A practical guide to operation of the Intra Touch

This simple guide will show you how to use the Intra touch from measurement to analysis.

Contents

1   Machine basics

The machine can measure a profile of up to 50 mm and with the stylus applied has a range of 1 mm (usually displayed as -0.5 mm to 0.5 mm. The machine will only perform 2D line profile measurements and works well on most surfaces. The measurements will be from left to right (in current set up) so that the piston moves into the body of the machine and the stylus dragged over the surface, rather than pushed which is more likely to damage the stylus.

Surfaces to avoid:
- Very rough surfaces (with standard 2 micron stylus)
- 3D printed surfaces (not all them, but unprocessed metal ones are porous and rough)
- Porous surfaces
- Anything with a large wear or corrosion hole/pit/feature

2   Common features

2.1   New Document (Ctrl+N)

Start a new document from either File>New document OR hot-keys CTRL + N.

Each new profile should be started new document.
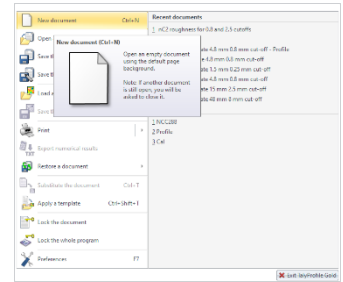
2.2   Open document (Ctrl+O)

To reprocess and existing profile either File>Open document OR hot-keys CTRL + O.

2.3   Save As

Save current profiles (first time, subsequently use CTRL+S). This is essential when using templates as they already have names. Save in your user directory.

EXPORTING the analysis as a document, there are three options (pdf, image and RTF). In most scenarios the RTF format is the best option as this can be opened in MS Word and the tables are treated as tables enable easy manipulation. The profiles and analysis frames are treated as images, but scalable vectors.
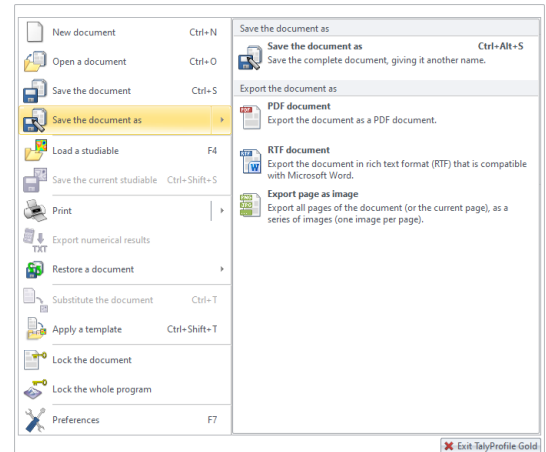
2.4   Export Profile (Ctrl+Shift+S)

To export the raw data you can do this from the File>Save a profile OR hot-keys CTRL + Shift + S. The best option for most compatible is the TXT option.

Note only the raw is export from the method data. Note you can save a processed profile by selecting that frame and right mouse click and select export.
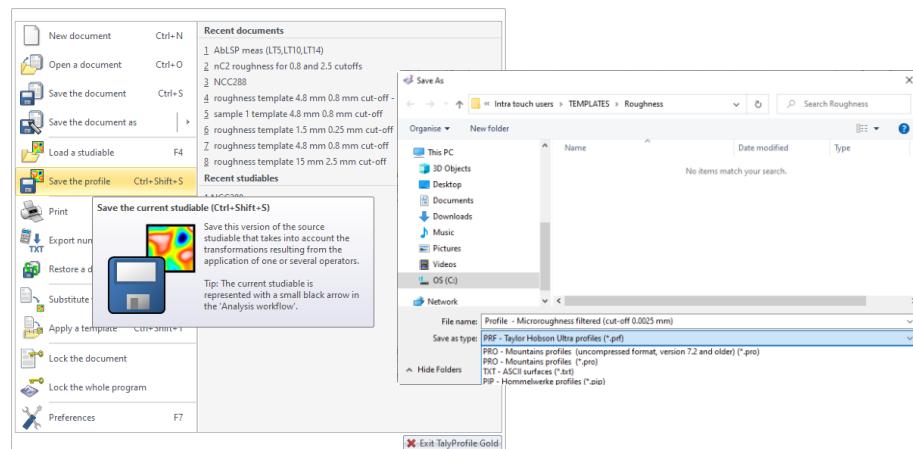
On active frame that has a move you can profile you zoom (both positive and negative) with the mouse wheel and move up and down, as well side to side with the cursor keys, sometimes this can be done accidentally and then the auto-scale ( ) button is really useful. This can be found in the ribbon and by right mouse click.

