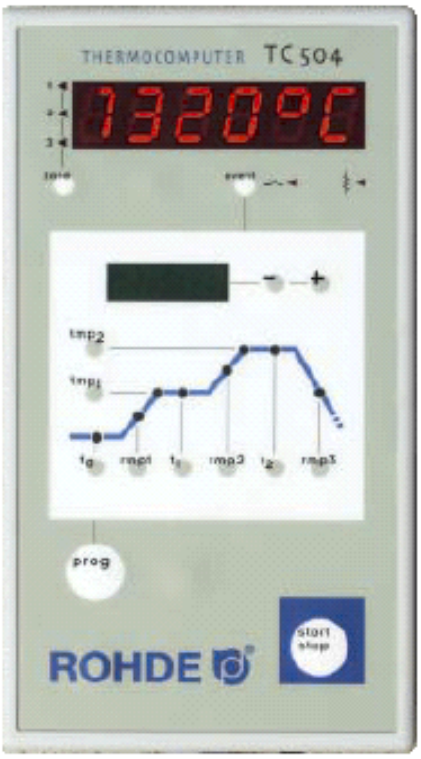
ROHDE

TC 504



Instruction Manual

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General Information

You have opted for a TC 504 controller, the professional model of the highly advanced bentrup TC 500 series. This controller series applies world-wide leading state-of-the-art technology for this controller type. The controller is very easy to operate from the outside. Inside, however, it houses a multi-channel controller structure, which can be freely adjusted to every desired setting (see Appendix C). These operating instructions will help you to become familiar with all the important features of your TC 504. Please read it carefully including the safety instructions of the manufacturer. Please make sure that the controller is installed in an adequate distance from the kiln. It should not be exposed to exhaust fumes or heat-radiation emitted by the kiln.

Quick instructions

Starting the programme:

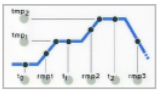
1. O I — Power on. Red display of actual temperature. The power switch is located at the bottom of the controller housing.

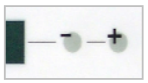
2. prog — Call up a programme by pressing the button one or several times. The programme number shows in the red display, the corresponding final temperature “tmp2” shows in the green display.

3. start stop — Starting or stopping the selected programme.

Changing the programme:

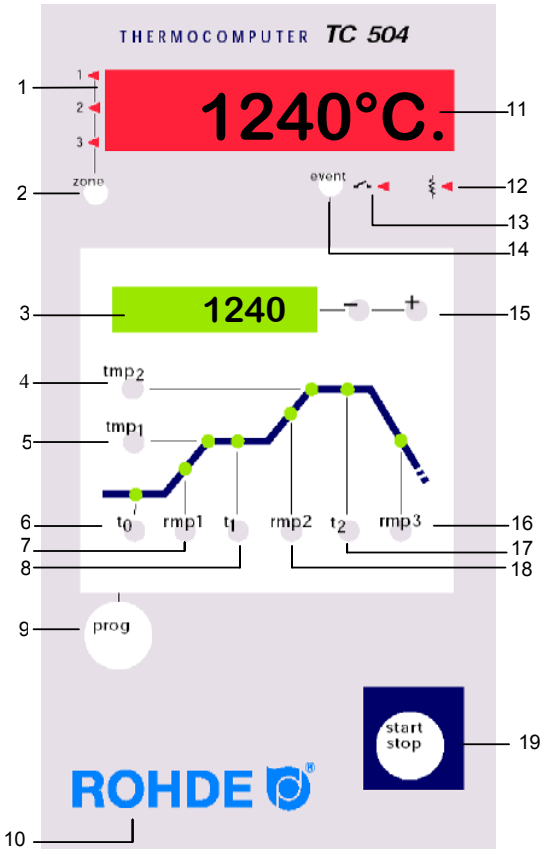
1.-2. See left.

3.  Call up adjustable firing curve values. The values flash up in the green display.

4.  Changing the retrieved values shown in the green display. New values are stored automatically. t stands for time in hours, rmp stands for ramp in °C/h and temp stands for temperature in °C.

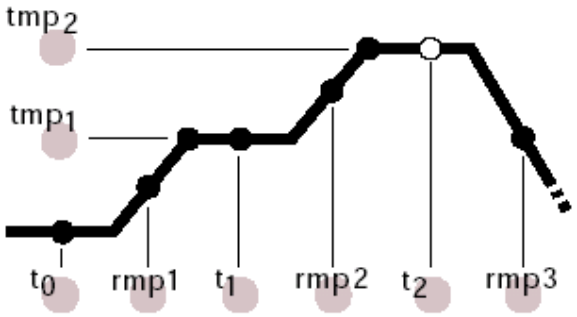
5. start stop — Starting or stopping the selected programme.

