LAMY RHEOLOGY INSTRUMENTS

USING MANUAL

FIRST PRODIG CP1000

VERSION N° F1PGCP1000-UK06/2023

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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:

τ = M x K_{Tau} with M for motor torque in mNm and K_{Tau} in Pa/mNm.

$\dot{\gamma}$ = n x 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 CP:** Measuring systems cone or plate compatible with DIN 53019 / ISO 3219 / ASTM D4278-D7395 (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 measurements on very small quantities for control or development of homogeneous products with or without particles (size <100µm), guaranteeing easy cleaning.

1.1 Components

Viscometer is delivered inside a foam protection to avoid any problem during transport. FIRST PRODIG CP1000 is delivered unmounted. You will find some cable, measuring system (according to order) and some tools for installation and using.

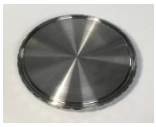
In detail, you will find different part in your box as shown below.

FIRST PRODIG CP1000 (FIRST PRODIG Head and CP1000 stand packaged separately).

Cable and power supply for measuring head

AC265-Bayonet adaptor with tool

Tool and screw to install FIRST PRODIG head on CP1000 Stand.



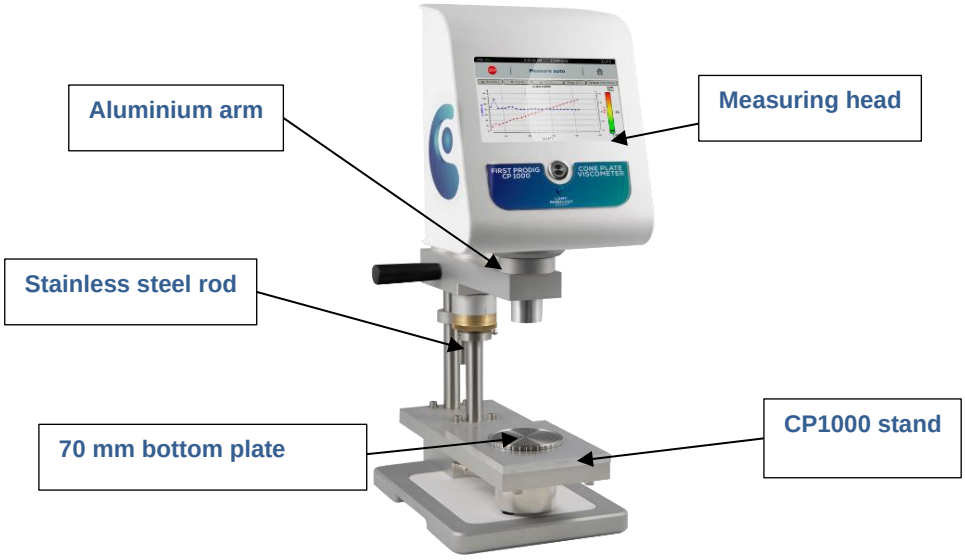
Bottom plate 70 mm.

2 pipes (1m)

Cable for electrical contact between head and CP1000

1.2 General view of your instrument

Once your device will be mount and installed, it looks like this (for standard stand only).

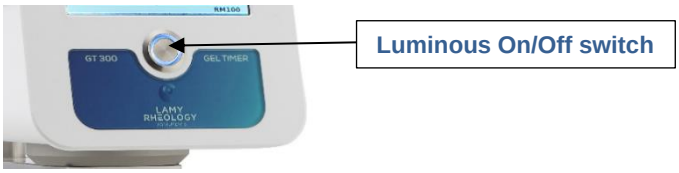


- **TOUCH Screen**

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

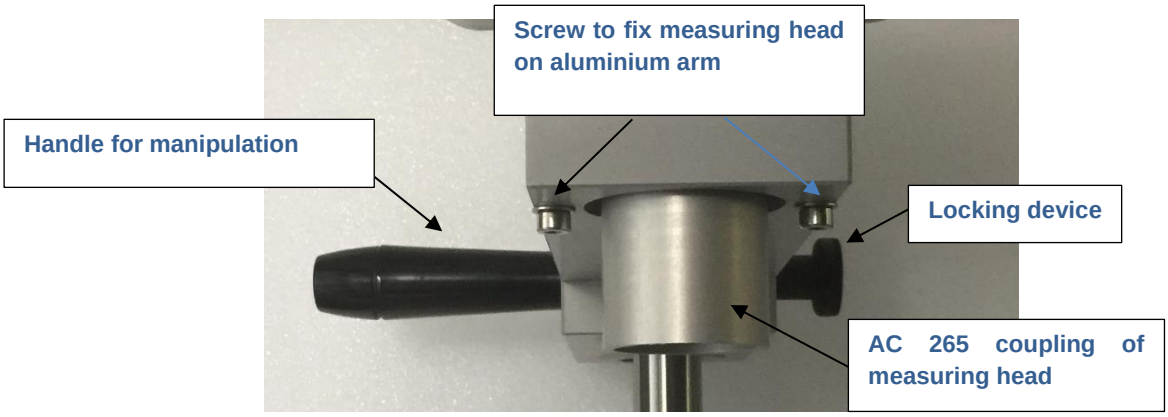
- **On / Off Switch**

Always with the aim of improving your experience, LAMY RHEOLOGY has decided to equip all of its PLUS range with a luminous and design switch. It has been placed in the centre of the device for greater intuitiveness.



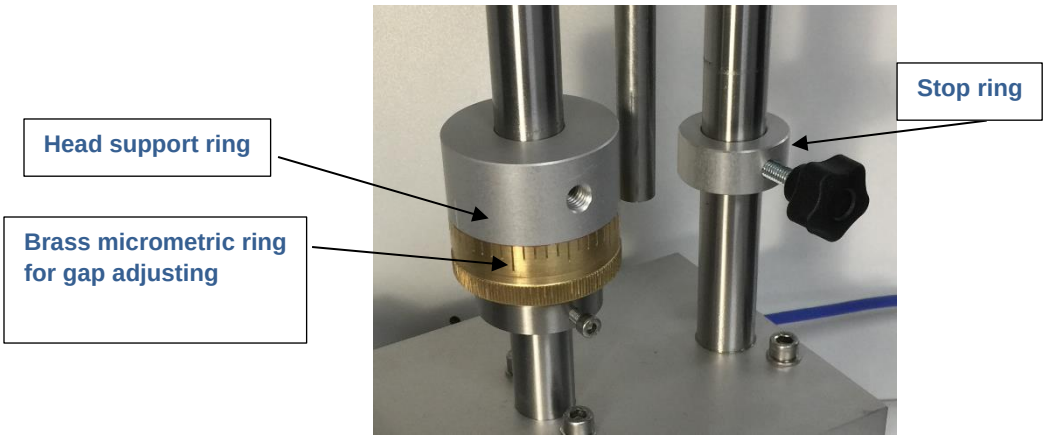
- **Aluminium arm**

The aluminium arm is equipped with the clamping knob allows you to maintain the height of the measuring head and a handle for easy handling. The measuring head is fixed to the arm by one screw.



- **Stainless steel rod**

The support rod is made of stainless steel for a solid hold of the measuring head. It has a very long life. One of them is equipped with a support ring for the head in the measuring position and the micrometric ring for adjusting the air gap. Other is equipped with stop ring when stand is used with MS RL/LV, MS KREBS, MS VANE, MS BV. It allows lock of measuring position according to spindle.

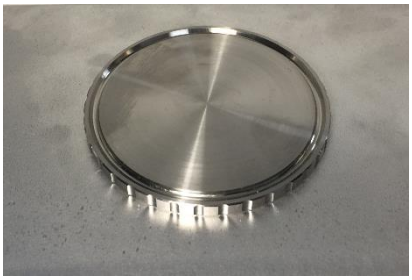


- **Stand CP1000**

This device doesn't regulate itself the temperature of your sample. It requires water chiller to set or maintain temperature between +5°C to +65°C. Two inlet are provided to allow pipe connection from chiller. No matter circulating sense.

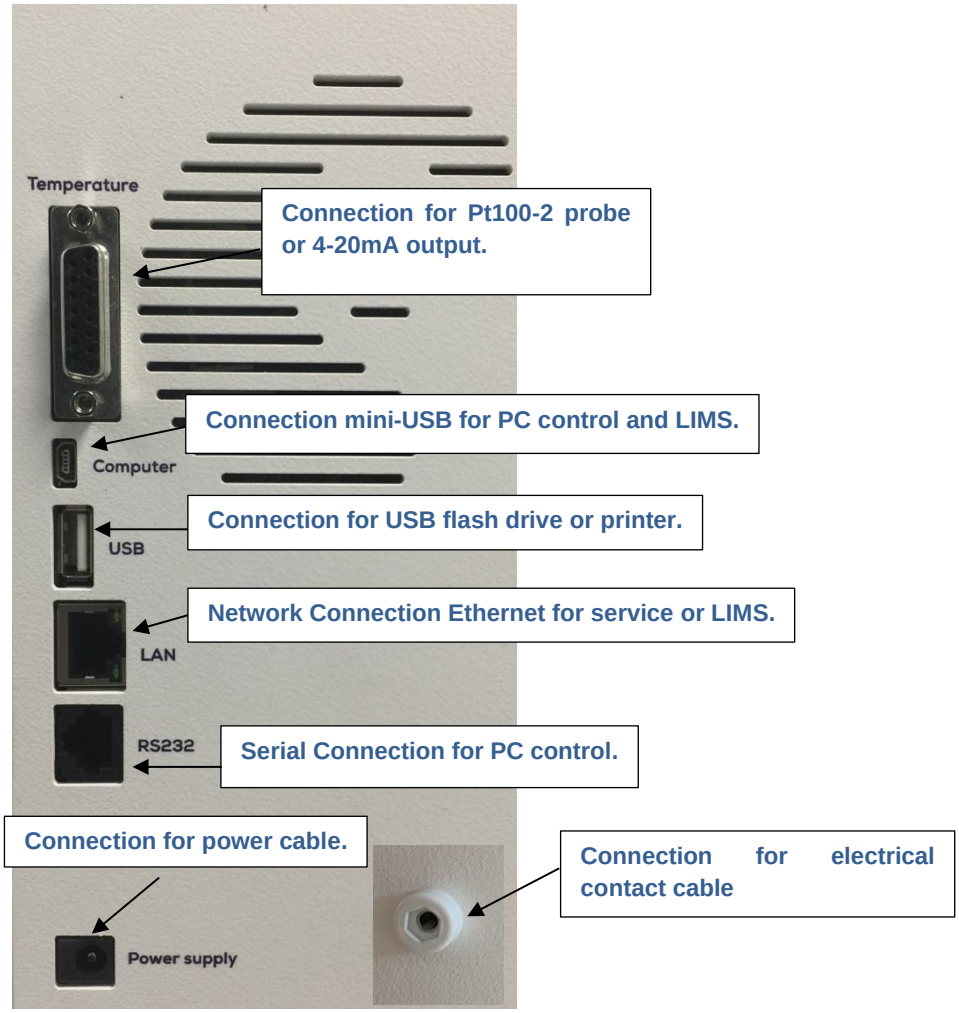
It is equiped with Pt100 temperature probe connected to measuring head with blue cable (need to be connected on rear panel of FIRST PRODIG Head – see section 1.3).

The lower plate is removable to get flat surface when you need to install beaker for measurement with other spindle as MS RV/LV or MS KREBS.



1.3 Connections

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



1.4 Specifications

Type of instrument: Rotating springless instrument with 7'' Touch screen
Rotation speeds: Unlimited number of speeds between 0.3 and 250 rpm
Torque range: From 0.05 to 13 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/German
Compatible measuring system: MS DIN, MS RV/LV, MS BV, MS VANE, MS CP/PP, MS-KREBS.
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: D320 x H550 x W200 mm. Weight: 14 kg

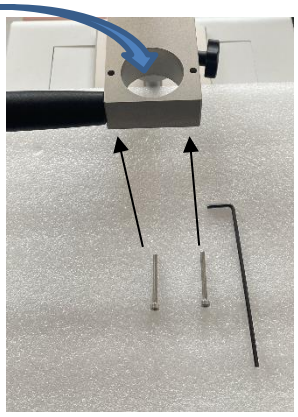
1.5 Installation

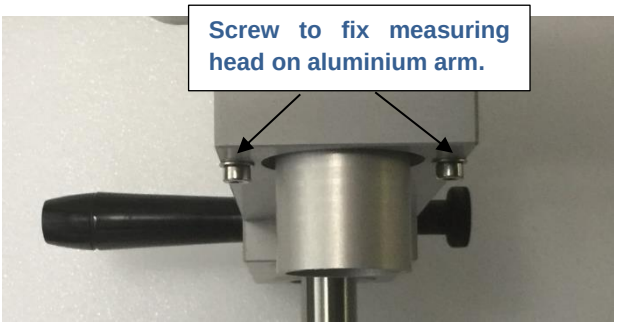
Your viscometer should be installed in a clean, vibration-free environment. Even if no level is necessary, choose a stable and flat table.

