Kibron

FilmwareX 4.2

User's Guide

Kibron MicrotroughX
Langmuir Instrument
User´s Guide

February 5th, 2016
Revision A

Preface

Congratulations for your purchase of Kibron's Microtrough and FilmwareX 4.2. This manual will acquaint you with the basic features of the software. Should you have any questions or other queries related to this product, please contact Kibron by phone or e-mail:

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Document Conventions

This manual uses the following typographic conventions:

Example	Description
	This icon alerts the user to the presence of important operating and maintenance (servicing) instructions
	This icon indicates a warning or caution.

Revision History

Revision	Date	Changes
A	11/2016	First Release
B	07/2017	Note added on the use of space in chemical names and abbreviations.
C	11/2018	Manual updated for FilmWareX 4.2 (incl. area hysteresis, setting up and selecting probes).

CONTENTS

Chapter 1: Installing the software – ‘Filmware'

It is assumed that you are familiar with standard Windows terminology, such as ‘directory’, ‘file’ and ‘right hand click’. If you are not, please read your Windows guide and/or watch the videos. If all else fails, please contact us and we can give you an on-line demo.

Unpacking:

The software for the trough, called the 'Filmware', can be acquired in different ways:

1: On the Kibron memory stick
- look for the FilmWareX40directory and run '**setup.exe**'
- or double click on: **FilmWareX40_inst_rel1.exe**

2. Via a 'drop box'
This is often distributed as a 'zip' file - just right-hand click on the zip file and use the Windows extractor to unzip it, and look for **FilmWareX40_inst_rel1.exe**.

3. Sent as an attachment by e-mail
This is often sent as a 'txt' file, in order to get around your university/company e-mail security filters.

Just rename the **FilmWareX40_inst_rel1.txt** to: **FilmWareX40_inst_rel1.exe**

Note: if your PC is set up not to show file extensions, you will need to enable this in:
'Folder Options' - accessible from 'Tools' in File Explorer.

4. Downloaded from Kibron’s eshop.
-Provided as **Filmware40_inst_rel1.exe**

Installing the Filmware

Left-hand click on:

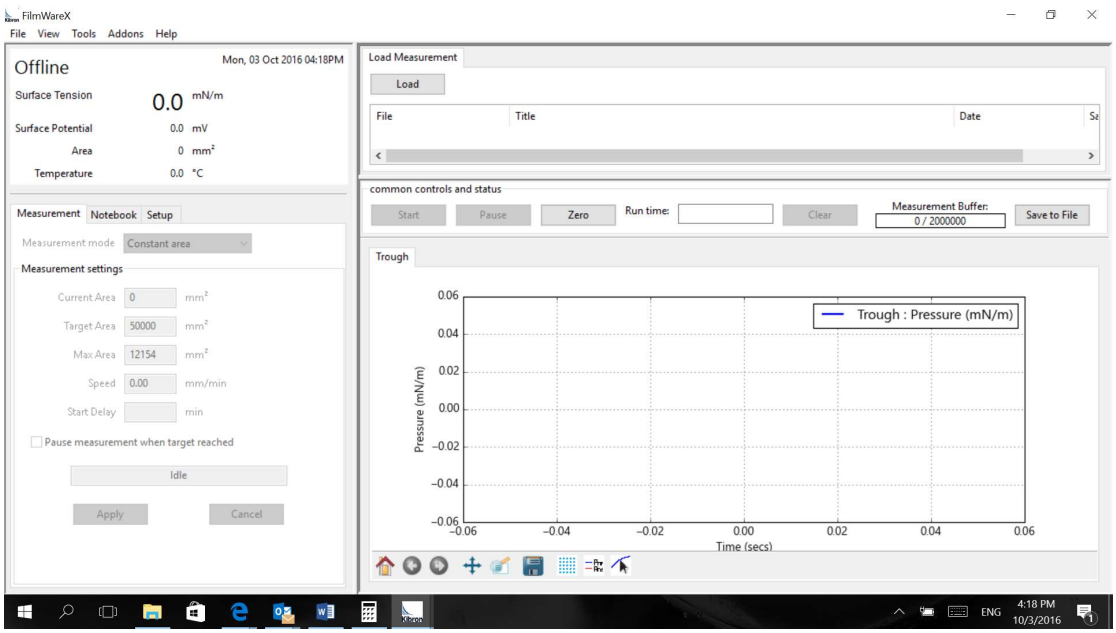
FilmWareX40_inst_rel1.exe

and the Windows installer will take over. It will place the software in c:\programs(X86)* and will ensure that all files are present. Note that there are configuration files that are placed in the installation directories as well. Install in a new directory. To avoid mismatch between new and old files, please do not install in an existing FilmWare directory.

Running the software for the first time

The installations package will have placed the FilmWare icon on your desktop. Please click it - there will be a delay of a few seconds and you may be prompted by Windows to allow the FilmWare to make changes to the computer. Then a Kibron logo will appear in the centre of the desktop and shortly afterwards the main screen will appear.

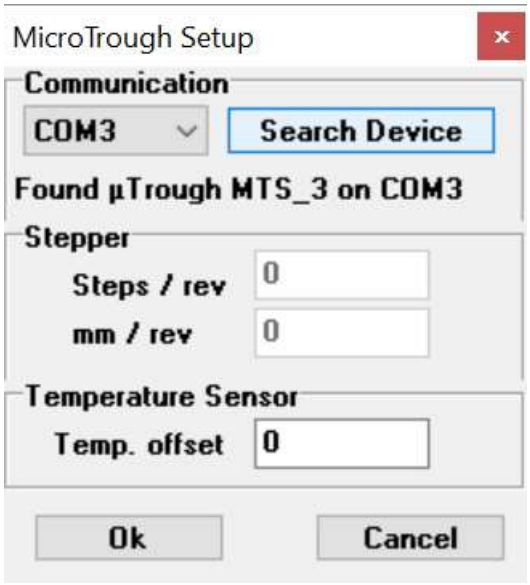
The following screen will appear, after a short delay... (about 8 seconds).



Establishing communications with the interface

Under normal circumstances the Filmware will automatically connect to the instrument if it is connected when the software is started. If the 'Offline' status message appears on the top left, the first thing we have to do is get the communications between PC and trough going. We do this by going to the 'Communications' window which comes off the 'Tools' drop down menu.

Click on '**Search Device**' to automatically locate the com port - once found the current port will be displayed (COM3 in the example). If you have other devices (e.g. dipper) connected to the computer, make sure that the right port is found.

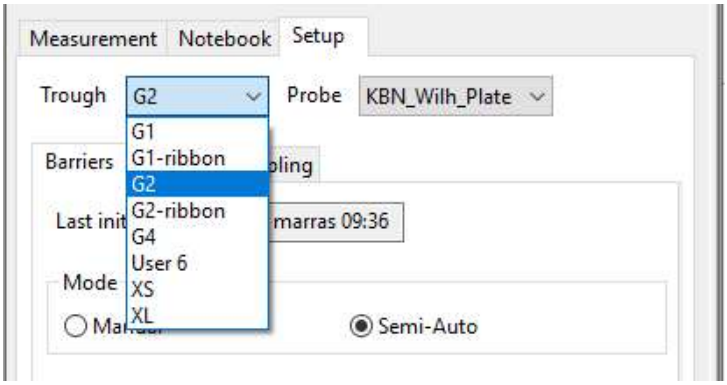


Click on OK to return to the main screen.

