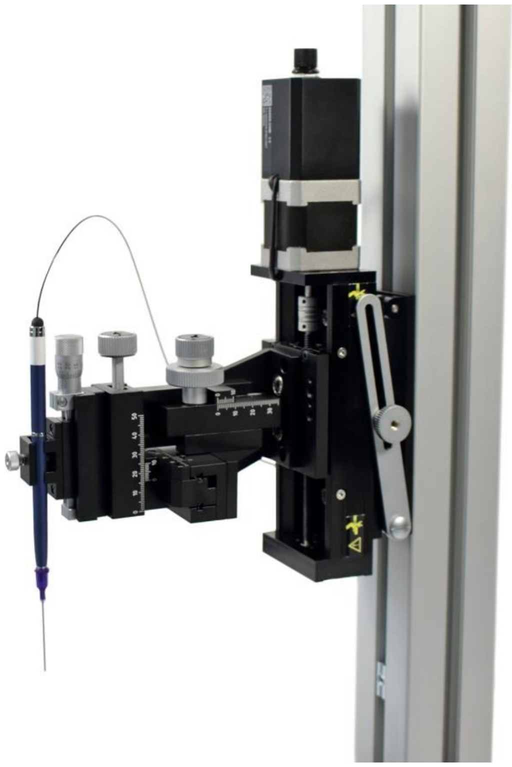
PROFILING

Automated Micromanipulator (AM)

User Guide



PreSens
PRECISION SENSING

Automated Micromanipulator (AM)

Specification:

Automated Micromanipulator for use with PM, NTH and IMP microsensors

Software Version:

PreSens Profiling Studio version 1.0.0

Document filename: User Guide_AM_dv2

Specifications may change without prior notice.

Manufacturer

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1 Preface

You have chosen a new, innovative technology for measuring oxygen and pH.

Chemical optical oxygen & pH microsensors (also called optrodes) have several important features:

- They are small and only minimally invasive.
- They are unaffected by nearby electrical fields.
- They allow measurements with high spatial resolution.

Therefore, they are ideally suited for the examination of small sample volumes and to measure inside opaque or semi-solid matrices.
A set of different microsensors is available to make sure you have the sensor which matches your application.

Please feel free to contact our service team to find the best solution for your application.

Your PreSens Team

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE WORKING WITH THIS DEVICE. WHEN DISREGARDING THESE INSTRUCTIONS THE SAFETY OF THE USER CAN BE IMPAIRED.

2 Safety Notes

This device is only intended for use in the laboratory by qualified personnel according to this user guide and the following safety guidelines:

! Before operating the Automated Micromanipulator (AM), please make sure that the travel path of your microsensor is free and unobstructed by any object other than your sample. Also, make sure that the programmed traveling path of the microsensor never exceeds the size of your vessel or the distance to the underlying surface or base plate.

! In case of an emergency pull the red power plug for immediate emergency stop.

! The potentiometric control knob for manual movement has to be in zero position before putting the AM back into operation after an emergency stop.

! Always use the delivered protective bag or operate the AM in a safe environment (such as a fume hood) to avoid any harm by possible breakage of the microsensor (e. g. in samples with unknown or inhomogeneous composition or consistency).

! Never operate the manual movement of the linear stage without direct supervision.

! The device may produce enough force to cause personal injury. Be careful to keep hair, body parts, jewelry, and clothing form being caught in moving components. Warning labels are used on the devices to indicate areas of particular concern.

! During continuous operation, the device's motor may feel hot to the touch. Although this is normal, care should be taken when handling the device. If the device emits a burnt smell, it may be damaged, in which case you should immediately cut the power supply, cease operation and contact our service team for assistance.

! The device is not splash or water proof. Do not submerse the device in liquid and avoid dusty or humid environments.

! Do not disassemble any electrical component.

3 Description of the Automated Micromanipulator

Fig. 1 Automated Micromanipulator mounted to the Heavy Stand

The Automated Micromanipulator (AM) is specifically designed for profiling applications with the PreSens profiling microsensors (PM), and can also be operated with needle-type housed (NTH) and implantable (IMP) microsensors. The system allows moving the microsensor vibration-free with µm reading accuracy and enables exact localization of the sensor in the sample. Automated profiling can be performed along one dimension over a maximum travel range of 7.5 cm in step sizes down to 10 µm. The micromanipulator additionally comprises a tilting platform, which allows adjusting the microsensor at an angled position. The associated, user-friendly, and database-supported software PreSens Profiling Studio enables control of the Automated Micromanipulator and the respective oxygen or pH meter. The AM is compatible with PreSens oxygen meters Microx TX3 (sensor type PSt1), Microx TX3 trace (with PSt1 sensor type only), Microx 4 (sensor type PSt7), Microx 4 trace (sensor type PSt7 & PSt8) and the pH meter pH-1 micro (sensor type HP5). The software offers multiple features from clear data organization and export, easy creation of profiling templates, to initial analysis functions.

Features

- Fully automated system
- Software ‘PreSens Profiling Studio’ included
- Plug & play USB-connection
- Manual Micromanipulation in 3D
- Automated profiling with 1 µm resolution
- For all PreSens microsensors and micro transmitters

3.1 Scope of Delivery

Fig. 2 All delivered equipment: (1) Manual Micromanipulator, (2) linear stage with tilting platform, (3) Profiling Studio software, (4) power adapter, (5) USB to serial-mini cable, (6) USB hub, (7) country adapter, (8) power strip, (9) clamp for bare fiber, (10) knurled screw, (11) Allen-socket screws, (12) Allen key, (13) key for knurled screw, (14) protective bag

Scope of Delivery

- 1 x Manual micromanipulator
- 1 x Linear stage with attached tilting platform
- 1 x PreSens Profiling Studio software (CD)
- 1 x Power adapter
- 1 x USB to serial-mini cable
- 1 x 7-port USB 2.0 hub
- 3 x Country adapters (UK, US, AU)
- 1 x Power strip with overvoltage protection
- 1 x Clamp for bare fiber microsensors
- 1 x Knurled screw (M6)
- 2 x Allen-socket screws (M6)
- 1 x Allen key (size 4.0)
- 1 x Key for knurled screw
- 1 x Protective bag

Optional:

- Heavy Stand
- Profiling Microsensor
- Safe Insert

Additionally required equipment (not supplied):

- Oxygen or pH Microsensor (PM, NTH, IMP)
- Respective PreSens oxygen or pH transmitter (Microx 4, Microx 4 trace, Microx TX3, Microx TX3 trace, pH-1 micro)
- PC / notebook, Minimum System requirements:

	Minimum System Requirements
Operating system	Microsoft® Windows® 7, 8, 10 (32 or 64 bit)
Processor	2 GHz CPU
RAM	2 GB
Hard disk	500 MB free memory
Interface	2 x USB 2.0 ports
Applications	.xslx and .csv format reader software

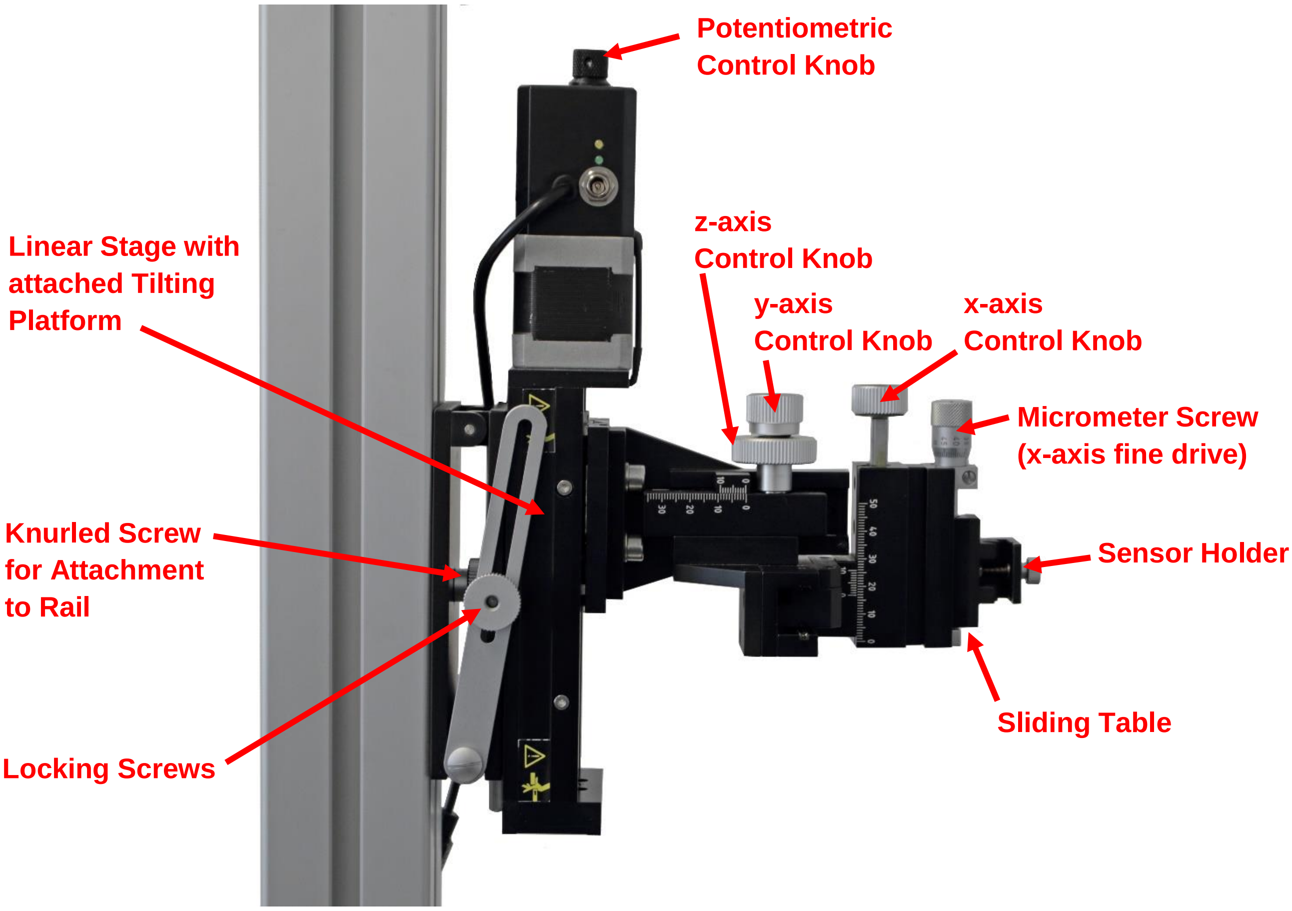


Fig. 3 Automated Micromanipulator: Naming of single parts

4 Installation

Make sure all components of the Automated Micromanipulator system are installed correctly according to the following instructions to avoid personal injury or material damage.

4.1 Software Installation

1. Close all other applications as they may interfere with the software.

2. Insert the supplied CD in a CD drive of your PC / notebook, and open the file menu. Alternatively download the software from: http://www.presens.de/support-services/download-center/software.html

3. Run the file Setup_Profiling_Studio_1.0.0.exe, and follow the onscreen instructions.

4. After installation of the .NET Framework the PreSens Profiling Studio software will be installed. Click the Finish button when the installation is completed.

4.2 Automated Micromanipulator Set-Up

A square profile rail should be used to mount the Automated Micromanipulator. We recommend using the Heavy Stand offered by PreSens for secure mounting and maximum stability.

4.2.1 Mounting the AM to a Stand

! In case you are not using the PreSens Heavy Stand, make sure you have a matching M6 thread, so the Automated Micromanipulator can be mounted securely to your stand and does not work loose during measurements.

1. Fasten the micromanipulator to the linear stage with the two Allen-socket screws using the Allen key (see Fig. 4). (In order to access the drill holes in the micromanipulators base more easily you can use the z-axis control knob and move the micromanipulator all the way up.)

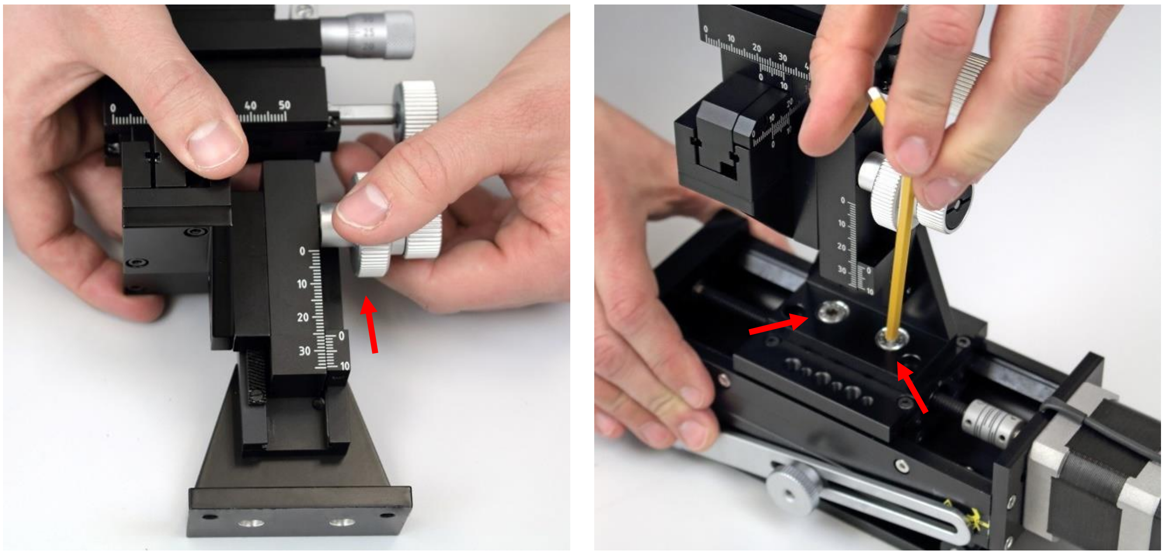


Fig. 4 Use the z-axis control know to move the micromanipulator upwards; then mount the AM to the linear stage with the two Allen-socket screws.

! Do not use excessive force when fastening the micromanipulator as this might damage the precision sliding table.

2. Loosen the locking screws at each side of the tilting platform; tilt the AM until you can comfortably reach the drill hole in the center of the platform. Place the knurled screw in the drill hole and attach it loosely to the nut block within the rail groove so the AM can still be moved along the rail.

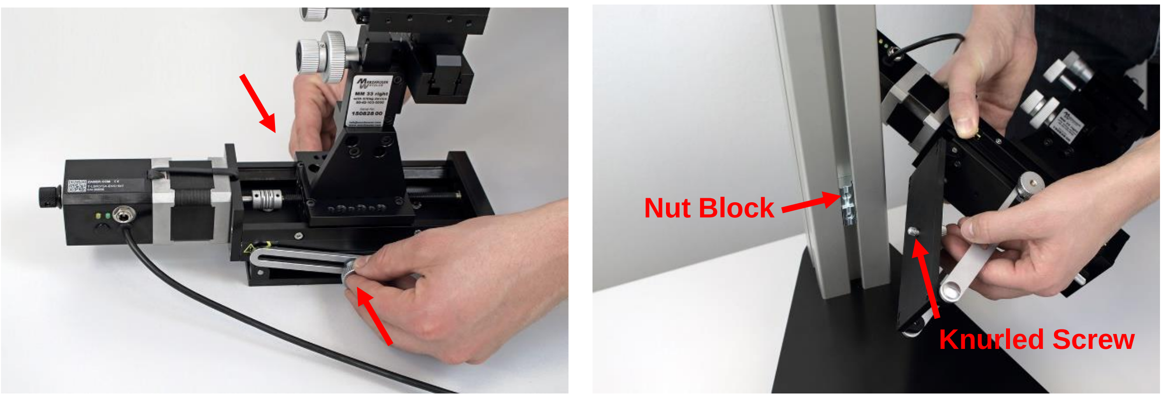


Fig. 5 Loosen the locking screws at the tilting platform, and place the knurled screw in the drill hole at the bottom

3. When the micromanipulator is at about the right height loosely tighten the knurled screw and then turn the micromanipulator in the desired angle to the profile rail.

4. Tighten the knurled screw with the respective key (it can be inserted in the hole on the screw head) so the Automated Micromanipulator is mounted securely to the heavy stand.

Fig. 6 Fasten the knurled screw with the key so the AM is attached securely to the rail

4.2.2 Connecting the AM

Connect the USB cable of the Automated Micromanipulator to the USB hub delivered with the AM. Connect the USB hub to your PC / notebook and its power adapter to the power grid.

Insert the red power adapter plug in the power connector on the AM and connect the power adapter to the power grid. As soon as it is connected to the power, the linear stage can already be moved manually with the potentiometric control knob on top.

Fig. 7 Connect the power adapter

! In case of any emergency, e. g. something gets caught in the linear stage while it is moving, pull the red power connector to stop the AM.

4.3 AM Adjustments

You are able to adjust the Automated Micromanipulator and linear stage to your set-up requirements by rotating or tilting the unit on the stand.

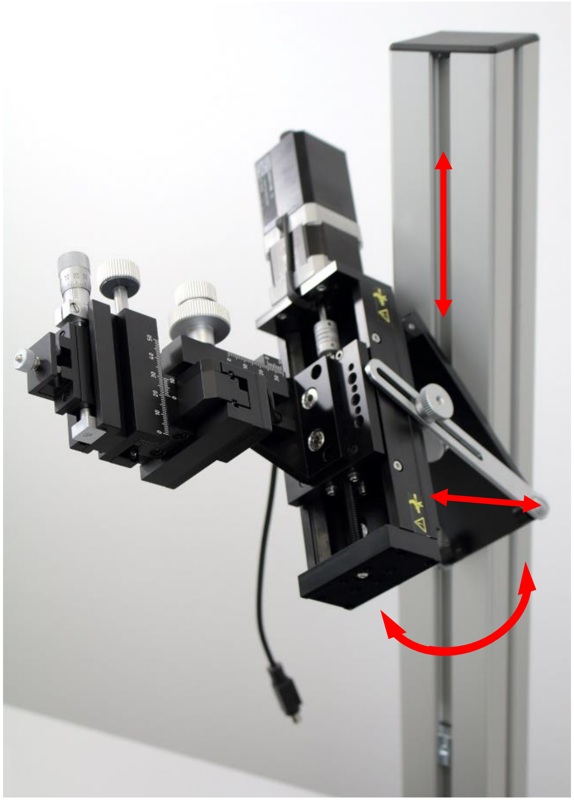


Fig. 8 AM adjustment options: rotation, angle, height

4.3.1 Rotation

1. Loosen the locking screws on both sides of the tilting platform. Tilt back the AM until you can reach the knurled screw below. Insert the delivered key for the knurled screw in the respective hole on the screw head (see Fig. 9) and loosen the screw (do not remove it completely).

! Please make sure to support the AM with one hand when loosening the knurled screw to prevent it from dropping. In case the Automated Micromanipulator is mounted to a long rail, there may not be enough room to tilt it completely when aligned with the rail. Please do not use force when tilting the AM in this case to avoid damage or injury.

2. Rotate the AM and adjust its angle relative to the stand. When it has the desired orientation tighten the knurled screw again.

Fig. 9 Fastening the AM in a straight (left) or rotated position (right).

3. Tilt back the AM and tighten the locking screws on both sides of the tilting platform.

4.3.2 Tilting

The AM can be tilted upward to an angle of 70°. Please make sure the AM is mounted securely to your stand, and in a way so there is enough room for tilting.

Adjust the tilting angle by loosening the locking screws on both sides of the tilting platform. Then move the micromanipulator in the desired position and tighten both locking screws firmly.

Fig. 10 Fix the AM in a tilted position; tighten the locking screws on both sides securely

! Make sure the locking screws are tightened properly, so the micromanipulator does not change its angle or tip over during measurements, which will damage the equipment and can even cause injury.

Using the small post, the linear stage can be tilted in all directions if mounted > 10cm from the base plate. The long post allows for sideways tilting (see Fig. 11).

Fig. 11 Tilting on a small post (left); sideways tilting on a long post (right)

4.4 Mounting Microsensors to the AM

The Automated Micromanipulator can be used with PreSens PM, NTH, and IMP microsensors. A Profiling Microsensor should be used for all profiling applications in semi-solid substrates, such as sediments, microbial mats or biofilms. The PM is specially designed for profiling applications and has a close-fitting fiber guidance and a mechanical interlock for precise vertical localization of the measurement tip.

However, if the sample's matrix is too hard or sturdy to be pierced directly with the sensor's glass fiber, it is recommended to use an NTH microsensor and the safe-insert function. The safe-insert function will allow you to puncture the sample with the NTH sensor's sharpened steel needle before extending the fragile glass fiber for automated profiling. A detailed description of how to insert an NTH microsensor with the safe-insert function can be found in the following video description:
www.presens.de/support-services/videos/video/manual-micromanipulator-profiling-916.html

4.4.1 Mounting a PM to the AM

A PM microsensor can simply be placed in the sensor holder. Fasten the holder with the screw on top so the microsensor is attached below the turning mechanism of the PM (silver ring). Tighten the holder firmly so the micromanipulator cannot move back or forth, or even wedge in the holder. Remove the protective plastic cap that covers the needle.

! Make sure to hold the plastic base of the needle (not the sensor housing itself), so it does not come off when removing the cap.

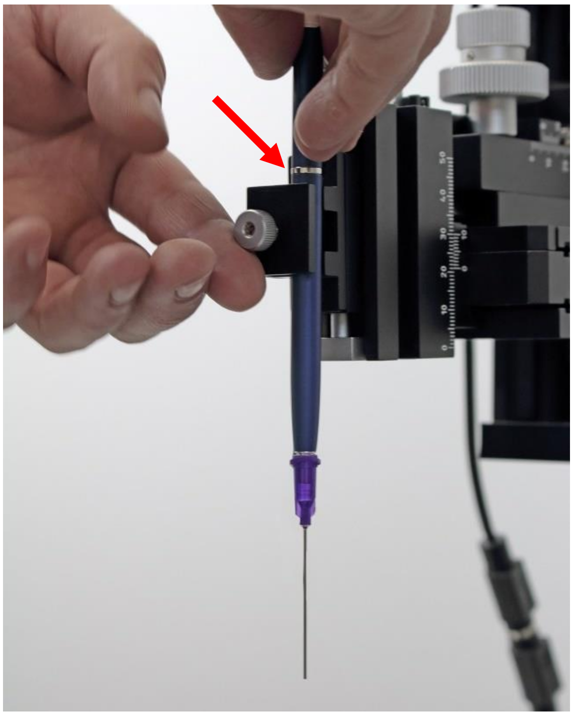


Fig. 12 Mounting a PM to the sensor holder; the turning mechanism (silver ring) has to be placed above the holder.

When the AM set-up is adjusted you can prepare the PM for measurements:
Turn the upper part of the PM clockwise until the sensor tip is extended.

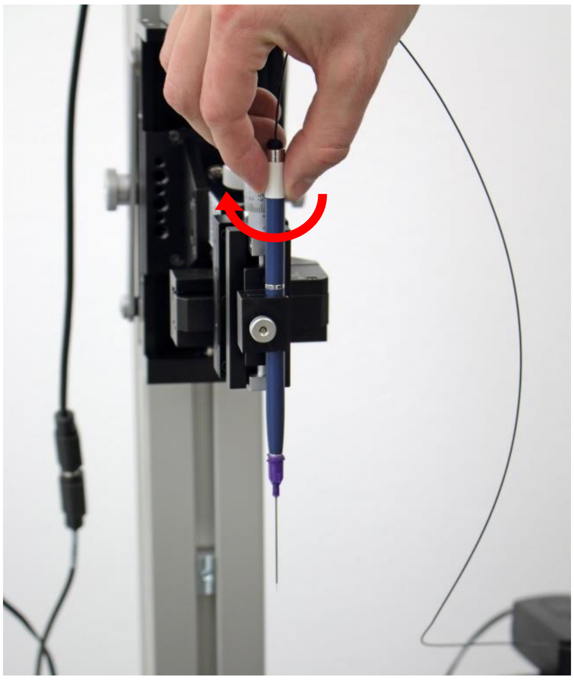


Fig. 13 Extend the PM tip by turning clockwise.