Place FIRST PRODIG head on aluminium arm, use the two provided screw and fix it.

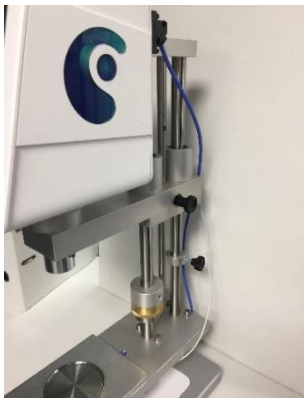
FIRST STEP:
Insert FIRST PRODIG head.

SECOND STEP:
Insert screw and fix head.





Connect cable for electrical contact on rear panel of device. Connect blue cable from CP1000 stand on rear panel of FIRST PRODIG head.



Connect your CP1000 stand to chiller with provided pipe if you need to control temperature.

Connect your viscometer by plugging power cable on to rear panel of device. And cable for software connection when it is provided.

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

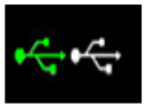
2 GETTING STARTED

Once power cable has been plugged on rear panel of device (see section 1.3), you can click on button to switch on your device (see section 1.2).

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.

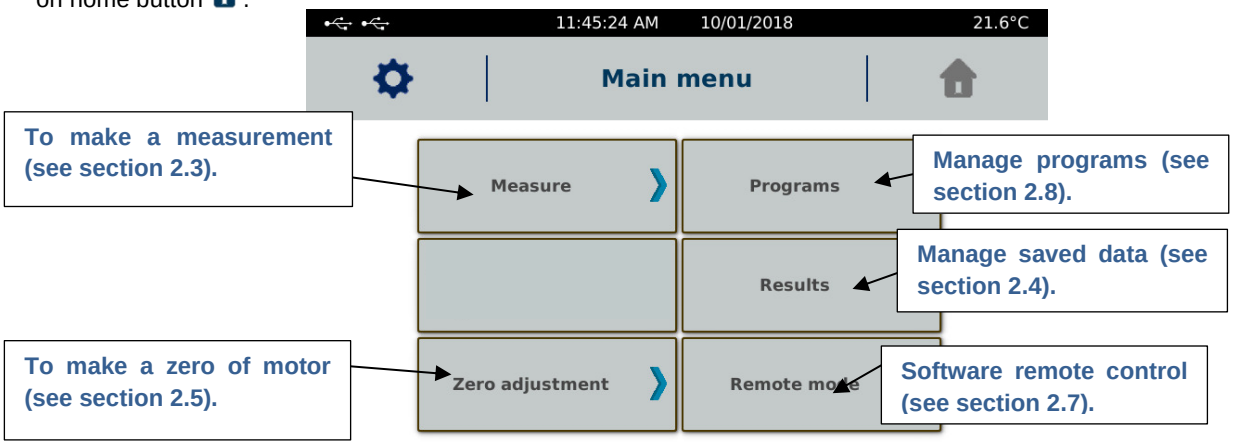
Enable to go to parameters of instrument.

Enable to come back to Main Menu.

Enable to come back to previous menu.

2.2 Main menu

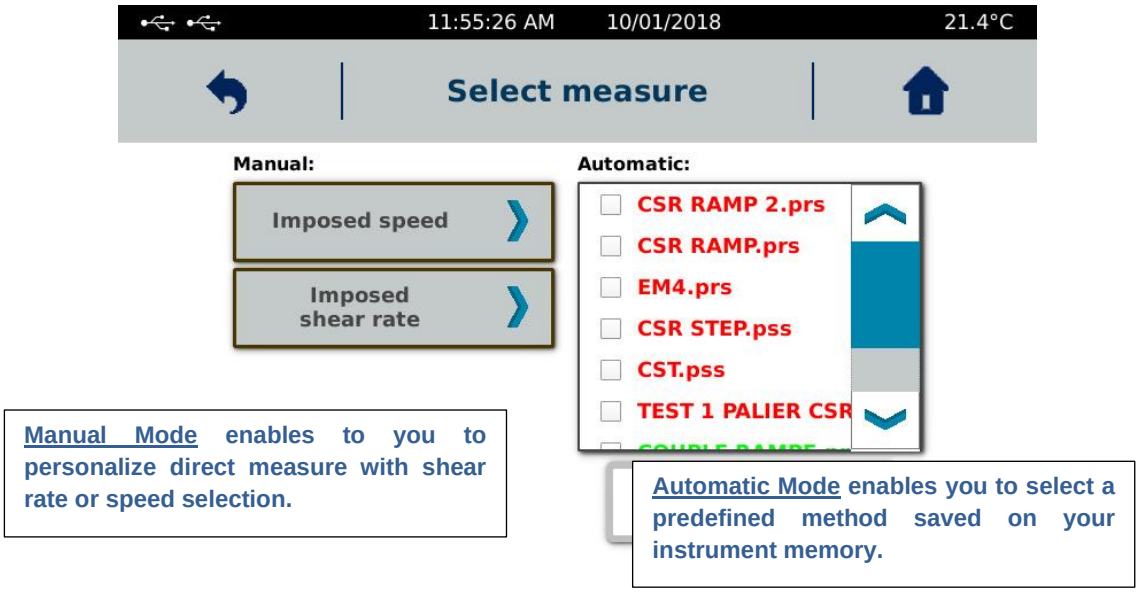
Main menu enable to you to browse between different tabs of your instrument. Acces is always available by clicking on home button  .



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.

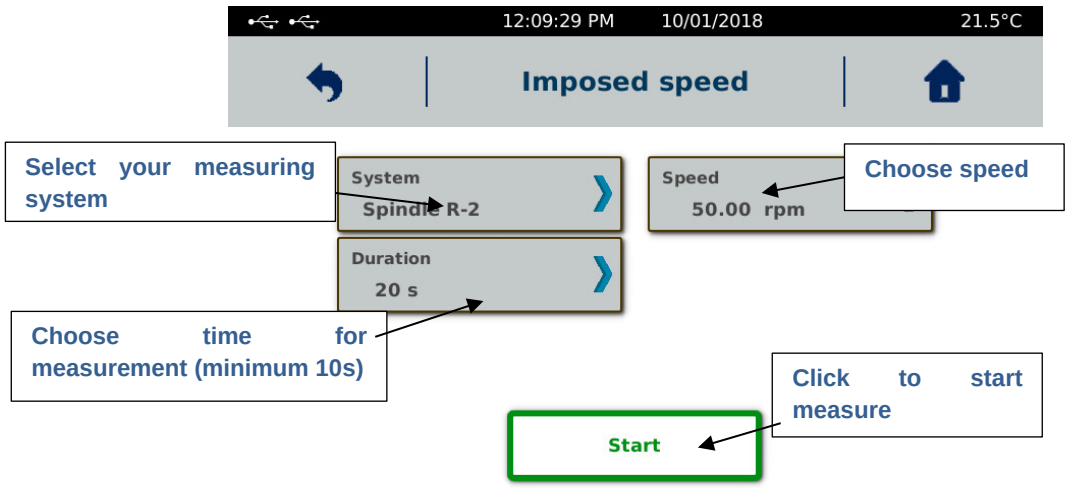


2.3.1 Manual mode

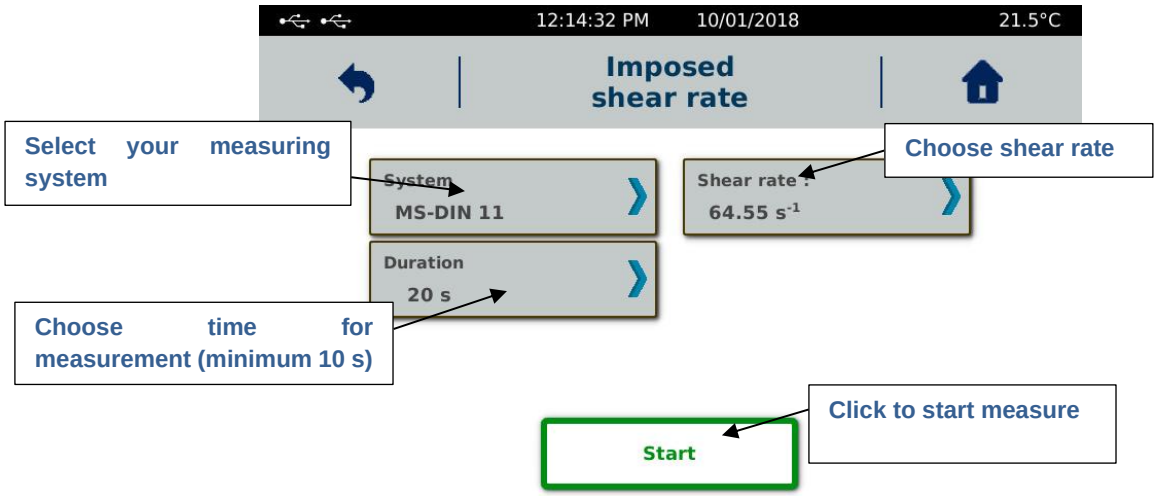
Manual Mode enables to choose your measurement parameters like “Measuring System”, “Speed” or “Shear rate” then “Time of measurement”.

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 CP/PP 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.

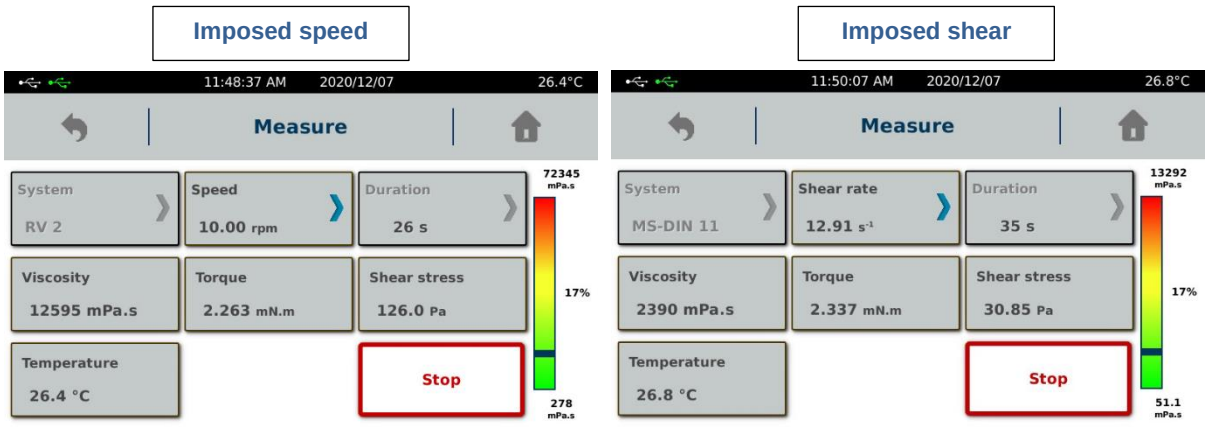
Choice between “Speed” or “Shear rate” is according to your measuring system. If you need to know what is the corresponding speed then you are using shear rate, you have to use constant K_D of your measuring system (information available in section 2.6.6) and use this simple equation.

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.



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).

