AQUALABO

Smart water solutions

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STACSENSE

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EXCLUSIVE DISTRIBUTOR microLAN On-line Biomonitoring Systems · Supratec Instrumentation GmbH

MENU

INTRODUCTION

1.1 Definition: BOD, COD, TOC

1.2. Generalities

1.1 Definitions

WHAT IS BOD, COD & TOC ?

BOD : Biochemical Oxygen Demand

It's the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter.

COD : Chemical Oxygen Demand

It's a measurement of the **oxygen-depletion capacity** of a water sample contaminated with organic waste matter.
Specifically, it measures the equivalent amount of oxygen required to chemically oxidize organic compounds in water.

TOC : Total organic carbon

It is the amount of carbon found in an organic compound. It's the measure of the level of organic molecules or contaminants in purified water.
It's an analytic technique that helps to understand whether the water is pure enough.

1.2 Generalities

Most of the organic matter absord **UV light** at **254 nm**.

Proven method for monitoring organic charge is to measure **UV absorption** at this wavelenght.

The amount of UV light absorbed is used to monitor organic matter levels.

The **Spectral Absorption Coefficient 254 (SAC)** is a sum parameter which indicates **organic load** and allow to **COD, TOC and BOD** by applying the appropriate correlation coefficients

FEATURES

2.1 Measuring principle
2.2 Features
2.3 Advantages
2.4 measurement campaign in WWTP

2.1 Measuring principle

The STACsense is an **optical** sensor for measuring **absorption** in natural water or wastewater.

The optical is composed by :

1. Main optical source, **UV-C LED**, peak wavelength **254 nm**,
2. Secondary optical source, **visible LED**, peak wavelength **530 nm**,
3. Assembly of **optical components** to manage light beams,
4. **Optical path** through the observed fluid,
5. Detector : **photo-diode**

The intensity of the light captured by the optical receiver is used to measure the SAC 254 parameter, **Spectral Absoption Coefficient**.

A reference measurement at **530 nm** is used to **compensate** for the presence of **particles** in the sample which also absorb UV light.

2.2 Features

- Integrated **grip** or suspension element
- In compliance with **NF EN 61326-1 : 2013-05**
- Air or liquid pressure **cleaning system**
- Power supply **5,2 to 26 V**
- Optical path **2 & 50 mm**

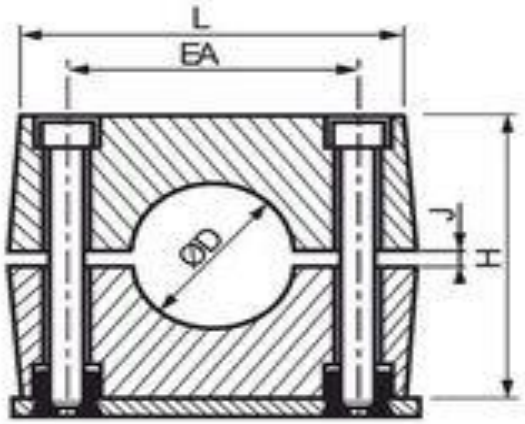
2.2 Features

Optical path	Parameters	Range of measure	Unity	Limit of détection	Limit of quantification	Accuracy	Appli
2 mm	CAS254	0-750	Abs/m	1,7	5	1 ou +/-3%	Waste Water
	CODeq	0-1300	mg/L	3	9	2 ou +/-3%	
	BODeq	0-350	mg/L	1	3	1 ou +/-3%	
	TOCeq	0-500	mg/L	1,5	4	1 ou +/-3%	
	Turbidity	0-500	FAU	1,5	5	5 ou +/-5%	
50 mm	CAS254	0-30	Abs/m	0,1	0,3	0,1 ou +/- 3%	Drinking Water
	CODeq	0-50	mg/L	0,15	0,6	0,2 ou +/- 3%	
	BODeq	0-15	mg/L	0,05	0,2	0,1 ou +/- 3%	
	TOCeq	0-20	mg/L	0,1	0,2	0,1 ou +/- 3%	
	Turbidity	0-40	FAU	0,4	1,2	1 ou +/-5%	

