893 Professional Biodiesel Rancimat

Standard compliant determination of the oxidation stability of biodiesel and biodiesel blends

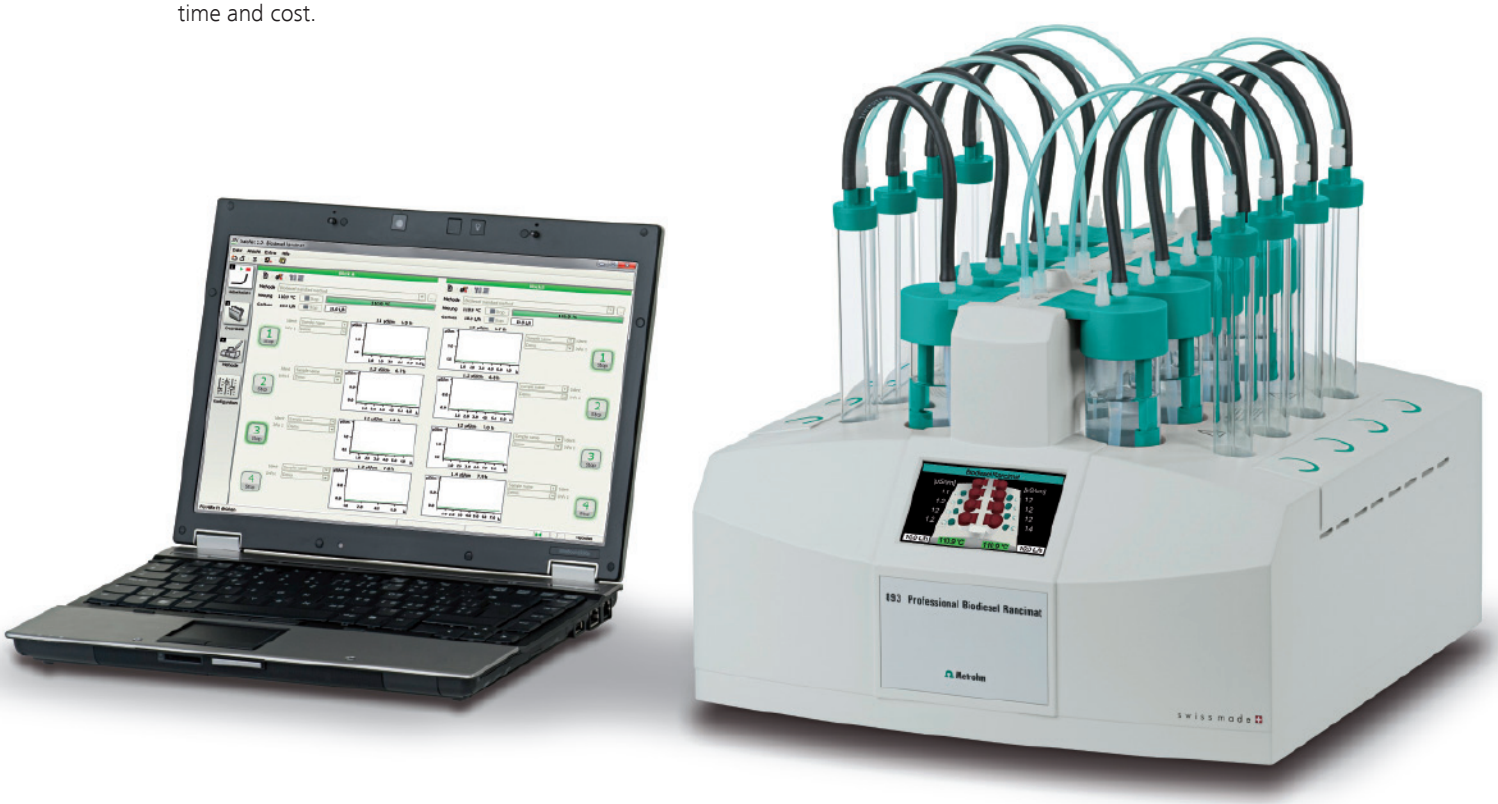
Metrohm

The 893 Professional Biodiesel Rancimat and StabNet in brief

The 893 Professional Biodiesel Rancimat, in conjunction with StabNet software, is a modern analytical system for easy and reliable determination of the oxidation stability of biodiesel and biodiesel blends according to standards EN 14112 and EN 15751.

