



LAMY
RHEOLOGY
INSTRUMENTS

USING MANUAL FIRST PRODIG

VERSION N° F1PG-UK04/2021



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1. INTRODUCTION

The FIRST PRODIG 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.

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

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:

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

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

The viscometer calculates the viscosity by dividing the shear stress by the shear rate for each measuring point. The K_{τ} 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 viscometer 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 viscometer 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 Viscometer FIRST PRODIG can be used with different measuring system. You will find below a list of compatible measuring system with this viscometer.

- **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.

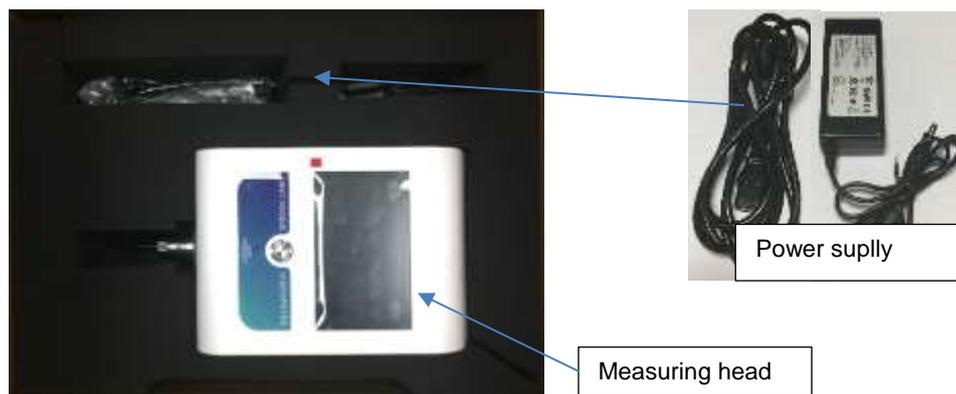
- **MS ULV:** Measuring system (316L stainless steel) for low viscosities usable with instruments LR version. This system, unlike the MS-RV/LV or MS-DIN systems, makes it possible to measure low viscosity products in control by applying a shear rate.

- **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.

1.1. COMPONENTS

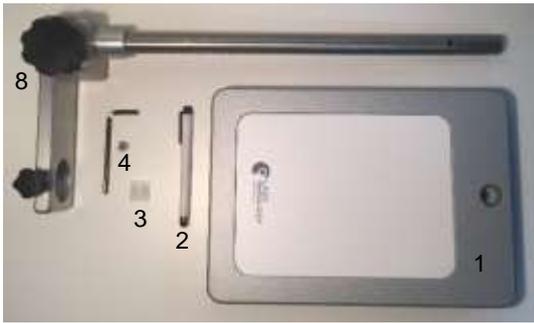
The viscometer is delivered inside a foam protection with power supply to avoid any problem during transport. All other accessories needed to use such as measuring geometries or stand and installation pieces are delivered in another carton.

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.

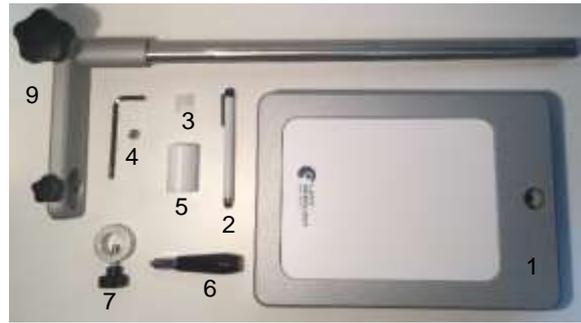


The FIRST PRODIG support is delivered in a box with the installation accessories. Its content depends on the type of stand ordered as shown below.

Viscometer with rack stand.



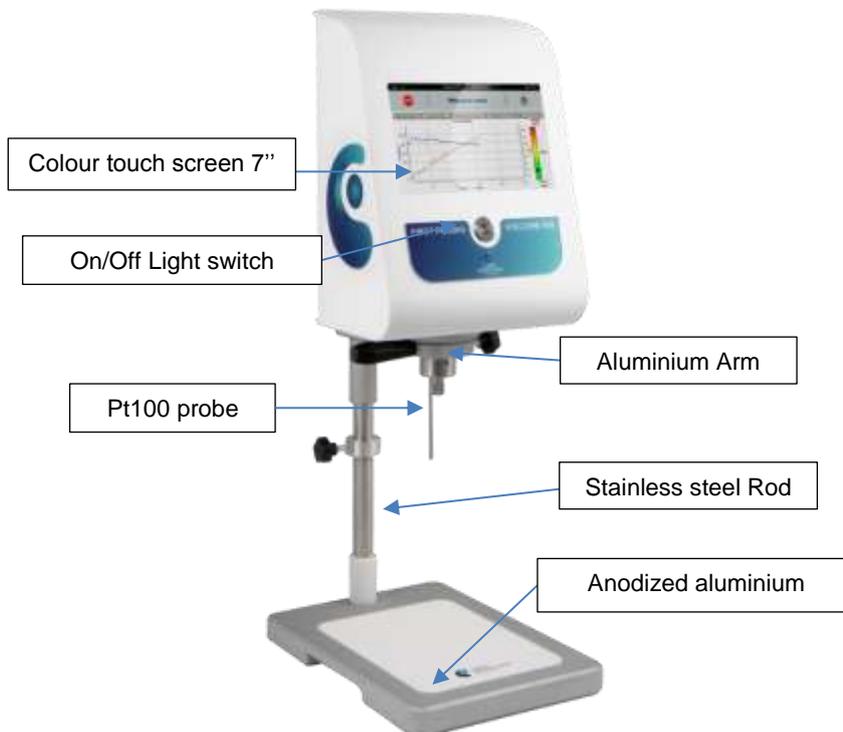
Viscometer with standard stand



1. Anodized aluminium support.
2. Touch screen stylus.
3. Guide for stylus.
4. Tool and screw.
5. Delrin safety ring.
6. Handle for arm.
7. Stop ring.
8. Notched rod and arm.
9. Smooth rod and arm.

1.2. GENERAL VIEW OF YOUR DEVICE

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).

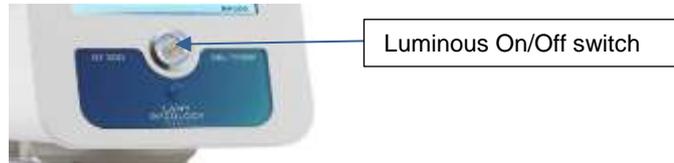


- [TOUCH Screen](#)

The new PLUS 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](#)

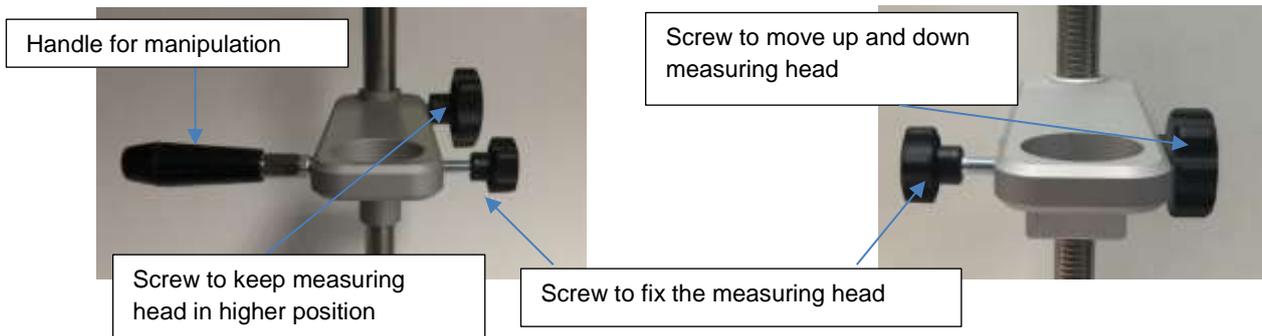
The aluminium arm of the standard stand has tightening knob that allows you to maintain the height of the measuring head and handle for easy handling.

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 stem using a screw fitted with a tightening knob.

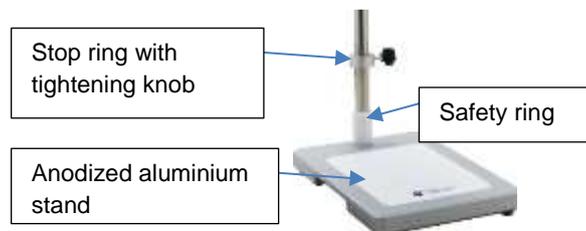
Standard stand

Rack Stand



- [Stainless steel rod](#)

The rod of supports is made of stainless steel for a solid hold on the measuring head. They have a very long lifespan. That of the standard support is fitted with a Delrin safety ring preventing the measuring head from touching the support. It is also equipped with a stop ring for memorizing a measurement height. These two rings are not present on the rack support.

