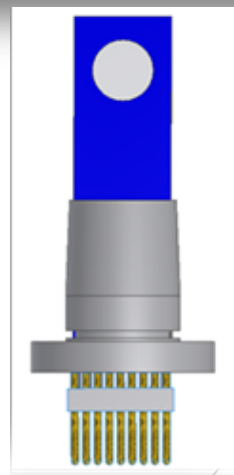
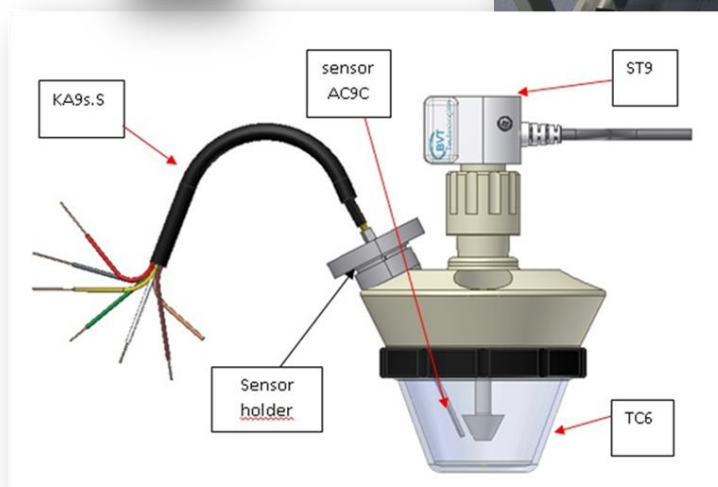
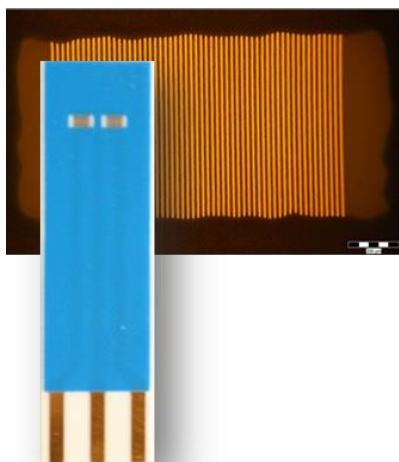


# CATALOGUE 2017

## BVT Technologies, a.s.



Contact us for more information

E-mail: [info@bvt.cz](mailto:info@bvt.cz)

Tel.: +420 563 034 298

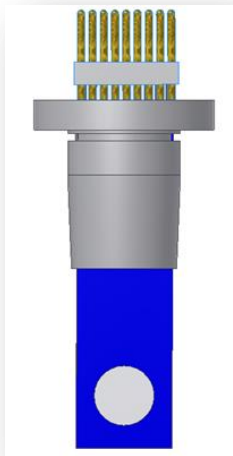
[www.bvt.cz](http://www.bvt.cz)

# NEW PRODUCTS

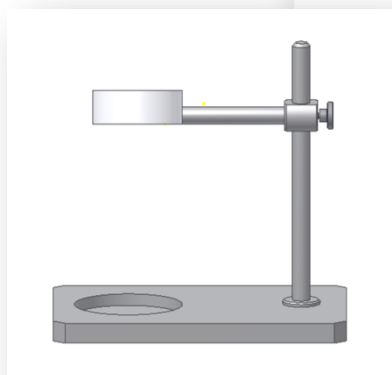
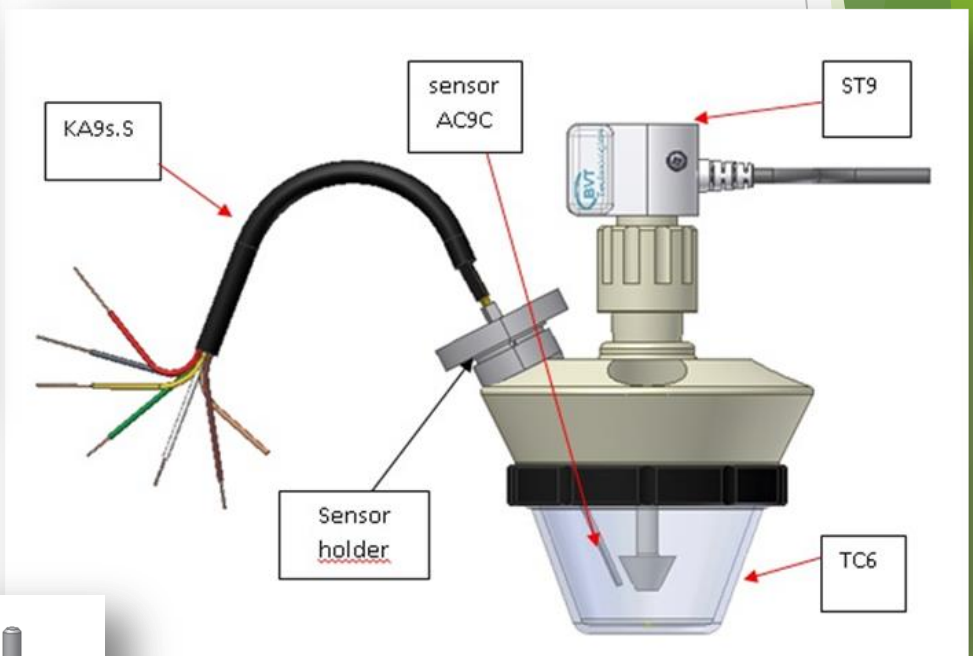
## Arrangement for measurement with multiarray electrode

AC9C electrochemical sensor with an array of 8 working electrodes and 1 common reference electrode. It is used as a biosensor substrate for multi-analyte detection. An integrated connector is at the end of sensor. Different enzymes can be put on the working electrodes of the sensor.

The electrodes can be made of variety of materials (Au/Pt, Au, Pt, Ag, C). Materials are applied by screen printing or sputtering.



Sensor holder

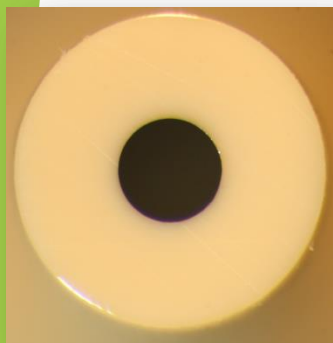


Universal stand for TC6

The construction of stirrer assures the optimum mass transport with minimum hydrodynamic noise in revolution range 100 - 1000 rpm. Stirrer is produced from high quality PEEK material which is chemically resistant.

