

TSE
Technical & Scientific
Equipment GmbH



TSE Analgesiameter

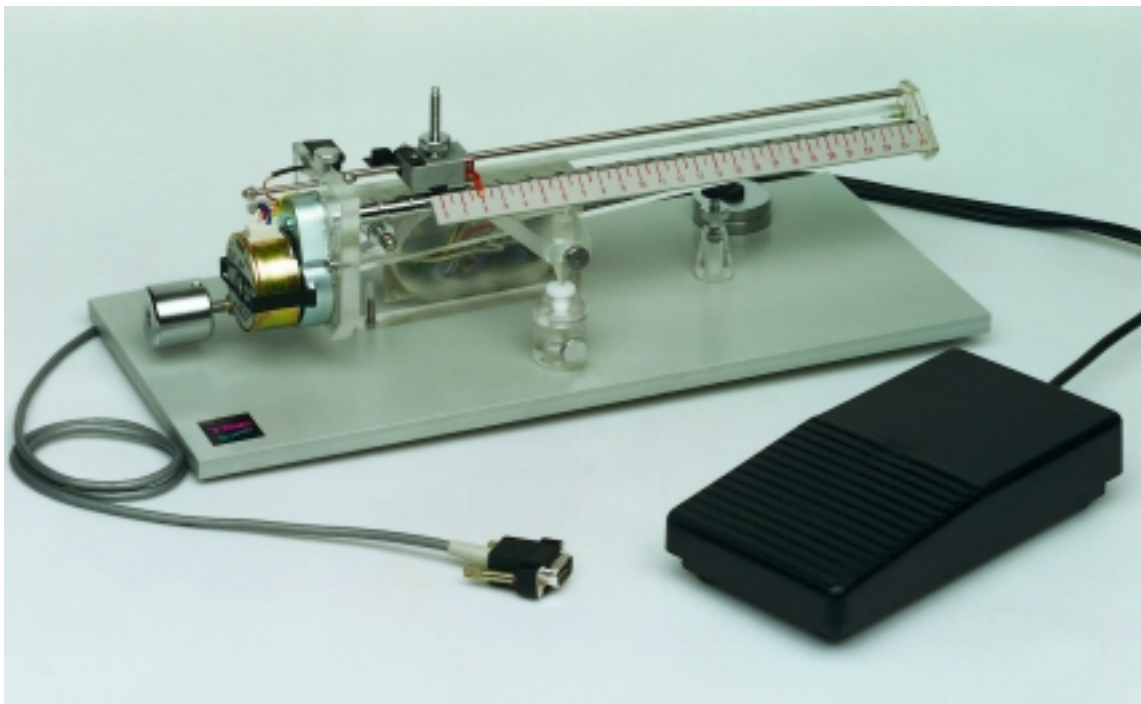
Randall-Selitto Test

T S E Analgesiameter

Randall Selitto Test

1. The System

The **TSE Analgesiameter "Randall-Selitto"** has been designed to perform rapid precise screening of analgesic drugs on the normal and inflamed paw of small laboratory animals (rat, guinea pig), according to the Randall-Selitto test.



When a foot pedal is depressed the geared motor then starts rotating the leading screw which moves a slide along the scale. This slide represents the applied weight.

A cone-shaped pusher with a rounded tip is mounted on the arm. A constant force is exerted on the animal's paw, which is held on a plinth, via this pusher.

The motion of the slide is uniform, i.e. the distance that the slide moves from its starting point is proportional to the elapsed time. As this distance simultaneously defines the length of the arm of the lever it is also proportional to the exerted force. As long as the foot switch is kept pressed down this force increases continuously.

When the rat struggles the operator releases the pedal which immediately stops the slide from advancing any further.

The plinth is made of Teflon which is biologically inert and has a very low coefficient of friction. Thus, if the animal suddenly withdraws its paw, it slips out easily without being injured.

The force can be read off the scale using the slide pointer.

1.1. The force-exerting mechanism

The pusher is fixed to the **arm** which pivots on a fulcrum. The paw is placed between the plinth and pusher. When the slide is moving along the scale at a rate of 16 mm per second the force applied to the paw increases at a **constant** rate, since the motor is running with a constant speed of 60 rpm. This will increase the force on the paw at a rate of 16 grams per second without weight, 16 x 2 grams with one disc added and 16 x 3 grams with two weight disks added.

The motor stops immediately the pedal is released.

