DESCRIPTION AND INSTRUCTIONS FOR USE

OF PROGRAMMABLE TEMPERATURE REGULATOR OF

TEMPREG 400 TYPE

The TEMPREG 400 is a four-zone programmable temperature regulator designed especialy for the programme control of electric resistance furnaces and other similar devices. It enables the variable control of output circuits of furnaces using classic contactors, semi-conducting relays, or proportional output elements.

Regulators are easy to control and programme in dialogue mode using a keyboard with twelve buttons and a two-line 16-symbol alpha-numerical display with quick access to data concerning the state of the system, including failure indication. An built-in clock, which shows actual time, has a built-in battery and enables an initiated heating cycle to finish even in the case of a short electric power fall-out loss.

I. BASIC PARAMETERS

Inputs

- Thermocouple thermometers, optional sensitivity - 25 or 50 mV, ambient temperature measuring with built-in or external heat sensor.
- 3 inputs for measuring transformers connecting for scanning the current flowing through the controlled system power circuits

Outlets

- 4x relays (230V/2A) for switching the heating circuit contactors
- or 4x signal 12V/50mA for semi-conducting relays control
- 1x relay 230V/2A for fan regulation, or signal indicating end of the programme (option)
- 2x relay with switch-over contact 230V/2A for flaps control (option)
- 2x analogue signal 0 ÷ 10V/1mA for output element control (option)
- 1x relay with switch-over contact 230V/2A for protective contactor control or for alarm switching (option)
- serial interface TTL for printer connection, or serial interface RS232 (COM) for communication with PC (option)

Dimensions

96x96x180mm (opening in panel 92x90mm)

Standard setting

As a standard, the regulator is supplied calibrated for S, K or J thermocouples. The indicated temperature is related to the ambient temperature measured at the location of the compensation line connection.

Table of temperature deviations of individual thermocouples

Thermocouple	Temperature range	Temperature deviation
S	350°C ÷ 1350°C	± 2°C
K	25°C ÷ 1100°C	± 2°C
J	25°C ÷ 800°C	± 2°C

Control

- using the twelve button keyboard (figures 0÷9, ENTER, DEL) for the purpose of regulator control
- alphanumeric display 2x16 symbols for: temperature indication 2 - 4 zones, data on the temperature cycle process and other supporting data
- 2x4 symbol LED display for time indication, set and actual 1st zone temperatures
- aural and visual failure indication
- regulator monitoring with a PC connected through a serial interface
- regulator control division in three levels– manipulation, technical, and service
- the technical level can be optionally protected with a password

Options for regulator programming

- enables the programming of 18 different temperature cycles, each temperature cycle can consist of a maximum of 8 linear sections, and their saving into the permanent memory.
- programmed cycles remain in the memory even after the regulator is switched off
- upon customer´s request, the regulator can be supplied either as a 40-program model or an 82-program model.
- The time scale is common for all 4 zones, the final temperature at the end of the selected zone is separately selectable for each of the 4 zones.
- The regulator configuration can be set either from the keyboard for 1,2,3 or 4 zones control, or 0, 1 or 2 flaps control, 0 or 1 fan, 0 or 1 fan control or by programme end signalling.
- It is possible to change the saved programme during the cycle.
- Temperature deviation setting for alarm activation is in a range of 1 - 99°C.
- It is possible to have an uncontrolled cooling option after the cycle is finished, or keep the final temperature without time limitation (manually finished).
- The maximum length of one linear section is 5999 minutes (≈100 hours). Total for the entire temperature cycle ≈ 800 hours (33 days).
- In case the maximum programmed temperature is exceeded more than the deviation set for the respective cycle, the zone in which the deviation was exceeded is disconnected, and the sound signal is switched on; the deviation is programmable at a range of 1 - 99°C.
- Flaps activity control at a set temperature in zone 1 and 2.
- Cycle start-up either immediately, or with a 1-week delay.
- The optional regulator zone with the exception of zone1 can be set either as a regulation zone or as a tracking zone.
- The first zone can be regulation only.
- If any of the zones is defined as tracking, the regulator indicates its temperature, but does not switch the appropriate output.

Precautions

- Auto-test of the system and tests carried out cyclically.
- Activity interruption in the event of thermocouple disconnection or in the event of output switch short-circuit and failure indication with a sound signal.
- Heating disconnection and switching sound signal system on if the maximum temperature exceeds the set deviation.
- Possibility of disconnecting heating using additional protective contactor or alarm switch-on (not included in delivery) if there is flow in heating bodies at a time when the regulator does not give the particular signal for heating-
- Saving all data in case of network breakdown.
- Continuing in heating cycle started after short supply fall-out loss; the time of acceptable supply fall-out loss is optional by the user in range 0 ÷ 99 minutes

- Actual time clock created by integrated circuit with long-durability built-in battery (manufacturer of the clock circuit guarantees 10 years of the built-in battery durability) with memory for data saving in case of feeding breakdown.
- Change of important regulator parameters protected with service password.
- Change of control programs and parameters is protected with technical password.
- Indication of heating circuits interruption in individual zones and phases.

