USING MANUAL

DSR 500

VERSION N° DSR500-UK06/2025

TABLE OF CONTENTS

1 INTRODUCTION

The instrument is a device able to measure the viscosity, which is the capacity of a product to resist to the flow.

The fluid is forced to a shear rate (rotational speed) and the shear stress (motor torque) is measured. The values of shear rate and shear stress then make it possible to calculate the viscosity using the Newton equation and the constants associated with the mobile used.

Equation of Newton is: $\eta = \frac{\tau}{\dot{\gamma}}$

With η for viscosity in Pa.s, τ for shear stress in Pa and $\dot{\gamma}$ for shear rate in s^{-1}.

Shear stress and shear rate are calculated by using constants of each measuring system as:

$\tau = M \times K_{Tau}$ with M for motor torque in mNm and K_{Tau} in Pa/mNm.

$\dot{\gamma} = n \times K_D$ with n for rotational speed in rpm and K_D in s^{-1}/ rpm.

The device calculates the viscosity by dividing the shear stress by the shear rate for each measuring point. The K_{Tau} and K_D constants used depend on the measuring system selected for the measurement.

Viscosity depends on the temperature, then it must be essential that all viscosity values are associated to a reading of the sample temperature, in order to compare viscosity for different samples.

There are some products for which the viscosity, to a constant temperature, stay unchanged, even if we change the shear rate. Those samples are named **Newtonian fluids**, i.e. : Oils, Water, Glycerol, etc…However, many substances have a variation of viscosity in function of speed of shearing, and the Flow Behaviour of those samples could be determined with measuring instruments able to set many speeds of rotation.

The instrument is constituted with a continuous current motor and an optical encoder, in order to warranty a great accuracy of rotational speed, on all torque range.

The instrument has an easy touch screen display, on which you could read the **speed**, **shear rate** (according to spindle), **shear stress**, **measuring spindle** reference, temperature, the measured torque and the dynamic **viscosity** in **mPa.s (=cPoises) or Pa.s**. It is possible to program and save methods (ramp, constant or step by step), use fitting models, show curve on display and print result directly on printer.

The instrument can be used with different measuring system. You will find below a list of compatible measuring system with this instrument.

- **MS RV/LV:** Measuring spindles according to ASTM / ISO 2555 (316L stainless steel).These systems are ideally suited for simple viscosity measurement at controlled rotational speed in all areas of activity. The standard recommends use of 600ml beaker for measurement.

- **MS BV:** Measuring spindle for 150ml beaker (316L stainless steel).These spindles are ideally suited for simple viscosity measurement at a rotating speed in control in all areas of activity. They are appreciated for their ease of use and the low volume of product needed compared to the MS ASTM spindles.

- **MS VANE:** Measuring spindles with blades (316L stainless steel). These systems are ideal for viscosity measurement (value or curve) in control or development of all types of products even of very high viscosity with or without particles (size <5mm). They can be used for direct measurement in user's containers or in tubes of MS-DIN systems.

- **MS KREBS**: Krebs type measuring spindles compatible with ASTM D562 standard (316L stainless steel). These systems are ideal for viscosity measurement in Krebs units in control of all types of products. They can be used for direct measurement in user containers in 600 or 150ml beakers.

- **MS DIN**: Coaxial cylinders measuring systems according to DIN / ISO 3219 (316L stainless steel).These systems make it possible to set the shear rate in order to carry out viscosity measurements or to obtain curves to study flow behaviour, yield stress or thixotropy. They are particularly suitable for the control or development of homogeneous products with liquid aspect and with or without particles (size <200µm).

- **MS SV:** Measuring systems for low volumes (316L stainless steel). These systems, unlike the MS-ASTM and MS-DIN systems, make it possible to measure products in small quantities by applying a shear rate up to temperatures of 200 ° C (according to models, see table). With RT1, these systems are compatible with ASTM D3236.

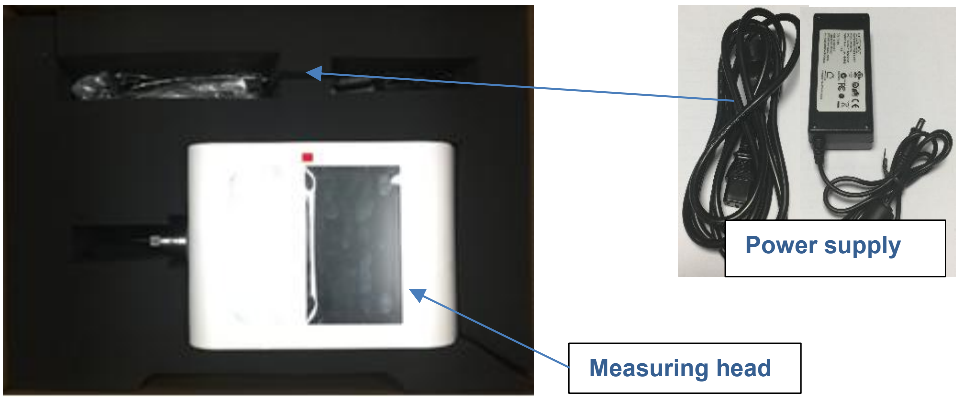
- **MS ULV:** Measuring system (316L stainless steel) for low viscosities usable with instruments LR version. This system, unlike the MS-RV/LV or MS-DIN systems, makes it possible to measure low viscosity products in control by applying a shear rate.

- **T-BARS:** Special spindle (316L stainless steel) used with HELIPRO stand. These spindle allow while move up/down of lift to avoid cavity formation. They are highly recommended with non-flowing materials.

- **MS-R:** Anchor-type measuring systems (316L stainless steel).These systems are ideally suited for measuring viscosity (value or curve) in the control or development of heterogeneous products, or having the appearance of soft solid at rest, present in cosmetics, paint, food or mineral chemistry industries. Used with their respective cups, they allow to apply a shear rate.

1.1 Components

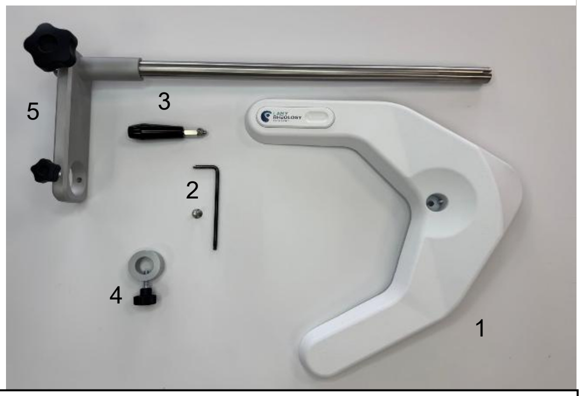
The instrument is delivered inside a foam protection with power supply to avoid any problem during transport. All other accessories needed to use such as measuring geometries or stand and installation pieces are delivered in another carton. Here is in detail what is contained in this foam. The measuring head must be dislodged with care in order to prevent the temperature probe from being damaged.



The instrument support is delivered in a box with the installation accessories. Its content depends on the type of stand ordered as shown below.

Instrument with rack stand.

Instrument with standard stand.

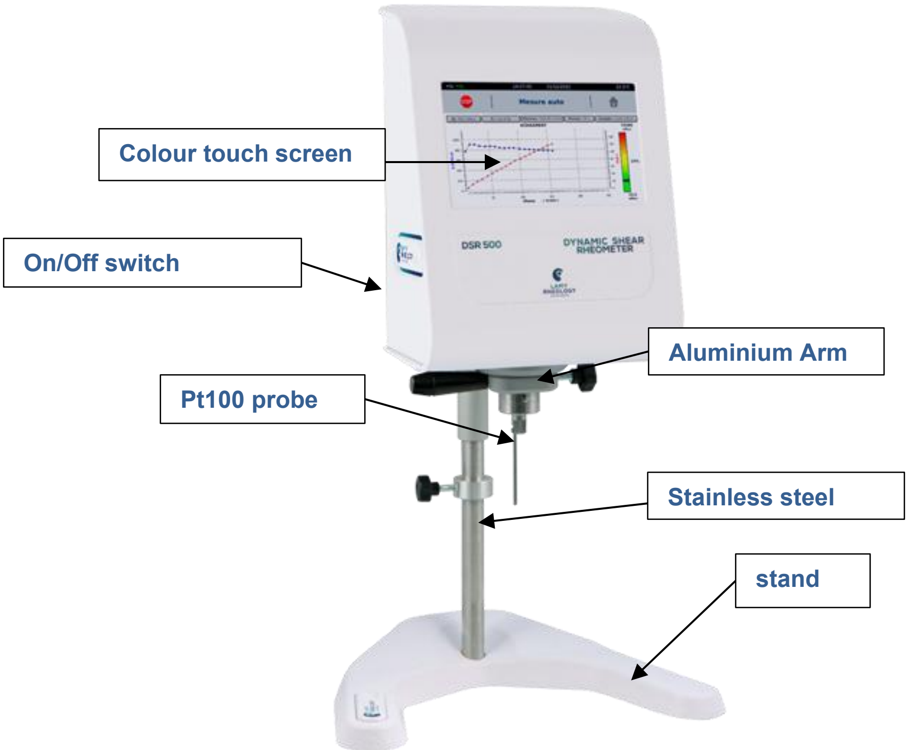


1. Stand.
2. Tool and screw.
3. Notched rod and arm.

1. Stand.
2. Tool and screw.
3. Handle for arm.
4.Stop ring.
5. Smooth rod and arm.

1.2 General view of your instrument

Following information concern device delivered without temperature control as EVA MS DIN, or RT-1 PLUS oven. Once your device will be mount and installed, it looks like this (for standard stand only).



- **TOUCH Screen**

The new series is equipped with a 7" colour touch screen. It gives you greater working comfort and a clearer view of your data and analysis results. Large screen allow display of curve

- **On / Off switch**

Always with the aim of improving your experience, LAMY RHEOLOGY has decided to equip its entire range PLUS with an On/Off button. It has been placed on the back of the device for greater intuitiveness.

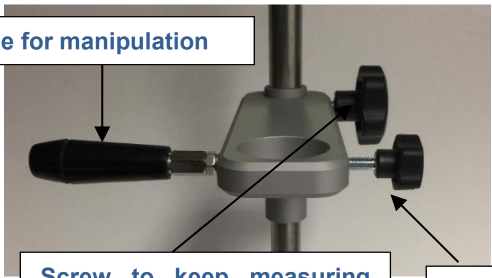
- **Aluminium arm**

The aluminium arm of the standard stand has tightening knob that allows you to maintain the height of the measuring head and handle for easy handling.

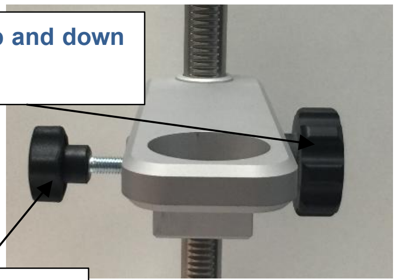
The aluminium arm of the rack support is fitted with a button for raising or lowering the measuring head.

The measuring head is attached to the arm using a screw fitted with a tightening knob.

Standard stand



Rack Stand

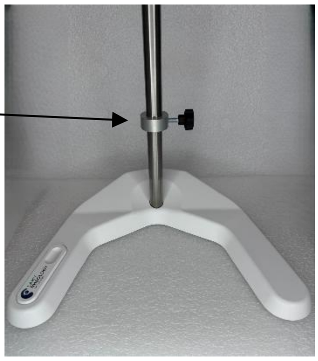


- **Stainless steel rod**

The rod of supports is made of stainless steel for a solid hold on the measuring head. It has a very long lifespan.

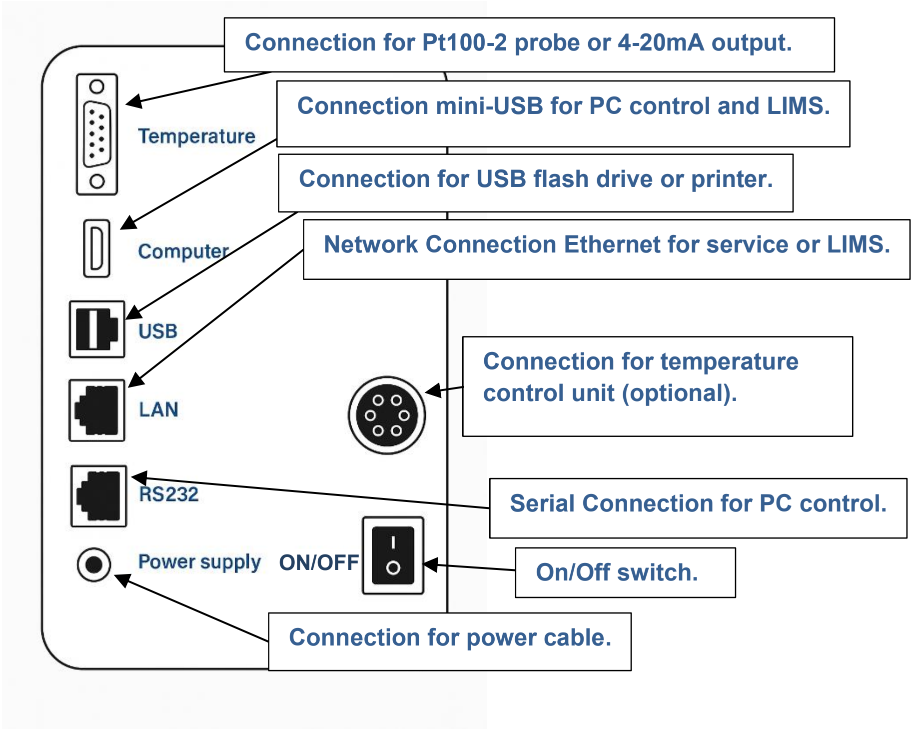
The standard support is fitted with a stop ring for memorizing a measurement height.

This ring is not present on the rack support.



1.3 Connections

According to delivery, rear panel of device get these available connections.



Connection for temperature control units is available when device has been ordered with a unit with programmer such as EVA DIN, EVA DIN MS-R or RT-1 PLUS oven.

1.4 Specifications

Type of instrument: Rotating springless instrument with 7'' Touch screen
Rotation speeds: Unlimited number of speeds between 0.3 and 1500 rpm
Torque range: From 0.05 to 30 mNm.
Temperature: The instrument has a PT100 sensor which indicates temperatures between -50 °C to + 300 °C
Accuracy: +/- 1 % of the full scale
Repeatability: +/- 0,2%
Display: Viscosity – Speed – Torque – Time – Temperature - Choice of viscosity units: cP/Poises or mPa.s / Pa.s – Shear rate, Shear stress.
Language: French/English/Turkish/Russian/German/Korean/Portuguese/Italian.
Compatible measuring system: MS DIN, MS RV/LV, MS BV, MS VANE, MS ULV, MS SV, T-Bars, MS-R.
Compatible temperature control: EVA DIN, EVA LR, RT1, EVA MS-R.
Supply voltage: 90-240 VAC 50/60 Hz
Analog output: 4 - 20 mA
PC connections: RS232 Port and USB.
Printer connections: USB Host Port – Compatible PCL/5
Options: See brochure.
Dimensions and weight: Head: D160 x H270 x W200 mm. stand: L340 x W305 x H70 mm. Stainless steel rod: Length 500 mm. Weight: 6.7 kg.

1.5 Installation

Your device should be installed in a clean, vibration-free environment. Even if no level is necessary, choose a stable and flat table.

This installation notice concern only instrument without any temperature device. If you have it, please refer to specific notice of temperature unit for installation.

For standard and rack stand: After unpacking all accessories from the box (or case if it is supplied), you must first screw the rod to the base with the help of the screw and the key provided.

For standard stand: The rod of supports is made of stainless steel for a solid hold on the measuring head. It has a very long lifespan.

The standard support is fitted with a stop ring for memorizing a measurement height.

This ring is not present on the rack support.

For standard and rack stand: You can then put the device on the arm, taking care not to touch the motor shaft or temperature sensor (if your device has one). Align the measuring head correctly and secure it with the screw provided.

Connect your device by plugging power cable on to rear panel of device. Also, cable for software connection and for temperature control unit (EVA or RT-1/THERMOCELL) when they are provided (see section 1.3).

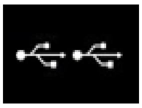
Your device will be used with different measuring system. To know how to mount and use it, please refer section 3.

2 GETTING STARTED

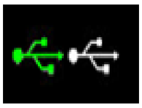
Once power cable has been plugged on rear panel of device, you can click on button On/ Off from behind your device to switch on (see section 1.3).

2.1 State icons

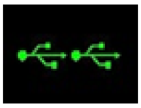
Once your device is switched on, you will see some icons on Touch Screen.



No Device is connected to the instrument.

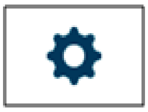


Only one Device is connected to the instrument.



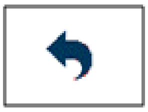
Two Devices are connected to the instrument.

Give you the temperature of probe in the sample.



Enable to go to parameters of instrument.

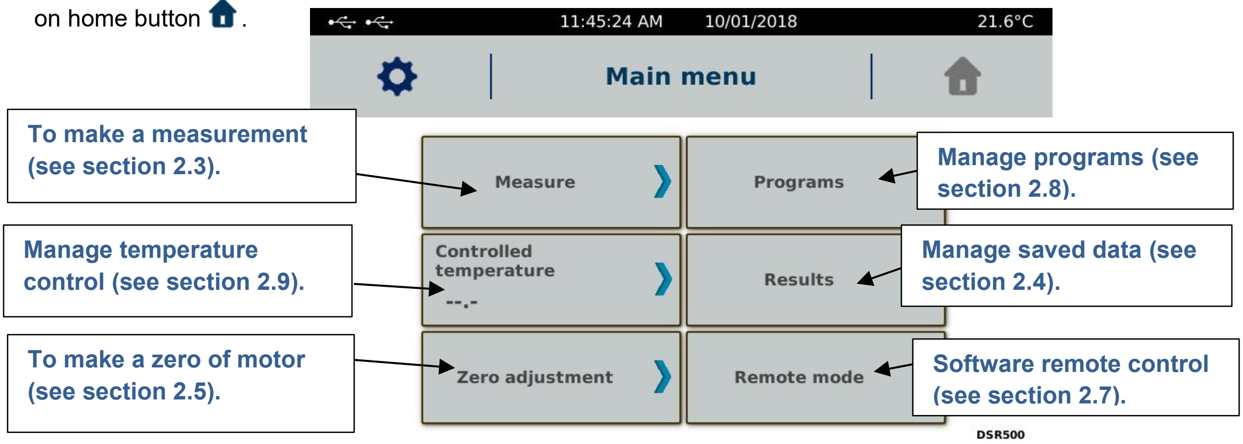
Enable to come back to Main Menu.



Enable to come back to previous menu.

2.2 Main menu

Main menu enable to you to browse between different tabs of your instrument. Acces is always available by clicking on home button .

