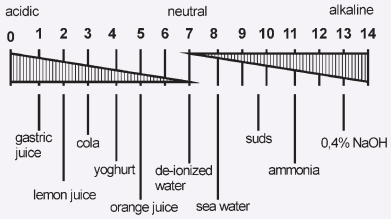
Content

Water analysis

The pH Value



The pH value is a logarithmic measure for the concentration of the H ions in a hydrous solution and indicates, by a numerical value, whether the solution has an acid, neutral or alkaline reaction.

The pH scale ranges from pH0 to pH14, pH7 is neutral.

The further the pH value deviates from 7, the more aggressive the sample is. The acidic or alkaline effect will increase by the factor 10 per pH unit.

The illustration on the left shows some examples for pH values of typical substances

The Redox Potential

The level of the Redox potential (measured in mV) indicates the strength of an oxidising or reducing reaction of a measuring solution. A negative voltage value means that the solution has reducing properties compared to a standard hydrogen electrode. A positive value indicates that the solution has an oxidising effect.

As the extermination of microorganisms (disinfection) is directly related to the strength of the oxidation (e.g. of chlorine) the Redox potential is successfully being used for monitoring disinfection processes, e.g. in swimming baths. However, redox measurements are also performed for controlling the denitrification of waste waters (redox break point determination) at the detoxification in galvanic plants and for monitoring multiple chemical processes (e.g. cyanide oxidation or chromate reduction).

ALMEMO® pH and Redox Measurement

By using reference solutions the calibration of pH and redox probes can be started with the push of a button. As the adjustment is stored in the ALMEMO® connector, the probe can also be used with other devices. If ALMEMO® devices with several input sockets are used, it is even possible to connect more probes with individual adjustments. The calculation of the pH value is based on the electrode steepness at 25°C. If the temperature of the measuring medium largely deviates from the reference temperature, it is possible for all ALMEMO® devices to perform a temperature compensation.

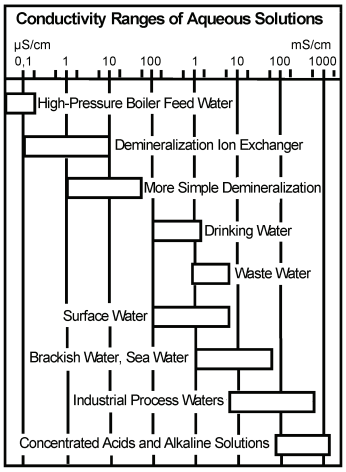
The Electrical Conductivity

The conductivity (unit S/m = Siemens/meter) is a measure for the ion concentration in a measuring solution.

It is proportional to the salt, acid or base content in the measuring solution. High-purity waters have a conductivity of approx. 0.05µS/cm (at 25°C), natural waters approx. 100 to 1000µS/m, some bases (e.g. potassium hydroxide solutions) up to slightly more than 1000mS/cm.

The diagram shows further examples of hydrous solutions relevant for measurements.

In practice, the conductivity measurement is used for monitoring plants, for producing of high-purity waters or for determining the salinity of sea water.



Solute Oxygen

Oxygen is not only a component of the air but it is also contained dissolved in water and, practically, in every liquid. For example, water contains approximately 9mg/l oxygen in saturated compound at a temperature of 20°C and an atmospheric pressure of 1019mbar.

Every liquid accepts as much oxygen until the oxygen partial vapour pressure in the liquid is in a balance with the ´contacting´ air or gas phase. The saturation state (air-saturated water) is reached when the partial pressure of the physically dissolved oxygen in the liquid equals the partial pressure of the oxygen in the air.

The current oxygen concentration increases with atmospheric pressures and with decreasing temperatures. Relevant for metrology are processes, such as the oxygen consumption involved with microbiological decomposition processes or an oxygen production, e.g. due to the growth of algae.

The oxygen concentration is very important for animals and organisms living in water and for the biological treatment of municipal and industrial waste water. Additionally, corrosion processes in lines and keeping the quality of beverages depend on the solute oxygen in the liquid.

This is only possible with ALMEMO® Devices

Through the complete electrical isolation of the measuring inputs it is possible to use only one single ALMEMO® device to simultaneously measure various chemical variables, and use several probes in one sampling vessel without having any mutual influences of the probes! Through pre-programmed ALMEMO® connectors it is possible to connect any environmental sensor technology.

ALMEMO® system with data logger and comprehensive sensor equipment — Order no.

