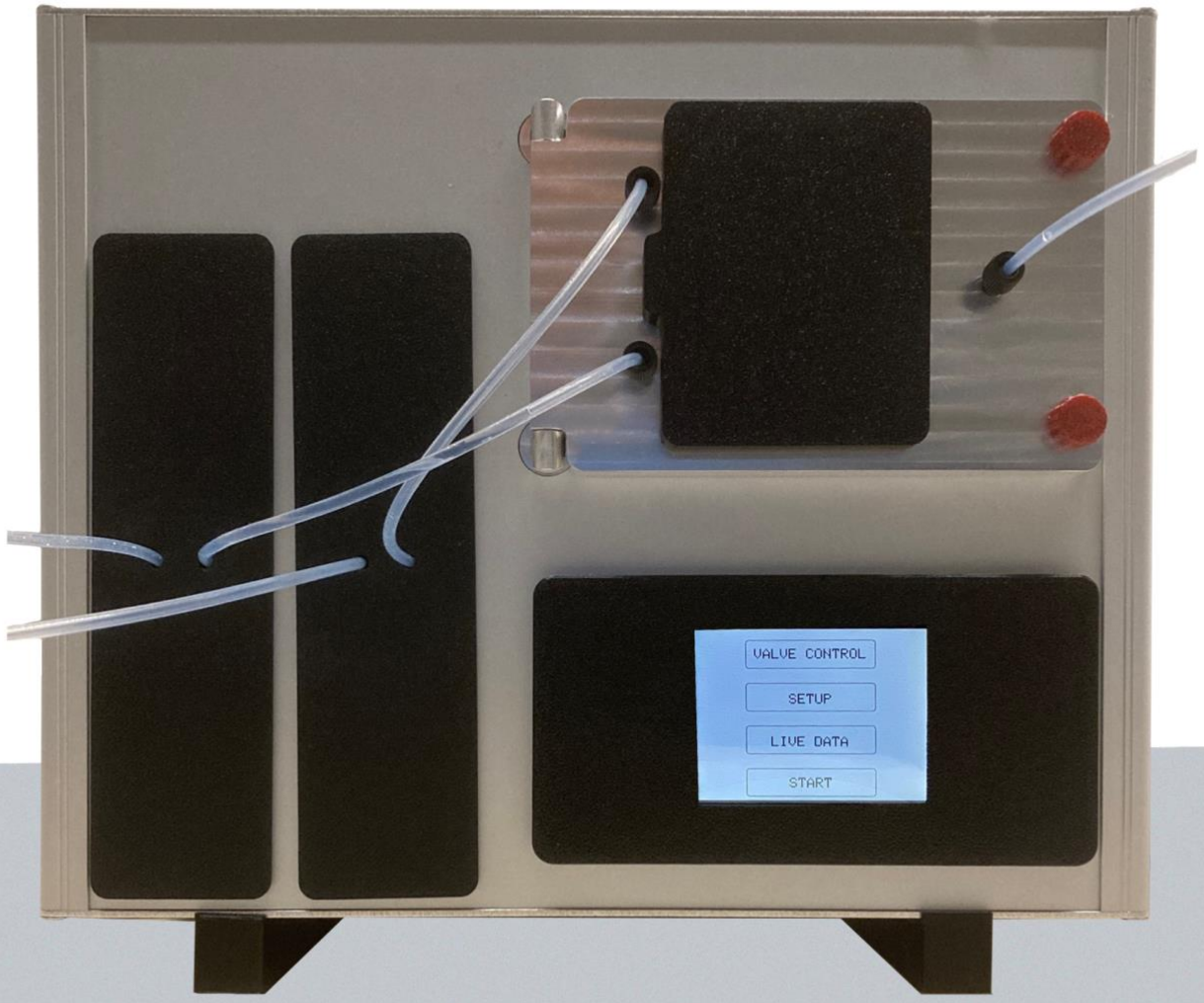
Functional description
LTF-phase separator



