

# Operating Instructions

## Controller

**B130/B150/B170/C280/C290/C295/P320**

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ENGLISCH

Translation of the original operating instructions



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## 1 Introduction

### Dear Customer,

Thank you for choosing a quality product from Nabertherm GmbH.

With this system, you have selected a product which is tailored specifically to your manufacturing and production conditions and of which you can be justifiably proud.

This product is characterized by

- Easy operation
- LCD display
- Rugged construction
- For use near machinery
- Optional RS-422 data interface

Your Nabertherm Team



### Note

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### Industrial property rights

All rights to drawings and other documents plus all rights of disposal are held by Nabertherm GmbH, including in the event of industrial property right applications.

## 1.1 Warranty and Liability



**The Nabertherm warranty conditions or warranty services regulated in the individual contracts apply with regard to the warranty and liability. However, the following also additionally applies:**

Warranty and liability claims in the event of personal injury and material damage are out of the question if these are attributable to one or more of the following causes:

- Each person involved in operating, installing, maintaining or repairing the system must have read and understood the operating instructions. No liability is accepted for damage and malfunctions arising from nonadherence to the operating instructions.
- Improper use of the system.
- Improper installation, commissioning, operation and maintenance of the system.
- Operation of the system with defective safety systems or improperly installed or nonfunctional safety and protective devices.
- Nonadherence to the notes contained in the operating instructions regarding the transport, storage, installation, commissioning, operation, maintenance and setup of the system.
- Unauthorized system design changes.
- Unauthorized operating parameter changes.
- Unauthorized parameterization, setting and program changes.
- Original parts and accessories have been designed especially for Nabertherm furnace systems. Only use original Nabertherm replacement parts. Otherwise, the warranty will be void. Nabertherm assumes no liability for damages resulting from use of nonoriginal parts.
- Catastrophes due to the effects of foreign bodies and force majeure.

## 1.2 General

Before working on electrical systems, switch the power switch to "0" and disconnect the power cord!

Even with the power switch off, some parts in the furnace may carry voltage!

Work on the electrical system may only be done by a trained person!

The furnace and switching system have been preset by the Nabertherm company. If required, a process-dependent optimization must be carried out in order to achieve the best possible control behavior.

The temperature curve must be modified by the user so that the load, furnace or surrounding are not damaged. Nabertherm GmbH assumes no guarantee for the process.



### Note

Before working on the program-controlled grounding receptacle (optional series L, HTC, N, HL) or the device connected to it, always turn off the furnace and disconnect the power cord.

Carefully read the operating manual of the controller in order to avoid operation mistakes or malfunction of the controller/furnace during operation.

## 1.3 Safety

The controller has a series of electronic safety systems. If a fault occurs, the furnace automatically shuts off and a fault message appears in the LCD display.



### Note

For more information, please see Chapter "Faults - fault messages"



### Warning! General Hazards!

The Operating Instructions must be followed prior to switching on the furnace.



## 2 Operation

### 2.1 Power switch/control current switch

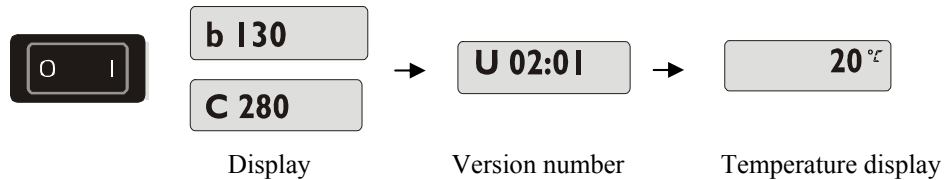


The power switch/control current switch is located below or next to the keyboard block. Stop running heating programs before turning off the furnace with the power switch.

### 2.2 Turning on the controller/furnace

Switch power switch to "I" position. The controller first displays the controller type and version number and then the temperature display. If the temperature is displayed, the controller is ready to operate.

#### Turning on the controller



All necessary settings for proper function have already been done at the factory.

For the B 130 and C 280, heating programs for baking and glazing (see chapter "Preconfigured programs for the B 130/C 280") are configured. For the other controllers, the heating programs must be configured on a process- or user-specific basis.



#### Note

Some new functions depend on the version number. Turn the controller off and on again briefly to be able to read the version number.

### 2.3 Turning off the controller/furnace

Turn off main switch at position "O".

#### Note

Stop running heating programs before turning the furnace off at the main switch, since the controller will otherwise generate a fault message when it is turned back on. See Faults/fault messages

### 3 Control fields and display

#### P 320

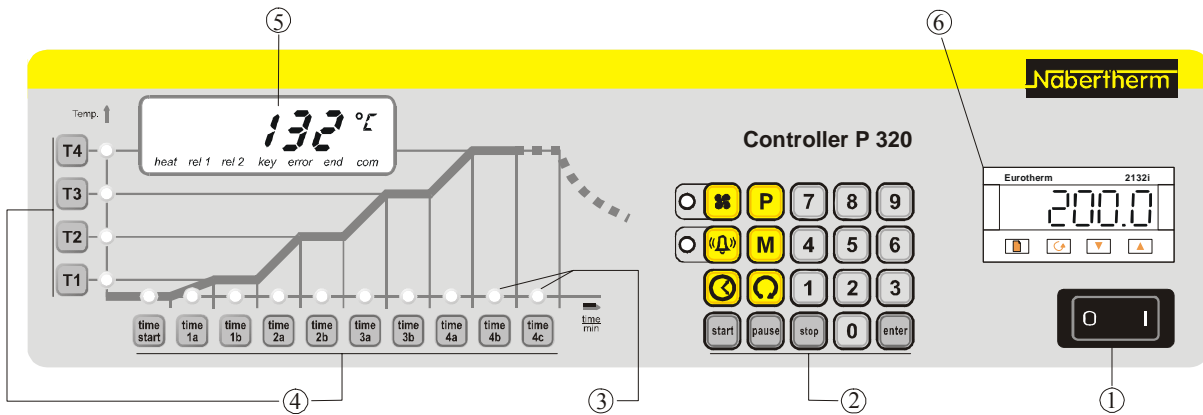


Fig. 1: P 320 control field

#### B 170

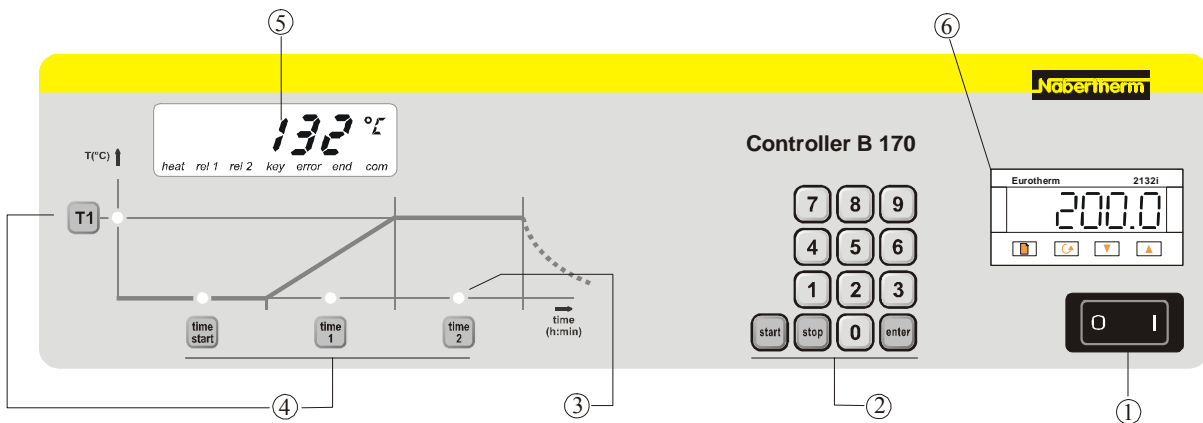


Fig. 2: B 170 control field

#### B130/B150/C280/C290/C295

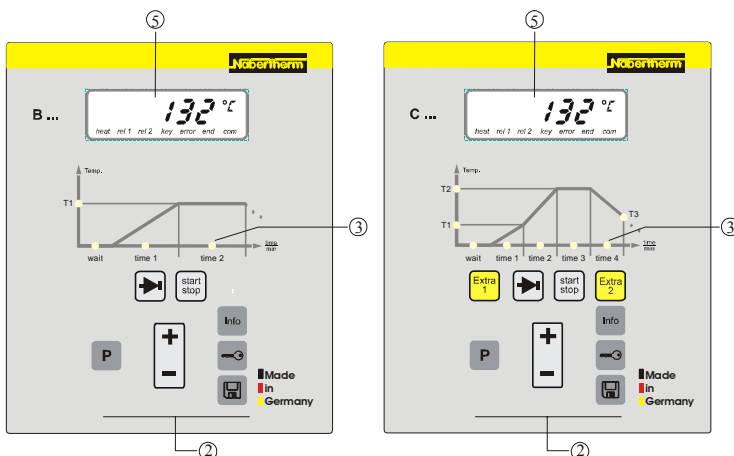


Fig. 3: B130/B150/C280/C290/C295 control field

- 1 = Power switch
- 2 = Keyboard block
- 3 = Program LED
- 4 = Programming keys
- 5 = Display
- 6 = Over-temperature limit controller (optional)

## 3.1 Displays

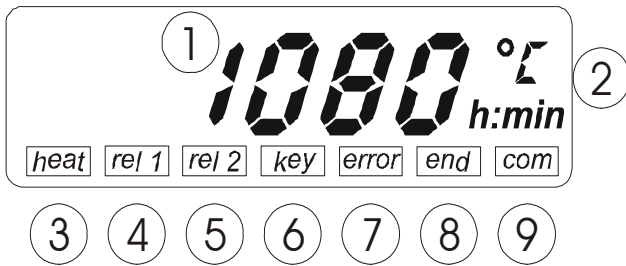


Fig. 4: Display

- 1 = Furnace temperature
- 2 = Temperature unit °C/°F
- 3 = Heating on
- 4 = Extra relay 1 ON
- 5 = Extra relay 2 ON (or ventilation motor ON)
- 6 = Key lock (B 130/C 280 only)
- 7 = Error message
- 8 = Program end
- 9 = PC communication (optional)

## 3.2 Keyboard blocks

### B150, C 290 and C295

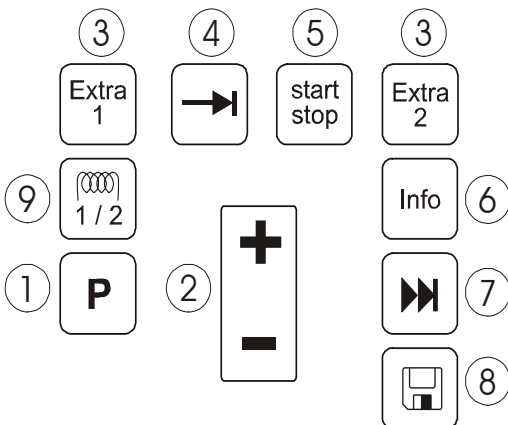


Fig. 5: B 150, C 290/C 295 keyboard block

- 1 = Program selection
- 2 = +/-
- 3 = Extra functions (not B 150)
- 4 = Page
- 5 = Program start/stop
- 6 = Info menu
- 7 = Segment skip (not B 150)
- 8 = Save
- 9 = Heating circuit (C 295 only)

### B 130 and C 280

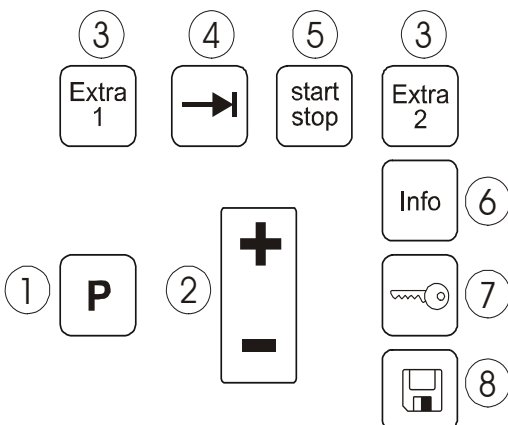


Fig. 6: B 130/C 280 keyboard block

- 1 = Program selection
- 2 = +/-
- 3 = Extra functions (not B 130)
- 4 = Page
- 5 = Program start/stop
- 6 = Info menu
- 7 = Key lock
- 8 = Save

