pH

mV

°C

µS/cm

m^2/s

Laboratory Products

Electrodes, Meters for Electrochemistry, Titrators, Hotplates and Stirrers, Capillary Viscometers, Automatic Viscosity Measurement Systems

pH

mV

°C

η_r

pH

mV

°C

µS/cm

pH

m^2/s

SCHOTT Instruments GmbH

A Nova Analytics Company NOVA ANALYTICS

Welcome to SCHOTT Instruments

In this new catalogue we are presenting you, for the first time in one single volume, our complete range of laboratory products. The catalogue covers the product areas of laboratory electrodes and electrochemical meters, titrators and high performance titration software, laboratory hotplates and stirrers, as well as our extensive range of viscometry products - including capillary glass viscometers and viscosity measurement systems.

Electrochemistry and capillary viscometry are two areas of measurement which have become increasingly important in fields such as general science, research and production monitoring. We have been involved in these areas right from the very beginning and have repeatedly succeeded in generating innovative impulses in the form of new products and technology.

Our customers, to whom we would like to express our heartfelt thanks, have made an enormous contribution to our success. Your analytical requirements, thoughts and experience have encouraged us to rise to the challenge again and again. The result of this fruitful dialogue can be seen in this catalogue.

We at SCHOTT Instruments look forward to a continuation of this close relationship with our customers and hope that our new catalogue will help us to support your needs.

SCHOTT Instruments GmbH

Sean Donnelly
Managing Director

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News and highlights in this catalogue

New: ScienceLine laboratory electrodes

It would be hard to improve our top-of-the-line electrodes as far as measurement technology is concerned. But we have succeeded in making them more durable and more practical.

On Page 19 and thereafter you can see why our ScienceLine range of electrodes is unsurpassed.

New: ScienceLine micro-electrodes

With an **integrated temperature sensor** for simultaneous measurement of pH and temperature, with a **SMEK plug** for connection to various devices, with a **practical seal** for easier opening and refilling, with a **particularly slim, stable shaft** for minimal sample quantities and small containers as well as **a robust membrane** made of A glass.

Further details can be found on Page 24.

Unequaled: the AVSPro automatic sampler

This fully automatic measurement work station for determining the viscosity of Newtonian liquids with capillary viscometers is characterized by a high rate of sample throughput and the highest level of accuracy and reproducibility. Despite this, working with the AVSPro is very simple and it even allows unsupervised 24-hour operation. An additional advantage is the improved safety level that is achieved when working with aggressive media, such as sulphuric acid.

More about the AVSPro on Page 152.

New: AVS 370 and AVS 470
Now for the first time: "suction" and "pressure" measurements are possible - with one instrument

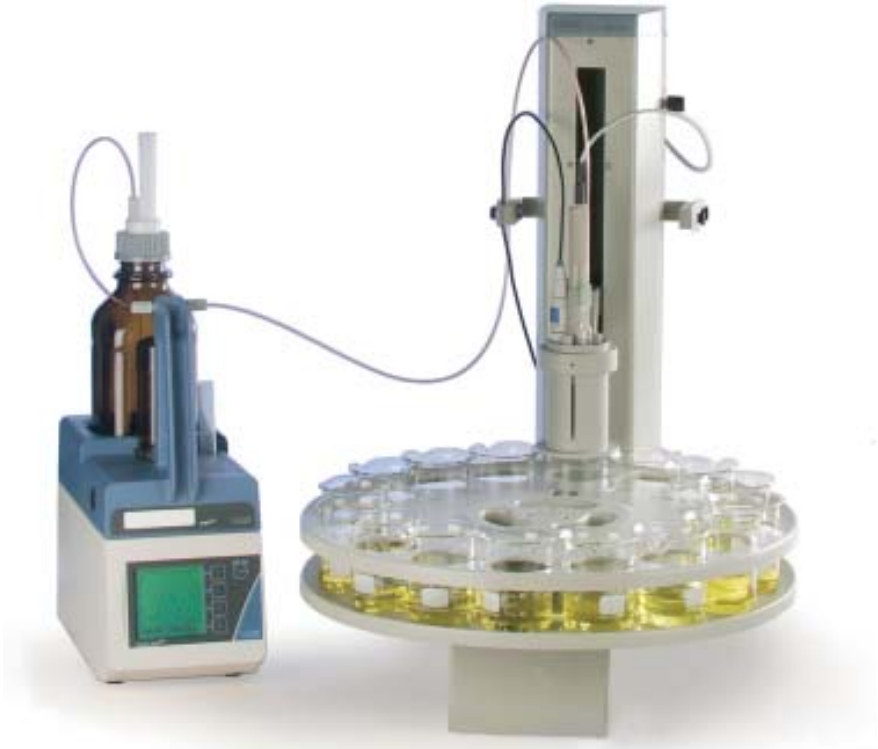
The ViscoSystem® AVS 370 is the first viscosity measurement apparatus that allows measurements by means of "suction" and "pressure". Up to 4 ViscoPump II modules can be integrated in the unit. This means that it is flexible and cost-effective to use. Utilization of the ViscoSystem® AVS 370 usually also results in perceptible time savings. With the AVS 470 you do not even need to have a PC.

More on Page 140.

New: suitable for simple and complex titration – the TitroLine alpha *plus*

The **TitroLine alpha *plus*** is a compact, flexible, very robust and all-purpose titrator. Its functional capacity ranges from simple endpoint titrations (EP), such as determination of total acidity in wine for example, to complex and difficult, non-aqueous titrations. Of course, the automatic **TitroLine alpha *plus*** titrator is also the ideal tool for pH-stat applications or for dead-stop titrations.

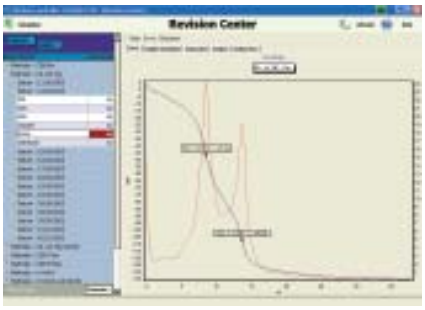
Find out more on Page 87.



The TW alpha *plus* sample changer from SCHOTT Instruments will help you to fulfill increasingly more exacting laboratory standards even more effectively.

Up to 24 samples in 50 ml glass beakers or 16 samples in 250 ml beakers can be loaded in the rotating sample tray. This means that you are well equipped to tackle most laboratory tasks. A sample tray for 24 COD containers is also available.

You can read more about the TW alpha *plus* on Page 98.



New: extremely simple and extremely productive: TitriSoft 2.5, the high-performance titration software

The **TitriSoft 2.5** titration software is the optimum solution for your titration tasks. This software works with WINDOWS 95/98/ME and WINDOWS NT/2000/XP and supports procedures during sample preparation, titration and results analysis in your day-to-day work. The software is sure to have you convinced because it is clearly arranged and logical.

For details see Page 97.

Perfectly designed, perfectly functional.

The multi-talented **SLK6 laboratory hotplate** offers you a high-performance heating element and a heating element with a stirrer. Because you can connect a Pt 1000 temperature sensor (accessory), it is possible to stir and simultaneously heat at a controlled temperature between 35 °C and 199 °C.

More about it on Page 110.

The ideal set for reliable readings:
SCHOTT Instruments laboratory pH meters
with ScienceLine combination electrodes

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Innovative electrochemistry: For more than 65 years …

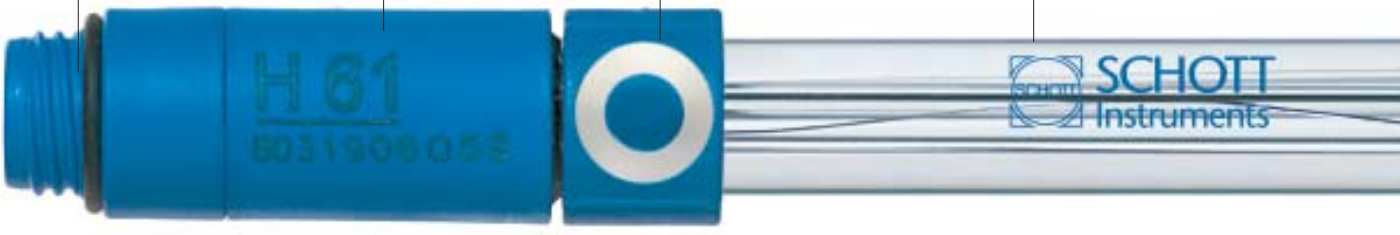
*The **plug head system** developed by SCHOTT in 1972 has proven itself millions of times over and for many years has been considered an unofficial European standard, also known as **S 7**.*

*For sensors capable of measuring more than pH values, SCHOTT has developed in cooperation with other well-known manufacturers the 6-pin **SMEK plug system** which has already proven itself in practical application.*

*Each sensor has its own **ID number** and a certificate to make your documentation even more reliable and safe.*

*One minor example for the improvement in practical handling: The **new cap** on the ScienceLine sensors which facilitates refilling and closing.*

*As a contribution to **practical environmental protection**, we volunteered years ago to take back all used sensors produced by us in order to dispose of them properly.*



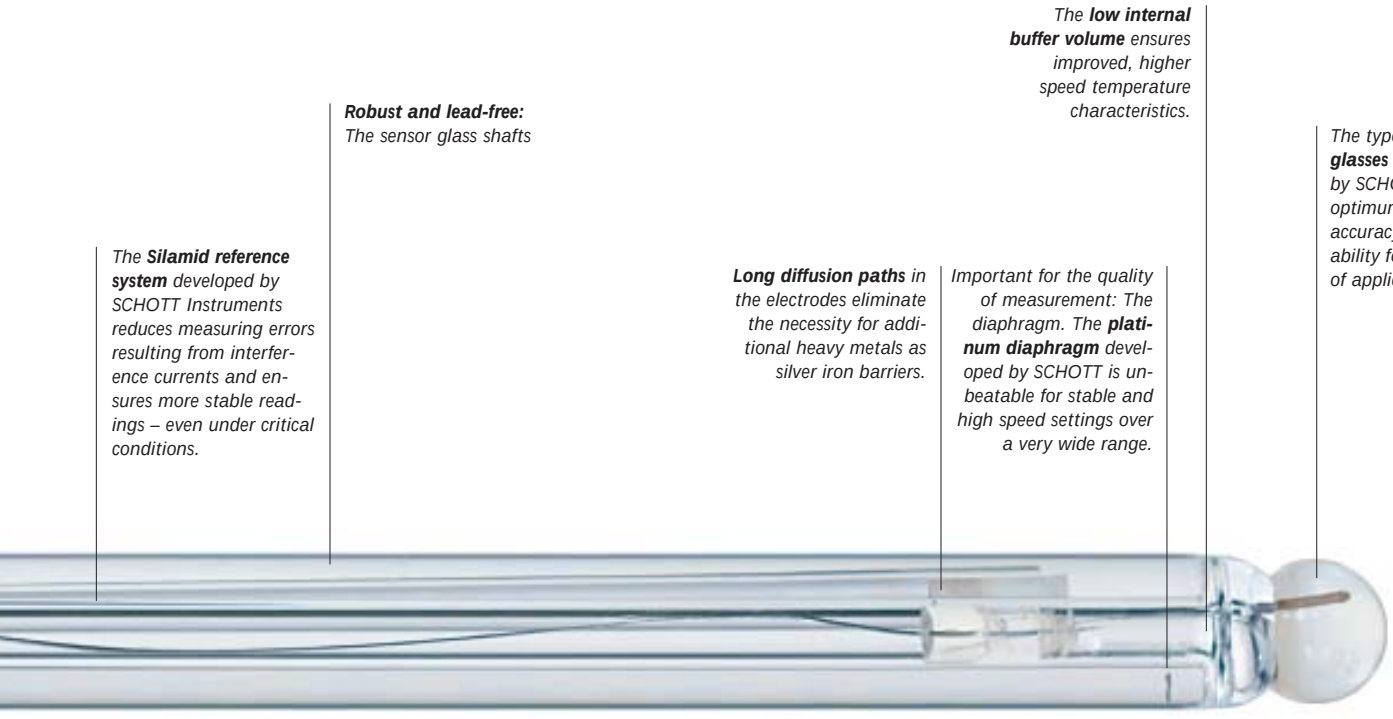
Innovative Electrochemistry – from the very beginning

As we developed glass electrodes over 65 years ago, we created the prerequisites for practical electrochemical pH measurement which since then has conquered the world. Today, use of such electrodes has replaced nearly all other methods of pH measurement. Without these electrodes, much important work in the areas of research, engineering and production would not be imaginable.

From the very beginning, we have continuously provided new impetus in the field of electrochemical measurement. We have improved the accuracy while continuously making our electrodes more reliable and durable. In fact, our developments were what made many measuring procedures possible at all.

Nor have we ever neglected the practical aspects. The bulky, sensitive electrodes of the past have become practical, robust sensors which are easy to handle. All progress in the improvement of electrodes has been made possible by continuous, close cooperation with our customers. Your needs, experience and ideas have led to a line of electrodes available only from SCHOTT Instruments in this variety and quality. Our BlueLine offers simple, robust sensors for everyday work.

… we have set the standards



For measurements with particularly high demands, our ScienceLine provides a wide spectrum of sensors which have distinguished themselves for demanding work and a wide range of operating conditions in terms of their accuracy, reliability and extremely long service life. And of course, we offer matching accessories such as cables and buffer solutions, etc. in proven quality.

You have a new application? Perhaps we already have the solution

Decades of work in development and improvement of electrochemical measuring procedures and close cooperation with our customer has allowed us to gain experience over the entire spectrum of applications. We are happy to share this experience with you. Call us or write us about your requirements; we will be glad to advise you how you can solve your problem with sensors from SCHOTT Instruments.

However, we are also interested in your experience – let us know what experience you have made in the use of our sensors which could be valuable for others.

Attractive shape, reliable function: BlueLine in use

The compact BlueLine program covers the most important measuring application in laboratories. Reliable, high speed settings over a wide temperature range, new membrane glass with higher mechanical stability as well as improved gel electrolyte are only a few features ensuring improved functionality. On electrodes with liquid electrolytes the refill opening is sealed tightly with a practical sliding plug.

Further recommendations for using BlueLine electrodes are given on the following pages. If you have any other special questions regarding BlueLine or the use of our electrodes: Simply call us.

BlueLine	**pH**						**Redox**		**Conductivity**
plug head (for cable: e.g. LB1A, LB1BNC)	**11 pH[1)]**	**22 pH[2)]**	**13 pH**	**16 pH**	**21 pH**	**27 pH**	**31 Rx**	**32 Rx**	
fixed cable, 8-pole plug									**48 LF**
Application	high perf.	robust	precision	micro	spear tip	surface	standard	robust	low conduct.
acid, diluted	■		■						
agar-agar gel					■	■			
aquarium water	■	■	■				■	■	
aqueous media in general	■	■	■				■	■	
bacteria cultures				■	■	■			
beer	■		■				■	■	
boiler feed water	■		■						■
bread					■				
butter/margarin					■				
cheese					■	■			
coffee extract	■		■						
condensate	■		■						■
cooling water	■	■	■				■		
cream	■		■						
cyanide detoxification	■		■				■		
desalination/ion exchange	■		■						■
detergent	■		■						
disinfectant	■		■				■	■	
dispersion paint	■		■					■	
drinking water	■		■				■	■	
effluents in general	■	■	■				■	■	
electroplating bath	■		■				■		
electroplating wastewater	■	■	■				■	■	
emulsions, water-based	■		■				■	■	■
environmental analysis	■		■				■	■	■
extreme pH values	■		■						
fertilizer solution	■		■				■	■	
field measurements	■	■						■	
fish					■				
fixing baths	■		■				■		
grease	■		■						
ground water	■		■				■	■	
infusion solutions	■	■	■						
jam	■		■						
juice	■	■	■				■		

These electrodes provide examples for electrodes with [1)] liquid electrolyte and with [2)] gel electrolyte. The corresponding versions with fixed cable and/or integrated temperature sensor are given in the technical descriptions below.

BlueLine	pH						Redox		Conductivity
plug head (for cable: e.g. LB1A, LB1BNC)	11 pH[1)]	22 pH[2)]	13 pH	16 pH	21 pH	27 pH	31 Rx	32 Rx	
fixed cable, 8-pole plug									48 LF
Application	high perf.	robust	precision	micro	spear tip	surface	standard	robust	low conduct.
kjeldahl distillation	■		□						
lemonade	■		□				□		
liquids containing protein	■		■						
low-ionic strength samples	■		■						■
lye, diluted[3)]	□		■						
measurement narrow vessels				■					
mediums containing sulfide	□		■						
milk	■		□						
mineral water	■	□	□						
oil/water emulsion			■						
organic percentile high	□		■						
paper						■			
paper extract	■		□						
photographic developer	■	□					□		
precision measurement	■		■						□
rain water	■		■						■
redox reaction/titration							■		
salt solution/brine	■		□						
sausage/meat					■	□			
seawater	■		■						
serum	■		□	■					
skin/leather						■			
soap	■		□						
soil extract	■	□	□				□		□
suspension, water-based	□		■						
titration in aqueous media	■		□				□		
toothpaste	□				■	□			
TRIS buffer solution	■		□						
ultra-pure water	■		■						□
varnish (water-based)	□		■				■		
vegetable/fruits					■	□			
wine	■		□						
yogurt	■		□						

■ Recommended by SCHOTT Instruments
□ Can be used for application
[3)] See also ScienceLine electrodes with H-glass.

For some applications, other application recommendations are practical. Please also observe the material resistance of the sensor to the measuring medium. Other sensors are available in our ScienceLine product range. If you cannot find your application, please ask us – by telephone, fax or E-mail.

BlueLine pH combination electrodes

The robust electrodes for general applications

pH range	0...14
Temperature range	-5...+80 °C
Shaft	Noryl, 12 mm ∅
Shaft length L	120 mm
Zero point	pH = 7.0 ± 0.3
Diaphragm	fibre
Reference system	Silamid®
Reference electrolyte	gel (KCl), low maintenance, not refillable
Shape of glass membrane	cylindrical
Resistance of glass membrane (25 °C)	400 MΩ
Type of membrane glass	A

The liquid electrolyte electrodes for demanding measurements

pH range	0...14
Temperature range	-5...+100 °C
Shaft	glass, 12 mm ∅
Shaft length L	120 mm
Zero point	pH = 7.0 ± 0.3
Diaphragm	platinum
Reference system	Silamid®
Reference electrolyte	KCl 3 mol/l
Shape of glass membrane	conical
Resistance of glass membrane (25 °C)	300 MΩ
Type of membrane glass	A

BlueLine	BlueLine
28 pH	**18 pH**
22 pH	*11 pH*
23 pH	*12 pH*
24 pH	*14 pH*
24-3 pH	*15 pH*
25 pH	*17 pH*
26 pH	*19 pH*
26 pH-Cinch	
28 pH-P	
28 pH-H	
29 pH	
29 pH-P	

Order No.	BlueLine Type No.	Temperature sensor integrated	Connection
285129225	22 pH	no	plug head, recommended cable: e.g. LB1A
285129233	23 pH	no	1 m fixed cable with DIN plug 19 262
285129241	24 pH	NTC 30 kΩ	1 m fixed cable with DIN plug 19 262 + banana plug
285129533	24-3 pH	NTC 30 kΩ	3 m fixed cable with DIN plug 19 262 + banana plug
285129258	25 pH	no	1 m fixed cable with BNC plug
285129266	26 pH	NTC 30 kΩ	1 m fixed cable with BNC plug + banana plug
285095712	26 pH-Cinch	NTC 30 kΩ	1 m fixed cable with BNC plug + cinch plug
285129282	28 pH	Pt 1000	1 m fixed cable with DIN plug 19 262 + banana plug
1065896	28 pH-P	Pt 1000	1 m fixed cable with DIN plug 19 262 + 2-mm pole plug
285129570	28-5 pH	Pt 1000	5 m fixed cable with DIN plug 19 262 + banana plug
1065895	29 pH	Pt 1000	1 m fixed cable with BNC plug + banana plug
1065894	29 pH-P	Pt 1000	1 m fixed cable with BNC plug + 2-mm pole plug

Order No.	BlueLine Type No.	Temperature-sensor integrated	Connection
285129114	11 pH	no	plug head, recommended cable: e.g. LB1A
285129122	12 pH	no	1 m fixed cable with DIN plug 19 262
285129147	14 pH	NTC 30 kΩ	1 m fixed cable with DIN plug 19 262 + banana plug
285129155	15 pH	NTC 30 kΩ	1 m fixed cable with BNC plug + banana plug
285129171	17 pH	no	1 m fixed cable with BNC plug
285129188	18 pH	Pt 1000	1 m fixed cable with DIN plug 19 262 + banana plug
285129190	19 pH	Pt 1000	1 m fixed cable with BNC plug + banana plug

BlueLine
Special sensors

The specialists
for special applications

Zero point of
pH electrodes pH = 7.0 ± 0.3

Connection cable
for pH/Redox
electrodes e.g. LB 1 A

BlueLine 13 pH **BlueLine 16 pH** **BlueLine 21 pH** **BlueLine 27 pH** **BlueLine 31 Rx** **BlueLine 32 Rx** **BlueLine 48 LF**

Precision electrode BlueLine 13 pH,
Glass shaft, screw ground joint diaphragm, electrolyte KCl 3 mol/l, Silamid® reference system, spherical membrane, A-glass, plug head, length 170 mm, 12 mm ∅ , -5 . . . +100 °C, 0 . . . 14pH,
Order No. 285129139

Micro electrode BlueLine 16 pH,
Glass shaft, platinum diaphragm, electrolyte KCl 3 mol/l, Silamid® reference system, spherical membrane, L-glass, plug head, length 40/80 mm, 12/5 mm ∅, -5. . . +100 °C, 0. . . 14pH,
Order No. 285129163

Spear tip electrode BlueLine 21 pH,
Glass shaft, hole diaphragm, Referid® electrolyte, Silamid® reference system, Spear membrane, L-glass, plug head, length 65/25 mm, 12/5 mm ∅, -5. . . +80 °C, 2. . . 13pH,
Order No. 285129217

Surface electrode BlueLine 27 pH,
Glass shaft, KPGå annular gap diaphragm, Referid® electrolyte, Silamid® reference system, flat membrane, L-glass, plug head, length 120 mm, 12 mm ∅, -5. . . +50 °C, 2. . . 13pH,
Order No. 285129274

Redox electrode BlueLine 31 Rx,
Glass shaft, ceramic diaphragm, electrolyte KCl 3 mol/l, Silamid® reference system, sensor platinum disk 4 mm ∅, plug head, length 120 mm, 12 mm ∅, -5. . . +100 °C,
Order No. 285129311

Redox electrode BlueLine 32 Rx,
Plastic shaft, fibre diaphragm, gel electrolyte, Silamid® reference system, sensor platinum pin 1 mm ∅, plug head, length 120 mm, 12 mm ∅, -5. . . +80 °C,
Order No. 285129320

Conductivity cell for low ionic media BlueLine 48 LF,
Stainless steel shaft, 2-pin cell, 1 m fixed cable with 8-pole plug, sensor stainless steel, cell constant 0.1 cm^{-1}, temperature sensor NTC 30 kΩ, length 120 mm, 12 mm ∅, -5. . . +80 °C,
Order No. 285129488

Tips and information for successful measuring

Storage

Store pH and redox electrodes in the solution for filling the reference electrodes (immerse up to diaphragm). In most cases this is a KCl solution (3 mol/l Type No. L300). Low maintenance electrodes should also be stored in a KCl solution. Conductivity measuring cells can be stored in a dry location after cleaning and rinsing with distilled water.

Measuring

Open the refill opening on refillable pH and redox electrodes before performing measurements. Immerse the sensor into the medium to be measured at least up to the diaphragm. When using refillable sensors pay attention to the electrolyte fill level (see refilling). Rinse the sensor with distilled water between measurements, however do not wipe off. Carefully dab off excess drops.

Calibration

For quality relevant pH measurements it is necessary to calibrate and, if necessary, adjust the pH measuring equipment using buffer solutions to ensure that they meet the requirements for measuring accuracy. If buffer solutions are taken from a bottle, ensure that the bottle is reclosed immediately after removal. Never return the used buffer solution to the bottle, always throw it away. DIN buffer solutions in ampoules are recommended for higher quality requirements, because such ampoules always contain fresh, single portions of the solution. Redox sensors are not calibrated. They can be checked for proper function using appropriate test solutions. The cell constant of conductivity measuring cells should be checked at regular intervals with test solutions and re-adjusted, if required. Major deviations in the cell constants indicate soiling or damage. It may be recommendable to replate the platinum electrode.

Refilling

Refillable pH and redox sensors should be filled with electrolyte solution so that the fill level of the electrolyte solution is at least 5 cm above the level of the medium to be measured. BlueLine electrodes can be refilled simply by pumping electrolyte solution into them with a small dispensing bottle (cf. Fig.).

Cleaning

Empty the soiled reference electrode, rinse with electrolyte solution and refill with electrolyte solution. When soiled, glass membranes or diaphragms should be cleaned to maintain the measuring function. Depending on the degree of contamination submerge only the glass membrane or the glass membrane and diaphragm in the cleaning solution. Ensure that any cleaning agent, which has leaked into the electrode, does not come into contact with the reference system; if necessary rinse out the reference electrode with electrolyte solution. We recommend the methods listed below depending on the degree of contamination.

After cleaning rinse off the sensor with distilled water and condition it for one hour or longer in electrolyte solution. Recalibrate the measuring equipment before performing further tests.

Contamination	Treatment	Remarks
Inorganic adhering substances	Several minutes with substances such as HCl 0.1 mol/l or NaOH 0.1 mol/l	Better cleaning action when solution is warm (40 - 50 °C).
Organic substances (oils, greases,...)	Rinse with suitable organic solvent (e.g. ethanol, acetone, etc.) or tenside solution	Observe resistance of plastic shaft to chemicals; Sensor can also be wiped off with a soft, moist rag.
Proteins	Approx. 1 hour with pepsin/HCl solution (type No. L 510)	
Sulfides (on ceramic diaphragm)	With thiocarbamide/HCl solution (7.5% in HCl 0.1 mol/l) until color is removed	Cause: Reaction between electrolyte and solution to be measured. Remedy: Electrodes with platinum diaphragm and Ag^+-free electrolyte.

pH glasses/diaphragms

Different applications require appropriate, especially matched pH electrodes. You can select the electrode with the optimum pH glass and diaphragm for your specific application.

pH glass

SCHOTT Instruments electrodes are manufactured using various types of pH glasses. These have been optimized for your application and offer high measuring accuracy and reliability. Select the right pH glass for your application:

pH glass	
N-glass:	for general applications over the entire pH range.
A-glass:	with short response time in drinking water, service water and wastewater, for general applications and in media with low ion content.
L-glass:	for low temperatures and general applications.
H-glass:	for high temperatures; in acid and alkaline range, even with high sodium ion concentrations.
S-glass:	in hot alkaline media with good reproducibility and short response times. For process electrodes .

Diaphragms

Selection of an electrode with a suitable diaphragm is an important factor for reliable and reproducible pH measurement:

Diaphragm:	
Platinum diaphragm:	for precision measurement, universal, shows its strength particularly with solutions containing solids and extreme pH values and temperatures. Ideal for titration and very insensitive to stirring.
Ceramic diaphragm:	robust for general applications. Low electrolyte outflow rate.
Ground joint diaphragm:	easy to clean, preferred for liquids with high quantities of solids, suspensions, emulsions, creams and low ion mediums. High electrolyte outflow rate.
Fibre diaphragm	robust, minimum maintenance electrodes. Preferred for general applications and field measurements.
KPG®-annular gap diaphragm:	On minimum maintenance electrodes with Referid® polymer electrolyte. Symmetrical annular gap, insensitive to soiling, low flow sensitivity, low immersion depth.

The platinum diaphragm developed by SCHOTT gives electrodes particularly constant and reproducible measuring characteristics.

It consists of twisted platinum wires potted into the glass shaft of the electrode. The defined intermediate space between the platinum wires ensures a continuously uniform electrolyte flow rate in all mediums and at all temperatures, which remains constant over the entire service life of the electrode.

Recommended applications for ScienceLine laboratory electrodes

Application/measuring medium	Recommended electrodes	Description	Page
General	N 61	wide range of application	21
	A 161, N 1051 A	wide range of applications, integrated temperature sensor	23
Ammonia	NH 1100	universal	34
Insert measurements	L 6880	refillable	25
	L 8880	low maintenance	25
	N 5800 A	refillable, micro-electrode	25
	N 48 A	refillable, robust	25
	N 1048 A, N 2048 A	refillable, robust, integrated temperature sensor	25
Mediums with low-ion content	N 61	platinum diaphragm, high speed	21
	N 64	ground joint diaphragm, higher KCl flow rate	21
	A 164	ground joint diaphragm, higher KCl flow rate, integrated temp. sensor	23
Small trial quantities, small vessels	N 5800 A	micro-electrode for insert type measurement	25
(e.g. ampoules, bulbs)	N 5900 A	micro-electrode	25
	N 6000 A	micro-electrode, 0.1 ml solution and higher	25
	N 6003	micro-electrode for NMR tubes	25
	A 157	micro-electrode with integrated temperature sensor	25
Portable Knick pH Meter	N 50 A	pH combination electrode	21
(knick electrode head)	N 1050 A	same as N 50 A, integrated temperature sensor	23
Alkaline solutions, acids (strong)	H 61	extreme pH values, also high temperatures	21
	H 161	extreme pH values, also high temperatures, integrated temp. sensor	23
Conductivity measurement	LF 613 T	universal	33
	LF 713 T	organic solutions, acids (particularly H_2SO_4)	33
	LF 413-3 T	universal, 4-pole graphite sensor	32
Sodium	Na 61	universal	34
Surface measurements	L 39	refillable, plastic shaft	25
Redox potentials	Pt 6880	general measurements	27
Oxygen	Ox 1100+	universal, galvanic electrode	34
	9009/61	universal, amperometric electrode	34
Wastewater with high quantities	N 64	normal conditions	21
of suspended matter, suspensions	A 164	normal conditions, integrated temperature sensor	23
	H 64	also high temperatures, extreme pH values	21
Titration	N 62	pH general, refillable	21
	N 61 eis, N 6480 eis	pH non-aqueous, electrolyte LiCl/glacial acetic acid	21
	A 7780	pH general, low maintenance	21
	A 162	pH general, refillable, integrated temperature sensor	23
	N 6480 eth	pH non-aqueous electrolyte LiCl/ethanol	21
	AgCl 62	halogenide ions	27
	KF 1100	Karl-Fischer titration	28
	Ca 1100 A	Ca/Mg total hardness	34
	Cu 1100 A	complexometric metal titration	34
	F 1100 A	fluoride titration	34
	Pb 1100 A	sulfate titration	34
	Pt 1200, Pt 1400	double Pt electrode for dead-stop titration	29
	Pt 6280, Pt 6580	redox titration general	27
	Pt 5901	redox tritration (COD)	27
Tris buffer	N 6250	calomel reference	21

Suitable electrodes for other applications are given in the corresponding chapters.

ScienceLine: A maximum of adaptability for all your applications

Only ScienceLine electrodes offer these advantages:

While the BlueLine electrodes were developed as reliable sensors for a series of standard tests, the ScienceLine electrodes have proven themselves million of times over as heavy-duty laboratory electrodes from SCHOTT Instruments for practically all applications in the laboratory and in the field.

ScienceLine electrodes not only offer you maximum measuring accuracy and measuring consistency – with optimum sensor service life – but also a maximum of adaptability for all your applications, even at high temperatures.

A few examples:

- With ScienceLine electrodes you have a larger selection of diaphragms, e.g. including the annular gap diaphragm which has proven itself exceptionally in the process field and is combined with the Referid® electrolyte in the L 8280.
- The ScienceLine electrodes offer you a larger selection of microelectrodes for particularly small sample quantities and small vessels as well as a variety of electrodes for insert-type tests also with liquid electrolyte, for example the L 6880.
- With ScienceLine electrodes, more types of membrane glass are available, including H-glass, which has a very high accuracy even in the highly alkaline range and is particularly suitable for measurements at high temperature.
- The ScienceLine also offers electrodes with extreme lengths up to 500 mm, which allow measurements in very deep vessel and test tubes.
- ScienceLine offers a large selection of metal electrodes for Redox potential measurements and titration.
- The ScienceLine also offers sensors for other parameters such as ammonia, sodium and oxygen.
- A large number of ScienceLine electrodes are already equipped with a temperature sensor. Many sensors have the SMEK plug head, which allows connection of the electrodes to various measuring instruments using the large selection of plug/cable combinations.
- For particularly demanding measuring applications, the ScienceLine also offers the possibility of using separate measuring and reference electrodes to fully utilize the longer service life of the glass electrodes for more economic testing.

More versatile, faster, more practical!
For example: the new Micro electrode A 157

SMEK plug head for connecting to various instruments

Practical seal facilitates opening and refilling

Slim, stable shaft for small sample quantities and large vessels

Integrated temperature sensor for simultaneous measurement of pH and temperature

A-glass membrane with particularly robust design

ScienceLine pH combination electrodes

pH combination electrodes with plug head and fixed cable

Reference system:	silver/silver chloride (See Remarks)
Shaft material:	glass
Zero point:	pH = 7.0 ± 0.3
Electrolyte:	KCl 3 mol/l (except N 6250: KCl 4.2 mol/l A 7780 und L 7780: gel electrolyte L 8280: Referid® electrolyte)
Membrane shape:	sphere
pH range:	0 . . . 14
Connection cable:	
for plug head:	e.g. L 1 A (See also page with connection cables)
fixed cable:	1 m long, with plug A acc. to DIN 19262 or with BNC plug

H 61
H 62
H 63
N 61
N 62
H 6180
H 6280
H 6380
N 6180
N 6250
N 6280
N 42 A
N 42 BNC
N 50 A
N 52 A
N 52 BNC
N 61 eis

H 64
N 64
N 6480 eis
N 6480 eth

N 65
H 65
H 6580
N 6580

L 32

L 7780
A 7780

N 6980

L 8280

Order No.	Type No.	Length L [mm]	∅ [mm]	Dia-phragm	pH-glass	Temp.-range [°C]	Connection	Remarks
285101260	A 7780	120	12	3 x ceramic	A	-5 . . .+80	plug head	gel electrolyte
285100207	H 61	170	12	platinum	H	+10 . . .+100	plug head	
285102524	H 6180	170	12	ceramic	H	+10 . . .+100	plug head	
285100215	H 62	120	12	platinum	H	+10 . . .+100	plug head	
285102532	H 6280	120	12	ceramic	H	+10 . . .+100	plug head	
285100223	H 63	320	12	platinum	H	+10 . . .+100	plug head	
285102549	H 6380	320	12	ceramic	H	+10 . . .+100	plug head	
285100231	H 64	170	12	ground joint	H	+10 . . .+100	plug head	
285100248	H 65	103[1)]	10	platinum	H	+10 . . .+100	plug head	standard taper NS 14.5
285102565	H 6580	103[1)]	10	ceramic	H	+10 . . .+100	plug head	standard taper NS 14.5
1061093	L 32	120	12	fibre	A	-5 . . .+50	plug head	plastic shaft
285101252	L 7780	120	12	ceramic	L	-5 . . .+80	plug head	gel electrolyte
285101277	L 8280	120	12	KPG®	L	-5 . . .+80	plug head	Referid® electrolyte
285100437	N 42 A	120	12	ceramic	A	-5 . . .+100	DIN plug	
285101544	N 42 BNC	120	12	ceramic	A	-5 . . .+100	BNC plug	
285100453	N 50 A	108	12	ceramic	A	-5 . . .+100	DIN plug	for portable Knick pH meters
285100494	N 52 A	120	12	platinum	A	-5 . . .+100	DIN plug	
285105451	N 52 BNC	120	12	platinum	A	-5 . . .+100	BNC plug	
285100001	N 61	170	12	platinum	A	-5 . . .+100	plug head	
285100018	N 6180	170	12	ceramic	A	-5 . . .+100	plug head	
285100034	N 62	120	12	platinum	A	-5 . . .+100	plug head	
285100112	N 6250	120	12	ceramic	A	+15 . . .+40	plug head	calomel ref., for TRIS buffers
285100042	N 6280	120	12	ceramic	A	-5 . . .+100	plug head	
285100059	N 64	170	12	ground joint	A	-5 . . .+100	plug head	
285100067	N 65	103[1)]	10	platinum	A	-5 . . .+100	plug head	standard taper NS 14.5
285102516	N 6580	103[1)]	10	ceramic	A	-5 . . .+100	plug head	standard taper NS 14.5
285101709	N 6980	103[1)]	10	ground joint	A	-5 . . .+100	plug head	standard taper NS 14.5
285092661	N 61eis	170	12	3 x platinum	A	+10 . . .+40	plug head	electrolyte L 5014
285092337	N 6480 eis	170	12	ground joint	A	+10 . . .+40	plug head	electrolyte L 5014
285092329	N 6480 eth	170	12	ground joint	A	0 . . .+40	plug head	electrolyte L 5034

[1)] Length from upper end of standard taper

ScienceLine pH combination electrodes with temperature sensor

pH combination electrodes with temperature sensor

Reference system:	silver/silver chloride
Shaft material:	glass
Zero point:	pH = 7.0 ± 0.3
Electrolyt:	KCl 3 mol/l
Temperature sensor:	Pt 1000
Membrane shape:	sphere
pH range:	0 . . .14
Connection cable:	
for SMEK-plug head:	e.g. LS 1 ANN (See also page with connection cables)
fixed cable:	1 m long, with plug A acc. to DIN 19262 or with BNC plug, as well as plug for temperature sensor

N 1042 A
N 1041 A
N 1041BNC
N 42 BNC
N 1050 A
N 1051 A
N 1051 BNC
N 1052 A
N 1052 BNC
N 2041 A
N 2041 BNC
N 2042 A

A 162
A 161
H 161
H 162

A 164

Order No.	Type No.	Length L [mm]	Dia-phragm	pH-glass	Temp.-range [°C]	Connection	Remarks
285129517	A 161	170	platinum	A	-5 . . .+100	SMEK plug head	
285129525	A 162	120	platinum	A	-5 . . .+100	SMEK plug head	
285129600	A 164	170	ground joint	A	-5 . . .+100	SMEK plug head	
285129590	H 161	170	platinum	H	+10 . . .+100	SMEK plug head	
285129580	H 162	120	platinum	H	+10 . . .+100	SMEK plug head	
285100486	N 1041 A	170	ceramic	A	-5 . . .+100	DIN- + 4-mm plug	
285100531	N 1041 BNC	170	ceramic	A	-5 . . .+100	BNC- + 4-mm plug	
285104541	N 1042 A	120	ceramic	A	-5 . . .+100	DIN- + 4-mm plug	
285105476	N 1042 BNC	120	ceramic	A	-5 . . .+100	BNC- + 4-mm plug	
285100375	N 1050 A	108	ceramic	A	-5 . . .+100	DIN- + 4-mm plug	for portable Knick pH-Meter
285100510	N 1051 A	170	platinum	A	-5 . . .+100	DIN- + 4-mm plug	
285100500	N 1051 BNC	170	platinum	A	-5 . . .+100	BNC- + 4-mm plug	
1054512	N 1052 A	120	platinum	A	-5 . . .+100	DIN- + 4-mm plug	
285100342	N 2041 A	170	ceramic	A	-5 . . .+100	DIN- + 2-mm plug	
285100334	N 2041 BNC	170	ceramic	A	-5 . . .+100	BNC- + 2-mm plug	
285100359	N 2042 A	120	ceramic	A	-5 . . .+100	DIN- + 2-mm plug	

ScienceLine micro, spear tip and surface pH combination electrodes

Micro, spear tip and surface pH combination electrodes

Reference system:	silver/silver chloride
Shaft material:	glass (except L 39: plastic shaft)
Zero point:	pH = 7.0 ± 0.3
Electrolyte:	KCl 3 mol/l (except L8880: Referid®)
Type of membrane glass:	A
Connection cable: for SMEK plug head:	e.g. LS 1 ANN (See also page with connection cables)
for plug head versions:	e.g. L 1 A (See also page with connection cables)
fixed cable:	1 m long, with plug A acc. to DIN 19262 or with BNC plug, as well as plug for temperature sensor

