SI Analytics

Laboratory Products Catalog

xylem

Laboratory Products

CATALOG

SI Analytics

a xylem brand

Welcome to SI Analytics!

With this new catalogue we are offering a broader selection of our laboratory products: The catalogue covers the product areas of electrochemical meters and electrodes, titrators, spectrophotometers as well as our extensive range of viscometry products – including capillary glass viscometers and viscosity measurement systems.

Electrochemical measuring methods and capillary viscometry are two areas of technology 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 new products and technology. We would like to draw your attention to our latest developments, which you will come across in nearly all product sections.

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 SI Analytics 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.

SI Analytics GmbH

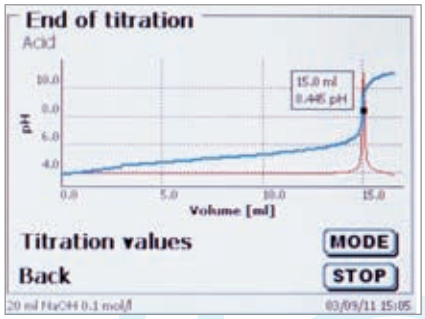
Dr. Robert Reining

Managing Director

Content

Please contact your dealer or consult our website for more products.

NEW: The titrator series TitroLine® and the piston burette TITRONIC® 500

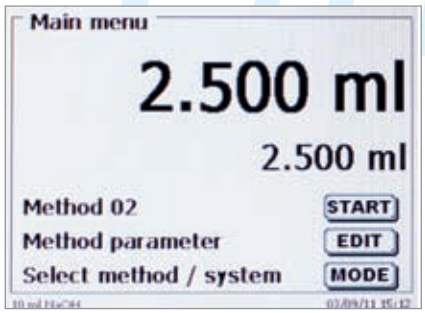


TITRONIC® 500

- Intelligent inter-changeable modules with 5, 10, 20 and 50 ml volume capacity.
- Connect to a printer and/or an analytical balance.
- Remote control access via RS232 or USB interface.

More on pages 120–121

NEW: TitroLine® 6 000 / 7000 titrators



TitroLine® 6000/7000

- High visibility, full color display that can be easily viewed from a distance and at extreme angles.
- Versatile and flexible for a variety of applications.

More on pages 122 to 125.

NEW: TitroLine® 7500 KF and 7500 KF *trace*

KF titrators

TitroLine® 7500 KF

- Beside the features which are mentioned in the general part of the titration family, the TitroLine® 7500 KF offers more performance
- The volumetric generalist for a wide range of use.
- With standard methods for different applications (titer determination, blank value…).
- With intelligent interchangeable modules.

TitroLine® 7500 KF *trace*

- Coulometric KF titrator for determining even smallest water contents.
- Easiest handling: Determination of concentration (titrant) of the titration solution is obsolete.

More on pages 130–133.

NEW: Sample changer TW 7400

TW 7400 with 72 sample rack

TW 7400

- Developed for high sample throughput.
- Controlling from PC or titrator TitroLine® 7000.
- Very quick and simple to change sample racks and titrator heads.

Content Meters

Laboratory Meters Lab and ProLab Series: A standard for electrochemical measurements

SI Analytics measurement systems consisting of electrodes and meters

Our Electrodes are used by professionals in laboratories all over the world. This comes as no surprise as we have been involved in the development, optimization and production of electrodes for more than 75 years. Our customers benefit from our expertise in glass composition and manufacture. What began with the patent on the pH electrode, has grown into an extensive range of products including several hundred electrodes designed to meet standard and special applications. Whether it is wastewater, varnish or wine, we have the appropriate electrode to meet our customers' requirements.

Only the optimal interaction between electrode, calibration and meter allows precise measurements. Consequently the challenge was to develop meters optimized to our electrodes and buffer solutions.

The result

The pH, ISE, conductivity and multi parameter measuring instruments from SI Analytics are setting standards for electrochemical measurment technology. Along with our premium electrodes and buffer solutions these instruments guarantee an ideal measurement result – fast, convenient and precise.

ProLab 2000

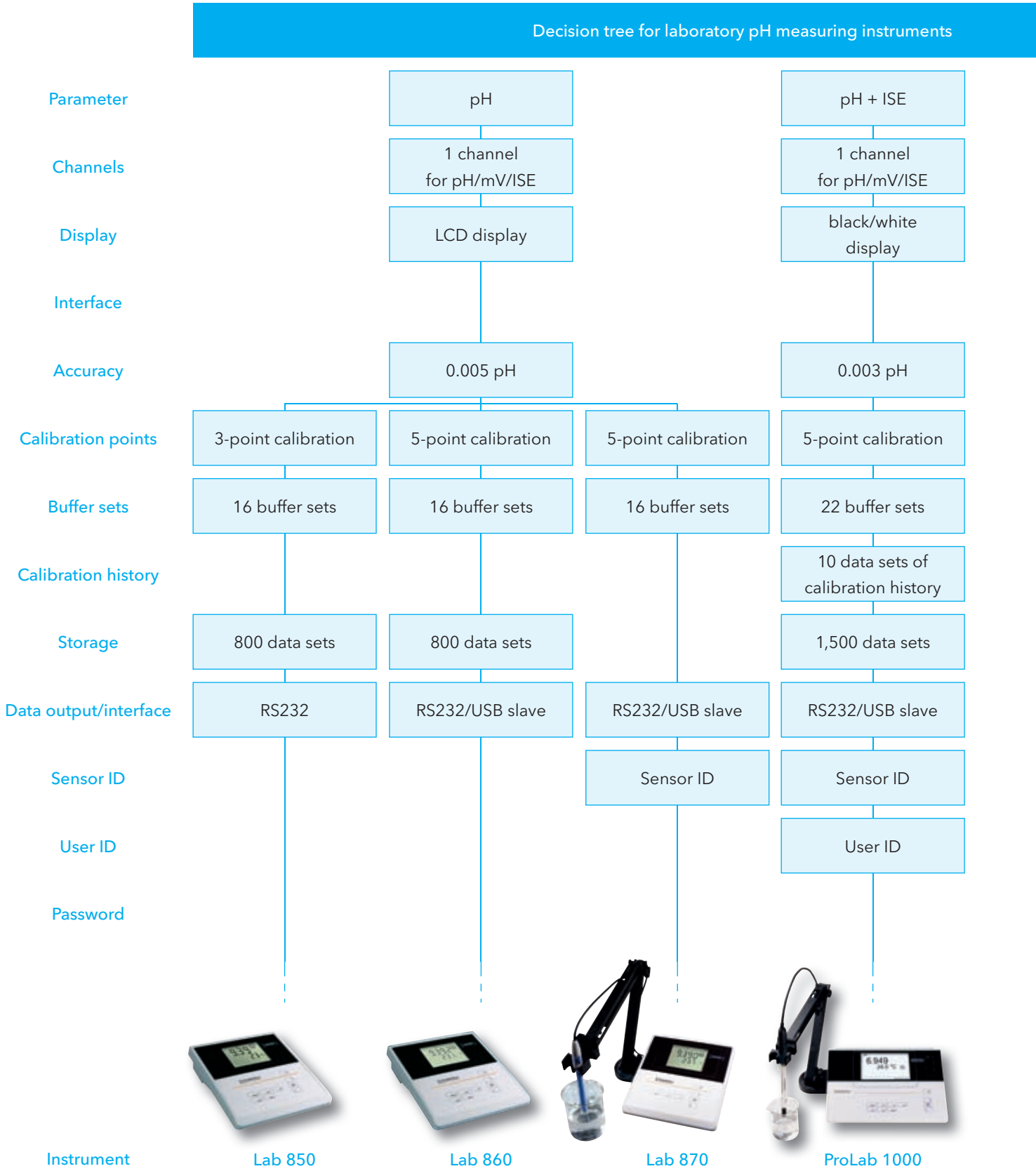
ProLab 3000

Lab 860

Performance Overview	Lab 850	Lab 860	Lab 870	Lab 960	Lab 970	ProLab 1000	ProLab 2000	ProLab 3000	ProLab 4000
Measuring Parameters & Special Functions (page)	8	8	8	10	10	12	14	16	20
pH	■	■	■			■	■	■	■
Dead Stop function						■			
2-channel pH measuring (galvanically separated)								■	■
16 pre-programmed pH buffer sets	■	■	■						
22 pre-programmed pH buffer sets						■	■	■	■
Automatic buffer recognition and display	■	■	■			■	■	■	■
pH calibration points max.	3	5	5			5	5	5	5
VariCal: manual calibration with selected buffer								■	■
mV	■	■	■			■	■	■	■
mV differential measurement								■	■
2-channel mV- (galvanically separated)								■	■
ISE						■	■	■	■
Control of external burettes in ISE measuring mode								■	■
Conductivity				■	■		■		■
D.O.							■		
Temperature - simultaneous display	■	■	■	■	■	■	■	■	■
GLP and User Convenience									
Automatic recognition of ID sensors			■		■	■	■	■	■
Automatic user recognition with electronic ID card						■	■	■	■
Additional password entry with user recognition								■	■
CalClock - at a glance: sensor evaluation and calibration timer	■	■	■	■	■	■	■	■	■
Selectable calibration interval	■	■	■	■	■	■	■	■	■
Display of actual calibration data incl. date/time	■	■	■	■	■	■	■	■	■
Display of calibration history (10 data sets) incl. date/time						■	■	■	■
Measuring with stability control	■	■	■	■	■	■	■	■	■
Display accuracy of measuring value adjustable	■	■	■	■	■	■	■	■	■
Display	LCD	LCD	LCD	LCD	LCD	black/ white graphic	black/ white graphic	colour graphic	colour graphic
Windows® user surface with optional mouse operation								■	■
Recorder function (display of measuring sequences over display)								■	■
Tactile response as well as optical and acoustical signal	■	■	■	■	■	■	■	■	■
Numerical keypad with12 keys								■	■
Data storage	■	■		■		■	■	■	■
USB (slave) and RS232 interface	RS232 only	■	■	■	■	■	■	■	■
USB host interface: plug and play connection of USB hub, USB printer, USB memory, keyboard, mouse, USB stick								■	■
Quality and Service									
Complete instrument kits: • instrument with cover, universal power supply unit and stand • set additionally with electrode and buffer	■	■	■	■	■	■	■	■	■
IQ/OQ documents available	■	■	■	■	■	■	■	■	■
3 year warranty	■	■	■	■	■	■	■	■	■

Decision tree

Laboratory measuring instruments Lab and ProLab series:



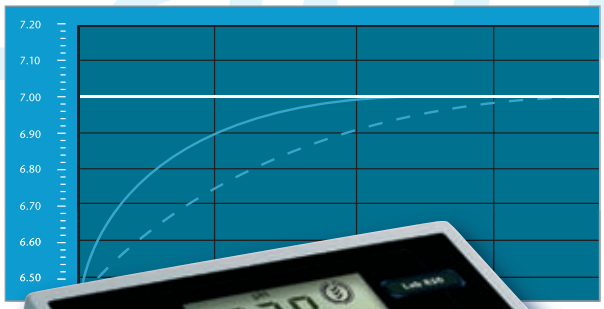
Decision tree for laboratory conductivity instruments

ProLab 2000	ProLab 3000	ProLab 4000	Lab 960	Lab 970
pH + ISE + conductivity + oxygen	pH + ISE	pH + ISE + conductivity	conductivity	
1 channel for pH/mV/ISE	2 channels for pH/mV/ISE	2 channels for pH/mV/ISE	1 channel	
black/white display	color display	color display	LCD display	
	Windows® User Interface	Windows® User Interface		
0.003 pH	0.002 pH	0.002 pH		
5-point calibration	5-point calibration	5-point calibration		
22 buffer sets	22 buffer sets	22 buffer sets		
10 data sets of calibration history	10 data sets of calibration history	10 data sets of calibration history		
1,500 data sets	> 10,000 data sets	> 10,000 data sets	800 data sets	
RS232/USB slave	RS232/USB host and slave	RS232/USB host and slave	RS232/USB	RS232/USB
Sensor ID	Sensor ID	Sensor ID		Sensor ID
User ID	User ID	User ID		
	Password protection	Password protection		

Measuring pH with the Lab 8xx series

pH Meter Lab 850

The new standard in the beginners' class



Quality saves time

All meters from the Lab 8xx series feature our advanced measuring algorithm specially adapted to our electrodes. The result is a calibration and measurement with exceptional precision – but in much shorter time!

Keeping reliability in view: The CalClock...

This unique combination of sensor evaluation and calibration timer control all relevant calibration settings. The sensor evaluation shows the electrode quality. The quality criteria are slope, zero point and reaction time. The preset calibration interval is displayed as a countdown in 6 steps.

New: data back-up and transfer capability:

RS232 interface and memory for 800 data sets provide convenient GLP.

CalClock

Lab 860: USB and RS232 interfaces

pH Meter Lab 860

Communication for fast documentation

Direct data transmission

All instruments with data transmission function are provided with a conventional RS232 plus a USB PC interface. No adapter is required.

New: 5-point calibration:

For more accuracy in pH measurement

pH Meter Lab 870

Laboratory practice improved – GLP with our measurement systems

Automatic sensor recognition

A quality control dream: An instrument that automatically recognizes the electrode. Sensors with distinct identification wirelessly send the data to the instrument. Incorrect measurements are avoided.

Wireless sensor recognition

Special stand S4D

- **Reliable and precise results** with our instruments, electrodes and buffer solutions.
- **"CalClock"** combines sensor recognition and calibration timer on the display.
- **Simple GLP compliant documentation** through perfect communication via USB (slave) and RS232 (Lab 850: only RS232).
- **Measurement and calibration security** through wireless sensor recognition (Lab 870): ID electrodes and meters with automatic identification and data exchange.
- **Instrument Kits**
  - Instrument
  - Electrode with integrated temperature sensor
  - Buffer solutions
  - Stand
  - Universal power supply unit
  - Cover

Advantages Lab 8xx

Determining Conductivity: Lab 9xx

Conductivity Meter Lab 960

GLP documentation at the highest

Dual interface included

Both RS232 and USB are integrated in the Lab 960. No adapter is required.

Reliable documentation

All GLP compliant calibration protocols and up to 800 stored data sets with time and identification can be recalled.

```
14.03.2012 08:53:54
Lab 960   02320025

CALIBRATION COND
Cal Time      :    14.03.2012 08:22:14
Cal Interval:  180d
Cal Std.:   0.01 mol/l KCL
            40.0 °C
Conduct./Tref25: 1413µS/cm
Cell Const :  0.650   1/cm
Probe :     +++
```

Calibration protocol

USB and RS232 interfaces

Instruments Kits

Conductivity Meter Lab 970

Laboratory practice at its best – GLP with SI Analytics measurement systems

Automatic electrode recognition

Ideally suited for measurements according to USP 28: The latest technology enables storage of the calibration data in the sensor. For each measurement the sensor logs in with its ID (type and serial no.). The transfer of the calibration data ensures the use of the correct sensor characteristics for calculation of the measuring value.

Direct data transmission

The Lab 970 sends the data directly via USB or RS232 to PC (no storing function). The instrument is therefore very easy to handle and can be integrated into automized systems such as a LIMS system. Extensive administrator levels are not necessary.

Service taken serious

For the Lab 970 also the complete IQ/OQ documentation is available.

Wireless sensor recognition

Advantages Lab 9xx

- **Reliable and precise results** with our lab instruments, conductivity cells and standard solutions.
- **Fast and easy GLP compliant documentation** through perfect communication via USB (slave) and RS232.
- **Complete support** including IQ/OQ documentation and qualified service.
- **Measurement and calibration security** through wireless sensor recognition (Lab 970): ID electrodes and meters with automatic identification and data exchange.
- **Instrument Kits**
  - Instrument
  - Conductivity cell
  - Conductivity testing solution
  - Stand
  - Universal power supply unit
  - Cover

ProLab 1000: pH for the professional

pH Meter ProLab 1000:

Superior performance in a sophisticated package

Precise measurements

With a measurement range of -2.000 up to +20.000 pH and an accuracy of 0.003 pH the ProLab is well suited for demanding measurements in research and process control.

Reproducible results

The automatic calibration with up to 5 points and the automatic buffer recognition from more than 16 selectable buffer sets guarantee reliable results.

User recognition with electronic ID card

Utmost reliability

The wireless sensor recognition and user identification allows a user name to be assigned to each measured value. ProLab 1000 also complies with further requirements, e.g. user levels allowing to allocate administrator rights or user identification via an electronic ID card.

New: Integrated ISE measurement

With a measurement range of 0.000 to 999,999 mg/l and a 2- to 5-point calibration and with standards from 0.000 to 500,000 mg/l.

Direct data transmission

RS232 and USB interfaces are integrated into the ProLab 1000. No adapter is required.

The integrated dead stop function allows for manual titration tasks. (wine industry, food industry).

Documentation complying with GLP

The calibration protocols comply with GLP as well as date and time and identification of up to 1,500 data entries. Data storage is conform to 21 CFR part 11 structurized into hierarchy levels with user identification.

Dead stop connection

USB and RS232 interfaces

Wireless sensor recognition

- **Highest safety level with measurements and calibration through:**
  - **automized user identification**
    user recognition with electronic ID card through transponder technology.
  - **wireless sensor recognition**
    ID electrodes and measuring instrument with automatic identification and data exchange.
- **High-precision and reliable measuring values**
  through perfect matching with the measuring system.
- **Fast and easy documentation complying with GLP**
  through perfect communication via USB (slave) and RS232
- **Scope of delivery, set**
  - Measuring instrument
  - Electrode with integrated temperature sensor
  - Buffer solutions
  - Stand
  - Universal power supply unit
  - Cover

Advantages ProLab 1000

ProLab 2000: the multi-talented …

Multi-parameter instrument ProLab 2000:

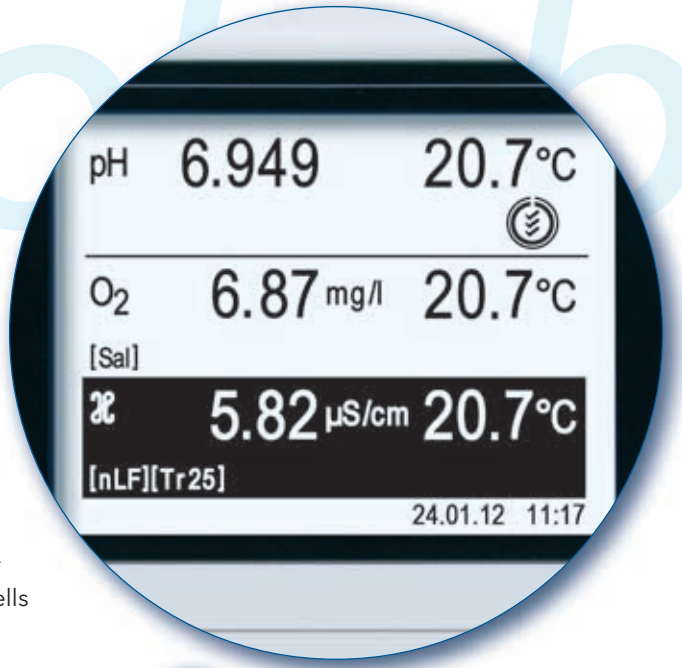
One for all

Versatile

The ProLab 2000 is a true all-rounder. pH, ISE, conductivity and D.O. measurements are integrated in a single instrument. Up to 4 parameters can be measured simultaneously and displayed in the graphic display. The parameters are selected via menu.

Professional

With a measuring range from -2.000 to +20.000 pH and an accuracy of 0.003 pH, the ProLab 2000 is especially suited for applications in research and development. The automatic pH and ISE calibration at up to 5 points guarantees reliable measurements. The galvanic D.O. sensor and conductivity measuring cells widen the functions for most applications.



User recognition with electronic ID card

Innovative – Sensors are automatically recognized

The latest microtechnology enables storage of calibration data in the individual sensor. Upon connection the sensor logs in with its ID (type and serial no.), and by transmitting its specific data assures a correct measurement. The sensors are identified unmistakably via a shielded, short-range radio connection. No input is needed. Even two sensors side by side can be individually identified.

pH combination electrode A 161 … ID

Combined conductivity cell and D.O. sensor LFOX 1400 ID

Measurement and calibration security:

- **automatic user identification**
  with electronic ID card through transponder technology.
- **wireless sensor recognition**
  ID electrodes and measuring instrument with automatic identification and data exchange.

High-precision and reliable measurement of
pH, ISE, conductivity and oxygen with SI Analytics measurement systems and sensors.

Reliability at a glance with „CalClock"
Sensor evaluation and calibration timer combined.

Instrument Kits

- Instrument
- Electrodes with integrated temperature sensor
- Buffer solutions
- Stand
- Universal power supply
- Cover

Advantages ProLab 2000

ProLab 3000: measure pH with “Windows®” like ease

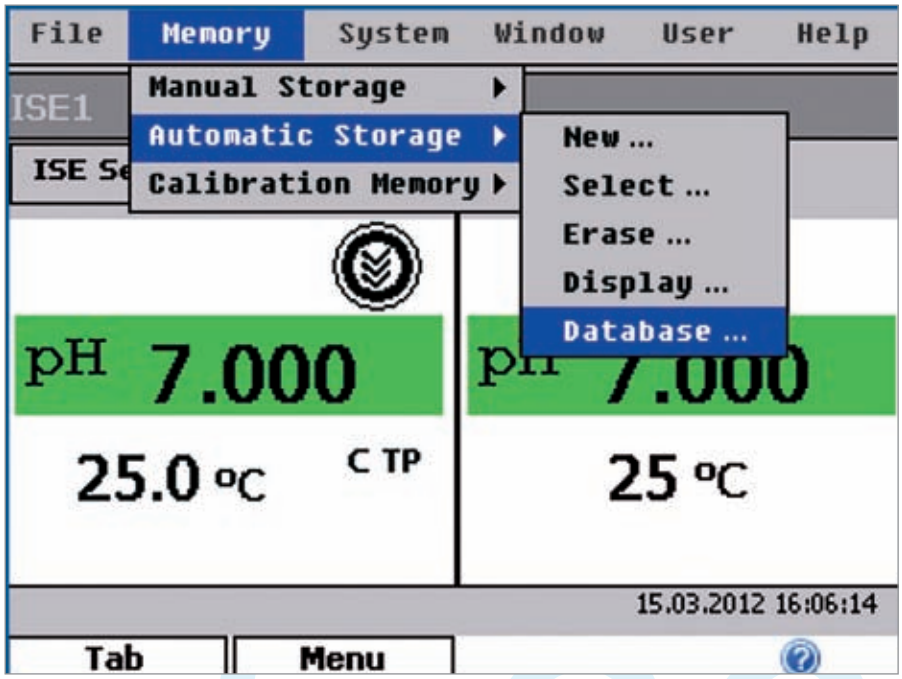
High end pH/ION meter ProLab 3000:

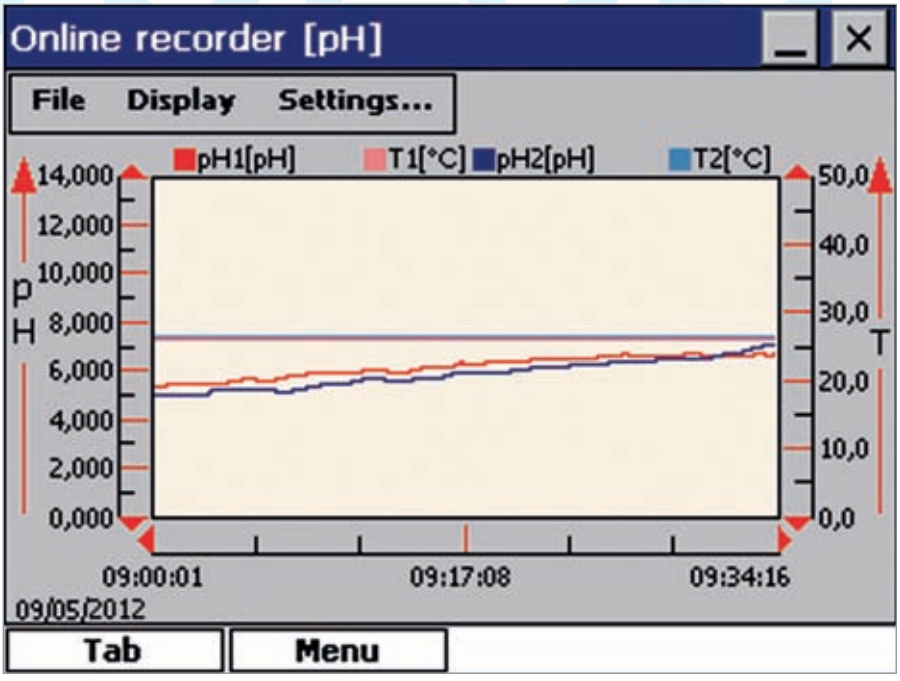
Operate it like “Windows®”

The menu structure which is similar to Windows® can be operated just like a PC via the menu keys on the instrument or by using the mouse, which is part of the kit. For example the entry of text and numbers can be carried out either by using the numeric keypad or an external keyboard.

New: control of a burette

Reliable and convenient dosing of ISE/TISAB solutions or standards with the ProLab 3000 in ISE measurement mode by controlling the TITRONIC® *universal*/110*plus*/500 burettes.





Flexible display and brilliant color graphics

The color graphic display (320 x 240 pixels) is backlit for high resolution and gives good readability even from the side from a distance of 2 to 3 meters. The display can easily be switched to full display of a measuring channel or multiple display of different measurement parameters (pH, mV, ISE). Another option is the completely flexible setting of the "recorder" display regarding the measurement sequences of all parameters versus time.

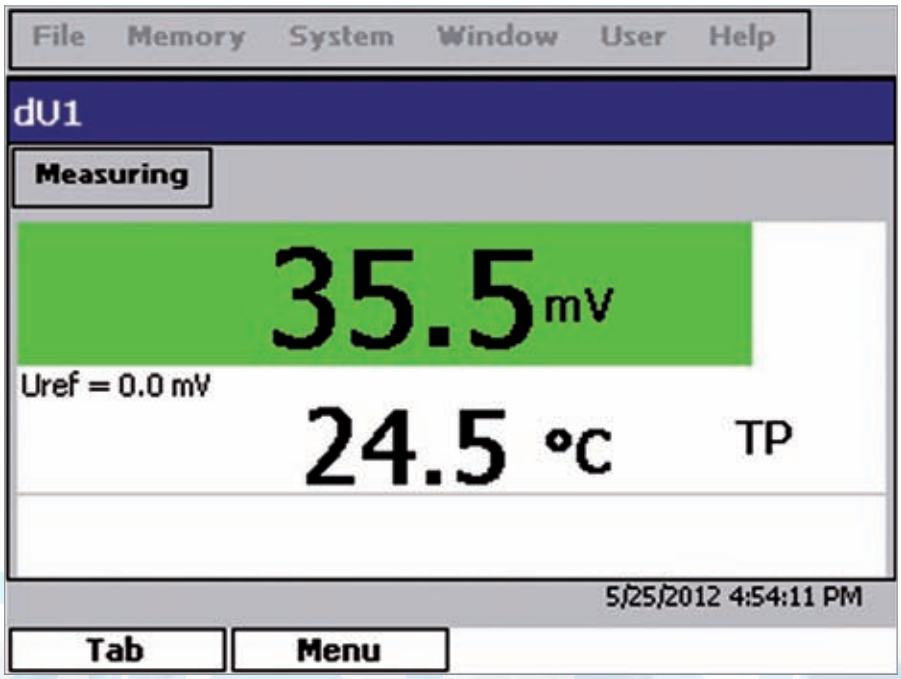
Plug and Play

Easy connection of peripheral devices with automatic recognition – no configuration required. The integrated USB host, USB slave and RS232 interfaces enable the instrument to communicate with mouse, printer and barcode reader. Even parallel operation is possible when a hub is connected to the USB host.

ProLab 3000:
pH measurement like with a personal computer

Differential measurement made easy

Two galvanically separated pH ports allow simultaneous measurement of two pH sensors, even in the same vessel without causing any interference – with our ID electrodes providing automatic sensor recognition. On each pH channel a differential measurement versus a reference value is possible.



GLP through-out

User recognition with electronic ID card including password entry

The automatic user recognition via transponder pendant enables access control and allocation of measurement values, calibrations etc. for each user. Each user is automatically and fully documented at time of use. The security guaranteed through the access control is further increased by the password protection.

Sensor recognition – wireless and automatic

The ID electrodes send their specific data wireless to the ProLab 3000 and 4000. Therefore, the instruments uses the correct calibration for the electrode and errors are eliminated even when using both measurement channels.

The ProLab user specific display automatically adapts to the ID sensor and activates only the necessary and admissible operation structures - this guarantees a higher usage convenience through increased transparency.

Measurement and calibration security:
- **automatic user identification**
  with electronic ID card, transponder technology and password entry
- **wireless sensor recognition**
  ID electrodes and instrument with automatic identification and data exchange

Measuring pH, mV, ISE – high precision with many special functions:
- 2-channel pH/mV measurement (galvanically separated)
- differential measurement
- professional ISE measuring with various addition/subtraction proceedures incl. control of TITRONIC® *universal*/110plus/500 burettes.

Operation via mouse or keyboard like with a PC
familiar menu structures and clear menu navigation

Plug and play by state of the art technology

Instruments sets
- Instrument (incl. mouse)
- Electrode with integrated temperature sensor
- Buffer solutions
- Stand
- Universal power supply
- Cover

Advantages ProLab 3000

ProLab 4000: now add Conductivity...

ProLab 4000: Advanced pH/ION/Conductivity meter

pH, ISE and conductivity in one sophisticated meter

The ProLab 3000 – taken to the next level

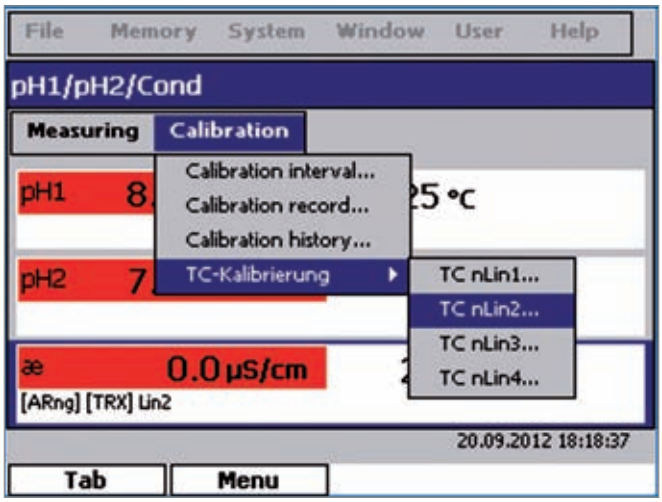
The ProLab 4000 offers the high-quality measurement technology similar to the ProLab 3000 with the addition of conductivity measurement capability: Measurement range from 0.000 µS/cm to 2000 mS/cm, TDS and salinity measurement as well as various functions for temperature compensation and selectable cell constant set the standard for performance. The ProLab 4000 offers even more …

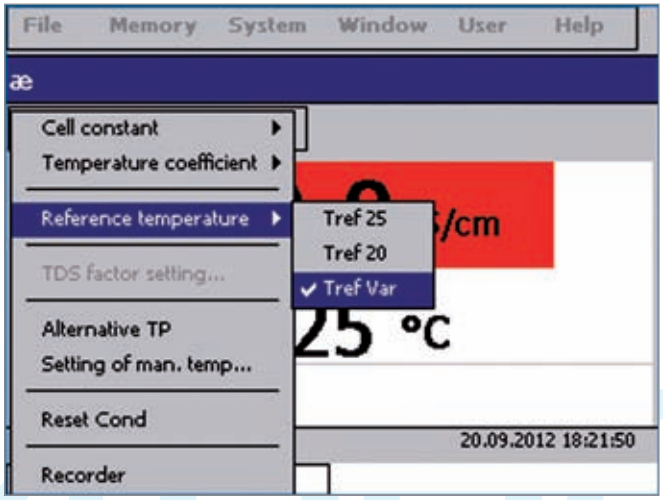
Special functions for determine the dependency of conductivity with regard to temperature or concentration

The conductivity of aqueous solutions effected by to temperature and concentration of dissolved substances. For comparing measurement values, which were determined at different temperatures, all values have to be recalculated to the same reference temperature. Both common procedures linear and non-linear compensation (acc. to EN 27888) should only be applied with diluted solutions, otherwise the concentration dependency can be masked. Furthermore, the measurement temperature range should be within ± 10 °C of the reference temperature. The ProLab 4000 eliminates these issues thanks to special compensation procedures, for example:

- Use of two pre-programmed temperature coefficients for HCl, NaOH, NaCl and KCl for a temperature range of 0 to 40°C
- Possibility of entering literature values for two temperature coefficients for additional solutions.
- Determination of temperature coefficients by:
  - Setting the temperature range and intervals
  - Measurement of one or multiple solutions of known and even unknown concentrations (through equidistant dilution).

ProLab 4000 is therefore ideally suited for research and for monitoring industrial processes. The instrument enables high precision conductivity measurements in a wide temperature and concentration ranges.





New: Control a burette

Accurate and convenient dosing of ISE/TISAB solutions or standards with the ProLab 4000 in ISE measuring mode by controlling TITRONIC® *universal* / 110plus / 500 burettes.

- pH, mV, ISE measurement
- Conductivity measurement
  Determine the dependency of temperature and concentration through
  - using a temperature coefficient
    (stored value or entry of own literature values)
  - Self-determination of temperature coefficients in various standards of known or unknown concentrations in a self-defined termperature range and span
- Highest safety level with measurements and calibration through:
  - automatic user identification
    with electronic ID card through transponder technology with password entry
  - wireless sensor recognition
    ID electrodes and measuring instrument with automatic identification and data exchange
- Operation via mouse or keyboard as at a PC
  familiar menu structures and clear menu navigation
- Plug and play technology
- Instrument kits
  - Instrument (incl. mouse)
  - Electrodes with integrated temperature sensor
  - Buffer- and conductivity test solutions
  - Stand
  - Universal power supply
  - Cover

Advantages ProLab 4000

Performance in black and white ...

Measuring technology in detail...	Lab 850	Lab 860	Lab 870	Lab 960
page	*p. 8/9*	*p. 8/9*	*p. 8/9*	*p. 10/11*
pH measurement	■	■	■	
Range / Accuracy	-2.000 to +19.999 pH -2.00 to +19.99 pH	-2.000 to +19.999 pH -2.00 to +19.99 pH	-2.000 to +19.999 pH -2.00 to +19.99 pH	
Accuracy (for each measuring area) (±1 digit)	±0.005 pH ±0.01 pH	±0.005 pH ±0.01 pH	±0.005 pH ±0.01 pH	
Calibration: pre-programmed pH buffer sets	16	16	16	
Automatic buffer recognition and display	■	■	■	
pH calibration points max.	3	5	5	
VariCal: manual calibration with selectable buffers	–	–	–	
Dead stop function	–	–	–	
2-channel pH measurement (galvanically separated)	–	–	–	
mV measurement	■	■	■	
Range / Accuracy	-999.9 to +999.9 mV -1,999 to +1,999 mV	-999.9 to +999.9 mV -1,999 to +1,999 mV	-999.9 to +999.9 mV -1,999 to +1,999 mV	
Accuracy (for each measuring area) (±1 digit)	±0.3 mV ±1 mV	±0.3 mV ±1 mV	±0.3 mV ±1 mV	
AutoRange function (can be switched off)	■	■	■	
mV differential measurement	–	–	–	
2-channel mV measurement (galvanically separated)	–	–	–	
ISE measurement				
Range / Accuracy				
Display in %, ppm, mg/kg, mol/l				
Two separate ISE channels (with dedicated separate temperature channels)				
Methods				
ISE calibration points				
Standard concentrations				
Control of external burettes TITRONIC® *universal* / 110plus / 500.				
Conductivity measurement				■
Range / Accuracy				0.000 µS/cm to 500 mS/cm
TDS measurement with factor 0.4 to 1.0				■
Salinity measurement acc. to Natural Sea Water Scale (UNESCO 1966b)				■
Accuracy in % from measuring value (±1 digit)				0.5
Calibrated cell constant 0.450 to 0.500 cm^{-1}; 0.585 to 0.715 cm^{-1}; 0.800 to 1.200 cm^{-1} (calibration with control standard) d 0.01 mol KCl:				■
Adjustable cell constant 0.250 to 2.500 cm^{-1} and 0.090 to 0.110 cm^{-1}				■
Fixed cell constant 0.010 cm^{-1}				■
Temperature compensation nLF / Lin (0.001 to 3.000 %/K) / selectable				■
Temperature compensation purity water				■
Pre-programmed temperature coefficients for HCl, NaOH, NaCl and KCl				
Determination of temperature coefficients for one or multiple standards and known or unknown concentrations at various temperatures				
Reference temperature 20 °C or 25 °C selectable				■

... the technical data

Lab 970	ProLab 1000	ProLab 2000	ProLab 3000	ProLab 4000
p. 10/11	*p. 12/13*	*p. 14/15*	*p. 16–19*	*p. 20/21*
	■	■	■	■
	-2.000 to +20.000 pH -2.00 to +20.00 pH -2.0 to +20.0 pH	-2.000 to +20.000 pH -2.00 to +20.00 pH -2.0 to +20.0 pH	-2.000 to +20.000 pH -2.00 to +20.00 pH -2.0 to +20.0 pH	-2.000 to +20.000 pH -2.00 to +20.00 pH -2.0 to +20.0 pH
	±0.003 pH ±0.01 pH	±0.003 pH ±0.01 pH	±0.002 pH ±0.01 pH	±0.002 pH ±0.01 pH
	22	22	22	22
	■	■	■	■
	5	5	5	5
	–	–	■	■
	■	–	–	–
	–	–	■	■
	■	■	■	■
	-1,999.9 to +1,999.9 mV -1,999 to +1,999 mV	-1,999.9 to +1,999.9 mV -1,999 to +1,999 mV	-2,200.0 to +2,200.0 mV -2,200 to +2,200 mV	-2,200.0 to +2,200.0 mV -2,200 to +2,200 mV
	±0.2 mV ±1 mV	±0.2 mV ±1 mV	±0.1 mV ±1 mV	±0.1 mV ±1 mV
	■	■	–	–
	–	–	■	■
	–	–	■	■
		■	■	■
	0.000 to 999,999 mg/l	0.000 to 999,999 mg/l	1.0E-40 to 9.9E39 mg/l	1.0E-40 to 9.9E39 mg/l
		–	■	■
		–	■	■
		–	Std. Add., Double Std. Add., Std. Sub., Sample Add., Sample Sub., Blank Add., Blank Corr., Ref. Measurem.	Std. Add., Double Std. Add., Std. Sub., Sample Add., Sample Sub., Blank Add., Blank Corr., Ref. Measurem.
	2 to 5	2 to 5	2 to 9	2 to 9
	0.000 to 500,000 mg/l	0.000 to 500,000 mg/l	0.000 to 500,000 mg/l	1.00E-30 to 1.00E30 mg/l can be inserted
			■	■
■		■		■
0.000 µS/cm to 500 mS/cm		0.000 µS/cm to2,000 mS/cm		0.000 µS/cm to 2000 mS/cm
■		■		■
■		■		■
0.5		0.5		0.5
■		■		■
■		■		■
■		■		■
■		■		■
■		■		■
				■
				■
■		■		■

The technical data continued...

Measuring technology in detail...	Lab 850	Lab 860	Lab 870	Lab 960
page	*p. 8/9*	*p. 8/9*	*p. 8/9*	*p. 10/11*
D.O. measurement (O_2 dissolved)				
Range / Accuracy:				
O_2 concentration				
O_2 saturation				
O_2 partial pressure				
Accuracy in % from measuring value (± 1 digit) at an ambient temperature of 5 to 30 °C				
Salinity correction				
Calibration in calibration vessel with water vapor-saturated air				
Temperature measurement	■	■	■	■
Range / Accuracy	-5.0 +120.0 °C	-5.0 to +120.0 °C	-5.0 to +120.0 °C	-5.0 to +120.0 °C
Accuracy (± 1 digit)	± 0.1 °C	± 0.1 °C	± 0.1 °C	± 0.1 °C
Two separated temperature channels	–	–	–	–
Selectable °C / °F (Fahrenheit)	■	■	■	■
Automatic switch-over to manual temperature input when no temperature sensor is connected	■	■	■	■
Design & Quality				
Display	LCD 75 x 60 mm	LCD 75 x 60 mm	LCD 75 x 60 mm	LCD 75 x 60 mm
Contrast adjustment via menu	–	–	–	–
Glass display	–	–	–	–
Display integrated in keyboard plastic foil	■	■	■	■
Measuring value storage (manual / automatic)	800 data sets, storage intervals from 5s to 60 min	800 data sets, manual operated	–	800 data sets, storage intervals from 5 s to 60 min
Calibration history incl. date and time	–	–	–	–
USB (slave) and RS232 interface	RS232	■	■	■
USB host interface: plug and play connection of USB hub, USB printer, USB memory, keyboard, mouse, USB stick				
Lower housing	plastic	plastic	plastic	plastic
Plastic foil keypad (polyester) with tactile response	■	■	■	■
Power supply: external universal power supply (medical approval) with country specific primary adapters, (primary: 100–240V, 50/60 Hz, secondary: 9V = 1,5A)	■	■	■	■
built-in real-time clock (processor solution) battery buffered, exchangeable battery	■	■	■	■
Battery operation possible (4 mignon)	■	■	■	■
Battery switch-off automatic (adjustable 10 min to 24 h, default 1 h, cannot be switched off)	■	■	■	■
Dimensions (W x H x D mm)	190 x 80 x 240	190 x 80 x 240	190 x 80 x 240	190 x 80 x 240
Weight	~1.0 kg	~1.0 kg	~1.0 kg	~1.0 kg
Compliance	CE, cETLus	CE, cETLus	CE, cETLus	CE, cETLus
Safety	protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001
Climate class	2 (VDI/VDE 3540)	2 (VDI/VDE 3540)	2 (VDI/VDE 3540)	2 (VDI/VDE 3540)
Complete delivery scope: - Instrument with cover, power supply unit and stand - set additionally with electrode and buffer	■	■	■	■
IQ/OQ documents available	■	■	■	■
Warranty 3 years	■	■	■	■

Lab 970	ProLab 1000	ProLab 2000	ProLab 3000	ProLab 4000
p. 10/11	*p. 12/13*	*p. 14/15*	*p. 16–19*	*p. 20/21*
		n		
		0 to 20.00 mg/l / 0.01 mg/l 0t o 90.0 mg/l / 0.1		
		0 to 200.0 % / 0.1 % 0 to 600 % / 1 %		
		0 to 200.0 mbar / 0.1 mbar 0 to 1250 mbar / 1 mbar		
		0.5		
		■		
		■		
■	■	■	■	■
-5.0 to +120.0 °C	-10.0 to +120.0 °C	-10.0 to +120.0 °C	-35.0 to +150.0 °C	-35.0 to +150.0 °C
± 0.1 °C	± 0.1 °C	± 0.1 °C	± 0.1 °C	± 0.1 °C
–	–	–	■	■
■	■	■	■	■
■	■	■	■	■
LCD 75 x 60 mm	black & white graphic 120 x 90 mm with lighting	black & white graphic 120 x 90 mm with lighting	QVGA colour graphic display 120 x 90 mm with lighting	QVGA colour graphic display 120 x 90 mm with lighting
–	■	■	–	–
–	■	■	■	■
■	–	–	–	–
–	1,500 data sets, storage intervals from 1 s to 60 min	1,500 data sets, storage intervals from 5 s to 60 min	> 10,000 data sets, storage intervals from 1 s to 60 min	> 10,000 data sets, storage intervals from 1 s to 60 min
–	last 10 calibrations	last 10 calibrations	last 10 calibrations	last 10 calibrations
■	■	■	■	■
			■	■
plastic	metal	metal	metal	metal
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■
■	–	–	–	–
■	–	–	–	–
190 x 80 x 240	280 x 80 x 240	280 x 80 x 240	280 x 80 x 240	280 x 80 x 240
~1.0 kg	~2.5 kg	~2.5 kg	~2.5 kg	~2.5 kg
CE, cETLus	CE, cETLus	CE, cETLus	CE, cETLus	CE, cETLus
protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001	protection class III, EG guidelines 73/23, EN 61010-1: 2001
2 (VDI/VDE 3540)	2 (VDI/VDE 3540)	2 (VDI/VDE 3540)	2 (VDI/VDE 3540)	2 (VDI/VDE 3540)
■	■	■	■	■
■	■	■	■	■
■	■	■	■	■

Ordering information

Type no.	Order no.	Product	Description
Lab series			
Lab 850	285201300	Laboratory pH Meter	Measuring parameters pH, mV, temp., RS232-C-interface, microprocessor, data storage for 800 data sets, DIN 19262 connection. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 850 Set	285201310	Laboratory pH Meter	Measuring parameters pH, mV, temp., RS232-C-interface, microprocessor, data storage for 800 data sets, DIN 19262 connection. Including cover Z 880, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode BlueLine 14 pH, calibration solutions (DIN).
Lab 850 BNC	285201360	Laboratory pH Meter	Measuring parameters pH, mV, temp., RS232-C-interface, microprocessor, data storage for 800 data sets, BNC connection. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 850 BNC Set	285201370	Laboratory pH Meter	Measuring parameters pH, mV, temp., RS232-C-interface, microprocessor, data storage for 800 data sets, BNC connection. Including cover Z 880, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode BlueLine 15 pH, calibration solutions (DIN).
Lab 860	285201320	Laboratory pH Meter	Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, data storage for 800 data sets, GLP conform, DIN 19262 connection. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 860 Set	285201330	Laboratory pH Meter	Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, storage for 800 data sets, GLP conform, DIN 19262 connection. Incl. cover Z 880, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode BlueLine 14 pH, calibration solutions (DIN).
Lab 860 BNC	285201380	Laboratory pH Meter	Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, data storage for 800 data sets, GLP conform, BNC connection. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 860 BNC Set	285201390	Laboratory pH Meter	Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, storage for 800 data sets, GLP conform, BNC connection. Including cover Z 880, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode BlueLine 15 pH, calibration solutions (DIN).
Lab 870	285201340	Laboratory pH Meter	Electrode recognition. Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, DIN 19262 connection. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 870 Set	285201350	Laboratory pH Meter	Electrode recognition. Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface,GLP conform, DIN 19262 connection. Including cover Z 880, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode BlueLine 14 pH ID, calibration solutions (DIN).
Lab 870 BNC	285201400	Laboratory pH Meter	Electrode recognition. Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, BNC connection. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 870 BNC Set	285201410	Laboratory pH Meter	Electrode recognition. Measuring parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, BNC connection. Including cover Z 880, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode BlueLine 15 pH ID, calibration solutions (DIN).
Lab 960	285201420	Laboratory Conductivity Meter	Measuring ranges 0.000 µS/cm to 500 mS/cm, salinity, total dissolved solids (TDS), temp., RS232-C and USB (slave) interface, microprocessor, data storage for 800 data sets, GLP conform. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 960 Set	285201430	Laboratory Conductivity Meter	Measuring ranges 0.000 µS/cm to 500 mS/cm, salinity, total dissolved solids (TDS), temp., RS232-C and USB (slave) interface, microprocessor, data storage for 800 data sets, GLP conform. Including cover Z 880, stand S4D Z 865, power supply Z 850, conductivity cell LF 413 T and conductivity testing solution.
Lab 970	285201440	Laboratory Conductivity Meter	Sensor recognition. Measuring ranges 0.000 µS/cm to 500 mS/cm, salinity, total dissolved solids (TDS), temp., RS232-C and USB (slave) interface, microprocessor, GLP conform. Including cover Z 880, stand S4D Z 865 and power supply Z 850.
Lab 970 Set	285201450	Laboratory Conductivity Meter	Sensor recognition. Measuring ranges 0.000 µS/cm to 500 mS/cm, salinity, total dissolved solids (TDS), temp., RS232-C and USB (slave) interface, microprocessor, GLP conform. Including cover Z 880, stand S4D Z 865, power supply Z 850, conductivity cell LF 413 T ID and conductivity testing solution.
ProLab series			
ProLab 1000	285201700	Digital laboratory pH Meter	Electrode recognition and user identification. Parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, DIN 19262 connection. Including cover Z 881, stand S4D Z 865 and power supply Z 850.
ProLab 1000 Set	285201710	Digital laboratory pH Meter	Electrode recognition and user identification. Parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, DIN 19262 connection. Including cover Z 881, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode A 161 1M-DIN-ID, calibration solutions (DIN).
ProLab 1000 BNC	285201720	Digital laboratory pH Meter	Electrode recognition and user identification. Parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, BNC connection. Including cover Z 881, stand S4D Z 865 and power supply Z 850.
ProLab 1000 BNC Set	285201730	Digital laboratory pH Meter	Electrode recognition and user identification. Parameters pH, mV, temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, BNC connection. Including cover Z 881, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode A 161 1M-BNC-ID, calibration solutions (DIN).
ProLab 2000	285201740	Digital laboratory multi Meter	Electrode recognition and user identification. Parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, DIN 19262 connection. Including cover Z 881, stand S4D Z 865 and power supply Z 850.
ProLab 2000 Set	285201750	Digital laboratory multi Meter	Electrode recognition and user identification. Parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, DIN 19262 connection. Including cover Z 881, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode A 161 1M-DIN-ID, combined conductivity and D.O. sensor LFOX 1400 ID, calibration solutions (DIN), conductivity testing solutions.

Type no.	Order no.	Product	Description
ProLab 2000 BNC	285201760	Digital laboratory multi Meter	Electrode recognition and user identification. Parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, BNC connection. Including cover Z 881, stand S4D Z 865 and power supply Z 850.
ProLab 2000 BNC Set	285201770	Digital laboratory multi Meter	Electrode recognition and user identification. Parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS232-C and USB (slave) interface, GLP conform, BNC connection. Including cover Z 881, stand S4D Z 865, power supply Z 850, pH-temp. combination electrode A 161 1M-BNC-ID, combined conductivity and D.O. sensor LFOX 1400 ID, calibration solutions (DIN), conductivity testing solutions.
ProLab 3000	285203600	Digital laboratory pH Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE measuring mode. Parameters: double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z 880, Z 865 + Z 850.
ProLab 3000 Set	285203610	Digital laboratory pH Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z 880, Z 865 + Z 850. Z 880, Z 865, Z 850, IL-pHT-A170MF-DIN-N, DIN buffers.
ProLab 3000 BNC	285203620	Digital laboratory pH Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z 880, Z 865 + Z 850.
ProLab 3000 BNC Set	285203630	Digital laboratory pH Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z 880, Z 865, Z 850, IL-pHT-A170MF-BNC-N, DIN buffers.
ProLab 4000	285203640	Digital laboratory multi Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z 880, Z 865 + Z 850.
ProLab 4000 Set	285203650	Digital laboratory multi Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z 880, Z 865, Z 850, IL-pHT-A170MF-DIN-N, LF413TID, DIN buffer, conductivity testing solution.
ProLab 4000 BNC	285203660	Digital laboratory multi Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z 880, Z 865 + Z 850.
ProLab 4000 BNC Set	285203670	Digital laboratory multi Meter	Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Control of external burettes in ISE mode. Parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z 880, Z 865, Z 850, IL-pHT-A170MF-BNC-N, LF413TID, DIN buffer, conductivity testing solution.
Accessories			
Logbook Lab 850	285201800	Logbook	for Lab 850 (DIN and BNC) incl. review after sending the filled in documents.
Logbook Lab 860	285201810	Logbook	for Lab 860 (DIN and BNC) incl. review after sending the filled in documents.
Logbook Lab 870	285201820	Logbook	for Lab 870 (DIN and BNC) incl. review after sending the filled in documents.
Logbook Lab 960	285201840	Logbook	for Lab 960 incl. review after resending the filled in documents.
Logbook Lab 970	285201850	Logbook	for Lab 970 incl. review after resending the filled in documents.
Logbook ProLab 1000	285201830	Logbook	for ProLab 1000 (DIN and BNC) incl. review after sending the filled in documents.
Logbook ProLab 2000	285201860	Logbook	for ProLab 2000 (DIN and BNC) incl. review after sending the filled in documents.
Logbook ProLab 3000	285203680	Logbook	for ProLab 3000 (DIN and BNC) incl. review after sending the filled in documents.
Logbook ProLab 4000	285203690	Logbook	for ProLab 4000 (DIN and BNC) incl. review after sending the filled in documents.
Z 390	285201560	Cable for connection to PC	RS232 6-pin cable for connection to PC for all instruments being part of the Lab- and ProLab series
Z 396	285201580	Software	Software for documentation for all instruments being part of the Lab- and ProLab series
Z 850	285204889	Power supply	Universal power supply unit, 230 and 120 V for the Lab- and ProLab-meter family
Z 865	285201520	Stand set S4D	Stand set S4D, including arm and electrode holder for the Lab- and ProLab-meter family
Z 875	285201540	USB cable	for Lab 860, Lab 870, Lab 960 and Lab 970 as well as for all instruments of the ProLab-meter series with USB (slave)
Z 876	285201890	Transponder	User recognition transponder for ProLab instruments
Z 880	285201550	Cover	for the Lab-meter family
Z 881	285201880	Cover	for the ProLab-meter family
Z 890	285203700	Universal paper printer	Star SP-712 (9-matrix printer). Easy paper load. Serial interface. Dimensions: 160 (width) x 245 (depth) x 152 (height) mm. Weight 2.96 kg. Integrated power supply..
Z 891	285203710	ink riboon (black)	for printer Z 890. Product life cycle: 3 million charachters.
Z 892	285203720	printer paper role	for printer Z 890, 1 piece. Universal paper. Width 76 mm. External diameter 80 mm, inner core 12 mm.
Z 893	285203730	Connecting cable	for connection of printer Z 890 to the ProLab meters (except Lab 850) and ProLab-meter family.
	285209081	Manufacturer certificate	for SI Analytics measurement instruments

handylab – portable-size – fits to many applications …

handylab – the portable, multi-functional mini-laboratories

The latest handylab generation is available in seven different models – all with expanded features. These compact, battery powered, 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 needed accessories, providing the user with a high performance mini-laboratory.

