



## 893 Professional Biodiesel Rancimat

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

PEOPLE  
YOU  
CAN  
TRUST

 **Metrohm**

# The 893 Professional Biodiesel Rancimat and StabNet in brief

The 893 Professional Biodiesel Rancimat, in conjunction with StabNet software, is an 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 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)

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 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
- User administration with freely configurable access rights
- Meets all the requirements of FDA and GLP
- Monitoring the working life of all accessories



# 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.

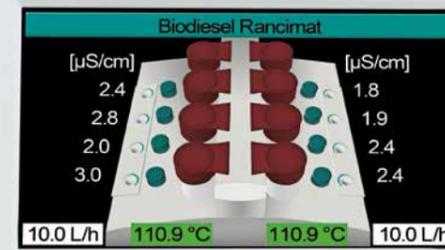


## Standards

**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



893 Professional Biodiesel Rancimat

## 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 is integrated in the cover of the measuring vessel. It is immediately put in the correct position when the cover is put on the sample vessel. The electrodes are made of stainless steel and tolerate thorough cleaning with detergents or in a dishwasher without damage.



## 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.



## AIR SUPPLY

Ambient air is drawn in and any contained moisture is removed by the molecular sieve. The gas flow is controlled between 1-25 L/h based on parameters set in the method.



# 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. Up to four 893 Biodiesel Rancimats can be controlled simultaneously via StabNet.



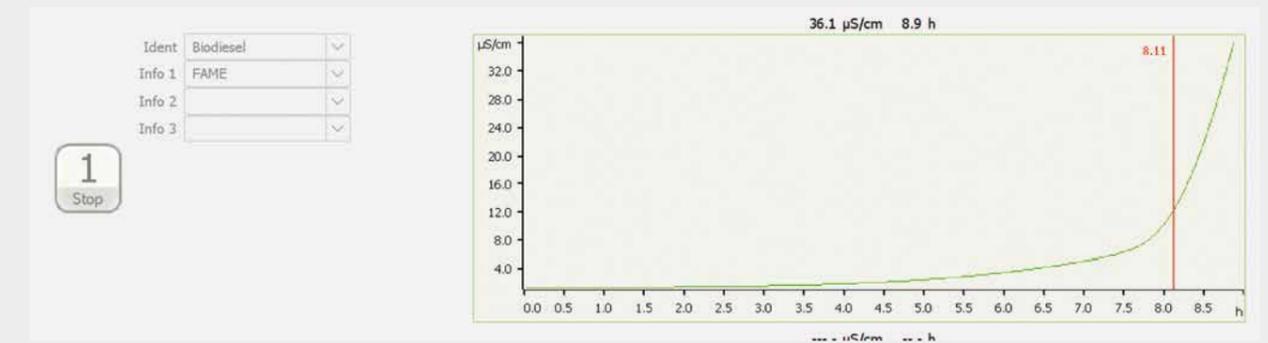
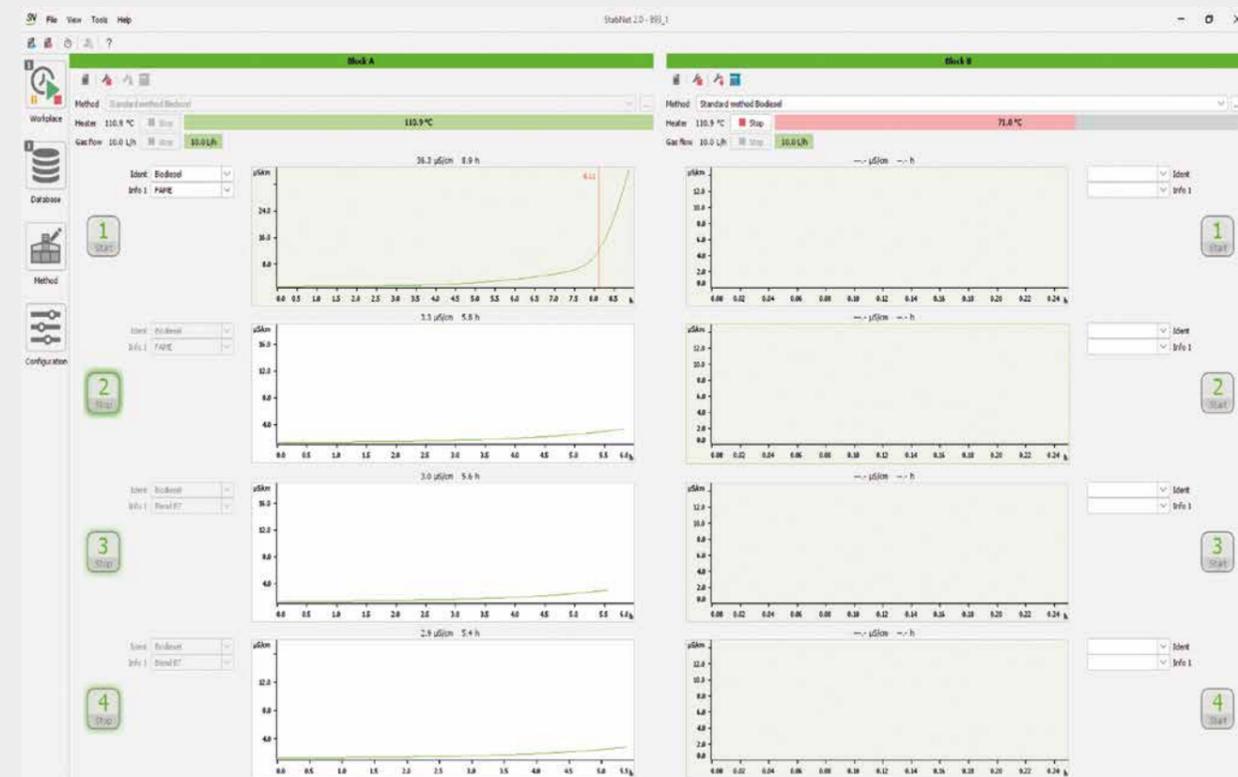
For each heating block it is possible to load an individual method in which, amongst other things, the temperature and gas flow are defined. The heating is switched on manually in the «Workplace» part of the program. The heating can also be started automatically, and very conveniently, at a defined time with the help of a timer; the instrument will then be ready for use right on the start of the working day.

