TSE InfraMot

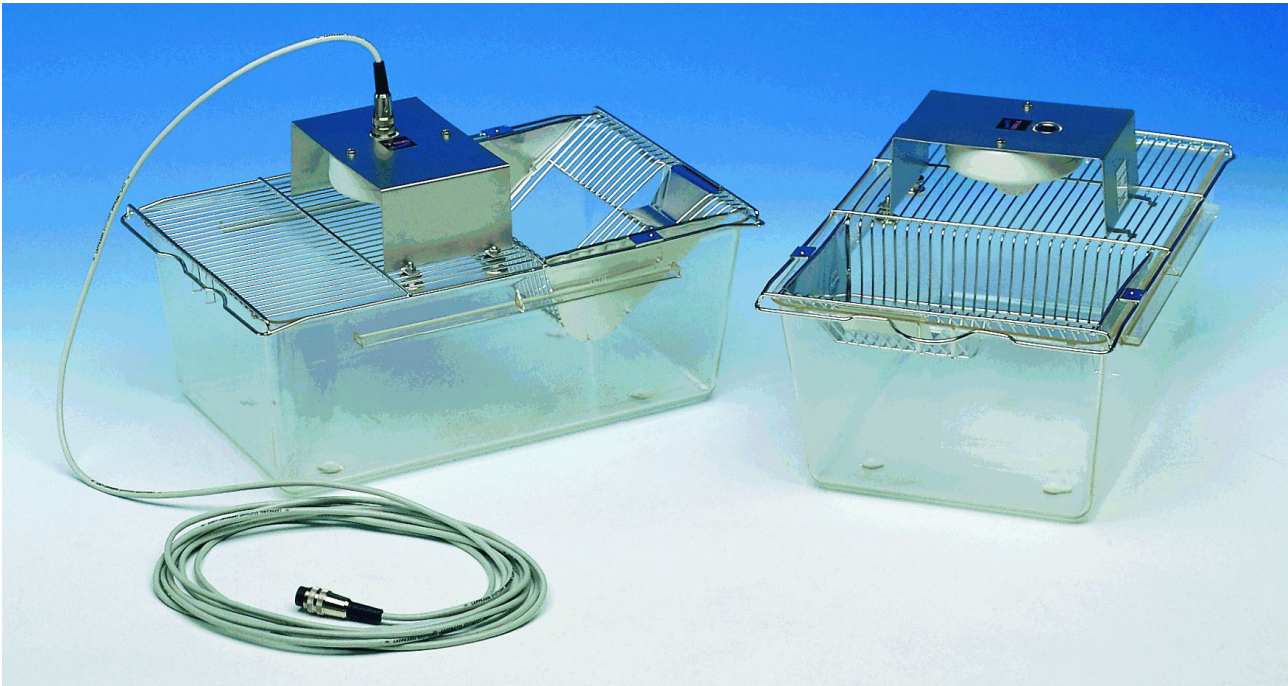## Animal activity measurement in home cages

Rel. May 2005

◆ TSE InfraMot

TSE InfraMot is a system for rapidly and easily determining the activity of mice, rats and other small laboratory animals.

The system uses so-called "passive infrared sensors". These sensors register the activity of one or more subjects by sensing the **body-heat image**, i.e. the infrared radiation, and its spatial displacement over time. In this way movement within the cage can be reliably determined. This even includes brief movement events of only a few milliseconds duration! The wide angle detector means that rearing events are also included in the activity data.

Activity can be measured under **any lighting conditions**. Measurements can even be made in complete darkness.

The standard sensor assembly is designed to be mounted on top of a **home cage** but it can also be configured for any other arena such as an operant cage or an open field. The recorded area depends on the height at which the sensor unit is mounted.

The recording sensitivity is virtually unaffected by grid-shaped materials such as a grid cover. Closed materials prevent heat detection. This means that – provided that the assembly height is suitable –

animals (=sources of heat) in neighboring cages do not interfere with the recording.

The user-friendly **TSE InfraMot software** records the counter totals at adjustable intervals. This measuring data provides a relative measure of the duration and intensity of the activity. The scanning interval can be defined by the operator.

In order to be able to use the **InfraMot** program the spread-sheet program **MS-Excel** must be installed on the computer. This allows the marked individual values to be transferred *directly* into an Excel worksheet in order for statistical calculations to be carried out.

System components

◆ N x sensor units for home cages,

◆ one or more control units,

◆ a special control interface, and

◆ the TSE InfraMot software package.

Up to 512 measuring stations can be integrated in a system!

One control unit can control 32 sensors; several control units can be combined.