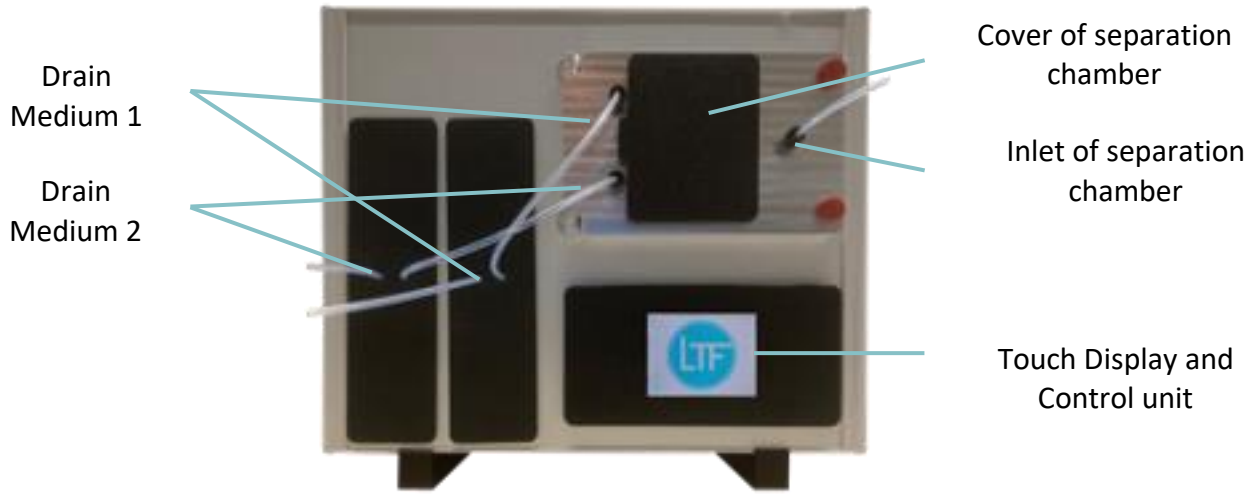
Inhaltsverzeichnis

1. Intended use

The phase separator is designed to separate two media into medium 1 (top) and medium 2 (bottom) on the basis of their different mass densities. The separation takes place in a so-called separation chamber made of glass. By means of a built-in control system, the separation takes place automatically after calibration to these two media.

2. Construction of the phase separator

The structure of the phase separator is shown below.



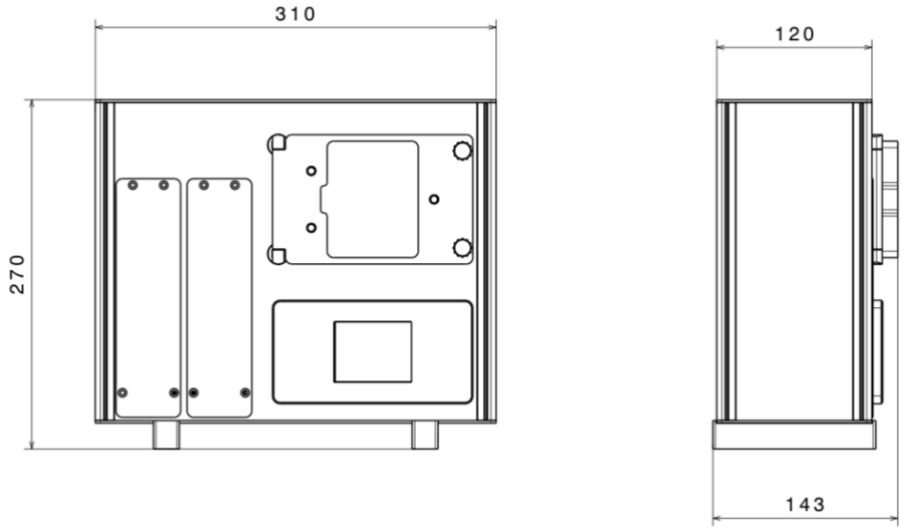
The phase separator is controlled via the touch display.

