ibaInCycle

Monitoring and analyzing cyclical or rotating processes

Manual

Issue 1.1

Measurement Systems for Industry and Energy

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The current version is available for download on our web site www.iba-ag.com.

Version	Date	Revision - Chapter / Page	Author	Version SW
1.1	01-2022	ibaAnalyzer-InCycle	CR-st	7.3.4

Content

1 About this manual

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 vibration measurement 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>
File names, paths	"Filename", "Path" Example: "Test.doc"

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.

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 makes it possible to use 4 InCycle modules. If more modules are needed, an additional *ibaInCycle* license must be purchased for each 4 additional modules.

Order no.	Product name	Description
30.681215	ibaInCycle	Analysis of cyclical processes, 4 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

3 System requirements

3.1 Hardware

- PC, Multicore CPU 2 GHz, 4 GB RAM, 100 GB HDD

3.2 Software

- *ibaPDA*, version 7.3.4 or higher
- *ibaAnalyzer*, version 7.3.0 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.

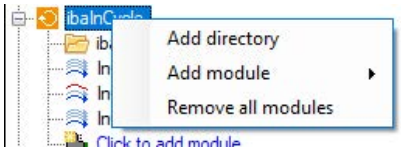


Fig. 1: Context menu of the ibaInCycle interface

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.

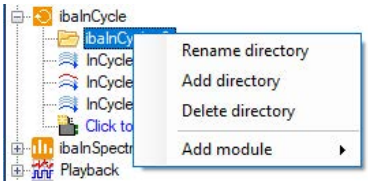


Fig. 2: Context menu of the ibaInCycle subdirectory

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.

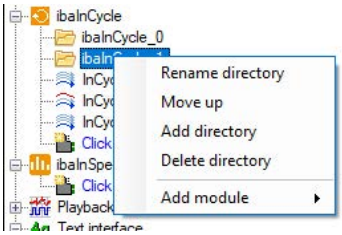


Fig. 3: Context menu of ibaInCycle subfolder, several subdirectories

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).

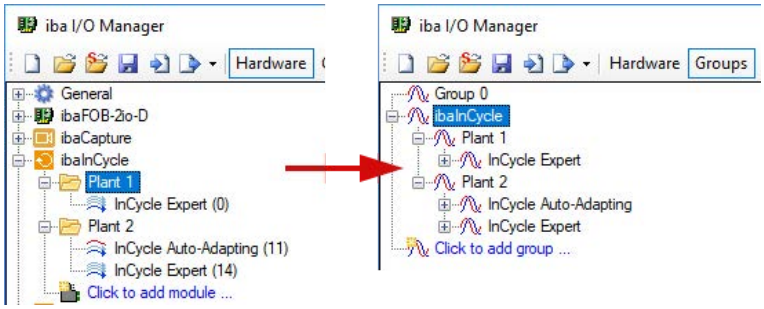


Fig. 4: ibaInCycle interface structure and resulting group structure

4.2 Know-how protection

4.2.1 Introduction

The know-how protection area offers mechanisms for protecting intellectual property associated with certain calculations and/or settings in *ibaPDA*, which are considered as user know-how worth protecting.

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.
- Dongle protection
  The protected elements are only executed on systems that run with a previously registered dongle. Several dongle numbers can be registered.

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

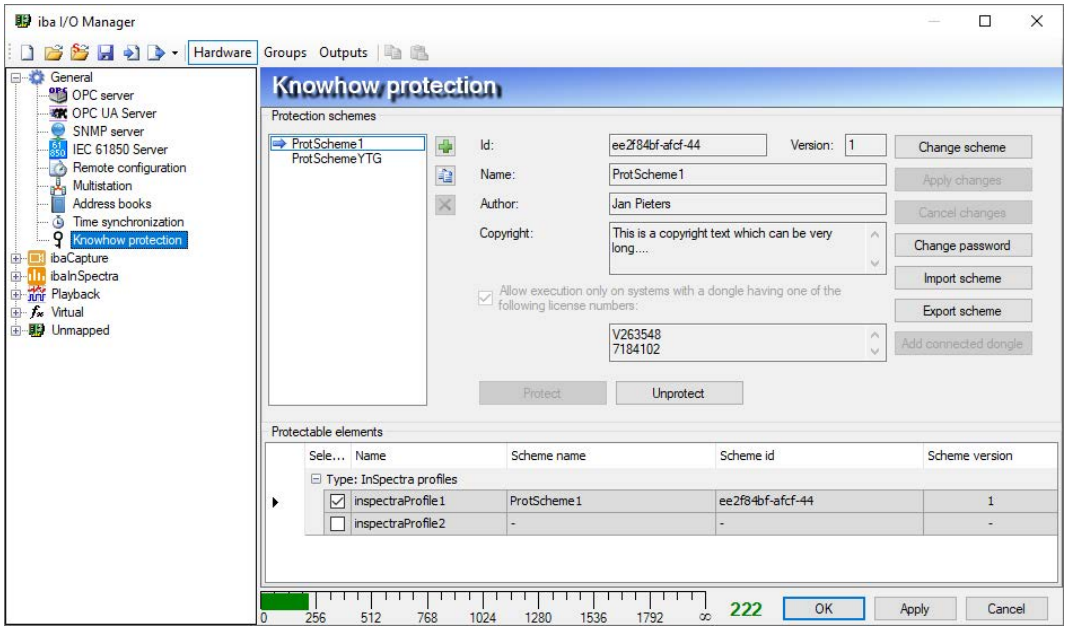


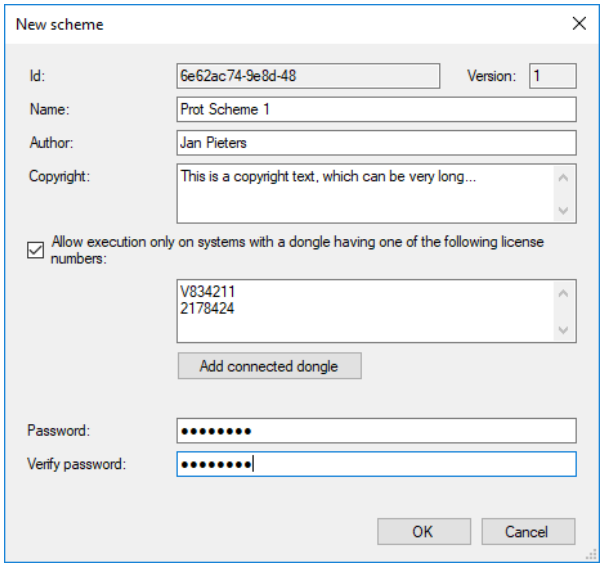
Fig. 5: Configuration of the know-how protection

The basic procedure is as follows:

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

4.2.2 Creating a protection scheme

1. Open the I/O manager and highlight the branch *Knowhow protection* in the interface tree under the node *General*.
2. Click on the button with the green plus symbol to add a new rule.
   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 (dongle protection). Then enter all respective dongle or license numbers in the field below. You can easily enter the number of the respective connected dongle 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 “Configure profiles” dialog and click on <Unlock>.

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

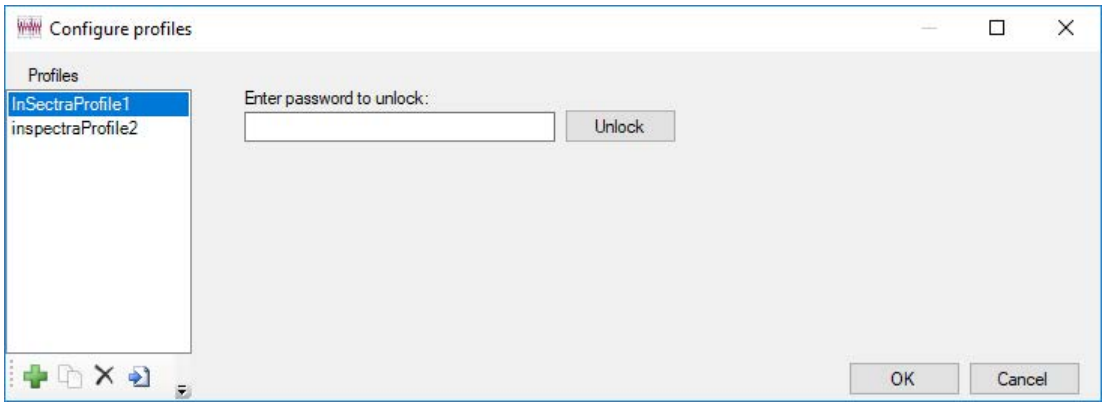


Fig. 6: ibaInSpectra example: The password must be entered in order to view protected profiles.

5 ibaInCycle in ibaAnalyzer

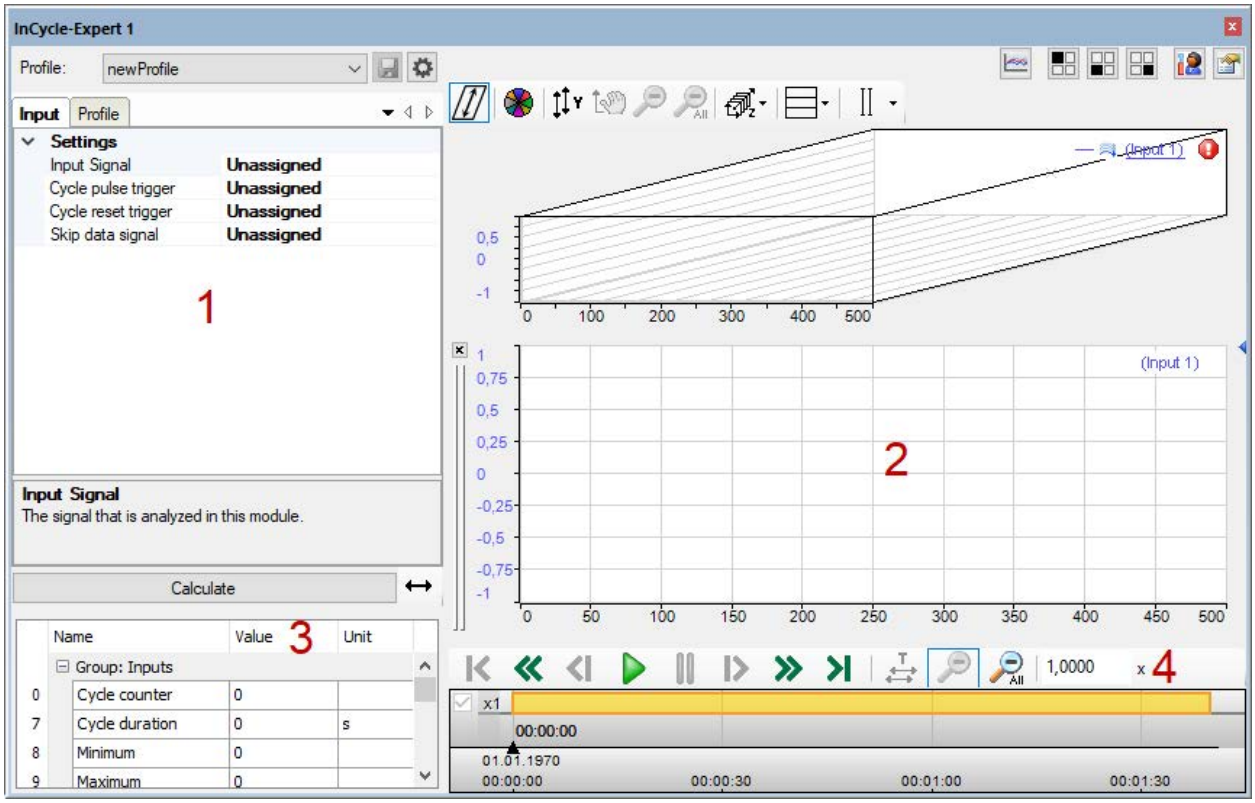
ibaInCycle is integrated in *ibaAnalyzer* with the InCycle Expert view. Here you can create profiles and test calculations offline.

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

 Settings for the current view

 *Preferences* for global settings for all InCycle Expert views

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 60

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 21

A detailed description of the circle view can be found in chapter ↗ *The circle view*, page 53

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 68

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.

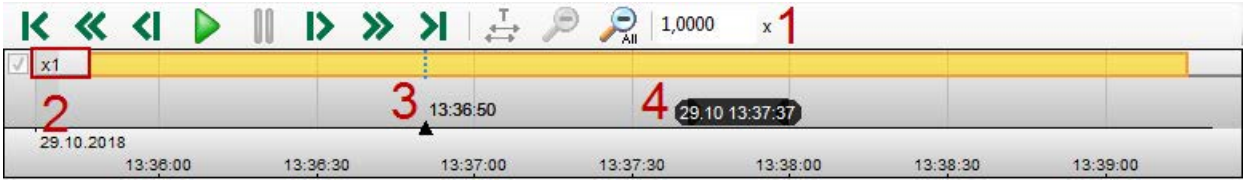


Fig. 7: Playback area

Meaning of buttons:

Start / stop playback

Jump to start / end

Reduce/increase replay speed
(The set replay speed is shown on the left (1))

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 charts 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.

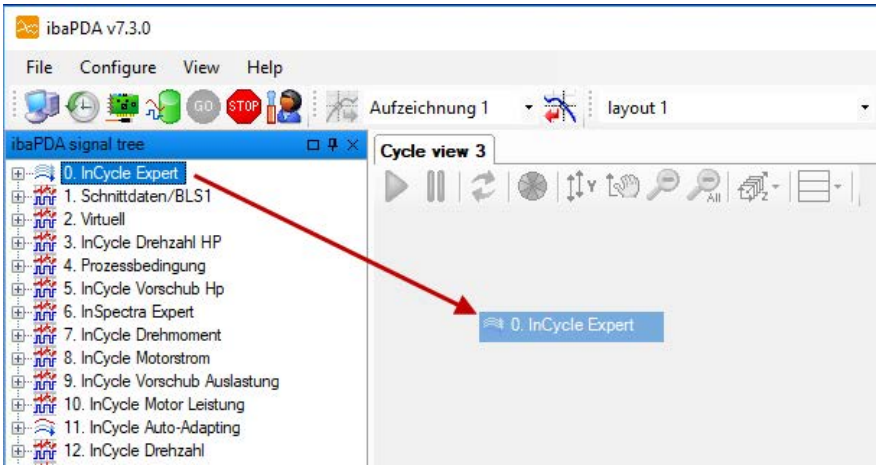


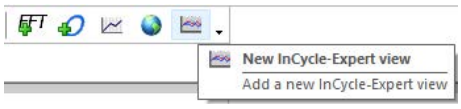
Fig. 8: Drag InCycle module into cycle view

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.

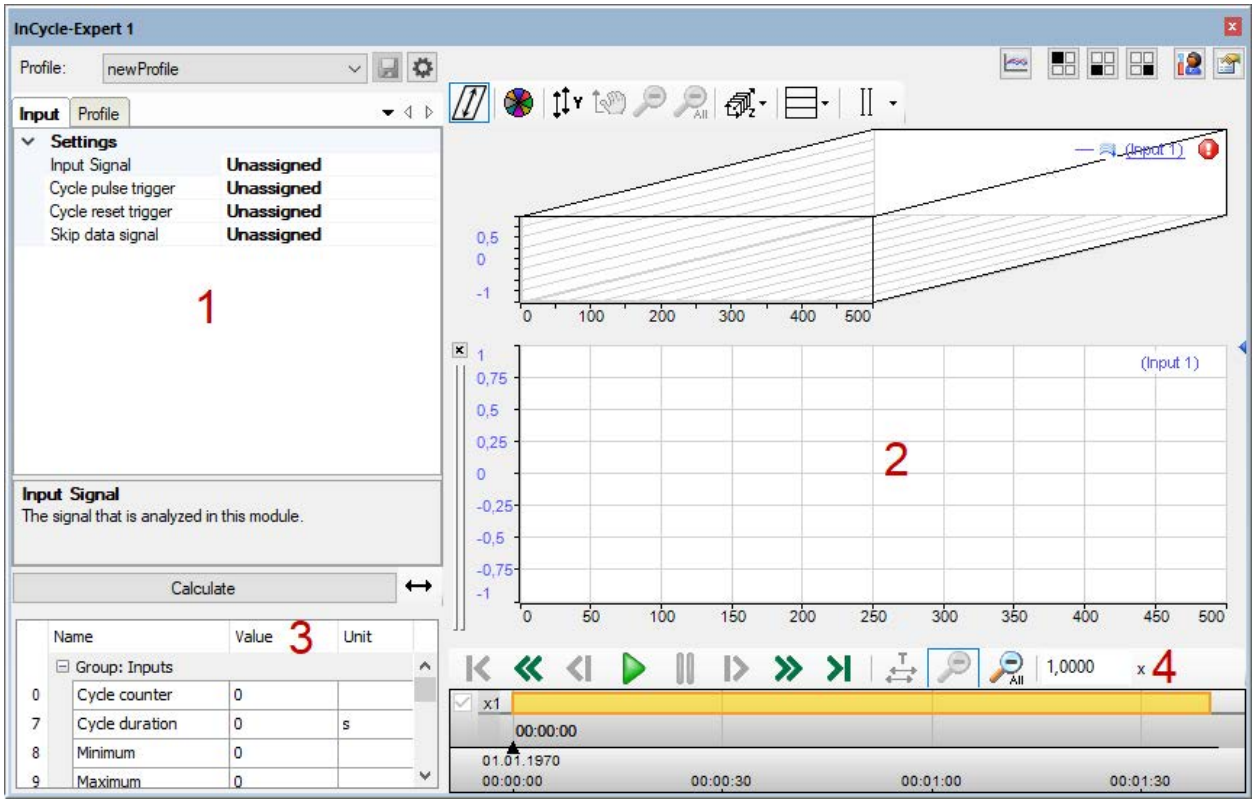


Fig. 9: InCycle Expert view in ibaAnalyzer

1 Configuration area (input signals, profiles) see ↗ *Setting calculation parameters*, page 66

2 Visualization area of the cycle view

3 Result area, see ↗ *Results of the calculations of the Expert module*, page 68

4 Playback area (playback settings), see ↗ *Playback area*, page 19

The description of the cycle view can be found in chapter ↗ *Overview of the cycle view*, page 23.

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.

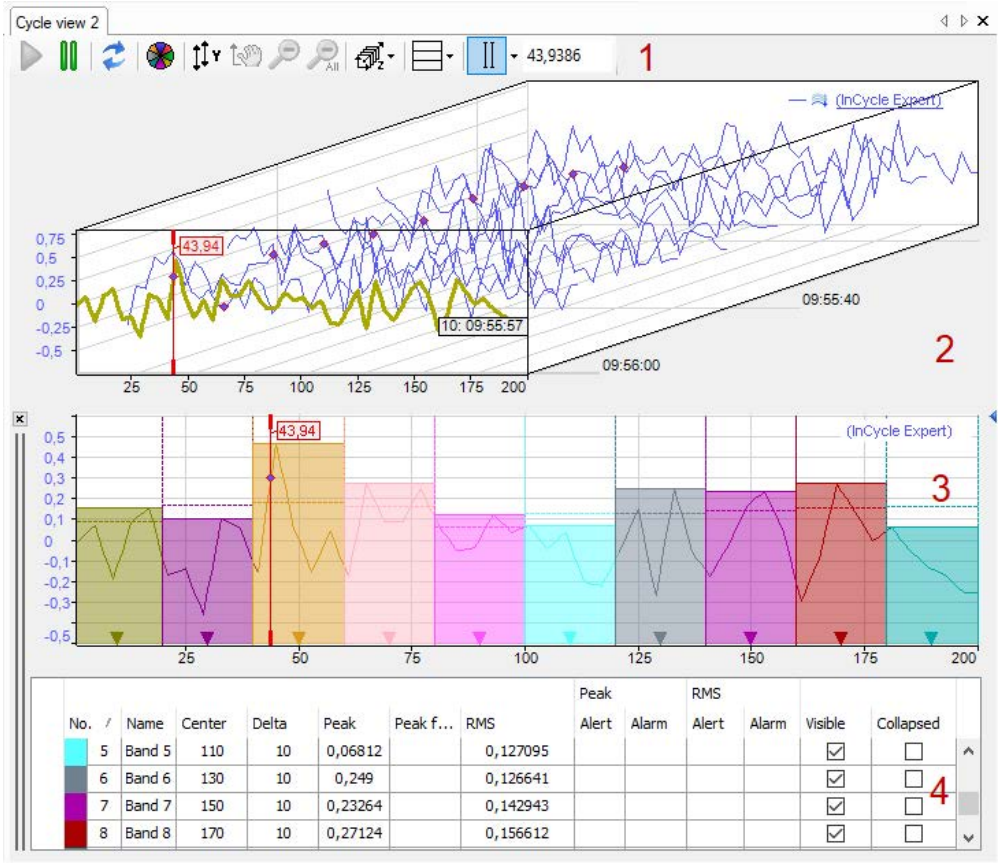


Fig. 10: Overview of the cycle view

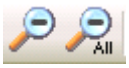
Legend

1	Toolbar
2	Main window
3	Cycle slave graph
4	Cycle slave 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 painted 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 slave graph Cycle slave table
	Show/hide, center, configure interactive marker No function for configured markers
	[1] acts individually on the main window or cycle slave 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.

