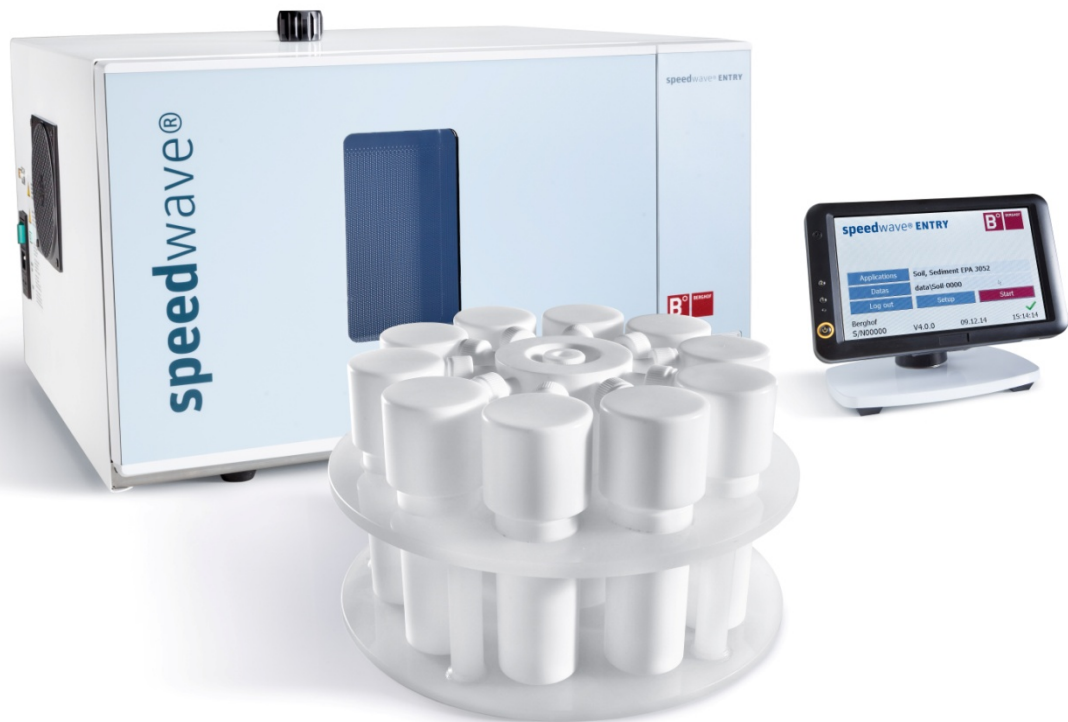


Speedwave Entry Microwave Digestion System



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Disclaimer

The content of this publication was checked for compliance with the hardware and software described. However, discrepancies may arise; therefore no liability is assumed regarding complete compliance. The information in this document will be checked regularly and all necessary corrections will be included in subsequent editions. Suggestions for improvements are always welcome. Subject to technical changes.

Trademarks

Speedwave® is a registered trademark of Berghof Products + Instruments GmbH.

General Information

This Manual:

- describes the microwave pressure digestion system Speedwave Entry from Berghof Products + Instruments GmbH. It contains product specific information, current as of the date of publication of this manual.
- guides the user in the safe and proper use of the Speedwave Entry system. Familiarity with the relevant chapters of this handbook is required for safe and intended use of the equipment.
- should read the user carefully prior to operating the equipment. Failure to follow these instructions could result in damage to the instrument as well as personal injury.
- does not include repair instructions. Should repairs be required, please contact your dealer or Berghof Products + Instruments GmbH.

After unpacking, carefully check the equipment for mechanical damage and missing parts. Should you find any damage incurred during shipment, contact the manufacturer immediately and do not operate the equipment.

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1. General Notes

Please read this instruction manual carefully before operating your high pressure digestion system. Failure to follow these instructions could result in damage to the equipment as well as personal injury.

Safety instructions are described in section 'Danger Categories and Signal Words'. These safety notes must be heeded in all cases!

1.1. Danger Categories and Signal Words

The signal words described below are used in connection with warnings throughout this manual. For your own safety and to avoid property damage, you must strictly heed these warnings!

The safety signals are printed in boldface or are otherwise marked throughout this manual and have the following meanings:

 DANGER	Means that failure to follow the safety instructions is likely to cause severe personal injury, death or severe property damage.
 WARNING	Means that failure to follow the safety instructions may cause severe personal injury, death or severe property damage.
 CAUTION	Means that failure to follow the safety instructions may cause personal injury or some property damage.
 NOTICE	This symbol indicates that this is important information regarding the product or refers to a part of the manual, which requires particular emphasis.

1.2. Qualified Users

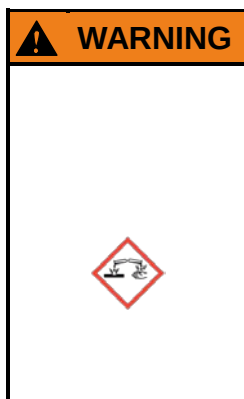
Only Qualified Users should operate this equipment. Qualified Users with respect to this manual are relevantly schooled and trained specialists with a basic knowledge of chemistry and technology. They should be trained in the relevant legal regulations for handling of chemicals.

1.3. Proper Use



Explosion hazard!

The unit is not designed for extraction and metabolization procedures employing organic solvents.



Observe all operating instructions!

Since sample composition is generally not precisely defined, a certain residual risk exists when performing pressure digestion processes. Careful working practices and conscious compliance with safety regulations can only minimize this risk, not totally eliminate it. Due to different degrees of mixing, even identical samples can exhibit totally different behaviors during the course of the reaction!

Please strictly comply with the operating instructions, particularly when handling the pressure vessels, that is, when removing and opening the vessels. Incorrect handling of the hot, pressurized vessels can result in injuries from escaping acid vapors!

→ Application area

The speedwave microwave digestion system Speedwave Entry has been designed to perform chemical digestion procedures under extreme pressure and temperature conditions in chemical laboratories. Digestion is understood to mean the decomposition of a solid material by means of a suitable digestion reagent at increased temperature in a vessel that is permeable with regard to microwaves. The digestion solutions are directly heated through the absorption of the microwave radiation by the polar digestion reagent, which generally also contains ionic components.

Digestion reagents used include nitric acid (65%), hydrochloric acid, hydrofluoric acid, phosphoric acid, and sulfuric acid, as well as mixtures of these acids. The maximum initial weight for organic compounds depends on the digestion vessel being used and the sample's carbon content, must always be observed. The use of organic solvents is strictly prohibited in microwaves since the spontaneous combustion of any solvent vapors that escape into the oven chamber cannot be precluded.

Heating the pressure vessel results in digestion temperatures in excess of 200 °C (392°F).

The Speedwave Entry has been specially developed for sample preparation for AAS and ICP spectroscopy procedures. Very temperature spikes >280 °C (>536°F) such as can occasionally occur during the course of exothermic reactions can result in irreversible damage to the Teflon vessels. Since such scorching cannot always be avoided, even with optimum microwave power regulation, damage of this kind is excluded from the warranty! When quartz glass inserts are employed, the greatest care must be taken when handling the glass as even the slightest amount of damage to the surface can greatly diminish surface strength. For this reason, glass components are excluded from the warranty!

Adapters for evaporating and concentrating digestion solutions are optionally available for all vessel types. Qualified handling and, possibly, proper transport, storage, set-up, and use, as well as conscientious maintenance are all prerequisites for the trouble-free and safe operation of the Speedwave microwave digestion system.

The system may only be used within the context of data and applications specified in this documentation and the associated user manuals.

The stirring systems may only be used:

- Properly
- In a technically flawless condition
- Without unauthorized alterations or modifications
- By qualified users

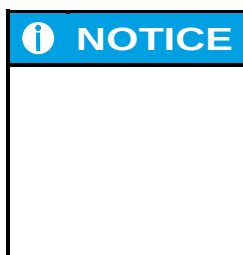
Please also observe all regulations published by professional/trade associations, the TÜV, VDE regulations, or corresponding national regulations.

1.4. General Safety Information

Performing microwave digestion procedures involves taking into account various safety precautions which go beyond those for general laboratory practices. The following general safety information should therefore be read carefully prior to using the system, and should be observed at all times.

The following information must be complied with when working with the associated digestion vessels!

We can assume no liability for damages resulting from improper handling of a failure to comply with this information.



Renew the vessels after around 10,000 digestions to maintain reliable operating conditions and to prevent negative influences on your analysis results (e.g. memory effects etc.). Berghof Products + Instruments GmbH includes its digestion vessels in the warranty coverage. Nevertheless, all of the vessels are subject to a certain aging process, which also depends on the type and frequency of the application. Typically the service life is 10,000 digestion processes or at least 3 years.



Explosion hazard!

Do not use perchloric acid.

No organic solvents (alcohols, hydrocarbons, etc.) may be placed in the pressure vessels or the microwave.

Highly reactive substances which spontaneously react at higher temperatures or in the presence of oxidizing agents or which may be nitrated and are potentially explosive may not be digested in the microwave. Examples of such substances include: explosives (TNT, etc.), perchlorates, ether, pyrophoric substances, etc.

⚠ DANGER




Pressure vessels!

Use only digestion vessels and spare parts authorized by Berghof Products + Instruments GmbH for use with the Speedwave Entry. These can be obtained either from your local dealer or directly from Berghof Products + Instruments GmbH (Refer to the "Repairs / Customer Service" section for contact addresses).

Always wear safety glasses/goggles and protective gloves when working with the pressure vessels!

Note any changes in the appearance of the pressure vessel which could indicate possible material fatigue, e.g., deformation of the vessel, difficulty screwing on lids, etc. even when the vessel is cold and not under pressure. All such vessels should be immediately returned to Berghof Products + Instruments GmbH for inspection.

Never attempt to use force to open the vessels. Never use tools to open the vessels!

The pressure vessels are equipped with a rupture disc which produces a spontaneous pressure release upwards through the screw-on tube connections in case of excessive vessel pressure. In some cases, such a spontaneous pressure release may occur after the vessel has been removed from the microwave oven.

Hot gases and vapors may be released from the digestion vessel when it is opened! Always make sure the vent opening on pressure vessels faces away from both yourself and other individuals!!

Only open the digestion vessel under a fume hood or other exhaust system. Particular care is required when working with hydrofluoric acid (HF). Observe all relevant data sheets and safety instructions!

Never use more than one rupture disc per vessel!

Only use rupture discs which are designed for the respective vessel!

⚠ WARNING



Always wear eye protection!

Always wear safety glasses/goggles and protective gloves during work which may involve contact with chemicals, that is, when working with acids, pressure vessels, during cleaning, etc.!

⚠ WARNING




The unit employs high voltage and generates microwave radiation!

The Speedwave Entry must always be connected to a grounded conductor. Provided the wall outlet used is equipped with a ground connection, the supplied power cord will ensure proper connection. If it is necessary to use an extension cord to connect the system to the power supply this cord must be equipped with a ground connector.

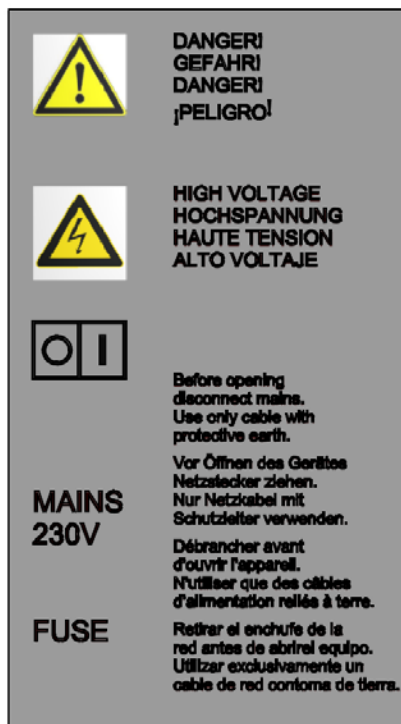
The unit should not be set up near any devices which are sensitive to electromagnetic radiation. If necessary, a warning sign or label indicating "Caution, Microwave Emissions" should be applied or attached to the unit. Should there be any suspicion or indication of increased levels of microwave radiation, please immediately inform the Service Department at Berghof Products + Instruments GmbH (Refer to the "Repairs / Customer Service" section for the contact address).

1.5. Safety

In the following situations, the unit must be disconnected from the mains power supply and be locked out to prevent accidental use:

- If the unit evidences visible signs of damage
- If unit parts or components are found to be loose
- If the unit fails to operate
- If the unit is to be stored for extended periods of time under unfavorable conditions (e.g., outdoors, in very moist or humid environments)

1.5.1. Warning label on the unit



High Voltage

This label is located on the left side of the device



Prohibited for persons with heart pacemakers

This label is located on the left side of the device

1.6. Safety regulation

This device has been designed and tested in accordance with the following IEC publications:

Title	Norm
Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements	EN 61010-1:2010 IEC 61010-1:2010 + Corr.:2011
Electrical equipment for measurement, control and laboratory use – EMC- requirements Part 1: General requirements	EN 61326-1:2013 IEC 61326-1:2012 The equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes (Class A). The equipment is intended to be used in a controlled electromagnetic environment.

1.6.1. CE Designation

Products from Berghof + Instruments GmbH comply with the guidelines of the VDE and the European Standards. The conformity tests performed by Berghof Products + Instruments GmbH comply with the currently required standards for electrical safety. All limit values with respect to interference emission and interference protection have been maintained.

Conformity declaration

Refer to chapter Appendix

1.7. Information on Disposal

→ Disposal within
the EU

European Community

Electrical and electronic products should not be mixed with general household waste. Berghof Products and Instruments GmbH accept its electrical and electronic instruments from on a free of charge basis for proper treatment, recovery and recycling from their business users. If you wish to discard electrical and electronic products, please contact your local dealer or Berghof Products and Instruments GmbH (laboratorytechnology@berghof.com). They will provide further information. Disposing of this product correctly will help to protect our environment.

→ Disposal outside
the EU

Countries outside the European Union

This regulation is only valid in the European Union

 NOTICE

Berghof products are **not used** in private households.

1.8. Warranty / Limitation of Warranty

Limited Warranty

Each product manufactured by Berghof Products + Instruments GmbH is warranted to conform to Berghof Products + Instruments GmbH's applicable specifications on the date on shipment. The warranty period is twelve (12) months after the date of delivery, unless another period is specified. The warranty does not extend to damages due to improper installation, improper maintenance, abuse, accident, negligence, alteration, misuse, ordinary wear and tear, or the like. Claims for replacement of parts caused by ordinary wear and tear are excluded, as are claims for replacement of parts meant to be expended during the operation of the equipment.

Remedies

Under the limited warranty, Berghof Products + Instruments GmbH repairs or replaces any products which Berghof Products + Instruments GmbH determines to be defective and covered by this limited warranty. This is the sole and exclusive remedy. If Berghof Products + Instruments GmbH determines that repair or replacement fails its essential purpose, the purchaser will, at its option, be entitled to a refund of the purchase price for the products in question or a credit therefore.

All warranty claims must be accompanied by a description of the claim; which description must be attached to the equipment claimed to be defective. Claim descriptions must include the claimants name, address, department (if applicable) and telephone number.