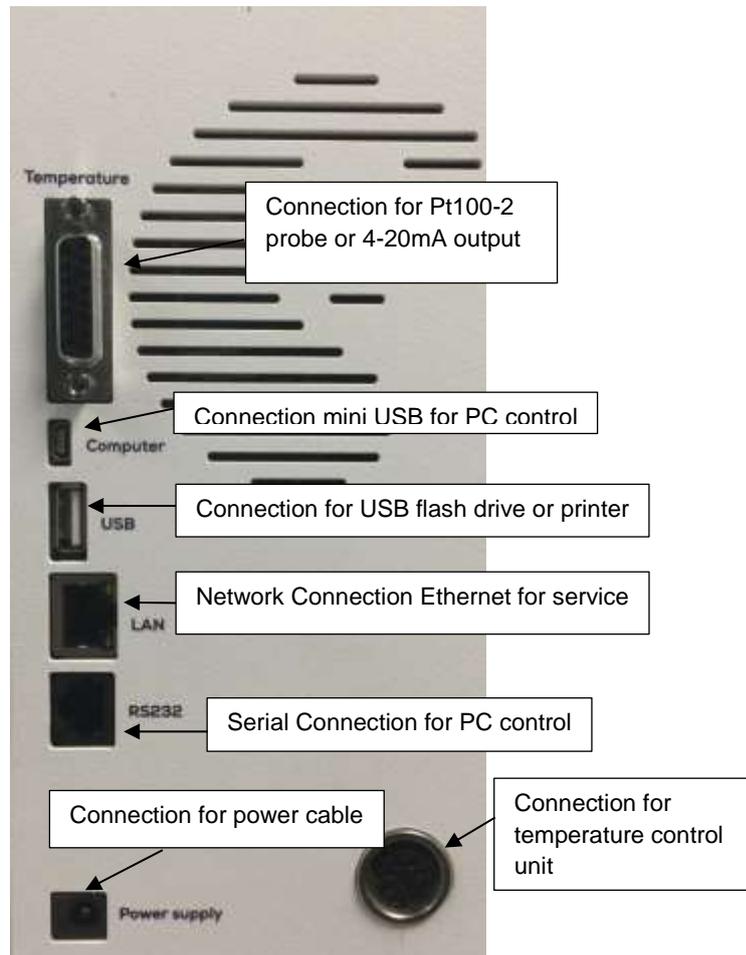


- [Anodized aluminium support](#)

The stand is entirely made of anodized aluminum. It gives our instruments a very good stability (the maximum permissible temperature on the white part is 50 ° C).

1.3. CONNECTIONS

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



Connection for temperature control units is available when viscometer 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 viscometer with 7" Touch screen

Rotation speeds: Unlimited number of speeds between 0.3 and 250 rpm

Torque range: Standard Version: 0.05 to 13 mNm. LR version: 0.005 to 0.8 mNm.

Temperature: The FIRST PRODIG 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 ULV, MS SV, T-Bars.

Compatible temperature control: EVA DIN, EVA LR, RT1.

Supply voltage: 90-240 VAC 50/60 Hz

Analog output: 4 - 20 mA

PC connections: RS232 Port and USB (Some device with Bluetooth)

Printer connections: USB Host Port – Compatible PCL/5

Options: See brochure.

Dimensions and weight: Head: D160 x H270 x W200 mm. Hardened steel stand: L280 x W200 x H30 mm. Stainless steel rod: Length 500 mm. Weight: 6.7 kg.

1.5. INSTALLATION

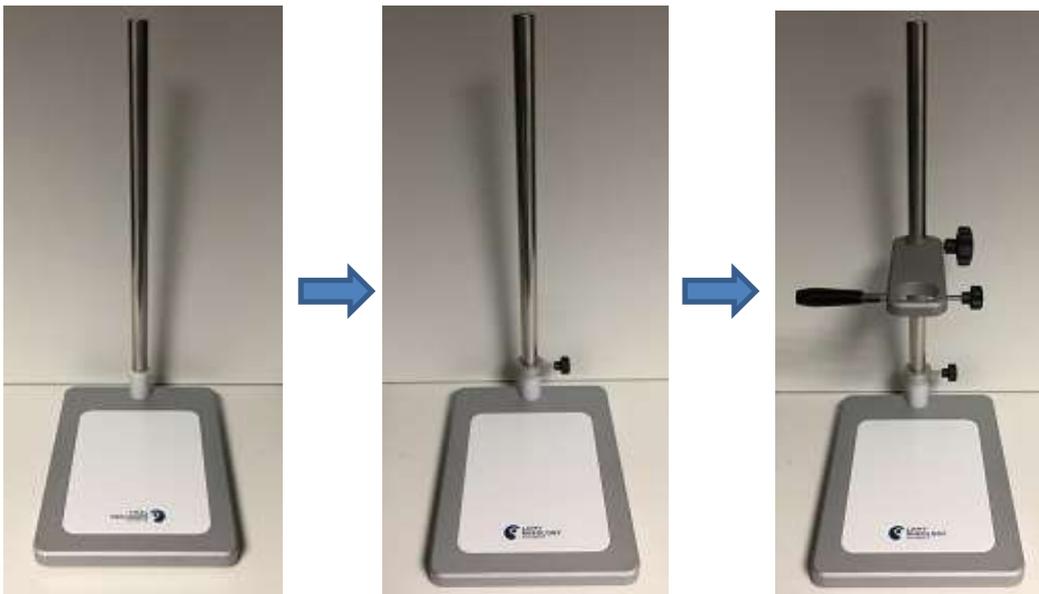
Your viscometer should be installed in a clean, vibration-free environment. Even if no level is necessary, choose a stable and flat table.

This installation notice concern only viscometer 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: Then make sure to insert the white Delrin cylinder and set it to the lowest position. Then place the stop ring on the stainless steel rod. Then place arm on rod, respecting the direction as described below. The arm is equipped with two buttons and a handle. You can change them for your convenience if you are left-handed.



For standard and rack stand: You can then put the viscometer 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 viscometer 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.



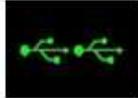
Your viscometer will be used with different measuring system. To know how to mount and use it, please refer section 3.

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

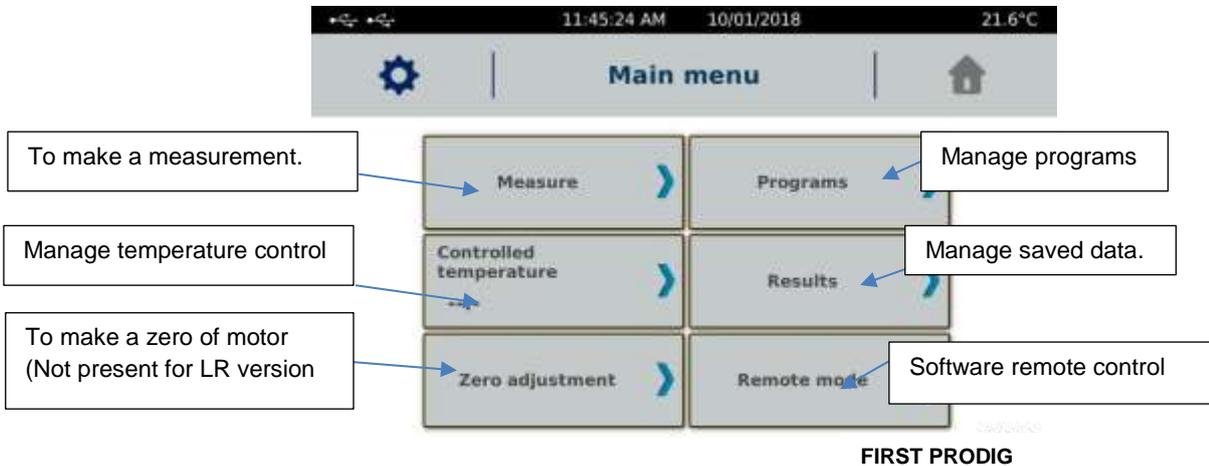
Once your device is switched on, you will see some icons on Touch Screen.

| | |
|---|--|
|  | 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. PRIMARY CONCEPTS

2.2.1. MAIN MENU

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



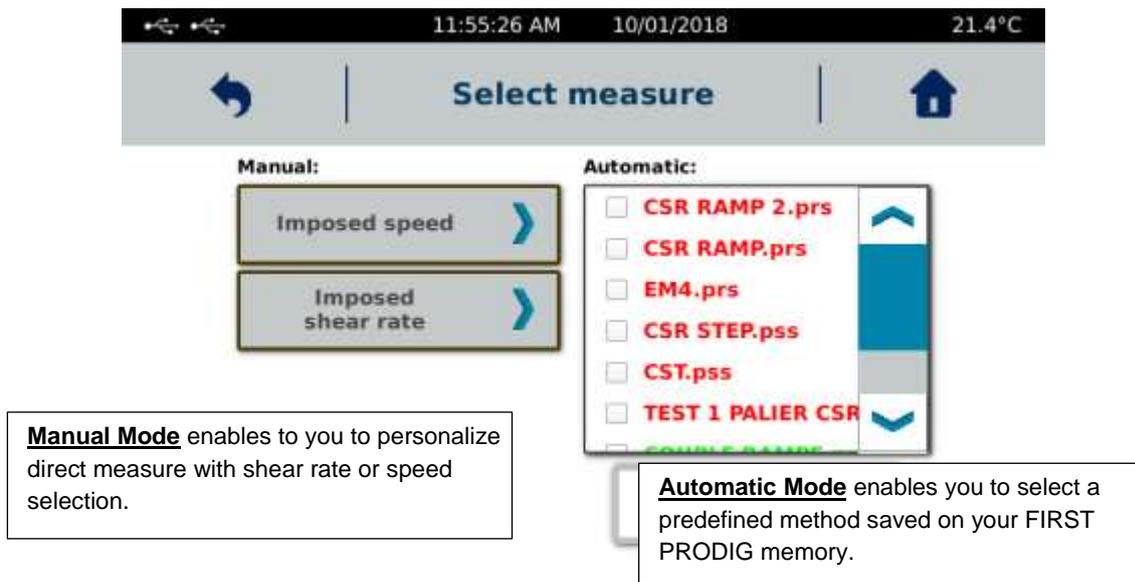
Button "Zero Adjustment" is not present on this screen when you are using FIRST PRODIG LR. Please see section 2.2.2.1 to see how to find similar button on LR device.

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

2.2.2. MEASURE

Measure tab is central part of your FIRST PRODIG. 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.



2.2.2.1. 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 2.2.7).

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

The screenshot shows the 'Imposed speed' mode interface. At the top, the status bar displays the time 11:31:09 AM, date 2020/12/07, and temperature 24.7°C. The main title is 'Imposed speed'. Below the title, there are three main sections: 'System' (RV 2), 'Speed' (10.00 rpm), and 'Duration' (20 s). At the bottom, there are two buttons: 'Zero' and 'Start'. Callouts point to these elements: 'Select your measuring system' points to the 'System' dropdown; 'Choose speed' points to the 'Speed' dropdown; 'Choose time for measurement (minimum 10)' points to the 'Duration' dropdown; 'To make zero of motor before measurement. Only available on LR device.' points to the 'Zero' button; and 'Click to start measurement' points to the 'Start' button.

