

Please read this operating manual carefully before starting use of your new TRS 300 control unit!

The manual introduces you to the use of the apparatus with clear and simple guidance. Additional information, which is useful and important for an understanding of the manner of operation of the apparatus, is denoted by a gray stripe in the margin.

For reasons of safety in use of the system, please follow all safety warnings carefully. These are designated in the text by a warning symbol .

We wish you success in the use of the

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**behrotest®**

**TRS 300**

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## Notes for safety

 **Danger of electric shock!**  
 Always install all cables in such a way that they cannot come into contact with the hot inner zone of the heating block; they could otherwise smoulder through!  
 Always ensure that no liquids can come into contact with cable connections or the interior of the unit!  
 Always disconnect the mains plug before opening the unit! Repairs on electrical, electronic and mechanical modules of this unit may be performed only by authorized specialist staff!

 **Danger of injury in case of breakage of glass!** Always adhere to your professional association's regulations when using and handling glass elements!

 **Care is required when using and handling acids and alkalis! Danger of corrosive burns and injuries!** Always adhere to the safety regulations in the latest edition of the Hazardous Substances Ordinance!

 **Hazard from toxic gases!** Always perform digestion operations which can result in evolution of toxic or corrosive vapours in a fume cabinet and/or using an exhauster system! We recommend operation of the digester and exhauster system in the fume cabinet.

 **Never operate the TRS 300 control unit in wet, humid or explosion-endangered areas!**  
 Maximum air humidity = 80%  
 Maximum temperature = 40° C

## Scope of supply

Please check the contents of the pack for completeness and freedom from damage immediately upon receipt.

Claims resulting from damage during transportation which is externally apparent must be lodged immediately with the carrier (i.e., the post/mail service, the railway administration, the freight organization, etc.) - see the label on the packaging.

In case of damage which is not apparent from outside („concealed transportation damage“), please contact the behr after-sales service immediately upon discovery of the damage. The same applies in the case of any other complaints.

Address:

behr Labor-Technik GmbH  
Spangerstrasse 8  
D-40599 Düsseldorf, Germany  
Telephone: (0211) 7 48 47 17  
Telefax: (0211) 7 48 47 48  
e-mail: info@behr-labor.com

Your TRS 300 control unit is supplied ready for connection.

## Correct use of the TRS 300

The behr TRS 300 is used for actuation of behrotest® digesters.

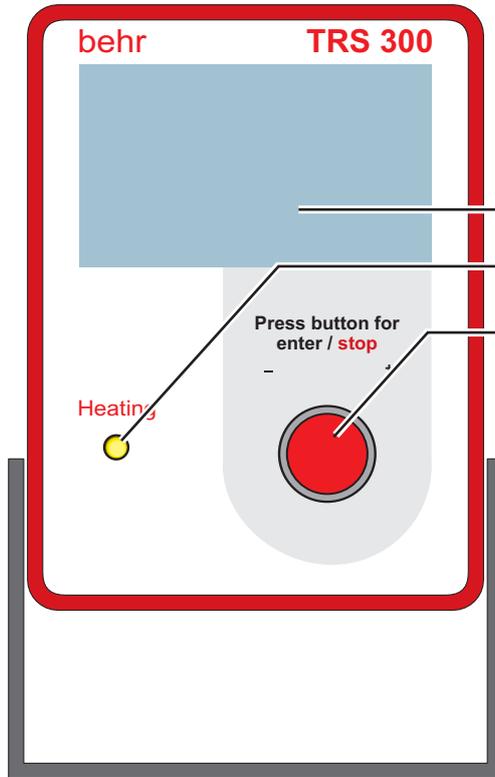
Potential adjustments available to you, and those that are recommendable for your tasks, depend on the unit connected. Please read the explanatory notes in this manual for this information.

Please under all circumstances adhere to the following items, which are intended to assure for you maximum possible operating safety and reliability and the longest possible service-life for your behr TRS 300:

- **Always operate the unit in accordance with the instructions and information contained in this operating manual!**
- **Modifications to the unit will result in forfeiture of any guarantee liability and may cause serious defects in the operating safety and reliability of your behr TRS 300.**
- **Never expose the control unit to aggressive vapours, such as acidic, alkaline or solvent fumes!**

Only operate your behr TRS 300 under normal laboratory conditions.

