



byko-visc CP

Cone and Plate Viscometer

Operating Manual

Table of Contents

1	Introduction	6
1.1	For Your Safety	8
1.2	Symbols	9
1.3	Disclaimer	10
1.4	Copyright	10
1.5	Declarations	11
1.5.1	Declaration of Conformity (EU)	11
1.5.2	Declaration of Conformity (UK)	11
2	System Description	12
2.1	Intended Use	13
2.2	Measurement Principle	14
2.3	Feature Matrix	15
3	Getting Started	16
3.1	Delivery Content	17
3.2	Viscometer Back	17
3.3	System Operation	18
3.3.1	Main Menu	18
3.3.2	User Interface	19
4	Measurement Settings	20
4.1	Cone	21
4.2	Speed	22
4.3	Temperature	23
4.4	Time to Stop	23
4.5	Ramp	24
4.6	Limits	24
4.7	Curve Fitting	25
4.7.1	Newton	26
4.7.2	Bingham	26
4.7.3	Casson	27
4.7.4	Ostwald	28
4.7.5	Herschel-Bulkley	29
5	System Configuration	30

5.1	Units	31
5.2	Language	32
5.3	Date / Time	33
5.4	Color-Scheme	33
5.5	Information	34
5.6	Save Results	34
5.7	Lock Settings	35
5.8	Table Settings	35
5.9	Change Cone	36
5.10	Averaging	36
5.11	Storage Position	37
6	Perform Measurements	38
6.1	Attach Cone	39
6.2	Apply Sample	40
6.3	Measure Viscosity	41
6.4	Change Parameters	42
6.5	Access all Screens	42
6.6	End Measurement	43
7	Special Measurements	44
7.1	Time to Stop	45
7.2	QC-Limits	45
7.3	Ramp-Up	46
7.4	Curve Fitting	47
7.5	Temperature	48
8	Browse Measurements	49
8.1	Rename Test Series	50
8.2	Export to USB	51
8.3	Print to USB	52
8.4	Delete Data	53
9	Appendix	54
9.1	Addendum	55
9.1.1	Viscometer-related Factors	55

9.1.2	Checking Calibration Results	56
9.1.3	Generating Reliable Results	56
9.2	Firmware Update	58
9.3	Technical Data	59
9.3.1	Instrument	59
9.3.2	Viscosity Range	60
9.3.3	General Data	61
9.3.4	Documentation	61
9.4	Maintenance	62
9.5	Service Points	63

1

Introduction

Dear customer,

Thank you for deciding to use a BYK-Gardner product. BYK-Gardner is committed to providing you with quality products and services. We offer complete system solutions to solve your problems in areas of color, appearance and physical properties. As the basis of our worldwide business, we strongly believe in total customer satisfaction.

Therefore, in addition to our products, we offer many VALUE-ADDED services:

- Technical Sales Force
- Technical and Application Support
- Application and Technical Seminars
- Repair and Certification Service

BYK-Gardner is part of ALTANA AG and a direct subsidiary of BYK, a leading supplier of additives for coatings and plastics. Together, we offer complete and unique solutions for you, our customer.

Thank you for your trust and confidence. If there is anything we can do better to serve your needs, do not hesitate to let us know.

Your BYK-Gardner Team

<https://www.byk-instruments.com>

1.1 For Your Safety



CAUTION: Familiarization with safety instructions necessary

Failure to read and understand the safety instructions threatens your health and can damage the instrument. Read the safety instructions before you use the instrument the first time.

The safety instructions are part of the delivery content. You find the safety instructions in the dedicated booklet enclosed to the instrument carrying case.

The safety instructions also include information about disposal, liability and copyright.



WARNING: Injuries possible

This manual cannot address all of the safety considerations associated with its use. It is the responsibility of the user to consult this manual and establish appropriate safety practices for use with this equipment and the individual material being tested.

The byko-visc viscometers are designed and intended for the use described in the manual. Using the viscometer for other purposes for which it was not designed may reduce or eliminate the protection offered by the features of the device. Serious injury may result.

This instrument is not intended for use in a potentially hazardous environment or with materials that may release toxic or flammable gases at the temperatures encountered during testing.

Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.



WARNING: Extreme heat

The sample plate at the bottom of the device heats up during the test procedure and cools down again (premium models). Never touch the sample plate or parts that come into contact with the plate during or immediately after the test without appropriate protective equipment. The full measurement range of the instrument is from 5°C to 235°C; the exact range depends on the model used. The temperature of the sample plate is always shown on the display. Before starting any cleaning, wait until the instrument has cooled down to room temperature.



WARNING: Severe material damage

Only devices meeting the requirements for low voltage safety may be connected to the USB interface.

1.2 Symbols

The label on the instrument contains the following symbols.



Do not dispose of this product together with your household trash. Please refer to the information of your local community or contact our dealers regarding the proper handling of end-of-life electric and electronic equipment. Recycling of this product will help to conserve natural resources and prevent potential negative consequences for the environment and human health caused by inappropriate waste handling.



Read the instruction manual before operation.



The manufacturer or importer affirms the good's conformity with European health, safety, and environmental protection standards. Details see [Declarations](#)¹¹.



This symbol denotes the TUV certification mark for the United Kingdom and the European Union.



This symbol denotes the TUV certification mark for Canada and the United States.

1.3 Disclaimer

Exclusion of Liability

No liability other than as provided by law is assumed for direct or indirect damage sustained in association with the use of the instrument, the software or documentation.

BYK-Gardner precludes all liability claims if the usage described in "Intended Use" is disregarded. Any other usage than described in "Intended Use" is not according to the purpose of the instrument and leads to termination of liability claims.

See also

- [Intended Use](#) ¹³

1.4 Copyright

Specific properties and structural characteristics of the instrument are intellectual property of BYK-Gardner. The copyright of this manual remains with BYK-Gardner.

This document must not be reproduced fully or in part, published or used for any other competitive purposes, no matter whether against payment or not, without prior written authorization from BYK-Gardner.

BYK-Gardner reserves the right to update the instrument, software and written documentation without prior notice.

© Copyright 2026 BYK-Gardner GmbH

All rights reserved

1.5 Declarations

1.5.1 Declaration of Conformity (EU)

We,

BYK-Gardner GmbH
Lausitzer Strasse 8
D-82538 Geretsried

declare, that the instrument **byko-visc CP** complies with the requirements of the following directives:

- 2014/30/EU - Electromagnetic Compatibility (EMC)
- 2014/35/EU - Low Voltage

The following harmonized standards were applied:

- EN 61010-1:2010/A1:2019 - Safety Requirements
- EN 61326-1:2013 - EMC Requirements

Geretsried, September 2024



Dr. Jörg Krames
President • BYK-Gardner GmbH

1.5.2 Declaration of Conformity (UK)

Hereby,

BYK-Gardner GmbH
Lausitzer Strasse 8
D-82538 Geretsried

declares, that the products of type **byko-visc CP** comply with the requirements of the following directives:

- S.I. 2016/1091 - Electromagnetic Compatibility (EMC)
- S.I. 2016/1101 - Low Voltage

The following harmonized standards were applied:

- EN 61010-1:2010/A1:2019 - Safety Requirements
- EN 61326-1:2013 - EMC Requirements

Geretsried, September 2024



Dr. Jörg Krames
President • BYK-Gardner GmbH

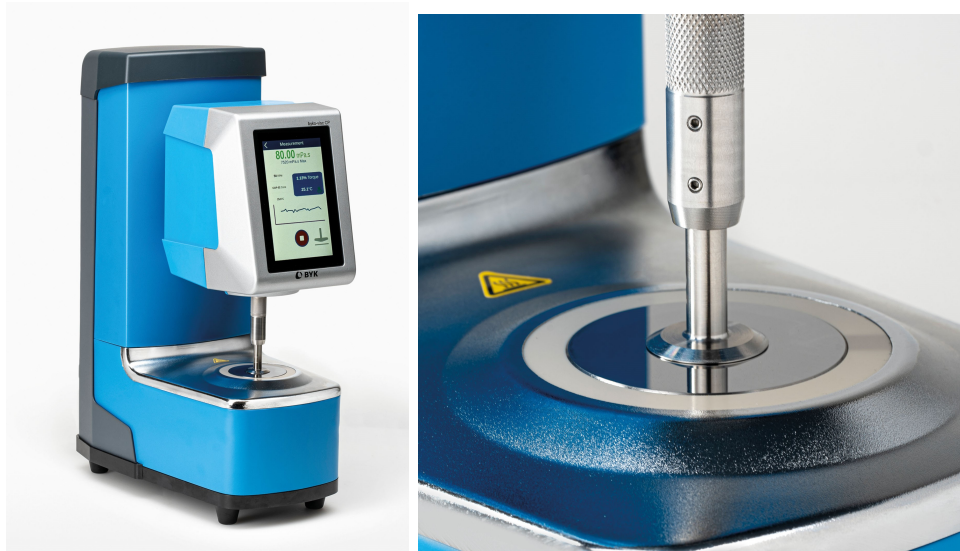
2

System Description

The byko-visc CP allows for the precise determination of the absolute viscosity of materials using minimal sample sizes. With built-in temperature control and constant shear rates throughout the whole sample it can measure and predict the performance of your samples closer to the conditions in your manufacturing or application process (e.g. spreading of paint on a wall or flowing of a polymer melt inside a pipe).

2.1 Intended Use

Thank you for acquiring your new byko-visc CP viscometer from BYK-Gardner.



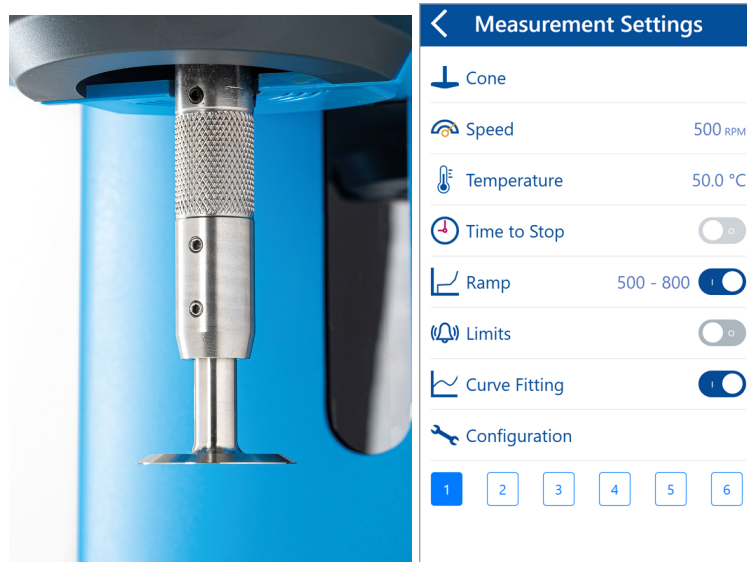
The byko-visc CP combines the ability to measure low shear applications such as automotive clear coats and high shear applications such as wall paints in one instrument without a loss in accuracy. The desired viscosity ranges can be customized according to different use cases by a selection of ten (separately available) cones. The byko-visc CP offers a practical solution for any QC or R&D lab requiring quick, easy and reliable testing of the behaviour of a liquid under different conditions.



The instrument is designed for indoor use. For supported functions see [Feature Matrix](#)¹⁵.

2.2 Measurement Principle

Cone and plate viscometry offers several advantages over other testing methods. Firstly, it is an easy-to-use technique with a wide range of applications while requiring minimal sample preparation. Secondly, it provides reliable results even when testing viscous fluids. This method offers precise shear rate control for accurate viscosity measurements for quick and easy analysis of different samples without the use of various instruments.