Operating elements



1 Display of current zone
2 Calling up another zone (only for kilns equipped with multi-zones)
3 Display of nominal value
4 Calling up / input of final temperature
5 Calling up / input of 1st dwell time
6 Calling up / input of delay time
7 Calling up / input of 1st heating time
8 Calling up / input of 1st dwell time
9 Programme key
10 Keyboard lock in “O”
11 Display of actual value
12 Display of heating circuit status “On/Off”
13 Display of event status “On/Off”
14 Event switched on / off
15 Changing the retrieved values
16 Calling up / input of cooling time
17 Calling up / input of firing time
18 Calling up / input of heating speed to final temperature
19 Starting and stopping a programme

The microprocessor of your TC 504 controller allows you to control your kiln with high precision and reproducible results. The firing curve of the TC 504 is illustrated in the following diagram. In consists of various segments:



t_0

Delay time / delay of programme start
The controller waits for the preset period of time until it starts the actual firing process. With this function the firing can be initiated automatically, e.g. by night.

rmp1

Heating to 1st dwell temperature
The kiln is heated up with the preset speed. The input is made in degree Celsius per hour (for information on how to set the time, please refer to Appendix C).

tmp1

Temperature for 1st dwell temperature
The kiln is heated with the speed set above until it reaches the 1st dwell temperature. The input is made in degree Celsius.

t_1

Dwell time at 1st dwell temperature
After the kiln has reached the temperature, this temperature is maintained for the preset period of time. The input is made in hours/minutes.

rmp2

Heating to final temperature
The kiln is heated up to the final temperature in the preset speed. The input is made in degree Celsius per hour (for information on how to set the time, please refer to Appendix C).

tmp2

Temperature for 2nd dwell temperature
The kiln is heated with the speed set above until it reaches the 2nd dwell temperature. The input is made in Degree Celsius.

t_2

Dwell time at final temperature
The kiln maintains the final temperature for the preset time. The dwell time ensures that the goods are heated thoroughly and evenly.

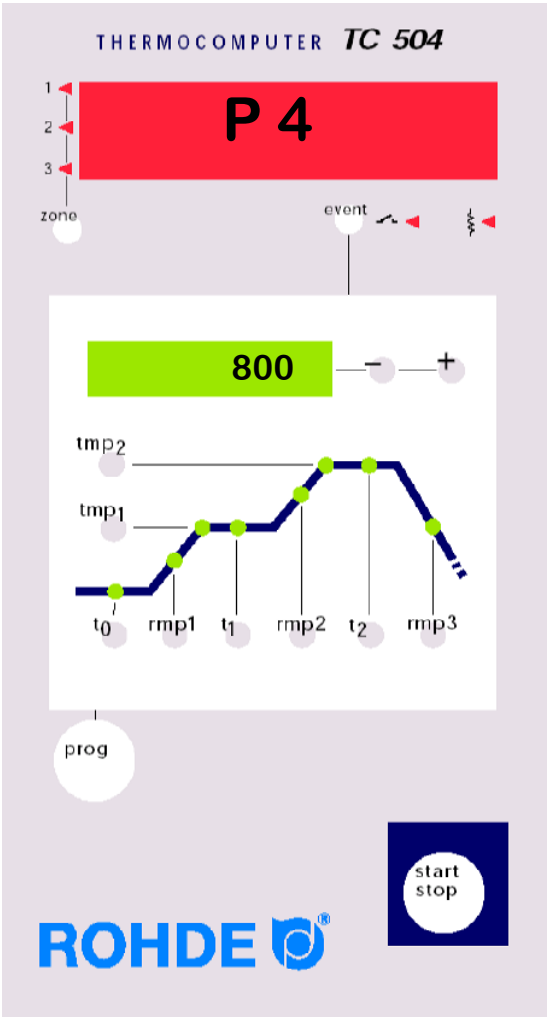
rmp3

Cooling down / end of programme:
After the dwell time is finished the kiln will cool down; this can either happen controlled (e.g. 200° C/h) or uncontrolled (=SKIP). The controller will terminate temperature control at 150° C and indicates the end of the firing process by displaying “End” in the green display (3).

