



# VARIOKLAV<sup>®</sup> Steam Sterilizer 75 S - 175 S Operating manual

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# 1 User information

## 1.1 Initial symbols

- ◆ Operating step: If you are prompted to act, this is the symbol you will find this symbol preceding the respective description.

- Enumeration

Conditional instruction: If an instruction depends on conditions as described in the context, you will find this symbol preceding the respective description.

## 1.2 Important information



### **INFORMATION**

In this manual, this symbol and term precede any important information that is called to your attention.

## 1.3 Safety warnings

This manual contains safety warnings you must observe in the interest of your personal safety and in order to prevent damage to equipment and machinery. Safety warnings are characterized by hazard icons and a grey shaded background. Safety warnings fall into various categories depending on the nature and degree of the respective hazard:



### **DANGER!**

In this manual, this symbol indicates potential physical injury or considerable damage to equipment and machinery in the event this safety warning is not heeded.



### **DANGER!**

In this manual, this symbol indicates that hazardous voltages may cause potential physical injury or considerable damage to equipment and machinery in the event this safety warning is not heeded.



### **EXPLOSION HAZARD!**

In this manual, this symbol indicates that explosions may cause potential physical injury or considerable damage to equipment and machinery in the event this safety warning is not heeded.



### **CAUTION!**

In this manual, this symbol indicates potential minor physical injury or damage to equipment and machinery in the event this safety warning is not heeded.



## 2 Safety instructions

VARIOKLAV™ steam sterilizers are state-of-the-art devices. They meet the requirements of all the applicable standards as most recently amended and are safe to operate. However, hazards may arise from user error or incorrect use. Devices with defects that were not or not properly repaired or which have been subject to unauthorized alteration or modification may also be a source of hazards.

### 2.1 Correct use



#### CAUTION!

**VARIOKLAV™ steam sterilizers must be employed only for the uses described in catalogues, technical descriptions or the operating manual and only in connection with accessories and options recommended or approved by HP Medizintechnik. The use of HP Medizintechnik steam sterilizers will only be error-free and safe if they are transported, stored, deployed and assembled correctly and operated and serviced carefully.**

VARIOKLAV™ steam sterilizers are suitable for sterilizing the items described below. Depending on intended use, on the relevant protection class or level and on applicable standards, specific sterilizer options may have to be used and may be required by law. Operation of the sterilizer without these accessories or options is considered to be contrary to its designated use.

#### **Solids**

Glassware and instruments, simple devices, filtration housings (open), Metal, glass, plastics  
unwrapped, wrapped and/or in metal or plastic transport containers

#### **Porous items**

Textile materials, filters, pipettes and pipette tips, syringes (empty)  
Hollow items with wide or narrow (cannulas) lumens, high-tech instruments and devices  
unwrapped, wrapped and/or in metal or plastic transport containers

### **Liquids**

Liquids, culture media, food

unwrapped (open)/lightly closed or pressure sealed, e.g. storage flasks, Erlenmeyer flasks, screw-cap bottles, Infusion flasks, ampoules

unwrapped, wrapped and/or in metal or plastic transport containers

### **Mixed materials**

as above, with percentages of solids, porous items and liquids in one container  
e.g. consumables with a large percentage of liquids and/or porous substances;  
collected in destruction bags or tins;

unwrapped, wrapped and/or in metal or plastic transport containers

### **Waste/refuse**

These substances may be present in the form of solids, porous items, or mixed materials and must be inactivated or sterilized in accordance with the areas of application and the requirements of the applicable standards.

### **Biological materials**

are assigned to one of the risk levels numbered R1 to R4. They may consist of microorganisms (bacteria, viruses, fungi, protozoa), cell cultures, genetically modified microorganisms, endoparasitic human pathogens, and TSE-associated agents (BSE, scrapie, CJD).

### **Genetic engineering materials**

are genetically engineered organisms that would not occur naturally by breeding or natural recombination.

### **Infectious pathogens**

Six resistance levels have been defined for safe disinfection or sterilization of infectious pathogens by moist heat.

Example: Resistance level III for boiling, level IV for saturated steam at 105 °C or level VI for CJD pathogens (prions) at 134 °C over 60 minutes.

## **2.1.1 Incorrect use**

Items and devices not specifically designated by their manufacturers as suitable for sterilization must not be sterilized.

Easily combustible or toxic liquids must not be sterilized!

In particular the following products are not suitable for sterilization:

- Alcoholic solutions
- Wooden items
- Bonded parts
- Plastic materials sensitive to hot water (e.g. screw tops)
- Electrical equipment
- Vessels or instruments made from iron

## 2.2 Maintaining operational safety

The following points must be observed to maintain operational safety:

- The electrical safety of this device will be assured only when connected to a properly installed and grounded mains circuit. The manufacturer will not be responsible for any injury or damage caused by missing or defective ground wires.
- Any repairs may only be performed by HP Medizintechnik service personnel or by persons specifically authorized by HP Medizintechnik. HP Medizintechnik will not be responsible for any injury or damage to persons or equipment unless the sterilizers have been repaired and serviced by HP Medizintechnik authorized personnel only.
- Use only original replacement parts and authorized accessories offered by HP Medizintechnik GmbH! Using any other parts may compromise safety. The manufacturer will not be responsible for any injury or damage caused by third-party accessories or parts.
- Protective installations must not be tampered with. In particular, it is prohibited to bypass protective switches or to remove protective installations.  
The maximum removal temperature (see Section 5.2.1) of the thermolock must not be exceeded.
- In the event that, in the course of operating this sterilizer significant hazards become evident, the operator of the sterilizer is obliged to immediately inform the manufacturer of this fact, in writing, in order for the manufacturer to be able to take appropriate measures to reduce the hazard potential.

## 2.3 User categories

The operating software is organized such that certain functions or menus are accessible only to specifically authorized personnel. The following classes of users are defined:

### 2.3.1 Users

Users operate the sterilizer according to the programs released for use. They do not need to use the key switch. Users must perform only tasks for which they have been sufficiently trained and that they have mastered completely. Users must be able to:

- Properly load the sterilizer
- Interpret and properly react to the indicator and control elements
- Select the appropriate sterilizer program
- Unload the sterilizer
- Clean the sterilizer as needed
- Document the sterilizing process if required
- Recognize malfunctions and notify the operator

### 2.3.2 Operators

Operators or their representatives have custody of the key for the key switch. They are responsible for:

- Complying with all regulatory requirements and permit conditions
- Ensuring that maintenance intervals are observed
- Maintaining the operational safety of the sterilizer
- Supervising consumables (electrical power, demineralized water, pressurized air)
- Releasing the sterilizer for actual sterilizing activities
- Selection of items to be sterilized
- Storage of logs for successful sterilizations
- Operator training
- Configuring programs (to be performed by suitably trained personnel).

### 2.3.3 Service technicians

Service technicians are persons who, thanks to pertinent training and extensive technical knowledge, are qualified to service and repair steam sterilizers. To do so, they must have at their disposal the required replacement parts, tools and measuring instruments.

## 2.4 Information on potentially hazardous situations

### 2.4.1 Setting the removal temperature

VARIOKLAV® steam sterilizers are equipped with a thermal safety device (thermolock) that will unlock the lid only after the temperature has fallen below the set removal temperature <sup>1)</sup> when sterilizing liquids.



#### **DANGER!**

**Boiling liquids pose a scalding hazard.**

**Adjust the removal temperature low enough<sup>1)</sup> in order to avoid any hazards to sterile services staff.**

### 2.4.2 Sterilizing liquids in pressure sealed vessels



#### **EXPLOSION HAZARD!**

**An explosion hazard exists when sterilizing liquids in pressure-sealed vessels.**

**Vessels may explode on removing and seriously injure operators by scattering splinters and splashing hot liquids.**

**Sterilizing liquids in pressure-sealed vessels is permitted only**

- in sterilizers equipped with the requisite options**
- only when using the Liquid RG program**
- only if the removal temperature is  $\leq 80$  °C**

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1) Statutory removal temperatures:

According to EN 61010-2-241: 1996, the removal temperature must be:

- For open vessels, 5 K below the boiling point of the fluid
- For closed bags, 10 K below the boiling point of water
- For pressure sealed vessels, 20 K below the boiling point of water

According to DIN 58950 and DIN 58951, the removal temperature must always be lower than 0.8 times the boiling temperature of the items sterilized, at normal atmospheric pressure.

### 2.4.3 Opening the lid



#### **Danger!**

Scalding hazard from hot steam when opening the sterilizing chamber.

- Do not open the sterilizing chamber until the removal signal is heard.
- Use the pneumatic opening aid.
- Stand back when opening the sterilizer.

### 2.4.4 Unloading the sterilizer



#### **Danger !**

Hot surfaces and hot steam pose a scalding hazard while removing the sterilized items.

Glass containers may break and scatter glass splinters around.

When removing sterilized items, always wear protective clothing, heat-insulated gloves and eye protectors.

Use baskets.

### 2.4.5 Contamination by exhaust air

Exhaust air contamination is prevented by the FA <sup>1)</sup> exhaust air filter.

For the exhaust air filter to work properly, it must be serviced and the filter insert replaced at regular intervals.

### 2.4.6 Contamination by sterilized items



#### **Danger!**

Insufficient or incomplete sterilization cycles may result in contamination by the items that were not properly sterilized.

Incomplete sterilization may result e.g. from program interruptions because of an interrupted water or power supply or other malfunctions.

- ◆ If the sterilizer itself is in perfect working order, repeat the sterilization cycle.
- ◆ If the sterilization cycle cannot be repeated, treat the improperly sterilized items as non-sterile.

Insufficient sterilization may result from operator error such as the selection of an unsuitable sterilization program, insufficient duration, insufficient temperature,

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1) Option, not included with the standard model

incorrect loading or defective filters.

- ◆ Only entrust trained personnel with operating the sterilizer.
- ◆ Prevent unauthorized program configurations by removing the key.

#### 2.4.7 Removing the cover



##### **ELECTRICAL SHOCK HAZARD!**

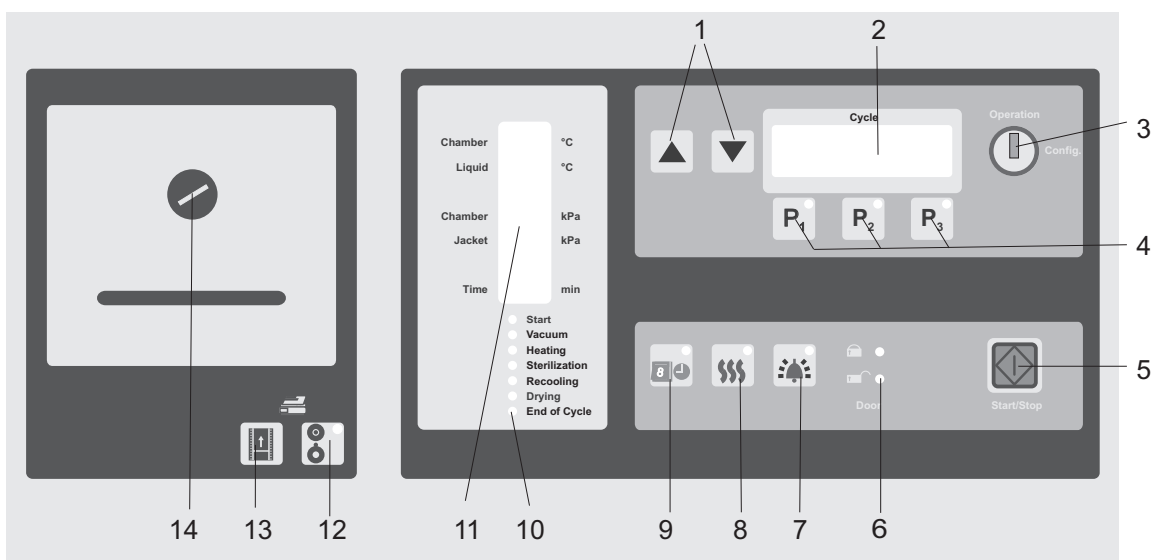
**All operative electrical devices will have certain parts that are subject to dangerous voltages! Always disconnect the sterilizer from mains before removing any covers.**





## 3 Controls

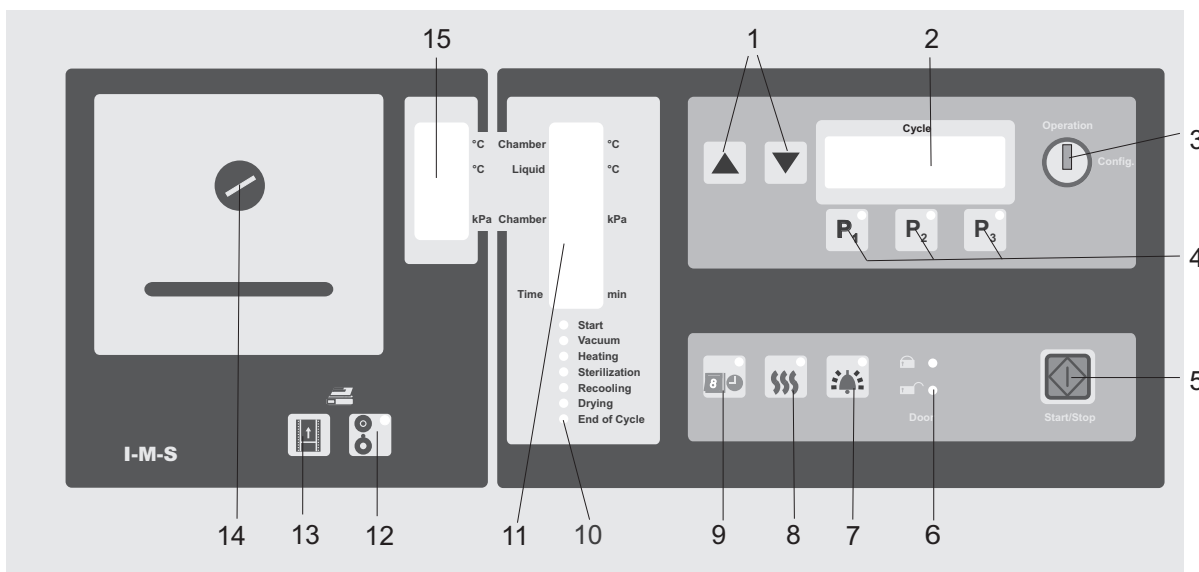
### 3.1 Standard control panel



- |   |                     |  |
|---|---------------------|--|
| 1 | Control keys        | For setting values and adjusting program functions marked by in the cycle display.   |
| 2 | Cycle display       | Displays program parameters (see the program descriptions in Section 4) or error messages. The symbols to the left of a parameter or setting indicate that you can adjust the parameter or setting using the control keys.   |
| 3 | Key-operated switch | Used to alternate between operation and configuration modes <ul style="list-style-type: none"> <li>– <b>Operation:</b> Operation mode for sterilization using configured programs.</li> <li>– <b>Config.:</b> Configuration mode for customizing program settings.<br/>To avoid inadvertent changes to the parameters of the configured programs, remove the key when the key-operated switch is in the Operation position.</li> </ul> |
| 4 | Program keys        | Used to select a sterilizing program.<br>Current program parameters are displayed by pressing the corresponding program key several times.   |

