



ibaInCycle

Monitoring and analyzing cyclical or rotating processes

Manual Issue 1.1

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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

Action	Notation
Menu command	Menu <i>Logic diagram</i>
Calling the menu command	Step 1 – Step 2 – Step 3 – Step x
	Example:
	Select the menu Logic diagram - Add - New function
	block.
Кеуѕ	<key name=""></key>
	Example: <alt>; <f1></f1></alt>
Press the keys simultaneously	<key name=""> + <key name=""></key></key>
	Example: <alt> + <ctrl></ctrl></alt>
Buttons	<key name=""></key>
	Example: <ok>; <cancel></cancel></ok>
File names, paths	"Filename", "Path"
	Example: "Test.doc"

In this manual, the following notations are used:

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.

Тір



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 mouseclick 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.

B iba I/O Manager	Groups (outputs 🖻 🛍	ction	1			- 🗆 X
OPC server OPC server OPC UA Server OPC UA Server OPC INSTANCE IEC 61850 Server OPC INSTANCE Address books O Time synchronization O Monohow protection Ibah Spectra Mohow Protection Mohow	Protection schemes		Id: Nai	ne: hor: ynght: Allow execution or following license n	ee2/34bf-afcf-44 Version: 1 ProtScheme 1		Change scheme Apply changes Cancel changes Change password Import scheme Export scheme Add connected dongle
	Protectab	e elements			onprotect		
	Se 	e Name Type: InSpectra profile inspectraProfile2	iles 1 2 1024	Scheme name ProtScheme 1 - 1280 155	Schem ee2f84 - - - - - - - - - - - - - - - - - - -	e id bf-afcf-44 2 OK	Scheme version

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*.
- 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.

ld:	6e62ac74-9e8d-48 Version: 1
Name:	Prot Scheme 1
Author:	Jan Pieters
Copyright:	This is a copyright text, which can be very long
Allow execution numbers:	n only on systems with a dongle having one of the following license
Allow execution numbers:	n only on systems with a dongle having one of the following license V834211 2178424
Allow execution numbers:	Nonly on systems with a dongle having one of the following license V834211 2178424 Add connected dongle
Allow execution numbers: Password:	n only on systems with a dongle having one of the following license V834211 2178424 Add connected dongle

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 *ibalnSpectra* or *ibalnCycle*, 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>.

Configure profiles			1111	
Profiles	2010/01/02/02/02			
SectraProfile1	Enter password to unlock:			
pectraProfile2		Unlock		

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

Fig. 6: ibalnSpectra 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.

InCycle-Expert 1 100 ~ 🗔 🗘 Profile: newProfile / 🛞 🏥 x 🕼 🔎 🔎 🖓 🖓 - 🗐 - 🗍 -- 4 0 Input Profile Settings 🔍 <u>(Inpat 1)</u> Input Signal Unassigned Cycle pulse trigger Unassigned Cycle reset trigger Unassigned Skip data signal Unassigned 0,5 0 -1 1 100 200 300 400 500 × (Input 1) 0.75 0.5 0,25 2 0 Input Signal -0.25 The signal that is analyzed in this module -0.5 -0,75 Calculate \leftrightarrow -1 50 100 150 200 250 350 400 450 500 0 300 3 Name Value Unit XI **«** <| Θ x 4 Group: Inputs ~ 10 >> 1,0000 Κ 0 Cycle counter 0 x1 7 0 Cycle duration 00:00:00 0 8 Minimum 01.01.1970 00:01:30 0 00:00:00 00:00:30 00:01:00 9 Maximum

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.

Land.	Toggling	hetween	cvcle	and	circle	view
	loggiilig	Dermeen	cycle	anu	CITCLE	view

Show/hide the configuration area

Show/hide the results area





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 **7** 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 **7** The cycle view, page 21

A detailed description of the circle view can be found in chapter **7** *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 **7** 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.

K «	< <		11	1>	>>	Х		🖻 🔎 1,00	00 x			
/ x1						1						
2					3	3 13:36	6:50	40	9.10 13:37:37)		
29.10.2	2018											
	13:38:	00	1	3:36:30)	13:3	37:00	13:37:30	13:3	8:00	13:38:30	13:39:00



Meaning of buttons:

	00	Start / stop playback
Κ	К	Jump to start / end
«	»	Reduce/increase replay speed (The set replay speed is shown on the left (1))
<	Þ	Jump to the next result in the respective direction
₽		Display the total time period
Þ		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.

Кеу	Function
<← >	One result backward
$\langle \rightarrow \rangle$	One result forward
< 1 >	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.

ibaPDA v7.3.0 File Configure View Help		
😒 🕀 🕮 🖓 🚳 🕶 😫	🛛 🕂 Aufzeichnung 1 🔹 👬 🛛 Iayout 1	Ē
ibaPDA signal tree ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・ ・	Cycle view 3 ► II 2 III 2 III 7 100 P P	₽z • □ •

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.

