MORE THAN HEAT 30-3000 °C

Operating Instructions

Controller

AC590

You can obtain the operating instructions in Spanish or French via the following link or by scanning this QR code: Apps to scan QR codes can be downloaded from the corresponding sources (app stores).

Spanish
https://nabertherm.com/es/descargas/manuales-de-instrucciones

French
https://nabertherm.com/fr/telechargements/manuels-dutilisation

M03.0025 ENGLISCH

Original instructions

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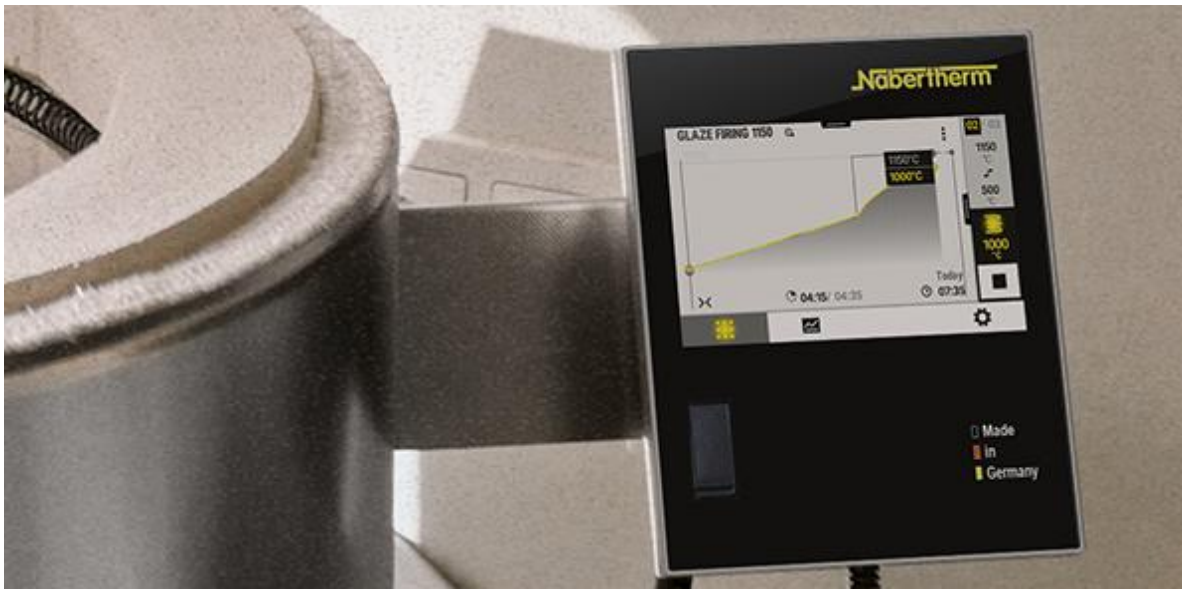
Nabertherm controller AC590

The Series 590 controllers impress with their unique range of features and intuitive operation. In combination with the free “MyNabertherm” smartphone app, monitoring your kiln becomes even easier and more efficient than ever before. It is operated and programmed via a large, high-contrast touch panel which displays exactly the information that is relevant at that particular moment.

Standard design

- Transparent, graphical display of temperature curves
- Clear presentation of firing data
- Choice of 24 operation languages
- Consistent, appealing design
- Easy to understand symbols for many functions
- Precise and accurate temperature control
- User levels
- Program status display with expected end time and date
- “Conny”, the cone firing wizard, to help you start your program easily
- Up to 50 programs each with 40 segments
- Documentation of firing curves on USB storage media in .csv file format
- Service information can be read out via a USB flash drive
- Clear presentation
- Plain text display
- Can be configured for all kiln families
- Can be parameterized for different firings
- “Solar mode” to utilize electricity from photovoltaic systems with and without batteries
- Delayed start possible



1 Safety Information and Intended Use

1.1 General Safety Information

Notice

For general safety instructions, refer to the kiln operating manual

This section contains an overview of the most important safety information. Please also observe the detailed descriptions and other safety information in the subsequent sections.

1. Before working on electrical systems, switch the power switch to “0” and disconnect the power cord.
2. Even with the power switch off, some parts in the kiln may carry voltage.
3. Work on the electrical system may only be done by a trained person.
4. The kiln and switchgear are preset by Nabertherm. If required, process-specific optimization should be carried out in order to achieve the best possible control mode.
5. The user must modify the temperature curve so that the charge, kiln and surroundings are not damaged. Nabertherm provides no guarantee for the process.
6. Before working on the program-controlled plug-in device or the appliance connected to it, always turn off the kiln and disconnect the power cord.
7. Read the operating instructions for the controller carefully to avoid mistakes or malfunctions in the operation of the controller or the kiln.
8. When entering data in text fields, such as entering program names, do not use personal content.
9. The controller has a range of electronic monitoring functions. If a malfunction occurs, the kiln switches off automatically and an error message is shown on the LC display.
10. This controller is not approved for monitoring or controlling safety-related functions without additional safety technology. If the failure of kiln components poses a danger, additional qualified safety measures are required.
11. The behavior of the controller after a power outage is set in the factory. If the power outage is shorter than approx. 2 minutes, a running program will continue, otherwise the program is stopped. If this setting is not suitable for your process, the setting can be changed to suit your process (see “Power Outage Behavior Settings”.
12. The operating instructions must be observed prior to switching on the kiln.

Installation location and constructional requirements

This controller may only be operated if the following environmental conditions have been met:

- Height of the installation site: < 2000 m (sea level)
- No corrosive atmospheres
- No explosive atmospheres
- Temperature and air humidity in conformance with the technical data.

The controller may only be operated with the USB cover is in place, since otherwise dampness and dirt can enter the controller and perfect functionality cannot be ensured.

No warranty is given if the module is dirty because the USB cover was not used correctly or if there was no USB cover.

1.2 Key to the Symbols and Terminology Used in Warnings

SAFETY INFORMATION	Draws attention to certain safety-relevant instructions or procedures.
NOTICE	Indicates a hazard that could damage the equipment.
CAUTION	Indicates a hazardous situation that could result in minor or moderate injury.
WARNING	Indicates a hazardous situation that could result in death or serious or irreversible injury.
DANGER	Indicates a hazardous situation that will result in death or serious injury.

Information Symbols in the instructions

General
This symbol draws attention to important rules that must be observed. Mandatory action signs protect people against injury and show what needs to be done in certain situations.

Pull the plug to disconnect the kiln from the power supply
This symbol tells the operator to pull the plug to disconnect the kiln from the power supply (depends on the model – no circuit breaker installed).

Disconnect the kiln from the power supply by using the circuit breaker
This symbol tells the operator to disconnect the kiln from the power supply by using the circuit breaker (depends on the model – no plug installed).

Risk of explosion
This symbol warns about explosive substances. Caution is required when working with or near explosive substances.

Important information for operators
This symbol tells the operator that small parts are NOT suitable for children under 3 years of age or for persons who tend to put inedible things in their mouth. There is a risk of suffocation.

1.3 Intended Use

The device is used solely to control and monitor the furnace temperature and to control other peripheral devices.

The device may be used only under the conditions and for the purposes for which is was designed.

The controller may not be modified or converted. It may also not be used to implement safety functions. If the device is used for unauthorized purposes, its operational safety is no longer guaranteed and all warranty claims will be invalid.

The applications and processes described in these instructions are exclusively examples of applications. The operator is responsible for choosing suitable processes and the individual application purpose.

Nabertherm accepts no guarantee for the results of processes described in these instructions.

All described application and processes are examples and are based solely on the experience and knowledge of Nabertherm GmbH.

1.4 Symbols Used in this Manual

In these instructions, explanations about how to operate Series 500 controllers are supported by symbols. The following symbols are used:

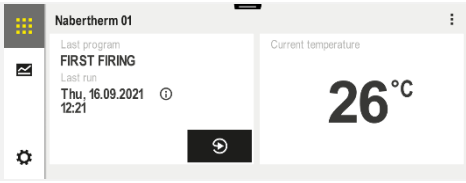
Symbol	Explanation
	Press the touch panel to select a menu or a parameter to specify settings, to change values and to confirm set values. The touch panel is capacitive and cannot be operated with work or safety gloves.
	When no program is active, select the “Kiln” icon to see an overview of the kiln status. If a program is active, use the icon to go to the current program run.
	The “Programs” icon is used to edit and select programs.
	Optional – The “Archive” icon can be used to display the graphs of the last 16 program runs.
	The “Settings” icon is used to access the controller settings.
	The “Start” button starts a heating program.
	The “Stop” button stops an active heating program.
	The “Pause” button pauses an active heating program. The current temperature setpoint is maintained. Extra functions in use remain activated.
	The “Repeat” button restarts the last heating program that has finished. (Press and hold the button)
	The “Remaining time” icon shows the remaining time of a program / segment. The time is displayed with [-] in front.
	The “Expired time” icon shows the expired time of a program / segment.
	The “Heating” icon shows the activity of the heater.
	The “Heating” icon changes color depending on the percentage of output power. If controlled cooling is active, the icon turns blue.
	Press the “Process data” icon on the segment player to change between actual and setpoint values of all temperature measuring points in tabular format.
	The “Clock” icon shows a point in time / a time.
	The “Warning/Malfunction” icon shows an active warning or malfunction.
	If the “Favorite” icon is filled out, this shows that a heating program has been marked as a favorite.
	If the “Favorite” icon is not filled out, this shows that a heating program has not been marked as a favorite.

Symbol	Explanation
	The “Forward” icon is used to navigate between the segments of a program.
	The “Back” icon is used to navigate between the segments of a program.
	The “Delete” button is used to delete programs or segments.
	The “Multiple selection” button is used to select several programs in one category / segments of a program.
	The “Select” button is used to select/deselect a program / segment. A deselected program / segment is shown as a square.
	The “Select” button is used to select/deselect a program / segment. A selected program / segment is shown as a tick.
	The “Close” button is used to close a selected program / segment.
	The “Add” button is used to add a program / segment.
	The “Back” button is used to navigate in the “Settings” icon and for initial set-up.
	The “Save” button is used to save a program.
	The “Info” button opens context-related help advice.
	The “Edit” button is used to edit a program / kiln name.
	When a heating program is active, the “Expand” button is used to switch from the graphical program view to the graphical segment view.
	When a heating program is active, the “Collapse” button is used to switch from the graphical segment view to the graphical program view.
	The “Categories” button is used to select the program categories.
	The “Context menu” button (3 dots) provides more selection/setting options depending on the screen.
	The “Extend/Retract” tab is used to extend and retract the segment player, which is achieved by swiping.
	The “Extend/Retract” tab is used to extend and retract the header, which is achieved by swiping. Information about Wi-Fi, users and other basic information is shown here.
	This segment type icon shows a rising temperature ramp.
	This segment type icon shows a falling temperature ramp.
	This segment type icon shows a hold time.

Symbol	Explanation
	This segment type icon shows a rising temperature jump.
	This segment type icon shows a falling temperature jump.
	The “Segment type” icon shows an end segment.
	This icon enables quick selection for a setpoint jump with ramps or an infinite time during hold times. Quick selection can be chosen directly on the key pad.
	The “Program settings” button is used to select a holdback type.
	The “Holdback manual” icon shows the selected holdback type “manual”.
	The “Holdback extended” icon shows the selected holdback type “extended”.
	The “Wi-Fi” icon shows an active connection with high connection strength.
	The “Wi-Fi” icon shows an active connection with low connection strength.
	The “Wi-Fi” icon shows that there is no connection.
	The “Repeat” button repeats the program over and over again (see end segment).
	The “Extra functions” button activates selection/deselection of extra functions.
	Icon for the user level required for operation (operator, supervisor or administrator)
	The icon indicates that solar mode is active.

2 Operation

2.1 Turning on the Controller/Furnace

Switching the controller on		
Procedure	**Display**	**Comment**
Turn on the power switch.		Set the power switch to “I”. (Power switch type varies according to design/kiln model)
The kiln status is displayed. After a few seconds, the temperature is displayed.		Once the temperature is shown on the controller, the controller is ready for operation.

All the necessary settings for perfect functions have already been made at the factory.

If required, heating programs can also be imported by loading a program file onto a USB flash drive.

2.2 Turning off the Controller/Furnace

Switching the controller off		
Procedure	**Display**	**Comment**
Switch off the power switch.		Switch the power switch to the "**O**" position (Power switch type varies according to design/furnace model)

Notice

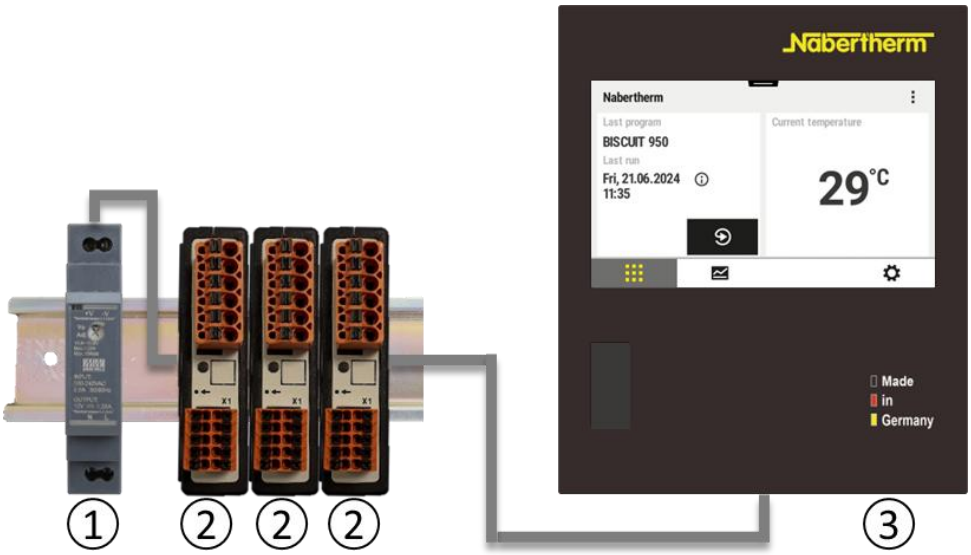
End running heating programs before switching the kiln off at the power switch, as otherwise the controller would generate an error message the next time it is switched on.

See "Malfunctions/Error Messages"

3 Construction of the Controller

3.1 Arrangement of the Individual Modules of the Controller

The controller consists of the following modules:	
1	Power supply
2	Controller modules for controlling zones and charges (-103K3/4). One control module per controller.
2a – 2c	Other modules depend on the additional features
	Communication module for USB and Ethernet connections for a PC
3	Operating and display unit (-101A8)



Voltage supply (1) and control modules (2) are located in the switchgear; the operating and display unit (3) can be installed in the front or side of the switchgear or in the front of the furnace. The control modules (2) are linked via a pluggable backplane bus connector.

3.2 Areas of the User Interface

Series 500 controllers have a convenient and clear user interface. The device has easy to understand operating icons and is split into different operating areas to ensure that operators quickly find the function they are looking for. These basic elements are described below.

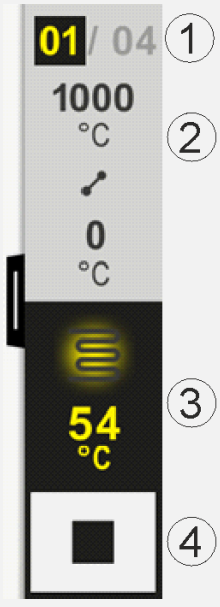
3.2.1 Menu Bar

On the left of the user interface are some icons with which operators select the main areas.

No.	Explanation
1	**Kiln overview:** Shows all the relevant kiln data and graphs while a program is active.
2	**Programs**: Selection, view, input and management of programs.
3	**Settings**: Shows settings, such as control parameters, extra functions, measurement section calibration and data recording.

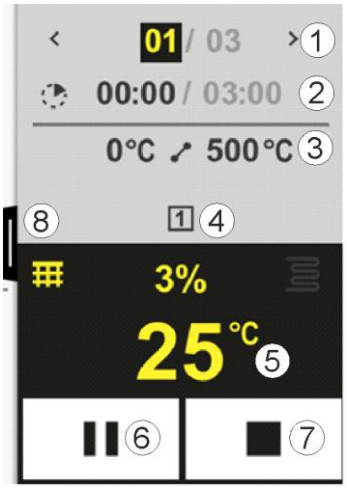
3.2.2 “Small Segment Player”

During an active program, the small segment player is displayed on the right-hand side of the screen. The segment player enables operation of the controller and displays information about the current segment. The segment player is displayed in different operation areas.

No.	Description	
1	**Segment display:** Left: Current segment number Right: Number of segments in the program	
2	**Temperature profile of the segment:** Top/bottom: Start temperature and target temperature of the current segment in the selected temperature unit Middle: Icon for the temperature profile (rising hold time, hold time and falling hold time)	
3	**Temperature and heating**: Top: Shows active heating. The icon is colored differently depending on the heating output. Value: Current temperature of the control zone in the selected temperature unit	
4	**Stop button:** This button is used to stop the current kiln program at any time.	

3.2.3 “Large Segment Player”

The large segment player can be opened during an active program by swiping the small segment players to the left. The small segment players is swiped via a tab on the left-hand side. The large segment player extends the small segment player with additional information about the active segment.



No.	Description
1	**Segment display:** < : Show previous segment > : Show next segment Left number: Segment currently selected Right number: Number of segments in the program
2	**Time details for the selected segment:** Time on the left: Remaining time in segment or expired time in segment (switchable) Time on the right: Time of an entire segment Bar: Progress bar for the current segment
3	**Temperature profile of the segment:** Left: Start temperature of the current segment in the selected temperature unit Middle: Icon for the temperature profile (rising hold time, hold time and falling hold time) Right: Target temperature of the current segment in the selected temperature unit
4	**Shows extra functions that are currently active**
5	**Temperature and heating**: Left icon: Button to select the process data table (see “Displaying Process Data”) Middle: Current heating output as a percentage Right icon: Shows active heating. The icon is colored differently depending on the heating output Value: Current temperature of the control zone in the selected temperature unit
6	**Program hold button:** In ramps: Setpoint is frozen In hold times: Time progress is frozen

No.	Description
7	**Program stop button:** If selected, operators are asked if they are sure they want to stop the program. If the answer is “YES”, the program is stopped immediately. Press the button until you reach the end of the progress bar. This can take about 2-3 seconds. If you press the button by mistake, simply release it again. The program will not be stopped.
8	Tab to expand/collapse the segment player

3.2.4 Status Bar

To display the status bar, drag the tab in the middle of the top edge of the screen down.

The status bar provides additional information about the status of Wi-Fi, operator, etc.

No.	Description
1	Date and time
2	Status of the Wi-Fi connection (visible only when a network is connected)
3	Status of a PC connection (visible only when VCD software is connected)
4	Icon for the controller lock (visible only when the controller was locked).
5	Logged in user (e.g., SUPERVISOR; when pressed, go to [User Administration])

4 Features of the Controller

Function		AC590
x = Serial feature **o = Option**		
	Internal overtemperature protection[1)]	X
Program functions	Programs	50
	Number of segments per program	40
	Segment jump	x
	Select the start time	x
	Wizard for ceramic processes	x
	Manual holdback function	x
	Extended holdback function	x
	Extra functions	o (max. 6)
	Program name to be selected	x
	Ramps as gradient/rate or time	x

Function		AC590
x = Serial feature **o = Option**		
	Active extra functions, also after the end of the program	x
	Copy programs	x
	Delete programs	x
	Program start at current kiln temperature	x
Hardware	Thermocouple type B/C/E/J/K/L/N/R/S/T	x
	Pyrometer inlet 0-10 V/4-20 mA (depends on module type)	x
	Constant heating control	o
Controller	Zones	1 – 3
	Controlled cooling	o
	Manual heating circuit setting (2nd heating circuit)	o
	Start-up circuit	x
	Self-optimization (only single zone)	x
Documentation	Process documentation NTLog	x
	Display and recording of up to 3 additional thermocouples	o
Settings	Calibration (max. 10 base points)	x
	Control parameters (max. 10 base points)	x
Monitoring	Alarm functions (band/min/max)	6
Other	Controller lock	x
	Heating delay after door is closed	o
	User administration	x
	Changing the time format	x
	Changing between °C/°F	x
	Adjusting the power failure behavior	x
	Import/export of parameters, programs and archives	x
	Protection function for air circulation [2)]	o
	Display of the decimal place	o
	Display of PID control values for optimization	x
	Energy meter (kWh)[3)]	x
	Statistics (operating hours, consumption values...)	x
	Real time clock (battery buffered)	x
	Acoustic signal, parameterizable	o
	Operation via touch screen	x
	Graphical view of the last program	o

Function		AC590
x = Serial feature o = Option		
	WiFi – connection for MyNaberthern app	x

1) When the program starts, the highest temperature that is set in the program is determined. If, during the program, the furnace is 50/122 °C/°F hotter than the highest program temperature, the controller switches the heating and the safety relay off and an error message is displayed.

3) The kWh 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. Aging heating elements may also cause deviations.

5 AC590 Operating Instructions Summary

		QR code
Video tutorial:	**Basics of the controller**	

5.1 Basic Functions

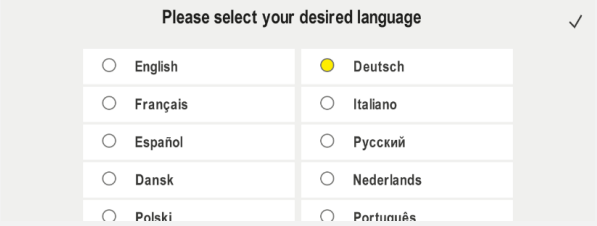
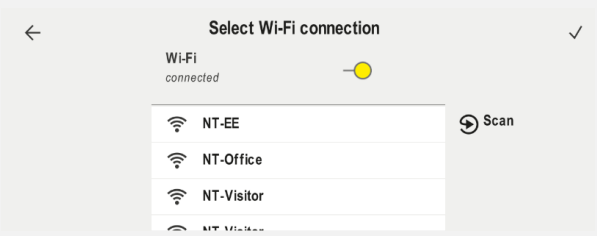
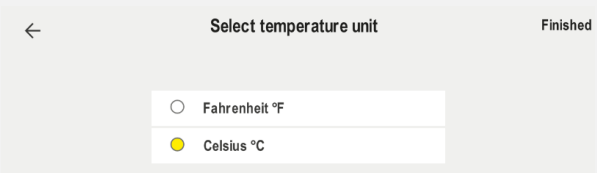
		QR code
Video tutorial:	**Initial set-up**	

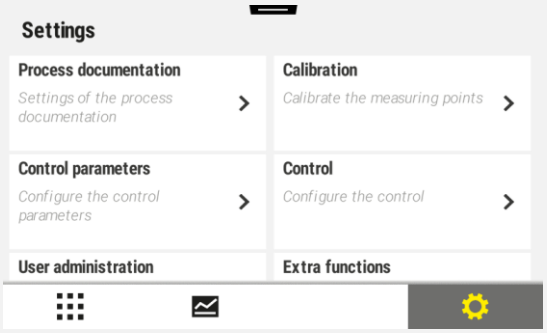
Print this section in order to have the basic operating instructions at hand at all times.

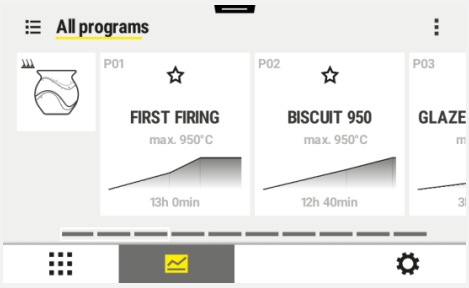
Beforehand, read the safety instructions in the controller operating instructions.