Calling up a Programme

The TC 504 has the capacity of storing 10 firing curves (programmes). The manufacturer has preset the programmes with standard firing curves, which can be modified. The preset programmes contain the following values:

Prog.nr.	Description	t0(min)	rmp.1(°C/h)	tmp.1(°C)	t1(min)	rmp2(°C/h)	tmp.2(°C)	t2(min)	rmp3 (°C/h)
01	drying 150°C	0	50	150	10	skip	150	10	skip
02	drying 200°C	0	50	200	10	skip	200	10	skip
03	glazing 750°C	0	150	750	10	skip	750	5	skip
04	bisquit firing 800°C	0	100	600	10	150	800	5	skip
05	slow bisquit firing 800°C	0	80	600	10	100	850	5	skip
06	bisquit firing 900°C	0	100	600	10	150	950	5	skip
07	earthenware 1050°C	0	150	300	5	skip	1050	20	skip
08	stoneware 1150°C	0	150	300	5	skip	1150	20	skip
09	pottery 1240°C	0	150	300	5	skip	1240	20	skip
10	pottery 1280°C	0	150	300	5	skip	1280	20	skip



In the following example we will call up the firing curve for programme number 04 and will start the firing process.

After the TC 504 has been switched on the red display will indicate the momentary temperature.

You can call up programme number 04 by pressing the Prog key four times. In the green display you will see the respective final temperatures of the selected programmes.

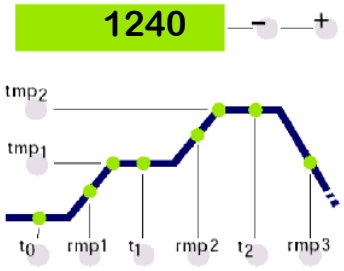
Initiating the firing process

In order to start the programme, press the Start key. In the firing curve the green LED for the current firing segment will light up now. The green display shows the current nominal temperature. The red display shows the current kiln temperature.

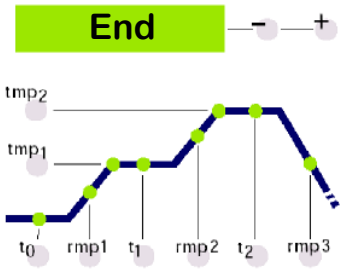
Please note:
The flashing decimal dot on the right side of the red display shows that a firing process is in operation.

Programme values are indicated by a **flashing** light in the respective firing segment in the green display

Display during the firing process



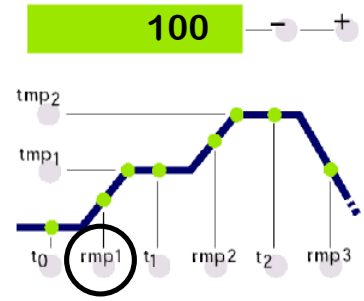
Usually the green display shows you the current nominal temperature during the firing process. While the kiln is heating up this temperature will “count” upwards according to the programme settings. Every 15 seconds the maximal temperature of the firing curve will flash up. This makes it easy for you to check if you have inserted the correct value without having to press any button.



By means of the firing curve you can monitor how the TC 504 executes the firing segments one by one. The programme is finished, when the kiln has reached 150° C during the cooling process. At that moment the display (3) will show “End” for the end of the programme (see diagram to the left).

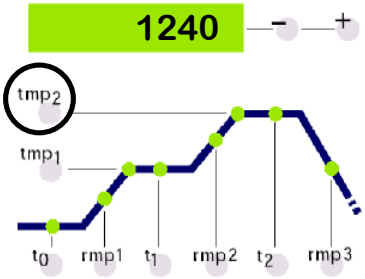
Input and control of a firing curve

You can view and adjust the preset values of the firing curve at any time, i.e. even while the programme is running. You only have to stop the programme if you want to change the values.



In order to control e.g. the heating speed, press the rmp1 key. The currently programmed value for heating appears in the green display in °C/h. The corresponding section of the firing curve lights up.

If you want to change this value just insert a new value using the +/- key.

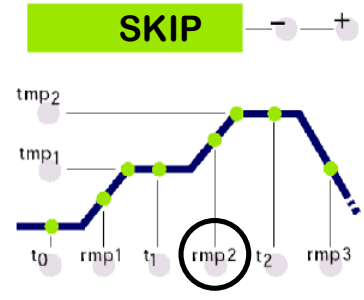


In order to control e.g. the final temperature press the tmp2 key. Again the current value will appear on the green display the corresponding section on the firing curve will light up.

The value can be changed as described above.

All values can be controlled and changed in the way described above. The order in which you control or change the values is not relevant. The only thing you have to keep in mind is that you have to stop the programme if you want to change any values. If you pause checking the values for more than 15 seconds while the programme is running the display will return to the active nominal value.

