

TSE  
Technical & Scientific  
Equipment GmbH



# TSE Volume Meter

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## 1. The system

This fully computerized volume meter allows the plethysmometric determination of rodent paw volume (rats & mice). It is also suited for any other solid specimen. In the basic configuration volumes **up to 9.99 ml** can be measured accurately and reproducibly.



After conversion into volume the numeric values are displayed in user-defined units (ml or  $\mu\text{l}$ ). The data can be printed as a protocol. Data files are generated for further statistical evaluation.

## 2. Measuring principle

The volume is measured by immersing object to be measured in a cuvette filled with water.

A highly sensitive pressure transducer is used to measure the **pressure difference** which is caused by the rise of the water column. The analog signal passes through an amplifier on its way to a high-resolution ADC (Analog-Digital Converter) where it is converted into a numerical value. Immersion triggers the measurement automatically. The refilling of the measuring vessel is carried out by computer-switched valves, so that a constant water level is always maintained.

Before the start of each series of measurements a **calibration** must be carried out. This is done by entering a value for the volume on the PC and then immersing the calibrated volume in the measuring vessel. The program determines the conversion factor for the further measurements.

## 3. System components

The system consists of:

- Volume measuring instrument with measuring cuvette,
- PC with built-in interface,
- 3 calibration weights (for 1, 2 and 5ml),
- Connection cable.

## 4. Program start – the main screen

All program files are contained in the directory **WOL** on the hard disk. Start the file **vol.exe**.

### **Status line**

File name

Status            Stop - Measure - Fill - Blocked

Adc(%)           control of the Analog-Digital-Converters (Adc) in %

### **Date/Time**

Automatically provided by the system.

### **Text fields 1- 5**

For identifying the measurement.

## 2 Text fields "Group labels"

The system arranges the measuring data in groups. The groups are identified by these two labels. The label also appears as column heading in the export file.

### Table area

Display of the values during the measurement.

### N=

Shows the number of groups measurements in the currently selected file. A group measurement consists of any number of individual measurements. A series of measurements consists of 1-N group measurements. N=0 means that the file still does not contain any measuring data.

## 5. The menu item "File"



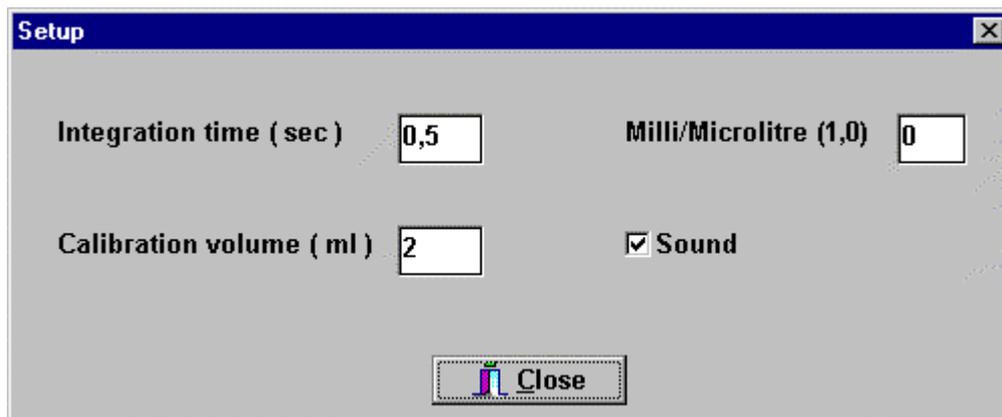
Before the measurement a decision must be made about which file the data of the following measurement are to be stored in.

When the menu item **File** is clicked the window "Open" is opened. This now allows

- a **new file name** to be entered if a new file is to be created, or
- an existing name to be selected. In this case the new measuring data are appended to the data which are already stored in the file.

The files are stored in an internal binary format (.BIN).

## 6. The menu item "Setup"



### Integration time (sec)

Range: **0.1 - 10.0 sec**

This value determines the integration time of the AD converter during the measurement. It should be determined by test measurements with a known volume. A large value slows down the measurement and 'calms down' the display.

### Milli/Microliter

Output of the measured values in milliliters or microliters. 1=milliliter, 0=microliter

### Calibration volume (ml)

Range: **0.1 - 10.0 ml**

Volume used for calibration. 3 calibration volumes – 1, 2 and 5 ml - are included in the system. The calibration volume which should be used for the measurement depends on the required measuring range. It should always be slightly **larger** than the expected maximum measured value.