The touchscreen display allows user interaction with the instrument and the display of measurement results. Results can also be saved and transferred to a USB thumb drive for importation into Microsoft Excel on a PC for further data analysis.

2.3 Feature Matrix

The BYK-Gardner byko-visc CP product family offers a wide range of high quality benchtop viscometers. For every purpose the best instrument is available. The byko-visc CP product group offers the premium models. The byko-visc CP Lite product group offers the economic models.

Catalog number	5210	5211	5212	5213
Product name	byko-visc CP L	byko-visc CP H	byko-visc CP Lite L	byko-visc CP Lite H
Measuring range	15 - 1.5 Mio. cP		20 - 75,000 cP	
Temperature range	5 - 75 °C 41 - 167 °F	50 - 235 °C 122 - 455 °F	5 - 75 °C 41 - 167 °F	50 - 235 °C 122 - 455 °F
Shear rate	10 - 13,300 1/sec		200 - 12,000 1/sec	
No. of cones	10 (not included)			
No. of speeds	Freely selectable		4	
Speed range	5 - 1000 rpm		100 - 900 rpm	
Speeds	Variable		100, 400, 750 & 900 rpm	
Repeatability	0.2%			
Accuracy	±2.0% of full scale			
Power supply	Worldwide power supply, 24 V voltage DC input / Separate 24 V DC power supply			
Weight	6.5 kg / 14.3 lb			
Dimensions (L x W x H)	30 x 17 x 43 cm / 11.5 x 6.5 x 17 in			
Languages	English, German, French, Italian, Spanish, Chinese, Japanese, Portuguese			
Product housing				

3

Getting Started

The entire system consists of instrument, power supply and a cone. The cone is to be ordered separately.

3.1 Delivery Content

The items listed below are contained in the packaging:

- Cone and Plate Viscometer
- Power Supply
- 17025 Certificate
- Safety and Short Instructions



NOTICE

Retain the packaging in case you want to ship the instrument at a later date.

3.2 Viscometer Back

On the back of the viscometer the power button and following connectors are provided:

- 1x Power Supply
- 2x USB Type A
- 1x USB Type C
- 1x Ethernet



NOTICE

Before switching off the instrument always return to the [Main Menu](#)¹⁸ to save all data. In order to turn off the unit press the power button and the unit will shut down. After switch off always wait 30 seconds before you switch on again. To disconnect the unit from the power source unplug the external power supply.

3.3 System Operation

The byko-visc CP is a benchtop viscometer which is operated by the touch screen. The power button - used to switch on the instrument - is located on the rear of the instrument above the power connector. Using the touch screen display icons and functions can be selected directly. The instrument can be used to repeatably measure viscosity of many types of liquid samples in the laboratory and in production.

3.3.1 Main Menu

In the main menu the following symbols are displayed.



	Viscosity Measurement Perform measurements using existing parameters, change parameters and save results in instrument memory.
	Browse Measurements View and manage measurement results saved in instrument memory.
	Measurement Settings Change measurement settings and / or instrument configuration.

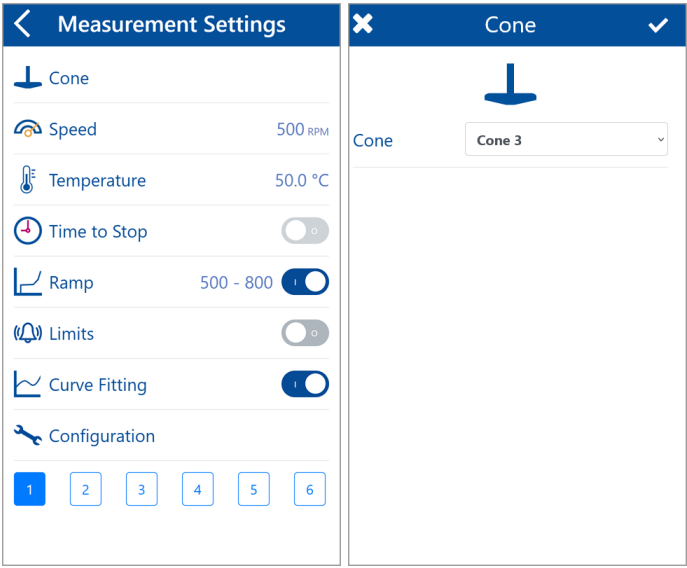


CAUTION!

To avoid damage of the precise mechanic: Always apply a small amount of sample to the plate before starting a viscosity measurement - i.e. before the cone begins to rotate on the plate.

3.3.2 User Interface

To control the system the following UI elements are available.



	Activated The current option or function is active. Tap to deactivate.
	Deactivated The current option or function is inactive. Tap to activate.
	Save Save your changes and go back to previous screen.
	Back Go back to previous screen with existing settings.
	Close Go back to previous screen without saving.



NOTICE

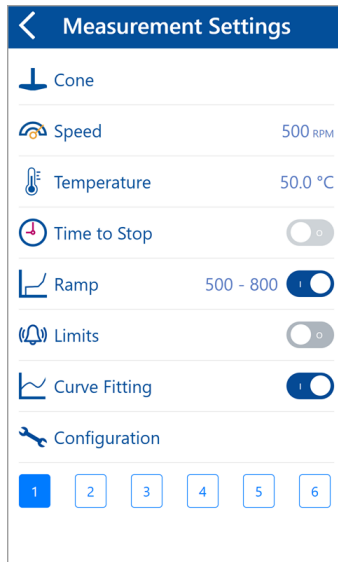
If there is a check mark for **Save** it is to be tapped to save the changes in the current screen. If there is no such check mark all changes are automatically saved.

4

Measurement Settings



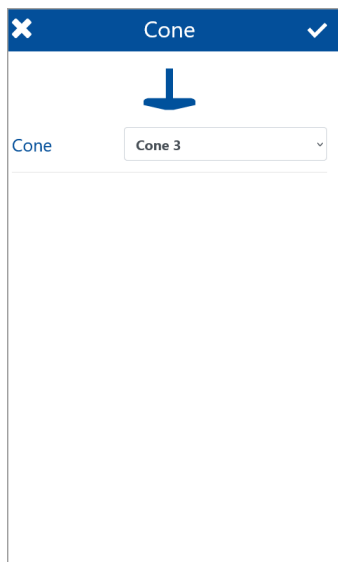
Tap the settings icon in the main menu to manage settings that are **often** changed. Before starting with measurements these parameters may have to be controlled.



For settings that are **seldom** changed see [System Configuration](#)³¹.

4.1 Cone

Here the cone currently mounted can be selected to announce it to the measurement system. The cone to be selected depends on the viscosity range and shear rate requirements of your sample.



For the byko-visc CP we offer 10 different cones, see [Ordering Information](#)⁶².



The cone type is printed on the shaft of the cone. For measurement details see [Viscosity Range](#)^{D60}.

4.2 Speed

Enter the speed of the cone in Revolutions per Minute (RPM).

×

Speed

✓


Select Speed

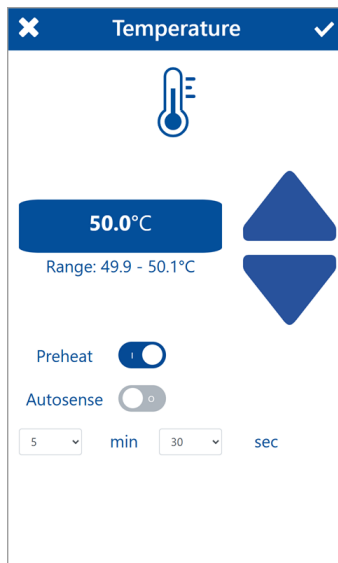
500

1	2	3
4	5	6
7	8	9
.	0	<

Type in the requested value - between 5 and 1000 - and save with the check mark.

4.3 Temperature

Enter the target temperature of the material to be measured. The plate will be heated until this value is reached. The maximum value for the to be entered depends on the model.



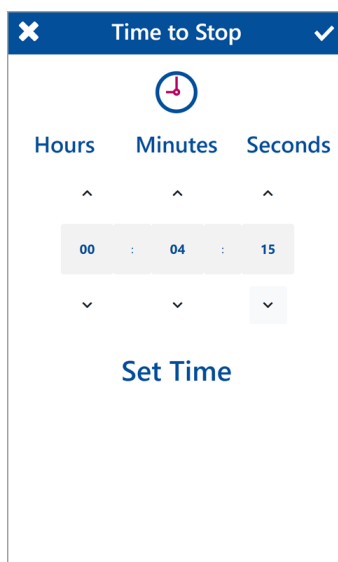
The interface shows a temperature control screen. At the top, there is a blue header with a close button (X) on the left and a checkmark on the right, with the title "Temperature" in the center. Below the header is a thermometer icon. In the center, a large blue button displays "50.0°C". To its right are two large blue diamond-shaped buttons, one pointing up and one pointing down. Below the temperature display, it says "Range: 49.9 - 50.1°C". Further down, there are two toggle switches: "Preheat" (which is turned on) and "Autosense" (which is turned off). At the bottom, there are two input fields: the first contains "5" and is followed by "min", and the second contains "30" and is followed by "sec".

You have following options:

- **Preheat:** The measurement starts after the timer has elapsed.
- **Autosense:** The measurement starts as soon as the device detects that the sample has reached the desired temperature.

4.4 Time to Stop

Activate the option to go to the screen **Time to Stop**. Enter the measurement time here.

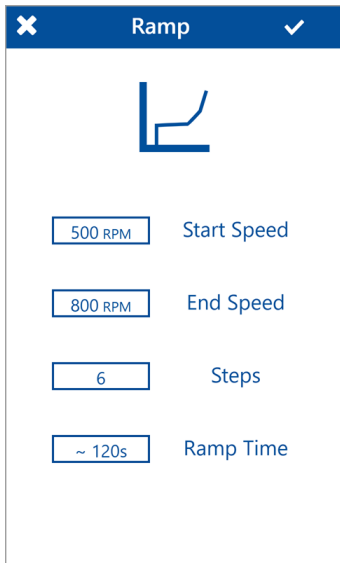


The interface shows a "Time to Stop" screen. At the top, there is a blue header with a close button (X) on the left and a checkmark on the right, with the title "Time to Stop" in the center. Below the header is a clock icon. Underneath, the labels "Hours", "Minutes", and "Seconds" are displayed. Below these labels are three sets of up and down arrow buttons for adjusting the time. In the center, there is a display showing "00 : 04 : 15". Below the display are three more sets of up and down arrow buttons. At the bottom, there is a blue button labeled "Set Time".

Use the arrow buttons to enter **Hours**, **Minutes** and **Seconds** and save with the check mark.

4.5 Ramp

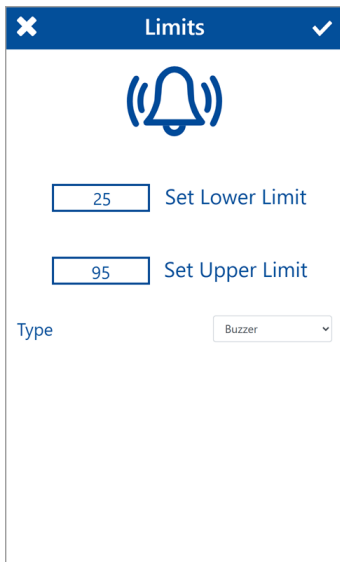
Activate the option **Ramp** and tap the values to go the details screen **Ramp**. Enter a dynamic speed range here. Instrument will adjust speed accordingly.



