



ViscoClock | AVS[®] | CT72

VISCOMETRY PRODUCTS



SI Analytics

a xylem brand

Capillary viscometry from SI Analytics – know-how from the very beginning

Innovative capillary viscometry – from the outset

The viscosity of Newtonian fluids can be most precisely determined using capillary viscometers. This method of measurement, measures the time taken for a defined quantity of fluid to flow through a capillary with a known diameter and known length. With the industrial production of such precisely calibrated capillary viscometers, we have created the conditions to enable this measuring method to establish itself worldwide as a reliable procedure.

With the development of the first automatic measuring systems, we replaced the stopwatch with automatic registration of the fluid at the start of the 1970's. Since then, subjective measuring errors have been a thing of the past.

Further developments and improvements of viscometers, measuring instruments and accessories led to a range of products whose excellent performance is universally recognized. It is therefore no wonder that our viscosity measurement systems have become indispensable production control and quality insurance tools worldwide, whether in the mineral oil industry, for polymer manufacturers and processors, in the pharmaceutical or food industry.



*Our capillary viscometers are the
worldwide basis for precise viscosity
measurements of Newtonian fluids.*

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Visco

ViscoClock.

If you need more accuracy:

The ViscoClock is the economically priced introductory model in the field of automatic viscosity measurements. Manual measurements with a stopwatch and a trained eye is therefore something of the past because time is money.

The ViscoClock

The ViscoClock is an electronic time-measuring unit used to determine absolute and relative viscosity. It consists of a stand which is used to mount a viscometer and the electronic measuring unit. The two measuring levels are integrated in the stand made of high-quality PPA synthetic material, and the electronic measuring unit is included in a PP casing. The large LCD display allows the measured values to be read off easily.

Range of use

The ViscoClock is designed for the use of our Ubbelohde viscometer, Micro-Ubbelohde viscometer or Micro-Ostwald viscometer. The ViscoClock automatically measures the flow-through time of temperature-stabilized liquids through the capillaries of the viscometer at temperatures ranging from $-40\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$.

For temperature stabilization in the thermostatic bath, the following liquids are suitable: water, alcohol water, paraffin oil, and silicone oil. Liquid samples can be measured that qualify for use with the viscometer being used in each instance.

Accuracy

The operating time is indicated with a resolution of $1/100\text{ sec}$. with quartz precision. The accuracy of 0.1% of the measured time used to calculate the absolute and relative viscosity is indicated as measuring uncertainty with a confidence level of 95% .

Absolute viscosity

Only the calibrated viscometers are suitable for the calculation of absolute viscosity in the temperature-stabilized, transparent thermostatic baths.

Relative viscosity

For the measurement and calculation of relative viscosity, all Ubbelohde viscometers, uncalibrated and calibrated, can be used for manual or automatic measurements.



- Comfortable and highly precise time measurement
- Use of all common viscometers possible
- Includes software for determination of absolute and relative viscosity, t_0 -extreme value test and Hagenbach correction

Advantages
ViscoClock

Technical data ViscoClock

Measuring range - time	up to 999.99 s; resolution 0.01 s
Accuracy of time measurement	± 0.01 s/ ± 1 digit; however no more precise than 0.1 %; indicated as measuring uncertainty with a confidence level of 95 %
Measuring range - viscosity	0.35 ... 10,000 mm ² /s (cSt) the absolute, kinematic viscosity is additionally dependent on the uncertainty of the numerical value of the viscometer constant and on the measuring conditions, in particular the measuring temperature.
Display	5-digit LCD display, 20 x 48 mm (H x W), digit height 12.7 mm, seconds indication with 2 decimal digits after the decimal point, resolution 0.01 s
Voltage supply	low voltage U: 9 V
Plug-in connection	socket for low voltage connection: jack plug, internal contact Ø = 2.1 mm, plus pole at pin contact, for connection of Universal power supply TZ 1858
Power supply	in accordance with class of protection III. degree of protection for dust and humidity IP 50 in accordance with DIN 40 050 Universal power supply TZ 1858: 100–240 V, 50–60 Hz (9 V, 550 mA) not suitable for use in areas subject to explosion hazards
	RS-232-C interface for connection of a printer with serial interface or of a computer (PC) for documentation of the data
	Plug-in connections 4 pole circular plug, mini, DIN
	Configuration of RS-232-C interface, permanently set 4800 baud, 7 bit word length, 2 stop bits, no parity; after each measurement, the measured value is transmitted automatically. the string of digits consists of 4 digits before the decimal point, 2 digits after the decimal point, and the terminating characters CR and LF.
Ambient Conditions	Ambient temperature +10 ... +40 °C for storage and transport Operating temperature stand: -40 ... +150 °C electronic measuring unit: +10 ... +40 °C Air moisture in accordance with EN 61 010, Part 1; max. relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % of relative humidity at a temperature of 40 °C
Housing	Materials stand: polyphthalamide (PPA) casing*: polypropylene (PP) sealing membrane: silicone Dimensions approx. 490 x 95 x 50 mm (H x W x D) Weight approx. 450 g (without viscometer) power supply unit: approx. 220 g
Country of origin	Federal Republic of Germany
CE symbol	in accordance with Guideline 89/336/EEG (electromagnetic compatibility EMC): emitted interference in accordance with Standard EN 50 081, Part 1 interference immunity in accordance with Standard EN 50 082, Part 2, in accordance with Guideline 93/23/EEG (low voltage guideline), last altered by Guideline 93/68/EEG: Testing basis EN 61 010, Part 1
Viscometer types	Ubbelohde (DIN; ISO; ASTM; Micro), Micro-Ostwald
Transparent thermostatic baths	the ViscoClock can be used in every of our transparent thermostatic bath.