3. Functional description

For the separation of the two phases into medium 1 and medium 2 takes place in a separation chamber made of glass. Actively controlled valves connected to the two outlets of the separation chamber are used for this purpose. The position of the phase boundary between medium 1 and medium 2 is determined with a laser detector arrangement and the two valves for medium 1 and medium 2 are controlled accordingly. For this purpose, the phase separator regulates the position of the phase boundary in the separation chamber by controlling the valves for the two media.

In the basic version, the maximum inlet pressure to the separating chamber depends on the installed separating chamber. Version V012.00-4348 can be loaded up to 2 bar, version V012.00-4316 up to 3 bar.

4. Technical data



Dimensions (W x H x D):	310mm x 270mm x120mm
Weight:	4 kg
Permissible working temperature range:	5°C bis 35°C
Permissible media temperature:	5°C bis +50°C
Maximum allowable pressure:	2 bar (with separation chamber 8,75 ml; V012.00-4348) 3 bar (with separation chamber 6 ml; V012.00-4316)
Connection thread:	UNF 1/4“x28
Power supply:	through supplied power supply units
Main connection	230VAC (50 Hz)

5. Start phase separator

When the plug-in power supply unit is plugged in, the phase separator starts initializing the two valves. The upper valve of the separating chamber is then opened, the lower valve remains closed after initialization. The process takes about 30 seconds, after which the phase separator is ready for operation. This can be recognized by the display of the start menu.

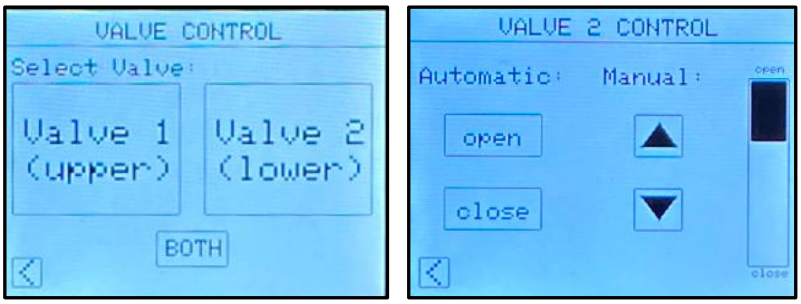
5.1. Start menu

After initialization, the following startup menu appears with the following options:

- **Valve Control** Manual control of the valves
- **Setup** Configuration laser and calibration to the media
- **Live Data** Sensors data
- **Start** Start of the control in the separation chamber

5.2. Valve Control:

The "Valve Control" menu item allows manual access to the valves.



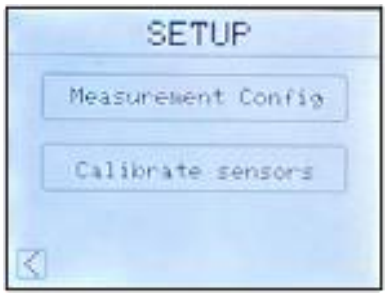
Valve 1 (upper): Open, Close or Manual in small steps, the status is shown on the right side.

Valve 2 (lower): Open, Close or Manual in small steps, the status is shown on the right side.

Both allows the control of the two valves simultaneously

5.3. Setup

The "Setup" menu contains the submenus for configuring the laser ("Measurement Config") and the routines for calibrating to the media to be separated ("Calibrate sensors").



