

Field Instrumentation

Sensors and analyzers for the
process control in the water treatment

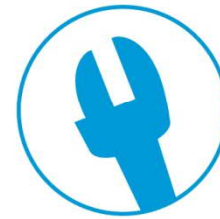
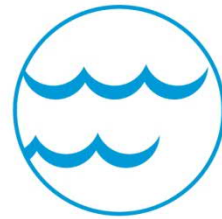
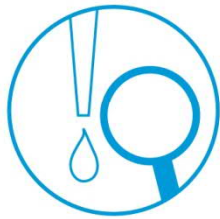
Aalto-university 22.5.2019

Pasi Puranen

HyXo Oy

HyXo Oy

HyXo Oy



RELIABLE PARTNER SINCE 1968

We care for Your process!



Company figures

| | |
|-------------|---------------------|
| Established | 1968 |
| Turnover | 17,0 milj. € (2018) |
| Budget | 18,4 milj. € (2019) |

Personnel 56

- Sales and marketing 28
- Aftersales and service 15
- Projects 7
- Administration 6

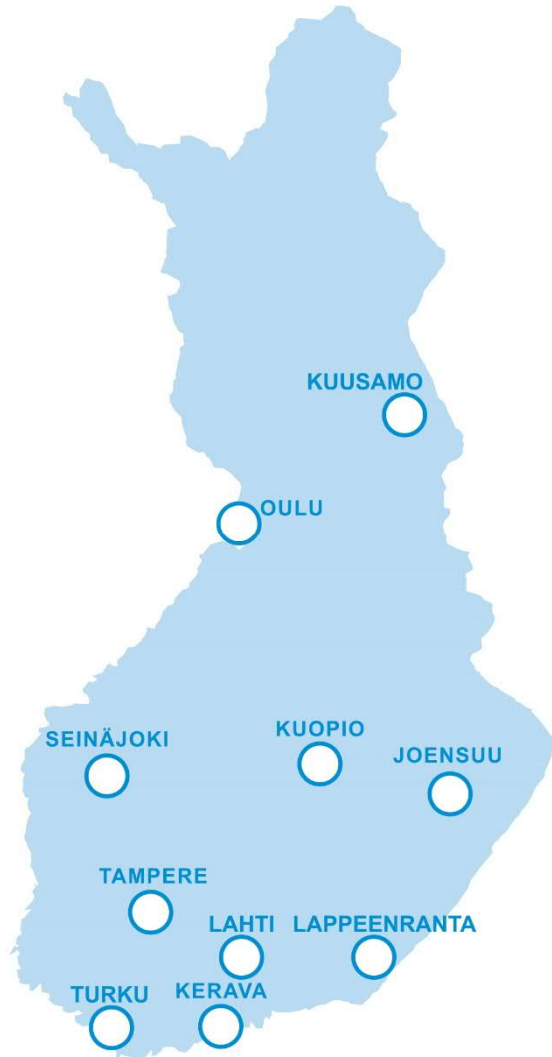
Offices in Finland

- Main office Kerava
- Regional offices Lahti, Joensuu, Seinäjoki, Oulu, Tampere, Kuopio and Kuusamo

ISO9001 certified



HyXo in Finland



KERAVAL Head office

LAHTI South Finland

SEINÄJOKI West Finland

KUOPIO/JOENSUU East Finland

TAMPERE South West Finland

OULU North Finland

Supporting offices:

Kuusamo, Lappeenranta, Turku



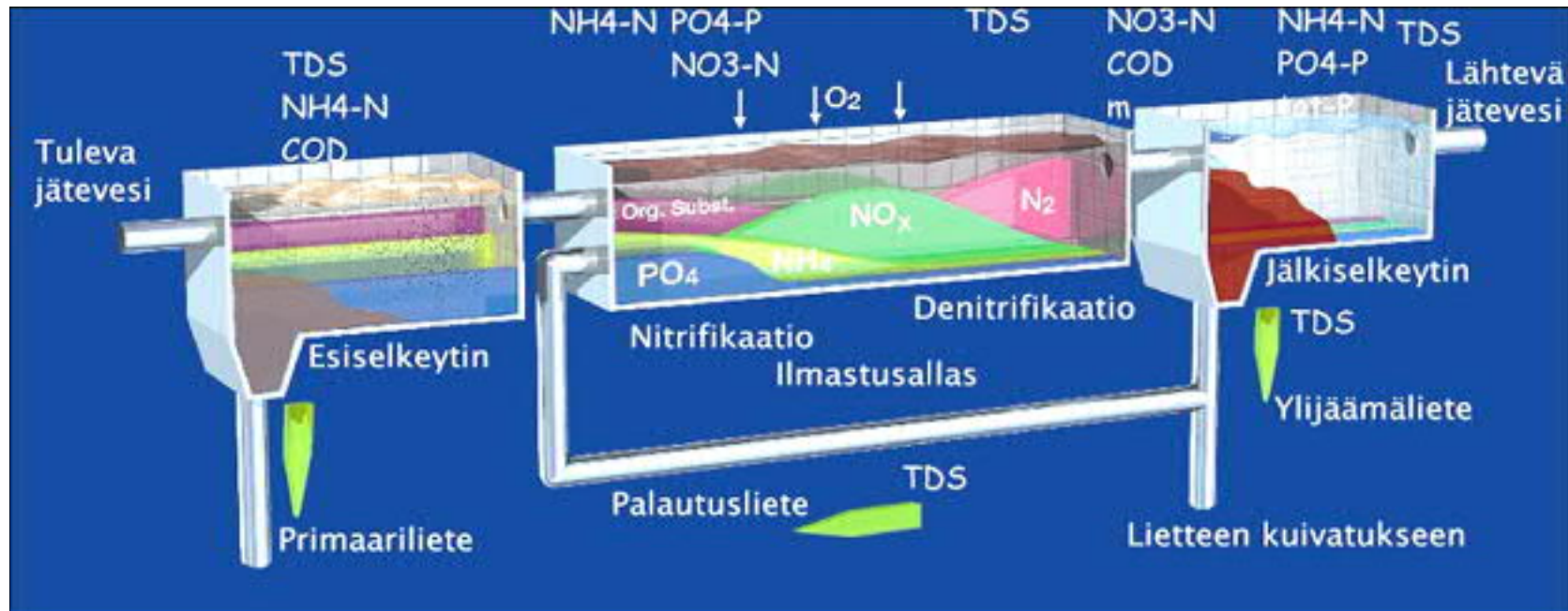
Operation ranges

- **Instrumentation**
 - Process measurements
- **Laboratory products**
 - Laboratory measurements and equipment
 - Food & Bev measurements
- **Pumps & Dosing**
 - Dosing pumps and systems
 - Powder and liquid chemicals
 - Pumps
- **Water treatment & Filtration**
 - Particle removal
 - Different inorganic salt removal solutions
- **After-Sales Support**
 - Service agreements, local service etc.



Process measurements

- pH- and redox
- DO (dissolved oxygen)
- Suspended solids and turbidity
- Sludge level
- Samplers
- Process analyzers
 - Ammonia
 - Nitrate
 - Phosphorous (P_{tot} and PO₄-P)
 - TOC
 - Organic matter (for ex. Potassium permanganate)





pH definition

pH law:

- $\text{pH} = -\log a_{\text{H}^+}$
 a_{H^+} is hydrogen ion activity means
pH is opposite of the denary logarithm's
activity



Common pH-values

- Coca-Cola 2,5
- Vinegar 2,9
- Orange Juice 3,5
- Beer 4,5
- Coffee 4–5
- Tea 5,5
- Milk 6,5
- Water 7–8
- Hand Soap 9–10
- Washing Powder 12,5



Measurement of pH

- pH-sensor is based on electrochemistry and measures hydrogen ions activity in the solution.
- pH- transmitter is a voltage transmitter, which changes measured cell potential to pH-value.
- Based on change in cell potential - means according to $59,16 \text{ mV:n}$ ($25 \text{ }^\circ\text{C}$) is 1 pH value.