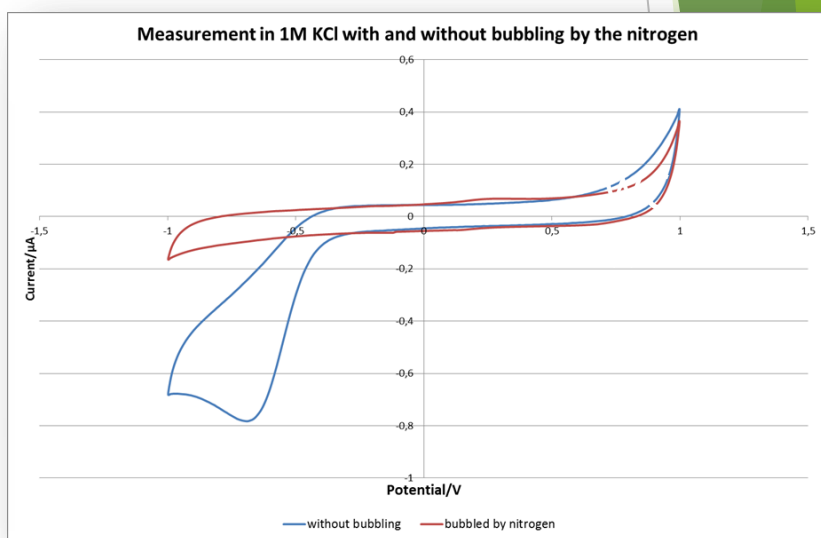
# Glassy carbon electrode

## WCE.W4



- ✓ Roughness better than in classic working electrode (WCE) with the NJ 10/8.
- ✓ It can be inserted in TC4, TC5, TC6 glass cells.
- ✓ Standard cable length **WCE.W4** is 1.5 m.
- ✓ Connecting wires (or banana plugs) - red

Capacity in the zero voltage	
	WCEc.W4
$I_c(U_0)$ (A)	$4,395 \cdot 10^{-8}$
scan rate (V/s)	0,1
$C_c$ (F)	$4,40 \cdot 10^{-7}$
scan rate (V/s)	-0,10
$I_a(U_0)$ (A)	$-4,49 \cdot 10^{-8}$
$C_a$ (F)	$4,49 \cdot 10^{-7}$



Differential resistance	
	WCEc.W4
$U_{1c}$ (V)	0,05
$I_{1c}$ (A)	$4,36 \cdot 10^{-8}$
$U_{2c}$ (V)	0,4
$I_{2c}$ (A)	$5,50 \cdot 10^{-8}$
$dR_c$ ( $\Omega$ )	$3,07 \cdot 10^7$
$U_{1a}$ (V)	0,05
$I_{1a}$ (A)	$-4,303 \cdot 10^{-8}$
$U_{2a}$ (V)	0,4
$I_{2a}$ (A)	$-3,20 \cdot 10^{-8}$
$dR_a$ ( $\Omega$ )	$3,18 \cdot 10^7$

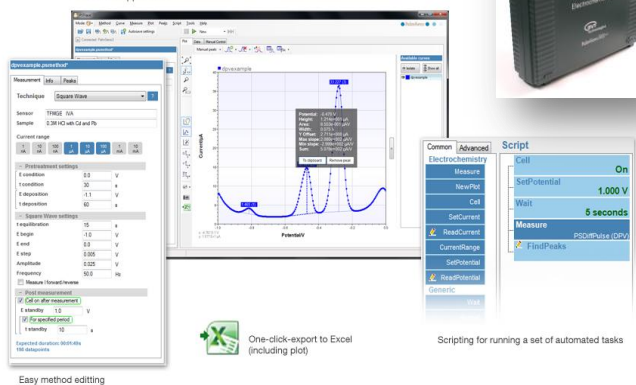
# Starter kit for Electrochemistry (SK4E)

## The kit consists of:

- **EmStat Blue** (potentiostat with integrated Bluetooth) or **PalmSens 3 EIS**
- **TC4 cell** (a glass cell with 5 openings) with **3 stoppers** (for the glass cell)
- **stirrer ST1** (controlled via the PalmSens3 EIS, designed for TC4)
- **BVT classic electrodes** or **screen printed electrodes (with connector)**



Three dedicated program modes for different applications



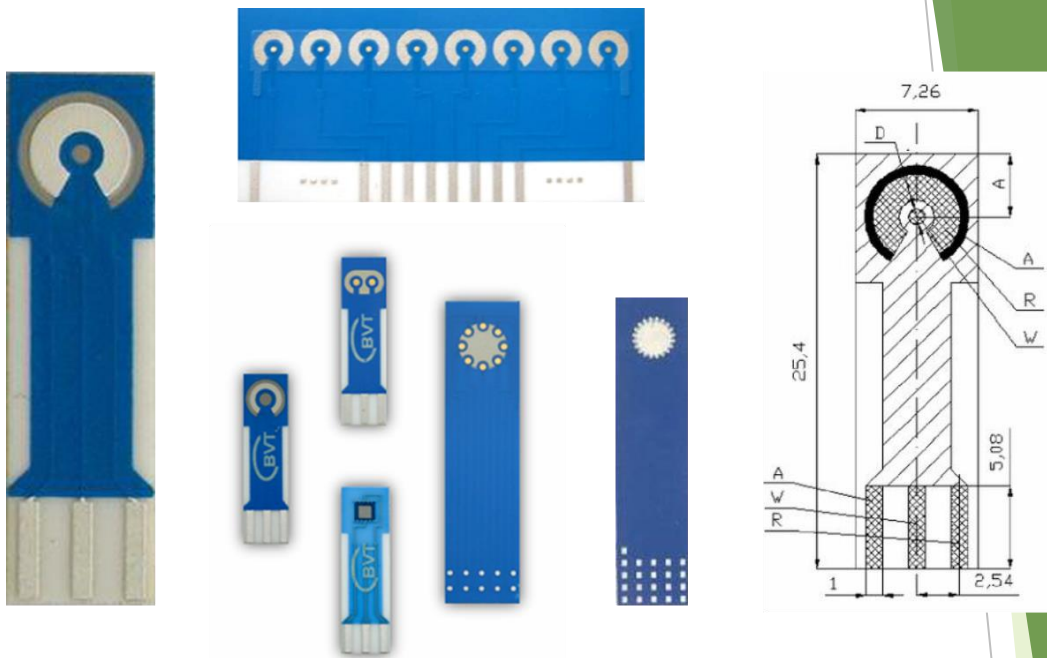
One-click-export to Excel (including plot)

Scripting for running a set of automated tasks

With this set of electrochemical equipment all you need to start your electrochemical experiments are chemicals and solutions. With the functional, convenient and high quality equipment of BVT and the portable, economical and easy to use research grade potentiostats of PalmSens, SK4E enables you to carry out many education and practical electrochemical measurements.



# ELECTROCHEMICAL SENSORS



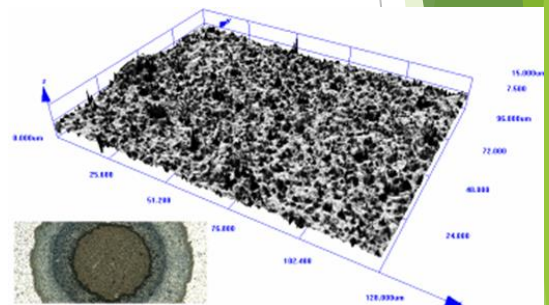
Basic ordering formula:  
ACn.W\*.R\*\*

## DIFFERENT MATERIALS ON WE

We can offer you not only - Au/Pt, Au, Pt, Ag, C but Ni, Cu, and other materials in 1 or 2 mm diameter of WE as well

## BIOSENSORS

We can offer you sensor with immobilized AChE (for detection of organophosphorous and carbamate pesticides, toxic and neurotoxic gases,...), GOD (for glucose measurements), LOC (for lactate measurement)

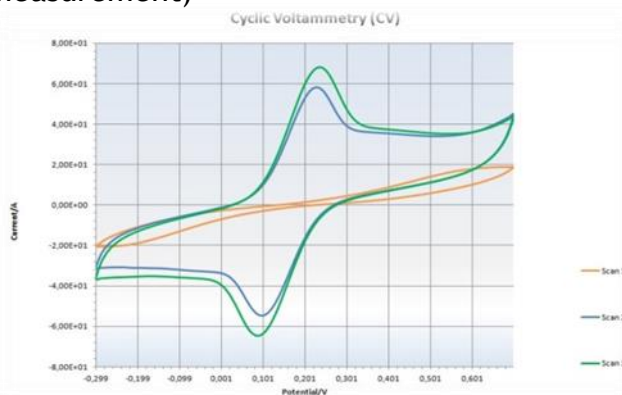


## Usage in measurement of:

- Basic electrochemical and bioelectrochemical techniques ( $H_2O_2$ ;  $Fe(CN)_6/Fe(CN)_6$ ...)
- Glucose
- Toxicity caused by pesticides
- Enzyme activity
- Ferro - Ferricyanide couple

## HIGH-PURITY MATERIAL ON WE

We can provide polished working electrode - AC1P or insert a high-purity material on WE (99.9% or better). The WE can be applied by sputtering.