InCyc	le-Expert 1							E
Profil	e: newProfile		~	¢	16 - XI			
Inpu	t Profile			4 0	/ 🛞 🎵 🖉) 🔎 🎘 🖓 -		
~	Settings Input Signal Cycle pulse trigger Cycle reset trigger Skip data signal	Unassigned Unassigned Unassigned Unassigned				200 300	400 '500	
					Ⅰ 1 0,75 - 0,5 - 0,25 -		2	(Input 1)
Inpu The	It Signal signal that is analyzed	l in this module.			0 -0,25- -0,5			
	Calc	ulate		↔	-0,75			
	Name	Value 3	Unit]] '0 50	100 150	200 250 300	350 400 450 500
	Group: Inputs			^	K 《 <		× X 🗄 🔎) 🔎 1,0000 x 4
0	Cycle counter	0			✓ x1			
7	Cycle duration	0	s		00:00:00		a f	
8	Minimum	0			01.01.1970			76
9	Maximum	0		~	00:00:00	00:00:30	00:01:00	00:01:30

Fig. 9: InCycle Expert view in ibaAnalyzer

- 1 Configuration area (input signals, profiles) see **才** Setting calculation parameters, page 66
- 2 Visualization area of the cycle view
- 3 Result area, see **7** Results of the calculations of the Expert module, page 68
- 4 Playback area (playback settings), see **7** Playback area, page 19

The description of the cycle view can be found in chapter **7** 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 <i>ibaPDA</i>)
	Stop or continue the cycle display update
2	Reset all painted data (only <i>ibaPDA</i>)
¥	The display is cleared only once and all values are set to zero until the next cycle calculation is completed.

[1]	Determine planecount automatically (only <i>ibaAnalyzer</i>)
*	Auto color signals
ţ‡×	Auto scale value axes
t.®	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
II -	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 **7** 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.

Properties				<u>800</u> 8	×
	Display configuration				
	Single curve	 Original curve 	Show main window		
Markers	Waterfall	O Band curve	Show close buttons		
<u>×</u> Base axes ∱ ¥ Value axis 1	O Contour				





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 **7** 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 **7** *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.

Properties		– 🗆 X
Cycle view	Type Position: Left Notation: Auto V	
→ X Base axes → Y Value axis → Time axis → Printing → -Curve slave	Scaling	
	Opynamic auto scale Opynamic auto scale (increase only) Omanual scale Min: Max: Contour colors: Opynamic auto scale (increase only) Omanual scale Number of color bands: Verticate Heat	

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 a or InCycle Auto-Adapting module a. 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*.



Cycle view Visuals	Visibility Show graph						
Markers	Show table	Automatic sorting bas	ed on:	Band number	\sim		
Y Value axis 1 ↑Y Value axis 2 ↓ Value axis 2 ↓ Time axis		Sorting:		 Ascending Descending 			
× Base axes ↑Y Value axis	Additional legend	Plac	ceholders for leaer	nd text:			
		A Par %sr %iu	ameters: n: input signal nam n: input unit	e	^		

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
- %I: 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).



The configuration of the ranges is described in chapter **7** *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.

25 50	Properties	(InCycle Auto-Adapting)	25 25
	Signals •	(InCycle Expert)	
50	Fixed slave height Space slaves equally		
100-	Visualize table Visualize graph		
150-	Show legend		
200-	Clear zoom F4 Auto scale value axes F5 Restore manual scale		
-43,9	4 Dindo zoom F3	(InC	ycle Expert)

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.

Properties						<u>80</u> 2	×
Cycle view	Base axes						
	Туре:	 Linear 					
		🔿 Loga	rithmic				
···· ∴ Base axes ···· ↑ Y Value axis 1	Manual scale:	Min:	0	<u>+</u>	Hz		
Time axis 2		Max:	500	-	Hz		
Printing	_						
Grue slave	scale with main	n window					
Try Value axis							

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.

Properties										×
Cycle view	Type Position Notatio	n: m:	Left Auto	~						
	Scaling Scale t	 Linear Decibel Logarithmic 								
	Dynamic auto scale Dynamic auto scale (increase only) Manual scale				Show of Min: Max:	events/references	on dynamic auto scale			
	Data cycle 1 Input Function: Visuals Style: Fill:	Main windov Main windov Main windov	v setting v setting v setting	> > >						
							Apply	OK	Cano	cel

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.	7	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					\checkmark		
		1	Band 1	15	5	238,97		230,912					\checkmark		
		2	Band 2	25	5	252,826		248,182							
		3	Band 3	35	5	253,496		247,765							1
		4	Band 4	45	5	248,742		240,958					\checkmark		1
		5	Band 5	55	5	235,921		217,594							-
		6	Band 6	65	5	202,484		110,29					\checkmark		
		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).



RMS 213,2 108,961 6,45815	>	Visualize graph Visualize table Fixed slave height Space slaves equally			Vis	ible		^				
7,00664		Co	olumns		•	~	Band	number				
6,8/481		Pr	operties			~	Nam	e				
5,25736	-		Properties			~	Cent	er				
6,72334	_				~	Delta						
6,20001	_					Lowe	er.					
5,82000	_					Llowe						
5,05649	_						Uppe	er				
6,06129						~	Peak					
5,71503						~	Peak frequency					
6,72254						~	RMS					
5,78342						~	Peak	Alert				
5,56879						~	Peak Alarm					
								RMS Alert				
							RMS Alarm					
						~	 Visible 					
						~	Colla	psed				

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 **7** *Cycle slave graph and cycle slave table*, page 29

ſ										Peak		RMS						
		No.		No.		Name	Center	Delta	Peak ∇	Peak fr	RMS	Alert	Alarm	Alert	Alarm	Visible	Collapsed	
	×	0 Band 0 5		5	222,853	222,853 21								^				
			6	Band 6	65	5	208,785		113,449					\checkmark				
			20	Band	205	5	9,534		5,47118					\checkmark				
			19	Band	195	5	9,482		6,04339					\checkmark				
			24	Band	245	5	9,432		4,60625					\checkmark				
			23	Band	235	5	9,352		6,78062					\checkmark				
			17	Band	175	5	9,214		5,86167					\checkmark				
			16	Band	165	5	9,202		5,97208					\checkmark				
							1			1	1					4		

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).

