MSA Thermal Stimulator

High precision thermal stimulator for Clinical research applications including QST

Figure 1, Intraoral QST ①

Background

In 1985, Somedic SenseLab AB presented the first commercially available thermal stimulator of Quantitative Sensory Testing (QST), the Somedic Thermotest^{TM}, based on the Marstock simulator ② of Prof. Frühstorfer and Lindblom, representing the state of the art at that time.

During the years, Somedic SenseLab AB has improved this original concept by implementation of the latest technology and continuous user feedback, resulting in an instrument that is not only serving the clinical world with standard QST examinations, but that also has been used for a number of scientific breakthroughs. Particularity in the area of pain, like the first PET image of "Pain in Brain" ③, followed by fMRI investigations of brain activation from panful stimulation ④, studies of secondary pain from burn injuries ⑤, a.s.o..

Today the broad application areas of the latest Somedic SenseLab Thermal Stimulator, the Somedic MSA (Modular Sensory Analyser), can be seen from the variety of specialities where it is used, like in numerous clinics of Pharmacology, Neurology, Dentistry, Hand surgery and Occupational medicine, just to name a few.

Thermodes

The thermodes are instrumental to the function and usability of any thermal stimulator. Thus the Somedic MSA Thermotest offers a range of thermodes suitable for a wide range of applications where the thermal stimuli can be applied to a large variety of anatomical locations.

The stimulation temperature range offered by these thermodes are +5 to +52°C, with an exceptionally even spatial thermal profile over the thermode surface area, providing high accuracy thermal ramps in the range of 0.1 to 5°C/sec (lower range at temperature extremes). Standard thermodes are shown below, with other designs made to order.

25x50 mm standard thermode

Used in most normal QST examinations and recommended for thermal burn studies. Also the thermode of choice for fMRI investigations, where an extender cable allow for the additional cable length needed in the fMRI setting.

Figure 2: 25x50 mm standard thermode

18x18 mm thermode

Providing a smaller stimulation area, for easier access and better spatial resolution in densely innervated areas, like in the face.

Figure 3: 18x18 mm thermode

9x9 mm thermode

Providing an even smaller stimulation area, for those really small stimulations sites (like next to the nose) and/or where a very good spatial resolution is needed.

Figure 4: 9x9 mm thermode

9x9 mm dental thermode

Originally considered for dental use, but has also found applications where the excellent manoeuvrability and visibility is appreciated. Is intended for work at stimulation temperatures > 20 °C and for a slope of 1 °C/sec.

Figure 5: 9x9 mm dental thermode

SenseLab MSA Software

For QST examinations, the standard SenseLab Method of Limits (MoL) software is the ideal choice. Each diagnostic question can have its preconfigured optimal sequence of tests where the program guides the user through the sequence and guarantee that all relevant tests are done – independent of the user. Thus it is ideal also for larger multi-centre studies where reference material shall be collected or used. An example of the Windows desktop, when running SenseLab, is seen in figure 6.

Examination results obtained through SenseLab software can be printed together with comments in user configurable reports. For virtually any type of analysis and presentation, data can be imported into an EXCEL spreadsheet or extracted from the main ACCESS database.