* Use in heat carrier liquids can result in discoloration of the synthetic material. The discoloration does not, however, have any effect on the function and quality of the ViscoClock. DURAN® is a registered trademark of Duran Group. Subject to technical changes.

Precise Capillary Viscometry – Easy, Flexible and Independent: AVS® 470



That's new: "Suction" and "Pressure" measurements with just one instrument, no need for a PC

The AVS® 470 is the first viscosity measuring device that allows "suction" and "pressure" measurements completely independent of a PC. This makes for maximum independence and flexibility, allowing you to set up a measuring station that meets highest requirements even under difficult conditions, e.g. to monitor production or control quality in the polymers and mineral oil industry.

▶ Perfectly equipped for fully Automatic Viscosity Measurements

The AVS® 470 is a measuring system that includes almost everything you need to take precise and reproducible measurements. All common types of viscosity calculation are already integrated into the device, a small PS2 keyboard is all you need to enter additional data. A serial printer can be used to conveniently document your measuring results.

So, in a minimum of space, you can set up a measuring station equal in every way to complex measuring installations in terms of precision and reproducibility.



“Suction” or “Pressure”?

Preferred applications in comparison

		“Pressure”	“Suction”
highly viscous samples e.g. oils, polymers		■	■
Solvents: (examples)	highly volatile	■	-
	Dichloromethane	■	-
	Chloroform	■	-
	Sulfuric acid	-	■
	Dichloroacetic acid	-	■
	Toluene	■	■
	Hexafluoro-isopropanol	-	■
	m-cresol	-	■
	Formic acid	-	■
	Phenol-dichlorobenzene	-	■
	Phenol-Tetrachloroethane	-	■

Simple and updateable Modular Concept

The AVS® 470 is of a modular design and an optional optical or TC version ViscoPump II module.

You can use your existing accessories such as thermostats, stands, flow-through coolers or automatic cleaners e.g. AVS® 26. Also, virtually all customary capillary viscometers can be used.

- ▶ Automatic and highly precise measurements – independent from the PC
- ▶ "Suction" and "pressure" measurements with the same module
- ▶ Comfortable data input and parameterization via included PS2-mini-keyboard
- ▶ GLP/GMP-standards fulfilling documentation possible through optional paper printer

Advantages
AVS® 470

470

AVS[®] 470 – Precise and Reliable

Working With the AVS[®] 470 Is Easy

The desired measuring method can be preselected and started on the device. The entire measurement is taken automatically to rule out subjective measurement errors. Once the set pre-heating time is reached, the desired number of measurements are taken and the viscometer automatically cleaned if required. The status of the measurements is continuously indicated on the LC.

If required, individual parameters may be input via a PS 2 key board (in scope of delivery). A serial printer can be used to print measurement logs.

The connections are on the front panel of the device for easy control. Over-pumping and oversuction are prevented by means of a capacitive sensor (optional).

The print-out shows everything you need for reliable documentation of your test.

```
No. 1 = 77.20s
No. 2 = 77.21s
No. 3 = 77.20s

=====

*****
*                               *
*  UiscoSystem AUS470          *
*      protocol                 *
*                               *
*****

Indication of method set ----- method : absolute

Designation of specimen ----- lot: SIM Test sample
                               ----- usr: O. Hofbeck

Readings used for evaluation ----- measurements [s]
                               No. 1 = 77.20*
                               No. 2 = 77.21*
                               No. 3 = 77.20*

Set equalization time ----- delta%choice = 0.01%
                               ----- pre temp. time = 0min

Corrected average running time ----- average = 77.203s
                               ----- stand. dev. = 0.006

Calculated Viscosity ----- constant = 0.029999996
                               ----- AbsVisc=2.3161mm^2/s

                               ----- temperature: 25.00 C
                               ----- date: 05/12/2011
                               ----- time: 09h 47m 27s
                               -----
                               -----
```

Individually determined readings

Charge Number

User

Set maximum permissible deviation from average

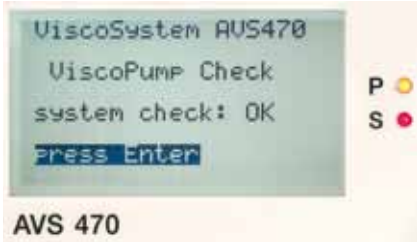
Average of running times

Viscosimeter constant

Operating temperature, date and time at time of test

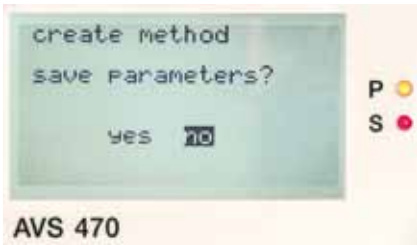
Technical data

Clear user guidance, clear status – even without PC!



