TSE Rotameter System

For small laboratory animals

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1.   General information

The TSE **Rotameter System** is a flexible computer-controlled rotometry monitor for small laboratory animals (rats, mice) designed to analyze rotational behaviour induced by unilateral brain lesions in pharmacological studies.

Rotameter System

The animal that moves about in a special arena is tethered to a rotary sensor. The low-torque construction ensures that the animal´s movement is not restricted in any way. The sensor monitors clockwise and counter-clockwise rotations and records changes of directions. Different sensor sensitivities are available in order to adapt the system to the specific needs of the user.

Advantages:

➢ Up to 32 rotameter units can be controlled by a single PC!
➢ The experiments can be started and stopped independently from one another in all rotameters which are connected up.
➢ The rotameter system runs under Windows allowing easy data exchange.

2.   Hardware components

The complete system consists of the following hardware components:

- Up to 8 **rotameter units** (up to 32 units if the sensor with the lowest resolution (1/4 turn) is chosen)
- One **rotary sensor** for each rotameter. The sensor features a remote start switch.
- Animal **harness.**
- A **control unit**.
- IBM-compatible **computer** with **special interface.**

The rotameter unit

In the standard version the rotameter units are designed as **open bowl** cages made from clear plastic to allow optimum visibility. Two different types are available, which differ in diameter and depth:

- Stand-alone large units for **rats**
- Stand-alone small units for **mice**

Optional mice inserts can also be provided for the rat system to easily change between rat and mouse applications.

The sturdy metal base is available with different heights and sizes depending on the space available in your lab. The units can be easily dismantled for cleaning purposes.

Please inform us of your special needs when placing an order. We can supply custom-made units on request. We can also manufacture **cylindrical** cages.

The animal harness

A soft, flexible adjustable belly strap harness is used to connect the tether to the animal. Different types are available depending on the animal´s size.

The rotary sensors

Each rotameter is equipped with a special rotary sensor that is mounted on a u-shaped bracket and that records the direction and number of rotations. Standard resolution is 1/10 full rotation (=36°); higher resolutions up to 1/100 turn are available on request (100 increments for one full rotation=3.6°). These sensors are connected to the common control unit.

Control unit / PC

The **control unit** contains the electronics for recording the rotations. It is connected to both the rotary sensors of the rotameter units and to the special computer interface. A Pentium processor starting from 100 MHz is recommended especially whenever large numbers of units are to be monitored.

3. Software – Trial Description

The **ROTAMETER** software is used to control the complete system, to record the animal´s rotations in all connected units and to store and analyze the measuring data. The system runs under the Windows operating system.

In principle an experiment proceeds according to the following scheme:

- preparing for the experiment
- start and execution
- end of experiment
- data analysis
- data export

Note: *If your experiment requires software features other than those mentioned below please ask for adaptation to your specific needs!*

3.1.   Preparing for the experiment

Before the start of the experiment all the data which describe the laboratory animal and the experiment are defined by the operator for each chosen unit. This information can be used later in data evaluation for selection of the experimental data (*Animal Data / Trial Data*).

Control parameters influence the course of the experiment:

The **termination criterion** defines when a session in a specific unit will be stopped automatically.

1. When a certain maximum time has elapsed (unlimited duration).
2. After a fixed number of rotations in the preferred direction, or
3. After a fixed number of rotations in the direction opposite to the preferred direction.

Trial Monitor

The **preferred direction** of rotation can result from a unilateral cerebral lesion of the laboratory animal, for example. It can be freely defined by the operator.

The first termination criterion to occur ends the experiment. It can also be ended **manually** at any time**.**

3.2.   Start

Two different starting modes are available:

1. Staggered Start

After definition of all parameters the experiment can be started **immediately** for an individual rotameter. The animal is placed in the rotameter and START NOW is pressed. Alternatively the *remote start switch* on the sensor can be pressed in order to start data acquisition as soon as the animal has been placed into the arena. Data

recording now starts for this rotameter. **All required units can be started independent of one another in this way** allowing a single user to handle a large number of units.

