



DaphTox II Concept and Enhancements compared to DTox I

Carsten Lüring

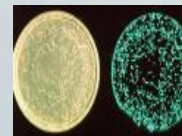
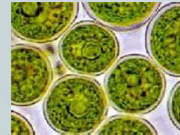
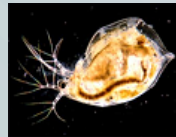
bbe Moldaenke



The “Organisms” of Biomonitoring

- Pre-Taster (old Egypt)
- Canary (Gas in Mining)

- daphnids
- algae
- luminescent bacteria
- mussels
- fish





Why use Biomonitorors?

- **Fast and online detection of toxic substances**
- **Detection known as well as unknown or unexpected toxic substances**
- **Detection of the security-relevant substances**
- **Massive reduction of effort for chemical analysis**



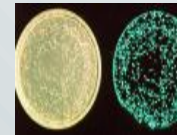
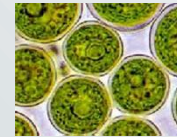
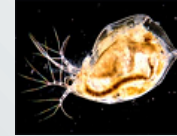
Chemical vs. Real-Time Biomonitoring

Chemical analysis detects substances you are looking for but misses others.

Real-time biomonitors detect all acute toxic substances without revealing the kind of substance.

-> Using biomonitors for fast response applications

-> Sorting out the relevant samples for chemical analysis by using biomonitoring





Development and Progress of the Daphnia Toximeter



1987



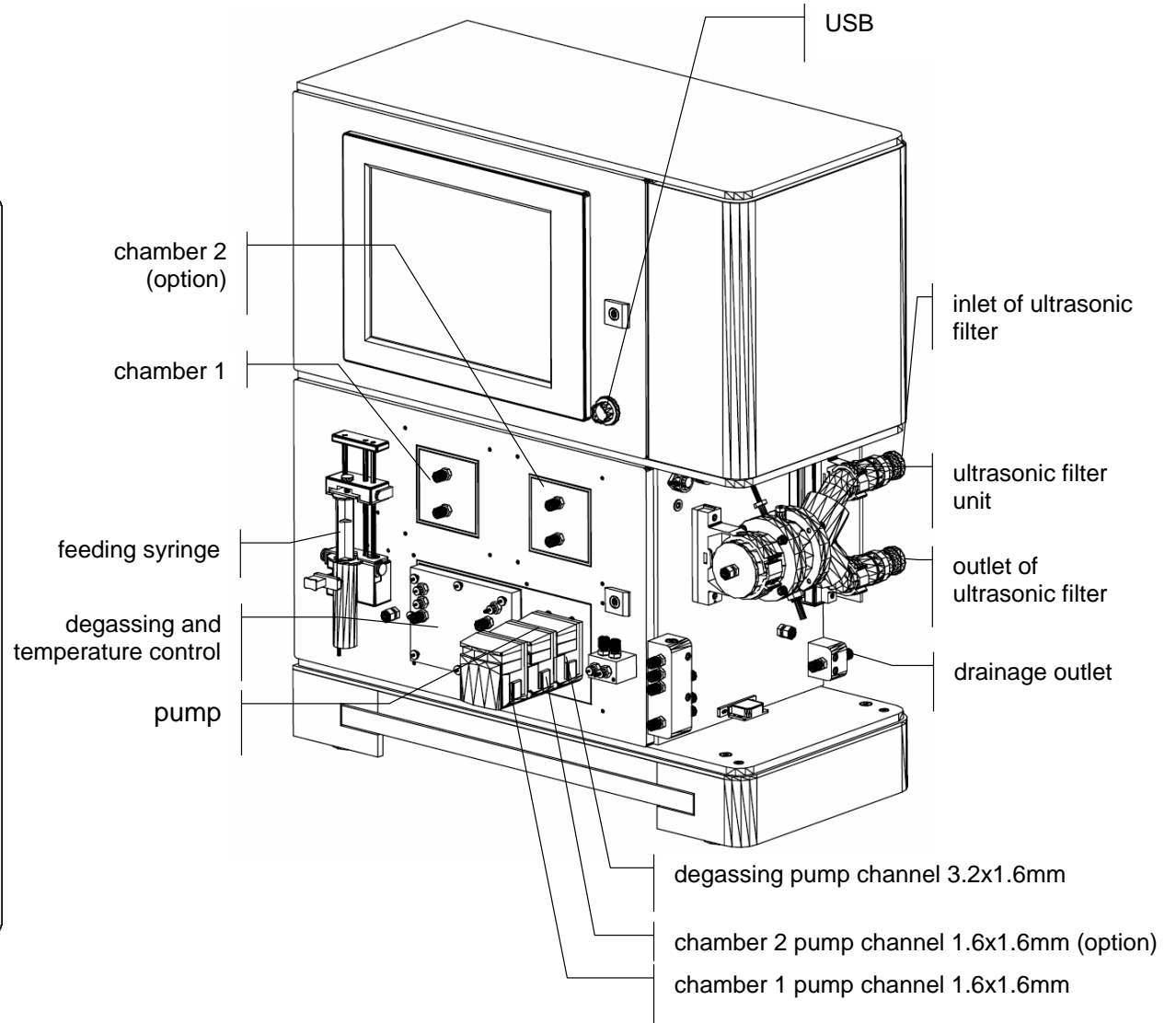
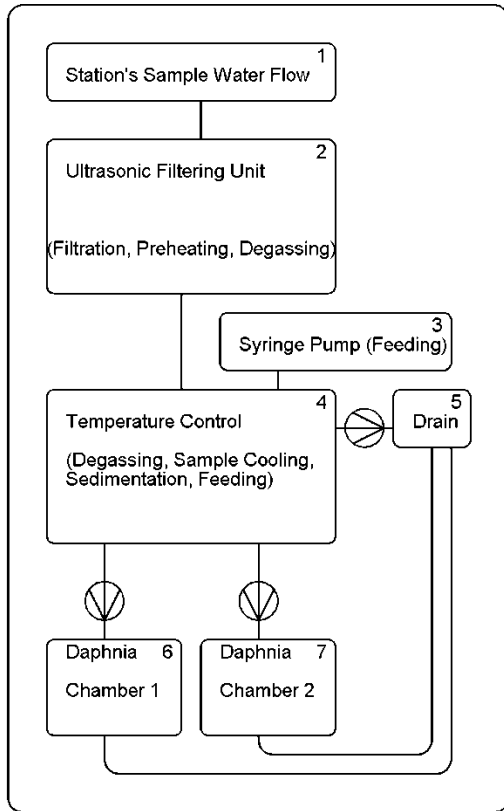
1996