Also note any analysis done, no matter what frame it is on, will appear at the end of the document.

3   Measure a profile

3.1   Basics

From the Studiables tab select 'Measure a profile'.
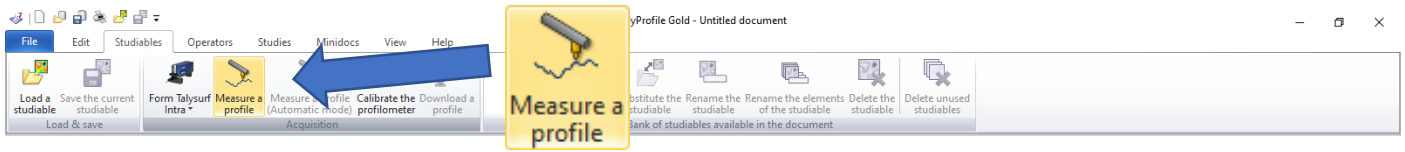
The figure below shows the measurement window and the usual steps to produce a profile prior to analysis. Step 1 – Alignment of stylus and sample ready for measurement; Step 2 – Contact and setting height position in gauge range; Step 3 – Set up measurement length; Step 4 – Measure and check; Step 5 – Post-processing (don't forget to check this); Step 6 – Accept and start analysis.
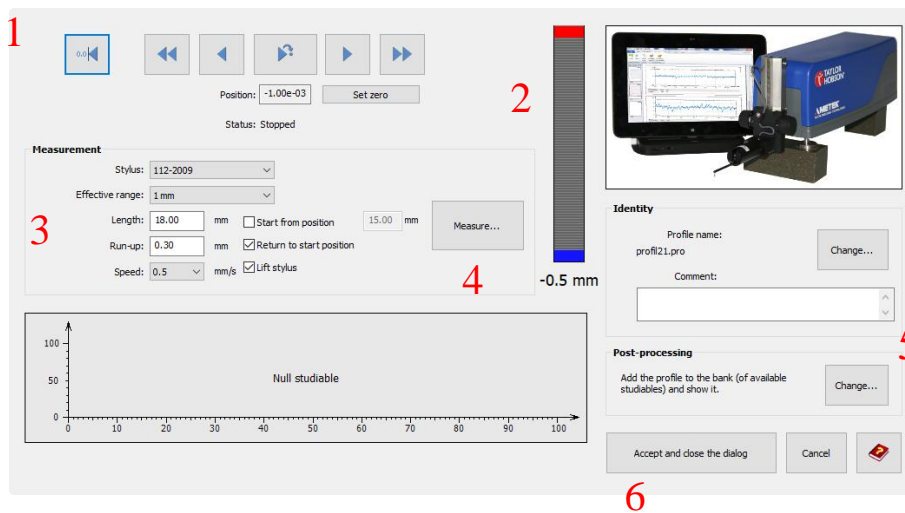
For more details of each step see next section.

3.1.1   Positioning of stylus start position

The start the position will depend on the type of measurement (roughness or wear, more details is shown in those sections), but in general use the positioning buttons fast right ▶▶ ; right ▶ ; fast left ◀◀ ; left ◀ ; home 0.0◀ and go to ↱ .   The home key will move the stylus to the maximum extension (far left) and you can set this to zero (if necessary). The go to button is useful for precise locating particular wear scar measurements.
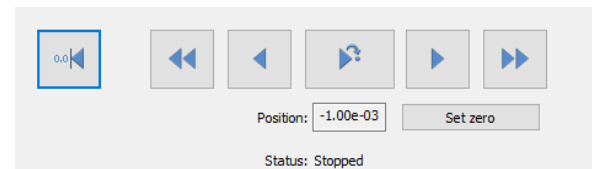
Note that you need to be aware of the lateral position of the machine or you may not be able to measure (if it is fully retracted – all the way to the right) or produce a much reduced profile length that required, i.e. it hits the end stop (fully retracted) and stops.

3.1.2 Contact and setting height position

Now move the stylus into contact with the surface, best to visually make contact initial, then use the gauge to adjust to the appropriate place, for flat sample this could be around 0 (bar goes from green to yellow at the very centre.