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

The screenshot shows the 'Imposed shear rate' mode interface. At the top, the status bar displays the time 12:14:32 PM, date 10/01/2018, and temperature 21.5°C. The main title is 'Imposed shear rate'. Below the title, there are three main sections: 'System' (MS-DIN 11), 'Shear rate' (64.55 s⁻¹), and 'Duration' (20 s). At the bottom, there are two buttons: 'Zero' and 'Start'. Callouts point to these elements: 'Select your measuring system' points to the 'System' dropdown; 'Choose shear rate' points to the 'Shear rate' dropdown; 'Choose time for measurement (minimum 10)' points to the 'Duration' dropdown; 'To make zero of motor before measurement. Only available on LR device.' points to the 'Zero' button; and 'Click to start measurement' points to the 'Start' button.

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 2.2.5.6.

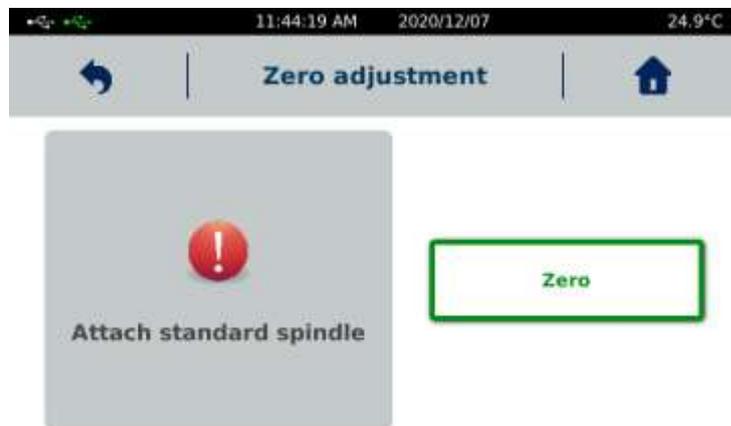
Choice between “Speed” or “Shear rate” is according to your measuring system. If you need to know what is the corresponding speed then you are using shear rate, you have to use constant K_D of your measuring system (information available in section 2.2.5.6) and use this simple equation.

$$\text{SPEED} = \text{SHEAR RATE} / K_D$$

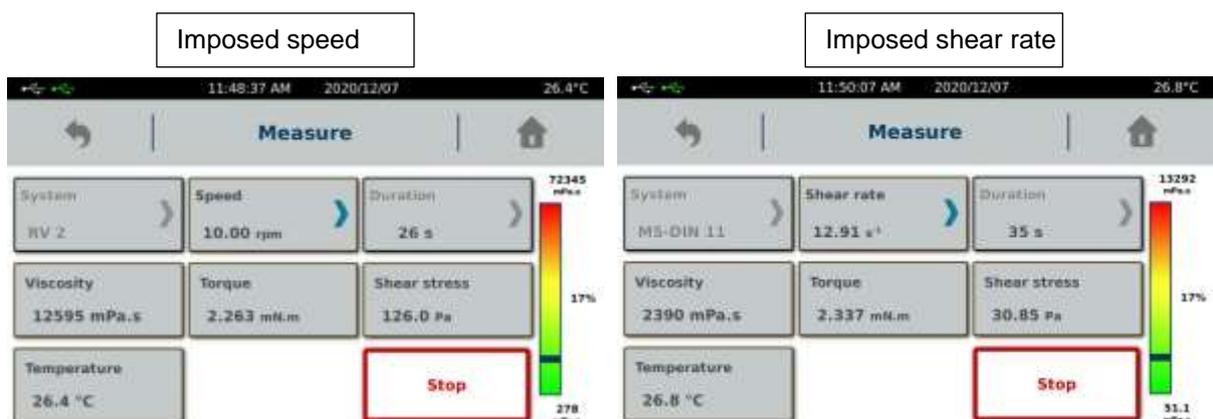
With speed unit in rpm, shear rate in s^{-1} and K_D is rpm/ s^{-1} .

When your parameters are filled in, you can click on "Start" to start your measurement after having installed the geometry (see paragraph 3).

With LR version, device will ask you to make zero of motor before measurement. Soon you have done it, click on back arrow and follow next step as standard version.



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 gauge 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 2.2.5.11).

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.

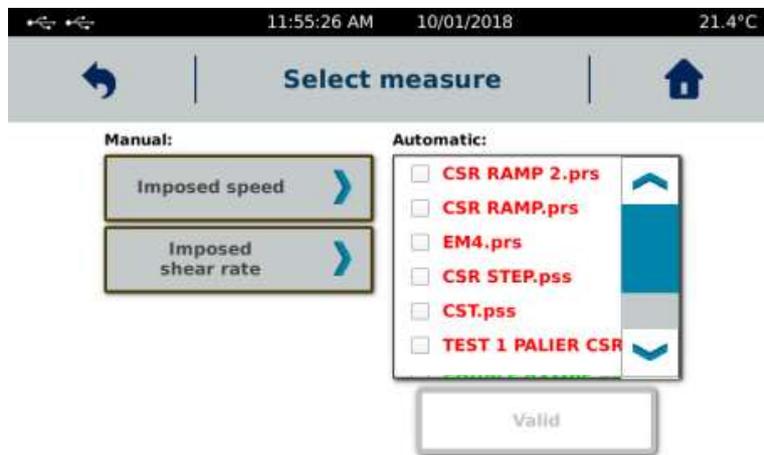
You will find several information available on the screen such as torque (mN.m), stress (Pa), temperature (°C), time (s) or viscosity (mPa.s). If the units do not suit you, you can change them in parameters (see section 2.2.5.5).

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 viscometer will ask you to give a name to your measure. You will have the opportunity to read it later (see section 2.2.3.).



2.2.2.2. AUTOMATIC MODE

Automatic mode allows you to select pre-recorded programs (see section 2.2.7).



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.

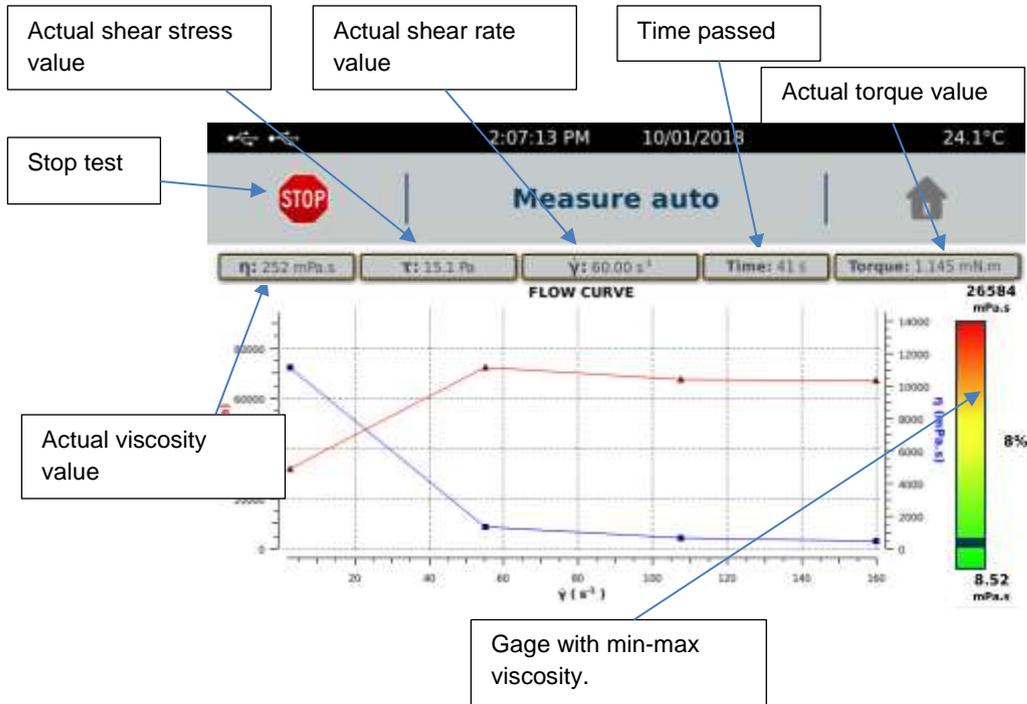
Select the program from the list and click "Valid" to start your measurement. The display adjusts automatically to show you the parameters of the chosen program.



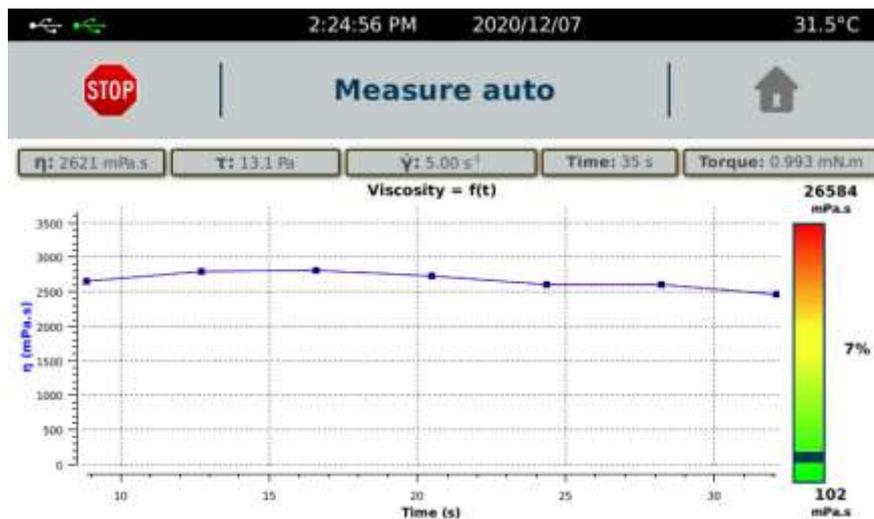
For LR device, additional button is there to allow you to make zero adjustment of motor before measurement. This button is not present for standard version (see section 2.2.4).

