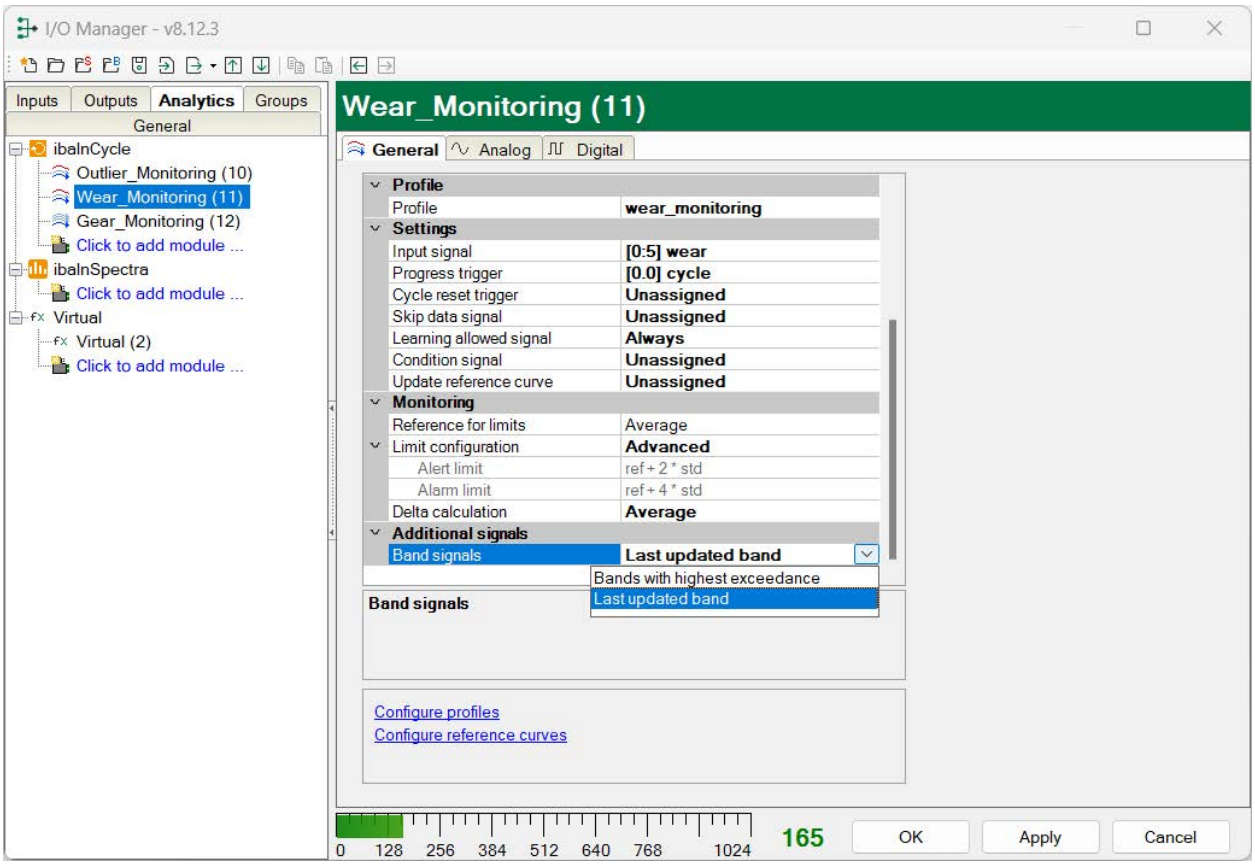
With the settings listed above, the live visualization is automatically enabled. The calculation results for the last calculated band are then available as additional analog signals. These signals are in the "Live results" group. The values of these signals are gradually updated as the cycle builds up.

Signals in the InCycle Expert module



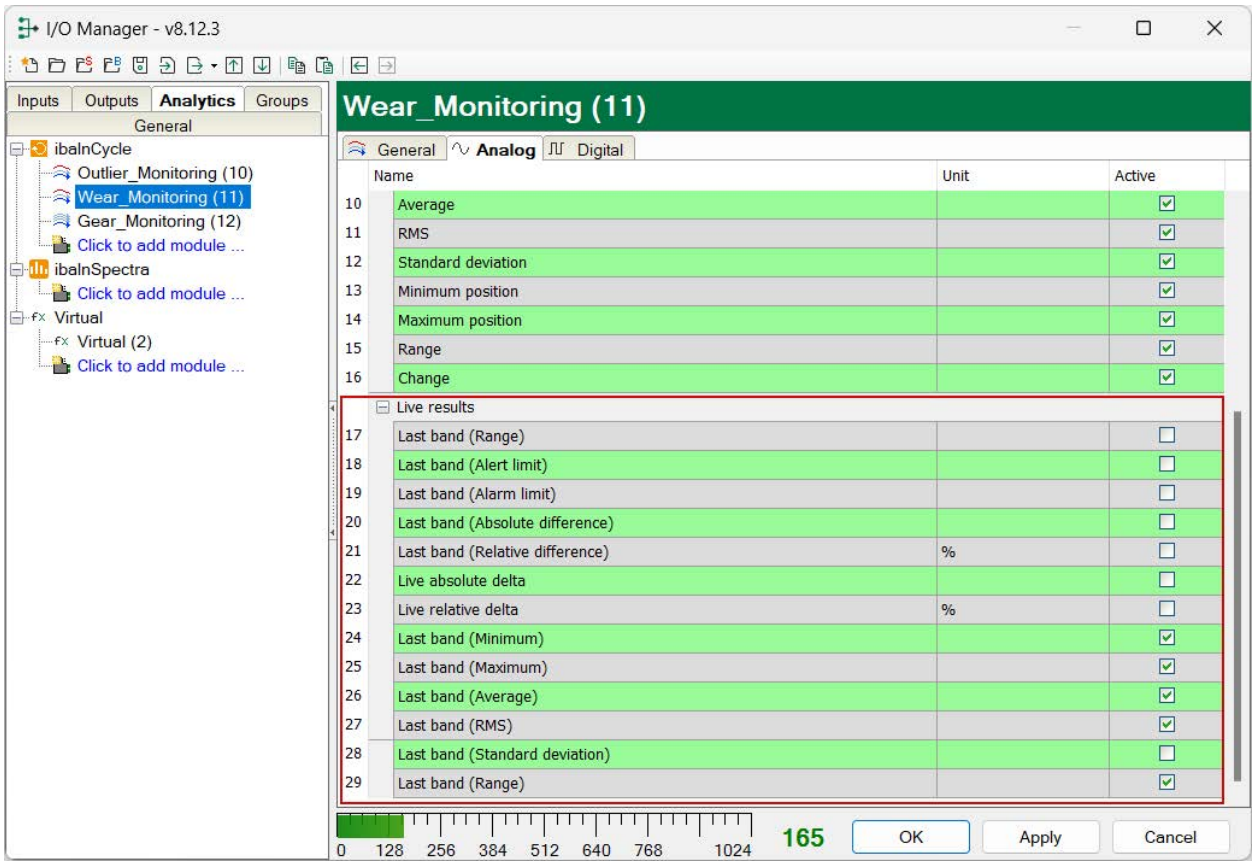
Signal in the InCycle Auto-Adapting module

In the InCycle Auto-Adapting module, the additional signals with live results are optional. To enable the signals with the live results, select the *Last updated band*option in the *Band signals* field on the *General* tab. The "Live results" signal group will then also appear in the *Analog* tab.



Not only are the calculation results from the last volume available as signals, but also:

- Alert and alarm limits, or lower and upper limits of the last band
- Absolute and relative difference of the last band
- Live absolute and relative delta, based on the bands already available


I/O Manager - v8.12.3
Inputs
Outputs
Analytics
Groups
General
ibaInCycle
Outlier_Monitoring (10)
Wear_Monitoring (11)
Gear_Monitoring (12)
Click to add module ...
ibaInSpectra
Click to add module ...
Virtual
Virtual (2)
Click to add module ...
Wear_Monitoring (11)
General
Analog
Digital
Name
Unit
Active
10 Average
11 RMS
12 Standard deviation
13 Minimum position
14 Maximum position
15 Range
16 Change
Live results
17 Last band (Range)
18 Last band (Alert limit)
19 Last band (Alarm limit)
20 Last band (Absolute difference)
21 Last band (Relative difference) %
22 Live absolute delta
23 Live relative delta %
24 Last band (Minimum)
25 Last band (Maximum)
26 Last band (Average)
27 Last band (RMS)
28 Last band (Standard deviation)
29 Last band (Range)
0 128 256 384 512 640 768 1024
165
OK
Apply
Cancel

7 The circle view

The circle view is used to visualize the results of the InCycle Expert module and the InCycle Auto-Adapting module in *ibaPDA* of rotating processes.

A circle view may include one or more InCycle modules.

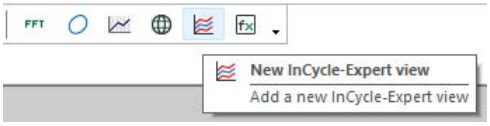
7.1 Open a circle view in ibaPDA

Use the button to add a new circle view:

You can drag individual or several InCycle Expert or InCycle Auto-Adapting modules from the signal tree to the circle view main view using drag & drop. In doing so, relevant parameters for the circle view are copied from the module settings. Individual signals cannot be displayed.

7.2 Opening a circle view in ibaAnalyzer

Use the button in the toolbar to add a new InCycle Expert view

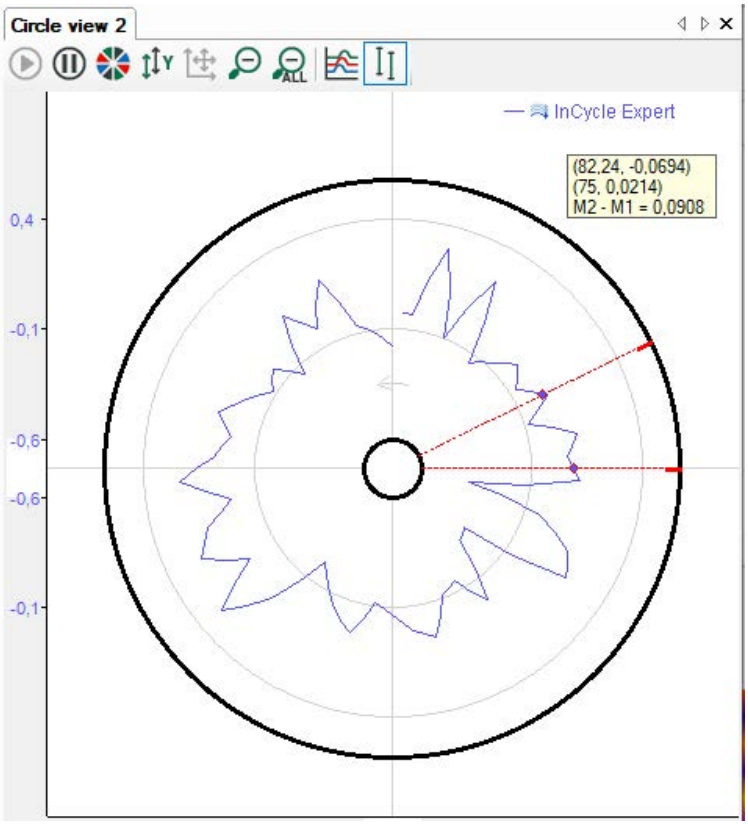


and switch the view to the circle view with the button  .

See chapter ↗ *The InCycle view in ibaAnalyzer*, page 18

7.3 Overview of the circle view

The toolbar is located to the left above the circle view. The control elements are largely identical to those of the other views.



Toolbar

	Start / Pause (only *ibaPDA*) Stop or continue the cycle display update
	Reset all display values (only *ibaPDA*) The display is cleared only once and all values are set to zero until the next cycle calculation is completed.
	Automatically adjust plane count (only *ibaAnalyzer*)
	Automatically assign signal colors
	Auto scale value axis
	Redo manual scale
	Zoom out last step/all steps
	Toggle the perspective (2D / isometric 3D)
	Show/hide, center interactive marker

7.4 Markers

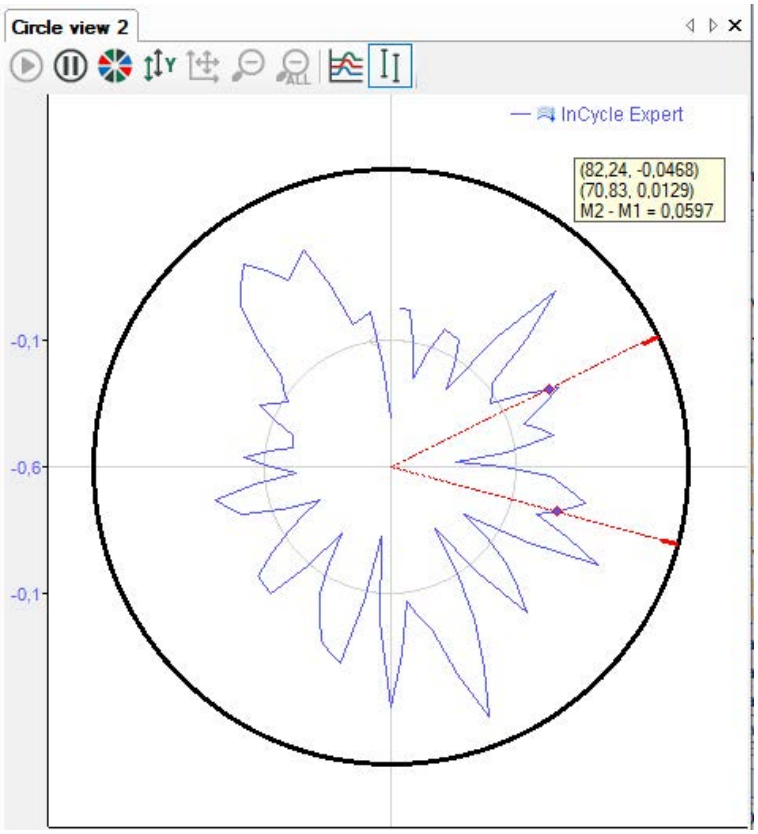
Markers can be shown for a better analysis. You can enable or disable the display of the markers either:

- with the marker button in the toolbar of the circle view
- or select *Display markers* in the context menu of the circle view

2 radial markers are displayed, which you can move independently of each other on the outer circle line by holding down the mouse key.

If you hold down the <Shift> button while dragging a marker, the second marker moves in sync with it, i.e. the angle between the markers remains constant.

If you cannot see the markers any more after a zoom operation, you can use the *Center markers* function to bring it back into the middle of the visible area.



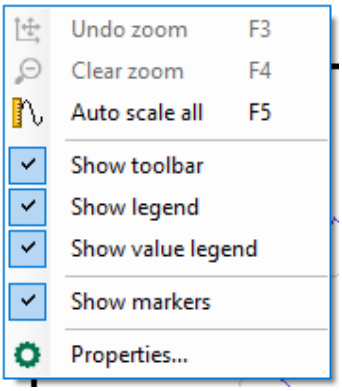
Values in the legend

The value legend can be displayed in order to see the marker positions. Select *Show value legend* in the context menu of the circle view.

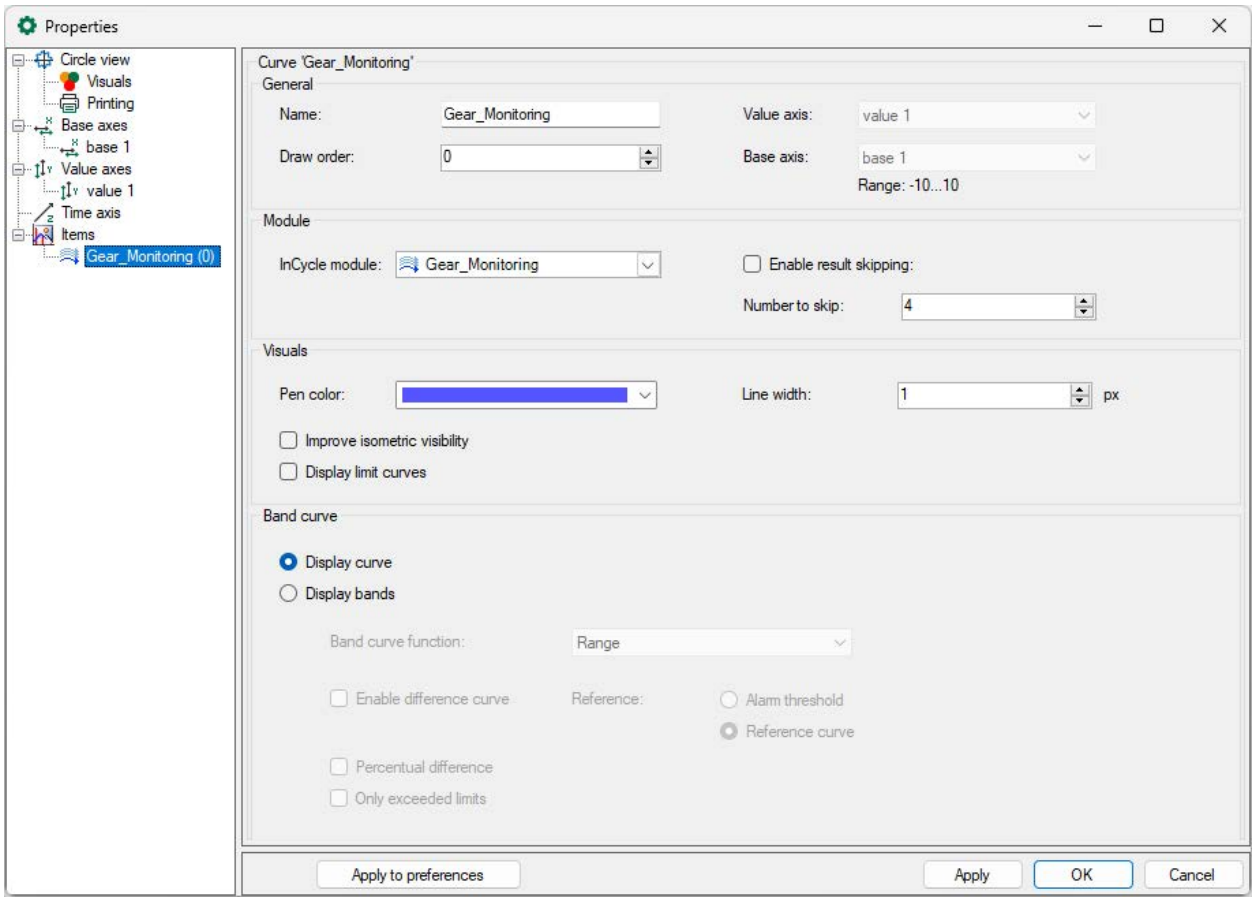
In the value legend, the positions of both markers are given in the X-Y coordinates and the difference of both markers to each other is displayed.

7.5 Configuration

Right click in the view to open the context menu and select *Properties*. All settings for the circle view can be made in the properties dialog.



The settings of the individual appearance options of a circle are made under the node *Items* in the respective item.



General

Name

The name of the item can be changed here. This name is also shown as a legend in the circle view.

InCycle module (only *ibaPDA*)
The InCycle module can be selected here.

Enable result skipping
If all calculated cycles cannot be visualized, cycles can be skipped for the visualization. The calculation of the parameters is not affected by this. Enter the number of cycles that are to be ignored for the visualization in the field *Number to skip*.

Pen color/Line width
The color of the circle and the thickness of the circle line can be defined here.

Improve isometric visibility
The *Improve isometric visibility* option makes the curves opaque. This makes some effects in the waterfall view more visible.

Display limit curves
When displaying an InCycle Auto-Adapting module in the circle view, the limit curves can be displayed. A limit value line connects all band limit values of the same type (warning, alarm, lower or upper limit value).

Band curve

Display curve/Display bands
The band values of each cycle can be displayed instead of the original curve. To do this, enable the *Display bands* option.

The bands are configured in the *Bands* tab of the InCycle Expert module profile. In the *Calculations* tab of the profile, you can configure which calculations are performed for each band.

In the *Band curve function* drop-down list, you can choose which function is displayed. The calculations defined in the profile are available for selection.

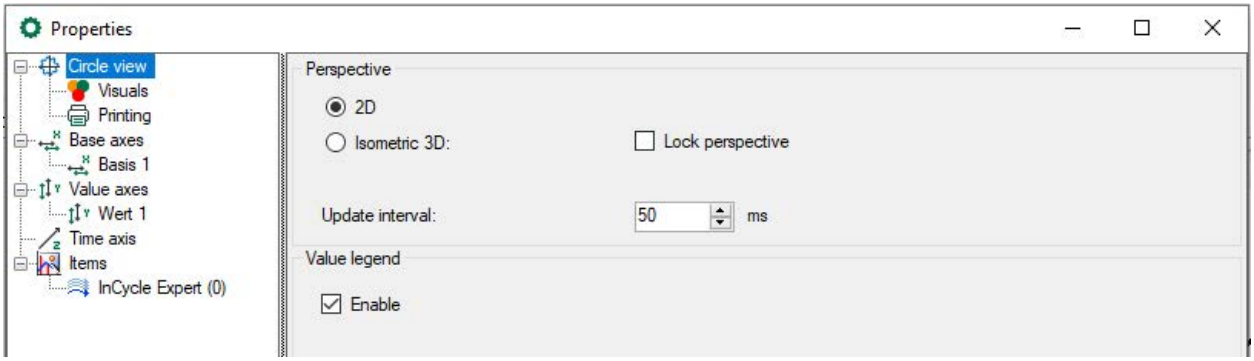
Enable difference curve
When displaying an InCycle Auto-Adapting module in the circle view, a difference curve can be displayed. For the difference curve, the difference between a band value and a reference is calculated and displayed in a circle. The reference is either the Alarm threshold or the Reference value of the band.

