



## Set-up for automatic measurements of volume/mass flow through membranes

Marek Staniszewski and Stanisław Koter

Nicolaus Copernicus University  
Faculty of Chemistry  
Gagarin St. 7  
87-100 Toruń  
Poland

volume flow, automatic measurements, membrane characteristic

### 1. Set-up and software

The flows ranging from 1  $\mu\text{L/h}$  to above 1 L/h can be measured in the systems presented (the working membrane area 2  $\text{cm}^2$ ). Each measurement system is controlled by a computer with a software. The computer programs for the automated measurement of:

- osmotic and electroosmotic volume flows,
- osmotic pressure,
- volume or mass flow driven by the hydrodynamic pressure

have been written in Dephi programming language. The programs run in Windows 3.1/95/98 operating systems.

### 2. The measurement of osmotic and electroosmotic volume flows

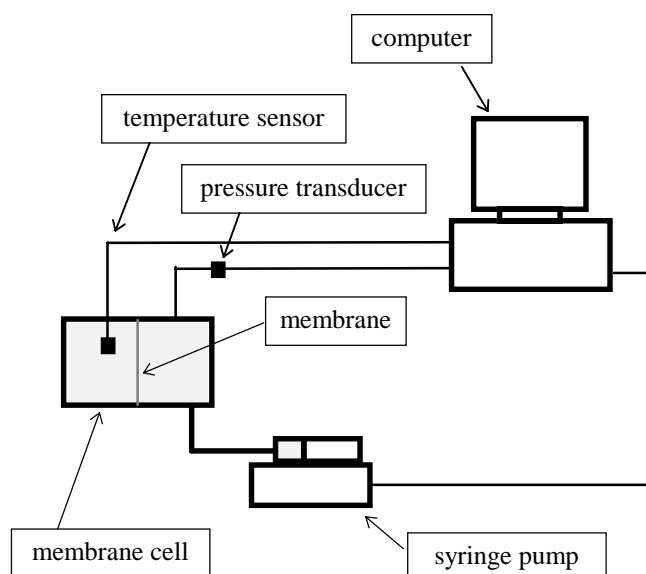


Fig. 1. Experimental set-up for measuring osmotic and electroosmotic volume flows; in the case of electroosmotic experiment the membrane cell is equipped with the electrodes (e.g. Ag/AgCl)

## Software

The functions of the program Flometer 1.8™ for the measuring of volume flow accessed from main menu of program (Fig. 2) are listed below.

Measure (Fig 2) - start measure, save results to file, view current readings.

Options - setting the sampling interval, time interval for record, rate units, mode of operation of pump (infusion/withdrawal), pumping rate, rate units, volume change in one step, parameters for calibration of temperature sensor.

Hardware - select communication port and baud rate for syringe pump, syringe diameter and capacity, address and channels for accessing A/D card.

View - plot, compare and print saved results.

