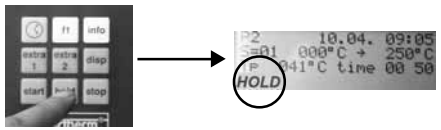
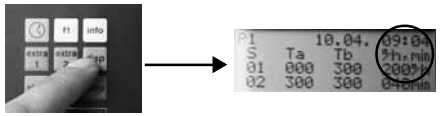
Enter the desired figures with the numerical keys **0 - 9**.

Press the **enter** key after each alteration to overwrite the old values and to store the new values in the memory (see section "**Storing a program**").

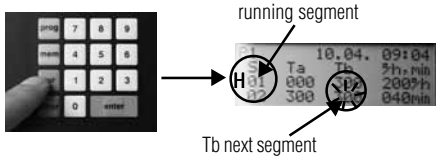
During a running program:
Before altering program, you must holding on the actual program.



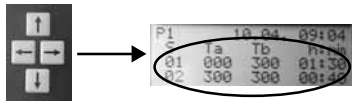
Press the **hold** key; the actual program is hold on and the display shows **hold**.



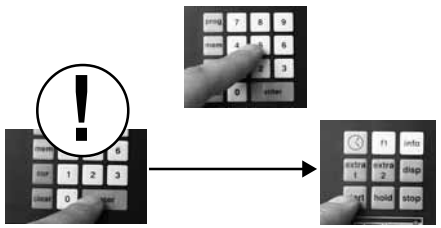
With the **disp** key, select the input display Rate (°**C/h**) and dwell time in **min** (see section "**Input display**" on Page 6).



Press the **cur** key, the entered program value **Tb** of the following segment flashes and letter **H** (=hold).

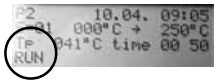


Move the cursor keys **left/right** or **up/down** on to the figure on the entry display that you wish to alter.

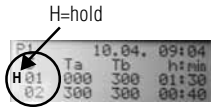


Enter the desired figures with the numerical keys **0 - 9**.

Press the **enter** key and the **start** key, the program is continued, processing the



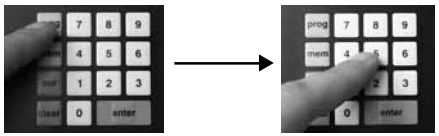
new values, and the program start display appears with status **RUN**. For a detailed explanation, see section "**What to do, when**..." on Page 21.



Note:
When you alter a running segment (">" in front of segment) the letter "**H**" (hold).

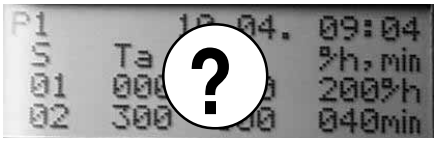
Clearing a program

You can clear a whole program to create memory space for a new program.



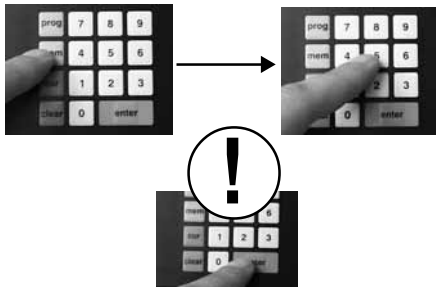
Call up the program you wish to clear. To do so, press the **prog** key and the relevant program number **(1 - 9).**

Press the **enter** key, the program appears on the input display with the entered values.



Make sure that this is the program you wish to clear.

Having checked this, press the **clear** key, all program values entered are set to **0** on the input display.

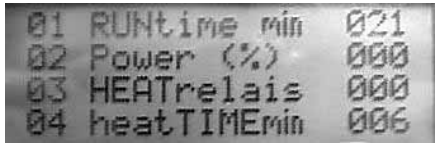


Press **mem** key, the relevant memory location 1-9 and the **enter** key, all values on the memory are cleared.

Checking informations

The controller also offers additional information which can be called up at any time, i.e. even during a running program.

Press the **info** key, the following information appears:

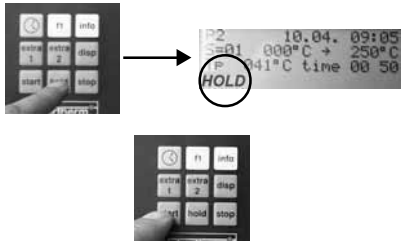


01 RUNtime min
Time already processed in current program
02 Power (%)
Current heating performance
03 HEATrelais
State of heating relay (1= ON, 0= OFF)
04 heatTIMEmin
Effective heating time of program

05 maxTEMP.
Maximum temperature reached during program
06 last1Error
Last fault indication
07 last2Error
Fault indication before last
08 TEMPlimit
Factory-set max. operating temperature of controller

09 start
Sum of all program starts
10 h T>200 °C
Total operating time at furnace temperature over 200°C
11 h T>900 °C
Total operating time at furnace temperature over 900°C

Holding on a program

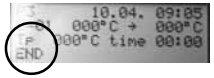


A running program can be holded on at any time.