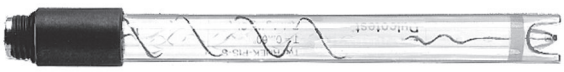
For exploring abandoned polluted areas and their environments or for performing groundwater quality tests

ALMEMO® data logger including sensor equipment and accessories

- ALMEMO® 2690-8 with 5 measuring inputs, including PC data cable — **MA26908AKSU**
- Temperature sensor -70 to +400 °C — **FPA30L0250 + OFS0008**
- pH electrode 1 to 12 pH including connecting cable and buffer solutions pH 4/7/10 — **FY96PHEK + ZA9610AKY4W + ZB98PHPL4 + ZB98PHPL7 + ZB98PHPL10 + ZB98PHNL**
- Redox electrode including connecting cable and buffer solution 220 mV and KCl solution — **FY96RXEK + ZA9610AKY5W + ZB98RXPL2**
- Conductivity probe 0.01 to 20.00 mS/cm including reference solution 2.77 mS/cm — **FYA641LFP1 + ZB96LFRL**
- Probe for measuring solute oxygen 0 to 40 mg/l or 0 to 260 % saturation including filling solution — **FYA640O2**
- Adjustment set for the oxygen probe, saturation and zero point adjustment — **ZB9640AS**

Water analysis

pH One-Bar Measuring Chain FY96PHEK



Applications:

manual measurements e.g. swimming pools, drinking water ...

Technical Data

pH range::	1 … 12	Reference:	Ag / AgCl (3mol KCl / gel)
Operating range	0 ... 13pH / 0 … 60°C	Shaft length:	125 ±3mm
Operating pressure:	unpressurised	Shaft diameter:	12mm (polycarbon)
Conductivity:	> 150 µS / cm	Electrode head:	plug head SN6
Diaphragm type:	glass fiber		

Type	Order no.
pH-one-bar measuring chain pH 1 … 12, 0 … 60°C for unpressurised operating	**FY96PHEK**

pH One-Bar Measuring Chain FY96PHER

Applications:

Waste water, drinking water, industrial water, chemical industry, paper industry, food industry ...
(not media contained for chlorine and fluride, for not frequent temperature fluctuations).

Technical Data

pH range:	1 … 12	Shaft diameter:	12mm (glass)
Operating range	0 ... 13pH / 0 … 80°C	screw connection	thread PG13.5
max. pressure:	6 bar	Shaft length:	120 ±3mm
Conductivity:	> 50 µS / cm	Electrode head:	plug head SN6
Diaphragm type:	PTFE ring diaphragm		
Reference:	Ag mit AgCl stock (3mol KCl / polymer)		

Type	Order no.
pH-one-bar measuring chain pH 1 ... 12; 0 … 80°C	**FY96PHER**

pH One-Bar Measuring Chain FY96PHEN

Applications:

manual measurements in the laboratory.

Technical Data

pH range:	0 … 12		KCl-elektrolyt refillable
Operating range	0 ... 13pH / 0 … 80°C	Shaft length:	160 ±3mm
Operating pressure:	unpressurised	Shaft diameter:	12mm (material: glass)
Conductivity:	> 150 mS / cm,	Electrode head:	plug head SN6
Diaphragm type:	ceramik diaphragm		
Reference:	Ag / AgCl stock (3mol KCl / liquid)		

Type	Order no.
pH-one-bar measuring chain pH 0 … 12, 0 … 80°C for unpressurised operating	**FY96PHEN**

pH Insertion Electrode FY96PHEE

Applications:

pH-measurings in semi-solid or pasty media,
e.g. foods like meat, cheese ...

Technical Data

pH range:	1 … 12
Operating range	0 ... 13pH / 0 … 60°C
Operating pressure:	unpressurised
Diaphragm type:	3 ceramic diaphragms
Reference:	Ag / AgCl (3mol KCl / liquid)
	KCl-elektrolyt refillable
Shaft length:	120 ±3mm (glass)
Penetrating tip	approx. 45 mm, Ø 6 to 8 mm
Electrode head:	plug head SN6

Type	Order no.
pH-insertion electrode pH 1 … 12, 0 … 60°C for unpressurised operating	**FY96PHEE**

Redox-One-Bar Measuring Chain FY96RXEK

Applications:

manual measurements e.g. swimming pools, drinking water ....

