892 Professional Rancimat

Determination of the oxidation stability of

- Oils and fats
- Fat-containing foods
- Cosmetics

Ω Metrohm

The 892 Professional Rancimat and StabNet in brief

The 892 Professional Rancimat, in conjunction with StabNet software, is a modern analytical system for easy and reliable determination of the oxidation stability of natural oils and fats using the long-established Rancimat method.

The 892 Professional Rancimat is controlled via the PC by StabNet software. Determination itself, however, can be started very conveniently directly on the instrument. Each measuring position has its own individual start button. In addition, the integral color display provides an overview of the status of each individual measuring position. Disposable reaction vessels reduce the cleaning of accessories to a minimum, thereby saving time and cost.

The StabNet software meets all the requirements of modern analytical software. Apart from acquiring and evaluating data automatically, the database enables managing large volumes of data comfortably. User administration with freely configurable access rights as well as automatic backup functions ensure a high level of data security. In addition, the StabNet software meets the requirements of «Title 21 CFR part 11» of the FDA (United States Food and Drug Administration).
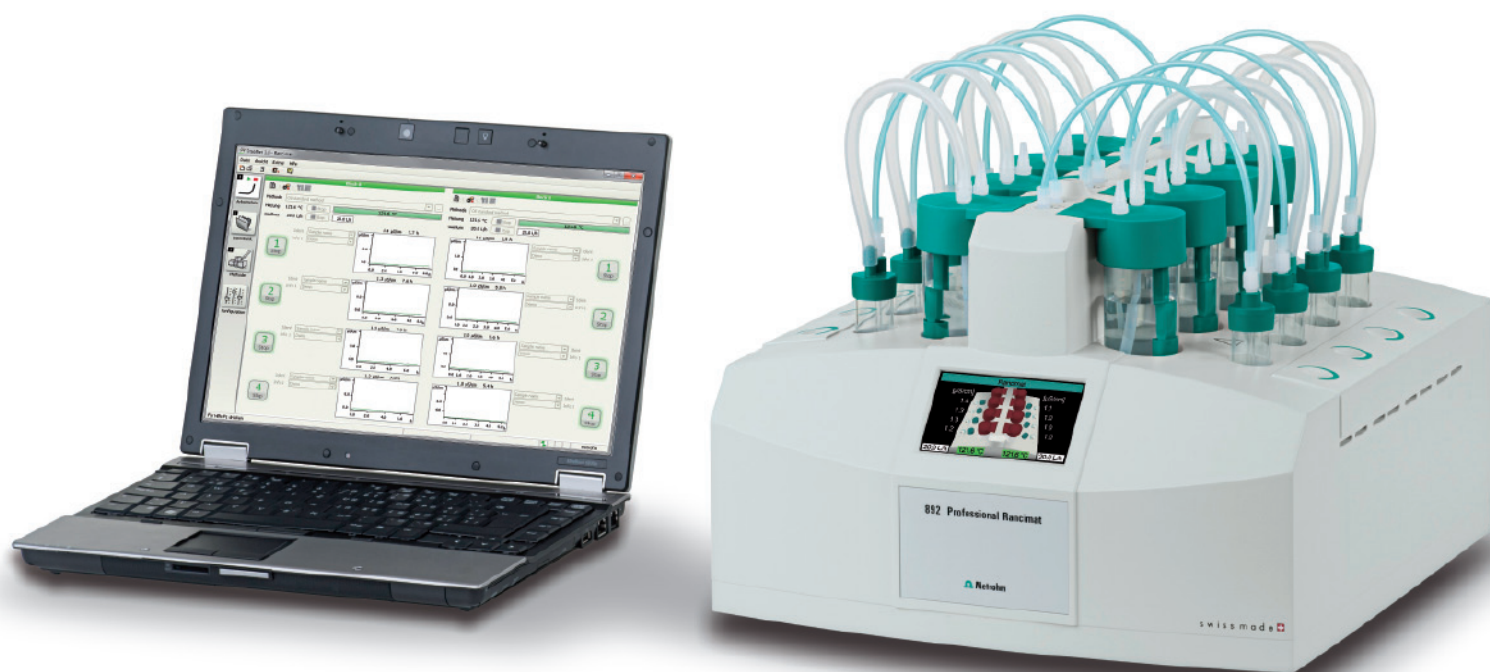
The most important applications

- Oxidation stability of vegetable and animal oils and fats
- Examination of the effectiveness of antioxidants
- Oxidation stability of oil and fat-containing foods and cosmetics
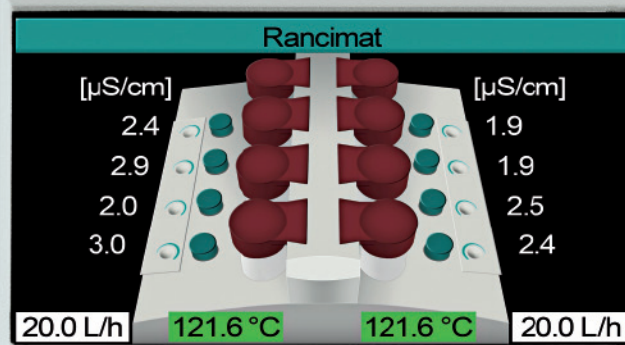
The most important advantages at a glance

The instrument

- All instrument functions controlled via PC
- Separate starting of each measuring position directly on the instrument
- Overview of the status of all measuring positions on the instrument display
- Unparalleled reliability and simple operation due to unique accessories
  - Affordable disposable glass parts
  - Robust conductivity cells with electrical connections integrated in the reaction vessel cover
- 2 heating blocks with 8 measuring positions per instrument. Up to 4 instruments can be connected to 1 PC