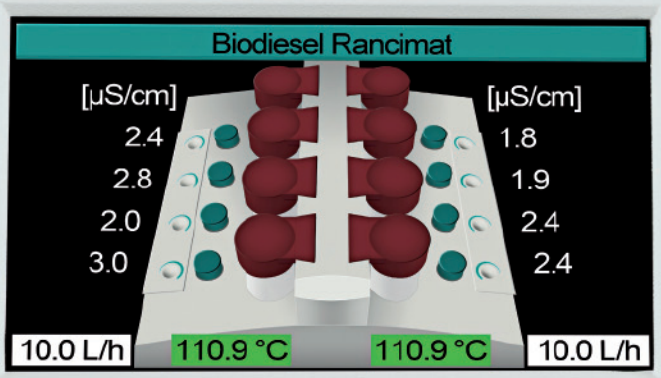
The 893 Professional Biodiesel Rancimat is controlled from the PC by way of StabNet software. Determination itself, however, can be started very conveniently directly on the instrument. Each measuring position has its own individual start button. In addition, the integral color display provides an overview 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 and automatic backup functions ensure a high level of data security.



The most important applications

- Oxidation stability of biodiesel according to EN 14112 or EN 15751
- Oxidation stability of biodiesel blends according to EN 15751
- Oxidation stability of biolubricants
- Oxidation stability of light heating oil (with copper catalyst)



893 Professional Biodiesel Rancimat

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

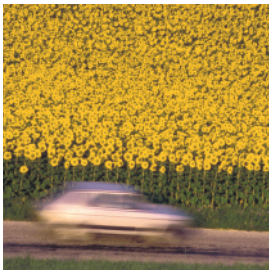
- Clearly laid-out user interface
- Database with flexible filtering, sorting and statistical functions
- High transparency of results due to
  - storage of all determination, method and instrument parameters
  - storage of the history for reevaluation or recalculation of measurement data
- High level 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

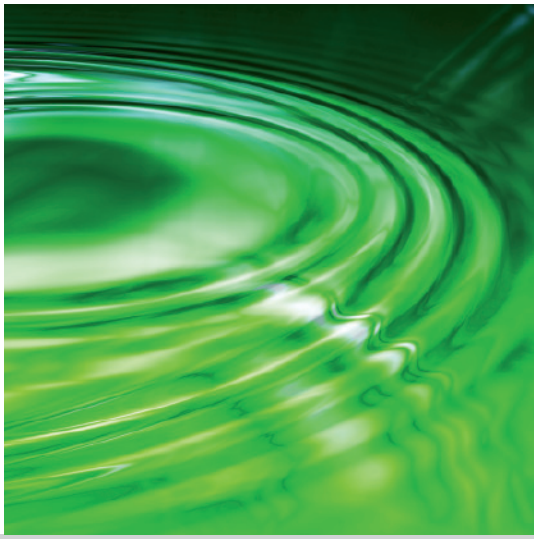
Oxidation stability of biodiesel (fatty acid methyl esters, FAME) and biodiesel blends

The use of alternative fuels made from renewable plant sources has become more widespread in recent years and is likely to increase in the future. Besides other alternative fuels such as ethanol, methanol or biogas (methane), fatty acid methyl esters – also known as biodiesel, RME (rapeseed oil methyl esters) and FAME – have become another important renewable energy source. Fatty acid methyl esters are usually obtained from oil seeds and are used automotive fuel either in their pure form or mixed with conventional diesel fuel as biodiesel blends.

Biodiesel is usually produced from vegetable oils, but animal fats or waste products from the production or processing of foods can also be used. The oil is transesterified with methanol in a catalyzed process. This produces the methyl esters of the fatty acids present in the oil together with glycerol as a by-product. Fatty acid methyl esters are relatively unstable in storage, as like all natural oils and fats they are slowly oxidized by atmospheric oxygen. The substances thus produced may cause motor damage. This is why oxidation stability is an important quality criterion for biodiesel and is determined regularly during the production process. The 893 Professional Biodiesel Rancimat is the instrument of choice to determine the oxidation stability of biodiesel simply and reliably.

