

Automatic viscosity measurement has been improved ...

The AVSPro II automatic sampler is a fully automated measuring instrument for determining the viscosity of Newtonian fluids with capillary viscometers. In spite of the high sample throughput, the AVSPro II provides maximum accuracy and reproducibility. Furthermore, working with the AVSPro II is easy and even allows unsupervised 24-hour operation.

Particularly with time consuming measurement runs, the AVSPro II helps to substantially reduce the burden on qualified employees. An additional advantage is the increased level of safety when handling aggressive media, e.g. sulphuric acid, which is achieved through the fully automatic measurement procedure.

The ProClean system and the micro dosing make routine operation safer. The filtration of solutions, which occasionally may be harmful, can thereby be omitted.

The capacitive sensors in the suction pipe effectively prevent any damage of the measuring system.

Because of its large throughput capacity and its functional reliability, which it has demonstrated in the course of continuous practical operations, the AVSPro II has proven itself to be an indispensable instrument for day-to-day utilization, particularly in the petroleum and plastics industries.



The AVSPro II automatic sampler works with the capillary method, which is the most precise method for determining the viscosity of Newtonian liquids in terms of physical chemistry. Using this method, measurements with an accuracy of more than 0.1% can be achieved. The great versatility offered by viscometers with optical and TC sensing systems opens up an extremely wide range of applications. This includes measurements of clear liquids as well as opaque petroleum products.

The viscosity measurement requirements of the polymer and petroleum industries in particular have been incorporated into the design of the AVSPro II. The main feature of the automatic unit is the three-axis positioning mechanism of the sample dosing system. The X-Y-Z positioning mechanism allows operation of up to four Micro TC viscometers in two thermostatic baths, which can be set at two different measurement temperatures. This method is used in the oil industry in order to determine the viscosity index.

... with the AVSPro II Automatic Sampler:



Two different sample racks are supplied:
a) one rack with 56 positions for 20 ml sample bottles for micro-viscometer applications



b) one rack with 16 positions to accommodate 100 ml sample bottles for normal volume applications



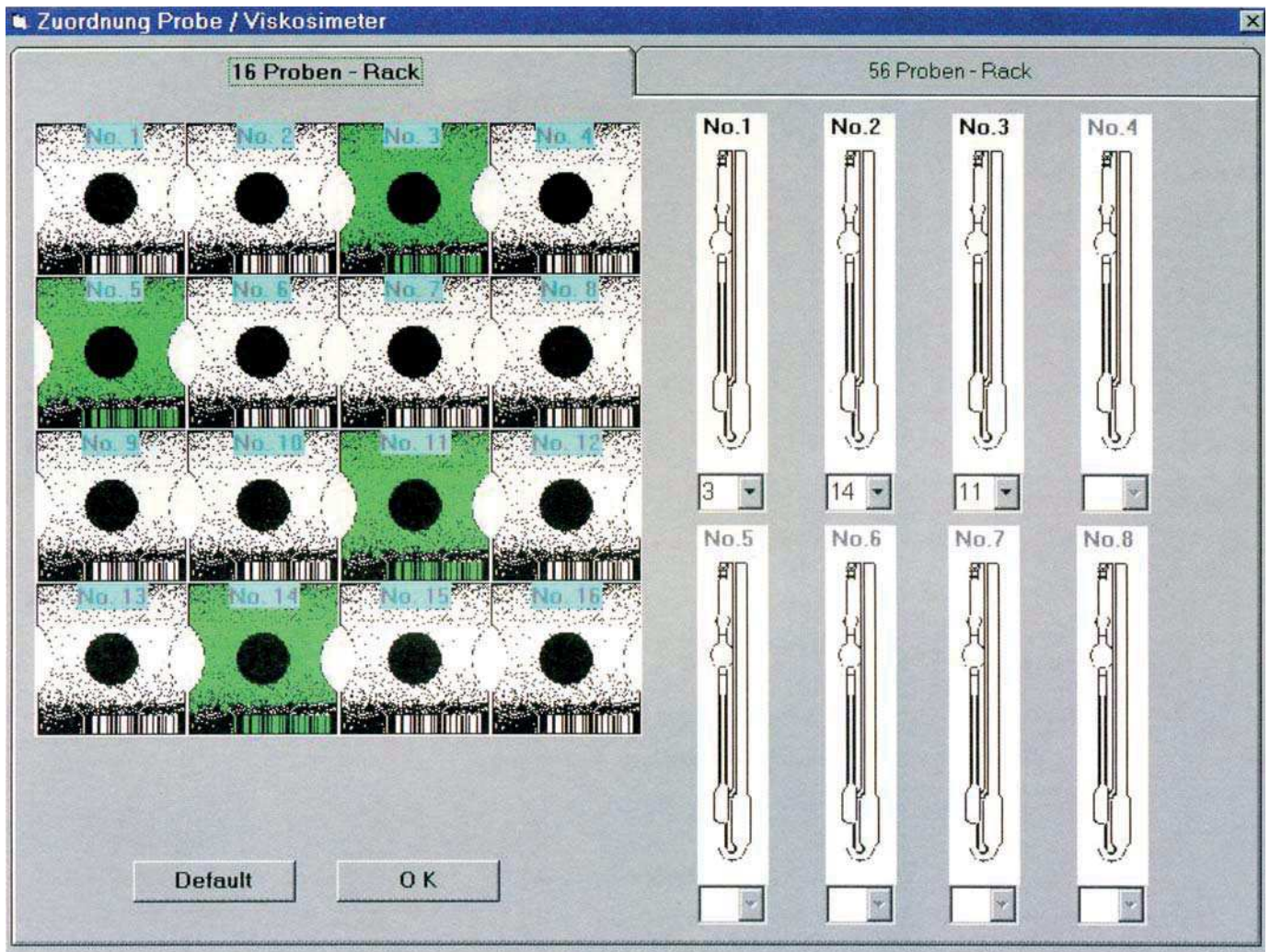
The electric sample lift ensures positioning of the samples in the rack at a convenient and easily monitored working height.