The handylab pH/LF 12 multi-parameter portable meter can be used to determine pH values, redox potential, conductivity and temperature. The handylab multi 12, which is a real workhorse, can also be used to measure oxygen concentrations.

The measurement parameters pH, mV and °C make the handylab pH 11 and pH 12 meters suitable for a variety of uses. The fully automatic one to three point calibration including preprogrammed DIN or technical buffers makes practical work simple.

The handylab OX 12 oxygen meter automatically takes 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.

All of the handylab 12 models have data memory, which means that measurements can be recorded manually or automatically using a timer control, and can be evaluated later. In addition, they have a serial interface, and an optional power supply is avail-able for use in a laboratory type setting.

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	■	■	–	–	–	■	■
ORP	■	■	–	–	–	■	■
Temperature	■	■	■	■	■	■	■
Conductivity	–	–	■	■	–	■	■
Dissolved Oxygen	–	–	–	–	■	–	■
AutoRead	■	■	■	■	■	■	■
Battery operation	■	■	■	■	■	■	■
Power connection (power supply optional)	–	■	–	■	■	■	■
Data memory	–	–	–	■	■	■	■
RS232	–	■	–	■	■	■	■

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

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

Content

Portable pH meters with GLP functions handylab pH 11 and handylab pH 12

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

Measurement parameters

Our portable meters measure pH, mV and C making them ideal for a variety of applications.

Memory and interface capability

The handylab pH 12 offers data storage either manual or automatic using the timer control for evaluation at a later date. The configurable RS232 allows connection to a computer (bi-directional) or a printer or recorder.

Measurement reliability

When the special AutoRead function is activated the value is measured when the stability criteria is met. This ensures the reproducibility of measurement results.

Temperature compensation

Measurements can be performed with and without a temperature sensor. Temperature compensation of pH measurements can be performed automatically or manually. The meter will automatically recognize if a temperature sensor is connected.

Calibration

A fully automatic one to three point calibration using SI Analytics buffers that have already been pre-programmed into the meter in accordance with DIN or technical buffers. The meter recognizes the buffer solutions. A sensor symbol indicates the status of the pH electrode after the calibration. The adjustable calibration timer of the handylab pH 12 can be set to remind the user of calibration that is due to be performed.

Power supply

The battery-powered meters allow the user to work independently of a 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

A comprehensive product range of precision pH electrodes offers the right sensor for every type of application.

Separately or as a set

The handylab pH 11 and handylab pH 12 portable pH meters are available as meter only or as a complete kit 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 pH 11	handylab pH 12
Measuring ranges			
pH	range	-02.000 to +19.999 pH	-02.000 to +19.999 pH
	resolution max.	0.001 pH	0.001 pH
	accuracy	+0.005/±0.010 pH	+0.005/±0.010 pH
mV	range max.	-1999 to +1999 mV	-1999 to +1999 mV
	resolution max.	0.1 mV	0.1 mV
	accuracy	+0.3/±1.0 mV	+0.3/±1.0 mV
temperature	range	-5.0 to +105.0 °C	-5.0 to +105.0 °C
	resolution	0.1 K	0.1 K
	accuracy (with NTC 30)	±0.1 K	±0.1 K
	manual adjustment	-020 to +130 °C	-020 to +130 °C
drift control	can be switched off	yes	yes
slope matching		085 to 105 %	085 to 105 %
zero point matching		±30 mV	±30 mV
sensor evaluation	via symbol in the display	yes	yes
input resistance		>1012 W	>1012 W
offset current		<1012 A	<1012 A
Calibration			
buffer sets	DIN (1.68/4.01/6.87/9.18)	1/2/3 point	1/2/3 point
	technical (2.00/4.00/7.00/10.01)*	1/2/3 point	1/2/3 point
	selectable buffers	1/2 point	1/2 point
calibration interval control		-	001 to 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 s to 60 min)	-	800 data records
Connections			
electrode (socket in accord. with DIN 19 262)		yes	yes
temperature sensor (NTC 30/Pt 1,000, 2 x 4 mm banana plug)		yes	yes
Interface			
for analogue recorder cable Z 394		-	4 poles socket
for RS232-Cable Z 395, bi-directional		-	4 poles socket
Ambient temperature			
operating temperature		-10 to +55 °C	-10 to +55 °C
relative humidity (annual average)		<90 %	<90 %
Power supply			
battery operated (type AA)		4 x 1.5 V cells	4 x 1.5 V cells
battery life time (data is saved even if batteries are changed)		~2,500 h	~2,500 h
power supply		-	optionally
automatic power-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		~0.3 kg	~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

* SI Analytics technical buffers

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 cases 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.

Memory and interface capability

The handylab LF 12 offers data storage either manual or automatic using the timer control for evaluation at a later date. The configurable RS232 allows connection to a computer (bi-directional) or a printer or recorder.

Measurement reliability

When the special AutoRead function is activated the value is measured when the stability criteria is met.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 20 °C or 25 °C can be selected.

Calibration

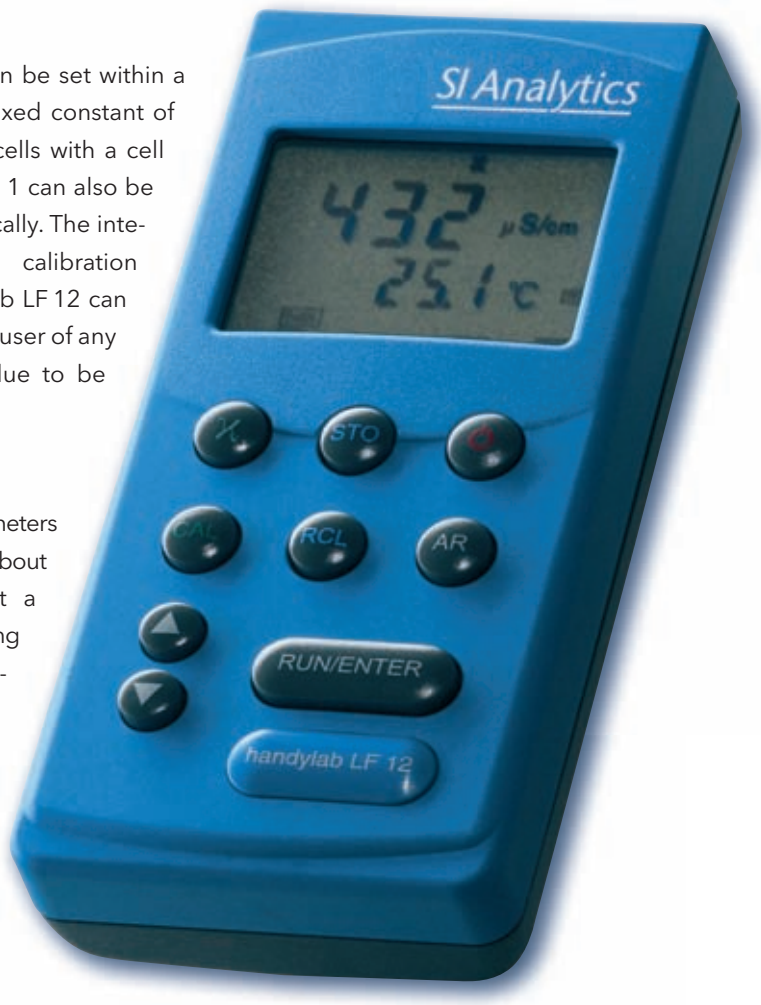
The cell constant can be set within a wide range with a fixed constant of 0.01. Combination cells with a cell constant of 0.475 or 1 can also be calibrated automatically. The integrated adjustable calibration timer in the handylab LF 12 can be set to remind the user of any calibration that is due to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

Power supply

The conductivity meters can be used for about 2,500 hours without a 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 LF 12 can also be operated with the optional power supply.

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.



Included in the set

The LF 11 and LF 12 conductivity meters are 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 to 500 mS/cm	0.0 µS/cm to 500 mS/cm
	at k = 0.1 and k = 0.01	00.00 µS/cm to 19.99 µS/cm	00.00 µS/cm to 19.99 µS/cm
	at k = 0.01	0.000 µS/cm to 1.999 µS/cm	0.000 µS/cm to 1.999 µS/cm
specific resistance		0.000 to 1999 MW·cm	0.000 to 1999 MW·cm
salinity	acc. to IOT table	00.0 to 70.0	00.0 to 70.0
TDS	factor adjustable 0.40 to 1.00	0 to 1999 mg/l	0 to 1999 mg/l
temperature	automatic, 3 modes selectable	-5.0 to + 105.0 °C	-5.0 to + 105.0 °C
	resolution	0.1 K	0.1 K
	manual adjustment	-005 to + 100 °C	-005 to + 100 °C
Cell constants	adjustable	0.010; 0.090 to 0.110;	0.010; 0.090 to 0.110;
		0.250 to 2.500	0.250 to 2.500
	calibrate	0.450 to 0.500 ; 0.800 to 1.200	0.450 to 0.500 ; 0.800 to 1.200
	calibration interval control	-	1 to 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 to 3.000 %/K	0.001 to 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 s ... 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 RS232-Cable Z 395, bi-directional		-	4 poles socket
Ambient temperature			
operating temperature		-10 to + 55 °C	-10 to + 55 °C
relative humidity (annual average)		< 90 %	< 90 %
Power supply			
battery operated (type AA)		4 x 1.5 V cells	4 x 1.5 V cells
battery life time (data remain when changing batteries)		~2,500 h	~2,500 h
power supply		-	optionally
automatic power-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		~0.3 kg	~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 OX 12

The handylab OX 12 portable oxygen meter in a shock-proof, water-tight case is 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 handylab OX 12 has a variety of uses.

Memory and interface capability

The meter has a data memory, whereby measurements can be saved manually or automatically using the timer control for evaluation at a later date. The configurable RS232 allows connection to a computer (bi-directional) or a printer or recorder."

Measurement reliability

When the special AutoRead function is activated the value is measured when the stability criteria is met. This ensures the reproducibility of measurement results.

Measurements

During measurement variables such as temperature and air pressure are automatically compensated. 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 OX 12 can be performed easily using the air calibration vessel. The vessel ensures a defined humidity and ideal calibration conditions. After automatic calibration, a sensor symbol indicates the status of the oxygen electrode. The adjustable calibration timer can remind the user when the next calibration is due to be performed.

Power supply

The handylab OX 12 can be operated for at least 2,000 hours independently of a power supply using four conventional batteries. A reminder for the user to replace the batteries appears on the display. The calibration data are retained when the batteries are changed.

Sensor

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

As a kit

The handylab OX 12 portable oxygen meter is available as a kit in a carrying case 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 to 50 mg/l O_2
temperature range	0 to 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 s
	t_{95} (95 % of final value) after < 16 s
	t_{99} (99 % of final value) after < 60 s
internal consumption	0.008 µg/h
drift	~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 OX 12

Oxygen meter		handylab OX 12
Measuring ranges		
O_2 concentration	ranges	00.00 to 19.99 mg/l / 0 to 90.0 mg/l
	resolution max.	0.01
	accuracy	± 0.5 % of measured value
O_2 saturation index	ranges	000.0 to 199.9 % / 0 to 600 %
	resolution max.	0.1 %
	accuracy	± 0.5 % of measured value
O_2 partial pressure	ranges	00.0 to 199.9 mbar / 0 to 1250,0 mbar
temperature	range	00.0 to + 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 to 1100 hPa
temperature	automatic (IMT)	0 to + 40 °C
salinity	using setting keys	0.0 to 70.0
Calibration		
procedure		air calibration procedure
slope range		0.60 to 1.25
calibration interval control		001 to 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 s to 60 min)	800 data records
Connections		
oxygen sensor		8 pole socket
Interface		
for analogue recorder cable Z 394		4 pole socket
for RS232-Cable Z 395, bi-directional		4 pole socket
Ambient temperature		
operating temperature		- 10 to + 55 °C
relative humidity (annual average)		< 90 %
Power supply		
battery operated (type AA)		4 x 1.5 V cells
battery life time (data remain when changing batteries)		~2,000 h
power supply		optionally
automatic power-off during battery operation		60 min
Housing		ABS, water-tight key pad
dimensions (H x W x D)		172 mm x 80 mm x 37 mm
weight		~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 portable meters – handylab pH/LF 12 and handylab multi 12 – in shock-proof, water-tight casings are ideally suited for field work.

Measurement parameters

The SCHOTT® Instruments pH/LF 12 multi-parameter meter measures pH, redox potential, temperature and conductivity making them ideal for a variety of applications. The handlylab multi 12 adds the ability to measure oxygen.

Memory and interface capability

The meters have a data memory, which means that measurements can be saved manually or automatically by using the timer control for evaluation at a later date. The configurable RS232 allows connection to a computer (bi-directional) or a printer or recorder.

Measurement reliability

When the special AutoRead function is activated the value is measured when the stability criteria is met. This ensures the reproducibility of measurement results.

Calibration

For calibration of the pH measurement, there is a one or two point calibration with our technical buffers. For calibration of the conductivity sensor and the oxygen sensor 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

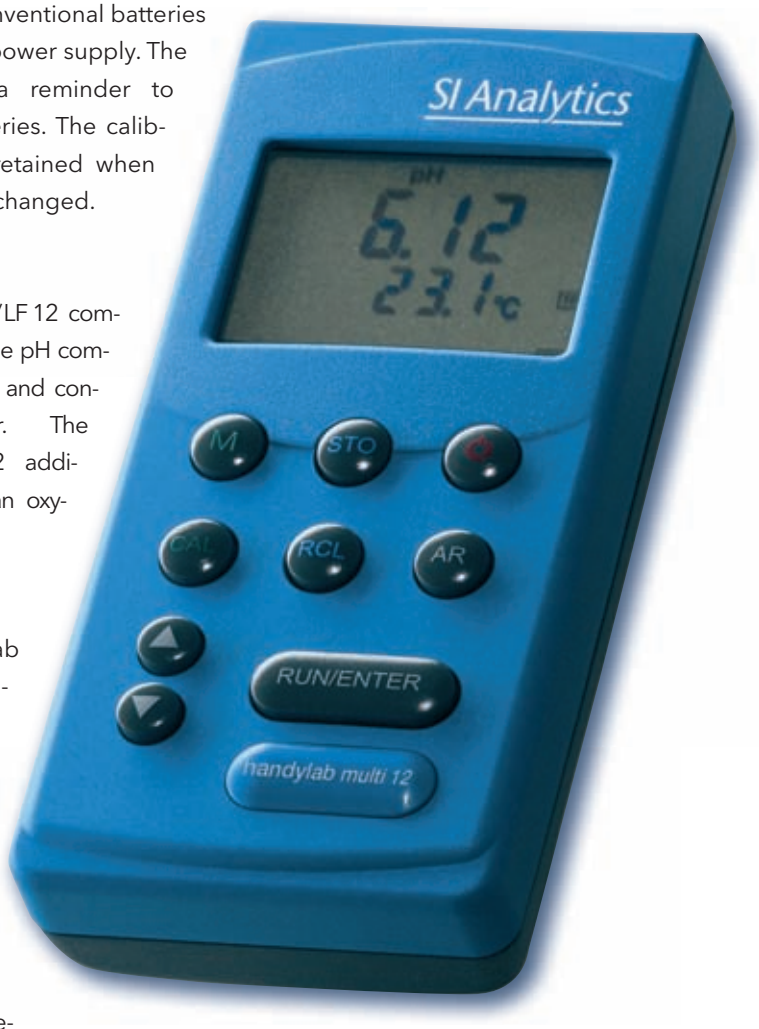
The multi-parameter portable meters can be operated for approx. 2,500 hours independently of a power supply using four conventional batteries or with optional power supply. The display shows a reminder to replace the batteries. The calibration data are retained when the batteries are changed.

Sensors

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 kit

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



Technical data
handylab pH/LF 12, handylab multi 12

Parameters		handylab pH/LF 12	handylab multi 12
Measuring ranges			
pH/mV	pH range/resolution	-02.00 to +19.99 pH	-02.00 to +19.99 pH
	accuracy (±1 digit)	±0.01 pH	±0.01 pH
	mV range/resolution	-1,999 to +1,999 mV	-1,999 to +1,999 mV
	accuracy (±1 digit)	±1 mV	±1 mV
temperature	measuring range	-005.0 to +105.0 °C	-005.0 to +105.0 °C
	manual setting	-020 to +130 °C	-020 to +130 °C
oxygen	concentration: ranges/resolution	-	0.00 to 19.99 mg/l / 0 to 90.0 mg/l
	saturation: ranges/resolution	-	0.00 to 199.9 %/0.0 to 600 %
	accuracy (±1 digit)	-	±0.5 % of measured value
	temp. compensation, automatically	-	0.0 to 50.0 °C
conductivity	4 ranges/Auto range	1 µS/cm to 500 mS/cm	1 µS/cm to 500 mS/cm
	salinity acc. to IOT table	00.0 to 70.0	00.0 to 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 to 0.500	0.450 to 0.500
drift control	deactivatable	yes	yes
sensor evaluation	by symbol on display	yes	yes
Calibration			
pH	technical (2.00/4.00/7.00/10.01)*)	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		001 to 999 days	001 to 999 days
calibration data store		yes	yes
real time clock	integrated with time/date	yes	yes
Serial interface			
type		RS232, bi-directional	RS232, 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 s ... 60 min)	500 data records	500 data records
Input			
pH/redox-electrode (opt. with temperature sensor)		socket acc. to DIN 19262 + socket 4 mm	socket acc. to DIN 19262 + socket 4 mm
conductivity/oxygen sensor		8 pole socket	8 pole socket
Output			
for RS232-Cable Z 395, bi-directional		4 pole socket	4 pole socket
for recorder cable Z 394		4 pole socket	4 pole socket
Ambient temperature			
operating temperature		–10 to +55 °C	-10 to +55 °C
relative humidity (annual average)		<90 %	<90 %
Power supply			
battery operated (type AA)		4 x 1.5 V cells	4 x 1.5 V cells
battery life time (data remain when changing batteries)		~2,500 h	~2,500 h
automatic power-off at battery operation		60 min	60 min
power supply		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		~0.3 kg	~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

*) SI Analytics technical buffers

Ordering information handylab pH meters, conductivity meters and oxygen meters

pH meters	Type no.	Order no.
handylab pH 11, meter only	handylab pH 11	28 520 2871
handylab pH 11, meter only with carrying case	handylab pH 11/K	28 520 2863
handylab pH 11, case kit, 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 kit, 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 kit, 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, meter only	handylab pH 12	28 520 2896
handylab pH 12, meter only with carrying case	handylab pH 12/K	28 520 2888
handylab pH 12, case kit, 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 kit, complete, ready to use with pH combination electrode BlueLine 14 pH, calibration solutions and plastic beakers	handylab pH 12/14 pH	28 520 3062
Conductivity meters		
handylab LF 11, meter only	handylab LF 11	28 520 3292
handylab LF 11, meter only with carrying case	handylab LF 11/K	28 520 3276
handylab LF 11, case kit, complete, ready to use with 4-pole conductivity cell LF 413 T, calibration solutions and plastic beaker	handylab LF 11/413 T	28 520 3310
handylab LF 11, case kit, 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 LF 11, case kit, complete, ready to use with 4-pole conductivity cell LF 613 T, calibration solutions and plastic beaker	handylab LF 11/613 T	28 520 3346
handylab LF 12, meter only	handylab LF 12	28 520 3362
handylab LF 12, meter only with carrying case	handylab LF 12/K	28 520 3354
handylab LF 12, case kit, complete, ready to use with 4-pole conductivity cell LF 413T, calibration solutions and plastic beaker	handylab LF 12/413 T	28 520 3330
handylab LF 12, case kit, 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 meter		
handylab OX 12, meter only with carrying case	handylab LF 12/K	106 3835
handylab OX 12, case kit, complete, ready to use with oxygen sensor 9009/61, calibration and maintenance accessories	handylab OX 12 kit	28 520 2793

Ordering information
handylab multi-parameter portable meters

Multi-Parameter meters	Type no.	Order no.
handylab pH/LF 12,meter only	handylab pH/LF 12	28 520 3465
handylab pH/LF 12, case kit, 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 kit	28 520 3473
handylab multi 12, meter only	handylab multi 12	28 520 3502
handylab multi 12, case kit, 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 kit	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, 1,000 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 OX 12 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 ... 240V for all handylab 12 models	Z 850	28 520 4889
Connecting cable for analogue recorder, for handylab pH 12, LF 12, OX 12	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.
DURAN® is a trademark of the Duran Group.

The most reliable measurement results:
SI Analytics electrodes and meters

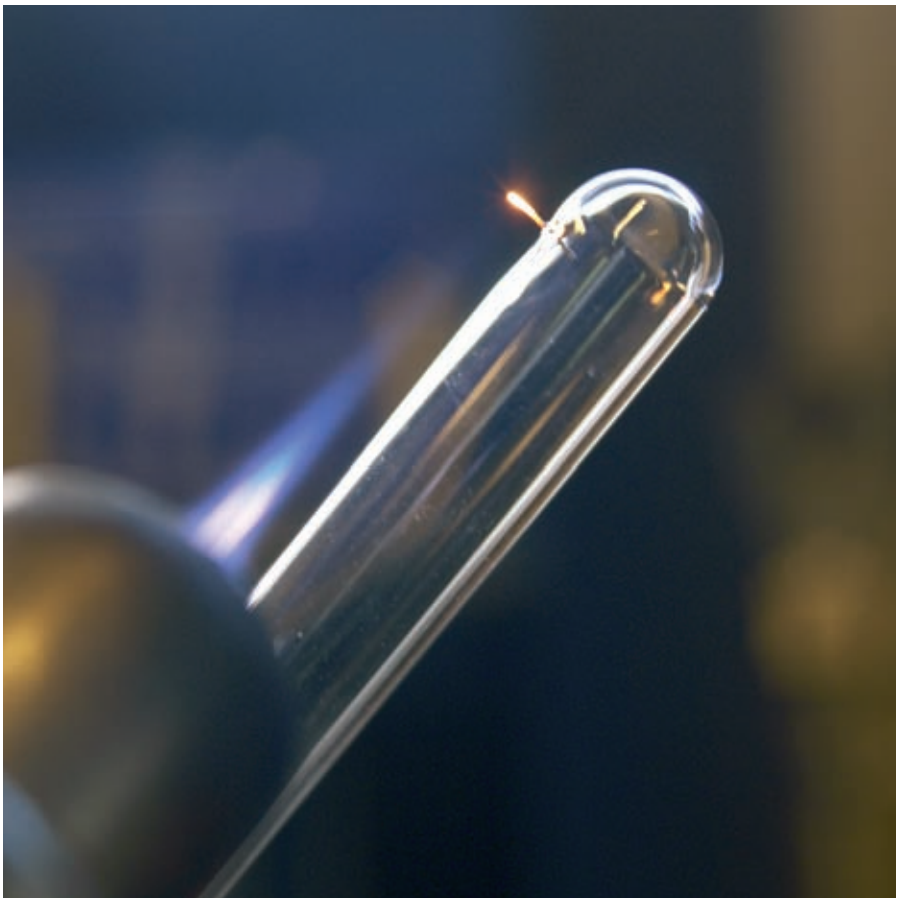
Content laboratory electrodes

Our laboratory electrodes: application orientated and perfectly matched

The standards for pH measurement are very high regarding precision, reproducibility, speed, handling and reliability. Every measurement is different. Different compositions, temperatures, conductivities and viscosities of samples and different measured conditions make for a million of different applications. Only application orientated and perfectly matched systems of electrodes, meters and buffer solutions can meet these standards. At SI Analytics we supply such systems.

The pH electrode is a very important part of the system as it comes in direct contact with the sample and provides the measurement signal. For more than 75 years our focus has been set on the electrode and we have dedicated ourselves to the development and manufacturing of glass electrodes. For a long time our electrodes have been used for the most demanding tasks in labs throughout the world where quality matters, and our customers benefit from this expertise.

Our first instruction booklet appeared in 1938. In those days the electrochemical pH measuring and the potentiometric titration still needed to be explained.



Even today glass blowing talent is still indispensable.

It all started with a patent on pH electrodes – today it is a range of several hundred different sensors. Our electrode line includes three product families BlueLine, ScienceLine and IoLine to meet your applications. Whether for ultrapure water, jam, wine, creme or drinking water, SI Analytics offers the right electrode for every application.

BlueLine Electrodes

Reliable function

Our compact BlueLine range is a basic series including electrodes for the typical laboratory applications which simplifies the user's choice.

An accurate and fast measurement is ensured by precision manufacturing and employment of high quality material, e.g. low-resistance A-type membrane glass or the unique platinum junction.

The BlueLine family includes robust electrodes with gel electrolyte and plastic shaft for general use, liquid-electrolyte sensors for more critical measurements and special sensors. The gel and the liquid electrolyte sensors are available with different connections and with different cable lengths. Some offer built-in temperature sensor. The special electrodes range includes pH electrode for surface measurements, for small sample amounts, for ultrapure water and emulsions or measurements in semi-solid samples (insert measurements).

- Basic series simplifies choice of the electrode for specific application
- Gel electrolyte, liquid electrolyte and special sensors with universal membrane glass
- Liquid electrolyte electrodes with unique platinum junction and refill port slider for easier refilling of the electrolyte
- Each electrode with individual serial number for clear documentation

Advantages BlueLine

ScienceLine Electrodes

The proven high-end laboratory electrodes

In research and development, manufacturing and quality control, our ScienceLine electrodes have become standard for the most demanding measurement tasks. Each electrode has an individual serial number and pH- and metal combination electrodes are supplied with a quality certificate, better making documentation simple and better traceable.

We have kept on improving the glass membrane shapes and types to make the electrodes even more robust, durable and easier to clean. Furthermore, they achieve stable measurement values even faster.

Our ScienceLine electrodes ensure high measurement accuracy and stability and long service life, but are highly adaptable to your measurement tasks. We can offer you a range of electrodes with unmatched versatility and quality.

Typical examples:

- pH electrodes with a length of up to 600 mm for measurements in very deep vessels
- The N 6003 electrode allows pH measurements even in NMR tubes or other small sample vessels. The A 157 is a micro electrode with an integrated temperature sensor with a 5 mm in diameter.
- For more demanding media, choose among different junctions and membrane glasses. For measurements in samples of low ionic strength there is a choice between the N 64 and A 164. Both types feature a ground joint junction, and the A 164 offers a temperature sensor.
- A wide selection of separate reference and glass electrodes completes the offering.

The more stable display of the measured value with Science Line electrodes, as well as their longer life are due to their Silamid reference system. In contrast to the silver/silver chloride reference system of the BlueLine series, the ScienceLine employs. The ScienceLine employs a double junction design where the inner tube is coated with silver which provides for a very stable electrode. Hence, the stability of the potential is much higher.

Advantages ScienceLine

- Proven high-end electrodes for demanding measurement tasks
- Double junction Silamid® reference system for fast and stable acquiring of measured values and for longer electrode life.
- Utmost versatility of pH electrodes is achieved by a large selection of junctions, membrane glass types and shapes, shaft lengths and diameters, ground joints, plug connections and integrated temperature sensors.
- Each pH and metal combination electrode comes with individual serial number and quality certificate.
- Large selection of separate glass and reference electrodes, metal combination electrodes, conductivity sensors, ion selective electrodes and ammonia, sodium and oxygen sensors.

IoLine pH electrodes
for the most demanding measurement tasks

Patented three-chambers system with Iodine reservoir in the iodine/iodide reference electrode

The reference system is a very important part of the pH electrode. The standard hydrogen electrode has proven too difficult in practical use to gain more than a mere theoretical importance. The Ag/AgCl system, which is nowadays almost exclusively used, can cause measurement instabilities in contrast from potential variations with changing temperatures or reactions between the silver ions and the measuring solution in the area of the junction.

IoLine electrodes, in contrast, have the advantage of a much lower temperature sensitivity and a metal ion free reference system. The reference system is based on the following reaction:

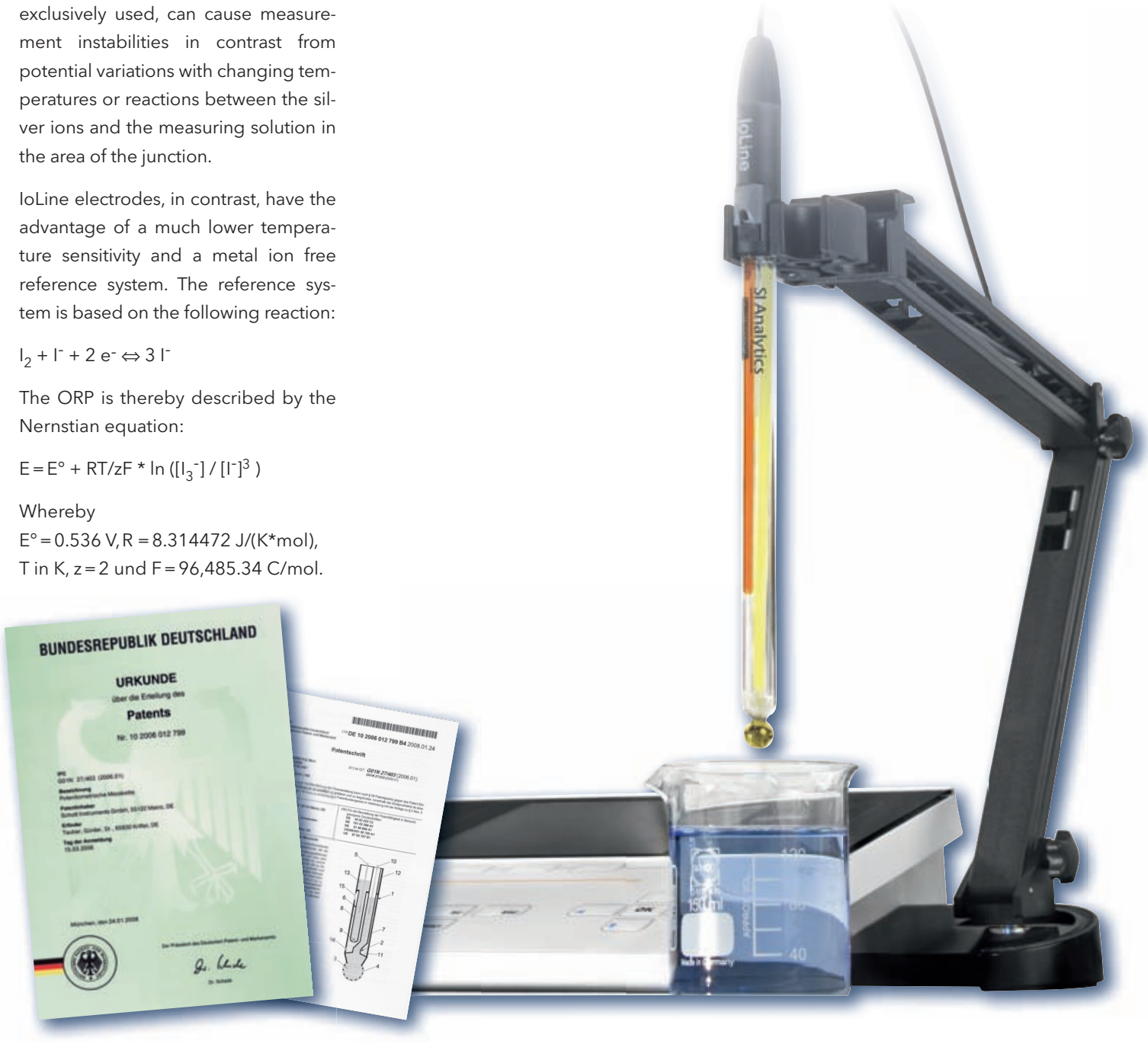
$I_2 + I^- + 2\ e^- \Leftrightarrow 3\ I^-$

The ORP is thereby described by the Nernstian equation:

$E = E° + RT/zF * \ln([I_3^-] / [I^-]^3)$

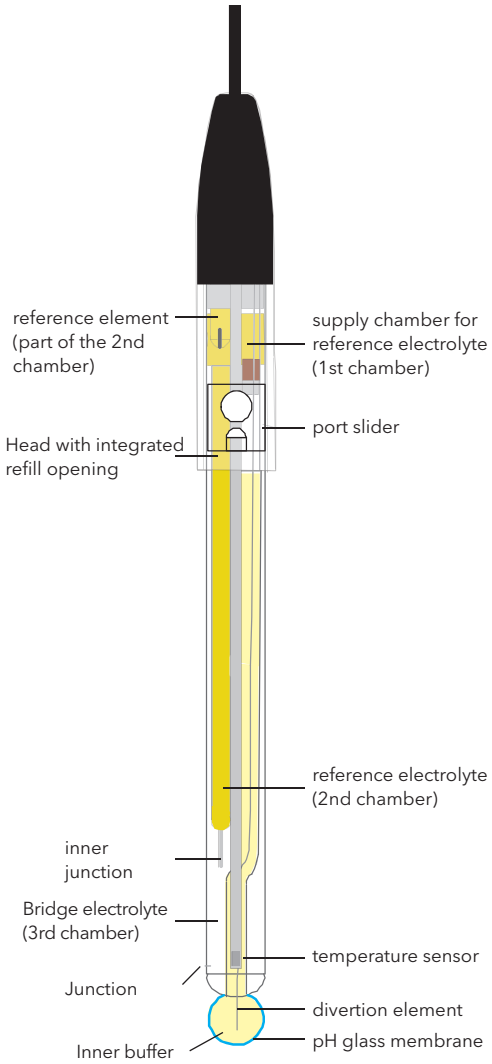
Whereby
$E° = 0.536$ V, $R = 8.314472$ J/(K*mol),
T in K, $z = 2$ und $F = 96{,}485.34$ C/mol.

The stability of the reference system potential even at changing temperatures is the key to the IoLine electrodes' superior response speed and measurement stability.



Platinum junction for fast response and high stability

Responsible for the high stability and fast response of the iodine/iodide reference system is our platinum junction, which has been developed by SCHOTT. It makes for remarkably constant and reproducible measurement characteristics of the electrode. The platinum junction contains twisted platinum wires being fused into the glass shaft of the electrode. The defined spaces of the platinum wires guarantee a continuous and steady electrolyte flow and high stability of the reference system in all media and at changing temperatures.



- **Unique iodine/iodide reference system**
  offers unbeatable stability, fast response times high accuracy and independence from sample composition and temperature compared to the electrodes with the usual Ag/AgCl reference system. Furthermore independent from sample composition and temperature.
- **Metal ion free reference system**
  avoids contamination of measurement media by unwanted metal ions i.e. optimal for use with Tris buffers. for measurements in Tris buffer.
- **Exchangeable bridge electrolyte**
  enables a matching of electrolyte solution and sample.
- **Wide application area**
  Ideal for most precise pH measurements in media for research and quality control i.e. pharmacy, biotechnology or food industry.
- **Electrode head with integrated refill port**
  enables easy refilling of the bridge electrolyte.
- **Extensive selection:**
  Many variants regarding the connection, the membrane glass types and shapes as well as junctions.
- **Delivered with:**
  Liquid vessel with bayonet connector to avoid drying of membrane and for storage of the electrode and certificate.

Advantages
IoLine

The corresponding sensor for any application: Application recommendations for pH and ORP electrodes

The table provides an orientation to the large variety of our electrodes. The listed electrodes give an example for similar measuring models, i.e. variation only regarding the connection system or the integrated temperature sensor. The electrode BlueLine 11 pH for instance also represents the versions 12 pH, 14 pH, 15 pH, 17 pH, 18 pH and 19 pH. These models are also available with longer shaft lengths: ScienceLine and IoLine pH electrodes N 62 and H 62 as well as IL-pH-A120MF and IL-pH-H120MF. An extension of length under the same application conditions delivers faster and more stable measuring results; additionally it enables a longer life of the electrode. The higher electrolyte along with the increased electrolyte outflow reduces unwanted diffusion potentials on the junction and rinses it free.

Some applications may require other electrode recommendations due to certain conditions, as identical applications can differ fundamentally with varying concentrations and temperatures. Please also note the material resistance of the sensor towards the measuring media. The recommended and additional sensors with the corresponding technical data are stated on the following pages and the highlighted last section.

… and conductivity cells

Electrode series		IoLine		pH measurement							BlueLine			ORP ScienceLine			ORP BlueLine		Conductivity ScienceLine			
Application area	Sensor example	IL-pH-A120MF	IL-pH-H120MF	A 7780	H 62	H 64	L 32	L 8280	N 62	N 64	11 pH	22 pH	13 pH	Ag 6280	Pt 62	Pt 8280	31 RX	32 RX	LF 313 T NFTC	LF 413 T	LF 613 T	LF 713 T
	Application																					
Chemistry	Etching and degreasing baths	■	■		■	■			■	■	■		■		■		■					■
	Bleach and dyeing solutions	■	■		■	■			■	■	■		■		■		■					■
	Cutting oil emulsions	■						■	■	■	■		■		■		■					■
	Cyanide detoxification	■	■		■	■			■	■	■		■		■		■					■
	Dispersion paint	■	■		■	■			■	■			■		■		■					■
	Emulsions, water-based	■	■		■	■		■	■	■	■		■		■		■		■			■
	Emulsions, partly water-based	■							■	■	■		■		■		■		■			■
	Paint/varnish, water-soluble	■	■		■	■			■	■	■		■		■		■		■			■
	Fixing bath	■	■		■	■			■	■	■		■	■					■			■
	Varnish, water-based	■	■		■	■			■	■	■		■		■		■		■			■
	Varnish, partly water-based	■							■	■	■		■		■		■		■			■
	Lye, extreme		■		■	■									■		■			■		■
	Oil/water-emulsions	■							■	■	■		■		■		■			■		■
	Organic percentile high	■							■	■			■		■		■		■			■
	Paper extract	■	■		■	■			■	■	■		■		■		■		■			■
	Acid, extreme	■	■		■	■			■	■	■		■		■		■					■
	Sulphide containing liquid	■	■						■	■					■		■		■			■
	Suspension, water-based	■	■		■	■		■	■	■			■		■		■		■	■		■
	Ink	■	■		■	■			■	■			■		■		■		■			■
	Viscose samples	■				■				■			■		■		■			■		
Field measurements	Beck	■		■			■	■	■	■	■	■	■		■	■	■	■		■	■	
	Ground water	■		■			■	■	■	■	■	■	■		■	■	■	■		■	■	
	Lake water	■		■			■	■	■	■	■	■	■		■	■	■	■		■	■	
	Seawater	■		■			■	■	■	■	■	■	■		■	■	■	■		■	■	
	Rain water	■		■			■	■	■	■	■	■	■		■	■	■		■	■	■	
Drinks production	Beer	■		■			■	■	■	■	■	■	■		■	■	■			■	■	
	Fruit juice	■		■			■	■	■	■	■		■		■	■	■			■	■	
	Vegetable juice	■		■			■	■	■	■	■		■		■	■	■			■	■	
	Lemonades/soda	■		■			■	■	■	■	■	■	■		■	■	■			■	■	
	Mineral water	■		■			■	■	■	■	■	■	■		■	■	■			■	■	
	Juice	■		■			■	■	■	■	■		■		■	■	■			■	■	
	Spirits	■		■				■	■	■	■		■		■		■			■	■	
	Wine	■		■				■	■	■	■		■		■	■	■			■	■	
		IL-pH-A120MF	IL-pH-H120MF	A 7780	H 62	H 64	L 32	L 8280	N 62	N 64	11 pH	22 pH	13 pH	Ag 6280	Pt 62	Pt 8280	31 RX	32 RX	LF 313 T NFTC	LF 413 T	LF 613 T	LF 713 T

Further application recommendations for pH

Electrode series		pH measurement															ORP					Conductivity			
		IoLine		ScienceLine								BlueLine					ScienceLine			BlueLine		ScienceLine			
Application area	Sensor example	IL-pH-A120MF	IL-SP-pH-A	A 7780	N 1048 A	L 32	L 39	L 6880	L 8280	N 62	N 64	11 pH	22 pH	13 pH	21 pH	27 pH	Pt 62	Pt 6140	Pt 8280	31 RX	32 RX	LF 313 T NFTC	LF 413 T	LF 613 T	LF 713 T
	Application																								
Cosmetics	Creme	■	■		■		■	■		■	■	■		■	■	■	■			■		■	■		
	Hair dye	■								■	■	■		■			■			■		■	■		
	Hair gel	■	■		■		■	■			■				■	■	■			■		■			
	Hair mousse	■								■	■	■		■			■			■		■	■		
	Lotions	■								■	■	■		■			■			■		■	■		
	Make-up	■								■	■	■		■		■	■			■			■		
	Mouth wash	■								■	■	■		■			■			■		■	■		
	Shaving cream	■								■	■	■		■			■			■		■	■		
	Sun lotion	■								■	■	■		■			■			■		■	■		
	Tooth paste		■		■		■	■			■	■		■	■	■	■			■		■	■		
Agriculture	Ground (extract/slug)	■		■		■			■	■	■	■		■			■		■	■	■		■		
	Fertilizer solution	■		■		■			■	■	■	■	■	■			■		■	■	■		■		
	Vegetables		■		■		■	■							■	■		■							
	Liquid manure	■		■		■			■	■	■	■		■			■		■	■	■		■		
	Fruit		■		■			■							■			■							
Food production	Bread/dough/pastry		■		■			■							■			■							
	Vinegar	■		■						■	■	■	■	■			■		■	■			■		■
	Grease	■								■	■	■		■			■			■			■		
	Fish		■		■			■							■			■							
	Meat		■		■			■							■			■							
	Honey		■		■			■						■	■		■				■			■		
	Margarine	■								■	■	■		■			■			■			■		
	Coffee extract	■								■	■	■		■			■		■	■			■	■	
	Jam/marmelade	■								■	■	■		■			■			■			■		
	Mayonnaise	■								■	■			■			■		■	■			■		
	Sausage		■		■		■	■							■	■		■							
Dairy	Butter	■	■							■	■				■		■			■			■		
	Yoghurt	■		■		■				■	■	■		■			■			■			■		
	Cheese		■		■		■	■		■	■				■	■	■			■					
	Milk	■		■		■				■	■	■		■			■			■			■		
	Cream	■								■	■	■		■			■			■			■		
Surface	Skin						■									■									
	Leather						■									■									
	Paper						■									■									
	Textiles						■									■									
		IL-pH-A120MF	IL-SP-pH-A	A 7780	N 1048 A	L 32	L 39	L 6880	L 8280	N 62	N 64	11 pH	22 pH	13 pH	21 pH	27 pH	Pt 62	Pt 6140	Pt 8280	31 RX	32 RX	LF 313 T NFTC	LF 413 T	LF 613 T	LF 713 T

… ORP electrodes and conductivity cells

Application area	Application	Sensor example	IL-pH-A120MF	IL-pH-H120MF	IL-Micro-pH-A	IL-SP-pH-A	A 157	A 7780	H 62	H 64	N 1048 A	L 32	L 39	L 6880	L 8280	N 62	N 64	N 6000 A	N 6003	11 pH	22 pH	13 pH	16 pH	21 pH	27 pH	Pt 62	Pt 6140	Pt 8280	Pt 5900 A	31 RX	32 RX	LF 213 T	LF 313 T	LF 313 T NFTC	LF 413 T	LF 613 T	LF 713 T
		Electrode series	IoLine				pH measurement ScienceLine													BlueLine						ORP ScienceLine				BL*		Conductivity ScienceLine					
Pharmacy, biology, biotechnology, medicine, microbiology	Agar-agar gel					■					■		■	■										■	■		■										
	Enzyme solution		■	■	■															■		■				■			■	■							■
	Infusion solutions		■	■	■											■	■			■		■				■				■							■
	Small vessels/sample quantitiy				■		■											■	■				■						■								
	Bacteria cultures		■	■	■		■	■								■	■	■	■	■		■	■			■				■							■
	Gastric juice			■												■	■			■		■				■				■							■
	NMR tubes																		■																		
	Precision measurement		■	■	■											■	■									■				■							
	Protein containing liquid		■	■	■											■	■									■				■							
	Serum		■	■	■		■									■	■	■	■				■			■			■	■							■
	Tris puffer		■		■																																■
	Urine		■	■	■											■	■			■		■				■				■							■
	Vials				■		■											■	■				■						■								
Techni-cal	Cooling water		■					■								■	■			■		■				■				■			■				
	Lye, hot			■					■	■																■				■							■
	Acid, hot			■					■	■																■				■							■
Washing agents	Detergents		■													■	■			■		■				■				■				■	■	■	■
	Disinfectant		■													■	■			■		■				■				■				■			■
	Cleaning agent		■													■	■			■		■				■				■				■	■		
	Soap solution		■													■	■			■		■				■				■				■	■		
	Dishwashing liquid		■													■	■			■		■				■				■				■	■		
	Surfactant solution		■													■	■			■		■				■				■				■	■		
Water	Waste water, general		■					■	■			■				■	■			■	■	■				■		■		■	■				■	■	
	Aquarium water		■					■				■				■	■			■	■	■				■		■		■	■				■	■	
	Demineralization/ion exchanger		■													■	■			■		■				■				■			■	■			
	pH values, extreme			■					■	■												■				■				■							■
	Media containing low ions		■					■								■	■			■		■				■				■			■	■			
	Boiler feed water		■					■								■	■			■		■				■				■		■	■	■			
	Condensate		■					■								■	■			■		■				■				■		■	■	■			
	Purity water		■														■			■		■				■				■		■					
	Salt solution			■				■	■			■			■					■		■				■		■		■	■				■	■	
	Drinking water		■					■								■	■			■		■				■		■		■	■		■	■	■	■	
	Drops												■												■												
			IL-pH-A120MF	IL-pH-H120MF	IL-Micro-pH-A	IL-SP-pH-A	A 157	A 7780	H 62	H 64	N 1048 A	L 32	L 39	L 6880	L 8280	N 62	N 64	N 6000 A	N 6003	11 pH	22 pH	13 pH	16 pH	21 pH	27 pH	Pt 62	Pt 6140	Pt 8280	Pt 5900 A	31 RX	32 RX	LF 213 T	LF 313 T	LF 313 T NFTC	LF 413 T	LF 613 T	LF 713 T

* BL = BlueLine

ID electrodes – reliable and precise pH measurements through automatic electrode recognition

Measurements with the utmost accuracy using complete systems

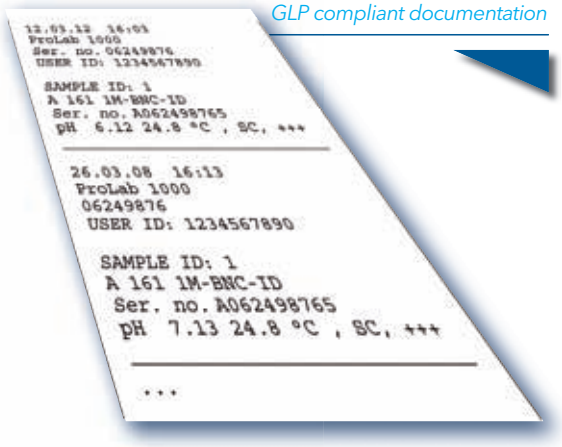
The demand for accuracy, reproducibility and primarily stability of the pH measurement is exceedingly high. It has become even more important to have an application focussed measurement system, consisting of electrodes, instrument and buffer solutions, as each measurement is unique. SI Analytics has taken this into account and offers premium components ideally corresponding to all your applications. Only a perfectly harmonising system will enable measurements of utmost accuracy.

Automatic electrode recognition guarantees the accuracy of the measurement

Basis for the accuracy of pH measurement is the calibration. So far the main efforts for optimizing the calibration focussed on instrument-based help functions, such as the automatic buffer recognition. Still the uncertainty regarding the electrode remained, not knowing for sure if the electrode was matches the calibration data stored with the instrument. To assure that the electrode's slope and zero point corresponded to the instrument stored data for calculation of the pH value it was necessary to re-calibrate.

The Lab 870 and 970 and the instruments of the ProLab family automatically recognizes the ID electrode. The ID sensors automatically transmit their individual data via a in the plug integrated micro transponder. The sensor data of the pH electrodes includes the slope and zero point, data of last calibration, buffer used as well as sensor type and serial number. The instrument uses this specific data for each corresponding ID electrode in order to calculate the pH value whether using the ID electrode with multiple instruments or various ID electrodes on one instrument.

GLP compliant documentation



Wireless sensor recognition

Continuous updating of sensor data

When the ID electrode is calibrated using with the Lab 870/970 or the ProLab instruments the data on the electrode are updated. The instrument will recognize and access the calibration data for the next measurement. This process runs in the background without any interaction by user. The result is taken with stable measurements and there is no need for repeated calibrations when changing the sensor.

Records include sensor type and serial number

The instruments also fulfil the increasing documentation requirements. The data, includes sensor type and serial number along with measurement values, data and time are part of the record, which can be transferred to the PC via interfaces.

- **Each ID sensor has a unique identification.**
- **Highest reliability** – data exchange between sensor and instrument is fully automatic.
- Several ID sensors can be used with one instrument and one ID sensor can be used with multiple instruments via recognition, **without having to re-calibrate.**
- Accurate and reliable measurements with sensor specific data
- **GLP at its best:**
  Automatic and complete documentation of calibrations and measurements including the electrode used (model and serial number) with date, time and measurement values.