2. Simultaneous Start
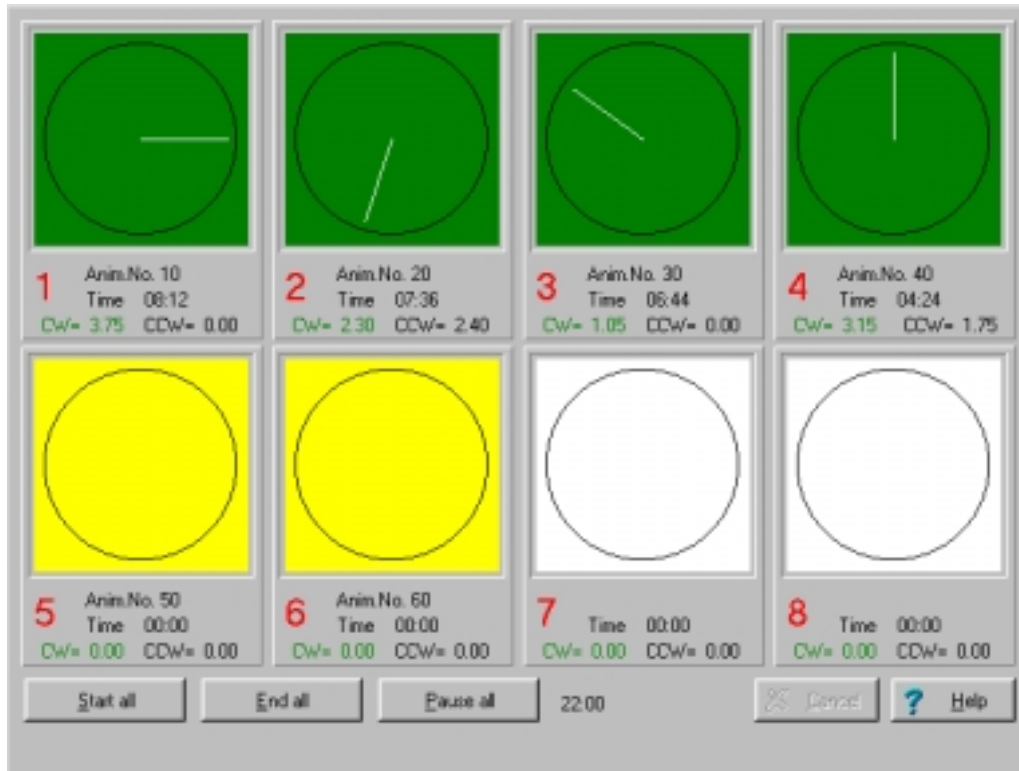
Trial Monitor (8-Unit-System with 1/20 full turn resolution)

Alternatively a rotameter can first be placed in a "ready" condition (START LATER). The experiment can then be started simultaneously at a later time for all rotameters activated in this manner by pressing a single key (common starting time).

3.3.   Experimental procedure

During execution of the experiment a schematic overview of 8 rotameters is displayed in the so-called **trial monitor**. If more than 8 units are integrated into the system a switch can be made to the next group of 8 rotameters by a mouse click.

The **colour** of a rotameter indicates its current status:

- White rotameters have not yet been activated for an experiment
- Yellow rotameters have been prepared for an experiment
- Green units have already been started
- In red rotameters data acquisition has been interrupted

When a rotameter has been started a pointer ("radius") which moves synchronously with the rotation of the sensor allows the experiment to be checked continuously.

In addition the following information is displayed:

- The actual time of the experiment and
- The number of **sensor rotations** determined by the rotary sensor
  - clockwise (CW)
  - counterclockwise (CCW)

The resolution depends on the type of sensor integrated into the system.

The values for CW and CCW are updated once per minute. The set preferred direction of rotation is indicated in green. The **number** of the animal is shown for each rotameter as a check.