Technical Data

Operating temperature	0 … 60°C
Operating pressure:	unpressurised
Conductivity:	> 150 µS / cm
Diaphragm type:	glass fiber
Metal electrode :	platinum
Shaft length:	125 ±3mm
Shaft diameter:	12 mm (material: plastic)
Electrode head:	plug head SN6

Type	Order no.
Redox-one-bar measuring chain 0 … 60°C for unpressurised operating	**FY96RXEK**

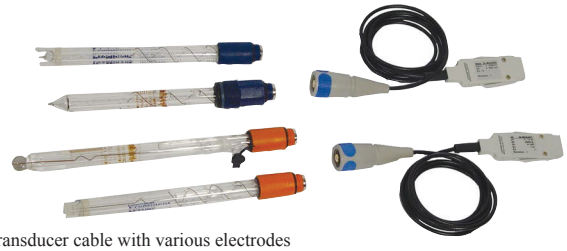
Accessories for pH-One-Bar Meas. Chains and Redox-One-Bar Meas. Chain

pH-One-Bar Measuring Chains	**Order no.**
ALMEMO® transducer cable* for pH probes,	
1.2 m	**ZA9610AKY4W**
5 m	**ZA9610AKY4WL05**
ALMEMO® transducer cable* for pH and redox probes,	
1.2 m	**ZA9610AKY6W**
5 m	**ZA9610AKY6WL05**
Buffer solution pH 4.0 50 ml	**ZB98PHPL4**
Buffer solution pH 7.0 50 ml	**ZB98PHPL7**
Buffer solution pH 10.0 50 ml	**ZB98PHPL10**
KCl solution, 3-molar, 50ml for refilling and storage	**ZB98PHNL**

Redox-One-Bar Measuring Chain	**Order no.**
ALMEMO® transducer cable* for redox probes,	
1.2 m	**ZA9610AKY5W**
5 m	**ZA9610AKY5WL05**
ALMEMO® transducer cable* for pH and redox probes,	
1.2 m	**ZA9610AKY6W**
5 m	**ZA9610AKY6WL05**
Redox buffer solution 220 mV	**ZB98RXPL2**
KCl solution, 3-molar for refilling and storage, 50ml	**ZB98PHNL**

* Cable with spray-coated ALMEMO®connector

ALMEMO® connecting cable for pH and redox probes



Transducer cable with various electrodes

Applications:

Transducer cables are available for all popular electrodes with a coaxial connector. To avoid the measuring signal being corrupted by the measuring instrument itself an extremely high-impedance amplifier is integrated in the ALMEMO® connector on the connecting cable . It is also possible, by means of impedance conversion and differential measurement, to measure several electrodes with different potentials, -free from interference and using only one ALMEMO® device.

Technical Data

Transducer	High-impedance measuring amplifier (>500 Gohm), integrated in the ALMEMO® connector	Electrode terminal	For plug-on head S7/SN6 or SMEK (see variants)

Type	Order no.
ALMEMO® connecting cable with transducer (ALMEMO® connector, spray-coated)	
For probes with plug-on head S7/SN6 (coaxial connector, screw-fit):	
Programming for pH probe	
Cable length 1.2 meters	**ZA9610AKY4W**
Cable length 5 meters	**ZA9610AKY4WL05**
Programming for redox probes	
Cable length 1.2 meters	**ZA9610AKY5W**
Cable length 5 meters	**ZA9610AKY5WL05**
Programming for pH or redox probe (1 probe connectable at a time)	
Cable length 1.2 meters	**ZA9610AKY6W**
Cable length 5 meters	**ZA9610AKY6WL05**

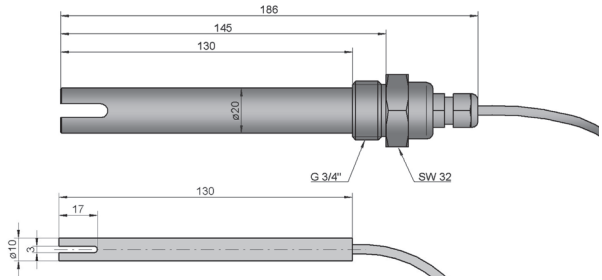
Type	Order no.
ALMEMO® connecting cable with transducer	
For probes with SMEK plug-on head	
Cable length 2 meters	
Programming for pH probe with integrated temperature sensor NTC (30 kohm at 25 °C), linearization saved in ALMEMO® connector (only for current V6 ALMEMO® devices)	**ZA9640AKY8**
Programming for pH probe	**ZA9610AKY8**
Programming for redox probe	**ZA9610AKY9**

