



## Manual

# Low Shear Viscometer LS 300

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# Manual Low Shear Viscometer LS 300

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## 1. Introduction

### 1.1. *Measuring system*

The Low Shear 300 is a rotational rheometer based on the Couette principle (measurement bob in a rotating cup). It is particularly suited for rheological measurements on biological substances (biorheology, haemorheology) and fluids of very low viscosity, f. e. fluids based on water or alcohol.

The highly sensitive torque measuring system ensures rapid response to changes in the torque value. It is, therefore, possible to observe the elastic behavior of such substances by the determination of relaxation curves. The software LS 300 controls the LS 300, so an optimum combination of the measuring program to test substances can be obtained. The results are plotted and the ...

### 1.2. *Principle of Operation*

The temperature-regulated, interchangeable measuring cup is driven by a speed-controlled motor incorporated in the measuring head. The speed is controlled by software and continuously variable programmed in the range  $\sim 10^2$  to  $10^{-2}$  rpm.

The measuring cup of the coaxial measuring system, rotating at accurately defined speeds, exerts a torque on the measuring bob through the test substance. The interchangeable measuring bob is attached to a tilting system on which is fixed a multi-pole magnet arrangement and mirror. The complete tilting system is suspended on a torsion wire.

An arrangement of electromagnetic coils, concentric to the pivoted magnet system, is rigidly mounted within the measuring head.

Using a photo-electric system, the angular position of the bob is monitored by the mirror. When the pivoting system undergoes a deflection caused by a torque exerted on the bob, a regulating current is produced by the photo-electric system in conjunction with the compensation amplifier.

This regulating current passes through the electromagnetic coils, and produces an electromagnetic torque on the multipole magnet which is in equilibrium with the mechanical moment. This regulating current is proportional to the torque prevailing on the bob and thus also to the torque prevailing at the bob and thus also to the shear stress.

## 2. Setting up the instrument

Avoid vibrating the measuring head (1) (floor, building). Also avoid air currents. Place the measuring head on weighting table and the control unit, PC etc. on a separate table.

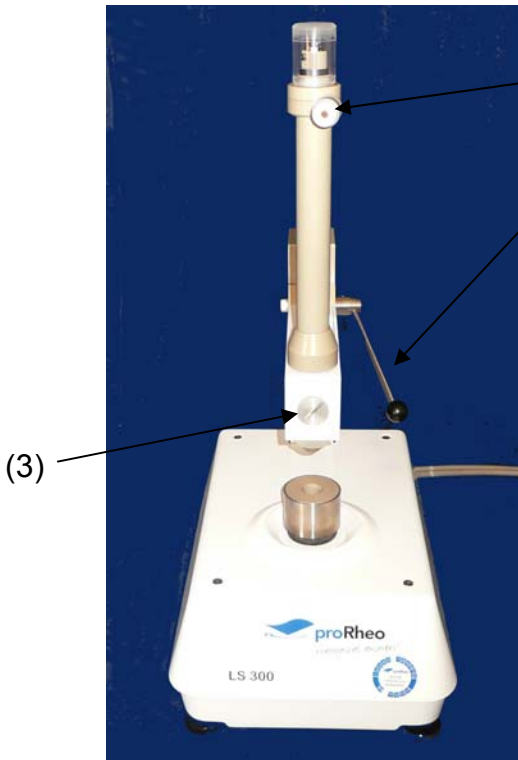


(1) Measuring head



(2) Control unit

### 2.1. Description of measuring head



Front



Rear

- (3) Sight hole (keep closed)
- (4) Zero point setting
- (5) Lever for lowering measuring bob
- (6) Measuring cables
- (7) Water connection for circulation thermostat

## 2.2. Description of control device



Front

Rear

(8)

- (8) Main Switch
- (9) K1 Connect to USB-Port of PC
- (10) K2 Connect to PC
- (11) K3 and K4 Connect to measuring head

## 2.3. PC



## 2.4. Procedure

- Connect circulation thermostat to water connections
- Fill measuring cup with water and check temperature with a thermometer. Then adjust.
- Insert measuring cables into control unit (K3 and K4)

- Connect control unit and PC (K1 and K2)
- Connect mains

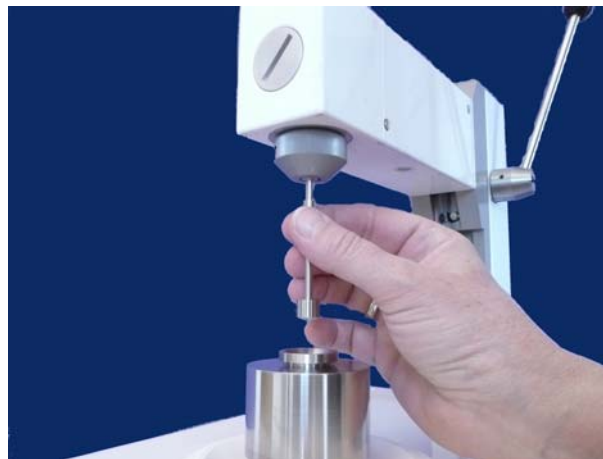
### 3. Starting operation

It is recommended to start with measuring system no. 1-1

1. Raise lever to upper position.
2. Insert the empty, thoroughly cleaned measuring cup. Even the smallest particles can give rise to disturbances.