The equipment should be returned in its original packaging, to the extent possible. We regret that Berghof Products + Instruments GmbH cannot be held responsible for damage caused during shipping due to improper packaging.

Limitation of warranty

Except as expressly set forth above, there are no other warranties hereunder, whether expressed or implied, arising by operation of law or otherwise, including without limitation, the warranties of merchantability, fitness for a particular purpose and any warranties arising under course of performance, course of dealing or usage of trade.

Under no circumstances will Berghof Products + Instruments GmbH be liable for any consequential, exemplary, incidental, indirect or special damages, or lost profits, expenses or losses arising out of or related to the sale or use of any of its products regardless of whether the liability resulted from any general or particular requirement or need which Berghof Products + Instruments GmbH knew or should have known of.

1.9. Exclusion of warranty

Berghof Products + Instruments GmbH does not accept any warranty for wearing parts (e.g. Rupture disc, lid) for the improper usage, storage and handling.

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2. Device Description

2.1. Basic Unit

The Berghof Speedwave Entry is a microwave based digestion system. It is produced with stainless steel housing and a corrosion protected interior that is illuminated by LED lighting. The plastic door has an inspection window and a double mechanical interlock.

→ [Speedwave Entry](#)

The necessary level of operational safety is guaranteed by 2 over-temperature switches and 2 micro switches. The Speedwave Entry microwave system is designed for pressure digestion at temperatures up to 230° C (446° F) in continuous use and pressures up to a max. of 75 bar (1088 psi).

The measurement physically determines the temperature radiation emitted by the vessel contents, that is, the digestion solution. Radiation components emitted by the vessel walls and, in particular, the exterior of the vessel, are completely filtered out.

→ [Speedwave DIRC](#)

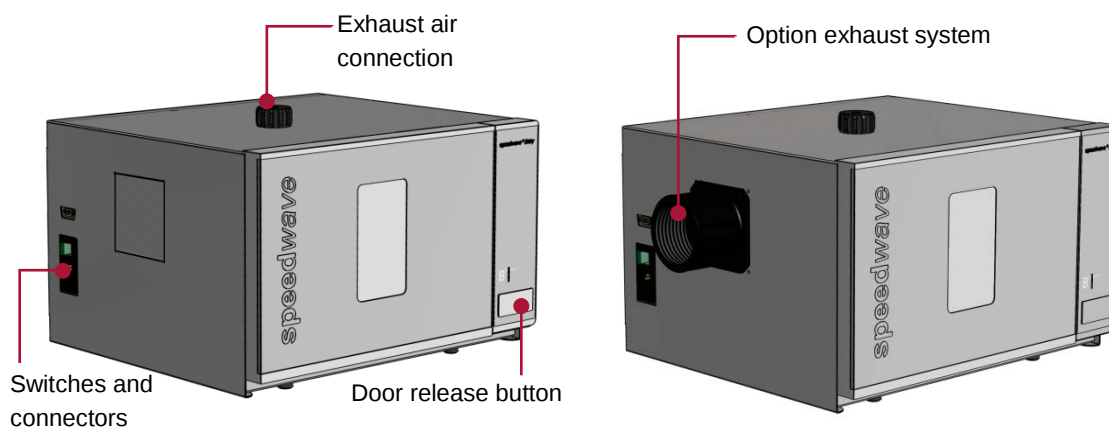
An unpulsed regulated 2.45 GHz magnetron provides 1,000 W of microwave power.

The Speedwave Entry is regulated by a separate 7"-touch-controller. After entering the desired temperature profile, the microwave power is continuously adjusted on the basis of the measured sample temperatures. The desired and actual temperatures of all samples are measured in real-time, with the highest individual detected temperature shown on the display and stored as a graph.

→ [Touch Control](#)

2.1.1. Connections

The Speedwave Entry has various connection options as shown in the following figures.



As an option for exhausting the Speedwave Entry a separate exhaust system is available.

2.2. Control unit

The microwave oven is controlled by a 7"-touch PC with a TFT display. The pre-installed languages are English, German, French, Spanish, Russian, and Czech.



2.2.1. Connection



Connection	
Item	Function
1	On / off switch
2	Reset, to restart press the key 3 to 5 sec
3	Setting the display brightness
4	Not used
5	Power supply via supplied 12 V DC power supply
6	Connection to microwave via supplied RS-232 cable
7	Not used
8	Not used
9	Slot for SD card (up to 4 GB)
10	mini USB, not used
11	Connection for USB-Stick, USB-keyboard or USB-mouse

2.3. Pressure Vessels and Rotor Systems

All Berghof pressure vessels are manually operated. A rupture disc placed in the vessel lid limits the interior pressure of all vessel types to the maximum permissible value for the individual type. Acid vapors that escape when the rupture disc activates are guided to a collection vessel integrated in the rotor. The vapors in the collection vessel can be vented or suctioned off through the PFA tube connected to the lid.



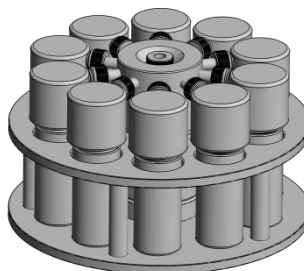
Protection of pressure vessels

The protection of the vessels is guaranteed by the rupture discs. The Temperature measurement serves to control the digestion process, but has no primary safety function.

2.3.1. Rotor for DAP-60K vessel

DAP-60K vessels are made entirely of TFM™ -PTFE. Aside from chemical resistance to all mineral acids including hydrofluoric acid, this ensures a high level of mechanical strength, even at high digestion temperatures.

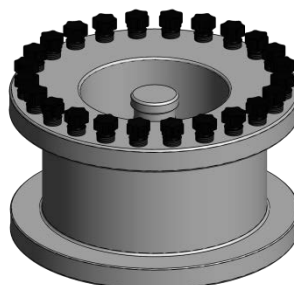
10 pressure vesels made of TFM™ -PTFE



2.3.2. Rotor for DAQ-10H vessel

The DAQ-10H is special rotors intended for digestion of small sample quantities in quartz glass.

24 pressure vesels made of quarz

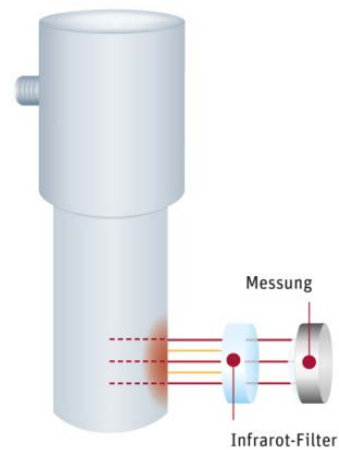


2.4. Temperature Monitoring

→ [Speedwave DIRC](#)
[Direct IR Control](#)

The Speedwave Entry is equipped with a temperature monitoring system. This system determines the temperature inside the pressure vessels by measuring the infrared radiation emitted by the sample. This allows the temperatures of all samples to be determined. This information is forwarded to the power control module which uses the highest measured temperature to regulate the oven power. Continuous adjustment of the magnetron output allows the temperature to be regulated on the basis of all vessel contents.

For measurement instrumentation reasons, only temperatures above 50° C (122°F) can be displayed.



2.5. Technical Specifications

2.5.1. Microwave und control unit

Speedwave Entry	
Microwave oven	
Power supply	230 V / 50 Hz
Current consumption	7 A
Power consumption	950 W
Power output (IEC-60705)	1000 W
Fuses	2 x 10 A M, 5 x 20 mm
Magnetron frequency	2450 MHz
Magnetron power	1000 W
Exterior dimension (W x D x H)	510 x 470 x 330 mm (20,0 x 18,5 x 13,0 inches)
Interior dimension (W x D x H)	355 mm x 365 mm x 251 mm / ca. 32 l
Weight	Ca. 22 kg (48 lb) without rotor and vessel
Noise level	< 60 dB
Temperature range DIRC-Thermometers	50° C – 260° C (122°F - 500°F) Accuracy 1°C at 200 °C
Control unit	
Power supply	110 – 240 V / 50/60 Hz
Operating system	Windows CE
Display	7" color TFT LCD Touch-screen-Monitor
Resolution	800 x 480 pixel
Storage medium	SD card, 2 GB
Program memory	15 pre-installed applications
Language	English, German, French, Spanish, Russian, Czech
Dimension with holder (W x D x H)	190 x 115 x max.170 mm (7,5 x 4,5 x max.6,7 inches)
Weight with holder	1,5 kg
Serial interfaces	RS-232, USB

2.5.2. Pressure vessels

Vessel type		
	DAP-60K	DAQ-10
Material	TFMTM-PTFE	Quartz
Volume	60 ml	10 ml
Minimum fill amount per vessel (acid)	7 ml	3 ml
Maximum sample quantity (organic)	300 mg	100 mg
Number of vessels per rotor	10	24
Minimum number of vessels in the rotor	3	12
Max. operating pressure	40 bar (580psi)	75 bar (1088psi)
Max. temperature (continuous operation)	230° C (446°F)	230° C (446°F)

2.6. Safety Equipment

Oven door

The system is equipped with a stainless steel housing with a door at the front. 2 micro switches ensure that the microwave is immediately switched off if the oven is opened during operation.



The unit emits microwave radiation!

Never operate the microwave oven if the door or the related lock mechanism has been damaged. Contact your local, authorized dealer or Berghof Products + Instruments GmbH to obtain the required service (Refer to the “Repairs / Customer Service” section for contact addresses).

Rupture discs

All vessels are equipped with a rupture disc which produces a spontaneous pressure release upwards through the screw-on tube connections in case of excessive vessel pressure. In some cases, such a spontaneous pressure release may occur after the vessel has been removed from the microwave oven.



Rupture discs as overpressure protection!

Use only original Berghof rupture discs and protective cover sheets. These can be obtained from your local, authorized dealer or Berghof Products + Instruments GmbH (Refer to the “Repairs / Customer Service” section for contact addresses).

Never use more than one rupture disc per vessel!

Only use rupture discs which are designed for the respective vessel!

Gas exhaust

All pressure vessels are equipped with a sealed connection to a gas collection vessel which, in turn, must be connected to an exhaust system via a PFA vent tube. The PFA tube is connected to the screw-on connection located in the center of the top of the microwave. Any hot acid vapors released when the rupture disc activates are safely removed through this PFA vent tube.



Hot acid vapors may be released.

The supplied vent tubes must therefore always be properly connected and attached to an exhaust system.

Make sure the PFA tube is securely attached so that it cannot pop off its connection fitting in case of a percussive pressure burst as occurs when a rupture disc activates.

→ [Weitere Sicherheitssysteme](#)

Temperature control

The system is equipped with a temperature control of all sample temperatures as described in the section, "Temperature Monitoring".

Overheat control

In case of overheating the magnetron or the microwave oven, the supply of the inverter is automatically interrupted. The supply is reactivated if the overheating state ends.

3. Setup and Commissioning

3.1. Standard Delivery

Because of the modular nature of the stirring systems, there is no generally applicable standard delivery. Therefore, please check the shipping documentation with regard to the completeness of your specific unit.

3.2. Ambient Conditions

The setup location must meet the following requirements:

Ambient conditions	
Ambient temperature	+10°C (50°F) to +35°C (95°F) In addition, the temperature should lie between -40°C (-40°F) and +70°C (158°F) during shipping and storage
Max. rel. humidity	85%
Space requirements (L x W x H)	approx. 90 cm x 75 cm x 90 cm approx. 35 x 30 x 35 inch
Load bearing capacity	Min. 50 kg (110 lb)
Electrical connection	230 V; 50/ 60 Hz

NOTICE

Make sure that the Speedwave Entry microwave system is set up and operated in a corrosion-free environment. If the microwave is used in a fume hood it is not allowed to use open acid in this hood. As well the opening of the microwave pressure vessel must happen in a separate fume hood. Corroded parts are excluded of the guarantee at nonobservance.

When the system is installed outside the hood the released gases must be safely discharged through the vent system via the PFA exhaust tube that is to be inserted in the oven.

3.3. Unpacking and Inspection

Open the shipping packaging and carefully remove it. Please save all packaging in order to be able to return the unit to the manufacturer in its original packaging, should service be required.

Two individuals should remove the microwave system from its packaging and place it on a lab bench. Also remove all other components and accessories and inspect the delivery to make sure it is complete.

Also remove all other components and accessories and inspect the delivery to make sure it is complete.

Inspect the system for shipping damage such as cracks, scratches, dents, etc.

 **WARNING**

Visible damage!

For safety reasons, never operate the unit if it exhibits visible signs of damage. Contact your local, authorized dealer or Berghof Products + Instruments GmbH to obtain the required service (Refer to the “Repairs / Customer Service” section for contact addresses).

 **NOTICE**

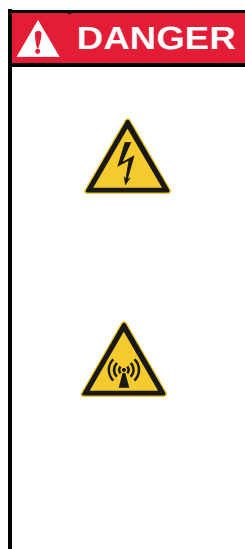
Should any components be missing or damages be detected, contact your local, authorized dealer or Berghof Products + Instruments GmbH directly (Refer to the “Repairs / Customer Service” section for contact addresses).

3.4. Positioning

Position the system on the intended work surface. Make sure the vent opening on the right and the back of the unit are not covered. The unit requires at least 50 cm (8inch) of clearance from the wall.

A clearance of at least 50 cm (19.7”) that opens towards the front of the unit must be available above the oven. The work surface must be able to support the weight of the oven (approx. 50 kg; 110lb) and must have a surface area of approx. 90 cm x 75 cm x 90 cm (35 x30 x 35 inches, W x D x H).

3.5. Installation



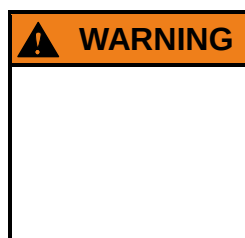
The unit employs high voltage and generates microwave radiation!

The Speedwave Entry must always be connected to a grounded conductor. Provided the wall outlet used is equipped with a ground connection, the supplied power cord will ensure proper connection. If it is necessary to use an extension cord to connect the system to the power supply, only a three-wire cord with a ground connection may be employed.

The unit should not be set up near any devices which are sensitive to electromagnetic radiation. If necessary, a warning sign or label indicating "Caution, Microwave Emissions" should be applied or attached to the unit. Should there be any suspicion or indication of increased levels of microwave radiation, please immediately inform the Service Department at Berghof Products + Instruments GmbH (Refer to the "Repairs / Customer Service" section for contact addresses).

Repair and servicing of the equipment may only be performed by trained personnel.

3.5.1. Venting



Hot acid vapors may be released.

The supplied vent tubes must therefore always be properly connected and attached to an exhaust system.

Make sure the PFA tube is securely attached so that it cannot pop off its connection fitting in case of a percussive pressure burst as occurs when a rupture disc activates.



