



**LAMY**  
**RHEOLOGY**  
INSTRUMENTS

# USING MANUAL B-ONE PLUS





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## 1. INTRODUCTION

The B-ONE PLUS 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  $\eta$  for viscosity in Pa.s,  $\tau$  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  $K_{\tau}$  and  $K_D$  constants used depend on the measuring system selected for the measurement.

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

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

The viscometer is constituted with a continuous current motor with an optical encoder, in order to warranty a great accuracy of the speed of rotation of bob, on all torque range.

The viscometer has an easy touch screen display, on which you could read the **speed**, **measuring spindle** reference, the measured torque and the dynamic **viscosity** in **mPa.s (=cPoises) or Pa.s**.

The Viscometer B-ONE PLUS can be used with different measuring system. You will find below a list of compatible measuring system with this viscometer.

- **MS ASTM:** 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 or in 600 or 150ml beakers.

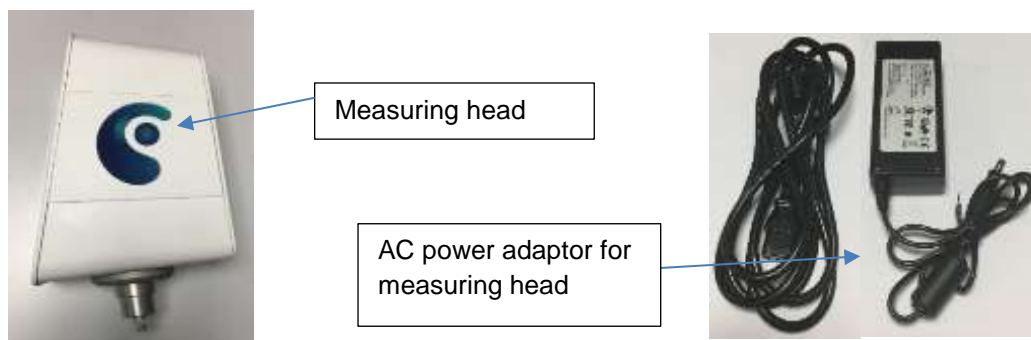
- **MS SV:** Measuring systems for low volumes (316L stainless steel). These systems, unlike the MS-ASTM and MS-DIN systems, make it possible to measure products in small quantities by applying a shear rate up to temperatures of 200 ° C (according to models, see table). With RT1, these systems are compatible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

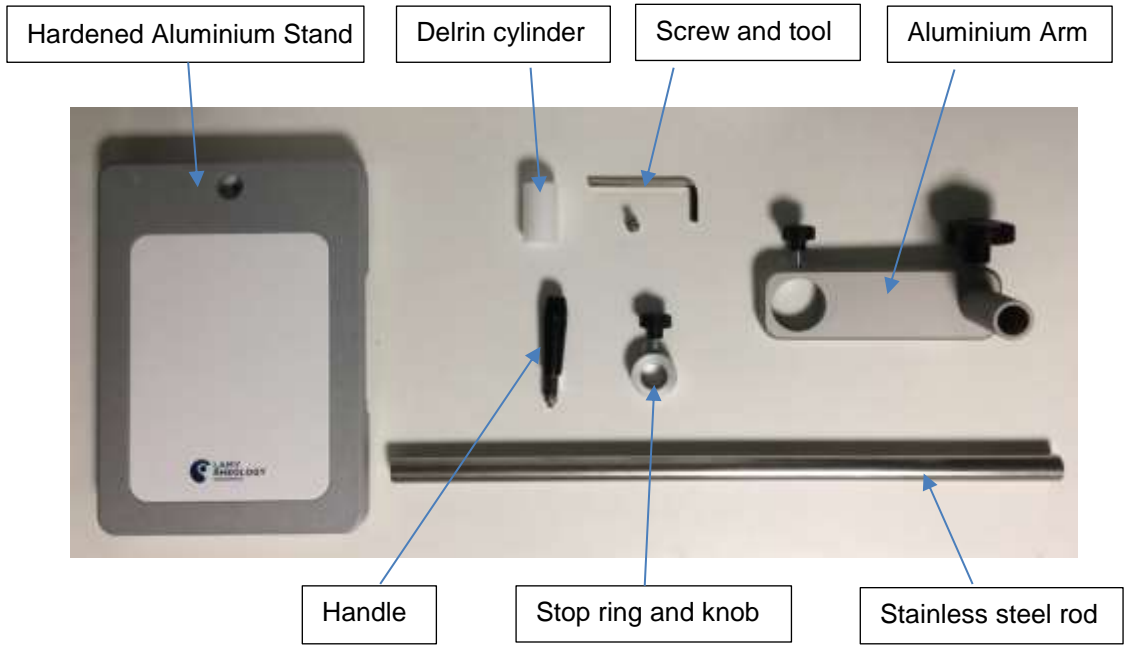
### 1.1. COMPONENTS

Viscometer is delivered inside a foam protection to avoid any problem during transport. According to your order this foam can be inside a box or a carrying case and can contain measuring system.



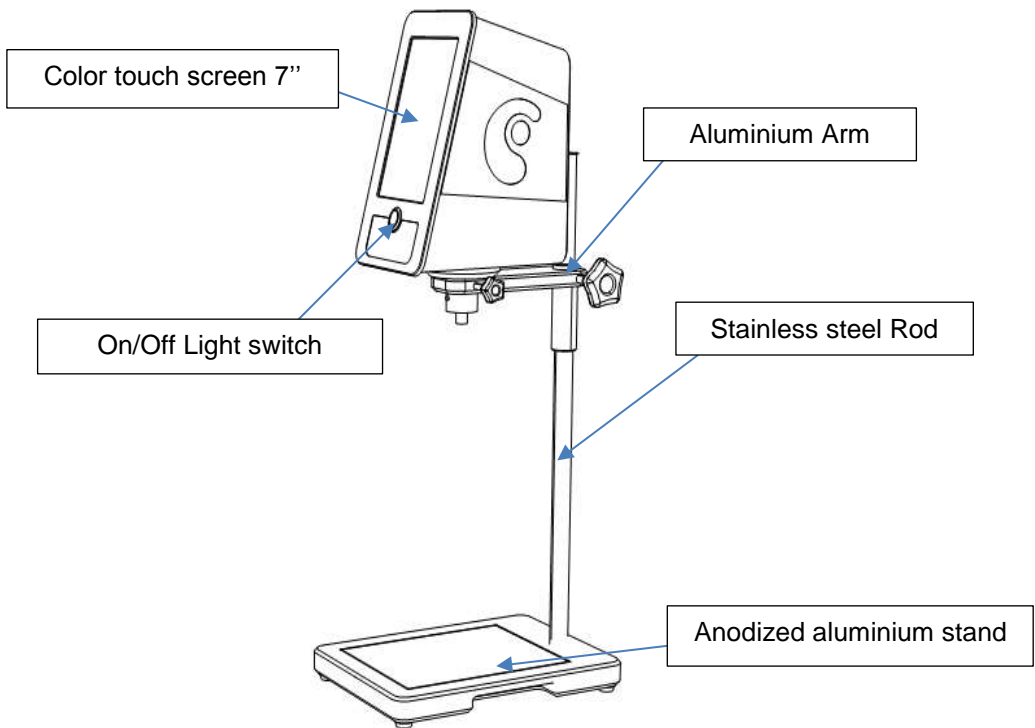
In detail, you will find different part in your box as shown below.