3. Insert the thoroughly cleaned measuring bob.



4. Slowly lower lever as far as limit stop. The measuring bob descends into the measuring cup.

#### 3.1. *Leveling*

The black feet on the left and right of the measuring head are rotated to adjust the vertical position of the measuring axis and suspension wire.

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The measuring bob must hang concentrically in the measuring cup. The measuring bob suspended in the cup can be regarded as a spirit level. Left side of measuring head is too low.



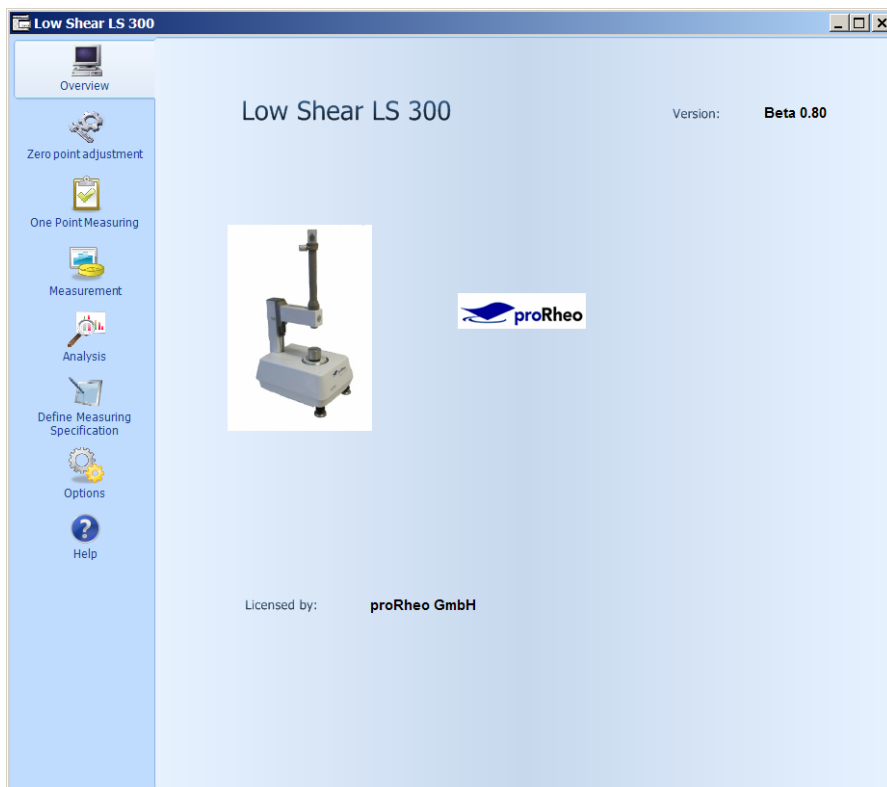
Rotate the left foot to the left.

Correct:



### 3.2. Starting Software LS 300

When the software is started, you will see the following window:

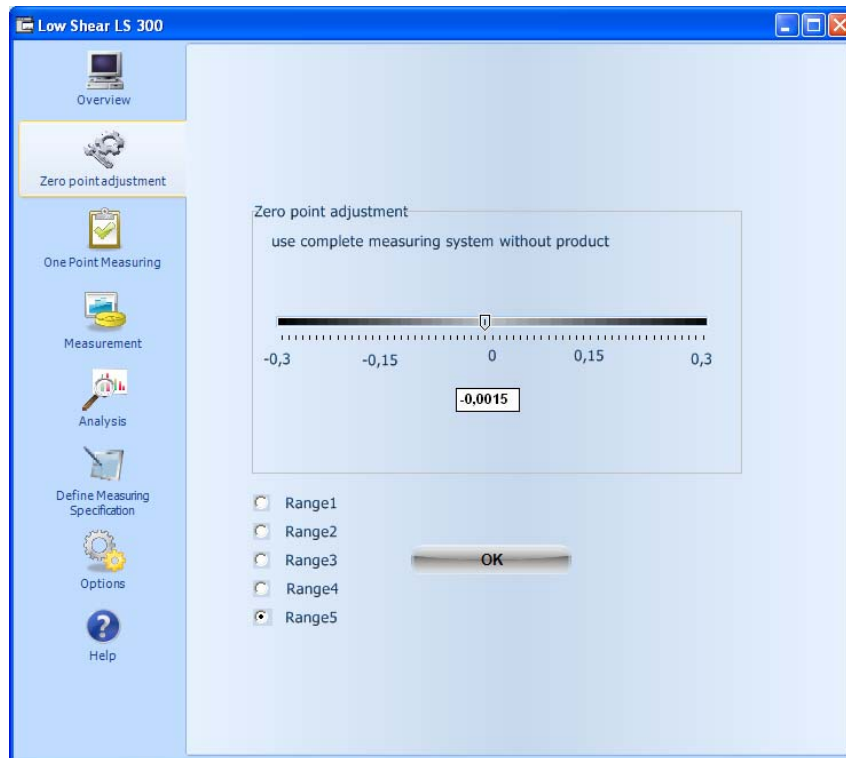


On the left hand side you see several functions:

- Zero Point adjustment
- One Point measurement
- Measurement
- Analysis
- Define Measuring Specification
- Options

### 3.3. Zero point adjustment

When substances are measured zero point setting must be done with the measuring system empty. After pouring the substance the zero point must remain unchanged.



Always start on the highest Range (normally 5).