Advantages ID

ID electrodes for highest reliability
… with fixed cable and integrated electrode recognition

ID electrodes for pH measurement

Shaft material:	glass
Zero point:	pH = 7.0 ± 0.3
pH range:	0 to 14
Reference system[1]:	iodine/iodide, Silamid®, Ag / AgCl
Reference electrolyte:	KCl 3 mol/l
Fixed cable:	1m long, with DIN or BNC plug and banana plug with the versions including an integrated temperature sensor

[1] please view the following pages for the technical data of each electrode

IL-pHT-A120-DIN-N
IL-pHT-A120-BNC-N

IL-pHT-A170-DIN-N
IL-pHT-A170-BNC-N

A 7780 1M-DIN-ID
A 7780 1M-BNC-ID

A 161 1M-DIN-ID
A 161 1M-BNC-ID

A 164 1M-DIN-ID
A 164 1M-BNC-ID

BlueLine 14 pH ID
BlueLine 15 pH ID

ID electrodes for conductivity measuring with temperature sensor

Temperature sensor:	NTC 30 kΩ
Fixed cable:	1 m long, 8-pole plug

* LFOX 1400 ID for oxygen measurement

LF 213 T-ID

LF 313 T-ID

LF 413 T-ID

LF 913 T-ID

LFOX 1400 ID*

A selection of our ID electrodes

ID electrodes for pH measuring

Micro, spear tip and surface combination electrodes

Shaft material:	glass (except BlueLine 21: plastic shaft)
Zero point:	pH = 7.0 ± 0.3
pH range:	0 to 14 (except BlueLine 21 and 27: 1 to 13 pH)
Reference system[1]:	iodine/iodide, Silamid®, Ag/AgCl
Reference electrolyte:	KCl 3 mol/l, gel or Referid®
Fixed cable:	1 m long, with DIN or BNC plug and banana plug with the versions including an integrated temperature sensor

[1] please view the following pages for the technical data of each electrode

IL-Micro-pHT-A-DIN-N	L 6880 1M-DIN-ID	N 1048 1M-DIN-ID	L 39 1M-DIN-ID	N 6000 1M-DIN-ID	BlueLine 21 pH 1M-DIN-ID	BlueLine 27 pH 1M-DIN-ID
IL-Micro-pHT-A-BNC-N	*L 6880 1M-BNC-ID*	*N 1048 1M-BNC-ID*	*L 39 1M-BNC-ID*	*N 6000 1M-BNC-ID*	*BlueLine 21 pH 1M-BNC-ID*	*BlueLine 27 pH 1M-BNC-ID*

lectrodes

IoLine pH combination electrodes

pH combination electrodes

Reference system:	iodine/iodide
Zero point:	pH = 7,00 ± 0.25
pH range:	0 to 14
Temp. range:	–5 to 100 °C
Shaft material:	glass

A **IL-pH-A120-MF**
IL-pH-A120

B **IL-pH-A170-MF**
IL-pH-A170

C **IL-pH-A120-MF-DIN**
IL-pH-A120-DIN
IL-pH-A120-MF-BNC
IL-pH-A120MF-R
IL-pH-A120-BNC

D **IL-pH-A170-MF-DIN**
IL-pH-A170-DIN
IL-pH-A170-MF-BNC
IL-pH-A170MF-R
IL-pH-A170-BNC

E **IL-Micro-pH-A**
IL-Micro-pH-A-DIN
IL-Micro-pH-A-BNC

F **IL-SP-pH-A**
IL-SP-pH-A-DIN
IL-SP-pH-A-BNC

Glossary

IL	IoLine
Micro	micro pH electrode for measuring in small sample vessels
SP	spear tip pH electrode for measuring in solid and semi-solid samples
pH	pH combination electrodes
pHT	pH combination electrodes with temperature sensor
A	A-type membrane glass
H	H-type membrane glass
120	120 mm overall length
170	170 mm overall length
MF	platinum junction (multi-flow)
DIN	DIN instrument plug
BNC	BNC instrument plug
R	Metrohm plug
N	4 mm banana plug
CI	cinch plug

Type No.	Order No.	Length L [mm]	Ø [mm]	Junction	Membrane glass	Membrane glass resistance	Membrane shape	Connection	Appli-cation	Shape
IL-pH-A120MF	285114140	120	12	platinum	A	200 MΩ	sphere	Screw plug head S7	■	A
IL-pH-A120	285114150	120	12	ceramic	A	200 MΩ	sphere	Screw plug head S7	■	A
IL-pH-A170MF	285114180	170	12	platinum	A	200 MΩ	sphere	Screw plug head S7	■	B
IL-pH-A170	285114190	170	12	ceramic	A	200 MΩ	sphere	Screw plug head S7	■	B
IL-pH-A120MF-DIN	285113810	120	12	platinum	A	200 MΩ	sphere	DIN[1)]	■	C
IL-pH-A120-DIN	285113820	120	12	ceramic	A	200 MΩ	sphere	DIN[1)]	■	C
IL-pH-A120MF-BNC	285114160	120	12	platinum	A	200 MΩ	sphere	BNC[1)]	■	C
IL-pH-A120-BNC	285114170	120	12	ceramic	A	200 MΩ	sphere	BNC[1)]	■	C
IL-pH-A120MF-R	285114410	120	12	platinum	A	200 MΩ	sphere	Metrohm plug[1)]	■	C
IL-pH-A170MF-DIN	285113830	170	12	platinum	A	200 MΩ	sphere	DIN[1)]	■	D
IL-pH-A170-DIN	285113840	170	12	ceramic	A	200 MΩ	sphere	DIN[1)]	■	D
IL-pH-A170MF-BNC	285114340	170	12	platinum	A	200 MΩ	sphere	BNC[1)]	■	D
IL-pH-A170-BNC	285114350	170	12	ceramic	A	200 MΩ	sphere	BNC[1)]	■	D
IL-pH-A170MF-R	285114420	170	12	platinum	A	200 MΩ	sphere	Metrohm plug[1)]	■	D
IL-MICRO-pH-A	285114280	200 (70/130)	12/6	platinum	A	400 MΩ	cylindrical	Screw plug head S7	■	E
IL-MICRO-pH-A-DIN	285113930	200 (70/130)	12/6	platinum	A	400 MΩ	cylindrical	DIN[1)]	■	E
IL-MICRO-pH-A-BNC	285114290	200 (70/130)	12/6	platinum	A	400 MΩ	cylindrical	BNC[1)]	■	E
IL-SP-pH-A	285114320	120 (50/70)	12/8	ceramic	A	400 MΩ	spear	Screw plug head S7	■	F
IL-SP-pH-A-DIN	285113940	120 (50/70)	12/8	ceramic	A	400 MΩ	spear	DIN[1)]	■	F
IL-SP-pH-A-BNC	285114330	120 (50/70)	12/8	ceramic	A	400 MΩ	spear	BNC[1)]	■	F

■ general applications, low ion media

■ small sample quantities

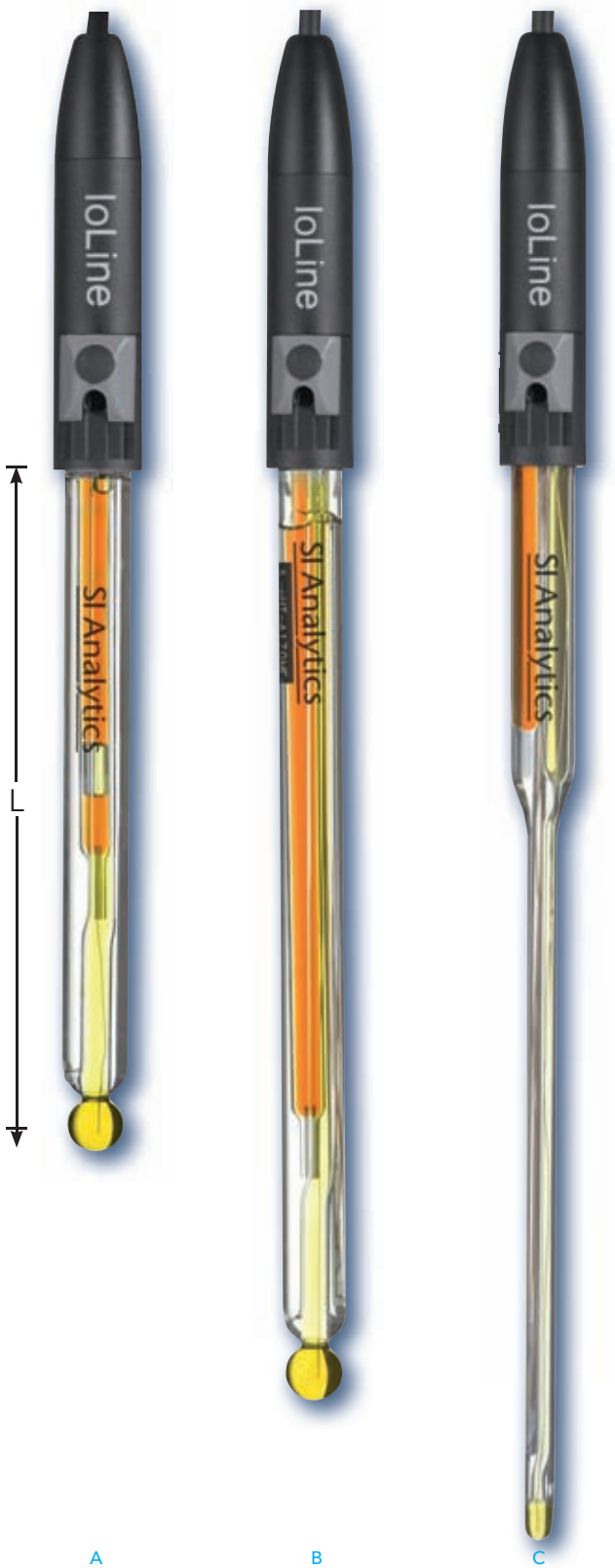
■ insert measurement

[1)] with 1 m fixed cable

IoLine pH combination electrodes with temperature sensor

pH combination electrodes with temperature sensor

Reference system:	iodine/iodide
Zero point:	pH = 7,00 ± 0.25
pH range:	0 to 14
Temp. range:	–5 to 100 °C
Shaft material:	glass



A
- **IL-pHT-A120MF-DIN-N**
- *IL-pHT-A120-DIN-N*
- *IL-pHT-A120MF-BNC-CI*
- *IL-pHT-A120MF-R-NN*
- *IL-pHT-A120MF-BNC-N*
- *IL-pHT-A120-BNC-N*
- *IL-pHT-H120MF-DIN-N*
- *IL-pHT-H120-DIN-N*
- *IL-pHT-H120MF-BNC-N*
- *IL-pHT-H120-BNC-N*

B
- **IL-pHT-A170MF-DIN-N**
- *IL-pHT-A170-DIN-N*
- *IL-pHT-A170MF-BNC-CI*
- *IL-pHT-A170MF-R-NN*
- *IL-pHT-A170MF-BNC-N*
- *IL-pHT-A170-BNC-N*
- *IL-pHT-H170MF-DIN-N*
- *IL-pHT-H170-DIN-N*
- *IL-pHT-H170MF-BNC-N*
- *IL-pHT-H170-BNC-N*

C
- **IL-MICRO-pHT-A-DIN-N**
- *IL-MICRO-pHT-A-BNC-N*

Glossary

IL	IoLine
Micro	micro pH electrode for measuring in small sample vessels
SP	spear tip pH electrode for measuring in solid and semi-solid samples
pH	pH combination electrodes
pHT	pH combination electrodes with temperature sensor
A	A-type membrane glass
H	H-type membrane glass
120	120 mm overall length
170	170 mm overall length
MF	platinum junction (multi-flow)
DIN	DIN instrument plug
BNC	BNC instrument plug
R	Metrohm plug
N	4 mm banana plug
CI	cinch plug

Type No.	Order No.	Length L [mm]	Ø [mm]	Junction	Membrane glass	Membrane glass resistance	Membrane shape	Temp. sensor	ID Function	Connection with 1 m fixed cable	Appli-cation	Shape
IL-pHT-A120MF-DIN-N	285113890	120	12	platinum	A	200 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	A
IL-pHT-A120-DIN-N	285113900	120	12	ceramic	A	200 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	A
IL-pHT-A120MF-BNC-N	285113850	120	12	platinum	A	200 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	A
IL-pHT-A120-BNC-N	285113860	120	12	ceramic	A	200 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	A
IL-pHT-H120MF-DIN-N	285113870	120	12	platinum	H	300 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	A
IL-pHT-H120-DIN-N	285113880	120	12	ceramic	H	300 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	A
IL-pHT-H120MF-BNC-N	285114200	120	12	platinum	H	300 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	A
IL-pHT-H120-BNC-N	285114210	120	12	ceramic	H	300 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	A
IL-pHT-A120MF-BNC-CI	285114370	120	12	platinum	A	200 MΩ	sphere	NTC 30 kΩ		BNC + cinch	■	A
IL-pHT-A120MF-R-NN	285114390	120	12	platinum	A	200 MΩ	sphere	Pt 1000		Metrohm plug + 2 banana plug	■	A
IL-pHT-A170MF-DIN-N	285113910	170	12	platinum	A	200 Mohm	sphere	Pt 1000	yes	DIN + banana plug	■	B
IL-pHT-A170-DIN-N	285113920	170	12	ceramic	A	200 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	B
IL-pHT-A170MF-BNC-N	285114220	170	12	platinum	A	200 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	B
IL-pHT-A170-BNC-N	285114230	170	12	ceramic	A	200 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	B
IL-pHT-H170MF-DIN-N	285114240	170	12	platinum	H	300 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	B
IL-pHT-H170-DIN-N	285114250	170	12	ceramic	H	300 MΩ	sphere	Pt 1000	yes	DIN + banana plug	■	B
IL-pHT-H170MF-BNC-N	285114260	170	12	platinum	H	300 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	B
IL-pHT-H170-BNC-N	285114270	170	12	ceramic	H	300 MΩ	sphere	Pt 1000	yes	BNC + banana plug	■	B
IL-pHT-A170MF-BNC-CI	285114380	170	12	platinum	A	200 MΩ	sphere	NTC 30 kΩ		BNC + cinch	■	B
IL-pHT-A170MF-R-NN	285114400	170	12	platinum	A	200 MΩ	sphere	Pt 1000		Metrohm plug + 2 banana plug	■	B
IL-MICRO-pHT-A-DIN-N	285114300	200 (70/130)	12/6	platinum	A	400 MΩ	cylindrical	Pt 1000	yes	DIN + banana plug	■	C
IL-MICRO-pHT-A-BNC-N	285114310	200 (70/130)	12/6	platinum	A	400 MΩ	cylindrical	Pt 1000	yes	BNC + banana plug	■	C

■ general applications, low ion media

■ small sample quantities

■ high temperatures, optimized for alkaline area

ScienceLine pH combination electrodes

pH combination electrodes with plug head and fixed cable

Reference system:	Silamid®
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 and L 7780: gel electrolyte, L 8280: Referid® electrolyte)
Membrane shape:	sphere
pH range:	0 to 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 64**	**N 65**	**L 32**	**A 7780**	**N 6980**	**L 8280**
H 62	*H 64 1M-DIN-ID*	*H 65*		*L 7780*		
H 63	*H 64 1M-BNC-ID*	*H 6580*				
N 61	*N 64*	*N 6580*				
N 62	*N 6480 eis*					
H 6180	*N 6480 eth*					
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 61-500						
H 61-600						

Order No.	Type No.	Length L [mm]	Ø [mm]	Junction	pH-glass	Temp. range [°C]	Connection	Remarks
285101260	A 7780	120	12	3 x ceramic	A	–5 to +80	plug head	gel electrolyte
285100207	H 61	170	12	platinum	H	+10 to +100	plug head	
285092583	H 61-500	500	12	platinum	H	0 to +100	plug head	
285092591	H 61-600	600	12	platinum	H	0 to +100	plug head	
285102524	H 6180	170	12	ceramic	H	+10 to +100	plug head	
285100215	H 62	120	12	platinum	H	+10 to +100	plug head	
285102532	H 6280	120	12	ceramic	H	+10 to +100	plug head	
285100223	H 63	320	12	platinum	H	+10 to +100	plug head	
285102549	H 6380	320	12	ceramic	H	+10 to +100	plug head	
285100231	H 64	170	12	ground joint	H	+10 to +100	plug head	
285130220	H 64 1M-DIN-ID	170	12	ground joint	H	+10 to +100	DIN plug[2)]	ID function
285130230	H 64 1M-BNC-ID	170	12	ground joint	H	+10 to +100	BNC plug[2)]	ID function
285100248	H 65	103[1)]	10	platinum	H	+10 to +100	plug head	standard taper NS 14.5
285102565	H 6580	103[1)]	10	ceramic	H	+10 to +100	plug head	standard taper NS 14.5
1061093	L 32	120	12	fibre	A	–5 to +50	plug head	plastic shaft
285101252	L 7780	120	12	ceramic	A	–5 to +80	plug head	gel electrolyte
285101277	L 8280	120	12	KPG®	A	–5 to +80	plug head	Referid® electrolyte
285100437	N 42 A	120	12	ceramic	A	–5 to +100	DIN plug[2)]	
285101544	N 42 BNC	120	12	ceramic	A	–5 to +100	BNC plug[2)]	
285100453	N 50 A	108	12	ceramic	A	–5 to +100	DIN plug[2)]	for portable Knick pH meters
285100494	N 52 A	120	12	platinum	A	–5 to +100	DIN plug[2)]	
285105451	N 52 BNC	120	12	platinum	A	–5 to +100	BNC plug[2)]	
285100001	N 61	170	12	platinum	A	–5 to +100	plug head	
285100018	N 6180	170	12	ceramic	A	–5 to +100	plug head	
285100034	N 62	120	12	platinum	A	–5 to +100	plug head	
285100112	N 6250	120	12	ceramic	A	+15 to +40	plug head	calomel ref., for TRIS buffers
285100042	N 6280	120	12	ceramic	A	–5 to +100	plug head	
285100059	N 64	170	12	ground joint	A	–5 to +100	plug head	
285100067	N 65	103[1)]	10	platinum	A	–5 to +100	plug head	standard taper NS 14.5
285102516	N 6580	103[1)]	10	ceramic	A	–5 to +100	plug head	standard taper NS 14.5
285101709	N 6980	103[1)]	10	ground joint	A	–5 to +100	plug head	standard taper NS 14.5
285092661	N 61eis	170	12	3 x platinum	A	+10 to +40	plug head	electrolyte L 5014, Ag/AgCl ref.
285092337	N 6480 eis	170	12	ground joint	A	+10 to +40	plug head	electrolyte L 5014, Ag/AgCl ref.
285092329	N 6480 eth	170	12	ground joint	A	0 to +40	plug head	electrolyte L 5014, Ag/AgCl ref.

[1)] Length from upper end of standard taper
[2)] with 1 m fixed cable

ScienceLine pH combination electrodes with temperature sensor

pH combination electrodes with temperature sensor

Reference system:	Silamid®
Shaft material:	glass
Diameter:	12 mm
Zero point:	pH = 7.0 ± 0.3
Electrolyte:	KCl 3 mol/l
Temperature sensor:	Pt 1000
Membrane shape:	sphere
pH range:	0 to 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 1042 BNC
N 1050 A
N 1051 A
N 1051 BNC
N 1052 A
N 1052 BNC
N 2041 A
N 2042 A
N 1041 A - 600
N 1043 A

A 162
A 161
H 161
H 162
A 161 1M DIN ID
A 161 1M BNC ID
H 161 1M DIN ID
H 161 1M BNC ID

A 164
A 164 1M DIN ID
A 164 1M BNC ID

A 7780 1M DIN ID
A 7780 1M BNC ID

Order No.	Type No.	Length L [mm]	Junction	pH-glass	Temp.-range [°C]	Connection	Remarks
285129517	A 161	170	platinum	A	–5 to +100	SMEK plug head	
285130240	A 161 1M-DIN-ID	170	platinum	A	–5 to +100	DIN[1]- + 4-mm plug	ID function
285130250	A 161 1M-BNC-ID	170	platinum	A	–5 to +100	BNC[1]- + 4-mm plug	ID function
285129525	A 162	120	platinum	A	–5 to +100	SMEK plug head	
285129600	A 164	170	ground joint	A	–5 to +100	SMEK plug head	
285130280	A 164 1M-DIN-ID	170	ground joint	A	–5 to +100	DIN[1]- + 4-mm plug	ID function
285130290	A 164 1M-BNC-ID	170	ground joint	A	–5 to +100	BNC[1]- + 4-mm plug	ID function
285130200	A 7780 1M-DIN-ID	120	3 x ceramic	A	–5 to +80	DIN-[1] + 4-mm plug	ID function
285130210	A 7780 1M-BNC-ID	120	3 x ceramic	A	–5 to +80	BNC-[1] + 4-mm plug	ID function
285129590	H 161	170	platinum	H	+10 to +100	SMEK plug head	
285130260	H 161 1M-DIN-ID	170	platinum	H	+10 to +100	DIN[1]- + 4-mm plug	ID function
285130270	H 161 1M-BNC-ID	170	platinum	H	+10 to +100	BNC[1]- + 4-mm plug	ID function
285129580	H 162	120	platinum	H	+10 to +100	SMEK plug head	
285100486	N 1041 A	170	ceramic	A	–5 to +100	DIN-[1] + 4-mm plug	
285093111	N 1041 A-600	600	ceramic	A	–5 to +100	DIN-[1] + 4-mm plug	Ag/AgCl ref.
285100531	N 1041 BNC	170	ceramic	A	–5 to +100	BNC-[1] + 4-mm plug	
285104541	N 1042 A	120	ceramic	A	–5 to +100	DIN-[1] + 4-mm plug	
285105476	N 1042 BNC	120	ceramic	A	–5 to +100	BNC-[1] + 4-mm plug	
285093009	N 1043 A	320	ceramic	A	–5 to +100	DIN-[1] + 4-mm plug	
285100375	N 1050 A	108	ceramic	A	–5 to +100	DIN-[1] + 4-mm plug	for portable Knick pH Meter
285100510	N 1051 A	170	platinum	A	–5 to +100	DIN-[1] + 4-mm plug	
285100500	N 1051 BNC	170	platinum	A	–5 to +100	BNC-[1] + 4-mm plug	
1054512	N 1052 A	120	platinum	A	–5 to +100	DIN-[1] + 4-mm plug	
285100380	N 1052 BNC	120	platinum	A	–5 to +100	BNC-[1] + 4-mm plug	
285100342	N 2041 A	170	ceramic	A	–5 to +100	DIN-[1] + 2-mm plug	
285100359	N 2042 A	120	ceramic	A	–5 to +100	DIN-[1] + 2-mm plug	

[1] with 1 m fixed cable

ScienceLine micro, spear tip and surface pH combination electrodes

Micro, spear tip and surface pH combination electrodes

Reference system:	Silamid®
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 1M BNC ID
A 157
A 157 1M DIN ID

N 5800 A
N 5800 BNC
N 5900 A

N 6000 1M DIN ID
N 6000 1M BNC ID
N 6000 A
N 6000 BNC

N 6003

L 6880
L 6880 1M-DIN-ID
L 6880 1M-BNC-ID
L 8880

N 1048 A
N 1048 1M DIN ID
N 1048 1M DIN ID
N 48 A
N 48 BNC

L 39
L 39 1M DIN ID
L 39 1M DIN ID

Order No.	Type No.	Length L [mm]	Ø [mm]	Junction	pH-glass	Membrane shape	Temp.-range [°C]	Range [pH]	Connection	Remarks
Micro										
285129610	A 157[1]	70/130	12/5	platinum	A	cylindrical	-5 to +100	0 to 14	SMEK plug head	
285130160	A 157 1M-DIN-ID[1]	70/130	12/5	platinum	A	cylindrical	-5 to +100	0 to 14	DIN plug[3]	ID function
285130170	A 157 1M-BNC-ID[1]	70/130	12/5	platinum	A	cylindrical	-5 to +100	0 to 14	BNC plug[3]	ID function
285105127	N 5800 A	96[2]	5	3 x platinum	A	spear	-5 to +100	0 to 14	DIN plug[3]	Ag/AgCl ref.
285105579	N 5800 BNC	96[2]	5	3 x platinum	A	spear	-5 to +100	0 to 14	BNC plug[3]	Ag/AgCl ref.
285105135	N 5900 A	96[2]	5	platinum	A	sphere	-5 to +100	0 to 14	DIN plug[3]	Ag/AgCl ref.
285105151	N 6000 A	96[2]	3	platinum	A	cylindrical	-5 to +100	0 to 14	DIN plug[3]	Ag/AgCl ref.
285105632	N 6000 BNC	96[2]	3	platinum	A	cylindrical	-5 to +100	0 to 14	BNC plug[3]	Ag/AgCl ref.
285130180	N 6000 1M-DIN-ID	96[2]	3	platinum	A	cylindrical	-5 to +100	0 to 14	DIN plug[3]	ID function, Ag/AgCl ref.
285130190	N 6000 1M-BNC-ID	96[2]	3	platinum	A	cylindrical	-5 to +100	0 to 14	BNC plug[3]	ID function, Ag/AgCl ref.
285105176	N 6003	70/180	12/3	ceramic	A	cylindrical	-5 to +100	0 to 14	plug head	Ag/AgCl ref.
Spear tip										
285101211	L 6880	70/50	12/8	3 x ceramic	A	spear	-5 to +100	0 to 14	plug head	
285130100	L 6880 1M-DIN-ID	70/50	12/8	3 x ceramic	A	spear	-5 to +100	0 to 14	DIN plug[3]	ID function
285130110	L 6880 1M-BNC-ID	70/50	12/8	3 x ceramic	A	spear	-5 to +100	0 to 14	BNC plug[3]	ID function
285101285	L 8880	70/50	12/8	hole	A	spear	-5 to +80	2 to 13	plug head	
285104611	N 1048 A[1]	120	12	ceramic	A	spear	-5 to +100	0 to 14	DIN-[3] + 4-mm plug	
285130120	N 1048 1M-DIN-ID[1]	120	12	ceramic	A	spear	-5 to +100	0 to 14	DIN-[3] + 4-mm plug	ID function
285130130	N 1048 1M-BNC-ID[1]	120	12	ceramic	A	spear	-5 to +100	0 to 14	BNC-[3] + 4-mm plug	ID function
285100445	N 48 A	120	12	ceramic	A	spear	-5 to +100	0 to 14	DIN plug[3]	
285101569	N 48 BNC	120	12	ceramic	A	spear	-5 to +100	0 to 14	BNC plug[3]	
Surface										
1061094	L 39	120	12	fibre	A	flat	-5 to +50	1 to 13	plug head	
285130140	L 39 1M-DIN-ID	120	12	fibre	A	flat	-5 to +50	1 to 13	DIN plug[3]	ID function
285130150	L 39 1M-BNC-ID	120	12	fibre	A	flat	-5 to +50	1 to 13	BNC plug[3]	ID function

[1] with integrated temperature sensor Pt 1000
[2] Length from upper end of standard taper (Standard taper NS 7.5)
[3] with 1 m fixed cable

ScienceLine metal combination electrodes

Metal combination electrodes with Silver/Silverchloride reference system, plug head and connection cable

Temperature range:	–5 to + 100 °C (except Pt 6140: + 10 to + 40 °C)
Reference system:	Silamid®
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

Metal-Reference electrodes with pH glass membrane reference system and plug head for titrations

Temperature range:	-5 to + 100 °C
Reference system:	pH glass membrane Type A
Shaft material:	glass
Length:	120 mm
Diameter:	12 mm
Connection cable for plug head:	z.B. L 1 A

(please refer to the page "connection cables")

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 6140

Pt 8280

Pt 5900 A
Pt 5900 BNC
Pt 5901

Pt 62 RG
Ag 62 RG
AgCl 62 RG
AgS 62 RG

Order No.	Type No.	Length L [mm]	Junction	Ø [mm]	Sensor Metal, shape	Connection	Remarks
285102051	Ag 42 A	120	ceramic	12	Ag, cap, 5 mm Ø	DIN plug[4]	electrolyte L 2114, Ag/AgCl ref.
285102208	Ag 6180	170	ceramic	12	Ag, cap, 5 mm Ø	plug head	electrolyte L 2114, Ag/AgCl ref.
285102343	Ag 6280	120	ceramic	12	Ag, cap, 5 mm Ø	plug head	electrolyte L 2114, Ag/AgCl ref.
285102216	Ag 6580	103[1]	ceramic	10	Ag, cap, 5 mm Ø	plug head	electrolyte L 2114, Ag/AgCl ref.
285102351	AgCl 6280[3]	120	ceramic	12	Ag, cap, 5 mm Ø	plug head	electrolyte L 2114, Ag/AgCl ref.
285102413	AgCl 62[3]	120	platinum	12	Ag, cap, 5 mm Ø	plug head	electrolyte L 2114, Ag/AgCl ref.
1061051	AgCl 65[3]	103[1]	platinum	12	Ag, cap, 5 mm Ø	plug head	electrolyte L 2114, Ag/AgCl ref.
285102121	Au 6280	120	ceramic	12	Au, pole, 2 mm Ø	plug head	
285102302	Pt 42 A	120	ceramic	12	Pt, pole, 1 mm Ø	DIN plug[4]	
285102224	Pt 48 A	120	ceramic	12	Pt, ring, 6 mm Ø	DIN plug[4]	Ag/AgCl ref.
285105192	Pt 5900 A	96[2]	platinum	5	Pt, pole, 1 mm Ø	DIN plug[4]	Ag/AgCl ref.
285105702	Pt 5900 BNC	96[2]	platinum	5	Pt, pole, 1 mm Ø	BNC plug[4]	Ag/AgCl ref.
285105065	Pt 5901	160[2]	platinum	5	Pt, pole, 1 mm Ø	plug head	
285102002	Pt 61	170	platinum	12	Pt, pole, 1 mm Ø	plug head	
285102019	Pt 62	120	platinum	12	Pt, pole, 1 mm Ø	plug head	
285097162	Pt 6140	150/20	platinum	12/5	Pt, pole, 1 mm Ø	plug head	for spear tip, electrolyte L420
285102232	Pt 6180	170	ceramic	12	Pt, pole, 1 mm Ø	plug head	
285102249	Pt 6280	120	ceramic	12	Pt, pole, 1 mm Ø	plug head	
285102257	Pt 6580	103[1]	ceramic	10	Pt, pole, 1 mm Ø	plug head	
285100075	Pt 6880	120	ceramic	12	Pt, ring, 6 mm Ø	plug head	
285102265	Pt 6980	170	ceramic	12	Pt, ring, 6 mm Ø	plug head	
285102281	Pt 8280	120	KPG®	12	Pt, round, 6 mm Ø	plug head	electrolyte Referid®
285102090	Ag 62 RG	120	–	12	Pt bearing – silver coated, ring, 6 mm Ø	plug head	
285102100	AgCl 62 RG	120	–	12	Pt-bearing – silver coated, chlorinated, ring, 6 mm Ø	plug head	
285102110	AgS 62 RG	120	–	12	Pt bearing – silver coated, sulfidized, ring, 6 mm Ø	plug head	
285102070	Pt 62 RG	120	–	12	Pt, ring, 6 mm Ø	plug head	

[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
[4] with 1 m fixed cable

ScienceLine single electrodes:
pH glass electrodes and metal electrodes

ScienceLine single electrodes

pH glass electrodes

Reference system:	Silamid®
Shaft material:	glass, 12 mm Ø
Zero point:	pH = 7.0 ± 0.3
Membrane shape:	sphere
Connection cable:	e.g. L 1 A

Metal electrodes

Shaft material:	glass, 12 mm Ø (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[1]	120	H	0 to 14	0 to + 80	plug head
285103212	H 1180	120	H	0 to 14	10 to + 100	plug head

Order No.	Type No.	Length L [mm]	Sensor Metal	Sensor shape	Temp. range [°C]	Remarks
285103607	Ag 1100	120	Ag	cap, 4 mm Ø	– 5 to + 100	plug head, cable e.g. L 1 A
285102030	KF 1100	96[1]	Pt[2]	2 pole, 1 mm Ø	– 30 to + 135	shaft 5 mm Ø, standard taper NS 7.5, fixed cable, 2 x 4-mm plug
285103512	Pt 1200	120	Pt[2]	2 pole, 1 mm Ø	– 30 to + 135	plug head, cable e.g. L 1 NN
285103537	Pt 1400	103[1]	Pt[2]	2 pole, 1 mm Ø	– 30 to + 135	shaft 10 mm Ø, standard taper NS 14.5, cable e.g. L 1 NN
285103553	Pt 1800	120	Pt	ring, 6 mm Ø	– 30 to + 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 to 14
Connection cable:	e.g. L 1 N

B 2220+ | B 2420+ | B 2810+ *B 2820+ B 2910+ B 2920+* | B 3420+ *B 3410+ B 3510+ B 3520+ B 3610+* | B 3920+

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

Conductivity measuring cells with fixed cable and 8-pole plug

Temperature sensor: NTC 30 kΩ

LF 213 T	LF 313 T NTFC	LF 413 T-3	LF 513 T	LF 713 T	LF 913 T	LFOX 1400
LF 213 T ID	*LF 313 T*	*LF 413 T*	*LF 613 T*	*LF 713 T-250*	*LF 913 T ID*	*LFOX 1400 ID*
	LF 313 T ID	*LF 413 T ID*	*LF 813 T*			

Order No.	Type No.	Length L [mm]	Ø [mm]	Sensor	Cell const. ~ [cm^{-1}]	Temp. range [°C]	Meas. range[1)] [µS/cm]. . .[mS/cm]	Remarks
285106150	LF 213 T	120	12	Stainless steel	0.01	0 to + 100	0 to 0.03	Trace conductivity cell with integrated flow-through vessel, stainless steel, 1.5 m cable
285106160	LF 213 T ID	120	12	Stainless steel	0.01	0 to + 100	0 to 0.03	Trace conductivity cell with integrated flow-through vessel, stainless steel, 1.5 m cable, ID function
285414360	LF 313 T	120	12	Stainless steel	0.1	0 to + 100	0 to 0.2	Ultrapure water conductivity cell **with** flow-through vessel, stainless steel shaft, fixed cable 1.5 m
285130300	LF 313 T-ID	120	12	Stainless steel	0.1	0 to + 100	0 to 0.2	Ultrapure water conductivity cell **with** flow-through vessel, stainless steel shaft, cable 1.5 m, ID function
285414351	LF 313 T NFTC	120	12	Stainless steel	0.1	0 to + 100	0 to 0.2	Ultrapure water conductivity cell **without** flow-through vessel, stainless steel shaft, fixed cable 1.5 m
285106172	LF 413 T	120	15.3	4 x Graphite	0.475	– 5 to + 80	1 to 2,000	Plastic shaft, 1.5 m cable
285130310	LF 413 T-ID	120	15.3	4 x Graphite	0.475	– 5 to + 80	1 to 2,000	Plastic shaft, 1.5 m cable, ID function
285106148	LF 413 T-3	120	15.3	4 x Graphite	0.475	– 5 to + 80	1 to 2,000	Plastic shaft, fixed cable 3 m
285106037	LF 513 T	120	12	2 Pt rings	1.0	– 5 to + 80	1 to 200	Plastic shaft, 1 m cable
285106131	LF 613 T	120	12	4 Pt rings	1.0	– 5 to + 80	1 to 2,000	Plastic shaft, 1 m cable
285106189	LF 713 T	120	12	4 Pt rings	1.0	– 30 to + 135	1 to 2,000	Glass shaft, 1 m cable
285106190	LF 713 T-250	250	12	4 Pt rings	1.0	– 30 to + 135	1 to 2,000	Glass shaft, 1 m cable
285106250	LF 813 T	120	12	5 Pt rings	0.650	– 5 to + 80	1 to 2,000	Plastic shaft, 1 m cable
285106260	LF 913 T	120	12	5 Pt rings	0.650	– 30 to + 135	1 to 2,000	Glass shaft, 1 m cable
285130320	LF 913 T-ID	120	12	5 Pt rings	0.650	– 30 to + 135	1 to 2,000	glass shaft, 1 m cable, ID function
285104630	LFOX 1400	145	15.3	Graphite	0.475	0 to + 50	1 to 2,000	Combined 4-pole conductivity cell and galvanic D.O. sensor LFOX 1400 ID, plastic shaft, fixed cable 3 m
285130330	LFOX 1400 ID	145	15.3	Graphite	0.475	0 to + 50	1 to 2,000	Combined 4-pole conductivity cell and galvanic D.O. sensor LFOX 1400 ID, plastic shaft, fixed cable 3 m, ID function

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

ScienceLine conductivity measuring cells with plug head

Conductivity measuring cells with plug head

Shaft: 12 mm Ø

LF 1100+ | LF 1100T+ | LF 4100+ | LF 5100+ *LF 5100T+*

Order No.	Type No.	Length L [mm]	Ø [mm]	Sensor	Cell const. ~ [cm^{-1}]	Temp. range [°C]	Meas. range[1] [µS/cm] to [mS/cm]	Remarks
1069976	LF 1100+	120	12	2 Pt plates	1.0	–30 to 135	1 to 200	SMEK plug head
1069977	LF 1100T+	120	12	2 Pt plates	1.0	–30 to 135	1 to 200	SMEK plug head
1069978	LF 4100+	100	12	2 Pt plates	1.0	–30 to 135	1 to 200	SMEK plug head, flow-through cell
1069979	LF 5100+	120	12	2 Pt rings	1.0	–5 to 80	1 to 200	SMEK plug head, plastic shaft
1069990	LF 5100T+	120	12	2 Pt rings	1.0	–5 to 80	1 to 200	SMEK plug head, plastic shaft

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

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

Ammonia combination electrode with plug head

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

Sodium combination electrode with plug head

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

Oxygen electrodes

Shaft material: plastic (POM)

ISE measuring cells

Shaft material: plastic
Length: 120 mm
Fixed cable: 1 m long, with DIN plug

ISE combination electrodes with plug head

Shaft material: plastic
Length: 120 mm

NH 1100 Na 61 OX 1100+ 9009/61 Cu 1100 A Ca 1100 A F 1100 A Pb 1100 A F 60 Cl 60 NO 60 K 60 CA 60 CN 60 AG-S 60 I 60 BR 60 CU 60 PB 60

Order No.	Type No.	Length L [mm]	Temp. range [°C]	Meas. range [mg/l]	Remarks
285102808	NH 1100	120	0 to +50	0.1 to 1,000	membrane module replaceable

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

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

Order No.	Type No.	Parameter	Temp. range [°C]	pH-range	Measuring range [mg/l]
285216314	Ca 1100 A	Calcium	0 to +40	2.5 to 11	0.02 to 40,000
285216312	Cu 1100 A	Copper	0 to +80	2 to 6	0.0006 to 6,400
285216313	F 1100 A	Fluoride	0 to +80	5 to 7	0.02 to saturated
285216315	Pb 1100 A	Lead	0 to +80	4 to 7	0.1 to 20,000

Order No.	Type No.	Parameter	Temp. range [°C]	pH-range	Measuring range [mg/l]
285130340	F 60	Fluoride	0 to +80	5 to 7	0.02 to saturated
285130350	Cl 60	Chloride	0 to +80	2 to 12	2 to 35,000
285130360	NO 60	Nitrate	0 to +40	2.5 to 11	0.4 to 62,000
285130370	K 60	Potassium	0 to +40	2 to 12	0.04 to 39,000
285130380	CA 60	Calcium	0 to +40	2.5 to 11	0.02 to 40,000
285130390	CN 60	Cyanide	0 to +80	0 to 14	0.2 to 260
285130400	AG-S 60	Sulfide / silver	0 to +80	2 to 12	0.003 to 32,000 / 0,01 to 108.000
285130410	I 60	Iodide	0 to +80	0 to 14	0.006 to 127,000
285130420	BR 60	Bromide	0 to +80	1 to 12	0.4 to 79,000
285130430	CU 60	Copper	0 to +80	2 to 6	0.0006 to 6400
285130440	PB 60	Lead	0 to +80	4 to 7	0.2 to 20,000

[1)] Other cable lengths available on request

Resistance thermometers

Resistance thermometers
with SMEK plug head

Resistance thermometers
with 1 m fixed cable

Resistance thermometer
with coaxial plug head

W 2030+
W 2130+

W 5780 NN

W 5790 NN
W 5790 PP
W 5791 NN

W 5980 NN

W 2180-KOAX

Resistance thermometers with SMEK plug head

Order No.	Type No.	Length L [mm]	Ø [mm]	Sensor	Temp. range [°C]	Shaft material	Connection cable e.g.
1069991	W 2030 +	120	12	Pt 100	–30 to + 135	glass	LS 1 N6
1069992	W 2130 +	120	12	Pt 1,000	–30 to + 135	glass	LS 1 N6

Resistance thermometers with 1 m fixed cable

Order No.	Type No.	Lenght L [mm]	Ø [mm]	Sensor	Temp. range [°C]	Shaft material	Connection plug
285105221	W 5780 NN	120	6	Pt 1,000	–30 to + 135	glass	2 x 4 mm Ø
285105254	W 5790 NN	120	4	Pt 1,000	–30 to + 135	stainless steel	2 x 4 mm Ø
285105776	W 5790 PP	120	4	Pt 1,000	–30 to + 135	stainless steel	2 x 4 mm Ø
285105262	W 5791 NN	170	4	Pt 1,000	–30 to + 135	stainless steel	2 x 4 mm Ø
285105287	W 5980 NN	96[1)]	5 NS 7.5	Pt 1,000	–30 to + 135	glass	2 x 4 mm Ø

Resistance thermometer with coaxial plug head

Order No.	Type No.	Length L [mm]	Ø [mm]	Sensor	Temp. range [°C]	Shaft material
285119030	W 2180-KOAX	120	12	Pt 1,000	–30 to + 135	glass

ceLine

[1)] length from upper end of standard taper

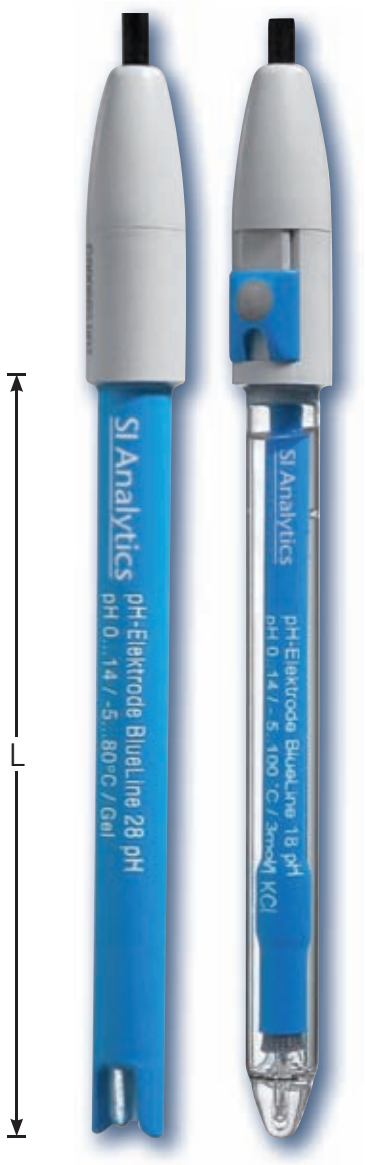
BlueLine pH combination electrodes

The robust electrodes for general applications

pH range	0 to 14
Temperature range	-5 to +80 °C
Shaft	Noryl, 12 mm Ø
Shaft length L	120 mm
Zero point	pH = 7.0 ± 0.3
Junction	fibre
Reference system	Ag/AgCl
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 to 14
Temperature range	-5 to +100 °C
Shaft	glass, 12 mm Ø
Shaft length L L	120 mm
Zero point	pH = 7.0 ± 0.3
Junction	platinum
Reference system	Ag/AgCl
Reference electrolyte	KCl 3 mol/l
Shape of glass membrane	conical
Resistance of glass membrane (25 °C)	200 MΩ
Type of membrane glass	A



BlueLine
28 pH
22 pH
23 pH
23-2 pH
23-5 pH-S
24 pH
24-3 pH
25 pH
25-2 pH
25-5 pH
26 pH
26 pH-Cinch
28 pH-P
28-5 pH
29 pH
29 pH-P

BlueLine
18 pH
11 pH
12 pH
14 pH
14 pH ID
15 pH
15 pH ID
15 pH Cinch
17 pH
17 pH-R
19 pH

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
1063462	23-2 pH	no	2 m fixed cable with DIN plug
1066411	23-5 pH-S	no	5 m fixed cable with S plug
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
1063461	25-2 pH	no	2 m fixed cable with BNC plug
285129540	25-5 pH	no	5 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 1,000	1 m fixed cable with DIN plug 19 262 + banana plug
1065896	28 pH-P	Pt 1,000	1 m fixed cable with DIN plug 19 262 + 2-mm pole plug
285129570	28-5 pH	Pt 1,000	5 m fixed cable with DIN plug 19 262 + banana plug
1065895	29 pH	Pt 1,000	1 m fixed cable with BNC plug + banana plug
1065894	29 pH-P	Pt 1,000	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
285129440	14 pH ID	NTC 30 kΩ	1 m fixed cable with DIN plug + 4-mm banana plug, ID function
285129155	15 pH	NTC 30 kΩ	1 m fixed cable with BNC plug + banana plug
285129450	15 pH ID	NTC 30 kΩ	1 m fixed cable with BNC plug + 4-mm banana plug, ID function
285095730	15 pH Cinch	NTC 30 kΩ	1 m fixed cable with BNC plug + cinch plug
285129171	17 pH	no	1 m fixed cable with BNC plug
1064746	17 pH-R	no	1 m fixed cable with Metrohm plug
285129188	18 pH	Pt 1,000	1 m fixed cable with DIN plug 19 262 + banana plug
285129190	19 pH	Pt 1,000	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

21 pH 1M DIN ID

21 pH 1M BNC ID

BlueLine 27 pH

27 pH 1M DIN ID

27 pH 1M BNC ID

BlueLine 54 pH

BlueLine 56 pH

BlueLine 56 pH Cinch

BlueLine 31 Rx

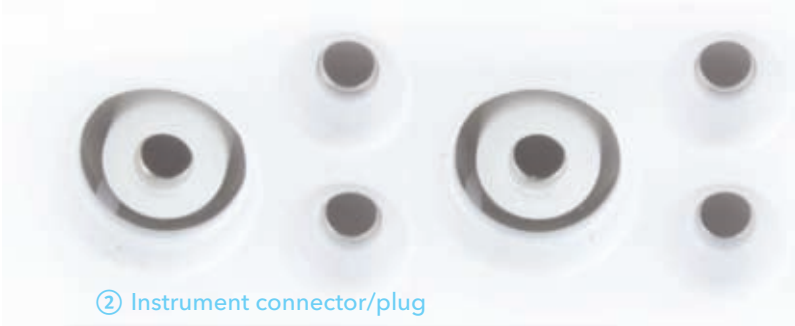
BlueLine 32 Rx

BlueLine 48 LF

BlueLine

Precision electrode BlueLine 13 pH	Glass shaft, screw ground joint junction, electrolyte KCl 3 mol/l, Ag/AgCl reference system, spherical membrane, A-glass, plug head, length 170 mm, 12 mm Ø, –5 to +100 °C, 0 to 14 pH, Order No. 285129139
Micro electrode BlueLine 16 pH	Glass shaft, platinum junction, electrolyte KCl 3 mol/l, Ag/AgCl reference system, spherical membrane, A-glass, plug head, length 40/80 mm, 12/5 mm Ø, –5 to +100 °C, 0 to 14 pH, Order No. 285129163
Spear tip electrode BlueLine 21 pH	Glass shaft, hole junction, Referid® electrolyte, Ag/AgCl reference system, Spear membrane, A-glass, plug head, length 65/25 mm, 12/5 mm Ø, –5 to +80 °C, 2 to 13 pH, Order No. 285129217
Spear tip electrode with sensor recognition BlueLine 21 pH 1M-DIN-ID	Like BlueLine 21 pH but with 1 m fixed cable with DIN plug and sensor recognition Order No. 285129930
Spear tip electrode with sensor recognition BlueLine 21 pH 1M-BNC-ID	Like BlueLine 21 pH but with 1 m fixed cable with BNC plug and sensor recognition Order No. 285129940
Surface electrode BlueLine 27 pH	Glass shaft, KPG® annular gap junction, Referid® electrolyte, Ag/AgCl reference system, flat membrane, A-glass, plug head, length 120 mm, 12 mm Ø, –5 to +50 °C, 2 to 13 pH, Order No. 285129274
Surface electrode with sensor recognition BlueLine 27 pH 1M-DIN-ID	Like BlueLine 27 pH but with 1 m fixed cable with DIN plug and sensor recognition Order No. 285129950
Surface electrode with sensor recognition BlueLine 27 pH 1M-BNC-ID	Like BlueLine 27 pH but with 1 m fixed cable with BNC plug and sensor recognition Order No. 285129960
Combination electrode with plastic shaft BlueLine 54 pH	Ceramic junction, electrolyte KCl 3 mol/l, Ag/AgCl-reference system, temp.-sensor NTC 30 kΩ, cylinder membrane, A glass, 1 m fixed cable with BNC- +4-mm banana plug, length 120 mm, 12 mm Ø, –5 to +80 °C, 0 to 14 pH Order No. 285129460
Combination electrode with plastic shaft BlueLine 56 pH	Like BlueLine 54 pH but with BNC plug Order No. 285129640
Combination electrode with plactic shaft Blueline 56 pH cinch	Like BlueLine 54 pH but with BNC and cinch plug Order No. 285129650
Redox electrode BlueLine 31 Rx	Glass shaft, ceramic junction, electrolyte KCl 3 mol/l, Ag/AgCl reference system, sensor platinum disk 4 mm Ø, plug head, length 120 mm, 12 mm Ø, –5 to +100 °C, Order No. 285129311
Redox electrode BlueLine 32 Rx	Plastic shaft, fiber junction, gel electrolyte, Ag/AgCl reference system, sensor platinum pin 1 mm Ø, plug head, length 120 mm, 12 mm Ø, –5 to +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 Ø, –5 to +100 °C, measuring range 0 to 300 µS/cm, Order No. 285129488

Connection cables



① Electrode socket/plug

Coaxial plug for pH, redox, ammonia and sodium combination electrodes, pH and redox single electrodes as well as reference electrodes in *Plus* series. The L and LB series plugs are compatible. The LB sockets are matching colors with the BlueLine electrodes.

plug L
plug LB

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

plug 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 9 907 / 00

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

plug 9 909 / 00

② Instrument connector/plug

A (DIN 19 262)

BNC

EE (Radiometer)

R (Metrohm)

S (UK socket without extension)

N (4-mm banana plug)

P (2-mm pole plug)

8-pole (for Handylab and Lab and ProLab conductometer)

9910 / 00

Not illustrated:

X (without instrument plug, meaning free cable end)

The connecting cables are available in various combinations of electrode socket, instrument plug and cable length. Should you i. e. require a coaxial cable for connecting a pH electrode to a meter, please select i. e.a cable type L 1 A. The "L" as part of the type description stands for the coaxial plug (please refer to page 86) of the electrode, the middle number stands for the cable length and the "A" for the instrument connection (in this example for a DIN plug).

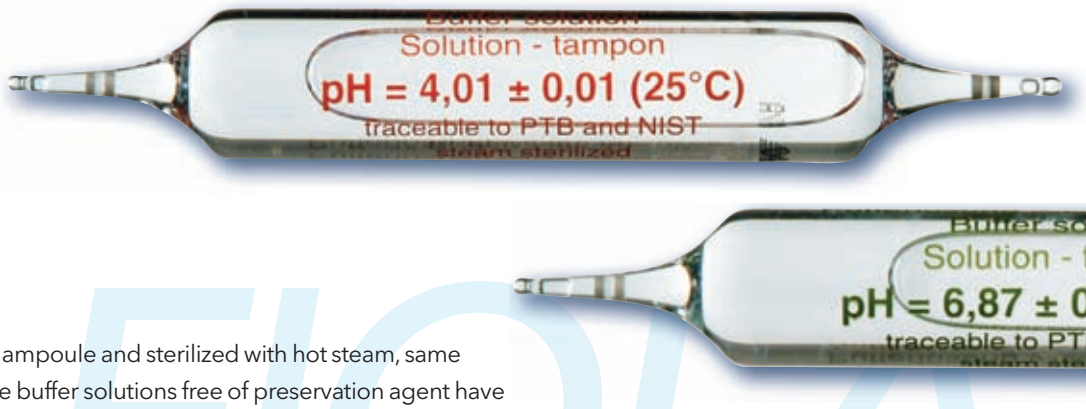
In case you do not find your desired cable combination listed below, please contact us.

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 1 X	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
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 (N)	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 (N)	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 (N)	1 m cable KA19
285122715	LS 3 ANN	SMEK electrode plug	DIN (A) + 2 x 4 mm banana plug (N)	3 m cable KA19
285122723	LS 1 BNCNN	SMEK electrode plug	BNC + 2 x 4 mm banana plug (N)	1 m cable KA19
285122731	LS 3 BNCNN	SMEK electrode plug	BNC + 2 x 4 mm banana plug (N)	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 (N)	1 m cable KA09
285122756	LS 1 RNN	SMEK electrode plug	Metrohm (R) + 2 x 4 mm banana plug (N)	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 (N) for LF cells	1 m two-conductor cable
285125618	9909/31	electrode plug (9907/00)	2 x 4-mm plug (N)	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

Solutions

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



The exactness of the pH measurement is mainly dependent on the accuracy of calibration. This again highly depends on the reliability of the buffer.

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

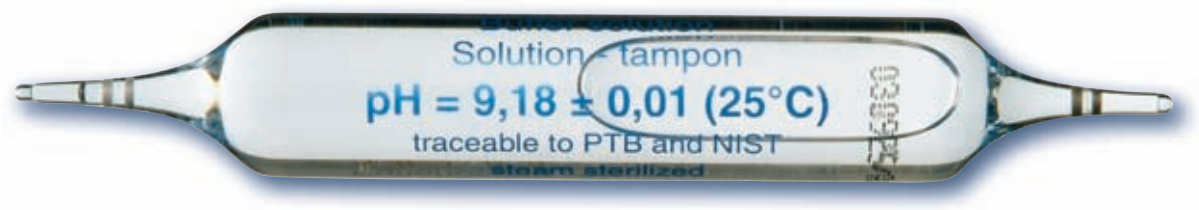
The ampoules can be easily opened at the breaking point. Tools are not required. Since refilling is not possible, you are always ensured of maximum calibration reliability.