Control unit

The system runs on a Pentium computer (at least PIII 700MHz) with the Windows operating system (98, NT, 2000 or XP – not 95!).

Technical data

Recording range:	360° beneath the sensor
Time constant:	approx. 5ms i.e. impulses ≥ 5ms are detected
Recording area:	depends on height of sensor unit

Sensor height* (cm)	Recording area diameter** (cm)
12	32
24	64
36	90
48	105

* Distance from lower edge of sensor to field of movement
** The given values are for guidance only

If large sensor unit mounting heights are necessary it is possible to increase the sensitivity of the sensor within certain limits. However, a higher sensitivity means that the interference from other heat sources also increases. Please contact us to discuss a suitable configuration.

Mounting the sensor unit

In the standard configuration the sensor is supplied mounted on a U-shaped stainless steel sheet. This so-called "sensor unit" is normally placed on the metal grid cover of a standard animal cage (*home cage*) and fixed in position by screwing it onto the cover.

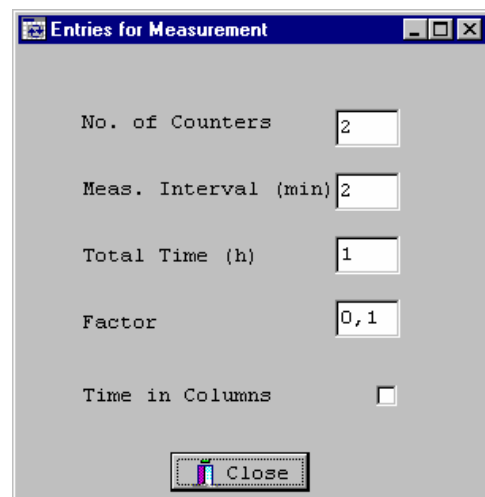The sensor units can be easily removed for cleaning purposes.

Other types of attachment are available on request.

Preparing the trial

When the program has been started the following buttons are available on the main screen:
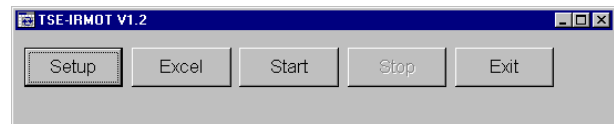
Now the control parameters have to be entered in the setup:

The following input fields are available for controlling the trial:

1. Under **Number of Counters** the number of sensors used in the trial is entered.

2. Under **Measuring Interval** the scanning rate, i.e. the observation interval for the sensors, is entered. The movement counters are scanned every X minutes. The range is 1...60 minutes (in steps of 1 minute). Values in seconds can also be entered by placing a negative sign in front of the entered value.

3. The **Total Measuring Time** can be entered between 0.1 and 720h (0.1 h = 6 minutes).

4. The values obtained during the measurement can be reduced by a certain factor with **Factor** in order to obtain a better display with high activities or large measuring intervals. A test should be carried out to determine a suitable value. Entries of 0.01-1.0 are possible.

5. **Time in Columns** refers to the arrangement of the data in the Excel table. The values of each counter can be stored in one column or one line.

Configuring an Excel sheet

In order to guarantee maximum flexibility the measuring values are transferred into the Excel sheet without any additional information.

In order to characterize the measurement you can create any desired sheet with all the necessary **labels** to fill in animal and experimental identifiers, control parameters etc. and **equations**.
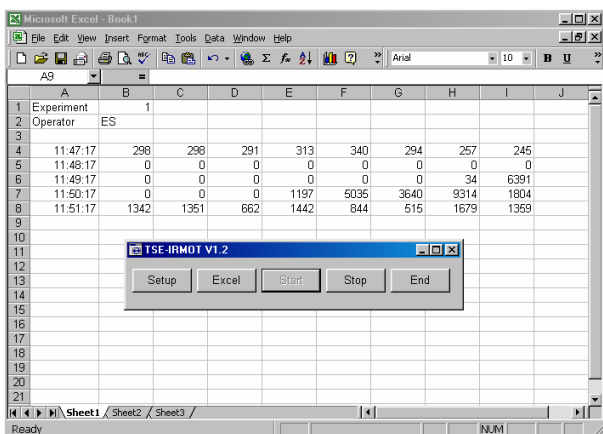
Carrying out a trial

Now the EXCEL link has to be established. Clicking on the **EXCEL** button automatically searches out Excel and starts it.