If you cannot find the COM port, please check the COM port number and set it to below 10 in the Windows Device manager, by right clicking the Prolific USB-to-Serial Comm port, choose Properties, Port settings and Advanced.

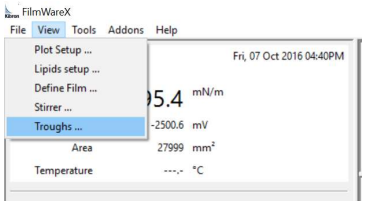
Chapter 2: Setting up for an experiment

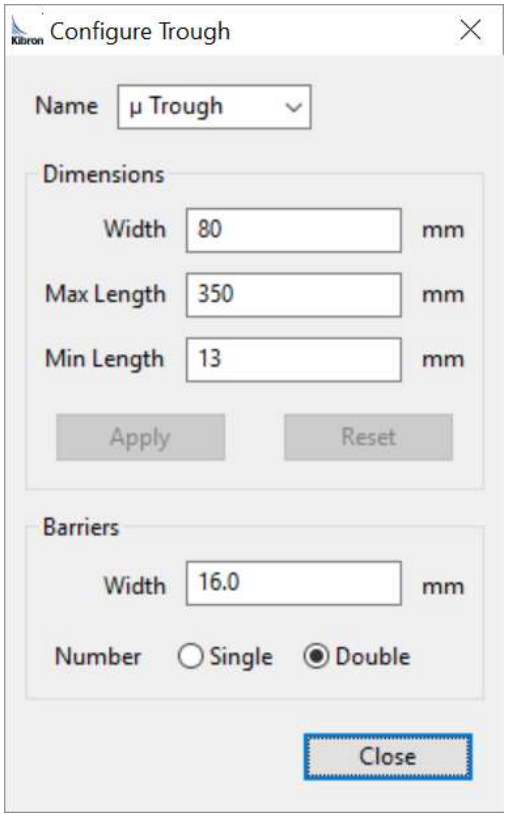
Selecting trough



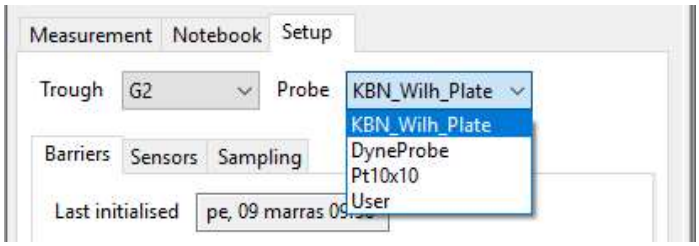
You need to 'tell' the software what trough you are using. This sets the correct length and width for the experiment. To do this select the 'Setup tab' on the left of the screen. Select the trough you are using. If you cannot find the correct trough, select View -> Troughs, and enter the correct parameters for the trough. Note that 'Max. Length' is usually the maximum distance between the barriers – not the internal length dimension of the trough. The 'Min Length' sets the limit for how close together the barriers can be moved, you may for example, want to increase this parameter if you have bulky equipment probing the mid-section of the trough. For some special trough with more complex shape, like the ribbon trough, the 'Max Length', 'Min Length' and 'Width' do not correspond directly to the physical dimensions of the trough. The parameters have rather been set so that the area and compression length is correct.

The ‘Barrier Width’ is a redundant parameter which does not affect the area calculated in the software. The ‘Number’ of barriers sets whether both barriers (symmetric) or one barrier (non-symmetric) is used for compression. This affects the rate at which the area is changed when the barrier drive is running. The knobs of the barriers drive should be set accordingly (see below).





Selecting probe



A new feature in FilmwareX 4.2 is the support of a variety of probes. You can switch between different probes with the same calibration. The calibration coefficient is recalculated based using the perimeters of the probes. The Zero calibration dialog is opened automatically when the probe is changed, when the probe is changed to remind the user to record a new reference level.
To do this select the ‘Setup tab’ on the left of the screen. Select the trough you are using. If you cannot find the correct trough, select View -> Probes, and enter the correct parameters for the probe. Please notice that the 10 mm x 10 mm platinum Wilhelmy plate cannot be used with our standard sensor.

Initializing the barrier drive

Before doing any measurements involving the barriers, the drive needs to be initialized. This procedure teaches the motor drive the datum position, to which all barrier movements are referred.

First of all, disconnect the barriers from the belt drive - by turning the knobs to the neutral position, as shown below in a):

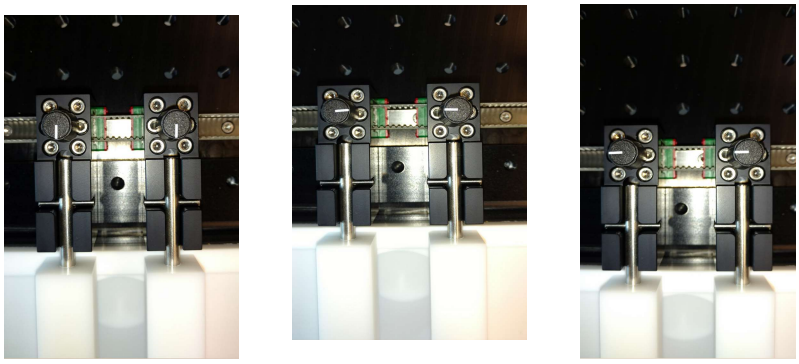


Fig. a) Belt drive knobs in neutral position. b) belt drive knobs inwards for normal compression. c) Belt drive knobs for in coupled mode for moving the barriers in the same direction.