NTC temperature sensor for automatic temperature compensation when measuring pH

Connector programming designation *T for ALMEMO® 2490 and 2590-2/-3S/-4S and (with effect from 07/2006) for ALMEMO® 2690/ 2890/ 5690/ 8590/ 8690

Type	Order no.
Stainless-steel sheathed sensor (see page 07.06) Diameter 3.0 mm, length 250 mm, Hexagonal cable sleeve with 1.5 meters PVC cable and ALMEMO® connector	**FNA30L0250T**
Safety hose made from PTFE (for aggressive media) Hermetically sealed on one side, inside diameter 3.0 mm, outside diameter 4.0 mm, length 700 mm	**ZT9000TS7**

Conductivity Probe FYA641LFP1 / LFL1



Applications:

Concentrated waste water, aggressive waters, general aqueous and partly aqueous solutions, beer, emulsions, electroplating, waters, concentrated acidic and alkaline solutions, corrosive acids and alkaline solutions, lacquers and paints, substances containing protein, soaps, detergents, suspensions, titrations in organic substances, environmental analysis.

Technical Data

Measuring range:	0.01 to 20mS/cm LFL1 up to 10mS/cm
Temperature sensor:	NTC, type N (10k at 25°C)
Temperature compensation:	0 to +70°C, automatic
Compensation coefficient:	1.9 linear
Cell constant:	approx. 1cm^{-1}
Electrode material:	special coal
Accuracy: 0.01 to 5mS/cm: 5 to 20mS/cm:	 ± 1% of meas. val. ± 0.05mS ± 2% of meas. val. ± 0.05mS
Nominal temperature:	25°C ± 3°C
Operating temperature:	–5 to 70°C

Minimum insertion depth:	30mm
Shaft material:	PVC - C
Shaft length/shaft diameter:	LFP1: 130mm/20mm LFL1: 130mm/10mm
Fitting length / thread	only LFP1 145 mm / G¾"
Maximum pressure	LFP1: 16 bar at 25 °C LFL1: not suitable for use under pressure
Cable length:	1.5m
Power supply:	8 to 12V through meas. instr.
Current consumption:	approx ca. 3 mA

Accessories

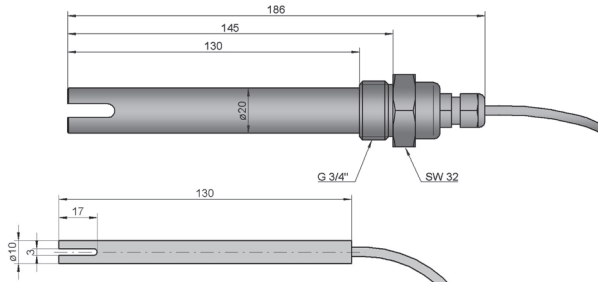
	Order no.
Reference solution 2.77mS/cm at 25°C 0.02mol KCl, 250ml	**ZB96LFRL**

Type (including manufacturer's test certificate)

	Order no.
Active conductivity probe with automatic temperature compensation, Built-in probe, G 3/4" thread, suitable for use under pressure up to 20mS/cm	**FYA641LFP1**
Laboratory probe, not suitable for use under pressure up to 10mS/cm	**FYA641LFL1**

Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates)

Conductivity Probe FYA641LFP2 / LFL2



Applications:

Low-salt waste water, general aqueous and partly aqueous solutions, fish tanks, emulsions, desalting/ion exchanger, beverages, waters, cold/boiler feed water, lacquers and paints, milk, samples with low ionic strength, substances containing protein, purest water, soaps, detergents, suspensions, drinking water, environmental analysis.

Technical Data

Measuring range:	1 to 200µS/cm
Temperature sensor:	NTC, type N (10k at 25°C)
Temperature compensation:	0 to +70°C, automatic
Compensation coefficient:	1.9 linear
Cell constant:	approx. 1cm^{-1}
Electrode material:	special coal
Accuracy:	± 2% of meas. val. ± 0.5µS
Nominal temperature:	25°C ± 3°C
Operating temperature:	–5 to 70°C
Minimum insertion depth:	30mm

Shaft material:	PVC - C
Shaft length/Shaft diameter:	LFP2: 130mm/20mm LFL2: 130mm/10mm
Fitting length / thread	only LFP2 145 mm / G¾"
Maximum pressure	LFP2: 16 bar at 25 °C LFL2: not suitable for use under pressure
Cable length:	1.5m
Power supply:	8 to 12V through meas. instr.
Current consumption:	approx. 3 mA