Note this is the start position so you need to consider if the stylus will go out of range as it traverses over the surface. It will carry on going is it comes out of as the surface falls away but will stop the machine if it reaches the red part to prevent damage. So be careful of sloped or curved surface.
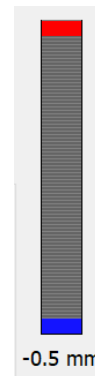
-0.5 mm

3.1.3 Set up measurement length

The measurement will be determined by the roughness or the size of the wear/feature, more details is shown in those sections. General enter the length, the standard run-up is 0.3 mm and speed 0.5 mm/s. In

most situations don't select "Start from position". Also for repeat (and parallel) measurement it is useful to select "Return to start position" and "Lift stylus".
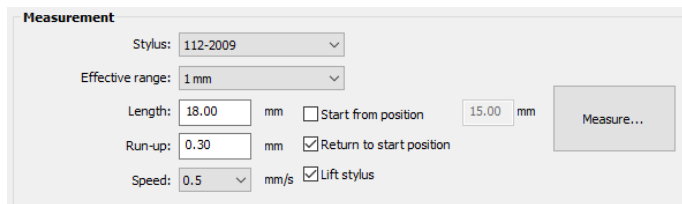
3.1.4 Measure

Once everything is setup it the Measure button. Note the screen will show a progress bar and only once a profile is measured will it appear in the preview window. Check that it is what is desired, no dust or measurement fallen of edge of sample.

3.1.5 Post-processing

After you are satisfied with the profile, check the current post-processing, it will be whatever was used last, thus if you don't want (the wrong) template applied it is worth checking.
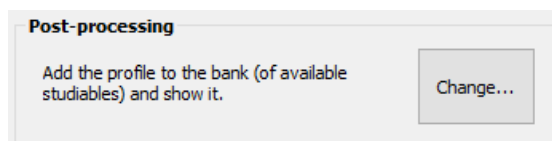
3.1.5.1 No post-processing

If you require no post-processing (i.e. a template) applied select "Load the profile in the bank", ensure show it on the document is also selected. The profile can also be levelled.
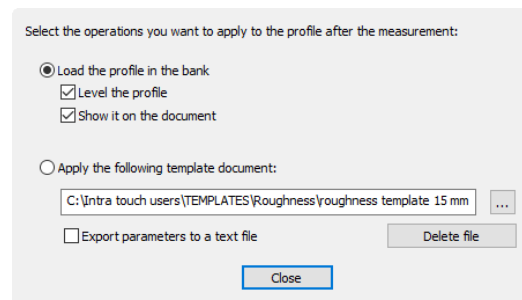
3.1.5.2 Applying a template

The can be applied by selecting "Apply the following template document:"

Select the appropriate template (if not the one shown) – templates are located in C:\Intra touch users\TEMPLATES. There are roughness and wear (maybe more in the future), see the relevant sections for more about these templates.

3.1.6 Accept and start analysis

Once you follow all the steps above and are happy click the "Accept and close dialog" button.
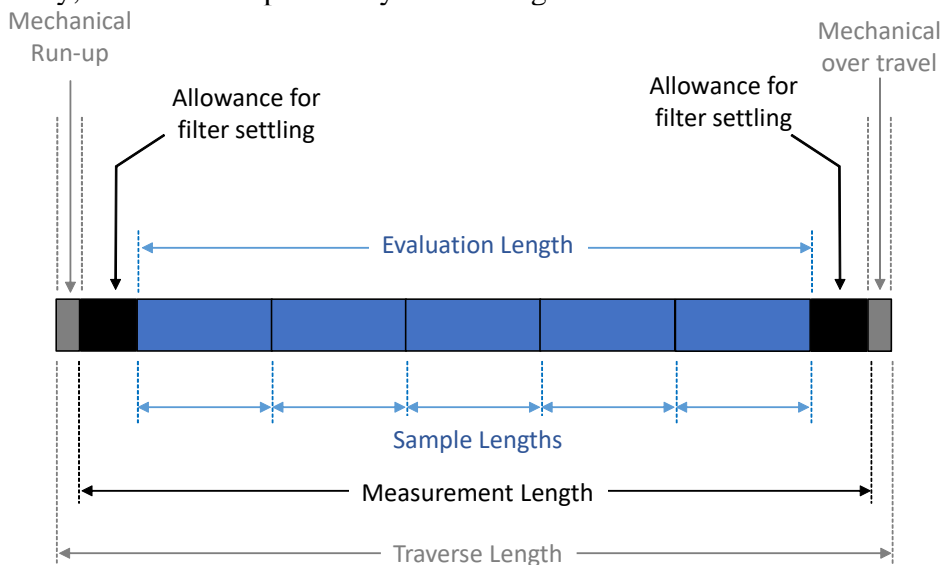
4   Roughness Analysis

4.1   Positioning and measurement length

The measurement length (and positioning) are very important when conducting roughness measurements. Unfortunately, you do need a rough idea of what range of roughness your surface is, use the table below as a guide. For the highest roughness you will need nearly the full lateral range and thus it will need to be fully extended to the left (⬛️) as the start position. Note measurements are quick and can be repeated in no time at all.