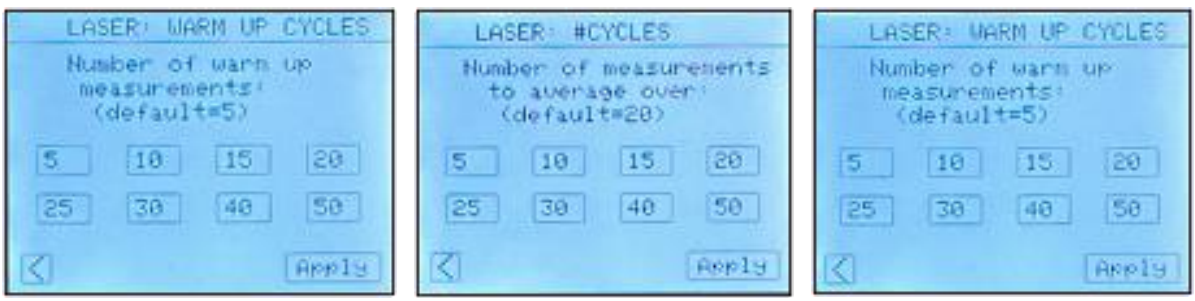
- **Measurement Config** Laser configuration
- **Calibrate sensors** Calibration to the media to be separated 1 and 2

5.4. Measurement Config

The menu "Measurement Config" allows the configuration of the laser. Three further submenus are provided for this purpose.

	Default values	Range
• **Laser: duty cycle**	**200**	50, 100, 150, 200, 250, 300, 350, 400
• **Laser: #cycles**	**20**	5, 10, 15, 20, 25, 30, 40, 50
• **Laser: Warm up cycles**	**5**	5, 10, 15, 20, 25, 30, 40, 50

The following figure shows the submenus.



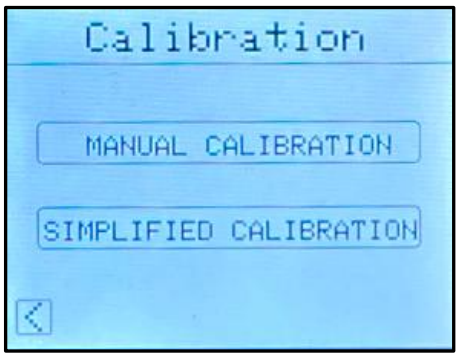
The **"Laser duty cycle"** is the dead time between measurements. 200ms allows safe operation with low heating (default = 200ms).

Laser #cycles is the number of measurements used for evaluation. Measurements become more accurate as the number of measurement cycles increases. For phase separation 20 cycles are sufficient (default =20).

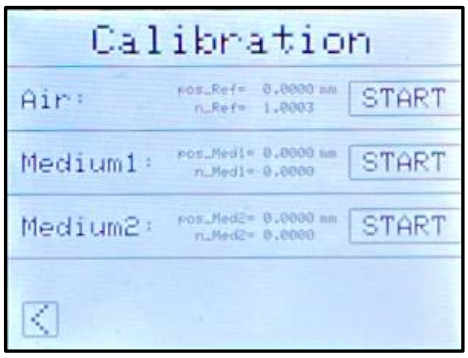
Laser warm up cycles specifies the number of cycles after which the measurement is started (default = 5).

5.5. Calibrate Sensors

The "Calibrate Sensors" menu allows calibration to the media 1 and medium 2 to be separated. The device must be calibrated before automatic control is started. First, a reference measurement is performed with air; the separation chamber must be empty and dry for this purpose. To do this, press the Start key on the display in the "Air" menu item.