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 20 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate
285138238	L 4798	4.01 / 6.87 / 9.18	3 x 20 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

Order No.	Type No.	pH value at 25 °C	Contents
285137841	L 168	1.68	1,000 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	1,000 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	1,000 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	1,000 ml in DURAN® glass bottle, with manufacturer's certificate
285138024	L 9184	9.18	250 ml in DURAN® glass bottle, with manufacturer's certificate

* 20 ml volume = ~17 ml content



- Highest measurement reliability
- Extremely long storage times, thanks to hot-steam sterilization
- No preservative agents
- Maximize calibration reliability

Advantages FIOLAX®

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

Order No.	Type No.	pH value at 25 °C	Contents
285138213	L 4694	4.00	60 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate
285138221	L 4697	7.00	60 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate
285138205	L 4691	10.01	60 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate
285138398	L 4690	4.00/7.00	2 x 30 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate
285138192	L 4698	4.00/7.00/10.01	3 x 20 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate
285138632	L 4895/Set	4.00/7.00	2 x 9 FIOLAX® ampoules à 20 ml*, with manufacturer's certificate, with electrolyte solution L 3008,

Order No.	Type No.	pH value at 25 °C	Contents
285138727	L 400	4.00	1,000 ml in DURAN® glass bottle, with manufacturer's certificate
285138032	L 4004	4.00	250 ml in DURAN® glass bottle, with manufacturer's certificate
285138735	L 700	7.00	1,000 ml in DURAN® glass bottle, with manufacturer's certificate
285138049	L 7004	7.00	250 ml in DURAN® glass bottle, with manufacturer's certificate
285138719	L 100	10.01	1,000 ml in DURAN® glass bottle, with manufacturer's certificate
285138057	L 1004	10.01	250 ml in DURAN® glass bottle, with manufacturer's certificate

* 20 ml volume = ~17 ml content

Solutions

Color-coded technical buffer solutions in plastic bottles

Order No.	Type No.	pH value at 25 °C	Contents
285139156	LC 4004 K	4.01	250 ml in PE bottle
285139189	LC 7004 K	7.00	250 ml in PE bottle
285139218	LC 1004 K	10.01	250 ml in PE bottle

Electrolyte solutions, aqueous
for reference electrodes, as electrolyte bridges and for storage

Order No.	Type No.	Description	Contents
285136956	L 101	potassium chloride solution 1 mol/l	1,000 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)	1,000 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
285138554	L 300	potassium chloride solution 3 mol/l	1,000 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
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	1,000 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	1,000 ml in DURAN® glass bottle
285138143	L 350	potassium chloride solution 3.5 mol/l	1,000 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	1,000 ml in DURAN® glass bottle
285138608	L 4204	potassium chloride solution 4.2 mol/l	250 ml in DURAN® glass bottle
285138590	L 911	storage electrolyte solution, sterilized	1,000 ml in DURAN® glass bottle
285138560	L 9114	storage electrolyte solution, sterilized	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
285138308	L 5034	LiCl 1,5 mol/l 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	30 ml in PE bottle
285138287	OX 060	zero point solution for oxygen electrodes OX 1100 / OX 1100 +	60 FIOLAX® ampoules à 20 ml volume = ~17 ml content

Solutions for ammonia measurements

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

Solutions for ISE electrodes

Order No.	Type No.	Description	Contents
106575	ELY / BR / 503	Bridge electrolyte, general (except potassium and nitrate)	250 ml
106577	ELY / BR / 503 / K	Bridge electrolyte for potassium	250 ml
106576	ELY / BR / 503 / N	Bridge electrolyte for nitrate	250 ml
120120	ES / Br	Standard solution conc. 10 g/l bromide	1,000 ml
120200	ES / Ca	Standard solution conc. 10 g/l calcium	1,000 ml
120140	ES / CL	Standard solution conc. 10 g/l chloride	1,000 ml
120190	ES / Cu	Standard solution conc. 10 g/l copper	1,000 ml
120160	ES / F	Standard solution conc. 10 g/l flouride	1,000 ml
120180	ES / I	Standard solution conc. 10 g/l iodide	1,000 ml
120210	ES / K	Standard solution conc. 10 g/l iodide	1,000 ml
120220	ES / NO_3	Standard solution conc. 10 g/l nitrate	1,000 ml
120100	ES / Pb	Standard solution conc. 10 g/l lead	1,000 ml
140120	ISA / Ca	Ionic strength adjustment solution for calcium	250 ml
140110	ISA / FK	250 ml Ionic strength adjustment solution for Pb^{2+}, Br^-, Cl^-, I^-, Cu^{2+}, SCN^-, Cd^{2+}	250 ml
106580	ISA / K	Ionic strength adjustment solution for K^+	250 ml
150130	MZ / NH_3 / CN	Alkaline solution for the adjustment of the ionic strength for the CN^- electrode	250 ml
140100	TISAB	Ionic strength adjustment solution for F^-	4 x 1,000 ml
150120	TISAB / NO_3	Ionic strength adjustment solution for nitrate	4 x 1,000 ml

Solutions

Solutions and accessories for conductivity measurements

Order No.	Type No.	Description	Contents
285126503	LF 990	test solution KCl 0.001 mol/l (147 µS/cm)	3 x 6 FIOLAX® ampoules à 20 ml*, with manufacturer certificate
285126511	LF 991	test solution KCl 0.01 mol/l (1.41 mS/cm)	3 x 6 FIOLAX® ampoules à 20 ml*, with manufacturer certificate
285126528	LF 992	test solution KCl 0.1 mol/l (12.9 mS/cm)	3 x 6 FIOLAX® ampoules à 20 ml*, with manufacturer certificate
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*, with manufacturer certificate
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*, with manufacturer certificate
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 (maximum shelf life: unopened three months, opened six hours)	250 ml in PE bottle
285126540	LF CSKC5	test solution KCl 5.0 µS/cm, (maximum shelf life: six months)	500 ml in PE bottle

Accessories for electrodes

Order No.	Type No.	Redox voltage Pt/Calomel (KCl sat.)	Pt/Ag/AgCl (KCl 3 mol/l)	Contents
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	3 x 20 FIOLAX® ampoules à 20 ml*
285138184	L 430	430 mV	470 mV	1,000 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	1,000 ml in DURAN® glass bottle
285138295	L 5104	pepsin / hydrochloric acid solution	250 ml in DURAN® glass bottle

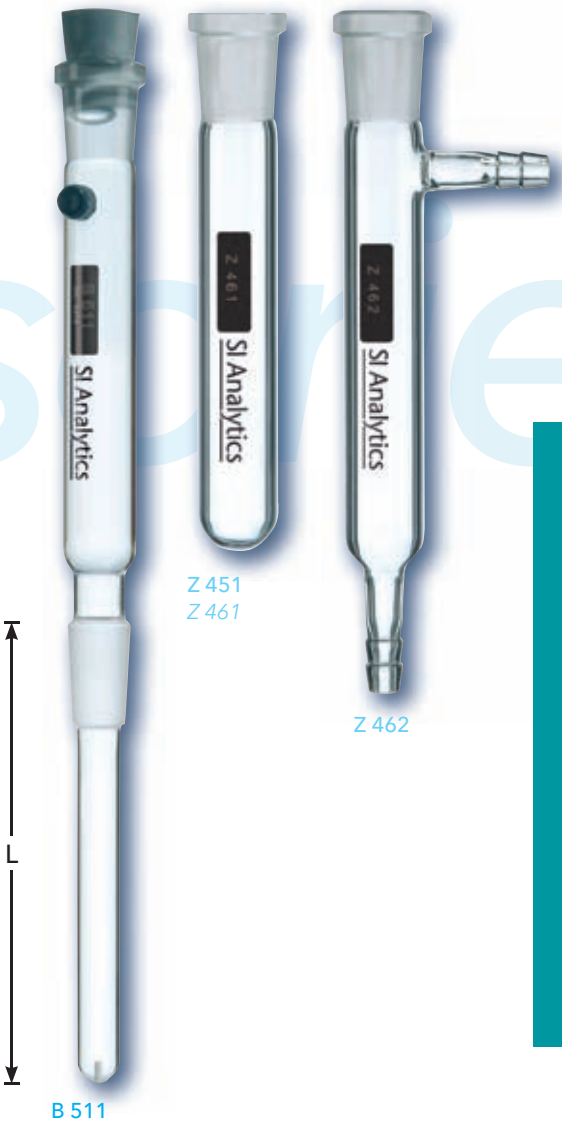
* 20 ml volume = ~17 ml content

Electrolyte bridges, other accessories

Electrolyte bridges
Shaft: glass, 12 mm Ø

Order No.	Type No.	Length L [mm]	Junction	Description
285104209	B 511	103[1)]	ceramic	standard taper NS 14.5 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



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Accessories for electrodes

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
285215229	TZ 1520	taper adapter NS 14.5 of PTFE for electrodes with Ø 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
285123170	Z 453	electrode vessel for storing electrodes with Ø 12 mm shaft
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 Ø 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
285129509	Z 512	plug head sealing cap with female thread for BlueLine electrodes

Z 453

Tips for succussful measurement with pH and redox electrodes

Content

Chapter 1: How are pH single-rod measuring cells constructed?

Problem

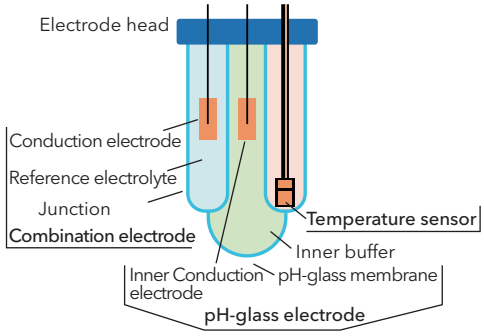
The users can select from a variety of different electrodes for the pH measurement. When first selecting, the selection is often the problem. It is therefore important to describe the components of the pH electrodes including their features, so that the best electrode can be found for the application.

Question

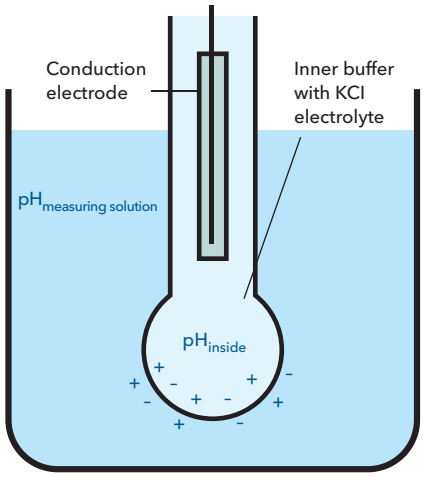
Which components make up a single-rod pH measuring cell and what functions do they have?

Answer

The basic structure of pH electrodes is very simple: As potentiometric measuring chains, they consist of a measuring electrode and a reference electrode. For many years, it has been the state of the art to integrate both in a shaft as single rod measuring cell. In addition, a large proportion of pH electrodes available on the market today have already an installed temperature sensor to automatically compensate the temperature dependence of the electrode slope in the pH meter. The construction of such pH-electrodes is described in DIN 19261 and clearly schematically shown in Figure 1 1.



1 *Structure of a single rod measuring cell*



2 *The processes on the junction of the single-rod measuring*

Why does the user need a reference electrode for the pH measurement?

The pH glass electrode is the measuring electrode. The pH signal is generated by it in mV, which is directly proportional to the pH value of the measurement solution. However, the measurement signal can only be measured against a reference electrode, since only differences in potential and therefore voltages can be measured. The reference electrode ideally has a stable, constant potential independent of the pH value and the composition of the medium at all temperatures.

What happens on the glass junction?

The glass junction changes due to the pH value 2. Under the effect of water, alkali ions dissolve from the glass surface and the oxide bridges of the silicate framework partially become OH-groups based on the absorption of water. This is how a "gel layer" develops. This gel layer acts on hydrogen ions as an ion exchanger.

Chapter 2:
Reference systems of pH electrodes

How does the exchange process work?

In the special pH junction glasses, a reproducible balance develops between the solution and the glass surface, which only depends on the hydrogen ion concentration in the solution and in the gel layer.

Finally, the question remains, how the user recognizes the right choice of the measuring chain: The correct measurement chain provides the highest measurement reliability and longest service life in the application.

Conclusion

Only an electrode matching the application achieves the best measurement reliability and maximum service life. It is especially important to pay attention to the type of junction in the selection of the electrode. This is established by the connection between the electrode and the measuring medium. For example, the platinum junction, which provides a fast and stable measurement setting with its defined electrolyte flow and at the same time protects itself against the penetration of the measurement medium, is generally usable.

Problem

Besides glass membranes and junctions, pH-electrodes differ in reference systems and junction types (junction). The desired application makes the choice between pH electrode reference systems and junctions easier.

Question

What is a pH electrode reference system and why do I need it? What kind of reference systems are there for pH electrodes and what features can they provide 3 ?

Answer

The most common method to obtain a pH measurement is by measuring a voltage. To measure a voltage the pH electrode must be able to measure the difference between two points with different electrical potential values. For a pH electrode to provide a voltage measurement of a solution's ion concentration a reference electrode is necessary because its potential essentially remains constant and independent of the solution and temperature relative to the solution being measured. The pH electrode can then use that reference electrode's potential to determine how the solution's ion concentration compares to the reference. The voltage developed from this comparison is then turned into the pH measurement.

The Standard Hydrogen Electrode (SHE) is used as the international reference system. Unfortunately due to its complicated handling requirements it is not typically used for standard applications. A common approved reference system is the Saturated calomel Electrode (SCE), however this electrode contains mercury and is toxic. The most common reference system is the silver/silver chloride reference system (Ag/AgCl). However, Ag/AgCl can precipitate silver when exposed to certain samples. An alternate configurations to the standard silver/silver chloride reference system is the double junction system. The double junction construction isolates the Ag/AgCl from the sample by means of a second chamber containg a simple electrolyte solution such as potassium chloride (KCl). A special type of double junction electrode is the Silamid double junction reference system which is a special construction of the Ag/AgCl reference system. Most electrodes having a Ag/AgCl system are built with an Ag wire coated with AgCl. Silamid reference systems have a glass tube with the inner part coated with Ag,

Reference System	Advantage	Disadvantage
Ag/AgCl	Well described, multifunctional, reproducible, wide temperature range, nontoxic ➔ environmental sustainability	Reference potential depends on temperature and could deliver a different potential, if measured at a different temperature as calibrated
Hg/Hg_2Cl_2 (Calomel)	Stable reference potential	Toxic, low temperature application range 59 to 104 °F (15 to 40 °C)
Tl,Hg/TlCl (Thalamide)	very low hysteresis, broad temperature range, low temperature coefficient	toxic, out of production
Iodine/Iodide	Low polarization, low temperature dependence, free of undesired heavy metal ions	formerly limited long-life-cycle

table 1 : Advantages and disadvantages of different reference systems

Chapter 3:
pH glass electrode types

then filled with AgCl, and plugged with a polyester fibre. This reference system creates greater contact surface area between Ag and AgCl compared to the standard Ag/AgCl wire system. This results in a reference system that is long lasting and very stable. A more recent reference system is the iodine/iodide system. The iodine/iodide reference system does not precipitate silver and can be used with Tris buffers. The advantages and disadvantages of different reference systems are displayed in table 1. Further characteristics of the reference electrode are defined by the junction.

Conclusion

The most important pH electrode reference system is the Ag/AgCl system because it is well described, reproducible, and nontoxic. In the few applications where this reference system does have problems the newer iodine/iodide reference system can be used instead. Due to an absence of silver ions or other contaminating metal ions the iodine/iodide reference system is an excellent alternative when working with applications requiring rapidly changing temperatures. Even with quick changing pH values such as titrations, the iodine/iodide reference system is beneficial.

Problem

There are many different pH glass electrodes on the market. Each pH glass electrode has particular qualities so they should be chosen carefully to suit the measurement application.

Question

What different kinds of pH glass electrodes are available? What are the main characteristics of these electrodes and which membrane glass is recommended for which measurement application?

Answer

Over time the glass membrane of a pH glass electrode changes due to the process of taking pH measurements. Because of exposure to water, alkali ions dissolve from the glass surface and oxide groups of the silicate become OH groups which causes a source layer. This source layer appears to hydrogen ions as an ion exchanger. Using a special pH glass electrode membrane there is a reproducible balance between the sample solution and glass surface, which is only dependent on the hydrogen ion concentration in the solution and the source layer 4.

Because pH glass electrodes have numerous different capabilities many different kinds of membrane glasses are needed to make accurate and reliable pH measurements for all applications. SI Analytics offers five different types: L-, H-, S-, A- and N-glass. The main characteristics of these pH glasses are:

- L: Wide application range, very low impedance resulting in accurate and rapid response times over a large temperature range 3
- H: Optimized for higher temperatures up to 275 °F (135 °C) and extreme pH-values, high accuracy in stronger alkaline range (Na^+)
- S: Tolerates sudden temperature changes, provides constant measurement values with fast response time in hot alkali solutions
- A: Fast response time in drinking water, surface water, sewage, and general applications
- N: At normal temperatures usable for the full pH-range and almost all kinds of samples.

The following examples illustrate the use of different pH glass electrodes: With a strong alkaline media the so called "alkaline measuring error" appears. This error is triggered by the confusion of sodium with hydrogen ions (cross sensitivity) and causes a measurement inaccuracy beginning at a pH value of 12 in presence of sodium ions. Under extreme conditions this inaccuracy could mean a

3 *Blue pH glass bulp of a pH electrode*

Chapter 4:
pH calibration and pH solutions

difference up to 1 pH unit. In those cases the H type glass electrode should be used.

Applications with hot alkaline treatments or sterilization by superheated steam impose great demands on the consistency of the membrane glass. Under these conditions a pH glass electrode usually ages faster and corrodes. In this case the right choice would be a S type pH glass electrode.

In common applications or drinking water measurements the challenge is the variety of applications and the low conductivity of the pH glass electrodes. This could lead to slow response times and unstable or unreliable data. For these demands the A type glass has been developed. It features rapid response times and extended use.

Conclusion

The characteristics of the membrane glass determine the quallity of the characteristics of the pH glass electrodes. Only the right choice of pH glass electrode will provide you with the highest accuracy and reliability.

Problem

To calibrate pH measuring systems you must use a solution with a known pH value, also known as pH reference or buffer pH solution. The accuracy of your subsequent pH measurements is dependent on how accurately the pH measuring system is calibrated, so particular attention must be paid to this step. Because there are a great number of different buffer pH solutions available many people are uncertain about how many and what pH calibration solutions should be used.

Question

What is a buffer pH solution and how many pH calibration points are reasonable?

Answer

A buffer pH solution is composed of either a weak acid and the conjugated base or a weak base and the conjugated acid. The main characteristic of a buffer pH calibration solution is that the pH value of the solution will not alter when a small amount of acid or a base is added. Dependant to the used components and their concentration the pH value of the buffer solution can be set over nearly the complete pH range, e.g. with HCl and sodium citrate (pH 1–5), citric acid and sodium citrate (2.5–5.6), acetic acid and sodium acetate (3.7–5.6), Na_2HPO_4 and NaH_2HPO_4 (6–9) or borax sodium hydroxide (9.2–11). The pH value of the calibration solution does not only alter with its composition but with temperature changes. An exact specification of reference pH calibration solutions is given by the DIN 19266. The thermal characteristics of these buffer pH calibration solutions have been determined by metrological institutes [5] (see Table 2).

Table 2: Temperature behavior of reference pH buffer

Temp. in °C	pH		
10	3,997	6,923	9,332
20	4,001	6,881	9,225
25	4,005	6,865	9,180
40	4,027	6,838	9,068
50	4,050	6,833	9,011

In contrast to reference pH calibration solutions the composition of technical buffer pH solutions is not regulated. So it is important to note that the temperature reaction of those pH calibration solutions can be manufacturer-specific, even if the same nominal pH value is specified at 25 °C. In particular at a calibration temperature other than 25 °C considerable errors can occur with the pH measurement results. In addition to different kinds of buffer pH solutions the calibration procedure plays a major role in determining the accuracy of the pH measurement. The following pH calibration procedures are described in detail in DIN 19288.

- One-point-calibration: A one-point-calibration is accomplished using one reference pH calibration solution. Here only the zero point of the pH electrode is verified and it is assumed that its slope is close to the-oretical Nernst slope. This method of pH electrode calibration is the fastest. It is recommended to use this calibration method for comparative only and not for absolute measurements.
- Two-point-calibration: This method is accomplished using two reference pH calibration solutions, with a minimum pH difference of two units. Here the maximum measurable pH value and zero point of the pH electrode are determined by a linear slope cutting through the measuring points (in the application of the measured mV against the nominal pH value of the buffer solution).

Chapter 5:
Accuracy of the pH measurement

- Multipoint-calibration: A multipoint calibration is accomplished with three or more reference pH calibration solutions. The difference between pH solutions should be greater than 0.5 pH units. The pH electrode calibration curve is determined by either linear regression through all measuring points or built from segments between neighbored buffers in which the zero point and slope can be calculated. To evaluate the certainty of the calibration procedure the stability index (R2) could be consulted. It shows whether the theory correlates with the results and should have a value around 1. Often alkaline buffer solutions are used to accomplish a multipoint calibration. These should be checked for freshness and percentage error effect has to be estimated.

Generally a two-point-calibration with DIN buffer pH calibration solutions 4.01 and 6.87 is sufficient, because they are very stable. Furthermore pH electrodes offer due to their high linearity a sufficient measuring security beyond the pH values of the used buffers. Even for additional coverage the two-point-calibration can be checked through an additional measuring of a buffer solution within the range of the estimated pH value.

Conclusion

The higher the required accuracy of the pH measurement, the higher the need for DIN-19266 buffer pH calibration solutions, which provide an accuracy of under 0.01 pH. Multipoint-calibrations should increase the accuracy and for most pH measurement applications a two-point-calibration will be satisfactory.

Problem

The question of the accuracy of pH measurement is not easy to answer because there are many factors that are often not or not precisely known to even the experts. However, one thing is certain: The pH value shown on the pH meter says nothing about its accuracy. The number of decimals is always deceptive in showing an excessively high accuracy.

Question

What are the key factors and how can the accuracy be determined?

Answer

In metrology, the uncertainty is likely selected as a standard for the measurement accuracy. The lower the uncertainty, the higher the measurement accuracy. This uncertainty is a part of every measured value. It is composed of the uncertainties of the individual contributions to the measured value. This difficult subject for the pH measurement is presented easily understandable for the user in standardDIN 19268 [6]. The important temperature effect is disregarded in the standard for the sake of simplicity, and adhering to the temperature constant is assumed. The following, however, must still be included:

- pH of the buffer solutions with uncertainty,
- Uncertainty of the measured values in buffer solutions and
- Uncertainty of the measured value in the sample solution.

In order to ensure a high measurement accuracy for the calibration, buffer solutions according to DIN 19266 are recommended, in which various manufacturers already specified the measurement uncertainty.

Now the question arises as to the uncertainty of the measurement values in these buffer solutions during calibration or adjusting. A dissolution of ±1 digit is assumed for the pH meter. This corresponds to 0.2 mV or 2 mV (depending on the dissolution of the pH meter and its digital display). Then the question of the uncertainty of the pH measuring chain voltage remains. Assuming that the pH glass electrode operates linearly up to pH < 12 prior to insertion of the "alkaline error", the reference electrode with the junction and the interference potential, the liquid junction potential (LJPs) remain as a critical point. The LJPs in buffer solutions according to DIN 19266 in reference/bridge electrolyte amount to about –2.5 mV at 3–4 mol/L KCl. If the measurement solution has approximately the same composition (if a buffer solution would be the sample), the LJP would also be

Table 3: Examples for measurement inaccuracies

Calculation in accordance with DIN 19268		Expanded inaccuracy ± U (k = 2)		
Measured value	value	Case 1	Case 2	Case 3
Puffer1	4.008	0.01	0.02	0.02
Puffer2	6.865	0.01	0.02	0.02
Measurement voltage 1 [mV]	174.6	0.2	0.2	2
Measurement voltage 2 [mV]	6.6	0.2	0.2	2
Measurement voltage x [mV]	-1.4	0.2	0.4	3
Measurement voltage x [pH]	7.001	0.023	0.045	0.131

Chapter 6:
Temperature effect – uncertainty in the pH measurement

in the same order of magnitude. If the composition of the sample solution is not the same, but similar, 0.2 mV is (arbitrarily) added to the uncertainty of the measured values during calibration. If the type and concentration of salts, acids or lyes in the solution significantly varies, the LJPs increase and can only be calculated or estimated according to elaborate equations (e.g. Henderson). The calculation of measurement uncertainties according to DIN 19268 are shown in Table 3 for three different cases. Now the user must decide which case is appropriate for his measurement.

Conclusion

At higher demands to the accuracy of the pH measurement for estimation of the overall measurement uncertainty, the knowledge of type and dimension of the measurement uncertainties in detail are required. This estimation can be eased by DIN 19268. The optimal choice of pH electrode and buffer solution helps reducing the uncertainty.

Problem

Varying temperatures affect the measurement of the pH value. These must therefore be included in the uncertainty of the measurement.

Question

What effect does the temperature have in the pH measurement? What are isotherms? How does the temperature compensation work? How does the pH value of buffer solution and the sample change with the temperature?

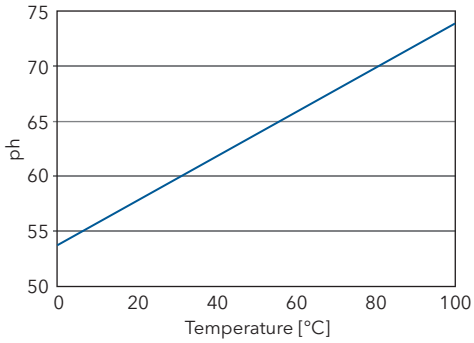
Answer

The voltage of the pH combination electrode changes with the temperature. This behavior can be described by the Nernst equation:
$U = U_{0+} (R \times T / n \times F) \times \ln a_{H+}$ with

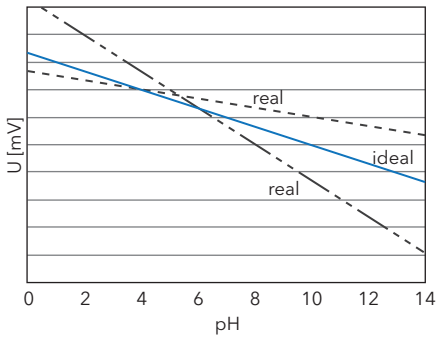
- a_{H+}: Activity of the hydrogen ion
- U_0: Standard potential
- R: Gas constant 8.3144 J/K*mol
- T: Temperature
- F: Faraday constant 9,6485*10^4 C/mol
- n: Number of electrons transferred

The Nernst factor (R*T/n*F) indicates the theoretical slope of the electrode. This factor is temperature dependent, it varies between 54.20 mV/pH at 0 °C and 74.04 mV/pH at 100 °C.

In real electrodes, the slope never exactly corresponds to the Nernst factor. In addition, the zero point of the measurement chain, especially in heavily aged electrodes, is temperature dependent. When recording the voltage of a real electrode at two different temperatures at different pH values, a characteristic curve is obtained for each temperature. These characteristics, called isotherms, intersect in the isothermal intersection. This intersection can vary markedly from the zero point of the ideal characteristic 5. When conducting measurements at many variable temperatures, you can even receive a field of isotherm intersections 2.



4 *Temperature dependency of the Nernst factor* 3



5 *Characteristics of a real and an ideal electrode*

The temperature compensation of pH meters only takes into account the change of the theoretical slope in temperature changes. When calibrating the metering device at a certain temperature and measures at another temperature as the calibration temperature, the temperature compensation adjusts the slope according to the the-

oretical change of the Nernst factor. Non-ideal behavior of the slope and the zero point is not recorded here. This plays a minor role for less critical applications. However, in measurements with far deviating temperatures that required maximum accuracy, the measuring chain must be calibrated for each measuring temperature with buffers at the same temperature..

The temperature responses for buffer solutions were precisely studied by metrological institutes. DIN buffer solutions are precisely specified by DIN 19266. These buffers show a temperature behavior such as shown in Table 4 5.

Technical buffers display a different temperature behavior than DIN buffer solutions, and their compositions are not defined, i.e. each manufacturer can produce his own mixture. Incorrect measurements can result here due to the lack of knowledge of the temperature responses of the buffer solutions.

The specific temperature dependence of the hydrogen ion activity of the sample is almost never known and therefore can neither be compensated nor be converted to a reference temperetaure as at the conductivity measurement. Hence it is mandatory to note the temperature at which the pH value has been determined. A comparison of the pH values of the same sample at different temperatures is nearly impossible. This frequently results in great variations between operational pH measurements at elevated temperatures and the measurement of the sample in the laboratory at room temperature.

Conclusion

The electrode zero point and slope, in practice, can have deviations from the ideal behavior, which is described by the Nernst equation. The greater the difference in the temperature between the calibration and measurement, the greater the measurement deviations. Deviations from 0.05 to 0.25 pH are possible, depending on the difference between the calibration temperature and the measurement temperature 4 5.

The calibration and measurement should be performed at the same temperature for a possibly precise measurement. Based on the more precise specification, buffer solutions according to DIN 19266 should be applied for the calibration.

In order to evaluate the measurement results and for a complete documentation, the measurement temperature, the electrode used and the calibration conditions must always be specified with the result of the pH measurement. A conversion of the pH value of a sample from the measured temperature to another temperature is not possible.

Temperature in °C	pH		
10	3,997	6,923	9,332
20	4,001	6,881	9,225
25	4,005	6,865	9,180
40	4,027	6,838	9,068
50	4,050	6,833	9,011

Table 4 : Temperature behavior of various DIN 19266 buffer solutions

Chapter 7:
Acid and alkaline errors in the pH measurement

Problem

What effects can occur during measurements in solutions with extreme pH values?

Question

What are acid and alkali errors? Under what conditions do they occur? What impact do they have?

Answer

Even measuring chains, which respond ideally over a wide pH range, i.e. linear, can display deviations in the very acidic (< pH 2) or basic (> pH 12) range 6 2.

The effect of these deviations is that too high pH values are displayed in the acid medium and too low pH values in an alkaline medium. In the first case, the acid error is stated and in the second case, the alkali error.

The acid error is generally lower than the alkali error. One cause of the acid error is the incorporation of acid molecules in the gel layer or the change of water activity, resulting in reduction of the H^+ ion activity 2. It is only observed under very extreme conditions in practice. In addition, high concentrations of acids dehydrate the source layer by osmotic pressure and accumulate the hydroxyl groups. Both results in apparently higher pH values 7.

The alkali error is much more relevant to the reliability of the measurement. It occurs when the measuring solution contains alkali ions (e.g. lithium or sodium) and has a pH value of greater than 12. Under these conditions, there is an exchange of alkali ions in the gel layer of the membrane glass and in the measuring solution. This cross sensitivity is also known as sodium error, since a sodium hydrozide solution is frequently used for setting very high pH values 3. Figuratively speaking, the alkali metal ions are detected in addition to the H^+ ions, simulating a lower pH value. Depending on the type of pH membrane glass, the pH value of the measurement solution, the temperature and the alkali ion concentration, the alkali error can amount up to one pH unit.

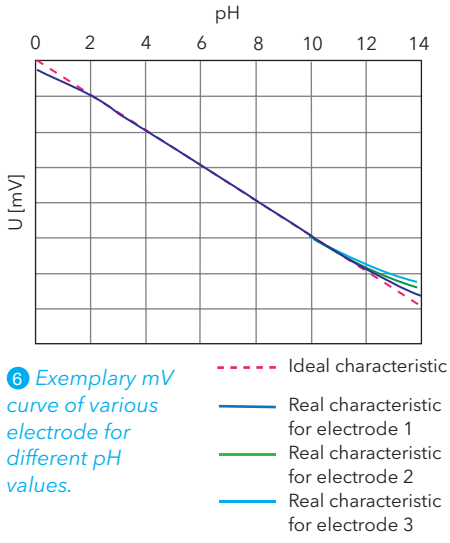
The alkaline error is slight in modern pH glasses. Results from the measurement of pH electrodes with various pH membrane glasses are compared in table 5. The measurements were each made in solutions of the same pH value (once with sodium ions and once without). The concentration of sodium ions equaled 1 mol/l. In order to obtain the maximum accuracy, a pH glass that possibly has a slight alkali error should be noted at this high pH value and high concentration of sodium ions.

	pH value without sodium ions	pH value with sodium ions	Alkali error
Electrode 1	13,72	13,15	0,57
Electrode 2	13,77	13,45	0,32
Electrode 3	13,98	13,63	0,35
Electrode 4	13,78	13,21	0,57
Electrode 5	13,80	13,25	0,55

Table 5 : Measurements with different membrane glasses in a solution with pH 14 without and with an addition of sodium ions (concentration 1mol/l).

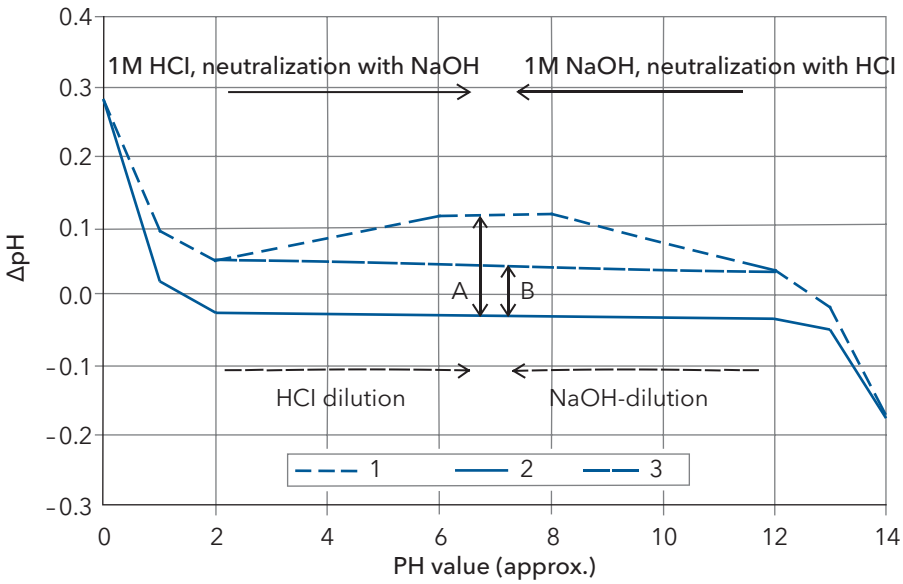
Conclusion

In order to achieve the highest possible accuracy of pH measurements, even under extreme conditions, the electrode should be selected to suit the application. At high alkali concentrations and high pH values, a pH electrode with a minimum of alkali errors should be selected.



6 Exemplary mV curve of various electrode for different pH values.

Chapter 8:
Diffusion potential as a error source



7 *Course of the measurement error of a pH electrode*

Problem

Diffusion potentials are often referred to as a disturbance variable in the pH measurement. However, their size and influence on the measurement accuracy are rarely known. Diffusion potentials were calculated for several examples and compared with practical measurements. In simple systems, the calculations were confirmed 8 9.

Question

How great can diffusion potentials be and how do they affect the accuracy?

Answer

The Henderson equation is usually applied for calculating the diffusion potentials. This requires that concentration, the mobility and the charge of all the ions involved in a sample are known. This means that if only one parameter is unknown, the calculation cannot be performed. In most solutions, however, even the composition is not precisely known. A number of assumptions must therefore be applied when calculating the diffusion potentials, which then results in a rough estimate of the expected measurement errors. Therefore, the following deliberations must be applied:

As a reference or bridge electrolyte, a three molar KCl solution is usually used. It should also be the basis for the calculation of the diffusion potentials according to Henderson.

The size of the diffusion potentials is essentially determined by the differences in the mobility of all the types of ions. Therefore, the contact with hydrochloric acid and caustic soda is therefore observed here regarded as an adverse event.

Since errors in the pH measurement must be considered here, the calculated diffusion voltages are converted into ΔpH at 25 °C and presented against the pH value of the solution 7.

The change of the pH values must again be achieved by a dilution (7 1) with water and once by neutralization (7 2). The figure shows the calculated variations in measurements ΔpH versus the pH value of the solutions for the mentioned cases. The following areas must be considered:

- Errors can greatly increase in extreme pH values.
- Extremely high values are measured in the acid range and extremely low values in the alkaline range.
- The error increases at great dilutions (purest water A). If the ion strength is higher, for example at a conductivity greater than 1mS/cm, the measurement errors from diffusion potentials are lower (3,B).

Conclusion

In solutions with conductivities greater 1 mS/cm and in the range of $2 < pH < 12$, the effect of diffusion potentials on the uncertainty of the pH measurement is approximately $\Delta pH < 0.05$. In the estimation of the measurement uncertainty, however, any additional sources of errors must be taken into account.

Chapter 9:
Selection of the pH electrode

Problem

It is crucial for the measurement reliability and the service life of a pH electrode to find the most suitable design for the application.

Question

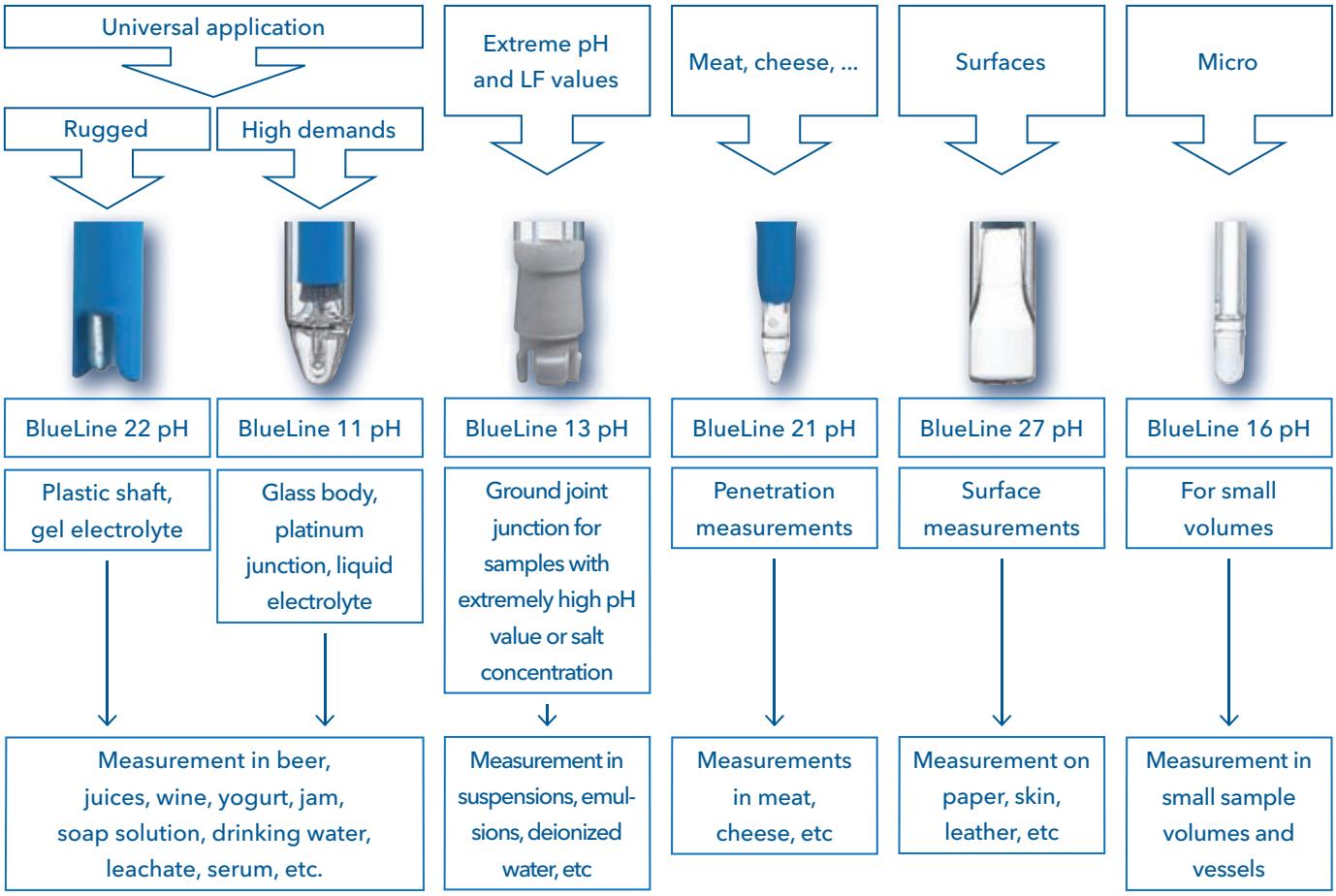
It is crucial for the measurement reliability and the service life of a pH electrode to find the most suitable design for the application.

Answer

As varied as the applications in which the pH value is measured, is the number of electrode types. These differ from one another in style and shape of the membrane glass, the reference system, the material and the length of the shaft up to the connection to the measuring device 8. In order to find a suitable electrode, it is easiest, to go through the following two checklists for the type of sample, and the design requirements of the electrode:

First, the user should deal with the type of sample and measurement conditions. The answer to the following questions helps here:

- At what temperature is measurement and calibration conducted? What is their pH application range? This information is important in the selection of the electrolytes (e.g., liquid or gel) and of the reference system and the membrane glass type.
- What conductivity of the sample solution is present? How high is the water content? Are solids or still undiluted components in the measuring solution? For samples with a low conductivity or a proportion of solids, for example, an electrode with liquid electrolyte and platinum or ground junctions provide for a stable electrolyte discharge and thus for accurate measurements.



8 *Choice of different electrode types and their applications*

- What is the consistency of the measurement solution? It makes a difference, for example, whether a puncture measurement or a measurement is performed in the solution.
- Are sulfide, bromide, iodide or other unwanted electrode poisons present within the solution? The reactions in the electrode can be avoided by the selection of the reference system and the junction.
- Is the measurement performed in aggressive compounds (such as HF or hot sodium hydroxide solution)? This information helps in the selection of the shaft material and the membrane glass.

Once these issues have been resolved, the design requirements for the electrode must be determined:

- Which installation length and diameter is required? This information is required when e.g. measuring in special vessels.
- What accuracy of the electrode is necessary, which strength is required? This information is important to decide whether a gel electrode with a plastic shaft or a liquid electrolyte electrode with a glass body is used.
- Will a temperature sensor be integrated in the electrode or not? What connections does the measuring device have for the electrode? This is important, in order to provide the appropriate connection of the electrode to the measuring device.
- Is the application area of the pH measurement in the laboratory or process? When the electrode is used in the process, it is important to clarify what pressure is applied in the measurement and how the electrode is installed. When used in the process, the electrodes have a special built-in Pg13.5 thread to be permanently installed at the measuring station via a holder. If liquid electrolyte electrodes are used under such conditions, a pressurization of the electrolyte storage must also be provided.

Conclusion

When selecting the electrode, it is important to coordinate it to the respective application. The user can only then assume an optimal service life and accuracy of the measurement.

Chapter 10: Care of the pH electrode

Problem

How do pH electrodes have to be maintained/cared for and stored?

Question

What influence does the maintenance and care have on the service life of the electrode and the accuracy of the measurement? How should the electrode be stored? What cleaning methods are there?

Answer

Careful handling and storage of the electrodes are elementary for reliable results. Furthermore, the durability is thereby increased. The following tips show an overview [10] [2] [3]:

- Storage:
  An electrode should never be stored dry, but always in watering solution. The watering cap should be filled with the following solutions depending on the type of electrode:

• Single-rod measuring cells and reference electrodes: In case of liquid electrolyte electrodes, the electrolyte solution in the reference electrode should also be used for watering. 3 mol/l KCl solution must be used in gel electrodes.

• Glass electrodes: In case of pure measurement electrodes, the watering cap can be filled with deionized water. For single-rod measuring cells and reference electrodes, this results in a reduction of the service life.

If the electrode has been stored incorrectly dry, it must be watered for at least 24 h in the above solutions before its first use. The functionality

must be tested by calibrating prior to the measurement.

- Cleaning:
  Dirt deposits of any kind on the membrane surface or the junction may result in the reduction of the service life of the electrode and inaccurate measurements. The electrode should preferably be chemically and not mechanically cleaned. In the event of dirt deposits outside the electrode and the junction, the following cleaning processes can be performed:

• Inorganic adhesions: Put the electrode for a couple of minutes into 0.1 mol/l HCl or 0.1 mol/l NaOH. If the buildup is not resolved, the solution should be a cautiously heated up to 50 °C before the acid or alkali concentration are increased.

• Organic adhesions: Rinse the electrode with organic solvents. The membrane can be carefully and briefly wiped with a damp, lint-free, soft cloth . The resistance of the plastic shaft of the electrode to organic solvents should be noted in this treatment.

• Proteins: Placing the electrode in a pepsin/HCl solution for at least 1 h.

• Sulfides on the ceramic junction: Store the electrode in a thiourea/HCl solution (7.5 % in 0.1 mol/l HCl) until the discoloration on the junction has disappeared. After cleaning, the electrode is rinsed with deionized water and placed in the electrolyte solution for at least 1 h. In addition, the electrode must be recalibrated prior to the next measurement.

- Cleaning of the reference electrode with liquid electrolyte:

• In case of dirt/particles in the reference electrode: remove the old and refill with new electrolyte. If necessary, repeat until the dirt is removed. Some heated electrolyte (about 45 °C) can also be used. An internal chemical cleaning is not advised, since the reference system can be irreversibly damaged.

• KCl crystals in the interior: The crystals can be dissolved when heating the electrode in a water bath at 45 °C. Then the electrolyte must be completely replaced.

- General treatment recommendations:

• After the measurement, the electrode must be rinsed immediately with deionized/distilled water and stored in the recommended manner.

• The electrode is regularly inspected for dirt deposits on the membrane surface, the junction and the interior.

• Measurements in aggressive and/or hot media result in a reduction of the service life.

• When using electrodes with liquid electrolyte, the filling opening must be opened during the measurement/calibration, in order to prevent a back diffusion of the sample by the electrolyte flow. The refilling opening must be closed when storing and between the measurements.

• The use of deionized water as a storage solution for any electrode reduces their service life.

• Never store the electrode dry, use it as an agitator or clean it mechanically.

Conclusion

The general treatment recommendations contribute greatly to the service life extension of the electrode and thus to the accuracy of the measurement.

Chapter 11
Qualifications of the pH measurement

Problem

pH measurements are operated in GMP/GLP-related companies for quality control of both raw materials and finished products. The measured pH values therefore are highly relevant in determining whether the sample meets the requirements or not. Accordingly, measures must be taken to ensure the accuracy of the measurement.

Question

What measures are available to ensure the pH measurement, and how are they performed?

Answer

The qualification process consists of up to four consecutive test stages 9. They include the following steps that must be documented accordingly:

- **DQ (Design Qualification)**: The user formulates the requirements for the components and operating conditions in the DQ prior to purchasing. Described are the purpose of use, environmental conditions, technical data, a description of the samples, as well as general and special requirements based on the application 11. The DQ is therefore the documented evidence that the instrument is designed and manufactured in accordance with the requirements and the user receives exactly what he needs.
- **IQ (Installation Qualification)**: The IQ is conducted at the site of the installation. The completeness of the system and the environmental and application conditions are examined after delivery. The IQ provides evidence that the delivered instrument meets the specifications of the order (DQ), is properly set up at the intended work area and is properly installed for the environmental conditions there. A first test can already be included in the IQ. After this training, the system is ready for use.
- **OQ (Operational Qualification)**: The OQ is used to check whether the installed system complies with the general conditions of the technical and functional specifications. The test includes a test of the device at the point of use. A comparison with the technical data of the components or a test with a standard can be performed, which can be attributed to a national standard. For a pH measuring system, this means the determination of the pH value of DIN buffer solutions after the calibration of the device.
- **PQ (Performance Qualification)**: The PQ is used to demonstrate that the measurement system consistently provides a performance according to specifications under real operating conditions. During the IQ and OQ, which must be carried out once, which the suppliers often offer in the form of prefabricated documents up to the implementation of the qualifications, the PQ is usually performed by the user on a regular basis. The testing interval is determined according to the application of the measurement system 12.

Conclusion

The individual tests of the pH meter and electrode yield only a statement about the current functioning of the electrode and the pH meter as individual components, but no statement about the continuous validity of pH measurements of the entire system. The qualification beginning from the design qualification prior to the purchase, over the one-time installation (IQ) and Operational Qualification (OQ) at the corresponding work station up to the routine performance qualification (PQ) together provide verification that the complete measuring system (consisting of pH meter, pH electrode, buffer solutions) yield a consistent performance according to specifications under the specific conditions.

Fig. 9

Chapter 12:
pH measurement in organic media

Problem

The requirements for the feasibility and accuracy of pH measurements and titrations in nonaqueous media for process and quality control increase steadily in the pharmaceutical industry.

It is therefore important to examine to what extent one can speak at all of a classic pH-measurement in such analyses and how the electrodes respond in such a medium.

Question

Under what conditions are pH measurements and titrations possible in non-aqueous media?

Answer

The pH value in accordance with DIN 19260 [13] is only defined in aqueous media. However, analog to the dissociation of the water:

$2H_20 \leftrightarrow H_3O^+ + OH^-$

similar observations for aqueous solvents can be employed and the following equation can be employed:

$2HLy \leftrightarrow H_2Ly^+ + Ly^-$

H_2Ly^+ is the protonated solvent molecule and is called Lyonium ion. Ly^- is the deprotonated solvent molecule and is called Lyat ion. Aprotic solvents such as DMSO or benzene do not dissociate from the equation. Only water-like solvents with a dissociation such as Ethanol allow the introduction of a pH scale. This results from the pKLy value of the solvent. Thus, the scale for water contains 14 units, 16.7 for methanol and 19.1 for ethanol.

With the creation of individual, that is solvent-dependent, pH scales, however, only the first step is accomplished. It requires then also individual reference buffer solutions to calibrate the electrode under these conditions. If the pH electrode is calibrated with aqueous buffer solutions and a pH measurement is then performed in an aqueous medium, this corresponds to the proverbial comparison of apples and oranges. The absence of reference buffer solutions based on the particular solvent may therefore not be followed with a conversion of the actual measured value mV, as delivered by pH-electrodes, into a pH-value.

In contrast to the pH measurement, the absolute pH value is not the relevant value for titrations, but the change of pH value. The consumption of titrant up to this pH jump is applied for the content calculation. Under such conditions, the conversion of the original mV measured value of the electrode into a pH-value is possible, but this conversion value is just as little reliable as an absolute measurement value.

In addition to the lack of individual reference buffer solutions and the associated lack of knowledge of the hydrogen ion activity in non-aqueous solvents, the challenge for the pH measurement in such samples, among others, is subject to the following two phenomena:

- The increased phase boundary voltage on the junction upon contact of the non-aqueous solvent with the reference electrolyte of the electrode complicates the pH measurement [14].
- The low conductivities of these solvents also result in problems. The effect of low conductivity is shown in very fluctuating measured values even at pH measurements in distilled water. Organic solvents even increase that effect.

The electrodes or their membrane should be conditioned or formed to the proper solvent even for recording the mV value. With immersing the electrode into the solvent the resistance of the glass membrane is reduced and a faster response time of the electrode is guaranteed [3].

Conclusion

No measurements to determine the absolute pH value in non-aqueous solvents (i.e., having a water content of less than 30 %) may be carried out, but only direct mV measurements.

With an increased setting period in these media, a pretreatment or formation of the electrode may also be anticipated [15].

References

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LS 3 ANN	285122715	87
LS 3 BNCNN	285122731	87
MZ/NH_3/CN	150130	91
NH 928	285126482	93
NH 995	285126499	93
OX 060	285138287	91
OX 920	285126606	91
OX 921	285126614	91
OX 923	285126639	93
OX 925	285126655	93
OX 929	285126277	93
OxiCal® SL	285126647	93
SF 300	285126622	93
SXX	285123728	93
TISAB	140100	91
TISAB/NO_3	150120	91
TZ 1520	285215229	93
Z 341	285123103	93
Z 451	285123136	93
Z 453	285123170	93
Z 461	285123152	93
Z 462	285123169	93
Z 472	285123185	93
Z 50	285122961	93
Z 501	285123193	93
Z 506	285123214	93
Z 512	285129509	93

ProcessLine Process electrodes for measuring pH, temperature and redox potential

One for all applications – for highest demands

ProcessLine electrodes are low maintenance sensors for heavy duty process applications, as they are especially present in the chemical industry.

They are ideally suitable for measuring media with extreme ionic strength – whether boiler feed water or brine – also in strongly oxidizing acid and alkali containing media.

The ProcessLine electrodes' special design with regard to accuracy, stability, rapidness and durability is very close to the one of liquid electrolyte electrodes, although the ProcessLine does not require refilling the electrolytes and its complex pressure sequence regulation. Therefore the ProcessLine electrodes require only low-maintenance, including calibration and adjusting efforts, hence offering a high potential for cost savings.

Duralid solid electrolyte with high content of KCl and special formulation

The solid reference electrolyte Duralid does not require a special junction – the reference system holds a direct contact to the measuring media via the two open connections. This minimizes the risk of contamination/blockage of the junction – the main source for measuring failures and even outfall – and guarantees long durability and high accuracy.

The long lifetime and small liqiuid junction potential resulting in high accuracy measurements of the ProcessLine elctrodes is based on the special formula and fabrication of the Duralid electrolyte:

- High content of the conductivity salt potassium chloride in polymer and therefore high electrolyte output into the measuring media, reduces the interferences of the measurement through diffusion potentials between the junction of reference electrode and measuring media.
- The special distribution of the potassium chloride in the Duralid polymer counteracts positively against a reduced durability of the reference system, by releasing a high quantity of electrolyte.

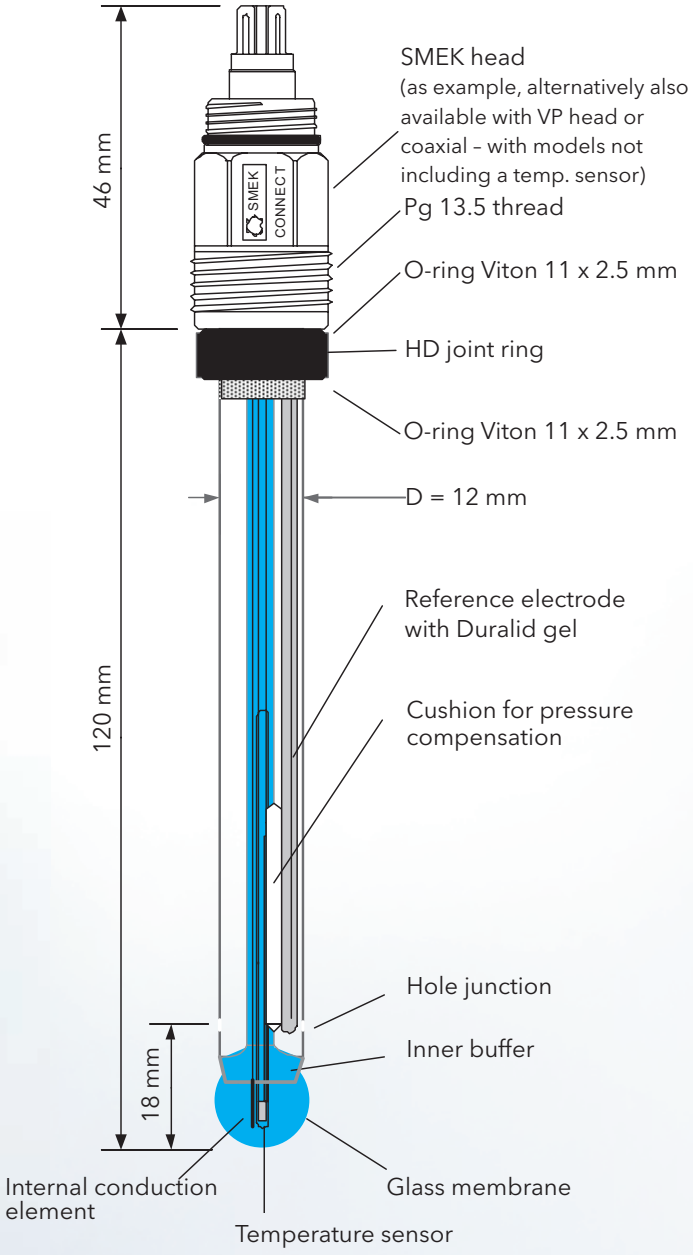
This special attribute given by the Duralid, does not only improve the durability and the response characteristic, it also enables stable measuring values – even under most difficult conditions such as changing flow rate/ rotational frequency of stirrer or with measurements in organic solvents.

