



**LAMY**  
**RHEOLOGY**  
INSTRUMENTS

# USING MANUAL

## DSR 500 CP4000

VERSION N° DSR500CP4K-UK07/2023



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## 1 INTRODUCTION

The DSR 500 CP4000 is a rheometer able to measure the viscosity, which is the capacity of a product to resist to the flow.

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

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

With  $\eta$  for viscosity in Pa.s,  $\tau$  for shear stress in Pa and  $\dot{\gamma}$  for shear rate in s<sup>-1</sup>.

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

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

$\dot{\gamma} = n \times K_{\text{D}}$  with n for rotational speed in rpm and  $K_{\text{D}}$  in s<sup>-1</sup>/ rpm.

The rheometer calculates the viscosity by dividing the shear stress by the shear rate for each measuring point. The  $K_{\text{Tau}}$  and  $K_{\text{D}}$  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 rheometer 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 rheometer has an easy touch screen display, on which you could read the **speed, shear rate** (according to spindle), **shear stress**, temperature, **measuring spindle** reference, 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 DSR 500 CP4000 can be used with different measuring system. You will find below a list of compatible measuring system with this rheometer.

- **MS CP:** Measuring systems cone or plate compatible with DIN 53019 / ISO 3219 / ASTM D4278-D7395 (316L Stainless Steel). These systems make it possible to set the shear rate in order to carry out viscosity measurements or to obtain curves to study flow behaviour, yield stress or thixotropy. They are particularly suitable for measurements on very small quantities for control or development of homogeneous products with or without particles (size <100µm), guaranteeing easy cleaning.

Models N500426 and N500427 can use these following measuring system

- **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).

- **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.

## 1.1 Components

Rheometer is delivered inside a foam protection to avoid any problem during transport. DSR 500 CP4000 PLUS is delivered mounted. You will find some cable, measuring system (according to order) and some tools for installation and using.

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



**DSR500 CP4000 PLUS**



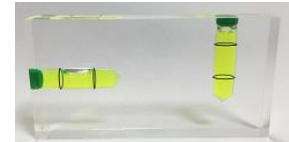
**Cable and power supply for measuring head**



**Cable for CP4000**



**Tool for levelling of DSR500 CP4000**



**Level indicator**



**Cable for connexion of measuring head with CP4000 temperature control.**



**Cable for connexion of measuring head with CP4000 for control (only models N500401, N500411, N500421, N500431 and N500426).**

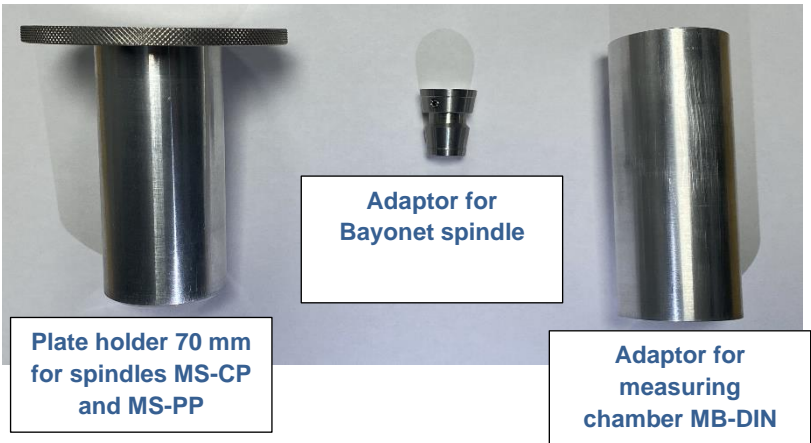


**Bottom plate 70 mm (excepted models N500426 and N500427).**



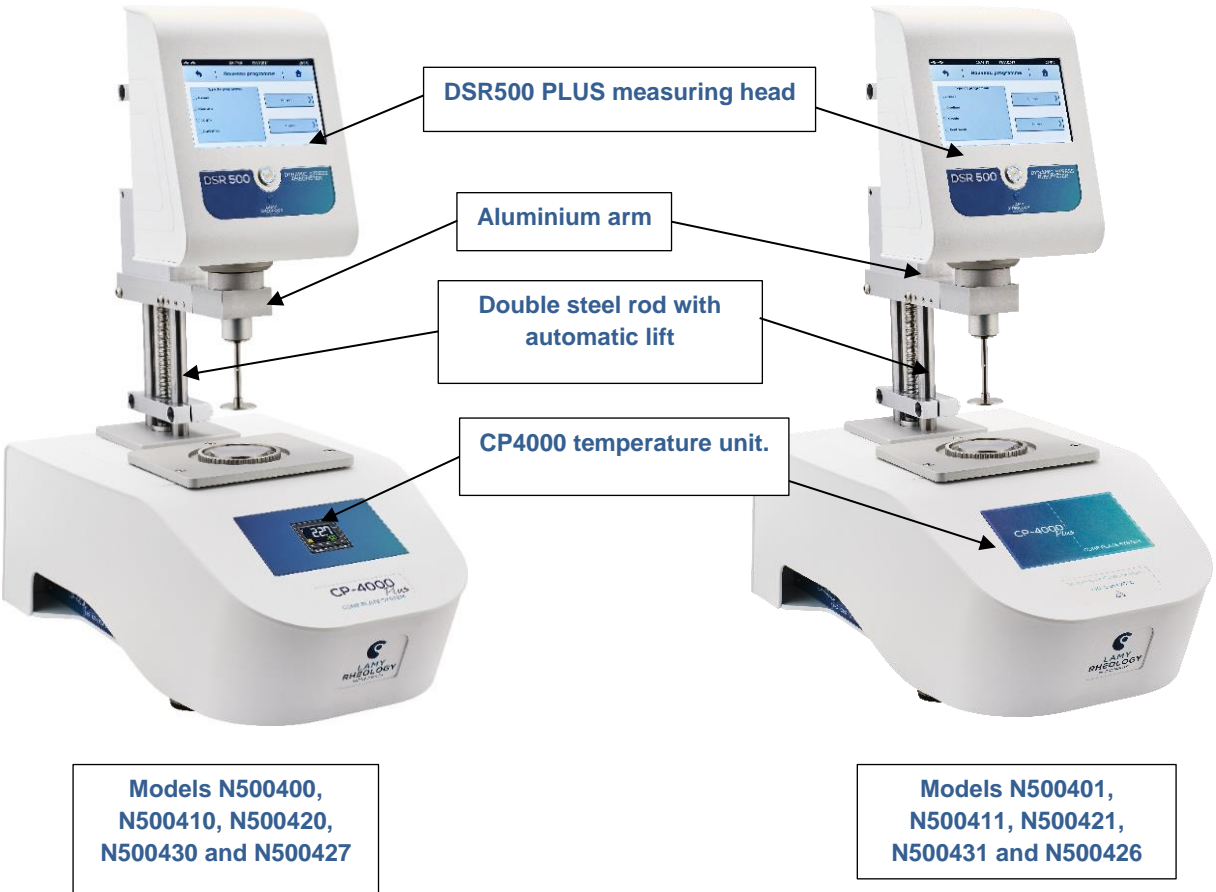
**Pipe with connector for liquid Peltier (only models N500420 and N500421).**

For models N500426 and N500427, please find above additional items included with device.



**1.2 General view of your instrument**

Once your device will be mounted and installed, it looks like this;

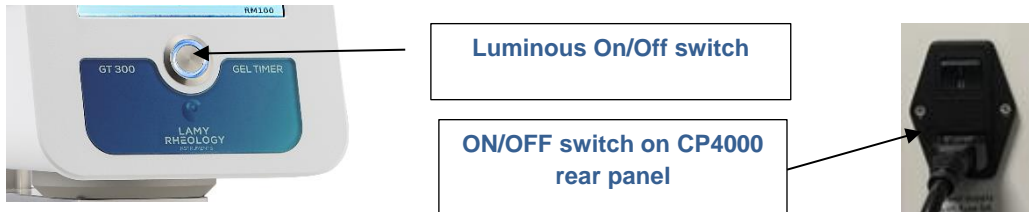


- **TOUCH Screen**

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

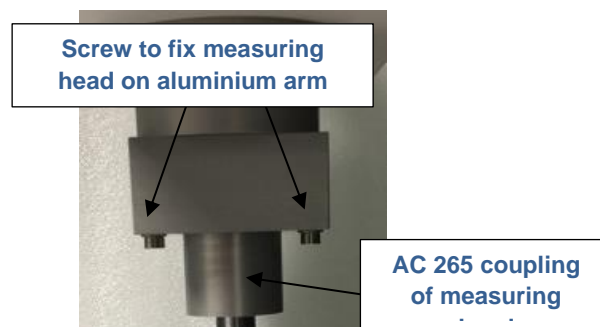
- **On / Off Switch**

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.



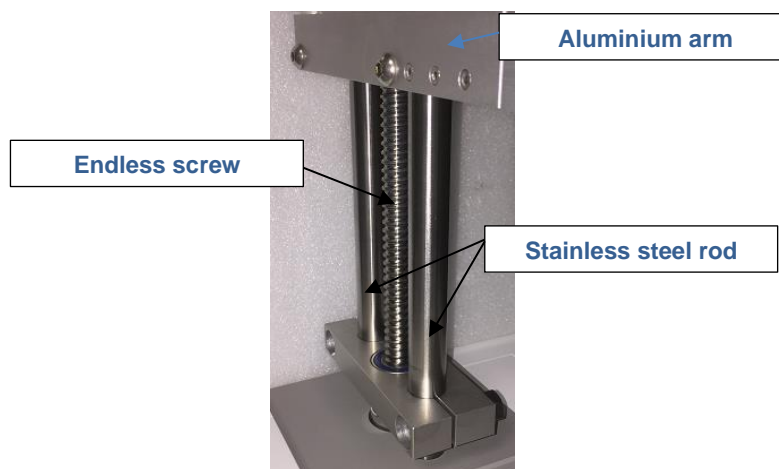
- **Aluminium arm**

The measuring head is fixed to the arm with tow screw.



- **Stainless steel rod**

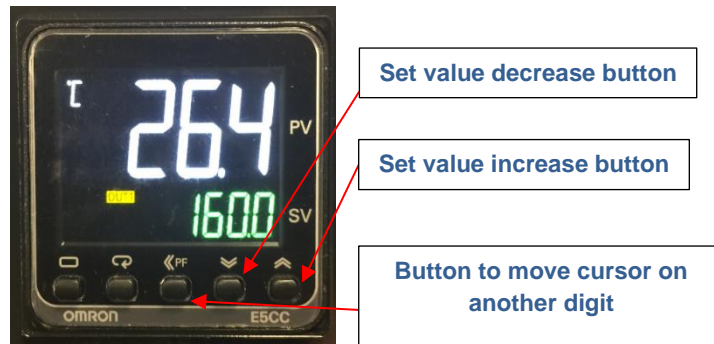
The support rod is made of stainless steel for a solid hold of the measuring head. It has a very long life. An endless screw in the middle acts as a lift to move the arm and the measuring head.





- **Temperature unit CP4000**

This device is present only for models N500400, N500410, N500420, N500430 and N500427 and allows you to regulate the temperature of your sample. It is equipped with an OMRON display/regulator (programmer for certain models).

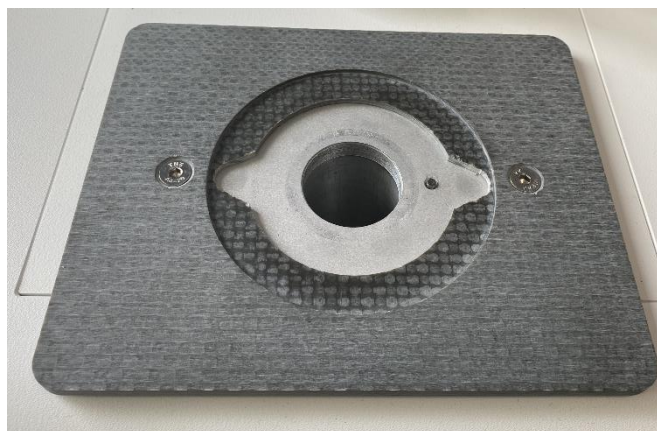


To adjust the temperature on models N500400, N500410, N500420, N500430 and N500427 please see section 2.9.

It is available in Peltier or electric version (see characteristics). The lower plate unscrews clockwise and is interchangeable to adapt to the diameter of the measuring geometry (other dimensions on request).



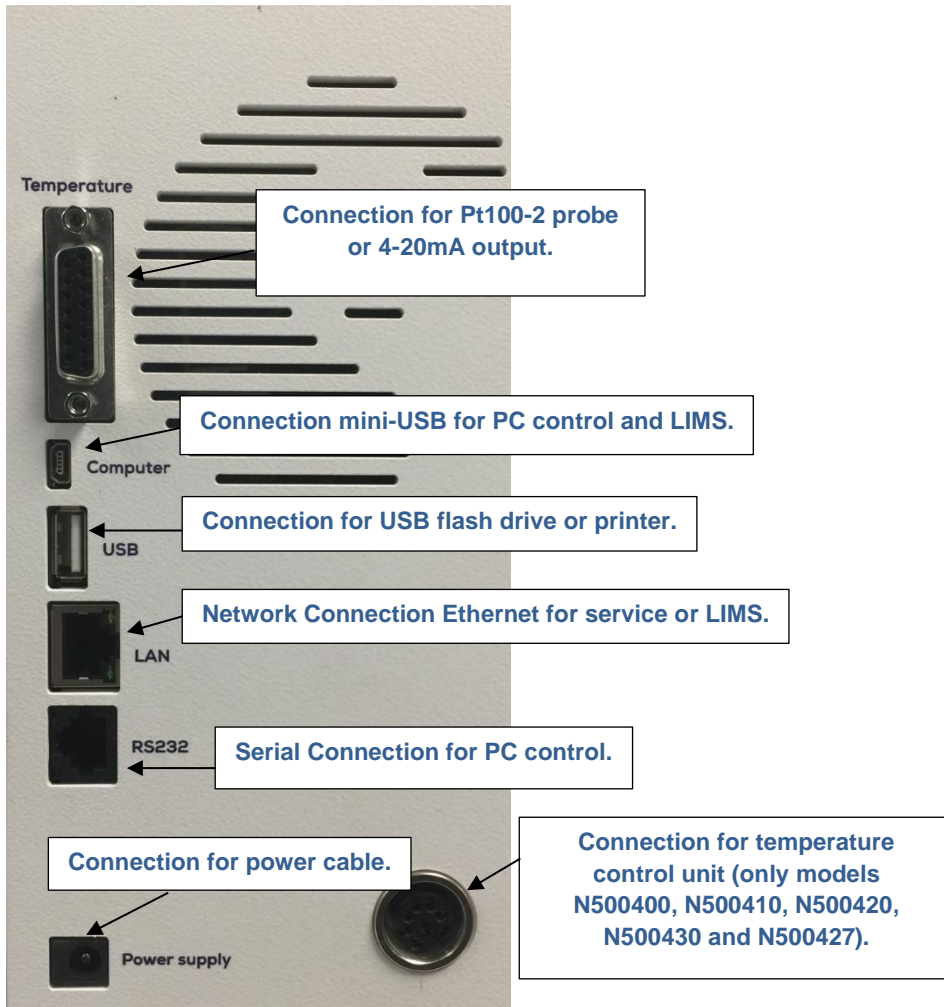
Models N500426 and N500427 get chamber to insert MB-DIN and MB-SV chamber.