Menu of version 2.0



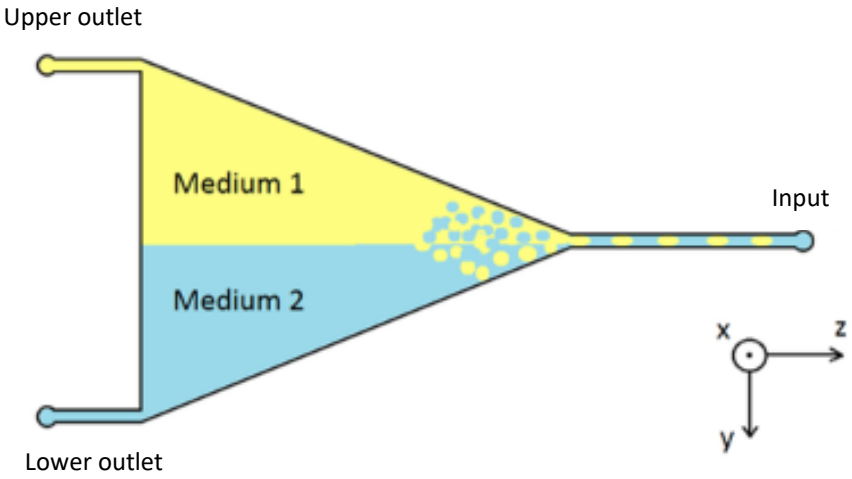
Manual Calibration

		Value	
• Air	pos_Ref =	0,0000	**Start**
	n_Ref =	1,0000	

After calibration, n_Ref= 1.0000 appears as the reference value for air. A position value is also output (Pos_Ref = ...).

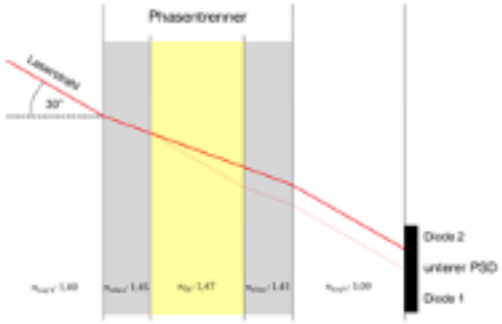
The next step is the calibration to medium 1.
The following rule applies: "Medium 1 floats on medium 2".

In the separation chamber, the separation into medium 1 (top) and medium 2 (bottom) takes place due to the different mass density as shown in the following figure.

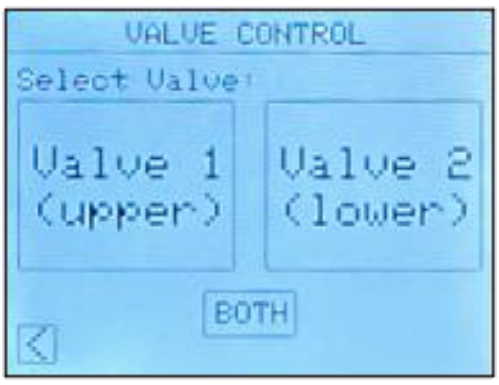


Medium 1 = Medium at the top, for example oil, *the optically denser medium*
Medium 2 = Medium at the bottom, for example water, *the optically thinner medium*

For calibration to **medium 1**, this is filled into the separation chamber. The fill level can be monitored by changing the data on the sensors (see Live Data menu). The values of the two diodes on the lower sensor (PSD3 and PSD4) change accordingly during the filling process.



Alternatively, the separation chamber can be filled until medium 1 exits at the top. For this purpose, the valves must be set accordingly (see Valve Control menu).



By pressing the "Start" key in the Medium 1 menu item, the reference values for medium 1 are determined.

- Medium 1: pos_Med1 = **Start**
  n_Med1=

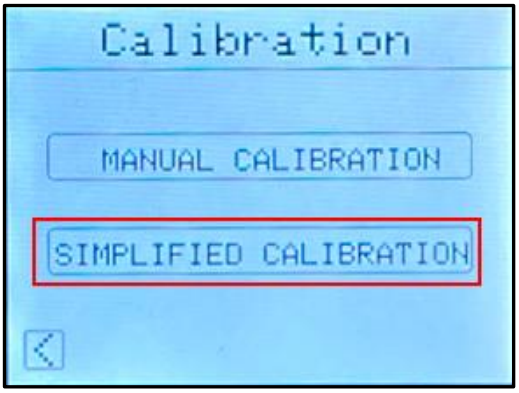
Shown here are values for toluene.

Medium 1 is then drained from the separation chamber. For this purpose, the lower valve is opened via the **"Valve Control"** menu and medium 1 is drained.