CONSUMPTION FEATURES

Consumption at 5.4 V	Stand by : 10 µA
	Maximum peak current: 600 mA
	Max current during the measurement: 100 mA
	Average current during the measurement: 70 mA
	Average current (1 meas. / 2s): 35 mA
	Energy for 1 measurement 158 µWh
Consumption at 24 V	Standby : 10 µA
	Maximum peak current: 300 mA
	Max current during the measurement: 65 mA
	Average current during the measurement: 50 mA
	Average current (1 meas. / 2s): 25 mA
	Energy for 1 measurement : 500 µWh

2.2 Features. Installation



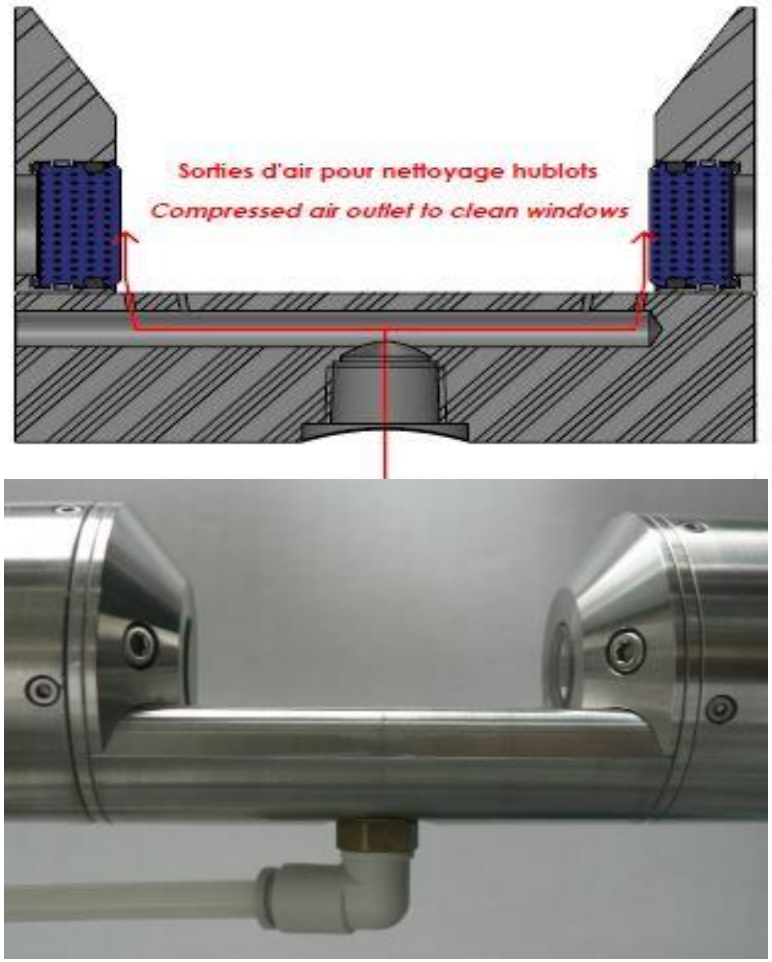
An holding system is required to :

- Keep the sensor in the **circulating fluid**
- Avoid **impacts**, contacts with the wall
- Eliminate **mechanical strain** on the sensor

This accessory is composed by :

- 2 half-shells
- 2 screws
- 1 stainless steel base

2.2 Features. Installation



This system is located near the two optical windows removes residue from the measurement zone.

We can propose a **90° elbow**.

This system connects the air supply tube (6mm) along the sensor body to the communication cable.

It’s fitted for **5 bars** compressed air input.

2.2 Features. Installation

INSTALLATION

With the UV technology, we're using a **specific buffer solution** (Khp) → to obtain the factory coefficients
This solution is **not representative** of the customer's environment

The customer has to make a **correlation** between **sensor's datas** & **micro methods datas**
→ Measurment campaign for 1 month and compare datas to determinate a correlation coefficient.

The best way is to take samplers at **various time of the day** to have the most suitable environment and stick to the reality.

2.2 Features. Installation

EQUIPMENT

Measurment campaign :

- Micro methods (tubs, kit reagents/pills)
- Photometer / Spectrophotometer

STACsense Integration :

- Automaton
- Data logger

STACsense with controller :

- S200

2.2 Features. Calibration

Calibration

For the SAC 254 :

- Adjust the reference optical signal in **clear water** (254 nm, 530 nm)

For COD, BOD and TOC :

- **No calibration step**. You have to complete directly the offset and the slope values on Calsens (Practical excercices) → measuring campaign

Maintenance

Very few, just keep the **optical windows clean** (soft cloth or with the air pressure).