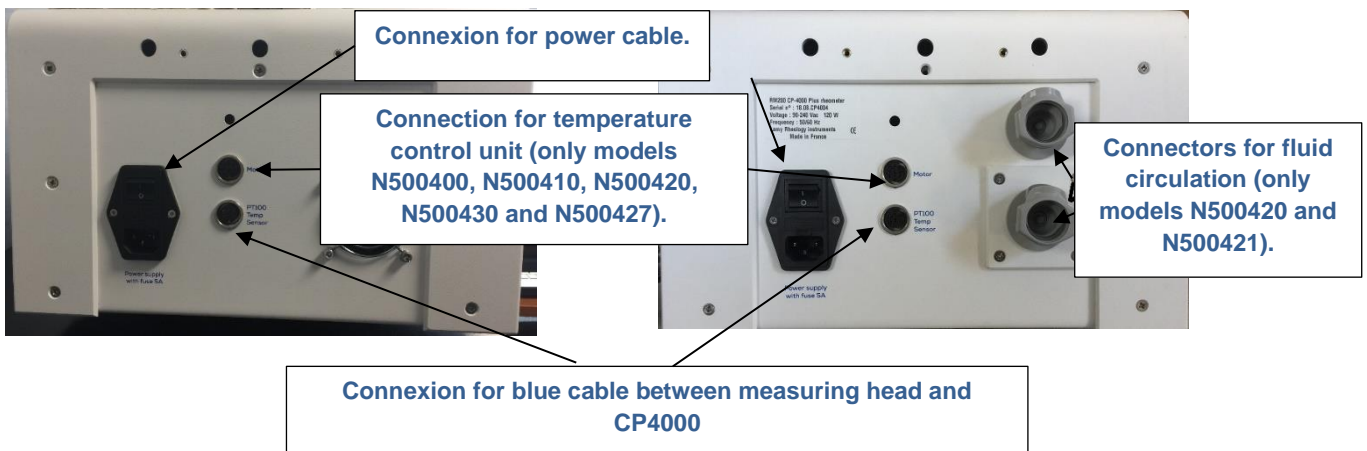


### 1.3 Connections

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



The rear panel of CP4000 Temperature unit get this connections:



## 1.4 Specifications

**Type of instrument:** Rotating springless rheometer with imposed speeds and 7" Touch screen

**Rotation speeds:** Unlimited number of speeds between 0.3 and 1500 rpm

**Torque range:** From 0.05 to 30 mNm

**Temperature:** Temperature range from – 20°C to + 300 °C (according to models)

**Accuracy:** +/- 1 % of the full scale

**Repeatability:** +/- 0,2 %

**Display:** Viscosity – Speed – Torque (% and mNm) – Time –Temperature - Choice of viscosity units: cP/Poises or mPa.s / Pa.s – Shear rate – Shear Stress.

**Language:** French/English/German/Turkish/Russian/Italian

**Compatible measuring system:** MS CP. **Models N500426 / N500427** : MS VANE, MS SV and MS DIN

**Supply voltage:** 90-240 VAC 50/60 Hz

**Analog output:** 4 – 20 mA

**PC connections:** Port RS232 and USB

**Printer connection:** USB Host Port – Compatible PCL/5

**Dimensions and weight:** D610 x W340 x H700 mm, Weight: 22 kg

This is the available models:

Part Number	Designation Instrument
N500400	DSR 500 CP4000 PLUS RHEOMETER AIR-AIR PELTIER (+10 to +70 °C)
N500401	DSR 500 CP4000 PLUS RHEOMETER AIR-AIR PELTIER (+10 to +70°C) with programmer*
N500410	DSR 500 CP4000 PLUS RHEOMETER AIR-AIR PELTIER (0°C to +150°C)
N500411	DSR 500 CP4000 PLUS RHEOMETER AIR-AIR PELTIER (0°C to +150°C) with programmer*
N500420	DSR 500 CP4000 PLUS RHEOMETER LIQUID PELTIER** (-20 to +100 °C)
N500421	DSR 500 CP4000 PLUS RHEOMETER LIQUID PELTIER** (-20 to +100 °C) with programmer*
N500430	DSR 500 CP4000 PLUS RHEOMETER H (room to +300°C)
N500431	DSR 500 CP4000 PLUS RHEOMETER H (room to +300°C) with programmer*
N500426	DSR 500 CP4000 PLUS RHEOMETER + CYL*** AIR-AIR PELTIER (+10 to + 70 °C)
N500427	DSR 500 CP4000 PLUS RHEOMETER + CYL*** AIR-AIR PELTIER (+10 to + 70°C) with programmer*

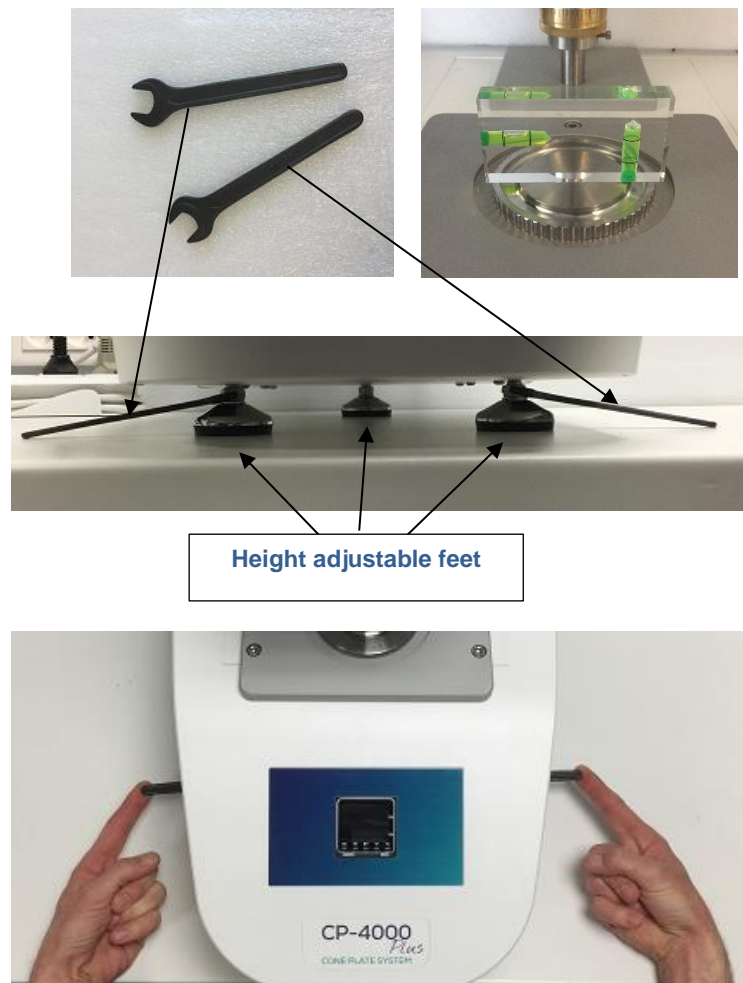
\* Allow temperature setting by RheoTex software or measuring head

\*\* Need a chiller. Not included.

\*\*\* Can use MS DIN, MS SV and MS Vane. More information on demand.

## 1.5 Installation

Install the DSR 500 CP4000 on a solid bench. Place the level on the plane and adjust the level using the 2 keys provided by playing on the three adjustable feet in height.



Connect the power cable. Connect the temperature reading cord (blue): SUB-D 15 connector on rear of the DSR 500 to the DIN plug on the back of the CP4000 stand. Connect the black cable for lift control between measuring head and CP4000.

Connect the DSR500 and CP4000 power cable. As well as the cable for the software connection when supplied.



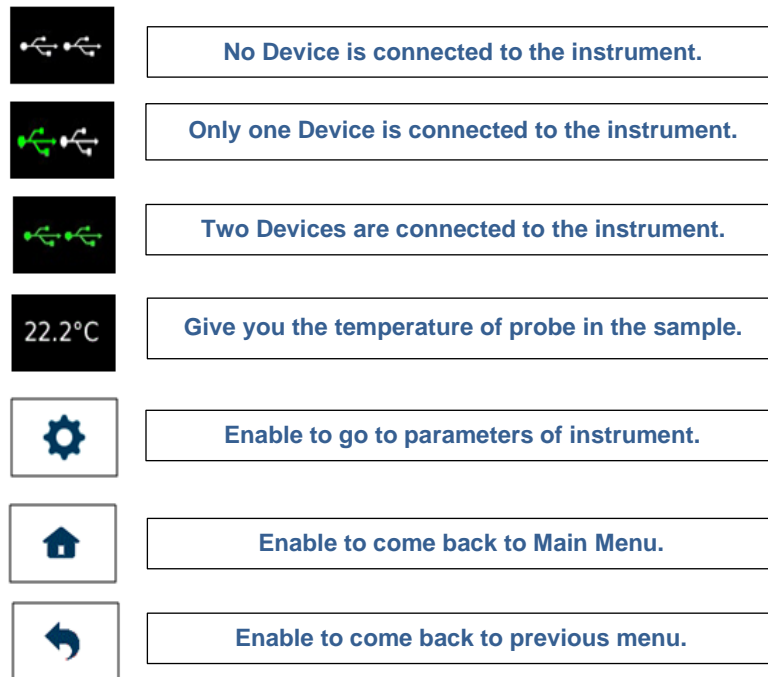
Some models like N500420 and N500421 require liquid circulation. You need to connect the supplied hose to the circulating bath. The direction of circulation does not matter. Please note to always turn on the circulating bath before using the rheometer. Your viscometer will be used with different measuring system. To know how to mount and use it, please see 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).

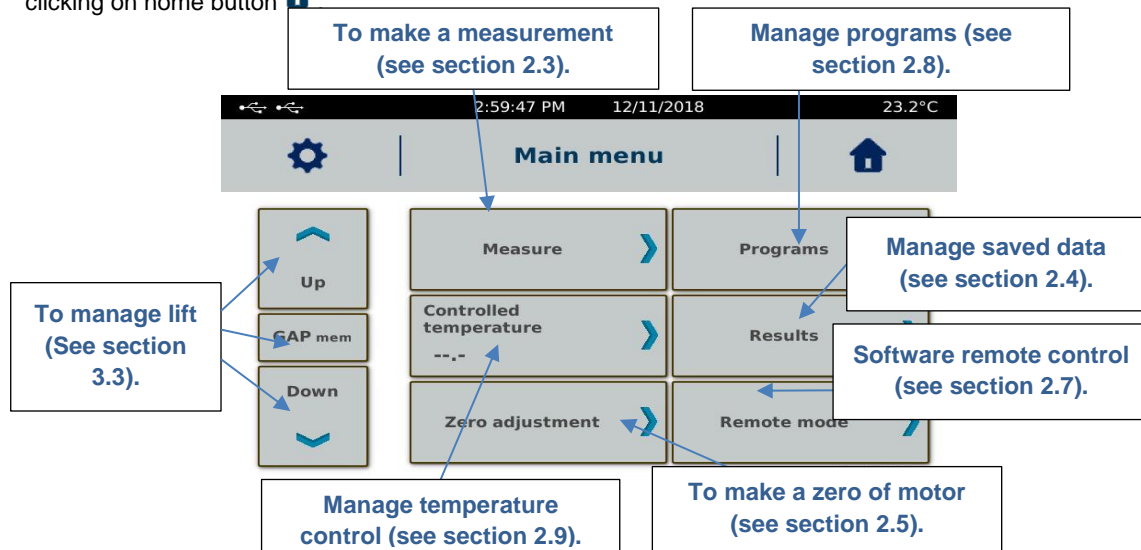
### 2.1 State icons

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



### 2.2 Main menu

Main menu enable to you to browse between different tabs of your DSR 500 CP4000. Acces is always available by clicking on home button 

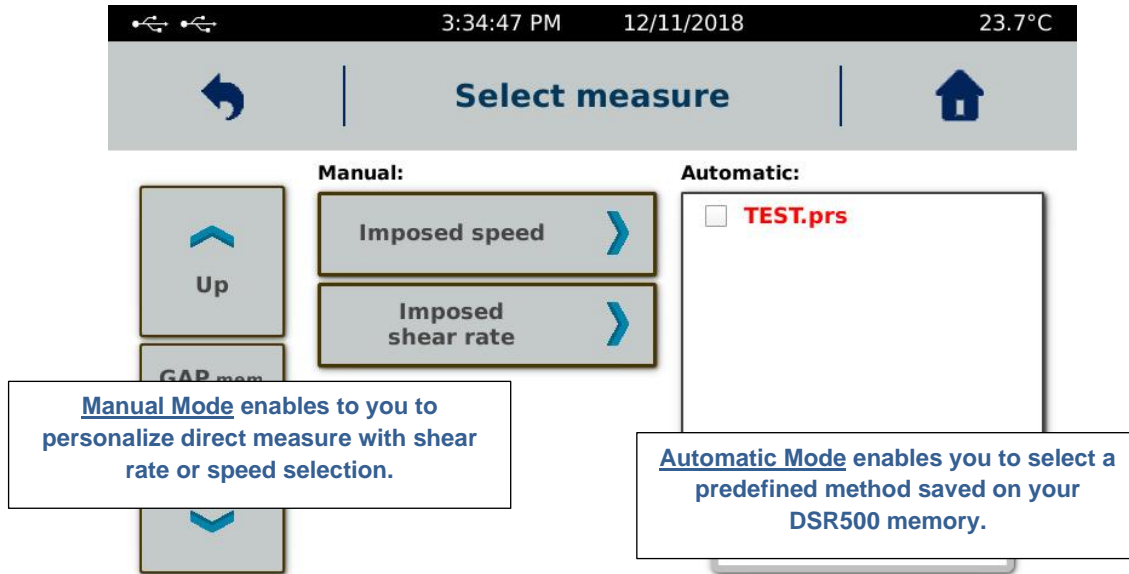


The "Controlled Temperature" button is present only for models N500400, N500410, N500420, N500430 and N500427.