Press the **hold** key ; the display shows status **hold**. The set value of the program shown on the display (TP=xxx °C) will be regulated and dwelled until program is continued.

With the **start** key the program will continue.

Stopping a program



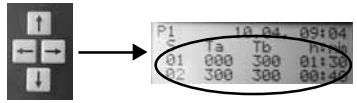
A program can be stopped automatically or manually.

Program stop automatically:
When the program stops **automatically**, the program entered has been fully executed. The program start display appears **END**.

Program stop manually:
To stop a program manually press the stop key; the program start display appears **STOP**.

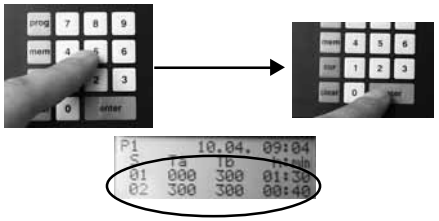
Attention:
At the end of the program all values entered remain stored.

Altering program cycles



All program values can be altered individually at any time.

When entering a program:
Having called up the program that you wish to alter, move the cursor keys **left/right** or **up/down** on to the figure on the input display that you wish to alter.

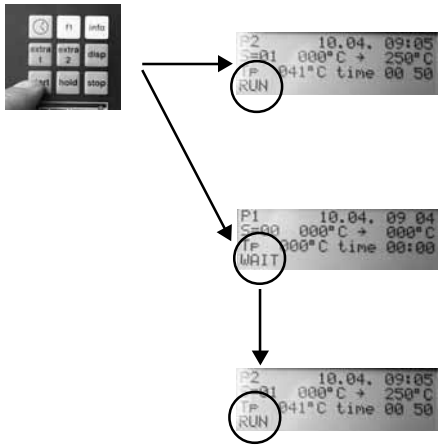


Enter the number of the program desired with the numerical keys **1 - 9** and press the **enter** key.

All program values stored appear on the entry display.

Starting a program

After the desired program has been called up, the program can be started.



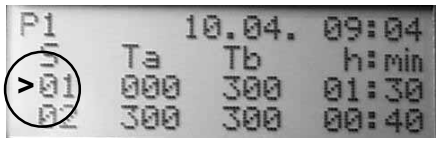
Press the **start** key, the program start display appears on the input display.

If you have entered a delayed program start (start time), the status **WAIT** appears on the program start display.

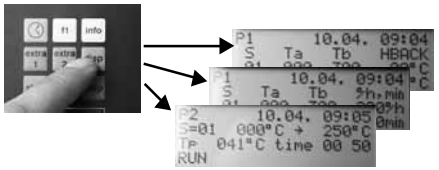
As soon as the start time has been reached the status **RUN** appears on the display and the program executes the program segments entered.

Overview of program cycle

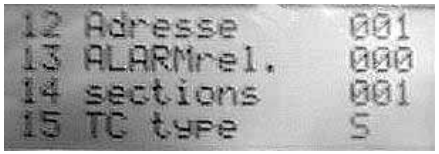
All program values entered can be viewed at any time, i.e. even whilst a program is running.



If the controller is switched into a running program, the symbol "**>**" appears in front of the segment which is currently being executed.



With the **disp** key you can select the various displays in the input display even whilst a program is running.



12 Adresse
Address of digital interface RS 422
13 ALARMrelais
status of an alarm relais (000=off, 001=on)
14 sections
Number of regulating zones (001=single zone)
15 TC type
type of thermocouple

Note:
With the **up/down** keys you can call up information not usually visible on the entry display.

Press **info** key to exit this area.

Altering configurations

The controller is delivered in a basis settings (configurations) which you can alter to suit your individual require-ments.

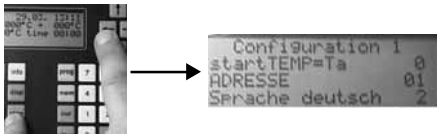
Configuration 0:
Press the **stop** key and keep it pressed. Then press the **right** key, any program running will be halted and the factory-set configuration **(Configuration 0)** appears on the input display.

holdback on 0
Holdback is not active. The regulator is working temperature depending. If **holdback on 0** defined, the input display **holdback** will not activate.

