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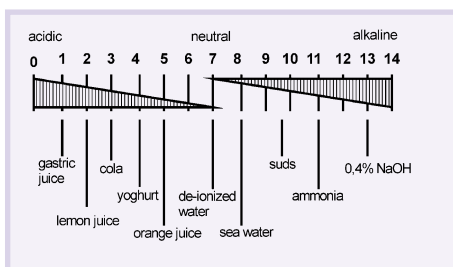
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# Water analysis



## 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

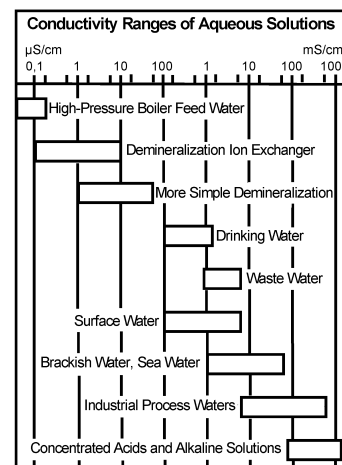
The conductivity (unit S/m = Siemens/meter) is a measure for the ion concentration in a measuring solution.

It is proportional to the salt, acid or base content in the measuring solution. High-purity waters have a conductivity of approx.  $0.05\mu\text{S/cm}$  (at  $25^\circ\text{C}$ ), natural waters approx. 100 to  $1000\mu\text{S/m}$ , some bases (e.g. potassium hydroxide solutions) up

to slightly more than  $1000\text{mS/cm}$ .

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  $20^\circ\text{C}$  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
- Temperature sensor  $-70$  to  $+400^\circ\text{C}$
- pH electrode 1 to 12 pH including connecting cable and buffer solutions pH 4/7/10
- Redox electrode including connecting cable and buffer solution 220 mV and KCl solution
- Conductivity probe 0.01 to 20.00 mS/cm including reference solution 2.77 mS/cm
- Probe for measuring solute oxygen 0 to 40 mg/l or 0 to 260 % saturation including filling solution
- Adjustment set for the oxygen probe, saturation and zero point adjustment

MA26908AKSU

FPA30L0250 + OFS0008

FY96PHEK + ZA9610AKY4W  
+ ZB98PHPL4 + ZB98PHPL7  
+ ZB98PHPL10 + ZB98PHNL

FY96RXEK + ZA9610AKY5W  
+ ZB98RXPL2

FYA641LFP1 + ZB96LFRL

FYA64002

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

pH-one-bar measuring chain pH 1 ... 12, 0 ... 60°C for unpressurised operating

### Order no.

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 fluoride, 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<br>(3mol KCl / polymer) |                  |               |

### Type

pH-one-bar measuring chain pH 1 ... 12; 0 ... 80°C

### Order no.

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<br>(3mol KCl / liquid) |                           |                        |

### Type

pH-one-bar measuring chain pH 0 ... 12, 0 ... 80°C for unpressurised operating

### Order no.

FY96PHEN

## pH Insertion Electrode FY96PHEE



### Applications:

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

### Technical Data

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

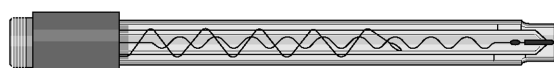
### Type

pH-insertion electrode pH 1 ... 12, 0 ... 60°C for unpressurised operating

### Order no.

**FY96PHEE**

## Redox-One-Bar Measuring Chain FY96RXEK



### Applications:

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

### Technical Data

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

### Type

Redox-one-bar measuring chain 0 ... 60°C for unpressurised operating

### Order no.

**FY96RXEK**

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

| pH-One-Bar Measuring Chains                              | Order no.             | Redox-One-Bar Measuring Chain                      | Order no.             |
|--|-----------------------|--|-----------------------|
| ALMEMO® transducer cable* for pH probes,                 |                       | ALMEMO® transducer cable* for redox probes,        |                       |
| 1.2 m  | <b>ZA9610AKY4W</b>    | 1.2 m  | <b>ZA9610AKY5W</b>    |
| 5 m  | <b>ZA9610AKY4WL05</b> | 5 m  | <b>ZA9610AKY5WL05</b> |
| ALMEMO® transducer cable* for pH and redox probes,       |                       | ALMEMO® transducer cable* for pH and redox probes, |                       |
| 1.2 m  | <b>ZA9610AKY6W</b>    | 1.2 m  | <b>ZA9610AKY6W</b>    |
| 5 m  | <b>ZA9610AKY6WL05</b> | 5 m  | <b>ZA9610AKY6WL05</b> |
| Buffer solution pH 4.0 50 ml                             | <b>ZB98PHPL4</b>      | Redox buffer solution 220 mV                       | <b>ZB98RXPL2</b>      |
| Buffer solution pH 7.0 50 ml                             | <b>ZB98PHPL7</b>      | KCl solution, 3-molar                              |                       |
| Buffer solution pH 10.0 50 ml                            | <b>ZB98PHPL10</b>     | for refilling and storage, 50ml                    | <b>ZB98PHNL</b>       |
| KCl solution, 3-molar, 50ml<br>for refilling and storage | <b>ZB98PHNL</b>       |  |                       |