| Periodic Profiles	Non-periodic profiles		Cut-off	Maximum Stylus Tip radius	Evaluation Length	Total Length
Spacing Distance RSm (mm)	R_z (µm)	R_a (µm)	λc (mm)	R_{tip} (µm)	L_{eval} (mm)	L_{tot} (mm)
>0.013 to 0.04	To 0.1	To 0.02	0.08	2	0.4	0.48
>0.04 to 0.13	>0.1 to 0.5	>0.02 to 0.1	0.25	2	1.25	1.5
>0.13 to 0.4	>0.5 to 10	>0.1 to 2	0.8	2	4	4.8
>0.4 to 1.3	>10 to 50	>2 to 10	2.5	5	12.5	15
>1.3 to 4.0	>50	>10	8	10	40	48

Note the total length does not include the mechanical run-up, but does allow for filtering, which the software removes automatically, this is shown pictorially in the image below.


4.2   Measurement of roughness

This section will show the basics of measuring roughness without any post-process or subsequent analysis. However, roughness templates (see next section for details) have been set up to streamline this.

Ensure the profile (raw or levelled or area extracted, but not filtered) frame is selected, go to the Studies tab as shown to the right and select "Filtered profiles" to produce filtered profile.
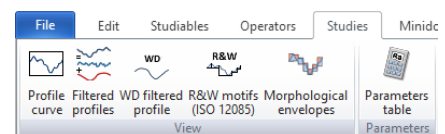
By default, the raw and waviness profiles are shown, but the tab will have automatically changed to the one shown below (and whenever a filtered profile frame is selected), deselect both Raw profile and Waviness profile and the roughness profile will be shown
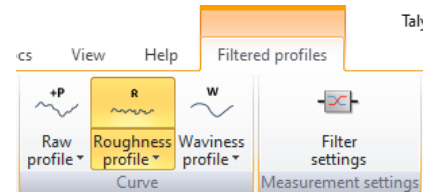
Note to get the roughness parameter (Ra, Rq, Rz, etc.) go back to the Studies tab and select "Parameter table". This will create a tabulated list of selected parameters, if you double click on the table it will show you the list and current filtering.

Note the default filter (cut-off) applied will be based on the measurement length and cannot exceed the required ISO standard cut-off, for example a cut-off of 0.8 mm requires a length of 4.8 mm or greater, if the length is shorter it (as well as higher cut-offs) cannot be selected. These default values will be shown on both the filtered profile and parameter table.

Check the Ra and Rz (for non-periodic) OR RSm (for periodic) values and they are within the ranges stated in the table below. If the values indicate the next (larger) cut-off is required a longer profile will need to be performed. However, if the previous (smaller) cut-off is required, both the filtered profile and parameter table can be altered to change the cut-off.

Periodic Profiles	Non-periodic profiles		Cut-off
Spacing Distance RSm (mm)	Rz (µm)	Ra (µm)	λc (mm)
>0.013 to 0.04	To 0.1	To 0.02	0.08
>0.04 to 0.13	>0.1 to 0.5	>0.02 to 0.1	0.25
>0.13 to 0.4	>0.5 to 10	>0.1 to 2	0.8
>0.4 to 1.3	>10 to 50	>2 to 10	2.5
>1.3 to 4.0	>50	>10	8

To change the cut-off first change the Parameter table by double left mouse clicking on it and change the cut-off until it the Ra and Rz (for non-periodic) OR RSm (for periodic) values match the ranges with cut-off in table above. Now use select the filtered profile frame and from the tab select "Filter settings" (this can also be achieved by right click on frame and selecting "Filter settings") change the cut-off to be the same as the Parameter table.

Note from the "Filtered profile" tab you can extract data from the roughness curve by clicking "Export roughness curve" .
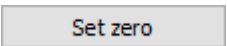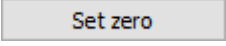
4.3 Roughness Templates

To streamline the process five roughness templates (located in C:\Intra touch users\TEMPLATES\roughness\) have been created and they align with the five cut-offs.