## 2.3 Measure menu

Measure tab is central part of your DSR 500 CP4000. Before to use it, you should install your measuring system and your sample. Please see section 3.

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

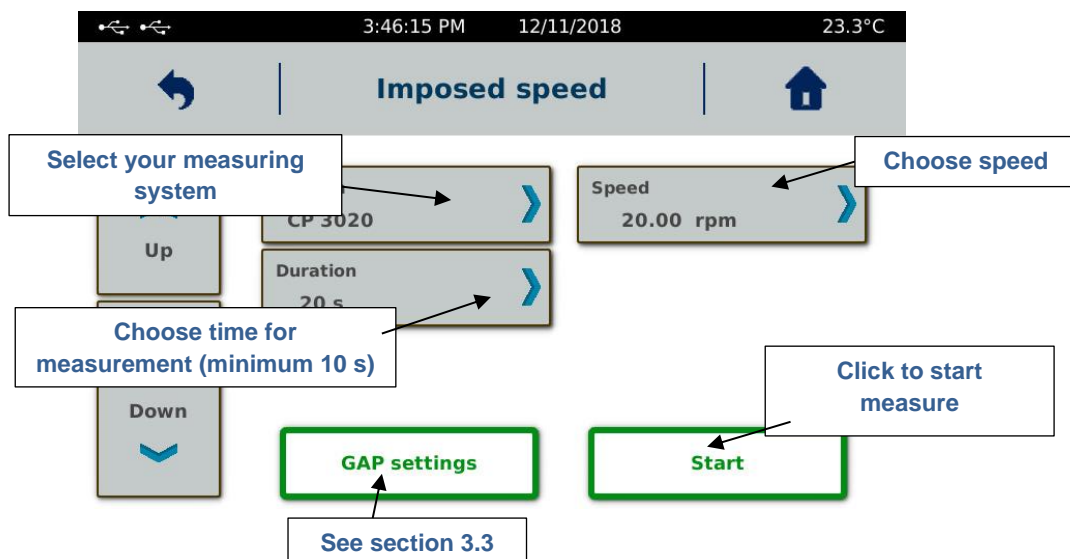


### 2.3.1 Manual mode

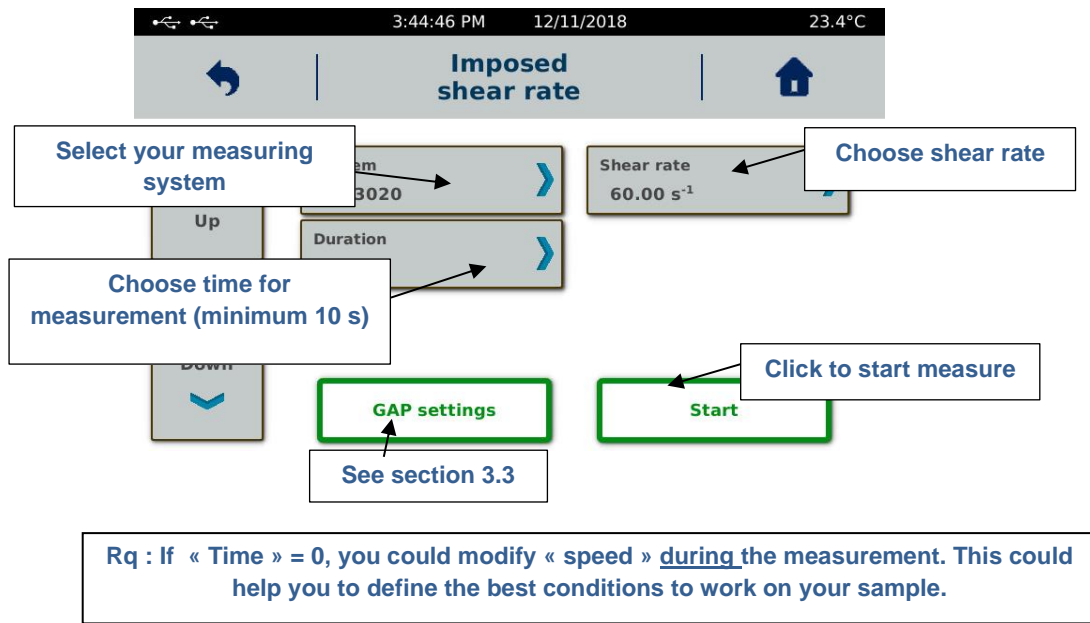
Manual Mode enables to choose your measurement parameters like "Measuring System", "Speed" or "Shear rate" then "Time of measurement".

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

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



"Imposed Shear rate" mode is recommended when using MS CP measuring system.



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

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

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

With speed unit in rpm, shear rate in s<sup>-1</sup> and  $K_D$  is rpm/s<sup>-1</sup>.

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

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

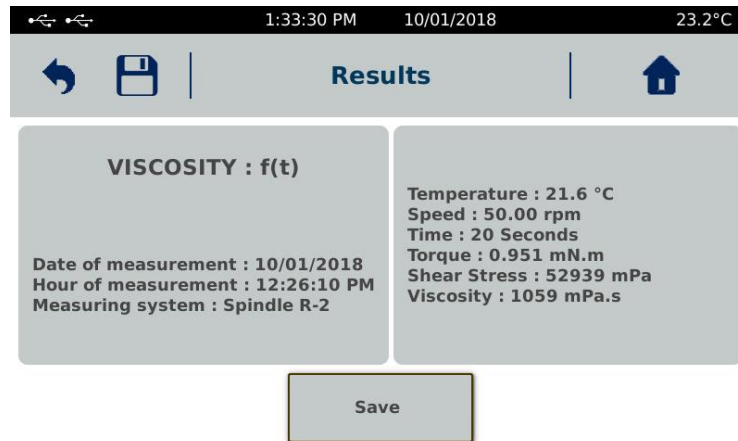


During your measurement, you will see a torque gauge (on the right side of the display). Boundaries of this gage give you minimum and maximum viscosity you can measure with your selected spindle and set speed/shear rate. You have also value in % corresponding of measured torque vs maximum torque of device.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

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

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

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

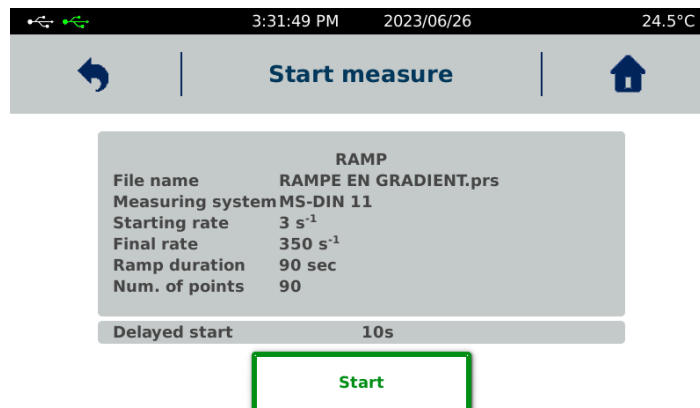


### 2.3.2 Automatic mode

The format of the methods is as follows:

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

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

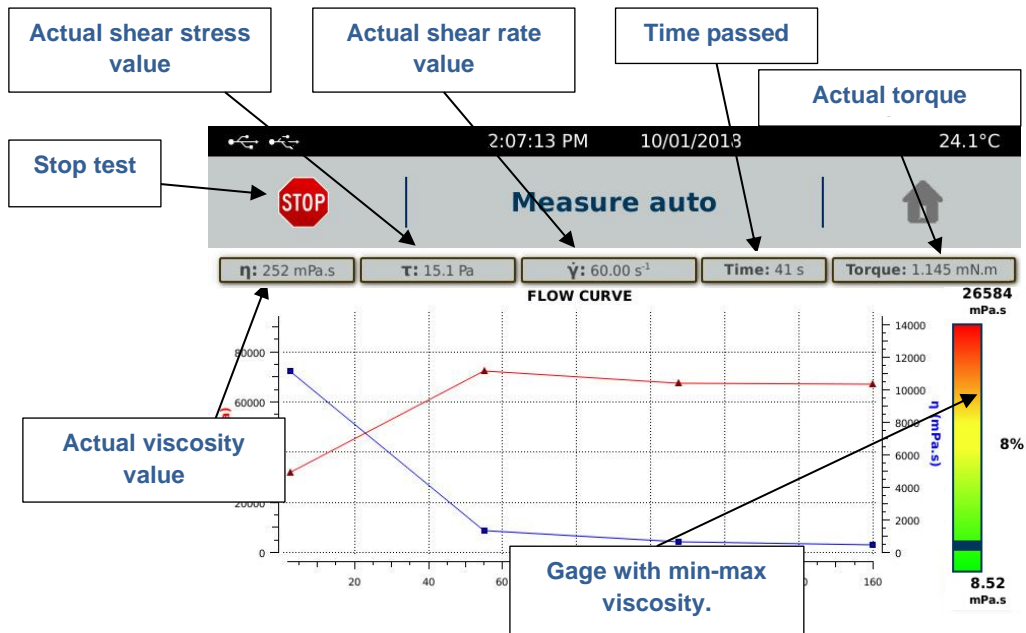


Check to make zero adjustment of motor before measurement (see section 2.5).

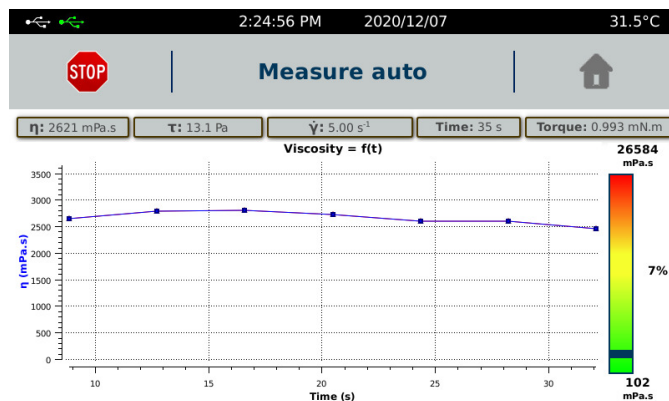
Whatever type of selected program, the instrument will ask you to save your measurement when you click on "Start". If you wish to see in detail the contents of each method, we invite you to consult the paragraph 2.8. If a delayed start has been requested in the program, the previous view displays a time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



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

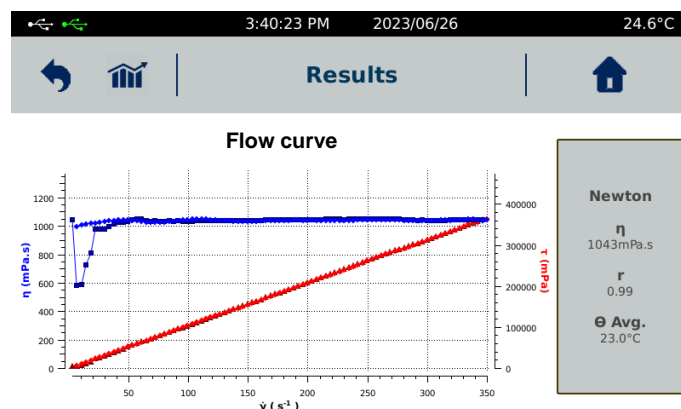


Some methods in step mode (format **pss**) contain only one step. These methods are intended for constant parameter measurements over time. The display of the curve will be different with time on x-axis. The name of the graph is also different (here Viscosity = f(t)).

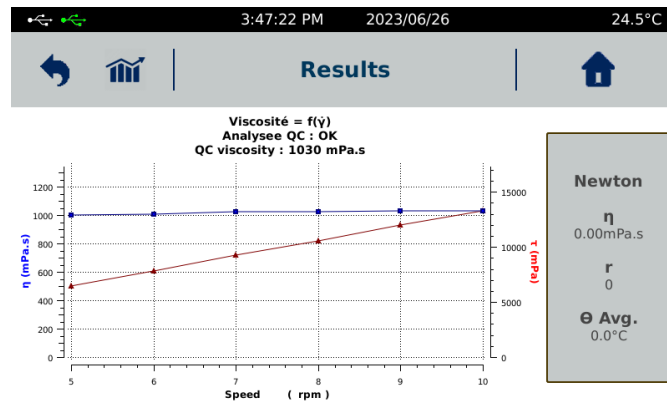



At any time you have the option to stop the measurement by clicking on the "Stop" button. The device will then ask you whether you want to save the measurement or not.