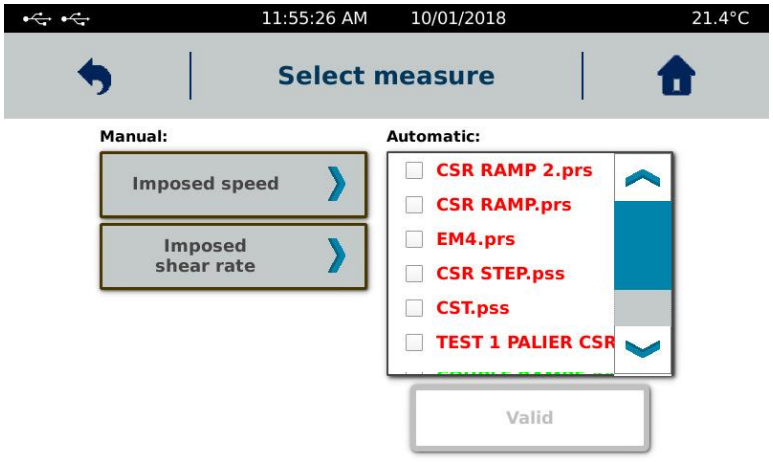
You must verify that the measured torque is not too close to the upper or lower limit, because you can get message as “Lower Torque” or “Torque Overload” and measurement will stop automatically. If this is the case, increase speed/shear rate or take a larger measurement system if you are close to the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

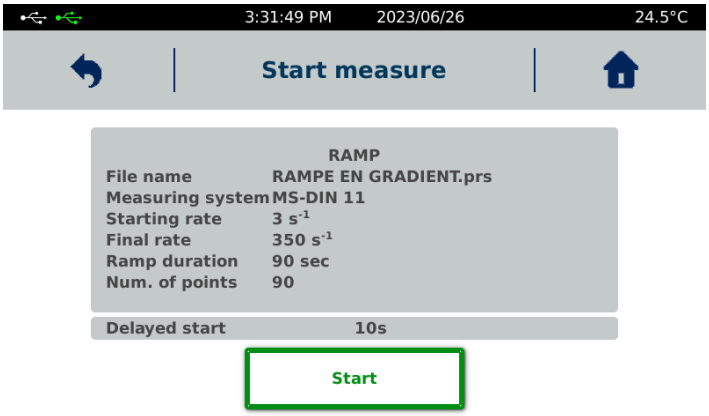
Automatic mode allows you to select pre-recorded programs (see section 2.8).



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.

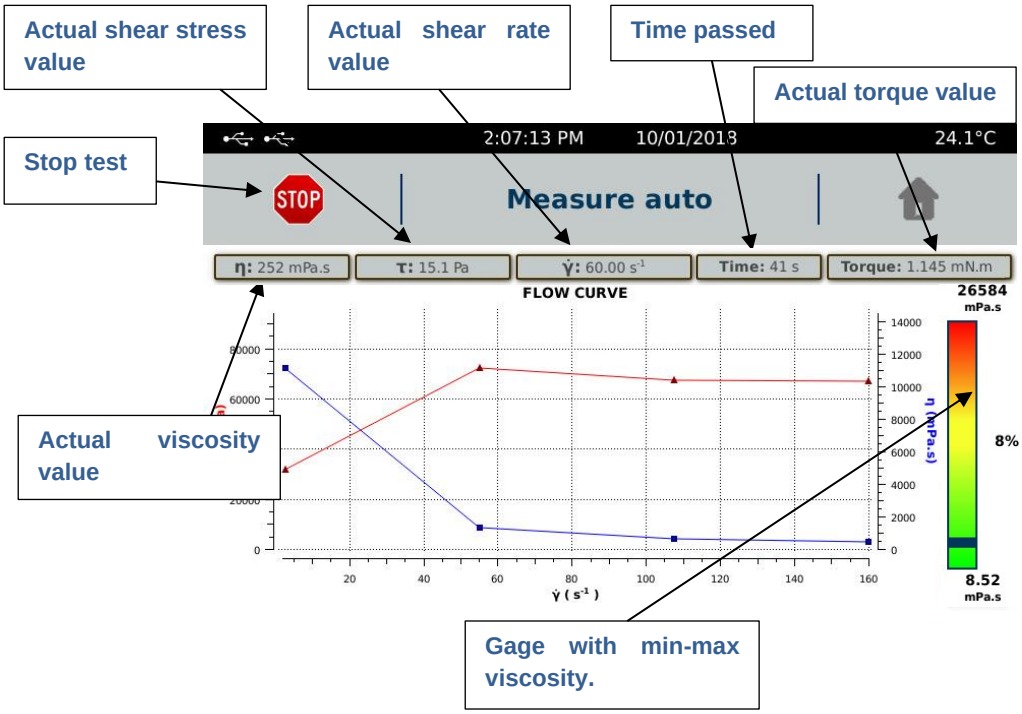
Select the program from the list and click "Valid" to start your measurement. The display adjusts automatically to show you the parameters of the chosen program.



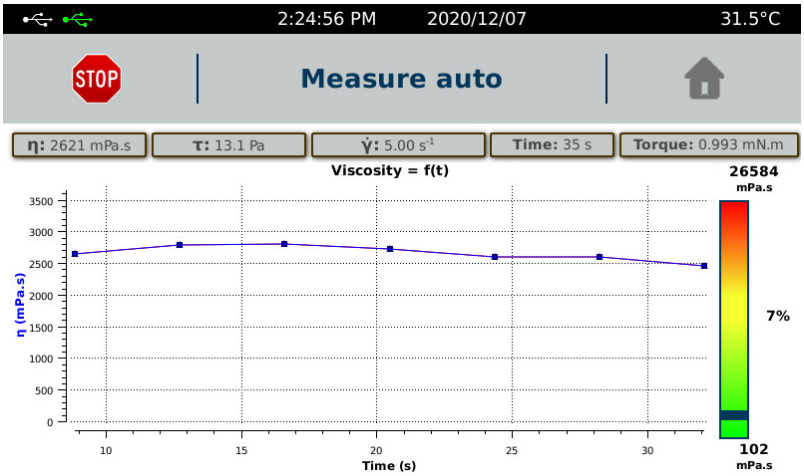
Check to make zero adjustment of motor before measurement (see section 2.5).

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.

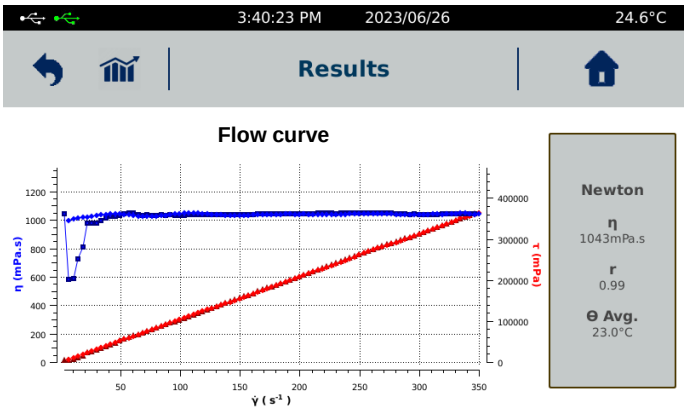


Some methods in step mode (format pss) contain only one step. These methods are intended for constant parameter measurements over time. The display of the curve will be different with time on x-axis. The name of the graph is also different (here Viscosity = f (t)).

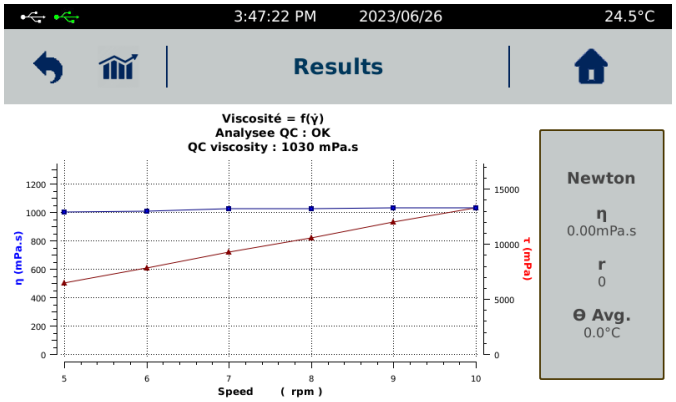


At any time you have the option to stop the measurement by clicking on the "Stop" button. The device will then ask you whether you want to save the measurement or not.

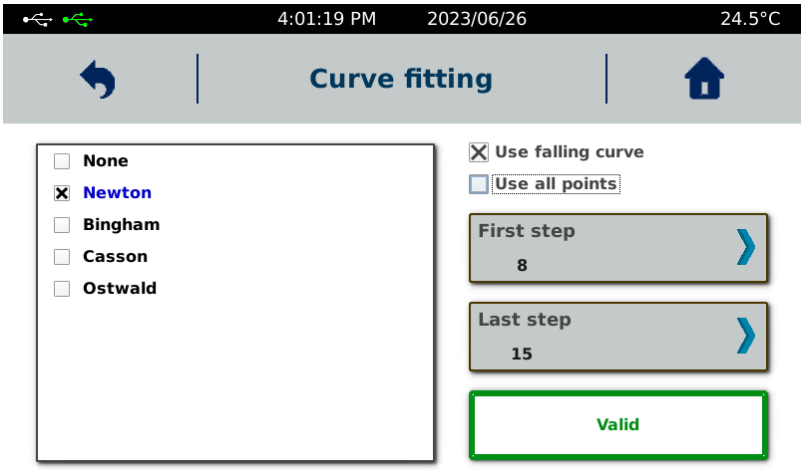
Some methods contain an analysis at the end of the measurement. When the measurement comes to an end, you will be able to see the result of this analysis as well as the curves obtained.



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  .

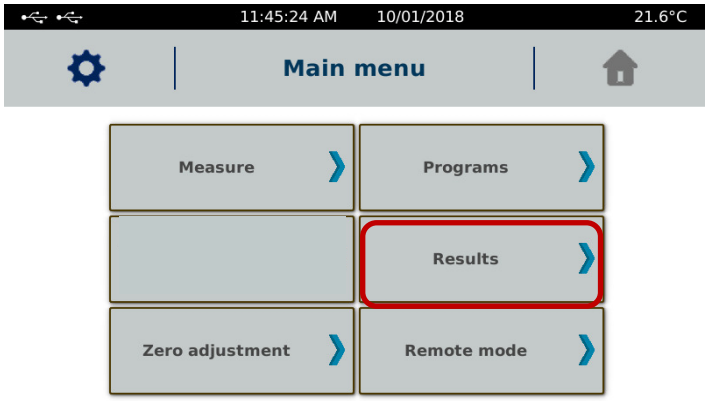


The analysis tool therefore makes it possible to use the same parameters as those available for programming. After making your changes, you can validate. The instrument will return to the end of measurement view with the new results.

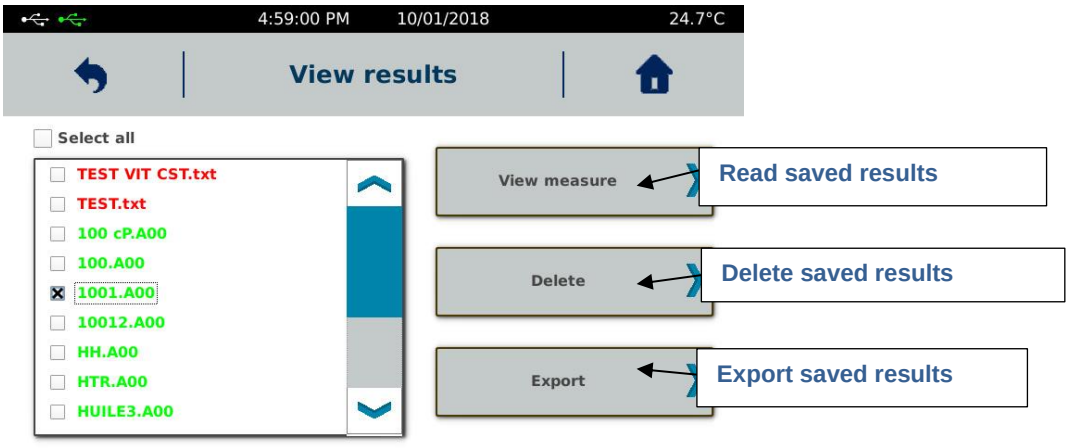
All saved results can be read later (see section 2.4).

2.4 Results menu

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

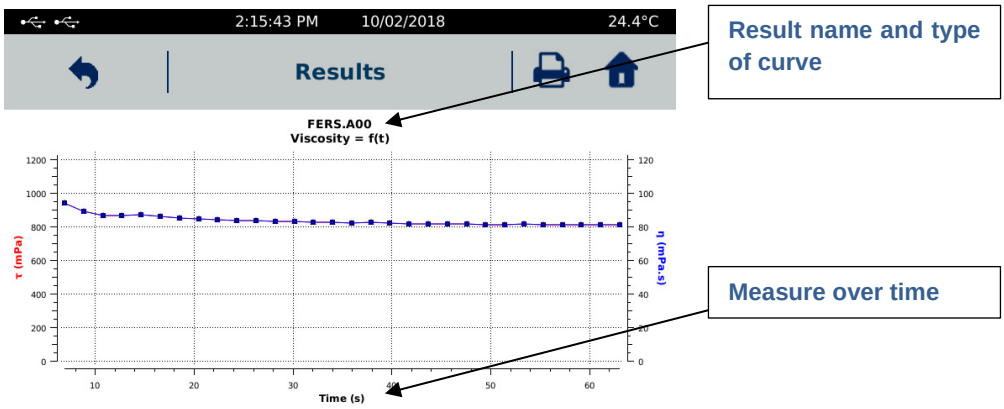


Once you are on the screen below, simply select the measurement in the list and choose the desired option. The measurements in green correspond to results obtained with a programmed method while the measurements in red come from measurement in manual mode (see paragraph 2.3).