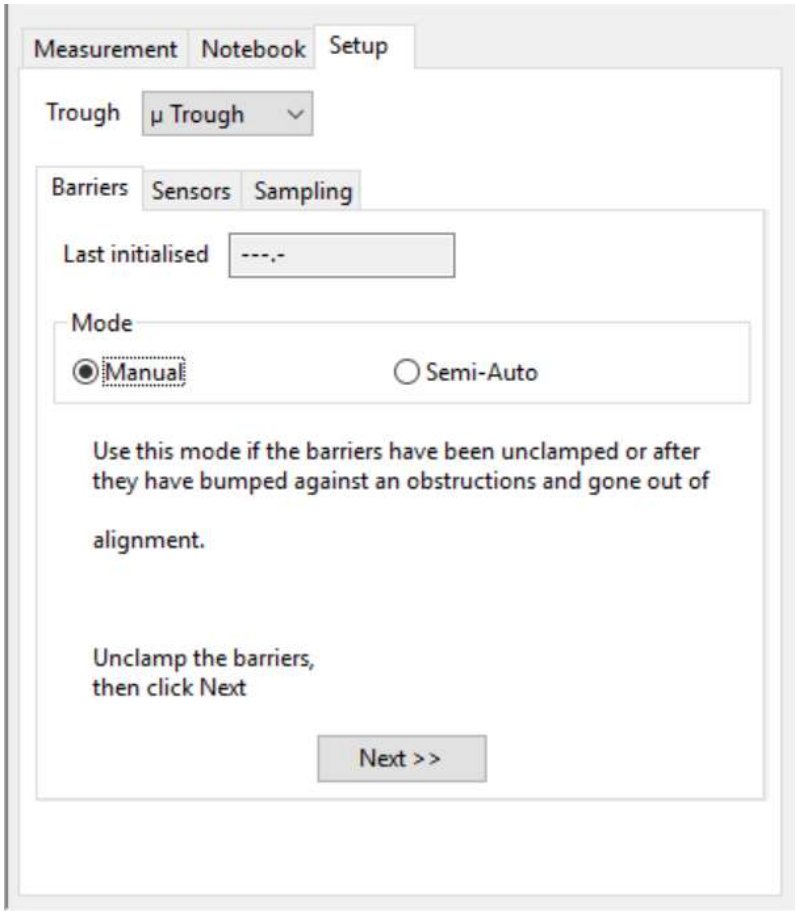


Fig. Screenshot of initialization

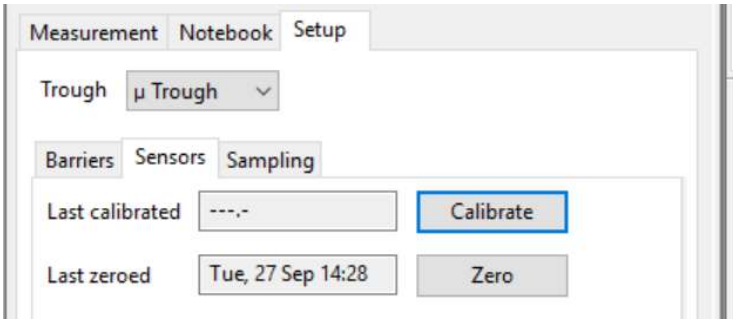
Choose 'Manual' and click on 'Next'**.** Then follow the instructions on the screen. Move the barriers (by hand) to the 'fully open' position and turn the knobs - both inwards, as shown in b). This will lock the barriers to the opposite sides of the belt so that they move in opposite directions. This is appropriate for methods where control pressure vs. area is required (almost all cases). You may also turn one knob inwards and leave the other in neutral as shown in d) - set the number of barriers to 'Single' as described above.

In the Semi-Auto mode the barriers are moved using the motor. You may use this mode if the barriers are symmetrically placed with respect to the center of the trough, i.e. you have initialized the trough previously, or you can use it to carry the barriers as far out as possible and then adjust them manually to make sure they are at datum positions.

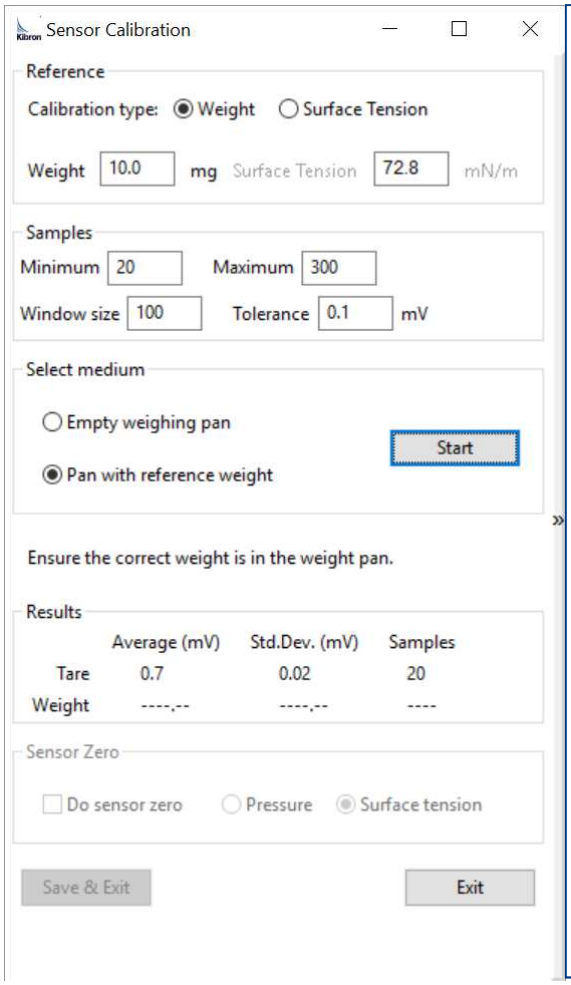
Calibration of the force sensor

The first time you use the instrument you must calibrate it, and we recommend that you check the calibration before an experiment and calibrate it if necessary.
The sensor can be calibrated using weight or using a liquid with known surface tension. The advantage of weight calibration is that a first principles relationship between the measured force and the surface tension can be shown, and the reference weight and probe circumference can be confirmed by other methods. Additionally, the method does not rely on a supply of clean calibration solvent (water), although this is less of a problem in well-equipped laboratories with high purity water systems as long as the handling procedures are in place.
The advantage of the calibration using a liquid is that small deviations in the probe diameter, shape and roughness, which are difficult to physically characterize, are included in the calibration factor. If high purity water or another solvent with accurately known surface tension is available, the method tends to give more accurate results than weight calibration. Under ideal conditions both methods yield the same results.

To begin calibration choose the 'Setup' -> 'Calibration tab' and push the 'Calibrate' button to open the calibration dialogue.



Calibration with a known weight



In the Samples section you can set the criteria required for sufficiently good data, in the example shown at least 20 samples is taken, and then continued until the set tolerance is reached. Once 100 samples have been recorded the last 100 samples will be analyzed, and when 300 samples have been reached sampling will stop independently of the tolerance.

The » symbol on the right border opens up a panel with calibration instructions.

We recommend a weight around 10 mg, since this is near the force range used in the measurements. You can buy a reference weight or for example cut a small piece of wire and weigh it on a high precision laboratory scale.

If you have lost the calibration hook provided with the instrument, you can conveniently make one by making a hook from an old probe.