4.4.2 Mounting a NTH to the AM

An NTH microsensor can simply be placed in the sensor holder. Fasten the holder with the screw on top, so the microsensor is attached firmly to the micromanipulator and cannot move back or forth, or even wedge in the holder.

When the AM set-up is adjusted you can prepare the NTH for measurements. Remove the protective plastic cap and the transport block that covers the needle.

! Make sure to hold the plastic base of the needle (not the syringe itself), so it does not come off when removing the cap.

The sensor tip can then be extended by pushing the syringe plunger downwards.

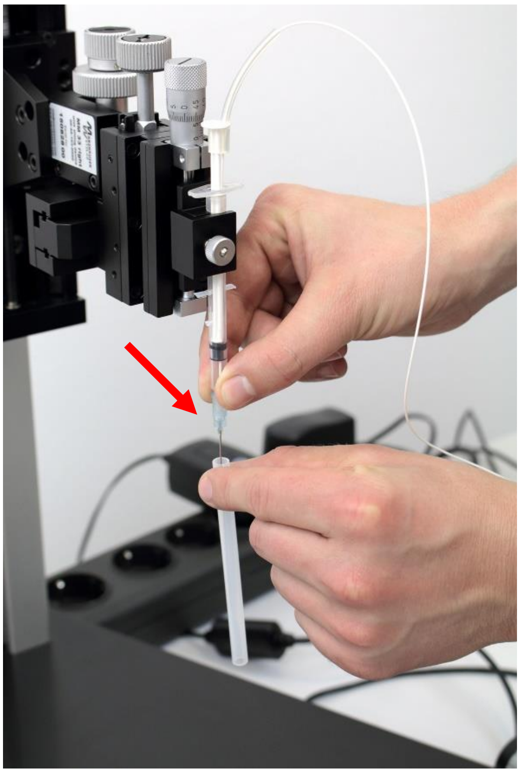
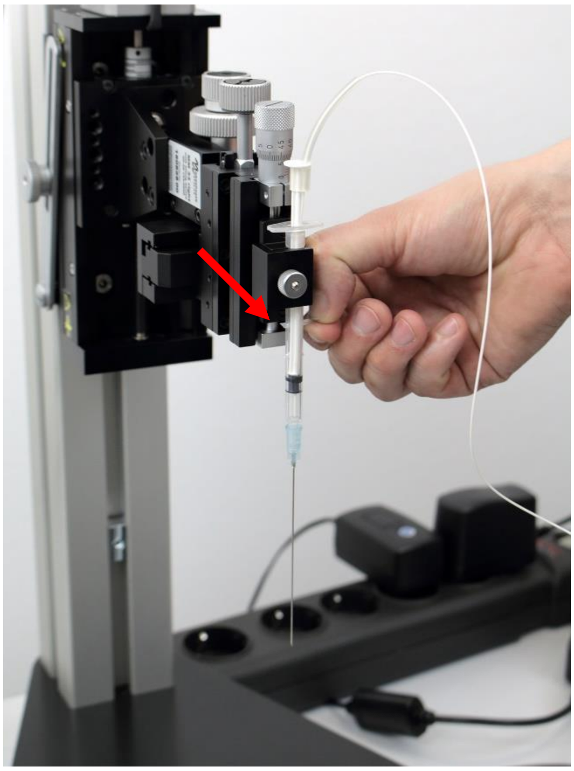



Fig. 14 Remove protective plastic cap and the transport block.

! The sensor tip must be retracted in its needle housing, when inserting the microsensor into semi-solid or solid samples, else the sensor fiber might break.

For very tough or hard samples the safe-insert function should additionally be used for NTH microsensors. It is recommended to use the safe-insert function when inserting an NTH sensor into semi-solid or solid samples, such as in food, packaging or animal physiology applications. With the safe-insert function the microsensor retracted in its steel needle can be securely inserted into your area of interest; the sensor tip can then be extended with a precise, specially designed mechanism before automated profiling, without risk of breaking the sensor fiber.
A detailed description of how to mount a NTH sensor with safe-insert can be found in the following video description: http://www.presens.de/support-services/videos/video/manual-micromanipulator-mounting-917.html

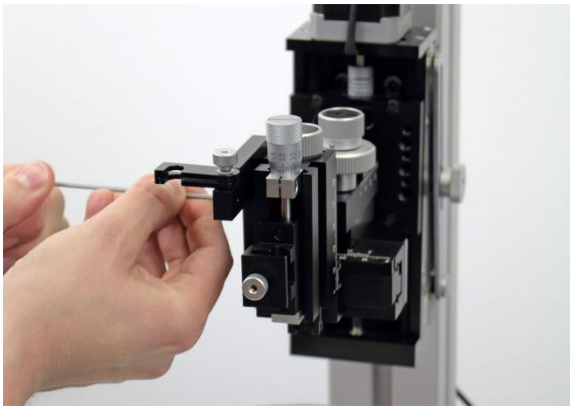


Fig. 15 Mounting the Safe Insert accessory.

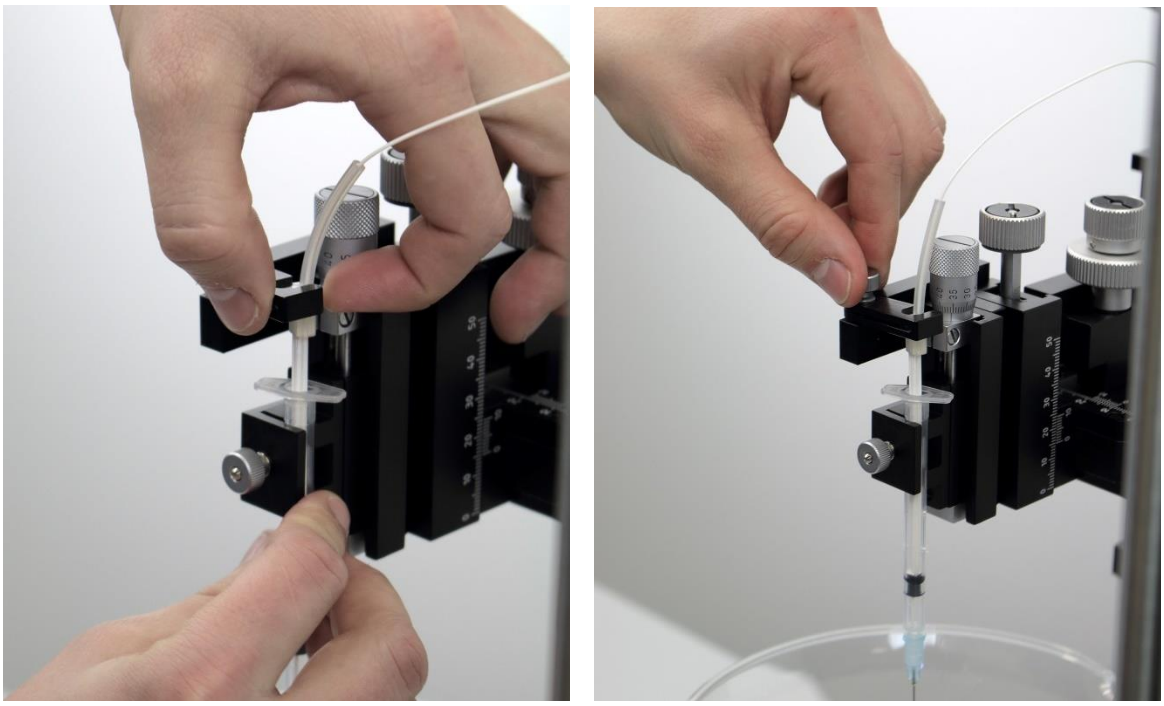


Fig. 16 Attaching the plunger fixing to the NTH to make use of the Safe Insert function.

4.4.3 Mounting an IMP to the AM

A special clamp is delivered with your Automated Micromanipulator, to attach an implantable microsensor.

Fig. 17 Clamp for bare fiber microsensors

Upon delivery the bare fiber and sensing tip of an IMP microsensor are protected by a glass housing. The fiber is prevented from slipping out of this housing by protective tubing. Loosen the protective tubing and carefully remove the IMP from the glass housing.

! Handle the IMP microsensor with care when it is removed from the glass housing. The glass fiber and sensor tip are very fragile and might break or get damaged when unprotected!

1. Take the clamp for bare fibers and loosen the thumbscrew in front.
2. Place the IMP microsensor in one of the two notches at the front of the clamp.

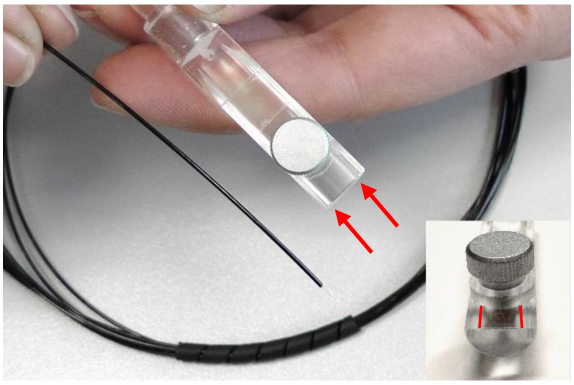


Fig. 18 Implantable oxygen microsensor and clamp for bare fiber microsensors; insert: clamp front – notches marked red.

! Insert the IMP from the side. Do not try to thread it into the notch from the back or the top, because whenever the fiber or sensor tip touches a surface it might get damaged or break.

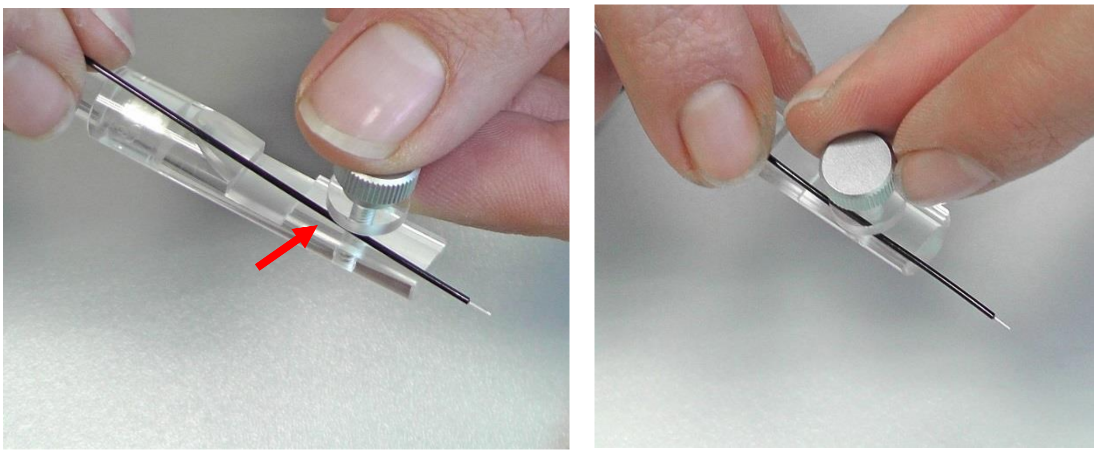


Fig. 19 Insert the IMP from the side and fix it in position by closing the thumbscrew.

3. Close the screw on the clamp, so the sensor fiber is securely fixed in position within the notch.
4. Open the sensor holder by loosening the respective thumbscrews.
   Then place the narrow part of the clamp with installed IMP in the sensor holder and close the holder with its thumbscrew.

! Make sure the sensor fiber of the IMP does not get caught in the sensor holder; the fiber might get damaged when fastening the holder.

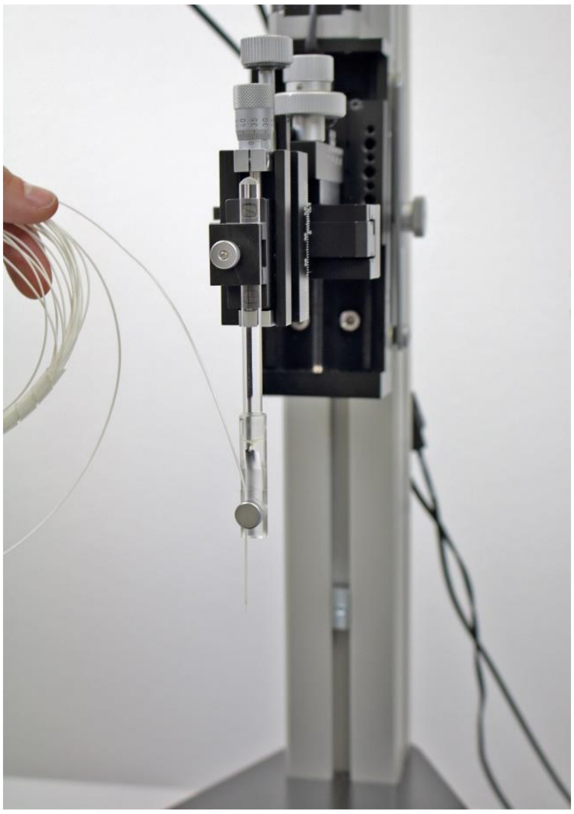


Fig. 20 Clamp with attached IMP in the sensor holder. The sensor fiber should not get caught in the clamp attachment.

5 Operation

5.1 Measurement Preparations

1. Connect the microsensor to the sensor connector on the transmitter.

2. Connect the transmitter to the power supply (not necessary with Microx 4 or Microx 4 trace) and to a USB port of the USB hub connected to the PC / notebook. Switch on the transmitter.

3. If you have not done so yet, connect the AM to the power supply and to a USB port of the USB hub connected to the PC / notebook (see chapter 4.2.2).

4. Close all other applications as they might interfere with the software and start PreSens Profiling Studio.

Please wait with positioning your sample and placing the microsensor into start position for profiling until you have started **Zero Level Adjustment** via the software (see chapter 5.6.1). The linear stage will have to be homed in on zero position and move all the way to the end of the linear stage so the software can calculate the available drive range. This will move the microsensor away from any preset position.

In case you are working with an NTH, please make sure the transport block and protective needle cover are removed. However, the sensor tip should be kept retracted in the needle until just before measurement start, to avoid damage to the fiber or sensor tip.

5.2 The File Menu

The Software starts in the File menu. Here recently stored data sets are listed and can be opened or exported, and new data sets can be created. The software is database supported. You can organize your data in Experiments, in which multiple Profiles belonging to the same experiment are pooled.

5.2.1 Recent Data Sets

When the software is started it first displays a screen with **Recent** Experiment data sets and their creation date. Click on one of the Experiment data sets so it is highlighted. Use the symbols below the data set information to **Open Series**, **Edit Name**, **Remove from List** or **Delete Series**. Removing a data set from the **Recent** list will not delete the data.

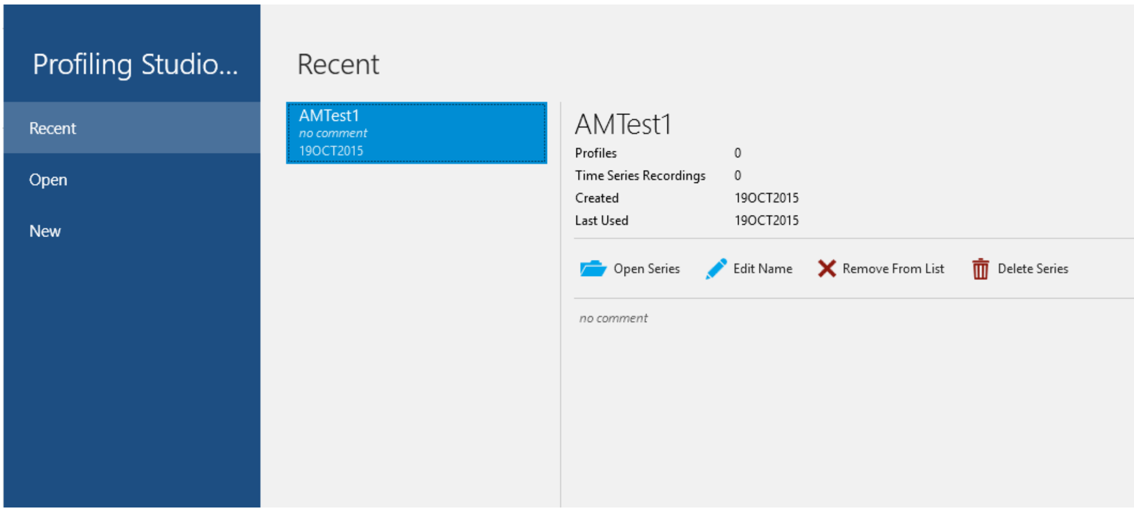


Fig. 21 File / Recent: A recently created Experiment is selected

Like Recent the **Open** menu gives you a list of Experiment data sets created with the software. Choose a data set from the list by clicking on it. Then use the symbols below the data set information to **Open**, **Rename** or **Delete** the selected data. Here a search bar is displayed where you can enter an Experiment name to find the respective data set.

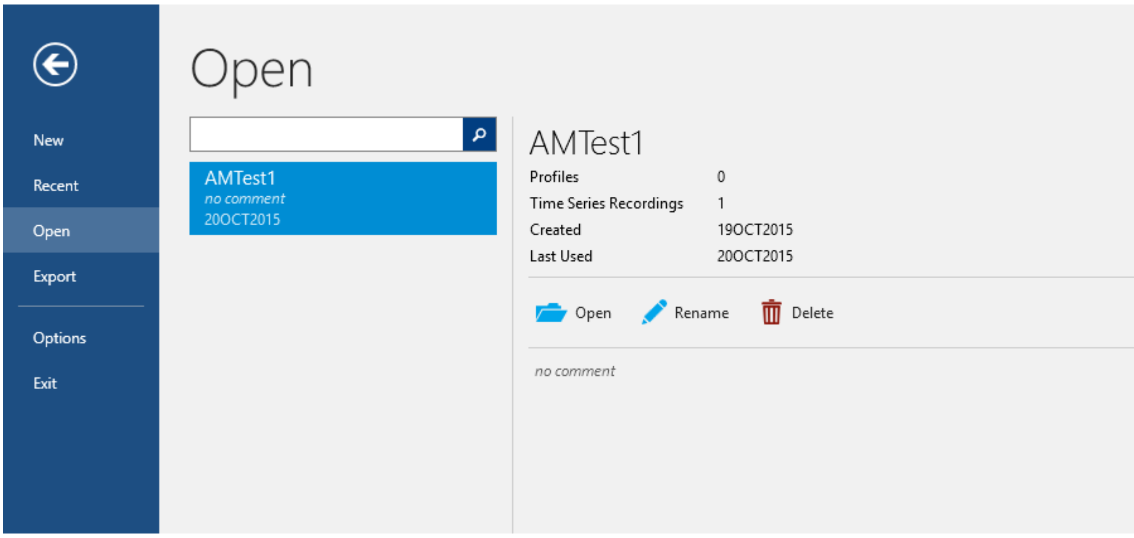


Fig. 22 File / Open: An Experiment is selected and its details are displayed

5.2.2 New Experiment & New Profile

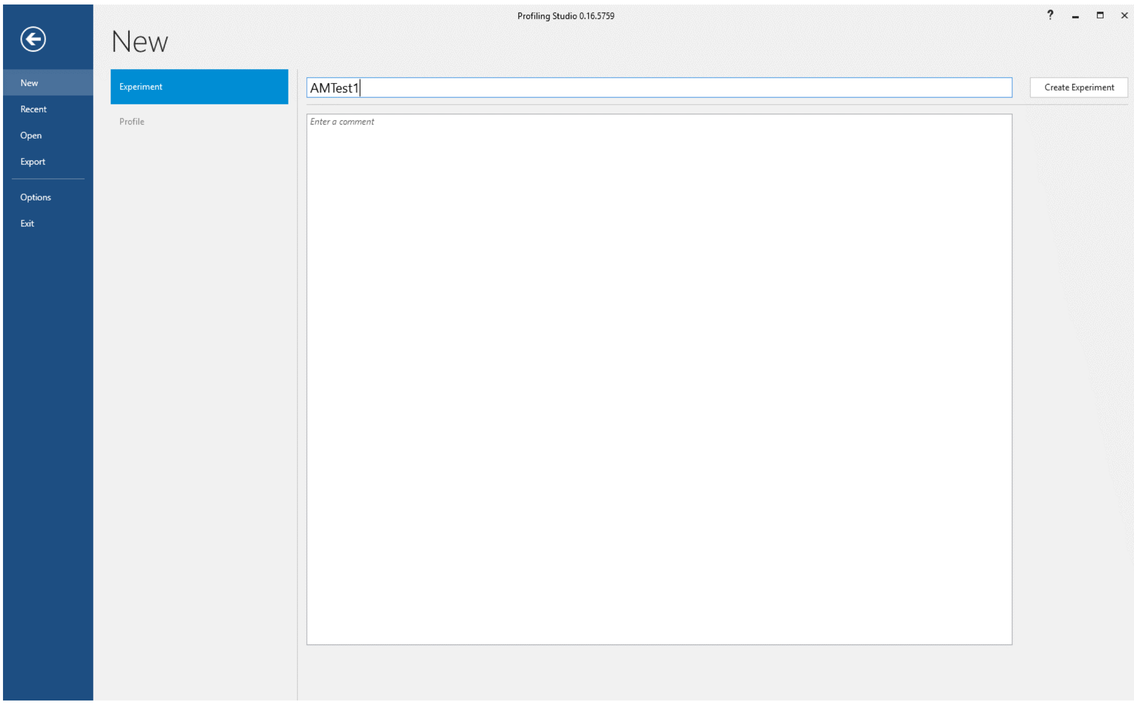


Fig. 23 File / New: Create a new Experiment

Select **New** in the menu on the left to create a new **Experiment**. Enter a name for the new experiment; additionally you can enter a comment in the input box below. Then click **Create Experiment** on the right.

The display switches to creating a new **Profile** automatically. Enter a name for the new profile; again you can enter a comment for this profile data set in the input box below. Then click **Create Profile** on the right.

Whenever you open an existing Experiment you will have to create a new Profile. Use the **Create Profile** button below the **Experiment Explorer** (see chapter 5.3) on the following screens to create a new profile.

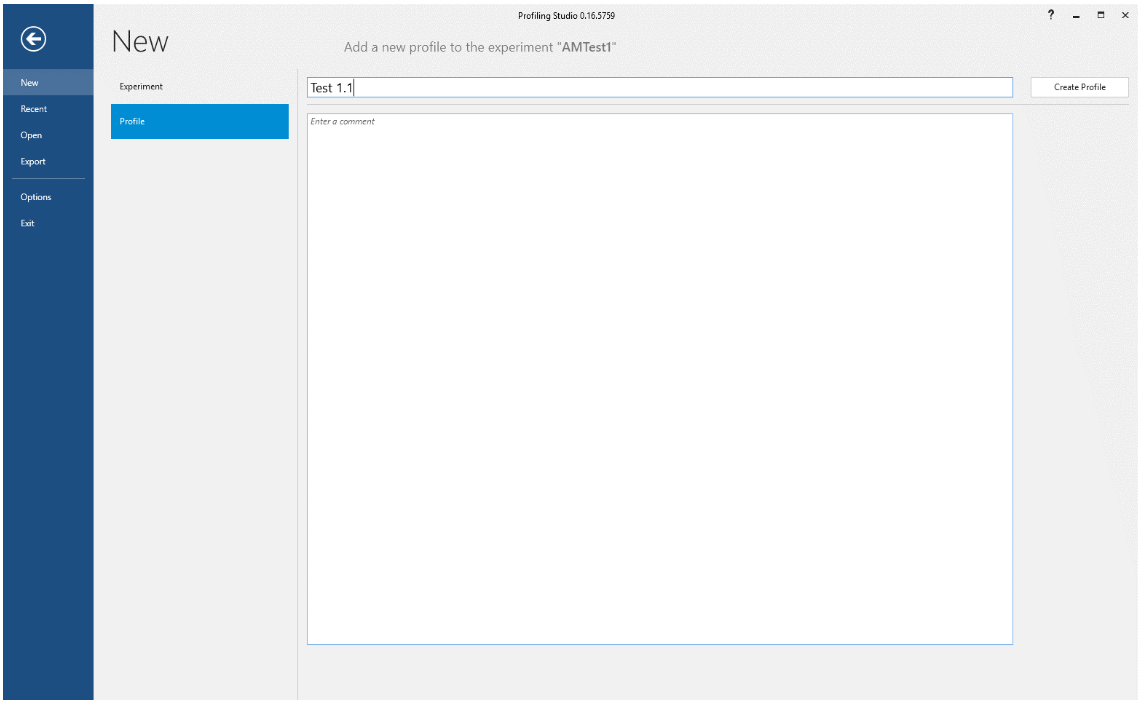


Fig. 24 File / New: Create a new Profile

The software switches to the Devices screen next.