**1.2. GENERAL VIEW OF YOUR DEVICE**

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

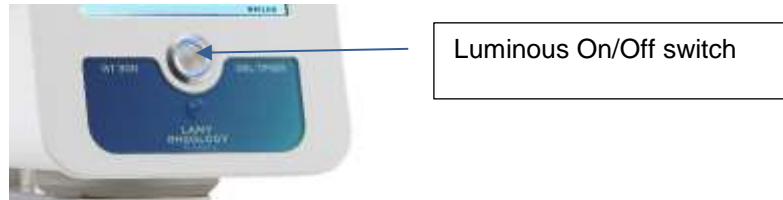


- TOUCH Screen

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.

- On / Off Switch

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



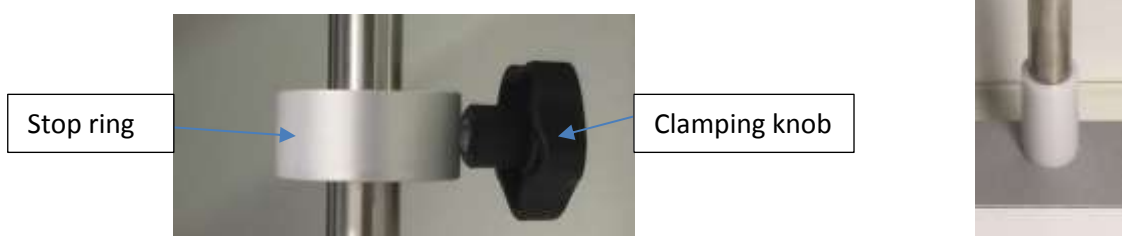
- Aluminium arm

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



- Stainless steel rod

The support rod is made of stainless steel for a solid hold of the measuring head. It has a very long life. It is equipped with a ring with a clamping button that is used as a stop for a repeatable positioning during the measurement.



The rod is equipped with a white Teflon ring acting as a stop, thus avoiding the arm being in a position that is too low.

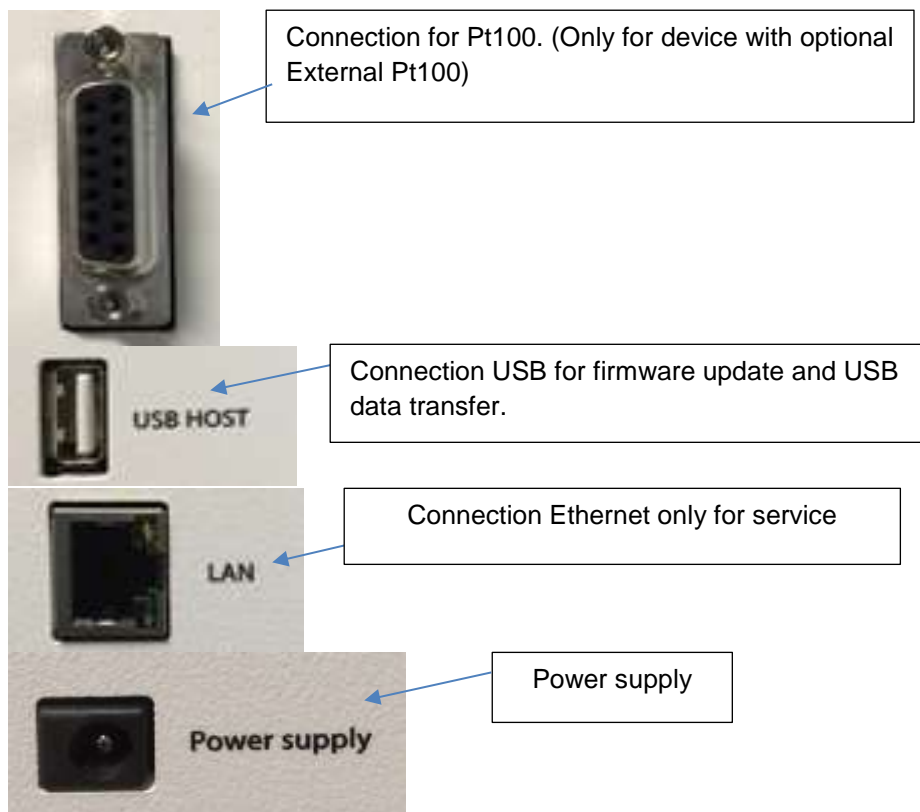
- Anodized aluminium support

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



### 1.3. CONNEXIONS

According to your order, rear panel of device get this available connexions.





## 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.

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

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

**Display:** Viscosity – Speed – Torque – Time - (Temperature in option), Choice of viscosity units: cP/Poises or mPa.s / Pa.s

**Language:** French/English/Russian/Spanish

**Compatible measuring system:** MS ASTM, MS BV, MS VANE, MS KREBS, MS SV

**Compatible temperature control:** EVA LR-BV, RT-1, EVA MS DIN

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

**Connection:** USB

**Options:** Carry case (PN 100500), PT100 probe (PN 900026), Rack stand (PN P008000)

**Dimensions and weight:** Head: L180 x W135 x H250 mm, Hardened steel stand: L280 x W200 x H30 mm, Stainless steel rod: Length 500 mm, Weight: 6.7 kg

## 1.5. INSTALLATION

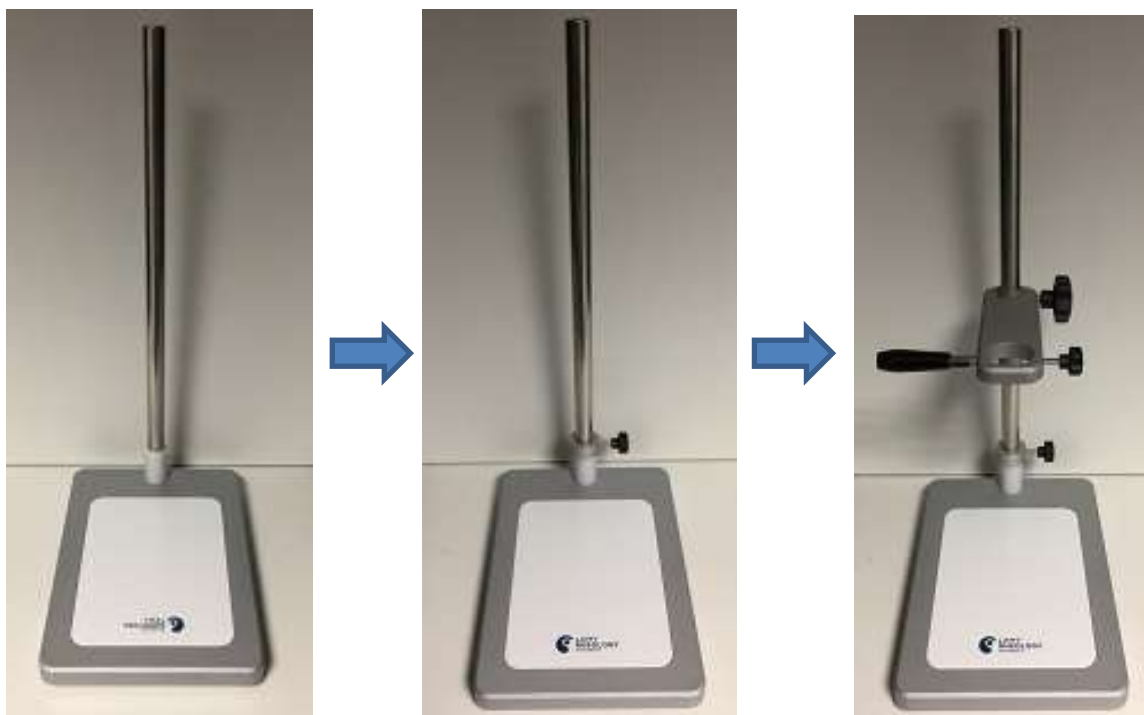
Your viscometer should be installed in a clean, vibration-free environment. Even if no level is necessary, choose a stable and flat table.

