bentrup

TC 60/8

Operating Instructions

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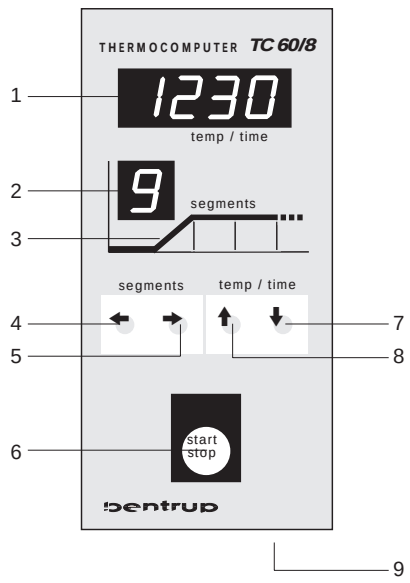
Contents

Controller Layout



1	**Display**
2	**Segment indicator**
3	**firing curve**
4	**key for selecting previous segment of the firing curve**
5	**key for selecting next segment of the firing curve**
6	**start/stop key**
7	**key for decreasing the displayed value**
8	**key for increasing the displayed value**
9	**main switch**

General Information

Your brand new bentrup TC60/8 is the most flexible kiln controller in the compact class specially designed for more complex firing curves (e.g. glass processing, fusing etc.). The TC60/8 combines many features for complex firing processes, safe and precise kiln operation at a reasonable price.

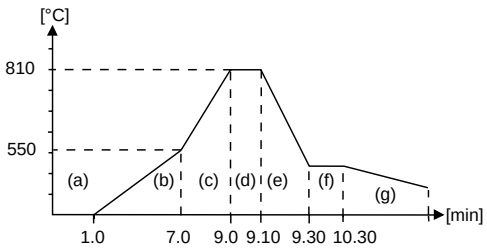
Before operating the TC60/8, please read and understand the manual carefully. This familiarizes you with all functions of the TC60/8 quickly and ensures that you can use all the capablities of your control.

Security Advice

Please refer to the security advice of the kiln manufacturer. Make sure that the control is mounted at a safe distance from the kiln and that the control is not exposed to direct heat or radiation when the kiln is opened whilst it is hot.

Firing Curves

The microprocessor controller TC60/8 provides your kiln with a precise and reproducable controlling unit. The firing course is shown as a firing curve consisting of up to 9 segments. An example is shown below. This firing curve consists of the following sements:



a. programme delay 1 hour
b. heat up to 550°C in 6 hours
c. heat up to 810°C uncontrolled
d. dwell 10 minutes
e. uncontrolled cooling to 510°C
f. dwell 1 hour
g. cooling to 460°C in 5 hours

Each segment consists of a temperature and the time to reach this temperature. You only need to enter the segments required (not all 9 segments).

The programme delay (e.g. useful to take advantage of "off peak" electricity) is entered as segment 0.

Example Curve

The firing curve shown above is translated for the TC60/8 into the following segments:

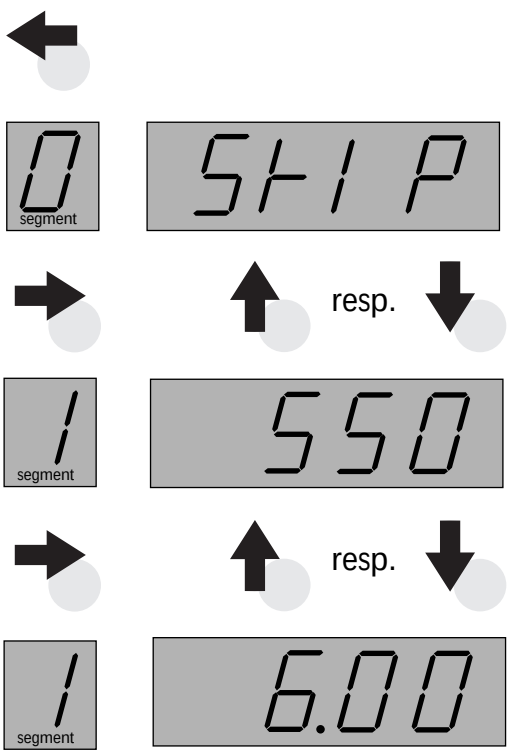
segment no.	temperature	time
0	--	1.00
1	550°C	6.00
2	810°C	SKIP*
3	810°C	0.10
4	510°C	SKIP*
5	510°C	1.00
6	460°C	5.00
7	End**	

*SKIP: This value stands for uncontrolled (=maximum) heat up or cooling.