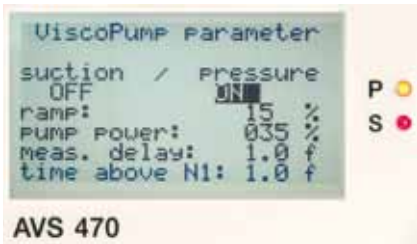
AVS 470

After switching on the AVS® 470 a self test is run and then an entry prompt appears.



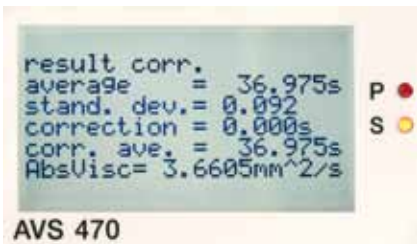
AVS 470

The parameters can be set in the test mode. The t_0 value is determined automatically.



AVS 470

All setup parameters can be preset conveniently, e.g. pressure/suction, velocity, waiting time between two tests, etc.



AVS 470

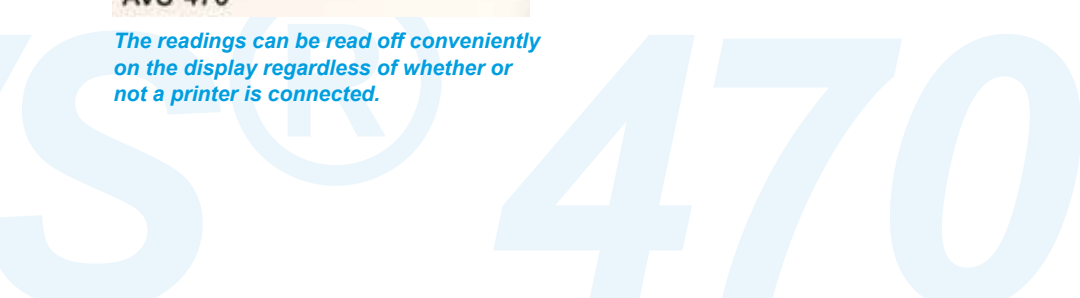
The readings can be read off conveniently on the display regardless of whether or not a printer is connected.

Measuring range (time)	up to 9,999.99 s; resolution 0.01 s	
Measuring range (viscosity)	pressure:	0.35 ... 1,800 mm ² /s (cSt)
	suction:	0.35 ... approx. 5,000 mm ² /s (cSt)
Measured parameter	flow-through time [s]	
Time measuring accuracy	± 0.01 %	
Measured value display	LC-Display	
Display accuracy	± 0.01 s, ± 1 Digit, but not exceeding 0.1%	
Pumping pressure	fully automatically controlled	
	suction up to approx. -160 mbar, pressure up to approx. +160 mbar	
Preselectable tempering period	0 ... 20 min	
Preselectable no. of measurements	1 to 99 for each sample	
Connections	Pneumatic connections	threaded connections for viscometers
	Electrical connections	circular connector with bayonet lock for viscometer 4-pin DIN socket for TC viscometer 4-pin circular connector for capacitive sensor 7-pin circular connector for AVS® 26, with bayonet lock
	RS-232-C interface	9-pin for serial printer
	Mains connection	connector in acc. with EN 60320
	Pump connection	socket outlet in accordance with EN 60320
Ambient Conditions	Ambient temperature	+10 ... +40 °C for operation and storage
	Air humidity	max. 80 % in acc. with EN 61010, Part 1
Housing	Material	steel aluminium housing; with chemically resistant 2-component coating
	Dimensions	(W x H x D) Approx. 255 x 205 x 320 mm
	Weight (incl. pump module)	approx. 5.4 kg
Power supply	90 ... 240 V ~, 50 ... 60 Hz	
Equipment safety	EMC in acc. with Council Directive 89/336/EWG;	
	low-voltage directive	

The AVS® 470 allows the use of the following viscometers: Ubbelohde viscometer to DIN, Ubbelohde viscometer to ASTM, micro Ubbelohde viscometer to DIN, micro Ostwald viscometer, Cannon-Fenske routine viscometer, TC Ubbelohde viscometer, TC micro Ubbelohde viscometer.

We reserve the right to make technical changes.

AVS® is a registered trademark of SI Analytics and stands for: "Automatic Viscosity System".



AVS® 370 makes maximum precision ...

Well equipped for every viscosity determination

With the AVS® 370 we have created a measuring device, which not only measures as precisely and consistently as you expect from us, but also offers you maximum flexibility and possibilities for future extensions. Furthermore, it also saves valuable space on the laboratory bench.

▶ Now possible for the first time ever: “suction” and “pressure” measurement – with one device

The AVS® 370 is the first viscosity measuring device, which can be used for both “suction” and “pressure” measurement. This enables simple adjustment of the method of measurement to each sample. This significantly reduces investment costs for measuring stations at which pressure and suction methods are to be used. In most cases, using the AVS® 370 also achieves noticeable savings in setting up time.