**P 320**

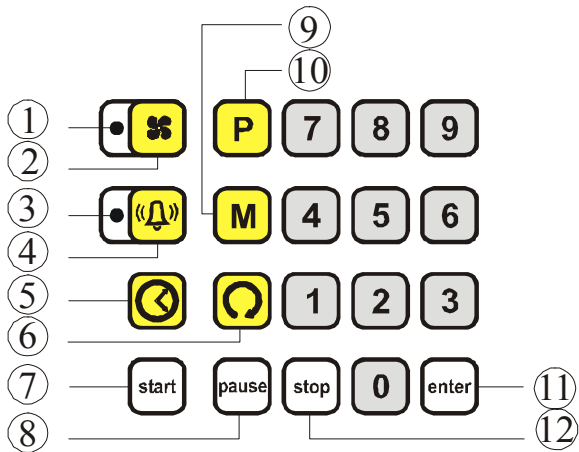


Fig. 7: P 320 keyboard block

**B 170**

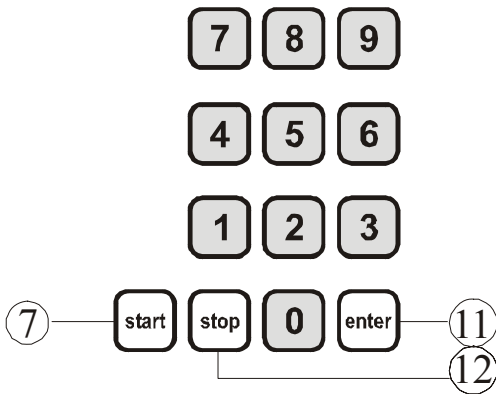


Fig. 8: B 170 keyboard block

- |                             |             |
|-----------------------------|-------------|
| 1 = LED, fan outlet ON      | (not B 170) |
| 2 = Button fan/KAT          | (not B 170) |
| 3 = LED, acoustic signal ON | (not B 170) |
| 4 = Acoustic signal         | (not B 170) |
| 5 = Time of day             | (not B 170) |
| 6 = Chaining                | (not B 170) |
| 7 = Program start           |             |
| 8 = Program pause           | (not B 170) |
| 9 = Memory/save             | (not B 170) |
| 10 = Program selection      | (not B 170) |
| 11 = Confirm input          |             |
| 12 = Program stop           |             |

## 4 Features of the Controller

### 4.1 Functions

Controller \ Function	B 130	B 150	B170	C 280	C 290	C 295	P 320
Over-temperature protection <sup>1)</sup>	√	√	√	√	√	√	√
Extra relay function	-	-	-	2 <sup>4)</sup>	2 <sup>4)</sup>	2 <sup>4)</sup>	1
Manual configuration of the heating circuits	-	-	-	-	-	√	-
Air circulation motor control <sup>2)</sup>		√	√	√	√	√	√
Waiting time	√	√	√	√	√	√	√
Number of programs	2	1	1	9	9	9	9
Number of segments	4	2	2	4	40	40	9
Program chaining	-	-	-	-	-	-	√
Auto tune	√	√	√	√	√	√	√
KW/hr counter <sup>3)</sup>	√	√	√	√	√	√	√
Operating hours counter	√	√	√	√	√	√	√
Real-time clock	-	-	-	-	-	-	√
Acoustic signal	-	-	-	-	-	-	√
RS-422 data interface	Option	Option	Option	Option	Option	Option	Option
Constant heat output	-	-	-	-	-	√	-

1) When the program starts, the highest temperature in the program is calculated. If the furnace is 30°C warmer than the highest program temperature for 3 minutes during the program sequence, the controller turns off the heating and the safety relay, and a fault message appears.

2) Preconfigured function for circulation furnaces: Once a program has been started on the controller, the air circulation motor starts. It remains in operation until the program terminates or is interrupted, and the furnace temperature falls back below 80°C. Extra function 2 is no longer available with this function.

3) The kW/hr counter calculates the power theoretically consumed over the time the heater is turned on for a heating program at nominal voltage. However, there may actually be deviations: If the voltage is low, the power consumption displayed will be too high, and for a higher voltage the power consumption displayed will be too low.

4) In furnaces with an air circulation motor, only one extra function is usually available (see furnace operating instructions).

## 5 New functions of the Nabertherm controller

### 5.1 Program entry with/without gradient as of version 3.xx

As of controller version 3.xx, the input of ramps can optionally be performed as a gradient (e.g. 120 °C/hr) or using combined "time and set temperature".

Turn the controller off and on again briefly to be able to read the version number.

The input mode can be changed on a user-specific basis in the configuration in support of the process specification. To change the input mode, see "Configuration"

The mode configured can be seen during program input in a segment, e.g. "time 1", as follows:

For "time and set temperature" input, only °C/°F or time hr:min is displayed as the input unit. For gradient input, °C/°F and hr:min appear together in the display as the unit. The maximum gradient is 6000 °C (fast heating)

### 5.2 Program starting behavior for warm furnaces as of controller version 3.xx

If the furnace temperature ① at program start is higher than the set temperature ② of the first segment "T 1", the program start is delayed until the furnace chamber temperature cools to a value of T1 + 10 °C ③. That is, segment "Time 1" is skipped and the program start occurs in the following segment "Time 2".

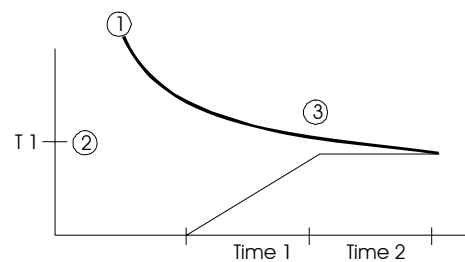


Fig. 9: Program start behavior

This **program start behavior** is permanently programmed into all controllers as of version number 3.xx and cannot be changed. Turn the controller off and on again briefly to be able to read the version number.

### 5.3 Power failure behavior

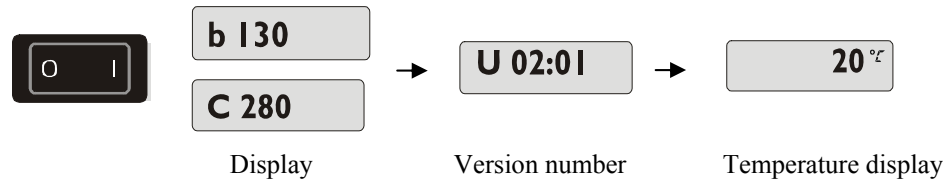
As of controller version 3.xx the power failure behavior can be configured.

Turn the controller off and on again briefly to be able to read the version number. To change the power failure behavior, see chapter "**Configuration/customer-specific settings**".

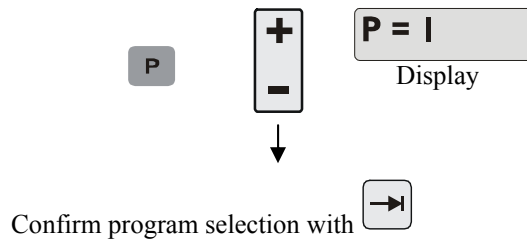
## 6 Controller B 130/C 280

### 6.1 Brief instructions

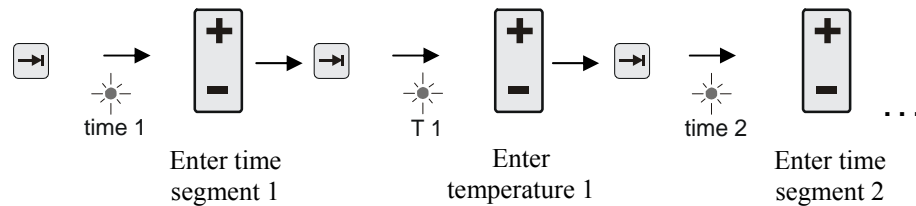
#### Turning on the controller



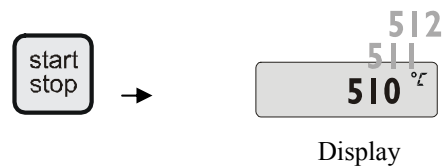
#### Call program



#### Enter / control program



#### Start program



### 6.2 Setting or changing program/waiting time

For the automatic operation of the furnace, before starting the controller a temperature characteristic must be configured which describes the desired temperature behavior. This configured temperature behavior is also called a heating program.

Each heating program for the B 130 and C 280 has two ramps, one holding time, and one cooling ramp.

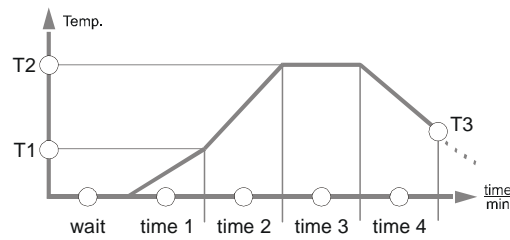



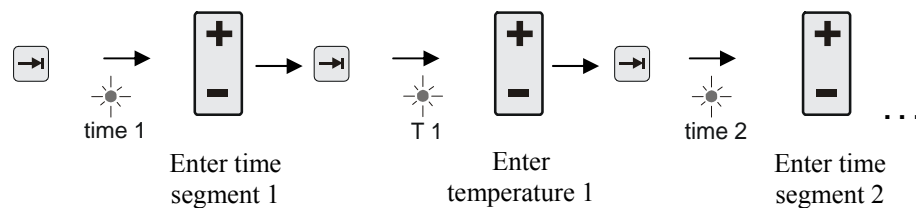
Fig. 10: Program graphic, B 130/C 280

- In the **ramps**, a segment temperature "**T**" and a segment time, "**time 1**" and "**time 2**" define a linear temperature increase (slow heating).
- In the **holding time**, "**time 3**" determines how long the temperature value configured in "**T 2**" should be held.
- In the **cooling time**, the natural cooling can be slowed using the rate set in "**T 3**" and "**time 4**". If there is no specification in "**T 3**" and "**time 4**", the program is already terminated after "**time 3**" has elapsed.


### Program Entry

Using the paging key  you can enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "**T**" or "**time**".

### Enter / control program





In the display, the temperature value "**T**" or time value "**time**" corresponding to the flashing LED is shown.

If the value displayed should not be changed, use the page key  to page to the next temperature or time value.


The display also shows the unit of the value expected:

- set temperature values with °C/°F
- set time specifications with **hr:min**
- set gradient specifications with °C/hr:min or °F/hr:min

If a value should be changed, you can set it with the  key.

Each time you press the  key, the value changes by 1 °C or by one minute.



If you hold the  key down, the value first changes in steps of 10,

and if you hold the  key down for a longer time, the value changes in steps of 100.

Entry of times is done in hours and minutes, e.g. **6 hr** and **30 min** as **06:30**.

For holding times, an entry of **99:59** means program execution will continue forever. When input is complete, the program can be started (see Starting the program).

If ramps contain the time entry **00:00**, the controller attempts to reach the temperature value stored in "T" as quickly as possible

If no key is pressed for 60 seconds, the display automatically returns to the display of temperature. Changed settings are initially only buffered. If a changed or new program should be permanently stored in the controller for more frequent use, see "Saving programs".

**Note**

Not all segments have to be programmed. For segments which are not needed, the temperature and time values must be set to "0". The controller then automatically ends the program after the last segment programmed

## 6.3 Setting or changing the waiting time

### Waiting time B 150/C 290/C 295

To start a heating program automatically at a later point in time, e.g. after a drying time, a waiting time "**wait**" can be programmed.

To select the waiting time, press the scroll key repeatedly until the "**Wait**" LED flashes.

The entry of times is in hours and minutes, e.g. 6 hrs and 30 min as 06:30, i.e., when a heating program is started, first the wait time elapses and only then does the program start with segment 1 and heating.

## 6.4 Programming extra functions

With controllers of types "C" and "P", up to two optional extra functions "**Extra 1**" and "**Extra 2**" can be turned on or off in the segments depending on the program

Extra functions are, for instance, exhaust air flaps, fans, solenoids, or optical and acoustic signals, which have been included in the furnace (if applicable, see additional operating instructions for extra functions)

These extra functions can be specified during program entry in all segments, e.g. "**time 1**", by selecting the "**Extra 1**" or "**Extra 2**" key.

That is, when the controller processes the programmed segment, the extra functions are automatically turned on and then turned back off in the next segment, for instance.

Programming of extra functions is done during program entry.

The desired segment must be selected as described in "Entering programs/wait time", so that the corresponding LED, e.g. "**time 1**", is flashing.

If the "**Extra 1**" or "**Extra 2**" key is now pressed, the extra function is specified for this segment, and in the display the status field "**REL 1**" lights up for "**Extra 1**" and/or "**REL 2**" for "**Extra 2**". During program execution, the programmed extra function is automatically turned on during this segment.

To turn off the specification of an extra function, press the corresponding "Extra" key again – in the display, the status field "REL 1" or "REL 2" disappears – the extra function is now no longer turned on. Both extra functions can also be activated at the same time.