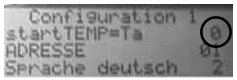
holdback on 1
Holdback is active. The regulator is working time-depending.

auto START 0
Describes the reaction of regulator in case of voltage loss. For details please look under **Technical data**.

auto START 1
The program will always be continued after loss of voltage.



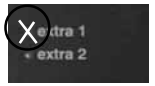
Configuration 1:
Press the **stop** key and keep it pressed. Then press the **left** key, any program running will be halted and the factory-set configuration (**Configuration 1**) appears on the input display.



Start temperature=Ta 0
(Factory-set)
The function of this is that, regardless of the start temperature entered in **Segment 1**, the program always starts with the current actual temperature of the furnace.

Start temperature=Ta 1
The program starts with the value entered in **Ta** of **segment 1**.

Attention:
To utilize the residual heat of the furnace, the value **0** should not be altered.



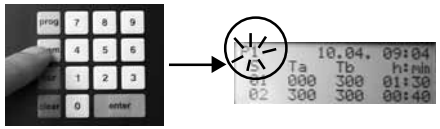
When programming the next segment, the function **extra1** resp. **extra2** is automatically deactivated and the LED extinguishes.

Switching on manually:
The function **extra1** resp. **extra2** can be activated or deactivated at any time during the program cycle by switching it on/off manually.

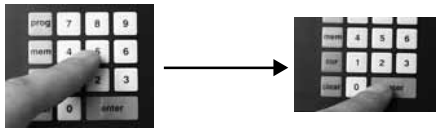
At the end of the segment in which the function **extra1** resp. **extra2** was switched on, the LED extinguishes and the function is automatically deactivated.
*e.g. blower, acoustic signal. This special function must be an integrated part of the switchgear (available as an option)

Storing a program

All program values entered can be stored in the memory of the controller.



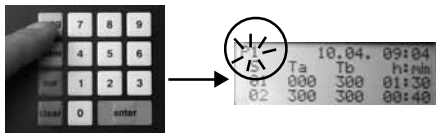
Press the **mem** key, select desired memory location with numerical keys **1 - 9**.



Press **enter** key.

Activating a program

When a program has been stored in one of the memory locations **1 - 9**, then this program can be retrieved again and again at any time.

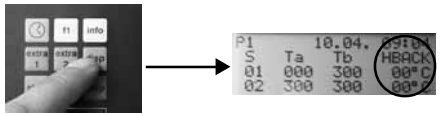


Press the **prog** key, the number of the program last processed flashes on the input display.

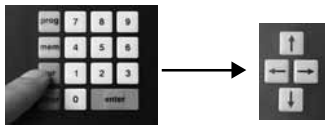
Entering holdback

With this Controller you can set a **holdback** if **holdback on 1** is defined in **configuration area 0** (see page 17). The **holdback** is the max. tolerance of temperature between set value and actual value in each segment.

A detailed description of function **holdback** can be found on page 25 under **„What to do, when...“**.



Press **disp** key until **holdback** is shown on the display.



Press **cur** key and move the cursor symbol to the required position by pressing the **up/down** key.

Set the required values by pressing the keys **0-9**.

Press **enter** to confirm each change and to memorize the values.

Activating extra functions

The controller offers an extra function* which can be switched on automatically or manually.

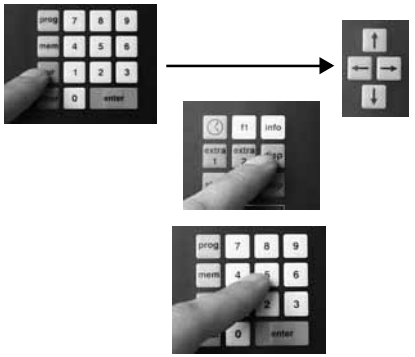
Switching on automatically:
Press the key **extra1** resp. **extra 2** when programming in the segment (**Ta, Tb** or **h:min** or **°/h, min**) in which the function shall be activated.

The integrated LED beside display **temperature** lights up.

Address (1 - 32)
Assignment of the digital interface **RS 422** is defined in the address. It must be ensured that the same address is selected as that on the PC connected . For further details, see the following section **Digital interface RS 422**.

Language of fault indications
English = **01**
German = **02**
French = **03**
Spanish = **04**

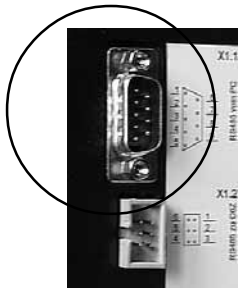
To alter the set values, press the **cur** key. With the keys **up/down** you can select the figure you wish to alter.



Press the **disp** key to exit this area.

To define the desired language, press the relevant numerical key.