Each unit has its own clock and works independently of the other units!

If a further test is to be started in a different rotameter then the required unit is selected with the left-hand mouse key. Data recording for the units which have already been started continues in the background while preparations for the new rotameter are being made.

The acquired data are stored automatically on the hard disk at regular intervals.

3.4.   Setting event markers

While the experiment is being carried out so-called **event markers** can be set in order to document particular events. The event markers appear in the evaluation table and in the export file.

Event markers can be defined before the start of the experiment and while the experiment is being carried out.

- 5 **global** markers are available; during the experiment they apply simultaneously to all active rotameters.
- 5 further **rotameter-specific** markers characterize events which only affect individual rotameters.

3.5.   Interrupting the experiment

It is possible to interrupt an experiment in a selected unit. A selection can be made as to whether

- the clock should be stopped, or
- the clock should continue to run.

During the **interruption** it is possible to carry out an intermediate evaluation of the previously recorded data in tabular and graphical form. All analytical possibilities (see 4.) are available.

During the interruption rotations are no longer recorded.

3.6.   End of experiment/data storage

In normal cases the experiment in a specific rotameter will be stopped **automatically** when the preset time has elapsed or when the preset number of rotations in either the preferred direction or opposite to the preferred direction has been reached.

An experiment can also be stopped manually at any time.

For each experiment with one animal the animal and experiment parameters together with the measuring data are stored in a *single* file. This storage structure satisfies the preconditions for a high level of data security.

4.   Evaluating the measuring data

When all experiments are finished **data analysis** is carried out. Data can be filtered from the data base by subject (animal number) or by treatment group, experiment or trial number or date of experiment thus allowing easy handling of large numbers of data records and grouping of data prior to generating export files.

The data of the selected records (1 record = 1 experiment in 1 unit) can be presented in the form of a list, the so-called **run table**.

This run table provides detailed information about the temporal course of the experiment. A selection of information about each data record is given at the start of the table.

Calculation and output of the results is carried out continually beginning from the start of the experiment at **analytical intervals** determined by the operator (1 minute in the example).

The resolution of the numerical values depends on the sensor type. In the example below a low-resolution sensor has been used (1/10 full turn resolution = 36°).

```
Rotameter

C:\Programme\TSE\Rotameter\WH000001.DAT

Anim.No.:   1     Trial No.:  1     Exp.No.:    2
Operator:
Start Time:   17/03/98    12:19     Duration:   5 min
Comment:
Strain:
Age:  150 days    Weight:     200 g
Substance:        Dosage:
Direction:  CW


            Time      CW     CCW   Changes   SumCW    SumCCW     Total    Marker
17.03.1998 12:20     0,0     0,0       0      0,0       0,0       0,0
17.03.1998 12:21     0,0     0,0       0      0,0       0,0       0,0
17.03.1998 12:22     7,5     0,0       0      7,5       0,0       7,5
17.03.1998 12:23     0,0     0,0       0      7,5       0,0       7,5
17.03.1998 12:24     4,3     3,3       1     11,8       3,3      15,0
```

The run table contains the following columns:

Time	Continuous analysis interval
CW	Clockwise rotations (incremental value)
CCW	Counterclockwise rotations (incremental value)
Changes	Changes of direction
Sum CW	Total number of clockwise rotations (accumulated value)
Sum CCW	Total number of counterclockwise rotations (accumulated value)
Total	Total number of CW and CCW rotations (accumulated value)
Marker	Marker text

The table can be printed out.