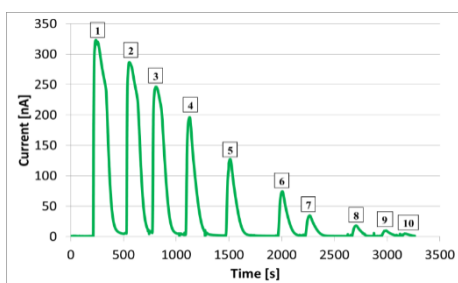
# Amperometric sensor with Glucose Oxidase - AC1.GOD

Glucose Oxidase (GOD) from *Aspergillus Niger* is immobilized on the active surface of electrochemical sensor AC1.W2.RS. The diameter of the immobilized bioactive membrane is 2 mm and the mean applied activity is 1 unit/mm<sup>2</sup>. The sensor is used for measurement of glucose concentration. ([www.bvt.cz](http://www.bvt.cz) - [Long term stability of GOD sensor](#))

Dimensions: 25.4 x 7.26 x 0.63 mm, WE material: Pt  
Enzymatic membrane containing cca 1 IU of GOD enzyme which is immobilized on the working electrode surface.

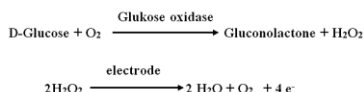
Unit definition: Glucose Oxidase from *Aspergillus Niger*: •GOD •β-D-Glucose: oxygen 1-oxidoreductase

•Sigma - type X-S •One unit will oxidize 1.0 μmole of β-D-glucose to D-gluconolactone and H<sub>2</sub>O<sub>2</sub> per min at pH = 5.1 at 35°C, equivalent to an O<sub>2</sub> uptake of 22.4 μl per min.



Number of response	Concentration of glucose [mmol/l]
1	10
2	5
3	2,5
4	1
5	0,5
6	0,25
7	0,1
8	0,05
9	0,025
10	0,01

### Reactions



Glucose sensors are delivered, in standard conditions, in dry state. It increases their storability to up to several years. The dry glucose sensor needs to stabilize its response which takes 1 - 5 hours in normal conditions. The stability of enzyme in wet conditions is significantly lower.

The sensors can be also delivered with integrated flow cell. They are calibrated, stabilized with buffer. Such sensor are immediately prepared for use. The verification of the function and stability of prefilled glucose sensor “in vitro” is described in poster.

([http://www.bvt.cz/\\_ftp/Poster%20Long%20term%20stability%20GOD\\_moc.pdf](http://www.bvt.cz/_ftp/Poster%20Long%20term%20stability%20GOD_moc.pdf))

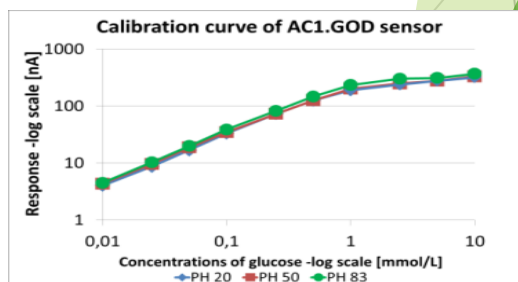
### Example of measurement:

#### Equipment for the example of measurement:

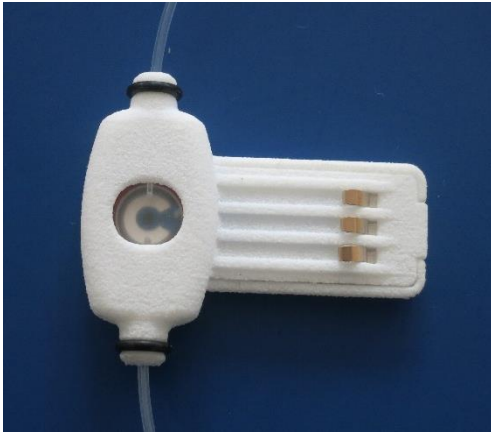
- ✓ FC2/FC4 with AC1.GOD sensor
- ✓ Linear Pump (Argus 606 S)
- ✓ Injection valve Pharmacia V7
- ✓ PalmSens potentiostat

### Universal use:

- Batch analysis - biosensor with connector KA1C loaded into glass cell TC4, TC6, etc.
- Flow analysis - biosensor inserted into flow cell FC2 or FC4.

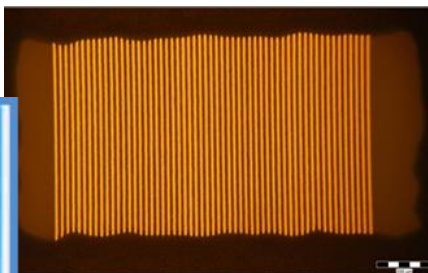


# New glucose sensors



## Sputtering electrochemical sensors - WSP

The sensors are formed on a corundum polished ceramic base. On to this surface working electrodes are applied by sputtering. The working electrodes are made of gold. It is connected with the active part by the silver conducting paths which are covered by a dielectric protection layer. A bio-chemically active substance can be applied on the working electrodes of the sensor.



Thickness of lines:  $20\ \mu\text{m}$   
Gap between lines:  $20\ \mu\text{m}$



### Reference:

Tomas Bertok, Erika Dosekova, Stefan Belicky, Alena Holazova, Lenka Lorencova, 5 Danica Mislovicova, Darina Paprckova, Alica Vikartovska, Robert Plicka, Jan Krejci, Marketa Ilcikova, Peter Kasak, Jan Tkac. Mixed Zwitterion-Based Self-Assembled Monolayer Interface for 2 Impedimetric Glycomic Analyses of Human IgG Samples in an Array 3 Format, Langmuir, 2015



# ALGATOX

**AlgaTox** (utility model no. 27636, patent no. 305687) is a device used to indicate environmental pollution through a measurements of oxygen production decline in freshwater algae. The device enables the implementation of certified methods - determination of toxicity of freshwater algae (IBSN)

The test determines the actual activity of the toxic substances that can act on the algae.

- ❖ Reaction vessel (optimal sample volume 5 ml)
- ❖ Minithermostat (- 10 °C ... 60 °C)
- ❖ Stirrer with speed control
- ❖ Changeable mixing cones.
- ❖ Stoppers for closing the reaction vessel
- ❖ Oxygen electrode
- ❖ Aeration pump
- ❖ Stoppers gas supply
- ❖ LED + switching relay
- ❖ Power adapter
- ❖ Potentiostat



Special accessories for routine determination of toxicity, for algae research, for development of new methodologies for measurement of toxicity and activity of substances, and for measuring the biological activity:

- 1) Photometr - measuring the light level inside the reaction vessel
- 2) External thermometer Pt1000 Ni 1000 - measuring temperature inside the reaction vessel.
- 3) The washer air - saturation standard atmospheric moisture.
- 4) KA1C. \* connector for sensors - measurement with the biosensor with immobilized enzymes.
- 5) Extension for shaker - sequential measurement



## BENEFITS OF ALGATOX

- ✓ The test allows for **detection of chemical agents** on the environment. Including those for which no classical analysis is methodically mastered, but a common feature is the toxic effect on sensitive organism.
- ✓ Biotest is based on the measurement of oxygen consumption via **AlgaTox** allows in principle to achieve a higher reproducibility because stable conditions can be maintained throughout the experiment. As is known, the mechanism of inhibition can be determined by the concentration of inhibitor. Ecotoxicological algal test according to ISO 8692 is an established method that is effective as a means of determining the toxicity of the sample. Its disadvantage is its duration, which is at least 72 hours. It depends on the skill of experimental users and laboratory conditions.
- ✓ The device works fully automatically.