The *Percentual difference* shows all values as a percentage of the reference values. If *Only exceeded limits* is enabled, the Y value is set to 0 for all bands in which the limit value is not exceeded.

7.6 Settings of the circle view

In the circle view, the settings can be adopted nodularly in the preferences and are therefore applied to newly opened circle views. Changes can be saved by pressing the button <Apply node to preferences>.

Circle view
In the *Circle view* node you can define the display options for the isometric 3D view.

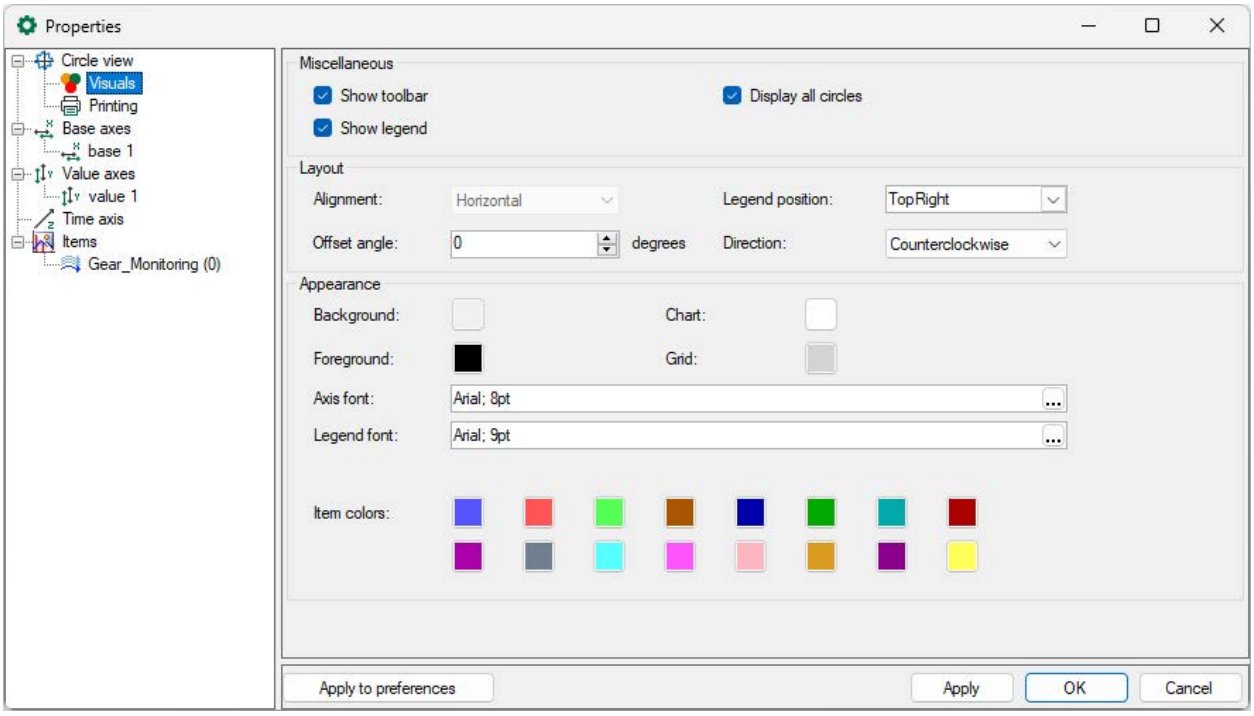


You can choose between 2D and isometric 3D view and set the number of planes for the 3D view. You can fix the perspective and set an update interval.

In addition, you can show or hide the value legend.

7.6.1 Visuals

In the *Visuals* branch, you can set the appearance and colors of the circle view.



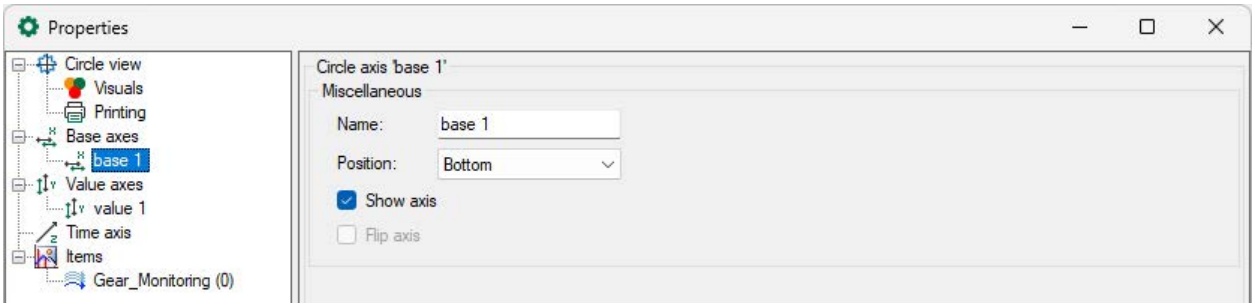
You can change the alignment of the axes from vertical to horizontal and vice versa and define the legend position. You can also select fonts and colors for the different elements.

If you enter an offset angle, the first data point in the circle view does not start at 0°, but at the defined offset angle. You can also set the offset angle in the circle view by dragging the small gray cross to the desired position.

You can choose the display direction between clockwise and counterclockwise. The direction is shown with a gray arrow in the circle views.

7.6.2 Base axes

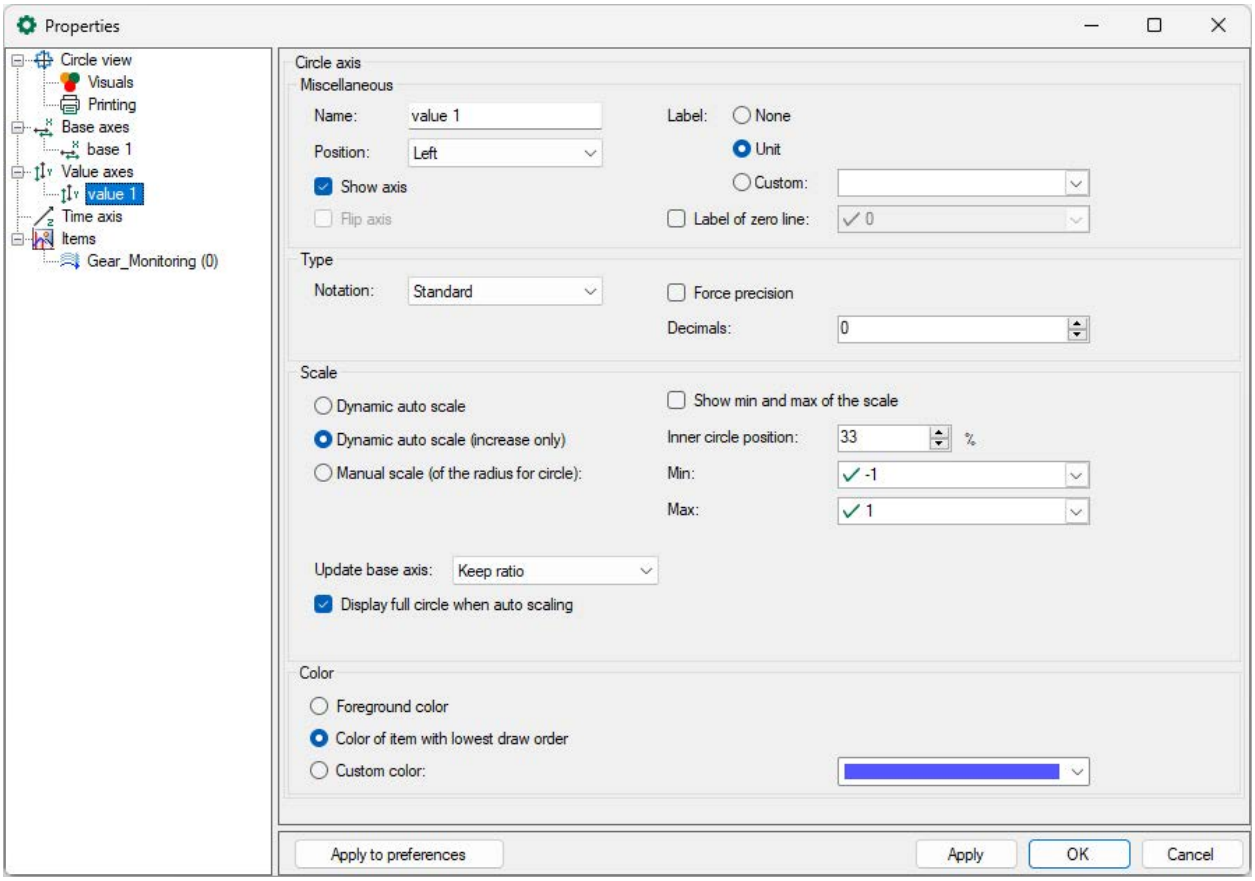
You can allocate a name to the base axis and set different representation options.



7.6.3 Value axes

You can allocate a name to the value axis and set different representation options and the display in the label. You can select the notation (default, scientific) and the number of decimals.

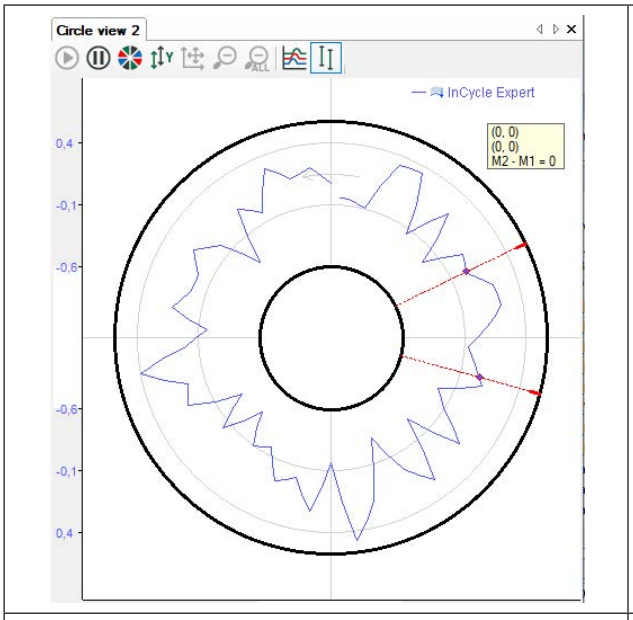
You can choose between dynamic auto scale and manual scale. You can specify the minimum and maximum with a set value or control it with a signal. You can individually select the color of the value axis (custom) or select the foreground color or the color of the rear-most item.



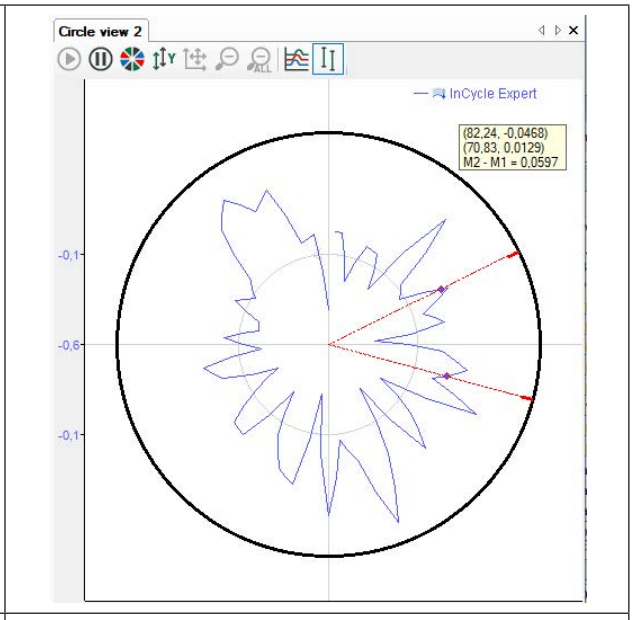
The definition of the inner circular position means that the minimum values are not displayed at the center of the circle, but rather are scaled up to an inner circle. The inner circle position is

specified in % as a maximum value. The default setting is 33%. This type of appearance makes it better to see details around the center of the circle.

Example:



Setting of the inner circle position 33%



Setting of the inner circle position 0

Update base axis

If the value axis is scaled automatically, the base axis is also scaled automatically. The settings here have the following effect:

- *Auto scale*: The available space on the base axis is fully used.
- *Keep ratio*: The ratio of the value axis to the base axis is retained and a circle is displayed, i.e. no ellipse.

  If the *Display full circle when autoscaling* option is enabled, the circle is completely visible.

8 The InCycle Expert module

The InCycle Expert module makes it possible to divide process cycles evenly into any number of ranges and freely define meaningful characteristic values for any range:

- Minimum / maximum / average
- Maximum position / minimum position
- Range / changes
- RMS / standard deviation

The characteristic values of any area are monitored for changes. For processes consisting of several steps, the cycles can be divided into several sub-cycles. All characteristic values can be recorded as a signal, visualized and monitored with regard to limit value violations.

The calculations for the analysis can be individually adjusted on many levels by the user and saved as profiles. In particular, the number of samples and ranges can be set per cycle. In addition, different methods of the averaging type are available to choose from. Defined profiles can be saved and used multiple times.

8.1 The InCycle Expert profile

InCycle Expert can be used to monitor several bands of a curve. The parameters for the band analysis can be freely configured and stored in profiles. This enables the reuse created profiles. Any number of profiles can be configured to adequately analyze different input signals. An InCycle Expert module is to be configured for each signal to be monitored. The modules can be structured through a directory structure to improve the overview.

Since an InCycle Expert module can only be completely configured if at least one valid calculation profile exists, in the following the configuration of a profile is first explained and then the configuration of the module settings is explained.

8.1.1 Create and manage profiles in ibaPDA

If you create an InCycle Expert module for the first time, no profiles are yet available. To be able to create and edit profiles, first add an InCycle Expert module. Then proceed as follows:

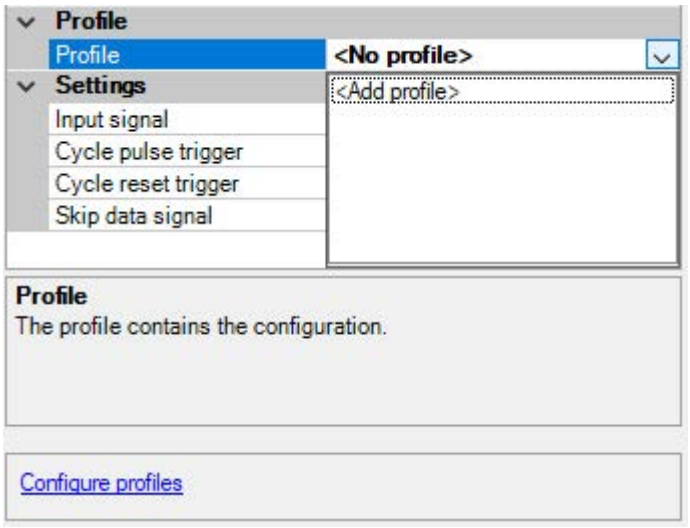
1. Open the I/O Manager in *ibaPDA*.
2. Switch to the *Analytics* tab.
3. If necessary, expand the *ibaInCycle* node and click on the link *Click to add module...*.

4. Select the *InCycle Expert* module type in the following *Add module* dialog and enter a module name in the corresponding field. Then click <OK>.

   The module is now created and you see the *General* and *Analog* tabs in the right part of the I/O manager.

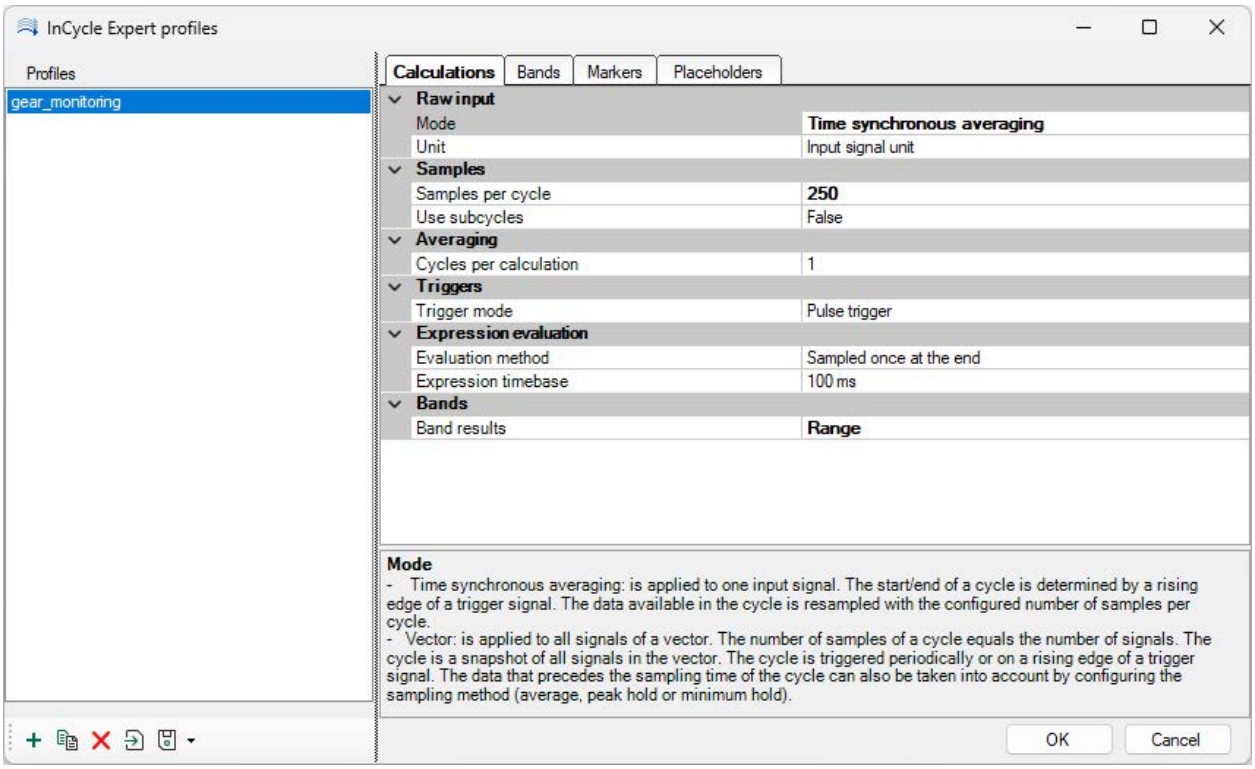
   Alternatively, you can use the right mouse key to click on the interface *ibaInCycle* and select *Add module* in the context menu. The module will then be created immediately. You can rename it in the *General* tab.

5. In the *Profile* field in the *General* tab of the module, open the drop-down list and click on <Add profile>.



   Alternatively, you can also click on the link *Configure profiles* below in the dialog window.

The dialog for the configuration of the (new) profile opens. Profiles can be created, changed, exported and imported in the profile manager.



All available profiles are listed on the left side of the profile manager. Profiles can also be renamed here. Below this list, there are buttons with the following functions:

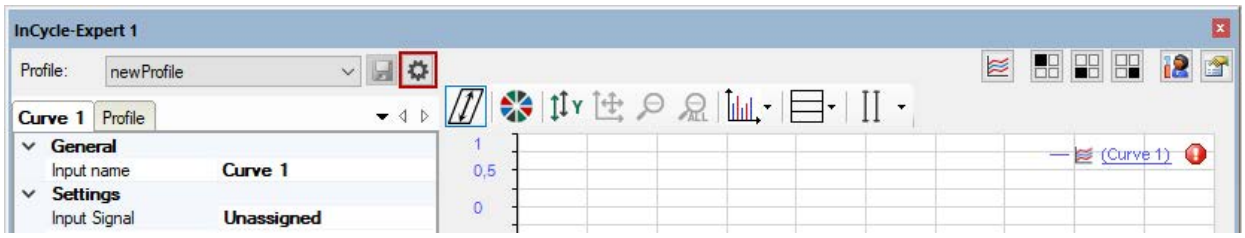
- Add new profile
- Clone current profile
- Delete current profile
- Import profile
- Export selected profile

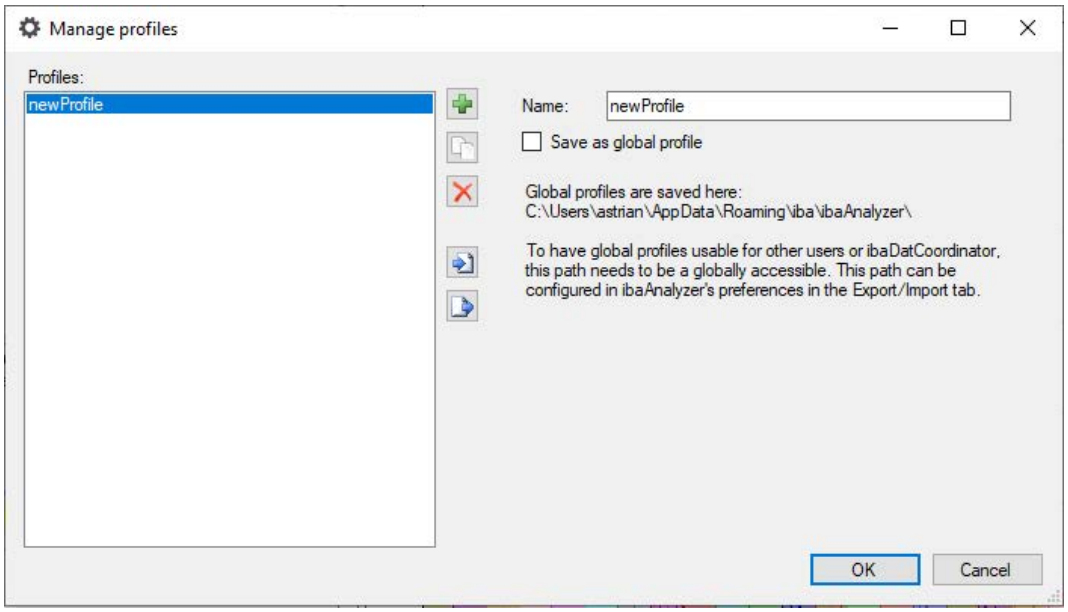
The settings of the profile selected in the list are made in the main area of the dialog.