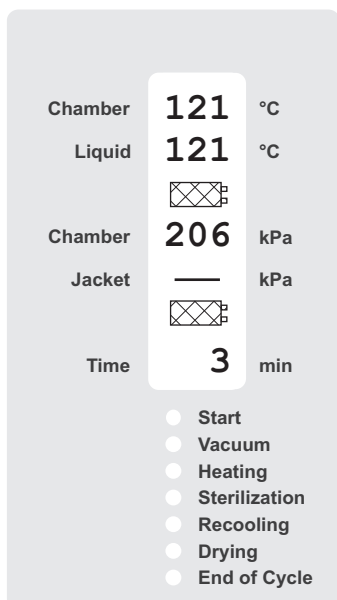
- 5 Green START/STOP key The functions of the green START/STOP key will vary depending on the current status of the sterilizer:
- If the LEDs are not lit and the display does not show anything, the device is in standby mode. You may exit standby mode by pressing the START/STOP key.
- If the cycle display shows a sterilizing program, the sterilizer lid is closed, but no program is run, start the program shown by pressing the START/STOP key.
- When a sterilizing program has been terminated, the START/STOP key will flash. To open the sterilizer you have to confirm the end of program by pressing the START/STOP key.
- If the cycle display (2) shows an error message, this message can be deleted by pressing the START/STOP key.
- In configuration mode, the START/STOP key works as follows:
- If no sterilization program is active, pressing START/STOP several times displays device specifications such as device type, serial number, software revision level, etc.
- If a sterilization program is active, pressing START/STOP cancels the program.
- 6 Lid closure and pressure build-up indicator Indicates whether the sterilizer lid is locked or unlocked:  
🟢 green = unlocked; 🟡 yellow = locked  
Flashing indicator: Waiting for pressure to build up in the pneumatic system.
- 7 Acoustic alarm key For turning the acoustic alarm (buzzer) on or off at the end of a program.
- 8 Preheating key For preheating and for keeping the device warm between sterilization programs. Length of program: 1 hour; can be terminated any time.
- 9 Timer key For turning the timer on or off and for checking the current date and time.
- 10 Sterilizing phase display Individual LEDs show what phases of the current sterilization cycle have been completed.
- 11 Current values display This display shows current values as determined by the internal control system.
- Printer (option)**
- 12 Printer ON/OFF key For turning the printer on or off.
- 13 Paper feed key Feeds (advances) the printer paper.
- 14 Printer cover with unlocking button Covers the printer head, the ribbon, and the paper roll; the cover can be taken off.

## 3.2 IMS Control Panel)



15 IMS current values display This display shows current values as determined by an independent measuring system (IMS).

## 3.3 Current values display



Current temperature in the sterilizing chamber

Current temperature at the flexible media temperature sensor <sup>1)</sup>

Symbol for exhaust air filter<sup>2)</sup>.

Chamber pressure

Symbol for air intake filter<sup>3)</sup>.

Remaining time. Sterilizing time, heating times, and drying times are counted down to zero while the corresponding program is run.

1) Only visible with option media temperature control.

2) Only visible with option exhaust air filtration.

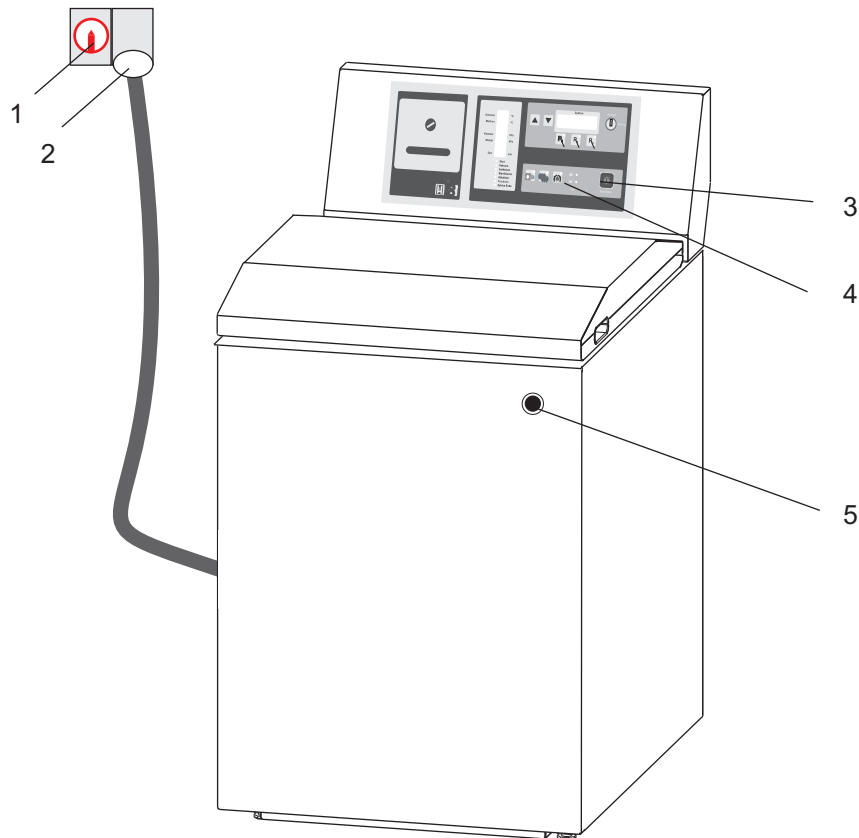
3) Only visible with option sterile venting (included in liquid cooling RM, RO, RG and vacuum drying).

## 3.4 Opening the device

When a program cycle is completed, the green START/STOP key (3) will flash. The sterilizer can only be opened after the end of program has been confirmed by pressing the START/STOP key.

- ◆ Press the flashing START/STOP key (3).
- ◆ Step back from the sterilizer and use the pneumatic opening aid (5).

## 3.5 Turning off the device



During routine operation, explicitly turning off the sterilizer will not be necessary. If no program is being run, the control unit will automatically go into standby mode after 5 minutes. In standby mode, all lamps and indicators on the control panel (4) will be turned off.

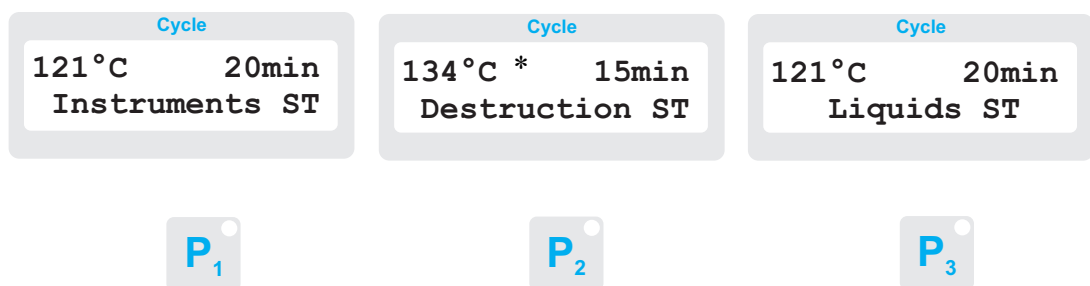
### **EMERGENCY OFF**

- ◆ Turn off the sterilizer at the circuit breaker (1) or pull the mains plug (2).

## 4 Description of programs

### 4.1 Standard programs

These standard programs are available in all VARIOKLAV™ sterilizers. This is how the program keys are laid out in the standard configuration:



Program keys are configurable by the operator (see Section 5.1). The programs they are assigned to can vary.

The same is true of the sterilizing temperature and time (see Section 5.2), which may have been redefined as well.



#### INFORMATION

The following pages include program examples with timing information.

Sterilizing times are contingent on numerous factors, such as:

- Amount, configuration, temperature and any air trapped within the items.
- Sterilizer preheating and operating temperatures, ambient temperatures, temperatures of the cooling water and the demineralized water.
- Sterilizer options such as media temperature control, exhaust air filtration, recooling, vacuum, drying.

The figures in the **Time (min)** column indicate the starting and ending points of the Program phase in the corresponding diagram.

They do not imply or guarantee specific program execution times.

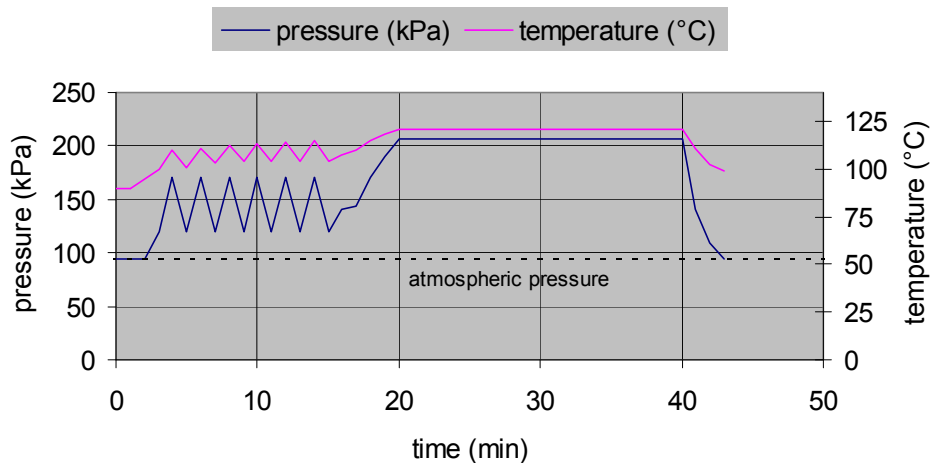
\* 140 °C in units with increased sterilization temperature

### 4.1.1 Instruments ST

This program can be used to sterilize **solid items** (e.g. glassware, instruments, pipette tips or filters).

**Example:**

Sterilizing time: 20 min.; sterilizing temperature: 121 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 18	Deaeration	The pressure in the sterilizing chamber will rise to 170 kPa. At that point, the deaeration valve will open to release air until the pressure has fallen to 120 kPa. The deaeration cycle will be repeated six times. <sup>1)</sup> The chamber is then flushed with steam for 40 seconds.
18 - 19	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
20 - 40	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
40 - 41	Recooling	The deaeration valve will open, followed by rapid and continuous pressure reduction to the preset removal pressure.
42	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

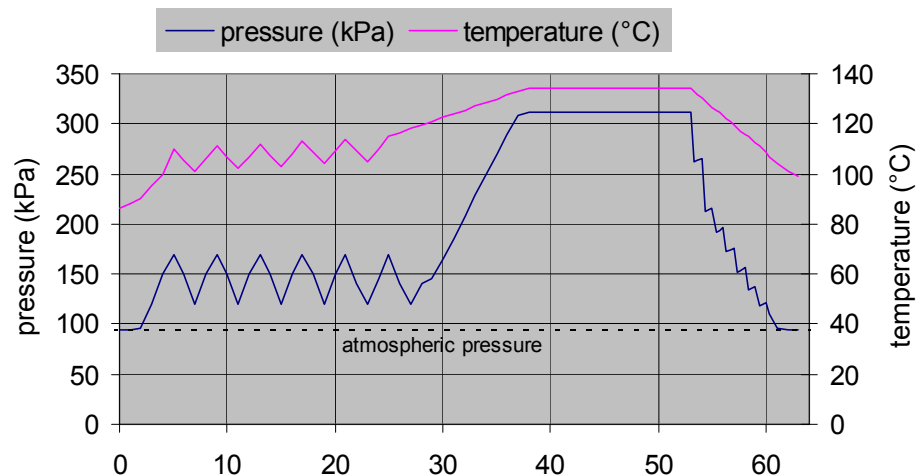
1) The number of deaeration cycles can be defined as 0–8 cycles.

### 4.1.2 Destruction ST

This program can be used to sterilize **laboratory waste** or **mixed loads with a low liquid content**, especially consumables (pipette tips, culture dishes, etc.).