Properties					<u>200</u> 2	×
Cycle view Visuals Bands X, Base axes Y Value axis 1 Z, Time axis Printing Curve slave	All markers Factored labeling for harmonics Connect marker dots between planes Hide marker dots	Fundamental: Harmonic: Sidebands:	······································	Bold		

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 left="" the="" to="">/<cursor right="" the="" to=""></cursor></cursor>	Normal step width
<shift>+<cursor left="" the="" to="">/<cursor right="" the="" to=""></cursor></cursor></shift>	Large steps
<ctrl>+<cursor left="" the="" to="">/<cursor right="" the="" to=""></cursor></cursor></ctrl>	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.

Properties			- 🗆 X
Cycle view Visuals Markens X Bands X Base axes Y Value axis 1 Y Value axis 1 Prnting Curve slave	All markers Factored labeling for harmonics Connect marker dots between planes Hide marker dots	Fundamental: Harmonic: Sidebands:	Bold
— <u>×</u> , Base axes —↑γ Value axis	Interactive Configured markers General Enabled Show marker label	Marker color:	
	Harmonic markers Fractional:		
	Sideband markers Count: 0 + Offset: 1 Show sidebands	×	
			Apply OK Cancel

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.

Enable collapsed	markers									
Enable collapsed	markers									
Show marker lab	els									
Show harmonic l	abels									
Local markers										
Local markers			Harmor	nics		Sidebar	nds	1		
Local markers	Fundamental	Factor	Harmor Below	nics Above	Mode	Sidebar Offset	nds Count	Color	Visible	Colla.
Local markers Name ▶ M_450	Fundamental	Factor	Harmor Below 0	nics Above 0	Mode Both	Sidebar Offset	nds Count 0	Color	Visible	Colla.
Local markers Name M_450 M_signal	Fundamental	Factor 1 1	Harmor Below 0	nics Above 0	Mode Both Both	Sidebar Offset √ 1 √ 1	ods Count 0	Color	Visible	Colla.

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.

Properties			X Bold Bold (10, 201) (10, 201)		41													
Scycle view Visuals Visuals Winden Xingen Xingen Xingen Xingen Xingen Xingen Xingen Yvalue axis The axis Printing Curve slave	All markers Factored labelir Connect marke Hide marker do	ng for harmonics r dots between planes ts	Fundar Hamoi Sideba	mental: nic: nds:			- > - >	Bold 		60 200	300 300 300 300 300 300 300 300 300 300	4203) 7× 447 1 18× 4 10 15 400 15 40 17× 18 400	10 10 10 10 10 10 10 10 10 10 10 10 10 1	15121 10x 2830 87	15.11.5 5 10.132.3 10.132.3 122.315.6	0 (A) (1) (1) (1)	Teat) (W/) (150: 420,8) 394,5	0
	Interactive Configured	markers									1 . A	NT. W	WVV	vin,	44	4x 388	2 19x: 409.7 7,1]- x: 473,4]-	1
	Enable collapse Show marker lat Show harmonic	d markers bels labels							J.M.	en Ma						4	4	the second second
	Local markers																1	
	Name	Fundamental	Factor	Harmonics Below Above	Mode	Sidebands Off Co	ount Color	Visible Col									1	
	Gear mesh	√ 25,3	1	0 0	Both	1 0												
									-	50 100	160	200	250	300	350	400	450 50	10
																	ą	×
					A	pply	OK	Cancel										

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.

Settin	gs Enable colla	need markers									
	Show marke	r labels nic labels		-	_						
Local	markers								_		
Local	markers	Fundamental	Factor	Harmor	ics Above	Mode	Sideband	is Count	Color	Visible	Collanser
Local Na	markers ame 450	Fundamental	Factor	Harmor Below	iics Above 0	Mode Both	Sideband Offset	ds Count 0	Color	Visible	Collapsed
Local	markers ame _450 _signal	Fundamental	Factor	Harmor Below 0	ics Above 0	Mode Both Both	Sideband Offset	is Count 0	Color	Visible	Collapsed

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.

Properties	6.4					<u></u>		×
Cycle view	Display configuration Single curve Waterfall Contour	 Original cur Band curve 	ve	Show main window	-			
Tr Value axis 2 Tr Value axis 2 Time axis Printing ⊡Curve slave	Perspective Perspective:	Custom perspective	~	Manage perspectives				
——X, Base axes ——↑γ Value axis	Additional legend		Placeholders for I	egend text:				
		^ •	Parameters: %sn: input signal %u: input unit %su: value unit %c1: input signal %sp: input signal %sp: input signal %x: X-value at in %y: Y-value at in %xmouse: X-valu	name first comment second comment sampling period teractive marker teractive marker ie at mouse cursor	`			
	Synchronization Main curve		(InCycle Expert)	1	~			
	Pause/Continue	Data source:			~			
	Apply node to preferen	ces			Apply	ОК	Cano	cel

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 **7** *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.

Properties	<i>4</i>			- 🗆 X
Cycle view	Miscellaneous Show toolbar	Show legend	Display grid lines	
····∏ Markers ····X, Base axes ····↑ Value axis 1 ····Z→ Time axis ····Ə Printing @···Curve slave	Layout Base axis: Value axis (contour only):	Horizontal Vertical Vertical	Flip value axes Flip base axis Flip time axis (contour only)	
	Appearance Background:	Chart:	Interactive marker color:	
	Axis font: Ari Label font: Ari	al: 8pt al: 8pt al: 8pt		
	Curve colors:			
	Marker colors:			
	Band colors:			
	Apply node to preferences		Apply)K Cancel

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 **7** *Band curve*, page 49.