8.1.2 Create and manage profiles in ibaAnalyzer

ibaAnalyzer-InCycle can be used to configure profiles offline and test them on acquired data. First open an InCycle Expert view with the button in the toolbar, see chapter ↗ *Opening a cycle view in ibaAnalyzer*, page 23.

Existing profiles are managed in the profile manager. You can open the profile manager with the button to the right of the profile selection.





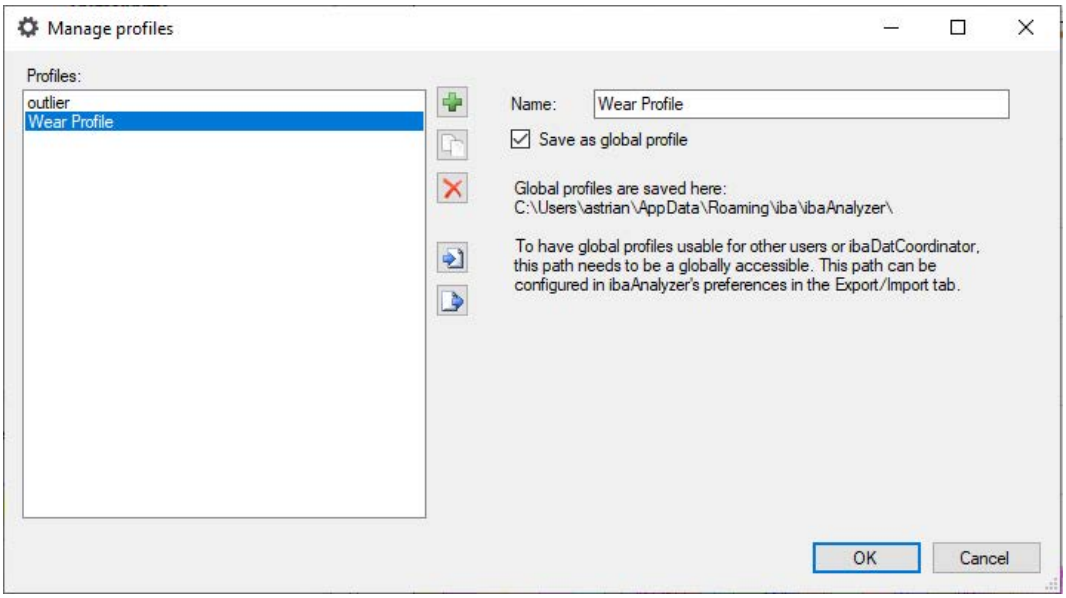
All available profiles are listed on the left side of the profile manager. Next to the list, there are buttons with the following functions:

- Create new profile
- Clone selected profile
- Delete selected profile
- Import profiles
- Export selected profile

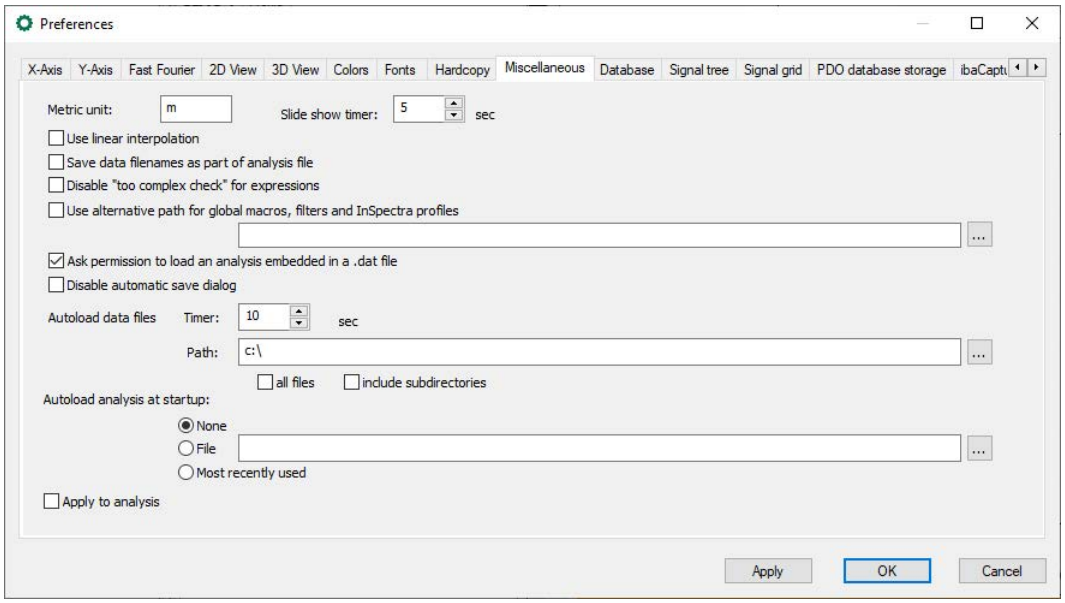
Save profile

On the right side in the field *Name,* the name of the currently selected profile can be changed and it can be determined how the profile should be stored.

InCycle profiles are stored in *ibaAnalyzer* by default with the respective analysis. However, if the option “Save as global profile” is selected, the profiles are not stored in the analyses, but rather under a global location and are therefore always available on this system.

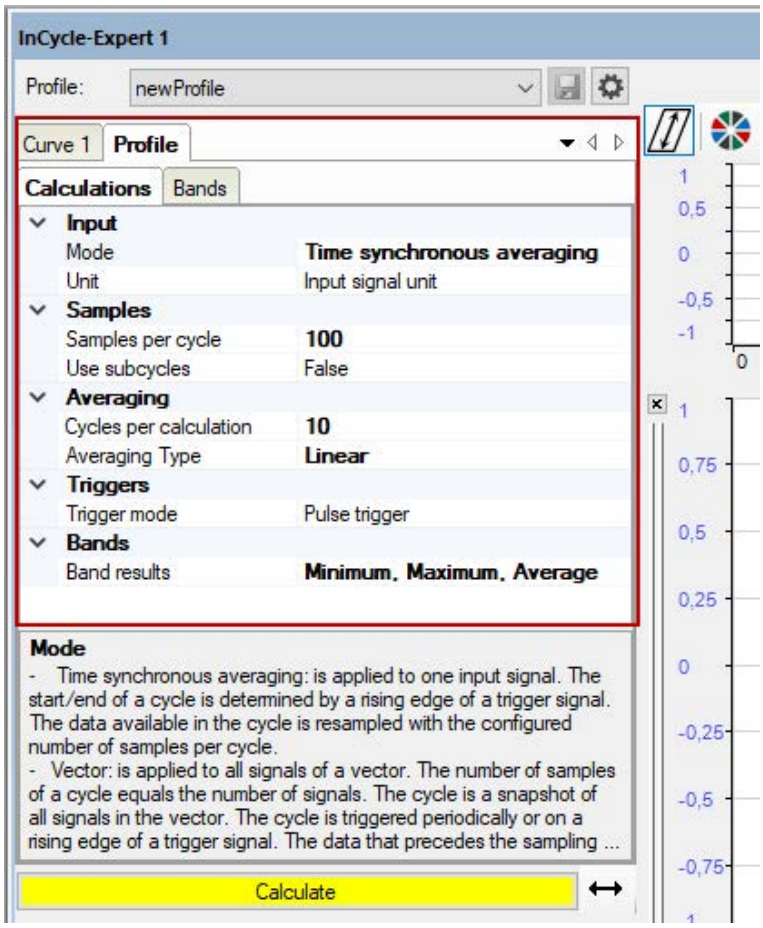


The storage location for global InCycle profiles can be changed in the preferences in the *Miscellaneous* tab.



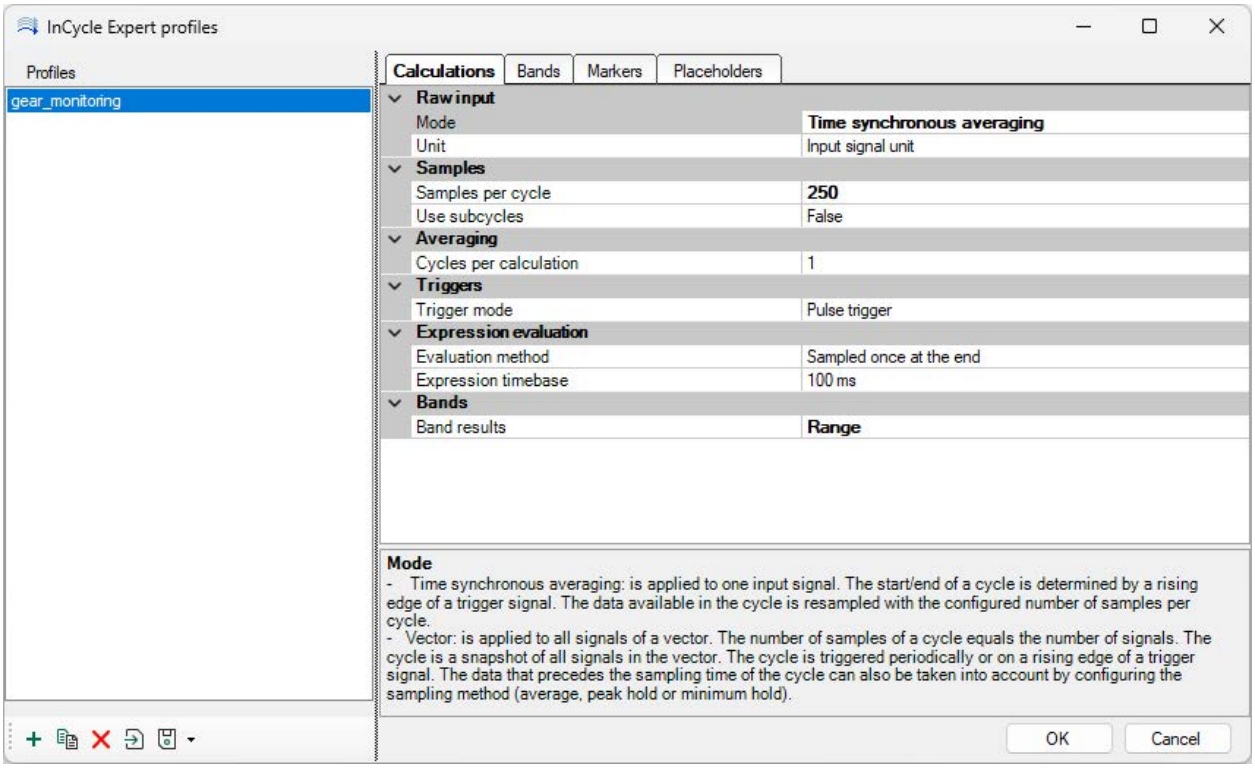
Profile settings

You can set or change the settings of the profile selected in the list in the *Profile* tab. Changes in the profile can be saved with the button .


InCycle-Expert 1
Profile:
newProfile
Curve 1
Profile
Calculations
Bands
Input
Mode
Time synchronous averaging
Unit
Input signal unit
Samples
Samples per cycle
100
Use subcycles
False
Averaging
Cycles per calculation
10
Averaging Type
Linear
Triggers
Trigger mode
Pulse trigger
Bands
Band results
Minimum, Maximum, Average
Mode
- Time synchronous averaging: is applied to one input signal. The start/end of a cycle is determined by a rising edge of a trigger signal. The data available in the cycle is resampled with the configured number of samples per cycle.
- Vector: is applied to all signals of a vector. The number of samples of a cycle equals the number of signals. The cycle is a snapshot of all signals in the vector. The cycle is triggered periodically or on a rising edge of a trigger signal. The data that precedes the sampling ...
Calculate
1
0,5
0
-0,5
-1
0
1
0,75
0,5
0,25
0
-0,25
-0,5
-0,75

8.2 Setting calculation parameters

By entering the calculation parameters, you determine as to how the bands are to be calculated mathematically. The input occurs in the configuration dialog for the profiles in the *Calculations* tab.



The following explains the calculation parameters and their meanings.

8.2.1 Raw input

Mode

A signal or vector can be selected as the input. If you want to apply the calculations to a signal, select *Time-synchronous averaging*; for a vector, select *Vector*. Depending on the selection, there are further parameters for the calculations.

For more information on generating vector signals, see chapter ↗ *Creating vector signals, page 119*.

Time synchronous averaging
Is applied to one input signal. The start/end of a cycle is determined by a rising edge of a trigger signal. The data available in the cycle is resampled with the configured number of samples per cycle.

Vector
Is applied to all signal of a vector. The number of samples of a cycle equals the number of signals. The cycle is a snapshot of all signals in the vector. The cycle is triggered periodically or on the rising edge of a trigger signal. The data that precedes the sampling time of the cycle can also be taken into account by configuring the sampling method (average, peak hold or minimum hold).

Unit

Select the unit of the sensor here, which you can find in the sensor's data sheet. If the appropriate unit is not available or unknown, select “Input signal unit”.

8.2.2 Samples

Define the number of samples here into which a cycle is divided. To avoid performance issues, this number should not exceed the number of samples in the raw data for each cycle.

8.2.3 Averaging

If averaging type is enabled, the results of several cycles are combined to an averaged curve. You can use the number of cycles per calculation to determine how many cycles are included in the averaging.

For calculating the average, you may choose between different methods:

Method	Description
None	No averaging is carried out. InCycle Expert always shows the results of each calculation.
Linear	Averaging *n* cycles at time T is done from the calculations at times T, T-δ, T-2δ,.., T-(*n-1)*δ. *n* = number of averages (cycles) δ = (time base)*(number of samples)*(1-overlap/100) $X = \frac{1}{N}\left(\sum_{i=1}^{N} x_i\right)$ *N* = number of the cycles for the averaging type *i* = Index of cycle; i = 1 oldest, i = N latest cycle *xi* = amplitudes or power value of a frequency line in the i’th FFT
Peak hold	The highest available value is used for each band.
Minimum hold	The smallest available value is used for each band.

8.2.4 Trigger

Use the triggermode to determine how the start and end of a cycle is triggered. There are different options depending on the mode selected under *Raw input*.

Trigger settings for the Time synchronous averaging mode:

- Pulse trigger (zero pulse)
  The pulse trigger indicates the start of a new cycle. This mode is for continuous processes and rotating equipment. The sampling is equidistant.
- Start and stop trigger
  Two triggers are used. The start and stop triggers determine the start and end of a cycle. The sampling is equidistant.
- Progress trigger
  The triggering and the sampling are determined by a numeric progress signal. This can be a length signal or a signal representing the actual angle of a rotating element. The progress trigger signal must be assigned in the *General* tab.

  During a cycle, this progress signal must increase from a start to a stop value, e. g. from angle x to angle y. This start and stop value have to be configured in the profile. You can also use a placeholder, which must be assigned in the *General* tab.

  When the start value is crossed, a new cycle starts. When the stop value is reached, the cycle ends. The rate of increase of the progress signal determines the sampling speed. This speed is dynamic during a cycle. If the progress signal rises faster, more samples are taken.

Trigger settings for the vector mode:
Determines when the data for a cycle is captured:

- Pulse trigger
  A rising edge of the pulse trigger signal triggers the start of a new cycle.
- Periodic trigger
  A new cycle is triggered periodically.

Sampling method
Defines how the data for a cycle is captured. Note that in all cases the sampling of each signal in the vector is handled individually:

- Sample once: The signal is sampled once. No data from before is taken into account (*).
- Average: The average of the signal since the end of the previous cycle is calculated (*)(**).
- Peak hold: The maximum of the signal since the end of the previous cycle is calculated (*) (**).
- Minimum hold: The mimium of the signal since the end of the previous cycle is calculated (*) (**).

(*) When the skip data signal is false, the data is not taken into account. If skipped data is false for all data, no cycle is created.

(**) If a reset trigger occurs in the time frame, only the data later than this reset is taken into account.

8.2.5 Expression evaluation

Evaluation method
The evaluation method determines how the center and delta expressions of a band are calculated.

- Average: The expression is averaged over the time stamps of the input (the precision depends on the setting of the timebase of the expression)
- Sampled once at the end: The expression is acquired once at the end of the input for the cycle calculation. This option requires the fewest resources.

Expression timebase
The timebase that is used for the expressions in the bands and events of a profile.

8.2.6 Band

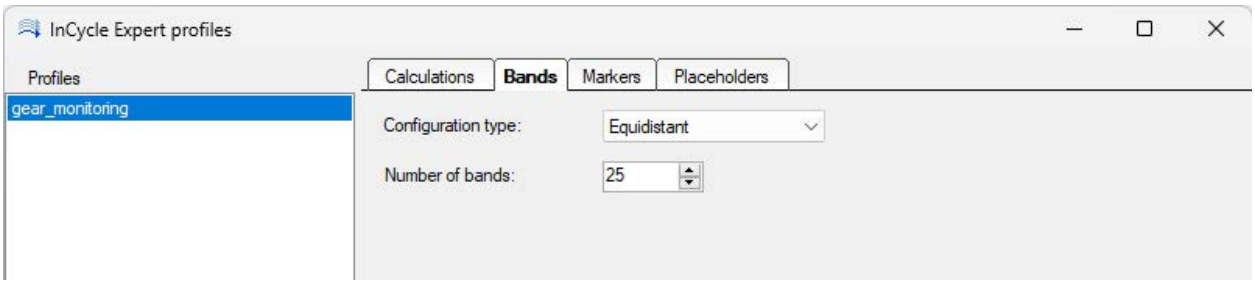
A cycle can be divided into several equal ranges or bands.

Band results
Select which results should be calculated for the bands. Multiple selections possible:

- Minimum: Minimum of the input signal
- Minimum position: Position where the minimum occurs
- Maximum: Maximum of the input signal
- Maximum position: Position where the maximum occurs
- Average: arithmetic average of the input signal
- RMS: square mean value of the input signal
- Standard deviation: Standard deviation of the input signal
- Range: Difference between the minimum and maximum
- Change: Difference between the first and last value of a range

8.3 Configuring bands

Configuration dialog for bands if input mode **Time synchronous averaging** is selected:



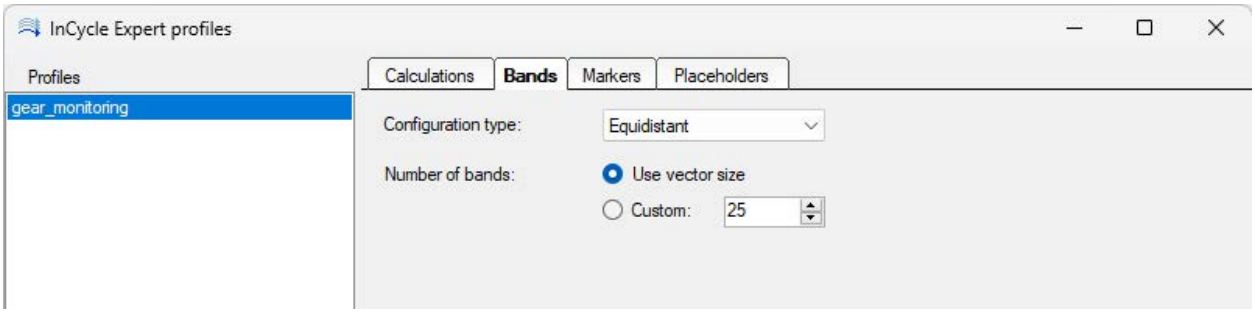
A cycle can be divided into several equal bands.

Configuration type
Select an option for subdividing the bands:

- *Equidistant:* The curve is divided into bands of equal width.
- *Logarithmic*: The subdivision of the bands follows a logarithmic scaling
- *Custom*: With the custom configuration type, you first select the number of bands. You can specify a center and a delta value for each band.

Number of bands
Specify the number of bands.

Configuration dialog for bands if input mode **Vector** is selected:

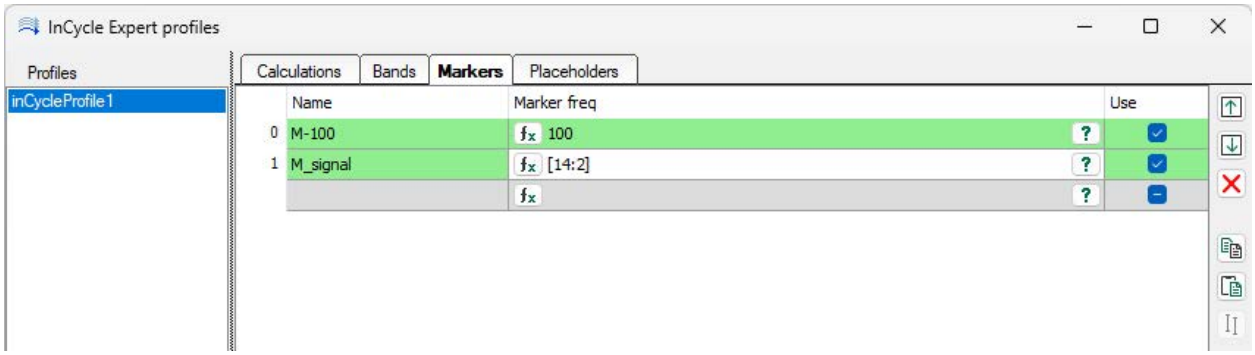


Use vector size
The data points of the vector correspond to the number of bands, i.e. the band results are calculated for all data points of the vector.