▶ Easy with a modular concept for future expansion

The AVS® 370 has a modular design. The basic version is available with one ViscoPump II module in optical or in TC version. Up to 3 other ViscoPump II modules can be inserted in the compact 19" housing. This means a measuring station can be adapted to increasing requirements at any time.

▶ Can be extended from an affordable single measuring station up to an 8-sample station

Already the basic version of the AVS® 370 is able to measure highly or low viscous liquids. In the version for TC viscometers, for example, it is ideal for measuring opaque and black fluids. If necessary, each single measuring station can be extended to form a multiple measuring station with PC-controlled multi-tasking. The WinVisco 370 software included in the standard

equipment enables parallel operation of two fully equipped AVS® 370, with a total of eight ViscoPump II modules. Each module can measure a different sample using its own method. All the results can be quickly and easily evaluated and documented independently of each other. It could hardly be more flexible!

▶ Compatible with existing accessories

Existing accessories (thermostats, stands, flow through cooler, etc.) can continue to be used with the AVS® 370. Also, virtually all customary capillary viscometers can be used.

... easier and more flexible, with provision for future extension!

“Suction” or “pressure”?

A comparison of preferred applications

		“pressure”	“suction”
Highly viscous samples e.g. oils, polymers			
Solvent: (examples)	highly volatile	■	-
	Dichlormethane	■	-
	Chloroform	■	-
	Sulfuric acid	-	■
	Dichloroethanoic acid	-	■
	Toluene	■	■
	Hexafluorisopropanol	-	■
	m-cresol	-	■
	Formic acid	-	■
	Phenol-dichlorobenzene	-	■
	Phenol-tetrachloroethane	-	■

▲ New: Two working principles with the same device.

For the first time ever, with the AVS® 370 you can use the same device to work with “pressure” or “suction”. This gives you more flexibility and better adjustment to the liquids to be examined.

In the “pressure” method of working an overpressure is applied to the liquid in the capillary, this is particularly advantageous for fluids with a low boiling point. In the “suction” principle the sample is sucked up into the capillary by a vacuum. A greater reproducibility of results is achieved using the “suction” method for higher viscosity samples.

▲ Working with AVS® 370 is easy

The whole measuring procedure takes place automatically, subjective measuring errors are reliably precluded. The PC starts the measurement. After the set pretempering period has expired the entered number of measurements are carried out and the measured values saved.

The system can be protected against accidental overpumping or oversuction by means of a capacitive sensor. This prevents the sample to be measured from getting into the vessel containing the tempering liquid or inside the device.

Anyone working with the AVS® 370 is perfectly equipped for all tasks involved in determining viscosity using capillary viscometers.

▲ How to automatically achieve the right results

PC-controlled, the AVS® 370 determines the time which the liquid to be examined requires to flow through the measuring distance in the capillary viscometer with quartz precision. The time is displayed with a resolution of 0.01 s (1 digit).

Measurement of the flow time of the liquid’s meniscus can be scanned optoelectronically or with TC sensors. During optoelectronic scanning the meniscus is detected by glass light fibres, with TC sensors the sensor detects the different thermal conductivity of the sample and air. Therefore the AVS® 370 offers an extraordinary broad field of uses, which range from viscosity measurement of clear fluids through to black or fully opaque liquids.

- ▲ Automatic and highly precise measurements
- ▲ "Suction" and "pressure" measurements with the same module
- ▲ Modular concept for up to four ViscoPump II modules in only one AVS® 370
- ▲ Each ViscoPump II module in a AVS® 370 can measure a different sample using a different method.
- ▲ Real multi tasking for up to eight parallel measurements with the software WinVisco 370
- ▲ TC version for measurement of nontransparent and black liquids

Advantages
AVS® 370

AVS[®] 370 – the right solution for all situations

Unique flexibility

In the PC-controlled multiple measuring station, the AVS[®] 370 offers you unique flexibility while working in a very small space: Up to eight modules, which equates to two fully equipped AVS[®] 370, can be run parallel with the WinVisco 370 software. Each module can measure the same or different samples using “pressure” or “suction”, fully independently of each other. In this way, series of measurements can be prepared extremely quickly and immediately evaluated and documented in the computer. This significantly reduces the time required to carry out viscosity measurements, especially for in process controls and quality assurance.

