



# Lab Manual

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## ***Tensiometer (KSV Sigma 701)***

**(tensiometer)**

### **1.0 Title**

Tensiometer (KSV Sigma 701)

### **2.0 Purpose**

The tensiometer measures the force on a sample being pulled through a fluid/fluid interface. This can be used to measure surface or interfacial tension. This information is commonly used to calculate a dynamic contact angle.

### **3.0 Scope**

There are two parts to the tensiometer. The measuring unit consists of a white plastic lifting stage and a balance connected a small wire hook for hanging samples. The lifting stage velocity can be set from 0.1 to 40 mm/min with a 75 mm total range of motion. The balance has a resolution of 1 uN, which practically translates to a minimum surface tension resolution of 0.01 mN/m. The second part of the tensiometer is the interface unit and is a silver box with a numeric LED display and the power switch.

The tensiometer is controlled via a computer running the Windows operating system. The control software is integrated with a database, which stores all measured results to the hard drive. This database does not get backed-up and can be modified or deleted by anyone, so it is recommended that you make a copy of your data after every use. This computer is also shared with the Kruss goniometer.

The tensiometer in the Microlab has the optional dynamic contact angle measurement software package.

### **4.0 Applicable Documents**

[Revision History](#)

### **5.0 Definitions & Process Terminology**

### **6.0 Safety**

### **7.0 Statistical/Process Data**

### **8.0 Available Process, Gases, Process Notes**

### **9.0 Equipment Operation**

#### **Operating Procedure for Measuring Contact Angle of a Liquid Solid Interface**

- 9.1 Enable tensiometer and switch on the interface unit.
- 9.2 Double-click on the icon labeled tensiometer on the Windows desktop.
- 9.3 Click on the **Experiment** menu and then **Surface Tension Measurement** in the window that pops up and then **OK**.
- 9.4 From the menus of the new window, select **File|New Experiment**.

If this is your first time using the tensiometer, click the **Edit Database** button. Select the **Users** tab. Click the **+** button. Type your Microlab userid on the blank line at the bottom of the list. Click **OK**.

- 9.5 Fill the experiment setup form as follows:
- Name:** a user defined string to identify the experiment
  - User:** your Microlab userid
  - Probe Name:** Wilhelmy
  - Heavy Phase Name:** Water
- Click **Start** (not all fields are required to be filled in).
- 9.6 Fill in the dipping form as follows:
- Speed up:** 20 mm/min
  - Speed down:** 20 mm/min
  - Wetting depth:** 6 mm
  - Min no. points:** 1
  - Min measurement time:** 1
  - Zero when wet:** checked
- Do **NOT** click **START** yet.
- 9.7 Click the **Probe Up** button and wait for the stage to move to the lowest position. Fill the dipping dish about half full with DI water and place on the lifting stage. Take the standard Pt plate, and hang it on the balance hook. Do not touch the flat part of the plate -- only handle by the neck of the probe.
- Click the **Probe Down** button. When the probe gets within a few mm of the water hit **Stop**. Click **Start**.
- 9.8 In about 2 minutes a surface tension for the water will appear. If this value is not between 69-75 mN/m, then some part of the setup is probably dirty and your results may be misleading.
- From the menu select **File|Exit**.
- 9.9 Click on the **Experiment** menu. Select **Contact Angle Measurement** and click **OK**. Click **File|New Experiment** on the menu of the new window.
- 9.10 Fill the experiment setup form as follows:
- Name:** a user defined string to identify the experiment
  - User:** your Microlab userid
  - Probe name:** Custom Plate
  - Probe width:** the width of your sample
  - Probe thickness:** the thickness of your sample
  - Liquid Name:** Water (the previously measured surface tension value should have automatically appeared in the light blue text box)
- Click Start (not all fields are required to be filled in).

9.11 Fill in the dipping form as follows:

**Speed up:** 5 mm/min

**Speed down:** 5 mm/min

**Start depth:** 2 mm

**Immersion depth:** 10 mm

**Ignore First:** 0mm

**No of Cycles:** 3

**Auto Zero:** checked

Do **NOT** click start yet.

Eventually you should tailor these numbers to your sample.

See the manufacture's manual for more information.

9.12 Remove the standard Pt probe and load your sample as the probe was loaded in step 9.7. The Pt probe should be completely dried by blowing N<sub>2</sub> over it before it is put back in its yellow box.

9.13 After each half cycle is completed a value will appear under Advancing or Receding, under the theta symbol. This is the advancing or receding contact angle in degrees.

9.14 Once measurements are completed, the shutdown procedure is as follows:

9.14.1 Remove your sample.

9.14.2 Empty and rinse the dipping vessel several times with DI water. Leave it upside down on a paper towel to dry.

9.14.3 Exit the tensiometer control program.

9.14.4 Turn off interface unit.

9.14.5 Disable tensiometer.

\*\* If you wish to use the tensiometer for something other than a surface tension or contact angle measurement, please discuss it with a superuser before proceeding.

**Note:** The most common reason for getting bad data from this tool is contamination. Keep the dipping vessel and standard Pt probe clean. If you need to use a liquid besides DI water, provide your own dipping vessel.