- Turn knob (LS 300 measuring head) until display shows reading less than  $\pm 0,03$ .
- Set Range 4
- Turn knob, if necessary, until reading is less than  $\pm 0,03$ .
- Repeat this for Range 3, 2 and 1.

When finished, press ok-button. Please wait and do not touch the LS 300 measuring head or the measuring system. The zero point will be adjusted by software.

When adjusting is finished, please confirm and the zero point will be stored.

## 4. Measurements

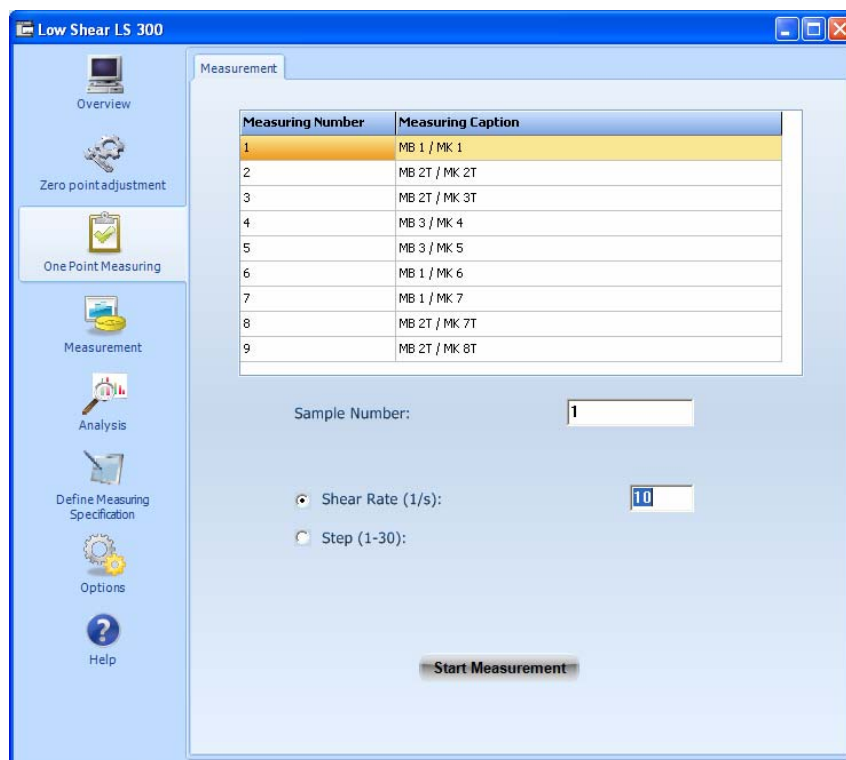
### 4.1. *Filling the measuring system*

Allow time for bob to center, help a bit by hand if necessary.

Look out for air bubbles!

Prick air bubbles open with a needle and squeeze them out.

### 4.2. *Single Point measurement*

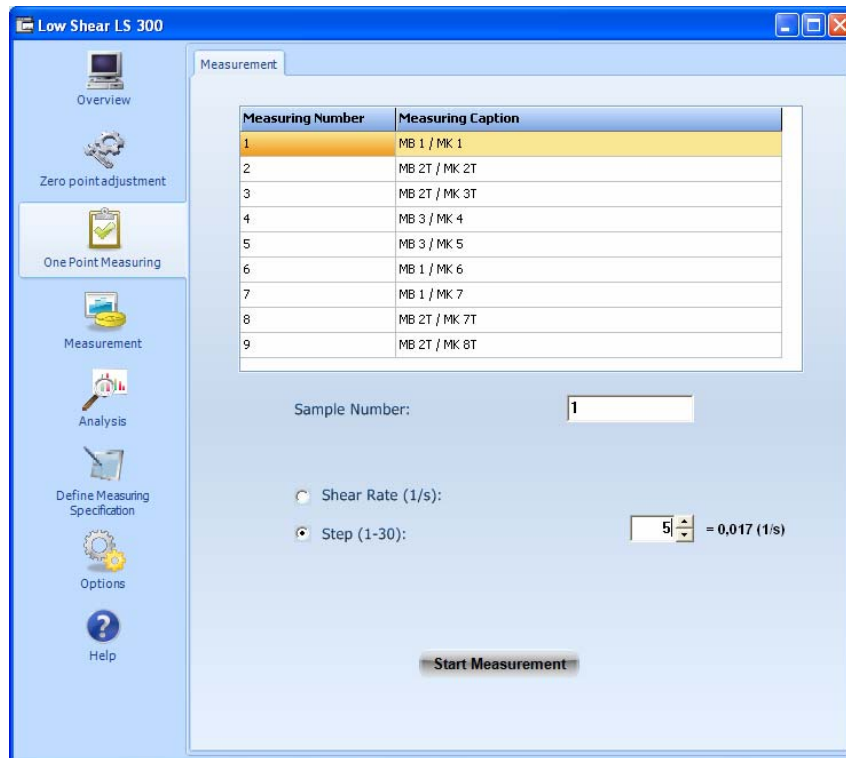


Choose the measuring system you are using. On every measuring bob and cup you find a small number (f.e. 1 or 3T). The number of the measuring system is MB 'number of cup' / MK 'number of bob'

As sample number you can use a specification of the substance, f. e. 'no.25-300 test' Choose a shear rate. Alternatively you can choose a step between 1 and 30. These are the steps the old LS 30 worked with.