Custom
The data points of the vector are divided into bands.

8.4 Markers

You can configure markers for a calculation profile here. The markers configured here appear in the table *InCycle markers* in the properties of the cycle view in the node *Markers*, in the tab *Configured markers,* see chapter ↗ *Configured marker*, page 42.



To create a marker, enter a name to be able to identify the marker. The marker frequency can be a constant value or be specified by a signal. If you want to use a signal for controlling the marker frequency, click the <fx> button in the table cell. The expression builder opens and you can select either an existing signal or enter an expression for calculating the marker frequency.

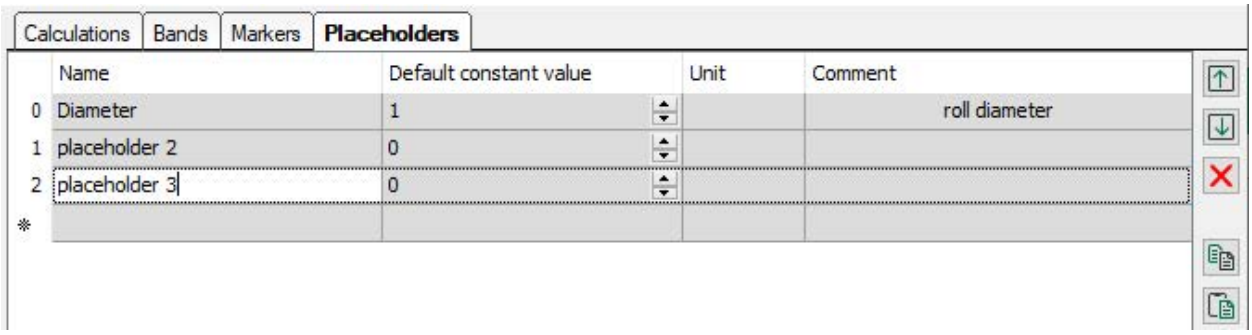
To the right of the table there are buttons with the following functions:

	Moves the selected rows up or down
	Deletes the selected rows
	Copies all rows in the clipboard, can be inserted in e.g. MS Excel
	Pastes a list separated by tabs from the selected column on

8.5 Placeholder

Placeholders can be used to reuse profiles for similar monitoring tasks. For example, a placeholder can be used for the diameter when monitoring different rolls.

Placeholders are defined in the profile, in the *Placeholder* tab. The value is allocated in the module the *General* tab.



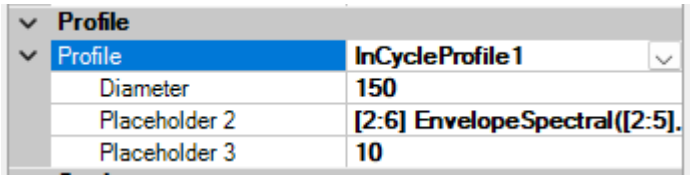
In the *Name* column, enter a name for the placeholder. In addition, you can enter a default constant value and a comment.

To the right of the table there are buttons with the following functions:

	Moves the selected rows up or down
	Deletes the selected rows
	Copies all rows in the clipboard, can be inserted in e.g. MS Excel
	Pastes a list separated by tabs from the selected column on

All defined placeholders appear in the module, in the *ibaPDA* I/O Manager *General* tab under *Profile* or in *Profile* in the *Spectrum* tab. You can allocate a constant value there or select a signal, which controls the value.

Also see chapter ↗ *InCycle Expert – General tab, page 87*



In addition, the defined placeholders can be used in the expression editor for additional calculations.

8.6 Results of the calculations of the Expert module

The InCycle Expert module calculates a series of characteristic values based on the configured settings.

8.6.1 Results in ibaPDA

The results of the calculations are available in *ibaPDA* as analog signals of the respective InCycle Expert module in the tab *Analog*. See chapter ↗ *InCycle Expert – Analog tab, page 90*

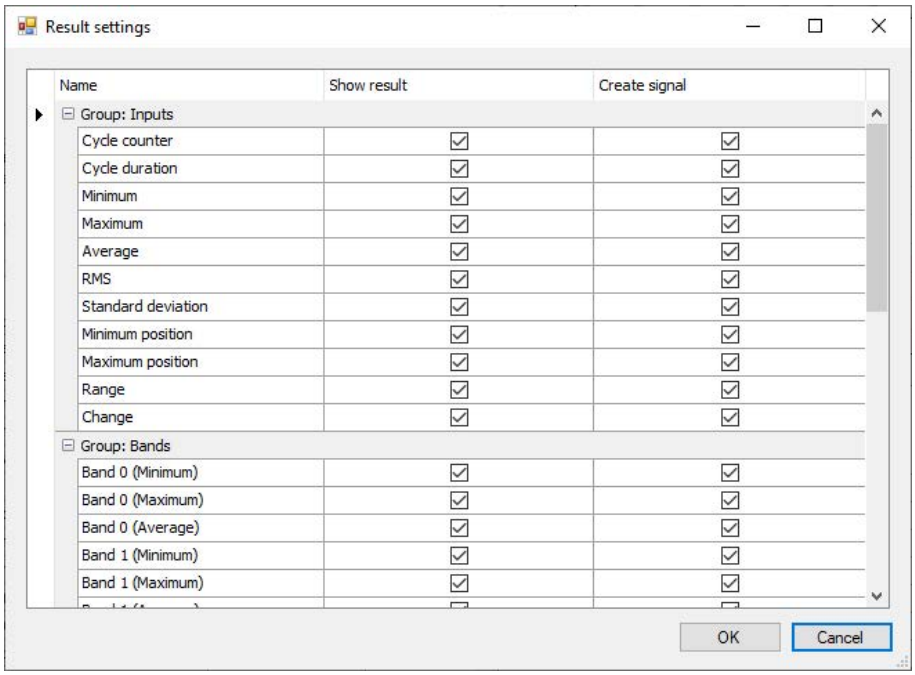
8.6.2 Results in ibaAnalyzer

The results of the calculations are displayed in the results area at the bottom left of the InCycle Expert view and are available as signals in the signal tree with the *ibaAnalyzer-InCycle+* license. The view of the characteristic values in the result table and in the signal tree can be configured individually.

All characteristic values of the respective modules are available as results. The signals are grouped according to inputs and bands. The sequence of the signals corresponds to the sequence in the analog signal table in the InCycle Expert module in *ibaPDA*. The results always relate to the current cursor position of the playback area.

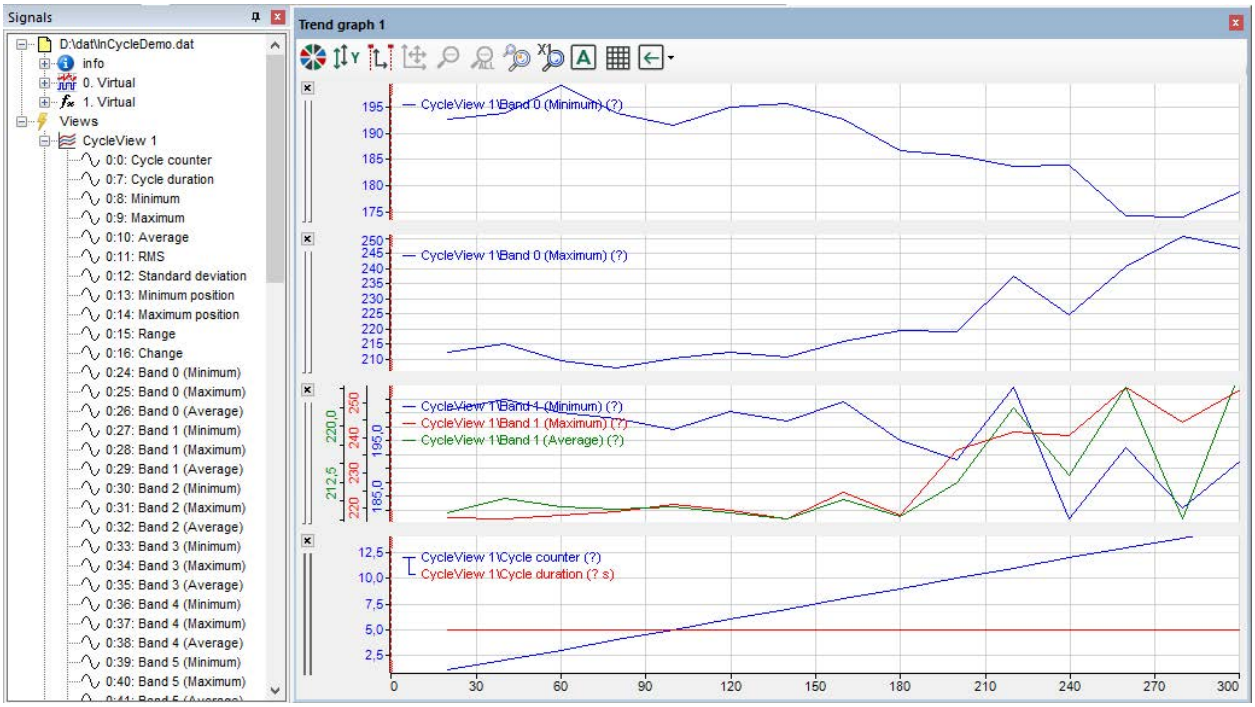
	Name	Value	Unit
	Group: Inputs		
0	Cycle counter	3	
7	Cycle duration	20	s
8	Minimum	-9,896	
9	Maximum	257,595	
10	Average	58,9779	
11	RMS	116,909	
12	Standard deviation	101,145	
13	Minimum position	191	
14	Maximum position	30	
15	Range	267,491	
16	Change	-207,53	
	Group: Bands		
24	Band 0 (Minimum)	200,119	
25	Band 0 (Maximum)	224,267	
26	Band 0 (Average)	211,561	
27	Band 1 (Minimum)	222,44	
28	Band 1 (Maximum)	246,823	

The context menu (right mouse click) opens a dialog where you can select which values are to be displayed in the result area and which results are to be available as signals in the signal tree.



Results as signals

The results of calculations, band results and characteristic values are available as signals in the signal tree.



The results are grouped per view in the signal tree. The name of the view can be changed via right-click on the title bar. The names for bands and characteristic values can be changed in the calculation profiles. The signal names cannot be changed.

The following signals are generated by default:

- Cycle counter
- Cycle duration
- Minimum: Minimum of the input signal
- Maximum: Maximum of the input signal
- Average: arithmetic average of the input signal
- RMS: square mean value of the input signal
- Standard deviation: Standard deviation of the input signal
- Minimum position: Position where the minimum occurs
- Maximum position: Position where the maximum occurs
- Range: Range
- Change: Change

In addition, the signals selected as range results in the profile are generated for each range:

- (Band n) Minimum
- (Band n) Maximum
- (Band n) Average

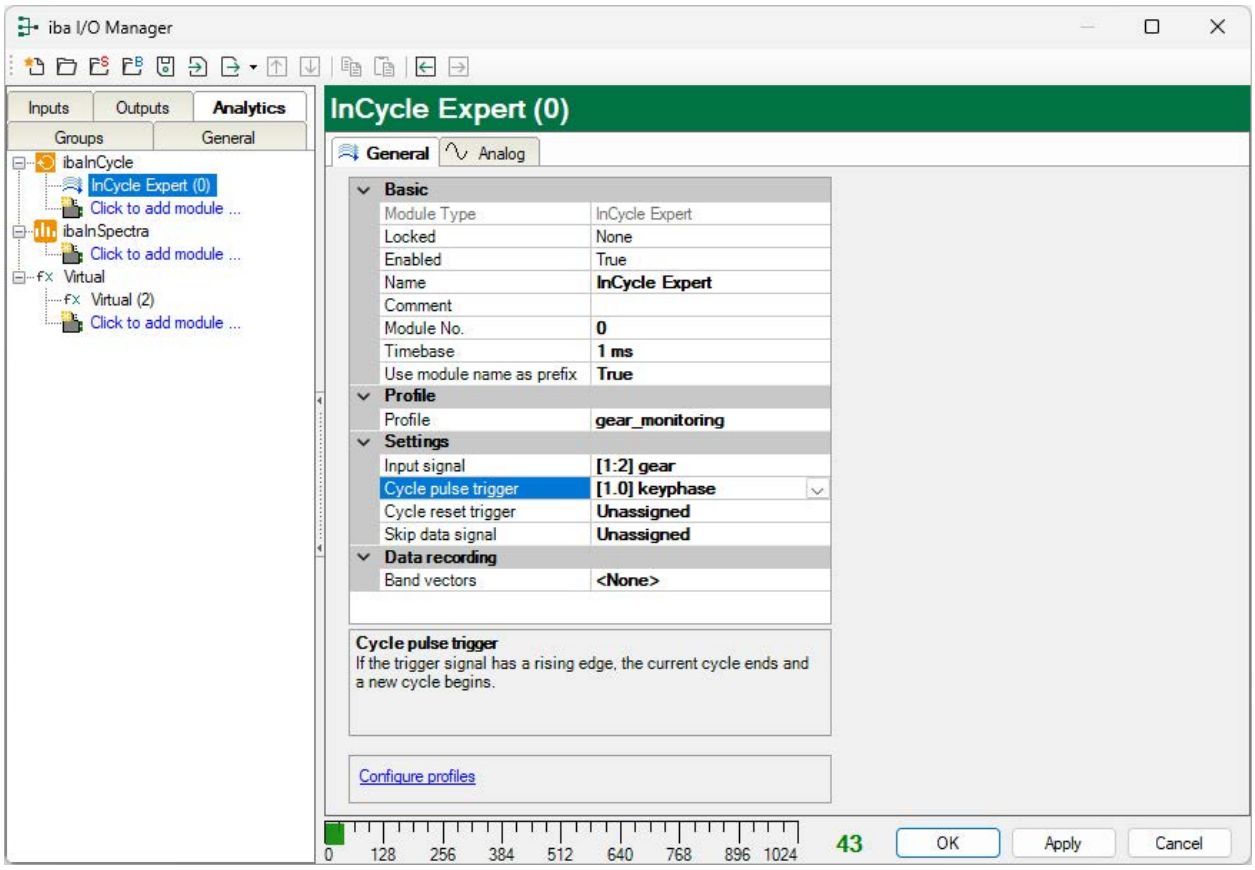
When extracting the results to a DAT file, the extracted expressions are also grouped per view.

8.7 Creating an InCycle Expert module in ibaPDA

1. Open the I/O manager in *ibaPDA*.
2. Switch to the *Analytics* tab.
3. Proceed as described in chapter ↗ *Create and manage profiles in ibaPDA, page 72* in steps 2 and 3. If a suitable profile already exists, you do not need to create a new profile.
4. Now configure the general settings for the module in the *General* tab.

8.7.1 InCycle Expert – General tab

In the *General* tab, make the basic settings, select the input signal and define the trigger conditions.



Basic settings

Module type
Indicates the type of the current module.

Locked
A module can be locked for preventing accidental or unauthorized changes of the module settings. The lock function is linked to the user management in *ibaPDA*. A module can be locked (true) or unlocked (false) only by users who have the required right, provided the user management is activated.

- FALSE: Any user can change the module settings.
- TRUE: No change of module settings possible. Module must first be unlocked by authorized users in order to change the settings.

Enabled
By selecting the options in the dropdown list in the field on the right side of "Enabled," you determine whether the module is enabled (TRUE) or disabled (FALSE). If a module is disabled, then its signals are excluded from acquisition. This means they are neither available for display nor for recording. Furthermore, the number of signals of a disabled module will not be taken into account in the signal statistics.

Name
Enter a comprehensive name for the module here.

It is recommended to use an application-specific naming rule for a better clearness and comprehension, particularly with vast numbers of modules. The name may refer to a technological purpose or a special location in the plant where the module is used or installed. The number of characters is unlimited. The name of the module is stored in the dat file and visible in *ibaAnalyzer*.

Comment
Extra description about the module. This will be displayed as tooltip in the signal tree.

Module No.
If you add modules to the configuration, the system automatically assigns the numbers in chronological order. However, you can select another order for subsequent analysis in the data file by changing the number. Feel free to change the module number according to your needs. It must be ensured that the number is unambiguous. The order of the modules in the signal tree of *ibaAnalyzer* is determined by their numbers.

Timebase
As time base , you may enter a value here, given in ms, which is an integer multiple of the general time base as configured in the "General" branch of the I/O manager. The value of the time base is limited upwards to 1000 ms.

Profile

Select the requested profile from the drop-down list for analyzing the selected signal. If no profile is available or a suitable profile is missing, you have to define a profile first. Please read the explanations in chapter for this purpose ↗ *Setting calculation parameters, page 78*

If no profile is selected or available, an error message will be output when checking the I/O configuration.

Settings

Note

Depending on which input mode is selected in the profile (time-synchronous averaging or vector), the parameters to be set for the input signal and the triggers change.

Input signal
Select the input signal here that is to be analyzed with this module. All signals configured in *ibaPDA* are available in the signal tree.

If the *Vector* input mode is selected, the field is called *Vector input* and you can select a vector.

Sampling pulse trigger/Sampling timebase
The *Sampling pulse* or *Sampling timebase* parameters appear if the *Vector* input mode is selected in the calculation profile. Depending on which trigger mode for vectors has been selected in the profile, a sampling pulse must be selected here or a sampling timebase must be set.

Sampling pulse trigger (trigger mode pulse trigger): If the trigger signal has a rising edge, all signals from the vector are sampled to compose a new cycle.

Sampling timebase (trigger mode periodic): Number of milliseconds between the sampling of two consecutive cycles.

Cycle pulse trigger / cycle start / stop trigger
The Cycle pulse trigger or Cycle start and stop trigger parameters appear if the *Time-synchronous averaging* input mode is selected in the calculation profile. Depending on which trigger-mode was selected in the profile, a pulse trigger signal or start and stop trigger must be selected here. If the trigger signal has a rising edge, then the running cycle is ended and a new cycle begins. Otherwise certain start and stop triggers determine the start and end of a cycle.

Progress trigger
The progress trigger signal is a numeric signal that determines the triggering and the sampling. During a cycle, this progress signal increases from a start value to a stop value. This start and stop value have to be configured. When the start value is crossed, a new cycle starts. When the stop value is reached, the cycle ends. The rate of increase of the progress signal determines the sampling speed. This speed is dynamic during a cycle. If the progress signal rises fast during a part of a cycle, more samples are taken in that part of the cycle.

Cycle reset trigger
The rising edge of this reset trigger signal drops all data from the current cycle. In the case of averaging type, data from previous cycles that would influence the next result are also dropped. If the reset trigger coincides with a start trigger, a new cycle is started. Otherwise the system waits for the next start trigger. If the reset trigger coincides with the (last) stop trigger of the previous cycle, this cycle is processed normally.

'Skip data' signal
The input data is ignored if the signal is TRUE.

Data recording

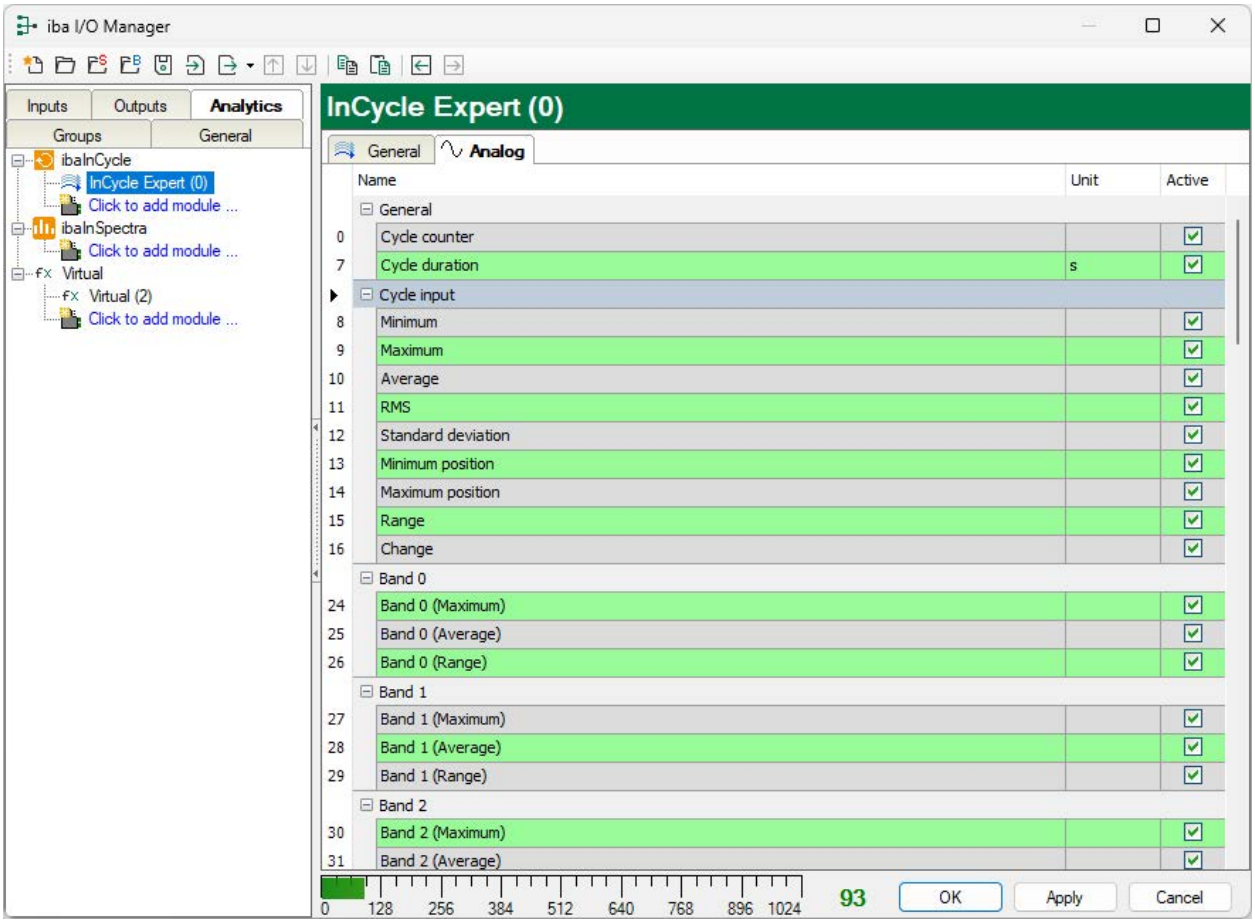
Band vectors
Vectors for a band indicator can be created from all bands. Select the desired band indicator(s) here:

- Minimum, Minimum position, Maximum, Maximum position, Average, RMS, Standard deviation, Range, Change

Vectors are automatically created across all bands for the selected band indicators and can be recorded. These vectors allow an easier analysis in *ibaAnalyzer*, especially when comparing data from multiple sensors.