The software

- Clearly laid-out user interface
- Database with flexible filtering, sorting and statistical functions
- High transparency of results due to
  - storage of all determination, method and instrument parameters
  - storage of the history for reevaluation or recalculation of measurement data
- High level of data security due to manipulation-proof database and automatic backup functions
- Network-compatible due to client-server functionality
- User administration with freely configurable access rights
- Meets all the requirements of FDA and GLP

Oxidation stability of oils and fats

The determination of the oxidation stability of oils and fats is the classical application for the 892 Professional Rancimat. The term oxidation stability denotes the resistance of oils and fats to oxidation. In the Rancimat method, oxidation is accelerated by means of heating up the reaction vessel and by passing air continuously through the sample. This process causes the fatty acid molecules in the sample to oxidize. First, peroxides form as primary products of oxidation. After some time the fatty acids are completely destroyed and secondary oxidation products are formed, including volatile low-molecular organic acids such as, acetic acid and formic acid. These are transported by the airstream to a second vessel containing distilled water, where conductivity is measured continuously. The appearance of volatile acids is recorded in the measuring vessel as an increase in conductivity. The time that elapses until these secondary reaction products appear is called «induction time», «induction period» or «Oil Stability Index (OSI)». This value characterizes the resistance of the sample to oxidation. The longer the induction time, the more stable a sample is.

The induction time determined by the Rancimat method is a standard parameter of quality control in the production, incoming goods inspection and further processing of oils and fats in the food industry. It is used both in companies that produce such oils and fats and in those that process them further. In addition to oils and fats from vegetable sources, the oxidation stability of animal fats such as lard, tallow and fish oil can, of course, also be determined by the 892 Professional Rancimat.

Foodstuffs normally contain antioxidants that slow down the oxidative decomposition of the oils and fats. These antioxidants may occur naturally or be added artificially. The 892 Professional Rancimat may also be used to control the effectiveness of existing and future antioxidants.
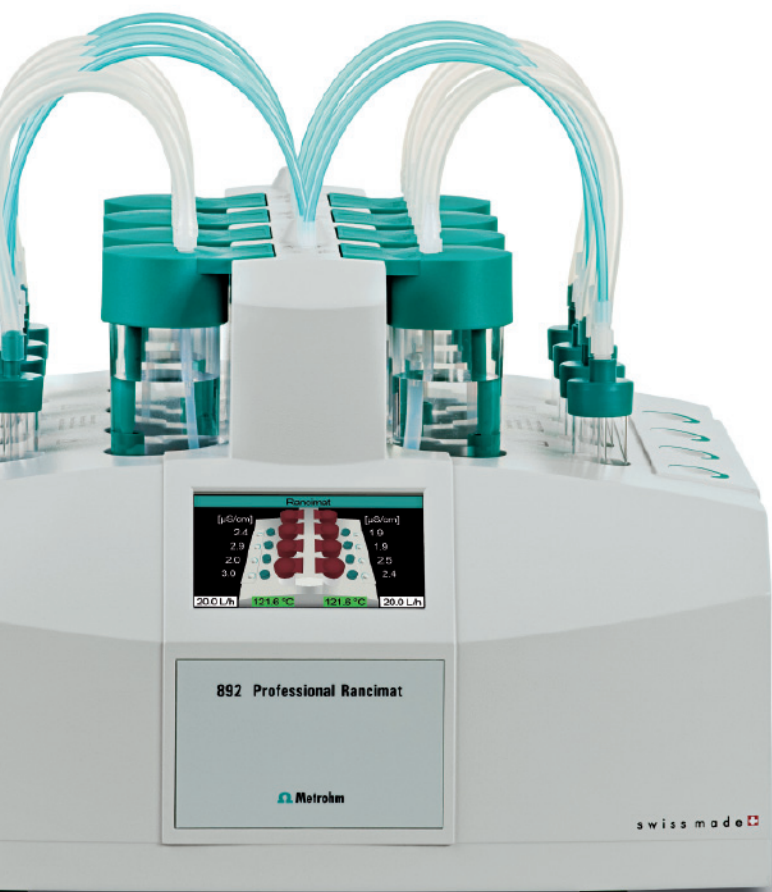
Standards

The Rancimat method is included in various national and international standards, such as:

- AOCS Cd 12b-92 (AOCS – American Oil Chemists' Society)
  Sampling and analysis of commercial fats and oils: Oil Stability Index

- ISO 6886 Animal and vegetable fats and oils – Determination of oxidative stability
  (accelerated oxidation test)

- 2.4.28.2-93 Fat stability test on Autoxidation. CDM, Japan

Oxidation stability of foods

Many foods contain oils and fats, either naturally or as a result of production. Just like the pure substances, the hidden oils and fats are also subject to oxidation, which contributes to their spoilage. Thus, the 892 Professional Rancimat can also be used to determine the oxidation stability of foods containing oils and fats.

Foods with a very high fat content can often be analyzed directly. The only preparation required is a reduction in the size of the sample particles. In the case of foods with a high proportion of water or proteins in addition to fat, the fat phase normally needs to be separated off first. The isolated fat can then be measured with the 892 Professional Rancimat. In these cases the fat is extracted by cold extraction with petroleum ether.

Typical examples of applications for direct measurements
• Butter cookies
• Instant noodles
• Potato chips (crackers)
• Microwave popcorn
• Nuts

Examples of determinations after extraction
• Mayonnaise
• Salad dressing
• Chocolate
• Waffles
• Sausage products

Oxidation stability of cosmetics

Many natural cosmetics and other high-quality cosmetic products contain a substantial proportion of vegetable oils and fats. For example, cocoa butter is an ingredient in many lip and body care products. In contrast to paraffin-based products, these cosmetics spoil over time, partly as a result of the oxidation of the vegetable fats contained. Depending on the proportion of fat, the samples can be measured directly with the 892 Professional Rancimat or the isolated fat can be measured after cold extraction with petroleum ether.