Users are responsible for assuring that appropriate ventilation of toxic gases is assured. Make sure that all ventilation procedures conform to applicable laws.

Acid vapors can be removed directly from the collection vessel or the pressure vessels via the PFA tube connected to the lid by connecting this tube to a vent or exhaust system (e.g., using a membrane pump or water-jet vacuum pump connected to a downstream gas scrubber bottle).

The PFA tube inserted through the top of the oven must be vented to the outdoors or be connected to an exhaust system.

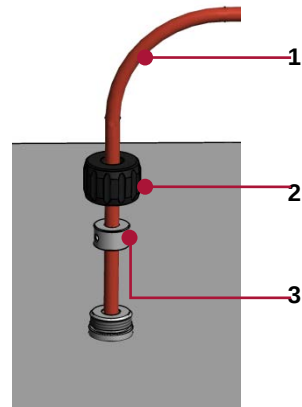
→ [prevention of emissions](#)

Process connect the exhaust tube

- Push the PFA exhaust hose **(1)** through the union nut **(2)**, afterwards tighten the screw on the top of the device.
- The retaining ring **(3)** functions as a spacer, so that the exhaust tube is automatically placed in the correct position.
- The exhaust tube must be connected to a venting system such as a fume hood.

For each vessel type a corresponding, pre-assembled exhaust tube is supplied.

When changing to another type of vessel the corresponding exhaust tube must also be replaced.



Option Exhaust System

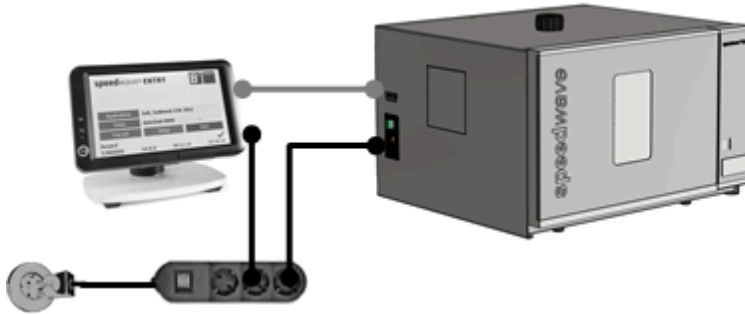
Optionally the oven chamber can be sucked with the Berghof Exhaust System.

See chapter “Option Exhaust System”

3.5.2. Electrical connection

Connect the device to a suitable 230V; 50 / 60Hz power connection by means of the mains cable provided. You connect the controller to a suitable 230V; 50 / 60Hz power connection using the wall power supply provided.

Thereafter connect the controller and the device with the connecting cable.



Use only specified power cord!

Detachable power cord may not be replaced by inadequately sized power cord. Use only approved and undamaged power cable.



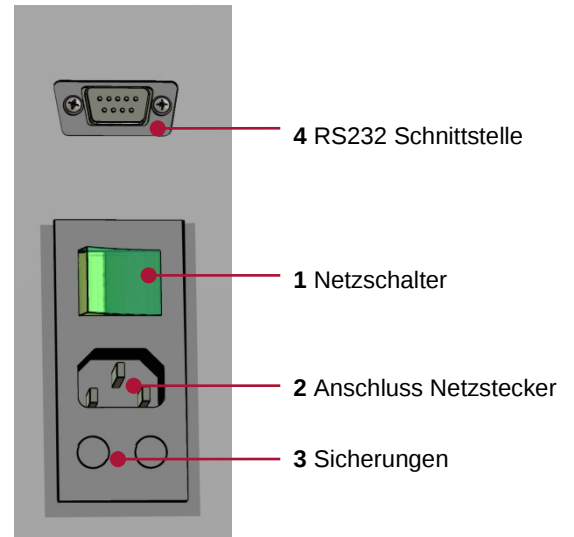
Basic unit and separate control unit must be connected to the same phase of mains.

3.5.3. Basic unit

The power switch **(1)** is located on the left-hand side of the unit.

The switch is illuminated while it is on.

Next to this are the connections for the power cord **(2)**, fuses **(3)** and the RS-232 **(4)** port for connecting the separate control unit.



3.5.4. Control unit

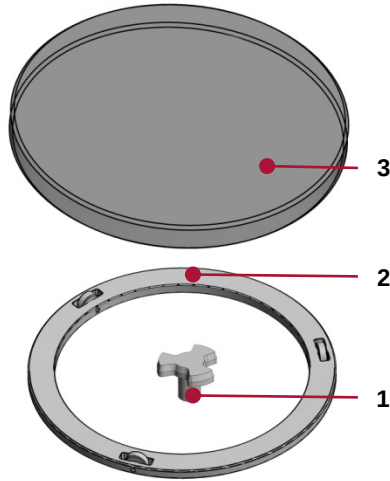
The control should be switched on before the basic unit.

The controller is switched on by means of the yellow-rimmed button at the front.



3.5.5. Turntable insertion

- Press firmly on the lever located to the right of the Speedwave Entry to release and open the door. The door will swing open.
- Make sure the driver axis **(1)** in the center properly engages in the motor drive shaft.
- First, place the turntable **(2)** with rolls in the micro-wave oven, then places the glass turntable **(3)** on top of the ring.



The system is now ready for use.

Blank page

4. Operation

4.1. Information Regarding Digestion

The applied microwave energy causes the sample material to heat rapidly. The speed of the heating process depends on the total volume of liquid in the oven as well as on the amount of microwave radiation applied (power). Power regulation for the Speedwave Entry is based on the continuous alteration of the output power. → [Controlled microwave power](#)

Heating the acid mixture results in a creation of vapor pressure. The degree of this vapor pressure depends greatly on the temperature. All digestion vessels have a maximum permissible pressure. If this maximum pressure is exceeded, the rupture disc in the pressure vessel activates, providing a rapid pressure release into the collection vessel.

In addition to the vapor pressure, reaction gases (primarily carbon dioxide generated by samples containing carbon) also produce pressure. This pressure is therefore dependent on the sample amount, the vessel volume, as well as the carbon content of the sample. → [Influence on the pressure](#)

Together with the applied microwave radiation, digestion of organic substances also releases reaction heat. These types of reactions frequently begin in the temperature range between 120 - 150°C (248 - 302°F). We therefore recommend holding the samples at this temperature for some time (3-5 minutes), in order to allow this reaction heat to subside somewhat. The temperature should then be increased to the desired maximum in a second stage in order to obtain optimum digestion quality.



Reaching the maximum pressure!

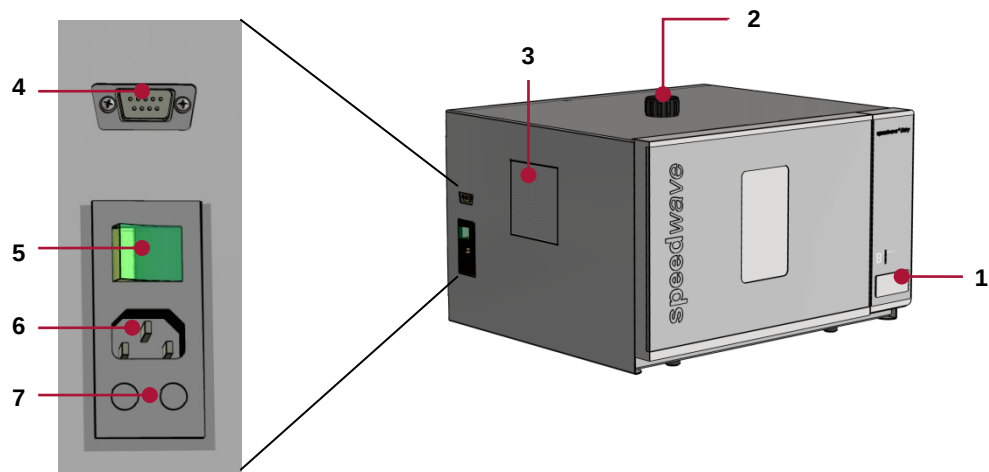
Please note that the reaction pressure is only reached during the course of the reaction, in other words, several minutes after the maximum temperature has been reached. Therefore, an activation of the rupture discs may be anticipated even after the temperature has reached a constant level.



Rupture disc corrosion!

Depending on the acid being employed and the digestion parameters, the aluminum rupture discs are subject to more-or-less extreme wear. Replace the discs regularly (after approximately every 20 digestion procedures) to prevent the discs from rupturing prematurely.

4.2. Basic unit



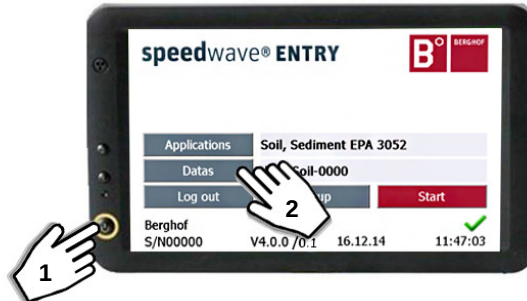
Item	Designation	Function / Description
1	Door release button	Open the microwave door mechanically
2	Connection exhaust air	Mounting see „Set up and Commissioning“
3	Air outlet	Basic unit without fan
4	RS232 Interface	Interface to the control unit, see next page
5	Power switch	Lights up when switched on
6	Connection power cord	Power cord included in delivery
7	Fuses	Replacing fuse, see „Maintenance“

4.3. Control unit

The control unit is operated via a touch screen (1).
To switch on press the yellow-black button (2).

In order to release a function, touch the displayed symbol or key field on the screen.

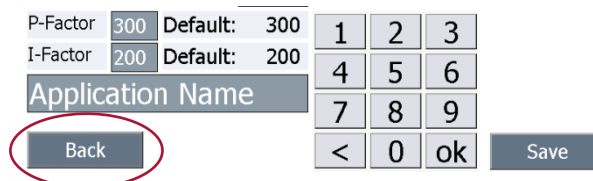
In the following text the key fields of the touch-screen are shown in a frame, e.g., Application.



Selecting a field that requires alpha-numeric input will bring up a touch keyboard or numeric keypad for the data to be entered.



You can access the previous menu by pressing the Back button. Indeed, from most menus you can access the main menu directly.



4.3.1. Login

After a short switch-on of about a minute, you will be prompted to sign in with your username and password. When switching on for the first time a user with administrator privileges must be created.

Two user groups are available, “user” or “administrator”, see also “right administration”

By pressing on the ‘User name’ you can select your name from the existing user names. Pressing on the ‘Password box’ opens the screen keyboard. If a valid password was entered, the `login` button will take you to the main menu.

speedwave® ENTRY

B

BERGHOF

username:

user

password:

login

Berghof

S/N 1244

V4.0.0/0.1

08.01.15

08:29:36

4.3.2. Main menu

speedwave® ENTRY



speedwave® ENTRY



Applications	Glass, Quartz		
Datas	data\Filename-0002		
Log out	Setup	Start	
Berghof S/N00000	V4.0.0/0.1	16.12.14	11:47:03

Applications	Glass, Quartz		
Datas	data\Filename-0002		
Log out	Setup	Start	
Berghof S/N 1244	V4.0.0	08.01.15	08:12:19

Main menu	
Key	Function
Application	Modification or creation of preinstalled or custom applications (temperature program)
Data	Delete, copy or review the digestion data *
Log out	Logout, to protect from unauthorized access or to change the user
Set up	Select the language, settings in the rights administration, date and time, Data transfer, zero off set and power test. This menu can be opened only with administrator privileges.
Start	Once the application has been selected, digestion is started here
communication line	Start- button is activated Start-button is deactivated no communication with the base unit
Footer	S/N= Serial number V= Software version controller / software version basic unit (The software version of the basic instrument is only visible when it is switched on) date and time

*User rights, see „rights of administration”



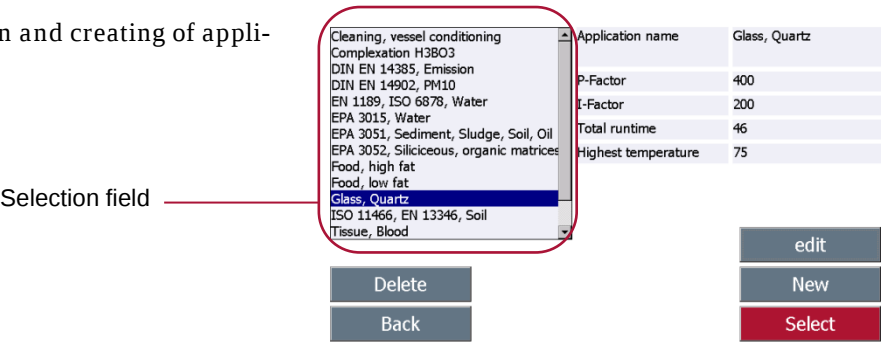
Never switch off the controller while digestion is taking place!

The magnetron can continue to provide power for up to 20 seconds (1 rotation of the turntable).

4.3.3. Menu Application

Applications can be selected via **Application** in the main menu. There are 15 preinstalled applications; they can be changed or deleted. The user can create new applications or delete them at any time.

Selection, modification and creating of applications



Application	
Key	Function
Selection field	Select the required application by tapping
edit	Name or parameter change of the selected application
New	Creates a new application based on default settings
Select	Takeover the selected application and return back to the main menu
Delete	Remove the selected application
Back	Return to main menu. The previously selected application remains valid

Creating or changing applications

Creating and changing applications is simple. A heating step consists of the 'Time Ramp', 'Holding Time' and 'Temperature' parameters. In addition, each step can be activated or deactivated individually.

Step		1	2	3	4	5
Ramp	min	5	0	1	1	1
Time	min	15	15	10	1	1
Temperature	°C	200	200	75	75	75
Active						
Max. Power	%	90				
P-Factor	400	Default: 300				
I-Factor	200	Default: 200				
Glass, Quartz						
Back						

1	2	3
4	5	6
7	8	9
<	0	ok

Save

An application consists of at least one and maximally 5 steps with the parameters:

Application		
Parameter	Description	Limit value
Ramp (min)	Time in which heating up to the target temperature takes place in min.	(Ramp + Time): 0 - 20 min
Time(min)	Holding time of this step at the target temperature in min.	0 - 20 min
Temperature (°C)	Target temperature in °C. The permitted maximum temperature for each vessel type must not be exceeded. (see technical data)	75 - 260°C
Active	All application steps can be switched on or off irrespective of the others (blue = switched on). The standard is for all steps to be active. For example, if step 3 is deactivated it will be missed out during digestion and step 4 will continue directly after step 2.	1 - 5 steps It is also possible to deactivate central/middle steps (1-on; 2-off; 3-on; 4-off; 5-on)
Max. Power (%)	Maximum microwave output applied in all application steps in % of 1000 W. This parameter must be selected in accordance with the number of samples and it limits the maximum heating-up speed. Preinstalled applications are designed for 10 samples. If you use fewer samples you reduce the maximum output by 10% for each sample.	10 - 100 %

4.3.4. Power control

The p factor and I factor values are the basis for controlling output.