Weight	Force increase [g/sec]	Force Range
without	16	0 - 250g
+ 1 disk	32 (2x16)	0 - 500g
+ 2 disks	48 (3x16)	0 - 750g

The rate at which the force increases has been found to be a satisfactory compromise for normal operation.

Excessively **high** speed reduces the duration of the test but entails a greater degree of error caused by variations in the operator's reaction time when he releases the pedal. On the other end, if the speed is too **low**, the animal is restrained for a longer period, which is inconvenient for the operator and may cause the animal to make spurious movements before it actually feels pain.

The scale is calibrated in grams x 10.

$$\text{Force [gram]} = \mathbf{10} \text{ x without weight}$$

The scale can be multiplied by 2 or 3 by placing one or two of the disks provided on the slide.

$$\text{Force [gram]} = \mathbf{20} \text{ x with 1 weight}$$

$$\text{Force [gram]} = \mathbf{30} \text{ x with 2 weights}$$

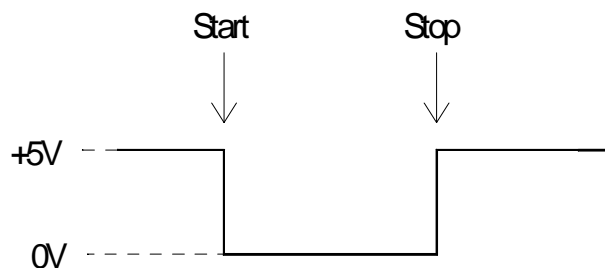
1.2. Data acquisition and analysis

The analgesiameter is connected to the special interface built into the computer.

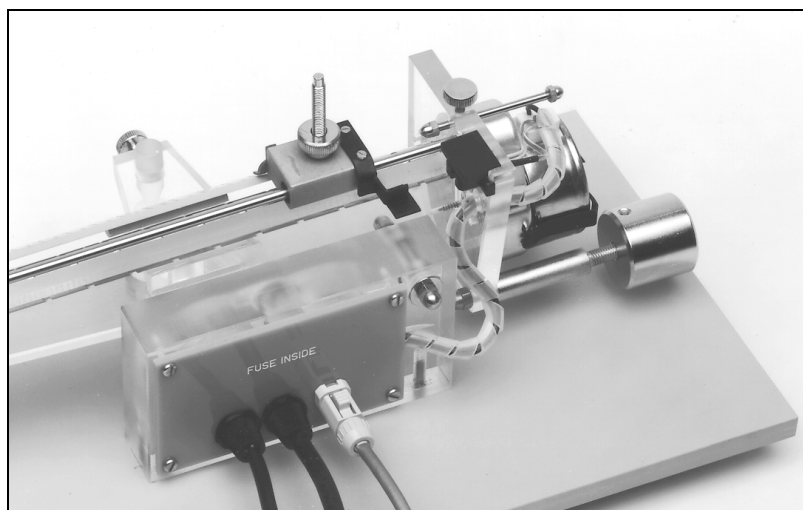
An **optical sensor** registers the start of the slide movement, i.e. the start of the force application and thus supplies the starting signal for the time measurement. The transmitter and receiver of this light barrier are permanently mounted on the motor endplate; the interrupter pin is attached to the slide. If the slide is still in the starting position then the light barrier is interrupted. If the interrupter leaves the light barrier setup then there is a **drop in potential (LOW)**.

The stop signal is defined as the moment at which the foot switch is released: the potential then returns to **HIGH**.

In this way the interface receives information about the start and end of the force application.



The software calculates the time interval between the start and stop signal. This time is shown on the monitor in seconds and stored on the hard disk. It can be printed out or stored in an export file for further statistical calculations.



2. System components

The system consists of:

- Analgesiameter
- Foot pedal,
- PC with built-in interface,
- ANG software,
- Connection cable.

3. Installation

The computer is supplied in a pre-installed condition.

- Connect the analgesiameter to the interface using the cable mounted to the connector labeled START/STOP SIGNAL on the rear panel. The interface features a 9-pole SUB-D socket.
- Connect the foot pedal to the rear panel connector PEDAL SWITCH.
- The third permanently fixed cable is for connecting the motor (GEARED MOTOR)
- Connect the analgesiameter to a suitable power supply provided with a reliable earth connection. The instrument is configured for 220 Volts, 50 Hz. Switch the instrument on.
- The motor should start and the driving screw rotate when the pedal is depressed. If the motor does not operate, check the fuse inside the connection box.
- After each test the slide should be returned to its starting point by lifting it and pushing it to the left.