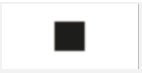
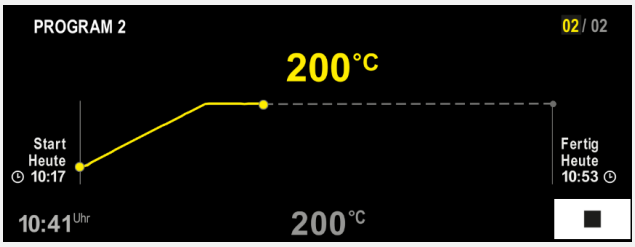
Switching the controller on		
Turn on the power switch. You are in the main overview.		Set the power switch to “I”. (Power switch type varies according to design/kiln model)

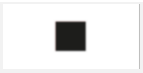
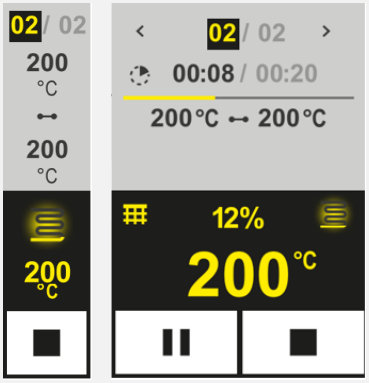
Switching the controller on		
Procedure	**Operation**	**Display**
When you switch on the kiln, a set-up wizard is opened		The wizard procedure can be repeated if necessary.

Switching the controller on		
Procedure	**Operation**	**Display**
Select and confirm language		
Set up the Wi-Fi connection. Select the correct Wi-Fi network Enter the Wi-Fi password		
Set up the temperature format	“Finished”	

Changing the language		
Procedure	**Operation**	**Display**
		
Select [Settings]		
Select [System] – [Language]. Swipe up if the item is not visible.		In the “Settings” menu, scroll down to “System” on the bottom left-hand side
Select the desired language		

Loading and starting the program (if applicable, after entering a program beforehand)		
Procedure	**Operation**	**Display**
		
Select [Programs]		
Select and check the program		
Start program		The controller opens the program overview in graph format with the small segment player.
Use the wizard		The ceramic wizard helps you create and start a program quickly. A description of how to use this can be found in “Creating Programs via the Ceramic Wizard”.

Stopping a program		
Procedure	**Operation**	**Display**
If the controller has not been used for some time, it goes into stand-by mode. Some key information is shown on a dark background. For example, the current temperature, a graph if a program is running, extra functions and other information. Touch the screen anywhere to exit stand-by mode.		
Stop a program in stand-by mode (controller has not been used for some time)		
Confirm the confirmation prompt [End program]	Confirm [Yes]/[No]	Press the button until you reach the end of the progress bar. This can take about 2-3 seconds. If you press the button by mistake, release it again. The program will not be stopped.

Stopping a program		
Procedure	**Operation**	**Display**
Stop via the segment player		
Confirm the confirmation prompt	Confirm [Yes]/[No]	
Pause program		When the program has been paused, the button flashes until the program is continued (See “Large Segment Player”). You have to press this button a little longer to rule out an operating error.

5.2 Entering a New Program (Program Table)

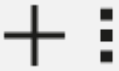
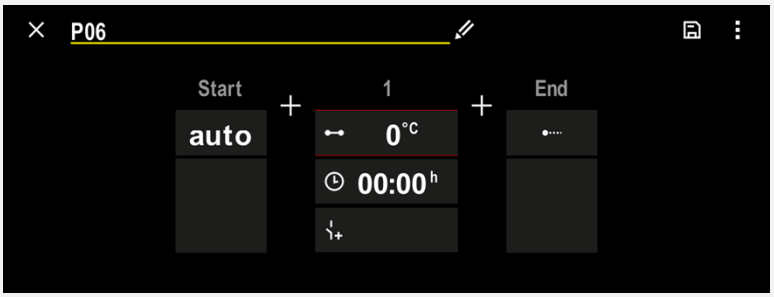
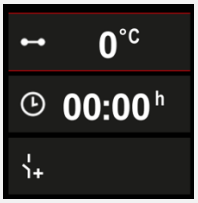
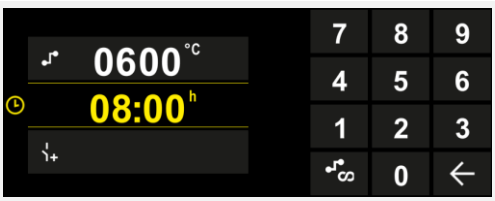
Program entry is described in more detail in “Entering or Changing Programs”.

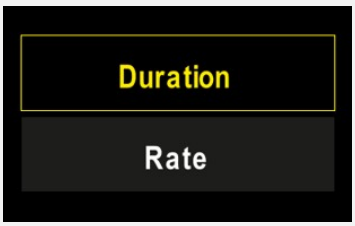
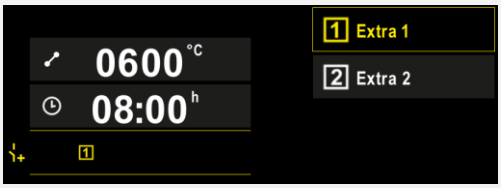
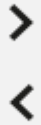
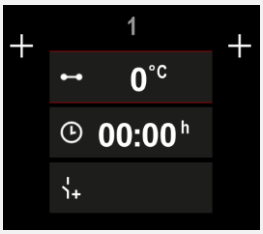
For simple, PC-supported program input and program import via a USB flash drive, please refer to “Preparing Programs on a PC with NTEdit”.

Fill in the program table			
Program name/Number			
Comments			
Segment	**Target temperature**	**Time [hh:mm] or rate [°/h])**	**Hold time**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

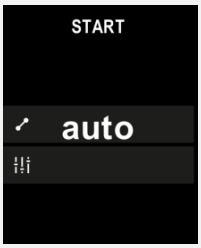
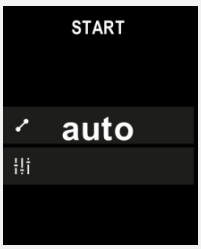
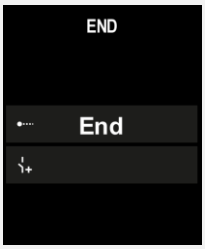
Segment	Target temperature	Time [hh:mm] or rate [°/h])	Hold time
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			

Entering a new program		
Procedure	**Operation**	**Display**
		

Entering a new program		
Procedure	**Operation**	**Display**
Select [Programs]		
Select either the [New program - plus icon] icon or the [New program] context menu (3 dots)		The plus icon is located between the segments.
Edit segments		
		
Edit the program name, maximum 19 characters.		
Select the segment to be edited		
Select and enter the target temperature of the segment		
Enter the duration of the segment.		

Entering a new program		
Procedure	**Operation**	**Display**
Select [Rate] to also enter a slope °/h for ramps		
Select/deselect extra functions		
Press segment navigation to select the segment before and after.		
Press [+] to add segments		
Repeat the steps described above until you have entered all the segments. Start and end segments are already provided and do not have to be changed, but they do allow entry of special functions. Extra functions set in the end segment remain after the end of the program until the stop button is pressed again.		
Save the program: If the program was modified, you will be asked if the program should be saved when exiting the program.		

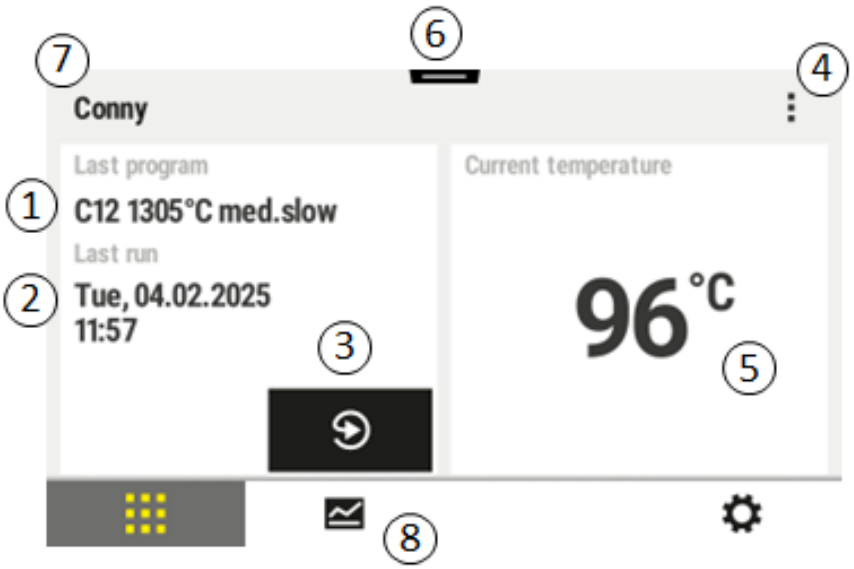
Entering a new program Edit program		SUPERVISOR	
Procedure	**Operation**	**Display**	**Comment**
A program consists not only of segments but also a name, a start segment and an end segment. Additional parameters can be changed there. In general, these parameters do not have to be changed for simple applications.			
Select [Programs]			
Select a program			

Entering a new program **Edit program**		**SUPERVISOR**	
Procedure	**Operation**	**Display**	**Comment**
Three-point menu, then [Edit program]			
Change the program name			Special characters as well as upper and lower case are available on separate buttons on the key pad.
Change the holdback type Manual Extended	  		Choose between [AUTO], [MANUAL] and [EXTENDED]. See “What Is a Holdback”.
Change the start temperature. In the basic setting, the current kiln temperature is used as a start value for the subsequent course of the program.	Auto		See “Using the Actual Temperature as the Program Setpoint at Program Start”.
Change the behavior when the end segment is reached	End		Choose between [END] and [REPEAT]. Choose active extra functions when the program has ended.
Save the program	Press the save icon.		

6 Overview Pictures

6.1 Start Screen (No Program Active)

The start screen provides information about the kiln when no program is running. A special feature is being able to restart the last program that was completed.



No.	Description
1	Name of the last program or wizard that was started
2	Starting time of the last run. The last firing can be viewed via (i). When the controller is restarted, this data is no longer available.
3	Restart the last program or wizard
4	Context menu (3 dots): – Info menu (with service export) – Display app TAN – Display process data – Control extra functions – Edit kiln name Help icon
5	Shows the current temperature of the control zone.
6	Show status bar (swipe down)
7	Kiln name (can be edited)
8	See “Menu Bar”

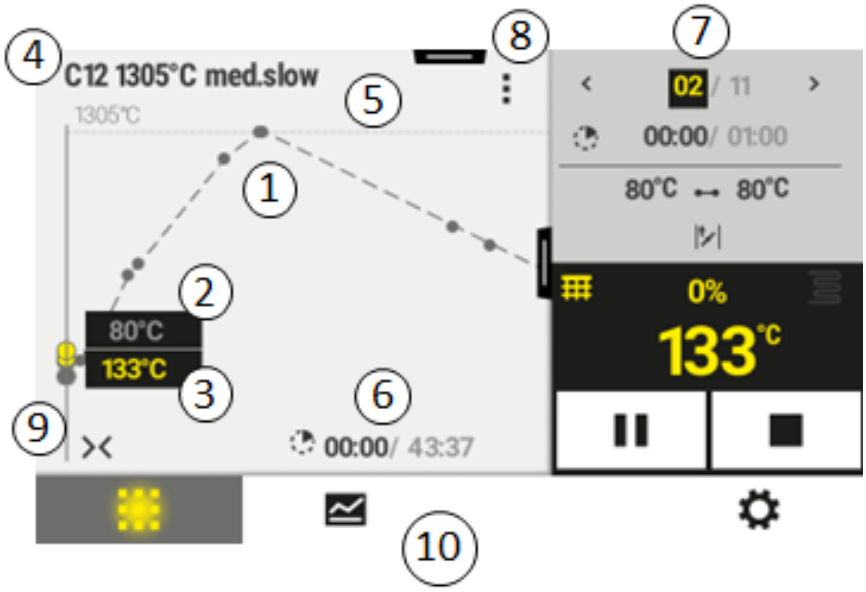
Notice

If the controller has not been operated for some time and no program is active, the display is dimmed. The Nabertherm logo is displayed. Touch the screen to activate it again.

6.2 Start Screen (Program Active)

The start screen allows you to observe kiln and program data while a program is running. Segment and kiln data are displayed in the “segment player”, which was described above.

If there is a power outage, the old data is no longer available, but all new data is displayed.



No.	Description
1	Graph of the temperature progress of the active program. The part of the graph colored yellow and/or filled in gray is in the past. The planned program profile defined in the program is shown to the right of this. If there is a power outage, the old data is no longer available, but all new data is displayed. A new measurement is shown every 30 seconds. Heating programs that take up to 1 week can be displayed. With programs that are longer than 1 week, the first measurements are overwritten.
2	Current kiln temperature
3	Setpoint of the temperature from the kiln program
4	Program name
5	Selected program options, such as a special holdback type (monitoring function)
6	Display of program times: Remaining time / expired time of the program / approximate time when the program will end
7	Segment player. See “Small Segment Player” and “Large Segment Player”. The small segment player is displayed in the basic setting. Swipe to the left to display the large segment player.

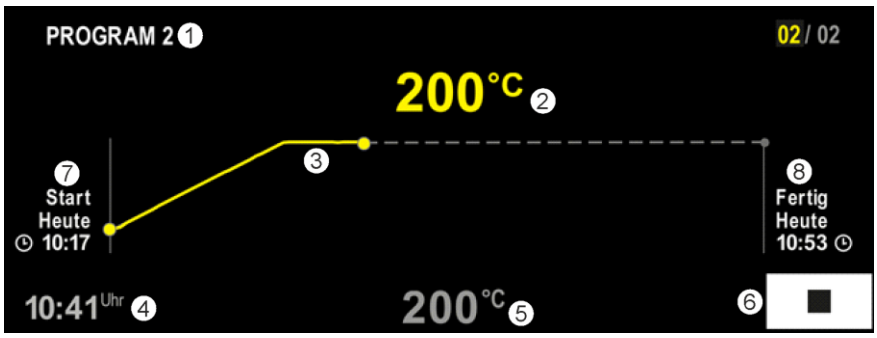
No.	Description
8	Shortcut menu (3 items): (Swipe up if not all entries are displayed) – Info menu (with service export) – Access the app TAN (access code to pair the MyNabertherm app) – Display process data (access tabular display of process data) – Change active program (does not relate to the saved program) – Control extra functions (change status of the extra functions to start of next segment) – Segment jump – Controller [lock]/[unlock] (lock controller for this program) – Graphs [expand] [collapse] (display all graphs or per segment) – Select graphs (selection of graphs displayed) Help icon
9	Expand or collapse graphs. When expanding, the graph is expanded from a program view to a segment view.
10	See “Menu Bar”

If the function for selecting graphs is used, the yellow graph may be replaced by one of the displayed colors. If the furnace has just one heating zone, this selection is empty.

7 Stand-By Mode

A special overview screen is displayed in stand-by mode. The controller goes into stand-by mode if it has not been operated for some time. In stand-by mode, the background lighting is dimmed.

Some of the following content is displayed only when a program is running.



No.	Description
1	Name of the program currently running (only when a program is running).
2	Actual temperature inside the kiln
3	Description of the program currently running (only when a program is running). After a power failure, the graph is deleted and continues only when power is restored.
4	Current time
5	Setpoint of the temperature inside the kiln
6	Stop button to stop the current program (only when a program is running).
7	Start time of the program currently running (only when a program is running).
8	Approximate time when the program will end (only when a program is running).

8 Displaying, Entering or Changing Programs and Wizards

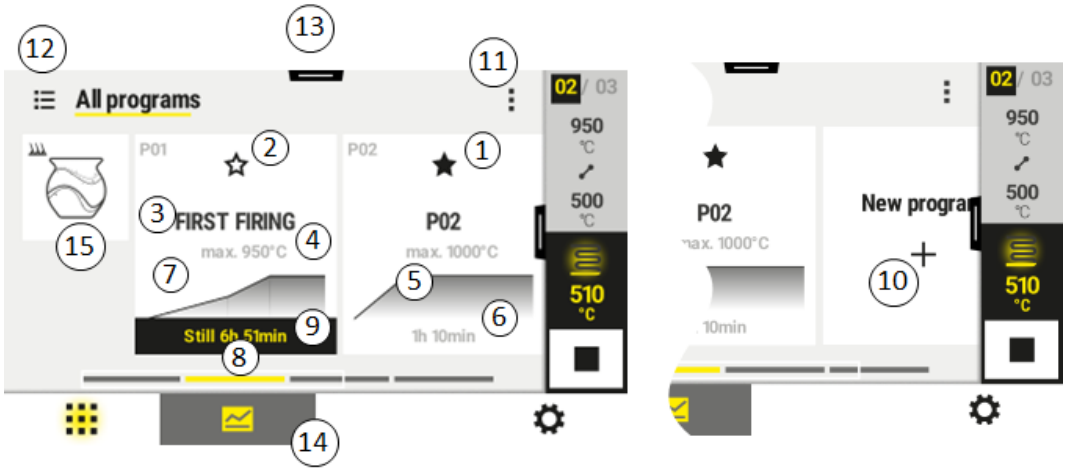
Programs can be entered or changed quickly with the touch panel. Programs can also be changed, exported or imported from a USB flash drive while a program is running.

Instead of a program number, you can assign a name to each program. If a program is to be used as a template for a different program, it can be copied or deleted easily.

For simple, PC-supported program input and program import via a USB flash drive, please refer to “Preparing Programs on a PC with NTEdit”.

Programs can also be created by using wizards. These wizards can be found on the left side of the program list.

8.1 Program Overview



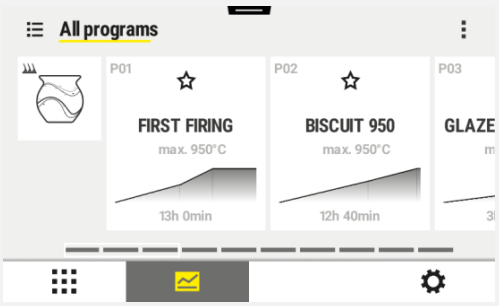
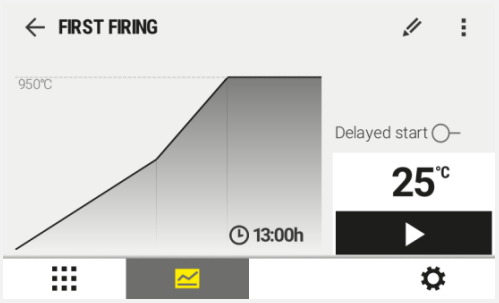
No.	Description
1	Program marked as a favorite
2	Program not marked as a favorite
3	Program name
4	Maximum temperature of the program
5	Graph of the program
6	Expected duration of the program
7	Program that is currently active
8	Graph of the program with indicator of the current processing status
9	Expected remaining time
10	Create a new program
11	Context menu: – New program Help icon
12	Select program category: Press the icon to select the category.
13	Show status bar (swipe down)

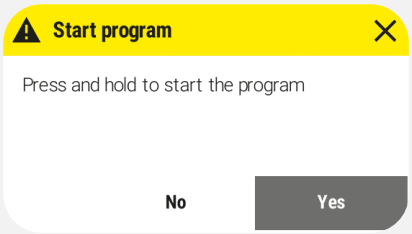
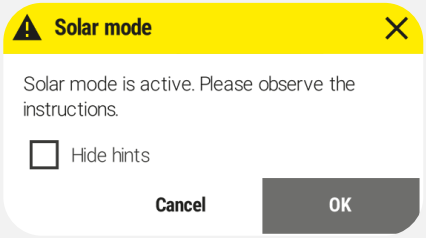
No.	Description
14	See “Menu Bar”
15	Section for wizard

8.2 Display and Start Programs

		QR code
Video tutorial:	**Selecting and starting programs**	

Saved programs can be viewed without accidentally changing the program. To do this, take the following steps:

Display program:		
Procedure	**Operation**	**Display/comment**
Select [Programs] menu		
Select a program from the list		

Display program:		
Procedure	**Operation**	**Display/comment**
Start the program		The following message window is displayed:  If selected, operators are asked if they are sure they want to start the program. If you select “Yes”, press the button until the end of the progress bar is reached. This can take about 1-2 seconds. If you press the button by mistake, simply release it again. The program will not be started. If solar mode is activated and display of the message text has been activated in the settings menu, an additional message is displayed before the above message window (see “Solar Mode”). 

8.3 Entering Programs via the Segment Editor

		QR code
Video tutorial:	**Entering and saving programs**	

A program is a temperature profile entered by the user.

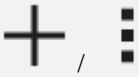
Each program has freely configurable segments:

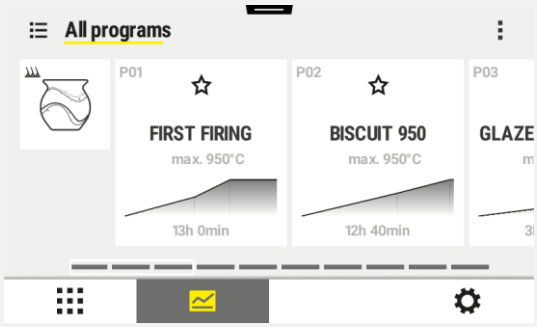
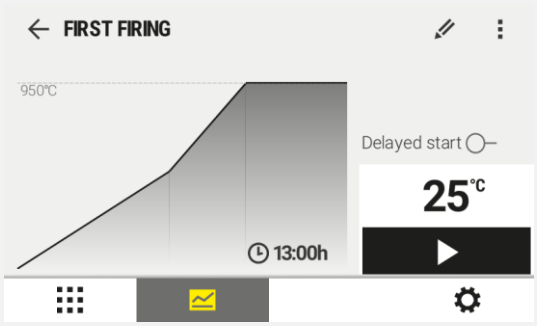
- AC590 = 50 programs/40 segments (39 segments + end segment)

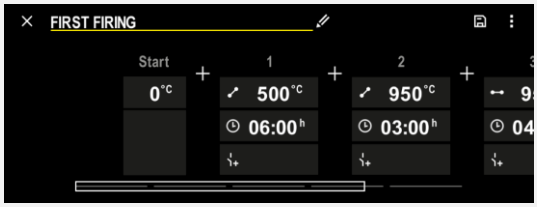
For simple PC-supported program input and program import via a USB flash drive, please refer to “Preparing Programs on a PC with NTEdit”.

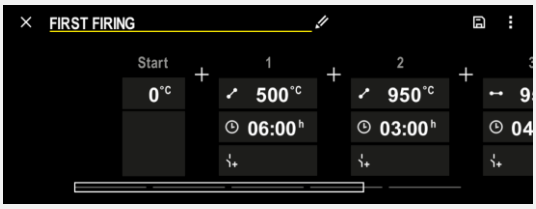
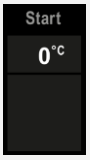
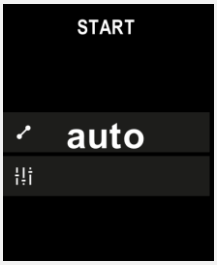
A program consists of 3 parts	
Start segment	The start segment allows you to enter general program parameters. In the start segment, the start temperature of the program can be selected once. All following start temperatures of the segments are based on the previous segment. Parameters such as holdback mode (monitoring) can also be activated.
Program segments	The program segments form the program profile. This consists of ramps and hold times.

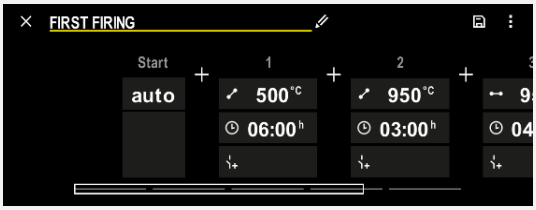
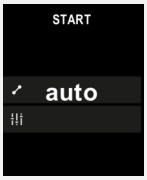
A program consists of 3 parts	
End segment	Extra functions that are to remain activated after the end of the program can be activated in the end segment. These are reset only when the stop button is pressed again. A function for infinite repetition of the program can also be selected.

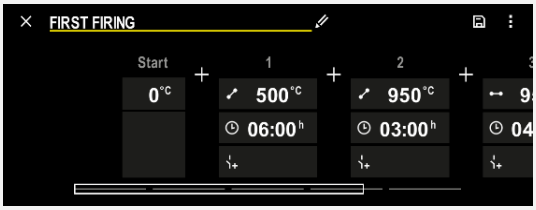
Creating a new program		**SUPERVISOR**
Procedure	**Operation**	**Display**
Select [Programs] menu		
Either select a tile [New Program] or select [New Program] in the context menu (3 dots)		

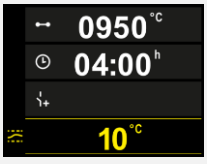
Editing a program		**SUPERVISOR**
Procedure	**Operation**	**Display**
Select [Programs] menu		
Select a program		
Change the name of the program: Select the pencil icon beside the program name		Upper and lower case are available on separate buttons on the key pad. Entry must be in Latin letters.