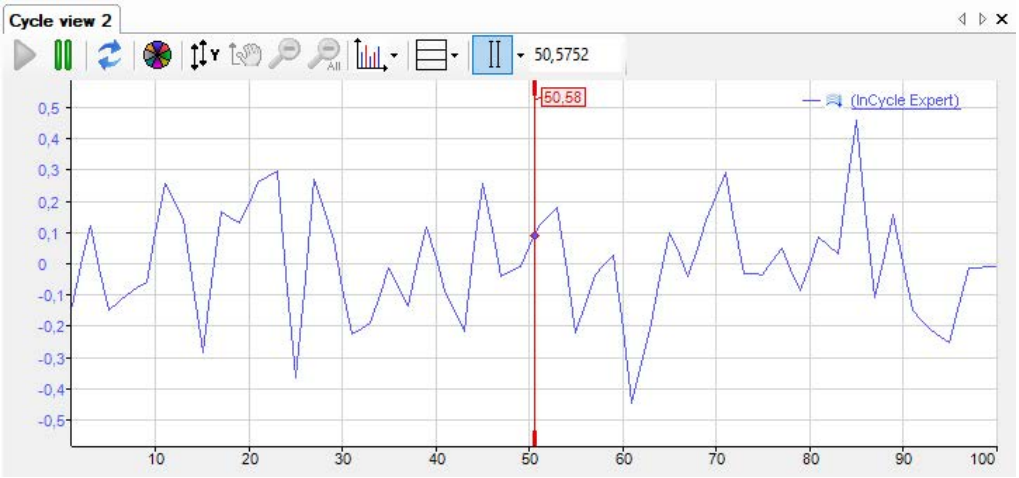


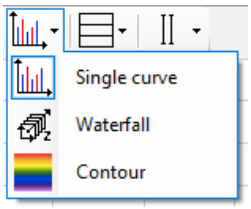
Fig. 11: Example of single curve

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 25

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 chart 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.

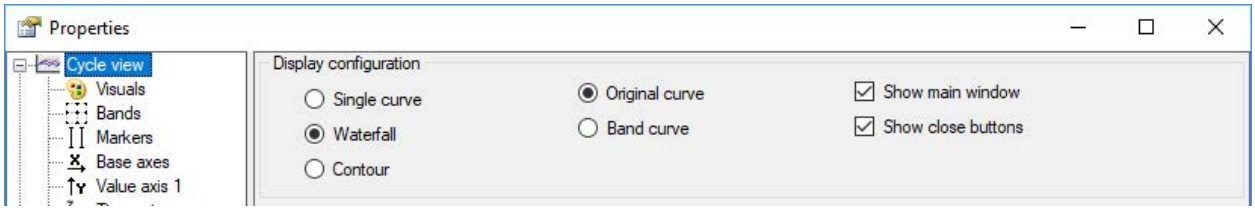


Fig. 12: Display configuration in the properties dialog

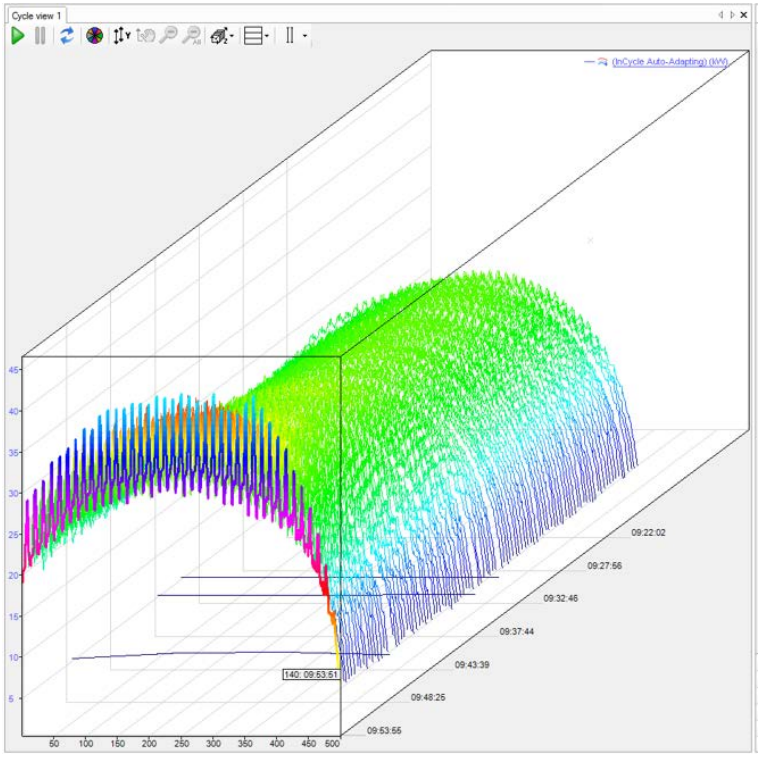


Fig. 13: Waterfall example

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 this and re-enable it again later at any time. See chapter ↗ *Settings of the cycle view*, page 42

Scales are always displayed at the side of the chart not 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 ↗ *Time axis*, page 52

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.

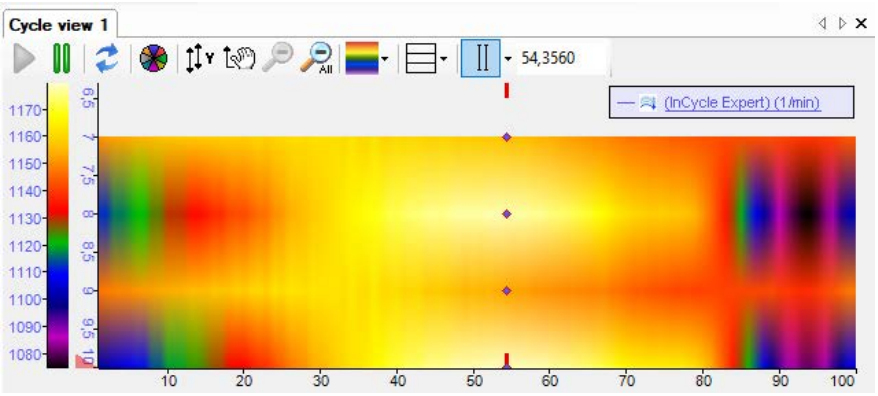


Fig. 14: Example contour view

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.

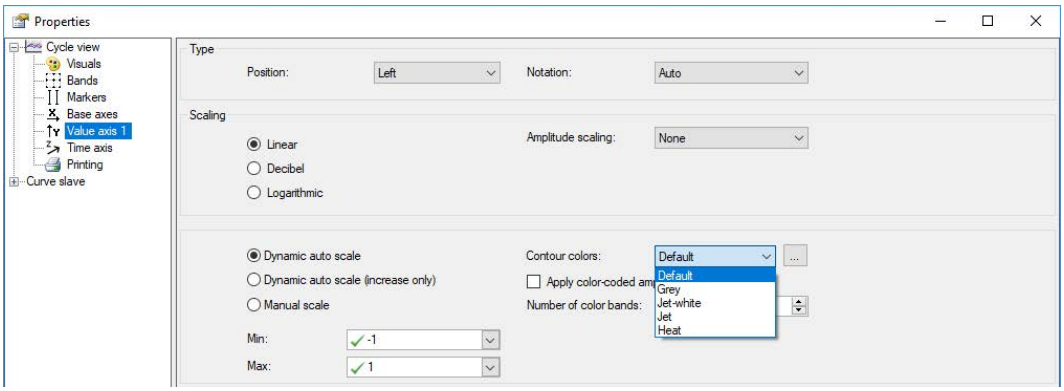
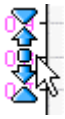


Fig. 15: Setting the color scheme for the contour view

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 symbol displays whether it is an InCycle Expert or InCycle Auto-Adapting module . Then the module name and unit of the input signal follows.

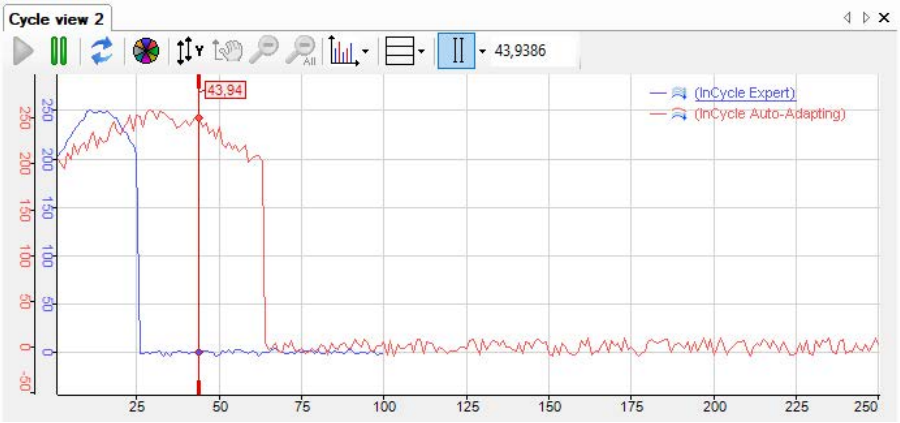


Fig. 16: Legend in the cycle view

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

Right clicking in a legend row makes the context menu of the legend appear.

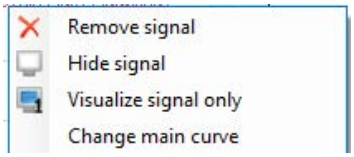


Fig. 17: Context menu

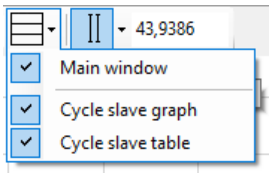
Clicking on “Remove signal” deletes the corresponding chart. Clicking on “Hide signal” hides the signal and shows the signal name transparently. The signal is only temporarily hidden and can always be displayed again.

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

In the context menu under “Properties,” you can display the selected settings for the charts. 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 slave graph and cycle slave 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.

Fig. 18: Display and data cycles visible and collapsed

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

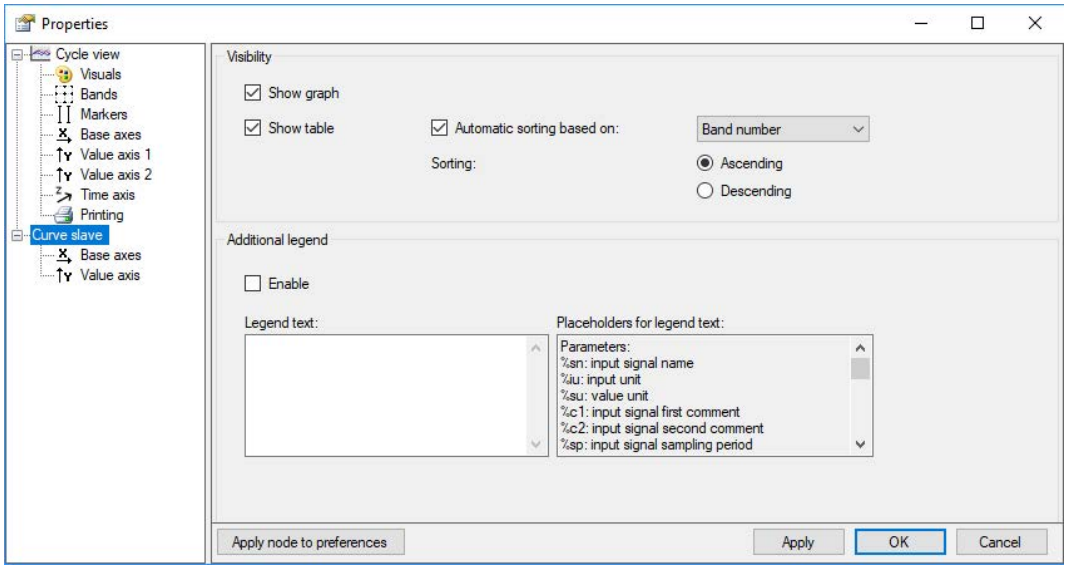


Fig. 19: Properties of the cycle view

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 chart. 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 slave graph

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

- Charts
- Ranges
- Value bands
- Characteristic values of the ranges
- Limit values of the ranges

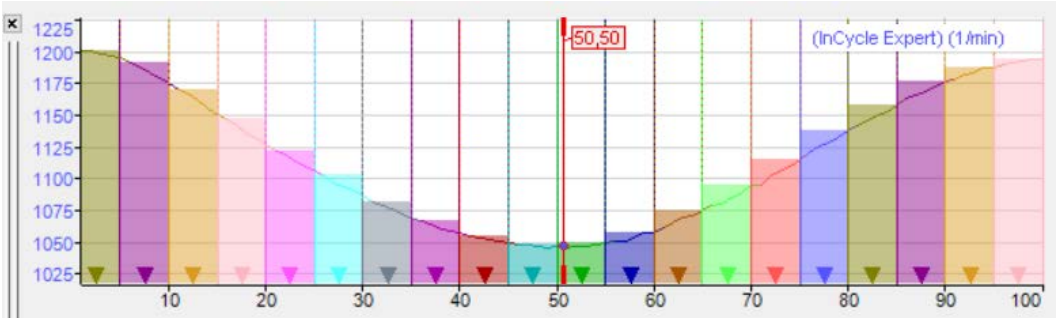
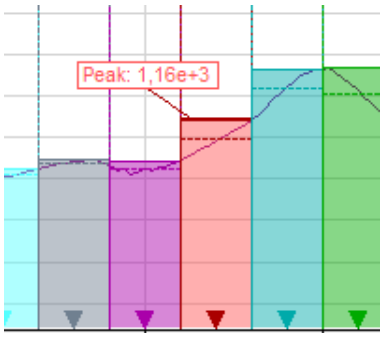


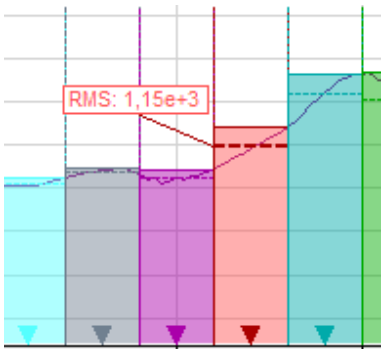
Fig. 20: Example of cycle slave graph

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

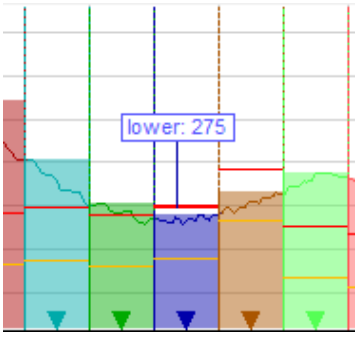
The most important parameters of the ranges are shown with dotted and colored lines. You are shown the respective values when you position the cursor on the lines (hovering).



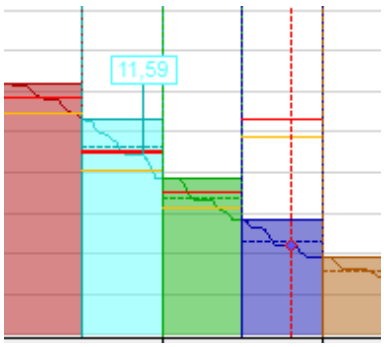
Peak



RMS



Upper/lower limit



Warning/alarm limit

The configuration of the ranges is described in chapter ↗ *Bands*, page 47. 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 curve is to obtain a color change when violating the alarm limits.

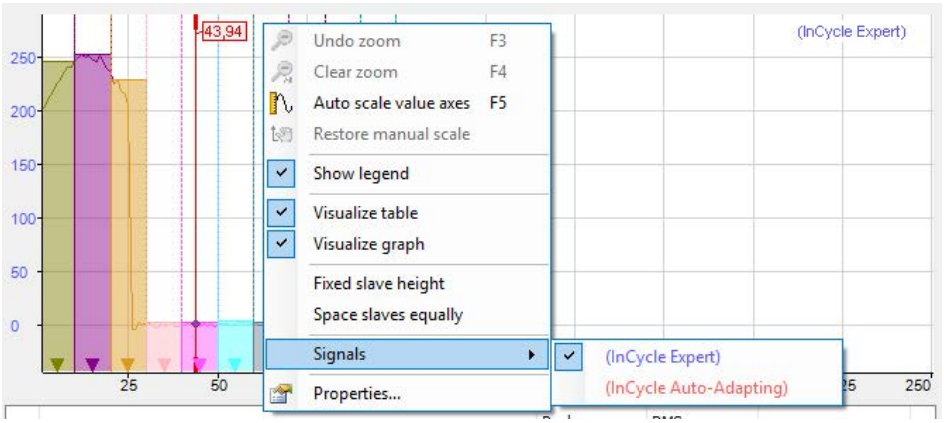


Fig. 21: Context menu for adding additional signals

If there are several charts in the display, individual display properties can be assigned to every chart. If the cycle slave 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 provide for a manual scale.

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

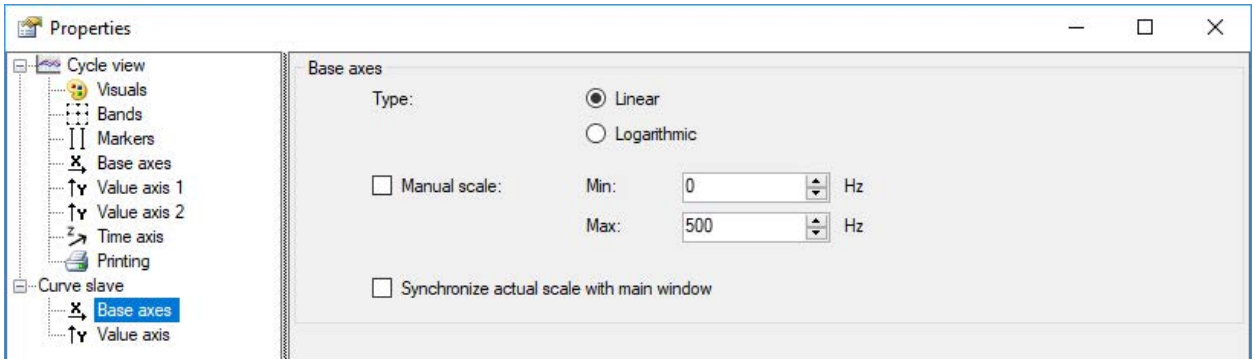


Fig. 22: Properties of the cycle slave graph, base axis

Value axis

The cycle slave graph has only one value axis. All charts 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.

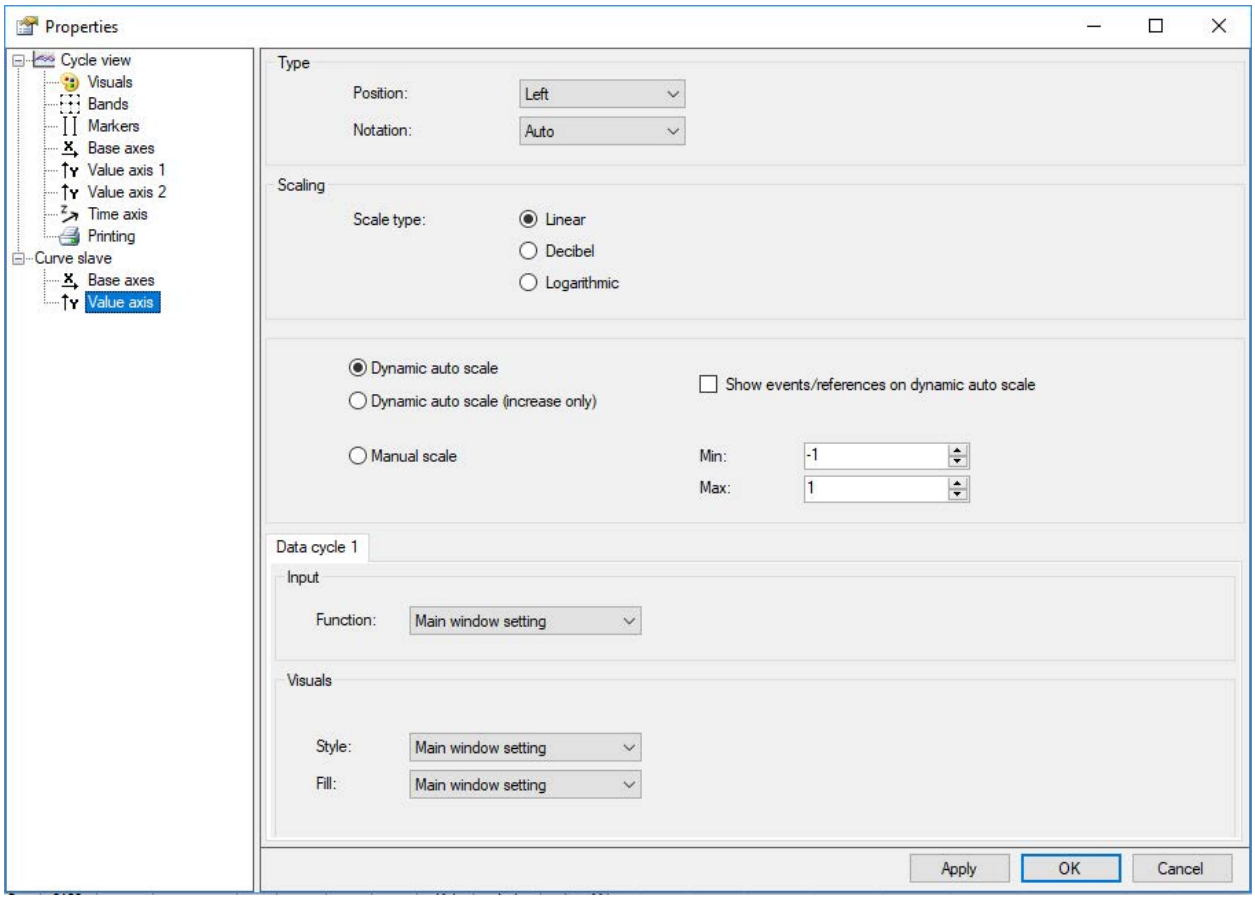


Fig. 23: Properties of the cycle slave graph, value axis

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

In the *Data cycle x* tabs, you can determine the display properties for style and filling for each data cycle separately. You can adopt the main window setting or select individual settings from the respective dropdown menu.