2.2 Features. Integration

Calibration

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- Adjust the reference optical signal in **clear water** (254 nm, 530 nm)

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2.3 New STACsense UV sensor

ADVANTAGES

- Spectral absorption UV 254 without **reagent** or **consumable**.
- Multiparameter measurement: **SAC254, CDOeq, TOCeq, BODeq, Turbidity eq**
- Automatic **compensation in Turbidity** & internal **temperature** compensation
- **Open protocol** Modbus RS-485/SDI12 Digital Communication,
  Low power consumption

2.4 Measurement campaign in WWTP

Installation at the inlet :

- 3 probes, Optical pathway = 2mm :
  - 2 StacSense (prototypes #15 and #16),
  - **1 LISA (TRIOS),**
- Triangular clamp configuration,
- Fluid : Mixture of Industrial and domestic waste water
- Measurement area : just after the biggest impurities get stuck on the weir.

2.4 Measurement campaign in WWTP - Inlet

Data recording :

- Probes are connected to the PCs, which are placed in suitcases to ensure tightness

- Datas are saved :
  - with CalSens V1.4 for StacSense probes,
  - with « Lisa Viewer », developed by ourself specially for field test, for Lisa probe

Conversion coefficients :

- SAC to COD Coefficient : 2,65 applied on the probe SN-PUVTA-0015, based on first results of COD micromethod samples analysis

- SAC to COD Coefficient : 1,81 applied on the probe SN-PUVTA-0016 . This coefficient value has been previously obtained in the laboratory with KHP aqueous solutions.

2.4 Measurement campaign in WWTP - Inlet

Common situations of probes during out of water inspection

- Obstructed optical path :

- Optical path oriented towards of the interior of the trio :

- We observed less shutter in this configuration

2.4 Measurement campaign in WWTP - Outlet

Installation at the outlet :

- 2 probes, Optical pathway = 50 mm :
  2 StacSense (prototypes #11 and #12),

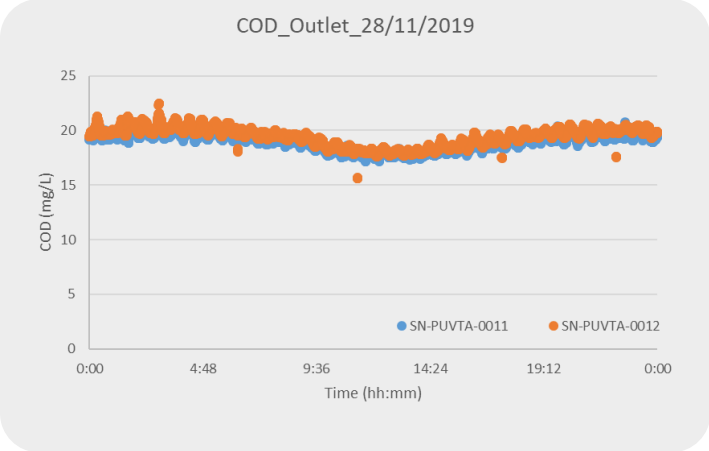
- Individual clamp configuration,along the wall of water outlet channel,

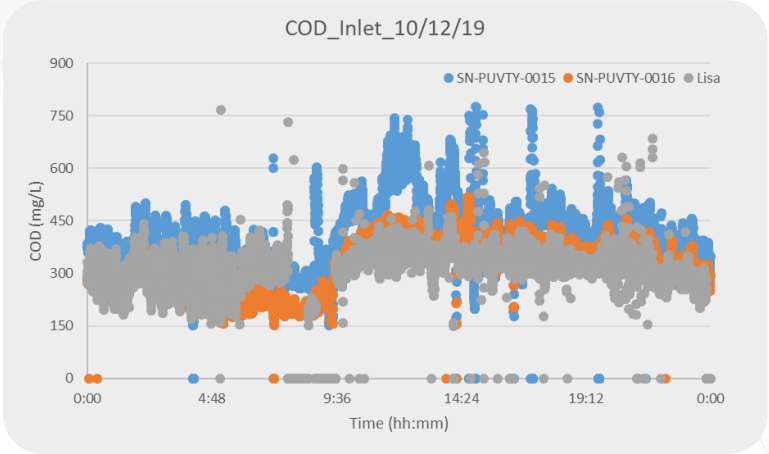
- Fluid :
Clear water, less risk of obstruction of the optical path.