Whatever type of program selected, 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 2.2.7.2.

Depending on selected program, the current display may be different. For all ramp and step modes (see section 2.2.7) the viscometer 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.

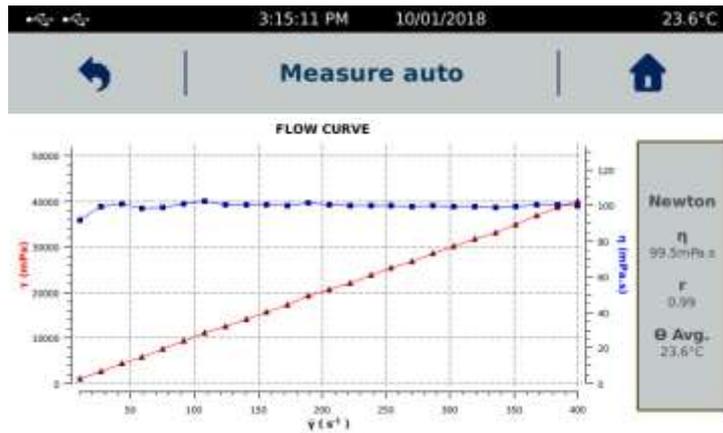


Some methods in step mode (format **pss**) contain only one step. These methods are intended for constant parameter measurements over time. The display of the curve will be different with time on x-axis. The name of the graph is also different (here Viscosity = f (t)).



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.

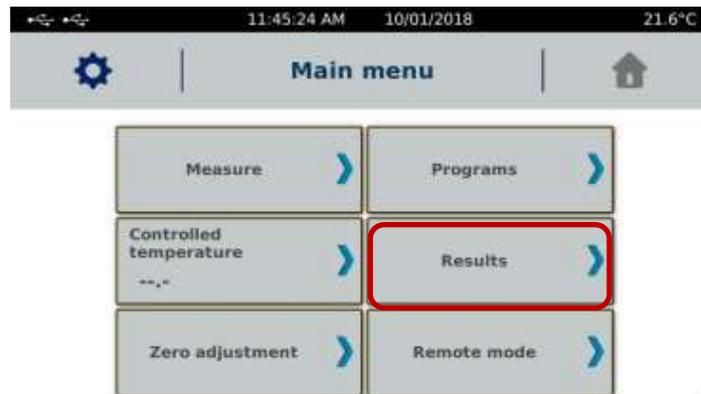
Some methods contain an analysis at the end of the measurement. When the measurement comes to an end, you will be able to see the result of this analysis as well as the curves obtained.



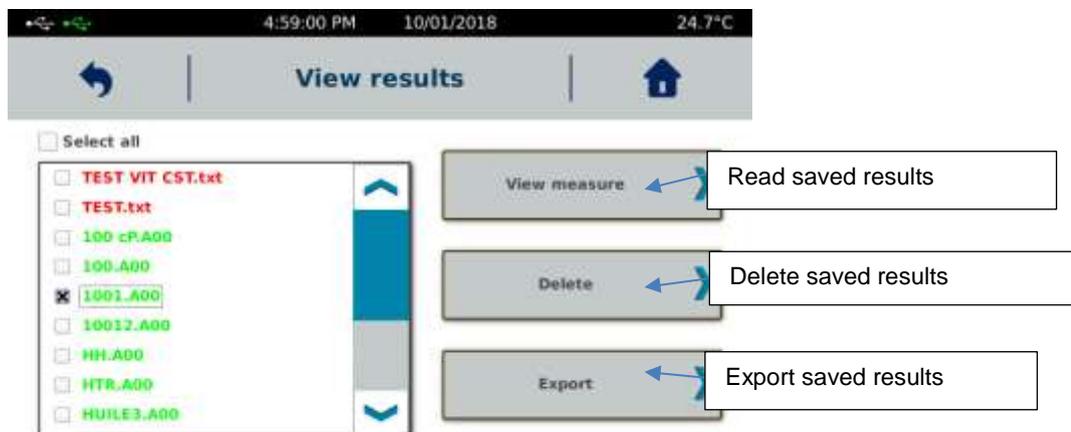
All saved results can be read later (see section 2.2.3.)

2.2.3. RESULTS

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



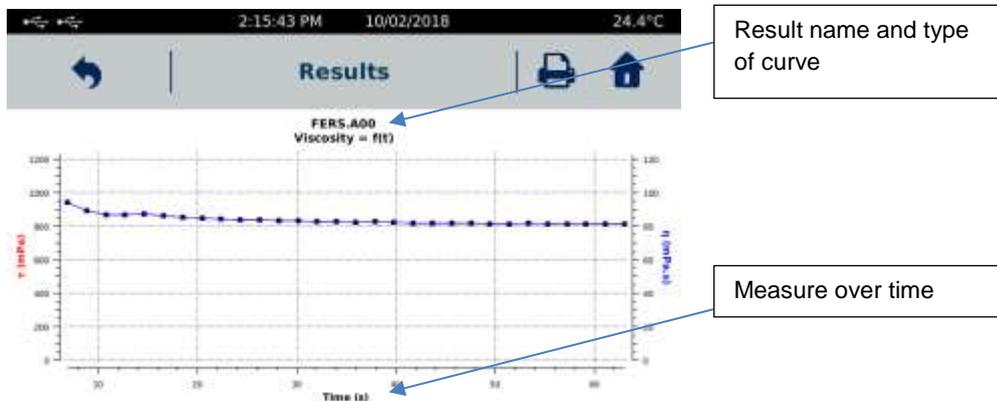
Once you are on the screen below, simply select the measurement in the list and choose the desired option. The measurements in green correspond to results obtained with a programmed method while the measurements in red come from measurement in manual mode (see paragraph 2.2.2).



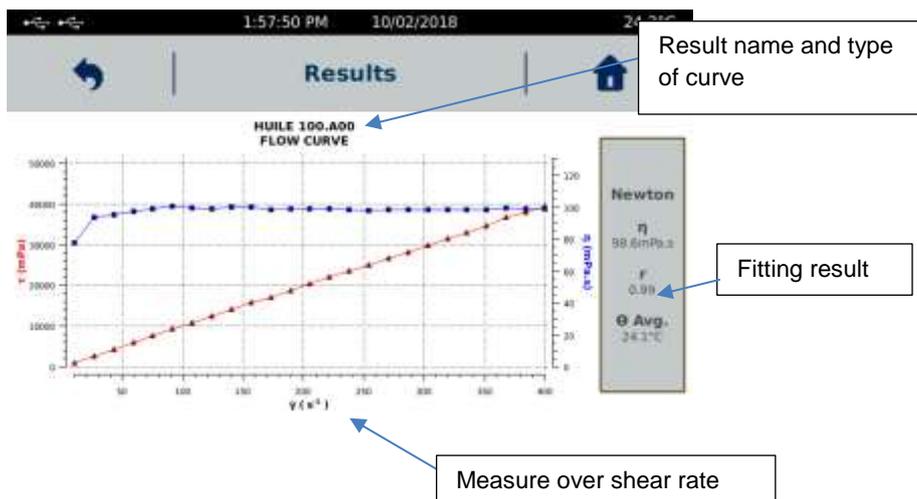
When you select measurements done in manual mode, you will get this view with all important information saved with the result.



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.

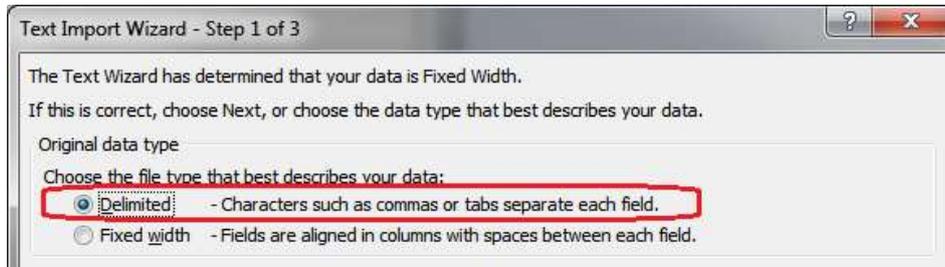
When a printer is installed and connected to your viscometer (see section 2.2.5.9.), A symbol next to the "Home" button allows you to directly print your curve or result.

The "Export" function is accessible only when a USB key is connected to the back of the FIRST PRODIG (see connection section 1.3). If you want to export all the measurements at the same time, you can do this by checking

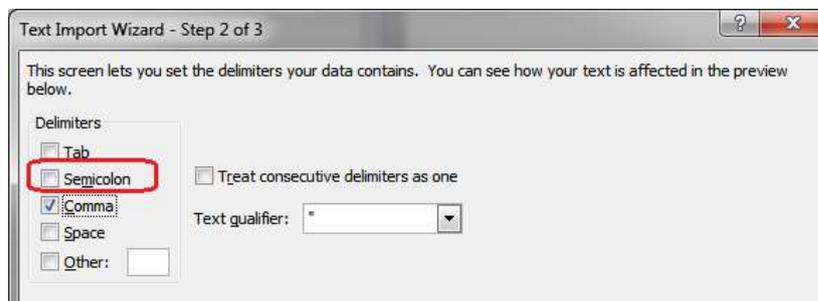
the "Select all" box. Whatever the program used for the measurement, only the recorded data can be exported. It is not possible to export or copy a diagram.

The format of the data generated and saved by the viscometer is ASCII (*.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.