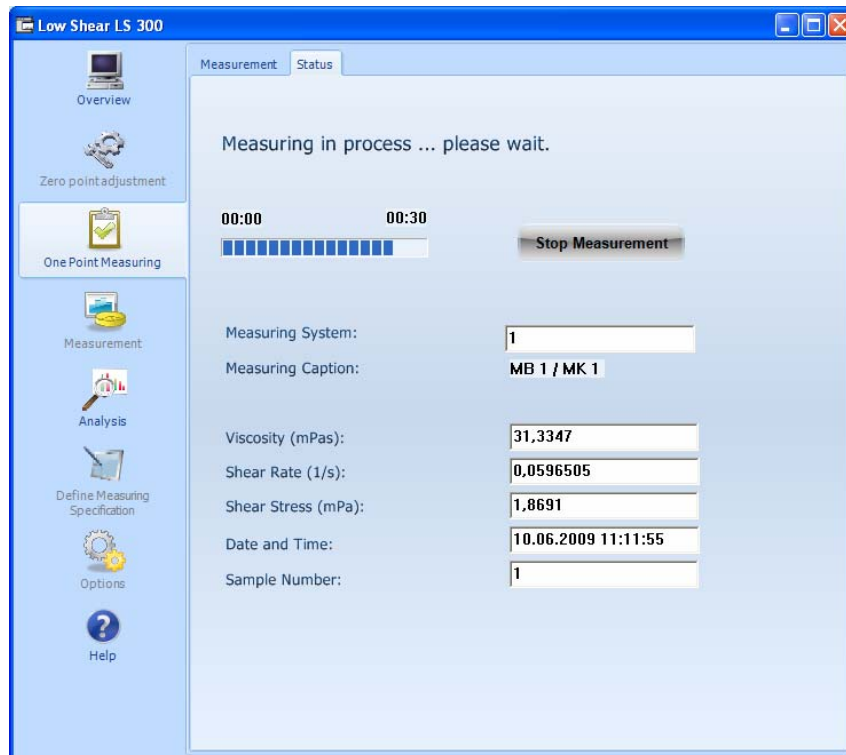
The shear rate is shown on the right side.

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Then click 'Start Measurement' button.

While the measurement is done, please do not touch the LS 300 measuring head.

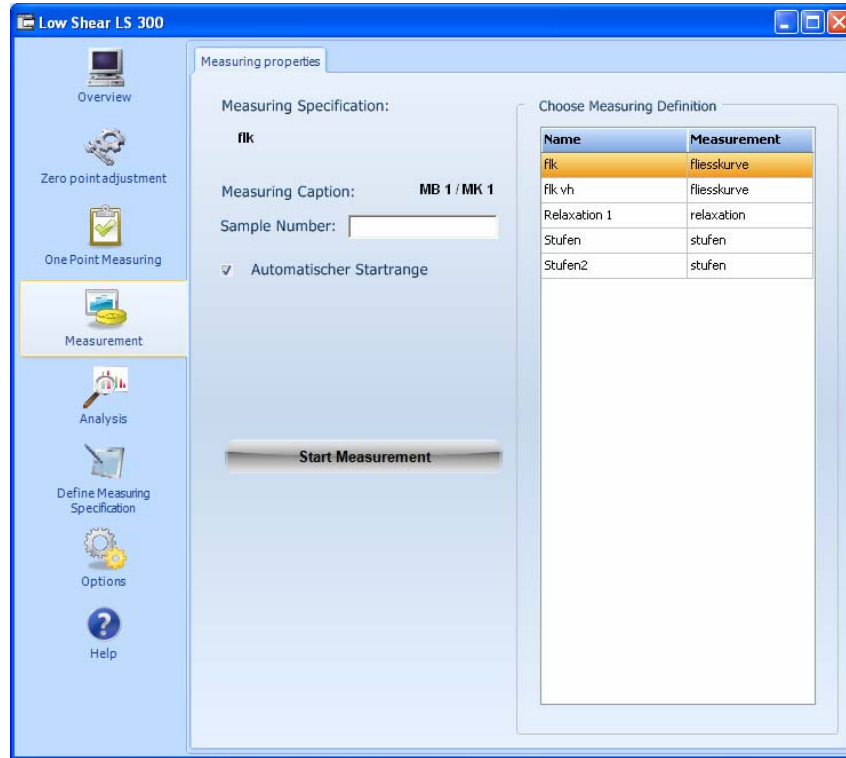


While the measurement is done, please observe if the measuring data is stable. If not, you can change measuring time. See 'Options'

When measurement is finished, all data is relevant data shown in this window. You can print it out, but it is not stored.