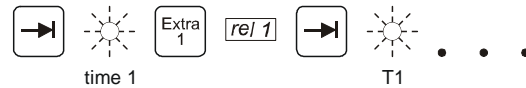


Fig. 11: Selection of "Extra 1 funktion" in segment "time 1"; LED "time 1" flashes

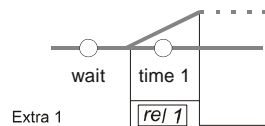



Fig. 12: In the display, "REL 1" lights up for the selected "Extra 1 funktion"

When paging through the program with , programmed extra functions are indicated in each segment ("time" LED flashing) with the status fields "REL 1" or "REL 2" in the display – if the status fields do not light up, the extra functions are not specified.



**Note**

The programming of extra functions is saved along with storage of heating programs!

## 6.5 Programming extra functions in "T3" (C 280 only)

When programming extra functions in the program value "T3" (C 280 only), the extra function stays turned on after conclusion of the program, for instance in order to continue cooling the furnace with a cooling fan.

Extra functions which are automatically turned on during program execution by "T3" must be turned off by hand if necessary.

## 6.6 Turning extra functions in program execution on and off by hand


Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "Extra" key.


If an extra function is turned on during a running program, it remains on until the program-specific segment transition to the following segment occurs.

## 6.7 Saving programs

Changed settings are initially only buffered. That is, buffered programs are overwritten once a different program is called up. If a changed or new program should be permanently saved in the controller for more frequent use, it can be saved to a permanent program slot as follows:

Press the save key  – a program number appears in the display.

The number can be changed to the desired program number using .

Pressing the save key  again finally saves to the selected program slot.

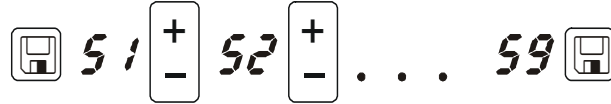



Fig. 13: Saving a program to program slot no. 9

The program can now be called up from this storage slot at any time (see Program start)



### Note

Existing heating programs already saved in a storage slot will be overwritten with no message or warning. Saved heating programs are still retained after the controller is turned off. Configured waiting times are not saved. They must be reentered before each process! The controller automatically returns to the display of the furnace temperature after about 10 seconds when you save without pressing the save key  again. The program is only buffered in this case.

## 6.8 Preconfigured programs for the B 130/C 280

The following programs are preconfigured and can be started directly.

Baking is suitable for the baking of clay, while glazing is suitable for the baking of glazes.



### Note

In any case, note the specifications and instructions of the manufacturer which may make it necessary to change or adapt the preconfigured programs. It cannot be guaranteed that optimum results can be obtained with the preconfigured programs. The configured factory programs can be overwritten for your own purposes (see Setting programs/wait time).

### B 130

➔	T1	Time1	T2	Time2	Time3	Time4	T3	
P1	650	6:00	900	0:00	0:20	0:00	0	Baking
P2	500	3:00	1050	0:00	0:20	0:00	0	Glazing

### C 280

➔	T1	Time1	T2	Time2	Time3	Time4	T3	
P1	650	3:00	900	0:00	0:20	0:00	0	Baking 1
P2	650	6:00	900	0:00	0:20	0:00	0	Baking 2

P3	650	5:00	1100	0:00	0:30	0:00	0	Baking 3
P4	320	2:00	1050	0:00	0:20	0:00	0	Glazing 1
P5	500	3:00	1050	0:00	0:20	0:00	0	Glazing 2
P6	500	3:00	1200	0:00	0:20	0:00	0	Glazing 3
P7								Unused
P8								Unused
P9								Unused



**Note**

For furnace models with lower maximum temperatures, the programs listed above are adapted at the factory to the maximum temperature of the furnace.

### 6.9 Calling programs

Call up saved programs with the **P** key. Use the **+**/**-** key to select the desired program number and control the program using the **→** key.



Fig. 14: Calling heating program no. 9



**Note**

Check the heating program called up before starting it, to be sure that it is the right heating program.

As of version 3, heating programs are reloaded after program termination. That is, the heating program can be started after a process without having to reenter it. Turn the controller off and on again briefly to be able to read the version number .

### 6.10 Program Start

After a heating program is entered or called up, it can be started with the **start/stop** key.

**As of version 3:** if the furnace temperature at the starting time is higher than the temperature specified in "T 1", the controller first waits until the temperature of the warm furnace has fallen to the first segment temperature T1, and only then does it start the rest of the program's execution. (See also Chapter "New functions of the Nabertherm controller"). For a cold furnace, the heating program is started immediately.


If the heating program has been started, during program execution the LED of the active segment "time 1 – time 4" lights up. The controller regulates the configured temperature profile completely automatically and the status field "**heat**" lights up in the heating cycle.


If the waiting time is set, the LED "**wait**" first lights up and the display counts down the remaining waiting time. The status field "**heat**" only lights up after program start in segment "**time 1**" if the heater is turned on. After conclusion of the last segment, the heater

is turned off and the program terminates. In the display, the end of the program is indicated with the message "end".

## 6.11 Program change during execution




During program execution, program changes can be made as follows:

Use the paging key  to enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "T" or "time".

In the display, the temperature value "T" or time value "time" corresponding to the flashing LED is shown. Holding times can be changed in steps of 5 minutes and temperatures by +/- 1 °C/°F. If the value displayed should not be changed, use the page key  to page to the next segment or time value. All temperature and time values, as well as the extra functions, can be changed; the only exception is the segment time of the ramp currently being processed.




### Note

Changes to individual values during program execution must be confirmed with . Otherwise, the change will not be accepted. If you only want to change the active holding time segment, this can be done without selecting using the paging key . To do this, you can use the  key directly to increase or decrease the holding time in steps of five minutes.

Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "Extra" key.

## 6.12 Terminating a program

To terminate a program, press the  key again. The heater is turned off and the status field "end" lights up. Program termination can be performed at any time.



### Note

It is not possible to interrupt a program temporarily!

## 6.13 Key locking



For protection against unintended or unallowed changes to the program execution, the keyboard can be locked after program start using the "key lock". Key locking can only be released by turning the controller off and on again. If the furnace is turned off while a program is running, see the power failure behavior.

## 6.14 Info menu

From the info menu, the current program status, program-relevant information, and fault messages can be read out.

### Info

You can reach the info menu by pressing the "**Info**" key.

Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.

Pr	Selected program
SP	Set temperature value
Pt	Program run time of the active/last program, in minutes
E	Power consumption of the active/last program, in kW/hr
tt	Total operating hours
OP	Heating output power in %
F1	Fault buffer of last fault
F2	Fault buffer of next to last fault
Ht	Highest program temperature of the active/last program
tA	Maximum furnace temperature



### Note

The info menu is **not automatically** switched back to the temperature display, so that you can observe it for longer periods of time.

Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.

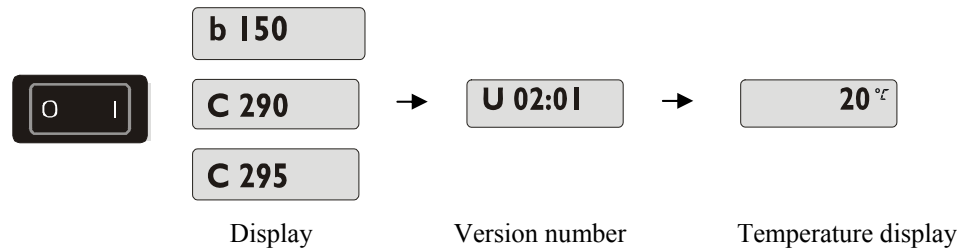
Some values are reset after a heating program is started.

The operating hour counter can only be reset by Nabertherm

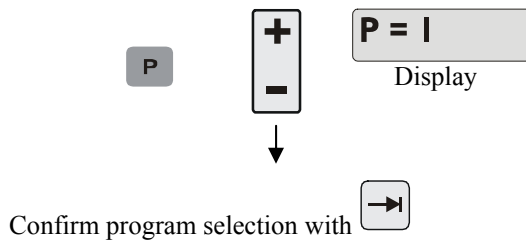
## 7 Controller B 150/C 290/C 295

### 7.1 Brief instructions

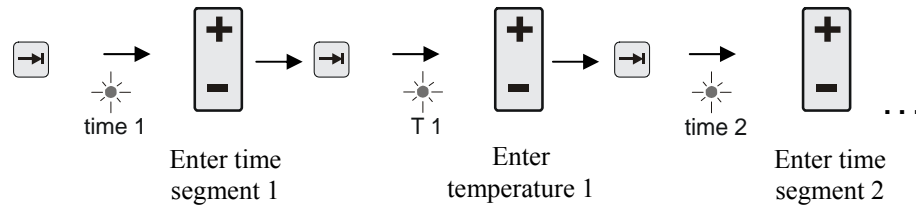
Turning on the controller



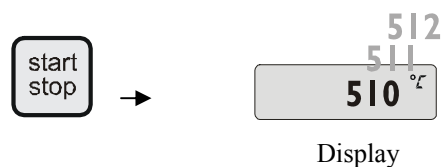
Call program



Enter / control program



Start program



### 7.2 Setting or changing program/waiting time

For the automatic operation of the furnace, before starting the controller a temperature characteristic must be configured which describes the desired temperature behavior. This configured temperature behavior is also called a heating program.

#### C 290/C 295

Each of the 9 heating programs for the C 290/C 295 has 20 ramps and 20 hold times (40 segments in all) which are connected together with the segment blocks **A – I**.

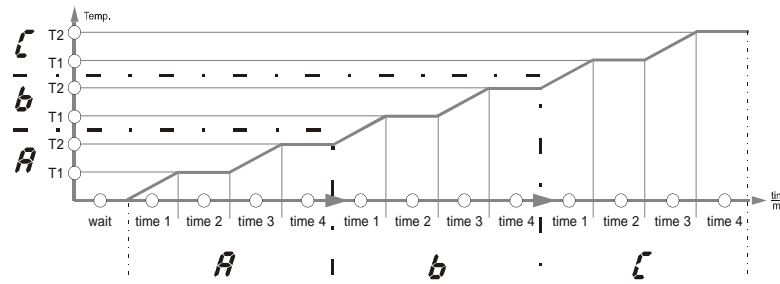


Fig. 15: Program graphic, C 290/C 295

**B 150**

The heating program for the B 150 has one ramp and one holding time.

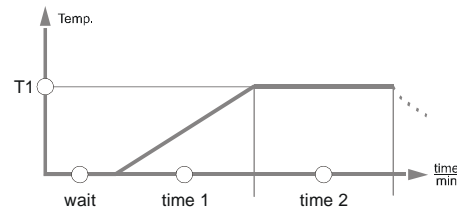



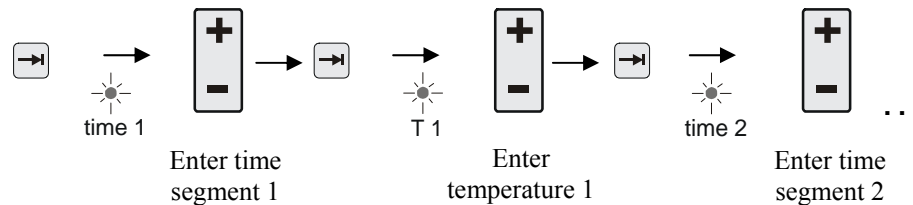
Fig. 16: Program graphic, B 150

- In a **Ramp**, a segment temperature "**T**" and a segment time, e.g. "**time 1**", define a linear temperature increase (slow heating).
- In a **holding time**, e.g. "**time 2**", it is configured how long the temperature value configured in "**T 1**" should be held.

**Program Entry**


Using the paging key  you can enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "**T**" or "**time**".

**Enter / control program**




In the display, the corresponding segment block **A-I** and the temperature value "**T**" or time value "**time**" corresponding to the flashing LED are also shown.





If the value displayed should not be changed, use the page key  to page to the next temperature or time value.

The display also shows the unit of the value expected:

- set temperature values with °C/°F
- set time specifications with **hr:min**
- set gradient specifications with °C/hr:min or °F/hr:min

If a value should be changed, you can set it with the  key.

Each time you press the  key, the value changes by 1 °C or by one minute.

If you hold the  key down, the value first changes in steps of 10,

and if you hold the  key down for a longer time, the value changes in steps of 100.

Entry of times is done in hours and minutes, e.g. **6 hr** and **30 min** as **06:30**.

For holding times, an entry of **99:59** means program execution will continue forever. When input is complete, the program can be started (see Starting the program).

If ramps contain the time entry **00:00**, the controller attempts to reach the temperature value stored in "T" as quickly as possible

If no key is pressed for 60 seconds, the display automatically returns to the display of temperature. Changed settings are initially only buffered. If a changed or new program should be permanently stored in the controller for more frequent use, see "Saving programs".