Enter a **Start Speed** greater Zero (e.g. "5") and an **End Speed** (e.g. "50") and the required **Steps** for increasing / decreasing the speed (e.g. "9"). The measurement time for the ramp-up is calculated by the instrument.

4.6 Limits

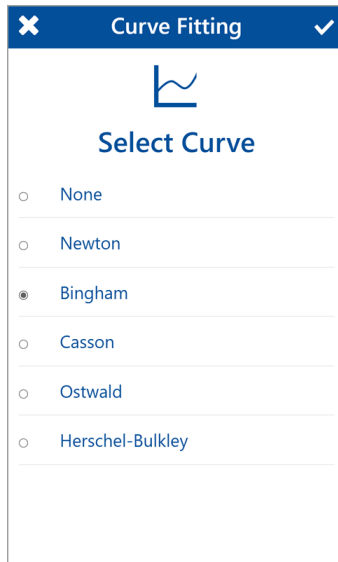
Here you can specify torque values to be observed for quality control. An alarm can be activated if current sample is not within the given range.



Tap on **Set Upper Limit** to enter the maximum torque values (e.g. "25%"). Repeat for **Set Lower Limit** (e.g. "95%"). Finally select the **Type** for the alarm: **Buzzer**, **Display Flash** or **Both**.

4.7 Curve Fitting

Several curve fitting models are available. Dependent on the type of sample you want to measure different fits will be applied and different curve parameters will be displayed. For every case the correlation factor, R^2 , will be displayed. This corresponds to how well the fit matches the measured data. R^2 is always between 0 and 1 with values closer to 1 being better.



Following curves can be selected:

- None
- [Newton](#) ²⁶
- [Bingham](#) ²⁶
- [Casson](#) ²⁷
- [Ostwald](#) ²⁸
- [Herschel-Bulkley](#) ²⁹

Select the required curve from the list and save with the check mark.

4.7.1 Newton

This mode is used only for Newtonian fluids. That means the shear stress of the fluid is proportional to the shear rate. The curve is described by a linear equation:

$$\tau = \eta * \gamma \quad (1)$$

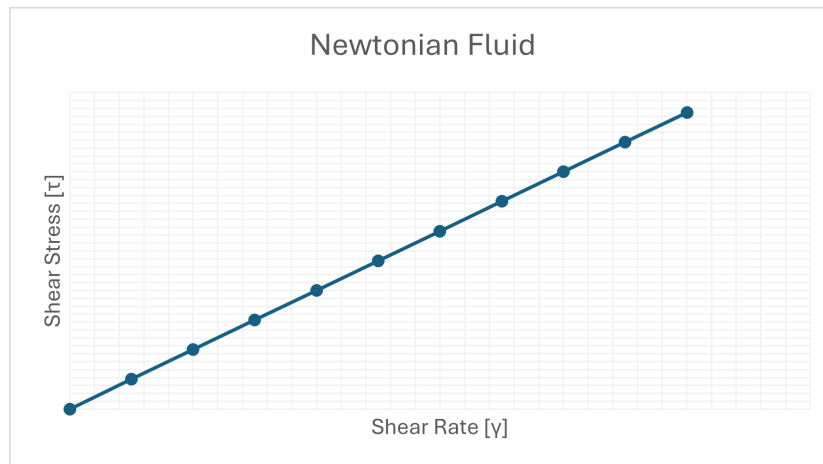


Figure 1: Example of the flow curve of a Newtonian fluid.

Where τ is the shear stress, η the dynamic viscosity and γ is the shear rate.

After the measurement is complete, two values will appear on the screen: R^2 and PV. PV is the plastic viscosity and corresponds to the slope of the curve.

4.7.2 Bingham

This mode is used for plastic fluids. That means, that finite stress must be applied to initiate flow, and that at greater stresses the flow will be linear. The curve of a Bingham fluid must therefore be described by two parameters, the yield value and the plastic viscosity. It is represented via the equation:

$$\tau = \tau_0 + \eta * \gamma \quad (2)$$

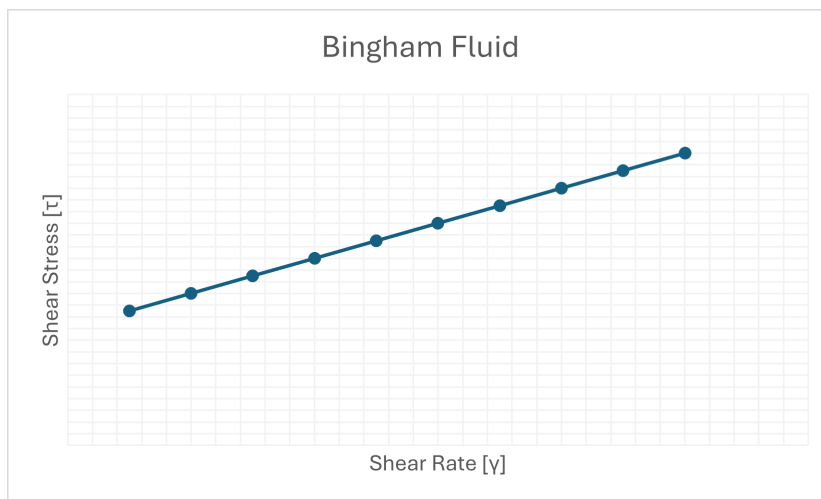


Figure 2: Example of the flow curve of a plastic fluid according to the Bingham model. The yield value corresponds to the point on the y-axis where the liquid begins to flow.

Where τ_0 is the yield value, or the stress where the liquid first begins to flow and the plastic viscosity which corresponds to the slope of the curve.

4.7.3 Casson

This mode is used for plastic fluids. These are similar to Bingham fluids, in that a finite amount of stress needs to be induced on the fluid to initiate flow. It is described by the equation:

$$\sqrt{\tau} = \sqrt{\eta} * \sqrt{\dot{\gamma}} \quad (3)$$

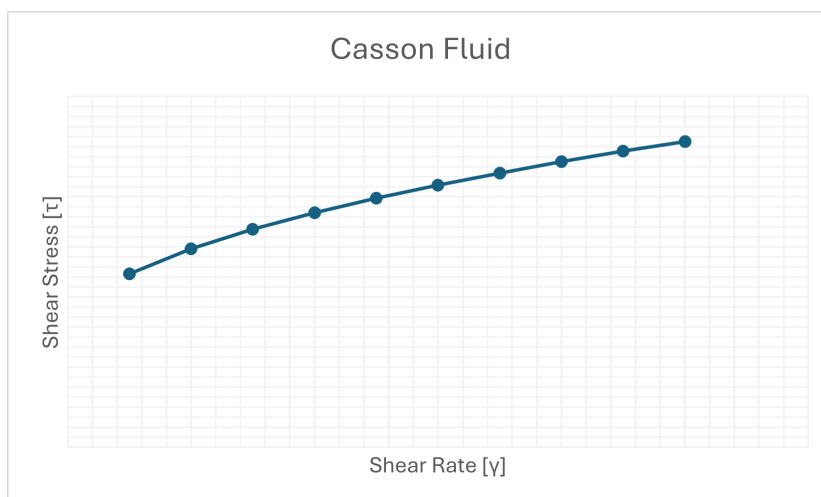


Figure 3 Example of the flow curve of a plastic fluid according to the Casson model. The yield value corresponds to the point on the y-axis where the liquid begins to flow.

The difference to the Bingham model is, that a certain degree of non-linearity is introduced, by utilizing the square root of the slope and viscosity values for fluids that are not quite accurately described by the Bingham model. This is mostly used to indicate shear thinning behavior. As with the Bingham model, the Casson option will display the plastic viscosity as well as the yield value on screen.

4.7.4 Ostwald

Ostwald or power-law fluids describe a generalized fluid equation for which the shear stress is given via a flow consistency index, the shear rate and a flow behavior index. It is described by the following equation:

$$\tau = K * \dot{\gamma}^n \quad (4)$$

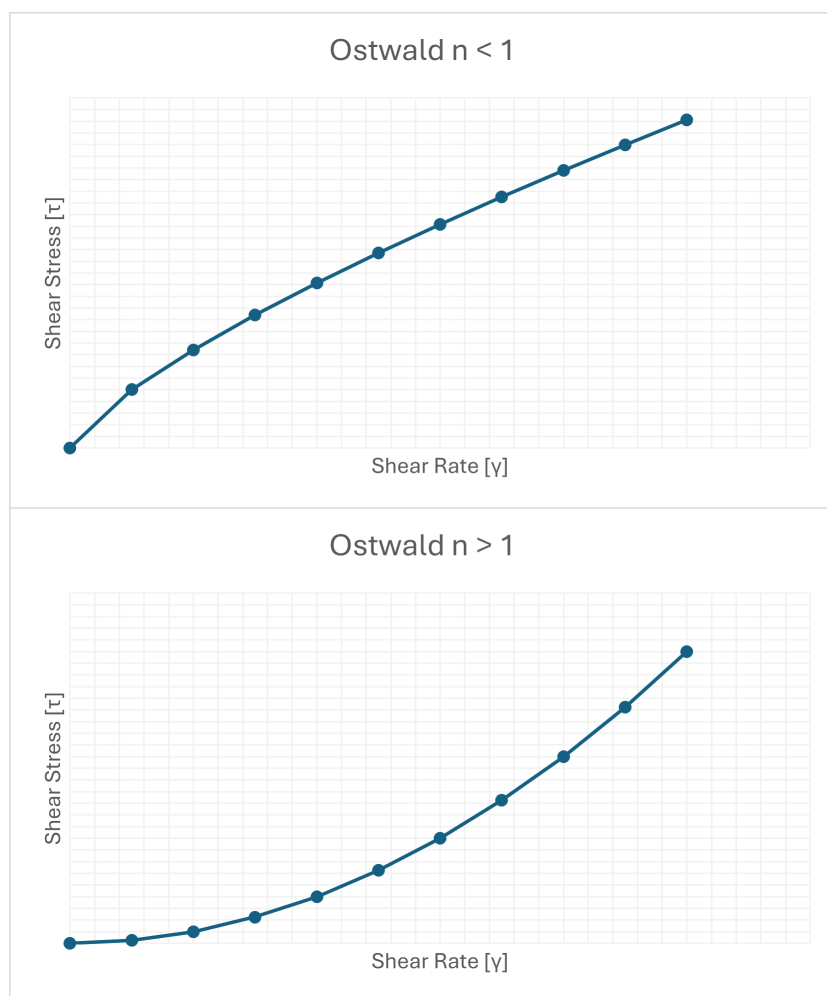


Figure 4: Example of the flow curves of a plastic fluid according to the Ostwald model that shows shear thinning (top) and shear thickening (bottom) behavior.

Where T is the shear stress, K is the flow consistency index, $\dot{\gamma}$ is the shear rate and n is the flow behavior index:

- For $n = 1$, this equation corresponds to Newtonian fluids.
- For $n > 1$ this equation corresponds to dilatant (or shear thickening) fluids.
- For $n < 1$ this equation corresponds to pseudoplastic (or shear thinning) fluids.

The instrument will display the consistency index as well as the behavior index on screen after the measurement is complete.