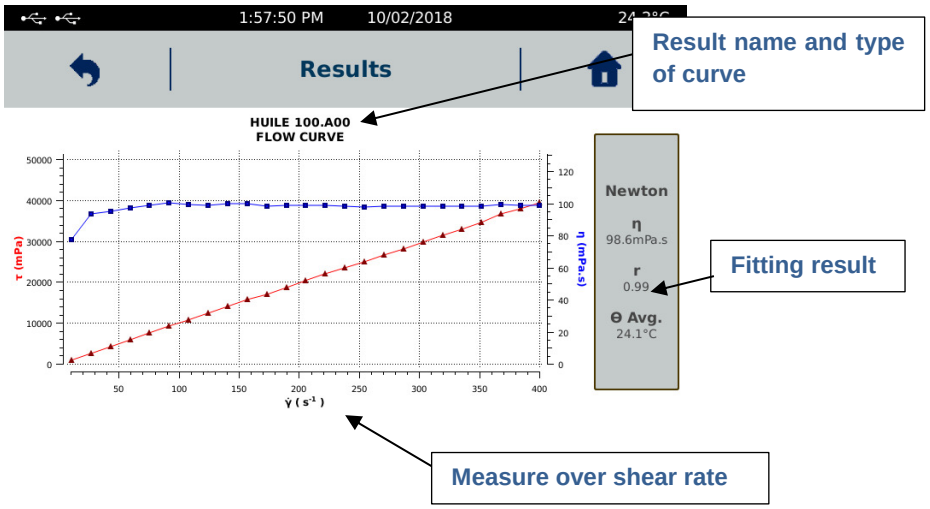


When you select measurements done in manual mode, you will get this view with all important information saved with the result. The options available are export if a USB key is connected to the instrument or printing (printer icon).

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.



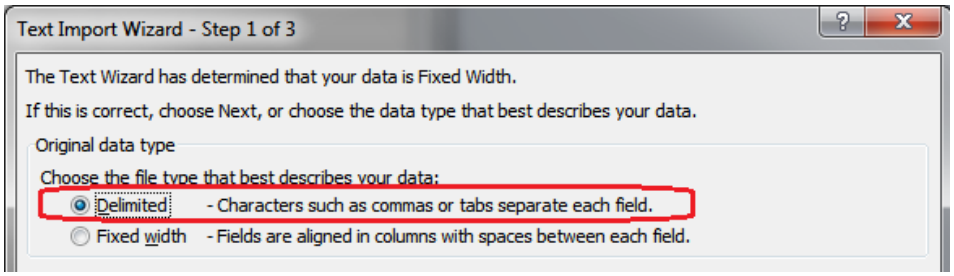
The box for regression is only present if your method allowed the calculation.

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.

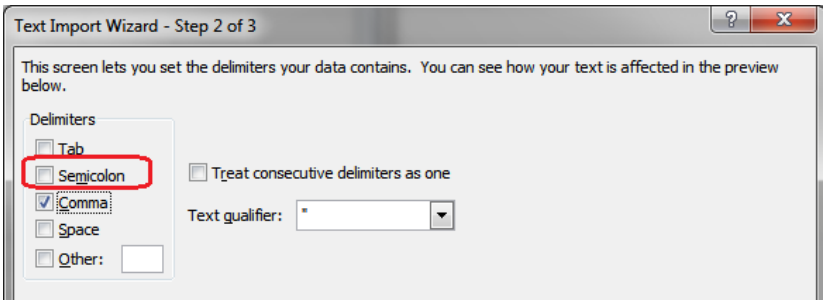
The "Export" function is accessible only when a USB key is connected to the back of the instrument (see connection section 1.3). If you want to export all the measurements at the same time, you can do this by checking the "Select all" box. Whatever the program used for the measurement, only the recorded 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.

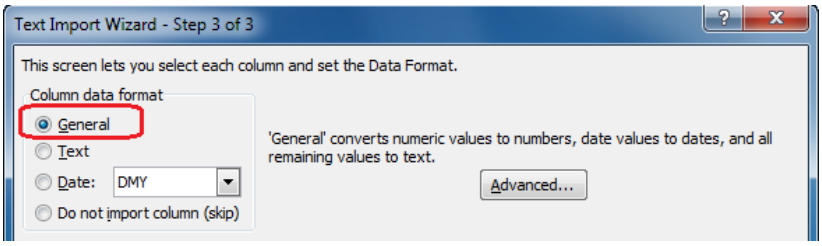
Verify that the "Delimited" function is selected and then click next.



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



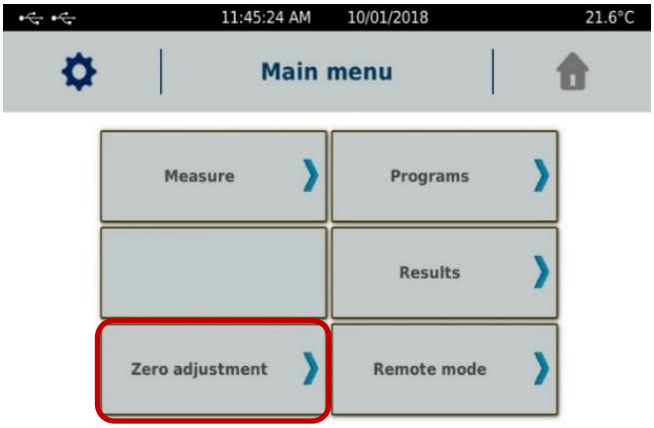
On the window below, select the general mode and click on finish. Your will get a table with all the information.



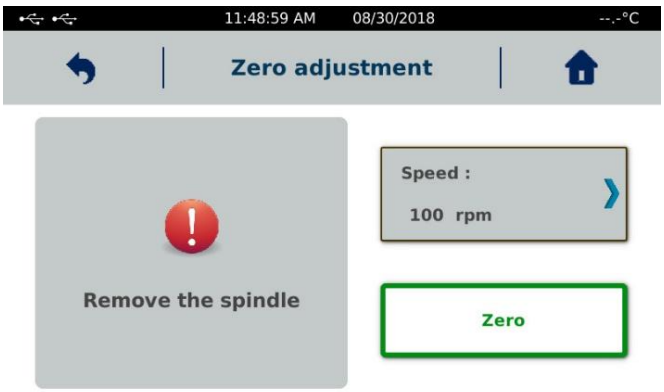
To delete a result, simply select your measurement in the list and click on "Delete". The deletion will be complete only after confirmation from you. You can also delete all measurements by clicking on "Select all" then “Delete”.

2.5 Zero adjustment menu

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



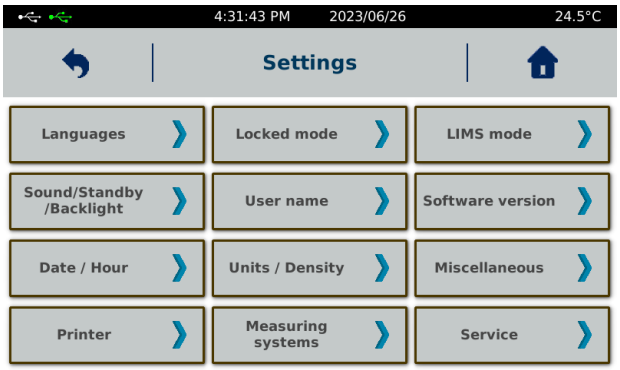
The rotation speed for zero adjustment can be changed to suit your needs, giving you much more accurate measurements at specific speeds close to your measurement parameters.



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”.

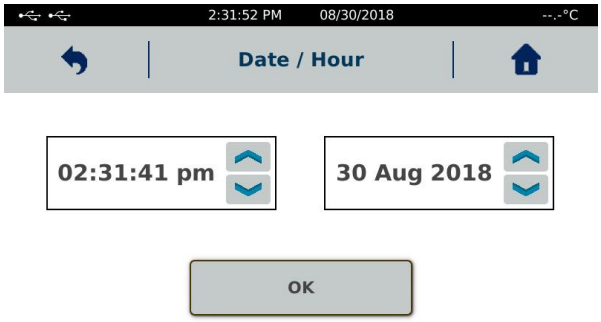


2.6.1 Languages

It enables you to select language of your instrument. You have choice between French, English, Turkish, Italiano, Russian and German. 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.

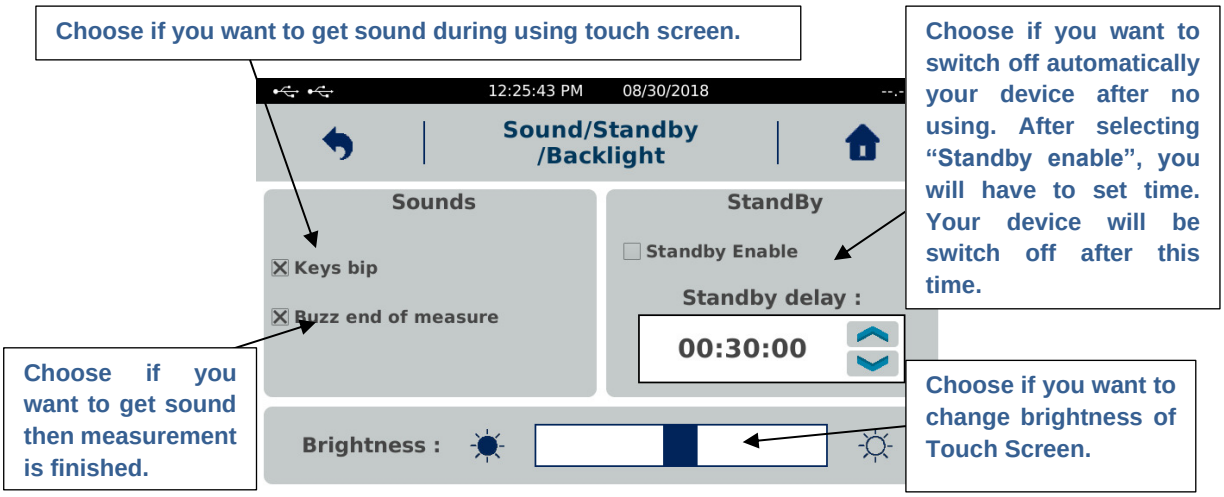
2.6.2 Date / Hour

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



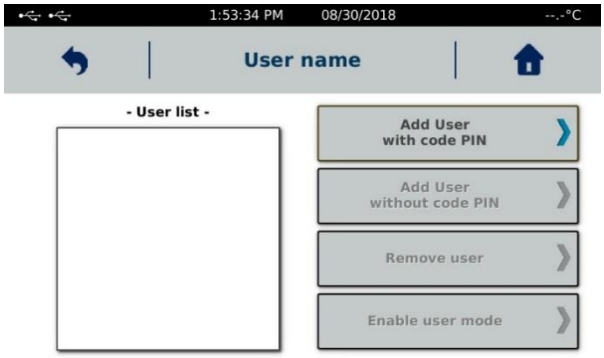
2.6.3 Sounds / Standby / Backlight

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

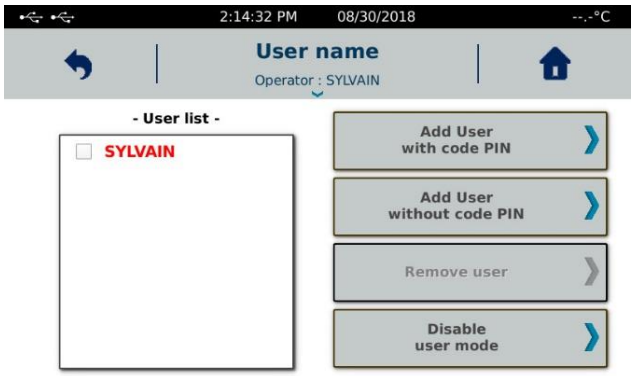


2.6.4 User name

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).