Conversion coefficients :
SAC to COD Coefficient 1,12 applied on the probes SN-PUVTA-0011 and SN-PUVTA-0012.

2.4 Measurement campaign in WWTP - Results

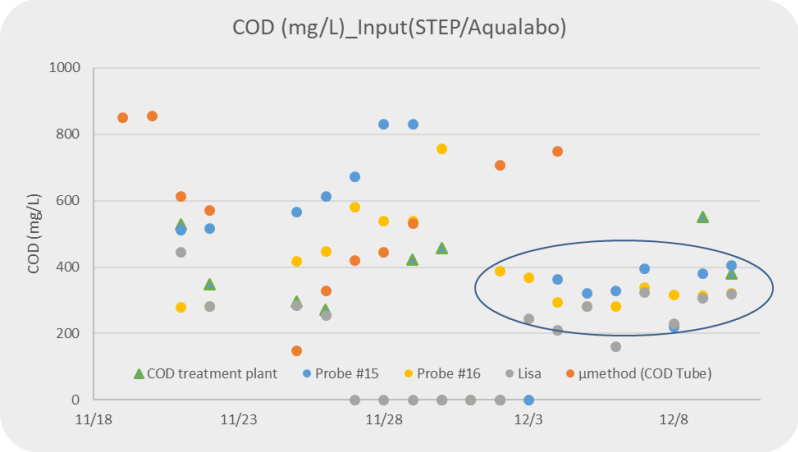
Examples of results in inlet and outlet for a day

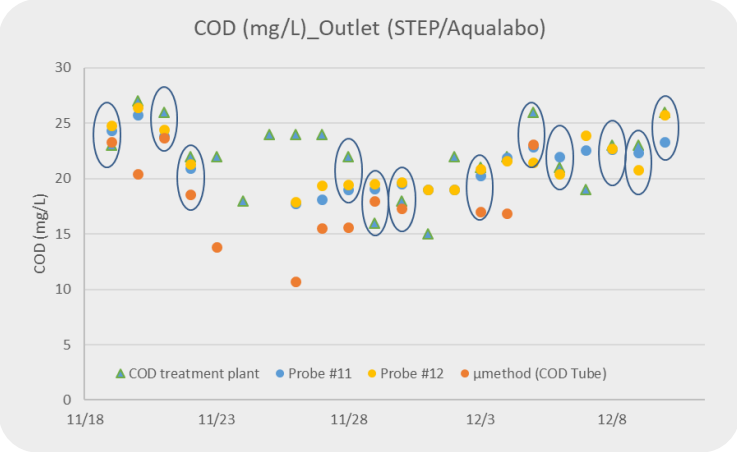




2.4 Measurement campaign in WWTP - Results

The points represent the average per day measured by StacSense, Lisa, and also CODmicromethod analysis results, operated by our student, and COD micromethod results from the operator of the waste water treatment. plant.





COD Average treatment plant (mg/L)	COD Average probe 15 (mg/L)	COD Average probe 16 (mg/L)	Error (%)
22	21,3	21,5	3,2

COD Average treatment plant (mg/L)	COD Average probe 11 (mg/L)	COD Average probe 12 (mg/L)	Error (%)
362	479	374	24

2.4 Measurement campaign in WWTP - Results

Input :

In view of the many more or less suspended matter, SAC measurements are more chaotic at the treatment plant entrance. The optical paths are easily obstructed.
In addition, a deposit appeared on the windows, resulting a 50% drop in transmission in the UV.
COD measurements with samples show the variability of the contaminent level.
However, the responses of the 3 probes (StacSense and Lisa) follow each other well (see time period, 4th to 10th of december).

Output :

Firstly, the two prototypes have the same behaviour in such field conditions.
Secondly, the responses of the probes are consistent with the COD measurements given by the treatment plant.
No baseline shift observed with clear water checking.
There is no need to readjust a user coefficient.

