

# User manual

## highpreactor<sup>®</sup> BRTR-88



Copyright 2024 © Berghof Products + Instruments GmbH

Distribution and reproduction of this document and reuse and notification of its content is not permitted without our express consent. All rights reserved. Contraventions are liable to compensation.

### **Disclaimer**

The content of this publication has been checked for conformity with the hardware and software described. Deviations can nevertheless not be excluded, therefore we cannot give any guarantee of complete conformity. The information in this publication is checked regularly and necessary corrections are included in subsequent editions. Improvement suggestions are always welcome. Subject to technical changes.

### **Trademarks**

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

### **General Information on this Manual**

This user manual:

- ➔ Describes the temperature controller BRTR-88 from Berghof Products + Instruments GmbH. It contains product specific information.
- ➔ guides the user in the safe and proper use of the temperature controller. Familiarity with the relevant chapters of this handbook is required for safe and intended use of the equipment.
- ➔ must be read carefully prior to operating the equipment to avoid errors during operation and become familiar with the device.
- ➔ does not include repair instructions. Should repairs be required, please contact your representative or Berghof Products + Instruments GmbH.

After unpacking, the device must be checked for mechanical damage or loose parts. If any transport damage is found, the manufacturer is to be informed immediately and the device is not to be put into operation.

Documentation no.: 53-0214-93-01-02-001

You can reach us centrally at:

Berghof Products + Instruments GmbH

Arbachtalstraße 26

72800 Eningen

Germany

T +49.7121.894-233

F +49.7121.894-300

E-Mail: [info.bpi@berghof.com](mailto:info.bpi@berghof.com)

[www.berghof-instruments.com](http://www.berghof-instruments.com)

Berghof Products + Instruments GmbH is certified according to DIN EN ISO 9001:2015.

## Document history

Version	Release date	Author	Changes
0.1	13.11.2023		Initial creation
1.0	01.02.2024	Gutwerk, Edele	First version
1.1	01.03.202	Edele	Address changed in "Disposal instruction". Sound level moved to "Technical data". House-side socket corrected.

## Table of contents

<b>1.</b>	<b>GENERAL INFORMATION</b>	<b>6</b>
1.1.	Information about the BRTR-88	6
1.1.1.	Type plate	6
1.2.	Warranty / Limitation of Warranty	7
<b>2.</b>	<b>SAFETY</b>	<b>8</b>
2.1.	Qualified Users	8
2.2.	Intended use	9
2.3.	Safety instructions	10
2.3.1.	Danger Categories and Signal Words	10
2.4.	General safety instructions	11
2.5.	Product Safety	12
2.5.1.	Safety and emission	12
2.5.2.	Safety instructions on the unit	12
2.5.3.	Safety regulations in the EU	12
2.5.4.	CE-mark	13
2.6.	Disposal instruction	14
<b>3.</b>	<b>DEVICE DESCRIPTION</b>	<b>15</b>
3.1.	Basic instrument	15
3.1.1.	Electrical connections Elektrische Anschlüsse	16
3.1.2.	Technical data	17
<b>4.</b>	<b>INSTALLATION AND COMMISSIONING</b>	<b>18</b>
4.1.	Scope of delivery	18
4.2.	Ambient conditions	19
4.3.	Unpacking / Inspection	20
4.4.	Positioning	20
4.5.	Installation	21
<b>5.</b>	<b>OPERATING</b>	<b>22</b>
5.1.	General	22
5.2.	Basic setting	26
5.3.	Setting the operating mode	27
5.4.	P.I.D.-Mode	27
5.5.	Autotuning	28
5.6.	Temperature ramp	29
5.7.	ON / OFF-Mode	29
5.8.	Temperature Calibration	30
5.9.	Operation and ramp parameterization	30
5.9.1.	Programming example	34

<b>6.</b>	<b>MAINTENANCE, TROUBLESHOOTING AND SERVICE .....</b>	<b>36</b>
<b>6.1.</b>	<b>Maintenance.....</b>	<b>36</b>
<b>6.2.</b>	<b>Cleaning .....</b>	<b>36</b>
<b>6.3.</b>	<b>Replacing the fuse .....</b>	<b>36</b>
6.3.1.	Thermal protection of load.....	36
6.3.2.	Fuse of control voltage .....	37
<b>6.4.</b>	<b>Error notes .....</b>	<b>38</b>
<b>6.5.</b>	<b>Repairs / customer service.....</b>	<b>39</b>
<b>7.</b>	<b>APPENDIX.....</b>	<b>40</b>
<b>7.1.</b>	<b>Declaration of conformity .....</b>	<b>40</b>
<b>7.2.</b>	<b>Conversion of units.....</b>	<b>41</b>
<b>7.3.</b>	<b>Abbreviations .....</b>	<b>41</b>

# 1. General information

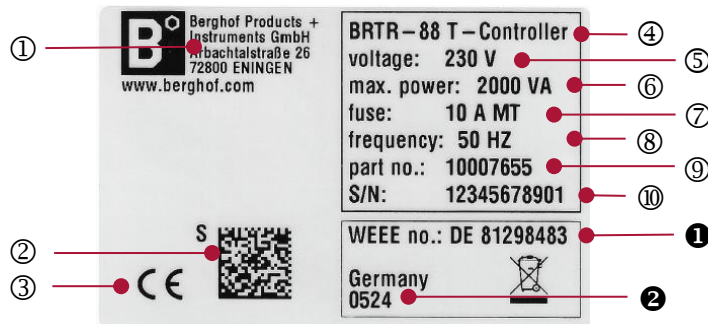
Please read these operating instructions carefully before operating your temperature controller. Failure to follow these operating instructions may result in damage to the equipment and injury to the operating personnel. Safety instructions and their classifications are described in the section Danger Categories and Signal Words. These instructions must be followed in any case!

## 1.1. Information about the BRTR-88

No modifications may be made to the unit without the written consent of Berghof Products + Instruments GmbH. Unauthorized modifications may affect the safety of the unit.

### 1.1.1. Type plate

The type plate is located on the bottom of the device.



① Manufacturer with address	⑦ Fuse
② QR Code	⑧ Input voltage frequency
③ CE-marking	⑨ Part No.
④ Model	⑩ Serial number
⑤ Input voltage	❶ WEEE Registration
⑥ Maximum power consumption	❷ Country of origin

## 1.2. Warranty / Limitation of Warranty

Berghof Products + Instruments GmbH subjects each device to a functional and safety test before delivery. Provided that no modifications have been made to the equipment, Berghof Products + Instruments GmbH warrants that all its products will conform to Berghof Products + Instruments GmbH specifications and will be free from defects in material and workmanship when operated under normal conditions of use and service. Berghof Products + Instruments GmbH's obligation ends after one (1) year and is limited to repair, or at its option, replacement free of charge, of such equipment that is proven by its own judgment to be defective within the meaning of this warranty statement. No warranty is given on wear parts.

In the event of any claim, please attach a mark to the unit and a description of the defect found. Please state your name, department, address, and telephone number so that a quick settlement can be made.

The unit should be returned in its original packaging to ensure adequate security. We regret that any damage caused in transit by improper packaging is not covered by this warranty.

Except as expressly set forth in this agreement, there is no other warranty, contractual or statutory, given by Berghof Products + Instruments GmbH hereunder, including the statutory warranty of merchantability and fitness for a particular purpose. Berghof Products + Instruments GmbH shall not be liable to the customer for loss of profit, consequential damages of any kind resulting from a breach of the foregoing warranty.

## 2. Safety

The safety of users and personnel can only be guaranteed if the safety instructions and safety related warnings are observed and followed. Therefore, this manual must be available to all persons working with the BRTR-88.

**Use the device only:**

- As intended
- In technically perfect condition
- Without unauthorized changes
- Under supervision
- Through qualified operators

Comply with the requirements of the professional trade bodies, the technical monitoring association, the VDE regulations, or corresponding national provisions.