P-I control algorithm

The output control of the Speedwave Entry is a PI control algorithm. It consists of a serial connection from the proportional part (P) and the integral part (I). The two portions complement each other and add up, whilst when the actual temperature approaches the target temperature the P part delivers less and less output; it counteracts the (I) part in order to reach and hold the target temperature as far as possible without vibrations.

The values for P and I are stored individually in each program.

P-factor

The P part acts as a basic controller. If the actual temperature is lower than the target temperature the heating is used. If the actual temperature is higher or the same than the target temperature the heating is not used. The heating phase is proportional within a limited range. This means that within this range the maximum is not output; output is proportionately lower. If the temperature rises the output is reduced proportionately.

This temperature range is referred to as the P bandwidth. The P bandwidth describes upwards of which difference in temperature (between actual temperature and target temperature) the proportional output is less than 100%. The upper limit of the P bandwidth is the target temperature.

The P portion is set using a proportional value. If the P factor rises, the yielded output rises, as does the lower limit value of the P bandwidth.

The lower limit is defined by means of the formula:

$$\text{Factor} = 10000 \text{ Kelvin} / \text{P-bandwidth in Kelvin}$$

The P bandwidth is the difference between the upper and the lower P bandwidth limits

I-factor

The I (integral) part acts as a compensator. The I-part compensates the temperature losses of the vessels. Each vessel inside the Speedwave Entry has losses from dispersing heat into the environment. The I-part compensates such losses. The consequence is that the temperature curve is flatter. The I-part is a very strong controller; even minor changes to the factor (± 50) can have major effects.

This characteristic becomes weaker as the factor increases.

The I-part is set at an antiproportional value. If the I-factor rises the output drops.

4.3.5. Developing a New Application

Digestion of new sample material, that is, of samples for which you have no previous experience, requires a special, systematic procedure. We recommend the following process when developing such an application:

→ [Tips for a successful digestion](#)

- Check the application list (see supplied CD) to determine whether it contains already a work instructions for the sample material in question or for a similar material then, if necessary, request a copy of the original process instructions from your local, authorized dealer or from Berghof Products + Instruments GmbH.
- Should you not be able to find your sample material, search through the relevant technical literature for a corresponding process instruction. You can also request assistance from your local, authorized dealer or from Berghof Products + Instruments GmbH.
- For safety reasons, initially reduce the specified sample amount by 30-50 %, while still using the specified acid quantity and digesting with the defined temperature program.
- Optimize the acid mixture and the temperature profile until you obtain a clear solution.
- In the final step you can gradually increase the sample amount until the higher pressure causes the rupture disc to activate. The maximum sample quantity to be used should be approx. 30 % of this amount.

Start the program

After an appropriate application has been selected or created digestion can be started using the **Start** button in the main menu.

Here you can choose under which name and in which directory you wish to store the digestion data. At the same time, you can see which application you have chosen again in a small graphic preview (. The table summarizes the numerical values of the temperature program.

Soil, Sediment EPA 3052

step	1	2	3	4	5
ramp	5	1	1	0	0
time	10	10	1	0	0
temperature	180	75	75	0	0

power

90

Graphic preview

save as filename:

filename e.g. sampling point

index:

0

<<

folder

e.g. customer

>>

new folder

back

start

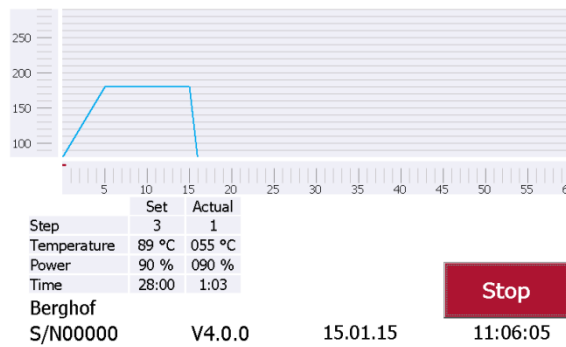
Application	
Key	Function
Filename	Key field for filename of the measured data
folder	Display field of the selected folder. After digestion the measured data are stored in this folder.
<< >>	Select an existing folder
New folder	Create a new folder
back	Back to the main menu without starting a digestion
start	Application is started

* A file name under which the data are saved consists of the text plus a 4-digit suffix. The suffix is automatically incremented.
Example: samplingpoint-0001.sw2

Real-time display

The current program step, the remaining and the entire digestion time are displayed in real-time. The output and the temperature last measured are updated every 20 seconds.

If the measured temperature is below 80°C (176°F), the curve runs below the visible range. The value is then just presented as a number in the lower part of the display.



If the digestion period has expired, the controller automatically changes for a comment to be input. Here you can enter comments for documentation of the digestion.

comments:

here you can enter a comment

clear Save

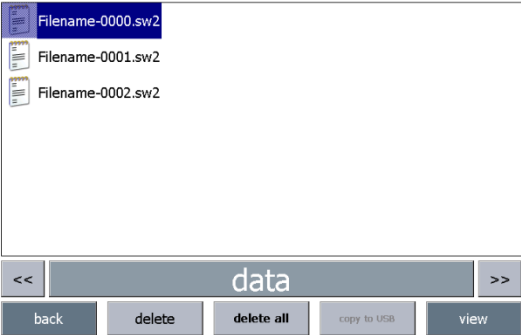


Opening the door during digestion!

The door should not be opened while the application is running. If it is opened nevertheless, the magnetron is automatically cut off. However, the time program continues to run. When re-closing the door, the magnetron can be activated again. To prevent this, the temperature program should be stopped as a matter of principle before the door is opened.

4.3.6. Menu Data

The measurement data directory can be accessed via Data. There digestions which have already been carried out can be viewed again and analyzed.

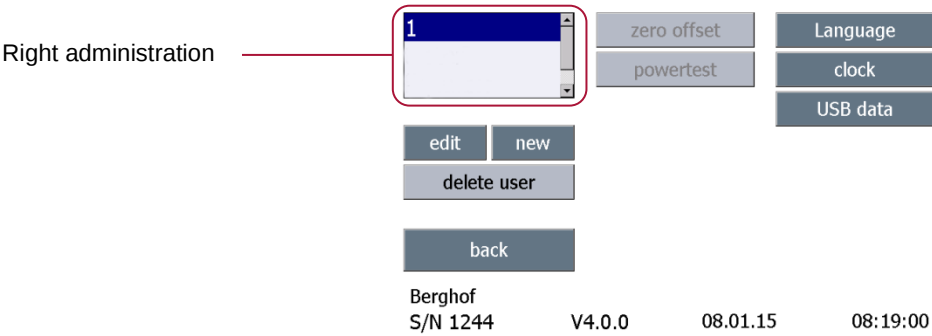


Data	
Key	Function
 Filename-0000.sw2	Tapping once the selected file is highlighted. By double-tapping the chosen file with their measure data is opened.
	Change the folder
data	Selection field for the created folder
back	Return to main menu
delete	Selected file is deleted*
delete all	All files in the selected folder will be deleted
copy to USB	Data transfer, for this a USB stick must be plugged in. The recognition of a USB stick can take several seconds. The copied data can be opened by using the Viewer software
view	Selected file with their measure data is opened

* User rights, see „rights of administration”

4.3.7. Menu settings

Only users with administrator rights can change the settings.



Data	
Key / Field	Function
Right administration	Display, create, modify and delete users (User or Administrator) Rights of the user group see next page
edit	Change the selected user password. The user name cannot be changed.
new	Creating a user
Delete user	Delete the user name
zero offset	Calibrating the temperature sensor
powertest	Verification of the microwave power. Is performed by service
Language	Select the language German, English, French, Spanish, Russian and Czech.
clock	Setting date and time
USB data	Call up from „USB Data Option“, to back up application and configuration data. For this a USB stick must be plugged in. The recognition of a USB stick can take several seconds.
back	Return to main menu to

Right administration

Action	User	Administrator
Create application	no	yes
Change application	no	yes
Use application	yes	yes
Delete application	no	yes
Start digestions	yes	yes
Abort digestion	yes	yes
View records	yes	yes
Save records on USB	yes	yes
Delete records	no	yes
Administrate users	no	yes
Change language	no	yes
Zero offset	no	yes
Output test	no	yes

Users are created and changed via the following dialog:

User

Password

Password

User

Administrator

user

back

Save

When a new user is created, the 'User' and 'Password' boxes must be filled out and the user group selected. This, and the password, can be changed at any time.

If a user is edited, the boxes have already been filled out. The user name cannot be changed. If it must be changed nevertheless, you must delete the user and create it anew. You can only replace a password.

The passwords are saved in encoded form. It is therefore not possible to have the password shown. If a password has been forgotten, the Administrator must define a new one.

A user is removed by means of **Delete user**. This takes place directly and without a query.

The user with which you are logged-in represents an exception. In this case you cannot change the user group. This is to ensure that the last user of the Administrator Group cannot be deleted.

Zero offset

⚠ CAUTION

Faulty zero adjustment

If zero adjustment is not carried out exactly as stipulated in the operating instructions the measurement results may be faulty and consequentially bursting discs may rupture or samples may not be fully digested.

You can obtain support from your local dealer or from Berghof Products + Instruments GmbH (for the contact address refer to the section 'Repairs / Customer Services')

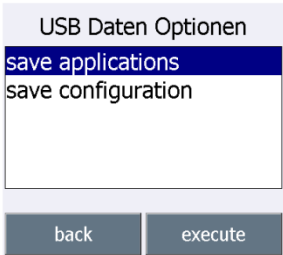
Zero adjustments enable the user to compensate any zero point shifts in the temperature measurement. This is necessary if the temperature in the lower temperature range appears unusually high; it should take place at least once a year.

To perform a zero adjustment all of the vessels and the turntable must be removed from the Speedwave Entry. The door and the housing must be closed. The device should be at room temperature. Only if all these factors are given, is it possible to ensure that the zero adjustment is correct. After having prepared everything, start the zero adjustment via "Zero Adjustment". A status line appears on the display. Adjustment itself takes place fully automatically and takes approximately 20 sec. It is completed as soon as the line disappears again. If the button is deactivated, the connection to the device is cut off.

USB options

The USB Actions menu offers a variety of interactions with a USB stick:

- Save applications
- Save configurations



Save application

The applications present on the controller can be saved on a USB stick under the save applications menu item. You can save single or all applications. If more than one application is to be saved but not all of them, it is advisable to first save them all and to then delete the ones that are not required on the computer. The controller creates a sub-directory named "SW2" on the stick; files are only written into or overwritten in this directory. In turn, a sub-directory is created in this folder bearing the name "appinst". There you will find the application.

ⓘ NOTICE

Please note that the controller replaces existing files without any query.

Save configuration

The controller configuration can be saved on a USB stick under the **save configuration** menu item. This is normally only necessary for diagnostics.

Language selection

The controller language is selected via the displayed flags. This entails rebooting the device because the language data are uploaded already during the boot phase. Please witch the controller off and on again. The following languages are currently available:

- English
- German
- French
- Spanish
- Russian
- Czech

Select the language by clicking on the banner



NOTICE

Please note that characters used for user name and password are available in the newly selected language. Otherwise a log on is no longer possible, because also the keyboard layout changes to the new language. If the language selection is frequently used, it is recommended to use only digits for user name and password.

4.4. Performing a Digestion Procedure

! DANGER   	Pressure vessels! Use only digestion vessels and spare parts authorized by Berghof Products + Instruments GmbH for use with the Speedwave Entry. These can be obtained either from your local dealer or directly from Berghof Products + Instruments GmbH (Refer to the “Repairs / Customer Service” section for contact addresses). Always wear safety glasses/goggles and protective gloves when working with the pressure vessels! Note any changes in the appearance of the pressure vessel which could indicate possible material fatigue, e.g., deformation of the vessel, difficulty screwing on lids, etc. even when the vessel is cold and not under pressure. All such vessels should be immediately returned to Berghof Products + Instruments GmbH for inspection. Never attempt to use force to open the vessels. Never use tools to open the vessels! The pressure vessels are equipped with a rupture disc which produces a spontaneous pressure release upwards through the screw-on tube connections in case of excessive vessel pressure. In some cases, such a spontaneous pressure release may occur after the vessel has been removed from the microwave oven. Hot gases and vapors may be released from the digestion vessel when it is opened! Always make sure the vent opening on pressure vessels faces away from both yourself and other individuals! Only open the digestion vessel under a fume hood or other exhaust system. Particular care is required when working with hydrofluoric acid (HF). Observe all relevant data sheets and safety instructions! Never use more than one rupture disc per vessel! Only use rupture discs which are designed for the respective vessel!
i NOTICE	Renew the PTFE-vessels after around 10,000 digestions to maintain reliable operating conditions and to prevent negative influences on your analysis results (e.g. memory effects etc.). Berghof Products + Instruments GmbH includes its digestion vessels in the warranty coverage. Nevertheless, all of the vessels are subject to a certain aging process, which also depends on the type and frequency of the application. Typically, the service life is 10,000 digestion processes or at least 3 years.

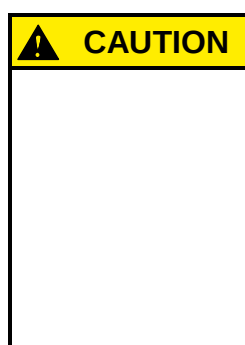
The Speedwave Entry microwave oven can hold up to 10 DAP-60K digestion vessels, or up to 24 DAQ-10 vessels. Vessel types must not be mixed as this will result in extreme differences in sample heating.

The procedure employed for all vessel types is basically similar. This section therefore first describes the general procedures, while any differences between the vessel types will be dealt with in detail in the following sections.

Sample amount

Weigh the sample material into the vessels and then add the acid. The maximum sample quantity depends on → [General procedure](#) the vessels employed and must be strictly observed (refer to the “Technical Specifications” section).

It is not advisable to digest very different kind of samples, generally this leads to large temperature differences.



Minimum fill amount!

Depending on the pressure vessel, a minimum fill amount should be employed so that the temperature sensor can determine the sample temperature precisely. See “technical data”

The microwave oven requires a certain minimum load of pressure vessels in order to achieve the required total load. See “technical data”

If the fluid amount employed is too small, the oven may be damaged during longer operation! An inadequate liquid load can also result in rotor overheating and, in the worst case, in rotor damage.

Rupture disc

Visually inspect the rupture discs. In case of extensive traces of corrosion or other visible damage to the rupture discs, they must be replaced for safety reasons.

A bulge in the center of the rupture disc after use is normal and will not affect its functions.

Make sure the rupture disc is properly seated in the lid, that is, that its edge sits uniformly in the lid groove.

Lid placement

After weighing-in the sample material, adding acid and placing the rupture disc on the lid, the vessel is sealed by means of the coupling cap. For this purpose, it is sufficient to close it hand-tight without exerting additional force. (Refer to 'Sample loading'). We recommend the use of our “Forming system Speedwave”.

Lock the vessel

Lock the vessel with the coupling cap. Only slight pressure is needed to secure the rupture disc. Proper vessel seal is ensured by the pressure supported seal lip, even under maximum interior vessel pressure.