Technical data

Measuring range (time)	up to 9,999.99 s; resolution 0.01 s	
Measuring range (viscosity)	pressure:	0.35 ... 1,800 mm ² /s (cSt)
	suction:	0.35 ... approx. 5,000 mm ² /s (cSt)
Measured parameter	flow through time [s]	
Accuracy of the time measurement	± 0.01 %	
Measured value display	via PC	
Display accuracy	± 1 digit (0.1 %)	
Pump pressure	automatically controlled	
Preselectable tempering period	0 ... 20 min	
Preselectable number of measurements	up to 10	
Connections	Pneumatic connections	threaded connections for viscometers
	Electrical connections	circular connector with bayonet lock for measuring stands and TC viscometers
	RS-232-C interface	9-pin
	Mains connections	plug in accordance with EN 60320
	Pump connection	socket outlet in accordance with EN 60320
	Data Input/Output	serial to EIA RS-232-C
Ambient conditions	Ambient temperature	+10 ... +40 °C
	Air humidity	max. 85 % rel.
Housing	Material	coated aluminum plate
	Dimensions (for 1 ... 4 modules)	(W x H x D) approx. 255 x 205 x 320 mm
	Weight (incl. 1 module)	approx. 5.4 kg
Power supply	90 ... 240 V ~, 50 ... 60 Hz	
Equipment safety	EMC-Compatibility according to the Directive 89/336/EEC of the Council; low-voltage directive according to the Directive 73/23/EEC of the Council, as amended by the Directive 93/68/EEC of the Council	
Multi-tasking	for 1 ... 8 ViscoPump II modules, with WinVisco 370 software	



The following viscometers can be used with the AVS[®] 370: Ubbelohde viscometer to DIN, Ubbelohde viscometer to ASTM, micro Ubbelohde viscometer to DIN, micro Ostwald viscometer, Cannon-Fenske routine viscometer, TC-Ubbelohde viscometer, TC-micro Ubbelohde viscometer. We reserve the right to make technical changes. AVS[®] is a registered trademark of SI Analytics and stands for: "Automatic Viscosity System".

Ordering information AVS[®] 470 and AVS[®] 370

The AVS[®] 470 viscosity test station is composed of individual components.

Please always request a detailed offer.

Type no.	Order no.	Description
AVS[®] 470 basic unit for opto-electronic sensing	285415709	AVS [®] 470 basic unit, housing incl. one ViscoPump II module for opto-electronic sensing, Keyboard Version: 95 V to 230 V/50-60 Hz
AVS[®] 470 basic unit for TC sensing	285415708	AVS [®] 470 basic unit, housing incl. one ViscoPump II module for TC sensing, Keyboard Version: 95 V to 230 V/50-60 Hz
VZ 8511	1054306	ViscoPump II module for optical sensing
VZ 8512	1054304	ViscoPump II module for TC sensing

The AVS[®] 370 viscosity test station is composed of individual components.

Please always request a detailed offer.

Type no.	Order no.	Description
AVS[®] 370 basic unit for opto-electronic sensing	1056509	AVS [®] 370 basic unit, housing incl. one ViscoPump II module and WinVisco 370 software, for opto-electronic sensing
AVS[®] 370 basic unit for TC sensing	1056515	AVS [®] 370 basic unit, housing incl. one ViscoPump II module and WinVisco 370 software, for TC sensing
VZ 8511	1054306	ViscoPump II module for optical sensing
VZ 8512	1054304	ViscoPump II module for TC sensing

Accessories AVS[®] 470 and AVS[®] 370

Type no.	Order no.	Description
CT 72/P, 230V	285418526	Immersion thermostat 230 V and thermostatic bath (acrylic glass container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/P, 115V	285418513	Immersion thermostat 115 V and thermostatic bath (acrylic glass container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/2, 230V	285418547	Immersion thermostat 230 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/2, 115V	285418532	Immersion thermostat 115 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/4, 230V	285418568	Immersion thermostat 230 V and thermostatic bath (stainless steel container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/4, 115V	285418554	Immersion thermostat 115 V and thermostatic bath (stainless steel container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
Z 900	285225620	RS-232-C Data printer (230 V)
Measuring stand AVS[®]/S	285410502	Metal measuring stand AVS [®] /S, preferably for nonaqueous bath fluids
Measuring stand AVS[®]/SK	285410876	PVDF measuring stand AVS [®] /SK, corrosion-free, suitable for aqueous and nonaqueous bath fluids
Measuring stand AVS[®]/SK-CF	285410892	PVDF measuring stand AVS [®] /SK-CF, particularly for the use of Cannon-Fenske routine viscometers
Measuring stand AVS[®]/SK-V	285410905	PVDF measuring stand AVS [®] /SK-V, particularly for the use of dilution viscometers
CK 300, 115V	285414331	CFC-free flow-through cooler for enhancing the temperature constancy of the bath fluid (according to configuration and environmental conditions are +/- 0.02 K possible) or for measurement at room temperature or below (min. +5°C).
CK 300, 230V	285414348	CFC-free flow-through cooler for enhancing the temperature constancy of the bath fluid (according to configuration and environmental conditions are +/- 0.02 K possible) or for measurement at room temperature or below (min. +5°C).
Fixing frame	285405043	Fixing frame

Automatic viscosity measurement has been improved ...



The AVS[®] Pro III 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 AVS[®] Pro III provides maximum accuracy and reproducibility. Furthermore, working with the automatic sampler is easy and even allows unsupervised 24-hour operation.

Particularly with time consuming measurement runs, the AVS[®] Pro III 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.

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. 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.