During measurement a stream of air is passed through the fatty acid methyl ester sample contained in a closed and heated reaction vessel. This treatment results in oxidation of the alkyl ester molecules in the sample, with peroxides initially being formed as the primary oxidation products. After some time the fatty acid methyl esters begin to decompose, and the secondary oxidation products thus formed include low-molecular organic acids such as, acetic acid and formic acid in addition to other volatile organic compounds. These are transported by the airstream to a second vessel containing distilled water, where the conductivity is measured continuously. The organic acids can be detected by the increase in conductivity. The time that elapses until these secondary reaction products appear is called induction time or induction period and characterizes the quality of the sample.





Standards

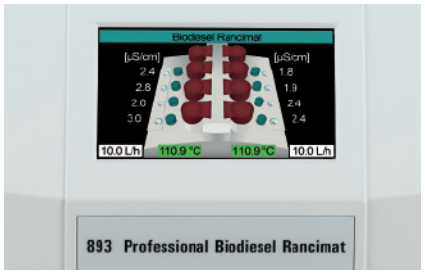
The oxidation stability of fatty acid methyl esters and their mixtures with diesel fuels is an important standard parameter in a series of standards defining the minimum quality requirements of biodiesel that is marketed as vehicle fuel or heating oil.

- ASTM D 6751 (ASTM – American Society for Testing and Materials) «Standard specification for biodiesel fuel blend stock (B100) for middle distillate fuels»
- ASTM D 7467 «Standard specification for diesel fuel oil, biodiesel blend (B6 to B20)»
- EN 14214 «Automotive fuels – Fatty acid methyl esters (FAME) for diesel engines – Requirements and test methods»
- EN 14213 «Heating fuels – Fatty acid methyl esters (FAME) – Requirements and test methods»
- EN 14112 «Fat and oil derivatives – Fatty acid methyl esters (FAME) – Determination of oxidation stability (accelerated oxidation test)»
- EN 15751 «Automotive fuels – Fatty acid methyl ester (FAME) fuel and blends with diesel fuel – Determination of oxidation stability by accelerated oxidation method»
- EN 590 «Automotive fuels – Diesel – Requirements and test methods»

The 893 Professional Biodiesel 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 sample 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 current 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.

Cover with built-in 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.