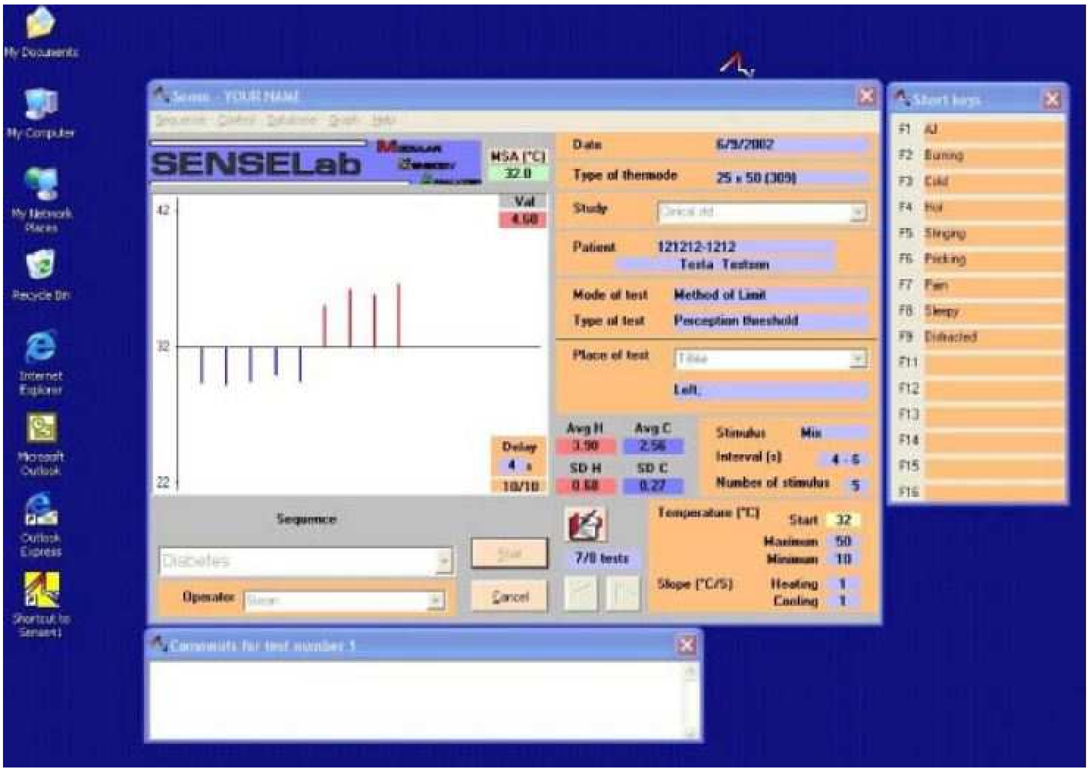

Figure 6: Windows desktop, when running the SenseLab program

The SenseLab Exposure program allows generation of single thermal pulses, like what may be needed for the IASP recommended "thermal burn" model. Complex temperatures patterns for temperature or pain scaling experiments, as well as repetitive pulses for thermal stimulation in fMRI, are other examples where the Exposure program will be quite useful.

When neither of these two standard software meet your requirements, the MSA can be controlled using a set of simple commands, the MSA Programming Language. MSAPL allows you to control and read the temperature of the MSA, as well as the patient response, by simple ASCII commands sent over the serial or USB port. Your program will then have full control of the thermal stimulus and can easily synchronize it with other types of activities, like a MRI system and/or a VAS.

Accessories

To adapt the Somedic MSA to different applications, not only different thermodes may be needed, but also a range of accessories. Below you can find a list of our standard accessories, please inquire if you have other needs,

For response scaling

Somedic offers both VAS and NRS for quantifying the subjective response to thermal stimuli. Complete solutions including software for electronic reading of these scales can be offered, resulting in very efficient data collection.

Figure 7: VAS and NRS

For fMRI

To allow the thermode to be placed inside the MRI unit, a special extender cable is used for the thermode.
A rack mounted hardware synchronisation unit is also available generating synchronisation signals between MSA and the MRI system.

Figure 8: fMRI extender cable

For mobility and ease of work

Different types of tables can be supplied, usually with several shelves, where the MSA and other equipment cab be either free standing or mounted to the table. Please ask for further information.

For calibration

Even the best of equipment may need service and calibration. We can then supply a calibration unit that will allow fully computer controlled calibration of the MSA thermodes.

References

① Measurement of intraoral QST. Picture courtesy of M. Pigg, Faculty of Odontology, Malmö University, 2007.
② Frühstorfer, H. and Lindblom, U., Method for Quantitative estimation of thermal thresholds in patients. JNNP, 1976, 39, 1071-1075.
③ Jones, A.K.P. et.al. Cortical and subcortical localisation of response to pain in man using positron emission tomography. Proc. R. Soc. Land., 1991, 244, 39-444.
④ Seymour, B., et. Al. Opponent appetitive-aversive neutral processes under lie predictive learning of pain relief. Nat neuroscience 2005, 9, 1234-1240
⑤ Petersen, K.L., Experimental Cutaneous Hyperalgesia in Humans, IASP Newsletter Nov/Dec 1997.

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