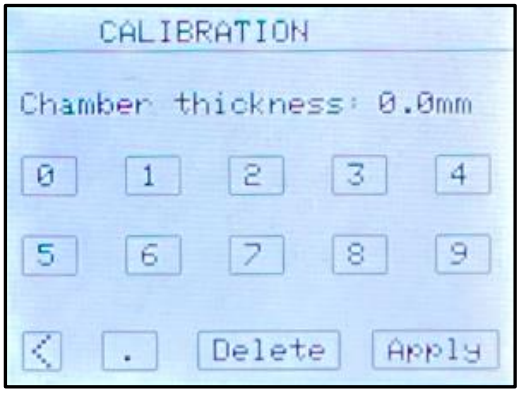
After filling with medium 2 in the same way as medium 1, the reference values for medium 2 are determined by pressing the **"Start"** key in the menu item Medium 2.

- Medium 2: pos_Med2 = **Start**
  n_Med2= 1,33… (Water)

With software version 2.0, the calibration options have been expanded. The routines under SIMPLIFIED CALIBRATION are new. In a first step, the chamber thickness is queried here. This will allow the pressure range to be extended in the future. The separation chambers available so far have a thickness of 4.9mm.

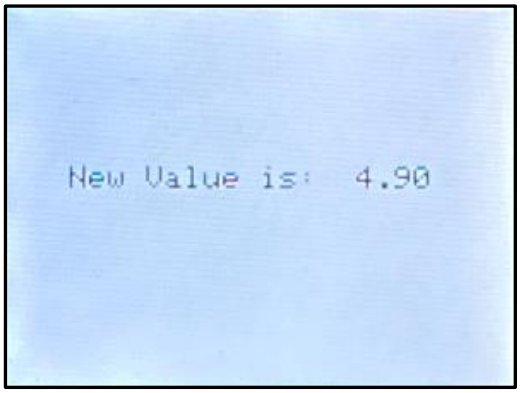


Menu of version 2.0



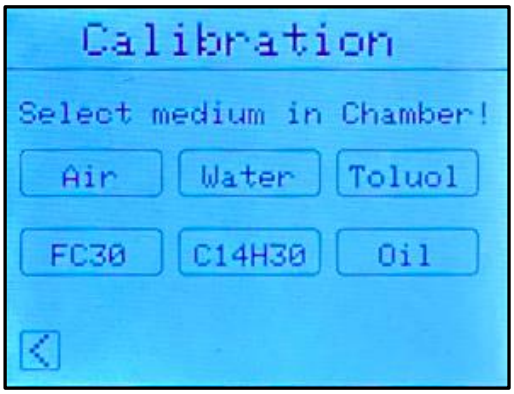
Chamber Thickness

By entering the thickness and using the **Apply** key, the value is entered and reported back in the subsequent display.

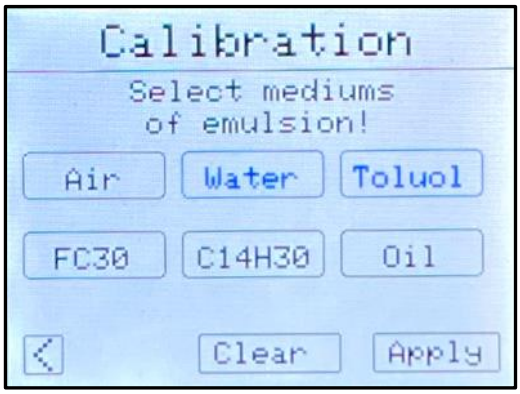


The next step is to fill the chamber with one of the media to be separated. **Via VALVE CONTROL** the menus as described under 5.2 are available here for the filling process.