Typical examples of applications

- Suntan oil
- Lip balm
- Hand cream
- Body lotion

The 892 Professional Rancimat in detail

Start buttons on the instrument

Next to each measuring position there is a button with which determination can be started immediately after the sample has been placed in the heating block. The start button is completely sealed on the outside, so no liquids such as oil or water can enter. Triggering is achieved with the help of capacitive finger detection and also works with gloves.

Instrument display

The status of the instrument and of each individual measuring position can be watched on the color instrument display. It shows the temperature of the two heating blocks, the gas flow, the status of the measuring position and the conductivity measured in each measuring position

Easy handling of the reaction vessels

Preparation of the reaction vessel, weighing-out of the sample and closing of the reaction vessel are very simple and safe. The use of disposable glass parts means there is no need for time-consuming cleaning after measuring. That not only saves working time and costs, but also improves the reproducibility of the measurement results, as new, clean measuring vessels prevent carryover effects and consequent interference with results.

Measuring vessel cover with integrated conductivity cell

The conductivity cell, with its electrical connections, is incorporated in the measuring vessel cover. When the cover is placed in position, the cell is immersed in the water and is immediately in the right position. At the same time electrical contact is made to the measuring electronics in the instrument. The conductivity cell itself is a robust stainless steel electrode that withstands even thorough cleaning with detergent and a brush or a wash cycle in the laboratory glassware washer without damage. The cleaning of a conductivity electrode has never been easier!

Air supply

The air used for measuring is drawn in through a filter by the integral pump and water vapor is removed by means of a molecular sieve. The gas flow to the various measuring positions is controlled within the range of 1 L/h and 25 L/h according to the method settings in StabNet.

Connections

The 892 Professional Rancimat is connected to the PC by way of a USB port. Up to four 892 Professional Rancimats can be connected to a PC and controlled by StabNet.

# StabNet – modern software for stability measurements

StabNet is the modern and user-friendly software for carrying out stability measurements and archiving the measurement data. The characteristic features of StabNet are its ease of use and flexibility.