2010



The DaphTox II





Components

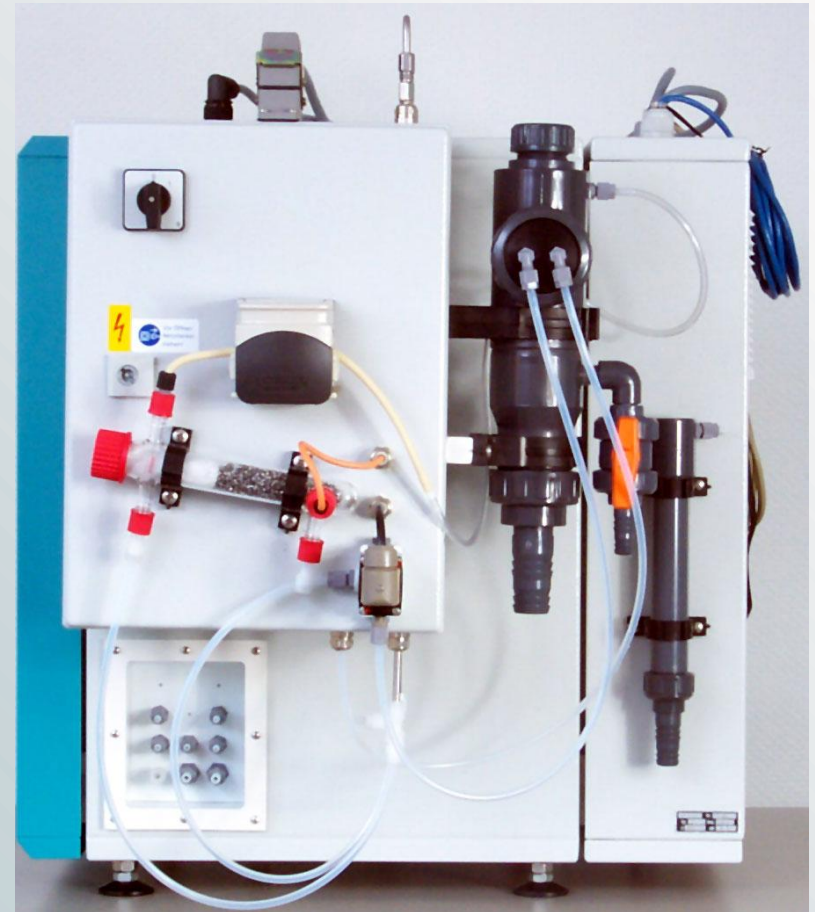
- **Filtration**
- **Degassing**
- **Temperature control**
- **Feeding**
- **Detection**
- **Chamber**
- **Display**
- **Service**
- **Set-Up**

- **Alarm Verification**



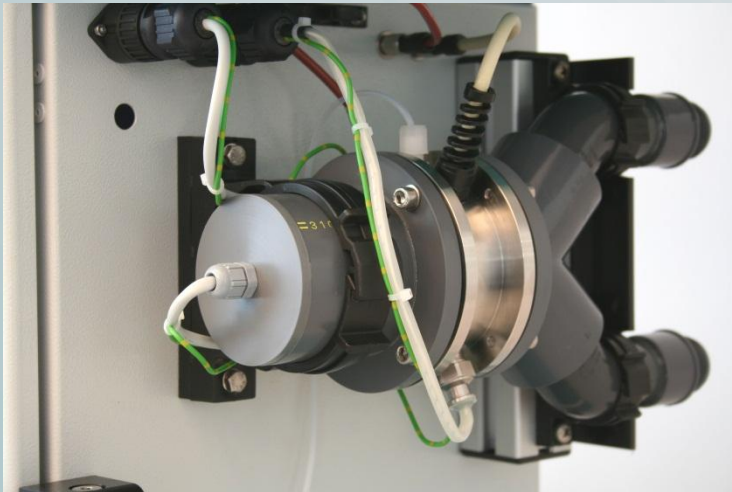
The bbe Daphnia Toximeter I - Filtration Unit