#### Example:

Sterilizing time: 15 min; sterilizing temperature: 134 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 28	Deaeration	The pressure in the sterilizing chamber will rise to 170 kPa. At that point, the deaeration valve will open to release air until the pressure has fallen to 120 kPa. The deaeration cycle will be repeated six times. <sup>1)</sup>
29 - 37	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
38 - 53	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
54 - 60	Recooling	The deaeration valve will open, followed by an incremental pressure reduction to the preset removal pressure.
61	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

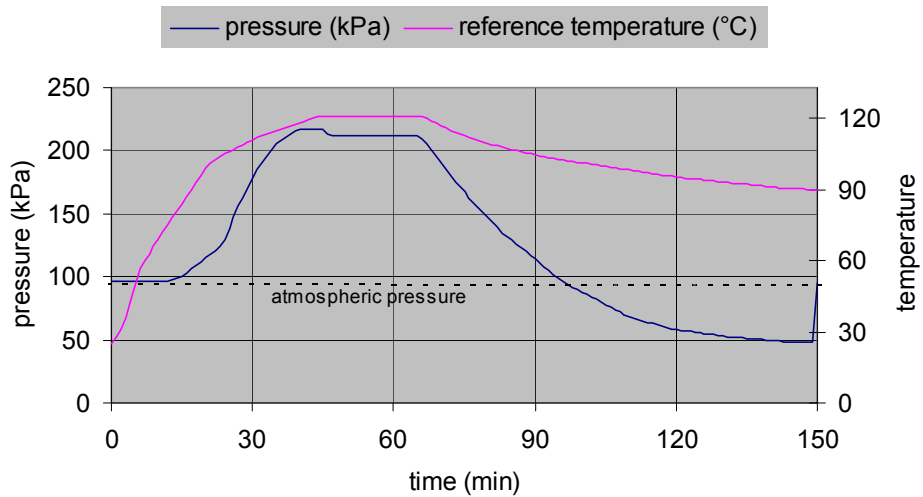
1) The number of deaeration cycles can be defined as 0–8 cycles.

### 4.1.3 Liquids ST

This program can be used to sterilize liquids or culture media in open vessels or liquid laboratory waste. This program involves **moderate liquid loss**.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; removal temperature: 90 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 22	Deaeration	The sterilizing chamber will be deaerated via gravitation method.
23 - 46	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
47 - 66	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
67 - 149*	Recooling	The pressure will be reduced discontinuously in small increments until the removal temperature (in this example 90 °C) is reached. This type of cooling involves retardation of boiling with moderate liquid loss.
150	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

\*The cooling time depends largely on the defined removal temperature and on the quantity of loading. The lower the removal temperature and the more the loading, the longer the cooling time will be.

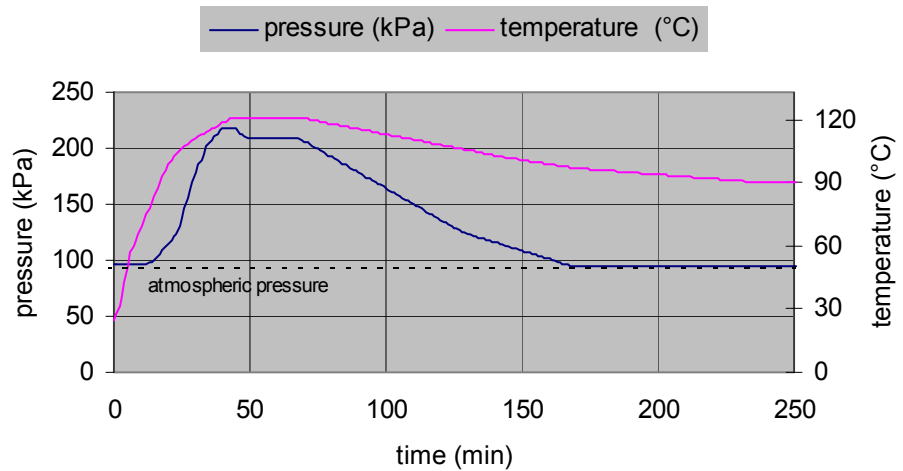


#### 4.1.4 Liquids LS

This program can be used to sterilize large amounts of liquids slowly **to minimize liquid loss**. Because this program takes longer to run, it is commonly run overnight.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; removal temperature: 90 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 -22	Deaeration	The sterilizing chamber will be deaerated via gravitation method.
23 - 48	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
49 - 68	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
69 - 249	Recooling	The pressure will be reduced in small increments to atmospheric pressure. Cooling continues slowly and with low loss at atmospheric pressure until the removal temperature (in this example 90 °C) is reached.
250	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

If you don't press the START/STOP key at the end of the program, a vacuum will be generated in the sterilization chamber.

## 4.2 Options

Depending on which options are installed and which software was enabled by factory default, the following programs may be available:

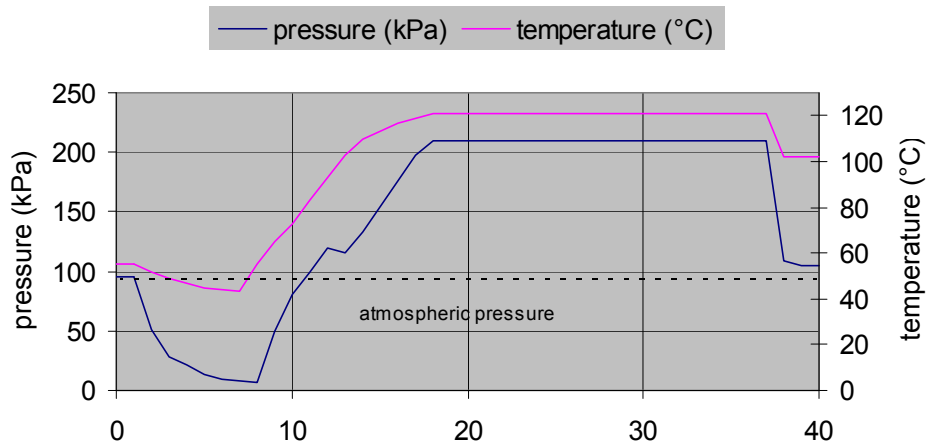
### 4.2.1 Instruments EV

This program generates a **simple vacuum** for deaeration.

This program is particularly well suited for sterilizing porous substances.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; vacuum: 7 kPa



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 13	Deaeration	The pressure in the sterilizing chamber will drop to the selected vacuum level, then rise to 120 kPa, then the sterilizing chamber will be flushed with steam for the next 2 min.
14 - 17	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
18 - 37	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
38	Recooling	The deaeration valve will open, followed by rapid and continuous pressure reduction to the preset removal pressure.
39	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

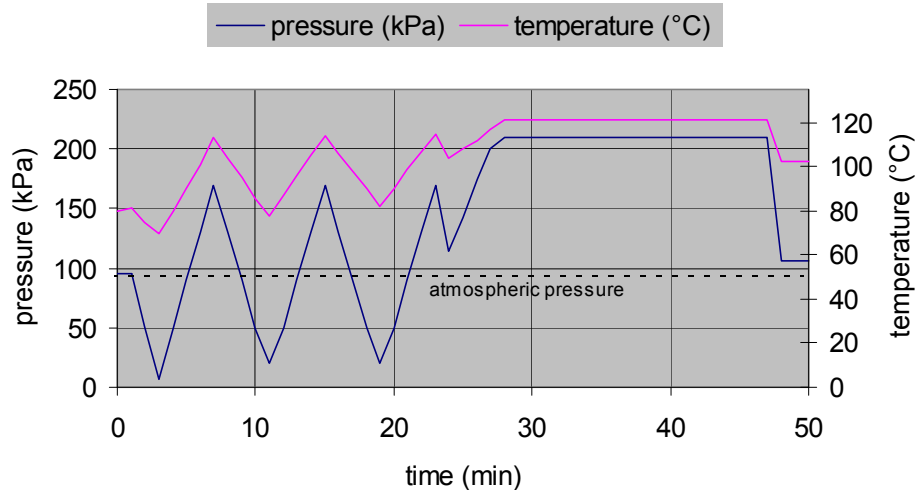
### 4.2.2 Instruments FV

This program generates a **fractionated vacuum** for deaeration.

This program is particularly well suited for sterilizing porous substances or tubes.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; vacuum: 7/20/20 kPa



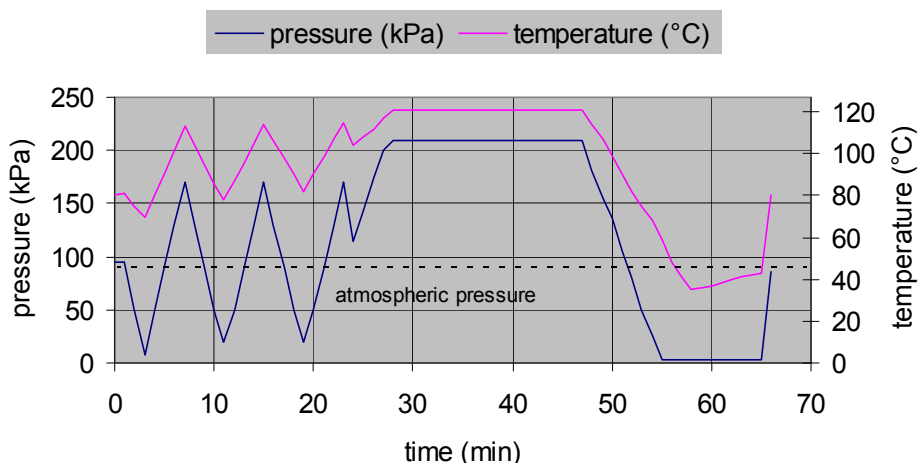
Time (min)	Program phase	Description
1	Start	Feed water control
2 - 24	Deaeration	The pressure in the sterilizing chamber drops to the selected vacuum level (in this example: 7/20/20 kPa), then rises to 170 kPa, then the sterilizing chamber will be flushed with steam for 40 sec. This cycle is repeated three times.
25 - 27	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
28 - 47	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
48	Recooling	The deaeration valve will open, followed by rapid and continuous pressure reduction to the preset removal pressure.
49	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

### 4.2.3 Instruments EV or FV with vacuum drying VT

In addition to the EV and FV vacuum programs, there is also a Vacuum Drying VT program. **Vacuum drying** can be used to dry both **solid objects** (e.g. instruments, pipette tips) and **porous materials** (e.g. textiles, filters).

**Example:**

Instruments FV; sterilizing time: 20 min; sterilizing temperature; 121 °C;  
fractionated vacuum: 7/20/20 kPa; drying time: 15 min



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 24	Deaeration	The pressure in the sterilizing chamber drops to the selected vacuum level (in this example: 7/20/20 kPa), then rises to 170 kPa, then the sterilizing chamber will be flushed with steam for 40 sec. This cycle is repeated three times.
25 - 27	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
28 - 47	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
48	Recooling	The deaeration valve will open, followed by rapid and continuous pressure reduction.
49 - 65	Drying	The sterilizing chamber will be heated from outside and alternatively evacuated and sterile vented. The drying time can be adjusted from 0 min to 199 min.
66	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

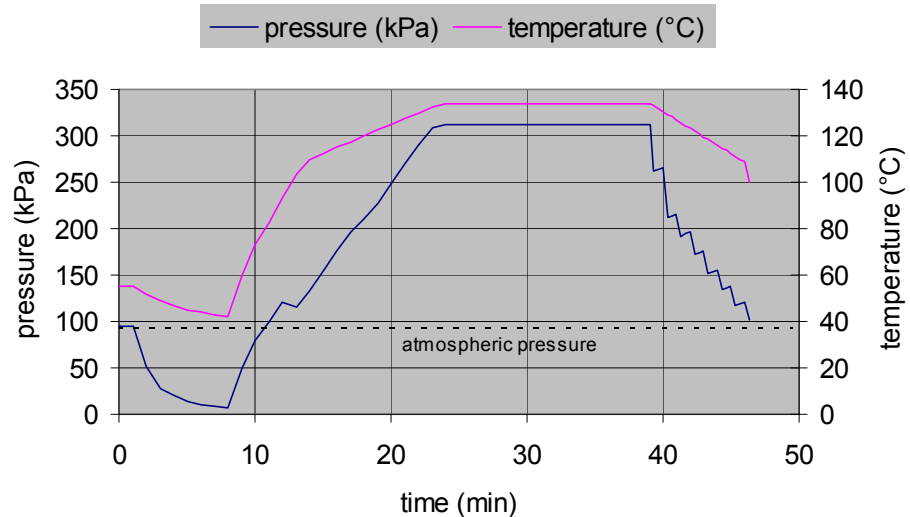
#### 4.2.4 Destruction EV

This program achieves **deaeration with simple vacuum**.

This program can be used to inactivate waste in refuse bags. <sup>1)</sup>

**Example:**

Sterilizing time: 15 min; sterilizing temperature: 134 °C; vacuum: 7 kPa



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 13	Deaeration	The pressure in the sterilizing chamber will drop to the selected vacuum level, then rise to 120 kPa, then the sterilizing chamber will be flushed with steam for the next 2 min.
14 - 23	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
24 - 39	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
40 - 45	Recooling	The deaeration valve will open, followed by incremental pressure release to the preset removal pressure.
46	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

1) Please refer to the notes concerning sterilization of waste in Section 6.2.2.3

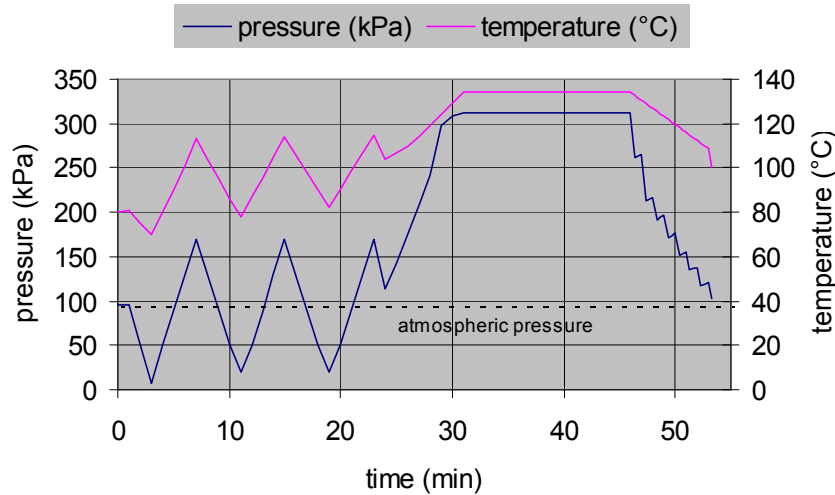
### 4.2.5 Destruction FV

This program achieves **deaeration with fractionated vacuum**.