The SKIP value



Most of the times it is desirable to reach the final temperature during the 2nd heating phase as quick as possible. For this purpose you can set the SKIP value. Select the desired firing phase by pressing the rmp2 key.

You can select the SKIP value by exceeding the maximal value 998° C/h.

Storing of programmes

The TC 504 automatically stores all changeable values of the firing curve.

Display of kiln temperature

The red display permanently shows the values of the process. These are for example: current kiln temperature, heating performance, status of control outlets etc. You can retrieve the kiln temperature values one by one by pressing the “zone” (2) key.
The TC 504 also supports multi-zone kilns. The symbols to the left of the red display indicate which zone belongs to which kiln value. The sequence of the displayed process values can be determined in the configuration. By pressing the key “O” (10) followed by the key “zone” (2) the following values will appear on the display (11).

Current kiln temperature
Display of current actual value. For multi-zone kilns the actual values can be retrieved by pressing the **“zone”** key (2) several times (for zone number see symbol to the left).

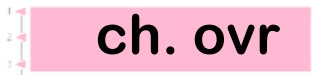
„over“: No sensor connected, sensor broken, sensor connection broken or temperature range exceeded.

„under“: Sensor / supply line connected incorrectly. When you reverse the polarity please make sure that you connect according to the colour coding. If you connect incorrectly on both sides (!) the controller cannot detect this and will overheat the kiln.

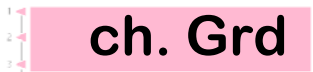
„invalid“: Value measurement invalid, measured value of sensor invalid or failure of measurement device.

Current kiln heating performance percentage.
For switching kilns the percentage of the heating performance is displayed as the relation impulse/break (e.g. 50% = kiln 15 s on and 15 s off).

„channel off“: No controller routine active, e.g. during delay time or when the programme has not been started.



„channel over“: Controller channel switched off, due to exceeded temperatures (e.g. due to “over” error at measurement input.



„channel gradient error“: For safety reasons the controller checks the minimal temperature increase during full load. If the temperature increase drops under 3°C per 15 min the firing will be aborted showing this error message. Typical reasons for this error: The heating spiral is too old or broken, a phase of the mains supply or the power relay has failed, short circuit of sensor. No controller failure!

Switch status of the control outlets
The number of the outlets activated is displayed (the example shows all four outlets are activated). The function of the outlets is determined during configuration.

Information on special process events
Any special process events are displayed here. To the left “E” is displayed permanently, to the right a code (here “A4”) appears if required. The possible events and codes will be explained in Appendix A.

Power consumption since programme start
The TC 504 calculates the power consumption of the current firing by consulting the operating cycles. The prerequisite for this is that the correct kiln performance has been entered once during configuration (see Appendix C).

Operating time of the heating elements since programme start
The TC 504 calculates the net operating time (i.e. only the actual operating time) for the current firing since programme start by consulting the operating cycles. In this way the load on the kiln can be determined during and after the firing.

Overall operating time of heating elements
As above, the individual results are added up to an overall value. This makes it easy to assess the service life of the heating elements. For safety reasons the meter can only be reset by the manufacturer.

Current day and time
The TC 504 can be equipped with a real-time clock with weekday function for an automatic programme start (optional, can be upgraded). If the TC 504 is equipped with this function the weekday and time are displayed in this place for control purposes.

Locking of controller

The TC 504 can be locked against unauthorized access by a key lock.

Press the **"O"** of ROHDE for at least 3 seconds. If the keys are locked you can see a dot in the red display on the left side next to the temperature display.

In order to unlock the keys press the "O" in ROHDE again, until the red dot disappears.

Power failure

Should a power failure occur during firing the firing will be halted. When the power returns the TC 504 will continue firing at the stage of the programme where the power failure occurred. If the kiln temperature has dropped by more than 50° C during firing, the firing will be interrupted (an error message will appear, see Appendix A).

If the power failure lasts longer than 30 minutes the programme will be aborted, as the quality of the goods cannot be safeguarded any more.

Actual duration of a ramp

Ideally the duration of a ramp will be exactly as long as programmed. However, if the current temperature at the beginning of the firing is already higher than the first value, then the time will be recalculated. Example: Ramp in 2 hours to 500° C. The kiln already has a temperature of 250° C, thus the remaining time will be only 1 hour. The ramp will be terminated exactly when the time is up.