8.7.2 InCycle Expert – Analog tab

Example of an *Analog* tab:



The following signals are generated by default:

General group

- Cycle counter
- Cycle duration

Cycle input group

- Minimum: minimum of the input signal
- Maximum: maximum of the input signal
- Average: arithmetic average of the input signal
- RMS: square mean value of the input signal
- Standard deviation: standard deviation of the input signal
- Minimum position: position where the minimum occurs
- Maximum position: position where the maximum occurs
- Range: difference between minimum and maximum
- Change: difference between the first and last value of a band

In addition, the signals are generated for each band that were selected as band results in the profile. In the example:

- Band n (Maximum)
- Band n (Average)
- Band n (Range)

8.8 Configuration of a calculation profile in ibaAnalyzer

With *ibaAnalyzer-InCycle* it is possible to configure calculation rules in the form of profiles offline and to test them on recorded data.

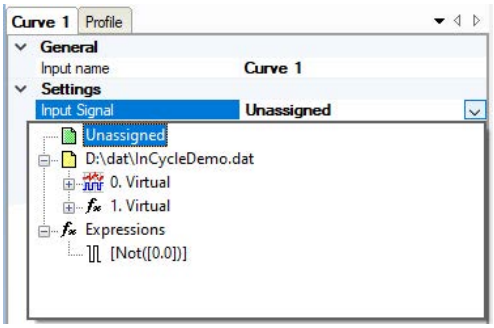
First open an InCycle Expert view with the button in the toolbar, see chapter ↗ *Opening a cycle view in ibaAnalyzer*, page 23

Open a data file (DAT file) containing the signals to be examined either

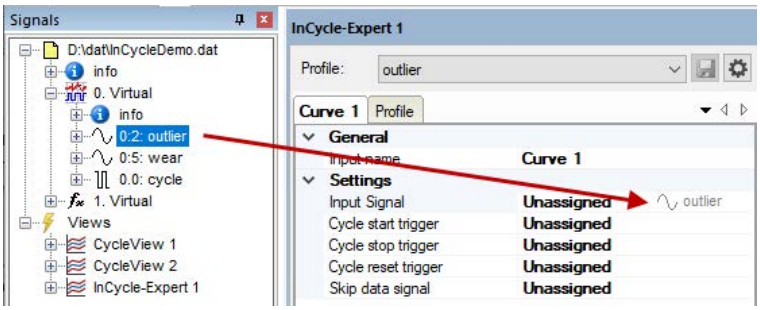
- via the menu *File - Open data file*.
- or drag a data file via drag & drop from the Windows Explorer into the opened *ibaAnalyzer* program window.

You can select any analog signal and test calculation rules on it. To do this, enter the respective signal in the configuration area as input signal, either

- by selection in the dropdown menu in the *Input Signal* field



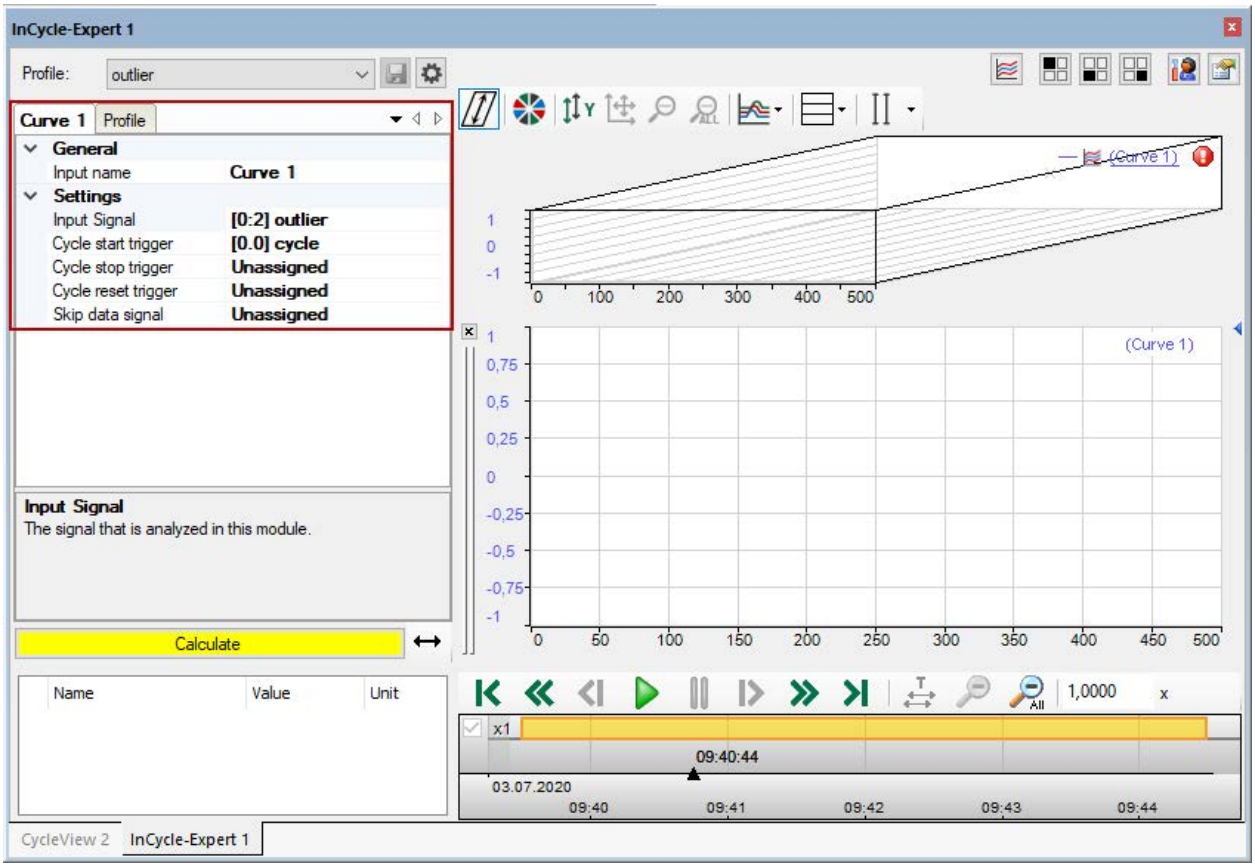
- or you drag the signal from the signal tree to the *Input Signal* field



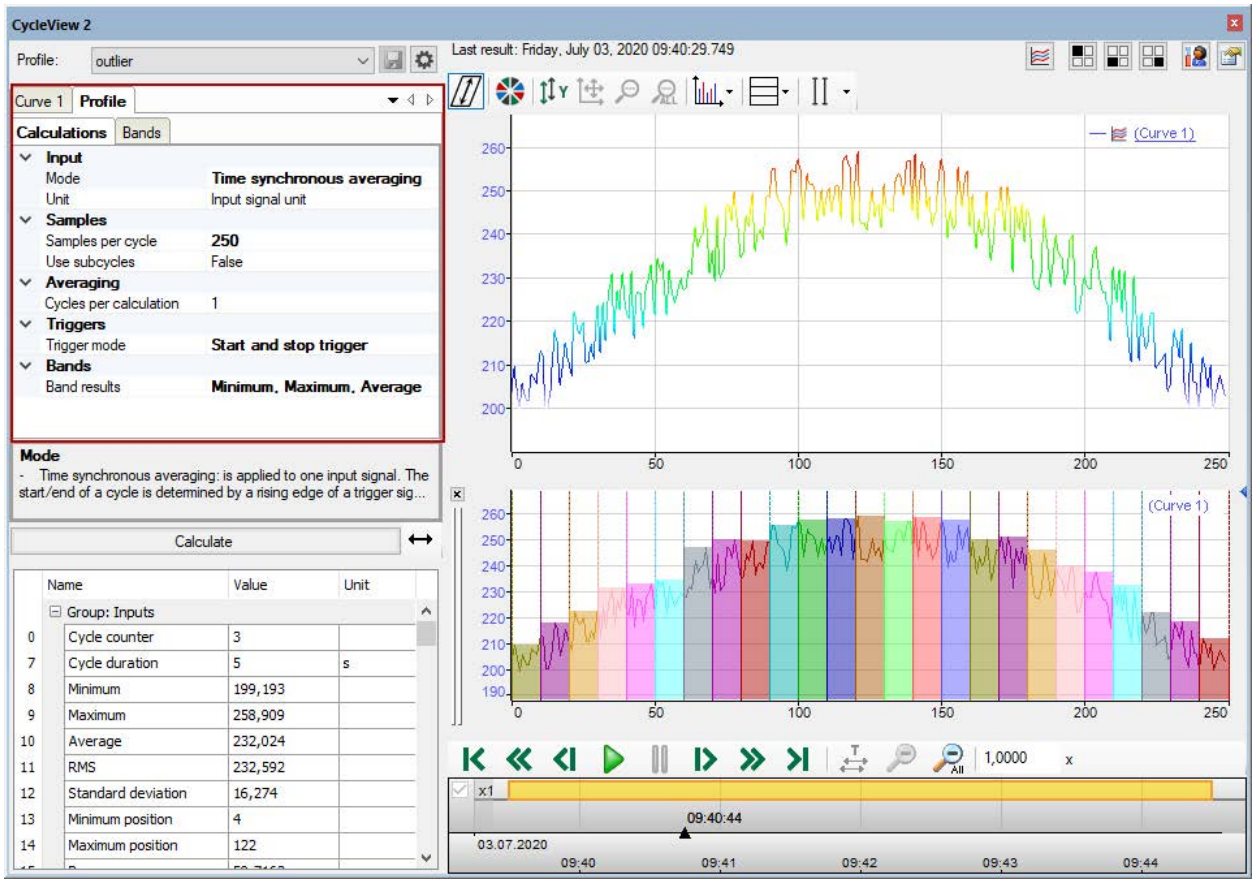
Select a trigger signal that defines the end or start of a cycle. Depending on which triggermode was selected in the profile, a trigger signal or start and stop trigger must be selected here. You can select the trigger signal or start and stop trigger either

- by selection in the dropdown menu in the corresponding field
- or you drag the signal(s) from the signal tree into the respective field.

The signals *Cycle reset trigger* and *Skip data signal* are optional. An explanation can be found in chapter ↗ *InCycle Expert – General tab, page 87*.



In the *Profile* tab, you can now create a calculation profile or, if profiles have already been imported or created, you can select a profile from the dropdown menu. The parameters for the calculation rules are identical to the parameters in *ibaPDA*. See chapter ↗ *Setting calculation parameters, page 78*



You can save configured profiles using the disk button. If you change the name, export profiles or would like to import profiles from *ibaPDA*, open the profile manager by using the ⚙ button. See chapter ↗ *Create and manage profiles in ibaAnalyzer, page 74*.

The calculation is started by pressing the <Calculate> button. The signal can be analyzed in detail in the cycle view on the right. The properties and settings in cycle view in ibaAnalyzer-InCycle are identical to the cycle view in *ibaPDA*. See chapter ↗ *Overview of the cycle view*, page 24.

Playback area

In the playback area, you can control the playback of the dat file using the buttons and the slider. You can find the description in chapter ↗ *Playback area*, page 20.

9 The InCycle Auto-Adapting module

The InCycle Auto-Adapting module automatically learns curves for different process conditions and uses this as a reference to detect changes in the curve over time. The module is based on the InCycle Expert module.

The behavior of the curves is also influenced by changes to the process, material and environmental conditions, i.e. other material properties, geometries, temperatures, speeds, etc.

The Auto-Adapting module therefore distinguishes between measurements for any number of defined process conditions. These are defined by an unambiguous ID.

The calculation rules can be individually adjusted and saved in profiles as with the InCycle Expert module. Defined profiles can be saved, imported, exported and used multiple times.

9.1 The Auto-Adapting profile

The InCycle Auto-Adapting module can be used to monitor a curve of a signal for changes. The parameters can be freely configured and stored in profiles. This makes it possible to reuse created profiles. Any number of profiles can be configured to adequately analyze different input signals. An InCycle Auto-Adapting module is to be configured for each signal to be monitored.

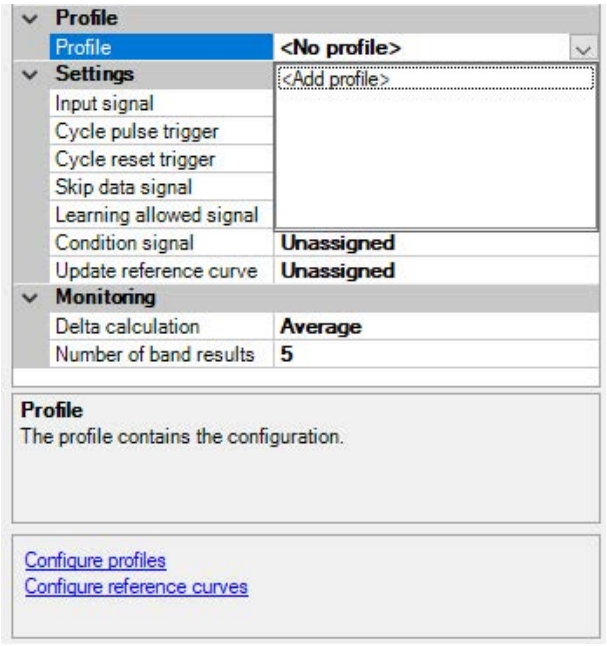
The modules can be structured through a directory structure to improve the overview. Since an InCycle Auto-Adapting module can only be completely configured if at least one valid calculation profile exists, in the following the configuration of a profile is first explained and then the configuration of the module settings is explained.

9.2 Create and manage profiles in ibaPDA

If you create an InCycle Auto-Adapting module for the first time, no profiles are yet available. To be able to create and edit profiles, first add an InCycle Auto-Adapting module. Proceed as follows:

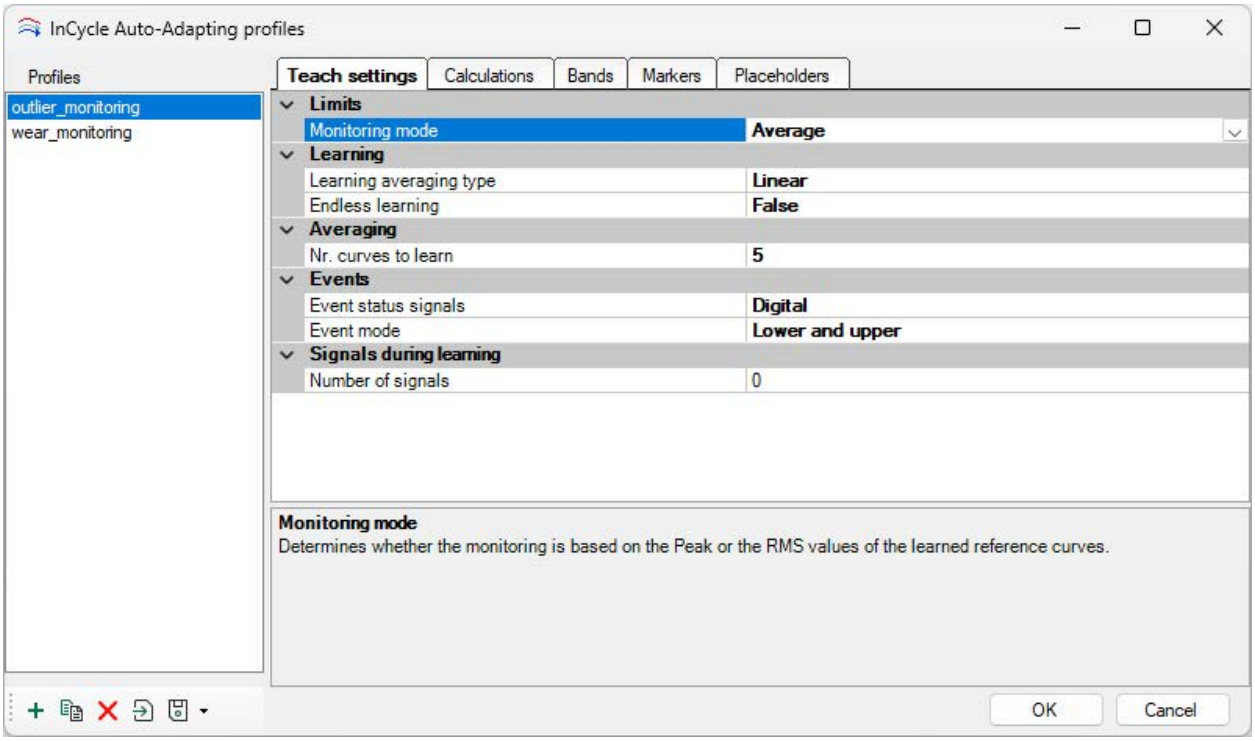
1. Open the I/O Manager in *ibaPDA*.
2. Select the *Analytics* tab.
3. If necessary, expand the "ibaInCycle" branch and click on the link *Click to add module...*.

4. Select the *InCycle Auto-Adapting* module type in the following *Add module* dialog and enter a module name in the corresponding field. Then click <OK>. The module is now created and you see the *General*, *Analog* and *Digital* tabs in the right part of the I/O Manager. Alternatively, you can use the right mouse key to click on the interface ibaInCycle and select *Add module* in the context menu. The module will then be created immediately. You can then rename it.
5. In the field *Profile* in the *General* tab of the module, open the drop-down list and click on <Add profile>.



Alternatively, you can also click on the link *Configure profile* below in the dialog window.

The dialog for the configuration of the (new) profile opens. Profiles can be created, changed, exported and imported in the profile manager.



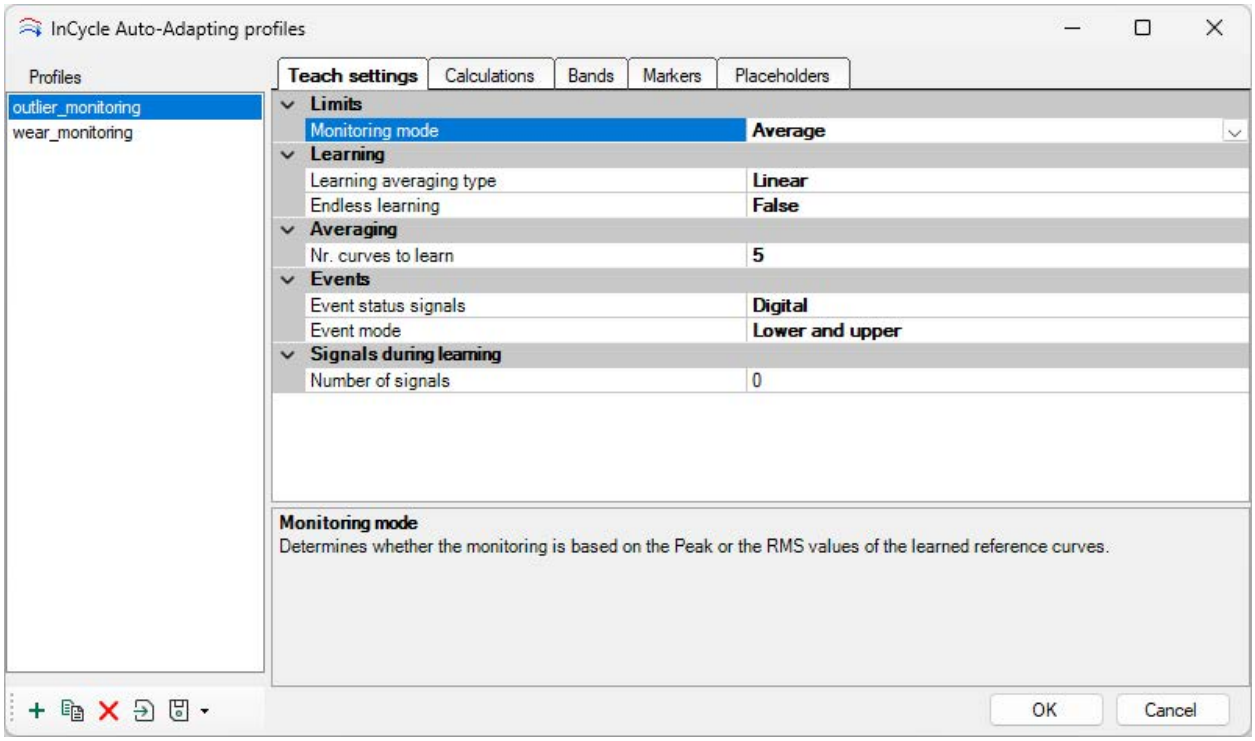
All available profiles are listed on the left side of the profile manager. Profiles can also be renamed here. Below this list, there are buttons with the following functions:

- Add profile
- Clone current profile
- Delete current profile
- Import profile
- Export selected profile

The settings of the profile selected in the list are made in the main area of the dialog.