### 2.1. Qualified Users

Qualified users in the sense of the safety instructions in this documentation are appropriately trained and instructed specialists with basic chemical and technical knowledge. They should be familiar with the relevant legal regulations for handling pressure vessels and chemicals.

The device may only be used by laboratory personnel who, as a result of their education and training, have an overview of the hazards that can arise during operation of the device.

## 2.2. Intended use



### **Follow the operating instructions!**

Always observe the operating instructions for the heating systems that are controlled by the temperature controller and for the devices that are to be heated. Particular care must always be taken when handling pressure vessels.

- **Scope of application of the BRTR-88** The Berghof Temperature Controller BRTR-88 is used for temperature control of Berghofs own reactor systems and pressure digestion vessels. Heating systems with up to 2000W can be operated. The main functions are:  
→ Control and PID control of the heating process based on temperature.

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



### **Intrinsically safe heating systems:**





Only intrinsically safe heating systems that do not pose a hazard if the control function fails may be used with the BRTR-88. The approved heating systems from Berghof Products + Instruments GmbH have independent safety switches (temperature switches).

## 2.3. Safety instructions

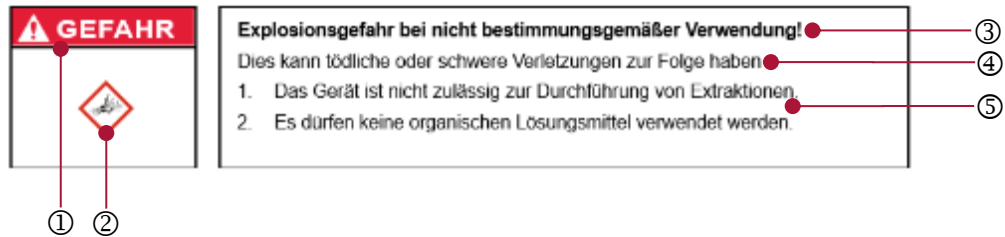
### 2.3.1. Danger Categories and Signal Words

DANGER, WARNING, CAUTION and NOTICE are standardized signal words for classifying the risk and danger of suffering injury or damage to property. All signal words relating to personal injury are listed together with the general safety symbol.

For safety reasons, it is necessary that you read and understand the table of signal words and their definitions below.

Symbol	Signal word	Definition
	<b>DANGER</b>	DANGER means that failure to follow the safety instructions <b>is likely to cause</b> severe personal injury or death.
	<b>WARNING</b>	WARNING means that failure to follow the safety instructions <b>may cause</b> severe personal injury or death.
	<b>CAUTION</b>	CAUTION means that failure to follow the safety instructions <b>may cause</b> personal injury.
	<b>NOTICE</b>	NOTICE means that failure to follow the safety instructions may cause damage to the device.

Additional safety symbols can be indicated under the signal word.



① Signal word classifying the risk	④ Type and source of danger
② Safety symbol	⑤ Measures to avoid risk
③ Possible consequences in the case of failure to comply	

## 2.4. General safety instructions

In addition to the safety precautions listed below, the operation of the BRTR-88 temperature controller also includes those that must be observed for the operation of the equipment to be heated. These can be found in the corresponding operating instructions.

The following general safety instructions must be read carefully and observed before setting up and commissioning the system.

No liability can be accepted for damage caused by improper handling or non-observance of these instructions.



### Comply with max. operating temperatures!

When operating the temperature controller, always observe the maximum permissible operating temperatures of the units to be heated!



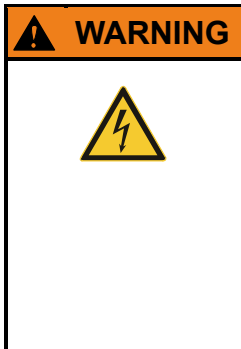
### Comply with max. current load!

Always observe the maximum permissible current load of 10 A when operating the temperature controller!



### Continuous operation, overnight operation

Only operate heaters overnight if they have at least one additional overtemperature switch!



### Unit uses mains voltage AC 230V!

The device must always be connected to a protective earth conductor. The connection from the unit to the power source must always be made via a three-core cable with a protective earth conductor.

Only use approved mains cables.

The socket used must be freely accessible at all times.

The device must not be put into operation if it is damaged.

Repair and service work may only be carried out by appropriately trained and qualified personnel of Berghof Products + Instruments GmbH.

### Emergency stop:

In the event of an emergency, the device can be switched off immediately by removing the plug from the socket. This also disconnects the load to be switched from the power supply, provided it is only connected to the BRTR-88.



### Emergency stop:

Access to the device's socket (power supply for the controller) must be guaranteed at all times due to the emergency stop function. Activating the ON/OFF switch on the front does not necessarily lead to the consumer being disconnected from the power supply in the event of a fault

## 2.5. Product Safety

### 2.5.1. Safety and emission

In the following cases, the unit must be disconnected from the mains supply and protected against unintentional use:

- if there is visible damage to the unit,
- if the unit has loose parts,
- if the unit does not work,
- after prolonged storage in unfavorable conditions (e.g., outdoors or in a very humid environment)

### 2.5.2. Safety instructions on the unit



This safety notice is located on the bottom of the unit.

### 2.5.3. Safety regulations in the EU

This appliance has been designed and tested in accordance with the following standards:

Title	Standards
Safety requirements for electrical equipment for measurement, control, and laboratory use Part 1: General requirements	IEC 61010-1:2010/AMD1:2016
Electrical equipment for measurement, control, and laboratory use – EMC- requirements Part 1: General requirements	EN 61326-1:2013 IEC 61326-1:2012 <b>Class A device</b> Professional equipment. The equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

## 2.5.4. CE-mark

The products from Berghof Products + Instruments GmbH comply with the VDE directives and European Standards. The conformity tests performed by Berghof Products + Instruments GmbH comply with the currently prescribed standards of safety for electrical measuring, control, regulation and laboratory equipment, as well as their EMC requirements (Class A).

### **Declaration of conformity**

See Chapter 7.1: Declaration of conformity

## 2.6. Disposal instruction

→ Disposal within the EU

The product is made of high-quality, recyclable, and reusable materials and components. Correct disposal is essential for environmental protection.

### European Union

Electrical and electronic devices must not be disposed via domestic waste. Berghof Products + Instruments GmbH takes back its electrical and electronic products from business customers for free disposal, raw material recovery and recycling. Contact your dealer or Berghof Products + Instruments GmbH directly, if you are intending to dispose of electrical and electronic devices.

The form "WEEE return of old devices" describes the return of old devices. Customers must fill this out and return it with the device. We will be happy to send you the form or you can download it from our website:

<https://www.berghof-instruments.com/en/downloads/>

Berghof Products + Instruments GmbH  
Arbachtalstraße 9/2  
D-72800 Eningen u. A.

E-Mail: [service.bpi@berghof.com](mailto:service.bpi@berghof.com)

Tel.: +49 7121 894-170  
Fax: +49 7121 894-300

### Important note!

Customers wishing to return instrumentation and/or associated materials to Berghof Products + Instruments GmbH or regional dealer are advised that all returned goods must be certified as clean and free from contamination. Therefore, clean and decontaminate your old device before returning it.

→ Disposal outside the EU

### Countries outside the European Union

Outside the European Union, the relevant regional and local laws regarding proper disposal must be complied with.



### Environmental hazard in case of incorrect disposal!

This can result in minor or moderate injuries.

1. The device must be disposed of in accordance with the requirements of the European Union.
2. The relevant regional and local laws regarding proper disposal must be complied with.
3. To ensure proper disposal, you can contact Berghof Products + Instruments GmbH.

## 3. Device description

### 3.1. Basic instrument

The BRTR-88 temperature controller can be used universally as a controller for loads up to a power consumption of 2000 W. The control parameters of the PID controller can be freely programmed for different temperature ranges. However, Berghof Products + Instruments GmbH recommends the BRTR-88 temperature controller specifically for controlling the heating process of the Berghof high-pressure laboratory reactors *highpreactor* and pressure digestion vessels *digestec*. Therefore, this manual describes the use of the BRTR-88 temperature controller specifically for these control tasks.

