

ROTALIGN®

Ultra

HYDROPOWER



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Firmware version 1.xx

PRÜFTECHNIK
Alignment Systems GmbH
Freisingerstr. 34
85737 Ismaning
Germany
Fax: +49 89 99616-100
eMail: info@pruftechnik.com

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PRÜFTECHNIK Alignment Systems GmbH

Freisinger Str. 34

D-85737 Ismaning

www.pruftechnik.com

info@pruftechnik.com

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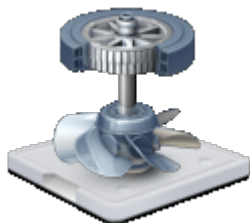
Application overview


The aim of this chapter is to provide basic information about *Hydropower* and familiarize user with functionality and structure of the application.

This chapter contains the following sections:

- Starting the application (page 8)
- Hydropower screen elements (page 10)
- Application menu (page 14)

Starting the application






To start the *Hydropower* application, select the **Hydropower** icon in the applications list of the Program Manager using the arrow buttons and press the  button.

A splash screen will be displayed and the application will be loaded.

The first screen to appear after the application is started is the *Welcome to Hydropower* screen. The screen provides access to the most common file management options. For details, see the *Welcome to Hydropower* screen section on page 35.

Basic navigation

The Hydropower application is divided into three main functional sections. You can switch between these sections simply by pressing corresponding buttons on ROTALIGN Ultra device's keyboard:

1. Setup  button
2. Measurement  button
3. Results  button

Getting help

Hydropower offers hints and tips for most of application's controls and options.

Status bar hints

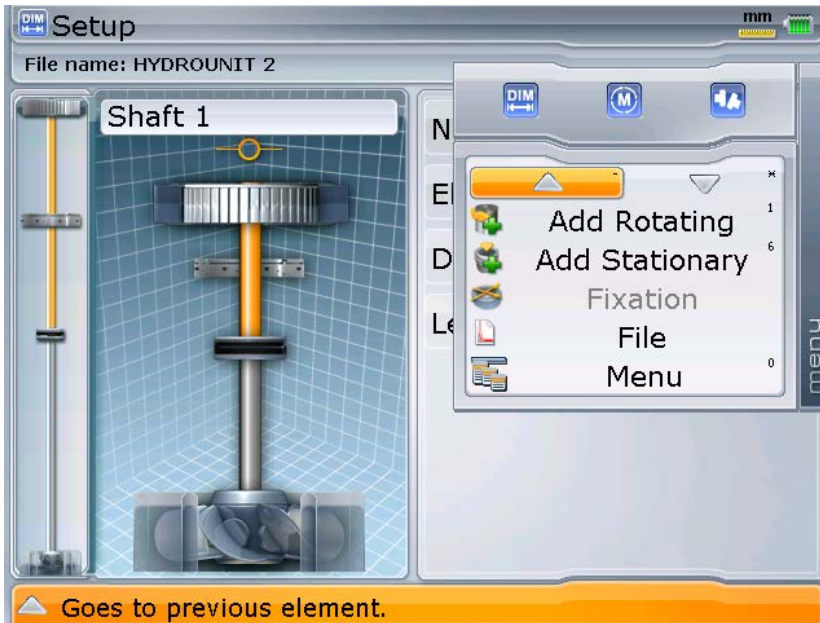
Press Enter to set-up all dimensions.

For each screen element, input control and context menu option short information on its use and function is displayed in the status bar at the bottom of the screen.

Balloon tips

Balloon tips are absent in the current version of the software.

Hydropower screen elements



Title bar



Title bar is located at the top of the application screen.

The name and symbol of the current screen is always displayed on it.

The title bar also contains additional useful information such as measurement units and battery charge status.

In the lower part of the bar the name of the currently loaded measurement file is displayed.

Content area



This is the main section of the application screen. It displays essential elements for each screen functionality. These elements vary in each screen and may include:

- Graphical representation of the measured hydrounit
- Controls for setting up and adjusting hydrounit components.
- Controls required to prepare and perform measurement at individual positions
- Table with measured values and other measurement points properties
- Diagrams presenting result values in graphical form
- Controls enabling adjustment of different application settings

For a detailed description of the contents of the main application screens, see corresponding sections of the manual:

- Hydrounit setup screen elements (page 31)
- Measurement screen elements (page 54)
- Results screen elements (page 80)

Mini hydrounit view

Mini hydrounit view is a narrow vertical diagram located at the left edge of the application screen.



The Mini hydrounit view is a simplified graphical representation of the hydrounit. It is designed to help the user navigate along complex long hydrounits with numerous components and measurement positions.

The following elements are displayed on the Mini hydrounit view:


- Graphical representation of the hydrounit
- Currently selected element (highlighted)
- Visible area – the part of the hydrounit, which is visible in the active application screen (additional frame)
- Scroll direction (arrows)

Context menus




Context menus are the main means of controlling the application.

Context menus are screen and state dependent. They always contain only options, which are available in the present screen.



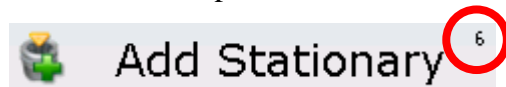
The context menu appears on the right of the screen, after the  button is pressed. It contains all actions available in a particular situation.

To activate a context menu option:


1. Use the   arrow keys to choose an option.
2. Press the  button to confirm the selection.

Alternatively:

Press the numerical keyboard button corresponding to the desired function. Shortcut buttons for context menu functions are indicated in the upper right corner of each option field.



The item labels can be displayed as icons, text captions or both together.

To leave the menu without performing any action, simply press the  button again.

Status bar

A horizontal orange status bar with a gradient effect, containing the text "Press Enter to set-up all dimensions." in a bold, black, sans-serif font.

Press Enter to set-up all dimensions.





Status bar is located at the bottom of the application screen. It contains one of following information types:

- **Hints**
for context menu options, screen controls or possible actions
- **Current application status**
currently performed tasks, errors, etc.

Application menu

The Application menu of *Hydropower* is accessible from every application screen.

To open the Application menu, do one of the following:

- Press and hold the  button until the Application menu appears
- Press the  button twice.
- Press the  button and then choose  **Menu** from the context menu.

There are following pull-down menus featured by the application:

1. File (page 14)
2. Configuration (page 15)
3. Dimensions (page 16)
4. Measurement (page 16)
5. Results (page 17)
6. Help (page 17)
7. Quit (page 17)


You can open each menu by selecting it with   arrow keys or by pressing the corresponding shortcut button on the numerical keyboard.






All these menus are described in detail in the following sections of this manual.

File menu (1)

All setup and measurement data from the *Hydropower* application is stored on the ROTALIGN Ultra device in dedicated files.





In the *File* menu you can find all functions related to *Hydropower* files management and maintenance.





Short-cut	Menu item	Function	Menu icon
1	Resume	Loads a recently opened measurement file. Only active if such a file is available.	

2	New	Invokes the <i>Welcome to Hydropower...</i> screen, which enables to create a new measurement file from scratch or from an existing template.	
3	Open	Invokes the <i>Open document</i> dialog enabling to browse the device file system for a <i>Hydropower</i> file to open.	
4	Save	Saves the current measurement file immediately. If the file has not been saved previously and thus has no name assigned, the <i>Save document as</i> dialog is opened.	
5	Save as	Opens the <i>Save document as</i> dialog, which allows saving the current file under a different name and/or in a different folder.	
6	Delete	Invokes the <i>Delete document</i> dialog, which enables to select obsolete or redundant files and remove them from the device	

Configuration menu (2)


This menu contains options enabling customization of the application working environment and setting up various properties of the device.

Short-cut	Menu item	Function	Menu icon
1	Units	Opens the <i>Units</i> screen containing settings of distance, angle and temperature units, distance precision and results resolution.	
2	Date & Time	Goes to the <i>Date & Time – settings</i> screen, which allows setting system date, time and time zone.	
3	Printer setup	Opens the <i>Print</i> screen, enabling configuration of a connected printer and printout parameters.	
4	Display settings	Invokes the <i>Display settings</i> screen allowing adjustment of the device's LCD brightness.	

5	Power management	Opens the <i>Power management</i> screen, which includes power saving settings and enables to adjust device suspend mode parameters such as LCD backlight dimming, sleeping mode and turn off time.	
6	Device information	Goes to the <i>Device information</i> screen, where system hardware, software and firmware information is presented.	
7	Language	Invokes the <i>Language</i> screen, which contains a language selection table enabling to change the language of the device user interface.	
8	Customization	Goes to the <i>Customization options</i> screen. This screen enables to adjust a number of options related to the user interface of the device.	



Setup menu (3)


This menu provides access to the *Setup* screen.

Short-cut	Menu item	Function	Menu icon
2	Dimensions	Invokes the <i>Setup</i> screen, in which the all parameters of the hydrounit to be measured can be set up.	

Measurement menu (4)


This menu contains elements related to the measurement data collection process itself.

Short-cut	Menu item	Function	Menu icon
1	Measurement overview	Opens the <i>Measurement overview</i> screen, which allows selecting measurement positions to be measured and choosing type of measurement to be performed.	
2	Measurement table	Opens the <i>Measurement Table</i> screen presenting measurement list and other properties of individual positions in a tabular form.	

3	Sensor selection	Invokes the <i>Sensor selection</i> screen, which enables setting up connection with INCLINEO sensor to be used for measurement.	
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Results menu (5)

This menu provides access to the *Results* screen of the application.

Short -cut	Menu item	Function	Menu icon
8	Results overview	Goes to the <i>Results</i> screen, which presents measurement results in graphical form and allows viewing and evaluating them and viewing calculated corrections.	



Help menu (6)



This menu provides access to the *About Hydropower* screen.

Short -cut	Menu item	Function	Menu icon
1	About	Invokes the <i>About Hydropower</i> screen, which presents information regarding the application, such as software version and date, serial ID and copyright information.	

Quit menu (7)

This menu enables closing the *Hydropower* application, turning of the ROTALIGN Ultra device and provides access to user management.

Short -cut	Menu item	Function	Menu icon
1	Quit to Program Manager	Quits the <i>Hydropower</i> application and loads the Program Manager. The application will ask for user confirmation before proceeding. Additionally, the application will prompt you to save the measurement file if any changes remain unsaved.	
2	User accounts	Invokes the <i>User accounts</i> screen enabling switching between users, adding new user.	

3	Turn off the device	Switches of the ROTALIGN Ultra device.	
		Works same as pressing and holding the  button.	
		The application will ask for user confirmation before proceeding. Additionally, the application will prompt you to save the measurement file if any changes remain unsaved.	





Application configuration

Hydropower offers a number of configuration options designed to facilitate adjusting the program to individual user's needs and different measurement applications.

This chapter contains the following sections:










- Units (page 20)
- Customization (page 22)

Units


The *Units* screen can be reached from the Application menu by choosing  **Configuration** >  **Units** or by selecting  **Settings** >  **Units** from the context menu of the *Overview* screen.

The *Units* screen enables selecting distance, angle and temperature units to be used during measurement in *Hydropower* application.

To edit a unit value:

1. Select the proper combo box using the     arrow keys.
2. Press the  button.
A list of all available options will appear.
3. Choose the proper option using the   arrow keys.
4. Press the  button again to confirm the selection.
If you want to revert the change to the original value press  instead.

After all changes are made, press the  button or use the  **OK** context menu option to apply them and return to the previous application screen.

If you want to leave the screen without applying the changes, choose  **Cancel** from the context menu.
The application will ask for your confirmation before proceeding.

Distance units

This combo box enables you to define distance units to be used during measurements.

There are following unit sets available:

- **Millimeters**
- **Inches and mils**
- **Inches and thous**

Angle units

This combo box enables you to define angle units to be used during measurements.

There are following unit sets available:

-
- ° (degrees)
 - mm/m
 - mils/inch

Distance precision

This option defines precision with which the distances will be presented.

Currently there is only one value available for this option field: **Standard**.

Results resolution

This option defines precision with which the result values will be presented.

There are two possible settings:

- **Normal resolution**
- **High resolution**

Check out the Examples section of the screen to see how the result presentation changes as the Result resolution is changed.

Normal result resolution values:

Distance:	12 mm
Corrections:	12.34 mm
Results:	12.34 mm

High result resolution values:

Distance:	12 mm
Corrections:	12.34 mm
Results:	12.345 mm

Showing SD value

This option is not supported in the current version of the software.

Temperature units




This combo box enables you to select temperature units:

-
- **Celsius degrees**
 - **Fahrenheit degrees**


Predefined units schemes

The application features ready-made units sets, which are defined according to measurement units used in different countries/regions.





You can select one of these schemes using appropriate context menu option:

Icon	Units scheme	Distance unit	Temperature unit
	US units	Inch and mils	Fahrenheit
	English units	Inch and thous	Fahrenheit
	Metric units	Millimeters	Celsius

Default settings










To revert all options to factory settings, select the  **Set defaults** option from the screen context menu.



Customization


The *Customization* screen can be reached from the Application menu by choosing  **Configuration** >  **Customization** or by selecting  **Settings** >  **Customization** from the context menu of the *Overview* screen.

The screen contains a set of combo boxes enabling personalization of appearance and behavior of different elements of the application interface.

To edit each value:

1. Select the proper combo box using the     arrow keys.
2. Press the  button.
A list of all available options will appear.
3. Choose the proper option using the   arrow keys.
4. Press the  button again to confirm the selection.
If you want to revert the change to the original value press  instead.

After all changes are made, press the  button or use the  **OK** context menu option to apply them and return to the previous application screen.

If you want to leave the screen without applying the changes, choose  **Cancel** from the context menu.

The application will ask for confirmation before proceeding.

Keyboard backlit

The ROTALIGN Ultra device keyboard is lit by default for better visibility when working in poorly lighted places. The keyboard illumination turns on automatically after any key is pressed and remains on for a programmed period of time.

You can however turn the light off permanently in order to save battery life.

- **Normal use**
standard backlit mode
- **Off**
keyboard backlit will not be used

Status bar and hints

This option enables choosing elements, for which the status bar hints should be displayed.

- **Normal use**
all status bar hints are displayed.
- **Never in menu**
all status bar hints but those for the context and application menu items are displayed.
- **Only in menu**
only hints for the menu items are displayed.
- **Never**
no status bar hints.

For more information, please see Status bar hints on page 8.

Beep

The device features an internal beeper that can emit sound signals when certain events occur. The **Beep** combo box allows you to specify the policy of using the sound signals:

- **Never**
the beeper is off.
- **System events only**
the sound signal is emitted only when a system event occurs.
- **Every key stroke**
the beep sound will accompany every system event and each use of any button.

Workflow assistant

This option is not supported in the current version of the software.

Resume policy

Use the combo box to specify, whether the recent file should be automatically resumed after the application is loaded:


- **Resume files manually**
a new blank file appears after the application restart.
To resume the most recent file, use the application menu or the Program Manager.
For details on the Application menu, see page 14.

-
- **Always resume last file**
the most recent file is automatically resumed at the application start.

Navigation scheme

For convenience of use, the navigation scheme can be customized to better suit the individual needs of the user.

Use the combo box to select the most suitable navigation scheme.


- **Default**
The standard navigation scheme. All arrow keys are used to navigate between the screen items and you need to press  to activate the input control.
- **Editing moves focus**
When the editing of one input control is done the focus cursor will be automatically moved to the next input control.

User viewable files

Use the combo box to specify file visibility policy. This option is visible in *Customization* screen only for Administrator user.


- **Only user files and templates**
User can see only files created by him and all templates.
- **All files from all user**
Every user can see all files created by other users.

Default settings

To revert all options to factory settings, select the  **Set defaults** option from the screen's context menu.

Measurement file overview




When a new *Hydropower* file is created or an existing one opened, the next application screen invoked is the *Overview* screen.

The screen can also be reached from any high level application screen by pressing the  button.



The *Overview* screen presents a list of properties of the current measurement file:










- **File**
Name of current measurement file.
- **User**
Name of current user.
- **Number of measurements**
Number of measurements taken within currently opened measurement file.
- **Last modification**
Date and time of the last modification made to the measurement file.
- **Last measurement**
Date and time of the last measurement performed in the current measurement file.