Editing a program		**SUPERVISOR**
Procedure	**Operation**	**Display**
To edit: Select the [Edit Program] context menu (3 dots) or click the pencil icon		

Start segment – select holdback type		**SUPERVISOR**	
Procedure	**Operation**	**Display**	**Comment**
Select a program			
Select the start segment			
Change the holdback type	  manual  extended		Choose between [AUTO], [MANUAL] and [EXTENDED]. See the description below: “What is a Holdback”.
Exit the start segment			
Save the program			

Start segment – changing the start temperature	**SUPERVISOR**	
Procedure	**Operation**	**Display**
Select a program in the program overview		
Select the start segment		
Change the start temperature. In the start segment, select [auto]		
		The start temperature is a chosen temperature that specifies the starting point of the first segment. It does not necessarily have to be the ambient temperature. Remember that the current kiln temperature can be used as the starting temperature at program start. See “Using the Actual Temperature as the Setpoint at Program Start”. Automatic “use of actual value” is active if “auto” is selected here. When the program is started, the current temperature is then always taken as the start setpoint.

Adding and changing segments	**SUPERVISOR**		
Procedure	**Operation**	**Display**	**Comments**
Select a program			
Add segments			The [+] icon enables a segment to be added at the respective point between start and end segments, up to the maximum number of segments.

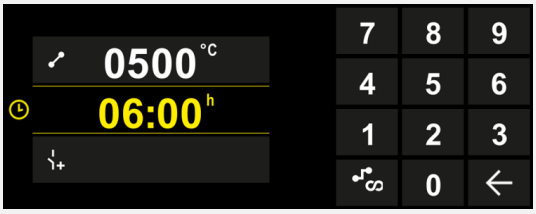
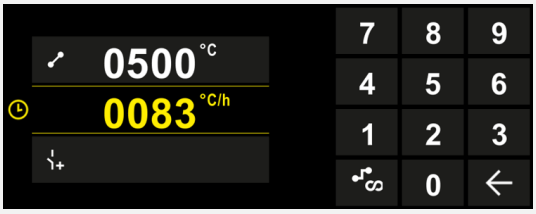
Procedure	**Operation**	**Display**	**Comments**
Only with hold times and holdback mode [MANUAL/EXTENDED]: Set the holdback bandwidth [HB].			Note: Holdback entry [HB] is available only during hold times.

If, for example, a value of “3°” is entered, the temperatures will be monitored in the range +3 ° to -3 ° and the setpoint will be “frozen” when the band is left. If “0°” is entered, the program is not influenced.

Procedure	Operation	Display
Enter the target temperature of the segment		

The target temperature is simultaneously the start temperature of the following segment.

Then a time (for dwell times and ramps) or a rate (for ramps) can be attributed to the segment.

Procedure	Operation	Display
Enter the duration of the segment: With the steps icon, select the fastest possible increase (step, time = 0:00h). An infinite hold time is set with the [infinite] icon.		
As an alternative to the duration of a segment, it is also possible to enter a rate in °C/h. Here, too, the fastest possible increase is entered via the stairs icon.		

The [Time] is entered in the format hhh:mm.

[RATE] is specified in the format °/h.

Note: With long hold times and activated data recording, the maximum recording time must be considered and, if necessary, process data archiving must be set to [24 h-LONG TERM REC].

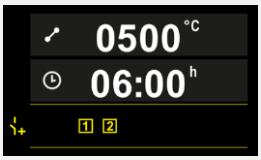
The maximum hold time of a program segment is 499:59 [hh:mm].

If [RATE] is selected: Minimum slope: 1°/h

If [TIME] is selected: Minimum slope: (Delta T)/500h.
Example: at 10°C temperature difference: 0.02°/h. Gradation: approx. 0.01°

The controller automatically calculates the rate and time at switchover.

Depending on the features of the furnace, external, switchable functions, also called extra functions, are available.

Procedure	Operation	Display	Comments
Select/deselect extra functions			The number of extra functions depends on how the kiln is equipped

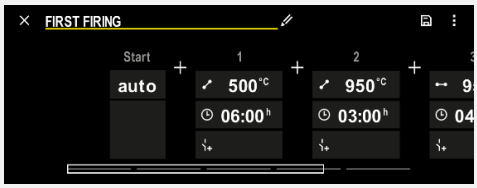
Simply select the desired extra function from the list. The number of extra functions available depends on the how the furnace is equipped.

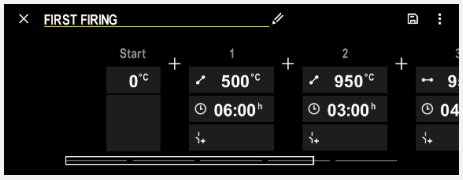
This parameter entry is repeated until all the segments have been entered.

The “end segment” is a special feature in program input. It allows the program to be repeated automatically or extra functions to be set once the program ends.

End segment – functions	**SUPERVISOR**	
Procedure	**Operation**	**Comments**
Set the behavior of the end segment: *Program end* *Repeat program.*		If “Repeat program” is selected, the selected program is started again directly once the program ends.
Set the behavior of the end segment: Extra functions after program end		Extra functions set in the end segment remain after the end of the program until the stop button is pressed again.

If “Repeat” is set in the end segment, the complete program is repeated over and over again after the end segment; it can be stopped only by pressing the stop button.

Organize segments	**SUPERVISOR**		
Procedure	**Operation**	**Display**	**Comments**
Select a program			
Select context menu (3 dots) [Organize Segments]			
Select segments	Select one or more segment tiles.		Press the tile again to deselect.
Move segments	After selecting a segment: Use the arrows to select the destination	The segment is moved to the chosen location.	
Select all segments		All segments in the program are selected, apart from the start and end segments	This function can also be selected in the context menu (3 dots) (“All Segments”)
Delete selected segments			The selected segments are deleted.

Assign category		SUPERVISOR
Procedure	**Operation**	**Display**
Select a program		
Select context menu (3 dots) [Assign category]		A list of favorites opens. Select the desired category to display the program in this category.

When all parameters have been entered, decide whether you want to save the program or exit without saving.

Saving a program		SUPERVISOR
Procedure	**Operation**	**Comments**
Save the program		When your try to exit the program without saving it, you will be asked if you want to save it.

When the entries are complete, the program can be started (see “Starting a Program”).

If no buttons are activated for some time, the display returns to the overview.

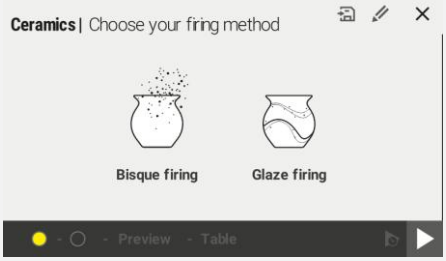
For simple, PC-supported program input and program import via a USB flash drive, please refer to “Preparing Programs on a PC with NTEdit”.

8.4 Creating Programs via “Conny”, the Ceramic Wizard

		QR code
Video tutorial:	**Using the ceramic wizard**	

As an alternative to manual program entry, the AC590 controller provides an option to enter a firing program easily with the help of the wizard “Conny”. This can be especially useful if the kiln is used for pottery and firing programs are to be created on the basis of cones.

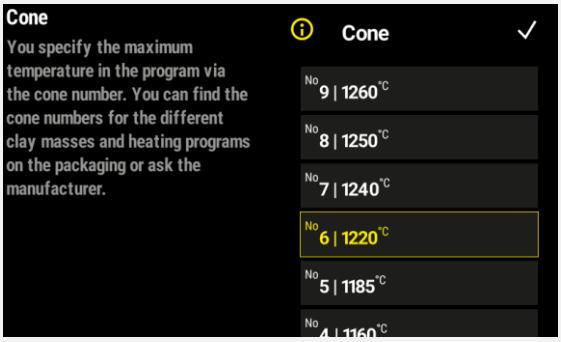
The wizard guides you through all steps of the program and queries them. At the end, the wizard generates the firing program, which you can either start immediately or save in a program storage location. You also have the option of changing the program to suit your individual needs after it has been created.

Opening the wizard		SUPERVISOR
Procedure	**Operation**	**Display**
Select this tile to open the wizard “Conny”		
Select the firing process (bisque or glaze firing)		

By selecting bisque or glaze firing, the wizard goes to the next step. Now, you can change the current step by selecting the entry field.

If you select the next entry field on the right side of the screen, the screen section automatically moves to the next step.

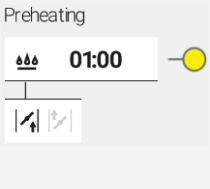
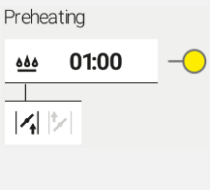
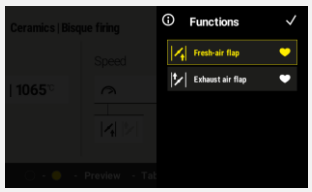
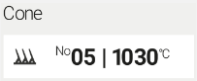
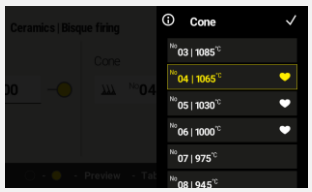
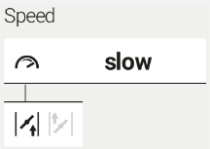
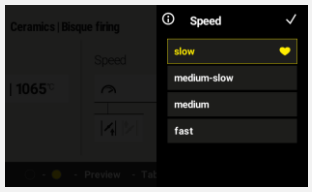
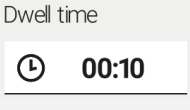
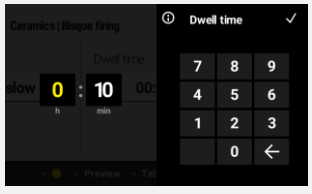
At the bottom of the wizard you can see where you are in the wizard. You can go there directly through selection.

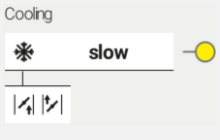
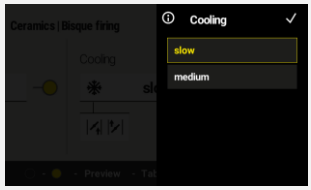
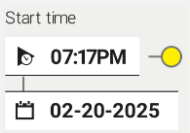
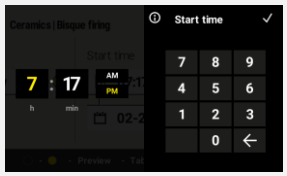
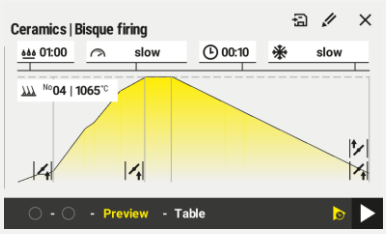
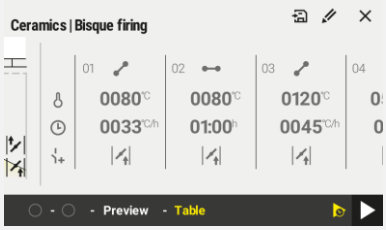


No.	Description
1	Entry field for the step
2	Section for functions (visible only if functions are available)
3	Button to deactivate the step
4	Save the current wizard as a separate program
5	Change individual values via the segment editor
6	Display showing in which section the wizard is at present
7	Icon to start the program
8	Icon to start the program with a delay
9	Help icon to show the help text

No.	Description
10	Help text
11	Icon to exit the entry screen
12	Recommended settings

The wizard consists of different steps:

Step	Description	Description	Entry
Pre-heat	Create a slow pre-heating curve		
Ceramics must be sufficiently dry before being fired in the kiln. Depending on the clay and the geometry of your ceramics, there may still be small amounts of moisture in the objects. Pre-heating allows gentle removal of small amounts of residual moisture. This step must not be used to dry the ceramics as this would damage the kiln.			
Switchable functions (optional)	In some steps of the wizard, there are fields to select and deselect switchable functions (such as an automatic air inlet flap, if this is ordered as an option)		
If the kiln has no additional functions, the field for the functions is hidden.			
Select the required pyrometric cone	The maximum temperature of the firing program is determined via the cone type.		
The respective temperatures must be pre-selected in relation to the firing mode and the material.			
Rate	Select the rate of heating up		
Thin-walled ceramics can be heated up faster than thick-walled ceramics. Depending on the geometry and thickness of the ceramics to be fired, you can set the rate at which the kiln is heated to the cone temperature. Choose “fast” only if your ceramics are not sensitive.			
Hold time	Select the duration of the hold time		
Hold time is used to ensure that the end temperature is evenly distributed among the ceramics.			

Step	Description	Description	Entry
Cooling	Select the rate of cooling		
Cooling can be activated as an option. By selecting the cooling rate you can set faster or slower (careful) cooling. Accelerated cooling can be set only if the kiln is equipped with an automatic fresh-air flap. Otherwise, slow cooling can be set via the wizard. In kilns without additional functions, only “slow” cooling is available as a choice.			
Delayed start	Start a program at a desired time		
The firing process can be started with a delay by setting a time in the future. Make sure that the correct system time is set in the controller.			
Preview	View of the wizard settings as a graphical curve		
Values shown her can be changed by selection. If the kiln has switchable functions, they are shown at the end of a step. Each step in the created program consists of several segments that can be seen in the curve. Depending on the number of steps, the presentation may differ from the actual process.			
Table	A wizard presentation showing the segments in table format.		
Each step in the created program consists of several segments that can be seen in the table.			
Save a wizard in a program in the list of programs	Save the data entered in the wizard as a separate program in the list of programs.		When you enter a program name and save the program, the wizard is shown again
Call up a saved program	The program saved from the wizard is in the program list and can be started from there.		The saved program is at the end of the list.
Saving a wizard setting as a separate program allows it to be used again later. This is done by selecting the saved program in the program overview.			

Step	Description	Description	Entry
Changing a single value in the wizard by saving it in a program	Changing program settings that are not available in the wizard.		When you confirm a prompt, a program name is entered. The program is saved in the program and opened in the segment editor where it can be changed. This closes the wizard.
The segment editor is opened to make changes.			All functions of the segment editor are described in “Entering Programs via the Segment Editor”.
If the setting options in the wizard are insufficient, all value of the program can be changed subsequently via this function. To do this, it is saved and opened under a chosen program name. When all the changes have been made, the controller asks if the changes should be saved.			

8.5 Preparing Programs on a PC with NTEdit

Entering the required temperature curve is simplified considerably by using software on the PC. The program can be entered on the PC and then be imported to the controller with a USB flash drive.

This is why Nabertherm offers a valuable aid with the freeware **NTEdit**.

The following features support you in your day-to-day work:

- Selecting your controller
- Filtering of extra functions and segments depending on the controller
- Setting extra functions in the program
- Exporting a program to a hard disk (.xml)
- Exporting a program to a USB flash drive for direct import into the controller

- Graphical display of the program sequence

Notice

If you do not have a functioning USB flash drive, you can purchase one from Nabertherm (part number 524500024) or download a list of tested USB flash drives. This list is part of the download file for the NTLog function (see information in “Saving Data on a USB Flash Drive with NTLog”). The corresponding file is called: “USB flash drives.pdf”.

Notice

This software and the corresponding documentation for NTEdit can be downloaded at the following address:

http://www.nabertherm.com/download/
Product: NTEDIT
Password: 47201701

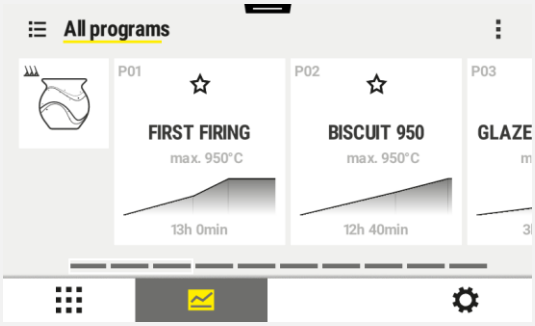
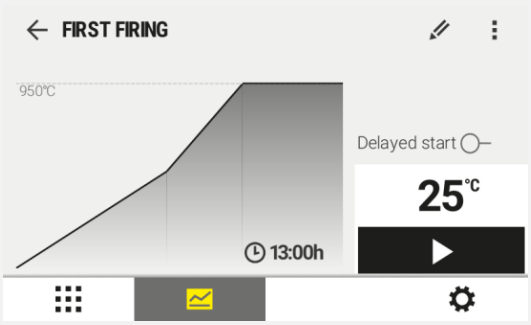
The downloaded file must be unzipped before you can use it.

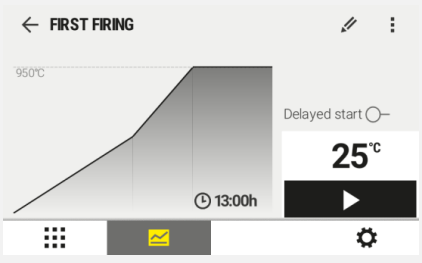
Before using NTEdit, read the instructions, which are also in the directory.

System requirements: Microsoft EXCEL™ 2010, EXCEL™ 2013 or Office 365 for Microsoft Windows™.

8.6 Managing Programs (Delete/Copy)

Besides the entry of programs, it is also possible to delete or copy them.

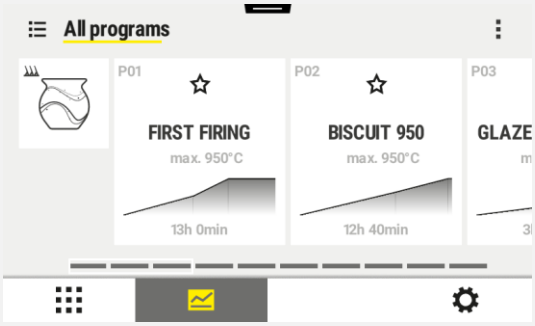
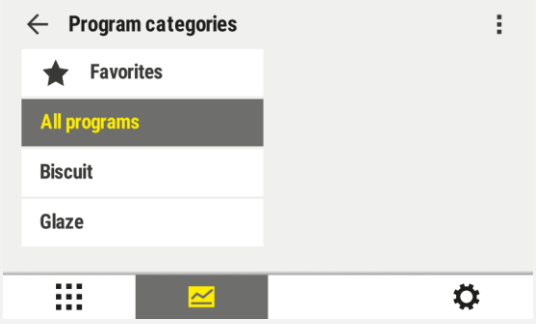
Deleting programs		**SUPERVISOR**
Procedure	**Operation**	**Display**
Select [Programs] menu		
Select a program		
Select the context menu (3 dots) and [Delete program]		
Confirm the confirmation prompt	Yes/No	

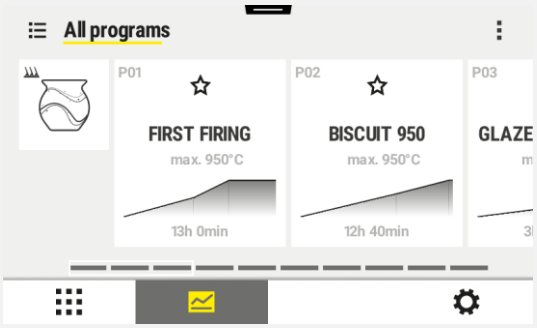
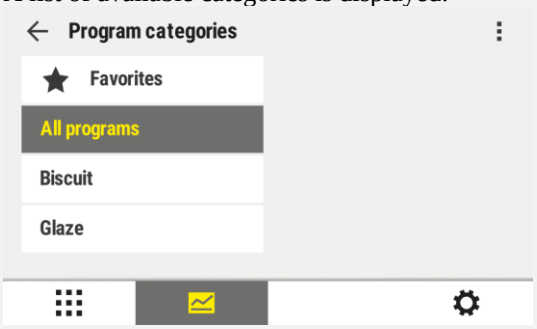
Copying programs		**SUPERVISOR**	
Procedure	**Operation**	**Display**	**Comments**
Select [Programs] menu			
Select a program			
Select the context menu (3 dots) and [Copy Program]			

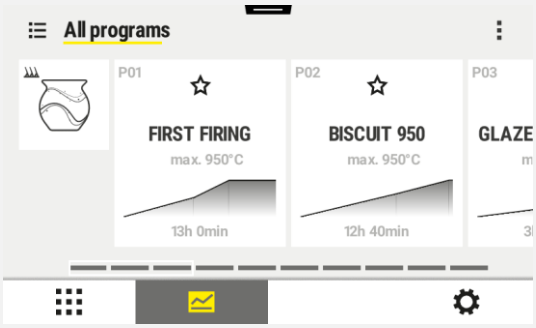
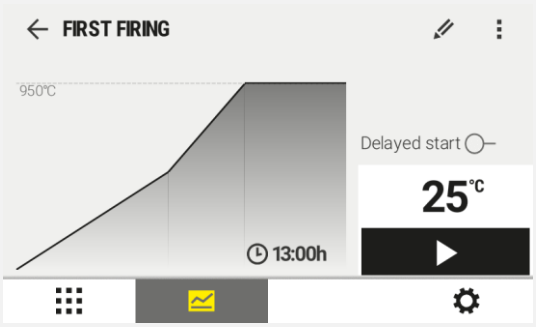
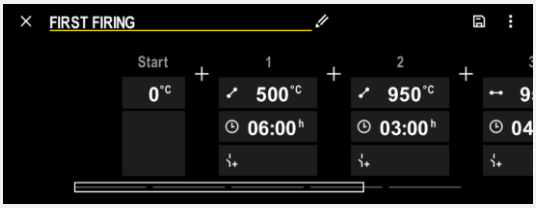
Copying programs		SUPERVISOR	
Procedure	**Operation**	**Display**	**Comments**
Copy			The program to be copied is written to an empty program slot. If there are no empty program slots, the program cannot be copied.

8.7 Assigning and Managing Program Categories

So that you can filter programs later in groups, the individual programs can be assigned to a category. To do this, take the following steps:

Filtering by program categories		
Procedure	**Operation**	**Display/Comment**
Select [Programs] menu		
Select the “Categories” icon		A list of available categories is displayed: 
Select a category from the list and arrow back		All programs in the selected category are displayed

Creating, editing and deleting program categories		
Procedure	**Operation**	**Display/Comment**
Select [Programs] menu		
Select the “Categories” icon		A list of available categories is displayed: 
New category: In the context menu (3 dots), select “New category” and then enter the name of the new category		The new category is shown in the list. Up to 6 categories can be entered.
Edit category: Select a category. In the context menu (3 dots), select “Edit category”		The name of the category can be reentered. On the key pad, use the arrow left button to delete letters. The menu item is available only if an existing category is selected.
Delete category: Select a category. In the context menu (3 dots), select “Delete category”		

Assigning a category			
Procedure	**Operation**	**Display**	**Comments**
Select [Programs] menu			
Select program			
To edit: Select [Edit Program] in the context menu (3 dots) or click the pencil icon			
In the conntext menu (3 dots), select [Assign category]			A list of favorites opens. Select the desired category to display the program in this category.

8.8 What is a Holdback?

A holdback is a temperature band around the program setpoint. Should the actual value drift outside this band the holdback function will pause the setpoint adjuster and remaining time – and maintain the current setpoint value – for as long as necessary for the actual value to return within the temperature band.

Holdback cannot be used if processes have to run according to an exact specified time. Delaying a segment with a holdback when the actual value slowly approaches the setpoint or when there are delay effects with multi-zone controls, for example, is then not acceptable.

Holdback only affects the control zone in “Auto” and “Manual” modes. The other control zones are not monitored.

With “Extended” holdback, the selected control zones are monitored. This function is available in the VCD software from version 2 x.

The holdback monitoring is only possible in dwell times.

