**OPERATIONS MANUAL**

ba76138e07 02/2024

# 4210W / 4211 / 4220W

ORP ELECTRODE

YSI®

a xylem brand

For the most recent version of the manual, please visit www.ysi.com.

**Contact**

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# 1 General information

**Automatic sensor recognition**

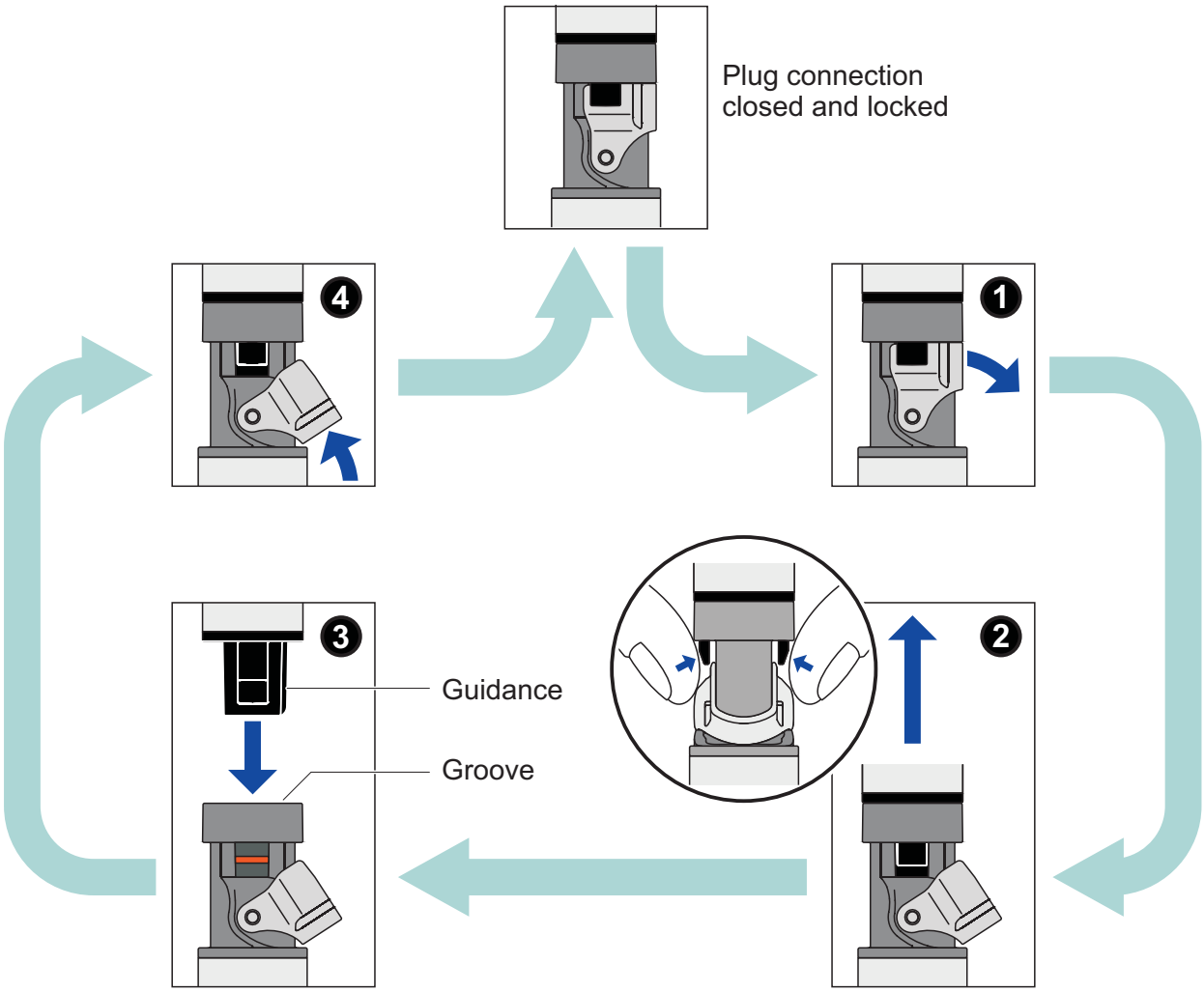
The sensor electronics with the stored sensor data are in the connecting head of the electrode. The data include, among other things, the sensor type and series number. The data are recalled by the meter when the sensor is connected and are used for measurement and for measured value documentation.

The digital transmission technique guarantees the failure-free communication with the meter even with long connection cables. The sensor firmware can be updated via the meter.

# 2 Commissioning, measuring, checking

## 2.1 Opening and closing the IDS plug connection

This section only applies to variants with IDS plug (42xxW).