- filtration (20 μ m)
- cleaning with compressed air
- removal of air bubbles and pre-heating





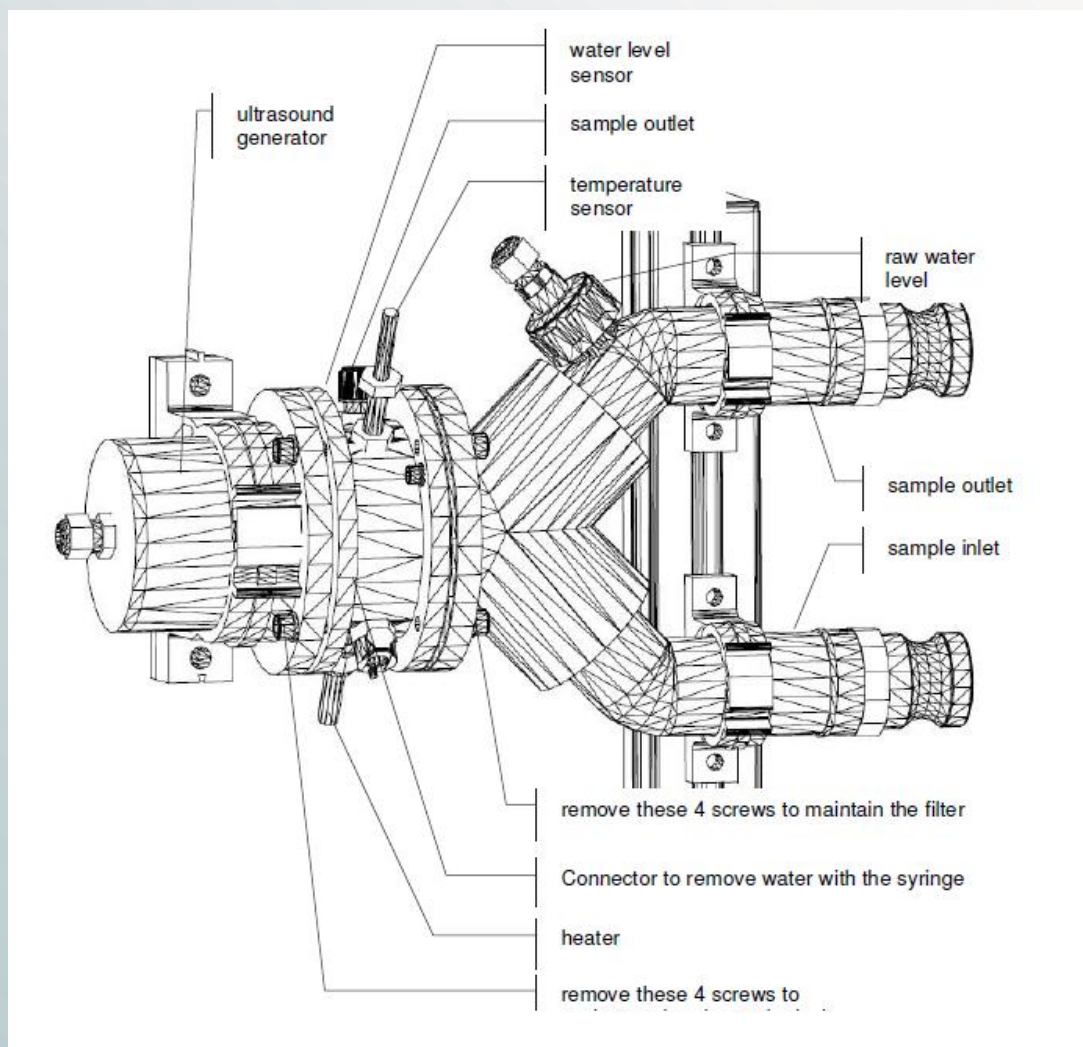
The bbe DaphTox II - Filtration Unit



- filtration (2 μm) - ultrasonic cleaning
- heating
- removal of air bubbles supported by the ultrasonic device