Possibilities of function spreading

- Record of temperature cycle course in the inside memory and its later transfer to PC using serial interface (COM).
- Programme for graphic view of the cycle process on PC and its printing.
- ON-LINE record of the temperature cycle process by means of panel 40-column printer in optional intervals 1 to 60 minutes.
- ON-LINE monitoring of the temperature cycle process by PC connected through serial interface.
- Increasing the number of saved programmes in the regulator from 18 to 40, or 82.

TEMPREG 400 regulators protection

The regulator electronics itself is secured with fusible cut-out **T200L250V**, which is built in the supply plate of the regulator.

II. INSTALLATION OF TEMPREG 400 REGULATOR

Important warning:

Connecting TEMPREG 400 regulators can be accomplished by an authorised person only, or by the manufacturer upon the user´s request.

During installation, ventilation openings must not be covered. 2 clamps, which are supplied with the regulator, serve for fixing – they are fitted in two pins placed at the opposite side walls on the regulator box.

Regulators are equipped with current sensor and programme adaptation which controls whether the switching output elements were not broken. If current passes the power circuits at the moment when the regulator does not give any signal for switching, the regulator connects the alarm or disconnects the protective contactor circuit that is recommended by the regulator manufacturer to be connected to output circuits of the furnace (not included in the delivery). During normal operation, the contactor is switched, it disconnects only in case of failure or when the maximum cycle temperature is exceeded more than the optioned deviation or, as the case may be, in case of inside regulator circuits breakdown detection.

III. ACTIVITY OF REGULATOR IN COURSE OF TEMPERATURE CYCLE

Course of cycle

The regulator distinguishes the three following positions:

1. **Increasing temperature zone – increase /** The regulator controls the furnace to achieve temperature increase programmed within the set time. The control proceeds so that the regulator calculates the temperature from the starting and programmed temperature of the section, that it shall achieve in the zone within the specified time. It compares the worked-out temperature with the actual temperature and switches the heating on, according to the temperature difference, so that it achieves zero difference between the temperatures. Besides the temperature differences, the regulator uses also previous states (derivations).
2. **Section of constant temperature keeping– dwell -** the regulator controls the furnace, whether it keeps the zero difference between the programmed and actual temperature. It controls heating of the furnace according to the temperature difference with regards to the preceding differences of temperatures (derivation, integration).
3. **Falling temperature section – fall -** the regulator calculates the temperature for the specific moment from the starting and programmed temperature. It controls the fall and according to the difference between temperatures controls the furnace heating to achieve the programmed temperature within the scheduled time.

Ending the cycle

The following two ways of finishing the cycle can be programmed:

1. **Temperature dwell** the regulator keeps the programmed temperatures of the last section of the cycle. If the programme end signalling is set, it switches this signal system on. Neither flaps, nor the fan are controlled. The programme must be ended by the operator using the keyboard.
2. **Uncontrolled fall** the regulator leaves the furnace to cool spontaneously. If it controls flaps or fan, the temperature achieving is controlled by the first-zone fan and opening the valves/flaps in the first and second zones. After the temperature drops below 100°C in all zones, the regulator ends the cycle. If the fan is in operation, the regulator will put it off. The valves remain in open position.

Ending the processed section and moving to another one is done by the regulator only provided that the programmed section temperatures have been reached in all zones and the scheduled time is achieved. There is an exception – the first section which is ended after the programmed temperatures are achieved.

By programming the temperature and time in which the temperature should be achieved we can obtain an optional speed of heating. If higher speed of increase or drop is programmed, than the furnace is capable of achieving, the regulator continues in the section, until the programmed temperature ± allowed deviation is obtained.

WARNING:

The maximum allowed length of linear section is ca 4 days (5999 minutes, to be exact, i.e. 4 days 3 hours and 59 minutes). This length must not be exceeded, even by potential cycle prolongation.

After ending the last section, which is done when the temperature drops below 100°C, the regulator will switch both heating and fan off and further cooling of the system is more-or-less spontaneous. Even after the cycle is finished, the regulator indicates the actual temperature of the system.

Activity of flaps and fan

Regulator is able to control two flaps controlled by depend the temperature in zones 1 and 2. In addition, it can also control the fan, which is controlled by depend the first-zone temperature. If the regulator controls the flaps, it will close them when the programmed temperature in the respective zone is exceeded for the first, anywhere in the programme (except of the end of it). The flaps are opened and the fan turned on by the regulator in the phase of the cycle ending – see above for the uncontrolled fall.