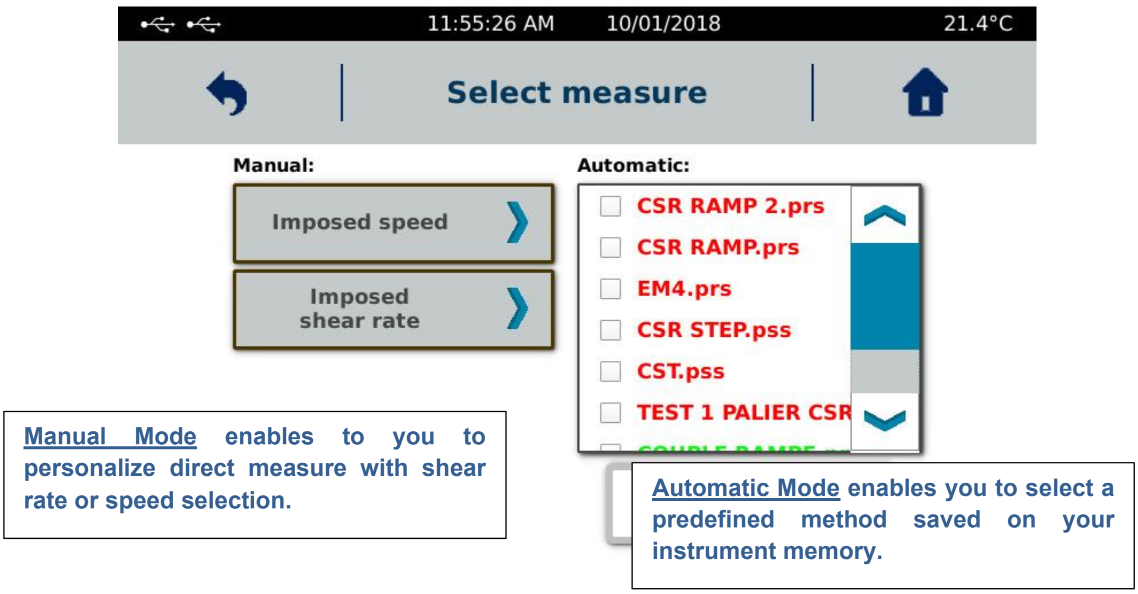


The "Controlled Temperature" button is present when the instrument has been ordered and delivered with a programmable temperature control such as EVA or THERMOCELL / RT-1. If you purchase such a unit at a later date, we invite you to contact LAMY RHEOLOGY or your local agent to activate this function

2.3 Measure menu

Measure tab is central part of your instrument. Before to use it, you should install your measuring system and your sample. Please see section 3.

Then you click on "Measure", you will see a new window.

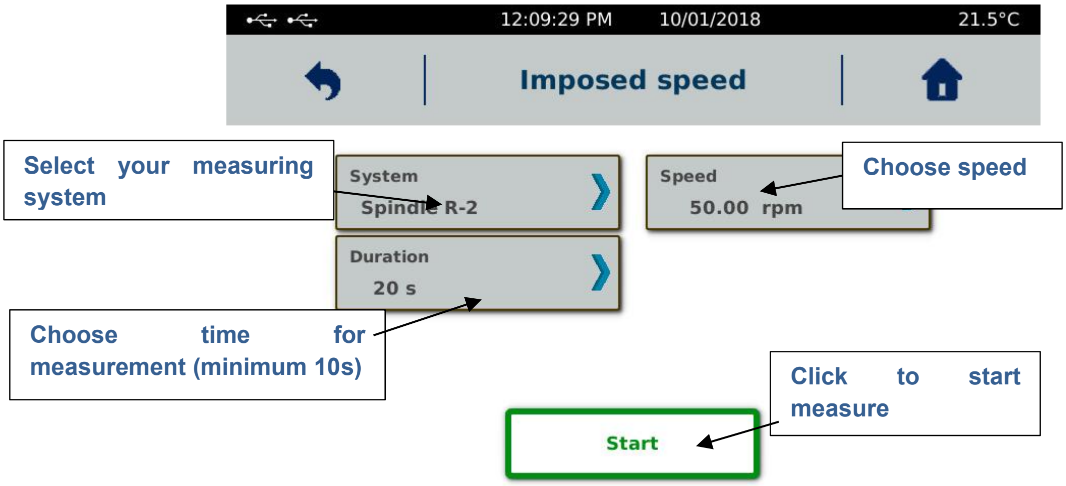


2.3.1 Manual mode

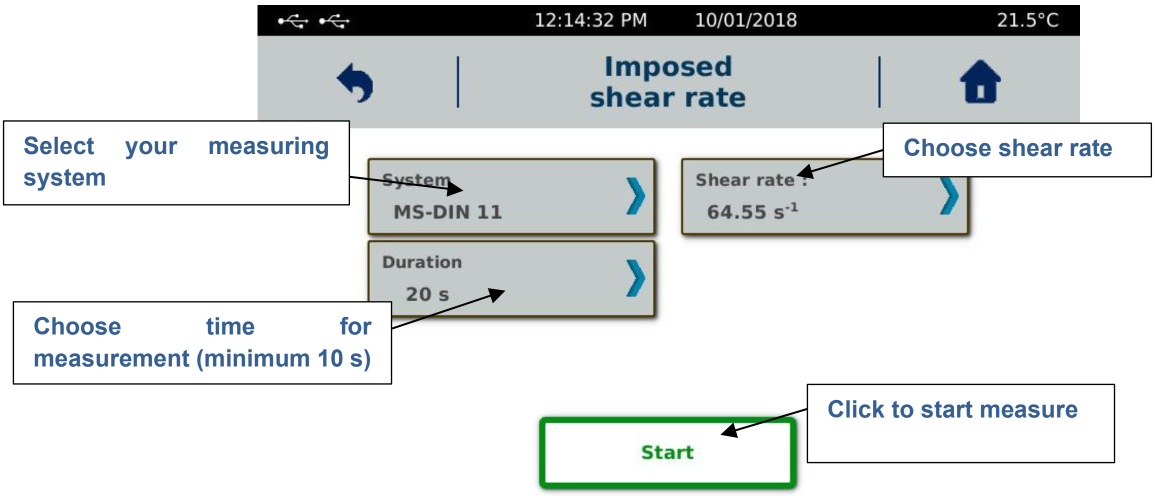
Manual Mode enables to choose your measurement parameters like “Measuring System”, “Speed” or “Shear rate” then “Time of measurement”.

This mode is interesting when a simple measurement of viscosity at a constant speed or shear rate is sufficient. When your test has to incorporate ramps, it will be necessary to create a program (see section 2.8).

The "imposed speed" mode is recommended when MS RV/LV, MS BV, MS KREBS or MS VANE are used.



"Imposed Shear rate" mode is recommended when using MS DIN, MS ULV or MS SV measuring system.



Rq : If « Time » = 0, you could modify « speed » during the measurement. This could help you to define the best conditions to work on your sample.

If your measuring system is not in list, you may have to create it. Please refer to section 2.6.6.

Choice between “Speed” or “Shear rate” is according to your measuring system. If you need to know what is the corresponding speed then you are using shear rate, you have to use constant K_D of your measuring system (information available in section 2.6.6) and use this simple equation.

SPEED = SHEAR RATE / K_D

With speed unit in rpm, shear rate in s^{-1} and K_D is rpm/s^{-1}.

When your parameters are filled in, you can click on "Start" to start your measurement after having installed the geometry (see paragraph 3). Check before starting measure that zero of motor has been done (see section 2.5).

Depending on the chosen control mode, you will get both views during the test.

Imposed speed

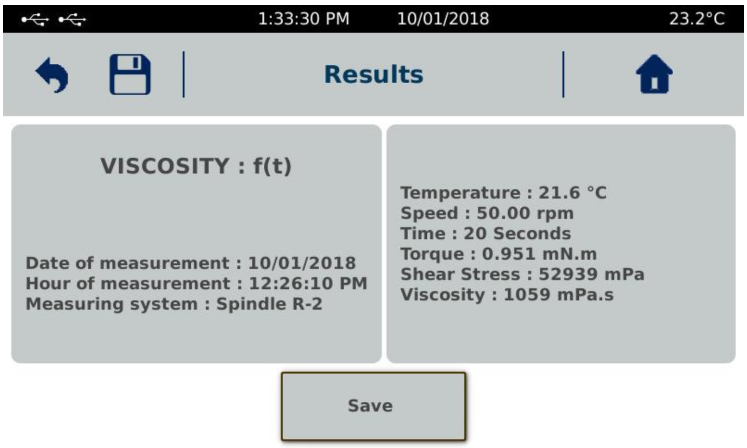
Imposed shear

During your measurement, you will see a torque gauge (on the right side of the display). Boundaries of this gage give you minimum and maximum viscosity you can measure with your selected spindle and set speed/shear rate. You have also value in % corresponding of measured torque vs maximum torque of device. This maximum torque or viewing % can be set on device (see section 2.6.11).

You must verify that the measured torque is not too close to the upper or lower limit, because you can get message as “Lower Torque” or “Torque Overload” and measurement will stop automatically. If this is the case, increase speed/shear rate or take a larger measurement system if you are close to the lower limit. Please decrease speed/shear rate or choose a smaller measurement system if the torque reading is close to the upper limit.

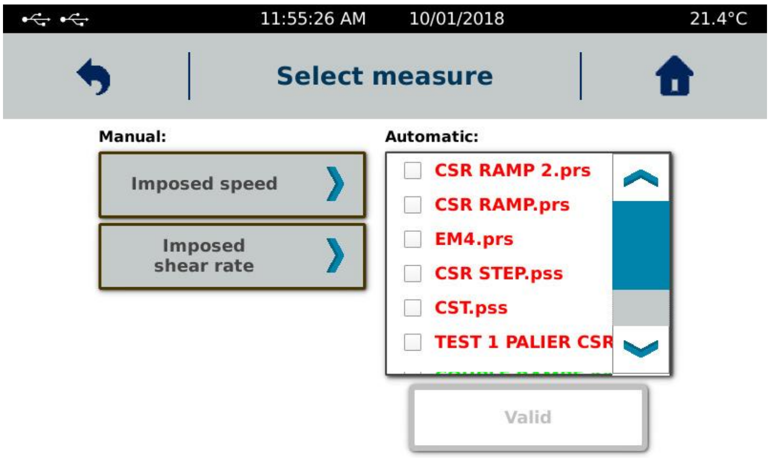
You will find several information available on the screen such as torque (mN.m), stress (Pa), temperature (°C), time (s) or viscosity (mPa.s). If the units do not suit you, you can change them in parameters (see section 2.6.5).

When your measurement is complete, you will get the window below. You will find all the data you need and will be able to save it in the internal memory or print it (if a printer is connected). If you choose "Save", the device will ask you to give a name to your measure. You will have the opportunity to read it later (see section 2.4).



2.3.2 Automatic mode

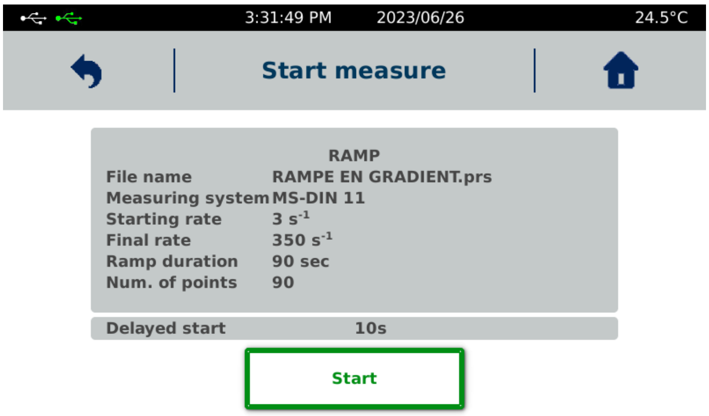
Automatic mode allows you to select pre-recorded programs (see section 2.8).



The format of the methods is as follows:

- Files in "* .prs" for speed/shear rate ramp method.
- Files in "* .pss" for speed/shear rate step method.

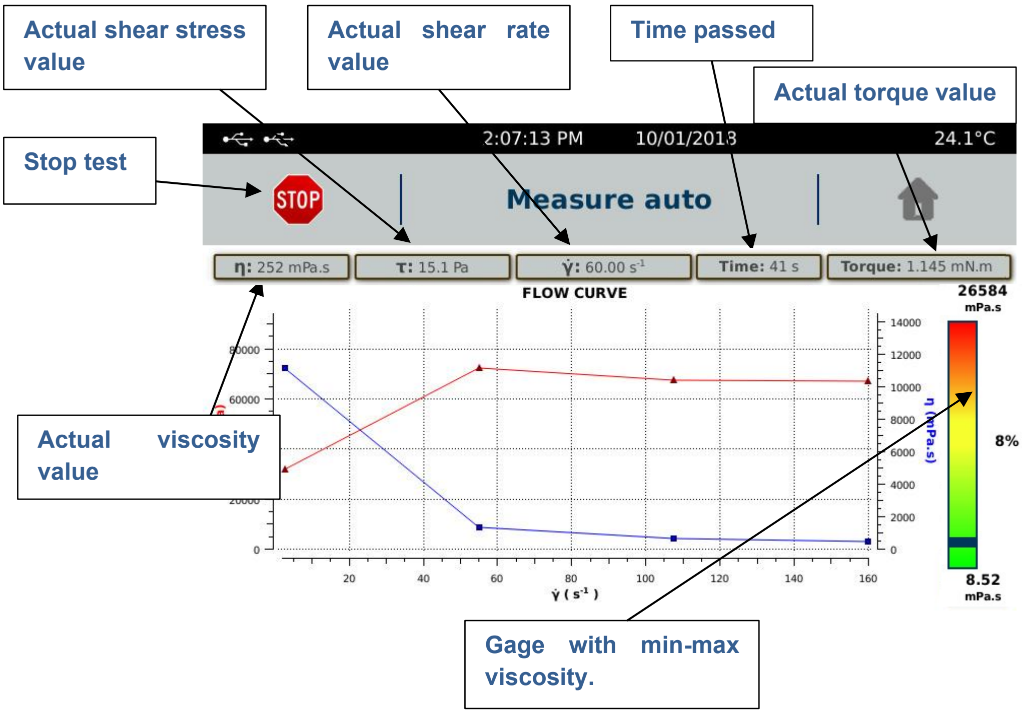
Select the program from the list and click "Valid" to start your measurement. The display adjusts automatically to show you the parameters of the chosen program.



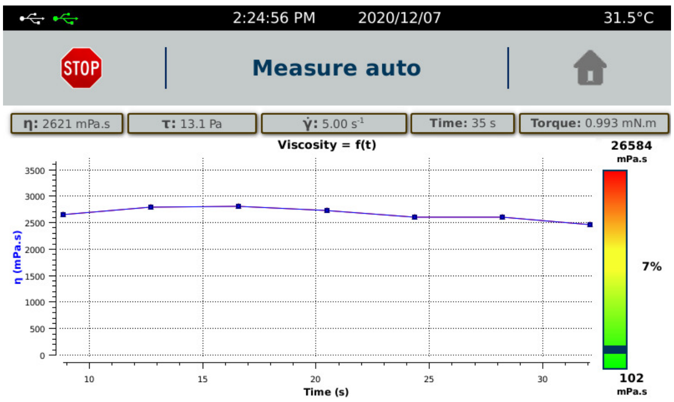
Check to make zero adjustment of motor before measurement (see section 2.5).

Whatever type of selected program, the instrument will ask you to save your measurement when you click on "Start". If you wish to see in detail the contents of each method, we invite you to consult the paragraph 2.8. If a delayed start has been requested in the program, the previous view displays a time countdown before switching to the view currently measuring.

Depending on selected program, the current display may be different. For all ramp and step modes (see section 2.8) the device will display a curve with the shear rate or velocity as x-axis, and two axes on the y-axis showing shear stress for one and viscosity for the other.

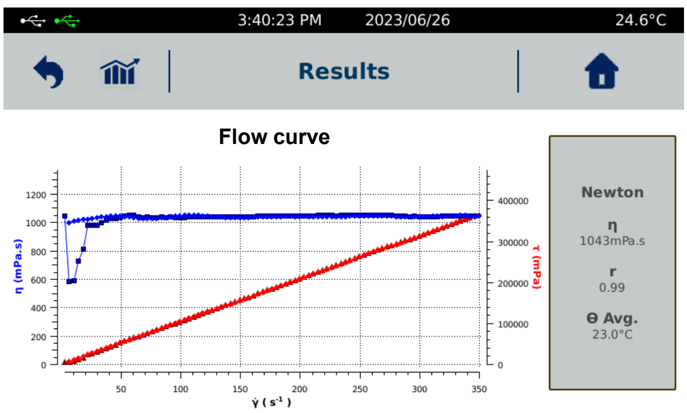


Some methods in step mode (format pss) contain only one step. These methods are intended for constant parameter measurements over time. The display of the curve will be different with time on x-axis. The name of the graph is also different (here Viscosity = f (t)).

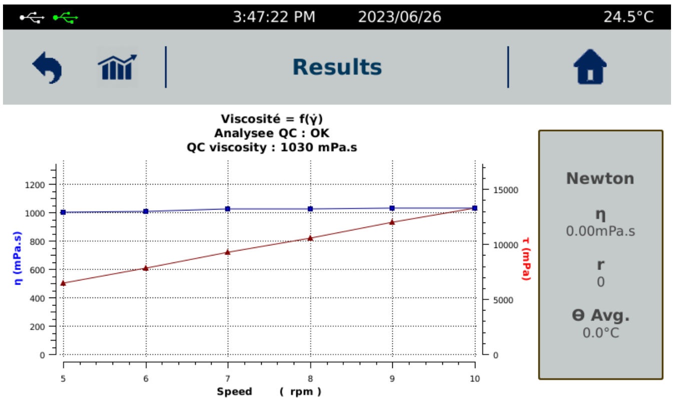


At any time you have the option to stop the measurement by clicking on the "Stop" button. The device will then ask you whether you want to save the measurement or not.

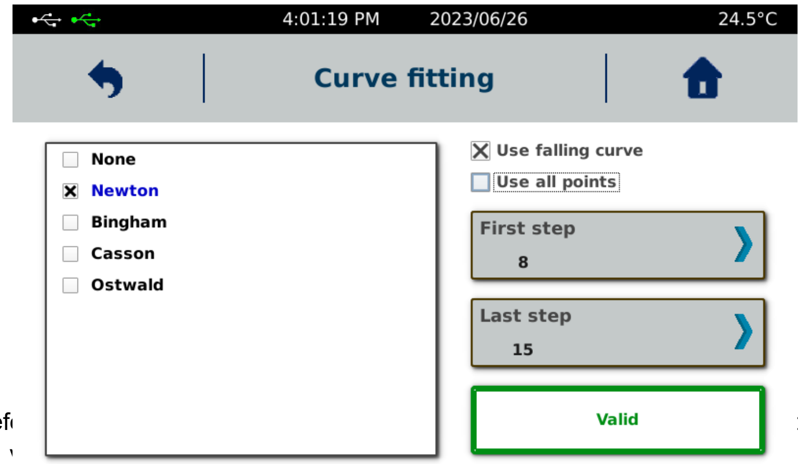
Some methods contain an analysis at the end of the measurement. When the measurement comes to an end, you will be able to see the result of this analysis as well as the curves obtained.



For measurements using a step method, it is possible to use a QC analysis at the end of the measurement. This analysis is performed on the last measurement of the last step (see the method parameters in paragraph 2.8).



Step or ramp programs that can combine a rheological analysis by regression. This can be reused with other parameters by clicking on the icon .

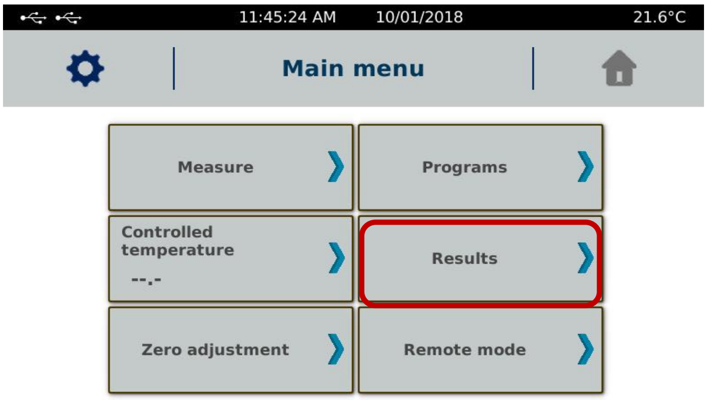


The analysis tool therefe ogramming. After making your changes, ew with the new results.