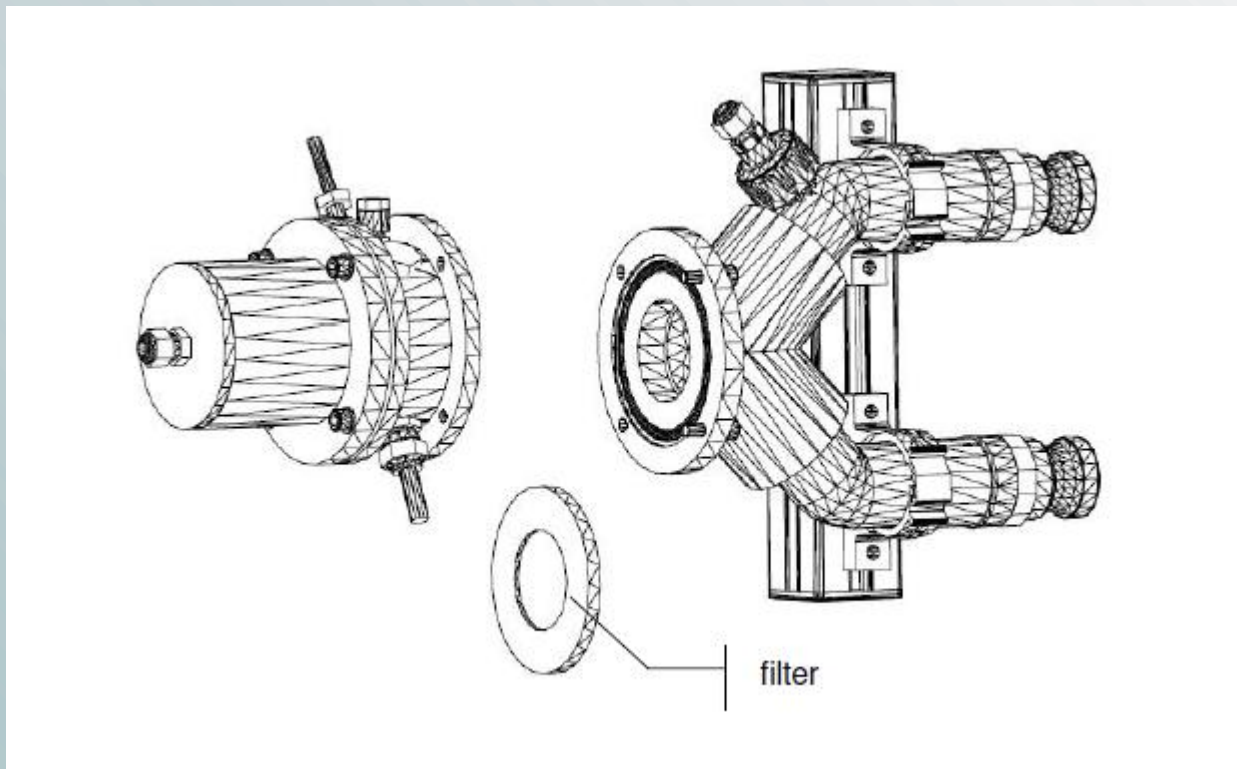


The bbe DaphTox II - Filtration Unit



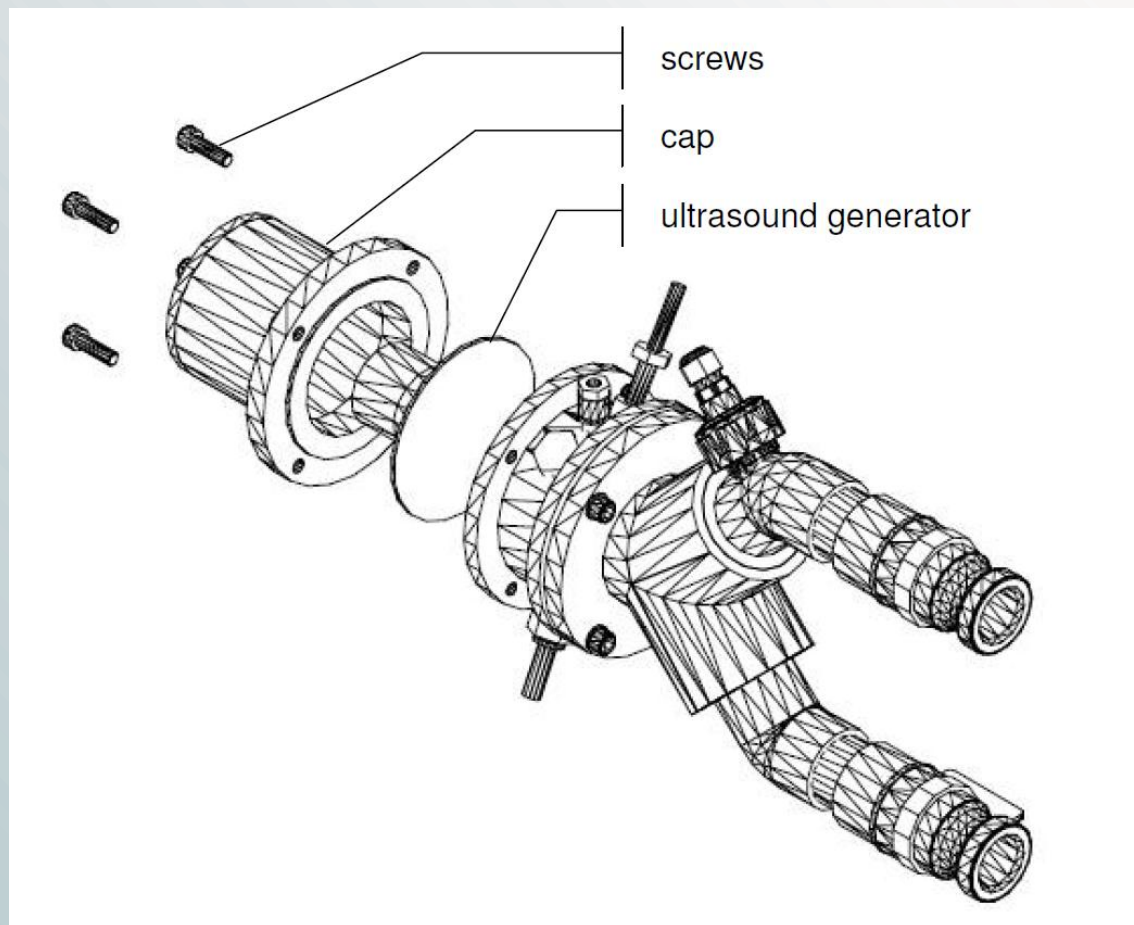


The bbe DaphTox II - Filtration Unit





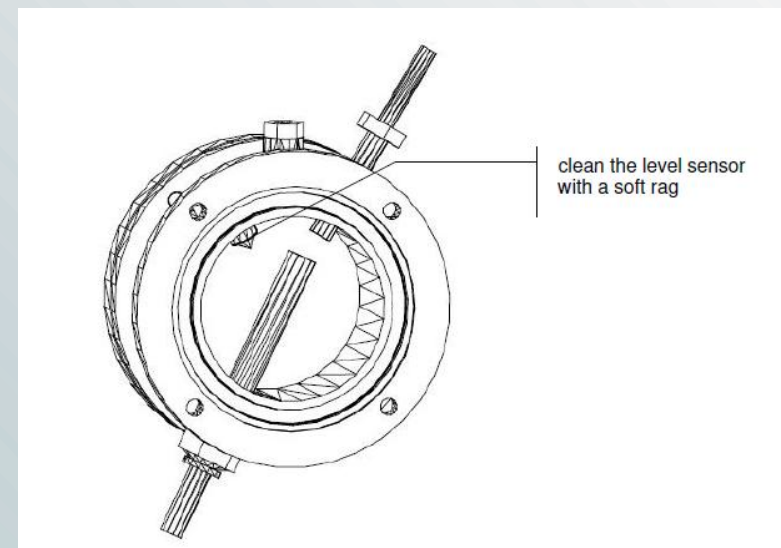
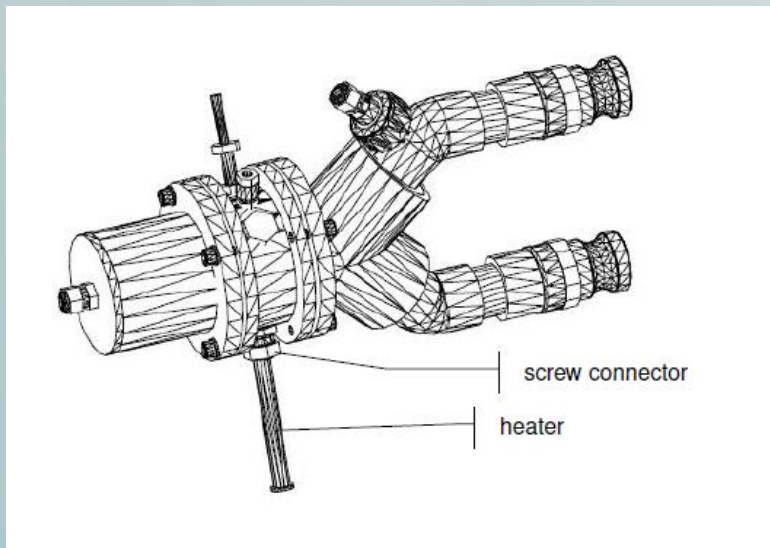