IV. DESCRIPTION OF ACTIVITY MODES, SERVICE, PROGRAMMING

Control

The regulator is controlled by a 12-key keyboard. The buttons function as menu buttons with an allocated task, or function as numerical keys for numbers setting. For safety reasons, the regulator controls the time from the last key pressing; if one minute passes from the last key pressing, the regulator shall cancel the setting and returns either to the **SYSTEM OK** mode or waiting mode or regulation loop.
Currently the regulator control is divided in three levels:

1. **Service level** at this level**,** the already written programmes can be started and the regulator test can be carried out. It is available for everybody, there is no need to use a password.
2. **Technical level** writing and adaptation of programmes are accomplished at this level, quantities important for the regulation cycle are adjusted. Technical password must be set in order to enter this level. Setting the password can be put off.
3. **Manipulation level** thermocouple configuration, number of zones, flaps, fan and phases revision configuration.

WARNING

If setting the values is finished by time limit run-out, the newly set data are not saved. If this happens during the programme recording or editing, then the programme is invalid and cannot be used any more !

Number setting

Values of variables – during setting the values of variables, firstly the actual values of variables are offered. If we agree with the value offered, we press the **ENTER** key, which confirms the value and finishes the setting. If we wish to change the said value, by pressing the numerical key the existing value is rewritten and the value of the key pressed is written on its place. By writing numbers the value is changed within allowed limits of variable (for instance: I have 24 as the value allowed, when I press 1 – 2 – 3 – 4, the value set is 1 – 12 – 23 – 4), the setting is finished with the **ENTER** key. If we place a wrong figure, we can change it either by further writing of figures (e.g. we have written 34 but we wanted to write 36, we will write 3 – 6), or with the **DEL** key. By the **DEL** key we can delete the numerals until we reach the 0 value, the next press will show dot and if we press again, we will finish the setting, whilst the original value remains unchanged.

Number of programme - set by pressing a numerical key and confirmed by the **ENTER** key which ends the setting. Figure deletion can be accomplished using the **DEL** key, repeatedly pressing the **DEL** key will finish the setting. Number of the programmes **a** - **g** can be carried out by pressing the **0** key and subsequent number 1 - 7.

WARNING

Everything described in this chapter applies for a fully stepped regulator (4 zones, 2 flaps and a fan). If you have a regulator that is not fully stepped, then everything is proceeded just for those regulator components that are stepped !

Regulator Initialisation

If the regulator is OK, the following introductory text shows on the display after the regulator is connected to the power supply:

```
PROGR. REGULATOR
TEPL. TEMPREG400
```

which disappears in several seconds. During the introductory text projection, the regulator carries out its initialisation and then it moves to the **TEST** mode.

TEST

Checks if the regulator, thermocouples and switching device are problem-free. Therefore, it has an essential influence on the function of the regulator. If it reports error, the regulator does not allow to start up the programme until the trouble is resolved and another test proceeded!

The test proceeds as described below. The regulator will write the following:

```
TEST...
```

And starts testing in the following steps:

1) If semi-conducting relays are connected and if their control is switched on (see ZONES ADJUSTING – PHASES CONTROL), it checks correctness of their function.

First it checks the main switch, in case of its failure it will write the following report:

```
SWITCH  PHASE !
ERROR   UxVxWx !
```

And the below written values may be put on the places marked with x:

0	Phase does not switch on
1	Correct switch of phase – correct value
9	Phase does not switch off – permanent connection

If the previous dialogue is shown, the system waits for pressing the **ENTER** or **DEL** keys (if the error is a serious one, the regulator waits for pressing for an unlimited period of time !)

Then it checks individual phases of semi-conducting relays of each connected zone.

```
U V W T H PA B t
X X X
```

If there is no problem, **O** shows on the X places, in case they are broken, some of the values in range 1 to F is written to the respective phase; you can use the numbers in the following table to find the zone in which the error appeared:

0	No problem	4	Zone 3 broken	8	Zone 4 broken	C	Zones 3 and 4 broken
1	zone 1 broken	5	Zones 3 and 1 broken	9	Zones 4 and 1 broken	D	Zones 4,3 and 1 broken
2	Zone 2 broken	6	Zones 2 and 3 broken	A	Zones 4 and 2 broken	E	Zones 4, 3 and 2 broken
3	Zones 1 and 2 broken	7	Zones 1,2 and 3 broken	B	Zones 4,2 and 1 broken	F	Zones 4,3 and 1 broken

If the regulator does not use semi-conducting relays, they are recorded like this '**–**' and the test is not performed; in the extract dashes (‘-‘) are shown on X places.