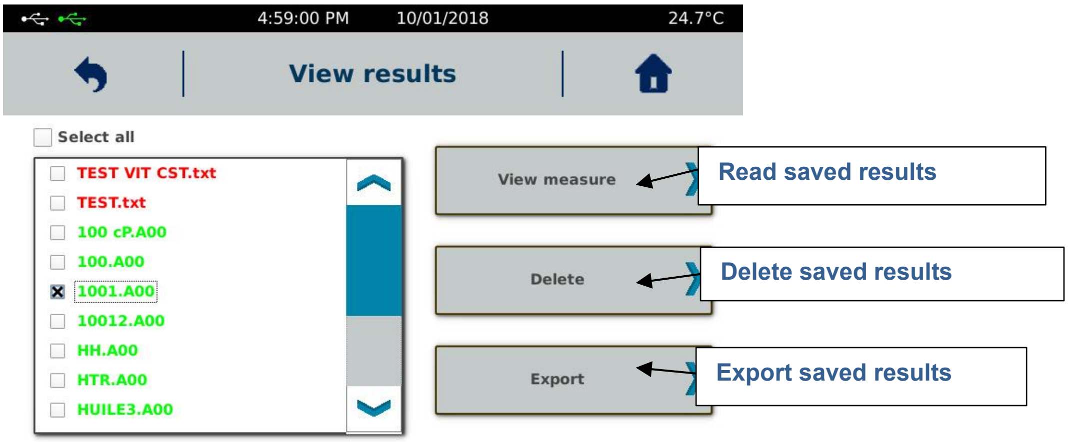
All saved results can be read later (see section 2.4).

2.4 Results menu

This menu allow you to read, export or delete data from internal memory. Press on «Results» tab in Main menu.

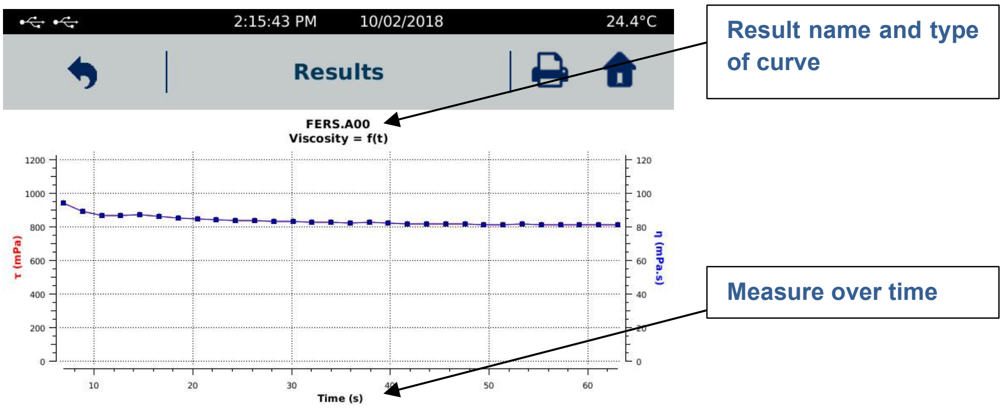


Once you are on the screen below, simply select the measurement in the list and choose the desired option. The measurements in green correspond to results obtained with a programmed method while the measurements in red come from measurement in manual mode (see paragraph 2.3).

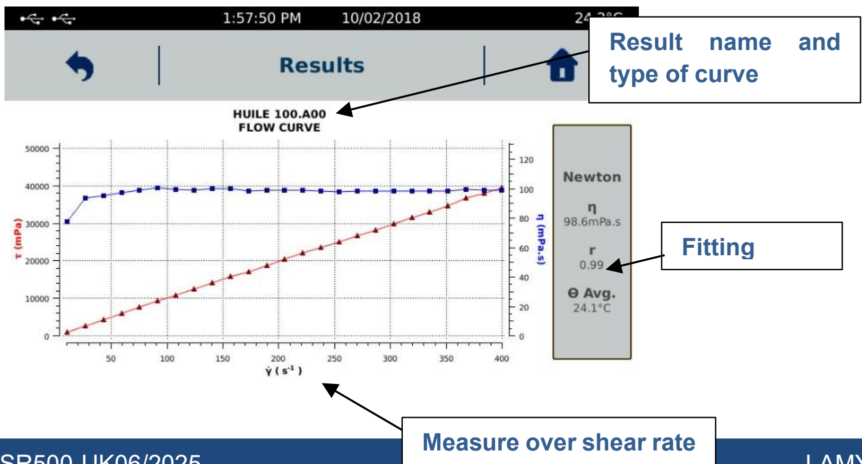


When you select measurements done in manual mode, you will get this view with all important information saved with the result. The options available are export if a USB key is connected to the instrument or printing (printer icon).

When you select a measurement obtained through a programmed method, you will get two different displays. The first display concerns the measurements obtained with a step method containing only one step.



The following display concerns all other types of methods.



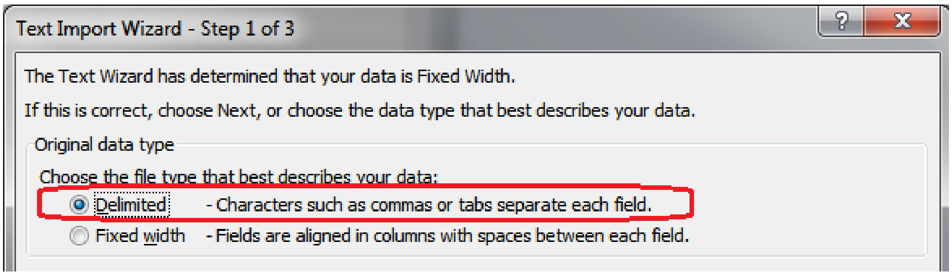
The box for regression is only present if your method allowed the calculation.

When a printer is installed and connected to your device (see section 2.6.9), A symbol next to the "Home" button allows you to directly print your curve or result.

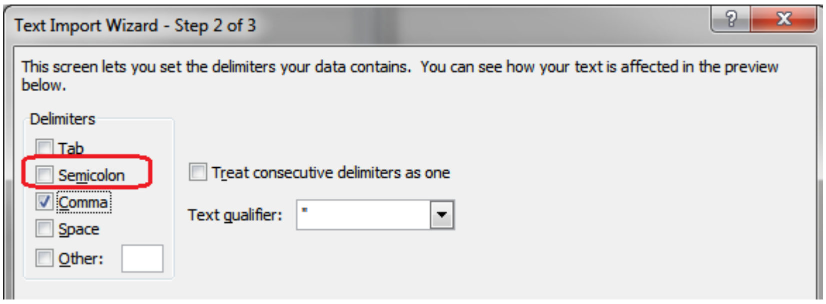
The "Export" function is accessible only when a USB key is connected to the back of the instrument (see connection section 1.3). If you want to export all the measurements at the same time, you can do this by checking the "Select all" box. Whatever the program used for the measurement, only the recorded data can be exported. It is not possible to export or copy a diagram.

The format of the data generated and saved by the device is ASCI (* .csv). Once your data has been copied to the USB drive, you can open the files using the EXCEL spreadsheet. To do this, simply copy the data from the USB stick to your computer. Then open Excel, then choose "File", "Open", taking care to select "All files *. *". The Excel spreadsheet will offer you to convert your data by displaying three successive windows.

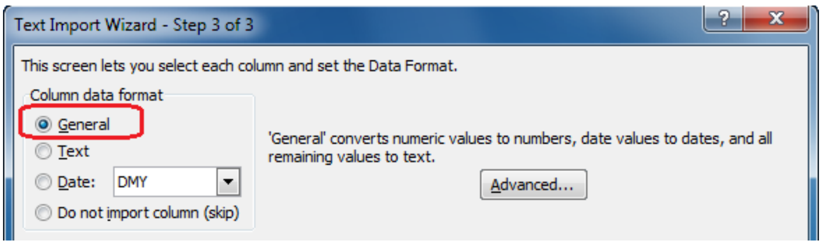
Verify that the "Delimited" function is selected and then click next.



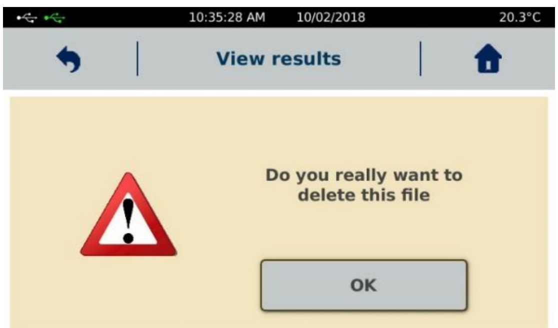
On the next window, be sure to select the "semicolon" as the separator and click next



On the window below, select the general mode and click on finish. Your will get a table with all the information.

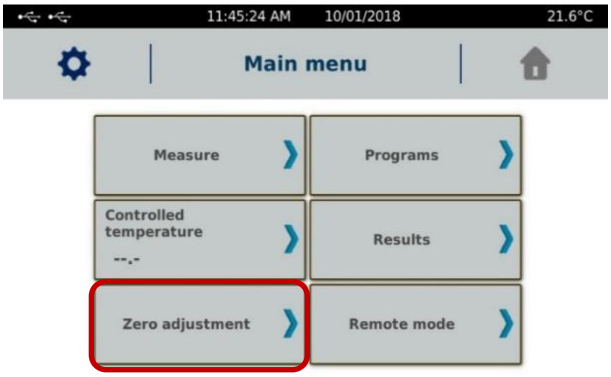


To delete a result, simply select your measurement in the list and click on "Delete". The deletion will be complete only after confirmation from you. You can also delete all measurements by clicking on "Select all" then “Delete”.

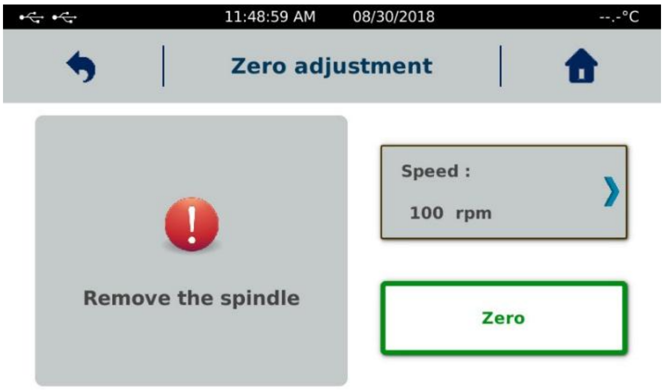


2.5 Zero adjustment menu

The zero setting allows you to calibrate your instrument to take account of the engine's empty friction.



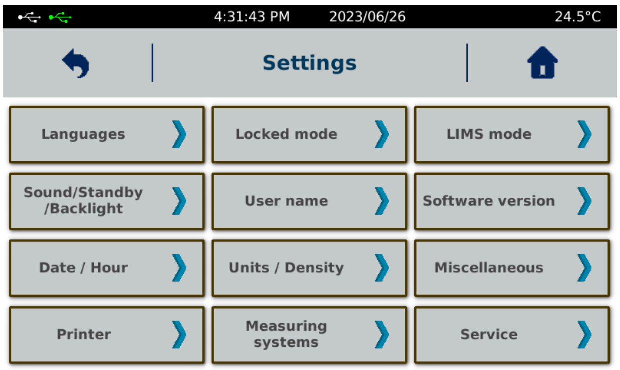
The rotation speed for zero adjustment can be changed to suit your needs, giving you much more accurate measurements at specific speeds close to your measurement parameters.



This operation must be done without measuring system for standard device. Then zero is finished you can click on OK and internal motor friction will be automatically saved inside memory of device. If a problem occurs during zero setting, please try again. If the problem still present, please contact your local distributor or society LAMY RHEOLOGY.

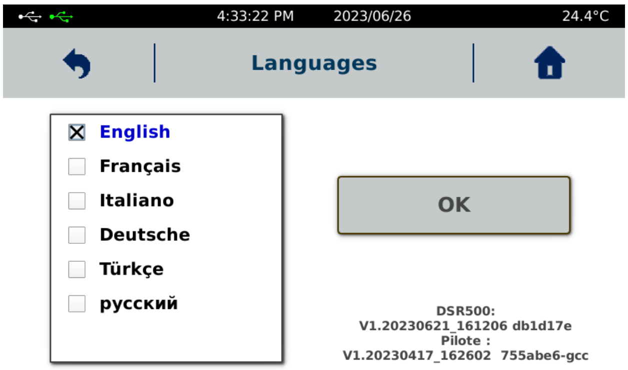
2.6 Settings menu

This parameters menu allows you to change settings of your device. It is reachable by clicking on icon in upper left corner of touch screen which is only available then you are in "Main menu".



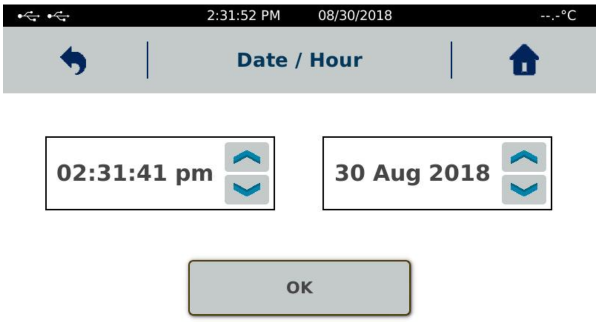
2.6.1 Languages

It enables you to select language of your instrument. You have choice between French/English/Turkish/German/Korean/Portuguese/Italian. Then you have selected your desired language, you have to click on “Ok” and device will reboot automatically to show new language. In this menu you will be able to see Firmware version of your device.



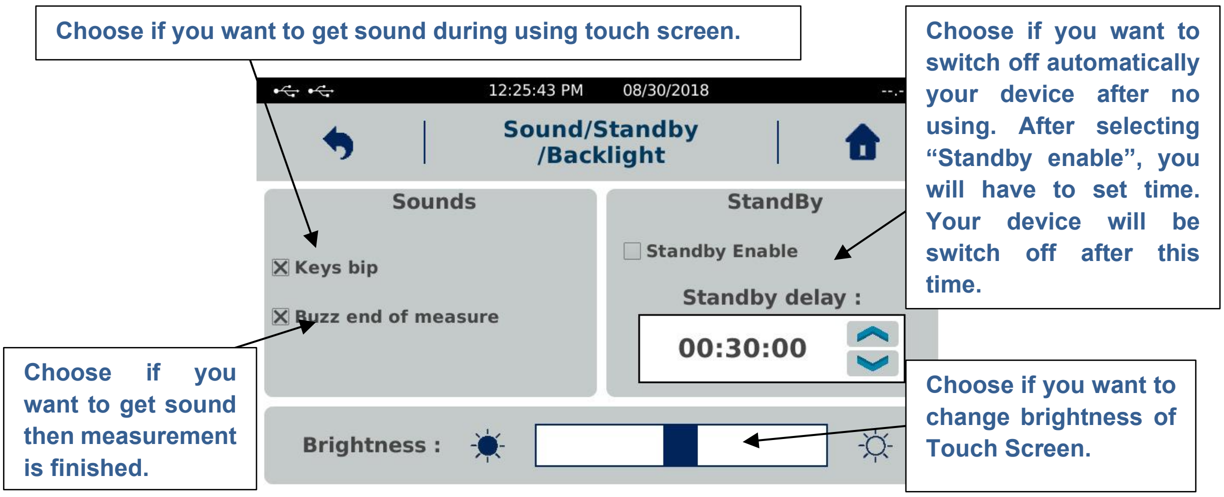
2.6.2 Date / Hour

It enables you to adjust hour and date of your instrument.



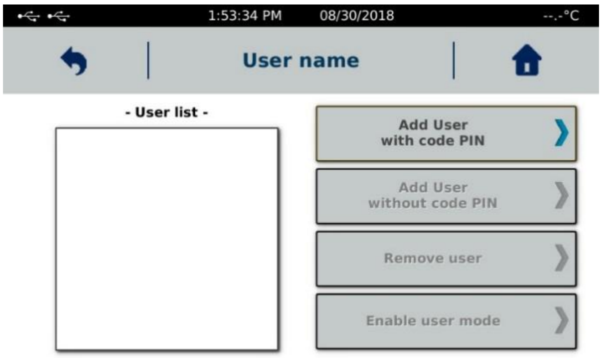
2.6.3 Sounds / Standby / Backlight

It allows you to modify sounds, lighting and activate or not the Standby mode of your instrument.

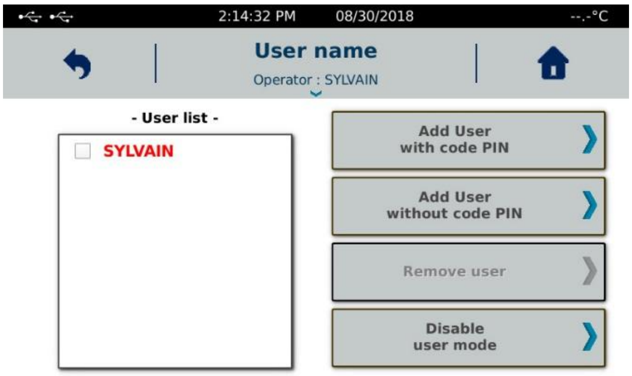


2.6.4 User name

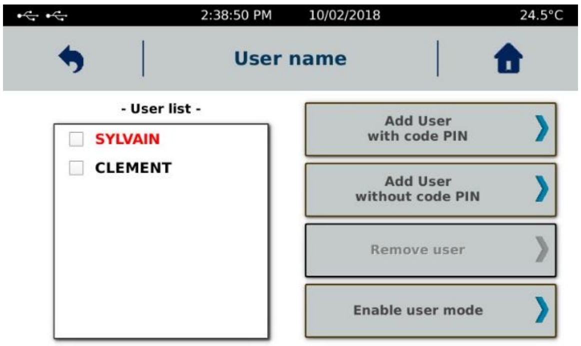
Operator mode will allow you to create different operators for your instrument. This function allows you to identify operator doing measurement and lock some functions of instrument. It can be combined with the "Locked mode" to increase protection level of settings and data (see section 2.6.7).



Operator management must always start with the creation of the first account, which will become the administrator. You can create other operator accounts or delete them. The administrator account must be associated with a password (here called PIN).

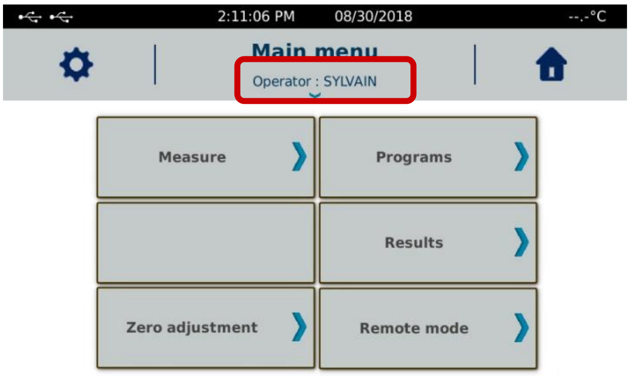


To create the administrator account, click on "Add user with code PIN". Fill in the name and the associated PIN code.
After indicating the name and password, the administrator just created will have his name in red in the list. You can now create other operators with or without a PIN. All other accounts will be indicated with black colour.

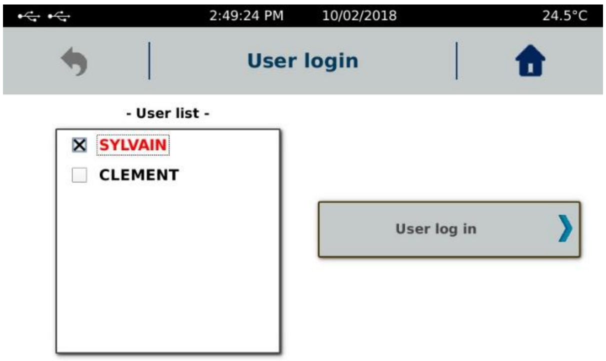


To delete an account, administrator account must be used. Select the account to be deleted from the list and click on "Remove user". The administrator account can only be deleted when it is the last available account.