There are 3 holdback modes:

Holdback = AUTO: There are no effects of a holdback on the program except when switching over from ramps to dwell times. Here, the controller waits for the dwell time temperature to be achieved. The program waits at the end of a

ramp for the dwell time temperature to be reached. Once the dwell time temperature is reached the controller jumps into the next segment and the processing is continued.

Holdback = EXTENDED When ramps switch over to hold times, the controller waits until the hold time temperatures are reached in all selected control zones. When the hold time temperature is reached in all selected zones, the controller jumps to the next segment and processing continues.

If a control zone leaves the entered holdback band after it has been reached, a warning message is generated referring to the zone leaving the positive or negative band.

Note: The evaluation that a temperature has entered this band is reset if there is a power failure. During a power failure, there is no message that temperatures are out of the band.

Note: If a thermocouple in this band that is used to monitor the extended holdback breaks, in addition to the warning about the breakage, another warning is output: “Out of under-temperature band”.

Holdback = MANUAL: A tolerance band can be entered for each hold time. If the temperature of the control zone leaves the band, the program is stopped (Hold). The program continues once the control zone is in the band again. If 32 °F (0 °C) is entered as the band, the program is not stopped and is time-controlled, regardless of the temperatures that are measured.

This band does not work in ramps and prolongs the hold time when the temperature leaves the band.

If the value entered is "0", the program works "purely time-controlled". No influence of the program takes place.

Paramter Entry:

In program input, operators can set the holdback to “Auto”, “Manual” or “Extended” in the start segment (program-wide parameters).

8.9 Changing a Running Program

A running program can be changed without ending it or changing the saved program. Remember that no past segments can be changed unless you again go to the desired segment, using the function [SEGMENT JUMP].

Note: With a manual segment leap it may happen that more than one segment is skipped per leap. This depends on the current temperature of the furnace (automatic application of actual value).

Notice

Changes made to an active program remain only until the program is finished. The changes (including hold function) are deleted when the program is finished or if there is a power outage during the program.

If the current segment is a ramp, the current actual value after the program change, is accepted as a setpoint and the ramp is continued at this point. If a current dwell time is changed, then a change in the running program has no impact. Only a manual segment jump into this segment results in the execution of a change in the dwell time. The changes on following dwell times are executed without any restrictions.

The following steps must be performed to change an active program:

Changing the current program			**SUPERVISOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu			
Select the context menu (3 dots):			

Changing the current program			SUPERVISOR
Procedure	**Operation**	**Display**	**Comments**
Select [Change active program]			This can be selected only when a program is active. The administrator can block access to this function for supervisors in the settings.

In active programs, only the individual segments can be changed. Global parameters, such as holdback operating mode, cannot be changed.

After saving the change, the program is continued at the time of the change.

8.10 Performing Segment Jumps

Besides changing a program, it is also possible to jump between the segments of a running program. This can make sense if, for example, a dwell time needs to be shortened.

Note: With a manual segment jump it may happen that more than one segment is bypassed per step, even if this was not intended. This depends on the current temperature of the furnace (automatic application of actual value).

The following steps must be taken to execute a segment step:

Carrying out a segment jump			SUPERVISOR
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu			
Select the context menu (3 dots)			
Select [Segment jump] and enter the target segment			The administrator can block access to this function for supervisors in the settings.

8.11 Template to Enter a Program

Fill in the program table			
Program name/Number			
Comments			
Segment	**Target temperature**	**Time [hh:mm] or rate [°/h])**	**Hold time**
1			
2			
3			
4			
5			
6			
7			

Segment	Target temperature	Time [hh:mm] or rate [°/h])	Hold time
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
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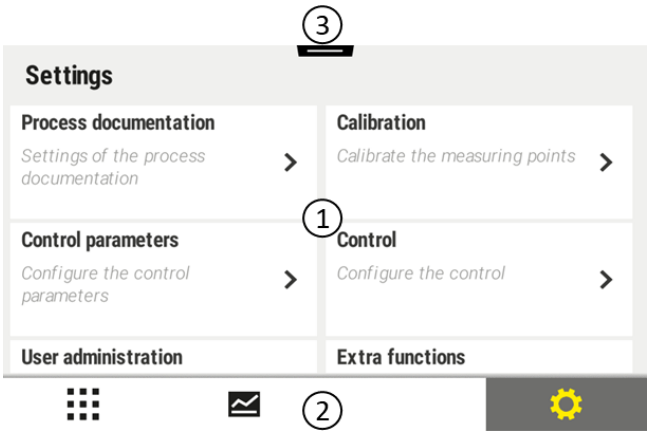
9 Setting the Parameters

9.1 “Settings” Overview

		QR code
Video tutorial:	**Changing settings**	

The controller can be modified in “Settings”. Only Nabertherm can access the “Service” parameter group. The individual parameter groups can be swiped up so that the lower groups become visible.
If certain parameter groups are not visible, swipe the picture up.



No.	Description
1	Tiles for the setting groups. Select a group to open a sub-menu with the respective settings.
2	See “Menu Bar”
3	Actuating element for the status bar (swipe down to make it visible).

9.2 Measurement Range Calibration

Notice

The correction function “Measuring section calibration” offers an option to balance out various offsets, such as from a calibration or a check of the temperature uniformity.

The measurement range from the controller to the thermocouple can exhibit measurement errors. The measurement range consists of the controller inputs, the measurement wires, sometimes terminals and the thermocouple.

If you discover that the temperature value on the controller display no longer agrees with the value of a comparison measurement (calibration), this controller offers the option of an easy matching of the measurement values for each thermocouple.

By entering up to 10 base points (temperatures) with the relevant offsets these temperatures can be matched very flexibly and precisely.

When an offset of a grid point is entered, the actual value of the thermocouple and the entered offset are added.

Examples:

- **Adaptation using a comparative measurement:** The control thermocouple outputs a value of 1000 °C. Calibration measurements near the control thermocouple return a temperature value of 1003 °C. By entering an offset of "+3 °C" at 1000 °C, this temperature is raised by 3 °C and the controller, then also returns a value of 1003 °C.
- **Adaptation using a transducer:** Instead of the thermocouple, a transducer supplies the measurement range with an actual value of 1000 °C. The display outputs a value of 1003 °C. The deviation is "-3 °C" from the reference value. Hence, the offset that must be entered is "-3 °C".
- **Adaptation using a calibration certificate:** On the calibration certification (for example for a thermocouple) there is, at 1000 °C, a deviation of "+3 °C" from the reference value. The correction is "-3 °" between the display and the reference value. Hence, the offset that must be entered is "-3 °C".
- **Adaptation using a TUS measurement:** During a TUS measurement, a deviation of the display from the reference band of "-3 °C" is determined. Here, the offset that must be entered is "-3 °C".

	**Notice** The thermocouple calibration certificate does not take into account the deviations of the measurement range. Deviations of the measuring section must be determined by a measuring section calibration. Added together, the two values are the correction value to be entered.

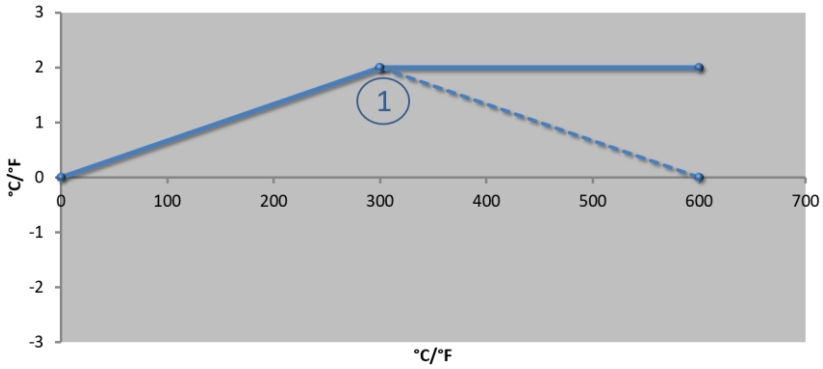
	**Notice** Observe the information at the end of the section.

The setting function in this instance follows specific rules:

- The values between two support points (temperatures) are linearly interpolated. That means that a straight line is projected between the two values. The values between the supporting points are then on this line.
- The values below the first support point (for example, between 0 and 20 °C) are located on a straight line that is connected (interpolated) with 0 °C.
- Values above the last supporting point (for example >1800 °C) are project further with the final offset (a final offset at 1800 °C of +3 °C is also used at 2200 °C)
- Temperature inputs for the support points must be in ascending order. Support points that follow gaps ("0" or a lower temperature for a support point) are ignored.

Example:

Use from only one supporting point

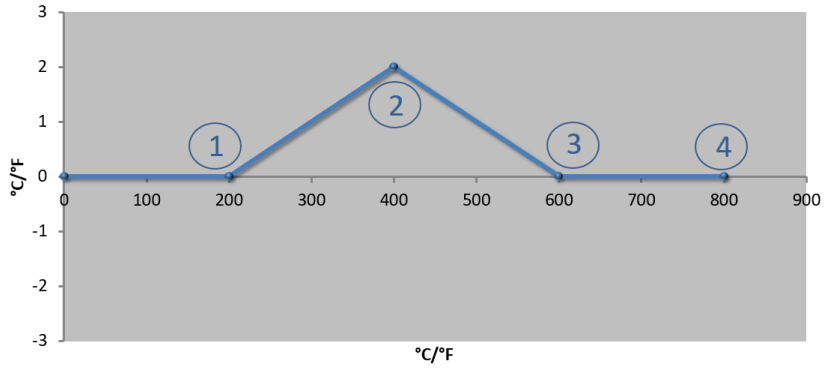


Similar to picture

No.	Meas. Point	Offset
1	300.0°	+2.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°

Comments: The offset is continued beyond the final supporting point. The gradient of the dashed line would be achieved by entering an additional line with an offset of 0.0 °C at 600.0 °C.

Use of only one offset for several supporting points

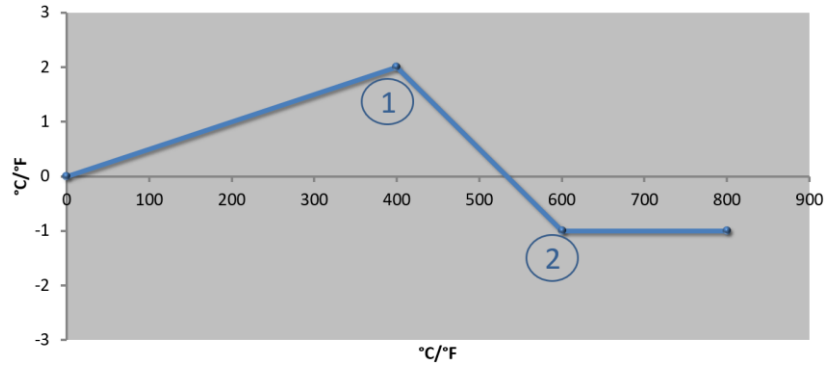


Similar to picture

No.	Meas. Point	Offset
1	200.0°	0.0°
2	400.0°	+2.0°
3	600.0°	0.0°
4	800.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°

Comments: When several supporting points are entered, but only one offset, the result is that to the left and right of this supporting point the offset has the value "0". This can be recognized at the points 200 °C and 600 °C.

Use of 2 supporting points

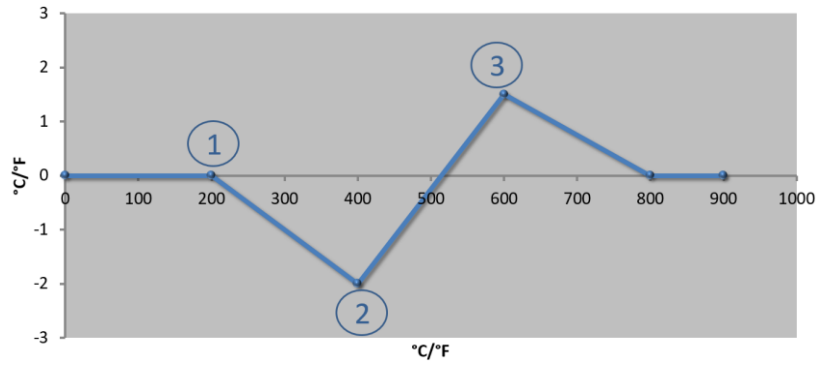


Similar to picture

No.	Meas. Point	Offset
1	400.0°	+2.0°
2	600.0°	-1.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°

Comments: If two supporting points are entered, each with an offset, there is an interpolation between the offsets (see points 1 and 2).

Use of only two offsets for several supporting points

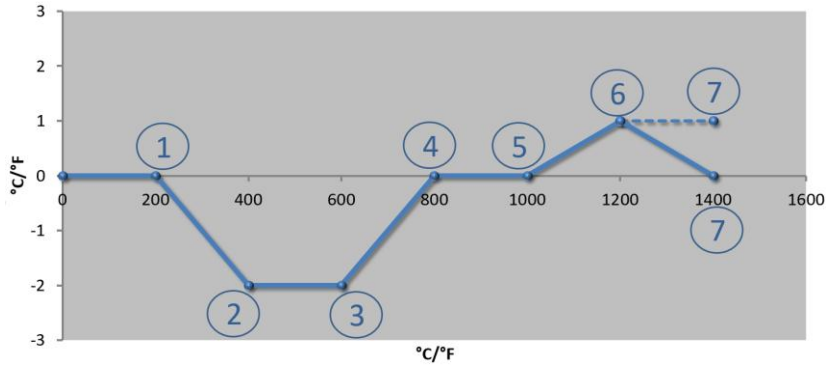


Similar to picture

No.	Meas. Point	Offset
1	200.0°	0.0°
2	400.0°	-2.0°
3	600.0°	+1.5°
	800.0°	0.0°
	0°	0°
	0°	0°
	0°	0°
	0°	0°
	0°	0°

Comments: Here, too, the range around the offsets entered can be eliminated again.

Use of several supporting points with separated offsets



Similar to picture

No.	Meas. Point	Offset
1	200.0°	0.0°
2	400.0°	-2.0°
3	600.0°	-2.0°
4	800.0°	0.0°
5	1000.0°	0.0°
6	1200.0°	1.0°
7	1400.0°	0.0°
	0.0°	0.0°
	0.0°	0.0°

Comments: If the final line were left out, the gradient of the dashed line would reach (1400.0 °C). The offset would then continue beyond the final supporting point.

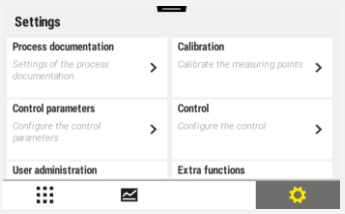
Notice

This function is intended for setting the measurement section. If deviations outside the measurement section are to be balanced out, such as temperature uniformity measurements inside the kiln, the actual values of the corresponding thermocouples are falsified.

We recommend that you create the first base point at 0 ° with an offset of 0 °.

When you have set a measuring point, you must always carry out a comparison measurement with an independent measurement device. We recommend that you document and file changed parameters and comparison measurements.

The following steps must be performed to set the measurement range calibration:

Calibrating a measuring point			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Calibration]			
Select the measuring point (zone)	e.g., [Zone 1]		Each measuring point has its own calibration menu. The current temperature of the respective measuring point is also shown at the top right-hand side
If required: Change the base point	e.g., select base point 1 (e.g., 400°)	Entry field for the base point	

Calibrating a measuring point			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Change correction value	Select correction value	Entry field for correction	You can also enter a negative value
Save or cancel the entry	✓ or ✕		When you exit the page or change to a different measuring point, the entered date is saved automatically. After saving, open the page again to check that all the changes were entered correctly.
Repeat this procedure for the other measuring points			
Exit the menu	←		The values are saved automatically after they have been entered.

9.3 Control Parameters

Control parameters define the behavior of the controller. For example, the control parameters influence the speed and accuracy of control. This allows users to adjust the controls to suit their particular requirements.

This controller provides a PID controller. The output signal of the controller consists of 3 parts:

- P = proportional portion
- I = integral portion
- D = differential portion

Proportional Portion

The proportional portion is a direct reaction to the difference between the setpoint and the actual value of the furnace. The larger the difference, the larger the P-portion. The parameter that influences this P-portion is the parameter "X_p".

Here the following applies: The larger the "X_p", the smaller the reaction to the deviation. So it acts inversely proportional to the control deviation. At the same time, this value describes the deviation, for which the P-portion rises to = 100 %.

Example: A P controller should, for a control deviation of 10 °C, output a power of 100 %. X_p is therefore set to "10".

$$Power\ [\%] = \frac{100\%}{XP} \cdot Deviation\ [°C]$$

Integral Portion

The integral portion grows as long as a control deviation is present. The speed at which this portion grows is determined by the constant T_N . The bigger this value is, the more slowly the I-portion increases. The I-portion is set using the parameter [T_I] unit: [Seconds].

Differential Portion

The differential percent reacts to the change in the control deviation and works against it. If the temperature in the furnace approaches the setpoint, the D-portion acts against this approach. It "dampens" the change. The D-portion is set using the parameter [T_D] unit: [Seconds].

The controller calculates a value for each of these percentages. Then all three percentages are added together and the results is the power output of the controller for this zone in percent. Whereby, the I- and D-portions are each limited to 100 %. The P-portion is not limited.

Display of the Controller Equation

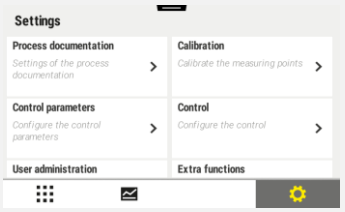
$$F(s) = \frac{100\%}{XP} \cdot \left[1 + \frac{1}{T_N \cdot s} + \frac{T_v \cdot s}{T_{cyc}}\right]$$

Integrating PID parameters from B130/B150/B180/C280/C290/P300-P310 controllers (index 2) for Series 500 controllers (index 1)

The following factors must be used to integrate the parameters:

$xp_1 = xp_2$
$Ti_1 = Ti_2$
$Td_1 = Td_2 \times 5.86$

The following steps must be taken to set the control parameters:

Calibrating a measuring point			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control parameters]			
Select the measuring point	e.g., zone 1		The selection depends on the equipment of the kiln.
Select [Base points]			
If required: Set base points 1-10	e.g., 400°- 800°	Entry field for PID parameters	Based on the base points, you can choose the temperature range for which the parameters are to be set. The number of base points can be freely selected (up to 10).
Repeat the procedure for other measuring points			
Exit the menu			The values are saved automatically after they have been entered.

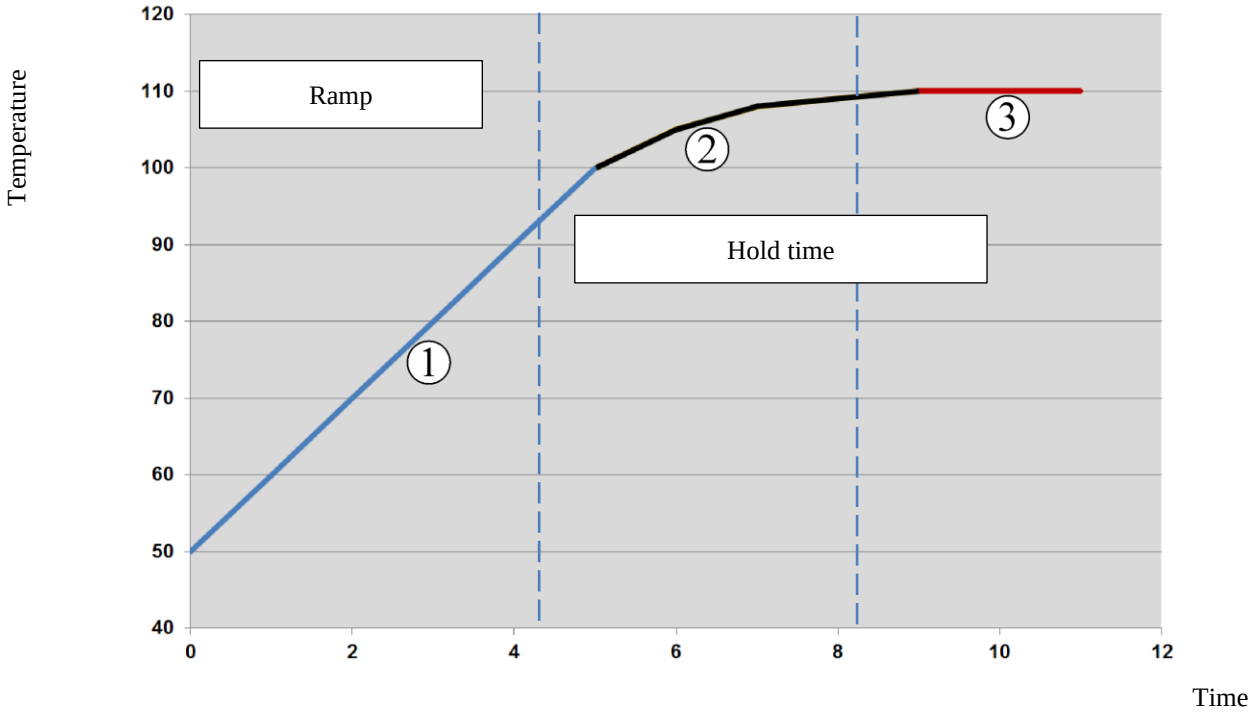
Notice
The I part is increased only until the P part reaches its maximum value. The I part is then no longer changed. In certain situations, this can prevent large “overshoots”.

9.4 Properties of the Controls

This section describes how to adjust integrated controllers. Controllers are used depending on the equipment for zone heating.

9.4.1 Smoothing

A heating program usually consists of ramps and hold times. At the transition between these two parts of the program, “overshoots” can easily occur. To dampen these overshoots, the hold time can be “smoothed” shortly after the transition from the ramp.



Smoothing the ramp time

No.	Description
1	Normal course of the ramp
2	Smoothed area of the hold time
3	Normal hold time range

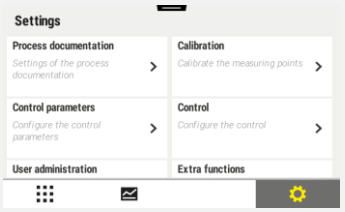
Notice

Smoothing is always applied at the start of a segment, not the end of the ramp.

Notice

In a hold time with a smoothed segment start, the temperature at the beginning is lower than the actual hold time temperature. This means that the length of the hold time at the desired temperature is reduced. This must be taken into account when entering the hold time; the hold time may have to be extended.

The following steps must be performed to set the smoothing parameters:

Smoothing setting			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [General]			
Select [Smoothing] and set the smoothing factor			
Save			The changes are saved automatically when you exit the menu.

Notice

Calculation of smoothing:

With a setpoint jump, the setpoint reaches 63% of the target setpoint after 30 seconds with a smoothing time of 30 seconds and 99% of the target setpoint after 5 x 30 seconds.

Equation:

$Sollwert\ (t) = 1 - e^{-t/\tau}$

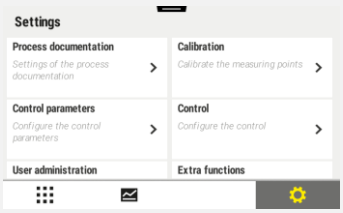
Notice

The results of a firing should be checked after the smoothing parameter has been adjusted.

9.4.2 Heating Delay

If a furnace is loaded hot and with the door open, the cooling of the furnace will result in intensive reheating and overshooting after the door has been closed.

This function can delay the switching on of the heating so that the heat stored in the furnace first raises the temperature in the furnace again. If the heating switches on again after the delay time, the heating need not reheat the furnace as much and overshooting is avoided.

Setting heating delay			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [General]			
Select [Heating delay] and set the delay time			
Save			The changes are saved automatically when you exit the menu.

Notice

In order to use this function, the door switch signal (“door closed” = “1” signal) must be connected to the input of the controller module. The respective input can be adjusted only in the service level and must therefore have been set before the controller is delivered.

9.4.3 Manual Zone Control

It is possible that for furnaces with 2 heating circuits that do not have their own multi-zone control, different output powers are needed.

Using this function you can individually adapt the power of two heating circuits to the process. The controller has two heating outputs whose ratio in relation to each other can be set differently by the optional reduction of one output power. When shipped from the factory, both heating outputs are set to 100 % output power.