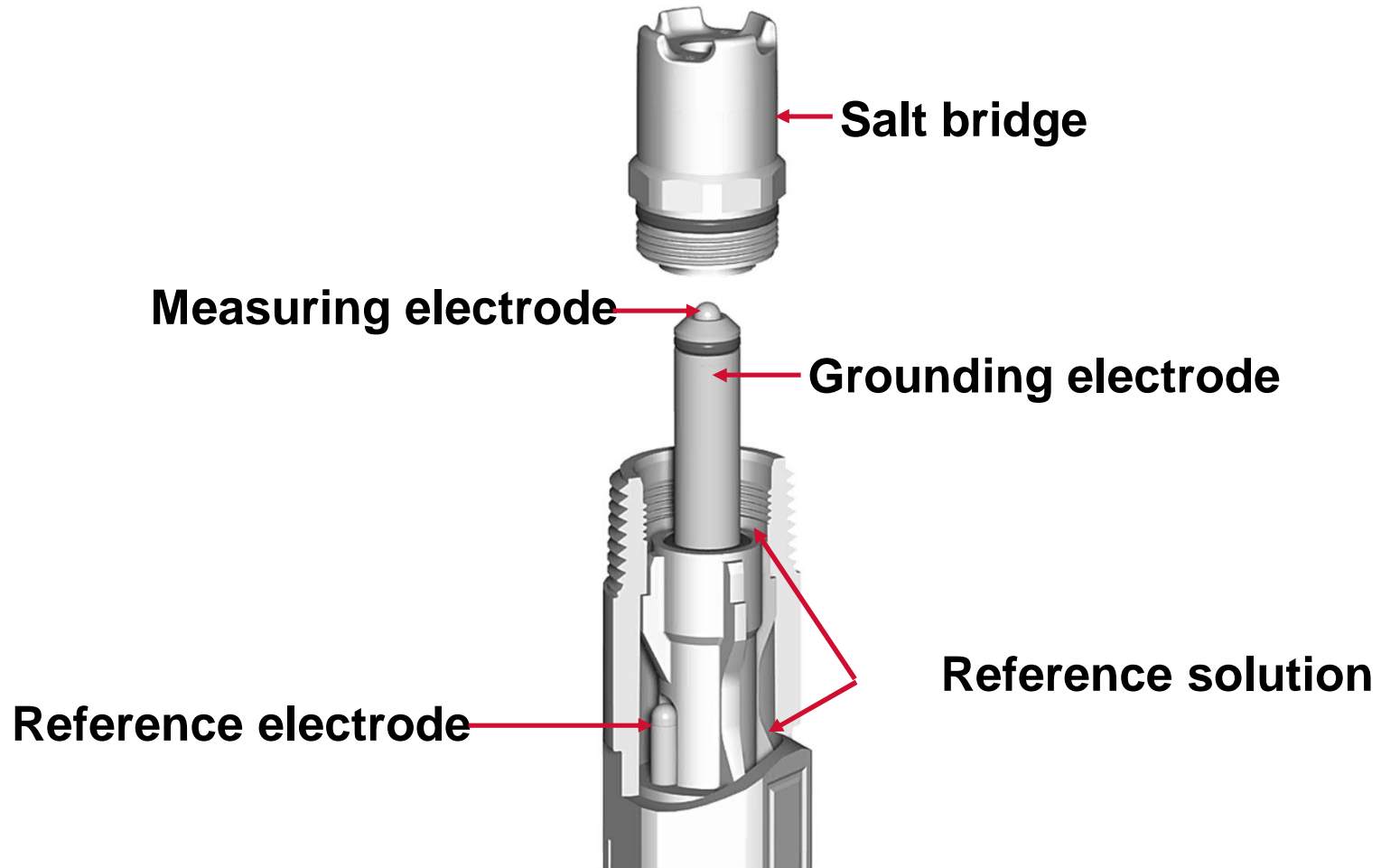
Hyx Oy pH-electrodes

- Glass electrode (most common)
Based on measure electrode and reference electrode.
- Differential electrode
Includes 2 pcs measuring electrodes and metall electrode as a reference electrode. This type of electrode is highly suitable for process water and waste water.
- There are also some special electrodes in the market like ceramic electrode. This model is suitable for the food industry.



Differential electrode

pHD-sensor





Sensor calibration

Glass electrode

- High sensitivity: +/- 0,1 pH – once a week
- For ex. Drinking water application
 - Other applications: 2 times per month



Combined electrode (plastic body),

- Includes the PT100-temperature sensor
- Suitable for the process water



pHD-differential electrode

- Calibration once a month
- **(change the salt brige once a year)**
- Suitable for the waste water and process water



Differential pH-electrodes



- 1" body PEEK®- tai Ryton®- material
- Long life time
- Suitable for the process water and waste water. Not for the drinking water
- Also for the high temperature

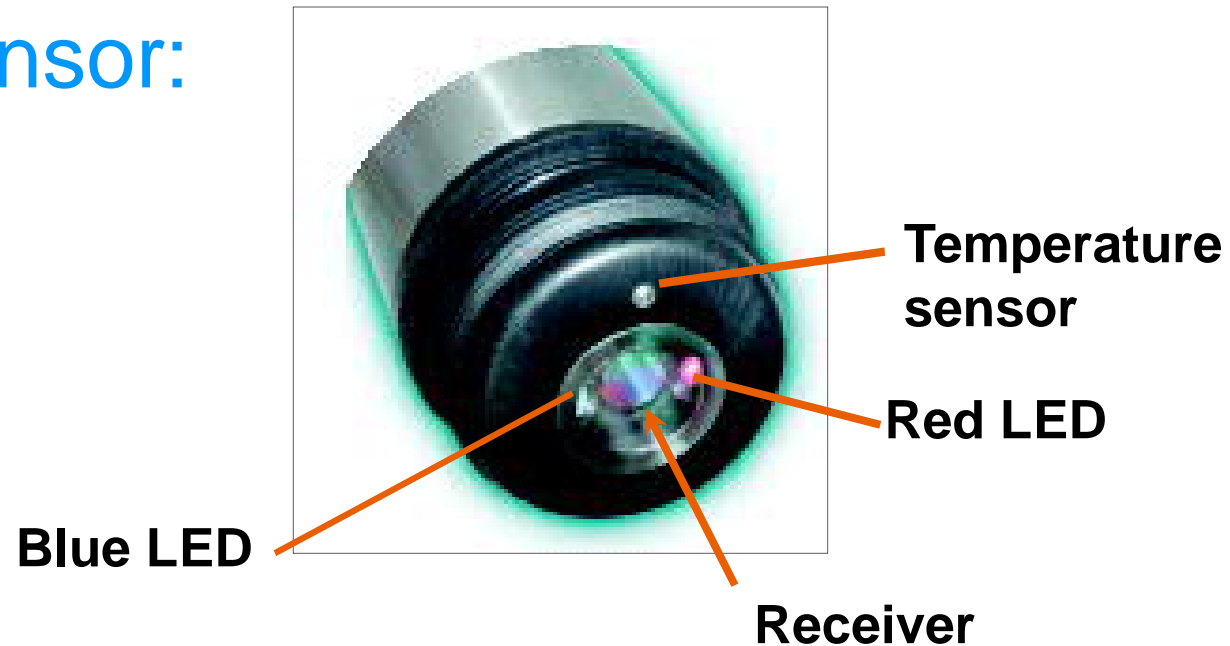


DO measurement

- Application in aeration basin typically
- Nowadays photometric measurement
- Includes always temperature measurement
- One of the most important measurements in the waste water plant.
- With the accurate principle saves energy a lot.

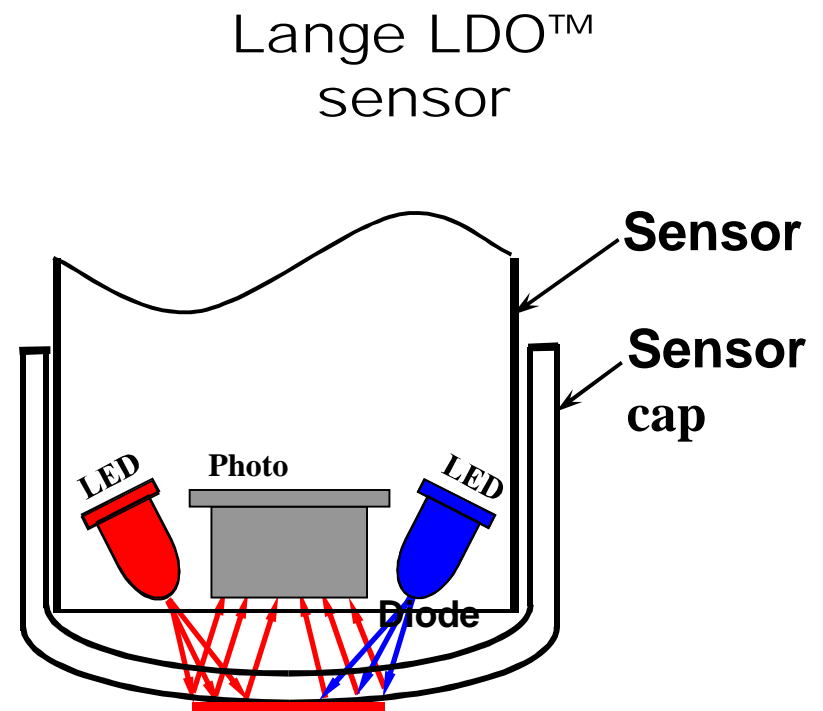
Luminescence (optic) measurement

- LDO™ sensor:



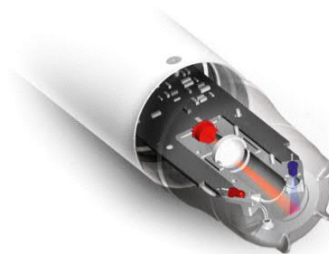
Luminescence (optical) measurement

- Based on time measuring
- First send blue light to luminescence layer and that will reflect red light detector
- Additional red LED is working as a reference beam



Dissolved Oxygen HACH Lange LDO sc

- Latest version
- The first version came year 2004
- Better accuracy and easier to install