This program can be used to inactivate waste in refuse bags. <sup>1)</sup>

**Example:**

Sterilizing time: 15 min; sterilizing temperature: 134 °C; vacuum: 7/20/20 kPa



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 24	Deaeration	The pressure in the sterilizing chamber drops to the selected vacuum level (in this example: 7/20/20 kPa), then rises to 170 kPa, then the sterilizing chamber will be flushed with steam for 40 sec. This cycle is repeated three times.
25 - 30	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
31 - 46	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
47 - 53	Recooling	The deaeration valve will open, followed by incremental pressure release to the preset removal pressure.
54	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

1) Please refer to the notes concerning sterilization of waste in Section 6.2.2.3

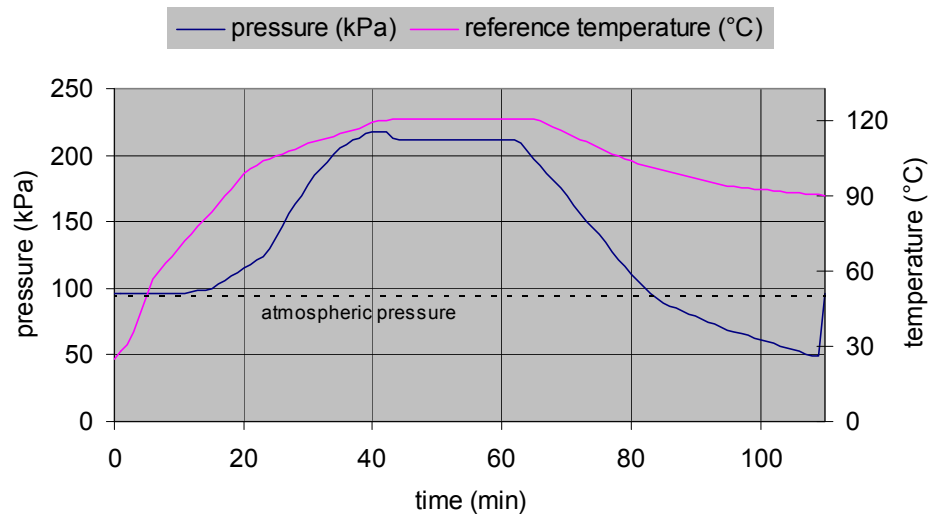
## 4.2.6 Liquids RM

This program works with a fast recooling system. The sterilizing chamber is cooled externally using a cooling medium. In this way, the sterilized item is cooled **quickly** and **gently** until the defined removal temperature is reached.

The **Liquids RM** program can be used to rapidly sterilize liquids and culture media in open vessels.

### Example:

Sterilizing time: 20 min; sterilizing temperature: 121 °C; removal temperature: 90 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 22	Deaeration	The sterilizing chamber will be deaerated via gravitation method.
23 - 43	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
44 - 63	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
64 - 108	Recooling	The sterilizing chamber is cooled externally. In this way, the pressure will be reduced and the liquids will boil slightly.
109	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

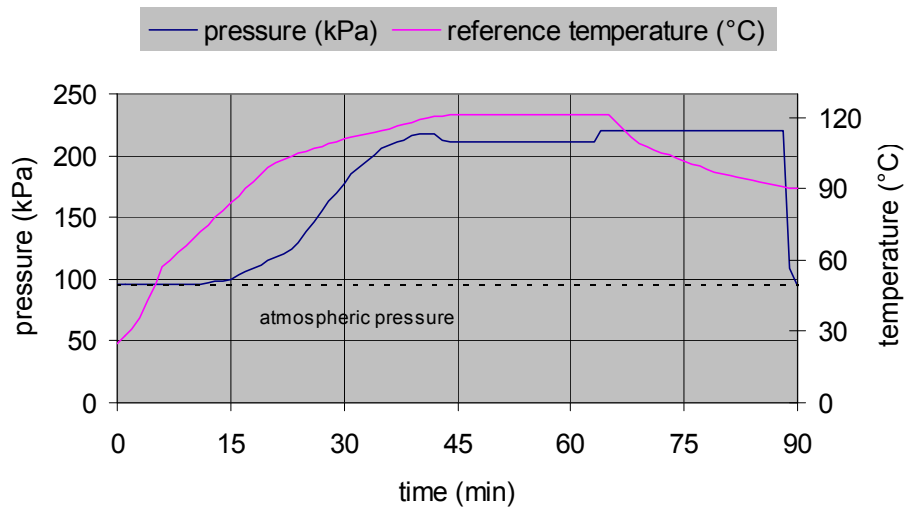
### 4.2.7 Liquids RO

This program works with fast recooling, supporting pressure and a radial fan. The sterilizing chamber is cooled externally using a cooling medium. In this way, the sterilized item is cooled **quickly** and **gently** until the defined removal temperature is reached. Supporting pressure is built during the cooling phase, which greatly reduces liquid loss. The radial fan mixes steam and pressurized air and prevents temperature layering.

The **Liquids RO** program can be used to sterilize liquids and culture media in open vessels **rapidly** and **at low loss**.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; removal temperature: 90 °C; fixed supporting pressure: 220 kPa



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 21	Deaeration	The sterilizing chamber will be deaerated via gravitation method.
22 - 43	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
44 - 63	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
64 - 89	Recooling	Constant supporting pressure is built before the beginning of the cooling phase. The sterilizing chamber is cooled externally until the removal temperature (in this example 90 °C) is reached. The radial fan dissipates the steam-air mix. Retardation of boiling in the cooling phase is prevented by constant supporting pressure.



Time (min)	Program phase	Description
90	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

#### 4.2.8 Liquids RG

This program works with fast recooling, supporting pressure and steam-air circulation.

A radial fan integrated in the sterilizing chamber mixes steam and air during the heating, sterilizing and cooling phase. In addition, supporting pressure is built that is in line with the sterilizing temperature. This ensures that the internal pressure developing in the heating phase will not cause any sealed vessels to burst.

The radial fan will also dissipate the steam-air mix in the cooling phase, thus ensuring that the sterilized item is cooled down rapidly and uniformly. A cooling medium flows externally around the sterilizing chamber. In this way, the sterilized items are cooled quickly and gently until the preset removal temperature is reached. Meanwhile, the supporting pressure is maintained, which prevents the boiling of liquids being retarded in the cooling phase.

The **Liquid RG** program can be used to sterilize:

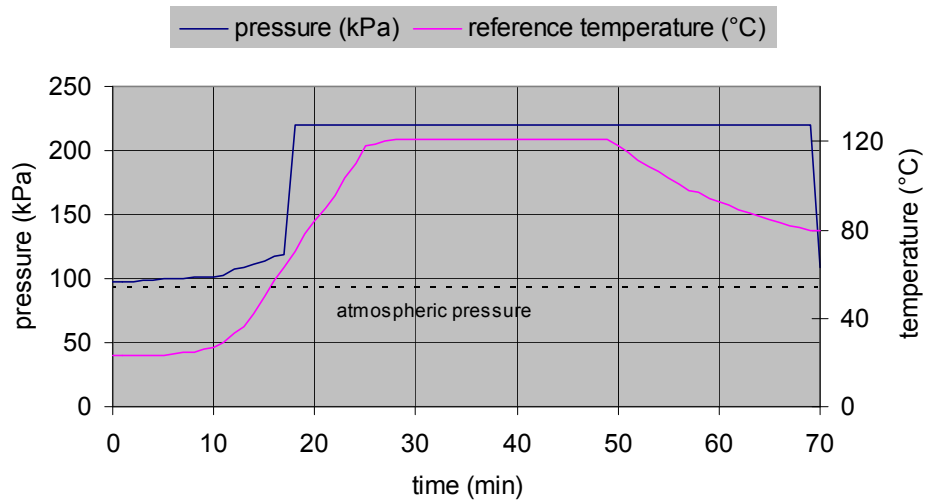
- Liquids in closed or pressure sealed flasks
- Liquids in infusion flasks with a flanged stopper
- Creams, solutions or food <sup>1)</sup> in vacuum sealed plastic bags
- Solutions in thermally unstable plastic containers
- Food <sup>1)</sup> wrapped in aluminium foil

---

1) The items to be sterilized must not contain gas or elements becoming gaseous at increase of temperature as e.g. carbonic acid.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; removal temperature: 80 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 21		The sterilizing chamber will be heated to 70 °C.
22 - 29	Heating	Supporting pressure is built. The steam is mixed with air by the radial fan.
30 - 49	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
50 - 69	Recooling	The sterilizing chamber is cooled externally until the removal temperature (in this example 80 °C) is reached. The radial fan dissipates the steam-air mix. Retardation of boiling in the cooling phase is prevented by constant supporting pressure.
70	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

## 4.3 Maintenance programs

### 4.3.1 Transport

The transport program locks the lid and prevents the mechanics of the lid to be shifted when the sterilizer is transported.

After the program has been started, the lid is locked. Then, the message "Ready for transport" is shown on the display. The unit can be separated from mains and transported after this message has been displayed.

#### **Open the sterilizer after transport**

- ◆ Plug the power cable into a socket outlet.
- ◆ Press the START/STOP key to finish the transport program

### 4.3.2 Preheating

This program can be used either to preheat the sterilizer before an initial sterilization cycle or to keep its temperature up between two sterilization cycles.

In the Preheating program, the chamber pressure is limited to 120 kPa.

The Preheating program has a fixed runtime of 60 minutes. After these 60 minutes, the program is automatically terminated, and the lid is unlocked. The control unit will automatically go into standby mode after 5 minutes. The Preheating program can be terminated at any time by pressing START/STOP or the Preheating key.

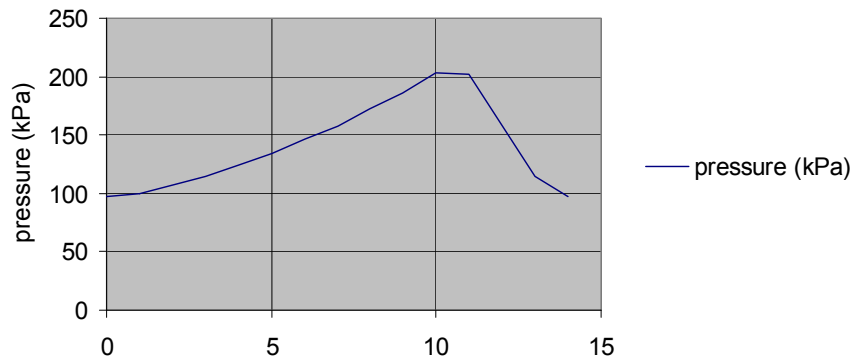


#### **INFORMATION**

Another popular use of the Preheating program is to dissolve or warm up agar in a pressure-free manner.

### 4.3.3 Emptying

This program can be used to empty and desludge the steam generator.



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 13		The Steam generator is heated and pressure is built in the sterilizing chamber. When a level of 200 kPa has been reached, a valve is opened, and the feed water is pressed out of the steam generator. The pressure drops rapidly once the chamber has been drained of water.
13	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

## 4.4 Special programs

### 4.4.1 Steam pot

This is not a sterilizing program.

In this program, items to be sterilized are exposed to a selected temperature without pressure. The program is suitable

- for defrosting, heating and keeping warm liquids
- for dissolving agar-agar
- for disinfecting heat-sensitive culture media and solutions without pressure
- as climatic chamber for rapid ageing, diffusion and sealing tests in hot steam

The temperature can be selected from 50 °C to 98 °C.

The program runtime can be selected from 1 to 999 minutes.

The Steam pot program can be terminated anytime by pressing the START/STOP key.

### 4.4.2 Durham tubes

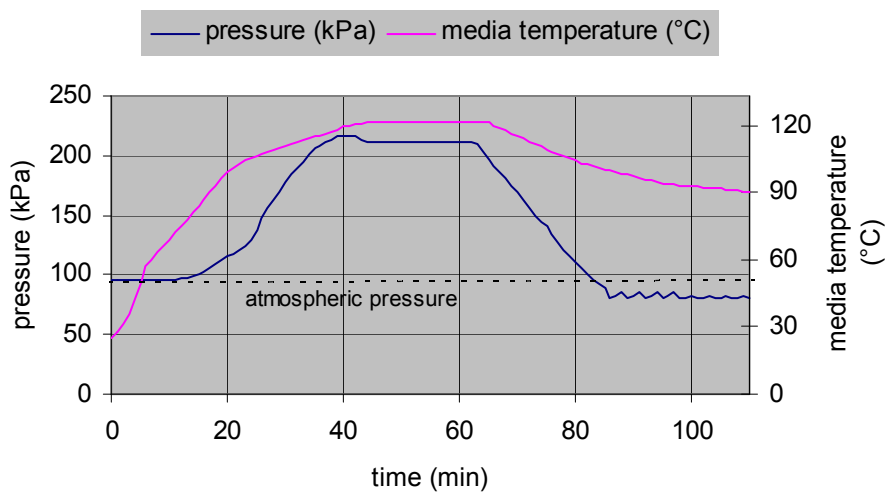
This program is especially suitable for sterilizing Durham tubes.

This program works with a fast recooling system. The sterilizing chamber is cooled externally using a cooling medium. In this way, the sterilized item is cooled **quickly** and **gently** until the defined removal temperature is reached.

In addition, the pressure does not drop below 80 kPa as venting is now included in the cooling phase.

**Example:**

Sterilizing time: 20 min; sterilizing temperature: 121 °C; removal temperature: 90 °C



Time (min)	Program phase	Description
1	Start	Feed water control
2 - 22	Deaeration	The sterilizing chamber will be deaerated via gravitation method.
23 - 43	Heating	The sterilizing chamber is heated up until the sterilizing temperature is reached.
44 - 63	Sterilization	The sterilizing chamber will be heated to the proper sterilizing temperature.
64 - 109	Recooling	The sterilizing chamber is cooled externally.
110	End of program	The acoustic signal will sound (if activated) and the START/STOP key will flash. After pressing START/STOP, the program will terminate, the chamber pressure will be reduced to the ambient pressure and the lid will be unlocked.

## 5 Program configuration



### DANGER!

Program parameter alterations made in configuration mode may result in violations of normative regulations and may compromise the result of the sterilization effort.