The setting of the ratios of the two heating circuits and their output powers are shown in the following table:

Display	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**	**160**	**170**	**180**	**190**	**200**
A1 in %	0	10	20	30	40	50	60	70	80	90	100	100	100	100	100	100	100	100	100	100	100
A2 in %	100	100	100	100	100	100	100	100	100	100	100	90	80	70	60	50	40	30	20	10	0

Example:

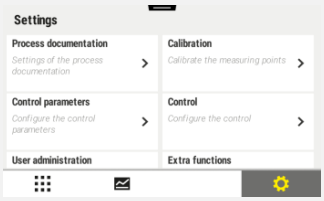
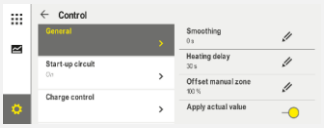
1) At the setting "200", the furnace is heated only through output 1 (**A1**), for instance for a furnace for fusing applications, if only the ceiling heater is to be used and the side or floor heater is to be turned off. Note that when operating with reduced heating power, the furnace may no longer be able to reach the maximum temperature specified on the type plate!

2) At setting "100", 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 "0", output 1, for instance, the ceiling heater in fusing furnaces, is turned off. The furnace is heated only through the heater attached to output 2 (**A2**), 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!

The settings can only be saved globally and not program-dependent.

The following steps must be performed to set the function:

Setting the zone control			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			This function can be parametrized only if the kiln is fitted with this function.
Select [Control]			
Select [General]			
Select [Offset manual zone] and set the offset			
Save			The changes are saved automatically when you exit the menu.

Notice

Refer to the kiln operating manual to see which output (A1) (A2) is responsible for which heating area. In the case of kilns with two heating circuits, output 1 is always the top heating circuit and output 2 is always the bottom one.

9.4.4 Integrating the actual value as setpoint for the program start

Application of the actual value is a useful function to shorten heating up times.

Normally, a program starts at the start temperature that was entered in the program. If the furnace is below the start temperature of the program, the specified ramp is still started and the furnace temperature is not applied.

When deciding the temperature at which it will start, the controller always bases its decision on which temperature is higher at that time. If the furnace temperature is higher, the furnace starts at the current furnace temperature; if the start temperature set in the program is higher, the program starts with the temperature that is set there.

This function is switched on when the controller is delivered.

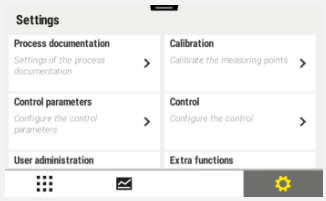
With segment leaps actual value application is always activated. Therefore, segments may be skipped with segment leaps.

Example:

A program with a ramp from 20 °C to 1500 °C is started. The furnace still as a temperature of 240 °C. With activated take over actual value the furnace does not start at 20 °C but at 240 °C. The program can be substantially shortened.

This function is also used for segment steps and program changes in a running heating program.

The following steps must be performed to activate or deactivate the automatic take over value:

Activate/deactivate automatic use of actual value			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [General]			
Select/deselect [Use actual value]			
Save			The changes are saved automatically when you exit the menu.

9.4.5 Self Optimization

The behavior of controllers is determined by control parameters. The control parameters are optimized to a specific process behavior. To allow furnace operation to be as rapid as possible other parameters are used than those for an operation that is as precise as possible. To simplify this optimization, this controller offers the option of an automatic optimization, self-optimization. This does not replace the manual optimization and can only be used for single-zone furnaces, not multi-zone furnaces.

The control parameters of the controller have already been set at the factory for an optimum control of the furnace. If the control behavior must be adapted for your process, you can improve the control behavior by means of a self-optimization.

The self-optimization takes place in a specific sequence and, in addition, can only be performed, each time, for one temperature [OPT TEMPERATURE]. The optimization of several temperatures can only be performed one after another.

Start the self-optimization only when the furnace is cooled down (T < 60 °C), since otherwise false parameters are calculated for the control section. First enter the optimization temperature. The self-optimization is performed in each case at approx. 75 % of the set value to prevent a destruction of the furnace, for example for the optimization of the maximum temperature.

For some models, the self-optimization can take longer than 3 hours depending on the type of furnace and temperature range. The control behavior can be worsened by a self-optimization in other temperature ranges! Nabertherm assumes no liability for damages that are caused by manual or automatic change in the control parameters.

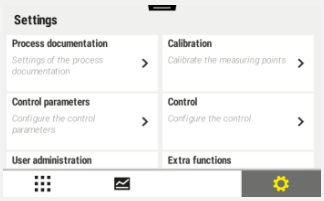
For this reason, check the control quality after autotune by operating the furnace without charge.

Notice

If necessary, carry out self-optimization for several temperature ranges. Due to the calculation processes, self-optimization in lower temperature ranges (< 932 °F/500 °C) can produce extreme values. If necessary, correct these values through manual optimization.

Always check the determined values with a test run.

The following steps must be performed to launch a self-optimization:

Starting self-optimization			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [Self-optimization]			
Enter the optimization temperature			
Start self-optimization			When this is confirmed, the controller starts to heat the kiln to the set temperature.

If self-optimization was started, the controller heats to 75 % of the optimization temperature at full power. The heating process is then stopped and restarted at 100 % power. This procedure is carried out twice. Self-optimization is then finished.

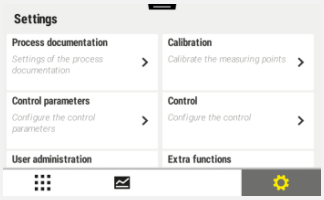
After the autotune has been completed, the controller ends the heating and enters the calculated control parameters but not yet into the corresponding base point of the control parameters.

To save the calculated parameters, open the autotune menu again and check the parameters. Then you can select the base point in the same menu in which you want to copy the parameters.

Self-optimization: Checking and saving parameters			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Wait until optimization is finished			
View and check the determined control parameters xp, Tn, Tv			

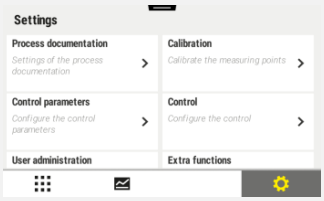
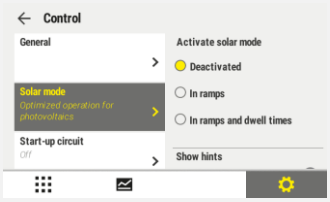
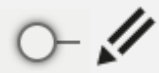
9.4.6 Extended Holdback

To set the extended holdback, the zones to be monitored for the transition of a temperature ramp can be defined in a hold time. Depending on how the furnace is equipped, you can select a check of control zones 1-3, documentation thermocouples 1-3, cooling and charge.
To select the thermocouples, take the following steps:

Selection of the thermocouples to be monitored for extended holdback			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [Extended holdback]			
Select or deselect the thermocouple			The selected thermocouples are used for extended holdback.
Save data			Data is saved automatically when it is entered.

9.4.7 Regulator Damping

This function allows you to influence the controller's behavior in rising temperature ramps. This can be used to set a limit for the integral component of the PID controller.

Changing regulator damping			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [Regulator damping in ramp mode]			
Release regulator damping, adjust limit temperature and maximum integrator value.			
Exit the menu			The values are saved automatically after they have been entered.

	Notice If a wrong maximum integrator value is entered, this can result in the selected temperature not being reached. As a result, error message 04-01 “No heating power” may not be displayed. If a wrong limit temperature is entered, this can have similar consequences and also cause serious temperature overshooting.

	Notice This function is available from firmware version 2.01 (operating unit) and 1.40 (controller module).

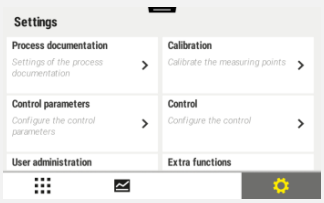
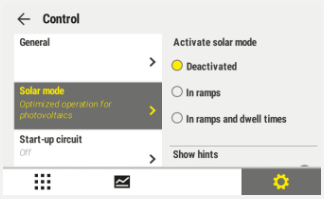
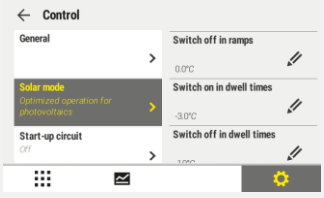
9.4.8 Solar Mode

Activating solar mode increases consumption of energy from electricity storage systems.

A special control concept ensures that the delayed switchover times of solar storage systems are taken into greater account..

Solar mode can be used in the following constellations

- One or more zones
- Manual zone control
- Controlled cooling (automatically deactivated with controlled cooling)
- Charge control

Activating and adjusting solar mode			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Control]			
Select [Solar mode]			
Activate solar mode			
Show notes, switch on or off in ramps or hold times, adapt control behavior.			If activated, a message window is displayed when a program is started. The message window can be hidden.

Activating and adjusting solar mode			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Exit the menu	←		The values are saved automatically after they have been entered.

Notice

Active solar mode leads to a lower control quality in contrast to PID control.

If more accuracy during hold time is required, solar mode can be activated only in ramps.

The influence of solar mode on the quality of the process and its products must be considered individually before it is used.

Notice

This function is available from firmware version 2.01 (operating unit) and 1.40 (controller module).

Notice

Some functions, such as start-up circuit, are not active during solar mode. The results of firing with solar mode should be examined.

9.4.9 User Administration

		QR code
Video tutorial:	**User logon**	

The user administration allows certain operating functions to be protected by a password. This means that an operator with basic rights cannot change any parameters.

Four user levels are available for this:		
User	**Description**	**Passwords (factory setting)**
OPERATOR	Operator	00001[1]
SUPERVISOR	Person in charge of process	00002[1]
ADMINISTRATOR	Person with responsibility for the system	00003[1]
SERVICE	Only for Nabertherm Service	*****
Reset passwords	Available on request	*****

[1] For security reasons, we recommend that you change passwords when starting the kiln for the first time. To do this, you must be in the user level where you can change the password for the respective user level (see “Change User Administration According to Requirements”).

The rights of the individual users are assigned as follows:	
User	**Assignment of rights**
OPERATOR	

The rights of the individual users are assigned as follows:	
User	**Assignment of rights**
	View overviews
	Create and start a program in the wizard
	Operate extra functions manually
	Unlock controller
	Load, view, start, hold and stop the program
	Select language
	Initiate export files
	Select user, reset all passwords and change the password for the operator
	Read out the information menu
SUPERVISOR	*All rights of the [Operator], plus*
	Segment jump
	Change current program
	Enter, delete, and copy programs
	Switch on controller lock
	Upload process documentation
	Set date and time
	Change the password for the supervisor and log out users
	Switch on operating lock
ADMINISTRATOR	*All rights of the [Supervisor], plus*
	Enable/disable interface (USB)
	Calibration
	Controller smoothing
	Set delay after door is closed
	Set control parameters
	Set manual zone control
	Enable/disable actual value application
	Carry out self-optimization
	Set zone offsets
	Set extended holdback
	Set control damping
	Change extra functions
	Change alarm functions
	Change gradient monitoring
	System: Temperature unit, date and time format

The rights of the individual users are assigned as follows:	
User	**Assignment of rights**
	Set power failure behavior (only operating mode)
	Import parameters and programs via USB flash drive
	Log on modules
	Change the administrator’s password and reset passwords
	Define standard users
	Define logout time
	Reset passwords of other users individually
	Define who may change the active program
	Define who may create the app TAN

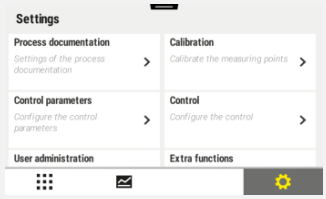
User Registration

Note – Quick log-on for users

To log on as a user quickly, go to the status bar. To do this, pull down the top tab. Press the user icon. The user selection view opens.

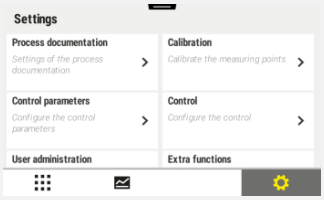
Select the respective user and then enter the password.

You can log-on a user without using the quick selection by carrying out the following steps:

User log-on (user level)			**ADMINISTRATOR/ SUPERVISOR/ ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [User administration]			
Select user			
Enter password			If you enter an incorrect password, a warning will be issued [PASSWORD INCORRECT].
Changes do not have to be saved			They are saved immediately after entry.

Adopting User Administration by Needs

To adapt the user administration to their needs, please perform the steps described below. Here, the time can be set after which the user is automatically logged off again. Equally, the user level can be set to which the controller returns after the log-off [STANDARD USER]. That means, which functions are available without having to register.

Changing user administration according to requirements			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [User administration] →[User level]		- Display current user - Log out current user (standard user is activated) - Select user	
If required, change the password of a user. Select the user and enter the new password twice.		Only users themselves can change their passwords (Operator, Supervisor, Administrator).	Write down changed passwords
Select [User administration] →[User rights]			
If necessary, change the [Logoff time]			
Select [Standard user]		The standard user is the user that is active automatically when the controller is switched on.	
Activate [OPERATION LOCK]: Select this parameter to activate a basic operation lock for the operator			See “Continuous Controller Lock”.
[Change active program]		The user set here is allowed to create and change programs.	
If necessary, reset the passwords of all users with [PASSW RESET CMPL]			Request the necessary password from Nabertherm Service
Save data			Data is saved automatically when it is entered.

Rights of the individual users for rights management:			
Function	**OPERATOR**	**SUPERVISOR**	**ADMINISTRATOR**
Change user	x	x	x
Reset all passwords	x	x	x
Switch on operating lock	-	x	x
Log out current user	-	x	x
Log out standard user	-	-	x
Change logout time	-	-	x

Rights of the individual users for rights management:			
Function	**OPERATOR**	**SUPERVISOR**	**ADMINISTRATOR**
Reset operator’s password	-	-	x
Reset supervisor’s password	-	-	
Reset administrator’s password	-	-	x
Change operator’s password	x	-	-
Change supervisor’s password	-	x	-
Change administrator’s password	-	-	x
Define which users may change the active program	-	-	x
Define which users may view the app TAN	-	-	X
Use the ceramic wizard	x	x	x

9.5 Controller Lock and Operation Lock

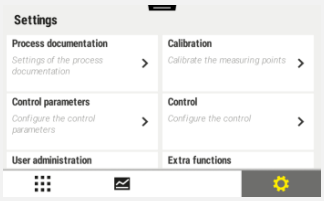
9.5.1 Permanent Lock (Operation Lock)

To prevent operation of the controller permanently, use the function [Operation Lock]. This prevents any access to the controller, even if no program has been started.

The supervisor or administrator can activate the operation lock in user administration with the parameter [Operation Lock].

The operation lock is effective when the user is logged off automatically or manually. The operation lock is also activated when the controller is switched on.

A password prompt is displayed for every operation step. Enter the password for the required user.

Operation lock activation			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [User administration]			
Select [User rights]			
Select [Operation lock]	Select Yes/No		If you select [Yes], the controller is locked after you switch it off and on again and also after you log off.

Operation lock activation			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
The controller lock is shown by an icon in the status bar			
Unlocking operation	Entering the required user name and password		

9.5.2 Locking the Controller While a Program is Running

If you want to prevent a program being interrupted deliberately or inadvertently while it is running, this can be done by locking the controller. The lock prevents input on the controller.

Operation can be released only when a user logs on (operator, supervisor, administrator) with his/her password.

To lock the controller, take the following steps:

Locking the controller			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu			A heating program must have been started.
In the context menu, select [Lock controller]			If the controller is locked, the selection “unlock” is available, which unlocks the controller once the administrator password has been entered.
The controller lock is shown by an icon in the status bar			

To unlock the controller, take the following steps:

Unlocking the controller			**SUPERVISOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu			

Unlocking the controller			SUPERVISOR
Procedure	**Operation**	**Display**	**Comments**
Select the context menu [Unlock controller]			If the controller is locked, the selection [Unlock controller] is available, which unlocks the controller when the administrator password is entered.
Select the standard user and enter the password			

9.6 Configuring the Extra Functions

Besides heating, many furnaces support additional functions such as exhaust-air flaps, fans, solenoid valves, optical and acoustic signal (see, as necessary, addition instructions for the extra functions). For this purpose, each segment offers an opportunity to enter values. How many extra functions are available depends on the furnace design.

With this controller, in the basic configuration, optionally, up to 2, with additional modules, up to 6 extra functions, depending on the program, can be switched on or off in the segments.

Extra Functions Are for Example

- Activating a fresh-air fan
- Activating an exhaust air flap
- Activating a signal lamp

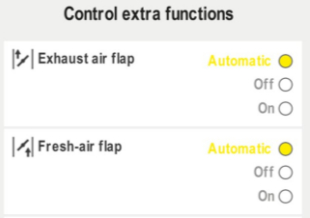
If you want to deactivate or rename individual functions, perform the following steps.

9.6.1 Hide or Rename Extra Functions

Deactivating or renaming extra functions			ADMINISTRATOR
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Extra Functions]			
Select extra function			
Switch extra function on or off			
If required, edit the selected name			If you change the name of the extra function, the icon selected previously is not changed.
Save data			Data is saved automatically when it is entered.

9.6.2 Manually Operating Extra Functions During a Running Heating Program

The following steps must be performed if you want extra functions to be manually switched on during a running heating program.

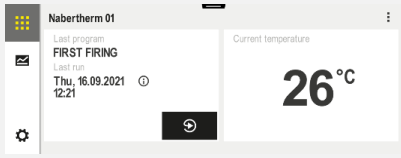
Using extra functions during a current heating program			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu			A heating program must have been started.
Select [Control extra functions] in the context menu			A list of available extra functions is displayed
If required, change the status of the extra function	Choose from the selection field next to the statuses [Auto]/[Off]/[On]	The selection field changes color	
	The extra function has now been changed manually. There are three statuses available for extra functions **AUTO** The extra function is controlled only by the extra functions defined in the heating program **OFF** The extra function is switched off regardless of the heating program **ON** The extra function is switched on regardless of the heating program		

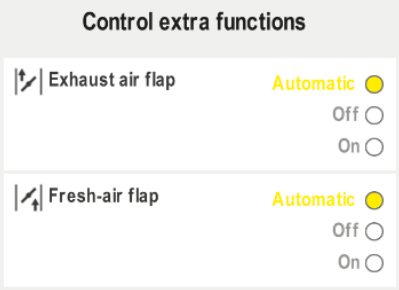
Notice

Before manually setting and resetting an extra function, check the effects that this will have on your charge. Carefully consider the pros and cons of manual intervention.

9.6.3 Manually Operating Extra Functions According a Heating Program

The following steps must be performed if you do not want extra functions to be manually operated during a running heating program.

Using extra functions when no heating program is running			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu			.

Using extra functions when no heating program is running			OPERATOR
Procedure	**Operation**	**Display**	**Comments**
Select [Control extra functions] in the context menu	⋮		
If required, change the status of the extra function	Choose from the selection field next to the statuses [Auto/Off/On]	The selection field changes color	
	The extra function has now been changed manually. There are three statuses available for extra functions **AUTO** The extra function is controlled only by the extra functions defined in the heating program **OFF** The extra function is switched off regardless of the heating program **ON** The extra function is switched on regardless of the heating program		
Reset extra functions	Extra functions that have been set manually are reset either with [AUTO] or [OFF]. Extra functions that have been set manually are also reset at: • Program start • Segment change Program end		

Notice

Before manually setting and resetting an extra function, check the effects that this will have on your charge. Carefully consider the pros and cons of manual intervention.

9.7 Alarm Functions

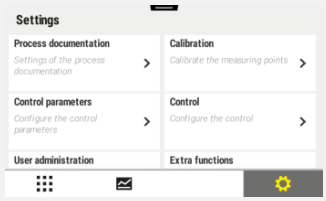
9.7.1 Alarms (1 and 6)

This controller has 6 freely configurable alarms. An alarm triggers a response in a certain situation. An alarm can be changed flexibly.

Parameters of the alarms:	
Parameters	
[SOURCE]	*Cause for the alarm:*
	[BAND ALARM]: A tolerance band is exceeded or undershot. Evaluation is relative to the current setpoint.
	[MAX]: A temperature limit is exceeded. The evaluation relates to the absolute actual temperature

Parameters of the alarms:	
Parameters	
	[MIN]: A temperature limit is undershot. The evaluation relates to the absolute actual temperature
	[PROGRAM END]: The end of the program is reached
	[A1] – [A6]: These two signal sources are linked with inputs in the module configuration. Only Nabertherm can make this link.
	[A1 inverted] – [A6 inverted]: These two signal sources are linked with inputs in the module configuration and are then inverted. Only Nabertherm can make this link.
[RANGE]	*Range in which monitoring is to take place*
	[HOLD TIME]: A hold time has the same start and target temperatures
	[RAMP]: The start and target temperatures differ in a ramp
	[PROGRAM]: For hold times and ramps, in other words, during the complete program
	[ALWAYS]: Regardless whether a program is active or not.
[LIMITS]	*Range in which monitoring is to take place*
	[HOLD TIME]: A hold time has the same start and target temperatures
	[RAMP]: The start and target temperatures differ in a ramp
[DELAY]	*Time that the alarm is to be delayed in seconds*
[TYPE]	*Definition whether the alarm reaction has to be acknowledged before it is reset. It is also defined here whether a warning is to be output.*
	[GOING]. If the alarm is no longer present, the reaction is automatically reset. No warning is displayed.
	[GOING+REPORT]: If the alarm is no longer present, the reaction is automatically reset and must be acknowledged by the operator. A warning is displayed
	[SAVE+REPORT]: If the alarm is no longer present, the reaction is not automatically reset and must be acknowledged by the operator. A warning is displayed
[RESPONSE]	*Response to the alarm. If the alarm condition is fulfilled, the following reactions are possible:*
	[RELAY ONLY]: A relay is set. This relay must be configured in the module configuration
	[ACOUSTIC ALARM]: An acoustic alarm is output. The acoustic alarm has additional parameters
	[PROGRAM STOP]: The current program is interrupted
	[HOLD]: The current program is paused
	[HOLD HEATING OFF]: The current program is paused and the heating is switched off. The safety relay is also deenergized.

Alarms can be configured as follows:

Alarm configuration			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Alarm functions]		In the “Settings” menu, scroll down to [Alarm functions]	
Select an alarm	Alarm 1 - 6		
Select [SOURCE] and set the required mode			
Select [RANGE] and select the required range			
Select [LIMIT MAX] and enter the required value			The visibility of the parameter depends on the selected source
Select [LIMIT MIN] and enter the required value			The visibility of the parameter depends on the selected source
Select [DELAY] and enter the required value			Do not set the time too short so that fluctuations in the process do not cause false alarms.
Select [TYPE] and enter the required value			
Select [RESPONSE] and enter the required value			

Validity of the Band Alarm and the Min/Max Analysis:

Below you can see a table showing which thermocouples are monitored by a band alarm.

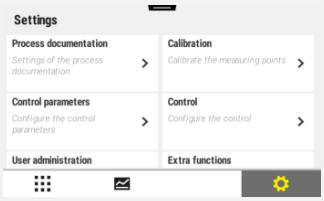
An optional documentation thermocouple is not included.

Kiln has one zone	The control thermocouple is monitored
Kiln has several zones	Control thermocouple (control zone) is monitored

9.7.2 Acoustic Alarm (Option)

The acoustic alarm is one of the possible “reactions” in alarm configuration. The parameters of the acoustic alarm allow the operator to set certain additional properties. Regardless of the configuration, the output where the acoustic alarm is connected can be output constantly, at intervals or with time limits.
The acoustic alarm is acknowledged by acknowledging the error message.

"Mode" parameter	
[Constant]	In the event of an alarm, a continuous alarm signal is generated
[Limited]	The alarm signal stops after a set time and then remains switched off.
[Interval]	The alarm signal is switched on for a set time and then switched off for the same length of time. This is repeated.

The acoustic alarm can be set as follows:			
Alarm configuration			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Alarm functions]			
Select [ACOUTSIC ALARM]			
Select [MODE] and set the required mode			
Set the duration			See description above
Save data			The effect of this duration depends on the selected mode (see above)

9.7.3 Examples of Alarm Configuration

Below is some help to parameterize frequently occurring alarms. These examples are for illustration purposes only. The parameters may have to be adjusted to the specific application:

To adjust the alarms, remember to log on as [ADMINISTRATOR].