Cushion for pressure compensation in the reference electrode

Pressure and temperature fluctuations can easily be managed by the ProcessLine electrodes due to the integrated pressure compensation cushion inside the reference electrode.

Reliable H membrane glass

Besides the reference electrode, also the measuring electrode is of great importance regarding rapidness and accuracy of the measurement. The glass electrode of the ProcessLine series features a H membrane glass, a very high-quality and approved special glass. It excels by its high-temperature application range and very low alkaline errors. The special ball shape enables an optimal membrane resistance of 300 MΩ and ensures an easy cleaning.



- **Low maintenance**, i. e. no refilling of electrolyte or installation of complicated pressure sequence regulations.
- **Hole junctions**, therefore no contamination or blockage of the reference electrode.
- **Duralid electrolyte with high proportion of KCl and special consistency**
  Long durability as well as fast and stable measuring values. Furthermore, no substances of animal origin.
- **Buffer in the reference electrode** for compensation of pressure and temperature fluctuation.
- **Approved H membrane glass** with very low alkaline error and optimized ball shape.
- **Wide application range for media** with extreme ionic strength, strong oxidation character, high alkaline or acid components and also organic solvents.
- **Certificate for temperature and pressure resistance** of 12 bar at 0 to 130 °C.
- **Shaft length** from 120, 225, 325, 360 and 425 mm suitable for all assembling conditions.
- **Versions with Pt 100 and Pt 1000 temperature sensor** with SMEK- and also VP plug head for high flexibility.

Advantages ProcessLine

Process Electrodes

The ProcessLine electrodes take up a small part of our extensive process electrode program:
Further information is available in our specialized catalog “Process Electrodes” displayed and downloadable on our website; it can also be delivered personally on request.

Content titration

Selection table titration – piston burettes TITRONIC® and automatic titrators TitroLine®

The most important features of titrators TitroLine® and piston burettes TITRONIC® at-a-glance

Application	TITRONIC® *universal*	TitroLine® 500	TitroLine® *easy*
Intelligent interchangable units (5, 10, 20 and 50 ml)	–	■	–
Manual titration	■	■	■
Dosing	■	■	–
Solutions preparation (manually or automatically with connected balance)	–	■	–
Automatic titration (independent with external software)	1)	1)	■
pH/mV titrations „aqueous“ (Alkalinity, hydrochloric acid, citric acid, Kjeldahl…)	–	–	■
pH/mV titrations „non aqueous““ (TAN/TBN, FFA, titrations with perchloric acid…)	–	–	–
Redox titrations (iodometry, permanganometry….)	–	–	■
Redox titrations (COD)	–	–	–
Halide titrations (chloride, “salt”…)	–	–	■
Hydrogen sulphide and mercaptans	–	–	–
Sulfurous acid in wine and beverages	–	–	–
Bromine number	–	–	–
pH-stat-applications (enzyme kinetics, soil samples, biotechnology)	–	–	–
Water analysis according to KF Volumetric method (10 ppm – 100 %)	–	–	–
Water analysis according to KF Coulometric method (1 ppm – 5 %)	–	–	–
Applications with sample changer	–	–	–
Applications with TitriSoft	■	■	–

1) Can be used as titration and dosing burette in automatic titration systems

TitroLine® 6000	TITRONIC® 7000	TitroLine® 7500 KF	TitroLine® 7500 KF *trace*
■	■	■	–
■	■	–	–
■	■	■	–
■	■	■	–
■	■	■	■
■	■	–	–
–	■	–	–
■	■	–	–
■	■	–	–
■	■	–	–
–	■	–	–
■	■	–	–
■	■	■	■
–	■	–	–
–	–	■	–
–	–	–	■
–	■	–	–
–	■	■	■

New from SI Analytics:
Simplicity without sacrificing accuracy

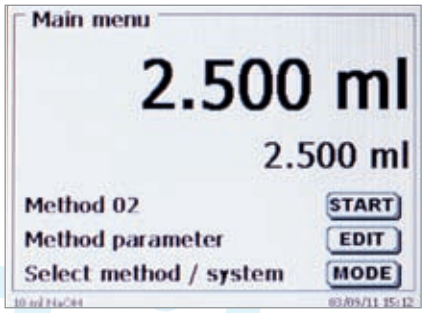
Introducing the new titrators

TitroLine® 6000, 7000, 7500 KF, 7500 KF *trace* and the new TITRONIC® 500 piston burette with innovative features for simple and easy operation – without sacrificing accuracy:

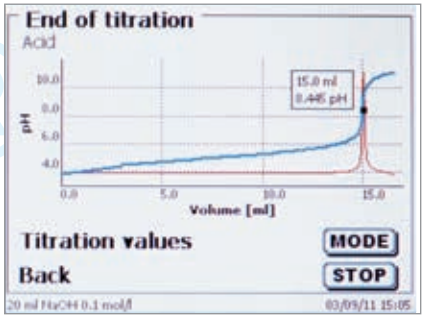
- High visibility, full color display that can be easily viewed from a distance and at extreme angles.
- Reagent data is securely stored in the intelligent and interchangeable modules.
- Automatic wireless recognition of SI Analytics ID electrodes guarantees accurate calibration and measurements (TitroLine® 7000).
- Touch keypad interface for error free operation.
- Includes three USB and two RS232 ports for expansion and connection of devices such as USB storage of methods and data, stirrer, laboratory balance, PC and additional SI Analytics peripheral devices.
- Export the results as PDF or CSV.
- Transfer of methods via USB device.
- Versatile and flexible for a variety of applications.

Advantages TitroLine®/TITRONIC®

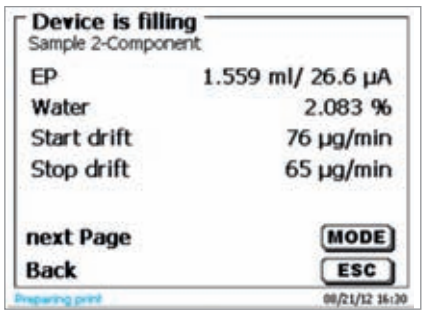
TITRONIC® 500
piston burette



TitroLine® 6 000/
TitroLine® 7000
titrators



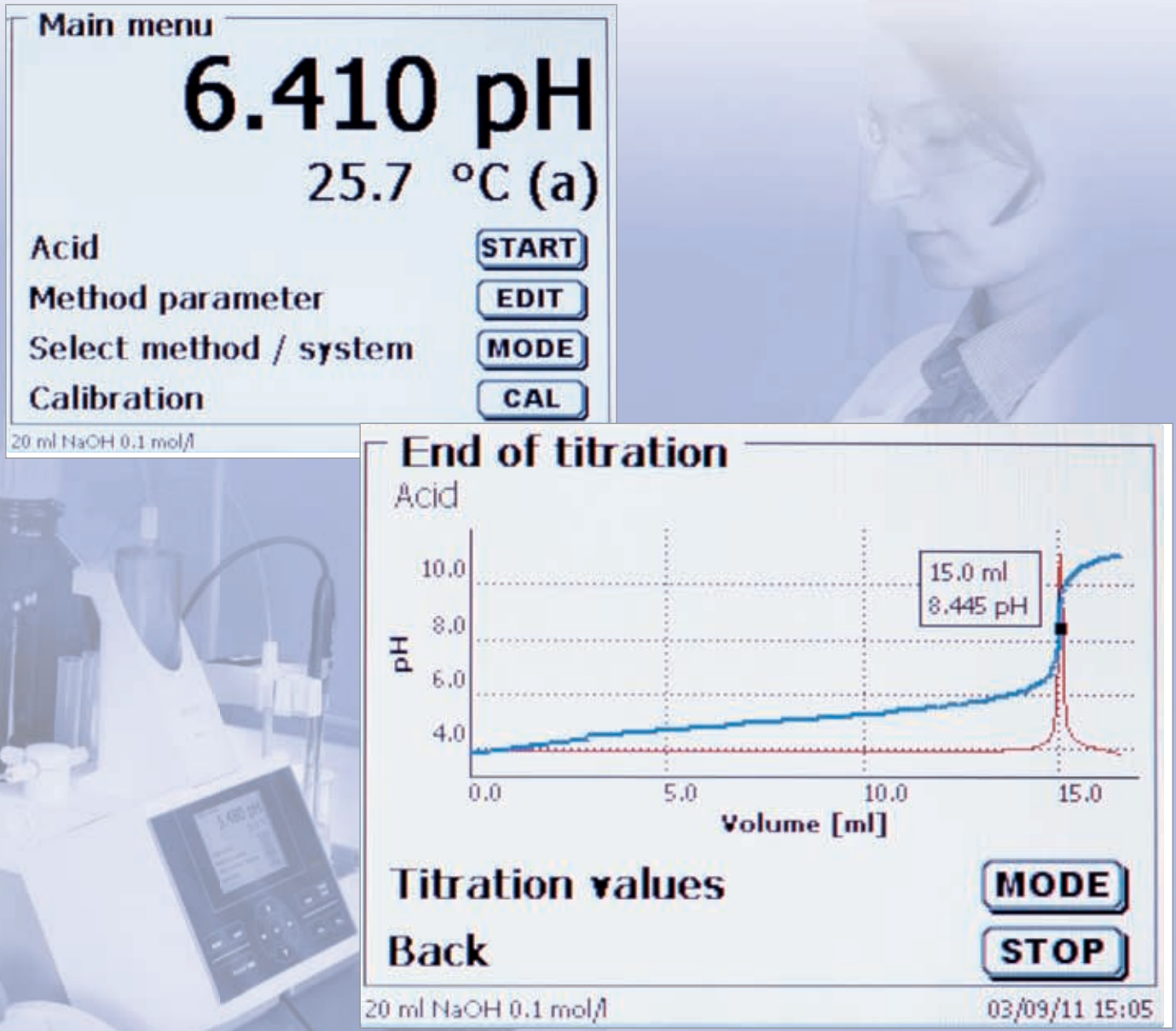
TitroLine® 7500 KF/
TitroLine® 7500 KF trace titrators



Loaded with features: TITRONIC® 500, TitroLine® 6000 and 7000 for routine titrations

High visibility graphic display

- Exceptional high visibility graphic display for viewing even at extreme angles.
- Clear graphic representation of titration curves and the first derivative curve (TitroLine® 6000/7000).
- Equivalence point values are displayed in the titration curve (TitroLine® 6000/7000).



New intelligent, interchangeable modules

- Size options of 5, 10, 20 and 50 ml.
- Compact, space saving footprint.
- All relevant reagent and unit data
  are stored in the integrated RFID-chip including:
  - Burette size (ml)
  - Titrant name
  - Titrant concentration or titer value of solution
  - Date of manufacture or expiration date of the reagent.

Flexible configuration features

Expand and customize your workstation using the three USB and two RS232 ports for a total of five connection options for:

- Magnetic stirrer TM 235 and USB Mouse
- USB printer (Standard A4 HP-PCL) and compact printer (ESC POS)
- USB keyboard
- USB storage device and hub
- Balance and PC
- other devices from SI Analytics

printer

USB-manual controller

TITRONIC® 500:

The piston burette for simple and accurate dosing …

The TITRONIC® 500 is the ideal piston burette for manual titrations, accurate dosing applications as well as the preparation of solutions. When used with TitriSoft 3.0, it acts as a titration burette or with the TitroLine®7000 and TitriSoft 3.0, it is an automatic dosing unit perfect to pre-dose a titrant.

Important features:

- Intelligent interchangeable modules with 5, 10, 20 and 50 ml volume capacity.
- Connect to a printer and/or an analytical balance.
- Remote control access via RS232 or USB interface.
- Connect up to 16 devices using one USB or RS232 port of a PC with the two integrated RS232 interfaces (Daisy Chain).

… preparing solutions and manual titrations

Manual Titration

It is true that the automatic titration is gaining ground, but manual titration remains one of the standard cost effective applications in the lab. Everywhere high precision and flexibility are required; a piston burette with an interchangeable dosing module is the best choice.

Important features:

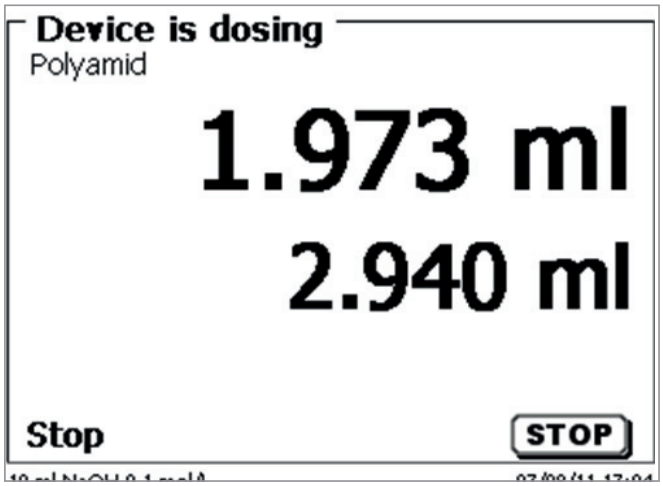
- Titration using the manual controller dosing buttons.
- Titration rate can be adjusted to optimize titration speed and accuracy.
- Programmable automatic calculations, printer ready.
- Automatic weight recording when balance is connected.

Dosing

Besides titration, there are various routine dosing tasks that must be performed in the lab.

Important features:

- Control dosing using the manual controller and the dedicated keypad.
- Adjustable dosing and filling rates optimize speed and accuracy.
- Store dosing methods with different parameters.



Solutions preparation

A special sample preparation mode is available on the TITRONIC® 500 where a reagent is dosed into a sample until the required concentration is reached. The sample is weighed, the dosing volume is determined. The volume can then be automatically added to the sample. This mode is used for e.g. preparing standard and sample solutions for viscometry.

Important features:

- Adjustable dosing and filling speed.
- Dosing volume is automatically calculated without additional PC software.
- Several methods with different parameters can be stored.
- Automatic weight recording when balance is connected.

Potentiometric titrator: TitroLine® 6000 – ideal for food, water, wastewater and environmental applications

The simple and easy-to-use TitroLine® 6000 does not sacrifice performance when doing potentiometric titrations. It is the perfect choice for analysis in food, water, wastewater and environmental applications. Thanks to the high-resolution and precise pH/mV and "dead-stop" measuring interface, it is possible to determine a wide range of parameters quickly, reliably and accurately.

Typical applications of the water/wastewater and environmental analysis:

- pH-value, alkalinity ("p+m-value")
- Permanganate index
- COD
- Total Kjeldahl nitrogen
- FOS/TAC (See application example)
- Chloride in wastewater
- Free and Total Chlorine in drinking water
- Total hardness (sum of Ca+ and Mg+)
- Dissolved oxygen according to "Winkler" method.

Features of the TitroLine® 6000 include:

- High resolution pH/mV electrode and temperature inputs for pH, ISE, redox or photometric titrations.
- Polarizable electrode input for set endpoint applications.
- Available standard methods such as FOS/TAC, alkalinity, total acidity in soft drinks.
- Linear (fixed increment) and dynamic equivalence point titration modes.
- Titrations to pH, mV and µA end-point.
- Manual titration mode and routine dosing tasks are also available.

Application "Total acidity in drinks"

Application example for the water/wastewater and environmental analysis: FOS/TAC (Total volatile fatty acids/Total inorganic carbon, also total alkalinity)

An important parameter for monitoring the fermentation process of biogas plants is a titration method commonly known as FOS/TAC value. The TAC value is determined using 20 ml of a centrifuged sample from the fermenter titrated to pH 5.0 with 0.05 mol/l sulfuric acid. The FOS value is determined by a titration of the same sample to a pH of 4.4. Both titrated ml values are then used in the following calculation formula.

TAC – ml H_2SO_4 to pH 5.0 × 250

FOS – (ml H_2SO_4 from pH 5.0 to pH 4.4 × 1.66 – 0.15) × 500

A different sample volume could also be considered. The FOS/TAC value is the average calculated value. The method and all parameters and calculation formulas are stored as a standard method in the TitroLine® 6000 and 7000.

Accurate results without compromise

The TitroLine® 6000 is the ideal choice for food and beverage applications such as QA/QC, R&D, food science and nutritional evaluation.

Application:
Chemical Oxygen Demand (COD)

Typical applications of food analysis:

- Salt content (chloride, sodium chloride).
- pH-value, total acidity in wine, beverages and food products such as condiments.
- Formol number in fruit and vegetable juices.
- Ascorbic acid (Vitamin C).
- Calcium in milk and dairy products.
- Protein determination (Kjeldahl-nitrogen) in milk and dairy products.
- Reducing sugar in wine and juices.
- Iodine number, peroxide number, free fatty acids and saponification number[1)].
- Determination of free and total sulfurous acid (H_2SO_3) in wine and must. Further detail is available in the application example.

[1)] The use of Free fatty acids and saponification number has to be tested in each individual case.

Application example for food analysis: Determination of free and total sulphurous acid (SO_2) in wine.

Since ancient time, "sulfur" (sulfurous acid) has been added to wine as a preservative. Sulfurous acid inhibits the oxidation process and prevents the growth of unwanted microorganisms, extending the life and preserving the quality of wine.

Free and total sulfur (sulfur dioxide) content is determined by the titration of a 10–50 ml sample after the addition of sulfuric acid and potassium iodide with an iodine solution as titrant (0.025 mol/l) and using a double platinum electrode as indicator electrode. The free SO_2 is titrated directly. Total SO_2 is titrated after the hydrolysis with sodium hydroxide which converts the bound SO_2 into the free form.

The method with all parameters and calculation formulas is a standard method in the TitroLine® 6000 and 7000.

TitroLine® 7000:

Featuring enhanced automation and additional methods

Besides the specifications of the series and the TitroLine® 6000 already mentioned in the introduction, the TitroLine® 7000 provides more functions.

More methods

Do you require simple and easy titration but need more features? The TitroLine® 7000 offers storage of up to 50 user methods.

Measurement and calibration with the highest accuracy

The wireless sensor recognition automatically recognizes SI Analytics ID electrodes and instantly stores dedicated sensor data-eliminating measurement and calibration errors.

Interfaces

Perfect for non-aqueous titrations

Eliminate the need for special electrodes (e.g. separate indicator, reference and auxiliary electrodes) with the built-in amplifier–ideal for titrations in non-aqueous solvents such as:

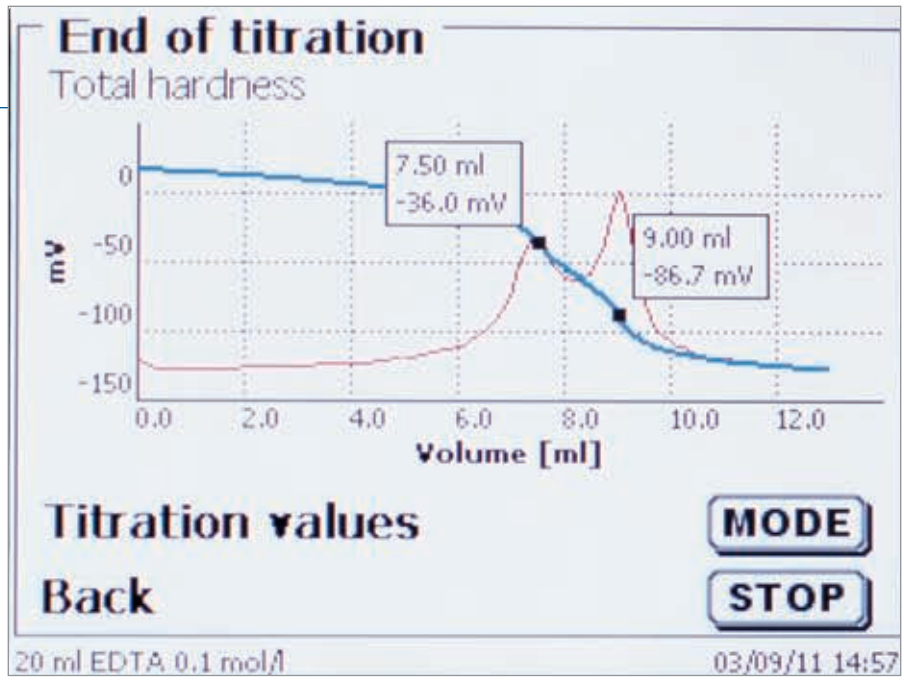
- Acid and base numbers in oils.
- Titrations in glacial acetic acid with perchloric acid.
- Hydroxyl, NCO (Isocyanate) number and further specific values.

pH Stat Titrations

With a pH stat application, a given pH is first adjusted and then kept constant during the analysis with an acid or a base. The pH stat titration is often applied to:

- Determination of the enzyme activity (ex. Lipase).
- pH stat elution of soil sample at pH 4.
- Monitoring of the pH value during chemical syntheses.

Titration curve:
Total hardness (Calcium and Magnesium hardness)



Typical application example for two equivalence points: Titration of amino hydrochlorides (method according Ph. EUR).

Up to now the amino hydrochlorides were dissolved in glacial acetic acid, the amines released through the addition of mercuric acetate and titrated with perchloric acid in glacial acetic acid.

According to the environmentally friendly method of the European Pharmacopeia the amino hydrochlorides are dissolved in ethanol and being dosed with exact 5.00 ml of a 0.01 mol/l HCl. This mixture is then titrated with NaOH 0.1 mol/l. Most titration curves show two equivalence points. The result is calculated from the difference between the first and second equivalence point.

This method, with all parameters and calculation formulas, comes standard in the TitroLine® 7000 and can be used after the input of equivalent substance weight.

More equivalence points to expand application possibilities

Yes, it is now possible to detect and calculate up to two equivalence points during one titration with the TitroLine® 7000. It is possible to determine both the calcium and magnesium hardness individually in a single step, instead of the total hardness combined.

Applications Overview



Water and Wastewater Analysis

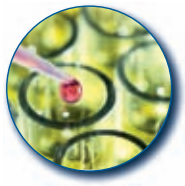
Application	TITRONIC® 500 (manual)	TitroLine® 6000 (manual or automated)	TitroLine® 7000 (manual or automated)
Alkalinity (p+m-value)	■	■	■
COD	■	■	■
Permanganate index	■	■	■
FOS/TAC	■	■	■
Kjeldahl-nitrogen/ammonia (after destillation)	■	■	■
Chloride in drinking and wastewater	■	■	■
Chlorine in drinking water	■	■	■
Calcium and magnesium hardness (2 equivalence points)	■	–	■
Total hardness (Sum Ca/Mg; 1 equivalence point)	■	■	■



Food

Application	TITRONIC® 500 (manual)	TitroLine® 6000 (manual or automated)	TitroLine® 7000 (manual or automated)
Total acidity in wine and soft drinks	■	■	■
Total acidity in food (ketchup, salad dressing)	■	■	■
Acidity in bread and sourdough	■	■	■
Ash alkalinity	■	■	■
Chloride (“salt”) in food and mineral water	■	■	■
Sulfurous acid (SO_2), free and total	■	■	■
Volatile acids	■	■	■
Titratable acidity in milk (Soxlet Henkel (SH) index)	■	■	■
Reducing sugars	■	■	■
Ascorbic acid (vitamin C)	■	■	■
Calcium in milk and dairy products	■	■	■
Calcium and magnesium in mineral water	■	–	■
Formol index	■	■	■
Nitrite in pickling salt	■	■	■
Iodine number	■	■	■
Peroxide number	■	■	■
Saponification number	■	■	■
Acidity (FFA) in fats and oils	■	■	■





Industrial Products

Application	TITRONIC® 500 (manual)	TitroLine® 6000 (manual or automated)	TitroLine® 7000 (manual or automated)
Titration of strong acids and bases (1 equvalence point)	■	■	■
Phosphoric acid (2 equivalence points)	■	■	■
Hydroxyl number	■	■	■
NCO (Isocyanate) number	■	■	■
Epoxy number	■	■	■
Acid number in resins and other industrial products	■	■	■
Acidity in oils (TAN, max. 2 equivalence points)	■	–	■
Total base number (TBN) in oils	■	–	■



Miscellaneous Applications

Application	TITRONIC® 500 (manual)	TitroLine® 6000 (manual or automated)	TitroLine® 7000 (manual or automated)
Surfactants	■	■	■
Metals (redox)	■	■	■
Metals (zinc, copper…, complexometric)	■	■	■
Titrations with perchloric acid (non aqueous titrations)	■	■	■
Potentiometric titration to 1 equivalence point (general)	■	■	■
Potentiometric titration to 2 equivalence points (general)	■	–	■

■ Excellent application suitability

■ Manual titration must be evaluated for this application

■ Titration is possible for this application with restrictions and must be evaluated

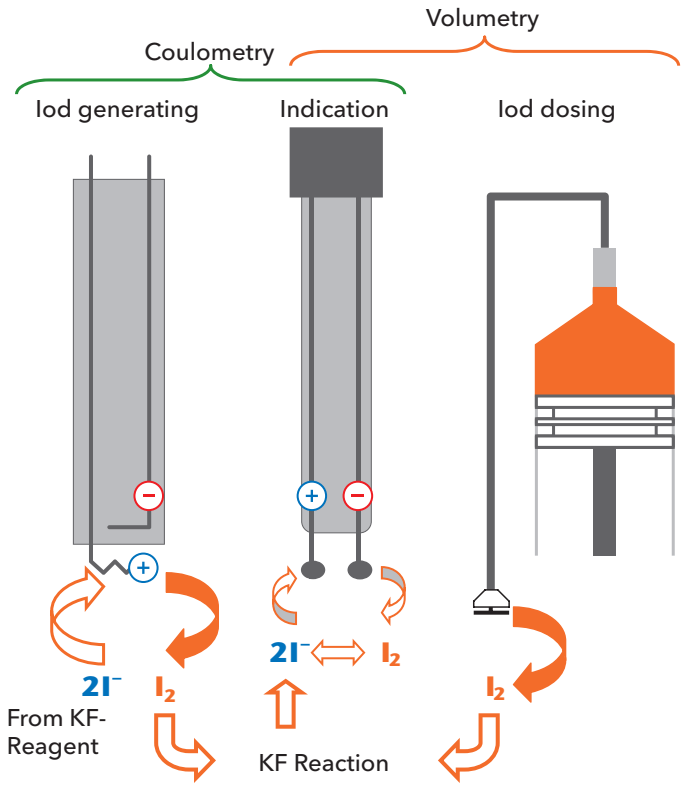
Karl Fischer Titration – the method for determining water

Experienced analyst may be unpleasantly reminded by the pyridine smell, when hearing the name Karl Fischer. However, modern reagents and most user-friendly analyzing instruments have eliminated the problem. Nowadays all applications can be handled and processed very easily by using the **coulometric** and **volumetric** Karl Fischer titration instruments. Thanks to its selectivity and precision, the Karl Fischer titration very easily and accurately established as the most important method for determining water and humidity.

The basic principle of the water determination according to Karl Fischer (short: **KF**) is a reaction of iodine with water in an alcoholic solution with presence of sulfurous acid and a base.

With the **volumetric** method the iodine can be accurately added through a piston burette or **coulometric** directly produced in the reaction vessel. The difference between the volumetry and coulometry mainly exists in the manner of dosing the iodine for the titration.

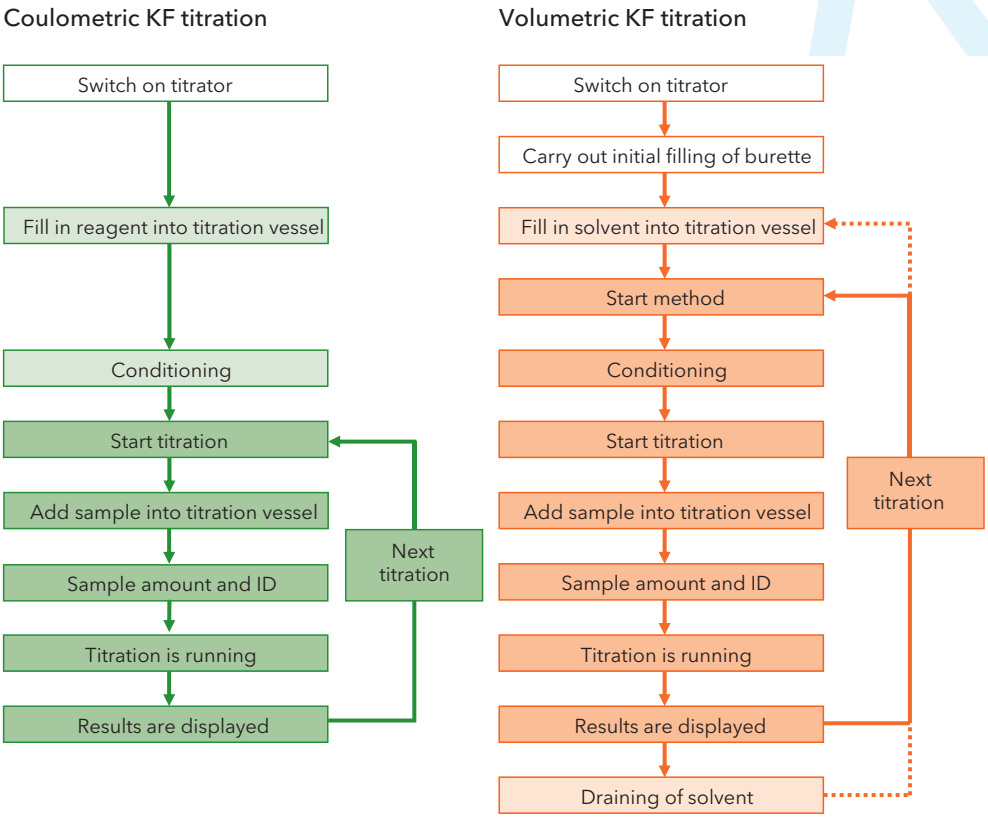
The illustration shows the different types of dosing:



TitroLine® 7500 KF

TitroLine® 7500 KF *trace*

In practice small differences occur between the two methods which are displayed in the table. The advantages of the volumetry lie in the different types of sample addition and solvent variations, offering more flexible operation potentials. Where on the other hand the coulometry can handle lower detection limits and the even simpler handling. The compared work flow with coulometry and volumetry are shown with the following illustration. The clearly shorter and easer sequence is noticable with the coulometry.



Comparison: Coulometric and volumetric Karl-Fischer-titration		
Property	**Coulometry**	**Volumetry**
Water amount and sample amount	Small water amount Small sample amounts	Medium and large water amounts Adapted sample amount
Sample types	Liquid Gaseous (i.e. KF oven) Solid samples with oven	Solid Liquid
Sample addition and preparation	Direct with syringe Gas inlet with oven External extraction Solid samples are evaporated with an oven	Solid samples are added directly Sample preparation with homogenisator Working at higher temperature Direct with syringe
Working method	Very fast Very simple	Fast Simple
Working range	µg range 10 µg up to 5 mg water	mg range 200 µg up to 50 mg water
Trueness	Pretty good for small water amounts > 400 µg Wasser (± 0,5 %)	Pretty good for water amounts > 5 mg water (± 0,5 %, standardization required!)
Reproducibility	Typical RSD of appr. 1 % for water > 400 µg	Typical RSD of appr. 1 % for water > 5 mg

TitroLine® 7500 KF and TitroLine® 7500 KF *trace* –

You can't go wrong with the new TitroLine® KF titrators from SI Analytics

The TitroLine® 7500 KF is the volumetric generalist for a wide range of use and the TitroLine® 7500 KF *trace* is the specialist for low water contents. Both new titrators are to be characterized by following features:

- Fast, easy and precise
- With standard methods for different applications (titer, blank value, 1 or 2 component reagent)
- The addition of solvent and the extraction of the titrated sample are managed by the titration stand TM 235 KF (optional for TitroLine® 7500 KF trace)
- Online display of curve and measurement drift during titration

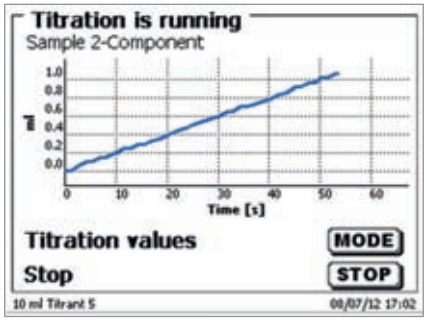
Advantages TitroLine®/TITRONIC®

TitroLine® 7500 KF *trace*

Karl Fischer Titration made easy

Titration curve live

The online display of the measurement curve, measurement drift and titration solvent consumption (TitroLine® 7500 KF only) make accurate monitoring of the titration possible and one can determine any unwanted side reactions immediately.



TitroLine® 7500 KF

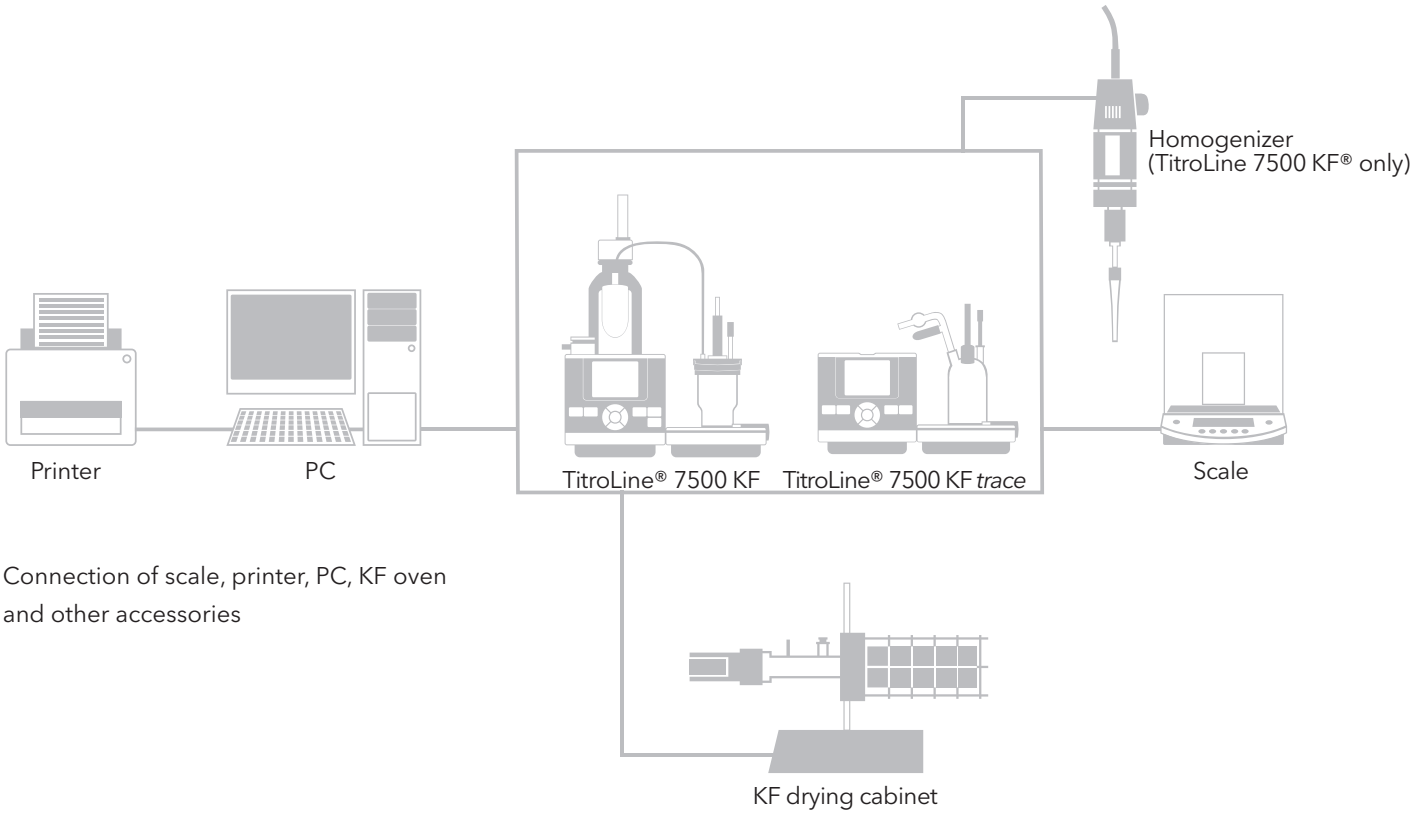
Accessories

Titration stand TM 235 KF

Titrated samples are simply extracted by pressing a button on the KF titration stand TM 235 (standard on TitroLine® 7500 and KF and part of the modules 2 + 4 TitroLine® 7500 KF *trace*). With another push on a button you add fresh solvent or anolyte. A built-in magnetic stirrer ensures a consistent dilution of solution and sample.

The titration vessels are sealed to thus avoid the ingress of moisture (low drift!). The removable glass vessel on the TitroLine® 7500 KF comes in two sizes and is easy to clean. It is also available as thermostatable version.

For the TitroLine® 7500 KF *trace* you have the choice of two different vessels made of solid glass with three and five openings. They have a very low drift.



Connection of scale, printer, PC, KF oven and other accessories

Specifications –TitroLine® 7500 KF and TitroLine® 7500 KF *trace*

Specific Features	TitroLine® 7500 KF	TitroLine® 7500 KF *trace*
Measuring range	10 ppm–100%	1 ppm–5% (10 µg–200 mg)
Accuracy	Dosing accuracy <0.15%	<0.3% at 1 mg water
Applications	KF volumetry, Dead- stop-titrations (SO_2, bromine number …)	KF coulometry, bromine number
Titration stand with integrated pump and magnetic stirrer TM 235 KF	■	Module 2 and 4

You will find more general features on page 146/147

TW alpha *plus* and TW 7400 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 and the TW 7400 sample changers by SI Analytics 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® 7000 titrator or from a PC with the TitriSoft software.

Higher flexibility due to exchangeable sample racks

With four sample racks for up to 72 samples (TW 7400) and titration head fittings for a variety of beaker and titrator vessels you get the flexibility your lab needs. The sample racks and titrator heads are very quick and simple to change. The size of the rack can be selected in the TitroLine® 7000 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".

TW alpha plus with 16 sample dish and pump MP 25

TW alpha plus with sample dish for CSB vessels after DIN

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 MP 25 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.

Automatic CSB Titration

For the direct titration of the CSB there is a special sample tray for TW alpha plus with 24 positions available.

For the large sample throughput – TW 7400 sample changer

The new X / Y sample changer TW7400 has been developed for high sample throughput. There are three different sample rack sizes of 42, 48 and 72 positions, and three different titration heads available.

Both the sample racks and the titration heads are easily exchanged. The sample rack with the 42 positions can be operated with beakers of either 150 or 250ml volume. These are used in particular in the water and environmental analysis. With this sample rack the use of the irrigation pump MP 25 is recommend. The sample rack with 72 positions can be operated with beakers of 50ml and special sample containers for a sample volume up to approximately 75ml. Typical applications include e.g. the wine and beverage analysis, pH measurements in soil samples or the determination of the alkalinity in Seawater.

The sample with 48 positions is suitable for 100ml beakers especially used for wine analysis.

TW 7400 with 42 sample rack

TW 7400 with 72 sample rack

Selection table autosampler TW alpha plus and TW 7400

Feature/Accessory	TW *alpha* plus	TW 7400
Stirring from the bottom with built-in magnetic stirrer	■	–
Rod stirrer TZ 1847 Suitable for all sample racks besides COD	■	■
Rod stirrer TZ 1846 Suitable only for COD sample rack	■	–
Rinsing pump MP 25. Suitable for sample racks: TZ 1452, TZ 1459 und TZ 3942	■	■
Sample rack for 12 positions TZ 1452 Suitable for titration vessel 250 ml low form (scope of supply) and 400 ml tall form	■	–
Sample rack for 16 positions TZ 1459 Suitable for titration vessel 150 ml low form (scope of supply) and 250 ml tall form	■	–
Sample rack for 24 positions TZ 1454 Suitable for titration vessel 50 ml tall form (scope of supply) and titration vessel up to 75 ml sample volume (TZ 1786)	■	–
Sample rack for 24 positions TZ 1444 Suitable for COD sample vessel 100 ml according to DIN (not included in scope of supply!)	■	–
Titration head TZ 1463 with 7 openings NS 14 Suitable for sample rack TZ 1459 and TZ 1452	■	–
Titration head TZ 1467 with 7 openings NS 14, splash shield and rinsing spray Suitable for sample rack TZ 1459 and TZ 1452 in combination with rinsing pump MP 25	■	–
Micro-titration head TZ 1469 with 4 openings Suitable for sample rack TZ 1454	■	–
COD titration head TZ 1461 with 3 openings Suitable for COD sample rack TZ 1444.	■	–
Sample rack for 42 position TZ 3942 Suitable for titration vessel 150 ml low form (scope of supply) and 250 ml tall form	–	■
Sample rack for 48 positions TZ 3948 Suitable for titration vessel 100 ml tall form (scope of supply)	–	■
Sample rack for 72 positions TZ 3972 Suitable for titration vessel 50 ml tall form (scope of supply) and titration vessel for up to 75 ml sample volume (TZ 1786)	–	■
Titrierkopf TZ 3963 with 7 openings NS 14 Suitable for sample rack TZ 3942	–	■
Titration head TZ 3967 with 7 openings NS 14, splash shield and rinsing spray Suitable for sample rack TZ 3942 in combination with rinsing pump MP 25	–	■
Micro-titration head TZ 1469 with 4 openings Suitable for sample rack TZ 3948 and TZ 3972	–	■

Important note: The rinsing pump MP 25 can only be used in combination with the titration heads TZ 1467, TZ 3967 and the sample rack TZ 1452, TZ 1459 and TZ 3942.

TitriSoft 3.0 – convincingly simple …

The TitriSoft 3.0 titration software is the optimum solution for your titration tasks. The software can be used with Windows XP, Vista and 7 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.

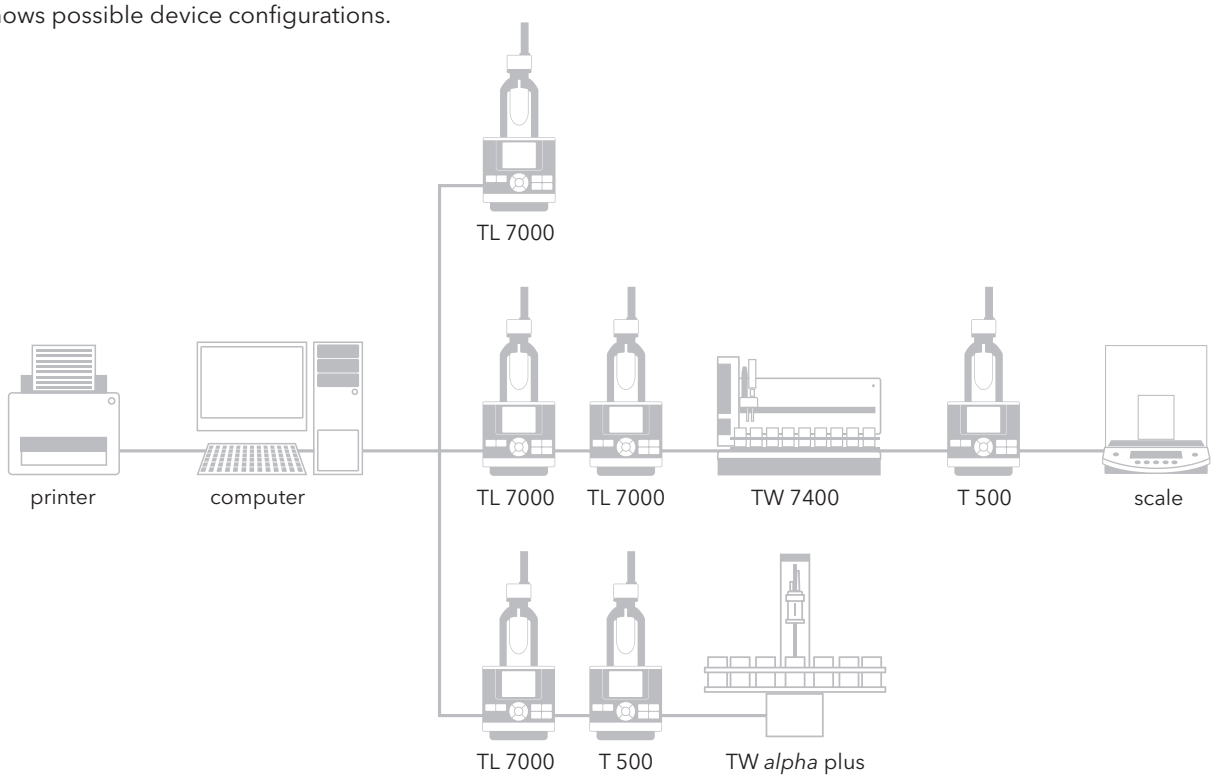
Connection possibilities

Using TitriSoft 3.0 you can control the following devices from a PC:

- **Titrators** (TitroLine® 7000, 7500 KF, 7500 KF *trace* and TitroLine® *alpha* plus)
- **Sample changers** (TW *alpha* plus, TW 7400, TW alpha und TW 280)
- **Piston burettes** (TITRONIC® 500 and TITRONIC® *universal*, TITRONIC® 110/200 and TITRONIC® 110 plus)
- **Balances**

You can connect the titration hardware to any of your PC's available USB-A or serial interfaces. Each of the interfaces allows different combinations of devices (configurations). To automate a titration procedure the software may be used to control the TitroLine® 7000 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® 7000. Of course, you can also use the software for dosing only.

The image below shows possible device configurations.



System requirements

For optimal and fast working with the TitriSoft 3.0 software your system should be equipped as shown below:

Interface: a free USB or RS232-interface per configuration

Computer: Pentium D (Dual-Core) 2 GHz or higher

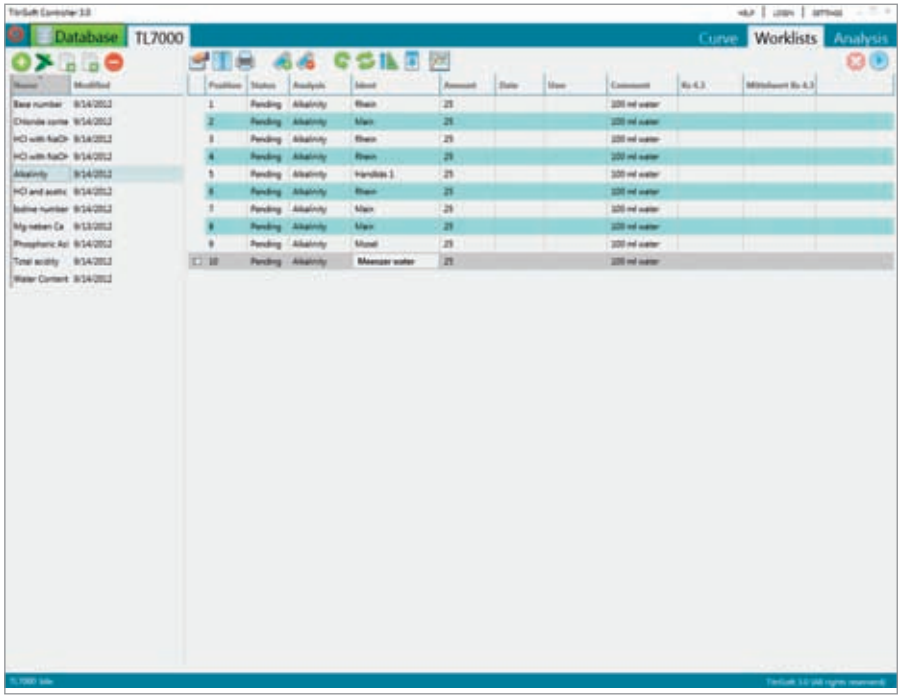
Operating system: Windows XP, Vista or 7

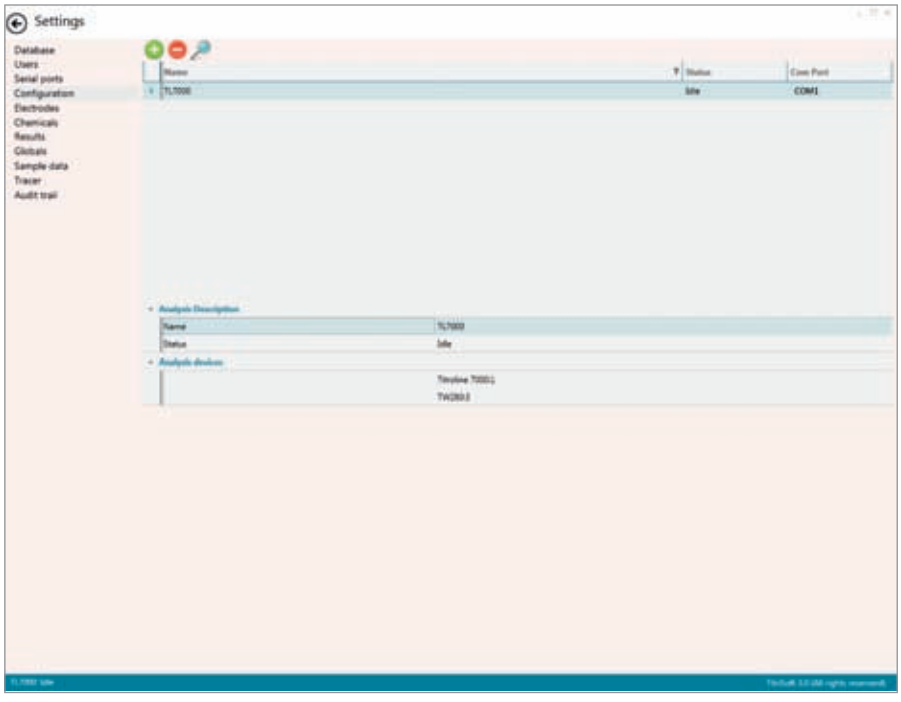
RAM: minimum 2 GB

Hard disk:
minimum free storage volume 200 MB

Graphics card:
minimum resolution 1280 x 1024

… strong benefits …





›Navigator‹, the main menu

The different software tasks are assigned to five different centers:

- Settings,
- Database,
- Analysis,
- Worklists
- Curve

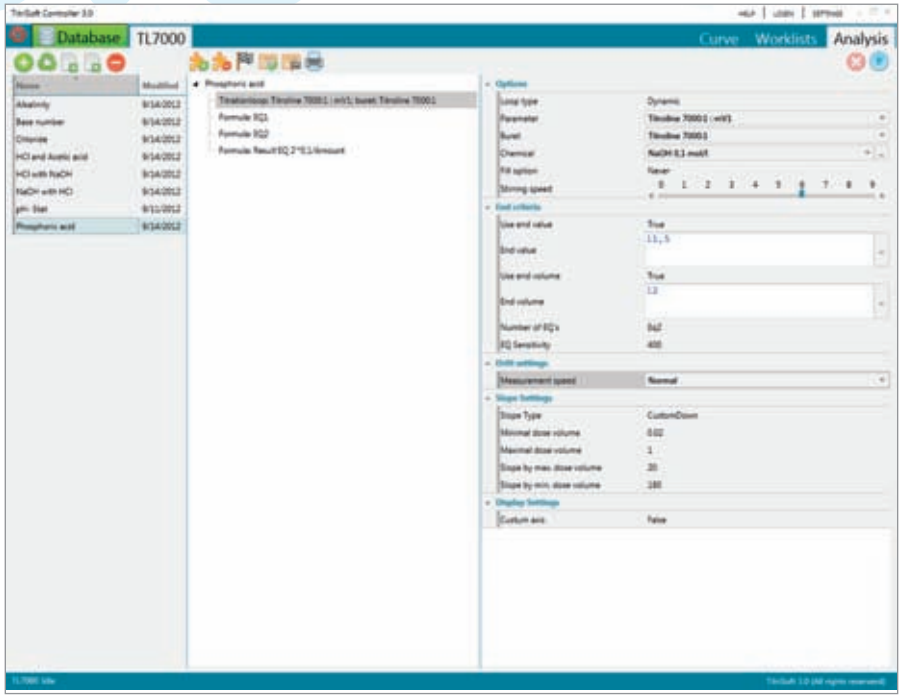
Each of these centers can be chosen at the menu bar.