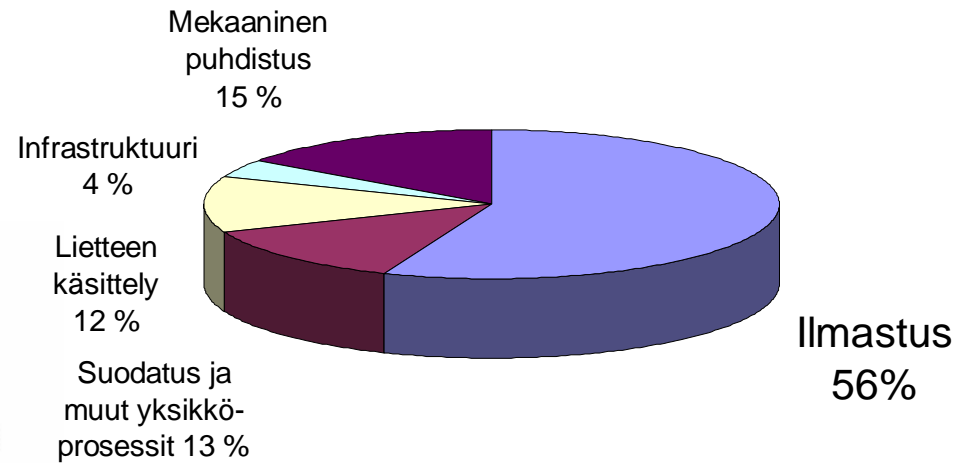
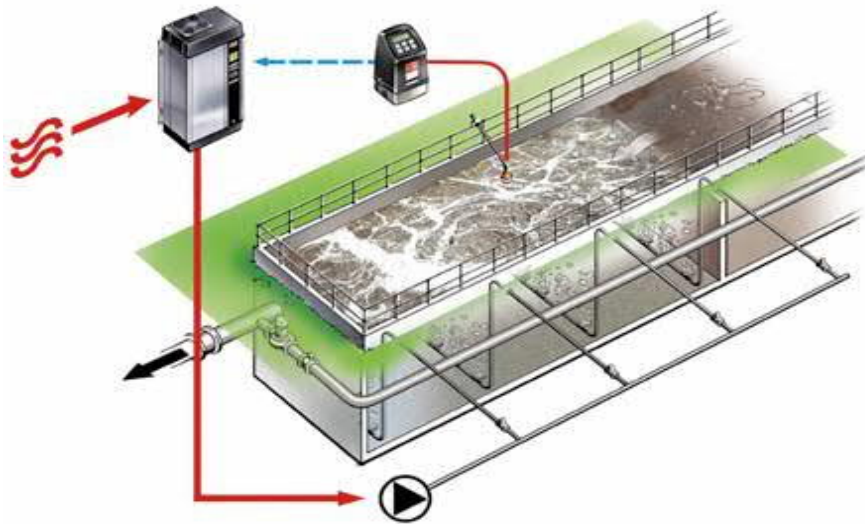


LDO sc probe: Technical data



- ▶ Oxygen measurement range:
0–20 mg/L
- ▶ Oxygen measurement accuracy:
0–5 mg/L ± 0.1
5–20 mg/L ± 0.2
- ▶ Temperature measurement range:
0–50 °C
- ▶ Warranty:
Probe: 3 years
Sensor cap: 2 years

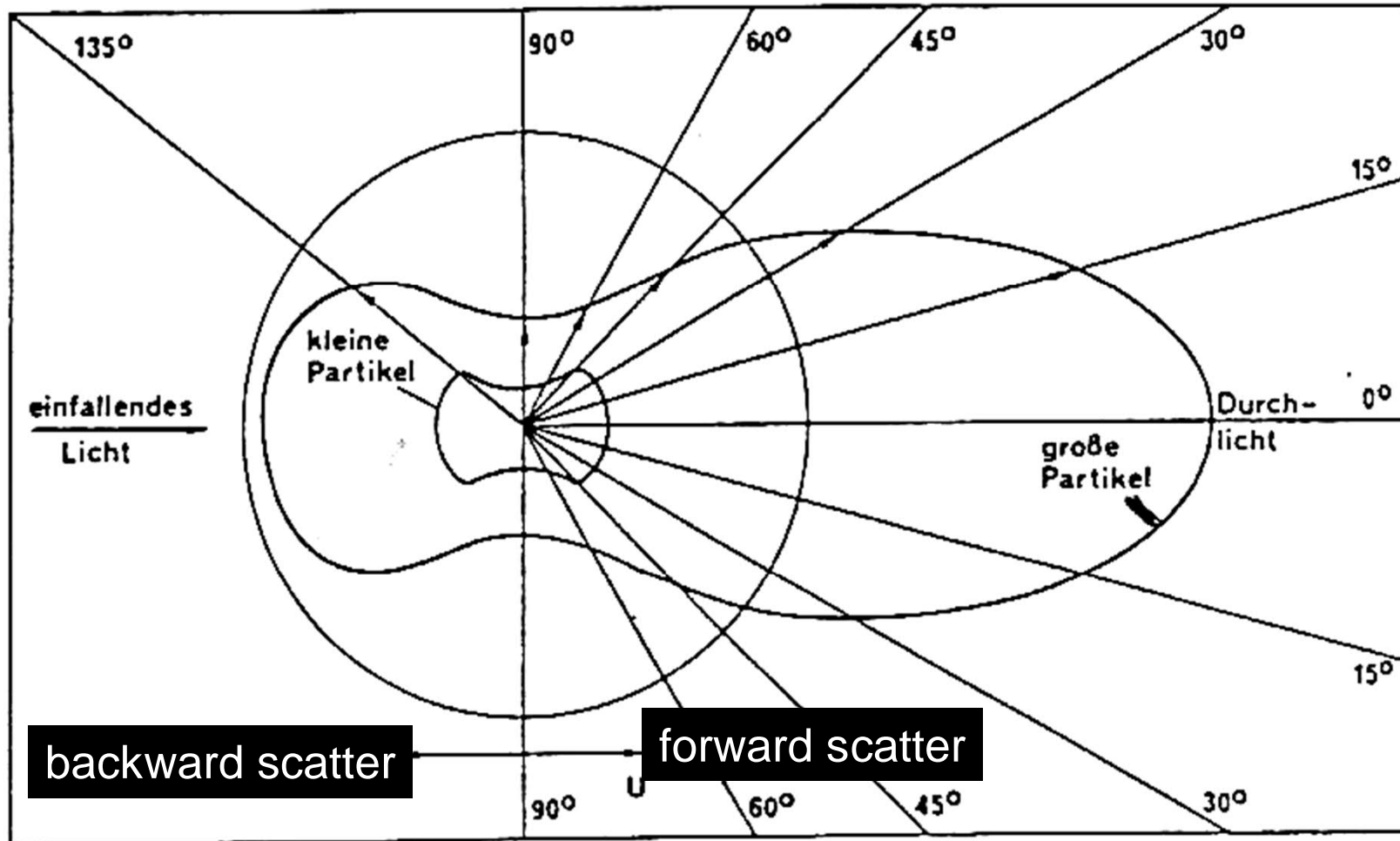
- To follow the licence by the authorities
- Process operation → reduce the costs

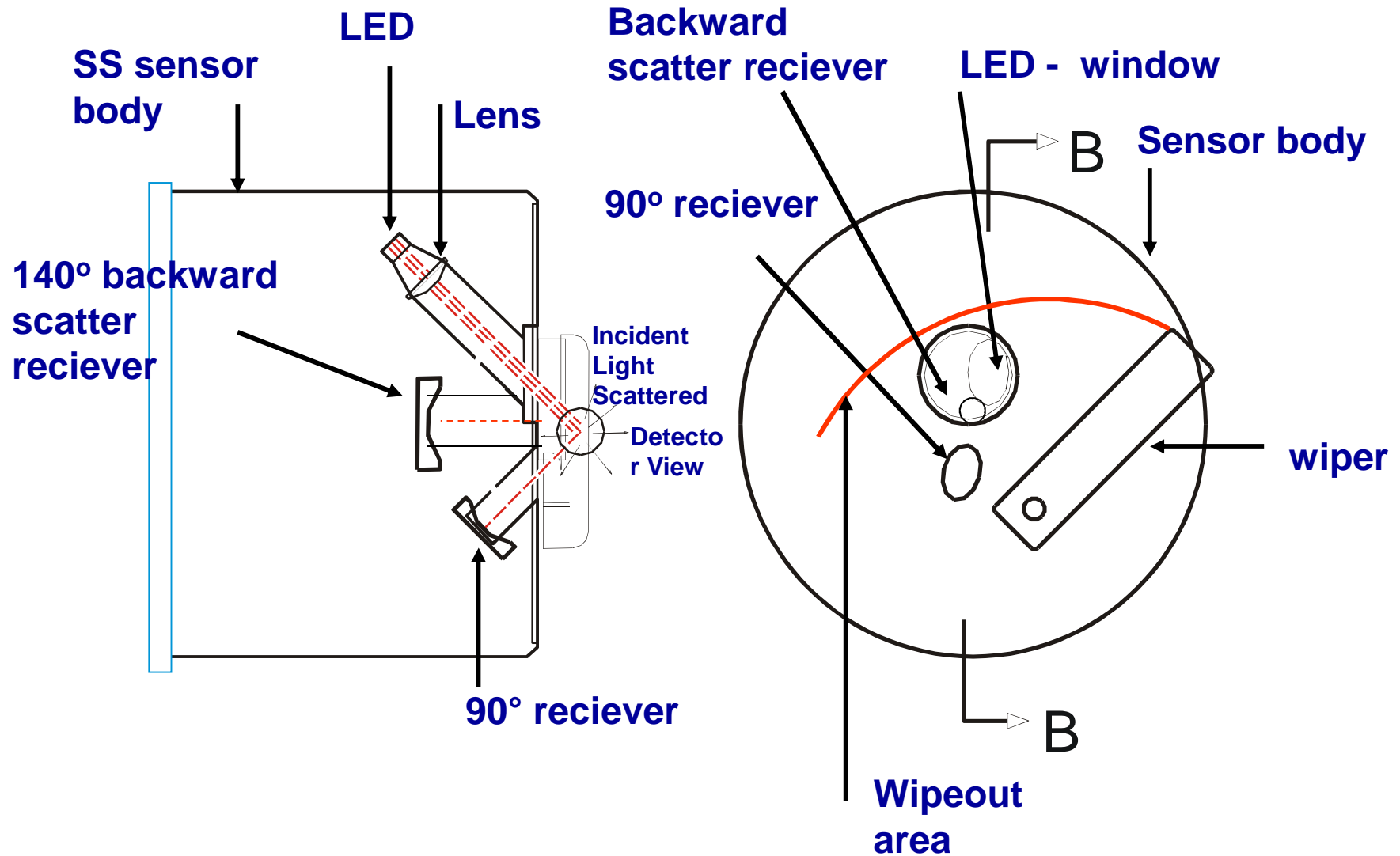


With accurate optimisation of the aeration you can save energy a lot and the money also