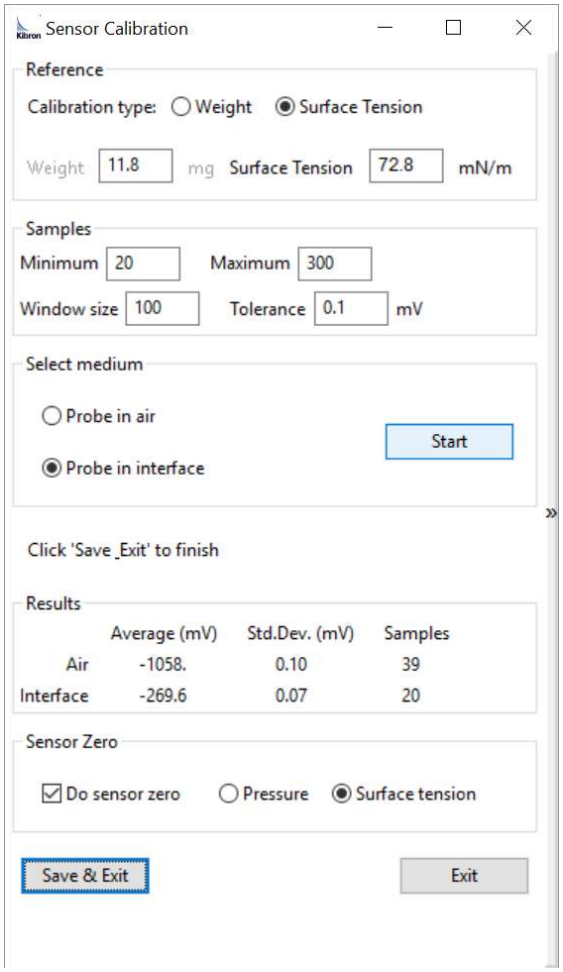
1. Select Calibration type: Weight, and enter the magnitude of weight you are using.
2. Select the medium empty weighing pan and place the weighing hook on the sensor. If you rather measure with the reference weight first, then add the reference weight to the hook.
3. Push Start. Once the sampling has been done the medium will be shifted to the other (If you record several times, the medium is not automatically switched).

4. Add (remove) the reference weight and push Start.

5. Once finished push Save & Exit. You can also redo a medium if you are not satisfied with the results.

Calibration with a reference weight does not provide a zero point for the surface tension scale - proceed to Zero on the Sensor tab to do this step.

Calibration with liquid



1. Select Calibration type: Surface tension. The default surface tension value is 72.8 mN/m (20 °C), but should be corrected according to temperature. At 25 °C the surface tension has dropped to 71.99 mN/m.

2. Place the probe on the sensor and select 'Probe in air'. If you rather measure with the probe in the interface first lower the probe to the interface. Please notice that for the Wilhelmy plate we recommend to always start by recording the air reference value, since it takes several minutes for the Wilhelmy plate to dry in ambient air. See the information box below for instructions on how to immerse the probe.

3. Push Start. Once the sampling has been done the medium will be shifted to the other (If you record several times, the medium is not automatically switched).

4. Immerse (pull out) the probe and push Start. Please see the information box below how to properly immerse the probe.

5. Before pushing Save & Exit, you can choose to use the calibration data for taring the sensor. You can also redo a medium if you are not satisfied with the results.

When the probe is lowered to the interface, we recommend the following procedure to ensure a negligibly small contact angle, while keeping the buoyancy error small. First flame-clean the probe and let it cool for a minute.
Then lower the probe until the tip touches the surface. This is the ideal level for measurements as at this level the buoyancy is zero. Then continue to lower the probe by ca. 1 mm and bring it back up by exactly the same amount, so that the tip of the probe is at the "ideal" level. These steps ensure a receding contact angle, which tends to be negligibly small. For a clean and freshly flamed probe the contact angle is very small, however, if the probe surface is compromised the receding contact angle is less sensitive.

Zeroing / Taring

Taring may be necessary for setting a correct force reference level, for example at the beginning of an experiment, or if you change the immersion depth of the probe. The latter affects the buoyancy term of the measured force. There are two ways to tare the force sensor. You can do it either by holding down the 'Zero' button on the common controls and status panel (see 'Menus and Windows' section for details), or by opening the 'Zero dialog' window on the 'Setup' -> 'Sensors' tab. The former simply averages the readings taken while the button is pressed, whereas the latter provides a more rigorous approach where a tolerance is set for a given Window of samples.

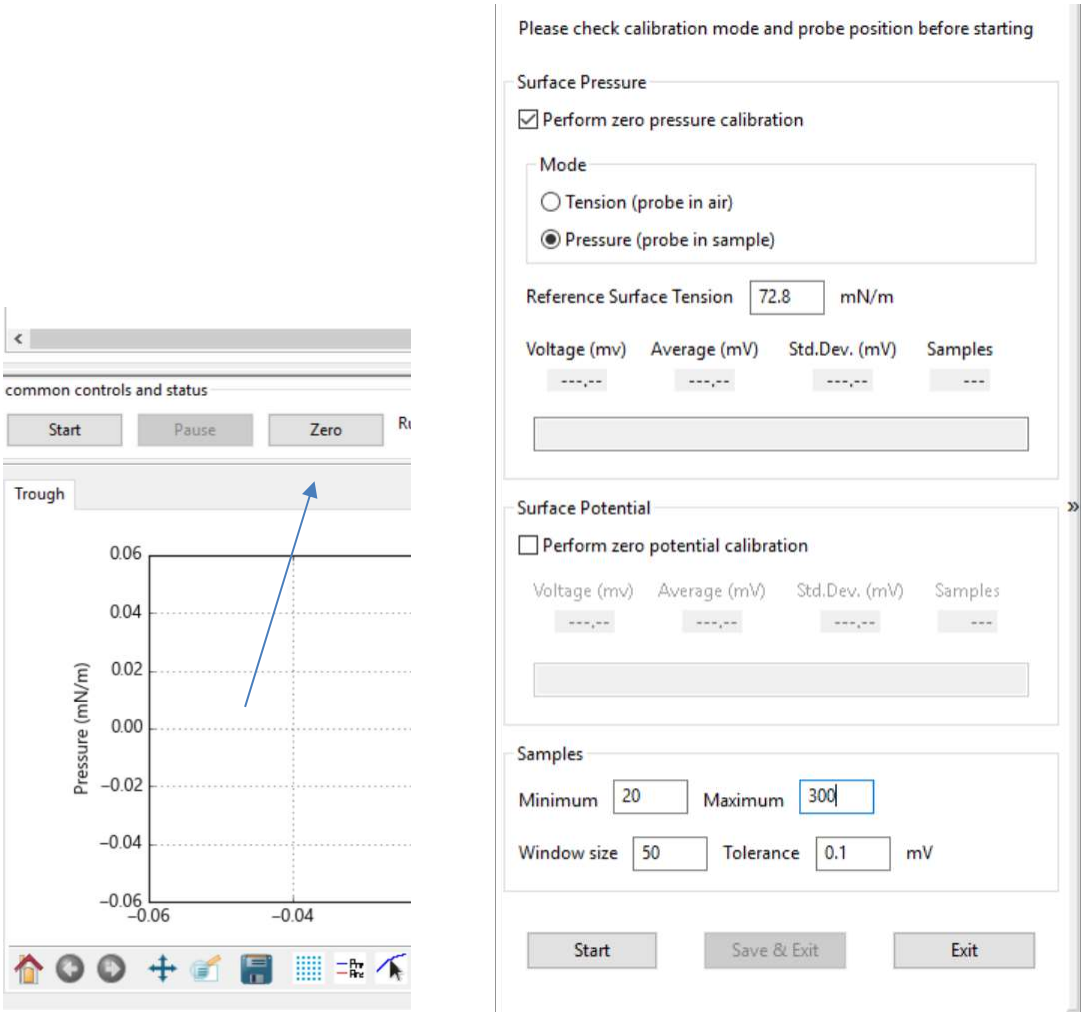


Fig. *Left* Zero button, which averages the values collected while pressed, and *Right* Zero dialog window.