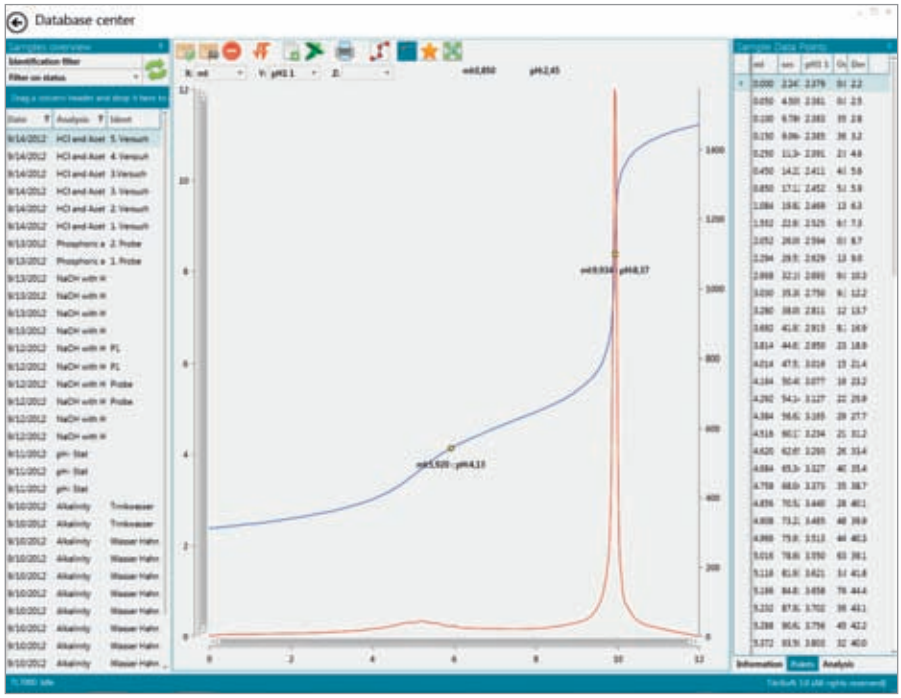
›Settings‹, the system configuration

In the system configuration, 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 five user types. The Administrator has access to all configuration and software operation options. The "Administrator" has access to all configuration and software operation options. The "User" or "Advanced User" has the same rights as the Administrator but is not allowed to delete results, methods and worklists. Users are restricted to operation of the Titration Center which very much simplifies matters.

… clearly structured …





›Analysis‹,
your method center

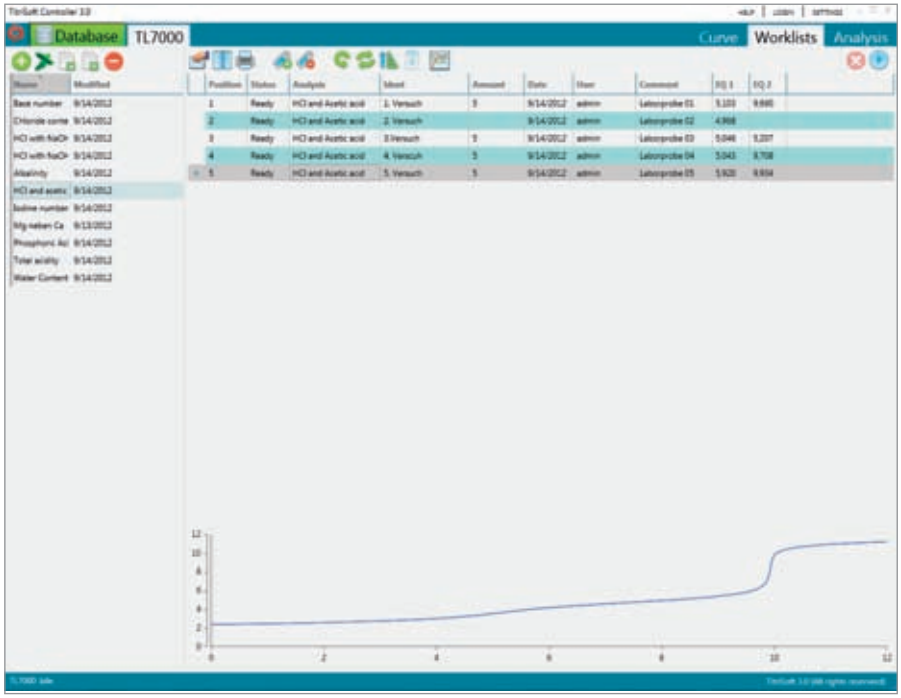
This is where you set up and save your titration methods. Even complex methods can be installed with a few mouse clicks. Adjustment of the titration parameters is facilitated by the use of symbolic slide controls. Functions such as waiting time, IF loops, repetition, dosings and measurements in addition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

›Database‹, your database

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

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 and print it out together. Additionally, an export of the data to Excel and ASCII is also available.

… highly productive: TitriSoft 3.0



›Worklists‹, your clearly structured workplace

›Worklists‹ 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 process you can follow the titration under „curve" or directly via the worklist. 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 and TW 7400 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 a LIMS.

TitriSoft 3.0 P – simply reliable …

In this case, the "P" stands for "pharmaceutical". "The TitriSoft 3.0 P fully meets all requirements of the FDA 21 CFR Part 11 regulation regarding „Electronic Records", „Electronic Signature" and „Audit Trail".

The FDA (i. e. **F**ood and **D**rug **A**dministration of the USA) 21 CFR Part 11 regulations describe how to deal with electronically stored data ("Electronic Records") and how to prepare electronic signatures ("Electronic Signature"). These regulations are binding for all companies offering medical, pharmaceutical or food products and services in the USA.

System requirements

For optimal and fast working with the TitriSoft 3.0 software your system should be equipped as shown below:

Interface: a free USB or RS232-interface per configuration

Computer: Pentium D (Dual-Core) 2 GHz or higher

Operating system: Windows XP, Vista or 7

RAM: minimum 2 GB

Hard disk:
minimum free storage volume 200 MB

Graphics card:
minimum resolution 1280 x 1024

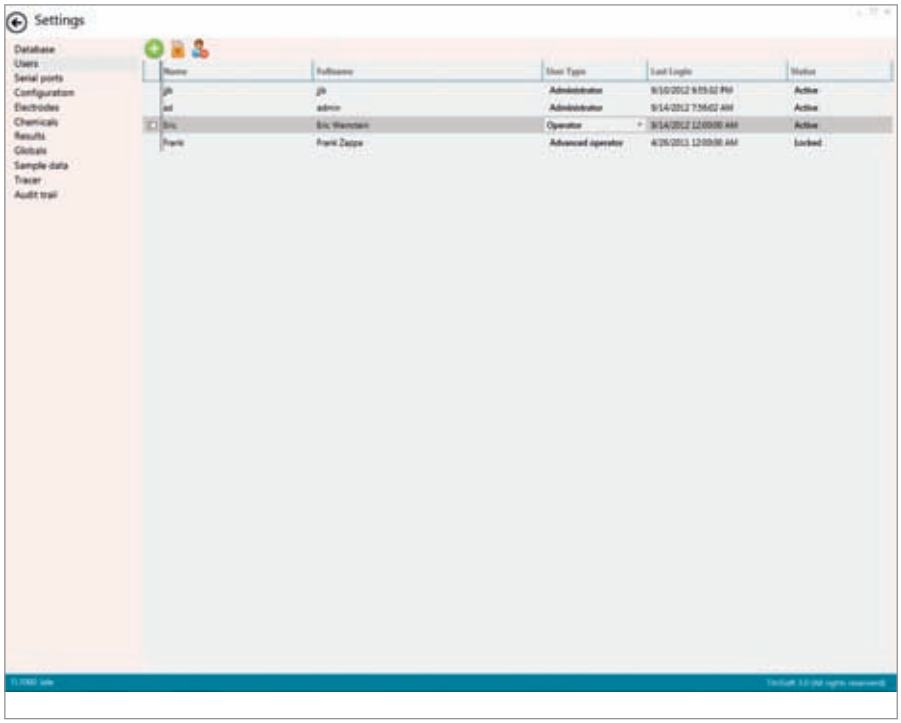
Comparison between TitriSoft 3.0 and 3.0 P

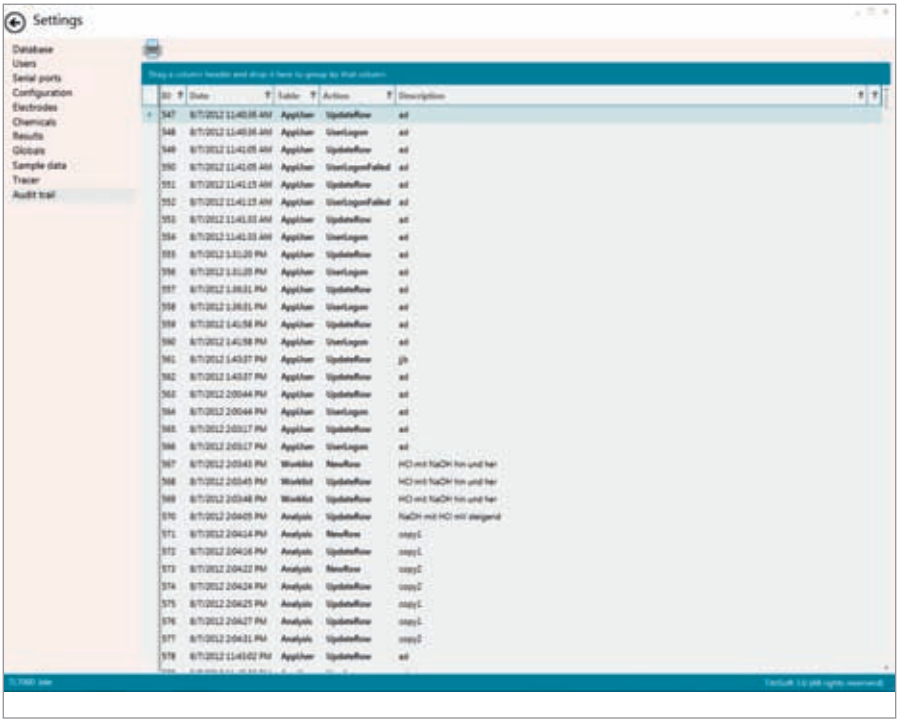
Functions	TitriSoft 3.0	TitriSoft 3.0 P
Electronic Record		■
Electronic Signature		■
Audit Trail		■
Controlled Access		■
Copies of Records		■
Manual with forms for SOPs, IQ, OQ, PQ and validation reports		■
Straightforward procedure	■	■
All types of titrations	■	■
Comfortable worklists	■	■
Online titration curves	■	■
Clear documentation	■	■
Perfect titration control by PC	■	■

Controlled Access

The controlled access guarantees that only authorized individuals have access to the software functions, according to your company's security policy and the FDA requirements.

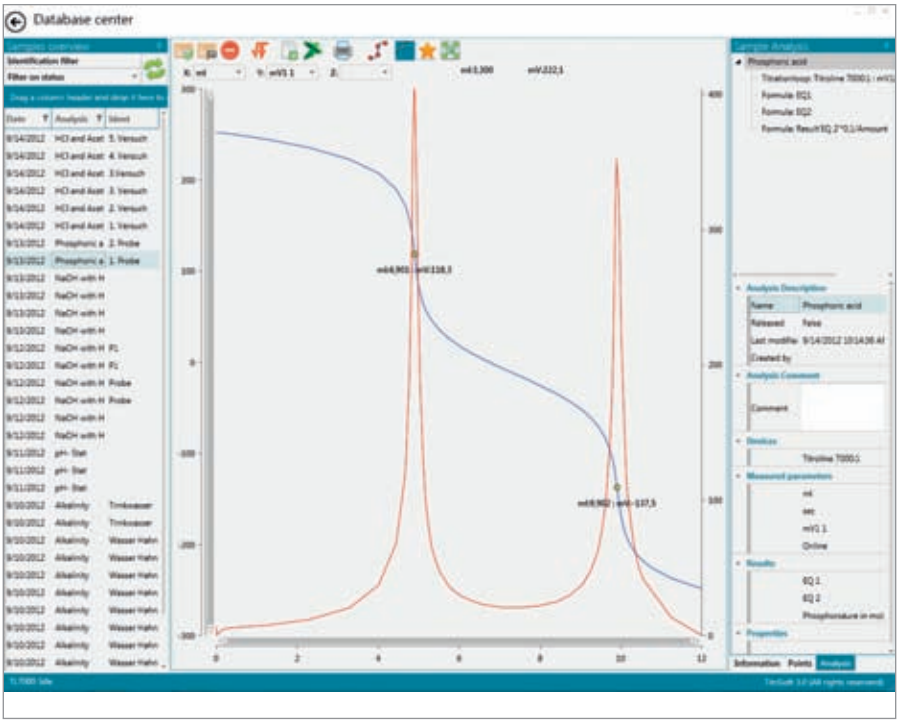
TitriSoft 3.0 P has 5 different access levels: The "Operator" level does only allow to carry out the routine titrations, whereas the "Advanced User" level is entitled to approve the methods. The highest level, the "Administrator" may set up the users and assign them the user rights. He even has the permission to delete records, but only after a copy of the database has been generated.





Audit Trail

The 21 CFR Part 11 prescribes that creating methods, modifying passwords or saving results, generates an entry in the Audit Trail. TitriSoft 3.0 P automatically generates an entry in the Audit Trail table as soon as an access to the database has taken place. The local time and the GMT are automatically stored together with this entry in the Audit Trail. Each entry also asks for a comment. The Audit trail or parts of it can be printed out, or a "human" readable digital copy of it, e.g. a PDF file can be generated.



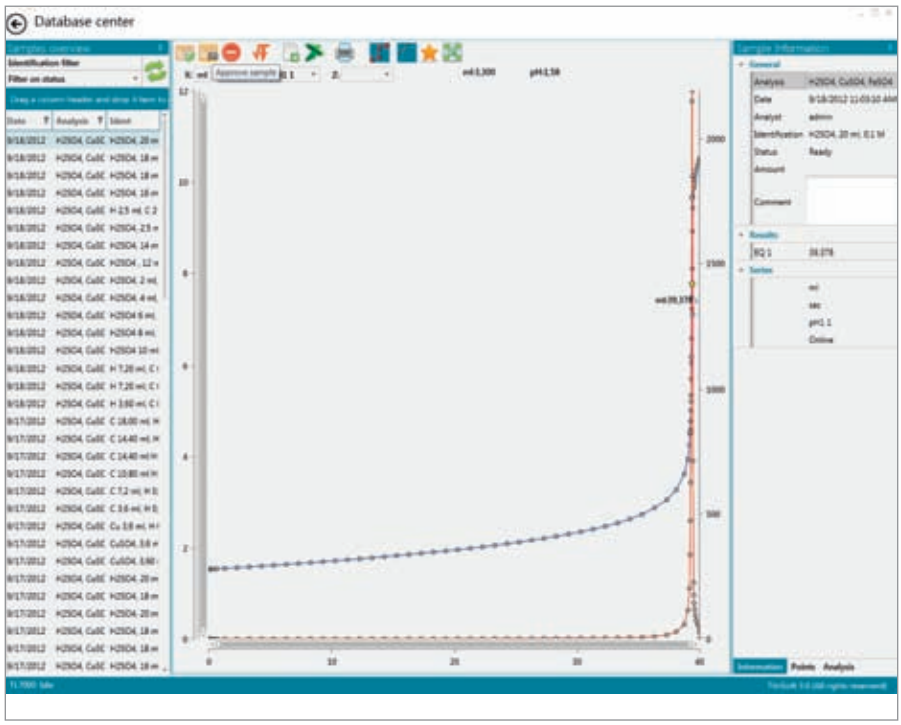
Electronic Records

The 21 CFR Part 11 prescribes how to safeguard and store the generated results over time. Besides regularly making backup copies of the complete database, is it possible to generate readable digital copies of the results, methods, worklists, the Audit Trail, the user administration and the configuration(s). For that purpose, a PDF writer is already integrated in the software. The purchase of expensive third-party software for generating PDF files ist not necessary.

Of course the database is password protected against unauthorized access.

Electronic Signature

Digital analysis results have to be as reliable as classical, manually checked results with a handwritten signature. A digital signature, which is as safe as a handwritten one, can be placed to approve all electronic records. The approver has to enter the name and an additional password. The electronic signature is stored together with the signer's function, the reason of signing and the date and time.



Specifications – Piston burettes TITRONIC® 500 and automatic

Features	TITRONIC® 500	TitroLine® 6000
Display	Color online graphic	Color online graphic
Measuring input pH/mV with reference input	–	■
Wireless electrode recognition	–	–
Measuring input Dead stop (2 x 4 mm connector)	–	■
Measuring input generator electrode (2 x 4 mm connector)	–	–
Measuring input temperature (2 x 4 mm connector)	–	■
Interfaces	2 x USB-A, 1 x USB-B 2 x RS232	2 x USB-A, 1 x USB-B 2 x RS232
Balance connection	RS232	RS232
Printer (USB-A)	HP PCL, Seiko DPU S445, PDF	HP PCL, Seiko DPU S445, PDF
Intelligent interchangeable modules (5, 10, 20 and 50 ml)	■	■
Burette solution (steps)	10,000	10,000
Manual titration	■	■
Dosing applications	■	■
Solution preparation (manual or automatic when connected to balance)	■	■
Automatic Titration (Independent without external software)	1)	■
Titration to mV and pH end points	–	2 EP
Dynamic and linear titration to inflection points (EQ) mV and pH	–	1 EQ
Particularly suitable for non aqueous titrations	–	–
Dead-stop-titration	–	■
pH-stat-titration	–	–
Water determination according to KF volumetry (10 ppm – 100 %, recommended)	–	–
Water determination according to KF coulometry (1 ppm – 5 %, recommended)	–	–
Standard methods	■	■
Number of user methods	15	15
Connection and control of autosamplers	–	–
Can be controlled with TitriSoft 3.0	■	–

[1] Can be used as titration and dosing burette in automatic titration systems

Titrators TitroLine® 6000 / 7000 / 7500 KF / 7500 KF *trace*

TitroLine® 7000	TitroLine® 7500 KF	TitroLine® 7500 KF *trace*
Color online graphic	Color online graphic	Color online graphic
■	–	–
■	–	–
■	■	■
–	–	■
■	–	–
2 x USB-A, 1 x USB-B 2 x RS232	2 x USB-A, 1 x USB-B 2 x RS232	2 x USB-A, 1 x USB-B 2 x RS232
RS232	RS232	RS232
HP PCL, Seiko DPU S445, PDF	HP PCL, Seiko DPU S445, PDF	HP PCL, Seiko DPU S445, PDF
■	■	–
10,000	10,000	–
■	–	–
■	■	–
■	■	–
■	■	■
2 EP	–	–
2 EQ	–	–
■	–	–
■	■	–
■	–	–
–	■	–
–	–	■
■	■	■
50	50	50
■	–	–
■	■	■

Specifications – Piston burette TITRONIC® 500

Features	TITRONIC® 500	TitroLine® 6000
Measuring input pH/mV with reference electrode input	–	pH/mV-input with 24 bit transducer Electrode socket according to DIN 19 262 or additional with BNC socket insert
Measurement range pH	–	–3.0 to 18.00
Display resolution pH	–	0.001
Accuracy pH (without sensor probe)	–	0.002 ± 1 Digit
Measurement range mV	–	–2000 to 2000
Display resolution mV	–	0.1
Measurement input Dead stop (2 x 4 mm socket)	–	Connector (µA) for double platinum electrodes Polarisation voltage variably adjustable from 40 to 220 mV
Measurement range µA	–	0 to 100
Display resolution µA	–	0.1
Accuracy µA (without sensor probe)	–	0.2 ± 1 Digit
Measurement input temperature (2 x 4 mm socket)	–	Connector for Pt 1000 resistance thermometer
Measurement range temperature °C	–	–75 to 175
Display resolution °C	–	0.1
Accuracy °C (without sensor probe)	–	0.2 K ± 1 Digit
Display	3.5 inches -1/4 VGA TFT display with 320 x 240 pixels	3.5 inches -1/4 VGA TFT display with 320 x 240 pixels
Housing material	Polypropylene	Polypropylene
Front keyboard	Polyester coated	Polyester coated
Housing dimensions	15.3 x 45 x 29.6 cm (W x H x D), height with interchangeable unit	15.3 x 45 x 29.6 cm (W x H x D), height with interchangeable unit
Display resolution °C	–	Polypropylene Polypropylene
Weight	2.2 kg for basic unit 3.5 kg for complete device incl. interchangeable unit (with empty reagent bottle, without magnetic stirrer)	2.3 kg for basic unit 3.5 kg for complete device incl. interchangeable unit (with empty reagent bottle, without magnetic stirrer)
Ambient conditions	Ambient temperature: +10 to +40 °C for operation and storage	Ambient temperature: +10 to +40 °C for operation and storage
Material: intelligent interchangeable units (5, 10, 20 and 50 ml)	Valve: PTFE/ETFE Cylinder: borosilicate glass 3.3 (DURAN®) Hoses: FEP, blue	Valve: PTFE/ETFE Cylinder: borosilicate glass 3.3 (DURAN®) Hoses: FEP, blue
Dosiing accury according DIN EN ISO 8655, part 3	Accuracy : 0.15 % Precision: 0.05–0.07 % (Depending on the used interchangeable unit)	Accuracy : 0.15 % Precision: 0.05–0.07 % (Depending on the used interchangeable unit)

TitroLine® 6000/7000/7500 KF/7500 KF trace

TitroLine® 7000	TitroLine® 7500 KF	TitroLine® 7500 KF *trace*
pH/mV-input with 24 bit transducer Electrode socket according to DIN 19 262 or additional with BNC socket insert RFID receiver for SI Analytics ID electrodes	–	–
–3.0 to 18.00	–	–
0.001	–	–
0.002 ± 1 Digit	–	
–2000 to 2000	–	–
0.1	–	–
Connector (µA) for double platinum electrodes Polarisation voltage variably adjustable from 40 to 220 mV	Connector (µA) for double platinum electrodes Polarisation voltage variably adjustable from 40 to 220 mV	Connector (µA) for double platinum electrodes
0 to 100	0 to 100	–
0.1	0.1	–
0.2 ± 1 Digit	0.2 ± 1 Digit	–
Connector for Pt 1000 resistance thermometer	–	–
–75 to 175	–	–
0.1	0.1	–
0.2 K ± 1 Digit	–	–
3.5 inches -1/4 VGA TFT display with 320 x 240 pixels	3.5 inches -1/4 VGA TFT display with 320 x 240 pixels	3.5 inches -1/4 VGA TFT display with 320 x 240 pixels
Polypropylene	Polypropylene	Polypropylene
Polyester coated	Polyester coated	Polyester coated
15.3 x 45 x 29.6 cm (W x H x D), height with interchangeable unit	15.3 x 45 x 29.6 cm (W x H x D), height with interchangeable unit	15,3 x 18 x 29,6 cm (W x H x D)
Polypropylene	–	–
2.3 kg for basic unit 3.5 kg for complete device incl. interchangeable unit (with empty reagent bottle, without magnetic stirrer)	2.3 kg for basic unit 3.5 kg for complete device incl. interchangeable unit (withempty reagent bottle, without TM 235 KF)	2.3 kg for basic unit without magnetic stirrer TM 235 or TM 235 KF
Ambient temperature: +10 to +40 °C for operation and storage	Ambient temperature: +10 to +40 °C for operation and storage	Ambient temperature: +10 to +40 °C for operation and storage
Valve: PTFE/ETFE Cylinder: borosilicate glass 3.3 (DURAN®) Hoses: FEP, blue	Valve: PTFE/ETFE Cylinder: borosilicate glass 3.3 (DURAN®) Hoses: FEP, blue	–
Accuracy : 0.15 % Precision: 0.05 – 0.07 % (Depending on the used interchangeable unit)	Accuracy : 0.15 % Precision: 0.05 – 0.07 % (Depending on the used interchangeable unit)	–

The right electrode for your titration application

The applicable electrode for the titration application is a decisive factor for the accuracy and reproducibility of the results. In order to support you with selecting the appropriate electrode, we have summarized the according electrodes for the most important applications in the following.

Application	Electrode (w.o. temp.-sensor)	Electrode with integrated. temp.-sensor
Acid-base-titrations		
Aqueous, general strong acid and bases	A 7780	A 7780 1M-DIN-ID
Kjeldahl	A 7780	A 7780 1M-DIN-ID
Alkalinity	N 62, N 61	A 162-2M-DIN-ID
Aqueous, difficult applications	IL-pH-A120MF IL-pH-A170MF	A 162-2M-DIN-ID
Low ionic liquids	IL-pH-A120MF IL-pH-A170MF	A 162-2M-DIN-ID
Small sample amounts	N 5900 A	A 157 IL-MICRO-pHT-A-DIN-N
Titration with sample changer (100–250 ml vessels)	N 65	N 1051 A IL-pHT-A170-DIN-N
Titration with sample changer (50 ml vessels, micro)	N 5900 A	–
Non aqueous acid base-titrations		
TAN (ASTM 664)	N 6480 eth	–
OH-No, NCO-No, FFA saponification No. …	N 6480 eth	–
TBN (ISO 3771/ASTM 2896)	N 6480 eis	–
Epoxy value	N 6480 eis	–
Titrations with perchloric acid/acetic acid	N 6480 eis	–
Precipitation titrations		
Halogenides (chloride, "salt")	AgCl 62, AgCl 62 RG	–
Halogenides, sample changer	AgCl 65, AgCl 62 RG	–
Pseudo halogenides (cyanide …)	Ag 6280	–
Detergents	TEN 1100*	–
Redox titrations		
General, iodometric, permanganometric, cerimetric	Pt 62 Pt 6280	–
Iodine number, peroxid number	Pt 61	–
COD	Pt 61	–
Sample changer, general	Pt 6580	–
Sample changer, COD	Pt 5901	–
Dead stop (SO_2 bromine no. …) general	Pt 1200	–
Dead stop (SO_2 bromine no. …) sample changer, general and titration vessels	Pt 1400	–
Dead stop (SO_2 bromine no. …) sample changer micro	KF 1100	–
KF-titrations	KF 1100	–
Complexometric titrations		
Water hardness (Ca/Mg separated)	Ca 1100 A*	–
Water hardness, total	Cu 1100 A*	–
Copper, zinc, nickel, aluminia …	Cu 1100 A*	–

* An applicable reference electrode is required:. B 2920+ respectively. B 3520+

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 RS232-C interface.

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

We have equipped the TITRONIC® *universal* with two serial RS232-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 serieswhenever required. The burettes are connected to one another via the RS232-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.

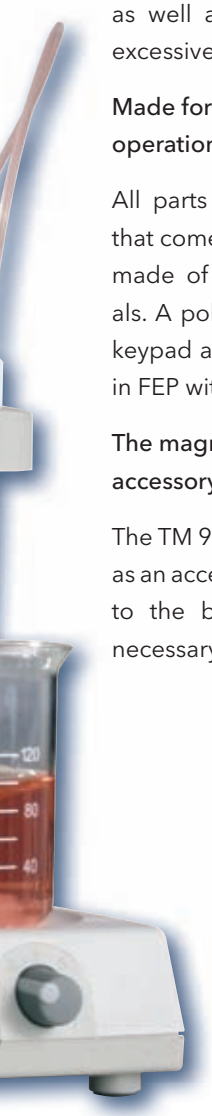
Made for robust laboratory operation

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 necessarypow er.

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
RS232-C-1	for connecting a printer with serial interface or a PC to document consumption in ml or for data backup
RS232-C-2	connection of additional piston burettes TITRONIC® *universal* ('Daisy Chain')
Configuration of the RS232-C interface	connection: miniature 4 pole round socket 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 to 999.9 ml
Display resolution	0.01 ml
Dosing volume	0.0 to 999.99 ml
Dosing speed	0.1 to 40 ml/min (with 20 ml dosing unit) 0.1 to 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 to 999.99 ml
Waiting time between the increments	0.1 to 999.9 s
Cylinder	20 ml or 50 ml DURAN® borosilicate glass cylinder with UV protection sleeve
Dosing accuracy	systematic error 0.15 %, 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	135 x 310 x 205 mm (W x H x D), including dosing unit, without stirrer
Weight	~2.1 kg
Ambient temperature	+ 10 to + 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 conven-iently 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.)

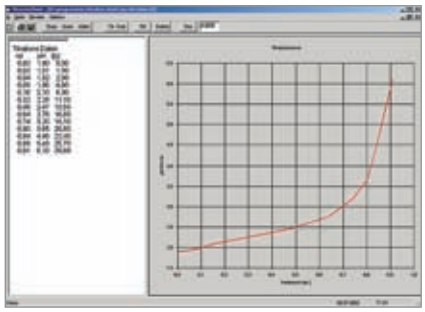
TitroLine *easy*

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 preinstalled 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

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 to 14.00
	measuring range mV: -1400 to +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 to +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
RS232-C interface	for connecting a printer with serial interface or PC for documentation
Configuration of the RS232-C interface	preset: 4800 baud, 7-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 to 999.9 ml
Display resolution	0.01 ml
Cylinder	20 ml DURAN® borosilicate glass cylinder with UV protection
Dosing accuracy	systematic error 0.15 %,
	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	~2.4 kg
Ambient temperature	+10 to +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

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 2.00/4.00/4.01/6.87/7.00/9.18/10.01/12.45 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.

Ordering information: TITRONIC® 500, TitroLine® 6000 / 7000 / 7500 KF / 7500 KF *trace*

Type-no.	Order no.	Description
T 500-M1	285220210	TITRONIC® 500 basic unit with magnetic stirrer TM 235, with stand rod TZ 1510, electrode clamp Z 305, hand controller TZ 3880, power supply 100-240 V
T 500-M2/20	285220220	TITRONIC® 500 basic unit with magnetic stirrer TM 235 and 20 ml exchange unit WA 20, with stand rod TZ 1510, electrode clamp Z 305, hand controller TZ 3880, power supply 100-240 V
TL 6000-M1/10	285220050	TitroLine® 6000 basic unit with magnetic stirrer TM 235 and 10 ml exchangeable unit WA 10, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TL 6000-M1/20	285220060	TitroLine® 6000 basic unit with magnetic stirrer TM 235 and 20 ml exchangeable unit WA 20, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TL 6000-M1/50	285220070	TitroLine® 6000 basic unit with magnetic stirrer TM 235 and 50 ml exchangeable unit WA 50, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TL 6000-M2/20	285220080	TitroLine® 6000 basic unit with magnetic stirrer TM 235 and 20 ml exchangeable unit WA 20, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip. With pH-combination electrode and buffer set.
TL 6000-M2/50	285220090	TitroLine® 6000 6000 basic unit with magnetic stirrer TM 235 and 50 ml exchangeable unit WA 20, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip. With low maintenance pH-combination electrode A 7780-1M-DIN-ID and buffer set.
TL 7000-M1/10	285220140	TitroLine® 7000 basic unit with magnetic stirrer TM 235 and 10 ml exchangeable unit WA 10, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TL 7000-M1/20	285220150	TitroLine® 7000 basic unit with magnetic stirrer TM 235 and 20 ml exchangeable unit WA 20, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TL 7000-M1/50	285220160	TitroLine® 7000 basic unit with magnetic stirrer TM 235 and 50 ml exchangeable unit WA 50, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TL 7000-M2/20	285220170	TitroLine® 7000 basic unit with magnetic stirrer TM 235 and 20 ml exchangeable unit WA 20, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip. With pH-combination electrode and buffer set.
TL 7500 KF 05	285220810	Volumetric KF-Titrator, scope of supply: basic titrator unit, exchange unit WA 05, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1770, micro double platinum electrode KF 1100 and starter kit, power supply 100-240 V
TL 7500 KF 10	285220820	Volumetric KF-Titrator, scope of supply: basic titrator unit, exchange unit WA 10, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1770, micro double platinum electrode KF 1100 and starter kit, power supply 100-240 V
TL 7500 KF 20	285220830	volumetric KF-Titrator, scope of supply: basic titrator unit, exchange unit WA 20, TM 235 KF titration stand with integrated stirrer and pump, titration vessel TZ 1770, micro double platinum electrode KF 1100 and starter kit, power supply 100-240 V
TL 7500 KF trace M1	285220860	Module 1, coulometric KF-Titrator, scope of supply: basic titrator unit, generator electrode TZ 1752 without junction + connection cable, magnetic stirrer TM 235, stand rod, titration vessel TZ 1751, micro double platinum electrode KF 1150
TL 7500 KF trace M2	285220870	Module 2, coulometric KF-Titrator, scope of supply: basic titrator unit, generator electrode TZ 1752 without junction + connection cable, TM 235 KF titration stand with integrated stirrer and pump, stand rod, titration vessel TZ 1754, micro double platinium electrode KF 1150
TL 7500 KF trace M3	285220880	Module 3, coulometric KF-Titrator, scope of supply: basic titrator unit, generator electrode TZ 1753 with junction + connection cable, magnetic stirrer TM 235, stand rod, titration vessel TZ 1751, micro double platinum electrode KF 1150
TL 7500 KF trace M4	285220890	Module 4, coulometric KF-Titrator, scope of supply: basic titrator unit, generator electrode TZ 1753 with junction + connection cable, TM 235 KF titration stand with integrated stirrer and pump, stand rod, titration vessel TZ 1754, micro double platinum electrode KF 1150

Accessories for TITRONIC® 500, TitroLine® 6000 / 7000 / 7500 KF / 7500 KF *trace*

Type-no.	Order no.	Description
WA 05	285220300	5 ml exchangeable unit with integrated chip for reagent data, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
WA 10	285220310	10 ml exchangeable unit with integrated chip for reagent data, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
WA 20	285220320	20 ml exchangeable unit with integrated chip for reagent data, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
WA 50	285220350	50 ml exchangeable unit with integrated chip for reagent data, with brown glass bottle for titrant, GL 45 and S 40-bottle adapter, tubes, drip tube and titration tip
TM 235, 115-230 V	285220400	Magnetic stirrer for vessels up to 500 ml, agitator speed infinitely adjustable from 500 - 2000 r/min, for the connection to TitroLine® 6000/7000 and TITRONIC® 500
TM 235 KF, 115-230 V	285220900	Titriation stand with pump; Scope of delivery: Basic unit with 1 l DURAN ®-reagent bottle TZ 1791, 1 l DURAN®-waste bottle TZ 1792, moisture bottle, tubes and screw threads, power supply TZ 1855 (110 to 240 V)
TZ 1052	285214721	KF-drying stove, 230 V
TZ 1055	285215183	KF-drying stove, 115 V
TZ 1060	285218115	Accessories set for KF drying stove TZ 1052/TZ1055
TZ 1065	285201973	Flowmeter with valve and hose connectors for gas volumes (air, nitrogen) from 50 - 500 ml/min.
TZ 3863	285220480	USB-thermo printer, 112 mm for TitroLine® 6000/7000/7500 KF/7500 KF trace/7750 and TITRONIC® 500
TZ 3864	285220710	Thermal paper for TZ 3863 with very high durability (5 rolls)
TZ 3865	285220440	DIN A4 standard printer, HP PCL-compatible, with USB-connection cable, 230 V

Software TitriSoft 3.0

Type-no.	Order no.	Description
TZ 3071	285220717	Titration software for TitroLine® 7000, TitroLine® 7500 KF/7500 KF trace, TitroLine® 7750 and TitroLine® alpha plus
TZ 3072	285220727	Titration software like Version 3.0, but 21 CFR, part 11 compliant version

Ordering information:
Sample changer TW *alpha* plus and TW 7400

Type-no.	Order no.	Description
TW alpha plus, 230 V	1007290	Basic unit with integrated magnetic stirrer, incl. mains cable and connection cable for rod stirrer TZ 1581, 230 V
TW alpha plus, 115 V	1007291	Basic unit with integrated magnetic stirrer, incl. mains cable and connection cable for rod stirrer TZ 1581, 115 V
TW alpha plus 12, 230 V	1007292	Basic unit TW alpha plus with sample rack TZ 1452 for 12 samples, incl. titration head TZ 1463, mains cable, connection cable TZ 3084 and 20 beakers, 250 ml, low form, 230 V
TW alpha plus 12, 115 V	1007293	Basic unit TW alpha plus with sample rack TZ 1452 for 12 samples, incl. titration head TZ 1463, mains cable, connection cable TZ 3084 and 20 beakers, 250 ml, low form, 115 V
TW alpha plus 16, 230 V	1007294	Basic unit TW alpha plus with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1463, mains cable, connection cable TZ 3084 and 20 beakers, 150 ml, low form, 230 V
TW alpha plus 16, 115 V	1007295	Basic unit TW alpha plus with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1463, mains cable, connection cable TZ 3084 and 20 beakers, 150 ml, low form, 115 V
TW alpha plus 24, 230 V	1007296	Basic unit TW alpha plus with sample rack TZ 1454 for 24 samples, incl. titration head TZ 1469, mains cable, connection cable TZ 3084 and 30 beakers, 50 ml, high form, 230 V
TW alpha plus 24, 115 V	1007297	Basic unit TW alpha plus with sample rack TZ 1454 for 24 samples, incl. titration head TZ 1469, mains cable, connection cable TZ 3084 and 30 beakers, 50 ml, high form, 115 V
TW alpha plus MP, 230 V	1007305	Basic unit TW alpha plus with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1467, washing unit MP 25, mains cable, connection cable TZ 3084 and 20 beakers, 150 ml, low form, 230 V
TW alpha plus MP, 115 V	1007306	Basic unit TW alpha plus with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1467, washing unit MP 25, mains cable, connection cable TZ 3084 and 20 beakers, 150 ml, low form, 115 V
TW alpha plus CSB, 230 V	1007298	Basic unit TW alpha pluswith sample rack TZ 1444 for COD-24 samples according to DIN 38 409, incl. titration head TZ 1461, redox electrode Pt 5901, rod stirrer TZ 1846, titration tip TZ 1648, mains cable and connection cable TZ 3084, 230 V
TW alpha plus CSB, 115 V	1007299	Basic unit TW alpha pluswith sample rack TZ 1444 for COD-24 samples according to DIN 38 409, incl. titration head TZ 1461, redox electrode Pt 5901, rod stirrer TZ 1846, titration tip TZ 1648, mains cable and connection cable TZ 3084, 115 V
TW 7400	1007400	Basic unit without titration head and sample rack. With connection cable TZ 3987 for the connection on titrator TitroLine® 7000, power supply 100-240 V

Accessories for sample changer TW *alpha* plus and TW 7400

Type-no.	Order no.	Description
TZ 1444	285213836	Sample tray for TW alpha plus for 24 COD vessels according to DIN 38 409
TZ 1452	285214927	Sample tray for TW alpha plus for 12 sample vessels, incl. 20 beakers, 250 ml, low form
TZ 1454	285213844	Sample tray for TW alpha plus for 24 sample vessels, incl. 30 beakers, 50 ml, tall form
TZ 1459	285213166	Sample tray for TW alpha plus for 16 sample vessels, incl. 20 beakers, 150 ml, low form
TZ 1463	285213647	Titration head for TW alpha plus for 12 (TZ 1452) and 16 sample rack TZ 1459 with 7 drillings NS 14.5
TZ 1467	285213671	Titration head for TW alpha plus for 12 (TZ 1452) and 16 sample rack TZ 1459 with 7 drillings NS 14.5 incl. splash shield and rinsing spray
TZ 1469	285213884	Titration head for TW alpha plus for 24 pos. sample rack TZ 1454 with 4 openings (2 x NS 14,5 and 2 x NS 7,5) and 1 adapter for micro electrodes with 6 mm diameter.
TZ 3942	285217790	Sample rack for TW 7400 with 42 positions for 150 ml beakers low form or 250 ml beakers tall form
TZ 3948	285217800	Sample rack for TW 7400 with 48 positions for 100 ml beakers low form
TZ 3972	285217810	Sample rack for TW 7400 with 72 positions for 50 ml beakers tall form
TZ 1846	285215134	Rod stirrer long version with NS 14,5 for COD-reaction vessles according to DIN 38 409, part 41 zu Probenwechsler TW alpha plus
TZ 1847	285215175	Rod stirrer, short version with NS 14,5 for titration head TZ 1463, TZ 1467, TZ 1469, TZ 3942, TZ 3948 and TZ 3972
TZ 1545	285214232	Magnetic stirrer bar, 30 mm, 30 mm, 10 pcs. for TW alpha plus
MP 25 230 V	285216010	Membrane pump MP 25 with accessories (5 L - storage bottle, connection tubes, rinsing nozzle, connection cable) for TW alpha/TW alpha plus, 230 V
MP 25 115 V	285216010	Membrane pump MP 25 with accessories (5 L - storage bottle, connection tubes, rinsing nozzle, connection cable) for TW alpha plus and TW 7400, 115V

Data cable

Type-no.	Order no.	Description
TZ 3840	285220690	USB-connection cable type A (M), USB type B (M), 1,8 m
TZ 3081	1007979	TW alpha *plus*, Mettler AB-S, PG – balances, 5 m
TZ 3082	1007977	TW alpha *plus*, Sartorius-balances, 5 m
TZ 3087	1007976	TitroLine® 7000, TitroLine® 7750, TITRONIC® 500 or TITRONIC® *universal*, TW 7400, 1,5 m
TZ 3091	285223504	TITRONIC® *universal*, TITRONIC® 500 TitroLine® *easy*, TitroLine® 6000, 7000, 7500 KF, 7500 KF *trace*, PC, 5 m
TZ 3092	285223529	TitroLine® 6000,7000, 7500 KF, 7500 KF trace, Sartorius balances
TZ 3094	285223545	TITRONIC® *universal*, TITRONIC® *universal*, TITRONIC® 500, TITRONIC® 500, TitroLine® 7000, TitroLine® 7000
TZ 3097	285223578	TITRONIC® *universal*, TITRONIC® 500 TitroLine® *easy*, TitroLine® 6000, 7000, 7500 KF, 7500 KF *trace*, PC 1,5 m
TZ 3099	285223594	TitroLine® 6000,7000, 7500 KF, 7500 KF *trace*, Mettler AB-S, PG – balances, 1,5 m
TZ 3987	285217860	TitroLine® 7000, TitroLine® 7750, TITRONIC® 500 or TITRONIC® *universal*, TW 7400, 1,5 m

Ordering information:
TITRONIC® *universal* and TitroLine® *easy*

Type-no.	Order no.	Description
T universal M1/20-115 V	285211921	Module 1: Basic unit ready to use with 20 ml dosing unit TZ 3130 with tubes, screw threads, titration tip TZ 1503, electrode-/titration tip holder TZ 3660, stand rod TZ 3665, hand control element TZ 3680, 115 V
T universal M1/20-230 V	285212429	Module 1: Basic unit ready to use with 20 ml dosing unit TZ 3130 with tubes, screw threads, titration tip TZ 1503, electrode-/titration tip holder TZ 3660, stand rod TZ 3665, hand control element TZ 3680, 230 V
T universal M1/50-115 V	285211979	Module 1: Basic unit ready to use with 50 ml dosing unit TZ 3160 with tubes, screw threads, titration tip TZ 1503, electrode-/titration tip holder TZ 3660, stand rod TZ 3665, manual control TZ 3680, 115 V
T universal M1/50-230 V	285212445	Module 1: Basic unit ready to use with 50 ml dosing unit TZ 3160 with tubes, screw threads, titration tip TZ 1503, electrode-/titration tip holder TZ 3660, stand rod TZ 3665, manual control TZ 3680, 230 V
T universal M2/20-115 V	285211962	Module 2: with 20 ml dosing unit, as module 1, with the addition of magnetic stirrer TM 96, 115 V
T universal M2/20-230 V	285212437	Module 2: with 20 ml dosing unit, as module 1, with the addition of magnetic stirrer TM 96, 230 V
T universal M2/50-115 V	285211987	Module 2: with 50 ml dosing unit, as module 1, with the addition of magnetic stirrer TM 96, 115 V
T universal M2/50-230 V	285212494	Module 2: with 50 ml dosing unit, as module 1, with the addition of magnetic stirrer TM 96, 230 V
TL easy M1 BNC-115 V	285212872	Basic unit without electrode, ready to use with 20 ml dosing unit TZ 3130 with tubes and screw threads, magnetic stirrer TM 96, titration tip with tube, electrode-/ titration tip holder TZ 3660, stand rod TZ 3665, 115 V
TL easy M1-230 V	285212597	Basic unit without electrode, ready to use with 20 ml dosing unit TZ 3130 with tubes and screw threads, magnetic stirrer TM 96, titration tip with tube, electrode-/ titration tip holder TZ 3660, stand rod TZ 3665, 230 V
TL easy M2 BNC-115 V	285212831	for pH-titrations, Scope of delivery: as module 1, with the addition of a pH electrode and buffer set, 115 V
TL easy M2-230 V	285212848	for pH-titrations, Scope of delivery: as module 1, with the addition of pH electrode and buffer set, 230 V
TL easy M3 BNC-115 V	285212856	for halogenide-titrations, Scope of delivery: as module 1, with the addition of silver combination electrode AgCl 62 RG, 115 V
TL easy M3-230 V	285212864	for halogenide-titrations, Scope of delivery: as module 1, with the addition of silver combination electrode AgCl 62 RG, 230 V

Accessories for TITRONIC® *universal* and TitroLine® *easy*

Type-no.	Order no.	Description
TZ 2005	285221055	Bottle attachment with GL 45 thread
TZ 2004	285221047	Bottle set for titration agent
TZ 2008	285221088	Bottle attachment with S 40 thread (Merck)
TM 96	285223253	Magnetic stirrer for TITRONIC® universal and TitroLine® easy

Content Spectrophotometers

Selection table Spectrophotometers

	PRIM Light/ PRIM Advanced	UviLine 9100/ UviLine 9400
Wavelength range	VIS	VIS/ UV-VIS
Technique	single beam	single beam
Display	2 lines	QVGA
Data storage		■
Methods	50 methods	100 methods; unlimited with external data storage
Interfaces	RS232	2 x USB and RS232
Cell changer		■
Sipper	■ (manual)	■
Absorbance / Transmission	■	■
Concentration	■	■
Spectra scanning	■ (Advanced only)	■
Kinetics	■ (Advanced only)	■
Multi-wavelength	■ (Advanced only)	■

Compact Visible Spectrophotometers
PRIM Light and PRIM Advanced

PRIM Light & PRIM Advanced spectrophotometers combine a high level of performance with a simple and intuitive user interface. Compact and light, these new spectrophotometers are ideal for standard applications in education or in the laboratory.

Real-time display

- **Internal Applications**
  All applications, basic or standard, are included as standard and are immediately available with each spectrophotometer.
- **50 User Methods**
  All PRIM spectrophotometers can store up to 50 methods in memory. Stored applications can be recalled at any time without re-programming the method parameters. Prior to running a method, it is possible to check the stored parameters using only one button from the navigation keys.
- **Real-time Display**
  Absorbance and transmission are displayed in real-time in any measurement mode.
- **1 Key = 1 Function**
  The keyboard is clearly arranged with each button corresponding to one specific single function. Operation is therefore simple and fast.
- **Low Voltage Power Supply**
  Makes these spectrophotometers ideal for education and laboratory applications.
- **Compact**
  Light at only 2.5 kg and compact footprint, PRIM takes only a small amount of bench space and can be handled easily.
- **Internal Calibration Filter**
  In order to certify accurate and repeatable results, the spectrophotometer calibrates itself automatically at each start-up using the internal didymium filter; a complete report is automatically printed if connected to an external printer.

Advantages PRIM

Choose between 2 PRIM units:

PRIM Light:

Basic internal software including standard spectrophotometric applications of absorbance, transmission and single standard concentration.

PRIM Advanced:

Advanced applications for absorbance, transmission, multi-standard concentration, kinetics, multi-wavelength and spectrum scanning.

A wide choice of measuring modes

Kinetics

- Analysis of absorbance variation as a function of the time.
- Program to include lag-time and reaction time.
- Automatic calculation of absorbance variation during each segment of time or the total time.

Spectrum Scan*

- A curve of absorbance values as a function of the wavelength with detection of absorbance maxima and minima.
- User-definable scan mode using the entire or partial visible range: 330 to 900 nm, in 1 nm steps, with automatic recording of the baseline.

* with optional external printer.

Multi-Wavelenght Mode

- Measure of ratio and difference of absorbance at 2 wavelengths.
- Simultaneous display of calculation results as well as individual absorbance values at each wavelength

Accessories

A complete range of accessories:

Printer, tube-holder, manual aspiration system, thermostatted cuvette holder are available as options..

Technical Specifications	PRIM Light	PRIM Advanced
Spectral range	330 – 990 nm	
Bandwidth	10 nm	
Accuracy	± 1.5 %	
Precision	± 1 nm	
Photometric range	– 0.3 to 2.5 Abs, 0 to 200 %T	
Accuracy	± 2 %	
Drift	< 0.003 A/h @ 500 nm	
Stray Light	0.5 %T @ 340 & 400 nm	
Display	Alphanumeric, LCD, back-lit, 2 lines, height 8 mm, 16 characters	
Zero	Automatic	
Light source	Halogen	
Detector	Silicon diode	
Interface	Serial RS232C	
Cell holder	1 cuvette 10 mm	
Power	115 / 23 V; 50 / 60 Hz	
H x W x D, Weight	180 x 280 x 220 mm, 2.5 kg	
Software equipment		
Absorbance	■	■
% Transmission	■	■
Concentration with factor	■	■
Concentration with 1 standard	■	■
Concentration with 1 to 8 standards		■
Kinetics		■
Multi-wavelengths		■
Spectrum scanning		■
Peaks and valleys detection		■
Multi-language	■	■
Automatic stand-by	■	■

Type no.	Order no.	Product	Description
PRIM Light	285600190	Spectrophotometer	VIS Spectrophotometer with 10 mm cell holder
PRIM Advanced	285600200	Spectrophotometer	VIS Spectrophotometer with 10 mm cell holder

UviLine 9100/9400:
VIS- and UV-VIS-Spectrophotometers

Our UviLine range comprises
two high-performance single beam photometers:

- UviLine 9100 for measurements in the VIS range from 320 – 1100 nm
- UviLine 9400 for measurements in the UV-VIS-range from 190 – 1100 nm

These spectrophotometer's superior performance and exceptional performance range.

- Measurement of absorbance and transmission
- Concentration measurements up to 8 standards
- Multi-wavelength
- Spectra scan with online graphic
- Kinetics

Powerful optics

The UviLine is characterized by an superior optical design in its class:

- 1200 lines/mm holographic, concave grating for minimal stray light
- Wide wavelength range from 190 – 1100 nm
- High optical resolution of 4 nm
- Automatic compensation of ambient light
- Automatic wavelength calibration

Wide measurement range and extensive accessories

The wide cell chamber allows the use of cell holders with a length of max. 100 mm thereby enabling measurements of very low concentrations. Five different cell holders/sample changers are available, which can be easily exchanged:

- Single cell holder 10 mm (included
- Single cell holder 10–100 mm
- Single cell holder 10 mm, water thermostated
- Single cell holder 10 mm, Peltier thermostated
- Automatic 5 + 1 cell changer

Extensive evaluation functions

Store more than 100 user-defined methods and up to 1000 measurement values, approx. 30 spectra (expandable via USB device).

Large backlit graphic display

The large display allows a clearly structured navigation and enhances the graphic evaluation using arrow keys and zoom function.

Interface capability

The USB-B (slave) interface will connect to a PC. Both UviLines also have a USB-A (master) interface for connection to various instruments:

USB memory sticks and USB hard disks. This enables an easy expansion of the internal memory volume and also facilitates bi-directional data exchange.

- Standard printers with USB interface
- External PC keyboard
- A RS232 interface is also included

Clear and well-arranged keyboard

With four function keys F1 – F4 for fast and direct triggering of functions, such as settings, tools, zoom etc.

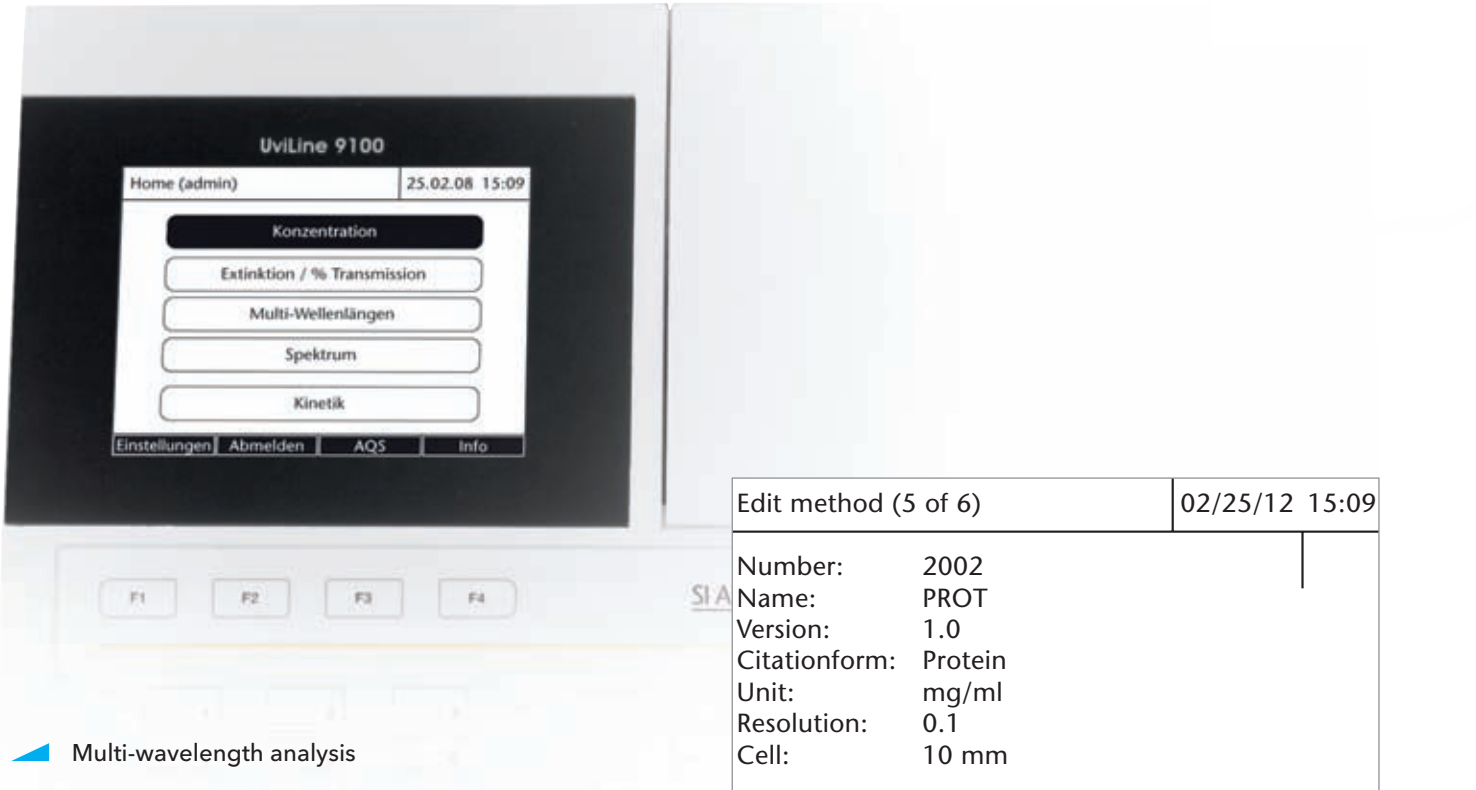
Alphanumeric keys for entering the wavelengths, sample ID's and other parameters.