**Block A**

Method: Standard method Biodiesel

Heater: 110.9 °C Stop 110.9 °C

Gas flow: 10.0 L/h Stop 10.0 L/h



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 detect-

ed 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 «Data-base». Because of the clear symbols and the well laid-out structure the user interface is easy to follow and can be operated intuitively.

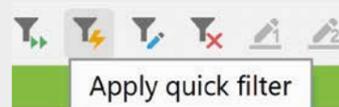


Completed determinations are stored in a database.

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

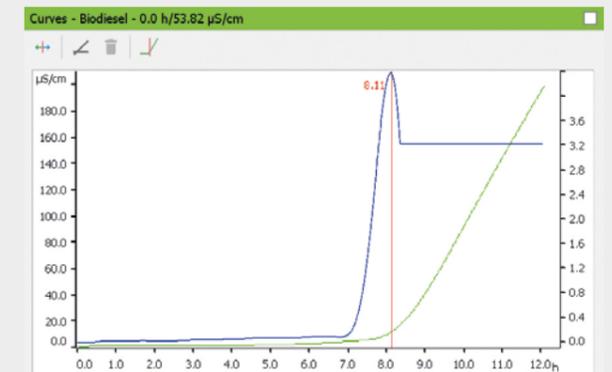


Convenient sort, search and filter functions make it easy to find data quickly.



**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.



Determination start	Ident	Info 1	Induction time [h]	Sample temperature [°C]	Determination version	Method name	User (short name)
2023-06-06 09:59:40 UTC+2	Biodiesel	FAME	3.92	120.0	3	Biodiesel 120 °C	Metrohm
2023-06-06 09:58:58 UTC+2	Biodiesel	FAME	3.94	120.0	3	Biodiesel 120 °C	Metrohm
2023-06-06 09:58:37 UTC+2	Biodiesel	FAME	8.11	110.0	3	Biodiesel 110 °C (EN 15751)	Metrohm
2023-06-06 09:58:15 UTC+2	Biodiesel	FAME	8.05	110.0	3	Biodiesel 110 °C (EN 15751)	Metrohm
2023-05-14 15:51:48 UTC+2	Linseed oil	sheff life 17.10.2023	3.89	100.0	7	Oil 100 °C auto	Metrohm
2023-05-14 15:51:05 UTC+2	Linseed oil	sheff life 17.10.2023	8.06	90.0	3	Oil 90 °C auto	Metrohm
2023-05-14 10:31:53 UTC+2	Linseed oil	sheff life 17.10.2023	17.54	80.0	3	Oil 80 °C auto	Metrohm
2023-05-14 09:08:36 UTC+2	Linseed oil	sheff life 17.10.2023	1.04	120.0	3	Oil 120 °C auto	Metrohm
2023-05-14 09:07:48 UTC+2	Linseed oil	sheff life 17.10.2023	1.97	110.0	3	Oil 110 °C auto	Metrohm
2023-05-11 11:25:37 UTC+2	Soy bean oil	sheff life 31.12.2023	20.44	90.0	4	Oil 90 °C auto	Metrohm
2023-05-11 11:25:16 UTC+2	Soy bean oil	sheff life 31.12.2023	43.02	80.0	4	Oil 80 °C auto	Metrohm
2023-05-09 09:59:04 UTC+2	Soy bean oil	sheff life 31.12.2023	1.49	130.0	4	Oil 130 °C auto	Metrohm
2023-05-09 09:58:24 UTC+2	Soy bean oil	sheff life 31.12.2023	9.83	100.0	4	Oil 100 °C auto	Metrohm
2023-05-08 11:45:27 UTC+2	Soy bean oil	sheff life 31.12.2023	2.46	120.0	5	Oil 120 °C auto	Metrohm
2023-04-11 09:05:04 UTC+2	Corn oil	sheff life 05.2024	22.75	100.0	3	Oil 100 °C auto	Metrohm
2023-04-11 09:04:22 UTC+2	Corn oil	sheff life 05.2024	47.64	90.0	3	Oil 90 °C auto	Metrohm