# Measuring principle

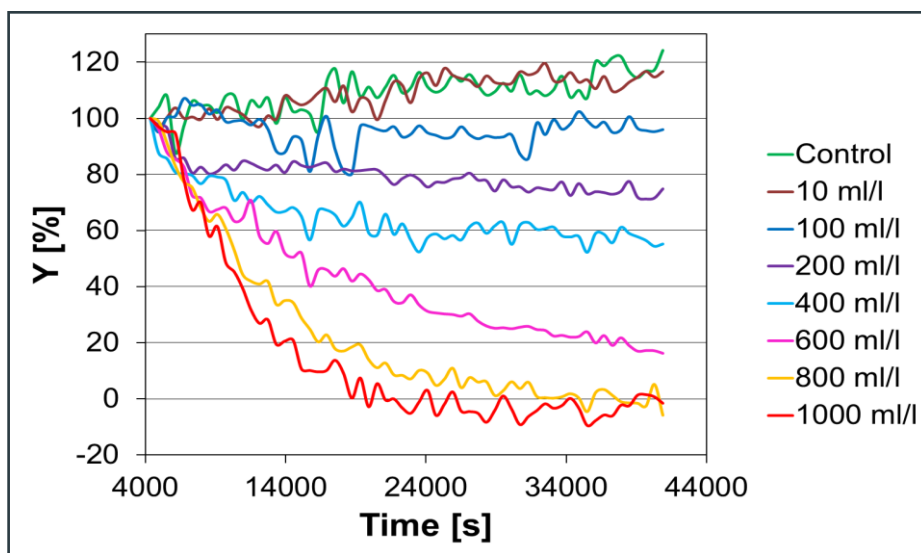
The measurement is based on the extraordinary sensitivity of BVT oxygen measurement. It allows to determine the changes of oxygen in the range of 0.1 - 1% of saturated equilibrium concentration. This enables to measure small changes in O<sub>2</sub> concentration caused by its productions and to determine which substances are inhibiting photosynthesis.

## Example of measurement

It is used for measuring the algae *Desmodesmus quadricauda* strain GREIFSWALD / 15 CCALA Trebon. Three days before the measurement is started preculture shaking algae in Simmer ½ - Šetlík medium at  $24 \pm 1$  ° C and lighting 6000 - 7000 lux. Optimal cell density for measurement algae 700,000 - 1,300,000 cells / ml. Algae are centrifuged (3000 rev / min, 5 minutes - depending on the type of centrifuge) and the supernatant is decanted. To the reaction vial 5 ml of extraction solution in the selected concentration is added, and a quantity of the concentrated algal cell density so that the container was in the range of 700,000 cells / ml - 1500000 cells / ml. The suspension is left for 15 minutes. The suspension is stirred and tempered to the desired temperature and then the measurement is triggered. After stabilizing the concentration of oxygen (ca. 1000s - 2000s) the light cycle starts.

Results of 12-hour measurements show the system's ability to detect even relatively good growth of algae. Sensitivity values below the EC50 for a classic algal test, but with careful measurements can reliably capture concentrations 10 times higher than the corresponding EC50 for algal test.

The device works fully automatically. 12 hours of measurement in the automatic mode is very efficient. The sample can be run at the end of normal working shifts (approximately 15-17 hours). As a sample can be used in the material being processed in the current inning. The next morning prior to starting the shift results are known. This is the most significant contribution of the AlgaTox device. Results of classic algal test are obtained after at least 72 hours. However, given the added administrative and overhead activities (transportation of samples, repeat measurement in the proper dilution) often fail to get results sooner than 1-2 weeks.



**Results of water leachate measurements by the AlgaTox device**

(Y = relative decrease of oxygen produced by algae during measurement referenced to oxygen production by algae at the beginning of the measurement).

# ELECTROCHEMICAL SENSORS

## MEASUREMENT OF SMALL VOLUMES

We offer you **AC1 with integrated microreactor (MAC)** for measurements of volumes of 20  $\mu\text{l}$  in a closed system

- SENSOR with microreactor
- patent applications PV 2009-22
- small volume and reactor size means that the diffusion can assure equilibrium of concentration in the solution
- when using toxic materials there is minimum contamination risk
- the volume is not changed during measurement by evaporation (the system can be closed)
- it allows to mix its content by shaking

## CONDUCTOMETRIC SENSORS

CC1 - the band 150  $\mu\text{m}$ , the gap 200  $\mu\text{m}$

CC2 - the band 50  $\mu\text{m}$ , the gap 50  $\mu\text{m}$

CC3 - the band 20  $\mu\text{m}$ , the gap 20  $\mu\text{m}$

## TEMPERATURE SENSING INTEGRATION

All sensors can be equipped with heating and temperature sensing element

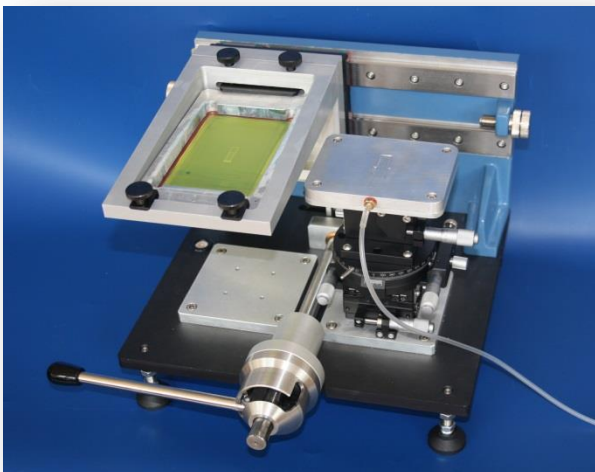
**Thermistor** (must be calibrated) x **Pt 1000**  
(response in agreement of ISO)

## DIFFERENT TYPE OF STRUCTURE OR DIMENSION

We can produce sensors according to your demands.