5.3 Devices

The Profiling Studio software is compatible with Microx TX3, Microx TX3 trace (only with PSt1 type sensor), Microx 4, Microx 4 trace and the pH-1 micro transmitters.

The main screen shows a list of all switched on **Devices** connected to the PC via USB, their **Serial** number, the **Analyte** they measure, and whether a **Temperature Sensor** is connected to the device or not. The **Experiment Explorer** on the right shows the active **Experiment** and **Profile**, and again you are able to add a comment to the data set in the input box below. You also have the option to **Create New Profile**. The active **Profile** is highlighted in green.

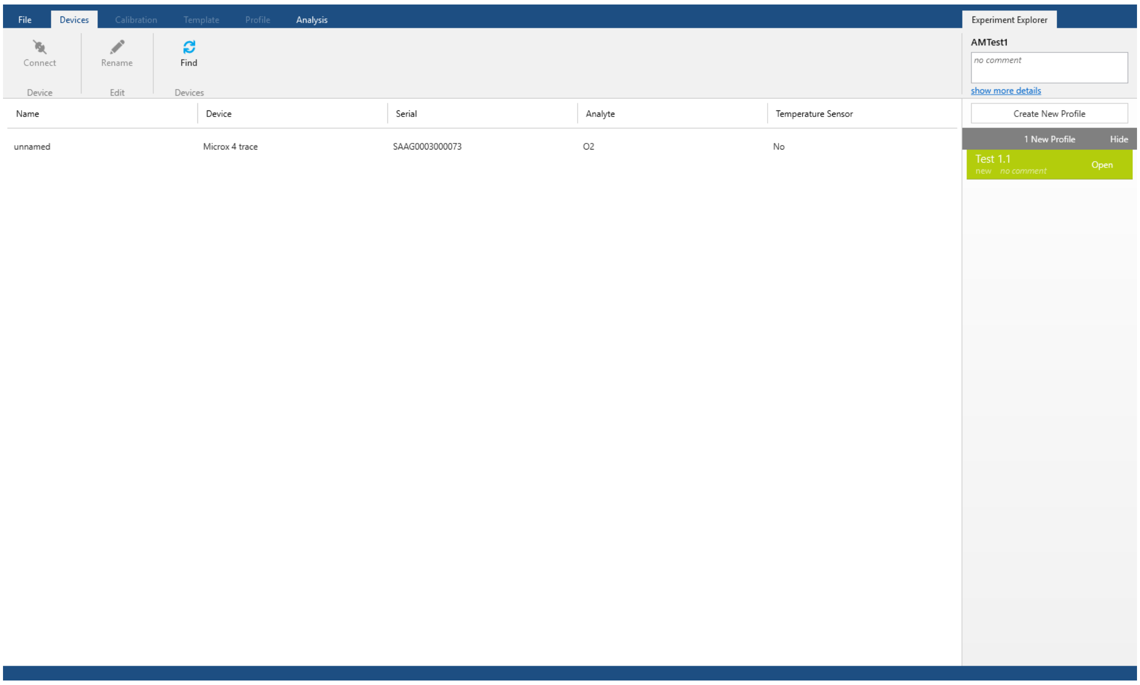


Fig. 25 Devices screen - a Microx 4 trace without a temperature probe is connected to the PC and was detected by the software

The buttons in the main menu bar offer the following functions:

Connect: Select a device in the list so it is highlighted. Then click this button to connect the device with the software.

! If you want to use automatic temperature compensation, please connect the temperature sensor to the respective transmitter before you press **Connect**. After connecting the temperature sensor click **Find** to update the **Temperature Sensor** status (it will show as 'Yes').

Rename: Select a device in the list so it is highlighted. Then click this button to change the device **Name** (see Fig. 26).

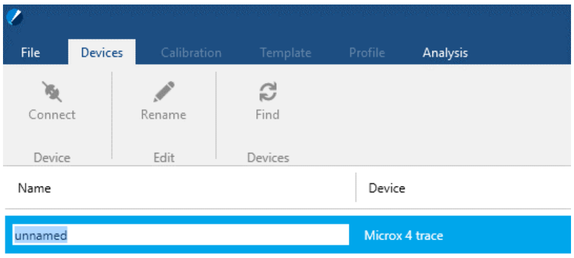


Fig. 26 Rename a device

Find: In case no device is shown in the list, please check if the transmitter is connected correctly via USB. Then click this button and the software will scan for all connected (and switched on) devices.

! In case a Microx 4 is connected and not recognized: the USB-connection sign must show on the Microx 4 screen. If not, the transmitter must be restarted (by turning it off and on via its start button) or its USB replugged.

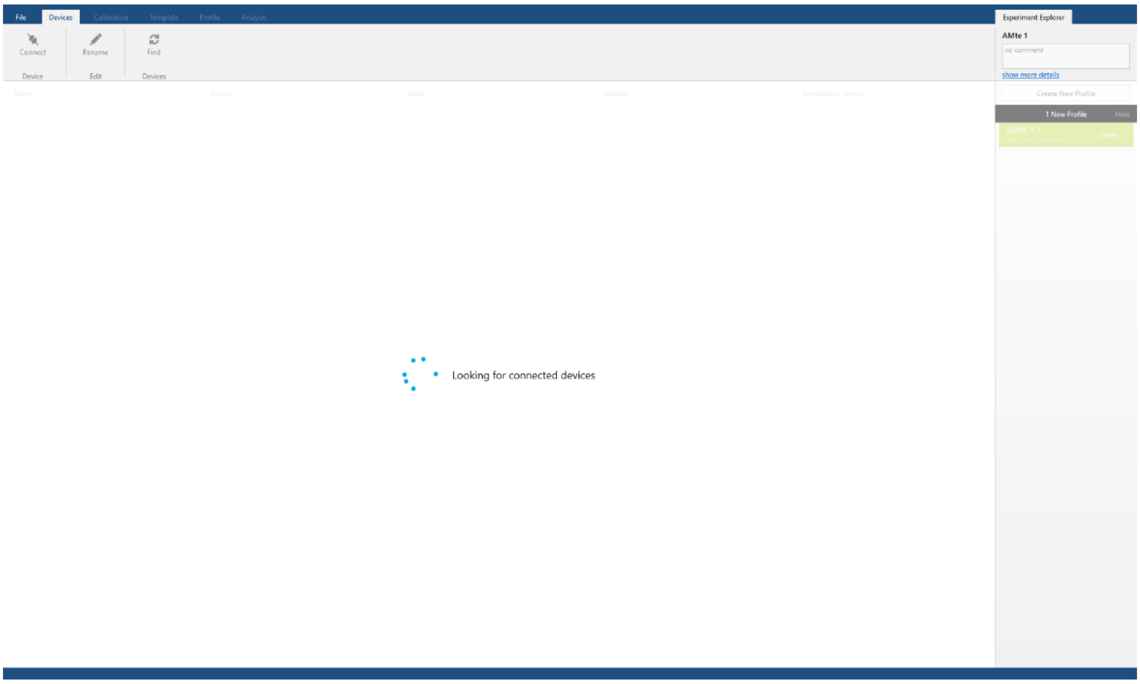


Fig. 27 The software is scanning for connected devices

When you have selected a device and connected it to the software, it will be highlighted green. The software then automatically switches to the calibration screen. The Devices tab will be marked green, indicating that a device has successfully been connected.

5.4 Calibration

It is recommended to calibrate oxygen and pH microsensors prior to each measurement. Especially after longer measurement periods (more than 10,000 measurement points or > 8 h of continuous measurement) the sensors should be re-calibrated.

The Calibration screen shows a list of all Calibrations that have been created with the respective sensor type. If the software is running for the first time, the list is empty and you will have to create a **New** calibration.

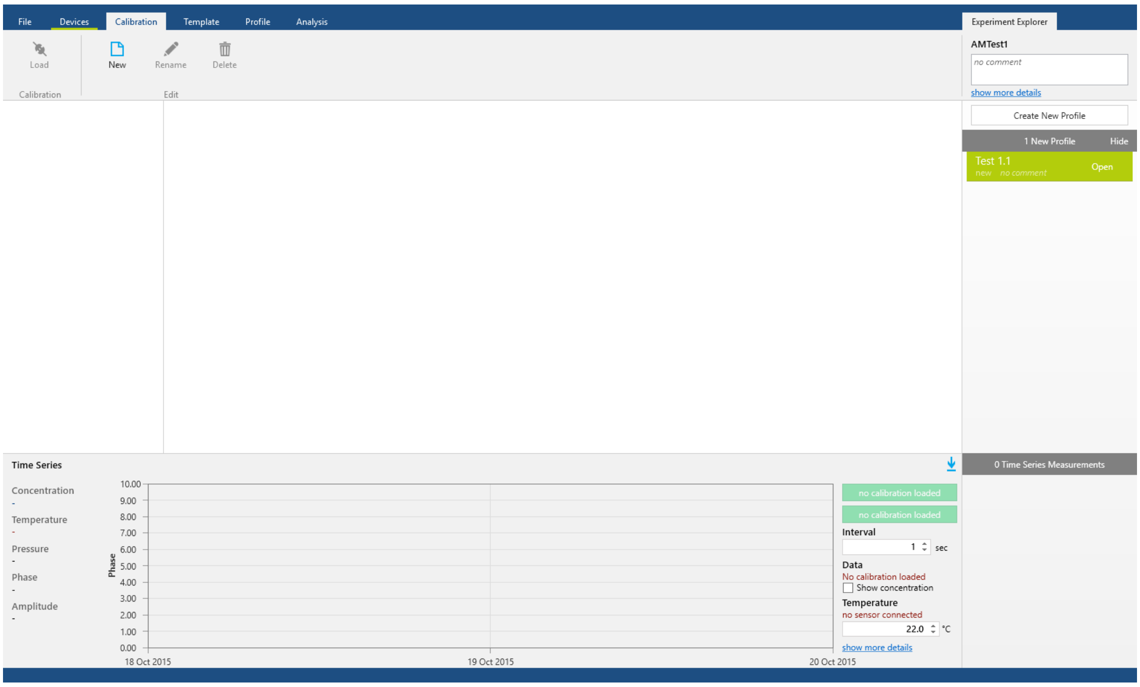


Fig. 28 Calibration screen - no calibration has been created so far

The buttons in the main menu bar offer the following functions:

New: Create a new calibration for the connected microsensor. Select the sensor type you have connected to your transmitter in the drop-down menu (only sensor types compatible with the connected device are shown) and start creating a new calibration file.

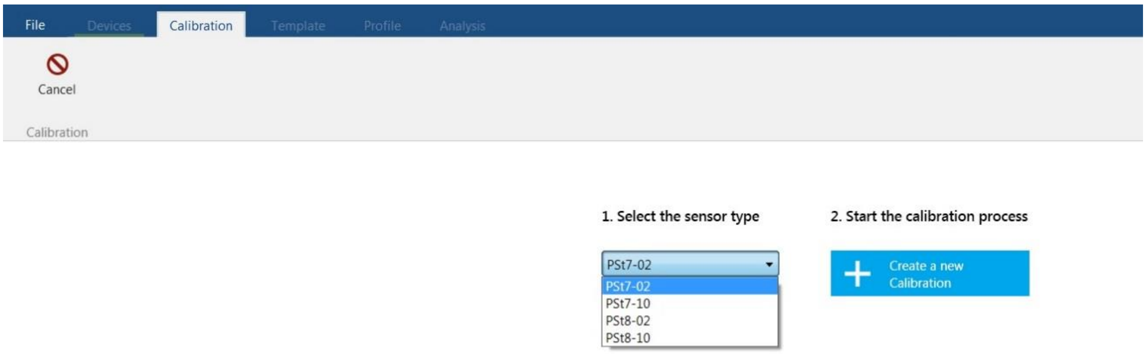


Fig. 29 Create a new calibration and sensor type selection

Load: In case you are working with a sensor you have used before you can load an already created calibration. Select the calibration in the list, so it is highlighted and click Load. The display will switch to the Template screen automatically and the chosen calibration data will be applied for your measurements.

Rename: Select a calibration file from the list, so it is highlighted. Then click this button to change the calibration name.

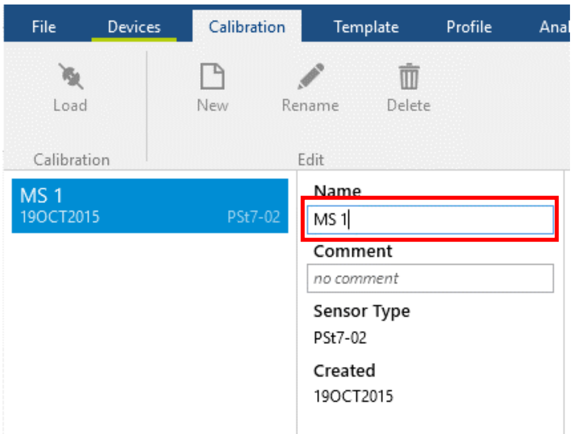


Fig. 30 Rename a calibration

Delete: Select a calibration that is no longer needed form the list so it is highlighted. Then click the Delete button to remove it. A warning window appears asking if you are sure to permanently delete this calibration. Click **Yes** to proceed or **Cancel** to abort deleting the entry.

5.4.1 Calibrate an Oxygen Microsensor

! For more details on the ‘Preparation of Calibration Standards’ for your specific oxygen microsensor type, please refer to the sensor’s instruction manual (IM_OxMicro and IM_PMO2).

Click **New** in the main menu bar and select the sensor type you have connected to your transmitter in the drop-down menu (only sensor types compatible with the connected device are shown). Then click **Create a new Calibration** (see Fig. 31).

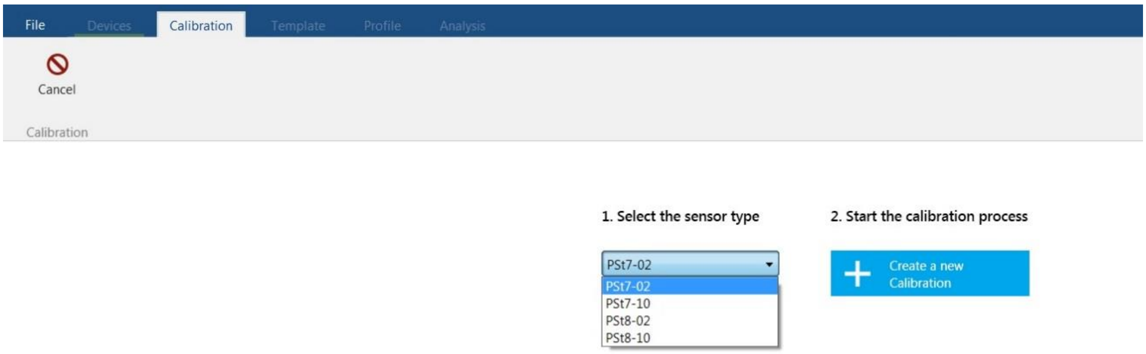


Fig. 31 Select the oxygen sensor type connected to your oxygen meter

The main screen switches to the input mask for calibration.

5.4.1.1 Input a Pre-Calibration of an Oxygen Microsensor

All oxygen microsensors are pre-calibrated. Calibration data are listed on the Final Inspection Protocol which is delivered with the microsensor:

Data

Atmospheric pressure:	**972**	hPa
Calibration Mode	**Humid**	
User Signal Intensity	**0**	

	Phase signal	**Valide range**	**Temperature**	**Valid range**	**Amplitude**	**QC-passed?**
	[°]	**[°]**	**[C°]**	**[C°]**	**[µV]**	**(ok / failed)**
cal0 **0 % air-sat.**	**55,69**	52.00 - 58.00	**20,0**	18.0 - 22.0	556691,2	OK
cal2nd **100 % air-sat.**	**21,84**	18.00 - 26.00	**20,0**	18.0 - 22.0	212841	OK

Response time [t90]: < 60 s **Valid range:** < 60 s

Please type in these values into the software for "manual calibration"

Sensor Constants

f1 = 0,894	**dPhi1 = -0,02045**	**dKSV1 = 0,000356**
m = 27,28	**dPhi2 = -0,00020**	**dKSV2 = 0**

Fig. 32 Example of a Final Inspection Protocol (FIP) for PSt7 and PSt8 type sensors

Use the values in the grey highlighted boxes on the Final Inspection Protocol and insert them in the respective input fields on the calibration and constants screen (see Fig. 33). Use the tab selection to switch between the Calibration and Constants input fields. Finally enter a calibration name and click **Save** in the main menu bar to finish manual calibration of the oxygen microsensor. The new calibration file will now show in the Calibration list on the left. On the main screen the respective calibration values of the selected file are displayed. Select a calibration from the list and press the **Load** button in order to apply the calibration.

The display switches to the Template screen automatically. The Calibration tab will be marked green, indicating that the calibration data has successfully been loaded and will be applied for the following measurements.

5.4.1.2 Two-Point Calibration of an Oxygen Microsensor

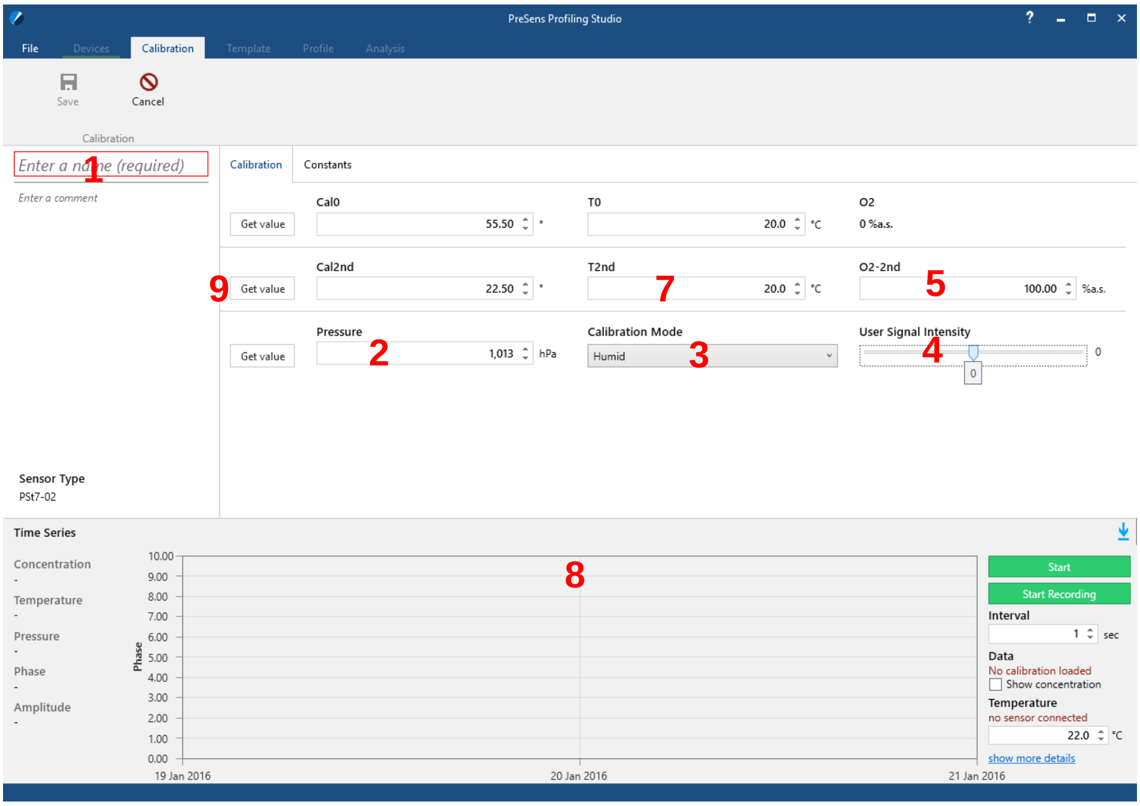


Fig. 33 Input mask for oxygen calibration values

Set the first calibration point:

1. Enter a name for the new calibration (you can also enter a comment in the input field below).
2. Set the atmospheric **Pressure** value during calibration. Either type in the value manually, or if working with a device with an integrated pressure sensor, you can click on **Get value** next to the Pressure box to receive the ambient pressure.
3. Set the **Calibration Mode**: Select Humid for calibration in liquids, or Dry for calibration in the gas phase.
4. If you are using a PSt7/8 sensor set the **User Signal Intensity** to the values stated in the sensor's Final Inspection Protocol. Also enter the sensor constants stated on the FIP in the **Constants** tab.
5. Set the **O2-2nd** value = oxygen concentration of your second calibration solution Cal2nd in % air saturation.
6. Carefully place the oxygen microsensor in calibration solution **Cal2nd** (air saturated environment for normal, or 2 - 4 % O_2 for trace microsensor). In case you are performing a calibration in liquids, please ensure that the sensor tip is dipped at least 4 mm into the solution.
7. If you want to use the temperature sensor for compensation put it into the calibration vessel, together with the oxygen microsensor. If necessary fix the temperature sensor and make sure that neither the temperature sensor nor its cable can touch the microsensor tip.

Else type the calibration temperature of Cal2nd in the **T2nd** input field manually (the temperature of the calibration solution has to be known and remain constant throughout the calibration procedure).

8. Start a **Time Series** measurement (see chapter 5.5) in order to get the phase values measured by the oxygen microsensor. Wait for about 3 minutes until the phase values are constant (the variation of the phase angle and temperature should be smaller than ± 0.2 ° and ± 0.2 °C, respectively). Stop the Time Series measurement.

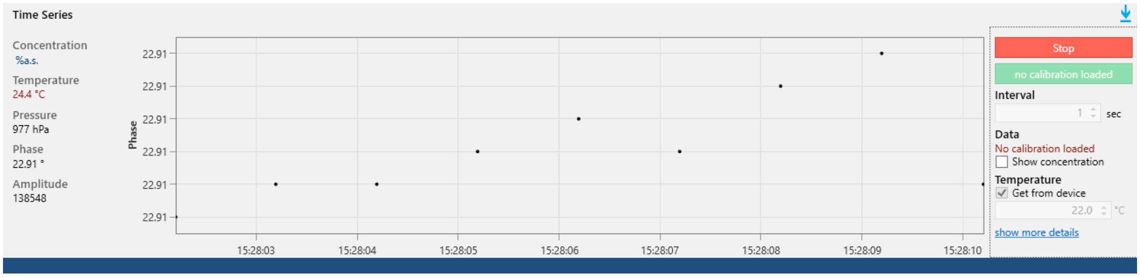


Fig. 34 Running Time Series measurement to monitor phase values stabilizing

9. Then click **Get Value** next to the **Cal2nd** box. The new calibration value for Cal2nd is displayed.

   Whenever the microsensor has been dipped into liquid calibration solutions other than distilled water rinse it several times with distilled water to remove all residues.

Set the second calibration point:

1. Carefully place the oxygen microsensor in calibration solution **Cal0** (oxygen free environment). In case you are performing a calibration in liquids, please ensure that the sensor tip is dipped at least 4 mm into the solution.
2. If you want to use the temperature sensor for compensation put it into the calibration vessel, together with the oxygen microsensor. Else type the calibration temperature of Cal0 in the **T0** input field manually (the temperature of the calibration solution has to be known and remain constant throughout the calibration procedure).
3. Again start a Time Series measurement in order to get the phase values measured by the oxygen microsensor. Wait for about 3 minutes until the phase values are constant (the variation of the phase angle and temperature should be smaller than ± 0.2 ° and ± 0.2 °C, respectively). Then click **Get Value** next to the **Cal0** box. The new calibration value for Cal0 is displayed.