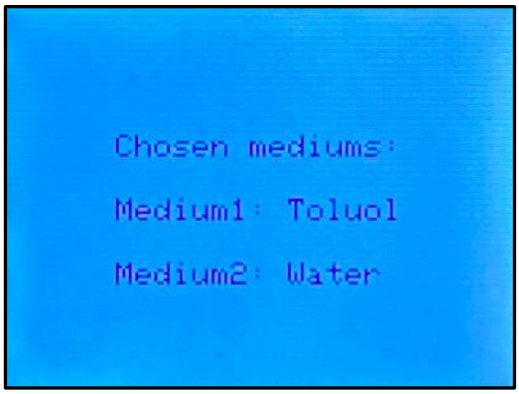
With **DONE** you reach the following menu:



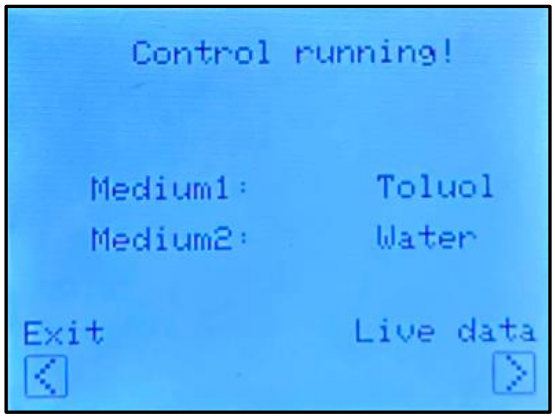
With the selection, the calibration to this medium starts. Afterwards, the second medium can be selected, in the example shown below this is water and toluene.



Via the **Apply** key the following display is reported back.

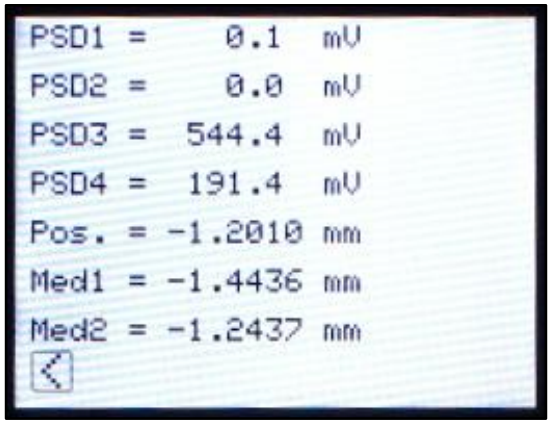


From the stored data, the media are displayed according to the density, then you land in the start menu. The control process is started by pressing the **START** key.



5.6. Live Data

This menu item allows access to the data of the two upper sensors (PSD1 and PSD2) and the two lower sensors (PSD3 and PSD4)



	Value	
• PSD1 =	x.x	mV (Top sensor)
• PSD2 =	x.x	mV (Top sensor)
• PSD3 =	x.x	mV (Bottom sensor)
• PSD4 =	x.x	mV (Bottom sensor)
• Pos. =	x.x	mm (Current value => you can see which medium is currently being captured)
• Med1 =	x.x	mm (Position from calibration measurement)
• Med2 =	x.x	mm (Position from calibration measurement)

Note: The sensor elements can be imagined as two sensors plugged into each other. The values shown are influenced, for example, by the mounting of the separation chamber when the separation chamber is replaced or by a coating on the side wall of the separation chamber, such as moisture.

5.7. Start

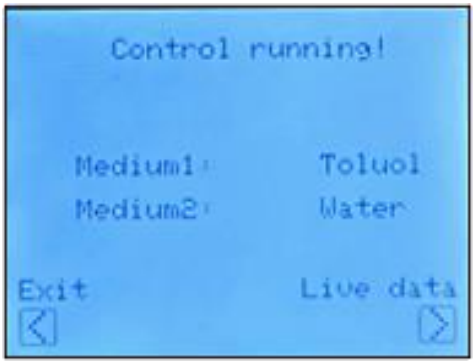
This menu item starts the automatic control in the separation chamber.
The prerequisite for this is that the calibration has been carried out with medium 1 and medium 2.

Since both media are drained by gravity, it is helpful to fill the hose for medium 2 completely. For this purpose, the valves must be set accordingly (see **Valve Control** menu).