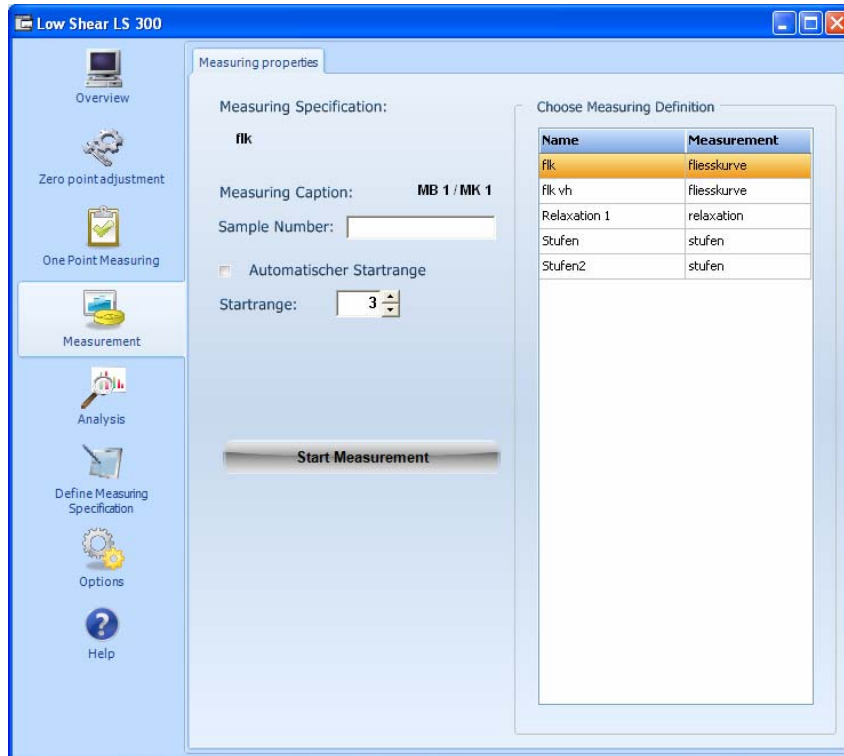
If you want to store data, you have to choose the function 'Measurement'.

### 4.3. Measurement



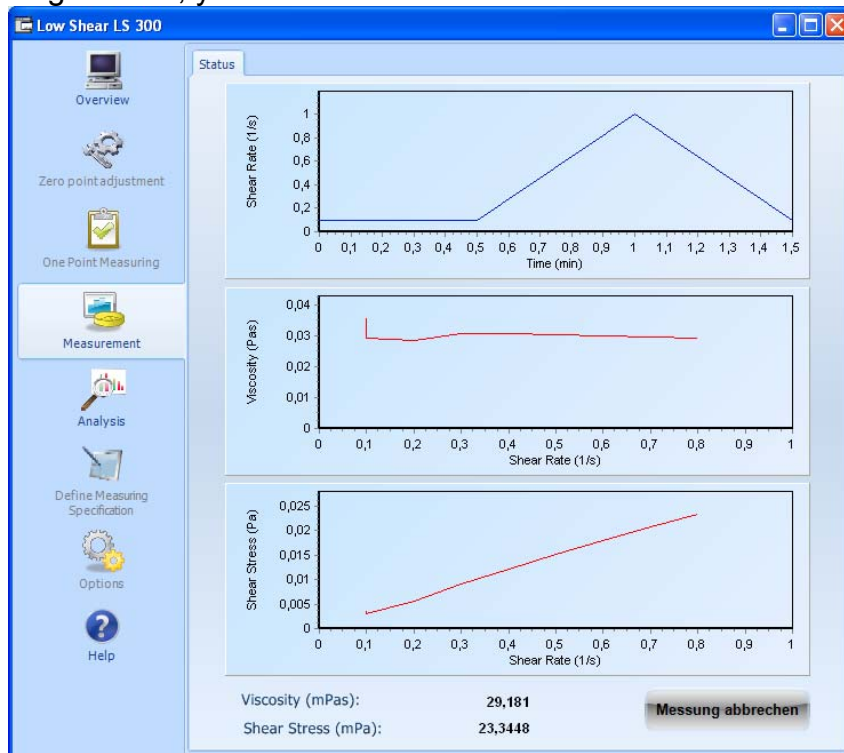
Choose a Measuring Definition in the list on the right side.  
If you want to measure in a special range, you can select this range.

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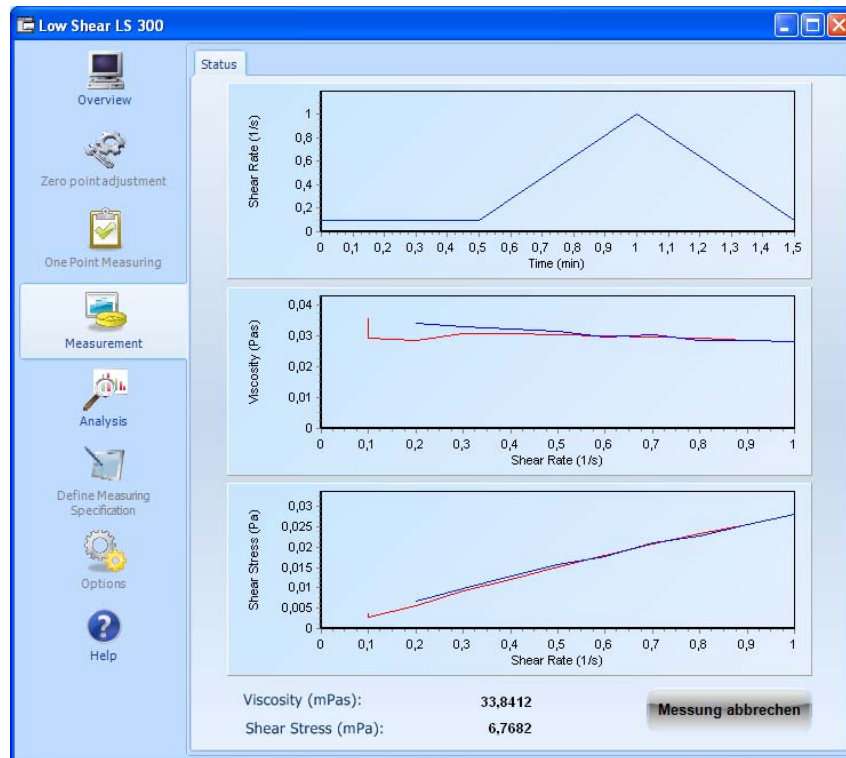


Input sample number (optional) and click 'Start Measurement'.

