*The first address for*
***Precision measurement***

# *Laboratory Products*


SCHOTT
Instruments

# Welcome to SCHOTT Instruments


With this new catalogue we are presenting you our complete laboratory products: The catalogue covers the product areas of electrochemical meters and electrodes, titrators, spectrophotometers, laboratory hotplates and stirrers 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 measuring 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 impulses in the form of new products and technology. Since 2006 spectrophotometers complete our traditional programme. With this catalogue we would like to draw you special attention to our latest product developments, which you will come across in all product sections and hope you enjoy discovering these novelties.

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

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

SCHOTT Instruments GmbH

Dr. Robert Reining
Managing Director

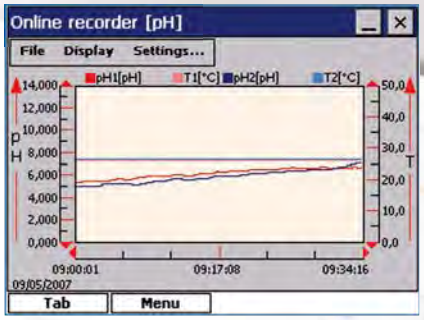
# Contents

# Something to be measured against: the first pH meter with integrated PC

- **ProLab 3000**
  **2-channel pH / ISE**
- **ProLab 4000**
  **2-channel pH / ISE / Conductivity**


## Operate the new ProLabs like a PC

- **You have a 300 MHz processor and a storage volume of 64 MB.**
- **On a brilliant QVGA colour graphic display the operation is handled via a Windows menu structure. The display can be configured in the same manner as on a PC.**
- **Operate by using the numeric key pad or using an external keyboard or optionally use the mouse, which is part of the delivery scope.**




## Electrode and user identification

- **When operating SCHOTT Instruments ID electrodes their individual data is transmitted to the meter for the calculation of the measurement values. Hence, optimum measurement accuracy is achieved.**
- **The automatic user recognition via transponder pendant plus password protection enables access control and allocation of measurement values, calibrations etc. for each user to meet GLP requirements.**


**More information on pages 16 to 21.**


# IoLine, the pH electrode for the most challenging measuring tasks

- **Iodine/iodide reference system with patented three-chambers system**
- **100 % free of metal ions**

The new IoLine product family from SCHOTT Instruments with iodine/iodide reference system for demanding measurements in the laboratory is 100 % metal ion free. This makes the electrode perfectly suitable for measurements not allowing any metal ion contamination of the samples. Besides other convincing features, the IoLine electrodes give the right answer to the demand for a suitable electrode for pH measurements in Tris buffers. IoLine electrodes are the right choice for all pH measurements with highest quality requirements in the area of research and quality control of pharmacy, biotechnology or food industry.

IoLine electrodes persuade with the following advantages compared to the conventional Ag/AgCl reference system:

- Patented three-chambers system with iodine storage reservoir in the reference electrode for prolonging the product lifecycle.
- Fast response times and most precise measurements with remarkably stable measuring values, especially with changing temperatures or a temperature deviating from the calibration through the metal ion free iodine/iodide system with a low temperature dependency of the reference potential.
- Free choice of bridge electrolyte and consequently optimal adaptation to each sample thanks to the double electrolyte system.

By using different membrane glass shapes and types with different glass shaft lengths and connection opportunities you always have the perfectly matching electrode for your corresponding application at hand. The comprehensive technical data of the IoLine series are as follows:

| | |
|---|---|
| pH application area | 0 to 14 |
| Temperature range | -5 up to 100 °C |
| Reference system | Iodine/iodide |
| Diaphragm | Platinum or ceramic |
| Glass membrane | Type: A or H glass;<br>Shape: ball, spear or micro (cylinder) |
| Application area | Utmost precise and fast pH measurements in manifold media in the research and quality control areas of pharmacy, biotechnology or food industry |

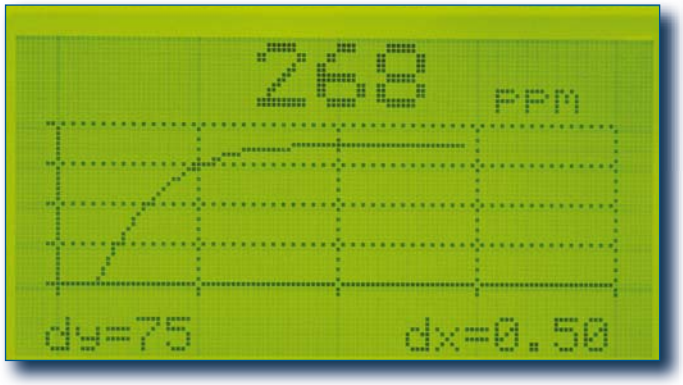
**For further information please refer to pages 46/47 and the section starting at page 56.**

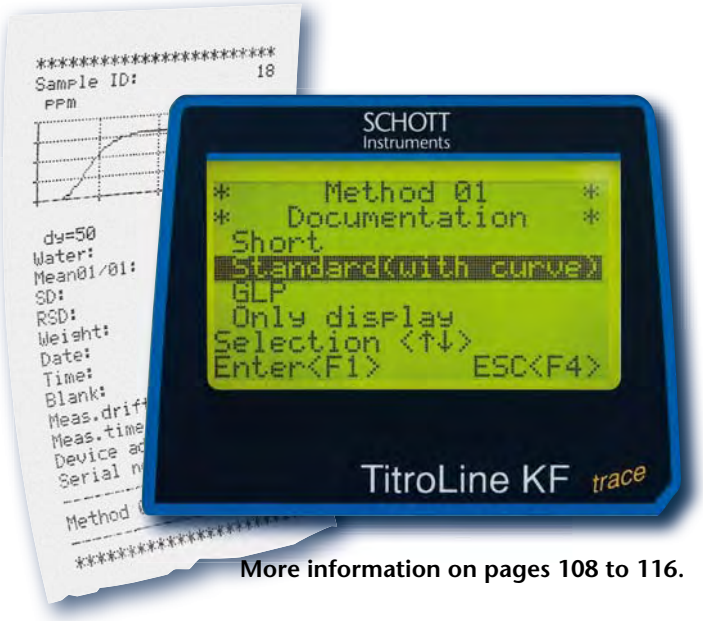
# TitroLine KF *trace*

## The new coulometric KF-titrator from SCHOTT Instruments

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


- **Use without delay through pre-programmed methods.**
- **Large graphic display with online curve and clear instructions for navigation.**
- **GLP compliant documentation incl. curve print out.**
- **With optional password safety to avoid unwanted altering of methods.**
- **USB port for PC**




More information on pages 108 to 116.

# UviLine 9100 and 9400

## The new spectrophotometers from SCHOTT Instruments

Two completely new high-performance single beam photometers

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


- Absorption and transmission measurements
- Concentration measurements of up to 8 standards
- Multi wavelength measurements
- Spectra adding with online graphic
- Kinetics measurements
- Extensive evaluation tools
- Large storage capacity for data and spectra
- USB-A and USB-B interfaces for communication

**More information on pages 144 to 151.**

# Laboratory Meters of the Lab- and ProLab Series: The new standard for electrochemical measurements

### Electrodes and meters by SCHOTT Instruments

Electrodes from SCHOTT Instruments 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 for electrodes for more than 70 years. A know-how all around glass from which our customers can benefit. What once 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 perfectly matching our electrodes and buffer solutions.

### The result

The new pH, ISE, conductometer and multi parameter measuring instruments from SCHOTT Instruments. These instruments again are setting standards for electrochemical measuring technology. Along with our successful 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 | 3 | 3 | | | 5 | 5 | 5 | 5 |
| VariCal: manual calibration with selected buffer | | | | | | | | ■ | ■ |
| **mV** | ■ | ■ | ■ | | | ■ | ■ | ■ | ■ |
| mV differential measurement | | | | | | | | ■ | ■ |
| 2-channel mV- (galvanically separated) | | | | | | | | ■ | ■ |
| **ISE** | | | | | | | ■ | ■ | ■ |
| **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 | QVGA colour graphic | QVGA 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 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| USB host interface: plug and play connection of USB hub, USB printer, USB memory, keyboard, mouse, USB stick | | | | | | | | ■ | ■ |
| Quality and Service | | | | | | | | | |
| Complete scope of delivery: - instrument with cover, universal power supply unit and stand - set additionally with electrode and buffer | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| IQ and OQ documents available | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Warranty 3 years | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

# 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 SCHOTT Instruments electrodes. The result is a calibration and measurement in usual precision – but in much shorter time!

### Keeping reliability in view: The CalClock...

This unique combination of sensor evaluation and calibration timer controls all calibration relevant settings. The sensor evaluation shows the electrode quality in increments. The quality criteria are slope, zero point and reaction time. The preset calibration interval is displayed as a countdown in 6 steps. When the time interval has elapsed, an optical and an acoustical signal is activated. The CalClock combines both functions at a glance.

*CalClock*

*USB and RS 232-interfaces*

## pH Meter Lab 860

**Perfect communication for fast documentation**

### Direct data transmission

All instruments with data transmission function are provided with a conventional RS 232 plus a modern USB PC interface. No adapter is required.

## pH Meter Lab 870

**Laboratory practice improved – GLP with SCHOTT Instruments**

### Sensor is automatically recognized

The quality controller's dream: A measuring instrument that automatically recognizes the electrode and the user! The new sensors with distinct identification send their specific data to the measuring instrument wireless. Wrong measurements are excluded.

*Wireless sensor recognition*


*Special stand S4D*


- **Reliable and precise measuring values**
  due to perfect matching of the measuring instruments with our electrodes and buffer solutions.
- **Keeping reliablity in view with „CalClock"**
  sensor recognition and calibration timer combined.
- **Easy documentation complying with GLP**
  through perfect communication via USB (slave) and RS 232 (except Lab 850).
- **Highest safety for measuring and calibrating**
  through wireless sensor recognition (Lab 870): ID electrodes and meters with automatic identification and data exchange.
- **Scope of delivery, set**
  - Measuring 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 on highest level: the interface all-rounder**