The *Overview* screen also contains quick access buttons for all high-level application screens:

Button	Screen
	<i>Shaft setup</i>
	<i>Measurement overview</i>
	<i>Results</i>

Additionally the *Overview* screen context menu provides access to general *Hydropower* application options:














-  **Settings:**  **Customization**
Invokes the *Customization* screen.
See page 23.

-
-  **Settings:**  **Units**
Invokes the *Units* screen.
See page 20.
 -  **About**
Invokes the *About Hydropower* screen, which provides general information such as software version and date, serial ID and copyright information.
 -  **Report:**  **Print**
Allows printing measurement report to PDF format or use selected printer. If PDF report is selected, the file is saved on a connected USB drive.
After the option is selected, the *Report* screen is invoked enabling to set up additional report properties before printing.
 -  **Report:**  **Save**
This option is not supported in the current version of the software.
 -  **Program manager**
Exits *Hydropower* and returns to *Program Manager*.
The application will ask you for confirmation before closing. You will also have a chance to save any changes made to the currently opened measurement file.
 -  **Turn off**
Turns off the ROTALIGN Ultra device.
The application will ask you for confirmation before closing. You will also have a chance to save any changes made to the currently opened measurement file.

Hydrounit setup

All parameters and settings of the hydrounit are adjusted in the *Hydrounit setup* screen of the application.

This chapter contains the following sections:

- Setup wizard (page 29)
 - Hydrounit setup screen elements (page 31)
 - Hydrounit setup navigation (page 33)
 - Measurement files management (page 35)
1. Press and hold the  button until the Application menu appears.
 2. Select  **File** >  **Delete** and press . The *Delete document* dialog will appear. The dialog allows you to remove many files at once.
 3. Browse the directory tree to find the files you would like to remove. Use the   arrow keys to select consecutive folders and files. Use the   arrow keys to expand/collapse folders.
 4. When the proper file is chosen, press the  button to mark it for deletion. The marked file will be highlighted green. To unmark the file, press the  button again. To unmark all marked files, choose  **Deselect all** from the context menu.
 5. When all required files are selected, use the  Delete context menu option or the  button to remove the files from the device. The application will ask for your confirmation before proceeding.
- (page 38)
 - Thrust bearing fixation (page 45)

Setup wizard



The *Setup wizard* screen is only invoked after the **New hydrounit** option is selected in the *Welcome to Hydropower* screen.

The screen enables quick selection of basic features and elements of the hydrounit to be measured. More advanced properties can then be set in the *Setup* screen if required.


The following elements are present in the *Setup wizard* screen:

- **Hydrounit representation**
Graphical depiction of the hydrounit, which is being set up. The visual representation will be updated in accordance with current selection of properties made by the user.
- **Hydrounit properties**
A set of general properties of the measured hydrounit. For a detailed description of these properties please refer to section below.

Hydrounit properties

The *Setup wizard* screen provides a set of property boxes, which allow adjustment of basic properties of the measured hydrounit. These properties can be modified later in the *Setup* screen:

- **Shafts**
This spin box enables selecting the number of shafts present in the hydrounit.
- **Runner type**
This combo box contains a list of available turbine runner types:







-
- Kaplan
 - Francis
 - Pelton
 - Other
 - **Thrust bearing**
Mark this check box to include thrust bearing in the hydrounit setup.
 - **Stator**
Mark this check box to include stator of the generator in the hydrounit setup.
 - **Throat ring**
Mark this check box to include throat ring of the turbine runner in the hydrounit setup.
 - **Proceed**
After all properties are set correctly select this button and press  to proceed to the *Setup* screen.

Note: For a more detailed description of hydrounit elements, please see the After initial selection of hydrounit properties in the *Setup wizard* screen, the hydrounit settings can be further adjusted in the *Setup* screen.

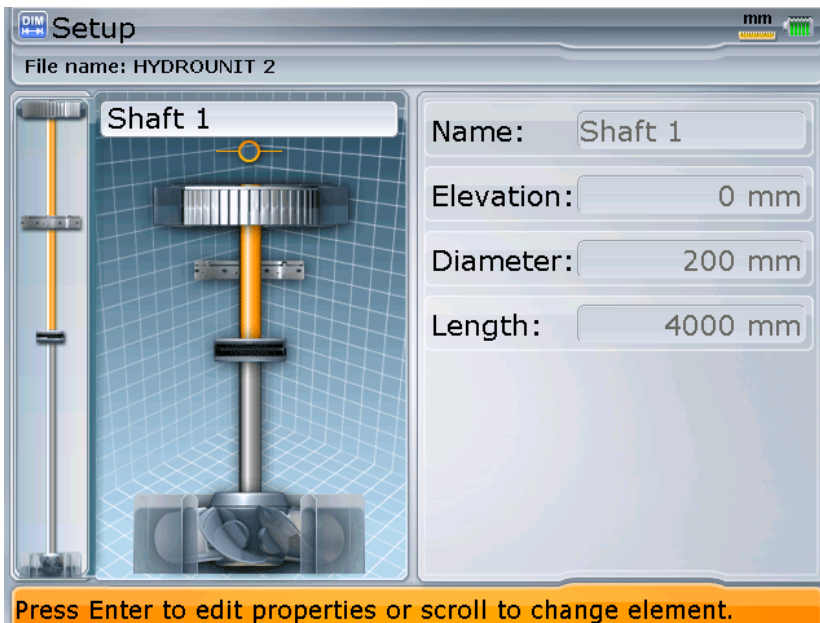
Controls available in the Setup screen allow adding and removing elements of the hydrounit and adjusting properties of existing elements.

Hydrounit elements section on page 39.

To change properties:

1. Navigate the table using the     buttons to select proper box.
2. Press  to activate the box and select proper element from the list or mark/unmark check box.
3. Press  again to confirm the choice.

Hydrounit setup screen elements



The aim of the *Hydrounit setup* screen is to enable the user to construct a visual representation of the measured hydrounit or adjust the representation constructed in the *Setup wizard* screen. Some of these elements will define positions for plumbness and rotation axis measurements. Other elements, e.g. guide bearings, can help in visual orientation and identification of the hydrounit or provide levels for runout offset verification.

The following elements are present in the *Hydrounit setup* screen:

- **Mini hydrounit view**
A simplified hydrounit diagram located on the left margin of the screen. It is designed to facilitate navigating complex hydrounits.
See Using mini hydrounit control on page 33.
- **Hydrounit representation**
Graphical depiction of the measured shaft's construction located on the left side of the application screen. This visualization presents all elements of the hydrounit and indicates, which element is currently selected.
For a comprehensive list of available hydrounit elements and their function please refer to the After initial selection of hydrounit properties in the *Setup wizard* screen, the hydrounit settings can be further adjusted in the *Setup* screen.

Controls available in the Setup screen allow adding and removing elements of the hydrounit and adjusting properties of existing elements.

- Hydrounit elements section on page 39.

- **Hydrounit element properties**

This section occupies the right hand side of the application screen and contains a set of properties of the currently selected hydrounit elements. Controls in this section enable user to adjust those properties for each component of the measured hydrounit.





For a detailed description of the properties, see the Element properties section on page 42.

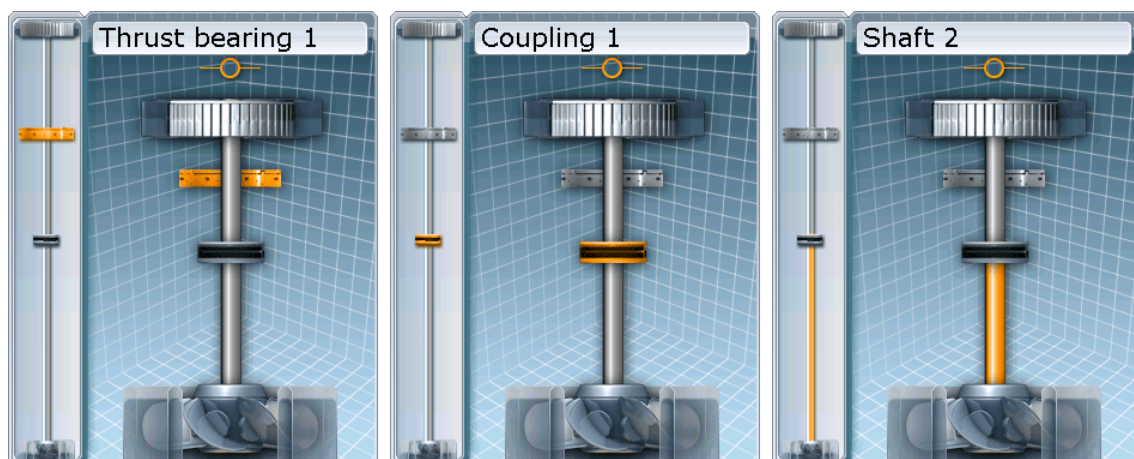
Hydrounit setup navigation

The *Hydrounit setup* view is equipped with straightforward navigation capabilities, which enable quick selection of components and scrolling the view of the hydrounit, thus facilitating work with complex units.

Note: For information on how to navigate element properties section of the Setup screen, please refer to see the Element properties section on page 42.

Selecting hydrounit elements

To select adjacent elements of the shaft, use the     arrow keys respectively.



Currently selected element is highlighted in orange.

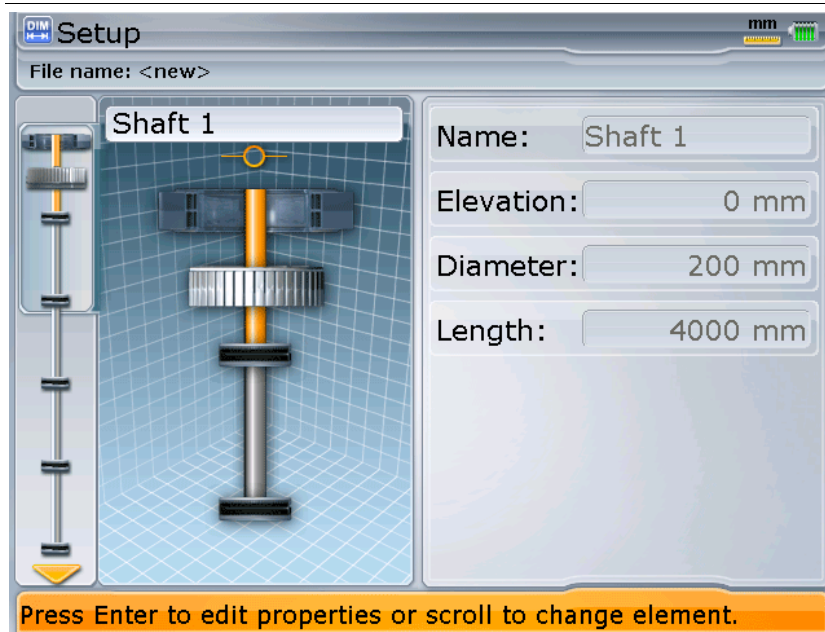
If the hydrounit is too long/complex to fit entirely in the graphical representation view, the view will be automatically scrolled in the corresponding direction when the user pressed the arrow key, which selects an element, which is currently off the view.

The mini hydrounit control on the left indicates the part of the hydrounit, which is currently visible in the graphical hydrounit view. For a detailed description of mini hydrounit capabilities, please see the next section.

Using mini hydrounit control

Mini hydrounit is a small vertical control, which occupies the left margin of the application window. The purpose of the control is to facilitate navigating long hydrounits, which cannot entirely fit into the graphical hydrounit representation.

The frame visible in the mini hydrounit setup encompasses the part of the hydrounit, which is currently visible in the graphical representation of the unit.





If the hydrounit is too complex to fit entirely into the mini hydrounit control the yellow arrows indicate the direction, in which the mini hydrounit view will scroll in order to show adjoining parts of the hydrounit. The mini hydrounit control will scroll automatically when consecutive elements are selected in the main graphical representation of the hydrounit in the *Setup* screen.

Measurement files management

All Hydropower setup and measurement data is stored in dedicated files on the ROTALIGN Ultra file system.

The application provides all functions necessary for management and maintenance of these files. Some of these functions can be accessed directly from the context menu of some of the application screens; others are available only from the *Application menu*.





Welcome to Hydropower screen

The *Welcome to Hydropower* screen appears after the  **File** >  **New** option is selected from the context menu.


The screen is also opened after the Hydropower application is started.

The *Welcome to Hydropower* screen provides a quick access to the most common functions connected with application's measurement files.

The functions are represented by corresponding icons.

Icon	Name	Function
	Resume	Loads the recently opened measurement file. This option will be inactive if no recent file is available.
	Open file	Invokes the Open document dialog enabling to browse the device file system for existing measurement files.
	Open template	Invokes the <i>Open template</i> dialog presenting a list of all application templates existing on the device.
	New hydrounit	Invokes the <i>Setup Wizard</i> screen, in which a new hydrounit can be created. For details, please see Setup wizard on page 29.

To activate the desired option:





- Use the  buttons to highlight corresponding icon.

2. Press  to activate the option.

All the options present in the *Create new file...* screen are also available in the Application menu.





Loading recently used file

To load a most recently used Hydropower file:

1. Press and hold the  button until the Application menu appears.
2. Select  **File** >  **Resume** and press  .
The most recently loaded file will be opened.



Creating new measurement file



To create a new measurement file from a template:

1. Press and hold the  button until the Application menu appears.
2. Select  **File** >  **New** and press  .
The *Welcome to Hydropower...* screen will be opened.

3. Select the  **New hydrounit** option and press  enter to create a new measurement file. The *Setup wizard* screen will be invoked.


or






4. Select the  **Open template** option and press  enter to go to the *Open template* dialog. It allows creating a new measurement file from an existing template.




The  **File** >  **New** option is also present in the context menu of the *Overview* and *Setup* screens.



Opening existing file

To open an existing *Hydropower* file:

1. Press and hold the  button until the Application menu appears.





-
2. Select  **File** >  **Open** and press  .
The *Open document* dialog will be invoked.
 3. Browse the directory tree to find the file you want to load.
Use the   arrow keys to select consecutive folders and files.



Use the   arrow keys to expand/collapse folders.
 4. When the proper file is highlighted with the orange selection focus, press the  button to open it.

The  **File** >  **Open** option is also present in the context menu of the *Overview* and *Setup* screens.

Saving file







To save the active file:





1. Press and hold the  button until the Application menu appears.
2. Select  **File** >  **Save** and press  .
The file will be saved immediately.



The  **File** >  **Save** option is also present in the context menu of the *Overview*, *Setup* and *Results* screens.

Saving files under different name

To save the active file under a different name or in a different folder:














1. Press and hold the  button until the Application menu appears.
2. Select  **File** >  **Save as** and press  .
The *Save document as* dialog will be invoked.
3. Browse the directory tree to select a folder to save the file in.
Use the   arrow keys to select consecutive folders and files.

Use the   arrow keys to expand/collapse folders.
4. When the proper folder is chosen is press the  button.
An edit window will be opened.
5. Use the numerical keyboard to type in the file name.
6. Press the  button again to confirm the name.
The file will be saved and you will be returned to the most recent application screen.

The  **File** >  **Save as** option is also present in the context menu of the *Overview* and *Setup* screens.

Deleting measurement file

To delete a superfluous file:

6. Press and hold the  button until the Application menu appears.
7. Select  **File** >  **Delete** and press  .
The *Delete document* dialog will appear.
The dialog allows you to remove many files at once.
8. Browse the directory tree to find the files you would like to remove.
Use the   arrow keys to select consecutive folders and files.
Use the   arrow keys to expand/collapse folders.
9. When the proper file is chosen, press the  button to mark it for deletion.
The marked file will be highlighted green.
To unmark the file, press the  button again.
To unmark all marked files, choose  **Deselect all** from the context menu.
10. When all required files are selected, use the  Delete context menu option or the  button to remove the files from the device.
The application will ask for your confirmation before proceeding.

Hydrounit element settings

After initial selection of hydrounit properties in the *Setup wizard* screen, the hydrounit settings can be further adjusted in the *Setup* screen.

Controls available in the Setup screen allow adding and removing elements of the hydrounit and adjusting properties of existing elements.