**Note**

Not all segments have to be programmed. For segments which are not needed, the temperature and time values must be set to "0". The controller then automatically ends the program after the last segment programmed

### 7.3 Setting or changing the waiting time

**Waiting time B 150/C 290/C 295**

To start a heating program automatically at a later point in time, e.g. after a drying time, a waiting time "**wait**" can be programmed.

To select the waiting time, press the scroll key repeatedly until the "**Wait**" LED flashes.

The entry of times is in hours and minutes, e.g. 6 hrs and 30 min as 06:30, i.e., when a heating program is started, first the wait time elapses and only then does the program start with segment 1 and heating.

### 7.4 Programming extra functions

With controllers of types "C" and "P", up to two optional extra functions "**Extra 1**" and "**Extra 2**" can be turned on or off in the segments depending on the program

Extra functions are, for instance, exhaust air flaps, fans, solenoids, or optical and acoustic signals, which have been included in the furnace (if applicable, see additional operating instructions for extra functions)

These extra functions can be specified during program entry in all segments, e.g. "time 1", by selecting the "Extra 1" or "Extra 2" key.

That is, when the controller processes the programmed segment, the extra functions are automatically turned on and then turned back off in the next segment, for instance.

Programming of extra functions is done during program entry.

The desired segment must be selected as described in "Entering programs/wait time", so that the corresponding LED, e.g. "time 1", is flashing.

If the "Extra 1" or "Extra 2" key is now pressed, the extra function is specified for this segment, and in the display the status field "REL 1" lights up for "Extra 1" and/or "REL 2" for "Extra 2". During program execution, the programmed extra function is automatically turned on during this segment.

To turn off the specification of an extra function, press the corresponding "Extra" key again – in the display, the status field "REL 1" or "REL 2" disappears – the extra function is now no longer turned on. Both extra functions can also be activated at the same time.

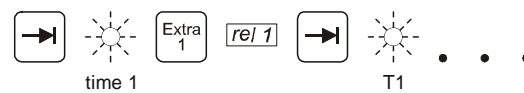


Fig. 17: Selection of "Extra 1 funktion" in segment "time 1"; LED "time 1" flashes

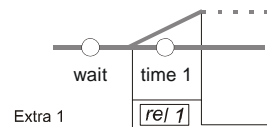



Fig. 18: In the display, "REL 1" lights up for the selected "Extra 1 funktion"

When paging through the program with , programmed extra functions are indicated in each segment ("time" LED flashing) with the status fields "REL 1" or "REL 2" in the display – if the status fields do not light up, the extra functions are not specified.



**Note**

The programming of extra functions is saved along with storage of heating programs!

## 7.5 Turning extra functions in program execution on and off by hand



Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "Extra" key.


If an extra function is turned on during a running program, it remains on until the program-specific segment transition to the following segment occurs.

## 7.6 Saving programs

Changed settings are initially only buffered. That is, buffered programs are overwritten once a different program is called up. If a changed or new program should be permanently saved in the controller for more frequent use, it can be saved to a permanent program slot as follows:

Press the save key  – a program number appears in the display.

The number can be changed to the desired program number using  .

Pressing the save key  again finally saves to the selected program slot.

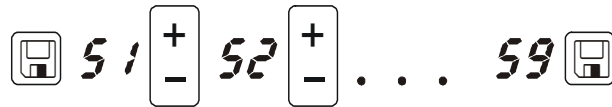


Fig. 19: Saving a program to program slot no. 9




Fig. 20: B 150 example programs

The program can now be called up from this storage slot at any time (see Program start)



### Note

Existing heating programs already saved in a storage slot will be overwritten with no message or warning. Saved heating programs are still retained after the controller is turned off. Configured waiting times are not saved. They must be reentered before each process! The controller automatically returns to the display of the furnace temperature after about 10 seconds when you save without pressing the save key  again. The program is only buffered in this case.

## 7.7 Calling programs




Call up saved programs with the  key. Use the  key to select the desired program number and control the program using the  key.



Fig. 21: Calling heating program no. 9




### Note

Check the heating program called up before starting it, to be sure that it is the right heating

program.

As of version 3, heating programs are reloaded after program termination. That is, the heating program can be started after a process without having to reenter it. Turn the controller off and on again briefly to be able to read the version number .

## 7.8 Program Start

After a heating program is entered or called up, it can be started with the  key.


**As of version 3:** if the furnace temperature at the starting time is higher than the temperature specified in "T 1", the controller first waits until the temperature of the warm furnace has fallen to the first segment temperature T1, and only then does it start the rest of the program's execution. (See also Chapter "New functions of the Nabertherm controller"). For a cold furnace, the heating program is started immediately.


If the heating program has been started, during program execution the LED of the active segment "time 1 – time 4" lights up. The controller regulates the configured temperature profile completely automatically and the status field "heat" lights up in the heating cycle.

If the waiting time is set, the LED "wait" first lights up and the display counts down the remaining waiting time. The status field "heat" only lights up after program start in segment "time 1" if the heater is turned on. After conclusion of the last segment, the heater is turned off and the program terminates. In the display, the end of the program is indicated with the message "end".

## 7.9 Program change during execution




During program execution, program changes can be made as follows:

Use the paging key  to enter input mode. Every push selects the following segment or time value. The selected value is displayed with the blinking LED for either "T" or "time".

In the display, the temperature value "T" or time value "time" corresponding to the flashing LED is shown. Holding times can be changed in steps of 5 minutes and temperatures by +/- 1 °C/°F. If the value displayed should not be changed, use the page key  to page to the next segment or time value. All temperature and time values, as well as the extra functions, can be changed; the only exception is the segment time of the ramp currently being processed.




### Note

Changes to individual values during program execution must be confirmed with . Otherwise, the change will not be accepted. If you only want to change the active holding time segment, this can be done without selecting using the paging key . To do this, you can use the  key directly to increase or decrease the holding time in steps of five minutes.

Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "Extra" key.

## 7.10 Terminating a program


To terminate a program, press the  key again. The heater is turned off and the status field "end" lights up. Program termination can be performed at any time.




### Note

It is not possible to interrupt a program temporarily!

## 7.11 Segment skip key (C 290, C 295 only)

Using the  key, the current segment can be shortened or accelerated as follows:


### Segment skip in a ramp



If the program is in a ramp, the  key sets the corresponding ramp time (e.g. "time 1" or "time 3") to zero, so that the controller attempts to reach segment temperature "T" as quickly as possible using maximum power and maximum gradients. After the segment temperature is reached, the segment advances.

### Segment skip in the holding time

If the "Segment skip" key is pressed during a holding time (e.g. "time 2" or "time 4"), then the holding time is ended immediately and the controller jumps directly into the next segment.

## 7.12 Heating circuits key (C 295 only)

The  key can be used to adapt the heating power individually to the process. The controller has two heater outputs whose relationship to one another can be adjusted by selectively reducing the two output lines. At delivery, both heating outputs are set to 100% output power.

By pressing the  key, the configured relationship in the table is initially shown. The  key can be used to change this relationship.




 0  - 1...99  + 1...99

Fig. 22: Setting the heating circuit relationship

Display	-100	-90	-80	-70	-60	-50	-40	-30	-20	-10	0	+10	+20	+30	+40	+50	+60	+70	+80	+90	+100
A1	0 %	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100	100	100	100	100	100	100	100	100	100	100
A2	100	100	100	100	100	100	100	100	100	100	100	90 %	80 %	70 %	60 %	50 %	40 %	30 %	20 %	10 %	0 %




### Examples:

1) At the setting "+ 100", the furnace is heated only over output A1. For instance, for a furnace for fusing applications, if only the ceiling heat should be used and the side or floor

heater should be turned off. Note that when operating with reduced heating power, the furnace may no longer be able to reach the maximum temperature specified on the type plate!

2) At setting "0", the furnace is operated with both heat outputs without reduction, for instance for an even temperature distribution when baking clay and ceramics.

3) At setting "-100", output 1, for instance the ceiling heat in fusing furnaced, is turned off. The furnace is heated only through the heater attached to output 2, e.g. the side and floor (see the furnace description). Note that when operating with reduced heating power, the furnace may no longer be able to reach the maximum temperature specified on the type plate! Since the configuration of the output power is process-dependent, these settings can be saved directly in the heating program. First enter the heating program as described, and

then press the  key to specify the relationship between heating outputs. By saving the heating program, the entire programming including the configured output power can be assigned to a program storage (see also "Saving programs"). The settings for the output power can also be controlled or changed at any time by pressing the  key. If there is no other input for 30 seconds, e.g. with the  keys, the display switches back to display of the temperature.



### Note

See the furnace instructions for which output (A1)(A2) is responsible for which heating zone

## 7.13 Info menu

From the info menu, the current program status, program-relevant information, and fault messages can be read out.

Info

You can reach the info menu by pressing the "**Info**" key.

Use the "**Info**" key to page through the entire info menu until the furnace temperature is displayed again.

Pr	Selected program
SP	Set temperature value
Pt	Program run time of the active/last program, in minutes
E	Power consumption of the active/last program, in kW/hr
tt	Total operating hours
OP	Heating output power in %
F1	Fault buffer of last fault
F2	Fault buffer of next to last fault
Ht	Highest program temperature of the active/last program
tA	Maximum furnace temperature



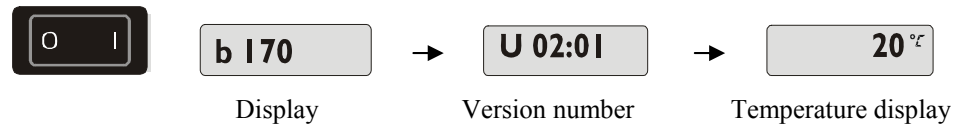
### Note

The info menu is **not automatically** switched back to the temperature display, so that you can observe it for longer periods of time.  
 Use the "Info" key to page through the entire info menu until the furnace temperature is displayed again.  
 Some values are reset after a heating program is started.  
 The operating hour counter can only be reset by Nabertherm

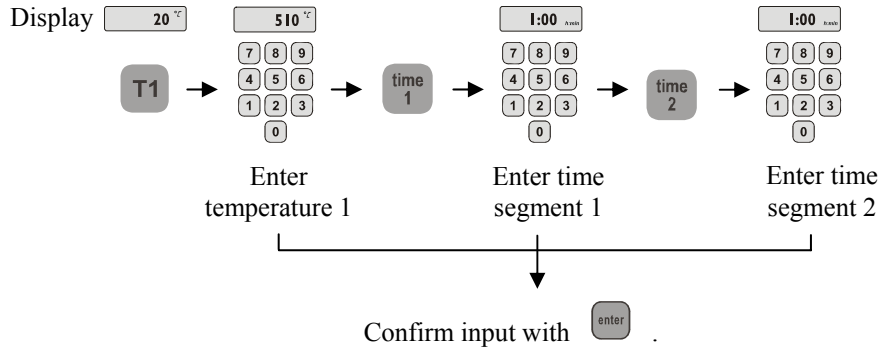
## 8 Controller B 170 (MB 1)

### 8.1 Brief instructions

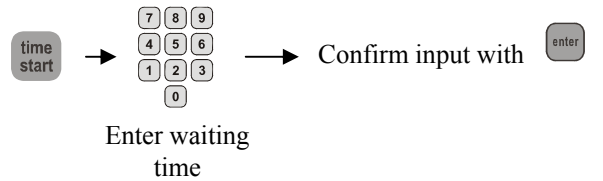
Turning on the controller



Enter program



Enter waiting time



Start program



## 8.2 Setting or changing program/waiting time

For the automatic operation of the furnace, before starting the controller a temperature characteristic must be configured which describes the desired temperature behavior. This configured temperature behavior is also called a heating program. The heating program for the B 170 has one ramp and one holding time.

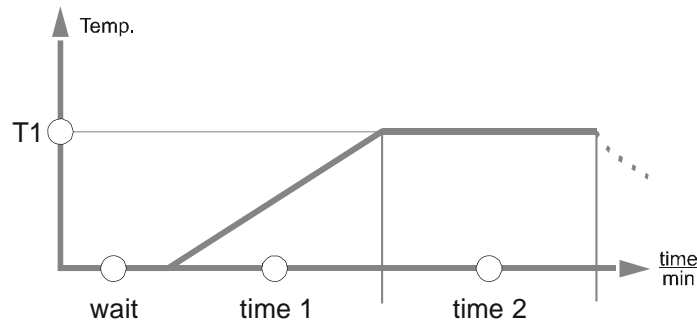


Fig. 23: Program graphic, B 170

- In the **ramp**, a segment temperature "**T**" and the segment time "**time 1**", define a linear temperature increase (slow heating).
- In the **holding time**, "**time 2**" determines how long the temperature value configured in "**T 1**" should be held.

### Program Entry

To enter a value, the desired program key "**T1**", "**time1**", or "**time 2**" is selected. The matching program LED "**T1**", "**time1**", or "**time 2**" starts to flash and the stored value is shown in the display.