### Dual interface included

Whether conventional via RS 232 or modern via USB – both interfaces 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.

```
14.03.2008 08:53:54
Lab 960  02320025

CALIBRATION COND
Cal Time     :    14.03.2008 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 RS 232 interfaces*


*Scope of delivery, set*

## Conductivity Meter Lab 970

**Laboratory practice at its best – GLP with SCHOTT Instruments**

### Electrode is automatically recognized

Ideally suited for measurements according to USP 28. A measuring instrument that automatically recognizes the electrode! The latest microtechnology enables storing of the calibration data in the sensor. For each measurement the sensor logs in with its ID (type and serial no.) and by sending its calibration data assures that only the sensor specific data are used to calculate the measured value.

*Wireless sensor recognition*


### Direct data transmission

The Lab 970 sends the data directly via USB or RS 232 to PC (no storing function). The instrument is therefore very easy to handle and can be integrated into automized systems such as i.e. LIMS. Extensive administrator levels are not necessary.

### Service taken serious

For the Lab 970 also the complete IQ and OQ documentation is available. The service from SCHOTT Instruments is pleased to assist you.

- **Reliable and precise measuring values** due to perfect matching of the Lab instruments with our conductivity cells and conductivity test solutions.
- **Fast and easy documentation complying with GLP** through perfect communication via USB (slave) and RS 232
- **Complete support** including IQ and OQ documentation and qualified service.
- **Highest safety for measuring and calibrating** through wireless sensor recognition (Lab 970): ID electrodes and meters with automatic identification and data exchange.
- **Scope of delivery, set**
  - Measuring instrument
  - Conductivity cell
  - Conductivity testing solution
  - Stand
  - Universal power supply unit
  - Cover

Advantages
Lab 9xx

# ProLab 1000: pH for the professional

## pH Meter ProLab 1000:

**Superior technique in a classy metal body**

### Precise measurements

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

### Reproducible results

The automatic calibration at up to 5 points and the automatic buffer recognition from more than 16 selectable buffer sets guarantee trustworthy measurement results on highest level.


*User recognition with electronic ID card*

### Utmost reliability

The wireless sensor recognition and user identification allows to assign a user name 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.

### Glass meets metal

Housed in a solid metal body, the big and brilliant graphic display is protected by a one-piece glass slide. The ProLab 1000's weight of approx. 2.5 kg guarantees a firm standing. The S4D stand can be attached without tools either to the left or the right side of the instrument to make up an immovable unit.

## Direct data transmission

Whether conventional via RS 232 or modern via USB – both interfaces to the PC are integrated in the ProLab 1000. No adapter is required.

The integrated dead stop function increases the ooperation area also for manual titration tasks. (wine industry, food industry).

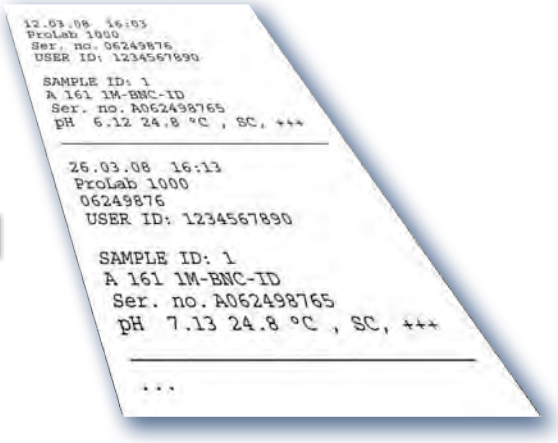
*Dead stop connection*

*USB and RS 232 interfaces*


*Wireless sensor recognition*

## Documentation complying with GLP

The calibration protocols comply with GLP as well as date and time and identification of up to 1500 data entries can be recalled. The storage is according to 21 CFR Part 11 in user levels with user identifications.




**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 RS 232

**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:**

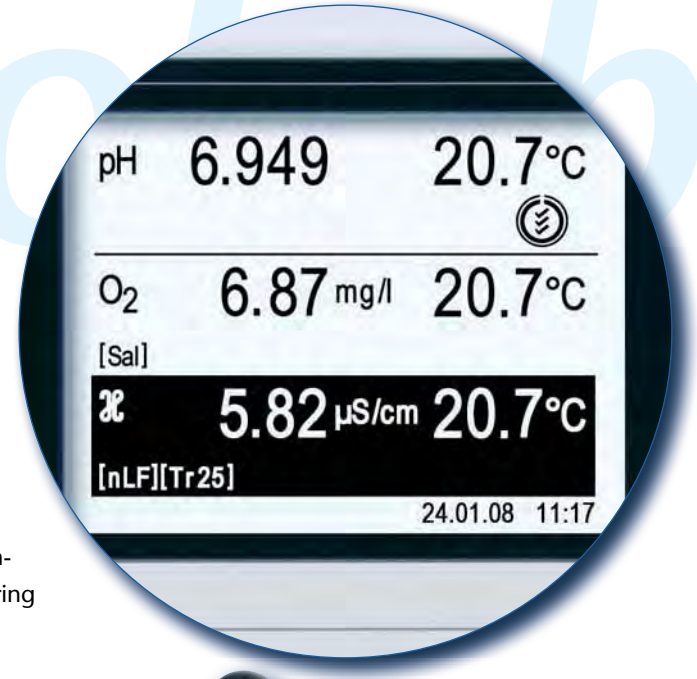
**One for all**

### Versatile

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

### Professional

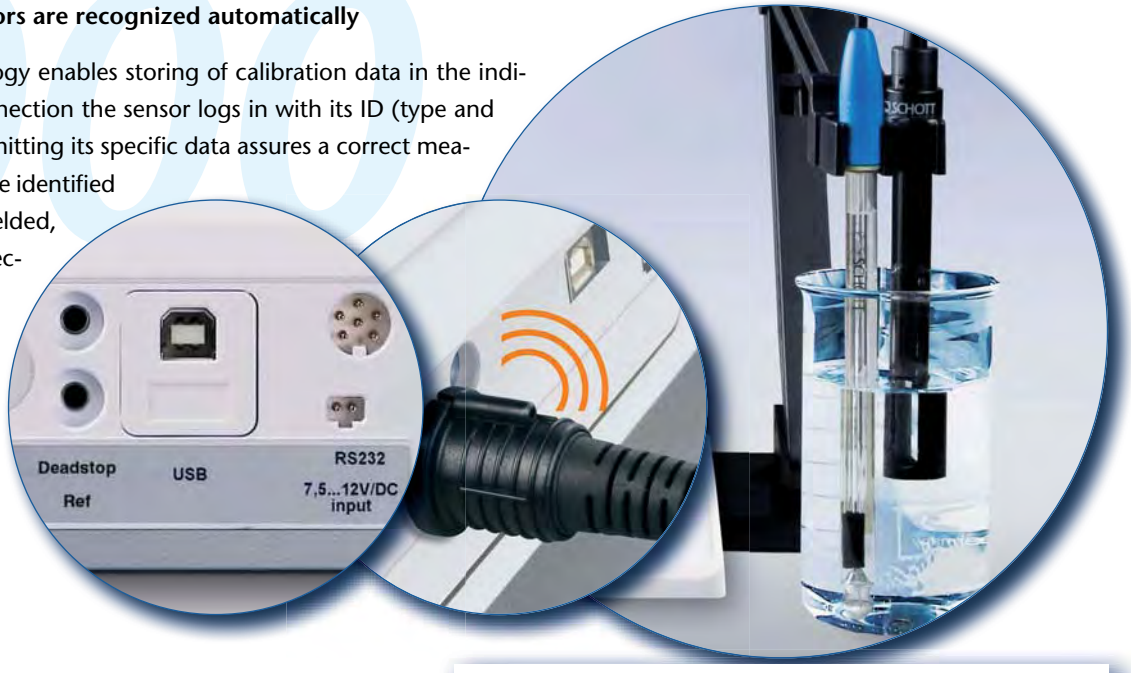
With a measuring range from -2.000 to +20.000 pH and an accuracy of 0.003 pH, the ProLab 2000 is especially suited for manifold applications in research and development. The automatic pH and ISE calibration at up to 3 points guarantees trustworthy measurments at the hightest stage. The galvanic D.O. sensor and mulit-pole conductivity measuring cells widen the measuring functions for most applications.




*User recognition with electronic ID card*

## Innovative - Sensors are recognized automatically

The latest microtechnology enables storing 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 identified unequivocally.




*pH combination electrode A 161 … ID*

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

- **Highest safety level with measurements and calibration through:**
  - **automized 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 sensors from SCHOTT Instruments perfectly matching the instrument
- **Safety at a glance with „CalClock“** Sensor evaluation and calibration timer combined.
- **Scope of delivery, set**
  - Measuring instrument
  - Electrodes with integrated temperature sensor
  - Buffer solutions
  - Stand
  - Universal power supply unit
  - Cover

## Advantages ProLab 2000

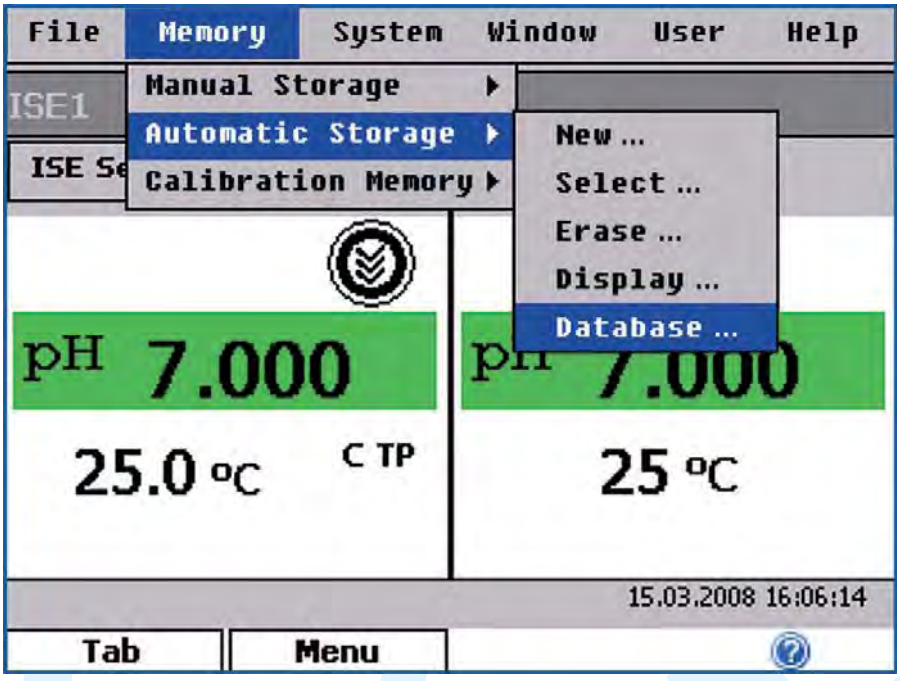
# ProLab 3000: measure pH as at a PC

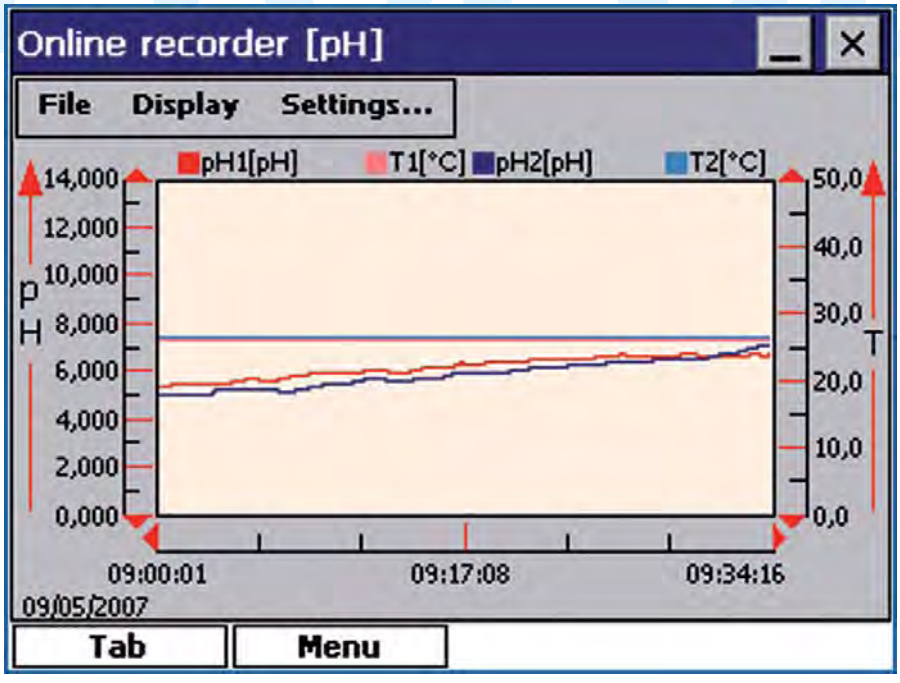
**High end pH/ION meter ProLab 3000:**

**The first pH meter with integrated PC**

**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 delivery scope. For example the entry of text and numbers for inserting file names can be carried out either by using the numeric keypad or an external keyboard. Mouse and keyboard can be used at the same time, as the USB (host) interface can be extended by a hub.




### Flexible display of measurements on a brilliant colour graphic display

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

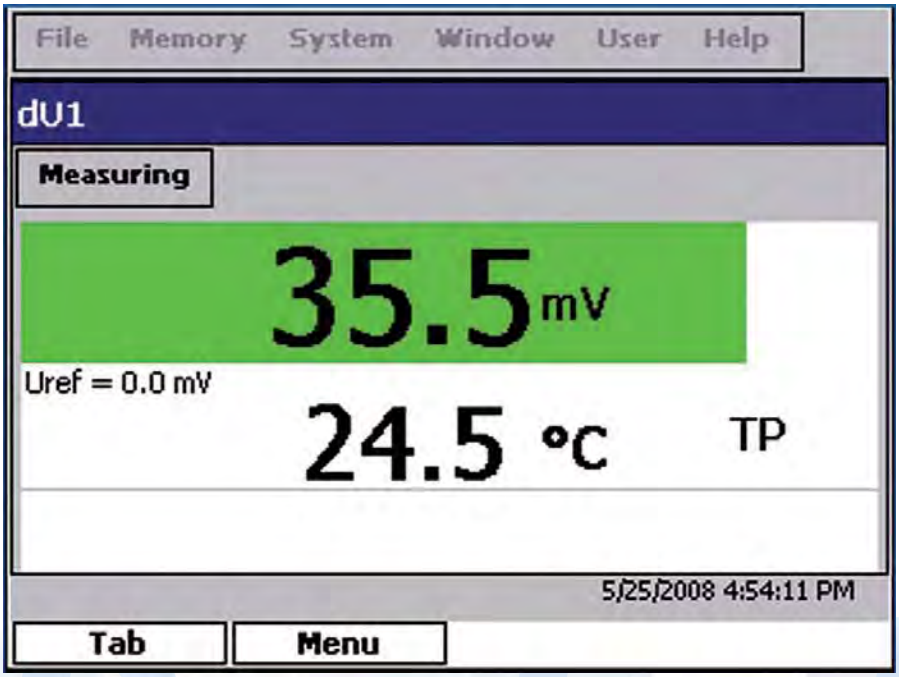
### Plug and Play

Easy connection of peripheral devices with the 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 – when interconnecting a hub to the USB host even a parallel operation is possible.

# ProLab 3000: measure pH as at a PC

### Differential measurement made easy

Two galvanically separated pH entries allow simultaneous measurement of both pH sensors, even in the same vessel without causing any perturbation – with SCHOTT Instruments' ID electrodes providing automatic sensor recognition even unequivocally. On every pH channel a differential measurement against a reference value is possible.




## GLP thought out

### User recognition with electronic ID card incl. password entry

The automatic user recognition via transponder pendant enables access control and allocation of measurement values, calibrations etc. for each user. Hence it is automatically documented which user did what at a certain time. The security guaranteed through the access control is furthermore increased by the password protection.

### Sensor recognition – wireless and automatic

The new ID electrodes send their specific data wireless to the ProLab 3000 and 4000. It is therefore guaranteed that each electrode always uses the correct calibration and erroneous measurements are excluded – unequivocal even with 2-channel measurements!

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.


- **Highest safety level with measurements and calibration through:**
  - **automized 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
- **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
- **Operation via mouse or keyboard as at a PC** familiar menu structures and clear menu navigation
- **Plug and play** by state-of-the-art technology
- **Scope of delivery, set**
  - Measuring instrument (incl. mouse)
  - Electrode with integrated temperature sensor
  - Buffer solutions
  - Stand
  - Universal power supply unit
  - Cover

## Advantages ProLab 3000

# ProLab 4000: and Cond on top...

## ProLab 4000: High end pH/ION/Conductivity meter

**pH, ISE and conductivity measuring on highest level**

### Equivalent to ProLab 3000 – added with another feature …

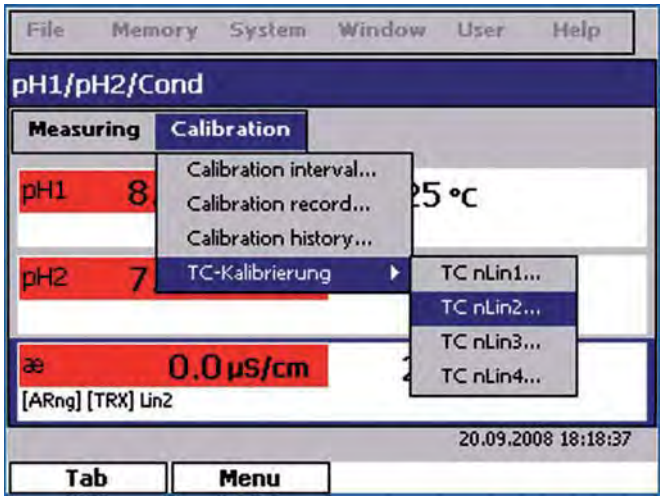
The ProLab 4000 offers the high-quality measurement technology known with ProLab 3000 and is futhermore completed with conductivity measurement for highest standards: A measuring range from 0.000 µS/cm … 2000 mS/cm, TDS and salinity measurement as well as various functions for temperature compensation and setting of the cell constant form the standard for a measuring instrument of this performance class. ProLab 4000 offers even more …

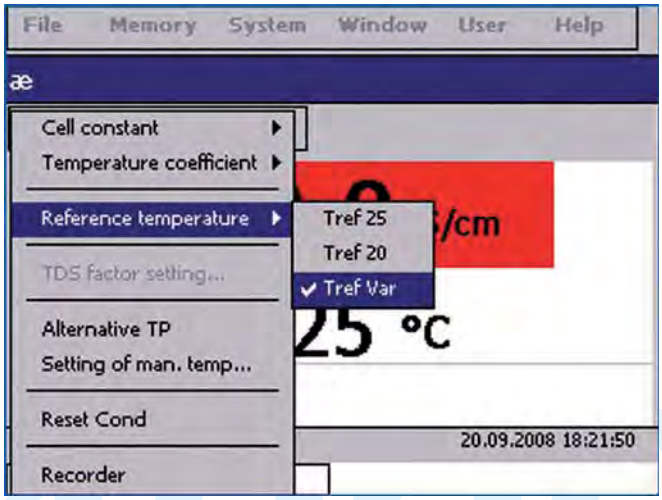
### Special functions for determining the dependency of conductivity regarding temperature or concentration

The conductivity of aqueous solutions is subject to temperature and concentration of dissolved substances. For comparing measurement values, which were determined at different temperatures, all values have to be recalculated onto the same reference temperature. Both common procedures linear and non-linear (acc. to EN 27888) compensation should however only be applied with diluted measuring solutions, as otherwise the concentration dependency goes unnoticed. Furthermore, the measurement temperature range should lay within ± 10K of the reference temperature. The ProLab 4000 eliminates these restrictions thanks to special compensation proceedures. These methods are featured for example by:

- Usage of two pre-programmed temperature coefficients for HCl, NaOH, NaCl and KCl for a temperature range of 0…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 qualified for operation in science and for monitoring industrial processes. The instrument enables high precision conductivity measurements in a wide temperature and concentration range.




- **pH, mV, ISE measuring – same as ProLab 3000 …**
- **Measuring conductivity on highest level:**
  Determining 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:**
  - **automized 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** by state-of-the-art technology
- **Scope of delivery, set**
  - Measuring instrument (incl. mouse)
  - Electrodes with integrated temperature sensor
  - Buffer- and conductivity test solutions
  - Stand
  - Universal power supply unit
  - Cover

## Advantages
ProLab 4000

# Performance black on 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 … +19.999 pH<br>-2.00 … +19.99 pH | -2.000 … +19.999 pH<br>-2.00 … +19.99 pH | -2.000 … +19.999 pH<br>-2.00 … +19.99 pH | |
| Accuracy (for each measuring area)<br>(±1 digit) | ± 0.005 pH<br>± 0.01 pH | ± 0.005 pH<br>± 0.01 pH | ± 0.005 pH<br>± 0.01 pH | |
| Calibration: pre-programmed pH buffer sets | 16 | 16 | 16 | |
| Automatic buffer recognition and display | ■ | ■ | ■ | |
| pH calibration points max. | 3 | 3 | 3 | |
| VariCal: manual calibration with selectable buffers | – | – | – | |
| Dead stop function | – | – | – | |
| 2-channel pH measurement (galvanically separated) | – | – | – | |
| **mV measurement** | ■ | ■ | ■ | |
| Range / Accuracy | -999.9 … +999.9 mV<br>-1999 … +1999 mV | -999.9 … +999.9 mV<br>-1999 … +1999 mV | -999.9 … +999.9 mV<br>-1999 … +1999 mV | |
| Accuracy (for each measuring area)<br>(±1 digit) | ± 0.3 mV<br>± 1 mV | ± 0.3 mV<br>± 1 mV | ± 0.3 mV<br>± 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<br>(with dedicated separate temperature channels) | | | | |
| Methods | | | | |
| ISE calibration points | | | | |
| Standard concentrations | | | | |
| **Conductivity measurement** | | | | ■ |
| Range / Accuracy | | | | 0.000 µS/cm…500 mS/cm |
| TDS measurement with factor 0.4 … 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 … 0.500 $cm^{-1}$;<br>0.585 … 0.715 $cm^{-1}$; 0.800 … 1.200 $cm^{-1}$<br>(calibration with control standard) d 0.01 mol KCl: | | | | ■ |
| Adjustable cell constant 0.250 … 2.500 $cm^{-1}$<br>and 0.090 … 0.110 $cm^{-1}$ | | | | ■ |
| Fixed cell constant 0.010 $cm^{-1}$ | | | | ■ |
| Temperature compensation<br>nLF / Lin (0.001 … 3.000 %/K) / selectable | | | | ■ |
| Temperature compensation purity water | | | | ■ |
| Pre-programmed temperature coefficients<br>for HCl, NaOH, NaCl and KCl | | | | |
| Determination of temperature coefficients<br>for one or multiple standards and known or<br>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 … +20.000 pH<br>-2.00 … +20.00 pH<br>-2.0 … +20.0 pH | -2.000 … +20.000 pH<br>-2.00 … +20.00 pH<br>-2.0 … +20.0 pH | -2.000 … +20.000 pH<br>-2.00 … +20.00 pH<br>-2.0 … +20.0 pH | -2.000 … +20.000 pH<br>-2.00 … +20.00 pH<br>-2.0 … +20.0 pH |
| | ± 0.003 pH<br>± 0.01 pH | ± 0.003 pH<br>± 0.01 pH | ± 0.002 pH<br>± 0.01 pH | ± 0.002 pH<br>± 0.01 pH |
| | 22 | 22 | 22 | 22 |
| | ■ | ■ | ■ | ■ |
| | 5 | 5 | 5 | 5 |
| | – | – | ■ | ■ |
| | ■ | – | – | – |
| | – | – | ■ | ■ |
| | ■ | ■ | ■ | ■ |
| | -1999.9 … +1999.9 mV<br>-1999 … +1999 mV | -1999.9 … +1999.9 mV<br>-1999 … +1999 mV | -2200.0 … +2200.0 mV<br>-2200 … + 2200 mV | -2200.0 … +2200.0 mV<br>-2200 … + 2200 mV |
| | ± 0.2 mV<br>± 1 mV | ± 0.2 mV<br>± 1 mV | ± 0.1 mV<br>± 1 mV | ± 0.1 mV<br>± 1 mV |
| | ■ | ■ | – | – |
| | – | – | ■ | ■ |
| | – | – | ■ | ■ |
| | | ■ | ■ | ■ |
| | | 0.000 … 10000 mg/l | 1.0E-40 … 9.9E39 mg/l | 1.0E-40 … 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 … 3 | 2 … 9 | 2 … 9 |
| | | 0.01 … 10 000 mg/l<br>in 19 selectable concentrations | 1.00E-30 … 1.00E30 mg/l<br>can be inserted | 1.00E-30 … 1.00E30 mg/l<br>can be inserted |
| ■ | | ■ | | ■ |
| 0.000 µS/cm…500 mS/cm | | 0.000 µS/cm…2000 mS/cm | | 0.000 µS/cm…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…30 °C | | | | |
| Salinity correction | | | | |
| Calibration in calibration vessel with water vapor-saturated air | | | | |
| **Temperature measurement** | ■ | ■ | ■ | ■ |
| Range / Accuracy | -5.0 … +120.0 °C | -5.0 … +120.0 °C | -5.0 … +120.0 °C | -5.0 … +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 vision panel | – | – | – | – |
| Vision panel integrated in keyboard plastic foil | ■ | ■ | ■ | ■ |
| Measuring value storage (manual/automatic) | – | 800 data sets, storage intervals from 5 s … 60 min | – | 800 data sets, storage intervals from 5 s … 60 min |
| USB (slave) and RS232 interface | | ■ | ■ | ■ |
| USB host interface: plug and play connection of USB hub, USB printer, USB memory, keyboard, mouse, USB stick | | | | |
| Lower casing | plastic | plastic | plastic | plastic |
| Plastic foil keypad (polyester) with tactile response | ■ | ■ | ■ | ■ |
| Power supply: external universal power supply unit (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 … 24 h, default 1 h, cannot be switched off) | ■ | ■ | ■ | ■ |
| Dimensions (W × H × D mm) | 240 x 190 x 80 | 240 x 190 x 80 | 240 x 190 x 80 | 240 x 190 x 80 |
| Weight | approx. 1.0 kg | approx. 1.0 kg | approx. 1.0 kg | approx. 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 and 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* |
| | | ■ | | |
| | | | | |
| | | 0…20.00 mg/l / 0.01 mg/l<br>0…90.0 mg/l / 0.1 | | |
| | | 0…200.0 % / 0.1 %<br>0…600 % / 1 % | | |
| | | 0…200.0 mbar / 0.1 mbar<br>0…1250 mbar / 1 mbar | | |
| | | 0.5 | | |
| | | ■ | | |
| | | ■ | | |
| ■ | ■ | ■ | ■ | ■ |
| -5.0 … +120.0 °C | -10.0 … +120.0 °C | -10.0 … +120.0 °C | -35.0 … +150.0 °C | -35.0 … +150.0 °C |
| ± 0.1 °C | ± 0.1 °C | ± 0.1 °C | ± 0.1 °C | ± 0.1 °C |
| – | – | – | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |
| | | | | |
| LCD<br>75 x 60 mm | black & white graphic<br>120 x 90 mm<br>with lighting | black & white graphic<br>120 x 90 mm<br>with lighting | QVGA colour graphic display<br>120 x 90 mm<br>with lighting | QVGA colour graphic display<br>120 x 90 mm<br>with lighting |
| – | ■ | ■ | – | – |
| – | ■ | ■ | ■ | ■ |
| ■ | – | – | – | – |
| – | 1500 data sets,<br>storage intervals from<br>1 s … 60 min | 1500 data sets,<br>storage intervals from<br>1 s … 60 min | > 10000 data sets,<br>storage intervals from<br>1 s … 60 min | > 10000 data sets,<br>storage intervals from<br>1 s … 60 min |
| ■ | ■ | ■ | ■ | ■ |
| | | | ■ | ■ |
| plastic | metal diecast | metal diecast | metal diecast | metal diecast |
| ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |
| ■ | – | – | – | – |
| ■ | – | – | – | – |
| 240 x 190 x 80 | 240 x 280 x 70 | 240 x 280 x 70 | 240 x 280 x 70 | 240 x 280 x 70 |
| approx. 1.0 kg | approx. 2.5 kg | approx. 2.5 kg | approx. 2.5 kg | approx. 2.5 kg |
| CE, cETLus | CE, cETLus | CE, cETLus | CE, cETLus | CE, cETLus |
| protection class III,<br>EG guidelines 73/23,<br>EN 61010-1: 2001 | protection class III,<br>EG guidelines 73/23,<br>EN 61010-1: 2001 | protection class III,<br>EG guidelines 73/23,<br>EN 61010-1: 2001 | protection class III,<br>EG guidelines 73/23,<br>EN 61010-1: 2001 | protection class III,<br>EG guidelines 73/23,<br>EN 61010-1: 2001 |
| 2 (VDI/VDE 3540) | 2 (VDI/VDE 3540) | 2 (VDI/VDE 3540) | 2 (VDI/VDE 3540) | 2 (VDI/VDE 3540) |
| ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |
| ■ | ■ | ■ | ■ | ■ |

# Order information

| Type no. | Order no. | Product | Description |
|---|---|---|---|
| **Lab series** | | | |
| **Lab 850** | 285201300 | Laboratory pH Meter | Measuring parameters pH, mV, temp. microprocessor, 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., microprocessor, 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., microprocessor, 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., microprocessor, 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, RS 232 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, RS 232 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, RS 232 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, RS 232 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, RS 232 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, RS 232 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, RS 232 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, RS 232 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...500 mS/cm, salinity, total dissolved solids (TDS), temp., RS 232 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...500 mS/cm, salinity, total dissolved solids (TDS), temp., RS 232 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...500 mS/cm, salinity, total dissolved solids (TDS), temp., RS 232 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...500 mS/cm, salinity, total dissolved solids (TDS), temp., RS 232 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. Measuring parameters pH, mV, temp., microprocessor, RS 232 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. Measuring parameters pH, mV, temp., microprocessor, RS 232 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. Measuring parameters pH, mV, temp., microprocessor, RS 232 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. Measuring parameters pH, mV, temp., microprocessor, RS 232 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. Measuring parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS 232 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. Measuring parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS 232 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. Measuring parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS 232 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. Measuring parameters pH, mV, ISE, conductivity, D.O. and temp., microprocessor, RS 232 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. Measuring parameters: double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z880, Z865 + Z850. |
| **ProLab 3000 Set** | 285203610 | Digital laboratory pH Meter | Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Measuring parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z880, Z865 + Z850. Z880, Z865, Z850, 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. Measuring parameters: double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z880, Z865 + Z850.. |
| **ProLab 3000 BNC Set** | 285203630 | Digital laboratory pH Meter | Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Measuring parameters: double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z880, Z865, Z850, 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. Measuring parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z880, Z865 + Z850. |
| **ProLab 4000 Set** | 285203650 | Digital laboratory multi Meter | Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Measuring parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. DIN connection. Incl. Z880, Z865, Z850, 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. Measuring parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z880, Z865 + Z850. |
| **ProLab 4000 BNC Set** | 285203670 | Digital laboratory multi Meter | Electrode recognition and user identification. QVGA colour display. Menu based operation. Recorder function. Measuring parameters: conductivity + double-pH, mV, Temp, ISE. RS232, USB host + USB slave interfaces. BNC connection. Incl. Z880, Z865, Z850, 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 by SCHOTT Instruments after resending the filled in documents. |
| **Logbook Lab 860** | 285201810 | Logbook | for Lab 860 (DIN and BNC) incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook Lab 870** | 285201820 | Logbook | for Lab 870 (DIN and BNC) incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook Lab 960** | 285201840 | Logbook | for Lab 960 incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook Lab 970** | 285201850 | Logbook | for Lab 970 incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook ProLab 1000** | 285201830 | Logbook | for ProLab 1000 (DIN and BNC) incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook ProLab 2000** | 285201860 | Logbook | for ProLab 2000 (DIN and BNC) incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook ProLab 3000** | 285203680 | Logbook | for ProLab 3000 (DIN and BNC) incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Logbook ProLab 4000** | 285203690 | Logbook | for ProLab 4000 (DIN and BNC) incl. review by SCHOTT Instruments after resending the filled in documents. |
| **Z 390** | 285201560 | Cable for connection to PC | RS 232 6pole cable for connection to PC for Lab 860, Lab 870, Lab 960 and Lab 970 as well as for all instruments being part the ProLab series |
| **Z 396** | 285201580 | Software | Software for documentation for Lab 860, Lab 870, Lab 960, Lab 970, handylab 12 as well as for all instruments being part of the 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 pH-Meter, conductivity meter and pH/mV simulators from SCHOTT Instruments |

# handylab – pocket-size all-rounders …

**handylab – the mobile, multi-functional mini-laboratories**

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

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

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

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

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

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

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

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

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

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


**Contents**

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


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

**Measurement parameters**

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

**Measurement memory and interface**

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

**Measurement reliability**

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

**Temperature compensation**

Measurements can be performed with and without the temperature sensor. Temperature compensation of pH measurements can be effected automatically or manually. The type of temperature sensor that is connected (Pt1000 or NTC 30) is recognized automatically.

**Calibration**

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

**Power supply**

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

**Sensors**

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

**Separately or as a set**

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

# Technical data
# handylab pH 11, handylab pH 12

| ph meters | | handylab pH 11 | handylab pH 12 |
|---|---|---|---|
| **Measuring ranges** | | | |
| pH | range | -2.000…+19.999 pH | -2.000…+19.999 pH |
| | resolution max. | 0.001 pH | 0.001 pH |
| | accuracy | +0.005/±0.01 pH | +0.005/±0.01 pH |
| mV | range max. | -1999…+1999 mV | -1999…+1999 mV |
| | resolution max. | 0.1 mV | 0.1 mV |
| | accuracy | +0.3/±1 mV | +0.3/±1 mV |
| temperature | range | -5.0…+105.0 °C | -5.0…+105.0 °C |
| | resolution | 0.1 K | 0.1 K |
| | accuracy (with NTC 30) | ±0.1 K | ±0.1 K |
| | manual adjustment | -20…+130 °C | -20…+130 °C |
| drift control | can be switched off | yes | yes |
| slope matching | | 85…105 % | 85…105 % |
| zero point matching | | ± 30 mV | ± 30 mV |
| sensor evaluation | via symbol in the display | yes | yes |
| input resistance | | $>10^{12}$ Ω | $>10^{12}$ Ω |
| offset current | | $< 10^{12}$ A | $< 10^{12}$ A |
| **Calibration** | | | |
| buffer sets | DIN (1.68/4.01/6.87/9.18) | 1-/2-/3 point | 1-/2-/3 point |
| | technical (2.00/4.00/7.00/10.01)* | 1-/2-/3 point | 1-/2-/3 point |
| | selectable buffers | 1-/2 point | 1-/2 point |
| calibration interval control | | - | 1…999 days |
| saving calibration data in memory | | - | yes |
| Real time clock | integrated with time/date | - | yes |
| **Data storage** | | | |
| storage by depression of key | | - | 800 data records |
| time controlled storage | in 7 intervals (5 sec. …60 min) | - | 800 data records |
| **Connections** | | | |
| electrode (socket in accord. with DIN 19 262) | | yes | yes |
| temperature sensor (NTC 30/Pt 1000, 2 x 4 mm banana plug) | | yes | yes |
| **Interface** | | | |
| for analogue recorder cable Z 394 | | - | 4 poles socket |
| for RS-232 cable Z 395, bi-directional | | - | 4 poles socket |
| **Ambient temperature** | | | |
| operating temperature | | -10…+55 °C | -10…+55 °C |
| relative humidity (annual average) | | < 90 % | < 90 % |
| **Power supply** | | | |
| battery operated (type AA) | | 4 x 1.5 V mignon cells | 4 x 1.5 V mignon cells |
| battery life time (data is saved even if batteries are changed) | | approx. 5.000 h | approx. 5.000 h |
| power supply (no akku) | | - | optionally |
| automatic switch-off during battery operation | | 60 min | 60 min |
| **Housing** | | ABS, water-tight keypad | ABS, water-tight keypad |
| dimensions (H x W x D) | | 172 mm x 80 mm x 37 mm | 172 mm x 80 mm x 37 mm |
| weight | | approx. 0.3 kg | approx. 0.3 kg |
| **Display** | | | |
| LCD multi-function display | | 60 mm x 45 mm | 60 mm x 45 mm |
| **Instrument safety** | protection class | 3, EN 61010-1 A2 | 3, EN 61010-1 A2 |
| | protection type | IP 66, EN 60529 | IP 66, EN 60529 |
| approvals/marks of conformity | | cETLus, CE | cETLus, CE |
| instrument warranty | | 3 years | 3 years |

* SCHOTT Instruments

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

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

**Measurement parameters**

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

**Measurement memory and interface**

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

**Measurement reliability**

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

**Temperature compensation**

The automatic temperature compensation works in various selectable modes:
- with an adjustable linear temperature coefficient,
- with a fixed non-linear temperature coefficient or
- with the temperature compensation deactivated.

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

**Calibration**

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

**Power supply**

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

**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. We would be pleased to advise you about your specific application.


**Included in the set**

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

# Technical data
# handylab LF 11, handylab LF 12

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

# Portable oxygen meter with GLP functions handylab OX 12


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

### Measurement parameters

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

### Measurement memory and interface

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

### Measurement reliability

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

### Measurements

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

### Calibration

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

### Power supply

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

### Sensor

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

### As a set

The handylab OX 12 portable oxygen meter is available as a complete set in a carrying case together with the 9009/61 sensor, the OX 925 maintenance set and the OxiCal®-SL calibration vessel.

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

# Technical data handylab OX 12

| **Oxygen meter** | | **handylab OX 12** |
|---|---|---|
| **Measuring ranges** | | |
| $O_2$ concentration | ranges | 0.00…19.99 mg/l / 0…90.0 mg/l |
| | resolution max. | 0.01 |
| | accuracy | ± 0.5 % of measured value |
| $O_2$ saturation index | ranges | 0.0…199.9 % / 0…600 % |
| | resolution max. | 0.1 % |
| | accuracy | ± 0.5 % of measured value |
| $O_2$ partial pressure | ranges | 0.0…199.9 mbar / 0…1250 mbar |
| temperature | range | 0…+50.0 °C |
| | resolution | 0.1 K |
| | accuracy | ± 0.1 K |
| drift control | can be switched off | yes |
| **Correction functions** | | |
| air pressure | automatic (built-in pressure sensor) | 500…1100 hPa |
| temperature | automatic (IMT) | 0…+40 °C |
| salinity | using setting keys | 0.0…70.0 |
| **Calibration** | | |
| procedure | | air calibration procedure |
| slope range | | 0.60…1.25 |
| calibration interval control | | 1…999 days |
| calibration data storage | | yes |
| sensor evaluation | via symbol on display | yes |
| real time clock | integrated with time/date | yes |
| **Data storage** | | |
| storage by depression of key | | 800 data records |
| time controlled storage | in 7 intervals (5 sec…60 min) | 800 data records |
| **Connections** | | |
| oxygen sensor | | 8 pole socket |
| **Interface** | | |
| for analogue recorder cable Z 394 | | 4 pole socket |
| for RS-232 cable Z 395, bi-directional | | 4 pole socket |
| **Ambient temperature** | | |
| operating temperature | | -10…+55 °C |
| relative humidity (annual average) | | < 90 % |
| **Power supply** | | |
| battery operated | | 4 x 1.5 V mignon cells (type AA) |
| battery life time (data remain when changing batteries) | | approx. 2,000 h |
| power supply (no akku) | | optionally |
| automatic switch-off at operation | | 60 min |
| **Housing** | | ABS, water-tight key pad |
| dimensions (H x W x D) | | 172 mm x 80 mm x 37 mm |
| weight | | approx. 0.3 kg |
| **Display** | | |
| LCD multi-function display | | 60 mm x 45 mm |
| **Instrument safety** | protection class | 3, EN 61010-1 A2 |
| | protection type | IP 66, EN 60529 |
| approvals/marks of conformity | | cETLus, CE |
| instrument warranty | | 3 years |

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

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

**Measurement parameters**

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

**Measurement memory and interface**

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

**Measurement reliability**

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

**Calibration**

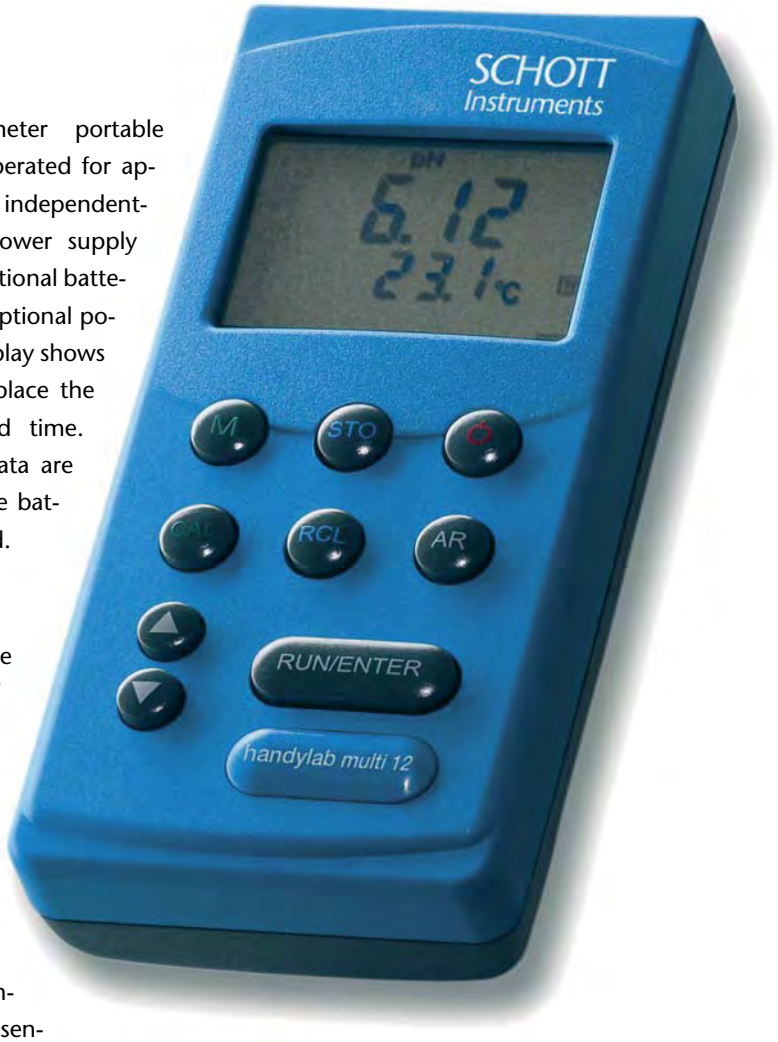
For calibration of the pH measurement, there is a one or two point calibration with technical buffers. For calibration of the conductivity sensor and the oxygen sensor, if needed, there is an automatic calibration function. After automatic calibration, a sensor symbol indicates the status of the calibrated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

**Power supply**

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

**Sensors**

We supply the handylab pH/LF12 complete with a suitable pH combination electrode and conductivity sensor. The handylab multi 12 additionally includes an oxygen sensor.




**As a set**

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

# Technical data
# handylab pH/LF 12, handylab multi 12

| Parameters | | handylab pH/LF 12 | handylab multi 12 |
|---|---|---|---|
| **Measuring ranges** | | | |
| pH/mV | pH range/resolution | -2.00…+19.99 pH | -2.00…+19.99 pH |
| | accuracy (±1 digit) | ±0.01 pH | ±0.01 pH |
| | mV range/resolution | -1999…+1999 mV | -1999…+1999 mV |
| | accuracy (±1 digit) | ±1 mV | ±1 mV |
| temperature | measuring range | -5.0…+105.0 °C | -5.0…+105.0 °C |
| | manual setting | -20…+130 °C | -20…+130 °C |
| oxygen | concentration: ranges/resolution | - | 0.00…19.99 mg/l/0…90.0 mg/l |
| | saturation: ranges/resolution | - | 0.00…199.9 %/0.0…600 % |
| | accuracy (±1 digit) | - | ±0.5 % of measured value |
| | temp. compensation, automatically | - | 0.0…50.0 °C |
| conductivity | 4 ranges/Auto range | 1 µS/cm…500 mS/cm | 1 µS/cm…500 mS/cm |
| | salinity acc. to IOT table | 0.0…70.0 | 0.0…70.0 |
| | accuracy (±1 digit) | ±0.5 % of measured value | ±0.5 % of measured value |
| | temperature compensation modes | linear, nonlinear, no compensation | nonlinear |
| | cell constant, calibrate | 0.450…0.500 | 0.450…0.500 |
| drift control | deactivatable | yes | yes |
| sensor evaluation | by symbol on display | yes | yes |
| **Calibration** | | | |