Kiln cannot follow ramp

What happens if the kiln cannot perform the required temperature increase? Example: In 1 hour to 1000° C. The TC 504 will perform as follows (only if parameter number 9 is set to 0 or 1): As soon as the controller has regulated the kiln at 100% heating performance and thus no further regulation can take place, the ramp time (and thus the nominal temperature) will be held (display (3) flashes "hold"). If the kiln temperature has caught up the timer will continue to run. In order to prevent the oven from getting stuck in a ramp due to insufficient performance the controller has been set to automatically switch to the next level. Outgoing from the "hold" function you can also terminate the halt manually ("**O**" in ROHDE followed by "**prog**" key), see below in section "Interrupt process".

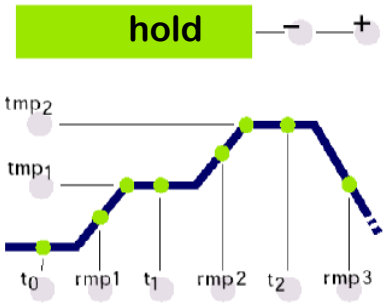
Forward switching for SKIP ramps

In the case of uncontrolled heating or cooling ramps the TC 504 will only switch to the next segment when the final temperature has been reached. For multi-zone kilns the TC 504 will wait at every zone. In order to prevent the kiln from locking itself due to heat shifts between the zones a complex algorithm automatically decides when a segment has to be terminated.

Programme abortion at failure

In the case of severe failure (e.g. broken sensor) the TC 504 will interrupt the firing process.

Stop firing process



The TC 504 allows you to stop the firing process manually. By pressing the "**O**" key in ROHDE followed by the "**prog**" key the controller will stop the firing process (the green display flashes "hold"). This means that the time and the nominal temperature of a ramp will be stopped. The kiln will be held at the current nominal temperature for an indefinite period of time (not the case for uncontrolled ramps!). The firing process will only be continued if you press the **"O**" key in ROHDE followed by the "**prog**" key again.

Appendix A: Event display of TC 504

Special events (power failure, sensor break, kiln problems etc.) will be detected by the controller and will be treated accordingly. Important events will be displayed immediately on the red display according to the codes (see example to the left, code A4). The events are stored internally (see Appendix B).

The event codes are categorized into operating and controller problems (code A…), power failure problems (code B…), internal problems (code C…) and hardware problems (code D…)

The possible event messages and their meanings are listed and explained below.

Event A1

Error at measurement input

Controller switched off due to error at measurement input (e.g. exceeding of measure range). The error will be reset after restarting the programme.
Possible causes:
• Thermocouple or supply interrupted
• Maximal temperature of controller exceeded
• Thermocouple connected to wrong poles (Temperature display „under“)

Event A3

Safety circuit activated

If the maximla programme temperature has been exceeded by more than 20°C the safety circuit gets activated and the safety power relay switches the kiln off (only if installed and configurated). This prevents the kiln from overheating.
Possible causes for overheating:
• Kiln power relay stuck in „ON“ position
• Contact of kiln power relay closed permanently

Event A4

Temperature increase too low despite heating on full load

This error message **always indicates a problem at the kiln**. Possible causes:
• Mains supply fuse / phase, heating element defect
• Heating elements too old (at high temperatures)
• Thermocouple or supply short-circuit
• Power relay defect (often occurs during firing)

Event A5

Kiln does not follow the programmed increase

In contrast to Event A4 here the cause can also be that the programmed temperature increase has been chosen too high for the kiln to follow. This message will only be activated if it has been set during configuration.

Event A8

Increase contiued automatically

If the kiln cannot follow the temperature increase the ramp is halted (see section on „kiln cannot follow ramp“). If the controller contiues the programme after the halt period has passed **without success** this message will be displayed for 1 minute.

Event A9

SKIP ramp forcefully terminated

If the controller has tried unsuccessfully to heat the kiln to final temperature in an uncontrolled ramp the controller switches to the next segment
(see section „uncontrolled ramps (SKIP)“). For the information of the operator this message will be displayed for 1 minute.

Event B2

Firing is continued after power failure

After the power has returned after failure the firing process has been continued successfully.

Event B3

Firing has been interrupted after power failure

After the power has retured after power failure the firing process has been aborted as e.g. the kiln temperature has dropped too far in the meantime. Further information about the event might be displayed by adding a decimal number (e.g. **B3.4 =** temperature has dropped too far). If this message appears immediately after you switched on the controller you can **ignore** it. In this case it only signifies that the controller had been switched off at the last firing while the programme was still running. Just start with the programme input.