While measuring is done, you see the data in this window.



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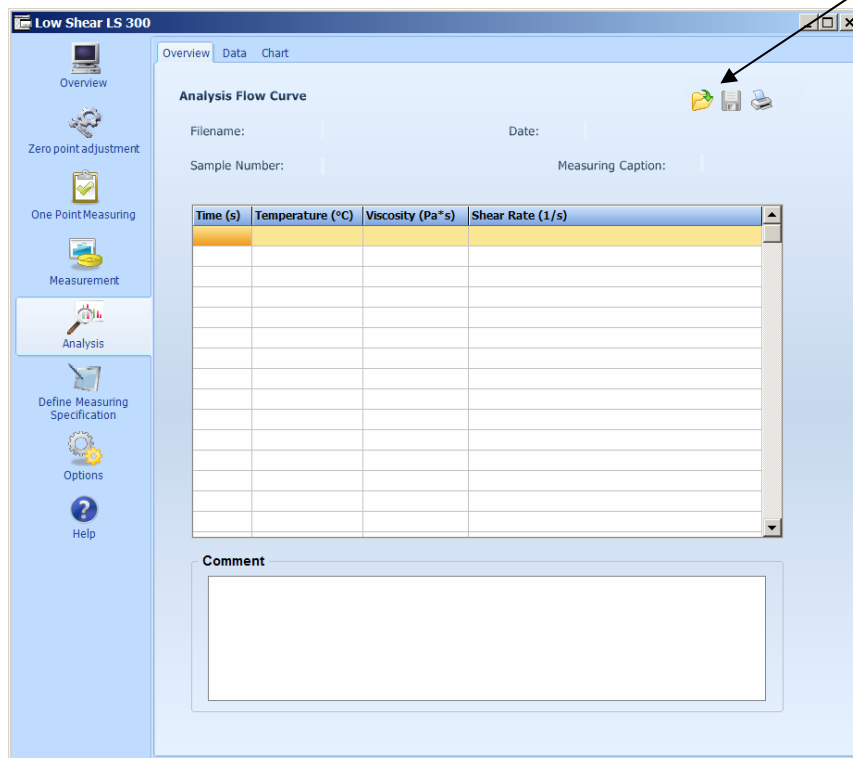


When measurement is finished you can store the data.

## 5. Analysis

For analysing stored data, select 'Analysis':

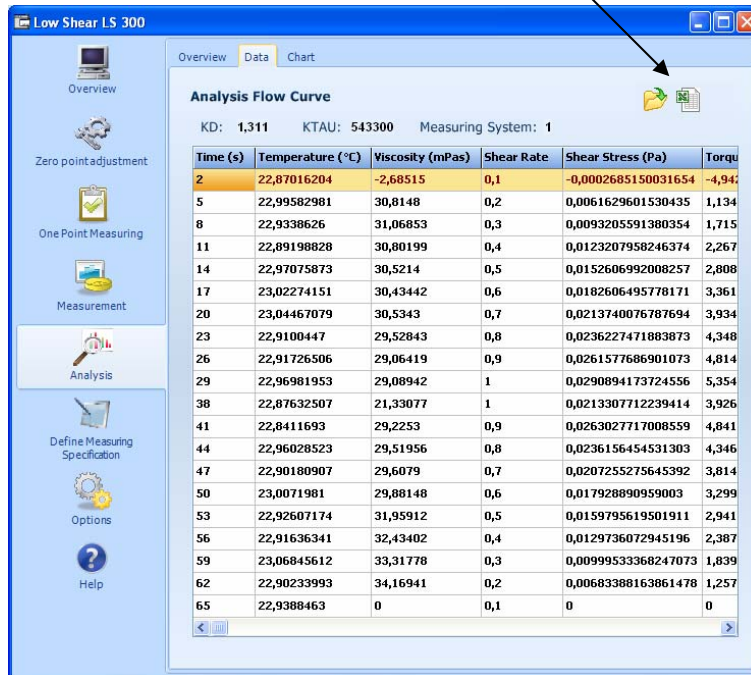
click to open File



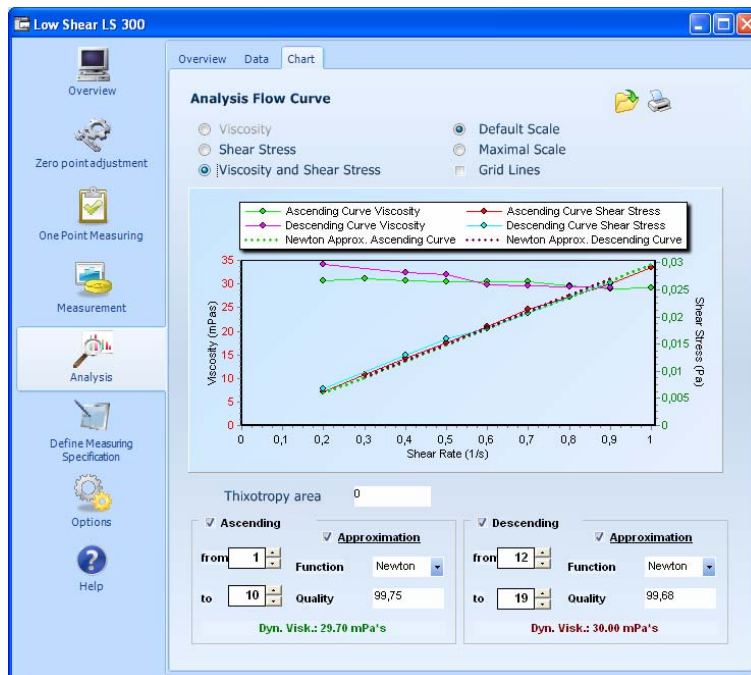
You see the measured data. You may give a comment or select 'Data' or 'Chart'.