The heating systems are connected via special connectors on the back of the unit. Special adapter cables are available on request for connecting third-party devices.

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



No.	Function
1	Built-in controller TR-88, user interface
2	Fine-wire fuse control voltage Glass fuse 5 x 20mm, 250 V, 400 mA medium time lag
3	Power: Illuminated mains switch

### 3.1.1. Electrical connections Elektrische Anschlüsse



No.	Function
4	Power Input: Mains connection
5	Load connection 230 VAC / 10A max. (resistive load). C19 device socket for connecting BHM or DAH heating jacket with C20 plug according to IEC 60320-1. Only intrinsically safe heating systems from Berghof Products + Instruments GmbH may be connected.
6	Thermal circuit breaker 10A Automatic shutdown in the event of overload, manual restart after tripping
7	Connection of PT100 temperature sensors (4-wire). Effectively 3-wire use as pin 4 is not used internally. This sensor is integrated into the housing of the DAH heating jacket.



#### Defective switching unit due to overcurrent

If the load output has been short-circuited or the load fuse has been triggered due to overcurrent, the internal SSR switching relay must be replaced or checked by qualified and authorized service personnel (switch-off function).

### 3.1.2. Technical data

BRTR-88	
Power supply	230 V, 2000 VA, 50 Hz
Maximum power output for heaters	2000 W (via solid state relays)
Quiescent current	ca. 2 W
Fuse protection	Thermal protection switch 10 A for the entire system: Automatic shutdown in the event of overload, manual restart after tripping  Fine fuse control voltage: Glass fuse 5 x 20mm, 250 V, 400 mA medium slow
Switching unit	SSR semiconductor relay with zero-crossing circuit (25 A).
Temperature sensor	PT100 (4-wire), but effectively used as a 3-wire.
Measuring range	0...+320 °C (32...608 °F)
Type of regulation	PID controller
Display	2x 4-digit display for temperature display in Celsius, 3x LED status displays, 1x "controller on" operating light
Sound pressure level	≤ 45 dB(A)
Connections	Power supply cable (length 2 m) with Schuko plug (CEE 7/4)
Weight approx.	approx. 1,0 kg (2,2 lbs)
Dimensions approx.. (W x D x H)	approx. 115 mm x 210 mm x 80 mm (4,53 inch x 8,27 inch x 3,15 inch)

## 4. Installation and commissioning



The security of a system into which the BRTR-88 is integrated is the responsibility of the operator of the system.

### 4.1. Scope of delivery

See the scope of delivery list enclosed with the unit.

## 4.2. Ambient conditions

When selecting the installation site, the corresponding regulations and conditions of the equipment to be heated (e.g., high-pressure laboratory reactors) must also be observed.

The BRTR-88 is intended for indoor use and must not be placed in wet areas (no splash resistance).

BRTR-88	
Ambient temperature	+5°C (41°F) to +40°C (104°F) It should also be - 40°C (-40°F) to +70°C (158°F) during transport or storage.
Maximum relative humidity	Maximum relative humidity 80% at temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C. Non-condensing.
Elevation	Up to 2000 m
Electrical connection	230 V, 2000 VA, 50 Hz Fluctuations of the mains supply voltage up to ±10% of the nominal voltage. Overvoltage category II. House-side socket (CEE 7/3, type F German) properly protected with 16 A residual current operated circuit breakers (FI).
Pollution degree	Pollution degree 2: Non-conductive pollution only, although occasional temporary conductivity caused by dew is expected.
Space requirement (W x D x H)	approx. 12 cm x 23 cm x 8 cm (4.8 inch x 9.1 inch x 3.2 inch) plus the necessary open areas
Load capacity	at least 1 kg (2,2 lbs)
Open spaces	To ensure sufficient internal ventilation, the following areas must be kept clear: <ul style="list-style-type: none"> <li>- Left side: min. 10 cm</li> <li>- backside: min. 10 cm</li> </ul> The housing feet ensure air circulation underneath the housing. The floor area must remain clear and must not be restricted by objects.

### 4.3. Unpacking / Inspection

Carefully open and remove the transport packaging. Please keep it so that you can return the unit in its original packaging to the manufacturer in case of service.

Also remove the other accessories and check the delivery for completeness.

Check the system for transport damage such as cracks, scratches, dents, etc.



#### Visible damage!

For safety reasons, do not operate the unit if any damage has been detected. Contact your local dealer or Berghof Products + Instruments GmbH directly to obtain the appropriate service.

(For contact address see section '6.5 Repairs / customer service').



If any parts are missing or damaged, contact your local dealer or Berghof Products + Instruments GmbH directly.

see section '6.5 Repairs / customer service'.

### 4.4. Positioning

First position the device in the designated place. The footprint (space requirements and free areas see above) must be level and statically dimensioned sufficiently for the weight of the temperature controller (see above). The controller generates heat during operation, which is also dissipated into the environment through the underside of the housing. Sensitive surfaces should be provided with an appropriate pad.

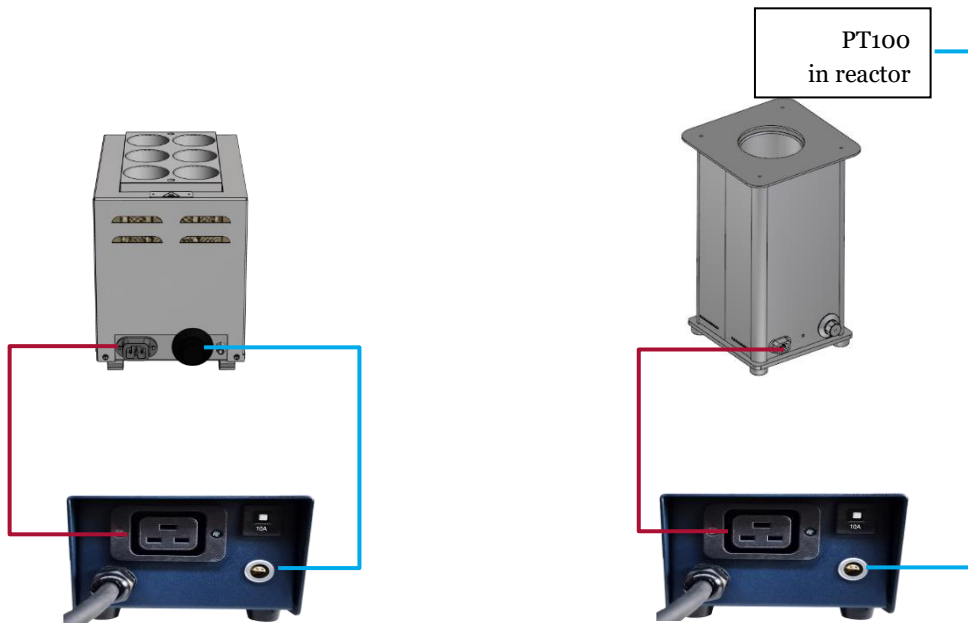


#### Emergency stop:

Access to the device's socket (power supply for the controller) must be guaranteed at all times due to the emergency stop function. Activating the ON/OFF switch on the front does not necessarily lead to the consumer being disconnected from the power supply in the event of a fault

## 4.5. Installation

The switched-off BRTR-88 is connected to suitable heaters as shown below. Finally, the BRTR-88 is connected to the mains and switched on.



### Intrinsically safe heating systems:

Only intrinsically safe heating systems that do not pose a hazard if the control function fails may be used with the BRTR-88. The approved heating systems from Berghof Products + Instruments GmbH have independent safety switches (temperature switches).

## 5. Operating



### Observe maximum operating temperatures!

When operating the temperature controller, always observe the maximum permissible operating temperatures of the equipment to be heated!



This manual describes the basics of operating the BRTR-88. Further and special functions are described in detail in the manufacturer's manual:

You can find the manufacturer's manual on the included USB stick.