4.7.5 Herschel-Bulkley

Herschel-Bulkley fluids also follow a generalized power law equation. They differ from Ostwald fluids by the introduction of a yield value, similar to how plastic fluids differ from Newtonian fluids. They are described by the following equation:

$$\tau = \tau_0 + K * \gamma^n \quad (5)$$

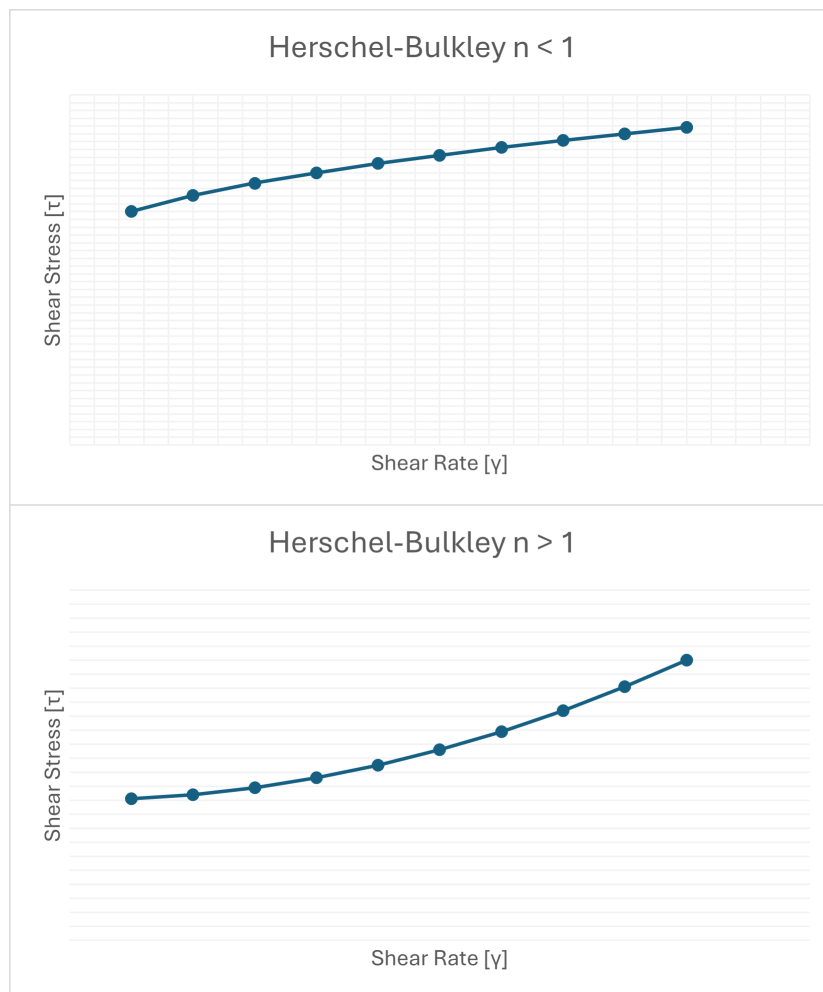


Figure 5: Example of the flow curves of a plastic fluid according to the Herschel-Bulkley model that shows shear thinning (top) and shear thickening (bottom) behavior. The yield value corresponds to the point on the y-axis where the liquid begins to flow

Where T is the shear stress, T_0 is the yield value, K is the flow consistency index, $\dot{\gamma}$ is the shear rate and n is the flow behavior index:

- For $n = 1$, this equation corresponds to Newtonian fluids.
- For $n > 1$ this equation corresponds to dilatant (or shear thickening) fluids.
- For $n < 1$ this equation corresponds to pseudoplastic (or shear thinning) fluids.

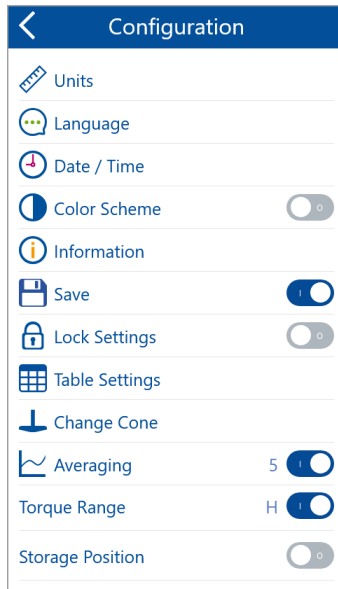
The instrument will display the consistency index, the yield value as well as the behavior index on screen after the measurement is complete.

5

System Configuration



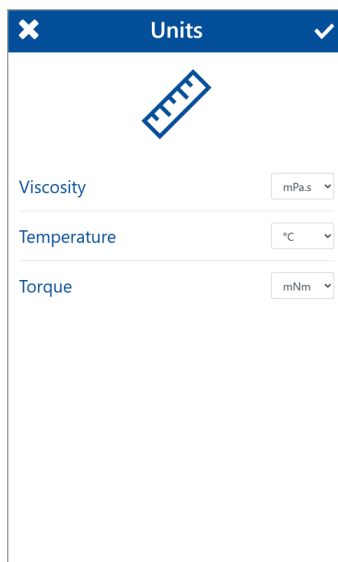
Tap the settings icon in the main menu and tap on **Configuration** to manage settings that are **seldom** changed.



Before starting with measurements the configuration may have to be controlled.

5.1 Units

Select the units used for measurement.



For the **Viscosity** following units are supported:

- Milli Pascal Second: **mPa.s**
- Centipoise: **cP**

For the temperature following units are supported:

- Celsius: **°C**
- Fahrenheit: **°F**

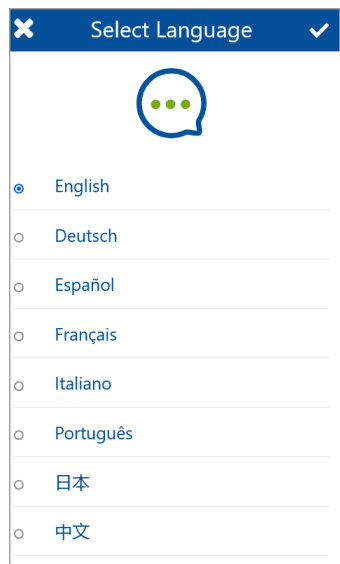
Select the required unit and save with the check mark.

**NOTICE**

The configuration for **Units** will be used as default and can also be changed directly during measurements.

5.2 Language

Select the language of the user interface here.



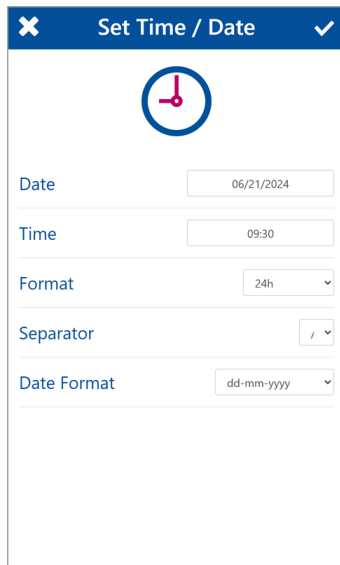
Following languages are supported:

- English: English
- German: Deutsch
- Spanish: Español
- French: Français
- Portuguese: Português
- Japanese: 日本語
- Chinese: 中国

Select the required language and save with the check mark.

5.3 Date / Time

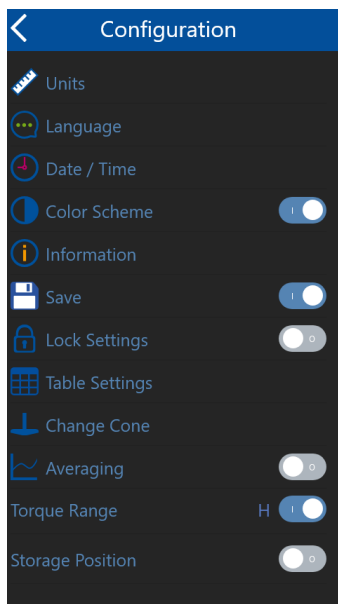
Here you can enter date, time and the format.



The **Time** is entered with **Hour** and **Minute**. The **Date** is entered with **Day**, **Month** and **Year**. For **Date** and **Time** the **Format** to be displayed can be selected.

5.4 Color-Scheme

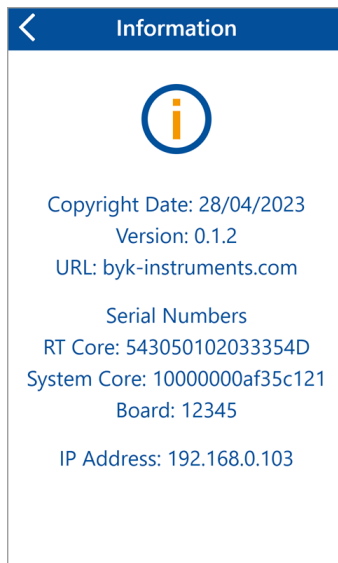
If this option is activated the white background of the display turns to black. This option is preferred in case of darker surroundings.



If this option is deactivated the background turns back to white.

5.5 Information

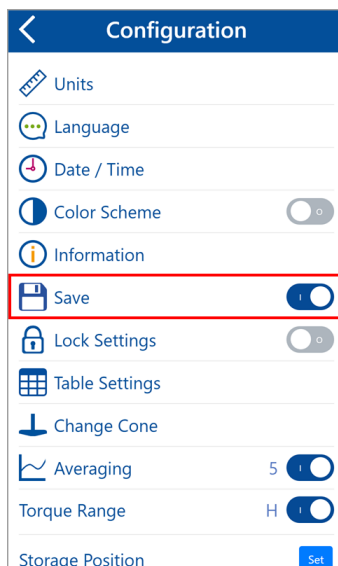
Under this option the details about instrument, firmware version and serial number can be retrieved.



In case you contact your local BYK-Gardner service center please have these data handy.

5.6 Save Results

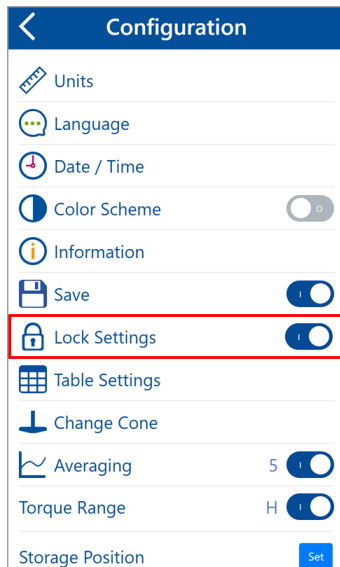
This option can be used to turn on saving the results of the viscosity measurements, see [Browse Measurements](#)⁵⁰.



If this option is deactivated the measurements results are not saved and will not be shown in the browse screen.

5.7 Lock Settings

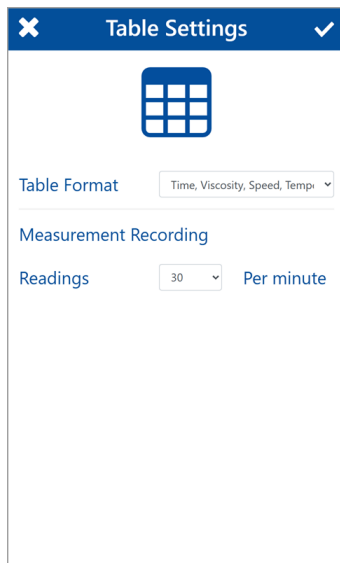
This option can be used to lock the current settings against unintentional changes.



If this option is deactivated the settings can be changed again.

5.8 Table Settings

Here you can configure the table format for the [Export to USB](#)⁵¹.