Example: External error

An external error, e.g. a temperature switch signals an over-temperature by closing a contact. This should result in a program interrupt.

Function	Source	Range	Limits	Delay	Type[1]	Response
External fault	A1	Always	-	2s	Save + report	[PROGRAM STOP]

Explanation: The source of the alarm is an input that was linked to [A1], which is evaluated [always], that is, during ramps and hold times. After a delay of [2 seconds], a reaction that must be acknowledged S = [Save], namely [Program interrupt], is triggered with a clear text message M = [Report].

The output configuration of an acoustic alarm must be set at the factory.

Examples: Cooling water monitoring

When the cooling water flow of a furnace is monitored. After a flow switch is triggered, the program will be held up and the heating turned off. An acoustic alarm will signal an error.

Function	Source	Range	Limits	Delay	Type[1]	Response
Cooling water monitoring	A1	Always	-	2s	Save + report	[HOLD-HEATING OFF]
Acoustic alarm	A1	Always	-	2s	Save + report	[ACOUSTIC ALARM]

Examples: Monitoring of an external vacuuming

For certain processes it is important that during the heating program an external venting is switched on. This should be monitored by the controller and the program interrupted, if necessary, if the venting has not been switched on. In addition, an acoustic alarm should signal the error.

Function	Source	Range	Limits	Delay	Type[1]	Response
External extraction	A1	Always	-	120s	Save + report	[PROGRAM STOP]
Acoustic alarm	A1	Always	-	120s	Save + report	[ACOUSTIC ALARM]

Explanation: The source of the alarm is an input that was linked to [A1], which is evaluated [always], that is, during ramps and hold times. After a delay of [120 seconds], a reaction that must be acknowledged S = [Save], namely [Program interrupt], is triggered with a clear text message M = [Report].

The output configuration of an acoustic alarm must be set at the factory.

Example: Relative Over-Temperature Monitoring

A dwell time should be monitored. Here, the program setpoint should not be exceeded by more than 5 °C.

Function	Source	Range	Limits	Delay	Type[1]	Response
Relative Temperature monitoring	Band	Hold time	Max = 5° Min = -3000°	60s	Going + report	[HOLD-HEATING OFF]

Explanation: The source of the alarm is band monitoring [Band], which is [always] evaluated, that is, during ramps and hold times. After a delay of [60 seconds], a reaction that must be acknowledged [Transient], namely [Program interrupt], is triggered with a clear text message M = [Report].

9.8 Network Failure Behavior Settings

In case of a power outage, no heater power remains. Hence, any power outage has an impact on the product in the furnace.

The behavior of the controller during a grid power outage has been preset at Nabertherm. But you can always change this behavior to suit your own needs.

There are 4 modes available:

“Mode” parameter	Parameters
Mode 1	[CANCEL]: If there is a power outage, the program is canceled

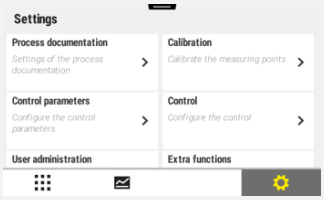
"Mode" parameter	Parameters
Mode 2	[DELTA T] When the power returns, the program continues if the kiln has not cooled too much [<50 °C/90 °F]. Otherwise, the program is canceled. The program is always canceled below a limit temperature [T min = 80 °C/144 °F]
Mode 3	[TIME] (preselection) When the power returns, the program continues if the power was not out for longer than the set time [max. power outage time 2 minutes]. Otherwise, the program is canceled.
Mode 4	[CONTINUE] When the power returns, the program always continues

Notice

After a power outage, the program will continue with the same increase and remaining time.

With power outages < 5s programs are always continued

The power outage behavior can be set as follows:

Set power outage			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [Power outage]			
If required, set the mode for power outage behavior as described in the table above			
Save data			Data is saved automatically when it is entered.

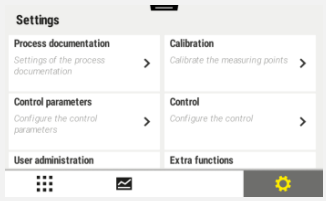
9.9 System Settings

9.10 Setting Date and Time

This controller needs a real-time clock for saving process data and the setting of a starting time. This is buffered with a battery in the operating housing.

There is no automatic reset from daily saving to standard time. The time must be reset manually.

The time may only be reset if no program is active to avoid irregularities during the recording of process data.

To set the time and date, do the following:			
Set date and time			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [System]			
Select [Date and time]			
Setting the time and date			
Save data			Data is saved automatically when it is entered.

Note

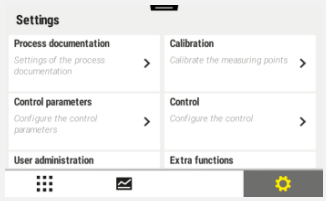
The battery life is about 3 years. When the battery is replaced, the set time and date and the “last firing” display on the main page are all lost. Archives, programs and controller settings are not affected. For the battery type, see “Specifications”.

9.10.1 Setting the Date and Time Formats

The date can be entered/outputted in two formats:

- DD.MM.YYYY - Example: *28.11.2021*
- MM-DD-YYYY - example *11.28.2021*

The time can be entered either in a **12**-hour or a **24**-hour format.

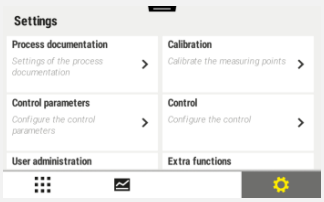
To set theses formats, do the following:			
Set the date and time format (12h/24h)			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [System]			

To set theses formats, do the following:			
Set the date and time format (12h/24h)			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select [Date format] and/or [Time format]		Date format 1: DD-MM-YYYY Date format 2: MM-DD-YYYY Time format: Choose between 12 and 24 h display	
Save data			Data is saved automatically when it is entered.

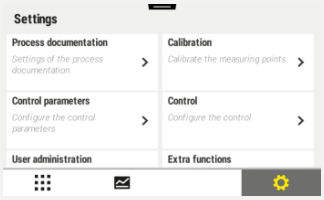
9.10.2 Language Setting

The available languages can be selected on the display/screen. When you are making your selection, a list of the available languages is displayed.

The language is selected via the wizard at initial set-up.

To set the language without using the quick selection function, do the following:			
Set language			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [System], then Language			
Select the language			
Save data			Data is saved automatically when it is entered.

9.10.3 Setting Display Brightness

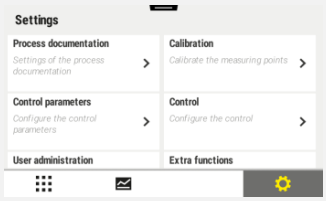
With this controller, the display brightness can be adjusted continuously in percentages.			
Setting display brightness			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [System], then Language			
Select [Display brightness]			
Enter the brightness value as a percentage.			
Save the changes.			

9.10.4 Adjusting the Temperature Display

This controller can display two temperature units:

- °C (Centigrade, default setting)
- °F (Fahrenheit)

After a reset, all the inputs and outputs of temperature values are displayed in the corresponding unit, and/or entered. Only the inputs in the service area are not reset.

To change the temperature display, do the following:			
Adjust the temperature display (°C/°F)			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [SYSTEM] and then [TEMPERATURE DISPLAY]			
Select the temperature unit	°C or °F		

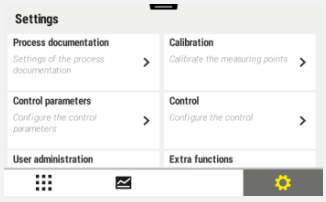
To change the temperature display, do the following:			
Adjust the temperature display (°C/°F)			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Save data			Data is saved automatically when it is entered.

9.10.5 Setting the Interface

Data recording via USB interface	
	On a USB flash drive via the USB interface
Interface	USB 2.0
Storage capacity	up to 2 TB
File system	FAT32

9.10.6 Setting the Wi-Fi Interface

		QR code
Video tutorial:	**Set up Wi-Fi**	

This controller can be connected with the Internet via Wi-Fi in order to call up the kiln status with the "MyNabertherm" app.			
Set the Wi-Fi interface			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [SYSTEM] and then [Wi-Fi interface]			
Switch the interface on/off with [Activate Wi-Fi]			
Wi-Fi connected		Display: connected / not connected / deactivated	Display of the connection status

This controller can be connected with the Internet via Wi-Fi in order to call up the kiln status with the “MyNabertherm” app.			
Set the Wi-Fi interface			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select [SSID] and enter the name of a Wi-Fi network.			If you are unsure, ask your IT department about connection data.
Select [Password] and enter the network password.			If you are unsure, ask your IT department about connection data.
Select [Encryption]	○ None ○ WPA 1 ○ WPA 2		If you are unsure, ask your IT department about connection data.
Select [Set up Wi-Fi] to start the Wi-Fi setup wizard.			If you are unsure, ask your IT department about connection data.
Select [Create app TAN] to connect a kiln in the “MyNabertherm” app.			Follow the instructions in the “MyNabertherm” app
Select [App connections] to delete linked users.			
Wi-Fi IPv4 address		e.g., 172.25.152.65	Display of the Wi-Fi network address
Wi-Fi MAC address			Display of the Wi-Fi MAC address
App server status		connected / not connected	Display of the connection status for the app server
Save data			Data is saved automatically when it is entered.

The rights that are required for the individual settings of the Wi-Fi connection can be seen in the following table:			
Menu item	**Display/Information**	**Rights to read/write**	**User**
Enable Wi-Fi	On / off	Read	-
		Write	Operator
Wi-Fi connected	Connected / not connected / disabled	Read	User “Change Wi-Fi”
		Write	Operator
SSID	Name of Wi-Fi network	Read	Operator
		Select	User “Change Wi-Fi”
Password	Wi-Fi key	Read (not plaintext)	Operator
		Write	User “Change Wi-Fi”

The rights that are required for the individual settings of the Wi-Fi connection can be seen in the following table:			
Menu item	**Display/Information**	**Rights to read/write**	**User**
Encryption	None / WPA 1 / WPA 2		Operator
			User “Change Wi-Fi”
Set up Wi-Fi	As with initial start-up		User “Change Wi-Fi”
			User “Change Wi-Fi”
Create app TAN	Display TAN		User “Change Wi-Fi”
			Administrator
App connections	Connected e-mail addresses		Operator
			Operator
Wi-Fi IPv4 address	Assigned IP address		Operator
			User “Change Wi-Fi”
App server status	Connected / not connected		User “Change Wi-Fi”
			User “Change Wi-Fi”

Notice
The user “Change Wi-Fi” is the user who was set in “User administration” > “User rights” > “Change Wi-Fi”.

9.11 Importing and Exporting Process Data, Programs and Parameters

Notice
If you do not have a functioning USB flash drive, you can purchase one from Nabertherm (part number 524500024) or download a list of tested USB flash drives. This list is part of the download file for the NTLog function (see information in “Saving Data on a USB Flash Drive with NTLog”). The corresponding file is called: “USB flash drives.pdf”.

		QR code
Video tutorial:	**Importing and exporting process data, programs and parameters**	

All the data in this controller can be saved on a USB stick (exported) or loaded (imported).

The following parameters are not taken into account for a parameter import:

- Controller type (User: [Service])
- Maximum possible temperature of the furnace (User: [Service])
- Information from the info-menu
- Passwords of the users

- Furnace power (User: [Service])
- Various monitoring parameters (over-temperature)

Stored data after a complete export on the USB flash drive	
Programs	File: [HOSTNAME]\PROGRAMS\prog.01.xml
Control parameters	File: [HOSTNAME]\SETTINGS\parameter.pid.xml
Settings	File: [HOSTNAME]\SETTINGS\parameter.config.xml
Error messages	File: [HOSTNAME]\ERRORLOG\dump.error.xml
Process data	File: [HOST-NAME]\ARCHIVE\20140705_14050102_0001.csv
Import folder	Folder \IMPORT\...

The control parameters, settings and programs can also be individually exported or imported. When a complete export is performed all the files are saved on the USB stick.

The use of this function can be best explained by several examples:

- **Example 1 - Import of Programs:**
  Three identical furnace should always be operated with the same program. The program is prepared using the controller, exported to a USB stick and re-imported to the other controllers. All controllers receive the same programs. Before importing, the exported data must always be copied to the IMPORT folder.
    - Make sure that the prepared programs do not include any temperatures higher than the maximum temperature of the furnace. These temperatures will be not be accepted. The maximum number of controller segments and programs must not be exceeded. A message shows whether the program was imported successfully.
- **Example 2 - Import of PID Parameters:**
  The control parameters of a furnace are optimized based on a temperature uniformity measurement. The control paramets can then be transferred to other furnaces or simply archived. Before importing, the exported data must always be copied to the import folder.
- **Example 3 – Send data to Nabertherm Service by e-mail:**
  In a service case, Nabertherm Service will ask you to export the complete data onto a USB flash drive. Simply send the data by e-mail as a zip file.

Notice

If the controller is faulty, all the operator’s settings are lost. A complete export of the data to a USB flash drive allows you to back up this data. This data can then simply be transferred to a new, identical controller.

Notice

Files to be imported must be stored on the USB flash drive in the folder “\IMPORT\”.

Do NOT create this folder in an exported folder of a controller. The “Import” folder must be on the top level.

When importing, all files in this folder are imported.

Do NOT use sub-folders.

Notice

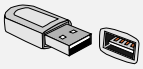
If you want to import files into the controller, the import process may fail if these files were changed beforehand. The import files must not be changed. If the import fails, make the required changes directly in the controller and then export the file again.

Notice

When you insert the USB flash drive, you will be prompted to decide what to save. A message is displayed while the operation unit writes or reads data. This can take up to 45 seconds. Do not remove the USB until the message is no longer displayed.

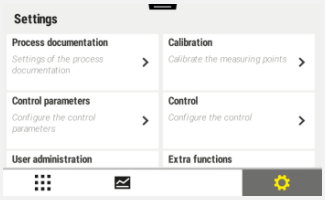
For technical reasons, all archive files on the controller are synchronized. Therefore, the time can vary depending on the size of the files.

IMPORTANT: Do not connect a PC, external hard drive or other USB host/controller here – under certain circumstances, you could damage both devices.

Proceed as follows to export or import data on a USB flash drive:		
Exporting or importing data to a USB flash drive		**OPERATOR/ADMINISTRATOR**
Procedure	**Operation**	**Comments**
Plug the USB into the connection/socket at the front of the controller		You must wait until the icon for the USB stops flashing.
Select [Settings]		
Select [SYSTEM] and then [IMPORT/EXPORT]		IMPORT is permitted only for [ADMINISTRATOR] users
Select which data is to be imported or exported		
Wait until the icon for the USB stops flashing.		
After importing parameters, switch the controller off, wait 10 seconds and switch it on again		See: - *Switching the Controller/kiln off* - *Switching the Controller/kiln on* After importing PID parameters and programs, a restart is not required.
Save data		Data is saved automatically when it is entered.

9.12 Registering Modules

If components, such as a control module or a control unit, are replaced, the modules have to be registered. This procedure is required to assign the module address to the control module. When a furnace is delivered, Nabertherm has already registered the modules.

To register a module, proceed as follows:			
Registering a module			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Select [SERVICE]			
Select [MODULE CONFIGURATION]			
Select the desired module.			
Select [ADD MODULE]	+		The icon is on the right-hand side
Press the small button on the top of the control module. You can access this via a small hole below the LED on the control module in the switchgear. Use a paper clip (if necessary, pinch off the thick end)			
Once the module has been registered, assign an address to the module			Confirm the confirmation prompt
Save data			Data is saved automatically when it is entered.
NOTE: The menu [Bus reset] is for service purposes only.			

10 Information Menu

The information menu supports the rapid display of selected controller information.

Information menu			**OPERATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Kiln] menu		An overview is displayed depending on the status of the program	
In the context menu, select [Info menu]		The info menu is displayed	

The following information can be called up one after the other	
Calling up the data via the information menu	
Serial number	Unique production number of the control unit
Error	Current error
Last errors	The last errors that occurred. The controller shows the error messages and warnings on the screen until they have been rectified and acknowledged. It may take up to one minute until these messages are saved in the archive.
Statistics Please also observe the notes below this table	Maximum kiln temperature reached [°C] Last consumption in [kWh] Total consumption in [kWh] Operating hours, e.g., [1D 17 h 46min] Number of starts [17] Number of starts > 200 °C [17] Number of starts > 1200 °C [17] Maximum temperature of last firing [°C]
Module status	Display of current input and output statuses of a controller module, the current zone temperature and the temperature of the reference point [DE1/2] Digital inputs 1 and 2 [DA1/2] Digital outputs 1 and 2 [AA1/AA2] Analog outputs 1 and 2
File name	Name of the process data file that is currently being recorded or was recorded. Example: [20140625_140400_0001].csv
Service export	If you confirm this menu entry with the button, all exportable information is saved on a plugged-in USB flash drive. Use this information within the scope of a service inquiry from Nabertherm Service, for example. This function is also available via the “Import/Export” function and is provided here simply because of its easier availability. If you do not have a functioning USB flash drive, you can purchase one from Nabertherm (part number 524500024) or download a list of tested USB flash drives. This list is part of the download file for the NTLog function (see information in “Saving Data on a USB Flash Drive with NTLog”). The corresponding file is called: “USB flash drives.pdf”.

Notice

In order to be able to help you quickly in the event of an error, the values in the info menu are very helpful for localizing the error. In the event of a malfunction, complete the checklist in “**Checklist for Controller Complaint”** and provide us with this.

Notice

The energy meter (kWh meter) calculates its value from the power output and the specified kiln power. If a regulator with non-linear behavior is used to control the heating (e.g., a phase section), this can lead to considerable deviations from the actual value when the energy consumption is being calculated. Multi-zone kilns also falsify the result so that the energy counter for these kilns does not provide proper results.

11 Process Documentation

11.1 Saving Data on a USB Flash Drive with NTLog

This controller has an inbuilt USB interface for using a USB flash drive (no external hard disks or network drives). Settings and programs can be imported and exported via this USB interface.
Another important function of this interface is saving process data for a current program on a USB flash drive.
It is unimportant whether the USB flash drive is inserted in the control unit during the heating program or afterwards. Each time the USB flash drive is inserted, all files that have been confirmed are copied from the control unit to the USB flash drive (up to 16 files).

Notice

If you do not have a functioning USB flash drive, you can purchase one from Nabertherm (part number 524500024) or download a list of tested USB flash drives. This list is part of the download file for the NTLog function (see information in “Saving Data on a USB Flash Drive with NTLog”). The corresponding file is called: “USB flash drives.pdf”.

Notice

During the current heating program, the process data is saved cyclically in a file on the internal memory of the controller. At the end of the heating program, the file is then copied to the USB flash drive (the USB flash drive must be formatted (file system FAT32), max. 2 TB).

Remember that a maximum of 16 process date files can be saved in the controller memory. If the memory is full, the first process data file is overwritten. In other words, if you want to evaluate all process data, leave the USB flash drive plugged into the control unit or plug it in directly after the heating program ends.

The process data file that is generated for each heating program has the following file name:

[DATE]_[CONTROLLER SERIAL NUMBER]_[CONSECUTIVE NUMBER].CSV

Example:

File: “20140607_15020030_0005.csv”

The consecutive number of the file name restarts with 0001 once 9999 has been reached.

The process data file is located in the [HOSTNAME]\ARCHIVE\ folder on the USB flash drive.

Example:

Folder: “N22060111P1\Archive\”

Files with the extension “.CSV” are used for evaluation with NTGraph (Nabertherm tool to display NTLog files) and Excel™.

Notice

Information about NTLog and NTGraph

Nabertherm provides the software to display NTLog process data files "NTGraph" for Microsoft Excel™ (freeware).

This software and the corresponding documentation for NTLog and NTGraph can be downloaded at the following address:

http://www.nabertherm.com/download/
Product: NTLOG_C4eP4
Password: 47201410

The downloaded file must be unzipped before you can use it.

Before using NTGraph, read the instructions, which are also in the directory.

System requirements: Microsoft EXCEL™ 2003, EXCEL™ 2010, EXCEL™ 2013 or Office 365 for Microsoft Windows™.

The following data is saved in the files:

- Date and time
- Charge name
- File name
- Program number and name
- Serial number of the controller
- The heating program
- Comments about the progress and result of the heating program
- Version of the display unit
- Controller name
- Product group of the controller
- Process data

Process data table

Process	Function	Description
Data 01	Program setpoint	Setpoint that is determined by the heating program that is entered
Data 02	Setpoint of zone 1	Setpoint for a zone. This consists of the program setpoint, the setpoint offset and the offset of the charge control.
Data 03	Temperature of zone 1	Measurement of the thermocouple for the zone
Data 04	Power of zone 1 [%]	Output of the controller for the zone in [0-100 %]
Data 05	Setpoint of zone 2	See above
Data 06	Temperature of zone 2	Measurement of the thermocouple for the zone or of a documentation thermocouple
Data 07	Power of zone 2 [%]	See above
Data 08	Setpoint of zone 3	See above
Data 09	Temperature of zone 3	Measurement of the thermocouple for the zone or of a documentation thermocouple
Data 10	Power of zone 3 [%]	See above

Process data table		
Process	**Function**	**Description**
Data 13	Temperature of the charge/documentation thermocouple	Measurement of the charge/documentation thermocouple
Data 14	Setpoint output of the charge control	Setpoint of the charge controller This consists of the program setpoint and the offset of the charge control.
Data 15	Temperature of the cooling thermocouple	Measurement of the cooling thermocouple
Data 16	Speed of the cooling fan [%]	Output of the controller for controlled cooling [0-100%]

The data that is available for your furnace depends on the furnace model.

Notice

When you insert the USB flash drive, you will be prompted to decide what to save. A message is displayed while the operation unit writes or reads data. This can take up to 45 seconds. Do not remove the USB until the message is no longer displayed.

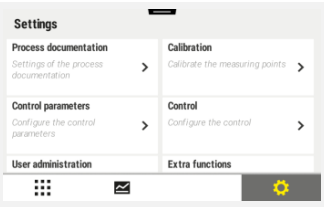
For technical reasons, all archive files on the controller are synchronized. Therefore, the time can vary depending on the size of the files.

IMPORTANT: Do not connect a PC, external hard drive or other USB host/controller here – under certain circumstances, you could damage both devices.

USB flash drive			
Procedure	**Operation**	**Display**	**Comments**
Plug the USB flash drive into the front of the control unit.		USB icon flashes	

Notice

The USB flash drive must **not** be removed while the message about writing or reading files is displayed. Otherwise, you could lose data.

The NTLog process documentation can be modified to suit personal and/or process requirements.			
NTLog parameters			**SUPERVISOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu			
Sub-item [PROCESS DOCUMENTATION]			
Switch documentation on or off			

The NTLog process documentation can be modified to suit personal and/or process requirements.			
NTLog parameters			**SUPERVISOR**
Procedure	**Operation**	**Display**	**Comments**
Interval Set the interval between 2 write processes		e.g., 60 seconds	Minimum setting 10 seconds. Nabertherm recommends an interval of 60 seconds to keep the data volume as low as possible.
[End of recording] Select the mode for the end of the process documentation		The parameter [End of recording] decides when recording of a process data file is stopped. **Two settings are possible:** **[Program end]** Recording ends automatically when the heating program finishes. This is the default setting **[BELOW LIMIT] [Temperature undershot]** Recording ends only when the temperature is below a certain threshold [LIMIT TEMPERATURE]. This setting is used to record cooling processes after the heating program is finished.	
Change the limit temperature [End temperature] for the end of process recording (factory setting = 200 °C)		Available only if [DOCU END] is set to [Temperature undershot].	
Set 24 h long-term recording		Long-term recording should be set if considerably more than 130,000 data records (approx. 90 days at 60-second intervals) are to be written to a file. This could be the case with infinite hold times or very long programs. In this case, the USB flash drive must remain inserted. A file is created for each day.	
Activate USB interface		**This function must be activated to use the USB flash drive.**	

Notice

In case of long-term recording, observe the maximum recording time. A maximum of approx. 130,000 data records can be recorded. A new file is created each day.