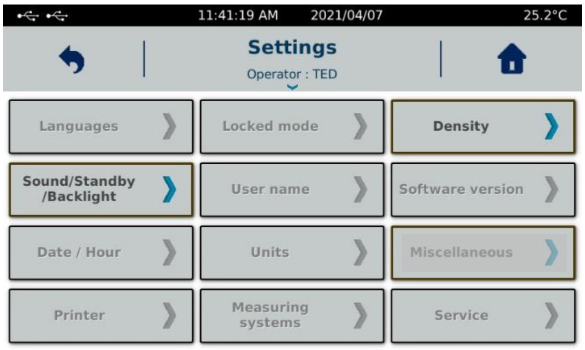
To use the operator accounts you must activate mode by selecting "Enable user mode". Once activated, you must select an operator and enter the PIN code if necessary. By returning to the Main Menu, you will be able to see the name of the operator logged under “Main Menu”. By clicking on the arrow below the name of the operator, you can turn off the instrument or change operator.



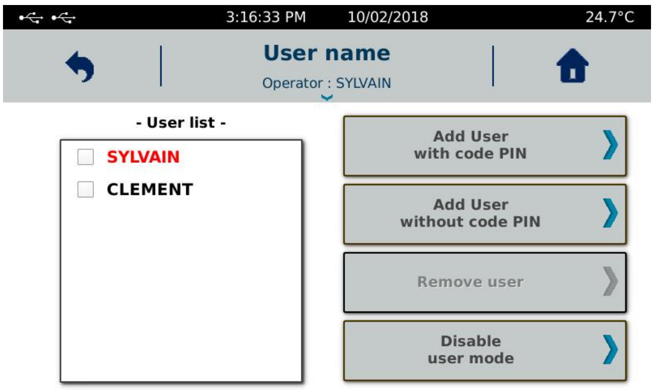
If the instrument is turned off and on while operator mode is on, it will be asked you to select the desired operator. Select the operator, enter the PIN code if necessary and confirm.



When an operator account other than the administrator account is used, some functions of the "Settings" menu are disabled.

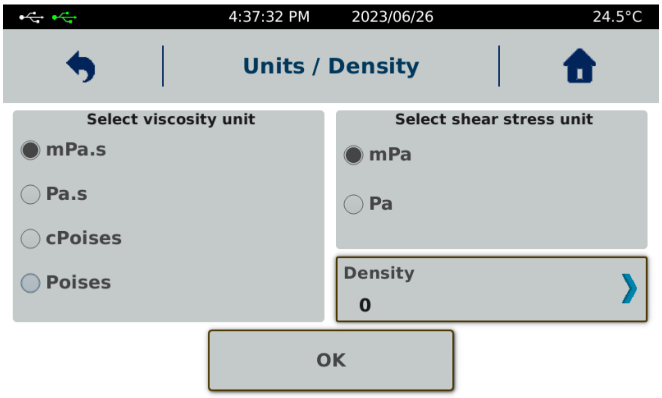


To disable the "User" mode, the administrator account must be used. Then click on "Disable user mode”. This disabling doesn’t lead to the deletion of created accounts.



2.6.5 Units / Density

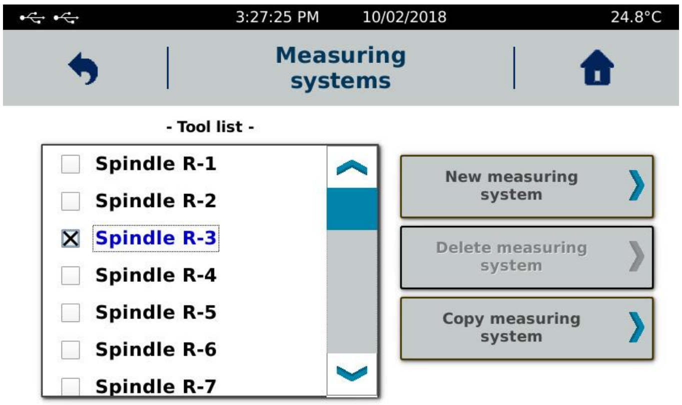
Allows you to change units of viscosity and stress used for programming methods and displaying results and diagrams.



If you set a density value, you will get all the time viscosity in cStoke. Please remove density information if you want to get back Pa.s or Poise for unit of viscosity.

2.6.6 Measuring systems

It allows you to add or remove a Measuring System.



All measurement systems stored by default in memory are not removable. Only those you have created yourself can be removed. To delete a measuring system, select it from the list and choose "Delete Measuring System". If this function remains greyed out when you have selected a system, it is part of the default mobile stored in the instrument's memory.

To add a new measuring system, you have two possibilities. Either create it using the "New measuring system" function, or select an existing system using the “Copy measuring system" function.

You are not allowed to change the constant of an existing measuring system. If you want to use a new constant for an existing measuring system, you have to copy this measuring system by renaming it and then enter the constants you want to use. Note that the KD constant is used to convert rotational speed to shear rate and KTau to convert torque to shear stress. Shear rate and shear stress are used to calculate the viscosity value. If you use a different constant value, you will get a different viscosity result. Here is the list of constants used for measuring systems compatible with the instrument.

MS BV

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
BV 1	6,1	1,001	1
BV 10	25,5	0,5	0,7
BV 100	76,5	0,15	0,5
BV 1000	510	0,1	0,5

MS RV/LV

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
RV 1	13,91	1	1
RV 2	55,65	1	1
RV 3	139,1	1	1
RV 4	278,2	1	1
RV 5	556,5	1	1
RV 6	1391	1	1
RV 7	5565	1	1
LV 1	106	1	1
LV 2	500	1	1
LV 3	1900	1	1
LV 4	8600	1	1
LV 5	17826	1	1

MS VANE

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
V71	36.5	1	0.5
V72	157	1	0.5
V72/2	270	1	0.5
V72/4	400	1	0.5
V72/6P	150	1	0.5
V-73	785	1	0.5
V-74	7850	1	0.5
V-75	2965	1	0.5
VT105	2180	1	0.5
VT2010	410	1	0.5
VT2020	59	1	0.5
VT3015	80	1	0.5
VT4020	34	1	0.5
VT4040	7.4	1	0.5
VT5025	17	1	0.5
VT6015	43	1	0.5
VT6030	10	1	0.5
VT608	150	1	0.5
VT8040	4.2	1	0.5
VT8070	1.2	1	0.5

MS DIN

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
MS-DIN 11	13.2	1.291	0.92
MS-DIN 12	19.4	0.354	0.73
MS-DIN 13	64.4	0.152	0.43
MS-DIN 22	25.8	1.291	0.92
MS-DIN 23	77.9	0.19	0.54
MS-DIN 33	130.1	1.291	0.92
MS-DIN 19	12.56	3.223	0.97

MS SV and MS ULV

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
SV414	877	0.4	0.69

SV415	**371**	**0.48**	**0.75**
SV416	**572**	**0.29**	**0.53**
SV418	**59.7**	**1.32**	**0.92**
SV421	**65.9**	**0.93**	**0.88**
SV425	**1918**	**0.22**	**0.25**
SV427	**126.8**	**0.34**	**0.62**
SV428	**205.2**	**0.28**	**0.49**
SV429	**367**	**0.25**	**0.40**
SV431	**166.5**	**0.338**	**0.62**
SV434	**271**	**0.28**	**0.49**
SVC	**68**	**0.43**	**0.71**
SVTR8	**66.15**	**0.92**	**0.88**
SVTR9	**127**	**0.34**	**0.62**
SVTR10	**204**	**0.28**	**0.49**
SVTR11	**374**	**0.25**	**0.40**
MS-ULV	**33.1**	**2.04**	**0.95**

T-Bars

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
T-A 92	**278**	**1**	**1**
T-B 93	**557**	**1**	**1**
T-C 94	**1392**	**1**	**1**
T-D 95	**2783**	**1**	**1**
T-E 96	**6957**	**1**	**1**
T-F 97	**13914**	**1**	**1**

MS-R

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
MS-R 1 / 75	5159.8	1	1
MS-R 2	12.68	0.35	1
MS-R 3	64.8	0.3	1
MS-R 4	300	0.25	1
MS-R 5	475	0.1	0.5

2.6.7 Locked mode

“Locked Mode" protects all data, settings, results and methods stored in the instrument's memory. It is indicated by the presence of a small padlock next to the USB symbols. It should be used if you want to protect some settings on your device. All the functions in the "Settings" menu will be locked, except for the "Locked mode" button to enable deactivation.

This function will also block the parameters for the measurement. This way, if you want to always use the same measurement settings, you must enable this locked mode to make sure that no one will change the measurement settings. Automatic mode is normally accessible for method selection.

In protected mode, it is not possible to change the temperature set-point or to access the program creation or editing mode. The visualization of results is accessible as well as the export of data. But no suppression is possible. The "zero adjustment" is accessible but it is not possible to change the speed of rotation used.

After selecting "Locked Mode", you must click "Enable". The instrument will ask you to register a 4-digit code that will be required to disable this protected mode. Each activation is independent and can be done with a different code and the deactivation of the mode will always be done with the code used to activate it. To disable protected mode, you must return to "Settings" and "Locked Mode" and click “Disable” by entering the 4-digit code.

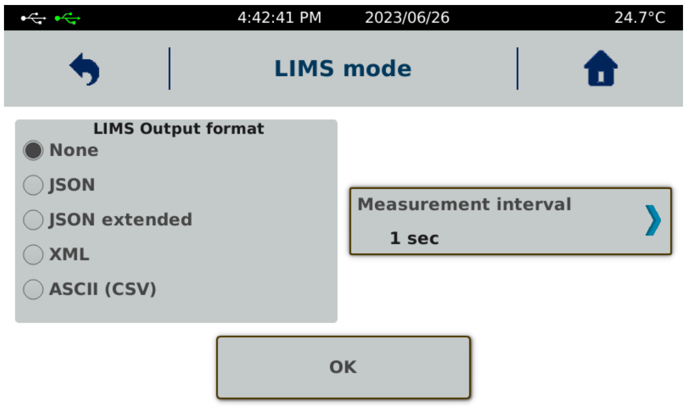
Disabling the protected mode in this configuration will be done only when the administrator is connected.

2.6.8 Mode LIMS

This menu allows you to select the data format for the LIMS function. To activate this function, a data format must be selected and a “measurement interval” must be entered. Then the instrument will send data at regular intervals to a client (Server). The destination of the data will be configured via the LIMS software used. The connection used will be Ethernet (LAN) on the rear panel of the instrument. The instrument's IP address for the LAN connection can be changed in the service menu. To do this, please contact LAMY RHEOLOGY or your local contact to provide you with an access password.

The “Measurement interval” function allows you to set the time interval used by the device to send data.

When a data format is selected, it is no longer possible to use the other connections (USB/RS232) for using the RheoTex software.



2.6.9 Printer

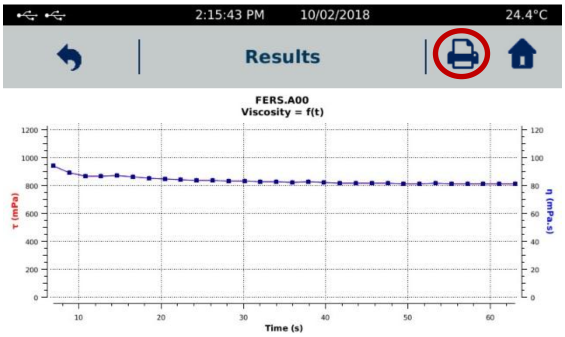
Allows you to connect a printer, print a test page, and choose the print interval time you want during measurement.

Printing a test page verifies good communication. If you choose to connect your instrument to another printer, be sure to delete the one already installed.

The instrument can be connected to all printers with a PCL5 print protocol. This includes many A4 printers. The connection is made to the "USB host" port on the back of the instrument.

Once the printer is connected, simply click on "Install Printer". Once the printer is recognized and installed, you can see its name on the screen.

When a printer is connected, the printer symbol appears when viewing a result or at the end of the measurement.

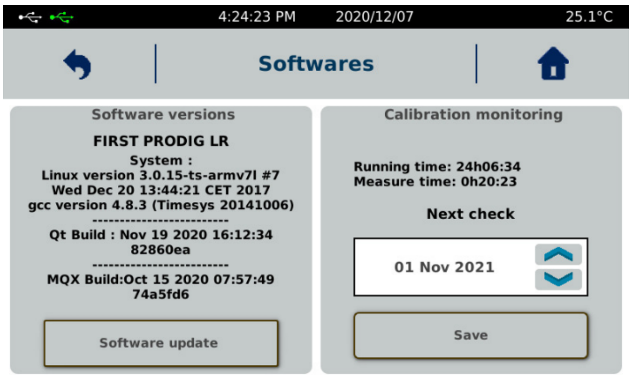


You have the possibility to print the measurement information (date, operator, result name, geometry used), a table with all the recorded values, the diagram and the result of the regression if they are present.

2.6.10 Software version

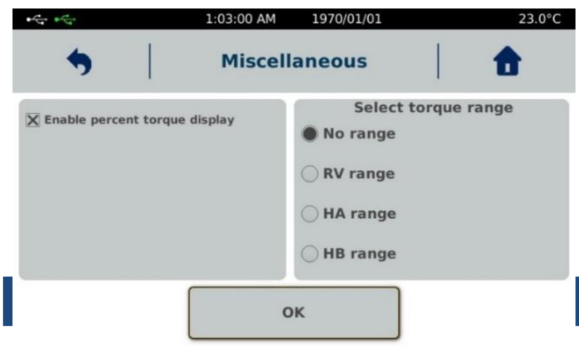
This menu allows you to update the firmware of your instrument. This function is used when updating the machine data is necessary. Do not go in this menu without being invited by the company LAMY RHEOLOGY. The update is done via a USB key connected to the "USB" port. You can then click on "Update" to update your instrument. At the end, your device will turn off and you will have to turn it on again.

“Calibration monitoring” settings indicate time while device has been switched ON and time while it was used for measurement. You can also set next date for checking to allow device to remind you.



2.6.11 Miscellaneous

Enable you to show torque in % close to gage and adjust the torque range of device according to spring device technology. Allows you to adjust the torque range of the device when you want to compare the torque displayed in % with a viscometer equipped with spring technology. If comparison with another spring instrument is not necessary, we advise you to select “None”. This setting simply changes the range of torque usable during measurement and the viscosity limitsThis setting will have effect on torque in % shown while measurement and viscosity limits.



Please see below torque covered by specific range:

- RV Range : From 0.07187 to 0.7187 mNm.
- HA Range : From 0.1437 to 1.4374 mNm.
- HB Range : From 0.5749 to 5.7496 mNm;

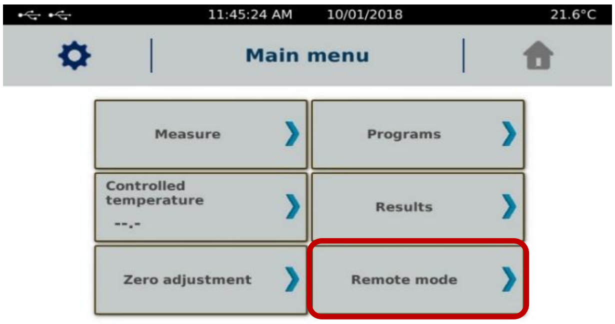
- None means no limits. So it will be complete range (see section 1.4)

2.6.12 Service

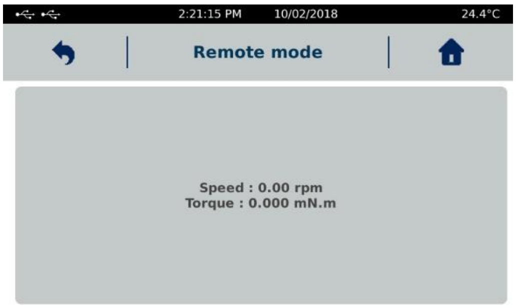
Reserved to LAMY RHEOLOGY engineers.

2.7 Remote mode

This mode enables to drive instrument by external RheoTex software, supplied on option. This function is available on the main menu.

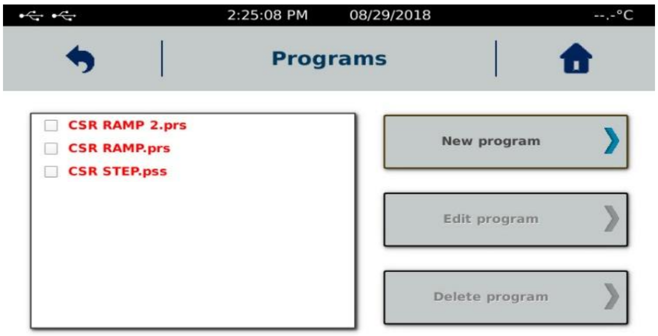


If all the connection choices are greyed out when you clik on “Remote mode” and the Ethernet port selected by default, LIMS mode has been activated (see paragraph 2.6.8). Once the device is connected to the PC, you must select the type of port (USB or RS232) and click on "Ok" to start the communication. As long as communication is not established, a "Waiting Connection ..." message appears on the screen. Then launch the software and check that the screen switches to the display below. If this is not the case, check the connections and make sure that the COM port number set in the default settings of the RheoTex software is correct and identical to that recognized by WINDOWS in "Control Panel", then "System and "Device Management" (see the operating instructions for the RheoTex software).



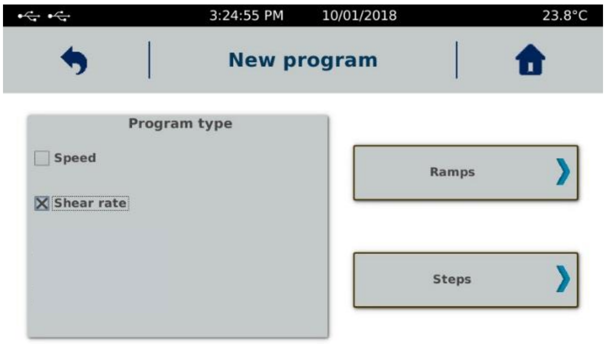
2.8 Programs

In the Programs tab you will be able to create your Measurement methods as well as edit / modify or delete them. The last two buttons are accessible only after selecting a saved method.



2.8.1 New program

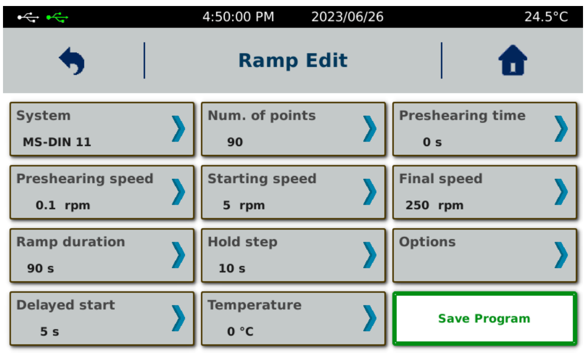
When you click on the "New Program" button, the device will offer you two different types of programs. Each of them can be declined in "ramp" or "step by step" mode.



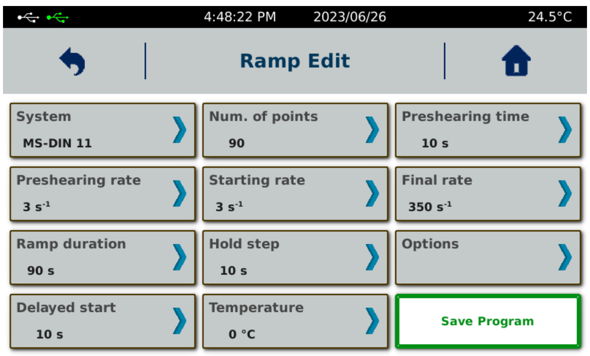
2.8.1.1 Speed/shear rate ramp mode

This programming mode makes it possible to carry out a speed / gradient ramp.