6.5.2 Cycle slave table

In the data table, a line is automatically created for every defined area of the displayed InCycle module. The parameters and – if configured – the results are shown for each area.

								Peak		RMS			
No.	Name	Center	Delta	Peak	Peak fr...	RMS		Alert	Alarm	Alert	Alarm	Visible	Collapsed
Show bands	Enable collapsed bands : (InCycle Auto-Adapting)												
0	Band 0	5	5	227,373		214,032						☑	☐
1	Band 1	15	5	238,97		230,912						☑	☐
2	Band 2	25	5	252,826		248,182						☑	☐
3	Band 3	35	5	253,496		247,765						☑	☐
4	Band 4	45	5	248,742		240,958						☑	☐
5	Band 5	55	5	235,921		217,594						☑	☐
6	Band 6	65	5	202,484		110,29						☑	☐
7	Band 7	75	5	8,856		6,55205						☑	☐

Fig. 24: Data table example

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

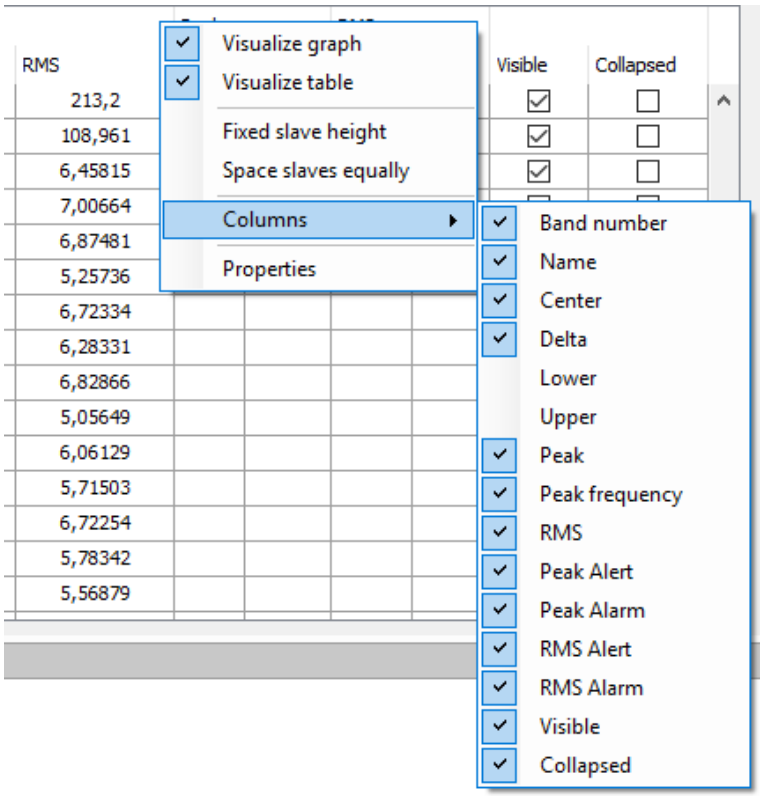


Fig. 25: Selection of the characteristic value columns

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 slave*. See chapter ↗ *Cycle slave graph and cycle slave table*, page 29

	No.	Name	Center	Delta	Peak	Peak fr...	RMS	Peak Alert	Peak Alarm	RMS Alert	RMS Alarm	Visible	Collapsed
▸	0	Band 0	5	5	222,853		210,804					☑	☐
	6	Band 6	65	5	208,785		113,449					☑	☐
	20	Band...	205	5	9,534		5,47118					☑	☐
	19	Band...	195	5	9,482		6,04339					☑	☐
	24	Band...	245	5	9,432		4,60625					☑	☐
	23	Band...	235	5	9,352		6,78062					☑	☐
	17	Band...	175	5	9,214		5,86167					☑	☐
	16	Band...	165	5	9,202		5,97208					☑	☐

Fig. 26: Sorting the data table according to the peak

Show bands / enable collapsed bands

Use this option to globally decide for all bands whether these are displayed in the *Cycle slave 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.

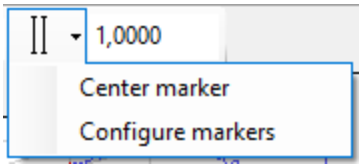
6.6 Markers

For a better evaluation of the cycles analysis, markers can be displayed in the main window and in the *Cycle slave 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. In the *Cycle slave graph*, only this type of marker is available.
- Configured marker
  Several markers of this type can be used in a display. This marker cannot be moved manually but its position is not necessarily fixed. The marker position can be set to a constant value or controlled by a signal.

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 slave graph.



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

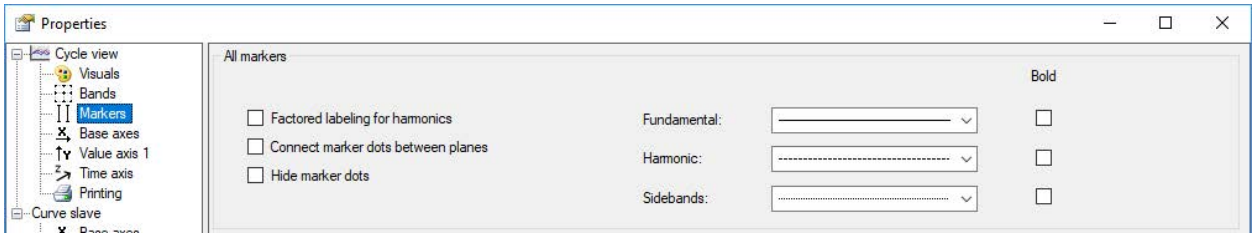


Fig. 27: General marker properties

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

To distinguish better, you can allocate the different markers (average, harmonic markers and sideband markers) their own line patterns or the bold mark-up.

6.6.1 Interactive marker

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

Fig. 28: Interactive marker symbol

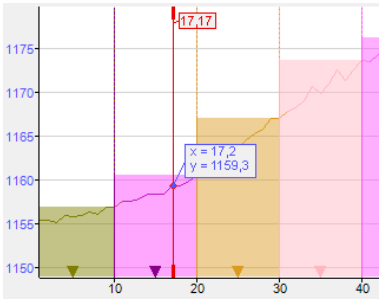
When activating for the first time, the marker is displayed at the position 0. Every time the marker is switched off and on again, it memorizes the last position.

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

Table 1: Key operation for marker movement

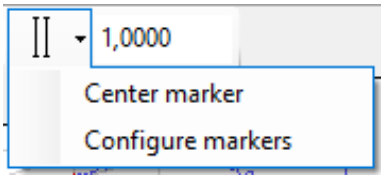
When you move the mouse over the thickened end of the marker, the cursor changes to a double-arrow symbol. You can then move the marker. In the label with the marker color (default: red), the X value is displayed on the base axis. If there are several base axes, you must specify in the settings of the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

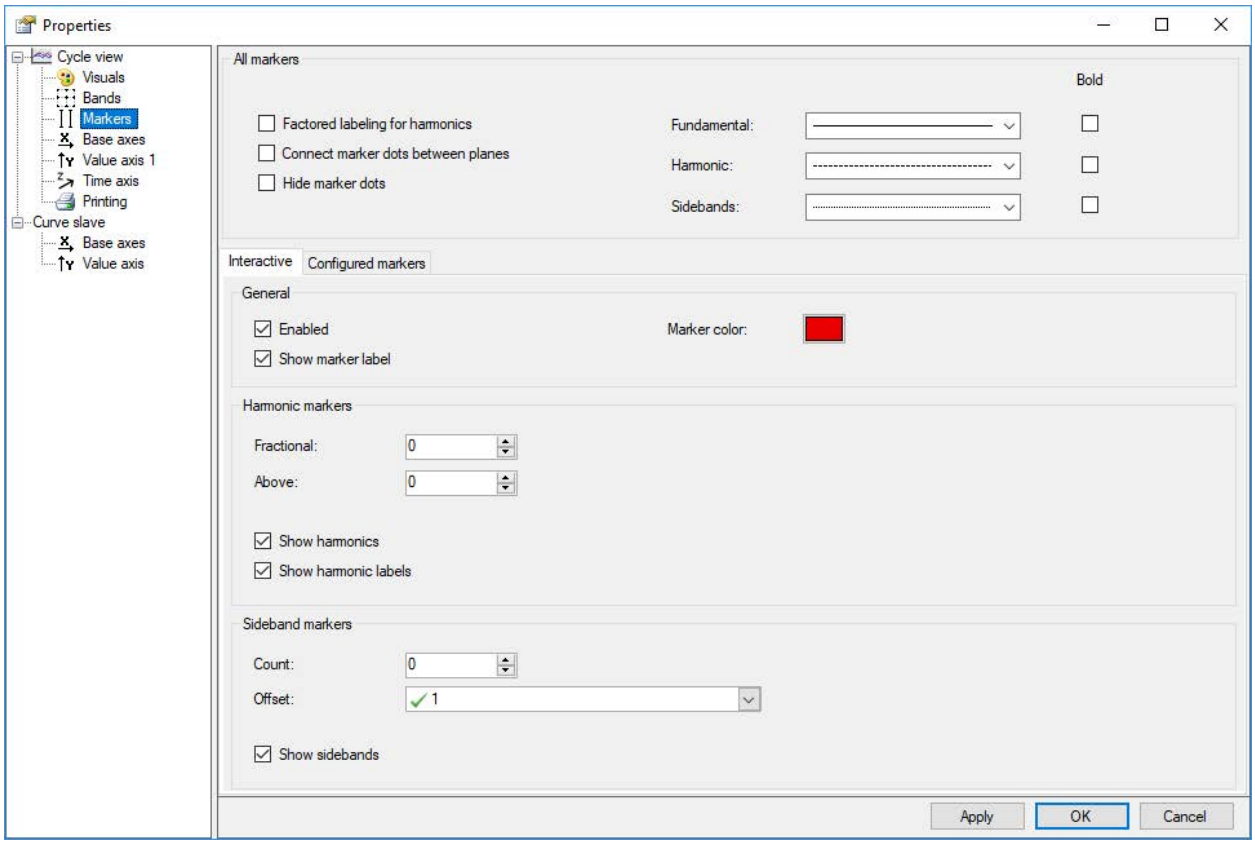


Fig. 29: Interactive marker properties

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 labels” to display the position values on the markers.

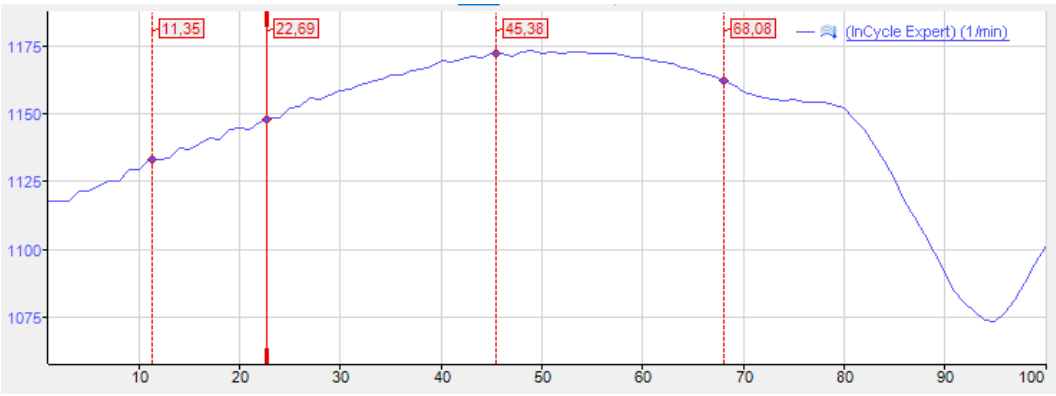


Fig. 30: Example of interactive markers with harmonic components

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.

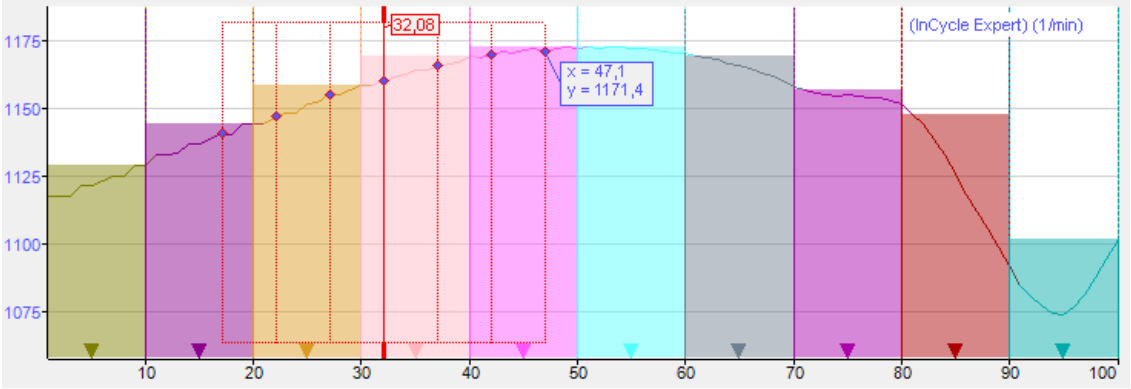


Fig. 31: Example of interactive markers with sidebands

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.

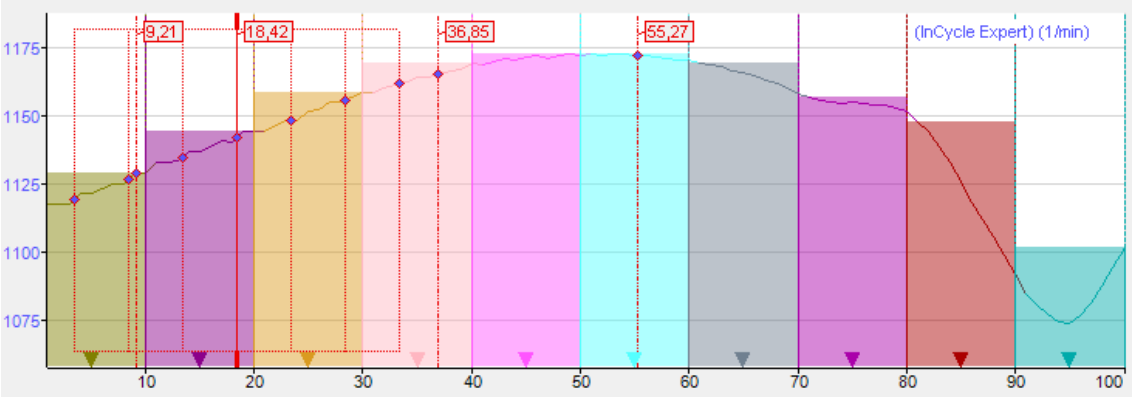


Fig. 32: View with a harmonic marker below and two above the main marker. The sideband offset is set to 5.

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.

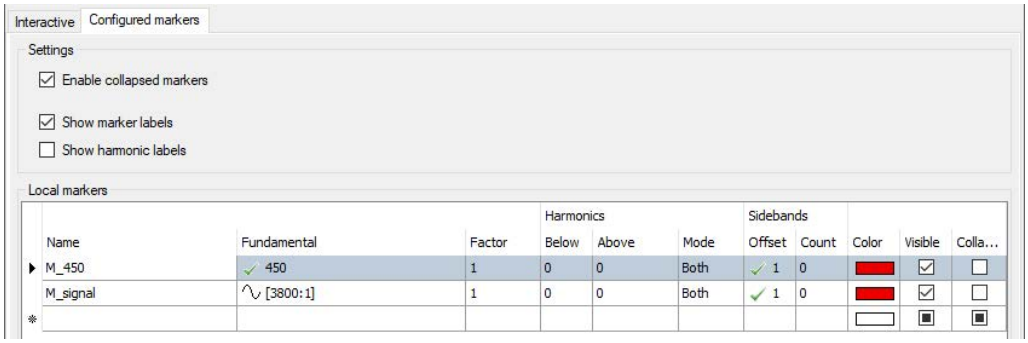


Fig. 33: Configured marker properties

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/position
For the basic position, 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.

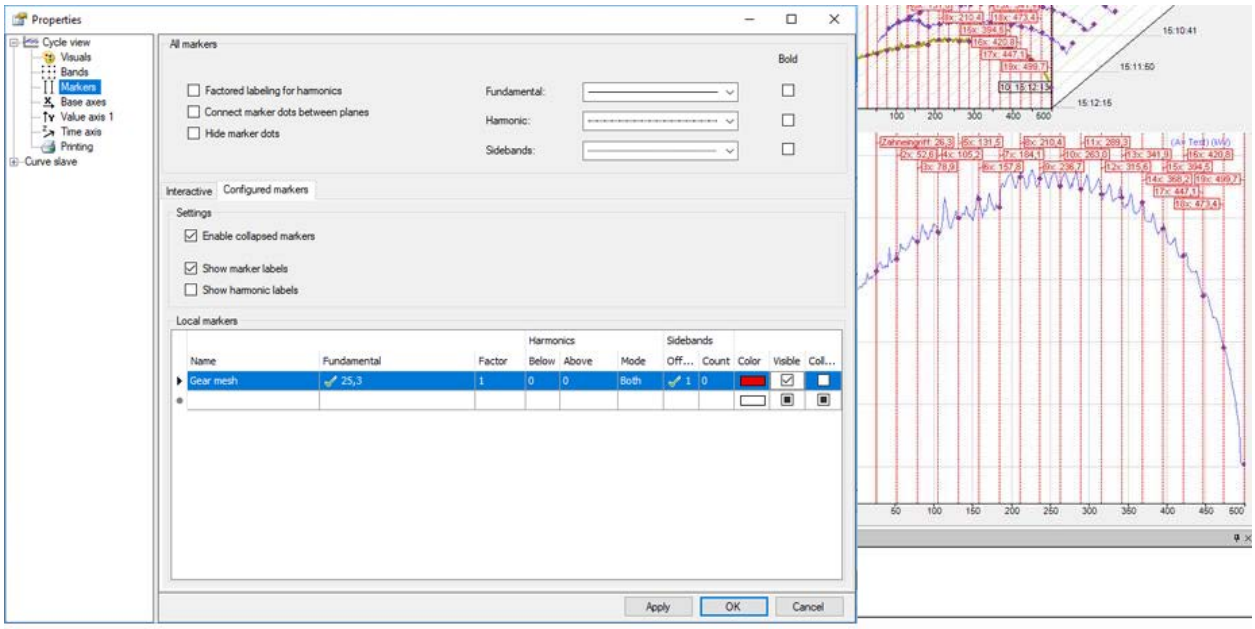


Fig. 34: Example of configured markers

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.

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 fixed marker.

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.

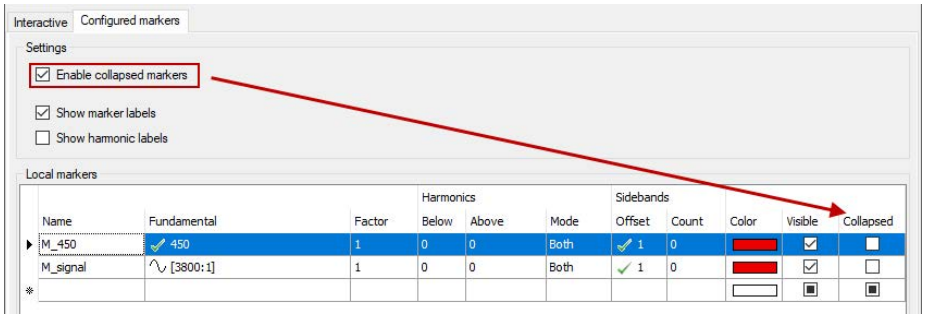


Fig. 35: Marker definition table

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.

