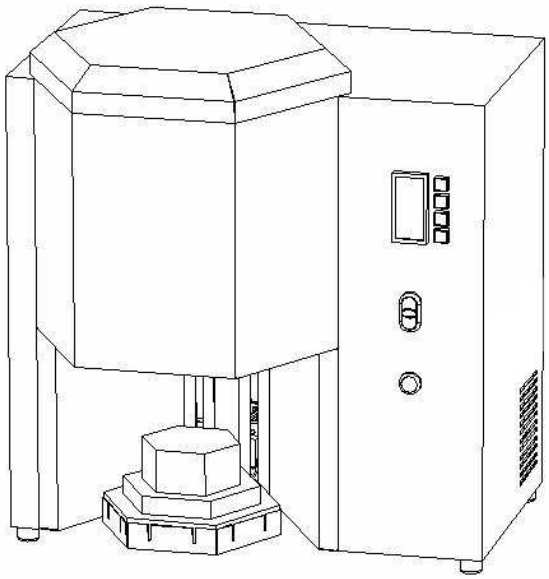
Thermo-Star
competence in thermo-technology

Instruction manual for the high-temperature furnace

Denta-Star



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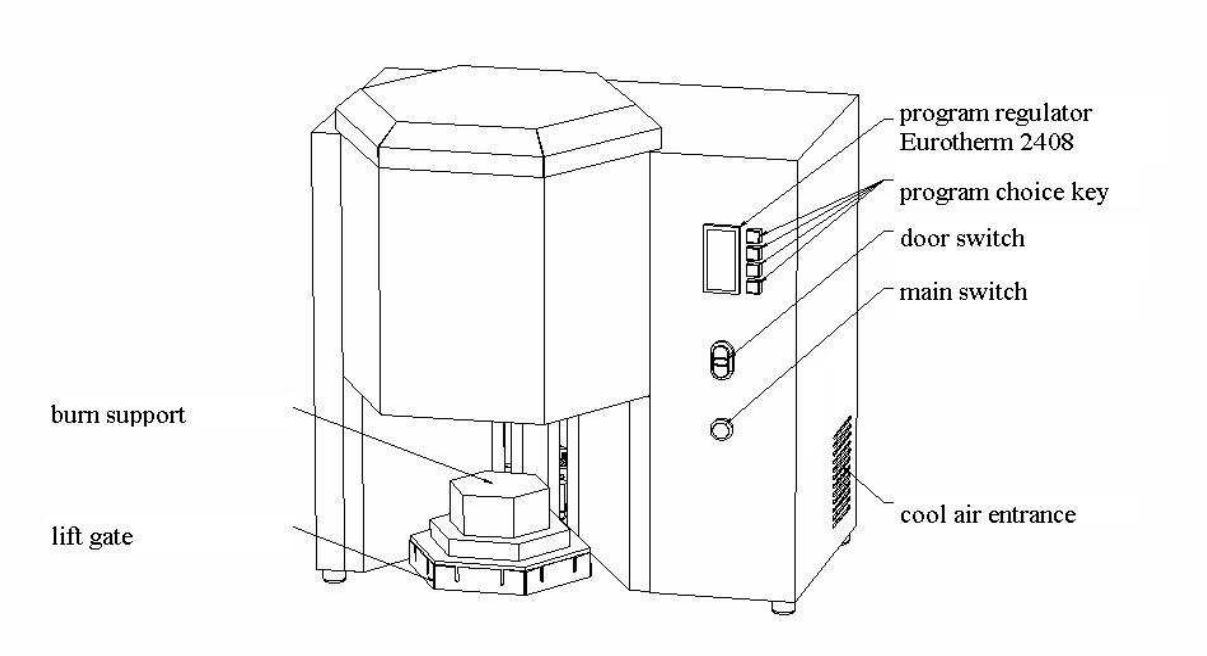
1. Technical data

	EU	US
maximum temperature	1.720 ℃	
net volume	1,25 liter	
net measurements D x H	120/140 x 100 mm	
electric supply	230 V	115 V
maximum current consumption	16 A	30 A
maximum output	2,5 kW	



2. Installation

The furnace will be installed from a service technician of the company Thermo-Star, also put into operation and the user will be briefed.