Imposed Speed



Imposed shear rate



At the beginning of your programming, all the buttons are grey except for the "System" button. Selecting the measurement system and validating will automatically activate the next button and so on. You will then be able to indicate the number of points (here of the rising ramp), the duration of the pre-shear (can be set to 0 if it is not necessary) as well as the speed/shear rate (a value must be indicated here even if pre-shearing is not necessary). Next is the speed/shear rate of the beginning of the ramp, the final speed/shear rate value (for information the speed range of the instrument is from 0.3 to 1500 rpm and for the shear rate range see the tables in paragraph 3 concerning each type of measuring system) and its duration in seconds. The "Hold Step" button is used to set a time when the speed/shear rate will be the same at the end of the rising ramp. This function is often necessary when you want to make a ramp up-hold-down. The number of points for the hold step is fixed and will be 1 point/second.

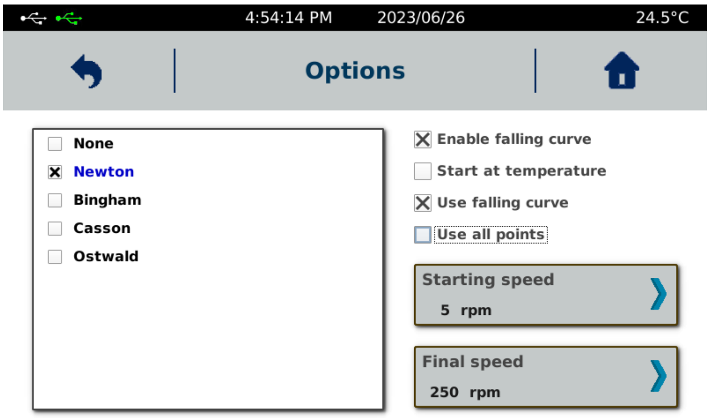
The "Delayed start" function allows you to set a waiting time before the start of the measurement. This time will be counted as soon as you start the measurement (see section 2.3).

The "Temperature" button is only available if your device is delivered with temperature device controllable by the instrument. By default this function is inactive. If you subsequently acquire such a warm-up unit, you must contact LAMY RHEOLOGY to activate the function on the instrument which will allow you to set a constant set point temperature for the duration of the measurement.

The "Options" button allows you to perform a rheological analysis on your measurement at the end of it. You will have to indicate which model you want, which part of the measurement will be used, specifying the area concerned (complete or partial). The regression will be automatically launched at the end of the measurement, except in the case of stopping it before its end.

The "Start at temperature" function allows you to wait for the set temperature to be reached before starting the measurement. It is only available if your device is delivered with a temperature control that can be controlled by the instrument.

The "Use falling curve" function allows you to automatically create a return curve where the speed or the shear rate will be reversed with respect to those of the rising ramp.



Click on the back arrow to return to ramp programming

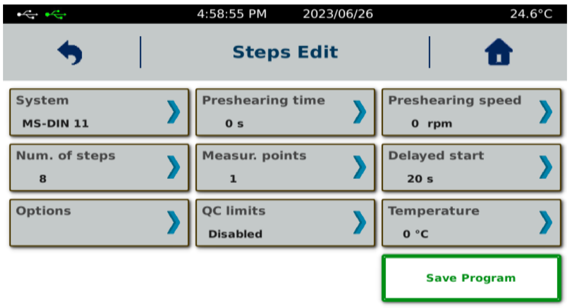
Once your programming is complete, click on "Save" and give a name to your method.

2.8.1.2 Speed/shear rate step mode

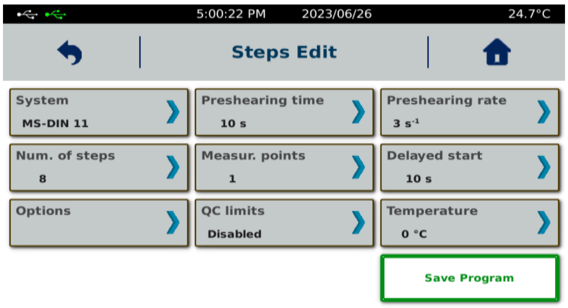
In the ramp mode (see above) the number of points sets the number of steps and duration of each of them is identical and calculated according to "Duration of the step = Duration of the ramp / number of points". In the step mode, you can set the number of steps, the speed/shear rate and duration of each one.

The "Step" mode also makes it possible to perform a measurement as a function of time at constant speed/shear rate. In this case, only one step must be set and the display being measured will be different (see section 2.3.2).

Imposed speed



Imposed shear rate



At the beginning of your programming, all the buttons are grey except for the "System" button. Selecting the measurement system and validating will automatically activate the next button and so on. You can then specify the duration of the pre-shear (can be set to 0 if it is not necessary) as well as the speed/shear rate (a value must be indicated here even if the pre-shearing is not necessary).

When you select the "Num. of step ", you get this view.

Clicking on "New step" will display the instrument's display on it.

Imposed speed

Imposed shear rate

Once the first step appears in the list, you can change the value of speed/shear rate and its duration by clicking on the buttons provided for this purpose. If you want other step, you have to click on the button "New step" as many times as desired levels. By default, the "New step" function copies the selected step (whose corresponding box is checked) and places a copy after it. This will allow in the case where all steps have the same duration to limit the actions. You can also delete a step by selecting it and then clicking on "Delete step".

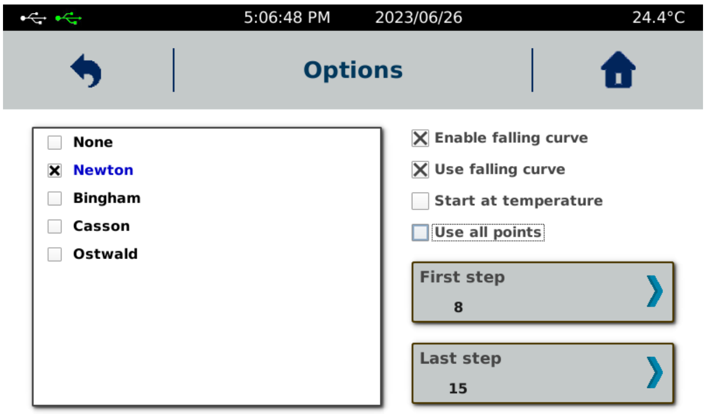
Once steps programming is complete, you must click on the back arrow (top left of the screen).

The new display now shows the number of steps in your program. The function "Measur. Points" means number of points for each step, the ideal value being 1. However, when programming a method containing only one step, it is recommended to put a larger number of points.

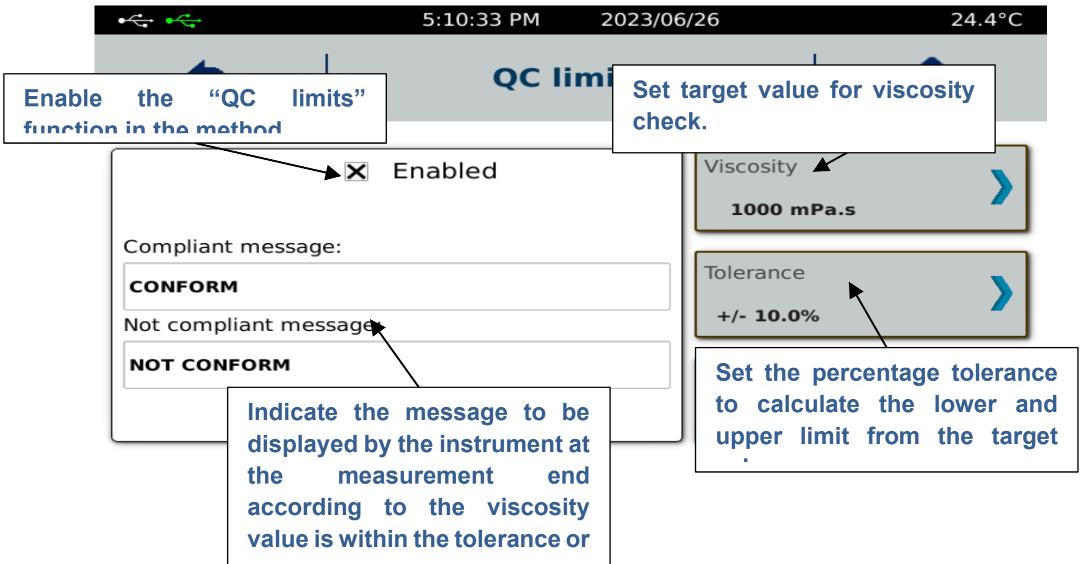
The "Temperature" button is only available if your device is delivered with temperature device controllable by the instrument. By default this function is inactive. If you subsequently acquire such a warm-up unit, you must contact LAMY RHEOLOGY to activate the function on the instrument which will allow you to set a constant set point temperature for the duration of the measurement.

The "Delayed start" function allows you to set a waiting time before the start of the measurement. This time will be counted as soon as you start the measurement (see section 2.3).

The "Options" button allows you to perform a rheological analysis on your measurement at the end of it. You will have to indicate which model you want, which part of the measurement will be used, specifying the area concerned (complete or partial). The regression will be automatically launched at the end of the measurement, except in the case of stopping it before its end.



The "Start at temperature" function allows you to wait for the set temperature to be reached before starting the measurement. It is only available if your device is delivered with a temperature control that can be controlled by the instrument.
The "Use falling curve" function is used to automatically generate a measurement based on the steps and the number of points already filled in but made in the opposite direction (decreasing value). Click the back arrow to return to the schedule of program.
The “QC limits” function makes it possible to verify that the measured viscosity value is between two limits that you have previously set. When choosing this function, the instrument displays the following view.

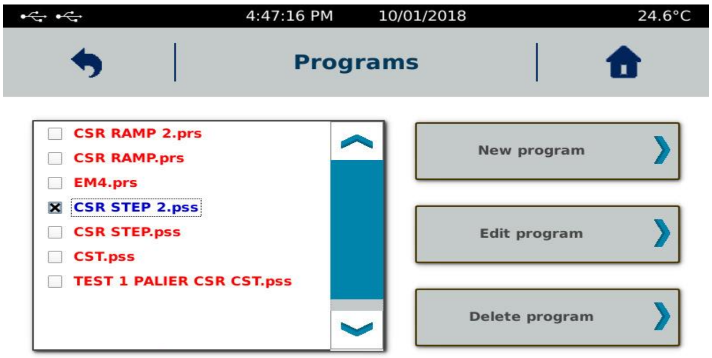


For this check, the instrument uses the last viscosity value measured in the last step. Do not forget to activate the "QC limits" function before validating to exit this window, otherwise the information will not be saved. At the measurement end according to the viscosity value is within the tolerance or not, the instrument will display the message that you have indicated in the "Compliant message" or "Not compliant message" fields.

Once your programming is complete, click on "Save" and give a name to your method.

2.8.2 Edit program

This function allows you to edit a program to view its content or edit it. Just select it from the list and click on "Edit Program". When you have made changes, you can save the new method by giving it a new name or rewrite the old method with the same name. If you only want to view the settings, just click the back arrow to return to the previous view.

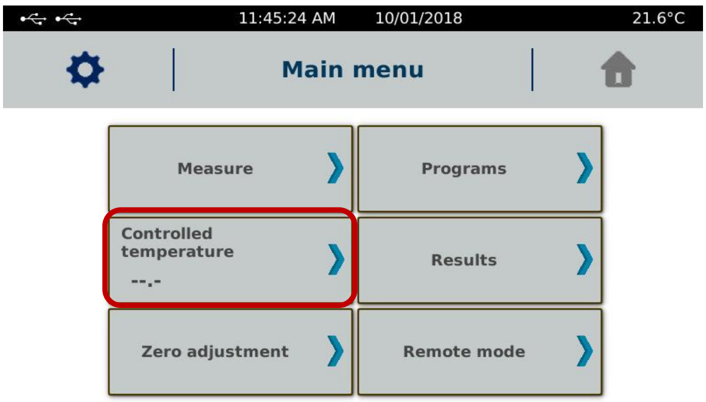


2.8.3 Delete program

This function allows you to delete a program from the memory. Just select it from the list and click on "Remove Program". The instrument will ask for confirmation of the deletion. If you do not want it anymore, just press the return arrow to return to the previous display.

2.9 Controlled temperature

This function is available on the main menu display.



As described in section 2.2, this function is only available if your device is delivered with temperature control controllable by the instrument. By default this function is inactive. If you subsequently acquire such a warm-up unit, you must contact LAMY RHEOLOGY to activate the function on the instrument which will allow you to set a constant set-point temperature for the duration of the measurement. It may be different from the temperature set-point set in the registered method. If so, temperature set in method will be automatically used then test will be launched.

3 MEASURING WITH YOUR DEVICE

This section will show how use the different measuring system with your device.

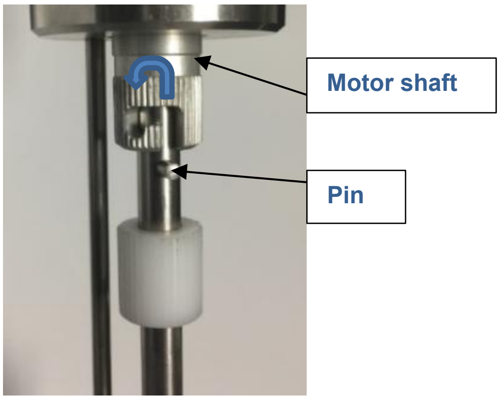
Instrument need to be installed before next section of this manual (see section 1.5).

3.1 Installation of measuring system

Read the installation of your measuring system in the following sections before inserting it on your instrument. Indeed, some measuring systems require the installation of accessory before the insertion of the spindle.

As the instrument get only one kind of bayonet coupling system, way to install measuring bob on shaft of instrument is always the same.

Insert the measuring system with the bayonet coupling into the motor shaft by pushing and turning slightly so that the pin is lodged in the space provided.



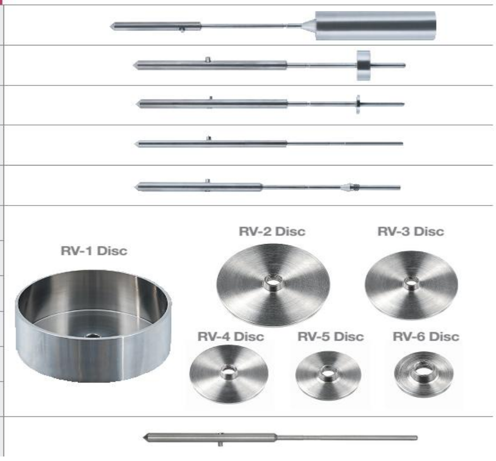
3.2 MS RV/LV (GuardLeg)

Measuring spindles according to ASTM / ISO 2555 (316L stainless steel).

These systems are ideally suited for simple viscosity measurement at controlled rotational speed in all areas of activity. The standard recommends use of 600ml beaker for measurement.

Here below are all available mobiles:

Name	Part number	Dim. (mm)
LV-1 spindle	111010	Ø 18.80 - L 65,1
LV-2 spindle	111011	Ø 18,72 - L 6,86
LV-3 spindle	111012	Ø 12,60 - L 1,78
LV-4 spindle	111013	Ø 3,20 - L 31
Axis R 1-6 without disc	111000	Axe fileté
RV-1 Disc	111001	Ø 56,26
RV-2 Disc	111002	Ø 46,93
RV-3 Disc	111003	Ø 34,69
RV-4 Disc	111004	Ø 27,30
RV-5 Disc	111005	Ø 21,14
RV-6 Disc	111006	Ø 14,62
RV-7 Spindle	111007	Ø 3,20



The spindle L are delivered complete, while the R discs must be screwed on the R1-6 axis (Ref 111000).

These spindles are composed of two groups. The mobiles L are intended for low viscosity fluids and R mobiles for medium to high viscosities (see tables below):

<table>
<tr><th>Designation spindle</th><th>Part Number Spindle</th><th colspan="2">Part Number Complete set**</th><th>Viscosity range Instrument LR (mPa.s)</th><th>Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)</th><th>Viscosity range RM100/RM200/ DSR500 (mPa.s)</th></tr>
<tr><td>RV1</td><td>111001*</td><td></td><td rowspan="7">111948</td><td>Not Usable</td><td>100 to 0.6M</td><td>50 to 1.4M</td></tr>
<tr><td>RV2</td><td>111002*</td><td rowspan="6">111947</td><td>200 to 0.14M</td><td>200 to 2.4M</td><td>100 to 5.5M</td></tr>
<tr><td>RV3</td><td>111003*</td><td>300 to 0.37M</td><td>300 to 6M</td><td>150 to 14M</td></tr>
<tr><td>RV4</td><td>111004*</td><td>400 to 0.74M</td><td>600 to 12M</td><td>200 to 28M</td></tr>
<tr><td>RV5</td><td>111005*</td><td>500 to 1.4M</td><td>1.2K to 24M</td><td>300 to 55M</td></tr>
<tr><td>RV6</td><td>111006*</td><td>1200 to 3.7M</td><td>2.8K to 60M</td><td>500 to 130M</td></tr>
<tr><td>RV7</td><td>111007</td><td>4500 to 15M</td><td>12K to 240M</td><td>2K to 550M</td></tr>
<tr><td>LV1</td><td>111010</td><td colspan="2" rowspan="4">111014</td><td>15 to 0.25M</td><td>200 to 4.3M</td><td>35 to 10M</td></tr>
<tr><td>LV2</td><td>111011</td><td>50 to 1.3M</td><td>1K to 20M</td><td>170 to 50M</td></tr>
<tr><td>LV3</td><td>111012</td><td>200 to 5M</td><td>4k to 82M</td><td>650 to 190M</td></tr>
<tr><td>LV4</td><td>111013</td><td>1000 to 22M</td><td>17K to 370M</td><td>3K to 860M</td></tr>
</table>

M for millions, K for thousand
a) Need additional axis (PN111000)
b) Complete set (delivered with axis PN 111000 only for RV spindle)

When measuring, it is strongly recommended to heat the 600ml beaker. You can use either a thermostatic bath or the EVA LR PLUS temperature control system.

Place the instrument on its support (see section 1.5). Fill the beaker with 500 ml of product to be tested, taking care not to introduce air bubbles.

Place it in a bath (if you have one) for a sufficient time to reach the desired temperature.

If the product contains volatile or hygroscopic material, cover the beaker for the duration of the operation.

Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

Install RV or LV Guardleg as pictures show below (these items are optional).

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

Use handle to manipulate the device on standard stand (see section 1.2), use screw on aluminium arm and go down to immerge the mobile in the product. With device on Rack stand, just turn screw to move down the measuring head. Beware of air bubbles under the disk!

Standard Stand

Rack Stand

Adjust the position of the instrument in the sample to immerge the mobile to the predefined mark (the lowest for discs # 2 -6, the highest for disc # 1), so as to immerge the Pt100 probe at least 3 mm (only for models equipped with a temperature probe integrated into the measuring head. If an external temperature sensor is used, the liquid level must always be in the mark on the axis mobile). Be careful that the tip of the mobile is 10 mm or more from the bottom of the beaker.

When the measurement height is optimum, use screw on arm to block height of measuring head when you are using standard stand. After you can use the stop ring on the support rod to memorize the position. With rack stand, you don't need to lock position and stop ring is not provided.

Wait until the temperature of the sample is within the prescribed limits (if you have temperature probe with your device).

Start the measurement at the desired speed and after choose the right measuring system (see section 2.3).

The torque measurement is indicated on the instrument screen using a gage. Ensure that the measured torque is always sufficiently far from the lower and upper limits (at least 5% above and below). If this is not the case, you can either change the measuring spindle or change the rotating speed.

Then your measurement is finished, raise the measuring head and lock it with screw on aluminium arm as wrote in section 1.2. Remove the measuring spindle to clean it.

3.3 MS BV

Measuring spindle for 150ml beaker (316L stainless steel).

These spindles are ideally suited for simple viscosity measurement at a rotating speed in control in all areas of activity. They are appreciated for their ease of use and the low volume of product needed compared to the MS RV/LV spindles.

Here below are all available spindle:

	Name	Part number	Dim. (mm)
	BV 1-100 Axis	117102	-
	BV centring device	117202	-
	BV Disc n°1	117001	Ø 45
	BV Disc n°10	117010	Ø 40
	BV Disc n°100	117100	Ø 20
	BV 1000 Axis	117101	Ø 4

This spindle allow measurement of huge viscosity range as showing below.