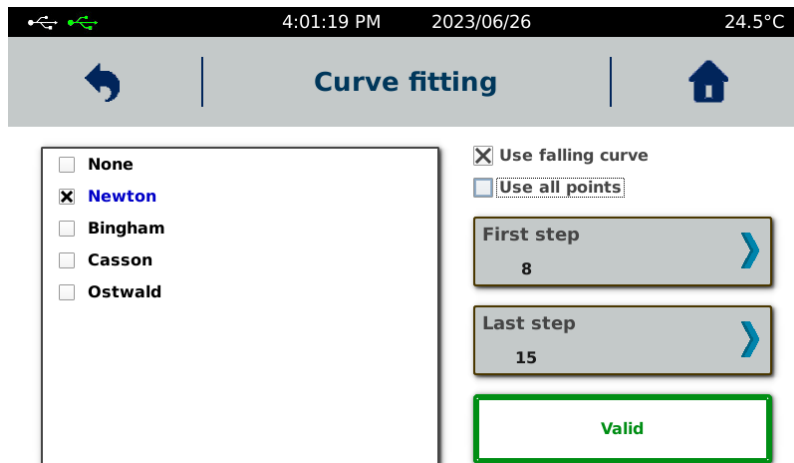
Some methods contain an analysis at the end of the measurement. When the measurement comes to an end, you will be able to see the result of this analysis as well as the curves obtained.



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



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

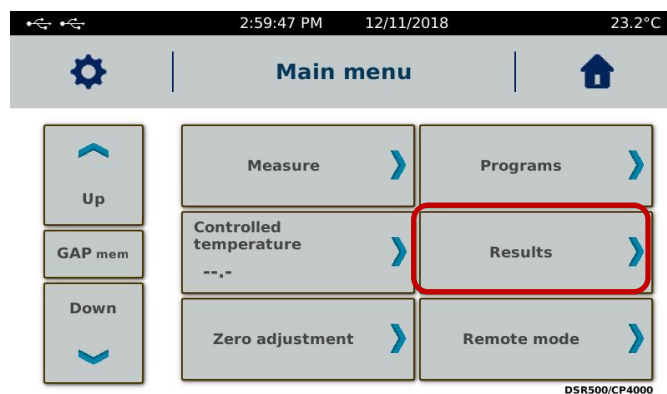


The analysis tool therefore makes it possible to use the same parameters as those available for programming. After making your changes, you can validate. The instrument will return to the end of measurement view with the new results.

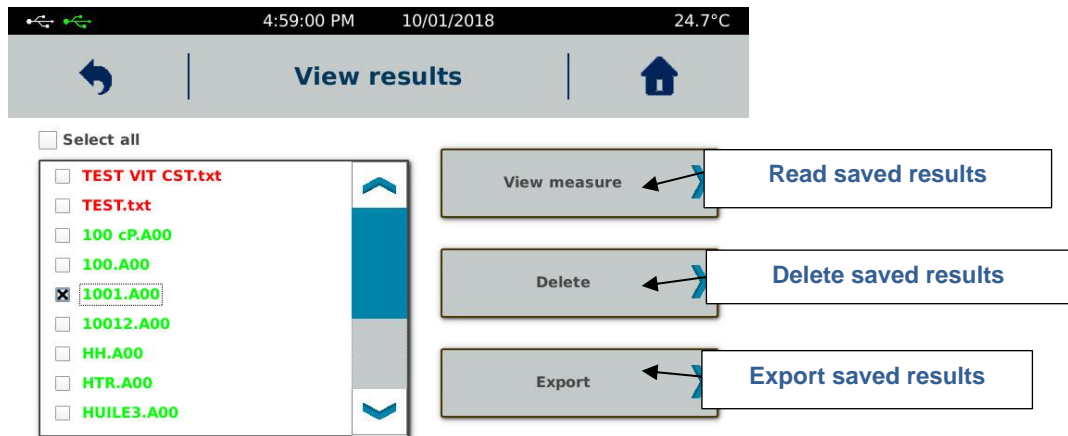
All saved results can be read later (see section 2.4).

## 2.4 Results menu

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



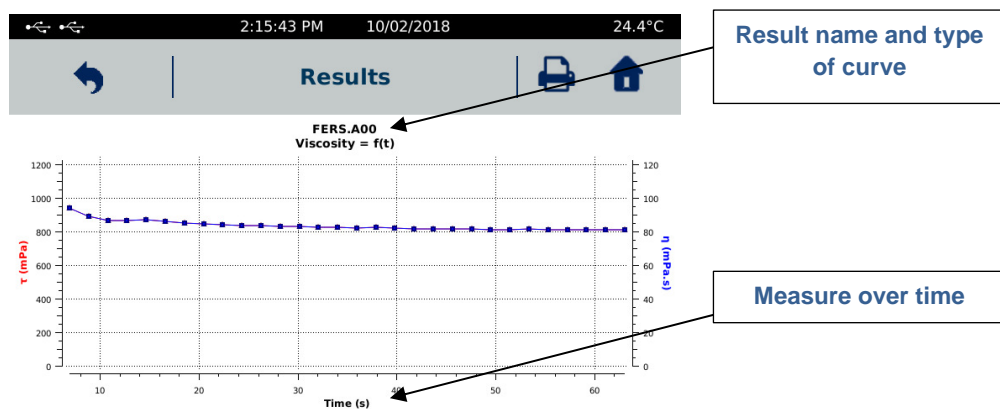
Once you are on the screen below, simply select the measurement in the list and choose the desired option. The measurements in green correspond to results obtained with a programmed method while the measurements in red come from measurement in manual mode (see paragraph 2.3).



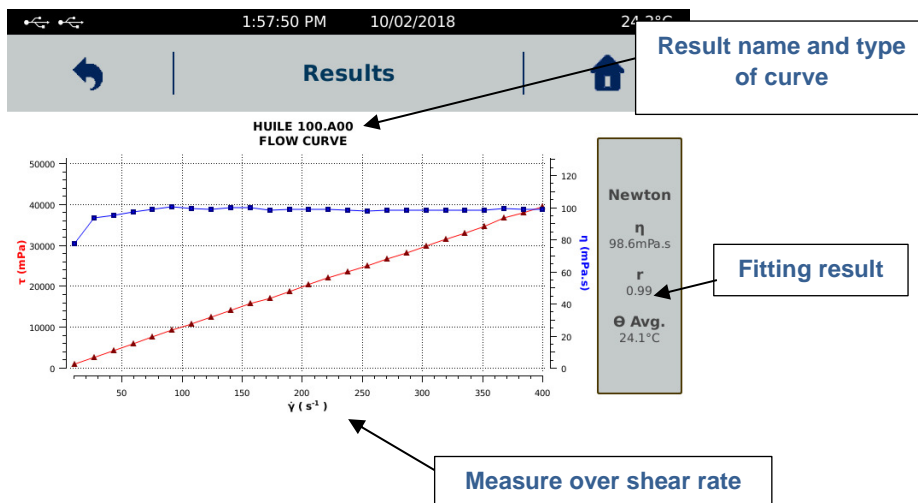
When you select measurements done in manual mode, you will get this view with all important information saved with the result. The options available are export if a USB key is connected to the instrument or printing (printer icon).



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



The following display concerns all other types of methods.



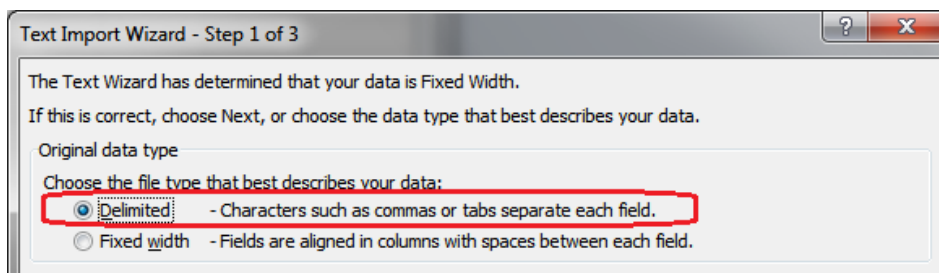
The box for regression is only present if your method allowed the calculation.

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

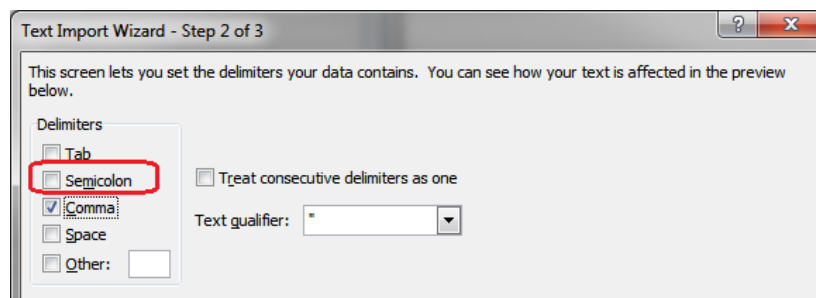
The "Export" function is accessible only when a USB key is connected to the back of the instrument (see connection section 1.3). If you want to export all the measurements at the same time, you can do this by checking the "Select all" box. Whatever the program used for the measurement, only the recorded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

The format of the data generated and saved by the device is 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.

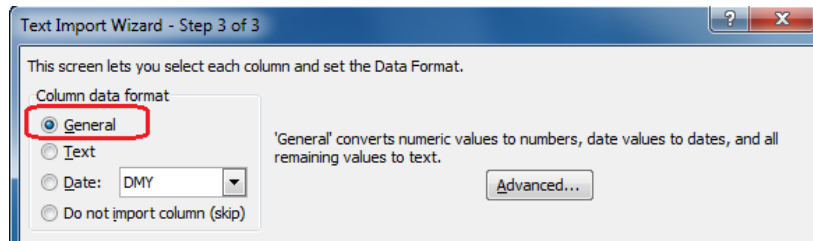
Verify that the "Delimited" function is selected and then click next.



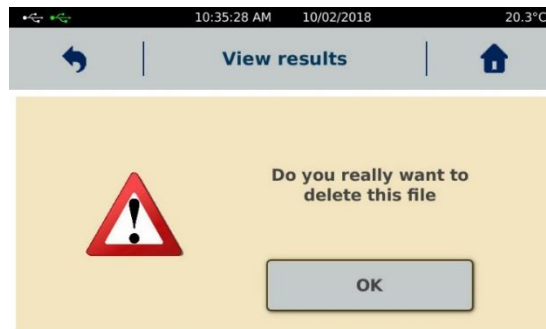
On the next window, be sure to select the "semicolon" as the separator and click next



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

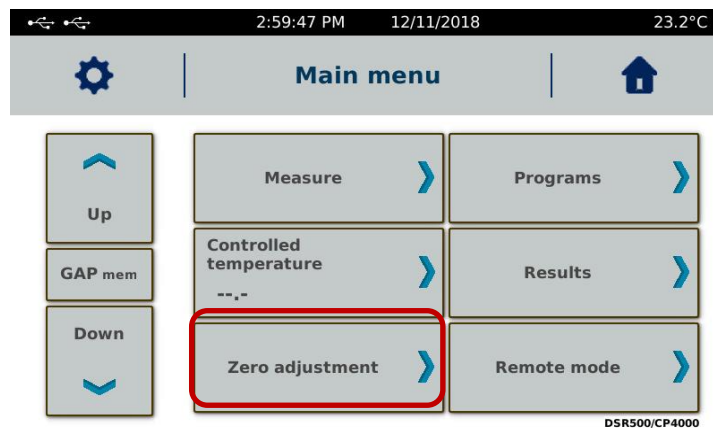


To delete a result, simply select your measurement in the list and click on "Delete". The deletion will be complete only after confirmation from you. You can also delete all measurements by clicking on "Select all" then "Delete".

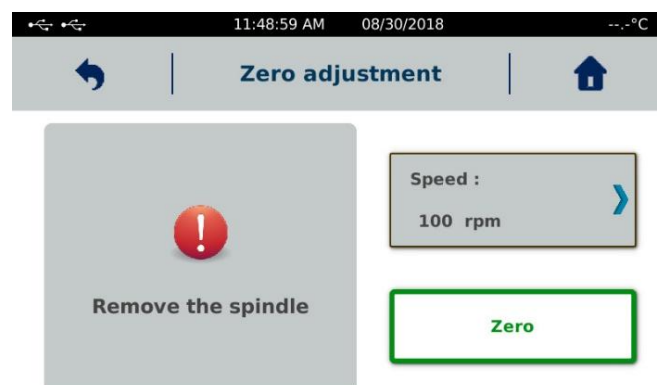


## 2.5 Zero adjustment menu

The zero setting allows you to calibrate your DSR 500 CP4000 to take account of the engine's empty friction.




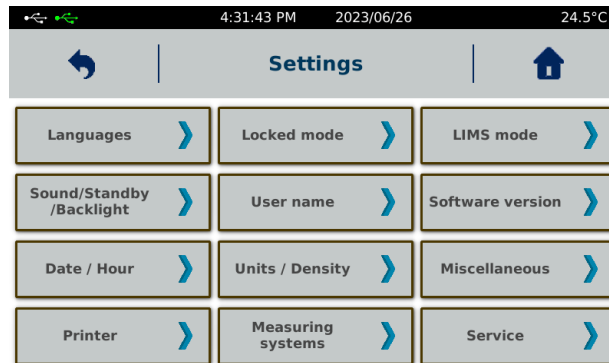
The rotation speed for zero adjustment can be changed to suit your needs, giving you much more accurate measurements at specific speeds close to your measurement parameters.