# YOUR OWN SENSOR MODIFICATIONS

## Manual Screen Printer



X axis adjustment 0...10 mm resolution 10  $\mu\text{m}$   
Y axis adjustment 0...10 mm resolution 10  $\mu\text{m}$   
Angle adjustment 0...360° fine angle adjustment 0... 15° resolution 1°  
Height adjustment 0...10 mm resolution 10  $\mu\text{m}$   
Repeatability of position adjustment 10  $\mu\text{m}$   
Dimensions: 350 x 250 x 300

Clamping vacuum table for AC1 customer design  
Screen and squeegee

We offer **training in the device use.**



# How to prepare your own sensor?

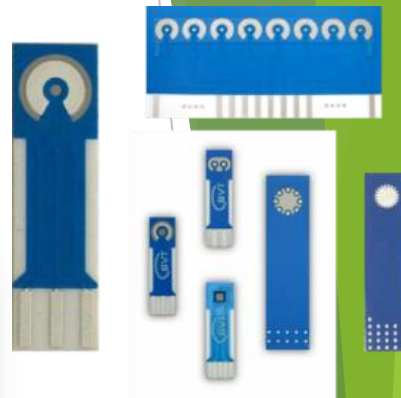
Ceramic



Paste



Screen

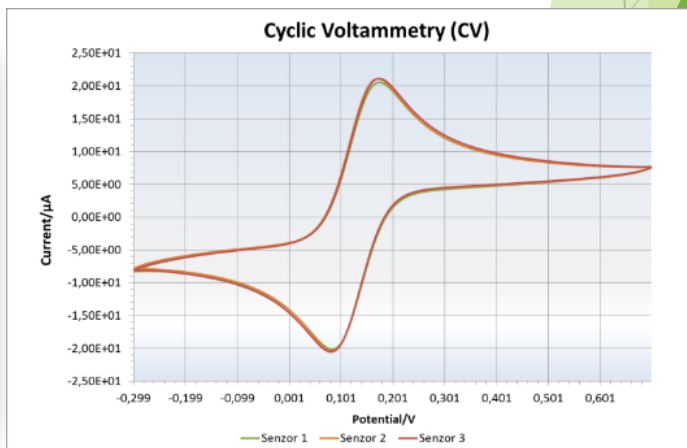
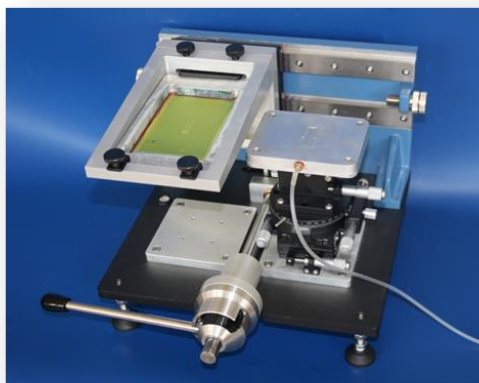


X axis adjustment 0...10 mm resolution 10  $\mu$ m  
Y axis adjustment 0...10 mm resolution 10 $\mu$ m  
Angle adjustment 0...360° fine angle adjustment 0... 15° resolution 1°  
Height adjustment 0...10 mm resolution 10 $\mu$ m  
Repeatability of position adjustment 10  $\mu$ m  
Dimensions: 350 x 250 x 300

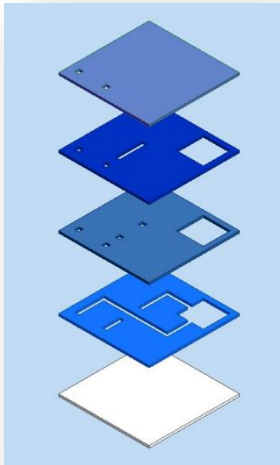
**Manual screen printer (MSP)** consists of MSP device with clamping vacuum table for AC1 customer design, screen and squeegee. Additional accessories are substrate (ceramic), pastes, detergents, screens....

We can prepare a price offer, help with device arrangements or suggest the products on your demand.

We offer training in the device use.



# 3D TFT New dimension of screen printing

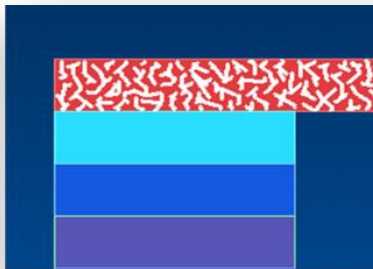
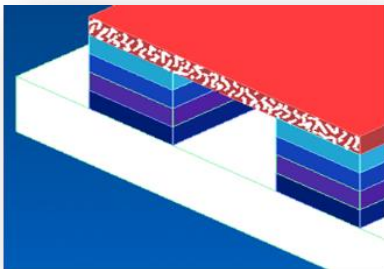


## Optimum structures for 3D -TFT

- Characteristic width 500 - 100 microns
- Characteristic height 10 - 500 microns
- The device function does not depend on wall surface quality

## Optimum structures for other technologies

- Characteristic width less than 20 microns
- Characteristic height less than 10 microns
- The device function depends on wall surface quality

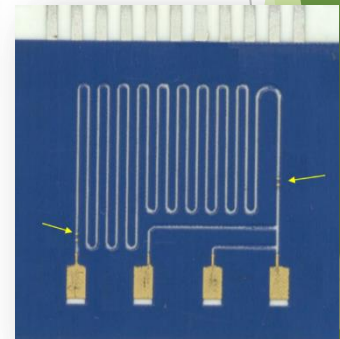


## Channel preparation

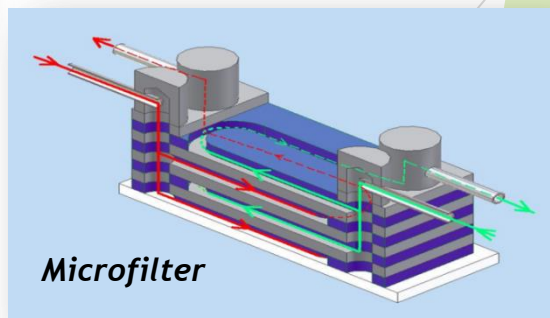
The structure of the supporting membrane ensures that the paste material penetrates to the membrane



**Oxygen electrode** - The internal space is filled by an internal electrolyte. Small windows within the membrane enable oxygen diffusion to get to the working electrode.



**Capillary Electrophoresis (Article: [http://www.bvt.cz/\\_ftp/Versatile%20tools.PDF](http://www.bvt.cz/_ftp/Versatile%20tools.PDF))**



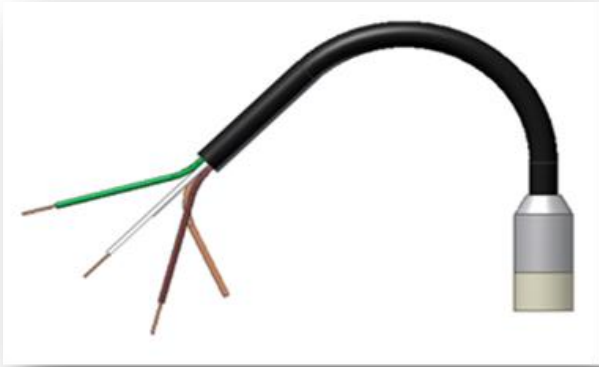
**Microfilter**

Contact us for more information  
E-mail: [info@bvt.cz](mailto:info@bvt.cz) – for ordering  
and information about goods  
[consultancy@bvt.cz](mailto:consultancy@bvt.cz) – for projects,  
research and development  
Visit us on the webpage [www.bvt.cz](http://www.bvt.cz)  
Follow us on FaceBook

# CONNECTORS

## SIMPLE CONNECTOR FOR ELECTROCHEMICAL SENSORS

The connector enables the use of the biosensor based on the substrates AC1, AC4, AC11, AC13, AP1, CC1, CC2 and TS1 in glass BVT vessels TC2, TC3, TC4, TC5 and TC6.



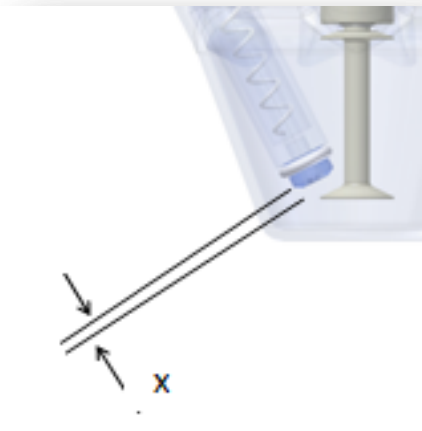
KA1S.\*



KA1C.\*

# STIRRER

- optimum mass transport
- minimum hydrodynamic noise
- supply voltage 3 V and current max 100 mA
- possible to use it as USB device.
- revolutions range: 100 - 1000 rpm



# CLASSIC ELECTRODES

The Working, Auxiliary and Reference (counter) electrodes are electrodes used in a three electrode electrochemical system for voltammetric analysis.