**Opening the plug connection**

- If necessary, clean the plug connection
- Open the locking device (step 1)
- Use your thumb and index finger to press the clips of the connector together, and pull the connector out of the plug (step 2).

**Closing the plug connection**

- Make sure that the plug connection is perfectly dry and clean.
- Align the guidance of the coupling to the groove in the plug and insert the coupling into the unlocked plug up to the stop (step 3)
- Close the locking device (step 4)

## 2.2 Commissioning

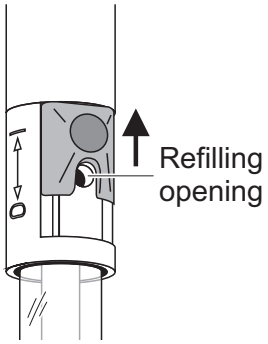
**Scope of delivery**

- Electrode 4210W / 4211 / 4220W
- Operating manual

**Commissioning**

Prepare the electrode for measuring as follows:

- 4210W / 4211:
  Open the refilling opening for the reference electrolyte solution. Depending on the model, the stopper of the refilling opening is an elastomer stopper or a slider.
  **The refilling opening must always be open during measurement!**




- Remove the watering cap from the electrode tip. Possible salt deposits in the area of the watering cap do not affect the measuring characteristics and can easily be removed with deionized water.

Please keep the watering cap. It is required for the electrode to be stored. Always keep the watering cap clean.

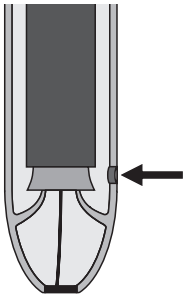
- Connect the sensor to the meter.
  The sensor is immediately ready to measure.

| | |
|---|---|
| 4211 | – via the sensor cable to a free IDS connector on the meter |
| 4210W<br>4220W | – via a connecting cable (accessory) to a free IDS connector on the meter<br>or<br>– wireless via an IDS WA-S adapter (accessory) to a WA-capable meter<br>Accessories for the connection of the 42xxW sensor to the meter: See chapter 7 WEAR PARTS AND ACCESSORIES.<br>Opening and closing the IDS plug connection, see section 2.1 OPENING AND CLOSING THE IDS PLUG CONNECTION. |

- Measure with the electrode according to the operating manual of the meter and observe the following rules while doing so:

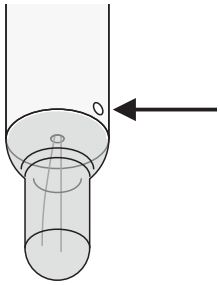
## 2.3 Measuring: General rules

- 4210W / 4211:
  Make sure the refilling opening for the reference electrolyte solution is open.
- Avoid the carryover of sample solution from one measurement to the next as follows:
  – Shortly rinse the sample beakers with the solution the beakers are to be filled with next.
  – Between measurements, rinse the electrode with the solution that follows. Alternatively, you can also rinse the electrode with deionized water and then carefully dab it dry.
- Immerse the electrode in the solution in a vertical or slightly tilted position.
- Make sure the immersion depth is correct. The junction must be completely submersed in the solution. The junction is in the area of the bottom end of the shaft (see arrow).



4210W / 4211

At the same time, the level of the reference electrolyte must be at least 2 cm above the level of the solution.



4220W

Minimum immersion depth:
25 mm

**Conversion to normal hydrogen electrode**

$U_H = U_{Meas} + U_{Ref}$

with: $U_H$ = ORP, referring to the normal hydrogen electrode

$U_{Meas}$ = Measured ORP

$U_{Ref}$ = Voltage of the reference system compared to the normal hydrogen electrode

**4210W / 4211**

$U_{Ref}$ is temperature dependent and can be taken from the following table (see also DIN 38404-6):

| T (°C) | $U_{Ref}$ [mV] 4210W / 4211 | T (°C) | $U_{Ref}$ [mV] 4210W / 4211 |
|---|---|---|---|
| 0 | +224 | 35 | +200 |
| 5 | +221 | 40 | +196 |
| 10 | +217 | 45 | +192 |
| 15 | +214 | 50 | +188 |
| 20 | +211 | 55 | +184 |
| 25 | +207 | 60 | +180 |
| 30 | +203 | | |

**4220W**

$U_{Ref}$ depends on the reference system and temperature and can be taken from the following table (see also DIN 38404-6 for the system Ag/AgCl/ saturated KCl):

| T (°C) | $U_{Ref}$ [mV] 4220W | T (°C) | $U_{Ref}$ [mV] 4220W |
|---|---|---|---|
| 0 | +221 | 35 | +187 |
| 5 | +216 | 40 | +181 |
| 10 | +212 | 45 | +176 |
| 15 | +207 | 50 | +171 |
| 20 | +202 | 55 | +165 |
| 25 | +197 | 60 | +160 |
| 30 | +192 | | |