OFFER

3.1. Product Range
3.2. Applications
3.3 Market
3.4. Competitor

3.1 Product Range

STACSENSE – Module 4200 – Calsens -> calibration AVAILABLE

STACSENSE – AQUAMOD – AQUACONNECT -> End of March

STACSENSE – S200 -> under development (display without calibration at first)

3.1 Product Range

STACSENSE – ACTEON 5000-> June

STACSENSE – ODEON -> end of first quarter 2020

3.1 Product Range

REFERENCE	DESIGNATION
	UV254 Probe StacSense
PF-CAP-C-00363	StacSense: UV254 Multiparameter Probe COD/BOD/TOC Optical Path 2mm 15m bare wires UV probe at 254 nm optical path 2mm for measurements of SAC254/CODeq/TOCeq/BODeq/ Turbidity eq in 15m bare wires. Turbidity compensation at 530 nm. Modbus outputs RS485/SDI12 Power supply 5.4 V to 26 V
PF-CAP-C-00364	StacSense: UV254 Multiparameter Probe COD/BOD/TOC Optical Path 50mm 15m bare wires UV probe at 254 nm optical path 50mm for measurements of SAC254/CODeq/TOCeq/BODeq/ Turbidity eq in 15m bare wires. Turbidity compensation at 530 nm. Modbus outputs RS485/SDI12 Power supply 5.4 V to 26 V
PF-CAP-C-00368	StacSense: UV254 Multiparameter Probe COD/BOD/TOC Optical Path 2mm 7m bare wires UV probe at 254 nm optical path 2mm for measurements of SAC254/CODeq/TOCeq/BODeq/ Turbidity eq in 7m bare wires. Turbidity compensation at 530 nm. Modbus outputs RS485/SDI12 Power supply 5.4 V to 26 V
PF-CAP-C-00369	StacSense: UV254 Multiparameter Probe COD/BOD/TOC Optical Path 50mm 7m bare wires UV probe at 254 nm optical path 50mm for measurements of SAC254/CODeq/TOCeq/BODeq/ Turbidity eq in 7m bare wires. Turbidity compensation at 530 nm. Modbus outputs RS485/SDI12 Power supply 5.4 V to 26 V
PF-CAP-C-00370	StacSense: UV254 Multiparameter Probe COD/BOD/TOC Optical Path 2mm 3m bare wires UV probe at 254 nm optical path 2mm for measurements of SAC254/CODeq/TOCeq/BODeq/ Turbidity eq in 3m bare wires. Turbidity compensation at 530 nm. Modbus outputs RS485/SDI12 Power supply 5.4 V to 26 V
PF-CAP-C-00371	StacSense: UV254 Multiparameter Probe COD/BOD/TOC Optical Path 50mm 3m bare wires UV probe at 254 nm optical path 50mm for measurements of SAC254/CODeq/TOCeq/BODeq/ Turbidity eq in 3m bare wires. Turbidity compensation at 530 nm. Modbus outputs RS485/SDI12 Power supply 5.4 V to 26 V
	Calibration with PC
NC-FIX-C-00020	Converter RS485/USB for One digital sensor MODULE 4201
NC-FIX-C-00021	Converter RS485/USB for Two digital sensor MODULE 4202
LO-EMB-C-00031	Software CALSENS
PF-ACC-C-00082	Cable : 1 bare wires digital sensor / ODEON (Adapter for ODEON)
	Accessories
M0243A	Stacsense Clamp (D48,3)

3.2 Application

DRINKING WATER

Raw water

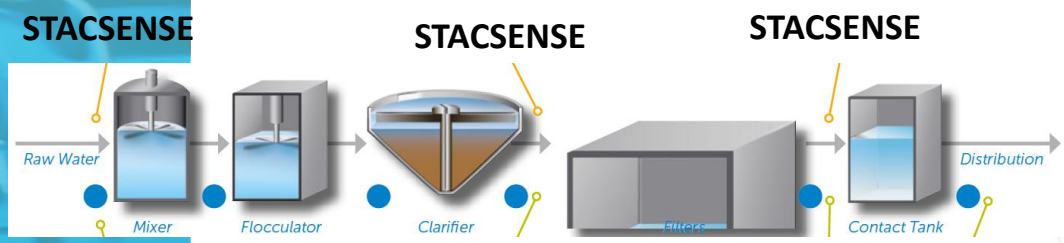
UV254, TOC

Organic matter assessment to calculate the capacity of the treatment process

Treatment Process

UV254, TOC

During the disinfection process risk of formation of by-products (residual chlorine reacts with organic matter)



3.2. Application

Sewer network

COD, BOD, UV254, NO_3 (**STACSENSE/STAC2**)
Organic load assessment, wastewater composition (urban/industrial).

