Automatic viscosity measurement has been improved ...

The AVS® Pro III automatic sampler is a fully automated instrument for determining the viscosity of Newtonian fluids with capillary viscometers. In spite of the high sample throughput, the AVS® Pro III provides maximum accuracy and reproducibility. Furthermore, working with the automatic sampler is easy and allows unattended 24-hour operation.

Particularly with time consuming measurement runs, the AVS® Pro III helps to substantially reduce the burden on qualified users. The fully automatic mode offers an increased level of safety when handling aggressive media, e.g. sulphuric acid.

The ProClean system and the microdosing make routine operation safer. The filtration of solutions, which occasionally may be harmful, may be ommitted. The capacitive sensors in the suction pipe effectively prevent any damage of the measurment system.

The AVS® Pro III 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. The great versatility offered by vis-cometers 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.

… with the AVS® Pro III 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 viscosity measurement requirements of the polymer and petroleum industries in particular have been incorporated into the design of the AVS® Pro III. 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 oil industry in order to determine the viscosity index.

The AVS® Pro III allows the operator to select 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 AVS® Pro III is equipped with opto-electronic and TC scanning (TC = thermal conductivity method) functions for the meniscus passage in the capillary viscometer. The samples are positioned in the easy-to-load sample rack, using the motorized lifting mechanism. If needed, the rack can be temperature-regulated.

Advantages AVS® Pro III

- **Fully automatic and highly precise measuring station. Time measurement with a precision of +/- 0.01s (but less precise than 0.1%)**
- **Ideal for highly aggressive media**
- Although in combination of optical and thermical sampling of the meniscus channel or different capillary sizes and types, **up to four viscometers selectable**
- **The ProClean system and micro-dosing elminate dangerous manual filtration of the sample**

Working with the AVS® Pro III is ...

The AVS® Pro III is controlled by a PC, connected via RS232-C interface. The intuitive user interface 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 AVS® Pro III is documented on the computer screen. Furthermore, status indicators can be selected for each individual measuring position, which provide additional information on operation.

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.

The proved and tested AVS® Pro III 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
- intrinsic viscosity and
- K-value after Fikentscher

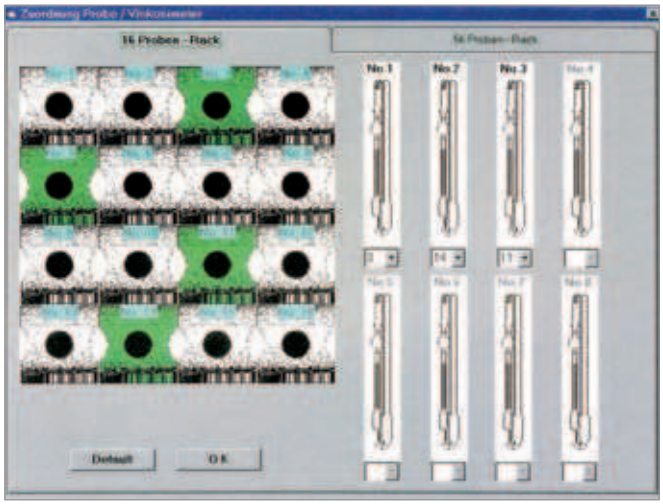
During the entire process, all of the parameters (depending on the menu level) and the respective status of the individual measuring positions, the temperature regulation system and the sample transfer system are either visible or can be selected.

The operator interface of the AVS® Pro III is available in German and English. Commercially available printers for which Windows drivers are available are suitable for documentation purposes.

Precision, reproducibility and comparability comply with DIN 51 562-1(1999-01), ASTM D 445 and ISO 3105 standards.

The AVS® Pro III is built in accordance with international equipment safety standards: CE symbol (equipment safety, low voltage safety, emitted interference and interference immunity).

If requested, the AVS® Pro III 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 51 562 - 4: 1999-01.



›16 sample rack‹

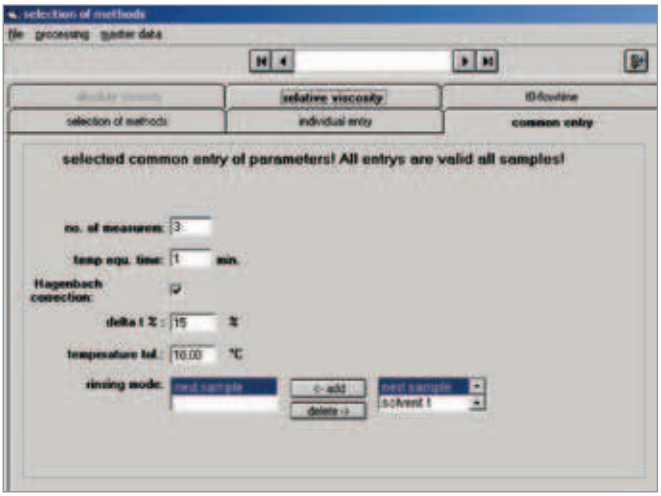
The AVS® Pro III allows individual allocation between the characteristics of the sample and the viscometers that are currently in operation.

... easy, reliable and safe

This means that it is not only possible to simultaneously test the characteristics of samples with greatly differing viscosities, but also to perform measurements in various capillary sizes and different 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 not necessary.

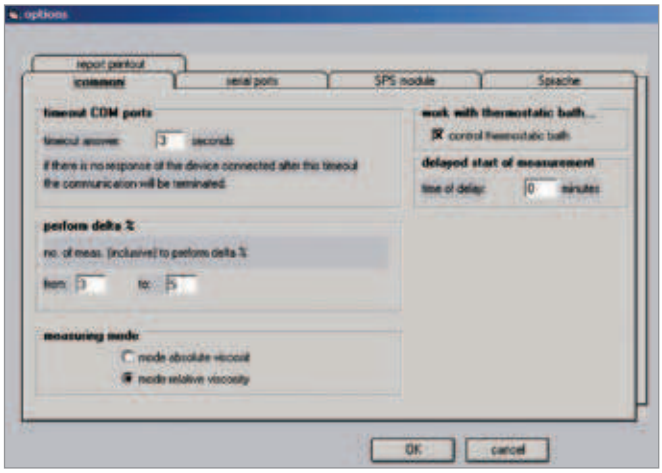
It is possible to "individually" allocate each sample to a capillary viscometer that is currently being used by means of the conventional MS-Windows® "drag and drop" method. This makes it possible to increase the sample throughput.

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



›selection of method‹

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



›options‹

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.

›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.

Technical data AVS® Pro III

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 to 99
	Temperature regulation period	0 to 99 min., selectable in increments of 1 min.
	Number of Viscometer tests	0 to 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 mm²/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 viscometerCannon-Fenske-Routine visco
		Cannon-Fenske-Routine viscometer
		TC Ubbelohde viscometer
		TC Micro-Ubbelohde viscometer

Measuring accuracy	± 0.01 s ± 1 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 to + 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 = 1,000 mm, d = 620 mm (~51" x 43" x 24")
	Weight	dependent on the number of measuring positions
		~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 RS232-C of suspended thermostat,
		type: 1 pc. CT 72/4 or up to 2 pcs. CT 72/2
	Interfaces	control system using PC with 2 x RS232-C interfaces
	Safety	overfilling safety device of waste bottle and suction hose
	Mains connection	European built-in plug DIN 49 457 6 with fuse
Data transmission	Interface internal	bidirectional serial interface in accordance with EIA RS232-C (daisy chain concept)
	Interface external	via PC, bidirectional serial interface in accordance with EIA RS232-C
Power supply	Mains voltage	230 V (AC) or 115 V (AC), 50 to 60 Hz (AC)