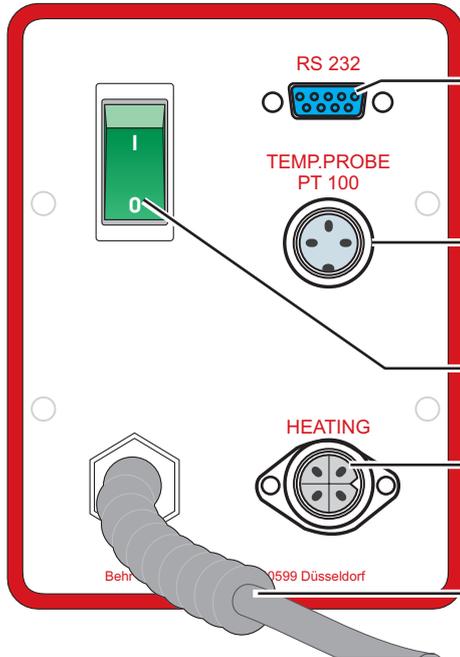
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## TRS 300: Connections and operating elements

**Figure 1: Front view**

- 1.1 Display
- 1.2 „Heating“ display lamp
- 1.3 Operating button
- 1.4 Positioning/carrier stand, adjustable in intervals of 30 degrees



**Figure 2: Rear view**

- 2.1 RS232 interface
- 2.2 Temperature sensor socket (Pt 100)
- 2.3 Mains switch
- 2.4 Digester unit connecting socket
- 2.5 Power cable

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## Connecting the TRS 300



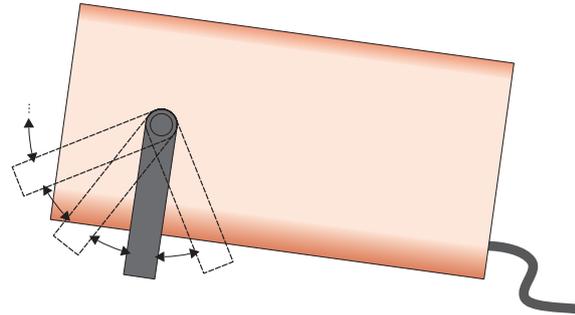
**Danger of electric shock!**  
Always install all cables in such a way that they cannot come into contact with the hot inner zone of the heating block; they could otherwise smoulder through!

Position the TRS 300 next to your digester.

The positioning/carrier stand can be adjusted; it engages at intervals of 30 degrees. Please select a position in which you can read off and operate the unit without difficulty.

Connect the power cable (Page 7, Section 2.5) of the control unit to a safety-contact power socket.

Then connect your digester to the control unit:



Insert the power-supply cable plug on the digester into the HEATING socket (Page 7, Section 2.4) and secure it using the union nut.

Insert the three-pole diode connector on the temperature sensor into the TEMP PROBE PT 100 socket (Page 7, 2.2) and secure it using the union nut.

## Switching the TRS 300 on

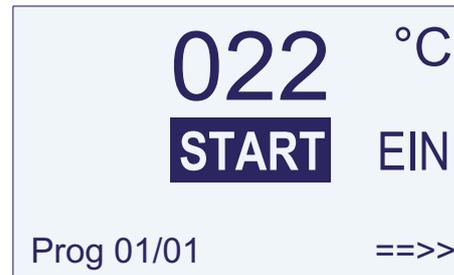
- ▶ Set the mains switch (Page 7, 2.3) on the rear panel of the unit to the „I“ position.

The mains switch on the TRS 300 performs two functions. It is used, on the one hand, to switch the unit on and off. There is, in addition, a fuse integrated into the switch.

This fuse functions similarly to a miniature circuit-breaker (m.c.b.) familiar from your household wiring system. It interrupts the electrical circuit if an overcurrent occurs.

Since it is necessary to pretension a spring for this safety function, the mains switch on the TRS 300 requires greater force for switching on than a conventional mains switch.

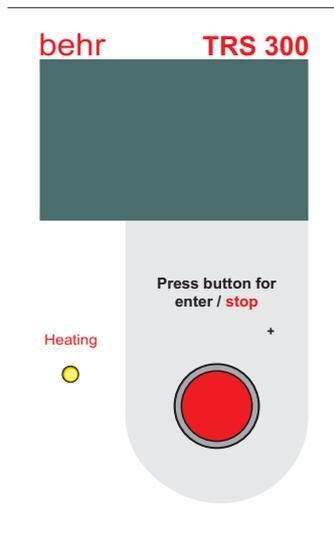
An initialization message will appear briefly on the display on the front panel when the unit is switched on. The main menu appears once the initialization routine has been completed:



The TRS 300 control unit is now ready for operation.