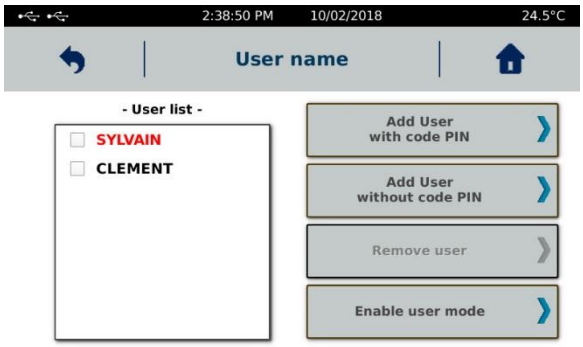


Operator management must always start with the creation of the first account, which will become the administrator. You can create other operator accounts or delete them. The administrator account must be associated with a password (here called PIN).



To create the administrator account, click on "Add user with code PIN". Fill in the name and the associated PIN code.

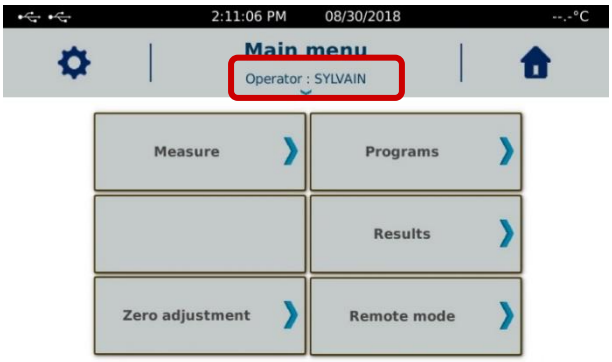
After indicating the name and password, the administrator just created will have his name in red in the list. You can now create other operators with or without a PIN. All other accounts will be indicated with black colour.



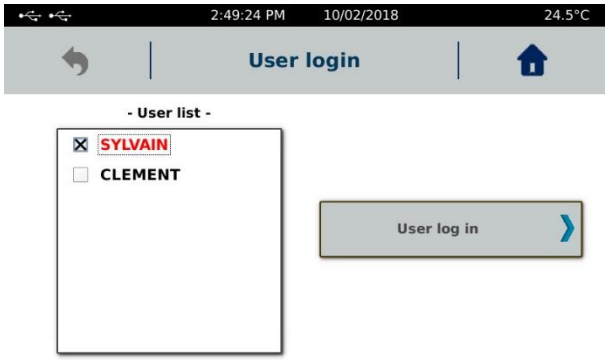
To delete an account, administrator account must be used. Select the account to be deleted from the list and click on "Remove user". The administrator account can only be deleted when it is the last available account.

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

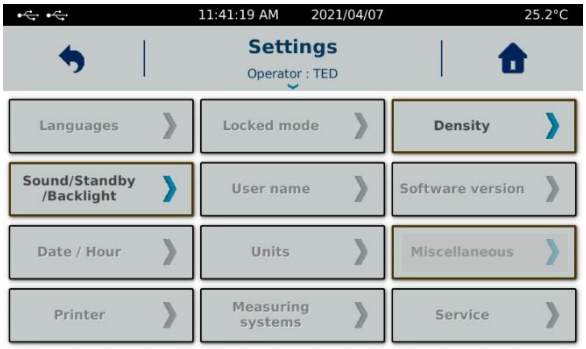
name of the operator logged under “Main Menu”. By clicking on the arrow below the name of the operator, you can turn off the instrument or change operator.



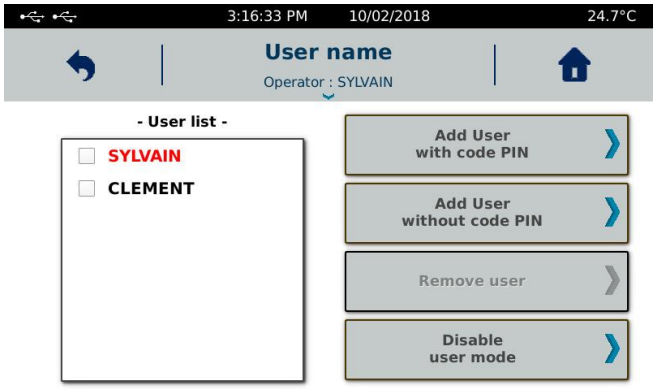
If the instrument is turned off and on while operator mode is on, it will be asked you to select the desired operator. Select the operator, enter the PIN code if necessary and confirm.



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

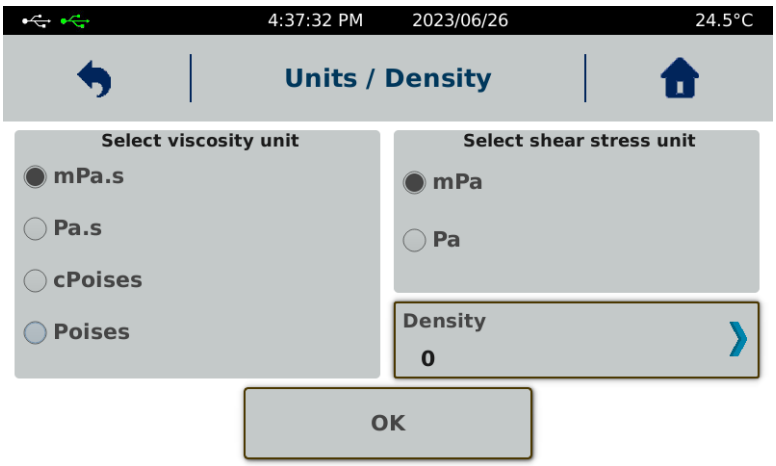


To disable the "User" mode, the administrator account must be used. Then click on "Disable user mode”. This disabling doesn’t lead to the deletion of created accounts.



2.6.5 Units / Density

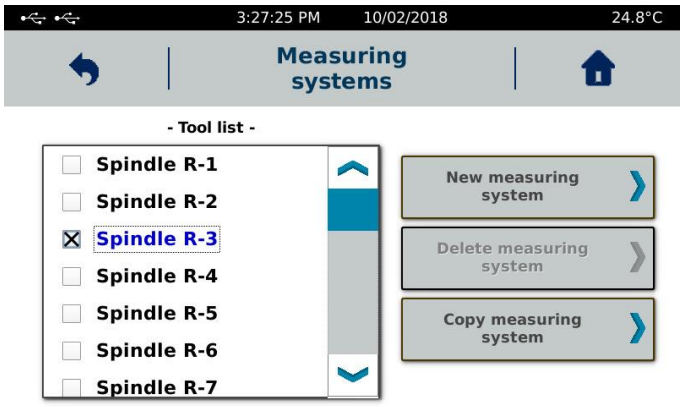
Allows you to change units of viscosity and stress used for programming methods and displaying results and diagrams.



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 CP/MS-PP

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
CP1005	3820	12	1
CP1010	3820	6	1
CP1020	3820	3	1
CP1030	3820	2	1
CP06	1380	3.3	1

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
CP03	552	13.3	1
CP05	552	3.3	1
CP09	552	2	1
CP2005	477.5	12	1
CP2010	477.5	6	1
CP2015	477.5	3.8	1
CP2020	477.5	3	1
CP02	276	13.3	1
CP2404	276	13.3	1
CP2405	276.3	12	1
CP51Z	276	4	1
CP04	276	3	1
CP2420	276.3	3	1
CP52Z	276	2	1
CP01	139	13.3	1
CP10	139	5	1
CP08	139	2	1
CP3510	89	6	1
CP4005	59.7	12	1
CP4010	59.7	6	1
CP4015	59.7	3.8	1
CP4020	59.7	3	1
CP4040	59.7	1.5	1
CP07	35	2	1
CP40Z	35	7.5	1
CP42Z	35	4	1
CP41Z	35	2	1
CP5005	30.6	12	1
CP5010	30.6	6	1
CP5020	30.6	3	1
CP6005	17.7	12	1
CP6010	17.7	6	1
CP6020	17.7	3	1
CP6030	18	2	1
CP6050	18	1.2	1
PP20*	636	1.04	1
PP25*	326	1.31	1
PP28*	232	1.47	1
PP35*	119	1.83	1
PP40*	79.5	2.1	1
PP50*	41	2.6	1

* Given values for gap 1mm.

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.

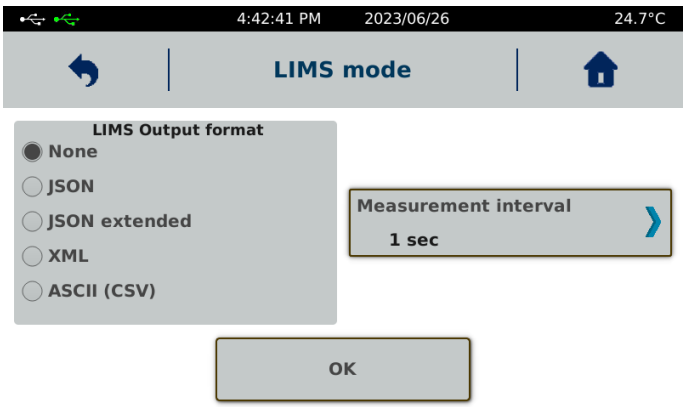
In protected mode, it is not possible to change the temperature set-point or to access the program creation or editing mode. The visualization of results is accessible as well as the export of data. But no suppression is possible. The "zero adjustment" is accessible but it is not possible to change the 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. This way, you can collect the data stored in the instrument's memory in the desired format. The connection used will be Ethernet (LAN) or USB 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 interval time will be used by the device to store the data point in memory after a time set for the LIMS function.



2.6.9 Printer

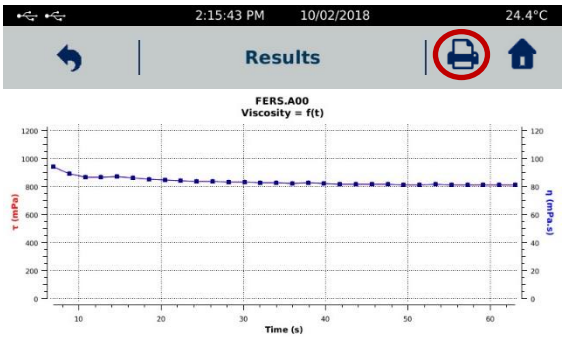
Allows you to connect a printer, print a test page, and choose the print interval time you want during measurement.

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.

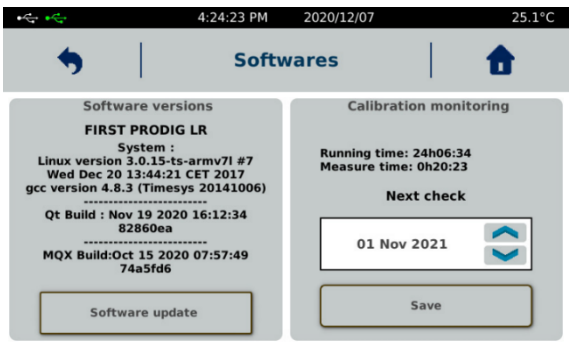


You have the possibility to print the measurement information (date, operator, result name, geometry used), a table with all the recorded values, the diagram and the result of the regression if they are present.

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. This setting will have effect on torque in % shown while measurement and viscosity limits.

Please see below torque covered by specific range:

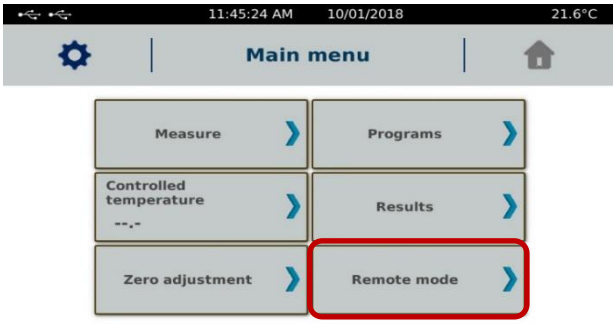
- RV Range : From 0.07187 to 0.7187 mNm.
- HA Range : From 0.1437 to 1.4374 mNm.
- HB Range : From 0.5749 to 5.7496 mNm;
- None means no limits. So it will be complete range for device (from 0.05 to 30 mNm).

2.6.12 Service

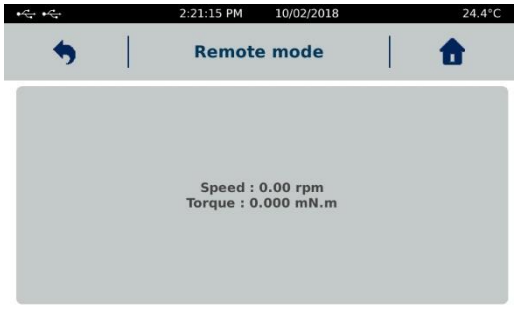
Reserved to LAMY RHEOLOGY engineers.