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

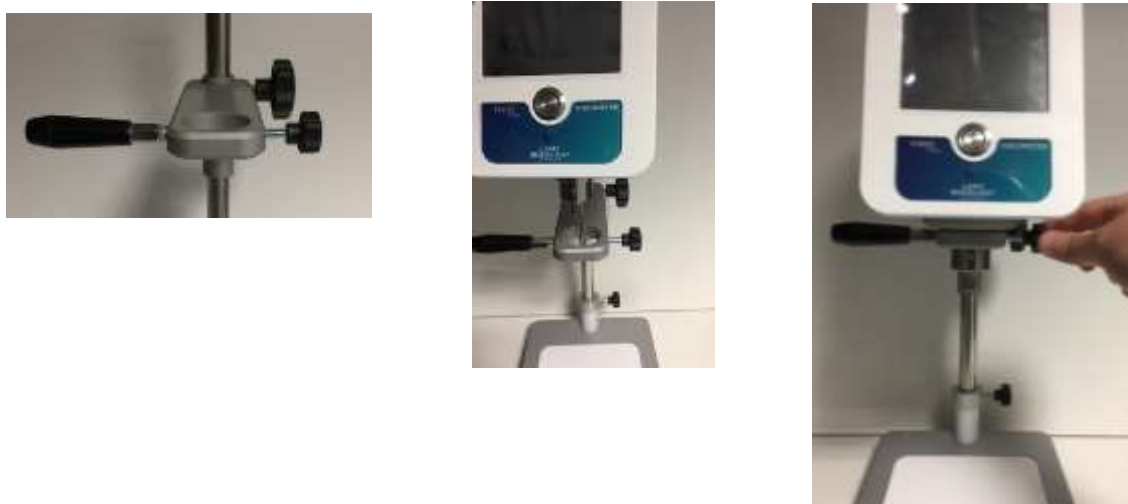
After unpacking all accessories from the box (or case if it is supplied), you must first screw the rod to the base with the help of the screw and the key provided.



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.



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.









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.

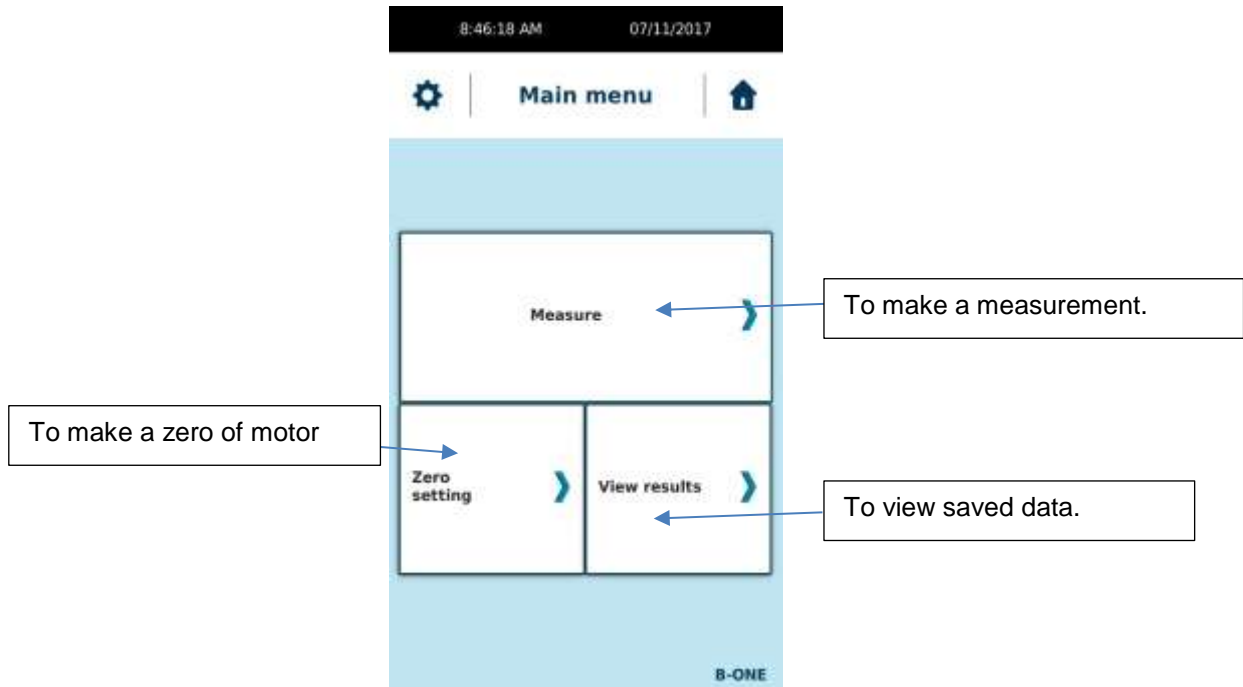
	No USB port used
	Port USB used
	Temperature reading of external Pt100 probe
	Enable to go to parameters of instrument.
	Enable to come back to Main Menu.
	Enable to come back to previous menu.

Some B-ONE PLUS are equipped with an external temperature sensor. When it has been ordered, the temperature display is shown at the top right of the screen. If this is not the case, see section 2.2.5.9 to enable reading. The USB port icon indicates that a USB flash drive has been connected. This is only used to update the firmware and cannot be used to transfer the results.

## 2.2. PRIMARY CONCEPTS

### 2.2.1. Main Menu

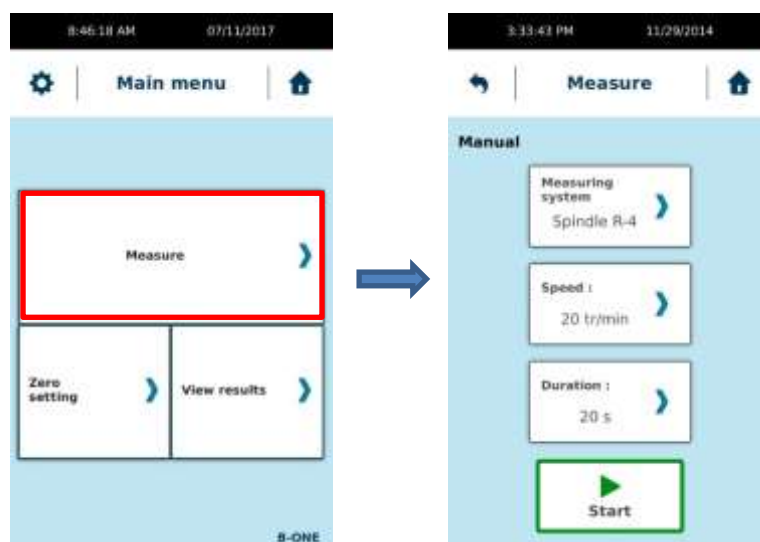
Main menu enable to you to browse between different tabs of your B-ONE PLUS. Acces is always available by clicking 