The AVSPro II allows the operator to select optionally the sample sequence and which sample is to be filled into which viscometer. The dosing system is available in either normal or micro construction and operates without a valve. It is thus suitable for nearly any type of sample.

The AVSPro II is equipped with optoelectronic and TC scanning (TC = thermal conductivity method) functions for the meniscus passage in the capillary viscometer. The samples are positioned in the sample rack, which is easy to load using the electric motorized lifting mechanism. If needed, the rack can be temperature-regulated.

The operator interface and control logistics are spatially and logically separate. This ensures a high degree of flexibility with regard to the installation location, and serves to reduce the environmental influences on the measurement results.

Working with the AVSPro II is ...



Operating the AVSPro II is extremely easy. The operator controls the process at a PC connected via the RS-232-C interface. The intuitive user interface of the operation software guides the user clearly through the program. All data inputs are made using the computer keyboard and mouse.

A faulty operating status is indicated by acoustic or optical signals such as arrows, icons and other status messages or request messages. During the entire work sequence, the respective status of the AVSPro II is documented on the computer screen. Furthermore, status indicators can be selected for each

individual measuring position, which provide additional information on the operating status.

For the respective type of measurement, pre-parameterized sets of parameters depending on the viscometers, temperature and other measurement criteria are already provided. In addition, all parameters can be individually adjusted to special requirements at a special menu level. All of the standard calculation methods are available.

Screenshot: 16 sample rack

The AVSPro II allows individual allocation between the characteristics of the sample and the viscometers that are currently in operation.

In practice, this means that it is not only possible to simultaneously test the characteristics of samples with greatly differing viscosity, but also to perform measurements in various different capillary sizes and types of viscometers. This even applies to a combination of optical and thermal scanning. Therefore, preliminary sorting of the samples with regard to viscosity and the size of capillary required for the testing process is no longer necessary.

It is possible to "individually" allocate each sample to a capillary viscometer that is currently being used by means of the conventional MS-Windows® "drag and drop" method. This procedure makes it possible to increase the sample throughput.

The allocation between the sample and the viscometer is shown on the status display.

... easy, reliable and safe

The proved and tested AVSPro II software also makes it possible to prepare additional individually selected calculations, such as:

- mean value,
- standard deviation,
- outlier test (A %),
- Hagenbach correction,
- absolute viscosity, dynamic viscosity (density value required),
- viscosity index (measurement at two temperatures required),
- SUS and SFS,
- relative viscosity,
- specific viscosity,
- reduced viscosity (viscosity number),
- inherent viscosity and
- K-value.

During the entire process, all of the parameters (depending on the menu level) and the respective status of the individual measuring positions, the temperature regulation system and the sample transfer system are either visible or can be selected.

The operator interface of the AVSPro II is available in German and English. Commercially available printers for which Windows drivers are available are suitable for documentation purposes.

Screenshot: selection of methods

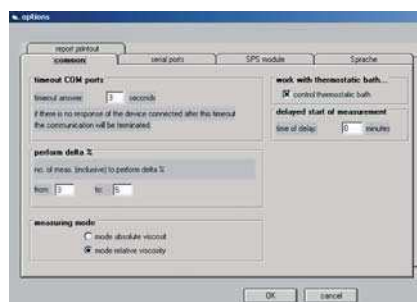
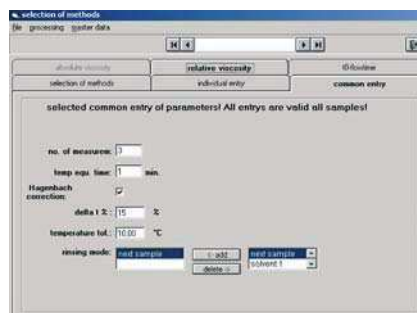
This mode is used to specify the number of measurements, the preliminary temperature regulation period, the allowable standard deviation, the maximum allowable temperature tolerance, the rinsing type and method of the viscometer.

Screenshot: options

This mode is used to specify what monitoring parameters are to be activated, e.g. if the temperature control of the thermostats is supposed to be handled via the PC.