The bbe DaphTox II - Filtration Unit





The bbe DaphTox II – Pre-Heater

- level sensor
- temperature sensor
- independent shutdown

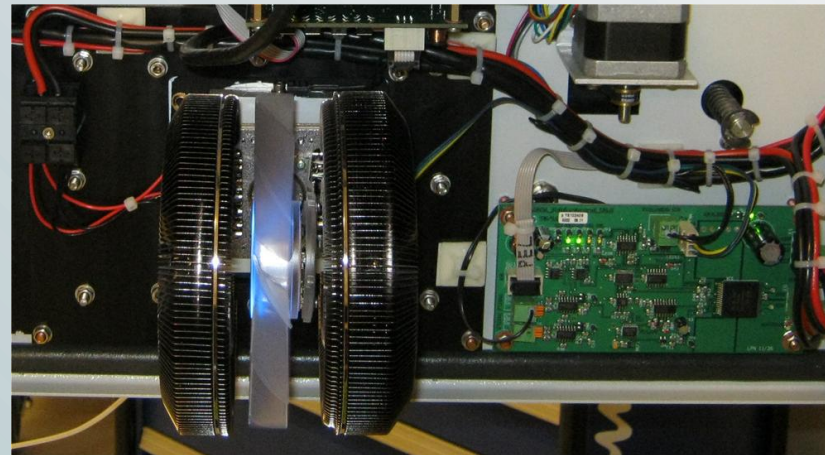
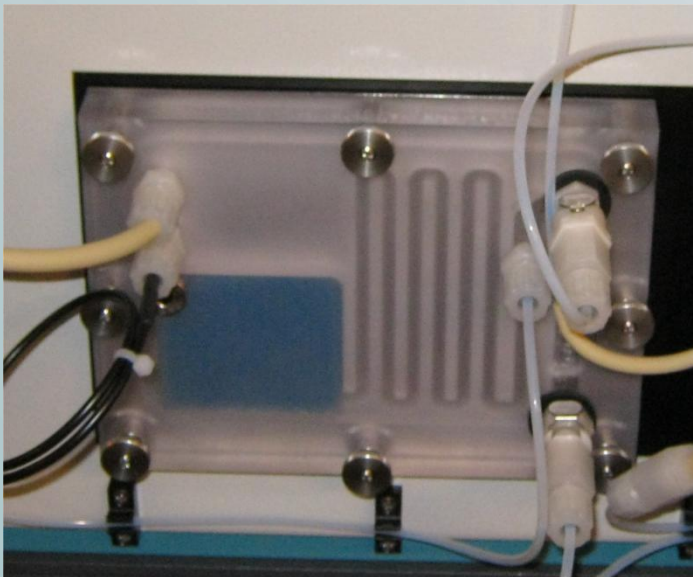