Hyxco Oy Turbidity and Suspended solids

- Measuring principle: Photometric, IR-light reflection
- Measuring ranges: 0–150 g/l or 0–4000 NTU(turbidity)
- With automatic cleaning system
- Measurement from the basin or from the pipe-line
- Equipped with the colour compensation of the sludge







- Sensor model: Hach Lange SOLITAX (made by SS)
- Measuring principle: IR-light scatterig (DIN EN 27027)

HACH Lange Solitax sc

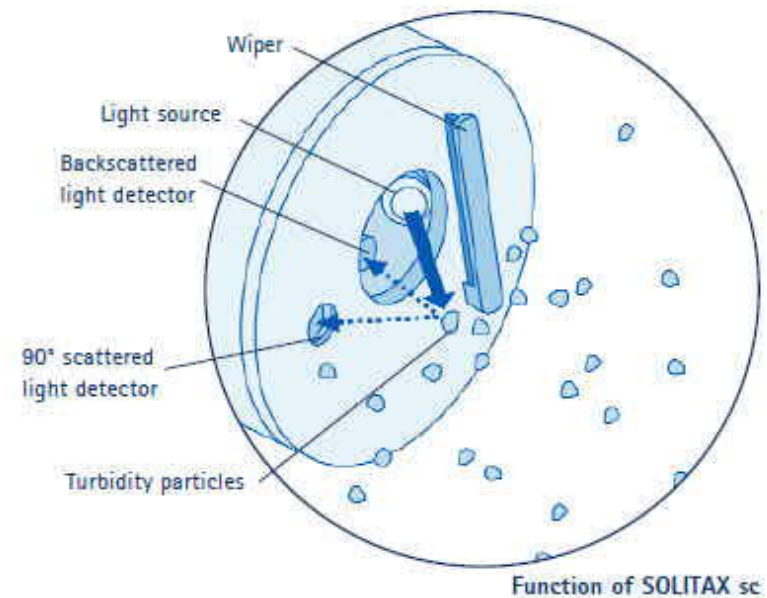
- Pipeline version



The SOLITAX so principle

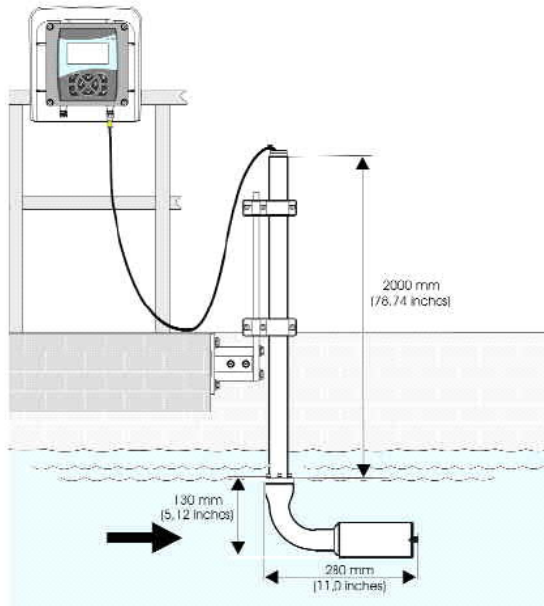
Unique colour-independent measurement of solids

Primary and active sludges with different structures and colours, dark digested sludges and light lime sludges make the highest demands on the precise measurement of solids. Only SOLITAX sc solids probes with the patented dual scattered light method can satisfy these demands. The key principle: Parallel evaluation of different scattered light signals.

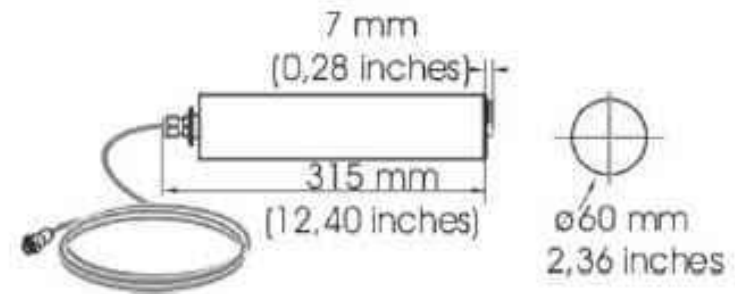




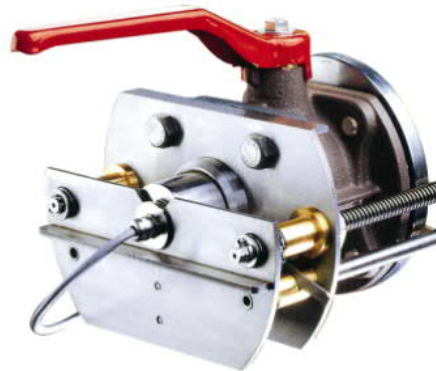
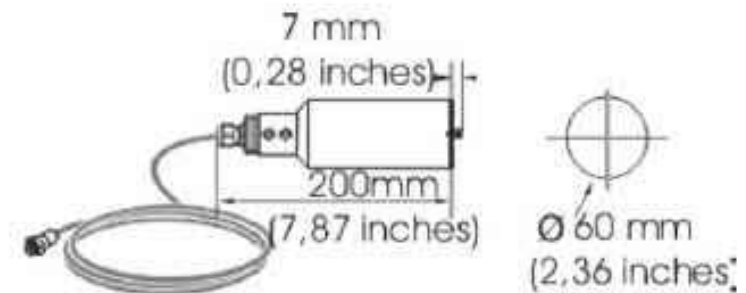
Turbidity & SS – Solitax sc



SOLITAX sc insertion probe



SOLITAX sc immersion probe





Sludge level measurement

- Measuring principle: ultrasonic
- Range: 0–12 m
- Profile in the display, shows sludge level behaviour
- Equipped also with the cleaning system
- Installation normally in the primary clarifier or secondary clarifier to control the pumping period and to follow sludge level

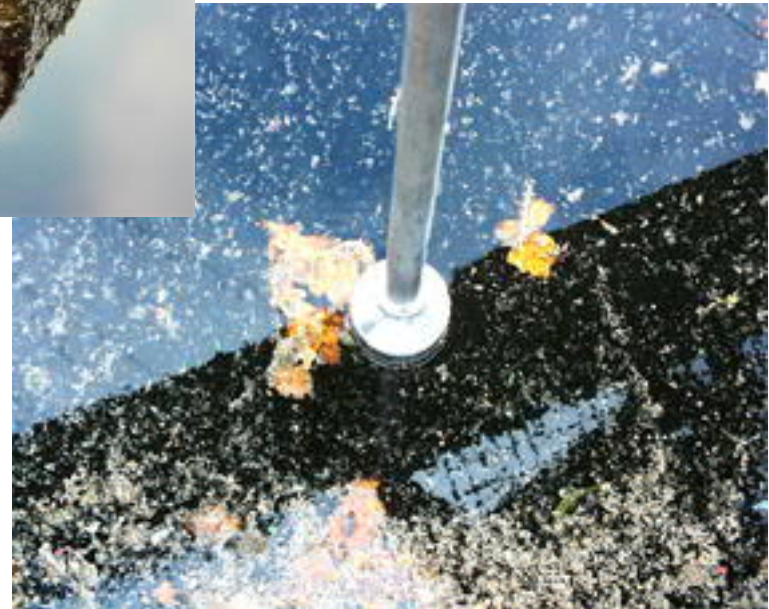
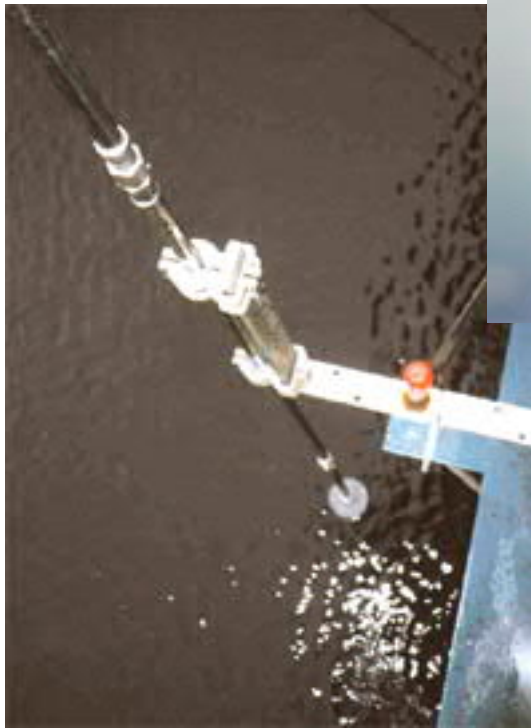
HyXo Oy Sludge level sensor Sonatax SC