4. Program start – the main screen

The screenshot shows the main interface of the TSE Analgesiameter V2.0 software. It features a menu bar with options: File, Setup, Measurement, Print, Table, and End. The top status bar displays 'File : TEST', 'STOP', and 'Sec : 0,0'. The main data entry area includes the following fields:

- Experiment No.: 100
- Date/Time: 10.02.1999 / 15:53
- User: Peter
- Substance: XYZ
- Comment-1: Control
- Comment-2: Females
- Group: Test1
- 10mg/kg KG
- N= 0

At the bottom of the screen is a large, empty table with 10 columns and 10 rows, intended for data recording.

The following menu commands are available:

File	Create new file or open existing file
Setup	Set hardware parameters
Measurement	Start measurement, stop and reject measured values
Print	Print table and set printer font
Table	Display and export table
End	Exit program

Status line

File name

Status Stop - Run

Sec Time in seconds (switched on with the foot switch)

Date/Time

Automatically provided by the system

Below there are several **Input fields**, in which the descriptive parameters can be entered before the start of the experiment. All the entries from the previous experiment are retained and only need to be altered if this is necessary.

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.

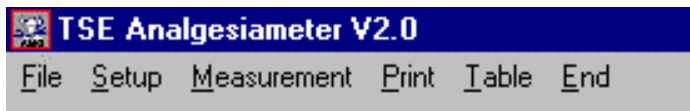
Table area

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"

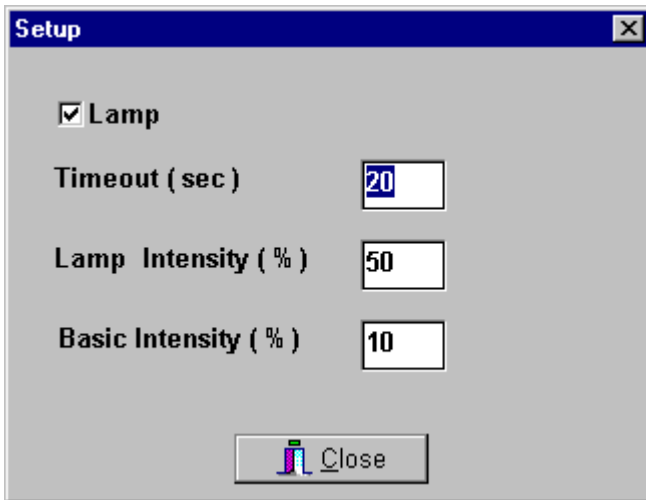


Before the measurement a decision must be made about which file the data of the following measurement are to be stored in. When the menu item **File** is clicked the window "Open" is opened. This now allows

- 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“



The software cannot just be used for the **Randall-Selitto analgesia system**, but also for tail-flick measuring setups.

If the connected system is a Randall-Selitto apparatus then the option "**Lamp**" must be deactivated.

In this case all the other parameters are unimportant.

7. Performing a measurement

If a file has been selected and all the entries carried out in Setup then a test can be carried out.

7.1. Balancing the arm

The arm carries a calibration weight which can be rotated inwards or outwards to a limited degree in order to balance the arm.

In practice, however, it is recommended to leave the arm slightly off balance in such a way that a small initial force is exerted on the paw (the slide should still be in the starting position). This means that before the start of the test a slight initial pressure will be exerted on the animal's paw and it can be held in the correct position more easily.

This slight initial force brings about a small error equivalent to an increase in the actual force as compared with that indicated on the scale. However, this error is constant in every measurement and every multiplication of the scale (i.e. it does not vary when the disk(s) is/are added) so that the measurements and their comparative values are not affected.

7.2. Preparation

- Connect the analgesiameter to the mains supply.
- Attach – if necessary – additional weights to the slide in order to increase the measuring range.

It is advisable to start the experiment with the range of pain response in the lowest third of the scale, if necessary by adding extra weights, so as to enable the activity of the drug to be evaluated, since the drug itself will cause the range of response to shift toward higher values on the scale.

The knurled nut should remain on its stud even if there are no additional disks, since the calibrated weight of the slide includes the nut.