This is why programs may only be configured on the request of the responsible operator of the device and only by suitably trained technical personnel!

To be able to configure the programs, you need the key switch (1).

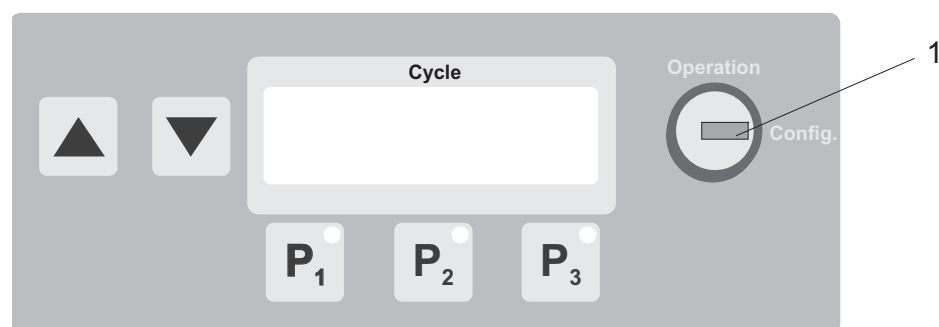
### 5.1 Reconfiguring program keys



### INFORMATION

Configure the program keys such that the three most important programs can be selected directly.

If only a single program is used, configure all three program keys for the same program and same program parameters.

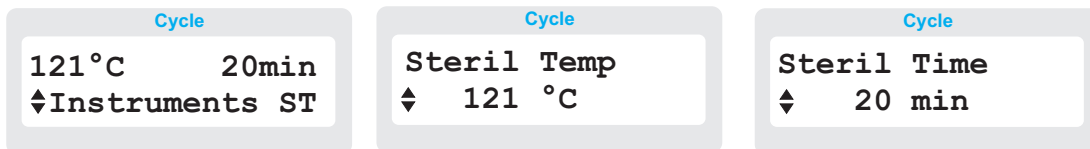


- ◆ Press one of the program keys P1, P2 or P3.
- ◆ Turn the key switch (1) clockwise to the Config. position.
- ◆ Press the or selection key until the desired program appears on the display.
- ◆ Turn the key switch to the Operation position. The selected program will be activated.

## 5.2 Changing program parameters

- ◆ Turn the key switch (1) to the configuration position.
- ◆ Repeatedly press one of the program keys P1, P2 or P3.

Program names and the individual program parameters will appear on the display, as in the following example:





A double arrow indicates that the value of the corresponding parameter may be modified.

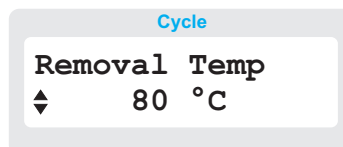


### INFORMATION

For available value ranges please consult the Technical Specifications in the Appendix.

- ◆ Press the  or  selection key until the desired value appears on the cycle display.
- ◆ Turn the key switch to the operating position. The modified settings will now take effect.

### 5.2.1 Removal temperature



VARIOKLAV<sup>®</sup> steam sterilizers are equipped with a thermal safety device that will terminate the program only after the temperature has fallen below the set removal temperature when sterilizing liquids.



### DANGER!

**Boiling liquids pose a scalding hazard.**

**Adjust the removal temperature <sup>1)</sup> low enough in order to avoid any hazards to sterile services staff.**

- 1) Statutory removal temperatures:  
 According to EN 61010-2-241: 1996, the removal temperature must be:
  - For open vessels, 5 K below the boiling point of the fluid
  - For closed bags, 10 K below the boiling point of water
  - For pressure sealed vessels, 20 K below the boiling point of water
 According to DIN 58950 and DIN 58951, the removal temperature must always be lower than 0.8 times the boiling temperature of the items sterilized, at normal atmospheric pressure.



## 5.2.2 Removal pressure

Cycle

Rem. pressure  
 ◆ 110 kPa

The removal pressure setting must be 10 to 15 kPa higher than the average ambient pressure.



### CAUTION!

If the removal pressure is set too high, steam may escape from the lid in sudden bursts if you acknowledge the removal message.

If the removal pressure is set too low, the program is never terminated because its termination criterion is never met.

## 5.2.3 Vacuum Settings <sup>1)</sup>

Cycle

Vacuum (kPa)  
 ◆ 7

A vacuum level can be set in the Instruments EV and Destruction EV program.

Cycle

Vacuum (kPa)  
 ◆ 7    20    20

Cycle

Vacuum (kPa)  
 7    ◆20    20

Cycle

Vacuum (kPa)  
 7    20    ◆20

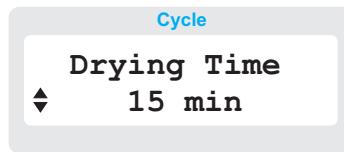
Three different vacuum levels for three consecutive vacuum cycles can be set for the Instruments FV and Destruction FV programs.

Three vacuum parameters are shown, the value for each of which can be adjusted in turn.

If you wish to use only two distinct vacuum levels, change the value for the last parameter to "--".

1) Only available for devices with vacuum pump.

## 5.2.4 Drying time



This program parameter is only present in the following programs:

- Instruments ST with sterile air drying TL.
- Instruments EV or FV with vacuum drying VT.

Generally, extended drying times will improve the drying result.

For vacuum drying, a drying time of 15 to 20 minutes will usually suffice, while sterile air drying requires drying times of 60 to 120 minutes.

## 5.3 Activating or deactivating the acoustic alarm or the printer

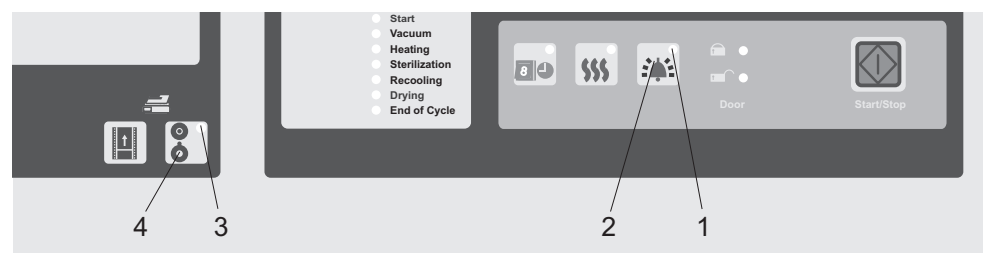


### INFORMATION

When the key switch is in the configuration position, the acoustic alarm and printer are permanently deactivated for a given program

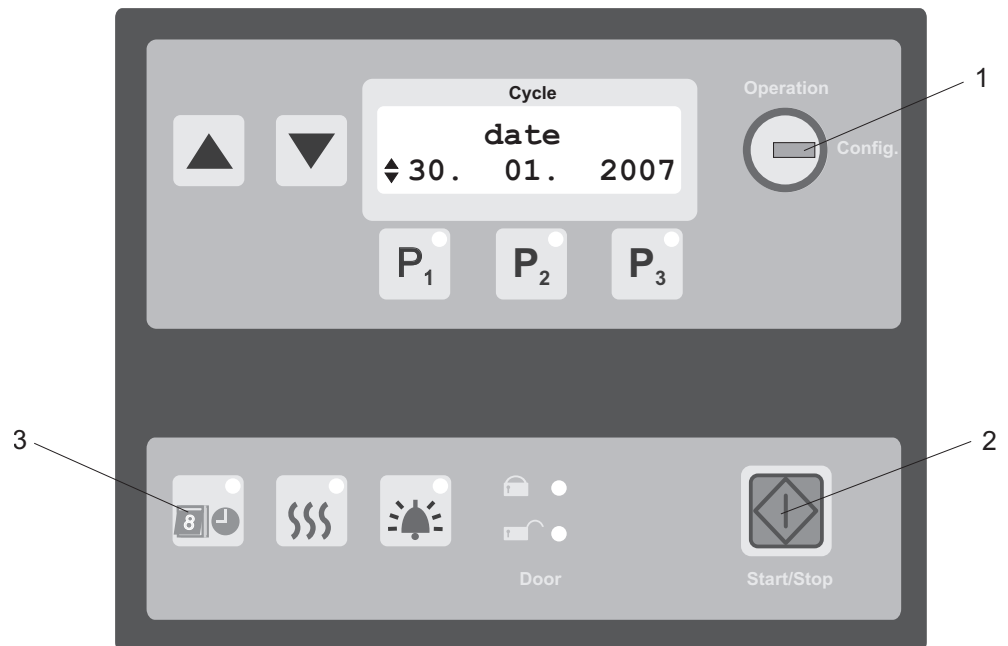
If the acoustic alarm and printer are to be deactivated for only one program run, put the key switch in the operating position (see Section 6.3.1).





The acoustic alarm and printer options can be activated or deactivated for each program key separately. An options are active if the respective indicator LED (1 or 3, respectively) in the corresponding program key is lit.



- ◆ Press one of the program keys P1, P2 or P3.
- ◆ Turn the key switch (1) to the configuration position.
- ◆ Press the acoustic signal key (2) or printer key (4).
- ◆ Turn the key switch to the operating position. The modified setting will now take effect.

## 5.4 Setting date and time



- ◆ Turn the key switch (1) to the configuration position.
- ◆ Press and hold the Timer key (3).
- ◆ At the same time, hold down the Start/Stop key (2).
- ◆ Release both keys. The selected time is shown.
- ◆ Use the  or  keys to alternate between the date and time displays.  
To change the settings for hours/ minutes/ seconds or day/ month/ year, press the respective program key below, and change the value using the  or  keys.
- ◆ Turn the key switch to the operating position. The modified settings will now take effect.



## 6 Sterilization

### 6.1 Preparing the sterilizer

If the external power switch is off, turn it on.

If the indicators on the control panel are off, press the START/STOP key to leave standby mode.



#### INFORMATION

The sterilizer automatically goes into standby mode to save power if no program is started within five minutes. The operation mode is reactivated by pressing the START/STOP key.

#### 6.1.1 Supply lines

Make sure that all stop valves in the supply lines (demineralized water, tap water, cooling water, compressed air) of the sterilizer are open.

#### 6.1.2 Feed water tank <sup>1)</sup>

- ◆ Before each sterilization cycle, check to see whether there is enough feed water in the feed water tank.
- ◆ Only use demineralized or distilled water when topping up the feed water tank. Do not use tap water.



#### INFORMATION

If the feed water tank gets completely drained while a program is being executed, an error message will appear in the cycle display and the program is automatically terminated (see 8, Troubleshooting).

---

1) Operation with feed water tank only:

### 6.1.3 Condensate collector <sup>1)</sup>



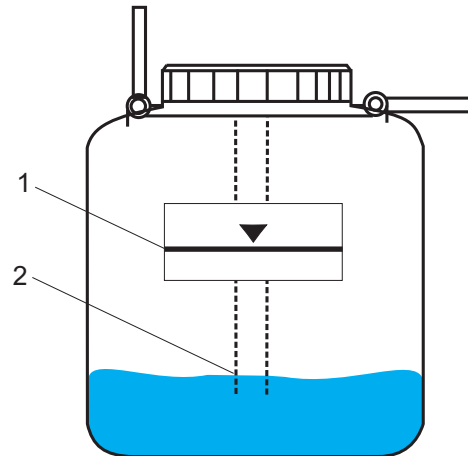
#### CAUTION!

To avoid damage by water, take precautions against collector overflow!

- ◆ Check the water level in the condensate collector.

Empty the condensate collector if the filling level is above the max line (1) before initiating a sterilization cycle.

If the condensate collector is empty, add around 5 liters of water so that the immersion tube (2) is covered.



### 6.1.4 Preheating

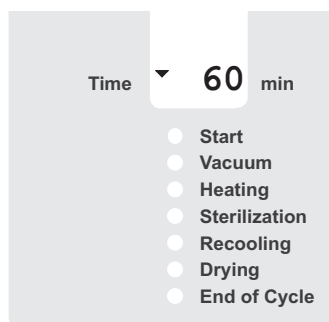
Batch times can be reduced by 10–15 minutes if the preheating function (1) is used. The preheating key must be activated at least 15 minutes before the planned program run is started.



- ◆ Close the lid.
- ◆ Press the PREHEATING key (1).

The indicator (2) lights up. The annular quick lock of the lid automatically closes. The time field in the current values display shows 60 min. and a flashing symbol. The time is being counted down to 0 min. during preheating, then the heating is automatically turned off and the lid automatically unlocks.

1) Operation with condensate collector only.



- ◆ You can terminate the preheating process at any time:
- ◆ Press the PREHEATING (1) key.

The indicator (2) goes off. The annular quick lock of the lid automatically unlocks.



#### INFORMATION

If pressure compensation between internal and ambient is necessary, the lid may take 1–2 minutes to unlock.

## 6.2 Preparing the items to be sterilized

### 6.2.1 Baskets

The sterilizing chamber can be loaded with various optional baskets of stainless steel:

#### 6.2.1.1 Wire-mesh baskets:



The steam easily penetrates the wire mesh of these baskets with no condensate forming at the floor of the basket.



#### INFORMATION

Protect all vessel openings in the baskets below from dripping condensate.

### 6.2.1.2 Wire-mesh baskets with collecting tray



**Not designed for the liquids RG program.**

Wire-mesh baskets that feature collecting trays prevent

- contamination of the chamber in the event of breaking glass or overboiling solutions,
- condensate dripping into lower-level vessels.



#### **INFORMATION**

Remove the trays carefully because there may be residual condensate in the collecting tray

### 6.2.1.3 Sheet-metal baskets without cover :



**Especially designed for sterilizing waste in destruction bags.**

**Not designed for the liquids RG program.**

Sheet-metal baskets prevent contamination of the chamber in the event of breakage or overboiling.



#### **RISK OF CONTAMINATION!**

**Incorrect loading will result in inadequate deaeration.  
In that case, successful sterilization is not guaranteed.**

- Use the sheet-metal basket as the lowermost basket in the sterilizer.
- Do not use more than one<sup>1)</sup> sheet-metal basket per batch.
- Insert wire-mesh baskets without collecting tray only.
- Fold back the destruction bags in the sheet-metal basket such that they cannot collapse during sterilization.