Digital Interface RS 422



The controller is equipped with a digital interface **RS 422** on the back of the casing. This interface renders connection to a conventional PC possible. With the use of appropriate **control software**, all program features can be comfortably controlled and monitored even externally.

Further information on the digital interface **RS 422** and appropriate software for using a PC can be obtained from Nabertherm directly.

Fault indications

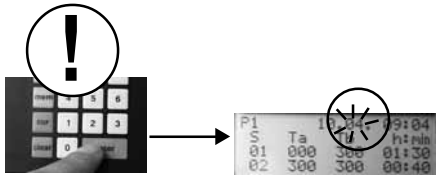
In the event of controller malfunction, the furnace switches off automatically and a fault indication appears on the LED display **temperature**. This fault indication often facilitates the tracing and elimination of the fault. The following fault indications may appear on the LED display, indicating a malfunction:

Fault indication **F3** appears when a fault in the temperature measuring circuit occurs. "**Fault thermocouple**" appears on the input display.
Possible cause:
- Thermocouple is defect
- Equalizing cable to thermocouple is defect

Fault indication **F4** appears when the thermocouple has been wrongly connected. "**Th.E reversed**" appears on the input display.
Cause:
- Thermocouple polarity reversed

Fault indications **F6.1** to **F6.8** appear when a system fault in the controller occurs. "**System fault**" appears on the input display.
Possible cause:
- The controller is defect
- External power system disturbance

Attention:
When this fault indication appears, switch off the controller for a moment and then switch it on again. In most cases this will rectify the fault and the program will continue automatically.

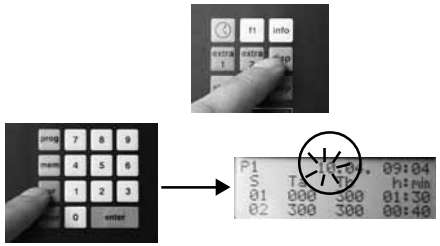


Press the enter key after entering each value. The cursor then jumps automatically to the next program segment.

Entering a program

The controller is equipped with 9 programs, each with 18 segments which can be individually programmed and stored.

Setting of a program is allways done in one of the input displays. More in-formation look page 6, **„Input display"**.

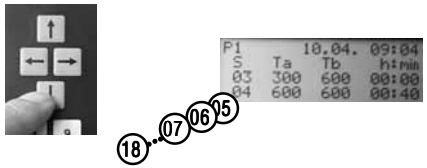


Press the **disp** key you need out of the several displays.

Press the **cur** key; the day, month or hour/min flash on the entry display.

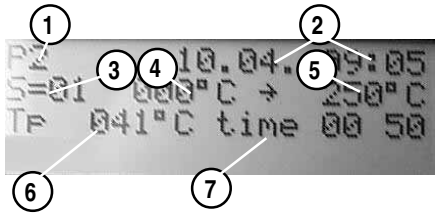
With the **left/right** or **up/down** keys you can directly select the position in the table desired and enter program values with the numerical keys **0 - 9**.

Press the **enter** key after entering each value to store the alteration.



By pressing the **up/down** keys you can select segments not usually visible on the input display.

Note:
We recommend not to alter starting temperature value **Ta000** in **segment 1**.



Program start display
This display shows all essential information about the current program or the one last processed.

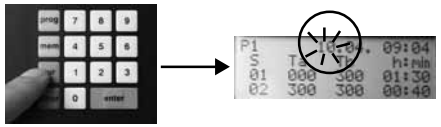
1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Actual Program setpoint value
7 Remaining segment time

Entering start time

The controller offers you the possibility of starting a program at any fixed time. This start time defines in day and time the desired program start time.

As the controller determines a delayed program start in accordance with the date and time of the integrated timer, please refer again to the section **"Entering date/ time"** on Page 6.

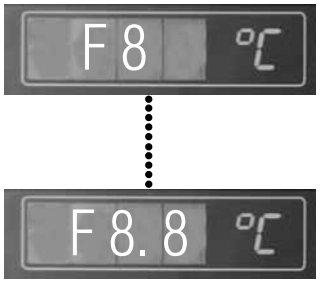
Select an input display with **disp** key (see Page 7/8).



Press the **cur** key; the day, month or hour/min flash on the entry display.

Enter start date and time with numerical keys **0 - 9**.

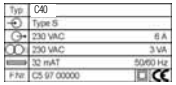
Fault indication **F7** appears when the actual temperature is 50°C higher than the maximum operating temperature. This fault indication is triggered only when the furnace temperature has exceeded 700°C.**„Temperature too high"** appears on the input display.
Possible cause:
- Contactor defect



Fault indications **F8** to **F8.8** appear when a system fault in the controller occurs. "**System fault**" appears on the input display.
Possible cause:
- Data transmission to the measuring card is interrupted
- RAM or ROM memory are faulty

If it is not possible to eliminate the fault, please contact your customer service or call Nabertherm direct.