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

## 2.6 Settings menu

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



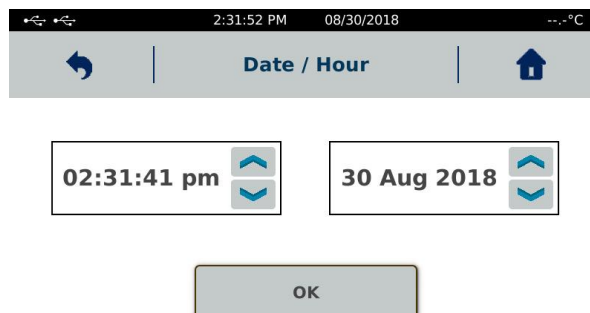
### 2.6.1 Languages

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



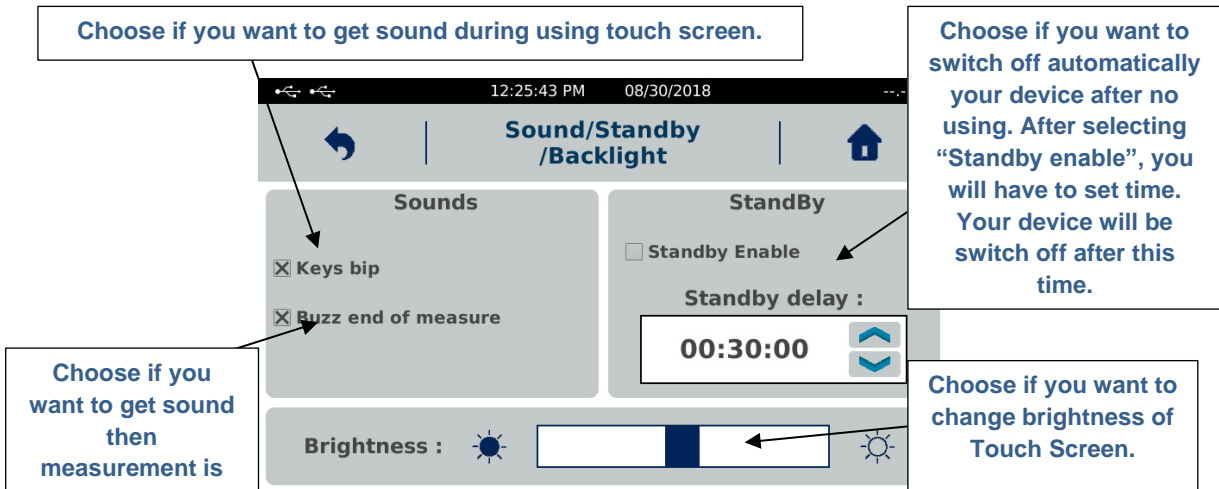
### 2.6.2 Date / Hour

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



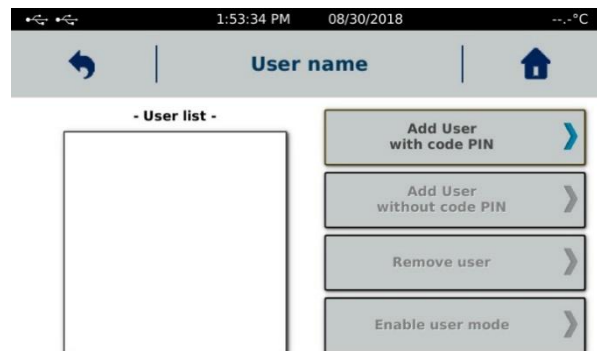
### 2.6.3 Sounds / Standby / Backlight

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

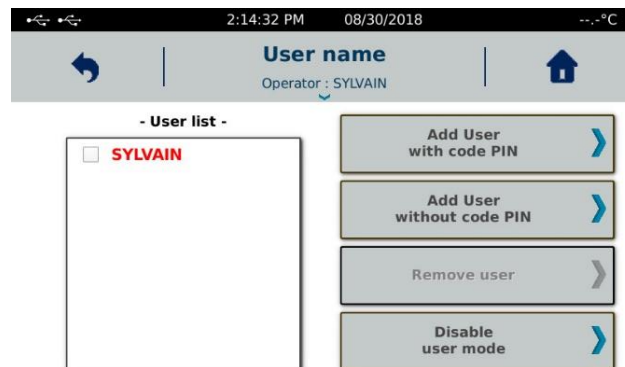


### 2.6.4 User name

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



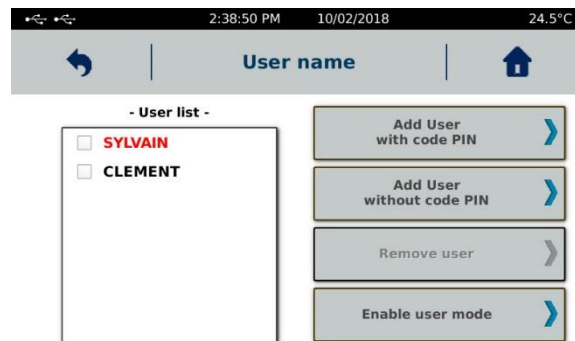
Operator management must always start with the creation of the first account, which will become the administrator. You can create other operator accounts or delete them. The administrator account must be associated with a password (here called PIN).





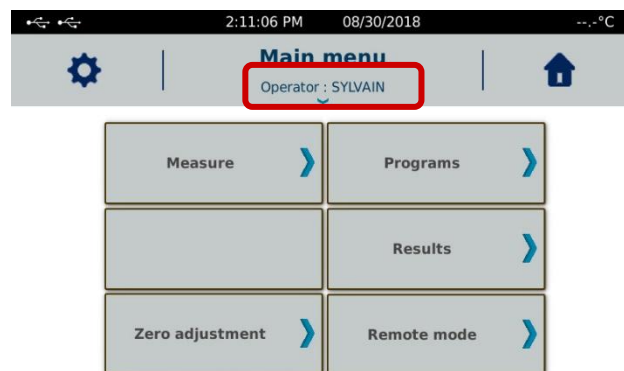
To create the administrator account, click on "Add user with code PIN". Fill in the name and the associated PIN code.

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

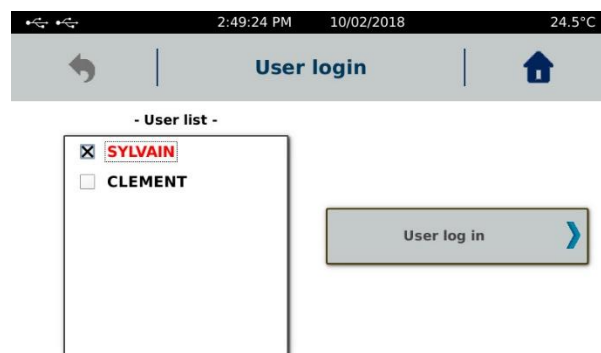


To delete an account, administrator account must be used. Select the account to be deleted from the list and click on "Remove user". The administrator account can only be deleted when it is the last available account.

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



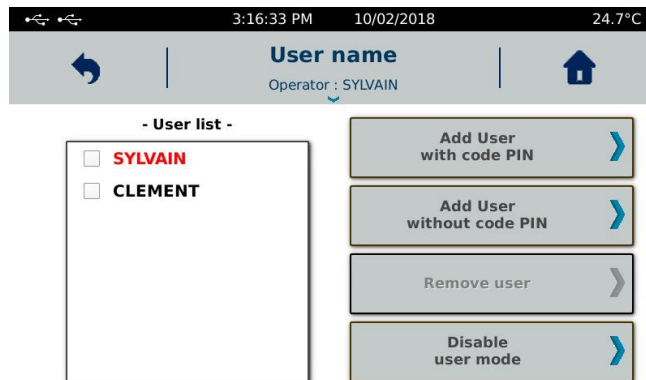
If the instrument is turned off and on while operator mode is on, it will be asked you to select the desired operator. Select the operator, enter the PIN code if necessary and confirm.



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

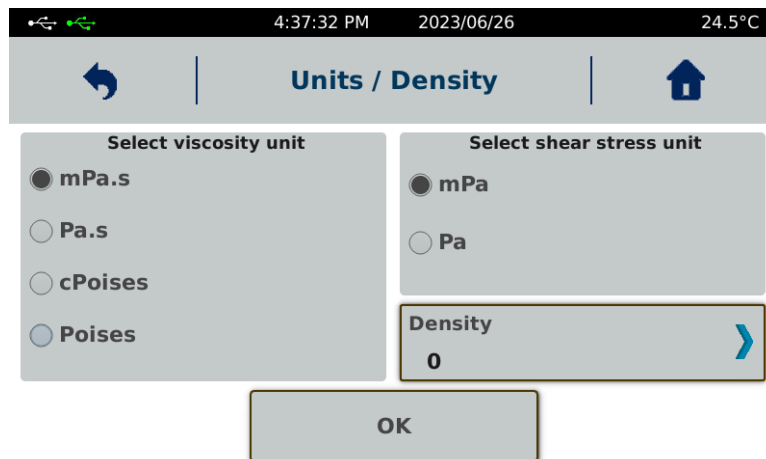


To disable the "User" mode, the administrator account must be used. Then click on "Disable user mode". This disabling doesn't lead to the deletion of created accounts.



## 2.6.5 Units / Density

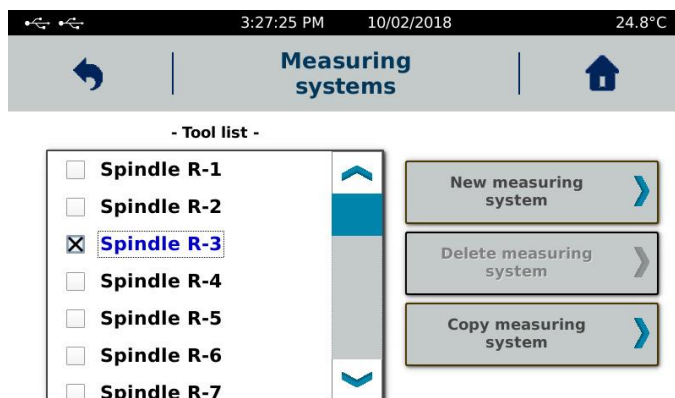
Allows you to change units of viscosity and stress used for programming methods and displaying results and diagrams.



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

## 2.6.6 Measuring systems

It allows you to add or remove a Measuring System.



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

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

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

Here is the list of constants used for measuring systems compatible with the instrument.

### MS CP

SYSTEM	K $\tau$ / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
CP 2005	477.5	12	1
CP 2015	477.5	3.8	1
CP 2020	477.5	3	1
CP 2045	477.5	13.3	1
CP 2405	276.3	12	1
CP 2420	276.3	3	1
CP 2445	276.3	13.3	1
CP 2520	244.5	3	1
CP 3020	141.5	3	1
CP 3520	89.1	3	1
CP 4005	59.7	12	1
CP 4015	59.7	3.8	1
CP 4020	59.7	3	1
CP 4040	59.7	1.5	1
CP 4221	51.6	3.8	1
CP 4530	41.9	2	1
CP 5005	30.6	12	1
CP 5010	30.6	6	1
CP 5020	30.6	3	1
CP 6005	17.7	12	1
CP 6010	17.7	6	1
CP 6020	17.7	3	1
PP 25 0.5	326	2.618	1
PP 25 (1mm)	326	1.309	1

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
PP 25 (2mm)	326	0.654	1
PP 40 (0.5mm)	79.5	4.188	1
PP 40 (1mm)	79.5	2.094	1
PP 40 (2mm)	79.5	1.047	1

Here is the list of compatible mobiles and their respective constants for models N500426 and N500427. MS-VANE spindles are used with MB-DIN cup (see section 3).

#### MS VANE

SYSTEME	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
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
VT5025	17	1	0.5

#### MS DIN

SYSTEME	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

SYSTEME	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

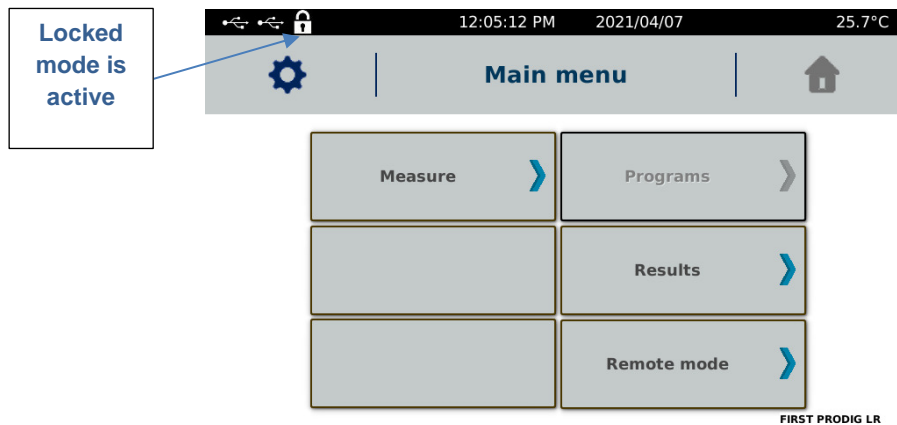
## 2.6.7 Locked mode

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

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

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

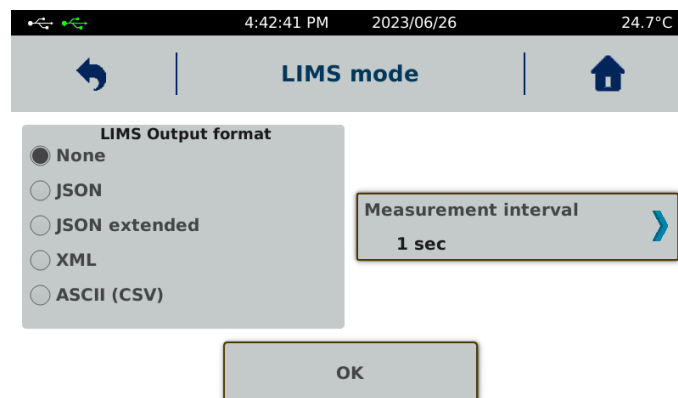
After selecting "Locked Mode", you must click "Enable". The instrument will ask you to register a 4-digit code that will be required to disable this protected mode. Each activation is independent and can be done with a different code and the deactivation of the mode will always be done with the code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



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

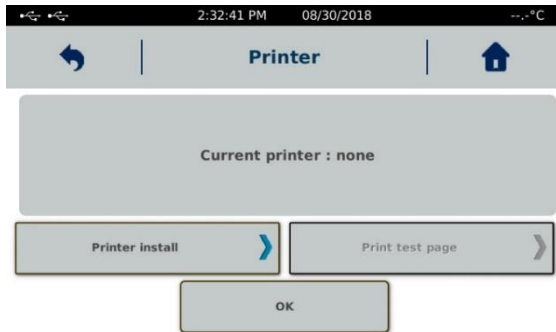
## 2.6.8 Mode LIMS

This menu allows you to select the data format for the LIMS function. This way, you can collect the data stored in the instrument's memory in the desired format. The connection used will be Ethernet (LAN) or USB on the rear panel of the instrument. The instrument's IP address for the LAN connection can be changed in the service menu. To do this, please contact LAMY RHEOLOGY or your local contact to provide you with an access password. The interval time will be used by the device to store the data point in memory after a time set for the LIMS function.