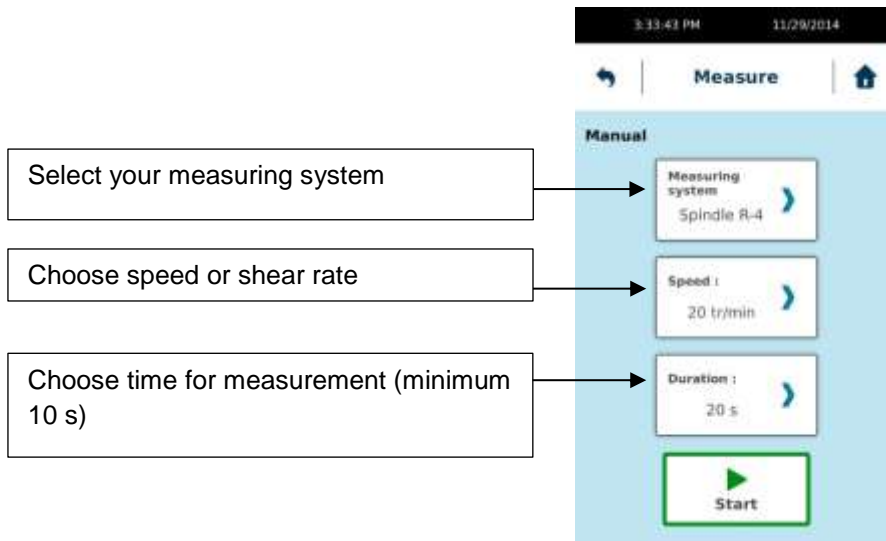
### 2.2.2. Measure

Measure tab is central part of your B-ONE PLUS. 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.



Manual Mode enables to choose your measurement parameters like «Measuring System », « Speed or shear rate» then « Time of measurement ».



**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.

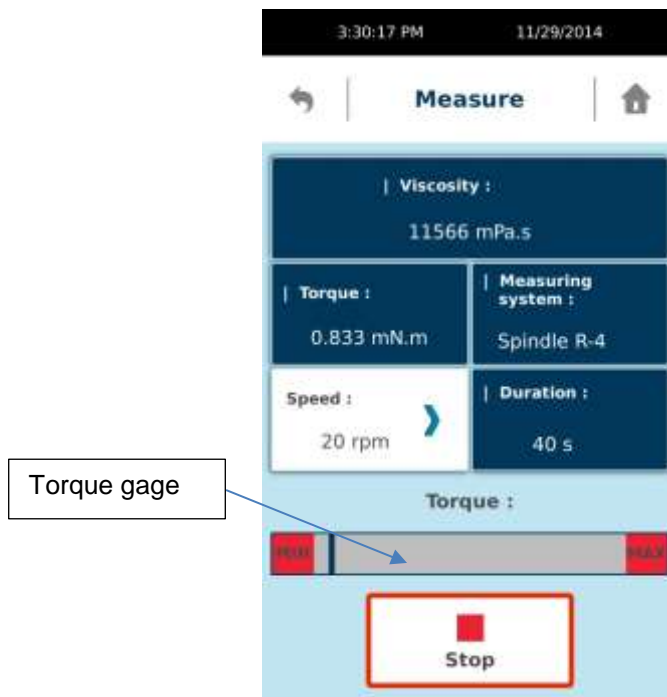
Choice between “Speed” or “Shear rate” is according to your measuring system. For MS ASTM, MS BV, MS KREBS and MS VANE, you should have only possibility to set the speed. For all other measuring system, you have to use shear rate. If you need to know what is the corresponding speed then you are using shear rate, you have to use constant  $K_D$  of your measuring system (information available in section 2.2.5.6).

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

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

Then your settings are ok, you can click “Start” to start your measurement. While your measurement, you will see a torque gage. Please try to not be closed to the upper and lower limit. Please increase speed or take a bigger measuring system if you are close to the lower limit. Please decrease speed or choose smaller measuring system if torque reading is close to the upper limit.

Picture below show how should be the closer position regarding lower limit.



Then your measurement is finished, you will get this windows below. You will find all data you need and get possibility to save them into internal memory. If you choose "Save", viscometer will ask you to give a name of your measurement. You will have after possibility to read it later (see section 2.2.3.).



### 2.2.3. View Result

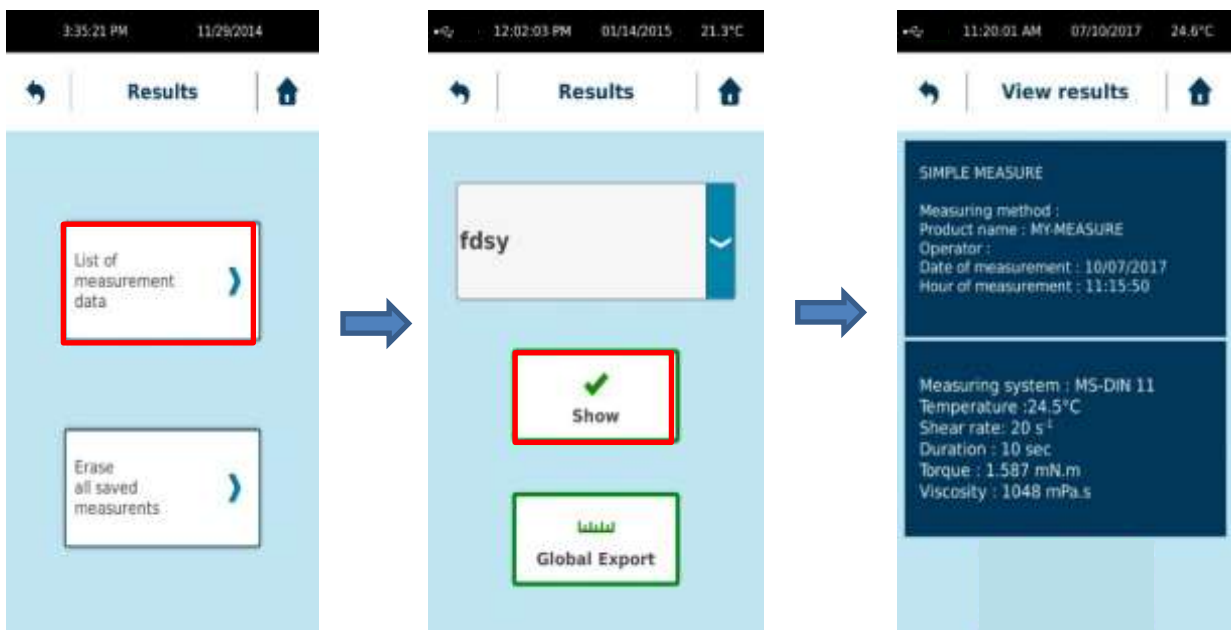
This menu allow you to read or delete data from internal memory. Press on « View results » tab in Main menu.



You will have two choice: See list of data to read them or delete data.

#### 2.2.3.1. Read saved data

By click on tab “List of measurement data” you could see all saved measurement made with your B-ONE PLUS. You could select which one you want to read.