It revises the thermocouples (see thermocouples). Error is reported with letter **F**, otherwise there is **O**. By moving to the **SYSTEM** mode, you can find out which thermocouple has been broken and the zone with the highest temperature has a broken thermocouple.

```
U V W T H PA B t
      X
```

It checks exceeding the maximum temperature in regulation zones (see Maximum Temperature). Error is reported with letter **F**, otherwise there is **O**.

```
U V W T H PA B t
               X
```

It tests the state of the built-in clock battery. Error is reported with letter **F**, otherwise there is **O**.

```
U V W T H PA B t
             X
```

It checks correctness of the data on the clock – time and date. Error is reported with letter **F**, otherwise there is **O**.

```
U V W T H PA B t
         X
```

It checks validity of data in the memory. If an error is found, it is replaced with an implicit value. It shall inform the user about the area of variables which is damaged. ***The user must correct the incorrect data otherwise he is in danger of fault function of the regulator and, as the case may be, the furnace may be damaged!***

```
U V W T H PA B t
          XX
```

Variables are divided in the below written areas:

1	Maximum Temperature, Alarm Deviation, Power Failure, Number of Zones
2	Thermocouple, Zones Adjusting, Number of Flaps, Fan Start-up, Revision of Phases
3	Time Constant, Deviation Allowed, Integration Constant
4	Actual values of regulation cycle in process – only in case of power failure or regulator switch-off during the cycle – these values cannot be corrected, as they bear information about the course of the cycle, the programme must be restarted.

On place XX the following values can be written:

OK	Everything is OK	F6	Error in areas 2 and 3	FC	Error in areas 4 and 3
F1	Error in area 1	F7	Error in areas 3, 2 and 1	FD	Error in areas 4, 3 and 1
F2	Error in area 2	F8	Error in area 4	FE	Error in areas 4, 3 and 2
F3	Error in areas 1 and 2	F9	Error in areas 4 and 1	FF	Error in all areas
F4	Error in area 3	FA	Error in areas 4 and 2		
F5	Error in areas 3 and 1	FB	Error in areas 4, 2 and 1		

If the test is proceeded with after the regulator is put in operation and if the test is accomplished without any problems, it moves to the **SYSTEM** mode immediately, or the programme continues. Otherwise the regulator starts up the sound signal system and waits for pressing the **ENTER** or **DEL** keys (since there is an error, the regulator waits for pressing for an unlimited period of time!)

Next step of the test is revision, in order to find out, whether the alarm deviation is higher than the temperature deviation allowed. If not, the following report appears:

```
ALARM DEV. IS <
THAN TEMP. DEV.
```

The last step of the test is checking whether the maximum set temperature of the regulator adjusted by the regulator manufacturer does not exceed the maximum allowed temperature for the type of the thermocouple used.

```
Fault adjustment
!MAX  TEMPERATURE!
```

By pressing the **ENTER** or **DEL** keys we will move to the starting position. In this position we have to correct the parameters.

If the regulator is OK, the test result dialogue will flash only:

U	V	W	T	H	PA	B	t
0	0	0	0	0	OK	0	0

Tests repeated periodically

The regulator does permanent tests for exceeding the Maximum temperature, correct function of the clock, correctness of the data in memory, and checks the function of semi-conducting relays – in case they are used. If it finds an error, it will replace the **SYSTEM OK** report with the error report and turns the sound signal system on.

- **!TEMPER.!** when the Maximum allowed temperature is exceeded in some of the zones
- **SYS ERROR!** for other errors

If error appears, the test must be carried out by pressing the TEST press button, to find the error, remove it and restart the test.

Starting position of regulator

After the test is initialised and finished, the regulator moves to the starting position:

TP4	TP3	TP2°C
SYSTEM	OK	HH:MM

In this position, the regulator shows on the display of lighting diodes (LED) – actual time on the red in shape hour: minute, on the green the zone 1 temperature. On the symbol display it shows temperatures of zones 2 – 4 (TP2 – zone 2 temperature, TP3 – zone 3 temperature, TP4 – zone 4 temperature), momentary time (HH:MM) and text SYSTEM OK, or reports an error.

In the starting position, the regulator waits for the instruction of the operator. By pressing the appropriate buttons the operator selects the activity to be performed by the regulator. Individual activities are divided into three levels according to their specification: level of operation, technical and service level.

Operation Level of Regulator

The regulator is operated by a worker, who operates the respective device, without the right to affect the technical process. The worker is allowed to test the regulator and start the already written programmes:

Quick programme start-up	- immediate start of selected programme	(key **0-START**)
Programme start-up	- delayed start of selected programme	(key **5-ZVOL**)
Regulator configuration	- regulator adjustment	(key **6-KAL**)
test	- test of the system	(key **7-TEST)**

Quick programme start (key 0)

By pressing the **START** key, the regulator moves to the mode of rapid programme start-up. The following test appears on the display:

```
START    PROGRAM
number         ?
```

The regulator waits for setting the programme number **1** to **18**. After the number is set, we press the **ENTER** key which finishes the setting. The regulator checks whether the selected programme exists. If the programme is not found, the following report appears:

```
Pn  not  exist !
```

We will confirm the above report by any key and the regulator returns to the starting position of the regulator. If the programme is found, the regulator will check if it is correct. In case the regulator finds an error, the following report appears:

```
PROGRAM ERROR n
```

After the above report is confirmed, the regulator returns to the starting position again. If the programme is OK, the regulator will start it up - **PROCESS**. A damaged programme can be repaired at the technical level– see the **Adjustment menu / programme modification**.