Template name	Periodic Profiles	Non-periodic profiles		Cut-offs
	Spacing Distance RSm (mm)	Rz (µm)	Ra (µm)	λc (mm)
roughness template 0.48 mm 0.08 mm cut-off	>0.013 to 0.04	To 0.1	To 0.02	0.08
roughness template 1.5 mm 0.25 mm cut-off	>0.04 to 0.13	>0.1 to 0.5	>0.02 to 0.1	0.25, 0.08
roughness template 8 mm 0.8 mm cut-off	>0.13 to 0.4	>0.5 to 10	>0.1 to 2	0.8, 0.25, 0.08
roughness template 15 mm 2.5 mm cut-off	>0.4 to 1.3	>10 to 50	>2 to 10	2.5, 0.8, 0.25, 0.08
roughness template 48 mm 8 mm cut-off	>1.3 to 4.0	>50	>10	8, 2.5, 0.8, 0.25, 0.08

Note the template can be used with length of equal or greater than the first number in the name and this will apply analysis to this and any cut-off lower than the second number in the name. Each analysis/cut-off is shown on a different page.

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5   Wear Analysis

5.1   Positioning and measurement length

The measurement length and positioning are very important when conducting wear measurements. With the stylus not in contact with the surface the best practice is to work from the middle of the lateral range, this can be achieved by going to the home [⌂] , now hit the [Set zero] then [↱] and type 25 (mm) and go. Once in middle align the sample under the stylus, use the right [▶] and left [◀] for fine adjust. Once position hit [Set zero] again. Now consider the total length and divide it in half (before and after the middle of the feature). Add on the run-up (0.3 mm) to half and make it negative. Hit [↱] and enter the negative value and go to this position (an example is shown below). You are now at the start position, make contact as usually and run measurement.

Example: total measurement length is 2 mm, thus 1 mm either side and to get to the start position need to go -1.3 mm.

5.2   Extract Area [Extract area]

No matter how careful you are at estimating the measurement length or middle of the feature you may need to centralise of reduce the length and this can be achieved with extract area feature, which can be found in the 'Operators' tab select 'Extract Area'. You can use the left and right limits around or use numerical values on the left input for precision alignment or total length for processing.

5.3   Analysis of wear

There are a number of analysis techniques to determine various aspects of your wear scar, but each method uses region selectors and the regions can be adjusted. If you hoover the mouse over the region the move symbol (orange circle and two triangles) appear – drag the region where appropriate. The left and right limit can also be move, over either and extend/reduce the width of the region.
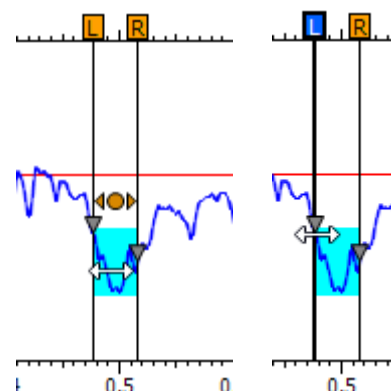
5.3.1   Width of wear track (measure distance) [Distance measurement]

From the Studies tab select "Distance measurement", this will create a new frame.
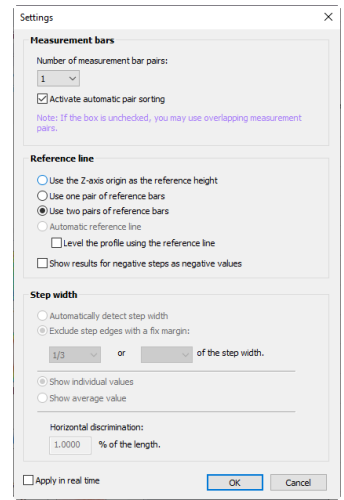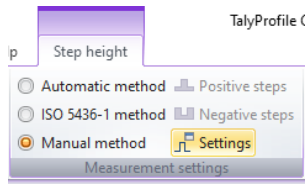
Adjust the left and right hand selector, note that multiple measurements can be made by changed the sets of cursors (two shown in below example).


Parameters	Unit	0-1	2-3
Horizontal distance	mm	0.4013	0.3058
Height difference	µm	0.0894	-0.4594
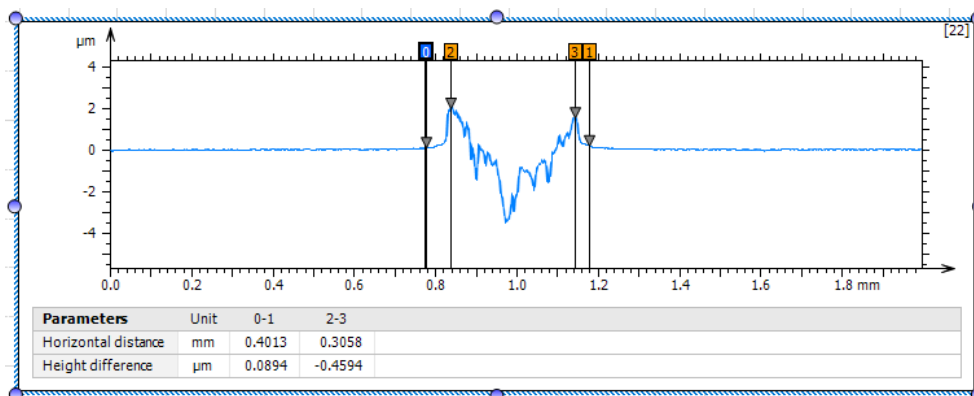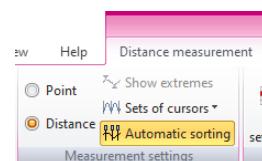
5.3.2 Depth of feature (Step height)