| pH | technical (2.00/4.00/7.00/10.01)*) | 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 | | 1…999 days | 1…999 days |
| calibration data store | | yes | yes |
| real time clock | integrated with time/date | yes | yes |
| **Serial interface** | | | |
| type | | RS 232, bi-directional | RS 232, bi-directional |
| baud rate | | adjustable | adjustable |
| **Data storage** | | | |
| storage by depression of key | | 500 data records | 500 data records |
| time controlled storage | in 7 levels (5 sec...60 min) | 500 data records | 500 data records |
| **Input** | | | |
| pH/redox-electrode (opt. with temperature sensor) | | socket 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 RS-232 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…+55 °C | -10…+55 °C |
| relative humidity (annual average) | | < 90 % | < 90 % |
| **Power supply** | | | |
| battery operated | | 4 x 1.5 V mignon cells (type AA) | 4 x 1.5 V mignon cells (type AA) |
| battery life time (data remain when changing batteries) | | approx. 2,500 h | approx. 2,500 h |
| automatic switch off at battery operation | | 60 min | 60 min |
| power supply (no akku) | | optionally | optionally |
| **Housing** | | ABS, water-tight key pad | ABS, water-tight key pad |
| dimensions (H x W x D) | | 172 mm x 80 mm x 37 mm | 172 mm x 80 mm x 37 mm |
| weight | | approx. 0.3 kg | approx. 0.3 kg |
| **Display** | | | |
| LCD multi-function display | | 60 mm x 45 mm | 60 mm x 45 mm |
| **Instrument safety** | protection class | 3, EN 61010-1 | 3, EN 61010-1 |
| | protection type | IP 66, EN 60529 | IP 66, EN 60529 |
| approvals/marks of conformity | | cETLus, CE | cETLus, CE |
| instrument warranty | | 3 years | 3 years |

*) SCHOTT Instruments

# Order overview handylab pH meters, conductivity meters and oxygen meters

| pH meters | Type no. | Order no. |
|---|---|---|
| handylab pH 11, individual meter | handylab pH 11 | 28 520 2871 |
| handylab pH11, individual meter with carrying case | handylab pH 11/K | 28 520 2863 |
| handylab pH 11, case set, complete, ready to use with pH combination electrode BlueLine 23 pH, calibration solutions and plastic beakers | handylab pH 11/23 pH | 28 520 2917 |
| handylab pH 11, case set, complete, ready to use with pH combination electrode BlueLine 24 pH, calibration solutions and plastic beakers | handylab pH 11/24 pH | 28 520 2982 |
| handylab pH 11, case set, complete, ready to use with pH combination electrode BlueLine 14 pH, calibration solutions and plastic beakers | handylab pH 11/14 pH | 28 520 2999 |
| handylab pH 12, individual meter | handylab pH 12 | 28 520 2896 |
| handylab pH12, individual meter with carrying case | handylab pH 12/K | 28 520 2888 |
| handylab pH 12, case set, complete, ready to use with pH combination electrode BlueLine 24 pH, calibration solutions and plastic beakers | handylab pH 12/24 pH | 28 520 3054 |
| handylab pH 12, case set, complete, ready to use with pH combination electrode BlueLine 14 pH, calibration solutions and plastic beakers | handylab pH 12/l4 pH | 28 520 3062 |
| **Conductivity meters** | | |
| handylab LF 11, individual meter | handylab LF 11 | 28 520 3292 |
| handylab LF11, individual meter with carrying case | handylab LF 11/K | 28 520 3276 |
| handylab LF11, case set, complete, ready to use with 4-pole conductivity cell LF 413T, calibration solutions and plastic beaker | handylab LF 11/413 T | 28 520 3310 |
| handylab LF 11, case set, complete, ready to use with 2-pole conductivity cell LF 513 T, calibration solutions and plastic beaker | handylab LF 11/513 T | 28 520 3321 |
| handylab LF 11, case set, 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, individual meter | handylab LF 12 | 28 520 3362 |
| handylab LF12, individual meter with carrying case | handylab LF 12/K | 28 520 3354 |
| handylab LF12, case set, 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 set, complete, ready to use with 4-pole conductivity cell LF 613 T, calibration solutions and plastic beaker | handylab LF 12/613 T | 28 520 3379 |
| **Oxygen meter** | | |
| handylab OX12, individual meter with carrying case | handylab LF 12/K | 106 3835 |
| handylab OX 12, case set, complete, ready to use with oxygen sensor 9009/61, calibration and maintenance accessories | handylab OX12-Set | 28 520 2793 |

# Order overview handylab multi-parameter portable meters

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

*Subject to technical changes.*
*DURAN® is a trademark of the SCHOTT AG, Mainz, Germany.*

The ideal set for reliable measuring results:
**Electrodes and meters**
from SCHOTT Instruments

# Contents laboratory electrodes

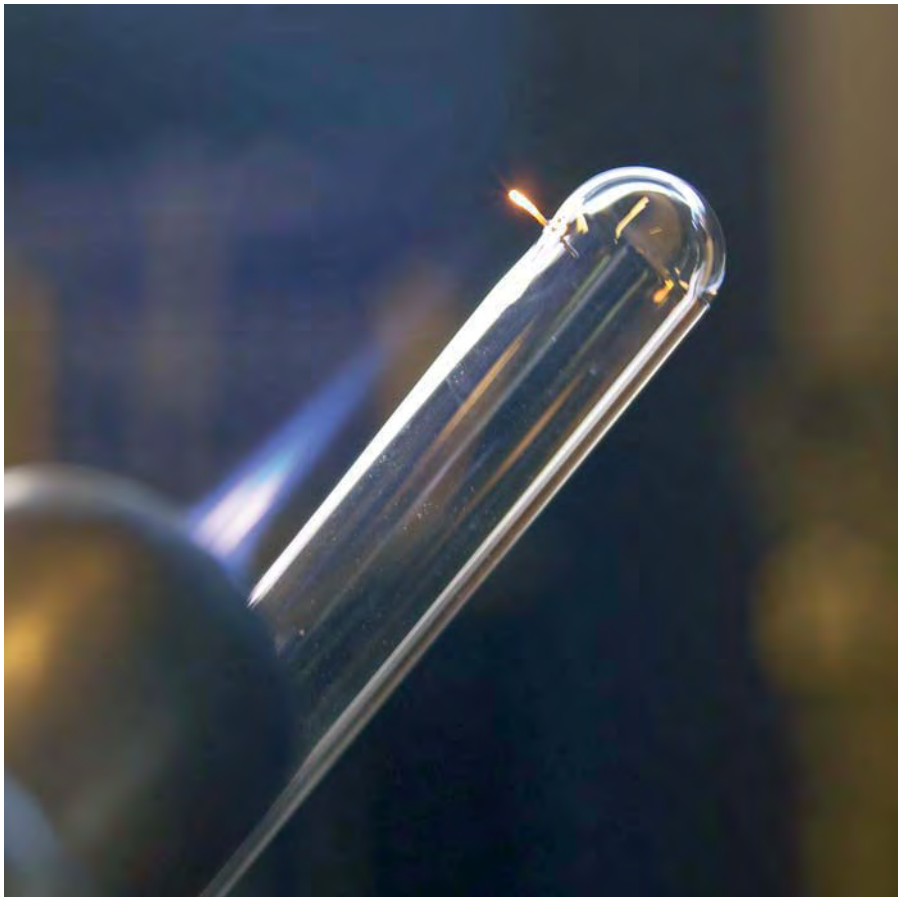
# Laboratory electrodes from SCHOTT Instruments: application orientated and perfectly matching

The standards for modern pH measurement are very high regarding precision, reproducibility, speed, comfortable handling and reliability. Every measurement is different. Different compositions, temperatures, conductivities and viscosities of samples and different measuring conditions make for a million of different applications. Only application orientated and perfectly matching systems of electrodes, meters and buffer solutions can meet these standards. Our concern at SCHOTT Instruments is to supply such systems.

The pH electrode is a very important part of the system as it comes in direct contact with the sample and delivers the measurement signal. For more than 70 years our focus has been set on the electrode and we have dedicated ourselves to the development and manufacturing of glass electrodes. For a remarkable long time our electrodes are being used for the most demanding tasks in labs throughout the world where quality really matters, and our customers benefit from this know-how.


*The glassmaker's skill is as important as ever: Our first instruction booklet appeared in 1938. In those days the electrochemical pH measuring and the potentiometric titration still needed to be explained.*

It all started with a patent on pH electrodes – today it is a range of several hundred different sensors. Our electrode programme comprising the three product families BlueLine, ScienceLine and IoLine is as manifold as your applications. Whether for ultrapure water, jam, wine, creme or drinking water, SCHOTT Instruments offers the right electrode for every conceivable use.



*Even today glass blowing talent is still indispensable.*

# BlueLine

### Attractive shape, reliable function

The compact BlueLine range is a basic series comprising electrodes for the usual laboratory applications which makes the user's choice easier.

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 diaphragm.

The BlueLine family comprises the robust electrodes with gel electrolyte and plastic shaft for general use, the liquid-electrolyte sensors for more critical measurements and special sensors. The gel and the liquid electrolyte sensors are available with different connections (e.g. plug head or fixed cable with either DIN or BNC type plug) and with different cable lengths and optionally with built-in temperature sensors (NTC 30 kΩ or Pt 1000). The special electrodes range includes pH electrodes for surface measurements, for small sample amounts, for ultrapure water and emulsions or measurements in semi-solid samples (insert measurements).



- **Compact basic series**
  for the usual applications, made from the universal A-type membrane glass
- **Comfortable handling, stylish design and reliable function**
- **Gel electrolyte, liquid electrolyte and special sensors**
- **Liquid electrolyte electrodes with unique platinum diaphragm and refill port slider**
- **Each electrode with individual serial number**

Advantages
BlueLine

# ScienceLine

## The proven high end laboratory electrodes

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

The ScienceLine electrodes from SCHOTT Instruments guarantee not only high measurement accuracy and stability and a long service life, but are highly adaptable to your measuring tasks. Today we can offer you a range of electrodes unmatched in versatility and quality.


**Here are some examples:**

- pH electrodes with a length of up to 600 mm for measurements in very deep vessels
- On the other hand, the N 6003 electrode allows pH measurements even in NMR tubes or other small sample vessels. Likewise, the A 157 is a micro electrode with an integrated temperature sensor with only 5 mm in diameter.
- For more demanding media, you can choose among different diaphragms and membrane glasses. For measurements in samples low on ions, you have the choice between the N 64 and A 164. Both types feature a ground joint diaphragm, and the A 164 additionally even a temperature sensor.
- A wide selection of separate reference and glass electrodes completes the programme.

The faster and more stable display of the measured value under critical circumstances with Science Line electrodes, as well as their longer lifespan are due to their Silamid reference system. In contrast to a chlorinated silver wire, as it is used in the silver/silver chlorine reference system of the BlueLine series, the ScienceLine employs discharge cartridges. The silver coating of the inner tube makes for a five times larger silver surface compared to the silver wire. Hence, the stability of the potential is much higher.

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

Advantages
ScienceLine

# IoLine pH electrodes
# for the most demanding measuring 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 measuring instabilities originating from potential variations with changing temperatures or reactions between the silver ions and the measuring solution in the area of the diaphragm.

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:

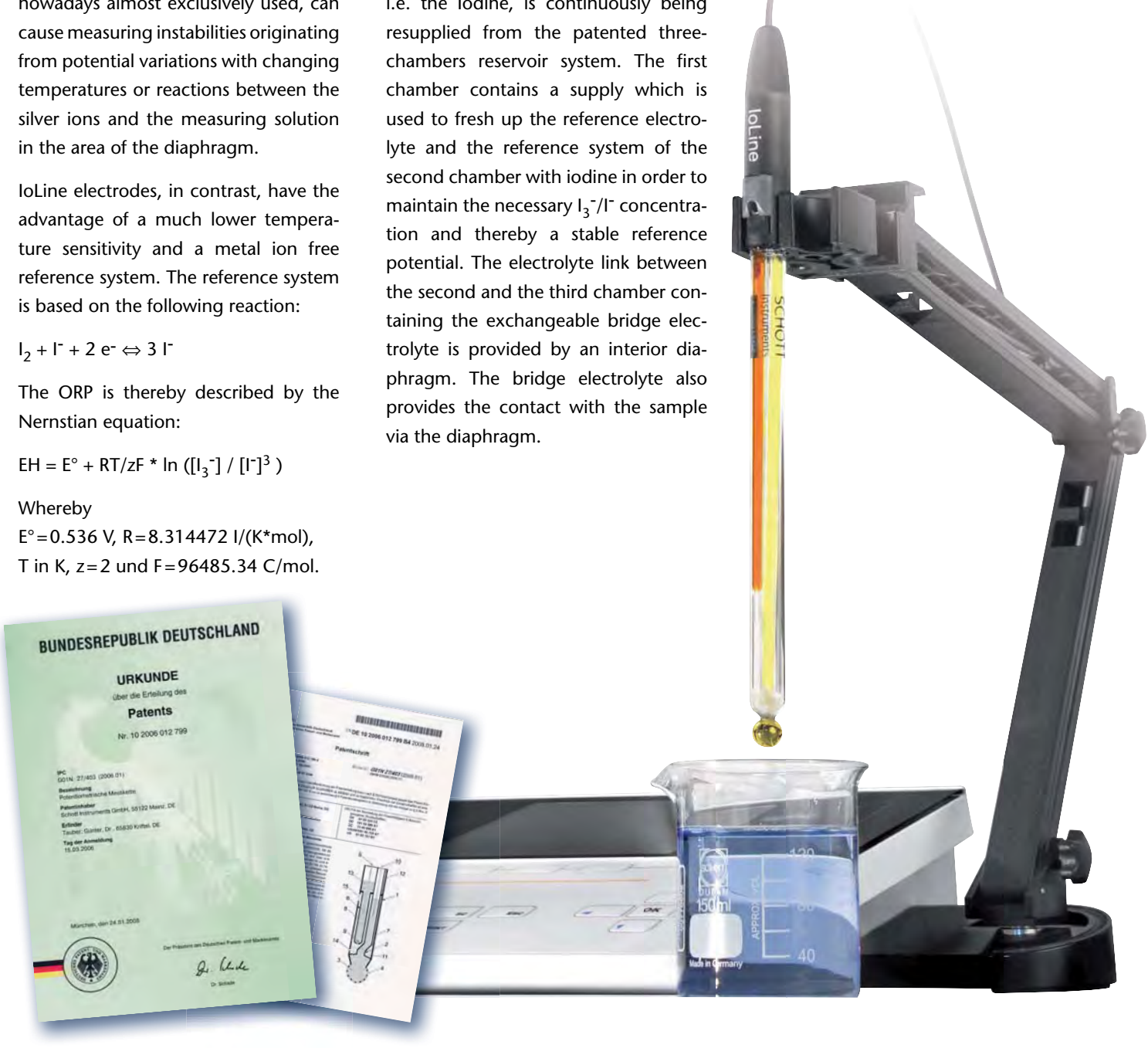
$EH = E° + RT/zF * \ln([I_3^-] / [I^-]^3)$

Whereby
$E° = 0.536$ V, $R = 8.314472$ I/(K*mol),
T in K, $z = 2$ und $F = 96485.34$ 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 and, additionally, higher accuracy compared to conventional Ag/AgCl electrodes.

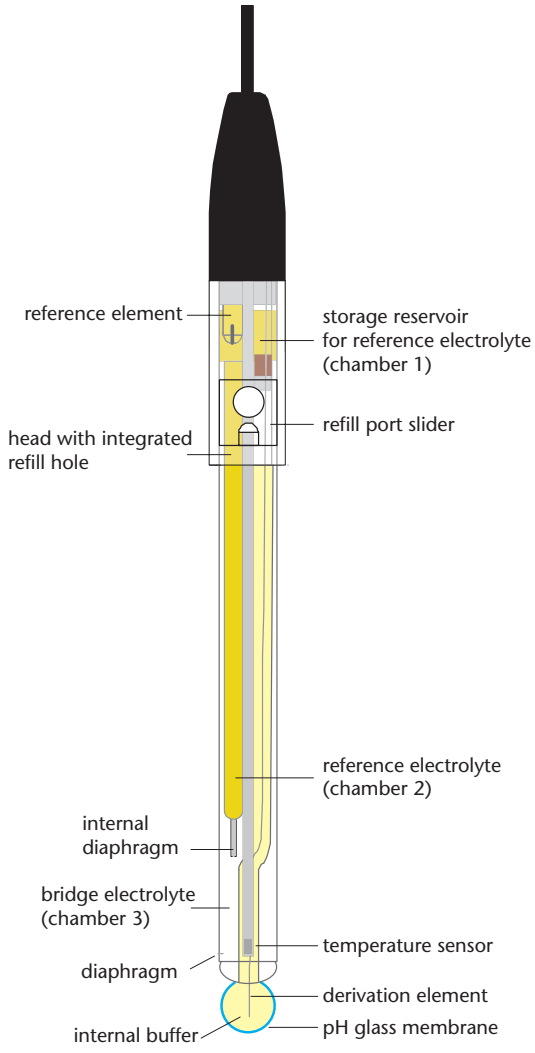
A further advantage is the fact that the component determining the potential, i.e. the Iodine, is continuously being resupplied from the patented three-chambers reservoir system. The first chamber contains a supply which is used to fresh up the reference electrolyte and the reference system of the second chamber with iodine in order to maintain the necessary $I_3^-/I^-$ concentration and thereby a stable reference potential. The electrolyte link between the second and the third chamber containing the exchangeable bridge electrolyte is provided by an interior diaphragm. The bridge electrolyte also provides the contact with the sample via the diaphragm.

The interior diaphragm is designed to allow only a minimal diffusion of $I_3^-/I^-$ (Tri-iodide/Iodide) into the bridge electrolyte. Hence, the iodine consumption in the reference electrolyte is very low and needs only very little re-supplying from the first chamber. The supply is practically unlimited and guarantees a high stability of the potential and a long lifespan of the IoLine electrodes.



## Platinum diaphragm for fast response and high stability

Further responsible for the high stability and fast response of the iodine/iodide reference system is the platinum diaphragm, which has been developed by SCHOTT. The platinum diaphragm makes for remarkably constant and reproducible measuring characteristics of the electrode. It 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**
  in connection with the patented three-chambers reservoir system including the large iodine reservoir offering unbeatable stability, fast response times and high accuracy at a higher speed compared to the electrodes with the usual Ag/AgCl reference system. Furthermore independent from sample composition and temperature.
- **100% metal ion free reference system**
  avoids the measuring media of being contaminated by metal ions i.e. optimal for measurements in Tris buffer.
- **Exchangeable bridge electrolyte**
  enables a matching of electrolyte solution and measuring sample.
- **Wide application area**
  Ideal for most precise pH measurements in manifold media for research and quality control i.e. in pharmacy, biotechnology or food industry.
- **Electrode head with integrated refill port**
  enables an easy refilling of the reference system in connection with the refill port slider.
- **Manifold selection:**
  Many variants regarding the connection, the membrane glass types and shapes as well as diaphragms.
- **Extensive delivery scope:**
  Liquid vessel with bayonet connector to avoid drying out and for comfortable storage of the electrode and certificate are included in the delivery scope.

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 connecting 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. Regarding the ScienceLine and IoLine pH electrodes there is special attention to be drawn to the versions N 62 and H 62 as well as to IL-pH-A120MF and IL-pH-H120MF; these models are also available with larger shaft lengths.

An extension of length under the same application conditions delivers faster and more stable measuring results; additionally it enables a longer lifespan of the electrode. The higher electrolyte stand along with the increased electrolyte outflow reduces unwanted diffusion potentials on the diaphragm and rinses it free.

Some applications may require other electrode recommendations due to certain operation 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 of our catalogue. Please contact us via telephone, fax or email whenever you cannot find your application or have any queries regarding certain operation conditions.

# … and conductivity cells

| Application area | Application | Sensor example | IoLine | | | | pH measuring ScienceLine | | | | | | | | | | | | BlueLine | | | | | | ORP ScienceLine | | | | | BL* | | Conductivity ScienceLine | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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 | Ag 6280 | 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 |
| 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 | 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 | Ag 6280 | 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

# Further application recommendations for pH

| Application area | Application | Sensor example | IoLine | | | | pH measuring ScienceLine | | | | | | | | | | | | BlueLine | | | | | | ORP ScienceLine | | | | | BL* | | Conductivity ScienceLine | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 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 | Ag 6280 | 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 |
| Cosmetics | Creme | | ■ | | | ■ | | | | | ■ | | ■ | ■ | | ■ | ■ | | | ■ | | ■ | | ■ | ■ | | ■ | | | | ■ | | | | ■ | ■ | | |
| | Hair dye | | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | | | ■ | | | | ■ | | | | ■ | ■ | | |
| | Hair gel | | ■ | | | ■ | | | | | ■ | | ■ | ■ | | | ■ | | | | | | | ■ | ■ | | ■ | | | | ■ | | | | ■ | | | |
| | Hair mousse | | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | | | ■ | | | | ■ | | | | ■ | ■ | | |
| | Lotions | | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | | | ■ | | | | ■ | | | | ■ | ■ | | |
| | Make-up | | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | ■ | | ■ | | | | ■ | | | | | ■ | | |
| | Mouth wash | | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | | | ■ | | | | ■ | | | | ■ | ■ | | |
| | Shaving foam | | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | | | ■ | | | | ■ | | | | ■ | ■ | | |
| | 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-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 | Ag 6280 | 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*

# … ORP electrodes and conductivity cells

| Electrode series | | IoLine | | | | pH measuring ScienceLine | | | | | | | | | | | | BlueLine | | | | | | ORP ScienceLine | | | | | BL* | | Conductivity ScienceLine | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Application area | Sensor example | IL-pH-A 120MF | IL-pH-H 120MF | 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 | Ag 6280 | 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 |
| | Application | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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 | ■ | | | | | | | | | | | | | ■ | ■ | | | ■ | | ■ | | | | | ■ | | | | ■ | | | | ■ | ■ | |
| | Tenside 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-A 120MF | IL-pH-H 120MF | 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 | Ag 6280 | 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 of utmost accuracy with matching systems from SCHOTT Instruments

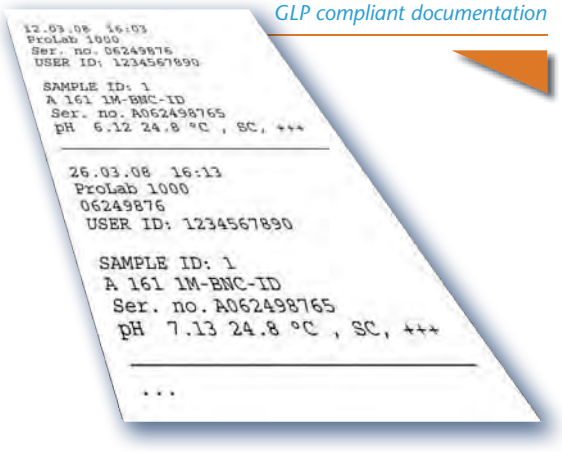
The demand for accuracy, reproducibility and primarily the stability of the pH measurement is exceedingly high. It has become even more important to have an application focussed measuring system at hand, consisting of electrodes, measuring instrument and buffer solutions, as each measurement is unique. SCHOTT Instruments has taken this into account and hence 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 for example the automatic buffer recognition. Still the uncertainty regarding the electrode remained, not knowing for sure if the connected electrode was the one matching the calibration data stored with the instrument. For assuring that the electrode's slope and zero point corresponded to the instrument stored data for calculating the pH value it was necessary to calibrate once more.

The Lab 870 and 970 and the instruments belonging to the ProLab family can recognize the ID electrodes automatically – making the wishes of all quality control reality. The electrode recognition works with especially for this purpose developed ID sensors. Individual sensor data is now transferred to the instrument automatically and wireless thanks to a tiny transponder integrated in the cable plug. The sensor data with pH electrodes is for example the slope and zero point, data of last calibration, buffer used as well as sensor type and serial number. The measuring instrument always uses this specific data for each corresponding ID electrode in order to calculate the pH value out of the measured mV, regardless 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 afresh with the Lab 870/970 or the ProLabs, the data on the electrode are accordingly updated. The instrument will recognize and access the data with the next measurement. This process runs in the background without any interaction of the user. The result shows stable measurements and no necessity for repeated calibrations when changing the sensor.

### Records include sensor type and serial number

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

- **Each ID sensor with unique identification.**
- **Qualified quality**
- **Highest comfort** – data exchange between sensor and instrument runs fully automatic in the background.
- Several ID sensors can interact with one instrument and one ID sensor can interact with multiple instruments via recognition, **without having to calibrate at every changing process.**
- **Accurate and safe measurements** through continuous usage of sensor specified data.
- **GLP at its best:** Automatic and complete documentation of calibrations and measurements including the used electrode (model and serial number) with date, time and measuring values.

## Advantages ID

# ID electrodes for highest safety

## ... 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 ... 14
**Reference system**[1)]: iodine/iodid, Silamid®, Ag/AgCl
**Reference electrolyte**: KCl 3 mol/l
**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-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 additionally with oxygen measurement


**LF 213 T-ID**

**LF 313 T-ID**

**LF 413 T-ID**

**LF 913 T-ID**

**LFOX 1400 ID***

# A selection of the SCHOTT Instruments ID electrodes programme

## 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 … 14 (except BlueLine 21 and 27: 1 … 13 pH)
**Reference system**[1]**:** iodine/iodid, 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**
*IL-Micro-pHT-A-BNC-N*

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

**N 1048 1M-DIN-ID**
*N 1048 1M-BNC-ID*

**L 39 1M-DIN-ID**
*L 39 1M-BNC-ID*

**N 6000 1M-DIN-ID**
*N 6000 1M-BNC-ID*

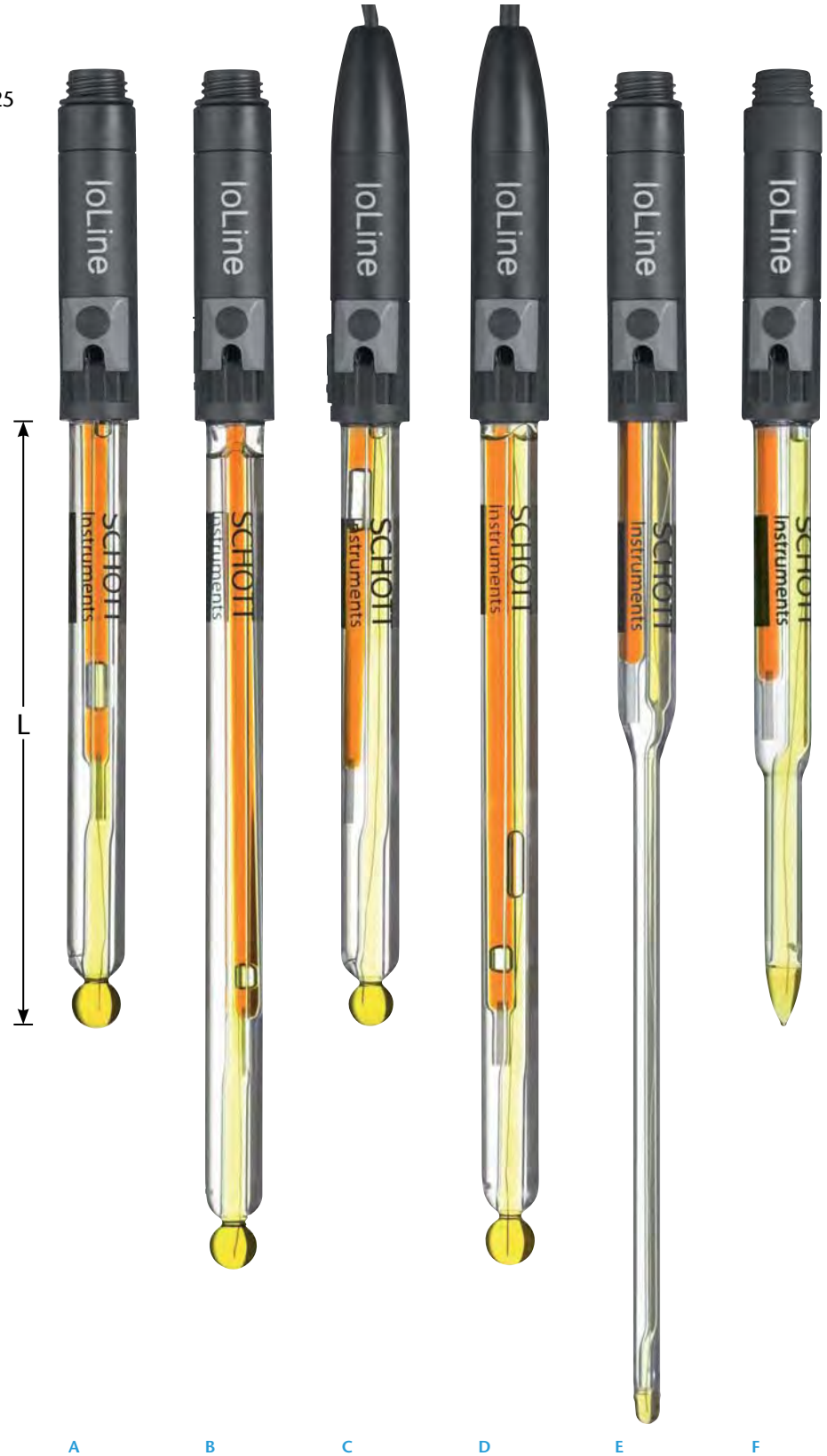
**BlueLine 21 pH 1M-DIN-ID**
*BlueLine 21 pH 1M-BNC-ID*

**BlueLine 27 pH 1M-DIN-ID**
*BlueLine 27 pH 1M-BNC-ID*

# IoLine pH combination electrodes

## pH combination electrodes

**Reference system:** iodine/iodide
**Zero point:** pH = 7,00 ±0.25
**pH range:** 0 … 14
**Temp. range:** -5 … 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-A120-BNC*

**D** **IL-pH-A170-MF-DIN**
*IL-pH-A170-DIN*
*IL-pH-A170-MF-BNC*
*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 diaphragm (multi-flow) |
| **DIN** | DIN instrument plug |
| **BNC** | BNC instrument plug |
| **N** | 4 mm banana plug |
| **CI** | cinch plug |

| Type No. | Order No. | Length L [mm] | Ø [mm] | Dia-phragm | 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 | 170 (130/40) | 12/6 | platinum | A | 400 MΩ | cylindrical | Screw plug head S7 | ■ | E |
| IL-MICRO-pH-A-DIN | 285113930 | 170 (130/40) | 12/6 | platinum | A | 400 MΩ | cylindrical | DIN[1)] | ■ | E |
| IL-MICRO-pH-A-BNC | 285114290 | 170 (130/40) | 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 | Screw plug head S7 | ■ | F |
| IL-SP-pH-A-BNC | 285114330 | 120 (50/70) | 12/8 | ceramic | A | 400 MΩ | spear | Screw plug head S7 | ■ | F |

■ general applications, low ion media

■ small sample quantities

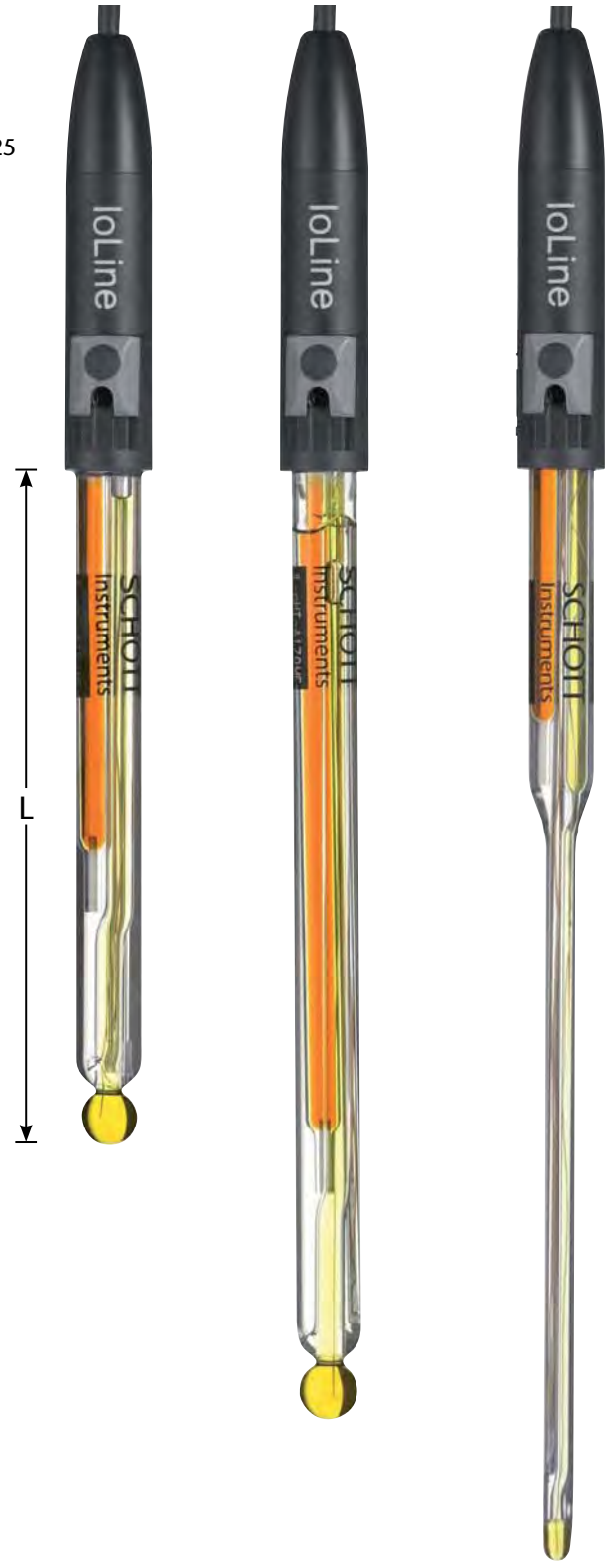
■ insert measurement

[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 … 14
**Temp. range:** -5 … 100 °C
**Shaft material:** glass




**A** **IL-pHT-A120MF-DIN-N**
*IL-pHT-A120-DIN-N*
*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-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 diaphragm (multi-flow) |
| **DIN** | DIN instrument plug |
| **BNC** | BNC instrument plug |
| **N** | 4 mm banana plug |
| **CI** | cinch plug |

| Type No. | Order No. | Length L [mm] | Ø [mm] | Dia-phragm | 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 | | Methrom 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 | | Methrom plug + 2 banana plug | ■ | B |
| IL-MICRO-pHT-A-DIN-N | 285114300 | 170 (130/40) | 12/6 | platinum | A | 400 MΩ | cylindrical | Pt 1000 | yes | DIN + banana plug | ■ | C |
| IL-MICRO-pHT-A-BNC-N | 285114310 | 170 (130/40) | 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 .. .14
**Connection cable for plug head:** e.g. L 1 A (See also page with connection cables)
**fixed cable:** 1 m long, with plug A acc. to DIN 19262 or with BNC plug


**H 61**
*H 62*
*H 63*
*N 61*
*N 62*
*H 6180*
*H 6280*
*H 6380*
*N 6180*
*N 6250*
*N 6280*
*N 42 A*
*N 42 BNC*
*N 50 A*
*N 52 A*
*N 52 BNC*
*N 61 eis*
*H 61-500*
*H 61-600*

**H 64**
*H 64 1M-DIN-ID*
*H 64 1M-BNC-ID*
*N 64*
*N 6480 eis*
*N 6480 eth*

**N 65**
*H 65*
*H 6580*
*N 6580*

**L 32**

**A 7780**
*L 7780*

**N 6980**

**L 8280**

| Order No. | Type No. | Length L [mm] | Ø [mm] | Dia-phragm | pH-glass | Temp. range [°C] | Connection | Remarks |
|---|---|---|---|---|---|---|---|---|
| 285101260 | A 7780 | 120 | 12 | 3 x ceramic | A | -5 … +80 | plug head | gel electrolyte |
| 285100207 | H 61 | 170 | 12 | platinum | H | +10 … +100 | plug head | |
| 285092583 | H 61-500 | 500 | 12 | platinum | H | 0...+100 | plug head | |
| 285092591 | H 61-600 | 600 | 12 | platinum | H | 0...+100 | plug head | |
| 285102524 | H 6180 | 170 | 12 | ceramic | H | +10 … +100 | plug head | |
| 285100215 | H 62 | 120 | 12 | platinum | H | +10 … +100 | plug head | |
| 285102532 | H 6280 | 120 | 12 | ceramic | H | +10 … +100 | plug head | |
| 285100223 | H 63 | 320 | 12 | platinum | H | +10 … +100 | plug head | |
| 285102549 | H 6380 | 320 | 12 | ceramic | H | +10 … +100 | plug head | |
| 285100231 | H 64 | 170 | 12 | ground joint | H | +10 … +100 | plug head | |
| 285130220 | H 64 1M-DIN-ID | 170 | 12 | ground joint | H | +10 … +100 | DIN plug[2)] | ID function |
| 285130230 | H 64 1M-BNC-ID | 170 | 12 | ground joint | H | +10 … +100 | BNC plug[2)] | ID function |
| 285100248 | H 65 | 103[1)] | 10 | platinum | H | +10 … +100 | plug head | standard taper NS 14.5 |
| 285102565 | H 6580 | 103[1)] | 10 | ceramic | H | +10 … +100 | plug head | standard taper NS 14.5 |
| 1061093 | L 32 | 120 | 12 | fibre | A | -5 … +50 | plug head | plastic shaft |
| 285101252 | L 7780 | 120 | 12 | ceramic | L | -5 … +80 | plug head | gel electrolyte |
| 285101277 | L 8280 | 120 | 12 | KPG® | L | -5 … +80 | plug head | Referid® electrolyte |
| 285100437 | N 42 A | 120 | 12 | ceramic | A | -5 … +100 | DIN plug[2)] | |
| 285101544 | N 42 BNC | 120 | 12 | ceramic | A | -5 … +100 | BNC plug[2)] | |
| 285100453 | N 50 A | 108 | 12 | ceramic | A | -5 … +100 | DIN plug[2)] | for portable Knick pH meters |
| 285100494 | N 52 A | 120 | 12 | platinum | A | -5 … +100 | DIN plug[2)] | |
| 285105451 | N 52 BNC | 120 | 12 | platinum | A | -5 … +100 | BNC plug[2)] | |
| 285100001 | N 61 | 170 | 12 | platinum | A | -5 … +100 | plug head | |
| 285100018 | N 6180 | 170 | 12 | ceramic | A | -5 … +100 | plug head | |
| 285100034 | N 62 | 120 | 12 | platinum | A | -5 … +100 | plug head | |
| 285100112 | N 6250 | 120 | 12 | ceramic | A | +15 … +40 | plug head | calomel ref., for TRIS buffers |
| 285100042 | N 6280 | 120 | 12 | ceramic | A | -5 … +100 | plug head | |
| 285100059 | N 64 | 170 | 12 | ground joint | A | -5 … +100 | plug head | |
| 285100067 | N 65 | 103[1)] | 10 | platinum | A | -5 … +100 | plug head | standard taper NS 14.5 |
| 285102516 | N 6580 | 103[1)] | 10 | ceramic | A | -5 … +100 | plug head | standard taper NS 14.5 |
| 285101709 | N 6980 | 103[1)] | 10 | ground joint | A | -5 … +100 | plug head | standard taper NS 14.5 |
| 285092661 | N 61eis | 170 | 12 | 3 x platinum | A | +10 … +40 | plug head | electrolyte L 5014, Ag/AgCl ref. |
| 285092337 | N 6480 eis | 170 | 12 | ground joint | A | +10 … +40 | plug head | electrolyte L 5014, Ag/AgCl ref. |
| 285092329 | N 6480 eth | 170 | 12 | ground joint | A | 0 … +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 … 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] | Dia-phragm | pH-glass | Temp.-range [°C] | Connection | Remarks |
|---|---|---|---|---|---|---|---|
| 285129517 | A 161 | 170 | platinum | A | -5 … +100 | SMEK plug head | |
| 285130240 | A 161 1M-DIN-ID | 170 | platinum | A | -5 … +100 | DIN[1)]- + 4-mm plug | ID function |
| 285130250 | A 161 1M-BNC-ID | 170 | platinum | A | -5 … +100 | BNC[1)]- + 4-mm plug | ID function |
| 285129525 | A 162 | 120 | platinum | A | -5 … +100 | SMEK plug head | |
| 285129600 | A 164 | 170 | ground joint | A | -5 … +100 | SMEK plug head | |
| 285130280 | A 164 1M-DIN-ID | 170 | ground joint | A | -5 … +100 | DIN[1)]- + 4-mm plug | ID function |
| 285130290 | A 164 1M-BNC-ID | 170 | ground joint | A | -5 … +100 | BNC[1)]- + 4-mm plug | ID function |
| 285130200 | A 7780 1M-DIN-ID | 120 | 3 x ceramic | A | -5 … +80 | DIN-[1)] + 4-mm plug | ID function |
| 285130210 | A 7780 1M-BNC-ID | 120 | 3 x ceramic | A | -5 … +80 | BNC-[1)] + 4-mm plug | ID function |
| 285129590 | H 161 | 170 | platinum | H | +10 … +100 | SMEK plug head | |
| 285130260 | H 161 1M-DIN-ID | 170 | platinum | H | +10 … +100 | DIN[1)]- + 4-mm plug | ID function |
| 285130270 | H 161 1M-BNC-ID | 170 | platinum | H | +10 … +100 | BNC[1)]- + 4-mm plug | ID function |
| 285129580 | H 162 | 120 | platinum | H | +10 … +100 | SMEK plug head | |
| 285100486 | N 1041 A | 170 | ceramic | A | -5 … +100 | DIN-[1)] + 4-mm plug | |
| 285093111 | N 1041 A-600 | 600 | ceramic | A | -5...+100 | DIN-[1)] + 4-mm plug | Ag/AgCl ref. |
| 285100531 | N 1041 BNC | 170 | ceramic | A | -5 … +100 | BNC-[1)] + 4-mm plug | |
| 285104541 | N 1042 A | 120 | ceramic | A | -5 … +100 | DIN-[1)] + 4-mm plug | |
| 285105476 | N 1042 BNC | 120 | ceramic | A | -5 … +100 | BNC-[1)] + 4-mm plug | |
| 285093009 | N 1043 A | 320 | ceramic | A | -5...+100 | DIN-[1)] + 4-mm plug | |
| 285100375 | N 1050 A | 108 | ceramic | A | -5 … +100 | DIN-[1)] + 4-mm plug | for portable Knick pH Meter |
| 285100510 | N 1051 A | 170 | platinum | A | -5 … +100 | DIN-[1)] + 4-mm plug | |
| 285100500 | N 1051 BNC | 170 | platinum | A | -5 … +100 | BNC-[1)] + 4-mm plug | |
| 1054512 | N 1052 A | 120 | platinum | A | -5 … +100 | DIN-[1)] + 4-mm plug | |
| 285100380 | N 1052 BNC | 120 | platinum | A | -5 … +100 | BNC-[1)] + 4-mm plug | |
| 285100342 | N 2041 A | 170 | ceramic | A | -5 … +100 | DIN-[1)] + 2-mm plug | |
| 285100359 | N 2042 A | 120 | ceramic | A | -5 … +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] | Dia-phragm | pH-glass | Membrane shape | Temp.-range [°C] | Range [pH] | Connection | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| **Micro** | | | | | | | | | | |
| 285129610 | A 157[1)] | 40/130 | 12/5 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | SMEK plug head | |
| 285130160 | A 157 1M-DIN-ID[1)] | 40/130 | 12/5 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | DIN plug[3)] | ID function |
| 285130170 | A 157 1M-BNC-ID[1)] | 40/130 | 12/5 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | BNC plug[3)] | ID function |
| 285105127 | N 5800 A | 96[2)] | 5 | 3 x platinum | A | spear | -5 … +100 | 0 … 14 | DIN plug[3)] | Ag/AgCl ref. |
| 285105579 | N 5800 BNC | 96[2)] | 5 | 3 x platinum | A | spear | -5 … +100 | 0 … 14 | BNC plug[3)] | Ag/AgCl ref. |
| 285105135 | N 5900 A | 96[2)] | 5 | platinum | A | sphere | -5 … +100 | 0 … 14 | DIN plug[3)] | Ag/AgCl ref. |
| 285105151 | N 6000 A | 96[2)] | 3 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | DIN plug[3)] | Ag/AgCl ref. |
| 285105632 | N 6000 BNC | 96[2)] | 3 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | BNC plug[3)] | Ag/AgCl ref. |
| 285130180 | N 6000 1M-DIN-ID | 96[2)] | 3 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | DIN plug[3)] | ID function, Ag/AgCl ref. |
| 285130190 | N 6000 1M-BNC-ID | 96[2)] | 3 | platinum | A | cylindrical | -5 … +100 | 0 … 14 | BNC plug[3)] | ID function, Ag/AgCl ref. |
| 285105176 | N 6003 | 180 | 3 | ceramic | A | cylindrical | -5 … +100 | 0 … 14 | plug head | Ag/AgCl ref. |
| **Spear tip** | | | | | | | | | | |
| 285101211 | L 6880 | 70/50 | 12/8 | 3 x ceramic | A | spear | -5 … +100 | 0 … 14 | plug head | |
| 285130100 | L 6880 1M-DIN-ID | 70/50 | 12/8 | 3 x ceramic | A | spear | -5 … +100 | 0 … 14 | DIN plug[3)] | ID function |
| 285130110 | L 6880 1M-BNC-ID | 70/50 | 12/8 | 3 x ceramic | A | spear | -5 … +100 | 0 … 14 | BNC plug[3)] | ID function |
| 285101285 | L 8880 | 70/50 | 12/8 | hole | A | spear | -5 … +80 | 2 … 13 | plug head | |
| 285104611 | N 1048 A[1)] | 120 | 12 | ceramic | A | spear | -5 … +100 | 0 … 14 | DIN-[3)] + 4-mm plug | |
| 285130120 | N 1048 1M-DIN-ID[1)] | 120 | 12 | ceramic | A | spear | -5 … +100 | 0 … 14 | DIN-[3)] + 4-mm plug | ID function |
| 285130130 | N 1048 1M-BNC-ID[1)] | 120 | 12 | ceramic | A | spear | -5 … +100 | 0 … 14 | BNC-[3)] + 4-mm plug | ID function |
| 285100445 | N 48 A | 120 | 12 | ceramic | A | spear | -5 … +100 | 0 … 14 | DIN plug[3)] | |
| 285101569 | N 48 BNC | 120 | 12 | ceramic | A | spear | -5 … +100 | 0 … 14 | BNC plug[3)] | |
| **Surface** | | | | | | | | | | |
| 1061094 | L 39 | 120 | 12 | fibre | A | flat | -5 … +50 | 1 … 13 | plug head | |
| 285130140 | L 39 1M-DIN-ID | 120 | 12 | fibre | A | flat | -5 … +50 | 1 … 13 | DIN plug[3)] | ID function |
| 285130150 | L 39 1M-BNC-ID | 120 | 12 | fibre | A | flat | -5 … +50 | 1 … 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 plug head and connection cable

**Temperature range:** -5 … +100 °C (except Pt 6140: +10 … +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


**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*

| Order No. | Type No. | Length L [mm] | Dia-phragm | 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 | KPC® | 12 | Pt, round, 6 mm Ø | plug head | electrolyte Referid® |

[1] Length from upper end of standard taper; standard taper NS 14.5
[2] Length from upper end of standard taper; standard taper NS 7.5
[3] Sensor coated with AgCl
[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[)] | 120 | H | 0 … 14 | 0 … +80 | plug head |
| 285103212 | H 1180 | 120 | H | 0 … 14 | 10 … +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 … +100 | plug head, cable e.g. L 1 A |
| 285102030 | KF 1100 | 96[1)] | Pt[2)] | 2 pole, 1 mm Ø | -30 … +135 | shaft 5 mm Ø, standard taper NS 7.5, fixed cable, 2x 4-mm plug |
| 285103512 | Pt 1200 | 120 | Pt[2)] | 2 pole, 1 mm Ø | -30 … +135 | plug head, cable e.g. L 1 NN |
| 285103537 | Pt 1400 | 103[1)] | Pt[2)] | 2 pole, 1 mm Ø | -30 … +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 … +135 | plug head, cable e.g. L 1 A |



[1)] Length from upper end of standard taper

[2)] Double platinum electrode

# ScienceLine single electrodes:
# Reference electrodes

## Reference electrodes

**Shaft material:** glass
**Electrolyte depending on reference system:**
Ag/AgCl: KCl 3 mol/l, e.g. L 300
Calomel: KCl 4.2 mol/l, e.g. L 420
**$Hg/Hg_2SO_4$:** $K_2SO_4$ 0.6 mol/l, e.g. L 1254
**pH range:** 0 … 14
**Connection cable:** e.g. L 1 N


**B 2220+**

**B 2420+**

**B 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] | Dia-phragm | Reference system | Remarks |
|---|---|---|---|---|---|---|---|
| 1069994 | B 2220+ | 120 | 12 | -5 … +100 | platinum | Ag/AgCl | double electrolyte system |
| 1070028 | B 2420+ | 120 | 12 | -5 … +100 | ground joint | Ag/AgCl | |