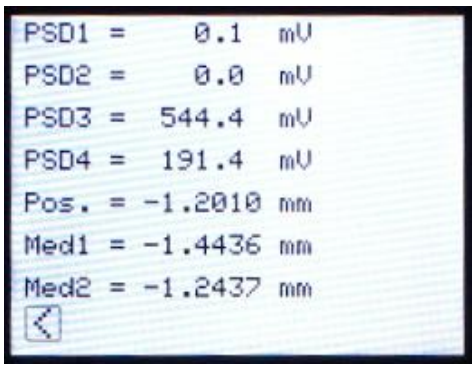
By pressing the "**Start**" key, the phase separator starts to adjust the phase limit to the center of the separation chamber. At the beginning, the valves move more frequently than later when the middle position of the phase boundary is reached in the separating chamber.

The automatic control process is shown in the display with **Control running.**

Display after start



Display Live data

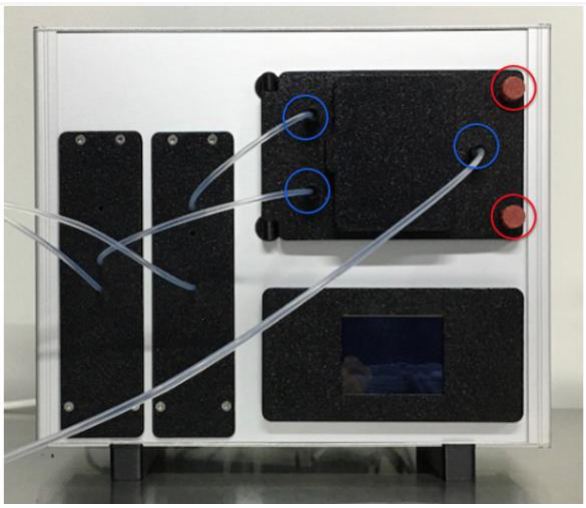


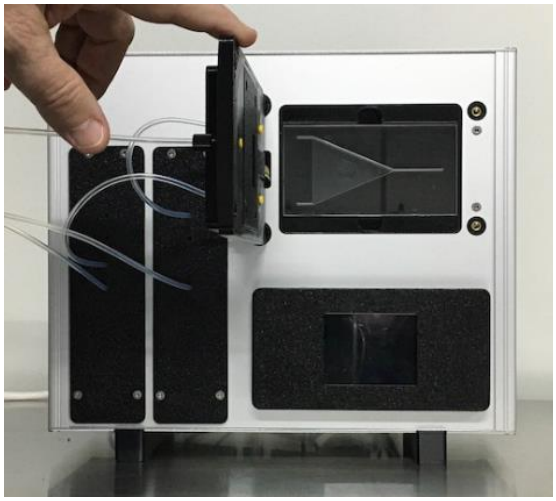
6. Inserting / changing the separating chamber

Before inserting a separation chamber, switch off the phase separator.

To insert a separation chamber into the phase separator, first loosen the three screw connections of the hoses (blue circles). After loosening the two red screws, the cover of the separation chamber can be folded to the side and a separation chamber can be inserted or replaced.

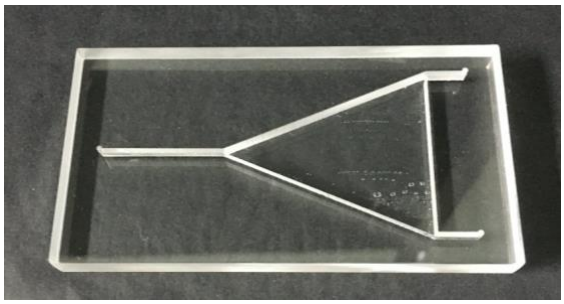
Afterwards, the red screws must be tightened again and the three screw connections of the hoses (blue circles) must be retightened. The phase separator is then ready for operation again.





6.1. Available separation chambers

Article no.: V012.00-**4316**
1mm channels, Separation chamber length 53,3 mm;
Volume: 6 ml
p_{max} = 3,0 bar



Article no.: V012.00-**4348;**
2mm channels, Separation chamber length 75 mm;
Volume: 8,75ml
p_{max} = 2,0 bar