## 2.6.9 Printer

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



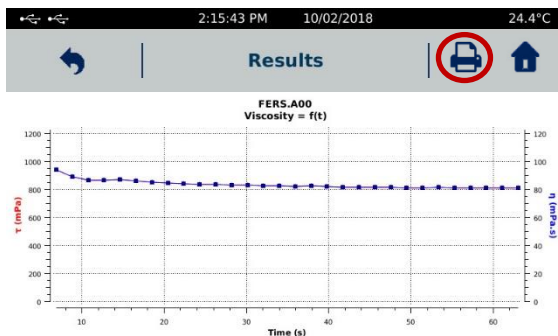
Printing a test page verifies good communication. If you choose to connect your instrument to another printer, be sure to delete the one already installed.

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

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



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

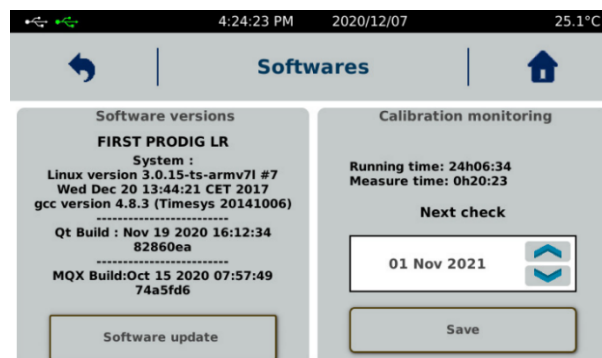


You have the possibility to print the measurement information (date, operator, result name, geometry used), a table with all the recorded values, the diagram and the result of the regression if they are present.

## 2.6.10 Software version

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

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



## 2.6.11 Miscellaneous

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



Please see below torque covered by specific range:

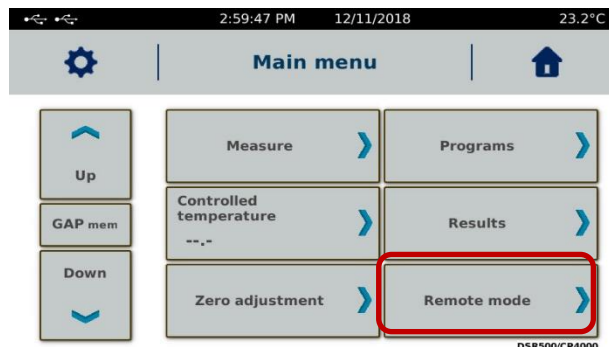
- RV Range : From 0.07187 to 0.7187 mNm.
- HA Range : From 0.1437 to 1.4374 mNm.
- HB Range : From 0.5749 to 5.7496 mNm;
- None means no limits. So it will be complete range for device (from 0.05 to 30 mNm).

## 2.6.12 Service

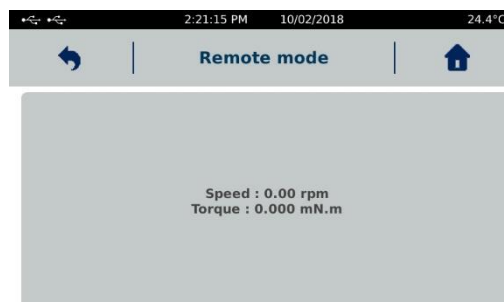
Reserved to LAMY RHEOLOGY engineers.

## 2.7 Remote mode menu

This mode enables to drive DSR 500 CP4000 by external RheoTex software, supplied on option. This function is available on the main menu.



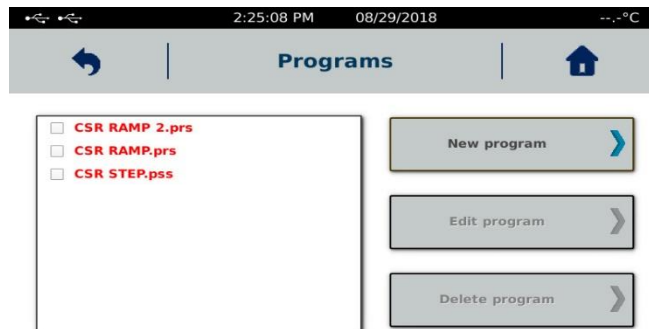
Once the device is connected to the PC, you must select the type of port (USB or RS232) and click on "Ok" to start the communication. As long as communication is not established, a "Waiting Connection ..." message appears on the screen. Then launch the software and check that the screen switches to the display below. If this is not the case, check the connections and make sure that the COM port number set in the default settings of the RheoTex software is correct and identical to that recognized by WINDOWS in "Control Panel", then "System and "Device Management" (see the operating instructions for the RheoTex software).





## 2.8 Programs menu

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



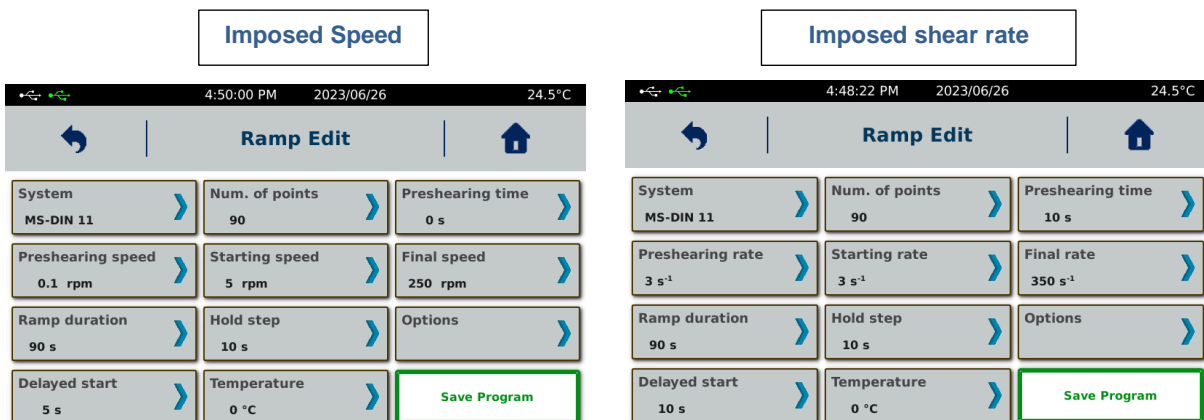
### 2.8.1 New program

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



#### 2.8.1.1 Speed/shear rate ramp mode

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



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

necessary) as well as the speed/shear rate (a value must be indicated here even if pre-shearing is not necessary). Next is the speed/shear rate of the beginning of the ramp, the final speed/shear rate value (for information the speed range of the instrument is from 0.3 to 1500 rpm and for the shear rate range see the tables in paragraph 3 concerning each type of measuring system) and its duration in seconds. The "Hold Step" button is used to set a time when the speed/shear rate will be the same at the end of the rising ramp. This function is often necessary when you want to make a ramp up-hold-down. The number of points for the hold step is fixed and will be 1 point/second.

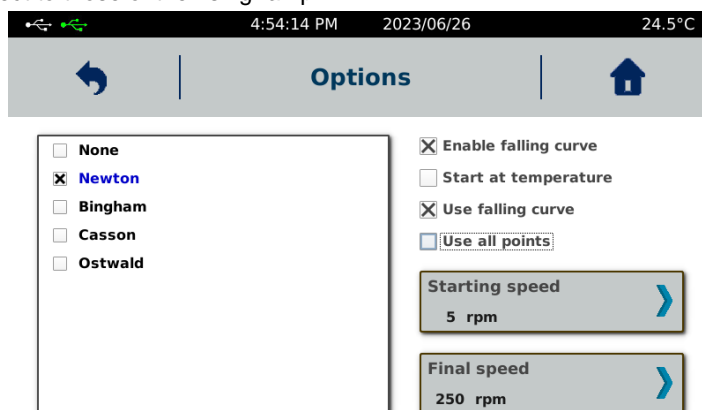
The "Delayed start" function allows you to set a waiting time before the start of the measurement. This time will be counted as soon as you start the measurement (see section 2.3).

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

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

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

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



Click on the back arrow to return to ramp programming

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

### 2.8.1.2 Speed/shear rate step mode

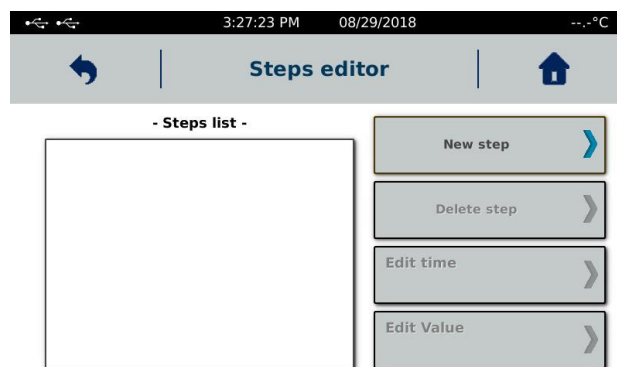
In the ramp mode (see above) the number of points sets the number of steps and duration of each of them is identical and calculated according to "Duration of the step = Duration of the ramp / number of points". In the step mode, you can set the number of steps, the speed/shear rate and duration of each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

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

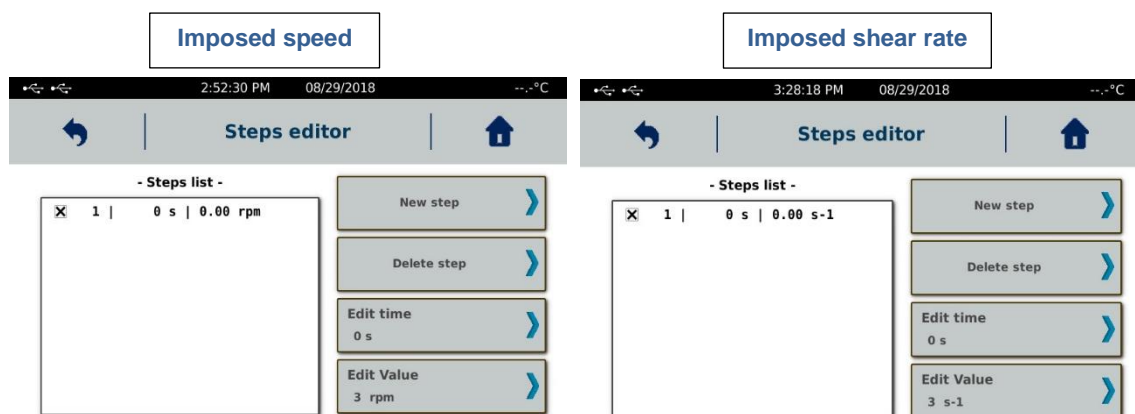


At the beginning of your programming, all the buttons are grey except for the "System" button. Selecting the measurement system and validating will automatically activate the next button and so on. You can then specify the duration of the pre-shear (can be set to 0 if it is not necessary) as well as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



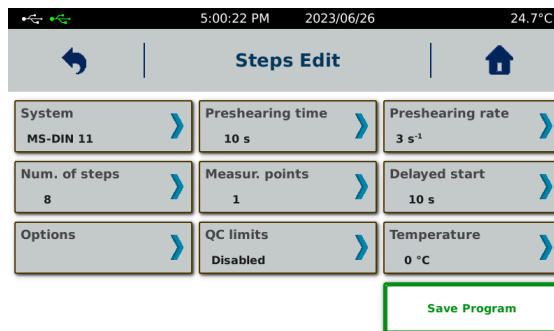
Clicking on "New step" will display the instrument's display on it.



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

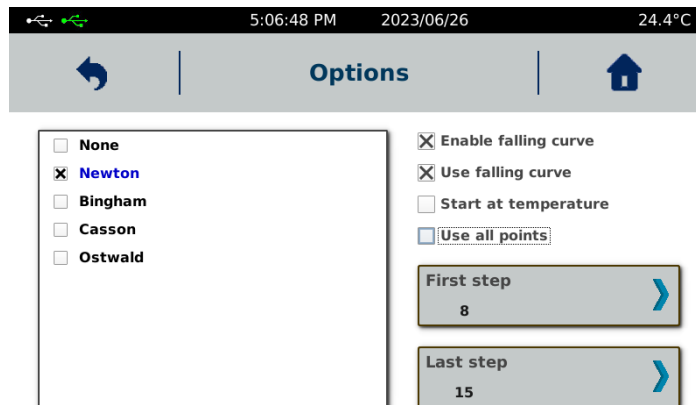
The new display now shows the number of steps in your program. The function "Measur. Points" means number of points for each step, the ideal value being 1. However, when programming a method containing only one step, it is recommended to put a larger number of points.



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

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

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

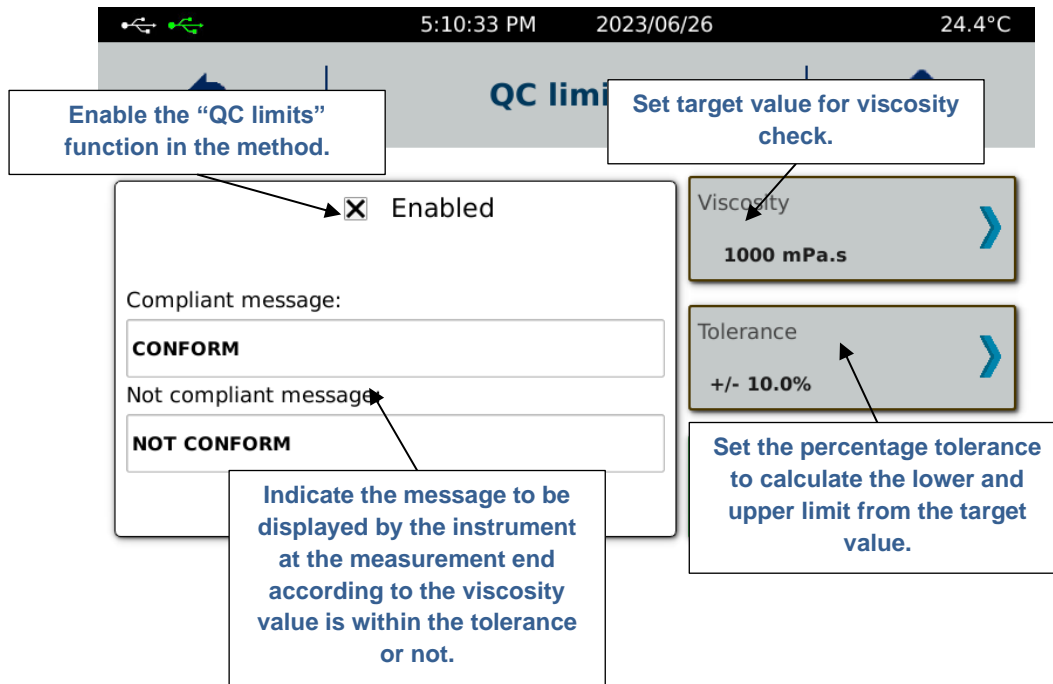


The "Start at temperature" function allows you to wait for the set temperature to be reached before starting the measurement. It is only available if your device is delivered with a temperature control that can be controlled by the instrument.