# Using the TRS 300

## The operating unit



You can program and operate your behrotest® TRS 300 control unit quite simply using a single button. The principle is the same in all cases:

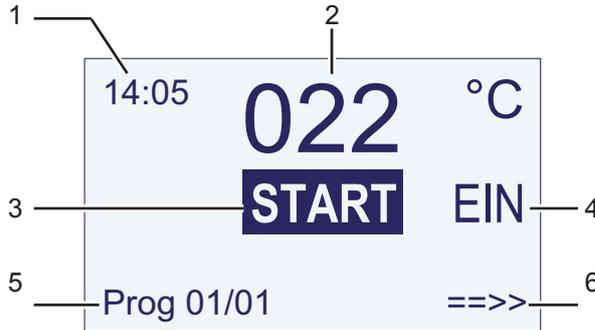
Turn the button to select an option. The option selected is indicated by the fact that it is shown inverted, i.e., bright characters on a dark background.

The button can be turned in both directions. In doing this, you will pass through all the possible options on the particular display and will always reach the option which you wish to select. Try it out!

Confirm the option selected by pressing the button.

This complete procedure, i.e., „Selecting by turning“ and „Selecting by pressing“ is referred to below simply as „Selecting“.

## The Start menu



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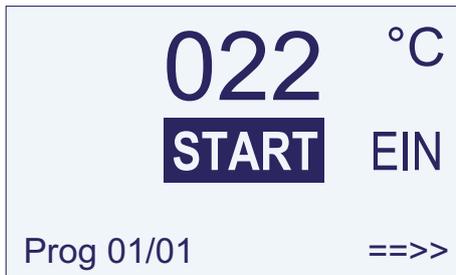
- 1 If a program has been started, or the unit is preheating, the target temperature is displayed here.  
If no program is running, but a starting time has been selected, the starting time is displayed here.  
This box is otherwise blank.
- 2 The temperature currently measured by the temperature sensor is always displayed here.
- 3 **„Start“** menu item: The temperature program most recently selected starts if this menu item is selected. What program this is is indicated at bottom left.
- 4 **„Preheat ON/OFF“** menu item: the TRS 300 will preheat to the starting temperature for the temperature program selected if this menu item is selected. The menu item will then change to **„OFF“**: Select **„OFF“** in order to switch the heating function off again.
- 5 The program currently selected, and the program step reached, are indicated here.
- 6 **„Continue“** menu item: select this menu item to access other possible settings. You can
  - select another program
  - write a new program
  - configure the unit to your needs

## Configuring the TRS 300 to meet your needs

You can, in fact, use your TRS 300 for analyses even now. You should, however, take a couple of minutes to perform one or two settings. For example, you might want to select another language for the screen displays.

These settings can, of course, also be made or modified at a later time.

This screen will appear when the unit is switched on:



Turn the operating button until the ==>> menu item is indicated and then press the button. The following menu will appear:



Select the **Geraet (Unit)** menu item. You will then move to a menu consisting of two pages.

Select the required entry by turning the operating button if you wish to change a setting. Press the button to select the entry and set the required value by turning the button. Store the value by pressing the operating button again.

## First page: Language and time

### Select language

Three languages are permanently programmed in the TRS 300: D (German), GB (English), F (French). A fourth language can be added as an option.

German is the default (ex-works) language. A different language can be selected using this menu.



- ▶ Select the ***Sprache (Language)*** menu item. The entry for the language will now appear on a dark background. Turn the operating button until the required language appears, and then press the button.

From this point on, all menus and messages will appear in the language you have selected.

## Setting the time

You should also set the time while you are on this page. The time is required to permit use of the TRS 300's Autostart function.

- ▶ Select the **Time** menu item. The first digit of the hours will then appear marked.



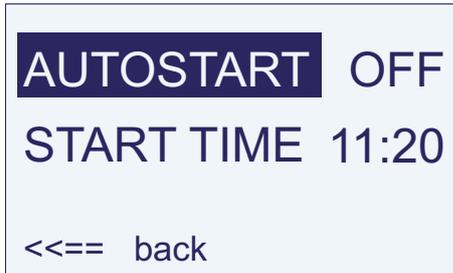
You can now enter the digits for the time one after the other. Turn the operating button until the correct digit appears, and then press it.