Zubehör

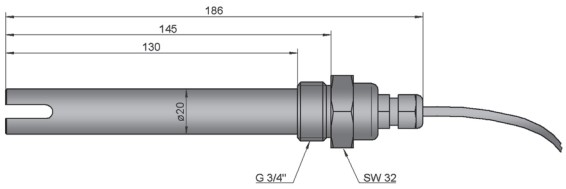
	Order no.
Reference solution 147µS/cm at 25°C 0.001mol KCl, 250ml	**ZB96LFRL2**

Type (including manufacturer's test certificate)

	Order no.
Active conductivity probe 0 … 200µS/cm with automatic temperature compensation,	
Built-in probe, G 3/4" thread, suitable for use under pressure	**FYA641LFP2**
Laboratory probe, not suitable for use under pressure	**FYA641LFL2**

Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates)

Conductivity Probe FYA641LFP3



Applications:

Concentrated waste water, aggressive waters, general aqueous and partly aqueous solutions, beer, emulsions, electroplating, waters, concentrated acid and alkaline solutions, corrosive acids and alkaline solutions, lacquers and paints, substances containing protein, soaps, detergents, suspensions, titrations in organic substances, environmental analysis.

Technical Data

Measuring range:	0 to 200 mS/cm
Temperature sensor:	NTC, type N (10k at 25°C)
Cell constant:	approx. 1cm^{-1}
Electrode:	4 electrodes, special coal
Accuracy:	1 mS/cm ± 1.5% of meas. val.
Nominal temperature:	25°C ± 3°C
Operating temperature:	0 to 70°C
Minimum insertion depth:	30mm

Shaft material:	PVC - C
Shaft length:	145mm
Shaft diameter:	20mm
Fitting length / thread	130 mm / G¾"
Maximum pressure	16 bar at 25 °C
Cable length:	1.5m
Power supply:	8 to 12V through meas. instr.
Current consumption:	approx. 15 mA

Accessories

	Order no.
Reference solution 111.8mS/cm at 25°C 1mol KCl, 250ml	**ZB96LFRL3**

Type (including manufacturer's test certificate)

	Order no.
Conductivity probe 0 … 200mS/cm without temp. compensation	**FYA641LFP3**

Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates)

Oxygen Sensor FYA640O2

Applications:

Determination of the conditions of life for fish and microorganisms in waters and fish tanks, biological treatment of municipal and industrial waste water, storage of organic liquids, examinations of drinking water, control of corrosion processes in heating system lines, examination of quality-keeping of beverages.

Technical Data

Measuring ranges:	
Temperature range:	–5.0 … 50°C
O2 saturation:	0 … 260% saturation
O2 concentration:	0.0 … 40mg/l (5 … 40°C)
Measuring principle:	Clark
Working electrode:	Pt cathode
Reference electrode:	Ag/AgCl counter electrode
Membrane:	PTFE
Response time (t_{90}%):	approx. 10–15s
Zero current at 0% saturation:	< 5nA
Meas. current at 100% saturation:	approx. 700nA
Accuracy, oxygen measurement:	< ± 1% of measured value
Velocity in blower stream:	approx. 10cm/s
Storage temperature:	–10 … 50°C
Insertion depth:	40mm
Filling volume (electrolyte):	0.6ml

Temperature sensor:	NTC type N (10k at 25°C)
Accuracy of temp. measurement (at nominal conditions):	–20 … 0°C: ±0.4°C, 0 … 70°C: ±0.1°C
Nominal conditions:	25°C ±3°C/1013mbar
Shaft material:	PVC, black
Membrane cap:	replaceable (spare)
Shaft length/shaft diameter:	145mm/12mm
Connecting cable:	1.5m long with spray-coated ALMEMO® connector
Polarisation voltage:	650mV
Service life (with one electrolyte filling):	several months
Total service life (durability):	several years

Accessories	Order no.
Adjustment set consisting of:	
25g sodium sulphite in 20ml PE bottle for preparation of the null solution, vessel for adjustment of the saturation level	**ZB 9640 AS**
25g sodium sulphite in 20ml PE bottle	**ZB 9640 NS**
20ml filling solution in PE bottle for O2 probe	**ZB 9640 NL**
Spare membrane cap with protection (2 pieces)	**ZB9640EM**

Type	Order no.
Oxygen sensor for O_2 measurements in liquids incl. connecting cable 1.5m long with spray-coated ALMEMO® connector	**FYA640O2**