   Whenever the microsensor has been dipped into liquid calibration solutions other than distilled water rinse it several times with distilled water to remove all residues.

Click the **Save** button in the main menu bar to store the new calibration data. The new calibration file will now show in the Calibration list on the left. On the main screen the respective calibration values of the selected file are displayed. Select a calibration from the list and press the **Load** button in order to apply the calibration.

The display switches to the Template screen automatically. The Calibration tab will be marked green, indicating that the calibration data has successfully been loaded and will be applied for the following measurements.

5.4.2 Calibrate a pH Microsensor

It is advised to calibrate pH microsensors prior to each experiment.

For highest accuracy and in case your sample solution differs significantly from physiological solutions, we advise to perform a Multipoint Calibration (see chapter 5.4.2.3) with buffer-sets prepared from your measurement solution or solutions of very similar ionic strength and buffering capacity.

Yet, when only small sample volumes of physiological measurement solutions are available, entering an existing calibration from the delivered Final Inspection Protocol (FIP, see chapter 5.4.2.1) followed by a One Point Adjustment (see chapter 5.4.2.2) can be performed.

For further information on buffer preparation and handling the sensor during calibration please refer to the pH Microsensor instruction manual and http://www.presens.de/support-services/faqs.html.

! Colored buffers often used for pH electrodes can interfere with chemical optical sensors. Please do not use colored buffers for calibrating chemical optical pH sensors.

The pH microsensor works best in solutions with an ionic strength > 50 mM and a buffer capacity > 2 mM; in case of lower salt concentrations or buffer capacities pH may fluctuate or get displayed incorrectly.

! Please note, the pH microsensors are not suited for measurements in tap / fresh water.

Click **New** in the main menu bar; for a pH microsensor the sensor type is HP5 as is already displayed in the drop-down menu. Click either **Enter existing Calibration** (see chapter 5.4.2.1) or **Create new Multipoint Calibration** (see chapter 5.4.2.3).

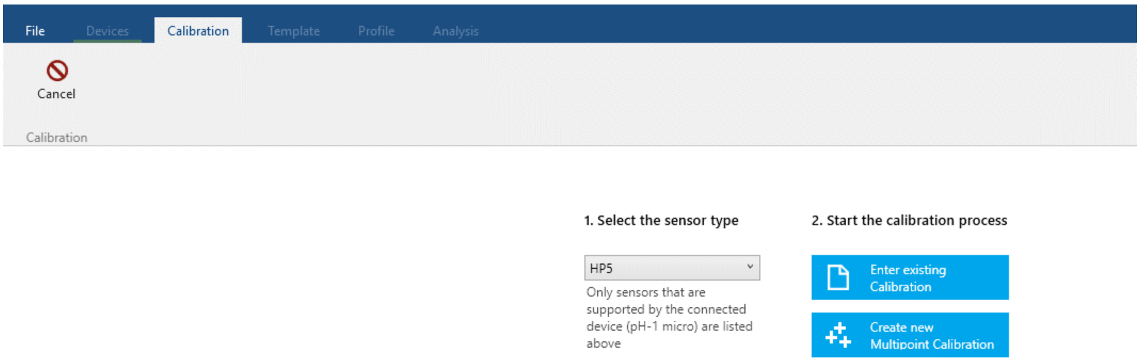


Fig. 35 Use existing data of a pre-calibration from the Final Inspection Protocol, or perform a new multipoint calibration for the pH microsensor.

5.4.2.1 Input a Pre-Calibration of a pH Microsensor

All pH microsensors are pre-calibrated. Calibration data are listed on the Final Inspection Protocol which is delivered with the microsensor:

Data

HP5 T= 22° C, Merck Standard pH4-9			
Constant	Actual value	Valide range	QC-passed? (ok / failed)
Imin	54,47	45.00 - 60.00	OK
Imax	21,83	10.00 - 30.00	OK
pH0	6,36	6.00 - 8.00	OK
dpH	0,47	0.30 - 1.00	OK
Temperature	22	18 - 25	OK

Fig. 36 Example for calibration data on a Final Inspection Protocol

Click **Enter existing Calibration** to get to the input mask; use the values in the grey highlighted boxes on the Final Inspection Protocol and insert them in the respective input fields. Finally enter a calibration name and click **Save** in the main menu bar to finish manual calibration of the pH microsensor. The new calibration file will now show in the Calibration list on the left. On the main screen the respective calibration values of the selected file are displayed. Select a calibration from the list and press the **Load** button in order to apply the calibration.

A message will appear to ask if you would like to perform a one point adjustment of your calibration. Please confirm and proceed with a One Point Adjustment as described in 5.4.2.2.

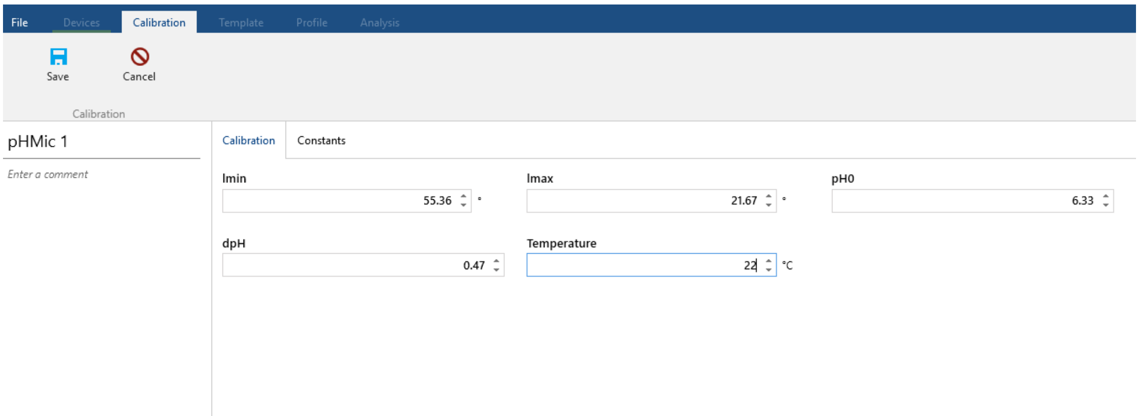


Fig. 37 Input mask for a pre-calibration of a pH microsensor

5.4.2.2 One Point Adjustment - Correct pH Offset

The **Correct pH Offset** button in the main menu bar offers a One Point Adjustment option, which is recommended before each experiment, whenever a multipoint calibration is not possible, especially when a significant offset of the measured pH and a known starting pH is observed. The one point adjustment is performed in a sample of known pH, ideally in the same medium as the measurements are going to be performed in, but if not possible in a similar medium of known pH.

! Prior to performing a one point adjustment a calibration must be loaded

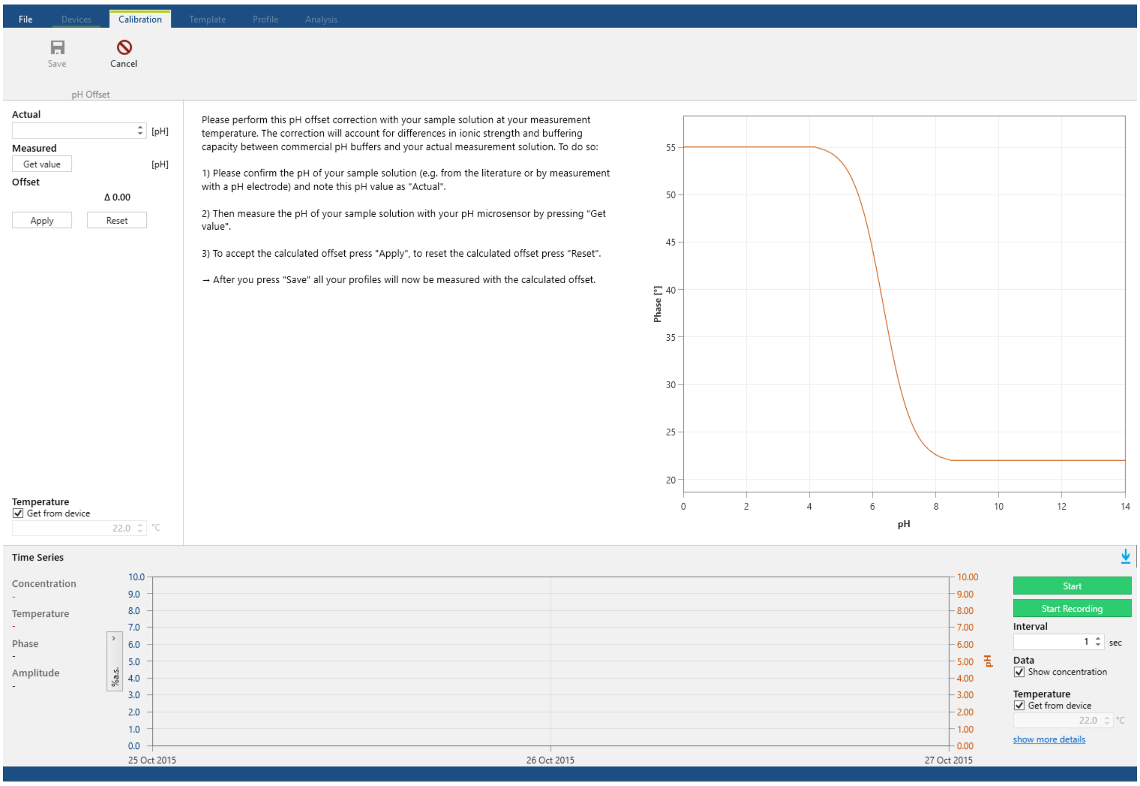


Fig. 38 Correct pH Offset screen

Follow the onscreen instruction:

1. Determine the pH of the sample solution with a reference electrode (or determine it from the literature) and type the value in the **Actual** field.
2. Then put your microsensor in the sample solution and let it soak for > 15 min without measuring. Afterwards, measure for 3 - 5 minutes until the phase values have stabilized (you can use the time series window for monitoring the equilibration), then press **Get value**. The **Offset** will be calculated automatically.
3. Press **Apply** to accept the calculated Offset, or **Reset** for resetting the calculated offset.

Click the **Save** button in the main menu bar to apply the calculated offset to all your following profile measurements.

5.4.2.3 pH Multipoint Calibration

A multipoint calibration is required to obtain best accuracy. It is necessary especially when working with difficult samples, e.g. with background fluorescence or samples that strongly differ in ionic strength and buffering capacity from standard buffer solutions.

A multipoint recalibration is recommended to ensure precise measurements. The transmitter and microsensor can only perform optimally by recalibrating the transmitter in combination with the microsensor.

Click **Create new Multipoint Calibration** (Fig. 35) to get to the multipoint calibration screen.

! You have to use at least 4 different buffer solutions of known pH for a multipoint calibration with the PreSens Profiling Studio.

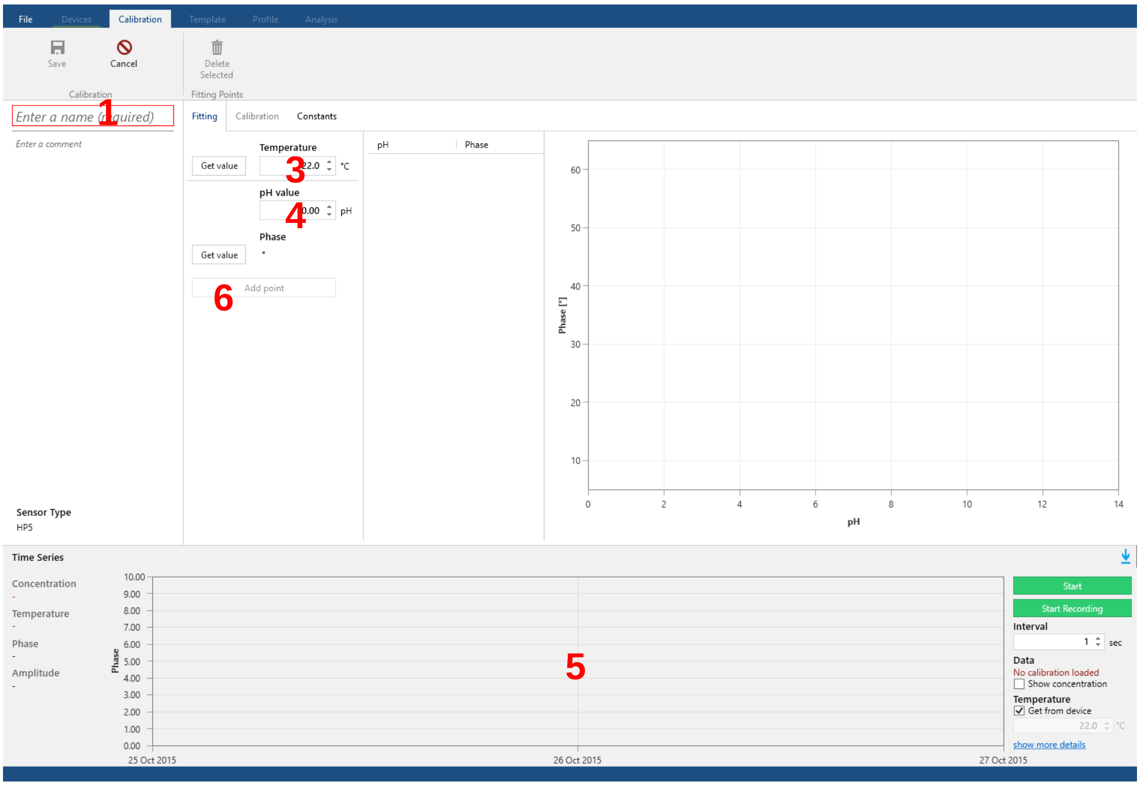


Fig. 39 Multipoint calibration screen

1. Enter a name for the new calibration (you can also enter a comment in the input field below).
2. Place the pH microsensor (and in case you have a temperature sensor connected to your transmitter, the temperature sensor as well) in the first calibration buffer and let it soak for > 15 min without measuring.
3. Set the calibration **Temperature**. Press **Get value** in order to receive the temperature measured with the connected temperature sensor. In case you have no temperature

sensor connected to your transmitter, type the temperature value in the Temperature input field; the calibration temperature of the respective calibration buffer has to be known and remain constant throughout the calibration process.

4. Enter the pH value of the first calibration buffer.
5. Start a **Time Series** measurement (see chapter 5.5) in order to get the phase values measured by the pH microsensor. Wait for about 3-5 minutes until the phase values are constant (the variation of the phase angle and temperature should be smaller than ± 0.2 ° and ± 0.2 °C, respectively). Stop the Time Series measurement.
6. Now click **Get value** next to **Phase** and the new calibration value will be displayed. Then press **Add point** to transfer the new value into the graph next to the input fields.
7. Create at least 4 data pairs (known pH value / phase value) by changing the pH of your calibration solutions. Ensure that the pH values cover your pH range of interest. Suitable pH values are 4, 5, 6, 7, 8 and 9.

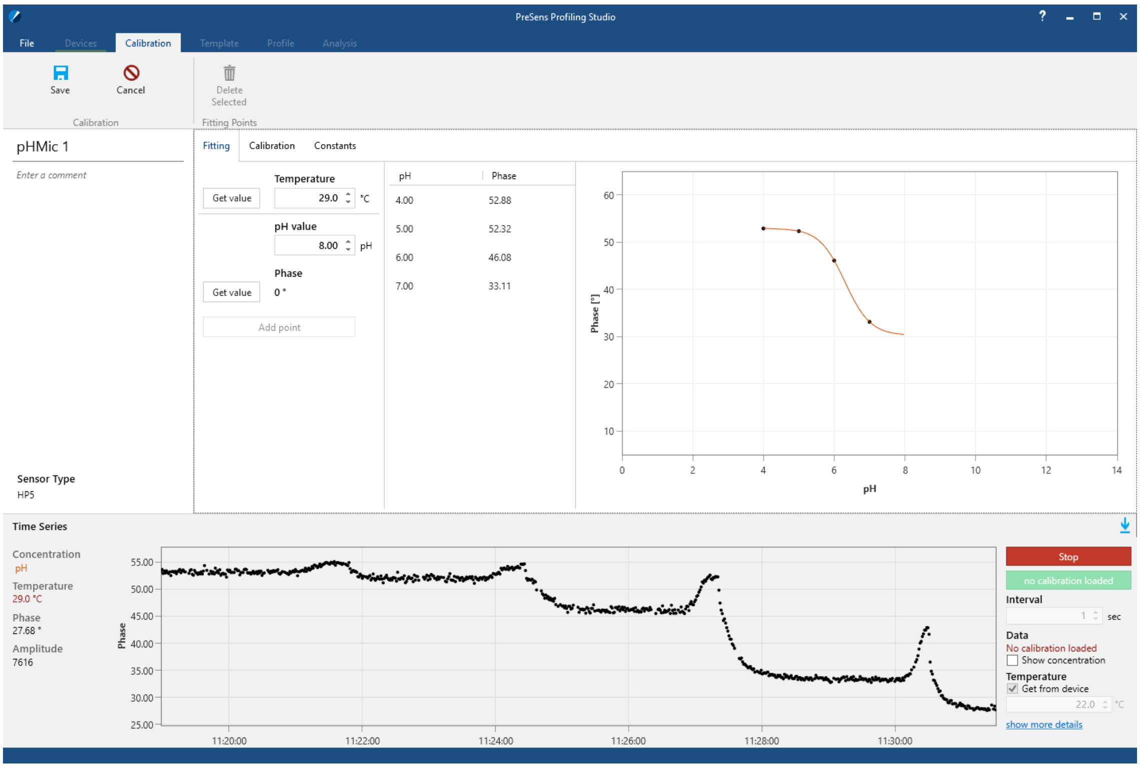


Fig. 40 Multipoint calibration – four calibration points have already been set

8. When at least four calibration values have been added, a fit will be generated in the graph to create the calibration values.

Click the **Save** button in main menu bar to store the new calibration data. The new calibration will now show in the calibration list on the left. On the main screen the respective calibration values of the selected calibration are displayed. Select a calibration from the list and press the **Load** button in order to apply the calibration.

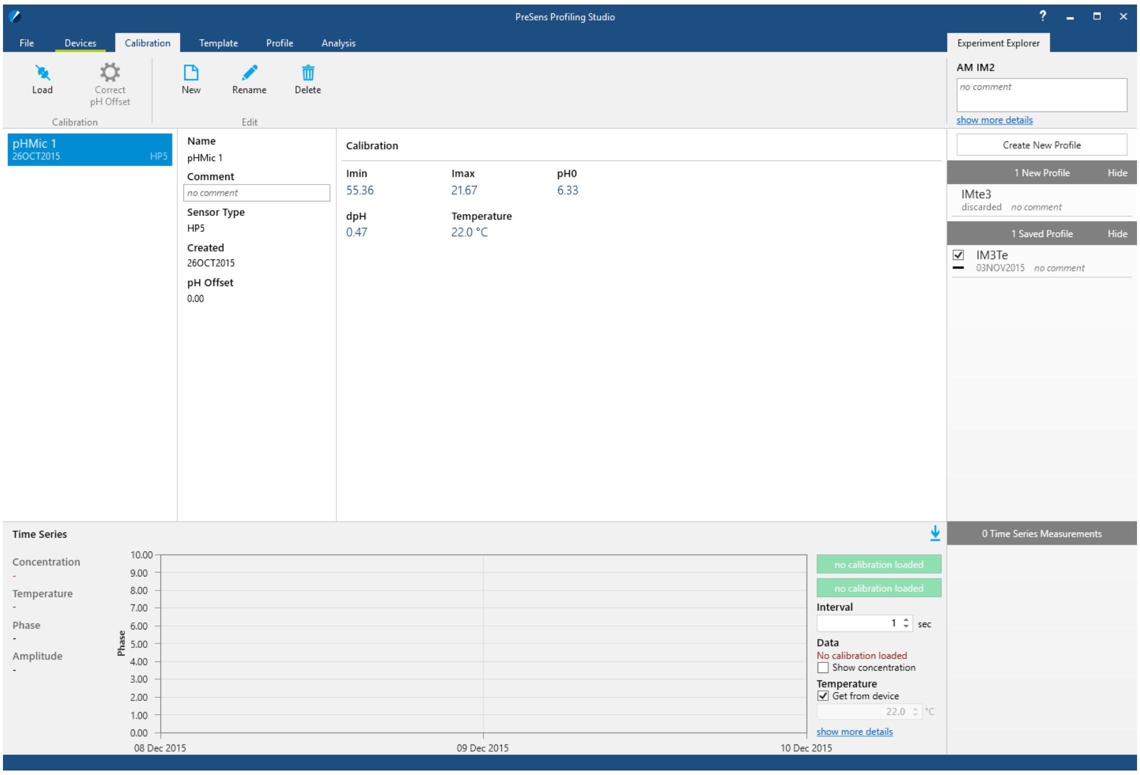


Fig. 41 Calibration screen – one calibration has been created

The display switches to the Template screen automatically. The Calibration tab will be marked green, indicating that calibration data has successfully been loaded and will be applied for the following measurements.

5.5 Time Series

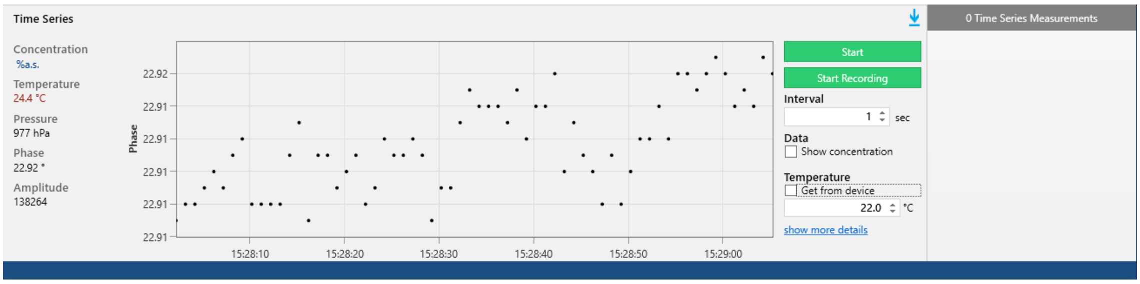


Fig. 42 Time Series – measurement with an oxygen microsensor

Below the main screen of the **Calibration** / **Template** / **Profile** tab the **Time Series** measurement field is displayed. You can increase the **Time Series** measurement field by dragging its upper border upwards. Here you are able to run a time series measurement with the connected microsensor at any time (except during a Profile measurement), e. g. for determining whether the measured phase values have stabilized when performing a calibration, or to determine spatial boundaries for profile measurements.

On the left hand side **Concentration**, **Temperature**, **Pressure**, **Phase** and **Amplitude** values are displayed in real time.

To the right of the graph are the control buttons to **Start** / **Stop** a time series measurement, or **Start** / **Stop Recording** the time series measurement. With **Recording** activated you are first asked to **Set a name** for the new time series measurement. Type in a name in the input field and click **Record** to start the measurement. The recorded data will be stored within the active Experiment data set and will be exported together with it.

Below the control buttons you can select the measurement **Interval**, and choose whether you would like the graph to **Show concentration** values instead of Phase values by checking the respective box. (Performing measurements with an oxygen microsensor, you are able to choose between different oxygen units, see Fig. 43). The measurements are colour coded showing black measurement points for phase, blue measurement points for oxygen and orange measurement points for pH.
If a temperature sensor is connected to your transmitter you can select **Get from device** by checking the respective box. With no temperature sensor connected you can enter the **Temperature** value manually in the respective field.
By selecting **show more details** you are also able to set the measurement **Mode** (Dry / Humid) and you can also set the **Salinity** value of your sample (see Fig. 44).

On the far right a list of already created **Time Series Measurement** files is displayed. You can select a file by checking the box next to it and add further data.