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.

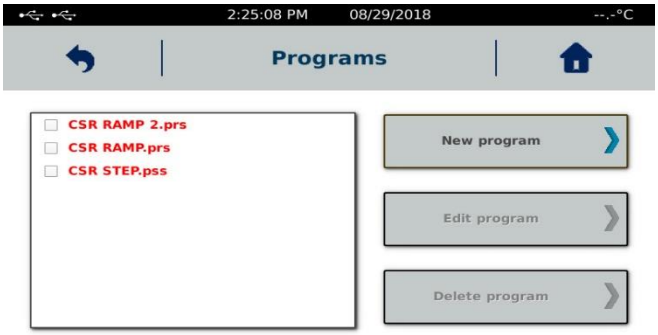


Once the device is connected to the PC, you must select the type of port (USB or RS232) and click on "Ok" to start the communication. As long as communication is not established, a "Waiting Connection ..." message appears on the screen. Then launch the software and check that the screen switches to the 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.



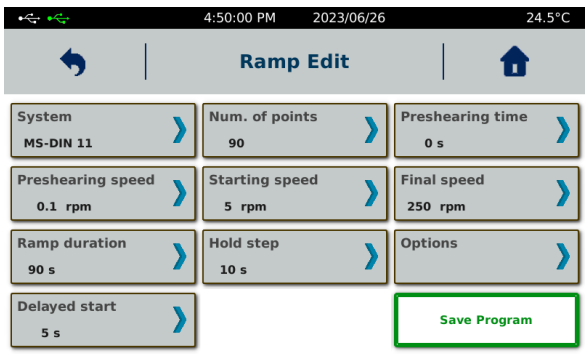
2.8.1 New program

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

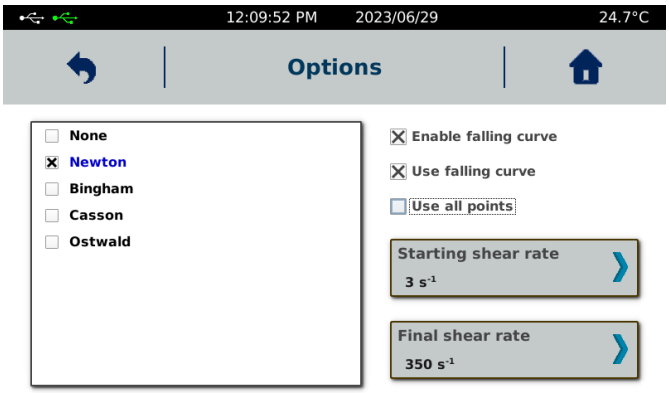
At the beginning of your programming, all the buttons are grey except for the "System" button. Selecting the measurement system and validating will automatically activate the next button and so on. You will then be able to indicate the number of points (here of the rising ramp), the duration of the pre-shear (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 "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 "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.

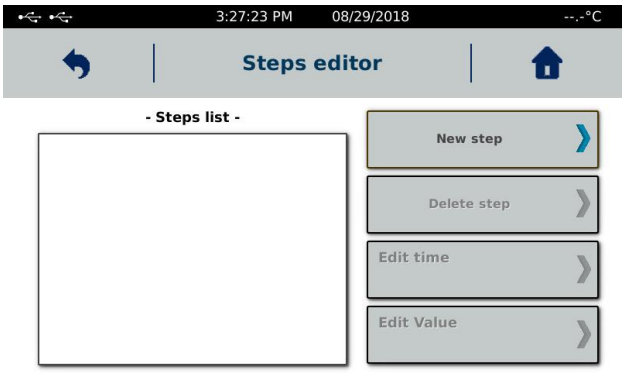
2.8.1.2 Speed/shear rate step mode

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).

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).

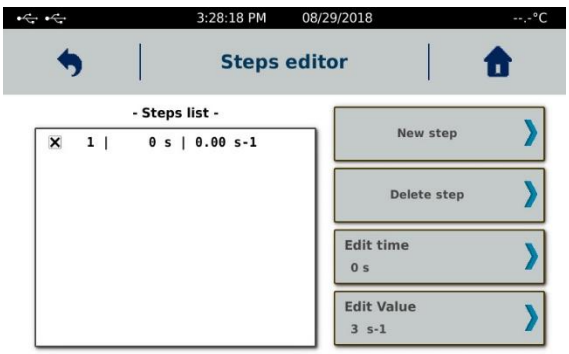
When you select the "Num. of step ", you get this view.



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

Imposed speed

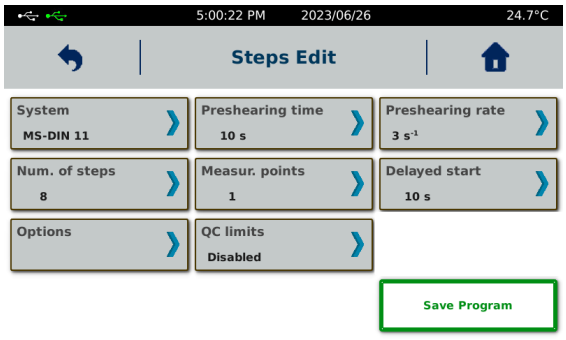
Imposed shear rate



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".

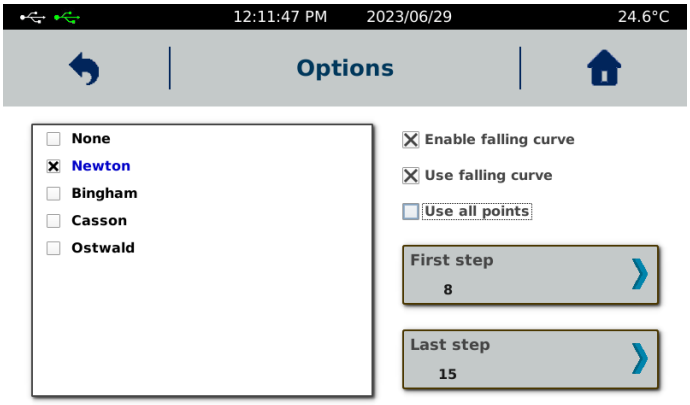
Once steps programming is complete, you must click on the back arrow (top left of the screen).

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 "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).

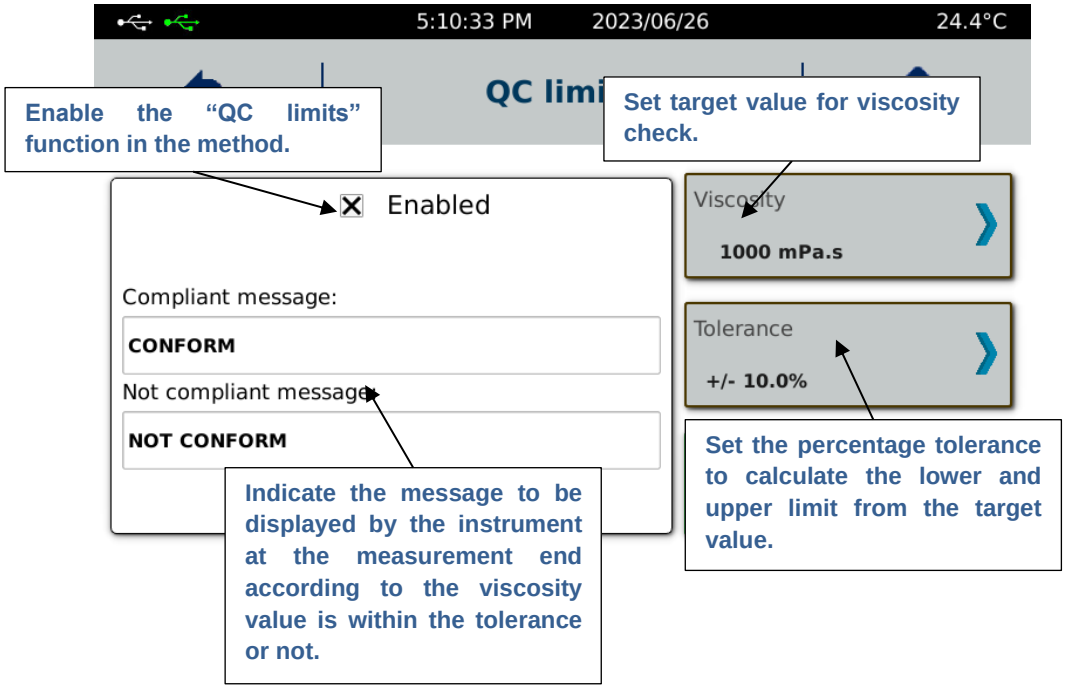
The "Options" button allows you to perform a rheological analysis on your measurement at the end of it. You will have to indicate which model you want, which part of the measurement will be used, specifying the area concerned (complete or partial). The regression will be automatically launched at the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



The "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.

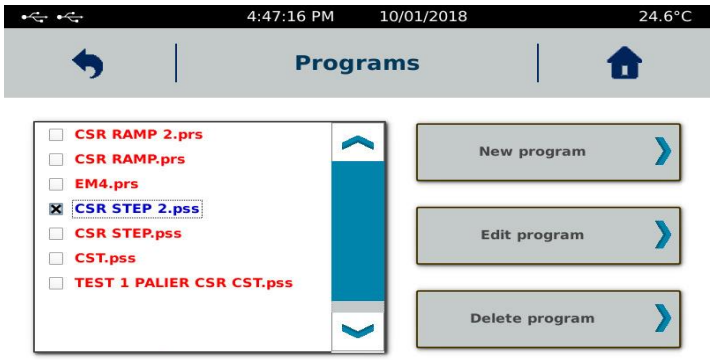


For this check, the instrument uses the last viscosity value measured in the last step. Do not forget to activate the "QC limits" function before validating to exit this window, otherwise the information will not be saved. At the measurement end according to the viscosity value is within the tolerance 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.

3 MEASURING WITH YOUR DEVICE

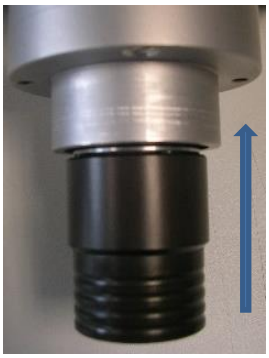
This section will show how use the different measuring system with your device.

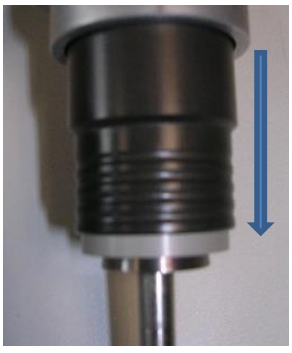
Instrument need to be installed before next section of this manual (see section 1.5).

3.1 Installation of measuring system

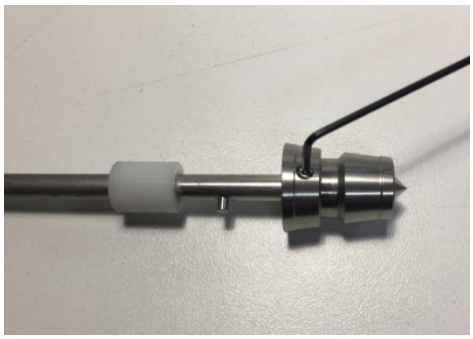
Read the installation of your measuring system in the following sections before inserting it on your viscometer. Indeed some measuring systems require the installation of accessory before the insertion of the spindle. Don't forget also to make a zero of measuring head before installing of measuring system (see section 2.5).

The coupling of instrument is of type AC 265. It is a system allowing the insertion and the quick fixing of the measuring mobiles. A simple vertical action of the ring upwards (release) or downwards (locking) allows easy manipulation of the measuring tool.





And adaptor AC265-BAYONET is provided with your device. It allow using of bayonet coupling spindle as MS RV/LV, MS KREBS, MS VANE or MS BV. To use it, you have to remove a littl bit screw on this adaptor, insert bayonet side of spindle inside hole and lock it with provided tool. Please do not insert it too much and check that only conical part of bayonet spindle shaft is visible.



3.2 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.

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	

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 with viscosity range in mPa.s):

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

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

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

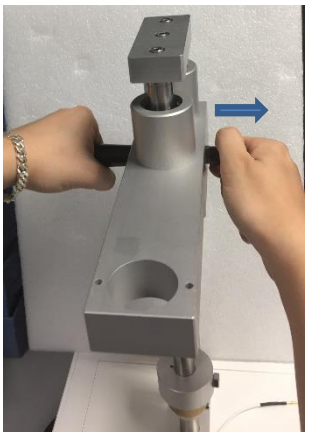
When measuring, it is strongly recommended to heat the 600ml beaker.