All electrodes are equipped with NJ 10/8 which enables their use in standard chemical apparatuses. All electrodes are in size approx 40 x  $\varnothing$  6 mm. Their reduced size enables to use small amount of chemicals.



**WCE** is a glass rod with a Pt or Au wire inside. The electrode ends with polished active surface of 1 or 2 mm<sup>2</sup>.

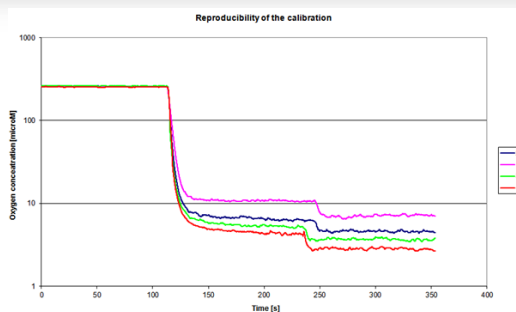
**ACE** is a glass rod with platinum wire or foil at the end.

**RCE** is a glass hollow tube with silver or silver covered by silver/silver chloride wire inside. Glass frit is at the end of electrode creating liquid junction. The tube is hollow with the hole in the wall for inserting KCl solution. Hole is covered by a rubber band.

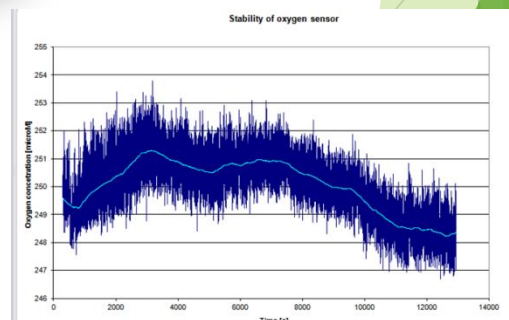
## Miniature Oxygen Electrode



The miniature oxygen electrode consists of a chemically resistant PEEK body, platinum electrode, silver reference electrode and membrane holder. The platinum electrode is encased in glass. The membrane holder with electrolyte is attached by thread. Oxygen electrode (OE) is designed for mounting in side opening NJ 10/8 of electrochemical glass cells (TC4, TC5, TC6).



Response



Long term stability

# ISE and pH Electrodes

**ISE electrodes** allow direct measurements of Ammonium, Lithium, Sodium, Calcium, Fluoride, Nitrate, Potassium and Barium. They are produced in standard dimensions: diameter 12 mm, length 100 mm.

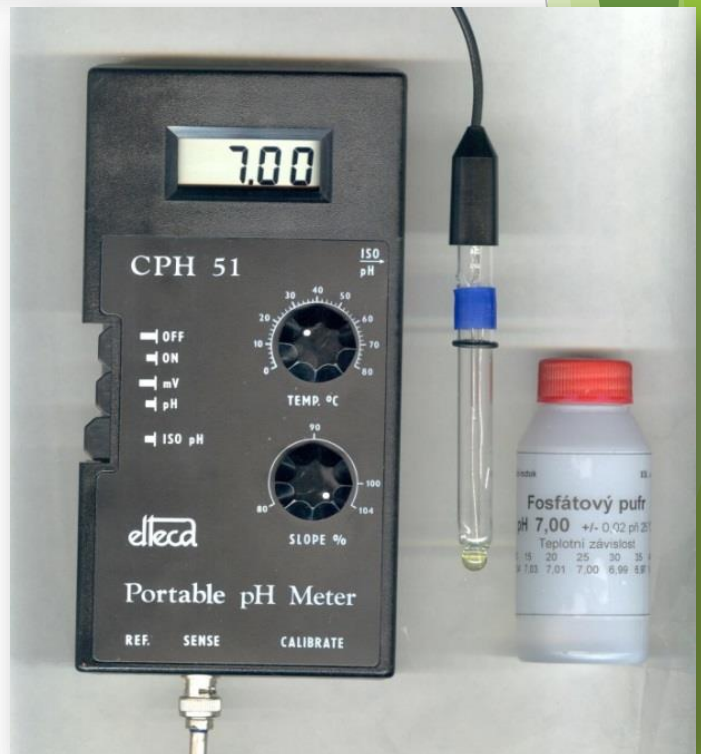
ISEs enable routine analysis in agriculture and food process, soil analysis, environmental analysis, tribotechnical analysis and explosives and pyrotechnical mixtures analysis. They can be used for water, pot-, waste-, boiler-, mineral-, and well water samples, They can be applied in research laboratories, biochemical process control, chemistry and other educational laboratories, and many others.



Electrodes are applicable to all commonly used measuring apparatuses, with internal resistance above  $10^9 - 10^{12}\Omega$ . Coaxial cable with BNC connector. The work with ion selective electrodes is time effective, requires only a small amount of chemicals, therefore, it is cost-effective. Standard cable length of Ion Selective electrode is 1.5 m

**pH Electrodes** are traditionally, for nearly a century, successfully used sensors for potentiometric determination of  $H^+$ , respective  $H_3O^+$  activity, expressed in commonly used pH units. These measurements are, perhaps, done in all fields of research, development, process, and in other human activities.

Electrodes are applicable to all common measuring apparatus with inner resistance of  $10^9 \Omega$  or more. Standard electrical connecting element is 0,8 to 1 mt. coaxial cable, specially low noise, with BNC connector.



# GLASS CELLS

Hand made glass cells for electrochemical measurements which enables measurements with miniaturised BVT classical electrodes. The cells have a lid with **NJ openings (NJ 10/8, NJ 12/10)** - kontrola to fix electrodes, stirrer or co in the cell.



## Types of glass cells:

TC2, TC3 - thermostated by external thermostat

TC4 - conic openings, thermostated by MT1

TC5 - conic openings, thermostated by external thermostat

TC6 - conic openings, easily washable



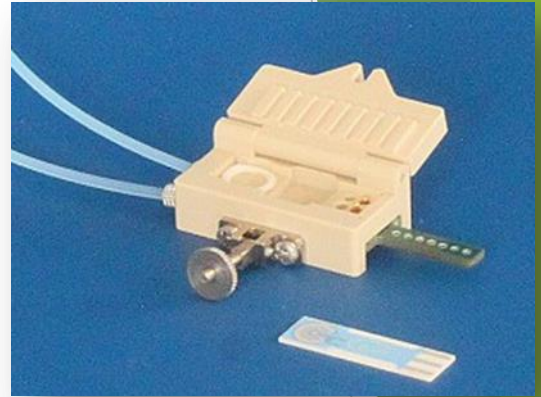
## NEW TYPES OF STOPPERS

for prevention of solution evaporation, for bubbling, for dosing by tubes or for measurements in an inert atmosphere.