This is evident already in the «Workplace» part of the program, where the day-to-day work is done. Here users will find all the elements that are needed to carry out determinations. The structure of the «Workplace» shows the setup of the 892 Professional Rancimat with its 2 heating blocks and the 8 measuring positions.
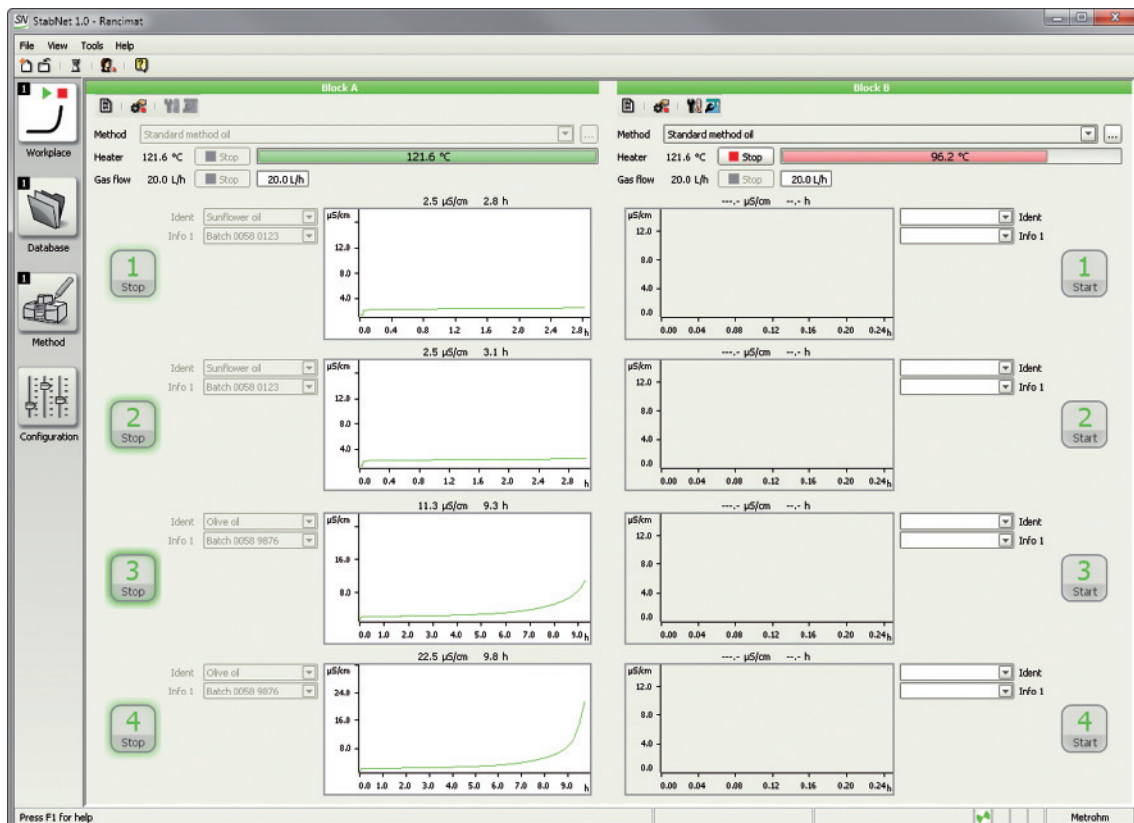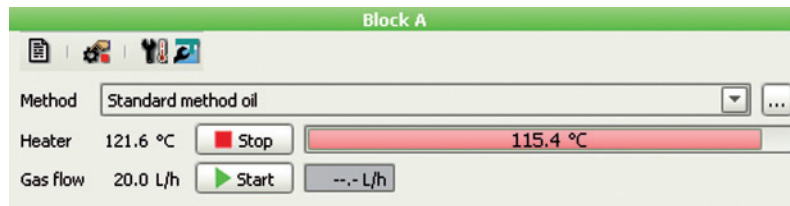
For each heating block it is possible to load an individual method in which, amongst other things, the temperature and gas flow are defined. The heating is switched on manually in the «Workplace» part of the program. The heating can also be started automatically, and very conveniently, at a defined time with the help of a timer; the instrument will then be ready for use right on the start of the working day.
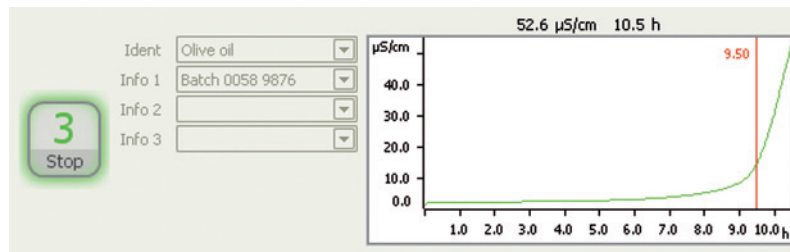
For each measuring position on the instrument there is a live display in the «Workplace» part of the program. The flashing Start/Stop button indicates a determination is running. From the corresponding live curve it is possible to see directly the current status of the determination and the already detected end points. The sample identification and other information about the sample can be entered in up to 4 fields. Frequently recurring identifications can be stored as text templates and can then be simply selected on the «Workplace».
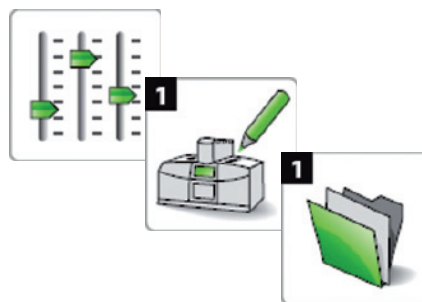
The symbols in the StabNet toolbar on the left edge of the program provide access to the other parts of the program: «Configuration», «Method» and «Database». Because of the clear symbols and the well laid-out structure the user interface is easy to follow and can be operated intuitively.
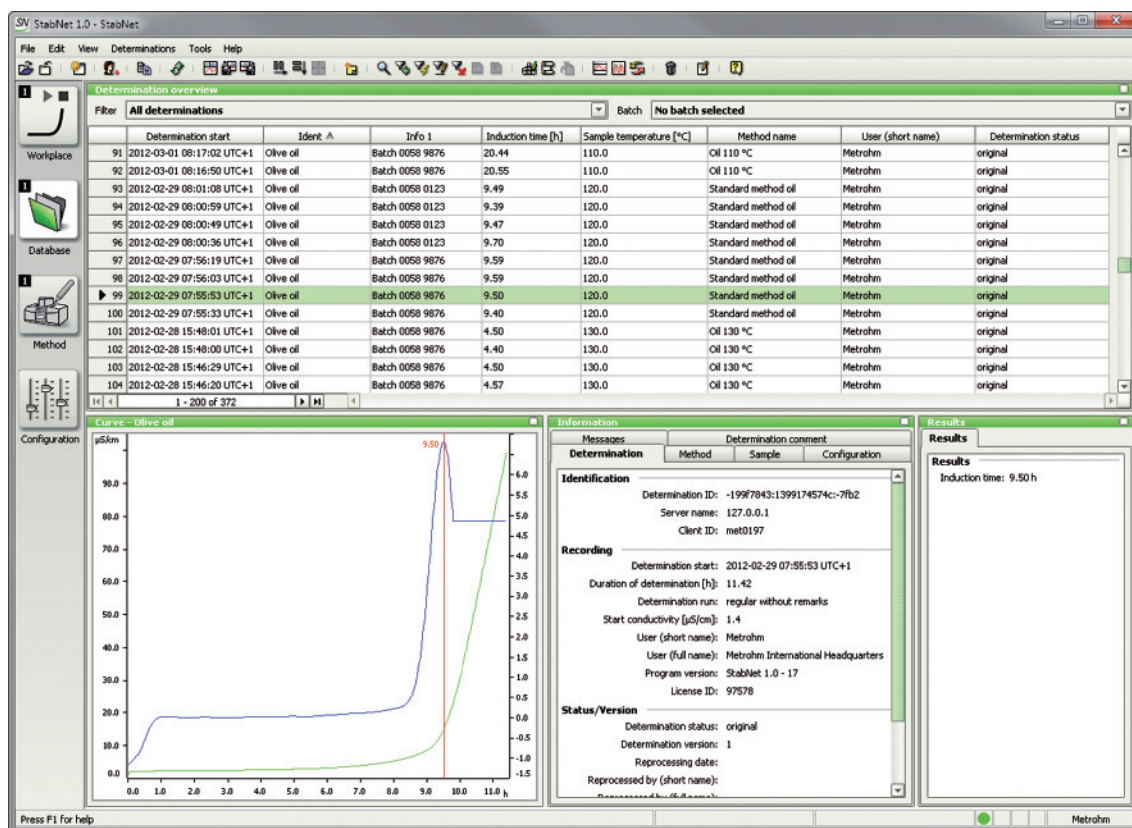
Data management

Completed determinations are stored in a database.


StabNet

In the «Database» part of the program it is possible to view the determinations including all the determination, method and instrument parameters.