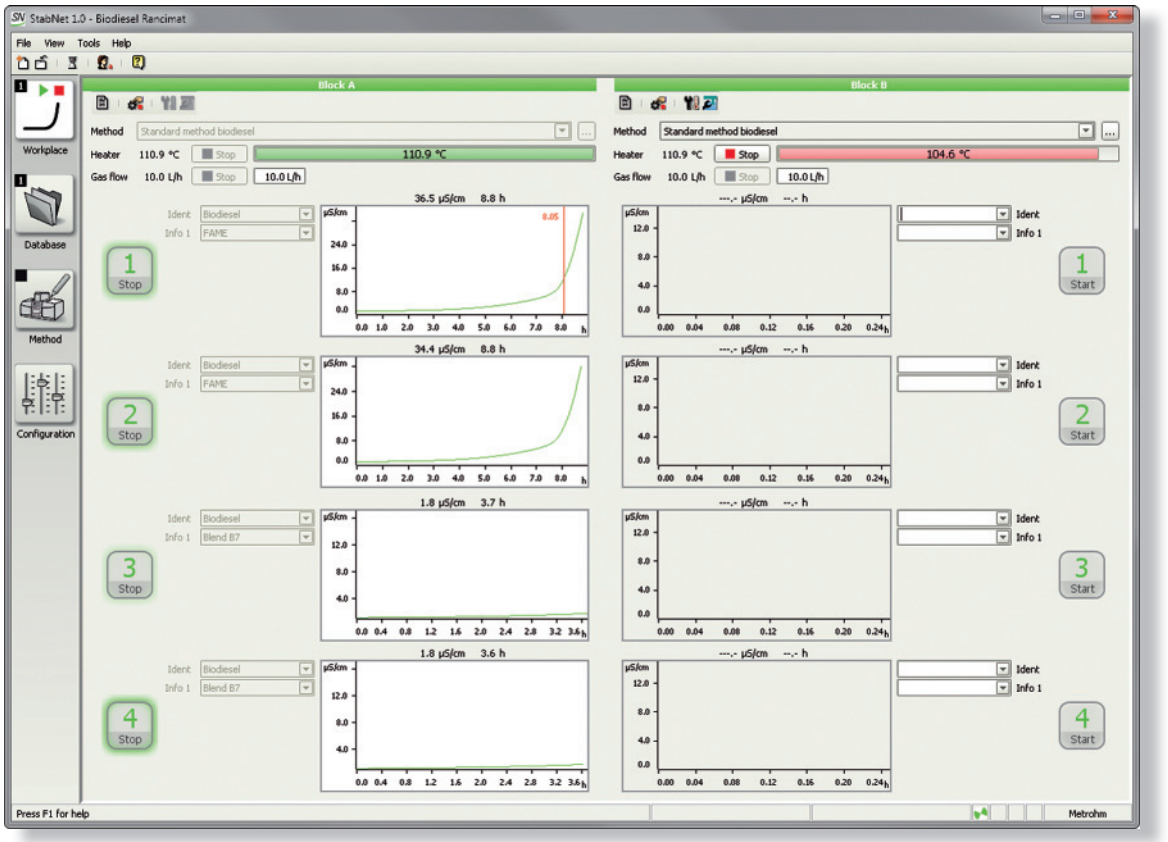
Connections

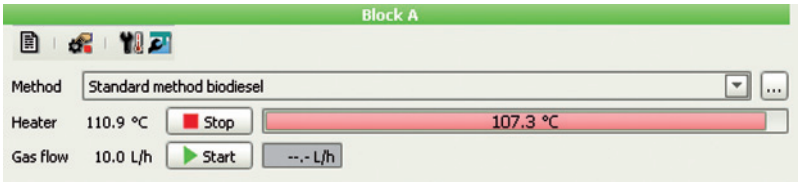
The 893 Professional Biodiesel Rancimat is connected to the PC by way of a USB port. Up to four 893 Professional Biodiesel Rancimats can be connected to a PC and controlled by StabNet.

StabNet – modern software for stability measurements

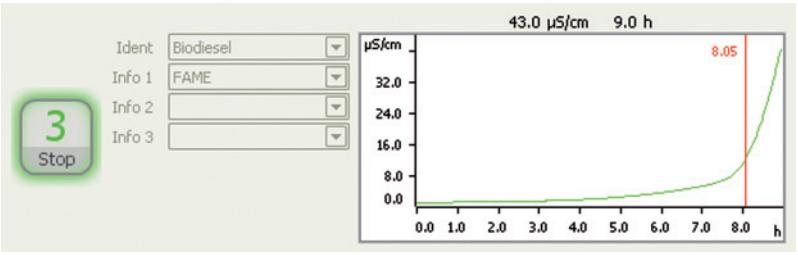
StabNet is the modern and user-friendly software for carrying out stability measurements and archiving the measurement data. The characteristic features of StabNet are its ease of use and flexibility.

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 893 Professional Biodiesel Rancimat with its 2 heating blocks and the 8 measuring positions.

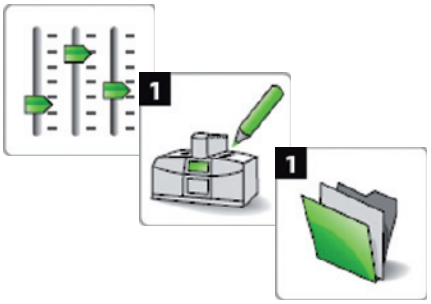




For each heating block it is possible to load an individual method in which, amongst other things, the temperature and gas flow are defined. The heating is switched on manually in the «Workplace» part of the program. The heating can also be started automatically, and very conveniently, at a defined time 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».