- Ultrasonic measuring
- Range: 0,2–12,0 m
- Connect to SC1000-controller

HyXo Oy

SONATAX SC



HyXo Oy

SC – controllers



Hach Lange

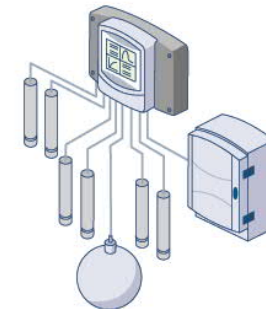
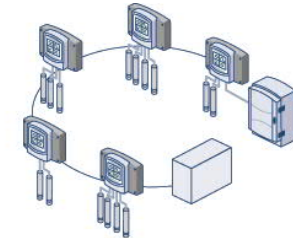
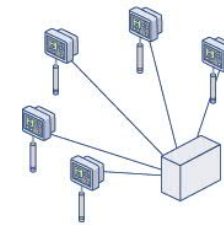
SC200 & SC1000

- Connect all digital sc-sensors
by Hach Lange



Hach Lange SC 1000

- Multichannel unit, can connect up to 8 sensors to one unit
- You can build measuring networks
- Save the costs
- Outputs
 - 0/4...20 mA
 - Relays
 - Modbus, ProfibusDP



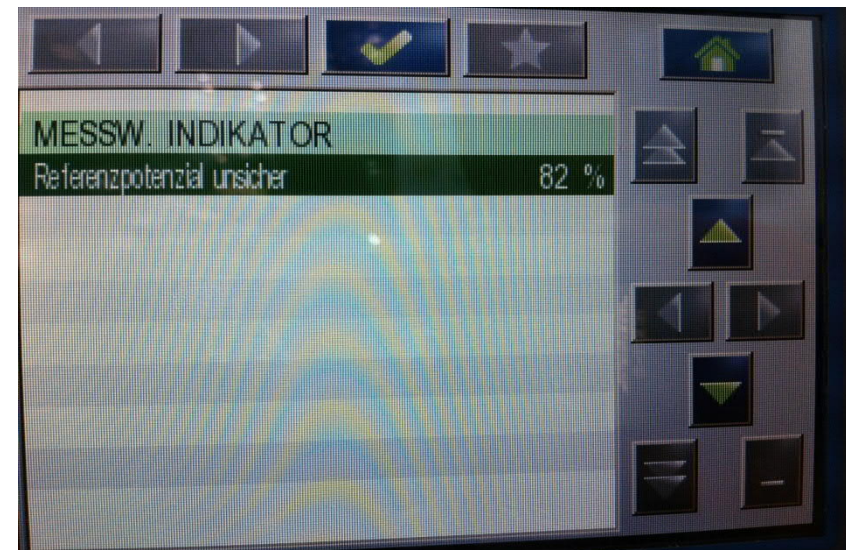
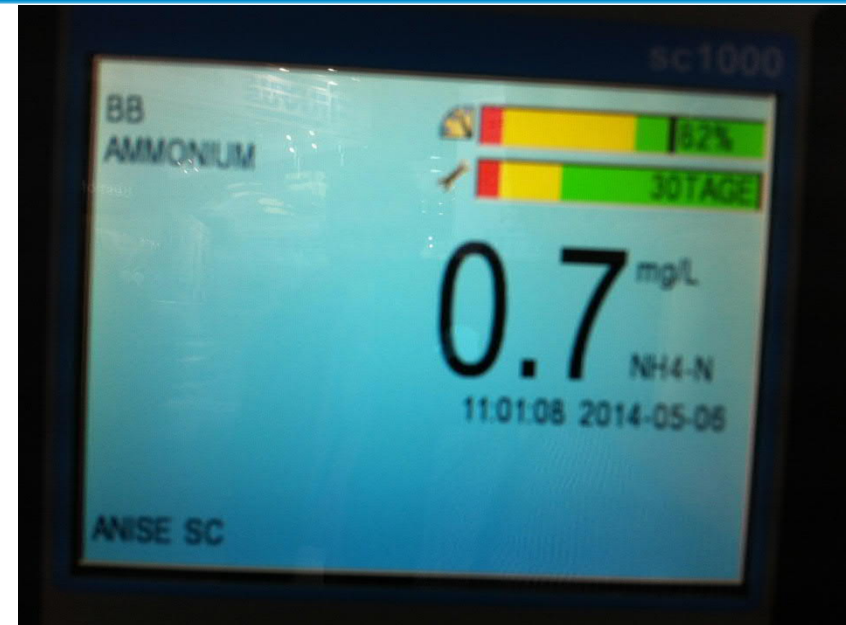
HyXo Oy Hach Lange SC 200 -controller

- 1 or 2 – channel version
- Outputs
 - 2x 0/4...20 mA,
 - 4 x relays
 - Modbus, ProfibusPD
- SD memory card possibility to collect the data



Hach-Lange SC 1000 Prognosis

- Sensor control system
- Tells the need of calibration and maintenance

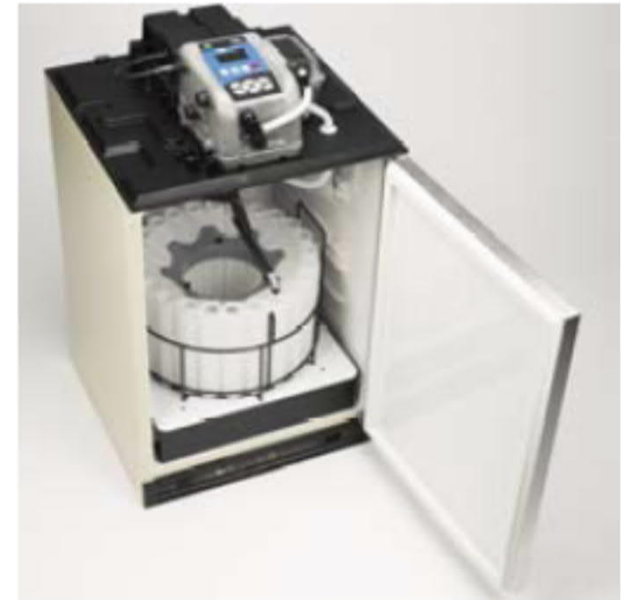


- Fixed samplers
- Portable samplers
- 1 bottle or multi bottle samplers
- Equipped with fridge
- Targetted wwtp sample to lab analysis



Sampler with fridge

- Working principle: peristaltic pump
- Temperature of the sample: 4 °C
- Can be installed from 1 bottle (20l) up to 24 bottle system



MJK 780

- Working principle :
→vacuum compressor
- Very easy to use
- Only for the wwtp – not for the industrial applications





- Sample preparation
- Ammonia
- Nitrate
- Phosphorous: P_{tot} and PO₄-P
- Organic matters
- TOC

- Fast reacting of process variations
 - For ex. : Process control 24/7





Sample preparation by FILTRAX[®] membrane filtration



- Controlled by analyzer
- Automatic air cleaning
- Installation: basin or flow through basin



HyXo Oy FILTRAX[®] -installation



- Module body by SS
- 2 pcs filter elements



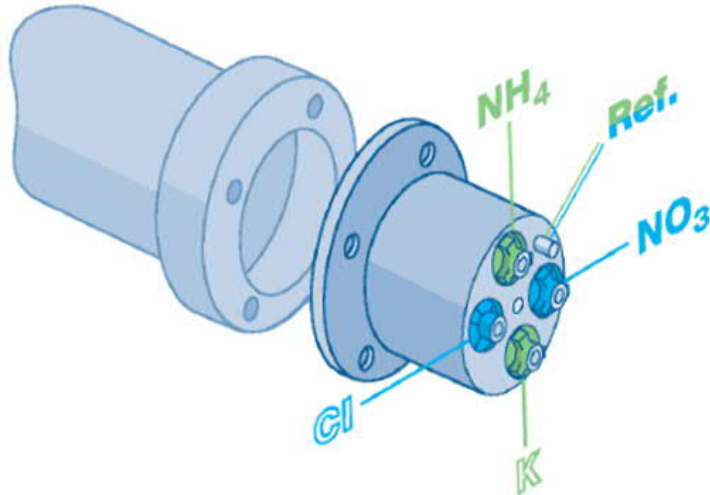
- Measuring principle: photometric or ion-selective sensor
- Normally demands pre-filtration before measurement
- Mainly used in the aeration basin and in the outlet water

AMTAX[®] *sc*

- Measurement with gas sensitive electrode (GSE)
- Measuring range:
0.05-20.0-1 000 mg/l NH₄-N
- Automatic calibration and cleaning