The determination overview is freely configurable, so all measurement results can be scanned easily. The subwindows «Curve» and «Information» display the measurement curve and other information on the determination, as well as method and instrument parameters for each determination that is selected.
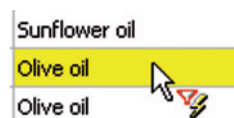
Convenient sort, search and filter functions make it easy to find data quickly.
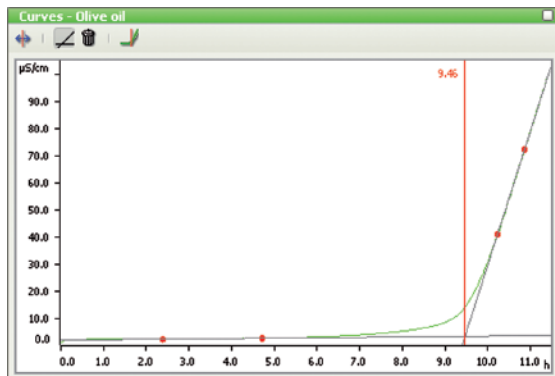
Recalculation of determinations

Should it ever be necessary, determinations can also be processed at a later time, either by recalculation with different evaluation parameters or by manual evaluation of the curve with tangents. The original data are not lost. All versions of the determination are archived.

Using the History function it is possible to restore the original version or any interim version or the final version at any time.

Report creation

The report generator offers complete freedom when it comes to creating the analysis report, whether it be an individual report with all the relevant sample and method information or a tabular report in the form of a table with all the results of a measurement series. StabNet contains a series of different report templates that can be adapted to the particular needs. As a result, a customized report can be created in next to no time; and a company logo can, of course, be added, if required.

Individual report with all the relevant details for the determination

Tabular report (with or without curve), in portrait or landscape format, provides an overview of larger measurement series

Other helpful database functions

Today entering a result in a table is simply not enough. Frequently, measurement results need to be set out as statistics and graphs. StabNet also supports this step.

Statistical calculations

Confirmation of relevant results usually requires multiple determinations. StabNet offers the possibility of linking 2 or 4 replicate determinations together statistically. At the end of the multiple determinations, statistical data, such as the mean value and the absolute and relative standard deviations, are then calculated automatically in addition to the individual result.
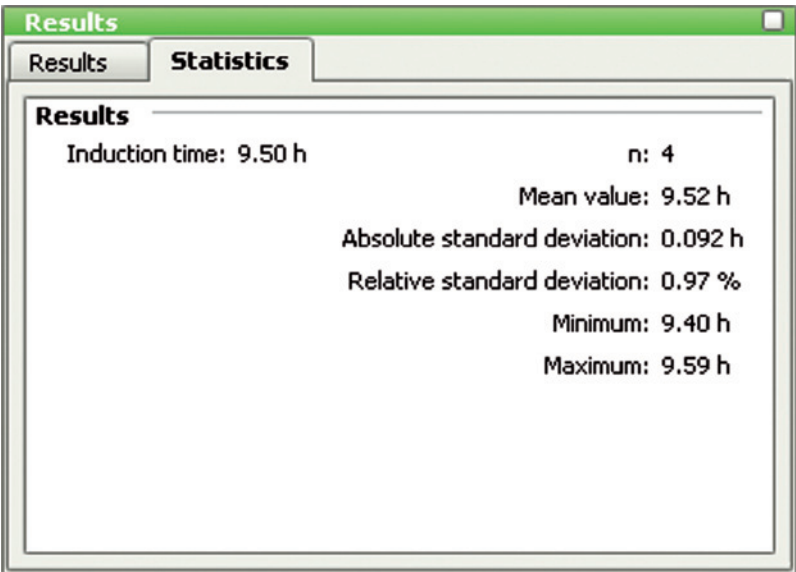
Detail overview and control chart

The function «Detail overview» shows trends and spreads in a clearly set-out chart. In addition, a table containing all the results of the selected determinations and their statistical evaluation is displayed.

Furthermore, a control chart provides the possibility for defining and visualizing warning and intervention limits.
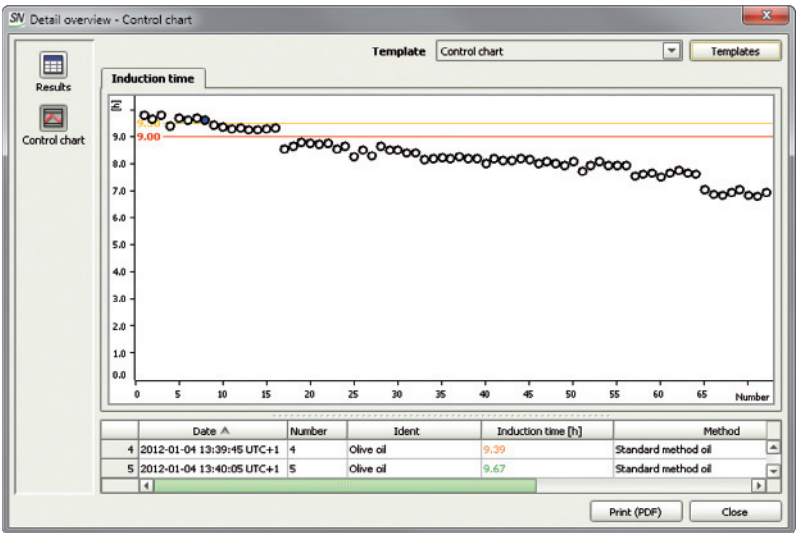
Temperature extrapolation

The Rancimat method is based on the fact that chemical reactions – in this case the oxidation of fatty acids – depend on temperature. With the help of «Extrapolation» it is possible to show the induction time or stability time results as a function of the temperature of the sample in the form of a graph. Moreover, «Extrapolation» enables recalculating results measured at one temperature in relation to a different temperature.