9.3 Teach settings

By entering the teach settings, you determine how the reference curves should be determined. Specify the settings in the configuration dialog for the profiles in the *Teach settings* tab.



9.3.1 Limits

Monitoring mode
The monitoring mode defines which characteristic value is taught for each range of the reference curve and is therefore also used later for monitoring.

- Maximum
- Minimum
- Average
- RMS
- Standard deviation
- Range
- Change

9.3.2 Learning

Learning average type

- Linear (default setting): the reference curve is the average of all spectra during the learning phase.
- Exponential: the most recent cycle is given a higher weight. If *exponential* is selected, the *Exponential learning percentage* field appears Enter the percentage weight of the most recent cycle here.

Endless learning

- True: There is no end of the learning phase.
- False: You can specify the duration of the learning phase by defining the number of cycles that the learning phase should comprise. The *Number of curves to learn* field appears. Enter here the number of cycles to be learned for each reference curve.

9.3.3 Averaging

Number of curves to learn
This defines how many curves the teach-in phase should include. The duration of the teach-in phase is therefore indirectly configured here. Different values for certain process conditions can also be defined for this purpose under “Configure reference curves.”

Only “complete” curves are used to teach-in the reference curve. This means that if the process conditions change while data points for a cycle are acquired, then the data acquired from the last calculated curve up to the change is not used for the reference curve.

The field does not appear if you have activated endless learning.

Exponential learning percentage
Here you can define the percentual weight of the most recent value in the exponential average. The field appears if you have selected exponential averaging.

9.3.4 Events

Event status signals
Here you can select whether the status signals for events (warnings and alarms) are digital or analog.

- Digital: When exceeding the entered limit value, the corresponding digital signal is set to TRUE (logical 1) and can be used for signaling.
- Analog: The analog signal can accept several values and, for example, be used to control a traffic light display in *ibaQPanel*.
  - 0 undefined
  - 1 OK

- 2 Warning
- 3 Alarm

Event mode
This property defines how the curves are monitored:

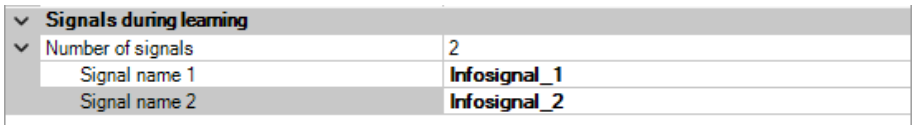
- Warning and alarm: generates events based on warning and alarm limits.
- Lower and upper: generates events based on lower and upper threshold values for the individual areas.

9.3.5 Signals during learning

During the learning phase, additional signals can be recorded whose values are also learned. The signals are learned for each reference during the learning phase. Example: The user wants to know what the temperature was during learning.

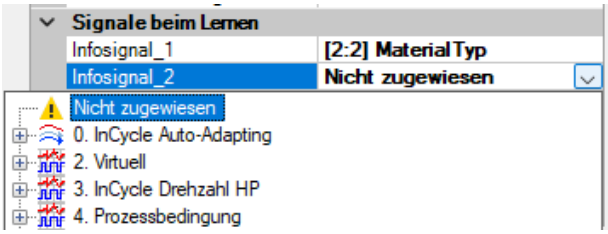
Number of signals
First enter the number of signals to be monitored during learning.

A line appears for each signal in which you can enter a signal name.



When you have configured the profile, close the dialog with <OK> and open the *General* tab of the InCycle Auto-Adapting module.

Input fields for the *Signals during learning* now appear in the *General* tab. Signals can be assigned via the drop-down list.



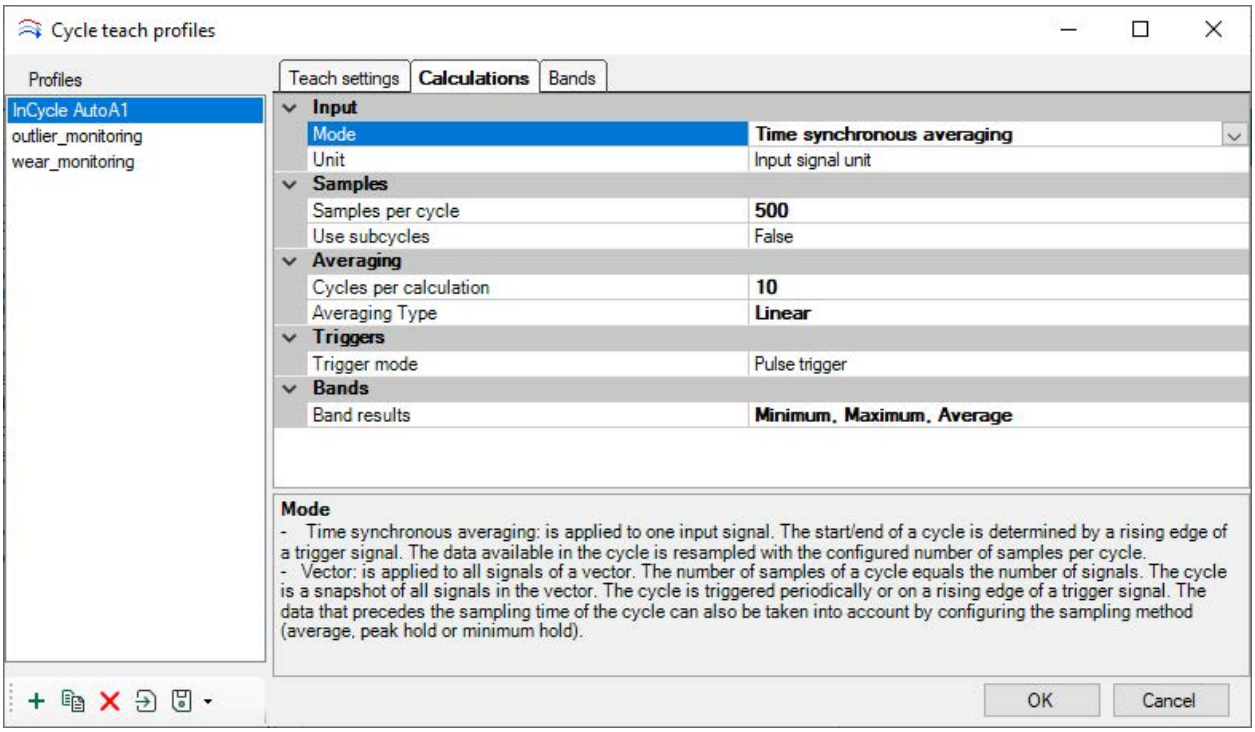
9.4 Bands

A cycle can be divided into several bands. The band configuration is identical to the InCycle Expert module, see ↗ *Configuring bands*, page 82.

9.5 Setting calculation parameters

By entering the calculation parameters, you determine as to how the cycle curves are to be calculated mathematically. The possible calculation parameters are identical to those of the expert module. For a description of the parameters, see chapter ↗ *Setting calculation parameters*, page 78.

The input occurs in the configuration dialog for the profiles in the *Calculations* tab.



9.6 Markers

The configuration of the markers in the calculation profile for InCycle Auto-Adapting modules is identical to the marker settings for InCycle Expert modules.

See chapter ↗ *Markers*, page 83.

9.7 Placeholder

The configuration of the placeholders in the calculation profile for InCycle Auto-Adapting modules is identical to the placeholder settings for InCycle Expert modules.

See chapter ↗ *Placeholder*, page 83.

9.8 Visualization and results of the Auto-Adapting module

The results of the Auto-Adapting module are calculated based on the configured profile and the settings for monitoring (see chapter ↗ *Teach settings, page 97*).

The following explains which results the module offers and how these can be visualized and used as signals.

9.8.1 Characteristic values

Like the InCycle Expert module, the Auto-Adapting module also calculates different characteristic values:

Group: General

- Cycle counter: Number of cycles
- Number learned: Number of cycles learned
- Condition
- Absolute delta
- Relative delta
- Last learning time: Date and time at which the reference curve was updated for the last time
- Cycle duration: Duration of a cycle

Group: Cycle input

- Minimum: Minimum of the input signal
- Maximum: Maximum of the input signal
- Average: Average of the input signal
- RMS: square mean value of the input signal
- Standard deviation: Standard deviation
- Minimum position: Position where the minimum occurs
- Maximum position: Position where the maximum occurs
- Range: Difference between minimum and maximum
- Change: Difference between first and last value of a range

These characteristic values are available as signals in the *Analog* tab (see chapter ↗ *InCycle Auto-Adapting – Analog tab, page 107*.

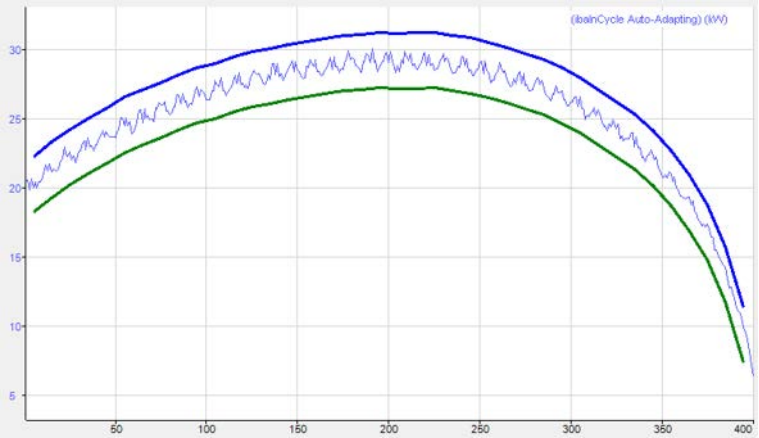
9.8.2 Band results

In addition to the characteristic values, ranges with the biggest differences to the respective limits are offered as signals for the configured “Number of band results.” These are listed in the *Analog* tab in the range “Bands with exceeded limits” under the name “Exceeded limit.”

- Band center: Center of the range of the limit value exceedance
- Relative difference: Relative difference between the current and limit value
- “{Band result of the monitoring mode}”: Result of the calculation of the band characteristic value selected under monitoring mode

9.8.3 Visualization

If an InCycle Auto-Adapting module is moved to a cycle view, the main window shows the current curves the same way as the InCycle Expert module. The individual visualization of the Auto-Adapting module is located in the *Cycle graph*.



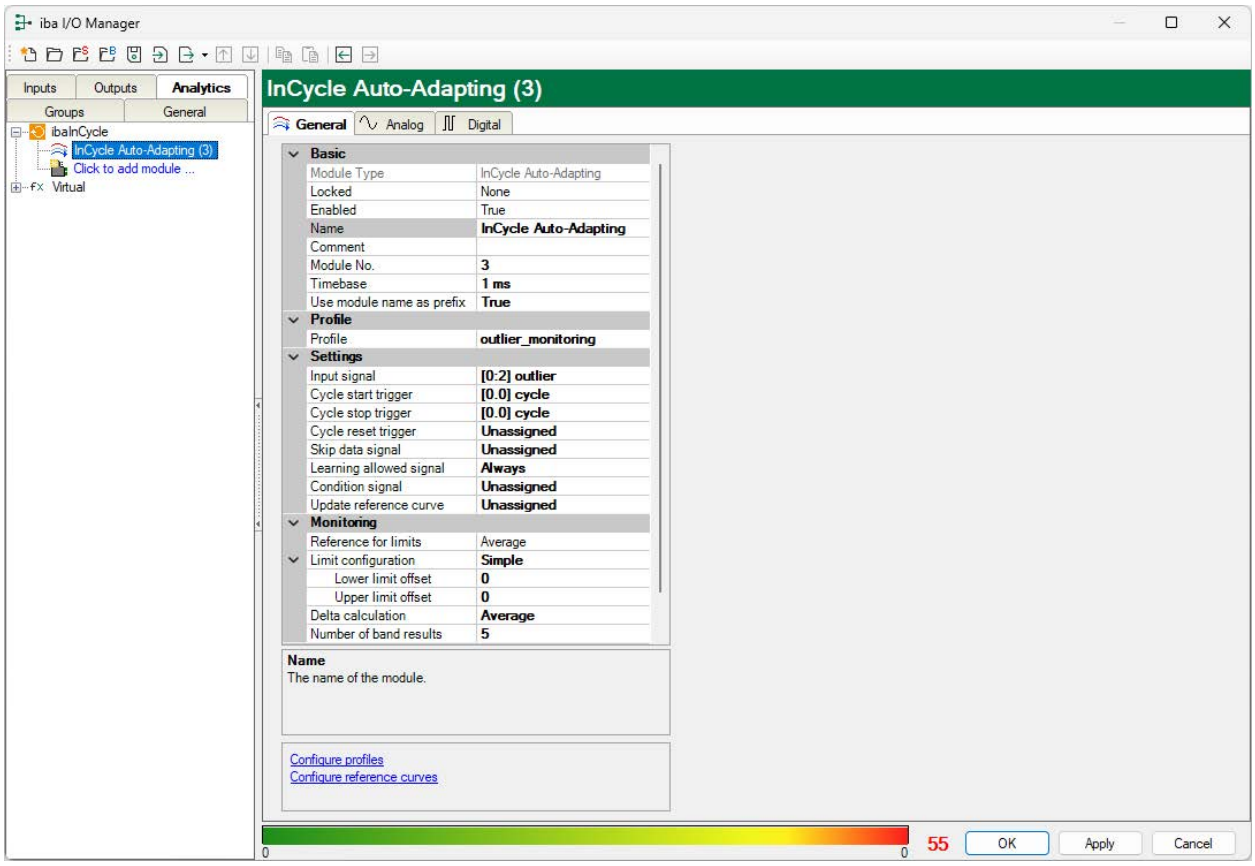
If “Warning and alarm” is used as an event mode, the warning limit is shown in yellow and the alarm limit in red.

If “Upper and lower” is used as an event mode, the lower limit is shown in green and the upper limit in blue.

9.9 Creating an auto-adapting module in ibaPDA

1. Open the I/O manager in *ibaPDA*.
2. Proceed as described in chapter ↗ *Create and manage profiles in ibaPDA, page 95* in steps 2 and 3. If a suitable profile already exists, you do not need to create a new profile.
3. Now configure the general settings for the module in the *General* tab.

9.9.1 InCycle Auto-Adapting – General tab



Basic settings

See InCycle Expert module, chapter ↗ *InCycle Expert – General tab*, page 87

Profile

Select the requested profile from the drop-down list for analyzing the selected signal. If no profile is available or a suitable profile is missing, you have to define a profile first.

Please read chapter ↗ *Setting calculation parameters, page 100* for this purpose. If no profile is selected or available, an error message will be output when validating the I/O configuration.

Settings

Note

Depending on which input mode is selected, the parameters to be set for the input signal and the triggers change.

Input signal / Vector input
Select the signal or the vector here that is analyzed with this module. All signals or vectors configured in *ibaPDA* are available in the signal tree.

If no input signal or vector is selected or available, an error message is output when validating the I/O configuration.

Sampling pulse trigger / Sampling timebase
The *Sampling pulse trigger* or *Sampling timebase* parameters appear if the *Vector* input mode is selected in the calculation profile. Depending on which trigger mode for vectors has been selected in the profile, a sampling pulse trigger must be selected here or a sampling timebase must be set.

Sampling pulse trigger (trigger mode pulse trigger): If the trigger signal has a rising edge, all signals of the vector are sampled to form a new cycle.

Sampling timebase (periodic trigger): Number of milliseconds between the sampling of two consecutive cycles.

Cycle pulse trigger / cycle start trigger / stop trigger
The *Cycle pulse trigger* or *Cycle start trigger* and *Cycle stop trigger* parameters appear if the *Time synchronous averaging* input mode is selected in the calculation profile. Depending on which triggermode was selected in the profile, a trigger signal or start and stop trigger must be selected here. If the trigger signal has a rising edge, then the running cycle is ended and a new cycle begins. Otherwise start and stop triggers determine the start and end of a cycle.

Cycle reset trigger
The rising edge of this reset trigger signal drops all data from the current cycle. In the case of averaging type, data from previous cycles that would influence the next result are also dropped. If it coincides with a start trigger, a new cycle is started. Otherwise the system waits for the next start trigger. If it coincides with the (last) stop trigger of the previous cycle, this cycle is processed again.

'Skip data' signal
The signal determines when the input data should be ignored.

'Learning allowed' signal
This signal defines whether new curves may be learned or not. Click on the dropdown arrow in this field and select one of the following options from a reduced signal tree:

- *Always*: This setting can be used to constantly learn new curves until the number of curves to be learned that is defined in the profile is met.
- *Signal tree*: As an alternative, all digital signals, including the virtual signals, are available to choose from to activate the teach-in phase (selected signal = TRUE) or to disable it (selected

signal = FALSE). This allows you to link the teach-in phase of the InCycle module to particular process states or e.g. to an ibaQPanel input. New curves are also learned here until the number of curves to be learned that is defined in the profile is met.

Condition signal
This integer number determines the current operating condition. A reference curve is learned for each condition.

Update reference curve
The value of this signal determines whether and how the reference curves are updated:

- 1 | 2: Reset for current condition | for all conditions
- 3 | 4: Save for current condition | for all conditions

Monitoring

The “Monitoring” section defines how the curves are to be compared with the learned reference curves and evaluated after the learning phase. The settings made here only affect the results of the module, but not the teaching phase or the learned reference curves.

Reference for limits
This setting is used to define the reference for the limits based on the reference curve. A distinction is made here about which event mode is used in the profile.

If “Warning and alarm” is used as event mode, these options are available:

- Average: The averages of the individual ranges of the reference curve that are learned across all curves are used as the reference here
- Maximum reference: The maximum values of the individual ranges of the reference curve occurring during the teaching phase are used as the reference here

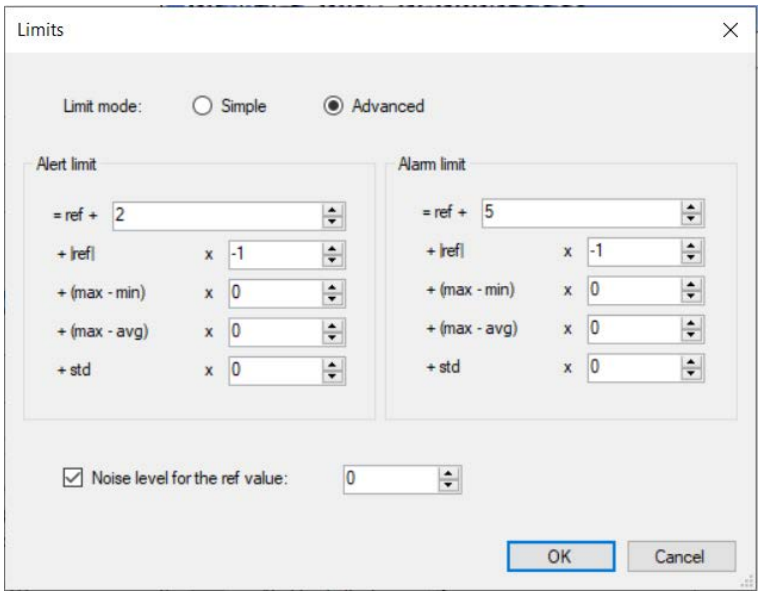
If “Upper and lower” is used as the event mode, these options are available:

- Average: The averages of the individual ranges of the reference curve that are learned across all curves are used as the reference here.
- Min./Max. reference: The maximum and minimum values of the individual ranges of the reference curve occurring during the teaching phase are used as the reference here.

Limit configuration
This defines how the limits should be calculated based on the reference for limits. Two possible types are available for selection:

- Simple: A distance can be used here to specify where respective limits exceed or fall below the reference.
- Advanced: In addition, the standard deviation for the limit learned for each range can be used for the advanced limits.

Clicking in the field *Limit configuration* opens the corresponding dialog.



The limits can be configured here depending on the selected limit mode and the event mode defined in the profile.

If “Warning and alarm” is used as the event mode, these limits can be configured:

- Alert limit: Limit for alerts
- Alarm limit: Limit for alarms

If “Lower and upper” is used as the event mode, these limits can be configured:

- Lower limit: Lower limit value
- Upper limit: Upper limit value

The thresholds for alerts/alarms can be entered in the fields *Alert limit offset / Alarm limit offset* or in the dialog for limit configuration.

With the option *Noise level for the ref value* you can set a limit value for the characteristic value calculations: Values smaller than the set value are ignored for the characteristic value calculations.