Hydrounit elements

Hydropower application provides a number of components for preparing an accurate representation of the actual hydrounit measurement situation. Some of these elements serve as measurement position, others are there for the sake of representation accuracy or to be used as additional reference points – for example, as a runout offset level.

Hydrounit components in Hydropower are divided into rotating and stationary elements.

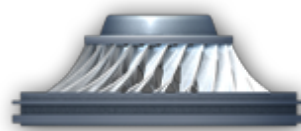
Shaft



It is a rotating element.

A hydrounit in the Hydropower application can have up to 14 shafts connected by couplings. Shafts are used for plumbness and rotation axis measurements.

Turbine runner



It is a rotating element.

Hydropower application enables selection of turbine runner type in order to provide better representation of the actual hydrounit setup.

There are following runner types available:

- Kaplan
- Francis
- Pelton
- Other – for a non-standard hydro-turbine runner type

Hydropower enables measurement of the rotation axis of turbine runners.

Thrust bearing runner



It is a rotating element.

This element represents the rotating part of the thrust bearing element.

Thrust bearing runner is not a measurable element. It is used to indicate position of the runner in the hydrounit.

Rotor



It is a rotating element.

This element indicates position of the generator rotor in the hydrounit setup.

No measurements are performed on the rotor.

Thrust bearing



It is a stationary element.

Thrust bearing is the main support element of the hydrounit and the element, which enables performing corrections of plumbness and rotation axis of the hydronit.

Hydropower application comes with additional functionality of adjusting thrust bearing fixation type, which enables proper calculation of required corrections and facilitates their application. For details see Thrust bearing fixation on page 45.

Hydropower application enables performing measurement of the thrust bearing surface.

Guide bearing



It is a stationary element.

Guide bearing element is not used for measurements. However it can be used to reflect the actual guide bearing position on the shaft and also can be used as a level for runout offset check.

Stator



It is a stationary element.

This element represents the generator stator. It is not used for measurement.

Throat ring



It is a stationary element.




This element represents throat ring of the turbine runner. It is not used for measurement.

Adding element

New element can be added using corresponding *Setup* screen context menu option.




There are separate options for adding rotating and stationary elements.

To add a new hydrounit element:

1. Press  to open the context menu.
2. Select  **Add rotating** or  **Add stationary** depending on which type of element you want to add.
3. Select proper element from corresponding submenu.

Removing elements

Redundant element can be removed from the hydrounit:

1. Highlight the element in the graphical hydrounit representation using the   buttons.
2. Press the  button to remove the element from the hydrounit.
The application will ask for your confirmation before proceeding.







Element properties

The *Setup* screen contains a number of control boxes, which enable to set up all necessary parameters of different types of hydrounit elements:

- **Name**
This text box contains the name of the current element. The name is assigned automatically as the element is created.
An automatically assigned name can be changed by the user at any time.
Elements: all.

-
- **Elevation**
This text box enables entering the distance between the currently selected element and hydrounit's reference point.
Elements: all.
 - **Diameter**
This text box contains diameter value of the currently selected element.
Elements: all except thrust bearing.
 - **Inner diameter**
This combo box enables entering inner diameter of the thrust bearing.
Elements: thrust bearing.
 - **Outer diameter**
This combo box enables entering outer diameter of the thrust bearing.
Elements: thrust bearing.
 - **Length**
This combo box contains length value (vertical dimension) of the currently selected element.
Elements: shaft, stator, rotor, throat ring, turbine runner.
 - **Type (coupling)**
This combo box enables selecting coupling type. There are two options available:
 - Single plane
 - Short flexElements: coupling.
 - **Type (turbine runner)**
This combo box enables selecting type of turbine runner used in the hydrounit. There are four options to select from:
 - Kaplan
 - Francis
 - Pelton
 - OtherElements: turbine runner.
 - **RPM**
Textbox containing RPM value of the currently selected coupling.
Elements: coupling.
 - **Format**
This combo box allows selecting proper format for displaying coupling misalignment values.
Element: coupling.





To change properties:


-
1. Navigate the table using the     buttons to select proper combo box.
 2. Press  to activate the box and select proper element from the list.
 3. Press  again to confirm choice.


Thrust bearing fixation

Proper setup of thrust bearing fixation is one of the essential elements of measurement preparation in *Hydropower*. Fixation type and its properties determine calculation of final corrections, which can be viewed in the *Results* screen after measurement. Selecting proper correction type and number of correction points enables the application to calculate proper correction values for each position.

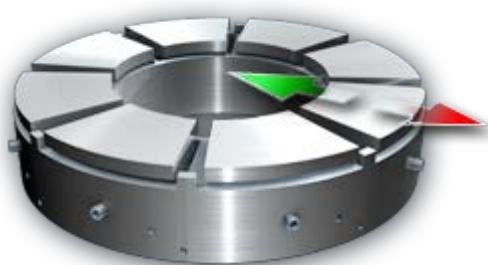
To select and adjust thrust bearing fixation:

1. Navigate the hydrounit using the  buttons to select the thrust bearing.
2. Press  to open context menu
3. Select  **Fixation** from the context menu and press  to open the fixation dialog

Note: The  **Fixation** context menu option will be active only when the thrust bearing is selected in the hydrounit view.

4. Select correct thrust bearing fixation type from the Fixation combo box. There may be additional edit boxes available – enabling adjustment of additional properties peculiar to the selected fixation type, necessary for proper calculation of required correction values.
5. After all properties are set correctly, select the **OK** button and press  to confirm changes and close the dialog. If you want to abandon any changes made in the fixation dialog, use the **Cancel** button instead.

Radial fixation

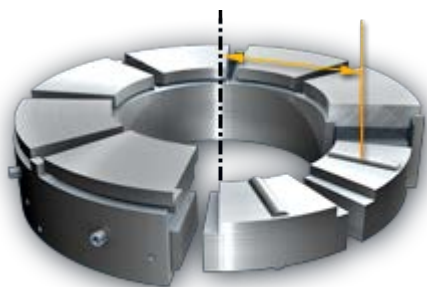


Radial fixation enables horizontal shift of the thrust bearing by means of adjustment points located along the circumference of the bearing housing.

The **Segments** combo box allows selecting the number of thrust bearing segments, at which adjustment points, which are used for position correction, are located.

When this type of fixation is selected the alignment corrections are calculated for each adjustment segment individually.

Shimming fixation



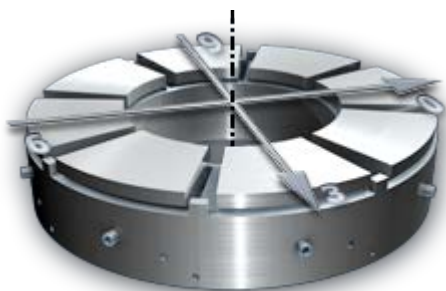
Shimming fixation allows correcting level of the thrust bearing by inserting or removing shims from shimming points located under the base of the bearing.

There are following additional properties available for shimming fixation:

- **Segments**
This combo box contains the number of thrust bearing segments, under which the shimming points are located.
- **Distance**
This text box enables entering the distance from the rotation axis of the hydrounit to the center of the shimming point (shimming points are equidistant to the axis).

When this type of fixation is selected the resulting alignment corrections are calculated to present the thickness of shims, which have to be added to or removed from each of the shimming points in order to correct the levelness of the thrust bearing.

Jack fixation



Jack fixation enables correcting horizontal position of the thrust bearing by shifting it in two perpendicular directions: **3 – 9** and **0 – 6**.

When this type of fixation is selected the resulting alignment corrections are recalculated for the two available correction directions.

There are no additional properties available for jack fixation.

Performing measurements

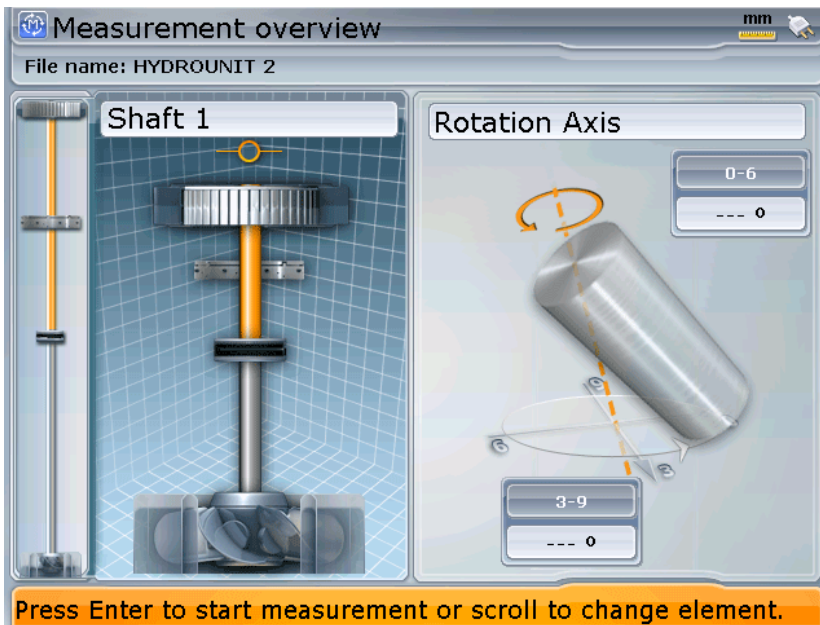
The main screen of the measurement section of Hydropower is the *Measurement overview* screen.

The screen allows selecting an element of the hydrounit to be measured and provides access to screens, in which measurements are performed. Additionally, various measurement settings screens can be accessed via the context menu of the *Measurement overview* screen.

This chapter contains the following sections:

- Measurement overview (page 49)
- Measurements modes (page 50)
- Connecting INCLINEO (page 51)
- Measurement screen elements (page 54)
- Preparing (page 56)
- 1. If rotation axis is to be measured, means for manual rotation of the rotating part of hydrounit must be prepared.
- Measurement: Shaft plumbness (page 58)
- Measurement: Thrust bearing angle (page 63)
- Measurement: Rotation axis (page 67)
- Runout offset (page 70)

Measurement overview








The *Measurement overview* screen is arranged similarly to the *Setup* screen. The main difference being that in *Measurement overview* screen only elements, which can serve as measurement positions for the currently chosen measurement mode are selectable in the graphical view of the hydrounit.

For a detailed description of screen elements, please see *Measurement screen elements* on page 54.

Measurements modes

Hydropower application offers two distinct measurement modes, which allow assessment of different aspects of hydrounit condition.

In order to select desired measurement mode, press  to open the context menu and then select either  **Mode:**  **Angle** or  **Mode:**  **Rotation axis** option.

***Note:** In the Measurement overview screen, only hydrounit elements for which currently selected measurement can be performed are selectable.*

Angle measurement

This mode enables to measure plumbness or levelness of different parts of the hydrounit.

Angle measurement mode is available for shafts plumbness and thrust bearing surface (tilting pads) levelness.

2. For details of measurement procedure, please see sections: If rotation axis is to be measured, means for manual rotation of the rotating part of hydrounit must be prepared.

Measurement: Shaft plumbness on page 58 and Measurement: Thrust bearing angle on page 63.


Rotation axis

This mode enables to measure rotation angle of rotating part of hydrounit.

Rotation axis measurement mode is available for shafts and turbine runners.

For details of measurement procedure, please see Measurement: Rotation axis on page 67.

Connecting INCLINEO

Connection with the INCLINEO sensor can be established in the *Sensor selection* screen, which can be accessed via the  **Sensor selection** context menu option in the *Measurement overview* screen.

Various INCLINEO connection properties can also be adjusted in the screen.



The following properties can be set up for the INCLINEO sensor in **the Sensor selection** screen:







- **Filter**
This combo box enables filter adjustment. The following settings are available:
 - off
 - max
 - mid
 - min

The filter settings determine the manner, in which readings from the INCLINEO sensor are interpreted by the application. The higher the filter setting the more stringent verification of the readings. Using filter can improve measurement accuracy but this make taking readings more time-consuming. You should consider higher filter settings when standard deviation values for measurements are high or when the repeatability of measurement results is insufficient.

Note: Filter setting affects overall measurement quality factor. The higher the setting the higher measurement quality.

- **Address**
INCLINEO sensor address. In current software version there is only one setting available in the combo box: Universal.
- **Comm. port**
This combo box contains a list of RF modules and cable connection port, which can be used for INCLINEO connection. Manual selection of port number can be used if there is more than one INCLINEO in device range.
The **Comm. Port** combo box also enables selecting cable connection with INCLINEO sensor, which can be used if for any reason RF connection is not used.

To change properties:

1. Navigate the table using the     buttons to select proper combo box.
2. Press  to activate the box and select proper element from the list.
3. Press  again to confirm choice.

The **State** window located below the connection properties presents current status of the connection with INCLINEO sensor:

Initializing


Please wait while ROTALIGN Ultra attempts to initialize communication with the sensor.


Sensor ready

Connection has been established successfully.


Comm. error!

ROTAGLIGN Ultra failed to establish connection with INCLINEO.
Most common reason for that is incorrect interface / port selected or INCLINEO not turned ON or out of RF module range.


After all required changes are made in the *Sensor selection* screen, choose  **OK** from the context menu to apply the changes and return to the *Measurement overview* screen.

To leave the screen without applying the changes, select  **Cancel** from the context menu.


Establishing connection automatically

The easiest way to establish connection between ROTALIGN Ultra device and INCLINEO sensor is to use Hydropower's  **Scan** option.

To automatically connect an INCLINEO sensor via RF connection:

1. Select  **Scan** from the context menu.
2. The scanning procedure will take a while. During that time a following information will be displayed, indicating that scanning procedure is in progress.

Scanning... Press CLR to interrupt.

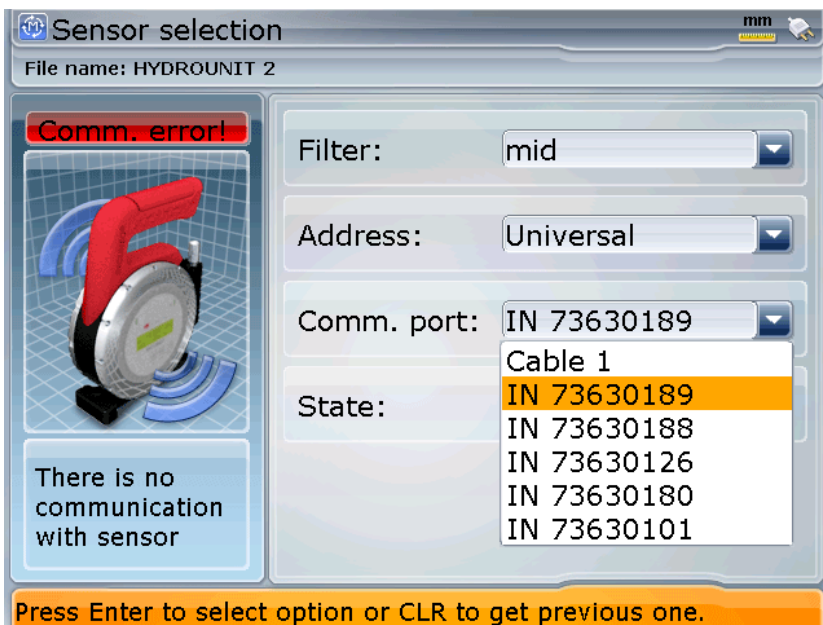
You can interrupt the scanning process by pressing .