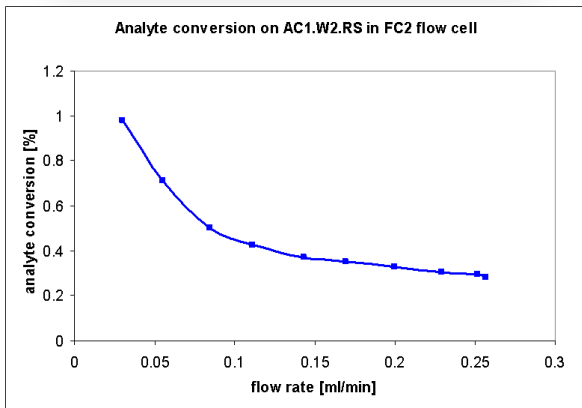
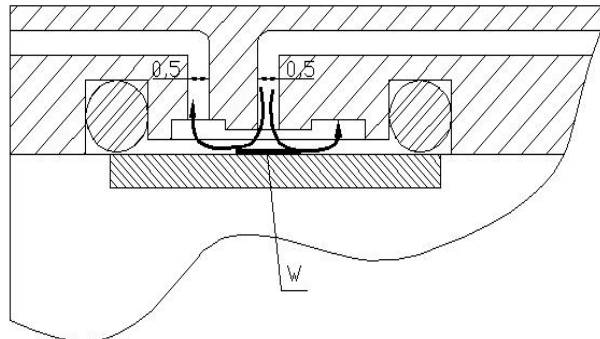
# FLOW CELLS

The flow cell enables the use of AC1, AP1, CC1 sensor in a flow through arrangement. The sensor is inserted into the slit of cell and tightened by closing of the door. The cell ensures the wall-jet flow around the working electrode and it is optimised so that no air bubbles cumulate in the cell. The cell contains also the contact and output cable.

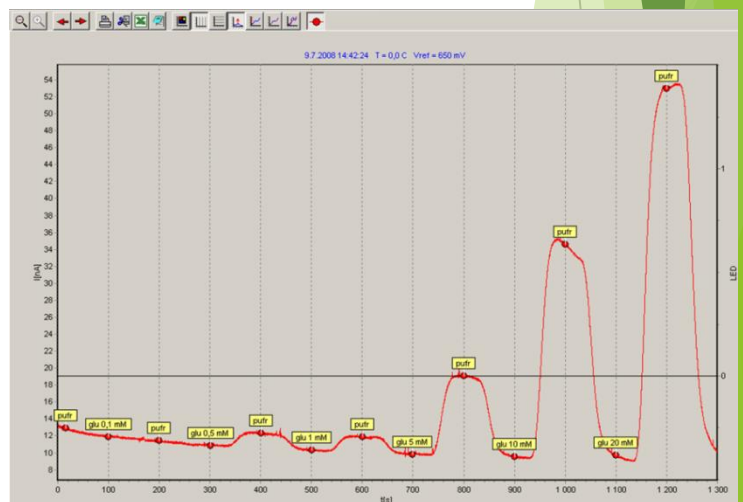


## Cell Material

FC2, FC3 - Polymethylmetacrylate  
FC4 - high quality chemically resistant Polyether ether ketone (PEEK) FC4 - microfluidic connectors permitting a fully compatible connection to chromatography tubing



We also offer special flow cells on demand of customers.



# LINEAR AND PERISTALTIC PUMPS

The **linear pump LP.\*** is designed for extremely **small applications**. It can be used in hand-held devices. The main advantage is **no pulsation** and **easy connection** with syringe piston. The pump can supply liquid through flow cells FC2/FC3.

- ✓ Portable device
- ✓ Hand-held use
- ✓ Low power application
- ✓ Flow rate: 0 - 250  $\mu\text{l}/\text{min}$

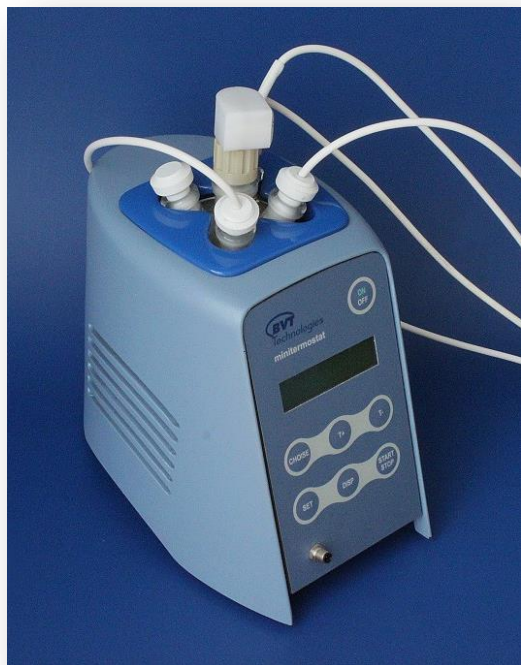


## Peristaltic pumps

- designed for extremely small applications such as medical or military applications
- hand-held device
- supplied by USB connection with PC
- the pulsation is minimized for flow cell FC2, FC4
- tubing with required diameter should be specified by customer: 0,127 mm, 0,254 mm, 0,504 mm, 0,750 mm or 1,016 mm

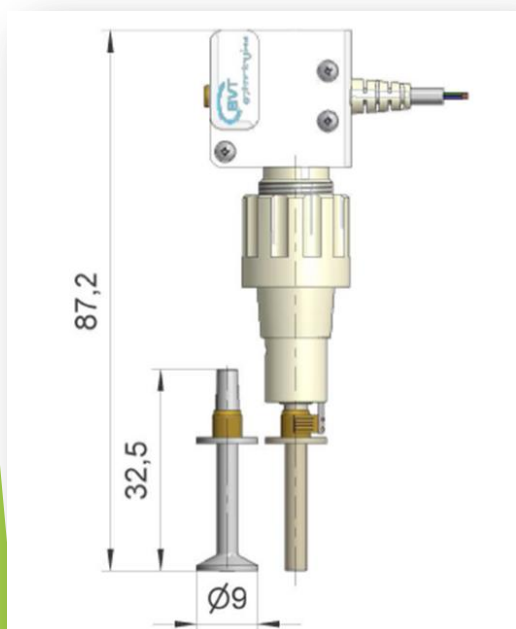


# Minithermostat



- allows temperature control in range: -9,9°C and max. temperature: 59,9 °C
- technical parameters
- supply: 12V
- for TC4, TC6

# Mini Rotating Disc Electrode



- optimum mass transport
- minimum hydrodynamic noise
- consists of TC4 glass cell, control electronics and SW
- enable to use it as USB device
- revolutions range: **10 - 1300** rpm

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# Training



We offer training activities which can help you in your practice measurements.

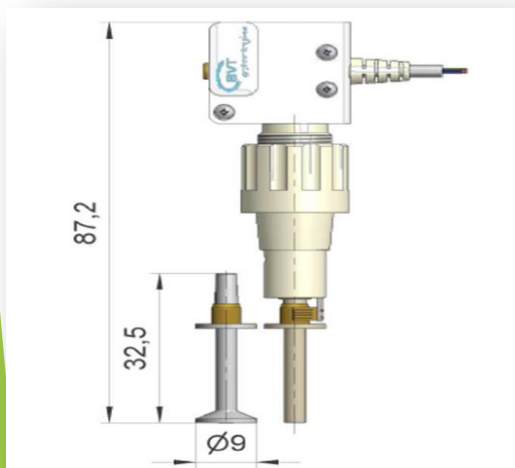
1. The measurement in classical arrangement. Difference between evaluation electronics. The phenomena which influences the measurement results.
2. The measurement with sensor - batch experiments
3. The measurement with sensors - flow through experiments
4. The measurement of H<sub>2</sub>O<sub>2</sub> and glucose
5. The batch measurement of enzyme activity (glucose oxidase). In fact the enzyme activity measurement is a base of immunoassay.