1) Exceptions include the Instruments EV, Instruments FV, Waste EV and Waste FV vacuum programs (options that are not included in the standard system). Deaeration in these programs is so effective that two sheet-metal baskets stacked on top of each other can be sterilized at a time.



**6.2.1.4 Sheet-metal baskets with rotating cover (perforated in the upper segment):**

**Only designed for pre-vacuum programs.**

Sheet-metal baskets with rotating cover can be used to transport infected materials. The cover can be rotated such that the holes are either closed for transport or opened for sterilization.

These baskets can only be placed with an additional grating (separately available) on wire or sheet-metal baskets. We recommend not to combine these baskets with other baskets but to sterilize them separately.

**RISK OF CONTAMINATION!**

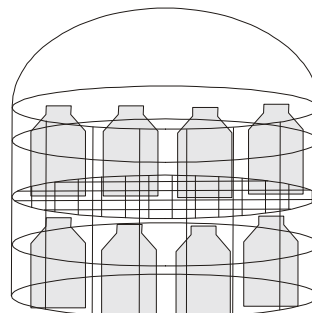
**If handled incorrectly, successful sterilization is not guaranteed.**

**The holes in the basket must be open.**

**The inflowing steam must not be obstructed by other loaded items.**

**6.2.1.5 Intermediate floor for wire-mesh basket:**

Allows a greater number of small vessels to be arranged in a wire-mesh basket.



## 6.2.2 Practical tips for various types of items

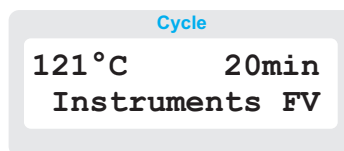
### 6.2.2.1 Glass items

- ◆ Remove all coarse soiling.
- ◆ Place all vessels in baskets so that openings face downwards.
- ◆ Concave and convex parts should be tilted, so that condensate can run off.
- ◆ Select a program for instruments (see Chapter 4 for program descriptions)

### 6.2.2.2 Pipette tips

If anchored boxes are used for storing pipette tips, these must be permeable to steam. Boxes must not be stacked on top of each other. Position the pipette box in this way, that the condensate can drop down from the box. Pipette tips will normally be wet following sterilization.

- ◆ Select a program for instruments (see Chapter 4 for program descriptions)..



#### INFORMATION

We recommend a programs including vacuum and drying for pipette tips.

### 6.2.2.3 Waste



#### RISK OF CONTAMINATION!

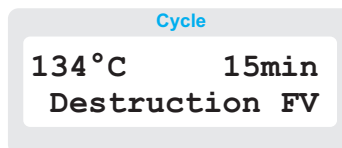
The sterilizing temperature in closed destruction bags can be up to 10 °C below the chamber temperature.

**Sterilize waste in open sterilizing baskets or in folded-back steam-permeable destruction bags<sup>1)</sup>.**

1) See price list for ordering details for steam-permeable destruction bags.

- ◆ Place the waste in open vessels or bags or a metal tray with a solid bottom.
  - Place open bags additionally into a metal boat with closed bottom. In this way, you avoid soiling the sterilizing chamber in the event that the bag tears open or leaks.
  - Select as high a sterilizing temperature as possible. More heat will result in better sterilization. As a rule, it is sufficient to set a sterilizing time of 15 minutes at 134 °C.

- ◆ Select a program for waste (see Chapter 4 for program descriptions).



#### INFORMATION

We recommend the Destruction EV and Destruction FV programs for waste to optimize deaeration performance.

For liquid waste (more than 0.3 l per item):

- ◆ Select a program for liquids (see Chapter 4 for program descriptions).

#### 6.2.2.4 Sterilizing liquids in open vessels:

##### Sterilization using media temperature control

If a media temperature sensor is used (see Section 6.2.4), the reference temperature for the start of sterilization is determined based on the temperature of a liquid medium.

In the cooling phase, the media temperature sensor **and** the fixed reference sensor must have fallen below the removal temperature so that the lid closure is released by the thermolock.

Use of a media temperature sensor is mandatory in the RO and RG programs, whereas the other programs for liquids will also allow sterilization in the absence of a media temperature sensor.

##### Sterilization without media temperature control



#### CAUTION!

The RO and RG programs may involve significant differences between the medium and chamber temperatures. Therefore, these programs must be run **in the presence** of a media temperature sensor inside a suitable reference flask.

In the Liquids ST, Liquids LS and Liquids RM programs, it is also appropriate to use a reference sensor instead of a media temperature sensor that is firmly installed in the chamber. This type of sensor will normally reach sterilization temperature 2–10 min. sooner than the liquid in the individual vessel. This time difference depends on the size and filling level of the flask, the heat capacity of the liquid, and on the ratio of the individual volume to the liquid surface. If you sterilize without a media temperature sensor, you need to make allowances for these factor and extend the sterilizing time in the program configuration (see Section 5.2) accordingly.

In the cooling phase, the steam pressure and hence the boiling temperature developing in all vessels (small, medium, large) as well as on the condensate

deposited on the chamber floor will be largely identical. Therefore, the same removal temperature applies to sterilizing with or without media temperature sensors.

#### **media volume increase**

During the heating phase, steam will condense on the surface of the vessels, and the amount of liquid will increase.

The heat causes the volume to expand.

In the boiling phase, bubbles will form.



#### **CAUTION!**

**Fill the stirring vessels to no more than 60% of the total capacity. Otherwise there is a risk of overboiling.**

#### **Liquid volume decrease**

During the cooling phase, the volume of water will decrease. The loss of water will depend on the recooling process, the cooling time, the shape of the vessel and the filling volume. Particularly if liquids are held for a long time in the hot sterilizing chamber, up to 12% of the liquid can be lost as a result of "evaporation".

#### **Liquid loss compensation**

The loss involved is reproducible, providing the sterilizing conditions are the same. For this reason, any loss can be compensated when producing culture media by adding the appropriate amount of liquid.

#### **Covering vessels**

Liquid loss can be reduced by covering vessels with aluminium foil or a cellulose stopper. If you use laboratory flasks made of boron silicate glass (such as DURAN®), you may loosely fit the screw cap, or screw it on by **no more than** one turn.



#### **EXPLOSION HAZARD!**

**There is an explosion hazard unless the vessels are pressure-sealed with an appropriate cover. For details on how to sterilize pressure sealed vessels, see Section 6.2.2.5.**

### 6.2.2.5 Sterilizing liquids in pressure-sealed vessels



#### EXPLOSION HAZARD!

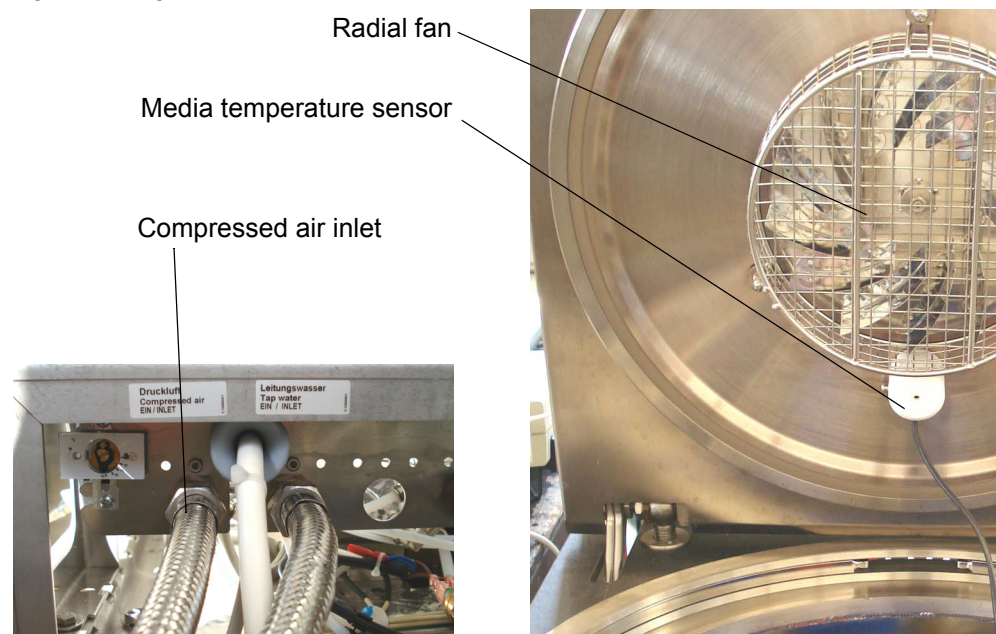
An explosion hazard exists when liquids are sterilized in pressure sealed vessels.

Vessels may also burst while being removed, which may result in serious injuries by broken fragments and jets of hot liquid.

**Sterilizing liquids in pressure sealed vessels is permitted only**

- in sterilizers equipped with the requisite options
- when using the Liquids RG program
- if the removal temperature is  $\leq 80\%$  of the boiling temperature of the liquid

#### Options required:





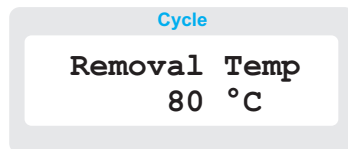
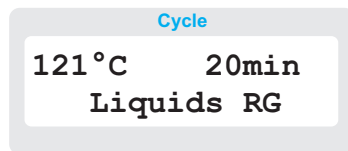
**RISK OF TEMPERATURE LAYERING!**

The Circulation of steam and air is obstructed by sheet-metal baskets and wire-mesh baskets

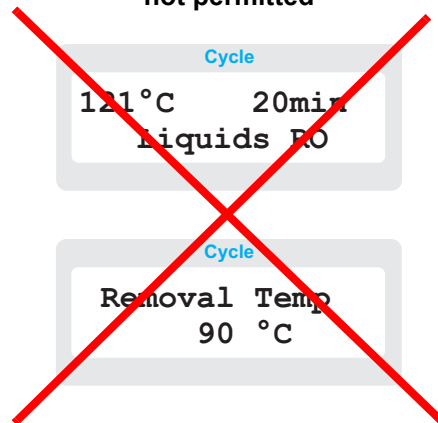
This baskets must not be used with the Liquids RG program.

**Examples of program settings:**

**permitted**



**not permitted**



**Sterilizing programs for liquids**

- Liquid LS            Passive cooling, low boiling loss, long program runtime
- Liquid ST            Passive cooling, medium boiling loss
- Liquid RM <sup>1)</sup>        Active cooling, medium boiling loss, rapid cooling phase
- Liquid RO <sup>1)</sup>        Active cooling and supporting pressure, low boiling loss, rapid cooling phase
- Liquid RG <sup>1)</sup>        Active cooling, supporting pressure and radial fan, low boiling loss, rapid cooling phase, can also be used for pressure sealed vessels.

1) Optional programs, not included in the basic device.

**6.2.3 Heat-sensitive culture media**

Culture media can discolour when subjected for too long to the effects of temperature. There may also be a loss of quality, to the extent that the culture medium becomes unusable. We therefore suggest you take note of the following

points to facilitate gentle treatment of culture media:

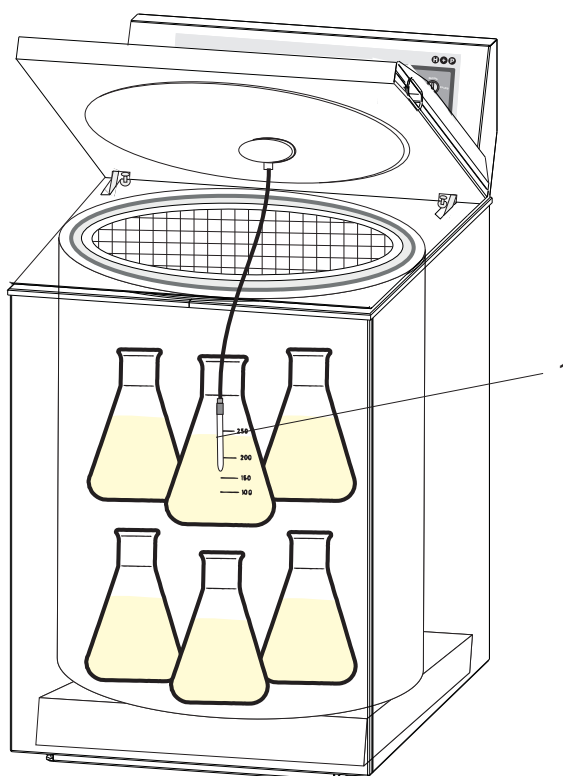
- ◆ Use small vessel sizes (max. 1000 ml) and modest filling levels (vessels max. half full).
- ◆ Do not make full use of the capacity of the sterilizer.
- ◆ Select **Liquids RM** or **Liquids RO** if present.
- ◆ Quickly preheat the liquid outside the sterilizer. This will keep heating time, compensating time and the cooling phase as short as possible.

#### 6.2.4 Sterilization using a media temperature sensor



##### ATTENTION

Danger of misinterpretation of measured values. In case of an existing media temperature probe it **has to be used** with all liquid programs.



A flexible temperature probe <sup>1)</sup> measures the temperature in a reference flask. Once the sterilization temperature has been reached in the flask, the sterilization process is started.

In the cooling phase, the media temperature sensor **and** the fixed reference sensor must have fallen below the removal temperature so that the lid closure is released by the thermolock.

1) Option, can be retrofitted

**The following points should be observed in connection with the reference flask:**

- It must be at least as large as the vessels for the sterilizing media.
- It must be filled at least as far as the vessels for the sterilizing media.
- ◆ Fill the reference flask with demineralized water or with the liquid destined for sterilization. <sup>1)</sup>
- ◆ Insert the flexible temperature probe (1) into the reference flask. The tip of the temperature probe must be in the bottom third of the reference flask (minimum insertion depth: 20 mm if the filling level is low).
- ◆ Place the reference flask in the upper area of the sterilizing chamber.