... with the AVS[®] Pro III Automatic Sampler:

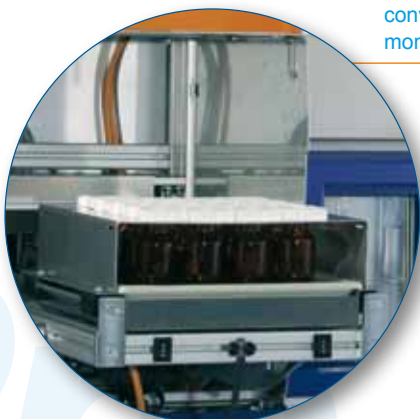
Two different sample racks are supplied:
a) one rack with 56 positions for 20 ml sample bottles for micro-viscometer applications



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 the oil industry in order to determine the viscosity index.

The AVS[®] Pro III 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 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 sample rack, which is easy to load using the electric motorized lifting mechanism. If needed, the rack can be temperature-regulated.

- ▶ Fully automatic and highly precise measuring station. Time measurement with a precision of $\pm 0.01s$ (but less precise than 0.1%)
- ▶ Prepared for highly aggressive media
- ▶ Although in combination of optical and thermal sampling of the meniscus channel or different capillary sizes and types, up to four viscometers selectable
- ▶ No dangerous manual filtration of the sample due to the ProClean system and micro-dosing

Advantages
AVS[®] Pro III

Working with the AVS® Pro III is ...

The AVS® Pro III is controlled by a PC, connected via 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 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 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.

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

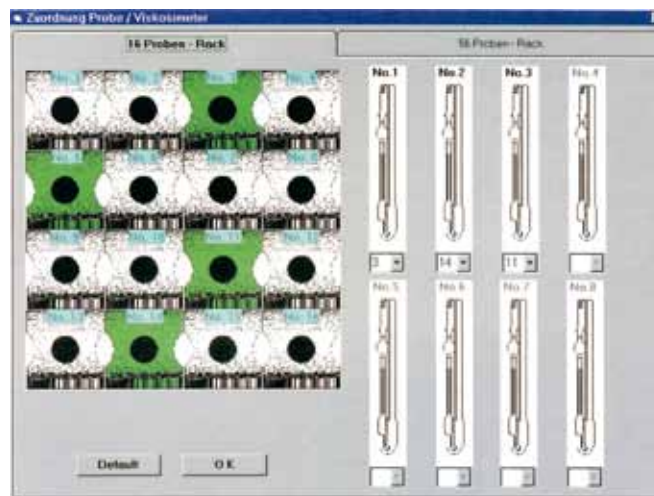
During the entire process, all of the parameters (depending on the menu level) and the respective status of the individual measuring positions, the temperature regulation system and the sample transfer system are either visible or can be selected.

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 are in compliance with the 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 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‹

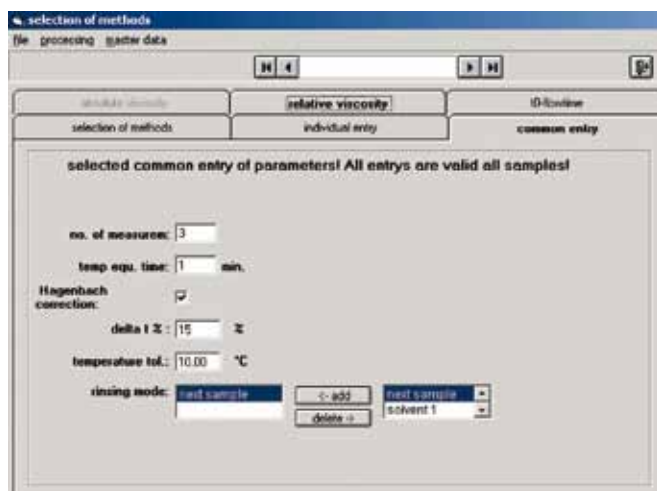
The AVS® Pro III allows individual allocation between the characteristics of the sample and the viscometers that are currently in operation.

... easy, reliable and safe

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.

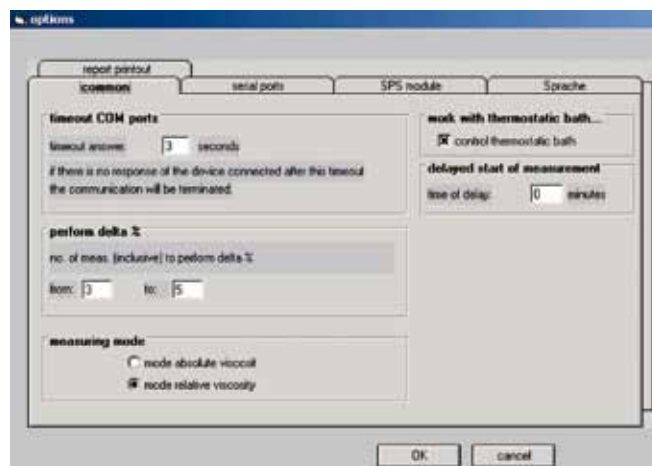
It is possible to “individually” allocate each sample to a capillary viscometer that is currently being used by means of the conventional MS-Windows® “drag and drop” method. This procedure makes it possible to increase the sample throughput.