The "Use falling curve" function is used to automatically generate a measurement based on the steps and the number of points already filled in but made in the opposite direction (decreasing value).

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

The "QC limits" function makes it possible to verify that the measured viscosity value is between two limits that you have previously set. When choosing this function, the instrument displays the following view.

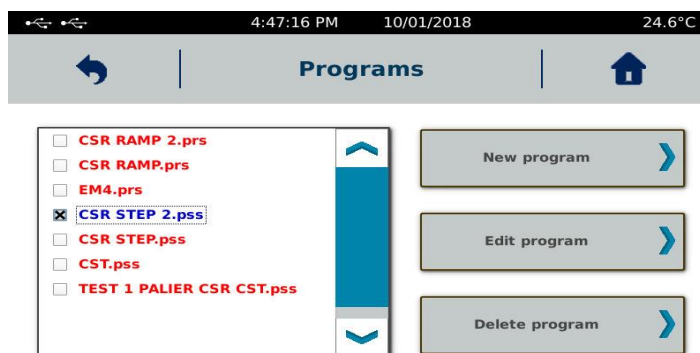


For this check, the instrument uses the last viscosity value measured in the last step. Do not forget to activate the "QC limits" function before validating to exit this window, otherwise the information will not be saved. At the measurement end according to the viscosity value is within the tolerance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

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

## 2.8.2 Edit program

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

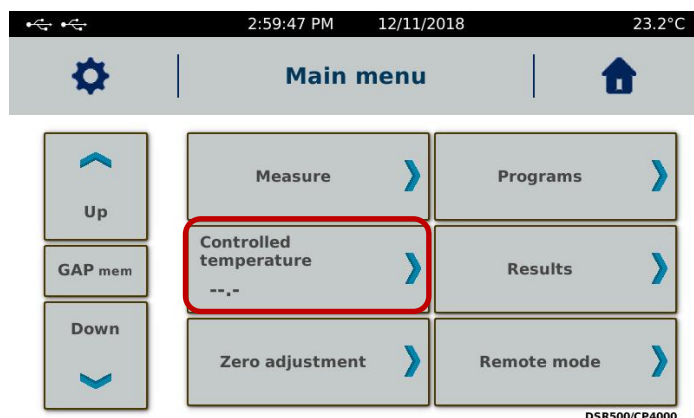


### 2.8.3 Delete program

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

## 2.9 Controlled temperature menu

This function is available on the main menu display.



As described in paragraph 2.3 and 2.8, this function is only available if your device is delivered with a temperature control that can be controlled (only for models N500400, N500410, N500420, N500430 and N500427). See section 3.2 to set the temperature of your methods with other models.

This mode does not allow temperature ramps to be carried out via the instrument. For this type of method, the use of RheoTex software is required.

Contrary to the use of the setpoint in a measurement method (see section 2.8), the use of this function is useful for controlling the temperature setting unit without performing a measurement. So, you can precondition your sample to the right temperature before starting the measurement.

## 3 MEASURING WITH YOUR DEVICE

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

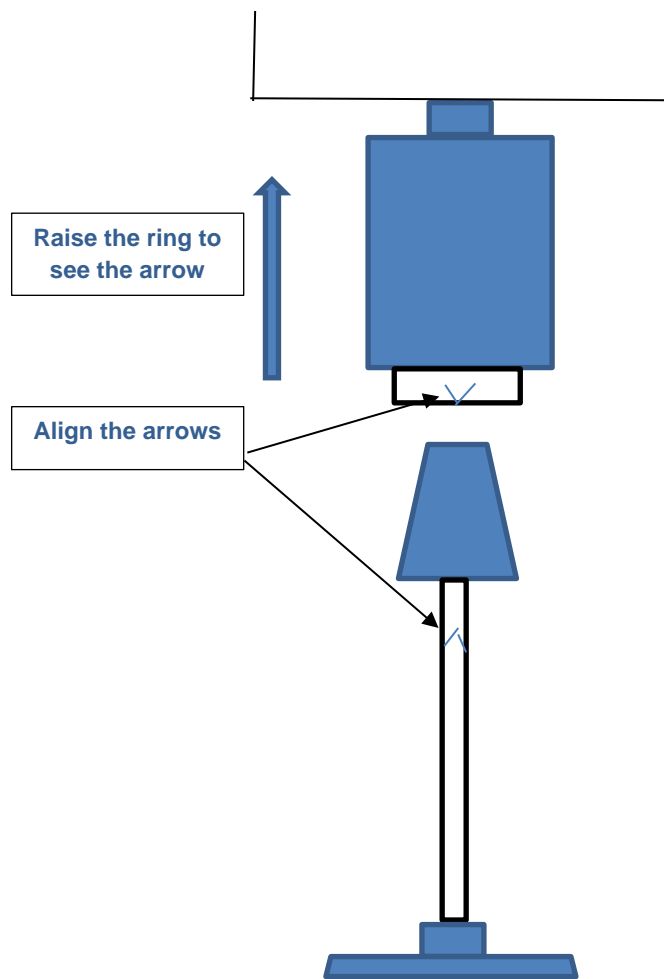
Instrument need to be installed before next section of this manual (see section 1.5).

### 3.1 Installation of measuring system

The coupling of the DSR500 CP4000 PLUS is of type AC 265. It is a system allowing the insertion and the quick fixing of the measuring mobiles. A simple vertical action of the ring upwards (release) or downwards (locking) allows easy manipulation of the measuring tool.



For a good rotation please respect the alignment of arrow on measuring cone and arrow on the coupling.



Models N500426 and N500427 allow the use of cylindrical rotors MS-DIN and MS-SV as well as vane rotors MS-VANE (in an MB-DIN cup). The AC265-BAYONET adapter is supplied with your device. It allows the use of bayonet coupling pins like MS-DIN, MS-SV and MS-VANE. To use it, you must unscrew the small screw of this adapter, insert the bayonet side of the pin inside the hole and lock it with the tool provided. Please do not insert it too much and check that only the conical part of the bayonet pin shaft is visible. These models contain an adapter (see section 1.1) to be fitted before inserting the MB-DIN or MB-SV cups.

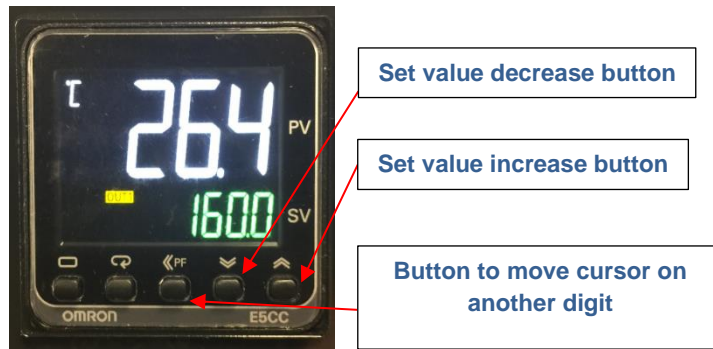


### 3.2 Temperature settings

This section only applies to models N500400, N500410, N500420, N500430 and N500427. For other models, please refer to section 2.9.

The value read on this display is the set temperature. The value read on the screen of the DSR500 CP4000 PLUS is the actual value of temperature.

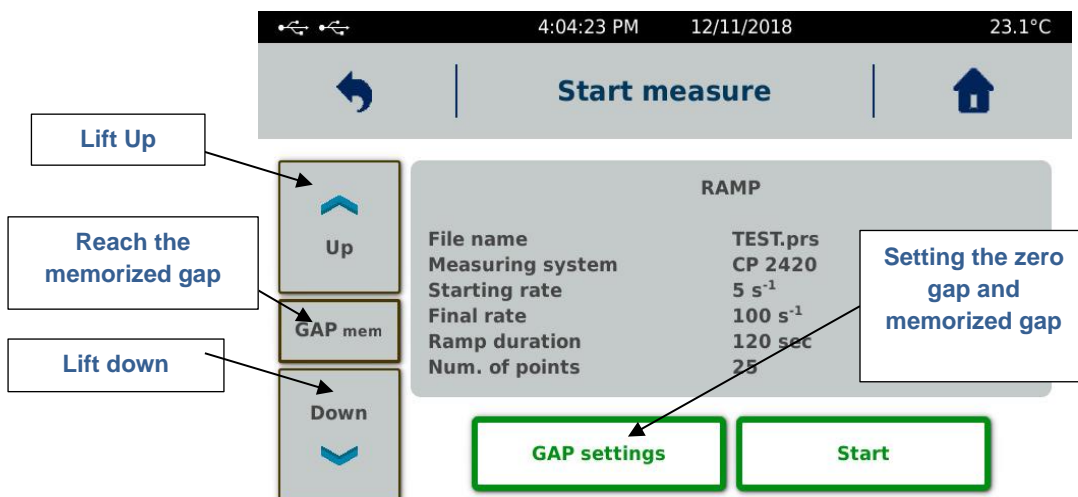
To change the setpoint, press the arrows to adjust the desired temperature, the new setpoint will be taken into account after a few seconds without validation



### 3.3 Gap settings

Gap adjustment is required before each measurement. It allows you to realize the contact position (also called zero gap), to memorize the measuring position and to place the geometry at this position in order to realize your measurement.

Elevator functions are available when you select the "Measure" tab on the main screen. Then you are in Measure windows, you can see settings for gap.

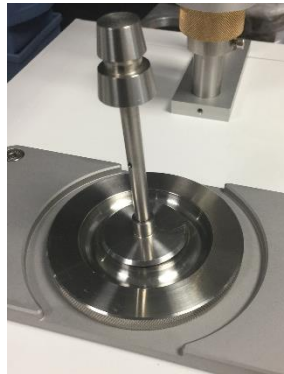




Each Measuring system can have its own positioning gap for measurement. To set this memorized gap or to make zero gap, you have to click on "GAP setting".

Your DSR500 CP4000 PLUS is equipped with an automatic lift device. Setting the zero gap is very important for the measuring position to be as ideal as possible. This adjustment must be done with the mobile, without sample, at the measuring temperature and be renewed temperature is different. Please also clean correctly upper and lower part before you start this procedure.

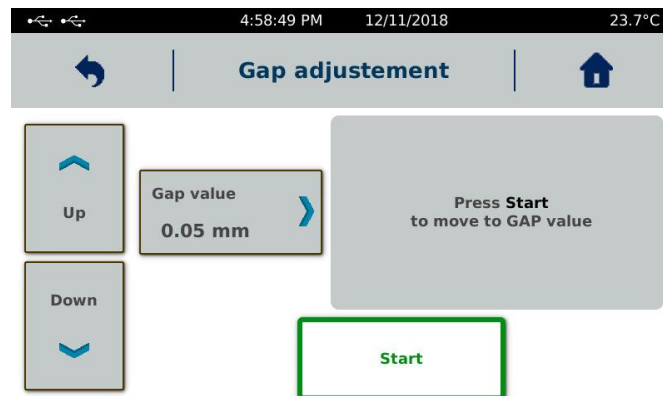
The first step is to select the mobile you have chosen for your measurement by pressing "Measuring System" (see screen on previous page). Indeed, if you change mobile later, the zero gap will no longer be valid and must be redone for the new measuring system you have selected. In the case of a measurement using a program (see section 2.3.2), it is preferable to load the protocol by selecting it before setting the zero gap. You must then warm up your measuring platform (see section 2.9 or 3.2 according model). You must also, especially if the set temperature is different from that of the room, put the measuring geometry on the lower plate to put it also in temperature.



When the temperature is stabilized, you must leave your geometry at least 5 minutes in this position.

You can then fix the mobile on the measuring head (see section 3.1) before accessing the next step.

Select "GAP setting" to access this screen.



Enter the desired measuring position value by selecting "GAP value". For a measuring system with truncation (part number starting with 365...), this value must be set to 0.05mm. For a system without truncation, the position must be set to 0.01mm. For a plate geometry, the measuring position can be set between 0.150 mm and 2 mm.

Once the position has been memorized, press the "down" arrow to reach a position above 1cm from the base and select "Start" to reach the zero gap.

Once the zero gap has been found, the lift will automatically place the geometry at the memorized position and you will get this screen then zero will be done.

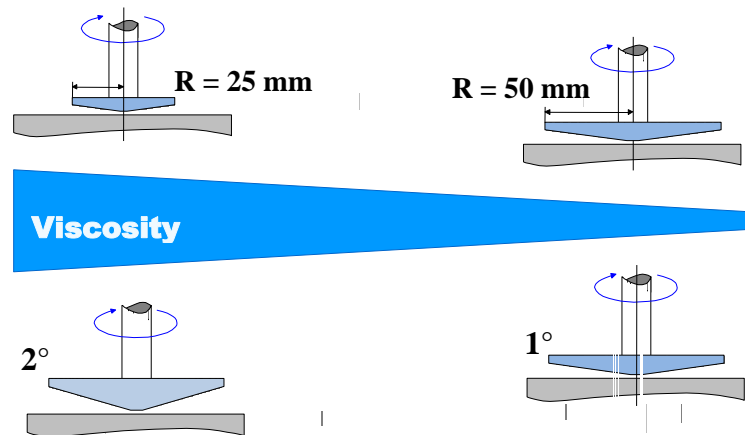


Once this step is completed, go to the "Measure" tab by pressing "Home" button and then "Measure". You can pull up the measuring head by pressing the arrow upwards, leaving enough space to place your product to measure. Then place your product as explained in paragraph 3.4 and then press the "mem GAP" button. The measuring head will go to the measuring position. Remove excess product, if necessary, by using a non-metallic soft tool with 90° angle.