InCycle bands

Properties								- 🗆 X
Cycle view	InCycle bands (Custom bands						
Visuals Bands	Band settings							
II Markers					Development	a		
		ands		lable collapsed bands	Band label:	Show never		~
Time axis	Highligh	t band on hover			Band label text:	%n		
Printing	Bands end a	st:	Peak	~	Bands start	at bottom		
	Display band	ds as:	Shad	ed band V				
	Diselau hase	d manufita :		mu aaak lina	Drow posts	anaition line		
	Display Dan	Tesuits.		aw peak lines on hover		ine		
				now value on hover:	Show yokup			
	_			iow value of flover.	Show value	*		
	Apply ba	and color to slave	e 🗋 Ap	oply band color to main win	ndow			
	Event settings							
				1				
	Show al	erts		aw alert color zones		hover		
		ams		aw alam color zones				
	Alert label:	Show never	~					
	Alarm label:	Show never	~	265				
	Bands							
	Band number	Collapsed	Name	Center		Delta	Color	Visible
	0		Band 0					
	1		Band 1					
	2		Band 2					
	3		Band 3					
	4		Band 4					
	5		Band 5					
	6		Band 6					
	7		Band 7	-				
	8		Band 8					
	Arabiandataa						Analy	OK Canad
	Apply houe to p	rerences					мрру	Cancel

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.

Band label text: %n	Parameters:
	%n: Bands name %nb: Bands number
Bands start at bottom	%r: rms value
	%p: peak value
_	%pf: peak position
Draw peak position line	%c: center position
Draw RMS line	%l: lower position %u: upper position

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
- %I: 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

Properties						×
Cycle view	Band curve Custom bands					
Bands	Curves					
Markers	Data cycle 1					
Base axes	Datasource					
^z Time axis		OLO LANAL C	1000			
	Module:	a InCycle Auto-Adapting	~			
Curve slave	6 m					
	Settings					
	Band curve function:	Range	~			
	Enable difference curve	Reference:	Reference curve			
			 Alarm threshold 			
		Percentual difference				
		Only exceeded limits				
	Apply node to preferences		Apply	ОК	Can	cel

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 **7** 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.

Properties	54						<u>200</u> 7		×
🖃 🕍 Cycle view	Base axes								
Visuals	Туре:	🖲 Line	ear	🗆 S	Show <mark>axis unit</mark>				
Markers		🔿 Log	arithmic						
Base axes → ↑ Y Value axis 1	Manual scale:	Min:	V 0	~					
Time axis		Max:	500	~					
Curve slave									
Base axes									
IT VOICE AND	Туре		Scale factor	Position	Notation	Axis unit	Marker axis	Show	
0.7	Main		 ✓ 1 	Bottom	Auto		۲	E	2
		~					0		
	Custom Percentage Angular position 360°								
	Angular position 720°		1						
							01/	-	
	Apply node to preferences					Apply	ОК	Cano	;ei

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.

enties					- U
Visuals Bands	Position:	Left ~	Notation:	Auto	~
Base axes Scalin	g				
Time axis	Linear		Amplitude scaling:	None	~
Printing	O Decibel				
slave	O Logarithmic				
	Dynamic auto scal	e	Contour colors:	Default	
	O Dynamic auto scal	e (increase only)	Apply color-coded a	amplitudes to waterfall	
	O Manual scale		Number of color bands:	10	+
	Min	2 1			
		/-I			
	Max:	/1 💌			
Data o	ycle 1				
Input					
	Data source:	🚔 InCycle Auto-Ac	apting	\sim	
		Sample rate:	100 Hz		
Visua	als				
30	Color:		→ Style:	Curve	~
	Fill:	None	~	Improve isome	tric visibility
					Construction of the
Apply	node to preferences			Apply	OK Cance

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.

Properties Cycle view Visuals Bands II Markers A Base axes Y Value axis 1 Contour time axis Pinting Curve slave Position: Apply node to pre	24		- 0	×
Cycle view	Available planes Plane count: Synchronize Z planes	10	Estimated memory: 10 MB	
Properties Visuals I Markers Asse axes Y Value axis 1 Printing Curve slave	Contour time axis			
	Manual scale:	In Plane by number:		
		 Custom number of planes: All available planes 	50	
		O Plane by time:		
		Manual time range:	10 💌 sec	
	Position:	Left ~		
	Apply node to preferences		Apply OK Can	cel

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 🔄 .

🗊 幻	~	٩		÷	
					New InCycle-Expert view
		_	-		Add a new InCycle-Expert view

See chapter **7** 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

	1
	Start / Pause (only <i>ibaPDA</i>)
	Stop or continue the cycle display update
2	Reset all display values (only <i>ibaPDA</i>)
	The display is cleared only once and all values are set to zero until the next
	cycle calculation is completed.
[1]	Automatically adjust plane count (only <i>ibaAnalyzer</i>)
*	Automatically assign signal colors
ţţ ×	Auto scale value axis
t.®	Redo manual scale
	Zoom out last step/all steps
₫.	Toggle the perspective (2D / isometric 3D)
II -	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.