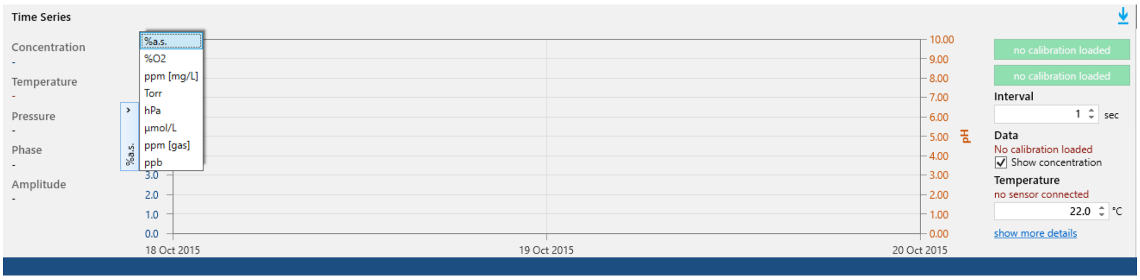


Fig. 43 Time Series – change the oxygen unit

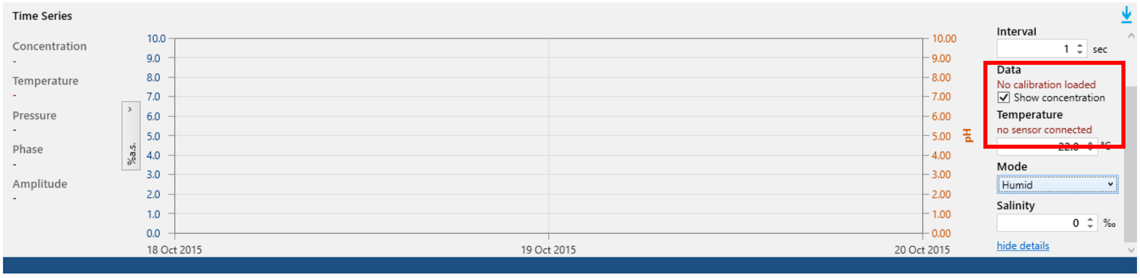


Fig. 44 Time Series – show more details

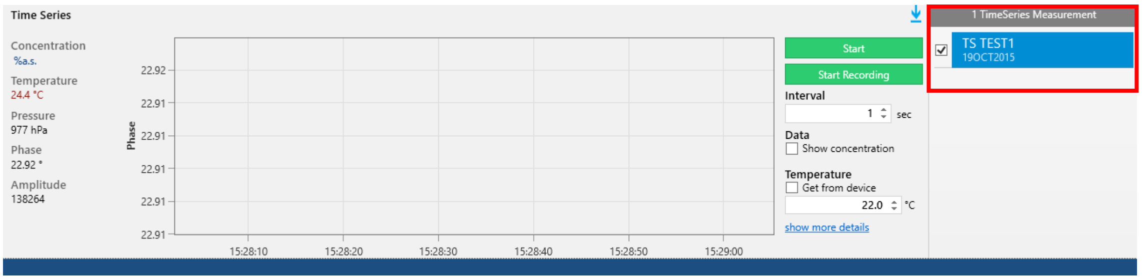


Fig. 45 Recorded Time Series measurement

In case you do not need the Time Series measurement you can hide this field by clicking the blue arrow in the upper right corner. You can also enlarge or minimize the window by dragging its frame.

5.6 Template

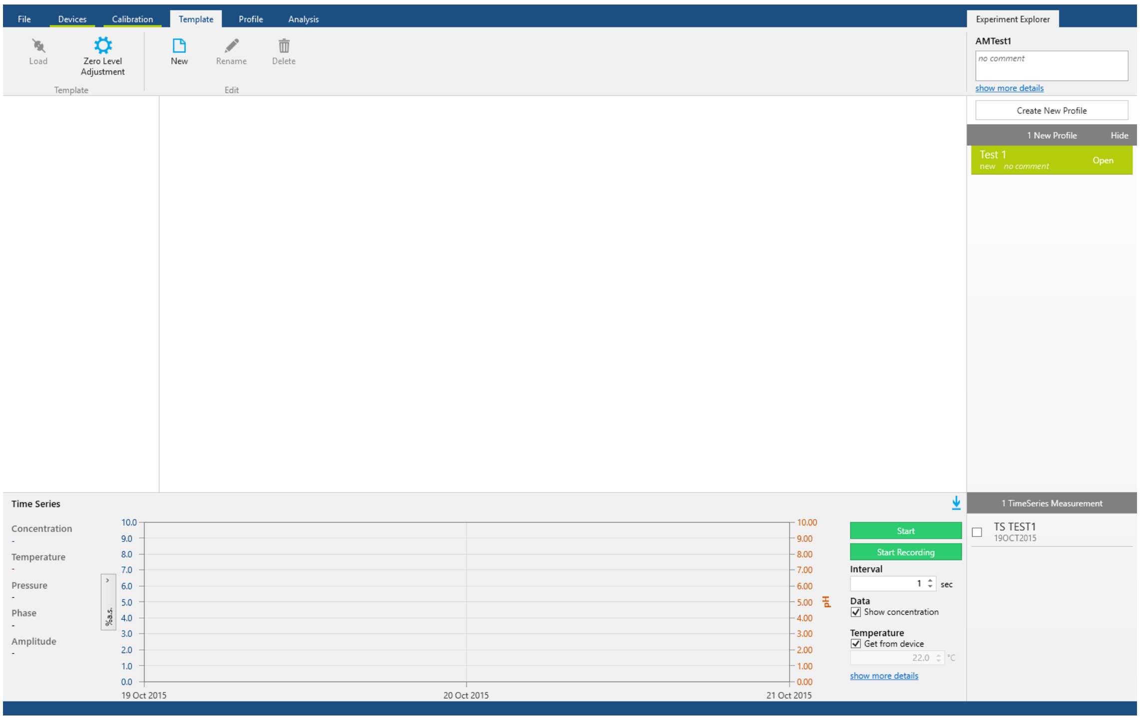


Fig. 46 Template screen

In the Template screen you are able to create templates for automated profile measurements. The profiling speed, step sizes, resting periods, etc. can be set here. One profile can be composed of different Zones with different numbers of steps and step sizes.
On the right again the Experiment Explorer and active Profiles are displayed. In case you have re-opened an existing Experiment file, you will have to create a new Profile for the following measurement.

Below the main Template screen the Time Series measurement is displayed (for more details, please refer to chapter 5.5).

Please note the following conventions for creating a profile template (Fig. 47). Profiles are unidirectional and are executed from above to below. Traveling distances above the defined zero level are indicated as negative, while distances below the zero level are indicated as positive.

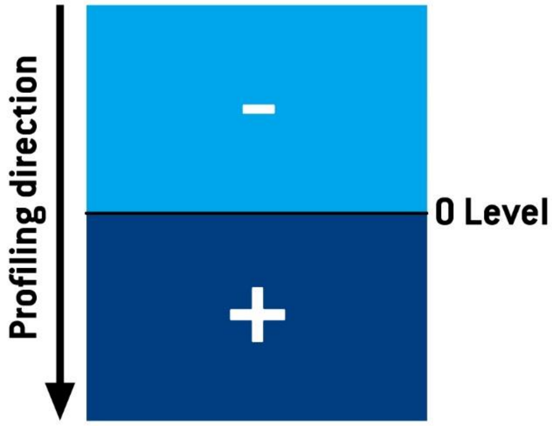


Fig. 47 Conventions for generating profile templates

The buttons in the main menu bar offer the following functions:

Load: Apply the selected template from the list for the following measurement.

Zero Level Adjustment: Opens a dialog for fine adjustment of your profile's zero level (see chapter 5.6.1).

New: Create a new profiling template (see chapter 5.6.2)

Rename: Select a template from the list so it is highlighted. Then click this button to rename the respective template.

Delete: If a template is not needed anymore you can remove it from the template list. It will be permanently deleted, and won't be accessible anymore.

5.6.1 Zero Level Adjustment

Before you can start creating new templates, or when you open an existing template you will have to set the zero level of your next profile. An information window will open if the zero level has not yet been set, or the message 'Zero level not set' will be displayed on screen (see Fig. 48).

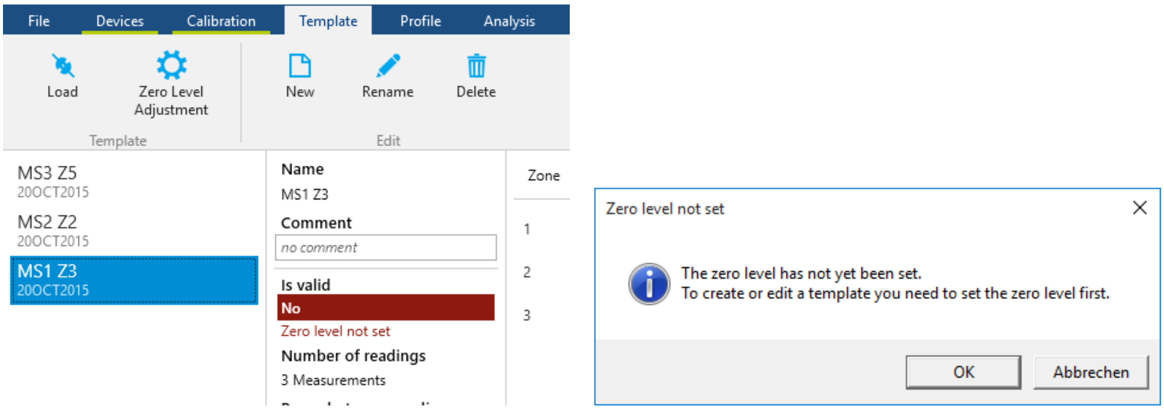


Fig. 48 Zero Level not set - on screen information and information window

Click the **Zero Level Adjustment** button in the main menu bar to open the respective dialog. A warning message is displayed, that the stage will start to move now. In case a microsensor is attached to the micromanipulator, both will be moved upward all the way to the end of the linear stage now. (This step is required for the first profile run only, for internal position referencing).

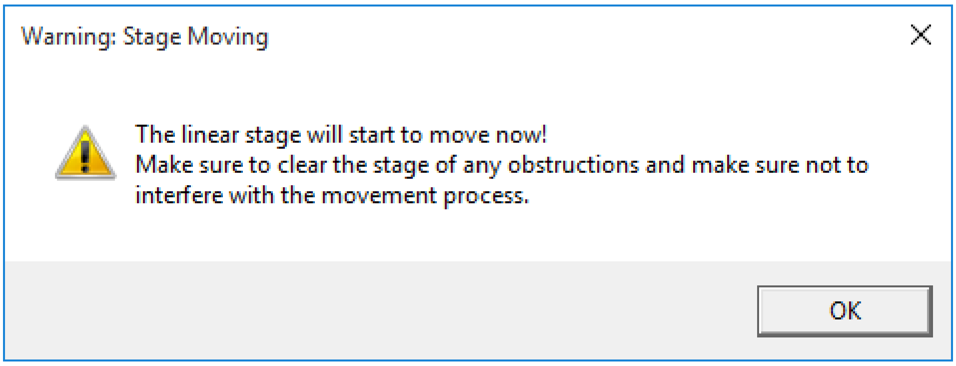


Fig. 49 Warning message – the linear stage will start to move

! Please make sure that the travel path of the linear stage and your microsensor is free and unobstructed by any object. Only then click **OK** to proceed.

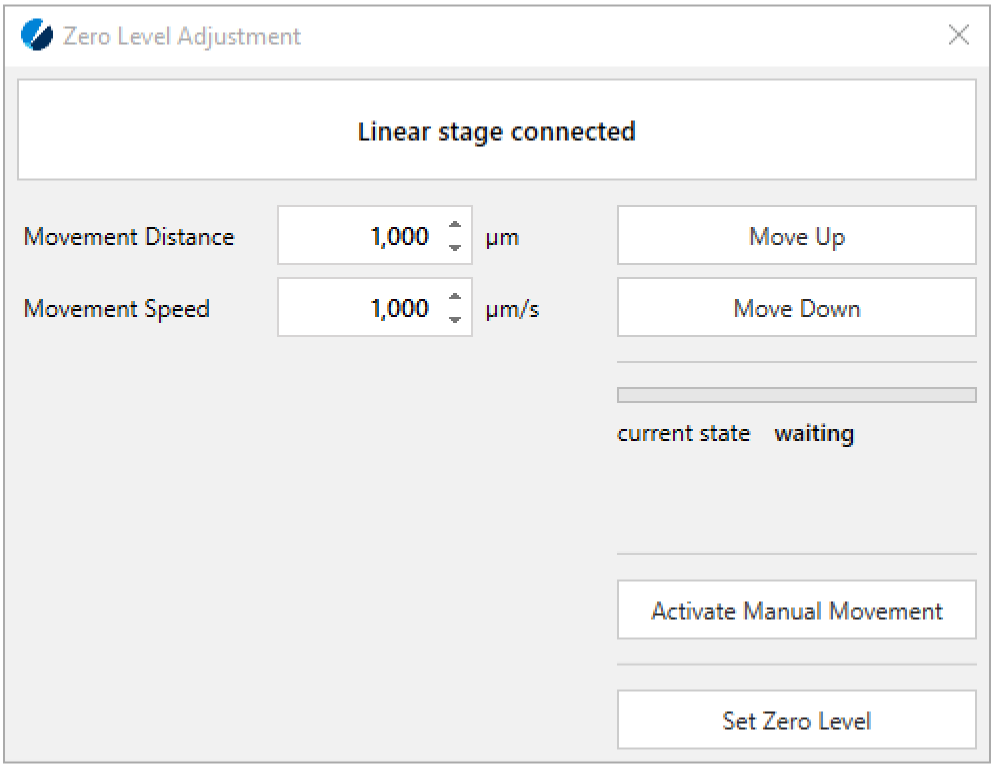


Fig. 50 Zero Level Adjustment dialog

When the referencing is finished, the AM will rest in the top position of the linear stage. You can use the dialog box that now opens to position your microsensor tip on to the desired zero level of your sample (e.g. the sediment or the tissue surface). You can use the **Move Up** and **Move Down** buttons (and set the **Movement Distance** and **Movement Speed**) for coarse adjustments (see Fig. 50). Alternatively you can also **Activate Manual Movement** and use the linear stages control knob to move your microsensor up or down.

! If you use a solid surface as a reference point, please approach the surface cautiously with your microsensor tip by using the Manual Movement option (or movement steps < 100 µm) to avoid breaking the fiber. We also advise the aid of a stereoscope or macro-USB camera (see chapter 5.10.3) for exact positioning of microsensor tips.

You can additionally use the X, Y, Z axes of your micromanipulator to move the sensor tip manually. This way you can exactly locate the microsensor tip on the desired zero reference value.

When the sensor tip is located in the desired zero position press **Set Zero Level**. All profile movements will now be executed relative to the defined zero level.

5.6.2 New Template

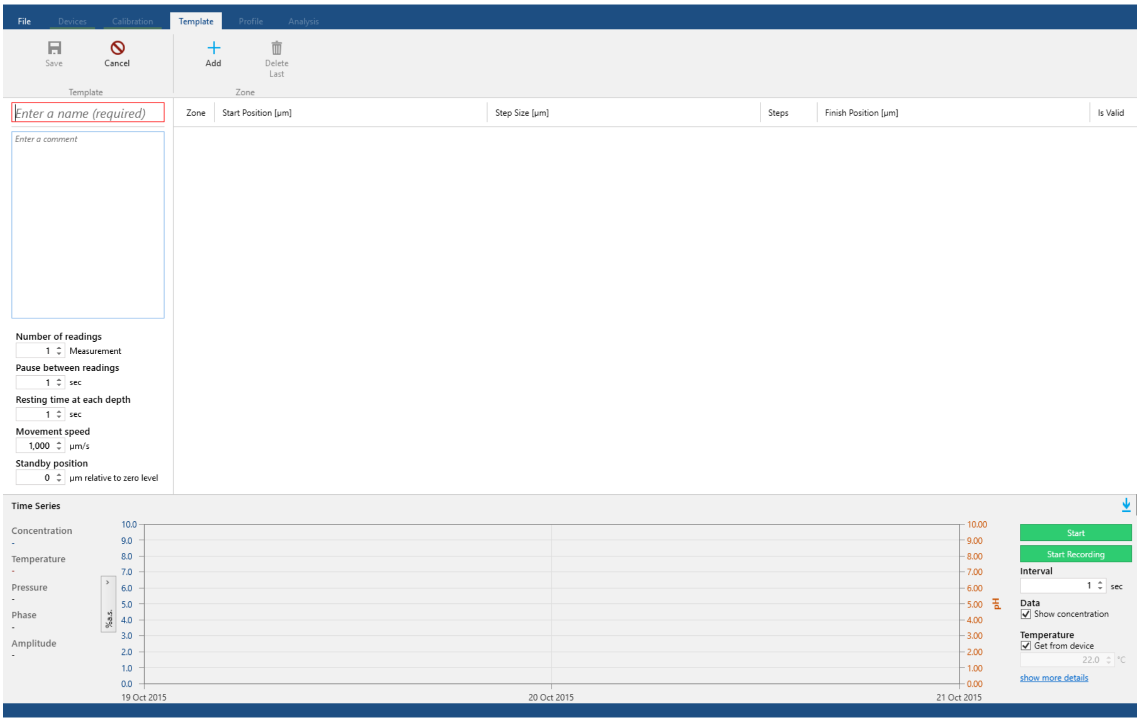


Fig. 51 New Template screen

Click the **New** button in the main menu and the screen switches to the input mask for a new profiling template.

1. Enter a name and optionally a comment for the new profiling template.

2. Then select measurement settings in the input fields below (see Fig. 52):

Number of readings: Number of measurement points at each depth.

Pause between readings: Wait time between measurement points at each depth.

Resting time at each depth: Wait time after the sensor has moved to the next depth.

Movement speed: Speed at which the sensor is moved downward by the Automated Micromanipulator when profiling.

! Please make sure that the movement speed is adequately chosen for your samples. Soft or very fragile samples may break or get ruptured by excessive speeds. A **maximum speed of 4000 µm/s** can be set.

Standby position: Sets the depth (relative to the zero level) at which the sensor tip will rest before starting a profile (= equilibration time) and after finishing a profile. It is also the depth where the sensor will rest in between profiles when performing Multiprofiling (see chapter 5.7.2).

! Please note the convention that measurement depths above the zero level are negative and below the zero level are positive (see Fig. 47)

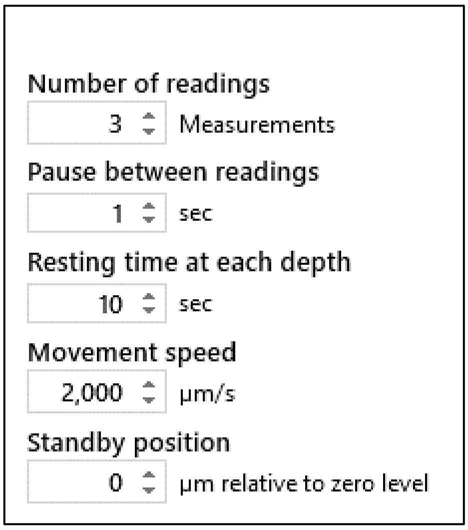


Fig. 52 Measurement settings

3. Next click on **Add** in the main menu bar to create a **New Zone** for your profile template (see Fig. 54):

Zone: Number of zone in the active profile template

Start Position: Depth (relative to the zero level) where measurements are started

Step Size: Movement distance in between measurement depths. A **minimum step size of 10 µm** can be set to move the sensor forward. The maximum step size you can choose depends on the number of steps you want to measure, and whether the total distance exceeds the maximum driving range (75,000 µm) of the Automated Micromanipulator. In case your settings exceed the maximum available range a warning message will be displayed in the dialog (see Fig. 53). Adjust your settings, so the maximum range is not exceeded.

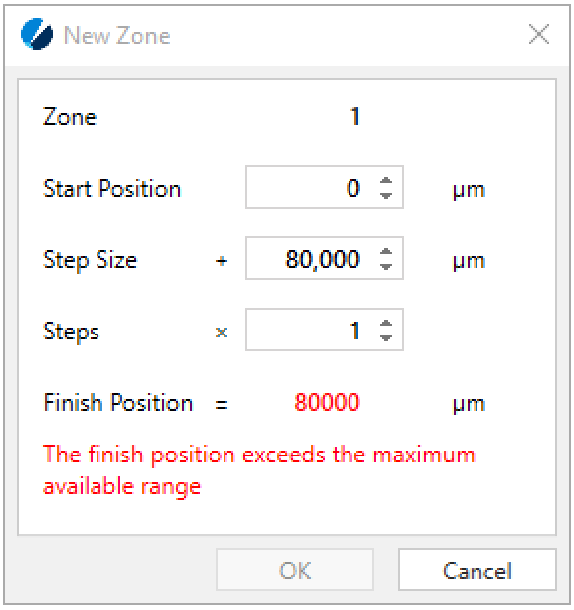


Fig. 53 New Zone settings – Warning: finish position exceeds the maximum range

Steps: Number of steps at which measurements are going to be taken.

Finish Position: Shows the total distance covered with this zone relative to the zero level of the profile.

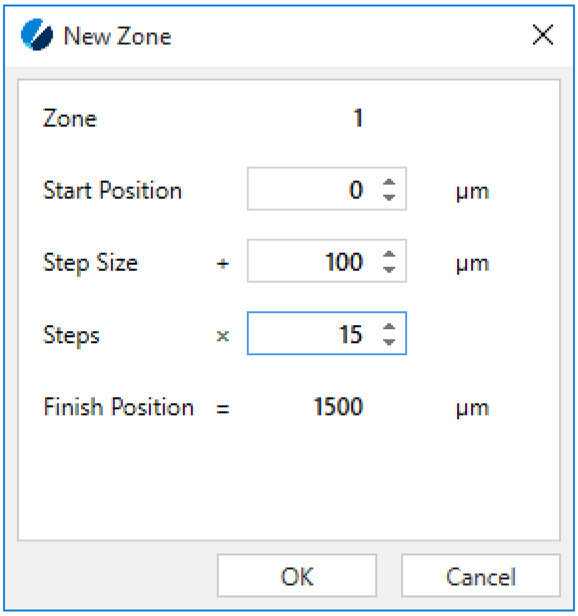


Fig. 54 New Zone settings

4. Click **OK** to add the **New Zone** to the profiling template.

In case your sample is composed of several layers, and you would like to adjust the step sizes for each layer, you can **Add** several zones, all with different settings to your profiling template. The next zone you add will automatically have the **Finish Position** of the former zone as the new **Start Position** (see Fig. 55).

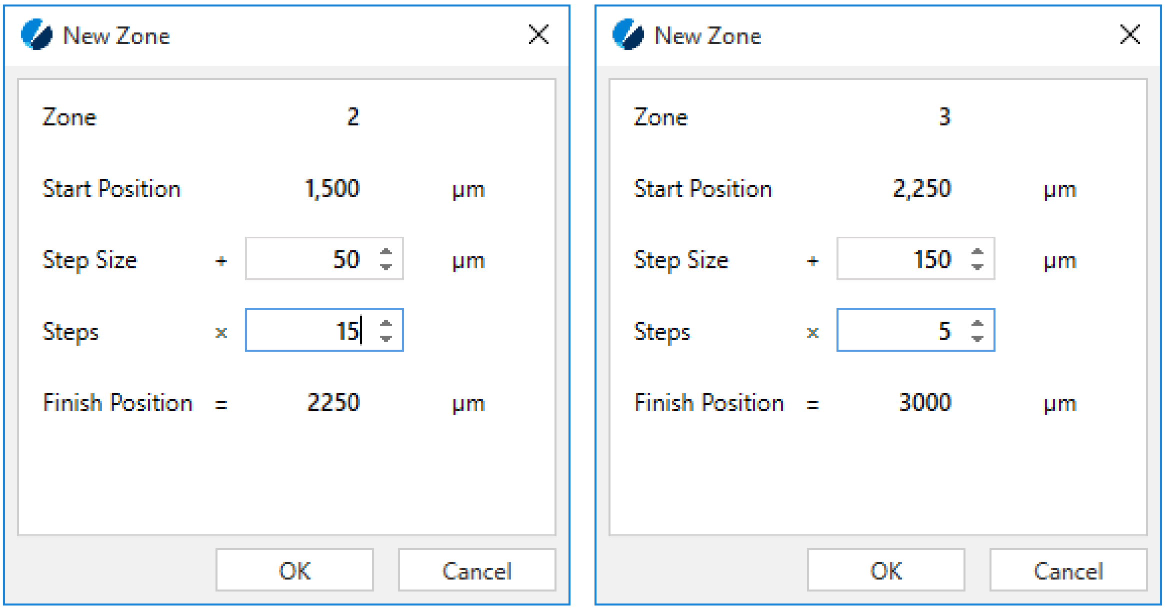


Fig. 55 Zones defined one after another

The main screen shows a list of all Zones with the respective settings that have been defined. Click the **Save** button in the main menu bar to store the template data.