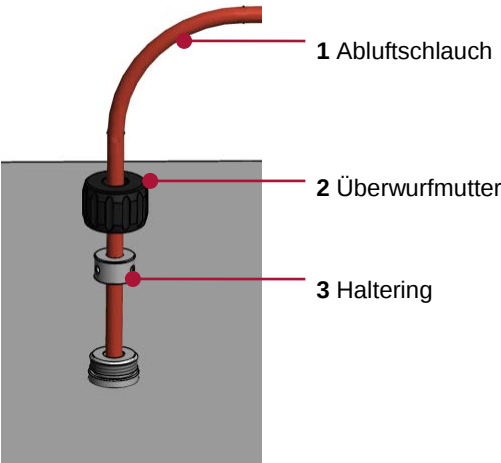
Vessel placement

Digestion vessels should be distributed as symmetrically as possible around the rotor. During placement, the vent fitting is simply screwed onto the associated collection vessel.
The minimum configuration hast to be considered. (see “Technical data”)

Mikrowelle schließen

Procedure:

- Close the Speedwave Entry by pushing the appliance door until it audibly click into place.
- Push the PFA exhaust hose (1) through the union nut (2); afterwards tighten the screw on the top of the device.
- The retaining ring (3) functions as a spacer, so that the exhaust tube is automatically placed in the correct position.
- The exhaust tube must be connected to a venting system such as a fume hood.



For each vessel type a corresponding, pre-assembled exhaust tube is supplied.
When changing to another type of vessel the corresponding exhaust tube must also be replaced.

⚠️ WARNING

Hot acid vapors may be released.

The supplied vent tubes must therefore always be properly connected and attached to an exhaust system.

Make sure the PFA tube is securely attached so that it cannot pop off its connection fitting in case of a percussive pressure burst as occurs when a rupture disc activates.

Start an application

Once a suitable application has been selected or created and the oven has been filled with the desired number of vessels, digestion can be started with the **Start** button.

The Speedwave Entry can only be started when the door is closed.

speedwave® ENTRY

B

BERGHOF

Applications	Glass, Quartz		
Datas	data\Filename-0002		
Log out	Setup	Start	

Berghof
S/N00000

V4.0.0/0.1

16.12.14

11:47:03

✓

4.5. Sample loading

4.5.1. Handling the DAP-60K Pressure vessels

The DAP-60K pressure vessels are made up of TFM™-PTFE pressure vessel, an aluminum rupture disc, a TFM™-PTFE lid, and a coupling cap. The PP rotor can hold up to 10 DAP-60K vessels.



Sample weight

Weigh the sample material into the vessels, and then add the acid. The maximum sample quantity depends on the vessels employed and must be strictly observed (refer to the “Technical Specifications” section).

Weighing in using TFM weighing cups

To simplify the weighing process and prevent loss of samples the samples can be weighed directly into the Berghof weighing cups made from TFM. These are placed in the digestion vessel with the sample and remain there during digestion. After digestion and thorough cleaning with distilled water they can be reused.



Adding the acid

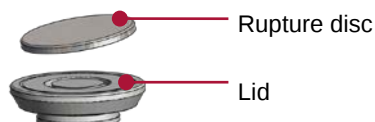
Now add the acid mixture, afterwards it is recommended to leave the pressure vessels for approx. 10-20 min open until the chemical reaction weakened.

Pay attention to the maximum and minimum filling quantity, which depends on the vessels. (Refer to 'Technical Data').

Rupture disc

Visually inspect the rupture disc. In case of extensive traces of corrosion or other visible damage to the rupture disc, it must be replaced for safety reasons.

A bulge in the center of the rupture disc after use is normal and will not affect its functions. Make sure the rupture disc is properly seated in the locking lid, that is, that its edge sits uniformly in the lid groove.



DANGER

Rupture discs!

Use only digestion vessels and spare parts authorized by Berghof Products + Instruments GmbH for use with the Speedwave. These can be obtained either from your local dealer or directly from Berghof Products + Instruments GmbH (Refer to the "Repairs / Customer Service" section for contact addresses).

The pressure vessels are equipped with a rupture disc which produces a spontaneous pressure release upwards through the screw-on tube connections in case of excessive vessel pressure. In some cases, such a spontaneous pressure release may occur after the vessel has been removed from the microwave oven.

Never use more than one rupture disc per vessel!

Only use rupture discs which are designed for the respective vessel!

Expand the lid

a) By using an enlarging tool

Each time, prior to locking the digestion vessels the sealing lip on the locking lid must be dilated. For this purpose, the sealing lip is dilated with the molded part in gentle circling movements. Attention should be paid that expansion is uniform in order to guarantee optimal tightness of the vessels, even at the maximum internal pressure within the vessels.



b) By forming system

Alternatively, the sealing lip of the locking lid can be dilated in the forming station. The stamp is wound downwards as far as possible. This station permits a more even dilation of the sealing lip

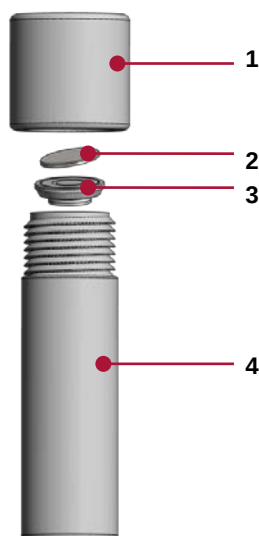


Closing DAP-60K Gefäße

After weighing-in the sample material and adding the acid the locking lid **(3)** is pressed on, whereby resistance should be clearly felt. If this is not the case, the sealing lip must again be dilated as described above.

The rupture disc **(2)** is now placed on the locking lid such that the edge is sitting evenly in the groove.

Finally the digestion vessel is locked by means of the Coupling cap **(1)**. For this purpose it is sufficient to close it by hand without exerting additional force.



i NOTICE

Sample quantity

The maximum sample quantity depends on the vessels employed and must be strictly observed

DAP-60K vessel: 300 mg

i NOTICE

Minimum fill amount!

For each the DAP-60K pressure vessel, should be employed at least approx. 7 ml acid so that the temperature sensor can determine the sample temperature precisely.

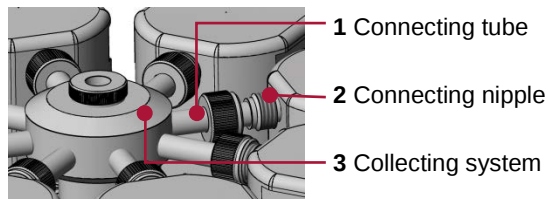
The microwave oven requires a certain minimum load of approx. 20 ml of liquid that means at a 7 ml use of acid per sample at least three vessels must be used for each run in order to achieve the required total load.

If the fluid amount employed is too small, the oven may be damaged during longer operation! An inadequate liquid load can also result in rotor overheating and, in the worst case, in rotor damage.

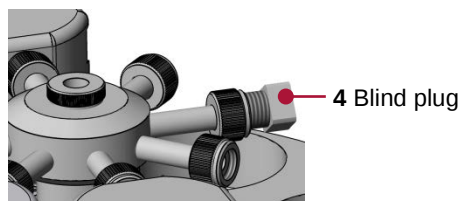
Vessel placement

Digestion vessels should be distributed as symmetrically as possible around the rotor.

The connecting nipple **(2)** is screwed to the connecting tube **(1)** of the collecting system **(3)** (It may be necessary to first move the vessel into the proper position).



Any unused positions on the collection vessel should be sealed with the supplied blind stoppers or with lock screws in order to ensure the proper operation of the gas removal.

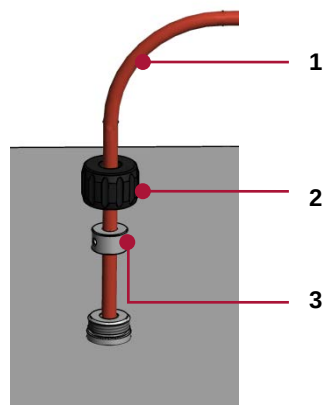


Insert the prepared rotor into the oven.

Insert exhaust tube **(1)** up to the retaining ring **(3)**, this ensures that the rotor is placed centrally in the oven. Screw the union nut **(2)** loosely

The exhaust tube **(1)** can be connected with an acid-resistant suction pump or to an exhaust system. The exhaust tube must be fixed properly.

Close the Speedwave Entry by pressing the door looking until it engages audibly.



i NOTICE

Digestion temperature

Digestion temperatures above 200° C (392°F) should not be set, otherwise the rotor may be damaged. The maximum selected digestion time should not exceed 30 minutes.

4.5.2. Handling the DAQ-10 Pressure vessels



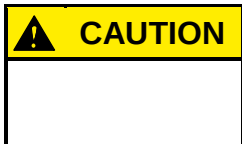
Explosion hazard!

The quartz glasses may only be vented in the safety box under an exhaust hood. Quartz glasses under pressure may explode!
The rotor must not be removed from the box until all quartz glasses have been vented!



Breakage hazard!

Hand-tighten the quartz glass lids. Excessive tightening can destroy the vessels!



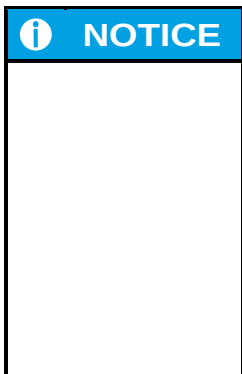
The maximum sample amount, which depends on the vessels, is to be observed. (see „Technical data“)

The further procedure, beginning with sample weight, adding acid, insert rupture disc is identical with the procedure described in Handling the pressure vessels DAP-60K.



Sample quantity

The maximum sample quantity depends on the vessels employed and must be strictly observed.
DAQ-10 quartz glasses: 100 mg



Minimum fill amount!

For each the DAQ-10 pressure vessel, should be employed at least approx. 3 ml acid so that the temperature sensor can determine the sample temperature precisely.
The microwave oven requires a certain minimum load of approx. 40 ml of liquid that means at a 3 ml use of acid per sample at least twelve vessels must be used for each run in order to achieve the required total load.
If the fluid amount employed is too small, the oven may be damaged during longer operation! An inadequate liquid load can also result in rotor overheating and, in the worst case, in rotor damage.

DAQ-10 Gefäße verschließen

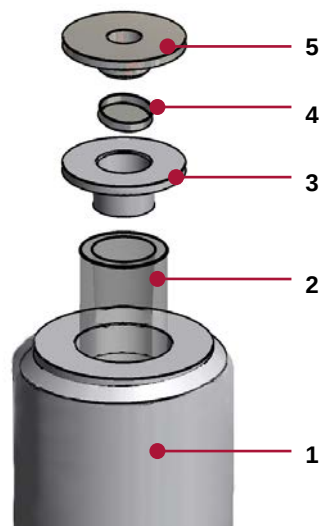
DAQ-10 pressure vessels consist of:

- (1) TFM™- PTFE- protective vessel
- (2) Quartz-insert (pressure vessel)
- (3) TFM™- PTFE-lid
- (4) Monel-rupture disc and
- (5) Fixation plate made of Titanium

The PP rotor can hold up to 24 DAQ-10 vessels.

Methods for expanding the lid, see “Handling the Pressure vessels”.

Visual inspection of the rupture disc see chapter “Appendix”.



DAQ-10 Gefäße einsetzen

The assembled DAQ-vessels are then inserted in the rotor.

Digestion vessels should be distributed as symmetrically as possible around the rotor.

Using the supplied socket wrench, hand-tighten the supplied, black locking screw in the rotor.

A 1-2 mm gap remaining between the glass and the lid will not affect the seal.

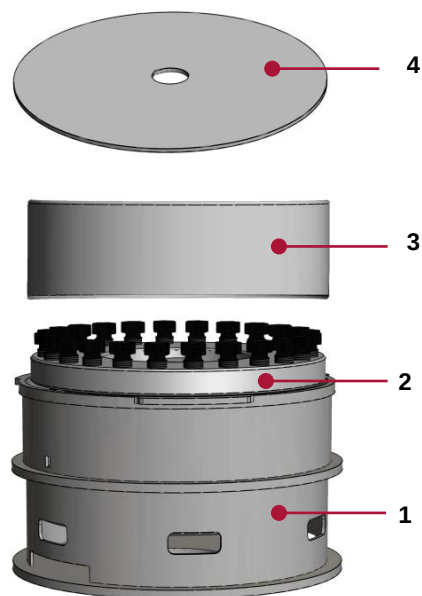


Breakage hazard!

Hand-tighten the quartz glass lids. Excessive tightening can destroy the vessels!

Rotor einsetzen

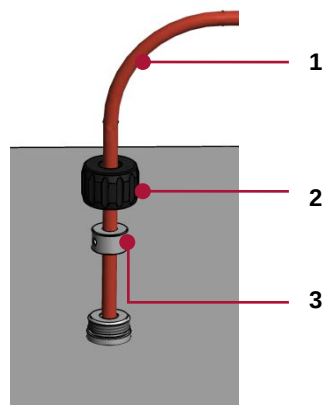
- Insert the PFA-protective **(3)** foil into the PP-box **(1)**, so that the foil fit tightly against the inside wall
- Insert the assembled DAQ-Rotor **(2)** in the PP-box **(1)**
- Lock rotor by turning the PP-lid **(4)** 15° clockwise
- Insert the prepared rotor into the oven. Make sure the glass turntable is not moved out of position.



4.6. Close the microwave

Procedure:

- Insert the prepared rotor into the oven.
- Insert exhaust tube (1) up to the retaining ring (3), this ensures that the rotor is placed centrally in the oven.
- Screw the union nut (2) loosely
- The exhaust tube (1) can be connected to an acid-resistant suction pump or to an exhaust system. The exhaust tube must be fixed properly.
- Close the Speedwave Entry by pressing the door looking until it engages audibly.



i NOTICE

Digestion temperatures

Digestion temperatures above 200° C (392°F) should not be set, otherwise the rotor may be damaged. The maximum selected digestion time should not exceed 30 minutes.

4.7. Start digestion

Once a suitable application has been selected or created and the rotor has been filled with desired number of vessels, digestion can be started with the **Start** button

Das Speedwave Entry can only be started when the door is closed.

speedwave® ENTRY



Applications	Glass, Quartz		
Datas	data\Filename-0002		
Log out	Setup	Start	
Berghof S/N00000	V4.0.0	16.12.14	11:47:03

First of all, all parameters are displayed for control purposes

Soil, Sediment EPA 3052						
step	1	2	3	4	5	power
ramp	5	1	1	0	0	90
time	10	10	1	0	0	
temperature	180	75	75	0	0	
save as filename:						index:
filename e.g. sampling point						0
<<	folder	e.g. customer			>>	new folder
back						start

Application	
Key	Function
Filename	Key field for filename of the measured data *
Folder	Display field of the selected folder. After digestion the measured data are stored in this folder.
<< >>	Select an existing folder
new folder	Create a new folder
back	Back to the main menu without starting a digestion
start	Application is started

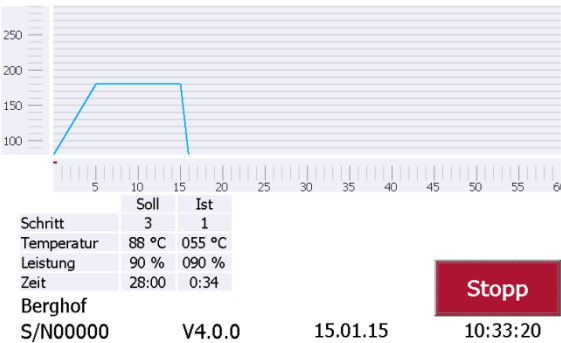
* A file name under which the data are saved consists of the text plus a 4-digit suffix. The suffix is automatically incremented.