Temperature Control

DTox I: external cooling water

DTox II: internal cooling fan





Feeding

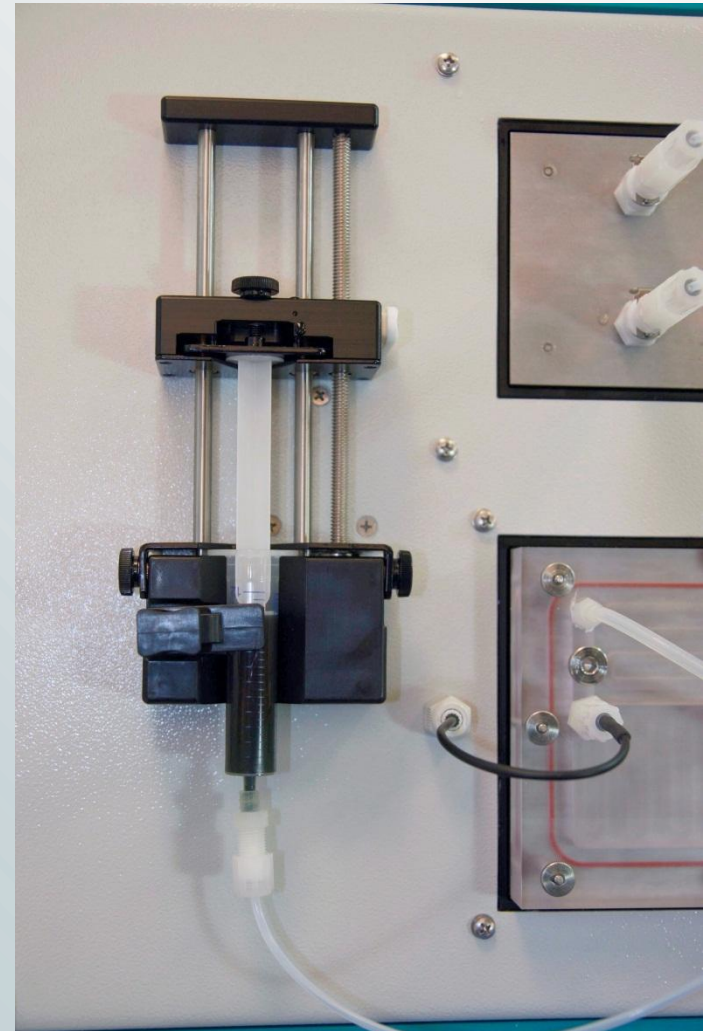
DTox I: algae culture





Feeding

DTox II: syringe with concentrated algae





Detection

DTox I :

1 camera for 2 chambers

Resolution 160*300px / chamber

20px/mm²

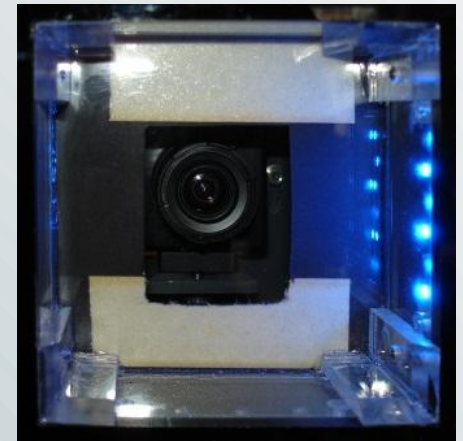
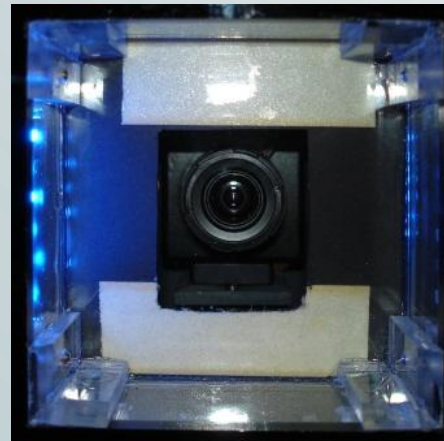


DTox II :