### Sound

If activated a long sound will indicate when the system is ready for measurement (after automatically refilling the cuvette). A short signal is heard when measurements are accepted.

## 7. Preparing the instrument

### 7.1. Filling in water

The internal storage container is filled via a connection which is accessible from the top of the instrument. A funnel should be used.

Container capacity: **250 ml**.

A few (1-2 drops) of detergent (e.g. dishwashing agent) should be added (in order to reduce the surface tension).

### 7.2. Positioning the cuvette

The measuring cuvette is brought into the measuring position with the aid of the rotary knob on the front panel. When the measurement is finished the cuvette should always be returned to the storage position.

### 7.3. Filling the cuvette



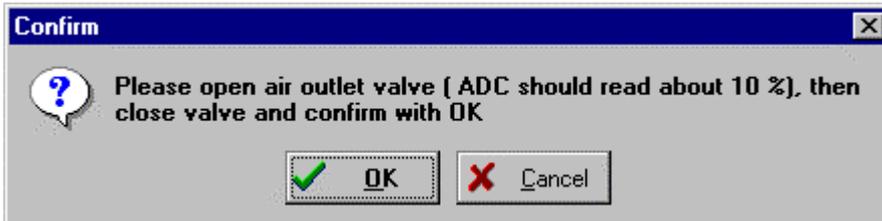
Before a measurement can be started the filling level of the cuvette has to be checked. If necessary, water can be refilled from the internal storage container.

- Select the menu item **Fill**. Make sure that there is sufficient liquid in the storage container.
- Confirm the message with OK.
- The filling procedure now starts.
- When the required level is reached press OK again (Warning! The filling process does not end automatically!)

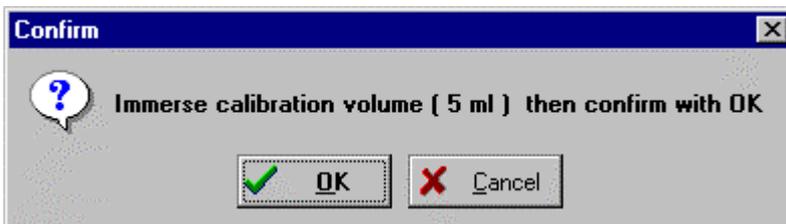
## 8. Calibration

After the program is started a **calibration** must be carried out. This is done by immersing a calibrated volume in the measuring vessel. The program determines the conversion factor for the further measurements.

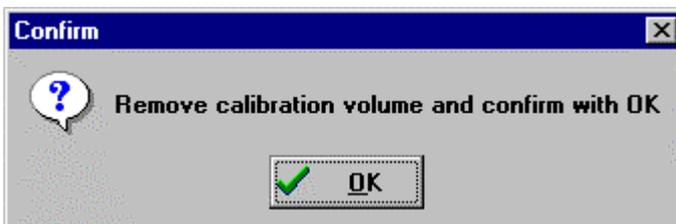
The required calibration volume must previously have been entered under "**Setup**".



- Open the air outlet valve that is mounted on top of the unit
- Wait a couple of seconds in order to ventilate the system
- Close the valve
- Take care that the volume meter is in a vibration-free location. Vibrations will influence the next step (determination of zero value).
- After confirmation with OK the zero value is stored.



- The calibration volume is then immersed in the measuring cuvette. The calibration volume should be completely immersed and remain steady.
- This process is confirmed with OK.
- The system now determines the pressure difference.



- The calibration volume is then removed and the end of the calibration confirmed with OK.

## 9. Performing a measurement

File : TEST3      Measure      Adc % : 26.1

Experiment No.       Date/Time

User       Substance

Comment1       Comment2

Group label             N= 4

824	750	846	831	846					

### 9.1.1. Starting a group measurement

- A measurement is started by activating the menu item **Measurement/Start** or by pressing the function key F2. This clears the table area; the first field is marked with a blue cursor. The system notes the current water level.
- All the subsequent single measurements form a group measurement. It is characterized by the two group labels. A new group only begins when the measurement has been stopped in between.
- Now the animal's paw is immersed into the measuring cuvette. It is recommended that the immersion depth is marked on the glass vessel. Within a single series of measurements the same depth must always be used, as otherwise the measurements would not be comparable.
- An alteration in the ADC value can now be recognized.
- When the value has settled down the volume value is automatically accepted and displayed. A signal will be heard if this has been defined.
- After the measured object has been removed from the cuvette it will be refilled to the original level ("Fill") if necessary. No measurement can be made during this period.