The base has to be solid and must be able to carry the weight of the furnace of approx 100 kilo.

The place of installation must be well ventilated during the use of the furnace.

The guidelines in the chapter **"cooling air fence"** must be strictly adhered to.
Is the installation location not able to make the grade, it must be fixed adequate.

3. Main switch

By pressing the main switch, the furnace will be activated. The main switch engages counter-sunk and lights up. The internal ventilators initiate, the program regulator and the programmable logic controller (PLC) will be configured automatically. 10 seconds after switching on, the furnace is ready for use.

At temperatures above 200 °C the furnace mustn't be turned off by main switch. Otherwise the cooling will be interrupted. The only exception is an emergency situation.

4. Door switch

While operating the door switch, the lift gate will be driven up or down.
The door switch is a momentary switch and for safety reasons it is necessary to press the door switch during the door movement. By reaching the upper or lower position, the door will stop automatically and the door switch lighting will be turned off.
The limit of travel can't be ridden over.
A door travel lasts approx. 35 seconds.

While opening the door it has to be assured, that there are no objects under the hexagonal furnace chamber.
Concerning the risk of crushing it is not allowed to grab under the door.

While closing the door it is responsible for seeing, that no objects protrude the burn support plate, as the insulating of the furnace and the heating elements will be damaged.
The position of the furnace loading has to be controlled while travelling upwards. Because of the risk of crushing, it is not allowed to grab between the door and the burn chamber.

For safety reasons the door is blocked by temperatures above 200 °C, independent from the status of the furnace. The limit value should be changed or abolished only by a service technician of the company Thermo-Star.

5. Lift gate

The lift gate will be powered by an electric motor via a specific shaft with a zero play ball flow screw nut. The laying of the door actuation according to an industry standard warrants a vibration free run. The arbor and the engine are affiliated with each other over a mechanic coupling disk. The coupling disk can avoid bigger disadvantages by failure, but it is no safety clutch, which avoids injuries by squashing.

It is not allowed to touch the lift gate during the handling from beneath. It gets hot and by touching can arise injury by burning up.

Details for actuation of the door you will see in the chapter "**door switch**".

6. Program controller Eurotherm 2408

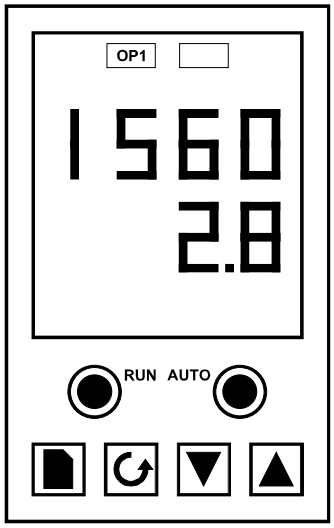
Factory made there are four identical programs inside the temperature controller. Each can be started easily by pushing a quick start button.