3. After scanning procedure the sensor State indicator should change to green and contain the following information:

Sensor ready



Connecting INCLINEO manually

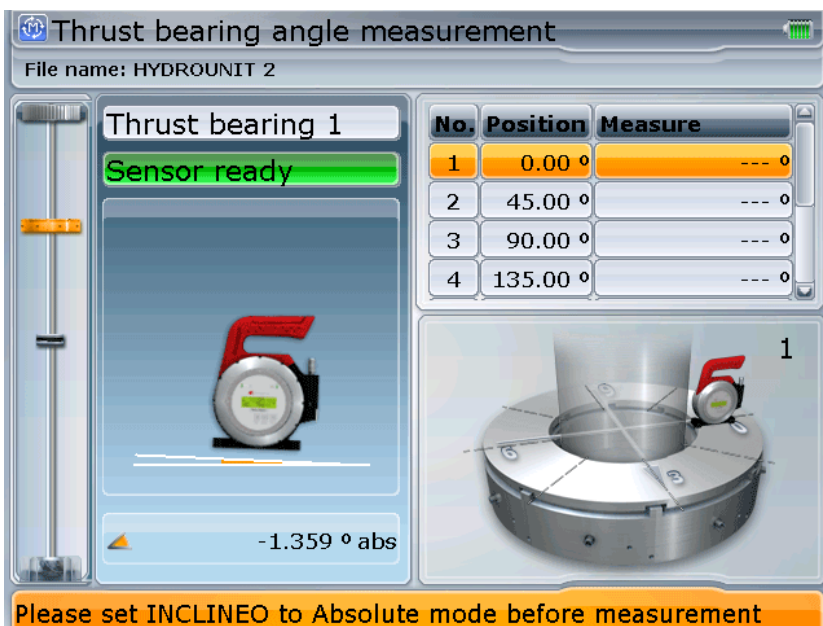
Manual connection with INCLINEO sensor can be established, if needed, by selecting proper port number or cable connection from the **Comm. port** combo box.



After the selection is confirmed by pressing , the device should be able to initiate the connection with INCLINEO and the 'Sensor ready' message should appear in the **State** indicator.

Measurement screen elements

After the proper measurement mode and element to be measured is selected in the *Measurement overview screen*, press either  or  to switch to the measurement screen for the selected mode.



Measurement screen is organized similarly for all modes.

- Mini hydrounit view**
 A simplified hydrounit representation, located at the left margin of the screen, shows which hydrounit element is currently selected (measured). See Using mini hydrounit control on page 33.
- Sensor diagram**



Sensor control occupies the left side of the *Measurement* screen. This diagram shows the INCLINEO sensor reading position. There is a sensor status window above the sensor plane diagram displaying sensor messages which inform about the status of the sensor and possible errors. Live angle reading is displayed at the bottom of the control.

Important sensor status messages:

Message	Description
Initializing	The device attempts to establish connection with the INCLINEO sensor. Please wait.
Sensor ready	Connection with the sensor works properly. INCLINEO is ready for measurement.
Range end	INCLINEO sensor is in overflow – out of measurable angle range. In most cases it indicates improper sensor mounting/placement.
Comm. error!	There is a communication error between the device and the sensor. This may indicate that INCLINEO is out of range or turned off, the connection has not been set up properly or the sensor malfunctions.

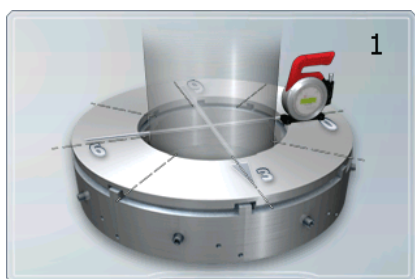
- **Measurement positions and table**

No.	Position	Measure
1	0.00 °	--- °
2	45.00 °	--- °
3	90.00 °	--- °
4	135.00 °	--- °

The upper right section of the *Measurement* screen is occupied by a table containing a list of all angular measurement positions, which should be measured during current measurement. The list consists of each position number, angle position value and measurement result.

The number of positions to be measured can be changed in the context menu. For details, please see the *Measured angles* section on page 56.

- **Measured element control**




The lower right part of the *Measurement* screen is occupied by a control, which displays a graphical representation of the measured object and current position of the INCLINEO in relation to it.

This control is used during measurement to display current position of INCLINEO sensor on measured object and to display measurement results after measurement.

Preparing measurement

Hydropower application offers a number of additional settings, which can be adjusted prior to measurement in order to facilitate the procedure and improve accuracy.

Measured angles

The number of measured angular positions can be adjusted using the  **Measured angles** option in the context menu.

There are following settings available:



4



8



16



32



User defined



***Note:** The **User defined** option is only available for the thrust bearing measurement. As a result of the construction characteristics of thrust bearing, it may be necessary to assign untypical number of measurement positions – based for example on the number of tilting pads of the bearing.*

Angle offset



Angle offset option is available in the context menu of the Measurement screen in thrust bearing angle measurement mode. The option allows shifting of all measurement positions on the thrust bearing by a defined angle.

In order to define angle offset for measurement positions:

1. Select the  **Angle offset** option from the context menu
2. Enter the desired offset value in current units into the edit window, which appears.
3. Press  to confirm.

Shaft rotation



Rotation option, which can be accessed from the context menu of the *Measurement* screen in the **Rotation Axis** mode, allows selecting the direction, in which the shaft or turbine runner will be manually rotated during the measurement:



Clockwise



Counterclockwise

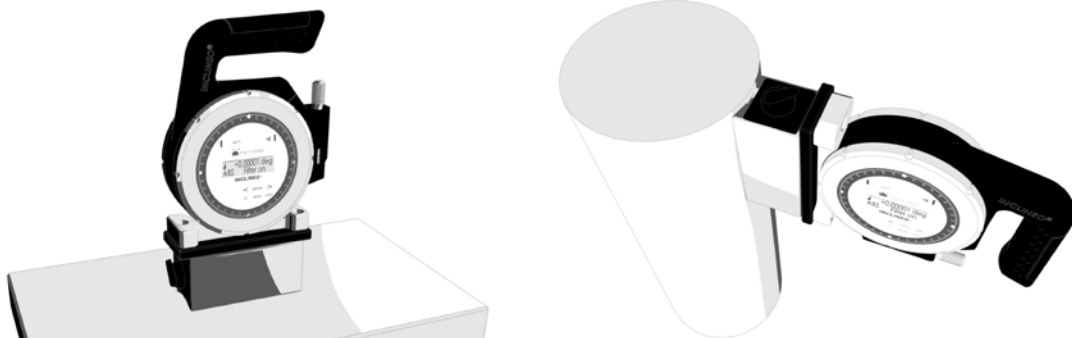
INCLINEO sensor setting

Before measurement make sure INCLINEO sensor:

1. Is properly connected and attached to its magnetic bracket.
2. Works in absolute angle mode if measuring thrust bearing levelness.

INCLINEO sensor best practice

ROTALIGN Ultra Hydropower measurement principles are based on comparing INCLINEO readings down to the fourth decimal place in degree and to the third one in mm/m. Therefore it is important for the device to be stable in temperature with regard to housing and electronics. In order to ensure maximal measurement precision, the INCLINEO should be turned on and stabilize in the first measurement position of any task for 40 minutes, e.g. horizontally on the first bearing pad, or vertically on the first measured shaft position.




Preparing measured object

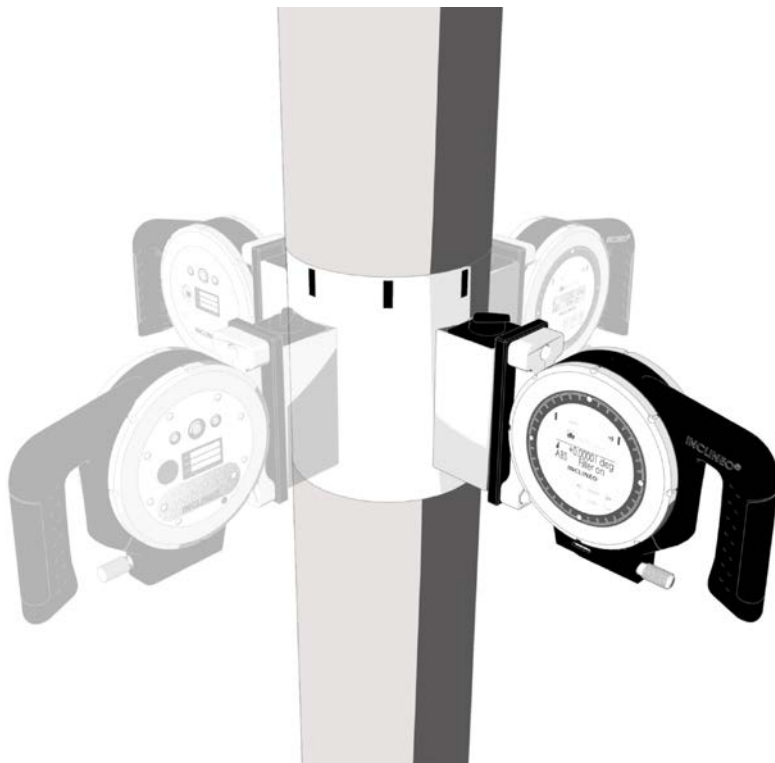
Before starting the measurement make sure that the hydrounit element to be measured is properly prepared for the procedure:

3. Measured surface of shaft or thrust bearing tilting plates must be fully accessible.
4. Angular positions for measurement must be precisely and clearly marked on the surface of the measured object – for example with a marker or adhesive tape.
5. If rotation axis is to be measured, means for manual rotation of the rotating part of hydrounit must be prepared.

Measurement: Shaft plumbness

Shaft plumbness is measured using the  **Angle** measurement mode.

Shaft plumbness is a static measurement, which means the shaft of the hydrounit will remain stationary throughout the measurement procedure while the INCLINEO sensor will be moved to consecutive measurement positions where readings will be taken.



The portion of the surface of the shaft at which the INCLINEO sensor is placed during measurement should be precisely machined prior to measurement to ensure accurate results.




The foot of the magnetic bracket is shaped in a way, which ensures firm placement and parallelism when mounted properly on the surface of the shaft.

Measurement procedure

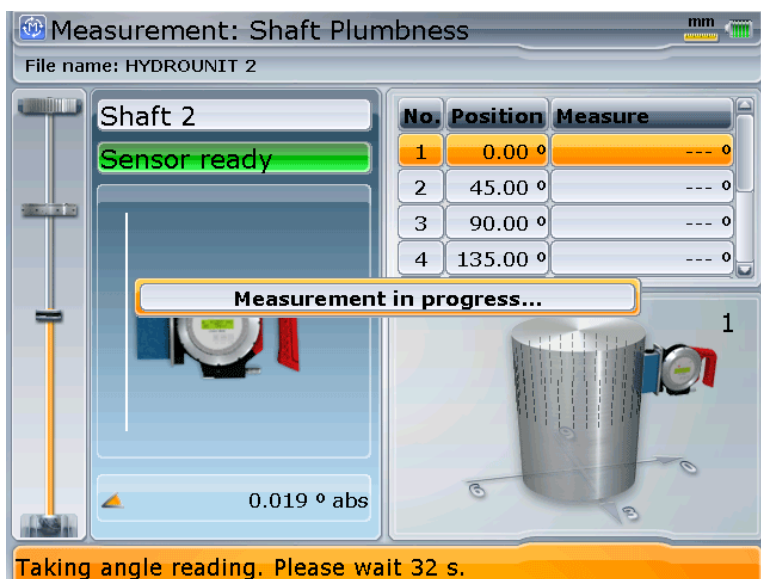
1. Make sure INCLINEO is properly mounted on shaft in the angular position selected in the table on the application's *Measurement* screen.

No.	Position	Measure
1	0.00 °	--- °
2	45.00 °	--- °
3	90.00 °	--- °
4	135.00 °	--- °

If not, move INCLINEO to correct position or select corresponding position in the table using  buttons.

2. To start measurement and take INCLINEO reading at the first position press the

 button or select  **New measurement** from the context menu.





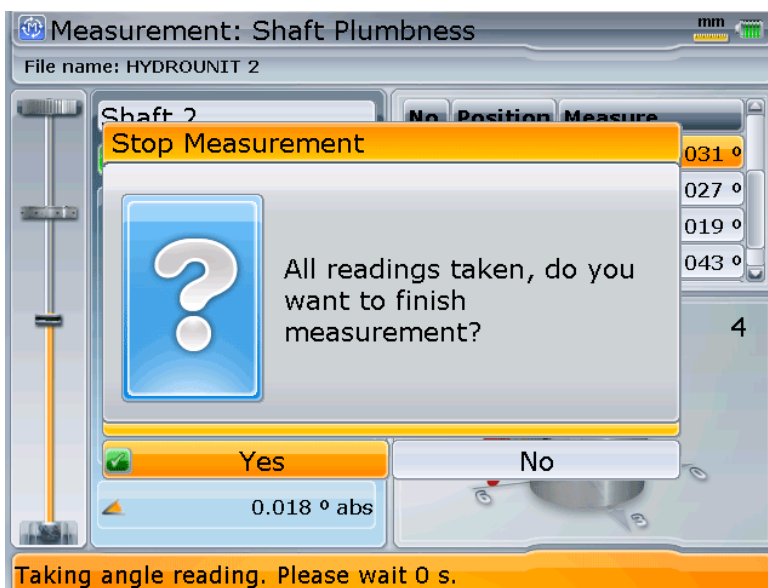
Obtaining the measurement can take a while – observe the counting message on the status bar.

3. After the measurement is taken and communication with the sensor is concluded the result value will appear in the table on the *Measurement* screen. The application will now automatically switch to the next measurement position.

Note: Measurement positions order forced by the Hydropower application is imposed by the fact that the opposite angle measurements compensate angle error of mounting INCLINEO in its magnetic bracket.



4. Move the INCLINEO sensor correspondingly and press  or select  **Take point** from the context menu in order to measure the new position
5. Repeat the procedure until all positions are measured.
6. After the last position is measured, the following message will pop up on the device screen.



Select **Yes** and press  to finish measurement.

Shaft plumbness result values will be displayed in the result section of the *Measurement* screen.

Measurement: Shaft Plumbness mm

File name: HYDROUNIT 2

Shaft 2

Sensor ready


No.	Position	Measure
1	0.00 °	0.045 °
2	45.00 °	0.044 °
3	90.00 °	0.030 °
4	135.00 °	0.031 °

0.035 ° abs

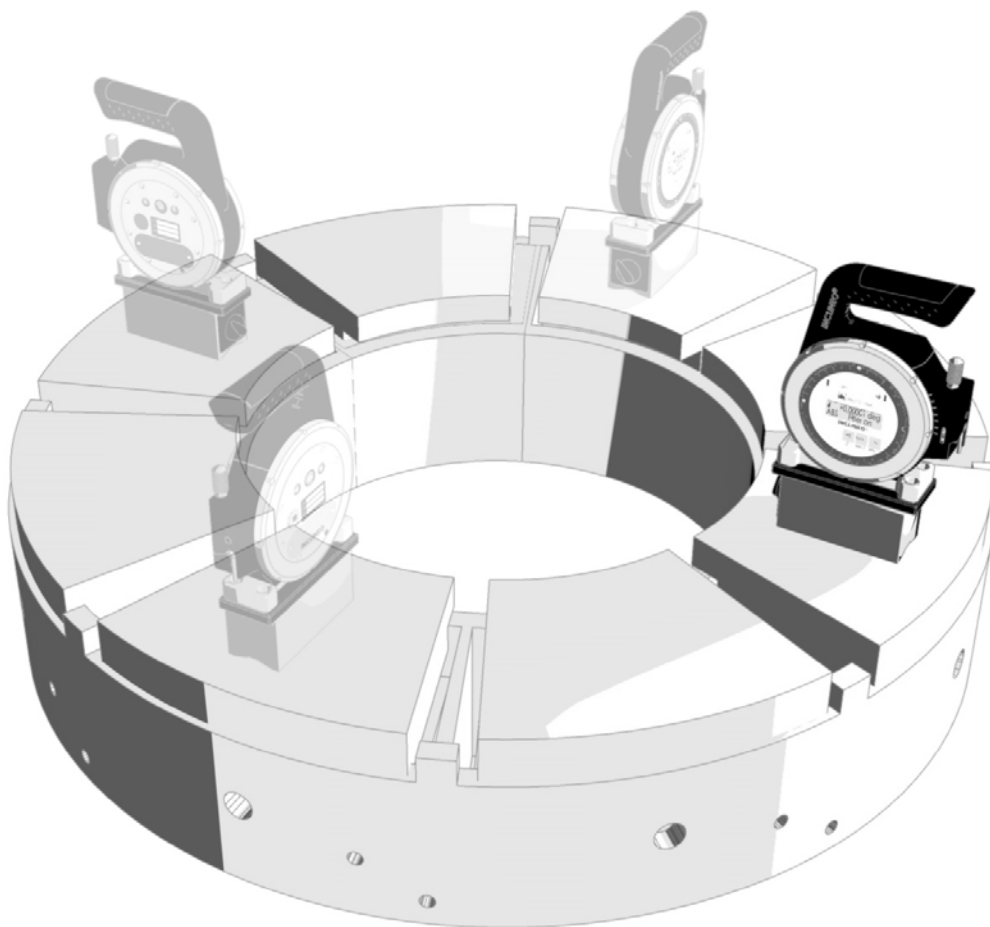
0-6: -0.009 ° 3-9: -0.001 °

Press Enter to start measurement.