### 5.1. General

The BRTR-88 controller automatically switches electrical loads with an operating voltage of  $\sim 230\text{ V} / 50\text{ Hz}$  on and off depending on an externally measured sensor temperature. For this purpose, the controller is connected between an existing standard household socket and a consumer to be controlled. The consumer to be regulated is plugged into the appliance inlet on the rear of the BRTR-88.

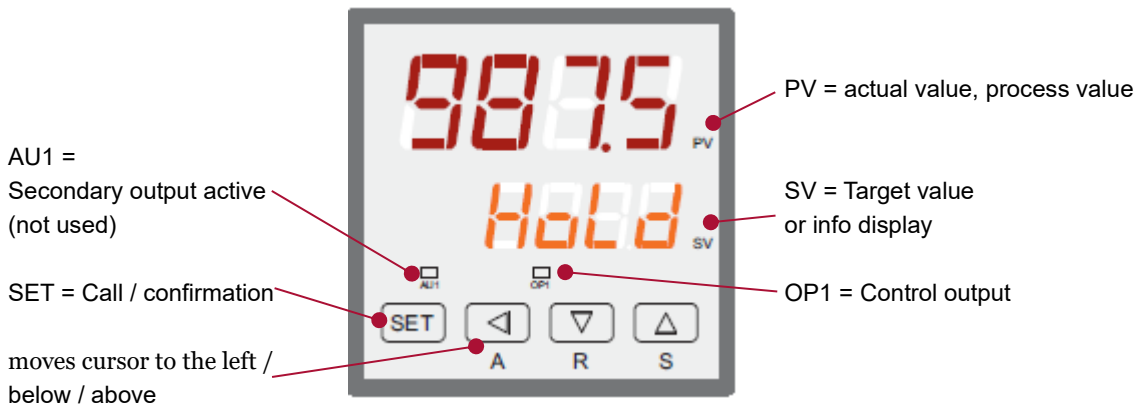
The regular switching process is triggered by a built-in microcontroller, which actuates a solid-state relay (SSR relay) depending on a previously programmed temperature.

A PT100 sensor is used to measure the temperature.

The A-senco® TR-88 microcontroller used in the BRTR-88 is a convenient PID controller with ramp control. This microcontroller offers extended setting options. Not all setting options can be used due to the device structure of the BRTR-88.

Immediately after switching on, the display shows the current software status for approx. 2 seconds. The controller then switches to PV/SV display mode.

If the lower display shows one or more status messages alternating with the setpoint value (e.g., "orAL"), the meaning of the message can be read out in the parameter table. The controller can be parameterized according to the requirements in the corresponding parameter menu.

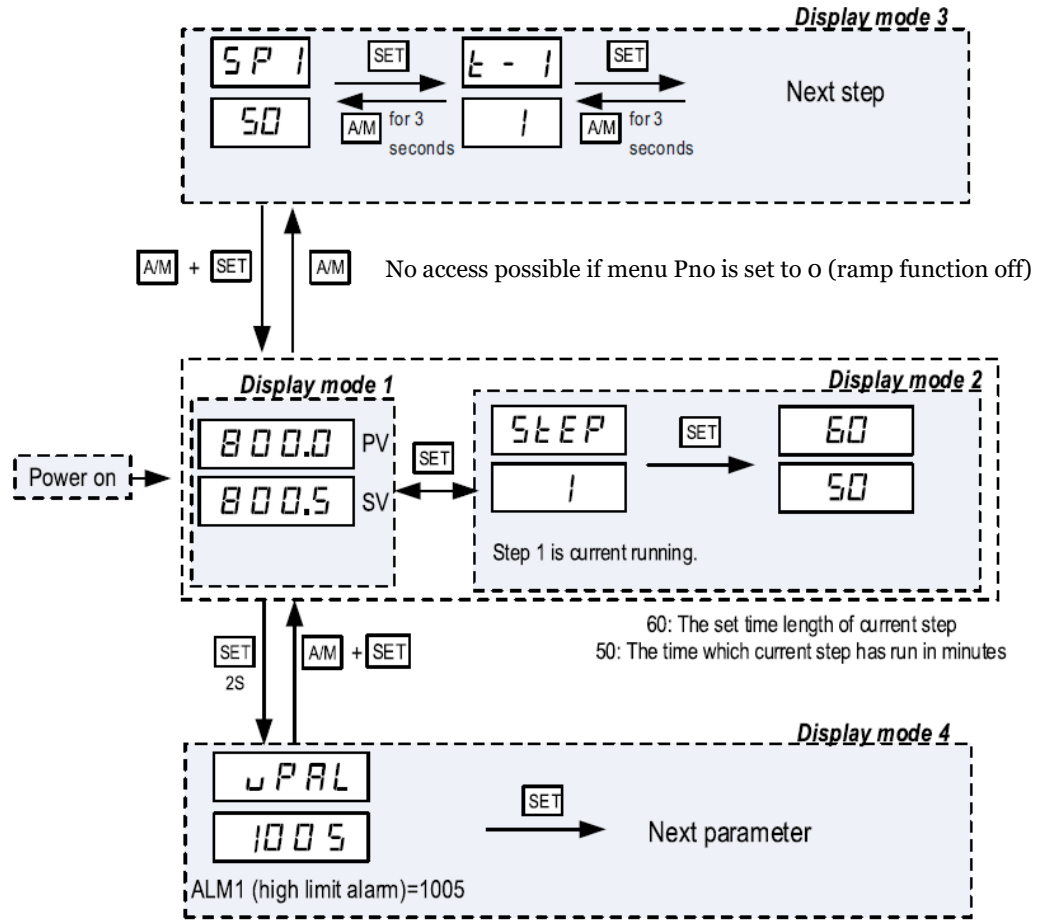


	Description	Function
SET	Call / confirmation	
◀	Cursor	Moves cursor left
▽	Value change	Value down
△	Value change	Value up
A	Changes display	Press briefly: Change from display mode 1 to STEP-mode (display mode 3) Long press: Ends parameterization
R	RUN	RUN- button
S	Stop	Stop- button

**NOTICE**








The arrow buttons on the controller have a dual function. Depending on the operating status, these are named as cursor keys (arrow keys) or with the designated function abbreviation (see below).

LED	Description	Explanation
AU1	Secondary output	Indicates whether the secondary output is active. (Not used)
OP1	Control output	Indicates whether the control output is active.



Settings and programs can be changed in STEP- mode.

Change parameters using arrow keys:	
	<div style="display: flex; align-items: center; gap: 10px;"> <span>SET</span> <span style="border: 1px solid red; padding: 2px;">◀</span> <span style="border: 1px solid red; padding: 2px;">▼</span> <span style="border: 1px solid red; padding: 2px;">▲</span> </div> <div style="display: flex; justify-content: space-around; font-size: small; margin-top: 2px;"> <span>A</span> <span>R</span> <span>S</span> </div>
	Short press: The cursor changes the marking of the active one position to the left. The cursor position marks the number, which can then be changed using the up/down arrow keys.
	Short press: Changes the value of the highlighted digit downwards by the value 1. Press and hold: Changes the value downwards as the speed progresses.
	Short press: Changes the value of the highlighted digit upwards by 1. Press and hold: Changes the value upwards as the speed progresses.