A 157

L 6880
L 8880

L 39

N 1048 A
N 2048 A
N 48 A
N 48 BNC

N 5800 A
N 5800 BNC
N 5900 A

N 6000 A
N 6000 BNC

N 6003

Order No.	Type No.	Length L [mm]	∅ [mm]	Dia-phragm	Membran-shape	Temp.-range [°C]	Range [pH]	Connection
Micro								
285129610	A 157[1)]	40/130	12/5	platinum	cylindrical	-5 . . .+100	0 . . .14	SMEK plug head
285105127	N 5800 A	96[2)]	5	3 x platinum	spear	-5 . . .+100	0 . . .14	DIN plug
285105579	N 5800 BNC	96[2)]	5	3 x platinum	spear	-5 . . .+100	0 . . .14	BNC plug
285105135	N 5900 A	96[2)]	5	platinum	sphere	-5 . . .+100	0 . . .14	DIN plug
285105151	N 6000 A	96[2)]	3	platinum	cylindrical	-5 . . .+100	0 . . .14	DIN plug
285105632	N 6000 BNC	96[2)]	3	platinum	cylindrical	-5 . . .+100	0 . . .14	BNC plug
285105176	N 6003	180	3	ceramic	cylindrical	-5 . . .+100	0 . . .14	plug head
Spear tip								
285104611	N 1048 A[1)]	120	12	ceramic	spear	-5 . . .+100	0 . . .14	DIN- + 4-mm plug
285104628	N 2048 A[1)]	120	12	ceramic	spear	-5 . . .+100	0 . . .14	DIN- + 2-mm plug
285100445	N 48 A	120	12	ceramic	spear	-5 . . .+100	0 . . .14	DIN plug
285101569	N 48 BNC	120	12	ceramic	spear	-5 . . .+100	0 . . .14	BNC plug
285101211	L 6880	70/50	12/8	3 x ceramic	spear	-5 . . .+100	0 . . .14	plug head
285101285	L 8880	70/50	12/8	hole	spear	-5 . . .+80	2 . . .13	plug head
Surface								
1061094	L 39	120	12	fibre	flat	-5 . . .+50	1 . . .13	plug head

[1)] with integrated temperature sensor Pt 1000

[2)] Length from upper end of standard taper (Standard taper NS 7.5)

ScienceLine metal combination electrodes

Metal combination electrodes with plug head and connection cable

Temperature range:	-5 . . .+100 °C (except Pt 6140: +10 . . .+40 °C)
Reference system:	silver/silver chloride (except Pt 6140: Calomel reference system)
Shaft material:	glass
Electrolyte:	KCl 3 mol/l (See also remarks)
Connection cable:	
for plug head:	e.g. L 1 A (See also page with connection cables)
fixed cable:	1 m long, with plug A acc. to DIN 19262 or with BNC plug

AgCl 62
AgCl 65
Ag 42 A
Ag 6180
Ag 6280
Ag 6580
AgCl 6280
Au 6280

Pt 61
Pt 62
Pt 6180
Pt 6280
Pt 6580
Pt 42 A

Pt 6880
Pt 6980
Pt 48 A
Pt 48 BNC

Pt 6140

Pt 8280

Pt 5900 A
Pt 5700 A
Pt 5900 BNC
Pt 5901

Order No.	Type No.	Length L [mm]	Dia-phragm	∅ [mm]	Sensor Metal, shape	Connection	Remarks
285102051	Ag 42 A	120	ceramic	12	Ag, cap, 4 mm ∅	DIN plug	electrolyte L 2114
285102208	Ag 6180	170	ceramic	12	Ag, cap, 4 mm ∅	plug head	electrolyte L 2114
285102343	Ag 6280	120	ceramic	12	Ag, cap, 4 mm ∅	plug head	electrolyte L 2114
285102216	Ag 6580	103[1)]	ceramic	10	Ag, cap, 4 mm ∅	plug head	electrolyte L 2114
285102351	AgCl 6280[3)]	120	ceramic	12	Ag, cap, 4 mm ∅	plug head	electrolyte L 2114
285102413	AgCl 62[3)]	120	platinum	12	Ag, cap, 4 mm ∅	plug head	electrolyte L 2114
1061051	AgCl 65[3)]	103[1)]	platinum	12	Ag, cap, 4 mm ∅	plug head	electrolyte L 2114
285102121	Au 6280	120	ceramic	12	Au, pole, 2 mm ∅	plug head	
285102302	Pt 42 A	120	ceramic	12	Pt, pole, 1 mm ∅	DIN plug	
285102224	Pt 48 A	120	ceramic	12	Pt, ring, 6 mm ∅	DIN plug	
285105192	Pt 5900 A	96[2)]	platinum	5	Pt, pole, 1 mm ∅	DIN plug	
285105702	Pt 5900 BNC	96[2)]	platinum	5	Pt, pole, 1 mm ∅	BNC plug	
285105065	Pt 5901	160[2)]	platinum	5	Pt, pole, 1 mm ∅	plug head	
285102002	Pt 61	170	platinum	12	Pt, pole, 1 mm ∅	plug head	
285102019	Pt 62	120	platinum	12	Pt, pole, 1 mm ∅	plug head	
285097162	Pt 6140	150/20	platinum	12/5	Pt, pole, 1 mm ∅	plug head	for spear tip, electrolyte L420
285102232	Pt 6180	170	ceramic	12	Pt, pole, 1 mm ∅	plug head	
285102249	Pt 6280	120	ceramic	12	Pt, pole, 1 mm ∅	plug head	
285102257	Pt 6580	103[1)]	ceramic	10	Pt, pole, 1 mm ∅	plug head	
285100075	Pt 6880	120	ceramic	12	Pt, ring, 6 mm ∅	plug head	
285102265	Pt 6980	170	ceramic	12	Pt, ring, 6 mm ∅	plug head	
285102281	Pt 8280	120	KPG®	12	Pt, round, 6 mm ∅	plug head	electrolyte Referid®

[1)] Length from upper end of standard taper; standard taper NS 14.5

[2)] Length from upper end of standard taper; standard taper NS 7.5

[3)] Sensor coated with AgCl

ScienceLine single electrodes: pH glass electrodes and metal electrodes

ScienceLine single electrodes

pH glass electrodes

Reference system: silver/silver chloride
Shaft material: glass, 12 mm ∅
Zero point: pH = 7.0 ± 0.3
Membrane shape: sphere
Connection cable: e.g. L 1 A

Metal electrodes

Shaft material: glass, 12 mm ∅
(See remarks)

A 1180 *H 1180* | Ag 1100 | KF 1100 | Pt 1400 *Pt 1200* | Pt 1800

Order No.	Type No.	Length L [mm]	pH-Glass	Range [pH]	Temp.-range [°C]	Remarks
1057997	A 1180	120	H	0 . . .14	0 . . .+80	plug head
285103212	H 1180	120				

Order No.	Type Nr.	Length L [mm]	Sensor Metal	Sensor shape	Temp.-range [°C]	Remarks
285103607	Ag 1100	120	Ag	cap, 4 mm ∅	-5 . . .+100	plug head, cable e.g. L 1 A
285102030	KF 1100	96[1]	Pt[2]	2 pole, 1 mm ∅	-30 . . .+135	shaft 5 mm ∅, standard taper NS 7.5, fixed cable, 2x 4-mm plug
285103512	Pt 1200	120	Pt[2]	2 pole, 1 mm ∅	-30 . . .+135	plug head, cable e.g. L 1 NN
285103537	Pt 1400	103[1]	Pt[2]	2 pole, 1 mm ∅	-30 . . .+135	shaft 10 mm ∅, standard taper NS 14.5, cable e.g. L 1 NN
285103553	Pt 1800	120	Pt	Ring, 6 mm ∅	-30 . . .+135	plug head, cable e.g. L 1 A

[1] Length from upper end of standard taper

[2] Double platinum electrode

ScienceLine single electrodes: Reference electrodes

Reference electrodes

Shaft material: glass

Electrolyte depending on reference system:

Ag/AgCl:	KCl 3 mol/l, e.g. L 300
Calomel:	KCl 4.2 mol/l, e.g. L 420
Hg/Hg_2SO_4:	K_2SO_4 0.6 mol/l, e.g. L 1254

pH range: 0 . . .14

Connection cable: e.g. L 1 N

B 2220+ | **B 2420+** | **B 2920+** *B 2810+* *B 2820+* *B2910+* | **B 3520+** *B 3410+* *B 3420+* *B 3510+* *B 3610+* | **B 3920+**

Order No.	Type No.	Length L [mm]	∅ [mm]	Temp.-range [°C]	Dia-phragm	Reference system	Remarks
1069994	B 2220+	120	12	-5 . . .+100	ceramic	Ag/AgCl	double electrolyte system
1070028	B 2420+	120	12	-5 . . .+100	ground joint	Ag/AgCl	
1070029	B 2810+	120	12	+15 . . .+40	ceramic	Calomel	
1070044	B 2820+	120	12	-5 . . .+100	ceramic	Ag/AgCl	
1070077	B 2910+	120	12	+15 . . .+40	platinum	Calomel	
1070046	B 2920+	120	12	-5 . . .+100	platinum	Ag/AgCl	
1070048	B 3410+	103[1)]	10	+15 . . .+40	ceramic	Calomel	standard taper NS 14.5
1070070	B 3420+	103[1)]	10	-5 . . .+100	ceramic	Ag/AgCl	standard taper NS 14.5
1070100	B 3510+	103[1)]	10	+15 . . .+40	platinum	Calomel	standard taper NS 14.5
1070073	B 3520+	103[1)]	10	-5 . . .+100	platinum	Ag/AgCl	standard taper NS 14.5
1070074	B 3610+	103[1)]	10	+15 . . .+40	ceramic	Hg/Hg_2SO_4	standard taper NS 14.5
1070075	B 3920+	103[1)]	10	-5 . . .+100	ground joint	Ag/AgCl	double electrolyte system, standard taper NS 14.5

[1)] Length from upper end of standard taper

ScienceLine conductivity measuring cells

Conductivity measuring cells with SMEK plug head

Shaft material: glass, 12 mm ∅
(See remarks)

Connection cable: e.g. LS 1 D8
(on CG 853(P)
or handylab units)
or LS 1 ST 4 LF (on
predecessor models)

Conductivity measuring cells with 1 m fixed cable with 8-pole plug

Shaft: 12 mm ∅
(except LF 413-3 T:
15.3 mm)

Temperature sensor: NTC 30 KΩ

LF 1100 T+
LF 1100+

LF 4100+

LF 5100+
LF 5100 T+

LF 513 T
LF 613T

LF 713 T

LF 413-3 T

Order No.	Type No.	Length L [mm]	Sensor	Cell const. approx. [cm^{-1}]	Temp.-range [°C]	Meas. range[1] [µS/cm]. . .[mS/cm]	Remarks
285104817	LF 1100+	120	2 Pt plates	1.0	-30 . . .+135	0 . . .200	
285105813	LF 1100 T+	120	2 Pt plates	1.0	-30 . . .+135	0 . . .200	t. sensor Pt 1000
285104866	LF 4100+	-	2 Pt plates	1.0	-30 . . .+135	0 . . .200	flow-through cell
285104944	LF 5100+	120	2 Pt rings	1.0	-5 . . .+80	0 . . .200	plastic shaft
285104952	LF 5100 T+	120	2 Pt rings	1.0	-5 . . .+80	0 . . .200	plastic shaft, t. sensor Pt 1000

Order No.	Type No.	Length L [mm]	Sensor	Cell const. approx. [cm^{-1}]	Temp.-range [°C]	Meas. range[1] [µS/cm]. . .[mS/cm]	Remarks
285106148	LF 413-3 T	120	4x Graphite	0.475	-5 . . .+80	0 . . .2000	plastic shaft
285106037	LF 513 T	120	2 Pt rings	1.0	-5 . . .+80	0 . . .200	plastic shaft
285106131	LF 613 T	120	4 Pt rings	1.0	-5 . . .+80	0 . . .2000	plastic shaft
285106189	LF 713 T	120	4 Pt rings	1.0	-30 . . .+135	0 . . .2000	glass shaft

[1] Outside the recommended ranges measuring errors >10% can occur with these LF measuring cells.

ScienceLine sensors for ammonia, sodium, oxygen, ion-selective indicator electrodes

Ammonia combination electrode with plug head

Shaft material: plastic, 12 mm ∅
Connection cable: e.g. L 1 A

Sodium combination electrode with plug head

Reference system: Silamid®
Shaft material: glass, 12 mm ∅
Zero point: pNa = 2.0
Membrane shape: sphere
Connection cable: e.g. L 1 A

Oxygen electrodes

Shaft material: plastic (POM)

ISE

Shaft material: plastic

NH 1100 | Na 61 | **OX 1100+** | **9009/61** | **Cu 1100 A**
Ca 1100 A
F 1100 A
Pb 1100 A

Order No.	Type No.	Length L [mm]	Temp.-range [°C]	Meas. range [mg/l]	Remarks
285102808	NH 1100	120	0 . . .+50	0.1 . . .1.000	membrane module replaceable

Order No.	Type No.	Length L [mm]	Dia-phragm	Membrane Glass	Temp. [°C]	Meas. range [pNa]	Remarks
285100026	Na 61	170	platinum	Na	+10 . . .+80	0 . . .6	electrolyte KCl 3 mol/l, aqueous solution NaCl 0.1 mol/l

Order No.	Type No.	Length L [mm]	Temp. [°C]	Meas. range [mg/l]	Remarks
1069975	OX 1100+	120	0 . . .+45	0 . . .60	galvanic sensor, Pt cathode, Ag-Anode, SMEK plug head, temperature compensated (NTC 100kΩ), shaft 12 mm ∅, measuring current at saturation approx. 100 nA, minimum flow rate 10 cm/s, connection cable e.g. LS 1 ST4 OX (for CG 867)
285111664	9009/61	145	0 . . .+50	0 . . .50	amperometric sensor, Au cathode, Pb anode, fixed cable 1.5 m[1)] with 8-pole plug, IMT temperature compensation, shaft 15.25 mm ∅, membrane FEP, 13 µm thick, accuracy 1% at 18 cm/s flow rate.

[1)] Other cable lengths available on request

Order No.	Type Nr.	Length L [mm]	Temp. [°C]	pH-range	Meas. range [mg/l]	Remarks
285216314	Ca 1100 A	120	0 . . .+40	2.5 . . .11	0.02 . . .40.000	DIN plug
285216312	Cu 1100 A	120	0 . . .+80	2 . . .12	0.0006 . . .6.400	DIN plug
285216313	F 1100 A	120	0 . . .+80	5 . . .7	0.02 . . .saturated	DIN plug
285216315	Pb 1100 A	120	0 . . .+80	4 . . .7	0.1 . . .20.000	DIN plug

Resistance thermometers

Resistance thermometers with SMEK plug head

Resistance thermometers with 1 m fixed cable

W 2130+
W 2030+

W 5780 NN

W 5791 NN
W 5790 NN
W 5790 PP

W 5980 NN

Resistance thermometers with SMEK plug head

Order No.	Type No.	Length L [mm]	Ø [mm]	Sensor	Temp. range [°C]	Shaft	Connection cable e.g.
1069991	W 2030+	120	12	Pt 100	-30 . . .+135	glass	LS1N6
1069992	W 2130+	120	12	Pt 1000	-30 . . .+135	glass	LS1N6

Resistance thermometers with 1 m fixed cable

Order No.	Type No.	Lenght L [mm]	Ø [mm]	Sensor	Temp.- range [°C]	Shaft	Connection plug
285105221	W 5780 NN	120	6	Pt 1000	-30 . . .+135	glass	2 x 4 mm ∅
285105254	W 5790 NN	120	4	Pt 1000	-30 . . .+135	stainless steel	2 x 4 mm ∅
285105776	W 5790 PP	120	4	Pt 1000	-30 . . .+135	stainless steel	2 x 4 mm ∅
285105262	W 5791 NN	170	4	Pt 1000	-30 . . .+135	stainless steel	2 x 4 mm ∅
285105287	W 5980 NN	96[1)]	5 NS 7.5	Pt 1000	-30 . . .+135	glass	2 x 4 mm ∅

[1)] length from upper end of standard taper

Connection cables

1 Electrode socket/plug

Connection cable for pH , redox, ammonia and sodium combination electrodes, pH and redox single electrodes as well as reference electrodes in Plus series

socket L

(Socket L and socket LB are compatibel among themselves)

SMEK for pH combination electrodes with temperature sensor as well as conductivity measuring cells, resistance thermometers and oxygen sensors from Plus series

socket LS

Electrode plug for reference electrodes from the predecessor series, i.e. “non-Plus“ versions

plug B

Plug for resistance thermometers in conductivity measuring cells without temperature sensor, for older models

plug 9907

Plug for conductivity measuring cells with temperature sensor and oxygen cells, for older models

plug 9909

2 Instrument connector/plug

A (DIN, Germany)

BNC (Europe, overseas)

EE (Radiometer)

R (Metrohm)

S (UK socket without extension)

N (4-mm banana plug)

P (2-mm pole plug)

8-pole (for Handylab and CG 853(P))

9910

Not illustrated:
D (USA, single electrodes)
H (Seibold, Lemo plug)
X (without instrument plug, free cable end)

Order No.	Type No.	1 Electrode socket/plug	2 Instrument connector/plug	Cable length and type
285122904	A 1 A	DIN instrument plug (A)	DIN instrument plug (A)	1 m coax. cable
285123793	A 1 BNC	DIN instrument plug (A)	BNC instrument plug	1 m coax. cable
285121916	B 1 N	reference electrode plug (B)	4 mm banana plug (N)	1 m single conductor cable
285122012	B 1 P	reference electrode plug (B)	2 mm Pole plug (P)	1 m single conductor cable
285121813	B 1X	reference electrode plug (B)	free end (X)	1 m single conductor cable
285122456	L 1 A	electrode plug (L)	DIN instrument plug (A)	1 m coax. cable
285122497	L 1 BNC	electrode plug (L)	BNC instrument plug	1 m coax. cable
285122604	L 1 DP	electrode plug (L)	(D) + 2 mm Pole plug (P)	1 m coax. cable
285122501	L 1 EE	electrode plug (L)	Radiometer instrument plug (EE)	1 m coax. cable
285122457	L 1 N	electrode plug (L)	4 mm banana plug (N)	1 m coax. cable
285122489	L 1 NN	electrode plug (L)	2 x 4 mm banana plug (NN)	1 m coax. cable
285122534	L 1 R	electrode plug (L)	Metrohm instrument plug (R)	1 m coax. cable
285122407	L 1 X	electrode plug (L)	free end (X)	1 m coax. cable
285122464	L 2 A	electrode plug (L)	DIN instrument plug (A)	2 m coax. cable
285122448	L 2 NN	electrode plug (L)	2 x 4 mm banana plug (NN)	2 m coax. cable
285122653	LB 1 A	electrode plug (LB)	DIN instrument plug (A)	1 m coax. cable
285122661	LB 1 BNC	electrode plug (LB)	BNC instrument plug	1 m coax. cable
285122678	LB 3 A	electrode plug (LB)	DIN instrument plug (A)	3 m coax. cable
285122707	LS 1 ANN	SMEK electrode plug	DIN (A) + 2 x 4 mm banana plug	1 m cable KA19
285122715	LS 3 ANN	SMEK electrode plug	DIN (A) + 2 x 4 mm banana plug	3 m cable KA19
285122723	LS 1 BNCNN	SMEK electrode plug	BNC + 2 x 4 mm banana plug	1 m cable KA19
285122731	LS 3 BNCNN	SMEK electrode plug	BNC + 2 x 4 mm banana plug	3 m cable KA19
1066726	LS 1 D8	SMEK electrode plug	8-pole instrument plug	1 m cable
1066728	LS 1 N6	SMEK electrode plug	6 x 4 mm banana plug	1 m cable KA09
285122756	LS 1 RNN	SMEK electrode plug	Metrohm (R)+2 x 4 mm banana plug	1 m cable KA19
1069104	LS 1 ST4LF	SMEK electrode plug	4-pole incremental plug	1 m cable
1066727	LS 1 ST4OX	SMEK electrode plug	4-pole incremental plug	1 m cable KA10
285124716	9907/21	electrode plug (9907/00)	2 x 4-mm plug for LF cells (NN)	1 m two-conductor cable
285125618	9909/31	electrode plug (9907/00)	2 x 4-mm plug (NN)	1 m two-conductor cable
285125515	9910/11	electrode plug (9909/00)	9910	1 m four-conductor cable
285125215	9910/21	electrode plug (9909/00)	9910	1 m four-conductor cable, shielded
285125523	9919/21	electrode plug (9907/00)	8-pole instrument plug	1 m two-conductor cable
285125548	9919/41	electrode plug (9909/00)	8-pole instrument plug	1 m four-conductor cable

Other plug/cable combinations available on request

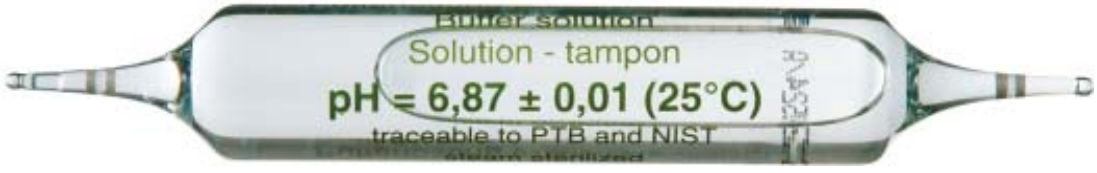
Cables

Solutions

Standard buffer solutions according to DIN 19 266

Hot steam sterilized for longer stability, no preservation agents used.

Order No.	Type No.	pH value at 25 °C	Contents
285137977	L 4791	1.68	60 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285138246	L 4794	4.01	60 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285138254	L 4796	6.87	60 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285138262	L 4799	9.18	60 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285138402	L 4790	4.01/6.87	2 x 30 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285137985	L 4797	1.68/6.87/9.18	3 x 30 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285138238	L 4798	4.01/6.87/9.18	3 x 30 FIOLAX® ampoules à 20 ml, with manufacturer's certificate
285138279	L 4893/Set	4.01/6.87	2 x 9 FIOLAX® ampoules à 20 ml, with manufacturer's certificate, with electrolyte solution L 3008
285137841	L 168	1.68	1000 ml in DURAN® glass bottle, with manufacturer's certificate
285137677	L 1684	1.68	250 ml in DURAN® glass bottle, with manufacturer's certificate
285138098	L 401	4.01	1000 ml in DURAN® glass bottle, with manufacturer's certificate
285138008	L 4014	4.01	250 ml in DURAN® glass bottle, with manufacturer's certificate
285138102	L 687	6.87	1000 ml in DURAN® glass bottle, with manufacturer's certificate
285138016	L 6874	6.87	250 ml in DURAN® glass bottle, with manufacturer's certificate
285138119	L 918	9.18	1000 ml in DURAN® glass bottle, with manufacturer's certificate
285138024	L 9184	9.18	250 ml in DURAN® glass bottle, with manufacturer's certificate



Technical buffer solutions according to DIN 19 267

Hot steam sterilized for longer stability, no preservation agents used.

Order No.	Type No.	pH-Wert at 25 °C	Contents
285138213	L 4694	4.00	60 FIOLAX® ampoules à 20 ml
285138221	L 4697	7.00	60 FIOLAX® ampoules à 20 ml
285138205	L 4691	10.00	60 FIOLAX® ampoules à 20 ml
285138398	L 4690	4.00/7.00	2 x 30 FIOLAX® ampoules à 20 ml
285138192	L 4698	4.00/7.00/10.00	3 x 20 FIOLAX® ampoules à 20 ml
285138632	L 4895/set	4.00/7.00	2 x 9 FIOLAX® ampoules à 20 ml, with electrolyte solution L 3008
285138727	L 400	4.00	1000 ml in DURAN® glass bottle
285138032	L 4004	4.00	250 ml in DURAN® glass bottle
285138735	L 700	7.00	1000 ml in DURAN® glass bottle
285138049	L 7004	7.00	250 ml in DURAN® glass bottle
285138719	L 100	10.00	1000 ml in DURAN® glass bottle
285138057	L 1004	10.00	250 ml in DURAN® glass bottle

Buffer solutions in the unique double-end ampoules offer a particularly high degree of reliability and measuring accuracy.

Hermetically sealed in the glass ampoule and sterilized with hot steam just like a pharmaceutical product, the buffer solutions free of preservation agent have an extremely long shelf life and guarantee continuously error-free characteristics.

The ampoules can be easily opened at the breaking point. Tools are not required. Since refilling is not possible, you are always ensured of maximum calibration reliability.

Solutions

Color-coded technical buffer solutions in plastic bottles

Order No.	Type No.	pH value at 25 °C	Contents
285139156	LC 4004 K	4.00	250 ml in PE bottle
285139189	LC 7004 K	7.00	250 ml in PE bottle
285139218	LC 1004 K	10.00	250 ml in PE bottle

Technical buffer solutions according to DIN 19 267 in canisters (preserved with Thymol for longer shelf life)

Order No.	Type No.	pH value at 25 °C	Contents
285138673	L 4655	4.65	5 L in plastic canister
285138681	L 6795	6.79	5 L in plastic canister

Electrolyte solutions, aqueous
for reference electrodes and as electrolyte bridges

Order No.	Type No.	Description	Contents
285136956	L 101	potassium chloride solution 1 mol/l	1000 ml in DURAN® glass bottle, sterilized
285138649	L 1254	potassium sulfate solution 0.6 mol/l	250 ml in DURAN® glass bottle
285138151	L 200	low temperature electrolyte (-30 °C)	1000 ml in DURAN® glass bottle
285138365	L 2004	low temperature electrolyte (-30 °C)	250 ml in DURAN® glass bottle
285138349	L 2114	2 mol/l KNO_3 + 0.001 mol/l KCl for Ag combination electrodes	250 ml in DURAN® glass bottle
285136923	L 2214	2 mol/l KNO_3 + 0.001 mol/l KCl for Ag combination electrodes, thickened	250 ml in DURAN® glass bottle
285138332	L 2224	potassium chloride solution 2 mol/l	250 ml in DURAN® glass bottle
285139029	L 2604	low temperature electrolyte (-60 °C)	250 ml in DURAN® glass bottle
285138554	L 300	potassium chloride solution 3 mol/l	1000 ml in DURAN® glass bottle, sterilized
285138427	L 3004	potassium chloride solution 3 mol/l	250 ml in DURAN® glass bottle, sterilized
285138505	L 3008	potassium chloride solution 3 mol/l	50 ml in PE bottle
285139004	L 301	potassium chloride solution 3 mol/l, Ag/AgCl saturated	1000 ml in DURAN® glass bottle
285138419	L 3014	potassium chloride solution 3 mol/l, Ag/AgCl saturated	250 ml in DURAN® glass bottle
285138468	L 310	potassium chloride solution 2 mol/l, gel for sterilizable electrodes	1000 ml in DURAN® glass bottle
285138484	L 3104	potassium chloride solution 2 mol/l, gel for sterilizable electrodes	250 ml in DURAN® glass bottle
285138702	L 320 K	potassium chloride solution 2 mol/l, gel for Ag_2S electrodes	1000 ml in DURAN® glass bottle
285138143	L 350	potassium chloride solution 3.5 mol/l	1000 ml in DURAN® glass bottle, sterilized
285138127	L 3504	potassium chloride solution 3.5 mol/l	250 ml in DURAN® glass bottle, sterilized
285138587	L 420	potassium chloride solution 4.2 mol/l	1000 ml in DURAN® glass bottle
285138608	L 4204	potassium chloride solution 4.2 mol/l	250 ml in DURAN® glass bottle

Solutions

Electrolyte solutions, organic
for measurements in organic solutions for reference electrodes and as electrolyte bridges

Order No.	Type No.	Description	Contents
285138324	L 5014	LiCl saturated in glacial acetic acid	250 ml in DURAN® glass bottle
285138316	L 5024	LiCl saturated in methanol	250 ml in DURAN® glass bottle
285138308	L 5034	LiCl saturated in ethanol	250 ml in DURAN® glass bottle

Solutions for oxygen measurements

Order No.	Type No.	Description	Contents
285138513	L 6708	electrolyte for oxygen electrodes OX 1100/OX 1100+/OX 1101	50 ml in PE bottle
285126606	OX 920	electrolyte for oxygen electrodes 9009/61	50 ml in PE bottle
285126614	OX 921	cleaning solution for oxygen electrodes 9009/61	50 ml in PE bottle
285138287	OX 060	zero point solution for oxygen electrodes OX 1100/OX 1100+	60 FIOLAX® ampoules à 20 ml
285136964	L 6218	cleaning solution citric acid solution 1 mol/l	50 ml in PE bottle

Solutions for ammonia measurements

Order No.	Type No.	Description	Contents
285137344	L 6408	electrolyte for ammonia combination electrodes	50 ml in PE bottle

Solutions and accessories for conductivity measurements

Order No.	Type No.	Description	Contents
285138616	LF 906	platinizing solution	1 x 6 FIOLAX® ampoules à 20 ml
285126503	LF 990	test solution KCl 0.001 mol/l (147 µS/cm)	3 x 6 FIOLAX® ampoules à 20 ml
285126511	LF 991	test solution KCl 0.01 mol/l (1.41 mS/cm)	3 x 6 FIOLAX® ampoules à 20 ml
285126528	LF 992	test solution KCl 0.1 mol/l (12.9 mS/cm)	3 x 6 FIOLAX® ampoules à 20 ml
285126293	LF 995	test solutions KCl 0.01/0,1/1 mol/l (1.41/12.9/112 mS/cm)	3 x 6 FIOLAX® ampoules à 20 ml
285126174	LF 999/Set	test solutions KCl 0.01/0.1 mol/l (1.41/12.9 mS/cm) and LF 906	3 x 6 FIOLAX® ampoules à 20 ml
285126166	LF 1000/Set	same as LF 999/set, in addition platinizing vessel and cable B 1 N	3 x 6 FIOLAX® ampoules à 20 ml
285136907	LF 1024	test solution KCl 0.01 mol/l (1.41 mS/cm)	250 ml in PE bottle
285126530	LF CSKC13	test solution KCl 1.3 µS/cm	250 ml in PE bottle
285126540	LF CSKC5	test solution KCl 5.0 µS/cm	500 ml in PE bottle

Redox test solutions

Order No.	Type No.	Redox voltage		Contents
		Pt/Calomel (KCl sat.)	Pt/Ag/AgCl (KCl 3 mol/l)	
285138373	L 4619	180 mV	220 mV	60 FIOLAX® ampoules à 20 ml, acc. to DIN 38 404-C6
285138357	L 4643	430 mV	470 mV	60 FIOLAX® ampoules à 20 ml
285138381	L 4660	600 mV	640 mV	60 FIOLAX® ampoules à 20 ml
285138784	L 4648	180, 430, 600 mV	220, 470, 640 mV	3x 20 FIOLAX® ampoules à 20 ml
285138184	L 430	430 mV	470 mV	1000 ml in DURAN® glass bottle
285138168	L 4304	430 mV	470 mV	250 ml in DURAN® glass bottle

Cleaning solutions for combination electrodes and reference electrodes

Order No.	Type No.	Description	Contents
285138538	L 510	pepsin/hydrochloric acid solution	1000 ml in DURAN® glass bottle
285138295	L 5104	pepsin/hydrochloric acid solution	250 ml in DURAN® glass bottle

Electrolyte bridges, other accessories

Electrolyte bridges

Shaft: glass, 12 mm ∅

Other accessories

Insert aid of PVDF,
with VA stainless steel tip

B 511 **Z 451** *Z 461* **Z 462** **Z 509**

Order No.	Type No.	Length [mm]	Dia-phragm	Remarks
285104209	B 511	103[1)]	ceramic	standard taper NS14.5 and sleeve NS 14.5 for electrode installation
285104217	B 521	120	ceramic	plastic sleeve and sleeve NS 14.5 for electrode installation
285104225	B 522	120	Pt lateral	plastic sleeve and sleeve NS 14.5 for electrode installation
285104233	B 524	120	ground joint	plastic sleeve and sleeve NS 14.5 for electrode installation

[1)] Length from upper end of standard taper

Order No.	Type No.	Description
285123806	BXX	plug for reference electrodes, single pole
285123703	KXX	coaxial plug for combination electrodes and indicator electrodes
285126482	NH 928	electrolyte for ammonia electrodes in 50 ml plastic bottle, 3 membrane modules
285126499	NH 995	membrane module set: 3 membrane modules, 3 caps
285126639	OX 923	3 spare membrane heads for oxygen electrodes 9009/61
285126655	OX 925	maintenance set (OX 920, OX 921, OX 923 and SF 300) for oxygen electrodes 9009/61
285126277	OX 929	5 spare membrane heads for oxygen electrodes OX 1100/OX 1100+/OX 1101
285126647	OxiCal® SL	calibrating vessel for oxygen electrodes 9009/61
285126622	SF 300	grinding foil for oxygen electrodes 9009/61
285123728	SXX	coaxial plug for extension cable and for UK socket
285216447	TZ 1114	calcium sensor for Ca 1100A
285215229	TZ 1520	taper adapter NS 14.5 of PTFE for Electrodes with 12 mm ∅ shaft
285123103	Z 341	stainless steel clamp for NS 7.5/16
285123136	Z 451	measuring and storage vessel with sleeve NS 7.5/16
285123152	Z 461	measuring and storage vessel with sleeve NS 14.5/23
285123169	Z 462	flow-through measuring vessel with sleeve NS 14.5/23
285123185	Z 472	watering cap for electrodes with 12 mm ∅ shaft
285122961	Z 50	Knick electrode adapter
285123193	Z 501	O-Ring seal 10.5/1.5 for electrode plug head
285123214	Z 506	plug head sealing cap with male thread for KXX and BXX plugs
1062534	Z 509	insert aid for electrodes, Type L 6880 and L 8880
285129509	Z 512	plug head sealing cap with female thread for BlueLine electrodes

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L 400	285138727	41	LF 990	285126503	45			
L 4004	285138032	41	LF 991	285126511	45			

Outstanding performance by process electrodes

)* *The **SMEK plug system was developed in co-operation with leading electrode manufacturers. It is the only 'complete' system: all versions of plug combinations can be realized because the system also includes cable plugs and apparatus sockets in addition to smooth electrode heads and Pg 13.5 threaded screw plug heads.. The SMEK plug system fulfils the requirements of Protection Class IP 68 and is recommended by NAMUR and VDI. As the system is independent of any specific manufacturer, it also gives the user optimum decision-making freedom with respect to procurement.*

*For sensors that measure more than pH values, we developed the 6-pin **SMEK plug system***), which has also proven its effectiveness for process electrodes.*

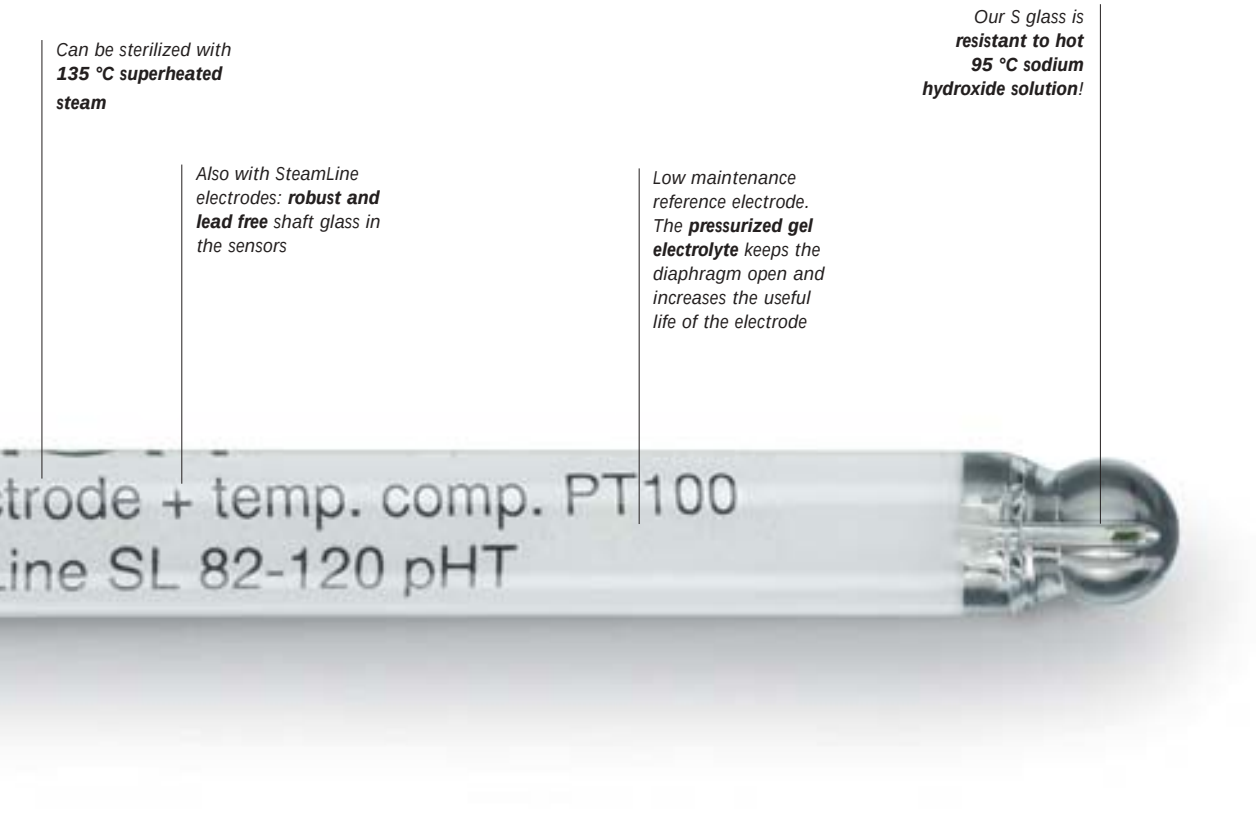
*As our **contribution to practical environmental protection**, for many years we have been taking back the used sensors manufactured by us, in order to ensure proper disposal.*

In the area of process electrodes, our range of products also includes unsurpassed state-of-the-art sensors – for example our SteamLine electrode. It is a long awaited all-round product for process applications. Among other things, this is evident in the wide temperature range from 0 to 135 °C and the pH application range from 0 . . .14 pH.

SteamLine electrodes are low-maintenance pH process electrodes. The reference electrode uses a gel electrolyte. A special feature of the SteamLine electrodes is the even, minimal flow of electrolyte: constant pressure is exerted on the electrolyte by a pressure mechanism that is integrated into the reference electrode. This ensures reliable and reproducible measurement results, and poisoning of the reference system can be avoided. That is why the useful life of SteamLine electrodes is substantially longer in comparison with non-pressurized, low maintenance electrodes.

We manufacture SteamLine electrodes out of S Glass, which is a highly alkali-resistant glass that we developed for the most extreme conditions. As a result, the electrodes can not only be utilized for SIP applications (Sterilization In Place, temperature of up to 135 °C), but also for CIP cleaning applications (Clean In Place), in which hot, concentrated sodium hydroxide solution is utilized. And obviously, it goes without saying that electrodes that were designed for this type of

For example: SteamLine



extreme cleaning processes can also demonstrate their strengths under other extreme application conditions.

With SteamLine electrodes you can choose from a varied selection of:

- pH combination electrodes
- pH combination electrodes with integrated Pt100 or Pt1000 temperature sensor,
- with SMEK or VP plug head or even
- as redox combination electrode

The choice of available electrode lengths – ranging from 120, 225, 325, 360 to 425 mm – also makes it easy to select the most suitable sensor for your application and mounting requirements.

For further information about our comprehensive range of products for process analytics, please consult our "Process Electrodes" catalogue, which we will send to you at your request.

Of course, we will also be glad to advise you on the selection of the electrode that is the most suitable for your requirements. Just call us or simply send us a description of your application by e-mail (telephone number and e-mail are on the back cover of this catalogue).

Laboratory pH meters, conductivity meters

Maximum measurement reliability with the high-performance laboratory pH meters from SCHOTT Instruments

All laboratory pH meters from SCHOTT Instruments are modern and functional in design. They are easy to handle and convenient to use. The large, easily legible multifunction display guarantees the highest level of reliability and error-free measurement. A large amount of information – such as the operational status of the sensor or the calibration intervals – is provided to ensure this reliability.

The automatic shut-off function when the meter is not being used saves power and makes up to 3,000 hours of continuous operation possible when the meter is operated using a battery power supply. Alternatively, a power pack unit (optional) can be plugged into a mains power supply outlet.

Calibration can be performed by means of various procedures with optionally selectable buffers. The meter checks the current status of the combination electrode and displays this in the form of a symbol on the display. A drift control function, which can also be deactivated, checks the stability of the measurement signal. This ensures the reproducibility of measurement results.

As the top-of-the-line meter in the series, the CG 843P offers GLP functions such as calibration protocol, documentation of the measurement values including the date, time, memory and identification number. A calibration timer can be set to alert the user when a calibration is due to be performed. The integrated printer makes it possible to document the measurement values and the calibration protocol directly at the work place in accordance with GLP.

The meters have an integrated interface with a recognition function that makes it possible to connect a printer, recorder (analog) or a PC (bi-directional).

Conductivity meters with GLP functions for maximum measurement reliability

The latest laboratory conductivity meters, which have the same design as the laboratory pH meters, offer the highest level of reliability and precision – and they are easy to handle and extremely convenient to use.

The measurement values can be adjusted by means of a temperature compensation function using various procedures; if desired, the temperature compensation function can also be deactivated. The cell constants of the sensors can be specified automatically or manually with optionally selectable solutions. An additional drift control function checks the stability of the measurement signal and thus ensures the reproducibility of the measurement results.

The meters offer GLP functions such as calibration protocol, documentation of the measurement values including the date, time, memory and identification number.

The meters have an integrated interface with a recognition function that makes it possible to connect a printer, recorder (analog) or a PC (bi-directional).

The integrated printer connected to the CG 853 P makes it possible to document the measurement values and the calibration protocol directly at the work place in accordance with GLP guidelines.