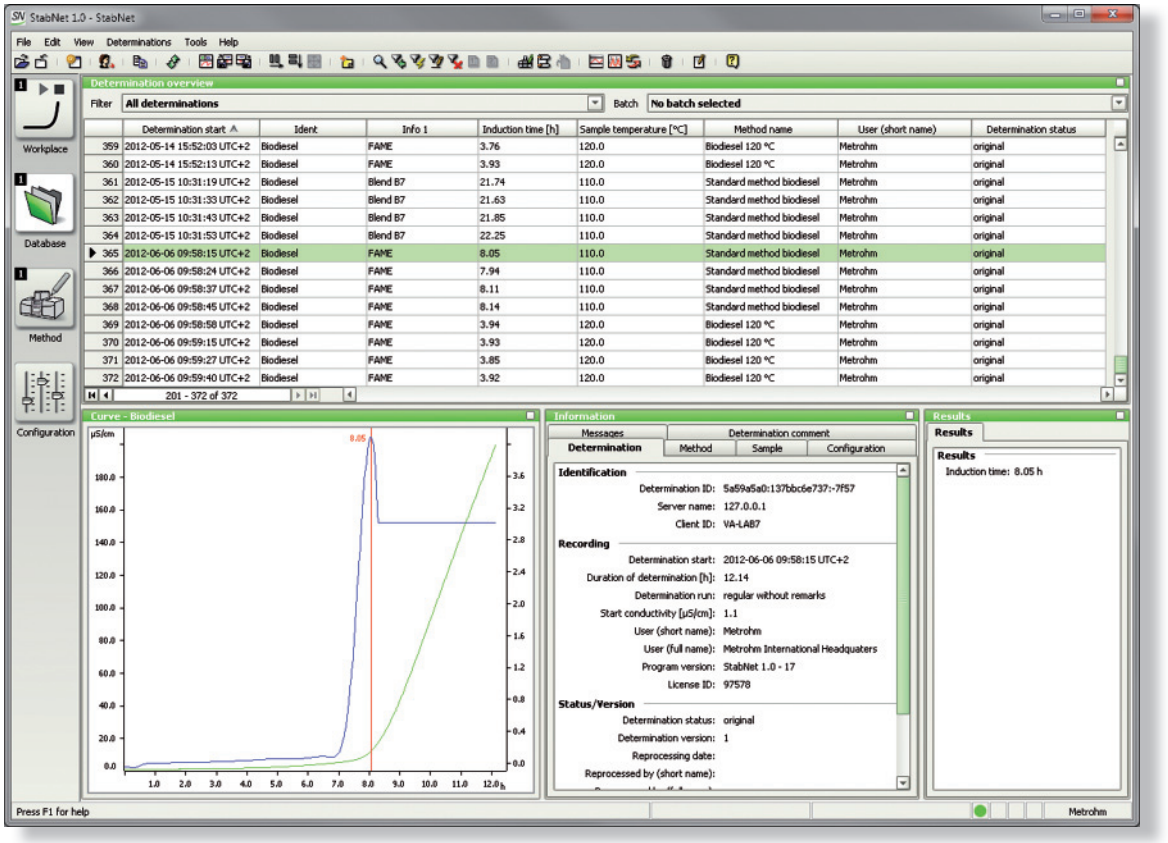
The symbols in the StabNet toolbar on the left edge of the program provide access to the other parts of the program: «Configuration», «Method» and «Database». Because of the clear symbols and the well laid-out structure the user interface is easy to follow and can be operated intuitively.

Data management

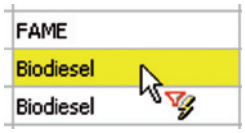
Completed determinations are stored in a database.

StabNet

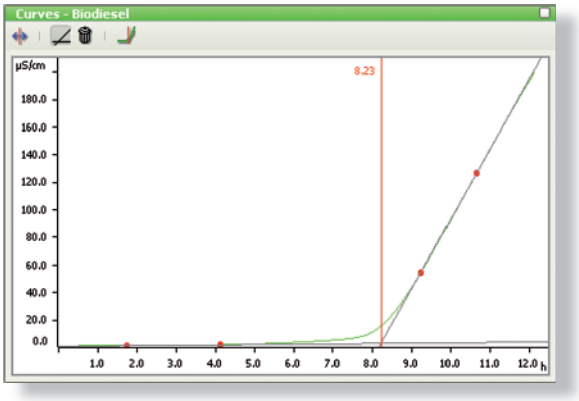
In the «Database» part of the program it is possible to view the determinations including all the determination, method and instrument parameters.



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.