<b>Change parameters using A R S:</b>	
    A      R      S	
 A	<p>In conjunction with the SET button, A is used to exit the menu. Please make sure that when you press the buttons together, you press them in the order listed. (e.g. first press the A key and then while holding A, then press the SET key. Both keys must be pressed together for a short period of time. Only if specified, together with the A key for a period of time hold for 2 seconds.</p> <p>Briefly pressing button A causes different navigation functions depending on the operating mode (see flow chart graphic).</p>
 R	<p><b>RUN / Hold – button:</b></p> <p>They include the run/hold function. The R button is active during ongoing operation, or the ramp is started with Run. The normal state is “Run”. For example, if R is pressed while a ramp is running, the controller switches to hold mode (Run / Hold). This is shown in the SV display alternating with the temperature.</p> <p>In the hold status, the temperature is maintained during a ramp, but the timer does not expire in the active hold status.</p>
 S	<p><b>Stop- button:</b></p> <p>Using the stop function, a running process can be ended manually.</p> <p>To do this, press the S button long (approx. 3 seconds) until the display shows SV “Stop” alternating with the setpoint.</p> <p>The process is ended with the stop command, the ramp segment is set back to the initial step and can be restarted with the Run button.</p>

### NOTICE

Status messages and the parameterization of the TR-88 installation controller are described in detail in chapter 4.9 and in the manufacturer's manual:  
You can find the manufacturer's manual on the included USB stick.

### Switching off

Please note that operating the rocker switch to the "o" position does not completely de-energize the controller. This is only possible by disconnecting the supply line from the mains.

### NOTE

The use of solid-state relays means that a voltage can be measured at the output even when the load is switched off

## 5.2. Basic setting

The A-senco ® TR-88 microcontroller used in the BRTR-88 offers expanded setting options. Not all setting options can be used due to the device structure of the BRTR-88.

PV-Display	Factory setting	Setting range	Description
uPAL	3200	-999 - 3200	Process high alarm
LoAL	-999	-999 - 3200	Process low alarm
ESAL	3200	-999 - 3200	Deviation high alarm
EIAL	-999	-999 - 3200	Deviation low alarm
AHYS	2	0 - 200	Hysteresis band
AdIS	On	On / off	Alarm indication
AoP	1111	0 - 6666	Alarm output assignment
Ctrl	APid	OnoF, APID, nPID, PoP,SoP	Control mode
Srun	Run	Run, Stop, Hold	Controller status
Act	rE	rE, dr, EbA, drbA	direct/reverse control selection
At	off	OFF, on, FOFF	Auto-tuning
P	25	0 – 3000 °C/F	Proportional band
I	200	1 – 9999 Secs	Integral time
d	50,0	0 – 3200 Secs	Derivative time
Ctl	2,0	0.2 – 300.0 Secs	Control cycle time
P2	25	0 – 3000 °C/F	Proportional band for cooling
I2	200	1 – 9999 Secs	Integral time for cooling control
d2	50,0	0 – 3200 Secs	Derivative time for cooling control
Ctl2	2,0	0.2 – 300.0 Secs	Control cycle time for cooling
CHYS	2	0 – 2000	Hysteresis for ON/OFF control
InP	21	0 – 37	Input sensor code
dPt	0	0/0.0/0.00/0.000	Decimal point
ScL	0	-999 – 3200	Lower limit for analog input
ScH	1000	-999 – 3200	Higher limit for analog input
Scb	0	-999 - 4000	Net adjustment
FILT	1	0 – 40	Filter strength
Fru	50C	50C/50F/60C/60F	Power frequency and °C/F selection
oPt	SSr	SSr/rELy/0-20/4-20/PHA1	Output type
Aut	SSr	SSr/rELy/0-20/4-20	Cooling output type
oPL	0	-110 -+110%	Output lower limit
oPH	100	0 - +100%	Output higher limit
OEF	3200	-999 - 3200	OPH effective range
Addr	1	0 - 80	Address
bAud	9600	0 – 19200	Baud rate
Et	nonE	nonE,ruSt,SP.1.2,Pld2,Eact	Event input
AF	32	0 – 255	System function
PASd	0	0 – 9999	Access protection
SPL	-999	-999 – 3200	SV lower limit
SPH	3200	-999 – 3200	Output higher limit
SP1	25	-999 – 3200	Set value 1
SP2	100	-999 – 3200	Set value 2
SPr	0	0 – 3200°C/minute	ramp up speed
Pno	30	0 – 30	Step number
PnoP	Cont	Cont,StoP,run1,dASt,Hold	Power failure handling mode
PAF	0	0 – 255	Program execution mode
EP1-EP8	-	EP1=UPAL,EP2=LOAL,	Field parameters

### NOTICE

Status messages and the parameterization of the TR-88 installation controller are described in detail in chapter 4.9 and in the manufacturer's manual:  
You can find the manufacturer's manual on the included USB stick.

### 5.3. Setting the operating mode

The BRTR-88 controller regulates in two different operating modes:

- ON / OFF mode with adjustable hysteresis  
This function is not usually used with heaters from Berghof Products + Instruments GmbH and is therefore not described further in this manual.
- P.I.D. - controlled system adaptation with fuzzy logic support and auto-tuning or manual setting of the P.I.D. parameters.

PID control with auto-tuning is preset at the factory.

Switching from P.I.D. mode to ON/OFF mode is done by changing the output scheme in the "Ctrl" menu.

The value is set to "OnoF" here (do not forget to set a hysteresis afterwards!).

The P.I.D. operating mode is preferable for ramp control whenever possible, as hysteresis, as is the case in ON/OFF mode, is usually undesirable for a desired linear temperature increase.

### 5.4. P.I.D.-Mode

The use of a P.I.D. controlled system is particularly suitable for controlling the temperature of resistive loads, such as electric heaters or similar loads.

In P.I.D. mode, the heating output, for example, is gradually reduced as the temperature to be controlled approaches the preselected setpoint.

The complex control parameters are set by the controller's auto-tuning function, which generally eliminates the need for manual readjustment.

P.I.D values are always only optimal for a specific control temperature. For this reason, P.I.D values should always be adjusted to the desired working temperature.

#### **i NOTICE**

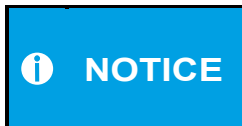
#### **P.I.D values:**

Some standard values for the P.I.D values can be found on the USB stick supplied.

## 5.5. Autotuning

P.I.D values are always only optimal for a specific control temperature. For this reason, the desired working temperature should always be used when determining the P.I.D values using autotuning.

1. hold the SET button until "uPAL" appears.
2. press the SET button again to access the Loc parameter.
3. set the Loc value to **808** using the up / down / left buttons to edit all parameters.
4. confirm the value by pressing the SET button again to access the parameter values, starting with "uPAL".
5. continue to press SET until you reach the **At** parameter (autotuning). Set this to "on".
6. press the SET button several times to navigate to the SP parameters and set them:
  - SP1** = temperature to which the tuning should be carried out (e.g., 200 °C)
  - SP2** = Return to room temperature (e.g., 25 °C)
7. Exit the parameter settings by waiting 20 seconds or holding Left/A and then pressing the SET button.
8. press left/A once in working mode (SP1 - 200 is displayed) and then SET to set the time **t-1** to 30 minutes.
9. press SET twice again to set **t-2** to 60 minutes.
10. after waiting 20 seconds or returning to working mode by pressing left/A+SET, autotuning can be started by briefly holding down Down/R (Run).
11. The red LED indicates the heating process, while SV alternately displays At and 200 (set temperature).
12. autotuning now runs automatically until the set room temperature of 25 is reached again. P, I, D values are automatically saved and stored in the parameters (can be viewed via Loc 808).



Only the last P.I.D values are ever saved; if a new autotuning is carried out, the old values are overwritten



Due to the way in which the control parameters are determined in autotuning, possibly high overshoots can occur, depending on the dynamics of the system and the selected temperature range. The maximum permissible temperatures of the components used and the maximum permissible pressure of the pressure vessel must be considered.

It is advisable to start with lower temperatures to detect the level of overshoots and then increase the temperature in small steps if the overshoots do not pose a problem.