Furnace rating plate



Controller rating plate

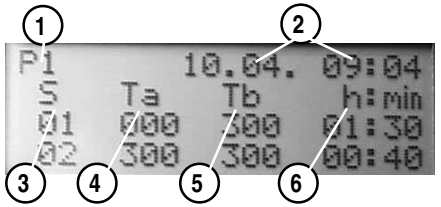
To deal with the problem as fast as possible the following is always required:
- Fault indication shown on display
- Rating plate data (furnace and controller)

Technical data

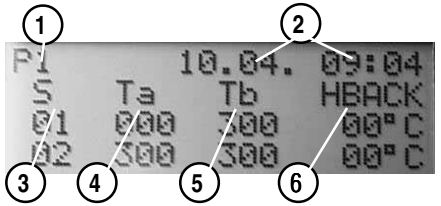
Tmax.	Set at works according to type of furnace
Measurement input:	Type K or S
Overvoltage category:	Class II
Environmental conditions:	5 °C - 40 °C in compliance with EN 60204, part 1 Humidity: 30% - 95%
Cleaning:	**Switch unit off load,** clean with damp cloth
Protection class:	protection class 2 / totally insulated
In the event of a power failure:	**at auto START 0:** **During the start delay time (wait):** • program is continued **Furnace temperature < 100 °C:** • at < 4 sec =program is continued • at > 4 sec =program is aborted **Furnace temperature > 100 °C and Temparature decrease < 20 °C:** • program is continued **Furnace temperature > 100 °C and Temperature decrease > 20 °C:** • program is aborted **at auto START 1:** • program is continued
Calculatorical resulution of temperature gradient:	in full minutes

Rating data

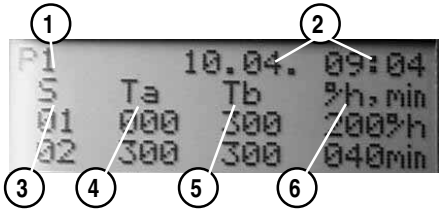
Type:	C40
Relay outputs:	220-250V - 6A (floating)
Supplay voltage:	220-250V - 50/60 Hz, 8 VA
Fusing:	100 mAT



Input display with h:min
In this input display you can enter the program values for heating up, cooling down, dwell time in **hours and minutes**
1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Heating up, cooling down or dwell time of segment in **hours/minutes**



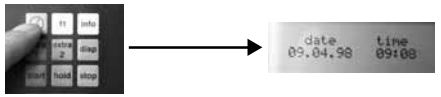
Input display with holdback
In this input display you can define the **holdback** in°C.
1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Holdback of segment in °C



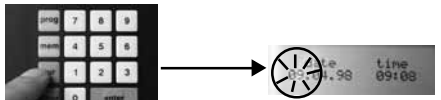
Input display with rate (°C/h) and dwell time in min
When you wish the program to heat up at a certain rate, i.e. **°C/h (hours)**, select this input display. The dwell time is entered here in **minutes** at the same time.
1 Current program number
2 Date/time of last program start
3 Segment number
4 Starting temperature of segment
5 End temperature of segment
6 Rate of segment in **°C/h** or dwell time of segment in **minutes**

Entering date and time

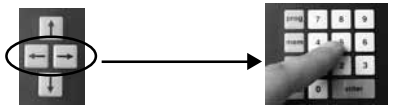
Bevor Sie ein Programm eingeben, überprüfen Sie die werkseitig eingestellten Werte für Datum und Uhrzeit.



Betätigen Sie die Taste **Datum/Uhrzeit**; im Eingabe-Display erscheint der werkseitig eingestellte Wert für Datum und Uhrzeit.



Datum bzw. Uhrzeit falsch?
Betätigen Sie die Taste **cur**; im Eingabe-Display blinkt der eingegebene Tag unter **date**.

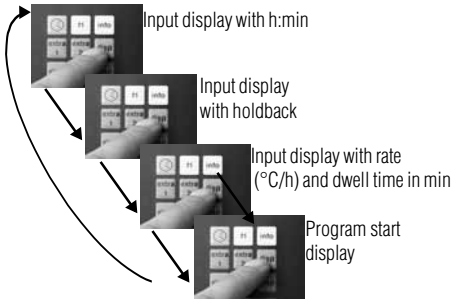


Mit den Tasten **links/rechts** wählen Sie die Stelle an, die Sie ändern möchten und geben mit den Zifferntasten **0 – 9** den gewünschten Wert ein.