Now simply load the pre-defined Excel sheet and fill in all required descriptive parameters to characterize the following measurement.
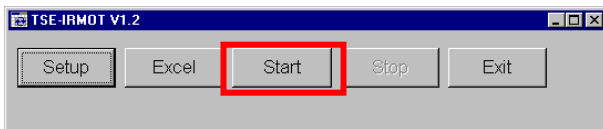
Then start the measurement with the **START** button.

The measured values are now immediately transferred to the Excel worksheet according to the measuring interval frequency!

This is particularly useful when carrying out long-term trials, as it allows access to the trial data without interrupting data acquisition.

Evaluating the measuring data

The table below is an example of a 3-day experiment with rats. The measuring interval is 10 minutes, i.e. the activity counter has been stored every 10 minutes.

|	A	B	C	D	E
293	10:56:14	2930	97	1324	3001
294	11:06:14	2940	0	492	201
295	11:16:14	2950	32789	1760	412
296	11:26:14	2960	24638	0	540
297	11:36:14	2970	9901	0	2508
298	11:46:14	2980	767	0	0
299	11:56:14	2990	2089	22006	0
300	12:06:14	3000	15	3279	0
301	12:16:14	3010	538	1752	0
302	12:26:14	3020	1102	420	0
303	12:36:14	3030	0	70	0
304	12:46:14	3040	88	1224	37644
305	12:56:14	3050	0	0	62770
306	13:06:14	3060	94	393	62351
307	13:16:14	3070	0	0	53386
308	13:26:13	3080	37	0	53894
309	13:36:13	3090	0	0	50441
310	13:46:13	3100	0	0	38219
311	13:56:13	3110	177	117	39419
312	14:06:13	3120	479	0	27676
313	14:16:13	3130	86	0	22902
314	14:26:13	3140	0	0	5220
315	14:36:13	3150	5639	1142	16844

Extract of the results table

1. The first column gives the clock time,
2. the second column is the time elapsed in minutes since the start of the experiment (added by the user).
3. Columns C, D and E correspond to the measuring values of 3 animals.

The animal displayed in column E is more active than the animals displayed in columns C and D. A period of very high-activity is marked with a yellow frame.

If formulas and equations for statistical parameters have been added into the Excel sheet (mean value, standard deviation etc.) these parameters are calculated and displayed in real time during the measurement.
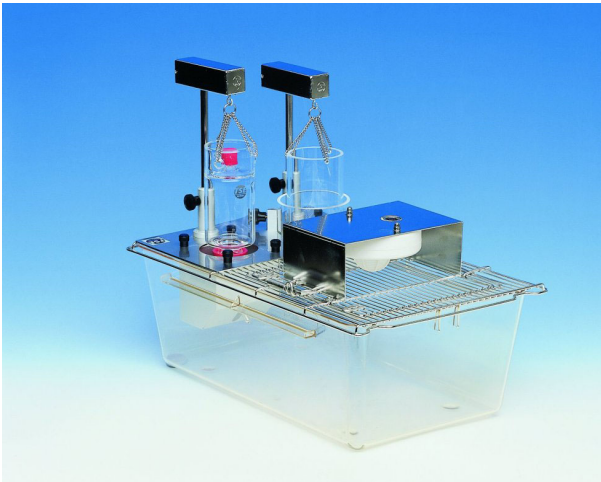
The **graph** below has been created in the Excel sheet using the InfraMot measuring values. 3 animals are shown:

- Animal in column C is shown in blue
- Animal in column D is shown in pink
- Animal in column E is shown in yellow
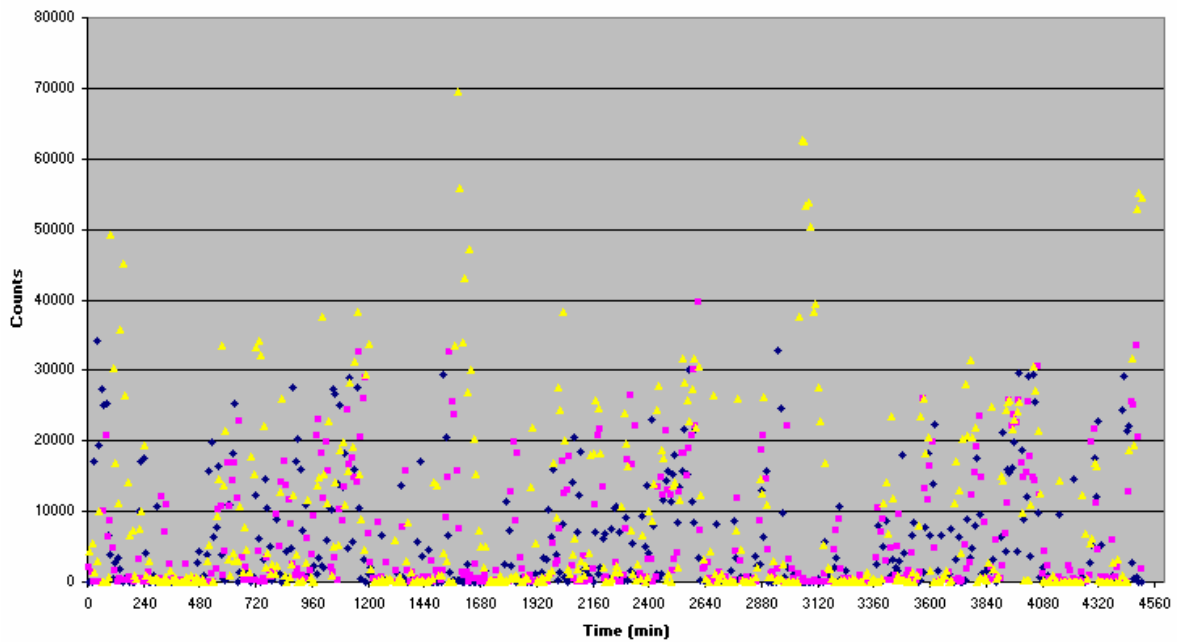
Animal displayed with yellow dots (column E in the table) shows increased activity.