Example: samplingpoint-0001.sw2

Real-time display

The current program step, the remaining and the entire digestion time are displayed in real-time. The output and the temperature last measured are updated every 20 seconds.

If the measured temperature is below 80°C (176°F), the curve runs below the visible range. The value is then just presented as a number in the lower part of the display.



If the digestion period has expired, the controller automatically changes for a comment to be input. Here you can enter comments for documentation of the digestion.

comments:

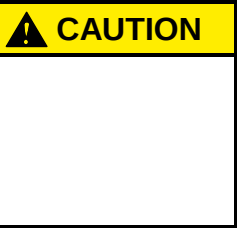
here you can enter a comment

Below the text input field are five empty text boxes for additional comments. At the bottom right of the form are two buttons: "clear" and "Save".



Uncontrolled digestion

If possible, do not operate the oven unsupervised, e.g., overnight.



Opening the door during digestion!

The door should **not** be opened while the application is running. If it is opened nevertheless, the Speedwave Entry is automatically cut off. However, the time program continues to run. When re-closing the door, the magnetron can be activated again. To prevent this, the temperature program should be stopped as a matter of principle before the door is opened.



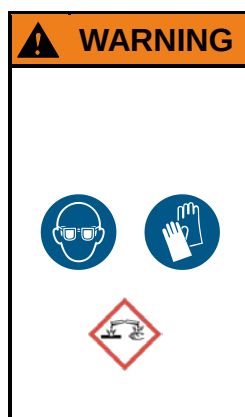
Vessels may not be left in the microwave overnight if filled with acid solution. Corrosion!

4.8. Sample Removal

After the microwave switches off, the vessels must remain in the oven for at least 10 minutes. For this purpose, we recommend to use the last step of the application.

After this time, the individual rotor can be removed (disconnect the vent tube first!) and can be placed under a vent hood or other exhaust system for further cooling. Acid vapors can leak out of the vessels during the cooling phase. This is due to the flow behavior of PTFE and, generally, does not result in any sample loss or contamination.

The vessels may only be opened after an adequate cooling period. When the vessels are opened, their internal temperatures should not lie above 100°C (212°F). The length of the cooling period depends on the heating time and the digestion temperature. The total cooling time before the vessels are opened should be at least half the digestion time and, if possible, somewhat more than this.



Burn and acid burn hazard!

The digestion vessels must not be removed from the oven for at least 10 minutes after the end of the digestion program. This will ensure that the samples have cooled sufficiently to avoid rupture disc breakage caused by jarring during removal.

Always wear safety glasses/goggles and protective gloves when opening vessels!

Always work under a vent hood or other exhaust system!

Never point the gas outlet towards yourself or anyone else. Aggressive gases are released from here when the vessels are opened or if the rupture disc activates!

4.8.1. Removing and Opening DAP-60K Pressure Vessels

A total cooling time of at least 20 minutes is required for the DAK-60K vessels.

The cooling-down time can be substantially reduced by cooling the digestion vessels in a water bath. Attention should be paid here to ensure that only the bases of the vessels come into contact with the cooling water.



Pressure vessels!

Always wear safety glasses/goggles and protective gloves when working with the pressure vessels!

Never attempt to use force to open the vessels. Never use tools to open the vessels!

The pressure vessels are equipped with a rupture disc which produces a spontaneous pressure release upwards through the screw-on tube connections in case of excessive vessel pressure. In some cases, such a spontaneous pressure release may occur after the vessel has been removed from the microwave oven.

Hot gases and vapors may be released from the digestion vessel when it is opened! Always make sure the vent opening on pressure vessels faces away from both yourself and other individuals!!

Only open the digestion vessel under a vent hood or other exhaust system. Particular care is required when working with hydrofluoric acid (HF). Observe all relevant data sheets and safety instructions!



Residual pressure in vessels!

Even after cooling, a residual pressure will remain in the vessels!

Always wear safety glasses/goggles and protective gloves when opening vessels!

Always work under a vent hood or other exhaust system!

Never point the gas outlet towards yourself or anyone else. Aggressive gases are released from here when the vessels are opened or if the rupture disc activates!



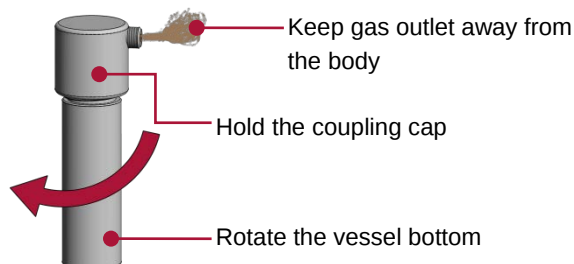
If there is still a high residual pressure in the vessel, it will be difficult to unscrew the lid. If in doubt, allow the vessel to cool for an additional period of time!

If the solution has a high CO₂ content, opening the vessel too quickly can cause the solution to foam up, resulting in sample loss!

Opening the vessels

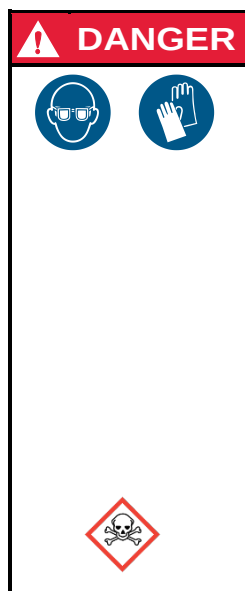
To open the vessels, hold onto the coupling cap and slowly turn the vessel clockwise. Make sure the gas outlet always faces away from you.

As gases begin to escape from the vessel, wait a moment or slightly close the vessel by turning it counterclockwise. Continue in this manner and gradually open the vessel.



4.8.2. Removing and Opening DAQ-10 Pressure Vessel

A total cooling time of at least 20 minutes is required for these vessels.



Pressure vessels!

Always wear safety glasses/goggles and protective gloves when working with the pressure vessels!

Never attempt to use force to open the vessels. Only use the supplied tools to open the vessels!

The pressure vessels are equipped with a rupture disc which produces a spontaneous pressure release upwards through the screw-on tube connections in case of excessive vessel pressure. In some cases, such a spontaneous pressure release may occur after the vessel has been removed from the microwave oven.

Hot gases and vapors may be released from the digestion vessel when it is opened! Always make sure the vent opening on pressure vessels faces away from both yourself and other individuals!

Only open the digestion vessel under a vent hood or other exhaust system. Particular care is required when working with hydrofluoric acid (HF). Observe all relevant data sheets and safety instructions!



Explosion hazard!

The quartz glasses may only be vented in the safety box under an exhaust hood. Quartz glasses under pressure may explode!

The rotor must **not** be removed from the box until all quartz glasses have been vented!

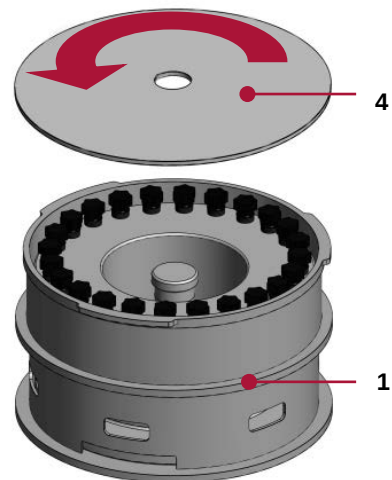


If there is still a high residual pressure in the vessel, it will be difficult to unscrew the lid. If in doubt, allow the vessel to cool for an additional period of time!

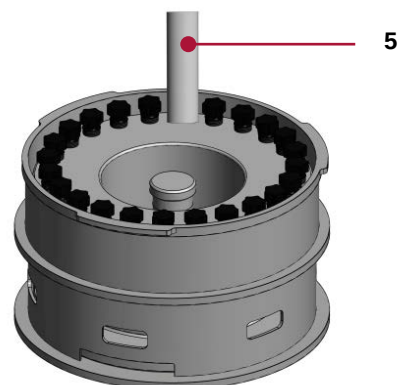
If the solution has a high CO₂ content, opening the vessel too quickly can cause the solution to foam up, resulting in sample loss!

Opening the vessels

First, open the PP box **(1)** by turning the PP lid **(4)** approx. 15° counterclockwise and removing it.



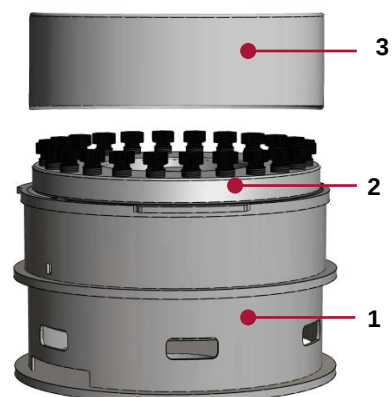
First, open the PP box **(1)** by turning the PP lid **(4)** approx. 15° counterclockwise and removing it. Using the supplied socket wrench **(5)**, slowly turn the black locking screws on the rotor counterclockwise to vent the vessels and release the excess pressure.



As gases begin to escape from the vessel, wait a moment or slightly close the vessel by turning the locking screw clockwise. Continue in this manner and gradually open the vessel.

Once all vessels have been vented the rotor **(2)** can be removed from the PP box **(1)** and the vessels can be completely opened.

Remove the PVA-protective foil **(3)**



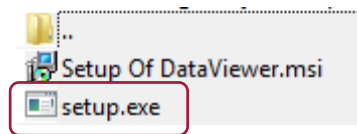
5. Options PC

5.1. Datarecord Viewer Software

The Datarecord Viewer Software is supplied on a CD ROM, using this software; a data review can be carried out on an external PC. The digestion data have to be previously transferred via USB stick to the PC.

5.1.1. How to install the Viewer-Software

For installation use “setup.exe”, this program checks if there is a need to install NET Framework.



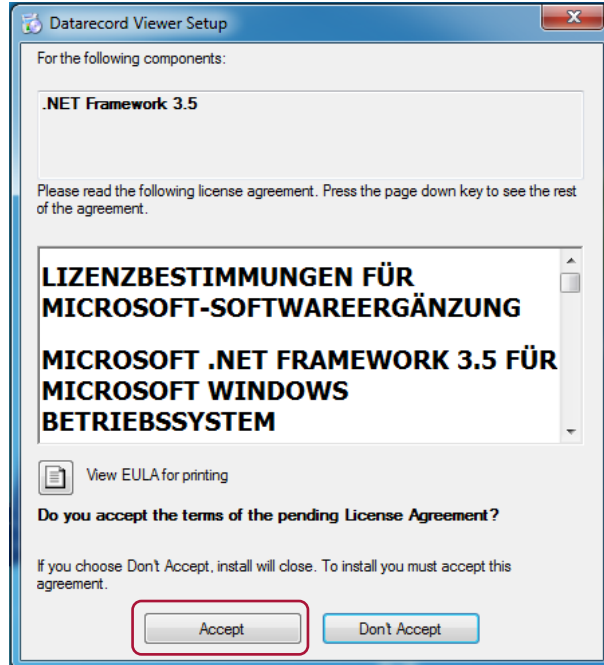
→ [Microsoft Viewer Software on CD-ROM](#)

To install the viewer software Microsoft®.net3.5 is required. This can be installed using setup.exe or may be downloaded free of charge from www.microsoft.com/downloads.

If you use the Windows 7 operating system installation is generally not needed since in most instances Microsoft®.net4 comes preinstalled.

Licence terms

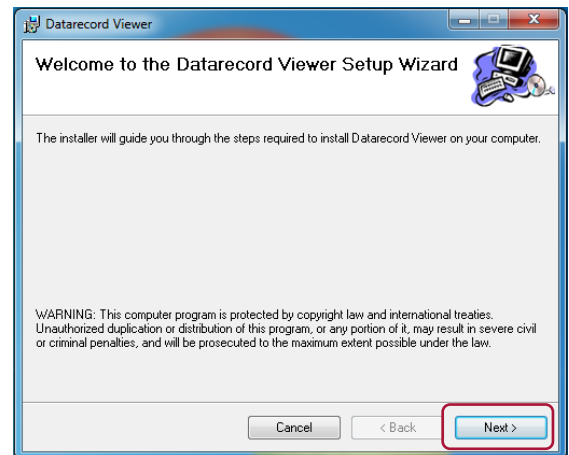
Click



Follow the instructions of the setup and install the Datarecord Viewer Software on your computer.

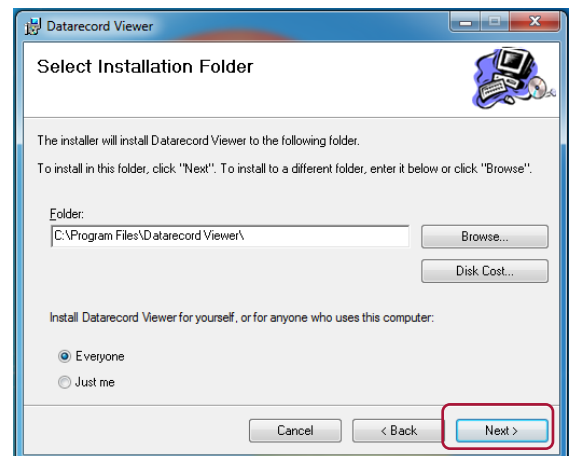
Welcome

Click **Next**



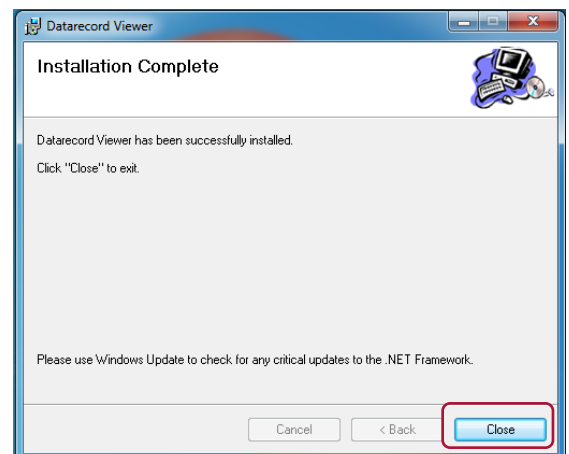
Select Installation Folder

Click **Next**



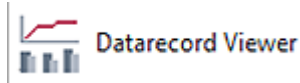
Installation Complete

Click **Close**

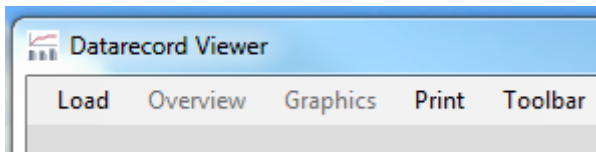


5.1.2. How to start the program

Once the installation is complete the program may be started via the desktop shortcut.