## 5.6. Temperature ramp

If autotuning has been carried out, the values can be viewed in steps 1-4. (They are also saved directly after autotuning and used for future temperature ramps)

1. hold the SET button until "uPAL" appears.
2. press the SET button again to access the Loc parameter.
3. use the up / down / left buttons to set the Loc value to **808** for editing all parameters.
4. confirm the value by pressing the SET button again to access the parameter values, starting with "uPAL".
5. continue to press SET until you reach the **At** parameter (autotuning). This value should automatically be "off".
6. press SET several times to access the SP parameters and set them to:  
**SP1** = Set start temperature/room temperature (e.g., 25°C)  
**SP2** = Set target temperature (here e.g., 200°C)
7. press left/A once in working mode (SP1 - 200 is displayed) and then SET to set the time **t-1** to the desired heating time.
8. press the SET button twice again to get to **t-2**. Set this to the desired time for which the temperature is to be maintained.
9. press SET once more to go to **SP3** and also set this value to the target temperature (e.g., 200°C)
10. continue with SET to get to t-3. Set the value to **-121** (negative value for ending the program).
11. wait 20 seconds or press Left/A+Down/R
12. start program with down/R

## 5.7. ON / OFF-Mode

This function is not usually used with heaters from Berghof Products + Instruments GmbH and is therefore not described further in this manual.

## 5.8. Temperature Calibration

Depending on the installed sensor type and cable length, display tolerances are possible. Inaccuracies of up to a few degrees temperature difference can occur. To compensate for this, a possible error value can be equalized by compensation if a reference temperature (e.g., calibrated thermometer) is available. Compensation should be carried out in a temperature range that is as close as possible to the desired setpoint value.



The BRTR-88 controller is not approved for temperature calibration. The calibration only serves to approximate the actual temperature value

**FILT:** Can be used to smooth the input. A high filter value increases the stability of the readout display but causes a greater delay in the response to temperature changes.  $FILT = 0$  deactivates the filter.

**Scb:** Calibration function to compensate for sensor deviations. The set value in degrees is added to the sensor value. If a reduction in value is required, enter a minus value. Calibration not calibratable. Recommendation: It is advisable to calibrate at the target value.

## 5.9. Operation and ramp parameterization



Observe maximum operating temperatures.  
When operating the BRTR-88, always observe the maximum permissible operating temperatures of the appliances to be heated!



Heating pressure vessels with PTFE lining  
Pressure vessels with PTFE lining may only be heated to higher temperatures under a minimum pressure of approx. 5 bar. This pre-pressure can be generated, for example, with water or other liquids.

The BRTR-88 controller does not require any ongoing operation once it has been set up and commissioned. Changes to the control temperature can be made during operation using the soft-touch field on the controller.

The ramp parameterization follows a simple "step for step" logic of successive temperature and time specifications, starting with a start temperature [Sp-1], a subsequent time value [t-1] until the next target temperature [Sp-2] is reached, which also serves as the start temperature of the next step.

According to the example diagram below, the parameterization of a ramp basically follows the simple sequence of:

[Sp-1] + [t-1] + [Sp-2] + [t-2] + [Sp-3] + [t-3] + SP4] + .....and so on.

A maximum of approx. 30 such steps are possible, each consisting of an initial temperature value and a time value (SP + t) (**Pno** menu). The end of a ramp is marked at the end of the required step by a subsequent

entry in the [t-] menu after the last step entry; the software recognizes this so-called end command or event handler from an entry in the [t-] menu by the preceding minus sign (e.g. -121.0).

### Special feature:

The controller expects an initial temperature - usually the ambient temperature when switched off and cooled down - from which the parameterized ramp starts to work. In reality, this initial temperature can deviate considerably in some cases, which is why the controller has a menu for this, in which you can specify how the controller behaves after switching on if the actual value deviates considerably from the setpoint. These options are shown in the parameter settings in the [Spr] menu (see graphic below).

With this basic knowledge, you can already parameterize simple ramp programs. However, it is important that you understand and can apply this logic.

More advanced functions are based on this scheme and require a basic understanding of the logical parameterization scheme.

### Definitions of terms:

**Step:** Smallest ramp unit consisting of start temperature, time value and target temperature.

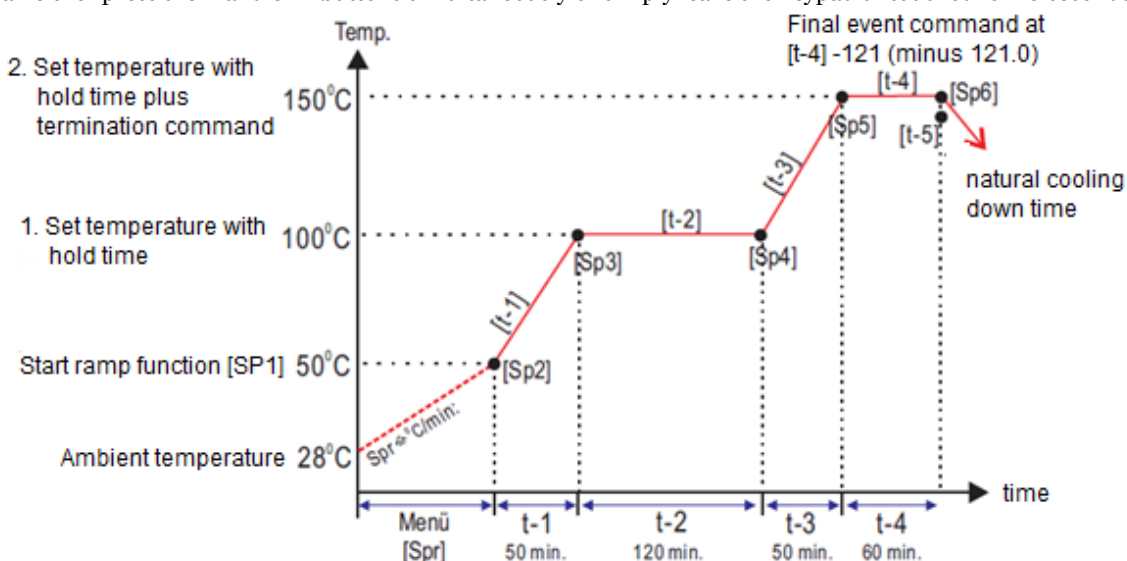
**Ramp program:** Functional ramp consisting of at least one step plus completion command (event output or event handler).

### Ramp programming

Press the A button to switch the controller to program setup mode (prerequisite: menu Loc=0). The controller displays the current step number in the upper window "SP XX" and the set temperature in the lower window. The default value "-0.1" is displayed (factory setting). Use the A button to select the digit to be edited. If you then confirm the selected digit by pressing the A button, this is indicated by a flashing decimal point and a beep. Use the arrow buttons to set the desired temperature. Then press the SET button to confirm and go to the next step. The set temperature and time are displayed in sequence for each program step. Repeat this process until all steps of your program have been entered.

**Note 1:** The above procedure is disabled if the program setup function is disabled (see 5.1.30 in the A-senco ® operating instructions for details of the Loc parameter).

**Note 2:** To return to the previous parameter in parameter setting mode or programming mode, simply press and hold the A button. The parameter will return to the previous one. To exit the program editing mode, you can either press the A and SET buttons simultaneously or simply leave the keypad untouched for 10 seconds



**[Spr] menu:** If required, enter the desired heating rate in degrees / min. at [Spr] up to the start of the defined initial temp. of [Sp1].

**Explanation:** In the example above, this corresponds to heating by 22°C. If you enter the value 0.5 for [Spr], the temperature increases by 0.5° per minute. The controller would therefore require 44 minutes if the actual value is 28°C when the controller is switched on. If, in our example, the actual value was 20° when switching on, the controller would need 60 minutes to start the ramp function with the same setting. Exit the parameterization mode (automatically after approx. 20 s inactivity).

**Menu [Sp-1]:** Call up the ramp parameterization mode by briefly pressing the A button. enter the initial temperature value "50.0" in degrees.

**Menu [t-1]:** After confirming the previous entry with the SET button, you will reach the next menu item [t1]. Now use the arrow buttons to enter the value 50.0 (in minutes for factory settings).

**Explanation:** The controller attempts to increase the setpoint value linearly up to the next target point [Sp2] within the entered time. The length of the time to be entered should be selected so that the connected heating system can easily reach the target temperature within the specified time. If the time is too short, the controller switches to wait function (on the Hold display).