Properties						<u></u>		×
⊡ - — Circle view 	Curve 'InCycle Expert' General		13				봐	
Young Printing X. Base axes X. Base axes X. Base 1 Y Value axes ↑Y Value axes ↑Y Value axes ↑Y Wet 1 Hems Micrycle Expert (0)	Name:	InCycle Expert		Value axis:	Wert 1		~	
	Draw order:	0	-	Base axis:	Basis 1		~	
					Range: -1010			
⊡-IM Items I≪InCycle Expert (0)	Module InCycle module:	💐 InCycle Expert	~	Enable res	ult skipping:			
				Number to skip	4		ŧ	
	Visuals							
	Pen color:		~	Line width:	1		¢ px	
	1							

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.

Properties				×
Circle view	Perspective Plane count:	10 🚖		
→ basis i → ↑ Value axes ↓ ↑ Value axes ↓ ↑ Wert 1 → ₩ tems ↓ □ function	O Isometric 3D: Update interval:	Lock perspective		
	Value legend			

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.

Properties						<u></u>	×
Circle view Visuals Visuals Visuals X, Base axes X, Basis 1	Miscellaneous Show toolbar Show legend		Display all circ	les			
↑ Y Value axes ↓ Y Vert 1 ↓ tems ↓ Topolo Evenet (0)	Alignment:	Vertical ~	Legend position:	TopRight	~		
······~; InCycle Expert (U)	Appearance Background: Foreground:		Chart: Grid:				
	Axis font: Legend font:	Arial; 8pt Arial; 9pt					
	Item colors:						

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.

Properties		<u>648</u> 5	×
Circle view Visuals Visuals Viniting X, Base axes Y Value axes Y Value axes Y Value axes Y Wet 1 Value for the former (0)	Circle axis 'Basis 1' Miscellaneous Name: Basis 1 Postion: Left Show axis Flip axis		
InCycle Expert (0)			

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.

Properties				– 🗆 X
Circle view Visuals Yniting X, Base axes X, Basis 1 Y Value axes Y Value axes Y Wert 1 Kems Kems	Circle axis Miscellaneous Name: Wert 1 Position: Bottom ~ Show axis Flip axis	Label: ○ None	 [∿[2:0]	× ×
,	Type Notation: Standard ~	Force precision Decimals:	0	¢.
	Scale			
	Dynamic auto scale	Show min and max	of the scale	A
	O Dynamic auto scale (increase only)	inner circle position:	33	× 10
	Manual scale (of the radius for circle):	Min:	√ -1	×
		Max:	√1	~
	Color			
	O Foreground color			
	 Color of item with lowest draw order 			
	Custom color:			~

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:



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>".

*	Profile				
	Profile	<no profile=""></no>	~		
*	Settings	<add profile=""></add>			
	Input signal				
	Cycle pulse trigger				
	Cycle reset trigger				
	Skip data signal				
Pr Th	ofile e profile contains the cor	figuration.			

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.

Configure profiles			111		×
Profiles	Calculations Bands				
inCycleProfile1	✓ Samples	273.0			
inCycleProfile2	Samples per cycle	100			
Samples bel cycle No Use subcycles False Sensor Units Input signal unit Averaging Cycles per calculation Averaging Type Linear Triggers Trigger Trigger mode Pulse trigger Band results Minimum, Maximum, Average					
	Sensor Unit	Input signal unit			
	✓ Averaging				×
	Cycles per calculation	IOO False Input signal unit IO Linear Pulse trigger Minimum, Maximum, Average			
	Configure profiles — — — — — — — — — — — — — — — — — — —				
	✓ Triggers				
	Trigger mode	Pulse trigger			
	✓ Bands				
	Band results	Minimum, Maximum, Average		Cancel	
	Use succycles Palse Sensor Unit Input signal unit Averaging Cycles per calculation Averaging Type Linear Triggers Trigger Mode Bands Bands Band results Minimum, Maximum, Average Sensor Unit The unit of the signal of this module				
Sensor Unit The unit of the signal of this module					
🖶 🗅 🗙 🔊 🔒 -			OK	Canc	el

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
- X 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 \bowtie in the toolbar, see chapter **7** 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.



InCycle-Expert 1					×
Profile: outlier		alttvtan .⊃ .⊃lilu			12 3
Settings Input Signal	Unassigned		•	— 🛤 (Input	1) 🕕

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
- X 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.



🌣 Manage profiles	- 0	×
Profiles: outlier Wear Profile	Image: Wear Profile Image: Wear Profile Image: Save as global profile Image: Global profiles are saved here: Image: C:\Users\astrian\AppData\Roaming\iba\ibaAnalyzer\ Image: C:\Users\astrian\AppData\Roaming\iba\ibaAnalyzer\ Image: To have global profiles usable for other users or ibaDatCoordinator, this path needs to be a globally accessible. This path can be configured in ibaAnalyzer's preferences in the Export/Import tab.	
	OK Cancel	

Fig. 58: Save profile globally

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

Preferences		
X-Axis Y-Axis Fast Fourier 2D	View 3D View Colors Fonts Hardcopy Miscellaneous Database Signal tree Signal grid PDO database storage	ibaCapture Overv
Metric unit: m Use linear interpolation Save data filenames as part Disable "too complex check"	Slide show timer: 5 sec t of analysis file 7 for expressions	
Use alternative path for glo	ibal macros, filters and InSpectra profiles nalysis embedded in a .dat file	
Autoload data files Timer: Path:	10 sec c:\	
Autoload analysis at startup:	all files include subdirectories	
© File ⊘ Most	: recently used	
Apply to analysis		
	Арріу ОК	Cancel

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 \square .