**End: This value entered instead of the temperature indicates to the controller the end of the programme.

As shown in segment 3 and 5, a dwell is simply achieved by repeating the temperature of the previous segment (followed by the required dwell time).

Entering a Firing Curve



The above firing curve is entered as follows: Turn on the controller by the mains switch. After a few seconds the actual kiln temperature appears on the display (1).

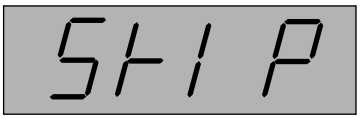
Select the segment 0 by pressing the key (4) once. The display (1) shows the actual programme delay as hours / minutes (SKIP=0.00). Use the keys (7) and (8) to change this value.

Press the key (5) to enter segment 1 (display (2) shows "1"). The display (1) reads the actual set temperature. Use the keys (7) and (8) to adjust to the required value of 550°C. Press the key (5) again to enter the value of 6.00 hours with the keys (7) and (8).

If you hold the key (7) or (8) pressed, the displayed value will run through automatically.

Check the decimal point in the middle of the display (1) to indentify whether the TC60/8 shows a *temperature* or a *time* (with decimal point)

Proceed in the same way to enter the temperature and time values for all segments. The sequence of entering the values can be any; however, to step to the next segment, the TC60/8 requires the previous segment to be entered. This avoid unintended skipping of a segment.

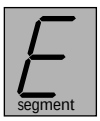


The value SKIP for uncontrolled heating / cooling is entered as a time by holding the key (7) pressed. SKIP is shown as depicted on the left.

The value End (indicates to the controller the end of the firing) is adjusted by holding the key (7) pressed while entering a temperature.

If you want to alter a value again or if you have skipped unintentionally a segment, you can select it at any time by using the keys (4) or (5) resp.

To start the firing, press the key (6). The display (1) shows from now on always the kiln temperature. During a programme delay, the display (1) shows the remaining time until the firing starts.



The segment display (2) reads the current segment of the firing curve. The flashing decimal point in the right hand corner indicates programme running. At successful completion the segment display reads "E" for "End".

Checking the Programme Values

To check or change the values of a programme when the firing has already been started, proceed as follows: Press the key (4) or (5), the firing is interrupted automatically (decimal point stops flashing). Now, you can step through the segments using the key (4) and (5) as described before. To change a value, use keys (7) and (8). To continue the firing with the new values press key (6) again.

Displaying Values during a Firing

During a firing there are two interesting values that can be displayed without interrupting the firing:

actual setpoint: press the key (8) and the controller shows the setpoint temperature for 3 seconds (the display shows a decimal point in the left corner).

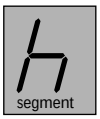
time remaining in actual segment: press the key (7). The time remaining in the actual segment is displayed for 3 seconds. In ramps, the actual time might differ e.g. if the kiln is too slow.

Both these values can only be called up during a running programme.

Direct Control

(ca. 3 seconds)

(ca. 3 seconds)



In certain applications it is very helpful to take direct control of the firing process (e.g. on glass fusing). The TC60/8 provides the following features:

Immediate skipping to next segment: Disregarding the present temperature and time you require to skip immediately to the next segment. Hold the key (8) pressed for 3 seconds, the TC60/8 enters the next segment immediately.

Hold a segment: You require to stop the time in a dwell or the remain at the present temperature in a ramp. Hold the key (7) pressed an "h" is flashing on the segment display confirms the TC60/8 in hold status. Attention: The TC60/8 remains in hold until it is released in the same way (hold key (7) until the "h" disappears).

Reaction on Power Breakdown

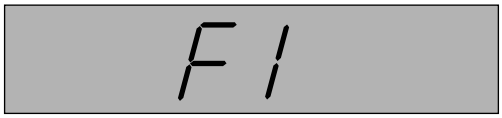
For security reasons the firing will be interrupted if a power breakdown occurs. For special applications a version with power breakdown restart feature is available on request.