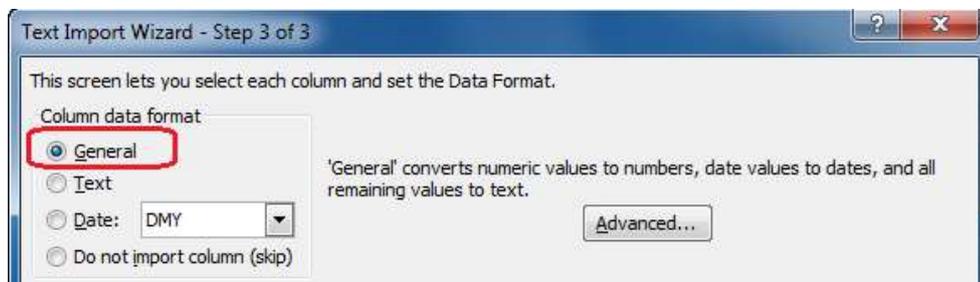
Verify that the "Delimited" function is selected and then click next.



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. You 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".



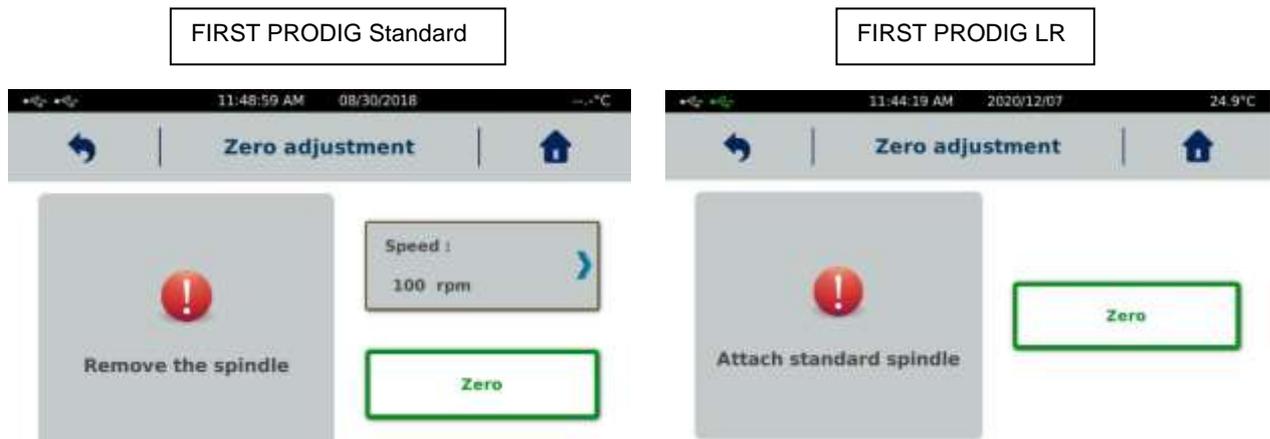
2.2.4. ZERO ADJUSTMENT

The zero setting allows you to calibrate your FIRST PRODIG to take account of the engine's empty friction. This function is not available on main menu for device in LR version. To find zero with LR device, please see section 2.2.2.1.



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.

For LR device, zero will be done at speed/shear rate set for manual measurement or at first speed/shear rate of ramp or Step by Step method.



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

2.2.5. SETTINGS

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".



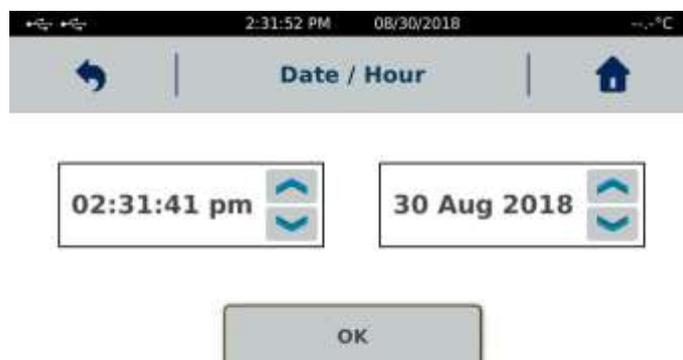
2.2.5.1. LANGUAGES

It enables you to select language of your FIRST PRODIG. You have choice between French, English, Turkish 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.



2.2.5.2. DATE / HOUR

It enables you to adjust hour and date of your FIRST PRODIG.



2.2.5.3. SOUNDS / STANDBY / LIGHTING

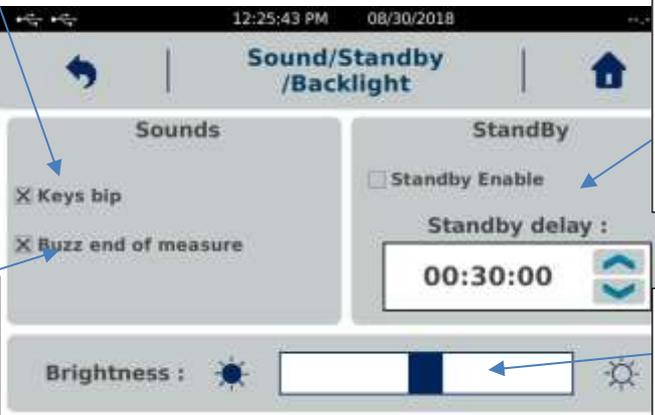
It allows you to modify sounds, lighting and activate or not the Standby mode of your FIRST PRODIG.

Choose if you want to get sound during using touch screen.

Choose if you want to switch off automatically your device after no using. After selecting "Standby enable", you will have to set time. Your device will be switch off after this time.

Choose if you want to get sound then measurement is finished.

Choose if you want to change brightness of Touch Screen.



2.2.5.4. USER NAME

Operator mode will allow you to create different operators for your FIRST PRODIG. 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 2.2.5.7).



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).



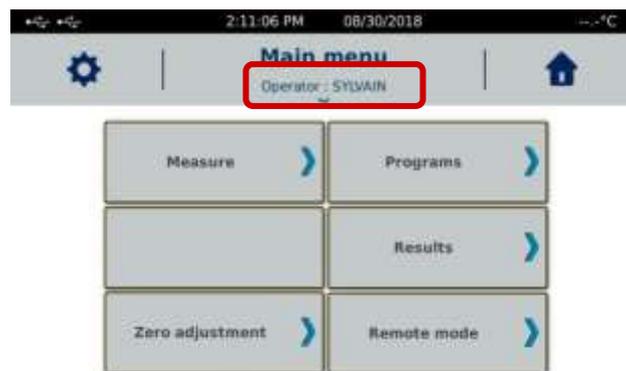
To create the administrator account, click on "Add user with code PIN". Fill in the name and the associated PIN code.

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 FIRST PRODIG 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.



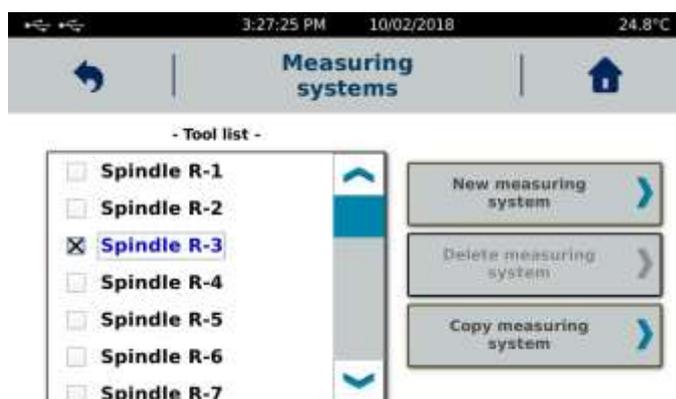
2.2.5.5. UNITS

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



2.2.5.6. 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 K τ 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 FIRST PRODIG.

MS BV

| SYSTEM | K τ / 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 | K τ / 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 |

2.2.5.7. 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.

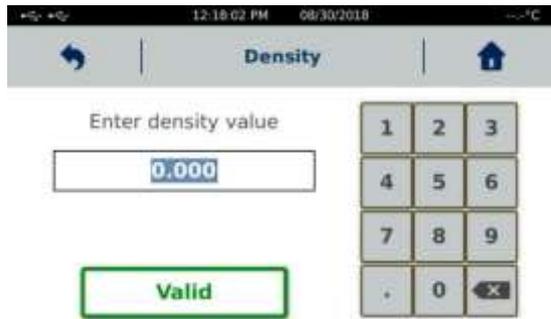
After selecting "Locked Mode", you must click "Enable". The FIRST PRODIG will ask you to register a 4-digit code that will be required to disable this protected mode. Each activation is independent and can be done with a different code and the deactivation of the mode will always be done with the code 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.

2.2.5.8. DENSITY

It enables you to enter density value of your product in order to measure his kinematic viscosity.



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.

2.2.5.9. PRINTER

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



The FIRST PRODIG 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.

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.



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.

2.2.5.10. SOFTWARE VERSION

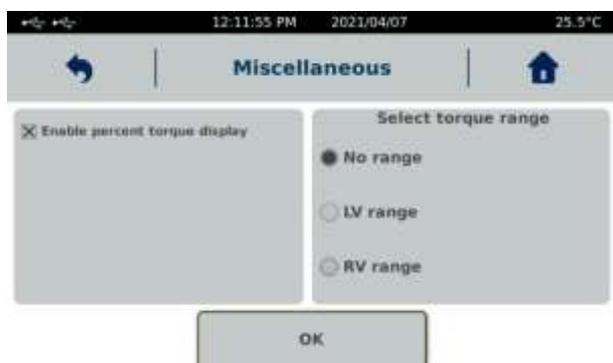
This menu allows you to update the firmware of your FIRST PRODIG. This function is used when updating the machine data is necessary. Do not go in this menu without being invited by the company LAMY RHEOLOGY. The update is done via a USB key connected to the "USB" port. You can then click on "Update" 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.



2.2.5.11. MISCELLANEOUS

Enable you to show torque in % close to gage and adjust the torque range of device according to spring viscometer technology. This setting will have effect on torque in % shown while measurement and viscosity limits.