If an illogical value is entered, such as „26“ for the hours or „61“ for minutes, for example, the unit will reject the value and instead jump back to the first digit of the setting.

Use **continue ==>>** to move to the next page of this menu.

## Second page: Autostart settings

The Autostart settings can be selected on this page. You can, for example, set the unit to pre-heat at a specified time or to start a temperature program at a specified time.



**Autostart** The following possibilities can be selected here:

**Off** - the TRS 300 will only start to heat when a program is started or **On** is selected in the Start menu.

**On** - the TRS 300 will preheat to the starting temperature of the most recently selected program as soon as it is switched on at the mains switch (p. 7, 2.3).

**Prg** - the TRS 300 will start the most recently selected temperature program at the **Start time**.

**Tme** - the TRS 300 will start to pre-heat to the starting temperature of the most recently selected temperature program at the **Start time**.

---

**Start time** Starting time for **Prg** and **Tme**.  
The value can be set digit-by-digit, as described above.

---

<== back.

---

Selecting <<== **back** repeatedly returns the unit to the Start menu.

## Write a temperature program

The TRS 300 can be used to write up to ten different temperature programs.

Program 00 is fixed; this is the program for COD quantitation; it is described further below.

A program can have up to 10 program steps.

When writing a program, always note its purpose and the settings selected.

- ▶ Select **continue ==>>** in the Start menu,



- ▶ and select **Program** in the menu which then appears.

You are now on the first page of the Program menu.



- ▶ Select the entry box for the Program No.
- ▶ Select the required Program No. You should select 01 if you have not yet written any other program.
- ▶ Then select **continue** ==>>.

You will now see for every program step a page, on which you can enter the settings for this step.

The Program No. and the Program Step No. which you are currently editing are shown in the top line.



Program 07/05, for example, indicates the fifth step in Program No. 07.

This screen page changes, depending on the Function you select.

There are the following possibilities:

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### Function T: Temperature step

Program	01/01
TEMPERATURE	350
TIME	120
FUNCTION	<b>T</b>
<<==	==>>

In this function, the unit heats up to the specified Temperature as quickly as possible (if it is not already preheated) and then maintains this temperature. The entire procedure (heating-up and maintaining, together) lasts the stated Time in minutes.

You can enter Temperature and Time digit-by-digit. The unit will not accept an impermissible temperature and will instead jump back to the first digit of the entry box.

### Function %: Heat output

Program	01/01
HEAT POWER	025
TIME	120
FUNCTION	%
<<==	==>>

This function enables you to specify **Heat output** in % of total output, and also **Time** in minutes.

The unit will then heat at the specified percentage of total heat output for the time specified.

**This function is appropriate only for digesters which do not operate with a temperature control system. This function should not be used for a heating block. It could result in the heating block heating up in an uncontrolled pattern and then switching off completely because the thermal cut-out has reacted.**

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### C/M function: Heating rate (degrees Celsius per Minute)

Program	01/01
TEMPERATURE	350
TIME	120
FUNCTION	C/M
<<==	==>>

In this function, the unit heats up uniformly to the specified **Temperature** (in degrees Celsius) in the specified **Time** (in minutes). It thus operates on a temperature gradient.

The temperature gradients which can in fact be operated depend on the type and heat output of the digester, and also on the heat capacity of the samples.

Perform a trial run and find out for yourself, using the temperature display, whether the temperature plots set can actually be achieved.

### Function E: End

This function is used to inform the TRS 300 that the temperature program ends here.

Every program memory slot consists of ten slots for program steps. The TRS 300 works through these ten program steps in sequence if it does not previously encounter an End step.

**The last program step of every program must therefore be an End step.** An End step is only not needed if the program actually has the maximum of ten steps.

## A program can thus be written as follows:

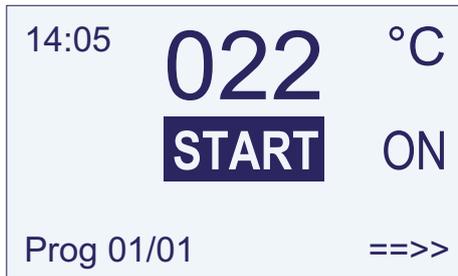
- ▶ For the first step, enter the required function and the corresponding values.
- ▶ Select ==>. This then leads to the next program step.
- ▶ Continue this procedure to program all the required steps.
- ▶ Select <<== if you wish to check or modify the program step entered. Use ==> to move forward again.
- ▶ Remember to enter End (Function E) as the final step. An End step is only not needed if the program has ten steps.