To measure the depth of a feature, use the "Step height" in Studies tab, this will create a new frame.

By default the Z-axis is used as a reference height, but as this is the average of the whole profile it may not yield the best results, go the Step height tab and select manual setting and change the reference line to "Use two pairs of reference bars". Adjust the position of the reference bars/regions (on the unworn surface) and the step height bit (middle region) to be the region of interest (near maximum depth of the wear scar)
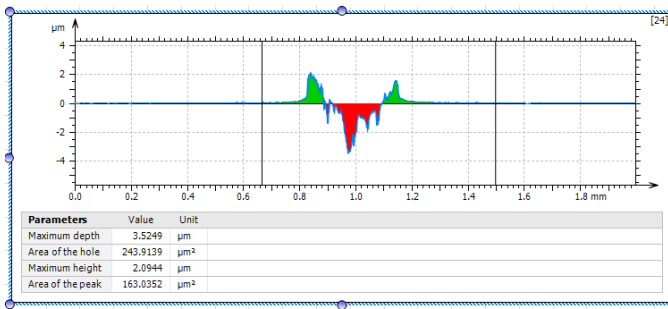
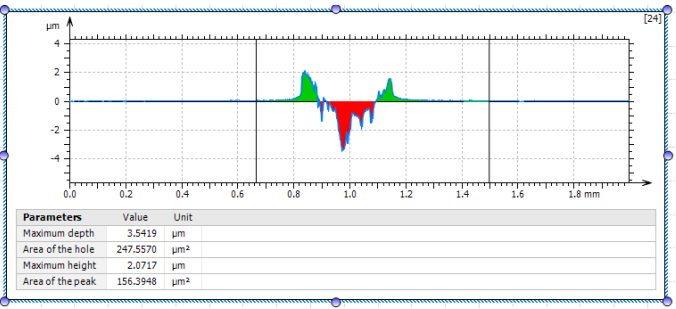| Parameters	Step 1	Unit
Width	0.4717	mm
Maximum height	3.5266	µm
Mean height	0.1917	µm
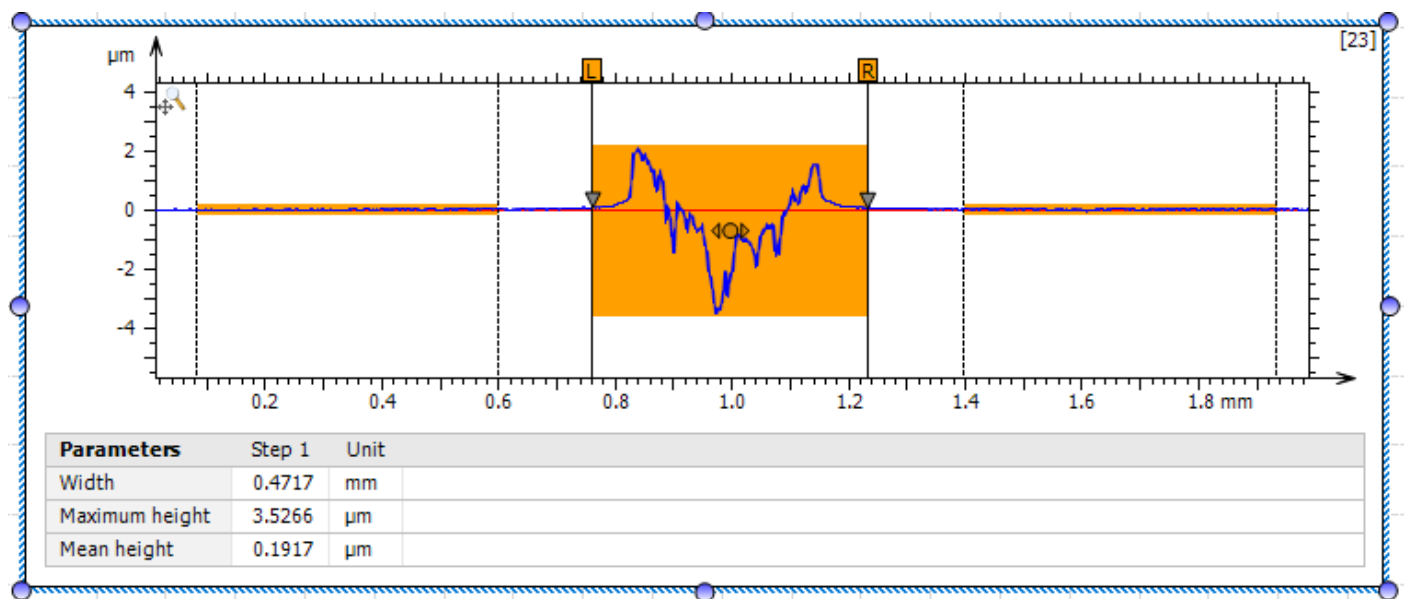
5.3.3 Cross-sectional area (Area of a hole)