	file: outlier	~ 🛃 🌣	Last result: Friday, July 03
npı	t Profile	▼ 4 ▷	/// 🏶 🖽 🕬
Cal	Iculations Bands		250
~	Samples		- ment
	Samples per cycle	250	150
	Use subcycles	False	50
~	Sensor Units		
	Sensor Unit	Input signal unit	-50 -
~	Averaging		25
	Cycles per calculation	15	× IIIII
	Averaging Type	Linear	n l
~	Triggers		
	Trigger mode	Pulse trigger	250-
~	Bands		(PP)
	Band results	Minimum, Maximum, Average	N
			N.
			200-1
			450
			150
Су	cles per calculation		150
Cy Th	cles per calculation e number of cycles taken ir	nto account for one calculation.	150-
Cy Th	cles per calculation e number of cycles taken ir	nto account for one calculation.	100-
Cy Th	cles per calculation e number of cycles taken ir	nto account for one calculation.	100-
Cy Th	cles per calculation e number of cycles taken ir	nto account for one calculation.	100-

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.

Configure profiles					×
Profiles	Calculations Bands				
inCycleProfile1 inCycleProfile2	Samples Samples per cycle Use subcycles Sensor Units Sensor Unit Averaging Cycles per calculation Averaging Type Triggers Triggers Trigger mode Bands Band results Sensor Unit The unit of the signal of this module	100 False Input signal unit 10 Linear Pulse trigger Minimum, Maximum, Average			
💠 🗅 X 🛐 🖬 -	I ne unit of the signal of this module		OK	Cano	cel

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 <i>n</i> cycles at time T is done from the calculations at times T, T- δ , T- 2δ ,, T- $(n-1)\delta$.			
	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>i</i> = Index of cycle; i = 1 oldest, i = N latest cycle			
	<i>xi</i> = 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

Configure profile	s				×
Profiles	Calculations Bands				
inCycleProfile1					
inCycleProfile2	Configuration type:	Equidistant	~		
	Number of bands:	10	+		
		Levie			

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 **7** "*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.

	Na	me	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		Rand 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.

N	ame	Show result	Create signal					
) E	Group: Inputs	Group: Inputs						
	Cycle counter							
	Cycle duration							
	Minimum							
	Maximum							
	Average			- 2				
	RMS							
	Standard deviation			- 2				
	Minimum position							
	Maximum position			- 2				
	Range							
	Change			- 2				
E	Group: Bands							
	Band 0 (Minimum)							
	Band 0 (Maximum)							
	Band 0 (Average)			~~				
	Band 1 (Minimum)			-				
	Band 1 (Maximum)			- 2				
	D 14 (2)							

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 **7** 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

🔢 iba I/O Manager							×
🗄 🗋 🚰 🎽 🎝 🌗 🕶 Hardware Gr	oups Outputs 📳 🛝						
General B-B-ID ibaFOB-2io-D	InCycle Expert	(0)					
ib- 🔁 ibaCapture	🙈 General 🔨 Analog						
ibalnCycle_0	✓ Basic						
InCycle Expert (0)	Module Type	InCycle Expert					
- Auto-Adapting (11)	Locked	False					
Ancycle Expert (14)	Enabled	True					
Click to add module	Name	InCycle Expert					
📴 📶 ibaln Spectra	Module No.	0					
Click to add module	Timebase	10 ms					
D Playback	✓ Profile	1 - Appendix					
Ag Text interface	Profile	inCycleProfile1					
Click to add module	v Settings	1.1.1					
j⊟ f ∞ Virtual	Input signal	[3800:1] Blocksaege1.Motor.D					
Click to add module	Cycle pulse trigger	[3850.2] Schnitttrigger neu ne					
Unmapped	Cycle reset trigger	Unassigned					
A STATE OF CONTRACTOR	Skip data signal	Unassigned					
	V Data recording	Lot and a start of the start of					
	Band vectors	<none></none>					
	Name The name of the module.						
	Configure profiles						
	0 256 512 7	68 1024 1280 1536	1792 of 5	09 ОК	Apply	Cano	cel

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 **7** *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:

🔢 iba I/O Manager			
🗋 💕 🎽 🛃 🌒 🌗 🗸 Hardwa	e Groups Outputs 📳 🖺		
B\$\$ General B₩ ibaFOB-2io-D B■ ibaCapture	InCycle Expert (0)		
🗄 🛃 ibalnCycle		Unit	Antina
InCycle Expert (0)		Unit	Acuve
InCycle Auto-Adapting (11)	Cycle counter		
Click to add module	7 Cycle duration	5	
Click to add module	Group: Cycle input	-	
Playback	8 Minimum		
Virtual (1)	9 Maximum		
Vitual (2)	10 Average		
Click to add module	11 RMS		
	12 Standard deviation		
Click to add module	13 Minimum position		
	14 Maximum position	1	
	15 Range		
	16 Change		
	Group: Band 0		
	24 Band 0 (Minimum)		
	25 Band 0 (Maximum)	l l	
	26 Band 0 (Average)		
	Group: Band 1		
	27 Band 1 (Minimum)	1	
	28 Band 1 (Maximum)		
	29 Band 1 (Average)		
	Group: Band 2		
	30 Band 2 (Minimum)		
	31 Band 2 (Maximum)		×
	0 256 512 768 1024 1280 1536 1792 ∞ 128	OK Apply	Cancel

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 offline and to test them on recorded data.