By clicking on “Global Export”, you will have possibility to transfer all saved measure on USB stick (if connected).

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 key to your computer. Then open Excel, choose "File", "Open", taking care to select "All files \*.\*". Excel will offer you to convert your data by displaying three successive windows. Be careful not to change the options offered except on the second where it will be necessary to choose the option "semicolon" for the separation of the columns. You can then see your measurement results with the possibility to save a new file in Excel format.

#### 2.2.3.2. Delete saved data

By click on tab you could delete all saved measure one by one as you want from your B-ONE PLUS memory.



Then you click on “Delete”, saved data will be completely deleted from internal memory without any new confirmation.

#### 2.2.4. Zero setting

The zero setting allows you to calibrate your B-ONE PLUS to take account of the engine's empty friction. This operation must be done without measuring system. The rotational speed for zero adjustment is set at the factory. But if you want to change it, you can change it by going to the "Parameters" menu (see section 2.2.5.8). The shifting allows you to give you much more accurate measurements at specific speeds. The best speed for zero setting should be the same as for your measurement.



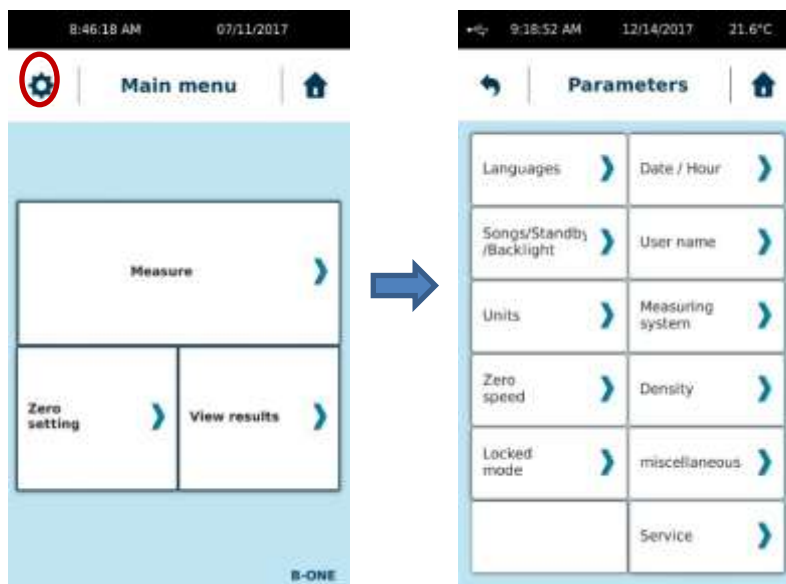


Then zero is finish you can click on OK and internal motor friction will be automatically saved inside memory of viscometer. If problem occur during zero setting, please try again. If problem still present, please contact your local distributor or society LAMY RHEOLOGY.

### 2.2.5. Parameters

This parameters menu allow you to change settings of your device. It is reachable by clicking on icon “wheel” in upper left corner of touch screen.

This icon is only available then you are in “Main menu”.



### 2.2.5.1. Languages

Enable you to select language of your B-ONE PLUS. You have choice between French, English, Russian and Spanish. 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


Enable you to adjust hour and date of your B-ONE PLUS.



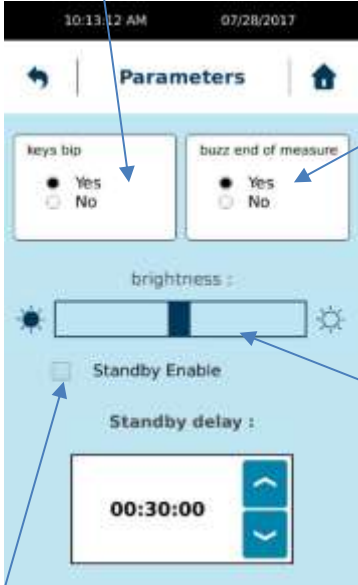
### 2.2.5.3. Sounds/Standby/Lighting

Allow you to modify sounds, lighting and activate or not the Standby mode of your B-ONE PLUS.

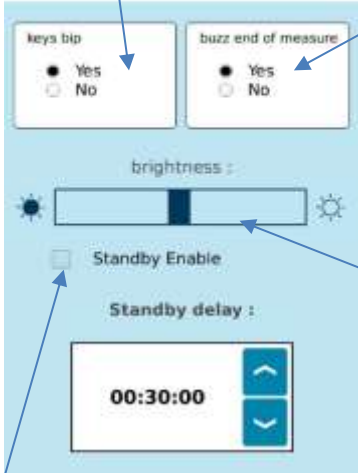
Choose if you want to get sound during using touch screen.




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



Choose if you want to change brightness of 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.



The image shows a sequence of four screenshots from a mobile application. The first screenshot shows the 'Parameters' menu with 'Songs/Standby/Backlight' highlighted in red. A blue arrow points to the second screenshot, which shows the 'Parameters' sub-menu with 'keys bip' and 'buzz end of measure' options, both with 'Yes' selected. A blue arrow points to the third screenshot, which shows the 'Parameters' sub-menu with a 'brightness' slider and a 'Standby Enable' checkbox. A blue arrow points to the fourth screenshot, which shows the 'Parameters' sub-menu with the 'Standby delay' time set to 00:30:00.

### 2.2.5.4. User Name

Operator mode will allow you to create different operators for your B-ONE. The use of the operators makes it possible to identify the person making the measurement. Operator management must always begin with the creation of the first account, which will become the administrator and thus create or delete another operator account.



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.



The image shows a sequence of two screenshots from a mobile application. The first screenshot shows the 'Parameters' menu with 'User name' highlighted in red. A blue arrow points to the second screenshot, which shows the 'Parameters' sub-menu with 'Create new User with PIN code' highlighted in red.

After specifying the name and password, the administrator will be named in red in the list.



You can now create another operator. The account of an operator may or may not be associated with a password (here called PIN code).

To delete an account, the administrator account must be used. Select the account you want to delete from the list and click on "Delete user name".



To use the operator accounts you must activate the mode. Device will ask you to select user name you want to use. By returning to the Main Menu, you will see the name of the operator in use. By clicking on the arrow below the name of the operator, you can switch off the B-ONE or change operator.



If the instrument is switched off and on while operator mode is activated, device will ask you to select the operator you want use.



### 2.2.5.5. Units

Enable to you to change unit of viscosity values.



### 2.2.5.6. Measuring System

Allows you to add or remove a Measurement System.



To create a measurement system, the instrument will ask for both constants and the name. You will find below list of measuring system compatible with your device and corresponding constant. You are not allow to change constant of existing measuring system. If you want to use new constant, you have to create a new measuring system with name as "Copy of..." and enter constant you want to use. Please remember that Constant KD is use to convert speed in shear rate and K $\tau$  to convert torque in shear stress. As shear rate and shear stress are using to calculate viscosity value, if you use different constant value, you will get different viscosity result.