### 9.1.2. Overwriting values

**Incorrect measurements** can be corrected as follows: place the cursor on the value to be overwritten with the mouse or via the keyboard (left/right arrows) and carry out the measurement again.

795	846	790	836	855
780	*859	*785	*846	*871

Corrected measurements are indicated in both the table area and later in the protocol by an asterisk (\*) before the measurement.

### 9.1.3. Ending a group measurement

**Measurement/Stop** (F3) ends the current group measurement. The measuring data are stored in the file. A new group measurement can now be triggered with Start – after altering the group labels if this is necessary.

### 9.1.4. Cancel

**Measurement/Cancel** rejects the **complete group measurement**, i.e. all the values of this measurement are deleted.

## 10. Data Output

### 10.1. The menu item "Table"



#### 10.1.1. Show Table

The measuring values of the loaded file are shown in tabular form on the monitor:

```

Group1  5mg/kg BW  11.02.1999 / 10:06
 750  754  858  775  784  834  789  770
 796  803  760  809  759  855

Group2  10mg/kg BW  11.02.1999 / 10:09
 756  786  864  795  846  790  836  855
 839  788

Group3  15mg/kg BW  11.02.1999 / 10:10
 770  790  808  780  853  784  810  768
 859  785  846

Group4  20mg/kg BW  11.02.1999 / 10:11
 871  811  860  853  753  768  768  813
 753

Group4  20mg/kg BW  11.02.1999 / 10:11
 824  750  846  831  846  838
  
```

#### 10.1.2. Export Table

An export file that can be easily imported into a statistical program for further evaluation is generated here. The file will automatically receive the extension \*.CSV (ASCII format)

The arrangement of the group data in the export file can be altered by the option "Groups in Columns" in the **Table** menu.

If activated the data are arranged in columns:

10 11.02.1999 / 10:06		Peter	XYZ	Control	Females
Group1	Group2	Group3	Group4	Group4	
5mg/kg BW	10mg/kg BW	15mg/kg BW	20mg/kg BW	20mg/kg BW	
11.02.1999 / 10:06	11.02.1999 / 10:09	11.02.1999 / 10:10	11.02.1999 / 10:11	11.02.1999 / 10:11	
	750	756	770	871	824
	754	786	790	811	750
	858	864	808	860	846
	775	795	780	853	831
	784	846	853	753	846
	834	790	784	768	838
	789	836	810	768	
	770	855	768	813	
	796	839	859	753	
	803	788	785		
	760		846		
	809				
	759				
	855				

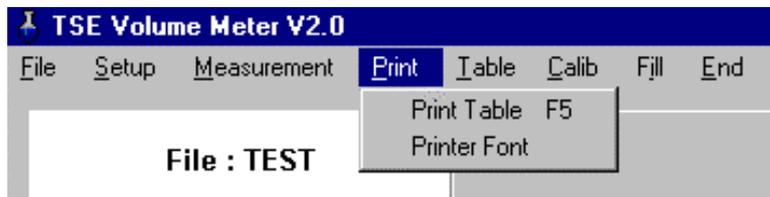
The header lists the experiment number, date and time as well as the descriptive parameters (data of the first measurement).

The two group labels are used as the column headings. Under them the date and time of the particular group measurements are given. The measured values are listed below these.

If the option has **not** been activated the measurements will be arranged **line by line**. The file then has the following format:

10 11.02.1999 / 10:06		Peter	XYZ	Control	Females
Group1	5mg/kg BW	11.02.1999 / 10:06	750	754	858 775 784 834 789 770 796 803 760 809 759 855
Group2	10mg/kg BW	11.02.1999 / 10:09	756	786	864 795 846 790 836 855 839 788
Group3	15mg/kg BW	11.02.1999 / 10:10	770	790	808 780 853 784 810 768 859 785 846
Group4	20mg/kg BW	11.02.1999 / 10:11	871	811	860 853 753 768 768 813 753
Group4	20mg/kg BW	11.02.1999 / 10:11	824	750	846 831 846 838

## 10.2. The protocol – menu item "Print"



### 10.2.1. Print table

All measurements are printed out in the form of a protocol. In addition the number of single measurements in the group, the mean value and the standard deviation will be given. The group labels as well as the date and time head each group measurement. The descriptive parameters appear in the protocol header.

If the descriptive parameters are altered in the main screen after the first measurement then the altered values will be listed before the particular measurement.

### 10.2.2. Printer font

A font with a uniform character width should be selected here (e.g. Courier New).

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