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In the Data-Window you can export the data to an Excel-file.



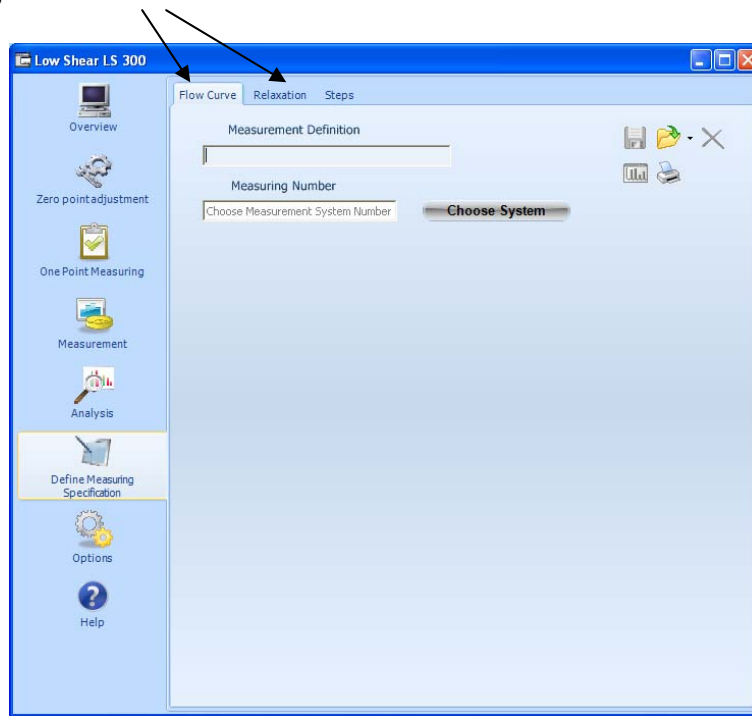
Here you can calculate viscosity by using the standard rheological models: Newton, Bingham, Steiger-Ory, Casson.  
If there are any further calculations you need, please contact us.



## 6. Define Measuring Specifications

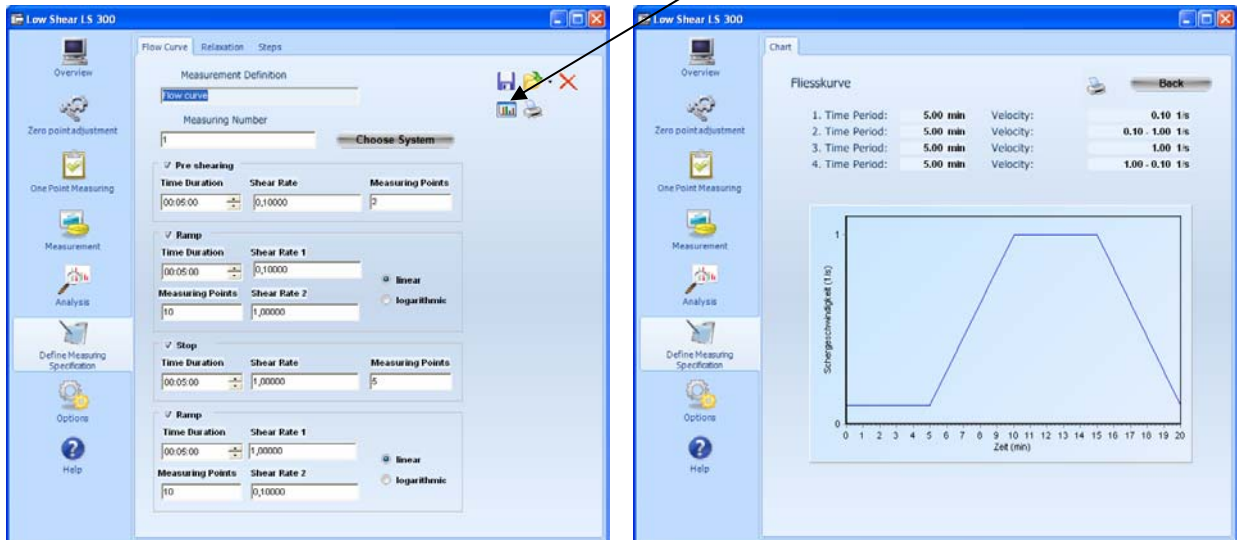
There are two possibilities to define a measuring:

- Measuring of flowcurve
- Measuring of relaxation



Defining of flowcurve:

Diagram window

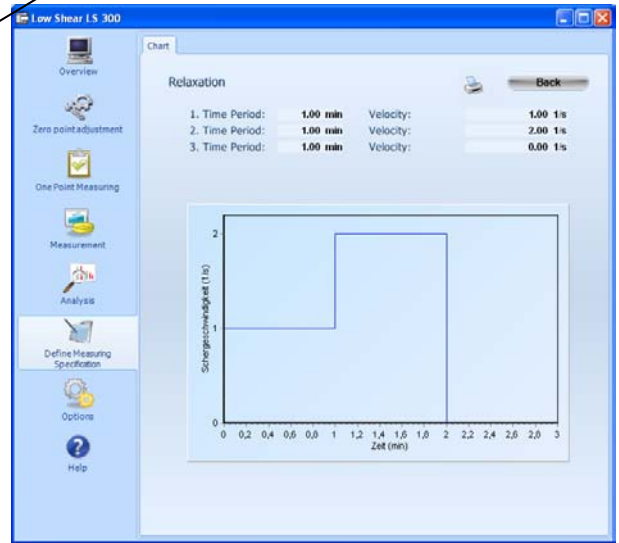


Note: Always choose measuring system first.

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Defining of relaxation measurement:

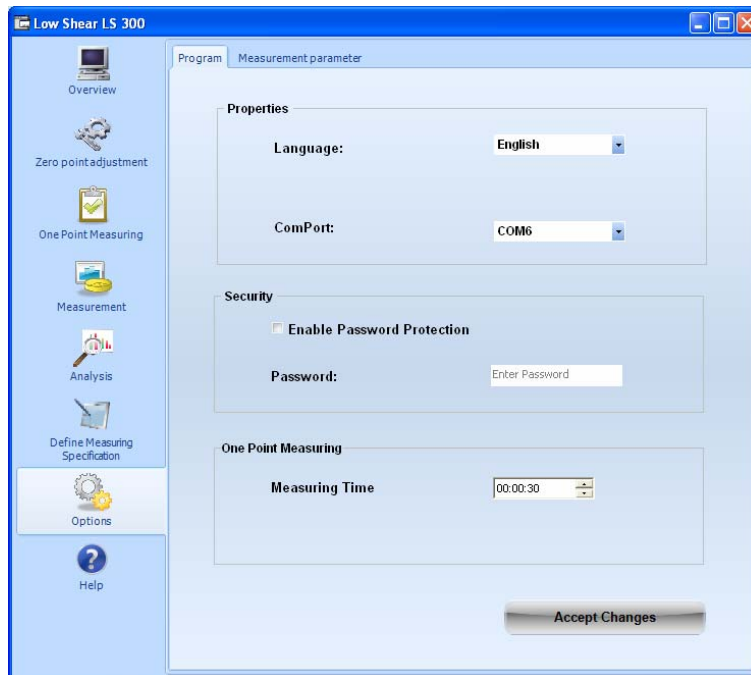
Diagram window



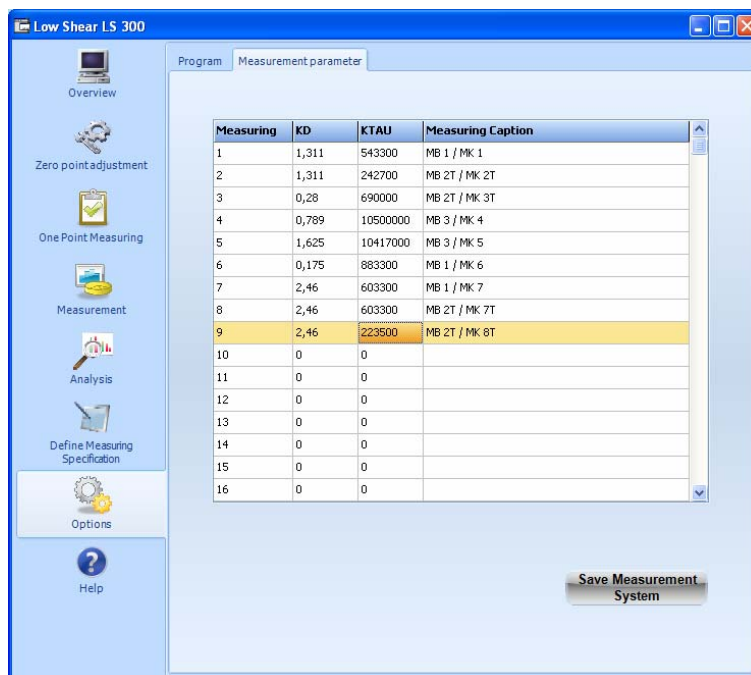
## 7. Options

Selection of

- language
- Comport connection to contrl unit
- Enable password (defining of measurement methods and zero settings)
- Measuring time (One point measurements)



Definition of measuring systems:



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### Technical Data LS 300:

Mains supply:	Alternating current 50 or 60 Hz; 110 to 240 V. Power input less than 50 W.
Rotational speed:	0,013 to 98 min <sup>-1</sup>
Speed tolerance:	± 0,5% of nominal value
Viscosity range:	1.5 * 10 <sup>-3</sup> to 6 * 10 <sup>6</sup> mPas Depending on measuring system
Shear rate range:	3.5 * 10 <sup>-3</sup> to 0.25 * 10 <sup>3</sup> s <sup>-1</sup> Depending on measuring system
Shear stress range:	20 * 10 <sup>-6</sup> to 0.1 Pa

Measuring



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