Influent

COD, UV254, NO_3 (**STACSENSE/STAC2**)
Incoming load for nutrient assessment, Monitoring pollution peaks.

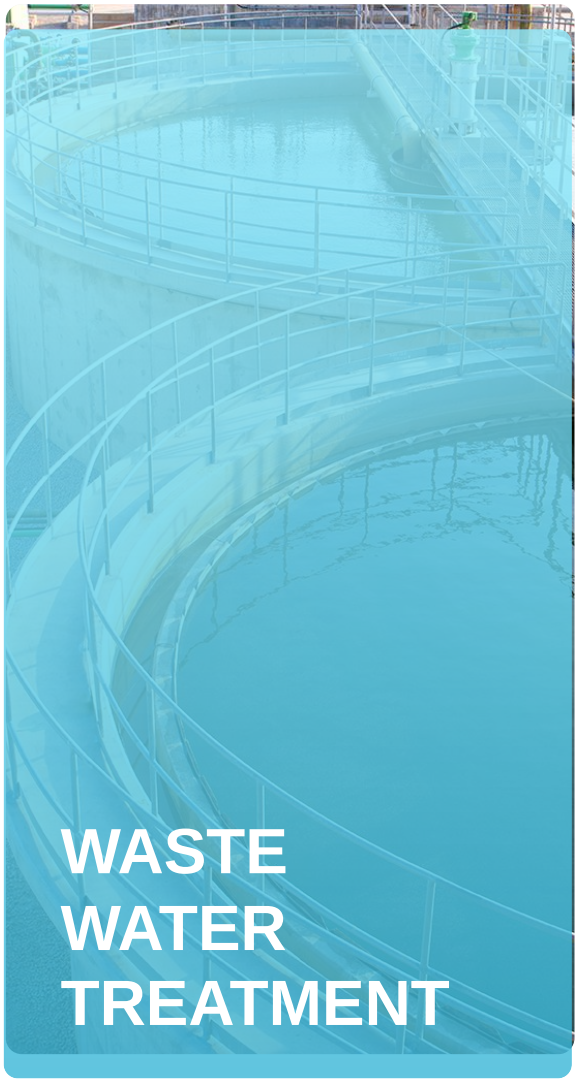
Aeration tank

COD, UV254, NO_3 (**STACSENSE/STAC2**)
Aeration control (Nitrif/denitrif), process optimization (Organic Mat. to degrade), operational cost reduction.

Outlet

COD, UV254, NO_3 (**STACSENSE/STAC2**)
Process efficiency, process control, compliance releases.

3.2. Application



STACSENSE / STAC2

	N-NO3 (mg/L)	COD (mg/L)	UV254 (Abs/m)	BOD (mg/L)
Influent	0-40	0-3750	0-12500	0-2000
Aeration tank	0-100	0-1200	0-2500	
Outlet	0-45	0-500	0-500	

3.2. Application

UV254, TOC
Water quality monitoring
Pollution control

3.2 Application

INDUSTRIAL WASTE WATER TREATMENT

Paper Mill

Influent : COD, BOD, UV254
Outlet : COD, UV254, NO_3 (**STACSENSE/STAC2**)
Biodegradability evaluation COD/BOD

	N-NO3 (mg/L)	COD (mg/L)	UV254 (Abs/m)
Influent		0-500	0-1250
Outlet	0-10	0-350	0-1250

Dairy Industry

Influent : COD, BOD, UV254, NO_3 (**STACSENSE/STAC2**)
Outlet : COD, BOD
Biodegradability evaluation COD/BOD

	N-NO3 (mg/L)	COD (mg/L)	UV254 (Abs/m)	BOD (mg/L)
Influent White water	0-80	0-12500	0-2500	220
Outlet		120		40

Brewery

Influent : COD, BOD, UV254

	N-NO3 (mg/L)	COD (mg/L)	UV254 (Abs/m)
Influent		0-4500	0-1250
Outlet			

3.3 Market

WASTE WATER TREATMENT PLANT
Inlet & Outlet monitoring : BOD, COD, NO_3 & sometimes TOC