Measurement: Thrust bearing angle

Thrust bearing angle is measured using the  **Angle** measurement mode. The measurement is designed to enable assessment of thrust bearing levelness.

Thrust bearing angle is a static measurement, which means the rotating assembly of the hydrounit will remain stationary throughout the measurement procedure while the INCLINEO sensor will be moved to consecutive measurement positions where readings will be taken.



Measurement procedure


1. Make sure INCLINEO is properly mounted on Thrust bearing in the angular position selected in the table on the application *Measurement* screen.

- INCLINEO should be working in Absolute mode.

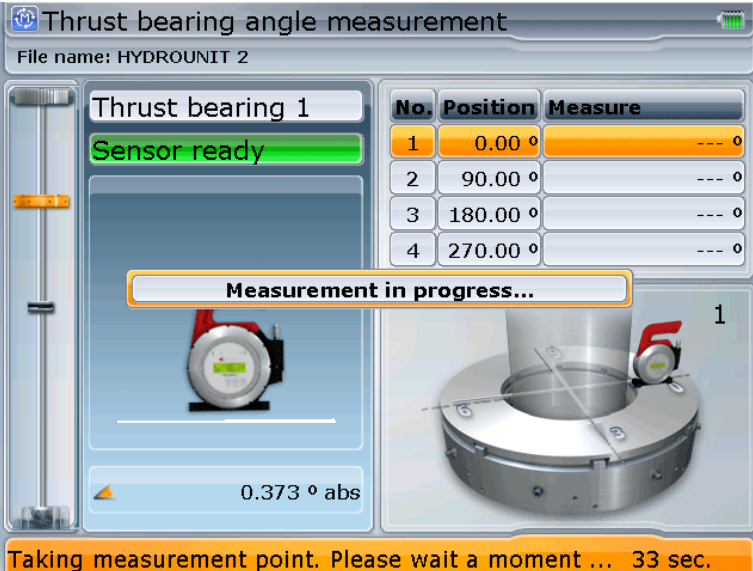
Best practice is to perform the absolute setup on a well leveled and well machined surface, e.g.

The proof of an accurate setup is comparing the readings on the same surface spot in opposite directions: these should ideally be equal and opposite in sign.

No.	Position	Measure
1	0.00 °	--- °
2	45.00 °	--- °
3	90.00 °	--- °
4	135.00 °	--- °

If not, move INCLINEO to correct position or select corresponding position in the table using  buttons.

- To start measurement and take INCLINEO reading at the first position press the  button or select  **New measurement** from the context menu.



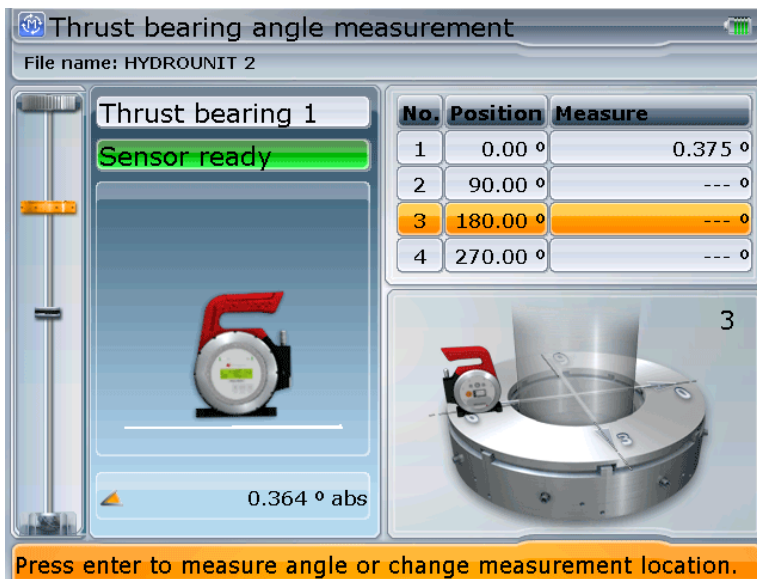
No.	Position	Measure
1	0.00 °	--- °
2	90.00 °	--- °
3	180.00 °	--- °
4	270.00 °	--- °



0.373 ° abs

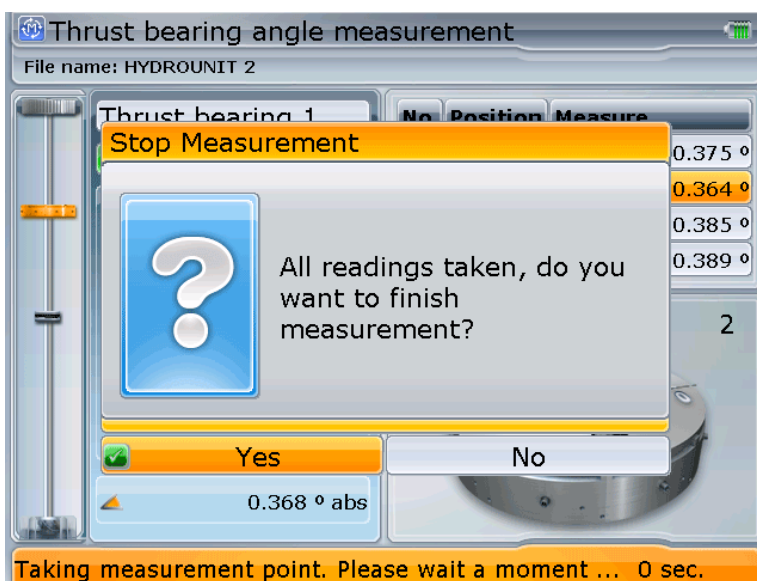
Taking measurement point. Please wait a moment ... 33 sec.

Obtaining the measurement can take a while – observe the counting message on the status bar.

- After the measurement is taken and communication with the sensor is concluded the result value will appear in the table on the *Measurement* screen. The application will now automatically switch to the next measurement position.



5. Move the INCLINEO sensor correspondingly and press  or select  **Take point** from the context menu in order to measure the new position
6. Repeat the procedure until all positions are measured.
7. After the last position is measured, the following message will pop up on the device screen.



Select **Yes** and press  to finish measurement.

Thrust bearing levelness result values are displayed in the result section of the *Measurement* screen.

Thrust bearing angle measurement

File name: HYDROUNIT 2

Thrust bearing 1

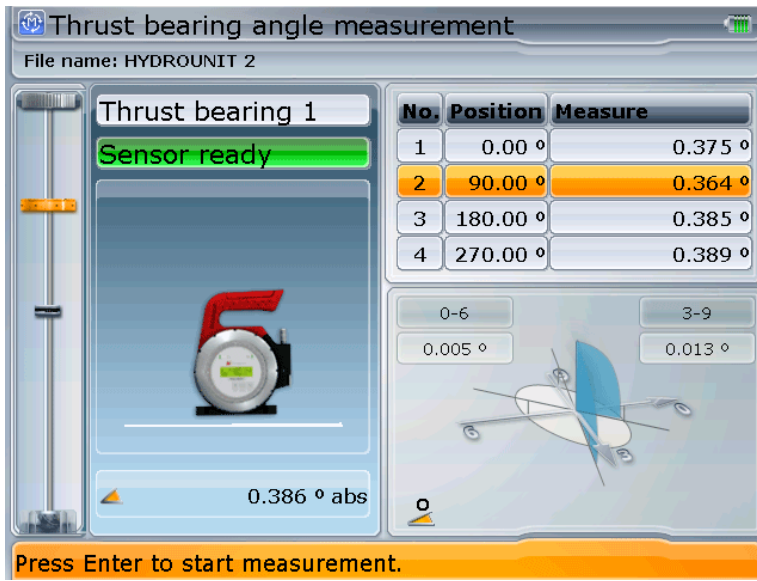
Sensor ready

No.	Position	Measure
1	0.00 °	0.375 °
2	90.00 °	0.364 °
3	180.00 °	0.385 °
4	270.00 °	0.389 °


0-6 3-9
0.005 ° 0.013 °

0.386 ° abs

Press Enter to start measurement.







Measurement: Rotation axis

Hydrounit's rotation axis is measured using the  **Rotation axis** measurement mode. This measurement can be performed on shafts or, if technically possible, on turbine runner. Rotation axis is calculated for the entire hydrounit.

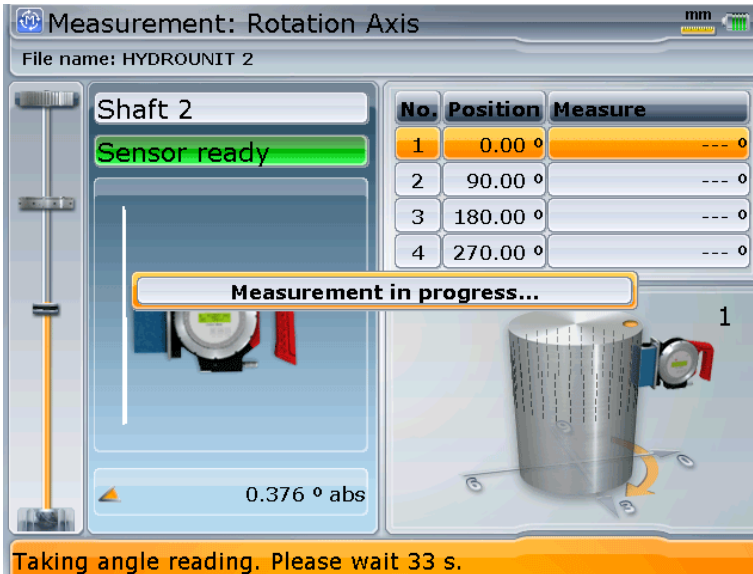
Measurement procedure

1. Make sure INCLINEO is properly mounted on shaft or turbine runner.
2. Make sure that element being measured was rotated to correct angular position selected in the table on the application *Measurement* screen.

No.	Position	Measure
1	0.00 °	--- °
2	45.00 °	--- °
3	90.00 °	--- °
4	135.00 °	--- °

If not, move INCLINEO to correct position or select corresponding position in the table using     buttons.

3. To start measurement and take INCLINEO reading at the first position press the  button or select  **New measurement** from the context menu.



No.	Position	Measure
1	0.00 °	--- °
2	90.00 °	--- °
3	180.00 °	--- °
4	270.00 °	--- °

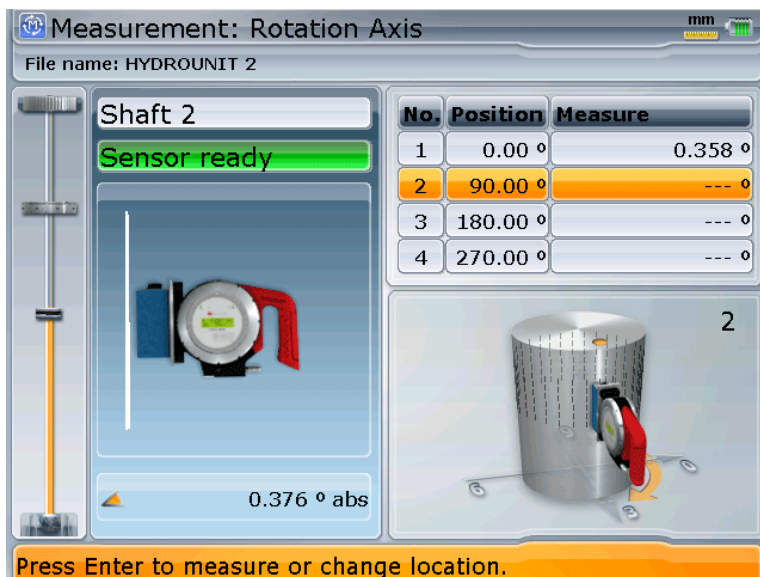
0.376 ° abs



Taking angle reading. Please wait 33 s.

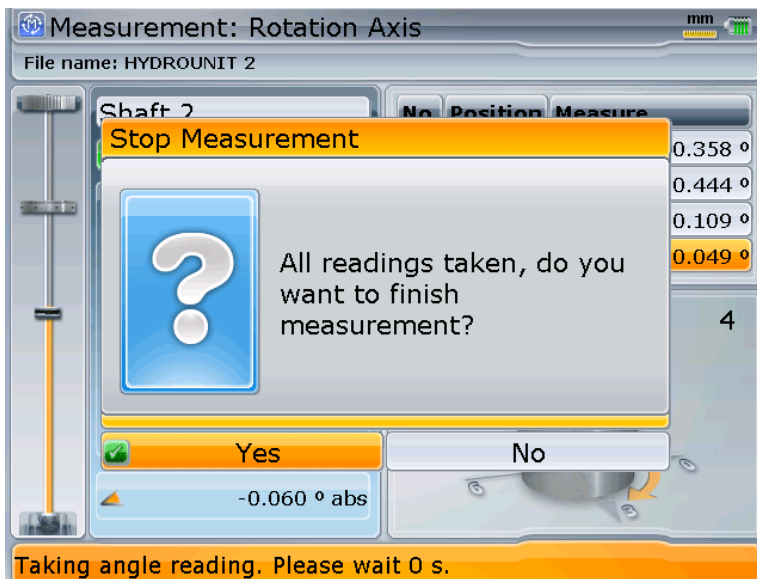
Obtaining the measurement can take a while – observe the counting message on the status bar.

4. After the measurement is taken and communication with the sensor is concluded the result value will appear in the table on the *Measurement* screen. The application will now automatically switch to the next measurement position.

Note: *Rotation axis single measurements are taken one after another in clockwise/counter-clockwise direction to minimize necessary hydrounit movement.*

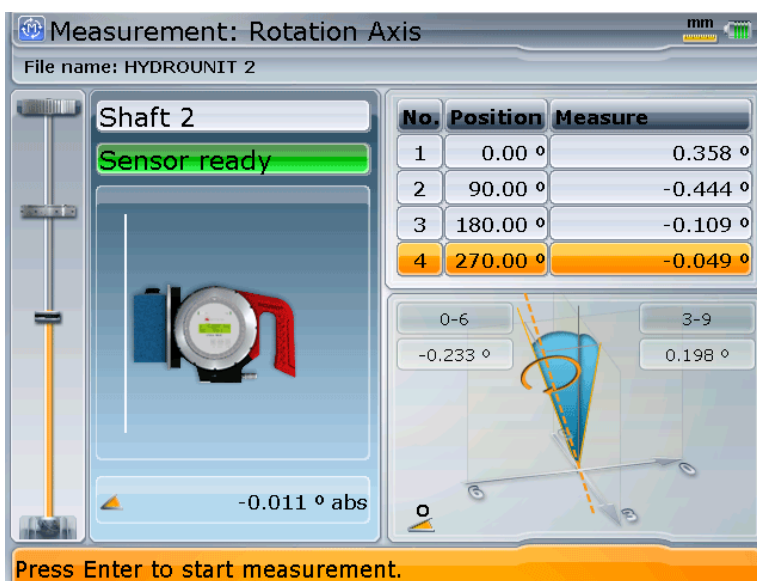


5. Rotate the shaft with INCLINEO sensor mounted to corresponding angular position and press  or select  **Take point** from the context menu in order to measure the new position
6. Repeat the procedure until all positions are measured.
7. After the last position is measured, the following message will pop up on the device's screen.



Select **Yes** and press  to finish measurement.

Rotation axis result values are displayed in the result section of the *Measurement* screen.