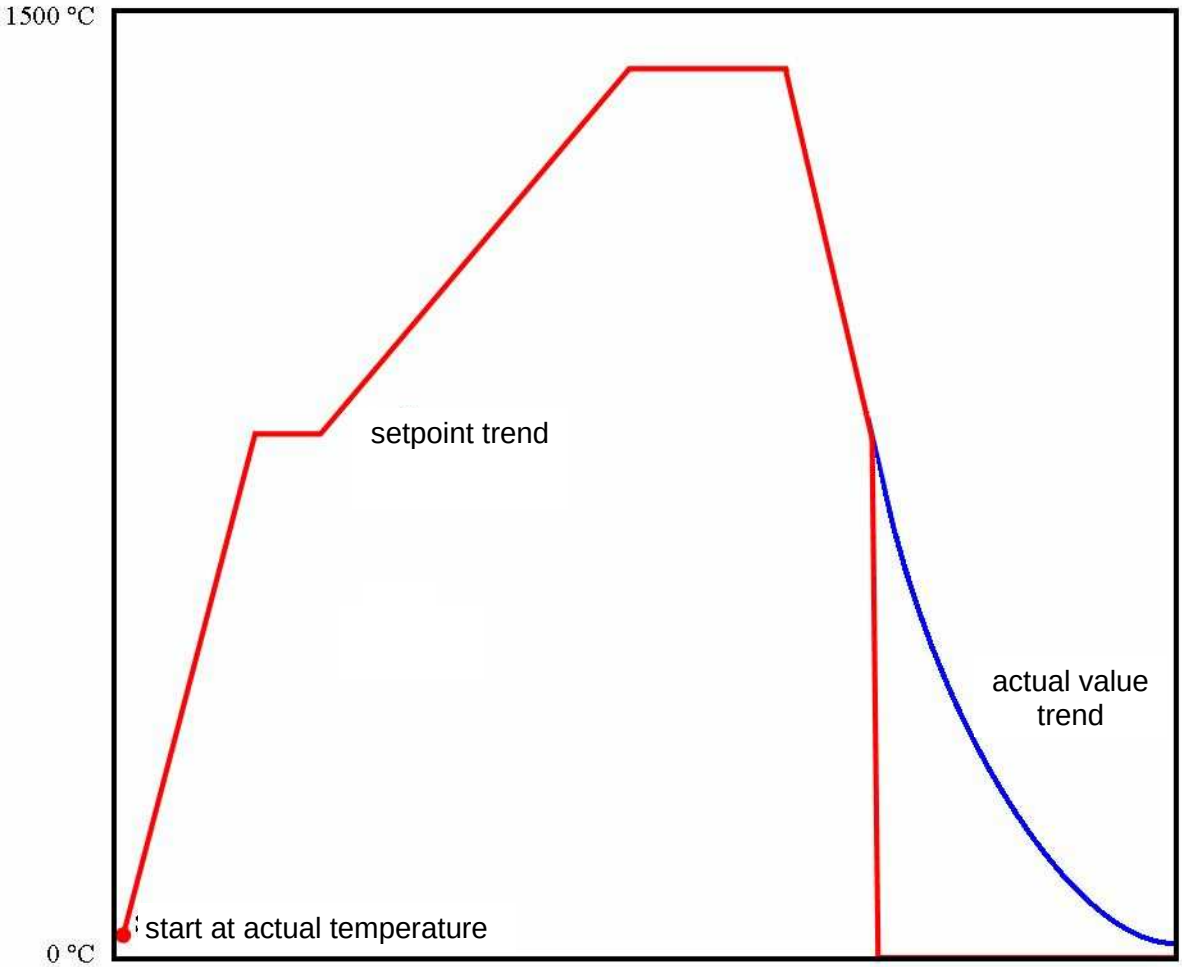
The programs consist of 3 segments, up to 16 segments are possible.

Segment 1	heating up	up to 900℃	with 600 K/h
Segment 2	hold time	0,5 h	
Segment 3	heating up	up to 1450℃	with 200 K/h
Segment 4	hold time	2 h	
Segment 5	cooling down	up to 900℃	with 600K/h
Segment 6	set point skip	up to 0℃	
Segment 7	PRG END	Type (dwell)	

While activated the temperature controller displays two temperature values denoted in "℃". The upper value is the measured temperatur e (actual value), The lower value is the set point (obliged value).

A program has been started, if a quick-start button lights up and the program controller indicates "RUN" und "AUTO".



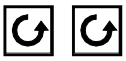


The factory-made sinter curve consists of an increasing ramp (heating up), a dwell time, another increasing ramp, another dwell time, a decreasing ramp (cooling down, controlled) and a skip (here cooling down, uncontrolled).

The actual value trend is almost congruent with the setpoint trend till the decreasing ramp reaches 800 °C. From there on the loss of temperature is less than 600 K/h which is a side action of the high grade insulation.

At the end of the program the furnace temperature averages about 600 °C and it lasts about one hour till the furnace cools down to 200 °C. Room temperature will be reached after another 2 to 4 hours, which depends on ambient conditions. The automatic door interlock will be lifted at 200 °C. The furnace door might be opened by now. The at least 200 °C hot products should be handled carefully, because of the risk of skin burning.