**CAUTION!**

**There is a risk of crushing the media temperature sensor while the lid is being closed. Place the cable of the sensor such that it cannot be crushed.**

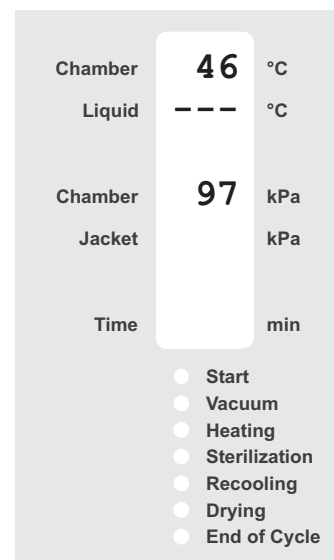
- ◆ Make sure that current media temperature values are visible on the display.

Two dashes (- -) indicate that no media temperature sensor has been connected.

Some programs allow liquids to be sterilized without the use of a media temperature sensor (see Section 6.2.2.4).

An “Err1” message indicates that the sensor does not work properly.

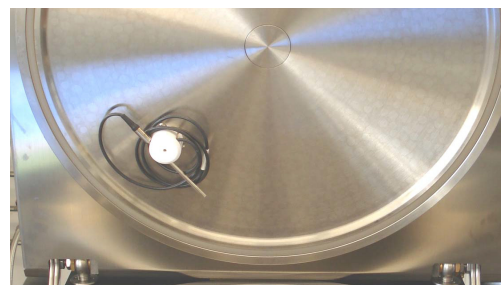
The sterilizer is not ready.  
Call Service.



**6.2.4.1 Disabling the media temperature sensor**

All sterilization programs for waste and instruments are run without the media temperature sensor.

- ◆ Wind up the cable and fasten the sensor to the lid.



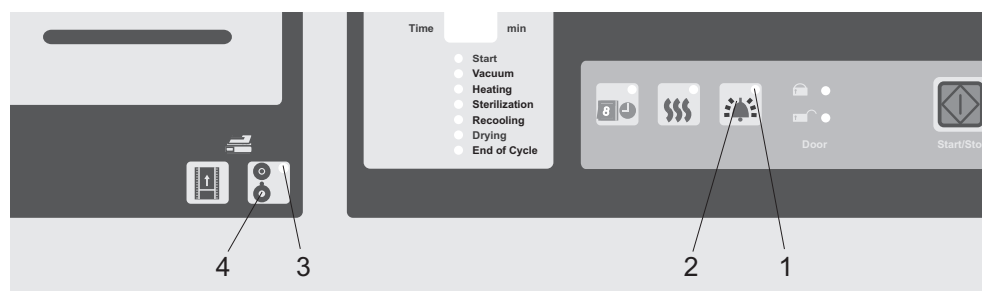
1) Only if the boiling point of this liquid differs a lot from the boiling point of water the reference flask has to be filled with the liquid destined for sterilization.



## 6.3 Starting and running a program

### 6.3.1 Turning the acoustic signal and batch printer On/Off

The acoustic signal should be deactivated if an operator is not expected to be around at the time the program ends (e.g. if it is run overnight).



When the indicator (1) is lit, the acoustic signal is activated and will sound when the program comes to an end.

- ◆ To activate or deactivate the acoustic signal, press key (2).

When the indicator (3) is lit, the batch printer is activated.

- ◆ To activate or deactivate the batch printer, press key (4).

### 6.3.2 Timer-controlled execution of programs

If the sterilization program is to be run at a later time, you can define the date and time at which you wish the program to be started by using the timer function.

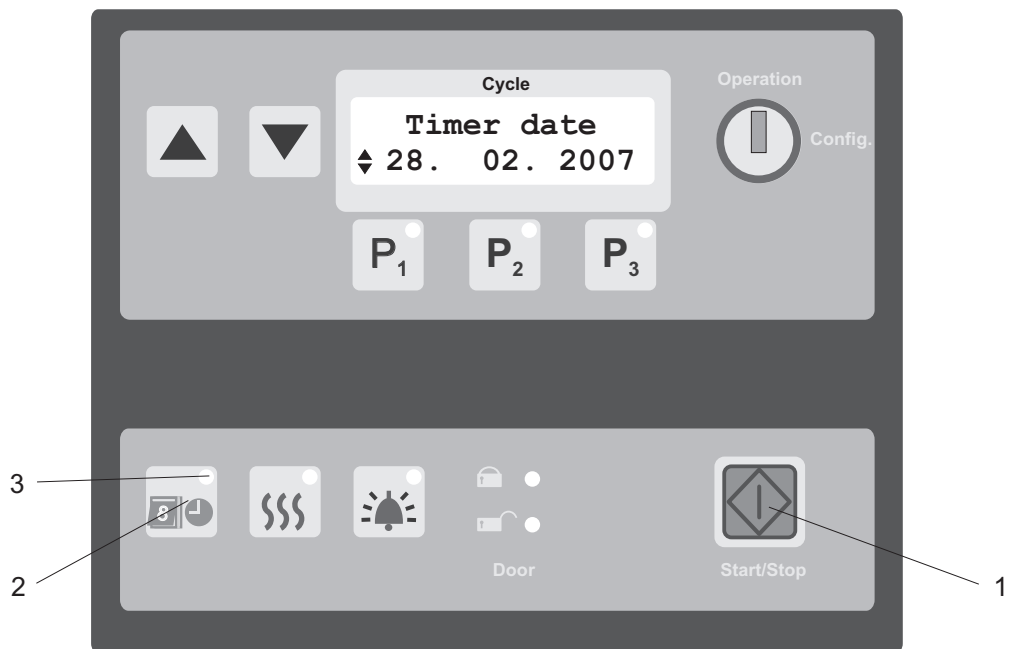
- ◆ Press the Timer key. The cycle display will show:

Cycle		
U	10 <sup>15</sup>	15.02.05
T	5 <sup>30</sup>	28.01.05

Current time and date  
Defined time and date

- ◆ Check if the values for current date and time are correct and adjust them if necessary (see Section 5.4).

### 6.3.2.1 Set timer



- ◆ Press the Timer key (2) in combination with the START/STOP key (1).
- ◆ Release both keys. The defined timer date is displayed.
- ◆ Use the cursor keys or to switch between the time and date displays.

To change the settings for hours/minutes or day/month/year, press the program key below and change the value using the and keys.

### 6.3.2.2 Activate timer


- ◆ Press the Timer key (1).  
The timer is turned on when the indicator (3) in the Timer key is lit.
- ◆ Press the START/STOP key.
  - The lid is locked.
  - With option batch printer: The log header is printed.
  - Sterilization does not start immediately, but on the day and at the time selected.


### 6.3.3 Execution of program

- ◆ Close the lid until it can be pushed no farther.

If the system is in standby mode (i.e. the indicators on the control panel are off), press the green START/STOP key once to leave standby mode.

- ◆ Press the green START/STOP key to start the defined sterilization program.

If the working pressure in the internal pressurized air system is too low, the compressor will now build up pressure. A corresponding message will appear in the cycle display, and the green  indicator will flash.

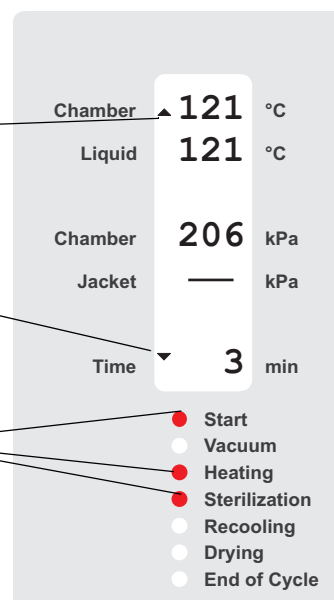
When an adequate pressure level has been reached, the annular quick lock of the lid is automatically closed. The yellow symbol  on the control panel indicates that the lid is locked successful.

The various phases of the program are shown in the sterilization phase display during execution.

A flashing triangle in the temperature display indicates that the heating is currently running.

A flashing triangle in the time display indicates the remaining program runtime (in our example 3 min.).

The configuration of indicators lighting up in our examples indicates that start and heating phases have been completed and that the program is now in sterilization mode.



- In the **Start** phase of the program, the system checks the water level in the steam generator and supplies feed water if necessary. If the targeted level cannot be reached, the program is terminated (Error 12, Water Low)
- In the **Vacuum** phase, the system performs deaeration in vacuum (Instruments EV, Instruments FV, Destruction EV and Destruction FV only). In programs without vacuum deaeration, this step is skipped, and the vacuum indicator remains off.
- In the **Heating** phase, the load is deaerated and heated up to sterilization temperature. A flashing triangle in the temperature display indicates that the chamber is being heated.
- In the **Sterilizing** phase, the load is sterilized. In the Time field, the remaining sterilizing time is displayed. A flashing triangle in this field indicates that the time is being counted down to zero.

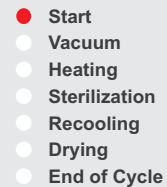
- In the **Cooling** phase of the program, the load is treated to reach the predefined removal criterion (pressure or temperature). The Cooling phase may last few minutes (Instruments ST) or several hours (Liquids LS). All liquid programs work with a thermolock, which prevents the lid from being unlocked before the liquids have cooled down to the defined removal temperature.
- A **Drying** phase is only performed by sterilizers that have this option installed, and it only applies to the Instruments family of programs. During drying, the Time field displays the drying time, the flashing triangle indicating that the time is being counted down to zero. If this program phase is not present, the indicator remains off.
- When the **Cycle End** lights up, the program is finished.

### 6.3.3.1 Abnormal termination of programs.

You can terminate the program cycle at any time.

If the sterilizer is just in the **Start** phase:

- ◆ To terminate the program press the START/STOP key.

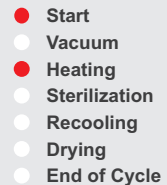


If the sterilizer is no more in the **Start** phase you need the key switch to terminate the program:

- ◆ Turn the key switch clockwise to the Config.position.

The message "Program termination possible" is shown on the display.

- ◆ To terminate the program press the START/STOP key.



This does **not** mean, however, that the sterilizer will **immediately** open. Depending on the type of program and to what point it has been executed, you have to expect the following delays:

- The sterilizer will open immediately, regardless of the type of program, when the system is still cold or moderately warm.
- The sterilizer will open within a few minutes after timed pressure release if the Destruction or Instruments programs have been run long enough for the system to be hot.
- The sterilizer will not open until it has cooled down to the defined removal temperature (in the worst case scenario this may take several hours) if any of the Liquid programs have been run long enough for the system to be hot.



#### INFORMATION

In the RM, RO and RG programs, abnormal termination will delay execution of the program when the system is hot because the cooling is not running at the time of termination.

**EXPLOSION HAZARD**

In the RG program, no supporting pressure is built if the program is terminated.

When the program is terminated while the system is hot, there is a risk that pressure sealed vessels may burst.

Vessels may also burst while being removed, which may result in serious injuries by broken fragments and jets of hot liquid.

## 6.4 Program end and removal


**DANGER!**

Be careful not to get scalded by hot steam when opening the sterilizing chamber.

- Step back when opening the sterilizer.
- Use the pneumatic opening aid.

The end of the program is signalled both acoustically and visually: a buzzer will sound, and the green START/STOP key will flash. This indicates that all phases of the sterilization cycle have been completed. The sterilizing phase display shows the indicator lights for all completed phases.

- ◆ Press the START/STOP key to acknowledge the removal message.

The acoustic alarm will be turned off. The pressure in the sterilizing chamber will adjust automatically to the outside pressure, which may take up to 2 minutes. The annular quick lock of the lid automatically unlocks. The green symbol  on the control panel indicates that the electronic and mechanical unlocking mechanism is in action.

- ◆ Use the opening button to open the lid. Hold the button of the opening aid until the lid is completely open.

**DANGER!**

Hot surfaces and hot steam pose a scalding hazard while removing the sterilized items!

Glass containers may break and scatter glass splinters around.

When removing sterilized items, always wear protective clothing, heat insulated gloves and eye protectors.

- ◆ Remove sterilized items.



**INFORMATION**

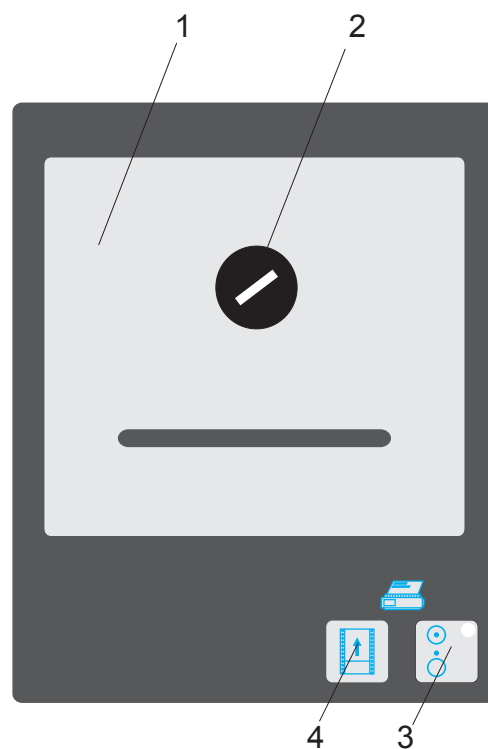
Without the use of additional drying equipment, filters, fabric, or cotton wool will not dry properly after sterilization.

The sterilizer is ready for a new cycle immediately after the sterilized items have been removed and the feed water tank has been filled up (if required) with distilled water.

Close the lid without locking while the sterilizer is out of use.

# 7 Sterilization documentation and monitoring

## 7.1 The batch printer<sup>1)</sup>



### Batch printer

- 1 Printer cover
- 2 Unlocking button
- 3 Printer ON/OFF key
- 4 Paper feed key


The batch printer logs sterilization process data.  
The printout is tamper-proof.

---

1) Option. At the basic device, the keys are without function.