To tare the force sensor select 'Perform zero pressure calibration'. Select Tension or Pressure depending on if you measure with the probe in air of in the subphase. Then set the reference tension, i.e. the surface tension of the subphase without surface film. This value is used for relating the surface pressure to the surface tension through,

$$\pi = \gamma_0 - \gamma$$

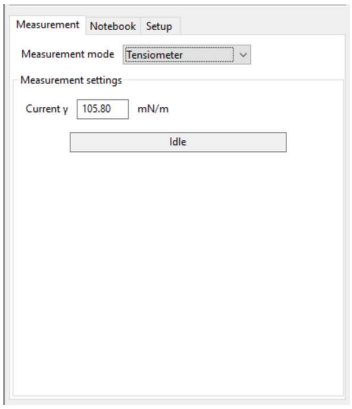
Where π is the surface pressure and γ_0 is the surface tension of the pure subphase. If you measure with the tip of the probe at the water level, and have the correct reference tension the result should ideally be the same for both Tension and Pressure zeroing. Set the statistical criteria for the taring (as in the calibration dialog). Push 'Start', and when the taring is finished push 'Save'. Please note that if you do not know the correct reference tension, either the surface tension or pressure scale is offset depending on choice. Many times it is sufficient to work with one scale correctly tared.

You can also select 'Perform zero potential calibration' to tare the surface potential scale. If you have chosen both surface potential and pressure, the calibration will proceed until both sensors satisfy the calibration criteria. If you need to use separate parameters for the acceptance criteria, you need to do the calibrations separately.

The software is now setup and ready for an experiment.

Chapter 3. Measurement methods

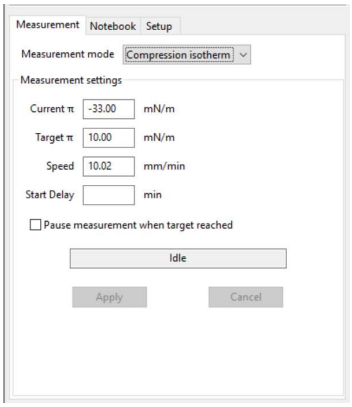
Tensiometer mode



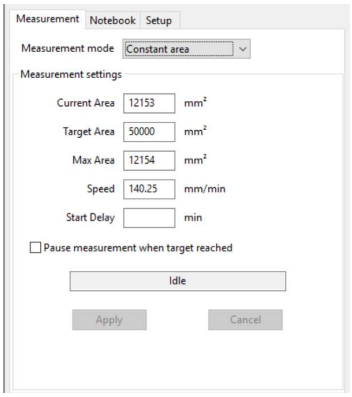
'Tensiometer mode' provides a simple interface to measure surface tension or the current reading of all connected sensors. The method does not provide a means to manipulate the positions of the barriers. For surface tension measurements, the force sensor should be tared with the probe in the air, and the surface tension measured with tip of the probe level with the subphase surface. To find the correct height, slowly lower the probe until it contacts the surface. Then, to ensure a negligible contact angle, immerse it around 1 mm further and pull it back by exactly the same amount. Push the 'Start' button to begin measuring.

Compression isotherm

The compression isotherm method provides an interface to setup a compression isotherm, where the barriers are moved at constant Speed (you can switch to rate defined in terms of area per molecule by clicking on the unit). When the surface pressure exceeds the target pressure, Target π, the measurement is stopped. You can also set a Start Delay to postpone the beginning of the experiment, for example if you want to equilibrate the film.

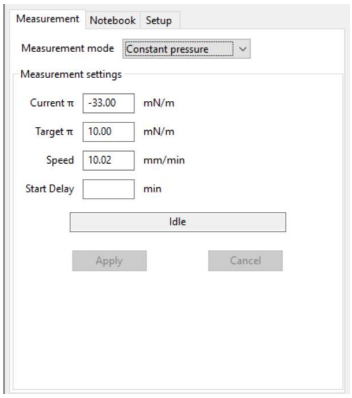


Constant area



The constant area measurement compresses or relaxes the film at a given speed until the desired area has been reached. Once the target area has been reached the barriers and recording are stopped.

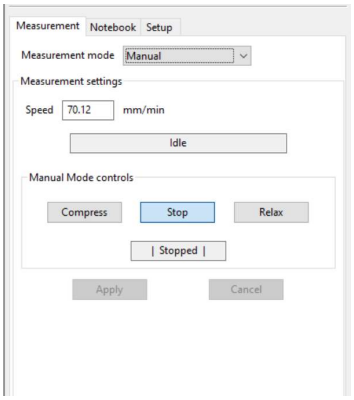
Constant pressure



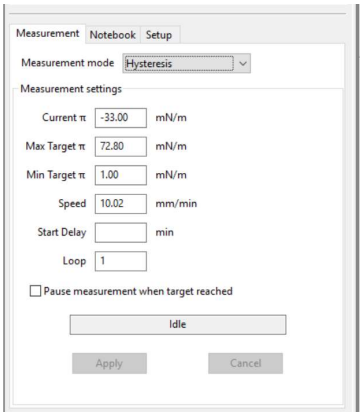
The constant pressure mode compresses/relaxes the film to a desired surface pressure π. Once reached, the pressure is maintained at the target until the experiment is stopped. There is a tendency for the pressure to oscillate around the target. This can be reduced by using lower speed. This method is useful for equilibrating the monolayer at a desired pressure, or to keep the pressure constant while depositing the monolayer film on a substrate.

Manual

In the manual mode the barriers can be manually controlled and data recorded. To start data recording push the Start button in the common controls and status panel. The barrier operations are independent and do not start data recording in this mode.

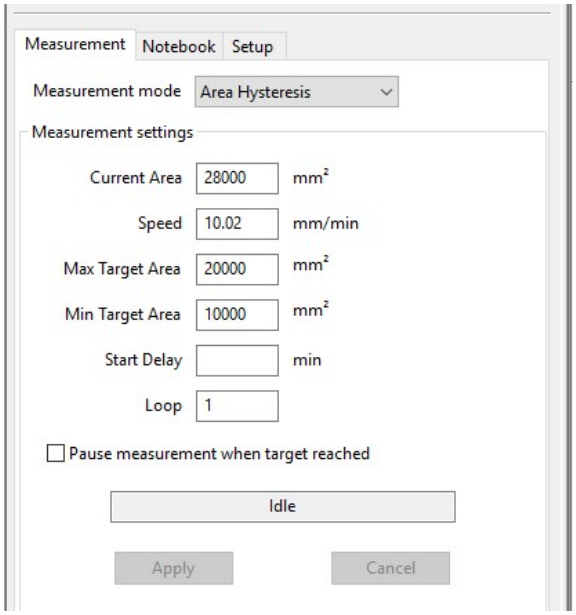


Hysteresis mode (pressure hysteresis mode)



The pressure hysteresis mode cycles between minimum and a maximum pressure target pressures. Please make sure that the target pressures corresponds to areas which can be reached by the barrier drive. If the barrier drive reaches either end the measurment will stop.
Min Target π and Max Target π set the low and high pressure vertex for the measurment. Loop sets number of times the pressure is cycled between the minimum and maximum target pressures π.