- Adjust the position of the pusher and the plinth to ensure that the arm is in a horizontal position for a given thickness of the paw; a slight deviation from horizontal does not affect the accuracy of the measurement.
- A height-adjustable travel-limit stand is provided on the base plate. This is used in order to prevent the pusher from striking the plinth if the animal withdraws its paw. Set the height of the limit with the screw so that the plinth and pressure pin (without paw) are separated from each other by a 1-2mm gap.
- Place the slide on the left-hand side of the scale with the pointer at zero (**start position**). The interrupter pin must be located completely within the light barrier setup (i.e. the light barrier is now interrupted). The pointer stands slightly to the left of the zero on the scale.

7.3. Advice about handling the animals

Some experience is required to hold the animal. It should struggle only when the force applied to its paw reaches the threshold of pain and not simply because of the position in which it is held by the operator. Do not hold the animal with its belly upwards as it will normally struggle to regain a natural position which may lead to a faulty reading.

7.4. Performing 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 status display changes to RUN

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.

- The slide is started by depressing the **foot pedal**.

1,3	2,3	2,4	4,1	2,6	2,9				

The real **starting signal** for the start of the time measurement is provided by the optical sensor, which registers the start of the slide movement.

- The time display at the top right-hand side starts running.
- Release the pedal as soon as the animal struggles to a noticeable degree (whether or not this is accompanied by a cry). This will stop the slide.
- The timer stops and the measuring value is shown in the table area.
- The force can be read off from the scale start position. Move the slide back to zero by lifting it and pushing it to the left.
- Now the second paw of the same animal or the first paw of the next animal is placed in position.
- The start of the next measurement in the series of measurements is carried out by pressing the foot switch again.

7.5. 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.

1,5	4,9	2,1	*2,5
2,5	*3,2	2,4	2,7

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

7.6. Ending a group measurement

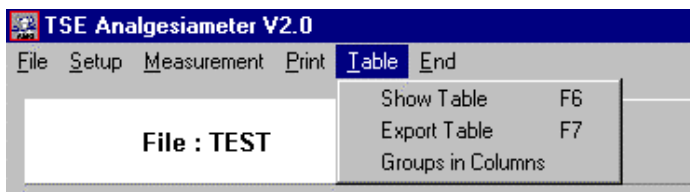
Measurement/Stop (F3) ends the current group measurement. The measuring data are stored in the file. A new group measurement can now be triggered with Start – after altering the group labels if this is necessary.

7.7. Cancel

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

8. Data Output

8.1. The menu item „Table“



The time values (seconds) of the loaded file are shown in tabular form on the monitor:

```

10B 2mg/kg BW 12.02.1999 / 14:45
1,3 2,3 2,4 4,1 2,6 2,9

```

```

10B 2mg/kg BW 12.02.1999 / 14:45
1,5 4,9 2,1 *2,5 2,0 1,8 2,2 1,8
3,3 3,2 2,5 *3,2 2,4 2,7

```

As the force increase per unit time, which is applied by the instrument depending on the added weights, is known it is possible to convert the **time** into **force**, for example.

Weight	Factor(*)
0	16
1	32
2	48

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:

```
5 12.02.1999 / 14:45 File XYZ Testgroup Females
```

```

10B          10B
2mg/kg BW   2mg/kg BW
12.02.1999 / 14:45 12.02.1999 / 14:45
           1,3          1,5
           2,3          4,9
           2,4          2,1
           4,1          2,5
           2,6           2
           2,9          1,8
                   2,2
                   1,8
                   3,3
                   3,2

```

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.

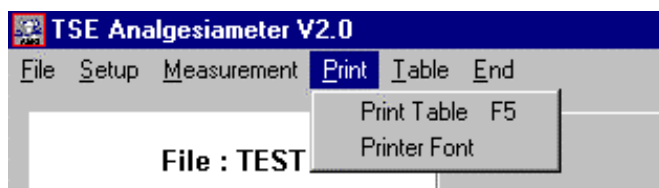
If the option has **not** been activated the measurements will be arranged **line by line**. The file then has the following format:

```

5 12.02.1999 / 14:45 File XYZ Testgroup Females
10B 2mg/kg BW 12.02.1999 / 14:45 1,3 2,3 2,4 4,1 2,6 2,9
10B 2mg/kg BW 12.02.1999 / 14:45 1,5 4,9 2,1 2,5 2 1,8 2,2 1,8 3,3 3,2

```

8.2. The protocol – menu item "Print"



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.

TSE Technical & Scientific Equipment GmbH

Saalburgstr. 157
D-61350 Bad Homburg / Germany

Phone: +49 (0) 6172-789-0
Fax: +49 (0) 6172-789-500
E-mail: info@TSE-Systems.de
Internet: <http://www.TSE-Systems.de>