For the table format select:

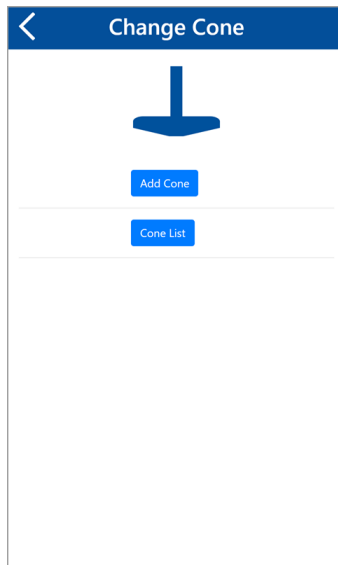
- Time, Viscosity, Speed, Temperature
- Time, Torque, Speed, Temperature
- Time, Shear Stress, Shear Rate, Temperature

For the readings per minute select:

- 120, 60, 30, 10, 5, 2, 1

5.9 Change Cone

Here you may add a new cone to the instrument memory.



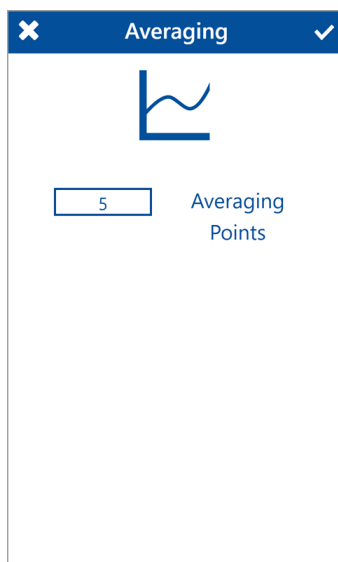
You have following options:

- **Add Cone:** Tap the button to add a new cone.
- **Cone List:** Tap the button to review known cones.

See also [Viscosity Range](#)⁶⁰.

5.10 Averaging

Activate this option to enter a number of measurements to be averaged. For standard measurements an averaging of 5 (default) is recommended. If performing ramp measurements, we recommend to disable averaging.

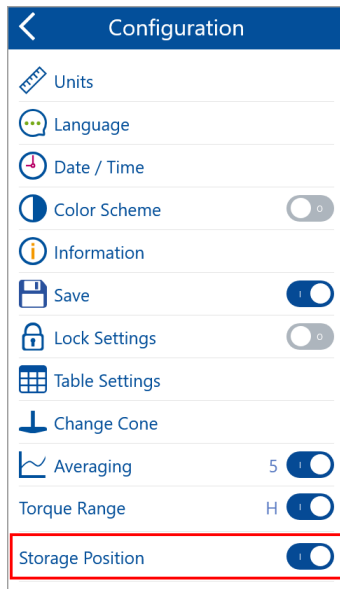


You have the following options:

- **Off:** The system records a measured value every 0.5 seconds. The result may look unstable.
- **On:** The last "n" measured values are averaged. The result may look more stable.

5.11 Storage Position

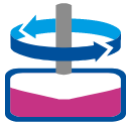
This option is used to move the instrument head down to the storage position.



In this position the instrument can be stored in the packaging. Switch off this option will reset the head to the default measurement position.

6

Perform Measurements



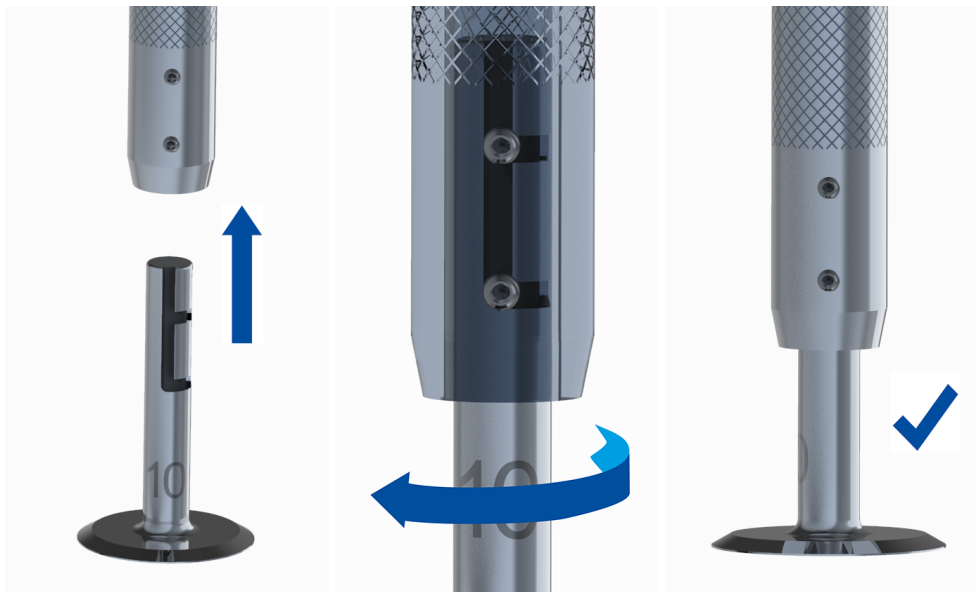
Tap the measurement icon in the main menu to access the measurement screen. For viscosity measurements perform following steps:

- [Attach Cone](#) ³⁹
- [Apply Sample](#) ⁴⁰
- [Measure Viscosity](#) ⁴¹
- [Change Parameters](#) ⁴²
- [Access all Screens](#) ⁴²
- [End Measurement](#) ⁴³

6.1 Attach Cone

Perform following steps:

1. Place the viscometer in a suitable location.
2. Plug the power supply into a mains outlet and plug the output cable into the back of the viscometer head.
3. Turn instrument on with the power button.
4. The viscometer head moves to the upper position (if not already up).
5. The main menu is shown on the touchscreen display.
6. Hold cone attachment with one hand and insert cone with the other hand.
7. Use the two screws to line up the groove; turn cone clockwise to attach it.



The cone is correctly fastened when one screw fits into each groove.

NOTICE



Check number on the cone and use the measurement settings to select the cone attached. Use the measurement screen to move the viscometer head up and down, if required.

6.2 Apply Sample

To measure viscosity a sample is necessary.

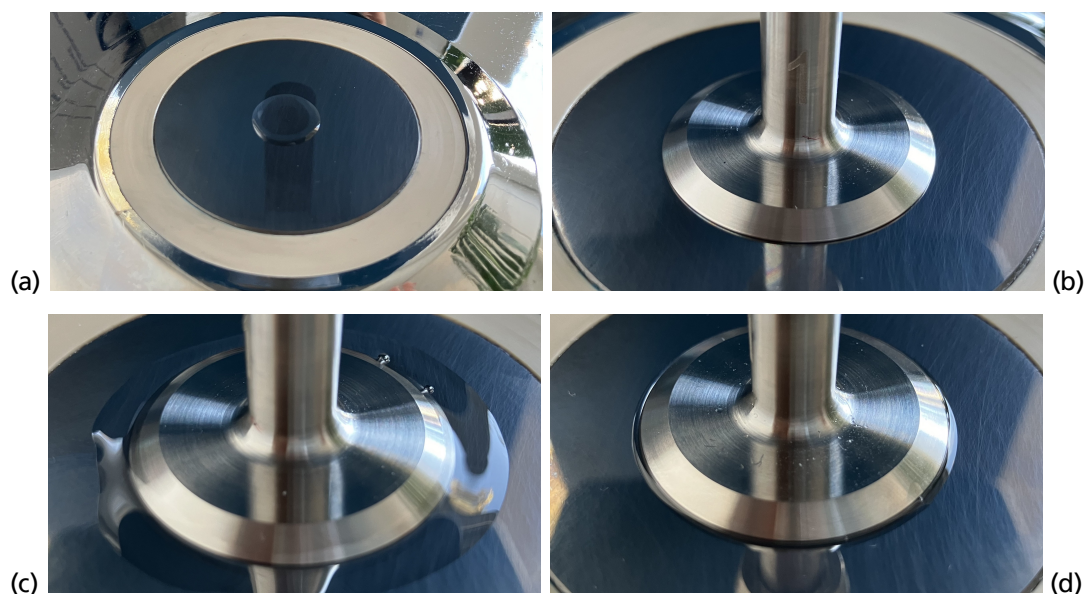


CAUTION!



To avoid damage of the precise mechanic: Always apply a small amount of sample to the plate **before** starting a viscosity measurement - i.e. before the cone begins to rotate on the plate.

The following pictures give a visual guide for the application of the correct amount of sample to the plate.



Following scenarios are shown:

- (a) Apply a small amount of sample according to the theoretical sample volume of the cone.
- (b) Too little sample, no liquid can be seen on the edges of the cone.
- (c) Too much sample, lots of liquid can be seen on the edges of the cone.
- (d) Good amount of sample, only a small ring of sample can be seen around the cone.

If too much sample was applied to the plate, carefully remove it around the edges with a flat wooden spatula.

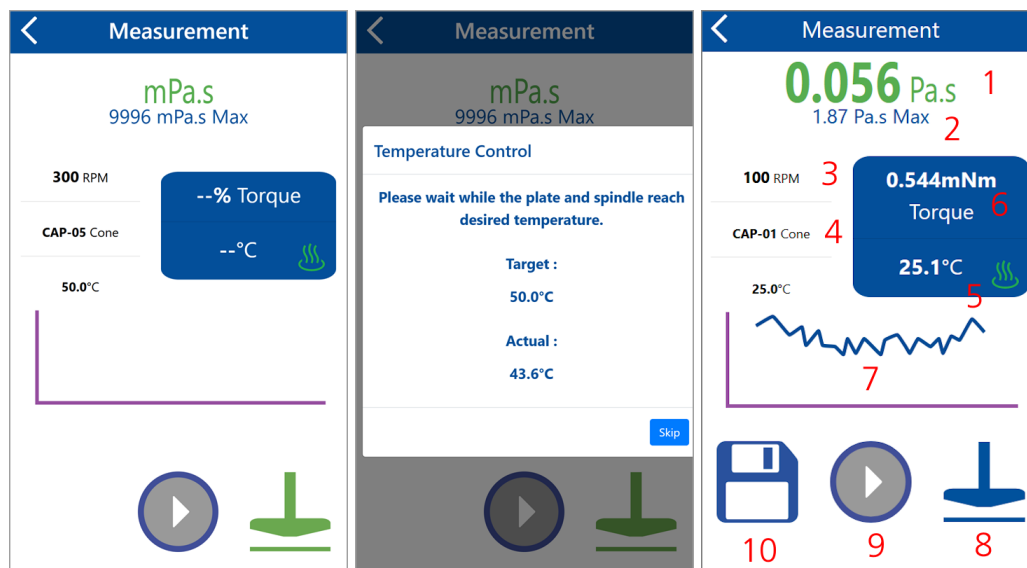
6.3 Measure Viscosity

The measurement takes place in two steps - heating up (or cooling down) and measuring:

1. Tap the green cone icon to lower the viscometer head the 1st time.
2. Remove any sample completely from the plate; confirm the message.
3. Viscometer head moves down, the system regulates the temperature.
4. When target temperature is reached, tap the green icon to raise.
5. Apply the sample to the plate.
6. Tap the blue cone icon to lower the viscometer head the 2nd time.
7. Play button becomes green; tap to start the measurement.

Heating up to high temperatures may take some time.

The measurement screen displays the following items.