Options

The TSE InfraMot sensor units can also be used in conjunction with the TSE Drinking & Feeding Monitor that allows to evaluate liquid and food consumption in home cages.

The results tables created by both systems can be easily combined to output both consumption and activity.
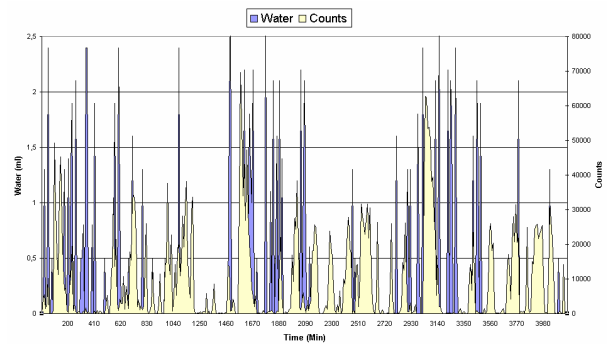
Please contact us for detailed information!

◆ Partial List of Users

- Abbott Laboratories, Abbott Park, IL, USA

- European Molecular Biology Laboratory - EMBL, Monterotondo - Scalo (RM), Italy

- Korea Research Institute of Chemical Technology - KRICT, Daejeon, Korea

- Novartis Pharma AG, Basel, Switzerland

- Physio-Tech Co., Ltd., Tokyo, Japan

- The Rowett Research Institute, Aberdeen, Great Britain

- University of Aberdeen, Great Britain

- University of Athens, GA, USA

- University of Berlin, Germany

- University of Frankfurt, Germany

- University of Innsbruck, Austria

- University of Leipzig, Germany

- University of Semnan, Iran

- University of Tuebingen, Germany

- Weizmann Institute of Science, Rehovot, Israel

◆ Ordering Information

Cat.No.	Description
1. Sensor Units	
302015-SENS	**InfraMot Infra-red Activity Sensor**. The sensor is mounted on top of the cage. It can also be mounted inside the cage. The sensor is connected to the control unit 302015-C/X.
2. Control Units	*Up to 512 infra-red activity sensor units can be integrated into* **one** *system.* *The control unit package comes complete with a PCI interface to be mounted into the computer.*
302015-C/04	**InfraMot Control Unit** for connection of up to 4 infra-red activity sensors 302015-SENS.
302015-C/08	**InfraMot Control Unit** for connection of up to 8 infra-red activity sensors 302015-SENS.
302015-C/16	**InfraMot Control Unit** for connection of up to 16 infra-red activity sensors 302015-SENS.
302015-C/24	**InfraMot Control Unit** for connection of up to 24 infra-red activity sensors 302015-SENS.

302015-C/32	**InfraMot Control Unit** for connection of up to 32 infra-red activity sensors 302015-SENS.
3. Software	
302015-S	**InfraMot Software Package** for measuring, storing and evaluating small and large movements in three (3) dimensions via infra-red activity sensors 302015-SENS. The software package registrates the total activity in x, y and z-axis, i.e. horizontal and vertical movements are summarized. The program stores the raw data for further evaluation with standard statistic and graphics software.

A complete system consists of:

1. **N** sensor units
2. 1 control unit suited for your number of sensors (including interface board)
3. 1 software package

N= Number of measuring places