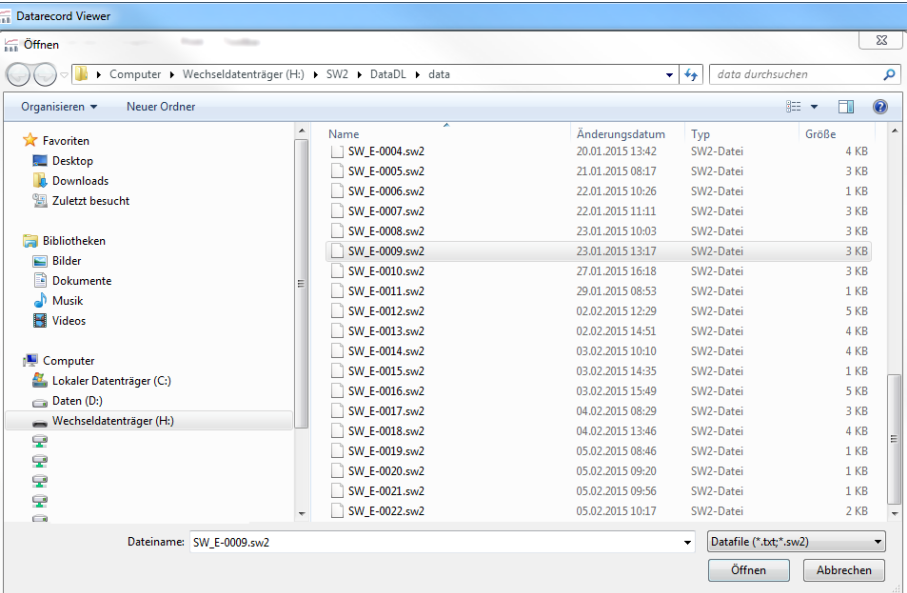
The following functions are available:



Application	
Key	Function
Load	Opens the Explorer, Datafiles can be selected
Overview	The digestion program and the date and time of digestion are displayed
Graphics	Graphical display of max. temperature and power with respective set temperature curve
Print	The current screen is printed
Toolbar	Displays time and temperature according to the selected cursor position

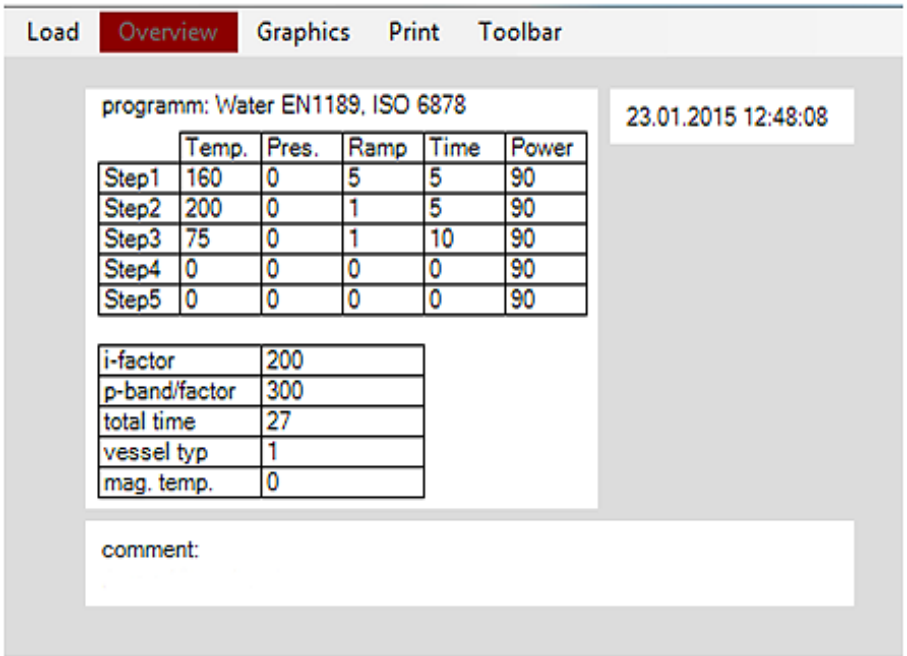
Load

Loading a data file



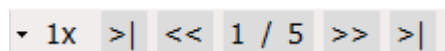
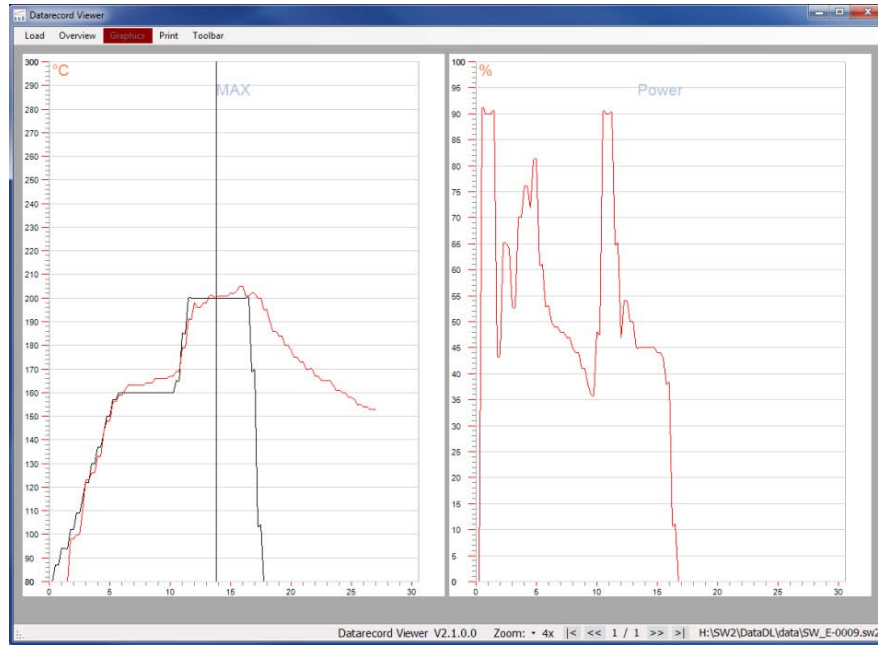
Overview

The digestion program, date and time of digestion, as well as the entered comments are displayed.



Graphics

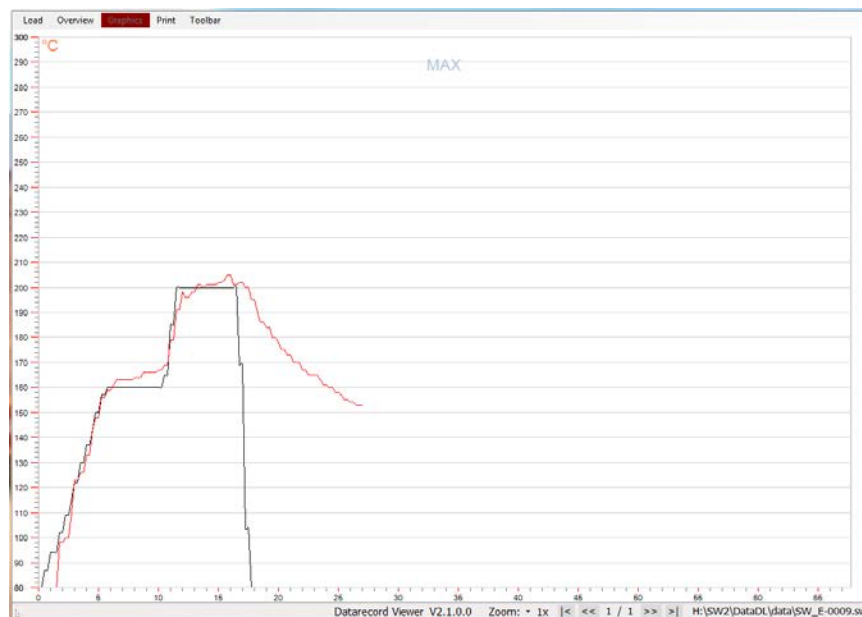
The course of the maximum temperature in [°C] is displayed on the left, the power ramp in [%] on the right side.



Using or you move on to the next time window, “1x” zooms the time axis (x axis) (1x = 0 to 30 min.; 2x = 0 to 15 min.; 4x = 0 to 7.5 min.).

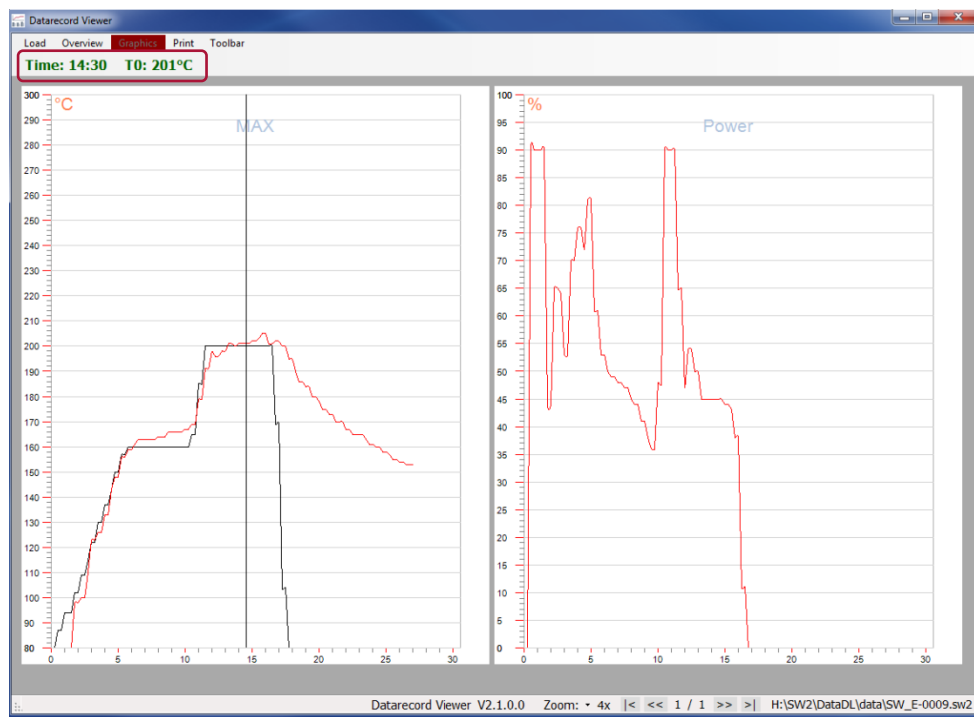
Graphics

Double-clicking on a curve it is displayed enlarged in full format. With a double click you return back



Toolbar

The measured values are displayed corresponding to the selected pressure digestion vessel and the position of the cursor.



Double-clicking on a curve it is displayed enlarged in full format.

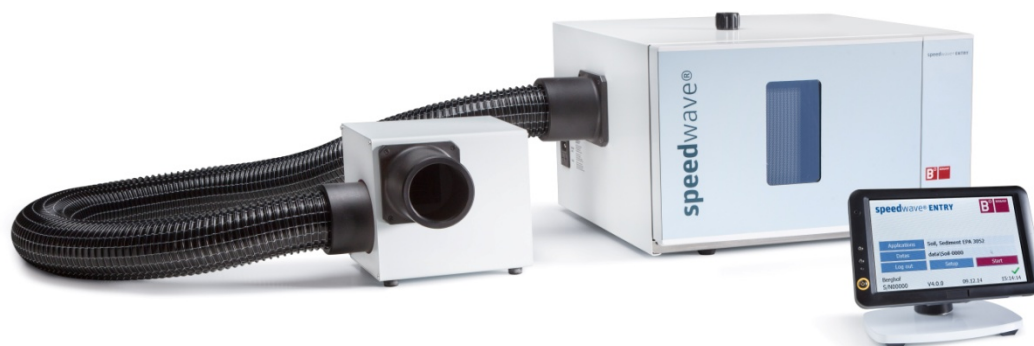
With another double click you return back.

6. Options

6.1. External Exhaust System

The Speedwave microwave systems can also be retrofitted as necessary with a specially designed Exhaust system for the Berghof microwave devices.

We recommend the External Exhaust System when using HF and HCl.



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7. Maintenance, Troubleshooting and Service

7.1. Maintenance and Cleaning



Risk to people from electric and chemical effects!

Switch off the appliance and remove the power plug during all cleaning and maintenance work.

Let pressure vessels cool down.

Always wear safety glasses/goggles and protective gloves during work which may involve contact with chemicals, that is, when working with acids, pressure vessels, during cleaning, etc.!

Repairs and service may only be performed by properly trained and qualified personnel of Berghof Products + Instruments.



Acid burn hazard!

Use only digestion vessels and spare parts authorized by Berghof Products + Instruments GmbH for use with the Speedwave. These can be obtained either from your local dealer or directly from Berghof Products + Instruments GmbH (Refer to the "Repairs / Customer Service" section for contact addresses).

Always wear safety glasses/goggles and protective gloves when working with the pressure vessels!

Note any changes in the appearance of the pressure vessel which could indicate possible material fatigue, e.g., deformation of the vessel, difficulty screwing on lids, etc. even when the vessel is cold and not under pressure. All such vessels should be immediately returned to Berghof Products + Instruments GmbH for inspection.



Detachable power cord

Detachable power cord cannot be replaced by inadequately designed power cord. Use only approved and undamaged power cord.

In order to ensure a high performance and a safe operation, regular cleaning work and proper maintenance is required. Maintenance work may only be carried out by qualified personnel.

From the proper execution depend on safety, reliability and long service life.

Damage which caused by improper cleaning, maintenance or repair shall be borne by the causer.

For a reliable service, maintenance, diagnostics and troubleshooting, please contact your local distributor or directly from Berghof Products + Instruments GmbH.

(See chapter "Repair and Service")

7.1.1. Oven chamber

→ [Tips for cleaning devices](#)

The oven should be wiped out with a moist cloth at regular intervals as well as after any rupture disc activation. All relevant safety measures should be observed in case of contamination by acids, particularly hydrofluoric acid. Allow the oven to thoroughly dry before again using it!

7.1.2. Control unit

Use only a dry cloth to wipe off the controller and the TFT display.

7.1.3. TFMTM-PTFE- Vessel

→ [Tips for cleaning the vessel](#)

Since the vessels exhibit practically no memory effects it is generally sufficient to thoroughly rinse out the vessels with distilled water after each digestion procedure involving complete digestion. If discoloration is noted or if carry over is suspected, the vessels are cleaned by a blank digestion using acid. In this case, the acid used for the particular application is filled into the vessel, but no sample is added. After filling, the temperature program for the application in question is started.

Cleaning methods

The necessary cleaning method depends on the degree of the previously performed digestion and its further use.

Complete digestion

After a complete digestion it is sufficient to clean it several times with demineralised water. (e. g. 3x 20 ml)

Nevertheless it is advisable to perform a blank digestion prior to a new series of digestions. (such as for example if the purity grade changes from % to ppm, ppb, sub-ppb).