The following charts are a leading in the simple systematic handling of the program controller using a free voted temperature profile.

Monitoring of the furnace parameter during a running program		
button	**display**	**comment**
		actual value 1.560 °C; remaining period 2,8 hours or setpoint (depends on the configuration of the controller)
 **2 x within 2 sec.**	 	temperature in degree Celsius (shown for a short time) push button **twice** within two seconds output power 56,2 % furnace runs for example with 56,2 % of the maximum power
		set point set temperature 1.560 °C
		push the buttons **at the same time**; for the base display section; actual value 1.560 °C; remaining period for example 2,8 hours or setpoint (depends on the configuration of the controller
Monitoring of the operating parameters during a running program		
button	**display**	**comment**
		actual value 1.560 °C; remaining period 2,8 hours or setpoint (depends on the configuration of the controller)
 **2 x within 2 sec.**	 	temperature in degree Celsius (shown for a short time) push the button **twice** within two seconds run list list of the operation parameters
		program 1 (indication of program 1 up to 4 possible) program 1 is running at present
		program set point the set point constitutes1.560 °C
		cycle number 0 (number of remaining cycles) When reaching the end of the program, there won't be any further automatic program start
		segment 2 (indication of segment 1 up to 16 possible) segment 2 is running at present
		segment type dwell dwell time might be a ramp as well (STYP/RAMP)

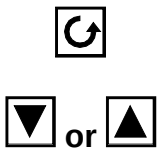
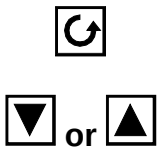
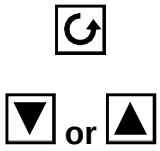
		segment time hour (remaining segment time in hours will be shown for just one second and alters automatically)
wait for 2 sec.		segment time 1.8 the remaining time of the segment constitutes 1,8 hours
		program time hour (remaining program time in hours) (will be shown for just one second and alters automatically)
wait for 2 sec.		program time 4.1 the remaining program time constitutes 4,1 hours
		push buttons **at the same time**; for the base display section; actual value 1.560 ℃; remaining time for example 2,8 hours.
		actual value 1.560 ℃; remaining time 2,8 hours; base display section
		temperature in degree Celsius (shown just for a short time) push the button **twice** within two seconds
2 x within 2 sec.		run list list of the operation parameter
		program list list of the program parameter
		program 1 (Indication of program 1 up to 4 possible) program 1 runs at present (compare with illuminated push-buttons 1 to 4)
 **or**		The number of the program to be verified might be altered via the "up" or "down" button.
		hold back off (setpoint retain function is disabled)The "set point brake" is switched off (perhaps used at bigger furnaces)
		hold back value 0 the "set point break" value is zero
		ramp unit hour indication of ramps by rate in degree(s) Celsius per hour
		dwell unit hour indication of dwell times in hour(s)
		cycle number 1 One program cycle will be executed

↻		segment number 1 indication of the parameters and values of segment 1
↻		type ramp rate (type ramp rate in degree Celsius / per hour) the segment is a ramp, the value is a rate
↻		target 1560 degree Celsius the target of the ramp is 1.560 °C (".. up to the value...")
↻		rate 600.0 (rate 600 degree Celsius per hour) the rate constitutes 600 °C / hour ("... with the r ate of ...)
↻		segment number 2 indication of parameters and values of segment 2
↻		type dwell the segment is a dwell time
↻	 	duration hour (will be shown for just 1 sec. and alters automatically) duration 2.0 the dwell time constitutes 2,0 hours
↻		segment number 3 indication of parameter and values of segment 3
↻		type ramp rate (typ rampe rate in degree Celsius / hour) the segment is a ramp, the value is a rate
↻		target value 200 degree Celsius the target value of the ramp is 200 °C (".. up to t he value ...")
↻		rate 600.0 (rate 600 degree Celsius per hour) the rate constitutes 600 °C / hour ("... with the rate of ...)
↻		segment number 4 indication of the parameter and values of segment 4
↻		type step the segment is a value skip
↻		target 0 the target value of the skip is 0 °C
↻		segment number 5 indication of parameter and values of segment 5
↻		type end defines the end of the program