- ▶ Press <<== repeatedly to return to the Start menu.

Which program settings are most useful for you will depend on your digester, the digestion method and the nature of the samples.

## Processing samples

Switch the TRS 300 on (mains switch on the rear panel of the unit, Page 7, 2.3).

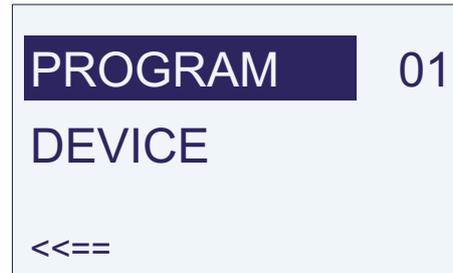


If you have selected **Prg** or **Tme** for the Autostart functions, the starting time will be shown at the top left; the target temperature will be shown in this position if the unit is preheating.

## Select program

The most recently selected program is displayed in the bottom line of the Start menu. Select a different program if this is not the program you require now:

▶ Select **continue ==>>**



▶ Select **Program**

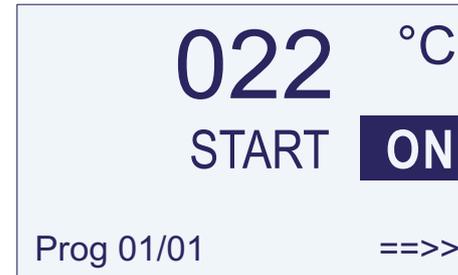
- ▶ and on the next page **Program No.**
- ▶ Select the required **Program No.**



- ▶ Return to the Start menu by selecting <<== repeatedly.

## Preheat digester

If necessary, preheat the digester to the starting temperature.

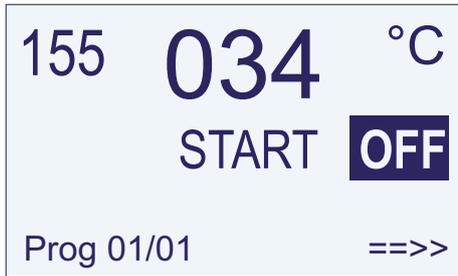


Select the **ON** menu item in the Start menu.

As soon as the unit is switched on, it will now start to preheat to the starting temperature of the program selected.

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The temperature to which preheating is to take place is now shown at the top left of the display, and the temperature reached at the center.



Select **OFF** if you wish to abort preheating.

The display lamp (Page 6, 1.2) indicates whether the unit is currently heating.

If the unit has reached the preheat target, a signal is heard.

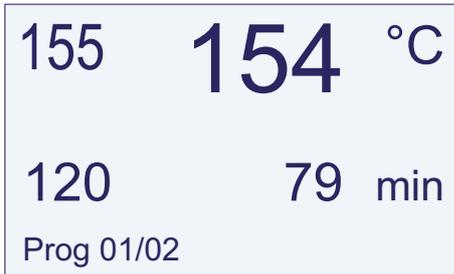
## Inserting the samples, starting the program

Insert the samples into the digester.

If necessary, put the exhaust collector in position and switch it on.

Select the Start menu item in the Start menu.





The selected target temperature will now appear at top left on the display, with the currently measured temperature next to it;

The time for this program step and total remaining time are shown in the next line down.

The program step which is currently being run is shown at the bottom.

The TRS 300 does not react to any operation of the operating button while a program is running. The program cannot be interrupted by actuating the operating button. This is intended to prevent any inadvertent interruption or manipulation of a program while it is running.

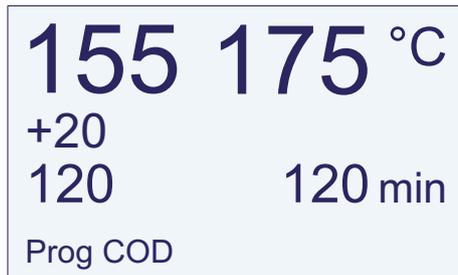
Please use the mains switch (Page 7, 2.3) on the rear panel if it is nonetheless necessary to abort a digestion operation.