Please see below torque covered by specific range:

- LV Range : From 0.00673 to 0.0673 mNm.
- 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 standard device (from 0.05 to 13 mNm) and LR device (from 0.005 to 0.8 mNm)

2.2.5.12. SERVICE

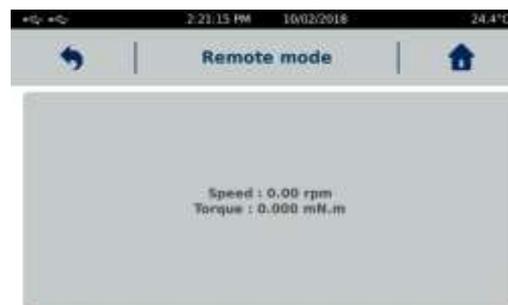
Reserved to LAMY RHEOLOGY engineers.

2.2.6. REMOTE MODE

This mode enables to drive FIRST PRODIG 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).



2.2.7. 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.



2.2.7.1. NEW PROGRAM

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



2.2.7.1.1. Speed/shear rate ramp mode

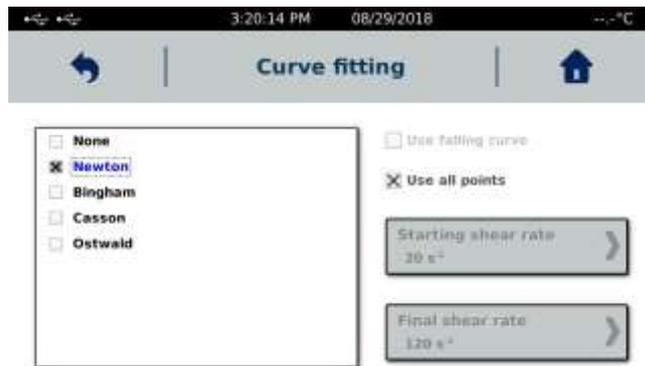
This programming mode makes it possible to carry out a speed / gradient ramp.



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 FIRST PRODIG is from 0.3 to 250 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. For the descending part, it will be activated by selecting "Enable falling curve" and will be strictly identical to the rising ramp in terms of number of points and duration.

The "Temperature" button is only available if your device is delivered with temperature device controllable by the FIRST PRODIG. 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 FIRST PRODIG which will allow you to set a constant set point temperature for the duration of the measurement. The "Start temperature" function allows you to wait for the set temperature to be reached before starting the measurement.

The "Regression" button allows you to perform a rheological analysis on your measurement at the end of it. You will have to indicate which model you wish, which part of the measure will be used, specifying the zone concerned (complete or partial). The regression will be automatically started at the end of the measurement, except if it stops before its end.



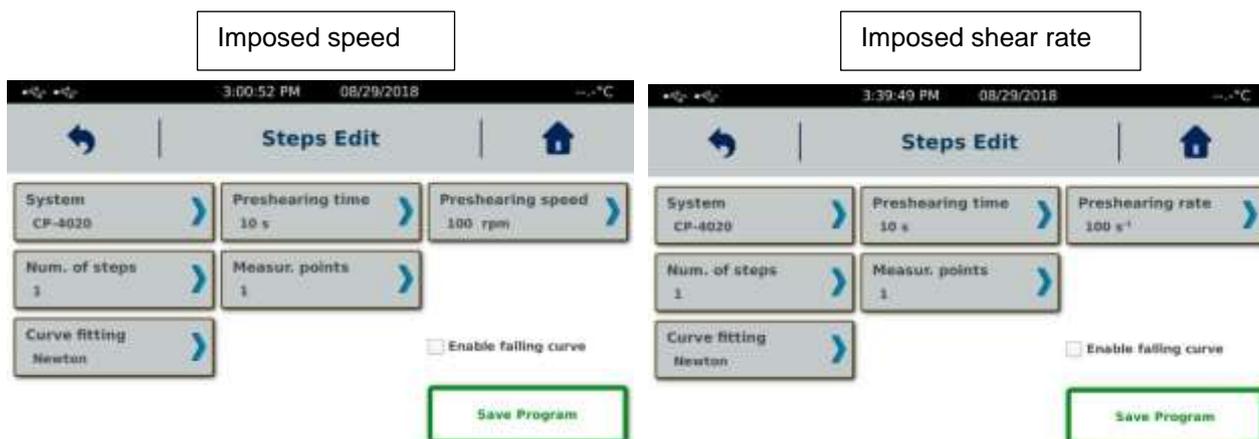
Click on the back arrow to return to ramp programming

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

2.2.7.1.2. 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 2.2.2.2).

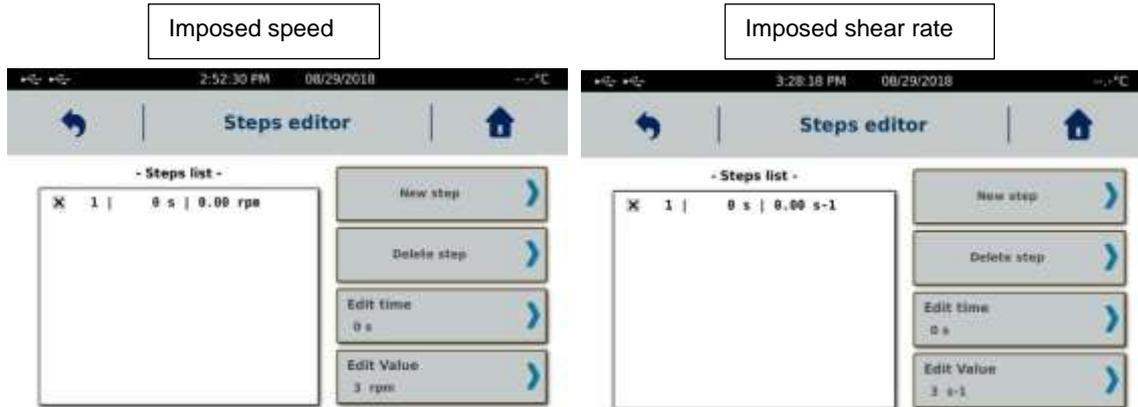


At the beginning of your programming, all the buttons are grey except for the "System" button. Selecting the measurement system and validating will automatically activate the next button and so on. You can then specify the duration of the pre-shear (can be set to 0 if it is not necessary) as well as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



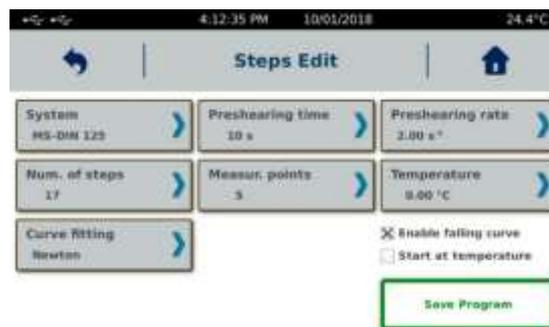
Clicking on "New step" will display the instrument's display on it.



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

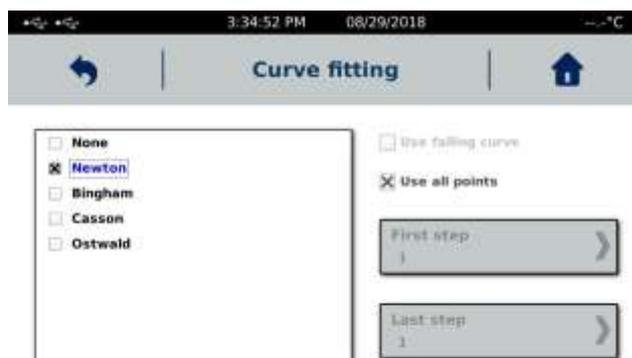
The new display now shows the number of steps in your program. The function "Measur. Points" means number of points for each step, the ideal value being 1. However, when programming a method containing only one step, it is recommended to put a larger number of points.



The "Enable 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).

The temperature management is the same as that described in paragraph 2.2.7.1.1.

The use of the "Curve fitting" button is identical to that described in section 2.2.7.1.1. The only important difference is that instead of taking into account the measuring points of a ramp, it is a part or all steps that will be involved in the analysis. The regression will be automatically started at the end of the measurement, except in case of stop before the end.

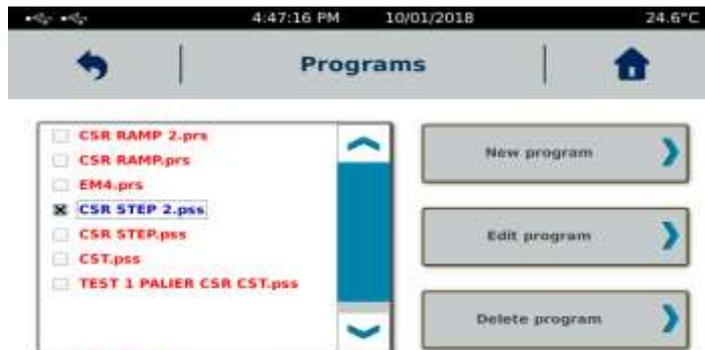


Click the back arrow to return to the schedule of the bearings.

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

2.2.7.2. 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.

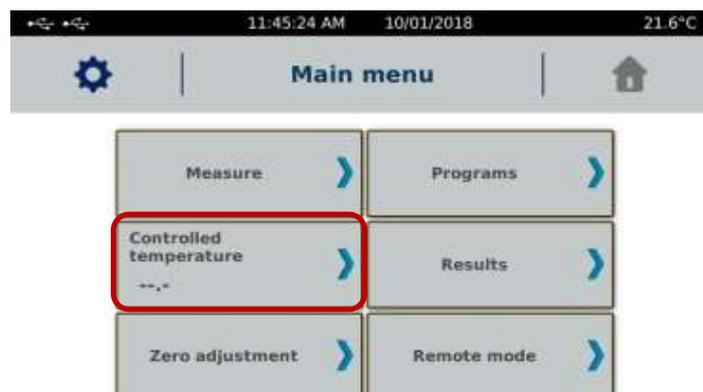


2.2.7.3. DELETE PROGRAM

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.

2.2.8. CONTROLLED TEMPERATURE

This function is available on the main menu display.