Features and applicability of laboratory pH meters / laboratory conductivity meters

Meters	CG 842	CG 843	CG 843P	CG 853	CG 853P
pH	+	+	+	-	-
Redox	+	+	+	-	-
Temperature	+	+	+	+	+
Conductivity	-	-	-	+	+
AutoRead/drift control	+	+	+	+	+
Battery operation	+	+	+	+	+
Operation possible via power mains (optional mains adapter)	+	+	+	+	+
Mains adapter incl.	-	-	+	-	+
Data storage/calibration timer	-	+	+	+	+
RS232	-	+	+	+	+
Integrated printer	-	-	+	-	+

The pH meters and conductivity meters are also offered as a cost-effective complete set including a stand, precision sensor and calibration solutions.

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Order overview for laboratory pH meters, conductivity meters, accessories	Page	72

CG 842, CG 843 und CG 843P
Laboratory pH meters with maximum measurement reliability

The latest high-performance pH meters from SCHOTT Instruments were designed for practical use in the laboratory. They are extremely easy to use, and offer maximum reliability and precision in all application areas. Routine work is facilitated by means of automated procedures.

Display

The relevant data are easy to read on the large multifunction display. A sensor symbol signals the status of the pH combination electrode after calibration and can also remind the user when a calibration is due to be performed.

Operation

The keys have a defined pressure point for reliable, precise operation and are arranged clearly. The film covered touch pad does not accumulate dirt and is easy to clean. Concise operating instructions are conveniently located on the meter.

Precision

The user can select the resolution of the display as desired. The user can also either decide to use the resolution of 0.01 pH or 1 mV – which is usually sufficient – or the higher resolution of 0.001 pH or 0.1 mV. The accuracy is 0.005 pH or 0.4 mV.

GLP

Calibration protocol, calibration monitoring and evaluation of the measurement conditions are provided with the CG 843 and CG 843P as GLP supporting functions.

Measurements

The versatile pH meters can be used to measure pH values, redox potential and temperature. For the pH and mV measurement areas, the temperature of the measurement medium is simultaneously displayed if the temperature sensor is connected.

Measurement reliability

The special AutoRead function, which can be additionally activated, serves to monitor the drift of the measurements. The measured value is not released until the stability criteria have been fulfilled. This ensures the reproducibility of measurements.

Temperature compensation

Measurements can be performed with or without the temperature sensor. The temperature compensation of the pH measurement can be effected automatically or manually. The type of temperature sensor that is connected (Pt 1000 or NTC 30) is recognized automatically.

Calibration

There are three optional calibration methods:

- Fully automatic two point or three point calibration (except CG 842) with buffers in compliance with DIN 19 266 already programmed into the meter. The meter automatically recognizes the buffer solutions.
- Fully automatic two point of three point calibration (except CG 842) with technical buffers by SCHOTT Instruments already programmed into the meter. The meter automatically recognizes the buffer solutions.
- Conventional two point calibration with two optionally selectable buffers or one point calibration as a fast method. The

data of the last calibration can be recalled from the memory. The user is reminded when a calibration is due to be performed by an adjustable calibration timer (integrated into pH meters CG 843 and CG 843P).

Calibration protocol

The calibration protocol contains the data of the last calibration. In the CG 843 and the CG 843P it can be recalled from memory. With the CG 843P, the protocol can be printed out after a valid calibration.

Power supply

The pH meters are designed optionally for mobile operation independent of the mains power supply by using batteries (approx. 3,000 hours of continuous operation), as well as for utilization at a stationary measurement location with a connection to the mains power supply using the optional power pack. When used with batteries, the display will indicate in good time when the batteries have to be replaced. For printing purposes, the CG 843P requires the universal power pack that is included with the meter.

Measurement memory

The CG 843 and CG 843P pH meters have an internal memory that can store up to 200 data records. One data record consists of the measured value, temperature, date, time, memory storage location number and an optionally selectable identification number. Measurement values can be saved manually by pressing a key or automatically at adjustable intervals, and can be displayed later on for further processing.

Data interface

The CG 843 and CG 843P pH meters have a data interface that independently recognizes a connected printer, analog recorder or a PC. The pH meters can be controlled by a PC via the bi-directional RS-232 interface.

Integrated printer

The CG 843P can print out current measurements, the measurement memory as well as the calibration protocol by means of the integrated thermoprinter. The special document quality paper guarantees readability for up to 10 years.

Sensors

It is possible to connect individual electrodes (glass and reference electrodes) as well as pH combination electrodes. For simultaneous measurement of temperature, pH combination electrodes with integrated temperature sensors or a separate temperature sensor can be used. They are connected via a plug in compliance with DIN 19 262 and 4 mm banana plugs.

Separately or as a set

The meters are not only available separately, but can also be purchase as a cost-effective set. With this set you can get to work right away. It also includes: a matching stand, a suitable pH sensor with integrated temperature sensor and calibration solutions.

Technical data on page 58

CG 853 and CG 853P
Precision and GLP with laboratory conductivity meters from SCHOTT Instruments

The latest high performance conductivity meters from SCHOTT Instruments were developed specifically for practical use in the laboratory. They are extremely easy to use, and offer maximum reliability and precision in all application areas. Routine work is facilitated by means of automated procedures.

Display

The relevant data are easy to read on the large multifunction display. A sensor symbol indicates the status of the electrode and can also remind the user when a calibration is due to be performed.

Operation

The keys have a defined pressure point for reliable, precise operation and are arranged clearly. The film-covered touch pad does not accumulate dirt and is easy to clean. Concise operation instructions are conveniently located on the meter.

GLP

Calibration protocol and calibration monitoring are included as GLP supporting functions. The printer that is integrated into the casing of the CG 853P serves to document measurement data on location.

Measurements

The versatile conductivity meters can be used to measure electrical conductivity, total dissolved solids (TDS), salinity and temperature:

- electrical conductivity between 0.0 µS/cm and 500 mS/cm
- total dissolved solids (TDS) between 0 and 1999 mg/l
- salinity between 0.0 and 70.0
- temperature between -5 °C and +100 °C

Temperature compensation

The automatic temperature compensation works in a number of different selectable modes: with an adjustable linear temperature coefficient, with a fixed non-linear temperature coefficient (for natural waters in compliance with EN 27888, pure water function for neutral waters), or alternatively the temperature compensation can be deactivated. A reference temperature of between 20 °C and 25 °C can be selected. The type of connected temperature sensor (Pt 1000 or NTC 30) is recognized automatically.

Cell constants

The cell constant can be set between 0.250 and 2.500. In addition, there are the two fixed constants 0.1 and 0.01. The cell constant can also be calibrated in the ranges between 0.450 and 0.500 as well as between 0.900 and 1.100.

Calibration protocol

The calibration protocol contains the data of the last calibration. It can be recalled from the data memory. With the CG 853 P, the protocol can be printed out after a valid calibration.

Calibration timer

The integrated adjustable calibration timer can remind the user when a calibration is due to be performed.

Power supply

The conductivity meters were designed optionally for mobile operation independent of the mains power supply by using batteries (approx. 2,500 hours of continuous operation), as well as for utilization at a stationary measurement location with a connection to the mains power supply using the optional power pack. When used with batteries, the display will indicate in good time when the batteries have to be replaced. For printing purposes, the CG 853P requires the universal power back that is included with the meter.

Measurement memory

Both conductivity meters have an internal memory that can store up to 200 data records. One data record consists of the measured value, temperature, date, time, memory storage location number and an optionally selectable identification number. Measurement values can be saved manually by pressing a key or automatically at adjustable intervals, and can be displayed later on for further processing.

Data interface

The conductivity meters have a data interface that independently recognizes a connected printer, analog recorder or a PC. The conductivity meters can be controlled by a PC via the bi-directional RS-232 interface.

Integrated printer

The CG 853P can print out current measurements, the measurement memory as well as the calibration protocol by means of the integrated thermoprinter. The special document quality paper guarantees readability for up to 10 years.

Sensors

It is possible to connect type LF 513 T electrodes (two pole technology) as well as type LF 613 T electrodes (four pole technology). Both types are equipped with an integrated temperature sensor (NTC 30) for automatic temperature compensation. They also have a 1.5 m long cable with an 8-pole plug for direct connection to the conductivity meter. Other electrodes with two or four pole technology and with or without temperature sensors can also be used by means of the appropriate adapter cable.

Separately or as a set

The meters are not only available separately, but can also be purchased as a cost-saving set. With this set you can get to work right away. It also includes: a matching stand, a suitable four-pole electrode with integrated temperature sensor (LF 613 T) and calibration solutions.

Technical data on page 59

Technical data for the laboratory pH meters

pH meters		**CG 842**	**CG 843 / CG 843P**
Measuring ranges			
pH	range max.	-2.000...+16.000	-2.000...+16.000
	resolution max.	0.001	0.001
	accuracy at resolution		
	0.01 / 0.001 pH	±0.01/±0.005	±0.01/±0.005
mV	range max.	-1999...+1999	-1999...+1999
	resolution max.	0.1 mV	0.1 mV
	accuracy at resolution		
	1/0.1 mV	±1/±0.4	±1/±0.4
temperatur	temperature range (°C or °F)	-5.0...+100.0 °C	-5.0...+100.0 °C
	resolution	0.1 K	0.1 K
	accuracy (with NTC 30)	± 0.1 K	± 0.1 K
	manual adjustment	-20...+130 °C	-20...+130 °C
drift control	deactivatable	yes	yes
slope matching		88...105 %	88...105 %
zero point matching		±30 mV	±30 mV
sensor condition	by symbol on display	yes	yes
input resistance		> 10^{12} Ω	> 10^{12} Ω
offset current		< 10^{12} A	< 10^{12} A
Calibration			
buffer sets	DIN (1.68/4.01/6.87/9.18)	2-point	2-/3-point
	technical (2.00/4.00/7.00/10.00)[1)]	2-point	2-/3-point
	any buffers	1-/2-point	1-/2-point
calibration interval control		-	1...999 days
calibration protocol print		-	only CG 843P
calibration data storage		-	yes
real time clock	integrated with time/date	-	yes
Data storage			
storage by depression of key		-	800 data records
time controlled storage	in 7 intervals (5 sec...60 min)	-	800 data records
Connections			
electrode (socket to DIN 19 262 or BNC)		yes	yes
temperature sensor (NTC 30, PT 1000, 2 x 4 mm sockets)		yes	yes
Output			
for connection cable to recorder (type no. Z 394)		-	4 pole socket
for connection cable to printer, serial (type no. Z 391)		-	4 pole socket
for interface connection cable to PC, bidirectional (type no. Z 395)		-	4 pole socket
Printer			
integrated thermal printer	(paper width 58 mm)	-	only CG 843P
Ambient temperature	storage temperature	-25...+65 °C	-25...+65 °C
	operating temperature	0...+55 °C	0...+55 °C
Power supply			
nonsystem-connected	4 x 1.5 V batteries type IEC-LR 6	yes	yes (except printing)
battery life time (data remain when changing batteries)		3000 h with continous use	3000 h with continous use
mains adapter		optional	optional/yes
automatic switch off at battery operation		60 min	60 min
Housing		ABS, key pad	ABS, key pad
dimensions		285 x 240 x 85 mm	285 x 240 x 85 mm
weight		1.0 kg	1.0/1.3 kg
short instructions at instrument		yes	yes
Instrument safety	protection class	3, EN 61010-1	3, EN 61010-1
	protection type	IEC 529, IP 43 without integrated printer	
Approvals/Marks of conformity		CE, UL/CUL	CE, UL/CUL
Display			
multifunctional display		75 mm x 60 mm	75 mm x 60 mm

[1)] SCHOTT Instruments

Technical data for the laboratory conductivity meters

Laboratory conductometers		**CG 853 / CG 853P**
Measuring ranges		
conductivity	5 measuring ranges / AutoRange	0.0 µS/cm…500mS/cm
	at k = 0.1 and k = 0.01	0.00 µS/cm…19.99 µS/cm
	at k = 0.01	0.000 µS/cm…1.999 µ/cm
salinity	to IOT table	0.0…70.0
TDS	factor adjustable 0.40...1.00	0…1999 mg/l,
temperature	automatic, 3 modes selectable	-5.0…+100.0 °C
	(°C oder °F)	
	resolution	0.1 K
	manual	-20…+100 °C
Cell constant	adjust	0.01; 0.1; 0.250…2.500
	calibrate	0.450…0.500 ; 0.800…1.200
	calibration interval control	1…999 days
Accuracy	conductivity	± 0.5 % of measuring value
	salinity	± 0.2
	TDS	±1
	temperature (NTC 30)	± 0.1 K
Reference temperature	selectable	between 20 °C or 25 °C
Temperature compensation mode		
nonlinear compensation for natural water (EN 27888) (DIN 38404)		yes
linear compensation		0.001…3.000 %/K
no compensation		yes
real time clock	integrated with time/date	yes
Data storage		
storage by depression of key		800 data records
time controlled storage	in 7 intervals (5 sec...60 min)	800 data records
Connections		
for 2 and 4 pole cells with/without temperature sensor		8 poles socket
Output		
for connection cable to recorder (type no. Z 394)		4 poles socket
for connection cable to printer, serial (type no. Z 391)		4 poles socket
for interface connection cable to PC, bidirectional (type no. Z 395)		4 poles socket
Printer		
integrated thermal printer	(paper width 58 mm)	only CG 853P
Ambient temperature	storage temperature	-25…+65 °C
	operating temperature	0…+55 °C
Power supply		
nonsystem-connected	4x1.5 V batteries type IEC-LR 6	yes (except printing)
battery life time (data remain when changing batteries)		2500 h with continous use
mains adapter		optional/yes
automatic switch off at battery operation		60 min
Housing		ABS, key pad
dimensions (W x D x H)		285 x 240 x 85 mm
weight		1.0 kg/1.3 kg
short instructions at instrument		yes
Instrument safety	protection class	3, EN 61010-1
	protection type	IEC 529, IP 43 (without integrated printer)
Approvals/Marks of conformity		CE, UL/CUL
Display		
multifunctional display		75 mm x 60 mm

handylab – pocket-size all-rounders …

handylab – the mobile, multi-functional mini-laboratories

The latest handylab generation is available in seven different models – all with a new modern look and expanded features. These compact, battery powered, pocket-size meters were specially designed for field work.

They are available as a set in a practical carrying case with the respective combination electrode and all of the requisite accessories, thus providing the user with a high performance mini-laboratory.

The handylab pH/LF12 multi-parameter portable meter can be used to determine pH values, redox potential, conductivity and temperature. The handylab multi12, which is a real all-rounder, can also be used to measure oxygen concentrations.

The measurement parameters pH, mV and °C make the handylab pH11 and pH12 pH meters suitable for a variety of uses. The fully automatic one to three point calibration including preprogrammed DIN or technical buffers makes practical work substantially easier.

The handylab OX 12 oxygen meter automatically takes influence variables such as temperature and air pressure into account during measurements. The influence of a higher salinity level on the oxygen measurement can also be corrected by entering the salinity value, after determining it using a conductivity meter.

All of the handylab 12 models have a data memory, which means that measurements can be recorded manually or automatically using a timer control, and can be evaluated at a later time. In addition, they have a serial interface, and an optional power pack is available for utilization at stationary measurement locations.

Features and applicability of the portable handylab pH meters and conductivity meters

handylab	pH 11	pH 12	LF 11	LF 12	OX12	pH/LF 12	Multi 12
pH	+	+	-	-	-	+	+
Redox	+	+	-	-	-	+	+
Temperature	+	+	+	+	+	+	+
Conductivity	-	-	+	+	-	+	+
Oxygen	-	-	-	-	+	-	+
AutoRead	+	+	+	+	+	+	+
Battery operation	+	+	+	+	+	+	+
Mains power connection (power pack optional)	-	+	-	+	+	+	+
Data memory	-	+	-	+	+	+	+
RS-232	-	+	-	+	+	+	+

All of the handylab pH meters and conductivity meters are also available as a complete, cost-effective set in a carrying case.

… for measuring pH values and redox potential, conductivity and oxygen

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Portable oxygen meter with GLP functions handylab OX12	Page 66
Technical data 9009/61 O_2 sensor	Page 66
Technical data handylab OX12	Page 67
Multi-parameter portable meters with GLP functions handylab pH/LF 12, handylab multi 12	Page 68
Technical data handylab pH/LF 12, handylab multi 12	Page 69
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Portable pH meters with GLP functions handylab pH 11 and handylab pH 12

These pocket-size meters in shock-proof, water-tight casings are ideally suited for field work.

Measurement parameters

The pH, mV and °C measurement parameters mean that the pocket pH meters from SCHOTT Instruments have a variety of uses.

Measurement memory and interface

In comparison with the handylab pH 11, the handylab pH 12 additionally has a data memory, which makes it possible to save measurements manually or automatically using a timer control, and then evaluate them at a later time. Furthermore, this pH meter has a configurable interface with a recognition function (RS-232) so that it can be connected to a computer (bi-directional) or a recorder.

Measurement reliability

The special AutoRead function, which can be additionally activated, serves to monitor the drift of the combination electrode. The measured value is only released when the stability criteria are fulfilled. This ensures the reproducibility of measurement results.

Temperature compensation

Measurements can be performed with and without the temperature sensor. Temperature compensation of pH measurements can be effected automatically or manually. The type of temperature sensor that is connected (Pt 1000 or NTC 30) is recognized automatically.

Calibration

The first option is a fully automatic one to three point calibration using buffers that have already been programmed into the meter in accordance with DIN or technical buffers from SCHOTT Instruments. The meter recognizes the buffer solutions automatically. Alternatively, conventional calibration with optionally selectable buffers can also be used. A sensor symbol indicates the status of the pH combination electrode after the automatic calibration. The adjustable calibration timer of the handylab pH 12 can be set to remind the user of any calibration that is due to be performed.

Power supply

The battery-powered meters allow the user to work independently of a mains power supply for thousands of hours. When the batteries are changed, all of the calibration data are retained in the memory. A message appears on the display in good time to remind the user to replace the batteries.
An optional power pack is also available for the handylab pH 12.

Sensors

We have a comprehensive product range of precision pH electrodes and can offer you the right sensor for every type of application. We would be pleased to advise you about your specific application.

Separately or as a set

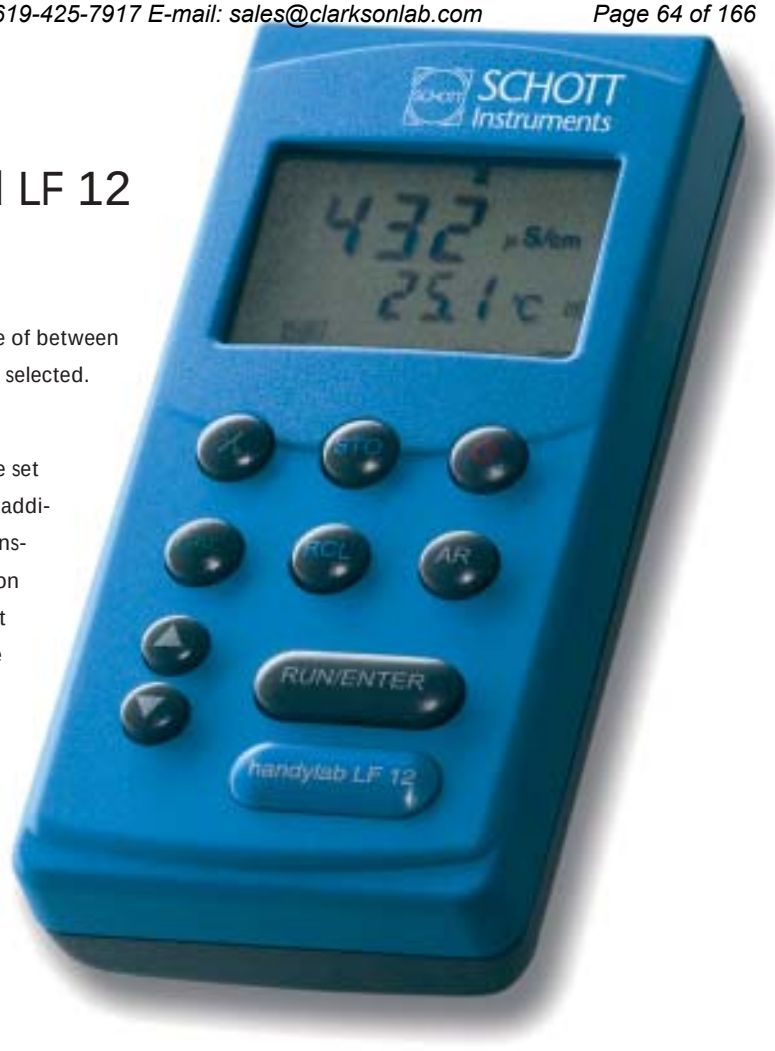
The handylab pH 11 and handylab pH 12 pocket-size pH meters are not only available separately, but can also be purchased in a complete cost-effective set that includes a combination electrode, buffer solutions and measuring beakers in a carrying case. With this set, you can get to work right away.

Technical data
handylab pH 11, handylab pH 12

ph meters		handylab pH11	handylab pH12
Measuring ranges			
pH	range	-2.000...+19.999 pH	-2.000...+19.999 pH
	resolution max.	0.001 pH	0.001 pH
	accuracy	+0.005/±0.01 pH	+0.005/±0.01 pH
mV	range max..	-1999...+1999 mV	-1999...+1999 mV
	resolution max.	0.1 mV	0.1 mV
	accuracy	+0.3/±1 mV	+0.3/±1 mV
temperatur	range	-5.0...+105.0 °C	-5.0...+105.0 °C
	resolution	0.1 K	0.1 K
	accuracy (with NTC 30)	+0.1 K	+0.1 K
	manual adjustment	-20...+130 °C	-20...+130 °C
drift control	can be switched off	yes	yes
slope matching		85...105 %	85...105 %
zero point matching		± 30 mV	± 30 mV
sensor evaluation	via symbol in the display	yes	yes
input resistance		>10^{12} Ω	> 10^{12} Ω
offset current		< 10^{12} A	< 10^{12} A
Calibration			
buffer sets	DIN (1.68/4.01/6.87/9.18)	1-/2-/3 point	1-/2-/3 point
	technical (2.00/4.00/7.00/10.00)[1]	1-/2-/3 point	1-/2-/3 point
	selectable buffers	1-/2 point	1-/2 point
calibration interval control		-	1...999 days
saving calibration data in memory		-	yes
Real time clock	integrated with time/date	-	yes
Data storage			
storage by depression of key		-	800 data records
time controlled storage	in 7 intervals (5 sec. ...60 min)	-	800 data records
Connections			
electrode (socket in accord with DIN 19 262)		yes	yes
temperature sensor (NTC 30/Pt 1000, 2 x 4 mm banana plug)		yes	yes
Interface			
for analogue recorder cable Z 394		-	4 poles socket
for RS-232 cable Z 395, bi-directional		-	4 poles socket
Ambient temperature			
operating temperature		-10...+55 °C	-10...+55 °C
relative humidity (annual average)		< 90 %	< 90 %
Power supply			
battery operated (type AA)		4 x 1.5 V mignon cells	4 x 1.5 V mignon cells
battery life time (data is saved even if batteries are changed)		approx. 5.000 h	approx. 5.000 h
power supply (no akku)		-	optionally
automatic switch-off during battery operation		60 min	60 min
Housing		ABS, water-tight keypad	ABS, water-tight keypad
dimensions (H x W x D)		172 mm x 80 mm x 37 mm	172 mm x 80 mm x 37 mm
weight		approx. 0.3 kg	approx. 0.3 kg
Display			
LCD multi-function display		60 mm x 45 mm	60 mm x 45 mm
Instrument safety	protection class	3, EN 61010-1 A2	3, EN 61010-1 A2
	protection type	IP 66, EN 60529	IP 66, EN 60529
approvals/marks of conformity		cETLus, CE	cETLus, CE
instrument warranty		3 years	3 years

[1] SCHOTT Instruments

Portable conductivity meters with GLP functions handylab LF 11 and LF 12



The handylab LF 11 and LF 12 portable conductivity meters in shock-proof, water-tight casings are ideally suited for field work.

Measurement parameters

The versatile conductivity meters can be used to measure electrical conductivity, total dissolved solids (TDS), salinity and temperature.

Measurement memory and interface

In comparison with the handylab LF 11, the handylab LF 12 additionally has a data memory, which makes it possible to save measurements manually or automatically using a timer control, and then evaluate them at a later time. Furthermore, this conductivity meter has a configurable interface with a recognition function (RS-232) so that it can be connected to a computer (bi-directional) or a recorder.

Measurement reliability

The special AutoRead function, which can be additionally activated, serves to monitor the drift of the combination electrode. The measure value is only released when the stability criteria are fulfilled. This ensures the reproducibility of measurement results.

Temperature compensation

The automatic temperature compensation works in various selectable modes:

- with an adjustable linear temperature coefficient,
- with a fixed non-linear temperature coefficient or
- with the temperature compensation deactivated.

A reference temperature of between 20 °C and 25 °C can be selected.

Calibration

The cell constant can be set within a wide range. In addition, there is a fixed constant of 0.01. Combination cells with a cell constant of 0.475 or 1 can also be calibrated automatically. The integrated adjustable calibration timer in the handylab LF 12 can be set to remind the user of any calibration that is due to be performed.

Power supply

The conductivity meters can be used for about 2,500 hours without a mains power supply using four conventional batteries. A reminder is shown on the display when the batteries have to be replaced. When the batteries are changed, the calibration data are retained in the memory. The handylab LF12 can also be operated with the optional power pack.

Sensors

Either type LF 513 T electrodes (two pole technology) or type LF 613 T electrodes (four pole technology) can be utilized alternatively. Both types have an integrated temperature sensor. Other electrodes with two or four pole technology with a glass or plastic shaft can also be utilized by means of the appropriate adapter cable. We would be pleased to advise you about your specific application.

Included in the set

The LF 11 and LF 12 conductivity meters are also available as part of a cost-effective set in a carrying case, which includes a combination electrode, calibration solutions and a measuring beaker. With this set, you can get to work right away.

Technical data
handylab LF 11, handylab LF 12

Parameter	handylab LF 11	handylab LF 12	
Measuring ranges			
conductivity	in 5 ranges or AutoRange	0.0 µS/cm…500 mS/cm	0.0 µS/cm…500 mS/cm
	at k = 0.1 and k = 0.01	0.00 µS/cm…19.99 µS/cm	0.00 µS/cm…19.99 µS/cm
	at k = 0.01	0.000 µS/cm…1.999 µS/cm	0.000 µS/cm…1.999 µS/cm
specific resistance	0.000…1999 MΩ·cm	0.000…1999 MΩ·cm	
salinity	acc. to IOT table	0.0…70.0	0.0…70.0
TDS	factor adjustable 0.40…1.00	0…1999 mg/l	0…1999 mg/l
temperature	automatic, 3 modes selectable	-5.0…+105.0 °C	-5.0…+105.0 °C
	resolution	0.1 K	0.1 K
	manual adjustment	-5…+100 °C	-5…+100 °C
Cell constants	adjustable	0.01; 0.090…0.110;	0.01; 0.090…0.110;
		0.250…2.500	0.250…2.500
	calibrate	0.450…0.500 ; 0.800…1.200	0.450…0.500 ; 0.800…1.200
	calibration interval control	-	1…999 days
Accuracy			
	conductivity	± 0.5 % of measured value	± 0.5 % of measured value
	salinity	± 0.2	± 0.2
	TDS	± 2 %	± 2 %
	temperature (NTC 30)	±0.1 K	±0.1 K
Reference temperature	selectable	20 °C or 25 °C	20 °C or 25 °C
temperature compensation mode			
non-linear function natural water	acc. to EN 27 888 (DIN 38 404)	yes	yes
linear compensation		0.001…3.000 %/K	0.001…3.000 %/K
no compensation		yes	yes
real time clock	integrated with time/date	-	yes
Data storage			
storage by depression of key		-	800 data records
time controlled storage	in 7 intervals (5 sec ... 60 min)	-	800 data records
Connections			
for 2 and 4 pole cells			
with/without temperature sensor (NTC 30)		8 poles socket	8 poles socket
Interface			
for analogue recorder cable Z 394		-	4 poles socket
for RS-232 cable Z 395, bi-directional		-	4 poles socket
Ambient temperature			
operating temperature		-10…+55 °C	-10…+55 °C
relative humidity (annual average)		< 90 %	< 90 %
Power supply			
battery operated		4 x 1.5 V mignon cells	4 x 1.5 V mignon cells
battery life time (data remain when changing batteries)		approx. 2,500 h	approx. 2,500 h
power supply (no akku)		-	optionally
automatic switch-off at operation		60 min	60 min
Housing		ABS, water-tight key pad	ABS, water-tight key pad
dimensions (H x W x D)		172 mm x 80 mm x 37 mm	172 mm x 80 mm x 37 mm
weight		approx. 0.3 kg	approx. 0.3 kg
Display			
LCD multi-function display		60 mm x 45 mm	60 mm x 45 mm
Instrument safety	protection class	3, EN 61010-1 A2	3, EN 61010-1 A2
	protection type	IP 66, EN 60529	IP 66, EN 60529
approvals/marks of conformity		cETLus, CE	cETLus, CE
instrument warranty		3 years	3 years

Portable oxygen meter with GLP functions handylab OX12

The handylab OX12 portable oxygen meter in a shock-proof, water-tight casing is also ideally suited for on-site oxygen measurements in rivers, lakes or effluent, as well as for BOD measurements.

Measurement parameters

The oxygen concentration, saturation index and temperature measurement parameters mean that the SCHOTT Instruments handylab OX 12 has a variety of uses.

Measurement memory and interface

The meter has a data memory, whereby measurements can be saved manually or automatically using a timer control, and then evaluated later on. In addition, the oxygen meter has a configurable interface with a recognition function (RS-232) so that it can be connected to a computer (bi-directional) or a recorder.

Measurement reliability

The special AutoRead function, which can be additionally activated, serves to monitor the drift of the combination electrode. The measured value is only released when the stability criteria are fulfilled. This ensures the reproducibility of measurement results.

Measurements

During the measurement process, influence variables such as temperature and air pressure are automatically taken into account and compensated. Even the influence of a higher salinity level on oxygen determination can be corrected by entering the salinity that has been determined using a conductivity meter.

Calibration

Calibration of the handylab OX12 can be performed easily on-site using the air calibration vessel. The vessel ensures a defined humidity and therefore ideal calibration conditions. After automatic calibration, a sensor symbol indicates the status of the oxygen combination electrode. The adjustable calibration timer can remind the user when the next calibration is due to be performed.

Power supply

The handylab OX12 can be operated for at least 2,000 hours independently of a mains power supply using four conventional batteries. A reminder for the user to replace the batteries appears on the display in good time. The calibration data are retained when the batteries are changed.

Sensor

The modern, zero current free, galvanic sensor 9009/61, which is included with the meter and can be used immediately for measuring purposes, ensures precise, reliable and rapid measurement of oxygen concentrations.

As a set

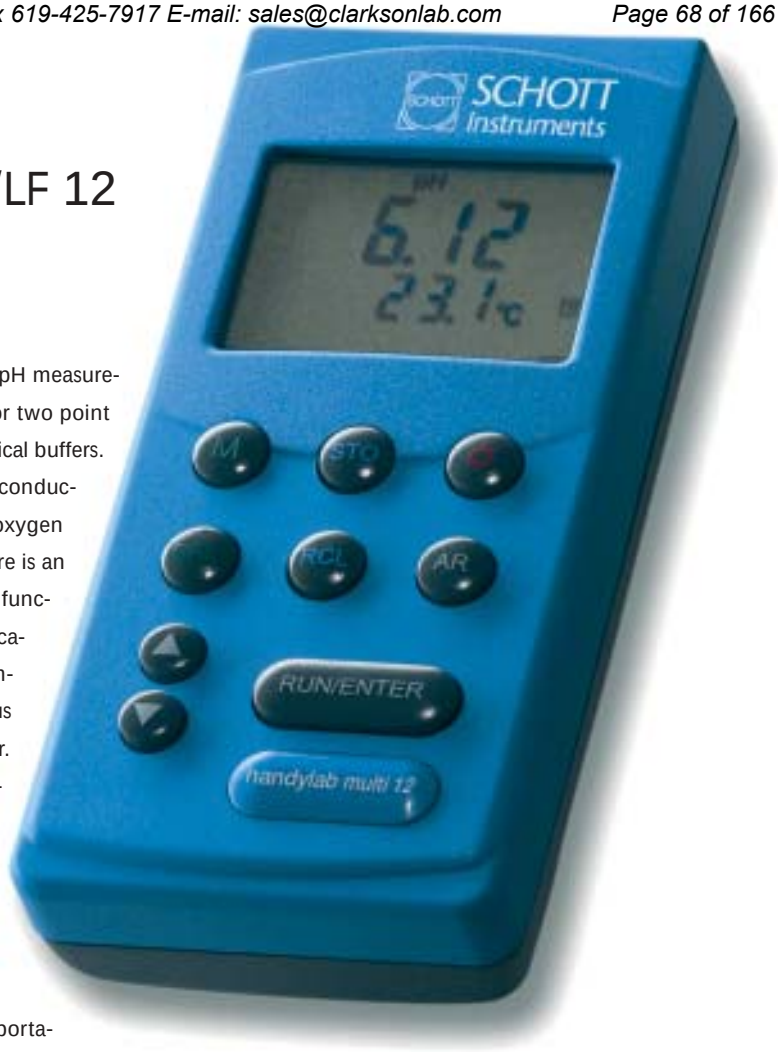
The handylab OX12 portable oxygen meter is available as a complete set in a carrying case together with the 9009/61 sensor, the OX 925 maintenance set and the OxiCal®-SL calibration vessel.

Technical data	**9009/61 O_2 sensor**
Measuring principle	membrane covered galvanic sensor
temperature compensation	IMT
measurement range	0…50 mg/l O_2
temperature range	0…50 °C
max. over-pressure	6 bar
immersion depth	min. 6 cm
	max. 20 m water depth
Material	membrane head and shaft: POM
	membrane FEP
	thermistor housing VA steel (1.4571)
Dimensions	shaft length: 145 mm
	diameter: 15.25 mm
	membrane thickness: 13 µm
Cable connection	fixed cable length: 1.5 m (standard); max. length: 20 m
Approach velocity	> 3 cm/s at 10 % measuring accuracy
	10 cm/s at 5 % measuring accuracy
	18 cm/s at 1 % measuring accuracy
Specifications of sensor when new	
zero signal	< 0.1 % of saturation value
reaction time at 20 °C	t_{90} (90 % of final value) after < 10 sec.
	t_{95} (95 % of final value) after < 16 sec.
	t_{99} (99 % of final value) after < 60 sec.
internal consumption	0.008 µg/h
drift	approx. 3 % per month under operating conditions
service life	min. 6 months per electrolyte filling
polarization time	not required; sensor can be used immediately

Technical data handylab OX12

Oxygen meter		handylab OX12
Measuring ranges		
concentration	ranges	0.00...19.99 mg/1 / 0...90.0 mg/1
	resolution max.	0.01
	accuracy	± 0.5 % of measured value
saturation index	ranges	0.0...199.9 % / 0...600 %
	resolution max.	0.1 %
	accuracy	± 0.5 % of measured value
partial pressure	ranges	0.0...199.9 mbar / 0...1250 mbar
temperature	range	0...+50.0 °C
	resolution	0.1 K
	accuracy	+ 0.1 K
drift control	can be switched off	yes
Correction functions		
air pressure	automatic (built-in pressure sensor)	500...1100 hPa
temperature	automatic (IMT)	0...+40 °C
salinity	using setting keys	0.0...70.0
Calibration		
procedure		air calibration procedure
slope range		0.60...1.25
calibration interval control		1...999 days
calibration data storage		yes
sensor evaluation	via symbol on display	yes
real time clock	integrated with time/date	yes
Data storage		
storage by depression of key		800 data records
time controlled storage	in 7 intervals (5 sec...60 min)	800 data records
Connections		
oxygen sensor		8 pole socket
Interface		
for analogue recorder cable Z 394		4 pole socket
for RS-232 cable Z 395, bi-directional		4 pole socket
Ambient temperature		
operating temperature		-10...+55 °C
relative humidity (annual average)		< 90 %
Power supply		
battery operated		4 x 1.5 V mignon cells (type AA)
battery life time (data remain when changing batteries)		approx. 2,000 h
power supply (no akku)		optionally
automatic switch-off at operation		60 min
Housing		ABS, water-tight key pad
dimensions (H x W x D)		172 mm x 80 mm x 37 mm
weight		approx. 0.3 kg
Display		
LCD multi-function display		60 mm x 45 mm
Instrument safety	protection class	3, EN 61010-1 A2
	protection type	IP 66, EN 60529
approvals/marks of conformity		cETLus, CE
instrument warranty		3 years

Multi-parameter portable meters with GLP functions handylab pH/LF 12 and handylab multi 12



The multi-parameter pocket-size meters – handylab pH/LF 12 and handylab multi 12 – in shock-proof, water-tight casings are ideally suited for field work.

Measurement parameters

The measurement parameters pH, redox potential, temperature and conductivity means that the handylab pH/LF 12 has a variety of uses. The handylab multi 12 can also be used to measure the oxygen concentration in solutions.

Measurement memory and interface

The meters have a data memory, which means that measurements can be saved manually or automatically by using a timer control, and evaluated later on. Both meters have a serial RS-232 interface (bi-directional) for data transfer purposes.

Measurement reliability

The special AutoRead function, which can be additionally activated, serves to monitor the drift of the combination electrode. The measured value is only released when the stability criteria are fulfilled. This ensures the reproducibility of measurement results.

Calibration

For calibration of the pH measurement, there is a one or two point calibration with technical buffers. For calibration of the conductivity sensor and the oxygen sensor, if needed, there is an automatic calibration function. After automatic calibration, a sensor symbol indicates the status of the calibrated sensor. The adjustable calibration timer can remind the user that calibration is due to be performed.

Power supply

The multi-parameter portable meters can be operated for approx. 2,500 hours independently of a mains power supply using four conventional batteries, or with the optional power pack. The display shows a reminder to replace the batteries in good time. The calibration data are retained when the batteries are changed.

Sensors

We supply the handylab pH/LF 12 complete with a suitable pH combination electrode and conductivity sensor. The handylab multi 12 additionally includes an oxygen sensor.

As a set

The handylab -pH/LF 12 and handylab multi 12 multi-parameter meters are available as a complete set in a carrying case with all of the requisite sensors, calibration and maintenance accessories. With the set, you can get to work immediately.

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Technical data
handylab pH/LF 12, handylab multi 12

Parameters		handylab pH/LF 12	handylab multi 12
Measuring ranges			
pH/mV	pH range/resolution	-2.00...+19.99 pH	-2.00...+19.99 pH
	accuracy (±1 digit)	±0.01 pH	±0.01 pH
	mV range/resolution	-1999...+1999 mV	-1999...+1999 mV
	accuracy (±1 digit)	±1 mV	±1 mV
temperature	measuring range	-5.0...+105.0 °C	-5.0...+105.0 °C
	manual setting	-20...+130 °C	-20...+130 °C
oxygen	concentration: ranges/resolution	-	0.00...19.99 mg/l/0...90.0 mg/l
	saturation: ranges/resolution	-	0.00...199.9 %/0.0...600 %
	accuracy (±1 digit)	-	±0.5 % of measured value
	temperature compensation, automatically	-	0.0...50.0 °C
conductivity	4 ranges/Auto range	1 uS/cm...500 mS/cm	1 uS/cm...500 mS/cm
	salinity to IOT table	0.0...70.0	0.0...70.0
	accuracy (±1 digit)	±0.5 % of measured value	±0.5 % of measured value
	temperature compensation modes	linear, nonlinear, no compensation	nonlinear
	cell constant, calibrate	0.450...0.500	0.450...0.500
drift control	deactivatable	yes	yes
sensor evaluation	by symbol on display	yes	yes
Calibration			
pH	technical (2.00/4.00/7.00/10.00)*)	1-/2-point	1-/2-point
	DIN (1.68/4.01/6.87/9.18)	1-/2-point	-
oxygen	automatic calibration	-	yes
conductivity	automatic calibration	yes	yes
calibration interval control		1...999 days	1...999 days
calibration data store		yes	yes
real time clock	integrated with time/date	yes	yes
Serial interface			
type		232, bi-directional	232, bi-directional
baud rate		adjustable	adjustable
Data storage			
storage by depression of key		500 data records	500 data records
time controlled storage	in 7 levels (5 sec...60 min)	500 data records	500 data records
Input			
pH/redox-electrode (opt. with temperature sensor)		socket to DIN 19262 +	socket to DIN 19262 +
		socket 4 mm	socket 4 mm
conductivity/oxygen sensor		8 pole socket	8 pole socket
Output			
for RS-232 cable Z 395, bi-directional		4 pole socket	4 pole socket
for recorder cable Z 394			
Ambient temperature			
operating temperature		-10...+55 °C	-10...+55 °C
relative humidity (annual average)		< 90 %	< 90 %
Power supply			
nonsystem-connected		4 x 1.5 V mignon cells (type AA)	4 x 1.5 V mignon cells (type AA)
battery life time (data remain when changing batteries)		approx. 2,500 h	approx. 2,500 h
automatic switch off at battery operation		60 min	60 min
power supply (no akku)		optionally	optionally
Housing		ABS, water-tight key pad	ABS, water-tight key pad
dimensions (H x W x D)		172 mm x 80 mm x 37 mm	172 mm x 80 mm x 37 mm
weight		approx. 0.3 kg	approx. 0.3 kg
Display			
LCD multi-function display		60 mm x 45 mm	60 mm x 45 mm
Instrument safety	protection class	3, EN 61010-1	3, EN 61010-1
	protection type	IP 66, EN 60529	IP 66, EN 60529
approvals/marks of conformity		cETLus, CE	cETLus, CE
instrument warranty		3 years	3 years

*) SCHOTT Instruments

Pocket-size precision pH meter CG 837

The CG 837 is a top quality pH meter in a practical pocket size. It offers a very compact, portable size, but also fulfils laboratory requirements with respect to features and precision.