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



›options‹

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



›selection of method‹

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.



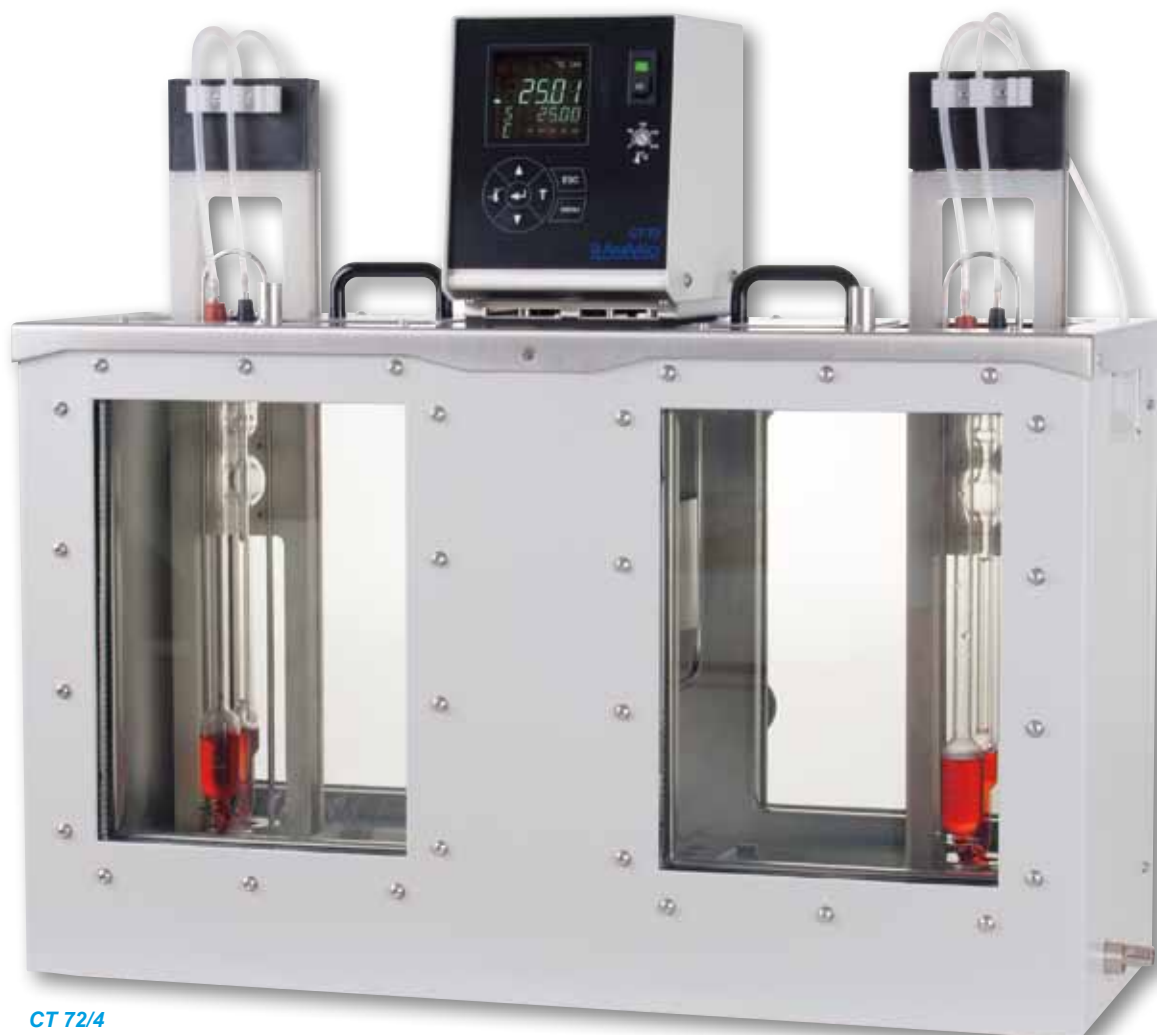
Technical data AVS[®] Pro III



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 ... 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 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 ... + 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 (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 72/4 or up to 2 pcs. CT 72/2
	Interfaces	control system using PC with 2 x RS-232-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 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)

CT 72 Thermostat Series – Transparent Thermostats conforming to Standards



CT 72/4

As the predecessor CT 52 our new transparent thermostats CT 72/P, CT 72/2, CT 72/2-TT and CT 72/4 meet the standards DIN 51 562 (part 1), ASTM D 445 and ISO 3105.

The transparent thermostats of SI Analytics are particularly designed for the determination of the viscosity of newtonian liquids in glass capillary viscometers. They may be adopted for manual as well as for automatic measurements. The appreciated and for viscometry necessary features of the CT 52 series remain while the compatibility of the new immersion thermostats with the known and established baths has been improved.

Safe and easy:
the VF-Display informs
you about the ongoing
process, at any time.



CT 72/2

- ▶ CT 72/2 and CT 72/4 can be used up to 150 °C. High temperature version is standard.
- ▶ Draining valve comes with CT 72/2, CT 72/2-TT and CT 72/4.