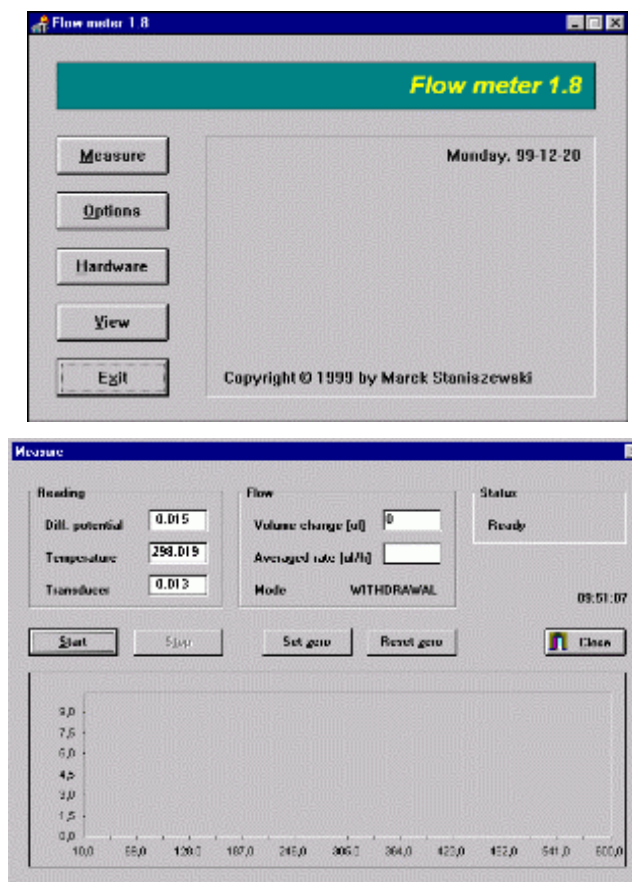


Fig. 2. Main window and the measuring window of the Flometer 1.8 program

## 3. The measurement of osmotic pressure

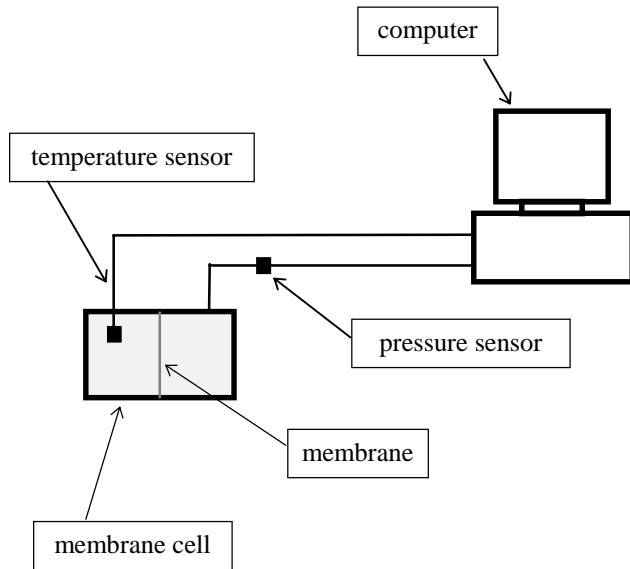


Fig.3. Experimental set-up for measuring osmotic pressure

### Software

The functions of the program Osmometer 1.0™ for the measuring of volume flow accessed from main menu of program (Fig. 4) are listed below.

Measure (Fig 4) - start measure, save results to file, view current readings.

Options - setting the sampling interval, time interval for record, parameters for calibration of pressure and temperature sensor.

Hardware - address and channels for accessing A/D card.

View - plot, compare and print saved results.

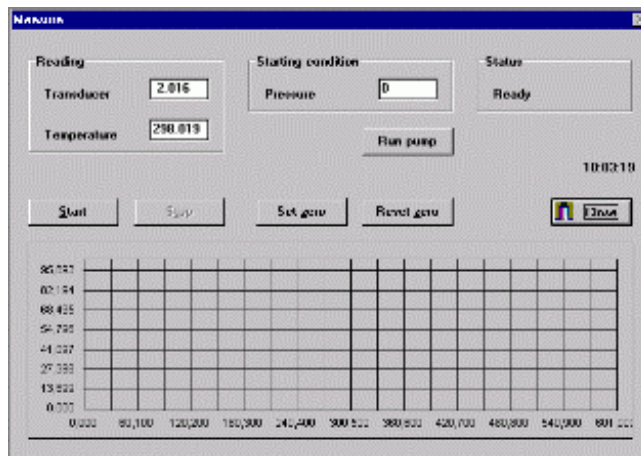
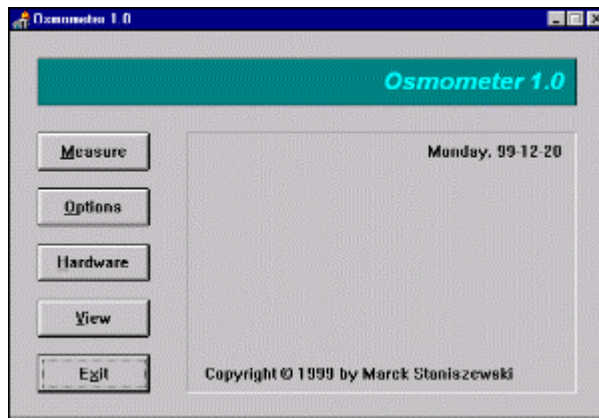