AMTAX[®] *inter 2*

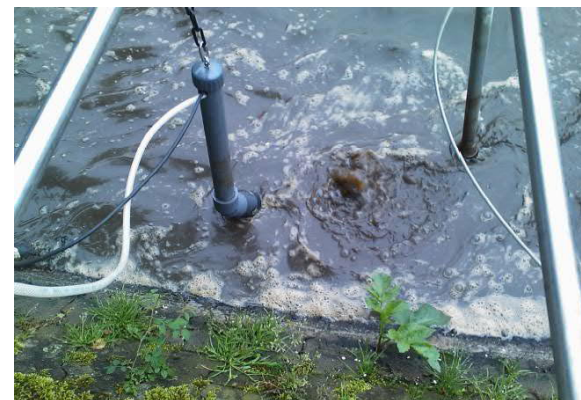
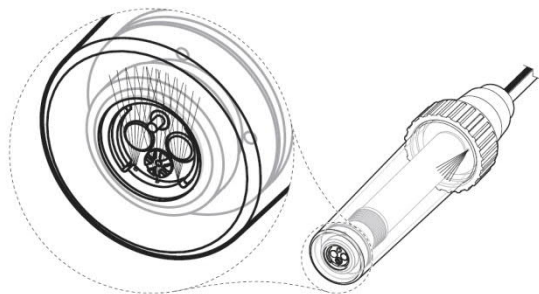
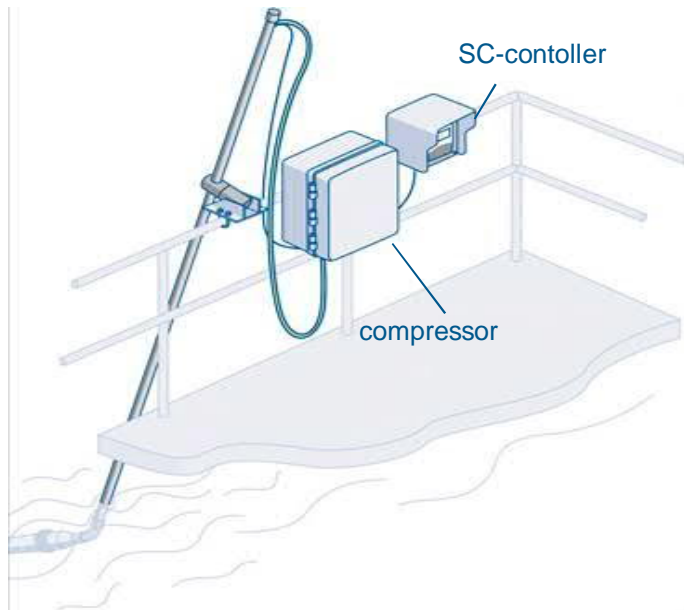
- Measuring principle: Indofenolblue-method according to DIN 38406 E5)
- Measuring range:
0.02-20.0-80 mg/l NH₄-N
- Automatic calibration and cleaning



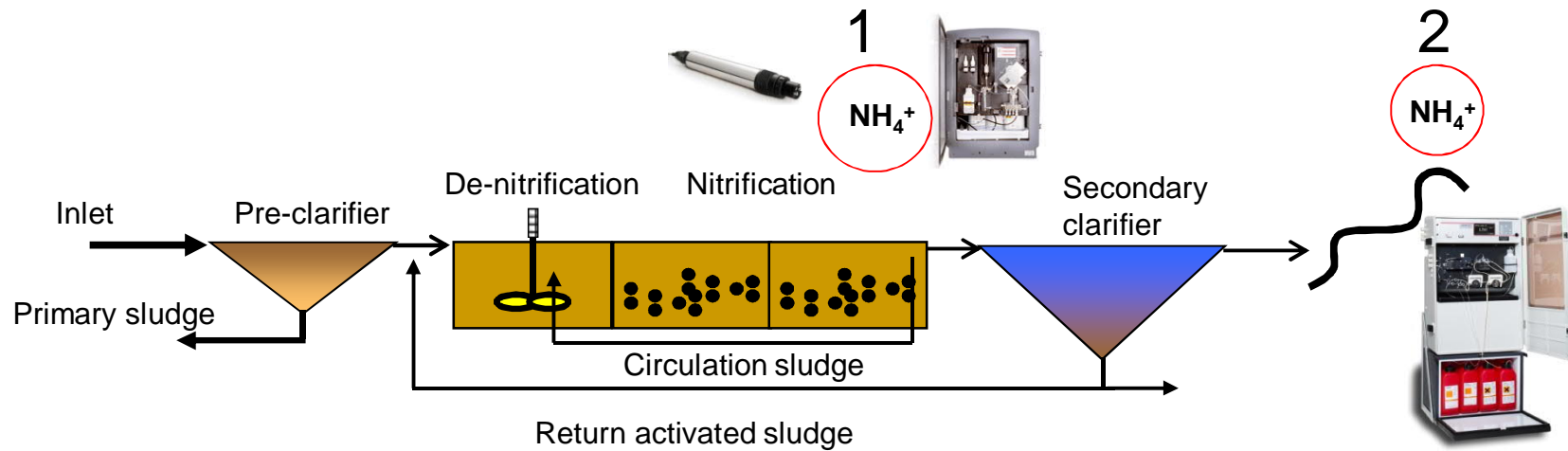
- Ion-selective electrode for **AMMONIA** and **NITRATE** in the same electrode
-
- Low cost version
- No reagents
- K^+ and Cl^- compensation
- Measuring range: 0...1000 mg/l



ISE elektrode - automatic cleaning system



Right analyzer in the right place



1: AMTAX[®] *sc* / NH_4D - *sc* / AN-ISE

2: AMTAX[®] *inter* 2

- Measuring principle:
ion-selective sensor or UV-light
- Measuring range: 0,1–1000 mg/l
- Mainly used in the process control in
the aeration basin and outlet water

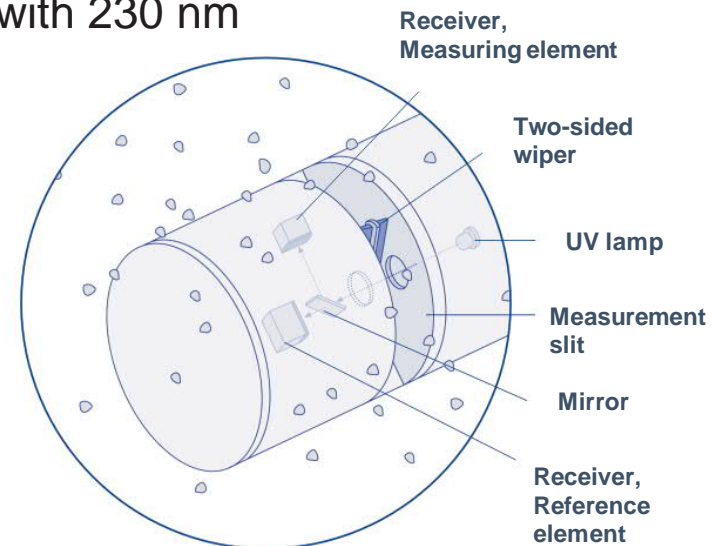
The NITRATAX sc principle

- ➔ Nitrate dissolved in water absorbs UV light.
- ➔ Measuring with 210 nm, reference beam with 230 nm
- ➔ Photometric determination of the nitrate concentration directly in the fluid:

- **without reagents,**
- **without sampling,**
- **without delay.**

- ➔ NITRATAX sc probes are characterised by:

- **low-maintenance operation**
- **automatic turbidity compensation.**



Measuring technologies for NO₃-N

NITRATAX Family



- **Easy handling**
 - Pure physical measurement
 - No reagents
 - Wiper cleaning
- **No calibration**
- **Low cost of operation**
- **Reliable technology**
 - UV-Absorbance method
- **Application adapted technology**
 - NITRATAXplus
 - NITRATAXeco
 - NITRATAXclear



Nitratax sc

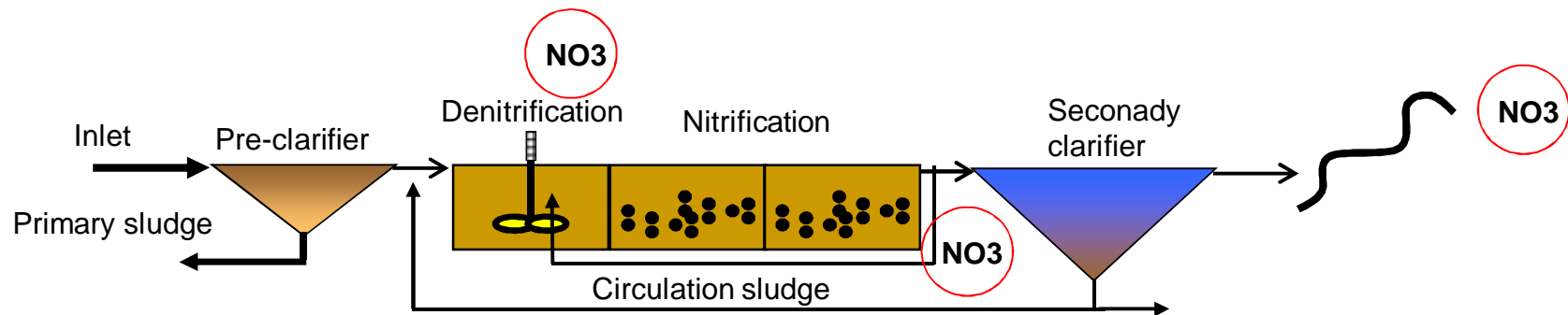
- UV - light based NO₃-measuring



- Precise measurement
 - UV-Absorbance
- Easy to use
 - No reagents
 - Automatic cleaning by wiper
 - **No need to calibrate**

| | NITRATAX plus sc | NITRATAX eco sc | NITRATAX clear sc |
|---------------------|------------------------------|-----------------------------|-----------------------------|
| Tekniset tiedot | | | |
| Valotien pituus: | 1 mm, 2 mm, 5 mm | 1mm | 5mm |
| Havaitsemisraja | 0,1 mg/l | 1 mg/l | 0,5 mg/l |
| Mittauksen max arvo | 100, 50, 20 mg/l | 20 mg/l | 20 mg/l |
| Tarkkuus | +/- 3% lukemasta +/-0,5 mg/l | +/-5% lukemasta +/-0,5 mg/l | +/-5% lukemasta +/-0,5 mg/l |
| Resoluutio | 0,1 mg/l | 0,5 mg/l | 0,1 mg/l |
| Lietekompensointi | Kyllä | Kyllä | Ei |
| Integrointiaika | >1 min, säädettävä | 15-30 min, säädettävä | >5 min, säädettävä |
| Min. mittausväli | 1 min | 5 min | 5 min |
| Vasteaika (t100) | 1 min | 15 min | 1min |