**Menu [Sp-2]:** After confirming the previous entry with the SET button, you reach the next menu entry [Sp2]. Enter the value 100.0.

**Explanation:** The target value Sp of the previous step is automatically the new output value for the following ramp segment.

**Menu [t-2]:** After confirming the previous entry with the SET button, you reach the next menu entry [t2]. Enter the time value 120.0.

**Explanation:** If the start value of a ramp segment (also known as a step) is identical to the target value (e.g., Sp1 to Sp2), there is no temperature increase, but the temperature is maintained by the T value. The time is always entered with one decimal place. The minutes are divided into decimal steps. Example: Entering 120.5 would correspond to a step time of 25 minutes and 30 seconds.

**Menu [Sp-3]:** After pressing the previous entry with the SET button, you reach the next menu entry [Sp3]. Enter the value identical to [Sp2] 100.0 (holding temperature).

**Menu [t-3]:** After confirming the previous entry with the SET button, you reach the next menu entry [t3]. Enter the time value 50.0 here.

**Menu [Sp-4]:** After pressing the previous entry with the SET button, you reach the next menu entry [Sp4]. Enter the value 150.0 for the target temperature.

**Menu [t-4]:** After confirming the previous entry with the SET button, you will reach the next menu entry [t4]. Enter the time value 60.0.

**Menu [Sp-5]:** After confirming the previous entry with the SET button, you will reach the next menu entry [Sp5]. Enter the value 150.0 (holding temperature) for the target temperature.

**Menu [t-5]:** After confirming the previous entry with the SET button, you reach the next menu entry [t5]. Enter the ramp termination command -121 (minus 121).

**Explanation:** The ramp termination commands, also known as event handlers, are entered in the [t-] menu as a minus entry using the arrow keys. If the software recognizes a minus sign for a t value, this is interpreted as an event handler. A list of the possible commands can be found in tabular form below:

Terminus = -A and B		Function Events
-A	B	This is the format of the command, -A is the integer, B is the value after the decimal point.
0	0	The event command in the t menu contains two command terminologies: -A represents an integer before the decimal point and is a reference to the following step (e.g.: A= -12. means that the controller jumps to step 12 when the signal is reached. B represents the single-digit value after the decimal point.
-1 ~122	0	For example, if t-5 = 0.0, the controller is put on hold at step 5. If -A falls in the range of -1~-122 and B=0 means that the command is for jump purposes, the program jumps to -A step after it has finished the previous step. For example, if t-5=-20.0, the program goes to step 20 after finishing step 4 because step 5 is a jump step.

-0	1~4	<p><i>AL1 and AL2 cannot be used with the BRTR-88 (documentation here for completeness only)!</i></p> <p>If -A=-0 and B falls within the range of 1~4, this means that the program goes to the next step and an event output is generated at the same time.</p> <p>t-5=-0.1, means that the program goes to step 6 and AL1 is activated, AL2 is enabled at the same time.</p> <p>t-5=-0.2, means that the program goes to step 6 and AL1 is enabled and AL2 is activated</p> <p>t-5=-0.3, means that the program goes to step 6 and AL1 and AL2 are activated at the same time.</p> <p>t-5=-0.4, means that the program goes to step 6</p>
-1~-120	1~4	<p><i>AL1 and AL2 cannot be used with the BRTR-88 (documentation here for completeness only)!</i></p> <p>If -A falls within the range of -1~-120 and B falls within the range of 1~4, this means that the program jumps to the specified step and AL1 and AL2 become active or drop out at the same time.</p> <p>For example:</p> <p>If -5=-10.1, this means that the program jumps directly to step 10 at step 5 and at the same time AL1 is activated and AL2 drops out.</p> <p>If t-5=-12.2, this means that the program jumps directly to step 12 at step 5 and at the same time AL1 drops and AL2 is activated.</p> <p>If t-6=-15.3, this means that the program jumps directly to step 15 at step 6 and AL1 and AL2 are activated at the same time.</p> <p>If t-10=-1.4, this means that the program jumps to step 1 at step 10 and starts again overall, while at the same time the relays AL1 and AL2 are de-energized.</p>

### 5.9.1. Programming example

This is a general programming example of the A senco ® microcontroller family used in the BRTR-88. The temperatures used cannot be used for BRTR-88, ramp times may not be achievable with heaters from Berghof Products + Instrument GmbH.

The program in the PU90 series controller has a standardized temperature-time-temperature format. The temperature setpoint of the current step increases linearly over the time interval between the two steps to the setpoint of the next step. It is not normally recommended to program a ramp that is faster than the system is capable of achieving, as this will cause the actual temperature to lag behind the schedule.

Unless you are using the "Wait" function (see section 6.1 for its definition), the time units are in minutes or hours. Negative values of the time interval represent program commands.

**Example: Maintaining the oven temperature at 800 °C for 2 hours**

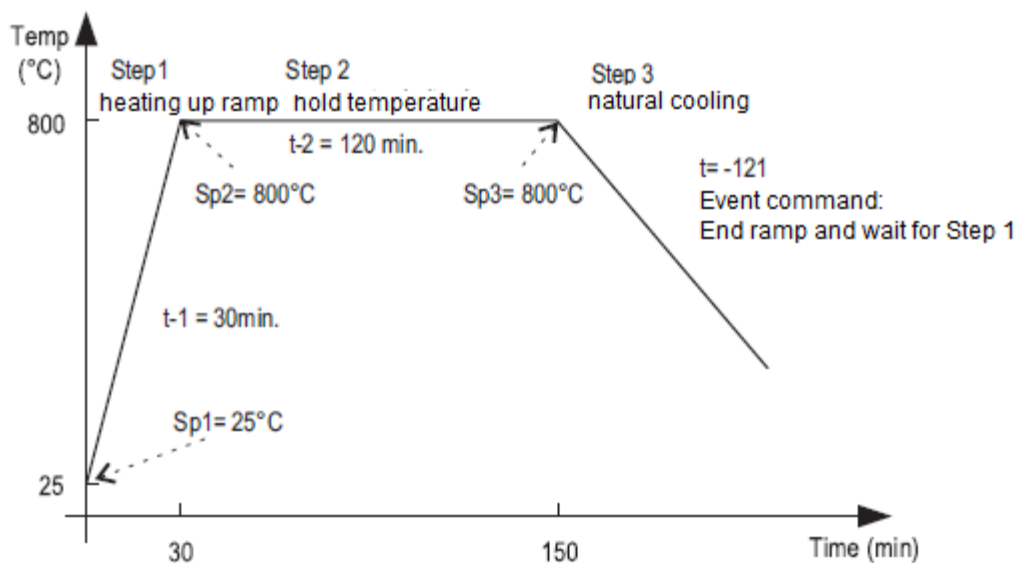
Assuming that the heater can heat the oven from 25 °C to 800 °C within 30 minutes, we can parameterize a program as follows:

Step 1: SP 1=25, t-1=30.0: Gradual heating from 25 °C to 800 °C over a period of 30 minutes (25.8 °C/minute)

Step 2: SP 2 = 800°C (initial temperature of Step 1 is also the initial temperature of Step 2). t-2 = 120.0: Hold the temperature at 800 °C for 120 minutes.

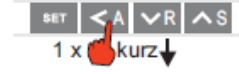



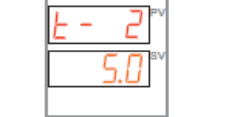
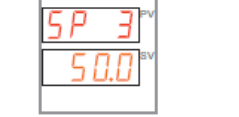
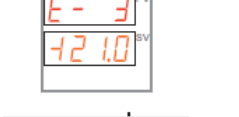
Step 3: SP 3=800. t-3=-121.0: Stop the program and let the oven cool down naturally.

#### Temperature profile of example ramp 1



**Parameterization of an example ramp (similar to example ramp 1)**

This example ramp is used as a basic setting when controllers are installed in A-senco temperature controls as a basic setting!