Theory

1. Basic principle of electrochemical measurement, diffusion, cell resistance influence
2. Cottrell equation
3. Cyclic voltammetry

## Rheodyne switch USB cable

- optimum mass transport
- minimum hydrodynamic noise
- consists of TC4 glass cell, control electronics and SW
- enable to use it as USB device
- revolutions range: **10 - 1300** rpm

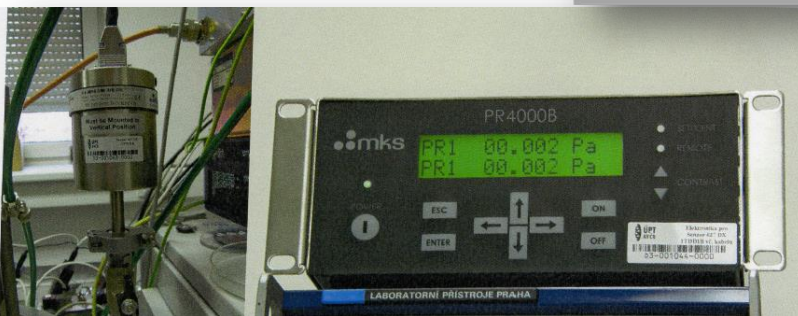
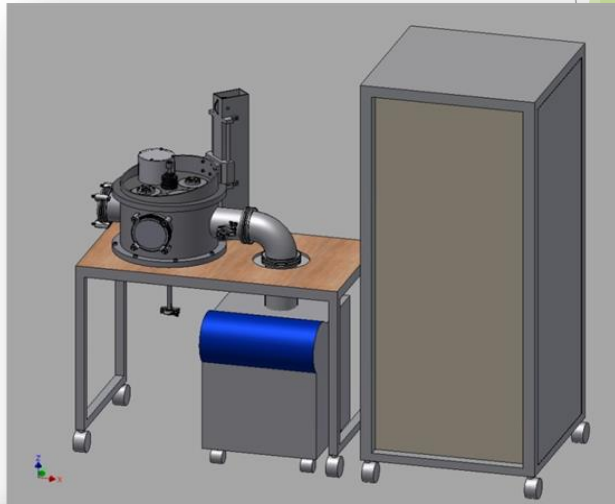


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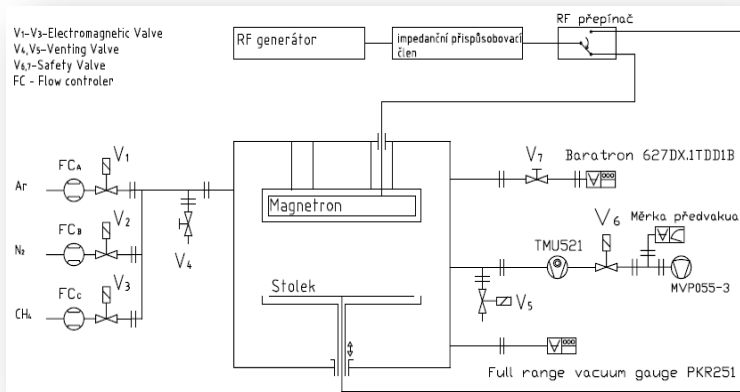
# Sputtering chamber

- ✓ Deposition of doped DLC coatings on sensors in a stationary mode with homogeneous layers on the surface with a diameter of 50 mm.
- ✓ Sensor holder located in masks with a minimum diameter of 100 mm, allowing high-frequency plasma cleaning.
- ✓ Sensor holder must be height-adjustable.
- ✓ Four sputtering positions.
- ✓ Resolves the rapid exchange of polluted areas around the magnetron.
- ✓ Incorporation of the window for visual inspection of the discharge during the deposition and plasma cleaning.
- ✓ Pumping system consisting of a turbomolecular vacuum pump 521 TSU Pfeiffer.
- ✓ Accurate and stable membrane process pressure sensor by MKS Instruments
- ✓ The standard Pirani pressure sensor for measuring the pre-vacuum.
- ✓ Penning pressure sensor for monitoring the vacuum background
- ✓ High-frequency generator Cesar AE 136 max. 300W, 13.56 MHz with an adaptation member
- ✓ Gas flow control through mass flowmeter
- ✓ Process controlled from PC - Labview
- ✓ Limit pressure  $5 \times 10^{-5}$  Pa

*The overall system concept*

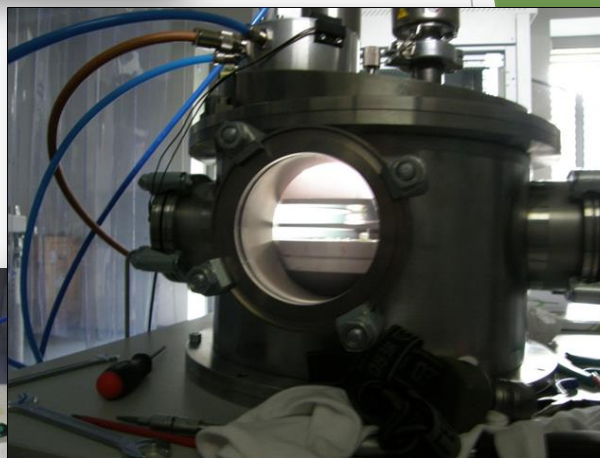


*Measuring the pressure inside the chamber*

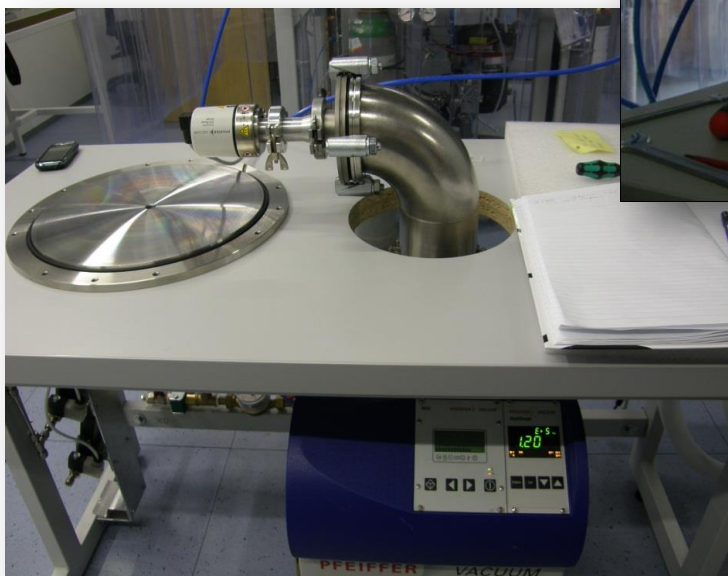


The chamber with accessory

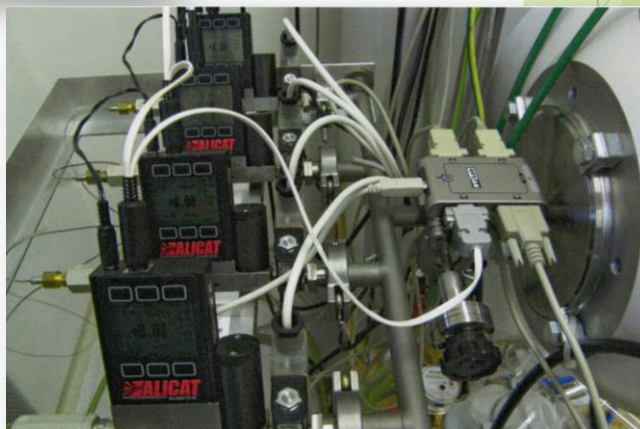
Block diagram of the apparatus



Pumping system (Pfeiffer TSU521 Turbocube)



Gas flow measurement



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