Event C1, C2 C3, C4

Internal problem

Technical support necessary (C1 memory for measured value defect, C2 measured value unprecise, C3 communication error of system bus, C4 wrong configuration of system bus).

Event D1, D2 D3, D4, D5

Hardware failure

Technical support necessary (D1 processor failure, D2 RAM defect, D3 bus failure, D4 configuration bus defect, D5 Calibration invalid).

Appendix B Data and events memory

Your TC 504 controller is equipped with a memory for data and events. All data produced during the entire firing process are recorded. This is a unique feature in controllers of this kind. You will no longer have to waste your time with monitoring the firing process when problems occur (and then nevertheless miss the crucial moment)!

Data memory

The data memory records all important values once per minute (kiln temperature, switching, timing etc.). This enables you to view the last 36 hours of the firing process. The data is background-safed automatically as long as the controller is switched on (no matter if the firing process is activated or not). When you switch off the controller the data will be deleted.

Event memory

The event memory will only record values if special events have occurred. These can be e.g. programme interruption due too kiln problems, power failure, interference by the operator etc. You can always call up the last 50 events. In the case your kiln requires servicing this will help the controller manufacturer to find and solve the problem quickly and successfully.

Both the data and the event memories contain basically the same information, namely the current kiln temperature and kiln performance (for multi-zone kilns of all zones), the nominal temperature, the remaining time, the programme segment, the status of the control outlets and the process information.

If the controller is equipped with a real-time clock the date and time will be stored additionally. This makes a fast and continuous reconstruction of all events possible.

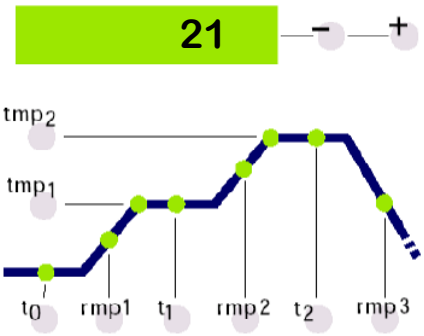
Calling up stored data

In order to call up the stored data please procede as follows:

Press the **"O"** key followed by the **tmp1** key. You may do this at any time, even if a programme is in operation.

The red display will show the letter "L" (for "Log") and a consecutive number. The other displays work as during normal operation (i.e. nominal value display, segment display, etc.). Likewise you can call up the process values by pressing the "**zone**" key (2).

In order to make this mode of the display distinguishable from the "normal" display the red decimal dot does not flash when a programme is in operation.



Now you can call up the following values which have been recorded in one-minute steps by using the keys **rmp1** and **t1.** You can call up the stored data value by value (skip to next with **rmp1** and to previous with **t1**).

If you do not press any key for 15 seconds the data memory will be switched off automatically and the current values will be displayed again. Alternatively you can also leave the data display by pressing the **"O"** in ROHDE(10) key followed by **"tmp1"** (5).

Please note: The controller stores a value every 60 seconds. A very short switch impulse might not be visible in the data memory if it has happened *in between* two recordings.

Calling up stored events

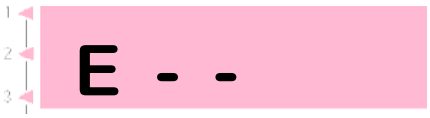
In order to call up the event memory press the "**O**" key followed by the **tmp2** key.
You may do this at any time, even if a programme is in operation.

The red display will show the letter "E" (for "Event") and a consecutive number. You can call up the last 50 events.

Please note: The event that has occurred last (i.e. the latest event) has the lowest number and will be displayed as first.

The way in which the values are displayed is absolutely identical to the one described in the section on calling up stored data.

The event memory records events continuously. The memory can only be cleared by the manufacturer, as it is an irreplaceable means of detecting failure.



If the event or data memories are empty the display shows "- -" (see left).

Appendix C Configuration

Some of the settings of the TC 504 depend on the kiln or the application. Usually the required settings have been made by your kiln manufacturer. If you are technically minded you may make changes yourself if required. The controller will store changes permanently. The following table shows an overview of the parameters.

Par.Nr.	Description	Preset	Unit
01	Kiln performance	0,0	KWh
02	< reserved >	0	-
03	Thermocouple Code (S,R,K,J)		-
04	Maximal temperature of kiln	1320	°C
05	Proportional range	2.0	%
06	Reset time	200	S
07	Delay time	10	S
08	Cycle time	30	S
09	Behaviour at heating problems	1	-
10	Number of heating segments	1	-
11	Input of ramp as gradient or time	grad	(grad/time)
12	Funktion of 1. additional control outlet	1	-
13	Funktion of 2. additional control outlet	0	-
14	Funktion of 3. additional control outlet	0	-

Attention!