If long-term recording is not selected, up to 5,610 data records are recorded in each file. If the heating program takes longer, a new file is created with no interruption to the heating program. Up to 16 files are written and saved in the controller if no USB flash drive is inserted. Recording is then stopped.

Notice

If there is a power outage, the last data records may be lost. When the power is restored, a new file for the data records is created.

Notice

Before starting to record, make sure that the date and time are set correctly (see [Setting Date and Time])

Note

If you are using the NTLog functions, when you switch on the controller, check that the date and time are set correctly. If not, set them correctly. If the time setting is lost after the controller is switched on, replace the buffer battery in the controller.

12 Connecting to the MyNabertherm App

		QR code
Video tutorial:	**Connecting to the MyNabertherm app**	

Series 500 controllers can be connected to an app for Android (from Version 9) and iOS (from Version 13). One or more furnaces can be linked via the app.

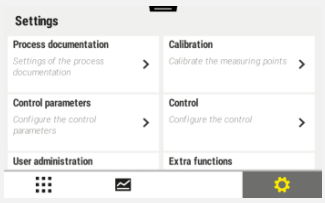
To pair an app, access to the controller via Wi-Fi must be ensured.

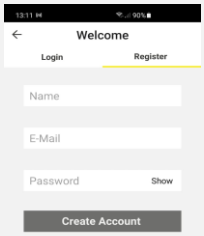
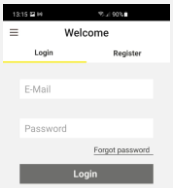
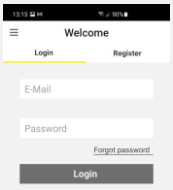
The app has the following features:

- Displays process data
- Current program progress
- Push message from a furnace.

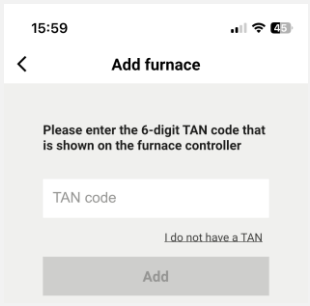
Notice

Up to 9 users (e-mail addresses) can be connected to a kiln.

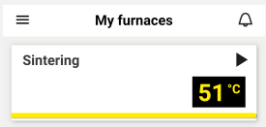
Switch on Wi-Fi on the controller and connect to the Internet			**SUPERVISOR**
Procedure	**Operation**	**Display**	**Comments**
As an alternative to the following procedure, you can also restart the set-up wizard (see “Basic Functions” -> Initial Set-Up). You can also set up the Wi-Fi interface there.			
Before switching on Wi-Fi, make sure that there is a Wi-Fi network near the controller with a sufficiently strong signal and also Internet access. If the signal is too weak, this can cause disconnections. If you require any help with this, contact your network provider or a local IT specialist.			
On the controller, select the [SETTINGS] menu			
Select [SYSTEM] and then [Wi-Fi INTERFACE]		Here, you can switch on the Wi-Fi connection. Enter the network password. Switch the Wi-Fi connection off again here if you do not want to allow external access.	The Wi-Fi interface supports WPA2 as encryption method.

Registering in the app			
Procedure	**Operation**	**Display**	**Comments**
Download the “MyNabertherm” app from the Apple App Store or Google Play Store to your mobile phone and install it.			You will see a new icon. The app is available for iOS from Version 13 and Android from Version 9.
Download on the App Store		GET IT ON Google Play	
Start the app			
Register in the app or register directly if you are already logged in	If you want to remain logged in, select the function “Stay logged in”.		Register with an e-mail address and your name. We use this data for authentication only.
If necessary, log in to the app again.	Confirm your registration via the link in the e-mail.	If you do not receive a confirmation e-mail, check your spam folder. Classify the sender as safe.	
If necessary, log in to the app again.		You will see an empty furnace overview	
If you forgot your password, you can reset it, using the “Forgot password” link.			A new e-mail will be sent to the user e-mail address. It contains a one-time password; enter this password and then choose a new password.

Registering in the app			
Procedure	**Operation**	**Display**	**Comments**
The controller cannot be connected to the Wi-Fi network	Open the router configuration interface	- The app cannot be used in China - Use Wi-Fi only with 2.4 GHz (5 GHz is not possible) - Wi-Fi signal too weak (see controller header) - Router encryption: WPA 1 or WPA 2, not WPA3 (hotspot of an iPhone from iOS15 cannot be used) - Port 1912 must not be blocked - IP address of the server (148.251.52.188) must not be blocked - Internet access that requires confirmation via a browser, such as in hotels, is not suitable! - Assignment of IP addresses in the router must be enabled (DHCP) - No MAC address filters must be activated in the router - When using a guest Wi-Fi access, the restriction of the Internet application to “Surfing and e-mail” must not be activated in the security settings of the router.	

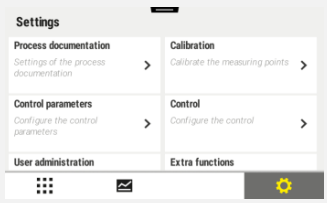
When you have logged in, you can add the first kiln in the app			
Procedure	**Operation**	**Display**	**Comments**
Add a kiln in the app by pressing the “+” icon in the kiln overview “My kilns”.			
You will be prompted to enter a TAN code. This TAN code has to be read from the controller.	Go to the kiln controller.		
Select the [Kiln overview] menu on the controller.			
In the context menu of the controller, select [DISPLAY APP TAN]		The 5-digit APP TAN is displayed. This page closes after some time.	The app TAN is valid for just a few minutes. If the TAN expires, repeat the procedure.
Enter the app TAN in the app.	When you have entered the TAN, press [Add].		
In the app, go to the kiln overview again.			

When you have logged in, you can add the first kiln in the app			
Procedure	**Operation**	**Display**	**Comments**
The kiln is now shown as a tile. Tap a tile to go to the “Individual kiln view”.		The tile shows basic information, such as temperature, program progress and status of the kiln.	

The individual kiln view provides a detailed overview of your kiln:		
Individual kiln view		
Procedure	**Operation**	**Display**
Tap the tile of a kiln		If the kiln is not available, this is shown by a light gray font.
You will see an overview clearly displaying the data of your kiln. Some data is shown only when a program is running.		Data: - Kiln name - Program name - Start time - Durations of programs and process steps - Temperatures/power of the kiln - Segment information - Extra functions and program mode
In the context menu (3 dots), you will find additional functions to manage the kiln or show details.	⋮	Functions of the context menu - Rename kiln - Remove kiln - Display process data - About this kiln - Help icon
Entries in the context menu (3 dots):	[Rename kiln]	Provides an option to change the name of the kiln. When the kiln was added in the app, the kiln name from the controller was used. This can be changed permanently in the app with this function. The original name remains in the controller.
	[Remove kiln]	Deletes the kiln from apps with this account.
	[Display process data]	Shows a list containing the current process data of the kiln.

The individual kiln view provides a detailed overview of your kiln:		
Individual kiln view		
Procedure	**Operation**	**Display**
	[About this kiln]	Shows the serial number of the kiln, for example
	[Help icon]	Opens a help text containing short explanations about the different functions.

If a kiln is to be removed from the app, the following steps are required. The kiln is removed from all apps with this e-mail address:			
Removing a kiln in the app			
Procedure	**Operation**	**Display**	**Comments**
Select the kiln that is to be removed in “My kilns”. The individual kiln view opens			
In the context menu, select [Remove kiln]		A confirmation prompt is displayed. Confirm.	The kiln is removed in the app under “My kilns”

The kiln can also be removed from the app, using the controller			
Removing a kiln in the app via the controller			**ADMINISTRATOR**
Procedure	**Operation**	**Display**	**Comments**
Select the [Settings] menu in the controller			
Select [SYSTEM] and then [Wi-Fi interface]			
Select [App links]		A list of the linked accounts (e-mail addresses) is displayed	
Select the account (e-mail address) whose link is to be deleted.	Press [REMOVE]	The account is deleted from the list.	The kiln is no longer displayed in the app.

12.1 Troubleshooting

FAQ		
Malfunction description	**Cause**	**Troubleshooting**
Before switching on Wi-Fi, make sure that there is a Wi-Fi network near the controller with a sufficiently strong signal and Internet access. If the signal is too weak, this can cause disconnections. If you require any help with this, contact your network provider or a local IT specialist.		
The Wi-Fi icon in the status bar is crossed out	Wi-Fi is not activated in the router or the Internet provider has a malfunction.	Test the Wi-Fi network with a mobile phone. If there is a provider malfunction, contact your provider's support service
The connection from the app to the controller is completely or partially interrupted.	The signal is too weak	Test the signal strength of the Wi-Fi with a mobile phone. Make sure that you are in the same Wi-Fi network as the controller Use a repeater to increase the signal strength of the router
After you have registered, you do not receive a confirmation e-mail	The confirmation e-mail is in the spam folder	Check the spam folder and classify the sender as safe
The controller cannot be connected to the Wi-Fi network	Open the router configuration interface	The app cannot be used in China Use Wi-Fi only with 2.4 GHz (5 GHz is not possible) Wi-Fi signal too weak (see controller header) Router encryption: WPA 1 or WPA 2, not WPA3 (hotspot of an iPhone from iOS15 cannot be used) Port 1912 must not be blocked IP address of the server (148.251.52.188) must not be blocked Internet access that requires confirmation via a browser is not suitable Assignment of IP addresses in the router must be enabled (DHCP) No MAC address filters may be activated in the router When using a guest Wi-Fi access, the restriction of the Internet application to "Browsing and e-mail" must **not** be activated in the security settings of the router.

FAQ		
Malfunction description	**Cause**	**Troubleshooting**
The app does not start or freezes when starting.		Delete the cell phone cache: **Android:** Settings > Apps > MyNabertherm > Storage – Clear cache and delete data I**OS**: Settings > General > iPhone Storage > MyNabertherm-App > Delete app – Reinstall app from the App Store

12.2 Over-Temperature Limiter with Manual Reset and Adjustable CutoutTemperature (Additional Equipment)

Over-temperature limiter (similar to picture)

Notice

The functions of over-temperature limiters and over-temperature limiters with automatic reset (option) must be checked regularly.

Notice

See additional operating instructions for description and function.

13 Potential-Free Contact to Switch on and Monitor an Exhaust Air Extraction System (Option)

This function controls and monitors an exhaust air extraction system. Control is automatic and the system is switched off only below a set kiln temperature, independently of an active program.

The exhaust air extraction system can be monitored via potential-free contact, installed by the customer.

The function is explained using an external exhaust air extraction system as an example:

- The exhaust air extraction system starts when the firing program starts
- The exhaust air extraction system switches off at the end of the program and the kiln has cooled to below 176 °F (80 °C).
- Monitoring an alarm contact from the customer that interrupts the current kiln program and switches off the heating when an external signal is received (e.g., breakdown of the customer’s exhaust air extraction system or general external alarm). Several contacts can be combined. Configured either in series (as normally closed contacts) or in parallel (as normally open contacts). When the alarm has been acknowledged, the kiln program continues.
- No warranty for the function of the exhaust system, no technical safety assessment.

14 Error Messages and Warnings

The controller shows the error messages and warnings on the screen until they have been rectified and acknowledged. It may take up to one minute until these messages are transferred to the archive.

14.1 Error Messages of the Controller

ID+ sub-ID	Text	Logic	Remedy
Communication error			
01-01	Bus zone	Communication connection to a control module disrupted	Check that the control modules are firmly attached LEDs on the control modules red? Check the cable between the control unit and the control module Plug of the connection cable not plugged correctly into the control unit
01-02	Bus communication module	Communication connection to the communications module (Ethernet/USB) disrupted	Check that the communications module is firmly attached Check the cable between the control unit and the communications module
Sensor error			
02-01	TC open		Check thermocouple, thermocouple terminals and cable Check contacts of the thermocouple cable in plug X1 on the control module (contacts 1+2)
02-02	TC connection		Check the thermocouple type that has been set Check poles of thermocouple connection
02-03	Reference point error		Control module defective
02-04	Reference point too hot		Temperature in the switchgear too high (approx. 70 °C) Control module defective
02-05	Reference point too cold		Temperature in the switchgear too low (approx. -10 °C)
02-06	Encoder disconnected	Error at the 4-20 mA input of the controller (<2 mA)	4-20 mA – check sensor Check the connection cable to the sensor
02-07	Sensor element defective	PT100 or PT1000 sensor defective	Check PT sensor Check connection cable to the sensor (cable break/short circuit)
System error			
03-01	System memory		Error after firmware updates[1)] Defective control unit[1)]

ID+ sub-ID	Text	Logic	Remedy
03-02	ADC error	Communication between AD converter and controller disrupted	Replace control module[1)]
03-03	File system defective	Communication between display and memory chip disrupted	Replace control unit
03-04	System monitoring	Program execution on the control unit defective (Watchdog)	Replace control unit USB flash drive removed too soon or defective Switch controller off and on again
03-05	Zone system monitoring	Program execution on a control module defective (Watchdog)	Replace control module[1)] Switch controller off and on again[1)]
03-06	Self-test error		Contact Nabertherm Service[1)]
03-07	Analog output / wrong voltage at output	Measured value of the output voltage does not correspond to the specified value	Have an electrician carry out the following steps: - De-energize the kiln - Disconnect loads at the analog output - Switch the kiln on again and start the program - Error does not re-occur: Replace loads. - Error still present: Replace control module Contact Nabertherm Service[1)]
Monitoring			
04-01	No heating power	No temperature increase in the ramps when heating output <> 100 % for 12 minutes and when the temperature setpoint is higher than the current kiln temperature	Possible causes: The lid/door switch has to be adjusted if there is absolutely no heating power or if the temperature drops suddenly during a program. The heating elements must be replaced if the maximum temperature is not reached or reached only very slowly. The heating elements are then worn. After the fault has been rectified, acknowledge the controller. Other fault sources (to be checked by a certified professional): - Check heating control unit and controller. - Check heating elements and heating element connections.

ID+ sub-ID	Text	Logic	Remedy
04-02	Excess temperature	The temperature of the control zone exceeds the max. program setpoint or the maximum kiln temperature by 50 Kelvin (from 200 °C) The equation for the switch-off threshold is: Maximum program setpoint + zone offset of the control zone + charge control offset [max] (if charge control active) + excess temperature switch-off threshold (P0268, e.g. 50 K)	Check solid-state relay Check thermocouple Check controller (with 3 minutes delay)
		A program was started at a kiln temperature higher than the maximum setpoint in the program	Do not start the program until the kiln temperature is lower.
04-03	Power failure	The set limit for restarting the kiln was exceeded	If possible, use an uninterruptible power supply
		The kiln was switched off at the main switch during the program	Stop the program on the controller before you switch off the main switch.
04-04	Alarm	A configured alarm was triggered	
04-05	Self-optimization failed	The determined values are implausible	Do not carry out self-optimization at the lower temperature range of the kiln working range
	Battery weak	Time is not shown correctly. A power failure may no longer be handled properly.	Export all parameters to a USB flash drive Replace the battery (see “Specifications”)
Other malfunctions			
05-00	General malfunction	Malfunction in the control module or Ethernet module	Contact Nabertherm Service Provide the service export
05-01	Self-test for lower limit switch	Self-test unsuccessful.	Please turn the kiln off and on again to repeat the self-test. If the problem is not resolved, contact Nabertherm Service
05-02	Self-test for upper limit switch	Self-test unsuccessful.	Please turn the kiln off and on again to repeat the self-test. If the problem is not resolved, contact Nabertherm Service
05-03	Self-test for heating	Self-test unsuccessful.	Please turn the kiln off and on again to repeat the self-test. If the problem is not resolved, contact Nabertherm Service

ID+ sub-ID	Text	Logic	Remedy
05-04	Vacuum pump / pressure switch	Evacuation was not successful.	Check whether the vacuum pump is switched on. Check the connection between the kiln and the vacuum pump. Check the seal on the kiln table. Dirt and correct closure Check and, if necessary, replace faulty seals. If the problem is not resolved, contact Nabertherm Service
1) The fault can be acknowledged only by switching the controller off.			

14.2 Warnings of the Controller

Warnings are not displayed in the error archive. They are only displayed on the display and in the file of the parameter export. Warning do not generally lead to a program crash.

No.	Text	Logic	Remedy
00	Gradient monitoring	The limit value of the configured gradient monitoring was exceeded	For troubleshooting, refer to “Gradient Monitoring” Gradient set too low
01	No control parameters	No “P” value was entered for the PID parameters	Enter at least one “P” value in the control parameters. It must not be “0”
02	Charge thermocouple defective	No charge thermocouple was determined with the current program and activated charge control	Plug in a charge thermocouple Disable charge control in the program Check the charge thermocouple and its cable for damage
03	Cooling thermocouple defective	The cooling thermocouple is not plugged in or is defective	Plug in a cooling thermocouple Check the cooling thermocouple and its cable for damage If there is a malfunction in the cooling thermocouple during active controlled cooling, the system switches over to the thermocouple of the control zone.
04	Documentation thermocouple defective	Either no documentation thermocouple or a defective one was determined.	Plug in a documentation thermocouple Check the documentation thermocouple and its cable for damage
05	Power failure	A power failure was determined. There was no program interrupt	None
06	Alarm 1 – Band	The configured band alarm 1 was triggered	Optimize the control parameters Alarm set too narrowly
07	Alarm 1 – Min	The configured min. alarm 1 was triggered	Optimize the control parameters Alarm set too narrowly
08	Alarm 1 – Max	The configured max. alarm 1 was triggered	Optimize the control parameters Alarm set too narrowly

No.	Text	Logic	Remedy
09	Alarm 2 – Band	The configured band alarm 2 was triggered	Optimize the control parameters Alarm set too narrowly
10	Alarm 2 – Min	The configured min. alarm 2 was triggered	Optimize the control parameters Alarm set too narrowly
11	Alarm 2 – Max	The configured max. alarm 2 was triggered	Optimize the control parameters Alarm set too narrowly
12	Alarm – External	The configured alarm 1 at input 1 was triggered	Check the source of the external alarm
13	Alarm – External	The configured alarm 1 at input 2 was triggered	Check the source of the external alarm
14	Alarm – External	The configured alarm 2 at input 1 was triggered	Check the source of the external alarm
15	Alarm – External	The configured alarm 2 at input 2 was triggered	Check the source of the external alarm
16	No USB flash drive inserted		When exporting data, insert a USB flash drive in the controller
17	Import/export of data via the USB flash drive unsuccessful	The file was edited with a PC (text editor) and saved in the wrong format or the USB flash drive was not detected. You want to import data that is not in the import folder on the USB flash drive	Do not edit XML files with a text editor; edit them only in the controller. Format the USB flash drive (format: FAT32). No quick formatting Use a different USB flash drive (to 2 TB/FAT32) When importing, all data must be in the import folder on the USB flash drive. The maximum storage capacity for USB flash drives is 2 TB/FAT32. If you experience problems with your USB flash drive, use a different USB flash drive with maximum 32 GB
	Programs are rejected during the import of programs	Temperature, time or rate are outside the limit values	Import only programs that are suitable for the kiln. The controllers differ as regards the number of programs and segments and the maximum kiln temperature.
	While programs are being imported, “Error occurred” is displayed	The complete parameter set (at least the configuration files) was not stored in the “Import” folder on the USB flash drive	If you deliberately left out files during import, ignore the message. Otherwise, check the completeness of the import files.
18	“Heating blocked”	This message is displayed if a door switch is connected to the controller and the door is open	Close the door Check the door switch
19	Open door	The kiln door was opened while a program was running	Close the door while a program is active.
20	Alarm 3	General message for this alarm number	Check the cause of this alarm message

No.	Text	Logic	Remedy
21	Alarm 4	General message for this alarm number	Check the cause of this alarm message
22	Alarm 5	General message for this alarm number	Check the cause of this alarm message
23	Alarm 6	General message for this alarm number	Check the cause of this alarm message
24	Alarm 1	General message for this alarm number	Check the cause of this alarm message
25	Alarm 2	General message for this alarm number	Check the cause of this alarm message
26	Multi-zone holdback temperature exceeded	A thermocouple that was configured for multi-zone holdback has left the temperature band downward	Check whether the thermocouple is necessary for monitoring. Check the heating elements and their activation
27	Multi-zone holdback temperature undershot	A thermocouple that was configured for multi-zone holdback has left the temperature band upward	Check whether the thermocouple is necessary for monitoring. Check the heating elements and their activation
28	Modbus connection interrupted	The connection to the superordinate system was interrupted.	Check if the Ethernet cables are damaged. Check the configuration of the communication connection

Notice

If you do not have a functioning USB flash drive, you can purchase one from Nabertherm (part number 524500024) or download a list of tested USB flash drives. This list is part of the download file for the NTLog function (see information in “Saving Data on a USB Flash Drive with NTLog”). The corresponding file is called: “USB flash drives.pdf”.

14.3 Malfunctions of the Switchgear

Error	Cause	Action
No light on controller	Controller switched off	Power switch to “I”
	No power available	Is the power cord plugged into the socket? Check the building fuses Check the fuse of the controller (if present) and replace it if necessary.
	Check the fuse of the controller (if present) and replace it if necessary.	Switch the power switch on. If it is triggered again, contact Nabertherm Service
Controller displays error	See separate instructions for the controller	See separate instructions for the controller
Kiln does not heat	Door/cover is open	Close the door/cover
	The door contact switch is faulty (if present)	Check the door contact switch

Error	Cause	Action
	“Delayed start” is displayed	The program is waiting for the programmed start time. Deselect “Delayed start” above the Start button.
	Error in entering the program	Check the heating program (see separate instructions for the controller)
	Heating element faulty.	Have this checked by Nabertherm Service or a qualified electrician.
Very slow heating of the heating chamber	The fuse(s) of the connection is/are defective.	Check fuse(s) and replace if necessary. Notify Nabertherm Service if the fuse trips again immediately.
The program does not jump to the next segment	In a “time segment” [TIME] in the program input, the wait time is set to [INFINITE]. If charge control is activated, the temperature of the charge is higher than the zone temperatures.	Do not set the wait time to [INFINITE]
	If charge control is activated, the temperature of the charge is higher than the zone temperatures.	The parameter [BLOCK REDUCING] must be set to [NO].
The controller module cannot be registered on the operating unit	Controller module addressing error	Perform a bus reset and readdress the controller module
The controller is not heating in the optimization	No optimization temperature has been set	The temperature to be optimized must be entered (see the separate instructions of the controller)
The temperature increases faster than the controller specifies	Switching element of the heater (solid state relay, thyristor or contactor) faulty Faulty individual components within a kiln cannot be completely ruled out from the outset. Therefore, the controller and switchgear are equipped with additional safety devices. For instance, with error message 04 - 02, the kiln switches the heater off via an independent switching element.	Have an electrician check and replace the switching element if necessary.

15 Specifications

Notice

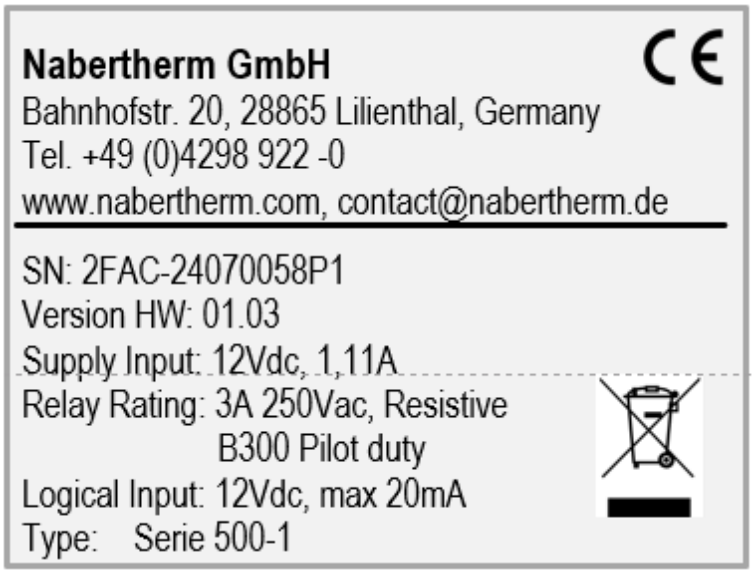
The electrical specifications of the kiln are on the type plate located on the side of the kiln. The type plate of the controller is located on the controller modules inside the switchgear.