#### MS BV

SYSTEM	K $\tau$ / 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 ASTM

SYSTEM	K $\tau$ / 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	100	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
VANE 72	157	1	0,5
VANE 72/2	270	1	0,5
VANE 72/4	400	1	0,5
VANE 72 6P	150	1	0,5
VANE 73	785	1	0,5
VANE 74	7850	1	0,5

## MS SV

SYSTEM	Ktau / 1 mNm in Pa	Kd / 1 RPM in S-1	Ri / Ra
MS-C/2-D	142.6	1.07	0.9
MS-C/2-3S	142.6	1.07	0.9
MS-D-D	328.6	0.175	0.5
MS-D-3S	328.6	0.175	0.5
MS-C-C	49.7	0.285	0.68
MS-C-D	62	1.07	0.9
MS-C18-C	35.1	0.997	0.9
MS-C19-C	33.1	2.04	0.95

### 2.2.5.7. Locked Mode

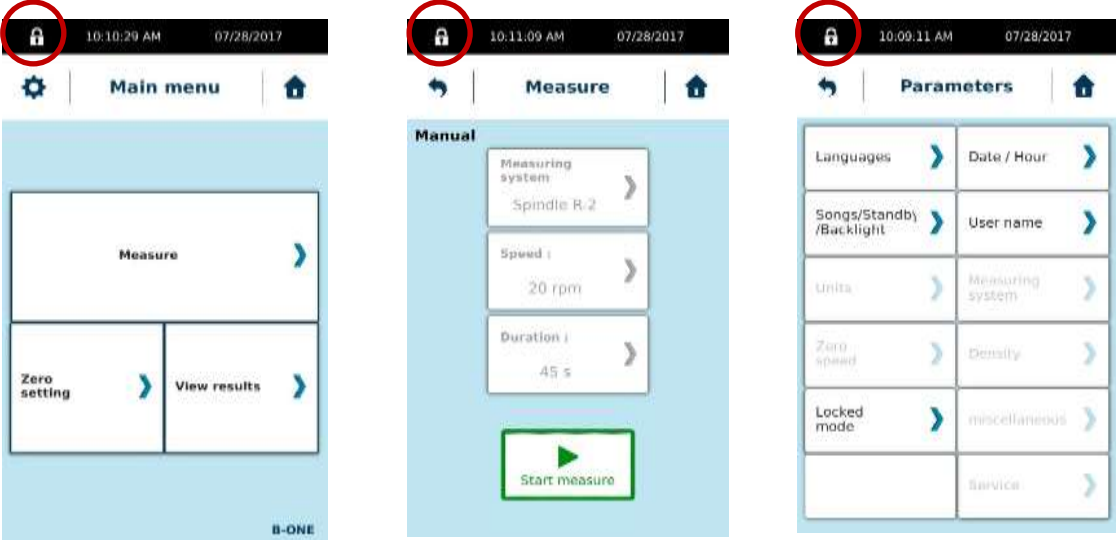
This option allow you to block measuring parameters and settings of your device. It should be set by an administrator or responsible of the device.

This function is not comparable to the “User name” menu (please see section 2.2.5.4). It should be use if you want to protect few settings on your device. All settings will be not lock by this function. You will see below which settings are concerned.

This function will block also parameters for measure. In this way, if you want to use all the time same parameters for measurement, you should enable this locked mode to be sure that nobody will change settings for measurement.

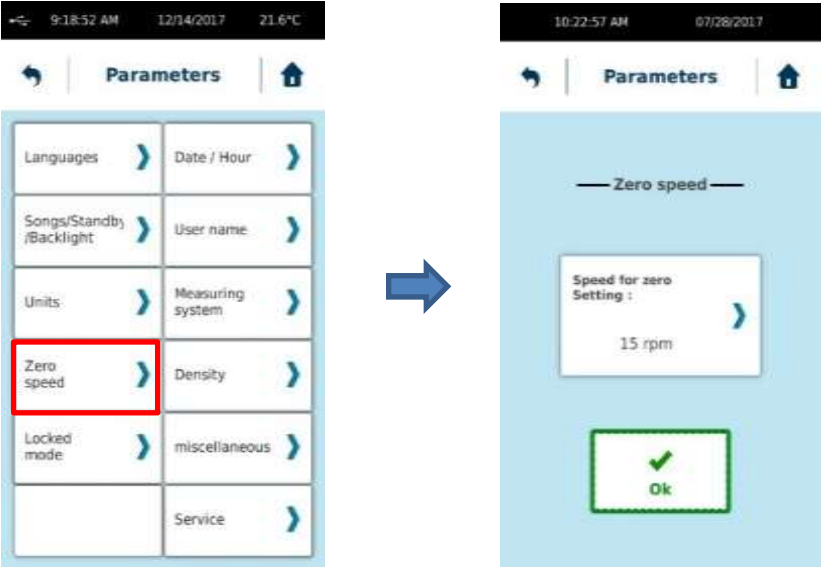


When you click "Enable", the B-ONE will ask you to save a 4-digit code that will be required to disable this protected mode. Each activation is independent and can be done with a different code. The protected mode is indicated by the presence of a padlock-like icon. **BUT TO DISABLE THIS LOCKED MODE, YOU SHOULD USE 4-digit CODE USED TO ENABLE IT.** Once protected mode is activated, you will see this icon on B-ONE Screen (see picture below). Protected mode protect programs, measuring parameters and some menu as shown on pictures below.



**2.2.5.8. Zero Speed**

Enable you to adjust the rpm value for the zero adjustment.

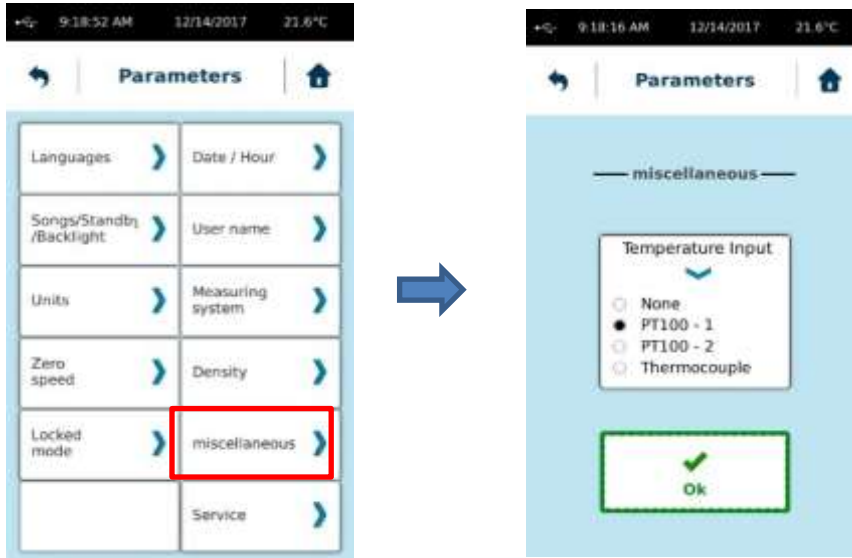


You have to use the same speed as for your viscosity measurement. Then zero setting is finished, you have to click "OK" to validate it.