First open an InCycle Expert view with the button \bowtie in the toolbar, see chapter **7** 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

Signals 🛛 🗘	InCycle-Expert 1	
D:\dat\InCycleDemo.dat	Profile: outlier	~ 🖵 🗘
0. Virtual	Input Profile	- 4 ▷
Into	V Settings	
E 0.5 wear	Input Signal	Onassigned 🔿 🖓 outlier
10 0.0: cycle	Cycle start trigger	Unassigned
f 1 Virtual	Cycle stop trigger	Unassigned
Views	Cycle reset trigger	Unassigned
InCycle-Expert 1	Skip data signal	Unassigned

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 **7** "General" tab, page 71.

InCycle	e-Expert 1														
Profile	outlier		~	¢	1 /77 🙈	l †Î v †⊛	Ð) T uar	. [].	Π.		×			12
Input	Profile		•	4 Þ		11+. 50	10-07	а і ЩЩь		11					
× 5		10-21 outline			250-						_		- 2	(Input 1	20
0	vole pulse trigger	[0.2] outlier			150										
C	vole reset trigger	Unassigned	1		150						-				
S	kip data signal	Unassigned	1		50										-
1000	Concerning of the second		Mar I		.50							1			
						25	50	75	100	125	150	175	200	225	250
Cycle If the t new c	Pulse trigger trigger signal has a risi rycle begins.	ing edge, the currer	nt cycle ends ar	nd a ↔	 I I										tt 1)
N	lame	Value	Unit	_	-1										
6	Group: Inputs			^		25	50	75	100	125	150	175	200	225	250
0	Cycle counter	0			11										
7	Cycle duration	0	s		K «				>>>		P		,0000	x	
8	Minimum	0										~ 01			-
9	Maximum	0				1	(9:40:44				1			
10	Average	0			03.07.2	020	-								
11	RMS	0	3	~		09:40		09:41		09:42		09:43		09:44	

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 **7** Setting calculation parameters, page 66

Profi	le: outlier		~ 🔒	Ö La	ast result: Fri	day, July 03	, 2020 09:4	0:44.749							2
Input	Profile		•	1 0	1/ 🛞	ţĮ v 🕼	PP	· •		II •					
Calo	ulations Bands				250	-man	nin.						- 8	(Input 1	2
~	Samples						m							40.000	
	Samples per cycle	250			150-										
	Use subcycles	False			50 -	1							1		
4	Sensor Units				-			Lanna	m	man	mm	mon	m	mm	m
	Sensor Unit	Input signal ur	nit		-50 -		-							-	
*	Averaging					25	50	75	100	125	150	175	200	225	250
	Cycles per calculation	1		×		1 1 1 1	I I I	111	1 1 1	1 1	1 1 1	1.1	E 1 E	1.1.1.1	1.
*	Triggers			11										(Input	1)
	Trigger mode	Start and st	op trigger		250-	SMA	M								
*	Bands				- Mart		The.								
Trig Dete	nger mode emines how the begin a se trigger: the pulse trigg	and end of a cyc	le is triggered: start of a new (100-										
	Calc	ulate		↔	0 -			www	Marrie W	wanth	m	mmm	a.e.t. Avan	- WAWA	MAN
	Name	Value	Unit			25	50	75	100	125	150	175	200	225	250
	E Group: Inputs			^		41 0				1 T					
0	Cycle counter	3			K «			1>	<u>>></u> >	÷	P	AII 1,00	00 x		
7	Cycle duration	20	s		x1										
8	Minimum	-9,896		-			0	9:40:44							
9	Maximum	257,595			03.07.20	20	*								
				- Y		09:40		09:41		09:42		09:43		09:44	

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 **7** 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 **7** 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 **7** *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 ibalnCycle 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>".

~	Profile									
	Profile	<no profile=""></no>	~							
~	 Settings <add profile=""></add> Input signal Cycle pulse trigger Cycle reset trigger Skip data signal Learning allowed signal 	<add profile=""></add>								
	Input signal									
	Cycle pulse trigger									
	Cycle reset trigger									
	Skip data signal									
	Learning allowed signal									
	Condition signal	Unassigned								
	Update reference curve	Unassigned								
~	Monitoring									
	Delta calculation	Average								
	Number of band results	5								
Pr Th	ofile e profile contains the confi	guration.								
<u>Co</u>	infigure profiles infigure reference curves									

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.

Configure profil	es						×
Profiles	Teach settings	Calculations	Bands				
InCycle AutoA1 inCycleProfile 1 outlier_monitoring	 Limits Monitoring mo Averaging Nr. curves to levents Events Event status si Event mode Event mode Event mode Using and alarm Lower and upper: of the status size	de earn gnals rmines how the creates events	curves are mor to based on a lin based on lower a	Range 10 Digital Warning and alarm itored: its for warnings and alarms and upper thresholds for the bands			
💠 🗅 🗙 🗿					OK	Can	cel

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



X Delete current 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.

a Configure profil	25				×
Profiles	Teach settings Calculations Bands				
InCycle AutoA1	✓ Limits	Cogram to the			
inCycleProfile1	Monitoring mode	Range			
outlier_monitoring	✓ Averaging				
The second s	Nr. curves to learn	10			
	✓ Events				
	Event status signals	Digital			
	Event mode	Warning and alarm			
	Event mode				
	This property determines how the curves are mo	onitored:			
	Warning and alarm: creates events based on a I Lower and upper: creates events based on lower	mits for warnings and alarms and upper thresholds for the bands			
🕂 🕞 🖊	Ē		ОК	Cano	cel

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

a Configure profil	es		_	×
Profiles	Teach settings Calculations	Bands		
InCycle AutoA1 inCycleProfile1	Configuration type:	Fouidistant		
outlier_monitoring	Number of bands:	20		

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 **7** *Setting calculation parameters*, page 66.