The display also shows the unit of the value expected:

- set temperature values with °C/°F
- set time specifications with **hr:min**
- set gradient specifications with °C/hr:min or °F/hr:min

(Factory setting "Time and set temperature")

Value entry is done using the numeric keys in the keyboard block. Entries are shown directly on the display.

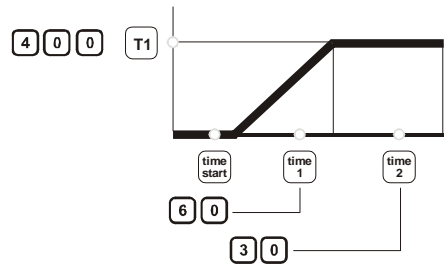
Time specifications must be given in the format **hr:min**, and preceding zeroes (**01:33**) are not required. The entry of the temperature value is done as a whole number, e.g. 800. If a holding time is specified as **99:59**, program execution will continue forever.

If ramps contain the time entry **00:00**, the controller attempts to reach the temperature value stored in "**T**" as quickly as possible

This program is configured as shown here:

**Example:** In 60 min, heat to 400 °C, then hold temperature for 30 min after it is reached.





When input is complete, the program can be started (see Starting the program). If no key is pressed for 60 seconds, the display automatically returns to the display of temperature. Changed settings are initially only buffered. If a changed or new program should be permanently stored in the controller for more frequent use, see "Saving programs".



### Note

Not all segments have to be programmed. For segments which are not needed, the temperature and time values must be set to "0". The controller then automatically ends the program after the last segment programmed

### Waiting time

To start a heating program automatically at a later time, for instance after a drying period, a waiting time "**time start**" can be programmed. The entry of times is in hours and minutes, e.g. 6 hrs and 30 min as 06:30, that is, when a heating program is started, first the wait time elapses and only then does the program start with segment 1 and heating.

**Example:** Turning on in 4h:00 min.



Fig. 24: Entry of a waiting period

## 8.3 Saving programs

The B 170 has no program storage




Configured waiting times are not saved. They must be reentered before each process!

## 8.4 Calling programs

The B 170 has no program storage

## 8.5 Program Start

After a heating program is entered or called up, it can be started with the  key.


If the heating program has been started, during program execution the LED of the active segment "time 1 – time 2" lights up.

The controller regulates the configured temperature profile completely automatically and the status field "heat" lights up in the heating cycle.

If the waiting time is set, the LED "wait" first lights up and the display counts down the remaining waiting time. The status field "heat" only lights up after program start in segment "time 1" if the heater is turned on.

After conclusion of the last segment, the heater is turned off and the program terminates. In the display, the end of the program is indicated with the message "end".

## 8.6 Terminating a program

To terminate a program, press the  key again. The heater is turned off and the status field "end" lights up. Program termination can be performed at any time.



### Note

It is not possible to interrupt a program temporarily!

## 8.7 Info menu

From the info menu, the current program status, program-relevant information, and fault messages can be read out.

**T1**

You can reach the info menu by pressing the "T1" key for > 5 sec.

Pr	Selected program
SP	Set temperature value
Pt	Program run time of the active/last program, in minutes
E	Power consumption of the active/last program, in kW/hr
tt	Total operating hours
OP	Heating output power in %
F1	Fault buffer of last fault
F2	Fault buffer of next to last fault
Ht	Highest program temperature of the active/last program
tA	Maximum furnace temperature



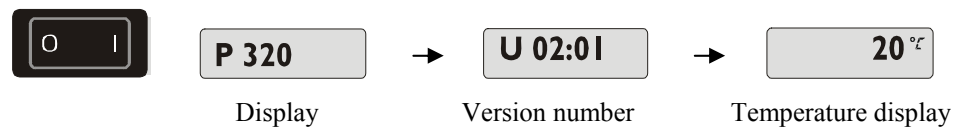
### Note

The info menu is **not automatically** switched back to the temperature display, so that you can observe it for longer periods of time.  
 Use the "T1" key to page through the entire info menu until the furnace temperature is displayed again.  
 Some values are reset again after a heating program is started  
 The operating hour counter can only be reset by Nabertherm

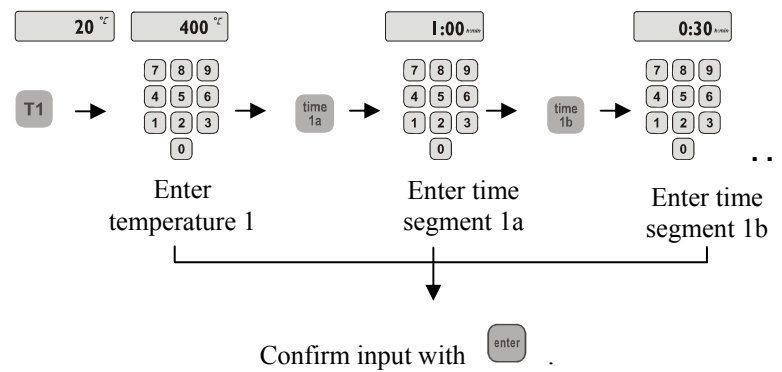
## 9 Controller P 320 (MB 1)

### 9.1 Brief instructions

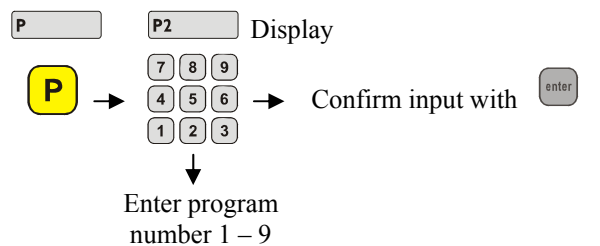
Turning on the controller



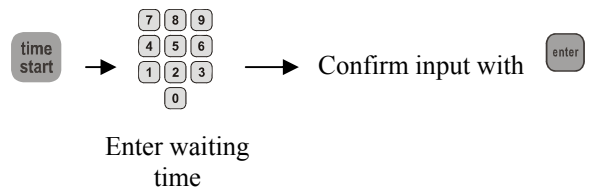
Enter program



Call program




Enter waiting time



Start program



## 9.2 Setting and displaying the date/time

The P 320 has a clock which is set at the factory. The time of day can be displayed by pressing the  key. If the time of day is displayed incorrectly, the clock can be set as follows: The clock is set using a numerical combination of the day of the week and the time. The setting of the day of the week corresponds to the first digit of the numerical combination. Each day of the week as its own number.

1=Mon, 2=Tue, 3=Wed, 4=Thu, 5=Fri, 6=Sat, 7=Sun.



Entry of the time of day must then be done with the last four digits of the combination using a 24-hour clock:

E.g. 0735 for 7:35 AM, 1700 for 5:00 PM, etc.

Example: Setting the time "Wednesday (day 3), 7:35 AM"



Fig. 25: Example of setting the clock

The day and time are saved by pressing the  key. They can be queried at any time with the symbol key .

This clock is a real-time clock, that is, even when the controller is turned off, the time is retained using a built-in battery. The lifetime of the battery is about 3 years. When the battery is replaced, the saved data (set time) is lost. For the battery type, see the chapter "Technical data".

The time can only be entered and displayed in 24-hour mode, that is, a display of 12:00 AM/PM is not possible. After the time is set, the controller is fully ready for operation.

## 9.3 Setting or changing program/waiting time

For the automatic operation of the furnace, before starting the controller a temperature characteristic must be configured which describes the desired temperature behavior. This configured temperature behavior is also called a heating program. Each of the 9 heating programs in the P320 has 4 ramps and 5 holding times (thus 9 segments in all)

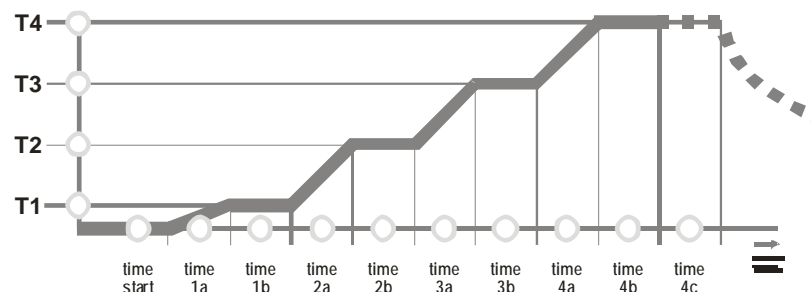


Fig. 26: Program graphic, P320

- In the **ramp**, a segment temperature "**T**" and the segment time "**time 1a**", define a linear temperature increase (slow heating).

- In the **holding time**, "**time 1b**" determines how long the temperature value configured in "**T 1**" should be held.

### Program Entry

To enter a value, the desired program key "**T1**", "**time1a**", or "**time 1b**" is selected. The matching LED "**T1**", "**time1**", or "**time 2**" starts to flash and the stored value is shown in the display.

The display also shows the unit of the value expected:

- set temperature values with °C/°F
- set time specifications with **hr:min**
- set gradient specifications with °C/hr:min or °F/hr:min

(Factory setting "Time and set temperature")

Value entry is done using the numeric keys in the keyboard block. Entries are shown directly on the display.

Time specifications must be given in the format **hr:min**, and preceding zeroes (**01:33**) are not required. The entry of the temperature value is done as a whole number, e.g. 800. If a holding time is specified as **99:59**, program execution will continue forever.

If ramps contain the time entry **00:00**, the controller attempts to reach the temperature value stored in "**T**" as quickly as possible

**Example:** In 60 min, heat to 400 °C, then hold temperature for 30 min at 400 °C. Then reach a temperature of 800 °C as quickly as possible and hold for 3 hours. This program is configured as shown here:

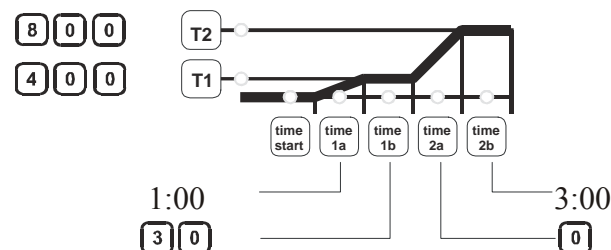


Fig. 27: Example program entry for the P320

When input is complete, the program can be started (see Starting the program). If no key is pressed for 30 seconds, the display automatically returns to the display of temperature. Changed settings are initially only buffered. If a changed or new program should be permanently stored in the controller for more frequent use, see "Saving programs".



### Note

Not all segments have to be programmed. For segments which are not needed, the temperature and time values must be set to "0". The controller then automatically ends the program after the last segment programmed

### Waiting time

To start a heating program automatically at a later time, for instance after a drying period, a waiting time "**time start**" can be programmed. The entry of times is in hours and minutes, e.g. 6 hrs and 30 min as 06:30, that is, when a heating program is started, first the

wait time elapses and only then does the program start with segment 1 and heating.

**Example:** Turning on in **4h:00** min.



Fig. 28: Entry of a waiting period

### Start time

To start a heating program automatically at a later point in time, e.g. after a drying time, a waiting time "time start" can be programmed via the 7-day timer.

The timer is set using a numerical combination consisting of the day of the week and the time. The setting of the day of the week corresponds to the first digit of the numerical combination. Each day of the week has its own number.

Example: Program start on Thursday at 08:00.



Fig. 29: Waiting time input

Display

1=Mon, 2=Tue, 3=Wed, **4=Thu**, 5=Fri, 6=Sat, 7=Sun.

Entry of the time of day must then be carried out with the last four digits of the combination using a 24-hour clock:



E.g. 0735 for 7:35 AM, 1700 for 5:00 PM, etc.


Also see "Setting and displaying the date/time"


## 9.4 Programming extra functions

Controllers of type "C" and "P" can have up to two optional extra functions turned off or on under program control in the segments.





Extra functions are, for instance, exhaust air flaps, fans, solenoids, or optical and acoustic signals, which have been included in the furnace (if applicable, see additional operating instructions for extra functions)



These extra functions can be programmed in all "time" segments by selecting the symbols keys  (fan) and  (acoustic signal > buzzer). That is, when the controller processes the programmed segment, the extra functions are automatically turned on and then turned back off in the next segment, for instance.

The  key represents an outlet installed for the furnace (see furnace instructions), by means of which, for instance, fans or catalyzers can be automatically controlled by the program.

The  key is used to turn on acoustic signals in the regulator. Programming of extra functions is done during program entry.

The desired segment must be selected as described in "Entering programs/wait time", so that the corresponding "time" LED is flashing.

If the  key or the  key is pressed now, the extra function is programmed in this segment and the LED lights up on the key. During program execution, the programmed extra function is now automatically turned on during this segment. To turn off an extra function, press the corresponding symbol key  or  – the LED goes out and the extra function will now no longer be automatically turned on. Both extra functions can also be activated at the same time.