Betätigen Sie nach jeder Änderung die Taste **enter**, um die Werte zu speichern.

Mit der Taste **Datum/Uhrzeit** oder **disp**, kommen Sie zurück in das Programm-Startbild.

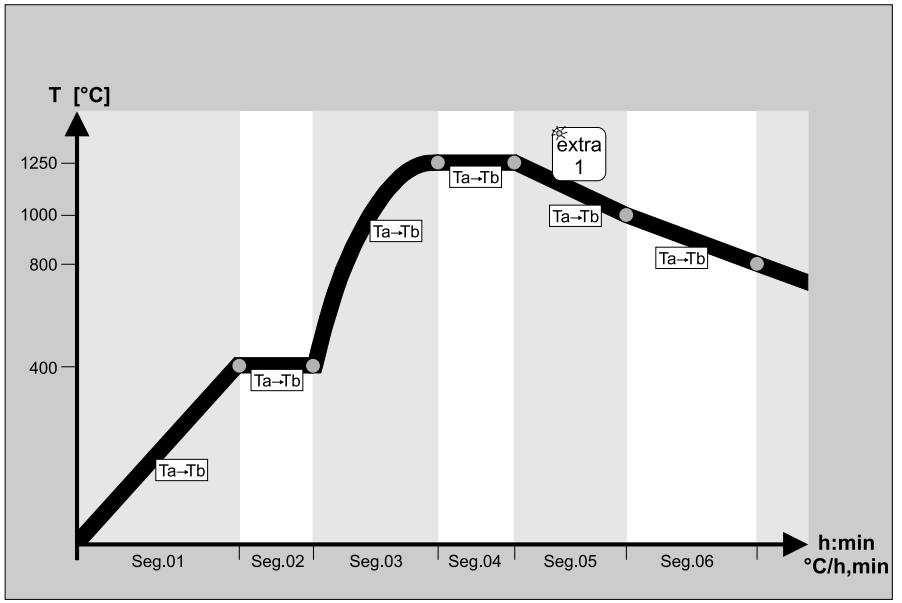
Input display



Durch mehrmaliges Betätigen der Taste **disp** können Sie sich verschiedene Bilder anzeigen lassen.
Die folgenden Beispiele geben Ihnen einen Überblick über die Darstellungsmöglichkeiten und deren Bedeutung.
Hinweis:
Das Eingabedisplay **Holdback** erscheint nur, wenn **holdback on 1** in der **Konfigurationsebene 0** aktiviert ist. Nähere Angaben siehe **Konfigurationen ändern** auf Seite 17.

Program example

The following program consists of six program segments selected at random. Maximum 18 segments in one program are possible.



S 01	Ta	=	000 °C	After program start the furnace heats linearly from the current actual temperature (**Ta**) of the furnace to 400 °C (**Tb**) within 6 hours at a rate of 66°**C/h** .
	Tb	=	400 °C	
	time	=	6h:00min	
	rate	=	66 °C/h	
S 02	Ta	=	400 °C	On reaching 400 °C, the temperature is maintained for 30 min.
	Tb	=	400 °C	
	dwell time	=	0h:30min	
S 03	Ta	=	400 °C	As no heating-up time was defined in this segment, the furnace heats at full capacity from 400°C (**Ta**) to 1250 °C (**Tb**). It is not possible to determine the rate as the heating-up time can vary considerably depending on the type and quantity of the charge as well as on the type of furnace employed.
	Tb	=	1250 °C	
	time	=	0h:00min	
	rate	=	---°C/h	

S 04	Ta	=	1250 °C	On reaching 1250 °C the temperature is maintained for 25 min.
	Tb	=	1250 °C	
	dwell time	=	0h:25min	
S 05	Ta	=	1250 °C	The furnace cools down linearly from 1250 °C (**Ta**) to 100 °C (**Tb**) within 3 hours and 30 min. The function **extra 1** (e.g. blower) is switched on simultaneously.
	Tb	=	1000 °C	
	time	=	3h:30min	
	rate	=	71 °C/h	
S 06	Ta	=	1000 °C	Here the furnace cools down in 5 hours from 1000 °C (**Ta**) to 800 °C (**Tb**). The extra function was switched off automatically as soon as this segment was reached. At the end of the segment the furnace switches off and the status **END** appears in the program start display of the controller.
	Tb	=	800 °C	
	time	=	5h:00min	
	rate	=	40 °C/h	

What to do, when...