Compact and precise

The carrying case with shoulder strap together with the necessary accessories makes the pH meter ideal for mobile use. Its high level of precision and minimal space requirements make this meter ideal for work in the field, as well a fully functional piece of laboratory equipment.

User friendly

The keys have defined pressure points for accurate, precise operation and are clearly arranged on the splash-proof key pad and clearly labeled. Related values such as pH value and temperature are displayed simultaneously. Calibration and temperature compensation are automated. The „hold“ key allows you to freeze the last measured value on the display.

Highly accurate measurements

The stable electronic engineering components guarantee the high measurement accuracy of 0.01 pH. Redox potentials can be measured to an accuracy of 1 mV. When measurements are performed using a temperature sensor, the microprocessor takes the temperature dependency of electrode and buffer solutions into account. Faulty electrodes are recognized during calibration and an error message is shown on the display.

Measurement areas

The versatile CG 837 can be used to measure pH value, redox potential and temperature. The pH meter is equipped with a recorder print out for monitoring measurements or for continuous monitoring.

Temperature measurements

If a combination electrode with an integrated temperature sensor is used for measurements, the correct temperature-compensated pH values and the temperature are both displayed simultaneously. If measurements are performed without a temperature sensor, the temperature can be entered manually.

Simple calibration with high precision

The pH values of three buffer solutions including their temperature dependence have already been saved in the meter. There is a separate, unmistakably labeled key for each buffer; the meter itself recognizes whether the buffer solutions have been mixed up. The user can choose between the usual two point calibration or one point calibration as a fast method. The calibration data determined, the zero point and the slope are displayed.

Power supply

Thanks to modern microelectronic engineering technology, the pH meter CG 837 has an extremely low power consumption, so that a set of batteries is sufficient for 6,000 hours of operation. A reminder is displayed in good time when the batteries have to be replaced. If the meter is not being used, it automatically switches itself off after 60 minutes.

Technical data CG 837

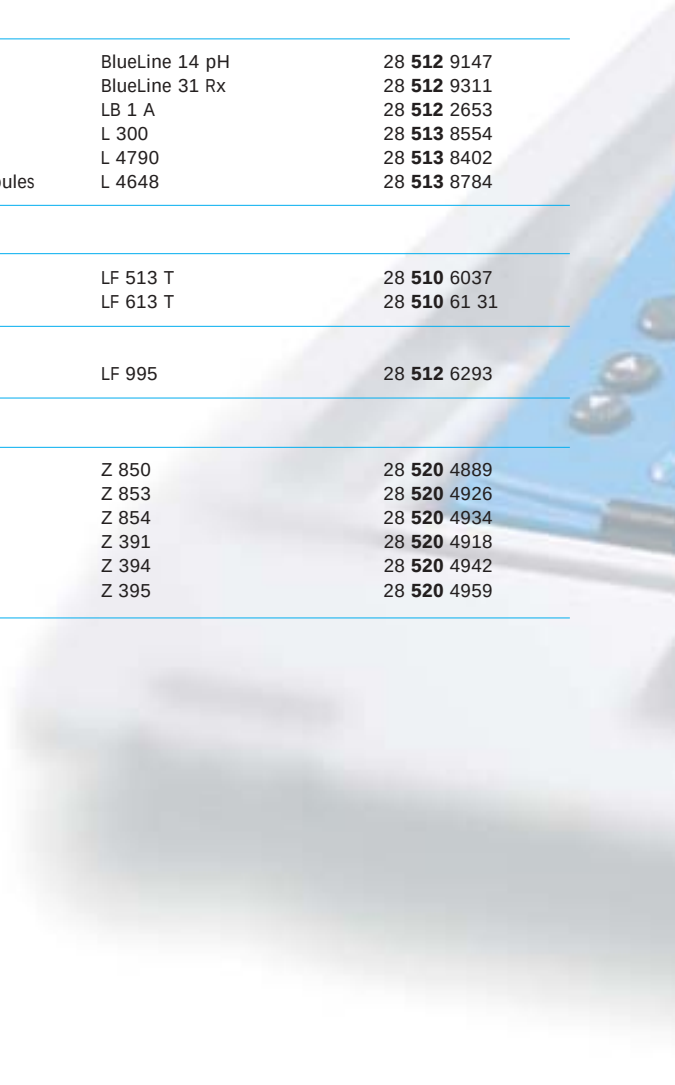
Parameters		CC 837
Measuring ranges		
pH	range	0.00...14.00 pH
	resolution	0.01 pH
	accurancy	± 0.01 pH
mV	range	-1000...+1700 mV
	resolution	1 mV
	accurancy	±1 mV
temperature	range	-199...+199 °C
	resolution	1 K
	accurancy	±0.2 K
	manual adjustment	0...+100 °C
slope matching		85...105 %
zero point matching		-60...+90 mV
input resistance		$>10^{12}$ Ω
offset current		$<10^{12}$ A
Calibration		
buffer sets	technical (4.00/7.00/10.00)[1)]	1-/2 point
Connections		
electrode		DIN 19 262 + 2 mm socket
temperature sensor (Pt 1000)		2 mm socket
Output		
recorder output		2 mm socket
Ambient temperature		
operating temperature		0...+50 °C
relative humidity (annual average)		< 90 %
Power supply		
battery operated		4 x 1.5 V mignon cells (type AA)
battery life time (data remain when changing batteries)		approx. 6,000 h
automatic switch-off (during battery operation can switched to continuous operation)		60 min
Housing		ABS, touch sensitive keypad
dimensions (W x H x D)		140 mm x 38 mm x 90 mm
weight		approx. 0.28 kg
Display		
CD-multi-function display		60 mm x 35 mm
instrument safety	protection class	IEC 1010/class 3
approvals/mark of conformity		TÜV CS, CE

[1)] SCHOTT Instruments

Order overview laboratory pH meters, conductivity meters, accessories

pH-Meter	Type No.	Order No.
pH meter CG 842	CG 842	28 **520** 2609
pH meter CG 842 Set, complete, ready to start with pH combination electrode BlueLine 14 pH with integrated temperature sensor, stand set Z 853 and calibration solutions	CG 842/14 pH	28 **520** 2641
pH meter CG 843	CG 843	28 **520** 2617
pH meter CG 843 Set, complete, ready to start with pH combination electrode BlueLine 14 pH with integrated temperature sensor, stand set Z 853 and calibration solutions	CG 843/14 pH	28 **520** 2658
pH meter CG 843P, with integrated printer, with universal mains power supply Z 850	CG 843P	28 **520** 2633
pH meter CG 843P Set, complete, ready to start with pH combination electrode BlueLine 14 pH with integrated temperature sensor, stand set Z 853, calibration solutions and universal mains power supply Z 850	CG 843P/14 pH	28 **520** 2666
Conductivity meters		
Conductivity meter CG 853	CG 853	28 **520** 0702
Conductivity meter CG 853 Set, complete, ready to start with 4-pole-conductivity cell LF 613 T with integrated temperature sensor, stand set Z 853 and calibration solutions	CG 853/613 T	28 **520** 0727
Conductivity meter CG 853P, with integrated printer, with universal mains power supply Z 850	CG 853P	28 **520** 0719
Conductivity meter CG 853 Set, complete, ready to start with 4-pole-conductivity cell LF 613 T with temperature sensor, stand set Z 853, calibration solutions and universal mains power supply Z 850	CG 853P/613 T	28 **520** 0735
Accessories for pH meters		
pH combination electrode, with integrated temperature sensor, 1 m fixed cable and DIN plug	BlueLine 14 pH	28 **512** 9147
Redox combination electrode with plug head	BlueLine 31 Rx	28 **512** 9311
Plug cable combination e.g. for BlueLine 31 Rx, 1 m cable, DIN plug	LB 1 A	28 **512** 2653
Electrolyte solution KCl 3 mol/l, 1000 ml DURAN® bottle	L 300	28 **513** 8554
DIN buffer solution pH 4.01 / 6.87, 2 x 30 ampoules, with manufacturer certificate	L 4790	28 **513** 8402
Redox test solution 180, 430, 600 mV Pt/calomel; 220, 470, 640 mV Pt/Ag/AgCl, 3 x 20 ampoules	L 4648	28 **513** 8784
Accessories for conductivity meters		
2-pole conductivity cell, with integrated temperature sensor, plastic shaft, 1.5 m fixed cable	LF 513 T	28 **510** 6037
4-pole conductivity cell, with integrated temperature sensor, plastic shaft, 1.5 m fixed cable	LF 613 T	28 **510** 61 31
Conductivity test solutions KCl 0.01 / 0.1 / 1 mol/l (1.41 mS/cm / 12.9 mS/cm / 112 mS/cm), 3 x 6 ampoules	LF 995	28 **512** 6293
Further accessories		
Universal mains power supply unit, 100...240 V	Z 850	28 **520** 4889
Stand set, including electrode double clamp	Z 853	28 **520** 4926
Printer paper, document quality, 3 rolls	Z 854	28 **520** 4934
Connection cable for printer	Z 391	28 **520** 4918
Connection cable for recorder	Z 394	28 **520** 4942
Interface connection cable for PC (software included)	Z 395	28 **520** 4959

More instruments, sensors and accessories please refer to other pages of this catalogue




SCHOTT
Instruments

Order overview handylab pH meters, conductivity meters and oxygen meters

pH meters	Type no.	Order no.
handylab pH 11, individual meter	handylab pH 11	28 520 2871
handylab pH 11, case set, complete, ready to use with pH combination electrode BlueLine 23 pH, calibration solutions and plastic beakers	handylab pH 11/23 pH	28 520 2917
handylab pH 11, case set, complete, ready to use with pH combination electrode BlueLine 24 pH, calibration solutions and plastic beakers	handylab pH 11/24 pH	28 520 2982
handylab pH 11, case set, complete, ready to use with pH combination electrode BlueLine 14 pH, calibration solutions and plastic beakers	handylab pH 11/14 pH	28 520 2999
handylab pH 12, individual meter	handylab pH 12	28 520 2896
handylab pH 12, case set, complete, ready to use with pH combination electrode BlueLine 24 pH, calibration solutions and plastic beakers	handylab pH 12/24 pH	28 520 3054
handylab pH 12, case set, complete, ready to use with pH combination electrode BlueLine 14 pH, calibration solutions and plastic beakers	handylab pH 12/14 pH	28 520 3062
CG 837, individual meter	CG 837	28 520 2058
CG 837, case set, complete, ready to use with pH combination electrode N 42 A, calibration solutions and plastic beakers	CG 837/42	28 520 2066
CG 837, case set, complete, ready to use with pH combination electrode BlueLine 28 pH-P, calibration solutions and plastic beakers	CG 837/28 pH-P	28 520 2360
CG 837, case set, complete, ready to use with pH combination electrode N 2042 A, calibration solutions and plastic beakers	CG 837/2042	28 520 2099
Conductivity meters		
handylab LF 11, individual meter	handylab LF 11	28 520 3292
handylab LF 11, case set, complete, ready to use with 2-pole conductivity cell LF 513 T, calibration solutions and plastic beaker	handylab LF 11/513 T	28 520 3321
handylab LF11, case set, complete, ready to use with 4-pole conductivity cell LF 613 T, calibration solutions and plastic beaker	handylab LF11/613 T	28 520 3346
handylab LF 12, individual meter	handylab LF 12	28 520 3362
handylab LF 12, case set, complete, ready to use with 4-pole conductivity cell LF 613 T, calibration solutions and plastic beaker	handylab LF 12/613 T	28 520 3379
Oxygen meters		
handylab OX12, case set, complete, ready to use with oxygen sensor 9009/61, calibration and maintenance accessories	handylab OX12-Set	28 520 2793

Order overview handylab multi-parameter portable meters

Multi-Parameter meters	Type no.	Order no.
handylab pH/LF 12, individual meter	handylab pH/LF 12	28 520 3465
handylab pH/LF 12, case set, complete, ready to use with pH combination electrode BlueLine 24-3 pH, 4-pole conductivity cell LF 413-3 T, calibration and maintenance accessories	handylab pH/LF 12-Set	28 520 3473
handylab multi 12, individual meter	handylab multi 12	28 520 3502
handylab multi 12, case set, complete, ready to use with pH combination electrode BlueLine 24-3 pH, 4-pole conductivity cell LF 413-3 T, oxygen sensor 9009/63, calibration and maintenance accessories	handylab multi 12-Set	28 520 3519
Accessories		
Redox combination electrode with plug head	BlueLine 31 Rx	28 512 9311
Plug cable combination e.g. for BlueLine 31 Rx, 1 m cable, DIN plug	LB 1 A	28 512 2653
Electrolyte solution KCl 3 mol/l, 1000 ml DURAN® bottle	L 300	28 513 8554
Technical buffer solutions pH 4.00 / 7.00, 2 x 30 ampoules	L 4690	28 513 8398
Redox test solution 180, 430, 600 mV Pt/calomel; 220, 470, 640 mV Pt/Ag/AgCl, 3 x 20 ampoule	L 4648	28 513 8784
Conductivity test solutions KCl 0.01 / 0.1 / 1 mol/l (1.41 mS/cm / 12.9 mS/cm / 112 mS/cm), 3 x 6 ampoules	LF 995	28 512 6293
Field armouring with holder carrying handle and shoulder strap, for handylab pH meters	Z 384	28 520 4848
Protective armouring with holder and carrying handle, for handylab pH meters	Z 385	28 520 4856
Holder set for protective armouring, for handylab OX12 meters	Z 386	28 520 4864
Rubberized elastic protective armouring with handle support, for all handylab meters	Z 387	28 520 4872
Universal mains power supply unit, 100...240 V for all handylab 12 models	Z 850	28 520 4889
Connecting cable for analogue recorder, or handylab pH 12, LF 12, OX12	Z 394	28 520 4942
Connecting cable for PC, for all handylab 12 models (software included)	Z 395	28 520 4959

Subject to technical changes.
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Selection table titration

Overview table piston burettes

Application	TITRONIC® basic	TITRONIC® universal	TITRONIC® 110 plus
Manual titration	+	+	+
Automatic titration [1]		+	+
Dosing of pre-selected volumes		+	+
Pre-titration		+	
Variable dosing and filling speed		+	+
20 ml dosing unit	+	+	+
50 ml dosing unit		+	+
1, 5, 10 , 20 and 50 ml changer units			+
Results output via RS-232	+	+	+
Remote control via RS-232		+	+

[1] if piston burette is connected to a TitroLine alpha plus or TitriSoft

Overview table of titrators

Application	TitroLine easy	TitroLine KF	TitroLine alpha plus
pH/mV titration aqueous (acidity, hydrochloric acid, citric acid, “Kjeldahl“, ammonia...)	+		+
pH/mV titration non-aqueous (TAN/TBN, FFA, titrations with perchloric acid...)			+
Redox titrations (iodometry, permanganometry...) [2]	+		+
Halogenide titrations (chloride, “salt“, bromide...)	+		+
H_2S and mercaptan			+
pH-stat applications (enzyme kinetics, soil samples, biotechnology			+
Water analysis according to KF (10 ppm – 100 %)			+
Water analysis according to KF (100 ppm – 100 %)		+	+
Bromine number			+
Titrations with more than one end point or equivalence point (phosphoric acid...)			+
Applications with several piston burettes		+	+
Applications with sample changer			+
Applications with TitriSoft			+

[2] except COD and sulphuric acid (SO_2)

Dosing, titrating and water analysis according to Karl Fischer can be so easy

Innovative electrochemistry – right from the start

With the development of the glass electrode more than 65 years ago, we created the basis for the success of electrochemical measurement. Since then, with our range of efficient pH glasses, innovative electrodes and instruments such as pH meters, conductometers, oxygen measuring instruments, we have turned the electrochemical measurement into an indispensable, trouble-free and reliable procedure that is now being used throughout the world.

Building on this know-how, we have also developed a range of reliable laboratory instruments for dosing, titrating and Karl Fischer water analysis.

These instruments combine ease of use with maximum accuracy, and the robustness required for daily operation in the laboratory. Benefits, which far outweigh the cost of these instruments.

For complex application such as difficult, nonaqueous titrations and for automatic measuring stations, the TitroLine alpha *plus* titration system is also available.

Just what you need to make your routine daily work simpler and even better

Like the TitroLine *easy* and TitroLine *KF* titrators, the TITRONIC® *basic* and TITRONIC® *universal* piston burettes are robust tools for dosing and titrating, which were designed specifically for daily routine use in the laboratory. Despite their robustness, these are high precision instruments. Even the simplest burette is equipped with an UV-protected precision glass cylinder made of DURAN® and a motor-controlled 3/2-way valve made of extremely resistant PTFE/ETFE. But we have also focussed our attention on the importance of easy, trouble-free operation – so a manual is something you may never need to use.

TITRONIC® and DURAN® are registered trademarks.
Subject to technical modifications.

TITRONIC® *basic*
The burette with the ›Mouse‹

Anyone with a TITRONIC® *basic* in the laboratory will leave bottle-top burettes and classic glass burettes on the shelf. Manual titration can be performed more reliably and accurately with the TITRONIC® *basic,* and the results can be documented when required.

Operation is so easy

The titration process is carried out by pressing a button on the ›mouse‹ – the handheld device TZ 3680. You can monitor the dosed quantity conveniently on the large display. The TITRONIC® *basic* is equipped with an RS-232-C serial interface so that you can document your results. Here, for example, you can also connect our small, practical TZ 3460 rollpaper printer or any other printer with a serial RS-232-C interface. Needless to say, you can also connect your PC to the TITRONIC® *basic*.

Precision is integrated

The accuracy of the TITRONIC® *basic* is guaranteed by the precision glass cylinder made of DURAN® borosilicate glass with its measurement deviation of less than 0.1 %. And the motor-driven, chemically resistant 3/2-way valve also provides its contribution for precise, reproducible values: It enables unpressurised drawing and dosing and therefore effectively prevents outgassing of liquids and vapour formation due to excessive vacuum pressure.

The magnetic stirrer is available as an accessory

The TM 96 magnetic stirrer is available as an accessory. It is connected directly to the burette, which provides the necessary power.

The complete workplace: precision analysis with no shaky compromises. With 8000-step resolution, precision glass cylinder with UV-protection, motor-controlled 3/2-way valve of extremely resistant PTFE/ETFE and an interface for documentation of the results. It's better to be on the safe side!
(The bottle set must be ordered separately as an accessory.)

Technical data

Hand control element	miniature 4 pole round socket, conforming to DIN standards
RS-232-C	for connecting a printer with serial interface or PC for documentation
Display	four digit LCD display, 20 x 48 mm, height of digits: 12.7 mm
Volume display	0.01 ... 999.9 ml
Resolution	0.01 ml
Cylinder	20 ml DURAN® borosilicate glass cylinder with UV protection sleeve
Tubing	FEP with UV protection
Dosing accuracy	systematic error 0.1 %, random error 0.05 %, determined according to EN ISO 8655-6
Valve	3/2-port directional control valve made of PTFE/ETFE
Housing material	polypropylene and polyflamm RPP 371 NT, 20 % talcum
Front foil	polyester
Dimensions	135 x 310 x 205 mm (W x H x D), including dosing unit, without stirrer
Weight	approx. 2.1 kg
Ambient temperature	+10 ... +40 °C (for operation and storage)
Power supply	230 V~; 50/60 Hz or 115 V~; 50/60 Hz
Appliance safety	corresponds to Protection Class II in accordance with DIN EN 61010, part 1
Conformity	EN ISO 8655-3

TITRONIC® *universal*
Titrating manually, dosing perfectly

The TITRONIC® *universal* is a perfect motor-driven burette for manual titration and an extremely precise dosing instrument for dosable liquids, solvents and titrating agents. However, the TITRONIC® *universal* not only first-rate as a stand-alone instrument – it also thrives as the heart of a computer-controlled dosing or titrating system.

Adjusting easily, dosing precisely

With the TITRONIC® *universal* you can preselect any dosing volume from 0.01 ml to 999.99 ml easily with the keypad and you can adjust the dosing speed to a continuously controllable setting. Furthermore, with the TITRONIC® *universal* you can define the waiting time between the volume steps, a useful tool for incremental dosing tasks. The dosing process is carried out precisely upon being called. This, by the way, is also extremely practical in the case of manual titration with the hand-held device: Using a precisely adjusting pre-titrating volume, which can be called up at the press of a button before each titration, you can reduce your titration times considerably.

Documenting results reliably

To document your results, simply connect our small, practical TZ 3460 rollpaper printer or any other printer with a serial RS-232-C interface.

The TITRONIC® *universal* gets on quite well with the PC

We have equipped the TITRONIC® *universal* with **two** serial RS-232-C interfaces. This allows you to not only connect a printer in order to document data in the stand-alone mode but also extends the available range of use of the TITRONIC® *universal* quite considerably. For instance, you can use a PC to control all functions of the TITRONIC® *universal* via one of the two serial interfaces. The address is set automatically or manually. But the TITRONIC® *universal* can do a lot more: For complex dosing and titrating processes, up to 16 burettes can be connected in series whenever required. The burettes are connected to one another via the RS-232-C interfaces according to the daisy chain principle. Accordingly, each instrument can then be addressed separately and provides independent feedback data – without an additional data cable.

Technical data

Designed for maximum precision

All components of the TITRONIC® *universal* are designed for maximum precision. This begins with the dosing attachments, which are available in 20-ml or 50-ml volumes. The glass cylinders made of DURAN® borosilicate glass are precisely calibrated and provided with an UV protective coating. The dosing piston is driven by a step motor with a resolution of 8,000 steps. The motor-controlled 3/2-way valve is made of extremely resistant PTFE/ETFE. This 3/2-way valve enables unpressurised drawing and dosing so that outgassing of liquids is prevented as well as vapour formation due to excessive vacuum pressure.

Made for robust laboratory operation

All parts of the TITRONIC® *universal* that come into contact with liquids are made of chemically resistant materials. A polyester front foil protects the keypad and display, and the tubing is in FEP with UV protection.

The magnetic stirrer is available as an accessory

The TM 96 magnetic stirrer is available as an accessory. It is connected directly to the burette, which provides the necessary power.

Keyboard connection	miniature 4 pole round socket, conforming to DIN standards
Stirrer connection	plug-and-socket connection with integrated low-voltage power supply
	(15 V DC) for the TM 96 magnetic stirrer low-voltage power supply
	(15 V DC) for the TM 96 magnetic stirrer
RS-232-C-1	for connecting a printer with serial interface or a PC to document
	and consumption in ml or for data backup
RS-232-C-2	connection of additional piston burettes TITRONIC® *universal* ('Daisy
	Chain')
Configuration of the	connection: miniature 4 pole round socket
RS-232-C interface	preset: 1 stop bit
	adjustable: baud rate: 1200, 2400, 4800 or 9600 baud
	word length: 7 or 8; parity: no, even or odd
Display	8-line LCD display, 69 x 39 mm, 64 x 128 pixel,
	with background illumination and contrast adjustment
Volume display	00.00 ... 999.9 ml
Display resolution	0.01 ml
Dosing volume	0.0 ... 999.99 ml
Dosing speed	0.1 ... 40 ml/min (with 20 ml dosing unit)
	0.1 ... 100 ml/min (with 50 ml dosing unit)
Filling time	30 s to 999 s adjustable (100% in relation to the cylinder volume)
Pre-titrating volume	0.1 ml to 99.99 ml
Increment volume	0.01 ... 999.99 ml
Waiting time between	0.1 ... 999.9 s
the increments	
Cylinder	20 ml or 50 ml DURAN® borosilicate glass cylinder
	with UV protection sleeve
Dosing accuracy	systematic error 0.1 %,
	random error 0.05 %, determined according to EN ISO 8655-6
Valve	3/2-port directional control valve made of PTFE / ETFE
Tubing	FEP with UV protection
Housing material	polypropylen and polyflamm RPP371 NT, 20% talcum
Front foil	polyester
Dimensions	134 x 310 x 205 mm (W x H x D),
	including dosing unit, without stirrer
Weight	approx. 2.1 kg
Ambient temperature	+10 ... +40 °C (for operation and storage)
Power supply	230 V~; 50/60 Hz or 115 V~; 50/60 Hz
Power consumption	18 VA
Conformity	EN ISO 8655-3

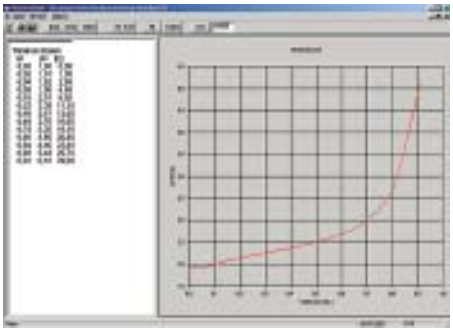
With the TITRONIC® *universal* in the stand-alone mode, you can use the keypad to input all settings conveniently on the instrument. The practical hand-held device can be used for manual titrations or to start and stop a dosing task. (The bottle set must be ordered separately as an accessory.)

TitroLine *easy*
The intelligent titrator for your routine daily work

Quick and easy as its name suggests

The TitroLine *easy* is the ideal titrator for your routine daily work. This instrument provides you with the perfect combination of a piston burette, a pH/mV meter and integrated intelligence. Ten titration methods for various applications are pre-installed and can be called up easily as required. The methods are pre-parameterised. You only need to select your titration procedure: with a self-searching end point, with a pre-set end point, or manual titration with the ›mouse‹. The titration process begins as soon as you press the start button. This saves you time and money.

Practical and compact: A complete measuring unit. The magnetic stirrer is included. It is connected to the TitroLine *easy*. The bottle set must be ordered separately as an accessory.



With the TitroLine Chart software (option), the titration curve can be displayed on the monitor of a connected PC and the titration data can be processed.

Suitable applications for the TitroLine *easy* include:

- salt content in foods (cheese, soya sauce, ketchup)
- total acid in wine and beverages
- nitrogen according to Kjeldahl
- degree of acidity in bread and sourdough

Technical data

Measuring amplifier	measuring input pH/mV electrode: pH-input with 12-bit converter
	for highly accurate resolution of the measuring signal during titration
	measuring range pH: 0.00 ... 14.00
	measuring range mV: -1400 ... +1400
	electrode socket according to DIN 19262 or BNC-socket and
	reference electrode 1 x 4 mm
	measuring input temperature sensor Pt 1000,
	measuring range: -30 ... +115 °C
	connection socket 2 x 4 mm and 1 x 2 mm
Keyboard connection	miniature 4 pole round socket, conforming to DIN standards
Stirrer connection	plug-and-socket connection with integrated low-voltage
	power supply (15 V DC) for the magnetic stirrer TM 96
RS-232-C interface	for connecting a printer with serial interface or PC for documentation
Configuration of the RS-232-C interface	preset: 4800 baud, 8-bit word length, 2 stop bits, no parity
Display	matrix-LCD display 69 x 39 mm, 64 x 128 Pixel
	background illumination and contrast adjustment
Volume display	00.00 ... 999.9 ml
Display resolution	0.01 ml
Cylinder	20 ml DURAN® borosilicate glass
	cylinder with UV protection
Dosing accuracy	systematic error 0.1 %,
	random error 0.05 % determined according to EN ISO 8655-6
Calibration	two-point calibration, selection of eight stored buffer solutions
	in conformity with DIN 19 266 and NBS
Valve	3/2-port directional control valve made of PTFE / ETFE
Tubing	FEP with UV protection
Housing material	polypropylene and polyflamm RPP 371 NT, 20 % talcum
Front foil	polyester
Dimensions	135 x 310 x 205 mm (W x H x D),
	including dosing unit, without stirrer
Weight	approx. 2.4 kg
Ambient temperature	+10 ... +40 °C (for operation and storage)
Power supply	230 V~; 50/60 Hz or 115 V~; 50/60 Hz
Power consumption	24 VA
Appliance safety	corresponds to Protection Class II in accordance with DIN EN 61 010, Part 1
Conformity	EN ISO 8655, part 3

The sensors – from SCHOTT Instruments

Suitable sensors include pH combination electrodes with or without integrated temperature sensors (Pt 1000), redox combination electrodes, Ag combination electrodes or separate measuring or reference electrodes.

Stored data: the buffer solutions

Data for 2.00/4.00/4.01/6.87/7.00/9.18/10.00/12.45 buffers, including temperature coefficients are already stored in the TitroLine *easy*.

Maximum precision for reproducible results

All components of the TitroLine *easy* are designed for maximum accuracy. The glass cylinders made of DURAN® borosilicate glass are precisely calibrated and provided with an UV protective coating. The motor-controlled 3/2-way valve is made of extremely resistant PTFE/ETFE. This 3/2-way valve enables unpressurised drawing and dosing so that outgassing of liquids is prevented as well as vapour formation due to excessive vacuum pressure.

As robust as required for laboratory operation

All parts of the TitroLine *easy* that come into contact with liquids are made of chemically resistant materials. A polyester front foil protects the keypad and display, and the tubing is in FEP with UV protection.

TitroLine *KF*
The dialogue mode: volumetric water analysis at its simplest simple!

Karl Fischer titrations easily made

Practically nothing can go wrong when you use the TitroLine *KF* for water analysis according to the Karl Fischer titration procedure: Each step in the analysis is prompted in a dialogue on the large display. The pre-parameterized methods can be called up easily and will facilitate your work. The versatility of the TitroLine *KF* makes it an ideal choice for KF analysis in the pharmaceutical, chemical, food, and mineral oil industries.

Easy – with methods

The TitroLine *KF* is already programmed with the following methods ready for you to use: sample titration, water titre, liquid standard titre, tartrate dihydrate titre, oven blank value and solvent blank value. All methods stored in the TitroLine *KF* are preassigned with the commonly used parameters. You can, however, change these parameters as required.

We are always glad to help you with your applications

The staff in our application laboratory are pleased to advise and assist you and will place the know-how they have gained through many years of practical work with KF titrations at your disposal. The application manual 'KF Titration in Practical Applications', which is enclosed with the TitroLine *KF*, puts some of this experience at your disposal. You will also find further applications in our application database at our Internet web site where application data can be downloaded free of charge (www.schottinstruments.com).

The TitroLine *KF* includes everything you need for water analysis according to Karl Fischer. The scope of supply includes the titrator, reagent bottle, titration stand TM KF, titration vessel, electrode and a starter kit (6 syringes with tubular needles, molecular sieve and three ampoules with a water standard specification). The waterproof mini keyboard TZ 2825 is available as an optional extra.

Adaptable for all sample types

For samples with very high water content, a specific **pre-titration volume** can be added in a single step at the start of the analysis to accelerate the titration process.

With the **extraction time** function, the start of the titration process can be delayed until the sample has dissolved or the water content has been extracted. As a criterion to end such titrations, a choice can be made between **drift stop** and the traditional **end point delay.**

The variation of the shutdown current and the **pole voltage** being applied enables proper adaptation to any solvent. For applications with the KF oven, the **max. titration period** is more suitable than the shutdown time or the drift stop.

For samples that only release water with difficulty, the **min. titration period** enables simultaneous extraction of the water during the titration.

Titration stand TM KF

At the press of a button used titration samples are drawn off by the titration stand TM KF. You can then place fresh solvent into the system by pressing another key. An integrated magnetic stirrer in the TM KF ensures even distribution of the solvent and sample.

The seals on the titration vessel moisture penetration to a minimum (minimum drift!). The removable glass vessel is available in two sizes and is easy to clean.

KF

The TitroLine *KF* – also an example of good laboratory practical work

Automatic selection of the correct calculation formula

Two different formulas may be used to calculate the result of a Karl Fischer titration. When choosing the method, the correct formula is automatically selected and pre-assigned with the corresponding values. Measurement units for the result can be selected from %, ppm, mg, mg/l, mg/pc (pc = piece) and ml. The titre is always shown in mg/ml, and the blank value in ml.

Quality assessment with statistics

For a statistical evaluation of the analysis, the mean value, standard deviation and the relative standard deviation can be determined. The mean value of the titre and of the blank value is the automatic reference for the calculation of the sample result.

Documentation – exactly the way you need it

To document your results, you can connect a printer, such as the TZ 3460, to one of the two RS-232-C interfaces. For documentation of your results, you can choose to print the results in standard, brief or GLP form. The GLP documentation includes the consumption, result, statistics, originally weighed quantity/submitted quantity, date, time, sample ID, titre, blank value, drift, titration period, method used, titration parameter, calculation formula with values used and an addition input field for the user.

Using your PC and the titration software ›KF-Soft‹, you can also display your KF titrations as curves. All results can be reliably documented in the database integrated in the PC and retrieved at will.

Sample labelling with a keyboard

Sample IDs can be entered using the external, protected keyboard TZ 2825 (optional). Alternatively, the PC keyboard TZ 2835, which is available as an accessory, or any other PC keyboard with a DIN plug can be connected.

We will support your instrument qualification

Within the framework of quality management systems, the traceability of analysis results is becoming increasingly important. We will gladly help you with a logbook that will provide you with the form sheets for the **IQ** (Installation Qualification), **OQ** (Operational Qualification) and **PQ** (Performance Qualification) qualifications. Using the logbook, the commissioning, routine work and verification of the TitroLine *KF* can be efficiently documented.

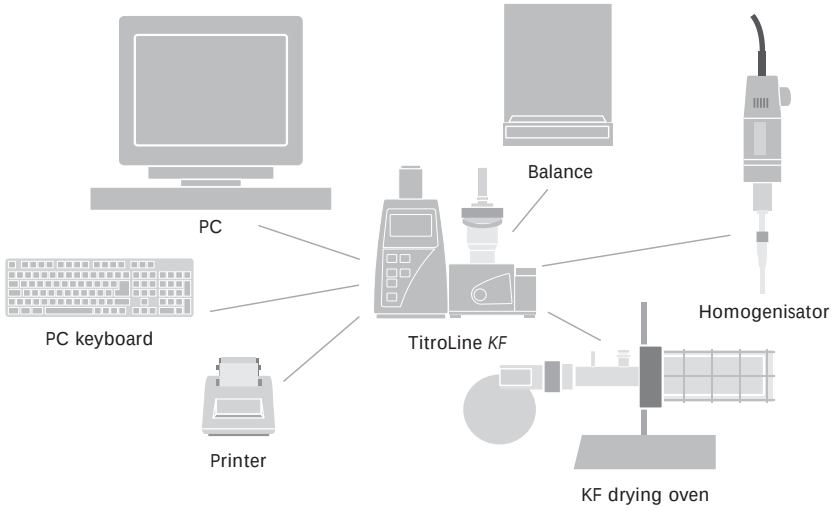
Technical data

Dosing accuracy	systematic error 0.1 %;
	random error 0.05 %;
	determined according to EN ISO 8655-6
Display	matrix LCD 69 x 39 mm, 64 x 128 pixels
	with background illumination, contrast adjustable
Electrode	connection for double platinum electrode; output voltage 100 mV,
	adjustable between 5 ... 200 mV by means of software;
	connection: 2 x 4 mm socket
Keyboard	5-pole DIN socket for TZ 2825
	and PC keyboards with DIN plug
RS-232-C interfaces	two bidirectional RS-232-C interfaces for PC/printer
	and balance/appliances
Cylinder	20 ml made of DURAN® (borosilicate glass 3.3)
Valve	3/2-port directional control valve made of PTFE / ETFE
Tubing	FEP with UV protection
Housing material	polypropylene and polyflamm RPP 371 NT, 20 % talcum
Front foil	polyester
Dimensions	310 x 265 x 205 mm (H x W x D)
	with titration stand TM KF and titration vessel,
	310 x 135 x 205 mm (H x W x D)
	height including of dosing unit (without titration stand)
Weight	approx. 3.2 kg for complete appliance with titration stand;
	approx. 2.1 kg for basic appliance
Ambient temperature	+10 ... +40 °C (for operation and storage)
Power supply	230 V~, 50/60 Hz or 115 V~; 50/60 Hz
Power consumption	30 VA
Conformity	EN ISO 8655, part 3

Precise and robust

All components of the TitroLine *KF* are designed for maximum accuracy. The glass cylinders made of DURAN® borosilicate glass are precisely calibrated and provided with an UV protective coating. The dosing piston is driven by a step motor with a resolution of 8,000 steps. The motor-controlled 3/2-way valve is made of extremely resistant PTFE/ETFE.

All parts of the TitroLine *KF* that come into contact with liquids are made of chemically resistant materials. A polyester front foil protects the keyboard and display, and the tubing is in FEP with UV protection.



Connections and PC control

The TitroLine *KF* is equipped with two RS-232-C interfaces. This, for example, will allow you to connect a balance for automatic transfer of the weighing data and a printer at the same time. Instead of the printer, you can connect a PC and use the titration software KF-Soft to document your data reliably, to store your data in the integrated database or to retrieve and process your data as required.


DURAN
SCHOTT
TITRONIC
FILL
START
STOP
MODE

Ordering information

TITRONIC® *basic* and TITRONIC® *universal*	**Order no.**
TITRONIC® *basic* module 1, (230 V)	**285212572**
TITRONIC® *basic* module 2, same as module 1, with magnetic stirrer TM 96, (230 V)	**285212823**
TITRONIC® *universal* 20 ml module 1, (230 V)	**285212429**
TITRONIC® *universal* 20 ml module 2, same as module 1, with magnetic stirrer TM 96, (230 V)	**285212437**
TITRONIC® *universal* 50 ml module 1, (230 V)	**285212445**
TITRONIC® *universal* 50 ml module 2, same as module 1, with magnetic stirrer TM 96, (230 V)	**285212494**
TITRONIC® *basic* module 1, (115 V)	**285212564**
TITRONIC® *basic* module 2, same as module 1, with magnetic stirrer TM 96, (115 V)	**285212815**
TITRONIC® *universal* 20 ml module 1, (115 V)	**285211921**
TITRONIC® *universal* 20 ml module 2, same as module 1, with magnetic stirrer TM 96, (115 V)	**285211962**
TITRONIC® *universal* 50 ml module 1, (115 V)	**285211979**
TITRONIC® *universal* 50 ml module 2, same as module 1, with magnetic stirrer TM 96, (115 V)	**285211987**
TitroLine *easy*	
TitroLine *easy* module 1 without electrode, (230 V)	**285212597**
TitroLine *easy* module 2 for pH titration, same as module 1, with one pH-electrode and buffer set, (230 V)	**285212848**
TitroLine *easy* module 3 for halogenide titration, same as module 1, with one silver combination electrode, (230 V)	**285212864**
TitroLine *easy* module 1 without electrode, (115 V)	**285212589**
TitroLine *easy* module 2 for pH titration, same as module 1, with one pH-electrode and buffer set, (115 V)	**285212831**
TitroLine *easy* module 3 for halogenide titration, same as module 1, with one silver combination electrode, (115 V)	**285212856**
TitroLine *KF*	
TitroLine *KF*, complete, (230 V)	**285212248**
TitroLine *KF*, complete, (115 V)	**285212231**
Accessories for TITRONIC® *basic*, TITRONIC® *universal*, TitroLine *easy* and TitroLine *KF*	
TZ 2005, bottle top adapter, GL 45	**285221055**
TZ 2008, bottle top adapter, S 40	**285221088**
TZ 2004, bottle top adapter GL 45, with 1 L reagent bottle, brown	**285221047**
TZ 3460, RS-232 printer including data cable, (230 V)	**285225608**
TZ 2825, mini PC keyboard (only TitroLine *KF*)	**285212753**
TZ 1052, KF drying oven, (230 V)	**285214721**
TZ 1050, accessory for KF drying oven	**285218107**
TZ 2073, KF-Soft for TitroLine *KF*	**285221733**
TZ 2074, TitroLine Chart for TitroLine *easy*	**1015738**

Easier Titration at any level of complexity: The new TitroLine alpha *plus*

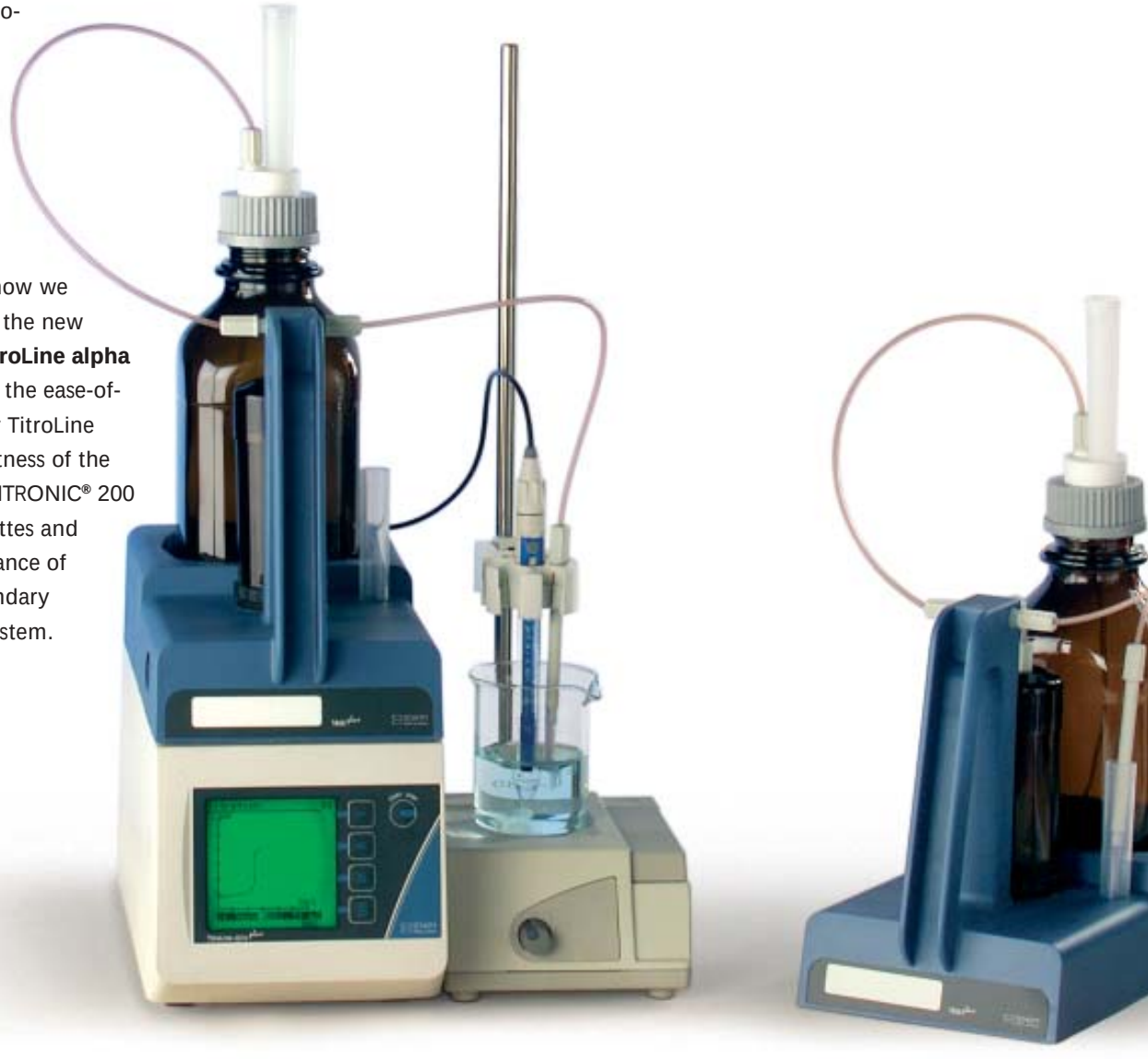
Innovative electrochemistry – from the very beginning

By developing the glass electrode 65 years ago, we laid the foundation for the success of electrochemical measurement. With high-performance pH glasses, innovative electrodes and electrochemical measuring instruments such as pH meters, conductometers, oxygen measuring instruments, piston burettes and titrators we have since made sure that electrochemical measurement today is an indispensable, trouble-free and reliable procedure all over the world.