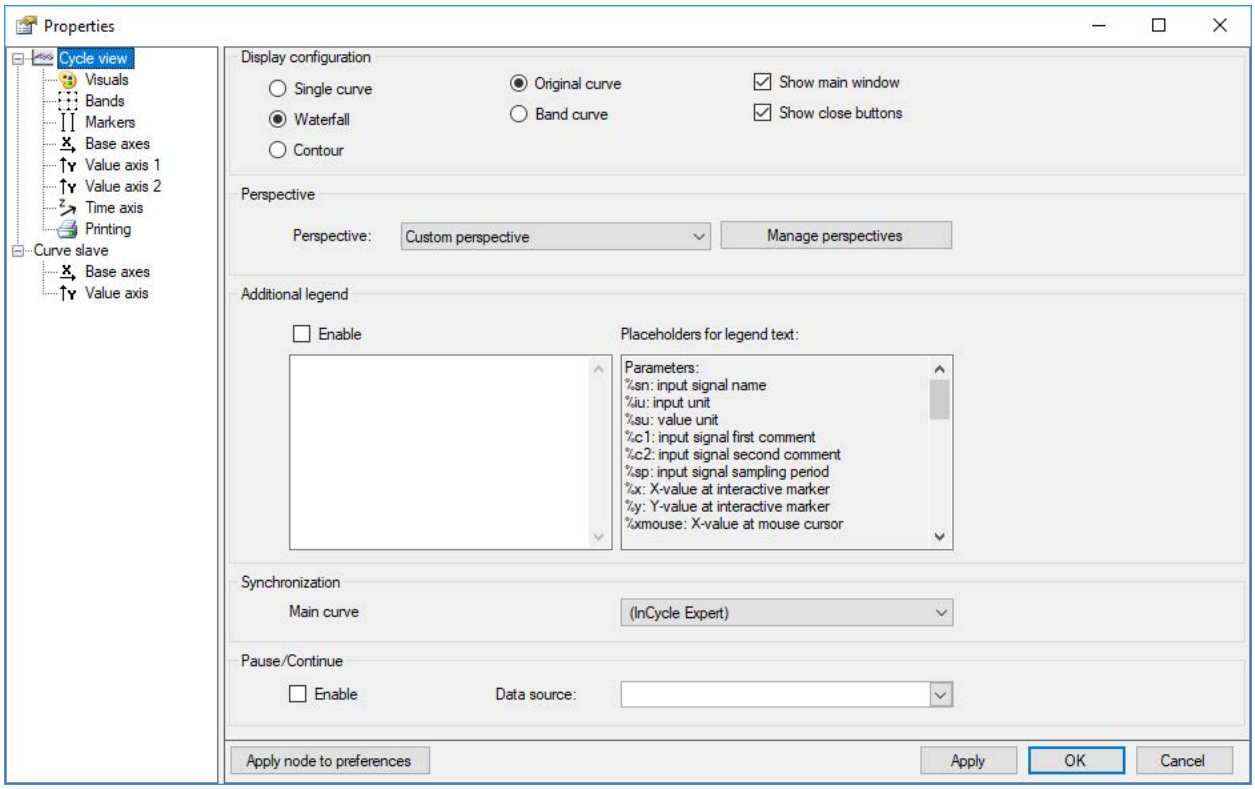


Fig. 36: Properties of the cycle view

Display configuration

Choose whether you prefer the single curve, the waterfall view or the contour view of the charts. 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 47

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

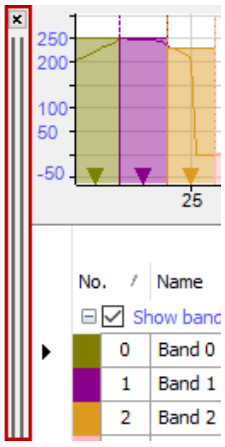


Fig. 37: Visibility of the close buttons

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.

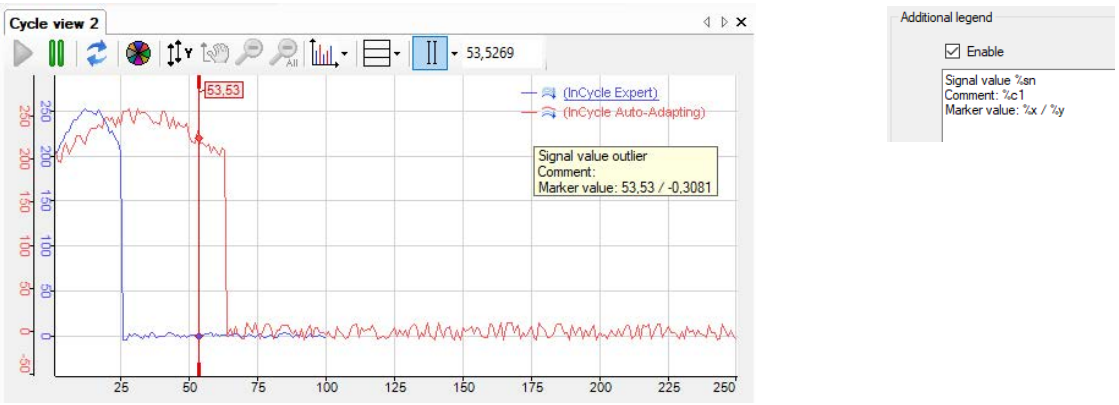


Fig. 38: Definition of additional legend (right) and display (left)

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.

6.7.1 Visuals

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

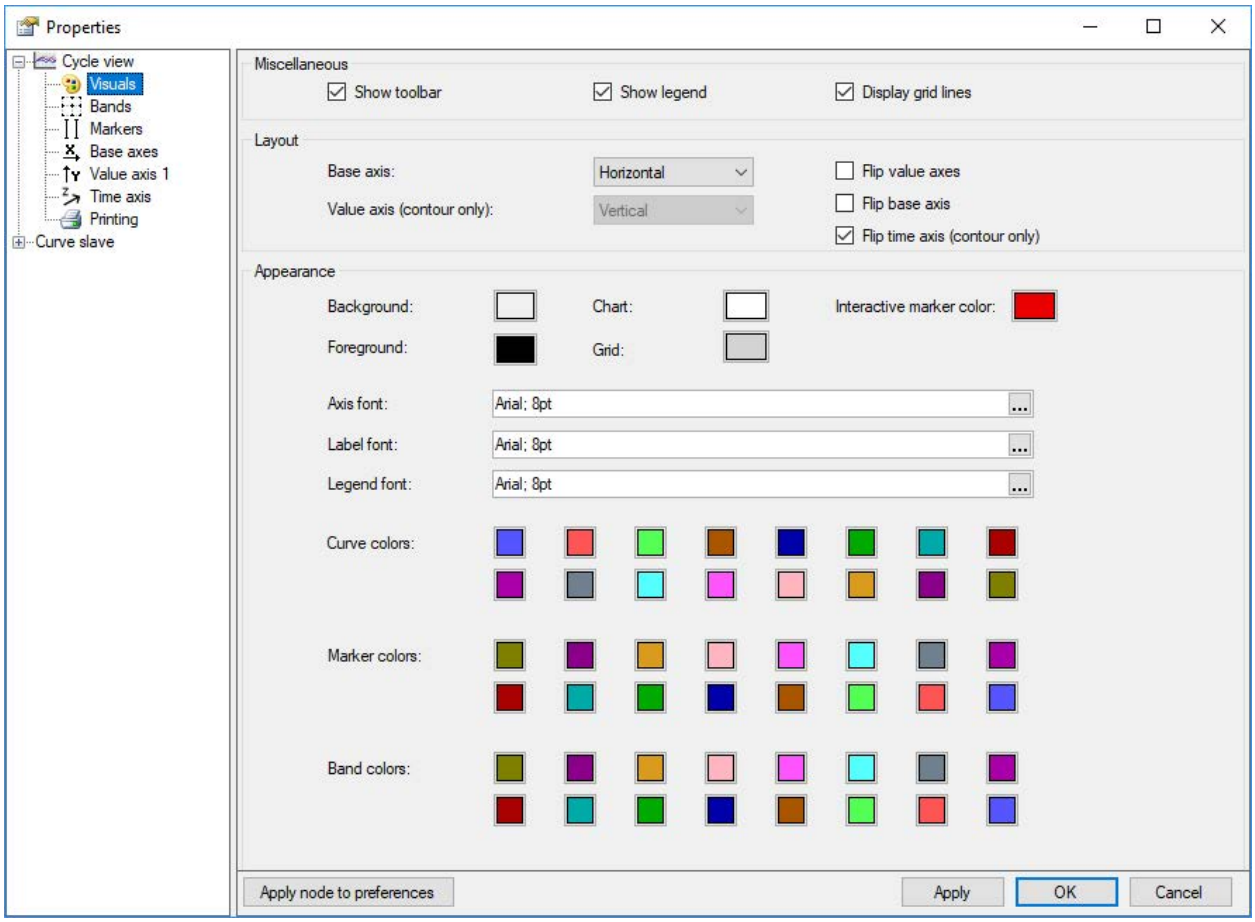


Fig. 39: Settings for visualizing the cycle view

Layout

You can change the alignment of the base axes from horizontal to vertical or vice versa by selecting the relevant option from the picklist *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
- Custom bands

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 49.

InCycle bands

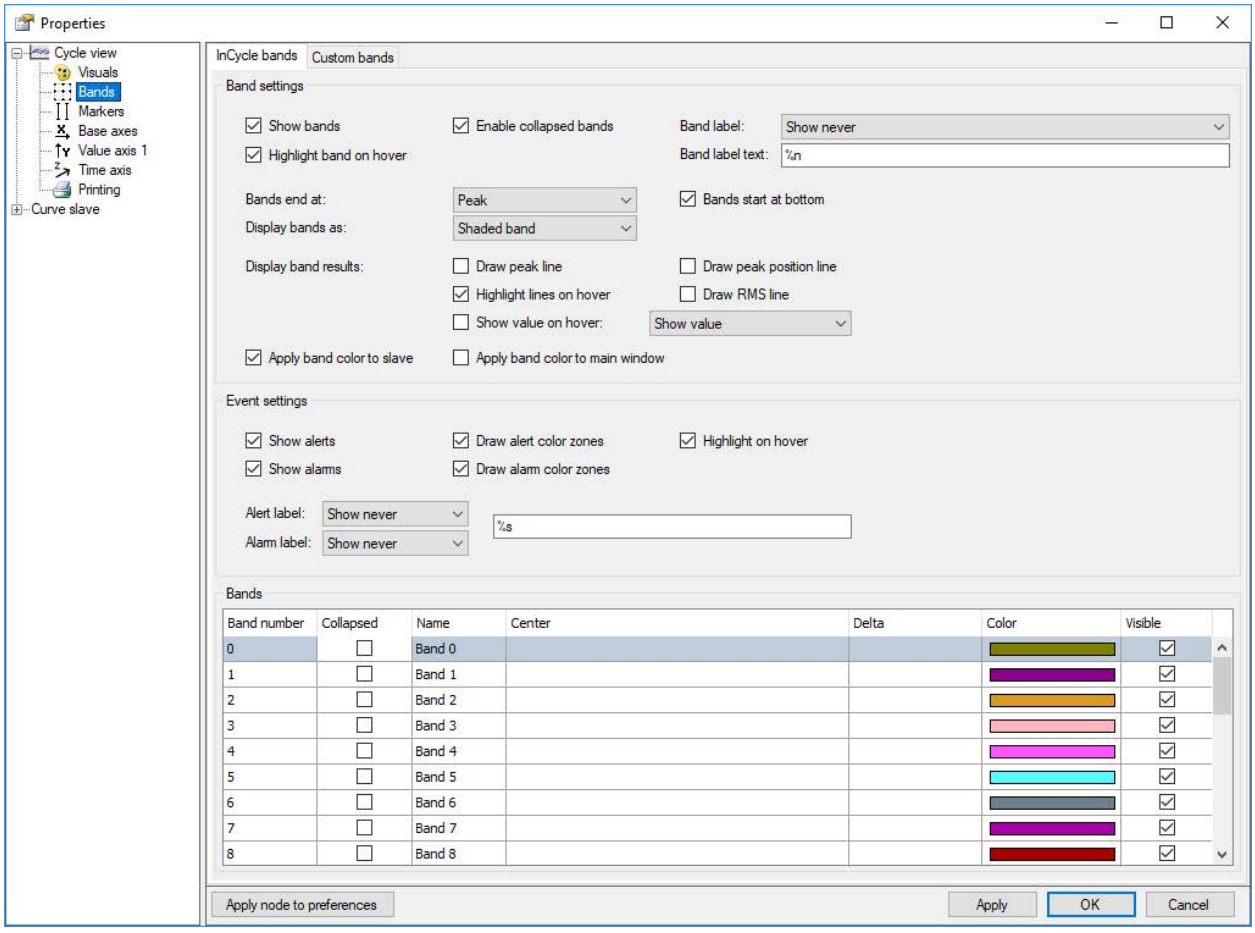


Fig. 40: InCycle bands

Band settings

Display properties of the InCycle bands can be determined in the *Band settings* area. You can enable the minimized appearance of the bands and whether the band is highlighted on hover. If this option 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.

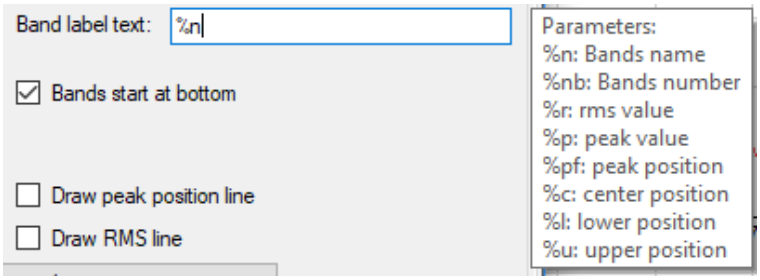


Fig. 41: Parameters for dynamic label text

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 graph, 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. Example:

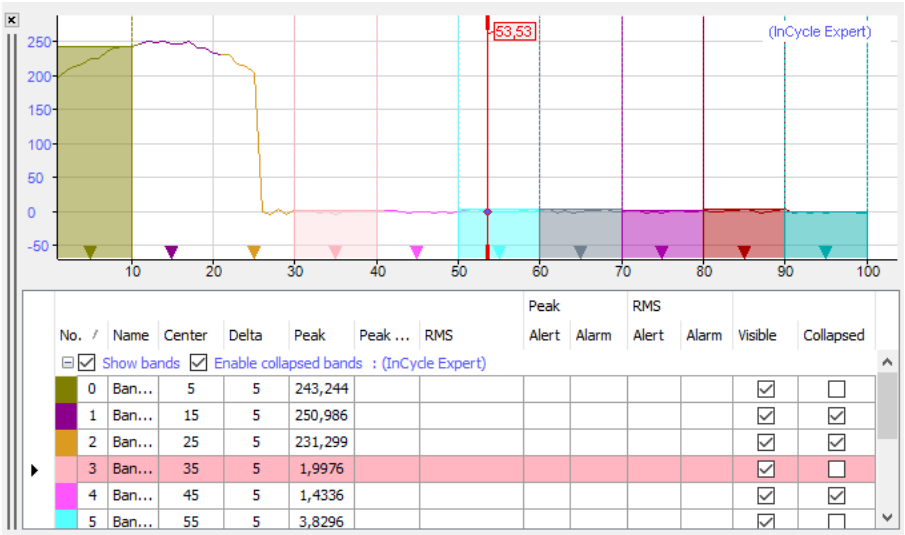


Fig. 42: Collapsed ranges are indicated by a triangle

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

Event settings
Display properties for events (warnings, alarms) can be set in the *Event settings* area. Dynamic label texts can also be defined for events. See band settings.

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.

6.7.2.1 Band curve

The *Band curve* display mode displays the results of the individual bands.

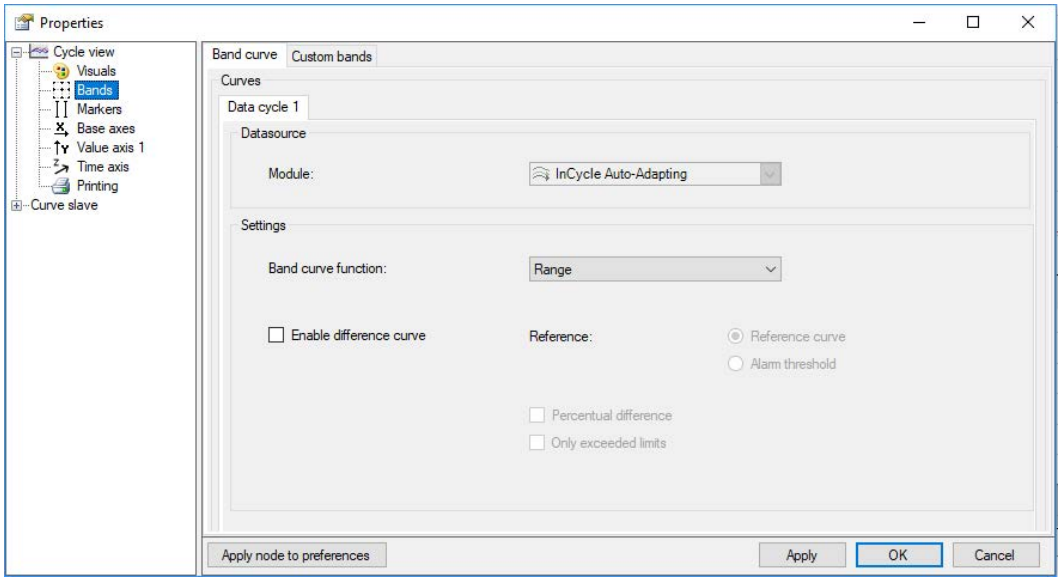


Fig. 43: Band curve settings

Datasource
Module display

Settings
In the *Band curve function* drop-down menu, you can select the curve function displayed:

- Minimum, maximum, 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.

6.7.3 Markers

You will find the description of the marker settings in chapter ↗ *Markers*, page 36

6.7.4 Base axes

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

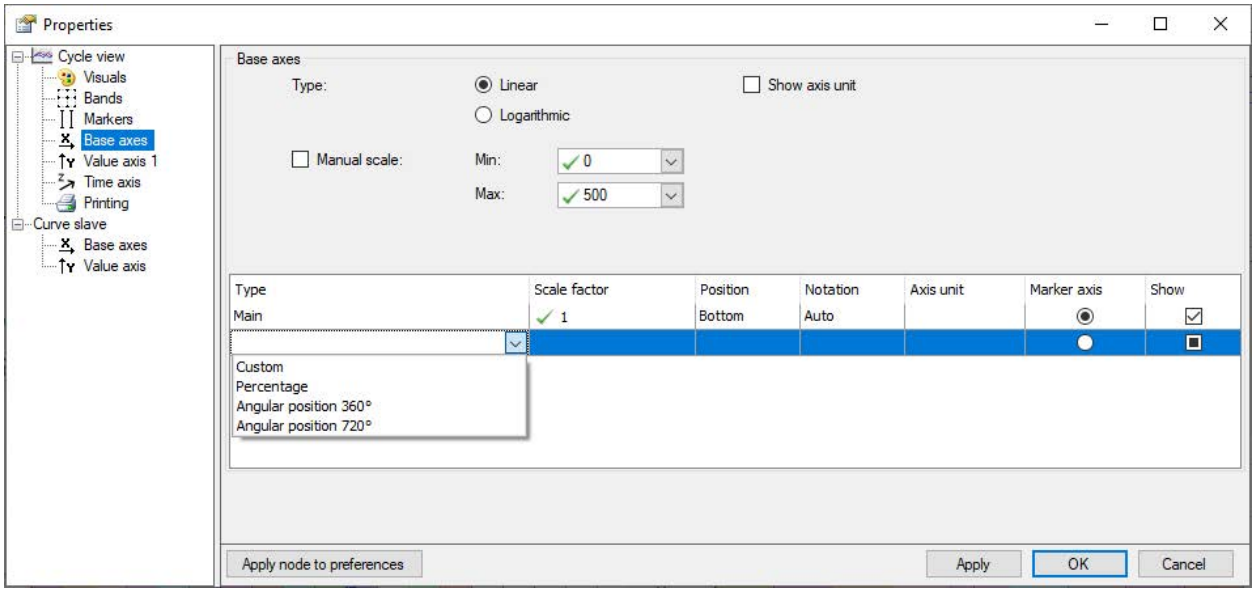


Fig. 44: Base axes settings

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 can be configured.

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 slave graph.

6.7.5 Value axes

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

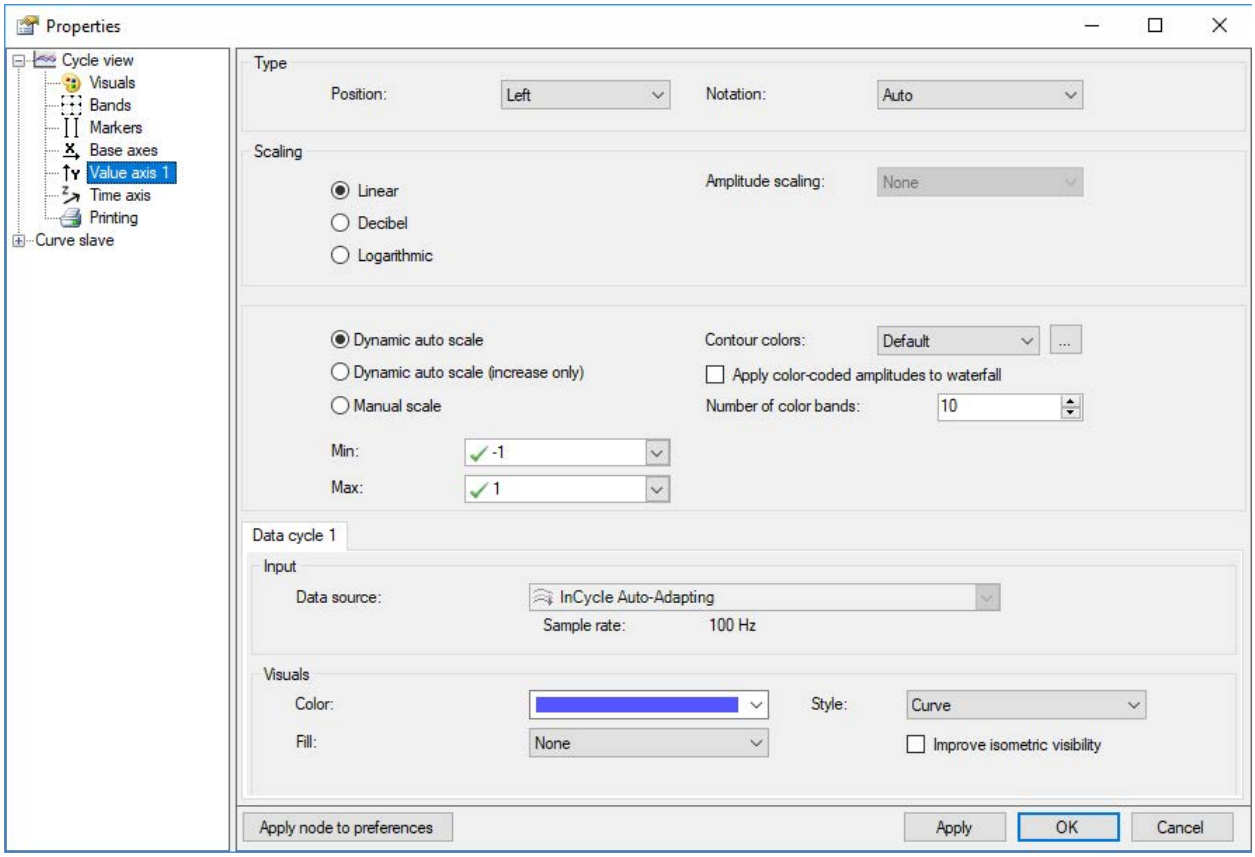


Fig. 45: Value axes settings

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.