... you wish the program to start at some later date/ time?	Enter the desired start time on the input display and press the **start** key.
... you wish to prolong the dwell time in a running program?	For example: The dwell time that you wish to prolong was originally set at 30 min. 20 minutes of this time have already run. If you wish to prolong the dwell time by another 10 min for example, enter 20 min. (**10 min remaining dwell time + 10 min prolongation of dwell time = 20 min**)
... a fault indication appears on the LED display?	Check the status of the fault indication with the aid of the operating instructions. If the fault cannot be eliminated, note down the fault indication and the data on the rating plates of the furnace/program controller and contact your customer service or call Nabertherm direct.

Features

The Controller is an electronic temperature controller which permits the precise control of your heat treatment processes.
The controller features:

- 9 programs, each with 18 segments which can be individually programmed and stored
- Two extra functions which can be switched on during a process
- Automatic timer for programmable start time
- 4-line LCD display
- Programming of date and time
- Digital interface RS 422 for connection to a PC

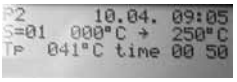
Safety

The controller is equipped with a number of electronic safety features. In the event of malfunction, the furnace switches off and a fault indication appears on the display. For more details see "**Fault Indications**" on page 20.

Switching on the controller

The controller is ready for operation when the control-current switch is **"On"**.

The furnace temperature (in this case, e.g. 40°C) appears on the LED display.



The program start display with information on the program last processed appears on the input display. For more details, refer to section **"Entry display"** on Page 6.

Control panel

1 Display **„temperature“**

2 LED **„extra 1, extra 2“**

3 Entering-Display

4 **„Date/time“** key

5 **„f1“** key

6 **„info“** key

7 **„extra 1“** key

8 **„extra 2“** key

9 **„display“** key

10 **„start“** key

Example 1

11 **„hold“** key

12 **„stop“** key

13 Program call key (**„prog“**)

14 Program memory key (**„mem“**)

15 **„cursor“** key

16 **„clear“** key

17 Cursor keys for entering values

18 Numerical keys **„0-9“**

19 **„enter“** key

...you want to define a **holdback**?

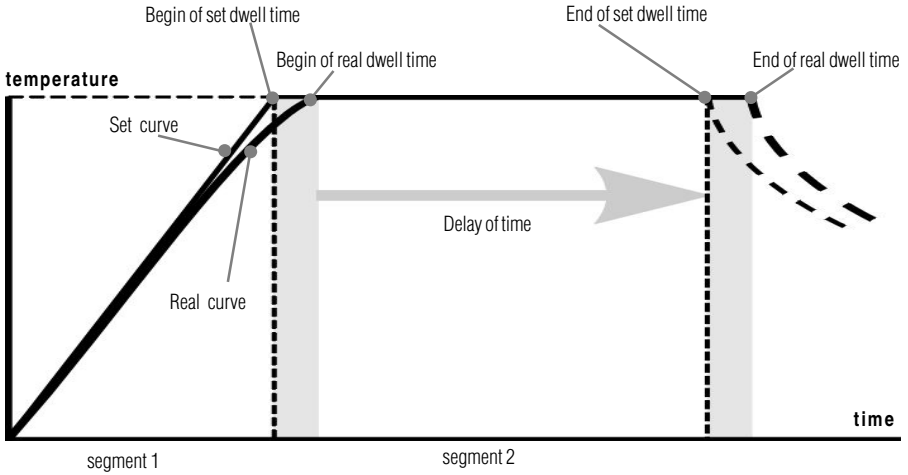
At first some general information:

With Controller C 40 you have the possibility to regulate your programs time-depending or temperature depending. For better understanding of these processes please see the follow-ing examples, resp. graphics.

Example 1

If you have set in configuration area 0 the function **holdback on 0** Controller works **temperature-depending** for all values.

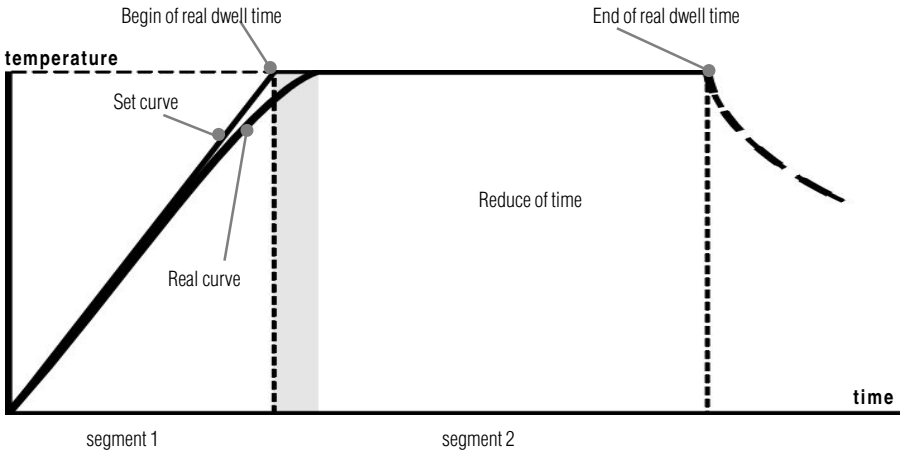
This means: The next segment will only be started if the set temperature is reached. If the furnace did not reach the set temperature at the set time the next segment will not be started. The process time will be increased for the time the former segment was delayed.