- Denitrification process optimisation
- Denitrification process - dosing of methanol
- Outlet water



HxXo Oy Phosphorous measurement

- Measuring principle: vanadate-molybdate ($\text{PO}_4\text{-P}$) and molybden blue method, both are photometric measurements
- Needs sample preparation first before analysing
- Applications for ex. Dosing of ferrosulphate and controlling the water quality of the outlet water



Phosphax sc -ortophosphate-analyzer

- Measuring principle: vanadate-molybdate-principle (photometric)
- Measuring range: 0.05–15–50 mg/l $\text{PO}_4\text{-P}$
- Automatic calibration and cleaning
- Sample preparation by Filtrax





Total P - analyzer PHOSPHAX *sigma*



- PHOSPHAX *sigma*: 0,01–5 mg/l
- Measuring principle: according to DIN 38405 D11, molybden blue
- Sample preparation: Sigmatax 2
- Measures also PO₄-P
- Automatic calibration and cleaning
- Installation: only for the outlet water



- Automatic sample preparation for Phosphax Sigma by ultrasonic termic. This is not filtration method.

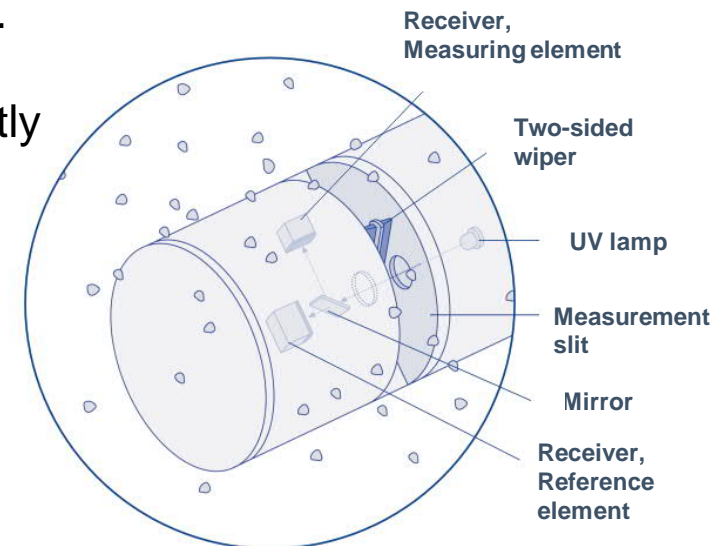


- Patented measurement (TSAO = Two Stage Advanced Oxidation)
 - Analyzer is targeted to difficult applications, like waste water in dairy business, Paper&Pulp process, food industry, municipal waste water(methanol dosing)
 - Do affect by salt & calcium
- Measured parameters
 - Directly: TOC, TIC, TC, VOC
 - By correlation: COD, BOD
- Can be connected up 6 sample streams(multi channel)



The UVAS plus sc principle

- The spectral absorption coefficient at 254 nm serves as a measure of the organic material.
- Photometric determination of SAC 254 directly in the fluid:
 - **without reagents,**
 - **without sampling,**
 - **without delay.**
- The UVAS sc probe is characterised by:
 - **low-maintenance operation**
 - **automatic turbidity compensation.**

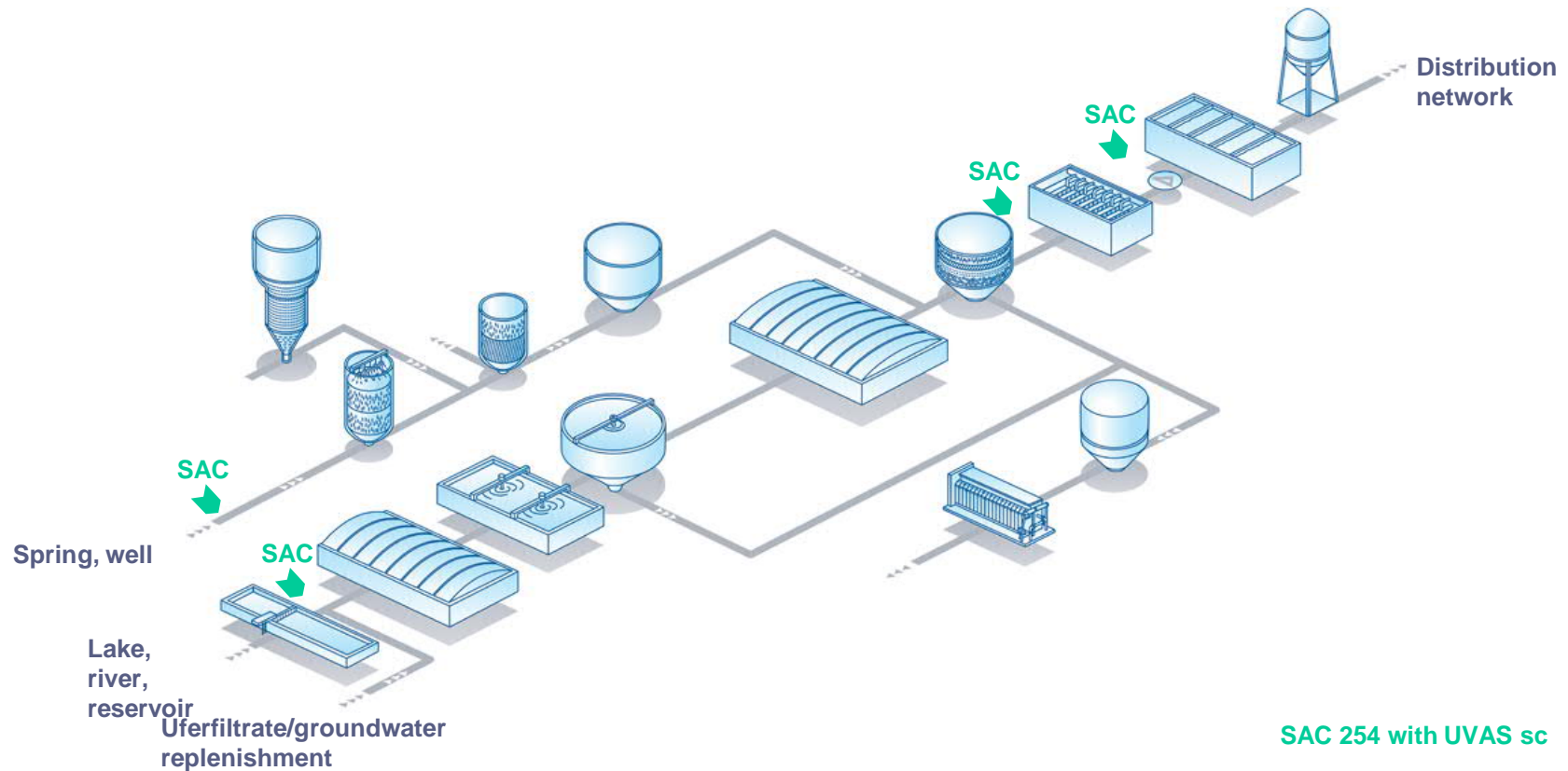


UVAS plus sc : fast results, low costs

- No sampling or sample preparation
- No delays in obtaining measurement results
- No reagents needed
- Self-cleaning probe
- As an immersion probe or in a bypass