Programme Start (key 5)

By pressing the **ZVOL (SEL)** key, the regulator moves to the programme start mode. The below written text appears on the display:

```
START    PROGRAM
number         ?
```

The regulator waits for setting the programme number **1** - **18**. After the number is set, we press the **ENTER** key, which finishes the setting. The regulator checks whether the selected programme exists. If the programme is not found the following report appears:

```
Pn  not  exist !
```

We will confirm the above report by any key and the regulator returns to the starting position of the regulator. If the programme is found, the regulator will check if it is correct. In case the regulator finds an error, the following report appears:

```
PROGRAM ERROR n
```

After the above report is confirmed, the regulator returns to the starting position again. A broken programme can be repaired at the technical level– see the **Adjustment menu / programme modification**. If the programme is OK, the regulator offers the following option for examining the programme:

```
READ   PROGRAM ?
Pn   SECTIONS  x
```

By repeatedly pressing the **ENTER** key we can read each section. When pressing any other key, the reading of the programme is finished. Afterwards, the regulator moves to the **START** mode.

Test of system (key 7)

By pressing the **TEST** key, the regulator tests the controlled device and accomplishes its own tests – see **TEST**.

Technical level

The technician is a person who decides on the regulation process. This person performs activities that affect the final product essentially. Therefore these adjustments are protected with technical passwords against an unauthorised person ´s intervention.

We can move to the technical level from the starting position, by pressing the **6-KAL** key. When we press this key, we will be asked to set the technical password:

```
CONFIGURATION ?
  password: ____
```

The technical password is a maximum four-figure number. During the password setting, these symbols appear after pressing the numerical key: "*". The password setting is finished by pressing the **ENTER** key. If we make a mistake in the setting, we can use the **DEL** key for deleting the wrongly set figures.

If the password is set to zero (0), the regulator does not require setting of the password – the password is turned off (see Other settings– change of password)

The manufacturer sets the 0 password, which we recommend changing after the first regulator start-up. Save the newly set password carefully. In the event of forgetting the password, the regulator manufacturer must be contacted.

If the password is set correctly, offer of settings is displayed– **technical menu**:

```
1-RP 3-E 7-I 9-P
2-CAL 5-OS 8-TIM
```

Regulation parameters	- parameters affecting the regulation cycle	(key **1-RP**)
Calibration of regulator	- calibration of regulator – service level	(key **2-CAL**)
Edit the programme	- adjustment of the existing programme	(key **3-E**)
Other settings	- print, sound and password setting	(key **5-OS**)
Information projection	- regulator setting is displayed	(key **7-I**)
Time setting	- time and date setting	(key **8-TIM**)
Programme record	- recording a new programme	(key **9-P**)

We can leave the technical menu by pressing the **ENTER** or **DEL** keys. We return to the starting position of the regulator.

Regulation parameters (key 1)

By pressing key **1** in the technical menu we get to the change of the regulation parameters.

The time constant

```
TIME CONSTANT
        xx sec.
```

is set in range from 3 to 99 seconds. It represents the period of one switching cycle in seconds. Lower values are set for smaller furnaces with semi-conducting relays, higher values are set for electromagnetic switches and bigger furnaces. An optimum value for a controlled device must be found by trial. Setting a higher value of the time constant removes or at least reduces temperature overshoots at rapid rise time, on the other side, however, it also slows the temperature increase down. We confirm the set data by pressing the **ENTER** key.

Temperature variation allowed

```
TEMPERATURE
DEVIATION xx °C
```

is set in range from 1 to 99 °C. It represent the difference between the actual temperature and the temperature required at the particular moment, at which the regulator starts to reduce the heating output proportionally (by intermittent furnace switching on and off). Setting a higher temperature deviation is convenient for furnaces with rapid temperature rise time and high excess power; if the excess power is low, a lower value must be set so that the furnace is

capable of reaching the required temperature at reduced power. The optimum value for a controlled device must be found by trial.

We shall confirm the data set by pressing the **ENTER** key.

Integration constant

```
INTEGRAL CONSTAN
              xx
```

is set in a range from 1 to 99. It represents time in which the regulator integrates deviation of real and desired temperature, so that the regulator is able to minimise the deviation after some time. The time set must be several times longer than the period of temperature fluctuation when switching on and off the heating, otherwise the integration method of control causes increase of the said periodical fluctuation. The optimum value for controlled device must be found by trial. We shall confirm the data set by pressing the **ENTER** key.

Alarm deviation

```
ALARM  TEMPERATUR
DEVIATION   XX °C
```

is set in range from 1 to 99 °C. It represents the maximum temperature deviation allowed via the highest one programmed for the zone and processed section of the temperature programme. It is calculated from the maximum temperature in the processed section, for each zone separately. In case it is exceeded, alarm is switched on and heating switched off. After the temperature is reduced to the allowed value, the alarm is switched off and the regulator continues working.