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.

6.7.6 Time axis

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

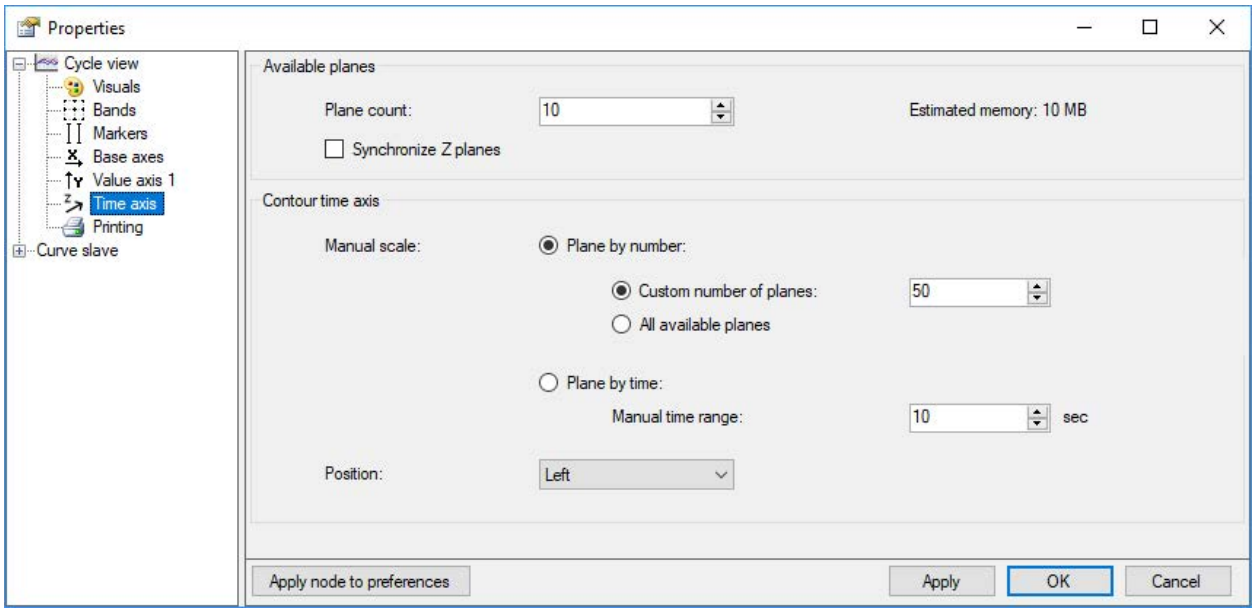


Fig. 46: Time axis settings

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 charts in a cycle view, then the charts 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 charts. With this option enabled, the cycle view will not allow a chart to advance over the Z planes until all charts have generated a new result. While the view is waiting for certain charts to generate results, the other charts keep showing their newest results on the front plane.
- Automatically set plane count (option only in *ibaAnalyzer*) The number of charts (data cycles) is automatically detected (max = 500)

Contour time axis

- Manual scale
  You can choose between a manually defined plane count or whether a new plane will be displayed after a specified time.
- Position
  Set the position (left or right) of the time axis.

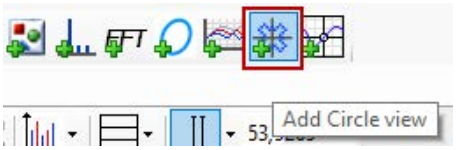
7 The circle view

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

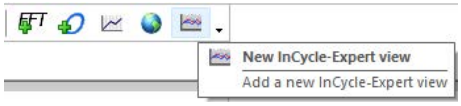
Use the button to add a new circle view:



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 17

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.

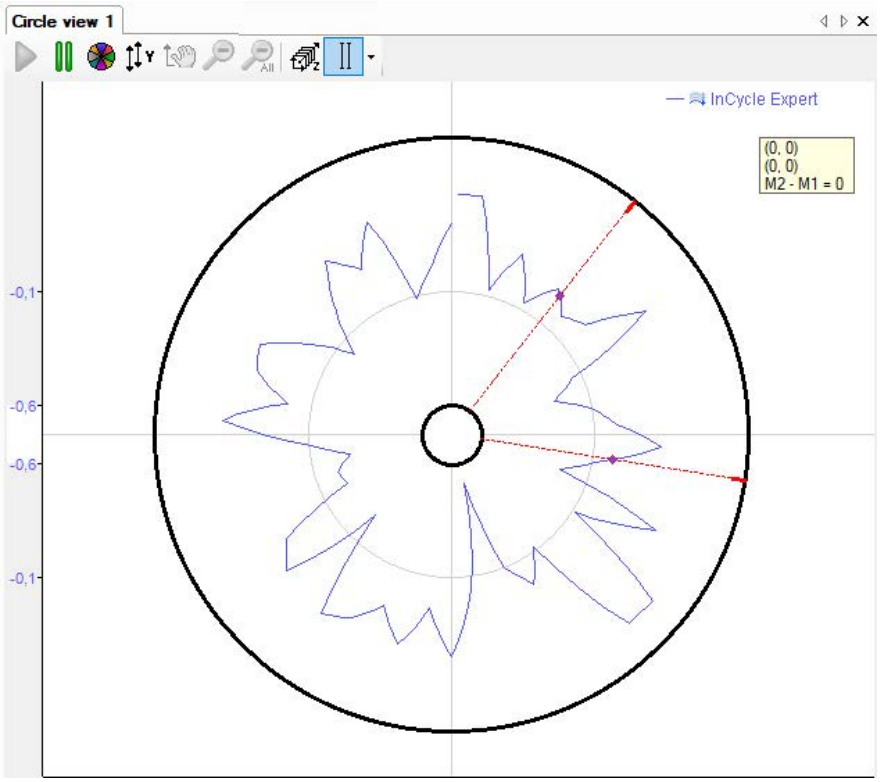


Fig. 47: Overview of the circle view

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 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.

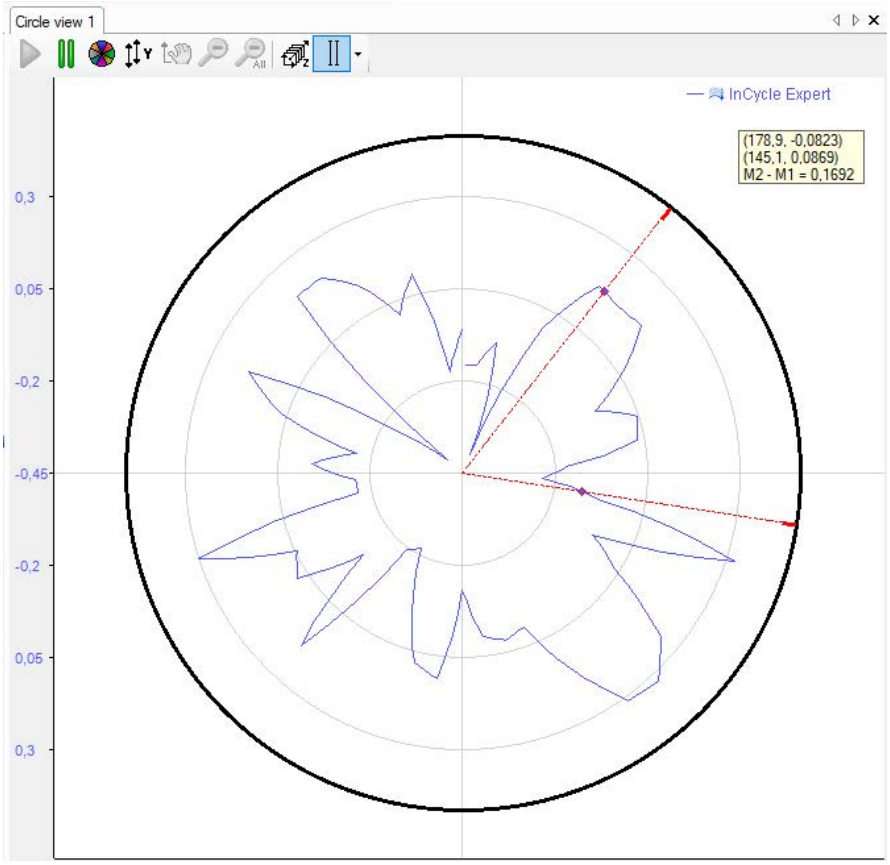


Fig. 48: Circle view with markers

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.

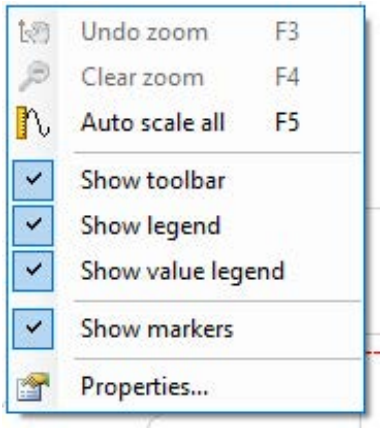


Fig. 49: Context menu for the circle view

The settings of the individual appearance options of a circle are made under the point “Items” in the respective item.

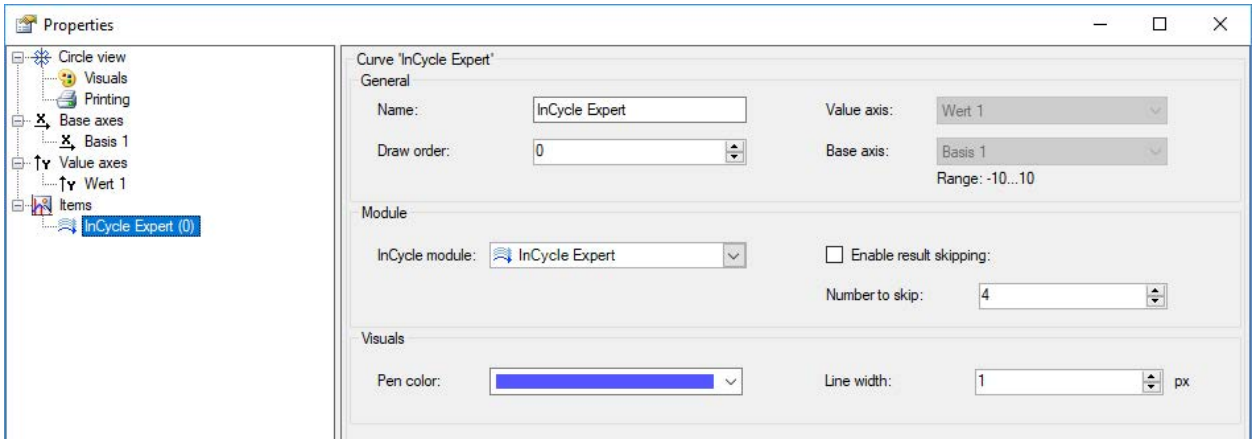


Fig. 50: Representation options of the InCycle module

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.

Number to skip: Number of cycles that are ignored for the visualization.

Pen color: The color of the circle can be selected here.

Line width: Defines the thickness of the circle line.

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.

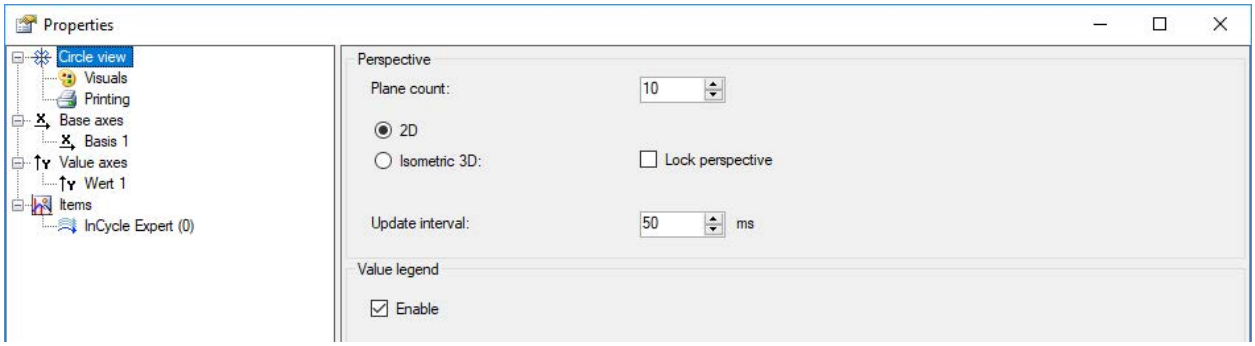


Fig. 51: Properties of the circle view

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.

Visuals

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

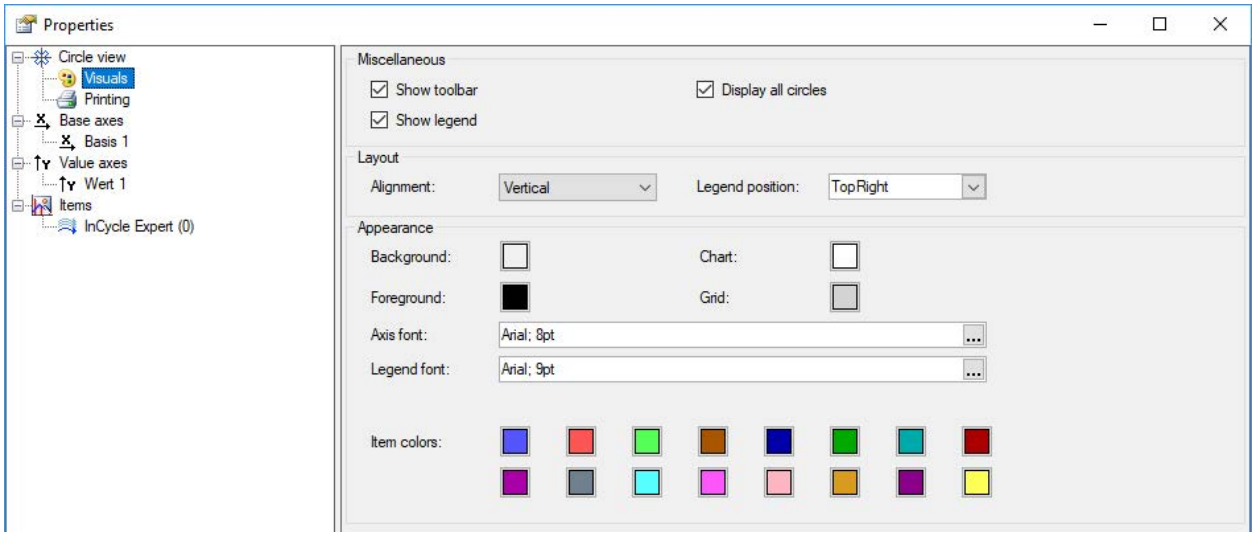


Fig. 52: View settings

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

Base axes

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

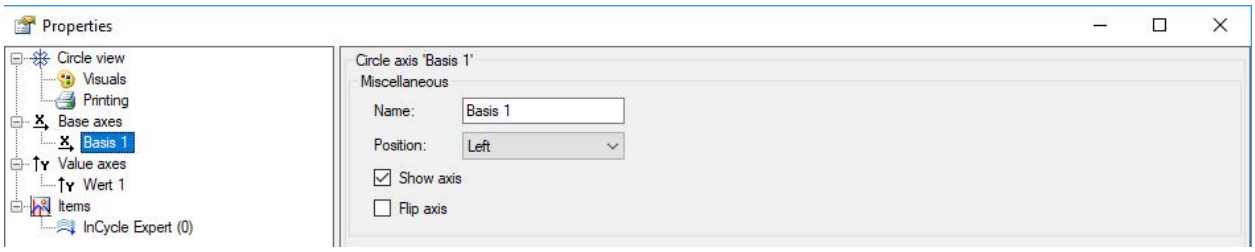


Fig. 53: Circle view, base axes

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.

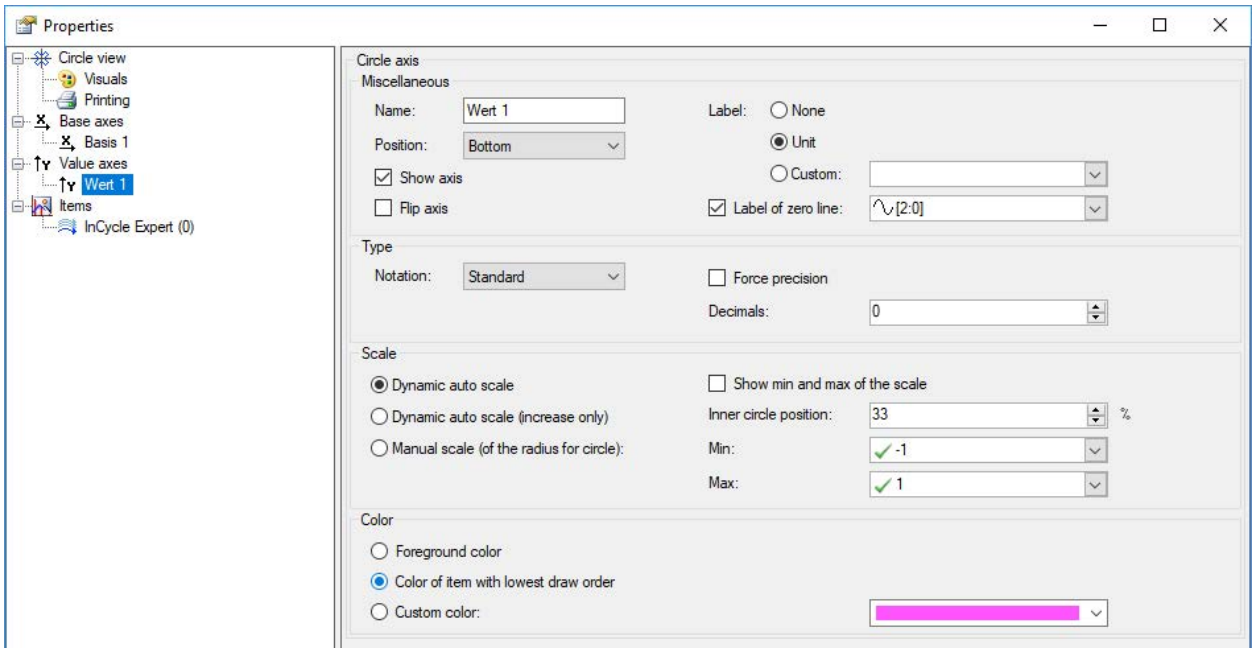
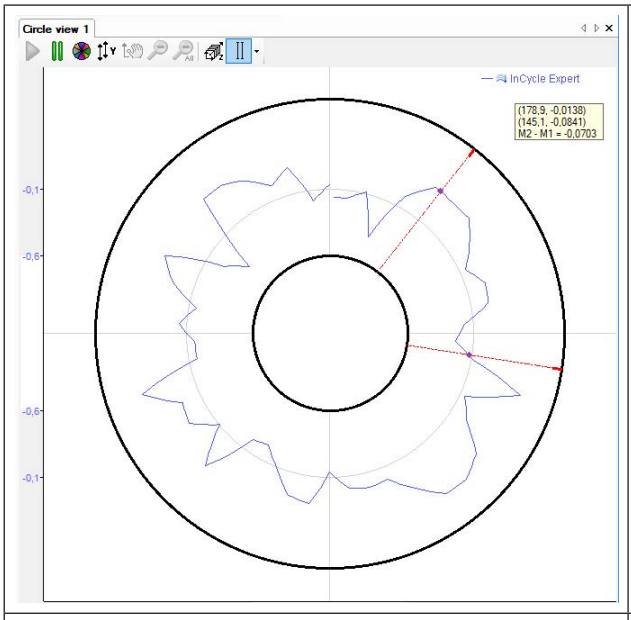
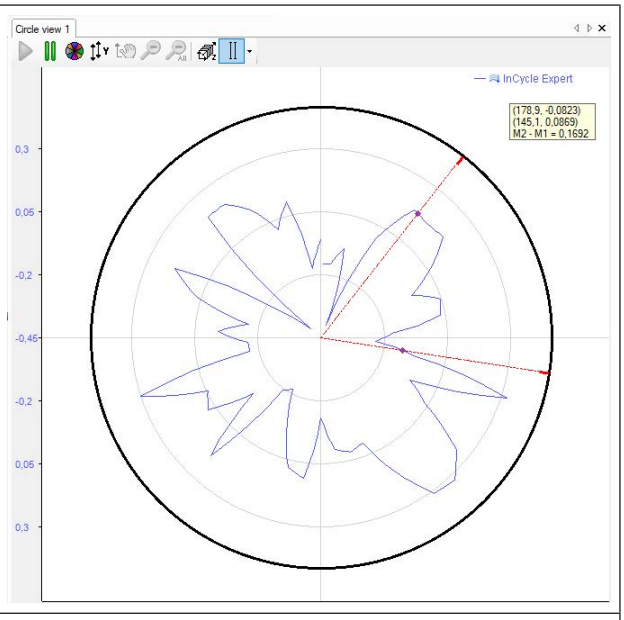


Fig. 54: Circle view, value axis

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

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 ranges of a chart. The parameters for the range analysis 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 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:

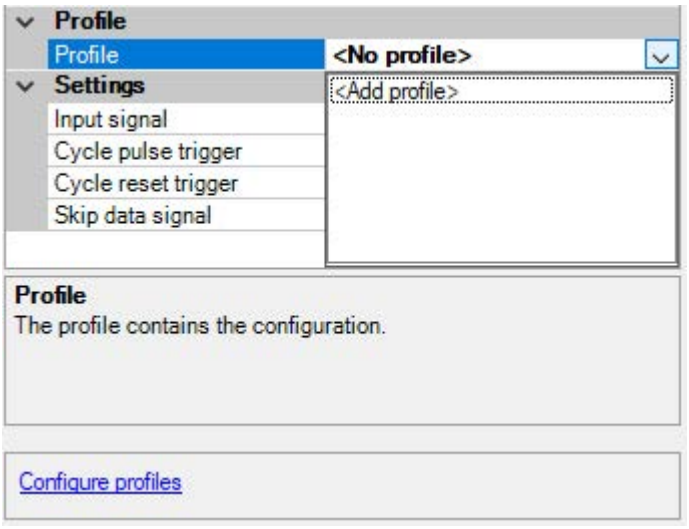
1. Open the I/O manager in *ibaPDA*.
2. If necessary, expand the "ibaInCycle" branch and click on the blue link "Click to add module...".