Fig. 4. Main window and the measuring window of the Osmometer 1.0 program

#### 4. The measurement of pressure driven volume flow

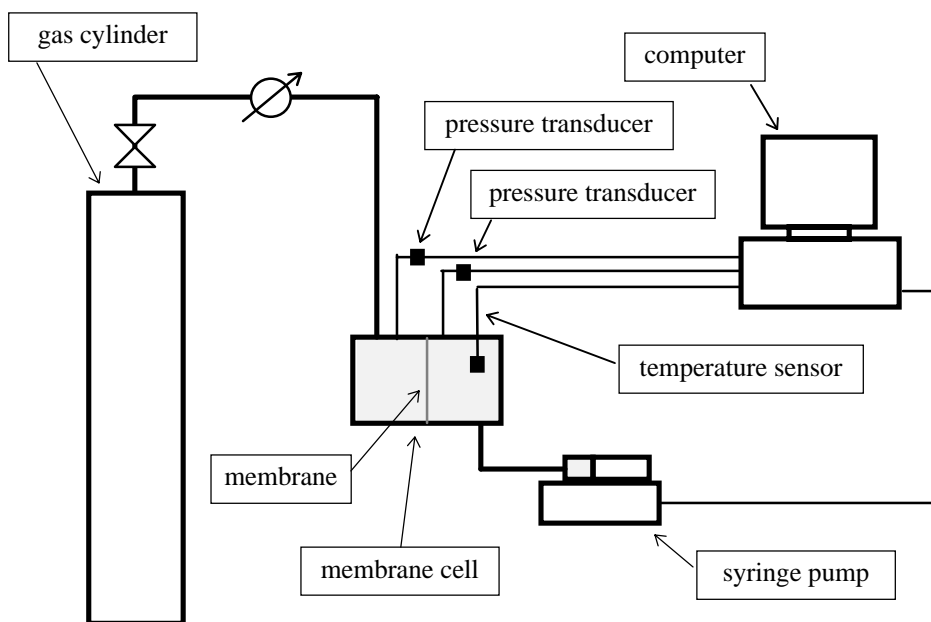


Fig. 5. Experimental set-up for measuring pressure driven volume flow

## Software

The functions of the program Flometer 1.0P™ for the measuring of volume flow accessed from main menu of program (Fig. 6) are listed below.

Measure (Fig 6) - start measure, save results to file, view current readings.

Options - setting the sampling interval, time interval for record, pumping rate, rate units, volume change in one step.

Hardware - select communication port and baud rate for syringe pump, syringe diameter and capacity, address and channels for accessing A/D card, parameters for calibration of pressure and temperature sensor.

View - plot, compare and print saved results.

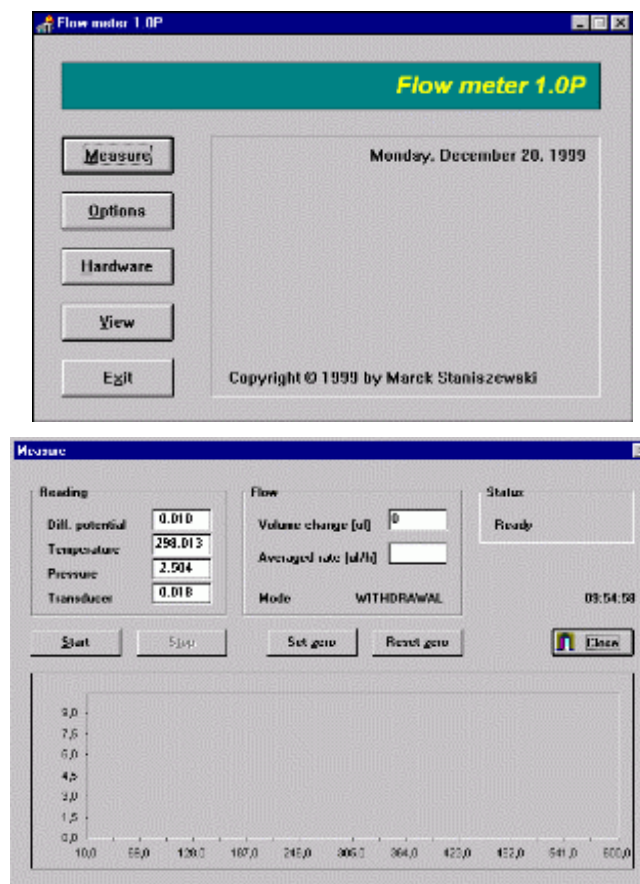


Fig. 6. Main window and the measuring window of the Flometer 1.0P program

## 5. The measurement of pressure driven mass flow

## Software

The functions of the program Flometer 1.0M™ for the measuring of volume flow accessed from main menu of program (Fig. 8) are listed below.