UVAS plus sc: Drinking water applications



SAC 254 with UVAS sc



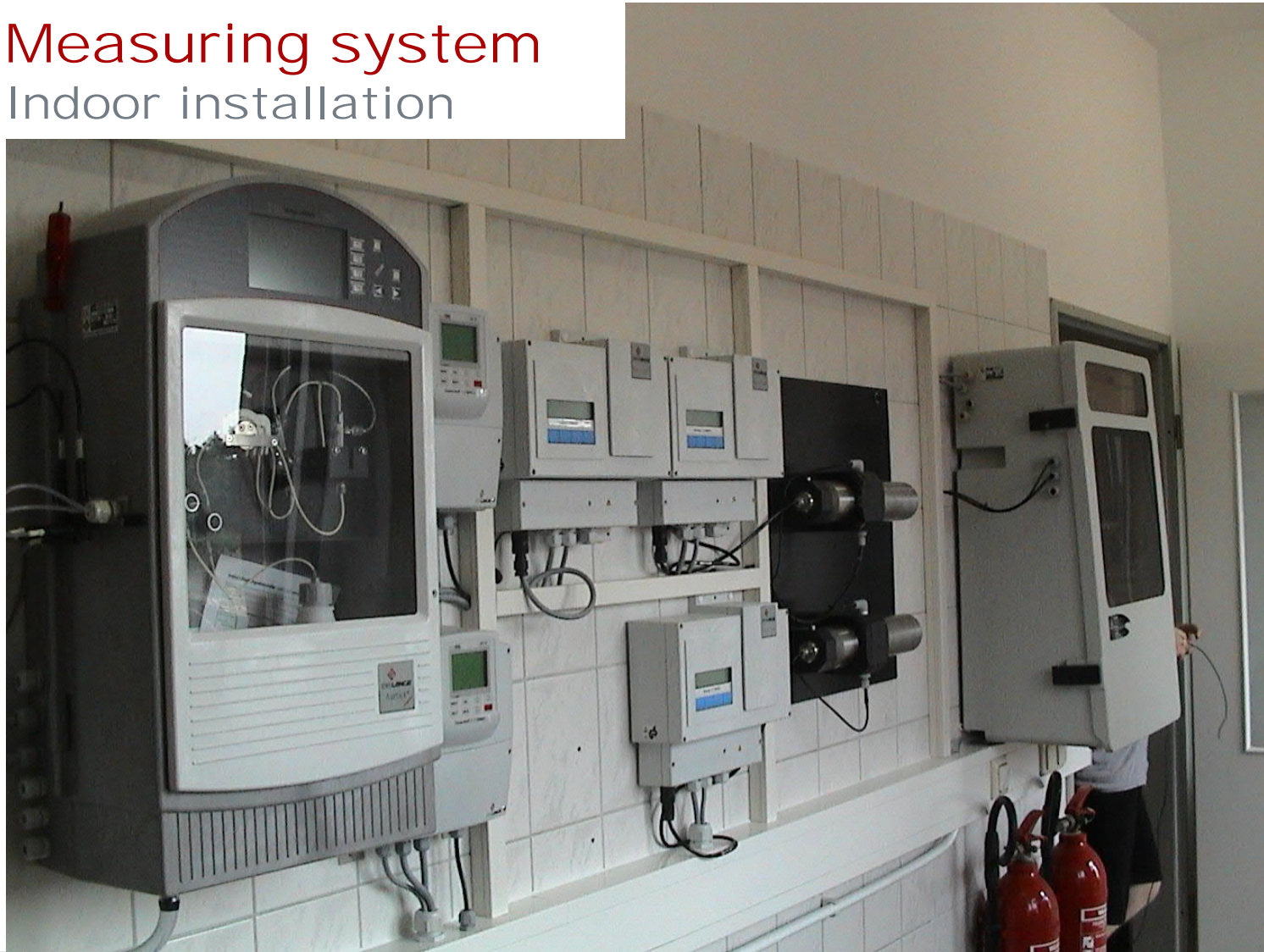
UNITED FOR WATER QUALITY

- **Generally:**
- Before comparing the results confirm that the sensor is clean and in the good shape.
- Take the sample beside of the sensor.
- **After that take the sample directly to lab.**
- Otherwise you will get totally wrong results and you will be unsure to whom to trust.
- Please follow the manufacture´s instruction.

Measuring system Outdoor installation



Measuring system Indoor installation





- Total P analyzer of Hach Lange Phosphax Sigma



Wwtp of the city of Porvoo



EZ Series

On-line Measurement of Fluoride, Sulphate, Sulphide, Ammonia and Chloride in Municipal and Industrial Waste Water Applications



Customer edit

- EZ Series: on-line analysis made easy
- Introducing the EZ 1000 - 3000 - 3500 - 4000 Series
- Analysis of fluoride, sulphate, sulphide, ammonia, chloride:
Relevance – Wet part – Hydraulics – Analytical specs
- Selection guide
- Service offerings
- Additional information section



| | EZ 1000 Colorimetry | EZ 3000 Direct ISE | EZ 3500 Standard addition ISE | EZ 4000 Titration |
|----------|------------------------|-----------------------|----------------------------------|----------------------|
| Fluoride | - | ✓ | ✓ | - |
| Sulphate | ✓ | - | - | ✓ |
| Ammonia | ✓ | ✓ | ✓ | ✓ |
| Chloride | ✓ | ✓ | ✓ | ✓ |
| Sulphide | ✓ | ✓ | ✓ | ✓ |

HyXo Oy

On-line Measurement of
Manganese, Aluminium,
Phosphate, Iron, Hardness
and Alkalinity in Drinking
water, Power and Waste
Water Markets

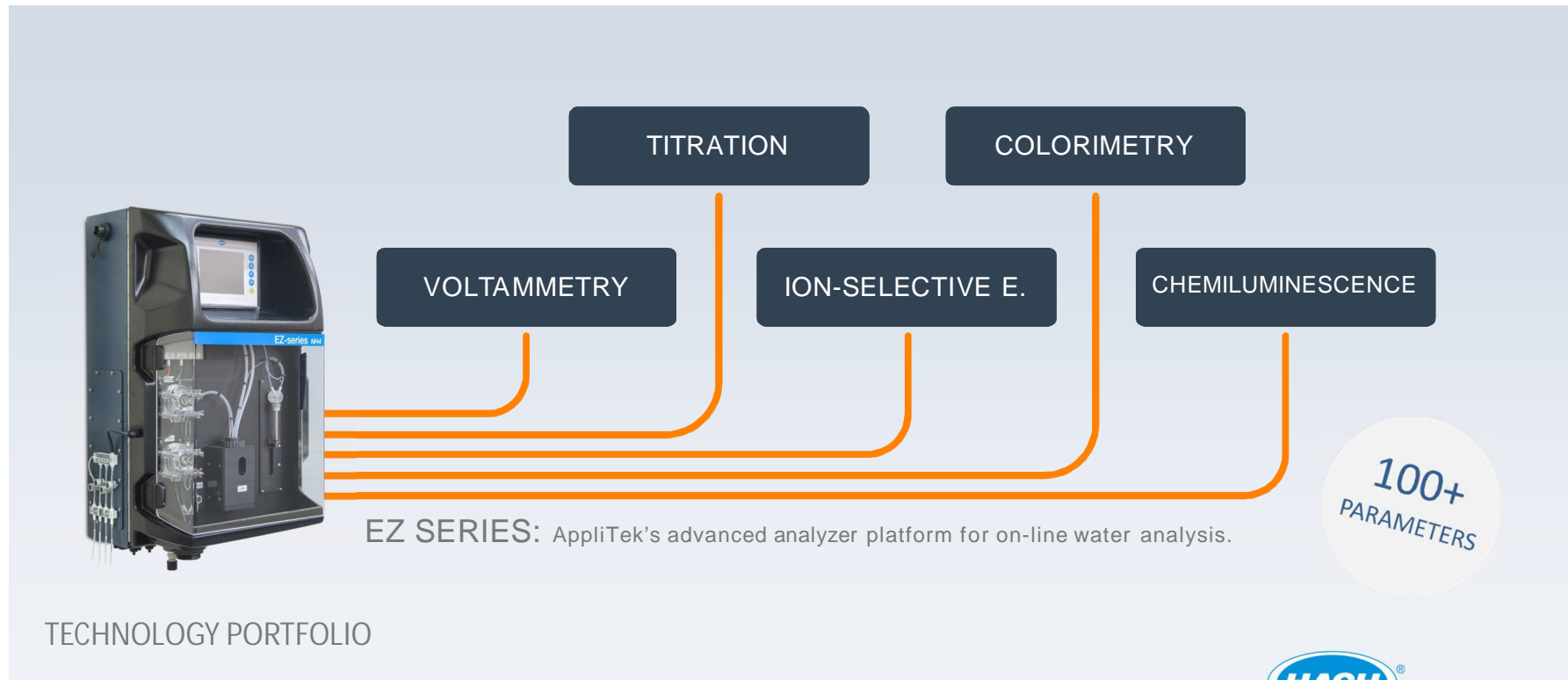


Customer edit

HACH[®]
Be Right[™]



- EZ Series: on-line analysis made easy
- Hach legacy in colorimetry and titration
- Manganese, iron, aluminium, phosphate, hardness and alkalinity: typical applications and analytical specs
- The EZ 1000 / 2000 / 5000 Series
- Service offerings
- Additional information section



TECHNOLOGY PORTFOLIO





Manganese, iron,
aluminium, phosphate,
hardness and alkalinity:

Typical applications and
analytical specs



Applications fields:

Drinking Water

Manganese, Iron, Aluminum, Total hardness + alkalinity

Power / Cooling Water

Iron, Phosphate/Phosphorous, Total hardness + alkalinity

Waste Water

Iron, Phosphate (blue method, yellow method) and Total Phosphorous

Total hardness + alkalinity

Vertical market matrix

| PARAMETER | Drinking water | Beverage | Power | Municipal |
|-----------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Iron | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Manganese | <input type="checkbox"/> | <input type="checkbox"/> | | |
| Phosphate | | | <input type="checkbox"/> | <input type="checkbox"/> |
| Aluminium | <input type="checkbox"/> | | | |
| TH + alkalinity | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> |