		end type dwell By reaching the end of the program, the controller remains in a stand-by state (prescribed)
		actual value 1.560 ℃; remaining time for example 2,8 hours Push the buttons **at the same time**; back to the base display section
Introduction to the programming section		
button	**display**	**comment**
		**20 / 0.0** (temperature of the furnace 20 ℃; remaining time 0,0 hours)
2 x within 2 sec.		temperature in degree Celsius (shown just for a short time) push button **twice** within two seconds
		**run / LiSt** (list of operation parameters)
		**ProG / LiSt** (list of program parameters)
oder		**PrG.n / 1** (program number 1) with arrow keys choose program 1 display twinkles once for confirmation
Entry of the characteristic values of the program		
oder		**Hb / OFF** Hold Back operation of the setpoint with arrow keys choose **OFF** display twinkles once for confirmation
oder		**Hb V / 0** Hold Back Value with arrow keys choose **0** display twinkles once for confirmation
oder		**rmP.U / Hour** Ramp value Hour with arrow keys choose **hour** display twinkles once for confirmation

↻ ▼ **oder** ▲		**dwL.U / Hour** Dwell value Hour with arrow keys choose h**our** display twinkles once for confirmation
↻ ▼ **oder** ▲		**CYC.n / 1** cycle number 1 with arrow keys choose **1** display twinkles once for confirmation
Entry of the segment 1 ramp		
button	**display**	**comment**
↻ ▼ **or** ▲		**SEG.n / 1** segment number 1 with arrow keys choose segment **1** display twinkles once for confirmation
↻ ▼ **or** ▲		**tYPE / rmP.r** type ramp rate with arrow keys choose **rmP.r** display twinkles once for confirmation
↻ ▼ **or** ▲		**tGt / 1560** target 1560 target value 1.560 ℃) with arrow keys choose **1560** display twinkles once for confirmation
↻ ▼ **or** ▲		**rAtE / 600.0** rate 600 ℃/hour with arrow keys choose **600** display twinkles once for confirmation
entry of the segment 2 abidance		
↻ ▼ **or** ▲		**SEG.n / 2** segment number 2 with arrow keys choose segment **2** display twinkles once for confirmation
↻ ▼ **or** ▲		**tYPE / dwEll** type dwell with arrow keys choose **dwEll** display twinkles once for confirmation
↻		**dur / Hour** duration hour

▼ or ▲		indicates for just one hour and alters automatically **dur / 2.0** duration 2.0 hours with arrow keys choose **2.0** display twinkles once for confirmation
Entry of the segment 3 ramp		
button	**display**	**comment**
↻ ▼ or ▲		**SEG.n / 3** segment number 3 with arrow keys choose segment **3** display twinkles once for confirmation
↻ ▼ or ▲		**tYPE / rmP.r** type ramp rate with arrow keys choose **rmP.r** display twinkles once for confirmation
↻ ▼ or ▲		**tGt / 200** target 200 °C with arrow keys choose **200** display twinkles once for confirmation
↻ ▼ or ▲		**rAtE / 600.0** rate 600 °C/hour with arrow keys choose **600** display twinkles once for confirmation
Entry of the end of the program		
↻ ▼ or ▲		**SEG.n / 4** segment number 4 with arrow keys choose segment **4** display twinkles once for confirmation
↻ ▼ or ▲		tYPE / StEP type step with arrow keys choose **StEP** display twinkles once for confirmation
↻ ▼ or ▲		**tGt / 0** target 0 °C with arrow keys choose **0** display twinkles once for confirmation

		**SEG.n / 5** segment number 5 with arrow keys choose segment **5** display twinkles once for confirmation
		**tYPE / End** type end with arrow keys choose e**nd** display twinkles once for confirmation
		**End.t / dwell** end type dwell with arrow keys choose **dwEll** display blinks once for confirmation
		push the buttons **at the same time**; back to the base display section; actual value 20 °C; remaining time 0,0 hours

For full particulars of the program modification, please refer to the instruction manual of the controller, which has been assigned with the furnace.