Area hysteresis mode



In the area hysteresis mode the barriers are looping between the Min Target Area and Max Target Area. Loop is the number of loops made between the verteces. Please notice that due to the discrete nature of the stepper motor the verteces may be exceeded by up to 75 mm^2 (i.e. 1 mm) at maximum speed. Please set the parameters with sufficient margin to the maximum and minimum range of the barrier drive. Overriding either end will cause the measurement to stop.

Chapter 4. Menus and Windows in Filmware 4.2

Main screen

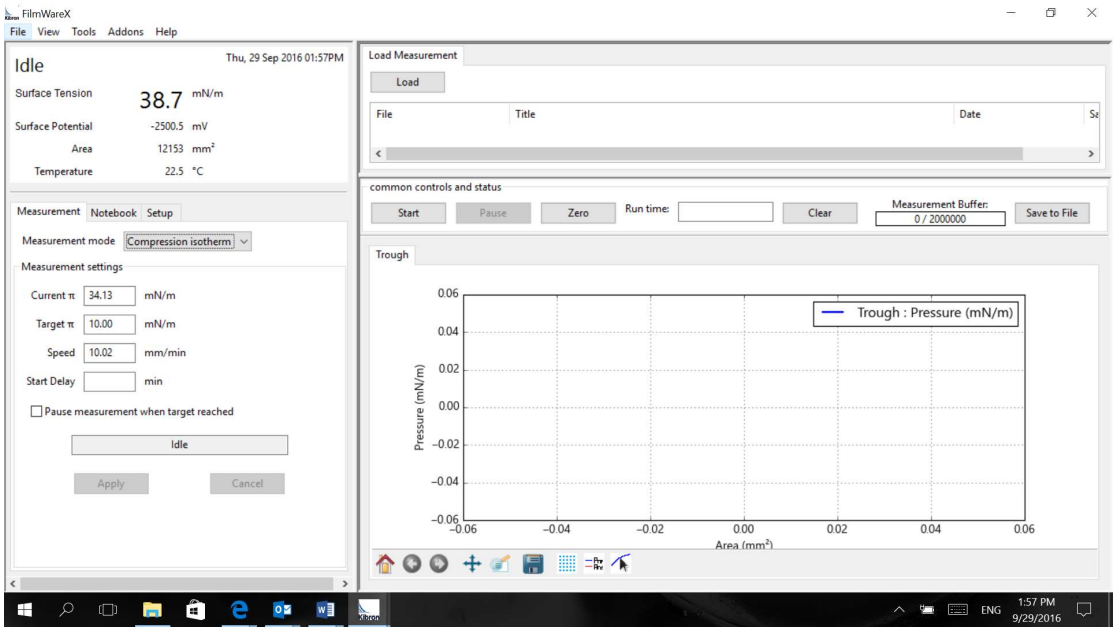


Fig. Layout of the main screen of Filmware 4.2.

Status, current sensor readings and barrier position (area) are shown in the top left panel. The first reading is the input from the force sensor. You can toggle between surface tension, surface pressure and output potential by clicking on the reading.

The second reading is the surface potential signal from the Microspot accessory connected to the SENSOR 2 inlet. If you do not have the Microspot accessory the reading corresponds to the resting potential of the analog to digital converter. You can also connect your own analog devices (please contact Kibron for details on the connection).

The third reading is the area between the barriers. You must make sure that you have **initialized** the instrument to get the datum position set, and that you have selected the correct trough.

The fourth reading is the temperature from the sensor connected to INPUT 1.

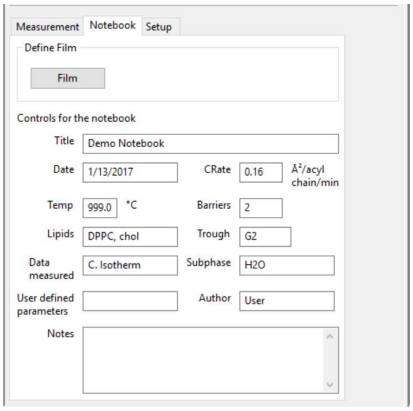
Tabs for selecting **measurement method**, defining and recording experimental parameters (**Notebook**), and **setup** of the instrument are located below the status panel.

Notebook tab

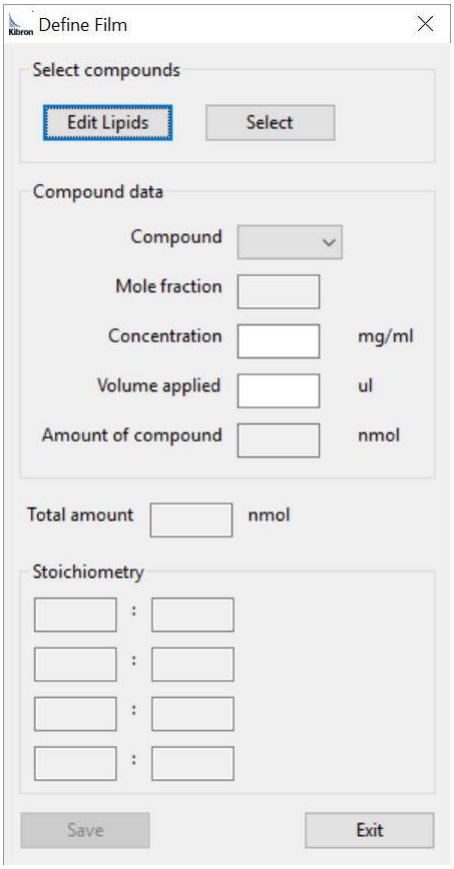
The notebook tab contains key experimental parameters describing an experiment. These are saved with the measured data. When an experiment is loaded (see Loading experiments below) the Notebook entries are shown with the loaded experiment. It is good practice to enter data which describe an experiment sufficiently and links it to entries in an ordinary laboratory notebook.