Thus, for example, extrapolation to room temperature provides a rough estimate for the shelf life of a sample. However, it must be kept in mind that mathematical extrapolation of hours to months and years involves a high degree of statistical uncertainty. Furthermore, the measuring conditions do not correspond to the storage conditions. For these reasons, it is impossible to calculate the shelf life exactly in this way.

Two models are available for extrapolation. Firstly, there is the empirical Q_{10} approach, which is based on the observation that the induction time approximately doubles with each 10 °C reduction in sample temperature. The second model also incorporates the reaction kinetics. It is based on the Arrhenius equation, which describes the temperature dependence of the reaction rate constant.
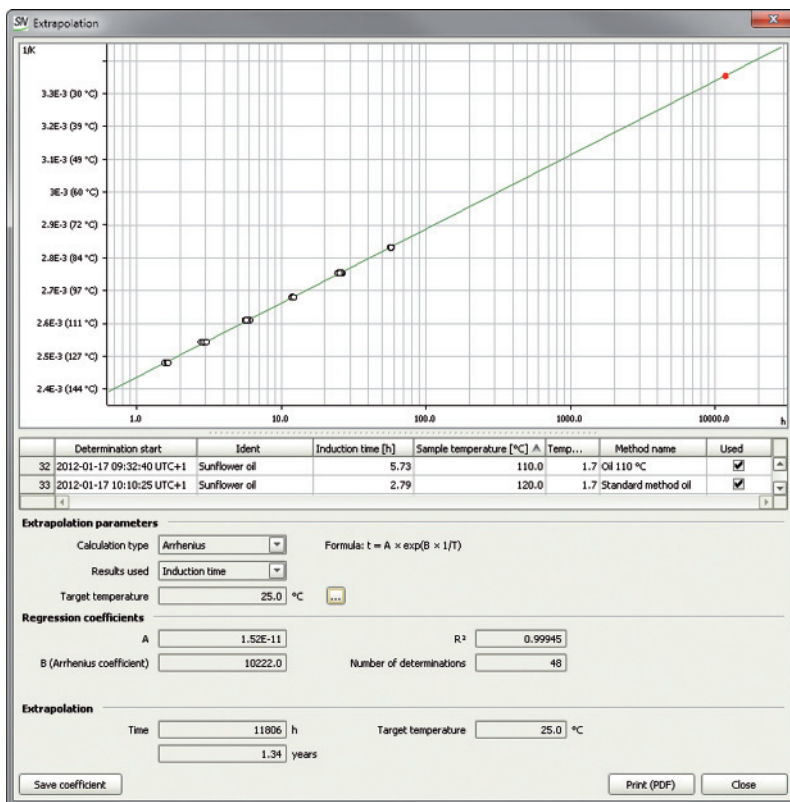
Data management and security

Central data management

In the client-server version, StabNet enables central data management on a server in the local network. Regarding operation and scope of functions, the client-server version does not differ from a local installation. However, all the methods and determinations are stored centrally on the StabNet server. The great advantage is that any data can be viewed and processed further from any PC on which a StabNet client is installed, whether in the laboratory or in the office. Thus, all the measurement data are available throughout the company.
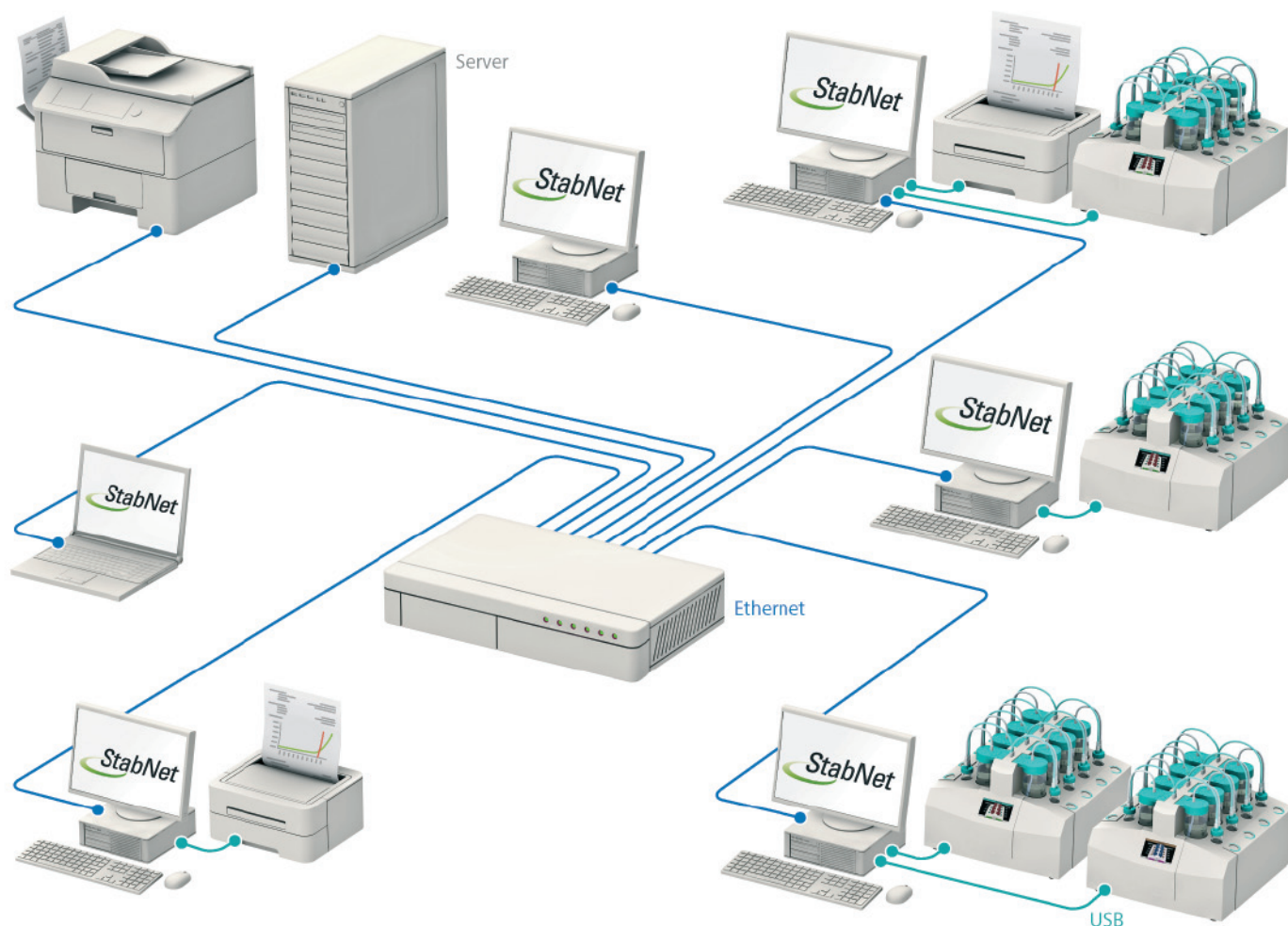
Security