Controller series 500-1 (AC590)		
Supply voltage:	12 Vdc	
Current consumption:	Maximum 300 mA for the control unit Maximum 235 mA per power unit Maximum 50 mA for the communication module Maximum 50 mA per power unit as charge control	Power consumption with 3 zone modules, 1 charge module, 1 cooling module and 1 communications module: Approx. max. 1110 mA
Sensor input (power unit):	TC thermocouple TC 0-10 V TC 4-20 mA	Parameterization only by Nabertherm
Thermocouple types:	Type B/C/E/J/K/L/N/R/S/T	Parameterization only by Nabertherm
Digital inputs 1 and 2: (power unit):	12 V, max. 20 mA	Connect a potential-free contact
Digital/analog outputs 1 and 2 (power unit):	Constant 0 – 5 V, 0 – 10 V, maximum 100 mA Output actual value, setpoint and max. setpoint of the segment (0-Tmax) with NT-LT: 1 – 9 V The range outside these limits should be considered an invalid signal.	Analog output, digitally switched. Imax approx. 100 mA
Safety relay (power unit):	Max. 250 Vac / 3 A with ohmic load, preliminary fuse max. 6.3 A (C-characteristic)	
Relay output (power unit):	Max. 250 Vac / 3 A with ohmic load, preliminary fuse max. 6.3 A (C-characteristic)	The relays of a module may only be supplied with one voltage. Voltages must not be mixed. If this is the case, another module must be used. Please replace only with the same type of battery.
Real-time clock:	Yes	
Buzzer:	Connect externally via output	
	3 V/285 mA Lithium Model: CR2430	When the battery is replaced, dispose of the used one properly. Batteries must not be disposed of with household waste. Replace only with the same or a similar type.
Protection type:	Mounted housing: IP40 with closed USB interface cover.	
	Controller module: IP20	
	kiln/switchgear	(See kiln/switchgear instructions)

Controller series 500-1 (AC590)		
Interface:	USB host integrated (USB flash drive)	No other devices, such as hard disks or printers, may be connected. Maximum size: to 2 TB, formatting: FAT32
	Wi-Fi	Encryption: WPA 2 Frequency band: 2.4 GHz Ports: 1912 (outgoing)
Measurement accuracy:	NT-LT: ±1 °C, 16 bit resolution NT-LTA: ± 0.44 K (TC type K) ± 0.61 K (TC type N) ± 0.80 K (TC type S) 24 bit resolution	This value does not correspond to the control accuracy, which depends on the area of operation (e.g., kiln and load).
Lowest possible rate:	1 °C/h when the rate is entered in the program	
Ambient conditions (according to EN 61010-1):		
Storage temperature:	-20 °C to +75 °C	
Working temperature:	+5 °C to +60 °C	Ensure sufficient air circulation
Relative humidity:	5 – 80% (to 31 °C, 50% at 40 °C)	not condensing
Altitude:	< 2000 m above sea level	

15.1 Type Plate

With the AC590 controller, the type plate is on the back of the housing.



Example (type plate of the control unit)

16 Cleaning

The surface of the device can be cleaned with a mild soap solution.

Use only a dry cloth to clean the USB interface.

Do not treat the stickers/signs with strong or alcohol-based cleaning products. After cleaning the screen, dry it thoroughly with a lint-free cloth.

17 Maintenance and Spare Times

As shown in the section "Construction of the Controller", the controller consists of several components. The controller modules are always installed in the interior of the switchgear cabinet or the furnace housing. The control unit can be installed in a switchgear cabinet or in the furnace housing. Moreover, there are furnace models whose control unit is attached to the furnace housing so that it can be taken off. The ambient conditions are described in the section "Technical Data".

You must prevent conductive dirt and dust from entering the switchgear cabinet or the furnace housing.

To minimize the coupling of malfunctions into the control and measurement range, you must ensure that they are kept separate and laid as far apart as possible the from power lines. If this is not possible, sheathed cable must be used.

	**⚠ DANGER** Work on the electrical equipment must be carried out by a licensed electrician. Danger of electric shock. Make sure that the power switch is switched to "**0**". Pull out the plug or disconnect the kiln from the power supply via the circuit breaker (depends on the model)	

17.1 Replacing the Battery

The controller has a battery in the operating unit, which must be replaced after a few years. This ensures that the time of day and the time details in the data recording are correct.

	**⚠ CAUTION** RISK OF EXPLOSION: If the battery is replaced by an incorrect type. Use CR2430 batteries. Dispose of old batteries in accordance with statutory regulations. Use public collection points.

	**⚠ WARNING** Do not allow children to play with packaging parts. There is a risk of suffocation from plastic films and plastic parts. Small parts are not for children under 3 years of age or persons who tend to put inedible things in their mouth.

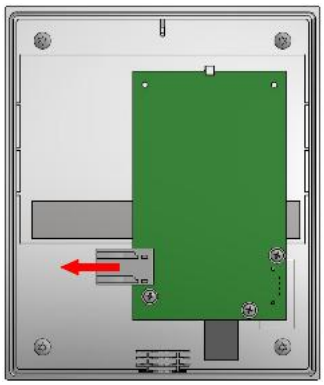
Replace the battery as follows:

- Disconnect the kiln from the supply voltage. Pull the plug from the kiln or, for kilns without a plug, switch the kiln off at the main switch.
- Undo all 4 screws in the back of the operating unit.
- Carefully remove the back.
- Remove the battery (round button cell CR2430) from under the clip.
- Insert a new battery. One side of the battery has a plus sign ("+"). This must face **upward.**

- Carefully screw the back and front parts of the operating unit together again. Do not over-tighten the screws. No screws or small parts may remain in the housing.
- Leaking batteries:

  Remove the battery and wipe the battery compartment with a damp cloth. Before doing this, make sure that the power is disconnected. If the contacts are corroded (with a greenish coating) sand this off. Also clean the contacts and battery compartment with a cotton bud dipped in an alcohol-based cleaning product. Leave to act for a short time, then wipe off with a damp cloth and allow to dry. Switch on again only when all damp areas are dry. Caution! Leaking electrolyte – liquid and crystallized – can have an irritating or corrosive effect. Wear gloves during cleaning and disposal. Avoid contact with skin and eyes.

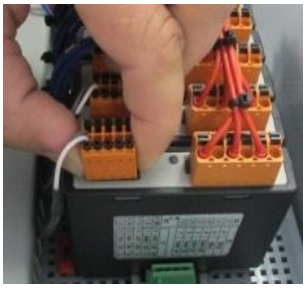
17.2 Replacing a Controller


- Remove the 4 screws on the back side of the housing with a Phillips-tip screwdriver. Depending on the variant, these may be Phillips or Torx.
- Carefully pull the two parts of the housing apart.
- Undo the cable from the board by pressing the two orange colored elements on the plug and carefully removing it.
- You can now insert the plug on the board of the new controller.
- Screw the back of the housing on again.
- If a control module was also delivered, replace this too. Proceed as described in “Removing the Controller Modules”.

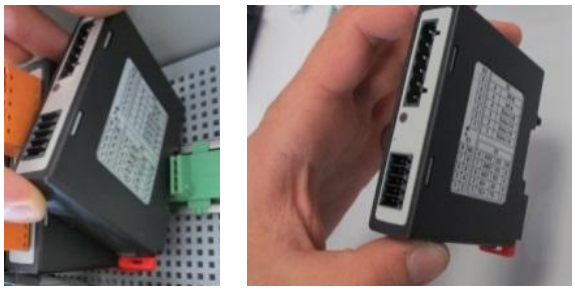
17.3 Removing the Controller Modules

- Disconnect the connections to the module by carefully pulling on the connector.
- To remove the module from the fastening bar, apply downward leverage with a flat-tip screwdriver to the red unlocking device.



Removing the controller modules – part 1 (similar to picture)

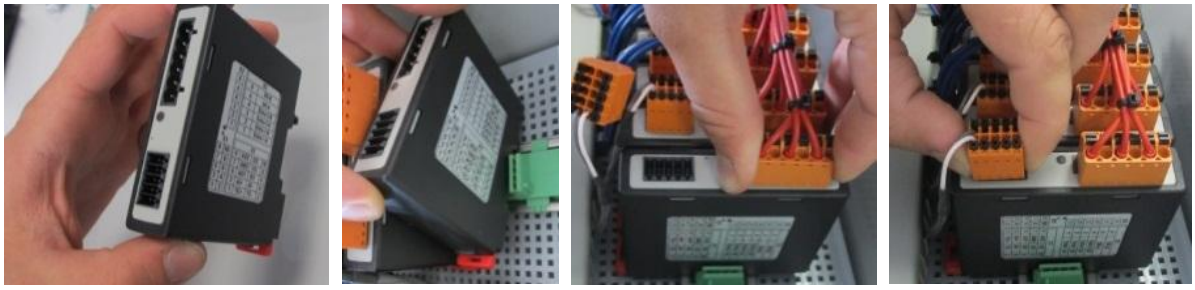
While doing this, carefully tilt the component upward. Now, you can remove it from the switchgear.



Removing the controller modules – part 2 (similar to picture)

17.4 Installing the Controller Module

- Hook the module into the fixing rail top first.
- Then tilt the module downward and allow it to engage.
- Carefully press the plug into the module. Make sure that the plug is pushed into the module as far as it can go. You feel the plug engaging. If not, increase the pressure.



Installing the controller modules (similar to picture)

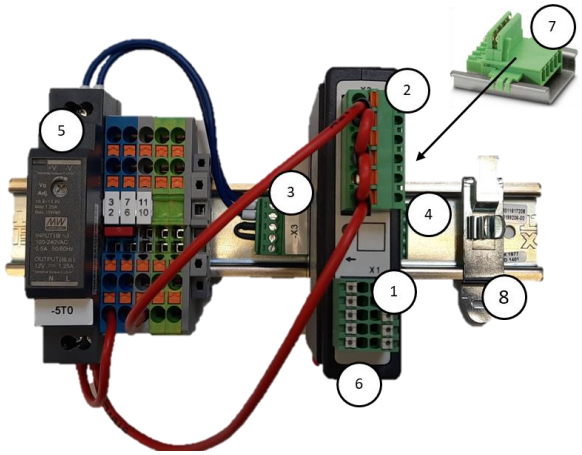
18 Electrical Connections

The following sample circuits illustrate different circuit variants. The final circuitry of the components is only permissible after having been checked by a qualified professional.

18.1 Controller Module

Every controller has at least one controller module in the switchgear. This controller consists of this controller module, together with the operating and display unit. Depending on the application, either a controller module for normal requirements (NT-LT) or one for increased requirements (NT-LTA) is used.

The overview shows the components:



Power supply and controller modules (similar to picture)

No.	Description
1	Plug X1
2	Plug X2
3	Plug connector incl. bus terminating resistor X3
4	Plug connector X4
5	12VDC power supply (example, not part of the controller)
6	Controller module
7	Backplane bus connector (beneath the controller module)
8	EMC shielding clamp

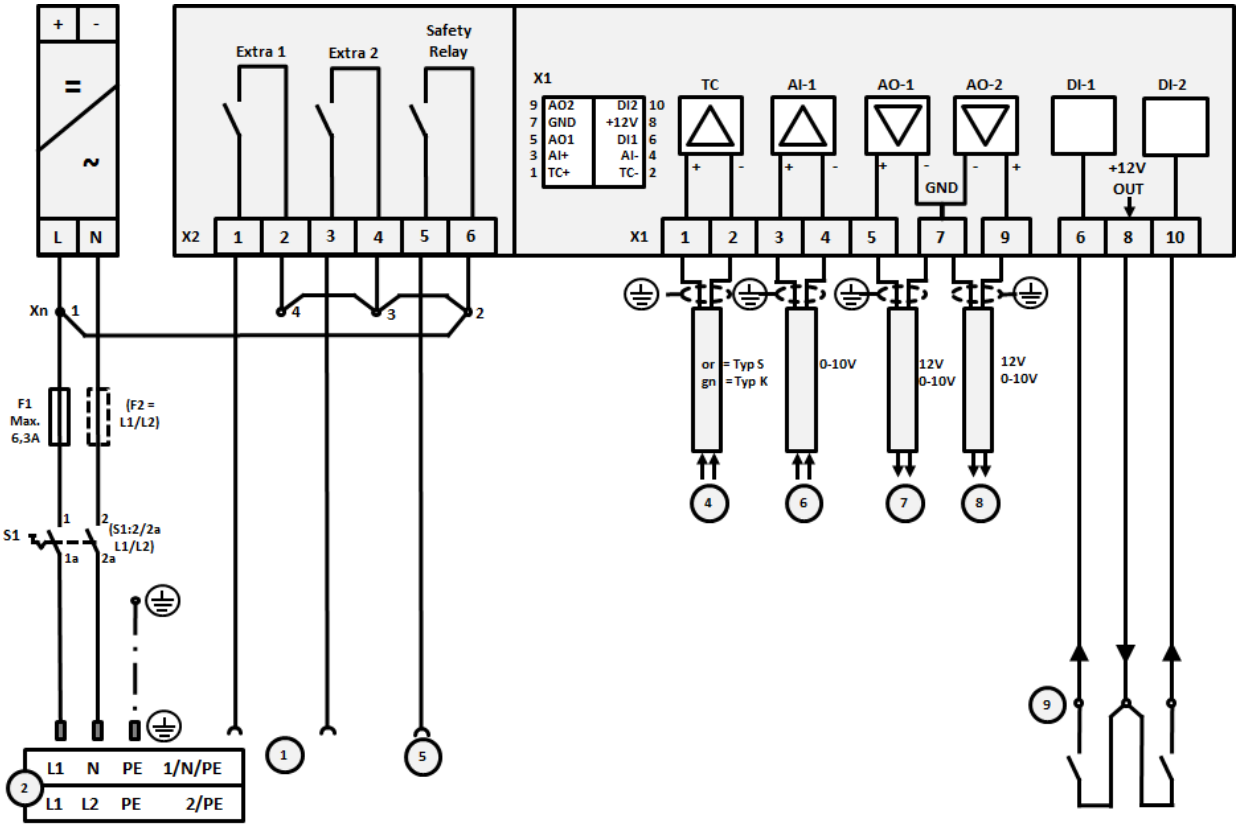
18.2 Power Line Requirements

For lines carrying mains voltage: Use 18 AWG or 1 mm² lines (multinorm line, 600 V, max. 105 °C, PVC insulation) and ferrules with insulation compliant with DIN 46228.

For lines carrying 12 V direct current: Use 20 AWG or 0.5 mm² (multinorm line, 600 V, max. 90 °C, brief periods 105 °C, PVC insulation) and ferrules with insulation compliant with DIN 46228.

18.3 General Connection

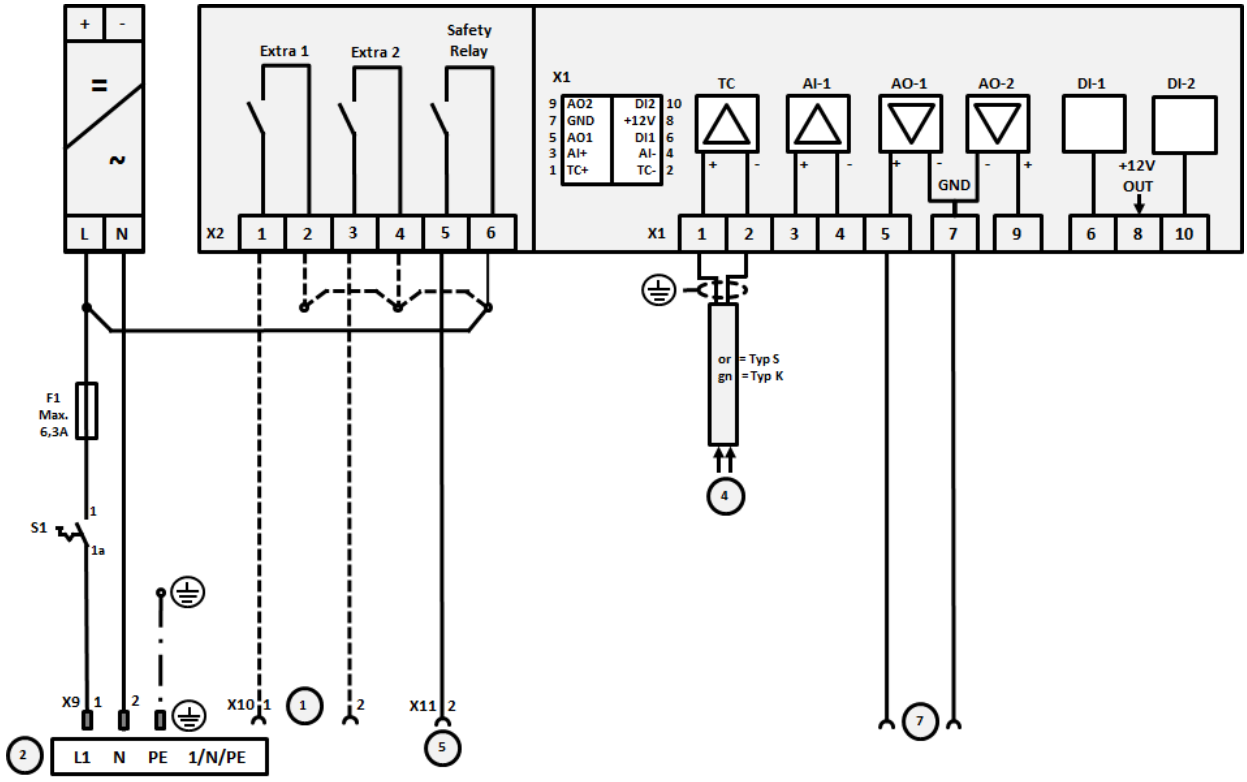
The following connection diagrams cover all possible wiring of the controller modules (NY-LT) for single-zone furnaces



General connection

No.	Description
1	Outputs for extra functions
2	Power supply
3	-
4	Thermocouple connection or 4-20 mA with 47 Ohm load
5	Output for safety relay
6	Analog input (0-10 V)
7	Analog output 1 (heating activation 12 V or 0-10 V; output actual value, setpoint and max. setpoint of the segment with 1-9V (0-Tmax). The range outside these limits should be considered an invalid signal.) Contactor actuation via converter relay
8	Analog output 2
9	Connections of potential-free contacts at inputs 1 and 2

18.4 Kilns, Single-Zone with Solid-State Relay or Contactor

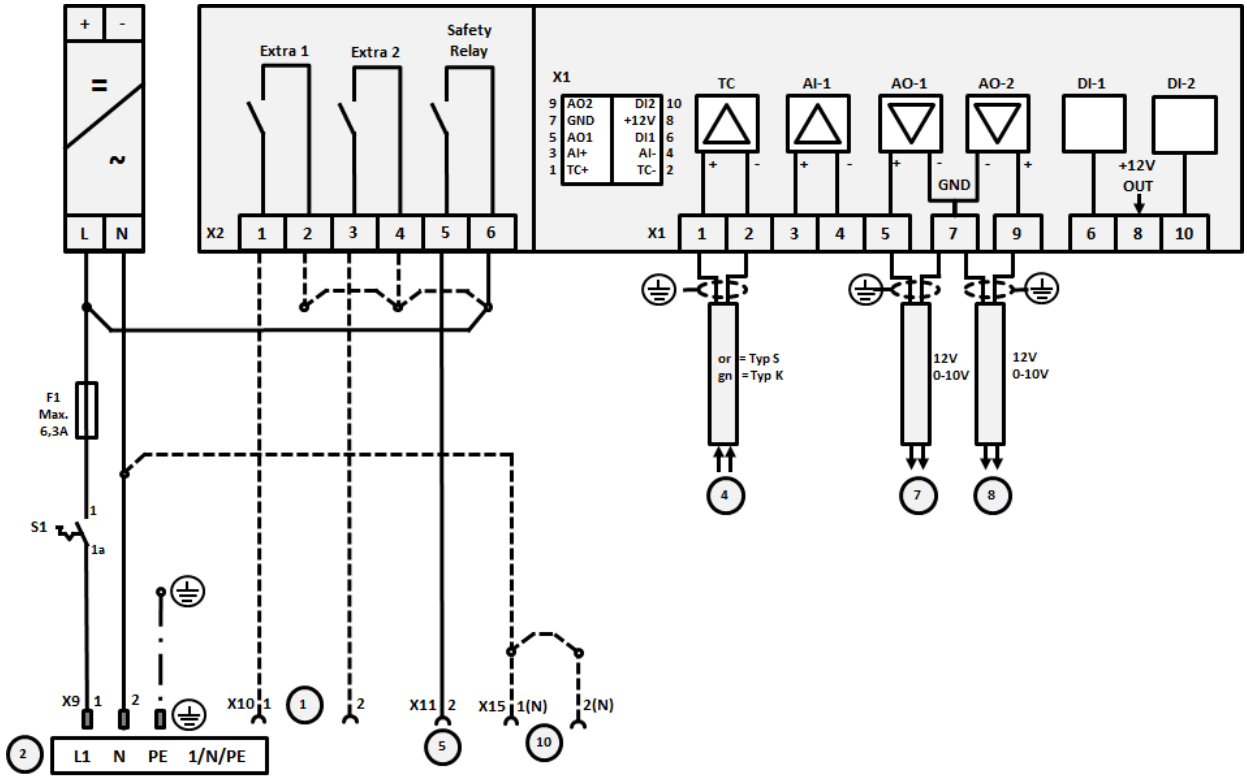


Kiln connection, single-zone

No.	Description
1	Outputs for extra functions (option)
2	Power supply
3	-
4	Thermocouple connection

No.	Description
5	Output for safety relay
6	-
7	Heating control 12 V or 0-10 V; output actual value, setpoint and max. setpoint of the segment with 1-9V (0-Tmax). The range outside these limits should be considered an invalid signal. Contactor control via transformer relay

18.5 Kilns with 2 Heating Circuits



Connecting kilns with 2 heating circuits

No.	Description
1	Outputs for extra functions
2	Power supply
3	-
4	Thermocouple connection
5	Output for safety relay
6	-
7	Heating control 12 V or 0-10 V heating circuit 1; output actual value, setpoint and max. setpoint of the segment with 1-9V (0-Tmax). The range outside these limits should be considered an invalid signal. Contactor control via transformer relay

No.	Description
8	Heating activation 12 V or 0-10 V heating circuit 2; output actual value, setpoint and max. setpoint of the segment with 1-9V (0-Tmax). The range outside these limits should be considered an invalid signal. Contactor control via transformer relay

19 Nabertherm Service

The Nabertherm Service team is available at all times for kiln maintenance and repair.

If you have any questions, problems, or requirements, contact Nabertherm Inc. by mail, phone or e-mail

Nabertherm Inc.
64 Reads Way
New Castle, DE 19720
United States
Phone +1 302 322 3665
Fax: +1 302 322 3215
contact@nabertherm.com

When contacting us, please have the details on the type plate of the kiln ready.

① Kiln model
② Serial number
③ Article number
④ Month and year of manufacture

20 Shut-Down, Dismantling, and Storage

Environmental regulations

These controllers contain a battery. This must be disposed of if the battery is replaced or if the controller is disposed of.

Empty batteries do not belong in the garbage. As a consumer, you are legally obliged to return used batteries. You can hand in your used batteries at your local public collection points or anywhere where batteries are sold. Of course you can also return used batteries that we provide to us.

	**SAFETY INFORMATION**
	Batteries that contain pollutants have a sign comprising a crossed-out garbage can and and the chemical symbol of the heavy metal determining the classification as a pollutant. A bar below the garbage can indicates that the product was launched onto the market after August 13, 2005.

	**Notice** The regulations applicable in the country where the equipment is installed must be observed.

21 NABERTHERM LIMITED PRODUCT WARRANTY

	**Warranties, guarantees and liability** Refer to the kiln operating manual

22 For Your Notes

For Your Notes