Runout offset

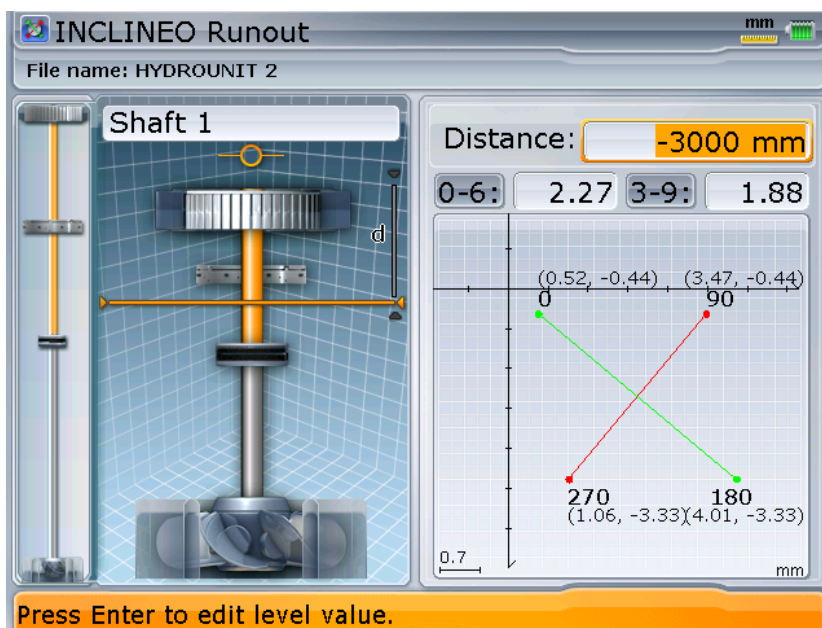
Static runout is the cone ascribed by the rotating shaft centerline due to its misalignment resulting from non-perpendicularity between the shaft and the runner of the thrust bearing. Other factors such as bent shafts and misaligned couplings can also contribute to presence of excessive runout offset, which can in turn lead to higher load on guide bearings and higher vibration levels.

Hydrounit static runout values are calculated by the *Hydropower* application using data from the angle and rotation axis *INCLINEO* measurements.

Note: *Static runout cannot and need not be measured for self-equalizing thrust bearings, which by their construction take care of correcting for non-perpendicularity of the thrust bearing runner.*

INCLINEO Runout screen elements

INCLINEO Runout screen can be accessed from the *Measurement overview* screen by selecting the  **Runout offset** option from the context menu.



The *INCLINEO Runout* screen features standard hydrounit and mini hydrounit views. Additional runout level control on the hydrounit view enables viewing runout values at different distances from the reference point of the hydrounit.

The right part of the *INCLINEO Runout* screen is occupied by a set of controls, which enable assessment of measured runout of the hydrounit:



- **Distance**
This text box displays and enables entering the distance of the current level – for which the runout values are displayed – from the reference point of the hydrounit.



Note: The current runout distance is also presented visually on the hydrounit view.

- **0-6, 3-9**
Runout values for 0-6 and 3-9 directions at the current level.
Runout components casted on 0-6 and 3-9 directions are the distances between rotation axis and the shaft at its angular position.
- **Runout diagram**
This diagram presents graphically runout component values at the current level at 0, 90, 180 and 270 degrees angular positions in reference to the plumb line of the hydrounit. Numerical X,Y distance values are presented in parentheses.

Note: If ‘Rotation axis measurement is necessary’ message is displayed instead of runout in the runout diagram, there is no valid rotation axis measurement present in the current measurement job. In order to see runout values you have to perform a correct rotation axis measurement or enable an existing one in the Measurement table screen.

INCLINEO Runout navigation

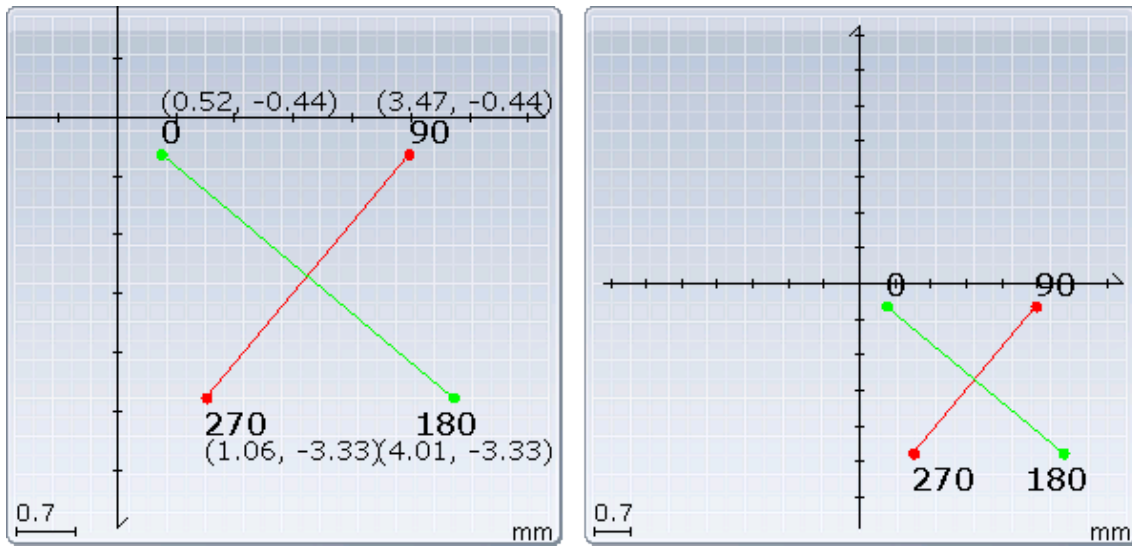
Current runout level (vertical distance from the reference point of the hydrounit) can be changed by pressing the   buttons respectively. The distance value will jump by a fixed number of units.

In order to view runout values at a specified distance, press  and enter the desired distance value into the edit window. Press  again to confirm entered value.

Note: Make sure to enter a correct number. If a nonexistent distance is entered, ‘Level is not valid’ message will be displayed.

Note: ‘There is no runout’ message signifies no runout values at the current level – probably the level/distance of the thrust bearing is selected.

Runout diagram can be zoomed in and out.



To toggle the zoom factor, press  to open the context menu and select the  **Zooms in/out** option.

Managing measurements

The Hydropower application is provided with *Measurement table* screen, which is dedicated to measurement list management.

The screen is especially useful when multiple measurements are performed at each measurement position.


This chapter contains the following sections:

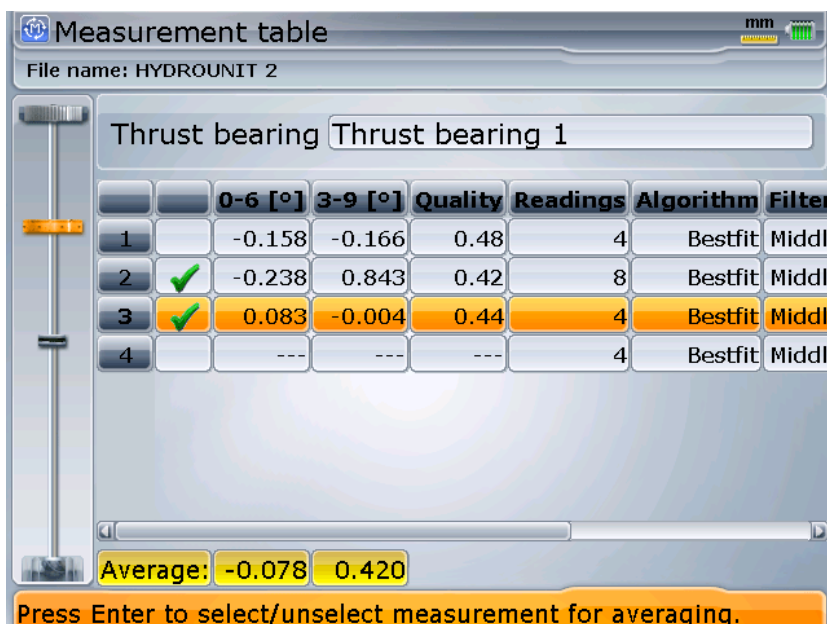
- Measurement table screen elements (page 74)
- Modifying measurement sets (page 77)

Measurement table screen elements

The *Measurement table* screen is designed to provide control over all measurements performed and recorded within the current measurement file.

The screen enables dealing with multiple measurements taken at each position, as it allows for viewing, comparing and manipulating measurements and selecting the most reliable measurements for final result calculation.

The *Measurement table* screen can be opened from the *Measurement* and *Results* screens by selecting the  **Table** option from the context menu.



The screenshot shows the 'Measurement table' interface for 'Thrust bearing 1'. The table has columns for '0-6 [°]', '3-9 [°]', 'Quality', 'Readings', 'Algorithm', and 'Filter'. The rows represent individual measurements, with the third row (row 3) highlighted in orange and marked with a green checkmark, indicating it is selected for averaging. Below the table, an 'Average' row shows the averaged values: -0.078 for the 0-6 [°] column and 0.420 for the 3-9 [°] column. A message at the bottom states: 'Press Enter to select/unselect measurement for averaging.'

	0-6 [°]	3-9 [°]	Quality	Readings	Algorithm	Filter
1	-0.158	-0.166	0.48	4	Bestfit	Middl
2	-0.238	0.843	0.42	8	Bestfit	Middl
3	0.083	-0.004	0.44	4	Bestfit	Middl
4	---	---	---	4	Bestfit	Middl
Average:		-0.078	0.420			

The *Measurement table* screen is occupied by a table containing all measurements performed at the current measurement position.


Note: Only measurements performed using currently selected measurement mode are listed. For details, please refer to the *Measurements modes* section on page 50.

Each row of the table contains data from one measurement.

The row at the bottom of the measurement screen, labeled **Average** contains measurement result averaged from all active results in the list.

Table columns:

- **Status column**


If a  symbol is present in this column, the measurement is selected to be averaged for final measurement results.

-
- **0–6**
This column contains the result of measurement in the 0-6 direction expressed as angle.
 - **3–9**
This column contains the result of measurement in the 3-9 direction expressed as angle.
 - **Quality**
Measurement quality given in a value from 0 to 1.
 - **Readings**
The number of readings selected for current measurement.
See Measured angles on page 56.
 - **Algorithm**
Result calculation algorithm selected for the measurement.
See Selecting result calculation algorithm on page 77.
 - **Filter**
Filter setting selected for the INCLINEO sensor.
 - **Sensor**
Serial number of the INCLINEO sensor used for measurement
 - **Date**
Date of the measurement.
 - **Time**
Time of the measurement.




Table screen navigation

The rows of the measurement table are too long to fit the device screen entirely. It is therefore necessary to scroll the table horizontally to view information in all columns.

To scroll the table horizontally, use  the arrow keys respectively.

To select consecutive measurements in the table, use the  arrow keys. If there are too many measurements to fit in the screen, the view will be scrolled in vertical direction automatically when either of the extreme rows is selected.




An additional navigation help is provided by the mini-hydrounit view occupying the top of the screen. It indicates, which measurement position/element is currently selected.

To switch between measurement lists of consecutive hydrounit elements without leaving the *Measurement table* screen, use the  context menu options or press and hold   respectively.

Changing measurement mode



Only measurements performed using currently selected measurement mode (Angle or Rotation axis) are visible in the measurement table. Additionally the application will only allow selection of hydrounit elements, which can be measured using the currently selected mode.

Measurement mode can be switched directly in the *Measurement table* screen using corresponding context menu options.

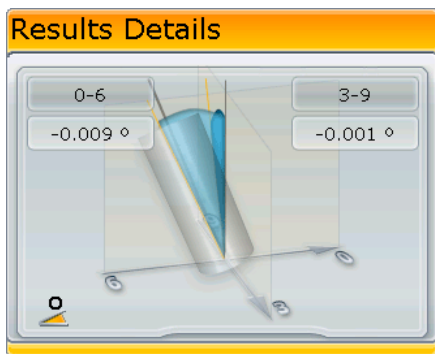
In order to select desired measurement mode, press  to open the context menu and then select either  **Mode: Angle** or  **Mode: Rotation axis** option.


Viewing measurement details

Measurement table screen offers a result details diagram similar to the one appearing in the Measurement screen when a measurement is finished.

In order to invoke the *Result details* diagram, press  to open the context menu and then select the  **Details** option.

A window with the result details for the currently selected measurement will pop up.



Press  to close the pop-up.


Note: *The Result Details window can also be invoked from within the Results screen.*

Modifying measurement sets





Each element of a hydrounit in *Hydropower* can be measured multiple times. Any of these measurements can be included in final result calculations – results from multiple measurements will be averaged.

In the *Measurement table* screen you can decide which of the performed measurements should be taken into account and which should be disregarded or even permanently removed from the table.

Selecting/deselecting measurements for averaging

The first column in the table may contain the  symbol, which indicates that a given measurement is active, i.e. it is to be included in averaged result calculations.

To toggle a measurement active/inactive:

1. Using the   arrow keys, move the selection focus to appropriate row of the table to select the measurement you would like to toggle.
2. Press the  button or choose  **Toggle** from the context menu to toggle the selected active/inactive.

Selecting result calculation algorithm

Result calculation algorithm determines, which measured points are taken into account during final result calculation.

There are two algorithms available:



0369

This is a simple calculation algorithm, which only takes into account values measured at 0,3,6 and 9 hour positions. This algorithm is not recommended as it may provide less accurate and less reliable result values.




Note: *In case of user defined number of measurement angles there may be no readings available at 0,3,6, 9 positions.*

Note: *Quality value of measurement with algorithm set to 0369 is set to .50.*





**Bestfit**

This algorithm is recommended for all *Hydropower* measurements. It takes into account all measured points and calculates resulting correction values basing on all readings from the current measurement. This ensures high reliability and accuracy of the result and helps to eliminate possible errors, which may occur at individual measurement points.

To select proper result calculation algorithm:

1. Using the   arrow keys, move the selection focus to appropriate row of the table to select the measurement.
2. Press the  button to open the context menu and choose desired option:

**Algorithm:****Bestfit****Algorithm:****0369****Deleting measurements****To remove a redundant measurement from the table:**

1. Use the   arrow keys, to select the measurement to delete.
2. Press the  button or choose  **Delete** from the context menu. The application will ask for confirmation before removing the measurement from the table permanently.

Results

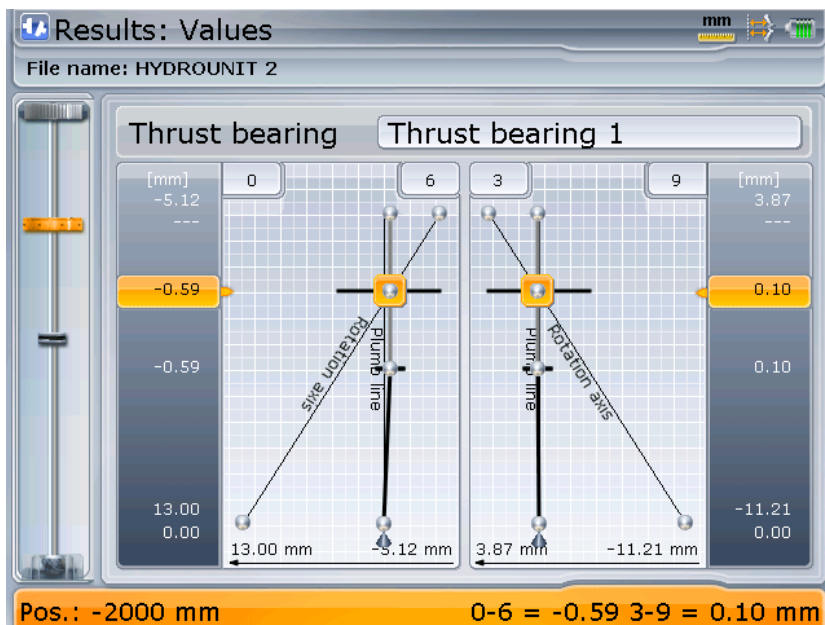
The *Results* screen of the *Hydropower* application presents graphical representation of the calculated plumb line and rotational axis of the hydrounit assembly. Numerical values for plumb line and axis offsets and angles are also presented.

The screen also provides access to options enabling results view adjustment and viewing result and corrections details.

This chapter contains the following sections:

- Results screen elements (page 80)
- Results screen navigation (page 83)
- Fixing measurement positions to plumb line (page 86)
- Result options (page 89)
- Viewing corrections (page 91)
- Correction adjustment (page 96)

Results screen elements



The main section of the *Results* screen is occupied by a graphical representation of measured positions. Measurement positions are displayed as points, which location in relation to the plumb line and rotation axis represent measured and calculated misalignment of each point in 0-6 and 3-9 directions respectively.