### 2.2.5.9. Miscellaneous

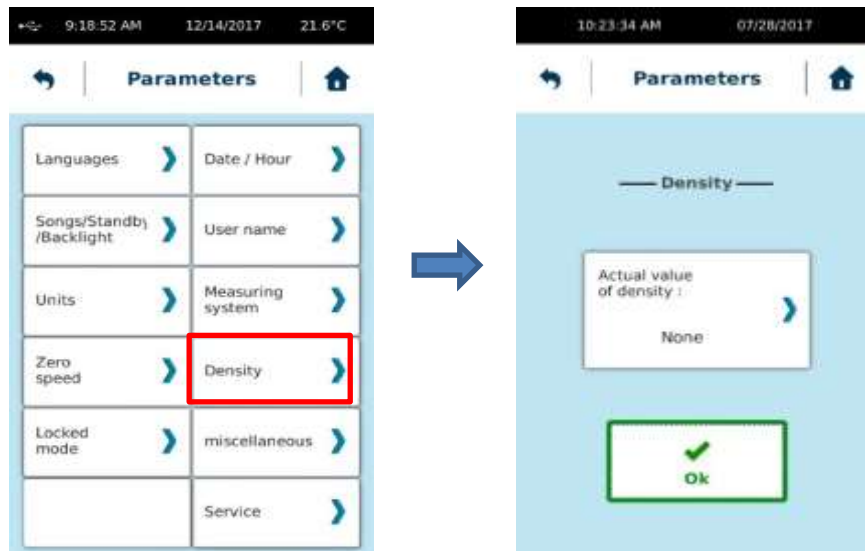
This menu allows you to select the temperature sensor used by the viscometer. The B-ONE allows the use of an external probe (Pt100-2) which must be connected to the back of the viscometer (see section 1.3).



The other input are not usable with B-ONE PLUS.

### 2.2.5.10. Density

Enable you to enter density value of your product to measure in order to calculate 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.

### 2.2.5.11. Service

Reserved to LAMY RHEOLOGY engineers.



## 3. MEASURING WITH YOUR DEVICE

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

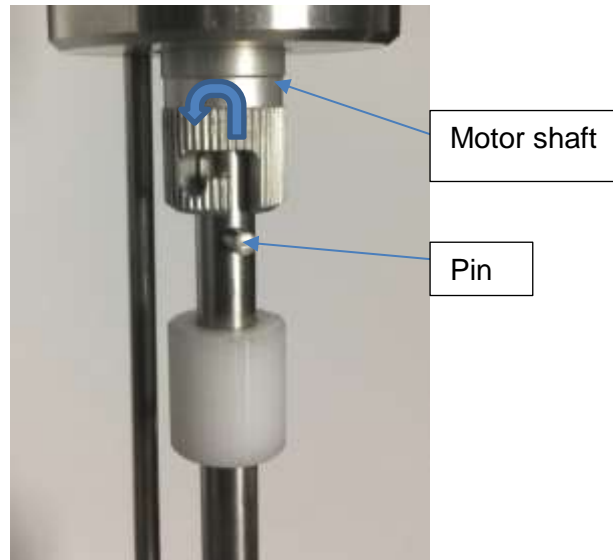
Viscometer need to be installed before next section of this manual (see section 1.5).

### 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 B-ONE PLUS 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 ASTM

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)
L-1 spindle	111010	Ø 18,80 - L 65,1
L-2 spindle	111011	Ø 18,72 - L 6,86
L-3 spindle	111012	Ø 12,60 - L 1,78
L-4 spindle	111013	Ø 3,20 - L 31
Axis R 1-6 without disc	111000	Threaded axis
R-1 Disc	111001	Ø 56,26
R-2 Disc	111002	Ø 46,93
R-3 Disc	111003	Ø 34,69
R-4 Disc	111004	Ø 27,30
R-5 Disc	111005	Ø 21,14
R-6 Disc	111006	Ø 14,62
Axis R-7	111007	Ø 3,20

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 <sup>b)</sup>		Viscosity range for FIRST/B-ONE (mPa.s)
RV1	111001 <sup>a)</sup>	111947	111948	100 to 0.6M
RV2	111002 <sup>a)</sup>			200 to 2.4M
RV3	111003 <sup>a)</sup>			300 to 6M
RV4	111004 <sup>a)</sup>			600 to 12M
RV5	111005 <sup>a)</sup>			1.2K to 24M
RV6	111006 <sup>a)</sup>			2.8K to 60M
RV7	111007			12K to 240M
LV1	111010	111014		200 to 4.3M
LV2	111011			1K to 20M
LV3	111012			4k to 82M
LV4	111013			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)

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

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

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

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

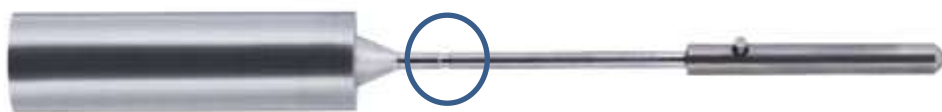
Place the measuring head in the highest position (use screw on aluminium arm as wrote in section 1.2) and make a zero of your viscometer (see section 2.2.4.).

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

Use handle to manipulate the device (see section 1.2), release screw on aluminium arm and go down to immerge the mobile in the product by tilting the beaker. Beware of air bubbles under the disk!



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



When the measurement height is optimum, use screw on arm to block height of measuring head. After you can use the stop ring on the support rod to memorize the position.



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 ASTM spindles.

Here below are all available spindle:

	Name	Part number	Dim. (mm)
	BV 1-100 Axis	117102	-
	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
	150-ml glass beaker	117150	Ø 50-52

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

Designation spindle	Part Number Spindle <sup>b)</sup>	Part Number Complete set <sup>c)</sup>	Viscosity range for FIRST/B-ONE (mPa.s)
BV1	117001 <sup>a)</sup>	117000	15 to 0.25M
BV10	117010 <sup>a)</sup>		100 to 2M
BV100	117100 <sup>a)</sup>		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) and make a zero of your viscometer (see section 2.2.4.).

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

Use handle to manipulate the device (see section 1.2), release screw on aluminium arm and go down to immerse the mobile in the product by tilting the beaker (see picture section 3.2). 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, you can use the stop ring on the support rod to memorize the position (see picture 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.

Here below are all available spindle:

Name	Part number	Dim. (mm)	
Vane 72	120017	Ø 21,67 - L 43,38	
Vane 73	111108	Ø 12,67 - L 25,35	
Vane 74	111115	Ø 5,89 - L 11,76	
Vane 72 6 blades	111121	Ø 21,67 - L 43,38	

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

Designation spindle <sup>a)</sup>	Part Number spindle	Diameter (mm)	Lenght (mm)	Shear rate range for FIRST/B-ONE (s <sup>-1</sup> )	Viscosity range for FIRST/B-ONE (mPa.s)
Vane 72	120017	22	43	0.3 to 250	314 to 6.8M
Vane 72/2	111112	22	20		540 to 11.7M
Vane 72/4	111113	22	10		800 to 17M
Vane 72-6P	111121	22	43		300 to 6.5M
Vane 73	111108	13	26		1.5K to 34M
Vane 74	111115	6	12		15.7K to 340M

M for millions, K for thousand

a) All Vane system get 4 blades (except PN 111121 6 blades).

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 B-ONE PLUS. 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) and make a zero of your viscometer (see section 2.2.4.).

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

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

Use handle to manipulate the device (see section 1.2), release screw on aluminium arm and go down to immerge the mobile in the product (see picture section 3.2).



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, you can use the stop ring on the support rod to memorize the position (see picture 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	1. 53,98
MK-75Y	111103	1. 42,88



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:

- 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) and make a zero of your viscometer (see section 2.2.4.).

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

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

Use handle to manipulate the device (see section 1.2), release screw on aluminium arm and go down to immerge the mobile in the product (see picture section 3.2).