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

a Configure profil	es						×	
Profiles	Teach settings	Calculations Ba	nds					
InCycle AutoA1	✓ Samples			N 1.111				
inCycleProfile1	Samples p	er cycle		500				
outlier_monitoring	Use subcy	cles		False				
The state of the state	 Sensor Units 	nits						
	Sensor Uni	t		Input signal unit			~	
	 Averaging 	P						
	Cycles per	calculation		10				
	Averaging	Туре		Linear				
	✓ Triggers							
	Trigger mo	de		Pulse trigger				
	✓ Bands							
	Band result	s		Minimum, Maximum, Average	•			
	Sensor Unit The unit of the	signal of this module						
🗣 🗅 🗙 🔊	Ð				ОК	Can	cel	

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 **7** 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 **7** "*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 **7** 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.

🔢 iba I/O Manager									×
🗋 📴 🎽 🛃 🍨 🌗 🕇 Hardware G	roup	s Outputs 📳 🛍							
General ibaFOB-2io-D	In (Cycle Auto-Ad	apting (11)						
ibaCapture	\sim		D 1						
🖶 🔁 ibalnCycle	⇒ G	eneral V Analog JU	Digital						
🕀 😁 Plant 1	~	Basic							
InCycle Expert (0)		Module Type	InCycle Auto-Adapting						
InCycle Auto-Adapting (11)		Locked	False						
Click to add module		Enabled	True						
⊡-111 ibalnSpectra		Name	InCycle Auto-Adapting						
Click to add module		Module No.	11						
Playback		Timebase	10 ms						
Virtual (1)	~	Profile							
Virtual (2)		Profile	outlier_monitoring						
Ag lext interface	~	Settings							
Click to add module		Input signal	[1:2] outlier						
		Cycle start trigger	[1.0] cycle						
Click to add module		Cycle stop trigger	[1.0] cycle						
HE Unmapped		Cycle reset trigger	Unassigned						
		Skip data signal	Unassigned						
		Learning allowed signal	Always						
		Condition signal	Unassigned						
		Update reference curve	Unassigned						
	~	Monitoring							
		Reference for limits	Average						
	~	Limit configuration	Simple						
		Lower limit offset	0						
		Upper limit offset	0						
		Delta calculation	Sum						
		Number of band results	5						
	Ma	nitoring							
			<u></u>		128	ок	Apply	Can	cel
0		256 512 7	68 1024 1280	1536 1792 00	1LU		. PPU		and a

9.7.1 "General" tab

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

Basic settings

See InCycle Expert module, chapter **7** "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 **7** 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.

ert limit					Alarm limit				
= ref +	2			*	= ref +	5			*
+ ref		x	-1	*	+ ref		x	-1	-
+ (max -	min)	x	0	-	+ (max	- min)	x	0	-
+ (max -	avg)	x	0	-	+ (max	- avg)	x	0	\$
+ std		x	0	•	+ std		x	0	-

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:

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General ibaFOB-2io-D	InCycle Auto-Adapting (11)			
	🚘 General 🔨 Analog 🔟 Digital			
Plant 1	Name	Unit	Active	
InCycle Expert (0)	🖃 Group: General			^
InCycle Auto-Adapting (11)	0 Cycle counter			
Lick to add module	1 Number learned			
Click to add module	2 Condition			
Playback	3 Absolute delta			
Virtual (1)	4 Relative delta	%		
Virtual (2)	7 Cycle duration	s		
Click to add module	🖃 Group: Cycle input			
	8 Minimum			
Click to add module	9 Maximum			
	10 Average			
	11 RMS			
	12 Standard deviation			
	13 Minimum position			
	14 Maximum position			
	15 Range			
	16 Change			
	► Group: Bands with exceeded limits			
	24 Exceeded limit 1 (Band begin)			
	25 Exceeded limit 1 (Relative difference)	%		
	26 Exceeded limit 1 (TeachAverage)			
	29 Exceeded limit 2 (Band begin)			
	30 Exceeded limit 2 (Relative difference)	%		
	31 Exceeded limit 2 (TeachAverage)			
	34 Exceeded limit 3 (Band begin)			
	35 Exceeded limit 3 (Relative difference)	%		
	36 Exceeded limit 3 (TeachAverage)			
	39 Exceeded limit 4 (Band begin)			
	40 Exceeded limit 4 (Relative difference)	%		
	41 Exceeded limit 4 (TeachAverage)			
	128 1280 1536 1792 ∞ 128	ОК Арріу	y Canc	el

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 **7** *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.

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⊞∰ ibaFOB-2io-D	In	Cycle Auto-Adapting (11)		
ibaCapture	2	😂 General 🔨 Analog 🔟 Digital		
E → Plant 1		Name	Active	
InCycle Expert (0) InCycle Auto-Adapting (11) Click to add module Click to add module Trip Playback Trip Virtual (1) Aa Text interface Click to add module Click to add module Click to add module Lick to add module Unmapped		🗉 Group: Module		
	23	Overall module event		
	24	Band 1 (Alert)		
	25	Band 1 (Alarm)		
	26	Band 2 (Alert)		
	27	Band 2 (Alarm)		
	28	Band 3 (Alert)		
	29	Band 3 (Alarm)		
	30	Band 4 (Alert)		
	31	Band 4 (Alarm)		
	32	Band 5 (Alert)		
	33	Band 5 (Alarm)		

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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