Based on this know-how we have now developed the new automatic titrator **TitroLine alpha *plus*** which combines the ease-of-use of its predecessor TitroLine alpha with the robustness of the TITRONIC® 110 and TITRONIC® 200 precision piston burettes and exceeds the performance of the now almost legendary TPC 2000 titration system.

The right choice for simple and complex titrations

The **TitroLine alpha *plus*** is compact, flexible, very robust and universally applicable. Its capabilities range from simple end-point titrations (EP), such as the determination of the total acid in wine, to complex and difficult, non-aqueous titrations such as the determination of the acid and base numbers in oils (TAN/TBN). Of course, the automatic titrator **TitroLine alpha *plus*** is also the ideal choice for pH-stat applications such as the determination of the enzyme activity or for "dead-stop" titrations such as water determination according to Karl Fischer (KF).



Whatever your titration needs are, it will be worth your while to take a closer look at the **TitroLine alpha *plus***, especially if your tasks include one of the following applications.

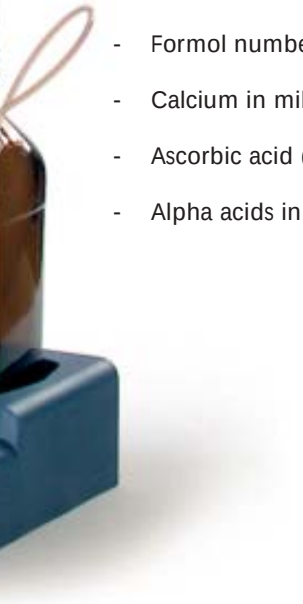
The addition of up to five piston burettes for dosing **and** titrating transforms the stand alone instrument into a team player.

Environmental and water analytics

- Chloride in tap water and sewage water
- Calcium and magnesium hardness
- pH values
- Alkalinity (“p and m values”)
- Permanganate index
- COD

Foodstuff and beverages

- Salt content (NaCl) in soya sauce, cheese, ketchup, spices and other foodstuff
- Peroxide number, saponification number, iodine and acid numbers in fats and oils
- Formol number in fruit juices
- Calcium in milk products
- Ascorbic acid (Vitamin C)
- Alpha acids in hop



Galvanics

- Determination of copper, zinc, nickel and aluminium with Cu-selective electrode
- Boric acid and chloride in nickel baths
- Alkali in degreasing baths

Petrochemistry

- Acid and base number (TAN and TBN)
- Bromine index
- Water determination according to Karl Fischer (KF)

Pharmaceutics

- Content determination of pharmaceutical products with perchloric acid in pure acetic acid
- Chloride
- Water determination according to Karl Fischer (KF)

General chemistry and plastics

- Titration of strong acids and alkaline solutions
- Epoxy number, isocyanates, acid number, hydroxyl number and saponification number
- Amino end groups
- Carboxyl end groups

Paper industry

- “White, green and black liquor”

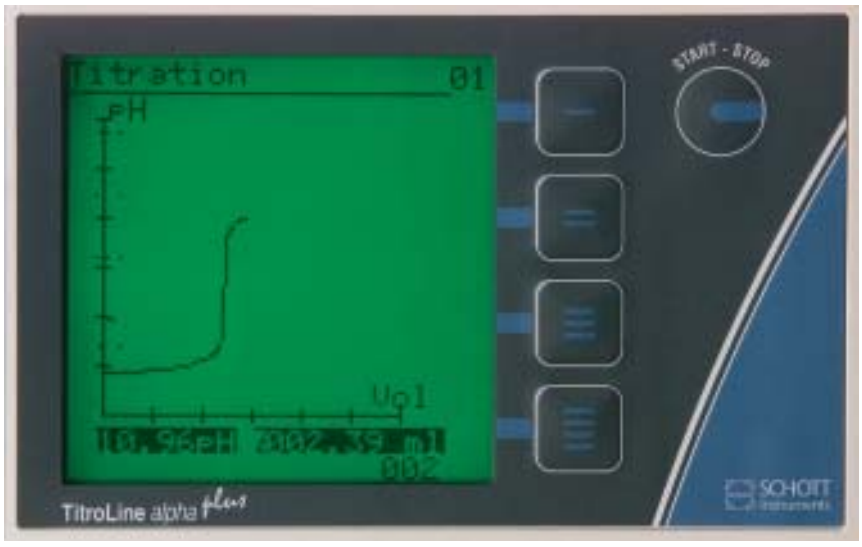
TitroLine alpha *plus*: So adaptable . . .

Working with the TitroLine alpha *plus* is so easy

Take a closer look at the large graphical display to see how easy it is to work with the TitroLine alpha *plus*. Everything you need to know is visible in clear text. Just press a few buttons to select the desired function: the method, the log you want, the kind of output ...

Two arrow buttons are enough to navigate you through the self explanatory menu. Use the enter button to confirm your selection and press ESC to leave a menu item. After set up, start your titration with the separate start/stop button. Parameterize your method from a connected keyboard.

Use the arrow buttons (centre keys) to navigate up and down in the menu, and confirm your selection with Enter (lower key). Use ESC (upper key) to leave a menu item.



During the titration, you can watch the entire procedure in real time at the titration curve shown on the large display. In this way, you are always in control and don't have to wait for the curve printout.

The TitroLine alpha *plus* adapts itself to your applications

For optimal adaptation of the titration to your application, the TitroLine alpha *plus* provides an extensive database with the most important titration methods pre-programmed. From this database of 100 methods you can download up to 50 methods into the free method memory and modify each method as required to meet your own specific needs. Needless to say you can also enter and save your own tried and tested methods.

Comfortable download of methods

As the TitroLine alpha *plus* does not depend on cards with fixed-program methods, you can also copy the method you need into the TitroLine alpha *plus* directly from a PC. Our application database in the internet is a useful source of methods which area available for download to your TitroLine alpha *plus*.

The right titration control for any method

Reagent can be added after a fixed waiting period or drift-controlled, in linear titration steps or with dynamic adaptation to the curve slope. Additionally, you can select other forms of control for end-point titrations for pH, mV and µA, and for KF and pH-stat titrations.

Up to five equivalence points can be preselected for **turning-point titrations**, and up to three end points for **end-point titrations**.

. . . as precise and robust as you need it.

**Correct results –
good documentation**

To calculate the results, you can choose from eight preset formulas. Additionally, the formula editor allows the creation of your own formulas. 50 variables are available, for example to store blank values, titre and means for other calculations and applications.

You can generate your own logs to document the measured results:

The **Brief Log**
contains the result, originally weighed-in quantity, sample name, date and time.

The **Standard Log**
in addition to the above also includes the titration curve with first derivation.

The **Detailed Log**
in addition to the above also includes the calculation formula, calibration data, dates of preparation and change of the method.

The **GLP Log**
includes all titration parameters of the method.

Method link to solve complex tasks

For complex tasks, the TitroLine alpha *plus* facilitates easy combination of methods. For example, in a first method you can determine the alkalinity ("m" value) with an end-point titration to pH 4.3 with HNO_3. Following this, a second method can be automatically started ("linked") to determine the chloride content with silver nitrate.

Unlock ...

... take off ...

... everything under control!

**Most precise and robust –
the exchangeable dosing units.**

The TitroLine alpha *plus* is available with a choice of five exchangeable units for the reagents, with volumes of 1, 5, 10, 20 and 50 ml. The dosing cylinders of the exchangeable units are made of high-precision calibrated Duran®. This is a speciality which enables you to dose your reagents with the highest accuracy. As only highly resistant materials (PTFE/PCTFE, FEP and FPA) are used for all other wetted parts, you can use practically any measurable liquids (except HF).

Changing the reagents on the TitroLine alpha *plus* is really child's play: Simply press the unlock button on the left side of the unit, and you can remove the unit with a flick of the wrist. Thanks to the robust design, you'll always have a firm grip even on well-filled bottles.

Fitting a new unit is just as easy. Not only does the unit lock itself automatically but the logical encoding corresponding to the volume is also automatically transferred to the titrator or piston burette. There's no need to adjust the titrator. And, by the way, the units of the TITRONIC® 100, TITRONIC® 110 and TITRONIC® 200 piston burettes are compatible with each other and can be used when working with the TitroLine alpha *plus*.

Water determination according to Karl Fischer – starting at 10 ppm with the TitroLine alpha *plus* KF

Just add a few accessories and your TitroLine alpha *plus* becomes a precise KF Titrator

The TMKF KF titration stand featuring solvent addition at the push of a button and automatic discharge of titrated samples, the TZ 1770 KF titration vessel and the TZ 1106 double platinum electrode will transform your TitroLine alpha *plus* into a fully functional, most powerful volumetric titrator for water determination according to Karl Fischer (KF).

KF titration parameters – exactly as required

All parameters required to optimally adapt the method to your sample are available for your KF titration: extraction time, drift stop, endpoint delay, stop current (µA), adjustable pole voltage, maximum and minimum titration time. The drift determined can be automatically corrected.

Versatile and very precise

The TitroLine alpha *plus* KF is a perfect choice for all volumetric KF applications in the fields of pharmaceutics, chemistry, petrochemistry, foodstuff and plastics industry. The very high precision of its 5 ml and 10 ml dosing units allow determination of water contents from as low as 10 ppm with excellent reproducibility. The upper limit is 100 %.

The KF drying oven extends the range of applications
Using the TZ 1052 drying oven allows you to analyse samples which cannot be titrated directly, e.g. samples of plastic or oil containing additives.

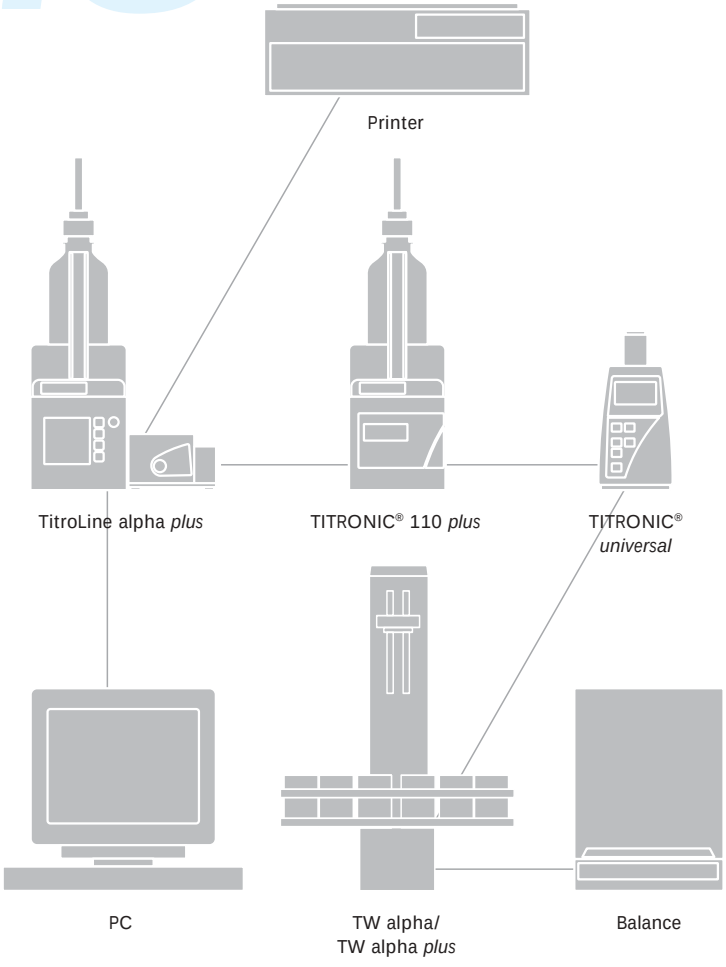
The TitroLine alpha *plus* gets along with everyone

The TitroLine alpha *plus* is well connected

The TitroLine alpha *plus* is top as a stand-alone device but it rises above itself a team member with the support of two RS-232 interfaces, combined with the possibility of concatenation (Daisy chain) of titrator, piston burettes and sample changer and a Centronics interface.

For example, the two RS-232-C interfaces allow simultaneous connection of a PC and a balance to automatically enter the weight of the sample. On the second RS-232-C interface you can connect additional TITRONIC® type piston burettes (except TITRONIC® *basic*), a sample changer and a balance.

Your Epson and HP-compatible printer (see Technical data) can be connected to the Centronics interface.



We are happy to support you with your applications

The staff in our **Application Laboratory** will be glad to assist you and impart their many years of practical experience.

You can also find much of this practical experience in our application database on the internet:
(www.schottinstruments.com).

Support for device qualification

In connection with quality management systems, more and more importance is being given to the traceability of analysis. We support your needs with a logbook that provides you with forms for **IQ** (Installation Qualification), **OQ** (Operational Qualification) and **PQ** (Performance Qualification). Using these instruments you can effectively document commissioning, routine work and inspections of the TitroLine alpha *plus*.

The new TITRONIC® 110 – the piston burette with the *plus*

Titrating and dosing

The TITRONIC® 110 *plus* is the piston burette for your precise dosing and titration. It can be used as stand-alone device, in combination with a titrator and additional piston burettes or in connection with a PC.

The TR 160 manual controller allows manual titrations to visual end point or in combination with a pH meter.

Very precise and robust

The resolution of 10,000 steps, the high-precision calibrated DURAN® glass cylinders - one of our specialities - the quick and easy to change units and the high-quality workmanship make the TITRONIC® 110 *plus* a piston burette unrivalled in accuracy and robustness.

Exchangeable units compatible

By the way, the exchangeable dosing units are compatible with those of the TitroLine alpha *plus* titrator and the TITRONIC® 100, TITRONIC® 110 and TITRONIC® 200 piston burettes.

As dosing and titration burette with TitroLine alpha *plus* and TitriSoft

You can also use the TITRONIC® 110 *plus* as a dosing burette for exact dispensing of reagents, as a titration burette in combination with the TitroLine alpha *plus*, or as a dosing and titration burette within the TitriSoft titration system.

PC control and concatenation (Daisy Chain)

All functions of the TITRONIC® 110 *plus* can be controlled via a PC serial interface, so the TITRONIC® 110 *plus* can be used within systems of other manufacturers, e.g. as dosing and titration burette. For complex applications, concatenation (Daisy chain) of up to 16 devices is possible. The devices are simply connected via the second serial interface. In this way, each device can be addressed separately and reply on its own without the need for an additional data line to the PC.

Special dosing applications

With the use of PC keyboard , dosing tasks can be performed at the push of a button. You can optimize dosing and filling speed for precise measurement even with very viscous liquids such as concentrated sulphuric acid, making, the TITRONIC® 110 *plus* most suitable for sample preparation in viscometry.

Technical data
TitroLine alpha *plus* and TITRONIC® 110 *plus*

Conformity:	ISO 8655, mark of conformity
CE sign:	CE
Valve:	motor-driven 3/2-way valve made of PTFE/ETFE
Hoses:	FEP with UV protection
Keyboard:	PS2 socket for connection of a PC keyboard. Connection TZ 2825 possible with adapter
RS-232-1:	PC, input for concatenation of several devices (Daisy chain)
RS-232-2:	piston burettes types TITRONIC® 110, TITRONIC® 110 *plus*, TITRONIC® 200 and TITRONIC® *universal*
	sample changer types TW 280, TW alpha and TW alpha *plus*
	TitroLine alpha *plus*: balances (Mettler, Sartorius, Kern, Ohaus, others on request)
Power supply:	mains: 230 V~, 50 / 60 Hz or 115 V~; 50 / 60 Hz, power consumption: 43 VA
Housing:	polypropylene
Front foil:	polyester
Housing dimensions:	145 x 260 x 270 mm (W x H x D), only exchangeable unit
	145 x 360 x 295 mm (W x H x D) height inclusive of exchangeable unit
Weight:	basic device approx. 4.1 kg, complete device with exchangeable unit approx. 5.1 kg
Climate:	ambient temperature: + 10 … + 40 °C for operation and storage
Units:	1, 5, 10, 20 and 50 ml units with calibrated glass cylinder made of DURAN® (borosilicate glass)
	size coding allows automatic detection of unit
Burette resolution:	1/10,000, smallest step 0.1 µl with 1 ml burette size
Dosing accuracy:	trueness: 0.1 … 0.3. %, referred to nominal volume (in dependence on burette size)
	precision: 0.05 … 0. 1% (in dependence on burette size)

Achievable accuracies in the entire system with exchangeable unit

Exchangeable unit	Volume	Tolerances of inside diameter of the glass cylinder	Dosing error referred to 100 % volume	Reproduce-ability
TA 01	1.00 ml	± 0.003 mm	± 0.3 %	0.10 %
TA 05 *plus*	5.00 ml	± 0.003 mm	± 0.15 %	0.07 %
TA 10 *plus*	10.00 ml	± 0.003 mm	± 0.1 %	0.05 %
TA 20 *plus*	20.00 ml	± 0.003 mm	± 0.1 %	0.05 %
TA 50 *plus*	50.00 ml	± 0.003 mm	± 0.1 %	0.05 %

TitroLine alpha *plus* only

Display:	matrix LCD display, 69 x 69 mm, with background illumination,
	contrast adjustable via keyboard
Measuring input A:	pH/mV input with electrode socket in accordance with DIN 19 262/or BNC
Measuring input B:	pH/mV input with electrode socket in accordance with DIN 19 262/or BNC, galvanic separated
Measuring input KF/µA:	Karl-Fischer (dead-stop) connection for double-platinum electrode
	(connection sockets: 2 x 4 mm), polarization voltage adjustable
Measuring input Pt 1000:	temperature sensor connection of resistance thermometer Pt 1000 (connection sockets: 2 x 4 mm)
Printer connection:	centronics interface for connection of an Epson (ESC/P2 and Raster) and HP (PCl 3) -compatible printers

TITRONIC® 110 *plus* only

Display:	LCD display, 4-digit with floating point
I/O multifunction port:	15-pole sub D-socket for connection of the TR 160 manual controller for manual titration
	Special applications on request
Volume display:	00.00 … 9.999 ml
Indication resolution:	0.000 … 9.999 ml
Dosing volume:	0.01 … 9.999 ml
Dosing speed:	0.01 ml/h … 100 ml/min (in dependence on burette size)
Filling speed:	30 … 999 s, freely selectable

TITRONIC® and DURAN® are registered trademarks.
Subject to technical changes without notice.

TW alpha *plus* sample changer – automatic titration in series

The number of samples to be processed is growing constantly while at the same time the demands on reliability are increasing in accordance with GLP and ISO 900X standards. The TW alpha *plus* sample changer by SCHOTT Instruments helps you meet these increased requirements and relieve qualified employees from routine work.

Control by titrator or by PC

You can control the sample changer from the TitroLine alpha *plus* titrator or from a PC with the TitriSoft software.

Higher flexibility due to exchangeable sample racks

With four sample racks for up to 24 samples and titration head fittings for a variety beaker and titrator vessels you get the flexibility your lab needs. A mere flick of the wrist is sufficient to change the sample racks and titrator heads. The size of the rack can be selected in the TitroLine alpha *plus* or in the ›Titration Center‹ of the TitriSoft software.

Stirring from “above” or “below”

As standard, the TW alpha *plus* comes with an integrated magnetic stirrer to stir the samples from “below”. Alternatively, you can use a rod stirrer which enables stirring from “above”.

Up to 24 samples in 50 ml glass beakers or 16 samples in 250 ml glass beakers will fit in the rotating sample tray. A sample tray for 24 COD containers is also available.

Washing the electrode and the titration tip

To ensure accuracy of the results, the electrodes and the titration tips are rinsed after each titration. This can, for example, be done by immersing the electrodes and titration tips into a washing solution. The number of rinsing positions to be used (up to a maximum of three) and the rinsing time are set in the method. Direct and fast rinsing of the electrodes and titration tips can be ensured by using the TP 20 washing unit that rinses directly after the titration. In addition to this, a waiting position may also used for example to immerse the pH electrodes into a KCl solution.

TitriSoft 2.5 – convincingly simple . . .

The TitriSoft 2.5 titration software is the optimum solution for your titration tasks. The software can be used with WINDOWS 95/98/ME and WINDOWS NT/2000/XP and supports your daily work procedures during sample preparation, titration and evaluation of the results. The software has been developed to be clear, logical and user-friendly.

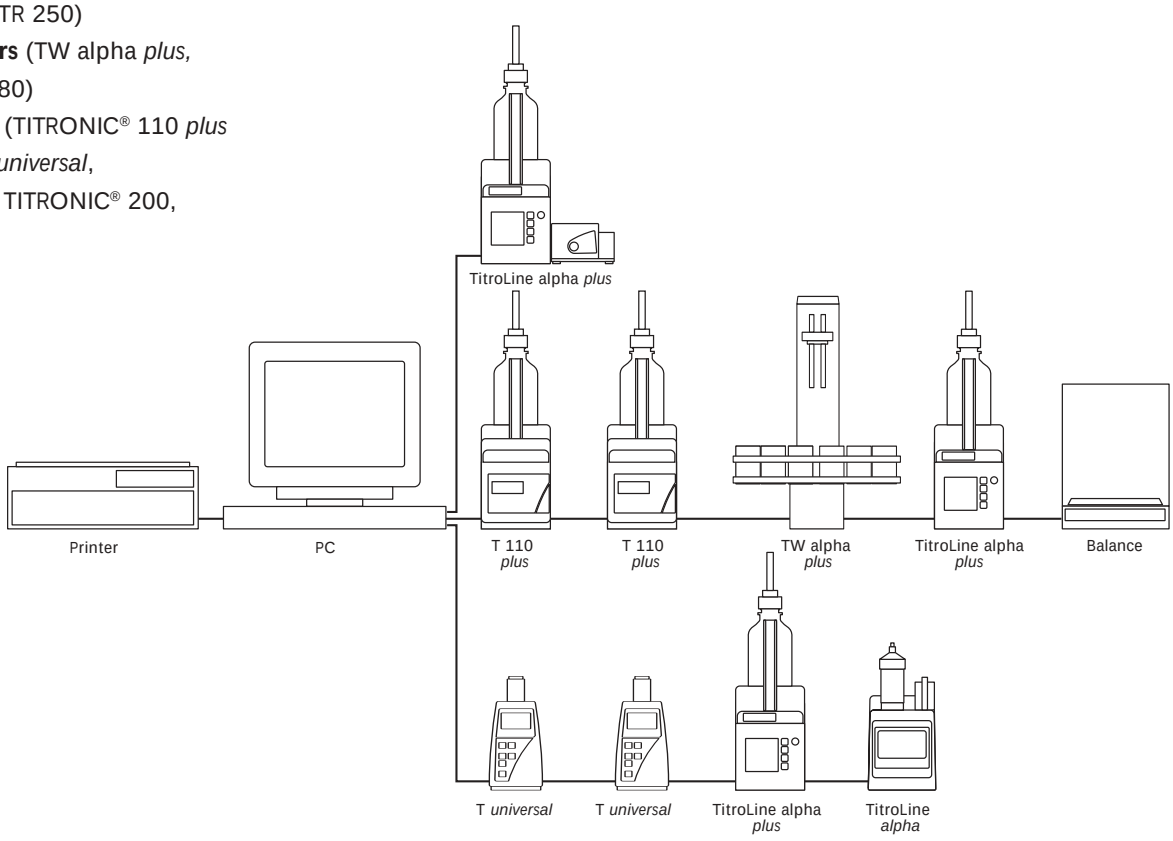
You can connect the titration hardware to any of your PC's available serial interfaces. Each of the serial interfaces allows different combinations of devices (configurations). To automate a titration procedure the software may be used to control, the TitroLine alpha *plus* in connection with the TW alpha *plus* sample changer. For more complex titration tasks with sample preparation you can dose with piston burettes followed by titration with a TitroLine alpha *plus*. Of course, you can also use the software for dosing only.

The image below shows possible device configurations.

Connection possibilities

Using TitriSoft 2.5 you can control the following devices from a PC:

- **Titrators** (TitroLine alpha *plus*, TitroLine alpha, TR 250)
- **Sample changers** (TW alpha *plus,* TW alpha, TW 280)
- **Piston burettes** (TITRONIC® 110 *plus* and TITRONIC® *universal*, TITRONIC® 110, TITRONIC® 200, TITRONIC® 97)
- **Balances**

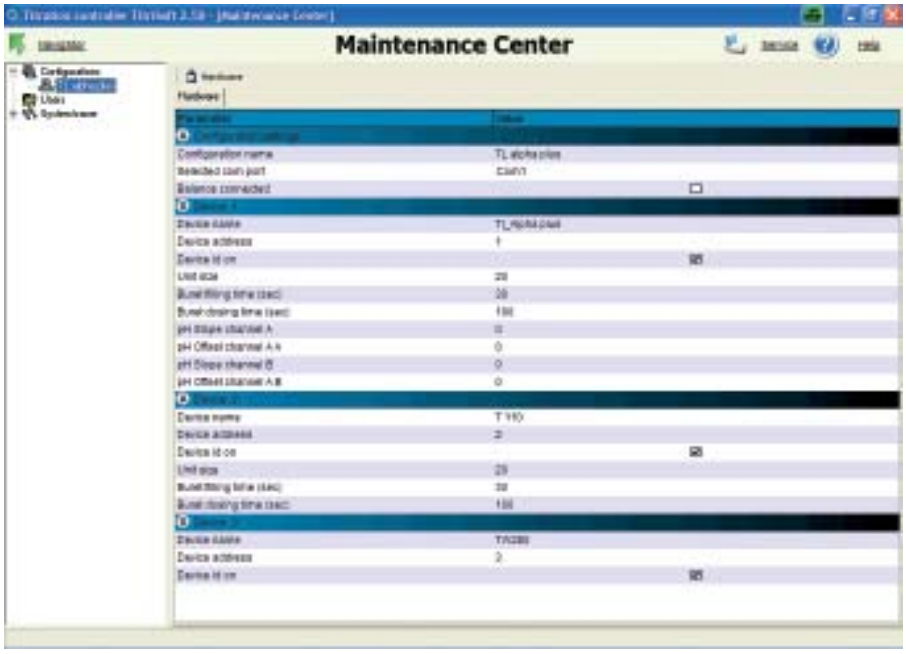


›Navigator‹, the main menu

The different software tasks are assigned to four different centers:

- the Maintenance Center,
- the Revision Center,
- the Analysis Center and
- the Titration Center.

The centers can be accessed from the main menu, the Navigator.

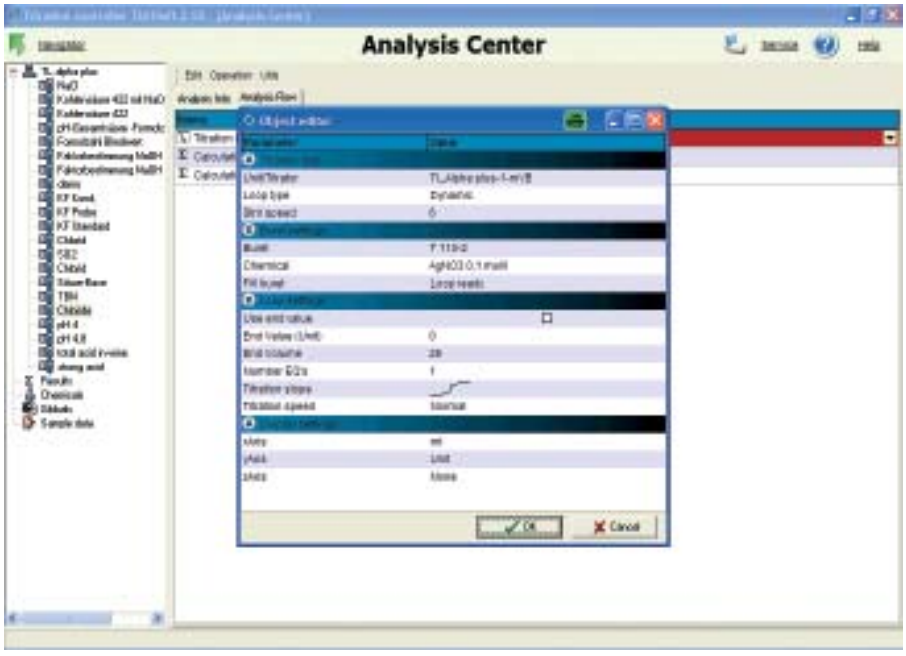


›Maintenance Center‹, the system configuration

In the Maintenance Center, the software is set up for operation prior to running the first application, i.e. a configuration is set up with the connected hardware. The configuration of the attached hardware is automatically detected in a hardware scan. Each of these hardware configurations allows any number of “methods” and “work lists”. Different configurations can work in parallel (see Connection Possibilities).

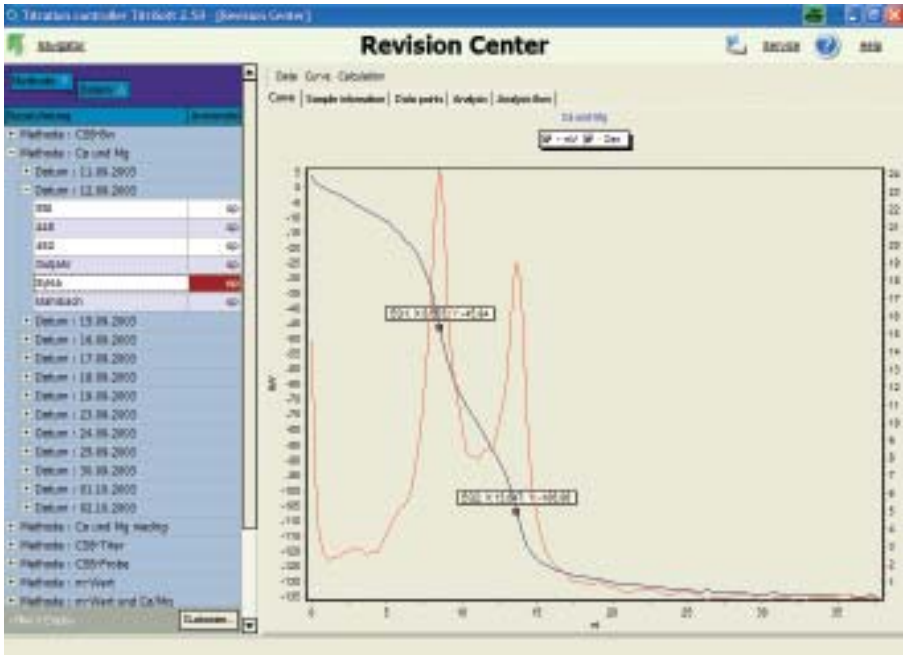
All TitriSoft users can be listed by their names. TitriSoft supports two user types. The Administrator has access to all configuration and software operation options. Users are restricted to operation of the Titration Center which very much simplifies matters.

. . . clearly structured . . .



›Analysis Center‹, your method center

This is where you set up and save your titration methods. Even complex methods can be installed with a few mouse clicks. Adjustment of the titration parameters is facilitated by the use of symbolic slide controls. Functions such as waiting time, IF loops, repetition, dosings and measurements in addition to the titration parameters and calculation formulas provide virtually unlimited options for method procedures.



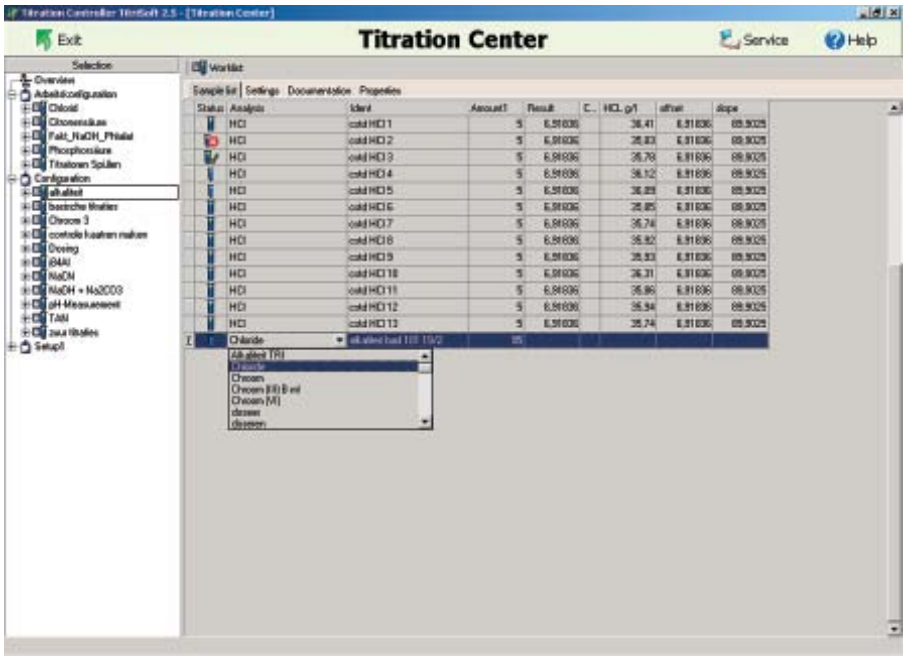
›Revision Center‹, your database

Titration curves, results and measured values of all titrations carried out are stored in the database. These data can be selected by sample name, date, user and method and loaded.

Information on titrations performed can be displayed in the form of a diagram, results list or measured value list. You can optimize stored titration information in accordance with your requirements, e.g. add and store subsequent calculations or analyze titration curves, including superposition of curves.

Import and export options (ASCII or Excel) are also available.

. . . highly productive: TitriSoft 2.5



System requirements

For optimal and fast working with the TitriSoft 2.5 software your system should be equipped as shown below:

Interface: 1 free serial RS-232-C interface per configuration
Computer: Pentium II or higher
Operating system: WINDOWS 95,98/ME WINDOWS NT(4.0 or higher)/2000 and XP
RAM: minimum 64 MB
Hard disk: minimum free storage place 100 MB
Graphics card: minimum resolution 800 x 600, minimum colours 16 K

›Titration Center‹, your clearly structured workplace

The ›Titration Center‹ is the place where you carry out your daily jobs, i.e. select methods, enter sample names and origin weighed-in quantities, start the work list and display (and print if desired) the results at the end of a titration. The work list shows the individual samples with the associated methods and their characteristics such as sample name, number, status, date, time, results and events and other freely configurable sample data, e.g. density.

During the titration you can observe the titration process in an on-line diagram. You can, however, simply allow the samples to be processed in the background and use the PC for other tasks or start an additional titration with another configuration in parallel.

When working with the TW alpha *plus* sample changer, you can adjust various settings such as skip empty items, rinse and waiting options.

Documentation, which is in accordance with GLP and ISO 9000 directives, can be produced in a number of different forms; tables, lists, curves or individual printouts with curves. In addition results can be saved in ASCII or CSV format, external documentation programs may be accessed and results transferred directly, e.g. into an LIMS.