We shall confirm the data set by pressing the **ENTER** key.

WARNING

The alarm deviation must be always higher than the deviation allowed. If this condition is not met, the regulator will not allow starting the program up! The alarm deviation is exceeded mostly due to incorrect setting of the regulation parameters !

Maximum allowed period of electric supply failure

```
POWER DOWN
TIME      XX min
```

Is set in range from 1 to 99 °C. It represents the maximum period of electric supply failure during the regulation loop. If the potential supply loss is lower than the one set herein, the regulator will continue in working after the failure ends from the section and the time when it was last interrupted. We shall confirm the data set by pressing the **ENTER** key. Afterwards the regulator returns to the technical menu.

Calibration of regulator (key 2)

By pressing key **2** in the technical menu we can move to the service level. For entering the service level we need to know the service password – see **service level – calibration menu.**

Program edit (key 3)

By pressing key **3** in the technical menu we get to adjustment of the already existing programme. The existing programme may also be copied. The regulator will ask us to set the number of the programme we wish to modify.

```
EDIT   PROGRAM
number       . ?
```

Then it waits for setting the programme number **1** to **18**. When the number is set, we press the **ENTER** key which ends the setting. The regulator checks whether the selected programme exists.

In case the programme does not exist the regulator places the following question:

```
Pn not exist !
9-write  5-other
```

By pressing **5-other** key the question about another programme number is repeated.
By pressing the **9-write** key a new programme will be created – see **programme editing.**
When using the above option, the old programme is not deleted and therefore the lost programme can be restored. At the same time, meaningless symbols may appear on the places of errors, that must be corrected.

If the programme exists, the regulator shows the **adjustments of programme** menu**:**

```
3-Edit
5-Copy
```

By pressing key **3** we move to the mode **programme editing**. By pressing the **5** key, we move to the programme copying mode. The regulator will copy the programme selected into the programme, number of which we will set in the next dialogue:

```
Copy xx to
Number       n ?
```

After setting the target number of the programme the regulator will check whether the programme of the set number exists already. If the target number programme does not exist, the regulator will proceed with copying. In case the programme exists already, the regulator shows the following appeal:

```
PROGRAM xx EXIST
rewrite ? YES/NO
```

By pressing the **ENTER** key we will confirm rewriting of the already existing programme and the regulator will start to copy. By pressing any other key the copying is finished. When the copying is finished, the regulator shows the following text:

```
 Copying  OK
```

When pressing the **ENTER** or **DEL** keys, the regulator returns to the technical menu.

If we set same numbers of programmes from where and where to copy, the regulator will show information saying that the operation cannot be done:

```
You cannot copy
a program itself
```

When pressing the **ENTER** or **DEL** keys, the regulator returns to the technical menu .

Other settings (key 5)

By pressing the **5** key at the technical level, we will enter the "other settings" menu. In this menu we will set the print interval, projected temperature in the course of regulation, options for printing, signal system putting on and change of the technical password.

```
1-pI 3-ALR 5-chP
2-SelP 4-chPassw
```

Print interval - period in which printing on the connected printer is repeated (key **1-pI**)
Selection of print - print setting for all sections or just some of them (key **2-SelP)**
Alarm - switch on / switch off using the sound signal system (key **3-ALR**)
Change of password – change of the technical password (key **4-chPassw**)
Change of projection – switching over the displaying of the calculated or final temperature (key **5-chP**)

The Other Settings Menu is left by pressing the **ENTER** or **DEL** keys. Thus we will return to the technical level.

Print interval

Setting of interval in which printing is repeated on the connected printer.

```
PRINT  INTERVAL
         xx min
```

Is set in range from 0 to 60 minutes. The print interval serves for setting the time after which the individual zones temperatures are printed. In case we do not use an additional printer, this data should be set at zero value. If a supplementary printer is connected, and the printing interval value is zero, no printing will be proceeded, either. If you use serial communication between the regulator and PC, we recommend setting the print interval to zero, you will avoid potential problems with communication.

Selection of printing

Enables to set print of selected items only.

```
PRINT EVERYTHING
 3-change  ENT->
```

Print is changed by key 3, by the **ENTER** key the selection is confirmed. If the option PRINT EVERYTHING is set, the entire course of the programme will be printed, by using the PRINT SELECTED option only these parts of the programme will be printed which are selected during writing the programme – see the **programme writing.**

Alarm

The alarm system switch-on / switch-off.

```
SOUND     YES/NO
 3-change  ENT->
```

By pressing key 3 we will switch on / switch off the sound signal system. By pressing the **ENTER** key we will confirm the setting.