Maximum Adjustable Values

programme delay.....0.00 to 10.00 hours
temperatures .....20°C to 1320°C*
ramp / dwell times.....0.00 to 10.00 hours
**this value varies depending on the kiln*

Error Messages

The integrated microprocessor inside your TC60/8 performs continous checking of the firing process. In case of any malfunction the display will show an error message pointing to the problem. Following is a description of the possible error messages:



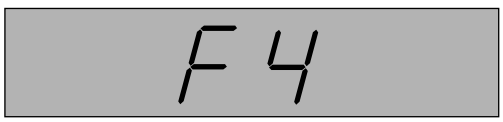
The kiln doesn´t follow the required temperature increase. This error message **points clearly to a kiln problem**. Possible cause:

- broken fuse, power phase or relay failed
- the door (lid) contact is open
- a heating element is broken
- the heating elements are too old
  (esp.with high firing temperatures)
- the thermocouple has a short circuit

Thermocouple or thermocouple circuit defect

Possible cause:

- thermocouple broken
- thermocouple wiring bad
- contacts of the connecting plug bad



Impossible values on data acquisition

Possible cause:

- thermocouple polarized bad
- thermocouple temperature less than -15°C

Safety Switch Off features was activated

The TC60 has measured an overtemperature in the kiln and switched off the kiln by the 2nd power relay (if fitted). Check carefully the cause before using the kiln again to avoid further damage ! Ask your dealer for assistance.

Error detected during power-up self check

On every power-up the controller performs a self check. If an error is detected the controller shows F8 (ROM error) or F9 (hardware error). Please contact your local dealer.

Setting the Parameters of the TC60/8

This information describes how to adapt the TC60/8 to the kiln. Usually, this is done by the kiln manufacturer.

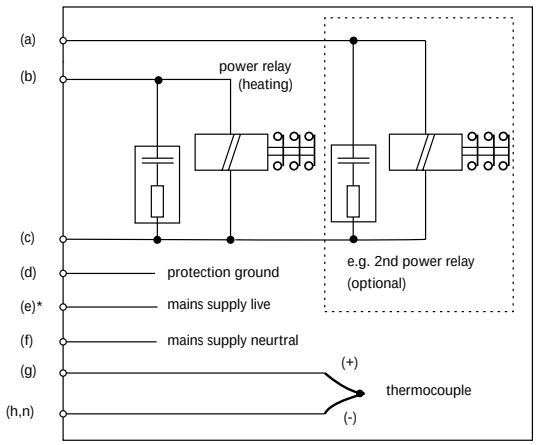
You can call up the parameters to view only; to change them, you need a special authorization code which is available from us on request.

To get into the parameter menu press the key start/stop and hold it pressed for about 4 seconds. Now, the display reads the first configurable value and you can step through the list by pressing the key (5).

code	usage	value range	unit
0	type of thermocouple S-R-K-J	0-3	-
1	max. adjustable temperature	20-1600	°C
2	proportional band	0.0-99.9	%
3	integral time	10-8000	s
4	derivative time	0-999	s
5	cyclus time power relay	1-100	s
6	units for temperatures °C - °F	0-1	-
7	lock error message F1 (heat up check)	0-1	-

Technical Informations

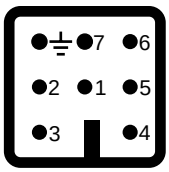
Schematic of a Kiln



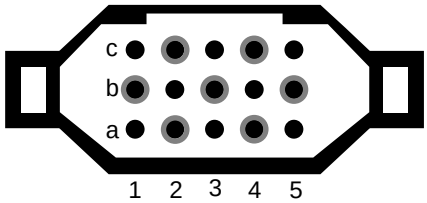
a ... n: electrical links for the controller

Pin Assignment

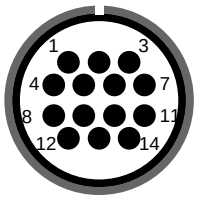
HAN 7 D



HAN 15 D



CPC14



connect.	function	HAN7D	HAN15D	CPC14
a	additional control output (live)	7	C3	12
b	control output power relay (live)	6	A3	14
c	control output power relays (neutral)	1	B3	13
d	protection earth *	⏚	PE clamp	11
e	mains supply live	5	A1	8
f	mains supply neutral	2	B1	9
g	thermocouple +	3	B5	1
h	thermocouple - (type S, R)	4	C5	2
n	thermocouple - (type K, J)	4	A5	3

* protection earth should be connected !

Important Note

Please compare type of thermocouple used in the kiln with the controllers thermocouple input marked on the back of the controller. Mismatch can cause severe damage of kiln and contents