Measure (Fig. 8) - start measure, save results to file, view current readings.

Options - setting the sampling interval, time interval for record, rate units.

Hardware - select communication port and baud rate for balance, address and channels for accessing A/D card.

View - plot, compare and print saved results.

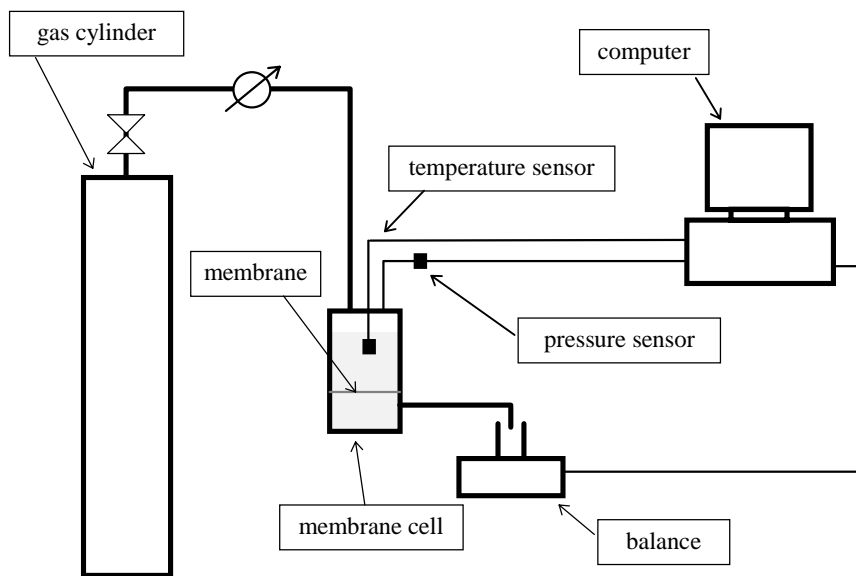


Fig. 7. Experimental set-up for measuring pressure driven mass flow

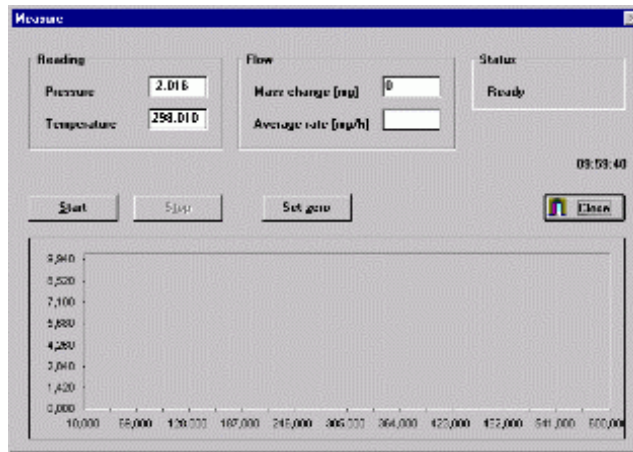
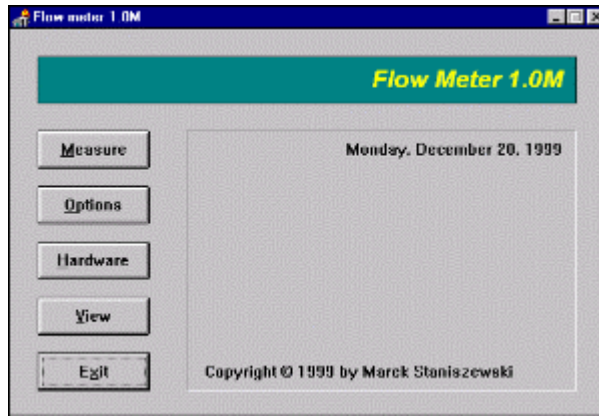


Fig. 8. Main window and the measuring window of the Flometer 1.0M program

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