For instance, for program-dependent activation of the fan  during time 1b and of the acoustic signal  in time 2b as a program end signal.

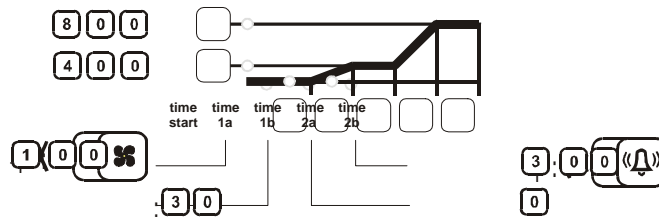


Fig. 30: Programming example for extra functions



**Note**  
 The programming of extra functions is saved along with storage of heating programs! Program key 4c can, for instance, be used with a holding time of 1 min to indicate program end with the acoustic signal.

## 9.5 Turning extra functions in program execution on and off by hand


Extra functions can be turned on or off during a started program, for the active segment or after termination of the program, by pressing the corresponding "Extra" key.

If an extra function is turned on during a running program, it remains on until the program-specific segment transition to the following segment occurs.

## 9.6 Saving programs

Changed settings are initially only buffered. That is, buffered programs are overwritten once a different program is called up.

If a changed or new program should be permanently saved in the controller for more frequent use, it can be saved to a permanent program slot as follows:

To save programs, press the memory key  and then select a program number between "1" and "9". The entry is shown on the display and concluded with the "enter" key


. The program is stored.




Fig. 31: Example of saving a program

The program can now be called up from this storage slot at any time (see Program start)



**Note**

Existing heating programs already saved in a storage slot will be overwritten with no message or warning. Saved heating programs are still retained after the controller is turned off. Configured waiting times are not saved. They must be reentered before each process! The controller automatically returns to the display of the furnace temperature after about 10 seconds when you save without pressing the save key  again. The program is only buffered in this case.

## 9.7 Calling programs



To call a saved program, use the program key  to select the corresponding program number "1-9" and confirm with . Once the program is loaded into the program storage, the program number appears on the display, "1P" in the example.



Fig. 32: Example of calling program 1




**Note**

Check the heating program called up before starting it, to be sure that it is the right heating program.

As of version 3, heating programs are reloaded after program termination. That is, the heating program can be started after a process without having to reenter it. Turn the controller off and on again briefly to be able to read the version number.

## 9.8 Program Start

After a heating program is entered or called up, it can be started with the  key.

**As of version 3:** if the furnace temperature at the starting time is higher than the temperature specified in "T 1", the controller first waits until the temperature of the warm furnace has fallen to the first segment temperature T1, and only then does it start the rest of the program's execution (see also Chapter "New functions of the Nabertherm controller").

For a cold furnace, the heating program is started immediately.

If the heating program has been started, during program execution the LED of the active segment "**time 1a– time 4c**" lights up.




The controller regulates the configured temperature profile completely automatically and the status field "**heat**" lights up in the heating cycle.

If the waiting time is set, the LED "**wait time**" first lights up and the display counts down the remaining waiting time. The status field "**heat**" only lights up after program start in segment "**time 1a**" if the heater is turned on.



After conclusion of the last segment, the heater is turned off and the program terminates. In the display, the end of the program is indicated with the message "end".

## 9.9 Brief interruption of a program

To interrupt program execution only temporarily, for instance to open the furnace door for removal or addition of material, press the "pause"  key. Unlike the "stop" key  the heating is still turned off, but the program is not reset (regulation data is retained). The program is continued with the "start" key  in the last active segment, taking the elapsed time in that segment into account.

If the furnace door is opened without the pause function, the regulator immediately reacts to the temperature drop and starts to heat immediately after the door is shut – the result can be an overcompensation in the furnace chamber temperature (see also "Safety" in the furnace operating instructions).

## 9.10 Program chaining

For very complex temperature profiles, the P 320 controller allows the chaining of up to 3 heating programs. That is, a maximum of 12 program segments can be connected together using program chaining.

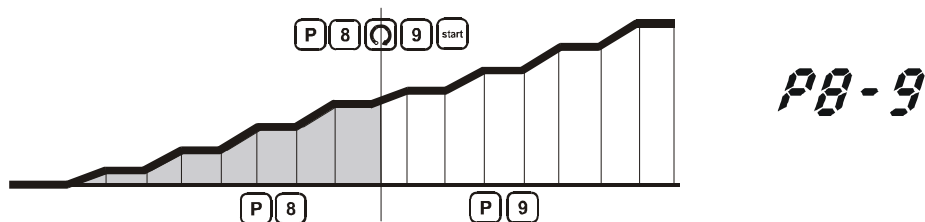


Fig. 33:



For chaining, call the programs up in sequence as described in the example, and then start the heating program with the "start" key . The programs are executed one after the other.



Fig. 34: Example of program chaining for programs 8 and 9

## 9.11 Terminating a program

To terminate a program, press the "stop" key  again. The heater is turned off and the status field "end" lights up.

Program termination can be performed at any time.



### Note

For a temporary interruption to open the furnace door, see **Temporary program interrupt**

## 9.12 Info menu

From the info menu, the current program status, program-relevant information, and fault messages can be read out.

**T1**

You can reach the info menu by pressing the "T1" key for > 5 sec.

Pr	Selected program
SP	Set temperature value
Pt	Program run time of the active/last program, in minutes
E	Power consumption of the active/last program, in kW/hr
tt	Total operating hours
OP	Heating output power in %
F1	Fault buffer of last fault
F2	Fault buffer of next to last fault
Ht	Highest program temperature of the active/last program
tA	Maximum furnace temperature



### Note

The info menu is **not automatically** switched back to the temperature display, so that you can observe it for longer periods of time.

Use the "T1" key to page through the entire info menu until the furnace temperature is displayed again.

Some values are reset again after a heating program is started

The operating hour counter can only be reset by Nabertherm

## 10 Power failure behavior for version 3.xx controllers and higher

The power failure behavior describes the behavior of the controller when the power supply is interrupted. The duration of the power failure is irrelevant.

### Ceramic/glass applications

- Program stop in wait segment with fault message F90
- Termination in all other segments with fault message F90
- Continuation from actual value in ramps if  $T > 100\text{ °C}$

### Metal/laboratory applications

Program continuation in any program state.

The power failure behavior configured can be checked or changed under Setting/checking power failure behavior (as of version 3.xx)

## 11 Power failure behavior for controller versions 1-2.xx, built through the beginning of 2007



### Note

The power failure fault message is only displayed after the first power failure. If multiple power failures in a row occur during a program, this can only be detected by the fact that the "end" indicator is not lit.

### 11.1 Power failure behavior in the different segments of B 130, C 280

**wait/time3/time4:** Program stop with fault message F90  
**time1/time2:** Continuation of program

### 11.2 Power failure behavior for the B 150

**wait:** Program stop with fault message F90  
**time 1:** Continuation of program from actual value  
**time 2:** Program stop if holding time less than 99:59  
**time 2:** Continuation of program if holding time set to 99:59

### 11.3 Power failure behavior for the B 170

**start time:** Program stop  
**time 1:** Continuation of program from actual value  
**time 2:** Program stop if holding time less than 99:59  
**time 2:** Continuation of program if holding time set to 99:59

### 11.4 Power failure behavior for C 290, C 295

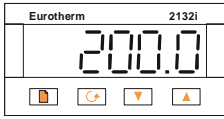
**wait:** Program stop with fault message F90  
**time 1, time 3:** For  $T < 450\text{ °C}$  (842 °F), continuation of program rt  
**time 1, time 3:** For  $T > 450\text{ °C}$  (842 °F), stop  
**time 2, time 4:** Program stop if holding time less than 99:59  
**time 2, time 4:** Continuation of program if holding time set to 99:59

### 11.5 Power failure behavior during program execution P 230



**start time:** Continuation  
**time 1a, time 2a:** Stop for  $T < 100\text{ °C}$  (212 °F)  
**time 1a, time 2a:** Continuation for  $T > 100\text{ °C}$  (212 °F) if temperature drop  $> 20\text{ °C}$ , (68 °F) otherwise stop  
**time 1b, time 2b:** Continuation of program if holding time set to 99:59

## 12 Eurotherm 2132i temperature selection limiter (optional)

### 12.1 Eurotherm 2132i temperature selection limiter



The Eurotherm 2132i temperature selection limiter monitors the furnace chamber temperature using an independent measurement circuit. If the furnace chamber temperature rises above the configured value (generally  $T_{max} + 30\text{ °C}/86\text{ °F}$ ), the heater is turned off by a safety fuse to protect the furnace – "FSH" alarm flashes on the temperature selection limiter.

If the temperature falls back below the configured value, it must be acknowledge for operation to resume. To do this, the keys  and  must be pressed simultaneously on the temperature selection limiter in order to release the heater again.

A temperature selection monitor (option), unlike the temperature selection limiter, can turn the heating back on after it exceeds the limit. No acknowledgement is necessary.



#### Note

The overtemperature limiter and overtemperature selection monitor (optional) must be checked for proper functioning at regular intervals!



#### Note




See Eurotherm 2132i instructions




## 13 Configuration/customer-specific settings

### 13.1 Configuration

Particular settings which influence the operating behavior of the controller are performed in the configuration. The configuration is divided into two access levels which can be opened with different passwords.



### 13.2 Opening the configuration for the B 130, B 150, C290, C 295


Hold the  key down and briefly press the  $>$   key, then release the  key again. The display shows "Co 0" and waits for the entry of the security code.


Use  to enter the password for the desired configuration level and confirm with the save key . Page with the  key to show the parameters one after another.

Changed settings must be saved with the  key! During the storage process, the value blinks briefly in the display.

### 13.3 Opening configuration for the B 170



Hold the  key down and briefly press the  key. The display shows "Co 0" and waits for the entry of the password.


Use the keyboard block to enter the password for the configuration level desired and confirm with the  key.


Page with the  key to show the parameters one after another.

Changed settings must be saved with the  key! During the storage process, the value blinks briefly in the display.

## 13.4 Opening configuration for the P 320

Hold the  key down and briefly press the  key. The display shows "Co 0" and waits for the entry of the password.

Use the keyboard block to enter the password for the configuration level desired and confirm with the  key.

Page with the  key to show the parameters one after another.

Changed settings must be saved with the  key! During the storage process, the value blinks briefly in the display.







### Note

By changing regulation parameters, the function of the control unit can be significantly influenced.

## 13.5 Configuration options in configuration level 1 (password "0")

### 13.5.1 Converting °C/°F




In the configuration level, enter password "0" and select the parameter "°F", use  or the  key block to set it to "1" and confirm with the save key  or the  key.

The safety shutoff in the controller is automatically converted, but all other temperature specifications must be changed to °F.

The **preset** and **subsequent** heating programs are always programmed in °C and must be manually adapted after the conversion.

### 13.5.2 Settings for kW/hr counter




For the calculation of electrical power consumption in kW/hr in the info menu, you must enter the furnace power from the type plate. The setting is generally already made by Nabertherm.

If this is not the case, select the parameter "PF" in the configuration level and enter the type plate power x 10 with  or the key block and confirm with the storage key  or the  key.

Example: furnace power 3.6kW \* 10 = "36" should be entered.

### 13.5.3 Setting the interface address

When operating multiple controllers in a data network, different addresses must be configured for the controllers.




In the configuration level, select parameter "Ad", enter the new address (1...99) with  or key block, and confirm with the save key  or .



#### Note

When operating the controller with furnace monitor software "MV-Controltherm", the interface address may not be set higher than 16




### 13.5.4 Program entry with/without gradient (as of version 3.xx)

Select the parameter "rA" in the configuration level, use  or the key block to set the desired input mode, and use the save key  or  key to confirm.

0 = input of ramps without gradient over time and set temperature

1 = input of ramps with gradient and set temperature

### 13.5.5 Setting/control of power failure behavior (version 3.xx or later)

In the configuration level, select parameter "Ur", set the desired power failure behavior with  or the key block, and confirm with the save key  or the  key.

0 = e.g. ceramic/glass applications

Interrupt in wait segment

Interrupt in all segments,

Continuation from actual value in ramps at T > 100 °C

1 = e.g. metal/laboratory applications

Program continuation in any program state.

Hold times are not repeated, but are continued from the time of the power failure with the remaining time.

### 13.6 Configuration options in configuration level 2 (password "2")

PA active parameter set

Configuration range 0 to 4 (see also auto tune)

TU Auto tune

Configuration range 1 (start)


- P1 Proportional range XP of the 1st parameter set  
 Configuration range from 0 to 100 %
  - I1 Settle time Tn for the 1st parameter set  
 Configuration range from 0 to 5000 sec
  - D1 Hold-back time Tv for the 1st parameter set  
 Configuration range from 0 to 250 sec
- following parameters sets P2, i2, d2 ... P4, i4, d4

## 13.7 Auto tune

The regulation parameters of the controller are already set at the factory for the optimum regulation of the furnace. If the regulation behavior is still not sufficient for your process, the regulation behavior can be improved using auto tune.