No manual found? >>> www.eurotherm.com/products/controllers/2400_doc.htm

Of course the support will be provided by service-technicians of "Thermo-Star" as well.

7. Program choice buttons

By pushing a program choice button, the particular burn program will be started. The accordant program choice button glows, during the execution.

By pushing any program choice button for about 2 seconds, the running burn program will be aborted. The controller and the programmable logic controller (PLC) will be reset as well.

In case of a system error, all program choice buttons will blink synchronously. In this case, please contact a service technician of the company Thermo- Star by telephone.

8. Burn support

The burn support is hexagonal with a flange size of 120 mm and the angle size 140 mm. The allowed loading height ex the surface of the burn support constitutes 80 mm in the middle und 100 mm outside the middle.

Not a single object may protrude the burn support. It may just be charged with burn utilities which were delivered or released by Thermo-Star. This should be observed, therewith the chamber-lining and the heating elements will not be overloaded or damaged mechanically or chemically.

The isolation of the furnace consists of vacuum formed plates of oxide ceramic filaments and is only intended for the firing of oxide ceramics like yttrium-stabilized zirconium dioxide (Y_2O_3-ZrO_2) or aluminium dioxide (Al_2O_3). Organic binder, alkali, chloride, nitride and other salts will gnaw at the isolation and the heating elements. These will be destroyed by chemical reactions and the lowering of the melting point.

By using wrong burn utilities and chemically aggressive loads the guarantee can expire. Before using other burn utilities please get in contact with an expert of the company Thermo-Star.

9. Cooling air inflow

Both sides of the furnace are equipped with air fences. The required cooling air will be aspirated from the ventilators, which are located inside.

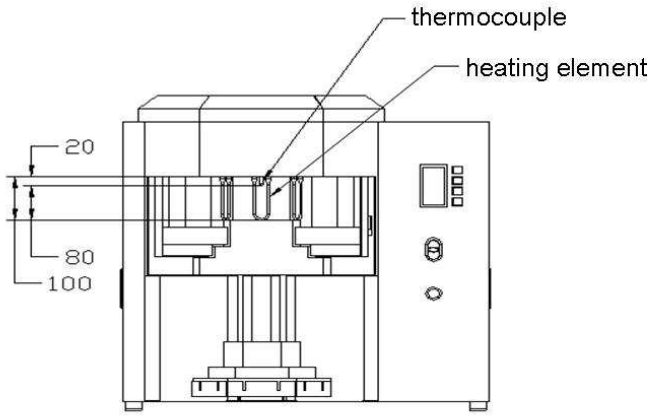
The air fences mustn't be covered anyway. The sideways distance to cold devices must be at least 20 cm, and the all-side distance to hot devices must be at least 1 m. The effect of hot devices must be controlled in individual case.

The design of the isolation and the cooling of the furnace assures chassis-temperatures of less than 60 °C (ambient temperatu re ≤ 25 ℃).

Ambient temperatures above 30 ℃ or a covered air f ence will result in higher chassis temperatures.

This might cause physical injuries, severe damages and fires.

10. Usable volume



As already described in the section "**burn support**", the base area of the burn chamber is hexagonal and it has diagonals of 120 or 140 mm respectively and a square footage of 125 cm^2.

The usable height constitutes 80 mm due to the centrally arranged thermocouple. The diameter of the thermocouple constitutes about 10 mm and it extends 20 mm into the furnace chamber. For ideal temperature survey the peak of the thermocouple must be positioned centrally.

While loading the furnace it is responsible for seeing, that the afore mentioned heights will not be exceeded, otherwise severe damages and fires might occur.

11. Failures

By appearance of any failures, please do not hesitate to contact a service technician of the company Thermo-Star.

Tel. +49-241 60845-0

Most of the defects can be diagnosed with your assistance via telephone and some of them might be repaired by yourself, under a code of practice.

At other failures or repairs the visit of a service technician is required.