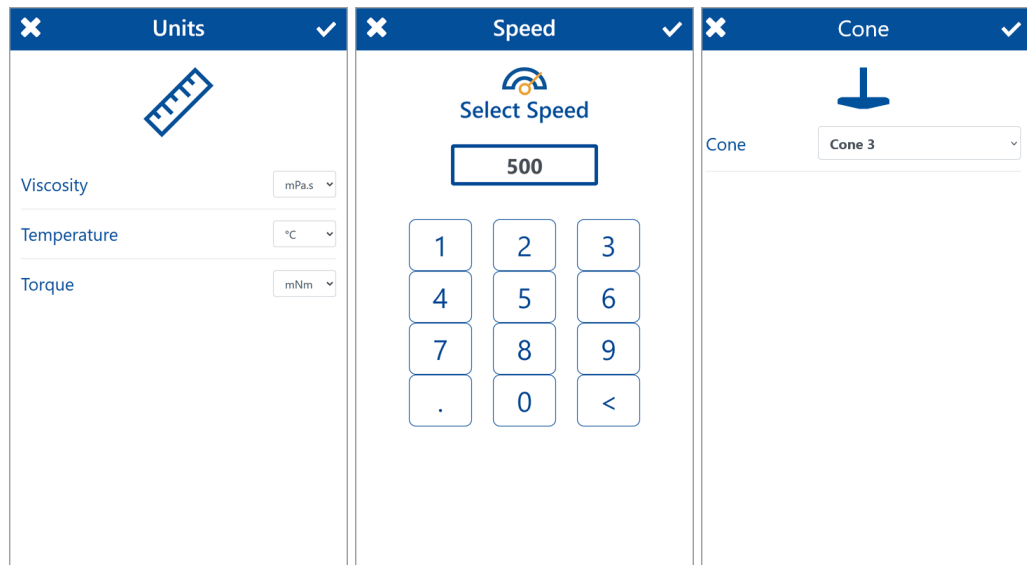
1	Viscosity	Value is taken every 0.5 seconds; tap to change unit.
2	Maximum	The max. value depends on cone, speed and torque setting.
3	Speed	Current cone speed in rotations per minute, tap to change.
4	Cone	Identifier for current cone, tap to change.
5	Temp.	Current temperature of sample: Green: OK. Red: Heating up. Tap to change unit.
6	Torque	Current value mNm or in percent of max. value; tap to change; change speed or cone or torque setting, if < 15% or > 95% (invalid measurement).
7	Graph	Shows a live updating graph of viscosity over time.
8	Lower	Green: Tap to regulate temperature. Blue: Tap to measure. Gray: Inactive.
9	Start	Green: Start measurement. Red: Stop measurement. Gray: Inactive.
10	Disk	Save results in system memory; appears after stopping measurement.

Touch areas of the screen with measured data to access corresponding setting.

6.4 Change Parameters

During measurement following parameters can be changed directly:

1. [Units](#)²¹: Tap on the unit currently shown.
2. [Speed](#)²²: Tap the speed in RPM currently shown.
3. [Cone](#)²¹: Tap the spindle name currently shown.

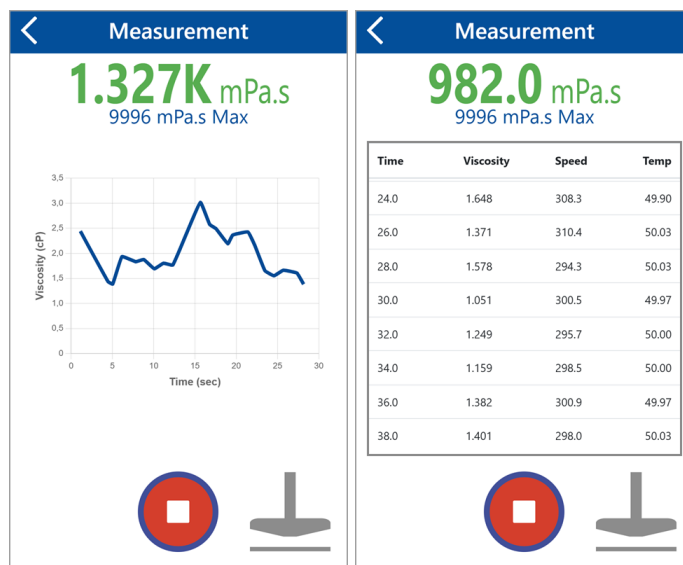


To change all other settings, stop the measurement and go back to the [Measurement Settings](#)²¹.

6.5 Access all Screens

Swipe left and right to access the other screens:

- Graph: Measurement data in graphical form
- Table: Measurement data in table form



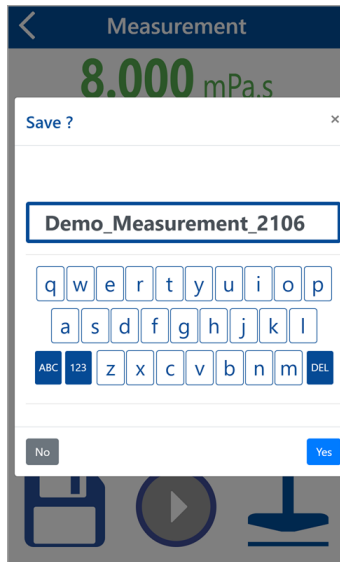
You can also double swipe left and right to access the other screens.

6.6 End Measurement

To end the measurement first tap the blue **Pause** button and then on red **Stop** button.

To end the measurement directly tap the **Back** button in the title row.

A confirmation for saving the data is displayed.



Tap on the file name to change it, if required. For saving you have following options:

- **No:** Current measurement data is not saved, use this to make quick measurements without saving.
- **Yes:** Current measurement data is saved in instrument memory.



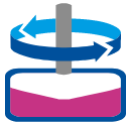
NOTICE

The dialog box **Save?** will be displayed, if option [Save](#)³⁴ is active in [System Configuration](#)³¹.

Go to [Browse Measurements](#)⁵⁰ to check the results or make a new measurement.

7

Special Measurements



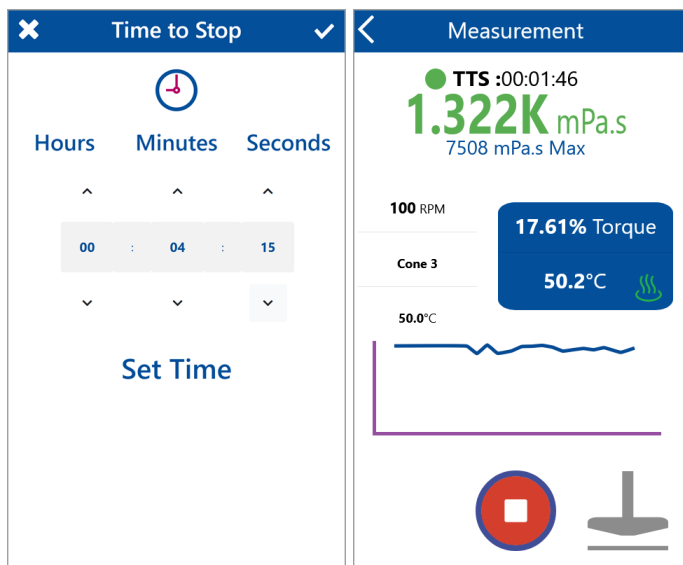
The instrument supports following measurement features:

- [Time to Stop](#)⁴⁵
- [Ramp-Up](#)⁴⁶
- [QC-Limits](#)⁴⁵
- [Curve Fitting](#)⁴⁷
- [Temperature](#)⁴⁸

7.1 Time to Stop

To use the **Time to Stop** feature perform following steps:

1. Go to [Measurement Settings](#)²¹ and tap on **Time to Stop**.
2. Enter the time duration the measurement should last.
3. Perform a measurement and check the remaining time.

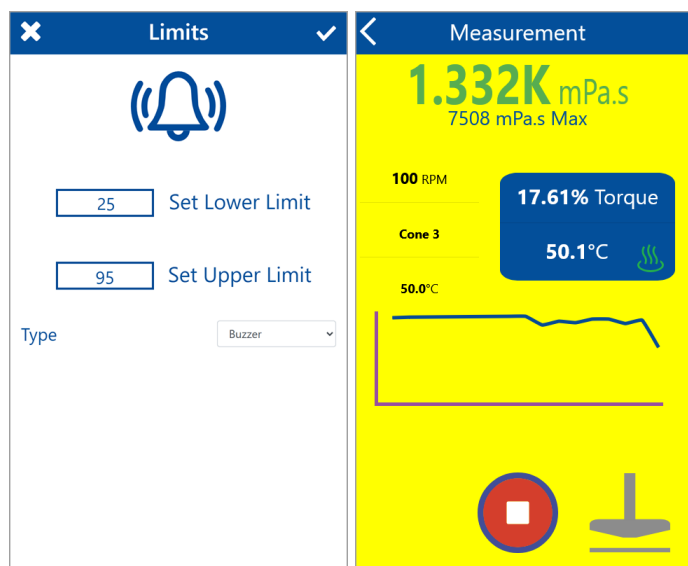


The measurement is stopped when the time has expired. Press **Play** to restart measurement.

7.2 QC-Limits

To use the **QC Limits** feature perform following steps:

1. Go to [Measurement Settings](#)²¹ and tap on **Limits**.
2. Enter the required values for **Upper** and **Lower** limit.
3. Select the required Alarm type: **Buzzer** or **Flash** or **Both**.
4. Perform a measurement and check the current torque value.



In the given example the display will start to flash if the torque measured is below 25% or above 95% of target value.



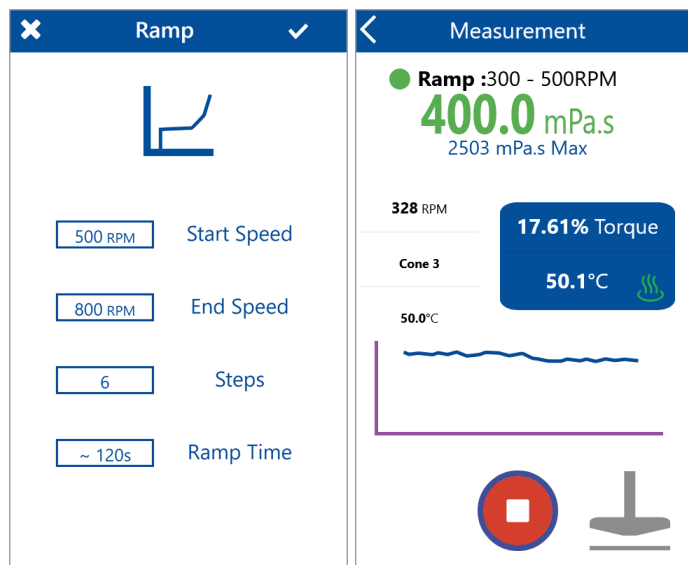
NOTICE

The QC limits feature can be combined with [Ramp](#)⁴⁶ or with [Time to Stop](#)⁴⁵.

7.3 Ramp-Up

To use the **Ramp-up** feature perform following steps:

1. Make sure, that [Averaging](#)³⁶ is disabled.
2. Go to [Measurement Settings](#)²¹ and tap on **Ramp**.
3. Enter the required values for the ramp:
 - **Start speed**
 - **End speed**
 - **Steps**
4. Perform a measurement and check ramp data and current speed in RPM.