The following elements are present in the screen:

- Mini hydrounit view**
 The mini hydrounit control on the left helps in hydrounit navigation and indicates the element of the hydrounit, which is currently selected
 See Using mini hydrounit control on page 33.
- Element name**
 The name of the currently selected element of the hydrounit is displayed above the result diagram.

- **Viewing directions**

Results of measurement in *Hydropower* can be viewed from two perpendicular directions at the same time.

Current result viewing directions are displayed at the top of result diagram.

Standard viewing directions are derived from clock hour positions: **0-6** and **3-9**.



If the default viewing direction settings are changed, the labels will display angular position for each direction rather than hour direction values.



Result viewing direction can be changed in the *Result options* screen. See page 89.

- **Shafts, couplings and thrust bearing**

These elements of the hydrounit are represented in the Result screen in a simplified way – as thick lines. Location and angularity of the lines help to depict the calculated deviation of individual measured elements of the hydrounit from the plumb line.

- **Plumb line**

Reference vertical axis of the hydrounit.

It is labeled on the diagram.

- **Rotation axis**

This line is the calculated rotation axis of the hydrounit. These are average values calculated from all marked measurements in rotation axis measurements tables .

The position of the line on the diagram represents its deviation from the plumb line of the hydrounit. It is labeled on the diagram.

- **Measurement positions**

These are represented in the *Results* screen as points.

icon	description
	Measurement position
	Fixed position

- **Current selection**



Currently selected measurement position is indicated by the selection focus frame.



- **Status bar**

The status bar located at the bottom of the *Results* screen is used to display important information related to the currently selected measurement position:

- Elevation of the position

-
- Result values in both directions (**0-6** and **3-9**). These values represent offset from or angle towards the hydrounit plumb line – depending on, which result mode is selected. See Changing results mode on page 84.



Results screen navigation

To select adjacent elements of the hydrounit, use the   arrow keys respectively.

Currently selected element is highlighted orange.

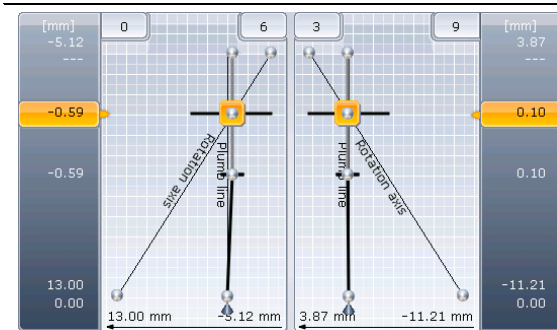
If the hydrounit is too long/complex to fit entirely in the graphical representation view the view will be automatically scrolled in the corresponding direction when the user pressed the arrow key, which selects an element, which is currently off the view.

The mini hydrounit control on the left indicates the part of the hydrounit, which is currently visible in the graphical hydrounit view. For a detailed description of mini hydrounit capabilities, please see the next section.

Note: The results can be displayed in two modes: **Values** (offset) and **Angles**. To quickly switch between the two modes, use the   buttons. To learn more about the two result display modes, please see *Changing results mode* on page 84.


Changing view direction mode


The *Results* screen offers the following direction viewing modes:

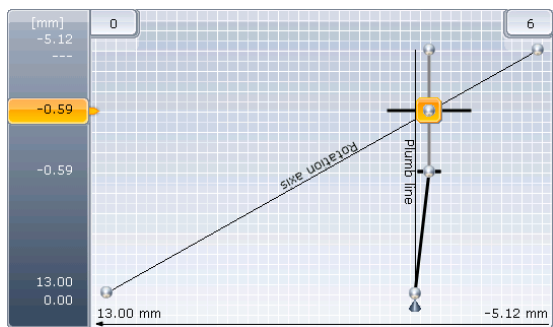


0-6 3-9

In this mode, the results are presented from two perpendicular directions in separate diagrams.

To select this mode, choose  **View**

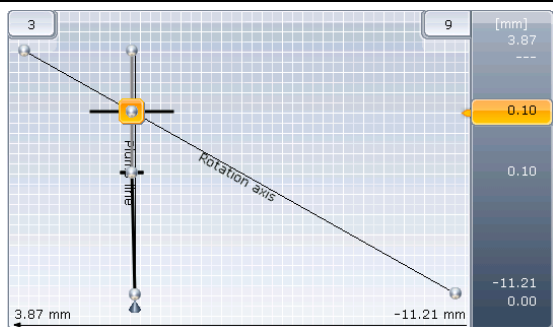
mode:  **0-6 3-9** from the context menu.



0-6
 In this mode only one diagram, presenting offsets in vertical plane occupies the entire *Results* screen.

To select this mode, choose **0 6 View**

mode: **0 6** 0-6 from the context menu.



3-9
 In this mode only one diagram, presenting offsets in horizontal plane occupies the entire *Results* screen.

To select this mode, choose **3 9 View**

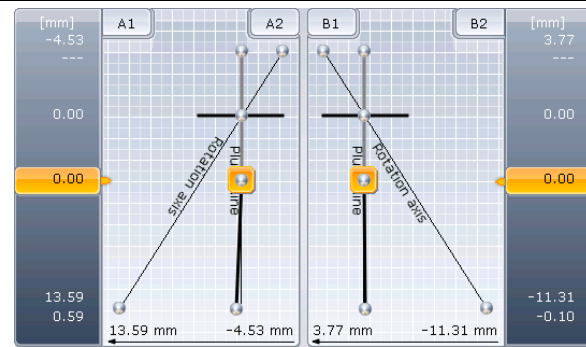
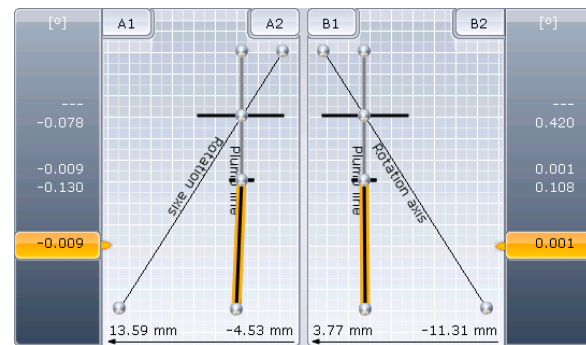
mode: **3 9** 3-9 from the context menu.



Note: The view direction mode names presented in the table are default names of the viewing directions. The names are subject to change if the result viewing directions are rotated or custom names are assigned to them. For details, see *Result options* on page 89. The direction viewing mode, which is currently selected is indicated in the context menu submenu with a mark.

Changing results mode

Calculated measurement results can be displayed in two distinctive modes:

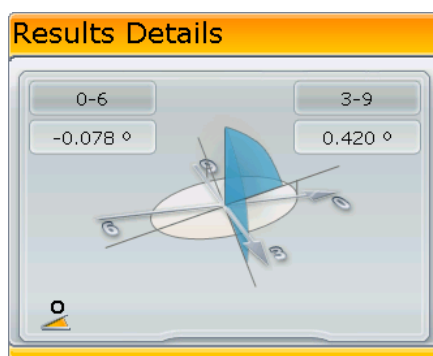
- **Values**
 Offset values for measurement positions are displayed.
 Offset values represent the distance to the measurement position from the hydrounit plumb line or from the fixed element (if present) of the hydrounit.
- **Angles**
 Angular inclination is displayed for individual elements of the hydrounit.
 The values of the inclination represent angle toward the plumb line of the hydrounit or the fixed element (if present).

Results diagram in **Values** mode.Results diagram in **Angles** mode.

To quickly switch between Values and Angles results mode, use the   arrow keys. Results mode can also be change in the *Result options* screen.

Viewing result details

Detailed information on the final measurement results at the currently selected position can be viewed in the *Results* screen in a form of a pop-up diagram.



In order to invoke the window press  to open the context menu and select  **Details**.

After viewing the *Results Details* pop-up you can close it using  button.

Note: The *Result Details* window can also be invoked from within the *Measurement table* screen.



Fixing measurement positions to plumb line



Measurement positions and components of the hydrounit can be designated as fixed to the hydrounit plumb line. This position will be placed on the plumb line. Its measured offset values will be set to 0 and offset values on all other measured positions will be recalculated accordingly.

Measurement positions located on the shaft in places where no alignment correction is possible can be “fixed” by the user to let the application know, they are immovable.

The *Hydropower* application will be able to recalculate measurement results in such a way as to bring the fixed points offsets to zero in both horizontal and vertical result planes in order to minimize misalignment at these positions. See *Optimizing results* below.

To fix/unfix a measurement position:

1. Select the desired position using the   arrow keys.

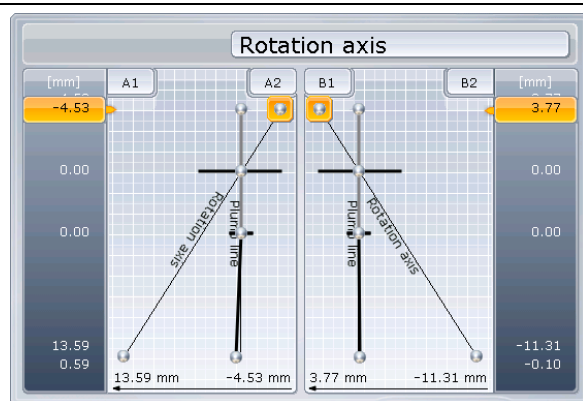
Use the   arrow keys to toggle between **Values** and **Angles** results modes (see *Changing results mode* on page 84 for details).

2. Press the  button to toggle the position fixed/moveable.

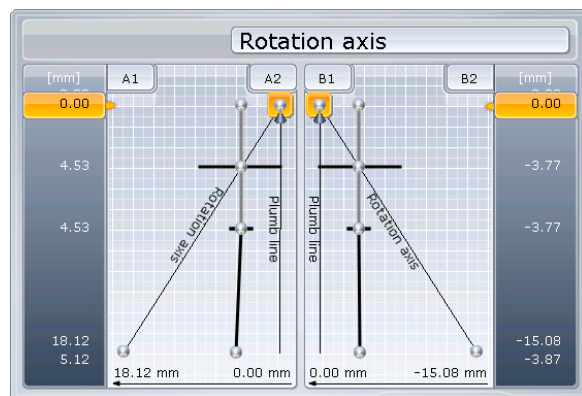
A fixed position is indicated by a  symbol located under the point icon.

Note: If another position was fixed prior to the new position being fixed the old fixed measurement position will be automatically set to unfixed.

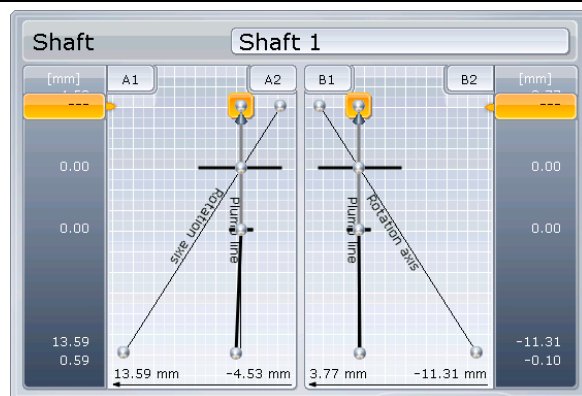
Depending on, which measurement position/element is set to fixed the results will be recalculated accordingly:



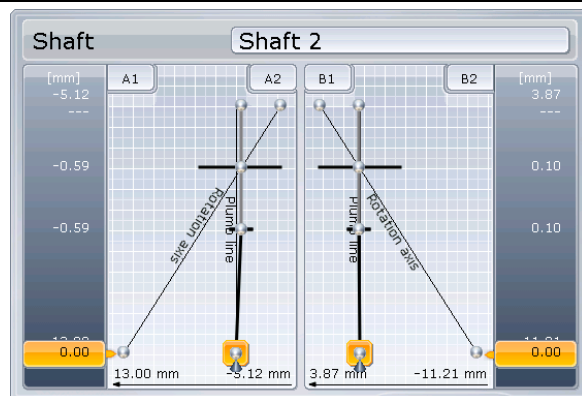
Values mode.
Rotation axis point selected.
Nothing fixed.



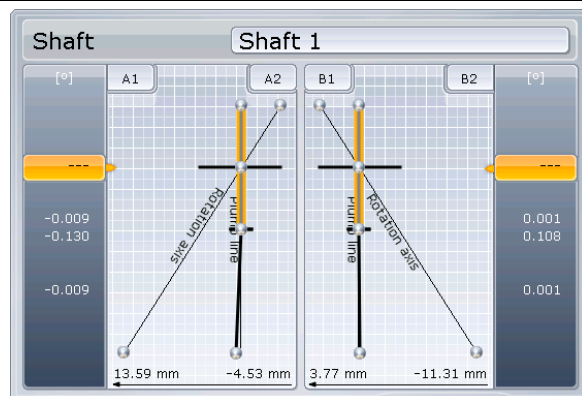
Values mode.
Rotation axis point fixed.



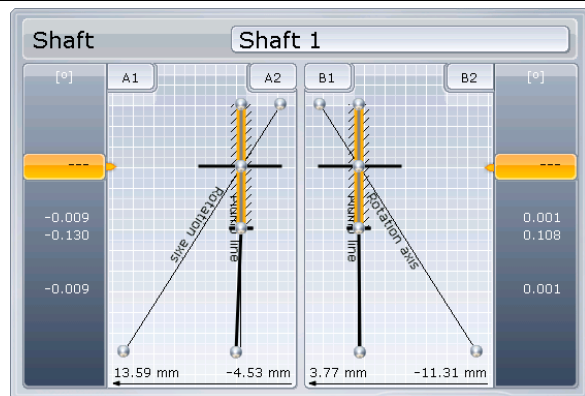
Values mode.
Shaft 1 point fixed.



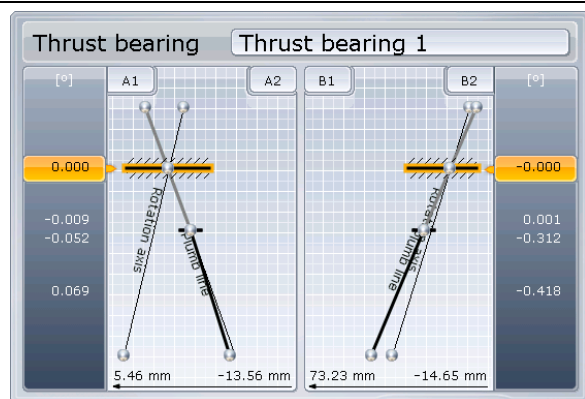
Values mode.
Shaft 2 point fixed.



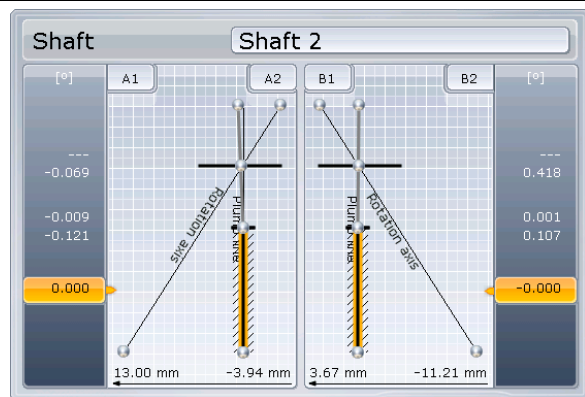
Angles mode.
Shaft 1 element selected.
Nothing fixed.



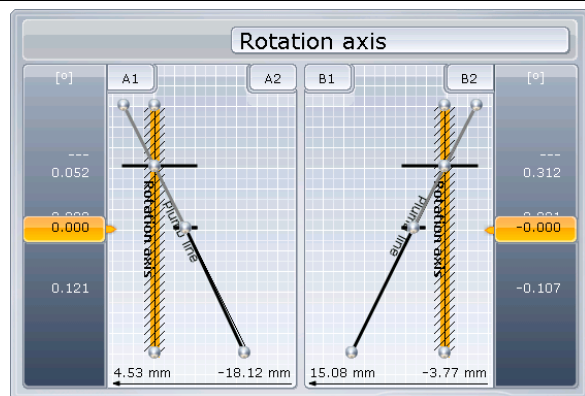
Angles mode.
Shaft 1 fixed.