Data security and the traceability of results are becoming ever more important. In StabNet the access rights of each user can be defined in accordance with the in-house security scheme. Password protection prevents unauthorized access to parts of the program and to data. Furthermore, there is the possibility to add a digital signature to both methods and determinations in accordance with the guidelines of FDA Title 21 CFR Part 11.
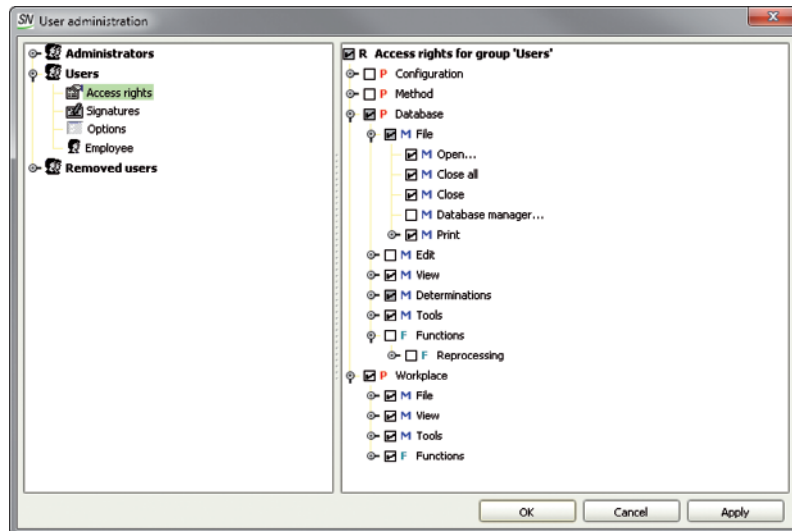
Data backup

StabNet also supports data backup. The entire database is backed up at a freely definable interval. Lost data can therefore be restored in a very short time.
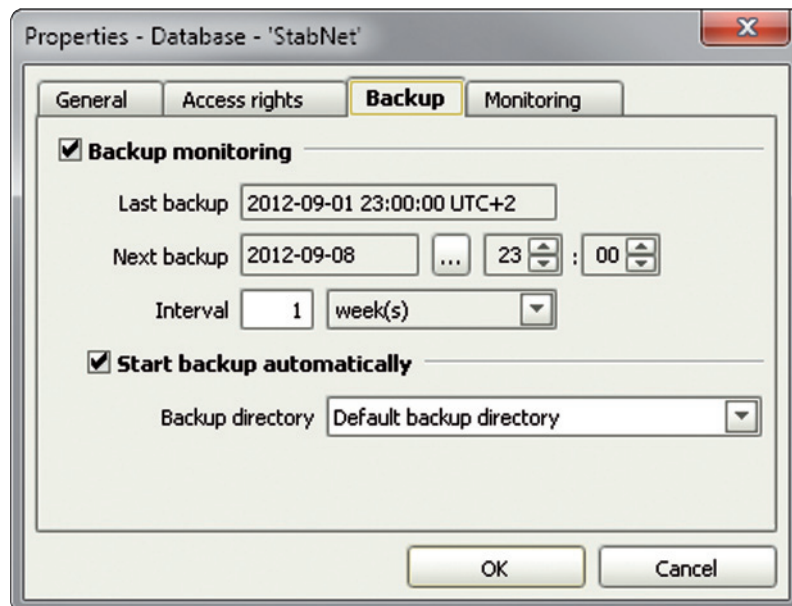
Technical specifications

892 Professional Rancimat

Heating blocks

2 aluminum heating blocks; electrically heated; can be set to different temperatures

Temperature control

Temperature range	50...220 °C, adjustable in 1 °C steps
Temperature correction	-9.9...+9.9 °C, adjustable in 0.1 °C steps
Deviation of the block temperature from the set value	< ±0.3 °C
Reproducibility of set temperature	Typically better than ±0.2 °C*
Temperature variations	Typically <0.1 °C*
Temperature difference between different measuring positions	Typically <0.3 °C*
Ambient temperature	<50 °C (at an operating temperature of 220 °C)
Response temperature of thermal protection	260 °C

* When operating temperature has been reached, with inserted reaction vessels with an identical filling and 20 L/h air throughput.