\* Cable with spray-coated ALMEMO®connector

# Water analysis

## 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

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

Cable length 5 meters

Programming for redox probes

Cable length 1.2 meters

Cable length 5 meters

Programming for pH or redox probe (1 probe connectable at a time)

Cable length 1.2 meters

Cable length 5 meters

### Order no.

**ZA9610AKY4W**  
**ZA9610AKY4WL05**

**ZA9610AKY5W**  
**ZA9610AKY5WL05**

**ZA9610AKY6W**  
**ZA9610AKY6WL05**



### Type

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)

Programming for pH probe

Programming for redox probe

### Order no.

**ZA9640AKY8**  
**ZA9610AKY8**  
**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

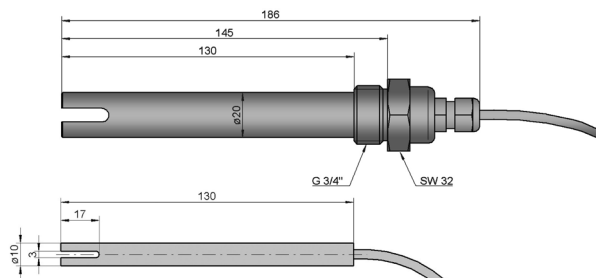
Stainless-steel sheathed sensor (see page 07.06) Diameter 3.0 mm, length 250 mm, Hexagonal cable sleeve with 1.5 meters PVC cable and ALMEMO® connector

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

### Order no.

**FNA30L0250T**  
**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<br>LFL1 up to 10mS/cm | Minimum insertion depth:     | 30mm  |
| Temperature sensor:       | NTC, type N (10k at 25°C)             | Shaft material:              | PVC - C   |
| Temperature compensation: | 0 to +70°C, automatic                 | Shaft length/shaft diameter: | LFP1: 130mm/20mm<br>LFL1: 130mm/10mm                                  |
| Compensation coefficient: | 1.9 linear                            | Fitting length / thread      | only LFP1 145 mm / G $\frac{3}{4}$ "                                  |
| Cell constant:            | approx. 1cm <sup>-1</sup>             | Maximum pressure             | LFP1: 16 bar at 25 °C<br>LFL1: not suitable for use<br>under pressure |
| Electrode material:       | special coal                          | Cable length:                | 1.5m  |
| Accuracy:                 |                                       | Power supply:                | 8 to 12V through meas. instr.   |
| 0.01 to 5mS/cm:           | ± 1% of meas. val. ± 0.05mS           | Current consumption:         | approx ca. 3 mA   |
| 5 to 20mS/cm:             | ± 2% of meas. val. ± 0.05mS           |                              |   |
| Nominal temperature:      | 25°C ± 3°C                            |                              |   |
| Operating temperature:    | -5 to 70°C                            |                              |   |

### Accessories

Reference solution 2.77mS/cm at 25°C 0.02mol KCl, 250ml

**Order no.**

**ZB96LFRL**

### Type (including manufacturer's test certificate)

Active conductivity probe with automatic temperature compensation, Built-in probe, G 3/4" thread, suitable for use under pressure up to 20mS/cm