As described in section 2.2.2, this function is only available if your device is delivered with temperature control controllable by the FIRST PRODIG. 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 FIRST PRODIG 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

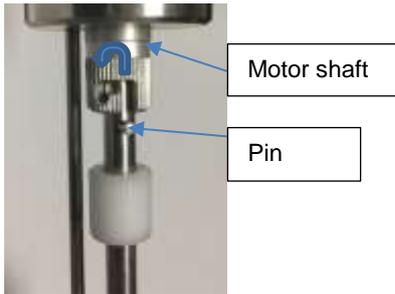
This section will show how use the different measuring system with your device.

Viscometer 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.

As the FIRST PRODIG get only one kind of bayonet coupling system, way to install measuring bob on shaft of viscometer 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

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 spindle 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):

| Designation spindle | Part Number Spindle | Part Number Complete set** | | FIRST PRODIG LR | FIRST PRODIG |
|---------------------|---------------------|----------------------------|--------|-----------------|--------------|
| RV1 | 111001* | 111947 | 111948 | Not Usable | 100 to 0.6M |
| RV2 | 111002* | | | 200 to 0.14M | 200 to 2.4M |
| RV3 | 111003* | | | 300 to 0.37M | 300 to 6M |
| RV4 | 111004* | | | 400 to 0.74M | 600 to 12M |
| RV5 | 111005* | | | 500 to 1.4M | 1.2K to 24M |
| RV6 | 111006* | | | 1200 to 3.7M | 2.8K to 60M |
| RV7 | 111007 | | | 4500 to 15M | 12K to 240M |
| LV1 | 111010 | 111014 | | 15 to 0.25M | 200 to 4.3M |
| LV2 | 111011 | | | 50 to 1.3M | 1K to 20M |
| LV3 | 111012 | | | 200 to 5M | 4k to 82M |
| LV4 | 111013 | | | 1000 to 22M | 17K to 370M |

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 viscometer 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).

Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



Standard Stand



Rack Stand

Use handle to manipulate the device on standard stand (see section 1.2), use screw on aluminium arm and go down to immerse 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 viscometer in the sample to immerse the mobile to the predefined mark (the lowest for discs # 2 -6, the highest for disc # 1), so as to immerse 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 2.2.2).

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 for FIRST PRODIG (mPa.s) |
|---------------------|-----------------------------------|--|--|
| BV1 | 117001 ^{a)} | 117000 | 15 to 0.25M |
| BV10 | 117010 ^{a)} | | 100 to 2M |
| BV100 | 117100 ^{a)} | | 1K to 22M |
| BV1000 | 117101 | | 10K to 220M |

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 viscometer 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 viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.

Use handle to manipulate the device on standard stand (see picture section 3.2), use screw on aluminium arm and go down to immerse 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 viscometer in the sample to immerse 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 2.2.2).

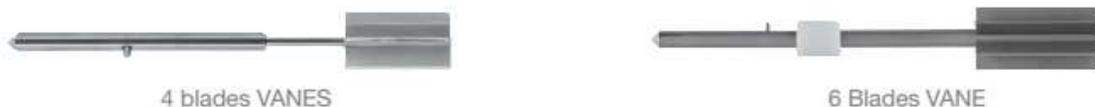
The torque measurement is indicated on the instrument screen using a gage. Ensure that the measured torque is always sufficiently far from the lower and upper limits (at least 5% above and below). If this is not the case, you can either change the measuring spindle or change the measurement speed.

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.



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 FIRST PRODIG. 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) | Lenght (mm) | FIRST PRODIG LR | FIRST PRODIG |
|-------------|-------------|---------------|-------------|-----------------|--------------|
| MK-V71 | 111114 | 34.39 | 68.78 | 1,4 to 18K | 14 to 300K |
| MK-V72** | 120017 | 21.67 | 43.38 | 5,6 to 74K | 56 to 1,2M |
| MK-V73** | 111108 | 12.67 | 25.35 | 28 to 370K | 280 to 6M |
| MK-V74** | 111115 | 5.89 | 11.76 | 280 to 3,7M | 2,8K to 60M |
| MK-V75** | 111111 | 8.026 | 16.05 | 111 to 1,4M | 1,1K to 24M |
| MK-V72/2** | 111112 | 21.67 | 20 | 54 to 720K | 540 to 11M |
| MK-V72/4** | 111113 | 21.67 | 10 | 80 to 1M | 800 to 17M |
| MK-V72-6P* | 111121 | 21.67 | 43 | 30 to 400K | 300 to 6,5M |
| MK-VT105** | 440105 | 5 | 10 | 430 to 5,8M | 4,4K to 94M |
| MK-VT2010** | 442010 | 10 | 20 | 82 to 1M | 820 to 17M |
| MK-VT2020** | 442020 | 20 | 20 | 12 to 150K | 118 to 2,5M |
| MK-VT3015** | 443015 | 15 | 30 | 16 to 210K | 160 to 3,4M |
| MK-VT4020** | 444020 | 20 | 40 | 7 to 90K | 68 to 1,4M |
| MK-VT4040 | 444040 | 40 | 40 | 1,5 to 19K | 15 to 320K |
| MK-VT5025** | 445025 | 25 | 50 | 4 to 45K | 34 to 730K |
| MK-VT6015 | 446015 | 15 | 60 | 9 to 114K | 86 to 1,8M |
| MK-VT6030 | 446030 | 30 | 60 | 2 to 26K | 20 to 433K |
| MK-VT608 | 446008 | 8 | 60 | 30 to 400K | 300 to 6,5M |
| MK-VT8040 | 448040 | 40 | 80 | 1 to 11K | 9 to 182K |
| MK-VT8070 | 448070 | 70 | 80 | 0,5 to 3,2K | 3 to 52K |

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 FIRST PRODIG. And most of the time, you will be able to use only speed for your viscosity measurement and not the shear rate.

Place the viscometer 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 viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.

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 immerse the mobile in the product. With device on Rack stand, just turn screw to move down the measuring head.

Adjust the position of the viscometer to immerse 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 2.2.2). If your Vane measuring system is not in the list of device, please refer to section 2.2.5.6 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 conform to the norm ASTM D562.

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 spindle 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 viscometer 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 viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.

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 immerse the mobile in the product. With device on Rack stand, just turn screw to move down the measuring head.

Adjust the position of the viscometer to immerse 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 2.2.2). If your Vane measuring system is not in the list of device, please refer to section 2.2.5.6 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.

3.6. 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 |  |

| Name | Reference | |
|--------------------|-----------|---|
| 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 * | | Volume (ml) | Shear rate (s ⁻¹)** | FIRST PRODIG LR | FIRST PRODIG |
|--------------------|-------------|-------------|---------------------------------|-----------------|--------------|
| Designation | Part Number | | | | |
| MS DIN 11 | 112801 | 27 | 1,29N | 2,5 to 27K | 25 to 0.44M |
| MS DIN 11S | 112809*** | 27 | 1,29N | 2,5 to 27K | 25 to 0.44M |
| MS DIN 12 | 112802 | 46 | 0,35N | 11 to 145K | 110 to 2.3M |
| MS DIN 13 | 112803 | 61 | 0,15N | 92 to 510K | 920 to 8.3M |
| MS DIN 13S | 112808*** | 22 | 0,15N | 93 to 510K | 920 to 8.3M |
| MS DIN 19 | 112806 | 25 | 3,22N | 0,8 to 10K | 8 to 0.17M |
| MS DIN 22 | 112804 | 22 | 1,29N | 4 to 53K | 40 to 0.86M |
| MS DIN 22S | 112815*** | 22 | 1,29N | 5 to 53K | 40 to 0.86M |
| MS DIN 33 | 112805 | 14 | 1,29N | 20 to 265K | 200 to 4.3M |
| MS DIN 33S | 112814*** | 14 | 1,29N | 20 to 265K | 200 to 4.3M |
| MS DIN 11M | 112812 | 23 | 1,29N | 2,5 to 27K | 21 to 0.44M |
| MS DIN 19M | 112811 | 18.5 | 3,22N | 0,8 to 10K | 8 to 0.17M |
| MS DIN 23 | 112816 | 36 | 0,19N | 81 to 1M | 810 to 17M |

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

Each tube is used with the matching cylinder (eg 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 the next page).

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 viscometer (see below). When your viscometer 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).

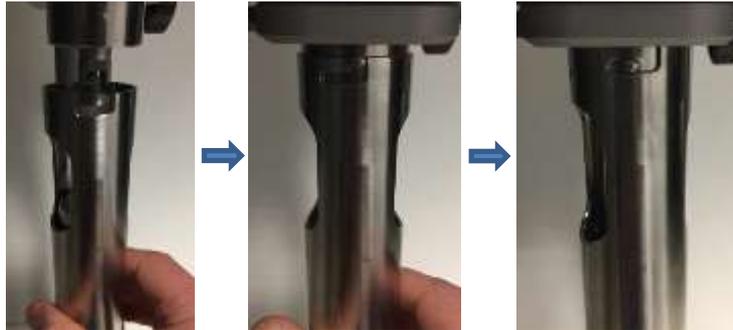
Place the viscometer on temperature unit or on its own stand if you are using CT-DIN or CT-LC. Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2).

Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.

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 viscometer 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 you device gets one) on the viscometer is at least 3mm deep into the liquid.

When using your viscometer 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 immersed 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 2.2.2).