If you apply the wrong settings you can easily cause damage to the kiln and goods. It is your own responsibility to assess the results of changes of parameters, or whether it is better not to apply any changes at at.

Certain settings are blocked against changing for safety reasons (e.g. the changing of thermocouple type S/R to J/K or vice versa).

Explanation of parameters (in brackets: parameter numbers)

Kiln performance (1)
The kiln performance value is only used for calculating the energy consumption. For multi-zone kilns you have to input the overall performance. The controller assumes an even distribution of heating performance for the calculation.

Thermocouple Code (3)
Type of the temperature sensor. S=PtRh10%-Pt, R=PtRh13%-Pt, K=NiCr-Ni, J=FeCu-Ni. Change from S/R to J/K and vice versa locked for safety reasons.

Maximal temperature of Kiln (4)
Highest insertable temperature. **Please note that this upper temperature level should NEVER lie above the maximal kiln temperature!**

Proportional range (5), reset time (6), delay time (7)
According to these parameters you can adjust the controller to the characteristics of your kiln. The auto-tuning mechanism for the standard parameters ensure excellent controller function even without individual setting.

Cycle time (8)
Decides the switching frequency of the power relay. A cycle time that is too short will result in increased wear of the power relay, if the cycle time is too long the kiln will be heated unevenly. The preset value of 30 s has proved to be a good compromise.

What to do in case of heating problems (9)
If the setting is 0 the controller will take all delays during heating into account. The time will be **held** (“hold”) in controlled ramps if **one** segment is heating on full load. This setting ensures that all segments of a heating ramp are properly controlled as far as technically possible. In multi-zone kilns this is possible even with low performance reserve. With this setting the programmed heating time might be exceeded considerably, due to frequent “hold” periods.

Setting 1 (standard) is the same as setting 0, with the only difference that the time will only be held when **all** zones are heating on full load. Thus the kiln performance will be used fully during heating with the compromise that the individual zones might not be controlled. For single-zone kilns the settings 0 and 1 lead to the same result!

With setting 2 the controller only checks the temperature increase during full load. As long as a certain temperature increase is being measured (3° C per 15 min.) the firing process will be continued.

For setting 3 the controller does not control the heating process at all. You should only chose this setting if it is **explicitly** desirable (e.g. when the kiln has to be opened during operation). Otherwise the safety of operation cannot be safeguarded. With this setting the controller will not detect irregularities, as e.g. a short-circuited thermocouple, and the kiln might overheat.

Number of heating zones (10)
The TC 504 is also available for 2 or 3 control zones. With these parameters the number of actually used controlled zones can be adjusted. Several controlled zones require an accordingly contructed kiln (several thermocouples, power relais and heating group). The temperature distribution for real multi-zone control is exceptionally good.

Input of ramps as gradient or time (12)
The values for heating and cooling segments can be input either in degree Celsius per hour (°C/h) or as time – you can choose the unit according to your preference.

Funktion of 1./2./3. additional control outlet (13) ff.
The TC 504 is available with up to 4 control outlets. For single-zone kilns you can opt for up to 3 control outlets for special functions. The respective functions have to be configurated. The settings have the following meanings:
0 – control outlet OFF (no function)
1 – outlet for safety power relay: ON during programme in operation, OFF for over temperature
2 - EVENT: outlet can be programmed as ON or OFF for every semi-segment.

Up to 2 outlets can be configurated as EVENT. After configuration please press the keys **event1** or **event2** during programme setting and insert for every segment “0” (=off) or “1” (=on). Every control outlet will be switched accordingly when the programme is running. In this way you can for example contol the cooling flaps

3 - ON during programme
4 - ON during programs, but not during delay time
5 - ON at end of programme

(for further functions please contact us)

The parameters (12), (13) and (14) will only be displayed if your kiln is equipped with the according modules and number of zones (i.e. according to the number of control outlets).

Calling up the configuration

Please press the **zone** key and keep it pressed for approx. 3 seconds. The TC 504 will switch into configuration mode and shows the first parameter of the list (see previous page). The red display shows the parameter number, the green display shows the current value.

By pressing the keys **tmp2** or **tmp1** you can navigate through all parameters of the list and change them by pressing the +/- keys.

In order to leave the configuration mode please press and hold the **zone** key as before. If you made changes and you want to store them permanently please **keep** the **zone** key **pressed** until the message “Save okay” is displayed. This will prevent the parameters from being changed accidentially.