The 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.

### 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.

# 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.

Results

Results Statistics

Results

Induction time: 0.99 h  
induction time: 1.0 h

Result definitions

induction time: 'RS.IND'

RS.IND: 0.9890605969647149

SV Detail overview - Control chart

Template Olive oil

Control chart

	Date	Number	Ident	Method	Induction time	Statistics
1	2012-02-09 15:06:41 UTC+1	1	Olive oil	Oil 100 °C auto	51.36 h	✓
2	2012-02-13 08:20:24 UTC+1	2	Olive oil	Oil 110 °C auto	21.85 h	✓
3	2012-02-14 14:11:28 UTC+1	3	Olive oil	Oil 120 °C auto	10.39 h	✓
4	2012-02-15 08:35:09 UTC+1	4	Olive oil	Oil 130 °C auto	4.51 h	✓
5	2012-02-16 10:15:09 UTC+1	5	Olive oil	Oil 140 °C auto	2.08 h	✓

Print (PDF) Close

## 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 determi-

nations 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

	Accessory name	Set to work	Expiry date
1	Reaction vessel cap	2023-03-29	2024-03-28
2	Silicone tube	2023-03-29	2024-03-28

## System health monitoring

Monitor and track all sensors and accessories of the instrument, and let the system inform you when you have to change, calibrate or clean them.

## 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.

SV User administration

Administrators

Users

Removed users

Access rights for group 'Users'

Configuration

Method

- Database
  - MFile
    - M Open... ✓
    - M Close all ✓
    - M Close ✓
    - M Database manager...
  - M Print ✓
  - M Edit ✓
  - M View ✓
  - M Determinations ✓
  - M Tools ✓
  - F Functions
    - F Reprocessing
  - Workplace
    - M File ✓
    - M View ✓
    - M Tools ✓
    - F Functions ✓

OK Cancel Apply

SV Properties - Database - 'StabNet'

General Access rights Backup Monitoring

Backup monitoring

Last backup 2023-03-16 07:53:26 UTC+1

Next backup 2023-04-16 01:00

Interval 1 week(s)

Start backup automatically

Backup directory Default backup directory

OK Cancel

## 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

### 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)

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

## Minimum PC requirements for StabNet

Operating system	64-bit version of: <ul style="list-style-type: none"> <li>- Windows 11 Pro / Enterprise</li> <li>- Windows 10 Pro / Enterprise</li> <li>- Windows Server 2022</li> <li>- Windows Server 2019</li> <li>- Windows Server 2016</li> </ul>
RAM	8 GB
Hard disk space	Program: 1 GB Data: <ul style="list-style-type: none"> <li>- Minimum: 10 GB</li> <li>- Recommended: 50 GB</li> </ul>
USB port	1 for each instrument that is connected (maximum 4)
Screen	Minimum resolution: 1024 x 768
Network	10 Mbit/s, stable and permanent Communication via TCP/IP



## ORDERING INFORMATION

Instrument	
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 are included in the scope of delivery. The StabNet software is required for instrument control, data recording and evaluation and for data storage (not included).
Recommended accessories	
6.5616.110	Equipment for determining the temperature correction for Biodiesel Rancimats
Consumables	
6.5706.010	Biodiesel Rancimat Consumable Kit
6.1429.050	Reaction vessel long for stability measurements, 100 pieces
6.2418.130	Air tube long for biodiesel measurements, 100 pieces
Options	
6.1111.020	Pt100 Temperature Sensor long for biodiesel measurements
6.1839.000	Iso-Versinic tubing
6.1428.030	Glass measuring vessel for stability measurements
6.2757.000	Air collection tube for stability instruments
6.2059.000	Turning ring
6.2324.010	Conductivity standard 100 $\mu$ S/cm (250 mL)
6.2326.000	Silicone oil for stability measuring instruments (50 mL)
Software	
6.6068.202	StabNet 2.0 Full