Designation spindle	Part Number Spindle[b)]	Part Number Complete set[c)]	Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)	Viscosity range RM100/RM200/ DSR500 (mPa.s)
BV1	117001[a)]	117000	15 to 0.25M	2 to 0.6M
BV10	117010[a)]		100 to 2M	17 to 5.1M
BV100	117100[a)]		1K to 22M	170 to 51M
BV1000	117101		10K to 220M	1.7K to 510M

M for millions, K for thousand
Use specific glass Beaker (PN117150 for 10pcs) or specific plastic beaker (PN117155 for 10 pcs).
a) Need additional axis (PN 117102)
b) Need to be used with Centring piece (PN 117202)
c) Complete set delivered with axis (PN117102) and centring tool (PN 117202)

The BV 1000 Axis can be used like this. But for BV Disc 1, 10 and 100, you should screw it on BV 1-100 Axis.

When measuring, it is strongly recommended to heat the 150ml beaker. You can use either a thermostatic bath or the EVA BV PLUS temperature control system.

Place the instrument on its support (see section 1.5). Fill the beaker with 120 ml of product to be tested, taking care not to introduce air bubbles.

Place it in a bath (if you have one) for a sufficient time to reach the desired temperature.

If the product contains volatile or hygroscopic material, cover the beaker for the duration of the operation.

Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

Use handle to manipulate the device on standard stand (see picture section 3.2), use screw on aluminium arm and go down to immerge the mobile in the product. With device on Rack stand, just turn screw to move down the measuring head. Beware of air bubbles under the disk!

Adjust the position of the instrument in the sample to immerge the mobile to the predefined mark. Be careful that the tip of the mobile is 10 mm or more from the bottom of the beaker.

When the measurement height is optimum, use screw on arm to block height of measuring head when you are using standard stand. After you can use the stop ring on the support rod to memorize the position. With rack stand, you don't need to lock position and stop ring is not provided (see picture on section 3.2).

Wait until the temperature of the sample is within the prescribed limits.

Start the measurement at the desired speed and after choose the right measuring system (see section 2.3).

The torque measurement is indicated on the instrument screen using a gage. Ensure that the measured torque is always sufficiently far from the lower and upper limits (at least 5% above and below). If this is not the case, you can either change the measuring spindle or change the measurement speed.

Then your measurement is finished, raise the measuring head and lock it with screw on aluminium arm as wrote in section 1.2. Remove the measuring spindle to clean it.

3.4 MS VANE

Measuring spindles with blades (316L stainless steel).

These systems are ideal for viscosity measurement (value or curve) in control or development of all types of products even of very high viscosity with or without particles (size <5mm). They can be used for direct measurement in user's containers.

4 blades VANES

6 Blades VANE

All data given in table next page are given for information and can be changed according container use for measurement. For example, shear rate range show same data as for speed range of instrument. And most of the time, you will be able to use only speed for your viscosity measurement and not the shear rate.

Here below are all available spindles with viscosity range (in mPa.s):

Designation	Part Number	Diameter (mm)	Length (mm)	Viscosity range LR Device (mPa.s)	Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)	Viscosity range RM100/RM200/ DSR500 (mPa.s)
MK-V71	111114	34,39	68,78	1,4 to 18K	14 to 300K	2,4 to 700K
MK-V72**	120017	21,67	43,38	5,6 to 74K	56 to 1,2M	9,4 to 2,8M
MK-V73**	111108	12,67	25,35	28 to 370K	280 to 6M	46 to 13M
MK-V74**	111115	5,89	11,76	280 to 3,7M	2,8K to 60M	463 to 139M
MK-V75**	111111	8,026	16,05	111 to 1,4M	1,1K to 24M	185 to 55M
MK-V72/2**	111112	21,67	20	54 to 720K	540 to 11M	90 to 27M
MK-V72/4**	111113	21,67	10	80 to 1M	800 to 17M	133 to 40M
MK-V72-6P*	111121	21,67	43	30 to 400K	300 to 6,5M	50 to 15M
MK-VT105**	440105	5	10	430 to 5,8M	4,4K to 94M	726 to 218M
MK-VT2010**	442010	10	20	82 to 1M	820 to 17M	137 to 41M
MK-VT2020**	442020	20	20	12 to 150K	118 to 2,5M	20 to 5,9M
MK-VT3015**	443015	15	30	16 to 210K	160 to 3,4M	27 to 8M
MK-VT4020**	444020	20	40	7 to 90K	68 to 1,4M	11 to 3,4M
MK-VT4040	444040	40	40	1,5 to 19K	15 to 320K	2,5 to 740K
MK-VT5025**	445025	25	50	4 to 45K	34 to 730K	6 to 1,7M
MK-VT6015	446015	15	60	9 to 114K	86 to 1,8M	15 to 4,3M
MK-VT6030	446030	30	60	2 to 26K	20 to 433K	3,5 to 1M
MK-VT608	446008	8	60	30 to 400K	300 to 6,5M	50 to 15M
MK-VT8040	448040	40	80	1 to 11K	9 to 182K	2 to 420K
MK-VT8070	448070	70	80	0,5 to 3,2K	3 to 52K	1 to 120K

M for million, K for thousand
* VANE 6 BLADES.
** These items can be used with tube MB-DIN1 (P.N.112932).

All data given in this table are given for information and can be changed according container use for measurement. For example, shear rate range show same data as for speed range of instrument. And most of the time, you will be able to use only speed for your viscosity measurement and not the shear rate.

Place the instrument on its support (see section 1.5).

Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

For the use of these measuring systems, you can use 600 ml or 150 ml beaker or your own container.

Fill your beaker or container. Use handle to manipulate the device on standard stand (see picture section 3.2), use screw on aluminium arm and go down to immerge the mobile in the product. With device on Rack stand, just turn screw to move down the measuring head.

Adjust the position of the instrument to immerge the measuring system in the sample (only part with blade) and not to close from the bottom of beaker (minimum distance should be 10mm). When the measurement height is optimum, use screw on arm to block height of measuring head when you are using standard stand. After you can use the stop ring on the support rod to memorize the position. With rack stand, you don’t need to lock position and stop ring is not provided (see picture on section 3.2).

Start the measurement at the desired speed and after choose the right measuring system (see section 2.3). If your Vane measuring system is not in the list, please refer to section 2.6.6 to create it.

The torque measurement is indicated on the instrument screen using a gage. Ensure that the measured torque is always sufficiently far from the lower and upper limits (at least 5% above and below). If this is not the case, you can either change the measuring spindle or change the measurement speed.

Then your measurement is finished, raise the measuring head and lock it with screw on aluminium arm as wrote in section 1.2. Remove the measuring spindle to clean it.

3.5 MS KREBS

Krebs type measuring spindles compatible with ASTM D562 standard (316L stainless steel). These systems are ideal for viscosity measurement in Krebs units in control of all types of products. They can be used for direct measurement in user containers or in 600 or 150ml beakers.

Here below are all available spindle:

Name	Part number	Dim. (mm)	
MK-KU 1-10	111100	L. 54,11	
MK-75Y	111103	L. 34,58	

For your information, only MK-KU1-10 is compliant with norm ASTMD562.

To get KU unit for your viscosity measurement with your instrument, you must choose the measuring spindle MK-KU1-10 and speed at 200 rpm. For all other speed and measuring spindle, you will get viscosity value in Pa.s.

Range for these spindles is (for LR on demand):

- MK KU1-10: 20-500mPa.s and 40-140KU (at 200 rpm).
- MK-75Y: 100-50000 mPa.s.

Place the instrument on its support (see section 1.5).

Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

For the use of these measuring system, you can use 600ml or 150 ml beaker or your own container. Fill your beaker or container.

Use handle to manipulate the device on standard stand (see picture section 3.2), use screw on aluminium arm and go down to immerge the mobile in the product. With device on Rack stand, just turn screw to move down the measuring head.

Adjust the position of the instrument to immerge the measuring system in the sample (only part with blade) and not to close from the bottom of beaker (minimum distance should be 10mm). Be careful that the tip of the mobile is 10 mm or more from the bottom of the beaker.

When the measurement height is optimum, use screw on arm to block height of measuring head when you are using standard stand. After you can use the stop ring on the support rod to memorize the position. With rack stand, you don't need to lock position and stop ring is not provided (see picture on section 3.2).

Start the measurement at the desired speed and after choose the right measuring system (see section 2.5). If your Vane measuring system is not in the list, please refer to section 1.2 to create it.

The torque measurement is indicated on the instrument screen using a gage. Ensure that the measured torque is always sufficiently far from the lower and upper limits (at least 5% above and below). If this is not the case, you can either change the measuring spindle or change the measurement speed.

Then your measurement is finished, raise the measuring head and lock it with screw on aluminium arm as wrote in section 1.2 Remove the measuring spindle to clean it.

3.6 MS DIN

Coaxial cylinders measuring systems according to DIN / ISO 3219 (316L stainless steel).

These systems make it possible to set the shear rate in order to carry out viscosity measurements or to obtain curves to study flow behaviour, yield stress or thixotropy.

They are particularly suitable for the control or development of homogeneous products with liquid aspect and with or without particles (size <200µm).

Please find below MS DIN items.

Name	Reference	
MK - DIN 1	112820	
MK – DIN 2	112821	
MK - DIN 3	112822	
MK – DIN 9	111875	
MB-DIN 1 Tube	112932	
MB-DIN 2 Tube	112937	
MB-DIN 3 Tube	112938	
CAP-DIN 1	112872	
CAP-DIN 2	112877	
CAP-DIN 3	112878	
CAP-DIN 1 Mooney	112874	
ST-R centring tool	114436	
MB-DIN 1 S Tube	112933	
MB-DIN 2 S Tube	112948	
MB-DIN 3 S Tube	112944	

Complete configurations include a DIN tube or DIN XS tube, a MK-DIN cylinder and a cap.

Measuring system		Spindle	Cup	Cap	Category
Designation	Part Number	Designation	Designation	Designation	
MS DIN 11	112801	MK-DIN1	MB-DIN1	CAP-DIN1	A
MS DIN 11 S	112809	MK-DIN1	MB-DIN1S	CAP-DIN1	B
MS DIN 12	112802	MK-DIN2	MB-DIN1	CAP-DIN1	A
MS DIN 13	112803	MK-DIN3	MB-DIN1	CAP-DIN1	A
MS DIN 13S	112808	MK-DIN3	MB-DIN1S	CAP-DIN1	B
MS DIN 19	112806	MK-DIN9	MB-DIN1	CAP-DIN1	A
MS DIN 22	112804	MK-DIN2	MB-DIN2	CAP-DIN2	A
MS DIN 22S	112815	MK-DIN2	MB-DIN2S	CAP-DIN2	B
MS DIN 33	112805	MK DIN3	MB-DIN3	CAP-DIN3	A
MS DIN 33S	112814	MK DIN3	MB-DIN3S	CAP-DIN3	B
MS DIN 11M	112812	MK-DIN1	MB-DIN1	CAP-MOONEY	A
MS DIN 19M	112811	MK-DIN9	MB-DIN1	CAP-MOONEY	A
MS DIN 23	112816	MK-DIN3	MB-DIN2	CAP-DIN2	A

Here are the measuring ranges (viscosity in mPa.s **) of the existing MS DIN measuring systems:

Measuring system * Designation	Volume (ml)	Shear rate (s^{-1})**	Viscosity range LR Device (mPa.s)	Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)	Viscosity range RM100/RM200/ DSR500 (mPa.s)
MS DIN 11	27	1,29N	2,5 to 27K	25 to 0.44M	3 to 1M
MS DIN 11 S	27	1,29N	2,5 to 27K	25 to 0.44M	3 to 1M
MS DIN 12	46	0,35N	11 to 145K	110 to 2.3M	18 to 5.5M
MS DIN 13	61	0,15N	92 to 510K	920 to 8.3M	146 to 19M
MS DIN 13S	22	0,15N	93 to 510K	920 to 8.3M	146 to 19M
MS DIN 19	25	3,22N	0,8 to 10K	8 to 0.17M	1 to 0.39M
MS DIN 22	22	1,29N	4 to 53K	40 to 0.86M	7 to 2M
MS DIN 22S	22	1,29N	5 to 53K	40 to 0.86M	7 to 2M
MS DIN 33	14	1,29N	20 to 265K	200 to 4.3M	34 to 10M
MS DIN 33S	14	1,29N	20 to 265K	200 to 4.3M	34 to 10M
MS DIN 11M	23	1,29N	2,5 to 27K	21 to 0.44M	3 to 1M
MS DIN 19M	18,5	3,22N	0,8 to 10K	8 to 0.17M	1 to 0.39M
MS DIN 23	36	0,19N	81 to 1M	810 to 17M	139 to 41M

M for million, K for thousand, N for rotational speed (rpm)
* Complete measuring system with spindle, cup and cap.
** These values are given when complete system is used.
*** Include centring tool ST-R (P.N. 114436).

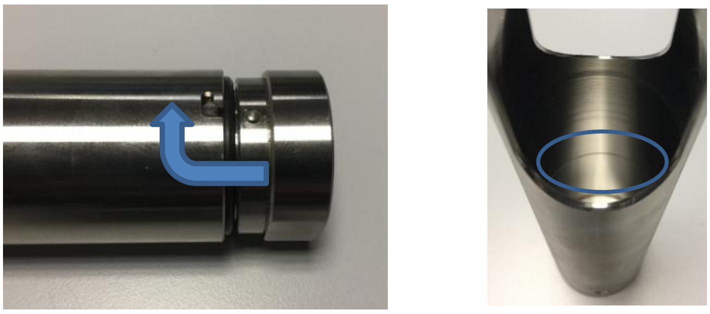
3.6.1 Use of category A (MS-DIN)

Each tube is used with the matching cylinder (e.g. DIN tube 1 with cylinder MK-DIN1). The cylinder MK-DIN 9 is used with the DIN tube 1. The tubes can be closed with their cap assorted or used open for a measurement immersed in a container containing the liquid to be measured. The Mooney plug is used exclusively with the DIN 1 tube and the MK-DIN 1 and MK-DIN 9 cylinders. It reduces the volume of product required for the measurement (see table on section 3.6).

In addition to these measuring systems, a DIN X tube with a MK-DIN X + 1 cylinder can be used. Thus, MS DIN 12, MS DIN 13 and MS DIN 23 measuring systems can also be used. The first digit always indicates the number of the tube and the second digit the number of the cylinder MK. There is also a measuring system MS DIN 19 which uses the DIN tube 1 and MK-DIN 9 cylinder.

All systems shown above can be used with or without a temperature control unit since the tube attaches to the base of the instrument (see below). When your instrument is combined with an EVA MS DIN, EVA MS DIN-MSR, EVA 100, RT1, CT DIN or CT-LC temperature setting unit, the positioning of the measuring cylinders and tubes is the same. It will be necessary to introduce the assembly into the temperature chamber.

The first step is to install the cap on the tube as shown in the picture below (not necessary if you make a dip measurement directly into a pot). Also check that the gasket is properly installed on the cap. The first insertion of the cap can be difficult. You must use some silicone grease to facilitate installation.



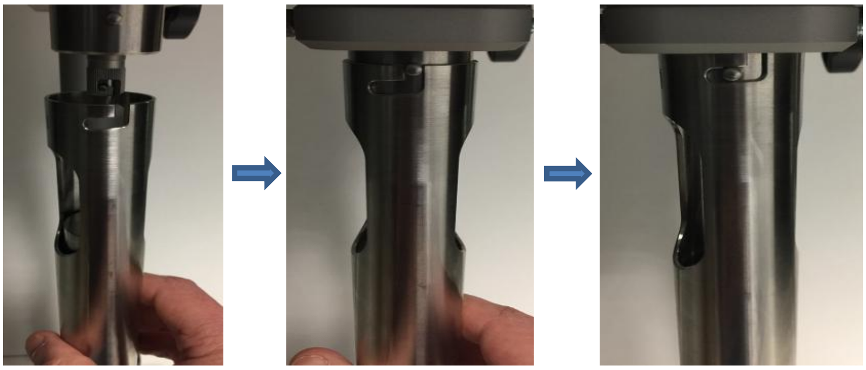
You can then put the product to be measured in the tube. The necessary volume is indicated in the table on the previous page according to the system used. There is a level line in the tube (see picture).

Place the instrument on temperature unit or on its own stand if you are using CT-DIN or CT-LC. Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

You can then introduce the MS DIN tube with the product from the bottom up slowly and making sure to align with the cylinder. Also place the groove on the tube facing you as shown in the picture below). When you are close enough to the instrument basis, you must rotate the tube to place the pin in the groove of the tube.



Once the tube is properly installed, check that the temperature sensor (if your device gets one) on the instrument is at least 3mm deep into the liquid.

When using your instrument with a temperature control system (EVA MS DIN, EVA MS DIN MSR, EVA 100, CT DIN or RT-1), you must then lower the measuring head in such a way that the tube comes inside the hole provided for this purpose. Check that there is no product on the outer wall of the tube.

Use the arm handle and screw (see section 1.2) to gently lower the measuring head. The tube should be easily housed in the chamber. If this is not the case, do not force it and contact your local distributor or LAMY RHEOLOGY.

When the measuring head is properly positioned, there is no need to lock the position using the screw on the stem. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the ambient temperature (at least 10 minutes) before making your measurement.

When using MS DIN measuring systems for immersion measurement, the order and method of installation is the same for cylinder and tube. Since there is no cap on the tube, you will need to put the product to be measured in a pot larger than the tube.

Then lower the measuring head by using the handle and the screw on the arm (see section 1.2) so that the tube is immersed in the pot and the temperature probe (if your device gets one) is sufficiently immerged in the liquid (at least 1 cm). Take care that the liquid level never exceeds the level of the white ring present on the cylinder axis MK DIN. You must use the screw on the arm (see section 1.2) to block the measuring position and take care that there is enough space between the tube and the bottom of the pot for the liquid to rise in the tube.

Once the setup is complete, you can do your measurement (see section 2.3).

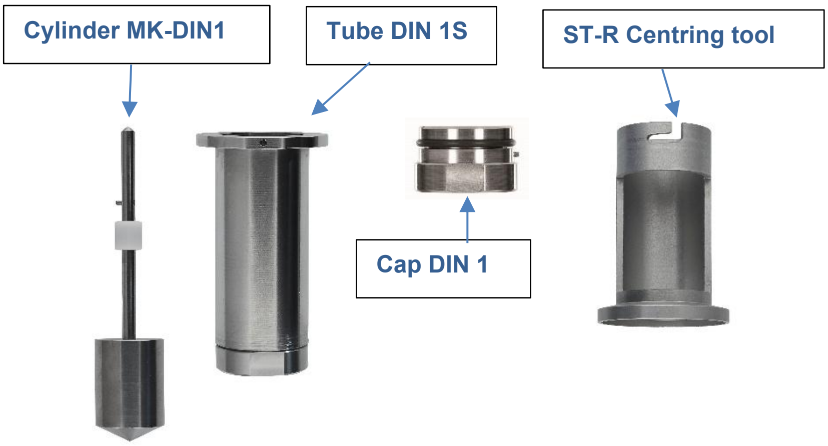
If you have just made a measurement with the tube closed by a cap, rise the measuring head to the highest position by blocking the arm with the screw provided for this purpose (see section 1.2). Carefully remove the cylinder from the instrument shaft, then remove the tube containing the product and the cylinder, being careful if the temperature is high. You can then remove the MK DIN cylinder from the DIN tube for cleaning. Remove the DIN tube cap to clean it. Remember to clean the temperature probe (if present).

If you have just made a measurement in immersion (without cap), it is preferable to remove the cylinder from the axis of the motor and after the tube from the base of the instrument before rise the measuring head. You can then take the tube and cylinder for cleaning. Remember to clean the temperature probe (if present).