3. 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 then rename it.

4. In the field “Profile” in the *General* tab of the module, open the dropdown list 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.

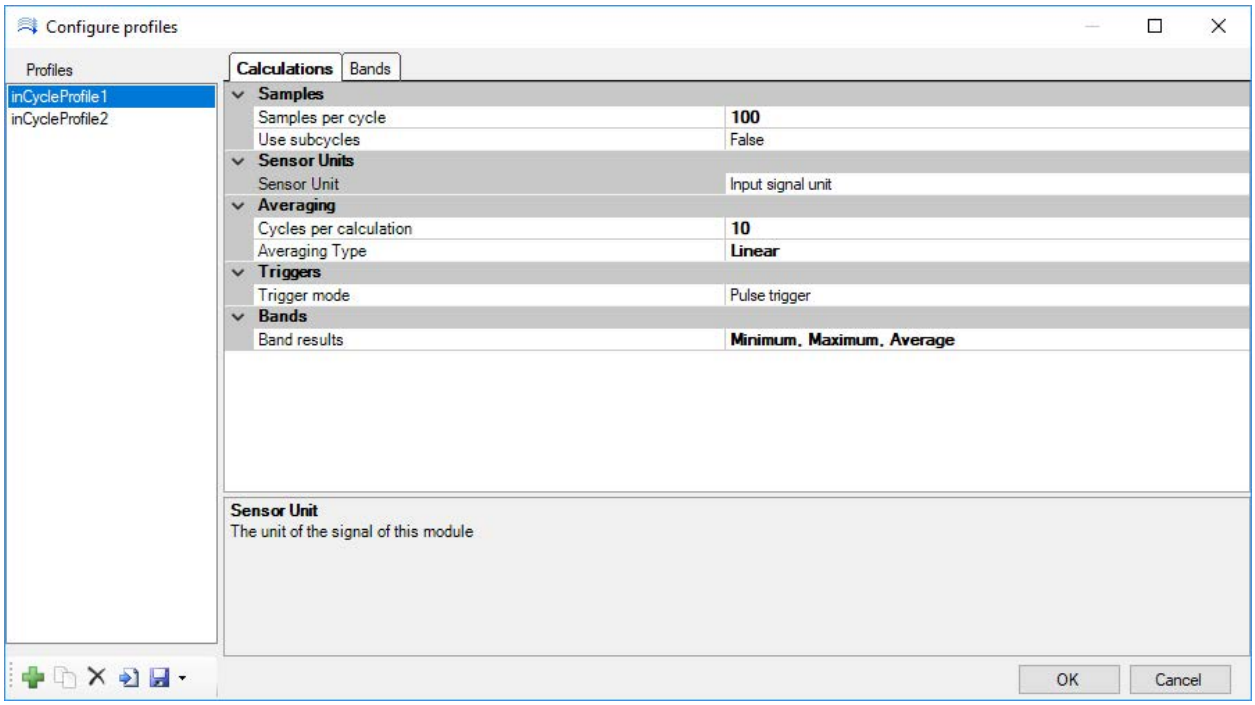


Fig. 55: Profile manager

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 22.

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

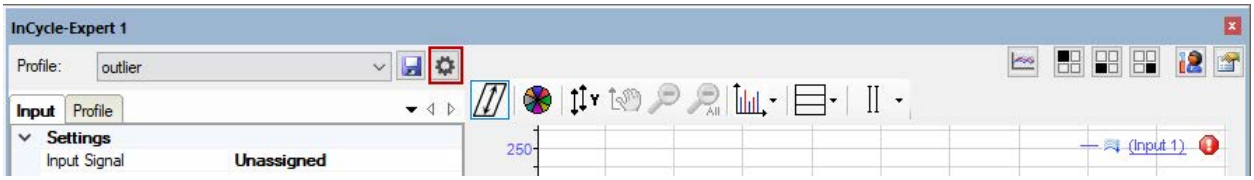


Fig. 56: Open profile manager

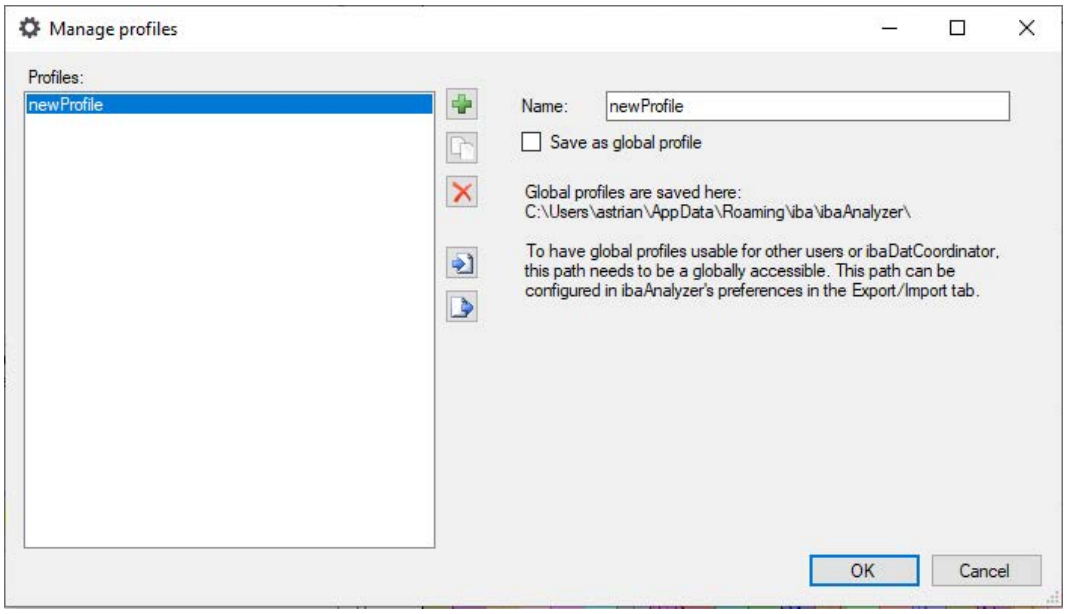


Fig. 57: Profile manager

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.

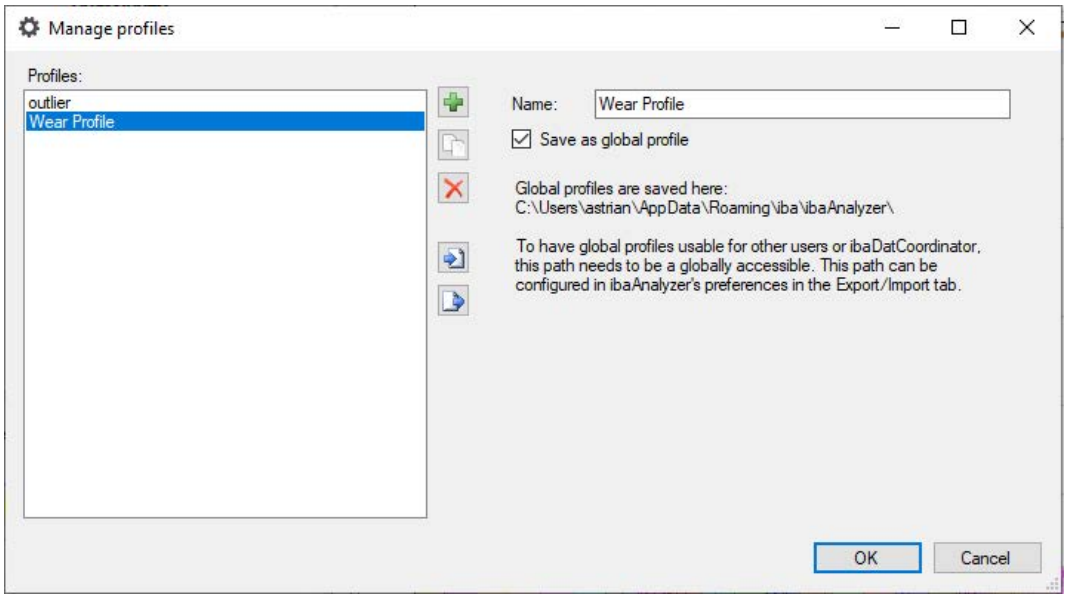


Fig. 58: Save profile globally

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

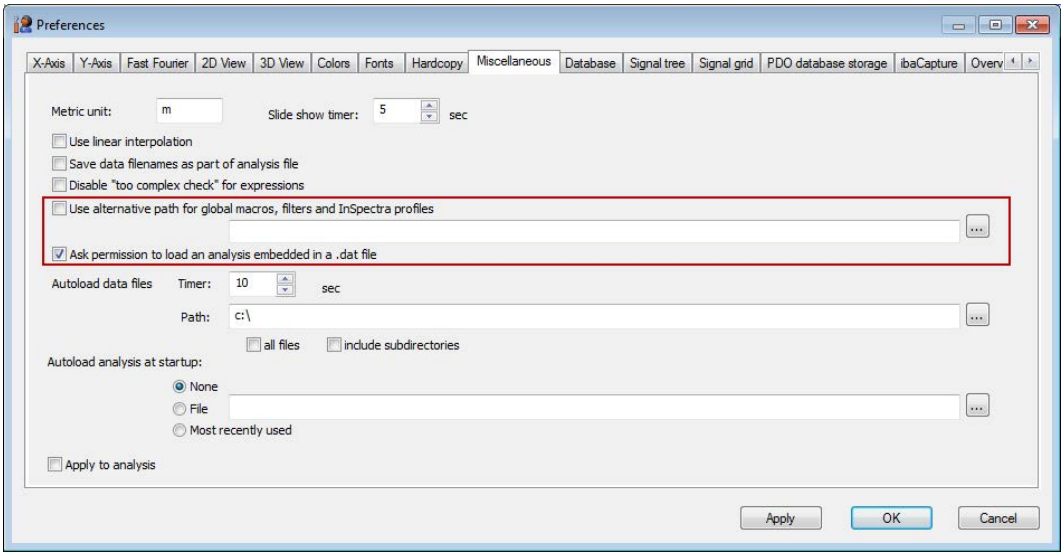


Fig. 59: Storage location for global profiles

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 .

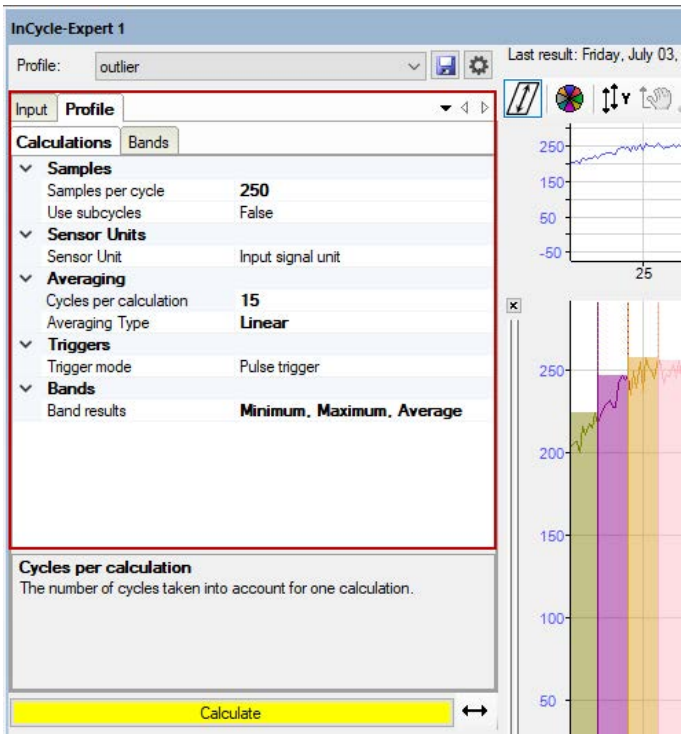


Fig. 60: Changing settings in the “Profile” tab

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.

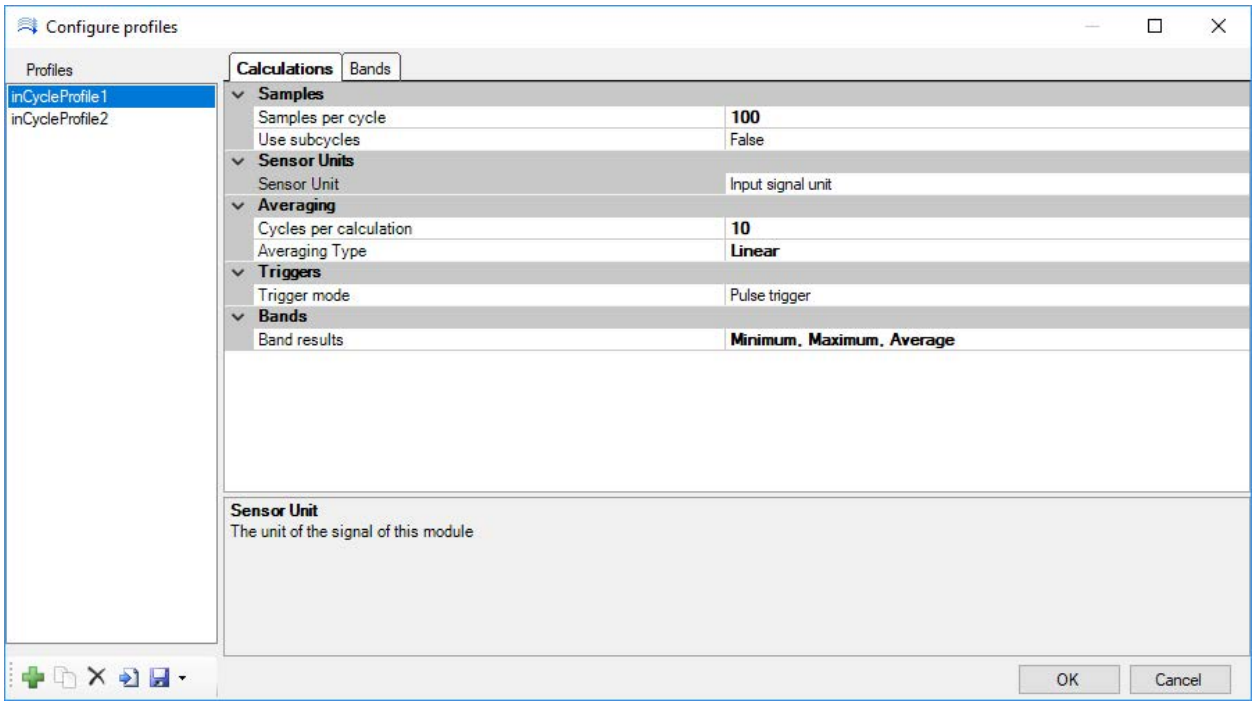


Fig. 61: Configuration dialog for profiles

The following explains the calculation parameters and their meanings.

8.2.1 Samples

Define the number of samples here into which a cycle is divided. You can also define subcycles here. If you divide a cycle into subcycles, the number of samples refers to the subcycles.

8.2.2 Sensor Units

Select the sensor unit here which can be found in the data sheet of the sensor. If the suitable unit is not available or unknown, select "Input signal unit".

8.2.3 Averaging

If averaging type is enabled, the results of several cycles are combined to an averaged chart. 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.

Table 2: Methods of the average calculation

8.2.4 Trigger

Use the triggermode to define the demarcation of a cycle. Choose between:

- Pulse trigger (zero pulse)
  If the trigger signal has a rising edge, then the running cycle is ended and a new cycle begins.
- Start and stop trigger
  The start and stop triggers determine the start and end of a cycle.

8.2.5 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

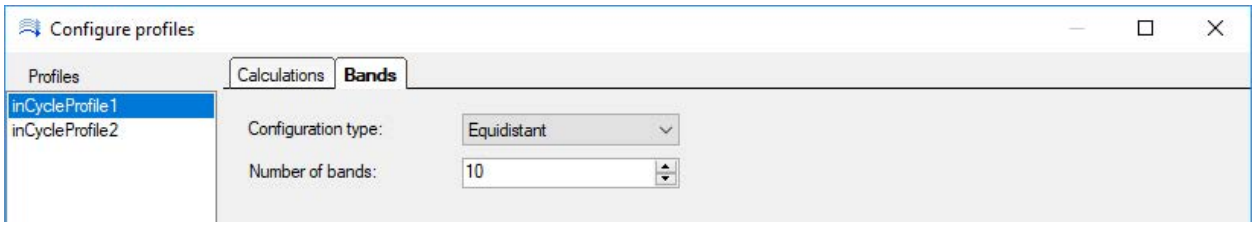


Fig. 62: Configuration dialog for profiles, bands tab

A cycle can be divided into several equal bands.

Configuration type
Select *Equidistant* to divide a cycle into several bands.

Number of bands
Specify the number of bands.

8.4 Results of the calculations of the Expert module

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

8.4.1 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 ↗ *"Analog" tab*, page 73

8.4.2 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 se-

quence 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	

Fig. 63: Example result area in InCycle Expert view

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.

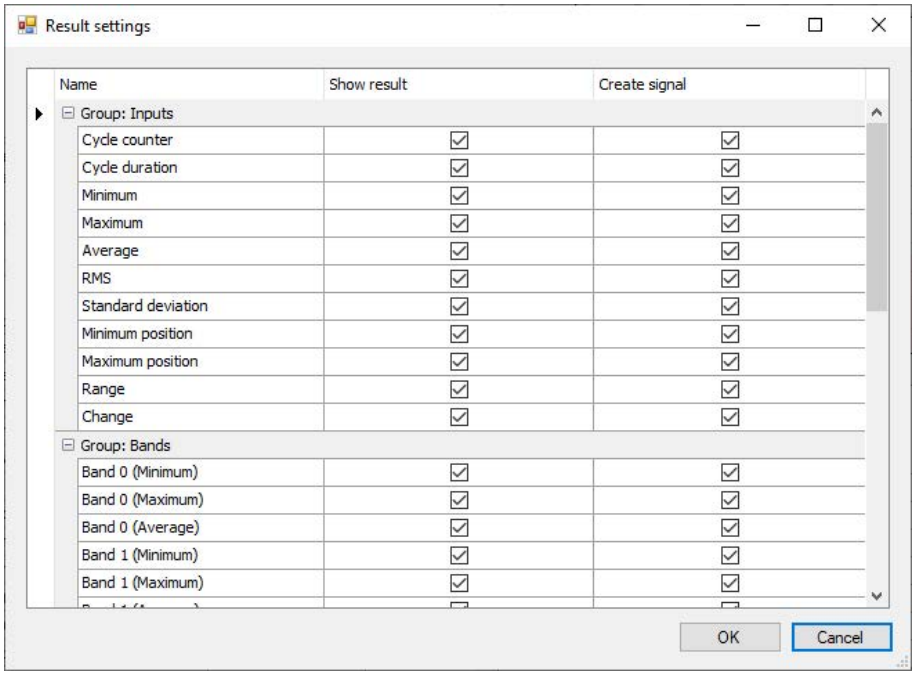


Fig. 64: Result settings dialog

Results as signals

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

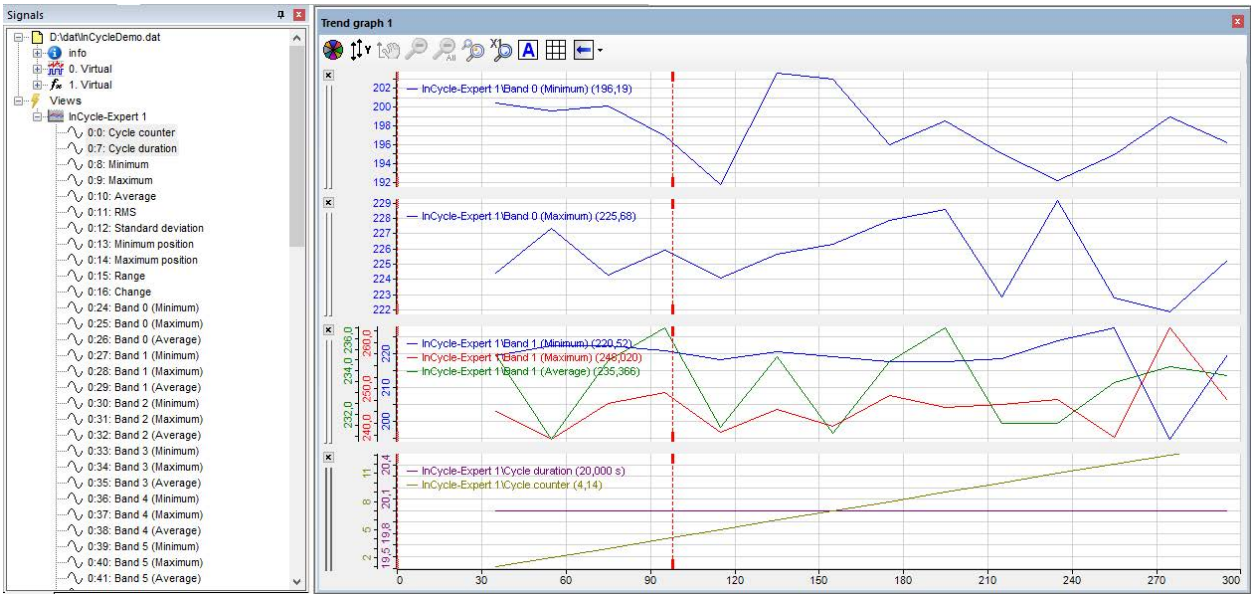


Fig. 65: Results as signals in the signal tree

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.