**Checking with Zobell ORP buffer solution (YSI 3682)**

URef is temperature dependent and can be taken from the following table:

| T (°C) | U [mV] 4210W / 4211 | T (°C) | U [mV] 4210W / 4211 |
|---|---|---|---|
| 0 | +262 | 30 | +214 |
| 5 | +254 | 35 | +206 |
| 10 | +246 | 40 | +199 |
| 15 | +238 | 45 | +191 |
| 20 | +230 | 50 | +183 |
| 25 | +222 | | |

# 3 Storage

**During short measuring breaks**

Immerse the electrode in the reference electrolyte with the refilling opening open.

| electrode | Reference electrolyte | Model (see page 12) |
|---|---|---|
| 4210W / 4211 / 4220W | 3 mol/l KCl, $Ag^{+}$free | KCl-250 (250 ml) |

Prior to the next measurement, shortly rinse the electrode with the test sample or deionized water.

**Overnight or longer**

Insert the clean electrode into the watering cap filled with reference electrolyte and shut the refilling opening.

***NOTE***
**Do not store the electrode dry or in deionized water.**
**The electrode could be permanently damaged by this.**

- 4210W / 4211 / 4220W:
  During longer storing periods, salt sediments may develop on the watering cap. They do not affect the measuring characteristics and can easily be removed with deionized water when the electrode is put into operation again.
- 4210W / 4211:
  During longer storing periods, salt sediments may develop on the watering cap and on the refilling opening. They do not affect the measuring characteristics and can easily be removed with deionized water when the electrode is put into operation again.

# 4 Aging

ORP electrodes are consumables. Every ORP electrode undergoes a natural aging process. Extreme operating conditions can considerably shorten the lifetime of the electrode. These are:

- Strong acids or lyes, hydrofluoric acid, organic solvents, oils, fats, bromides, sulfides, iodides, proteins
- High temperatures
- High changes in pH and temperature.

The warranty does not cover failure caused by measuring conditions and mechanical damage.

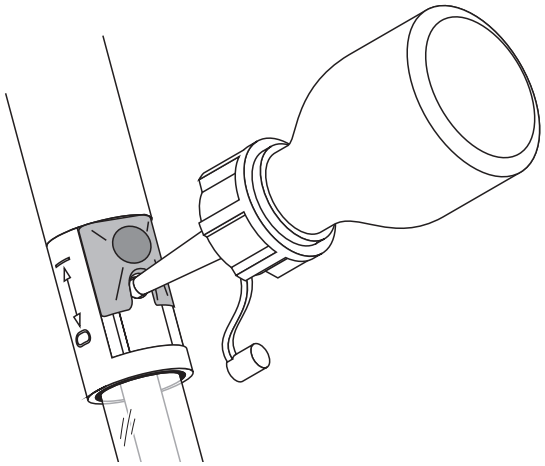
# 5 Maintenance and cleaning

During operation, a small amount of reference electrolyte leaks through the junction from the electrode into the test sample. If the level of reference electrolyte becomes too low with time, refill it through the refilling opening.

**Refilling the reference electrolyte (4210W / 4211)**

Refilling is very easy using a dropping bottle. Proceed as follows:

- Cut off the tip of the dropping bottle at a right angle until the opening in the tip can be seen
- Open the refilling opening of the electrode
- Press the tip of the dropping bottle into the refilling opening while turning it slightly
- Pump several small quantities of the reference electrolyte into the stem using the dropper bottle
- Pull the dropping bottle out of the refilling opening while turning it slightly as necessary.



**Cleaning**

Remove water-soluble contamination by rinsing with deionized water. Remove other contamination as follows:

| Contamination | Cleaning procedure |
|---|---|
| Fat and oil | Rinse with water containing household washing-up liquid |
| Lime and hydroxide deposits | Rinse with citric acid (10 % by weight) |

**After cleaning**

Rinse the electrode with deionized water.