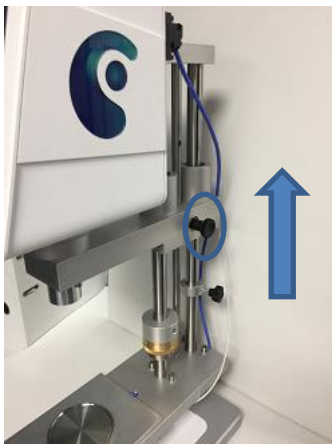
Fill the beaker with 500 ml of product to be tested, taking care not to introduce air bubbles.

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. Hold handle, release button, rise head and find new hole where button can fit in automatically.





You must choose the measuring spindle according to the viscosity you wish to measure:

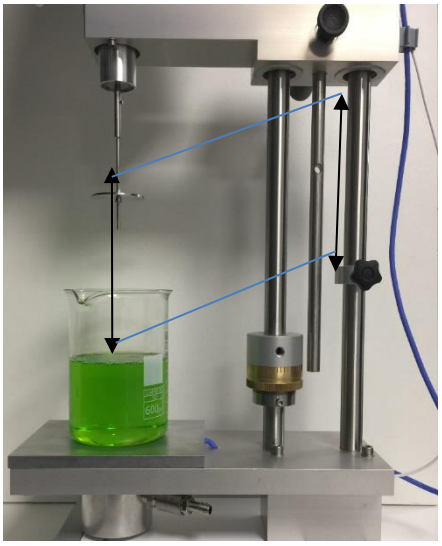
- For measurement of a low viscosity product, choose ASTM R-2 and run the unit at a high speed, such as 100 rpm.
- For the measurement of a high viscosity product, choose ASTM R7 and run the machine at low speed, for example 1 rpm.

Make a zero of your viscometer (see section 2.5).

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

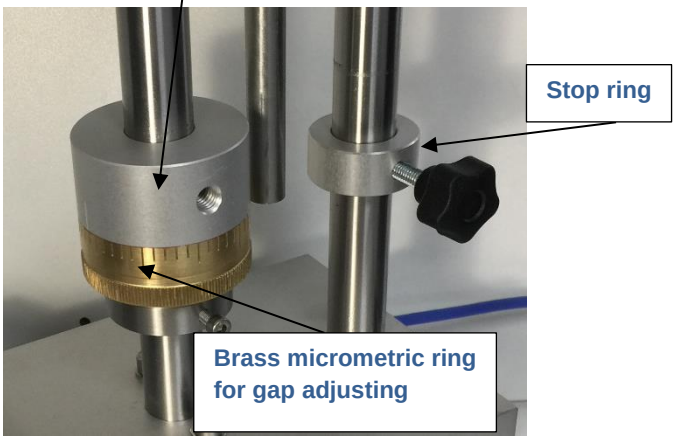
Place beaker with sample on base plate. You can remove bottom plate use for MS CP to get larger flat surface.

Check distance between mark on spindle shaft and liquid level.



Report same distance on metallic rod with stop ring and lock it with button.

Use handle to manipulate the device, release screw and move down measuring head to reach stop ring. Normally liquid level should be in same position as mark on spindle shaft.



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. 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

These spindles allow you to make measurements on 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.

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. Hold handle, release button, rise head and find new hole where button can fit in automatically (see section 3.2 for more detail).

Make a zero of your viscometer (see section 2.5).

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

Place beaker with sample on base plate. You can remove bottom plate use for MS CP to get larger flat surface.

Check distance between mark on spindle shaft and liquid level (see section 3.2).

Use handle to manipulate the device, release screw and move down measuring head to reach stop ring.

When the measurement height is optimum, you can use stop ring to block height of measuring head Adjust the position of the viscometer 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.

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 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 measuring spindle or change the measuring speed.

Then your measurement is finished, raise the measuring head and lock it. 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

Here below are all available spindles with viscosity range:

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

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-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.

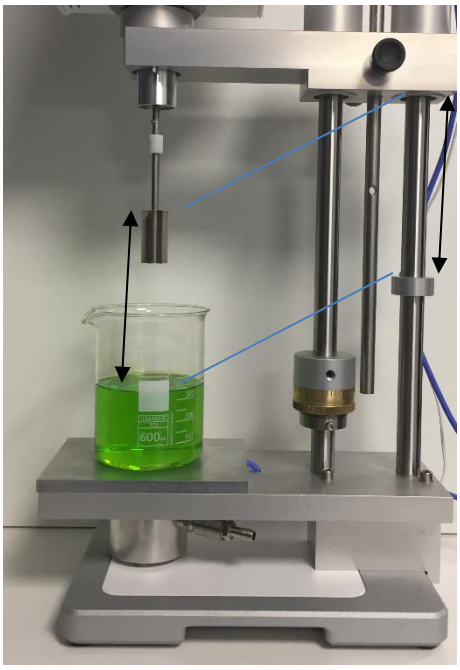
All data given in this table are given for information and can be changed according container which is used for measurement. And most of the time, you will be able to use only speed for your viscosity measurement and not the shear rate.
Place the measuring head in the highest position. Hold handle, release button, rise head and find new hole where button can fit in automatically (see section 3.2).

Make a zero of your viscometer (see section 2.5).

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

Place beaker with sample on base plate. You can remove bottom plate use for MS CP to get larger flat surface.

Check distance between top of blades and liquid level.

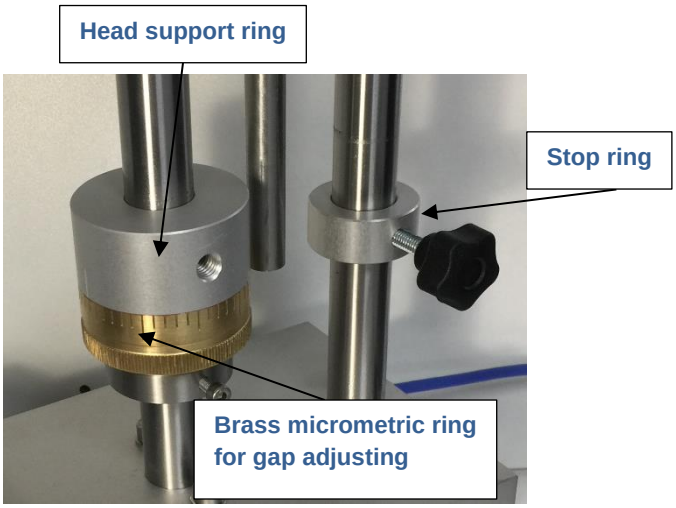


Report same distance +1cm on metallic rod with stop ring and lock it with button.

Use handle to manipulate the device, release screw and move down measuring head to reach stop ring (see section 3.2).

Adjust the position of the viscometer in the sample to immerge blade part at least 1 cm below surface. 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, you can use stop ring to block height of measuring head.



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 rotating speed.

Then your measurement is finished, raise the measuring head and lock it. 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 to the norm ASTMD562.

To get KU unit for your viscosity measurement with your viscometer, 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 with standard model (for LR on demand):

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

Place the measuring head in the highest position. Hold handle, release button, rise head and find new hole where button can fit in automatically (see section 3.2).

Make a zero of your viscometer (see section 2.5).

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

Place beaker with sample on base plate. You can remove bottom plate use for MS CP to get larger flat surface.

Check distance between top of blades and liquid level.

Report same distance +1cm on metallic rod with stop ring and lock it with button.

Use handle to manipulate the device, release screw and move down measuring head to reach stop ring (see section 3.2).

Adjust the position of the viscometer in the sample to immerge blade part at least 1 cm below surface. 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, you can use stop ring to block height of measuring head.

Start the measurement at the desired speed (200 rpm to get KU unit) and 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. Remove the measuring spindle to clean it.

3.6 MS CP/MS-PP

Measuring systems cone or plate compatible with DIN 53019 / ISO 3219 / ASTM D4278-D7395 (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 measurements on very small quantities for control or development of homogeneous products with or without particles (size <100µm), guaranteeing easy cleaning.

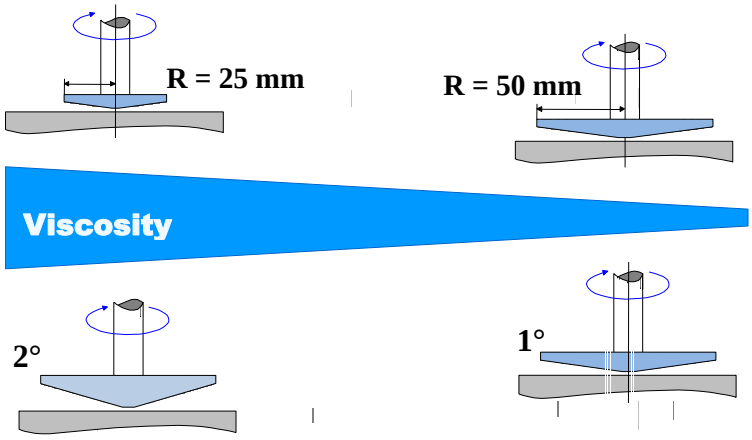
You will find below list of compatible measuring system with FIRST PRODIG CP1000.

Designation	Part number	Diameter (mm)	Angle (°)	Volume (ml)	Shear rate (s^{-1})	FIRST PRODIG CP1000	RM 100 CP1000 /CP2000 PLUS
MK-CP1005	265115	10	0.5	0.0023	12N	640 to 13M	106 to 318M
MK-CP1020	265120	10	2	0.01	3N	2.5K to 55M	424 to 1270M
MK-CP1030	265130	10	3	0.01	2N	3.8K to 80M	637 to 1910M
MK-CP06	2651418	14.04	1.8	0.02	3.3N	840 to 18M	139 to 418M
MK-CP03	2651945	19.06	0.45	0.015	13.3N	85 to 1.8M	14 to 41M
MK-CP05	2651918	19.06	1.8	0.05	3.3N	335 to 7.2M	56 to 167M
MK-CP09	2651930	19.06	3	0.1	2N	550 to 11.9M	92 to 273M
MK-CP2005	265205	20	0.5	0.018	12N	80 to 1.7M	13 to 39M

Designation	Part number	Diameter (mm)	Angle (°)	Volume (ml)	Shear rate (s^{-1})	FIRST PRODIG CP1000	RM 100 CP1000 /CP2000 PLUS
MK-CP2015	265215	20	1.59	0.058	3.8N	250 to 5.4M	42 to 125M
MK-CP2020	265202	20	2	0.073	3N	320 to 6.8M	53 to 159M
MK-CP02	2652445	24	0.45	0.03	13.3N	42 to 0.9M	7 to 20M
MK-CP2405	265245	24	0.5	0.031	12N	46 to 1M	8 to 23M
MK-CP51Z	2652415	24	1.5	0.1	4N	140 to 2.9M	23 to 69M
MK-CP04	2652418	24	1.8	0.12	3.3N	170 to 3.6M	28 to 83M
MK-CP2420	265242	24	2	0.126	3N	190 to 3.9M	31 to 92M
MK-CP52Z	265243	24	3	0.2	2N	280 to 5.9M	46 to 138M
MK-CP01	265345	30.2	0.45	0.06	13.3N	20 to 0.4M	3 to 10M
MK-CP10	2653012	30.2	1.2	0.15	5N	60 to 1.2M	9 to 27M
MK-CP08	2653030	30.2	3	0.38	2N	140 to 3M	23 to 69M
MK-CP4005	265405	40	0.5	0.146	12N	10 to 0.2M	2 to 5M
MK-CP4010	265401	40	1	0.29	6N	20 to 0.4M	3 to 10M
MK-CP4015	265515	40	1.59	0.465	3.8N	32 to 0.7M	5 to 15M
MK-CP4020	265402	40	2	0.585	3N	40 to 0.8M	7 to 20M
MK-CP4040	265404	40	4	1.17	1.5N	80 to 1.7M	13 to 40M
MK-CP07	2654830	48	3	1.5	2N	35 to 0.7M	6 to 17M
MK-CP40Z	265488	48	0.8	0.4	7.5N	9 to 0.2M	2 to 4M
MK-CP42Z	2654815	48	1.5	0.76	4N	18 to 0.3M	3 to 8M
MK-CP41Z	265483	48	3	1.5	2N	35 to 0.7M	6 to 17M
MK-CP5005	265505	50	0.5	0.285	12N	5 to 0.1M	1 to 2M
MK-CP5020	265502	50	2	1.142	3N	21 to 0.4M	3 to 10M
MK-CP6005	265622	60	0.5	0.5	12N	3 to 60K	1 to 1M
MK-CP6010	265610	60	1	1	6N	6 to 0.1M	1 to 3M
MK-CP6020	265602	60	2	2	3N	12 to 0.25M	2 to 6M
MK-CP6030	265603	60	3	3	2N	18 to 0.3M	3 to 9M
MK-PP20*	265020	20		0.314	1N	1220 to 26M	200 to 61.1M
MK-PP25*	265025	25		0.491	1.3N	500 to 10.8M	83 to 24.8M
MK-PP28*	265028	28		0.616	1.5N	315 to 6.8M	52 to 15.7M
MK-PP35*	265035	35		0.962	1.8N	130 to 2.8M	22 to 6.5M
MK-PP40*	265040	40		0.63	4.2N	38 to 0.8M	6 to 1.9M
MK-PP50*	265005	50		1	5.2N	16 to 34K	3 to 0.78M

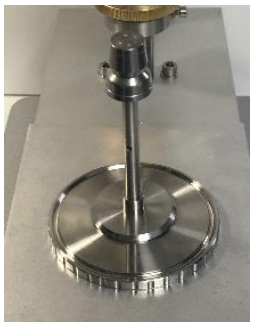
M for million, K for thousand, N for rotational speed (rpm).
* Given values for gap 1mm

Choice of measuring system must be done according to the product to be measured. Favor wide diameters for low viscosities as shown on diagram below.