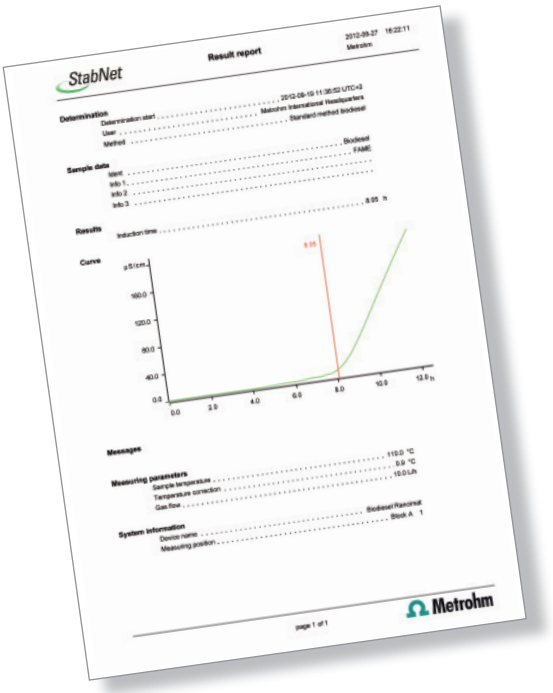
Recalculation of determinations

Should it ever be necessary, determinations can also be processed at a later time, either by re-calculation 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

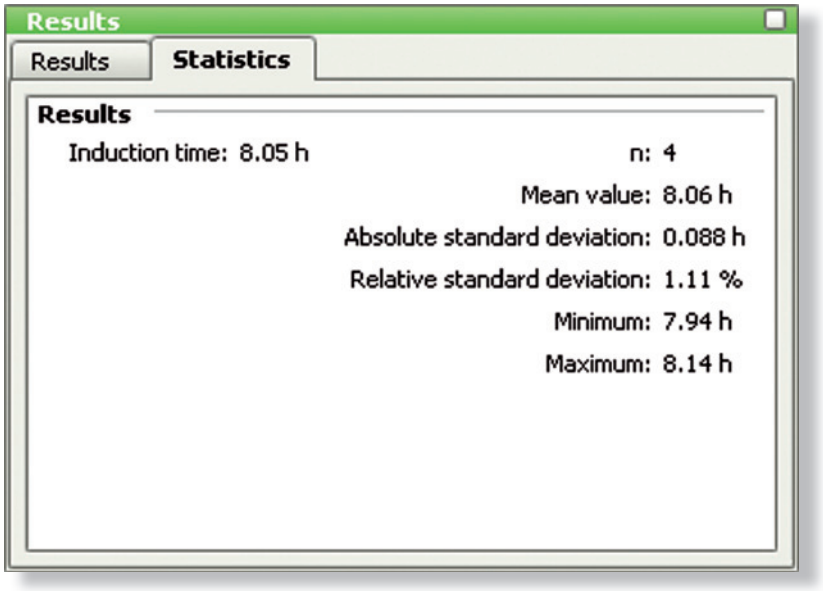
Other helpful database functions

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.

StabNet

Statistical calculations

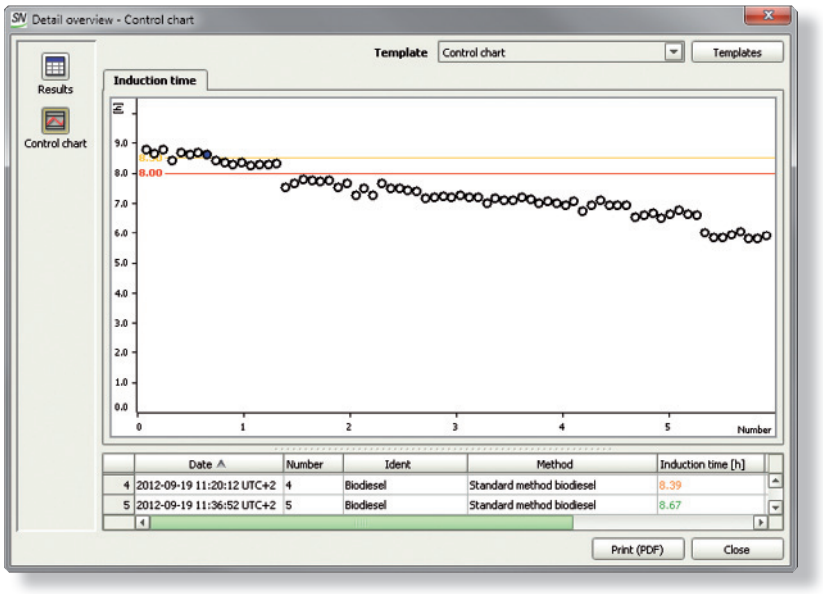
Confirmation of relevant results usually requires multiple determinations. StabNet offers the possibility of linking 2 or 4 replicate determinations together statistically. At the end of the multiple determinations, statistical data, such as the mean value and the absolute and relative standard deviations, 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.