Extensive parameter list

We kept the above mentioned parameter list as simple and compact as possible. It will allow you to adjust the parameters for most applications.

However, many functions of the TC 504 remain “hidden”. The **extensive parameter list** contains more than 2,000 parameters and allows for an absolutely unrestricted configuration of the entire controller layout. You can set different parameters for the individual zones, servodrive control, analog outlets and many more.

The extensive parameter list can be deblocked by setting a jumper. This can be done either by using the TC 504 keyboard or the configuration software WinConfig in Microsoft Windows (only for TC 504 with interface – see Appendix D).

For further information please see the “Technical Manual TC 500 Controller Series”. This manual (PDF format), as well as WinConfig can be downloaded free of charge at *http://www.bentrup.de*.

Appendix D
Data interface

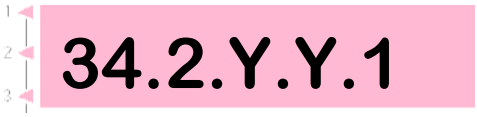
The TC 504 can be equipped with a RS232C data interface (for connection to a PC serial port) or a RS422/485 interface for industrial use. The electric signals are separated by galvanization. With the data interface you have full access to all process values, programmes, configuration parameters and operation commands. This allows for complete remote control. The following examples are typical applications:

• Changing of configuration with bentrup WinConfig (free software)
• Design of personal programs, direct access to controller via public protocol
• Design of personal programs, access to controller via simple command (e.g. “START”) with Windows DDE (bentrup FIELDBUS driver required)
• Visualisation for complete solutions, data measurement and recording, administration of programmes and configurations with bentrup WinControl.

For a detailed description including protocols please visit the manufacturer’s homepage at *http://www.bentrup.de.*

Appendix E
Calling up of layout

If you press the **zone** key while your controller is starting up, the TC 504 will display the hardware version and the upgrades if there are any installed. The codes have the following meaning from left to right:



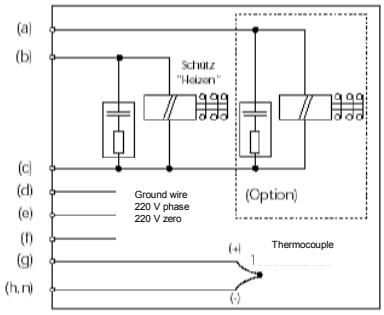
• Number of control channels *
• Number of contol outlets *
• Number of analog outlets *
• y/n: real-time clock installed: Yes / No
• y/n: Extended programme store: Yes / No
• Hardware version code

* The actual number can be lower, see number on the type plate of the controller behind the thermocouple code (e.g. TC 504-S-14- .. = 1 zone / 4 outlets)

Appendix F: Electrical connection

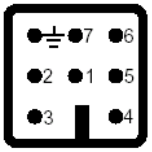
Important Note:
The specifications given here are exemplary only. The electrical connections are determined by the customer and often deviate from the specifications given in this example. Please check the documentation provided by the kiln manufacturer. If the controller layout is suitable for more than one zone or if it is equipped with more than two outlets, please use the HAN15DX connection (see additional description).

Simplified switch diagram of a kiln

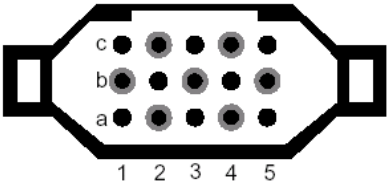


a….n Connection f. control unit

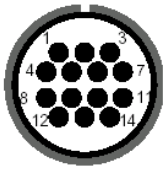
Plug designation HAN7D a



HAN15D a



CPC14 a



Connection	Function	HAN7D a	HAN15D a	CPC14a
a	Additional control outlet	7	C3	12
b	Control outlet connector (phase)	6	A3	14
c	Control outlet connector (zero)	1	B3	13
d	Ground wire *		termination fitting	11
e	Power supply phase	5	A1	8
f	Power supply zero	2	B1	9
g	Thermocouple +	3	B5	1
h	Thermocouple – (Pt Rh Pt)	4	C5	2
n	Thermocouple - (NiCrNi)	4	A5	3

* The ground wire **must** be connected!

Important Note:
Please compare the type of the thermocouple with the type specification that is stated on the back of the controller. Otherwise you might cause damage to the kiln and the kiln content!

We reserve the right to make changes contributing to technical improvement.
Instruction Manual TC 504 V1.20 (C) 2004 HELMUT ROHDE GMBH DEUTSCHLAND