Screenshot: dosing parameters

This mode is used to specify the filling quantity of the viscometer, the dosing speed depending on the viscosity and the type of rinsing.



Precision, reproducibility and comparability are in compliance with the DIN 51 562-1(1995-08), ASTM D 445 and ISO/DIS 3105 standards.

The AVSPro II is built in accordance with international equipment safety standards: CE symbol (equipment safety, low voltage safety, emitted interference and interference immunity).

The AVSPro II is produced by a manufacturer that is certified in accordance with DIN/ISO9001.

If requested, the AVSPro II automatic sampler can be supplied with a manufacturer's inspection certificate based on direct comparison with normal viscometers of the first order in accordance with DIN 51 532 - 4: 1995-08.

Technical data AVSPro II

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Sampling system	
Sample bottles	100 ml screw-type and bottles with standard ground joint (16 pcs per rack) 20 ml round bottom glass pieces (56 pcs. per rack)
Sample rack	for 100 ml screw-type and bottles with standard ground joint for 100 ml screw-type and bottles with standard ground joint (temperature controlled up to 135°C) for 20 ml round bottom glass pieces
Measured value recording	
Method	meniscus scanning by means of opto-electronic system or thermal conductivity (TC)
Measuring parameter	
	throughput time in seconds [s] temperature in degrees Celsius [°C]
Calculated parameters	
	mean value, standard deviation, outlier test (A %), Hagenbach correction, absolute viscosity, dynamic viscosity (knowledge of density required), viscosity index (measurement at two temperatures required) SUS and SFS, relative viscosity, specific viscosity, reduced viscosity (viscosity number), inherent viscosity, K-value
Selection parameters	
	by means of PC keyboard, mean value, standard deviation, outlier test (A %), Hagenbach correction, absolute viscosity, dynamic viscosity (knowledge of density required), viscosity index (measurement at two temperatures required) SUS and SFS, relative viscosity, specific viscosity, reduced viscosity (viscosity number), inherent viscosity, K-value, rack position, date/time, temperature regulation period, number of measurements, number of rinsing operations, start, stop/reset
Number of measurements	1 ... 99
Temperature regulation period	0 ... 99 min., selectable in increments of 1 min.
Number of Viscometer tests	0 ... 9 with next sample (observe sample quantity) or with preselected rack position
Data memory	by means of PC
Viscosity measurement range	
	0.35 to 1,200 mm ² /s (at room temperature of samples)
Time	up to 9999.99 s, resolution = 0.01 s
Vacuum pressure	automatically controlled
Viscometers available for use	
	Ubbelohde viscometer in accordance with DIN standards Ubbelohde viscometer in accordance with ASTM standards Micro-Ubbelohde viscometer in accordance with DIN standards Micro-Ostwald viscometer Cannon-Fenske-Routine viscometer Cannon-Fenske-Routine viscometer TC Ubbelohde viscometer TC Micro-Ubbelohde viscometer

/S Pro II

Measuring accuracy	$\pm 0.01 \text{ s} \pm 1 \text{ digit}$, but not more precise than 0.01% The measuring uncertainty for measurements of absolute kinematic viscosity is also dependent on the uncertainty of the numeric value for the viscometer constant and on the measuring conditions, especially the measuring temperature.
Evaluations / results	
Correction	Hagenbach correction (HC for Ubbelohde, Cannon-Fenske-Routine, Micro-Ubbelohde and Micro-Ostwald viscometers)
Statistical evaluation	standard deviation, outlier search
Ambient conditions	
Ambient temperature	10 ... + 40 °C
Air humidity	max. 85 % relative humidity
Equipment safety	
CE-symbol	in accordance with Guideline 89/336/EEC of the Council (EMC compatibility) in accordance with Standard EN 50 081, Part 1; interference immunity in accordance with Standard EN 50 082, Part 2; in accordance with Guideline 73/23/EEC of the Council (low-voltage guideline)
Housing	plastic/stainless steel / aluminium casing with chemically resistant two-component coating of the plastic pieces
Dimensions	w = 1,300 mm, h = 1,100 mm, d = 610 mm (approx. 51" x 43" x 24")
Weight	dependent on the number of measuring positions approx. 70 kg
Connections	
Pneumatic connections	screw-type connections for viscometer
Electric connections	circular connectors with bayonet lock for measuring stand and TC viscometer
Viscometers	up to 8 viscometers connected by individual control units
Temperature	via serial interface RS-232-C of suspended thermostat, type: 1 pc, CT 1654 or up to 2 pcs. CT 53 made by SCHOTT Instruments
Interfaces	control system using PC with 2 x RS-232-C interfaces
Safety	overfilling safety device or waste bottle
Mains connection	European built-in plug DIN 49 457 6 with fuse
Data transmission	
Interface internal	bidirectional serial interface in accordance with EIA RS-232-C (daisy chain concept)
Interface external	via PC, bidirectional serial interface in accordance with EIA RS-232-C
Power supply	
Mains voltage	230 V (AC) or 115 V (AC), 50 ... 60 Hz (AC)