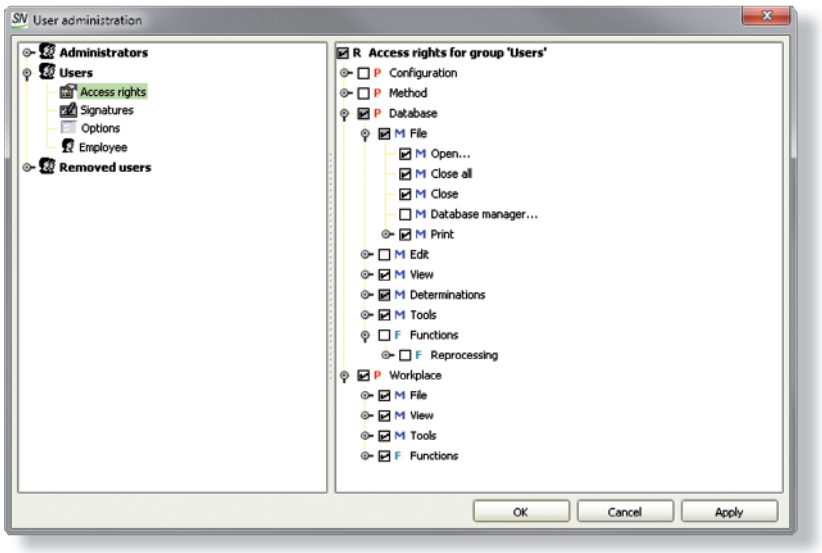
Data management and security

Central data management

In the client-server version, StabNet enables central data management on a server in the local network. Regarding its 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.

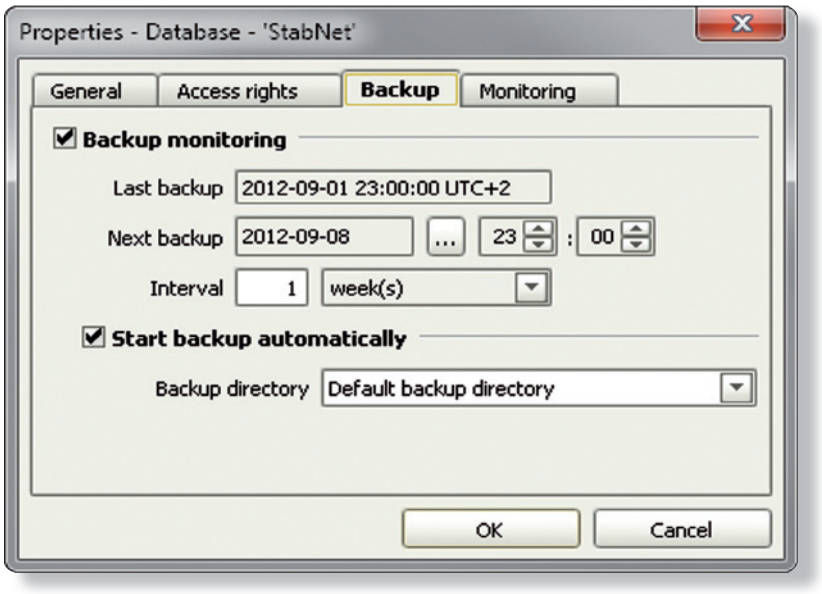
Security

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.



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

893 Professional Biodiesel Rancimat	
Heating blocks	
2 aluminum heating blocks; electrically heated; can be set to different temperatures	
Temperature control	
Temperature range	50...150 °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 150 °C)
Response temperature of thermal protection	180 °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. 1'000 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

2.893.0010	893 Professional Biodiesel Rancimat Instrument for determination of the oxidation stability of biodiesel (fatty acid methyl ester, FAME) and biodiesel blends in accordance with the standards EN 14112 and EN 15751. All of the necessary accessories 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

6.1111.020	Pt100 Temperature Sensor long for biodiesel measurements
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)
6.2757.000	Air collection tube for stability instruments
6.5616.110	Equipment for determining the temperature correction for Biodiesel Rancimats

Consumables

6.5706.010	Biodiesel 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

www.metrohm.com

Subject to change
Layout by Ecknauer+Schoch ASW, printed in Switzerland by Metrohm AG, CH-9100 Herisau
8.893.5000EN – 2012-10

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