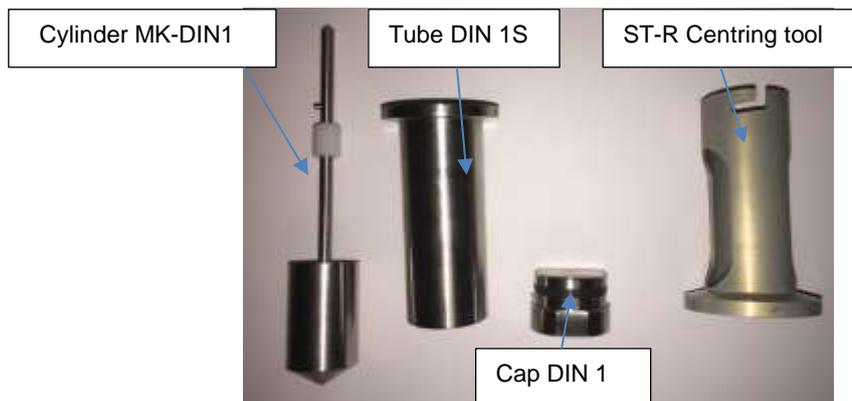
If you have just made a measurement with the tube closed by a cap, rise the measuring head to the highest position by blocking the arm with the screw provided for this purpose (see section 1.2). Carefully remove the cylinder from the viscometer shaft, then remove the tube containing the product and the 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 viscometer 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

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 viscometer 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 viscometer.

Also place the groove facing you as shown in the picture below. When you are close enough to the viscometer basis, you must rotate the piece to place the pin in the groove.

Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.

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 2.2.2).

When your measurement is complete, it is better to remove the cylinder from the viscometer 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

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:



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) | FIRST PRODIG LR | FIRST PRODIG |
|--------------------|--------|--------------------------------------|----------------------------|-------------|------------------|-----------------|--------------|
| Designation | Item | Designation | Item | | | | |
| MK-SV414* | 116114 | MB-SV6R* | 116206 | 3 | 0,4N | 44 to 5,8M | 440 to 95M |
| MK-SV415* | 116115 | MB-SV7R* | 116207 | 4.4 | 0,48N | 15 to 2M | 155 to 33M |
| MK-SV416* | 116116 | MB-SV8R* | 116208 | 4.6 | 0,29N | 39 to 5,2M | 394 to 85M |
| MK-SV418 | 116118 | MB-SV13R MB-SV13RC** MB-SVD*** | 116213 116214 116513 | 7.5 | 1,32N | 1 to 120K | 9 to 1,9M |
| MK-SV421 | 116121 | | | 8 | 0,93N | 1 to 188K | 14 to 3M |
| MK-SV425 | 116125 | | | 10 | 0,22N | 174 to 23M | 1,7K to 377M |
| MK-SV427 | 116127 | | | 12 | 0,34N | 7 to 0,99M | 75 to 16M |
| MK-SV428 | 116128 | | | 13 | 0,28N | 15 to 1,9M | 147 to 31M |
| MK-SV429 | 116129 | | | 13 | 0,25N | 29 to 3,9M | 294 to 63M |
| MK-SV431 | 116131 | | | 11 | 0,34N | 10 to 1,3M | 100 to 21M |
| MK-SV434 | 116134 | | | 11 | 0,28N | 19 to 2,5M | 194 to 41M |
| MK-SVC | 116002 | | | 13 | 0,43N | 3 to 420K | 32 to 6,8M |
| MK-SVTR8 | 140008 | | | 8 | 0,92N | 1 to 190K | 14 to 3M |
| MK-SVTR9 | 140009 | | | 12 | 0,34N | 7 to 0,99M | 75 to 16M |
| MK-SVTR10 | 140010 | | | 13 | 0,28N | 15 to 1,9M | 146 to 31M |
| MK-SVTR11 | 140011 | | | 13 | 0,25N | 30 to 3,9M | 300 to 64M |

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

- Category A: Spindle used with chamber MB-SVD.
- Category B: Spindle used with chamber MB-SV13R, MB-SV6R, MB-SV7R and MB-SV8R.
- Category C: Spindle used with chamber MB-SV13RC.

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 USE OF MEASURING SYSTEM OF CATEGORY A

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 viscometer.



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

Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



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 2.2.2).

Once the measurement is complete, unhook the mobile from the viscometer 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 viscometer for a next measurement.

3.7.2 USE OF MEASURING SYSTEM OF CATEGORY B

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 viscometer.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



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 below.

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 2.2.2).

When your measurement is complete, it is recommended to remove the cylinder from the viscometer 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 viscometer for a next measurement.

3.7.3 USE OF MEASURING SYSTEM OF CATEGORY C

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 viscometer.

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 viscometer (see section 2.2.4.) if you are using standard model.

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

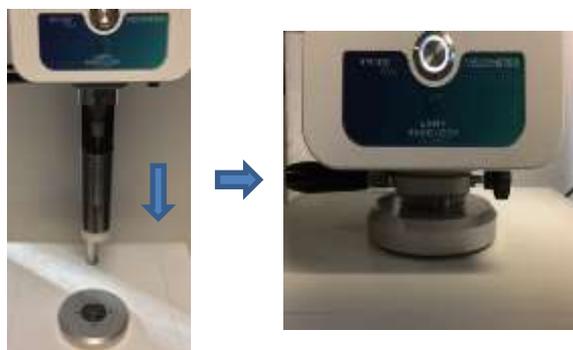
Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



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 Viscometer 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 viscometer is at least one centimeter deep into the liquid.

When using your viscometer 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 2.2.2).

When your measurement is complete, it is recommended to remove the cylinder from the viscometer 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 | 1 to 26K |
| 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.

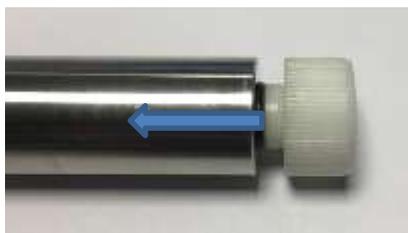
The part number 116030 includes item 116015P, 116001 and 116005. This system can be used with temperature control EVA DIN PLUS, CT-LC and CT DIN or alone without any other accessory.

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. USE OF 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 viscometer.

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 viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



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 Viscometer 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 viscometer is at least one centimetre deep into the liquid.

When using your viscometer 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 2.2.2).

When your measurement is complete, it is recommended to remove the cylinder from the viscometer 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. USE OF 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 viscometer. The screw locks the centring piece on the basis of the viscometer.

Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



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 2.2.2).

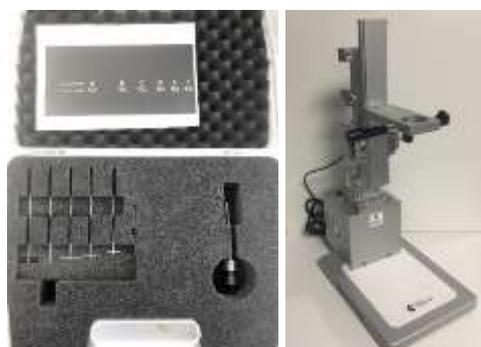
Once the measurement is complete, unhook the mobile from the viscometer axis and rise the measuring head. Remove the mobile to clean it. Remove the disposable cup. Also clean the temperature probe and the centring piece. It can stay in place on the basis of the viscometer for a next measurement.

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 viscometers and rheometers 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 for each T-Bars provide with HELIPRO STAND.

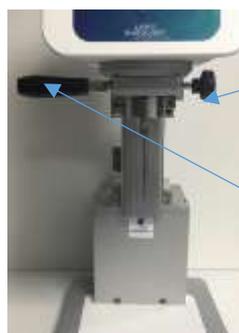
| T-Bars** | Part number | FIRST PRODIG LR (mPa.s) | | FIRST PRODIG (mPa.s) | |
|----------|-------------|-------------------------|---------|----------------------|---------|
| | | Minimum | Maximum | Minimum | Maximum |
| T-A (91) | 18091 | 93 | 740K | 930 | 12M |
| T-B (92) | 18092 | 186 | 1.5M | 1,9K | 25M |
| T-C (93) | 18093 | 464 | 3.7M | 4,6K | 60M |
| T-D (94) | 18094 | 1K | 7.5M | 9,2K | 120M |
| T-E (95) | 18095 | 1,9K | 15M | 18,6K | 240M |
| T-F (96) | 18096 | 4,6K | 37M | 46,4K | 600M |

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).



Fixing button

Handle

Install the viscometer on the stand and fix it with the button. Take care of temperature probe if your device gets one.

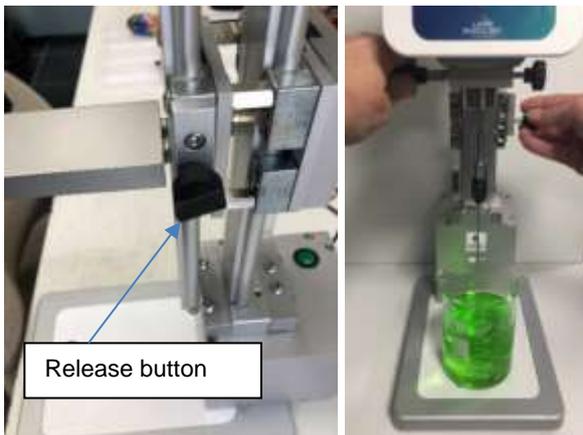
Insert the spindle inside chuck, lock it by screwing.



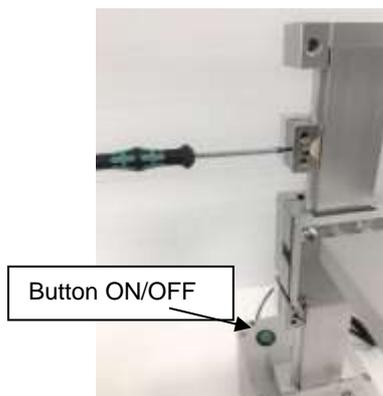
Make a zero of your viscometer (see section 2.2.4.) if you are using standard model.

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

Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.



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 limit 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 2.2.2).

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.

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 a 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 viscometer (see section 2.2.4.) 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).
- Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.
- 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 2.2.2).

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 viscometer (see section 2.2.4.) if you are using standard model.
- Insert the measuring system with the bayonet coupling in the motor shaft (see section 3.1).
- Make a zero of your viscometer (see section 2.2.4.) if you are using LR model.
- Fix the tube MB-DIN1 to the viscometer (see section 3.6.1)
- Insert the measuring system in a controlled temperature unit like a 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 2.2.2).

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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