To determine the cross-sectional area, use the "Area of a hole" in Studies tab, this will create a new frame.

Note form can cause issues with this analysis, but basically adjust the right and left limits and the parts below the plane are shown in red fill (material removal for wear) and above the plane are shown in green (plastic deformation for wear). You can try the others, but the default (under the mean line) and maybe 'Between the bars' will likely be the correct choice.

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Parameters	Value	Unit
Maximum depth	3.5249	μm
Area of the hole	243.9139	μm²
Maximum height	2.0944	μm
Area of the peak	163.0352	μm²

Parameters	Value	Unit
Maximum depth	3.5419	μm
Area of the hole	247.5570	μm²
Maximum height	2.0717	μm
Area of the peak	156.3948	μm²
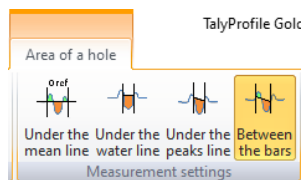
(under the mean line)   (between the bars)

5.4 Post processing

Currently there is two templates (located in C:\Intra touch users\TEMPLATES\wear\) one is fully automated and will generate all the above, you just have to move the measurement/analysis regions around. The second is much more basic and design if the extract area feature is need and then the user will need to manually add the analysis features previously shown after the extracted area is set.

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6   Calibration of system

Calibration is **only for superusers** and is only performed if the stylus is removed (and another used), but also to check that the system is working fine.