### 7.1.1 Sterilization log (example)

#### Log header

The log header indicates the device ID (type, model, serial number), batch information (date, time, batch number) and program parameters. The log header is printed out as soon as the lid is closed and the yellow  LED is lit.

#### Measurements

Continuously documents program cycles and measurements (time, temperature, pressure).

In the sterilizing phase of the program, measurements will be logged once a minute. In other program phases, measurements will be logged once every four minutes.

Any errors or program interruptions that occur are also logged.

#### Log footer

If and only if the sterilization cycle was successfully completed, a log footer with the note „Programming cycle successful“ and a signature line will be printed.

```

=====
VARIOKLAV 135S 7,5KW
ID_IMS 0.4864-60070
Date 24.02.2005
-----
batch no 22
-----
Instruments ST
121°C 20 min.

a> Chamber Temp[°C]
b> Media Temp[°C]
c> Chamber Press[°kPa]

-----
a> b> c>
-----
Start
17:37 28 37 95
Prevaccum
17:37 28 37 95
Deaeration
17:37 28 37 95
17:41 35 45 98
17:45 67 70 103
17:49 97 98 110
17:53 106 106 129
17:57 111 111 151
Heating
17:58 113 113 159
Sterilizing
18:00 121 121 206
18:01 122 122 210
18:02 121 121 203
18:03 121 121 206
18:04 121 121 205
18:05 121 121 204
18:06 121 121 206
18:07 121 121 208
18:08 121 121 204
18:09 121 121 204
18:10 121 121 207
18:11 121 121 206
18:12 121 121 204
18:13 121 121 206
18:14 121 121 208
18:15 121 121 206
18:16 121 121 204
18:17 121 121 206
18:18 121 121 208
18:19 121 121 206
18:20 121 121 206
Recooling
18:20 121 121 207
Compensation
18:23 101 102 104
End of Cycle
18:23 101 102 104
-----
program Cycle
successful

SIGN.
    
```



### 7.1.2 Inserting paper rolls into the batch printer

If a red line appears on the paper, the paper roll is almost used up and must be replaced.

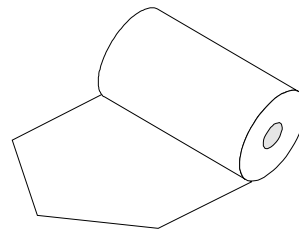


#### CAUTION!

**Never pull the paper backward, because this may damage the printer.**

**Use the Paper Feed key for advancing the paper.**

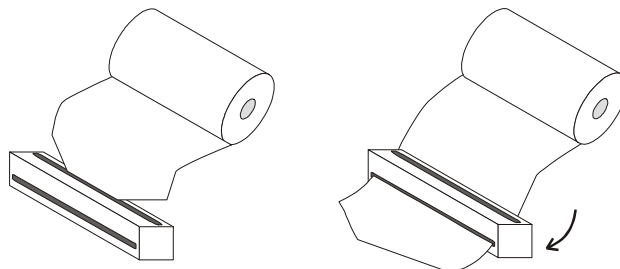
- ◆ Cut the end of the new paper roll, as shown in the illustration.



- ◆ Open the printer cover by turning the unlocking button.
- ◆ Remove the printer cover.
- ◆ Cut the paper strip off the old paper roll.
- ◆ Press the paper feed key repeatedly until the remaining paper has been removed from the printer head, or pull out the remaining paper **in the direction it normally moves**.
- ◆ Remove the old paper roll from the paper roll compartment.
- ◆ Insert the new paper roll into the paper roll compartment so the end of the paper roll is below the roll.
- ◆ Insert the end of the paper roll into the paper feeder.
- ◆ Press the Paper Feed key.

The paper end will now be pulled inside. It will curl slightly upward.

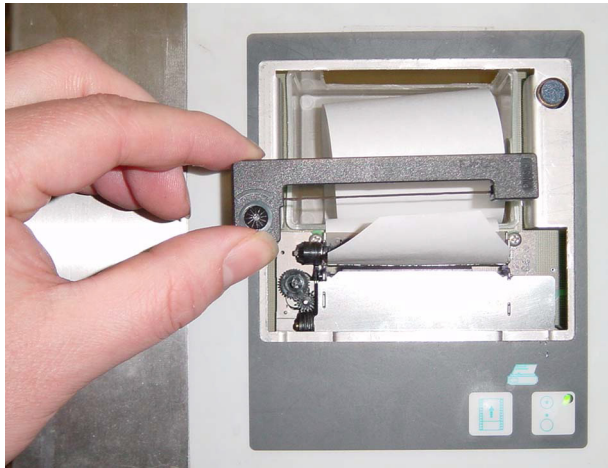
- ◆ Replace the printer cover. Guide the paper through the slot of the printer cover.



### 7.1.3 Changing the ribbon of the batch printer

If the printout starts to appear faded after a longer period of use, the printer ribbon should be replaced.

- ◆ Open the printer cover by turning the unlocking button.
- ◆ Remove the printer cover.
- ◆ Hold the left end of the ribbon cartridge with your left hand.
- ◆ Press the on right end of the cartridge.  
This will lift the left end of the cartridge.
- ◆ Remove the cartridge.
- ◆ Take a new cartridge.



- ◆ Insert the left end of the new cartridge in the left corner of the printer head. Make sure that the cartridge is parallel to the ribbon guide.

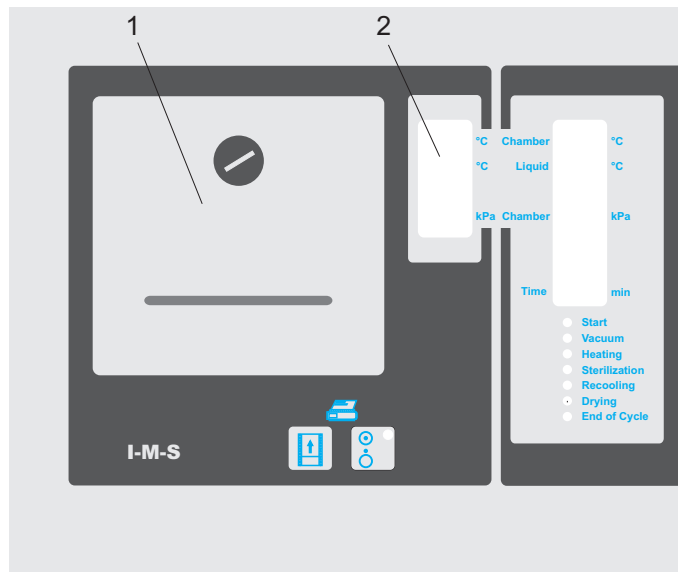


- ◆ Press the right end of the cartridge down into the right corner of the printer head.
- ◆ Replace the printer cover. Guide the paper through the slot of the printer cover.

## 7.2 Independent measuring system (IMS)

If your sterilizer is equipped with the independent measuring system (IMS) option, chamber pressures, chamber temperatures, and media temperatures will be logged as per GMP specifications using calibrated sensors that operate independently from the device's control system.

Measurements are output on the subsidiary display (2) and the batch printer (1).



## 7.3 RS-232 interface

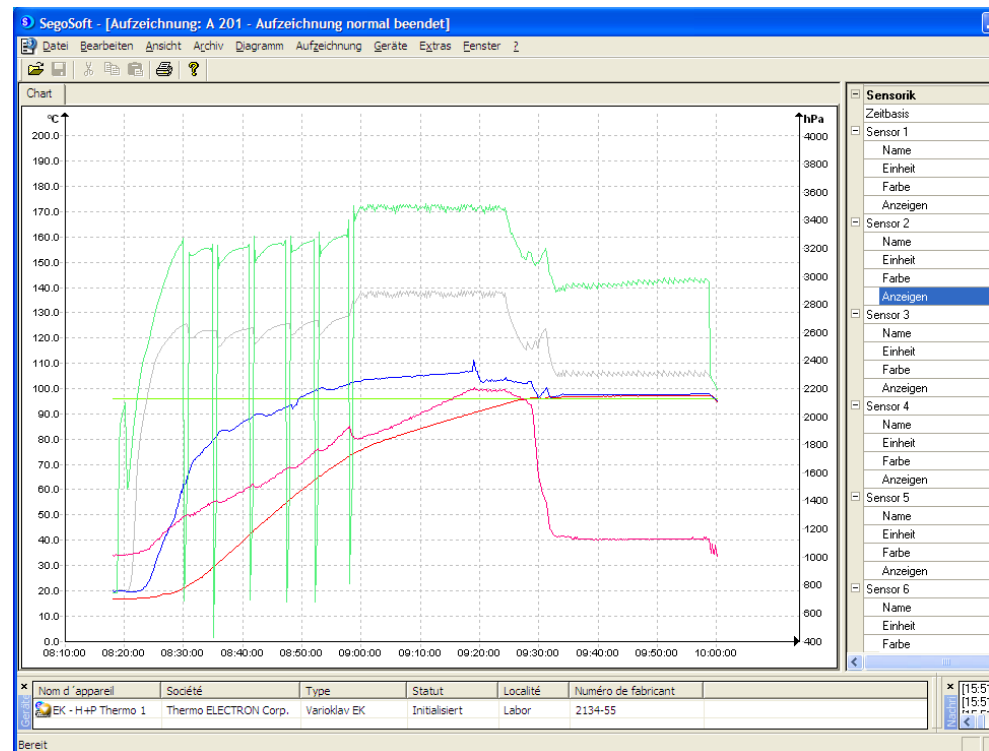
The RS-232 interface lets you transfer the sterilization data to a PC. We recommend the SEGOsoft software by Comcotec Messtechnik GmbH for analyzing the sterilization data.

### 7.3.1 SEGOSOFT

The SEGOSOFT software lets you log measurements on a PC.

SEGOSOFT displays the readings of all temperature sensors and the chamber pressure sensor in graphic mode. Measurements may be stored and archived.

Usable PC interfaces: serial interface (RS232), network (ethernet)



The SEGOSOFT screen

## 7.4 External temperature and pressure logging

If your sterilizer is equipped with the pressure sealed probe duct option, you may insert up to six external temperature sensors and connect them to an external logging system.

If your sterilizer is equipped with the vacuum or pressure test connector option, you may install an additional pressure sensors and connect it to an external logging system.

## 8 Troubleshooting

### 8.1 Error messages



Write down the error message. The error message is erased when the START/STOP key is pressed.

All error messages will cause the current program to be interrupted. The sterilizer is returned to a safe state following an error message. This means that opening the lid may require an extensive cooling phase or the assistance of a service technician.

Cycle display	Meaning	Remedy
Error 2 Lock open	The lid is not closed. The annular quick lock has not engaged.	<ul style="list-style-type: none"> <li>– Open the lid, close it again and then press the START/STOP key.</li> <li>– Contact after-sales service.</li> </ul>
Error 3 Seal pressure	The essential seal pressure is not reached.	<ul style="list-style-type: none"> <li>– Open the lid, close it again and then press the START/STOP key.</li> <li>– Contact after-sales service.</li> </ul>
Error 6 Compressor	The compressor cannot build up pressure.	Contact after-sales service.
Error 7 Maximum time	A pre-vacuum phase has lasted longer than 30 minutes.	<ul style="list-style-type: none"> <li>– Check loading</li> <li>– Check tap water supply</li> <li>– Remove condensate from the chamber.</li> <li>– Contact after-sales service.</li> </ul>
Error 8 Water level min.	Water-level sensor is defective.	Contact after-sales service.
Error 9 Running Dry	The heating was overheated.	Contact after-sales service.

Cycle display	Meaning	Remedy
Error 10 Vacuum pump	<ul style="list-style-type: none"> <li>– 1 phase is missing.</li> <li>– Drain blocked.</li> </ul>	<ul style="list-style-type: none"> <li>– Inspect fuses and mains supply.</li> <li>– Check drain.</li> <li>– Contact after-sales service.</li> </ul>
Error 11 Rem pressure	The pressure sensor or the removal pressure switch doesn't work correct.	Contact after-sales service.
Error 12 Water low	Water filling into the steam generator is not successful.	<ul style="list-style-type: none"> <li>– Check deionized water supply.</li> <li>– Check Aquastop system.</li> <li>– Restart the program.</li> <li>– Contact after-sales service.</li> </ul>
Error 14 Water level max	Temperature sensor in the steam generator is defective.	Contact after-sales service.
Error 17 Overheating	Chamber temperature exceeds acceptable limit.	<ul style="list-style-type: none"> <li>– <b>Disconnect sterilizer power cord!</b></li> <li>– Contact after-sales service.</li> </ul>
Error 18 Heating power	<ul style="list-style-type: none"> <li>– One or more phases are missing.</li> <li>– Heating is defective.</li> </ul>	<ul style="list-style-type: none"> <li>– Check mains supply and fuses.</li> <li>– Contact after-sales service.</li> </ul>
Error 19 Power failure	This error message is only recorded on the batch printer printout (Option).	The operator will have to decide whether or not the sterilization cycle has to be repeated.
Err1 in Chamber field in Liquid field	<ul style="list-style-type: none"> <li>Sensor defective.</li> <li>– Chamber temperature sensor.</li> <li>– Liquid temperature sensor *)</li> </ul>	Contact after-sales service.
Implausible value in temperature display e.g., room temperature is: 20 °C and device shows a chamber temperature of 3 °C	Sensor shorted.	Contact after-sales service.

\*) Option, can be retrofitted

## 8.2 Clearing Errors

### 8.2.1 Reset

A reset is only required:

- If the control unit no longer responds
- In order to increase the removal pressure in the event of a removal pressure error, possibly allowing the user to open the lid.



#### **CAUTION!**

With each reset, the program key configuration is returned to the factory defaults: P<sub>1</sub> Instruments ST, P<sub>2</sub> Waste ST, P<sub>3</sub> Liquid ST.

With each reset, all configurable program parameters such as sterilizing temperatures, sterilization times, removal temperatures, etc. will also be reset to their factory defaults.

- ◆ To perform a reset, press the Preheat and keys concurrently.