Air throughput

Pump	Diaphragm pump
Adjustable range volumetric flow rate	1...25 L/h (at 25 °C and 1013 hPa)
Max. error from set value	± (0.25 L/h + 5% of the measurement value)

Conductivity measurement

Electrodes	Conductivity cell 6.0913.130 with double steel-pin electrode integrated in measuring vessel cover
Measuring range	0...400 µS/cm

Line power

Voltage	100...120 V and 220...240 V
Frequency	50...60 Hz
Power consumption	Max. 450 VA

Dimensions

Width	383 mm
Depth	461.5 mm
Height	276.5 mm (without accessories)
Weight	16.1 kg (without accessories)

Minimum PC requirements for StabNet

Processor	Pentium 4; clock speed 1 GHz
Working memory	2 GB
Free hard disk memory	1 GB for program
Free memory for data	4 GB (for approx. 1000 determinations)
Operating system	Windows XP Professional
	Windows Vista
	Windows 7 (32-bit and 64-bit)
USB port	1 for each instrument that is connected (maximum 4)

Additional requirements for StabNet server installations

Operating system for server	Windows Server 2003
	Windows Server 2008
	Windows Server 2008 R2 (32-bit and 64-bit)
Network	Minimum 10 Mbit/s

Ordering Information

2.892.0010   892 Professional Rancimat
Instrument for the determination of the oxidation stability of natural fats and oils. All accessories necessary for the performance of the determinations is included in the scope of delivery. The StabNet software is required for instrument control, data recording and evaluation and for data storage (not included).
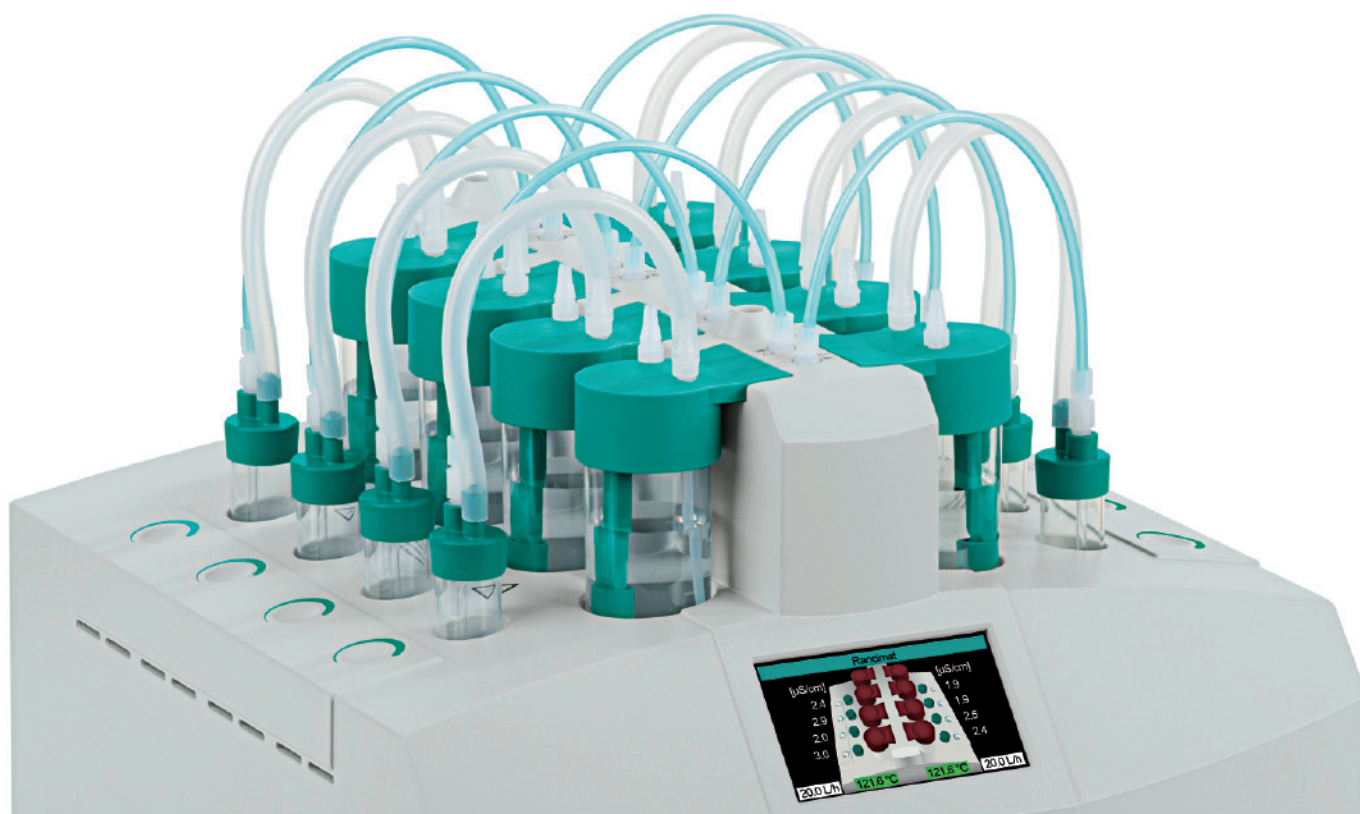
Options

6.1111.010   Pt100 Temperature Sensor
6.1428.030   Glass measuring vessel for stability measurements
6.1429.050   Reaction vessel long for stability measurements, 100 pieces
6.1839.000   Iso-Versinic tubing
6.2059.000   Turning ring
6.2324.010   Conductivity standard 100 µS/cm (250 mL)
6.2326.000   Silicone oil for stability measuring instruments (50 mL)
6.2418.130   Air tube long for biodiesel measurements, 100 pieces
6.2757.000   Air collection tube for stability instruments
6.5616.100   Equipment for determining the temperature correction for Rancimats and PVC Thermomats

Consumables

6.5706.020   Rancimat Consumable Kit
6.2821.090   Aspiration filter

StabNet

6.6068.102   StabNet 1.0 Full CD: 1 license
6.6068.103   StabNet 1.0 Multi CD: 3 licenses

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Subject to change

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