| 1070029 | B 2810+ | 120 | 12 | +15 … +40 | ceramic | Calomel | |
| 1070044 | B 2820+ | 120 | 12 | -5 … +100 | ceramic | Ag/AgCl | |
| 1070077 | B 2910+ | 120 | 12 | +15 … +40 | platinum | Calomel | |
| 1070046 | B 2920+ | 120 | 12 | -5 … +100 | platinum | Ag/AgCl | |
| 1070048 | B 3410+ | 103[1)] | 10 | +15 … +40 | ceramic | Calomel | standard taper NS 14.5 |
| 1070070 | B 3420+ | 103[1)] | 10 | -5 … +100 | ceramic | Ag/AgCl | standard taper NS 14.5 |
| 1070100 | B 3510+ | 103[1)] | 10 | +15 … +40 | platinum | Calomel | standard taper NS 14.5 |
| 1070073 | B 3520+ | 103[1)] | 10 | -5 … +100 | platinum | Ag/AgCl | standard taper NS 14.5 |
| 1070074 | B 3610+ | 103[1)] | 10 | +15 … +40 | ceramic | $Hg/Hg_2SO_4$ | standard taper NS 14.5 |
| 1070075 | B 3920+ | 103[1)] | 10 | -5 … +100 | ground joint | Ag/AgCl | double electrolyte system, standard taper NS 14.5 |



[1)] Length from upper end of standard taper

# ScienceLine conductivity measuring cells with fixed cable

## Conductivity measuring cells with fixed cable and 8-pole plug

**Shaft:** 12 mm Ø (except LF 413 T-3 and LF 413 T: 15.3 mm)

**Temperature sensor:** NTC 30 kΩ


**LF 213 T**
*LF 213 T ID*

**LF 313 T NTFC**
*LF 313 T*
*LF 313 T ID*

**LF 413 T-3**
*LF 413 T*
*LF 413 T ID*

**LF 513 T**
*LF 613 T*
*LF 813 T*

**LF 713 T**
*LF 713 T-250*

**LF 913 T**
*LF 913 T ID*

**LFOX 1400**
*LFOX 1400 ID*

| Order No. | Type No. | Length L [mm] | Ø [mm] | Sensor | Cell const. approx. [cm$^{-1}$] | Temp. range [°C] | Meas. range[1)] [µS/cm]. . .[mS/cm] | Remarks |
|---|---|---|---|---|---|---|---|---|
| 285106150 | LF 213 T | 120 | 12 | Stainless steel | 0.01 | 0 ... +100 | 0 … 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 ... +100 | 0 … 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 ... +100 | 0 … 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...+100 | 0 … 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 ... +100 | 0 … 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 … +80 | 1 … 2000 | Plastic shaft, 1.5 m cable |
| 285130310 | LF 413 T-ID | 120 | 15.3 | 4 x Graphite | 0.475 | -5 … +80 | 0 … 2000 | Plastic shaft, 1.5 m cable, ID function |
| 285106148 | LF 413 T-3 | 120 | 15.3 | 4 x Graphite | 0.475 | -5 … +80 | 1 … 2000 | Plastic shaft, fixed cable 3 m |
| 285106037 | LF 513 T | 120 | 12 | 2 Pt rings | 1.0 | -5 … +80 | 1 … 200 | Plastic shaft, 1 m cable |
| 285106131 | LF 613 T | 120 | 12 | 4 Pt rings | 1.0 | -5 … +80 | 1 … 2000 | Plastic shaft, 1 m cable |
| 285106189 | LF 713 T | 120 | 12 | 4 Pt rings | 1.0 | -30 … +135 | 1 … 2000 | Glass shaft, 1 m cable |
| 285106190 | LF 713 T-250 | 250 | 12 | 4 Pt rings | 1.0 | -30 … +135 | 1 … 2000 | Glass shaft, 1 m cable |
| 285106250 | LF 813 T | 120 | 12 | 5 Pt rings | 0.650 | -5 ... +80 | 1 … 2000 | Plastic shaft, 1 m cable |
| 285106260 | LF 913 T | 120 | 12 | 5 Pt rings | 0.650 | -30 ... +135 | 1 … 2000 | Glass shaft, 1 m cable |
| 285130320 | LF 913 T-ID | 120 | 12 | 5 Pt rings | 0.650 | -30 ... +135 | 1 … 2000 | 5-pole cell, glass shaft, 1 m cable, ID function |
| 285104630 | LFOX 1400 | 145 | 15.3 | Graphite | 0.475 | 0 ... +50 | 1 … 2000 | 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...+50 | 1 … 2000 | 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. approx. [$cm^{-1}$] | Temp. range [°C] | Meas. range[1] [µS/cm]. . .[mS/cm] | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1069976 | LF 1100+ | 120 | 12 | 2 Pt plates | 1.0 | -30 … 135 | 0 … 200 | SMEK plug head |
| 1069977 | LF 1100T+ | 120 | 12 | 2 Pt plates | 1.0 | -30 … 135 | 0 … 200 | SMEK plug head |
| 1069978 | LF 4100+ | 120 | 12 | 2 Pt plates | 1.0 | -30 … 135 | 0 … 200 | SMEK plug head, flow-through cell |
| 1069979 | LF 5100+ | 120 | 12 | 2 Pt rings | 1.0 | -5 … 80 | 0 … 200 | SMEK plug head, plastic shaft |
| 1069990 | LF 5100T+ | 120 | 12 | 2 Pt rings | 1.0 | -5 … 80 | 0 … 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 … +50 | 0.1 … 1,000 | membrane module replaceable |

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

| Order No. | Type No. | Length L [mm] | Temp. range [°C] | Meas. range [mg/l] | Remarks |
|---|---|---|---|---|---|
| 1069975 | OX 1100+ | 120 | 0 … +45 | 0 … 60 | galvanic sensor, Pt cathode, Ag anode, SMEK plug head, temperature compensated (NTC 100kΩ), shaft 12 mm Ø, measuring current at saturation approx. 100 nA, minimum flow rate 10 cm/s, connection cable e.g. LS 1 ST4 OX (for CG 867) |
| 285111664 | 9009/61 | 145 | 0 … +50 | 0 … 50 | amperometric sensor, Au cathode, Pb anode, fixed cable 1.5 m[1)] with 8-pole plug, IMT temperature compensation, shaft 15.25 mm 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 … +40 | 2.5 … 11 | 0.02 … 40,000 |
| 285216312 | Cu 1100 A | Copper | 0 … +80 | 2 … 6 | 0.0006 … 6,400 |
| 285216313 | F 1100 A | Fluoride | 0 … +80 | 5 … 7 | 0.02 … saturated |
| 285216315 | Pb 1100 A | Lead | 0 … +80 | 4 … 7 | 0.1 … 20,000 |

| Order No. | Type No. | Parameter | Temp. range [°C] | pH-range | Measuring range [mg/l] |
|---|---|---|---|---|---|
| 285130340 | F 60 | Fluoride | 0 … +80 | 5 … 7 | 0.02 … saturated |
| 285130350 | Cl 60 | Chloride | 0 … +80 | 2 … 12 | 2 … 35,000 |
| 285130360 | NO 60 | Nitrate | 0 … +40 | 2.5 … 11 | 0.4 … 62,000 |
| 285130370 | K 60 | Potassium | 0 … +40 | 2 … 12 | 0.04 … 39,000 |
| 285130380 | CA 60 | Calcium | 0 … +40 | 2.5 … 11 | 0.02 … 40.000 |
| 285130390 | CN 60 | Cyanide | 0 … +80 | 0 … 14 | 0.2 … 260 |
| 285130400 | AG-S 60 | Sulfide | 0 … +80 | 2 … 12 | 0.003 … 32,000 |
| 285130410 | I 60 | Iodide | 0 … +80 | 0 … 14 | 0.006 … 127,000 |
| 285130420 | BR 60 | Bromide | 0 … +80 | 1 … 12 | 0.4 … 79,000 |
| 285130430 | CU 60 | Copper | 0 … +80 | 2 … 6 | 0.0006 … 6400 |
| 285130440 | PB 60 | Lead | 0 … +80 | 4 … 7 | 0.2 … 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 … +135 | glass | LS 1 N6 |
| 1069992 | W 2130+ | 120 | 12 | Pt 1000 | -30 … +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 1000 | -30 … +135 | glass | 2 x 4 mm Ø |
| 285105254 | W 5790 NN | 120 | 4 | Pt 1000 | -30 … +135 | stainless steel | 2 x 4 mm Ø |
| 285105776 | W 5790 PP | 120 | 4 | Pt 1000 | -30 … +135 | stainless steel | 2 x 2 mm Ø |
| 285105262 | W 5791 NN | 170 | 4 | Pt 1000 | -30 … +135 | stainless steel | 2 x 4 mm Ø |
| 285105287 | W 5980 NN | 96[1)] | 5 NS 7.5 | Pt 1000 | -30 … +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 1000 | -30 … +135 | glass |



[1)] length from upper end of standard taper

# BlueLine pH combination electrodes

## The robust electrodes for general applications

| | |
|---|---|
| **pH range** | 0...14 |
| **Temperature range** | -5...+80 °C |
| **Shaft** | Noryl, 12 mm Ø |
| **Shaft length L** | 120 mm |
| **Zero point** | pH = 7.0 ± 0.3 |
| **Diaphragm** | 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...14 |
| **Temperature range** | -5...+100 °C |
| **Shaft** | glass, 12 mm Ø |
| **Shaft length L L** | 120 mm |
| **Zero point** | pH = 7.0 ± 0.3 |
| **Diaphragm** | 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 1000 | 1 m fixed cable with DIN plug 19 262 + banana plug |
| 1065896 | 28 pH-P | Pt 1000 | 1 m fixed cable with DIN plug 19 262 + 2-mm pole plug |
| 285129570 | 28-5 pH | Pt 1000 | 5 m fixed cable with DIN plug 19 262 + banana plug |
| 1065895 | 29 pH | Pt 1000 | 1 m fixed cable with BNC plug + banana plug |
| 1065894 | 29 pH-P | Pt 1000 | 1 m fixed cable with BNC plug + 2-mm pole plug |

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

# BlueLine
# Special sensors

**The specialists**
**for special applications**

**Zero point of**
**pH electrodes** pH = 7.0 ± 0.3

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


**BlueLine 13 pH**

**BlueLine 16 pH**

**BlueLine 21 pH**

*21 pH 1M DIN ID*

*21 pH 1M BNC ID*

**BlueLine 27 pH**

*27 pH 1M DIN ID*

*27 pH 1M BNC ID*

**BlueLine 31 Rx**

**BlueLine 32 Rx**

**BlueLine 48 LF**

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

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

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

**Spear tip electrode with sensor recognition BlueLine 21 pH 1M-DIN-ID**
Glass shaft, hole diaphragm, Referid® electrolyte, Ag/AgCl reference system, Spear membrane, L-glass, 1 m fixed cable with DIN plug and sensor recognition, length 65/25 mm, 12/5 mm Ø, -5...+80 °C, 2...13 pH
Order No. 285129930

**Spear tip electrode with sensor recognition BlueLine 21 pH 1M-BNC-ID**
Glass shaft, hole diaphragm, Referid® electrolyte, Ag/AgCl reference system, Spear membrane, L-glass, 1 m fixed cable with BNC plug and sensor recognition, length 65/25 mm, 12/5 mm Ø, -5...+80 °C, 2...13 pH
Order No. 285129940

**Surface electrode BlueLine 27 pH**
Glass shaft, KPG® annular gap diaphragm, Referid® electrolyte, Ag/AgCl reference system, flat membrane, L-glass, plug head, length 120 mm, 12 mm Ø, -5 … +50 °C, 2 … 13pH,
Order No. 285129274

**Surface electrode with sensor recognition BlueLine 27 pH 1M-DIN-ID**
Glass shaft, KPG® annular gap diaphragm, Referid® electrolyte, Ag/AgCl reference system, flat membrane, L-glass, 1 m fixed cable with DIN plug and sensor recognition, length 120 mm, 12 mm Ø, -5...+50 °C, 2...13 pH
Order No. 285129950

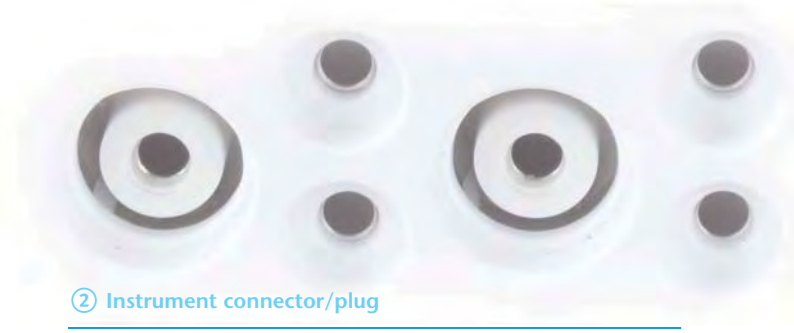
**Surface electrode with sensor recognition BlueLine 27 pH 1M-BNC-ID**
Glass shaft, KPG® annular gap diaphragm, Referid® electrolyte, Ag/AgCl reference system, flat membrane, L-glass, 1 m fixed cable with BNC plug and sensor recognition, length 120 mm, 12 mm Ø, -5...+50 °C, 2...13 pH
Order No. 285129960

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

**Redox electrode BlueLine 32 Rx**
Plastic shaft, fibre diaphragm, gel electrolyte, Ag/AgCl reference system, sensor platinum pin 1 mm Ø, plug head, length 120 mm, 12 mm Ø, -5 … +80 °C,
Order No. 285129320

**Conductivity cell for low ionic media BlueLine 48 LF**
Stainless steel shaft, 2-pin cell, 1 m fixed cable with 8-pole plug, sensor stainless steel, cell constant 0.1 $cm^{-1}$, temperature sensor NTC 30 kΩ, length 120 mm, 12 mm Ø, -5 … +80 °C, measuring range 0 … 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

plug L

**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 9907/00

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

plug 9909/00

## ② Instrument connector/plug

**A** (DIN)

**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, free cable end)

The connecting cables are available in various combinations, existing of electrode plug, instrument connection and cable length. Should you i.e. require a coaxial cable for connecting a pH electrode to a meter, please select a cable type L 1 A or L 2 A. The „L“ as part of the type description stands for the coaxial plug (plug L, please refer to page 82) of the electrode, the middle number stands for the cable length and the „A“ for the instrument connection (in this example for a DIN connection).

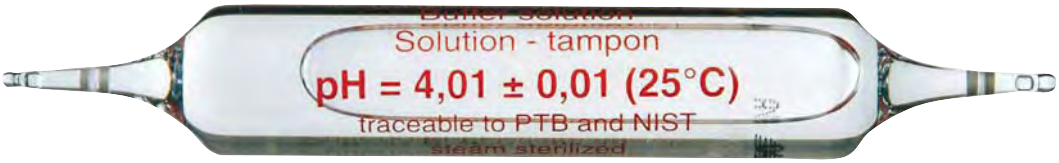
In case you do not find your desired cable combination listed below, please contact us.

| 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 1X | reference electrode plug (B) | free end (X) | 1 m single conductor cable |
| 285122456 | L 1 A | electrode plug (L) | DIN instrument plug (A) | 1 m coax. cable |
| 285122497 | L 1 BNC | electrode plug (L) | BNC instrument plug | 1 m coax. cable |
| 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.

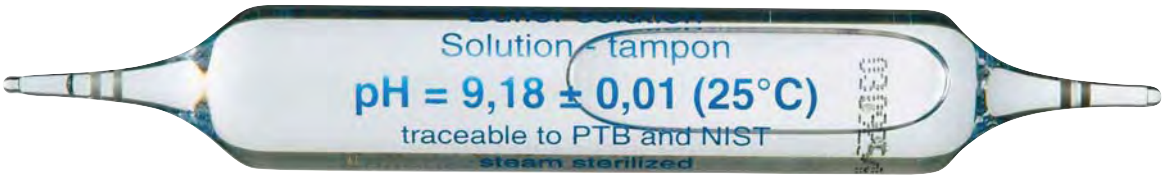
Hermetically sealed in the glass ampoule and sterilized with hot steam, same as a pharmaceutical product, the buffer solutions free of preservation agent have an extremely long shelf life and guarantee continuously error-free characteristics.

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 | 1000 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285137677 | L 1684 | 1.68 | 250 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285138098 | L 401 | 4.01 | 1000 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285138008 | L 4014 | 4.01 | 250 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285138102 | L 687 | 6.87 | 1000 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285138016 | L 6874 | 6.87 | 250 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285138119 | L 918 | 9.18 | 1000 ml in DURAN® glass bottle, with manufacturer's certificate |
| 285138024 | L 9184 | 9.18 | 250 ml in DURAN® glass bottle, with manufacturer's certificate |





- **Reliability and measuring safety**
- **Extremely long storage times,** thanks to hot-steam sterilization
- **Without preservative agent**
- **A maximum of calibration safety**

## 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* |
| 285138221 | L 4697 | 7.00 | 60 FIOLAX® ampoules à 20 ml* |
| 285138205 | L 4691 | 10.01 | 60 FIOLAX® ampoules à 20 ml* |
| 285138398 | L 4690 | 4.00/7.00 | 2 x 30 FIOLAX® ampoules à 20 ml* |
| 285138192 | L 4698 | 4.00/7.00/10.01 | 3 x 20 FIOLAX® ampoules à 20 ml* |
| 285138632 | L 4895/Set | 4.00/7.00 | 2 x 9 FIOLAX® ampoules à 20 ml* with electrolyte solution L 3008 |

| Order No. | Type No. | pH value at 25 °C | Contents |
|---|---|---|---|
| 285138727 | L 400 | 4.00 | 1000 ml in DURAN® glass bottle |
| 285138032 | L 4004 | 4.00 | 250 ml in DURAN® glass bottle |
| 285138735 | L 700 | 7.00 | 1000 ml in DURAN® glass bottle |
| 285138049 | L 7004 | 7.00 | 250 ml in DURAN® glass bottle |
| 285138719 | L 100 | 10.01 | 1000 ml in DURAN® glass bottle |
| 285138057 | L 1004 | 10.01 | 250 ml in DURAN® glass bottle |

* 20 ml volume = approx. 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 and as electrolyte bridges

| Order No. | Type No. | Description | Contents |
|---|---|---|---|
| 285136956 | L 101 | potassium chloride solution 1 mol/l | 1000 ml in DURAN® glass bottle, sterilized |
| 285138649 | L 1254 | potassium sulfate solution 0.6 mol/l | 250 ml in DURAN® glass bottle |
| 285138151 | L 200 | low temperature electrolyte (-30 °C) | 1000 ml in DURAN® glass bottle |
| 285138365 | L 2004 | low temperature electrolyte (-30 °C) | 250 ml in DURAN® glass bottle |
| 285138349 | L 2114 | 2 mol/l $KNO_3$ + 0.001 mol/l KCl for Ag combination electrodes | 250 ml in DURAN® glass bottle |
| 285136923 | L 2214 | 2 mol/l $KNO_3$ + 0.001 mol/l KCl for Ag combination electrodes, thickened | 250 ml in DURAN® glass bottle |
| 285138332 | L 2224 | potassium chloride solution 2 mol/l | 250 ml in DURAN® glass bottle |
| 285138554 | L 300 | potassium chloride solution 3 mol/l | 1000 ml in DURAN® glass bottle, sterilized |
| 285138427 | L 3004 | potassium chloride solution 3 mol/l | 250 ml in DURAN® glass bottle, sterilized |
| 285138505 | L 3008 | potassium chloride solution 3 mol/l | 50 ml in PE bottle |
| 285138419 | L 3014 | potassium chloride solution 3 mol/l, Ag/AgCl saturated | 250 ml in DURAN® glass bottle |
| 285138468 | L 310 | potassium chloride solution 2 mol/l, gel for sterilizable electrodes | 1000 ml in DURAN® glass bottle |
| 285138484 | L 3104 | potassium chloride solution 2 mol/l, gel for sterilizable electrodes | 250 ml in DURAN® glass bottle |
| 285138702 | L 320 K | potassium chloride solution 2 mol/l, gel for $Ag_2S$ electrodes | 1000 ml in DURAN® glass bottle |
| 285138143 | L 350 | potassium chloride solution 3.5 mol/l | 1000 ml in DURAN® glass bottle, sterilized |
| 285138127 | L 3504 | potassium chloride solution 3.5 mol/l | 250 ml in DURAN® glass bottle, sterilized |
| 285138587 | L 420 | potassium chloride solution 4.2 mol/l | 1000 ml in DURAN® glass bottle |
| 285138608 | L 4204 | potassium chloride solution 4.2 mol/l | 250 ml in DURAN® glass bottle |
| 285138590 | L 911 | storage electrolyte solution, sterilized | 1000 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 saturated in ethanol | 250 ml in DURAN® glass bottle |

## Solutions for oxygen measurements

| Order No. | Type No. | Description | Contents |
|---|---|---|---|
| 285138513 | L 6708 | electrolyte for oxygen electrodes OX 1100/OX 1100+/OX 1101 | 50 ml in PE bottle |
| 285126606 | OX 920 | electrolyte for oxygen electrodes 9009/61 | 50 ml in PE bottle |
| 285126614 | OX 921 | cleaning solution for oxygen electrodes 9009/61 | 30 ml in PE bottle |
| 285138287 | OX 060 | zero point solution for oxygen electrodes OX 1100/OX 1100+ | 60 FIOLAX® ampoules à 20 ml |

## Solutions for ammonia measurements

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

## Solutions and accessories for conductivity measurements

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

## Redox test solutions

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

## Cleaning solutions for combination electrodes and reference electrodes

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

# Electrolyte bridges, other accessories

## Electrolyte bridges

**Shaft:** glass, 12 mm Ø

## Electrode vessel

**Shaft:** plastic


**B 511** | **Z 451** *Z 461* | **Z 462** | **Z 453**

| Order No. | Type No. | Length L [mm] | Dia-phragm | Remarks |
|---|---|---|---|---|
| 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

| 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 |

# Notes for the successful measuring with pH and Redox electrodes:

Decisive for a most extensive lifetime of the electrode and therefore especially solid and reproducible measurements is the maintenance and care, besides the appropriate electrode for the according application. The following points are of high importance:

## Preparation and general

The electrode is delivered with a mounted watering cap. Prior to measuring and calibrating/adjusting remove this cap. It contains an aqueous solution. In most cases a 3 mol/l KCl solution (L 911) is used. For individual cases please check the technical data of the electrode. You are also welcome to contact us for further assistance.

## Measuring

Open the refill opening on refillable electrodes before processing measurements. Immerse the sensor into the solution to be measured at least up to the diaphragm. When using refillable sensors please pay attention that the electrolyte fill level is 5 cm above the level of the medium to be measured (see refilling). Rinse the sensor with distilled water between measurements, however do not wipe off. Carefully dab off excess drops.

## Calibration and setting

In order to minimize false measuring results with pH electrodes being used under extreme conditions or at the limit of the specified application areas, the electrodes should be calibrated more frequently and when necessary adjusted also for guaranteeing the appropriate condition for measuring safety. The measurement can only be as precise as the exactness of the last setting and its actuality. For determining whether the ph electrode has changed since the last setting, the electrode should be calibrated i.e. checked using the according buffer solution. When deviations are discovered, a setting i.e. calibration of the electrode data (slope and zero point) on the pH meter is necessary. If buffer solutions are taken from a bottle, ensure that the bottle is reclosed immediately after removal. Never refill the used buffer solution into the bottle, always throw it away. For an accurate calibration we recommend to operate with our certified buffer ampoules, which are sterilized in superheated steam acc. to DIN 19 266. These buffer ampoules correspond to national standards. Only use fresh buffer solutions and pay attention to the temperature stability. When using electrodes without an integrated temperature sensor, the pH meter must be set to the actual temperature of the buffer solution.

Redox sensors are not calibrated. They can be checked for proper function using appropriate test solutions.

## Refilling of liquid electrolyte electrodes

The missing solution in the electrolyte area of the reference system must be refilled regularly, in order to guarantee that the fill level of the electrolyte solution is at least 5 cm above the level of the medium being measured. BlueLine electrodes can be refilled simply by pumping electrolyte solution into them with a small dispensing bottle (cf. fig.).

The electrolyte solution must be completely renewed, when electrodes are used rarely and therefore the fill level varies only faintly. Any crystals in the electrolyte area can be disintegrated through warming of the electrode in a water base. The electrolyte solution should thereafter be renewed, whereby it should be rinsed a couple of times with fresh electrolyte solution prior to filling the new remaining solution into the electrolyte area.

## Storage and maintenance

The electrodes should be stored between 0 and 40°C in aqueous solution (L 911). They must not be stored in distilled water. Depending on the storage conditions (temperature and humidity) the aqueous solution in the cap can run dry preterm. In this case the electrode must be rinsed for a minimum of 24 hours (L 911). The usability of the electrode must then be checked.

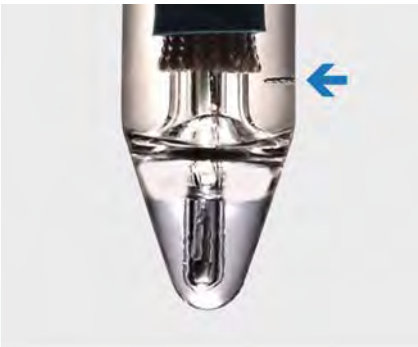
## Cleaning

Contaminations on the pH glass membrane/Redox sensor (measuring electrode) and the diaphragm cause measuring deviations. Before heading to further cleaning steps, the glass membrane should be cleaned with an ethanol tinctured cloth. For the case that further deviations should appear with the calibration, the cleaning process should be continued by the following steps. Depending on the degree of contamination, submerge only the measuring electrode or the complete electrode i.e. including also the diaphragm into the cleaning solution:

- Coverings can be removed with diluted inorganic acid (i.e. hydrochloric acid 0,1 mol/l or NaOH 0,1 mol/l).
- Organic contamination can be dissolved with suitable solutions.
- Fat is removed with tenside solution.
- Protein removed with hydrochloric pepsin solution (cleaning solution L 510).

## When cleaning please note:

- Ensure that any cleaning agent, which has leaked into the electrode, does not come into contact with the reference system; if necessary rinse out the reference electrode with electrolyte solution.
- After cleaning the electrode please rinse it with distilled water, do not rub dry.
- Any blocked ceramic diaphragms can be made functional through careful rubbing with sandpaper or using a diamond file.
- The pH glass membrane must not be scratched!
- Platinum diaphragms must not be maintained mechanically. A chemical cleaning (i.e. with diluted hydrochloric acid) will rinse and reopen (i.e. extraction with vacuum).



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

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

# Index

## electrodes

# electrodes



# accessories

# ProcessLine – Process electrodes for measuring pH, temperature and redox potentials

## 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 diaphragm – 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 diaphragm – 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.

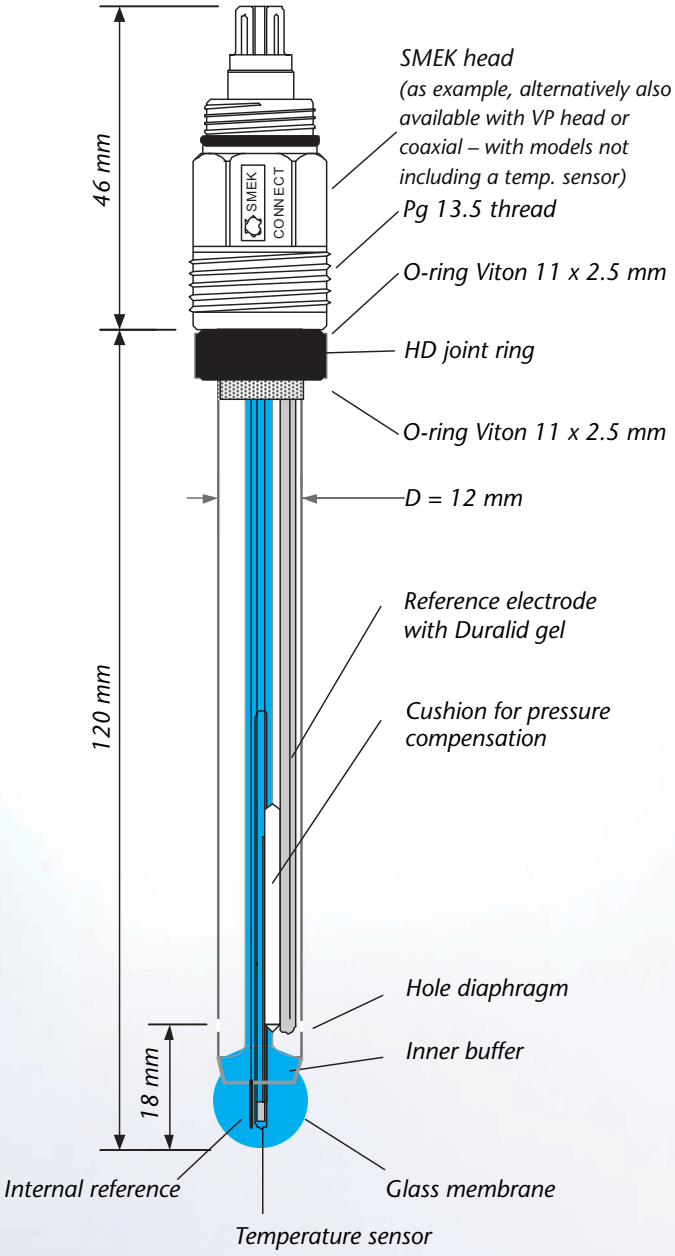
This special attribute given by the Duralid, does not only improve the durability and the response characteristic, it also enables stable measuring values – even under most difficult conditions such as changing flow rate/rotational frequency of stirrer or with measurements in organic solvents.

### 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 MOhm and ensures an easy cleaning.




- **Low maintenance**, i. e. no refilling of electrolyte or installation of complicated pressure sequence regulations.
- **Hole diaphragms**, 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 10 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 programme: Further information is available in our specialized catalogue "Process Electrodes" displayed and downloadable on our website; it can also be delivered personally on request.**

# Contents titration

# Selection table titration

**Overview table piston burettes**

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

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

**Overview table of titrators**

| Application | TitroLine *easy* | TitroLine *KF* | TitroLine *KF trace* | TitroLine alpha *plus* |
|---|---|---|---|---|
| pH/mV titration aqueous (acidity, hydrochloric acid, citric acid, "Kjeldahl", ammonia ...) | ■ | | | ■ |
| pH/mV titration non-aqueous (TAN/TBN, FFA, titrations with perchloric acid ...) | | | | ■ |
| Redox titrations (iodometry, permanganometry ...) [2] | ■ | | | ■ |
| Halogenide titrations (chloride, "salt", bromide ...) | ■ | | | ■ |
| $H_2S$ and mercaptan | | | | ■ |
| pH-stat applications (enzyme kinetics, soil samples, biotechnology) | | | | ■ |
| Water analysis according to KF Volumetric method (10 ppm – 100 %) | | | | ■ |
| Water analysis according to KF Volumetric method (0.01 % – 100 %) | | ■ | | ■ |
| Water analysis according to KF Coulometric method (1 ppm – 5 %) | | | ■ | |
| Bromine number | | | | ■ |
| Titrations with more than one end point or equivalence point (phosphoric acid ...) | | | | ■ |
| Applications with several piston burettes | | | | ■ |
| Applications with sample changer | | | | ■ |
| Applications with TitriSoft | | | | ■ |

[2] except COD and sulphuric acid ($SO_2$)

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

**Innovative electrochemistry – right from the start**

With the development of the glass electrode more than 70 years ago, we created the basis for the success of electrochemical measurement. Since then, with our range of efficient pH glasses, innovative electrodes and instruments such as pH meters, conductometers, oxygen measuring instruments, we have turned the electrochemical measurement into an indispensable, trouble-free and reliable procedure that is now being used throughout the world.

Building on this know-how, we have also developed a range of reliable laboratory instruments for dosing, titrating and Karl Fischer water analysis. The coulometric KF titrator TitroLine KF *trace* is the most recent instrument of this series.

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

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

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

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


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

# TITRONIC® *basic*

## The burette with the ›Mouse‹

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

### Operation is so easy

The titration process is carried out by pressing a button on the ›mouse‹ – the handheld device TZ 3680. You can monitor the dosed quantity conveniently on the large display. The TITRONIC® *basic* is equipped with an RS232-C serial interface so that you can document your results. Here, for example, you can also connect our small, practical TZ 3460 rollpaper printer or any other printer with a serial RS-232-C interface. Needless to say, you can also connect your PC to the TITRONIC® *basic*.

### Precision is integrated

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

### The magnetic stirrer is available as an accessory

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


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

**Technical data**

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

# TITRONIC® *universal*

## Titrating manually, dosing perfectly

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

**Adjusting easily, dosing precisely**

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

**Documenting results reliably**

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

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

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

# Technical data

### Designed for maximum precision

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

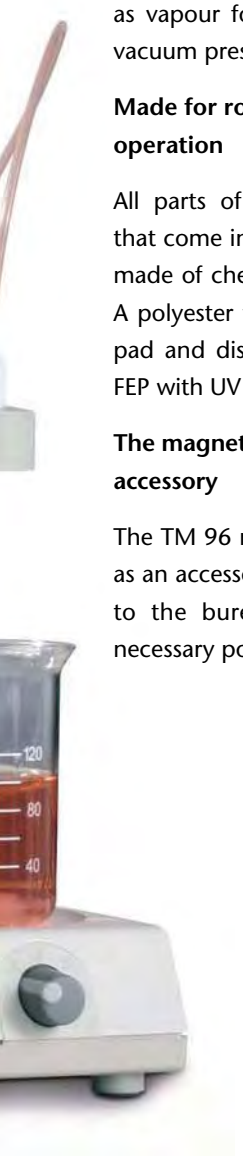
### Made for robust laboratory operation

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

### The magnetic stirrer is available as an accessory

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

| | |
|---|---|
| Keyboard connection | miniature 4 pole round socket, conforming to DIN standards |
| Stirrer connection | plug-and-socket connection with integrated low-voltage power supply |
| | (15 V DC) for the TM 96 magnetic stirrer |
| RS-232-C-1 | for connecting a printer with serial interface or a PC to document |
| | consumption in ml or for data backup |
| RS-232-C-2 | connection of additional piston burettes TITRONIC® *universal* ('Daisy Chain') |
| Configuration of the RS-232-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 … 999.9 ml |
| Display resolution | 0.01 ml |
| Dosing volume | 0.0 … 999.99 ml |
| Dosing speed | 0.1 … 40 ml/min (with 20 ml dosing unit) |
| | 0.1 … 100 ml/min (with 50 ml dosing unit) |
| Filling time | 30 s to 999 s adjustable (100 % in relation to the cylinder volume) |
| Pre-titrating volume | 0.1 ml to 99.99 ml |
| Increment volume | 0.01 … 999.99 ml |
| Waiting time between the increments | 0.1 … 999.9 s |
| Cylinder | 20 ml or 50 ml DURAN® borosilicate glass cylinder with UV protection sleeve |
| Dosing accuracy | systematic error 0.1 %, |
| | random error 0.05 %, determined according to EN ISO 8655-6 |
| Valve | 3/2-port directional control valve made of PTFE / ETFE |
| Tubing | FEP with UV protection |
| Housing material | polypropylen and polyflamm RPP371 NT, 20 % talcum |
| Front foil | polyester |
| Dimensions | 135 x 310 x 205 mm (W x H x D), |
| | including dosing unit, without stirrer |
| Weight | approx. 2.1 kg |
| Ambient temperature | +10 … +40 °C (for operation and storage) |
| Power supply | 230 V~; 50/60 Hz or 115 V~; 50/60 Hz |
| Power consumption | 18 VA |
| Conformity | EN ISO 8655-3 |




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

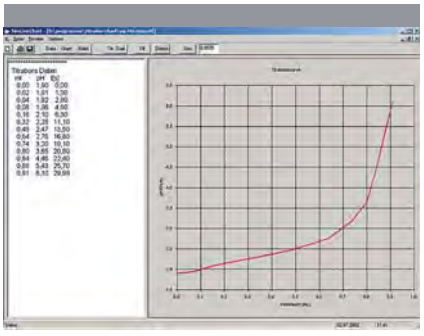
# TitroLine *easy*

## The intelligent titrator for your routine daily work

**Quick and easy as its name suggests**

The TitroLine *easy* is the ideal titrator for your routine daily work. This instrument provides you with the perfect combination of a piston burette, a pH/mV meter and integrated intelligence. Ten titration methods for various applications are 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 ... 14.00 |
| | measuring range mV: -1400 ... +1400 |
| | electrode socket according to DIN 19262 or BNC-socket and |
| | reference electrode 1 x 4 mm |
| | measuring input temperature sensor Pt 1000, |
| | measuring range: -30 ... +115 °C |
| | connection socket 2 x 4 mm and 1 x 2 mm |
| Keyboard connection | miniature 4 pole round socket, conforming to DIN standards |
| Stirrer connection | plug-and-socket connection with integrated low-voltage |
| | power supply (15 V DC) for the magnetic stirrer TM 96 |
| RS-232-C interface | for connecting a printer with serial interface or PC for documentation |
| Configuration of the RS-232-C interface | preset: 4800 baud, 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 ... 999.9 ml |
| Display resolution | 0.01 ml |
| Cylinder | 20 ml DURAN® borosilicate glass cylinder with UV protection |
| Dosing accuracy | systematic error 0.1 %, |
| | random error 0.05 % determined according to EN ISO 8655-6 |
| Calibration | two-point calibration, selection of eight stored buffer solutions |
| | in conformity with DIN 19 266 and NBS |
| Valve | 3/2-port directional control valve made of PTFE / ETFE |
| Tubing | FEP with UV protection |
| Housing material | polypropylene and polyflamm RPP 371 NT, 20 % talcum |
| Front foil | polyester |
| Dimensions | 135 x 310 x 205 mm (W x H x D), |
| | including dosing unit, without stirrer |
| Weight | approx. 2.4 kg |
| Ambient temperature | +10 ... +40 °C (for operation and storage) |
| Power supply | 230 V~; 50/60 Hz or 115 V~; 50/60 Hz |
| Power consumption | 24 VA |
| Appliance safety | corresponds to Protection Class II in accordance with DIN EN 61 010, Part 1 |
| Conformity | EN ISO 8655, part 3 |

**The sensors –
from SCHOTT Instruments**

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

**Stored data: the buffer solutions**

Data for 2.00 / 4.00 / 4.01 / 6.87 / 7.00/ 9.18 / 10.01 / 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.

# Karl-Fischer Titration – the method for determining water

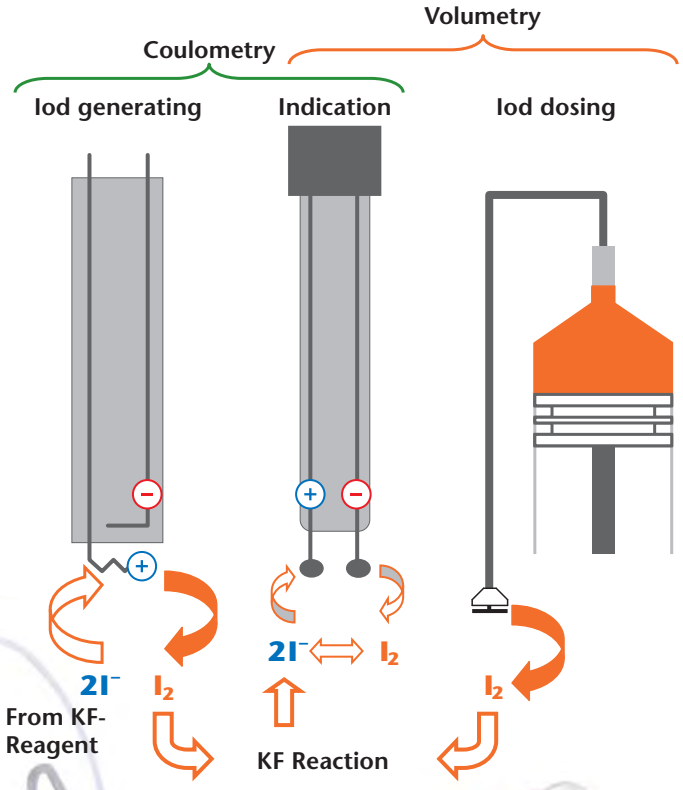
Quite some experienced analyst will be unpleasantly reminded by the pyridine smell, when hearing the name Karl Fischer. However, modern reagents and most user friendly analysing instruments have definitely cleared that picture. Nowadays all applications can be handled and processed very easily, fast and accurate by using the **coulometric** and **volumetric** Karl Fischer titration instruments. Thanks to its selectivity and precision, the Karl Fisher titration has achieved to be established as the most important method for determining water and humidity.

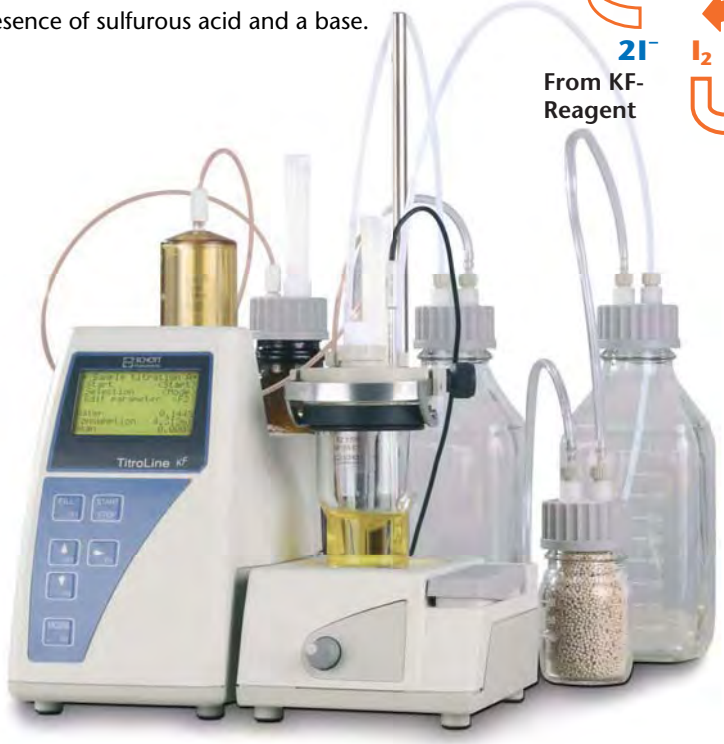
In the following, we would like to ease your decision for either the coulometric (TitroLine KF trace) or the volumetric (TitroLine KF) KF titrator a little.

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:**



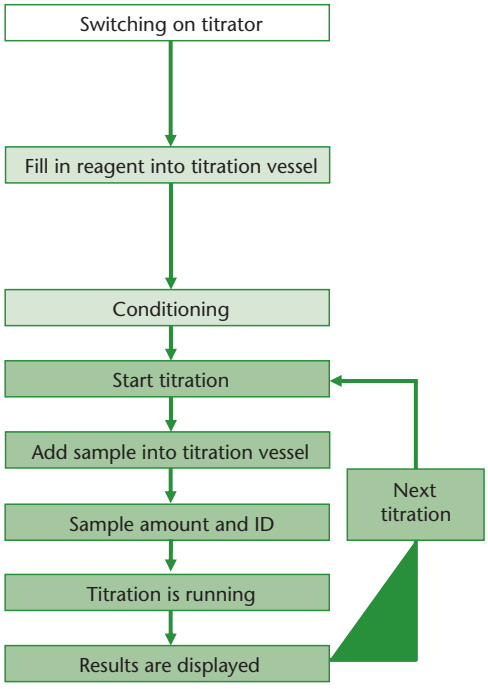




TitroLine *KF*

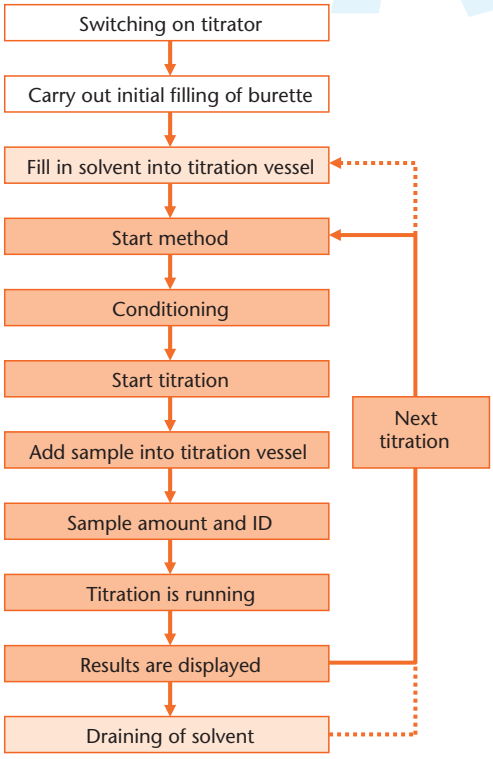

TitroLine KF *trace*

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 adding and solvent variations, offering more flexible operation potentials. Where on the other hand the coulometry can handle yet lower detection limits and score with 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.

**Coulometric KF titration**




**Volumetric KF titration**




| Comparison: Coulometric and volumetric Karl-Fischer-titration | | |
|---|---|---|
| **Property** | **Coulometry** | **Volumetry** |
| **Water amount and sample amount** | Small water amount<br>Small sample amounts | Medium and large water amounts<br>Adapted sample amount |