2 cameras for 2 chambers

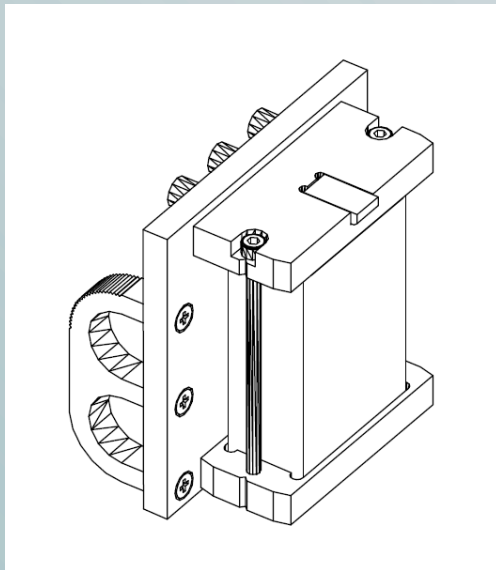
Resolution 440*440px / chamber

100px/mm²

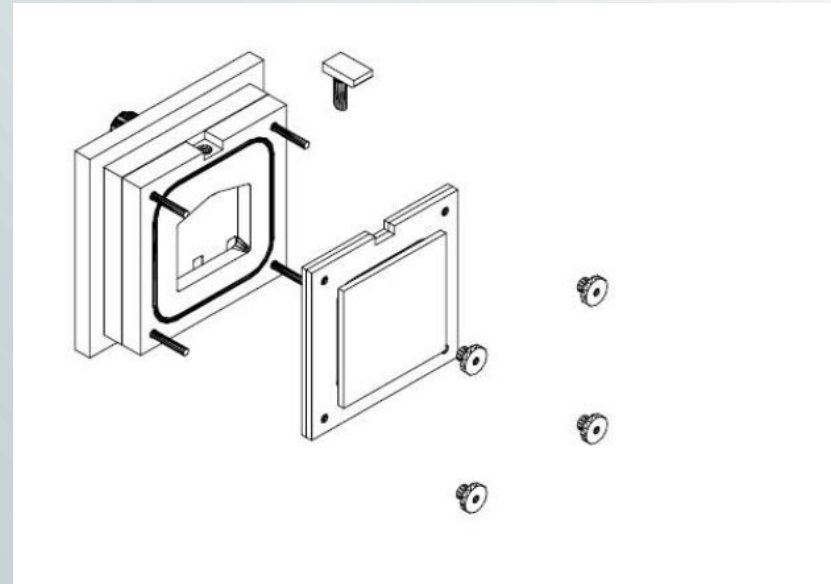




Chambers



DTox I style



DTox II



Displays



DTox I: 8"



DTox II: 15" Touchscreen display



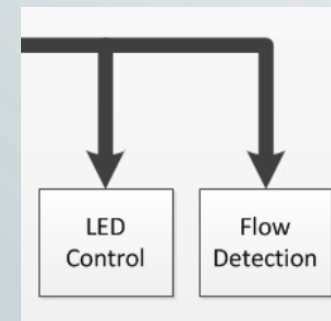
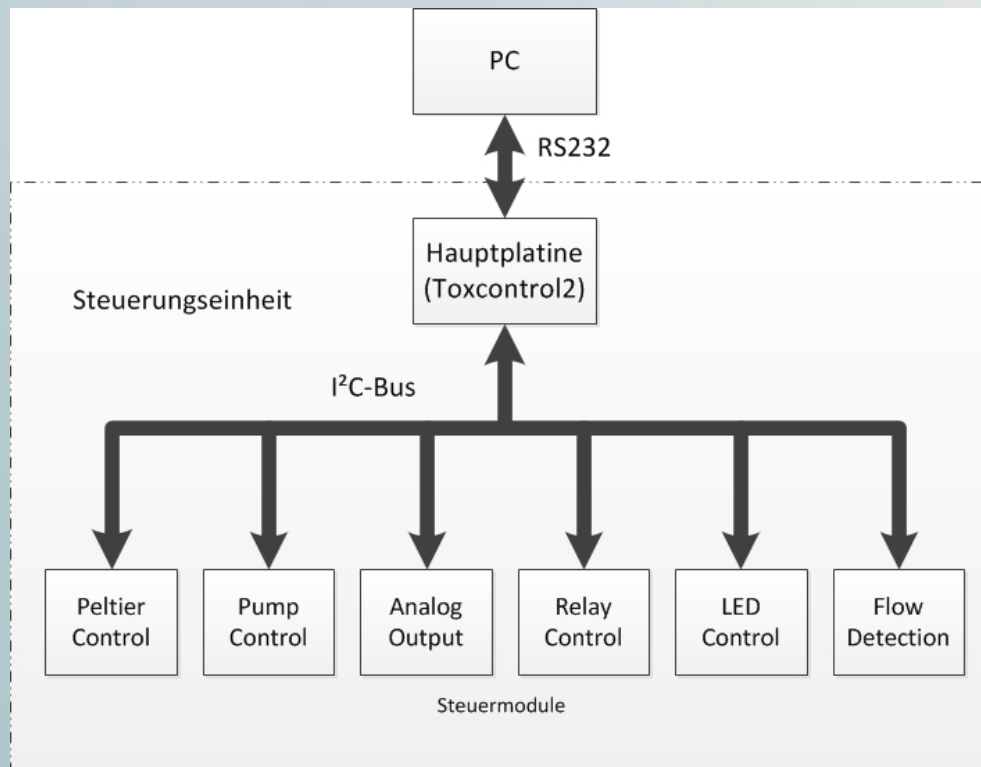
Service