Specially separated cursor section with (escape) and START / ENTER keys for fast navigation.

Also 5 additional keys with direct functions such as print, zero (reference), store etc.

UviLine 9100/9400:
Software for spectra, kinetics and multi-wavelength analytics

Besides the standard applications such as absorption, transmission and concentration measurement, both UviLine models comprise the complete functionality for the spectra, kinetics and multi wavelength analysis.



Multi-wavelength analysis

With the multi-wavelength analysis, up to 4 absorption values with different wavelengths can be measured and saved.

- Multi-wavelength measurements are used e.g. for DNA and RNA determinations and protein determinations according to Warburg-Christian.
- For each application you have the possibility to program a user-specific method. By using programmed methods, the evaluation of the measuring results becomes easier.

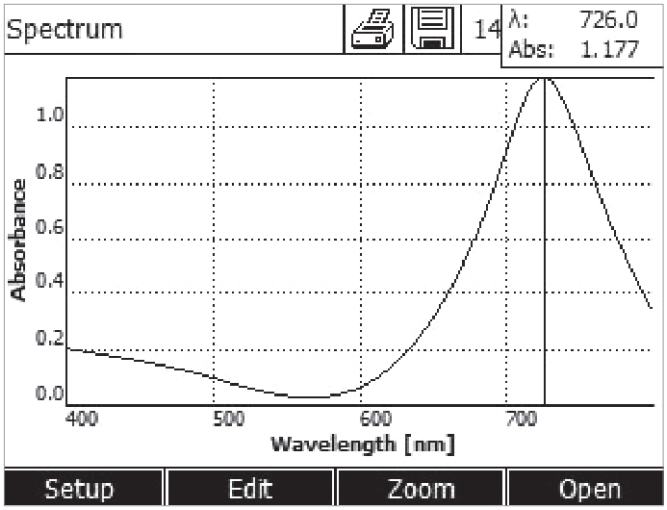
Edit method (5 of 6)	02/25/12 15:09
Number:	2002
Name:	PROT
Version:	1.0
Citationform:	Protein
Unit:	mg/ml
Resolution:	0.1
Cell:	10 mm
Back	Next

Edit method (6 of 6)	02/25/12 15:09
Function:	
$R = \frac{1.550 * A(280\ nm) - 0.757 * A(260\ nm)}{1.000}$	
Back	Next

Spectra

Whenever the optimal wavelength for the determination of the concentration is unknown or the purity of a solution is to be determined, the scanning of a spectrum becomes necessary.

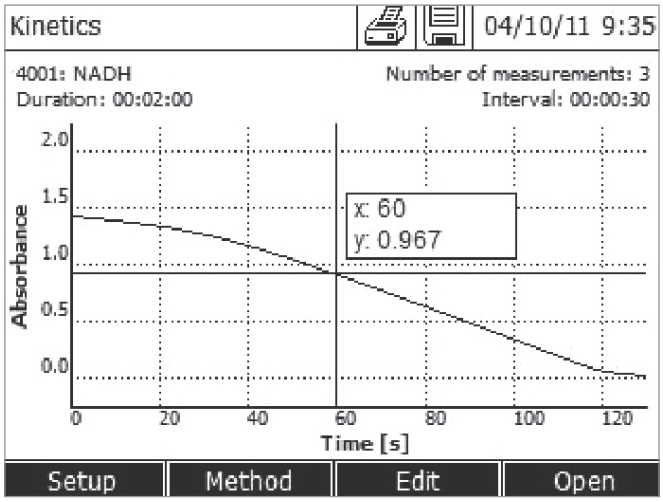
By using the zoom function and the cursor the spectra can easily be edited.



Kinetics

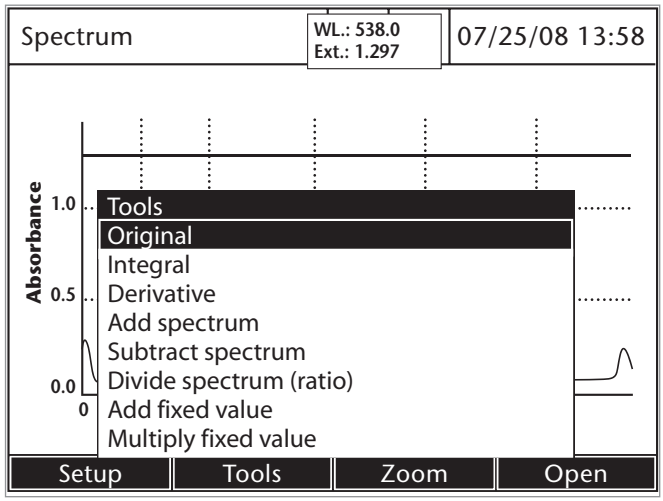
The kinetics program section allows the determination of the reaction rate constant.

- The kinetics measurement can be stored and subsequently evaluated using the cursor.



Other functions

Additionally, there is a whole range of additional evaluation functions such as min/max recognition, spectrum addition and subtraction, derivative calculation (1st–3rd derivative), peak area calculation (integral) and fixed value multiplication.



UviLine 9 100 / 9400:
Accessories for special applications

The UviLine's readily accessible cell compartment allows the use of a large range of accessories to extend these spectrophotometers' applications and to automate the workflow.

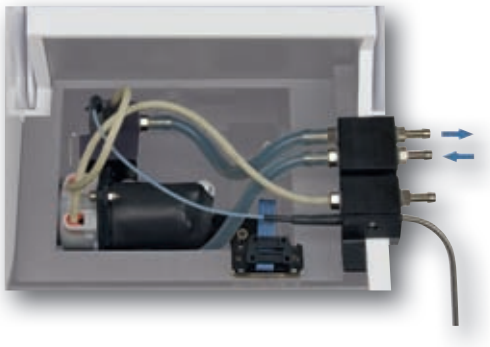
Easy exchange of accessories via QuickLock system

All accessories can be easily exchanged via a "QuickLock" system by a press of the finger. The massive metal baseplate of the accessories guarantees an optimal positioning of cells.

- All automatic accessories such as automatic cell changer, sipper or Peltier thermostated cell holder are fully software driven.

Single cell holder, up to 100 mm optical path length

This cell holder allows the use of long path length cells up to 100 mm.



Sipper

The sipper makes operation simpler and increases productivity. It comes with a peristaltic pump integrated in the cell holder which is water thermostated and allows:

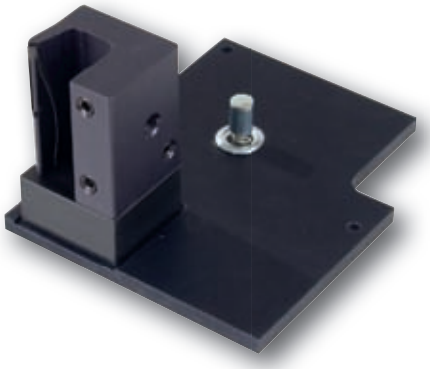
- Programmable suction from 500 µl to 3,000 µl and
- Use of flow-through cells from 30 µl to 450 µl.

Automatic cell changer 5 +1

Designed to analyze 5 samples and 1 blank. It guarantees automatic applications with stable measurements and unique advantages.

- Removable and easy to reinsert turret for convenient cells setup
- Accurate positioning of low volume cells

The blank value is always read before the sample measurement – a clear advantage for kinetics measurements.



Single cell holder, up to 10 mm optical path length

The 10 mm cell holder is included in the standard delivery of the UviLine. It guarantees a perfect positioning for all types of cells.

- It can be used with micro cells up to 50 µl.
- An optional water thermostated version is also available.

Peltier thermostatable cell holder

The thermoelectric Peltier element either heats or cools the sample in the cell to the required temperature. It is ideal for kinetic measurements:

- Temperature setup between 10 °C and 60 °C
- Accuracy: ± 0.5 °C
- No external thermostat needed
- Sipper option
- Fast, ultra compact and fully instrumentdr iven.

Technical Specifications

Software

Concentration	From 0 to 10 standards with interpolations. Graphic calibration curve management.
Kinetics	Dynamic graphic curve display, graphic management: zoom, slope calculation, current Abs
Spectrum scanning	Dynamic graphic curve display, graphic management: zoom, derivative, current Abs, maximum and minimum values
Multi Wavelength	Up to 10 wavelengths – flexible calculation of results
GLP compliant	User login with 3 levels
Storange capacity	internal: 100 methods / 30 graphics / 1,000 data sets – external (USB device): only limited by the volume of the USB device used
Methods	> 100 methods

Spectrophotometer

Technical Specifications	UviLine 9100	UviLine 9400
Wavelength range	320 – 1,100 nm	190 – 1,100 nm
Light source	Halogen	Xenon
Technique	single beam	
Optical resolution	4 nm	
Wavelength accuracy	± 1 nm	
Wavelength repeatability	< ± 0,2 nm	
Photometric range	-3.3 to 3.3 A	
Photometric accuracy	0.3 % or ± 0.003 A (from 0 – 0,6 A)	
Photometric linearity	< 1 % at 2 Abs between 340 – 900 nm	
Stray light	< 0.1 % at 340 and 400 nm	< 0.1 % at 220, 340 and 400 nm
Display	graphic display wih backlit, 320 x 240 pixel	
Update	via internet und USB Stick	
Interfaces	1 x USB-A, 1 x USB-B, 1 x RS232C	
Power supply	110 – 220 V, 50/60 Hz	
Temperature range	Use: 10 °C to 35 °C / Storage - 25 °C to 6 °C	
Dimensions	404 x 197 x 314 mm (W x H x D)	
Weight	4 kg	
Accessories	Sipper, 5 + 1 cell changer, cell holder (thermostated), cell holder 100 mm	

Ordering Information

Type No.	Order No.	Product	Description
UviLine 9100	285700100	Spectrophotometer	UviLine 9100, single beam spectro photometer, 4 nm with a measuring range from 320 to 1,100 nm
UviLine 9400	285700120	Spectrophotometer	UviLine 9400, single beam spectro photometer, 4 nm with a measuring range from 190 to 1,100 nm
SZ 2100	285700200	Automatic cell changer	5+1 cell changer, controlled from UviLine
SZ 2110	285700210	Cell holder	Single, 10 – 100 mm
SZ 2130	285700230	Cell holder	Single, 10 mm, (included in delivery of all UviLines)
SZ 2140	285700240	Cell holder	Single, 10 mm, water thermostated
SZ 2150	285700250	Sipper	controlled from UviLine
SZ 2160	285700260	Cell holder	Single, 10 mm, thermostated (Peltier)

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

Innovative capillary viscometry – from the outset

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

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

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

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

Content viscometry

AVS® measurement systems 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	
Plastics manufacturers	high polymer plastics of all types	
Plastics processors	high polymer plastics of all types	injection molding
Food industry	starch	instant flour thickeners
	gelatin	jelly bears
	packaging materials	yogurt containers
	milk products	yogurt 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, kerosene (jet fuel)
Textile	high polymer plastics of all types	for mixed fibers
	cotton	
Entertainment	high polymer plastics	CDs, DVDs

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 our automatic systems

Type	Abbr.	Solvent	Capillary	Operating temperature	Standards	Suitability of the AVS® measurement systems VC*	370	470	Pro
Cellulose	C I	Cuen/EWNN	0c	20 °C	SNV 195 598 DIN 60450 ASTM D 4243 ASTM D 1795 ISO 5351	■	■	■	■
		Couxam	I Micro		SCAN CM 15:88				
Cellulose acetate	CA	Dimethyl-chloride/ methanol	0c I I Micro	25 °C	ASTM D817	■	■	■	■
Polyamide	PA	Sulphuric acid (96 %)	II IIc	25 °C	ISO 307	■	■	■	■
Polyamide	PA	Formic acid (90 %)	I Ic	25 °C	ISO 307	■	■	■	■
Polyamide	PA	m-cresol	II IIc	25 °C	ISO 307	■	■	■	■
Polybutylene terephthalate	PBT	Phenol/dichloro benzene (50 : 50)	Ic II	25 °C	DIN 53 728/3 ISO 1628-5	■	■	■	■
Polycarbonate	PC	Dichloromethane	0c I	25 °C	ISO 1628-4	■	■	■	■
Polyethylene	PE	Decahydro -naphthalene	I Ic	135 °C	ISO 1191 ASTM D 1601	■	■	■	■
Polyethylene terephthalate	PET	m-cresol	II IIc IIc Micro	25 °C	DIN 53 728/3 ISO 1628-5 ASTM D 4603	■	■	■	■
Polyethylene terephthalate	PET	Phenol/dichloro benzene (50 : 50)	Ic II	25 °C	DIN 53 728/3 ISO 1628-5 ASTM D 4603	■	■	■	■
Polyethylene terephthalate	PET	Dichloroacetic acid	II IIc Micro	25 °C		■	■	■	■
Polymethyl methacrylate	PMMA	Chloroform	0c I	25 °C	ISO 1628-6	■	■	■	■
Polymethyl methacrylate	PMMA	Acetophenone	0c I	25 °C	ISO 1628-6	■	■	■	■
Polypropylene	PP	Decahydro-naphtalene	I Ic	135 °C	ISO 1628-3	■	■	■	■
Polyphenyl sulphide	PPS	Ortho dichloro naphtalene	IIc	230 °C		■	■	■	■
Polystyrene	PS	Toluene	I Ic	25 °C		■	■	■	■
Polysulphone	PSU	Chloroform	0c	25 °C		■	■	■	■
Polyvinyl chloride	PVC	Cyclohexanone	Ic	25 °C	ISO 1628-2 ASTM D 1243	■	■	■	■
Styrene-acrylo-nitrile copolymer	SAN	Ethyl methyl ketone	0c I	25 °C		■	■	■	■
Styrene-butadiene copolymer	SB	Toluene	0c I	25 °C		■	■	■	■

VC* = ViscoClock

■ 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 something of the past because time is money.

The ViscoClock

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

Range of use

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

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

Accuracy

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

Absolute viscosity

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

Relative viscosity

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

- Simple and highly precise time measurement
- Use with common viscometers is possible
- Includes software for determination of absolute and relative viscosity, t0-extreme value test and Hagenbach correction

Advantages ViscoClock

Technical data ViscoClock

Measuring range - time	up to 999.99 s; resolution 0.01 s	
Accuracy of time measurement	± 0.01 s / ± 1 digit; however no more precise than 0.1 %;	
	indicated as measuring uncertainty with a confidence level of 95 %	
Measuring range - viscosity	0.35 to10,000 mm²/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	
Power connection	socket for low voltage connection: jack plug, internal contact Ø = 2.1 mm, plus pole at pin contact,	
	for connection of Universal power supply TZ 1858	
Power supply	in accordance with class of protection III.	
	degree of protection for dust and humidity IP 50 in accordance with DIN 40 050	
	Universal power supply TZ 1858: 100 – 240 V, 50 – 60 Hz (9 V, 550 mA)	
	not suitable for use in areas subject to explosion hazards	
	RS232-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 RS232-C interface, permanently set	4,800 baud, 7 bit word length, 2 stop bits, no parity;
		after each measurement, the measured value is transmitted automatically.
		the string of digits consists of 4 digits before the decimal point,
		2 digits after the decimal point, and the terminating characters CR and LF.
Ambient Conditions	Ambient temperature	+ 10 to + 40 °C for storage and transport
	Operating temperature	stand: – 40 to + 150 °C
		electronic measuring unit: +10 to+40 °C
	Air moisture	in accordance with EN 61 010, Part 1;
		max. relative humidity 80 % for temperatures up to 31 °C,
		decreasing linearly to 50 % of relative humidity at a temperature of 40 °C
Housing	Materials	stand: polyphthalamide (PPA)
		casing*: polypropylene (PP)
		sealing membrane: silicone
	Dimensions	~490 x 95 x 50 mm (H x W x D)
	Weight	~450 g (without viscometer)
		power supply unit: ~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 one of our transparent thermostatic bath.	

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

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

No PC needed: "Suction" and "Pressure" measurements with just one instrument

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

Perfectly equipped for fully automatic viscosity measurements

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

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

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

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

Simple and updateable Modular Concept

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

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

Advantages AVS® 470

- Automatic and highly precize measurements – independent of a PC
- "Suction" and "pressure" measurements with the same system
- Simple data input and parameterization via included PS2-mini-keyboard
- GLP documentation compliant when connected to an optional printer

AVS® 470 – Precise and Reliable

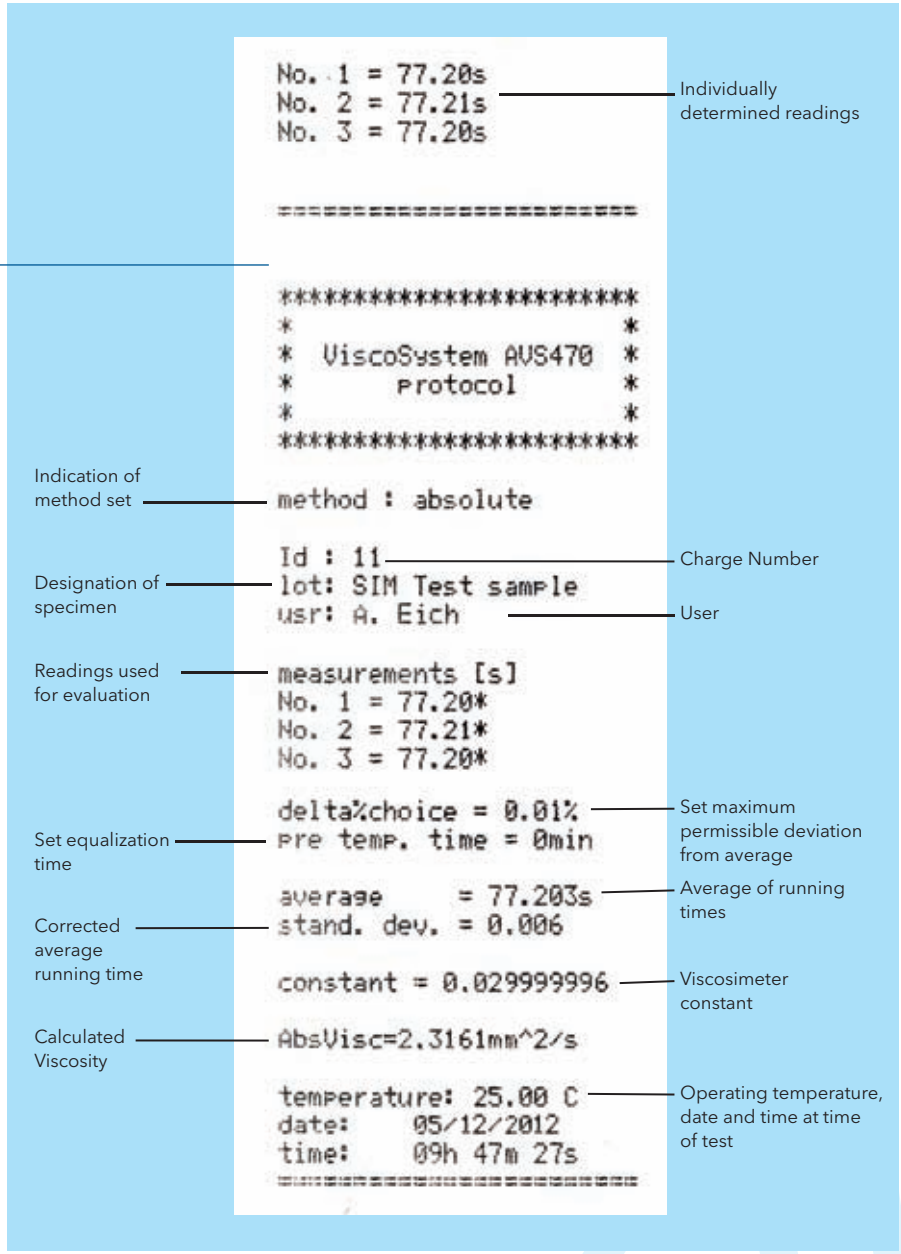
Working with the AVS® 470 is easy

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

If required, individual parameters may be input via an included PS 2 keyboard. A serial printer can be used to print measurement logs.

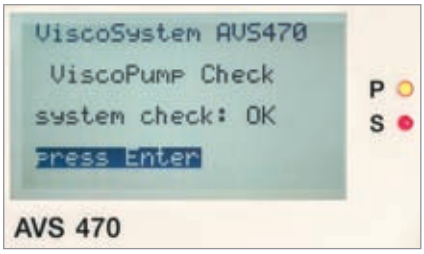
The connections are on the front panel of the device for easy control. Over-pumping and oversuction are prevented by the use of a an optional capacitive sensor.

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

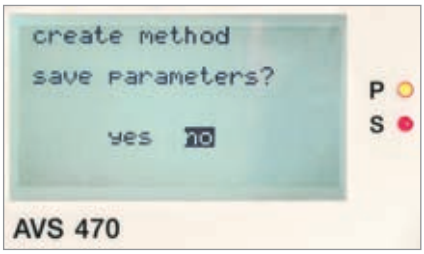


Technical data

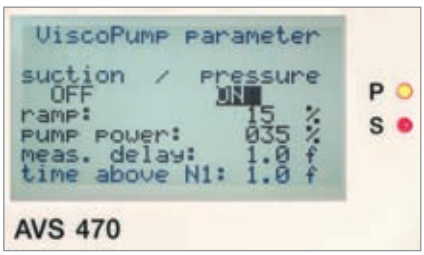
Clear user guidance, clear status – even without PC!



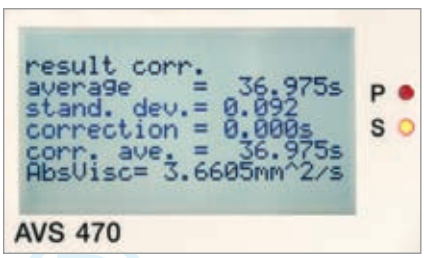
After switching on the AVS® 470 a self test is run and then an entry prompt appears.



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.

Measuring range (time)	up to 9,999.99 s; resolution 0.01 s	
Measuring range (viscosity)	pressure:	0.35 to 1,800 mm²/s (cSt)
	suction:	0.35 to ~5,000 mm²/s (cSt)
Measured parameter	flow-through time [s]	
Time measuring accuracy	± 0.01 %	
Measured value display	LC-Display	
Display accuracy	± 0.01 s, ± 1 Digit, but not exceeding 0.1%	
Pumping pressure	fully automatically controlled	
	suction up to ~-160 mbar, pressure up to ~+160 mbar	
Preselectable tempering period	0 to 20 min	
Preselectable no. of measurements	1 to 99 for each sample	
Connections	Pneumatic connections	threaded connections for viscometers
	Electrical connections	circular connector with bayonet lock for viscometer
		4-pin DIN socket for TC viscometer
		4-pin circular connector for capacitive sensor
		7-pin circular connector for AVS® 26, with bayonet lock
	RS232-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 to +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) ~255 x 205 x 320 mm
	Weight (incl. pump module)	~5.4 kg
Power supply	90 to 240 V ~, 50 to 60 Hz	
Equipment safety	EMC in acc. with Council Directive 89/336/EWG;	
	low-voltage directive	

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

We reserve the right to make technical changes.
AVS® is a registered trademark of SI Analytics and stands for: "Automatic Viscosity System".

AVS® 370 makes maximum precision ...

Well equipped for all viscosity determination

The AVS® 370 is a measuring device, which not only measures as precisely and consistently as you expect, but also offers maximum flexibility and future extensions. Furthermore, it saves laboratory space.

Now possible for the first time ever: "suction" and "pressure" measure-ment – with <u>one</u> device

The AVS® 370 is the first viscosity measuring device, which can be used for both "suction" and "pressure" measurement. This enables simple adjustment of the measurement method for sample. Significantly reducing investment costs for additional measuring stations at which pressure and suction methods are to be used. In most cases, using the AVS® 370 also saves set-up time.

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

Easy modular concept ideal for future expansion

The AVS® 370 has a modu-lar 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 installed in the compact 19" housing. The measuring station can be adapted to increasing requirements at any time.

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

The basic version of the AVS® 370 is able to measure high or low viscosity liquids. The TC version viscometers, for example, it is ideal for measuring opaque and black fluids. If necessary, each single measuring station can be expanded to a multiple measuring station with PC-controlled multitasking. The WinVisco 370 software included with the standard equipment enables parallel operation of two fully equipped AVS® 370, with a total of eight ViscoPump II modules. Each module can measure a different sample using its own method. All the results can be quickly and easily evaluated and documented independently. It could hardly be more flexible!

Compatible with existing accessories

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

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

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

Advantages AVS® 370

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

AVS® 370 – the right solution for all situations

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

How to automatically achieve the right results

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

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

New: Two working principles with the same device.

With the AVS® 370 you can use one device to work with either "pressure" or "suction" offering more flexibility with the liquids to be examined.

In the "pressure" method an overpressure is applied to the liquid in the capillary, this is particularly advantageous for fluids with a low boiling point. For the "suction" principle the sample is sucked up into the capillary by a vacuum. Greater reproducibility is achieved using the "suction" method for higher viscosity samples.

Technical data

Working with AVS® 370 is easy

The entire measurement procedure is place automatic, subjective measuring errors are reliably eliminated. The PC starts the measurement. After the set preconditioning period the selected number of measurements processed and the measured values saved.

The system protects 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 liquid or inside the device.

Unique flexibility

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

Measuring range (time)	up to 9,999.99 s; resolution 0.01 s	
Measuring range (viscosity)	pressure:	0.35 to 1,800 mm²/s (cSt)
	suction:	0.35 to ~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 (0.1 %)	
Pump pressure	automatically controlled	
Preselectable tempering period	0 to 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
	RS232-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 RS232-C	
Ambient conditions	Ambient temperature	+ 10 to + 40 °C
	Air humidity	max. 85 % rel.
Housing	Material	coated aluminum plate
	Dimensions (for 1 to 4 modules)	(W x H x D) ~255 x 205 x 320 mm
	Weight (incl. 1 module)	~5.4 kg
Power supply	90 to 240 V ~, 50 to 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 to 8 ViscoPump II modules, with WinVisco 370 software	

The following viscometers can be used with the AVS® 370:
Ubbelohde viscometer to DIN, Ubbelohde viscometer to ASTM, micro Ubbelohde viscometer to DIN, micro Ostwald viscometer, Cannon-Fenske routine viscometer, TC-Ubbelohde viscometer, TC-micro Ubbelohde viscometer.

We reserve the right to make technical changes.
AVS® is a registered trademark of SI Analytics and stands for: "Automatic Viscosity System".

Real multitasking for up to 8 measurements in parallel mode …

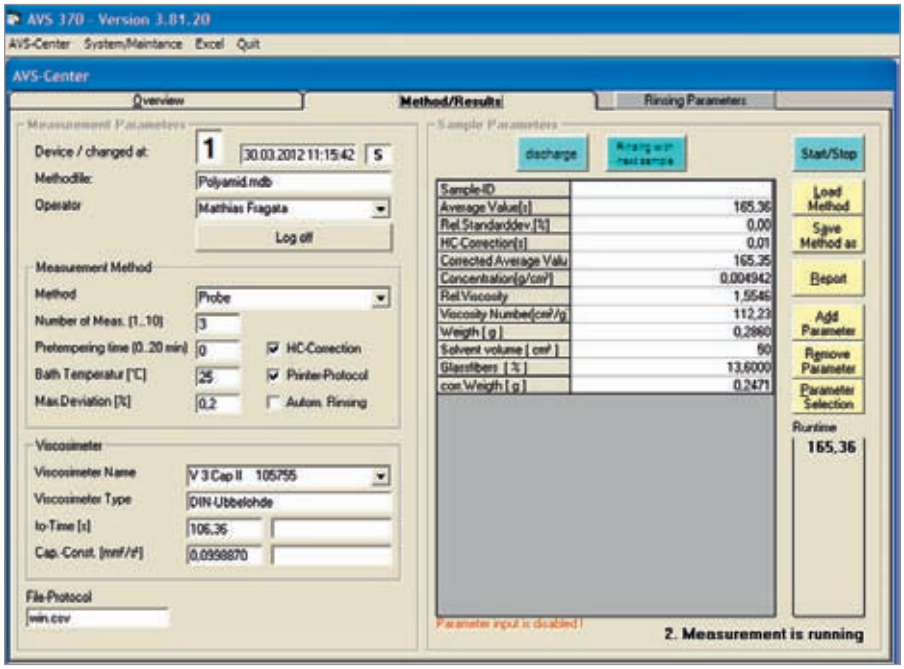
Easy to understand and proven: The WinVisco 370 software

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

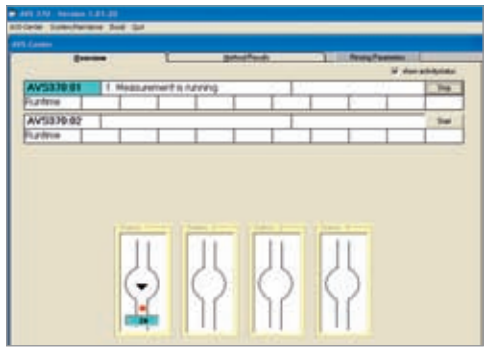
WinVisco 370 works in a real multitasking mode making it possible for each measurement to be processed independently from the others. It also means that time-consuming measurements can be carried out from the same PC, without hindering the course of other, faster measurements. During the measurements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

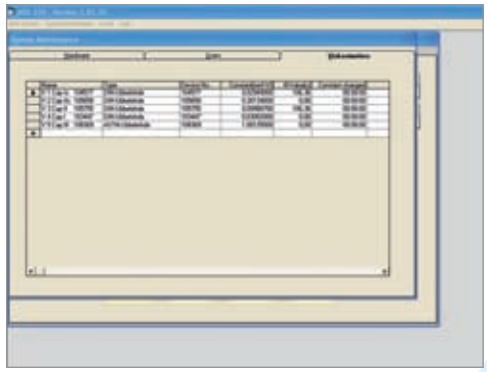
*) *The language (English or German) can be chosen after installation over the program menu.*



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.

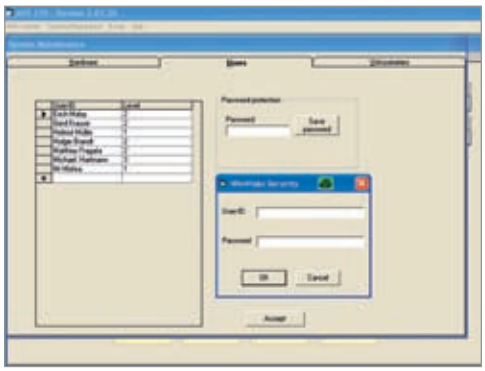


All the measurements currently running can be monitored in parallel in the overview.

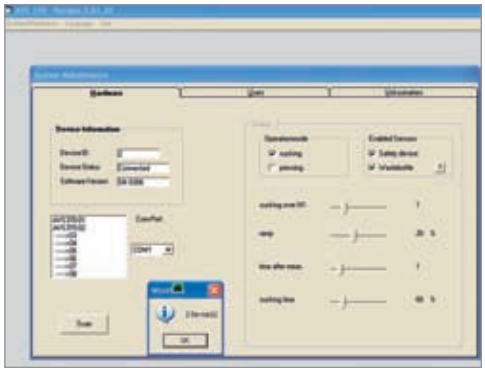


The viscometer data required for the evaluation can be stored in a table. This guarantees perfect allocation of e.g. the t_0 runtime, viscometer constants, the series number, etc. for each individual viscometer being used.

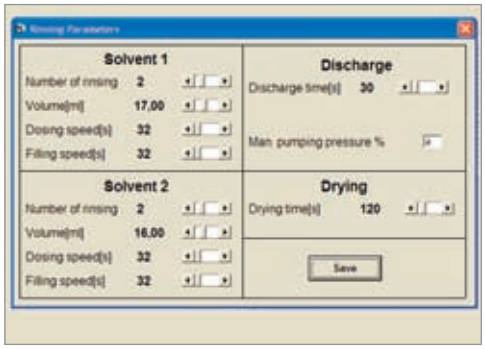
… with the proven WinVisco 370 software



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



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

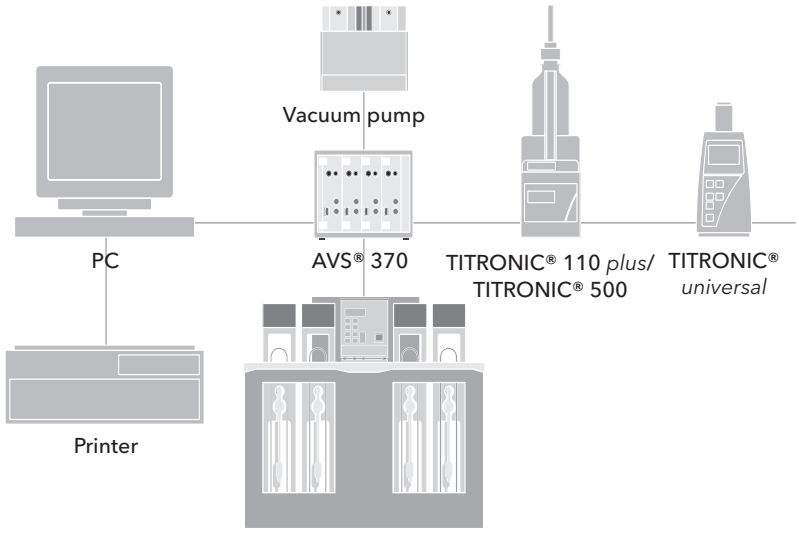


Each rinse/dry step can be individually preselected. Even the application dependent quantity of solvent and the drying time can be separately determined.

With AVS® 370 and WinVisco 370 the right connection for rinsing can be quickly determined

With the daisy chain link of the AVS® 370, additional devices can be integrated with 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,* TITRONIC® 110 *plus* burettes or the TITRONIC® 500. The TITRONIC® *universal* is preferable used for light solvents, the TITRONIC® 110 *plus* for solvents with a viscosity >3 mm²/s. For highly aggressive solvents special changeable modules are available (TA50V and WA50V).

A vacuum pump (accessory) integrated with the system can be used to conveniently remove samples and solvents.



Two basic concepts are available for the rinsing:

- An AVS® 370 with up to four ViscoPump II modules (max. four measurement positions) and up to eight burettes, which enables 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 AVS® 370 complete with up to four ViscoPump II modules each (max. eight measuring positions), which enables semi-automatic rinsing of the viscometer with the next sample or solvent.

Ordering information AVS® 470

Ordering information AVS® 370

The AVS® 470 viscosity test station is composed of individual components.
Please request a detailed quote.

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

The AVS® 370 viscosity test station is composed of individual components.
Please request a detailed quote.

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

Accessories AVS® 470 and AVS® 370

Type no.	Order no.	Description
CT 72/P, 230V	285418526	Immersion thermostat 230 V and thermostatic bath (acrylic glass container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/P, 115V	285418513	Immersion thermostat 115 V and thermostatic bath (acrylic glass container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/2, 230V	285418547	Immersion thermostat 230 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/2, 115V	285418532	Immersion thermostat 115 V and thermostatic bath (stainless steel container with one manual gauge slide), basic configuration for the attachment of one flow-through cooler.
CT 72/4, 230V	285418568	Immersion thermostat 230 V and thermostatic bath (stainless steel container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
CT 72/4, 115V	285418554	Immersion thermostat 115 V and thermostatic bath (stainless steel container with two manual gauge slides), basic configuration for the attachment of one flow-through cooler.
Z 900	285225620	RS232-C Data printer (230 V)
Measuring stand AVS®/S	285410502	Metal measuring stand AVS®/S, preferably for nonaqueous bath fluids
Measuring stand AVS®/SK	285410876	PVDF measuring stand AVS®/SK, corrosion-free, suitable for aqueous and nonaqueous bath fluids
Measuring stand AVS®/SK-CF	285410892	PVDF measuring stand AVS®/SK-CF, particularly for the use of Cannon-Fenske routine viscometers
Measuring stand AVS®/SK-V	285410905	PVDF measuring stand AVS®/SK-V, particularly for the use of dilution viscometers
CK 300, 115V	285414331	CFC-free flow-through cooler for enhancing the temperature constancy of the bath fluid (according to configuration and environmental conditions are ±0.02 K possible) or for measurement at room temperature or below (min. +5 °C).
CK 300, 230V	285414348	CFC-free flow-through cooler for enhancing the temperature constancy of the bath fluid (according to configuration and environmental conditions are ±0.02 K possible) or for measurement at room temperature or below (min. +5 °C).
05392	285405043	Fixing frame for Ubbelohde viscometers (not TC)

Automatic viscosity measurement has been improved ...

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

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

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

The AVS® Pro III automatic sampler works with the capillary method, which is the most precise method for determining the viscosity of Newtonian liquids in terms of physical chemistry. The great versatility offered by vis-cometers with optical and TC sensing systems opens up an extremely wide range of applications. This includes measurements of clear liquids as well as opaque petroleum products.

… with the AVS® Pro III Automatic Sampler:

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

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

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

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

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

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

Advantages AVS® Pro III

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

Working with the AVS® Pro III is ...

The AVS® Pro III is controlled by a PC, connected via RS232-C interface. The intuitive user interface guides the user clearly through the program. All data inputs are made using the computer keyboard and mouse.

A faulty operating status is indicated by acoustic or optical signals such as arrows, icons and other status messages or request messages. During the entire work sequence, the respective status of the AVS® Pro III is documented on the computer screen. Furthermore, status indicators can be selected for each individual measuring position, which provide additional information on operation.

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

The proved and tested AVS® Pro III software also makes it possible to prepare additional individually selected calculations, such as:

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

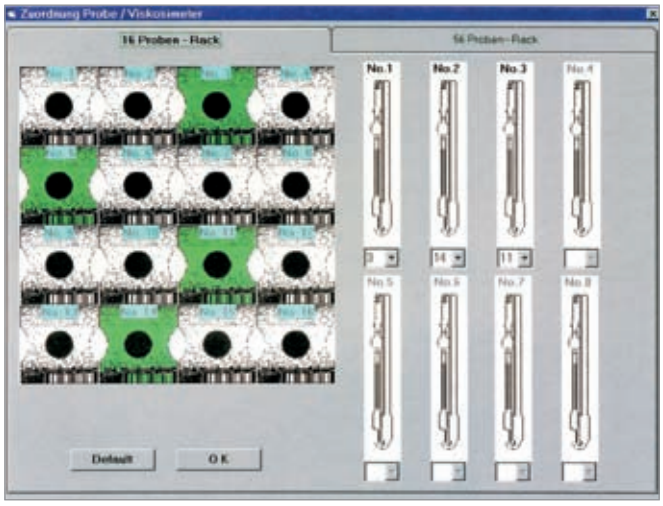
During the entire process, all of the parameters (depending on the menu level) and the respective status of the individual measuring positions, the temperature regulation system and the sample transfer system are either visible or can be selected.

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

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

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

If requested, the AVS® Pro III automatic sampler can be supplied with a manufacturer's inspection certificate based on direct comparison with normal viscometers of the first order in accordance with DIN 51 562 - 4: 1999-01.



›16 sample rack‹

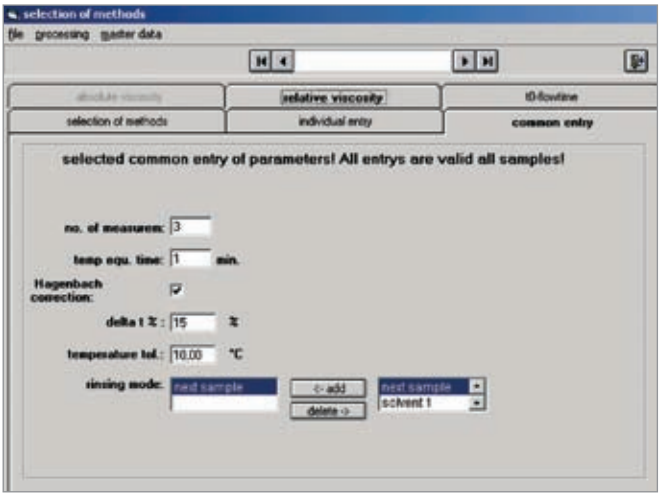
The AVS® Pro III allows individual allocation between the characteristics of the sample and the viscometers that are currently in operation.

… easy, reliable and safe

This means that it is not only possible to simultaneously test the characteristics of samples with greatly differing viscosities, but also to perform measurements in various capillary sizes and different types of viscometers. This even applies to a combination of optical and thermal scanning. Therefore, preliminary sorting of the samples with regard to viscosity and the size of capillary required for the testing process is not necessary.

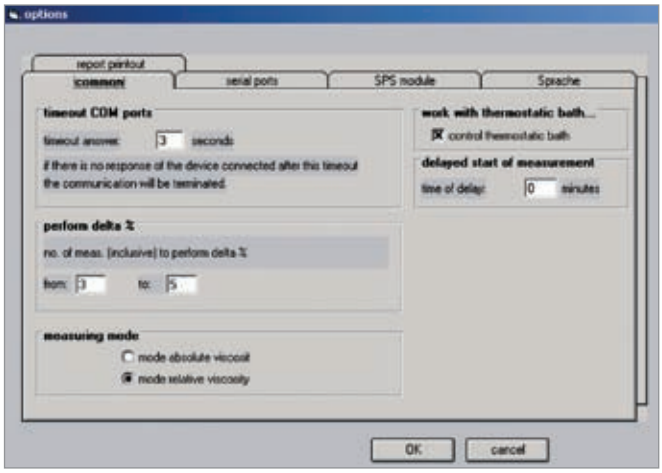
It is possible to "individually" allocate each sample to a capillary viscometer that is currently being used by means of the conventional MS-Windows® "drag and drop" method. This makes it possible to increase the sample throughput.

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



›selection of method‹

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



›options‹

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

›dosing parameters‹

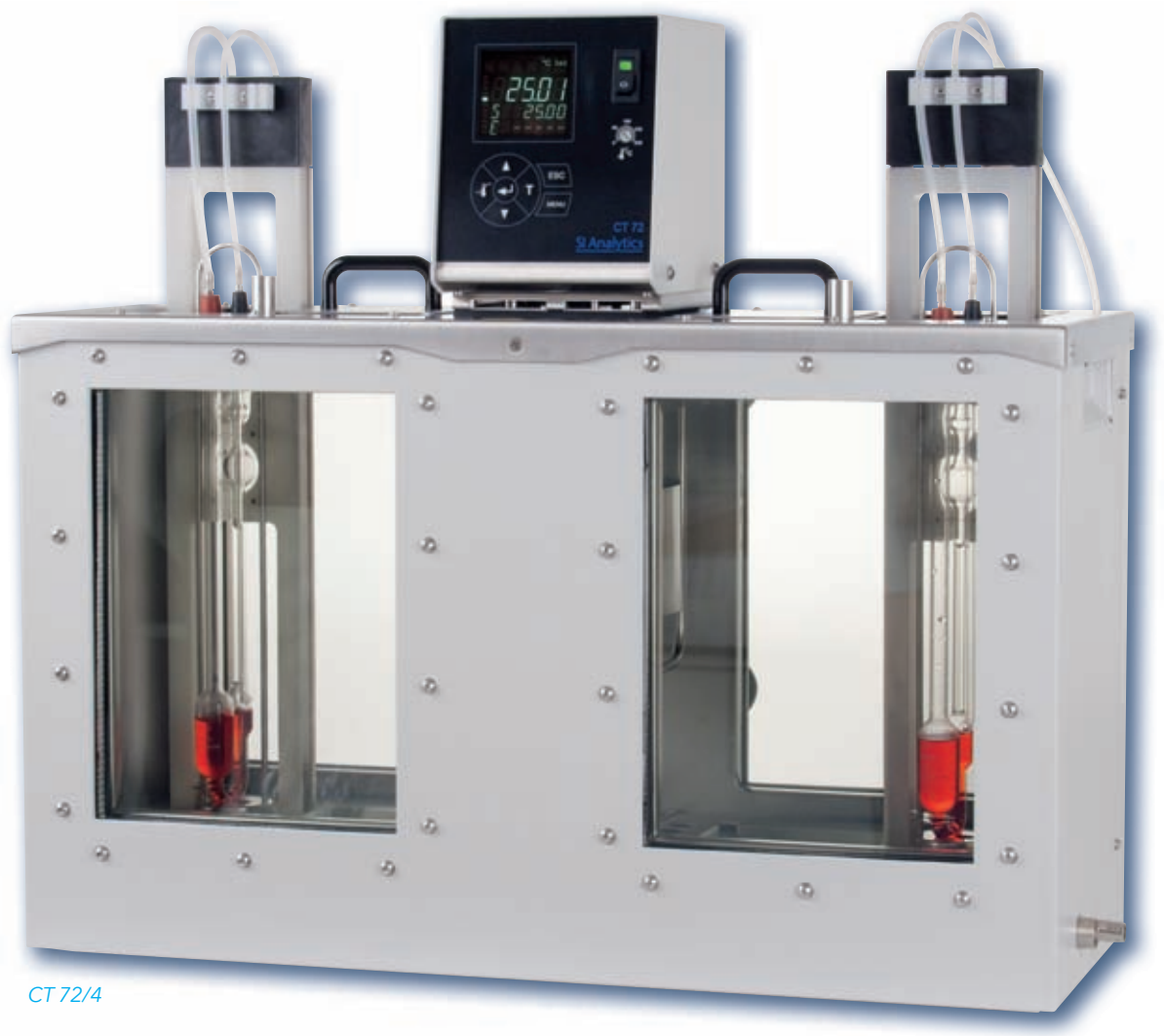
This mode is used to specify the filling quantity of the viscometer, the dosing speed depending on the viscosity and the type of rinsing.

Technical data AVS® Pro III

Sampling system	Sample bottles	100 ml screw-type and bottles with standard ground joint (16 pcs per rack)
		20 ml round bottom glass pieces (56 pcs. per rack)
	Sample rack	for 100 ml screw-type and bottles with standard ground joint
		for 100 ml screw-type and bottles with standard ground joint (temperature controlled up to 135°C)
		for 20 ml round bottom glass pieces
Measured value recording	Method	meniscus scanning by means of opto-electronic system or thermal conductivity (TC)
Measuring parameter	throughput time in seconds [s]	
	temperature in degrees Celsius [°C]	
Calculated parameters	mean value, standard deviation, outlier test (A %), Hagenbach correction, absolute viscosity, dynamic viscosity (knowledge of density required), viscosity index (measurement at two temperatures required) SUS and SFS, relative viscosity, specific viscosity, reduced viscosity (viscosity number), inherent viscosity, K-value	
Selection parameters	by means of PC keyboard, mean value, standard deviation, outlier test (A %), Hagenbach correction, absolute viscosity, dynamic viscosity (knowledge of density required), viscosity index (measurement at two temperatures required) SUS and SFS, relative viscosity, specific viscosity, reduced viscosity (viscosity number), inherent viscosity, K-value, rack position, date/time, temperature regulation period, number of measurements, number of rinsing operations, start, stop/reset	
	Number of measurements	1 to 99
	Temperature regulation period	0 to 99 min., selectable in increments of 1 min.
	Number of Viscometer tests	0 to 9 with next sample (observe sample quantity) or with preselected rack position
	Data memory	by means of PC
Viscosity measurement range	0.35 to 1,200 mm²/s (at room temperature of samples)	
	Time	up to 9999.99 s, resolution = 0.01 s
	Vacuum pressure	automatically controlled
	Viscometers available for use	Ubbelohde viscometer in accordance with DIN standards
		Ubbelohde viscometer in accordance with ASTM standards
		Micro-Ubbelohde viscometer in accordance with DIN standards
		Micro-Ostwald viscometerCannon-Fenske-Routine visco
		Cannon-Fenske-Routine viscometer
		TC Ubbelohde viscometer
		TC Micro-Ubbelohde viscometer

Measuring accuracy	± 0.01 s ± 1 digit, but not more precise than 0.01 %	
	The measuring uncertainty for measurements of absolute kinematic viscosity is also dependent on the uncertainty of the numeric value for the viscometer constant and on the measuring conditions, especially the measuring temperature.	
Evaluations / results	Correction	Hagenbach correction (HC) for Ubbelohde, Cannon-Fenske-Routine, Micro-Ubbelohde and Micro-Ostwald viscometers
	Statistical evaluation	standard deviation, outlier search
Ambient conditions	Ambient temperature	10 to + 40 °C
	Air humidity	max. 85 % relative humidity
Equipment safety	CE-symbol	in accordance with Guideline 89 / 336 / EEC of the Council (EMC compatibility)
		in accordance with Standard EN 50 081, Part 1;
		interference immunity in accordance with Standard EN 50 082, Part 2;
		in accordance with Guideline 73 / 23 / EEC of the Council (low-voltage guideline)
Housing	plastic/stainless steel / aluminium casing with chemically resistant two-component coating of the plastic pieces	
	Dimensions	w = 1,300 mm, h = 1,000 mm, d = 620 mm (~51" x 43" x 24")
	Weight	dependent on the number of measuring positions
		~70 kg
Connections	Pneumatic connections	screw-type connections for viscometer
	Electric connections	circular connectors with bayonet lock for measuring stand and TC viscometer
	Viscometers	up to 8 viscometers connected by individual control units
	Temperature	via serial interface RS232-C of suspended thermostat,
		type: 1 pc. CT 72/4 or up to 2 pcs. CT 72/2
	Interfaces	control system using PC with 2 x RS232-C interfaces
	Safety	overfilling safety device of waste bottle and suction hose
	Mains connection	European built-in plug DIN 49 457 6 with fuse
Data transmission	Interface internal	bidirectional serial interface in accordance with EIA RS232-C (daisy chain concept)
	Interface external	via PC, bidirectional serial interface in accordance with EIA RS232-C
Power supply	Mains voltage	230 V (AC) or 115 V (AC), 50 to 60 Hz (AC)

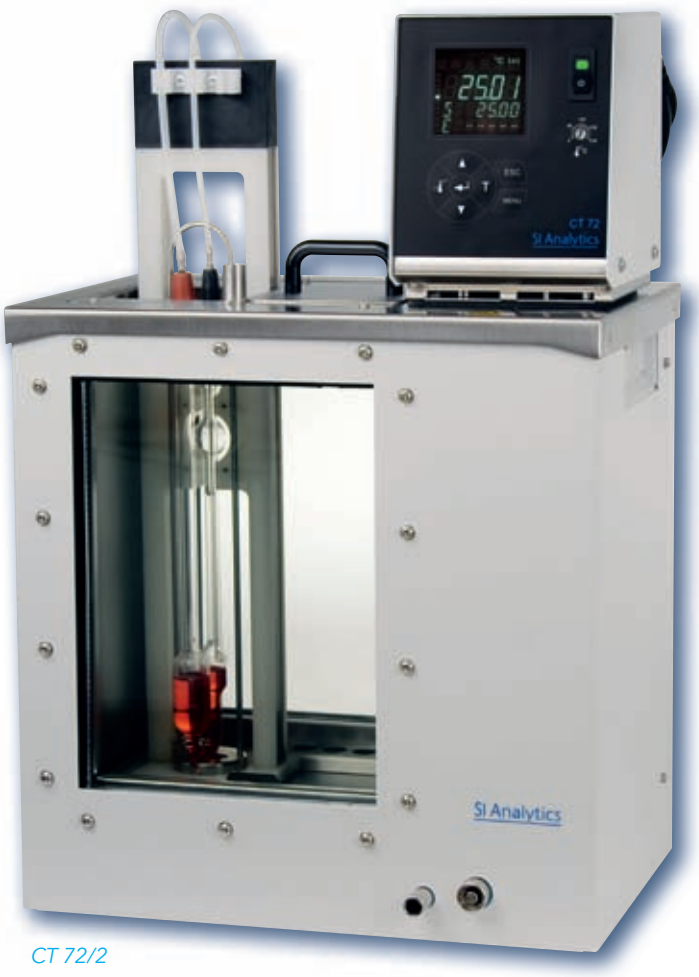
CT 72 Thermostat Series –
Transparent Thermostats conforming to Standards



CT 72/4

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

The SI Analytics transparent thermostats are particularly designed for the determination of the viscosity of newtonian liquids in glass capillary viscometers. They may be adapted for manual as well as for automatic measurements. The new models offer the core features of the CT 52 series incorporating the new improved immersion thermostats.



CT 72/2

Bright display shows ongoing process, at any time.