| **Sample types** | Liquid<br>Gaseous (i.e. KF oven)<br>Solid samples with oven | Solid<br>Liquid |
| **Sample addition and preparation** | Direct with syringe<br>Gas inlet with oven<br>External extraction<br>Solid samples are evaporated with an oven | Solid samples are added directly<br>Sample preparation with homogenisator<br>Working at higher temperature<br>Direct with syringe |
| **Working method** | Very fast<br>Very simple | Fast<br>Simple |
| **Working range** | µg range<br>10 µg up to 5 mg water | mg range<br>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 KF *trace*

# In dialogue the coulometric Karl Fischer Titration is quite easy!

### Karl Fischer titrations made easy

With the new TitroLine KF *trace* the coulometric water determination according to Karl Fischer you cannot go wrong:

The large display shows every work step ahead in a dialogue structure. The pre-parameterized methods are easily recalled and enhance the total work process. Also the versatility makes the both KF titrators a trouble-free KF measuring place for nearly all areas in the industry, such as for pharmaceutical, chemical and petroleum industry.

The coulometric Karl Fischer titrator TitroLine KF *trace* is the dedicated instrument for determining even smallest water content in your samples. As the coulometric determination of water does not require a standardisation of a titrant, the handling is easier compared with the volumetric titration: Once the instrument is installed, the reagents are inserted into the titration cell and the instrument is switched-on. The TitroLine KF *trace* starts to operate immediately. The conditioning is triggered in the background and automatically determines the drift. Only few minutes later the TitroLine KF *trace* is ready for the first samples.


### Conveniently with methods

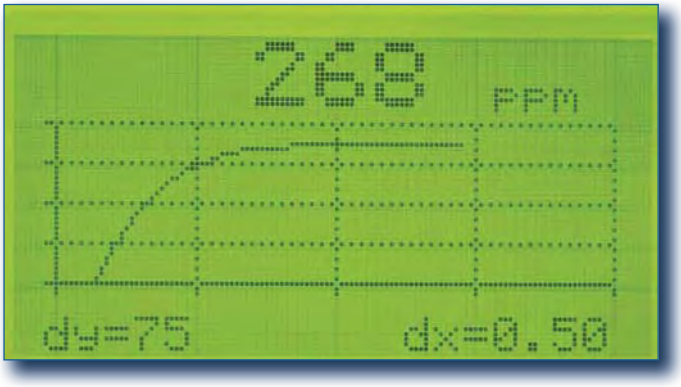
The TitroLine KF is already programmed with the following methods: sample titration, titre water, titre liquid standard, titre tartrate dihydrate, blank value ofen and blank value solvent. The methods for titre determination cease to apply for the TitroLine KF *trace*. All methods are already set with the commonly used parameters. However, should it become necessary, the parameters can of course be changed.


### Parameterization – just in case it will be necessary

The large display gives a clear overview of the next steps in process. Parameterization using the arrow key and the enter/F1 and ESC/F$ key is fairly easy. Taking a look into the operating manual is almost not necessary.

### Live titration process

The TitroLine KF *trace* allows watching over the titration by displaying a real-time measuring curve. With just a keystroke you have the option to switch between the standard or graphic display.




### Documentation – exactly the way you require it

You can decide if you want to print the results in either a short form, as standard form with a curve (only TitroLine KF *trace*) or as complete GLP printout including all method parameters. Of course all results are also indicate with the mean value and the drift on the display.


### Automatic selection of the correct calculation formula

Two different may be used to calculate the results. When choosing the method, the correct formula is automatically selected and pre-assigned with the corresponding values. Measurement units for the result can be selected from %, ppm, mg, mg/l, mg/pc (pc= piece) **µg** (TitroLine KF *trace*) or **ml** (TitroLine KF). The blank value is calculated in ml or µg and automatically substracted from the sample titartion result.

### Statistics

For the statistical evaluation of the analysis the mean value, standard devation or the relative standard devation can be determined. The mean value of the titre at the TitroLine KF is the automatic reference for the calculation of the sample result.

# Titration stand and titration vessel: Accessories made to match

Titrated samples can be extracted through pushing a button on the titration stand TM KF (standard with TitroLine KF and KF *trace* Module 2 + 4). A further keystroke provides a new reagent. An integrated magnetic stirrer in TM KF takes care of the balanced distribution of reagents and sample.


The titration vessels are hermetically sealed and avoid the penetration of moisture extensively (low drift!). The removable glass vessel from the TitroLine KF is available in two sizes and it is easy to clean. For the TitroLine KF *trace* are to be used two different glass vessels with 3 and 5 openings. Both have a very low drift.

# Connection of analytical balances, printers, PC KF oven ...

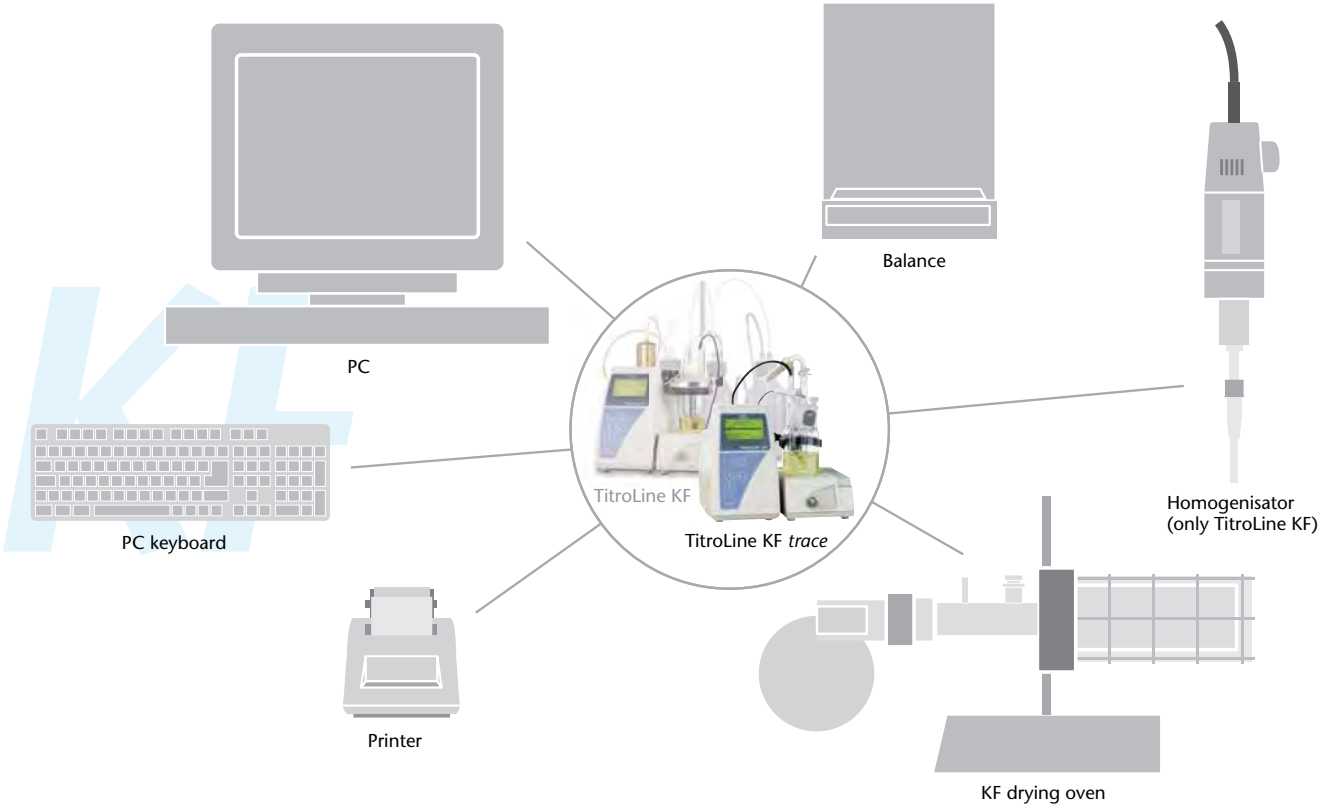
The two RS-232C interfaces and one USB-port* allow you to connect a balance and for automatic transfer of the weighing data and a printer at the same time. It is also possible to connect a PC via the additional USB-port*.

* only TitroLine KF *trace*

## PC control

Both titrators can be easily connected at a PC. The software “KF-Soft”* allows an easy transfer of the data and titration curve on a PC and store it in the integrated database. *

* only TitroLine KF



# Technical Specifications TitroLine KF / TitroLine KF *trace*

## Hardware

| | TitroLine KF | TitroLine KF *trace* |
|---|---|---|
| Display | High contrast 8-lines LCD with 64 x 128 pixel and background illumination ; contrast adjustable | High contrast 8-lines LCD with 64 x 128 pixel and background illumination ; contrast adjustable |
| Interfaces | 2 x RS232 for PC or printer, balance and further devices („daisy chain“) | 2 x RS232 for PC or printer, balance and further devices („daisy chain“)<br>1 x USB („slave“) for PC |
| Indicator electrode | Dual platinum electrode<br>Connection 2 x mm socket | Dual platinum electrode<br>Connection 2 x mm socket |
| Generator electrode | | Generator electrode<br>Connection 2 x mm socket |
| Keyboard | 5-pole DIN-socket for PC-keyboard | For PC-keyboard with PS/2-plug such as TZ 2835 |
| Stirrer/pump | Stirrer TM 135 respectively stirrer and pump of the titration stand TM KF | Stirrer TM 135 respectively stirrer and pump of the titration stand TM KF |
| Cylinder | 20 ml made out of DURAN® | |
| Valve | Motor driven 3/2 way valve made out of PTFE/ETFE | |
| Dimensions | 310 x 265 x 205 mm (h x w x d), height with titration stand and titration vessel | 200 x 265 x 205 mm (h x w x d) with titration stand TM 135/TM KF<br>310 x 265 x 205 mm (h x w x d), height with titration vessel |
| Weight | 2,1 kg for basic unit; appr. 3,2 kg for complete unit with titration stand TMKF | Appr. 1,4 kg for basic unit; appr. 2,5 kg for complete unit with titration stand TMKF (module 2 and 4) |
| Casing | Polypropylene | Polypropylene |
| Front foil | Polyester | Polyester |
| Temperature | Ambient temperature: + 10 ... + 40 C for operation and storage | Ambient temperature: + 10 ... + 40 C for operation and storage |
| Power supply | Mains 230 V, 50/60 Hz or 115 V ; 50/ 60 Hz<br>power drain: 30 VA | Universal power adapter 100-140 V; 50/60 Hz,<br>power drain: 30 VA |

## Software

| | TitroLine KF | TitroLine KF *trace* |
|---|---|---|
| Measuring range | 100 ppm – 100 % | 10 µg – 100 mg / 1 ppm – 5 % (recommended) |
| Number of methods | 8 (3 x sample, 3 x ritre, 2 x blank value) | 10 (9 x sample, 1 x blank value) |
| Conditioning | On start,<br>automatic drift correction | Automatic after switch on,<br>drift correction |
| End criteria | End point delay, drift | Drift, drift stop tolerance |
| Autostart after sample addition | Only after conformation of sample weight | ■ |
| Statistic | Mean value, standard devation and rel. relative standard devation | Mean value, standard devation and rel. relative standard devation |
| Recalculation | After new weighted sample or sample volume has been entered<br>Erasing of one result from a series of measurement | After new weighted sample or sample volume has been entered<br>Erasing of one result from a series of measurement |
| Online curve | | ■ |
| Documentation | GLP | GLP + curve print out |
| Result output | %, ppm, mg, mg/l, mg/pc (pc= piece), ml | %, ppm, mg, mg/l, mg/pc (pc= piece, µg |
| Password | | ■ |
| Update software | EPROM-change | Update via RS232 and USB |

# Ordering information TitroLine KF and TitroLine KF *trace*

| **TitroLine KF and TitroLine KF *trace*** | | **Order no.** |
|---|---|---|
| **TitroLine KF *trace* M1**<br>Complete module for coulometric Karl-Fischer titration | Scope of delivery: TitroLine KF *trace* basic unit, magnetic stirrer TM 135, generating electrode TZ 1752 without diaphragm, titration vessel TZ 1751, micro dual platinium-electrode KF 1150, connection cable generating electrode | 285212258 |
| **TitroLine KF *trace* M2**<br>Complete module for coulometric Karl-Fischer titration | Scope of delivery: TitroLine KF *trace* basic unit, titration stand with pump TM KF, generating electrode TZ 1752 without diaphragm, titration vessel TZ 1754, micro dual platinium-electrode KF 1150, connection cable generating electrode | 285212268 |
| **TitroLine KF *trace* M3**<br>Complete module for coulometric Karl-Fischer titration | Scope of delivery: TitroLine KF *trace* basic unit, magnetic stirrer TM 135, generating electrode TZ 1753 with diaphragm, titration vessel TZ 1751, micro dual platinium-electrode KF 1150, connection cable generating electrode | 285212278 |
| **TitroLine KF *trace* M4**<br>Complete module for coulometric Karl-Fischer titration | Scope of delivery: TitroLine KF *trace* basic unit, titration stand with pump TM KF, generating electrode TZ 1753 with diaphragm, titration vessel TZ 1754, micro dual platinium-electrode KF 1150, connection cable generating electrode | 285212288 |
| **TitroLine KF-230 V**<br>Volumetric KF-Titrator | Scope of delivery: titration unit, titration stand with integrated stirrer and pump TM KF, titration vessel TZ 1770, micro dual platinium-electrode KF 1100 and starter kit | 285212248 |
| **TitroLine KF-115 V**<br>Volumetric KF-Titrator | Scope of delivery: titration unit, titration stand with integrated stirrer and pump TM KF, titration vessel TZ 1770, micro dual platinium-electrode KF 1100 and starter kit | 285212231 |

| **Accessories for TitroLine KF and TitroLine KF *trace*** | | |
|---|---|---|
| **TZ 2835** | PC-keyboard (with PS2/DIN-adapter for TitroLine KF) | 1007852 |
| **TZ 1052** | Evaporation oven for water determination according to Karl-Fischer | 285214721 |
| **TZ 1060** | Accessory for Evaporation oven TZ 1052 | 285218115 |
| **TZ 2073** | KF-Soft for TitroLine *KF* | 285221733 |
| **TZ 3460** | RS-232-C printer for TitroLine KF, incl. connection cable TZ 3090, 230 V | 285225608 |
| **TZ 3461** | RS-232-C printer for TitroLine KF trace, incl. connection cable TZ 3090, 230 V | 285225610 |
| **TZ 3465** | RS-232-C printer for TitroLine KF, incl. connection cable TZ 3090, 115 V | 285225657 |
| **TZ 3466** | RS-232-C printer for TitroLine KF trace, incl. connection cable TZ 3090, 115 V | 285225660 |

# Ordering information TITRONIC®, TitroLine

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

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

**Innovative electrochemistry – from the very beginning**

By developing the glass electrode more than 70 years ago, we laid the foundation for the success of electrochemical measurement. With high-performance pH glasses, innovative electrodes and electrochemical measuring instruments such as pH meters, conductometers, oxygen measuring instruments, piston burettes and titrators we have since made sure that electrochemical measurement today is an indispensable, trouble-free and reliable procedure all over the world.

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

**The right choice for simple and complex titrations**

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

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

**Environmental and water analytics**

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

**Foodstuff and beverages**

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

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

**Galvanics**

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

**Petrochemistry**

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

**Pharmaceutics**

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

**General chemistry and plastics**

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

**Paper industry**

- “White, green and black liquor”

# 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 fort 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 | – |
| Kjeldahl | A 7780 | – |
| Alkalinity | N 62, N 61 | N 1052 A, N 1051 A |
| Aqueous, difficult applications | IL-pH-A120MF<br>IL-pH-A170MF | IL-pHT-A120MF-DIN-N<br>IL-pHT-A170-DIN-N |
| Low ionic liquids | IL-pH-A120MF<br>IL-pH-A170MF | IL-pHT-A120MF-DIN-N<br>IL-pHT-A170-DIN-N |
| Small sample amounts | N 5900 A | A 157<br>IL-MICRO-pHT-A-DIN-N |
| Titration with sample changer<br>(100 – 250 ml vessels) | N 65 | N 1051 A<br>IL-pHT-A170-DIN-N |
| Titration with sample changer<br>(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 | – |
| Halogenides, sample changer | AgCl 65 | – |
| Pseudo halogenides (cyanide …) | Ag 6280 | – |
| Detergents | TEN 1100* | – |
| **Redox titrations** | | |
| General, iodometric,<br>permanganometric, cerimetric | Pt 62<br>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. …)<br>sample changer, general and titration vessels | Pt 1400 | – |
| Dead stop ($SO_2$ bromine no. …)<br>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* | – |

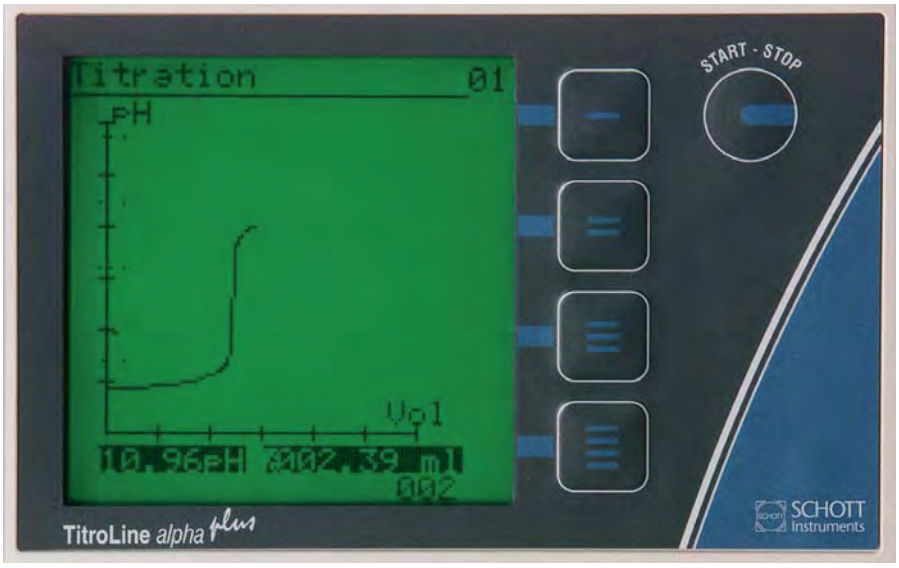
* An applicable reference electrode is required:. B 2920+ respectively. B 3520+

# TitroLine alpha *plus*: So adaptable …

**Working with the TitroLine alpha *plus* is so easy**

Take a closer look at the large graphical display to see how easy it is to work with the TitroLine alpha *plus*. Everything you need to know is visible in clear text. Just press a few buttons to select the desired function: the method, the log you want, the kind of output ...
Two arrow buttons are enough to navigate you through the self explanatory menu. Use the enter button to confirm your selection and press ESC to leave a menu item. After set up, start your titration with the separate start/stop button. Parameterize your method from a connected keyboard.


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




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

**The TitroLine alpha *plus* adapts itself to your applications**

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

**The right titration control for any method**

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

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

# … as precise and robust as you need it.

**Correct results –**
**good documentation**

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

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

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

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

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

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

**Method link to solve complex tasks**

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

Unlock …

… take off …

… everything under control!

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

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

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

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

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

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

The TMKF KF titration stand featuring solvent addition at the push of a button and automatic discharge of titrated samples, the TZ 1770 KF titration vessel and the KF 1100 double platinum electrode will transform your TitroLine alpha *plus* into a fully functional, most powerful volumetric titrator for water determination according to Karl Fischer (KF).

**KF titration parameters – exactly as required**

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

**Versatile and very precise**

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

**The KF drying oven extends the range of applications**

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

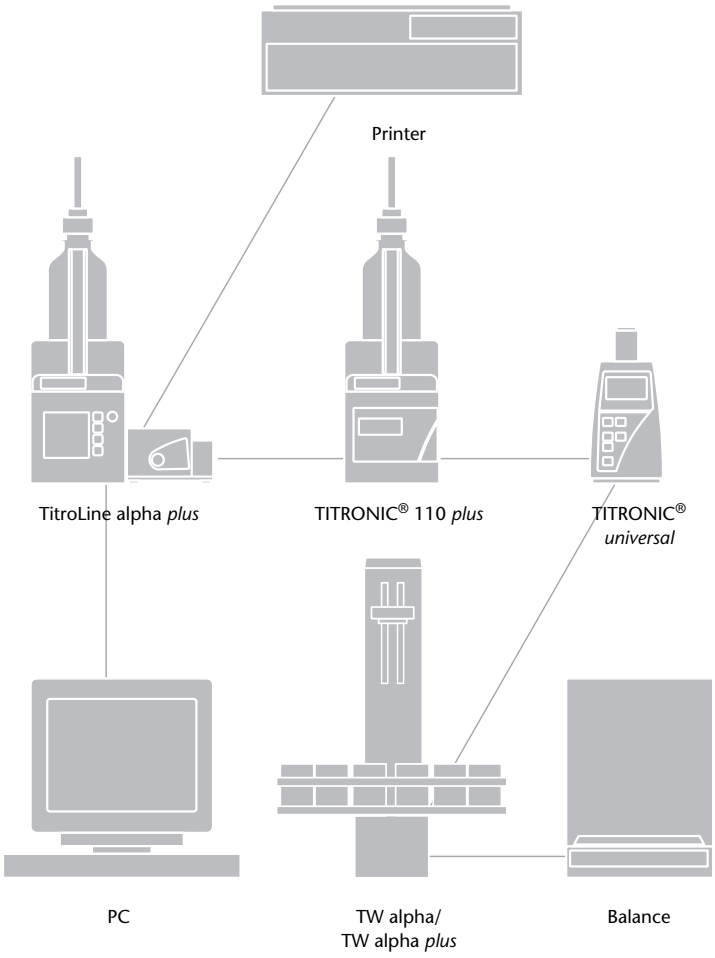
# The TitroLine alpha *plus* gets along with everyone

**The TitroLine alpha *plus* is well connected**

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

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

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




**We are happy to support you with your applications**

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

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

**Support for device qualification**

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

# TITRONIC® 110 –
# the piston burette with the *plus*

**Titrating and dosing**

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

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

**Very precise and robust**

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

**Exchangeable units compatible**

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

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

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

**PC control and concatenation (Daisy Chain)**

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

**Special dosing applications**

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

# Technical data

# TitroLine alpha *plus* and TITRONIC® 110 *plus*

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

**Achievable accuracies in the entire system with exchangeable unit**

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

**TitroLine alpha *plus* only**

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

**TITRONIC® 110 *plus* only**

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

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

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

**Control by titrator or by PC**

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

**Higher flexibility due to exchangeable sample racks**

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

**Stirring from "above" or "below"**

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


plus


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

**Washing the electrode and the titration tip**

To ensure accuracy of the results, the electrodes and the titration tips are rinsed after each titration. This can, for example, be done by immersing the electrodes and titration tips into a wash-ing 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.

# TitriSoft 2.6 – convincingly simple …

The TitriSoft 2.6 titration software is the optimum solution for your titration tasks. The software can be used with WINDOWS 98/ME and WINDOWS 2000/XP/Vista 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.

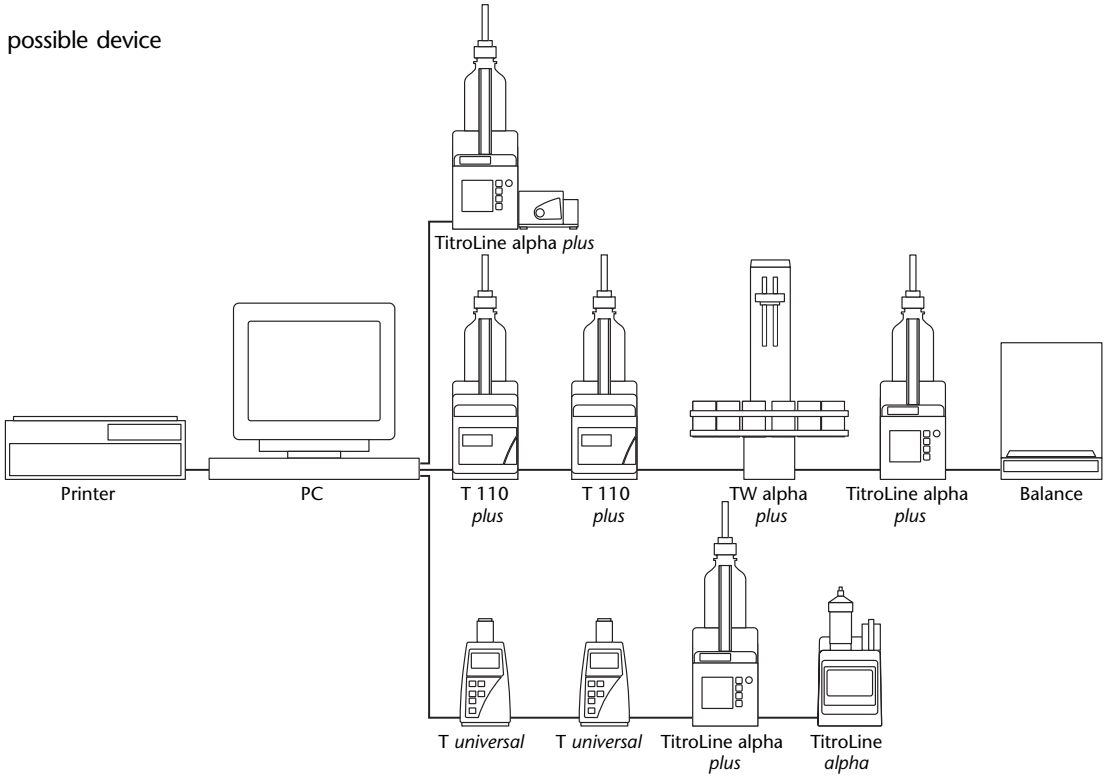
**Connection possibilities**

Using TitriSoft 2.6 you can control the following devices from a PC:

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

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

The image below shows possible device configurations.

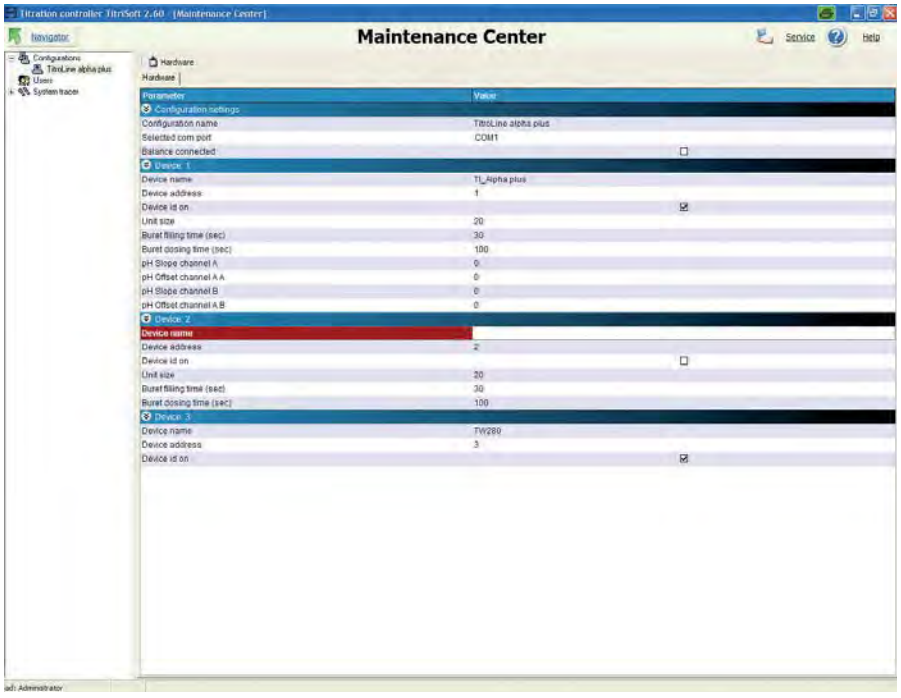



**System requirements**

For optimal and fast working with the TitriSoft 2.6 software your system should be equipped as shown below:

**Interface:** 1 free serial RS-232-C interface per configuration
**Computer:** Pentium II or higher
**Operating system:** WINDOWS 98/ME, WINDOWS 2000/XP or Vista
**RAM**: minimum 256 MB
**Hard disk:**
minimum free storage place 100 MB
**Graphics card:**
minimum resolution 1024 x 768

# … strong benefits …


**›Navigator‹, the main menu**

The different software tasks are assigned to four different centers:

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

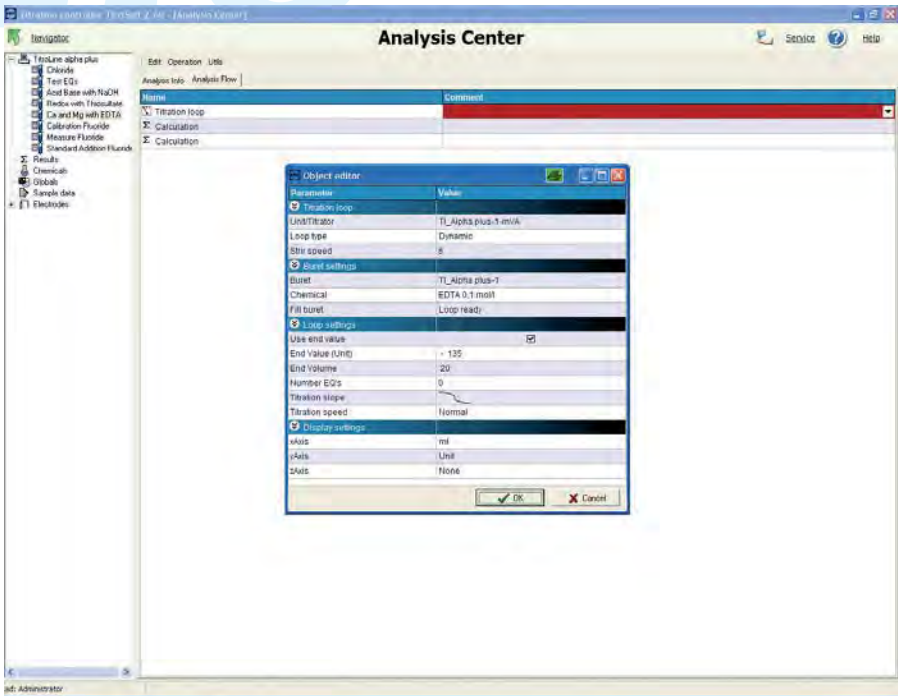
The centers can be accessed from the main menu, the Navigator.

**›Maintenance Center‹, the system configuration**

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

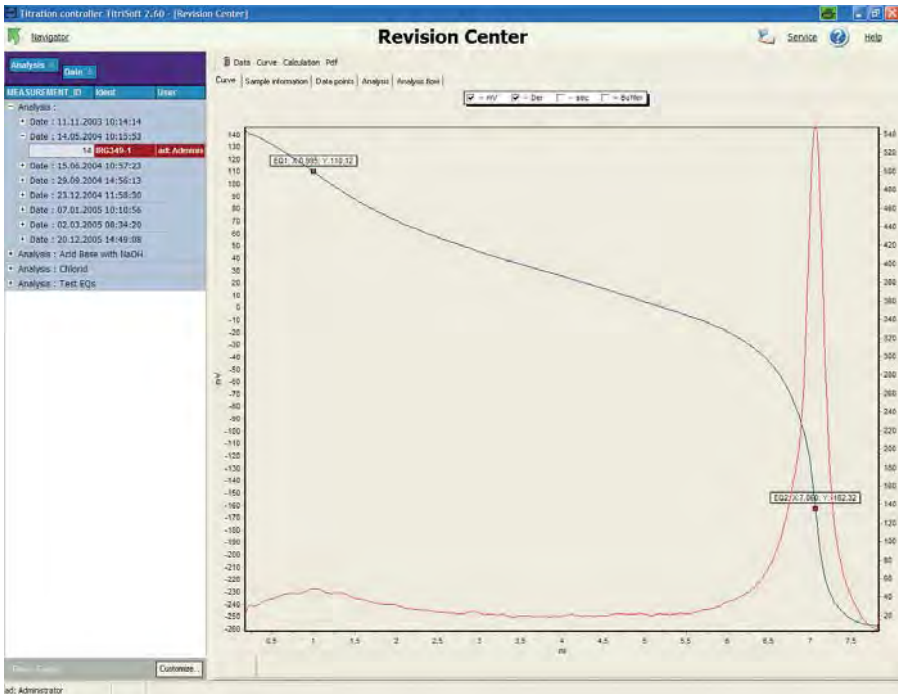
All TitriSoft users can be listed by their names. TitriSoft supports three user types. The Administrator has access to all configuration and software operation options. The “Administrator” has access to all configuration and software operation options. The “User” or “Advanced User” has the same rights 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 Center‹, your method center**

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

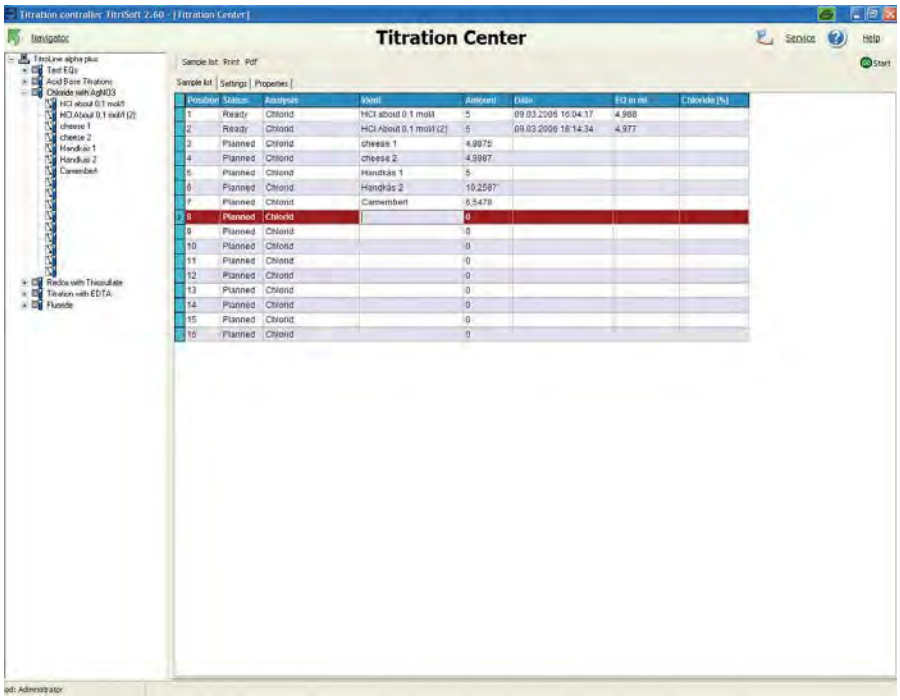



**›Revision Center‹, your database**

Titration curves, results, measured values and used methods of all titrations ever carried out 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 2.6




**›Titration Center‹, your clearly structured workplace**

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

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

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

Documentation, which is in accordance with GLP and ISO 9000 directives, can be produced in a number of different forms; tables, lists, curves or individual print-outs 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 2.6 P – simply safe …

In this case, the "P" does not mean "professional", but rather "pharmaceutical". Nevertheless, the performance of the "P" version is of course just as good and as professional as that of the standard verion "TitriSoft 2.6". Additionally to the standard version, the TitriSoft 2.6 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. Food and Drug Administration 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 2.6 P software your system should be equipped as shown below:

**Interface:** 1 free serial RS-232-C interface per configuration
**Computer:** Pentium II or higher
**Operating system:** WINDOWS 2000 and XP Pro/Vista
**RAM**: minimum 256 MB
**Hard disk:**
minimum free storage place 100 MB
**Graphics card:**
minimum resolution 1024 x 768

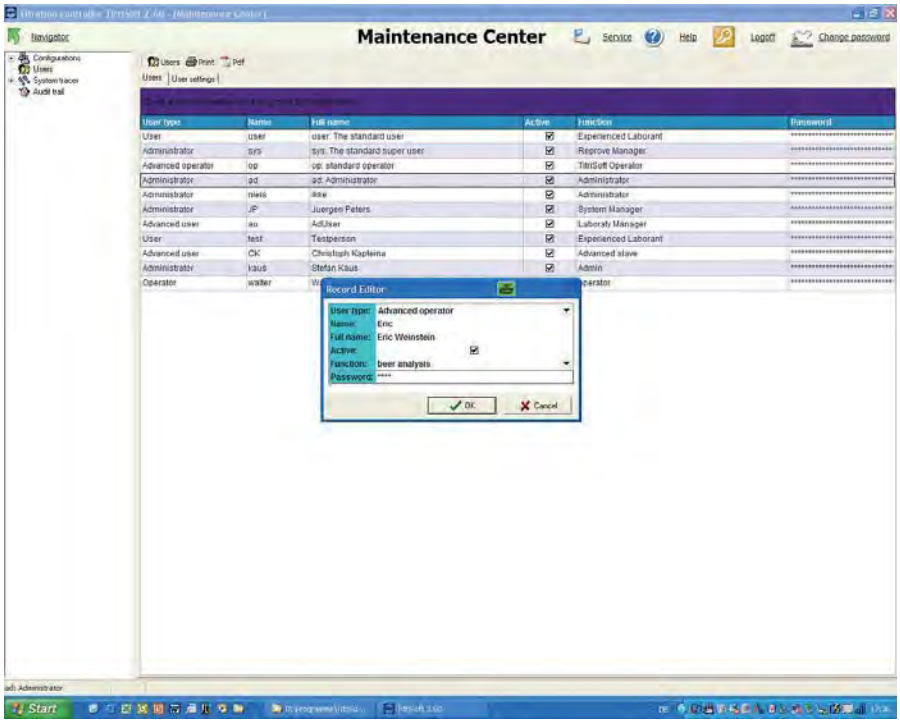
## Comparison between TitriSoft 2.6 and 2.6 P

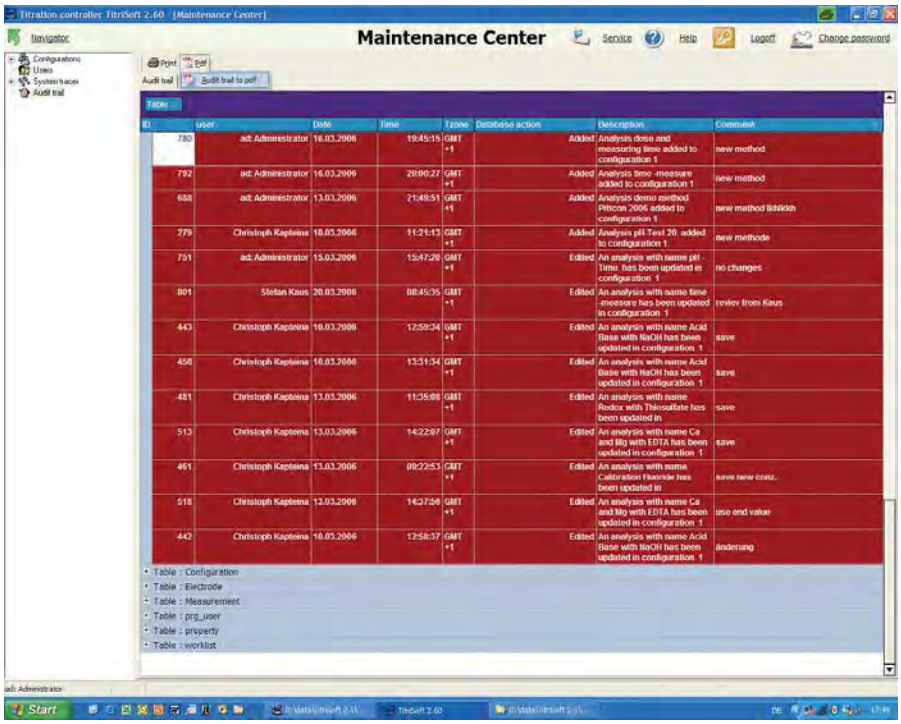
| Functions | TitriSoft 2.6 | TitriSoft 2.6 P |
|---|---|---|
| Electronic Record | | ■ |
| Electronic Signature | | ■ |
| Audit Trail | | ■ |
| Controlled Access | | ■ |
| Copies of Records | | ■ |
| Manual with forms for SOP´s, IQ, OQ, PQ and validation reports | | ■ |
| Straightforward procedure | ■ | ■ |
| 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.

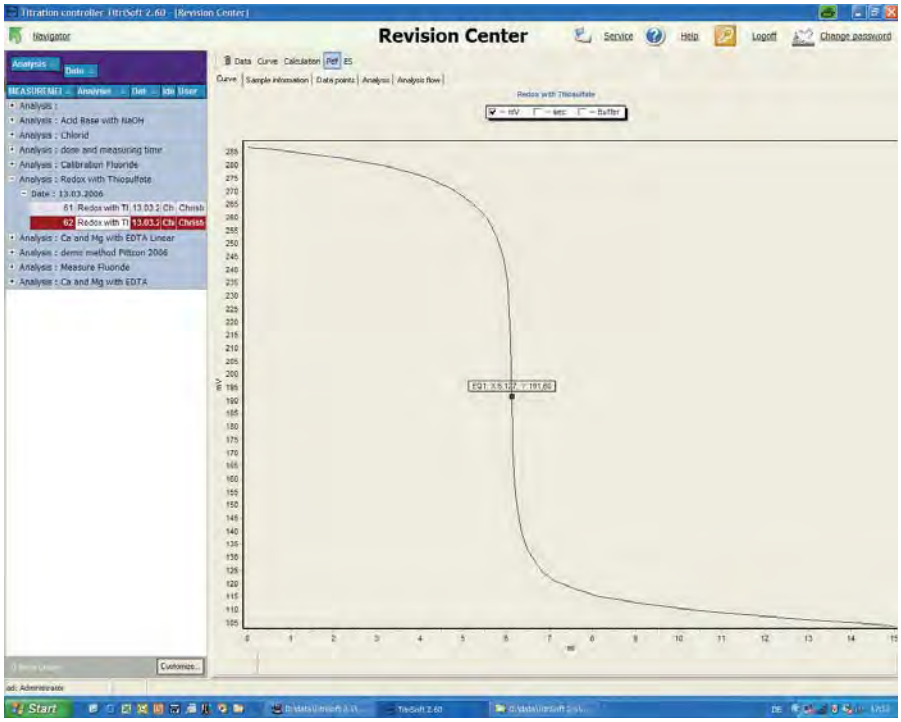
TitriSoft 2.6 P has 5 different access levels: The "Operator" level does only allow to carry out the routine titrations, whereas the "Advanced User" level is entitled to approve the methods. The highest level, the "Administrator" may set up the users and assign them the user rights. He even has the permission to delete records, but only after a copy of the database has been generated.






## Audit Trail

The 21 CFR Part 11 prescribes that each creating, saving oder modifying of records (e.g. creating methods, modifying passwords or saving results), generates an entry in the Audit Trail. TitriSoft 2.6 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.



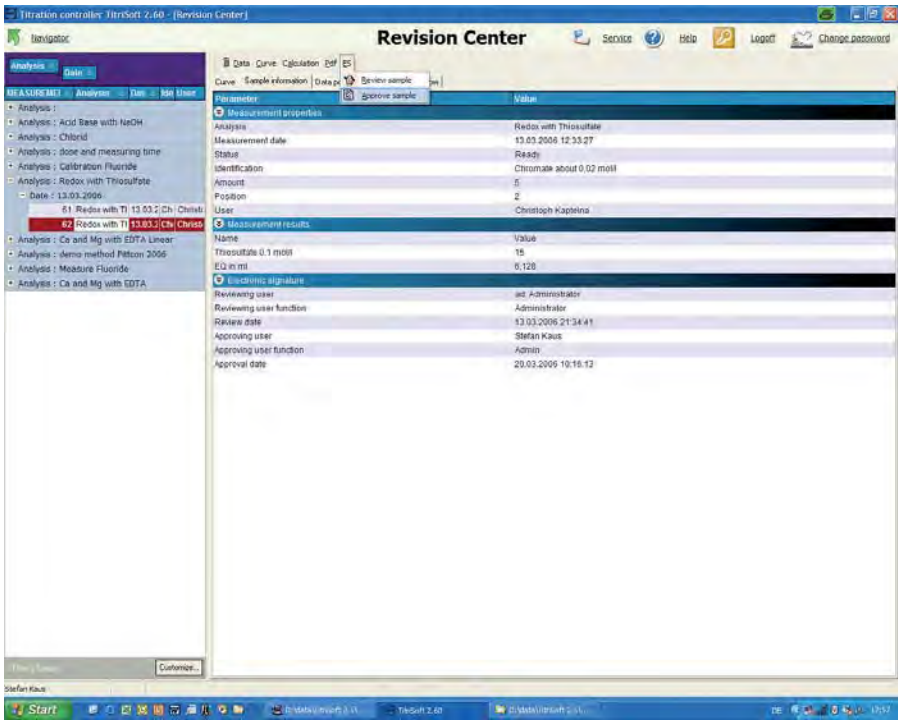

## Electronic Records

The 21 CFR Part 11 prescribes how to safeguard and store the generated results over a long timespan. 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.



# Ordering information TitroLine alpha *plus*

| **TitroLine alpha *plus*** | | **Order no.** |
|---|---|---|
| TitroLine alpha *plus* | TitroLine alpha *plus* basic unit without exchange unit, 230 V | 285216952 |
| TitroLine alpha *plus* | TitroLine alpha *plus* basic unit without exchange unit, 115 V | 285216969 |

**Scope of delivery:** TitroLine alpha *plus* incl. stand rod with holder, titration clamp, PC keyboard TZ 2835.

| | | |
|---|---|---|
| TitroLine alpha *plus* | TitroLine alpha 05 *plus* with 5 ml exchange unit, (230 V) | 285212934 |
| TitroLine alpha *plus* | TitroLine alpha 10 *plus* with 10 ml exchange unit, (230 V) | 285216944 |
| TitroLine alpha *plus* | TitroLine alpha 20 *plus* with 20 ml exchange unit, (230 V) | 285216977 |
| TitroLine alpha *plus* | TitroLine alpha 50 *plus* with 50 ml exchange unit, (230 V) | 285212983 |
| TitroLine alpha *plus* | TitroLine alpha 05 *plus* with 5 ml exchange unit, (115 V) | 285215467 |
| TitroLine alpha *plus* | TitroLine alpha 10 *plus* with 10 ml exchange unit, (115 V) | 285215475 |
| TitroLine alpha *plus* | TitroLine alpha 20 *plus* with 20 ml exchange unit, (115 V) | 285215631 |
| TitroLine alpha *plus* | TitroLine alpha 50 *plus* with 50 ml exchange unit, (115 V) | 285215648 |

**Scope of delivery:** As TitroLine alpha *plus* basic unit with 5, 10, 20 or 50 ml exchange unit, incl. brown glass bottle for titrant, GL 45 bottle adapter, hoses, drip glass and titration tip.

**TitroLine alpha KF *plus***

| | | |
|---|---|---|
| TitroLine alpha *plus* | TitroLine alpha KF 05 *plus* with 5 ml exchange unit, (230 V) | 285212991 |
| TitroLine alpha *plus* | TitroLine alpha KF 10 *plus* with 10 ml exchange unit, (230 V) | 285213109 |
| TitroLine alpha *plus* | TitroLine alpha KF 05 *plus* with 5 ml exchange unit, (115 V) | 285215656 |
| TitroLine alpha *plus* | TitroLine alpha KF 10 *plus* with 10 ml exchange unit, (115 V) | 285215664 |

**Scope of delivery:** As TitroLine alpha *plus* basic unit with 5 or 10 ml exchange unit, incl. brown glass bottle for titrant, GL 45 bottle adapter, hoses, drip glass and titration tip, titration stand TMKF incl. supply and waste bottle, micro-double-platinum electrode KF 1100, titration vessel TZ 1770.

**TITRONIC® 110 *plus***

| | | |
|---|---|---|
| TITRONIC® 110 *plus* | TITRONIC® 110 *plus* basic unit without exchange unit, 230 V | 1007302 |
| TITRONIC® 110 *plus* | TITRONIC® 110 *plus* basic unit without exchange unit, 115 V | 1007303 |

**Scope of delivery:** TITRONIC® 110 *plus* incl. stand rod with holder and titration clamp

**Exchange units for TitroLine alpha *plus* and TITRONIC® 110 *plus***

| | | |
|---|---|---|
| TA 01 | Exchange unit with 1 ml glass cylinder incl. reagent bottle | 285211313 |
| TA 05 *plus* | Exchange unit with 5 ml glass cylinder incl. reagent bottle | 285211038 |
| TA 10 *plus* | Exchange unit with 10 ml glass cylinder incl. reagent bottle | 285211046 |
| TA 20 *plus* | Exchange unit with 20 ml glass cylinder incl. reagent bottle | 285211054 |
| TA 50 *plus* | Exchange unit with 50 ml glass cylinder incl. reagent bottle | 285211062 |

**Software TitriSoft**

| | | |
|---|---|---|
| TitriSoft 2.6 | Titration software for TitroLine alpha *plus* and TitroLine alpha | 285221717 |
| TitriSoft 2.6 P | Titration software according to CFR 21 Part 11 | 285221720 |

**Accessories for TitroLine alpha *plus* and TITRONIC® 110 *plus***

| | | |
|---|---|---|
| TZ 2835 | PC keyboard for TitroLine alpha *plus* and TITRONIC® 110 *plus* | 1007852 |
| TM 135 | Magnetic stirrer | 285211013 |
| TM 128 | Titration clamp/rod stirrer combination | 285215167 |
| TMKF | Titration stand Karl-Fischer with suction pump and stirrer incl. supply and waste bottle | 285216611 |
| TZ 1770 | KF titration vessel 30 - 150 ml | 285216677 |
| TZ 1772 | KF titration vessel 80 - 200 ml | 285216693 |
| TZ 1052 | Drying oven for water determination according to Karl-Fischer, 230 V | 285214721 |
| TZ 1060 | Accessory for drying oven TZ 1052 | 285218115 |
| Z 303 | Titration clamp for TL alpha *plus* and TITRONIC® 110 *plus* | 1007304 |

# Ordering information TW alpha *plus*

| **Sample changer TW alpha *plus*** | | **Order no.** |
|---|---|---|
| TW alpha *plus* | Sample changer basic unit, **230 V** | 1007290 |
| TW alpha *plus* | Sample changer basic unit, **115 V** | 1007291 |

**Scope of delivery:** Sample changer basic unit TW alpha *plus* with integrated magnetic stirrer and connection cable TZ 1581 for rod stirrer.

| | | |
|---|---|---|
| TW alpha *plus* 12 | TW alpha *plus* basic unit with sample rack TZ 1452 for 12 samples, incl. titration head TZ 1463, connection cable and 20 beakers 250 ml, 230 V | 1007292 |
| TW alpha *plus* 16 | TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1463, connection cable and 20 beakers 150 ml, 230 V | 1007294 |
| TW alpha *plus* 24 | TW alpha *plus* basic unit with sample rack TZ 1454 for 24 samples, incl. titration head TZ 1462 and 30 beakers 50 ml, 230 V | 1007296 |
| TW alpha *plus* COD | TW alpha *plus* basic unit with sample rack TZ 1444 for 24 COD vessels in accordance with DIN, incl. titration head TZ 1461, rod stirrer TZ 1846, redox electrode Pt 5901, titration tip TZ 1648 and connection cable, 230 V | 1007298 |
| TW alpha *plus* MP | TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1467, membrane pump MP 25, connection cable and 20 beakers 150 ml, 230 V | 1007305 |
| TW alpha *plus* 12 | TW alpha *plus* basic unit with sample rack TZ 1452 for 12 samples, incl. titration head TZ 1463, connection cable and 20 beakers 250 ml, 115 V | 1007293 |
| TW alpha *plus* 16 | TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1463, connection cable and 20 beakers 150 ml, 115 V | 1007295 |
| TW alpha *plus* 24 | TW alpha *plus* basic unit with sample rack TZ 1454 for 24 samples, incl. titration head TZ 1462 and 30 beakers 50 ml, 115 V | 1007297 |
| TW alpha *plus* COD | TW alpha *plus* basic unit with sample rack TZ 1444 for 24 COD vessels in accordance with DIN, incl. titration head TZ 1461, rod stirrer TZ 1846, redox electrode Pt 5901, titration tip TZ 1648 and connection cable, 115 V | 1007299 |
| TW alpha *plus* MP | TW alpha *plus* basic unit with sample rack TZ 1459 for 16 samples, incl. titration head TZ 1467, membrane pump MP 25, connection cable and 20 beakers 150 ml, 115 V | 1007306 |

| **Accessories for TW alpha *plus*** | | |
|---|---|---|
| TZ 1444 | Sample rack for 24 COD vessels in accordance with DIN 38 409 | 285213836 |
| TZ 1452 | Sample rack for 12 sample vessels, incl. 20 beakers 250 ml | 285214927 |
| TZ 1454 | Sample rack for 24 sample vessels, incl. 30 beakers 50 ml | 285213844 |
| TZ 1459 | Sample rack for 16 sample vessels, incl. 20 beakers 150 ml | 285213166 |
| TZ 1461 | Titration head for COD sample rack TZ 1444 | 285213621 |
| TZ 1462 | Titration head for 24-sample rack TZ 1454 | 285213639 |
| TZ 1463 | Titration head for 12- (TZ 1452) and 16-sample rack (TZ 1459) | 285213647 |
| TZ 1467 | Titration head for 12- (TZ 1452) and 16-sample rack (TZ 1459) incl. splash shield with membrane pump MP 25 | 285213671 |
| MP 25 | Membrane pump MP 25 with accessories for rinsing, 230 V | 285216005 |
| TZ 1847 | Glass stirrer rod for 12-, 16- and 24-sample rack | 285215175 |
| TZ 1846 | Glass stirrer rod for COD sample rack | 285215134 |
| TZ 1545 | Magnetic stirring rods (10 pcs.) | 285214232 |

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

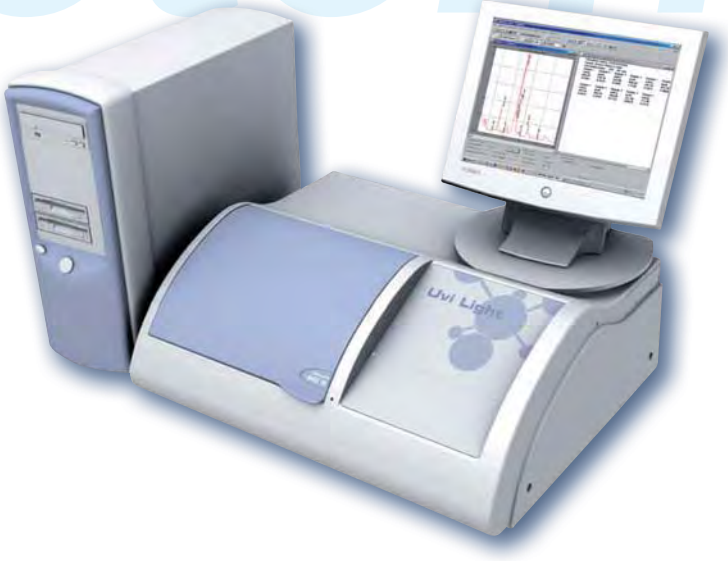
Informations on electrodes for titration and other sensors see section “Laboratory electrodes”

# Content Spectrophotometers




# Selection table Spectrophotometers

| Technical Specifications | PRIM Light/ PRIM Advanced | Uvi Light XS/ Uvi Light XT | UviLine 9100/ UviLine 9400 | UVIKON XS/ UVIKON XL |
|---|---|---|---|---|
| Wavelength range | VIS | UV-VIS | VIS/ UV-VIS | UV-VIS |
| Technique | single beam | single beam | single beam | double beam |
| Display | 2 lines | 2-lines VGA internal/external and PC | QVGA | PC |
| Data storage | | ■ (only with XT and PC) | ■ | ■ |
| Methods | 50 methods | 50 methods XS 250 for XT and unlimited for PC | 100 methods; unlimited with external data storage | unlimited |
| Interfaces | RS232 | RS232 and Centronics for XT | 2 x USB and RS232 | RS232 for PC |
| Cell changer | | ■ (XT and PC only) | ■ | ■ |
| 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.


**Internal Applications**
All applications, basic or standard, are included as standard and are immediately available on 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 navigator keys.

**Real-time Display**
The display of absorbance and transmission is processed in real-time with any measurement mode.

**1 Key = 1 Function**
The keyboard is clearly arranged with each button corresponding to one specific single function.
Operation is therefore simpler and faster.

**Safety – Low Voltage Power Supply**
Mandatory for the area of education and safeness of trainees and of course also applicable for any laboratory.

**Compact**
Light at only 2.5 kg and compact A4 size footprint, PRIM can be handled very 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 on the external printer if connected.

## Advantages PRIM

## Choose between 2 PRIM units:

### PRIM Light:

Basic internal software including standard spectrophotometric applications in 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.

### 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

*) on optional external printer.

## Accessories

### A complete range of accessories:

Printer, tube-holder, manual aspiration system, thermostatted cuvette holder are available on option.

| Technical Specifications | PRIM Light | PRIM Advanced |
|---|---|---|
| Spectral range | 330 – 990 nm | |
| Bandwidth | 10 nm | |
| Accuracy | ±1.5 % | |
| Precision | ±1 nm | |
| Photometric range | –0.3 … 2.5 Abs, 0 … 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 | 115/230V … 50/60Hz | |
| 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:
# The new series of Spectrophotometers from SCHOTT Instruments

**Two complete new high-performance single beam photometer:**

**UviLine 9100**

for measurements at VIS range from 320 – 1100 nm

**UviLine 9400**

for measurements at UV-VIS-range from 190 – 1100 nm

The new spectrophotometers from SCHOTT Instruments convince with an exceptional wide performance range.

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

And additionally:

**Extensive evaluation functions**

The option of storing more than 100 own methods and up to 1000 measuring values / saving approx. 30 spectra (extendable via USB!)

# UviLine


UviLine 9400
Home (admin)
02/25/08 15:09
Concentration
Absorbance / % Transmission
Multi wavelengths
Spectrum
Kinetics
General setup
Logout
AQA
Info
F3
F4
SCHOTT
Instruments
HOME
PRINT
STORE
ZERO • BLANK
TIMER
ESC
START • ENTER

# “Hard” facts:

### Large backlit graphic display

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

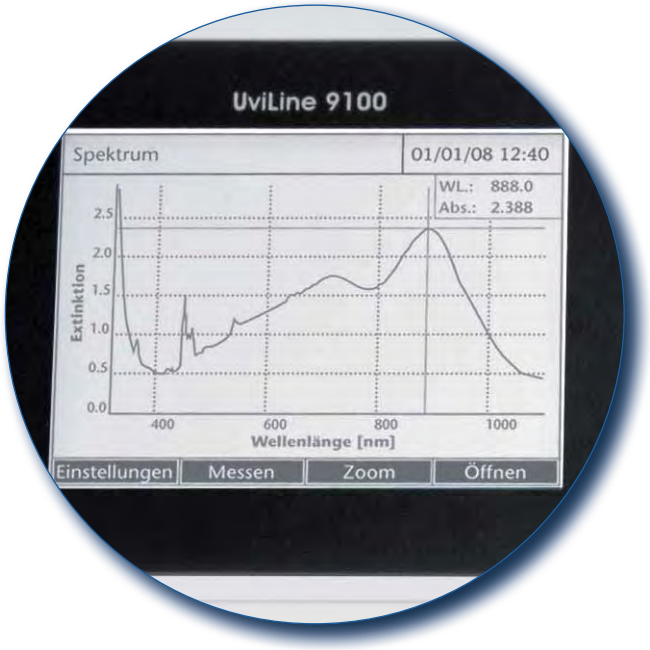
### Clear and well-arranged keyboard

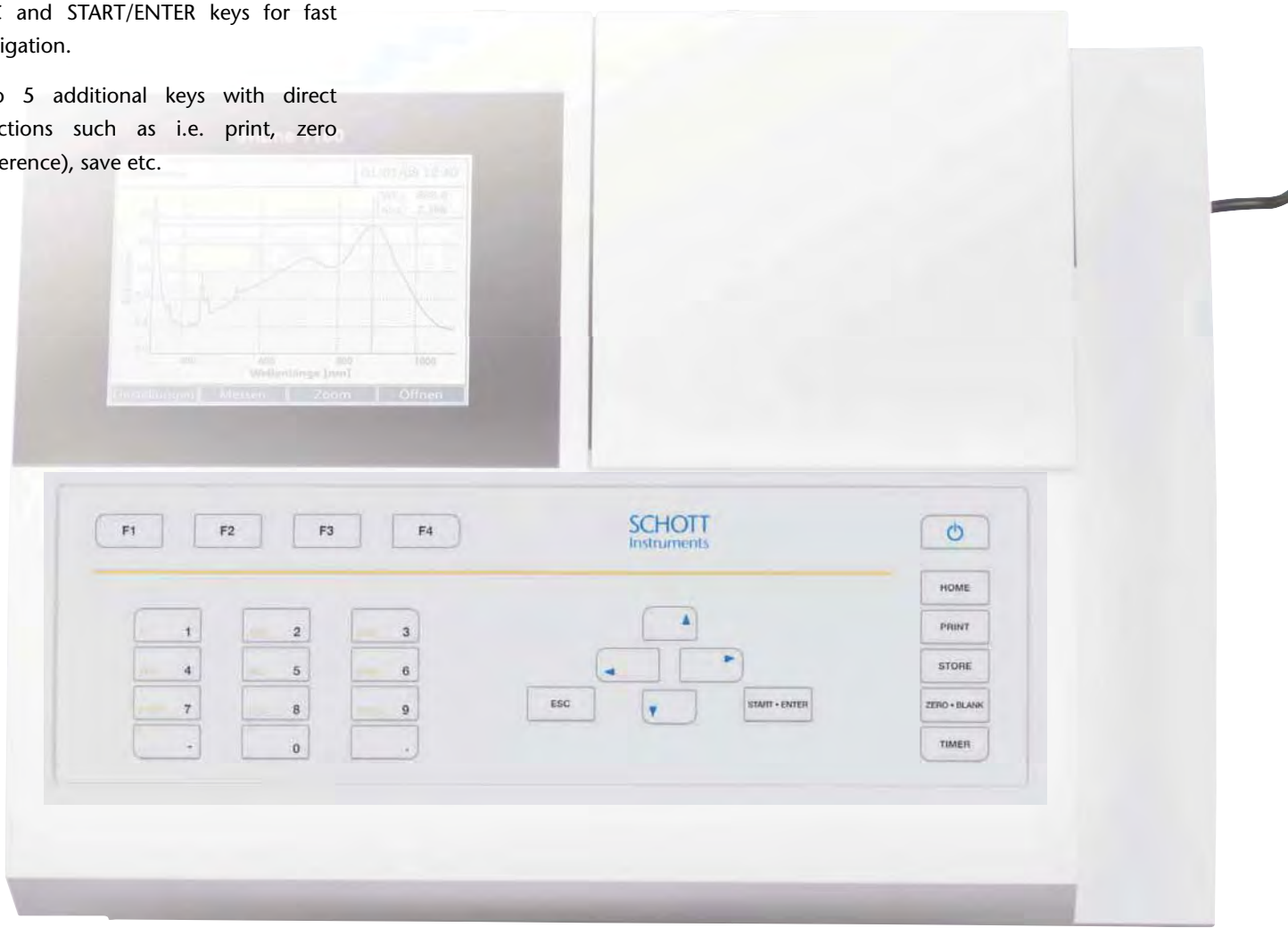
With four function keys F1 – F4 for fast and direct function triggering, such as settings, tools, zoom etc.

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

Specially separated cursor section with ESC and START/ENTER keys for fast navigation.

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



### Modern interfaces

Besides the USB slave interface (USB-B) for connecting a PC, both UviLines also feature a USB master interface (USB-A). This USB master interface enables the connection of various instruments via USB:

- USB memory sticks and USB hard disks. This enables an easy extension towards the internal memory volume and also facilitates the data exchange (bi-directional).
- Standard printers with USB interface
- External PC keyboard
- A RS232 interface is also included

### Powerful optics

The UviLine comprises an excellent optical design in this range:

- 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 wave length calibration

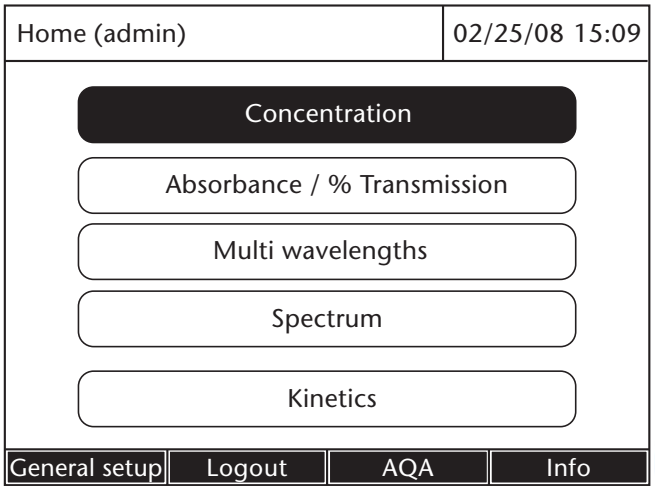
### Wide measuring range and extensive accessories

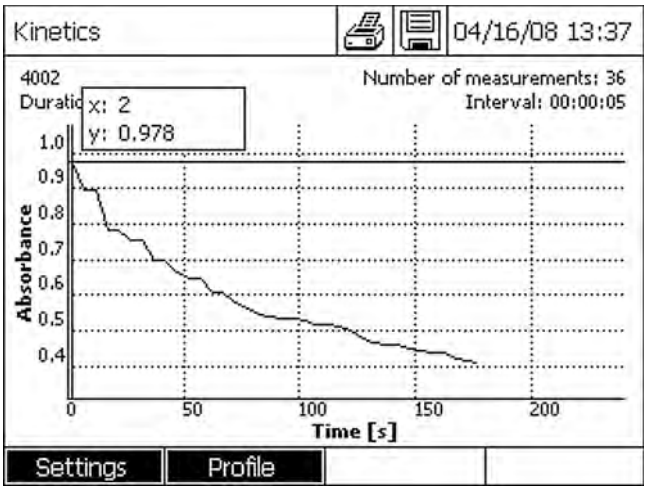
The wide measuring range enables the usage of cell holders with a length of max 100 mm. This also enables measurements with very low concentrations. There are 4 different cell holders/sample changers available, which can be replaced very easily:

- single cell holder, 10 mm (is included in the scope of delivery), thermostatable
- single cell holder 100 mm
- single cell holder, 10 mm thermostatable (peltier)
- automatic sample changer, 5+1

# “Soft” facts

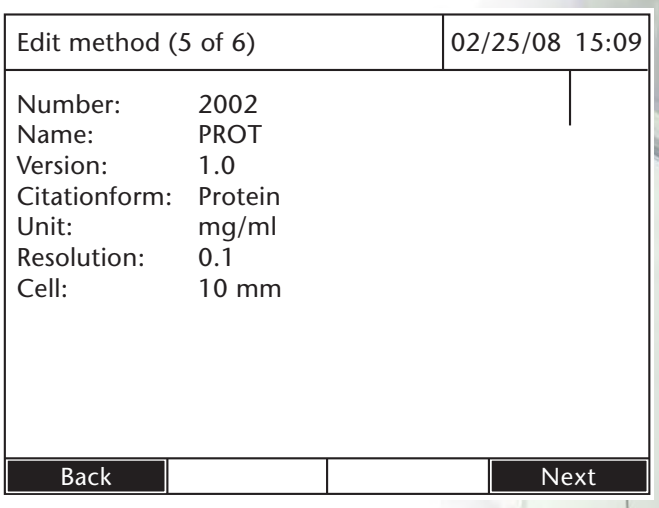
Besides the standard applications such as absorption, transmission and concentration measurement, both UviLine models comprise the complete functionality for the spectra, kinetics and multi wavelength analytics.

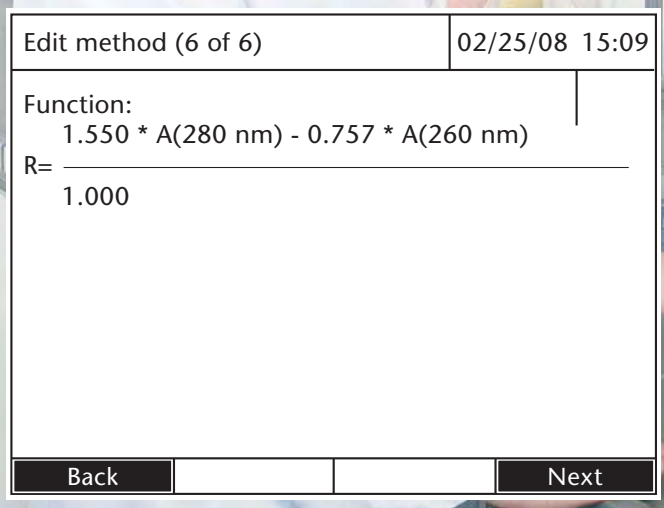


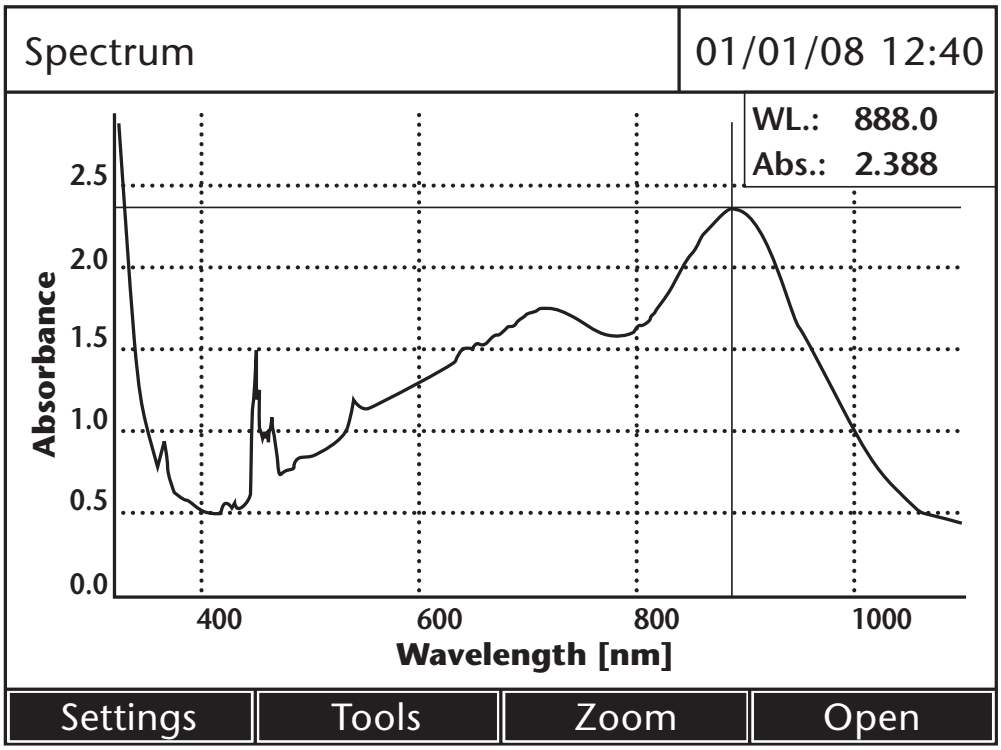




With the **multi wavelength analytics** up to 4 absorption values with different wavelengths can be measured and saved. For each application you have the possibility to programme an own optimized method. By using own programmed methods, the evaluation of the measuring results becomes easier.

The determination of the reaction time values is enabled through the **kinetics** programme section. The kinetics measurement can be stored and in the following evaluated using the cursor.

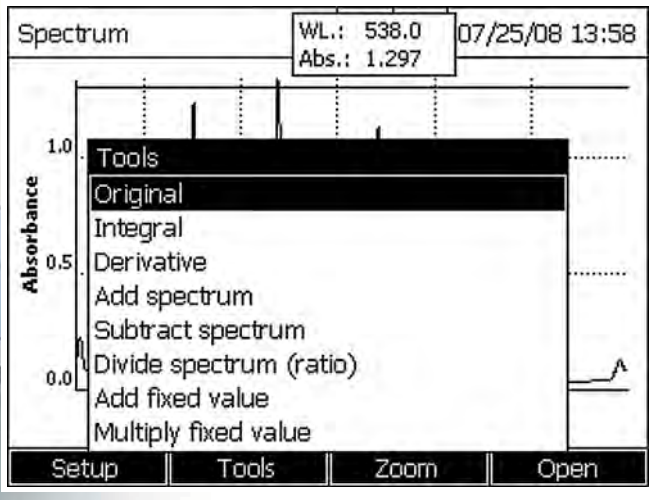





Whenever the optimal wavelength for the determination of the concentration is unknown or the purity of a solution is to be determined, the adding of a **spectrum** becomes necessary. By using the zoom function and the cursor it is quite easy to edit the spectra.

Furthermore, there is a whole range of additional evaluation functions such as min/max recognition, add spectrum and subtract spectrum, derivative calculation (1-3. derivative), peak surface calculation, as well as multiply fixed value.



# Technical Specifications

## Software

| | |
|---|---|
| **Concentration** | From 0 to 10 standards with interpolations. Graphic calibration curve management. |
| **Kinetics** | Dynamic graphic curve display, graphic management: zoom, sloop 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 wih 3 levels |
| **Storange capacity** | Internal: 100 methods/30 graphics/1000 Data – with USB stick: limited to the size of the USB Stick |
| **Methods** | > 100 methods |

## Spectrophotometer

| **Technical Specifications** | **UviLine 9100** | **UviLine 9400** |
|---|---|---|
| **Wavelength range** | 320 – 1100 nm | 190 – 1100 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, 320x240 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 65 °C | |
| **Dimensions** | 404 x 197 x 314 mm (W x H x D) | |
| **Weight** | 4 kg | |
| **Accessories** | Sipper, 5+1 cell changer, cell holder (thermostatable), cell holder 100 mm | |

# Ordering Information

| Type No. | Order No. | Product | Description |
|---|---|---|---|
| **UviLine 9100-EU** | 285700100 | Spectrophotometer | UviLine 9100, single beam spectro photometer, 4 nm with a measuring range from 320 to 1100 nm and EU-power cord |
| **UviLine 9100-US** | 285700110 | Spectrophotometer | UviLine 9100, single beam spectro photometer, 4 nm with a measuring range from 320 to 1100 nm and US-power cord |
| **UviLine 9400-EU** | 285700120 | Spectrophotometer | UviLine 9400, single beam spectro photometer, 4 nm with a measuring range from 190 to 1100 nm and EU-power cord |
| **UviLine 9400-US** | 285700130 | Spectrophotometer | UviLine 9400, single beam spectro photometer, 4 nm with a measuring range from 190 to 1100 nm and US-power cord |
| **SZ 2100** | 285700200 | Automatic cell changer | 5+1 cell changer, controlled from UviLine |
| **SZ 2110** | 285700210 | Cell holder | Single, 10 – 100 mm |
| **SZ 2120** | 285700220 | Cell holder | Single, 20 mm |
| **SZ 2130** | 285700230 | Cell holder | Single, 10 mm, (included in delivery of all UviLine) |
| **SZ 2140** | 285700240 | Cell holder | Single 10 mm, thermostatable |
| **SZ 2150** | 285700250 | Sipper | controlled from UviLiner |
| **SZ 2160** | 285700260 | Cell holder | Single 10 mm, thermostatable (Peltier) |

# Uvi Light –
# The universal single beam instruments

### A flexible range of instruments.

Any application can find a solution with one of the 7 Uvi Light models:

- Powerful software for any use level
- Huge cell compartment for any kind of sample
- Large range of accessories


### The best performance

Accurate results thanks to SCHOTT Instruments' best technological choices.

### Designed for most applications:

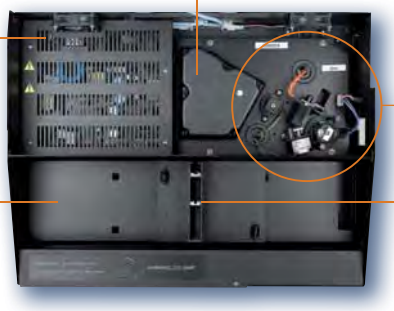
- Agro-food
- Biotechnology
- Chemistry & petro-chemistry
- Control labs
- Clinical biology
- Research
- Teaching

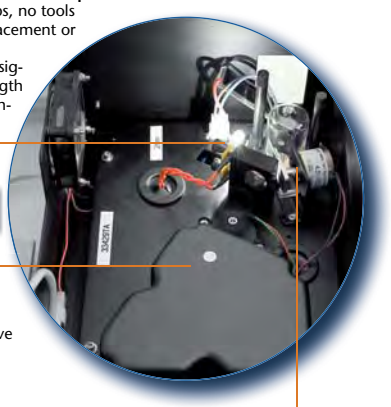

## The best technological choices:

**Compact & High Perf. Monochromator**
- New design with small footprint
- Holographic concave with 1200 lines/mm
- Sealed against dust

**Halogen and DeuteriumLamps**
- Preadjusted lamps, no tools required for replacement or adjustment
- Very continuous signal over wavelength for spectrum scanning efficiency

**Smart electronic design**
- New electronic board design
- Only one control card
- Fewer contactors, fewer connectors
- Less background noise
- Higher energy output





**Large Cell Compartment**
- More space for accessories settings
- Position for automatic 9-cells changer
- Drain for liquid spillage

**10 to100 mm Cell Holder**
- Standard delivery
- Unique cell holder for cells up to 100 mm, no extra holders needed

**Seiya Namioka Monochromator**
1200 l/mm holographic concave grating:
- High energy
- Low stray light

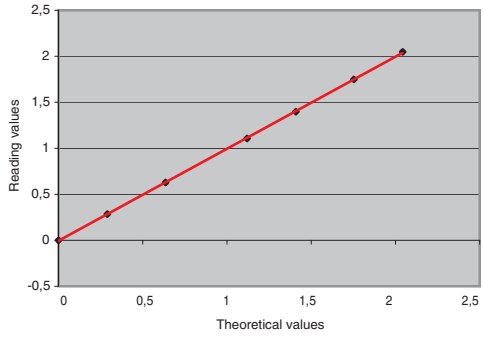
**Light Beam Chopper**
- Gives fixed light frequency
- Eliminates stray light from other sources

## Two bandwidths

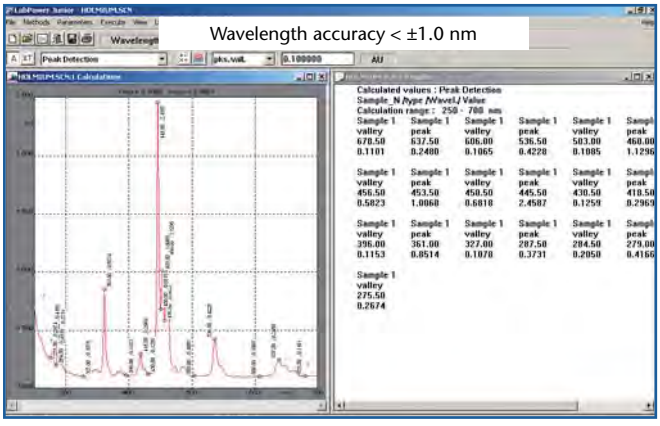
5 nm for the best energy, 2 nm for high-resolution applications

## For the best performances

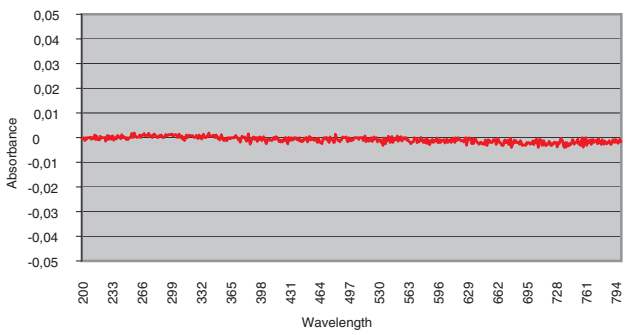
Linearity 0.99 % up to 3 Abs @ 250 nm and 540 nm



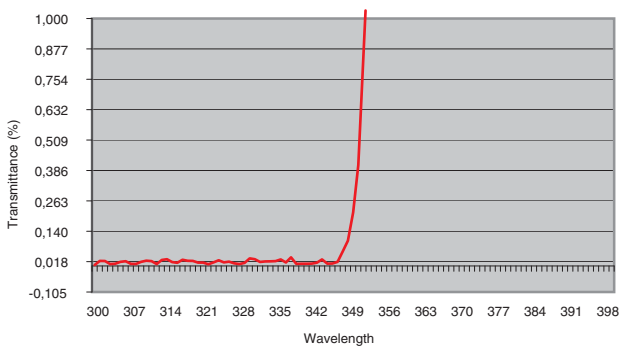

Wavelength accuracy < ±1.0 nm



Base line reproducibility ± 0.002




Stray light better than 0.05 % @ 200 and 340



# A wide range of models and accessories

## A choice of 3 different software/interfaces:

### XS: ready to use software for routine applications

- Absorbance/Transmittance
- Concentration up to 8 standards
- Spectrum scanning
- Kinetics
- 50 methods programmable

### XTD: Fully programmable advanced applications

- Absorbance/Transmittance, permanent reading
- Multi-standard concentration with graphic functions
- Spectrum scanning wiht calculation & graphic
- Kinetics with calculation & graphic
- Unlimited methods programmable with hard disk & floppy
- Macro-commands & programmable software
- Methods and data export

### PC: Enter the Windows world

- Absorbance, permanent reading
- Multi-standard concentration with graphic functions
- Spectrum scanning with calculation & graphic
- Kinetics with calculation & graphic
- Unlimited methods programmable with hard disk
- Methods and data transfer

## A large range of accessories

### SZ 1520 9 positions 10 mm cell holder

Accepts up to 9 standard 10 mm optical path cells. Requires automatic cell changer SZ1550.

### SZ 1550 Automatic cell changer for 9 positions cell holder

For use with 9-cell holder SZ1520 – quick and simple installation with 1/4 turn clips.

### SZ 1580 Aspiration system with 80 µl quartz cuvette

Automatic sample aspiration system delivered with peristaltic pump, 80 µl quartz flow-through cell and tubing kit.

### SZ 1010 LabPower software

The multiplatform Windows NT/2000 or XP compatible software package, LabPower provides a convenient and easy-to-use well proven software environment. Basic routine applications including control of Uvi Light accessories.

### SZ 1910 Serial Black & white KYOLINE thermal printer

40 columns with cable for Uvi Light XS.

### SZ 1915 KYOLINE thermal printer

40 columns with cable for Uvi Light XTD.

| Technical Specifications | |
|---|---|
| Band width | 2 or 5 nm |
| Spectral range | 190 – 900 nm |
| Accuracy | ± 1 nm |
| Reproducibilty | ± 0.1 nm |
| Display resolution | 1 nm (0.1 nm in spectral mode) |
| Photometric range | -0.1 to 3,000 A, 0.1 to 110 % T |
| Accuracy | ± 0.005 A |
| Drift | < 0.0003 A/h at 500 nm |
| Stray light | < 0.4 % at 200 nm<br>< 0.005 % at 220 and 340 nm |
| Base line stability | ± 0.002 A |
| Memories | 50 methods on XS, unlimited on XT/XTD and PC |
| Light source | Visible tungsten-halogen pre-adjusted lamp<br>UV deuterium pre-adjusted lamp |
| Monochromator | Concave holographic grating |
| Resolution | 1200 lines/mm |
| Detector | Silicon diode |
| Interfaces | RS232C & Parallel |
| Power | 115 V/60 Hz to 230 V/50 Hz |
| Dimensions | (H x L x D) 295 x 500 x 415 mm<br>(11,6 x 19,7 x 16,3 inches) |
| Weight | 7.5 kg (15 lbs) |

| Uvi Light Models | XS | XTD/ XT Color | PC |
|---|---|---|---|
| Range | UV-VIS | UV-VIS | UV-VIS |
| Optics | Single beam | Single beam | Single beam |
| WL, nm | 190 – 900 | 190 – 900 | 190 – 900 |
| BW, nm | 5 or 2 | 5 or 2 | 5 or 2 |
| Display | 2 lines | XTD: external<br>XT: internal | PC |
| Software | Abs/Trans, Concentration, Wavelength scan, Kinetics, Multi-wavelength (2), Storage 50 methods | Abs/Trans, Concentration, Wavelength scan with graphic, Kinetics with graphic, Multi-wavelength (10). Storage 250 methods, Storage of results, Macro commands | Abs/Trans, Concentration, Wavelength scan with graphic, Kinetics with graphic, Multi-wavelength (7). Storage of methods, Storage of results, Windows environment |

| Type no. | Order no. | Product | Description |
|---|---|---|---|
| **Uvi Light XS5** | 285600130 | Spectrophotometer | Uvi Light XS single beam spectrophotometer 5 nm, with 10 – 100 mm standard cell colder |
| **Uvi Light XS2** | 285600140 | Spectrophotometer | Uvi Light XS single beam spectrophotometer 2 nm, with 10 – 100 mm standard cell colder |
| **Uvi Light XTD5** | 285600170 | Spectrophotometer | Uvi Light XTD single beam spectrophotometer 5 nm, PS/2-mouse, keyboard and 15" TFT screen, 10 – 100 mm cell holder |
| **Uvi Light XTD2** | 285600180 | Spectrophotometer | Uvi Light XTD single beam spectrophotometer 2 nm, PS/2-mouse, keyboard and 15" TFT screen, 10 – 100 mm cell holder |
| **Uvi Light XT5** | 285600175 | Spectrophotometer | Uvi Light XT single beam spectrophotometer 5 nm, with integrated LCD colour screen and 10 – 100 mm cell holder |
| **Uvi Light XT2** | 285600185 | Spectrophotometer | Uvi Light XT single beam spectrophotometer 2 nm, with integrated LCD colour screen and 10 – 100 mm cell holder |
| **Uvi Light PC2** | 285600160 | Spectrophotometer | Uvi Light PC single beam spectrophotometer 2 nm, with 10 – 100 mm standard cell holder, LabPower software and PC-connection cable |
| **SZ 1010** | 285600300 | Software | LabPower for Uvi Light and Uvikon (delivered with UVIKON XS) with PC-connection cable SZ 1430 |
| **SZ 1520** | 285600810 | Cell holder | 9 positions, 10 mm, for Uvi Light (requires cell changer SZ 1550), the Uvi Light XS requires software LabPower for control |
| **SZ 1530** | 285600820 | Cell holder | 9 positions, 10 – 100 mm, for Uvi Light (requires cell changer SZ 1550), the Uvi Light XS requires software LabPower for control |
| **SZ 1540** | 285600830 | Cell holder | 9 positions, thermostatable 10 mm, for Uvi Light (requires cell changer SZ 1550), Uvi Light XS requires software LabPower for control |
| **SZ 1550** | 285600840 | Automatic cell changer | For all 9 positions cell holder |
| **SZ 1560** | 285600850 | Sipper | Contents peltier thermostated single cell holder, 80 µl flow-through quartz cell, peristaltic pump and tubing kit |
| **SZ 1580** | 285600870 | Sipper | Contents 80 µl flow-through quartz cell, peristaltic pump and tubing kit |
| **SZ 1910** | 285601200 | Printer | KYOLINE b&w thermal printer 40 columns with connection cable |
| **SZ 1915** | 285601205 | Printer | Black & white KYOLINE thermal (for Uvi Light XT and XTD only) |

# UVIKON – A true double beam instrument based on long-term experience

## Experience

Since more than 70 years SCHOTT Instruments provides innovative solutions for the laboratory analysis. Now SCHOTT Instruments introduces the fourth-generation UVIKON UV-VIS Spectrophotometers.

The UVIKON gives you confidence in your data. Its superior and highly efficient true double beam optical design is matched with the latest digital signal processing technology (ADSP, Advanced Digital Signal Processing). ADSP guarantees reliable data acquisition, outstanding sensitivity and extremely low signal noise for consistent linear measurement results – even for solutions with high ground absorption. These unique advantages give you the flexibility to accomplish the analyses you would like to process.

## The right instrument

Two UVIKON models – the UVIKON XS and XL – are available to match your budget and analytical needs. Both models include full software for simple reads, standard curves, wavelength scans, wavelength programming, time drive and kinetics. Its software is built to make it quick and easy for all to use – regardless of the analytical method – without sacrificing capabilities.

The UVIKON XS is provided with the software Lab Power. The UVIKON XL is provided with the software UV VISion. The UV VISion software is also available in a 21 CFR part 11 compliant version (please refer also to the technical specs of the software).

Make your next UV-VIS an instrument built to give you confidence in your data.

Let us prove value on how the UVIKON is the instrument of choice to meet your present and future UV-VIS needs.


*UVIKON XS/XL*
*Double beam UV-VIS Spectrophotometer*

## Ease of operation

### UVIKON XS

The UVIKON XS offers double beam capability at a very competitive price. It sets the standard for both value and performance. The UVIKON XS is quality-engineered with optimized simplicity to provide more productivity to every laboratory. Its advanced double-beam technology, high accuracy and precision, and quick usability assure top-quality results every time.

### UVIKON XL

The UVIKON XL sets the standard for excellence in optics, software and performance. With its low stray light, superior photometric linearity, and high resolution, the UVIKON XL easily meets your lab's advanced UV-VIS requirements. It gives every user the power to accomplish both routine and demanding applications with ease.

The UVIKON XL's automation and data handling capabilities also provide maximum versatility and productivity for your laboratory.


*The UVIKON's status display always shows the operating status of the system*

*The UVIKON's sample compartment is engineered to save you time. There is plenty of room to insert samples easily, and it lets you quickly exchange accessories whenever you want. And of course it is designed for easy maintenance.*

# Superior Optics

**Superior precision and accuracy begin with a superior optical design. SCHOTT Instruments sets the standard for uncompromised optical performance with the UVIKON's state-of-the-art optical design.**

### Measurement stability

- Reproducibility with every analysis
- Accurate data for long kinetics
- Double-beam optics with dark current correction
- Thermally insulated optical bench
- High-sensitivity detector

### Precise data

- Accurate peak wavelength values
- Superb resolution for fine molecular structure data
- State-of-the-art grating drive system
- Precise data uncompromised by noise

### Measurements even with open sample compartment lid

- Easy use of extra-large accessories
- Convenient access for larger cuvettes
- Optimised design of quartz windows in sample compartment

### Direct usability with microcuvettes

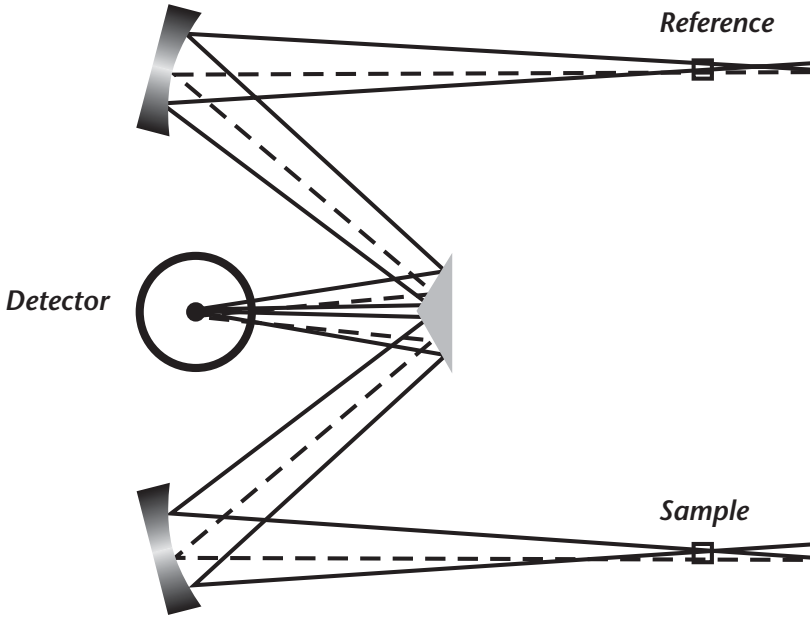
- Microcuvettes fit directly into the standard cell holder without adapters or beam masks to enable sensitive small-volume measurements.

### High energy throughput

- Extended photometric range
- Accurate measurements even at very high concentrations
- Modern computer-optimized optics
- Compact optics design
- Proven, efficient ZeissTM monochromator

### Consistent performance

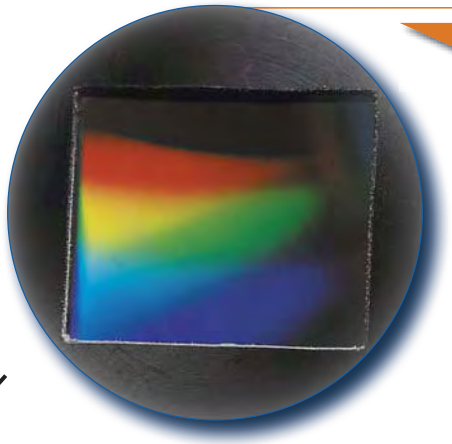
- Consistent performance now and in the future.
- Optics protected from lab environment
- Reproducible and reliable signal processing
- True symmetrical optics and electronics
- Automatic wavelength calibration at switch on



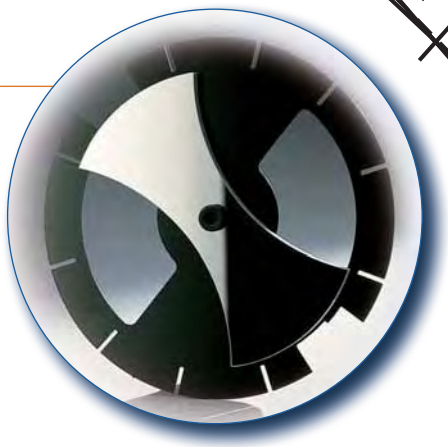
*Lamps compartment thermally isolated from optical bench*

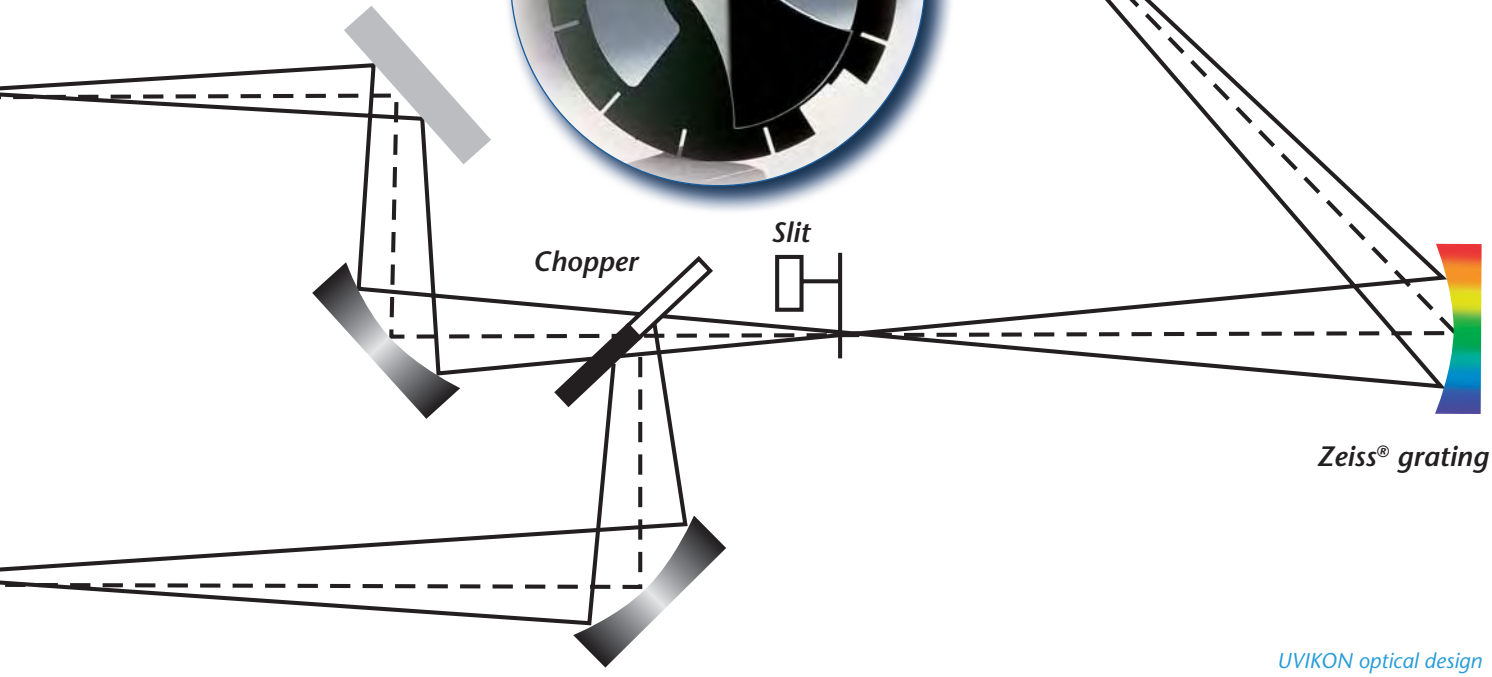
***Deuterium und Halogen lamp***

*High-efficiency Zeiss® grating designed for maximum optical throughput and low stray light*



*Chopper system corrects for any change in lamp output and dark current 100 times per second (120 at 60Hz)*

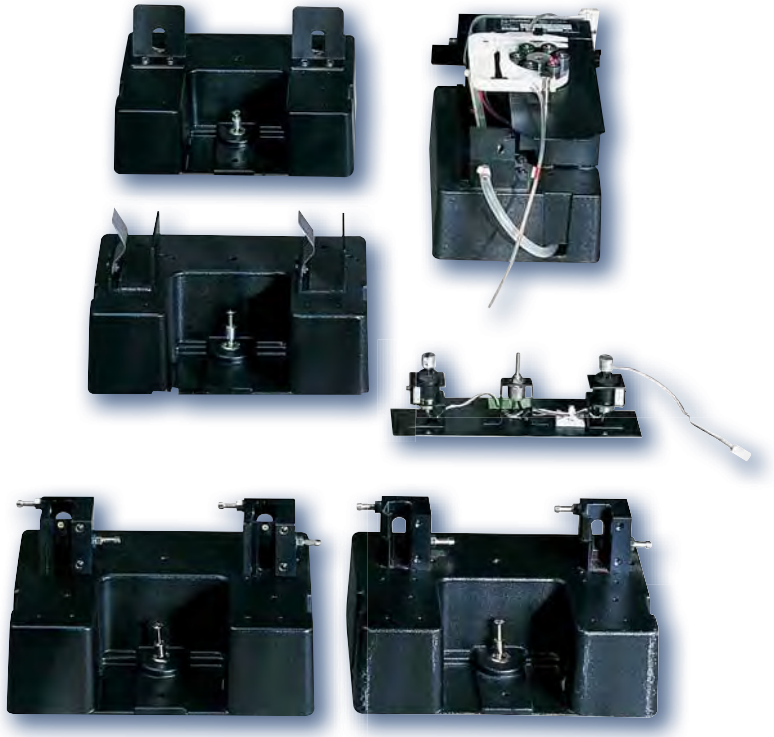




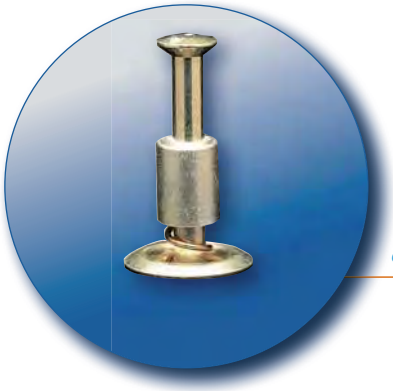

***Zeiss® grating***

# Multifunctional Accessories

SCHOTT Instruments offers a complete range of accessories for the UVIKON spectrophotometers. Designed for reliability and built to exact standards, each accessory is pre-aligned. All accessory components can be easily replaced in the sample shaft in its original operation position, not requiring any tools.



- *Peristaltic sipper with sample return and thermostatable flowcell holders*
- *Temperature sensors*
- *Magnetic stirrer*
- *Long path rectangular cell holder (up to 100 mm)*
- *Long path cylindrical cell holder (up to 100 mm)*
- *Filter and solid sample holder*



*The UVIKON's QuickLock feature allows installation and exchange of accessories without tools in a matter of seconds.*

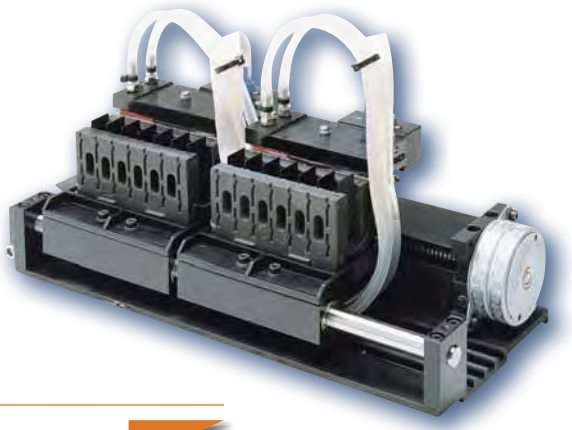
*Gilson auto sampler for laboratory automation*


*Thermopack – external Peltier thermostating system*

*Performance validation kit with filters and software. Every Uvikon comes fully tested and includes a factory Certificate of Performance. All test data is archived at the factory for full traceability*

*Automatic water-thermostated sample changer for simultaneous analysis of up to 10 enzyme reactions*


*Thermosystem – Software controlled, Peltier thermostated accessory for nucleic acid thermal melts*



# Software UV VISion

### Simple compilation of methods and automation of complex calculations:

All instrument parameters used for measuring, also including the formulas for calculating the results, are defined in a method and stored in the database. The registered measuring data is stored with the corresponding method and moreover the method version. As such, it is always traceable to see which method was used for generating the measuring data. In the event that a method is altered, a new version of the method will be released automatically.

The integrated formula editor enables to accomplish even complex calculations by automizing them. Regardless whether calculations of multiple samples and/or the calculation of one result of various wavelengths – every calculation is fully automated by the formula editor.

### Documentation and storage of measuring data:

Upon completion of a single measurement or a measurement sequence, an automatic report can be produced. The report records the curves, the original measurement data, the calculated results, the method with all measurement parameters, the current user, and the date and time of the measurement. Further, specific client data such as the company name, department and company logo can be included.

The measurement data, the corresponding results and methods used, as well as the report are stored in a save database. To guarantee further data safety, the database can be automatically stored by backup on two separate paths.This makes a loss of data practically impossible.

### Data export:

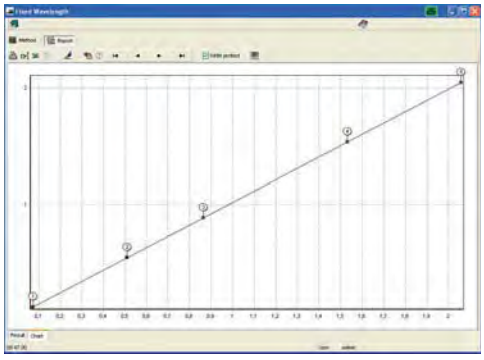
All raw data, graphics and results can be directly exported to Excel and as such be made available to other MS Office applications.

### UV VISion Pharma:

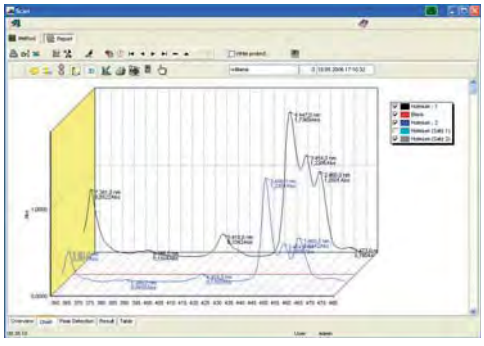
The version UV VISion Pharma fully complies with the requirements of the FDA Regulation 21 CFR Part 11 in respect to:

- User Management:
  Three separate user groups with varying rights. The administrator can limit the creation of methods to a small group, for example.
- Electronic Records:
  All measurement data, reports, results and the corresponding methods are stored in the database. Double-assured data security.
- Electronic Signature:
  The reports can be given a digital signature (login name and password).
- Audit Trail:
  Every alteration of method or report will be automatically registered in the audit trail with date/time/time zone process, user name and a detailed description.

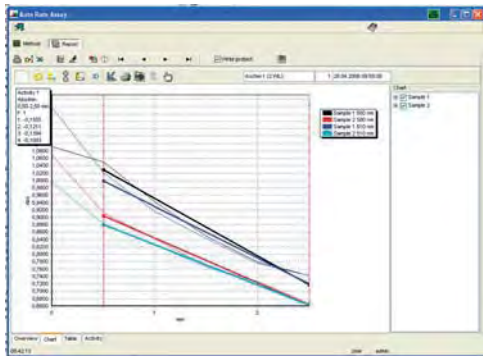

*The UVVISion software supports all measurement methods in photometry such as:*



- *Fixed Wavelength:*
  *Readings at a fixed wavelength, with calibration curve*
- *Wavelength Program:*
  *Readings at numerous wavelengths*



- *Wavelength Scan:*
  *Spectra recording*



- *Time Drive:*
  *Sequential readings with rapid kinetics*
- *Auto Rate Assay:*
  *Parallel measurements from up to 10 samples at slower assay of activity*

# Software Lab Power

The Lab Power software supports all basic routine applications in photometry such as:

### Fixed Wavelength:

Measurements at a single wavelength including calibration curves up to 33 standards.

### Wavelength Program:

Allows data acquisition at 2–14 wavelengths)

### Wavelength Scan:

Adding of spectra with real time calculation and post-run calculations of already existing spectra. Maximum, minimum and derivative evaluations as well as curve overlay maximum are possible.

### Time Drive:

Allows sequential measurements of kinetics data at very high speed (up to 2000 data points/min) or over a long period (15 hours).

### Auto Rate Assay:

Provides parallel kinetics measurements up to 10 samples using the cell changer

### Further evaluation functions:

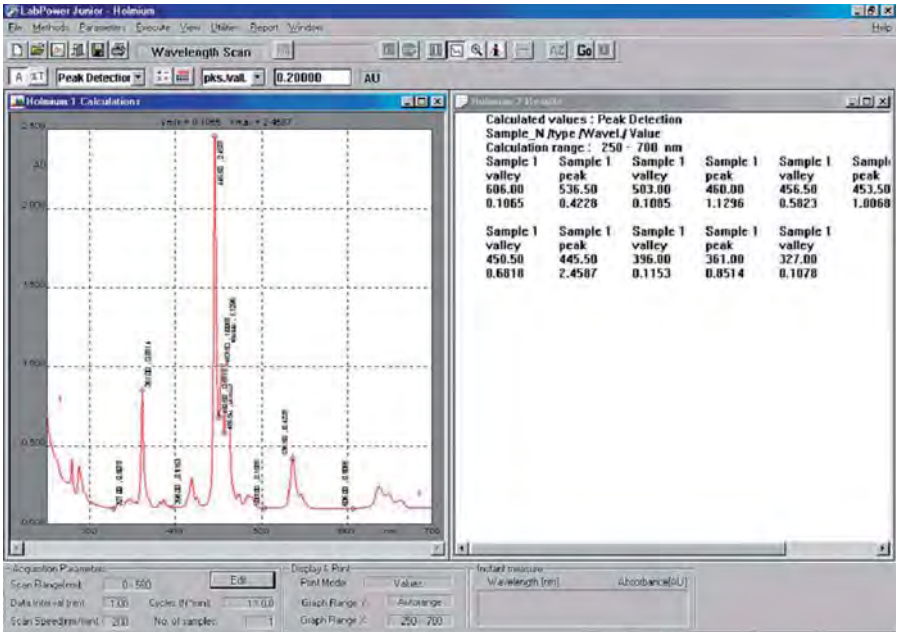
- Enzyme activity calculations by linear regression
- Calibration function via linear or quadratic regression as well as linear interpolation
- Curve addition, substraction, multiplication and division
- Wavelength ratio, difference and base point

### Report Capability:

Automatic printing and storage of individual analytical reports. All measuring data are stored with specific comments and file extension.

### Data Export:

Simple export into Excel or ASCII.



# Specifications

### Optical Design

- Well-proven true symmetric double beam optics with only 6 reflecting surfaces per beam.
- High energy diffraction Zeiss® monochromator design using a holographic blazed grating with 1300 lines per mm.
- Very sensitive photodiode (XS)/ photo-multiplier (XL) with a rotating chopper providing 100% energy in sample and reference beams plus dark current correction.
- External source bench providing thermal insulation with optical bench and isolation of the whole photometric assembly against contamination by ozone emitted by deuterium lamp.
- Optical bench base manufactured to a tolerance of 0.01 mm in 1 meter.
- Complete optical system sealed against atmospheric contamination from dust and volatile compounds.

### Sample Compartment

- 140 mm depth, 332 mm width, 162 mm height, with 120 mm beam separation.
- Total and easy access: front top and back covers are quickly removable.
- Three-point positioning of accessories for high reproducibility of results.
- Quartz windows at the beam entrance and exit to the sample compartment prevent the optics from being contaminated.

### Accessories

- Thermostatable standard cell holder directly useable with micro and ultramicro cells for small samples.
- Large family of optional Quick Lock accessories including a variety of cell holders, stirrer, thermostatable automatic cell changer, temperature sensor, thermostatable sipper, Thermopack and Thermosystem (PeltierTechnology).

### Ambient temperature

- Operating temperature: 15 to 30 °C.

### Configuration requirements

- Recommended: PC with Windows XP Pro, 1 free RS 232 port, 128 MB RAM, 50 MB free disk space.
- Optional printer: all standard Windows printers.

# Technical Specification UVIKON XS

| Technical Data UVIKON XS | |
|---|---|
| **Wavelength range** | 190 – 1100 nm |
| **Wavelength steps** | 0.05 – 10 nm |
| **Scan speed** | 5 – 2000 nm/min |
| **Transfer speed** | 5000 nm/min |
| **Spectral bandwidth** | 1.8 nm (fixed) |
| **Wavelength accuracy**<br>(Holmium oxide filter at 10 nm/1nm slit) | ± 0.3 nm |
| **Wavelength reproductibility**<br>(with Holmium oxide filter at 44.4 nm and second wavelength at 536.7 nm; positioning speed 7,000 nm/min) | ± 0.03 nm |
| **Baseline flatness, 200 – 800 nm**<br>(1 nm Step, 200 nm/min scanning speed)) | < ±1 mAbs |
| **Stray light**<br>(NaI (10g/l), 220 nm, 1.8 nm, 1 sec) | < 0.03 %T |
| **Linearity**<br>(250 nm, 1.8 nm, 1 sec. $r^2$>0.999) | 3.3 Abs |
| **Photometric range** | ±3.5 Abs |
| **Photometric accuracy**<br>(0.85 Abs, certified filters, 1 sec., 590 nm) | ±3 mAbs |
| **Photometric precision**<br>(0.85 Abs, certified filters, 1 sec., 590 nm) | ± 0.5 mAbs |
| **Noise (RMS),**<br>(measured at 580 nm for 5 min, 1 sec, ASTM E685) | < 30 µAbs |
| **Drift**<br>(580 nm, 1 sec, after 2 hrs. of warm-up) | < 0.1 mAbs/h |
| **Response time** | 0.02 – 5 sec |
| **Light sources** | Deuterium and Tungsten-Halogen |
| **Monochromator** | High energy, low stray light diffraction grating with 1300 lines/mm, 175 mm focal length |
| **Dimensions** (W x D x H) | 680 mm x 565 mm x 275 mm |
| **Weight** | 35 kg net |
| **Mains Power** | 100/240 VAC ± 10%, 50/60 Hz |
| **Power Consumption** | Max. 200 VA |

# … UVIKON XL and Ordering Information

| Technical Data UVIKON XL | |
|---|---|
| **Wavelength range** | 180 – 900 nm |
| **Wavelength steps** | 0.05 – 10 nm |
| **Scan speed** | 5 – 2000 nm/min |
| **Transfer speed** | 7000 nm/min |
| **Spectral bandwidth** | 0.2 – 0.5 – 1 – 2 – 4 – 6 nm;<br>0.5 – 1 – 2 – 4 nm, reduced height |
| **Wavelength accuracy**<br>(Holmium oxide filter at 10 nm/1nm slit) | ± 0.25 nm |
| **Wavelength reproductibility**<br>(with Holmium oxide filter at 44.4 nm and second wavelength at 536.7 nm; positioning speed 7.000 nm/min) | ± 0.025 nm |
| **Baseline flatness, 200 – 800 nm**<br>(1 nm Step, 200 nm/min scanning speed) | < ±1 mAbs |
| **Stray light**<br>(NaI, 220 nm, 1 nm, l sec) | < 0.015 %T |
| **Linearity**<br>(250 nm, 2 nm, 1 sec. $r^2$>0.999) | 3.3 Abs |
| **Photometric range** | ± 5 Abs |
| **Photometric accuracy**<br>(0.85 Abs, certified filters, 1 sec., 590 nm) | ± 3 mAbs |
| **Photometric precision**<br>(0.85 Abs, certified filters, 1 sec., 590 nm) | ± 0.5 mAbs |
| **Noise (RMS),**<br>(measured at 580 nm for 5 min, 1 sec, ASTM E685) | 40 µ Abs |
| **Drift**<br>(580 nm, 1 sec, after 2 hrs. of warm-up) | < 0.1 mAbs/h |
| **Response time** | 0.02 – 10 sec |
| **Light sources** | Deuterium and Tungsten-Halogen |
| **Monochromator** | High energy, low stray light diffraction grating with 1300 lines/mm,<br>175 mm focal length |
| **Dimensions** (W x D x H) | 680 mm x 565 mm x 275 mm |
| **Weight** | 35 kg net |
| **Mains Power** | 100/240 VAC ± 10% 50/60 Hz |
| **Power Consumption** | Max. 200VA |

| Type no. | Order no. | Product |
|---|---|---|
| **Uvikon XS (CE) (US/CSA)** | 285600110 | Includes LabPower software package.<br>The packages includes: LabPower software, DNA/RNA and validation applications |
| **Uvikon XS-UVVision** | 285600100 | Delivered with Software UV VISion |
| **Uvikon XL (CE) (US/CSA)** | 285600120 | Includes UVVISion Software Package (standard version)<br>All UVIKON models include standard thermostatable cell holder compatible with micro and ultra micro cells, accessory controller to allow connection of all UVIKON accessories. |
| **SZ 1015** | 285600305 | UVVISion software |
| **SZ 1016** | 285600306 | UVVISion Pharma, software according to 21 CFR, part 11 |
| **SZ 1017** | 285600307 | Upgrade to UVVISion Pharma |
| **SZ 1035** | 285600325 | Thermo system (6x6 Auto cuvette changer, Peltier thermostated) |
| **SZ 1036** | 285600326 | Thermo pack (external water bath with Peltier technology) |
| **SZ 1110** | 285600400 | 6+6 automatic cell changer, water thermostatable |
| **SZ 1140** | 285600430 | Sipper system |

# Capillary viscometry from SCHOTT Instruments – know how from the very beginning

**Innovative capillary viscometry – from the outset**

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

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

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

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

# Contents viscometry

# Viscometers within quality assurance systems

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

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

# Polymer applications for the AVS measurement systems

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

| Type | Abbr. | Solvent | Capillary | Operating temperature | Standards | Suitability of the AVS measurement systems VC* | 370 | 470 | Pro |
|---|---|---|---|---|---|---|---|---|---|
| Cellulose EWNN | C<br>I | Cuen<br><br>Couxam | 0c<br>CAN CM<br>I Micro | 20 °C | SNV 195 598S<br><br>15:88 | ■ | ■ | ■ | ■ |
| Cellulose acetate | CA | Dimethyl-chloride/ methanol | 0c<br>I<br>I Micro | 25 °C | DIN 53 728/1 | ■ | ■ | ■ | ■ |
| Polyamide | PA | Sulphuric acid (96%) | II<br>IIc | 25 °C | DIN 53 727<br>ISO 307 | ■ | ■ | ■ | ■ |
| Polyamide | PA | Formic acid (90%) | I<br>Ic | 25 °C | DIN 53 727<br>ISO 307 | ■ | ■ | ■ | ■ |
| Polyamide | PA | m-cresol | II<br>IIc | 25 °C | DIN 53 727<br>ISO 307 | ■ | ■ | ■ | ■ |
| Polybutylene terephthalate | PBT | Phenol/dichloro benzene (50:50) | Ic<br>II | 25 °C | DIN 53 728/3<br>ISO 1628-4 | ■ | ■ | ■ | ■ |
| Polycarbonate | PC | Dichloromethane | 0c<br>I | 25 °C | DIN 7744/2<br>ISO 1628-4 | ■ | ■ | ■ | ■ |
| Polyethylene | PE | Decahydro -naphthalene | I<br>Ic | 135 °C | DIN 53 728/5<br>ISO 1191ASTM D 1601 | ■ | ■ | ■ | ■ |
| Polyethylene terephthalate | PET | m-cresol | II<br>IIc<br>IIc Micro | 25 °C | DIN 53 728/3<br>ISO 1628-5ASTM D 4603 | ■ | ■ | ■ | ■ |
| Polyethylene terephthalate | PET | Phenol/dichloro benzene (50:50) | Ic<br>II | 25 °C | DIN 53 728/3<br>ISO 1628-5ASTM D 4603 | ■ | ■ | ■ | ■ |
| Polyethylene terephthalate | PET | Dichloroacetic acid | II<br>IIc Micro | 25 °C | | ■ | ■ | ■ | ■ |
| Polymethyl methacrylate | PMMA | Chloroform | 0c<br>I | 25 °C | DIN 7745/2<br>ISO 1628-6 | ■ | ■ | ■ | ■ |
| Polymethyl methacrylate | PMMA | Acetophenone | 0c<br>I | 25 °C | DIN 7745/2<br>ISO 1628-6 | ■ | ■ | ■ | ■ |
| Polypropylene | PP | Decahydro-naphtalene | IIc | 135 °C | DIN 53 728/4<br>ISO 1191 | ■ | ■ | ■ | ■ |
| Polyphenyl sulphide | PPS | Ortho dichloro naphtalene | IIc | 230 °C | | ■ | ■ | ■ | ■ |
| Polystyrene | PS | Toluene | I<br>Ic | 25 °C | | ■ | ■ | ■ | ■ |
| Polysulphone | PSU | Chloroform | IIc | 25 °C | | ■ | ■ | ■ | ■ |
| Polyvinyl chloride | PVC | Cyclohexanone | IIc | 25 °C | DIN 53 726<br>ISO 1628-2ASTM D 1243 | ■ | ■ | ■ | ■ |
| Styrene-acrylo-nitrile copolymer | SAN | Ethyl methyl ketone | 0c<br>I | 25 °C | | ■ | ■ | ■ | ■ |
| Styrene-butadiene copolymer | SB | Toluene | 0c<br>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 therefore 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 an Ubbelohde viscometer, a Micro-Ubbelohde viscometer or a Micro-Ostwald viscometer made by SCHOTT Instruments. The ViscoClock automatically measures the flow-through time of temperature-stabilized liquids through the capillaries of the viscometer at temperatures ranging from -40 °C to 150 °C.