The controller has four different parameter sets which are already configured for different furnace models. The configured parameter set can be seen in parameter "PA" (see also Configuration). When performing auto tune, the regulation parameters of the selected parameter set are determined and stored using a special measurement procedure.

Start the auto tune process only with a cooled furnace ( $T < 60\text{ °C}$ ), since otherwise incorrect parameters will be determined for the regulation segment. First enter a program in which "T1" specifies the temperature to be optimized. Set all times "time" to "00:00"n.

In configuration level 2, select parameter "tu", set it to "1", and confirm with the  key. This will start the auto tune and "tune" will alternate with the furnace temperature in the display. Once the optimization is complete, the status field "end" will show in the display. The parameters determined are stored by the controller into the parameter set for the corresponding temperature range.

Auto tune is always performed at about 70% of the value set in "T1" in any case, to avoid destruction of the furnace, for instance when optimizing the maximum temperature. Auto tune may take more than 3 hours for some models, depending on the furnace type and temperature range. The regulation behavior may be degraded in other temperature ranges after an auto tune! Nabertherm assumes no liability for damage caused by manual or automatic changes to the regulation parameters (see also Temperature-dependent parameter sets).

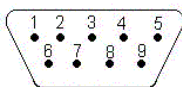


### Note

Perform an auto tune, if necessary, for all temperature ranges.

## 14 Data interface

### 14.1 RS-422 data interface (optional)



All controllers can be equipped with a RS-422 data interface, which is optionally implemented with a 9-pin D-Sub connector. This interface can be used to send or receive both control functions and archival data. Data exchange is indicated by the "com" (PC communication) indicator in the display.

The interface is immediately ready for operation; e.g for the Nabertherm furnace monitoring software "MV-Controltherm"

When operating multiple controllers/furnaces on a data network, the interfaces must be set to different addresses and changed if necessary (see Setting the interface address).

**Note**

If the data connection line between the furnace and the PC or notebook must be longer than 20m, an optionally available interface power supply (order no. 540100193) may be necessary to avoid communication errors.

If the Nabertherm furnace monitor package "MV-Controltherm" is not used, the RS422 interface must be equipped with an additional +5 volt power supply. The power supply is needed by the galvanically isolated driver components of the controller. For this purpose, for instance, an external interface switching power supply for the 9-pin D-Sub plug connector can be ordered (order number 540100193).



## 15 Faults

### 15.1 Fault messages

If a fault message occurs, one of the following fault messages (fault codes) is displayed:

Fault code	Meaning	Comment
<b>F 10</b>	The furnace is not reaching the configured temperature.	E.g. heater defective, door not closed, or door contact switch incorrectly adjusted.
<b>F 30 – 32</b>	Fault in thermocouple or measurement circuit.	Thermocouple defective.
<b>F 40</b>	Thermocouple polarity reversed.	E.g. after replacement of thermocouple – switch polarity.
<b>F 50</b>	Specification of temperature or time incorrect	Correct entry.
<b>F 60 – 61</b>	Controller system fault	Controller defective.
<b>F 62</b>	Ambient temperature too low <-10 °C (-50 °F)	Heat room if necessary.
<b>F 63</b>	Ambient temperature too high > 70 °C (158 °F)	Ventilate room if necessary.
<b>F 64 – 69</b>	Controller system fault	Controller defective.
<b>F 70</b>	Furnace temperature has exceeded the permitted value "Tmax"	Switching system or controller defective
<b>F 90</b>	Power failure	Appears after power restored

Fault messages can be reset by turning the power switch off and back on. Leave the unit switched off for at least 5 seconds. If the fault message no longer occurs within a minute after power is turned on, the controller is ready to operate. If there is another fault message, contact Nabertherm service. Ventilation motors (if present) remain on even in case of a fault. The heater is always turned off.

### 15.2 Fault diagnosis

Fault	Cause	Action
<b>Controller does not light up</b>	Controller turned off	Power switch to "I"
	No power available	Power plug in outlet? Check building circuit breaker/fuse
<b>Furnace not heating</b>	Door/lid open	Close door/lid
	Door contact switch actuated	Check door contact switch
	"wait" displayed	Set waiting time to "00:00"
	No temperature input	Check temperatures T1/T2
<b>Program doesn't go to next segment</b>	In one time segment, the holding time is set to infinity	Set a holding time less than 99:59
<b>Regulator doesn't heat during optimization</b>	No temperature set in "T1"	The temperature to optimize must be entered in "T1"

## 16 Replacement parts

### 16.1 Replacing a built-in controller



#### Note

Be sure that the power switch is on "0"!  
 Always unplug the power cord before opening the housing!  
 If the furnace does not have a power cord, disconnect the power to the fixed connection.

#### Disassembly

- Remove the 4 screw fasteners from the front side of the controller.
- Tilt the top of the controller carefully out of the housing.
- If applicable, remove the connector of the flat cable for the interface
- Remove the ground wire connections.
- Remove both plug connectors.
- Pull the controller gently by the wires out of the housing



Fig. 35: Replacing a controller

#### Assembly

- Plug both plug connectors onto the new controller.
- Fasten the ground connector to the controller
- Check the ground connection of the orange and gray measurement lines.
- If applicable, fasten the plug of the interface line.
- Check for correct connection of the ground lead before installing the controller.
- Place the controller back into the installation space.
- Check that no cables are protruding or caught.



#### Warning - danger due to electrical current!

Work on the electrical systems may only be performed by a qualified electrician!  
 Replacement may only be performed by a technical expert!



#### Note

Batteries and electrical parts do not belong in ordinary garbage. Never dispose of batteries in fire, since they can leak or explode. Dispose of unusable material at the appropriate disposal facility. Follow national environmental regulations!

## 17 Technical data



The electrical data are located on the type plate on the side of the furnace.

<b>Supply voltage</b>	~100 V – 240 V 50/60 Hz	
<b>Power consumption</b>	3.5 W	
<b>Sensor input</b>	Type S, K, R	
<b>Sensor input</b>	Type B	C 295 only
<b>Heater output 1</b>	12 V, max. 130 mA	
<b>Heater output 2</b>	12 V, max. 130 mA	C 295 only
<b>Heater output 3</b>	Continuous 0 – 5 V, 0 – 10 V	C 295 only
<b>Safety relay</b>	~250 V/16 A	
<b>Extra relay</b>	~250 V/3 A	

<b>Real-time clock</b>		P 320 only
<b>Buzzer</b>		P 320 only
<b>Battery</b>	3 V/285 mA Lithium Model: CR2430	P 320 only

<b>Protection rating:</b>	I (protective ground)	
<b>Protection class:</b>	Keyboard film IP 65	
	Installation housing IP 20	
	Furnace/switching system	(see furnace operating instructions)

<b>Interface</b>	RS 422 isolated	optional
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<b>Measurement accuracy:</b>	+/- 3 °C	
<b>Lowest possible rate</b>	0.25 °C/hr	

<b>Ambient conditions</b>		
Storage temperature	- 20 °C to + 75 °C	
Working temperature	0 to 40 °C	ensure sufficient air circulation
Relative humidity:	5 – 90 %	not condensing