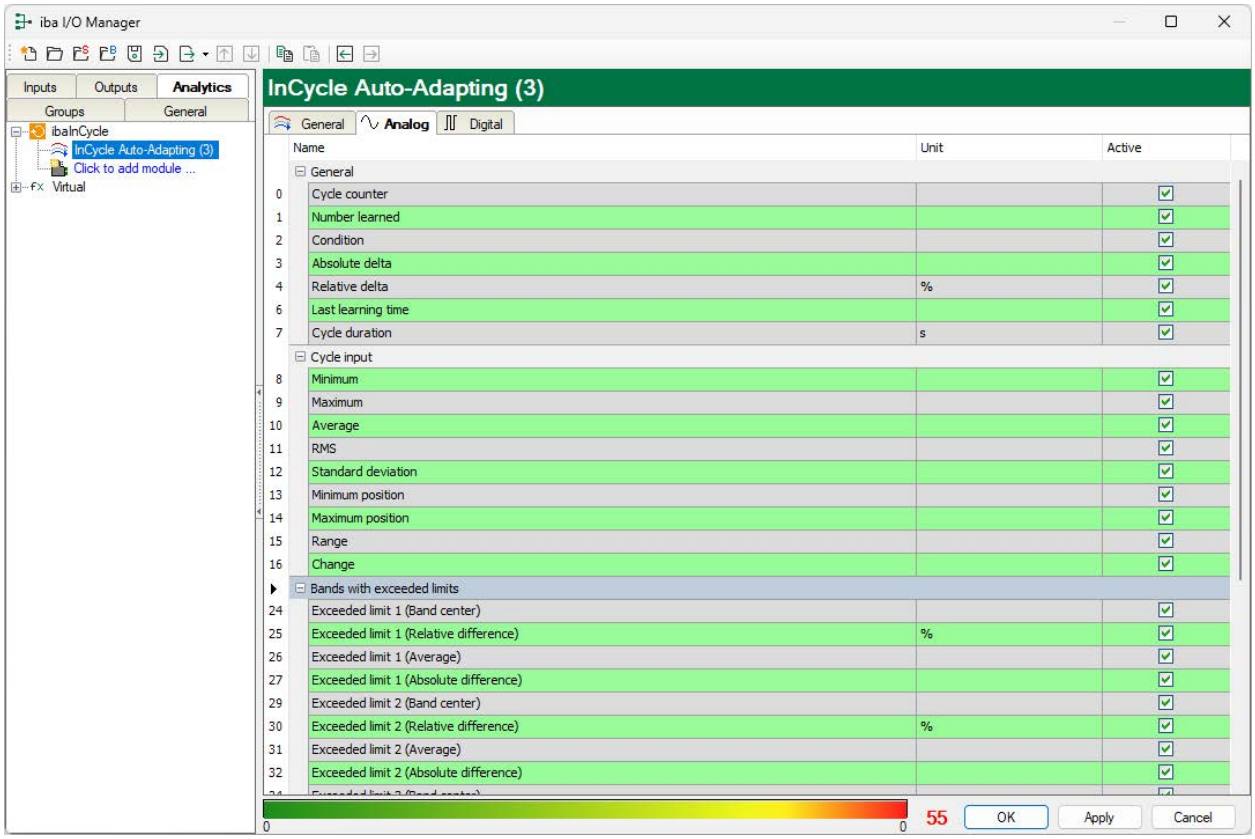
Delta calculation
This setting determines how the characteristic values absolute and relative delta are calculated.

- Sum: The differences between the current values and the limits are summed up across all bands.
- Average: The average of differences between the current values and the limits are formed across all bands.

Number of band results
Number of bands for which the results of the signals are available.

9.9.2 InCycle Auto-Adapting – Analog tab

Example of an Analog tab:



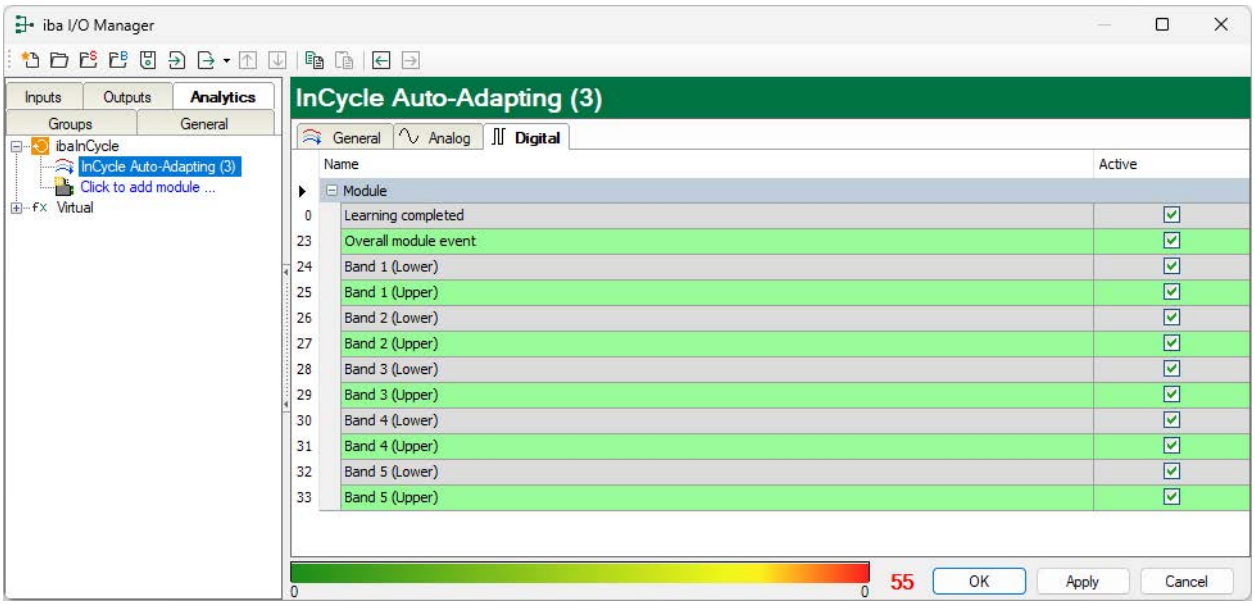
In the “General” group, 7 signals are generated. 9 signals are generated in the “Cycle input” group and several signals are generated in the “Bands with exceeded limits” group. These are explained in chapter ↗ *Visualization and results of the Auto-Adapting module, page 101*.

These signals are available later in the signal tree for the display and recording. If the event status signals are analog, they are also listed here.

9.9.3 InCycle Auto-Adapting – Digital tab

If the event status signals are configured as digital signals, the automatically configured warning and alarm messages are created in the *Digital* tab for each band. In addition, the signals *Learning completed* and *Overall module event* appear.

For the online display in the *ibaPDA* client, enable the "Cycle table” in the cycle view of the InCycle module.


iba I/O Manager
Inputs
Outputs
Analytics
Groups
General
ibaInCycle
InCycle Auto-Adapting (3)
Click to add module ...
Virtual
InCycle Auto-Adapting (3)
General
Analog
Digital
Name
Active
Module
0 Learning completed
23 Overall module event
24 Band 1 (Lower)
25 Band 1 (Upper)
26 Band 2 (Lower)
27 Band 2 (Upper)
28 Band 3 (Lower)
29 Band 3 (Upper)
30 Band 4 (Lower)
31 Band 4 (Upper)
32 Band 5 (Lower)
33 Band 5 (Upper)
0
0
55
OK
Apply
Cancel

10 The InCycle ONNX module

The ONNX module makes it possible to use AI models in *ibaInCycle* . This enables easy deployment of ONNX models in *ibaPDA* and live monitoring of any measurement data.

ONNX is an open exchange format designed specifically for the use of machine learning models. It enables models to be trained according to your own requirements and then—after export—flexibly executed in different systems or environments.

To use an ONNX model in *ibaInCycle* , the model must first be available as an ONNX file. This file can be loaded directly into the ONNX module of *ibaInCycle* . Measurement data can then be monitored live by applying the trained model to an input signal, such as the parameters calculated in *ibaInCycle*.

The outputs and results provided by the model are defined within the ONNX model itself. These results are available in the ONNX module and can be recorded as signals in *ibaPDA*.

The ONNX model must be available in advance and provided by the user.

10.1 The ONNX Profile

In the ONNX profile, you can configure calculation rules and load the ONNX model. Any number of profiles can be configured to adequately analyze different input signals. The profiles can also be reused. An InCycle ONNX module is to be configured for each signal to be monitored. The modules can be structured through a directory structure to improve the overview.

Since an InCycle ONNX module can only be completely configured if at least one valid calculation profile exists, in the following the configuration of a profile is first explained and then the configuration of the module settings is explained.

10.1.1 Create and manage profiles in ibaPDA

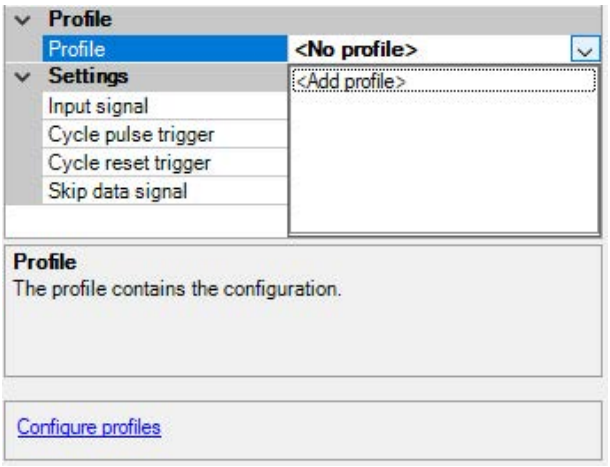
If you create an InCycle ONNX module for the first time, no profiles are yet available. To create and edit profiles, first add an InCycle ONNX module. Proceed as follows:

1. Open the I/O manager in *ibaPDA*.
2. Select the *Analytics*tab.
3. If necessary, expand the "ibaInCycle" branch and click on the blue link "Click to add module...".

4. Select the "InCycle ONNX" module type in the following "Add module" dialog and enter a module name in the corresponding field. Then click <OK>. The module is now created and you see the *General*, *Analog* and *Digital* tabs in the right part of the I/O manager.

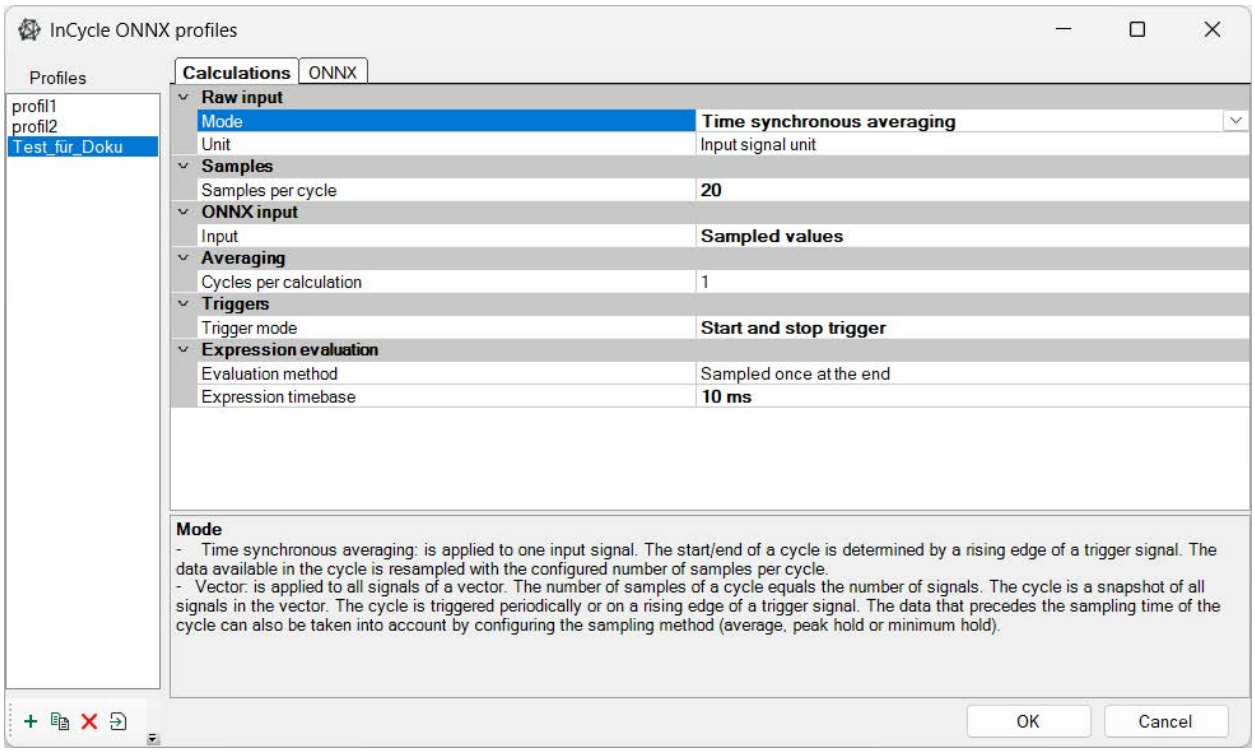
   Alternatively, you can use the right mouse key to click on the interface ibaInCycle and select "Add module" in the context menuand select *InCycle ONNX* in the submenu.

5. Open the drop-down list in the field “Profile” in the *General* tab of the module and click on “<Add profile>”.



   Alternatively, you can also click on the blue link “Configure profile” below in the dialog window.

The dialog for the configuration of the (new) profile opens. Profiles can be created, changed, exported and imported in the profile manager.



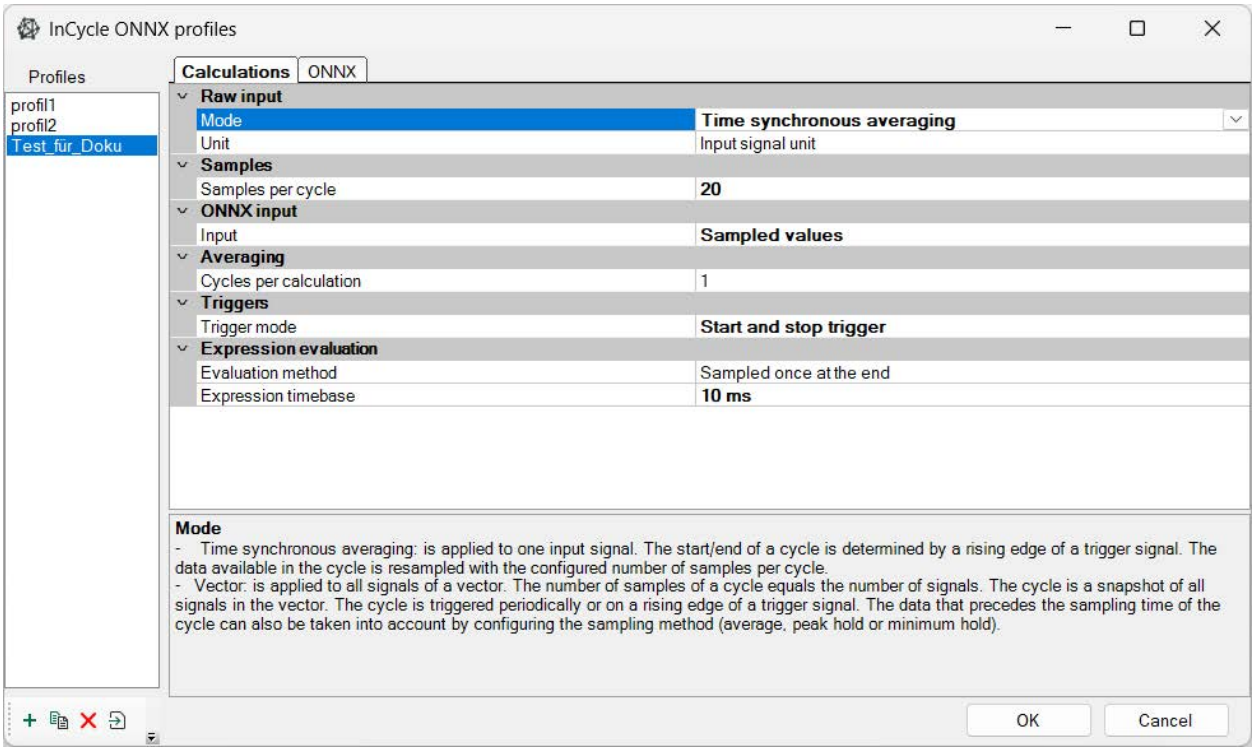
All available profiles are listed on the left side of the profile manager. Profiles can also be renamed here. Below this list, there are buttons with the following functions:

- Add new profile
- Clone selected profile
- Delete selected profile
- Import profiles
- Export selected profile

The settings of the profile selected in the list are made in the main area of the dialog.

10.2 Setting calculation parameters

By entering the calculation parameters, you determine how the cycle curves are to be calculated mathematically and which data will be used for the ONNX model.



The possible calculation parameters are identical to those of the Expert module. For a description of the parameters, see chapter ↗ *Setting calculation parameters*, page 78.

In the InCycle ONNX profile, the *ONNX Input* parameter must also be configured.

ONNX Input
Data used for the ONNX model. You can choose from two options:

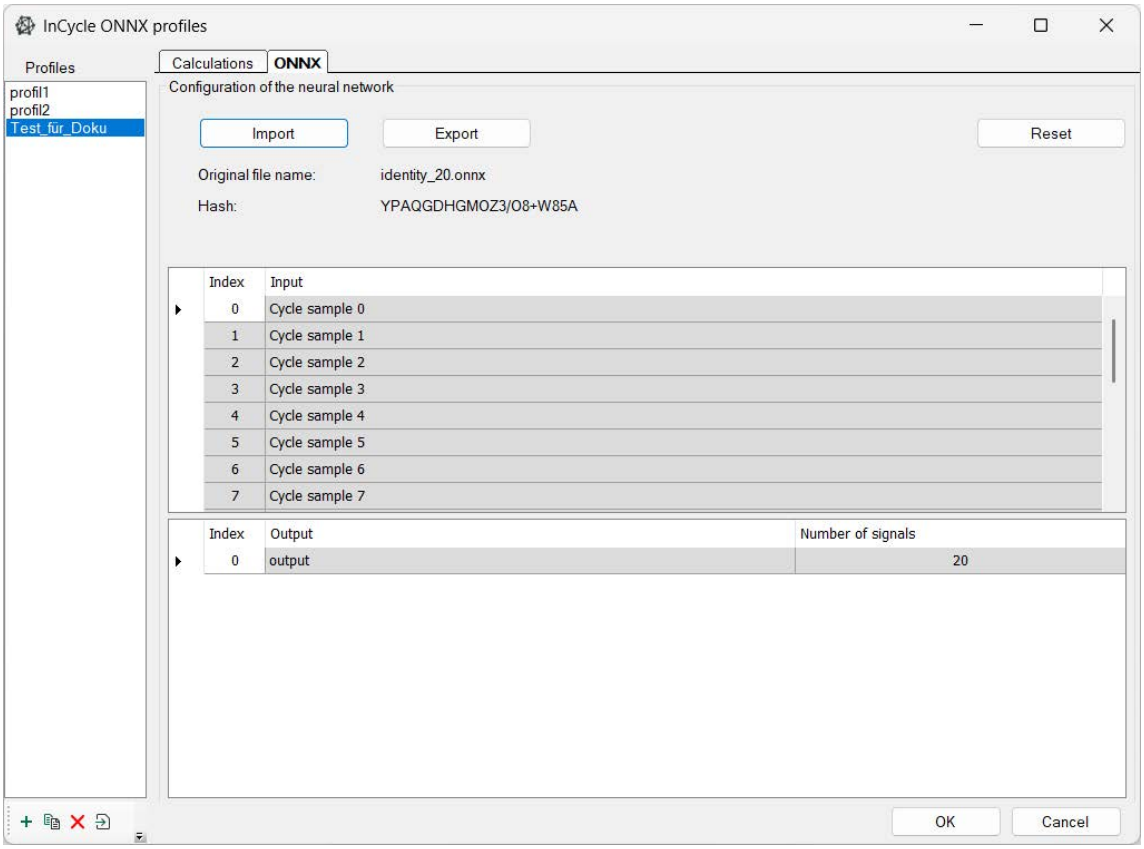
- Sampled values
  The sampled values from the data block are used.
- Band values
  Here, characteristic values are used for each band. When you select *Band Values* , the *Bands* section appears, along with the *Band results* drop-down list and the *Bands*tab.

  In the *Band results* drop-down list, you can select one or more parameters to be calculated for the bands: Minimum, Minimum position, Maximum, Maximum position, average, RMS, Standard deviation, Range, Change.

  If *Band Values* is selected, the number of bands must be configured in the *Bands* tab. You must also select a evaluation method to determine how the parameters are calculated. See ↗ *Setting calculation parameters*, page 78

10.2.1 ONNX

You can import any ONNX file by clicking <Import> and selecting the ONNX file in the File Explorer. The model is saved completely in the profile.



Inputs and outputs must be defined in the ONNX file. Once the file has loaded, the inputs and outputs will be displayed. Each output value is available as a signal in *ibaPDA* . The signals are displayed in the *Analog* register. See ↗ *InCycle ONNX – Analog tab, page 116*.

Click <Export> to export the ONNX file.