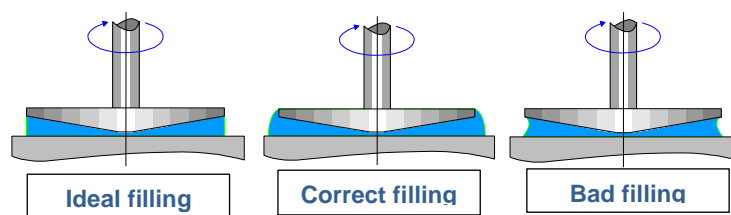
You can make your measurement after that (see section 2.3).

### 3.4 MS CP/MS-PP

Cone-plane or plane-plane measurement systems standardized DIN / ISO 3219 (316L stainless steel). These systems make it possible to fix the shear gradient in order to carry out viscosity measurements or to obtain curves allowing the study of the flow behaviour, the flow threshold or the thixotropy. They are particularly suitable for the control or development of homogeneous products with a liquid aspect without particles. Choice of measuring system must be done according to the product to be measured. Favor wide diameters for low viscosities as shown on diagram below.



After installing the measurement geometry (see section 3.1), you must set the air gap as described in section 3.3. The amount of sample should be sufficient to completely fill the space between the cone and the bottom. In the case of a liquid sample, you can take the recommended volume for the dimensions of your cone-plane (see table below). For thicker samples, you need to draw enough with a spatula or similar tool.













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

Sample volume for Plate measuring system depends on gap used. But filling need to be perfect as for cone. You can now perform your measurement by going to paragraph 2.3. After the measurement is completed, please remove the geometry before cleaning it.

### 3.5 MS DINS (models N500426 and N500427)

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	111875i	
CAP-DIN 1	112872	
CAP-DIN 2	112877	
CAP-DIN 3	112878	
MB-DIN 1 S Tube	112933	
MB-DIN 2 S Tube	112948	
MB-DIN 3 S Tube	112944	

Complete configurations include MB-DINXS tube, a MK-DIN cylinder and a cap.

Measuring system		Spindle	Cup	Cap
Designation	Part Number	Designation	Designation	Designation
MS DIN 11S	112809	MK-DIN1	MB-DIN1S	CAP-DIN1
MS DIN 12S		MK-DIN2	MB-DIN1S	CAP-DIN1
MS DIN 13S	112808	MK-DIN3	MB-DIN1S	CAP-DIN1
MS DIN 19S		MK-DIN9	MB-DIN1S	CAP-DIN1
MS DIN 22S	112815	MK-DIN2	MB-DIN2S	CAP-DIN2
MS DIN 33S	112814	MK-DIN3	MB-DIN3S	CAP-DIN3
MS DIN 23S		MK-DIN3	MB-DIN2S	CAP-DIN2

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

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

M for million, K for thousand, N for rotational speed (rpm)

\* Complete measuring system with spindle, cup and cap.

\*\* These values are given when complete system is used.

MB-DINXS tubes are used with the MK-DIN cylinders and CAP-DIN. 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.

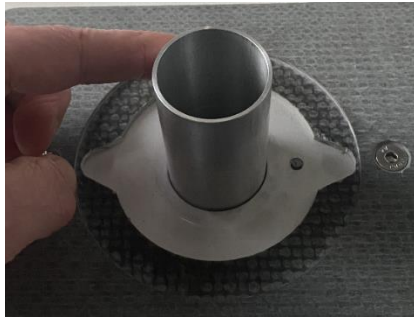


The first step is to install the cap on the tube as shown in the photo below. Also check that the gasket is properly installed on the cap. The first insertion of the cap can be difficult. You must use some silicone grease to facilitate installation.

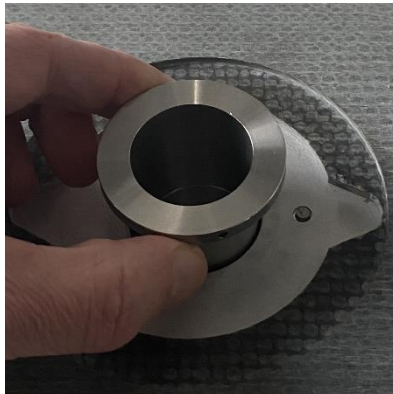
If necessary, remove the measuring plate in MS-CP/MS-PP.



Position the MB-DIN and MB-SV cup adapter. Insert it enough so that it does not protrude.



Then position the empty MB-DINS cup in the chamber.



Install the AC265-Bayonet adapter on the MK-DIN mobile (see section 3.1). Insert the geometry into the AC265 coupling of the instrument (see section 3.1).



Choose simple measurement parameters or a program in the instrument (see section 2.3) to have access to the adjustment of the gap (see section 3.3). Make sure the selected measurement geometry is correct (i.e. MS-DIN11).

Slowly lower the elevator to insert the MK-DIN cylinder into the cup. Do not go to the bottom of the cup. Select "Gap setting", enter the "GAP value" at least 5mm (10mm is recommended for MS-DIN measurement geometries). Click on "Start". The instrument will search for the bottom of the cup as the contact position and then go back to the "GAP value" that you entered previously.

Raise the elevator completely to allow you to remove the MK-DIN cylinder and the MB-DIN cup.

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



Put the MB-DIN cup back into the well of the instrument. Install the MK-DIN mobile again in the AC265 coupling. Descend with the elevator until the product to be measured is in contact with the MK-DIN mobile. Click on "GAP mem" so that the mobile reaches the position you have set before.

Once the installation is complete, you can take your measurement (see paragraph 2.3).

When your measurement is complete, it is advisable to remove the cylinder from the instrument shaft. The one will therefore rest in the tube. Raise the measuring head to the highest position using the lift. 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 to clean it. Remove the cap from the DIN tube to clean it.

### 3.6 MS SV (models N500426 and N500427)

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

These systems make it possible to measure products in small quantities by applying a shear rate up to temperatures of 70°C (according to models, see table).

Here are the available accessories:



**Measuring cylinder  
MK-SV**



**Measuring chamber  
MB-SV**

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 <sup>-1</sup> )	Viscosity range LR Device (mPa.s)	Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)	Viscosity range RM100/RM200/DSR500 (mPa.s)
Designation	Item	Designation	Item					
MK-SV414	116114	MB-SV6R	116206	3	0,4N	44 to 5,8M	440 to 95M	73 to 219M
MK-SV415	116115	MB-SV7R	116207	4,4	0,48N	15 to 2M	155 to 33M	26 to 77M
MK-SV416	116116	MB-SV8R	116208	4,6	0,29N	39 to 5,2M	394 to 85M	66 to 197M
MK-SV418	116118	MB-SV13R	116213	7,5	1,32N	1 to 120K	9 to 1,9M	2 to 4,5M
MK-SV421	116121			8	0,93N	1 to 188K	14 to 3M	2 to 7M
MK-SV425	116125			10	0,22N	174 to 23M	1,7K to 377M	291 to 870M
MK-SV427	116127			12	0,34N	7 to 0,99M	75 to 16M	12 to 37M
MK-SV428	116128			13	0,28N	15 to 1,9M	147 to 31M	24 to 73M
MK-SV429	116129			13	0,25N	29 to 3,9M	294 to 63M	49 to 146M
MK-SV431	116131			11	0,34N	10 to 1,3M	100 to 21M	16 to 49M
MK-SV434	116134			11	0,28N	19 to 2,5M	194 to 41M	32 to 96M
MK-SVC	116002			13	0,43N	3 to 420K	32 to 6,8M	5 to 15M

M for million, K for thousand, N for rotational speed (rpm).

MK-SV cylinders are used with MB-SV13R, MB-SV6R, MB-SV7R and MB-SV8R chambers.

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

If necessary, remove the measuring plate in MS-CP/MS-PP.

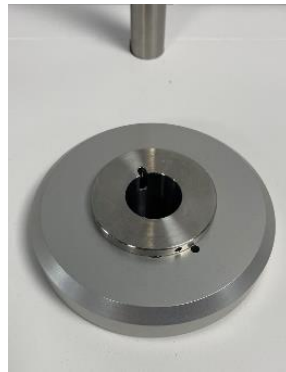


Position the MB-DIN and MB-SV cup adapter. Insert it enough so that it does not protrude.





Then position the empty MB-SV cup in the chamber.



Install the AC265-Bayonet adapter on the MK-SV mobile (see section 3.1). Insert the geometry into the AC265 coupling of the instrument (see section 3.1).



Choose simple measurement parameters or a program in the instrument (see section 2.3) to have access to the adjustment of the gap (see section 3.3). Make sure the selected measurement geometry is correct (i.e. SV434).

Slowly lower the elevator to insert the MK-SV cylinder into the cup. Do not go to the bottom of the cup. Select "Gap setting", enter the "GAP value" at least 5mm (10mm is recommended for MS-SV measurement geometries). Click on "Start". The instrument will search for the bottom of the cup as the contact position and then go back to the "GAP value" that you entered previously.

Raise the elevator completely to allow you to remove the MK-SV cylinder and the MB-SV cup. You can then put the product to be measured in the cup. The required volume is indicated in the table on the previous page according to the system used. Put the MB-SV cup back into the well of the instrument. Install the MK-SV mobile again in the AC265 coupling. Descend with the elevator until the product to be measured is in contact with the MK-SV mobile. Click on "GAP mem" so that the mobile reaches the position you have set before.

Once the installation is complete, you can take your measurement (see paragraph 2.3).

When your measurement is complete, it is advisable to remove the cylinder from the instrument shaft. The one will therefore rest in the tube. Raise the measuring head to the highest position using the lift. 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 to clean it.



### 3.7 MS-VANES (models N500426 and N500427)

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.



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

Designation	Part Number	Diameter (mm)	Length (mm)	Viscosity range LR Device (mPa.s)	Viscosity range B-ONE/FIRST/FIRST PRO/FIRST PRODIG (mPa.s)	Viscosity range RM100/RM200/DSR500 (mPa.s)
MK-V72**	120017	21,67	43,38	5,6 to 74K	56 to 1,2M	9,4 to 2,8M
MK-V73**	111108	12,67	25,35	28 to 370K	280 to 6M	46 to 13M
MK-V74**	111115	5,89	11,76	280 to 3,7M	2,8K to 60M	463 to 139M
MK-V75**	111111	8,026	16,05	111 to 1,4M	1,1K to 24M	185 to 55M
MK-V72/2**	111112	21,67	20	54 to 720K	540 to 11M	90 to 27M
MK-V72/4**	111113	21,67	10	80 to 1M	800 to 17M	133 to 40M
MK-V72-6P*	111121	21,67	43	30 to 400K	300 to 6,5M	50 to 15M
MK-VT105**	440105	5	10	430 to 5,8M	4,4K to 94M	726 to 218M
MK-VT2010**	442010	10	20	82 to 1M	820 to 17M	137 to 41M
MK-VT2020**	442020	20	20	12 to 150K	118 to 2,5M	20 to 5,9M
MK-VT3015**	443015	15	30	16 to 210K	160 to 3,4M	27 to 8M
MK-VT4020**	444020	20	40	7 to 90K	68 to 1,4M	11 to 3,4M
MK-VT5025**	445025	25	50	4 to 45K	34 to 730K	6 to 1,7M

M for million, K for thousand

\* VANE 6 BLADES.

\*\* These items can be used with tube MB-DIN1S (P.N.112933).

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

The use of MS-VANES spindles is done exclusively with the MB-DIN1S measuring cup (112933). Please follow the instructions in section 3.5. The MK-DIN mobile being here replaced by the MK-Vanes mobile present in the table above.

## 4 VERIFICATION OF YOUR DEVICE

Your instrument is calibrated at the factory with an 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.

You can nevertheless check your DSR500 CP4000 PLUS using your own geometry and a Newtonian standard oil of known and certified viscosity (preferably close to 1000 mPa.s). The tolerance on the accuracy of the viscosity measurement is at best 10% of the expected value with a cone-plane at a temperature whose viscosity value is known.

Here is the procedure to follow for your verification.

### **Viscosity measurement on a 1000 mPa.s standard silicon oil with a MS-CP measuring system.**

Follow the instructions in paragraph 3.5 and 3.4 for placement.

- Perform a motor zero (see section 2.5).
- Warm up your geometry and the lower plane according to the procedure described in paragraphs 3.2 and 3.3.
- Install your measuring system (see section 3.1).
- Set Gap as described in section 3.3.
- Put standard oil on lower plate and lowering measuring cone in measuring position (see section 3.4 to check good filling of gap).
- Select a measurement method in manual mode by choosing a measuring time of 120s minimum and a shear of 100 s<sup>-1</sup> (see section 2.3).

**Result at the end of the measurement must be within +/-10% of the standard viscosity value. If the measure is out, your instrument might need to be recalibrated.**

### **Viscosity measurement on a 1000 mPa.s standard silicon oil with a defined DIN11S measuring system (models N240256 and N240257).**

Follow the instructions in paragraph 3.5 for placement.

- Zero your instrument as described in paragraph 2.5.
- Install the MK-DIN 1 measuring spindle and the MB-DIN1S measuring bucket (see paragraph 3.5).
- Adjust the zero gap as described in paragraph 3.5.
- Remove the MB-DIN1 tube then fill it with oil and install it again on the base of the instrument.
- Place in measurement position as described in paragraph 3.5. Wait for temperature stabilization.
- Select the DIN11 measurement system on the instrument, select 50 s<sup>-1</sup> for the speed, select 30 seconds for the measurement time and start the measurement (see paragraph 2.3).

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

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



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