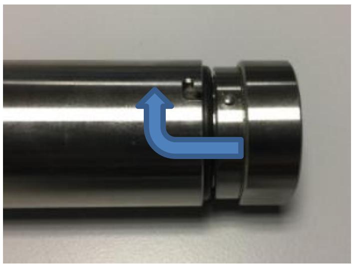
3.6.2 Use of category B (MS-DIN”S”)

There are also other DIN x S type tubes that are used with EVA MS DIN, EVA MS DIN-MSR, EVA 100, RT1, CT DIN or CT-LC temperature units.

DIN xS tubes are used with the same MK-DIN cylinders and caps as standard DIN tubes. The measuring ranges are therefore unchanged (see table section 3.6). Their using facilitates cleaning and filling since they are shorter and therefore easier to access. On the other hand, they require the use of an accessory (Ref 114436) which guarantees a perfect centering of the cylinder in the tube.



The first step is to install the cap on the tube as shown in the photo below. Also check that the gasket is properly installed on the cap. The first insertion of the cap can be difficult. You must use some silicone grease to facilitate installation.



You can then put the product to be measured in the cylinder. The necessary volume is indicated in the table section 3.6 according to the system used. There is a level line in the tube (see picture below).

Place the instrument on temperature unit or on its own stand if you are using CT-DIN or CT-LC. Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

You must then install the centring piece on the base of the instrument. Also place the groove facing you as shown in the picture below. When you are close enough to the instrument basis, you must rotate the piece to place the pin in the groove.

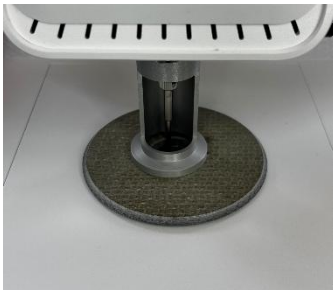
Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).


Put the tube with your product inside the warming unit.

Use the arm handle and screw (see section 1.2) to gently lower the measuring head. The centring piece must completely cover the rim of the tube.

When the measuring head is properly positioned, there is no need to lock the position using the screw on the arm. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the ambient temperature (at least 10 minutes) before making your measurement.




Once the setup is complete, you can do your measurement (see section 2.3).

When your measurement is complete, it is better to remove the cylinder from the instrument shaft. That will rest in the tube. Rise the measuring head to the highest position by blocking the arm with the screw provided (see section 1.2). Then remove the tube containing the product and the cylinder, being careful if the temperature is high. You can then remove the MK DIN cylinder from the tube for cleaning. Remove the DIN tube cap to clean it. Don't forget to clean the temperature probe (if available).

3.7 MS SV (Thermocell and Small Volume Package)

Measuring systems for low volumes (316L stainless steel).

This section explain also how to use THERMOCELL and Small volume package.

These systems, unlike the MS-RV/LV and MS-DIN systems, make it possible to measure products in small quantities by applying a shear rate up to temperatures of 300°C (according to models, see table). With RT-1 and THERMOCELL package, these systems are compatible with ASTM D3236 and D4402.

Here are the available accessories:

Measuring cylinder
MK-SV

Measuring chamber
MB-SV13RC
(REF:116214)

Disposable cup
MB-SV13RD
(REF:116413)

Holder H-SV13RD
(116313)
for disposable cup
MB-SV13RD
(REF 116313)

Measuring chamber
MB-SV13R
(REF :116213)

Centring tool ST-R
(REF 114436)

Delrin cap, temperature
maximum 80°C
(REF :116215)

Please find below all item as MK-SV spindle and MB-SV chamber with viscosity range (mPa.s):

Measuring Cylinder		Compatible chamber****		Volume (ml)	Shear rate (s-1)	Viscosity range LR Device (mPa.s)	Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)	Viscosity range RM100/RM200/ DSR500 (mPa.s)
Designation	**Item**	**Designation**	**Item**					
MK-SV414*	116114	MB-SV6R*	116206	3	0,4N	44 to 5,8M	440 to 95M	73 to 219M
MK-SV415*	116115	MB-SV7R*	116207	4,4	0,48N	15 to 2M	155 to 33M	26 to 77M
MK-SV416*	116116	MB-SV8R*	116208	4,6	0,29N	39 to 5,2M	394 to 85M	66 to 197M
MK-SV418	116118	MB-SV13R MB-SV13RC** MB-SVD***	116213 116214 116513	7,5	1,32N	1 to 120K	9 to 1,9M	2 to 4,5M
MK-SV421	116121			8	0,93N	1 to 188K	14 to 3M	2 to 7M
MK-SV425	116125			10	0,22N	174 to 23M	1,7K to 377M	291 to 870M
MK-SV427	116127			12	0,34N	7 to 0,99M	75 to 16M	12 to 37M
MK-SV428	116128			13	0,28N	15 to 1,9M	147 to 31M	24 to 73M
MK-SV429	116129			13	0,25N	29 to 3,9M	294 to 63M	49 to 146M
MK-SV431	116131			11	0,34N	10 to 1,3M	100 to 21M	16 to 49M
MK-SV434	116134			11	0,28N	19 to 2,5M	194 to 41M	32 to 96M
MK-SVC	116002			13	0,43N	3 to 420K	32 to 6,8M	5 to 15M
MK-SVTR8	140008			8	0,92N	1 to 190K	14 to 3M	2 to 7M
MK-SVTR9	140009			12	0,34N	7 to 0,99M	75 to 16M	12 to 37M
MK-SVTR10	140010			13	0,28N	15 to 1,9M	146 to 31M	24 to 72M
MK-SVTR11	140011			13	0,25N	30 to 3,9M	300 to 64M	50 to 149M

M for million, K for thousand, N for rotational speed (rpm).
* Not compatible with RT-1 PLUS THERMOCELL PACKAGE.
** This cup can be used without centring tool ST-R. Need CAP 116215. Temperature max 80°C.
*** This item include 100 disposable cup MB-SV13RD (116413) and holder H-SVRD (116313).
**** These items need centring tool ST-R (item 114436 include with THERMOCELL and SVP65/180).

Measuring cylinder can be used with different chambers and can be categorized as below:

- Category A: Spindle used with chamber MB-SVD (see section 3.7.1).
- Category B: Spindle used with chamber MB-SV13R, MB-SV6R, MB-SV7R and MB-SV8R (see section 3.7.2).
- Category C: Spindle used with chamber MB-SV13RC (see section 3.7.3).

Measuring systems of category A can only be used with temperature controllers EVA DIN, EVA DIN MS-R, RT-1 PLUS and water jacket CT-LC and CT DIN. They come with disposable cups (a batch of 100) ideal for measuring on aggressive or difficult to clean products.

Measuring systems of category B can only be used with temperature controllers EVA DIN, EVA DIN MS-R, RT-1 PLUS and water jacket CT-LC and CT DIN. They come with a reusable stainless steel measuring cup.

The measuring systems in category C can be used alone or with temperature controllers EVA DIN, EVA DIN MS-R and water jacket CT-LC and CT DIN. Temperature max will be 80°C. They come with a measuring cup in stainless steel and Delrin cap.

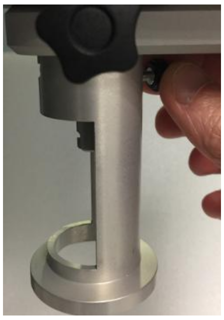
3.7.1 MS-SV with Chamber MB-SVD (Thermocell)

Whatever the measurement system model, the using is the same.

If you have temperature unit as RT-1 PLUS or EVA MS-DIN, the measuring head must first be installed on the heating unit (see installation instructions supplied with the temperature control). If you are using water jacket CT-LC or CT-DIN, please place it below instrument installed on its own stand.

The first step is to place the screw on the centring piece (ST-R) and then install the latter on the base of the instrument.



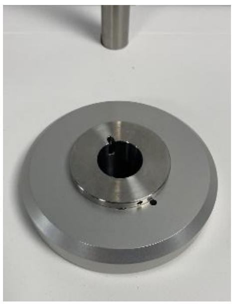


The screw locks the centring piece on the base of the instrument.

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

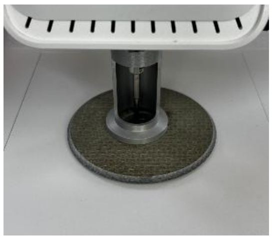
Place the disposable cup holder H-SV13RD in well of the temperature control.



Take a disposable cup MB-SV13RD, fill it with your product (see table section 3.7 for the volume of product to be put into the measurement system). Then place it in the disposable cup holder. Turn it so that the notch at the bottom fits snugly into the bottom of the disposable cup holder.

Use handle and screw of arm (see section 1.2) to gently lower the measuring head. Take care of the Pt100 (if you have one on device) and be sure that it will fit correctly hole of cup. The centring piece must completely cover the edge of the disposable cup insert.





When the measuring head is properly positioned, there is no need to lock the position using the screw on the arm. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the room temperature (at least 10 minutes) before taking your measurement.

You can do your measurement (see section 2.3).

Once the measurement is complete, unhook the mobile from the instrument axis and rise the measuring head. Remove the spindle to clean it.


Remove the holder with the disposable cup by using special tool provide for that operation (provided with Thermocell package). Place holder with disposable cup inside on flat table. Disposable cup will move up from holder. Also clean the temperature probe and the centring piece. It can stay in place on the basis of the instrument for a next measurement.

3.7.2 MS-SV with chamber MB-SV13R (Thermocell and SVP65/180)

Whatever the measurement system model, the using is the same.

If you have temperature unit as RT-1 PLUS or EVA MS-DIN, the measuring head must first be installed on the heating unit (see installation instructions supplied with the temperature control). If you are using water jacket CT-LC or CT-DIN, please place it below instrument installed on its own stand.

The first step is to place the screw on the centring piece (ST-R) and then install the latter on the base of the instrument.

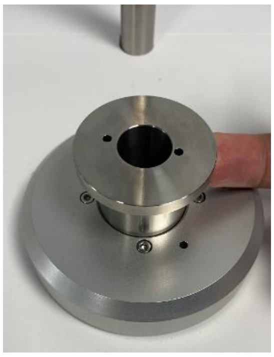

The screw locks the centring piece on the base of the instrument.

Make a zero of your instrument (see section 2.5) if you are using standard model.

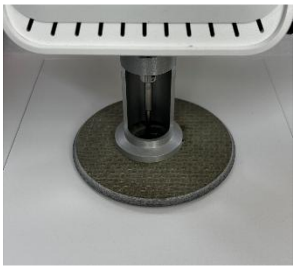
Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

You can then put the product to be measured in the cup MB-SVXR. The required volume is indicated in the table in section 3.7 according to the system used.

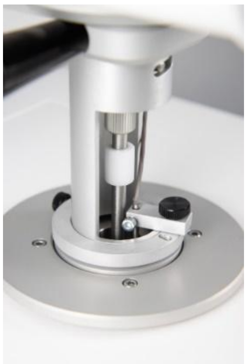
Install MB-SVXR chamber on the well of temperature unit or water jacket as shown.



Use handle and screw of arm (see section 1.2) to gently lower the measuring head. Take care of the Pt100 (if you have one on device) and be sure that it will fit correctly hole of cup. The centring piece must completely cover the edge of the disposable cup insert. When the measuring head is properly positioned, there is no need to lock the position using the screw on the arm. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the room temperature (at least 10 minutes) before taking your measurement.



If you are using immersion probe (Ref. 000696), this is time to install it as shown on picture below.



You can do your measurement (see section 2.5).

When your measurement is complete, it is recommended to remove the cylinder from the instrument shaft. It will rest in the tube. Rise the measuring head to the highest position by blocking the arm with the screw provided (see section 1.2). Remove the spindle to clean it.

Remove the cup by using special tool provide for that operation (provided with Thermocell). Also clean the temperature probe and the centring piece. It can stay in place on the basis of the instrument for a next measurement.

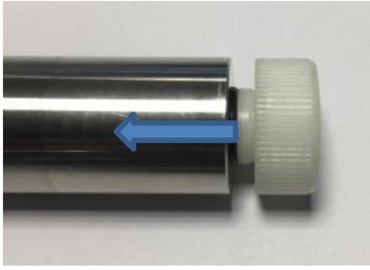
3.7.3 MS-SV with chamber MB-SV13RC

These systems can therefore be used with or without a heating unit (RT-1PLUS, DIN EVA and water jacket CT-DIN/CT-LC). The cup MB-SV13RC used for these systems is fixed directly to the base of the instrument.

Please note that maximum temperature with this system is 80°C.

If you have temperature unit as RT-1 PLUS or EVA MS-DIN, the measuring head must first be installed on the heating unit (see installation instructions supplied with the temperature control). If you are using water jacket CT-LC or CT-DIN, please place it below instrument installed on its own stand.

The first step is to install the Delrin cap on tube MB-SV13RC as shown in the photo below. Also check that the gasket is properly installed on the plug. The first insertion of the cap can be difficult. You must use some silicone grease to facilitate installation.



You can then put the product to be measured in the cup. The necessary volume is indicated in the table in section 3.7 according to the system used.

Make a zero of your instrument (see section 2.5) if you are using standard model.

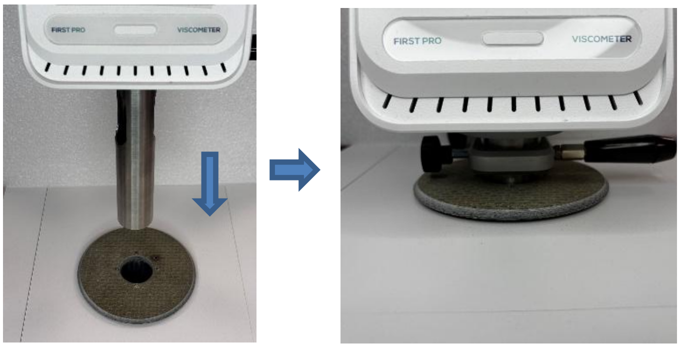
Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

You can then present the tube with the product from the bottom up slowly and making sure to align with the cylinder. Also place the mark on the tube facing you as shown in the picture below). When you are close enough to the Instrument base, you must rotate the tube to place the pin in the mark of the tube.

Once the tube is properly installed, check that the temperature sensor (if you have one) on the instrument is at least one centimeter deep into the liquid.

When using your instrument with a temperature control system (EVA MS DIN or CT DIN), you must then lower the measuring head so that the tube fits into the chamber provided for this purpose. Check that there is no product on the outer wall of the tube.

Use the handle and screw on arm (see section 1.2) to gently lower the measuring head. The tube should be easily housed in the hole of temperature controller. If this is not the case, do not force it and contact your local distributor or LAMY RHEOLOGY.



When the measuring head is properly positioned, there is no need to lock the position using the screw on the stem. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the room temperature (at least 10 minutes) before taking your measurement.

Once the setup is complete, you can do your measurement (see section 2.3).

When your measurement is complete, it is recommended to remove the cylinder from the instrument shaft. It will rest in the tube. Rise the measuring head to the highest position by blocking the stem with the screw provided (see section 1.2). Then remove the tube containing the product and the cylinder, take care if the temperature is high. You can then remove the cylinder from the tube to clean it. Remove the cap from the tube to clean it. Clean the temperature sensor.

3.8 MS ULV

Measuring system for low viscosities usable with instruments LR version (Stainless steel).

This system makes it possible to measure low viscosity products in control by applying a shear rate. Its advantage is to be compatible with instruments in LR version unlike all other measuring systems.

Here are the available measuring system:

Name	Part number	Dim. (mm)	
MK-C19	116015P	Ø 19	
C Tube with insert	116001	Ø 20	
Delrin cap	116005	-	
C Insert	111934	-	
ST-R centring tool	114436	-	
MB-C Alu Cup	114306	Ø 20	

All this part can be combined to create two different measuring system.

Designation	Part Number	Included					Volume (ml)	Viscosity range (mPa.s)
		Spindle	Cup	Holder	Cap	Tool		
MS-ULV*	116030	116015P	116001		116005		11	10 to 52K
MS-ULV/D**	116031	116015P	114306	111934		114436	11	

K for thousand
* Not compatible with oven RT1. Can be used without temperature unit.
** Include 100 disposable cup (114306). Must be used with temperature unit or water jacket.

The part number 116030 includes item 116015P, 116001 and 116005. This system can be used with temperature control EVA DIN PLUS, CT-LC and CT DIN or alone without any other accessory.

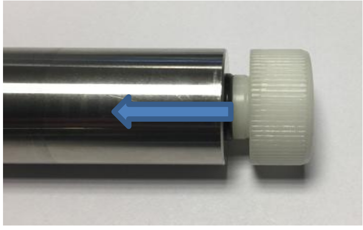
The part number 116031 is dedicated for measurement with disposable cup and includes item 116015P, 111934, 114436 and 114306 (100 disposable cup). It must be used with a temperature control as EVA DIN, CT DIN or RT-1 PLUS and can't be used alone.

3.8.1 MS-ULV (item 116030)

This system can be used with or without a heating unit (DIN EVA and CT DIN). The cup used for these systems is the PN116001. This is fixed directly to the basis of the instrument.

The measuring head must first be installed on the temperature control unit (see installation instructions supplied with the temperature control) or on the standard support if you not use a heating system (see section 1.5).

The first step is to install the cap on the tube as shown in the photo below. Also check that the gasket is properly installed on the plug. The first insertion of the cap can be difficult. You must use some silicone grease to facilitate installation.



You can then put the product to be measured in the cup. The necessary volume is indicated in the table in section 3.8 according to the system used.

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

You can then present the tube with the product from the bottom up slowly and making sure to align with the cylinder. Also place the mark on the tube facing you as shown in the picture below). When you are close enough to the Instrument base, you must rotate the tube to place the pin in the mark of the tube.

Once the tube is properly installed, check that the temperature sensor (if you have one) on the instrument is at least one centimetre deep into the liquid.

When using your instrument with a temperature control system (EVA MS DIN or CT DIN), you must then lower the measuring head so that the tube fits into the chamber provided for this purpose. Check there is no product on the outer wall of the tube.

Use the handle and screw on arm (see section 1.2) to gently lower the measuring head. The tube should be easily housed in the hole of temperature controller. If this is not the case, do not force it and contact your local distributor or LAMY RHEOLOGY. When the measuring head is properly positioned, there is no need to lock the position using the screw on the stem. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the room temperature (at least 10 minutes) before taking your measurement

Once the setup is complete, you can do your measurement (see section 2.3).

When your measurement is complete, it is recommended to remove the cylinder from the instrument shaft. It will rest in the tube. Rise the measuring head to the highest position by blocking the stem with the screw provided (see section 1.2). Then remove the tube containing the product and the cylinder, being careful if the temperature is high. You can then remove the cylinder from the tube to clean it. Remove the cap from the tube to clean it. Clean the temperature sensor.

3.8.2 MS-ULV/D (item 116031)

The measuring head must first be installed on the heating unit (see installation instructions supplied with the temperature control).

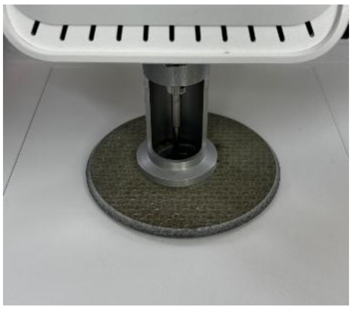
The first step is to place the screw on the centring piece and then install the latter on the base of the instrument. The screw locks the centring piece on the basis of the instrument.

Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).Place the disposable cup holder in the well of the temperature control.



Take a disposable cup, fill it with your product (see table on the previous page for the volume of product to be put into the measurement system). Then place it in the disposable cup holder.

Use handle and screw of arm (see section 1.2) to gently lower the measuring head. The centring piece must completely cover the edge of the disposable cup insert.

When the measuring head is properly positioned, this is no required to lock the position using the screw on the arm. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the room temperature (at least 10 minutes) before taking your measurement.

You can do your measurement (see section 2.3).

Once the measurement is complete, unhook the mobile from the instrument axis and rise the measuring head. Remove the mobile to clean it. Remove the disposable cup. Also clean the temperature probe and the centring piece. It can stay in place on the basis of the instrument for a next measurement.