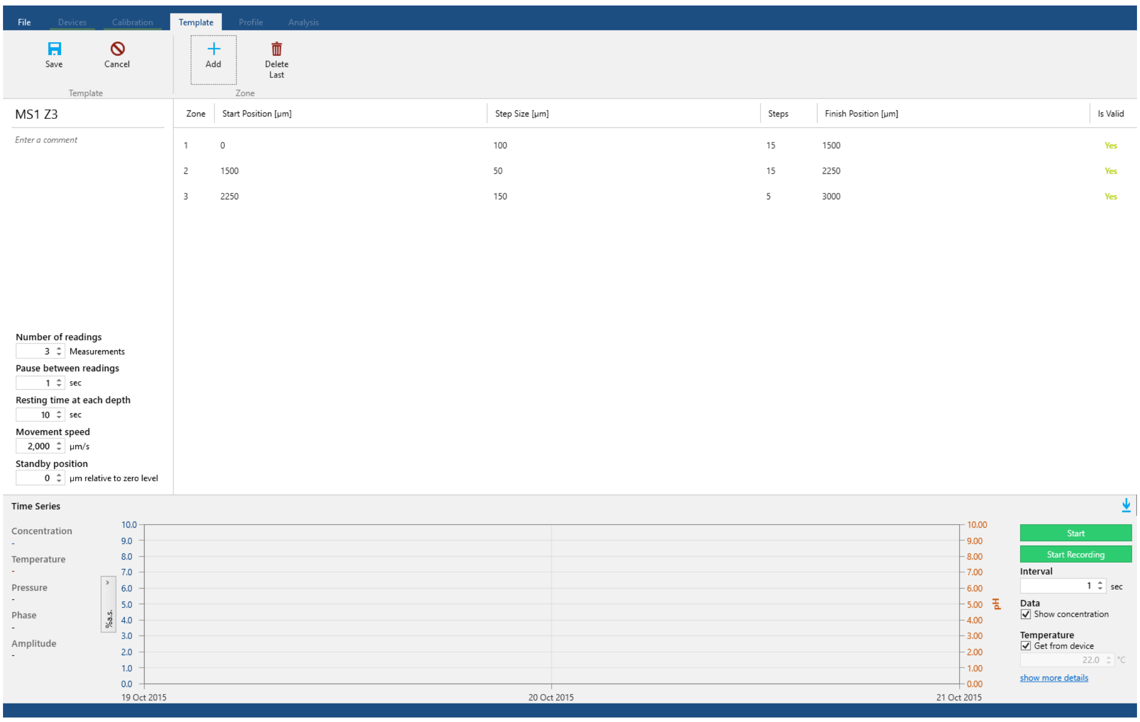


Fig. 56 New template – three zones have been defined

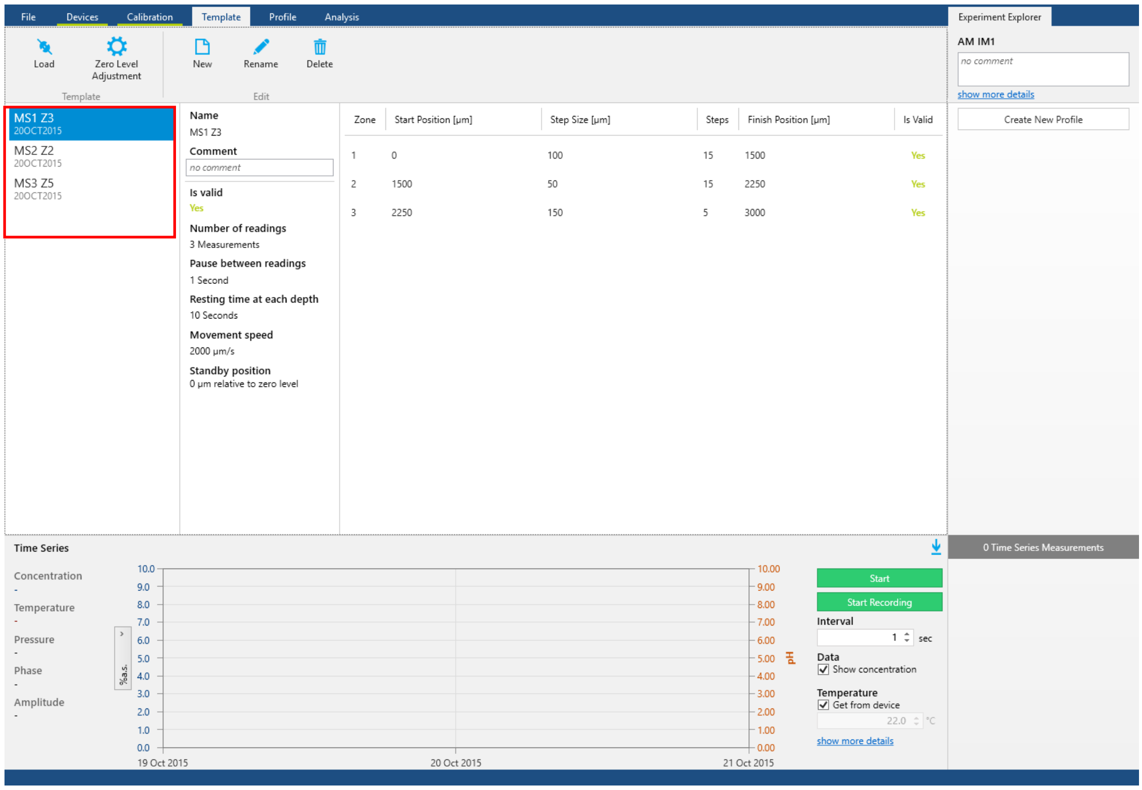


Fig. 57 Template list

The screen will switch back to the initial Template screen. The new template is now shown in the list on the left. The measurement and template settings of the selected Template are displayed on the main screen. The main screen will also show if the selected template is executable and valid to be loaded by the displaying 'Yes'. If this is not the case the sample, linear stage or the zero level needs to be readjusted.
Select the Template you wish to use from the list so it is highlighted and click the **Load** button in the main menu bar. The screen will switch to the Profile screen automatically. The Template will be marked green indicating that a template has successfully been loaded and will be applied for the following measurements.

5.7 Profile

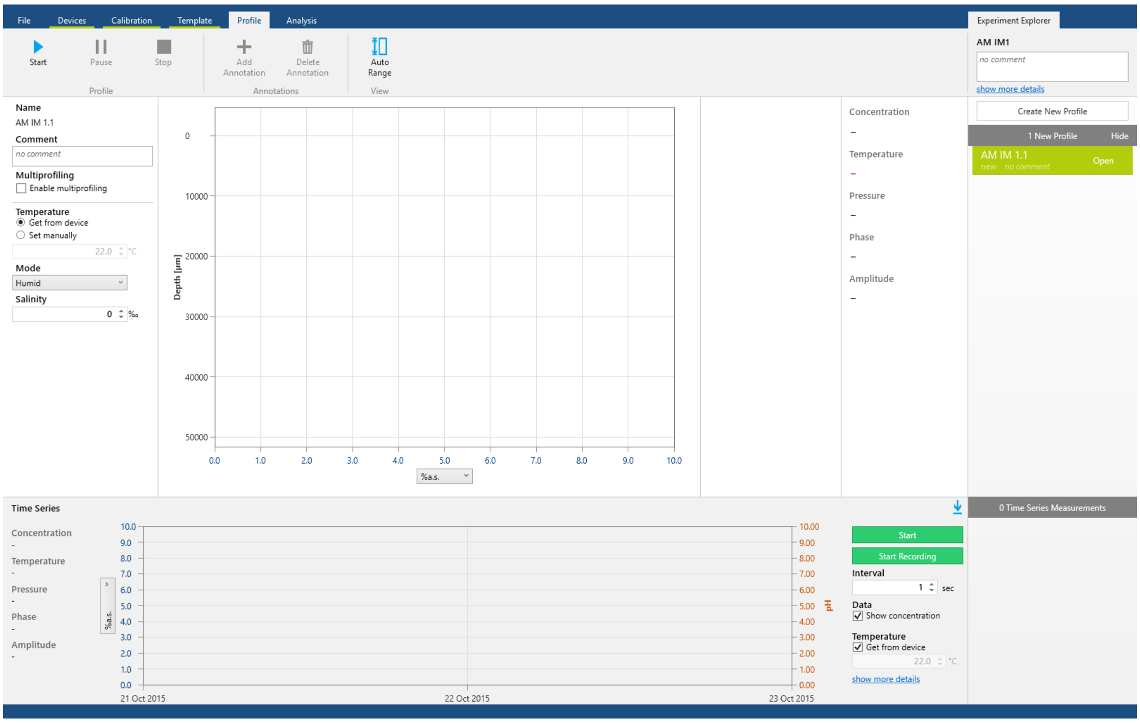


Fig. 58 Profile screen

In the Profile screen the running measurement will be displayed in a graph, where the profiling depth is shown on the y-axis, while the oxygen or pH values are given on the x-axis. The graph line is a moving average and connects the average of all measurement points taken at one depth with the average of the next depth. It is colour coded, showing blue graphs for oxygen and orange graphs for pH. The graph line is intended as a graphical support and will not be exported with the dataset. On the left the Profile **Name** and **Comments** are shown and you are able to adjust further settings for the following profiling. On the right hand side **Concentration**, **Temperature**, **Pressure**, **Phase** and **Amplitude** values are displayed in real time.

On the right the Experiment Explorer and active Profile are displayed. In case you have opened an existing Experiment and not yet created a new profile for the following measurement, you will be asked to do so; the message 'no profile created' will be displayed in the settings on the left. Press the **Create New Profile** button and assign a Profile name. The new Profile will be displayed in the New Profile list.

Below the main screen again you have the option to perform Time Series measurements (for more details, please refer to chapter 5.5).

The buttons in the main menu bar offer the following functions:

Start: Starts the Profile measurement according to settings in the activated template.

! Once you press start a warning message about the motor movement will be displayed. Please make sure that the travel path of the linear stage and your microsensor is free and unobstructed by any object. Only then click **OK** to proceed.

Pause: Pauses the running profile.

Stop: Terminates the running profile.

Add Annotation: Adds a short comment to the current measurement depth. A small box appears next to the graph showing date, time and profiling depth, in which you can type your annotation (see Fig. 59).

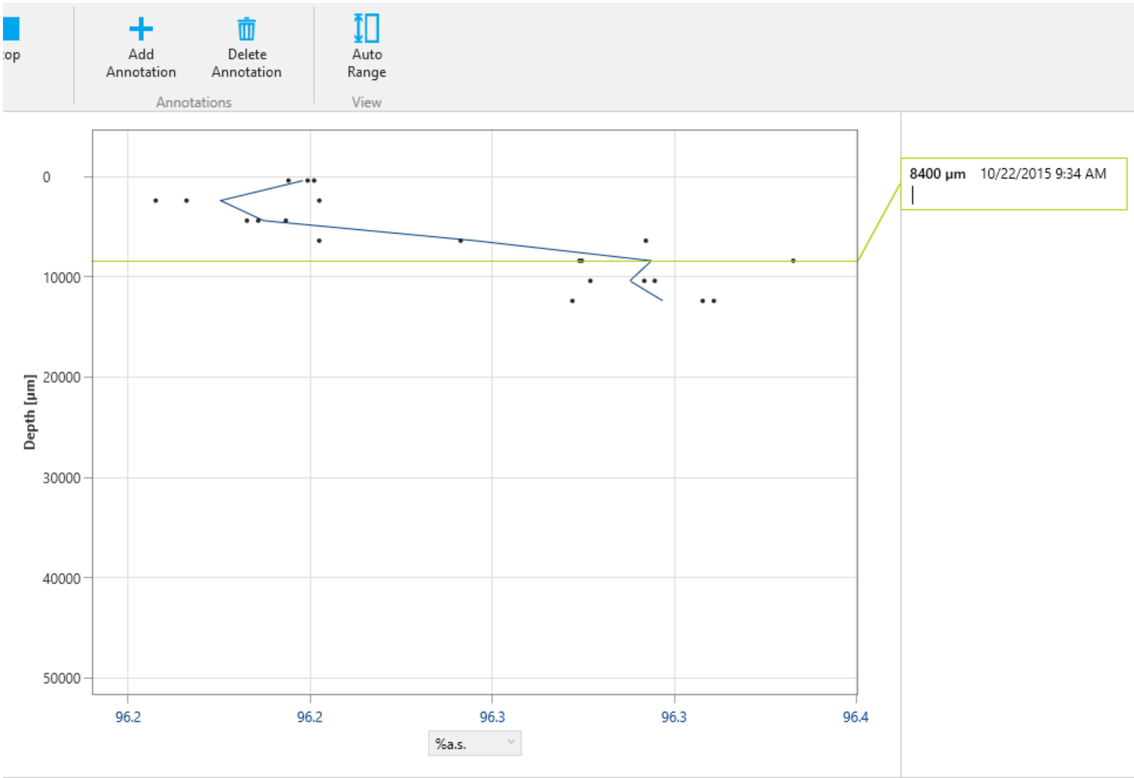


Fig. 59 Add Annotation – here at 8400 µm depth

Delete Annotation: Removes a previously created annotation.

Auto Range: The y-axis of the graph will be scaled automatically, so that only the already measured profile range is displayed over the entire height of the graph (see Fig. 60).

Profile Range: The y-axis of the graph will be scaled, so that the total profile range (sum of all Zones) is again displayed.

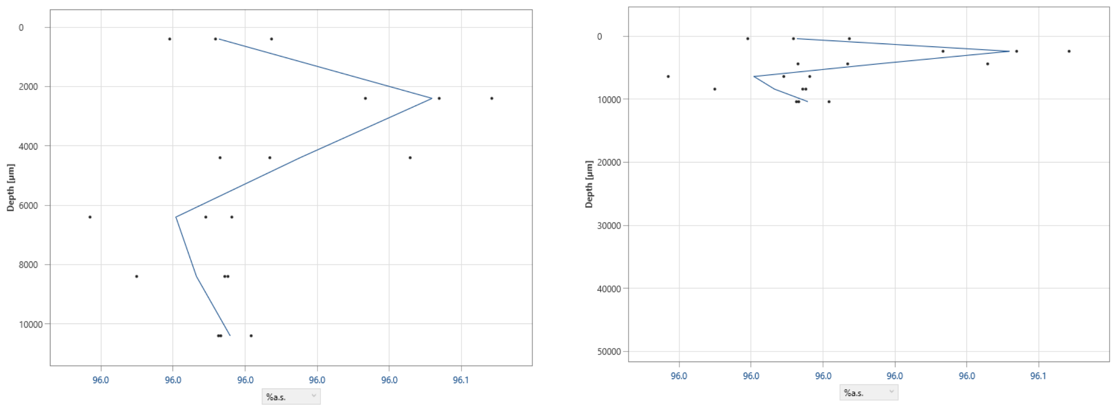


Fig. 60 Graph displayed in Auto Range and Profile Range

Apart from measurement settings you have defined in the Template, you can further adjust the following parameters (on the left of the screen):

Multiprofiling: Measures the selected Profile Template several times in series. See chapter 5.7.2 for more details.

Temperature: Sets the mode for temperature compensation during measurements. Temperature must be set before starting the measurement. Use **Get from device** to measure the temperature automatically with the delivered temperature sensor. Make sure the temperature sensor is inserted in the sample, or in a connected environment of the same temperature as the sample. If the measurement temperature is known and remains constant throughout the profiling you can select **Set manually** and type the temperature value in the input field.

Mode: Sets the measurement mode; select **Humid** if the measurements are performed in liquids or humid gases, or set **Dry** if you perform measurements in the gas phase (only for oxygen measurements). This function must be set before starting the measurement.

Salinity: Sets the salinity value of your sample in ‰ for salinity compensation of your measurements, e. g. when profiling in sea water or in salty buffer solutions (only applicable for oxygen measurements). The Salinity must be set before starting the measurement.

Oxygen Unit: In case you are performing oxygen measurements you can choose between different oxygen units in which the oxygen values in the graph are going to be displayed. Select the respective oxygen unit from the drop-down menu at the x-axis of the graph.
The Following units can be selected:

- %a. s.
- %O2
- ppm [mg/L]
- Torr
- hPa
- µmol/L
- ppm [gas]
- ppb

5.7.1 Running a Single Profile

Click the **Start** button in the main menu bar to start the profile. A warning message is displayed, that the stage will now start to move.
The microsensor will be moved to the standby position and rest there for 30 sec for equilibration before the profile is executed. This initial resting time of 30 sec is a default value and can be changed in the options menu (see chapter 5.10.4).

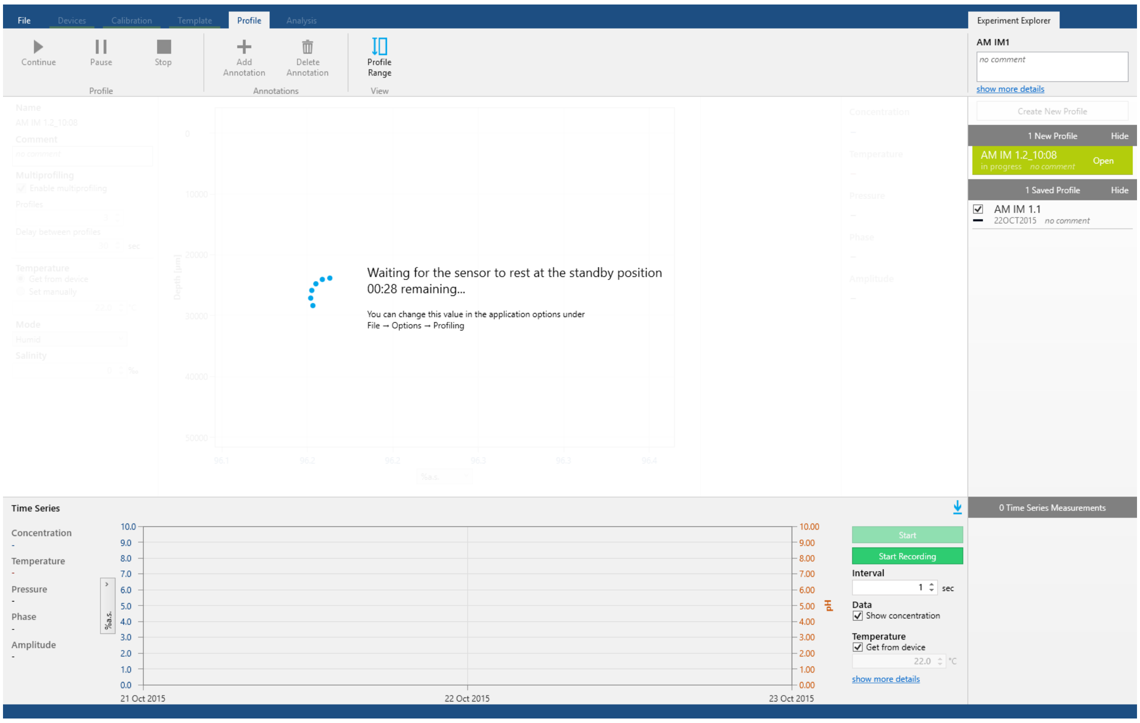


Fig. 61 Profile measurements started – sensor rests at the standby position

The measurement will start automatically.

On the right hand side **Concentration**, **Temperature**, **Pressure**, **Phase** and **Amplitude** values are displayed in real time.

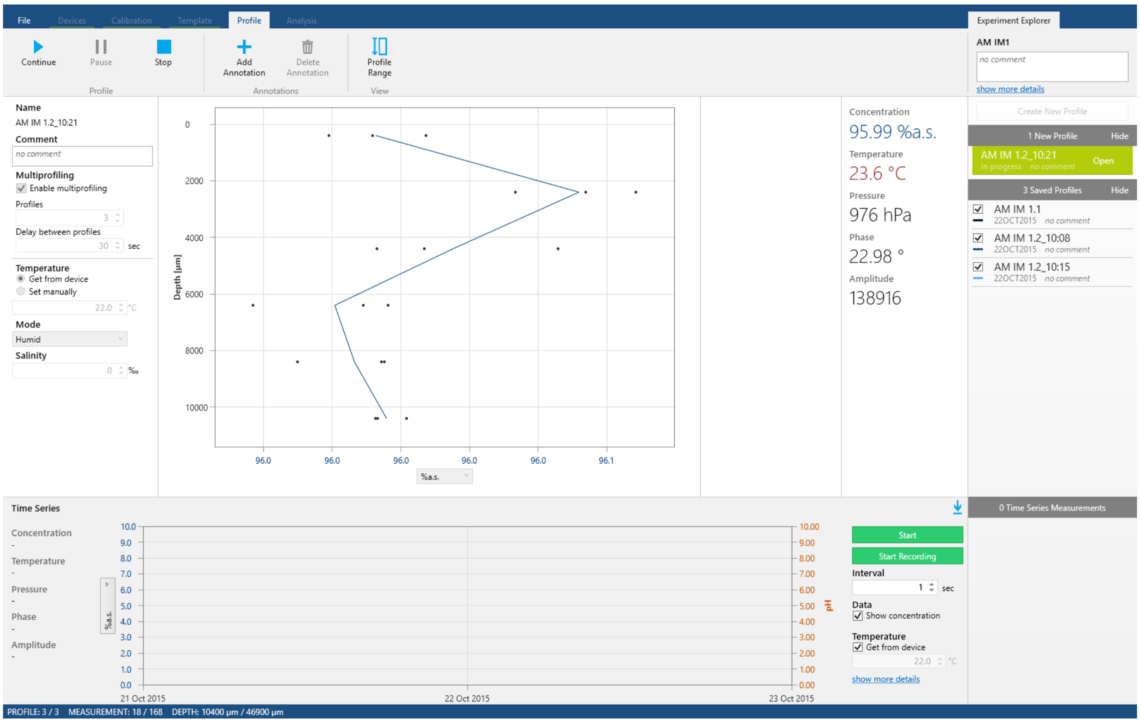


Fig. 62 Profile measurements – currently measured values are displayed on the right side of the graph

An information window will appear, when the profiling is completed.

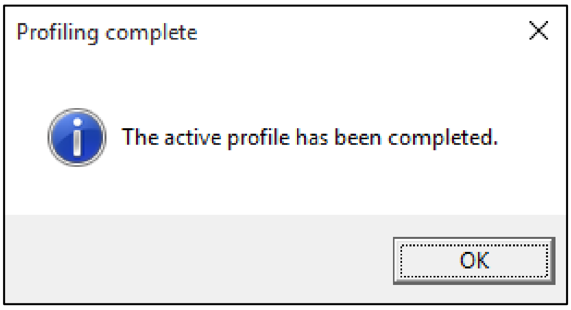


Fig. 63 Information window – profile measurements completed

Now you can decide whether to **Save Results** or **Discard Results** by pressing the respective button in the main menu bar. Click **Save** and the Profile will show in the **Saved Profiles** list on the right of the screen now.