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

**Accuracy**

The most precise method used to determine the viscosity of liquids is their measurement in capillary viscometers; the ViscoClock functions according to this method. The operating time is indicated with a resolution of 1/100 sec. with quartz precision. The accuracy of 0.01 % of the measured time used to calculate the absolute and relative viscosity is indicated as measuring uncertainty with a confidence level of 95 %.

**Absolute viscosity**

Only the calibrated viscometers made by SCHOTT Instruments are suitable for the calculation of absolute viscosity in the temperature-stabilized, transparent thermostatic bath.

**Relative viscosity**

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

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

# 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 %;<br>indicated as measuring uncertainty with a confidence level of 95 % |
| **Measuring range - viscosity** | 0.35 …10,000 $mm^2/s$ (cSt)<br>the absolute, kinematic viscosity is additionally dependent on the uncertainty of the numerical value<br>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,<br>seconds indication with 2 decimal digits after the decimal point, resolution 0.01 s |
| **Voltage supply** | low voltage U: 9 V |
| **Plug-in connection** | socket for low voltage connection: jack plug, internal contact Ø = 2.1 mm, plus pole at pin contact,<br>for connection of a TZ 1848 or TZ 1859 power supply unit |
| **Power supply** | in accordance with class of protection III.<br>degree of protection for dust and humidity IP 50 in accordance with DIN 40 050<br>power supply unit 230 V, 50-60 Hz (TZ 1848)<br>power supply unit 115 V, 50-60 Hz (TZ 1859), with US-plug<br>not suitable for use in areas subject to explosion hazards |
| RS-232-C interface | for connection of a printer with serial interface or of a computer (PC) for<br>documentation of the data |
| Plug-in connections | 4 pole circular plug, mini, DIN |
| Configuration of RS-232-C interface, permanently set | 4800 baud, 7 bit word length, 2 stop bits, no parity;<br>after each measurement, the measured value is transmitted automatically.<br>the string of digits consists of 4 digits before the decimal point,<br>2 digits after the decimal point, and the terminating characters CR and LF. |
| Ambient temperature | +10 …+40 °C for storage and transport |
| Operating temperature | stand: -40 …+150 °C<br>electronic measuring unit: +10 …+40 °C |
| Air moisture | in accordance with EN 61 010, Part 1;<br>max. relative humidity 80 % for temperatures up to 31 °C,<br>decreasing linearly to 50 % of relative humidity at a temperature of 40 °C |
| Materials | stand: polyphthalamide (PPA)<br>casing*: polypropylene (PP)<br>sealing membrane: silicone |
| Dimensions | approx. 490 x 95 x 50 mm (H x W x D) |
| Weight | approx. 450 g (without viscometer)<br>power supply unit: approx. 220 g |
| Country of origin | Federal Republic of Germany |
| CE symbol | in accordance with Guideline 89/336/EWG (electromagnetic compatibility EMC):<br>emitted interference in accordance with Standard EN 50 081, Part 1<br>interference immunity in accordance with Standard EN 50 082, Part 2,<br>in accordance with Guideline 93/23/EWG (low voltage guideline),<br>last altered by Guideline 93/68/EWG: Testing basis EN 61 010, Part 1 |
| Viscometer types | Ubbelohde (DIN; ISO; ASTM; Micro), Micro-Ostwald |
| Transparent thermostatic baths | the ViscoClock can be used in every transparent thermostatic bath made by SCHOTT Instruments. |

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

# ViscoSystem® AVS 370 makes maximum precision ...

**Well equipped for every viscosity determination**

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

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

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

**Easy with a modular concept for future expansion**

The ViscoSystem® AVS 370 has a modular design. The basic version is available with one ViscoPump II module in optical or in TC version. Up to 3 other ViscoPump II modules can be inserted in the compact 19" housing. This means a measuring station can be adapted to increasing requirements at any time. The modular concept also significantly reduces the space required, and measuring instrument set-ups can be more easily and clearly arranged, for example for parallel and comparison measurements.

# … easier and more flexible, with provision for future extension!

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

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

**Compatible with existing accessories**

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


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

# ViscoSystem® AVS 370 – the right solution for all situations

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

**How to automatically achieve the right results**

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

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

**New: Two working principles with the same device.**

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

In the "pressure" method of working an overpressure of up to 0.1 bar is applied to the liquid in the capillary, this is particularly advantageous for fluids with a low boiling point. In the "suction" principle the sample is sucked up into the capillary by a vacuum. A greater reproducibility of results is achieved using the "suction" method for higher viscosity samples. A further advantage of the "suction" principle is that it guarantees formation of the "hanging ball level" in Ubbelohde viscometers, even for the minimum required sample quantities.

**Working with the ViscoSystem® AVS 370 is easy**

The ViscoSystem® AVS 370 is very easy to use. The whole measuring procedure takes place automatically, subjective measuring errors are reliably precluded. The PC starts the measurement. After the set pretempering period has expired the entered number of measurements are carried out and the measured values saved.

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

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

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

# Technical data

### Unique flexibility

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

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

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

We reserve the right to make technical changes.
ViscoSystem® is a registered trademark.

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

# Real multitasking for up to 8 measurements in parallel mode …

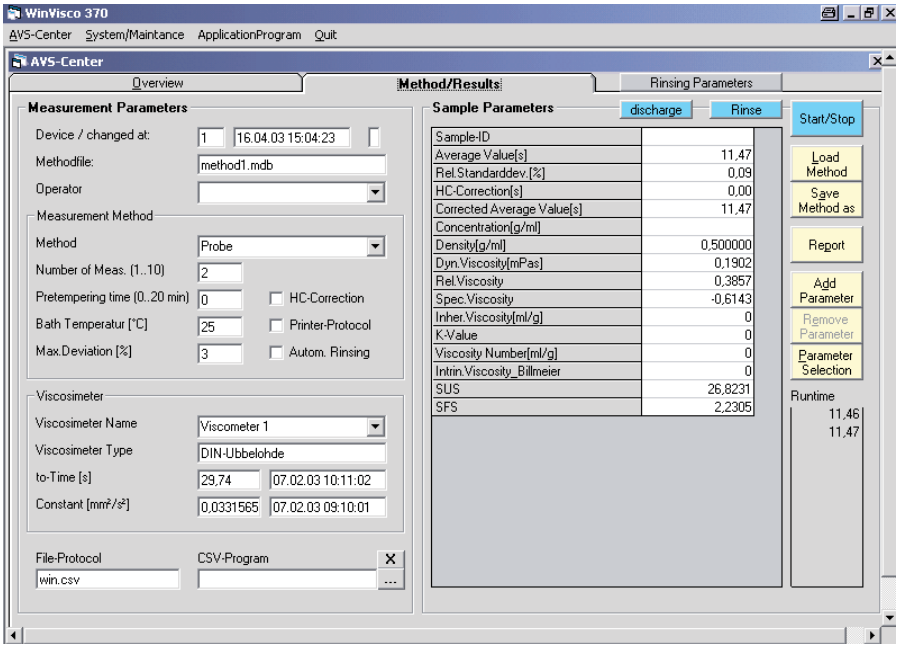
**Easy to understand, proven in practice: The WinVisco 370 software**

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

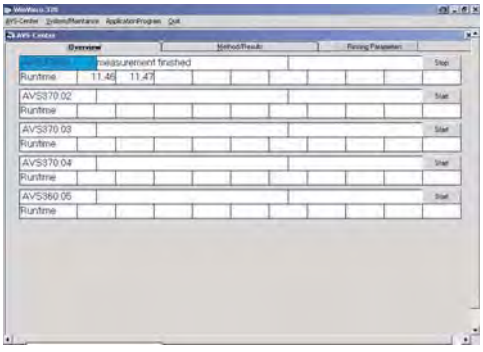
WinVisco 370 works in real multitasking mode. This makes it possible for each measurement to be processed independently from the others. It also means that time-consuming measurements can be carried out from the same PC, without hindering the course of other, faster measurements. During the measurements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

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

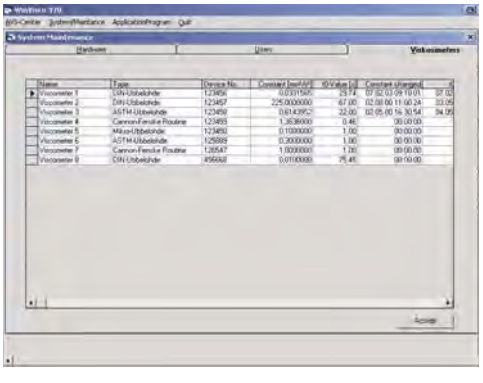
*) The language (English or German) can be chosen after installation over the programme menu.




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

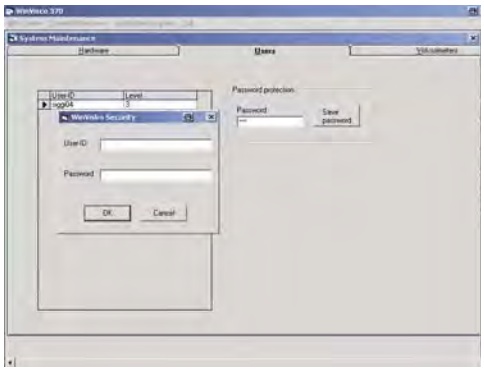


All the measurements currently running can be monitored in parallel in the overview.

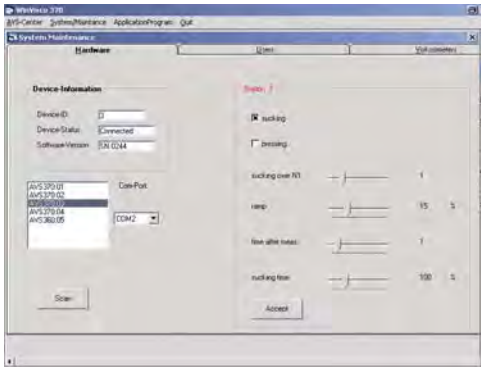


The viscometer data required for the evaluation can be stored in a table. This guarantees perfect allocation of e.g. the $t_0$ runtime, viscometer constants, the series number, etc. for each individual viscometer being used.

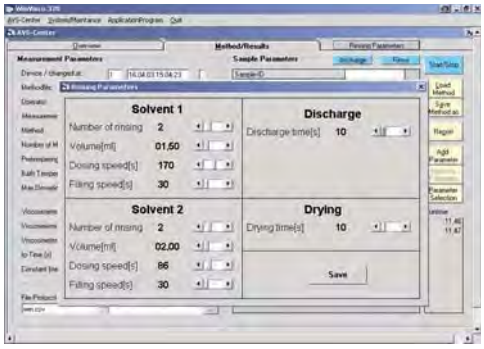
# … with the practically proven WinVisco 370 software



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



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

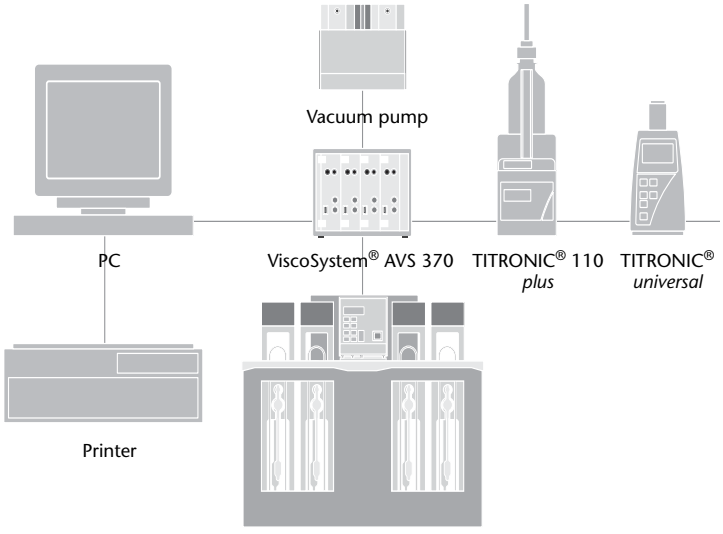



Each rinsing/dry step can be individually preselected. Even the application dependent quantity of solvent and the drying time can be separately determined.

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

With the daisy chain link of the ViscoSystem® AVS 370, further devices can be integrated in the system and controlled using the WinVisco 370 software. For example, when working in suction mode the viscometers can be rinsed using the TITRONIC® *universal* and TITRONIC® 110 *plus* burettes. The TITRONIC® *universal* is preferably used for light solvents, the TITRONIC® 110 *plus* for solvents with a viscosity >3 $mm^2/s$. A special interchangeable unit (TA 50V) is available for highly aggressive solvents.

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




Transparent thermostat CT 54 with four measuring stands

Two basic concepts are available for the rinsing:

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

VS 370

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


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

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

**Perfectly Equipped For Fully Automatic Viscosity Measurements**

The ViscoSystem® AVS 470 is a measuring system that includes almost everything you need to take precise and reproducible measurements. All common types of viscosity calculation are already integrated into the device, a small PS2 keyboard is all you need to


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

*Keyboard and printer are available as accessories.*

enter additional data. A serial printer can be used to conveniently document your measuring results.

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

**Simple and updateable Modular Concept**

The ViscoSystem® AVS 470 is of a modular design and an optional optical or TC version ViscoPump II module can be used to adapt your measuring station to new requirements at any time. It is possible to connect the new cleaning system AVS 270. You can use your existing accessories such as thermostats, stands, flow-through coolers or automatic cleaners e. g. AVS 26 with the ViscoSystem® AVS 470. Also, virtually all customary capillary viscometers can be used.

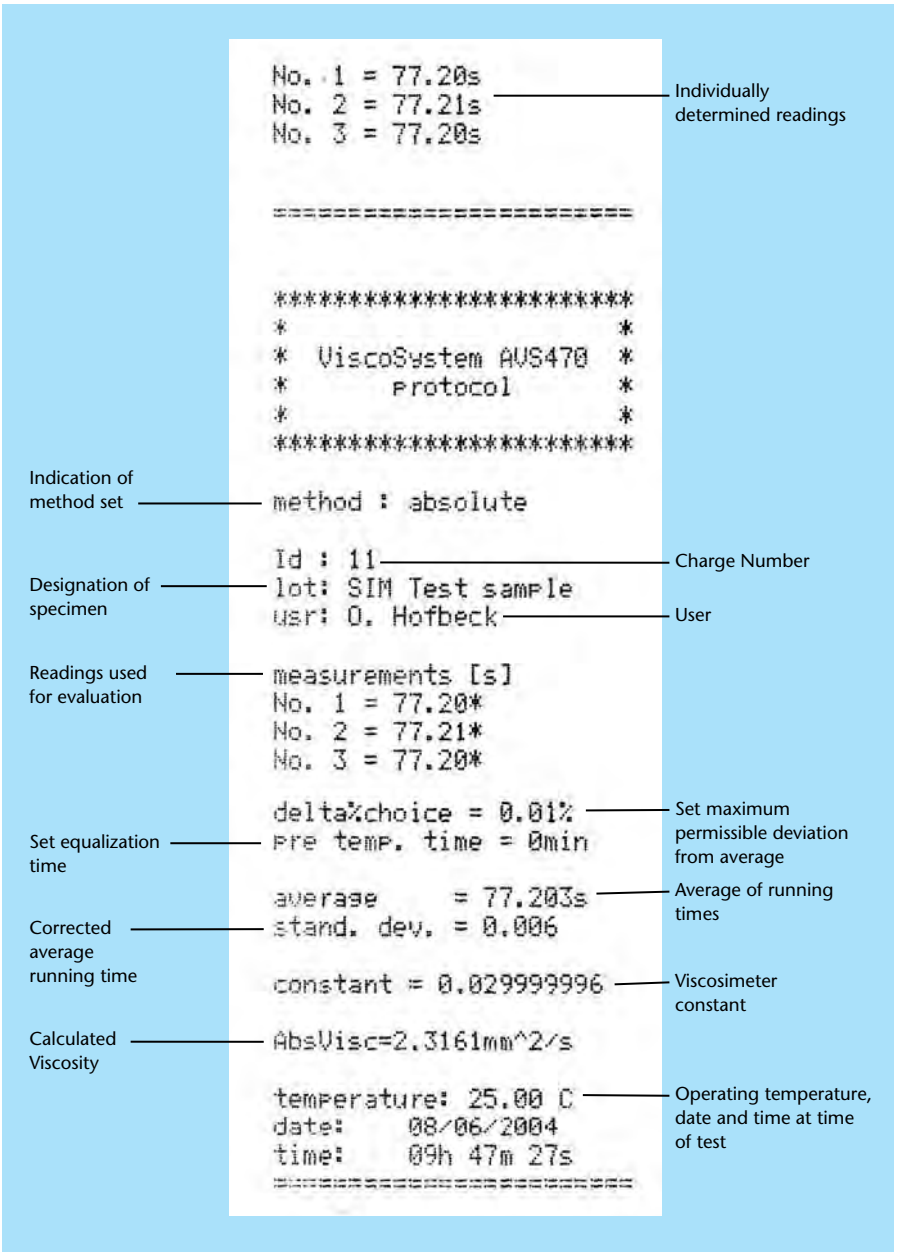
# Precise and Reliable – The ViscoSystem® AVS 470

### Working With the ViscoSystem® AVS 470 Is Easy

The ViscoSystem® AVS 470 is very easy to handle. The desired measuring method can be preselected and started on the device. The entire measurement is taken automatically to rule out subjective measurement errors. Once the set pre-heating time is reached, the desired number of measurements are taken and the viscometer automatically cleaned if required. The status of the measurements is continuously indicated on the LC.

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

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



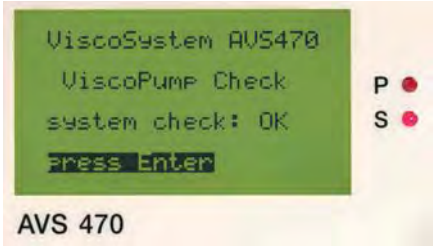

*Right figure:*
*The print-out shows everything you need for reliable documentation of your test. Simultaneously it demonstrates the unique performance of the ViscoSystem® AVS 470.*

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

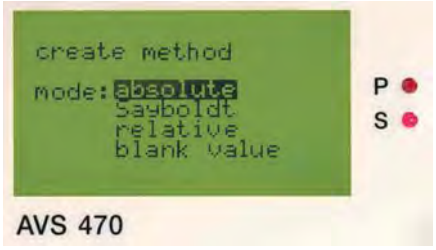
| | | "Pressure" | "Suction" |
|---|---|---|---|
| highly viscous samples e.g. oils, polymers | | ■ | ■ |
| Solvents (examples): | highly volatile | ■ | – |
| | Dichloromethane | ■ | – |
| | Chloroform | ■ | – |
| | Sulfuric acid | – | ■ |
| | Dichloroacetic acid | – | ■ |
| | Toluene | ■ | ■ |
| | Hexafluoro-isopropanol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

# Technical data

**Clear user guidance, clear status – even without PC!**

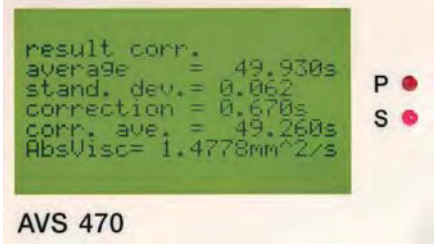



After switching on the AVS a self test is run and then an entry prompt appears.




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


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




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

| **ViscoSystem® AVS 470** | |
|---|---|
| Measuring range (time) | up to 9,999.99 s; resolution 0.01 s |
| Measuring range (viscosity) | pressure: 0.35 … 1,800 $mm^2/s$ (cSt) |
| | suction: 0.35 … approx. 5,000 $mm^2/s$ (cSt) |
| Measured parameter | flow-through time [s] |
| Time measuring accuracy | ± 0.01 % |
| Measured value display | LC-Display |
| Display accuracy | ± 0.01 s, ± 1 Digit, but not exceeding 0.01% |
| Pumping pressure | fully automatically controlled |
| | suction up to approx. -160 mbar, pressure up to approx. +160 mbar |
| Preselectable tempering period | 0 … 20 min |
| Preselectable no. of measurements | 1 to 99 for each sample |
| **Connections** | |
| Pneumatic connections | threaded connections for viscometers |
| Electrical connections | circular connector with bayonet lock for viscometer |
| | 4-pin DIN socket for TC viscometer |
| | 4-pin circular connector for capacitive sensor |
| | 7-pin circular connector for AVS 26, with bayonet lock |
| RS-232-C interface | 9-pin for serial printer |
| Mains connection | connector in acc. with EN 60320 |
| Pump connection | socket outlet in accordance with EN 60320 |
| **Ambient Conditions** | |
| Ambient temperature | +10 … +40 °C for operation and storage |
| Air humidity | max. 80 % in acc. with EN 61010, Part 1 |
| **Housing** | |
| Material | steel aluminium housing; |
| | with chemically resistant 2-component coating |
| Dimensions | (W x H x D) Approx. 255 x 205 x 320 mm |
| Weight (incl. pump module) | approx. 5.4 kg |
| **Power supply** | 90 … 240 V ~, 50 … 60 Hz |
| **Equipment safety** | EMC in acc. with Council Directive 89/336/EWG; |
| | low-voltage directive |

The following viscometers can be used with the ViscoSystem® AVS 470:
Ubbelohde viscometer to DIN, Ubbelohde viscometer to ASTM, micro Ubbelohde viscometer to DIN, micro Ostwald viscometer, Cannon-Fenske routine viscometer, TC Ubbelohde viscometer, TC micro Ubbelohde viscometer.

We reserve the right to make technical changes.
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# Ordering information ViscoSystem® AVS 370


## ViscoSystem® AVS 370

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

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

## Accessories

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

# Ordering information ViscoSystem® AVS 470


## ViscoSystem® AVS 470

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

| Description | Order No. |
|---|---|
| ViscoSystem® AVS 470 basic unit, housing incl. one ViscoPump II module for opto-electronic sensing, Version: 95 V to 230 V/50-60 Hz | 28 541 5709 |
| ViscoSystem® AVS 470 basic unit, housing incl. one ViscoPump II module for TC sensing, Version: 95 V to 230 V/50-60 Hz | 28 541 5708 |
| ViscoPump II module for optical sensing, VZ 8511 | 1054306 |
| ViscoPump II module for TC sensing, VZ 8512 | 1054304 |
| **Accessories** | |
| Support table | 1057903 |
| RS-232-C Data printer (230 V),TZ 3460 R | 28 522 5608 |
| Vacuum pump (230 V) | 1057901 |
| Vacuum pump (115 V) | 1057902 |
| Measuring stand AVS/S | 28 541 0502 |
| Measuring stand AVS/SK | 28 541 0876 |
| Measuring stand AVS/SK-CF | 28 541 0892 |
| Measuring stand AVS/SK-V | 28 541 0905 |
| Fixing frame | 28 540 5043 |
| Holder VZ 7191 | 28 542 1968 |

# ViscoSystem® AVS 270 – the automatic cleaning system

The automatic rinsing system AVS 270 replaces the proven rinsing automats AVS 24/26.

The used viscometer can be rinsed immediately after completion of the series of measurements or on demand. This has the advantage that the measured values can be examined first and the rinsing process started afterwards.

The modular construction of the AVS 270 allows the fast and easy exchange of system components.

The AVS 270 allows the usage of both detection systems (optical and thermical).


**Technical data AVS 270**

| | |
|---|---|
| Country of origin | Germany |
| Display | 7-segment LED for status message |
| Mains connection | Connector in accordance with EN 60320 |
| Pump connection | Socket outlet in accordance with EN 60320 |
| Power supply | 90 ... 240 V~, 50 ... 60 Hz<br>complies with protection class 1 acc. to DIN 57 411, part 1 /<br>VDE 0411, part 1 |
| Protection class | IP 20 in accordance with EN 60 529 |
| Power consumption | At 230 V [VA]: 100; at 115 V [VA]: 200 |
| Data transmission | Bidirectional serial interface in accordance with EIA RS-232-C |
| | Baud rate: 4.800 |
| | Parity: no |
| | Word length: 7 Bit |
| | Stop bit: 2 |
| Pneumatic connections | Threaded connections for viscometers and solvent |
| Dimensions | 205 x 255 x 350 mm (H x W x D) |
| Weight | 6 kg |
| Housing Material | Steel aluminium housing with chemically resistant 2-component coating, stackable |
| Keypad | Multi-color polyester foil |
| Ambient conditions | Ambient temperature: +10 ... 40°C (for operation und storage)<br>Air humidity in acc. with DIN EN 61 010, part 1<br>Max. relative humidity 80 % for temperatures up to 31°C, declining linearly to 50 % relative humidity at a temperature of 40°C |
| Equipment safety | EMC in acc. with Council Directive 89/336/EWG;<br>Low-voltage directive in acc. with Council Directive 73/23/EWG; as amended by Council Directive 93/68/EWG<br>Examination based on EN 61 010 |

# Ordering information ViscoSystem® AVS 270

## The following viscometers can be employed:

- DIN Ubbelohde
- ASTM Ubbelohde
- TC Ubbelohde without rinsing tube
- Micro TC Ubbelohde without rinsing tube
- DIN Micro Ubbelohde
- Cannon Fenske routine
- Micro Ostwald

**ViscoSystem® AVS 270**

The automatic rinsing system AVS 270 is composed of individual components, which must also be ordered separately. Please always request a detailed offer.

| Description | Order No. |
|---|---|
| ViscoSystem® AVS 270 basic unit for connection to viscosity measuring device ViscoSystem® AVS 470 (Scope of delivery: All necessary connection tubes/cables and solvent bottles) | 28 541 5697 |
| **Accessories** | |
| Vacuum pump VZ 8630, 230V/50Hz | 105 7901 |
| Vacuum pump VZ 8631, 115V/60Hz | 105 7902 |

## Safety:

The vacuum operation guarantees optimum safety. The materials in contact with the permitted solvents are according to the highest requirements of a modern lab. The screwing caps for instance are made form PTFE, PCTFE, PP and PPS.

## Parameter:

No PC is required when an AVS 470 is used. The rinsing parameters can be set easily and comfortably via the PS2 keyboard of the AVS 470 or via the foil keypad of the AVS 270.

## Flexibility:

Standard-Viscometer according to DIN, ASTM and ISO can be employed. No viscometers of special forms (i.e. with threads or special connections) are required.

## Selecting the solvents:

Proven solvents are, e.g., alcohols, ketons, esters, chlorinated hydrocarbons, aliphatic and aromatic hydrocarbons. Make sure the boiling point of the selected solvent is appropriate to the temperature of the thermostatic bath. The first solvent should have the maximum possible solving power (detergence) and the boiling point should be at least 50° above the bath temperature.

The second solvent is used mainly to eliminate the first, high boiling point solvent and its temperature should be slightly higher than that of the thermostatic bath.

Exclusively organic solvents or aqueous solvents are used with non-corrosive characteristics in respect to glass, brass and stainless steel. Only such solvents without solid components must be used. Otherwise there is a risk of contaminating the viscometer capillaries and valves.

When the according purity of the solvent cannot be guaranteed, it is recommended to use filters. A solvent that is now used will fulfil both requirements. It must be considered that the solvent temperature must not exceed the 80 °C.

Due to safety reasons it is not allowed to use any solvents with an ignition temperature of under 250°C. Regarding the solvent storage or disposal vessels it is authorized to use the standard laboratory bottles or customized vessels.

# Automatic viscosity measurement has been improved …

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

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

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

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

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


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

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

# … with the AVSPro II Automatic Sampler:

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

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

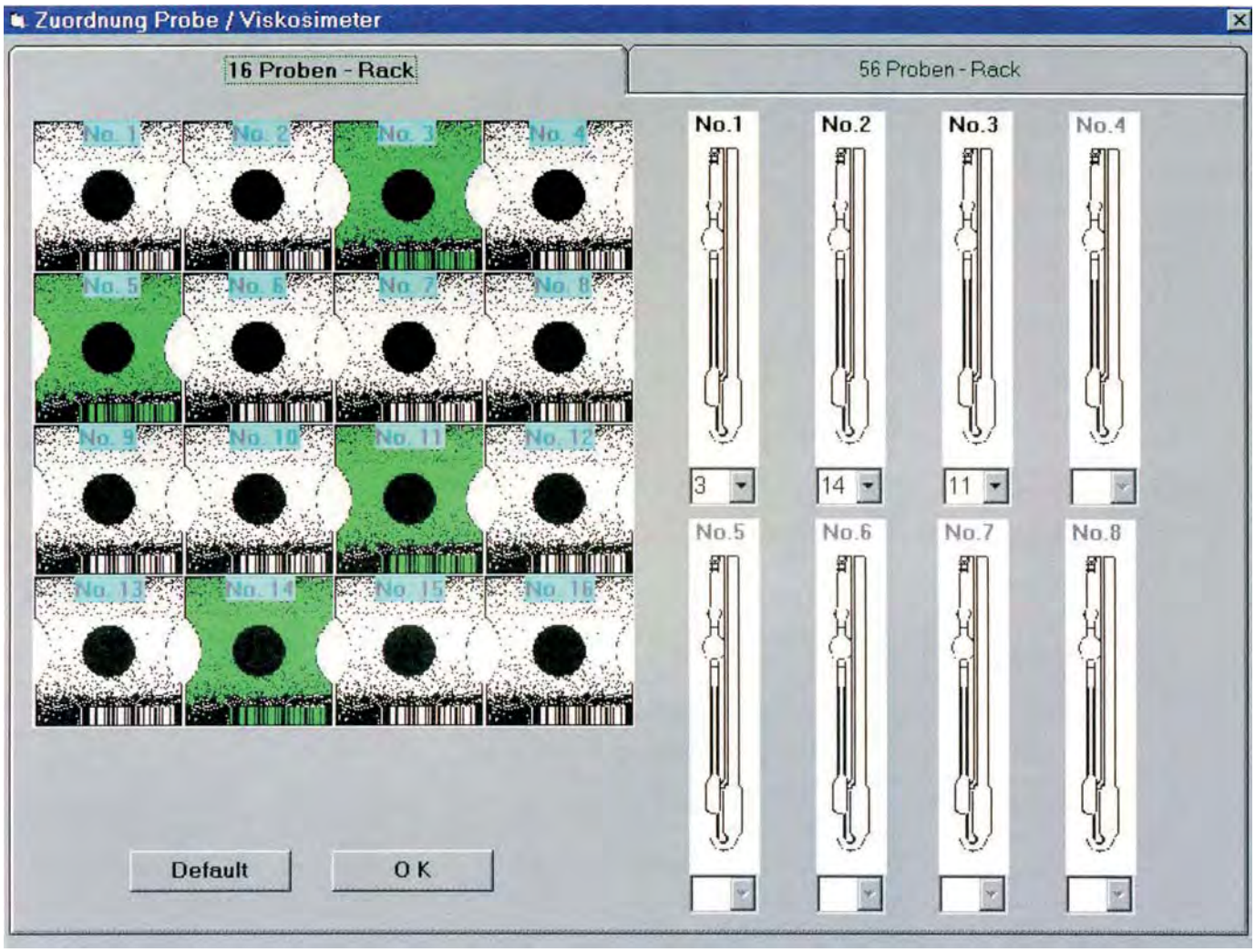
*The electric sample lift ensures positioning of the samples in the rack at a convenient and easily monitored working height.*

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

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

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

# Working with the AVSPro II is …




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

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

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

***Screenshot: 16 sample rack***

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

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

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

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

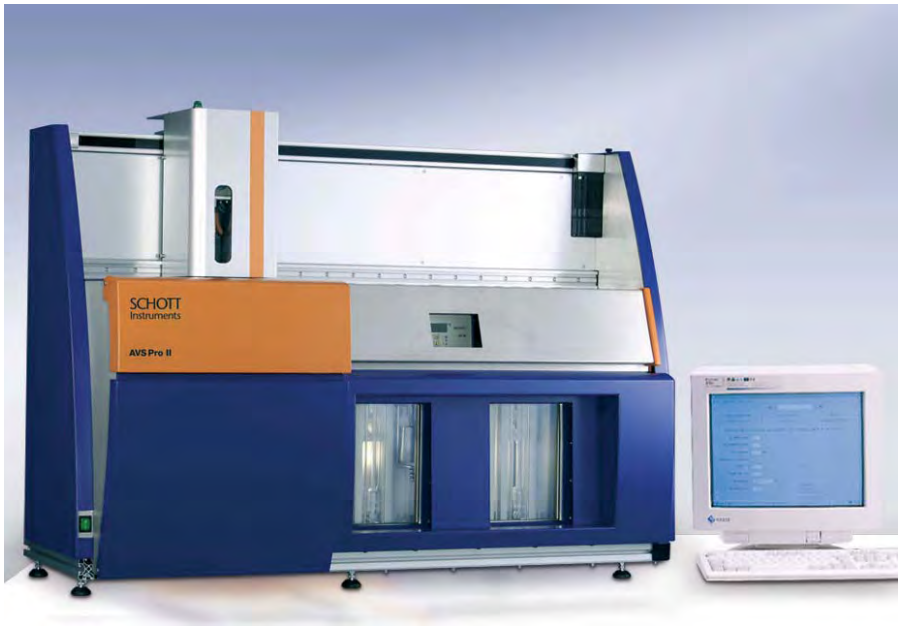
# … easy, reliable and safe

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

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

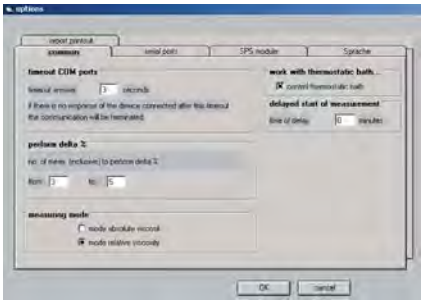
During the entire process, all of the parameters (depending on the menu level) and the respective status of the individual measuring positions, the temperature regulation system and the sample transfer system are either visible or can be selected.

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




***Screenshot: selection of methods***

*This mode is used to specify the number of measure-ments, the preliminary temperature regulation pe-riod, the allowable standard deviation, the maximum allowable temperature tolerance, the rinsing type and method of the viscometer.*



***Screenshot: options***

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

***Screenshot: dosing parameters***

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

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

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

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

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

# Technical data AVSPro II

| | |
|---|---|
| **Sampling system** | |
| Sample bottles | 100 ml screw-type and bottles with standard ground joint (16 pcs per rack) |
| | 20 ml round bottom glass pieces (56 pcs. per rack) |
| Sample rack | for 100 ml screw-type and bottles with standard ground joint |
| | for 100 ml screw-type and bottles with standard ground joint (temperature controlled up to 135°C) |
| | for 20 ml round bottom glass pieces |
| **Measured value recording** | |
| Method | meniscus scanning by means of opto-electronic system or thermal conductivity (TC) |

| | |
|---|---|
| **Measuring parameter** | throughput time in seconds [s] |
| | temperature in degrees Celsius [°C] |
| **Calculated parameters** | mean value, standard deviation, outlier test (A %), Hagenbach correction, absolute viscosity, |
| | dynamic viscosity (knowledge of density required), viscosity index (measurement at two temperatures |
| | required) SUS and SFS, relative viscosity, specific viscosity, reduced viscosity (viscosity number), inherent |
| | viscosity, K-value |
| **Selection parameters** | by means of PC keyboard, mean value, standard deviation, outlier test (A %), Hagenbach correction, |
| | absolute viscosity, dynamic viscosity (knowledge of density required), viscosity index |
| | (measurement at two temperatures required) SUS and SFS, relative viscosity, specific viscosity, |
| | reduced viscosity (viscosity number), inherent viscosity, K-value, rack position, date/time, |
| | temperature regulation period, number of measurements, number of rinsing operations, start, stop/reset |
| Number of measurements | 1 … 99 |
| Temperature regulation period | 0 … 99 min., selectable in increments of 1 min. |
| Number of Viscometer tests | 0 … 9 with next sample (observe sample quantity) or with preselected rack position |
| Data memory | by means of PC |

| | |
|---|---|
| **Viscosity measurement range** | 0.35 to 1,200 $mm^2/s$ (at room temperature of samples) |
| Time | up to 9999.99 s, resolution = 0.01 s |
| Vacuum pressure | automatically controlled |
| Viscometers available for use | Ubbelohde viscometer in accordance with DIN standards |
| | Ubbelohde viscometer in accordance with ASTM standards |
| | Micro-Ubbelohde viscometer in accordance with DIN standards |
| | Micro-Ostwald 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 … + 40 °C |
| Air humidity | max. 85 % relative humidity |
| **Equipment safety** | |
| CE-symbol | in accordance with Guideline 89/336/EEC of the Council (EMC compatibility) |
| | in accordance with Standard EN 50 081, Part 1; |
| | interference immunity in accordance with Standard EN 50 082, Part 2; |
| | in accordance with Guideline 73/23/EEC of the Council (low-voltage guideline) |
| **Housing** | plastic/stainless steel / aluminium casing with chemically resistant two-component coating |
| | of the plastic pieces |
| Dimensions | w = 1,300 mm, h = 1,100 mm, d = 610 mm (approx. 51“ x 43“ x 24“) |
| Weight | dependent on the number of measuring positions |
| | approx. 70 kg |
| **Connections** | |
| Pneumatic connections | screw-type connections for viscometer |
| Electric connections | circular connectors with bayonet lock for measuring stand and TC viscometer |
| Viscometers | up to 8 viscometers connected by individual control units |
| Temperature | via serial interface RS-232-C of suspended thermostat, |
| | type: 1 pc, CT 1654 or up to 2 pcs. CT 53 made by SCHOTT Instruments |
| Interfaces | control system using PC with 2 x RS-232-C interfaces |
| Safety | overfilling safety device or waste bottle |
| Mains connection | European built-in plug DIN 49 457 6 with fuse |
| **Data transmission** | |
| Interface internal | bidirectional serial interface in accordance with EIA RS-232-C (daisy chain concept) |
| Interface external | via PC, bidirectional serial interface in accordance with EIA RS-232-C |
| **Power supply** | |
| Mains voltage | 230 V (AC) or 115 V (AC), 50 ... 60 Hz (AC) |

# Transparent thermostats – CT series

**High temperature constancy and visual observation**

Transparent thermostats manufactured by SCHOTT Instruments have been specially designed to measure the viscosity of Newtonian liquids in capillary viscometers. They can be used for both manual measurements and, when used in connection with viscosity measuring equipment, for automatic measurements. The most important characteristics of the transparent thermostats are their ability to maintain a constant temperature and capability of visual observation of the flow of the fluid in the viscometer.

The transparent thermostats of the series CT 53 and CT 54 are suitable for viscosity measurements in compliance with DIN 51 562 (Part 1) and ASTMD 445. They are comprised of a stainless steel bath with insulating glass, a coated steel casing and a bath thermostat. In addition, the CT 54 has an integrated discharge outlet on one side to drain the bath. An RS-232-C interface enables it to be connected to a PC.


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

**CT 52**

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


**CT 53**

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

**CT 53 HT**

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

**2 or 4 measuring points**

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

**CT 53 TT**

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

# Transparent thermostats – CT series


### CT 54

The main technical features of this thermostat are identical to those of the CT53. The main differences are the number of measuring positions (the number doubles) and the additional discharge outlet to drain the bath. Up to 8 micro-TC-viscometers can be positioned in the thermostats if 2 special VZ 7191 holders are used.

**Recommended temperature equalization fluids**

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

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

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

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

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

# Accessories

**Flow-through cooler CK300**

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

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


**AVS Measurement stands**

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

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

*We reserve the right to make technical changes.*

# 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 |

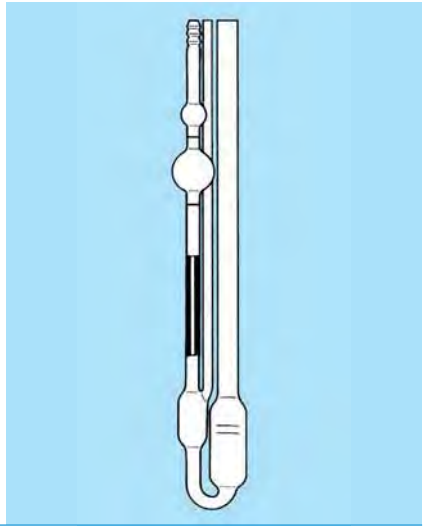
[1)] up to 30,000 $mm^2/s$

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

# Ubbelohde viscometers, normal form

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

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



**Ubbelohde-Viskosimeter (DIN)**

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

calibrated,
with constant,
for manual measurements

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

$\nu = K \cdot t$

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

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

$\nu$ = kinematic viscosity in $mm^2/s$
K = constant $[mm^2/s]$
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 $[mm^2/s]$ (approx.) |
|---|---|---|---|---|---|---|---|---|
| 501 00 | 285400004 | – | – | 0 | - | 0.36 | 0.001 | 0.3 ... 1 |
| 501 03 | 285400012 | – | – | 0c | - | 0.47 | 0.003 | 0.5 ... 3 |
| 501 01 | 285400029 | – | – | 0a | - | 0.53 | 0.005 | 0.8 ... 5 |
| 501 10 | 285400037 | – | – | I | I | 0.63 | 0.01 | 1.2 ... 10 |
| 501 13 | 285400045 | – | – | Ic | Ia | 0.84 | 0.03 | 3 ... 30 |
| 501 11 | 285400053 | – | – | Ia | - | 0.95 | 0.05 | 5 ... 50 |
| 501 20 | 285400061 | – | – | II | II | 1.13 | 0.1 | 10 ... 100 |
| 501 23 | 285400078 | – | – | IIc | IIa | 1.50 | 0.3 | 30 ... 300 |
| 501 21 | 285400086 | – | – | IIa | - | 1.69 | 0.5 | 50 ... 500 |
| 501 30 | 285400094 | – | – | III | III | 2.01 | 1 | 100 ... 1000 |
| 501 33 | 285400107 | – | – | IIIc | IIIa | 2.65 | 3 | 300 ... 3000 |
| 501 31 | 285400115 | – | – | IIIa | - | 3.00 | 5 | 500 ... 5000 |
| 501 40 | 285400123 | – | – | IV | IV | 3.60 | 10 | 1000 ... 10000 |
| – | – | 502 43 | 285400131 | IVc | IVa | 4.70 | 30 | 3000 ... 30000 |
| – | – | 502 41 | 285400148 | IVa | - | 5.34 | 50 | 6000 ... 30000 |
| – | – | 502 50 | 285400156 | - | V | 6.30 | 100 | > 10000 |

not calibrated,
without constant;
for determination of relative viscosity

calibrated,
with constant for automatic measurements

$\nu = K \cdot t$

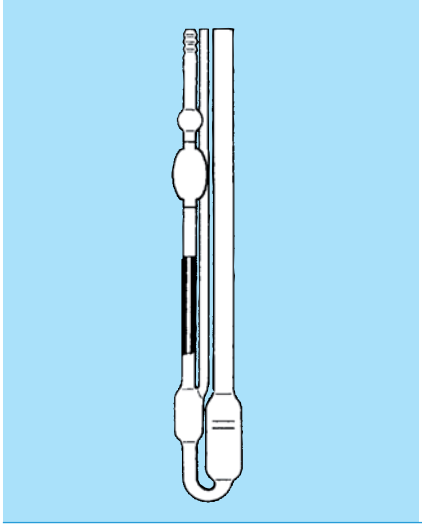
$K = \frac{\nu}{t}$

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

$\nu$ = kinematic viscosity in $mm^2/s$
K = constant $[mm^2/s]$
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 $[mm^2/s]$ (approx.) |
|---|---|---|---|---|---|---|---|---|
| – | – | 532 00 | 285400164 | 0 | - | 0.36 | 0.001 | 0.3 ... 1 |
| 530 03 | 285400304 | 532 03 | 285400201 | 0c | - | 0.47 | 0.003 | 0.5 ... 3 |
| 530 01 | 285400312 | 532 01 | 285400218 | 0a | - | 0.53 | 0.005 | 0.8 ... 5 |
| 530 10 | 285400329 | 532 10 | 285400226 | I | I | 0.63 | 0.01 | 1.2 ... 10 |
| 530 13 | 285400337 | 532 13 | 285400234 | Ic | Ia | 0.84 | 0.03 | 3 ... 30 |
| – | – | 532 11 | 285400172 | Ia | - | 0.95 | 0.05 | 5 ... 50 |
| 530 20 | 285400345 | 532 20 | 285400242 | II | II | 1.13 | 0.1 | 10 ... 100 |
| 530 23 | 285400353 | 532 23 | 285400259 | IIc | IIa | 1.50 | 0.3 | 30 ... 300 |
| – | – | 532 21 | 285400189 | IIa | - | 1.69 | 0.5 | 50 ... 500 |
| 530 30 | 285400361 | 532 30 | 285400267 | III | III | 2.01 | 1 | 100 ... 1000 |
| 530 33 | 285400378 | 532 33 | 285400275 | IIIc | IIIa | 2.65 | 3 | 300 ... 3000 |
| – | – | 532 31 | 285400197 | IIIa | - | 3.00 | 5 | 500 ... 5000 |
| 530 40 | 285400386 | 532 40 | 285400283 | IV | IV | 3.60 | 10 | 1000 ... 10000 |

# Ubbelohde viscometers, normal form (ASTM)



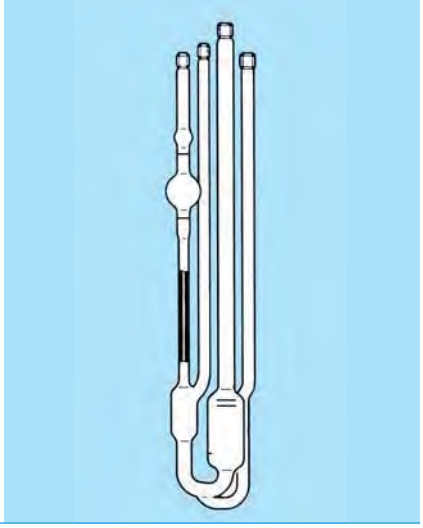
**Ubbelohde Viscometer (ASTM)**

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

| calibrated, with constant for manual measurements | | not calibrated, without constant for determination of relative Viscosity | | calibrated, with constant for automatic measurements | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type No. | 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 … 1 |
| 525 03 | 285400518 | 526 03 | 285400715 | 527 03 | 285401271 | 0c | 0.36 | 0.003 | 0.6 … 3 |
| 525 01 | 285400526 | 526 01 | 285400723 | 527 01 | 285401263 | 0b | 0.46 | 0.005 | 1 … 5 |
| 525 10 | 285400534 | 526 10 | 285400731 | 527 10 | 285401152 | I | 0.58 | 0.01 | 2 … 10 |
| 525 13 | 285400542 | 526 13 | 285400748 | 527 13 | 285401169 | Ic | 0.78 | 0.03 | 6 … 30 |
| 525 20 | 285400559 | 526 20 | 285400756 | 527 20 | 285401177 | II | 1.03 | 0.1 | 20 … 100 |
| 525 23 | 285400567 | 526 23 | 285400764 | 527 23 | 285401185 | IIc | 1.36 | 0.3 | 60 … 300 |