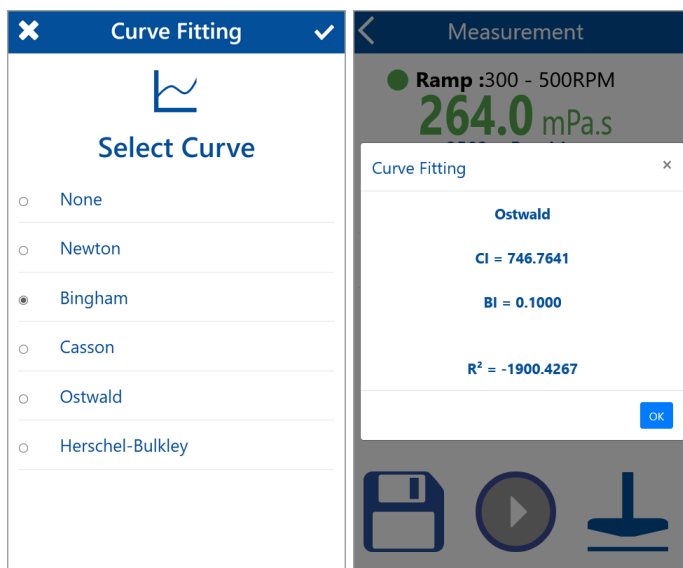


In the given example the instrument will start at 500 RPM, increase to 550 RPM and will end when 800 RPM have been reached. The measurement time for the ramp-up is calculated by the instrument.

7.4 Curve Fitting

To use the **Curve Fitting** feature perform following steps:

1. Go to [Measurement Settings](#)²¹ and tap on **Curve Fitting**.
2. Select the required curve and save with the check mark.
3. Activating **Curve Fitting** simultaneously activates [Ramp-Up](#)⁴⁶.
4. Tap on **Ramp** and configure the ramp-up to be measured.
5. Go to [Measure Viscosity](#)⁴¹ to start the ramp measurement.



During measurement swipe left or right to access data and table screen. When the ramp has finished, tap on **Back** or **Stop**. The curve fitting results are listed:

- Behavior Index (BI)
- Consistency Index (CI)
- Correlation Factor (R^2)
- Plastic Viscosity (PV)
- Yield Value (YV)

This depends on the curve selected:

- **Newton:** R^2 , PV
- **Bingham:** R^2 , PV, YV
- **Casson:** R^2 , PV, YV
- **Ostwald:** R^2 , CI, BI
- **Herschel-Buckley:** R^2 , CI, BI, YV

With the export following data will be exported:

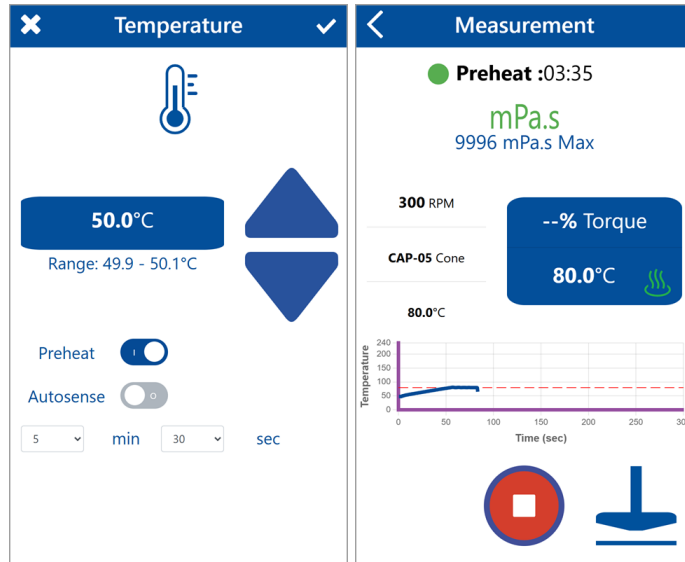
- Name of measurement file
- Curve fitting data
- Ramp data

Details see [Export to USB](#)⁵¹ / [Print to USB](#)⁵².

7.5 Temperature

To use the **Temperature** feature perform following steps:

1. Go to [Measurement Settings](#)³¹ and tap on **Temperature**.
2. Activate **Preheat** (Timer) or **Autosense** (Temperature).
3. Perform a measurement and check the current temperature value.



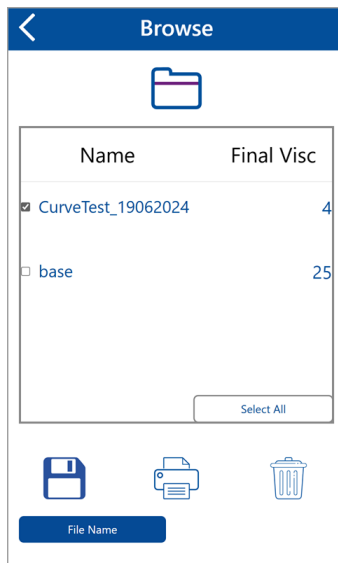
Tap on the temperature value to change the [Units](#)³¹, if required.

8

Browse Measurements



Using this function you can manage the measured data. In the main menu tap the icon **Browse**.



The final viscosity value for a measurement is displayed here.

Following operations are supported:

- [Rename Test Series](#)  ⁵⁰
- [Export to USB](#)  ⁵¹
- [Print to USB](#)  ⁵²
- [Delete Data](#)  ⁵³

NOTICE

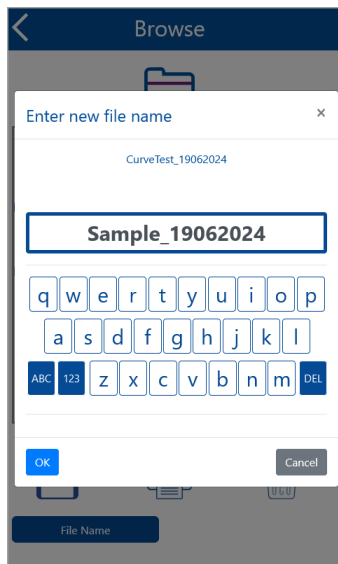


You can select single or multiple test series. Alternatively you can select all test series at once.

8.1 Rename Test Series

You can rename existing test series. Perform following steps:

1. Tap the check box for the series to be renamed.
2. Tap on button **File Name**.
3. Enter the new file name.
4. Tap on **OK** to save name.



The default file name can be configured in [Date / Time](#)³³.

8.2 Export to USB



Export to USB to see all viscosity values measured over time. Perform following steps:

1. Check the desired [Table Settings](#)³⁵.
2. Attach USB flash drive to the viscometer head.
3. Select all test series to be exported.
4. Tap on the **Export USB** icon.
5. Wait until process finishes.
6. Connect USB drive to PC.
7. Use MS Excel to view data.

Time(sec)	Viscosity(mPa.s)	Torque(%)	Speed(RPM)	Temperature(°C)	Shear Stress(Pa)	Shear Rate(s-1)
0	0	0	0	--	0	0
0,5	844,706	22,179	399,3	25,3	1111,469	1315,806
1	834,234	22,179	399,3	25,3	1109,192	1329,592
1,5	834,234	22,081	399,7	25,3	1109,192	1329,592
2	829,691	22,081	399,7	25,24	1104,273	1330,944
2,5	829,691	22,02	399,9	25,24	1104,273	1330,944
3	827,004	22,02	399,9	25,24	1101,236	1331,597
3,5	827,004	22,033	399,7	25,2	1101,236	1331,597
4	827,769	22,087	399,1	25,2	1101,89	1331,158
4,5	831,047	22,087	399,1	25,18	1104,572	1329,133
5	831,082	22,082	399	25,18	1104,337	1328,793
5,5	831,082	22,077	399,6	25,18	1104,337	1328,793
6	829,796	22,077	399,6	25,14	1104,053	1330,511
6,5	829,796	22,072	399,4	25,14	1104,053	1330,511
7	829,871	22,072	399,4	25,14	1103,827	1330,119
7,5	829,871	22,072	399,4	25,12	1103,827	1330,119
8	830,01	22,073	399,4	25,12	1103,857	1329,932
8,5	830,01	22,073	399,4	25,12	1103,857	1329,932
9	831,077	22,116	399,7	25,08	1106,051	1330,864
9,5	831,077	22,116	399,7	25,08	1106,051	1330,864
10	834,167	22,189	399,5	25,08	1109,663	1330,265
CONE SPEED TEMPERATURE						
Cone 3	400	25				

The export format is Comma Separated Values (CSV). In MS Excel create an empty sheet and select **Data > Get Data > From File > From Text/CSV** to convert the data in your file.

8.3 Print to USB



You can directly print a test series to a USB printer. Perform following steps:

1. Attach USB printer to the viscometer head.
2. Select all test series to be printed.
3. Tap on the **Print USB** icon.
4. Wait until process finishes.

We suggest a USB label printer, for example the Dymo Labelwriter 450 or 550.



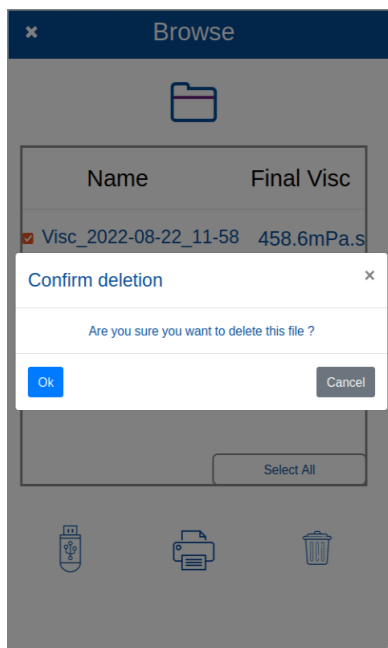
Depending on paper role you can print labels for the probes or just paper output.

8.4 Delete Data



Measurement data not required anymore can be deleted from instrument memory. Perform following steps:

1. Tap the test series to be deleted.
2. To delete all test series at once tap button **Select All**.
3. Tap button **Delete**.



Tap on **Yes** to confirm the request. The selected objects are deleted. To abort the deletion tap on **No**.

9

Appendix

9.1 Addendum

In order to get the best results possible, a number of factors have to be considered when taking measurements with the byko-visc CP. Firstly, there are instrument specific factors. These include the cone geometry and accuracy. Secondly, there are fluid dependent factors. Is the sample Newtonian or not? If not, is it pseudoplastic or thixotropic?

These factors should be considered before any measurement is made to get the most accurate result possible.

9.1.1 Viscometer-related Factors

The byko-visc CP is accurate to two percent of the full-scale range viscosity or FSR. The FSR depends on the cone geometry, speed of the rotation and the torque mode settings. It can be calculated according to equation 1. TC refers to the torque constant and is dependent on the selected torque mode of the instrument. For high torque mode, it corresponds to 18.1 mNm, for low torque mode to 0.797 mNm. The other constants are variable depending on the selected cone.

$$FSR[Pa/s] = \frac{\tau_{rep} \times TC}{SRC \times Speed} \quad (1)$$

The following Table 1 shows an overview over the different available cones, their shear rate constants, their force constants and their geometric constants. These values can be used to better choose your measurement conditions.

Table 1: Overview over the force constants, shear rate constants, minimum sample volumes, cone angles and cone radii of all ten different cones

Cone	τ_{rep} [Pa/mNm]	Shear rate constant [N/sec]	Sample Volume [μL]	Cone Angle [°]	Cone Radius [cm]
1	137.7	13.3	67	0.45	1.511
2	276.3	13.3	38	0.45	1.200
3	551.7	13.3	24	0.45	0.953
4	276.3	3.33	124	1.8	1.200
5	551.7	3.33	67	1.8	0.953
6	1380.3	3.33	32	1.8	0.702
7	34.5	2	1700	3.0	2.399
8	138.4	2	400	3.0	1.511
9	551.7	2	100	3.0	0.953
10	138.4	5	170	1.2	1.511

9.1.2 Checking Calibration Results

To perform a calibration check, a suitable reference oil is needed. Choose an oil and perform a measurement. Repeat this measurement two more times and record the results. Average these results and check if the measurement is inside the allowable 2% FSR range. If that is the case, the calibration of your instrument is okay. Please be aware, that when checking the calibration with a reference oil, the accuracy of this oil (usually 1%) has to be taken into account as well.