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

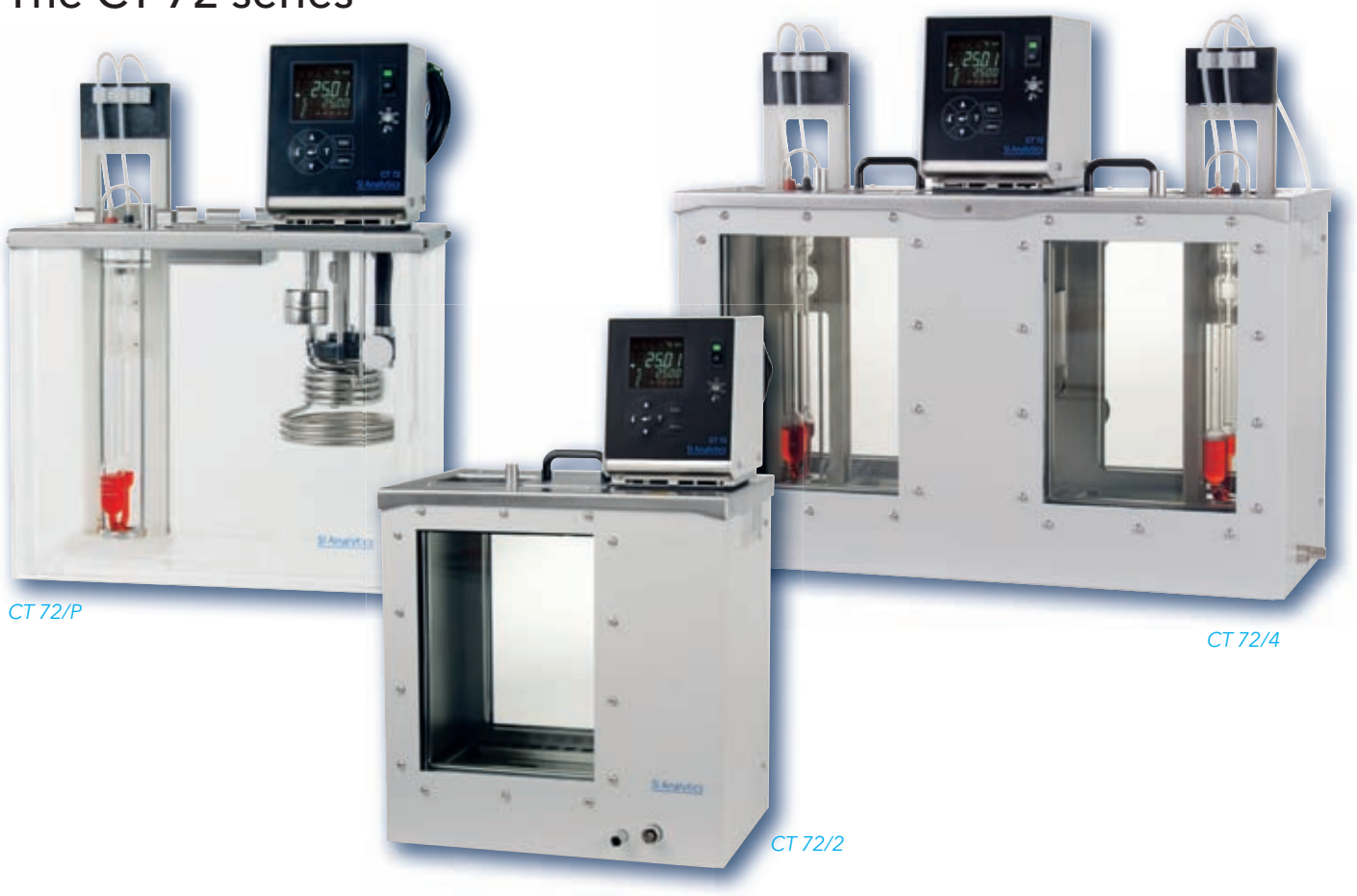
Advantages baths

- **Programmable set temperatures** through integrated clock with controller.
- Display of the momentary and the set temperature.
- Increased safety from separate operation and temperature safety sensors.
- Over-temperature safety system on front panel.
- Automatic fuses on the back panel.
- Output of data formats via RS232 connection.

New immersion thermostats

Transparent Thermostats conforming to Standards:

The CT 72 series



CT 72/P

CT 72/4

CT 72/2

Suitable temperature control liquids

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

Technical data

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

At applications within normal temperature range (+ 5 °C up to approx. + 40 °C) cooling will be necessary for maintaining temperature stability.

Ordering information

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

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

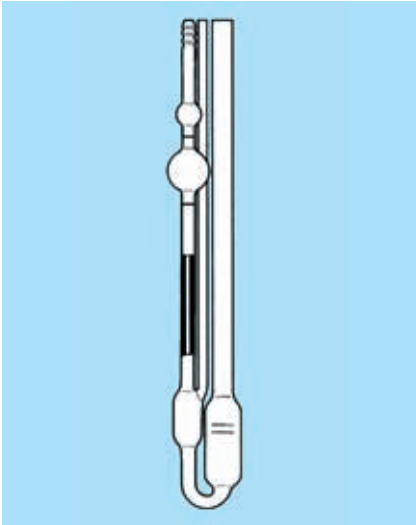
++ use preferably
+ highly suitable
o less suitable
- unsuitable

[1)] up to 30,000 mm²/s
[2)] above 30,000 mm²/s

Ubbelohde viscometers, normal form (DIN)

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-Viskosimeter (DIN)

- in accordance with DIN 51 562 Part 1, ISO/DIS 3105 (BS-IP-SL)
- filling quantity: 15 to 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.	Order No.	Type No.	Order No.	Capillary No. acc. DIN	acc ISO	Capillary Ø i ± 0,01 [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
501 00	285400004	–	–	0	-	0.36	0.001	0.3 to 1
501 03	285400012	–	–	0c	-	0.47	0.003	0.5 to 3
501 01	285400029	–	–	0a	-	0.53	0.005	0.8 to 5
501 10	285400037	–	–	I	I	0.63	0.01	1.2 to 10
501 13	285400045	–	–	Ic	Ia	0.84	0.03	3 to 30
501 11	285400053	–	–	Ia	-	0.95	0.05	5 to 50
501 20	285400061	–	–	II	II	1.13	0.1	10 to 100
501 23	285400078	–	–	IIc	IIa	1.50	0.3	30 to 300
501 21	285400086	–	–	IIa	-	1.69	0.5	50 to 500
501 30	285400094	–	–	III	III	2.01	1	100 to 1,000
501 33	285400107	–	–	IIIc	IIIa	2.65	3	300 to 3,000
501 31	285400115	–	–	IIIa	-	3.00	5	500 to 5,000
501 40	285400123	–	–	IV	IV	3.60	10	1,000 to 10,000
–	–	502 43	285400131	IVc	IVa	4.70	30	3,000 to 30,000
–	–	502 41	285400148	IVa	-	5.34	50	6,000 to 30,000
–	–	502 50	285400156	-	V	6.30	100	> 10,000

not calibrated,
without constant;
for determination of
relative viscosity

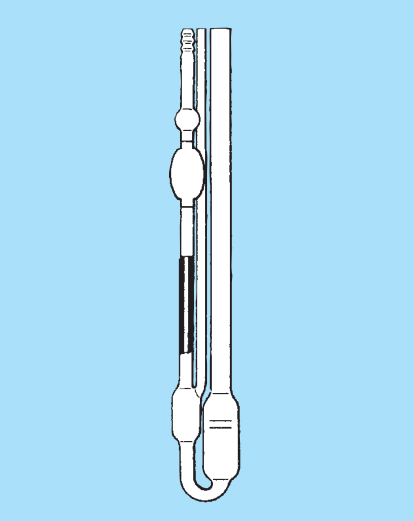
calibrated,
with constant for
automatic measurements

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

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

Type No.	Order No.	Type No.	Order No.	Capillary No. acc. DIN	acc ISO	Capillary Ø i ± 0,01 [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
–	–	532 00	285400164	0	-	0.36	0.001	0.3 to 1
530 03	285400304	532 03	285400201	0c	-	0.47	0.003	0.5 to 3
530 01	285400312	532 01	285400218	0a	-	0.53	0.005	0.8 to 5
530 10	285400329	532 10	285400226	I	I	0.63	0.01	1.2 to 10
530 13	285400337	532 13	285400234	Ic	Ia	0.84	0.03	3 to 30
–	–	532 11	285400172	Ia	-	0.95	0.05	5 to 50
530 20	285400345	532 20	285400242	II	II	1.13	0.1	10 to 100
530 23	285400353	532 23	285400259	IIc	IIa	1.50	0.3	30 to 300
–	–	532 21	285400189	IIa	-	1.69	0.5	50 to 500
530 30	285400361	532 30	285400267	III	III	2.01	1	100 to 1,000
530 33	285400378	532 33	285400275	IIIc	IIIa	2.65	3	300 to 3,000
–	–	532 31	285400197	IIIa	-	3.00	5	500 to 5,000
530 40	285400386	532 40	285400283	IV	IV	3.60	10	1,000 to 10,000

Ubbelohde viscometers, normal form (ASTM)



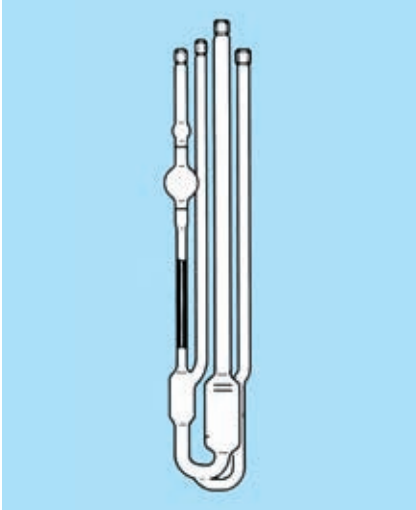
Ubbelohde Viscometer (ASTM)

- in accordance with ISO 3105, ASTM D 2515, ASTM D 446
- filling quantity: 15 to 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.	Order No.	Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i ± 0,01 [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
525 00	285400501	526 00	285400707	527 00	285401255	0	0.24	0.001	0.35 to 1
525 03	285400518	526 03	285400715	527 03	285401271	0c	0.36	0.003	0.6 to 3
525 01	285400526	526 01	285400723	527 01	285401263	0b	0.46	0.005	1 to 5
525 10	285400534	526 10	285400731	527 10	285401152	I	0.58	0.01	2 to 10
525 13	285400542	526 13	285400748	527 13	285401169	Ic	0.78	0.03	6 to 30
525 20	285400559	526 20	285400756	527 20	285401177	II	1.03	0.1	20 to 100
525 23	285400567	526 23	285400764	527 23	285401185	IIc	1.36	0.3	60 to 300
525 30	285400575	526 30	285400772	527 30	285401193	III	1.83	1	200 to 1,000
525 33	285400583	526 33	285400789	527 33	285401288	IIIc	2.43	3	600 to 3,000
525 40	285400591	526 40	285400797	527 40	285401296	IV	3.27	10	2,000 to 10,000
525 43	285400604	526 43	285400801	527 43	285401309	IVc	4.32	30	6,000 to 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 present serve as auxiliary marks in case the viscometers must be checked by manual measurements.

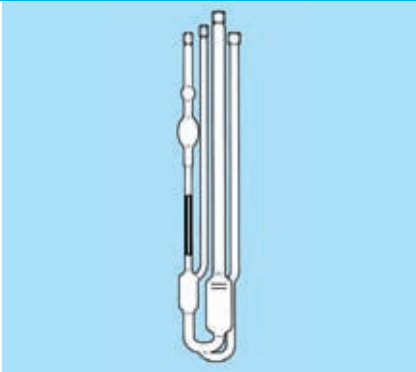


Ubbelohde viscometer (DIN)

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

calibrated,
with constant for automatic measurements

Type No.	Order No.	Capillary No. acc. DIN	acc. ISO	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
541 03	285401925	0c	-	0.47	0.003	0.5 to 3
541 01	285401917	0a	-	0.53	0.005	0.8 to 5
541 10	285401933	I	I	0.63	0.01	1.2 to 10
541 13	285401941	Ic	Ia	0.84	0.03	3 to 30
541 20	285401958	II	II	1.13	0.1	10 to 100
541 23	285401966	IIc	IIa	1.50	0.3	30 to 300
541 30	285401974	III	III	2.01	1	100 to 1,000
541 33	285401982	IIIc	IIIa	2.65	3	300 to 3,000
541 40	285401999	IV	IV	3.60	10	1,000 to 6,000



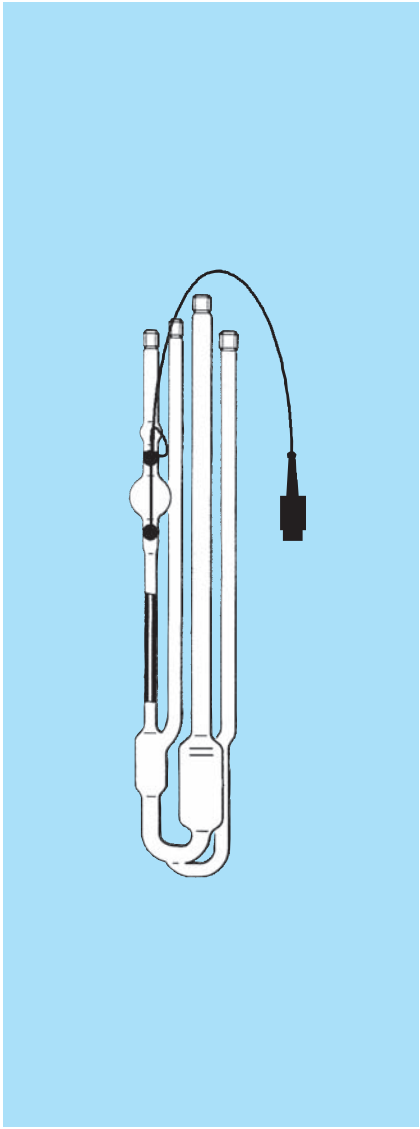
Ubbelohde viscometer (ASTM)

- the technical measurement characteristics are in accordance with ISO 3105, ASTM D 2515, ASTM D 446
- filling quantity: 15 to 22 ml
- overall length: approx. 290 mm

calibrated,
with constant for automatic measurements

Type No.	Order No.	Capillary No. acc. DIN	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
545 00	285402005	0	0.24	0.001	0.35 to 1
545 03	285402021	0c	0.36	0.003	0.6 to 3
545 01	285402013	0b	0.46	0.005	1 to 5
545 10	285402038	I	0.58	0.01	2 to 10
545 13	285402046	Ic	0.78	0.03	6 to 30
545 20	285402054	II	1.03	0.1	20 to 100
545 23	285402062	IIc	1.36	0.3	60 to 300
545 30	285402079	III	1.83	1	200 to 1,000
545 33	285402087	IIIc	2.43	3	600 to 3,000
545 40	285402095	IV	3.27	10	2,000 to 10,000
545 43	285402108	IVc	4.32	30	6,000 to 30,000

Ubbelohde viscometers with TC sensors



Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. 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 behavior.

They are especially suitable for liquids that cannot be detected with other systems: opaque and/or black and/or electrically conductive samples.

Due to the electrical properties of TC sensors, it is important to ensure that a suitable type is selected 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 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 to 22 ml
- overall length: approx. 355 mm
- suitable bracket Type No. 05393, Order No. 285405035

calibrated,
with constant for automatic measurements

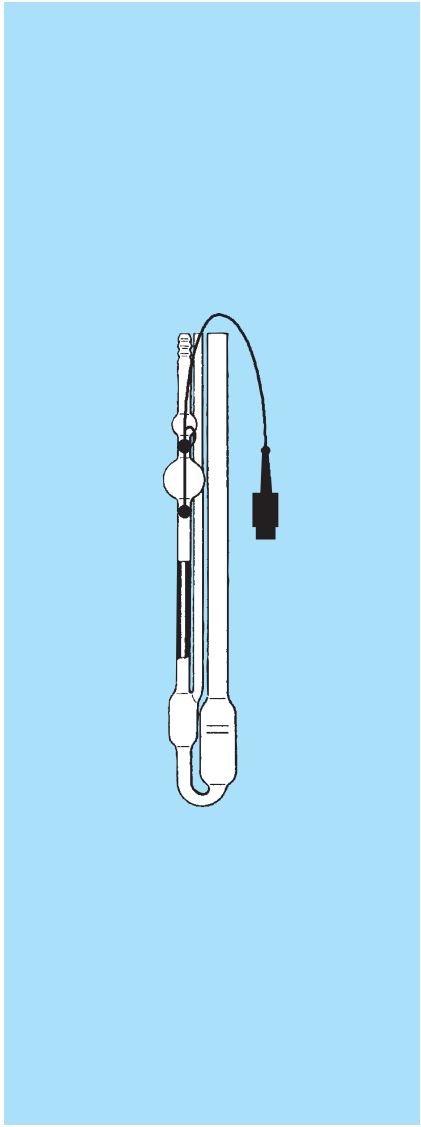
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
+10 to +80 °C		–40 to +30 °C		+70 to +150 °C					
562 03	285423120	–	–	–	–	0c	0.47	0.003	0.5 to 3
562 10	285423130	563 10	285423240	564 10	285423330	I	0.54	0.01	1,2 to 10
562 13	285423140	563 13	285423250	564 13	285423340	Ic	0.84	0.03	3 to 30
562 20	285423150	563 20	285423260	564 20	285423350	II	1.15	0.1	10 to 100
562 23	285423170	563 23	285423270	564 23	285423360	IIc	1.51	0.3	30 to 300
562 21	285423160	–	–	–	–	IIa	1.69	0.5	50 to 500
562 30	285423180	563 30	285423280	564 30	285423370	III	2.05	1	100 to 1,000
562 33	285423200	563 33	285423290	564 33	285423380	IIIc	2.7	3	300 to 3,000
562 31	285423190	–	–	–	–	IIIa	3.0	5	500 to 5,000
562 40	285423210	563 40	285423300	564 40	285423390	IV	3.7	10	1,000 to 10,000
562 43	285423230	563 43	285423320	564 43	285423400	IVc	4.9	30	3,000 to 20,000
562 41	285423220	563 41	285423310	–	–	IVa	5.3	50	5,000 to 30,000

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 mea-surement 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: opaque and/or black and/or electrically conductive measuring samples.

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



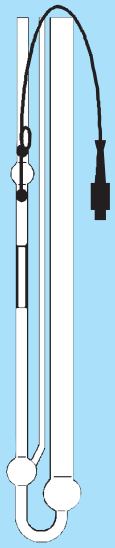
TC viscometers

- the technical measurement characteristics are in accordance with DIN 51 562, part 1, ISO 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 to 22 ml
- overall length: ca. 355 mm
- suitable bracket Type No. 05393, Order No. 285405035

calibrated,
with constant for automatic measurements

Type No.	Order No.	Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
+10 to +80 °C		–40 to +30 °C		+70 to +150 °C					
567 03	285423420	–	–	–	–	0c	0.47	0.003	0.5 to 3
567 10	285423430	568 10	285423540	569 10	285423630	I	0.64	0.01	1.2 to 10
567 13	285423440	568 13	285423550	569 13	285423640	Ic	0.84	0.03	3 to 30
567 20	285423450	568 20	285423560	569 20	285423650	II	1.15	0.1	10 to 100
567 23	285423470	568 23	285423570	569 23	285423660	IIc	1.51	0.3	30 to 300
567 21	285423460	–	–	–	–	IIa	1.69	0.5	50 to 500
567 30	285423480	568 30	285423580	569 30	285423670	III	2.05	1	100 to 1,000
567 33	285423500	568 33	285423590	569 33	285423680	IIIc	2.7	3	300 to 3,000
567 31	285423490	–	–	–	–	IIIa	3.0	5	500 to 5,000
567 40	285423510	568 40	285423600	569 40	285423690	IV	3.7	10	1,000 to 10,000
567 43	285423530	568 43	285423620	569 43	285423700	IVc	4.9	30	3,000 to 20,000
567 41	285423520	568 41	285423610	–	–	IVa	5.3	50	5,000 to 30,000

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 mea-surement 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.

IThey are especially suitable for liquids that cannot be detected with other systems: opaque and/or black and/or electrically conductive measuring samples.

Due to the electrical properties of TC sensors, it is important to ensure that a suitable type is selected 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 to 4 ml
- overall length: approx. 350 mm
- suitable bracket Type No. 05393, Order No. 285405035

not calibrated,
with constant for automatic measurements

Type No.	Order No.	Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)		
+10 to +80 °C		–40 to +30 °C		+70 to +150 °C							
572 10	285423710	573 10	285423780	574 10	285423850	M I	0.40	0.01	0.4	to	6
572 13	285423720	573 13	285423790	574 13	285423860	M Ic	0.53	0.03	1.2	to	18
572 20	285423730	573 20	285423800	574 20	285423870	M II	0.70	0.1	4	to	60
572 23	285423740	573 23	285423810	574 23	285423880	M IIc	0.95	0.3	12	to	180
572 30	285423750	573 30	285423820	574 30	285423890	M III	1.26	1	40	to	800

Micro-Ubbelohde viscometers

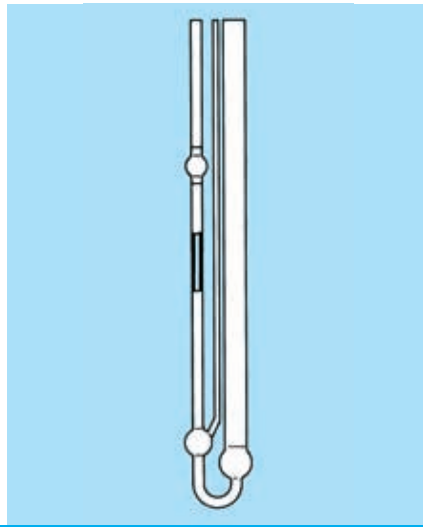
Viscometers for dilution viscometry

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 51562, Part 2
- filling quantity: 3 to 4 ml
- overall length: approx. 290 mm

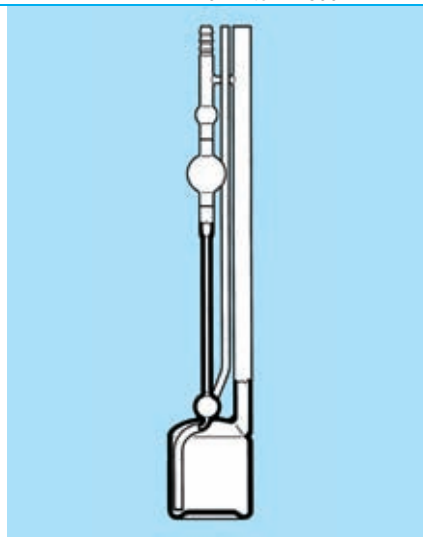


calibrated, with constant for manual measurement		calibrated, with constant for automatic measurement		not calibrated, without constant; for determination of relative viscosity					
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
536 10	285401009	537 10	285401103	538 10	285401206	M I	0.40	0.01	0.4 to 6
536 13	285401017	537 13	285401111	538 13	285401214	M Ic	0.53	0.03	1.2 to 18
536 20	285401025	537 20	285401128	538 20	285401222	M II	0.70	0.1	4 to 60
536 23	285401033	537 23	285401136	538 23	285401239	M IIc	0.95	0.3	12 to 180
536 30	285401041	537 30	285401144	538 30	285401247	M III	1.26	1	40 to 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 one of our piston burettes TITRONIC® *universal*, TITRONIC® 110 *plus* or TITRONIC® 500.

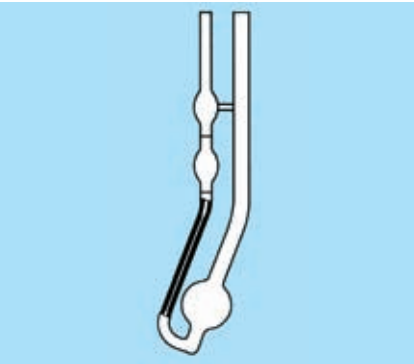
- filling quantity: 15 to 75 ml
- overall length: approx. 290 mm



calibrated, for automatic measurements,
Model with glass filter on request

Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
531 00	285401403	0	0.36	0.001	0.35 to 0.6
531 03	285401428	0c	0.47	0.003	0.5 to 2
531 01	285401411	0a	0.53	0.005	0.8 to 3
531 10	285401436	I	0.64	0.01	1.2 to 6
531 13	285401444	Ic	0.84	0.03	3 to 20
531 20	285401452	II	1.15	0.1	10 to 60

Cannon-Fenske viscometers



Cannon-Fenske routine viscometers

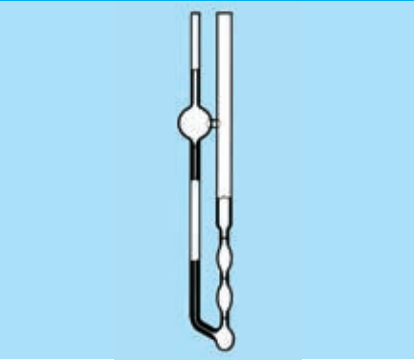
comply with standards ISO 3105, ASTM D 2515, BS 188 with respect to technical measuring specifications.

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

calibrated,
with ring mark,
for manual measurements

with constant
for automatic measurements

Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
513 00	285403507	520 00	285403704	25	0.30	0.002	0.4 to 1.6
513 03	285403515	520 03	285403712	50	0.44	0.004	0.8 to 3.2
513 01	285403523	520 01	285403729	75	0.54	0.008	1.6 to 6.4
513 10	285403531	520 10	285403737	100	0.63	0.015	3 to 15
513 13	285403548	520 13	285403745	150	0.78	0.035	7 to 35
513 20	285403556	520 20	285403753	200	1.01	0.1	20 to 100
513 23	285403564	520 23	285403761	300	1.27	0.25	50 to 200
513 21	285403572	520 21	285403778	350	1.52	0.5	100 to 500
513 30	285403589	520 30	285403786	400	1.92	1.2	240 to 1,200
513 33	285403597	520 33	285403794	450	2.35	2.5	500 to 2,500
513 40	285403601	520 40	285403807	500	3.20	8	1,600 to 8,000
513 43	285403618	520 43	285403815	600	4.20	20	4,000 to 20,000



Cannon-Fenske reverse flow viscometers

- Comply with standards ISO 3105, ASTMD 2515, ASTM D 446, NF T 60 - 100 with respect to technical measuring specifications.
- filling quantity: approx. 12 ml
- overall length: approx. 295 mm

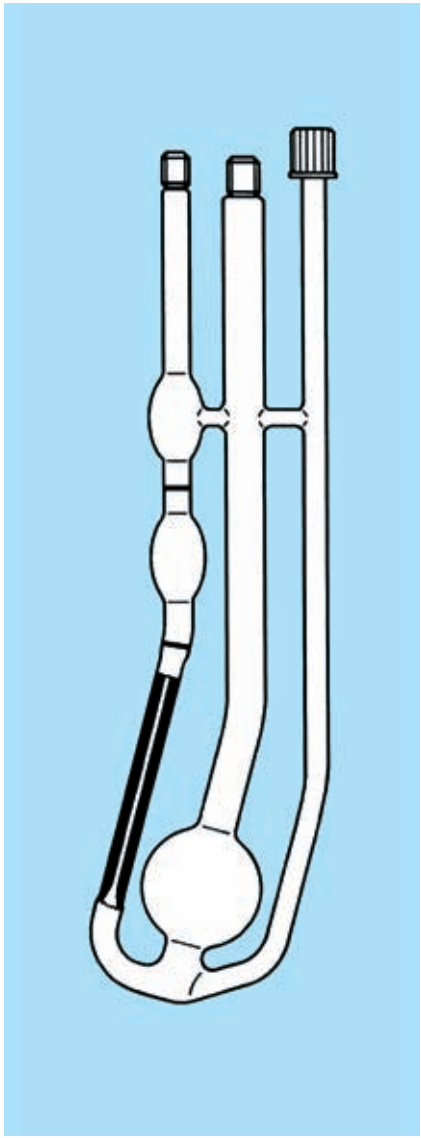
calibrated,
with 3 ring marks,
with 2 constants,
only for manual measurement

Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
511 00	285403001	25	0,31	0.002	0.4 to 1.6
511 03	285403018	50	0,42	0.004	0.8 to 3.2
511 01	285403026	75	0,54	0.008	1.6 to 6.4
511 10	285403034	100	0,63	0.015	3 to 15
511 13	285403042	150	0,78	0.035	7 to 35
511 20	285403059	200	1,02	0.1	20 to 100
511 23	285403067	300	1,26	0.25	50 to 200
511 21	285403075	350	1,48	0.5	100 to 500
511 30	285403083	400	1,88	1.2	240 to 1,200
511 33	285403091	450	2,20	2.5	500 to 2,500
511 40	285403104	500	3,10	8	1,600 to 8,000
511 43	285403112	600	4,00	20	4,000 to 20,000

Cannon-Fenske routine viscometers

comply with standards ISO 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.

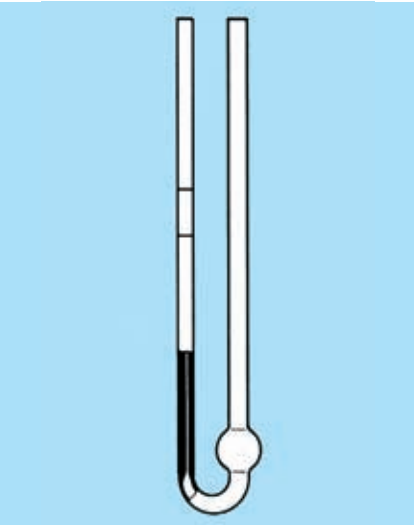
- are suitable for all Newtonian liquids with a viscosity of 0.35 to 20,000 mm²/s.
- filling quantity: approx. 7 to 12 ml
- overall length: approx. 245 mm



calibrated,
with ring marks,
with constant for automatic measurements

Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
546 00	285402116	25	0.30	0.002	0.4 to 1.6
546 03	285402132	50	0.44	0.004	0.8 to 3.2
546 01	285402124	75	0.54	0.008	1.6 to 6.4
546 10	285402149	100	0.63	0.015	3 to 15
546 13	285402157	150	0.78	0.035	7 to 35
546 20	285402165	200	1.01	0.1	20 to 100
546 23	285402181	300	1.27	0.25	50 to 200
546 21	285402173	350	1.52	0.5	100 to 500
546 30	285402198	400	1.92	1.2	240 to 1,200
546 33	285402202	450	2.35	2.5	500 to 2,500
546 40	285402219	500	3.20	8	1,600 to 8,000
546 43	285402227	600	4.20	20	4,000 to 20,000

Ostwald viscometers

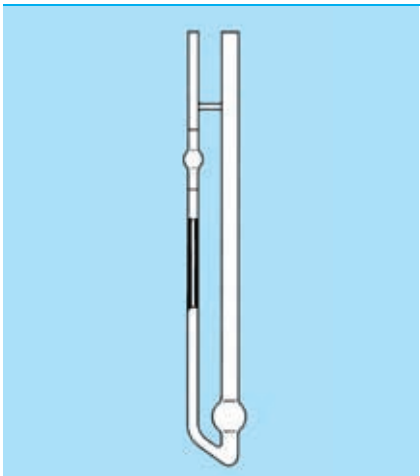


Ostwald viscometers

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

with ring marks,
without constant,
for manual measurements

Type No.	Order No.	Capillary Ø i [mm]	Transit time for water ~ [s]	Constant K (approx.)	for use from [mm²/s] (approx.)
509 03	285404006	0.3	250	0.004	0.3
509 04	285404014	0.4	75	0.01	1
509 05	285404022	0.5	30	0.03	2.5
509 06	285404039	0.6	15	0.07	5.5
509 07	285404047	0.7	10	0.1	10



Micro-Ostwald viscometers

- are suitable for measurements of small liquid quantities even with excessive foam formation.
- filling quantity: 2 ml
- overall length: approx. 290 mm

calibrated,
with ring marks,
with constant,
for manual measurements

calibrated,
with ring marks,
with constant,
for automatic measurements

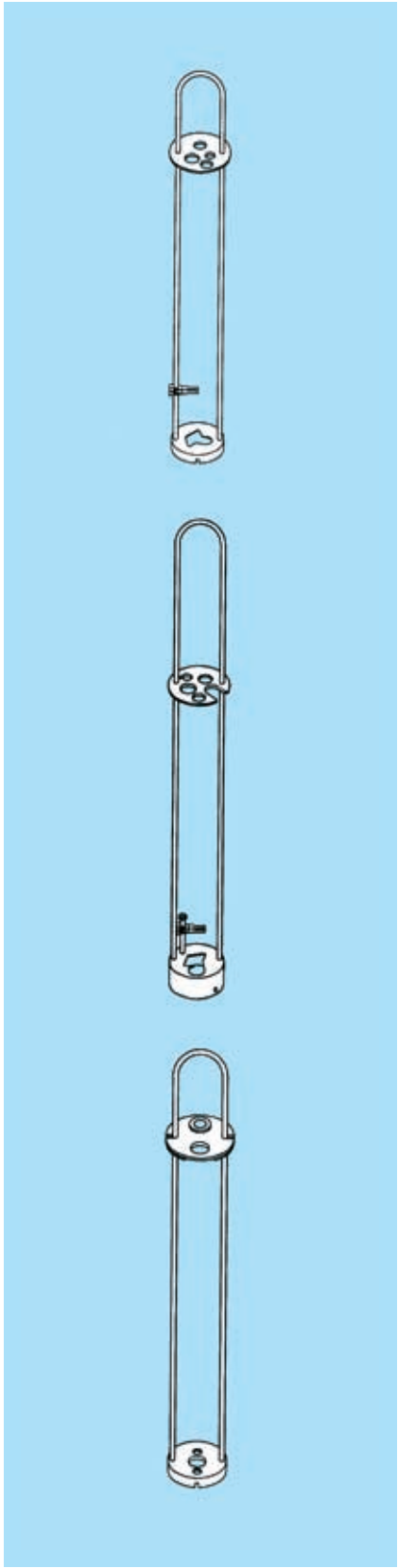
Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
516 10	285404203	517 10	285404306	I	0.43	0.01	0.4 to 6
516 13	285404211	517 13	285404314	Ic	0.60	0.03	1.2 to 18
516 20	285404228	517 20	285404322	II	0.77	0.1	4 to 60
516 23	285404236	517 23	285404339	IIc	1.00	0.3	12 to 180
516 30	285404244	517 30	285404347	III	1.36	1	40 to 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 conjunction with SI Analytics and other commercially available seethrough 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.	Order No.
053 92	285405043
VZ 5840 (accessory for reference measuring standard)	285417201

suitable for use with Ubbelohde viscometers with TC sensors

Type No.	Order No.
053 93	285405035

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.	Order No.
053 96	285405019

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

Type No.	Order No.
053 97	285405027

Accessories

Brackets for reference measuring standard

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

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

Type No.	Order No.
VZ 5840	285417201

Control thermometers

Type No.	Order No.	Measuring range °C	Graduation °C
VZ 2801	285415763	−5 to +38	1/10
VZ 2802	285415771	+33 to +67	1/10
VZ 2803	285415788	+66 to +102	1/10
VZ 2804	285415796	+95 to +152	1/10
VZ 2901	285415809	+20 to +25	1/100
VZ 2907	285417078	+22 to +27	1/100
VZ 2908	285415825	+37 to +42	1/100
VZ 2905	285415841	+45 to +50	1/100
VZ 2906	285415858	+97 to +101	1/100
VZ 2909	285417094	+132 to +137	1/100

Control thermometers for CT 72 thermostat series

Type No.	Order No.	Measuring range °C	Graduation °C
VZ 7100	285421051	+19 to +21	1/100
VZ 7101	285421068	+24 to +26	1/100
VZ 7102	285421076	+29 to +31	1/100
VZ 7103	285421084	+39 to +41	1/100
VZ 7104	285421092	+99 to +101	1/100
VZ 7105	285421105	+134 to +136	1/100

Accessories

LabPump

The LabPump VZ 5655 (not illustrated) used with manual and semi-automatic measurements to extract and pump solutions:

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

Since the LabPump VZ 5655 and the connections 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 mm²/s. For semi-automatic processing work, the PTFE tube combination with stand (see illus-tration) and the waste bottle, type no. VZ 5624, are used.

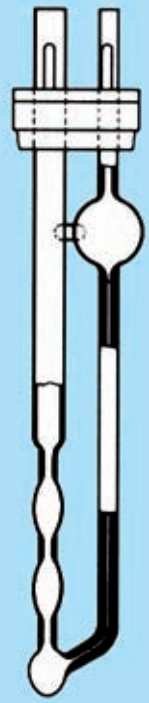
Type No.	Order No.
VZ 5655	1040755

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

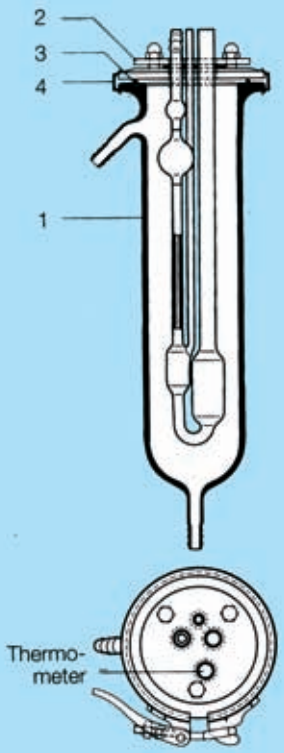
Type No.	Order No.
064 99	285405105

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

Type No.	Order No.
065 99	285405113



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.	Order No.	Item No.	Comment
577 00	285405508		complete, without viscometer
Component parts			
577 01	285405516	1	temperature stabilization jacket, straight
238 00	285405524	2	support plate with 4 silicone rings (d = 4, 6, 8 and 10 mm)
225 34	285405532	3	silicone O-ring, ND 60
072 34	285405549	4	quick-action seal, NW 60

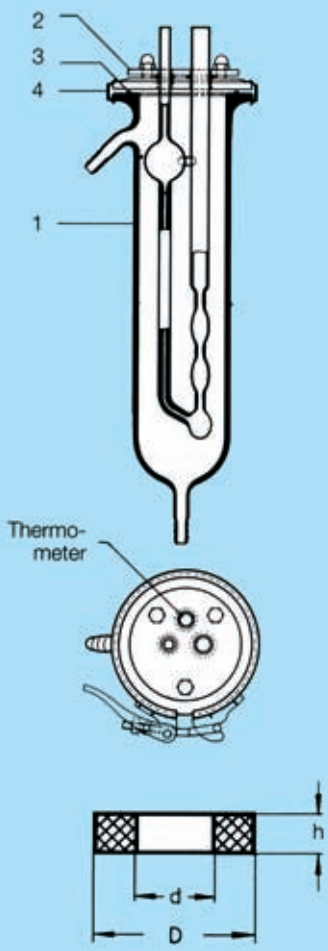
Accessories

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

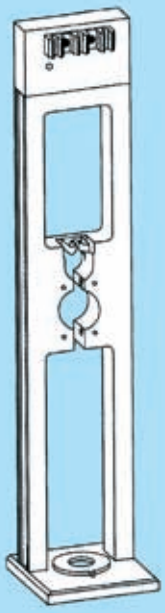
Type No.	Order No.	Item No.	Comment
Component parts			
577 01	285405516	1	temperature stabilization jacket, straight
225 34	285405532	3	silicone O-ring, ND 60
072 34	285405549	4	quick-action seal, NW 60

Silicone rings

Type No.	Order No.	d mm	D mm	h mm
228 11	285405808	4	10	5
228 14	285405816	6	16	5
228 16	285405824	8	16	5
228 17	285405832	10	16	5



AVS® measuring stands and tube sets



AVS® measuring stands

Measuring stands of the 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 SI Analytics 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 subjec-tive factors of influence
- the results can be printed and/or be automatically documented with a data memory system
- automatic processing of sample series is available.

The use of different materials ensures adaptation to existing measurement temperatures and applications.

The measuring stands or brackets can be exchanged.

The distance between the levels of the automatic optoelectronic unloading system is 40.00 mm ± 0.03 mm. This results in a standard deviation of VK = 0.05 % for Ubbelohde viscometers if the measuring stand is replaced or changed within the process.

For repetitive measurements with viscosity measuring instruments and Ubbelohde viscometers with measuring stands, the standard deviation VK = 0.03 %.

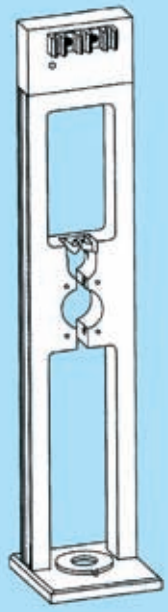
Manually calibrated Ubbelohde viscometers can also be used in AVS® measuring stands. If the automatic sensing levels do not correspond to the ring marks, the superimposed meniscus detection system will provide a higher constant. The difference amounts to 0.1 % per millimeter of height offset.

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 to +100 °C	–80 to +200 °C	0 to +60 °C	–80 to +100 °C	0 to +60 °C other temperature ranges available on request
Suitable brackets (type no.)	05392 05397			no bracket required	
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.



Suitable for use with the measuring units: AVS® 350, AVS® 360, AVS® 370, AVS® 450, AVS® 470, AVS®Pro

Suitable for use with the thermostatic baths: CT 72/P, CT 72/2-TT, CT 72/2, CT 72/4

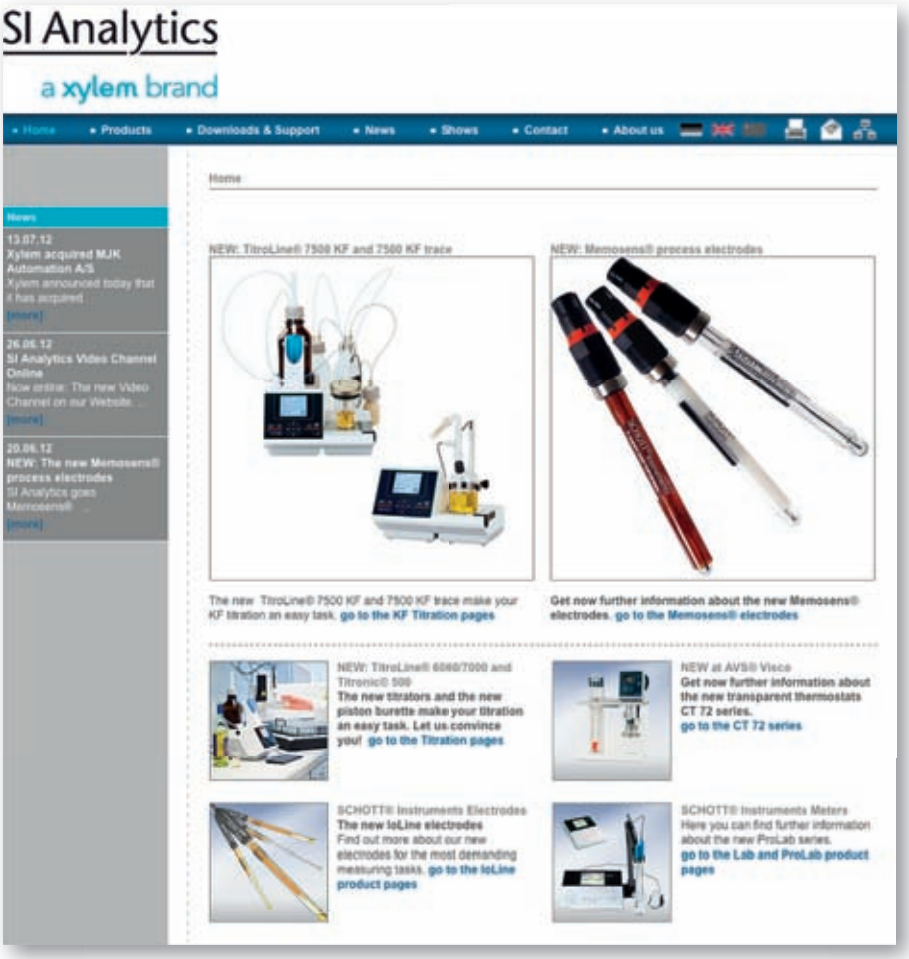
Electrical connection: Cable VZ 6225 for all measuring stands to all instruments (is included in hose sets VZ 5505, VZ 5622 and VZ 5857), control lamp as function display

Distance between measuring levels: 40.00 mm ± 0.03 mm at 25 °C

Signal transmission: Optically using optical fibres from the measuring level in the stand head, converted into analogue signal from stand to measuring instrument

www.si-analytics.com

The address for electrochemical measurements



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- always available
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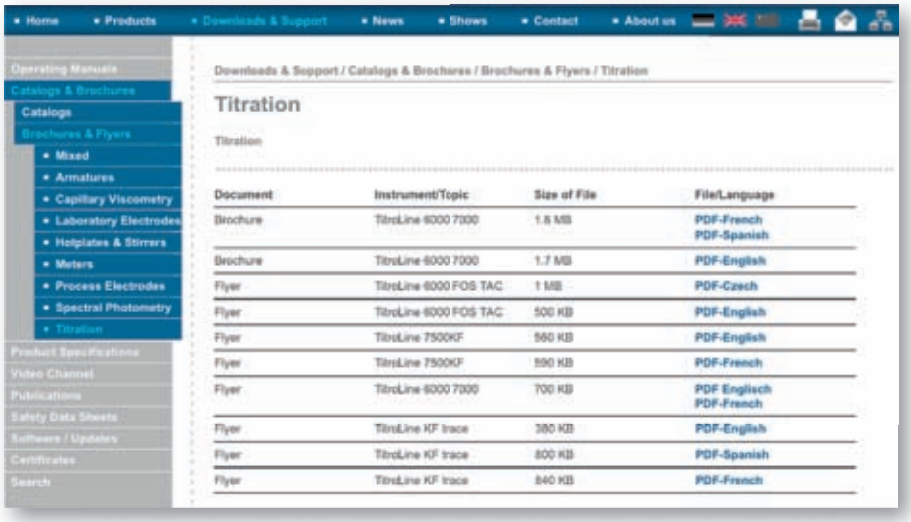

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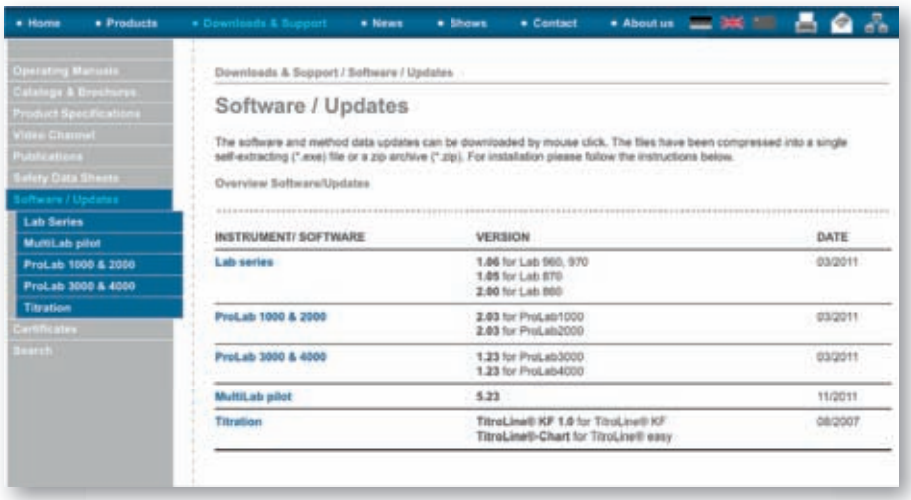
- Operator manuals
- Application reports and published articles
- Certificates
- Much more

You will find a detailed software-section.

- From software update page click the device family to access available updates.
- All software updates are free of charge and step by step installation directions are given.



Innovative electrochemistry, innovative viscometry – from the very beginning.

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.

Even today glass blowing talent is still indispensable.

The success story of electrochemical measurement began more than 75 years ago with the development of the glass electrode at SCHOTT.

It is hard to imagine – but in 1936 SCHOTT revolutionized the field of chemical measurements with a glass electrode that looks more like a glass bulb. Glass electrodes made from the newly created, electrically conductive pH glass were developed at the Jenaer Glaswerk SCHOTT & Gen., making it possible to achieve "sufficient accuracy" for pH measurements "with conventional pointer-type galvanometers".

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

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

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 needed 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 manually with a stop-watch. Today that works more comfortable and more precisely.

The success story of our meters began in the 1970s of the last century.

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 instruments.

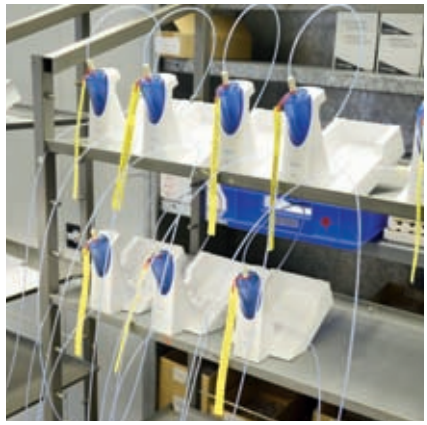
To enable us to react faster and more flexible to our customer needs SCHOTT Geräte GmbH was established in 1973 as a separate company. Our newly developed instruments – such as laboratory meters, pH meters and the automatic viscosity measurement system AVS® – caused a sensation and rapidly conquered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

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

Our innovative AVS® products have also made life much easier for our customers who need to measure viscosity. Examples include the practical ViscoClock, the AVS®Pro II, an apparatus for automatic viscosity measurements

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

With the processed calibration, the viscometers are provided with an ID number and a certificate documenting the specific characteristics.



Everything O.K. A batch of TitroLine® interchangable units after volume inspection.

that is top-of-the-line worldwide, or the modular measurement systems AVS® 370 and AVS® 470. We also have set new standards for top-of-the-line equipment with the TitroLine® 6000/7000 titrator, the TITRONIC® 500 piston burette and the new KF titrators TitroLine® 7500 KF and TitrLine® 7500 KF trace.

From SCHOTT to Xylem

In 2003 SCHOTT Geräte GmbH became SCHOTT® Instruments GmbH and part of Nova Analytics. The location including development and the production remained in Mainz. In 2009 SCHOTT® Instruments became SI Analytics. In 2010 Nova Analytics was acquired by ITT and was integrated into the company as ITT Analytics. The fluidtechnology part of ITT to which SI Analytics belonged became the stand-alone company Xylem Inc. Xylem is headquerted in White Plains, N.Y., USA and is a leading global water technology provider, enabling customers to transport, treat, test and efficiently use water in public utility, residential and commercial building services, industrial and agricultural settings. The company does business in more than 150 countries through a number of market-leading product brands with 2010 annual revenues of $3.2 billion and 12,000 employees worldwide.

More than 75 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 equipment offers 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.

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.

A brief excerpt from our company's history

Since 1936 – consistently new products from research and development

1936 Development and production of pH glass electrodes at Jenaer 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.

– S6 and S7 plug system from SCHOTT, copied time and again.

1973 SCHOTT Geräte GmbH established as an independant company.

– 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 The first titration control unit TR 155 and the T 100 piston burette with interchange 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 minimal alkali error.

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

– SCHOTT Geräte presents the first thermal scanning method for viscosity measurment.

– The first stand-alone viscosity measurement apparatus with integrated computing function (AVS® 400 and AVS® 440) are introduced to the market.

– Compact T 80/T 90 piston burettes and simple control unit TR 85.

1988 Presented 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 and plastic shaft.

1994 Compact TitroLine® alpha titrator.

1995 SILAMID®, stable reference system.

– First Windows titration software TitriSoft 1.0 (WIN 3.1).

1996 New SMEK shielded 6-pin plug system.

View over Mainz with premises of SI Analytics/SCHOTT AG

Source of image: SCHOTT AG

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 IP 68 version.
–	New Type A pH glass, rapid reaction in drinking water.
–	Market launch of the fully automatic AVS®Pro 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.
2005	The Lab meters family is introduced:
	A wireless sensor recognition guarantees the optimum communication between electrode and meter.
2006	Introduction of the ProLab family of instruments: Multi-functional measuring instruments with integrated user recognition guarantee utmost flexibility and reliability of measurement.
2007	ProLab 3000 and 4000 high-end laboratory instruments signify the cutting-edge standard for pH/ ionic and conductivity measuring and for the first time combine highest measuring quality with functionality, also providing a user-friendly navigation comparable to a Windows PC.
–	The new Karl Fischer titrator, TitroLine® *KF trace* from SCHOTT® Instruments, also offers a coulometric technique for determining even smallest water content.
2008	The new IoLine electrodes with their patented iodine/ iodid three-chambers reference system represent the perfect solution for accomplishing the ultimate challenging measuring tasks in i.e. pharmacy, biotechnology and food industry.
2009	SCHOTT® Instruments GmbH becomes SI Analytics GmbH.
2010	SI Analytics becomes part of ITT, USA.
2011	The new titrators TitroLine® 6000/7000 and the new Piston burette TITRONIC® are introduced.
–	The fluidtechnology part of the ITT group SI Analytics belongs to, becomes a stand-alone stock traded company named Xylem Inc.
2012	The new titrator series TitroLine® was supplemented by the new KF titrators TitroLine® 7500 *KF* (volumetric) and TitroLine® 7500 *KF trace* (coulometric).
–	Introduction of Memosens® elektrodes for contactless connnection to measurment devices.

What can Xylem do for you?

We're 12,500 people unified in a common purpose: creating innovative solutions to meet our world's water needs. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. We move, treat, analyze, and return water to the environment, and we help people use water efficiently, in their homes, buildings, factories and farms. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise, backed by a legacy of innovation.

For more information on how Xylem can help you, go to www.xyleminc.com

SI Analytics

a xylem brand

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980 069US *Version 12/2012*