Ordering information TitroLine alpha *plus*

TitroLine alpha *plus*		**Order no.**
TitroLine alpha *plus*	TitroLine alpha *plus* basic unit without exchange unit, 230 V	**285216952**
TitroLine alpha *plus*	TitroLine alpha *plus* basic unit without exchange unit, 115 V	**285216969**
Scope of delivery: TitroLine alpha *plus* incl. stand rod with holder, titration clamp, PC keyboard TZ 2835.		
TitroLine alpha *plus*	TitroLine alpha 05 *plus* with 5 ml exchange unit, (230 V)	**285212934**
TitroLine alpha *plus*	TitroLine alpha 10 *plus* with 10 ml exchange unit, (230 V)	**285216944**
TitroLine alpha *plus*	TitroLine alpha 20 *plus* with 20 ml exchange unit, (230 V)	**285216977**
TitroLine alpha *plus*	TitroLine alpha 50 *plus* with 50 ml exchange unit, (230 V)	**285212983**
TitroLine alpha *plus*	TitroLine alpha 05 *plus* with 5 ml exchange unit, (115 V)	**285215467**
TitroLine alpha *plus*	TitroLine alpha 10 *plus* with 10 ml exchange unit, (115 V)	**285215475**
TitroLine alpha *plus*	TitroLine alpha 20 *plus* with 20 ml exchange unit, (115 V)	**285215631**
TitroLine alpha *plus*	TitroLine alpha 50 *plus* with 50 ml exchange unit, (115 V)	**285215648**
Scope of delivery: As TitroLine alpha *plus* basic unit with 5, 10, 20 or 50 ml exchange unit, incl. brown glass bottle for titrant, GL 45 bottle adapter, hoses, drip glass and titration tip.		
TitroLine alpha KF *plus*		
TitroLine alpha *plus*	TitroLine alpha KF 05 *plus* with 5 ml exchange unit, (230 V)	**285212991**
TitroLine alpha *plus*	TitroLine alpha KF 10 *plus* with 10 ml exchange unit, (230 V)	**285213109**
TitroLine alpha *plus*	TitroLine alpha KF 05 *plus* with 5 ml exchange unit, (115 V)	**285215656**
TitroLine alpha *plus*	TitroLine alpha KF 10 *plus* with 10 ml exchange unit, (115 V)	**285215664**
Scope of delivery: As TitroLine alpha *plus* basic unit with 5 or 10 ml exchange unit, incl. brown glass bottle for titrant, GL 45 bottle adapter, hoses, drip glass and titration tip, titration stand TMKF incl. supply and waste bottle, micro-double-platinum electrode TZ 1106, titration vessel TZ 1770.		
TITRONIC® 110 *plus*		
TITRONIC® 110 *plus*	TITRONIC® 110 *plus* basic unit without exchange unit, 230 V	**1007302**
TITRONIC® 110 *plus*	TITRONIC® 110 *plus* basic unit without exchange unit, 115 V	**1007303**
Scope of delivery: TITRONIC® 110 *plus* incl. stand rod with holder and titration clamp		
Exchange units for TitroLine alpha *plus* and TITRONIC® 110 *plus*		
TA 01	Exchange unit with 1 ml glass cylinder incl. reagent bottle	**285211313**
TA 05 *plus*	Exchange unit with 5 ml glass cylinder incl. reagent bottle	**285211038**
TA 10 *plus*	Exchange unit with 10 ml glass cylinder incl. reagent bottle	**285211046**
TA 20 *plus*	Exchange unit with 20 ml glass cylinder incl. reagent bottle	**285211054**
TA 50 *plus*	Exchange unit with 50 ml glass cylinder incl. reagent bottle	**285211062**
Software TitriSoft		
TitriSoft 2.5	Titration software for TitroLine alpha *plus* and TitroLine alpha	**285221717**
Accessories for TitroLine alpha *plus* and TITRONIC® 110 *plus*		
TZ 2835	PC keyboard for TitroLine alpha *plus* and TITRONIC® 110 *plus*	**1007852**
TM 135	Magnetic stirrer	**285211013**
TM 128	Titration clamp/rod stirrer combination	**285215167**
TMKF	Titration stand Karl-Fischer with suction pump and stirrer incl. supply and waste bottle	**285216611**
TZ 1770	KF titration vessel 30 - 150 ml	**285216677**
TZ 1772	KF titration vessel 80 - 200 ml	**285216693**
TZ 1106	Micro-double-platinum electrode for TZ 1770	**285216369**
TZ 1052	Drying stove for water determination according to Karl-Fischer, 230 V	**285214721**
TZ 1050	Accessory for drying oven TZ 1052	**285218107**
Z 303	Titration clamp for TL alpha *plus* and TITRONIC® 110 *plus*	**1007304**

Ordering information TW alpha *plus*

Sample changer TW alpha *plus*		**Order no.**
TW alpha *plus*	Sample changer basic unit, **230 V**	**1007290**
TW alpha *plus*	Sample changer basic unit, **115 V**	**1007291**
Scope of delivery: Sample changer basic unit TW alpha *plus* with integrated magnetic stirrer and connection cable TZ 1581 for rod stirrer.		
TW alpha *plus* 12	TW alpha *plus* basic unit with sample rack TZ 1452 for 12 samples, incl. titration head TZ 1463, connection cable and 20 beakers 250 ml, 230 V	**1007292**
TW alpha *plus* 16	TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1463, connection cable and 20 beakers 150 ml, 230 V	**1007294**
TW alpha *plus* 24	TW alpha *plus* basic unit with sample rack TZ 1454 for 24 samples, incl. titration head TZ 1462, and 30 beakers 50 ml, 230 V	**1007296**
TW alpha *plus* COD	TW alpha *plus* basic unit with sample rack TZ 1444 for 24 COD vessels in accordance with DIN, incl. titration head TZ 1461, rod stirrer TZ 1846, redox electrode Pt 5901, titration tip TZ 1648 and connection cable, 230 V	**1007298**
TW alpha *plus* TP	TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1467, hose pump TP 20 connection cable and 20 beakers 150 ml, 230 V	**1007300**
TW alpha *plus* 12	TW alpha *plus* basic unit with sample rack TZ 1452 for 12 samples, incl. titration head TZ 1463, connection cable and 20 beakers 250 ml, 115 V	**1007293**
TW alpha *plus* 16	TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1463, connection cable and 20 beakers 150 ml, 115 V	**1007295**
TW alpha *plus* 24	TW alpha *plus* basic unit with sample rack TZ 1454 for 24 samples, incl. titration head TZ 1462 and 30 beakers 50 ml, 115 V	**1007297**
TW alpha *plus* COD	TW alpha *plus* basic unit with sample rack TZ 1444 for 24 COD vessels in accordance with DIN, incl. titration head TZ 1461, rod stirrer TZ 1846, redox electrode Pt 5901, titration tip TZ 1648 and connection cable, 115 V	**1007299**
TW alpha *plus* TP	TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1467, hose pump TP 20 connection cable and 20 beakers 150 ml, 115 V	**1007301**

Accessories for TW alpha *plus*		
TZ 1444	Sample rack for 24 COD vessels in accordance with DIN 38 409	**285213836**
TZ 1452	Sample rack for 12 sample vessels, incl. 20 beakers 250 ml	**285214927**
TZ 1454	Sample rack for 24 sample vessels, incl. 30 beakers 50 ml	**285213844**
TZ 1459	Sample rack for 16 sample vessels, incl. 20 beakers 150 ml	**285213166**
TZ 1461	Titration head for COD sample rack TZ 1444	**285213621**
TZ 1462	Titration head for 24-sample rack TZ 1454	**285213639**
TZ 1463	Titration head for 12- (TZ 1452) and 16-sample rack (TZ 1459)	**285213647**
TZ 1467	Titration head for 12- (TZ 1452) and 16-sample rack (TZ 1459) incl. splash shield with peristaltic pump TP 20	**285213671**
TP 20	Peristaltic pump with accessories for rinsing, 115 V/230 V	**285212334**
TZ 1847	Glass stirrer rod for 12-, 16- and 24-sample rack	**285215175**
TZ 1846	Glass stirrer rod for COD sample rack	**285215134**
TZ 1545	Magnetic stirring rods (10 pcs.)	285214232

Data cable		
TZ 3088	Data cable TitroLine alpha *plus*, TW alpha *plus* or TITRONIC® 110 *plus* ↔ PC, 5 m	**1007972**
TZ 3089	Data cable TitroLine alpha *plus*, TW alpha *plus* or TITRONIC® 110 *plus* ↔ PC, 10 m	**1007973**
TZ 3084	Data cable TitroLine alpha *plus*, TW alpha *plus*, TITRONIC® 110 *plus* ↔ TitroLine alpha *plus*, TW alpha *plus*, TITRONIC® 110 *plus*, 1.5 m	**1007974**
TZ 3086	Data cable TitroLine alpha *plus*, TW alpha *plus* or TITRONIC® 110 *plus* ↔ TitroLine alpha, TW alpha, TITRONIC® 110/ TITRONIC® 200, 1.5 m	**1007975**
TZ 3087	Data cable TitroLine alpha *plus*, TW alpha *plus*, or TITRONIC® 110 *plus* ↔ TITRONIC® *universal*,1.5 m	**1007976**
TZ 3082	Data cable TitroLine alpha *plus*, TW alpha *plus*, or TITRONIC® 110 *plus* ↔ Sartorius balances, 5 m	**1007977**
TZ 3083	Data cable TitroLine alpha *plus*, TW alpha *plus*, or TITRONIC® 110 *plus* ↔ Mettler AT, PM balances, 5 m	**1007978**
TZ 3081	Data cable TitroLine alpha *plus*, TW alpha *plus*, or TITRONIC® 110 *plus* ↔ Mettler AB-S, PG balances, 5 m	**1007979**

Hotplates and stirrers: Attractive design for the laboratory

Perfect function, exclusive design

The laboratory hotplates and stirrers from SCHOTT Instruments demonstrate the kind of creative design that results when practical laboratory experience is paired with the most advanced materials know-how. The perfectly nonporous surface of the unique Ceran glass ceramic material makes the surface nearly indestructible. And the touch control panel gives the laboratory hotplates and stirrers a truly exclusive touch. But you will hardly even notice that anymore once you have experienced how eminently practical they are.

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Overview of features

Hotplate / stirrer	SLK1	SLK2	SLK2-T	SLK6	SLR
Glass ceramic	+	+	+	+	+
Heating	+	+	+	+	+
Number of heating plates	1	1	1	2	1
Temperature control	-	-	+	+	+
Stirring	-	-	-	+	+
Touch control	+	+	+	+	-
Control knobs	-	-	-	-	+

Laboratory hotplates and stirrers with glass ceramic heating surface

Our know-how – your benefit

Our variety of 4 laboratory hotplates enables speedy heating up (SLK 1, SLK 2), with a temperature control if required (SLK 2-T, SLK 6). The laboratory stirrer (SLR) is the optimum solution for a careful to intense mixing of liquids. It can also be used for speedy heating up or controlled temperature adaptation.

Both product families have the benefits of the glass ceramic heating surface which as proven in millions of households. Chemical resistance, a high surface quality, and a resistance to temperature shocks of more than 700 °C provide the user with maximum benefits compared to conventional heating surface materials. The poreless smooth surface enables even most stubborn dirt to be easily removed. The high infrared permeability ensures that the heating energy is transferred quickly and with a low loss rate, i.e. it heats liquids faster than other heating surface materials, and thus saves energy.

Quality and safety

As a matter of course, our laboratory hotplates and laboratory stirrers bear the CE sign and are developed and produced according to high international quality standards.

A residual-heat display protects the user from the hazard of injuries (burning). Over-heating is prevented by the built-in over-temperature protection.

The corrosion-resistant, solid, casing with a hermetically sealed, non-inflammable top made of duroplastic in the case of the laboratory hotplates and of coated die-cast aluminium in the case of the laboratory stirrer ensure a long and trouble-free use of the devices. If the laboratory hotplates are to be used in an aggressive environment, we recommend the use of the compressed-air connector which is available as an option. The stand rod holder on the back panel of the device can be used to connect accessories such as a temperature sensor conveniently and securely.

SLR

Fast heating using the SLK 1 and SLK 2

To heat up liquids, the SLK 1 and SLK laboratory hotplates from SCHOTT Instruments are the optimum solution. The heating power of the infrared radiation heating element can be adjusted in nine steps, with an average heating output of 1.2 kW or 1.8 kW, respectively, on step 9. During the heating process, the temperature distribution across the hot plates surface is almost homogenous.

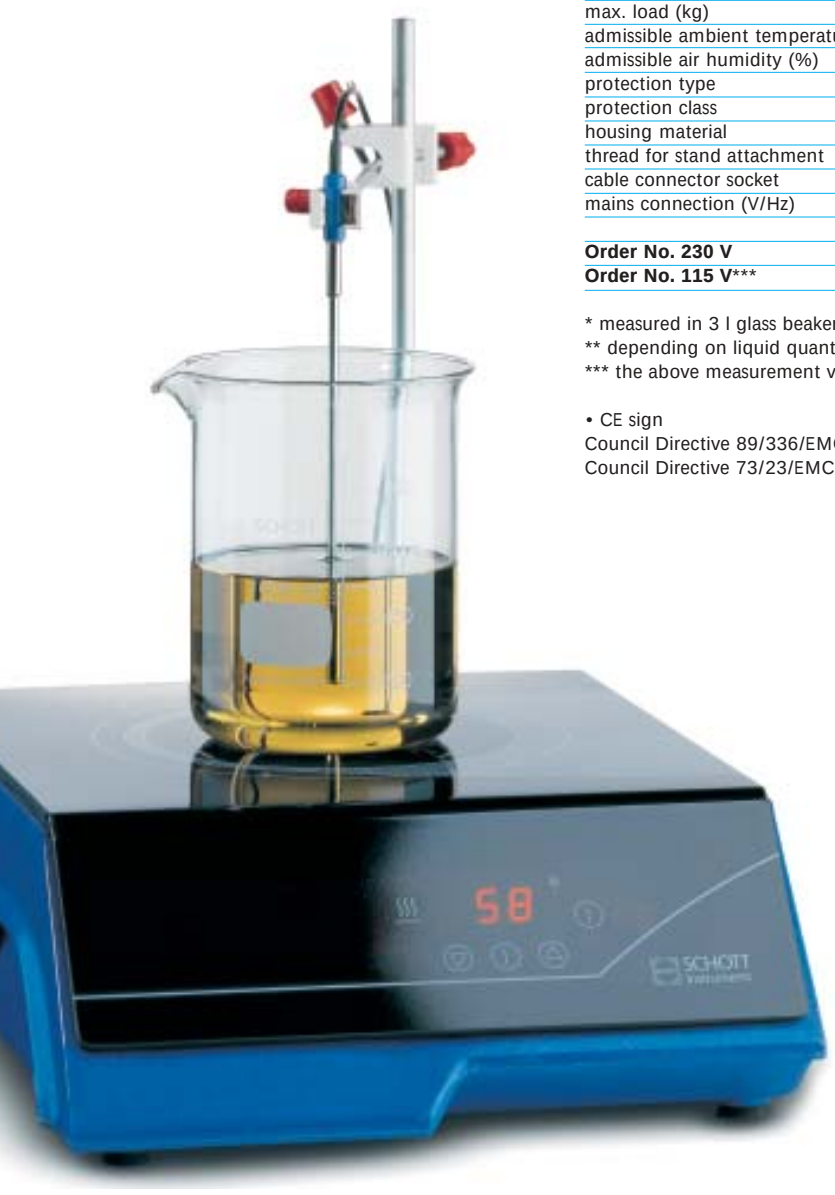
Technical data	SLK 1	SLK 2
Heating function		
heating power (kW)	1.2	1.8
heated zone (mm)	∅ 165	∅ 200
max. hot plates temperature (°C)	approx. 600	approx. 600
min. time to boiling point 1 l H_2O·(min)	approx. 10	approx. 7
hot plate material	glass ceramic	glass ceramic
hot plates area (mm)	280 x 280	280 x 280
General data		
dimensions (L x W x H in mm)	395 x 295 x 110	395 x295 x110
weight (kg)	approx. 3.6	approx. 3.6
max. load (kg)	25	25
admissible ambient temperature (°C)	10-40	10-40
admissible air humidity (%)	85	85
protection type	IP20	IP20
protection class	1	1
housing material	SMC	SMC
thread for stand attachment	M 8	M 8
cable connector socket	cold appliances	cold appliances
mains connection (V/Hz)	230 V, 50/60 or 115 V, 50/60	230 V, 50/60 or 115 V, 50/60
Order No. 230 V	28 541 6316	28 541 6324
Order No. 115 V**	28 541 6213	28 541 6221

* measured in 3 l glass beaker at 25 °C ambient temperature and 1 bar air pressure
** depending on liquid quantity, heat capacity, and ambient temperature
*** the above measurement values may deviate slightly when using the 115 V version

• CE sign
Council Directive 89/336/EMC (electromagnetic compatibility)
Council Directive 73/23/EMC (low-voltage directive), last modified by the Council Directive 93/68/EMC

Heating and controlling using the SLK 2-T

Many applications in the laboratory require temperature-controlled heating, or temperatures to be kept constant, respectively. Using the SLK 2-T, a Pt 1000 temperature sensor (optional) can be connected which enables a control between 35 °C to 199 °C at an accuracy level of ± 2 °C to 5 °C as a function of liquid volume, heat capacity, and ambient temperature. The actual and the set temperatures can be monitored on the LED display.



Technical data	SLK 2-T
Heating function	
heating power (kW)	1.8
heated zone (mm)	∅ 200
max. hot plates temperature (°C)	approx. 600
min. time to boiling point 1 l H_2O·(min)	approx. 7
temperature-sensor connector	yes, Pt 1000
setting accuracy with temperature sensor (°C)	1
controlling accuracy with temperature sensor** (°C)	± 2 bis 5
hot plate material glass ceramic	glass ceramic
hot plates area (mm) 280 x 280	280 x 280
digital set/actual temperature display (temperature sensor connector)	yes
General data	
dimensions (L x W x H in mm)	395 x 295 x 110
weight (kg)	approx. 4.0
max. load (kg)	25
admissible ambient temperature (°C)	10 - 40
admissible air humidity (%)	85
protection type	IP 20
protection class	1
housing material	SMC
thread for stand attachment	M 8
cable connector socket	cold appliances
mains connection (V/Hz)	230 V, 50/60 or 115 V, 50/60
Order No. 230 V	28 541 6398
Order No. 115 V* **	28 541 6295

* measured in 3 l glass beaker at 25 °C ambient temperature and 1 bar air pressure
** depending on liquid quantity, heat capacity, and ambient temperature
*** the above measurement values may deviate slightly when using the 115 V version

• CE sign
Council Directive 89/336/EMC (electromagnetic compatibility)
Council Directive 73/23/EMC (low-voltage directive), last modified by the Council Directive 93/68/EMC

SLK 6, the multi-talent

The multiple talents of the SLK 6 are particularly suited for laboratories in which highly differing tasks are to be coped with. The laboratory hotplate unit combines a powerful heating plate on the left side and a heating plate with a stirrer on the right side. The heating and the stirrer can be set in nine steps. The rpm range of the stirrer can be set in nine steps between 100 to 1100 min^{-1}. Owing to the possibility of connecting a Pt 1000 temperature sensor (optional), heating on the stirrer side can be done in a temperature-controlled range between 35 °C and 199 °C at an accuracy level of ± 2 °C to 5 °C as a function of the liquid volume, heat capacity and the ambient temperature. The actual and the set temperatures can be monitored on the LED display.

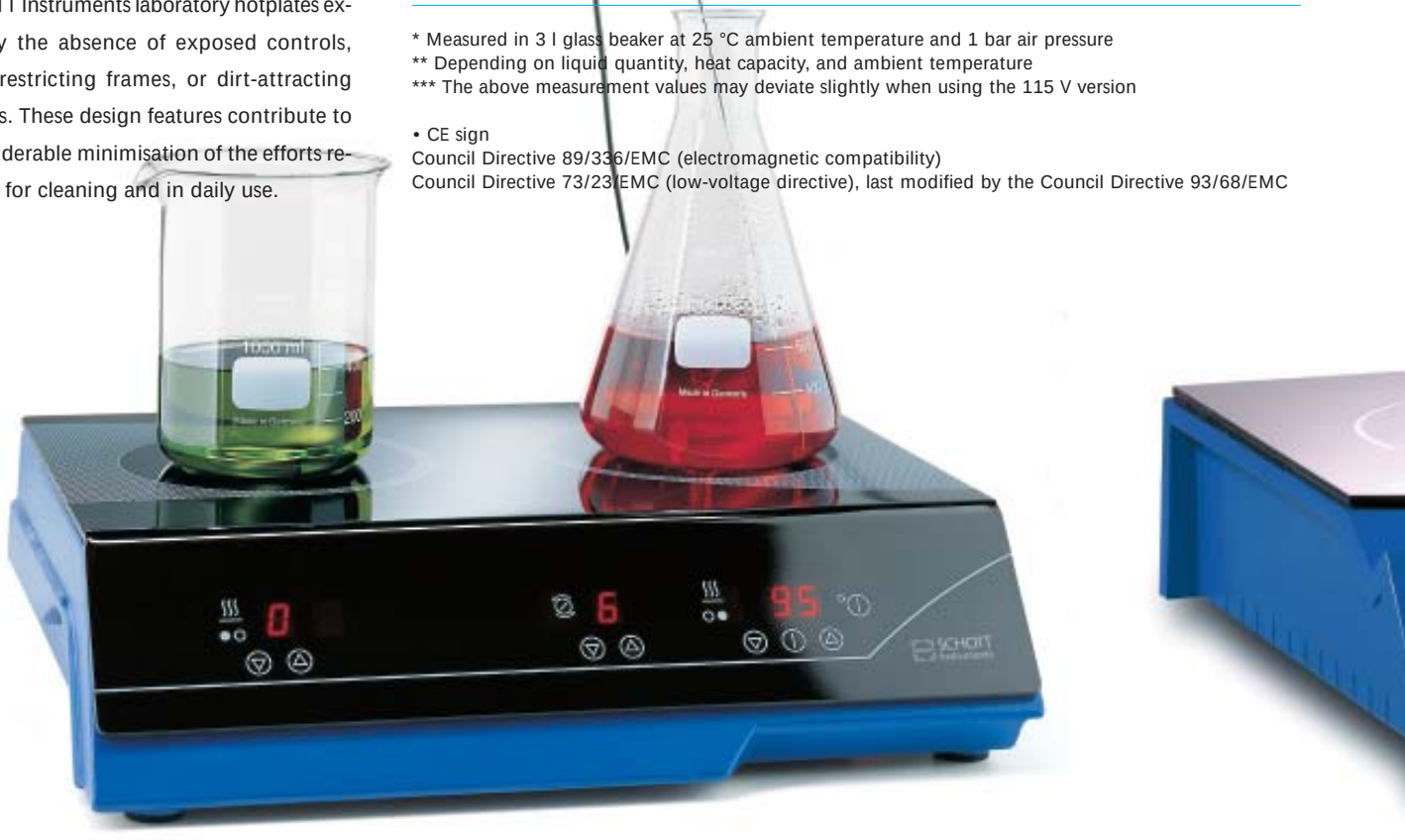
User-friendly design

As the device is controlled using infrared touchcontrol technology, the design of the SCHOTT Instruments laboratory hotplates excels by the absence of exposed controls, space-restricting frames, or dirt-attracting corners. These design features contribute to a considerable minimisation of the efforts required for cleaning and in daily use.

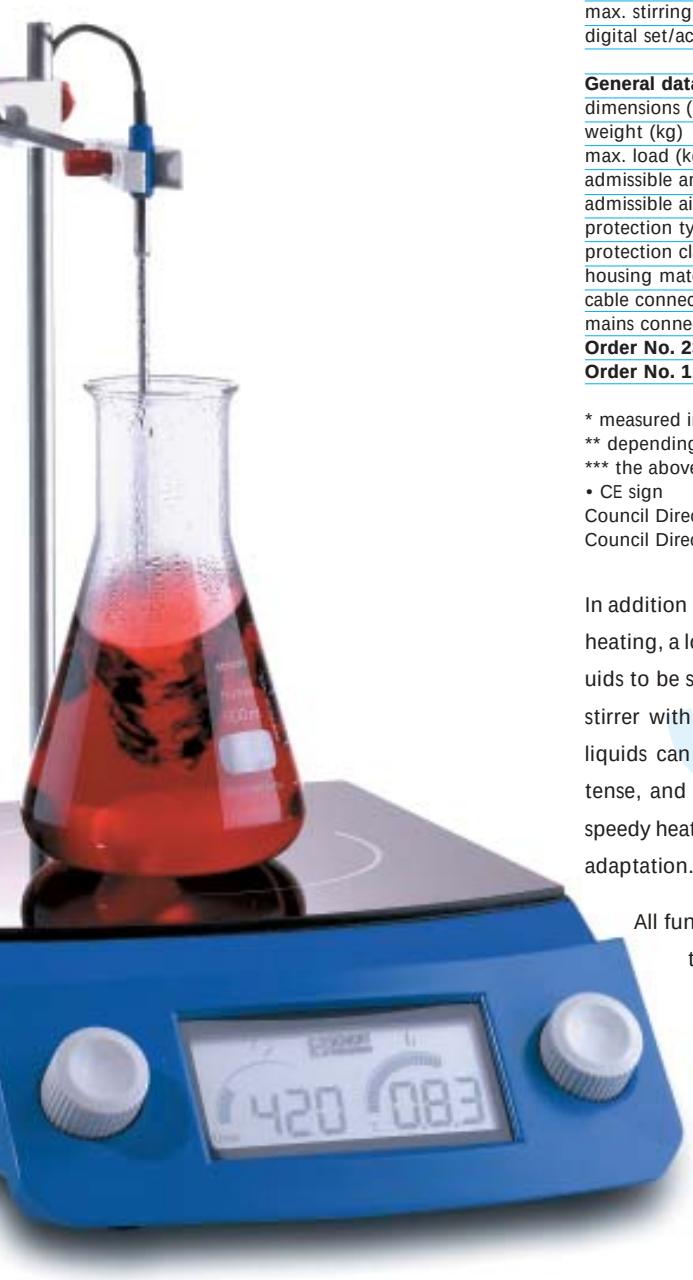
Technical data	SLK6
Heating function	
heating power (kW)	1.2; 0.5
heated zone (mm)	Ø 165; 145 x 145
max. hot plates temperature (°C)	approx. 600; ca. 500
min. time to boiling point 1 l H_2O* (min)	approx. 10; ca. 25
temperature sensor connector	yes, Pt 1000 (right heating plate)
setting accuracy with temperature sensor (°C)	1
controlling accuracy with temperature sensor** (°C)	± 2 to 5
hot plate material glass ceramic	glass ceramic
hot plates area (mm)	430 x 280
digital set/actual temperature display (temperature sensor connector)	yes
Stirring function	
max. rpm (min^{-1})	100 - 1100
setting accuracy rpm (min^{-1})	approx. 120
max. stirring volume (l H_2O)	10
General data	
dimensions (L x W x H in mm)	395 x 445 x 110
weight (kg)	approx. 6.2
max. load (kg)	25
admissible ambient temperature (°C)	10 - 40
admissible air humidity (%)	85
protection type	IP 20
protection class	1
housing materia	SMC
thread for stand attachment	M 8
cable connector socket	cold appliances
mains connection (V/Hz)	230 V, 50/60 or 115 V, 50/60
Order No. 230 V	28 541 6365
Order No. 115 V* **	28 541 6262

* Measured in 3 l glass beaker at 25 °C ambient temperature and 1 bar air pressure
** Depending on liquid quantity, heat capacity, and ambient temperature
*** The above measurement values may deviate slightly when using the 115 V version

• CE sign
Council Directive 89/336/EMC (electromagnetic compatibility)
Council Directive 73/23/EMC (low-voltage directive), last modified by the Council Directive 93/68/EMC



Stirring, heating and controlling using the SLR



Technical data	SLR
Heating function	
heating power (kW)	0.9
heated zone (mm)	Ø 155
max. hot plates temperature (°C)	approx. 550
min. time to boiling point 1 l H_2O* (min)	approx. 15
temperature sensor connector	yes, Pt 1000
setting accuracy with temperature sensor (°C)	1
controlling accuracy with temperature sensor** (°C)	± 2 to 5
hot plate material	glass ceramic
hot plates area (mm)	235 x 235
digital set/actual temperature display (temperature sensor connector)	yes
Stirring function	
max. rpm (min^{-1})	100-1100
setting accuracy rpm (min^{-1})	10
max. stirring volume (l H_2O)	10
digital set/actual rpm display	yes
General data	
dimensions (L x W x H in mm)	370 x 240 x 85
weight (kg)	approx. 3.8
max. load (kg)	25
admissible ambient temperature (°C)	10-40
admissible air humidity (%)	85
protection type	IP 20
protection class	1
housing material	die-cast
cable connector	fixed cable
mains connection (V/Hz)	230 V, 50/60 or 115 V, 50/60
Order No. 230 V	28 541 6373
Order No. 115 V* **	28 541 6279

* measured in 3 l glass beaker at 25 °C ambient temperature and 1 bar air pressure
** depending on liquid quantity, heat capacity, and ambient temperature
*** the above measurement values may deviate slightly when using the 115 V version
• CE sign
Council Directive 89/336/EMC (electromagnetic compatibility)
Council Directive 73/23/EMC (low-voltage directive), last modified by the Council Directive 93/68/EMC

In addition to fast or temperature-controlled heating, a lot of applications also require liquids to be stirred. Using our new laboratory stirrer with heating, the process of mixing liquids can be selected from careful to intense, and the device can also be used for speedy heating up or controlled temperature adaptation.

All functions can be viewed and monitored on the large and clear LCD display. The stirrer and heating are controlled separately by convenient turning knobs.

The rpm range of the stirrer stretches from 100 to 1100 min^{-1} and can be set in steps of 10 min^{-1}. The mean rpm is also indicated in the form of a bar graph. Even in the lower rpm range, the smooth-running properties of the device are excellent.

The heating power can be set in 24 steps and reaches an average heating output of 0.9 kW at step 24. If a Pt 1000 temperature sensor (optional) is connected, temperature-controlled work with fluctuations of ± 2 °C to 5 °C as a function of liquid volume, heat capacity, and ambient temperature is possible between 25 °C and 200 °C. The display will inform the user at intervals of 5 s alternately about the set and the actual temperature. In this case, too, the mean rpm is indicated in the form of a bar graph.

Accessories

Description	Type No.	Order No.
Temperature sensor stainless steel shaft (V4A), Pt 1000 sensor, 1 m fixed cable with 2 x 4 mm banana plug, length 170 mm, Ø 4 mm, -30 ...+200 °C	W 5791 NN HT	28 510 5308
Temperature sensor glass shaft, Sensor Pt 1000, 1 m fixed cable with 2 x 4 mm banana plug, length 250 mm, Ø 6 mm, -30 ...+ 200 °C	W 5780 N NHT	28 510 5238
Stand rod with fixing nut (M8) stainless steel, Ø 10 mm, length 450 mm	Z 601	28 541 6492
Temperature sensor holder clamp with extension rod made of stainless steel, connector	Z 602	28 541 6505
Magnetic stirrer rod set for standard applications AlNiCo5, circular cross-section, PTFE coated, 1 piece 15, 20, 30, 40, 50, 60, 70, 80 mm each	Z 603	28 541 6554
Magnetic stirrer ripe for medium volumes SmCo, circular cross-section, PTFE coated, 5 pieces 9 x 15 mm each	Z 604	28 541 6562
Magnetic stirrer for large volumes SmCo, elliptic cross-section, PTFE coated, 1 piece 19 x 75 mm each	Z 605	28 541 6579
Compressed-air connector (only SLK) for use in an aggressive environment (subsequent installation only by manufacturer)	Z 607	28 541 6595
Compressed-air connector set (only SLK)	Z 608	28 541 6608


Made in Germany
6
95
SCHOTT
Instruments

Water distilling apparatus

Maximum purity

With the water distilling apparatus made of DURAN® bososilicate glass 3.3 (hydrolytic class 1 glass), starting with normal tap water you can obtain a distillate of maximum purity that is substantially free from dissolved salts and of extremely low germ content. A maximum conductivity of up to approx.1 µS/cm (25 °C) is achieved in the distilled water. The immersion heater is made of high-quality stainless steel (CrNi 4876, Incoloy), so that the presence of heavy-metal ions in the distillate is excluded. And the apparatus saves energy and water, because the cooling water that is heated up in the cooling coil is used for feed water. The outflow of distillate is free from CO_2 because its temperature is 60 °C.

Cost-effective

In comparison with other water purification systems, such as ion exchangers or reverse osmosis apparatus, no costs are incurred for regeneration or replacement of resins, or for pretreatment modules that are required to protect the membrane.

Maximum operating safety

The automatic water level control and built-in boil-dry protection ensure maximum operating safety. Cleaning the apparatus is as easy as cleaning a household coffee maker.

Ready for connection

In the standard version, the compactly built apparatus is supplied including the connecting cable, plug and hoses and is ready for connection. Different versions are available.

Technical data, order information

Technical data

Type of heating	resistance heating
Dimensions of base	300 x 300 mm
Height	750 mm
Weight	11 kg
Subject to technical modifications.	

Order information

Output H_2O dist. l/h	Electrical input power V/A	Type no.	Order no.
4	230/14	D 82000	28550 2028
7	230/23	D 82100	28550 2036
7	400/3 x 8	D 82200	28550 2044

Accessories

	Type no.	Order no.
Cleaning agent (1l)	DZ 8050	28553 0276
Cleaning agent (5l)	DZ 8053	28553 0284

Capillary viscometry from SCHOTT Instruments – 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 viscosity measurement systems from SCHOTT Instruments 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.

SCHOTT Instruments capillary viscometers are the worldwide basis for precise viscosity measurements of Newtonian fluids.

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Viscometers and their range of use

Measurement substance property	Viscometer type: Ubbelohde	Micro Ubbelohde	TC Ubbelohde	Ostwald	Micro Ostwald	Cannon-Fenske-Routine	Cannon-Fenske reverse flow	BS/IP-U tube reverse flow
Transparent liquids manual measurement	++	++	-	+	+	+	o	o
Transparent liquids automatic measurement	++	++	+	-	+	+	-	-
Opaque liquids manual measurement	-	-	-	-	-	-	+	+[2)]
Opaque liquids automatic measurement	-	-	++[1)]	-	-	-	-	-
Foaming liquids	o	o	o	+	+	+	o	o
Liquid mixture with highly volatile components	o	o	o	+	+	+	o	o
Minimum measurement substance and/or rinsing agent quantities	-	++	-	-	+	-	-	-
High-temperature or low-temperature measurements	+	+	+	o	o	o	o	o

Selection of glass capillary viscometers

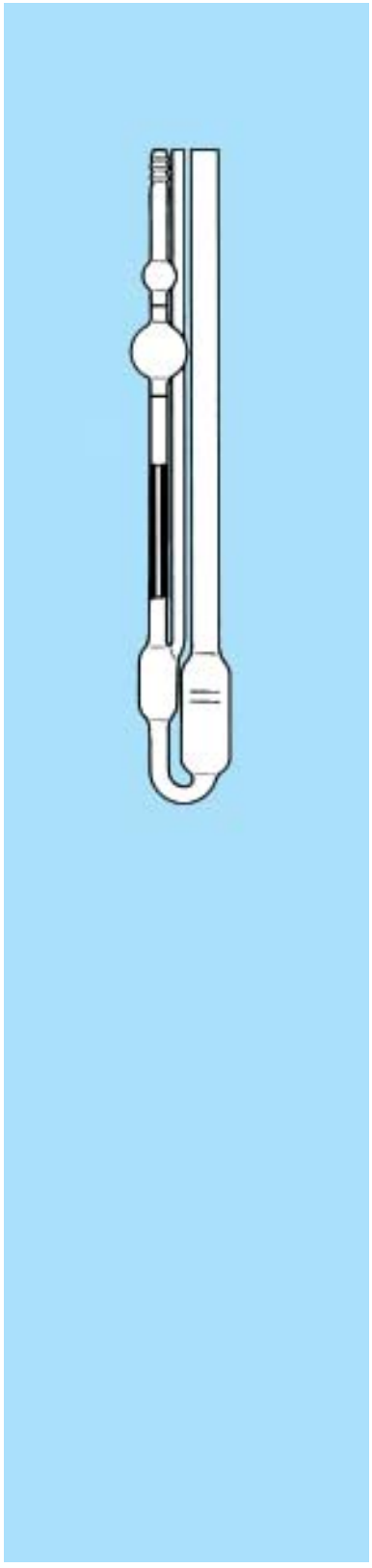
++	use preferably
+	highly suitable
o	less suitable
-	unsuitable

[1)] to 30,000 mm^2/s
[2)] above 30,000 mm^2/s

Ubbelohde viscometers, normal form

Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18.

All viscometers are provided with ring marks. This ensures that viscometers for automatic measurements can also be checked by means of manual measurements.
The recommended minimum flowthrough time is 200 s.



Ubbelohde viscometers (DIN)

- in accordance with DIN 51 562, Part 1, ISO/DIS 3105 (BS-IP-SL)
- filling quantity: 15 ... 20 ml
- overall length: approx. 290 mm

calibrated, with constant for manual measurements,
calibrated with constant, for manual measurements, automatic measurement with stand AVS/SK-HV

$\nu = K \cdot t$
$K = \frac{\nu}{t}$
$t = \frac{\nu}{K}$

ν = kinematic viscosity in mm²/s
K = constant [mm²/s]
t = flow-through time in s

Type No.	Type No.	Capillary No. acc. DIN	acc. ISO	Capillary ∅ i ± 0.01 [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
501 00	-	0	-	0.36	0.001	0.3 ... 1
501 03	-	0c	-	0.47	0.003	0.5 ... 3
501 01	-	0a	-	0.53	0.005	0.8 ... 5
501 10	-	I	I	0.63	0.01	1.2 ... 10
501 13	-	Ic	Ia	0.84	0.03	3 ... 30
501 11	-	Ia	-	0.95	0.05	5 ... 50
501 20	-	II	II	1.13	0.1	10 ... 100
501 23	-	IIc	IIa	1.50	0.3	30 ... 300
501 21	-	IIa	-	1.69	0.5	50 ... 500
501 30	-	III	III	2.01	1	100 ... 1000
501 33	-	IIIc	IIIa	2.65	3	300 ... 3000
501 31	-	IIIa	-	3.00	5	500 ... 5000
501 40		IV	IV	3.60	10	1000 ... 10000
-	502 43	IVc	IVa	4.70	30	3000 ... 30000
-	502 41	IVa	-	5.34	50	6000 ... 30000
-	502 50	-	V	6.30	100	> 10000

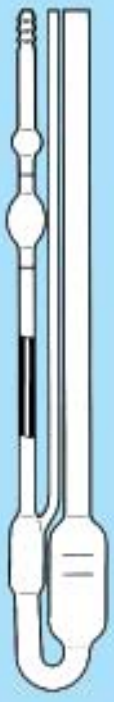
not calibrated, without constant, for determination of relative viscosity
calibrated, with constant for automatic measurements

$\nu = K \cdot t$
$K = \frac{\nu}{t}$
$t = \frac{\nu}{K}$

ν = kinematic viscosity in mm²/s
K = constant [mm²/s²]
t = flow-through time in s

Type No.	Type No.	Capillary No. acc. DIN	acc. ISO	Capillary ∅ i ± 0.01 [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
-	532 00	0	-	0.36	0.001	0.3 ... 1
530 03	532 03	0c	-	0.47	0.003	0.5 ... 3
530 01	532 01	0a	-	0.53	0.005	0.8 ... 5
530 10	532 10	I	I	0.63	0.01	1.2 ... 10
530 13	532 13	Ic	Ia	0.84	0.03	3 ... 30
-	532 11	Ia	-	0.95	0.05	5 ... 50
530 20	532 20	II	II	1.13	0.1	10 ... 100
530 23	532 23	IIc	IIa	1.50	0.3	30 ... 300
-	532 21	IIa	-	1.69	0.5	50 ... 500
530 30	532 30	III	III	2.01	1	100 ... 1000
530 33	532 33	IIIc	IIIa	2.65	3	300 ... 3000
-	532 31	IIIa	-	3.00	5	500 ... 5000
530 40	532 40	IV	IV	3.60	10	1000 ... 10000

Ubbelohde viscometers, normal form (ASTM)



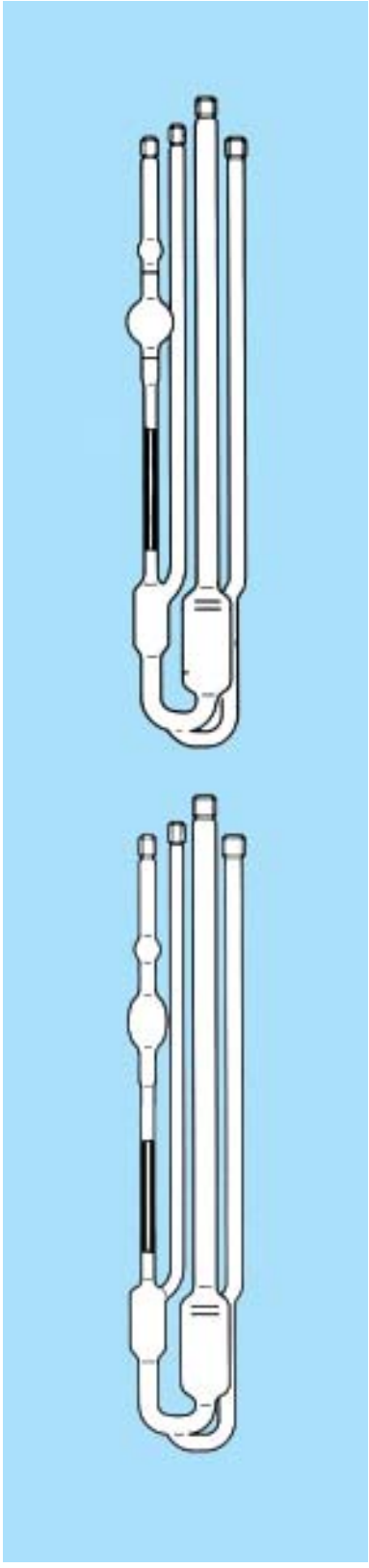
Ubbelohde Viscometer (ASTM)

- in accordance with ISO/DIS 3105, ASTM D 2515, ASTM D 446
- filling quantity: 15 ... 20 ml
- overall length: approx. 285 mm

calibrated, with constant for manual measurements	not calibrated, without constant for determination of relative Viscosity	calibrated, with constant for automatic measurements				
Type No.	Type No.	Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
525 00	526 00	527 00	0	0.24	0.001	0.35 ... 1
525 03	526 03	527 03	0c	0.36	0.003	0.6 ... 3
525 01	526 01	527 01	0b	0.46	0.005	1 ... 5
525 10	526 10	527 10	1	0.58	0.01	2 ... 10
525 13	526 13	527 13	IC	0.78	0.03	6 ... 30
525 20	526 20	527 20	II	1.03	0.1	20 ... 100
525 23	526 23	527 23	IIc	1.36	0.3	60 ... 300
525 30	526 30	527 30	III	1.83	1	200 ... 1000
525 33	526 33	527 33	IIIc	2.43	3	600 ... 3000
525 40	526 40	527 40	IV	3.27	10	2000 ... 10 000
525 43	526 43	527 43	IVc	4.32	30	6000 ... 30 000

Ubbelohde viscometers, with additional tube and threads

Viscometers with suspended ball level for determination of absolute or relative kinematic viscosity. These viscometers are preferably used for automatic measurements when an AVS 24 or AVS 26 automatic viscometer cleaner is used simultaneously. The additional filling and cleaning tube and the glass thread ensure safe operational use. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18. The ring marks that are also present serve as auxiliary marks in case the viscometers must be checked by means of manual measurements.