8.5 Creating an InCycle Expert module in ibaPDA

1. Open the I/O manager in *ibaPDA*.
2. Proceed as described in chapter ↗ *Create and manage profiles in ibaPDA*, page 60 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.

8.5.1 "General" tab

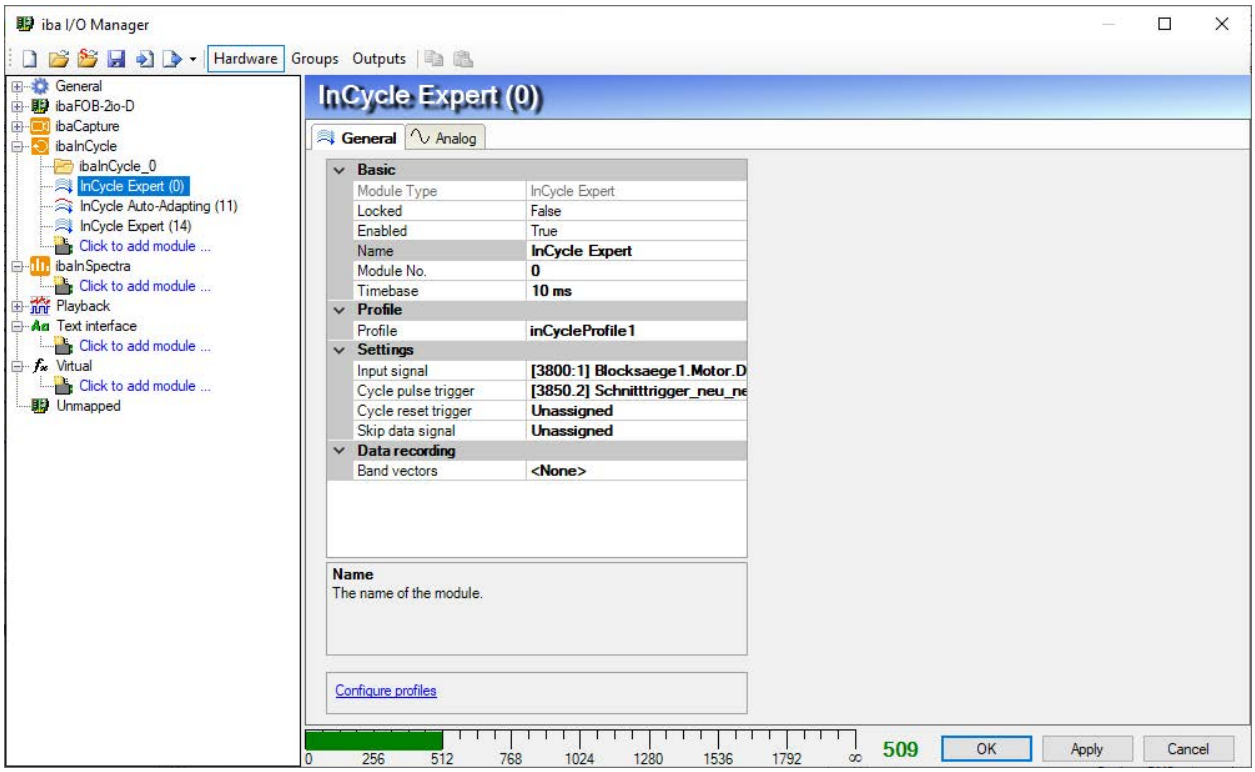


Fig. 66: General settings of an InCycle Expert module

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*.

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 dropdown 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 66

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

Settings

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.

Cycle pulse trigger / cycle start / stop trigger
Depending on which triggermode 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.

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 regularly processed.

'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.

8.5.2 "Analog" tab

Example of an *Analog* tab:

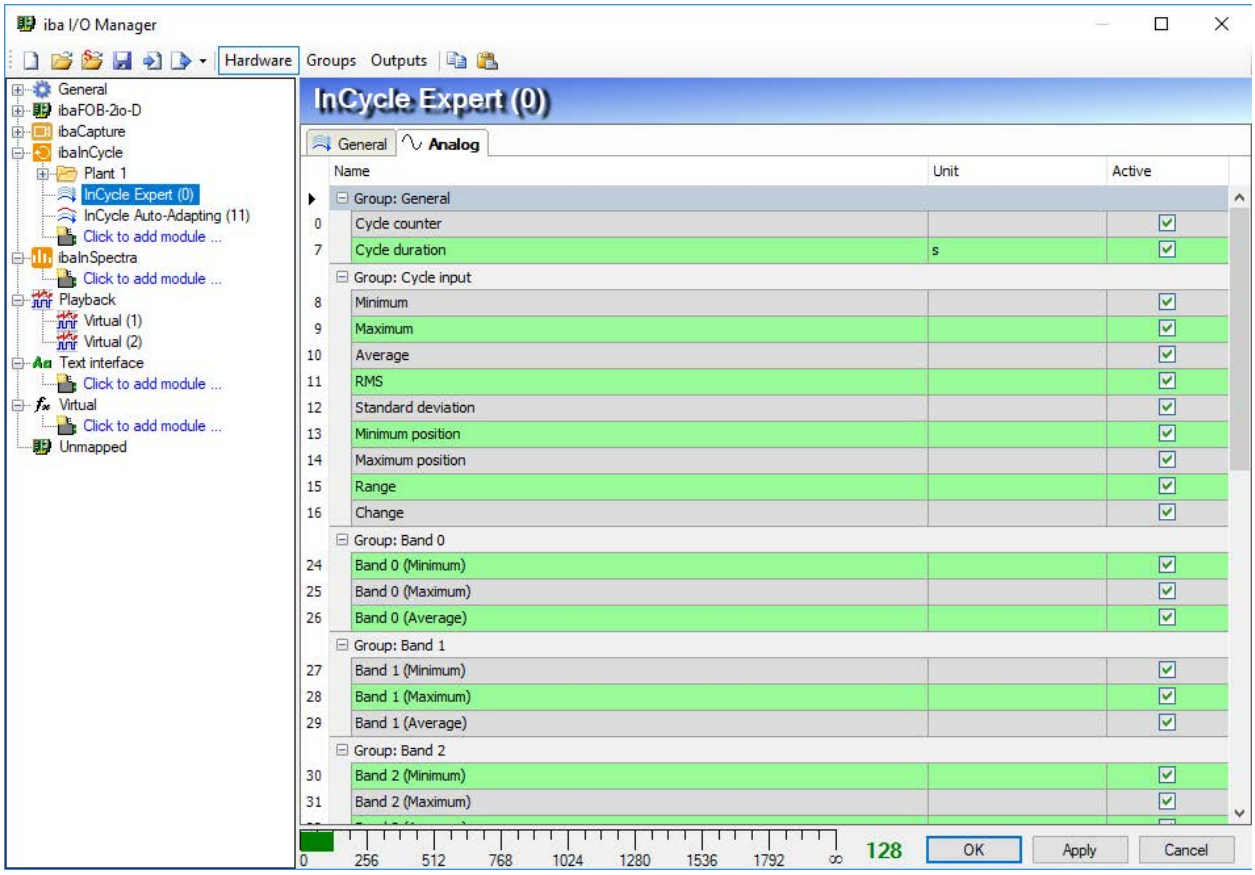


Fig. 67: Example of an InCycle Expert module with analog status signals and 4 ranges

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

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

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

8.6 Configuration of a calculation profile in ibaAnalyzer

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

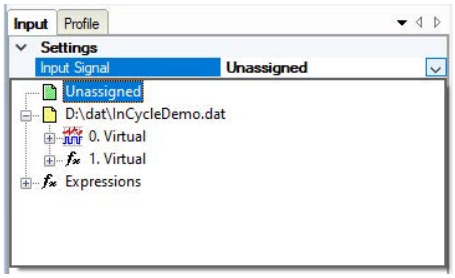
First open an InCycle Expert view with the button  in the toolbar, see chapter ↗ *Opening a cycle view in ibaAnalyzer*, page 22

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

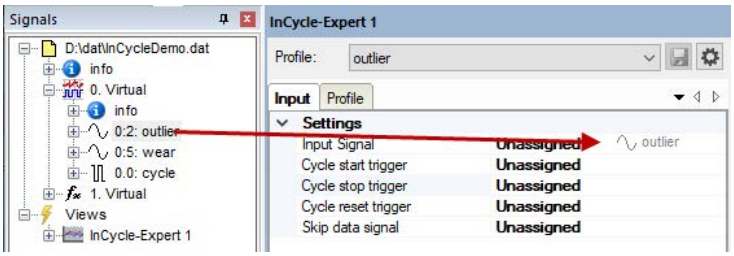
- via the menu *File - Open data file*.
- or drag a data file via drag & drop from the Windows Explorer into the opened *ibaAnalyzer* program window.

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 ↗ *"General" tab*, page 71.

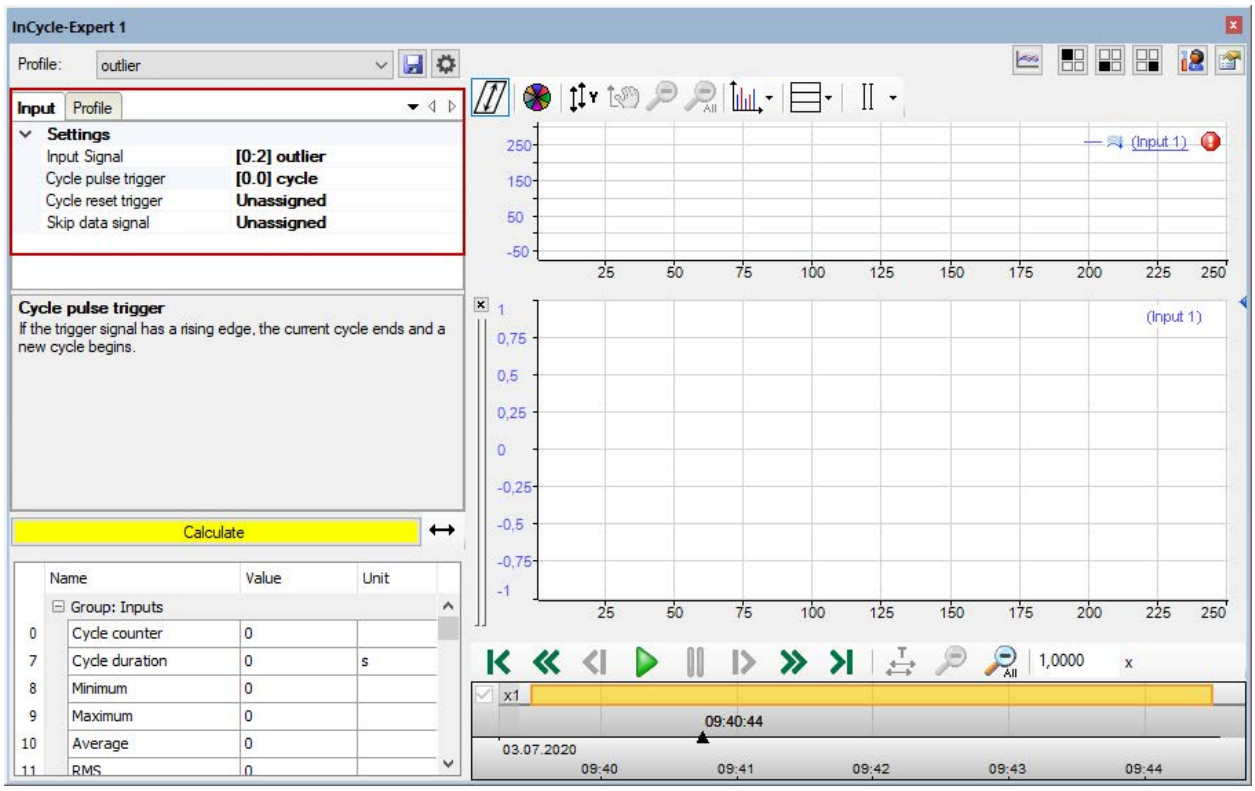


Fig. 68: Input tab in the cycle view

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 66

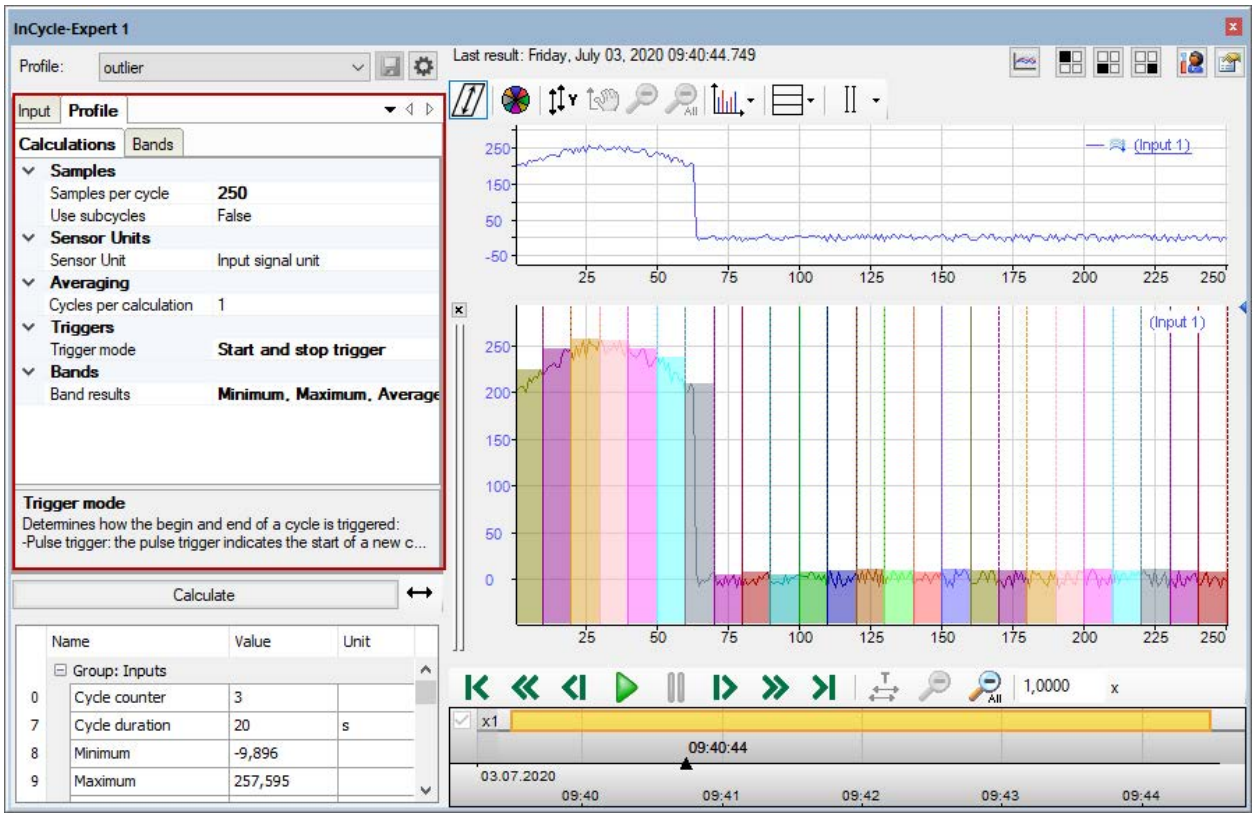


Fig. 69: Configure calculation profile

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 62.

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 23.

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 19.

9 The InCycle Auto-Adapting module

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

The behavior of the charts 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

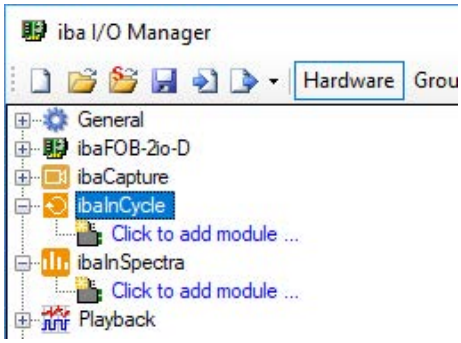
The InCycle Auto-Adapting module can be used to monitor a chart of a signal for changes. The parameters can be freely configured and stored in profiles. This makes it possible to reuse created profiles. Any number of profiles can be configured to adequately analyze different input signals. An InCycle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

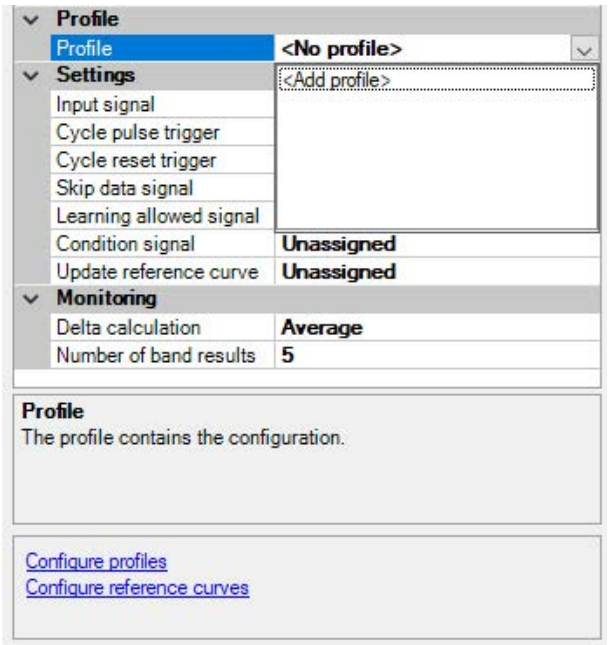
9.2 Create and manage profiles in ibaPDA

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. If necessary, expand the "ibaInCycle" branch and click on the blue link "Click to add module...".



3. 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.
4. In the field “Profile” in the *General* tab of the module, open the dropdown list 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.

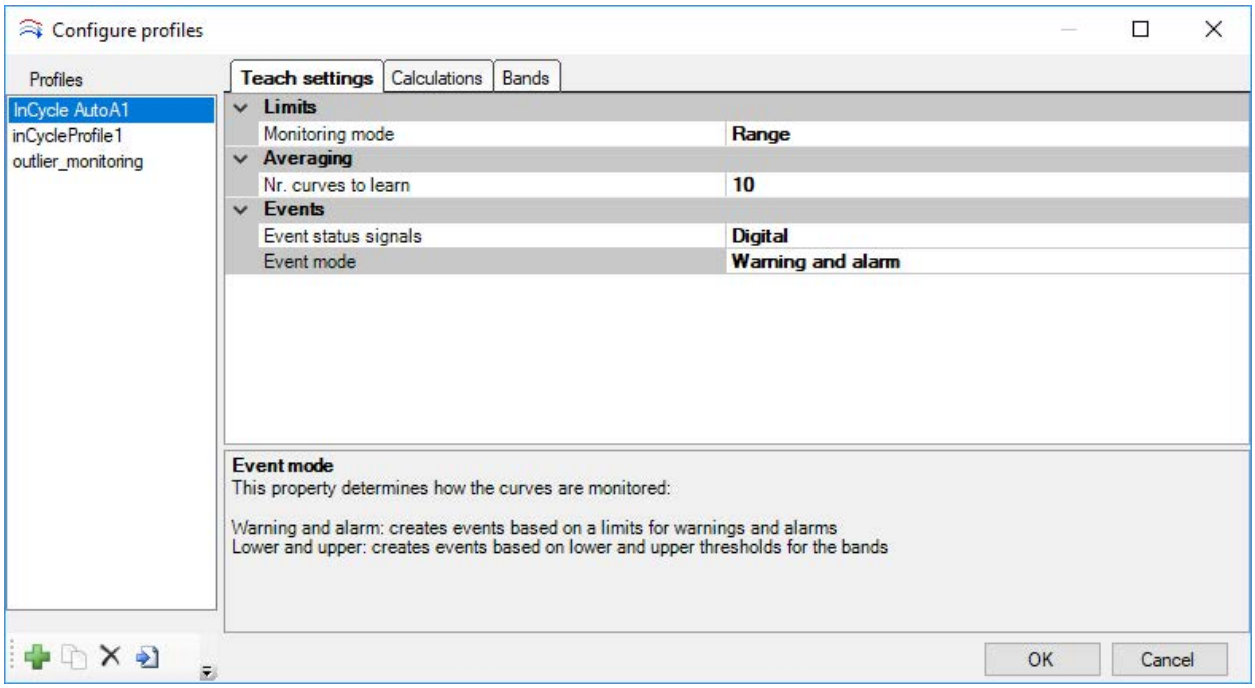


Fig. 70: Profile manager

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 Setting the teach-in phase

By inputting the settings for the teach-in phase, you determine how the reference curves should be determined. The input occurs in the configuration dialog for the profiles in the *Teach settings* tab.