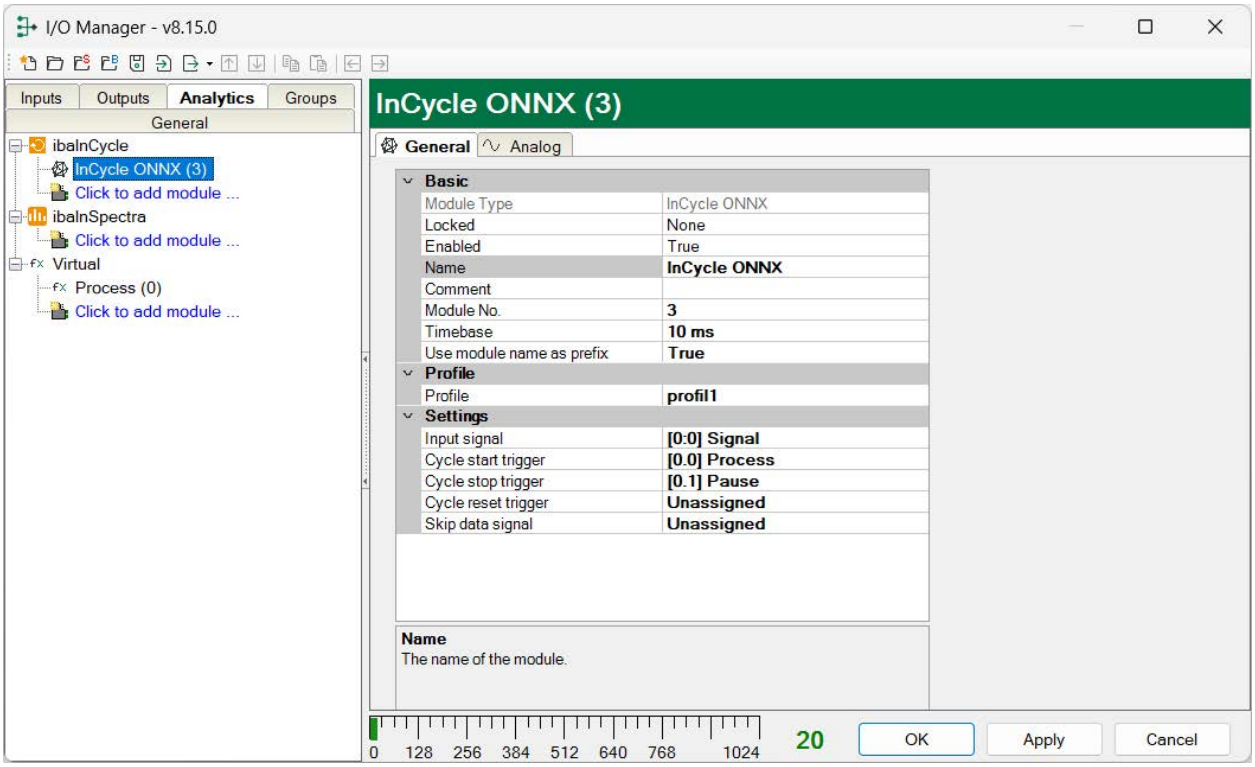
Click <Reset> to remove the ONNX file.

10.3 Creating an InCycle ONNX module in ibaPDA

1. Open the I/O manager in *ibaPDA*.
2. Go to the *Analytics*tab.
3. Proceed as described in chapter ↗ *Create and manage profiles in ibaPDA*, page 72 in steps 2 and 3. If a suitable profile already exists, you do not need to create a new profile.
4. Now configure the general settings for the module in the *General* tab.

10.3.1 InCycle ONNX – General tab

You can configure basic settings as well as settings for profiles and triggers in the *General* tab.



Basic

See InCycle Expert module, chapter ↗ *InCycle Expert – General tab*, page 87

Profile

Select the requested profile from the drop-down list for analyzing the selected signal. If no profile is available or a suitable profile is missing, you have to define a profile first.

Please read the explanations in chapter ↗ *ONNX, page 113* for this purpose. If no profile is selected or available, an error message will be output when checking the I/O configuration.

Settings

Note

Depending on which input mode is selected in the profile (time-synchronous averaging or vector), the parameters to be set for the input signal and the triggers will change.

Input signal / Vector input

Select the signal or vector here that is analyzed with this module. All signals or vectors configured in *ibaPDA* are available in the signal tree.

If no input signal or vector is selected or available, an error message is output when validating the I/O configuration:

Sampling pulse/Sampling timebase
The "Sampling pulse" and "Sampling timebase" parameters appear when the input mode *Vector* is selected in the calculation profile. Depending on which trigger mode was selected for vectors in the profile, you must either select a sampling pulse or set a sampling time here.

Trigger pulse (Pulse trigger mode): If the trigger signal has a rising edge, all signals in the vector are sampled to form a new cycle.

Sampling timebase (Periodic trigger mode): The number of milliseconds between the sampling of two consecutive cycles.

Cycle pulse trigger / cycle start/stop trigger
The Cycle pulse trigger and Cycle start and stop trigger parameters appear when the input mode *Time synchronous averaging* is selected in the calculation profile. Depending on the selected trigger mode in the profile, a trigger signal or start and stop trigger must be selected here.

If the trigger signal has a rising edge, then the current cycle is terminated and a new cycle begins. Otherwise start and stop triggers determine the start and end of a cycle.

Cycle reset trigger
The rising edge of this reset trigger signal drops all data from the current cycle. In the case of averaging, the data from previous cycles that would affect the next result are also dropped.

If it coincides with a start trigger, a new cycle is started. Otherwise the system waits for the next start trigger. If it coincides with the (last) stop trigger of the previous cycle, this cycle is regularly processed.

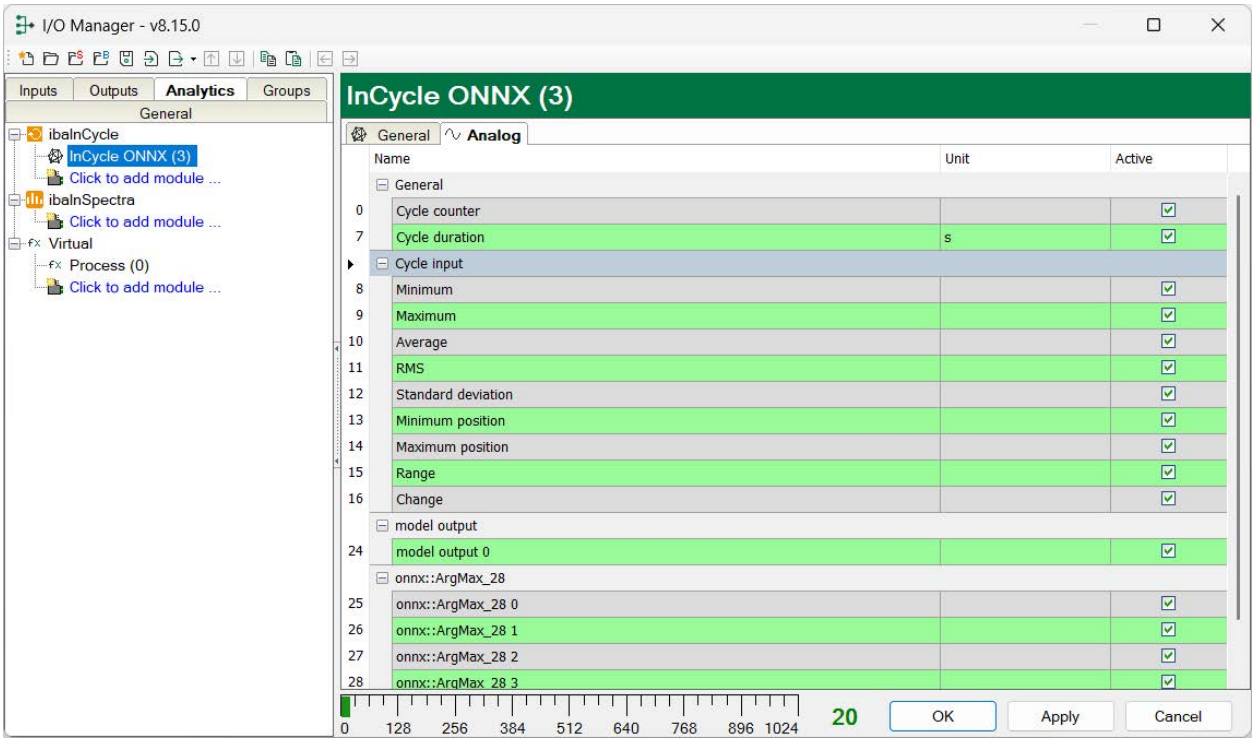
Progress trigger
The "Progress trigger" parameter appears when the "Progress trigger" trigger mode is selected in the calculation profile.

The progress trigger signal is a numeric signal that determines triggering and sampling. During a cycle, this progress signal must increase from a start value to a stop value. These start and stop values must be configured. If the start value is crossed, a new cycle starts. When the stop value is reached, the cycle ends. The rate of increase of the progress signal determines the sampling speed. This speed varies dynamically during a cycle. If the progress signal rises fast during a part of a cycle, more samples are taken in that part of the cycle.

'Skip data' signal
The signal determines when the input data should be ignored.

10.3.2 InCycle ONNX – Analog tab

Example of a *Analog* tab with analog status signals:



The following signals are generated by default:

General group

- Cycle counter
- Cycle duration

Cycle input group

- Minimum: Minimum of the input signal
- Maximum: Maximum of the input signal
- Average: arithmetic average of the input signal
- RMS: square mean value of the input signal
- Standard deviation: Standard deviation of the input signal
- Minimum position: Position where the minimum occurs
- Maximum position: Position where the maximum occurs
- Range: Range
- Change: Change

Results of the ONNX model

- All output values

These signals are available later in the signal tree for the display and recording.

10.4 Results of the ONNX module

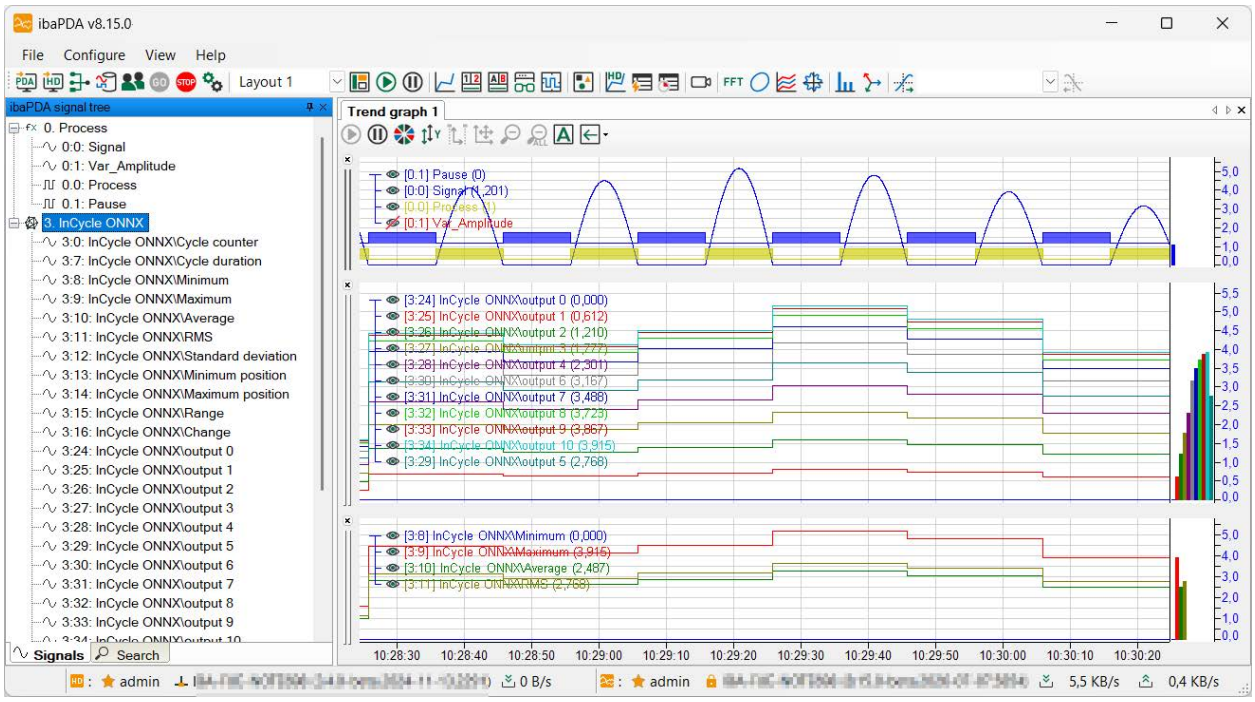
The InCycle ONNX module allows you to analyze measurement data by applying a neural network to segments of the input signal.

10.4.1 Results in ibaPDA

The results of the calculations are available in *ibaPDA* as analog signals of the respective InCycle ONNX module in the tab*Analog*. See chapter ↗ *InCycle ONNX – Analog tab, page 116*

The signals are available in the signal tree and can be displayed in a trend graph.

Visualization in the trend graph
In the following example, an ONNX model is applied to an input signal. The profile is configured so that a cycle is divided into 20 *samples per cycle* . The ONNX model outputs the current value for each sample, resulting in 20 output signals per cycle.



In the upper signal graph, the blue curve represents the analog input signal (signal). The two digital signals mark a cycle that is used in the calculation. The rising edge of the yellow signal (Process) serves as the start trigger; the rising edge of the blue signal (Pause) serves as the stop trigger.

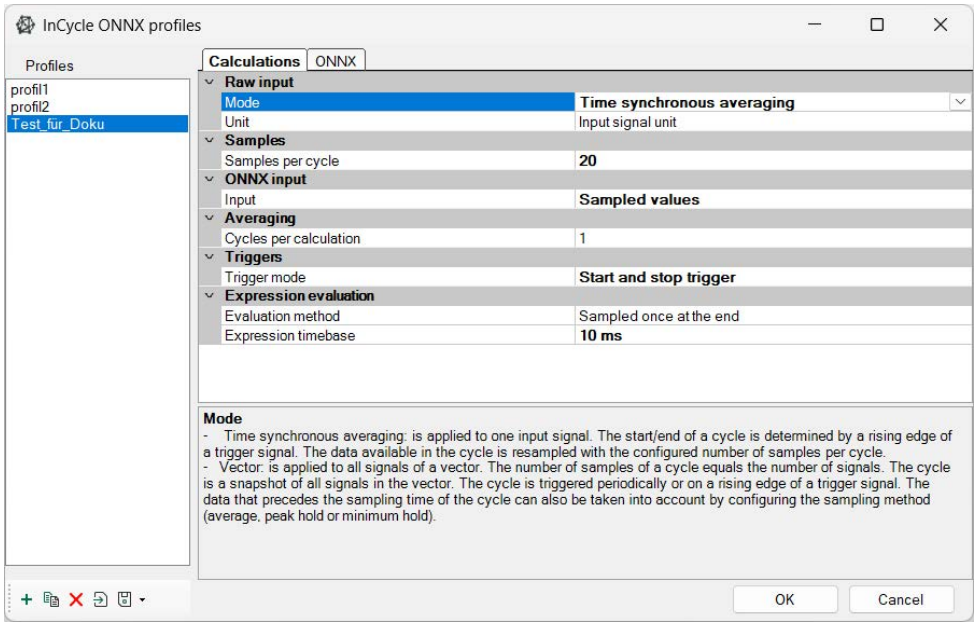
The middle signal graph shows the output signals. Each output is available in the signal tree as a signal under the InCycle ONNX module: ...\output 1 through ...\output 20.

In addition, characteristic values are calculated for each cycle of the input signal, which can also be displayed as a signal, such as the minimum, maximum, and average values. Selected characteristic values are displayed in the lower signal graph.

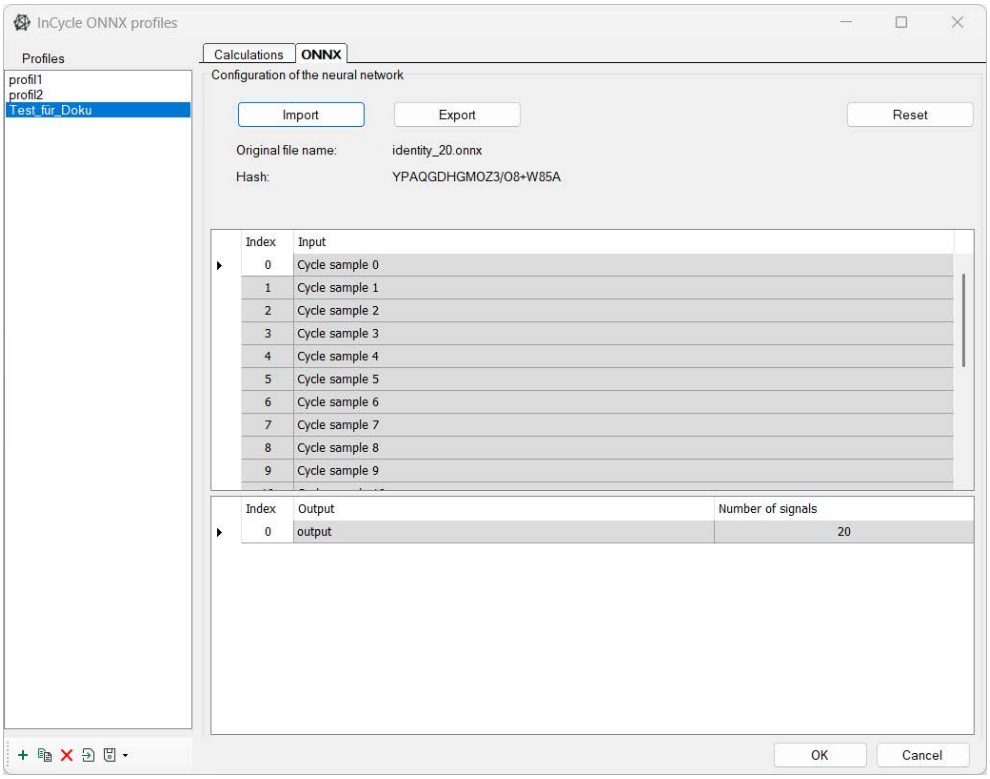
The description of the characteristic values can be found in chapter ↗ *InCycle ONNX – Analog tab, page 116*.

For this example, the following settings were configured in the InCycle ONNX profile:

Calculations



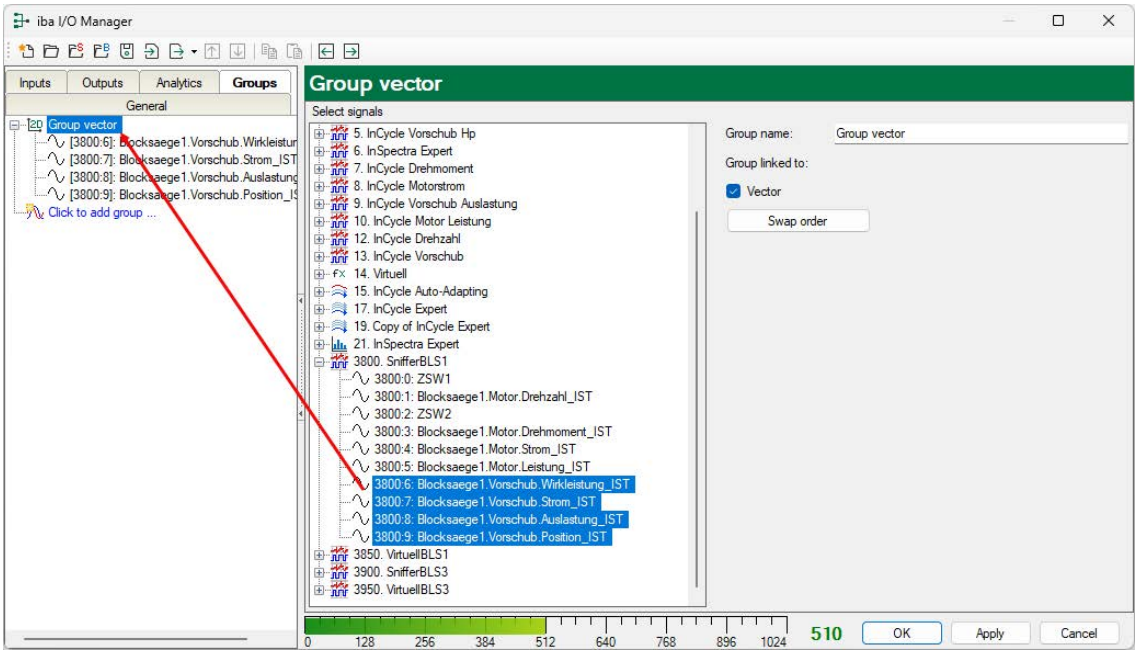
ONNX



11 Appendix

11.1 Creating vector signals

Vector signals consist of a number of signals that belong together, such as the signals of a flatness measurement system or the different zones of a temperature scanner.



1. In order to create a vector signal, first add a group. Select the *Groups* tab in the I/O Manager.
2. Click on *Click to add group* in the group tree to create a new group.

   Alternatively, right-click in the group tree area and select *Add group* from the context menu.
3. Enter group a name in the *Group name* field.
4. Select the group in the tree view and enable the *Vector* option.

→ The group is converted into a vector signal indicated by a 2D icon.

5. You may add signals to the vector from the signal tree by drag and drop.

An existing group can be transformed into a vector and vice versa at any time. Enable/disable only the option *Vector*.

By using the <Swap order> button, you can reverse the order of the signals within the vector. This is useful if, among other things, the order of the signals in the I/O Manager is not suitable for the spatial view of the visualized measurement, e.g., for 2D false color representations of material profiles.

Other documentation

Detailed information on groups and vector signals can be found in the manual *ibaPDA*, part 2.

12 Support and contact

Support

Phone: +49 911 97282-14

Email: support@iba-ag.com

Note

If you need support for software products, please state the number of the license container. For hardware products, please have the serial number of the device ready.

Product Security Incident Response Team (PSIRT) at iba

Current advisories: www.iba-ag.com/en/security

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