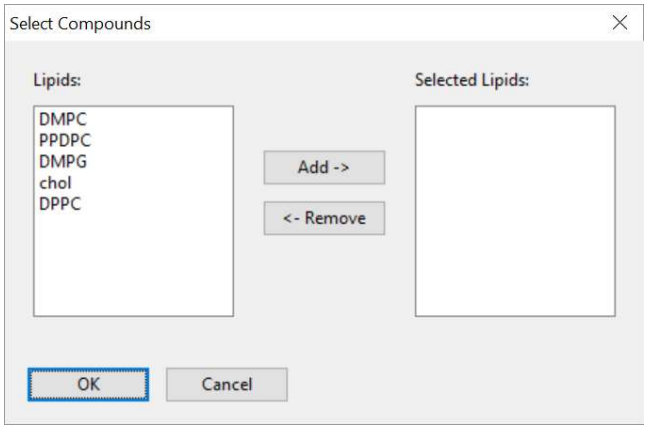
The data cannot be edited in FilmWareX after the measurement data has been cleared. If you need to edit, you can do it in a standard text editor, for example

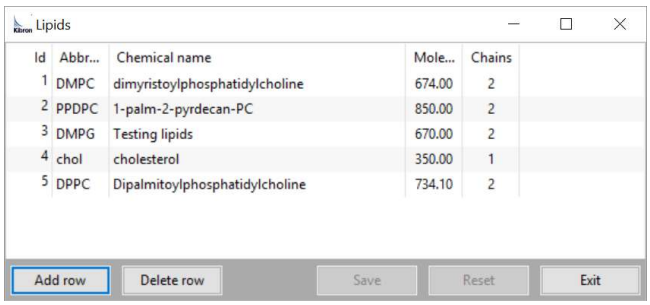
MS Notepad. Notice that if you alter structure of the of the data, Filmware may fail to open the file.



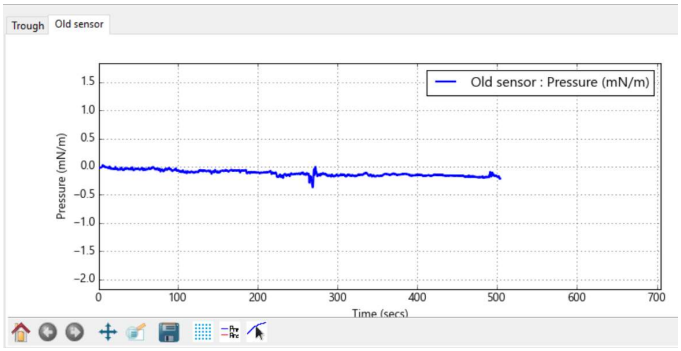
One of the central concepts in the notebook is the film or monolayer studied. Langmuir films have a strong tradition in the study of lipids and fatty acids, therefore we use the term "Lipid". It is equivalent to "Component". The FilmWare supports film of up to 4 components in the same film. Choose **Edit lipids** to enter new compounds in the compound library and select to add compounds to the studied film. If you set the number of chains equal to one, area / chain equals the area / molecule. It is not mandatory to define the film prior to an experiment, however, some parameters like area / chain and rate [Å/ chain min] are not defined. Avoid using space ( ) in the chemical name or abbreviations. This can lead to errors when loading previously saved data using space as a field separator.





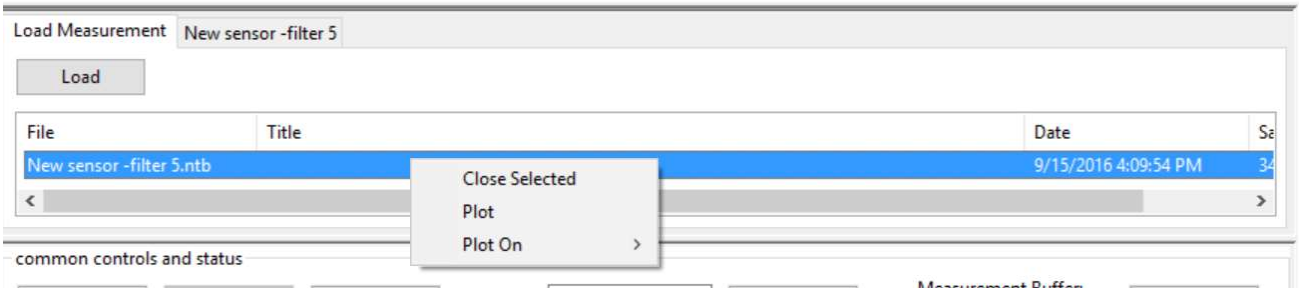


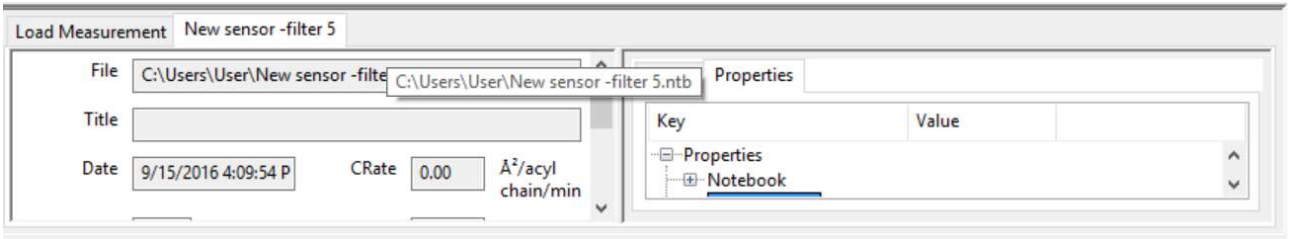
Display and loading measurement data

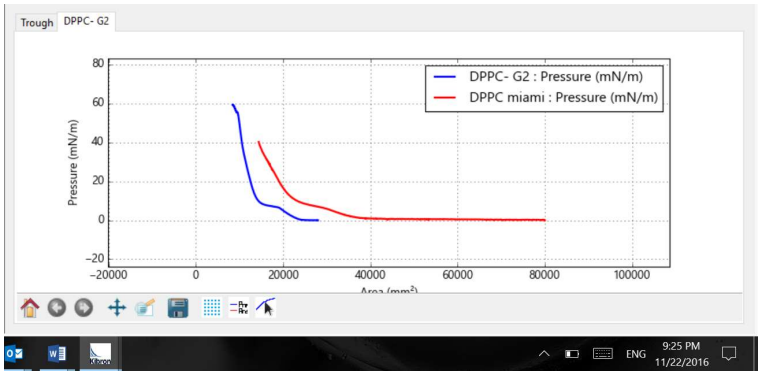


The graph for plotting ongoing and previously recorded data is found on the lower right side. The buttons below the graph are self-explanatory. The save button opens a dialogue to save the graph as a picture – notice that it does not save the measurement data! The legend can be toggled on/off by left clicking and rotated between all four corners by right clicking .

Double clicking the graph opens a dialog for setting axis data and ranges. You can also open the Plot Setup dialog from the View menu on the top.