INDUSTRIAL REJECT
Beverage industry → Outlet COD monitoring
Food industry → Outlet COD monitoring

DRINKING WATER
SAC 254, TOC monitoring

3.3 Competitor - TRIOS

Features	STACSENSE	Lisa (TriOS)
Path Lenght	2, 50 mm	1, 2, 5, 10, 50, 100 mm
Consumption	1 meas/10s = 65-192 mW Stand by = 54 µW	1 meas/10s = 960-980 mW No Stand by
Communication	Modbus/SDI 12	Modbus
Price (Public Price)	5490 €	6030 €

3.3 Competitor - TRIOS

Aqualabo StacSens (1mes/10s = 65-192 mW – Standby 54uW)

Power Supply	Stand by	Average during Measurement	Maximum Peak*	Average (1mes/2s)	Average (1mes/10s)	Minimum*** start current
5.4 V	10 uA (54uW)	70 mA (378 mW)	600 mA (2 ms)	35 mA (189 mW)	12 mA (65 mW)	100 mA
12 V	10 uA (54uW)	60 mA (720 mW)	400 mA (1.5 ms)	30 mA (360 mW)	9 mA (108 mW)	70 mA
24 V	10 uA (54uW)	50 mA (1200 mW)	300 mA (1 ms)	25 mA (600 mW)	8 mA (192 mW)	65 mA

- Lower min. voltage (5.4 V)
- Lower StandBy (listening Modbus) : less than 54uW
- Starts measure with less minimum available current than Lisa requirement to Power UP
- Consumption during measurement is less than LISA
- Average consumption for 2s or 10s measurement period using Standby is **at least 5x less** than LISA **without power dow**
- Higher Peak Current but less duration than LISA Power UP Pea

Trios LISA (1mes/10s = 960-980 mW – No Standby)

Power Supply	Stand by	Average during Measurement	Maximum Peak**	Average (1mes/2s)	Average (1mes/10s)	Minimum*** start current
10 V	95 mA (940 mW)	95 mA (940 mW)	390 mA (100 ms)	95 mA (940 mW)	95 mA (940 mW)	120 mA
12 V	80 mA (960 mW)	80 mA (960 mW)	390 mA (100 ms)	80 mA (960 mW)	80 mA (960 mW)	120 mA
24 V	41 mA (984 mW)	41 mA (984 mW)	140 mA (100 ms)	41 mA (984 mW)	41 mA (984 mW)	120 mA

- Higher min. voltage (10V)
- No Standby Mode (same consumption than while measureming – Need power Down to lower consumption)
- Peak consumption at startup is high (will be a constraint if the probe is powered up for each measure to compensate for the missing Standby mode)
- Minimum startup current is higher than StacSens
- Measurement current is more « continious » (no peak)
- Datasheet specifies <1W (ok)

3.3 Main Competitors

Competitor	Product	Measuring principle	Optical path (mm)	Proposed Parameters	Communication	Materials	Self cleaning	Public prices (€)
Endress & Hauser	Viomax CAS51D	UV 254 Compensation 550 nm	2, 8, 40	SAC254 TOC COD BOD	Digital Not alone with transmitter	Stainless Steel	Compressed air	
Hach Lange	UVAS	UV 254 Compensation Turbidity	1, 2, 5 , 50	SAC254 TOC COD BOD	Digital Not alone with transmitter	Stainless Steel	Scraper	
S::CAN	i:scan	UV 254 Compensation turbidity		SAC254 COD Turbidity ISO7027 Color	Digital Not alone with transmitter	PEEK POMC	Compressed air Auto-brush	4000
TRIOS	LISA254	UV 254 Compensation turbidity	1, 2, 5, 10, 50, 100	SAC254 TOC COD BOD	Ethernet (TCP/IP) RS-232 or RS-485 (Modbus RTU)	Stainless Steel Titanium	Compressed air	6030
Xylem WTW	UV701 IQ SAC UV 705 IQ SAC	UV 254 Compensation turbidity	1, 5	SAC254 TOC COD	Digital Not alone with transmitter	Stainless Steel PEEK	US	8750 + transmitter
AQUALABO	STACSENSE	UV 254 Compensation turbidity	2, 50	SAC254 TOC COD BOD Turbidity	RS485 Modbus or SDI12	Stainless Steel	Compressed air	5490

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