An example calibration check with three speeds with cone 3 and the reference oil D1000 can be seen in Table 2.

Table 2: Overview over the 2% full scale range accuracy for three speeds with Cone 3 and the reference oil D1000. Viscosity of D1000 at 25 °C = 1028 ± 10.3 cP

RPM	Maximum Value [cP]	Torque [%]	2% FSR [cP]	Allowable Error [cP]
100	7508	14	150.2	160.5
500	1501	68	30	40.3
700	1072	96	21	31.3

From this table, it can be deduced, that the choice of speeds can be detrimental to the validity of your data. While the calibration of the instrument might be okay, the allowable error under some measurement conditions might not be. It is obvious, that 100 rpm is not a suitable speed for this measurement, as the allowable error is almost ±15% of the total viscosity value of the standard.

9.1.3 Generating Reliable Results

Proper measurement conditions have to be taken into account to generate reliable and reproducible values. To ensure reproducibility always measure in triplicate and always use the same sample volumes. Sample volume can have a large effect on the measured viscosity. Under filling the cone has the biggest effect on the measurement while over filling the cone will also cause differences, albeit smaller. The easiest way to ensure this, is to utilize a pipette with a fixed volume. If a pipette cannot be used, make sure to remove any excess sample around the cone with a wooden spatula, taking care not to remove sample that is underneath the cone. For a visual guide of correct filling see section [Apply Sample](#)^{D40}. Always make sure, that the 2% FSR do not exceed 10% of the total viscosity of the fluid that is to be measured. Additionally, due to shear heating, a decrease in viscosity may be observed for speeds above 900 rpm. We cannot guarantee 2% FSR for these conditions, as it is dependent on the thermal conductivity of the sample that is being measured. Similarly, 2% FSR cannot be guaranteed for speeds above 400 rpm for cones 7 to 10, as higher speeds might cause the sample to flow out underneath the cones. This is due to the geometry of these cones.

In order to provide a guideline for cone and speed selection, the following Table 3 contains approximate viscosity ranges [cP] for each cone in different speed ranges.

Table 3: Suggested viscosity ranges for each cone at four different selected speeds

Cone	Speed			
	100	400	750	900
1	-	100-400	50-200	50-200
2	-	190-900	100-500	90-400
3	-	400-1800	200-900	200-800
4	3000-14000	900-3500	800-1800	400-1500
5	6000-28000	1800-7000	1200-3800	800-3000
6	15000-70000	3800-17000	2500-9000	1800-7000
7	700-2800	175-700	-	-
8	2500-11000	600-2800	-	-
9	10000-45000	2500-11000	-	-
10	1000-4500	250-1100	-	-
Viscosity values given in cP. 1 P = 100 cP; 1 Pa*s = 1000 cP.				

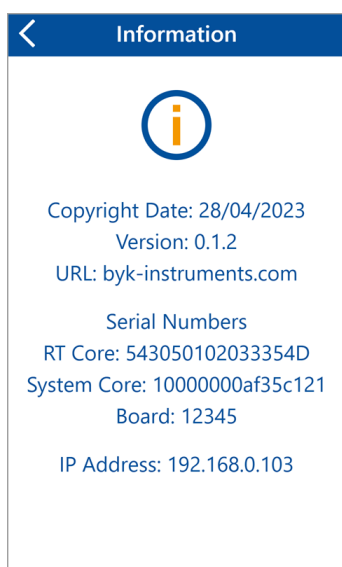
For repeatable results we recommend to accurately control and record the following conditions in the measurement report:

1. Temperature
2. Cone
3. Sample volume and how it was applied to the instrument
4. Speed and shear rate
5. Time to stop
6. Measured value and torque

9.2 Firmware Update

To update the firmware of your instrument perform following steps:

1. Go to [System Configuration](#)³¹ and tap on **Information**.
2. Check the current firmware version.
3. Get the new firmware, it is a compressed file of type "byko_update_x.y.z.tar.gz".
4. Copy the file into root directory of a USB flash drive.
5. Go to the [Main Menu](#)¹⁸.
6. Attach the flash drive to the [Viscometer Head](#)¹⁷.
7. The new firmware is detected and automatically installed.
8. Do not switch off the instrument during the update!
9. The system performs a reboot to load the new firmware.
10. Check the new version in the information screen.



In case you contact your local BYK-Gardner service center please have this data handy.

9.3 Technical Data

All technical data are subject to change without notice.

9.3.1 Instrument

Catalog number	5210: byko-visc CP L (Low temperature) 5211: byko-visc CP H (High temperature)
Measurement range	15 - 1,500,000 cP, depending on cone and speed, see " Viscosity Range " ⁶⁰
Temperature range	5210: 5 - 75 °C (41 - 167 °F) 5211: 50 - 235 °C (122 - 455 °F)
Shear rate	10 - 13,300 1/sec
Cones available	10, see " Maintenance " ⁶²
Cones in delivery	NONE
Speed range	5 - 1000 rpm
No. of speeds	Freely selectable within speed range
Repeatability	0.2%
Accuracy	±2.0% of full scale
Preset memory	6 memory locations for measurement settings presets
Measurement features	Curve Fitting, QC Limits, Multi-point Tests
Programmable features	Time to Stop, Multi-step Ramp
Display	Capacitive color display
Languages	English, German, French, Italian, Spanish, Chinese, Japanese, Portuguese

9.3.2 Viscosity Range

Viscosity ranges for byko-visc CP (5-1000 rpm)					
Cone	Shear rate constant [sec ⁻¹ /RPM]	Sample volume [μL]	Cone angle [°]	Cone radius [cm]	Viscosity range [cP]
No. 1 (8375)	13.3	67	0.45	1.511	20-37,500
No. 2 (8376)	13.3	38	0.45	1.200	40-75,000
No. 3 (8377)	13.3	24	0.45	0.953	80-150,000
No. 4 (8378)	3.3	134	1.80	1.200	100-300,000
No. 5 (8379)	3.3	67	1.80	0.953	300-600,000
No. 6 (8380)	3.3	30	1.80	0.702	800-1,500,000
No. 7 (8381)	2.0	1700	3.00	2.399	78 - 62,500 ^[a]
No. 8 (8382)	2.0	400	3.00	1.511	313-250,000 ^[a]
No. 9 (8383)	2.0	100	3.00	0.953	1,250-1,000,000 ^[a]
No. 10 (8384)	5.0	170	1.20	1.511	100-100,000 ^[a]

^[a] Maximum speed recommended with this spindle is 400 rpm. Viscosity range indicated is for operation at 400 rpm.

9.3.3 General Data

General Data

Usage	Indoor use
Temperature range	10° C to 40° C (50° F to 104° F) for operation 0° C to 60° C (32° F to 140° F) for storage
Relative humidity	Up to 85% non-condensing at 35° C (95° F)
Operation altitude	Up to 2000 m (6561 ft)
Dimensions (LxWxH)	300 x 170 x 430 mm (11.5 x 6.5 x 17 in)
Interface	2x USB Type A 1x USB Type C 1x Ethernet
Weight	6.5 kg (14.3 lbs)
Power supply instrument	byko-visc CP L models: 24 V  , max. 3.75 A byko-visc CP H models: 24 V  , max. 5 A
External power supply	Input: 100 - 240 V  ; 50 - 60 Hz ; max. 1.3 A Output: 24 V  ; max. 1.25 A Vendor: Mean Well Model: GE30I24 Safety standards: UL62368-1, CSA C22.2 NO. 62368-1, TUV BS EN/EN62368-1, AS/NZS 60950.1, CCC GB4943, EAC TP TC 004 approved
Overvoltage category	I
Pollution degree	2

9.3.4 Documentation

Safety Instructions	300 003 759	26 languages
Short Instructions	300 003 757	8 languages
Operating Manual	300 003 755	English

Download: <https://www.byk-instruments.com/p/5210>

9.4 Maintenance

Cleaning and Routine Maintenance

Remove the spindle after use to clean. Severe damage to the instrument can occur if the spindle is cleaned while mounted to the viscometer. The stainless steel paddle spindle may be cleaned with solvents required for the material being measured and a non-abrasive cloth.

Remove spilled material from the instrument case and base. Avoid solvents on the faceplate and the color display as they may be seriously damaged by strong solvents.

Restart instrument to check both leveling and zero check in regular intervals.

Troubleshooting

If problems occur, verify that power is being applied, first to the power supply then from the power supply to the instrument. If the power is good, disconnect the power supply from the back of the instrument for at least 30 seconds, reconnect the power supply and turn on the power switch. If problems persist, please contact your local BYK-Gardner office.

Service and Spare Parts

For all service and spare parts requirements, please contact your local BYK-Gardner office.

Do not perform any repairs on the unit. The unit must be opened by BYK-Gardner authorized repair locations only. Repair as this will void the warranty and affect the safety protection.

Ordering Information

Cones available for ordering	8375: Cone No. 1 for byko-visc CP 8376: Cone No. 2 for byko-visc CP 8377: Cone No. 3 for byko-visc CP 8378: Cone No. 4 for byko-visc CP 8379: Cone No. 5 for byko-visc CP 8380: Cone No. 6 for byko-visc CP 8381: Cone No. 7 for byko-visc CP 8382: Cone No. 8 for byko-visc CP 8383: Cone No. 9 for byko-visc CP 8384: Cone No. 10 for byko-visc CP
------------------------------	---

9.5 Service Points



 List of global service centers with ISO / IEC 17025 accredited laboratories		
Headquarter Germany c/o BYK-Gardner GmbH Lausitzer Strasse 8 82538 Geretsried / Germany		Service Point USA c/o BYK-Gardner USA 9104 Guilford Road Columbia, MD 21046 / USA
North Latin America c/o Exacolor Laboratories S.A. de C.V., Barranquilla 150, Alta Vista, 64840 Monterrey, N.L., Mexico	Service Point South Latin America c/o MAST Comercial e Importadora LTDA Rua Itaporanga, 340-B, Bairro Paraíso Santo André - SP, 09190-640 / Brazil	
Service Point Spain c/o Actega Artística S.A.U. Calle Balmes 8, Suite: 3º2ª 08291 Ripollet / Spain	Service Point France c/o Eckart France S.A.S. 31 Rue Amilcar Cipriani 93400 Saint Ouen / France	Service Point Austria, Hungary, Slovenia c/o Friedrich W. Bloch GmbH Wagramerstrasse 201 1210 Vienna / Austria
Service Point China c/o BYK (Tongling) Co. Ltd. Shanghai Branch Block 6A, Building A, No 88 Hong Cao Road, Xuhui District, Shanghai 200233 / P.R. China	Service Point India c/o IMCD India Private Limited 1101-03, B-Wing, ONE BKC, Bandra Kurla Complex, Bandra East, Mumbai, MH. Pin.:400 051. India	Service Point Japan c/o Tetsutani Co. Ltd. Chuo-ku, Osaka Tokuicho 2-2-2 / Japan
Complete list: https://www.byk-instruments.com/global-service-centers List of authorized agents: https://www.byk-instruments.com/contact-infos		

A member of  **ALTANA**

Download your manuals from:

<https://www.byk-instruments.com/p/5210>

BYK-Gardner GmbH
Lausitzer Strasse 8
82538 Geretsried
Germany

Tel +49 8171 3493-0
Fax +49 8171 3493-140

info.byk.gardner@altana.com
www.byk-instruments.com



300 003 755 - 2601