# 6 Technical data

**Measurement and application characteristics**

| | |
|---|---|
| mV measuring range | - 1250.0 ... + 1250.0 |
| Allowed temperature range | ● 4210W / 4211: 0 ... 100 °C<br>● 4220W: 0 ... 60 °C |
| Typical application | ● 4210W / 4211: Laboratory<br>● Field4220W: Field / Depth measurement |

**Accuracy of the IDS measuring technique**

| Measured parameter | Accuracy (± 1 digit) |
|---|---|
| U [mV] | ± 0.2 |
| T [°C] | ± 0.1 |

**General data**

| | |
|---|---|
| Reference electrolyte | ● 4210W / 4211: 3 mol/l KCl, Ag+-free<br>● 4220W: Polymer |

| | | |
|---|---|---|
| | Junction | ● 4210W / 4211: Ceramic<br>● 4220W: Hole (2 x) |
| | Double junction | 4210W / 4211 |
| | Electrode material and shape | ● 4210W / 4211: Platinum / circle<br>● 4220W: Platinum ring |
| | Shunt conduction element | Ag/AgCl |
| | Temperature sensor | Integrated NTC 30 (30 kΩ at 25 °C / 77 °F) |
| | Response time $t_{99}$ of the temperature sensor | ● 4210W / 4211: < 30 s<br>● 4220W: < 130 s |
| | Allowed pH range of the measuring medium | ● 4210W / 4211: 0 ... 14<br>● 4220W: 4 ... 12 |
| **Connection cable** | Lengths | ● 4211: 1.5 m<br>● 42xxW: see section 7 WEAR PARTS AND ACCESSORIES |
| | Diameter | 4.3 mm |
| | Smallest allowed bend radius | Fixed installation: 20 mm<br>Flexible use: 60 mm |
| | Plug type | Socket, 4 Wpoles |
| **Shaft dimensions, material** | Shaft length | 120 mm |
| | Shaft diameter | 12 mm |
| | Shaft material | ● 4210W / 4211: Glass<br>● 4220W: Glass |
| **IDS plug** | Connection type | 4W-pin, watertight plug connection with locking device, reverse polarity protected |
| | Material | ● Plastic parts: Glass fiber reinforced Noryl, TPU, TPC-ET, POM, PVC, PEEK, PBT<br>● O-ring: FPM<br>● Contacts gold-plated |

**Storage** With watering cap; filled with KCl 3 mol/L, $Ag^+$ free

**Pressure range at temperature 4220W**

| Temperature | Allowed overpressure |
|---|---|
| 0 °C (32 °F) | 1000 kPa (10 bar) |
| 20 °C (68 °F) | 1000 kPa (10 bar) |
| 30 °C (86 °F) | 500 kPa (5 bar) |
| 40 °C (104 °F) | 300 kPa (3 bar) |
| 60 °C (140 °F) | 100 kPa (1 bar) |

The electrodes meet the requirements according to article 3(3) of the directive 97/23/EC ("pressure equipment directive").

# 7 Wear parts and accessories

**Maintenance equipment**

| Description | Model | Order no. |
|---|---|---|
| Reference electrolyte solution 250 ml to fill the watering cap (KCl 3 mol/l, $Ag^+$-free) | KCl-250 | 109 705Y |
| Zobell ORP buffer solution (125 ml) | 3682 | 061320Y |

**Connection cable 42xxW - meter**

| Description | Model | Order no. |
|---|---|---|
| IDS connection cable, 1.5 m | IDS-CABLE-1.5 | 903 850Y |
| IDS connection cable, 3 m | IDS-CABLE-3 | 903 851Y |

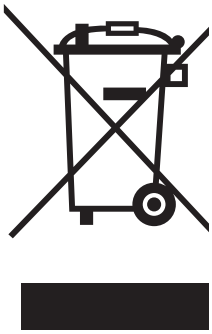
**Radio connection 42xxW - meter**

| Description | Model | Order no. |
|---|---|---|
| WA capable IDS meter + radio module for IDS meter | see Internet | |
| Radio module for plug head sensor | IDS WA-S | 108 141Y |

# 8 Disposal

Handle and dispose of all waste in compliance with local laws and regulations.

**EU only: Correct disposal of this product — WEEE Directive on waste electrical and electronic equipment**



This marking on the product, accessories or literature indicates that the product should not be disposed of with other waste at the end of its working life.

To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources.

Waste from electrical and electronic equipment can be returned to the producer or distributor.

# Contact Information

## *Ordering & Technical Support*

Telephone: (800) 897-4151
(937) 767-7241
Monday through Friday, 8:00 AM to 5:00 PM ET

Fax: (937) 767-1058

Email: info@ysi.com

Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387
USA

Internet: www.ysi.com

When placing an order please have the following information available:

- YSI account number (if available)
- Model number or brief description
- Quantity
- Name and Phone Number
- Billing and shipping address
- Purchase Order or Credit Card

## *Service Information*

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click ‘Support’ or contact YSI Technical Support directly at 800-897-4151.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for an YSI Service Center to accept the instrument for service. The Product Return form may be downloaded at www.ysi.com and clicking on the ‘Support‘ tab.

# Xylem |'zīləm|

1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

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

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