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

When the measurement height is optimum, you can use the stop ring on the support rod to memorize the position (see picture section 3.2).

Start the measurement at the desired speed (200 rpm to get KU unit) and 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 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 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.

Here are the available accessories:

	Name	Part number
	MK-C/2 MK-D MK-C MK-C18 MK-C19	116010 111878 116002 112507 116015
	DIN3S Tube	112944
	C Tube with insert	116001
	MB-D Alu Cup	114319
	MB-C Alu Cup	114306
	D Insert	150500
	C Insert	111934
	ST-R centring tool	114436
	n°3 Cap	112878
	Delrin Cap	116005

All these accessories can be combined to obtain the following measuring systems:

Name of measuring system	Part number of complete measuring system	Measuring cylinder	Measuring cup	Holder for disposable cup	Measuring disposable cup (100)	Centring tool	Cap	Category
MS-C/2-D (disposable)	116020 <sup>a)</sup>	116010		150500	114319	114436		A
MS-C/2-3S	116021	116010	112944			114436	112878	B
MS-D-D (disposable)	116022 <sup>a)</sup>	111878		150500	114319	114436		A
MS-D-3S	116023	111878	112944			114436	112878	B
MS-C-C	116000 <sup>b)</sup>	116002	116001				116005	C
MS-C-C (disposable)	116024 <sup>a)</sup>	116002		111934	114306	114436		A
MS-C-D (disposable)	116025 <sup>a)</sup>	116002		150500	114319	114436		A
MS-C18-C	116026 <sup>b)</sup>	112507	116001				116005	C
MS-C18-C (disposable)	116027 <sup>a)</sup>	112507		111934	114306	114436		A
MS-C19-C	116028 <sup>b)</sup>	116015	116001				116005	C
MS-C19-C (disposable)	116029 <sup>a)</sup>	116015		111934	114306	114436		A

Measuring systems of category A can only be used with EVA DIN, RT1 and CT DIN temperature controllers. 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 EVA DIN, RT1 and CT DIN temperature controllers. They come with a reusable stainless steel measuring cup.

The measuring systems in category C can be used alone or with DIN EVA and CT DIN temperature regulations. They come with a measuring cup in stainless steel.

Here is the detailed technical information and measurement ranges:

Designation Complete Measuring System	Part Number Complete measuring system	Diameter (mm)		Sample volume (ml)	Shear rate range for FIRST (s <sup>-1</sup> )	Shear rate range for RM100-200 (s <sup>-1</sup> )	Viscosity range for FIRST (mPa.s)	Viscosity range for RM100-200 (mPa.s)
		inner	outer					
MS-C/2-D(disposable)	116020 <sup>a)</sup>	13.6	15	6.81	0.5 to 260	0.5 to 1.6K	280 to 3.7M	45 to 8.5M
MS-C/2-3S	116021	13.6	15	4.52				
MS-D-D(disposable)	116022 <sup>a)</sup>	7.5	15	8.85	0.1 to 43	0.1 to 260	3.8K to 42M	630 to 98M
MS-D-3S	116023	7.5	15	6.56				
MS-C-C	116000 <sup>b)</sup>	13.6	20	18.45	0.1 to 71	0.1 to 427	350 to 6.4M	58 to 15M
MS-C-C(disposable)	116024 <sup>a)</sup>	13.6	20	22.22				
MS-C-D(disposable)	116025 <sup>a)</sup>	13.6	15	3.04	0.5 to 267	0.5 to 1.6K	116 to 1.6M	20 to 3.7M
MS-C18-C	116026 <sup>b)</sup>	18	20	11				
MS-C18-C(disposable)	116027 <sup>a)</sup>	18	20	11	0.5 to 250	0.5 to 1.5K	71 to 0.9M	12 to 2M
MS-C19-C	116028 <sup>b)</sup>	19	20	9				
MS-C19-C(disposable)	116029 <sup>a)</sup>	19	20	9	1 to 510	1 to 3K	33 to 0.43M	6 to 1M

**3.6.1. Use of measuring system of category A**

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

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

Check that the motor has been adjusted before proceeding to the next steps (see section 2.2.4).

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



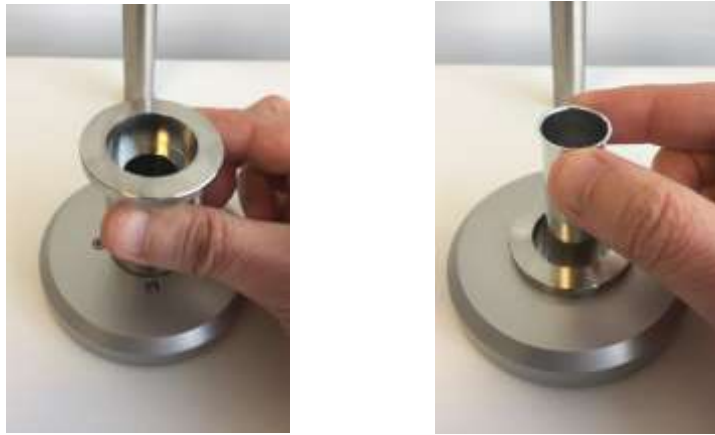
The screw locks the centring piece on the base of the viscometer.

You can then set up the cylinder on the bayonet coupling of the viscometer.



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, 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 mobile to clean it. Remove the disposable cup holder with 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.

### 3.6.2. Use of measuring system of category B

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

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

Check that the motor has been adjusted before proceeding to the next steps (see section 2.2.4).

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 base of the viscometer.

You can then set up the cylinder on the bayonet coupling of the viscometer.



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 required volume is indicated in the table in section 3.7 according to the system used.

Put the tube with your product inside the heat setting unit.



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, 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). 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 cup to clean it. Remove the cap from the tube to clean it. It should be necessary to clean the centring tool.

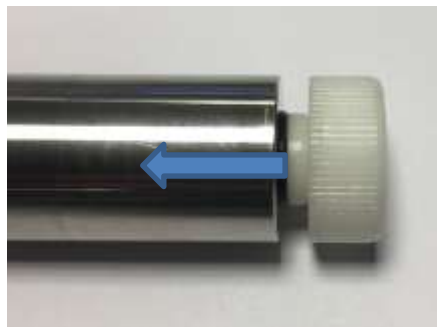
### 3.6.3. Use of measuring system of category C

These systems can therefore be used with or without a heating unit (DIN EVA and CT DIN). The cup used for these systems is the same (Ref 116001). This is fixed directly to the base 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).

Check that the motor has been adjusted before proceeding to the next steps (see section 2.2.4).

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 3.7 according to the system used.

You can then set up the cylinder on the bayonet coupling of the viscometer.

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.





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, 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.

#### 4. VERIFICATION OF YOUR DEVICE

Your instrument is calibrated at the factory with an ASTM R2 mobile and a certified oil with a viscosity close to 1000 mPa.s.

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

- See section 3.2 and 3.1 for detail about preparation.
- Adjust the automatic zero in the air at 50rpm, without any spindle, until it stops (see section 2.2.4).
- Fill the 600ml beaker with the standard oil.
- Insert the 600ml beaker in a controlled temperature unit like EVA LR system or thermostatic bath.
- Attach the spindle R2 to the viscometer and immerge the spindle in the oil at the good level (mark on the spindle).
- Wait for 15 minutes until the standard oil rise 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).

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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