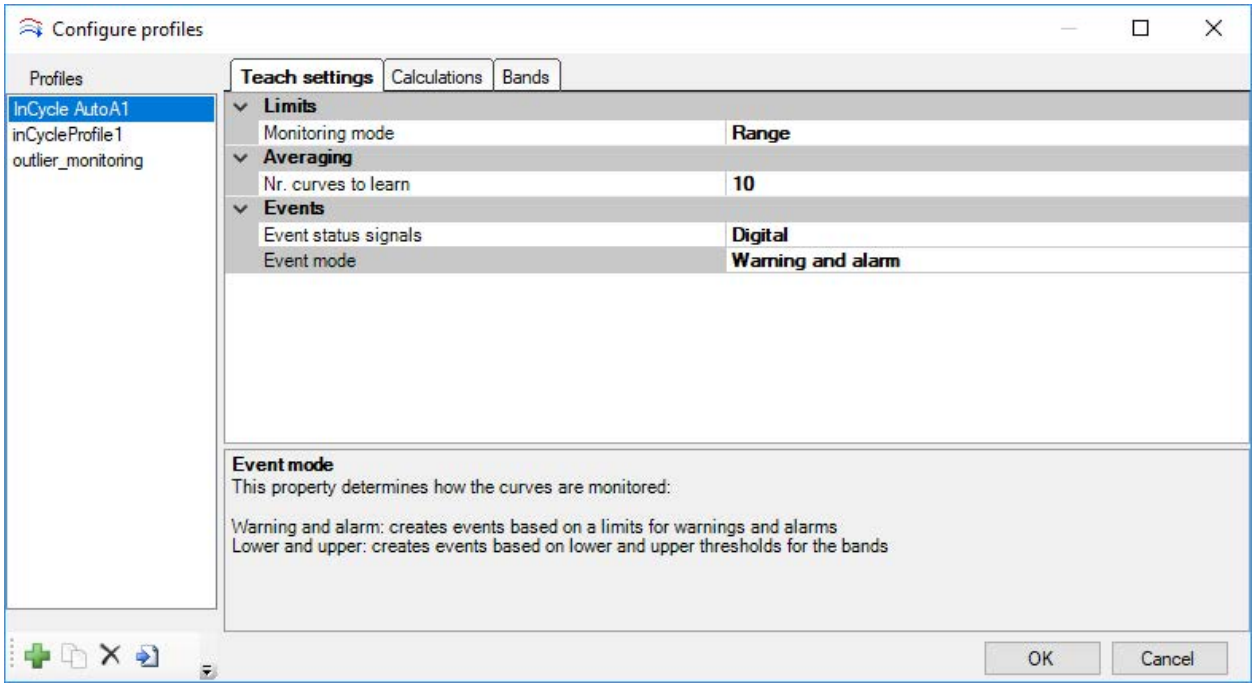


Fig. 71: Configuration dialog for the teach-in phase

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 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 “whole” 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.

9.3.3 Events

Event status signals
You can select here whether digital or analog event status signals are used.

- 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 charts 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.

9.4 Bands

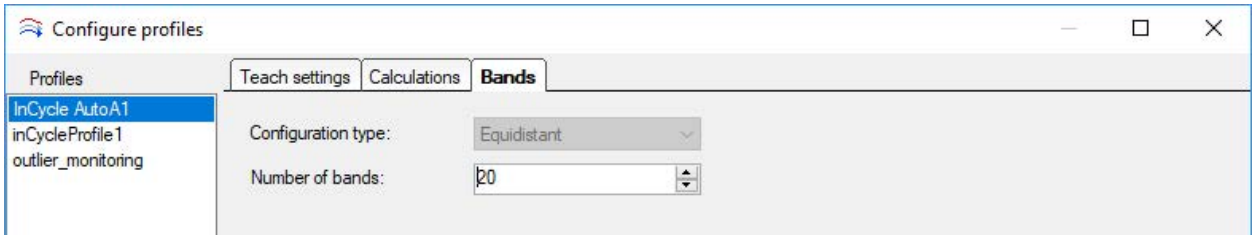


Fig. 72: Configuration dialog for profiles, bands tab

Configuration type
Select *Equidistant* to divide a cycle into several ranges.

Number of bands
Defines the number of bands that are seamlessly and evenly distributed over the cycle's time span.

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 66.

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

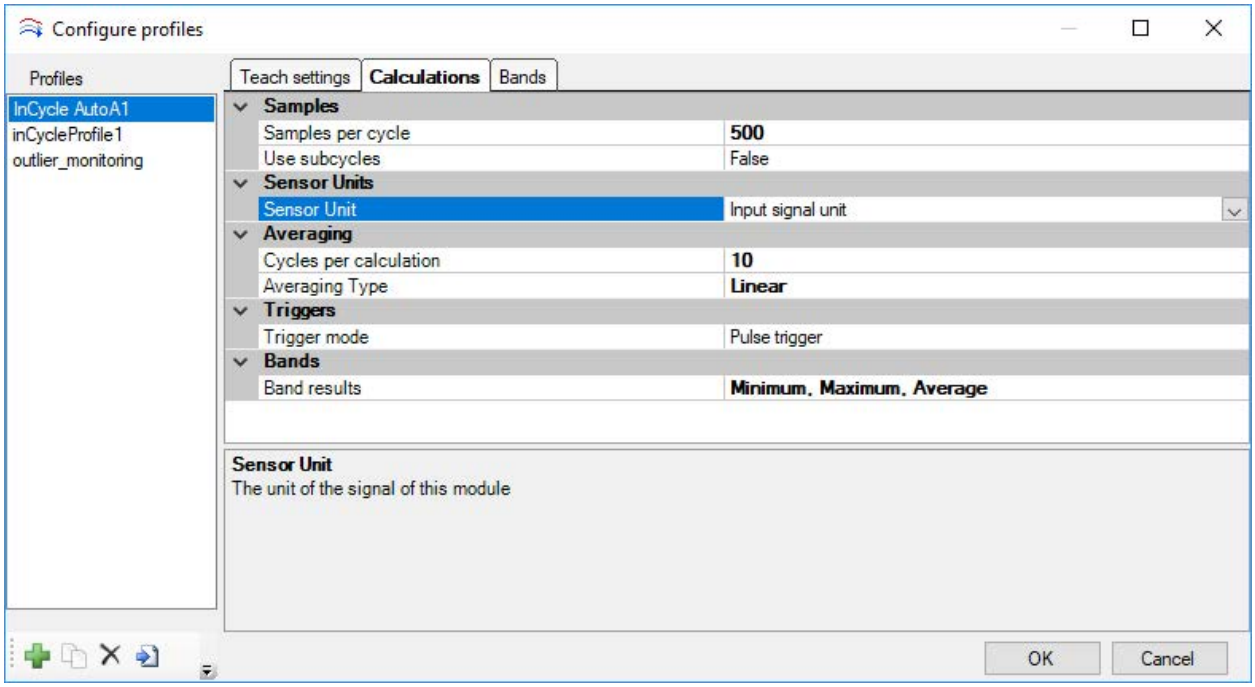


Fig. 73: Configuration dialog for calculation parameters

9.6 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 ↗ *Setting the teach-in phase*, page 81).

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

9.6.1 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: Range
- Change: Change

These characteristic values are available as signals in the *Analog* tab (see chapter ↗ *"Analog" tab*, page 90.

9.6.2 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 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

9.6.3 Visualization

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

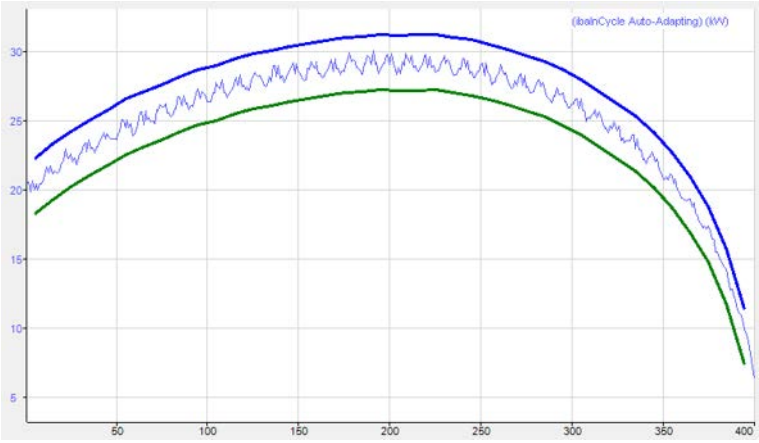


Fig. 74: Example of current cycle and upper and lower limits (blue and green)

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.

9.7 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 78 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.

9.7.1 "General" tab

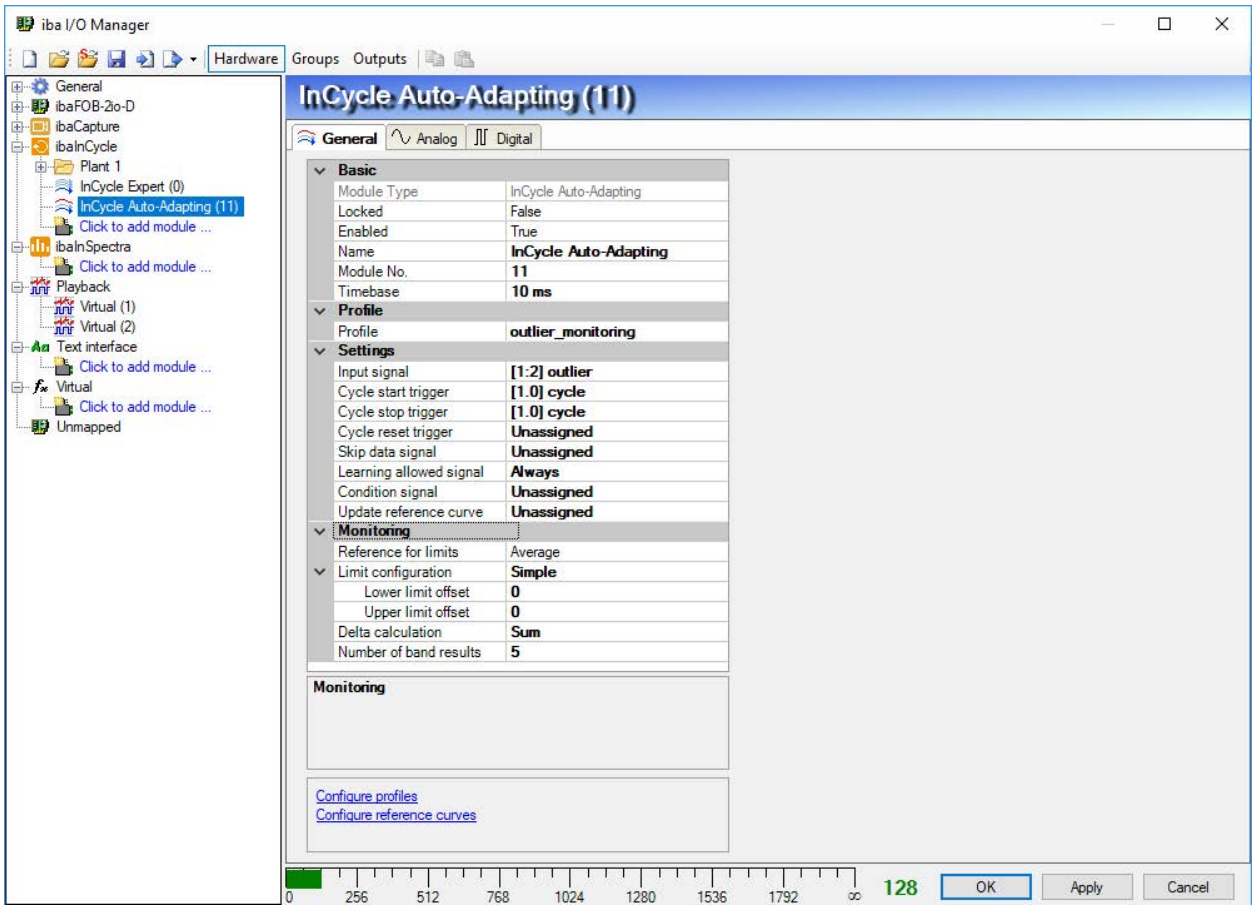


Fig. 75: General settings of an InCycle Auto-Adapting module

Basic settings

See InCycle Expert module, chapter ↗ *"General" tab*, page 71

Profile

Select the requested profile from the dropdown 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 ↗ *Setting calculation parameters*, page 83 for this purpose. If no profile is selected or available, an error message will be output when validating the I/O configuration.

Settings

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

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

Cycle pulse trigger / cycle start / stop trigger
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 certain 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 teach-in phase. The settings made here only affect the results of the module, but not the teach-in 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 reference curve: The averages of the individual ranges of the reference curve that are learned across all curves are used as the reference here
- Maximum reference curve: The maximum values of the individual ranges of the reference curve occurring during the teach-in phase are used as the reference here

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

- Average reference curve: 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 curve: The maximum and minimum values of the individual ranges of the reference curve occurring during the teach-in 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.

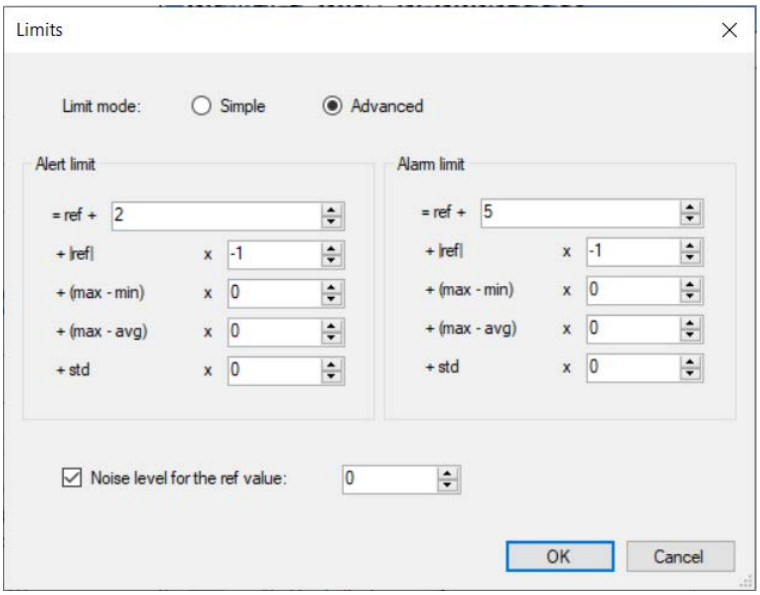


Fig. 76: Configure limits

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.

9.7.2 "Analog" tab

Example of an Analog tab:

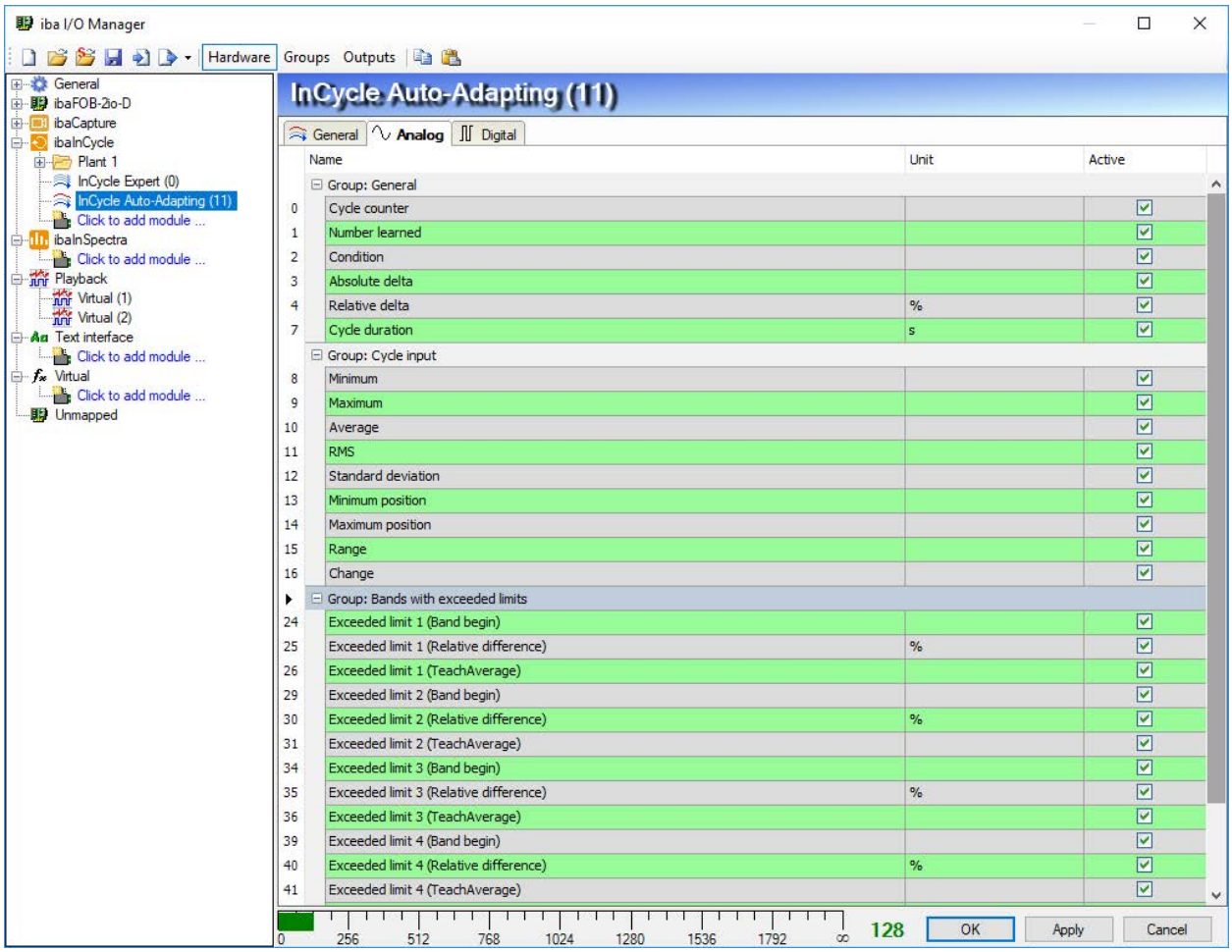


Fig. 77: Example of InCycle auto-adapting module with analog status signals

In the “General” group, 6 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 84.

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.

9.7.3 “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 range. In addition, the signal *Overall module event* appears.

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

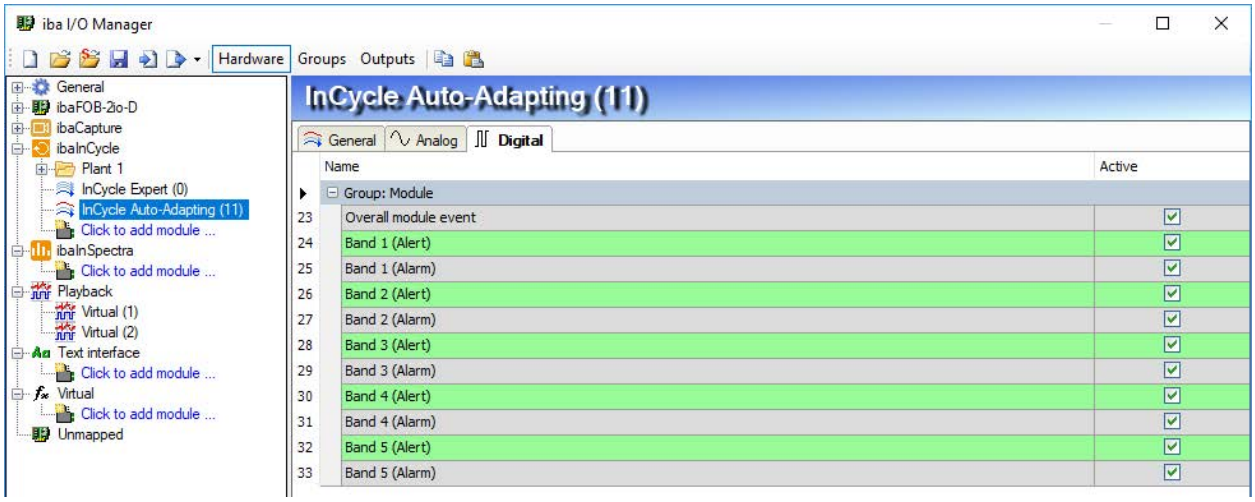


Fig. 78: Auto adapting module, Digital tab

10 Support and contact

Support

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Note

If you need support for software products, please state the license number or the CodeMeter container number (WIBU dongle). For hardware products, please have the serial number of the device ready.

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