<p>1x Press button A briefly!</p>	
<p>Determining the initial temperature Temperature value should be as close as possible to the actual actual value at the start. Select the desired value using the arrow buttons! -Then confirm</p>	
<p>Determination of the sequence time up to SP 2 t- 1 is the first-time cycle starting at SV= 25° until temp. SP 2 is reached. Select desired value with arrow keys! -Then confirm</p>	
<p>Definition of target temperature SP 2 Temperature value that should be reached after t- 1 should be reached. Select the desired value using the arrow buttons! -Then confirm</p>	
<p>Determination of the expiry time up to SP 3 t- 2 is the time cycle starting at SP 2 until the target temp. SP 3 is reached. Select the desired value with the arrow buttons! -Then confirm</p>	
<p>Determination of target temperature SP 3 Temperature value that should be reached after t- 2 should be reached. Select the desired value using the arrow buttons! -Then confirm</p>	
<p>Specification of ramp termination function t value preceded by a minus sign [- 121]: Stop and start on restart at step 1. Select the desired value using the arrow buttons! -Then confirm</p>	

## 6. Maintenance, troubleshooting and service.

### 6.1. Maintenance

The BRTR-88 requires no maintenance.

### 6.2. Cleaning

Do not use any aggressive cleaning agents to clean the unit, but only wipe it with a dry or damp cloth.

### 6.3. Replacing the fuse

#### 6.3.1. Thermal protection of load

To protect the load, the controller contains an automatic thermal protection device, which can be put back into operation manually after it has been triggered.



#### **Defective switching unit due to overcurrent**

If the load output has been short-circuited or the load fuse has been triggered due to overcurrent, the internal SSR switching relay must be replaced or checked by qualified and authorized service personnel (switch-off function).

### 6.3.2. Fuse of control voltage

To protect the control voltage, the device contains a 5 x 20 mm fuse on the front for 250 V / 400 mA (medium time lag).

A size 2 screwdriver is required to replace the fuse.



#### Eliminating the cause: defective fuse!

The fuse protects the internal control voltage of the BRTR-88. The cause can usually only be remedied by expert and authorized service personnel.

1. Make sure that the controller is disconnected from the mains and secured against being plugged in.
2. Eliminate the cause of the fuse break before replacing the fuse. Only authorized service personnel are allowed to open the device.
3. Loosen the fuse insert on the front of the device by turning it to the left. Depending on the fuse holder installed, slight pressure must be applied before turning to the left to release the lock.  
**Result:** The fuse insert can now be removed with the fuse.
4. Now insert a new, correct fuse.  
**Result:** The fuse is inserted into the fuse holder.
5. Insert the fuse holder with a new fuse back into the opening and lock it with a slight clockwise turn. Do not use great force or even violence.  
**Result:** The fuse has been replaced and the device is ready for operation again.



**Only use new fuses that conform to the specification**

## 6.4. Error notes

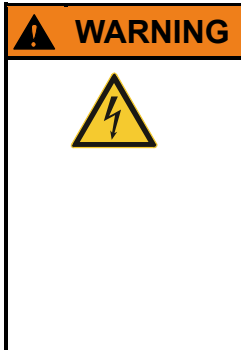
Error description	Cause	Remedy
Device does not heat	Overtemperature switch in the heating system has switched off.	Do not set the target temperature too high (<250°C for reactors with PTFE lining). Check the setting of the overtemperature switch (it may be too low).
	Heating system not connected to controller	Check connection cable and plug
Instrument fuse triggers	Short circuit in the heating system	Send heating system with controller to the factory for inspection.
Strong control deviations, strong overshoot	Unfavourable choice of parameters	Optimize control parameters with autotuning.
	Temperature sensor defective	Replace defective parts
Display shows error message <b>orAL</b>	Temperature sensor not plugged in or defective.	Plug in the PT100 temperature sensor or replace the defective temperature sensor.

Technical support is available from your regional Berghof dealer or directly from Berghof Products + Instruments GmbH at:

Berghof Products + Instruments GmbH  
 Arbachtalstraße 26  
 72800 Eningen  
 Germany  
 T +49.7121.894-170  
 F +49.7121.894-300  
 E-Mail: [service.bpi@berghof.com](mailto:service.bpi@berghof.com)  
[www.berghof-instruments.com](http://www.berghof-instruments.com)

Please state the serial number of your unit in all repair enquiries or repair orders. You will find it on the type plate.

## 6.5. Repairs / customer service



### **Unit uses mains voltage AC 230V!**

The unit must always be connected to a protective earth conductor. The connection from the unit to the power source must always be made via a three-wire cable with a protective earth conductor.

Only use approved mains cables.

The socket used must be always freely accessible.

The unit must not be put into operation if it is damaged.

Repair and service work may only be carried out by appropriately trained and qualified personnel of Berghof Products + Instruments GmbH.

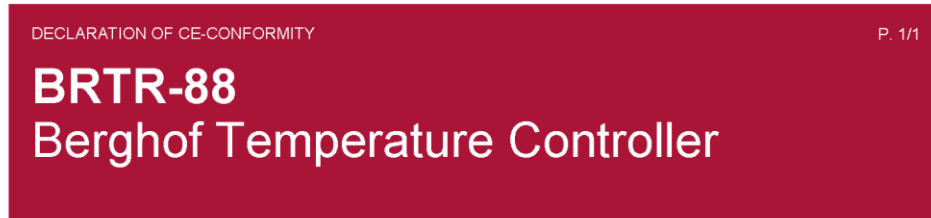
Technical support and information on spare parts (order no. and prices) can be obtained from your regional Berghof dealer or directly from Berghof Products + Instruments GmbH at:

Berghof Products + Instruments GmbH  
Arbachtalstraße 26  
72800 Eningen  
Germany  
T +49.7121.894-170  
F +49.7121.894-300  
E-Mail: [service.bpi@berghof.com](mailto:service.bpi@berghof.com)

Please state the serial number of your unit in all repair enquiries or repair orders. You will find it on the type plate.

## 7. Appendix

### 7.1. Declaration of conformity



<b>Manufacturer</b>	Berghof Products + Instruments GmbH Arbachtalstraße 26 D - 72800 Eningen
<b>Product</b>	<b>BRTR-88</b> – Berghof Temperature Controller Part numbers: 10007655

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

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

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

The following harmonized standards and technical specifications have been applied:

<b>Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements</b>	IEC 61010-1:2010/AMD1:2016
<b>EMC – Generally</b>	Professional equipment. The equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes (Class A).
<b>Electrical equipment for measurement, control and laboratory use – EMC- requirements Part 1: General requirements</b>	EN 61326-1:2013 IEC 61326-1:2012

Eningen, January 31, 2024  
Date

  
Dr. Dieter Gutwerk  
CEO



## 7.2. Conversion of units

Conversion of units			
Description	Units	Conversion	
Temperature	°C =	$(°F - 32°) / 1.8$	
	°F =	$1.8 * °C + 32°$	
Length	1 cm =	0.3937 inch	
	1 inch =	2.540 cm	
Volume	1 ml =	0.06102 inch <sup>3</sup>	= 2.642*10 <sup>-4</sup> gallon
	1 inch <sup>3</sup> =	16.387 ml	= 43.29*10 <sup>-4</sup> gallon
	1 gallon =	3785 ml	= 231 inch <sup>3</sup>
Pressure	1 bar =	14.504 psi	= 0.1 MPa
	1 psi =	0.06895 bar	= 0.0068948 MPa
	1 MPa =	10 bar	= 145.04 psi
Weight	1 kg =	2.2046 lb.	
	1 lb. =	0.4536 kg	

## 7.3. Abbreviations

Plastics	
Abbreviation	Full name
PE	Polyethylene
PEEK	Polyether ether ketone
PFA	Perfluoralkoxy
PTFE	Polytetrafluoroethylene
TFM™-PTFE	modified Polytetrafluoroethylene
PP	Polypropylene