| 525 30 | 285400575 | 526 30 | 285400772 | 527 30 | 285401193 | III | 1.83 | 1 | 200 … 1000 |
| 525 33 | 285400583 | 526 33 | 285400789 | 527 33 | 285401288 | IIIc | 2.43 | 3 | 600 … 3000 |
| 525 40 | 285400591 | 526 40 | 285400797 | 527 40 | 285401296 | IV | 3.27 | 10 | 2000 … 10000 |
| 525 43 | 285400604 | 526 43 | 285400801 | 527 43 | 285401309 | IVc | 4.32 | 30 | 6000 … 30000 |

# 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, AVS 26 or AVS 270 automatic viscometer cleaner is used simultaneously. The additional filling and cleaning tube and the glass thread ensure safe operational use. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18. The ring marks that are also present serve as auxiliary marks in case the viscometers must be checked by means of manual measurements.

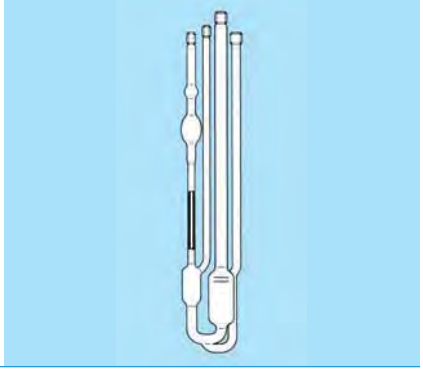


**Ubbelohde viscometer (DIN)**

- in accordance with ISO/DIS 3105, DIN 51 562, Part 1, BS 133, NFT 60-100
- filling quantity: 18 … 22 ml
- overall length: approx. 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 … 3 |
| 541 01 | 285401917 | 0a | - | 0.53 | 0.005 | 0.8 … 5 |
| 541 10 | 285401933 | I | I | 0.63 | 0.01 | 1.2 … 10 |
| 541 13 | 285401941 | Ic | Ia | 0.84 | 0.03 | 3 … 30 |
| 541 20 | 285401958 | II | II | 1.13 | 0.1 | 10 … 100 |
| 541 23 | 285401966 | IIc | IIa | 1.50 | 0.3 | 30 … 300 |
| 541 30 | 285401974 | III | III | 2.01 | 1 | 100 … 1000 |
| 541 33 | 285401982 | IIIc | IIIa | 2.65 | 3 | 300 … 3000 |
| 541 40 | 285401999 | IV | IV | 3.60 | 10 | 1000 … 6000 |



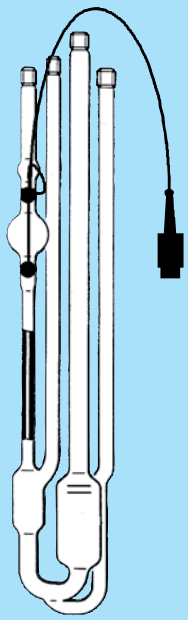
**Ubbelohde viscometer (ASTM)**

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

calibrated,
with constant for automatic measurements

| Type No. | 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 … 1 |
| 545 03 | 285402021 | 0c | 0.36 | 0.003 | 0.6 … 3 |
| 545 01 | 285402013 | 0b | 0.46 | 0.005 | 1 … 5 |
| 545 10 | 285402038 | I | 0.58 | 0.01 | 2 … 10 |
| 545 13 | 285402046 | Ic | 0.78 | 0.03 | 6 … 30 |
| 545 20 | 285402054 | II | 1.03 | 0.1 | 20 … 100 |
| 545 23 | 285402062 | IIc | 1.36 | 0.3 | 60 … 300 |
| 545 30 | 285402079 | III | 1.83 | 1 | 200 … 1000 |
| 545 33 | 285402087 | IIIc | 2.43 | 3 | 600 … 3000 |
| 545 40 | 285402095 | IV | 3.27 | 10 | 2000 … 10000 |
| 545 43 | 285402108 | IVc | 4.32 | 30 | 6000 … 30000 |

# Ubbelohde viscometers with TC sensors



Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour.

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

TC viscometers are manufactured from technical glass types with an expansion coefficient of  = ca. 9·10-6. Due to the electric properties of TC sensors, it is important to make sure that a type is selected that is suitable for the required application temperature.

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

- the technical measurement characteristics are in accordance with DIN 51 562, part 1, ISO/DIS 3105 (BS-IP-SL)
- for use in combination with an automatic viscosity measuring instrument and an AVS 24, AVS 26 or AVS 270 automatic viscometer cleaner
- filling quantity: 18 … 22 ml
- overall length: approx. 355 mm

calibrated,
with constant for automatic measurements

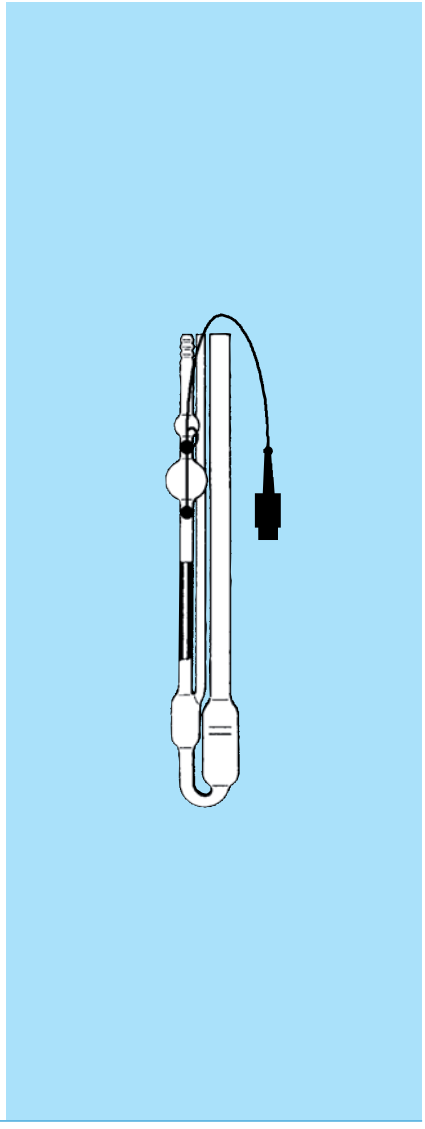
| Type No. | Order No. | Type No. | Order No. | Type No. | Order No. | Capillary No. | Capillary Ø i [mm] | Constant K (approx.) | Measuring range [mm²/s] (approx.) |
|---|---|---|---|---|---|---|---|---|---|
| +10 … +80 °C | | -40 … +30 °C | | +70 … +150 °C | | | | | |
| 562 03 | 285423120 | – | – | – | – | 0c | 0.47 | 0.003 | 0.5 … 3 |
| 562 10 | 285423130 | 563 10 | 285423240 | 564 10 | 285423330 | I | 0.54 | 0.01 | 1,2 … 10 |
| 562 13 | 285423140 | 563 13 | 285423250 | 564 13 | 285423340 | Ic | 0.84 | 0.03 | 3 … 30 |
| 562 20 | 285423150 | 563 20 | 285423260 | 564 20 | 285423350 | II | 1.15 | 0.1 | 10 … 100 |
| 562 23 | 285423170 | 563 23 | 285423270 | 564 23 | 285423360 | IIc | 1.51 | 0.3 | 30 … 300 |
| 562 21 | 285423160 | – | – | – | – | IIa | 1.69 | 0.5 | 50 … 500 |
| 562 30 | 285423180 | 563 30 | 285423280 | 564 30 | 285423370 | III | 2.05 | 1 | 100 … 1000 |
| 562 33 | 285423200 | 563 33 | 285423290 | 564 33 | 285423380 | IIIc | 2.7 | 3 | 300 … 3000 |
| 562 31 | 285423190 | – | – | – | – | IIIa | 3.0 | 5 | 500 … 5000 |
| 562 40 | 285423210 | 563 40 | 285423300 | 564 40 | 285423390 | IV | 3.7 | 10 | 1000 … 10000 |
| 562 43 | 285423230 | 563 43 | 285423320 | 564 43 | 285423400 | IVc | 4.9 | 30 | 3000 … 20000 |
| 562 41 | 285423220 | 563 41 | 285423310 | – | – | IVa | 5.3 | 50 | 5000 … 30000 |

# Ubbelohde viscometers with TC sensors

Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour.

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

TC viscometers are manufactured from technical glass types with an expansion coefficient of $\alpha$ = ca. $9 \cdot 10^{-6}$. Due to the electric properties of TC sensors, it is important to make sure that a type is selected that is suitable for the required application temperature.



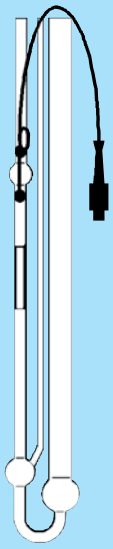
**TC viscometers**

- the technical measurement characteristics are in accordance with DIN 51 562, part 1, ISO/DIS 3105 (BS-IP-SL)
- for use in combination with an automatic viscosity measuring instrument and an AVS 24, AVS 26 or AVS 270 automatic viscometer cleaner
- filling quantity: 18 … 22 ml
- overall length: ca. 355 mm

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 … +80 °C | | -40 … +30 °C | | +70 … +150 °C | | | | | |
| 567 03 | 285423420 | – | – | – | – | 0c | 0.47 | 0.003 | 0.5 … 3 |
| 567 10 | 285423430 | 568 10 | 285423540 | 569 10 | 285423630 | I | 0.64 | 0.01 | 1.2 … 10 |
| 567 13 | 285423440 | 568 13 | 285423550 | 569 13 | 285423640 | Ic | 0.84 | 0.03 | 3 … 30 |
| 567 20 | 285423450 | 568 20 | 285423560 | 569 20 | 285423650 | II | 1.15 | 0.1 | 10 … 100 |
| 567 23 | 285423470 | 568 23 | 285423570 | 569 23 | 285423660 | IIc | 1.51 | 0.3 | 30 … 300 |
| 567 21 | 285423460 | – | – | – | – | IIa | 1.69 | 0.5 | 50 … 500 |
| 567 30 | 285423480 | 568 30 | 285423580 | 569 30 | 285423670 | III | 2.05 | 1 | 100 … 1000 |
| 567 33 | 285423500 | 568 33 | 285423590 | 569 33 | 285423680 | IIIc | 2.7 | 3 | 300 … 3000 |
| 567 31 | 285423490 | – | – | – | – | IIIa | 3.0 | 5 | 500 … 5000 |
| 567 40 | 285423510 | 568 40 | 285423600 | 569 40 | 285423690 | IV | 3.7 | 10 | 1000 … 10000 |
| 567 43 | 285423530 | 568 43 | 285423620 | 569 43 | 285423700 | IVc | 4.9 | 30 | 3000 … 20000 |
| 567 41 | 285423520 | 568 41 | 285423610 | – | – | IVa | 5.3 | 50 | 5000 … 30000 |

# Micro-Ubbelohde viscometers with TC sensors



Viscometers with suspended ball level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour.

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

TC viscometers are manufactured from technical glass types with an expansion coefficient of $\alpha$ = ca. $9 \cdot 10^{-6}$. Due to the electric properties of TC sensors, it is important to make sure that a type is selected that is suitable for the required application temperature.

**Micro TC viscometers**

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

calibrated,
with constant for automatic measurements

| Type No. | 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 … +80 °C | | -40 … +30 °C | | +70 … +150 °C | | | | | |
| 572 10 | 285423710 | 573 10 | 285423780 | 574 10 | 285423850 | M I | 0.40 | 0.01 | 0.4 … 6 |
| 572 13 | 285423720 | 573 13 | 285423790 | 574 13 | 285423860 | M Ic | 0.53 | 0.03 | 1.2 … 18 |
| 572 20 | 285423730 | 573 20 | 285423800 | 574 20 | 285423870 | M II | 0.70 | 0.1 | 4 … 60 |
| 572 23 | 285423740 | 573 23 | 285423810 | 574 23 | 285423880 | M IIc | 0.95 | 0.3 | 12 … 180 |
| 572 30 | 285423750 | 573 30 | 285423820 | 574 30 | 285423890 | M III | 1.26 | 1 | 40 … 800 |

# Micro-Ubbelohde viscometers

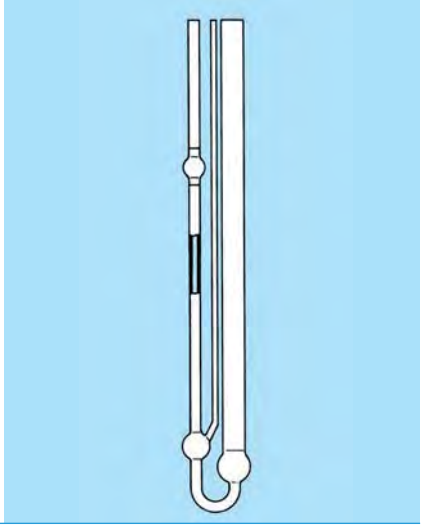
# Viscometers for dilution viscometry

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 … 4 ml
- overall length: approx. 290 mm

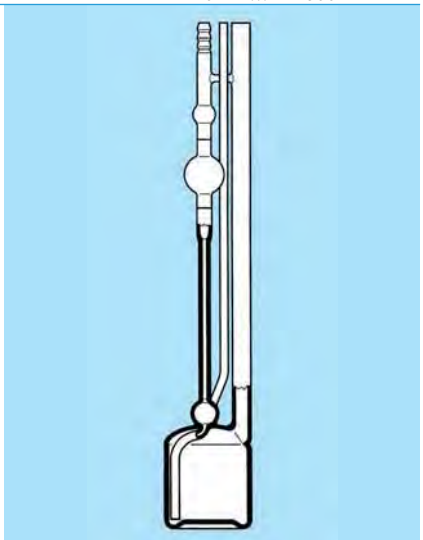


| calibrated, with constant for manual measurement | | calibrated, with constant for automatic measurement | | not calibrated, without constant; for determination of relative viscosity | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Type No. | Order No. | Type No. | Order No. | Type No. | Order 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 … 6 |
| 536 13 | 285401017 | 537 13 | 285401111 | 538 13 | 285401214 | M Ic | 0.53 | 0.03 | 1.2 … 18 |
| 536 20 | 285401025 | 537 20 | 285401128 | 538 20 | 285401222 | M II | 0.70 | 0.1 | 4 … 60 |
| 536 23 | 285401033 | 537 23 | 285401136 | 538 23 | 285401239 | M IIc | 0.95 | 0.3 | 12 … 180 |
| 536 30 | 285401041 | 537 30 | 285401144 | 538 30 | 285401247 | M III | 1.26 | 1 | 40 … 800 |

# Viscometers for dilution viscometry

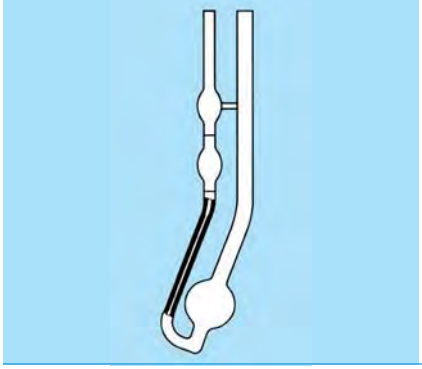
Viscometers with suspended ball level designed according to the principle of the Ubbelohde viscometers for determination of the limit viscosity number of polymers. The limit viscosity number is determined automatically in combination with viscosity measuring instruments and piston burette, type AVS 20,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

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



| not calibrated, for automatic measurements | | | | | |
|---|---|---|---|---|---|
| Type No. | 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 … 0.6 |
| 531 03 | 285401428 | 0c | 0.47 | 0.003 | 0.5 … 2 |
| 531 01 | 285401411 | 0a | 0.53 | 0.005 | 0.8 … 3 |
| 531 10 | 285401436 | I | 0.64 | 0.01 | 1.2 … 6 |
| 531 13 | 285401444 | Ic | 0.84 | 0.03 | 3 … 20 |
| 531 20 | 285401452 | II | 1.15 | 0.1 | 10 … 60 |

# Cannon-Fenske viscometers



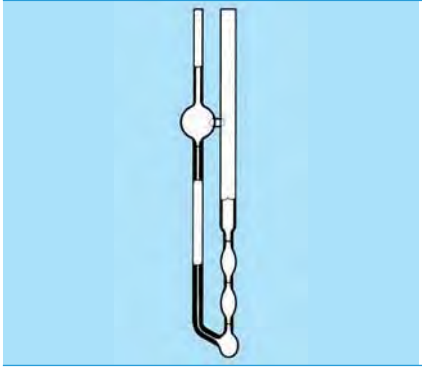
**Cannon-Fenske routine viscometers** comply with standards ISO/DIS 3105, ASTM D 2515, BS 188 with respect to technical measuring specifications.

- are suitable for all Newtonian liquids with a viscosity of 0.35...20,000 $mm^2/s$
- the present design has, as a supplement to the standard, a deepening in the lower bend. Accordingly, these viscometers can also be used for automatic measurements.
- filling quantity: approx. 7 ... 10 ml
- overall length: approx. 245 mm

calibrated,
with ring mark,
for manual measurements

with constant
for automatic measurements

| Type No. | Order No. | Type No. | Order No. | Capillary No. | Capillary Ø i [mm] | Constant K (approx.) | Measuring range [$mm^2/s$] (approx.) |
|---|---|---|---|---|---|---|---|
| 513 00 | 285403507 | 520 00 | 285403704 | 25 | 0.30 | 0.002 | 0.4 ... 1.6 |
| 513 03 | 285403515 | 520 03 | 285403712 | 50 | 0.44 | 0.004 | 0.8 ... 3.2 |
| 513 01 | 285403523 | 520 01 | 285403729 | 75 | 0.54 | 0.008 | 1.6 ... 6.4 |
| 513 10 | 285403531 | 520 10 | 285403737 | 100 | 0.63 | 0.015 | 3 ... 15 |
| 513 13 | 285403548 | 520 13 | 285403745 | 150 | 0.78 | 0.035 | 7 ... 35 |
| 513 20 | 285403556 | 520 20 | 285403753 | 200 | 1.01 | 0.1 | 20 ... 100 |
| 513 23 | 285403564 | 520 23 | 285403761 | 300 | 1.27 | 0.25 | 50 ... 200 |
| 513 21 | 285403572 | 520 21 | 285403778 | 350 | 1.52 | 0.5 | 100 ... 500 |
| 513 30 | 285403589 | 520 30 | 285403786 | 400 | 1.92 | 1.2 | 240 ... 1200 |
| 513 33 | 285403597 | 520 33 | 285403794 | 450 | 2.35 | 2.5 | 500 ... 2500 |
| 513 40 | 285403601 | 520 40 | 285403807 | 500 | 3.20 | 8 | 1600 ... 8000 |
| 513 43 | 285403618 | 520 43 | 285403815 | 600 | 4.20 | 20 | 4000 ... 20000 |



**Cannon-Fenske reverse flow viscometers**

- Comply with standards ISO/DIS 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

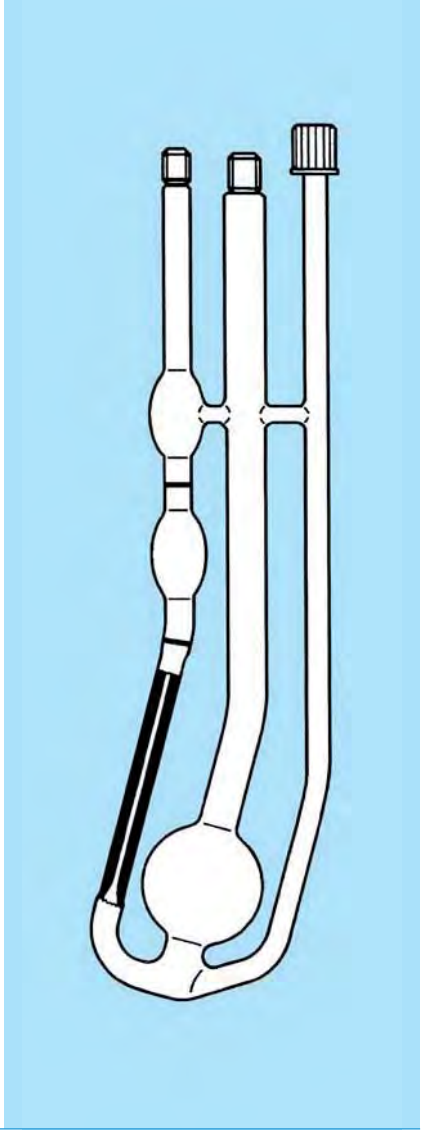
calibrated,
with 3 ring marks,
with 2 constants,
only for manual measurement

| Type No. | Order No. | Capillary No. | Capillary Ø i [mm] | Constant K (approx.) | Measuring range [$mm^2/s$] (approx.) |
|---|---|---|---|---|---|
| 511 00 | 285403001 | 25 | 0,31 | 0.002 | 0.4 ... 1.6 |
| 511 03 | 285403018 | 50 | 0,42 | 0.004 | 0.8 ... 3.2 |
| 511 01 | 285403026 | 75 | 0,54 | 0.008 | 1.6 ... 6.4 |
| 511 10 | 285403034 | 100 | 0,63 | 0.015 | 3 ... 15 |
| 511 13 | 285403042 | 150 | 0,78 | 0.035 | 7 ... 35 |
| 511 20 | 285403059 | 200 | 1,02 | 0.1 | 20 ... 100 |
| 511 23 | 285403067 | 300 | 1,26 | 0.25 | 50 ... 200 |
| 511 21 | 285403075 | 350 | 1,48 | 0.5 | 100 ... 500 |
| 511 30 | 285403083 | 400 | 1,88 | 1.2 | 240 ... 1200 |
| 511 33 | 285403091 | 450 | 2,20 | 2.5 | 500 ... 2500 |
| 511 40 | 285403104 | 500 | 3,10 | 8 | 1600 ... 8000 |
| 511 43 | 285403112 | 600 | 4,00 | 20 | 4000 ... 20000 |

**Cannon-Fenske routine viscometers**

comply with standards ISO/DIS 3105, ASTM D 2515, BS 188 with respect to technical measuring specifications. These viscometers are preferably used for automatic measurements when an AVS 24, AVS 26 or AVS 270 automatic viscometer cleaner is used simultaneously. The additional filling and cleaning tube and the glass thread ensure safe operational use. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18.

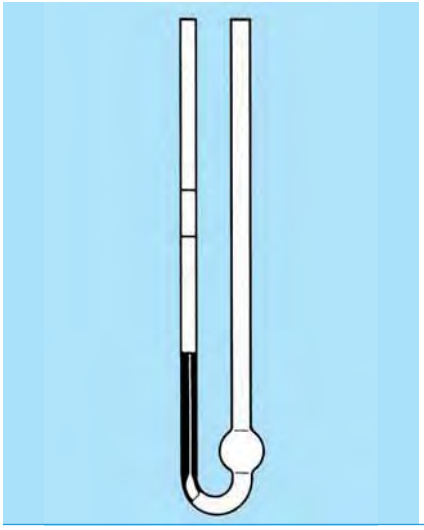
- are suitable for all Newtonian liquids with a viscosity of 0.35 … 20,000 $mm^2/s$.
- filling quantity: approx. 7 ... 12 ml
- overall length: approx. 245 mm



calibrated,
with ring marks,
with constant for automatic measurements

| Type No. | Order No. | Capillary No. | Capillary Ø i [mm] | Constant K (approx.) | Measuring range [$mm^2/s$] (approx.) |
|---|---|---|---|---|---|
| 546 00 | 285402116 | 25 | 0.30 | 0.002 | 0.4 … 1.6 |
| 546 03 | 285402132 | 50 | 0.44 | 0.004 | 0.8 … 3.2 |
| 546 01 | 285402124 | 75 | 0.54 | 0.008 | 1.6 … 6.4 |
| 546 10 | 285402149 | 100 | 0.63 | 0.015 | 3 … 15 |
| 546 13 | 285402157 | 150 | 0.78 | 0.035 | 7 … 35 |
| 546 20 | 285402165 | 200 | 1.01 | 0.1 | 20 … 100 |
| 546 23 | 285402181 | 300 | 1.27 | 0.25 | 50 … 200 |
| 546 21 | 285402173 | 350 | 1.52 | 0.5 | 100 … 500 |
| 546 30 | 285402198 | 400 | 1.92 | 1.2 | 240 … 1200 |
| 546 33 | 285402202 | 450 | 2.35 | 2.5 | 500 … 2500 |
| 546 40 | 285402219 | 500 | 3.20 | 8 | 1600 … 8000 |
| 546 43 | 285402227 | 600 | 4.20 | 20 | 4000 … 20000 |

# Ostwald viscometers

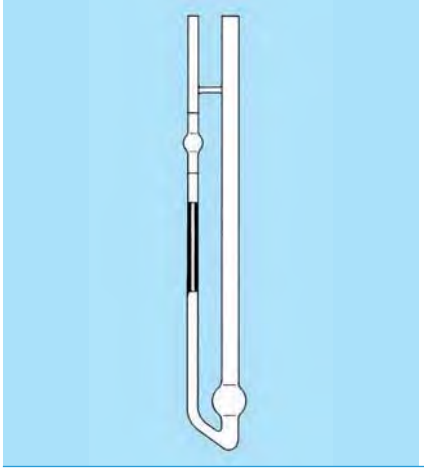


**Ostwald viscometers**

- 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 approx. [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 extreme formation of foam.
- 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

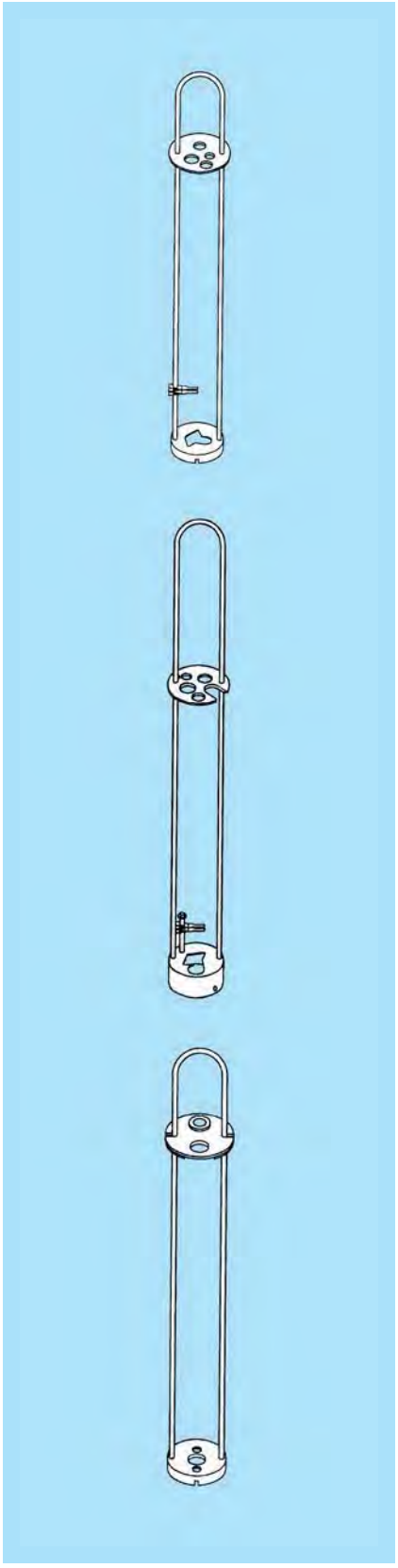
| Type No. | Order No. | Type No. | Order No. | Capillary No. | Capillary Ø i [mm] | Constant K (approx.) | Measuring range [mm²/s] (approx.) |
|---|---|---|---|---|---|---|---|
| 516 10 | 285404203 | 517 10 | 285404306 | I | 0.43 | 0.01 | 0.4 … 6 |
| 516 13 | 285404211 | 517 13 | 285404314 | Ic | 0.60 | 0.03 | 1.2 … 18 |
| 516 20 | 285404228 | 517 20 | 285404322 | II | 0.77 | 0.1 | 4 … 60 |
| 516 23 | 285404236 | 517 23 | 285404339 | IIc | 1.00 | 0.3 | 12 … 180 |
| 516 30 | 285404244 | 517 30 | 285404347 | III | 1.36 | 1 | 40 … 800 |

# Accessories

**Brackets and stands**

All brackets and stands are designed to ensure that the viscometers are held vertically. They also protect the viscometers from breakage. The maximum deviation is < 1°. In application in conjunction with SCHOTT Instruments and other commercially available see-through thermostats the viscometers can only be used with the appropriate stand or bracket.

For DIN Ubbelohde viscometers that are used as reference measuring standard, specifically modified bracket (VZ 5840) must be used.



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

| Type No. | 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

**Stands made of PTFE**
suitable for use with Cannon-Fenske routine viscometers
for automatic measurements only (not illustrated)

| Type No. | Order No. |
|---|---|
| 065 99 | 285405113 |

**Brackets for reference measuring standard**

DIN Ubbelohde viscometers which are used as testing standard should be stored in a specially modified viscometer bracket (053 92) according to official inspection / calibration authorities. The extension set for the test standard (VZ 5840) guarantees vertical slope with a maximum deviation of < 1° and the centered positioning of the capillaries.

| Type No. | Order No. |
|---|---|
| VZ 5840 | 285417201 |

**Control thermometers**

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

# Accessories

**LabPump**

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

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

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

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

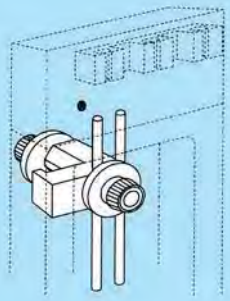
| Type No. | Order No. |
|---|---|
| VZ 5655 | 1040755 |

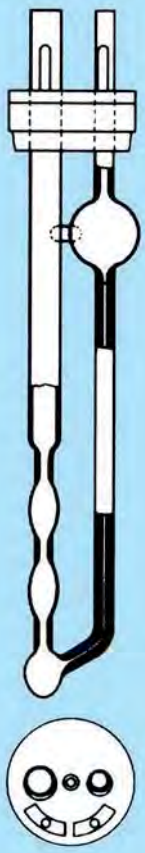
**Polyamide bracket**
**for use with Cannon-Fenske routine viscometers,**
**Cannon-Fenske reverse flow viscometers and all Ostwald viscometers**
for manual measurements only

| Type No. | Order No. |
|---|---|
| 064 99 | 285405105 |

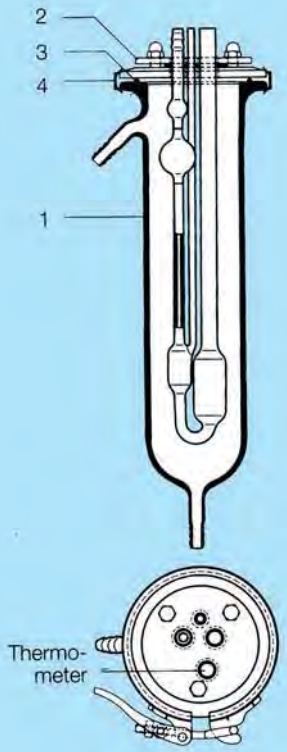
**PTFE bracket**
**for use with Cannon-Fenske routine viscometers,**
for automatic measurements only (not illustrated)

| 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**

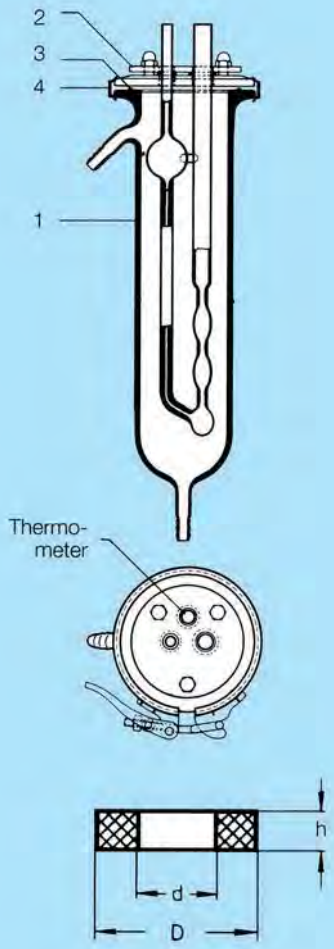
| Type No. | Order No. | Item No. | Comment |
|---|---|---|---|
| 577 00 | 285405508 | | complete, without viscometer |
| Component parts | | | |
| 577 01 | 285405516 | 1 | temperature stabilization jacket, straight |
| 238 00 | 285405524 | 2 | support plate with 4 silicone rings (d = 4, 6, 8 and 10 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**

Component parts

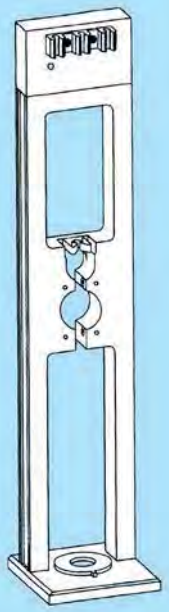
| Type No. | Order No. | Item No. | Comment |
|---|---|---|---|
| 577 01 | 285405516 | 1 | temperature stabilization jacket, straight |
| 225 34 | 285405532 | 3 | silicone O-ring, ND 60 |
| 072 34 | 285405549 | 4 | quick-action seal, NW 60 |




**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 type series AVS/S can be used to measure the flow-through time in viscometers automatically.

The measuring stands can be connected to all measuring instruments made by SCHOTT Instruments for automatic measurement of viscosity and operate with all standard viscometers for repetitive measurements.

Automatic measurements have the following advantages:

- the repetitive standard deviation is less than for manual measurements
- the measurement is free from subjective factors of influence
- the results can be printed out and/or be automatically documented on data memory system
- automatic processing of sample series is available.

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

The measuring stands or brackets can be exchanged at random.

The distance between the levels of the automatic optoelectronic unloading system is 40.00 mm ±0.03 mm. When measuring stands are replaced, this results in a standard deviation of VK = 0.05 % for Ubbelohde viscometers.

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

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

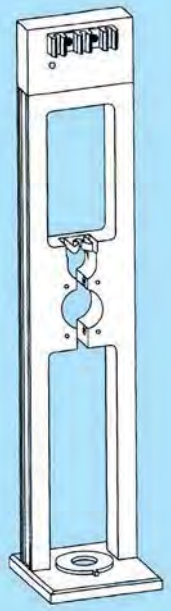
**Required tube/cable combinations**

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

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

# AVS measuring stands

| Measuring stands AVS/S | AVS/S-HT | AVS/SK | AVS/S-CF | AVS/SK-V |
|---|---|---|---|---|
| **Available viscometers** | Ubbelohde viscometers in accordance with DIN, ASTM, ISO 3105, Micro-Ubbelohde viscometers, Micro-Ostwald viscometers | | Cannon-Fenske-routine viscometer | Ubbelohde-dilution viscometer |
| **Temperature range** | -80 ...+100 °C | -80 ...+200 °C | 0 ...+60 °C | -80 ...+100 °C | 0 ...+60 °C other temperature ranges available on request |
| **Suitable for use with the measuring units** | AVS 310, AVS 350, AVS 360, AVS 361, AVS 370, AVS 410, AVS 450, AVS 470, AVS 500, AVSPro | | | | |
| **Suitable for use with the thermostatic baths** | CT 52, CT 53, CT 53 HT, CT 53 TT, CT 54 | | | | |
| **Suitable brackets (type no.)** | 05392<br>05397 | | | no bracket required | |
| **Electrical connection** | Cable VZ 6225 for all measuring stands to all instruments (is included in hose sets VZ 5505,<br>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 | | | | |
| **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.

# Hotplates and stirrers:

## Attractive design for the laboratory with glass ceramic heating surface

**Perfect function, exclusive design**

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

**Our know-how – your benefit**

Both laboratory hotplates SLK 1 and SLK 2 enable speedy heating up. The laboratory stirrer (SLR) is the optimum solution for a careful to intense mixing of liquids. It can also be used for speedy heating up or controlled temperature adaptation.

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

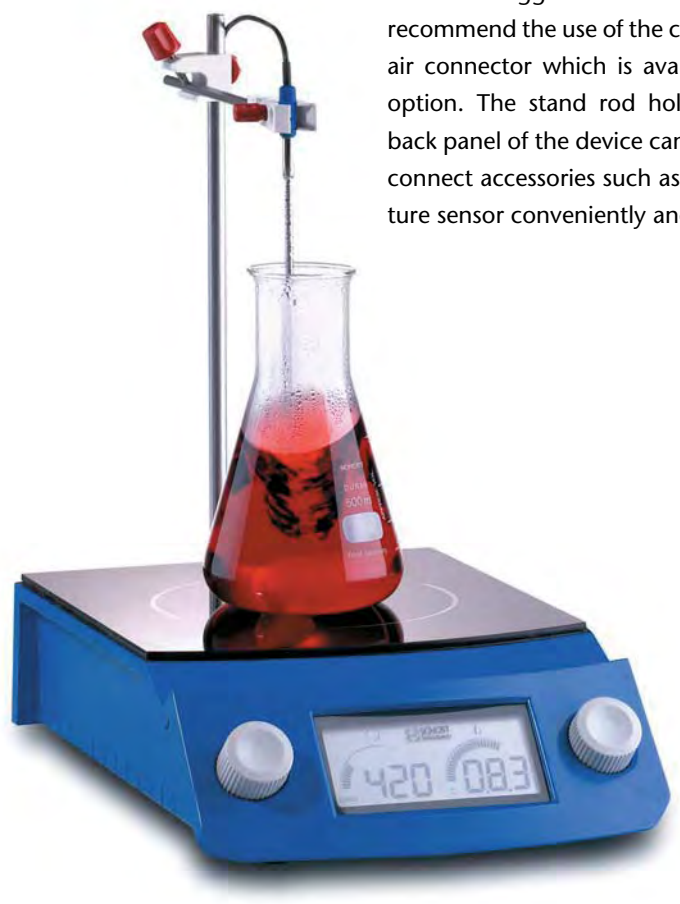
**Quality and safety**

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

A residual-heat display protects the user from the hazard of injuries (burning).

The corrosion-resistant, solid, casing with a hermetically sealed, non-inflammable top made of duroplastic in the case of the laboratory hotplates and of coated die-cast aluminium in the case of the laboratory stirrer ensure a long and trouble-free use of the devices.

If the laboratory hotplates are to be used in an aggressive environment, we recommend the use of the compressed-air connector which is available as an option. The stand rod holder on the back panel of the device can be used to connect accessories such as a temperature sensor conveniently and securely.



**Overview of features**

| Hotplate / stirrer | SLK1 | SLK2 | SLR |
|---|---|---|---|
| Glass ceramic | ■ | ■ | ■ |
| Heating | ■ | ■ | ■ |
| Number of heating plates | 1 | 1 | 1 |
| Temperature control | - | - | ■ |
| Stirring | - | - | ■ |
| Touch control | ■ | ■ | - |
| Control knobs | - | - | ■ |

# Fast heating using the SLK 1 and SLK 2

To heat up liquids, the SLK 1 and SLK 2 laboratory hotplates from SCHOTT Instruments are the optimum solution. The heating power of the infrared radiation heating element can be adjusted in nine steps, with an average heating output of 1.2 kW or 1.8 kW, respectively, on step 9. During the heating process, the temperature distribution across the hotplates surface is almost homogenous.

| Technical data | SLK 1 | SLK 2 |
|---|---|---|
| **Heating function** | | |
| heating power (kW) | 1.2 | 1.8 |
| heated zone (mm) | Ø 165 | Ø 200 |
| max. hot plates temperature (°C) | approx. 600 | approx. 600 |
| min. time to boiling point 1 l $H_2O$* (min) | approx. 10 | approx. 7 |
| hot plate material | glass ceramic | glass ceramic |
| hot plates area (mm) | 280 x 280 | 280 x 280 |
| **General data** | | |
| dimensions (L x W x H in mm) | 395 x 295 x 110 | 395 x 295 x 110 |
| weight (kg) | approx. 3.6 | approx. 3.6 |
| max. load (kg) | 25 | 25 |
| admissible ambient temperature (°C) | 10 - 40 | 10 - 40 |
| admissible air humidity (%) | 85 | 85 |
| protection type | IP 20 | IP 20 |
| protection class | 1 | 1 |
| housing material | SMC | SMC |
| thread for stand attachment | M 8 | M 8 |
| cable connector socket | cold appliances | cold appliances |
| mains connection (V/Hz) | 230 V, 50/60<br>or 115 V, 50/60 | 230 V, 50/60<br>or 115 V, 50/60 |
| **Order No. 230 V** | 28 541 6316 | 28 541 6324 |
| **Order No. 115 V*** ** | 28 541 6213 | 28 541 6221 |

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

# Stirring, heating and controlling using the SLR

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

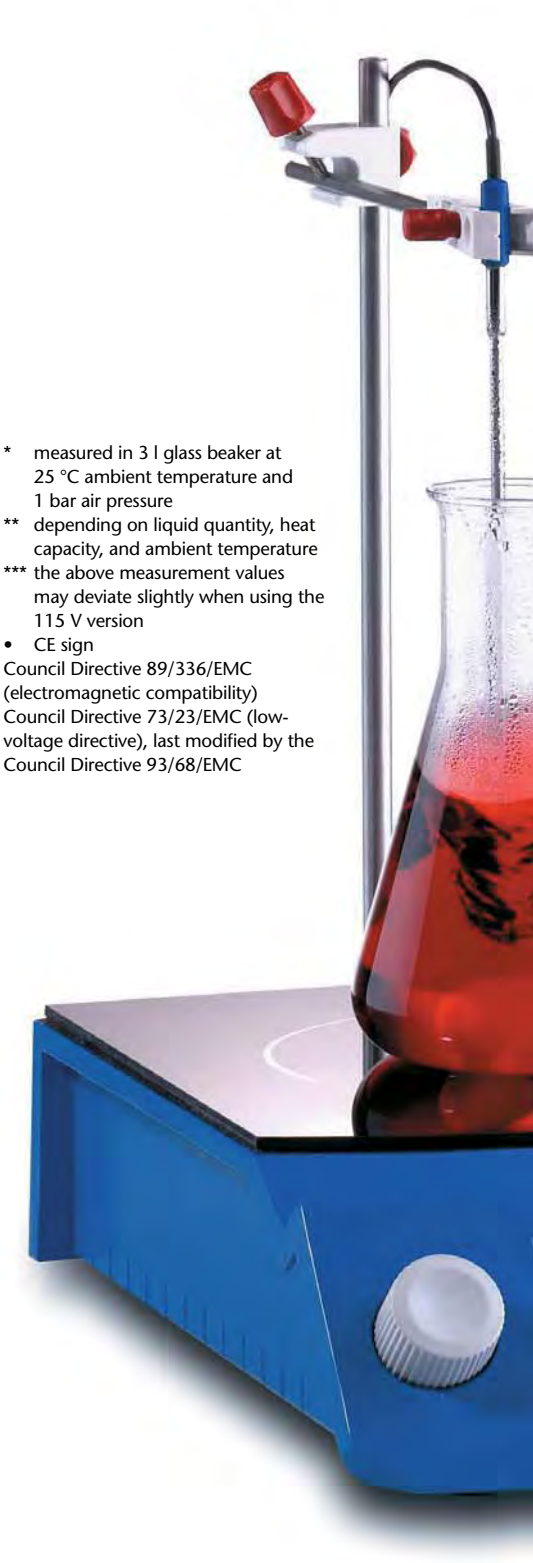
All functions can be viewed and monitored on the large and clear LCD display. The stirrer and heating are controlled separately by convenient turning knobs.

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

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

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

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



# Accessories

| Description | Type No. | Order No. |
|---|---|---|
| Temperature sensor<br>stainless steel shaft (V4A), Pt 1000 sensor,<br>1 m fixed cable with 2 x 4 mm banana plug,<br>length 170 mm, Ø 4 mm, -30 …+ 200 °C | W5791NNHT | 28 510 5308 |
| Temperature sensor<br>glass shaft, Sensor Pt 1000,<br>1 m fixed cable with 2 x 4 mm banana plug,<br>length 250 mm, Ø 6 mm, -30 …+ 200 °C | W5780NNHT | 28 510 5238 |
| Stand rod with fixing nut (M8)<br>stainless steel, Ø 10 mm, length 450 mm | Z 601 | 28 541 6492 |
| Temperature sensor holder<br>clamp with extension rod<br>made of stainless steel, connector | Z 602 | 28 541 6505 |
| Magnetic stirrer rod set for standard applications<br>AlNiCo5, circular cross-section, PTFE coated,<br>1 piece 15, 20, 30, 40, 50, 60, 70, 80 mm each | Z 603 | 28 541 6554 |
| Magnetic stirrer ripe for medium volumes<br>SmCo, circular cross-section, PTFE coated,<br>5 pieces 9 x 15 mm each | Z 604 | 28 541 6562 |
| Magnetic stirrer for large volumes<br>SmCo, elliptic cross-section, PTFE coated,<br>1 piece 19 x 75 mm each | Z 605 | 28 541 6579 |
| Compressed-air connector (only SLK)<br>for use in an aggressive environment<br>(subsequent installation only by manufacturer) | Z 607 | 28 541 6595 |
| Compressed-air connector set (only SLK) | Z 608 | 28 541 6608 |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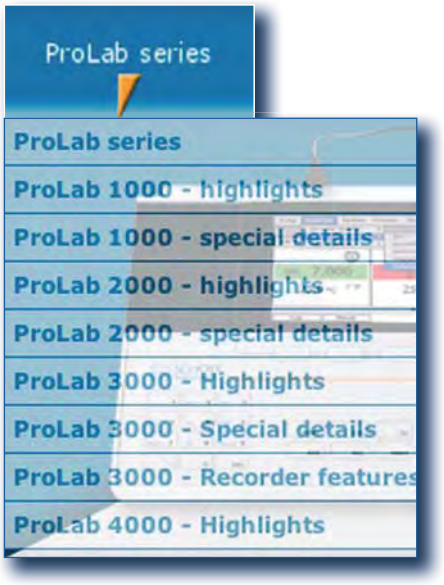
## The first address for electrochemical measurements


**Product innovations in detail!**

SCHOTT Instruments present new products, further developments and and much more ...

- **up-to-date**
- **and detailed**

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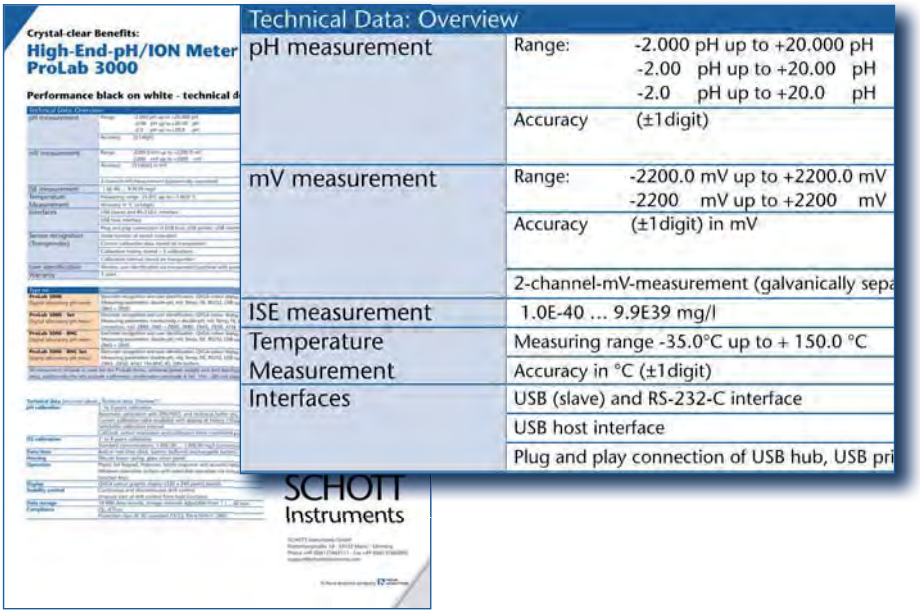
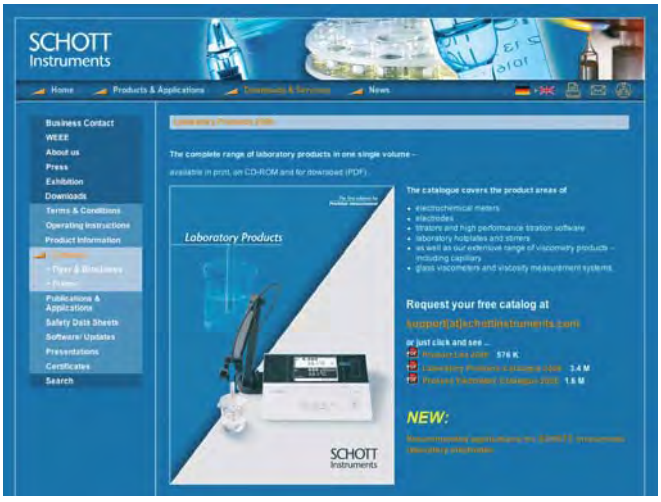



A further click displays all technical product details and ordering data:

- **Stored as PDF file**
- **All essential information summarized on one sheet of paper – ready for printout.**

# Information around the clock.

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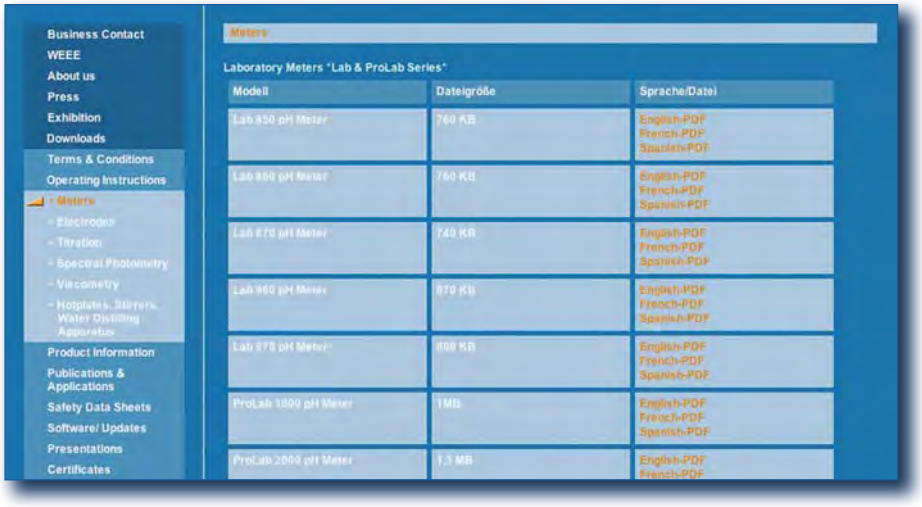


Here you can find a lot of useful information, such as e. g.:

- **Catalogues and product brochures**
- **Operating manuals**
- **Application reports and published articles**

A further downlowad service is the detailed section „Software“

- **Just one look at the software introduction page will quickly indicate, whether a new software update is available for your instrument.**
- **All software updates can be downloaded for free at any time – the installation directions will explain all necessary steps for your update.**

# 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 70 years ago with the development of the glass electrode at SCHOTT.**

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


*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 small brochure described how this was achieved. The development was based on the experience which we had gained from close co-operation with pioneer users in the industry.
Glass know-how was also the idea behind another measurement process that we pioneered in 1940: capillary viscometry. With precisely calibrated glass capillaries it was possible to determine the viscosity of Newtonian liquids more accurately than with any other method known at that time. You only need to measure the time required for a liquid sample to flow through a calibrated capillary with a defined constant. Then the required time was measured with a stop-watch. We have changed that.

**The success story of our meters began in the seventies**

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

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

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

In recent years we have repeatedly demonstrated our remarkable power of innovation. With the SILAMID reference system, the multi-functional electrodes, the SMEK plug system, the complete BlueLine laboratory electrode program, the new Type A pH glass, the SteamLine electrodes for CIP and SIP applications, the ScienceLine range of products and the new IoLine product family with

*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.*

the iodine/iodide reference system, we have provided new impulses for electrochemistry.

Our innovative AVS products have also made life much easier for our customers who need to measure viscosity. Examples include the practical ViscoClock, the AVSPro II, an apparatus for automatic viscosity measurements that is top-of-the-line worldwide, or the latest modular measurement systems AVS 370 and AVS 470. This is also true of our most recent developments in the area of titration equipment, where we have set new standards for top-of-the-line equipment with the TitroLine alpha *plus* titrator, the T110 *plus* piston burette and the TW alpha *plus* sample changer, the titration software TitriSoft 2.6 as well as the new coulometric KF titrator, TitroLine KF *trace*.

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

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

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

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

**More than 70 years of research and development and a long-standing tradition**

The list of our innovations is long: today our electrodes are smaller, more precise, faster and more stable; our measurement equipment offers incomparably higher performance. Over the years the electrochemical measurement methods and the viscometry that we initiated have established themselves as problem-free and reliable methods throughout the world, and they have become indispensable for an incredibly varied range of applications. Nevertheless, since our pioneering days, one thing has invariably remained the same – our tradition of working very closely together with those who use our products in order to create something new. We intend to remain true to this tradition in the future.

*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.*

# Just a brief excerpt from our company's history

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

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

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

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

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

**1964** Double electrolyte system for reference electrodes.

**1970** Introduction of semiconductor preamplifiers for pH measurement technology.

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

**1972** Plug system from SCHOTT, copied time and again.

**1973** SCHOTT Geräte GmbH established as an independant company.

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

**1974** Development and production of electronic laboratory pH meters.

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

**1977** Development and production of portable electronic pH meters.

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

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

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

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

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

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

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

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

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

**1990** REFERID® electrodes with polymer electrolyte, low-maintenance.

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

– Automatic sampler TW 280.

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

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

**1993** Combination pH electrodes with temperature sensor and plastic shaft.

**1994** Compact TitroLine alpha titrator.

**View over Mainz with premises of SCHOTT AG/SCHOTT Instruments**

*Source of image: SCHOTT AG*

**1995** SILAMID®, potential-stable reference system.
– First Windows titration software TitriSoft 1.0 (WIN 3.1).

**1996** New SMEK 6-pin plug system, shielded.

**1997** New BlueLine range of laboratory electrodes and VP plug system.
– Electrodes with certified pressure and temperature range.
– Market launch of the Visco-Clock for capillary viscosity measurement.

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

**1999** Range of industrial electrodes up to 10 bar and 135 °C, SMEK plug system in IP 68 version.
– New Type A pH glass, rapid reaction in drinking water.
– Market launch of the fully automatic AVSPro viscosity measurement system for high sample throughput.

**2000** Introduction of a completely new series of compact, simple piston burettes and titrators: TITRONIC® *basic*, TITRONIC® *universal* and TitroLine *easy*.
– Introduction of the Karl Fischer titration system TitroLine *KF*.

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

**2002** Sales launch of newly developed "*plus*" product line: TitroLine alpha *plus*, T 110 *plus*.
– Introduction of TW alpha *plus* sample changer.
– Market launch of TitriSoft 2.5 software.

**2003** The compact and highly flexible AVS 370 viscosity measurement system is presented to the market.
– Change of company name to SCHOTT Instruments GmbH, Mainz, integration into the internationally active Nova Analytics Group.

**2004** Amalgamation and further development of the laboratory electrode product range for the most exacting requirements in the "ScienceLine" product line.
– The new generation of automatic viscosity measurement systems is rounded off with the AVS 470.

**2005** The Lab meters family is introduced:
A wireless sensor recognition guarantees the optimum interplay 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.


*Precision measurement*
***in a complete system***

# SCHOTT
## Instruments

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