*Adaptation of the results output to meet operator-specific requirements is possible.*

In the **run graph** the rotation events are shown graphically. Both directions of rotation appear as separate curves in a coordinate system with time (in minutes) as the X-axis and number of rotations as the Y-axis.
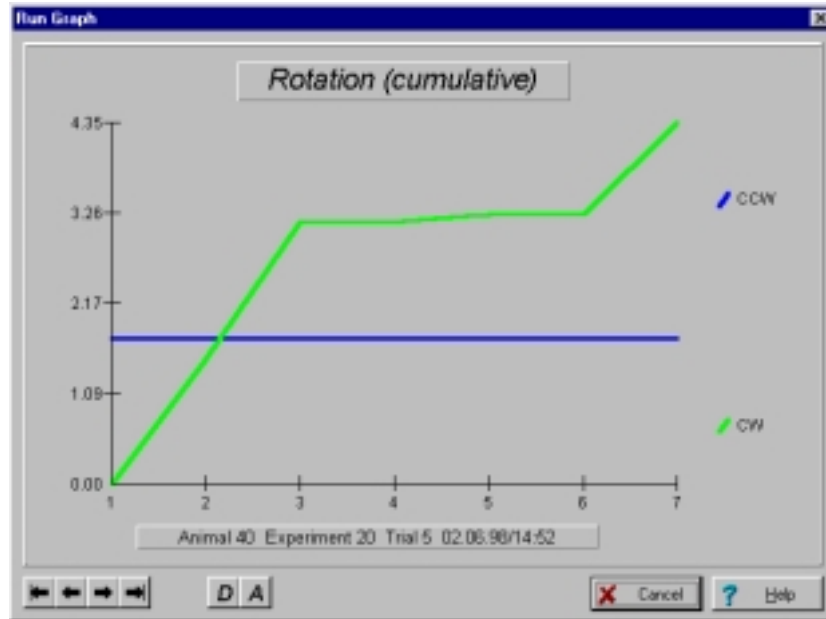
Run Graph

The presentation can be carried out differentially (rotations per unit of time) or cumulatively (rotations from the start of the experiment added together). In addition, a switch can be made between absolute and relative presentation. Absolute presentation with standardized axis scales makes it easier to compare the run data of different experiments.

Numerous possibilities for individually altering the standard graph are available. The graph can be printed out and stored in various graphical formats (e.g. for import into word processing programs).
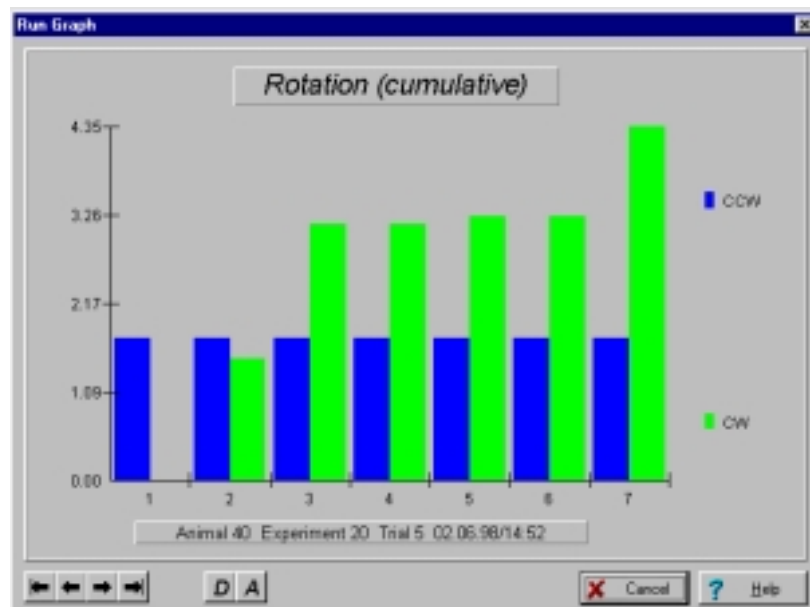
Bar Graph

3.6.   Data export

For further statistical calculations in special statistics packages or spread sheet programs (e.g. SAS or Excel) the results of the run table can be stored in an **export file**. This ASCII-compatible orthogonal export file (CSV-format) contains the data of all those records which had previously been selected. The results are completed by information about the animal, trial and experiment number as well as the date and starting time.

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