3.9 T-Bars and Helipro Stand

The HELIPRO device makes it possible to measure viscosity of gels, pastes, creams and more generally products that do not flowing.

When a measuring mobile turns in this type of product, we can observe appearance of cavities around the rotating spindle which has effect of reducing measured viscosity values. Through its movement vertical, HELIPRO system with its mobile T shape will prevent formation of cavities within product and will ensure reliable and consistent measurement.

This accessory is compatible with instruments and instruments from the LAMY RHEOLOGY range except FIRST PRODIG CP 1000, RM 100 CP 1000/2000 PLUS, RM 200 CP 4000 PLUS, GT-300 PLUS, GT-300 PRODIG and DSR 500 CP 4000 PLUS.

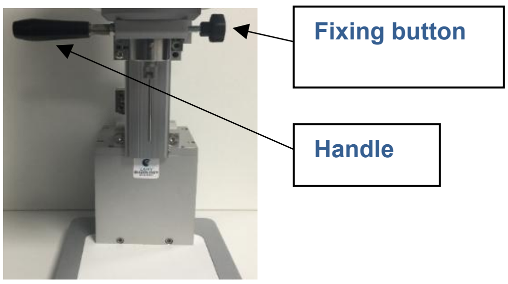
THE HELIPRO SYSTEM is delivered with a box including 6 T-bar spindles and 1 adaptation to fix the spindles. It is also delivered with a Hex screw driver for adjust the lower and upper switch limits of the up and down moving, one handle and button already installed on arm.

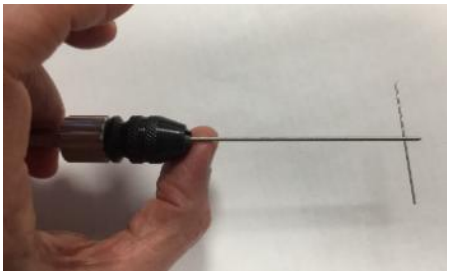

You can find below measuring range for each T-Bars provide with HELIPRO STAND.

Designation T-Bars**	Part number	Viscosity range LR Device (mPa.s)		Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)		Viscosity range RM100/RM200/ DSR500 (mPa.s)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
T-A (91)	18091	93	740K	930	12M	930	28M
T-B (92)	18092	186	1.5M	1,9K	25M	1,9K	56M
T-C (93)	18093	464	3.7M	4,6K	60M	4,6K	140M
T-D (94)	18094	1K	7.5M	9,2K	120M	9,2K	280M
T-E (95)	18095	1,9K	15M	18,6K	240M	18,6K	558M
T-F (96)	18096	4,6K	37M	46,4K	600M	46,4K	1400M

M for million, K for thousand
* Viscosity value done for speed range from 0,3 to 15 rpm.
** Included with HELIPRO package (P.N. 111015).

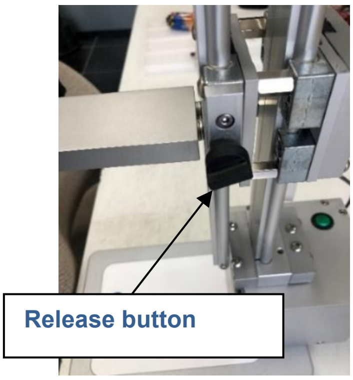
Install the instrument on the stand and fix it with the button. Take care of temperature probe if your device gets one. Insert the spindle inside chuck, lock it by screwing.

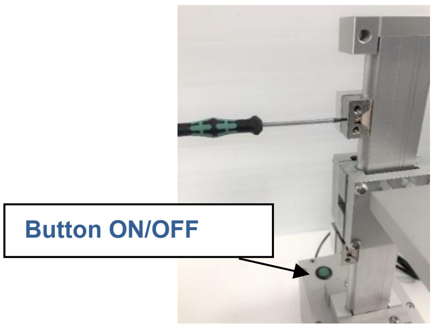




Make a zero of your instrument (see section 2.5) if you are using standard model.

Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).



Place the container with product to be measured below and adjust position of measuring head so that spindle reaches desired position. A release button and handle help you lower the measuring head.

Adjust the position of the 2 limits switch up and down with the screw driver to fix path should be done by measuring head.

Press the button ON/OFF for starting the up and down movement. Helipro stand moves at speed 1 mm/s.

Start the measurement at the desired speed (15 rpm maximum) and choose the right measuring system (see section 2.3).

The torque measurement is indicated on the instrument screen using a gauge. Ensure that the measured torque is always sufficiently far from the lower and upper limits (at least 5% above and below). If this is not the case, you can either change the speed.

Then your measurement is finished, stop the movement of Helipro stand, raise the measuring head by using handle and release button and lock it in high position. Remove the measuring spindle to clean it.

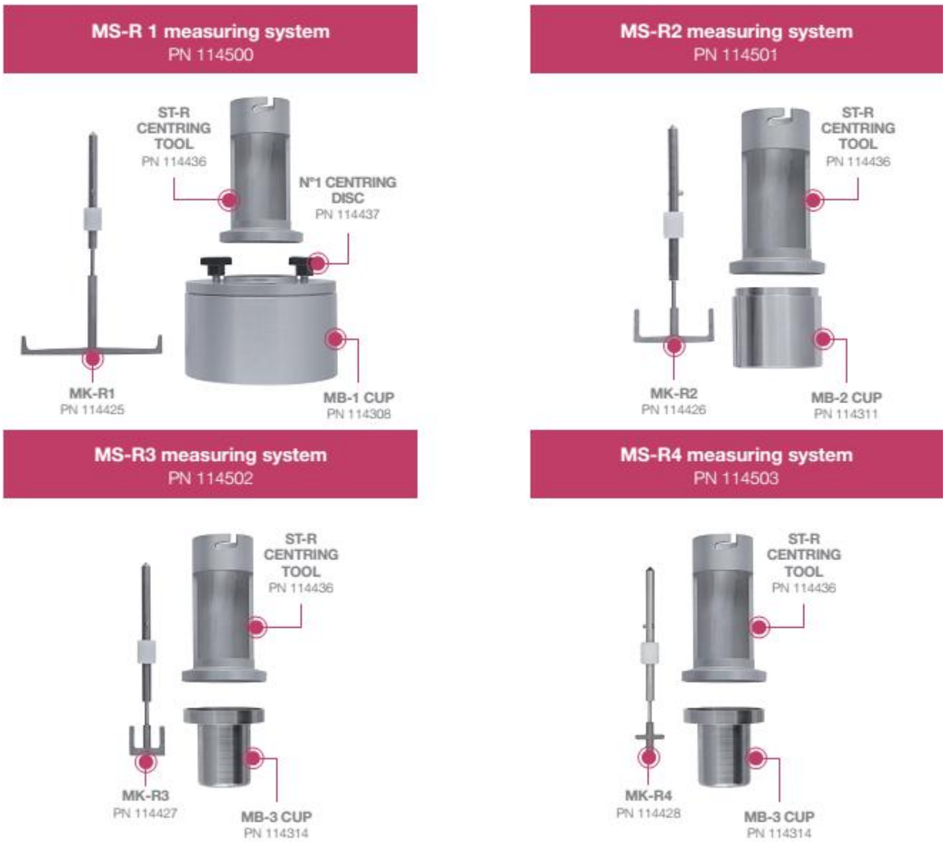
3.10 MS-R

Anchor-type measuring systems (316L stainless steel).

These systems are ideally suited for measuring viscosity (value or curve) in the control or development of heterogeneous products, or having the appearance of soft solid at rest, present in cosmetics, paint, food or mineral chemistry industries.

Used with their respective cups, they allow to apply a shear rate.

This is the measuring systems available:



For each anchor MK-Rx there is a cup associated with it. When the assorted cup and anchor assembly is used, these measuring systems allow measures by applying a shear gradient (except for the MK-R1 system). But it is possible to use these anchors alone, in a pot for example. In this case, it is better to create a new measurement system (see section 2.6.6) using the same K_{Tau} constant but setting the K_D constant to 1.

The MK-R5 can be used with cup MB-3 or MB-2 .

Here are the measurement ranges of the existing measurement systems:

Designation system	Part Number System	Part Number Complete set[d]		Diameter (mm)		Sample volume (ml)	Shear rate range for RM100/RM200 /DSR500 (s^{-1})	Viscosity range for RM100/RM200 /DSR500 (mPa.s)
				Inner	Outer			
MS-R1[c]	114500[a]	111949		93	98	300	200 rpm	1 to 40 UD
MS-R2	114501[a]		111950	46	54	70	0.105 to 525	12 to 3.6M
MS-R3	114502[a]			23	36	25	0.09 to 450	72 to 21.6M
MS-R4	114503[a]			20	36	25	0.075 to 375	400 to 120M
MK-R5	114429[b]			5			0.03 to 150	1.5K to 475M

M for millions, K for thousand
a) Complete system (bob+cup+centring tool)
b) Only spindle. Can be use with cup MB2 (Ref. 114311) and MB3 (Ref. 114314)
c) Can be used only at 200 rpm and UD result
d) Complete set-in case with cup and centring part

All data given in this table are given for information and can be changed according container use for measurement.

As you can see in the table above, the MS-R1 system is used exclusively at 200 rpm and gives results in % UD (correspondence curve in mPa.s on request). For all other systems, the viscosity measurement will be displayed in mPa.s (Pa.s, cP or P). If you want to obtain a result in % UD (whatever the system used), you must select the MS-R75 system at 200 rpm when you set up your measurement or program (see section 2.3.1). Calibration curves for each mobile used are available on request for viscosity matching.

MS-R2 to MS-R5 systems can be used alone or in combination with our EVA MS-R and EVA MS DIN / MS-R temperature controls. The MS-R1 measuring system is used exclusively without temperature control.

3.10.1 MS-R without temperature control

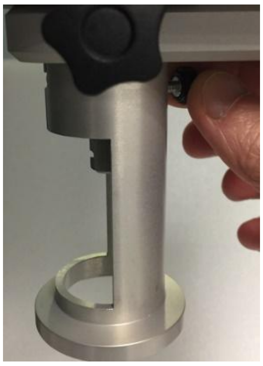
After installing the measuring head on the arm, rise it to the maximum height (see sections 1.5 and 1.2).

Check that the motor has been adjusted before proceeding to the next steps (see section 2.5).

3.10.1.1 For systems MS-R2 to MS-R5

The first step is to place the screw on the centring tool ST-R and install it on the instrument.

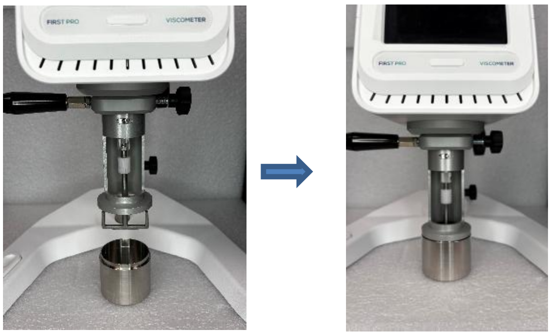




The screw locks the centring piece on the base of the instrument.

You can then set up the anchor on the bayonet coupling of the instrument.

Fill the cup with your product, place it under the measuring head and lower the measuring head to place the centring piece on the cup.



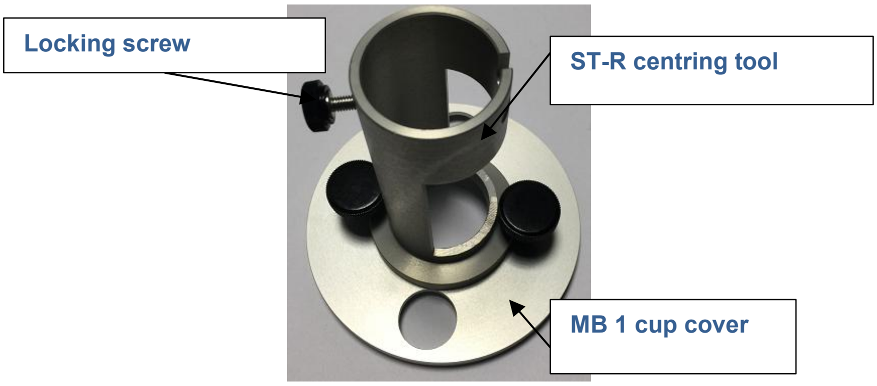
There is no need to block the height of the arm, the instrument can rest directly on the cup using the centring piece.

You can then do your measurement (see section 2.5).

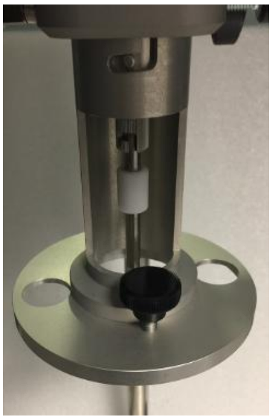
Once the measurement is complete, unhook the mobile from the instrument axis and reassemble the measuring head. Remove the mobile to clean it. Also clean the temperature probe and the centring piece. It can stay in place based on the instrument for a next measurement.

3.10.1.2 For system MS-R1

The first step is to attach the cup cover MB 1 to the centring piece ST-R and the locking screw. This screw keeps the centring piece on the base of the instrument (see pictures paragraph 3.10.1.1).



You can install the centring piece and cover assembly on the base of the instrument. Use the screw to lock the ST-R tool.




You can then set up the anchor on the bayonet coupling of the instrument.


Fill the cup with your product, place under the measuring head and lower the measuring head to place the lid on the cup.

There is no need to block the height of the arm, the instrument can rest directly on the cup using the centring piece.

You can then do your measurement (see section 2.3).

Once the measurement is complete, unhook the mobile from the instrument axis and reassemble the measuring head. Remove the mobile to clean it. Also clean the temperature probe and the centring piece. It can stay in place based on the instrument for a next measurement.

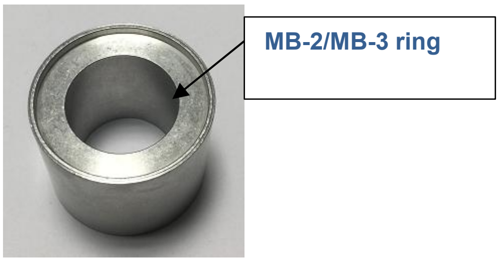
3.10.2 Utilisation with temperature control

As a reminder, only the MS-R2 to MS-R5 measuring systems can be used with the EVA temperature controls (Ref N950002, N950020, N950030, N950200 and N950210).

The measuring head must first be installed on the temperature control unit (see installation instructions supplied with the EVA temperature control).

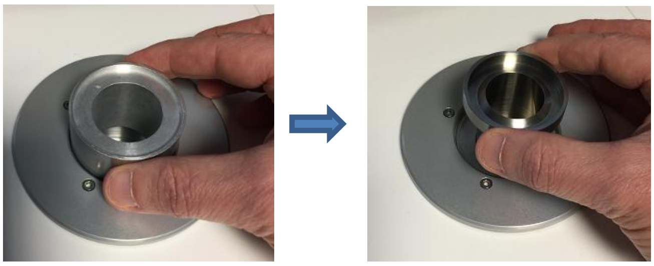
The EVA MS-R PLUS (Ref N950200 and N950210) have 9 positions for measuring cups while the other DIN / MS-R EVA have only one. But the positioning of cups MB-2 and MB-3 is the same.

The MB-2 bucket installs directly into the EVA unit while the MB-3 bucket is to be used with the MB-2 / MB-3 ring supplied with the EVA unit.



Check that the motor has been adjusted before proceeding to the next steps (see section 2.5).

For the MB-3 cup, fit the MB-2 / MB-3 ring into the EVA chamber, then insert the MB-3 bucket.



For the MB-2 cup, insert it directly into the EVA.

The placement of the centring piece and MK-R2 to MK-R5 is the same as in section 3.10.1.1. After having installed the centring piece and the MK-Rx spindle, you can lower the measuring head in this position, making sure that the centring piece covers the MB cup.

There is no need to block the height of the arm, the instrument can rest directly on the cup using the centring piece. Also, be sure to allow sufficient time for stabilization if the measurement temperature is different from the ambient temperature (at least 10 minutes) before making your measurement.

You can then do your measurement (see section 2.3).

Once the measurement is complete, unhook the mobile from the instrument axis and reassemble the measuring head. Remove the mobile to clean it. Also clean the temperature probe and the centring piece. It can stay in place based on the instrument for a next measurement.

4 VERIFICATION OF YOUR DEVICE

Your instrument is calibrated at the factory with an ASTM R2 mobile or MS DIN11 measuring system (see calibration certificate) and a certified oil with a viscosity close to 1000 mPa.s. The verification method differs depending on the measurement system selected. You may decide to perform the verification with your own measurement systems, but it is highly recommended to use one of the two measurement systems mentioned above. In case other systems are used, please contact LAMY RHEOLOGY for the most appropriate verification method.

When checking your instrument, it is important to calculate the maximum permissible error for the measurement. This error combines the precision of the instrument (1% of full scale for all mobiles and 2% with MS-CP) and the uncertainty in the viscosity value of the verification oil (generally 1% of the nominal value).

The full scale is calculated according to:

Full scale viscosity (Pa.s) = (KTAU * M) / (KD * RPM).

Using the maximum torque of the instrument M (or the selected torque range, see section 1.4 or 2.6.11) for each rotation speed RPM and integrates constants KTAU and KD from the measurement geometries (see section 2.6.6).

Example: Mobile MS-DIN11 with a DSR500 at 50 rpm. We have: M = 30mNm (maximum torque of the instrument without torque range selection from section 2.6.11); KTAU = 13.2; KD = 1.291.

The full viscosity scale is therefore: (13.2 * 30) / (1.291 * 50) = 6.13 Pa.s.

1% of this value corresponds to: 0.061 Pa.s or 61 mPa.s.

For a check on a 1 Pa.s standard oil, the uncertainty on this value is 1% or 10 mPa.s.

The maximum allowed error is therefore: Precision from device + Incertitude from oil

Here we have: 0.33 + 0.01 = 0.071 Pa.s or 71 mPa.s.

A measurement of this oil between 0.929 Pa.s and 1.071 Pa.s is therefore acceptable.

Viscosity measurement on a 1000 mPa.s standard silicon oil with an ASTM 2555 RV2 measuring system.

- Fill the 600ml beaker with the standard oil.

- Insert the 600ml beaker in a controlled temperature unit like EVA LR system or thermostatic bath.

- Make a zero of your device (see section 2.5) if you are using standard model.

- Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1 and 3.2).

- Immerge the spindle in the oil at the good level (mark on the spindle, see section 3.2).

- Wait for 15 minutes until the standard oil rises to the good temperature.

- Select on the instrument the measuring system R2, select 50 rpm for the speed, select 60 seconds for the measuring time, and start the measurement (see section 2.3.1).

Viscosity measurement on a 1000 mPa.s standard silicon oil with a defined DIN11 measuring system.

- Fill the measuring tube DIN 1 with the standard oil.

- Make a zero of your device (see section 2.5) if you are using standard model.

- Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).

- Fix the tube MB-DIN1 to the device (see section 3.6.1)

- Insert the measuring system in a controlled temperature unit like an EVA DIN system or CT-LC/CT-DIN with thermostatic bath.

- Wait for 10 minutes until the standard oil rises to the good temperature.

- Select on the instrument the measuring system DIN11, select 50s-1 for the speed, select 30 seconds for the measuring time, and start the measurement (see section 2.3.1).

For both methods, the result at the end of the measurement must be within the tolerance due to the maximum tolerated error as explained previously. If the measurement is out of range, your instrument may require recalibration.

Check if the error does not come from a wrong filling, a wrong zero adjustment, a wrong spindle rotation, or a wrong temperature value.

LAMY RHEOLOGY
11 A, rue des Aulnes
69410 Champagne au Mont d'Or (France)

Tel : 33 (0)4 78 08 54 06
Fax : 33 (0)4 78 08 69 44
contact@lamyrheology.com