Example 2

If **holdback on 1** is set in the configuration area Controller C 40 works **time-depending** for all values. This means: The controller jumps over to the next segment if the set time of the former segment has been is over. If the temperature of the next segment was not reached on time the furnace continues heating and the set time of the next segment will be shortened accordingly.

The next example will show you how to adapt the following segment times compareable to the temperature-relevant way of regulating.



Nabertherm
MORE THAN HEAT 30-3000 °C

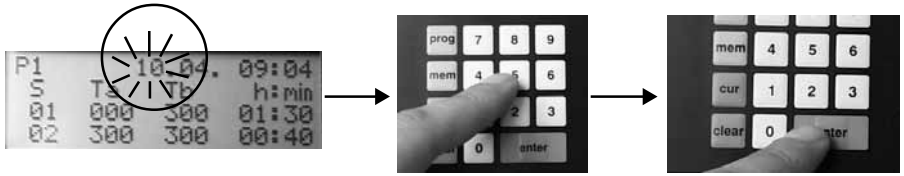
Contents

Short instructions

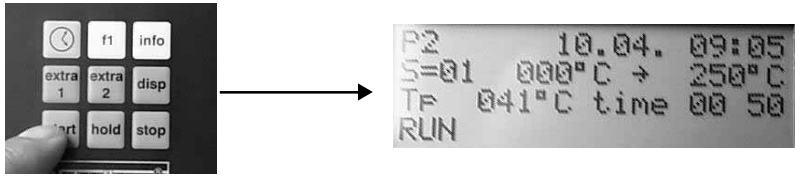
Switching on the controller

Activating a program

Entering start time



Starting a program

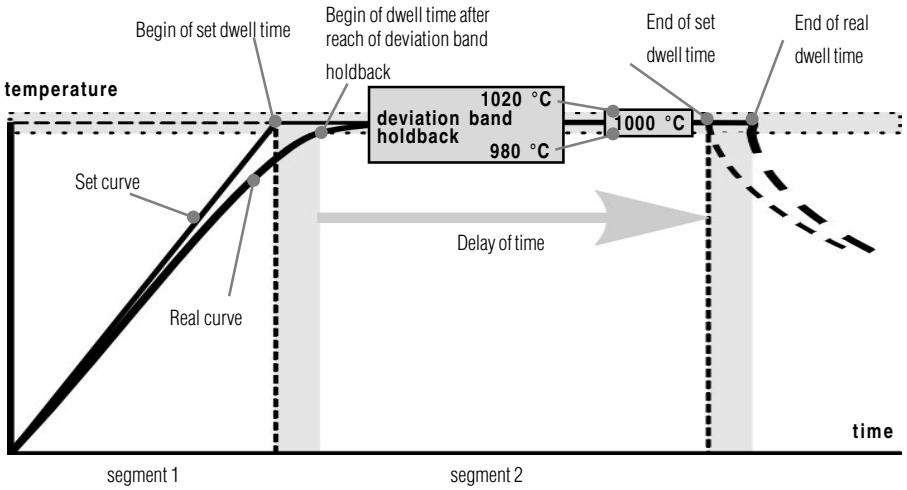


Example 3

The second example gave you a first idea about function **holdback**. The special features, namely the advantages of a **deviation band holdback** will follow now. On Setting a program you can assign a **deviation band holdback** to each segment. The **deviation band holdback** is defined in °C and describes the tolerance of temperature above and under a set temperature. If f.e. the furnace shall heat-up to 1000°C and you have set a **deviation band holdback** of 20 °C it jumps over to the next segment if 980 °C are reached. While working in the new segment the furnace continues heating until the set temperature of the former segment is reached. A **deviation band holdback** is recommended if type, quantity, weight or other physical features of the charge influence the furnace and result in heating-up times slower than set.

A **deviation band holdback** is normally used for large-scaled regulating processes (f.i. multi-zone control, etc.).

We recommend to set the **deviation band holdback** for linear heating-up cycles and dwell times not too small (>10 °C).



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Operating instructions

Controller C 40

Read the operating manual before commissioning the Controller.

Reg.-Nr. B 2.23 (englisch) März 2002

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