Ubbelohde viscometer (DIN)

- in accordance with ISO/DIS 3105, DIN 51 562, Part 1, BS 133, NFT 60-100
- filling quantity: 18...22 ml
- overall length: approx. ca. 290 mm

calibrated, with constant for automatic measurements

Type No.	Capillary No. acc. DIN	acc. ISO	Capillary ∅ i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)		
541 03	0c	-	0.47	0.003	0.5	...	3
541 01	0a	-	0.53	0.005	0.8	...	5
541 10	I	I	0.63	0.01	1.2	...	10
541 13	Ic	Ia	0.84	0.03	3	...	30
541 20	II	II	1.13	0.1	10	...	100
541 23	IIc	IIa	1.50	0.3	30	...	300
541 30	III	III	2.01	1	100	...	1000
541 33	IIIc	IIIa	2.65	3	300	...	3000
541 40	IV	IV	3.60	10	1000	...	6000

Ubbelohde viscometer (ASTM)

- the technical measurement characteristics are in accordance with ISO/DIS 5105, ASTM D 2515, ASTM D 446
- filling quantity: 15 ... 22 ml
- overall length: approx. 290 mm

calibrated, with constant for automatic measurements

Type No.	Capillary No.	Capillary ∅ i (mm)	Constant K (approx.)	Measuring range [mm²/s] (approx.)		
545 00	0	0.24	0.001	0.35	...	1
545 03	0c	0.36	0.003	0.6	...	3
545 01	0b	0.46	0.005	1	...	5
545 10	I	0.58	0.01	2	...	10
545 13	Ic	0.78	0.03	6	...	30
545 20	II	1.03	0.1	20	...	100
545 23	IIc	1.36	0.3	60	...	300
545 30	III	1.83	1	200	...	1000
545 33	IIIc	2.43	3	600	...	3000
545 40	IV	3.27	10	2000	...	10000
545 43	IVc	4.32	30	6000	...	30000

Ubbelohde viscometers with TC sensors

Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour. They are especially suitable for liquids that cannot be detected with other systems: untransparent and/or black and/or electric conductive measuring samples.

TC viscometers are manufactured from technical glass types with an expansion coefficient of α = ca. $9 \cdot 10^{-6}$.

Due to the electric properties of TC sensors, it is important to make sure that a type is selected that is suitable for the required application temperature.

TC viscometers with additional filling and cleaning tube and with glass thread

- the technical measurement characteristics are in accordance with DIN 51 562, Part 1, ISO/DIS 3105 (BS-IP-SL)
- for use in combination with an automatic viscosity measuring instrument and an AVS 24 or AVS 26 automatic viscometer cleaner
- filling quantity: 18 ... 22 ml
- overall length: approx. 355 mm

calibrated,
with constant for automatic measurements

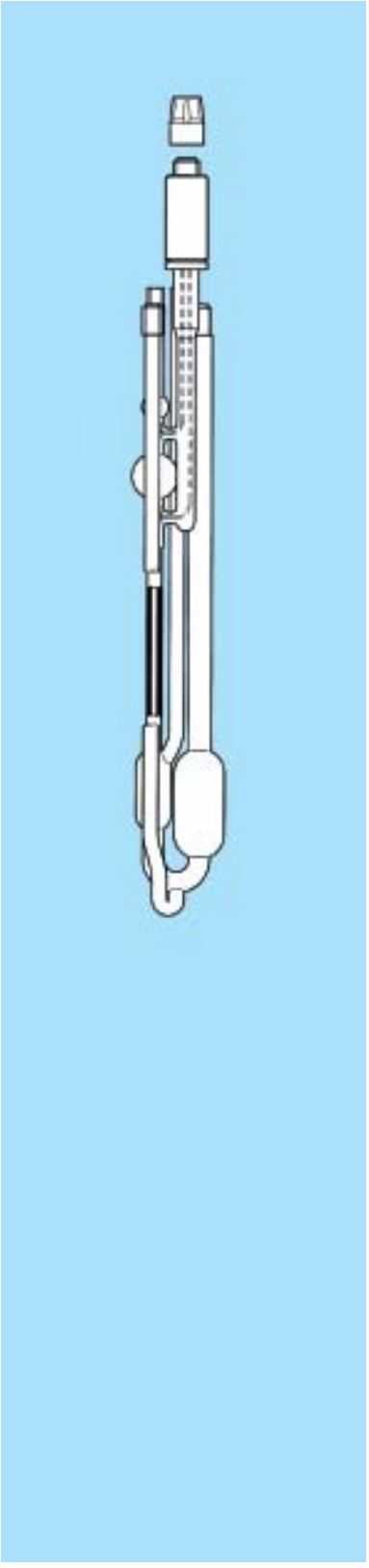
Type No. + 10 ... + 80 °C	Type No. - 40 ... + 30 °C	Type No. + 70 ... + 150 °C	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	Measuring range (mm^2/s] (approx.)		
542 03	-	-	0c	0.47	0.003	0.5	...	3
542 10	543 10	544 10	I	0.54	0.01	1.2	...	10
542 13	543 13	544 13	Ic	0.84	0.03	3	...	30
542 20	543 20	544 20	II	1.15	0.1	10	...	100
542 23	543 23	544 23	IIc	1.51	0.3	30	...	300
542 21	-	-	IIa	1.69	0.5	50	...	500
542 30	543 30	544 30	III	2.05	1	100	...	1000
542 33	543 33	544 33	IIIc	2.7	3	300	...	3000
542 31	-	-	IIIa	3.0	5	500	...	5000
542 40	543 40	544 40	IV	3.7	10	1000	...	10000
542 43	543 43	544 43	IVc	4.9	30	3000	...	20000
542 41	543 41	-	IVa	5.3	50	5000	...	30000

Ubbelohde viscometers with TC sensors

Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour. They are especially suitable for liquids that cannot be detected with other systems: untransparent and/or black and/or electric conductive measuring samples.

TC viscometers are manufactured from technical glass types with an expansion coefficient of α = ca. $9 \cdot 10^{-6}$.

Due to the electric properties of TC sensors, it is important to make sure that a type is selected that is suitable for the required application temperature.



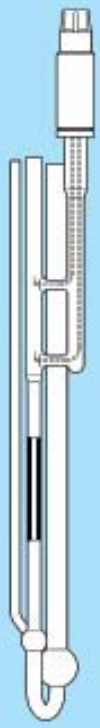
TC viscometers

- the technical measurement characteristics are in accordance with DIN 51 562, Part 1, ISO/DIS 3105 (BS-IP-SL)
- for use in combination with an automatic viscosity measuring instrument and an AVS 24 or AVS 26 automatic viscometer cleaner
- filling quantity: 18 ... 22 ml
- overall length: approx. 355 mm

calibrated,
with constant for automatic measurements

Type No. +10...+80 °C	Type No. -40...+30 °C	Type No. +70...+150 °C	Capillary No.	Capillary ∅ i (mm)	Constant K (approx.)	Measuring range (mm^2/s) (approx.)		
547 03	-	-	0c	0.47	0.003	0.5	...	3
547 10	548 10	549 10	I	0.64	0.01	1.2	...	10
547 13	548 13	549 13	Ic	0.84	0.03	3	...	30
547 20	548 20	549 20	II	1.15	0.1	10	...	100
547 23	548 23	549 23	IIc	1.51	0.3	30	...	300
547 21	-	-	IIa	1.69	0.5	50	...	500
547 30	548 30	549 30	III	2.05	1	100	...	1000
547 33	548 33	549 33	IIIc	2.7	3	300	...	3000
547 31	-	-	IIIa	3.0	5	500	...	5000
547 40	548 40	549 40	IV	3.7	10	1000	...	10000
547 43	548 43	549 43	IVc	4.9	30	3000	...	20000
547 41	548 41	-	IVa	5.3	50	5000	...	30000

Micro-Ubbelohde viscometers with TC sensors



Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour. They are especially suitable for liquids that cannot be detected with other systems: untransparent and/or black and/or electric conductive measuring samples.

TC viscometers are manufactured from technical glass types with an expansion coefficient of α = ca. $9 \cdot 10^{-6}$.

Due to the electric properties of TC sensors, it is important to make sure that a type is selected that is suitable for the required application temperature.

Micro TC viscometers

- the technical measurement characteristics are in accordance with DIN 51 562, Part 2 for use in combination with an automatic viscosity measuring instrument
- filling quantity: 3 ... 4 ml
- overall length: approx. 350 mm

calibrated,
with constant for automatic measurements

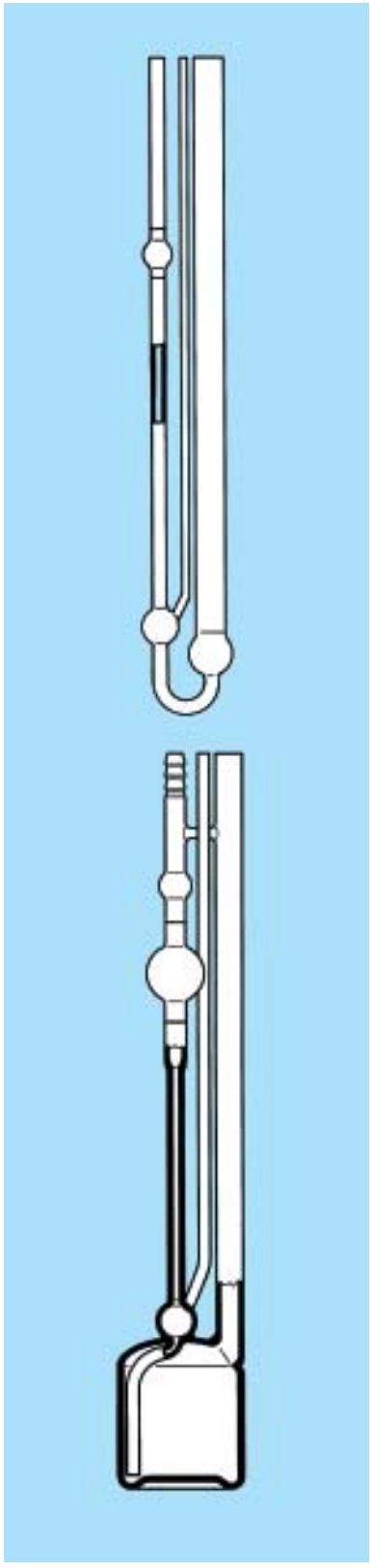
Type No. +10 ...+80 °C	Type No. -40 ...+30 °C	Type No. +70 ...+150 °C	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)		
552 10	553 10	554 10	M I	0.40	0.01	0.4	...	6
552 13	553 13	554 13	M Ic	0.53	0.03	1.2	...	18
552 20	553 20	554 20	M II	0.70	0.1	4	...	60
552 23	553 23	554 23	M IIc	0.95	0.3	12	...	180
552 30	553 30	554 30	M III	1.26	1	40	...	800

Micro-Ubbelohde viscometers

Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. Due to their design, these viscometers are especially suitable for measurement of small liquid quantities and for particularly short running times. All viscometers are provided with ring marks. This ensures that viscometers for automatic measurements can also be checked by means of manual measurements.

Micro-Ubbelohde viscometers (DIN)
The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18. For measurements with automatic viscosity measuring instruments, another constant is valid. This constant is determined by multiplication of the constant K with the correction factor F.

- in accordance with DIN 51 562, Part 2
- filling quantity: 3 ... 4 ml
- overall length: approx. 290 mm



calibrated, with constant for manual measurement	calibrated, with constant for automatic measurement	not calibrated, without constantn for determination of relative viscosity						
Type No.	Type No.	Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)		
536 10	537 10	538 10	M I	0.40	0.01	0.4	...	6
536 13	537 13	538 13	M Ic	0.53	0.03	1.2	...	18
536 20	537 20	538 20	M II	0.70	0.1	4	...	60
536 23	537 23	538 23	M IIc	0.95	0.3	12	...	180
536 30	537 30	538 30	M III	1.26	1	40	...	800

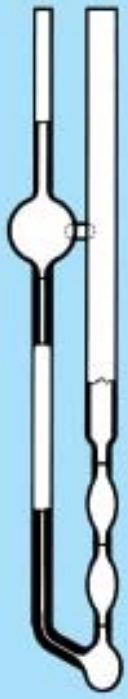
Viscometers for dilution viscometry

Viscometers with suspended ball level designed according to the principle of the Ubbelohde viscometers for determination of the limit viscosity number of polymers. The limit viscosity number is determined automatically in combination with viscosity measuring instruments and piston burette, type AVS 20, made by SCHOTT Instruments.

- filling quantity: 15 ... 75 ml
- overall length: approx. 290 mm

not calibrated, for automatic measurements						
Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)		
531 00	0	0.36	0.001	0.35	...	0.6
531 03	0c	0.47	0.003	0.5	...	2
531 01	0a	0.53	0.005	0.8	...	3
531 10	I	0.64	0.01	1.2	...	6
531 13	Ic	0.84	0.03	3	...	20
531 20	II	1.15	0.1	10	...	60

Cannon-Fenske viscometers



Cannon-Fenske routine viscometers
comply with standards ISO/DIS 3105, ASTM D 2515, BS 188 with respect to technical measuring specifications.

- are suitable for all Newtonian liquids with a viscosity of 0.35 ... 20,000 mm²/s.
- the present design has, as a supplement to the standard, a deepening in the lower bend. Accordingly, these viscometers can also be used for automatic measurements.
- filling quantity: approx. 7 ... 10 ml
- overall length: approx. 245 mm

calibrated, with ring mark, for manual measurements	with constant for automatic measurements						
Type No.	Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	measuring range [mm²/s] (approx.)		
513 00	520 00	25	0.30	0.002	0.4	...	1.6
513 03	520 03	50	0.44	0.004	0.8	...	3.2
513 01	520 01	75	0.54	0.008	1.6	...	6.4
513 10	520 10	100	0.63	0.015	3	...	15
513 13	520 13	150	0.78	0.035	7	...	35
513 20	520 20	200	1.01	0.1	20	...	100
513 23	520 23	300	1.27	0.25	50	...	200
513 21	520 21	350	1.52	0.5	100	...	500
513 30	520 30	400	1.92	1.2	240	...	1200
513 33	520 33	450	2.35	2.5	500	...	2500
513 40	520 40	500	3.20	8	1600	...	8000
513 43	520 43	600	4.20	20	4000	...	20000

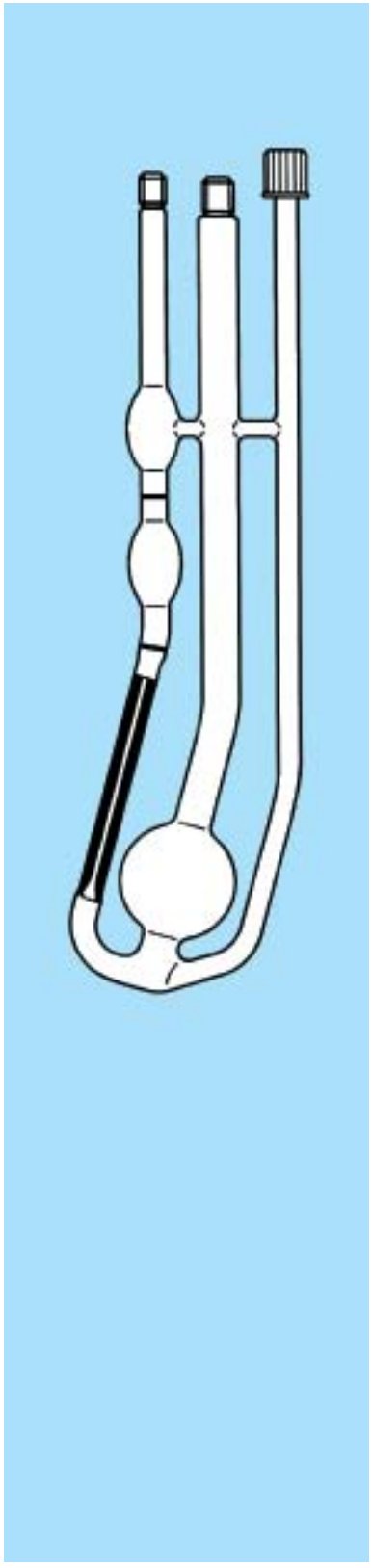
Cannon-Fenske reverse flow viscometers
Comply with standards ISO/DIS 3105, ASTM D 2515, ASTM D 446, NF T 60 - 100 with respect to technical measuring specifications.

- filling quantity: approx. 12 ml
- overall length: approx. 295 mm

calibrated, with 3 ring marks, with 2 constants, only for manual measurment						
Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	measuring range [mm²/s] (approx.)		
511 00	25	0.31	0.002	0.4	...	1.6
511 03	50	0.42	0.004	0.8	...	3.2
511 01	75	0.54	0.008	1.6	...	6.4
511 10	100	0.63	0.015	3	...	15
511 13	150	0.78	0.035	7	...	35
511 20	200	1.02	0.1	20	...	100
511 23	300	1.26	0.25	50	...	200
511 21	350	1.48	0.5	100	...	500
511 30	400	1.88	1.2	240	...	1200
511 33	450	2.20	2.5	500	...	2500
511 40	500	3.10	8	1600	...	8000
511 43	600	4.00	20	4000	...	20000

Cannon-Fenske routine viscometers comply with standards ISO/DIS 3105, ASTM D 2515, BS 188 with respect to technical measuring specifications. These viscometers are preferably used for automatic measurements when an AVS 24 or AVS 26 automatic viscometer cleaner is used simultaneously. The additional filling and cleaning tube and the glass thread ensure safe operational use. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18.

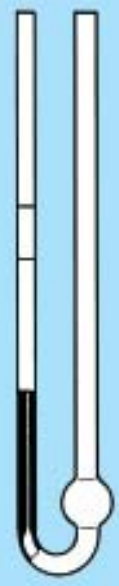
- are suitable for all Newtonian liquids with a viscosity of 0.35 ... 20,000 mm^2/s.
- filling quantity: approx. 7 ... 12 ml
- overall length: approx. 245 mm



calibrated, with ring marks, with constant for automatic measurements

Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	measuring range [mm^2/s] (approx.)
546 00	25	0.30	0.002	0.4 ... 1.6
546 03	50	0.44	0.004	0.8 ... 3.2
546 01	75	0.54	0.008	1.6 ... 6.4
546 10	100	0.63	0.015	3 ... 15
546 13	150	0.78	0.035	7 ... 35
546 20	200	1.01	0.1	20 ... 100
546 23	300	1.27	0.25	50 ... 200
546 21	350	1.52	0.5	100 ... 500
546 30	400	1.92	1.2	240 ... 1200
546 33	450	2.35	2.5	500 ... 2500
546 40	500	3.20	8	1600 ... 8000
546 43	600	4.20	20	4000 ... 20000

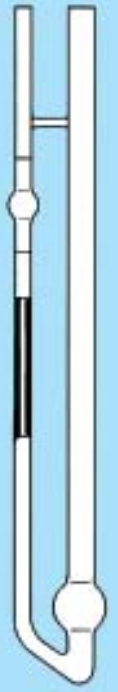
Ostwald viscometers



Ostwald viscometers

- filling quantity: approx. 3 ml
- overall length: approx. 220 mm

Type No.	Capillary ∅ i [mm]	Transit time for water approx. [s]	Constant K (approx.)	for use from [mm²/s] (approx.)
calibrated, with ring marks, without constant, for manual measurements				
509 03	0.3	250	0.004	0.3
509 04	0.4	75	0.01	1
509 05	0.5	30	0.03	2.5
509 06	0.6	15	0.07	5.5
509 07	0.7	10	0.1	10



Micro-Ostwald viscometers

are suitable for measurements of small liquid quantities even with extreme formation of foam.

- filling quantity: 2 ml
- overall length: approx. 290 mm

Type No.	Type No.	Capillary No.	Capillary ∅ i [mm]	Constant K (approx.)	measuring range [mm²/s] (approx.)
calibrated, with ring marks, with constant, for manual measurements	calibrated, with ring marks, with constant, for automatic measurements				
516 10	517 10	I	0.43	0.01	0.4 ... 6
516 13	517 13	Ic	0.60	0.03	1.2 ... 18
516 20	517 20	II	0.77	0.1	4 ... 60
516 23	517 23	IIc	1.00	0.3	12 ... 180
516 30	517 30	III	1.36	1	40 ... 800

Accessories

Brackets and stands

All brackets and stands are designed to ensure that the viscometers are held vertically. They also protect the viscometers from breakage. The maximum deviation is < 1°. In application in conjunction with SCHOTT Instruments and other commercially available see-through thermostats the viscometers can only be used with the appropriate stand or bracket.
For DIN Ubbelohde viscometers that are used as reference measuring standard, specifically modified bracket (VZ 5840) must be used.

Brackets made of stainless steel
suitable for use with all Ubbelohde viscometers
for manual and automatic measurements

Type No.
053 92
VZ 5840 (accessory for reference measuring standard)

suitable for use with Ubbelohde viscometers with TC sensors

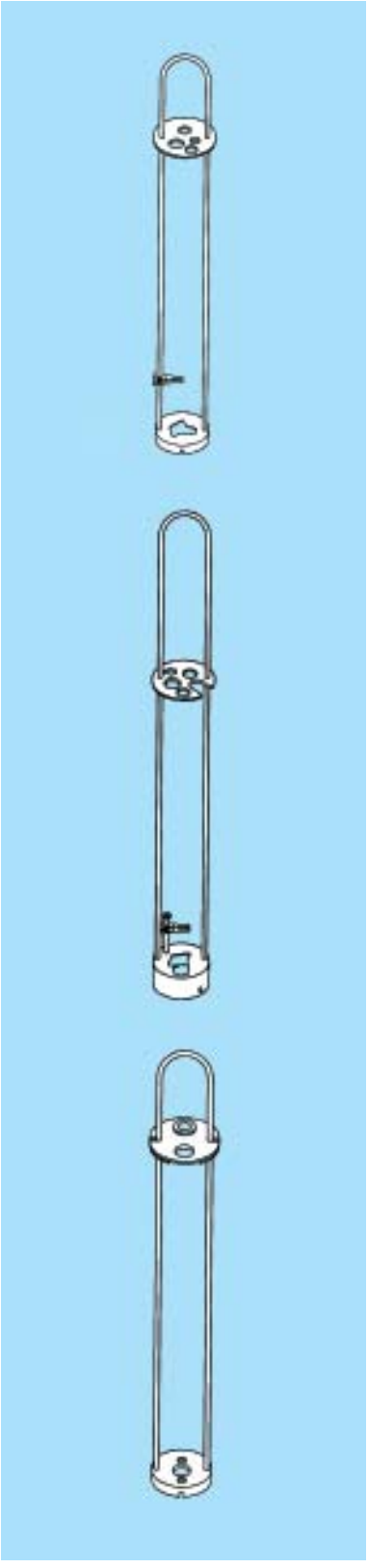
Type No.
053 93

suitable for use with all reverse flow viscometers
(Cannon-Fenske and BS/IP U-tube viscometers) for manual and automatic measurements (not illustrated)

Type No.
053 96

suitable for use with Micro-Ostwald viscometers
for manual and automatic measurements

Type No.
053 97



Accessories

Stands made of PTFE

suitable for use with Cannon-Fenske routine viscometers for automatic measurements only (not illustrated)

Type No.
065 99

Brackets for reference measuring standard

DIN Ubbelohde viscometers which are used as testing standard should be stored in a specially modified viscometer bracket (053 92) according to official inspection / calibration authorities.

The extension set for the test standard (VZ 5840) guarantees vertical slope with a maximum deviation of < 1° and the centered positioning of the capillaries.

Type No.
VZ 5840

Control thermometers

Type No.	measuring range °C			Graduation °C
VZ 2801	- 5	bis	+ 38	1/10
VZ 2802	+ 33	bis	+ 67	1/10
VZ 2803	+ 66	bis	+ 102	1/10
V2 2804	+ 95	bis	+ 152	1/10
VZ 2901	+ 20	bis	+ 25	1/100
VZ 2907	+ 22	bis	+ 27	1/100
VZ 2904	+ 35	bis	+ 40	1/100
VZ 2908	+ 37	bis	+ 42	1/100
VZ 2905	+ 45	bis	+ 50	1/100
VZ 2906	+ 97	bis	+ 101	1/100
VZ 2909	+ 132	bis	+ 137	1/100

Accessories

LabPump

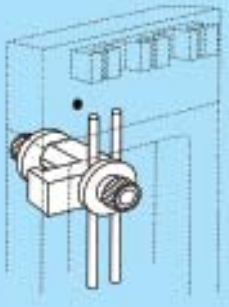
The LabPump VZ 5655 (not illustrated) used in manual measurements and semi-automatic measurements to suck and pump up solutions:

- filling of viscometers
- rinsing with the next sample
- sucking up between manual measurements
- emptying of viscometers without removing them from the thermostatic bath

Since the materials used and the connections of the LabPump VZ 5655 are made of PTFE or stainless steel, the pump is suitable for use with aggressive mediums.

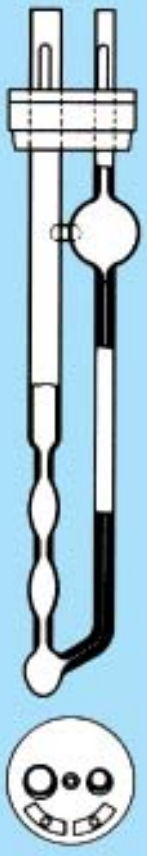
The range of use for semi-automatic processing of samples, e.g. with a viscosity measuring instrument AVS 360, AVS 370 or AVS 470, is possible up to a viscosity of 30,000 mm^2/s. For semi-automatic processing work, the PTFE tube combination with stand (see illustration) and the waste bottle, type no. VZ 5624, are used.

Type No.
VZ 5655



Polyamide bracket
for use with Cannon-Fenske routine viscometers,
Cannon-Fenske reverse flow viscometers and all Ostwald viscometers
for manual measurements only

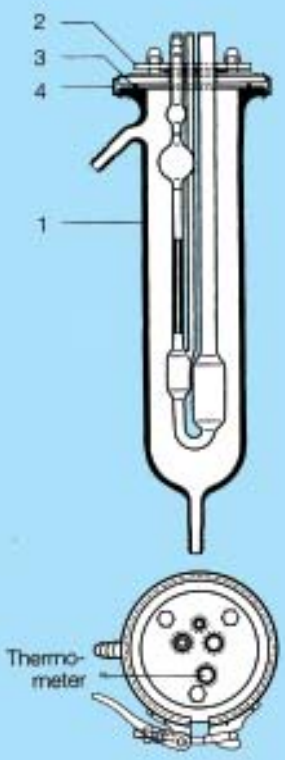
Type No.
064 99



PTFE bracket
for use with Cannon-Fenske routine viscometers,
for automatic measurements only (not illustrated)

Type No.
065 99

Accessories



Temperature stabilization jackets

In the absence of a see-through thermostat the temperature of capillary viscometers can be stabilized in this type of jacket using circulation thermostats in the temperature range 0 to 180 °C. The shape of the jacket and the number of holes in the support plate depend upon the type of viscometer being used. The support plate has been designed to facilitate changing the viscometer when required. An additional hole is provided in the support plate so that a control thermometer can be fitted. A quick-action seal simplifies changing viscometers.

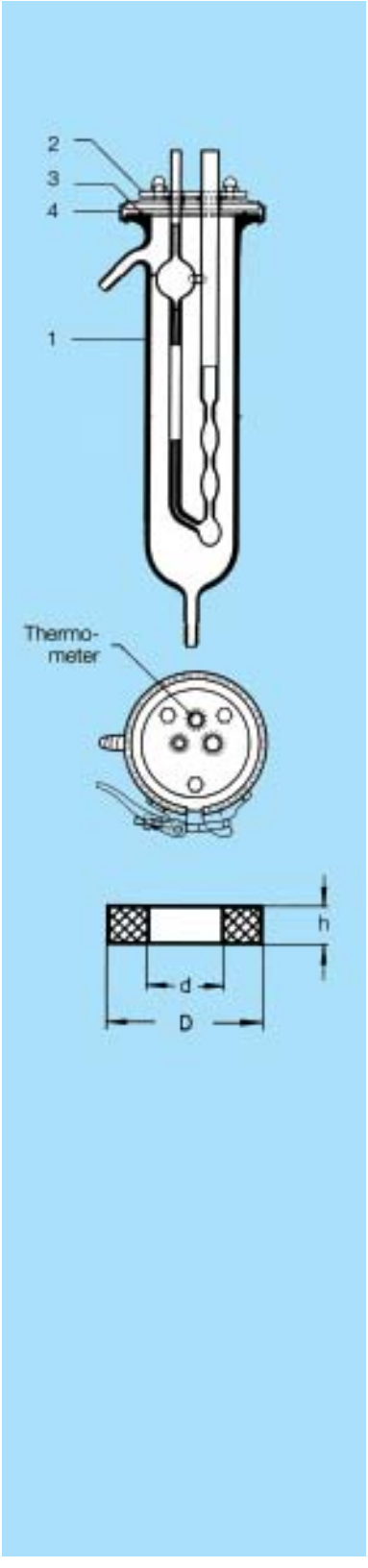
Temperature stabilization jacket with support plate for Ubbelohde viscometers

Type No.	Item No.	Comment
577 00		complete, without viscometer
Component parts		
577 01	1	temperature stabilization jacket, straight
238 00	2	support plate with 4 silicone rings (d = 4, 6, 8 and 10 mm)
225 34	3	silicone O-ring, ND 60
072 34	4	quick-action seal, ND 60

Accessories

Temperature stabilization jacket with support plate
for Cannon-Fenske reverse flow viscometers and Ostwald viscometers

Type No.	Item No.	Comment
579 00		complete, without viscometer
Component parts		
577 01	1	temperature stabilization jacket, straight
239 00	2	support plate with 3 silicone rings (d = 6, 8 and 10 mm)
225 34	3	silicone O-ring, ND 60
072 34	4	quick-action seal, ND 60



Silicone rings

Type No.	d mm	D mm	h mm
228 11	4	10	5
228 14	6	16	5
228 16	8	16	5
228 17	10	16	5

AVS measuring stands and tube sets

AVS measuring stands

- Measuring stands of the type series AVS/S can be used to measure the flow-through time in viscometers automatically.
- The measuring stands can be connected to all measuring instruments made by SCHOTT Instruments for automatic measurement of viscosity and operate with all standard viscometers for repetitive measurements.
- Automatic measurements have the following advantages:
  - the repetitive standard deviation is less than for manual measurements
  - the measurement is free from subjective factors of influence
  - the results can be printed out and/or be automatically documented on data memory system
  - automatic processing of sample series is available.
- The use of different materials ensures unproblematic adaptation to existing measurement temperatures and applications.
- The measuring stands or brackets can be exchanged at random.
- The distance between the levels of the automatic optoelectronic unloading system is 40.00 mm ± 0.03 mm. When measuring stands are replaced, this results in a standard deviation of VK = 0.05 % for Ubbelohde viscometers.
- For repetitive measurements with viscosity measuring instruments and Ubbelohde viscometers with measuring stands, the standard deviation VK = 0.03 %.
- Manually calibrated Ubbelohde viscometers can also be used in AVS measuring stands. If the automatic sensing levels do not correspond to the ring marks, the superimposed meniscus detection system will provide a higher constant. The difference amounts to 0.1 % per millimeter of height offset.

Required tube/cable combinations

	Viscometer type				
	517 ...	540 ...	542 ...	547 ...	531 ... [3]
	520 ...	541 ...	543 ...	548 ...	
	530 ...	545 ...	544 ...	549 ...	
	532 ...	546 ...		552 ...	
	537 ...			553 ...	
				554 ...	
Instrument	**Tube/cable combinations**				
AVS 300 and AVS 310	VZ 5505[1] or VZ 5501[2]	VZ 5621[1] and VZ 5505[1]	-	-	VZ 5857[1]
AVS 350	VZ 5505[1] or VZ 5501[2]	VZ 5623[2]	VZ 5606[1]	VZ 5505[1] and VZ 6226	VZ 5857[1]
AVS 360 and AVS 361	VZ 5104[1] or VZ 5622[2]	VZ 5623[2]	VZ 5623[2]	VZ 5104[1] or VZ 5622[2]	VZ 5104[1] or VZ 5622[2]
AVS 400 and AVS 410	VZ 5505[1] or VZ 5501[2]	VZ 5621[1] and VZ 5505[1]	-	-	VZ 5857[1]
AVS 440 and AVS 450	VZ 5505[1] or VZ 5501[2]	VZ 5621[1] and VZ 5505[1]	VZ 5606[1]	VZ 5505[1] and VZ 6226	VZ 5857[1]

(1) Silicon tube
(2) PTFE tube (aggressive mediums)
(3) The necessary connection tube TZ 1607 (l = 1.5 m) is included at the piston burette ViscoDoser AVS 20.

AVS measuring stands

	Measuring stands AVS/S	AVS/S-HT	AVS/SK	AVS/S-CF	AVS/SK-V
Available viscometers	Ubbelohde viscometers in accordance, with DIN, ASTM, ISO 3105, Micro-Ubbelohde viscometers, Micro-Ostwald viscometers			Cannon-Fenske-routine viscometer	Ubbelohde-dilution viscometer
Temperature range	-80 …+100 °C	-80 …+200 °C	0 …+60 °C	-80 …+100 °C	0 …+60 °C other temperature ranges available on request
Suitable for use with the measuring units	**AVS 310, AVS 350, AVS 360, AVS 361, AVS 370, AVS 410, AVS 450, AVS 470, AVS 500, AVSPro**				
Suitable for use with the thermostatic baths	**CT 52, CT 53, CT 53 HT, CT 53 TT, CT 54**				
Suitable brackets (type no.)	05392 05397			no bracket required	
Electrical connection	Cable VZ 6225 for all measuring stands to all instruments (is included in hose sets VZ 5505, VZ 5622 and VZ 5857), control lamp as function display				
Distance between measuring levels	40.00 mm ± 0.03 mm at 25 °C				
Signal sion	Optically using optical fibres from the measuring level in the stand head, converted into **transmis-** analogue signal from stand to measuring instrument				
Material	Aluminium, TiO_2-anodized		PVDF, stainless steel	Aluminium, TiO_2-anodized	PVDF, stainless steel
Dimensions W x H x D) mm	90 x 447 x 90	90 x 496 x 90	90 x 447 x 90	90 x 447 x 90	90 x 447 x 90
Weight (kg) appr.	1.0	1.25	0.8	1.0	0.8
Accessories included in scope of delivery	Bracket Type No. 05392 for Ubbelohde viscometers, tube/cable combination VZ 5505			tube/cable combination VZ 5505	tube/cable combination VZ 5857, magnetic stirring rods, fastening springs for viscometer

Note:

When TC viscometers are being used, a bracket type no. 05393, with the necessary tube set is required only. A measuring stand is not required.

Viscometers within quality assurance systems

Business sector	Product	Example
Automotive engineering	motor oil (fresh and used)	
	high polymer plastics	bumpers
Brewery	original wort	beer
	hop-wort	beer
Electrical engineering and electronics	high polymer plastics of all types	chips, casings
Power supply	turbine oil	generators
	transformer oil	
Film	gelatine as pigment-bearing agent	color films
	carrier film for film material	
Plastics manufacturers	high polymer plastics of all types	
Plastics processors	high polymer plastics of all types	injection molding
Food industry	starch	instant flour thickeners
	gelatine	jelly bears
	packaging materials	yoghurt containers
	milk products	yoghurt drink
	fruit and fruit juice concentrates	
	gelatinizing agents	pectin
Aviation	high polymer plastics of all types	
	fuels	kerosene
	hydraulic fluids	horizontal stabilizers and undercarriages
Mechanical engineering	mold oil	mill trains
	hardening emulsions	stamp shops
	hydraulic fluids	
Medicine	body fluids	blood, bile
	injection solutions	insulin
	tinctures and drops	nose, eyes
	blood substitute materials	blood plasma
Mineral oil	light motor oil	
	turbine oil	
	liquid fuels of all types	gasoline, diesel fuel
Textile	high polymer plastics of all types	for mixed fibers
	cotton	
Entertainment	high polymer plastics	CDs, videotapes

The table on the right illustrates the extensive area of high polymer plastics and the large variety of testing methods.

Polymer applications for the AVS measurement systems

Polymers, their applications and utilization of automatic systems from SCHOTT Instruments GmbH

Type	Abbr.	Solvent	Capillary	Operating temperature	Standards	Suitability of the AVS measurement systems VC	370	470	Pro
Cellulose EWNN	C I	Cuen Couxam	0c CAN CM I Micro	20 °C	SNV 195 598S 15:88	■	■	■	■
Cellulose acetate	CA	Dimethyl-chloride / methanol	0c I I Micro	25 °C	DIN 53 728/1	■	■	■	■
Polyamide	PA	Sulphuric acid (96%)	II IIc	25 °C	DIN 53 727 ISO 307	■	■	■	■
Polyamide	PA	Formic acid (90%)	I Ic	25 °C	DIN 53 727 ISO 307	■	■	■	■
Polyamide	PA	m-cresol	II IIc	25 °C	DIN 53 727 ISO 307	■	■	■	■
Polybutylene terephthalate	PBT	Phenol / dichloro benzene (50:50)	IcII	25 °C	DIN 53 728/3 ISO 1628-4	■	■	■	■
Polycarbonate	PC	Dichloromethane	0c I	25 °C	DIN 7744/2 ISO 1628-4	■	■	■	■
Polyethylene	PE	Decahydro -naphthalene	I Ic	135 °C	DIN 53 728/5 ISO 1191ASTM D 1601	■	■	■	■
Polyethylene terephthalate	PET	m-cresol	II IIc IIc Micro	25 °C	DIN 53 728/3 ISO 1628-5ASTM D 4603	■	■	■	■
Polyethylene terephthalate	PET	Phenol / dichloro-benzene (50:50)	Ic II	25 °C	DIN 53 728/3 ISO 1628-5ASTM D 4603	■	■	■	■
Polyethylene terephthalate	PET	Dichloroacetic acid	II IIc Micro	25 °C		■	■	■	■
Polymethyl methacrylate	PMMA	Chloroform	0c I	25 °C	DIN 7745/2 ISO 1628-6	■	■	■	■
Polymethyl methacrylate	PMMA	Acetophenone	0cI	25 °C	DIN 7745/2	■	■	■	■
Polypropylene	PP	Decahydro-naphthalene	IIc	135 °C	DIN 53 728/4 ISO 1191	■	■	■	■
Polyphenyl sulphide	PPS	Ortho dichloro naphthalene	IIc	230 °C		■	■	■	■
Polystyrene	PS	Toluene	I Ic	25 °C		■	■	■	■
Polysulphone	PSU	Chloroform	IIc	25 °C		■	■	■	■
Polyvinyl chloride	PVC	Cyclohexanone	IIc	25 °C	DIN 53 726 ISO 1628-2ASTM D 1243	■	■	■	■
Styrene-acrylonitrile copolymer	SAN	Ethyl methyl ketone	0c I	25 °C		■	■	■	■
Styrene-butadiene copolymer	SB	Toluene	0c I	25 °C		■	■	■	■

■ excellent suitability; ■ can be used; ■ limited suitability for application related reasons.
This table makes no claim to completeness.

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 an Ubbelohde viscometer, a Micro-Ubbelohde viscometer or a Micro-Ostwald viscometer made by SCHOTT Instruments. The ViscoClock automatically measures the flow-through time of temperature-stabilized liquids through the capillaries of the viscometer at temperatures ranging from -40 °C to 150 °C.

The ViscoClock can be used with any SCHOTT Instruments thermostats bath. The viscometer stand is included.

For temperature stabilization in the thermostatic bath, the following tempering liquids are suitable: water, alcohol water (e.g. ethanol, methanol), paraffin oil, and silicone oil. Liquids can be measured that qualify for use with the viscometer being used in each instance.

Accuracy

The most precise method used to determine the viscosity of liquids is their measurement in capillary viscometers; the ViscoClock functions according to this method. The operating time is indicated with a resolution of 1/100 sec. with quartz precision. The accuracy of 0.01 % 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 made by SCHOTT Instruments are suitable for the calculation of absolute viscosity in the temperature-stabilized, transparent thermostatic bath.

Relative viscosity

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

Technical data ViscoClock

Measuring range - time	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 a TZ 1848 or TZ 1859 power supply unit
Power supply	in accordance with class of protection III.
	degree of protection for dust and humidity IP 50 in accordance with DIN 40 050
	power supply unit 230 V, 50-60 Hz (TZ 1848)
	power supply unit 115 V, 50-60 Hz (TZ 1859), with US-plug
	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 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
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/EWG (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/EWG
	(low voltage guideline), last altered by Guideline 93/68/EWG: 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 transparent thermostatic bath made by SCHOTT Instruments.

** 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 Schott Glaswerke Mainz, Germany*

Subject to technical changes.

The new ViscoSystem® AVS 370 makes maximum precision ...

Well equipped for every viscosity determination

With the new ViscoSystem® AVS 370 we have created a measuring device, which not only measures as precisely and consistently as you expect from SCHOTT Instruments, 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 ViscoSystem® 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 ViscoSystem® AVS 370 also achieves noticeable savings in setting up time.

Easy with a modular concept for future expansion

The ViscoSystem® 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. The modular concept also significantly reduces the space required, and measuring instrument set-ups can be more easily and clearly arranged, for example for parallel and comparison measurements.

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

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

The basic version of the ViscoSystem® AVS 370 is an affordable starter model, which can be used to measure high or low viscosity 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 a different 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 ViscoSystem® AVS 370. Also, virtually all customary capillary viscometers can be used.

The new ViscoSystem® AVS 370 from SCHOTT. Up to 4 ViscoPump II modules can be integrated in the compact 19" housing. With a PC and the WinVisco 370 software, all kinds of different samples can be measured, evaluated and documented in parallel, independently of each other.

ViscoSystem® AVS 370 – the right solution for all situations

Anyone working with the ViscoSystem® 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 ViscoSystem® 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 ViscoSystem® AVS 370 offers an extraordinary broad field of uses, which range from viscosity measurement of clear fluids through to black or fully opaque liquids.

New: Two working principles with the same device.