DTox II:

- **massive reduction of tubing**
- **no support of algae culture (algae, nutrient, cleaning)**
- **no cooling water**
- **access to all components from the front of the instrument**



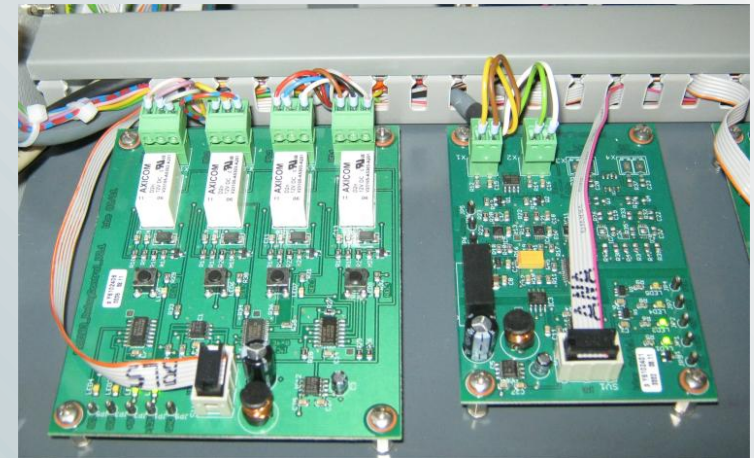
Set-Up – Electronic Modules





Set-Up – Electronic Modules

- combination of electronics and mechanics in one module
- standard communication (I2C-Bus)
- standard electric connectors
- easy exchange / easy maintenance
- easy to add new functions
- multiple use in different instruments
- integrated safety functions
- integrated test functions





Alarm Verification

- subjects of research -

Verification mechanism :

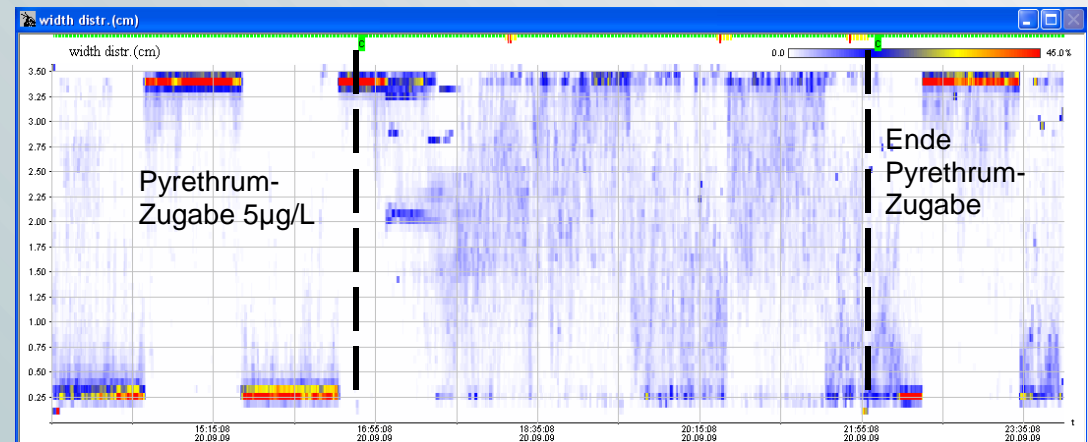
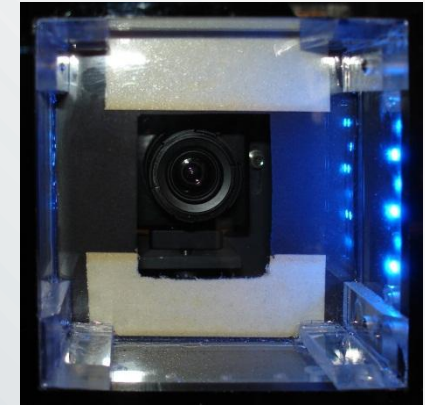
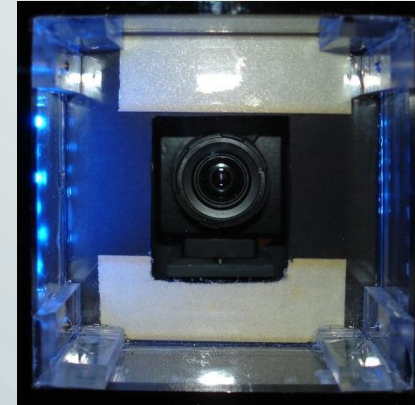
A second mechanism is to check whether or not an alarm is a real alarm since:

- **real alarms in drinking water networks are extremely seldom**
- **1 false alarm / year is a really good biomonitor - but if there are 12 instruments in a network it is about one false alarm / month**
- **- > too many**
- **- > 2 instruments or 2 channels**
- **- > 2nd mechanism to check the same organisms**



Verification Mechanism

- using the phototaxis of the daphnia for a second test
- additional alternating blue light on the left and right side in case of alarm
- horizontal distribution of daphnia after adding 5 μ g/l Pyrethrum





**Many thanks for
your attention**



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