Change of password

Enables to change the technical password or, as the case may be, to put it off. The regulator will show an order for setting the old password:

```
enter      old
password: ______
```

When the password is set, the regulator will check it. In case the password is not the right one, the change will be ended. If the password is correct, the regulator will ask for setting a new password.

```
enter      new
password: ______
```

When the new password is set, the regulator will ask to repeat it.

```
re-enter   new
password: ______
```

If the password is correctly set, the regulator will show report on correctness of setting the new password.

```
 Password changed
   successfully
```

Afterwards the new password became valid. If **zero** is set as a new password, the password will be turned off – access to all parts requiring the technical password will be free!

Change of projection

Enables selection of the worked-out or final temperature projection, which is displayed on red LED display of the regulator.

```
Show calcul. Tem
  3-change ENT->
```

By pressing key **3** we will switch projection of the calculated or final temperature over. We will confirm the selection by pressing the **ENTER** key.

Information projection (key 7)

Menu of Information projecting:

```
SHOW     1-SETTING
4-MEM    9-ID Info
```

Projection of regulator setting (key **1-SETTING**)
Memory viewing (key **4-MEM**)
Regulator identification (key **9-ID Info**)

Projection of regulator setting (key 1)

By pressing key **1** in the setting projection menu we will get to the projection of individual settings of the regulator. The regulator shows individual settings, by pressing the **ENTER** key we will get to the projection of other set values, by pressing any other key we will return to the regulator settings projection menu.

Time constant xx, and allowed temperature deviation yy:

```
TIME CONS. xxsec
TEMP.DEV.  yy °C
```

Integration constant xx and allowed temperature deviation yy:

```
INT.CONS.   xx
ALRM.DEV.   yy °C
```

Allowed electric supply fall-out loss xx:

```
POW. DOWN xx min
```

Type of thermocouple set t, maximum allowed temperature of device xxxx°C:

```
THERMOCOUPLE   t
MAX.TEM.  xxxx °C
```

Number of zones x, zones setting RPPP, number of flaps k, fan relay control setting **Yes**/**N**o fan, **S** – signal of the programme end - v:

```
NUMBER OF BAND x
RPPP   K:k   V:v
```

Setting of phases check-out on places x will be displayed– **Yes**/**N**o to check the respective phase:

```
POWER INSPECTION
phaseU-x V-x W-x
```

Way of printing – PRINT EVERYTHING / SELECTED, the interval of printing xx minutes:

```
PRINT SELECTED
PRINT.int xx min
```

Sound signal system – YES / NO, Project the calculated / actual temperature:

```
SOUND YES / NO
Show calcul. Tem
```

By next pressing the **ENTER** key the process is repeated from the beginning. Pressing any other key will get us back to the menu on the settings view.

Memory viewing (key 4)

By pressing the **4** key in the projection (view) menu we will get to the projection of the memory contents.

This item is important for the manufacturer only ! We are giving the description of it to submit the manual in its complete form.

It enables reading the contents of the clock memory and the memory of constants:

```
CM A AA AA AA AA
DATA XX XX XX XX
```

AA is address and XX is hexadecimal-given value at the AA address. By pressing the **ENTER** key we are reading other four addresses. By pressing any other key we will return to the settings projection/viewing menu.

Regulator identification (key 9)

By pressing key **9** in the settings projection menu the regulator will successively project information about:

Type of regulator:

```
PROGR. REGULATOR
TEPL. TEMPREG400
```

When pressing the **ENTER** key the regulator will show the number of the software version, which is contained in the regulator and the date of its workout:

```
Verze    2.00.13
11. 4.99(c)SMART
```

After pressing the **ENTER** key the regulator will show its serial number:

```
Serial number
          12345
```

Afterwards it goes back to the settings projection menu. We can return to the menu even during viewing, by pressing any other key than the **ENTER** key.

Please submit the above information to the manufacturer if a failure or any other problem occurs with the regulator. You will simplify significantly all negotiations regarding the failure removal, or obtaining information about the problem occurred.

Time setting (key 8)

By pressing key 8 in the technical mode we will get to the time setting menu. The following text will then appear:

```
CHANGE  1-CLOCK
        2-DATE
```

Clock setting - change of hours (key **1-CLOCK**)
Date setting - change of date (key **2-DATE**)

The regulator returns to the technical menu when pressing the **ENTER** or **DEL** keys.

Clock setting (key 1)

When pressing key **1** in the time setting menu, the regulator displays question on change of the day in a week and change of time:

```
DAY IN WEEK&TIME
D=(1..7)d  hh:mm
```

On place “d”, the day of the week appears, we can confirm the number or change it. The day of the week is represented by a number ranging from **1** to **7** (1 – Monday .. 7 – Sunday). The value is confirmed by pressing the **ENTER** key. Then there is the hour on place hh or, if the

hour information of the regulator is invalid, a dot appears. When you set the hour (the European time system, from 0 to 23 hours is used), minutes appear (0 - 59) and the regulator waits for the minutes to be set and confirmed. Afterwards the regulator waits for confirmation of the time set:

```
TIME SET  OK?
        d  hh:mm
```

If the **ENTER** key is pressed now, the regulator sets the newly set time, by pressing any other key the newly set values are ignored. Then the regulator returns to the time setting menu.