Your FIRST PRODIG CP1000 is equipped with a manual adjustment of the gap. This setting is very important for the measurement position to be as ideal as possible. This adjustment must be made with the mobile but without sample. And it is necessary to do this at the measuring temperature.

The first step is to heat up your measuring plate if you want to measure at temperature different to ambient. Refer to user manual of water circulating bath to set correctly the temperature (temperature should be from +5°C to 65°C). Also, especially if the test temperature is different from that of the room, place the measuring geometry on the bottom plate to also bring it to temperature.



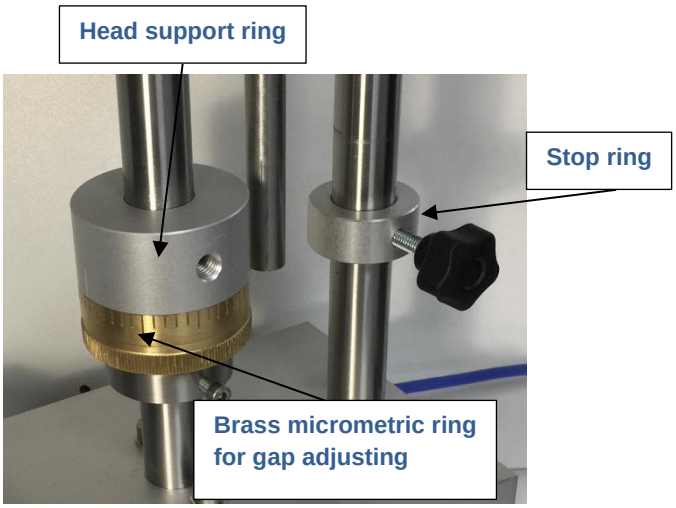
When the temperature has stabilized, you must leave your geometry in this position for a minimum of 5 minutes.

Place the measuring head in the highest position. Hold handle, release button, rise head and find new hole where button can fit in automatically (see section 3.2).

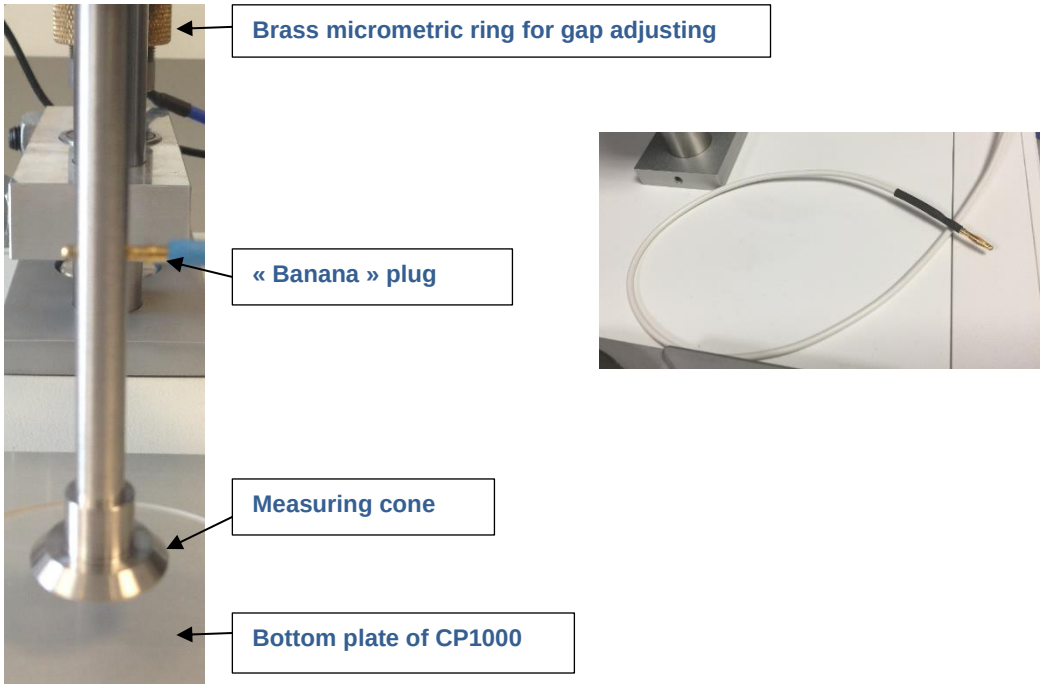
Make a zero of your viscometer (see section 2.5).

You must then attach the mobile to the viscometer without use of Bayonet-AC265 adaptor (see paragraph 3.1).

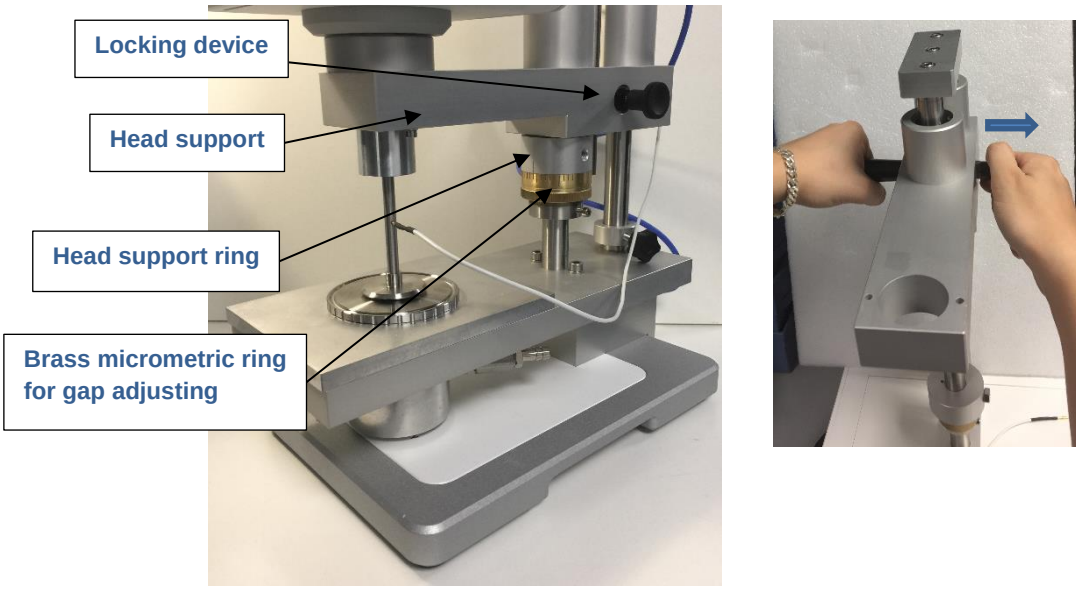
Release Stop ring and move down it at lowest position.



Insert the "banana" plug located at the end of the white wire into the hole located on the axis of the measuring cone. This makes it possible to establish an electrical contact between the measuring cone and the lower plane.

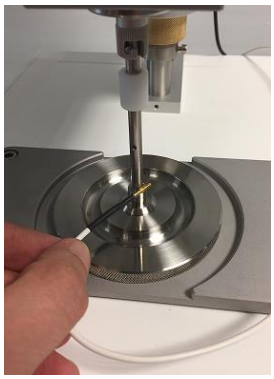


Lower the arm of the FIRST PRODIG CP1000 by pulling on the locking device and holding the head with the handle.



Go to its low position in such a way that the arm rests on the grey ring. If a beep sounds and the head cannot be lowered completely because the geometry already touches the plate of the FIRST PRODIG CP1000 before the arm is in contact with the grey ring, it is important not force and raise the head completely up to the upper stop. Before descending the head, turn the brass ring a few turns anticlockwise to raise it. Move the head down again until it stops on the grey support ring, making sure that the geometry does not touch the plate of the FIRST PRODIG CP1000. Repeat the operation on the brass ring if it is not.

Gently turn the bronze ring clockwise to gently lower the arm of the FIRST PRODIG CP1000 until the "beep" is heard; this means that the measuring cone is in contact with the lower plane. Then remove banana plug from axis and keep it in your hand and start a measurement without sample (for example put time at 0 and shear rate at 250 s-1 to get continuous rotation). During rotation, touch axis with banana and hear if a continuous “bip” is present. If this is not the case, use brass ring to get a constant “bip”. Then you get it, stop the test.



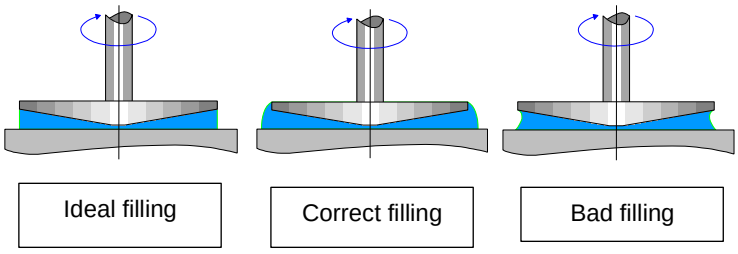
Then you are using a plate-plate measuring system, you have to set in same way the contact position as explained previously. But contact position need to be done by inserting metallic spacer (optional item 100047 as shown on picture above) between MS-PP and 70mm bottom plate. Choice of spacer need to be done according to gap you would like to use with MS-PP measuring system for measurement.

Raise your measurement head. The gap is then adjusted for the cone or plate used.

Do not touch the brass ring again and raise the FIRST PRODIG CP1000 head.

Place sample on 70 mm bottom plate. Move down measuring head to lower position in such a way that the arm will be hold by grey ring.

The amount of sample should be sufficient to completely fill the space between the cone or plate and the bottom part. In the case of a liquid sample, you can take the recommended volume for the dimensions of your cone-plane (see table below). For thicker samples, you need to draw enough with a spatula or similar tool.



Diameter (mm)	Angle (°)	Sample volume (ml)
10	0.5	0.0023
20	0.5	0.018
20	0.5	0.018
20	1.59	0.058
20	2	0.073
24	0.5	0.031
24	2	0.126
40	0.5	0.146
40	1.59	0.465
40	2	0.585
40	4	1.17
50	0.5	0.285
50	2	1.142
60	0.5	0.5
60	1	1
60	2	2
60	3	3

Start the measurement at the desired speed or shear rate and after choose the right measuring system (see section 2.3). If your 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 rotating speed.

Then your measurement is finished, raise the measuring head and lock it. Remove the measuring spindle to clean it.

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.

Viscosity measurement on a 1000 mPa.s standard silicon oil with an ASTM 2555 R2 measuring system.

- See section 3.2 and 3.1 for detail about preparation.

- Adjust the automatic zero in the air at 50rpm, without any spindle, until it stops (see section 2.5).

- Fill the 600ml beaker with the standard oil.

- Insert the 600ml beaker in a controlled temperature unit like EVA LR system or thermostatic bath. Wait for 15 minutes until the standard oil rises to the good temperature.

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

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

- 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).

Result at the end of the measurement must be within +/-5% of the standard viscosity value. If the measure is out, your instrument might need to be recalibrated.

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

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