For the first time ever, with the ViscoSystem® 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 of up to 0.1 bar 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. A further advantage of the "suction" principle is that it guarantees formation of the "hanging ball level" in Ubbelohde viscometers, even for the minimum required sample quantities.

Working with the ViscoSystem® AVS 370 is easy

The ViscoSystem® AVS 370 is very easy to use. 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.

"Suction" or "pressure"? A comparison of preferred applications

		"pressure"	"suction"
Highly viscous samples e.g. oils, polymers		yes	yes
Solvent (examples):	highly volatile	yes	no
	Dichloromethane	yes	no
	Chloroform	yes	no
	Sulfuric acid	no	yes
	Dichloroethanoic acid	no	yes
	Toluene	yes	yes
	Hexafluoroisopropanol	no	yes
	m-cresol	no	yes
	Formic acid	no	yes
	Phenol-dichlorobenzene	no	yes
	Phenol-tetrachloroethane	no	yes

Technical data

Unique flexibility

In the PC-controlled multiple measuring station, the ViscoSystem® AVS 370 offers you unique flexibility while working in a very small space: Up to eight modules, which equates to two fully equipped ViscoSystem® 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.

ViscoSystem® AVS 370		
Measuring range (time)	up to 9,999.99 s; resolution 0.01 s	
Measuring range (viscosity)	pressure:	0.35 ... 1,800 mm²/s (cSt)
	suction:	0.35 ... approx. 5,000 mm²/s (cSt)
Measured parameter	flow through time [s]	
Accuracy of the time measurement	± 0.01 %	
Measured value display	via PC	
Display accuracy	± 1 digit (0.01 s)	
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 ViscoSystem® 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.
ViscoSystem® is a registered trademark.

Compact, space-saving viscosity measuring station with the ViscoSystem® AVS 370. The measuring device is attached to a support table (recommended accessory). All the connections are within view and easily controlled. If necessary the sample can be automatically sucked away and the viscometer flushed e.g. with the TITRONIC® *universal* or the TITRONIC® 110 *plus* burette.

Real multitasking for up to 8 measurements in parallel mode ...

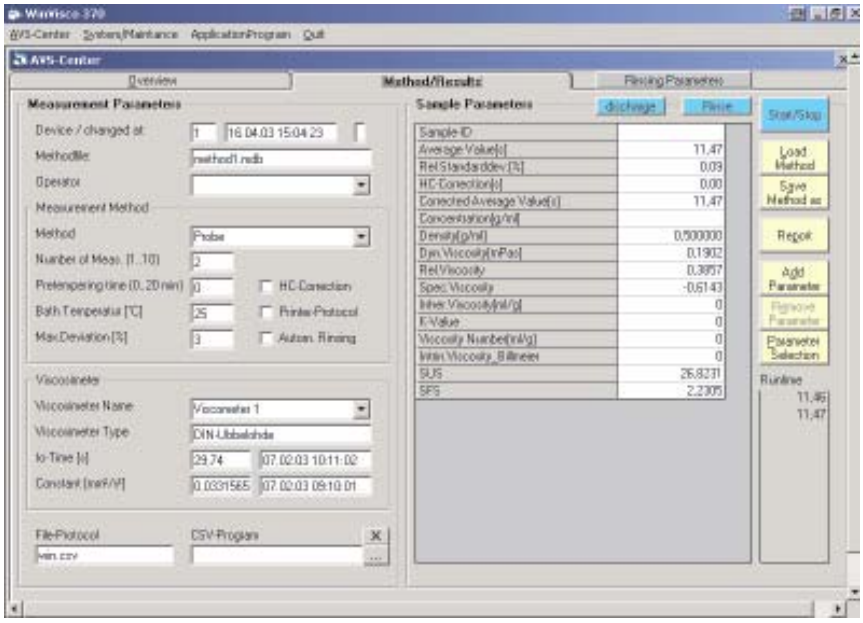
Easy to understand, proven in practice: The WinVisco 370 software

WinVisco 370 is the ideal software for the ViscoSystem® AVS 370*). It is supplied as part of the standard equipment. WinVisco 370 is easy to understand and can be quickly learned. Up to eight viscosity measurement modules can be controlled with only a few operating steps. The device parameters are easy to enter: Constants, t_0 flow time, number of measurements, pretempering period, type of viscometer, date and sample labeling for each measuring station.

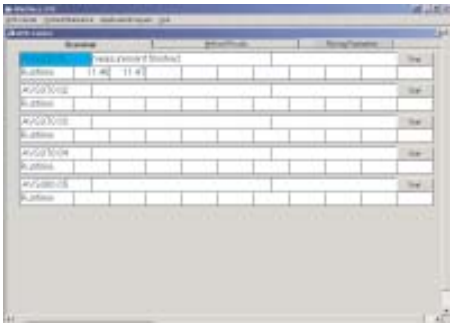
WinVisco 370 works in real multitasking mode. This makes it possible for each measurement to be processed independently from the others. It also means that time-consuming measurements can be carried out from the same PC, without hindering the course of other, faster measurements. During the measurements you can change the monitor displays, start or stop other measurements, print out or save measured values. All data provided by the software can be passed on to an LIMS system.

WinVisco 370 supports three groups of users. For simple use, access is limited to: select viscometer, measure, load and save methods as well as enter parameters. In the highest level, users with administrator status can access all the software's facilities. Each user is given a user ID, an access level and a password.

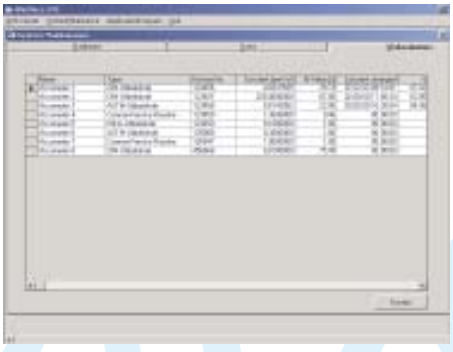
*) The language (English or German) can be chosen after installation over the programme menu.



All the important parameters required for the measurement are displayed on the "Methods/Results" page. If necessary, the parameter editor can be called up using "Add Parameter", in order to enter non-standard or customer specific formulae.

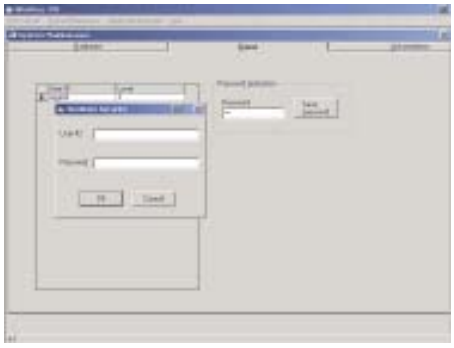


All the measurements currently running can be monitored in parallel in the overview.



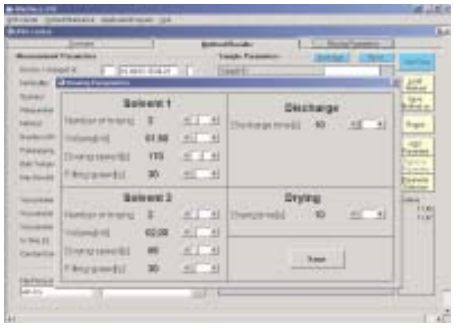
The viscometer data required for the evaluation can be stored in a table. This guarantees perfect allocation of e.g. the t_0 runtime, viscometer constants, the series number, etc. for each individual viscometer being used.

… with the practically proven WinVisco 370 software



The password protection prevents unwanted or confusing changes to the important measurement parameters.

The parameters can be individually adjusted to the measurement for each measuring position.

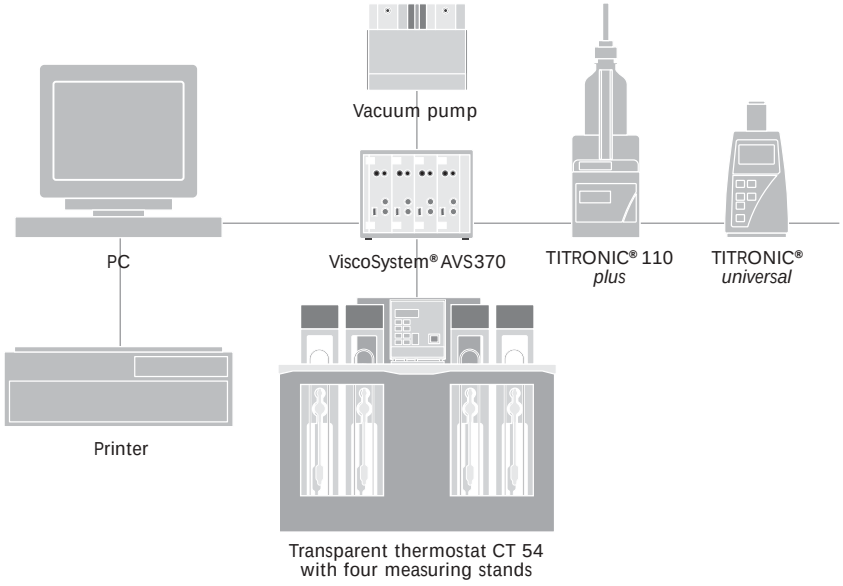


Each rinsing/dry step can be individually preselected. Even the application dependent quantity of solvent and the drying time can be separately determined.

With the ViscoSystem® AVS 370 and WinVisco 370 you will even quickly find the right connection for rinsing

With the daisy chain link of the ViscoSystem® AVS 370, further devices can be integrated in the system and controlled using the WinVisco 370 software. For example, when working in suction mode the viscometers can be rinsed using the TITRONIC® *universal* and TITRONIC® 110 *plus* burettes. The TITRONIC® *universal* is preferably used for light solvents, the TITRONIC® 110 *plus* for solvents with a viscosity >3 mm²/s. A special interchangeable unit (TA 50V) is available for highly aggressive solvents.

A vacuum pump (accessory) integrated in the system is used to conveniently suck away samples and solvents.



Transparent thermostat CT 54 with four measuring stands

Two basic concepts are available for the rinsing:

- A ViscoSystem® AVS 370 with four ViscoPump II modules (four measuring positions) and eight burettes, which enable each viscometer to be rinsed with two solvents. Time-consuming removal of the transparent thermostat for external rinsing of the viscometer is no longer necessary.
- Two ViscoSystem® AVS 370 complete with four ViscoPump II modules each (eight measuring positions), which enables semi-automatic rinsing of the viscometer with the next sample or solvent.

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

That's New: "Suction" and "Pressure" Measurements With Just One Instrument, No need for a PC

The ViscoSystem® 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 new ViscoSystem® 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 ad-

The ViscoSystem® AVS 470 needs no PC and therefore requires just a little more space than a sheet of paper.

Keyboard and printer are available as accessories.

ditional 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.

Simple and updateable Modular Concept

The ViscoSystem® AVS 470 is of a modular design and an optional optical or TC version ViscoPump II module can be used to adapt your measuring station to new requirements at any time. You can use your existing accessories such as thermostats, stands or flow-through coolers with the ViscoSystem® AVS 470. Also, virtually all customary capillary viscometers can be used.

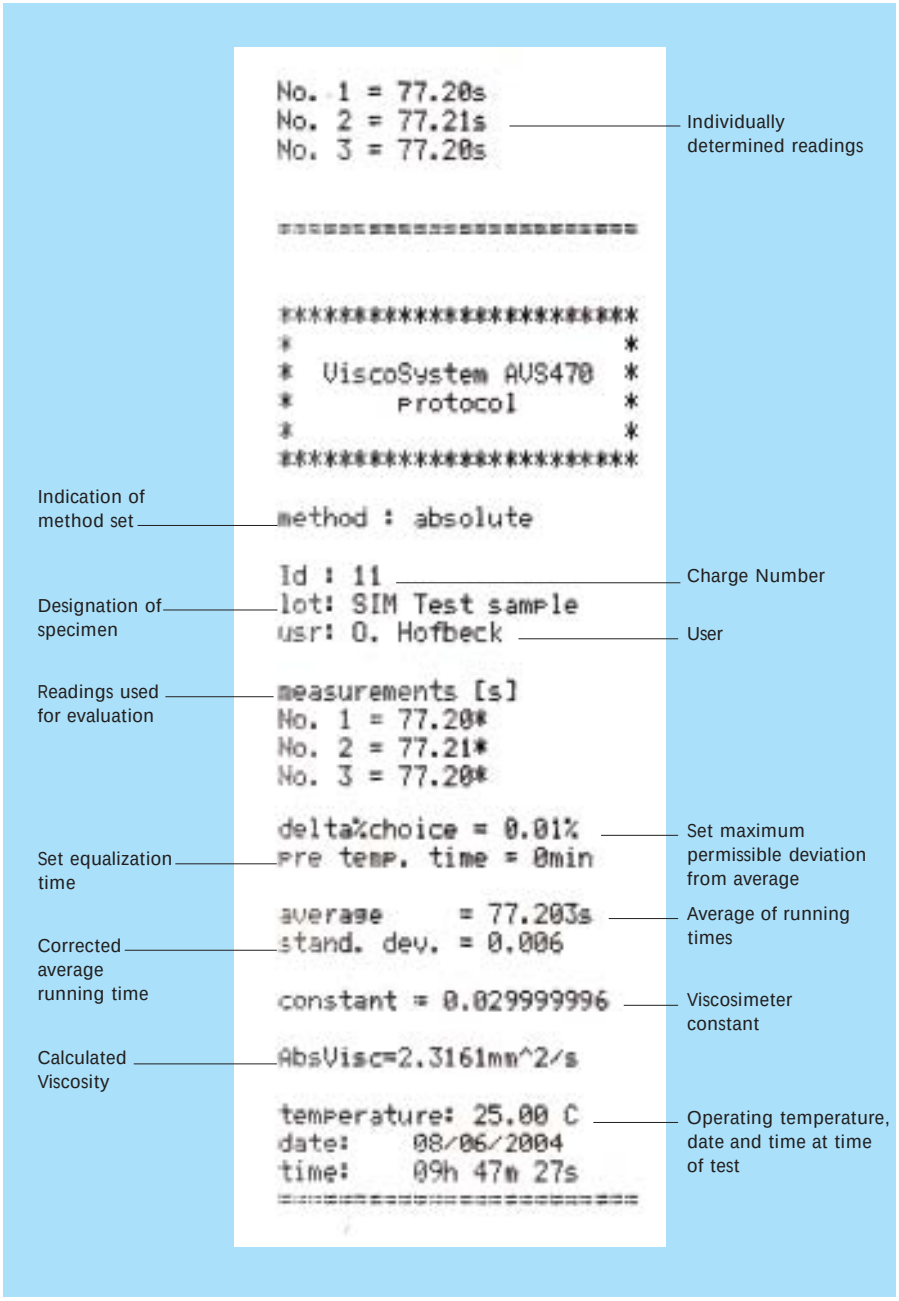
Precise and Reliable – The New ViscoSystem® AVS 470

Working With the ViscoSystem® AVS 470 Is Easy

The ViscoSystem® AVS 470 is very easy to handle. 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 while the status of the measurements is indicated on the LC.

If required, individual parameters may be input via a PS2 keyboard (optional). A serial printer can be used to print measurement logs.

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



Right figure: The print-out shows everything you need for reliable documentation of your test. Simultaneously it demonstrates the unique performance of the new ViscoSystem® AVS 470.

"Suction" or "Pressure"? Preferred applications in comparison:

		"Pressure"	"Suction"
highly viscous samples e.g. oils, polymers		Yes	Yes
Solvents (examples):	highly volatile	Yes	No
	Dichloromethane	Yes	No
	Chloroform	Yes	No
	Sulfuric acid	No	Yes
	Dichloroacetic acid	No	Yes
	Toluene	No	Yes
	Hexafluoro-isopropanol	No	Yes
	m-cresol	No	Yes
	Formic acid	No	Yes
	Phenol-dichlorobenzene	No	Yes
	Phenol-Tetrachloroethane	No	Yes

Technical data

Clear user guidance, clear status – even without PC!

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

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

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

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

ViscoSystem® AVS 470 Technical Data	
Measuring range (time)	up to 9,999.99 s; resolution 0.01 s
Measuring range (viscosity)	pressure: 0.35 . .. 1,800 mm²/s (cSt)
	suction: 0.35 ... ca. 5,000 mm²/s (cSt)
Measured parameter	flow-through time [s]
Time measuring accuracy	± 0.01 %
Measured value display	LC-Display
Display accuracy	± 0.01s, ± 1 digit, but not exceeding 0.01%
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
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 following viscometers can be used with the ViscoSystem® AVS 470:
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.
ViscoSystem® is a registered trademark of SCHOTT Instruments.

Ordering information AVS 370

ViscoSystem® AVS 370

The AVS 370 viscosity measuring system is made up of individual components, which have to be individually ordered. Please always ask for a detailed offer.

Description	Order No.
ViscoSystem® AVS 370 basic unit, housing incl. one ViscoPump II module and WinVisco 370 software, for optoelectronic scanning	**1056509**
ViscoSystem® AVS 370 basic unit, housing incl. one ViscoPump II module and WinVisco 370 software, for TC scanning	**1056515**
ViscoPump II module for optical scanning, VZ 8511	**1054306**
ViscoPump II module for TC scanning, VZ 8512	**1054304**

Accessories

Support table	**1057903**
Vacuum pump (230 V) Vacuum pump (115 V)	**1057901** **1057902**
Measuring stand AVS/S Measuring stand AVS/SK Measuring stand AVS/SK-CF Measuring stand AVS/SK-V	**28 541 0502** **28 541 0876** **28 541 0892** **28 541 0905**
Fixing frame Holder VZ 7191	**28 540 5043** **28 542 1968**

Ordering information AVS 470

ViscoSystem® AVS 470

The AVS 470 viscosity test station is composed of individual components, which must also be ordered separately. Please always request a detailed offer

Description	Order No.
ViscoSystem® AVS 470 basic unit, housing incl. one ViscoPump II module for opto-electronic sensing, Version: 95 V to 230 V/50-60 Hz	**28 541 5709**
ViscoSystem® AVS 470 basic unit, housing incl. one ViscoPump II module for TC sensing, Version: 95 V to 230 V/50-60 Hz	**28 541 5707**
ViscoPump II module for optical sensing, VZ 8511	**1054306**
ViscoPump II module for TC sensing, VZ 8512	**1054304**
Accessories	
Support table RS-232-C Data printer (230 V),TZ 3460 R	**1057903** **28 522 5608**
Vacuum pump (230 V) Vacuum pump (115 V)	**1057901** **1057902**
Measuring stand AVS/S Measuring stand AVS/SK Measuring stand AVS/SK-CF Measuring stand AVS/SK-V	**28 541 0502** **28 541 0876** **28 541 0892** **28 541 0905**
Fixing frame Holder VZ 7191	**28 540 5043** **28 542 1968**

Automatic viscosity measurement has been improved . . .

The AVSPro 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 provides maximum accuracy and reproducibility. Furthermore, working with the AVSPro is easy and even allows unsupervised 24-hour operation.

Particularly with time consuming measurement runs, the AVSPro 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.

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

The AVSPro 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. The main feature of the automatic unit is the three-axis positioning mechanism of the sample dosing system. The new X-Y-Z positioning mechanism allows parallel operation of up to eight 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 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

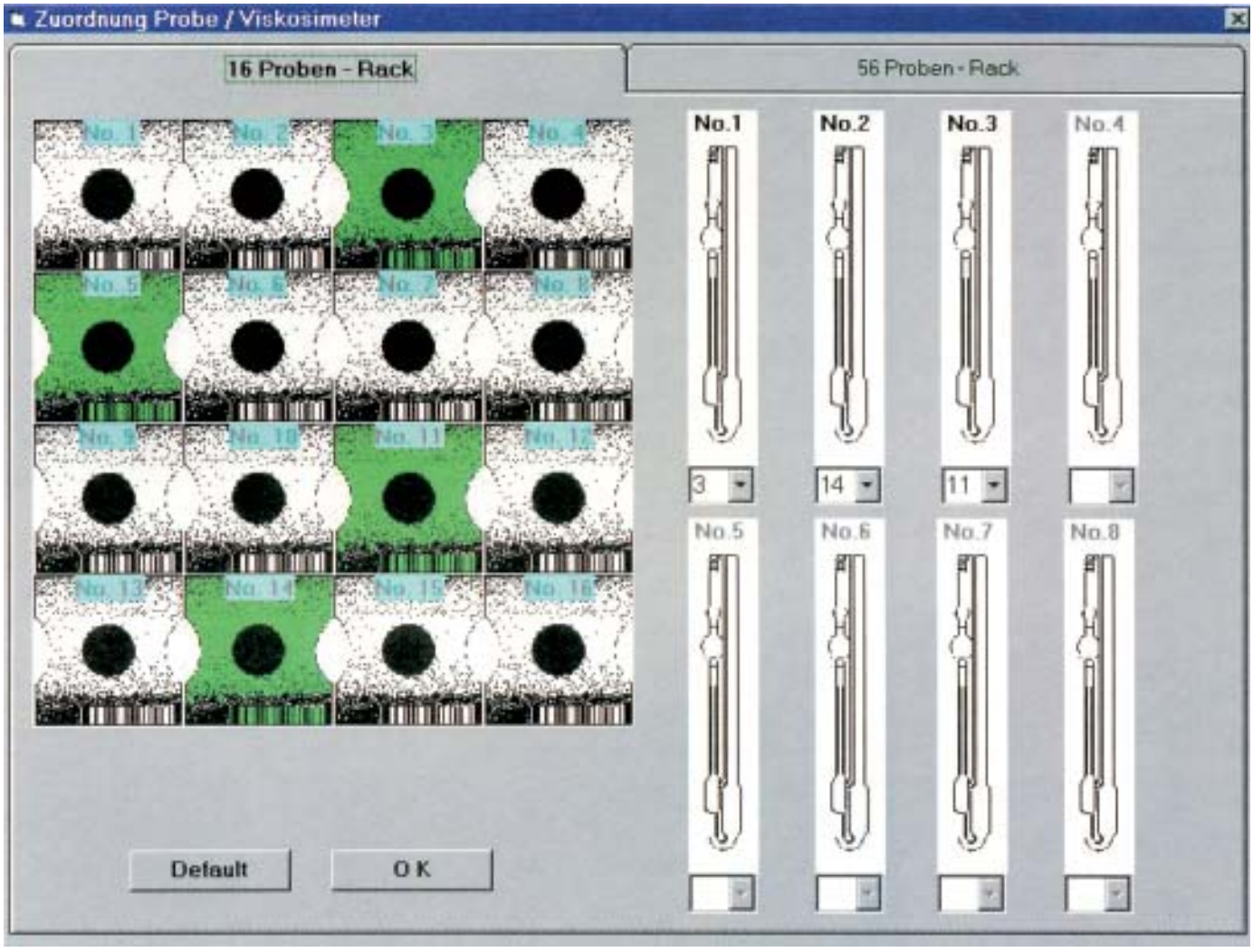
The electric sample lift ensures positioning of the samples in the rack at a convenient and easily monitored working height.

The AVSPro allows the operator to optionally select the sample sequence and which sample is to be filled into which viscometer. The dosing system operates without a valve and is thus suitable for nearly any type of sample. Utilization of reliable control components commonly used in the industry ensures a very high level of operating safety.

The AVSPro 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.

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 is . . .



Operating the new AVSPro 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 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 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.

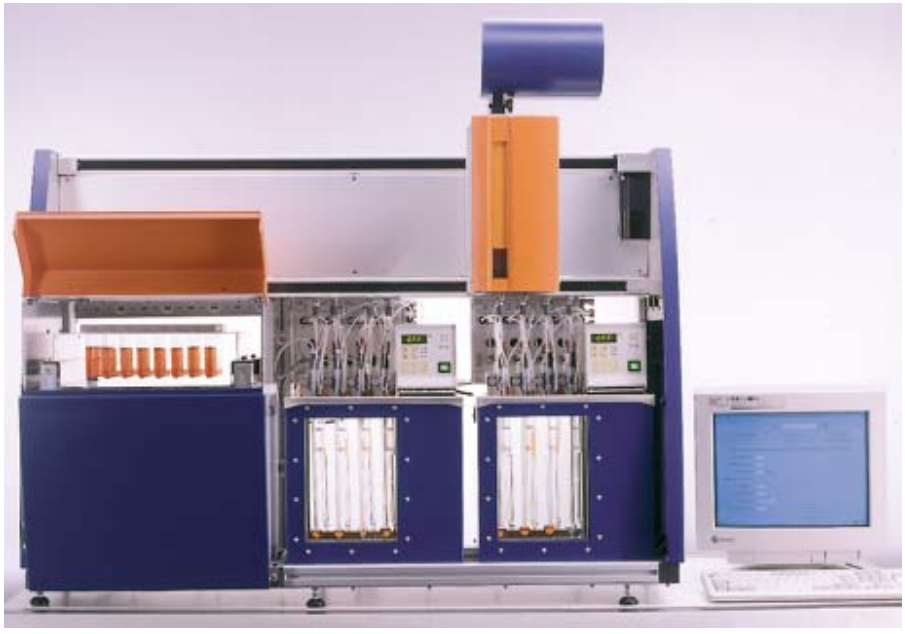
. . . easy, reliable and safe

The proved and tested AVSPro 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.

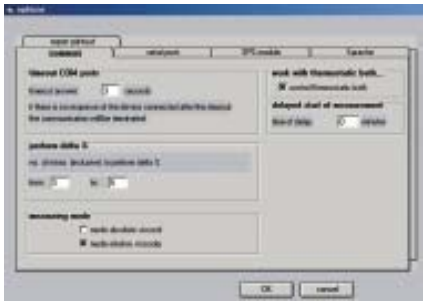
During the entire process, all of the parameters (depending on the menu level) and the respective status of the individual measuring positions, the temperature regulation system and the sample transfer system are either visible or can be selected.

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

The AVSPro is produced by a manufacturer that is certified in accordance with DIN/ISO 9001. For the manufacture of the AVSPro, environmentally critical materials were only used where utilization of alternative materials was impossible for technical reasons.

If requested, the AVSPro 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

Sampling system	
Sample bottles	100 ml screw-type and bottles with standard ground joint
	20 ml round bottom glass pieces (36 pcs. per rack)
Sample rack	for 100 ml screw-type and bottles with standard ground joint
	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
Sample identification	alphanumeric or optional bar code recorder
Data memory	by means of PC
Viscosity measurement range	0.35 to 1,200 mm^2/s (at room temperature of samples)
Time	to 9999.99 s, resolution = 0.01s
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
	TC Ubbelohde viscometer
	TC Micro-Ubbelohde viscometer

Measuring accuracy	± 0.01 % ± 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 = 1,100 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)

Transparent thermostats – CT series

High temperature constancy and visual observation

Transparent thermostats manufactured by SCHOTT Instruments have been specially designed to measure the viscosity of Newtonian liquids in capillary viscometers. They can be used for both manual measurements and, when used in connection with viscosity measuring equipment, for automatic measurements. The most important characteristics of the transparent thermostats are their ability to maintain a constant temperature and capability of visual observation of the flow of the fluid in the viscometer. The transparent thermostats of the series CT 53 and CT 54 are suitable for viscosity measurements in compliance with DIN 51 562 (Part 1) and ASTM D 445. They are comprised of a stainless steel bath with insulating glass, a coated steel casing and a bath thermostat. In addition, the CT 54 has an integrated discharge outlet on one side to drain the bath. An RS-232-C interface enables it to be connected to a PC.

The viscosity of Newtonian liquids is extremely dependent on temperature. Depending on the measurement medium, a deviation of 0.5 to 2% can be expected for a temperature deviation of 0.1 K. For this reason, the significant influence of temperature on the viscosity of a fluid must be taken into consideration when selecting a thermostat. All SCHOTT Instruments thermostats have the possible temperature stability of 0.01 K (see Technical Specifications) under optimum ambient conditions.

CT 52

The transparent thermostat CT 52 is made of acrylic glass and it is able to take up to two automatic measurement positions or brackets for manual measurements. Due to its design its ability to keep the temperature constant is not quite as great and it can only be used up to temperatures of + 60 °C. If temperature constancy is not a top priority, the CT 52 is a cost-effective alternative.

CT 53

This thermostat is for use with temperatures between +5 °C and +102 °C. Between +5 °C and +50 °C cooling is recommended to maintain the temperature constancy. Either a flowthrough cooler (e.g. CK 300, see Accessories) or simple cooling with circulated water can be used.

CT 53 HT

The high temperature version of the thermostats is used to measure viscosity at temperatures above +80 °C (see Technical specification).

2 or 4 measuring points

All CT 53 models enable the user to position 2 measurement stands or brackets into the thermostats. Up to 4 micro-TC viscometers can be positioned in the thermostats using the special VZ 7191 holder.

CT 53 TT

These thermostats have been specifically designed for use at temperatures well below room temperature. Viscosity measurements can be measured between -40 °C and +102 °C. For measurements under +5 °C, a cryostat is necessary to reach the low temperatures.

Transparent thermostats – CT series

CT 54

The main technical features of this thermostat are identical to those of the CT 53. The main differences are the number of measuring positions (the number doubles) and the additional discharge outlet to drain the bath. Up to 8 micro-TC-viscometers can be positioned in the thermostats if 2 special VZ 7191 holders are used.

Recommended temperature equalization fluids

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

The following applies to all temperature equalization fluids:
The viscosity of the temperature equalization fluid should be a max. 10 mm^2/s (cSt) bei 25 °C betragen.

Technical specifications	**CT 52**	**CT 53 TT****	**CT 53**	**CT 53 HT**	**CT 54**
Operating temperature	+10 ...+60 °C	-40 ...+102 °C	+5 ...+102 °C	+5 ...+150 °C	+5 ...+102 °C
Measurement points for AVS/S	2	2	2	2	4
Measurement points for TC	2	2	2	2	4
Measurement points Micro-TC	2	4*	4*	4*	8*
Temperature constancy in compliance with DIN 58 966 at 25 °C	± 0.02 K	± 0.01 K	± 0.01 K	± 0.01 K	± 0.01 K
Dimensions (W x H x D in mm)	355 x 370 x 250	355 x 370 x 250	355 x 370 x 250	355 x 370x 250	605 x 370 x 250
Volume	18 l	15 l	15 l	15 l	27 l
Weight (empty)	approx. 5 kg	approx. 13.5 kg	approx. 13.5 kg	approx. 13.7 kg	approx. 28 kg

When using in the normal temperature range it is necessary to cool the system (+5 °C to approx. +50 °C) to maintain the temperature constancy. This can be achieved either by using circulated water or a flow-through cooler (e.g. CK300).

** When using with 4 or 8 micro-TC-viscometers, a special holder (Type: VZ 7191) is required for two of the existing measurement positions.*
*** When using at very low temperatures (well below room temperature) a cryostat is required. Cryostats can be included in delivery (at the list price of the manufacturer).*

Accessories

Flow-through cooler CK300

The fluor-hydro-carbon gas free flow-through cooler serves to mechanically cool the bath fluid and is filled with environment compatible coolant R 134a. It works at ambient temperatures between +5 and +50 °C. Refrigeration power is 300 W at 20 °C. The CK300 is very compact (200 x 430 x 300 mm (W x H x D) and very stable (approx. 25 kg).

The flow-through cooler is available for all standard international voltage and frequency ranges (230 V, 50 Hz; 115 V, 60 Hz). Other voltage and frequency combinations are only available upon request as special productions.

AVS-Measurement stands

For the use of capillary viscometers for opto-electronic measurement recording.

Type no.: AVS/S	Metal measurement stand, preferably for non-aqueous bath fluids	For use with temp. range: -80 ...+80 °C
Type no.: AVS/SK	PVDF measurement stand, corrosion free, suitable for both aqueous and non-aqueous bath fluids	For use with temp. range: 0 ...+80 °C
Type no.: AVS/SK-CF	PVDF measurement stand specially for use of Cannon-Fenske-Routine viscometers	For use with temp. range: 0 ...+80 °C
Type no.: AVS/SK-V	PVDF measurement stand specially for the use of dilution viscometers	For use with temp. range: 0 ...+80 °C
Dimensions	90 x 90 x 460 mm (W x D x H)	
Weight	approx. 1.1 kg	

We reserve the right to make technical changes.

Innovative electrochemistry, innovative viscometry – from the very beginning.

The success story of electrochemical measurement began more than 65 years ago with the development of the glass electrode at SCHOTT.

It is hard to imagine – but in 1936 SCHOTT revolutionized the area of chemical measurements with a glass electrode that looks more like a glass bulb to our modern eyes. Glass electrodes made of the newly created, electrically conductive pH glass were developed at the *Jena*^{er} *Glaswerk SCHOTT & Gen.*, thus making it possible to achieve "sufficient accuracy" for pH measurements "with conventional pointer-type galvanometers".

In 1938 our first small brochure described how this was achieved. The development was based on the experience which we had gained from close co-operation with pioneer users in the industry.

The new measurement method had to be explained: in 1938 we published our first instructions for electrochemical pH measurement and potentiometric titration.

Glass know-how was also the idea behind another measurement process that we pioneered in 1940: capillary viscometry. With precisely calibrated glass capillaries it was possible to determine the viscosity of Newtonian liquids more accurately than with any other method known at that time. You only need to measure the time required for a liquid sample to flow through a calibrated capillary with a defined constant. Then the required time was measured with a stopwatch. We have changed that.

*Thorough quality control checking is an essential element from start to finish. The zero point and response time of **every** electrode is checked – as shown here with a batch of BlueLine laboratory electrodes.*

The success story of our meters began in the seventies

In addition to our pH electrodes and viscometers, advances in the field of microelectronics in the seventies paved the way for the development of our first measurement instruments.

To enable us to react faster and more flexible to our customer needs SCHOTT Geräte GmbH was established in 1973 as a separate company. Our newly developed electronic instruments – such as laboratory meters, pH meters or the automatic viscosity measurement system AVS - caused a sensation and rapidly conquered their respective markets.

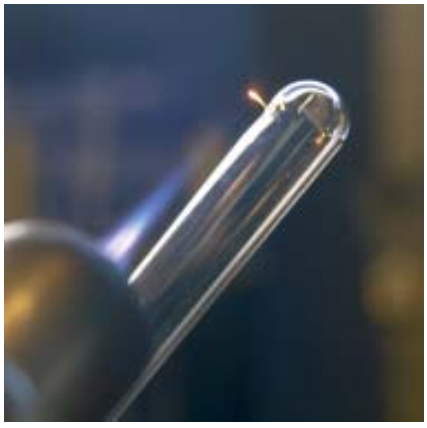
Our first microprocessor-controlled piston burette and our titration systems were a small sensation in the industry. Our inexpensive, portable, pocket-size pH meters and conductivity meters were an instant success. In 1988, SCHOTT Geräte presented the first PC-supported titration system.

In recent years SCHOTT Geräte GmbH has repeatedly demonstrated its remarkable powers of innovation. With new electrodes, such as the NH_3 electrode, the new SILAMID reference system, new multi-functional electrodes, the SMEK plug system, the complete BlueLine laboratory electrode program, the new Type A pH glass, the SteamLine electrodes for CIP and SIP applications and the ScienceLine range of products, we have provided new impulses for electrochemistry.

Our innovative AVS products have also made life much easier for our customers who need to measure viscosity. Examples include the practical ViscoClock, the AVSPro, an apparatus for automatic viscosity measurements that is top-of-the-line worldwide, or the lat-

A customer satisfaction center. In our application laboratory, for example, new methods can be developed for our customers or the suitability of existing methods for new applications can be tested.

est modular measurement systems AVS 370 and AVS 470. And of course we also develop the software for our measurement systems – and not just the hardware.



Even today glass blowing talent is still indispensable.

This is also true of our most recent developments in the area of titration equipment, where we have set new standards for top-of-the-line equipment with the TitroLine alpha *plus* titrator, the T110 *plus* piston burette and the TW alpha *plus* sample changer, as well as the new titration software TitriSoft 2.5.

The success story continues - SCHOTT Geräte has become SCHOTT Instruments and is now even more international.

In October 2003 SCHOTT Geräte GmbH transferred to SCHOTT Instruments GmbH and became part of the Nova Analytics group of companies. This was a logical step for us – because although our historical roots lie in the area of glass manufacturing, our core competence has long since been measurement technology for the laboratory and production industry. Our relationship with the affiliated companies within the Nova Analytics Group will result in synergy effects that will benefit our customers and distributors worldwide. In particular, it will be possible to improve service and logistics in America and Asia even further.

Our buffer solutions are hermetically sealed in double-pointed ampules and sterilized with superheated steam. You can rest assured that you will always have a reliable buffer solution on hand for calibration.

Each viscometer is calibrated and given an ID number and a certificate with its specific characteristics.

More than 65 years of research and development and a long-standing tradition

The list of our innovations is long: today our electrodes are smaller, more precise, faster and more stable; our measurement equipment offers incomparably higher performance. Over the years the electrochemical measurement methods and the viscometry that we initiated have established themselves as problem-free and reliable methods throughout the world, and they have become indispensable for an incredibly varied range of applications.

Nevertheless, since our pioneering days, one thing has invariably remained the same – our tradition of working very closely together with those who use our products in order to create something new. We intend to remain true to this tradition in the future.

Everything O.K. A batch of TITRONIC® basic piston burettes after final inspection

Just a brief excerpt from our company's history

Since 1936 – new impulses from research and development time and time again

1936 Beginning of development and production of pH glass electrodes at *Jena*er *Glaswerk SCHOTT & Gen.* in Jena.

1940 Beginning of viscometer production using capillaries that were manufactured in accordance with the calibrated precision glass method that SCHOTT had developed.

1952 Development and production of the first gel-filled, low-maintenance reference electrodes.

1962 The unique platinum diaphragm makes substantially faster response times possible, among other things.

1964 Double electrolyte system for reference electrodes.

1970 Introduction of semiconductor preamplifiers for pH measurement technology.

1972 Buffer solutions in double-pointed ampules sterilized with superheated steam guarantee reliable calibration – even after several years in storage.

1972 Plug system from SCHOTT, copied time and again.

1973 SCHOTT Geräte GmbH established as an independant company.

1973 Beginning of viscometer calibration using PTB tested reference measurement standards. (German Physical Technical Institute)

1974 Development and production of electronic laboratory pH meters.

1975 Market launch of the first automatic viscosity measurement apparatus for aggressive and corrosive solvents (AVS/G and AVS/PA).

1977 Development and production of portable electronic pH meters.

1978 Production start for the first titration control unit TR 155 and the T 100 piston burette with exchange unit.

1982 The first microprocessor-controlled viscosity measurement apparatus (AVS 300).

1983 Development of the new Type S pH glass for hot alkaline solutions with extraordinarily high reliability and useful life, and Type H pH glass, robust and small alkali error.

1984 Combination measurement and reference pH electrode with integrated Pt 1000 as standard.

- SCHOTT Geräte presents the first thermal scanning method for viscosity measurement.
- The first stand-alone viscosity measurement apparatus with integrated computing function (AVS 400 and AVS 440) are introduced on the market.
- Compact T 80/T 90 piston burettes and simple control unit TR 85.

1988 Presentation of the first PC-controlled titration system TPC 2000 at the Achema 1988.

1989 With the AVS 500, the tradition of successful automatic samplers for determination of the viscosity of aggressive polymer solutions was continued.

1990 REFERID® electrodes with polymer electrolyte, low-maintenance

1991 Low-impedance Type L pH glass for low temperatures and ultrapure water.

- Automatic sampler TW 280

1992 TT electrodes, capable of withstanding up to -60 °C

- T 200 and T 110 piston burettes and universal titration control unit TC 1200

1993 Combination pH electrodes with temperature sensor, plastic shaft

1994 Compact TitroLine alpha titrator

1995 SILAMID®, potential-stable reference system.

- First Windows titration software TitriSoft 1.0 (WIN 3.1)

1996 New SMEK 6-pin plug system, shielded

1997 New BlueLine range of laboratory electrodes and VP plug system

- Electrodes with certified pressure and temperature range
- Market launch of the Visco-Clock for capillary viscosity measurement.

1998 Development of TitriSoft 2.0 software (as of WIN 95)

1999 Range of industrial electrodes up to 10 bar and 135 °C, SMEK plug system in IP68 version

- New Type A pH glass, rapid reaction in drinking water
- Market launch of the fully automatic AVSPro viscosity measurement system for high sample throughput.

2000 Introduction of a completely new series of compact, simple piston burettes and titrators: TITRONIC® basic, TITRONIC® universal and TitroLine easy

- Introduction of the Karl Fischer titration system TitroLine KF.

2001 Development and production of SteamLine process electrodes for CIP and SIP applications in the pharmaceutical, food and chemical sectors.

2002 Sales launch of newly developed "*plus*" product line: TitroLine alpha *plus*, T 110 *plus*,

- Introduction of TW alpha *plus* sample changer
- Market launch of TitriSoft 2.5 software

2003 The compact and highly flexible AVS 370 viscosity measurement system is presented to the market.

- Change of company name to SCHOTT Instruments GmbH, Mainz, integration into the internationally active Nova Analytics Group

2004 Amalgamation and further development of the laboratory electrode product range for the most exacting requirements in the "ScienceLine" product line

- The new generation of automatic viscosity measurement systems is rounded off with the AVS 470.

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A Nova Analytics Company NOVA ANALYTICS

55063 e gl/ toc 0105 12.0 Printed in Germany