A signal is heard, and the heating system switches off, when the program has been completed.

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## The COD program

The program for quantitation of Chemical Oxygen Demand (COD) in accordance with DIN 38409, Parts 41 and 42, is permanently programmed. It can be found by selecting Program 00.



The standard specifies that the samples should be heated to 148° C (the boiling point of the water/sulfuric acid mixture) within 10 minutes and should then be left to simmer for the remainder of the total of two hours.

A heating temperature of 155° C has proven adequate for keeping the samples simmering. Greater heat is required to bring the samples to this boiling temperature. For this reason, the COD program firstly heats 20° C above the target temperature, i.e., to 175° C. Insertion of the cold samples causes the temperature of the heating block to firstly drop drastically, and the control unit will heat to compensate for this. Boiling temperature is reached after around 6 minutes and the samples will boil. The temperature boost switches off at this point.

„155 + 20“ is shown on the display as the target temperature during preheating and during the six-minute starting phase.

So don't be surprised by these temperature settings; they are necessary to bring the samples to boiling point in the required time. The samples themselves cannot exceed 148 °C, since the water/sulfuric acid mixture boils at this temperature.

The COD program can also be edited; only the 20° C temperature boost during the six-minute starting phase is fixed.

The default settings should normally be retained, however:

155° C, 120 minutes.

The COD program only has a slot for one program step. There is therefore no End step.

## Maintenance of your TRS 300



### **Danger of electric shock!**

**Always ensure that no liquids can come into contact with cable connections or the interior of the unit.**

**Never attempt to open the unit!**

**Repairs to electrical equipment may be performed only by specialist electricians.**

The housing surface of the TRS 300 is low-care and largely insensitive to acids. Never use aggressive cleaning agents for cleaning of the front or rear panels.

## What do I do if...?

The behrotest® TRS 300 control unit has an internal fault scanning system. This is capable of detecting five different error situations. „Error“ will then appear on a red background, together with a Code No., on the display. An alarm signal (bleep tones) is also heard. The numbers have the following meanings:

<b>Code</b>	<b>Meaning</b>	<b>Remedy</b>
002	The temperature sensor is not connected or not firmly inserted	Switch the unit off. Connect the temperature sensor of the digester to the „Temp Probe Pt 100“ socket (Page 7, 2.2). Ensure firm seating of the diode connector. Secure the connector using the union nut. Only then switch the unit on again.
003	Short-circuit in temperature sensor	The digester must be repaired or replaced. Switch the digester and the TRS 300 off and inform the behr after-sales service.

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<b>Code</b>	<b>Meaning</b>	<b>Remedy</b>
010	The digester's power-supply cable is not connected to the TRS 300 or the plug is not firmly inserted	Switch the TRS 300 off. Insert the power-supply cable connector of the digester firmly into the „Heating“ socket (Page 7, 2.4) on the rear panel of the TRS 300 and secure it using the union nut. Then switch the unit on again.
	The digester's thermal cut-out has tripped	Switch the unit off and allow the digester to cool down for a while. Check that the Function % has not been inadvertently selected in your temperature program.
	The digester's heating system is defective or the triac control system of the TRS 300 is defective	The digester and/or the TRS 300 must be repaired or replaced. Switch off both units and inform the behr after-sales service.
011	The unit heats without stopping	The TRS 300 is defective. Switch it off and inform the behr after-sales service.
100	General error	Switch the unit off and inform the behr after-sales service.

If the TRS 300 cannot be switched on (display remains dark), the mains fuse may have tripped. Switch the unit off and on again after a few minutes. If the unit can still not be switched on or if the problem occurs repeatedly, inform the behr after-sales service.

## Technical data

Dimensions	Width 150 mm Height with stand in position 175 mm depth 320 mm Positioning / carrier stand engages at 30° intervals
Supply voltage:	230 VAC, 50 Hz
Switching rating:	max. 2200 W Ohmic load
Connection of digester	Power-supply socket on rear panel of unit (special 4-pin connector with screw cap)
Connection of temperature sensor	Three-pole diode socket with screw cap Pt 100 three-wire circuit
Temperature-control range	up to 450 °C, digitally adjustable
Time setting range	0 to 999 minutes, digitally adjustable
Programs:	10
Display:	LCD