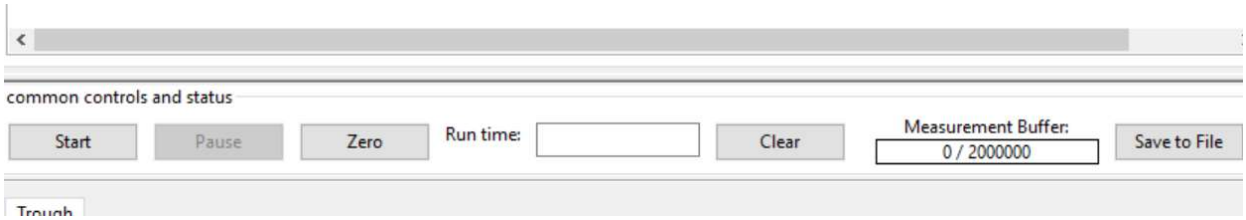






On the top right side you find a dialog to load and plot previous experiments. The Load button opens a file dialogues. Once loaded the data can be plotted by right clicking on the experiment. **Plot** opens a new tab in the graph, while **Plot on** allows you to select the tab to plot on (Overlays). Each opened Notebook file creates a new tab in the panel. These tabs contain experimental and notebook data corresponding to the experiment.

Control buttons for the experiment



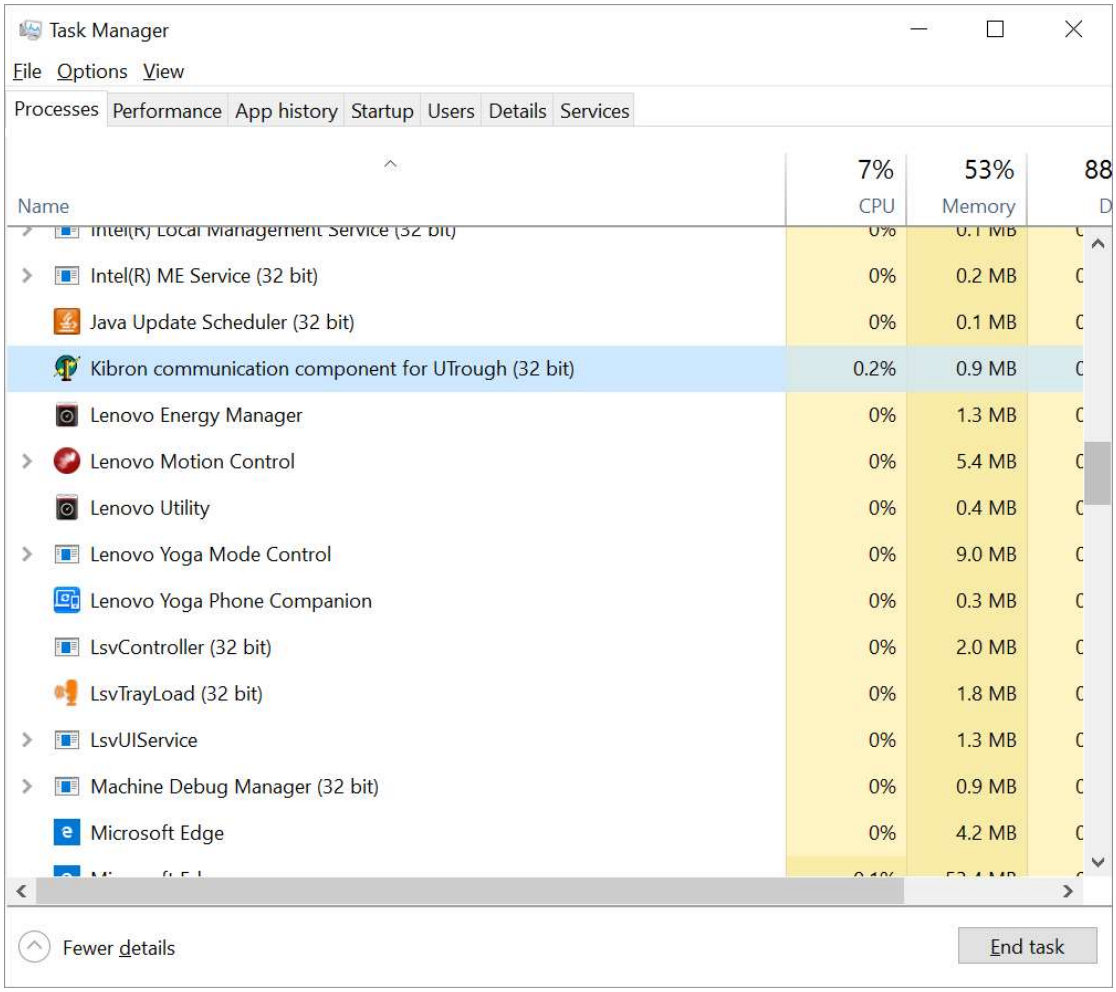
Between the two right hand panels you find a set of controls for your measurements. Clicking the **Start** button begins measuring with the selected method and parameters. The button automatically changes to **Stop** when the measurement is running. **Pause** / **Continue** pauses and continues the current experiment. **Zero** is a quick button to zero the surface pressure. ***It averages samples while the button is pressed.*** There is another Zero method, found on the Setup tab, which more rigorously collects data until a given tolerance has been achieved.

The **Run time** box shows the time elapsed from the beginning of an experiment. The **Clear** button empties measurement data buffer. The **Measurement Buffer** box shows the number of samples recorded and the maximum number of samples that can be recorded. We have set the buffer rather large (138 h at 0.25 s sample rate) and it should be sufficient for all imaginary experiments, but if you need more even more samples in your measurement, you can increase the buffer size as described in the **Specials** section. The **Save to file** button opens a dialog for saving your data, i.e. measurement buffer and notebook information in so called notebook files (.ntb).

Troubleshooting

Filmware does not start up

The most common problem in starting FilmWare occurs after the electronics unit has been shut down or disconnected before the software has been closed. This may lead to a situation where FilmWare cannot start or take control over the previous communication process, which is still running. If the FIlmware does not start open the Task Manger (Shift + Ctrl +Del). End the **Kibron communication component process** (KbnMTIO~.exe). Then end the FilmWareX 4.2 app.



Filmware runs but the communication is interupted

Some virus protection softwares with behavioral analysis modules may interpret the Kibron Communication component (KbnMTIO~.exe) as malicious. If this occurs the FilmWare directory needs to be safe listed in the virus protection software.

Separator in Notebook (.ntb) files

You can choose the separator used in the Notebook (.ntb) files from the Tools=> Notebook format… Notice that if you use space as a separator, loading of saved files fail if the chemical name or abbreviation contains space(s). It is good practice to use underscore (_) instead of space. The default separator is semicolon (;). The .ntb files are ascii based and can be read into most spreadsheet or text editors.

Other bugs and crashes

Please report crashes and bugs to Kibron along with a copy of FWX_40.log. This log contains information on the command sequence and responses from the last session.

Setting the Measurement Buffer size

If you need to set the measurement buffer size for very long measurements, open a command prompt window, go to the FilmWare directory. Then start the FilmWare with the command:

```
FilmWareX_40.exe -b <buffer-size>
```

The buffer setting is only valid for the started session, i.e. if you start FilmWare from the windows menu or desktop the original buffer size of 2 000 000 is restored.