Advantages
baths

- ▶ Programmable set temperatures through integrated clock with program controller.
- ▶ Display of the momentary and the set temperature through VF display.
- ▶ Higher safety due to separate operation and safety temperature sensors.
- ▶ Easy to reach over temperature safety system on front panel.
- ▶ User friendly through automatic fuses on the back panel instead of micro fuses.
- ▶ Output of different data formats via RS-232 connection.

New
immersion
thermostats

Transparent Thermostats conforming to Standards:

The CT 72 series



Suitable temperature control liquids

Liquid	Alcohol	Water	Paraffine oil	Silicon oil
Temperature range	-40 °C ... +10 °C	+5 °C ... +80 °C	+40 °C ... +150 °C	+80 °C ... +150 °C

Valid for all temperature control liquids:

The viscosity of the temperature control liquid should reach max. 10 mm²/s at 25 °C. Liquids with a higher viscosity avoid an optimal circulation inside the bath.

Technical data

	CT 72/P	CT 72/2-TT	CT 72/2	CT 72/4
Working temperature	+10 °C ... +60 °C	-40 °C ... +150 °C	+5 °C ... +150 °C	+5 °C ... +150 °C
Measuring positions for AVS	2	2	2	4
Measuring positions TC	2	2	2	4
Measuring positions micro TC	2	2	2	4
Temperature stability according DIN 58 966 at 25 °C	±0.01 K	±0.01 K	±0.01 K	±0.01 K
Size (W x H x D in mm)	355 x 370 x 250	355 x 370 x 250	355 x 370 x 250	605 x 370 x 250
Filling volume	18 l	15 l	15 l	27 l
Material	PMMA	St. steel & glass	St. steel & glass	St. steel & glass
Weight (empty)	approx. 5 kg	approx. 14 kg	approx. 13.5 kg	approx. 28 kg

At applications within normal temperature range (+5 °C up to approx. +40 °C) a counter cooling will be necessary for maintaining the temperature stability. This can occur with tap water or by the operation with a flow through cooler (e.g. CK 300/310). For applications at cryogenic temperatures a cryostat is necessary.

Ordering information

Type no.	Order no.	Description
CT 72/P, 230V	285418526	Immersion thermostat 230 V and thermostatic bath (acrylic glass container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/P, 115V	285418513	Immersion thermostat 115 V and thermostatic bath (acrylic glass container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/2, 230V	285418547	Immersion thermostat 230 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/2, 115V	285418532	Immersion thermostat 115 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/2 -M, 230V	285418584	Immersion thermostat 230 V and thermostatic bath (stainless steel container with one manual gauge slide), equipped with two magnetic stirrer positions. Basic configuration for the attachment of one flow-through cooler.
CT 72/2 -M, 115V	285418593	Immersion thermostat 115 V and thermostatic bath (stainless steel container with one manual gauge slide), equipped with two magnetic stirrer positions. Basic configuration for the attachment of one flow-through cooler.
CT 72/2 -TT, 230V	285418615	Immersion thermostat 230 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/2 -TT, 115V	285418607	Immersion thermostat 115 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/4, 230V	285418568	Immersion thermostat 230 V and thermostatic bath (stainless steel container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/4, 115V	285418554	Immersion thermostat 115 V and thermostatic bath (stainless steel container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/E, 230V	285418501	Immersion thermostat 230 V/50 Hz
CT 72/E, 115V	285418495	Immersion thermostat 115 V/60 Hz
More Accessories and spare parts		
CK 300, 230V	285414348	Flow through cooler, 230 V
CK 300, 115V	285414331	Flow through cooler, 115 V
CK 310, 230V	285414320	Flow through cooler, 230 V, stainless steel version
CK 310, 115V	285414310	Flow through cooler, 115 V, stainless steel version
VZ 5210	1007628	CT 72 retrofit set for CT 62-thermostatic bath, contains: Immersion thermostat CT72/E-230 V, adapter plate and cooling devices
VZ 5213	285420397	CT 72 retrofit set for CT 62-thermostatic bath, contains: Immersion thermostat CT72/E-115 V, adapter plate and cooling devices
VZ 5402	285415171	Manual gauge slide for transparent thermostats
VZ 5403	285420684	3-fold manual gauge slide for transparent thermostats
VZ 5404	285418573	Dust protection cover for transparent thermostat
VZ 5405	285418620	Transparent thermostatic bath backlight
VZ 7100	285421051	Control thermometer measuring range +19 to +21 °C
VZ 7101	285421068	Control thermometer measuring range +24 to +26 °C
VZ 7102	285421076	Control thermometers measuring range +29 to +31 °C
VZ 7103	285421084	Control thermometers measuring range +39 to +41 °C
VZ 7104	285421092	Control thermometers measuring range +99 to +101 °C
VZ 7105	285421105	Control thermometers measuring range +134 to +136 °C

SI Analytics

a **xylem** brand

SI Analytics GmbH

Hattenbergstraße 10

55122 Mainz

Deutschland

Phone +49 (0)6 131/66-5111

Fax +49 (0)6 131/66-5001

si-analytics@xyleminc.com

www.si-analytics.com