Angles mode.
Thrust bearing fixed.



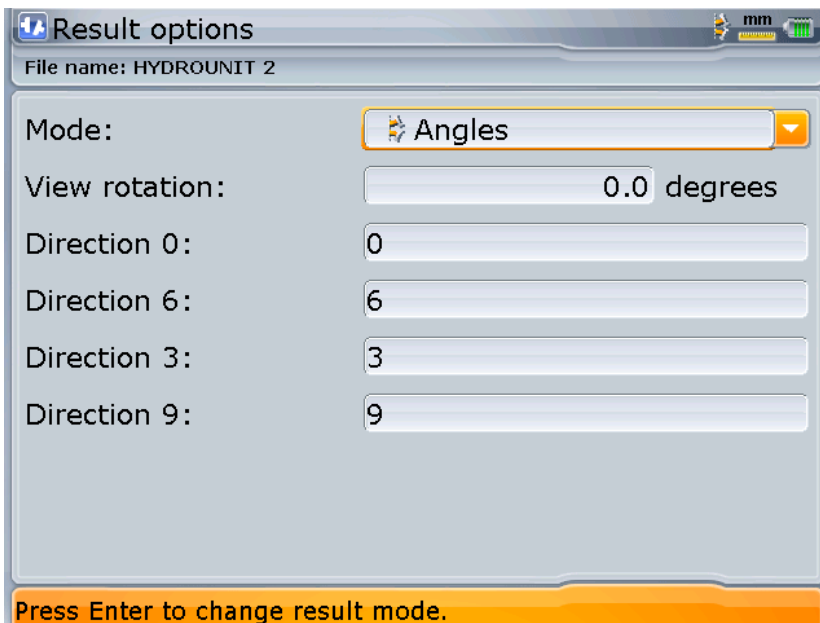
Angles mode.
Shaft 2 fixed.



Angles mode.
Rotation axis fixed.

Result options

The *Results options* screen enables additional customization of result presentation



The following options are available in the *Result options* screen:

- **Mode**
This combo box allows selecting result mode, in which the measurement results should be displayed. There are two settings available:



Positions

Result values are presented as offsets from the hydrounit plumb line.



Angles

Result values are presented as angles between the measured element and the hydrounit plumb line.

- **View rotation**
This text box enables entering value for the angle, by which the result viewing directions should be shifted.

- **Direction 0, 6, 3, 9**
These text boxes enable entering custom names for result view directions.



Default labels:




Example custom labels:



Note: Custom names entered here are used to replace the standard **0-6, 3-9** labels for the viewing direction. The names will not therefore be visible if the result viewing directions are shifted using the **View rotation** option.


You can use the  button or  **OK** context menu option to commit changes made in the Result options screen and return to Results screen.

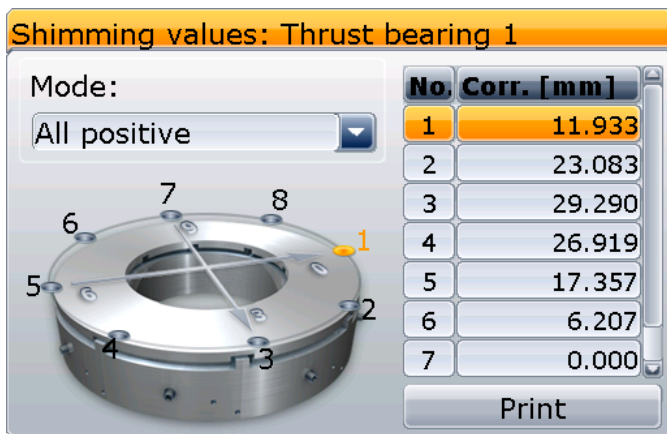
If you want to abandon changes made in the screen, select  **Cancel** from the context menu. The application will ask for your confirmation.

Viewing corrections


The *Hydropower* application features a dialog window, which enables viewing details for corrections at the thrust bearing required to reduce misalignment of the hydrounit with accordance to the current settings – i.e. to align the thrust bearing with the plumb line of the hydrounit or with the currently highlighted element.

Corrections dialog

Corrections values can be viewed in a dedicated dialog window, which can be invoked from the *Results* screen by selecting the  **Corrections** option from the context menu.






The dialog features the following elements:

- **Title bar**
Title bar displays correction type and thrust bearing name.
- **Thrust bearing diagram**
A graphical representation of the thrust bearing with adjustment points and correction direction indicated.
Currently selected adjustment point/direction is highlighted.
You can choose adjustment point to see its position on thrust bearing using the  arrow keys.
- **Correction table**
A table containing a list of all adjustment points and their corresponding correction values.
- **Mode**
This combo box is only present in the dialog for the shimming corrections. It enables selecting shimming correction values mode. For details, please see the Shimming corrections section on page 93.

- **Print**

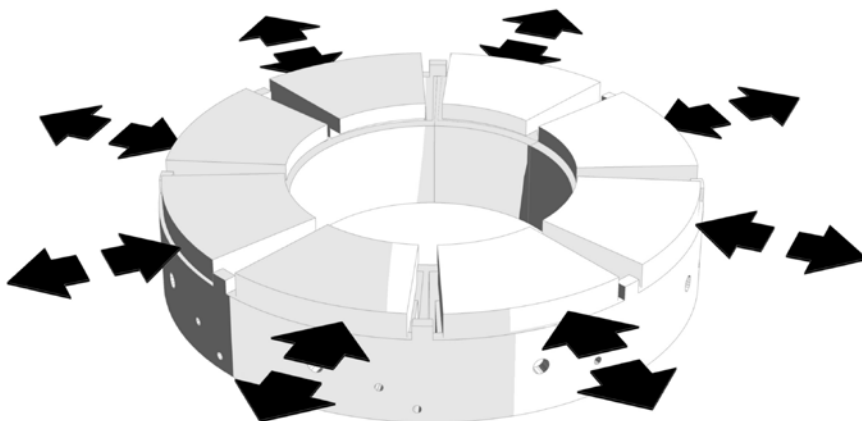
This button allows printing correction report to a connected pendrive.

Select the button using the     arrow keys and press  to print the report.

The type of calculated correction corresponds to the type of fixation selected for the thrust bearing during setup. See the Thrust bearing fixation section on page 45.

Note: The fixation type and properties can be changed in the Hydropower application at any time should a need arise.

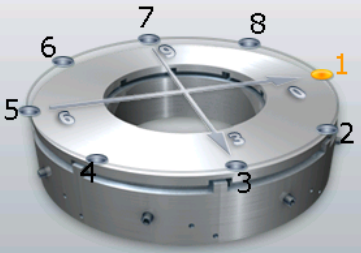
Radial corrections



In **radial** mode (radial fixation) the horizontal position of the thrust bearing can be adjusted.

The corrections are performed at a set number of adjustment points located along the circumference of the thrust bearing housing.

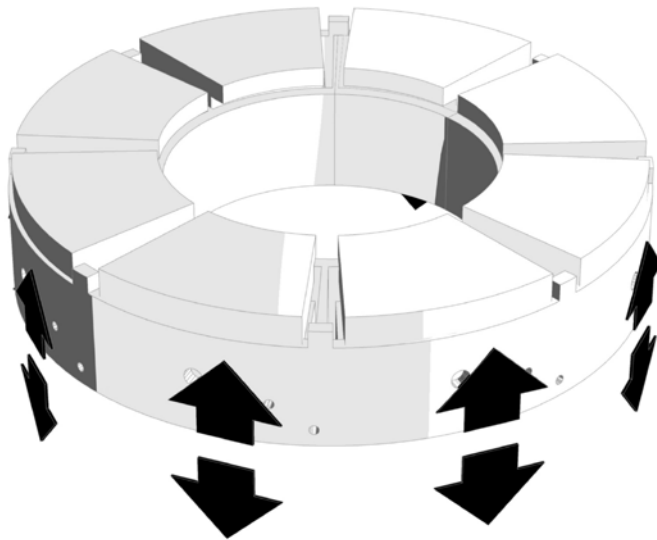
Radial correction: Thrust bearing 1



No.	Corr. [mm]
1	4.530
2	0.538
3	-3.769
4	-5.869
5	-4.530
6	-0.538
7	3.769

The number of adjustment points in radial corrections mode can be adjusted during setup. See Radial fixation on page 45.

Shimming corrections



In **shimming** mode (radial fixation) the angular position of the thrust bearing can be adjusted.

The corrections are performed at a set number of adjustment points located along the circumference of the thrust bearing housing.

Shimming values: Thrust bearing 1

Mode:
All positive

No.	Corr. [mm]
1	11.933
2	23.083
3	29.290
4	26.919
5	17.357
6	6.207
7	0.000

Print

 A small 3D diagram of the thrust bearing housing, showing eight adjustment points numbered 1 through 8 around its circumference. Point 1 is highlighted in orange.

The number of adjustment points in shimming corrections mode can be adjusted during setup. See Radial fixation enables horizontal shift of the thrust bearing by means of adjustment points located along the circumference of the bearing housing.

The **Segments** combo box allows selecting the number of thrust bearing segments, at which adjustment points, which are used for position correction, are located.

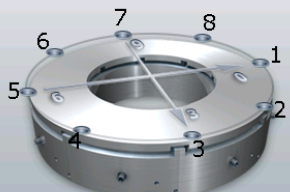
When this type of fixation is selected the alignment corrections are calculated for each adjustment segment individually.

Shimming fixation on page 45.

The additional **Mode** combo box enables adjustment of shimming values, which can facilitate correction process.

Shimming values: Thrust bearing 1

Mode: **All positive**



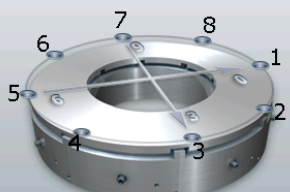
No.	Corr. [mm]
1	0.000
2	0.122
3	0.346
4	0.542
5	0.594
6	0.472
7	0.247

Print

All positive.
Shimming values in this mode are recalculated to ensure only **adding** shims at adjustment points will be required – positive correction values.

Shimming values: Thrust bearing 1

Mode: **All negative**



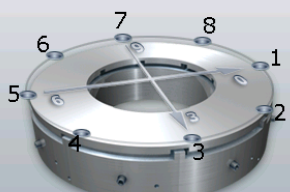
No.	Corr. [mm]
1	-0.594
2	-0.472
3	-0.247
4	-0.052
5	0.000
6	-0.122
7	-0.346

Print

All negative.
Shimming values in this mode are recalculated to ensure only **removing** shims at adjustment points will be required – negative correction values.

Shimming values: Thrust bearing 1

Mode: **Minimal correction**



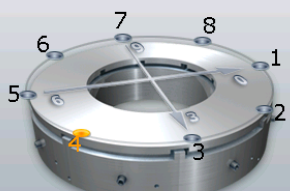
No.	Corr. [mm]
1	-0.346
2	-0.224
3	0.000
4	0.195
5	0.247
6	0.125
7	-0.099

Print

Minimal correction.
Shimming values in this mode are recalculated to **minimize** thickness of shims required for corrections. In this mode removing as well as adding shims can be required.

Shimming values: Thrust bearing 1


Mode: **Zero at certain locati**




No.	Corr. [mm]
1	-0.542
2	-0.420
3	-0.195
4	0.000
5	0.052
6	-0.070
7	-0.295

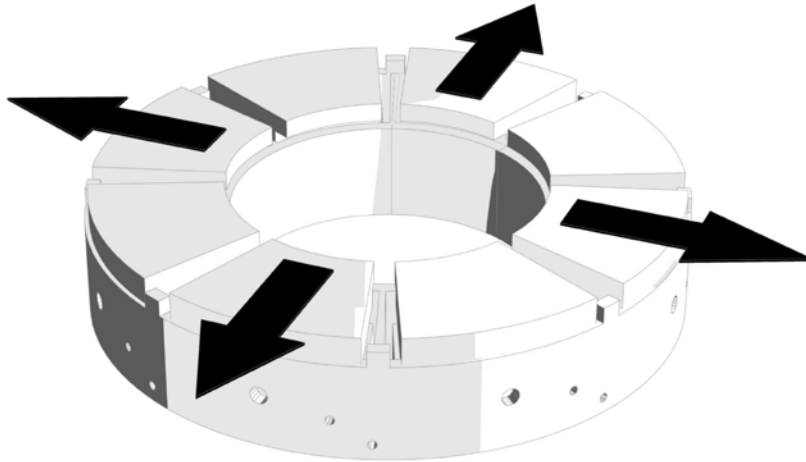
Print

Zero at certain location.
This is an advanced corrections mode, which enables the user to select an adjustment points and set its required correction value to **zero**. Shimming values for other adjustment points will be recalculated accordingly.

In order to set shimming value of a desired adjustment point to zero, select the proper row in the corrections table using the arrow keys and press .

Symbol  will appear and the value will be set to zero.

Jack corrections



In **jack** mode (jack fixation) the correction of the horizontal position of the thrust bearing can be performed by shifting the bearing along two perpendicular axes (0-6 and 3-9).

Jack correction: Thrust bearing 1

No.	Corr. [mm]
0-6	-4.530
3-9	3.769

Print

The direction of the required shift is indicated by an arrow, which appears on the graphical representation of the thrust bearing as corresponding axis is selected in the correction table on the right.

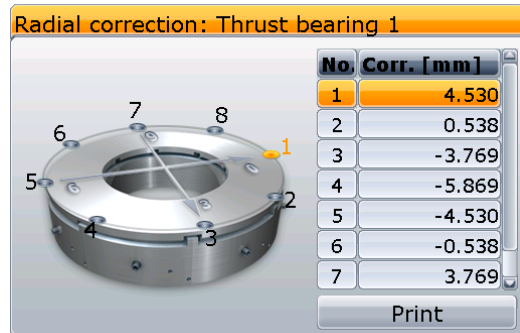
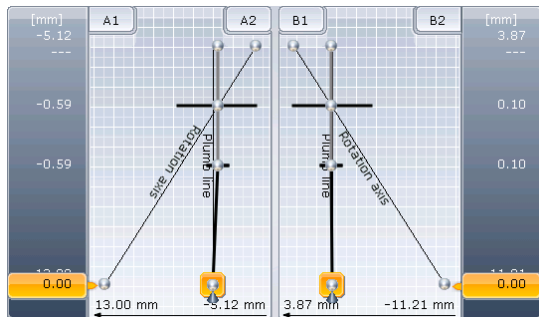
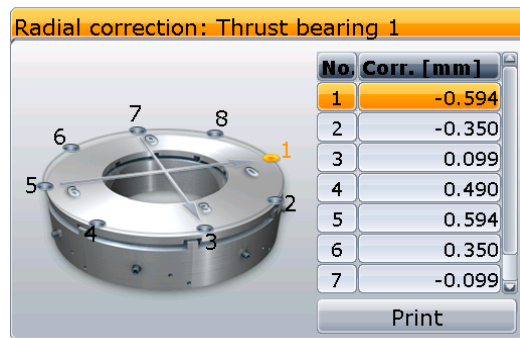
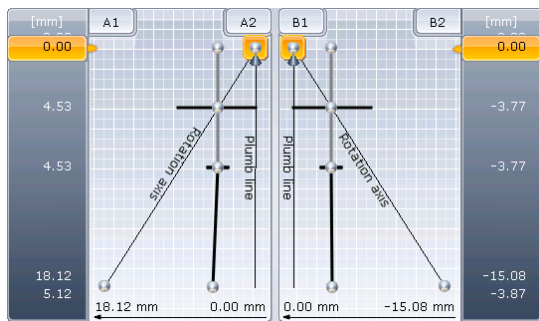
Correction adjustment

Calculated corrections represent values, by which the thrust bearing must be adjusted at each of the correcting points in order to align it or any fixed element of the hydrounit with the plumb line. As a result, the corrections values depend on which (if any) point or element of the hydrounit is fixed.

Calculated correction values are subject to change when fixed point/element of the hydrounit is changed.

Result diagram with fixed point visible

Correction values for the current state



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