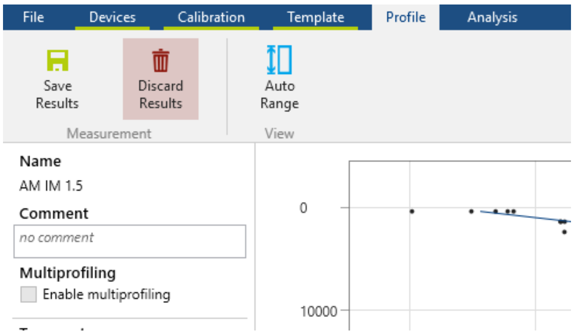


Fig. 64 Discard Results – the data will not be stored

The display switches to the Analysis tab automatically.

! Data are only going to be stored after the profiling is completed. When measurements are disrupted during profiling, e. g. the power or USB connection is cut, data of the last running Profile will be lost.

5.7.2 Running Multiple Profiles in Series

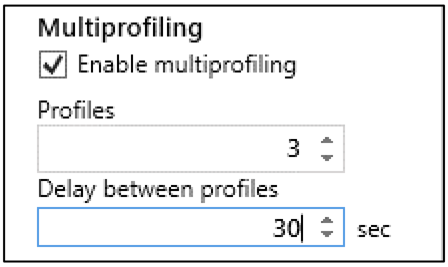


Fig. 65 Multiprofiling settings

Click the box next to **Enable multiprofiling** in order to measure the selected Profile with the set Template parameters several times in series. Set the number of **Profiles**, how often the Profile shall be measured, and the **Delay between profiles**, the time the Automated Micromanipulator pauses in the standby position between profile measurements. This way long term measurements can be programmed to run automatically.

Then click the **Start** button in the main menu. Like when running a single Profile a warning message is displayed, that the stage will now start to move.
The microsensor will then be moved to the standby position and rest there for 30 sec (default value; see chapter 5.10.4) before profiling is started. Measurements will be executed according to the selected Template. After the first profile run is completed, the sensor will again move to the standby position and remain there for the set **Delay between profiles**. Then the template execution is repeated.

The first profile is displayed in the list of **Saved Profiles** now. Profiles measured via multiprofiling all have the same profile name but the respective start time as suffix, so the single profile runs can be distinguished (see Fig. 66).

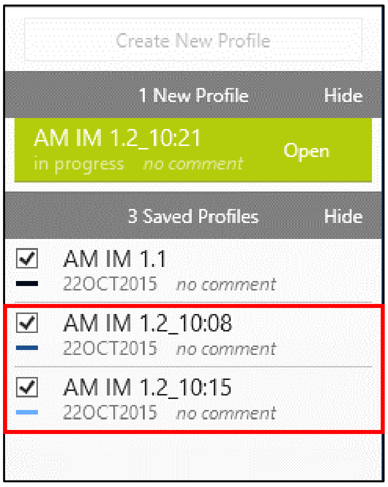


Fig. 66 Multiprofiling – 2 profiles completed

After the final profile run is completed, the display switches to the Analysis screen automatically.

5.8 Analysis

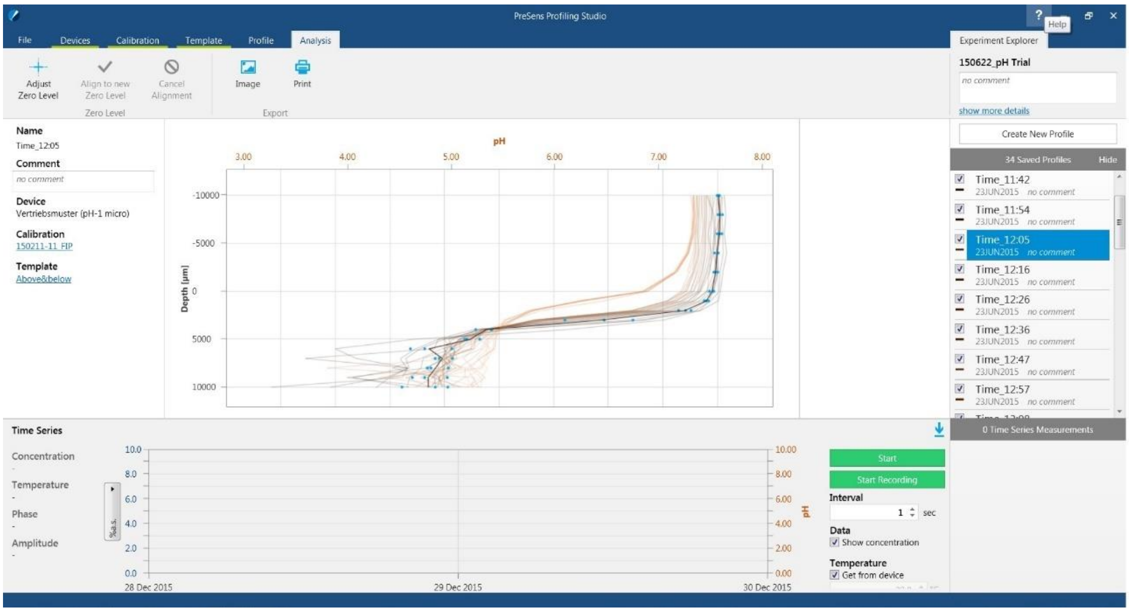


Fig. 67 Analysis screen – one profile selected

On the Analysis screen all Profiles measured in the currently selected Experiment are displayed in the graph. The profiles are colour coded showing blue graphs for oxygen and orange graphs for pH. The shade of the moving average depicts the temporal order in which the profiles were measured (dark to light). Click on a profile in the graph to show more details; the single measurement points and annotated comments for the selected profile are displayed.

On the left the details (**Name**, **Comment**, **Device**, **Calibration**, and **Template**) of the currently selected Profile are shown. Click on the **Calibration** or **Template** name to open the respective overview window with all data (see Fig. 67).

The buttons in the main menu bar offer the following functions:

Adjust Zero Level: In case the results of several profiles show that you have not always referenced the desired starting point for profiling you can adjust the zero level of each profile. The previously set zero level will show as a red line in the graph. Insert the new value in the input field on the left. The new zero level is shown in the graph now. Then click

Align to new Zero Level: The selected measurement will be spatially shifted to the new zero level.

Cancel Alignment: Stop adjusting the zero level without making any changes.

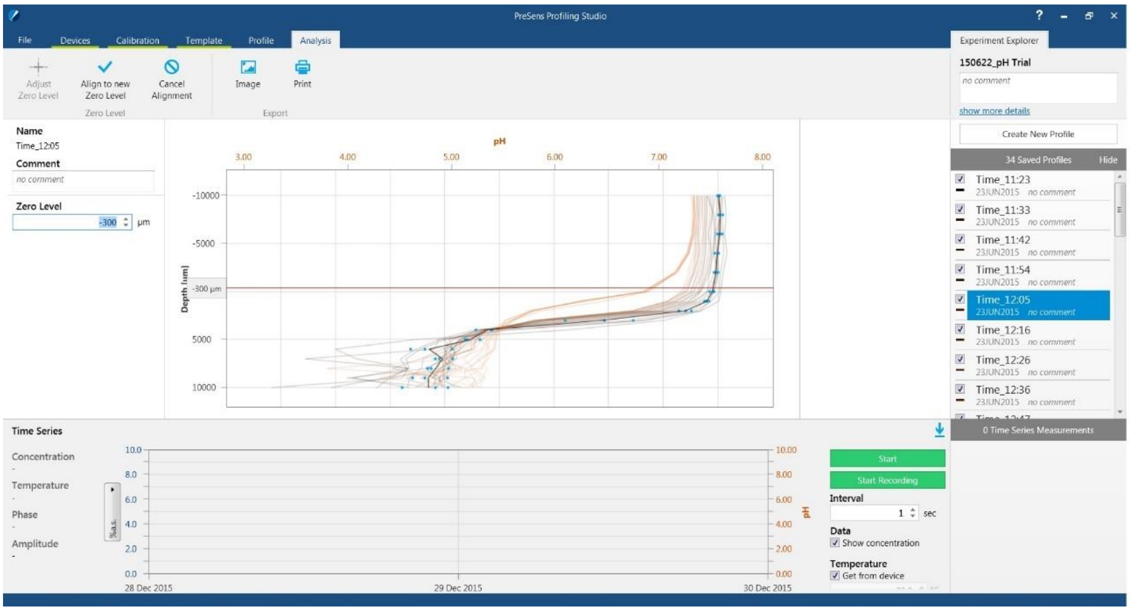


Fig. 68 Align to new Zero Level

Image: Saves an image of the graph in .pgn, .jpeg, or .bmp format for quick and easy communication of results. A dialog opens in which you can assign a file name and directory, and choose the format for the image.

Print: Prints the graph for quick and easy communication of results. The Print dialog (if a printer is installed on your PC / notebook) opens and you can adjust print settings.

Moving the cursor over a point in the measurement graph will display the depth and average measurement value at this point in the profile (see Fig. 69).

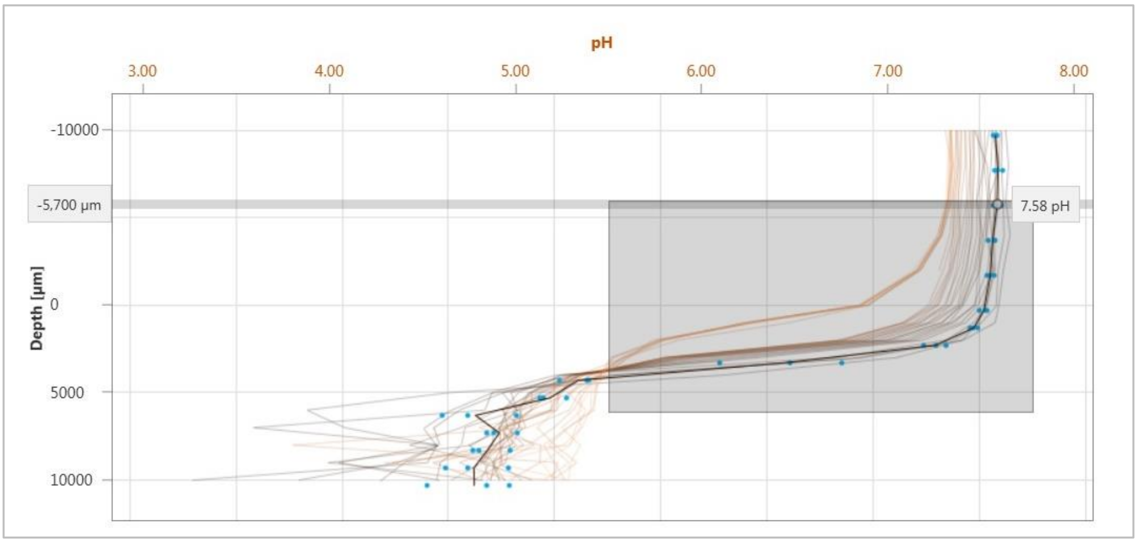


Fig. 69 Measurement point details: place the cursor over it
Zoom: drag a frame around the area of interest

Check or uncheck the boxes next to a Profile name in the **Saved Profiles** list in order to hide or show the respective measurement data in the graph.

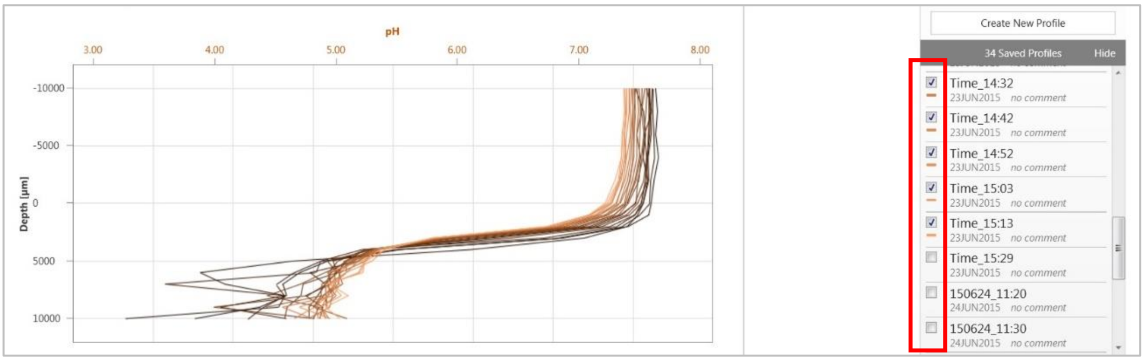


Fig. 70 Show or hide a Profile in the graph

Zoom: For zooming in on a certain region of interest, perform a left mouse click on the graph and drag a frame around the respective region while holding the mouse key pressed. When the mouse key is released, the marked region will be enlarged (see Fig. 69).

Undo Zoom: Perform a double click anywhere on the graph to undo the zoom.

5.9 Export Experiment Data

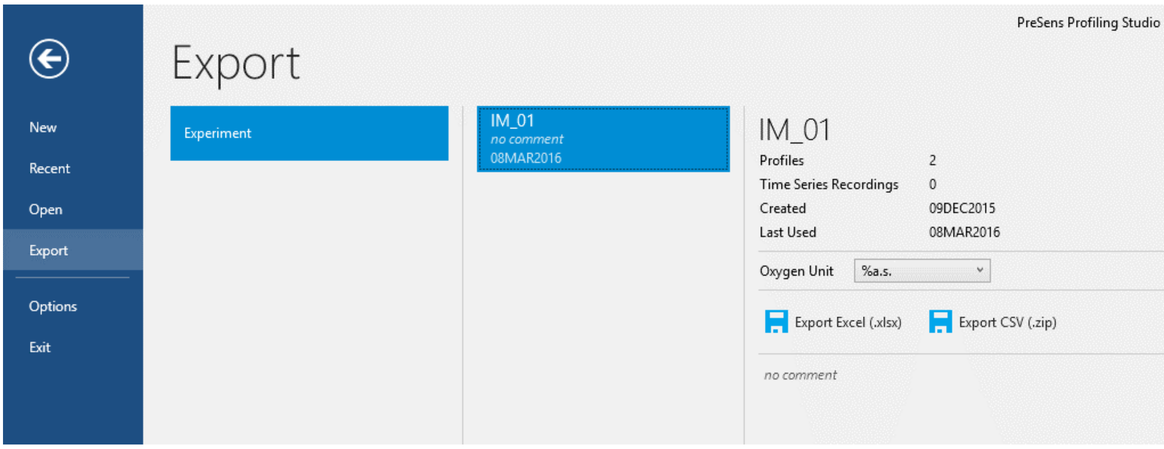
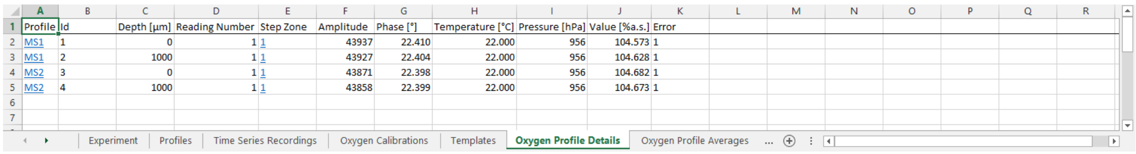


Fig. 71 Export Experiment data, here: oxygen profiling

In order to export measurement data go to the **File** menu and select **Export**. A list of all **Experiments** stored on the PC / notebook is shown. Select the Experiment data you want to export. For oxygen profiling the **Oxygen Unit** in which the data will be exported can be selected from a drop-down menu (see Fig. 71). You can choose between .xlsx (**Export Excel**) and .csv (**Export CSV**) file format.
In .xlsx format the data is partitioned and displayed on separate Excel sheets showing e. g. general information about the Experiment on one sheet, or Time Series Recordings and Oxygen Profile Details on further sheets (see Fig. 72).



Profile	Id	Depth [µm]	Reading Number	Step Zone	Amplitude	Phase [°]	Temperature [°C]	Pressure [hPa]	Value [%a.s.]	Error
MS1	1	0	1	1	43937	22.410	22.000	956	104.573	1
MS1	2	1000	1	1	43927	22.404	22.000	956	104.628	1
MS2	3	0	1	1	43871	22.398	22.000	956	104.682	1
MS2	4	1000	1	1	43858	22.399	22.000	956	104.673	1

Fig. 72 Example for Experiment data exported to .xlsx format and opened in Excel

Export in .csv format will create a .zip folder in which the **Profile Results** of each Profile are stored in a separate .csv file, while additional **Profile Info** (e. g. Calibration and Template details) is given in a corresponding .txt file (see Fig. 73). The Info.txt file gives details about the Experiment, the used Device and Software Version.

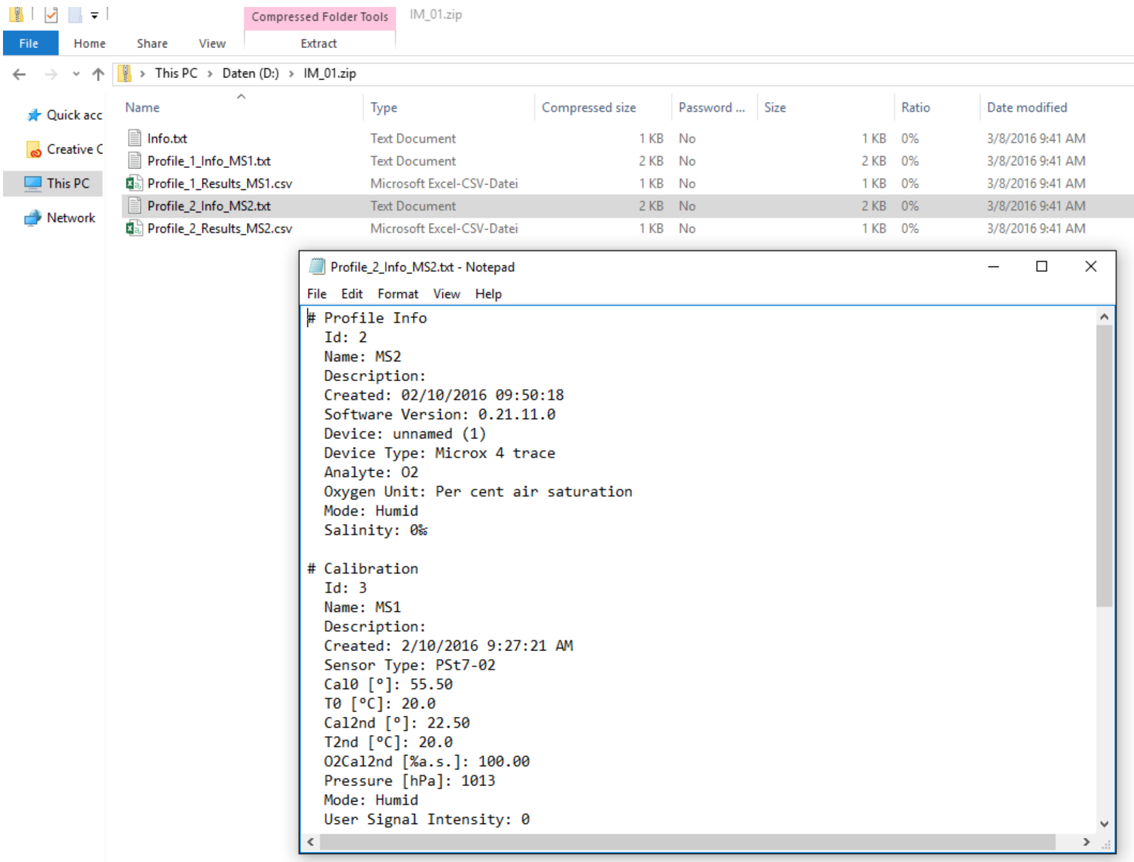


Fig. 73 Export CSV - created .zip folder opened with Windows Explorer: It contains separate .csv files for each Profile and corresponding Info files in .txt format.

5.10 Software Settings

Software settings can be accessed in the **FILE / Options** menu.

! Please note that the software settings cannot be accessed during a running measurement.

5.10.1 Application Settings

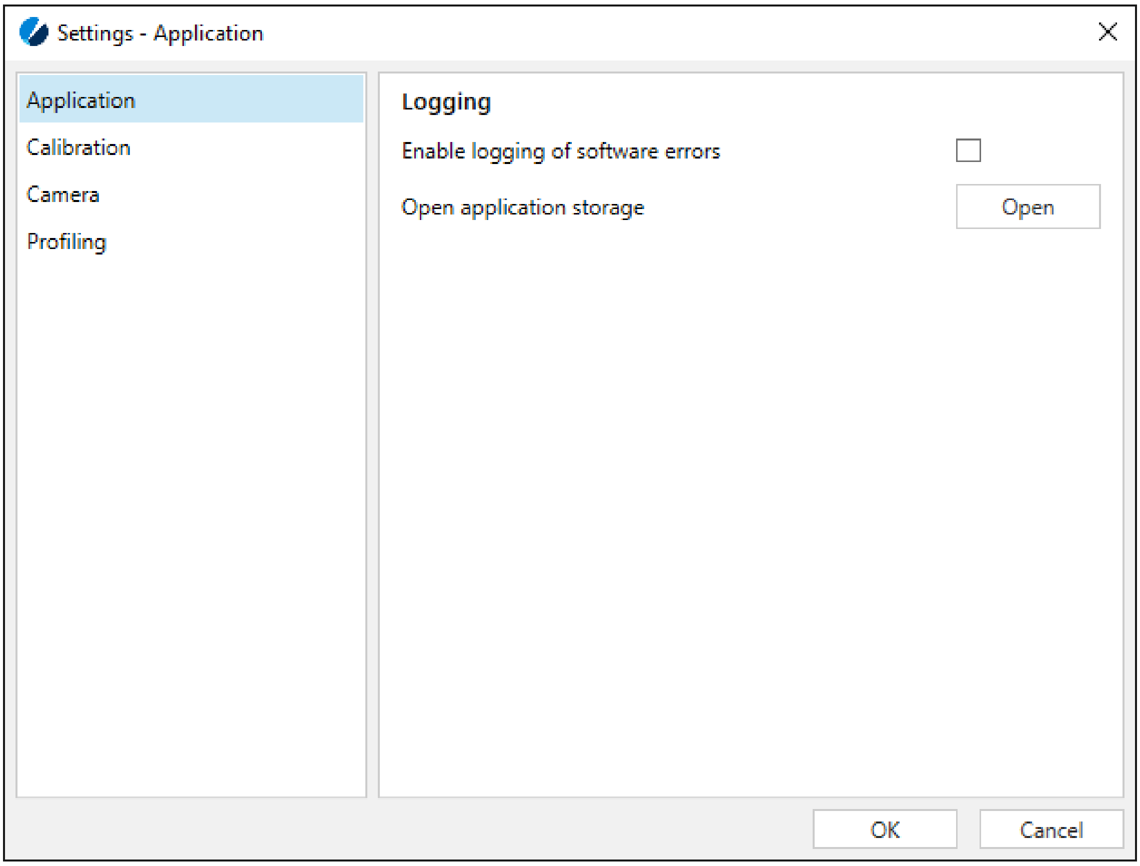


Fig. 74 Settings - Logging

Troubleshooting: by default **Logging** of software errors is deactivated. However, software errors can be recorded if you check the box next to **Enable logging of software errors**. The log-file log.trace.txt can be used for support, in case a software problem occurs. Click on **Open** to access the directory and folder where the log files are stored (User/xx/AppData/Roaming/PreSens/AMMS) and e-mail the file to PreSens support.