## 18 Electrical connections (wiring diagram)

### 18.1 Furnaces up to 3.6 kW – B 130, B 150, B 170, C 280, C 290, C 295, P 320

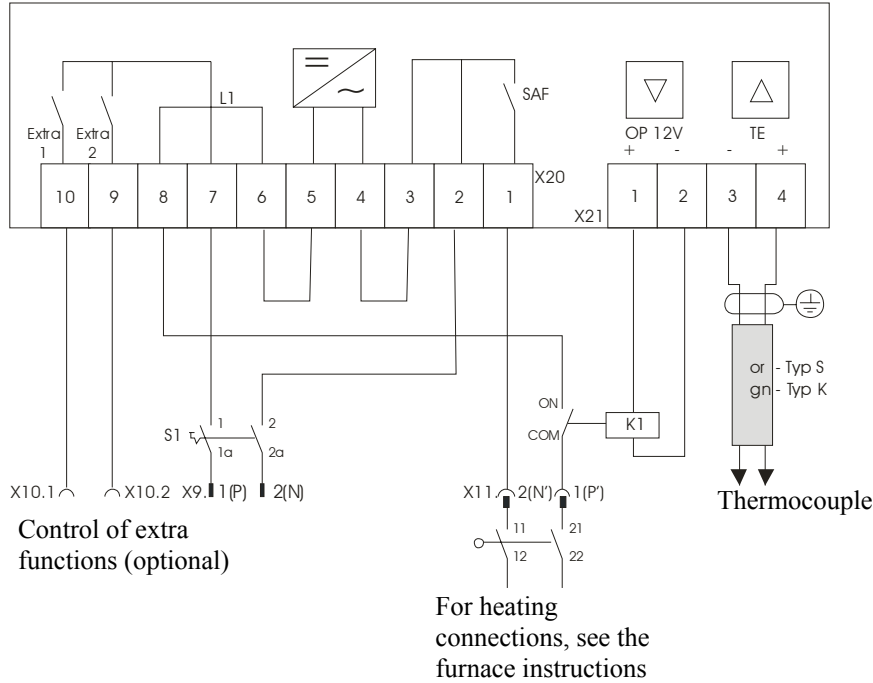


Fig. 36: Furnaces up to 3.6 kW

### 18.2 Furnaces > 3.6 kW with semiconductor relay - B130, B150, C280, C290

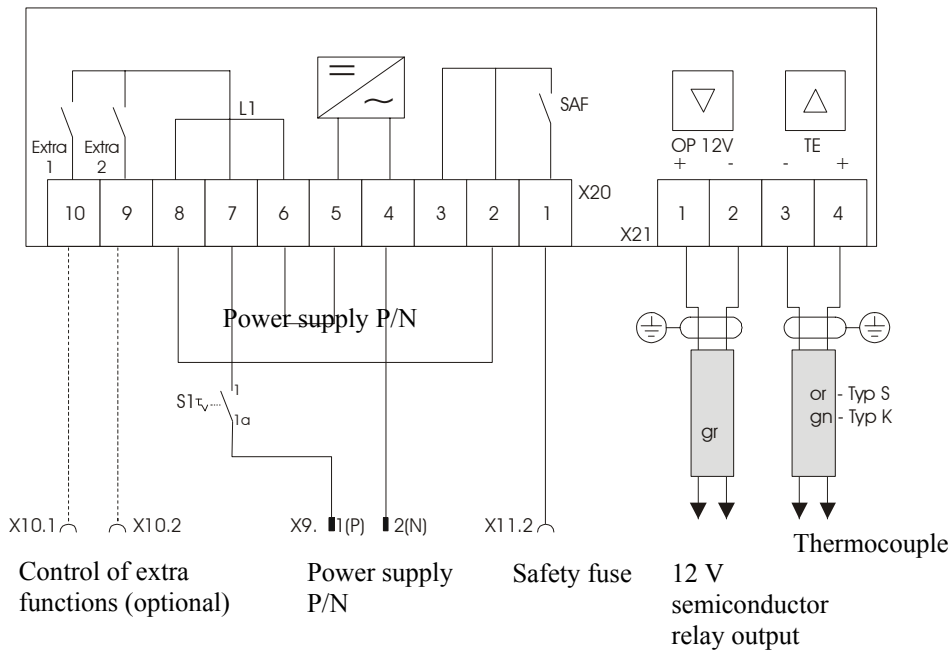


Fig. 37: Furnaces > 3.6 kW with semiconductor relays

## 18.3 Furnaces > 3.6 kW with heat fuse – B 130, B 150, C 280, C 290

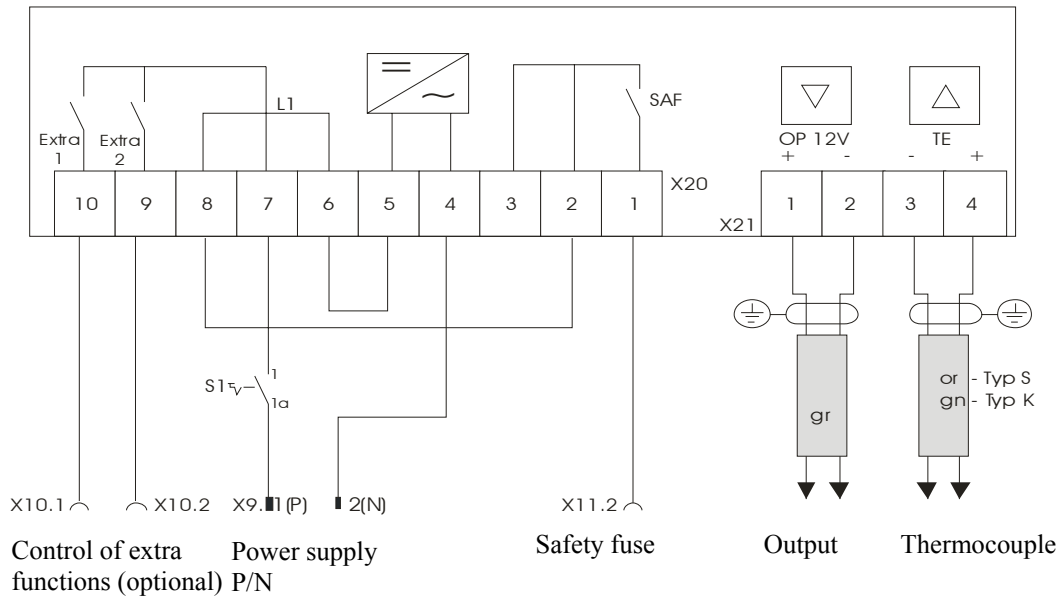


Fig. 38: Furnaces > 3.6 kW with heat fuse

## 18.4 Furnaces > 3.6 kW with 2 heating circuits – C 295

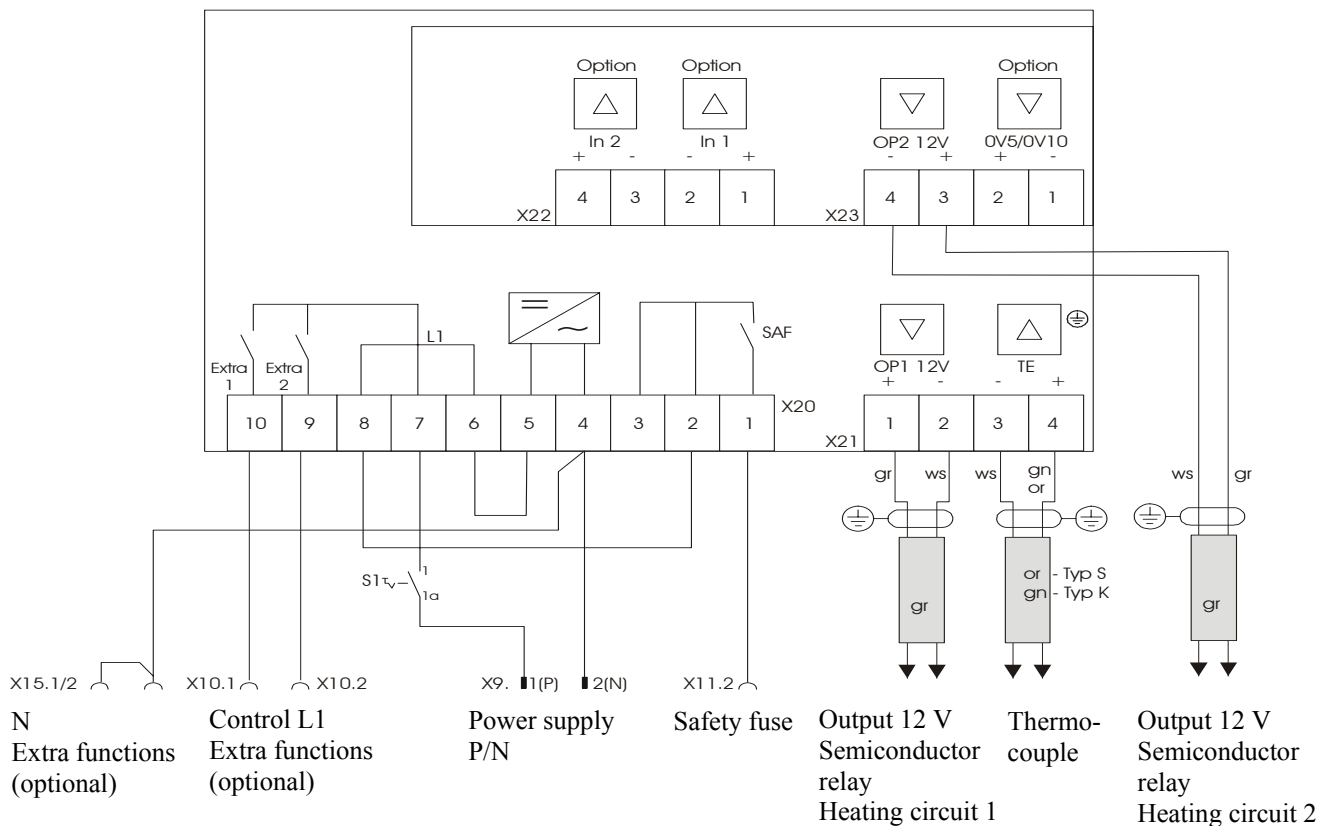


Fig. 39: Furnaces > 3.6 kW with two heating circuits – C 295

**18.5 B 170, P 320 (Mb 1)**

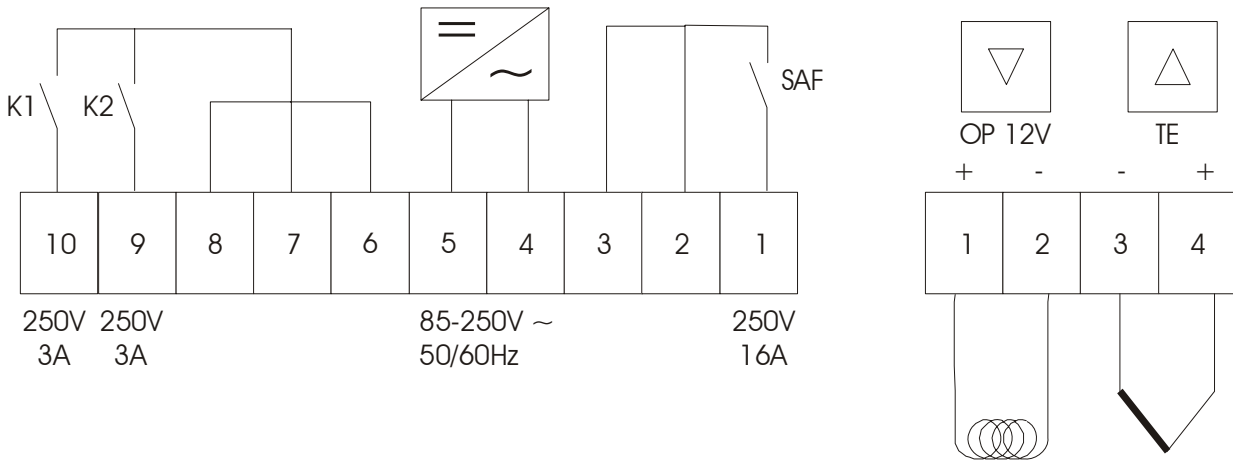


Fig. 40: Electrical connections for B 170/P 320 (Mb 1)

## 18.6 Replacement controller for models C/S 3; C/S 5; C/S 7; C/S 8; C/S 19; C/S 30

### 18.6.1 Replacement for old S controller up to 3.6 kW

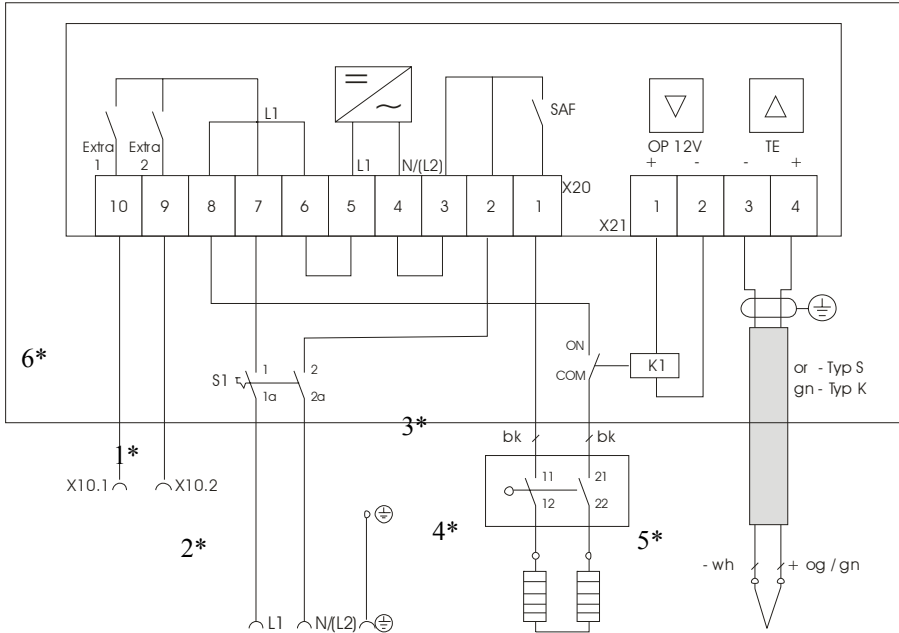
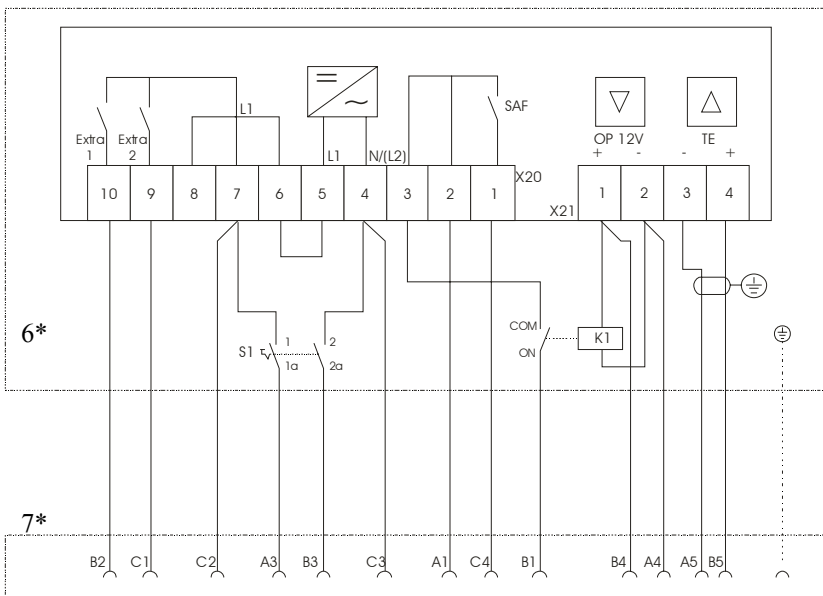


Fig. 41: Replacement for old S controller up to 3.6 kW

### 18.6.2 Replacement for old C controller



Legend:

- 1\* = Control of extra functions (optional)
- 2\* = Power plug
- 3\* = Door contact switch
- 4\* = Furnace heating
- 5\* = Thermocouple
- 6\* = Controller
- 7\* = HAN 15D plug connector
- bk = black
- og/gn = orange/green
- wh = white

Fig. 42: Replacement for old C controller

## 19 Nabertherm Service



For the maintenance and repair of the system, the Nabertherm Service department is available at any time.

If you have questions, problems, or desires, please contact Nabertherm GmbH. In writing, by telephone, or through the Internet.



### In writing

Nabertherm GmbH  
Bahnhofstrasse 20  
28865 Lilienthal/Germany



### By telephone or fax

Phone: +49 (4298) 922-0  
Fax: +49 (4298) 922-129



### Internet or email

[www.nabertherm.com](http://www.nabertherm.com)  
[contact@nabertherm.com](mailto:contact@nabertherm.com)

**When making contact, please have the type plate data of the furnace or controller ready.**

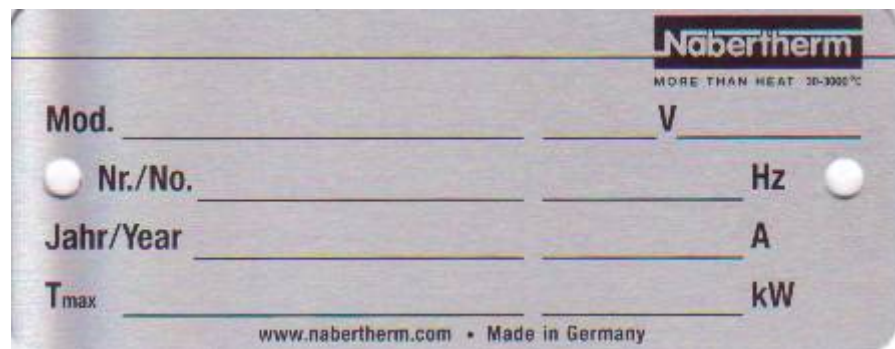


Fig. 43: Type plate