Move the stylus to central position (see later for how to do this) and move the stylus to its maximum height; careful place the calibration ball on the Y-stage (ideally with the Y-stage in middle position), align visually so that the stylus is approximately over centre of the ball.
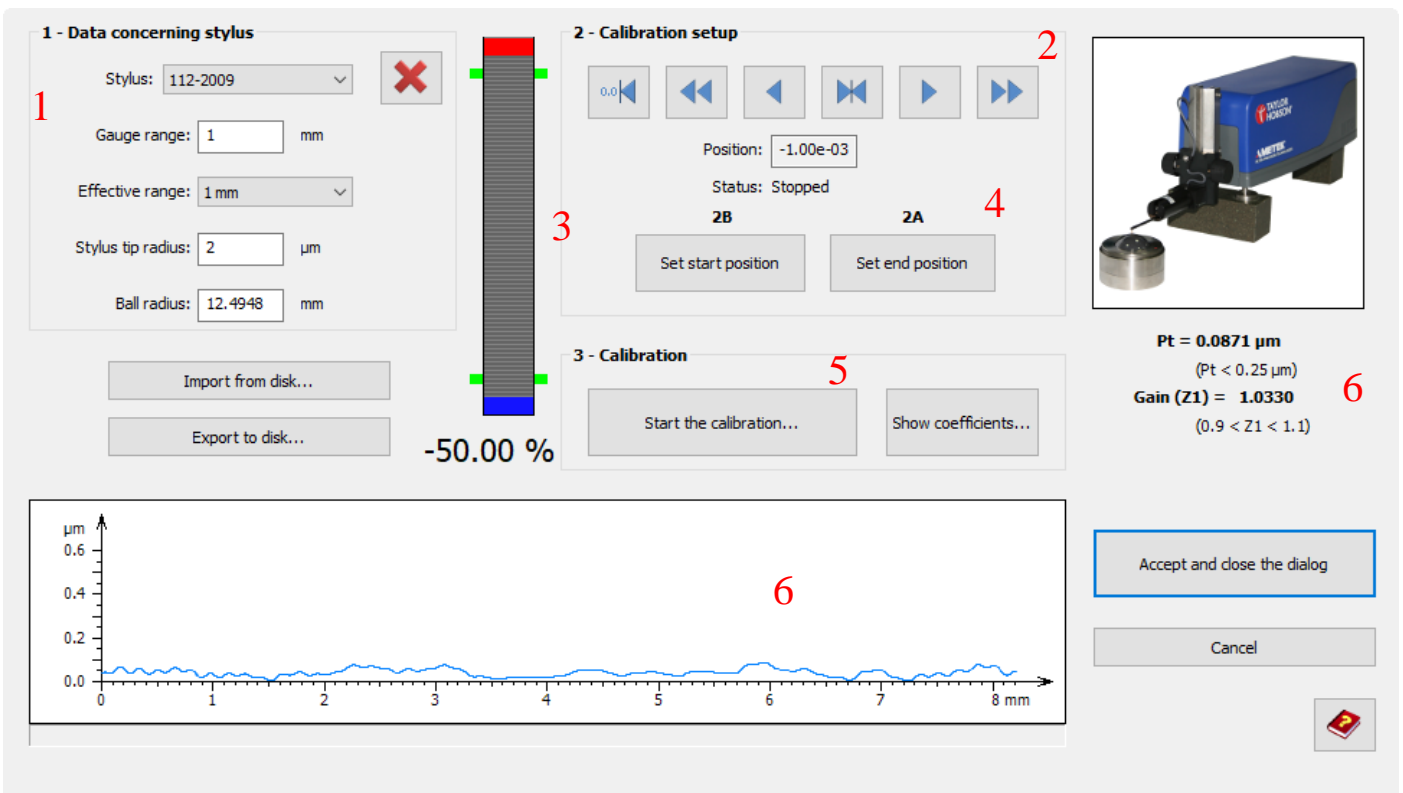
From the Studiables tab select 'Calibrate the profilometer'.
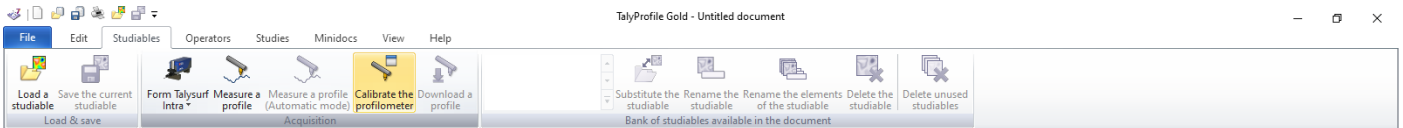
The password is "my surface is rough".
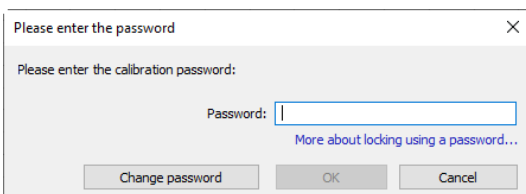
Note the calibration window is slightly different from the measure window.

The figure above shows the measurement window and the usual steps to produce a profile prior to analysis.

Step 1 – Check that the stylus is correct, the new one has its number on the side; the details should be the same as those shown above.

Step 2 – Set to middle of travel
The best option for calibration is to set the top of the ball to be near the middle of the lateral transverse range (25mm), in calibration window this is easily by pressing the [⬚] button
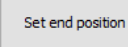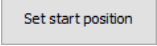
Step 3 – Contact and setting height position in gauge range
Now make contact (visually as usual) and then adjust to around 80-90%, this allows for not hitting the very top on the initial contact. Somewhere around the red arrow shown on the right.
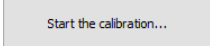
Now move the Y-axis micrometer until the maxima is found in that direction.
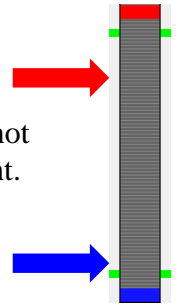
Step 4 – Set up calibration limits
Move the stylus to right with [▶▶] and use [▶] until the gauge is around where the blue arrow then press [Set end position] , now move left with [◀◀] and then use [◀] until the gauge is around where the blue arrow again, press the [Set start position] .

Step 5 – Start Calibration
Press the [Start the calibration…] button and as the same for measuring a profile the screen will just show a progress bar, but it is also worth watching the stylus as it does the calibration, at least that it moves.

Step 6 – check the graph and it should be really smooth and flat, dust may cause error; check that the Pt and Gain (Z1) are in acceptable range, note an error will show if they are outside.

Note is the gain is out by a factor 2 it maybe that the wrong (longer/shorter) stylus is selected.

Step 7 – Accept calibration, if you have achieved an acceptable calibration.

If the machine will not calibrate contact the facility manager.

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