5.10.2 Calibration Settings

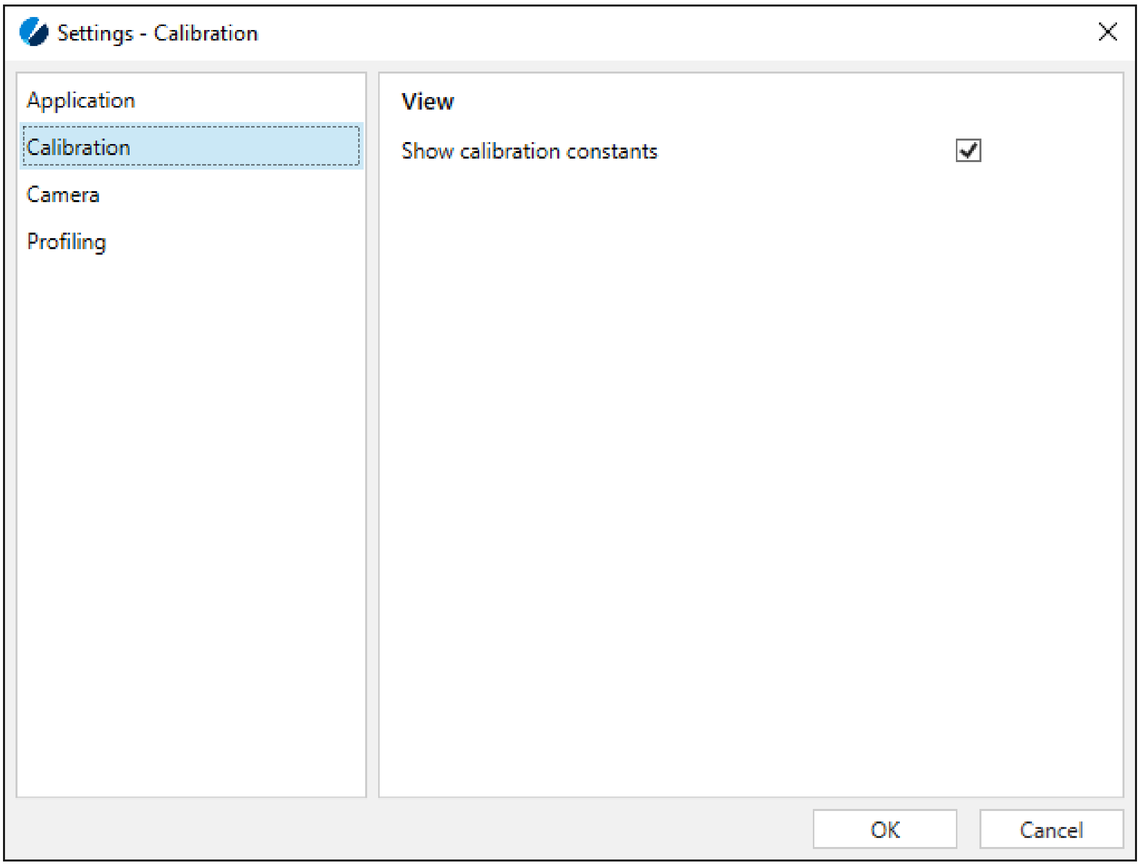


Fig. 75 Settings - Calibration

Uncheck this box to hide the calibration constants on the calibration screen. Only do so when you are working with sensor types where sensor constants are not subject to change (i. e. PSt1 or HP5). Else the sensor constants will be displayed next to the calibration data on the calibration screen.

5.10.3 Camera Settings

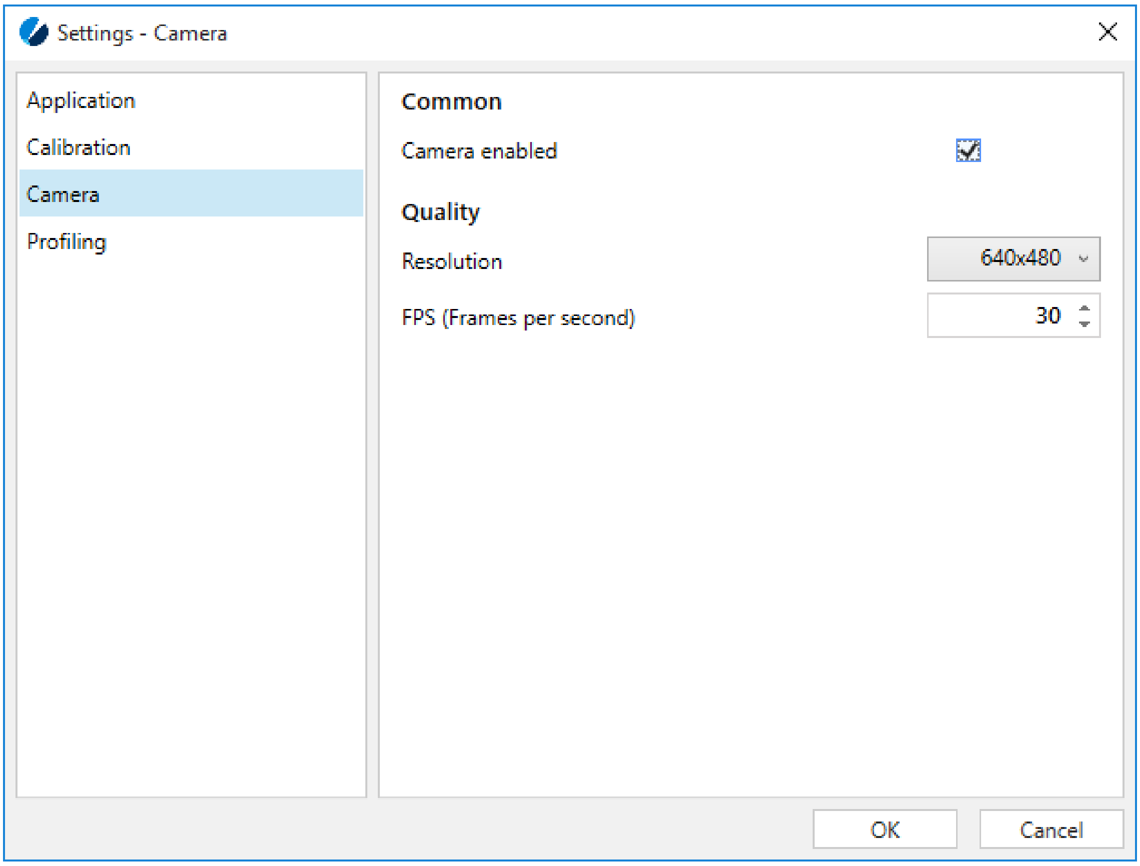


Fig. 76 Settings - Camera

The Profiling Studio software also allows operation of a USB-camera in combination with the Automated Micromanipulator. This way you can connect a USB-camera and set it up for monitoring the sensor tip during profiling, get an enlarged view when setting the zero level, or simply monitor the profiling process in detail.

For owners of a PreSens VisiSens system: Connected to the Profiling Studio the VisiSens detector unit can be operated as a video camera.

Connect a USB camera to your PC and check the box next to **Camera enabled**.
Set a video **Resolution** (formats from 320 x 240 up to 1280 x 720 can be selected), and the number of **FPS** (frames per second) that shall be recorded. For a smooth video presentation a minimum value of 15 fps is recommended.

With the camera enabled the display for **Zero Level Adjustment** will change and additionally show the camera view so the level can easily be adjusted on screen.

The software will detect all connected and integrated cameras of your PC / notebook. So in case the Zero Level Adjustment screen shows the view of your e. g. webcam, use the **Camera** drop-down menu at the bottom of the window to switch to the right camera. In the example in Fig. 77 only the camera for the Automated Micromanipulator ('**Endoscope**') is connected.

Adjust the zero level according to the instructions in chapter 5.6.1.

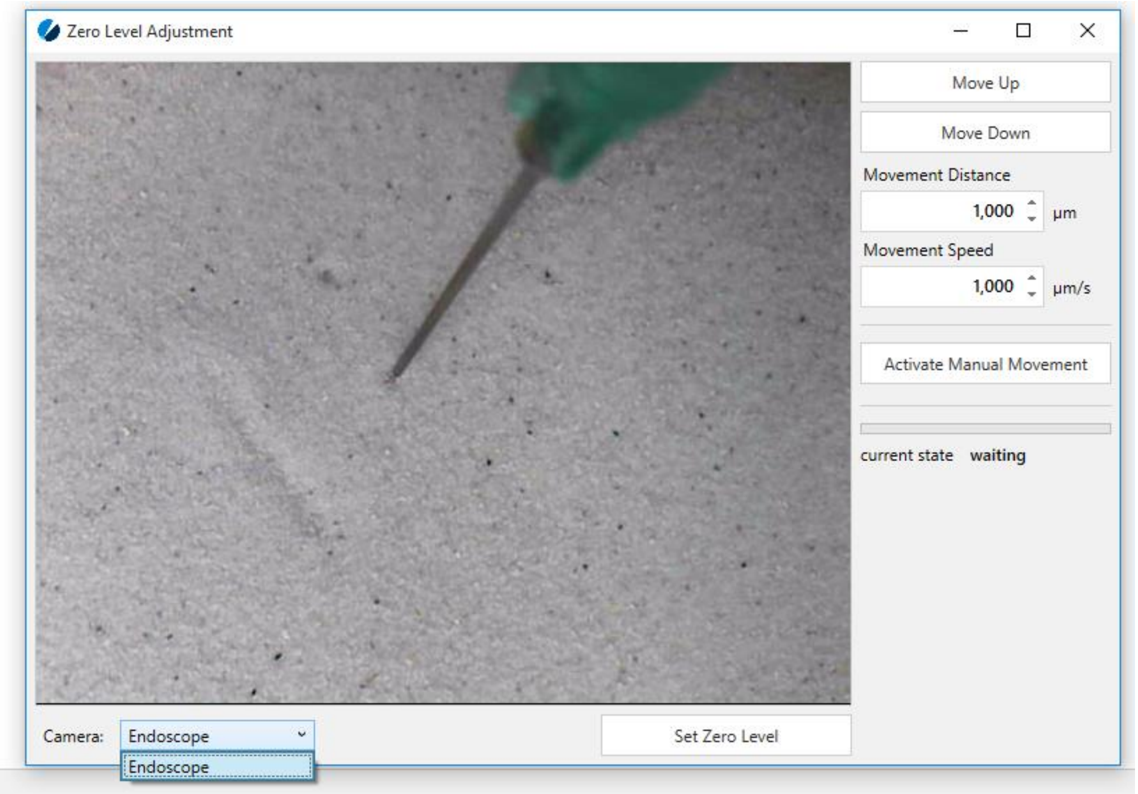


Fig. 77 Zero Level Adjustment dialog with 'Camera enabled"

Furthermore, you can display the camera view while running a profile measurement. Click on **Show camera** in the main menu bar, and the **Camera** screen will open, giving you a detailed view of the sensor moving into the sample.

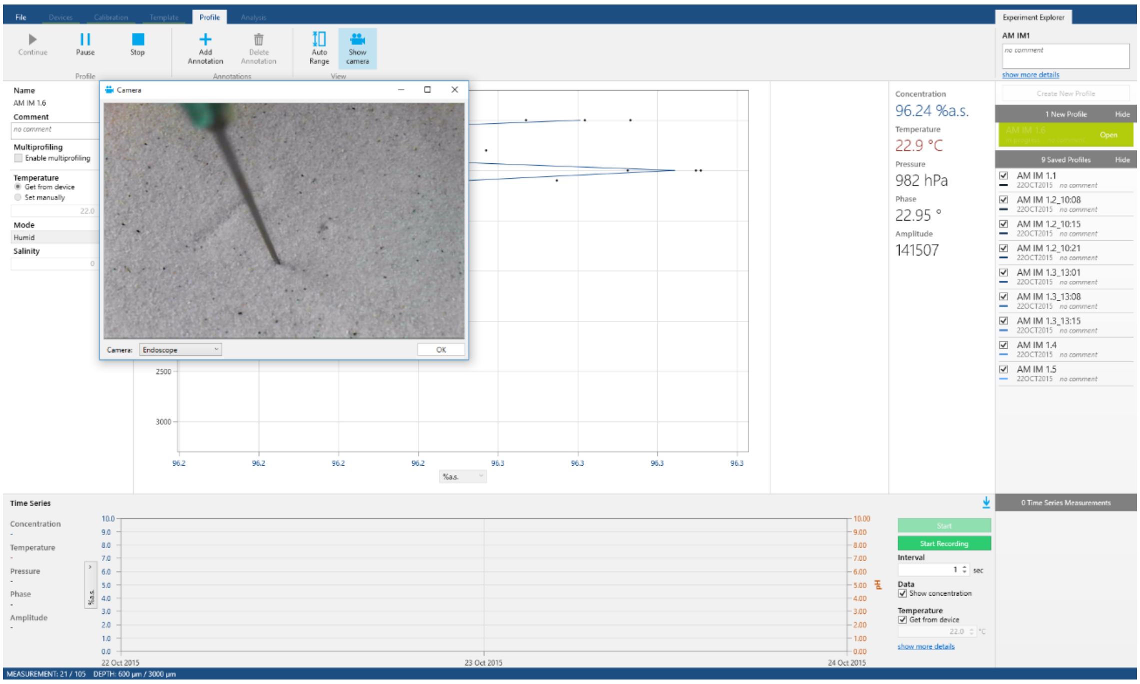


Fig. 78 Camera window on the Profile screen

In case you have selected **Camera enabled** but the software is unable to detect a camera, the respective camera view screen will show 'No camera connected'. Please check the camera and USB-connection to the PC and click **Retry**.

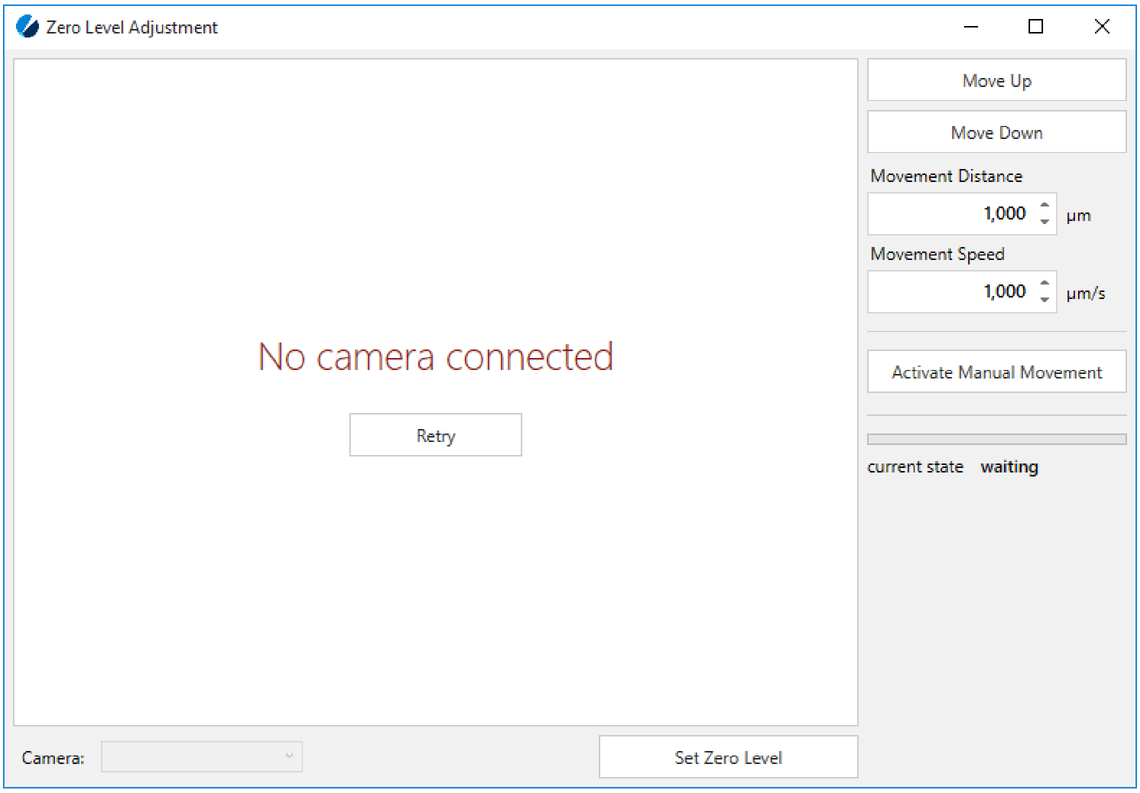


Fig. 79 Information – Camera enabled but no camera connected

5.10.4 Profile Settings

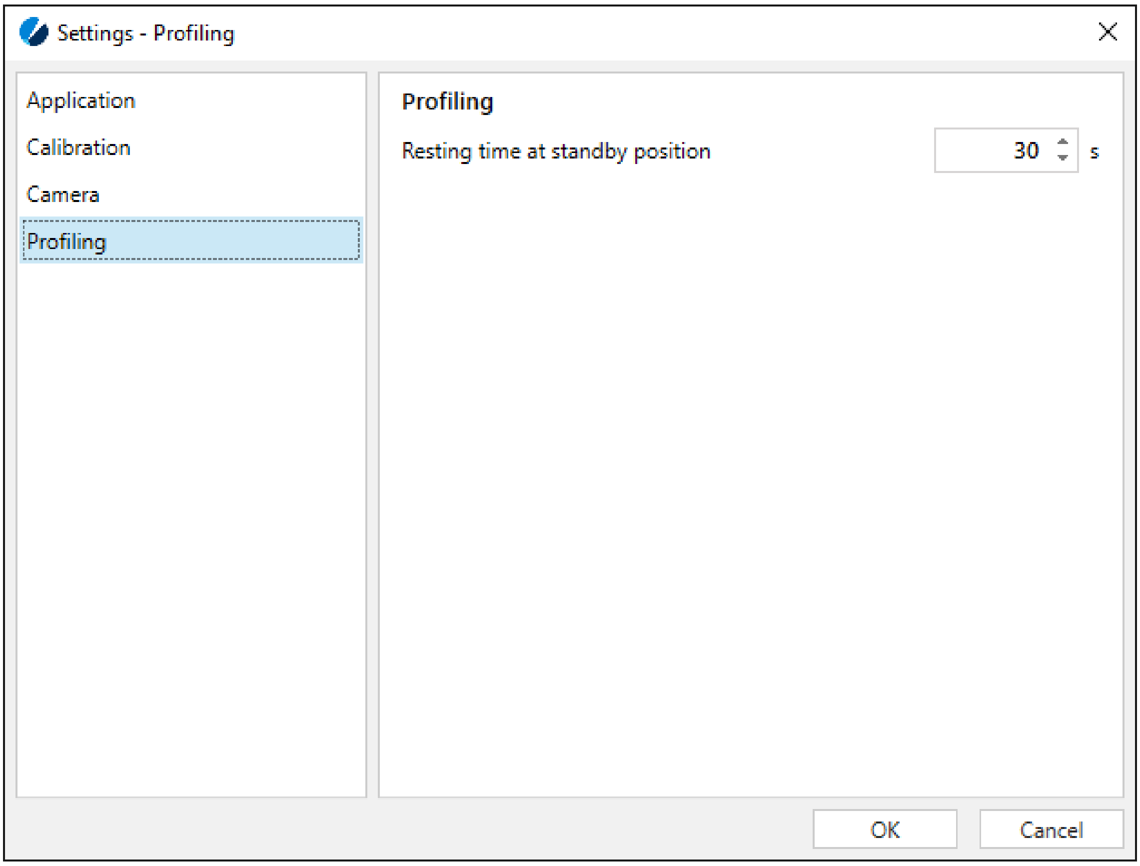


Fig. 80 Settings - Profiling

In this menu you can set the initial resting time of the sensor in standby position before a measurement is started. The initial resting time is often needed to allow the sensor some equilibration time after moving from the zero level (inside the measured gradient) to the standby position (often outside the gradient) and before starting a profile. By default this value is set to 30 seconds (see also chapter 5.7.1).

5.11 Software Menu Structure

Main	Submenu 1	Submenu 2
File	→ New	→ Experiment → Profile
	→ Recent	
	→ Open	
	→ Export	→ Experiment
	→ Options (Software settings)	→ Application → Calibration → Camera → Profiling
	→ Exit	

Tab	Menu	On-Screen Options
Devices	→ Connect / Disconnect	
	→ Rename	
	→ Find	
Calibration	→ Load / Unload	
	→ Correct pH Offset	pH: → Perform pH Offset Correction
	→ New	O2: → Create a new Calibration → Input a Pre-Calibration → Two-Point Calibration pH: → Enter existing Calibration → Create new Multipoint Calibration
	→ Rename	
	→ Delete	
Template	→ Load / Unload	
	→ Zero Level Adjustment	→ Perform Motor Movements → Perform Zero Level Referencing
	→ New	→ Set Measurement Settings → Add & Define New Zones
	→ Rename	
	→ Delete	
Profile	→ Start	→ Enable Multiprofiling → Set Measurement Parameters (Temperature, Salinity, etc.)
	→ Pause	
	→ Stop	
	→ Add Annotation	
	→ Delete Annotation	
	→ Auto Range / Profile Range	
Analysis	→ Adjust Zero Level	
	→ Align to new Zero Level	
	→ Cancel Alignment	
	→ Image	→ Export Profile Screenshot
	→ Print	→ Print Profile Screenshot

Modules	On-Screen Options
Experiment Explorer	**→ Create New Profile**
	→ Edit Profile History
	→ Edit Time Series History
Time Series	**→ Start / Stop Measurements**
	→ Start / Stop Recording
	→ Set Measurement Parameters (Interval, Temperature, Salinity, etc.)

6 Technical Data

6.1 Specifications

Automated Micromanipulator	
Compatibility	Profiling (PM), Needle-type housed (NTH) and Implantable (IMP) oxygen & pH microsensors
Travel range automated	x-axis: 75 mm
Travel range manual	x-axis: 37 mm, fine drive 10 mm y-axis: 20 mm z-axis: 25 mm
Max. motor velocity	4 mm/s
Min. motor velocity	1 µm/s
Resolution	1 µm
Repeatability	< 2.5 µm
Maximum continuous thrust	100 N
Maximum cantilever load	100 N cm
Mounting adapter	M6 screw, 13 mm length

Power Supply	
Supply voltage	15 VDC (2.1 mm center positive plug)
Power adapter	100 – 240 VAC, 50 – 60 Hz (Use supplied power adapter only)

Environmental Conditions	
Operating temperature	0 to +50 °C
Max. relative humidity	Up to 80 % (non-condensing)

Dimensions / Weight	
Dimensions	275 mm x 95 mm x 220 mm
Weight	2070 g

Digital Interface

USB interface cable to PC	Cable included

Control Software

PreSens Profiling Studio (compatible with Windows 7, 8, 10 at 32 or 64 bit)

7 Operational Notes

7.1 Storage

Before storing your device, retract any extended components in order to keep them clean and to protect them from damage. Store the device in a dry environment.

7.2 Environmental Conditions

The device is NOT splash or water proof. Do not submerse the device in liquid. Do not expose the device to vibration or shock, or extreme conditions, such as temperatures exceeding device ratings, radiation, and dusty or humid environments.

7.3 Power Adapter

The Automated Micromanipulator always has to be used with the original power adapter (Input: 100 / 240 VAC, 50 – 60 Hz; Output: 15 VDC / 1.2 A, max. 16.2 W, type 3A-183WP15) which is supplied.

7.4 Maintenance

The Automated Micromanipulator is maintenance-free.
The housing should be cleaned with a cloth only. Avoid any moisture entering the housing. Never use benzine, acetone, alcohol or any other organic solvents for cleaning.

7.5 Service

Alignment, rework or repair work may only be carried out by the manufacturer:

PreSens
Precision Sensing GmbH

Am BioPark 11
93053 Regensburg
Germany

Phone +49 941 94272100
Fax +49 941 94272111

info@PreSens.de
www.PreSens.de

Please contact our service team in case of any questions. We look forward to helping you and are open for any proposition or criticism.

8 CE Conformity

The equipment is confirmed to comply with the requirements set out in the Council Directive relating to Electromagnetic Compatibility (2004/108/EEC), Low Voltage (2006/95/EEC) and machinery (2006/42/EC). For the evaluation of the above mentioned Council Directives the following harmonized standards were consulted:
EMC: EN 61000-6-1:2005, EN 61000-6-2:2005, EN 61000-6-3:2005, EN 61000-6-4:2005
LVD: EN 61010-1: 2010

9 Concluding Remarks

Dear Customer,

With this user guide, we hope to provide you with an introduction to work with the Automated Micromanipulator.

This guide does not claim to be complete. We are endeavored to improve and supplement this version.

We are looking forward to your critical review and to any suggestions you may have.

You can find the latest version at www.PreSens.de.

With best regards,

Your PreSens Team

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