Laboratory probe, not suitable for use under pressure up to 10mS/cm

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

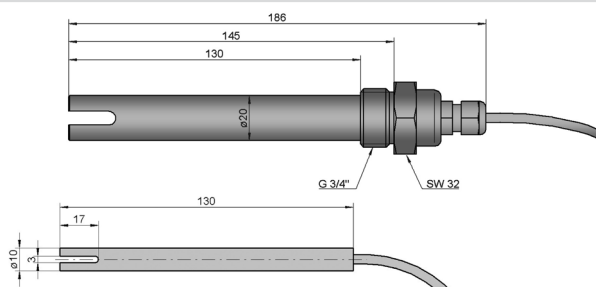
**Order no.**

**FYA641LFP1**

**FYA641LFL1**

# Water analysis

## 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.

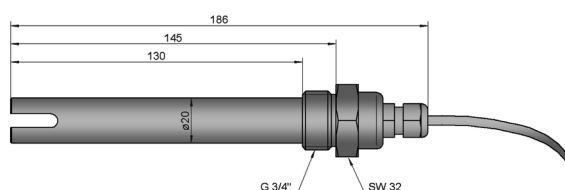
### Technical Data

|                           |   |                              |  |
|---------------------------|---|------------------------------|--|
| Measuring range:          | 1 to 200 $\mu\text{S}/\text{cm}$              | Shaft material:              | PVC - C  |
| Temperature sensor:       | NTC, type N (10k at 25°C)                     | Shaft length/Shaft diameter: | LFP2: 130mm/20mm<br>LFL2: 130mm/10mm                               |
| Temperature compensation: | 0 to +70°C, automatic                         | Fitting length / thread      | only LFP2 145 mm / G $\frac{3}{4}$ ''                              |
| Compensation coefficient: | 1.9 linear                                    | Maximum pressure             | LFP2: 16 bar at 25 °C<br>LFL2: not suitable for use under pressure |
| Cell constant:            | approx. 1 $\text{cm}^{-1}$                    | Cable length:                | 1.5m   |
| Electrode material:       | special coal                                  | Power supply:                | 8 to 12V through meas. instr.                                      |
| Accuracy:                 | $\pm 2\%$ of meas. val. $\pm 0.5 \mu\text{S}$ | Current consumption:         | approx. 3 mA   |
| Nominal temperature:      | 25°C $\pm 3^\circ\text{C}$                    |                              |  |
| Operating temperature:    | -5 to 70°C                                    |                              |  |
| Minimum insertion depth:  | 30mm  |                              |  |

| Zubehör  | Order no. |
|--|-----------|
| Reference solution 147 $\mu\text{S}/\text{cm}$ at 25°C 0.001mol KCl, 250ml | ZB96LFRL2 |

| Type (including manufacturer's test certificate)  | Order no.                |
|---|--------------------------|
| Active conductivity probe 0 ... 200 $\mu\text{S}/\text{cm}$ with automatic temperature compensation,<br>Built-in probe, G $\frac{3}{4}$ '' thread, suitable for use under pressure<br>Laboratory probe, not suitable for use under pressure<br>Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates) | FYA641LFP2<br>FYA641LFL2 |

## 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 $\text{mS}/\text{cm}$                  | Shaft material:         | PVC - C                       |
| Temperature sensor:      | NTC, type N (10k at 25°C)                       | Shaft length:           | 145mm                         |
| Cell constant:           | approx. 1 $\text{cm}^{-1}$                      | Shaft diameter:         | 20mm                          |
| Electrode:               | 4 electrodes, special coal                      | Fitting length / thread | 130 mm / G $\frac{3}{4}$ ''   |
| Accuracy:                | 1 $\text{mS}/\text{cm} \pm 1.5\%$ of meas. val. | Maximum pressure        | 16 bar at 25 °C               |
| Nominal temperature:     | 25°C $\pm 3^\circ\text{C}$                      | Cable length:           | 1.5m                          |
| Operating temperature:   | 0 to 70°C                                       | Power supply:           | 8 to 12V through meas. instr. |
| Minimum insertion depth: | 30mm  | Current consumption:    | approx. 15 mA                 |

| Accessories  | Order no. |
|--|-----------|
| Reference solution 111.8 $\text{mS}/\text{cm}$ at 25°C 1mol KCl, 250ml | ZB96LFRL3 |

| Type (including manufacturer's test certificate)  | Order no.  |
|---|------------|
| Conductivity probe 0 ... 200 $\text{mS}/\text{cm}$ without temp. compensation<br>Factory calibration KY90xx conductivity for measuring chain (sensor + device) (see chapter Calibration certificates) | FYA641LFP3 |



## Oxygen Sensor FYA64002



### 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 sensor:                                    | NTC type N (10k at 25°C)                            |
| Temperature range:                 | -5.0 ... 50°C               | Accuracy of temp. measurement (at nominal conditions): | -20 ... 0°C: ±0.4°C,<br>0 ... 70°C: ±0.1°C          |
| O2 saturation:                     | 0 ... 260% saturation       | Nominal conditions:                                    | 25°C ±3°C/1013mbar                                  |
| O2 concentration:                  | 0.0 ... 40mg/l (5 ... 40°C) | Shaft material:  | PVC, black  |
| Measuring principle:               | Clark                       | Membrane cap:  | replaceable (spare)                                 |
| Working electrode:                 | Pt cathode                  | Shaft length/shaft diameter:                           | 145mm/12mm  |
| Reference electrode:               | Ag/AgCl counter electrode   | Connecting cable:                                      | 1.5m long<br>with spray-coated<br>ALMEMO® connector |
| Membrane:                          | PTFE                        | Polarisation voltage:                                  | 650mV   |
| Response time (t <sub>90</sub> %): | approx. 10–15s              | Service life   |   |
| Zero current at 0% saturation:     | < 5nA                       | (with one electrolyte filling):                        | several months                                      |
| Meas. current at 100% saturation:  | approx. 700nA               | Total service life (durability):                       | several years                                       |
| 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                       |  |   |

### 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 | <b>ZB 9640 AS</b> |
| 25g sodium sulphite in 20ml PE bottle   | <b>ZB 9640 NS</b> |
| 20ml filling solution in PE bottle for O <sub>2</sub> probe   | <b>ZB 9640 NL</b> |
| Spare membrane cap with protection (2 pieces)   | <b>ZB9640EM</b>   |

### Type

### Order no.

Oxygen sensor for O<sub>2</sub> measurements in liquids incl. connecting cable 1.5m long with spray-coated ALMEMO® connector

**FYA64002**