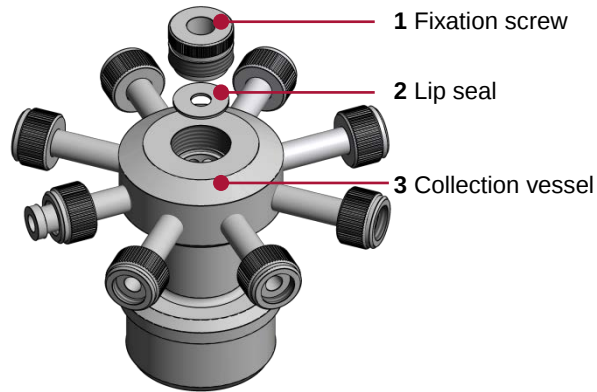
Partial digestion

In the case of an incomplete digestion, mechanical removal of the undigested compounds with cleansing wipes, a sponge or brush can be recommended or a subsequent complete digestion with a suitable acid mixture.

7.1.4. Rotor system

If a rupture disc has activated, perform the following procedure:

- First, allow the rotor to cool sufficiently under a vent hood or other exhaust system, as described in the “Sample Removal” section.
- Remove all vessels from the rotor and open them as described in the “Sample Removal” section.
- Remove the **(3)** collection system.
- Rinse all components clean and allow them to dry.
- Reinstall the rotor and the collection system.



The lip seal on the collection system should be occasionally replaced.

Procedure:

- Unscrew the fixation screw **(1)** in the collection vessel **(3)**
- Replace the used lip seal **(2)** with a new one
- retighten the fixation screw **(1)** hand-tighten only

7.2. Troubleshooting

7.2.1. Microwave

Fault	Possible cause	Corrective action
Magnetron switches off during digestion	Magnetron overheated	Contact Service
	Over overheated	Contact Service
	Too little fluid	Increase acid volume or number of vessel
	Door is not closed properly Connection of control unit to basic unit is interrupted	Close door properly Check serial data connection (cord)
Microwave does not start	Door is open	Close door
	Defective door switch	Contact Service
	Manipulation to door switches	
Oven chamber gets very hot, especially the rotor	Acid volume too low See "technical data"	Increase quantity of fluid refer to "Operation", minimum filling quantity Reduce total running time (max. 30 minutes)
Spark formation in the oven	Acid volume too low see "technical data"	Increase quantity of fluid refer to "Operation", minimum filling quantity
	Rupture disc corroded or damaged	Exchange rupture disc
Turntable is not turning	Driver axis of the turntable is not locked to the drive shaft	Insert driver axis correctly
	Rotor not centered	Check the rotor position
	Turntable position shifted	Check the turntable position
	Motor faulty	Contact Service
Exhaust air tube cannot be plugged into the gas collection system	Lip seal is slipped or defective	Position lip seal correctly, or replace
	Wrong exhaust tube in use	Use a vessel type matching exhaust tube
RCCB switch of the supply line triggers often	Magnetron defective Short circuit in the device	Contact Service
Gas fumes and/or gas odor escapes	Vessels leak	Dilate lip seal of locking lid more; if damaged, replace Refer to „Operation“
Oven chamber dark	LED defective	Change LED, Contact Service

7.2.2. Control unit

Fault	Possible cause	Corrective action
Temperature already shows values >100° C (212°F) after program starts	Temperature measurement faulty	Adjust temperature offset, recalibrate sensor (See chapter "operation" / zero offset)
	Defect on the temperature sensor	Contact Service
	Highly exothermal reaction	Observe waiting period after adding acid
Start button is inactive (grayed out), program start not possible	No communication between control and basic unit	Establish communication by using supplied connection cord Switch basic unit on
Software version of the basic unit is not displayed	Control unit was switch on before the basic unit	Switch off and on the basic unit
Control program does not start after switching on the control unit	SD card removed	Insert SD card. Control program is on the SD card
	SD card defective	Contact Service

7.2.3. Pressure vessel

Fault	Possible cause	Corrective action
Vessels leak	Locking lid is not firmly enough in place on the digestion vessel	Dilate lip seal of the locking lid more; if damaged, replace Refer to Operation
Rupture disc trigger frequently	Corroded rupture disc	Replace Rupture disc more frequently
	Turntable function faulty	Check turntable function
	Sample quantity too big	Reduce weighing-in quantity
	Spontaneous reaction	Reduce maximum temperature
	Temperature measurement faulty	Adjust temperature offset, recalibrate sensor (See chapter "operation" / zero offset)
	Temperature measurement defective	Contact Service

You can obtain technical support from your regional Berghof dealer or directly from Berghof Products + Instruments GmbH by contacting:

Berghof Products + Instruments GmbH
 Harretstr. 1
 72800 Eningen / Germany
 Tel: +49/(0)7121/894-171
 Fax: +49/(0)7121/894-300
 e-mail: service.bpi@berghof.com

Please provide your unit's serial number with all repair questions or repair orders. The serial number is located on the nameplate.

7.3. Communication

7.3.1. Serial interface – device / touch controller

The oven has a built-in micro controller with an integrated RS-232 interface. During a digestion this communicates serially with the touch controller. This connection must not be cut off during digestion.

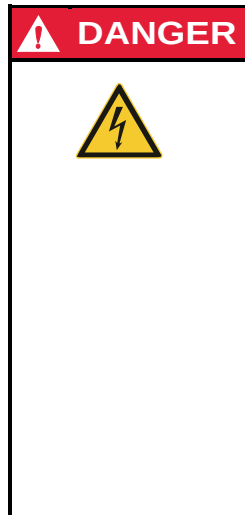
7.3.2. USB interface – touch controller

The touch controller has both a USB host controller and a USB client controller. The host controller manages clients such as USB sticks or HID. The client controller provides the option of operating the touch controller itself as the client of a desktop or notebook PC system. However, this function is not necessary for normal use; only when service is required might it be used.

7.3.3. SD card slot – touch controller

The control software is installed on the SD card supplied and already installed. All of the data are stored on it, both records and applications. It is not really necessary to take the memory card out; if it is nevertheless removed, this should only be done when the device is switched off. Removal of the memory card during operation may prompt unforeseeable results. You can read out the memory card in a suitable card reader and save your applications or records if you do not wish to do this via USB.

7.4. Repairs and Customer Service



The unit employs high voltage and generates microwave radiation!

Any repair and service work may only be performed by properly trained and qualified personnel.

Always unplug the unit from the power supply before beginning any repair or maintenance work.

The high voltage condenser may still carry a charge even after the mains power plug has been pulled. It must therefore be discharged by bridging the terminals, e.g., with a well-insulated screwdriver. Make sure you are not in contact with any metal while discharging.

Never alter the settings of the contact switches. However, should it be necessary to do so, the proper function of the switches must be checked before the unit is again taken into service. Proper switch function must then be confirmed by measuring the unit's microwave leakage radiation. This value must lie below the limit value of $< 5 \text{ mW} / \text{cm}^2$.

→ Berghof Service

You can obtain technical support from your regional Berghof dealer or directly from Berghof Products + Instruments GmbH by contacting:

Berghof Products + Instruments GmbH

Harretstr. 1

T +49.7121.894-171

F +49.7121.894-300

e-mail: service@berghof-instruments.de

Please provide your unit's serial number with all repair questions or repair orders. The serial number is located on the nameplate.

7.4.1. Fuse Replacement

Remove the power cord. The mains plug and the fuse holder form a single unit and are located on the left side of the device. The holder contains two fuses. Always replace both fuses. Make sure the fuse holder is oriented in the proper direction when reinstalling it!

If the fuses again trip after being replaced, please inform the Service Department.

Procedure

- Remove power cord
- Using a screwdriver, turn the plastic screw counter clockwise until it pops out
- Remove the fuse holder and both fuses
- Insert a new fuse in the fuse holder
- Use a screwdriver to tighten the screw by turning it clockwise

NOTICE

Use only OEM fuses in accordance with the description below.

Fuse type

Micro-fuse, 5 mm x 20 mm, 10 A M, 250 V,

7.4.2. Reshipment

 **NOTICE**

Cleaning and decontamination methods

Before using any cleaning or decontamination methods except those specified by Berghof Products + Instruments, users should check with Berghof Products + Instruments or your regional Berghof dealer that the proposed method will not damage the equipment.

→ [Safety and Health Declaration](#)

Customers wishing to return instrumentation and/or associated materials to Berghof Products + Instruments GmbH or regional dealer for repair, maintenance, warranty, inspection or trade-in purposes are advised that all returned goods must be certified as clean and free from contamination.

The customer’s responsible body is required to fill in and sign the form “Safety and Health Declaration” and to display this declaration on the exterior of the shipping container.

This document is available at:
Berghof Service (see contact data above)

Outside the Federal Republic of Germany goods may only be returned to us via our authorized dealer. Before returning the goods, please contact our service department.

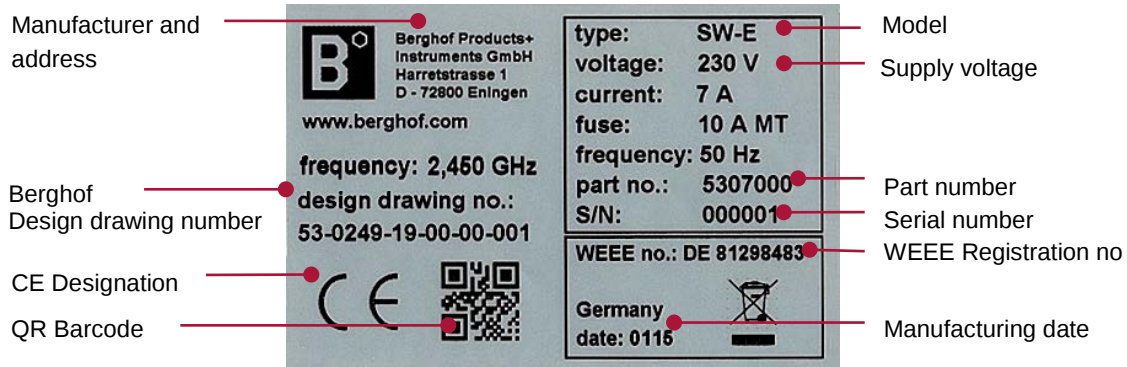
7.4.3. Safety and Health Declaration

Return shipments of instruments and equipment not having decontamination certificates display on the exterior of the shipping container will not be processed and will remain unopened, in a sealed condition, until a determination of decontamination is received.

7.5. Nameplate

The nameplate is located on the left side of the device.

Example



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8. Appendix

8.1. Tips and Tricks

8.1.1. Higher sample throughput

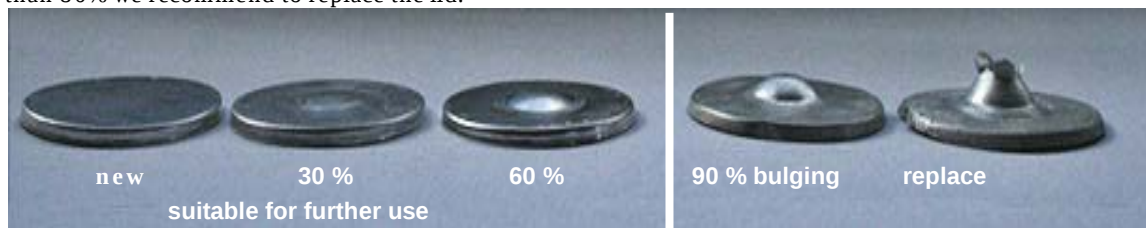
The sample throughput can also be increased by removing the vessels from the Speedwave Entry approximately 5 minutes after completion of the last heating stage and replacing them with new samples. Therefore, no time is wasted on cooling down the samples and idle time in the microwave is restricted to a minimum.

8.1.2. Cooling down samples

As a rule, the samples cool down in 15-20 min. to the point at which they can be opened. However, the cooling-down time can be reduced to 5-10 min. if the digestion vessels are placed in a water bath containing cold water.

8.1.3. Check the rupture disc

A bulge in the center of the rupture disc after use is normal and will not affect its functions, for a bulge lager than 80% we recommend to replace the lid.



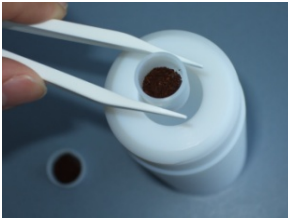
8.1.4. Check the lids

A bulge in the center of the locking lid after use is normal and will not affect its functions, for a bulge lager than 80% we recommend to replace the lid.



8.1.5. Weighing cup

To simplify the weighing process and prevent loss of samples the samples can be weighed directly into the Berghof weighing cups made from TFMTM-PTFE. These are placed in the digestion vessel with the sample and remain there during digestion. Since the vessels exhibit practically no memory effects the cleaning process is the same as in the case of the digestion vessels.



Weighing cup		
	small	large
Volume	2,5 ml	2,5 ml
External diameter	15 mm	20 mm
Part-no. for a single piece	5303611	5303613
Part-no. for a set	5303612	5303614

8.2. Applications

See supplied CD

8.3. Declaration of conformity



Manufacturer	Berghof Products + Instruments GmbH Harretstrasse 1 D - 72800 Eningen
Product	Speedwave Entry - Microwave Digestion System P/N: 5307000 (Basic instrument) P/N: 5307500 (Start up package)

This declaration of conformity is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant Union Harmonisation Legislation:

Low Voltage Directive (LVD) 2014/35/EU
EMC Directive 2014/30/EU
RoHS Directive 2011/65/EU

The following harmonized standards and technical specifications have been applied:

Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements	EN 61010-1:2010 IEC 61010-1:2010 + Corr.:2011
Electrical equipment for measurement, control and laboratory use – EMC- requirements Part 1: General requirements	EN 61326-1:2013 IEC 61326-1:2012 The equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes (Class A). The equipment is intended to be used in a controlled electromagnetic environment.

Eningen, 31 August 2017
Date


Dr. Thomas Horvath
CEO



Berghof Products + Instruments GmbH | Harretstrasse 1 | 72800 Eningen | www.berghof.com
53-0249-41-01-02-001. Änderungen und Irrtümer vorbehalten. All rights reserved; subject to changes and errors

8.4. Conversion Table

Conversation of units		
Dimension	Unit	Conversion
Temperature	°C =	(°F – 32°) / 1.8
	°F =	1.8 * °C + 32°
Length	1 cm =	0.3937 inch
	1 inch =	2.540 cm
Volume	1 ml =	0.06102 inch ³ = 2.642*10 ⁻⁴ gallon
	1 inch ³ =	16.387 ml = 43.29*10 ⁻⁴ gallon
	1 gallon =	3785 ml = 231 inch ³
Pressure	1 bar =	14.504 psi = 0.1 Mpa
	1 psi =	0.06895 bar = 0.0068948 Mpa
	1 Mpa =	10 bar = 145.04 psi
Weight	1 kg =	2.2046 lb.
	1 lb. =	0.4536 kg

8.5. Abbreviation

Plastics	
Abbreviation	Technical term
PE	Polyethylene
PEEK	Polyetheretherketone
PFA	Perfluoralkoxy
PTFE	Polytetrafluorethylene
TFMTM-PTFE	Modified Polytetrafluorethylene
PP	Polypropylene