WARNING:

For proper function of the regulator, both time data (hours and minutes) are necessary, as well as the information about the day of the week. Incorrect time information does not appear in the course of the cycle started-up immediately after the setting but it will appear at the wrong moment of the cycle if there is a delayed start, when also the DAY IN WEEK information is used. The regulator does not use the information about the date, month and year for its function, A potential error in the said data does not affect the function of the regulator, it will appear in printed reports/reviews when printer is connected.

Date setting (key 2)

When pressing key 2 in the time setting menu, the regulator displays a question on setting the date:

```
  DATE SETTING
D dd M mm Y yy
```

We will set or just confirm the day dd (1 - 31), month (1 - 12), year (0 - 99). When the year is set, the regulator will ask for confirmation of the data correctness:

```
 SET DATE OK?
D dd M mm Y yy
```

When pressing the **ENTER** key, the regulator will set the newly set date. By pressing any other key the set values are ignored. Afterwards the regulator returns to the time setting menu.

Programme record (key 9)

By pressing key **9** in the technical menu we will get to record of a new programme. The regulator asks us on the number of the new programme:

```
WRITE    PROGRAM
number         ?
```

The regulator waits for the programme number **1** – **18** to be set. After setting the number, we will press the **ENTER** key and finish setting the number. The regulator checks whether the programme selected exists. If the selected programme does not exist, the regulator sets all temperatures in the programme at 25°C and moves to the **programme editing** mode. In case the said programme does exist, the regulator will show the following question:

```
PROGRAM  n EXIST
3-E 5-OTHER 9-RE
```

By pressing key **5-OTHER** the question about another programme number repeats. By pressing key **3-E**, editing of the already existing programme will be accomplished – see the **programme editing**.

By pressing key **9-RE** the regulator rewrites the already existing programme – see the **programme editing.**

When using this option, the old programme is deleted and there is no chance at all to restore it !

By pressing any other key the regulator returns to the technical menu.

Service level

We will get to the service level from the technical menu by pressing key **2**. When pressing this key, the regulator asks for setting the service password:

```
Calibration ?
..ENTER PASSWORD
```

If we set the correct service password, the regulator shows the **calibration menu:**

```
1-TC 3-OC 5-BAND
2-maxT 4-SC 6-PI
```

At the service level, setting and calibration of thermocouple is carried out, maximum furnace temperature setting, setting of zones and phases control. Individual options in the calibration menu are the following ones:

Type of thermocouple - selection of type of thermocouple (key **1-TC**)
Maximum temperature of device - maximum temperature allowed for the device (key **2-maxT**)
offset calibration - temperature shift setting (key **3-OC**)
steepness calibration - calibration of inclination (key **4-SC**)
zones setting - setting of zones, flaps/valves and fan (key **5-BAND**)
power inspection - setting of individual phases control (key **6-PI**)

Type of thermocouple (key 1)

When pressing key **1** in the calibration menu, the regulator offers to change the type of the thermocouple:

```
THERMOCOUPLE   x
 3-change  ENT->
```

On place x there is the type of the actual set thermocouple. By pressing key **3** we will select the thermocouple. Currently the regulator supports three types of thermocouple - **S**, **K**, **J.** if there is the thermocouple required by us on the x place, we will confirm the set data by pressing the **ENTER** key, and we will finish the dialogue by pressing the **DEL** key. Afterwards we go back to the calibration menu.

When the type of the thermocouple is changed, the maximum temperature of the device must be changed, too, as well as the shift calibration and calibration of gradient. These settings are connected with the type of the thermocouple.

Maximum temperature of device - (key 2)

By pressing key 2 in the calibration menu, the regulator asks us to set the maximum temperature of the device.:

```
MAX. TEMPERATURE
          .... °C
```

We can set the maximum device temperature in range 1 to the Maximum temperature specified in the table for the type of the thermocouple selected by us:

Type of thermocouple	Maximum Temperature °C
S	1600
K	1150
J	820

Setting the desired temperature is finished by the **ENTER** key. The regulator asks to confirm the correctness of the set temperature:

```
TEMPERATURE  OK?
          xxxx °C
```

If the temperature is set correctly, we will confirm it by the **ENTER** key and the regulator saves it in its memory, by pressing the **DEL** key the setting is repeated. Afterwards the regulator moves back to the calibration menu.

The maximum temperature of the device is specified by the manufacturer. It is the maximum constructional temperature of the device. If the temperature is exceeded, all heating is put out of operation, the main switch is turned off , the cycle in process is stopped, the sound signal system is started and on the place of the ***SYSTEM OK*** *report, the* ***!TEMPERATURE!*** *warning appears.*

Offset calibration (key 3)

By pressing key **3** in the calibration menu, the regulator asks to accomplish calibration of temperatures shift:

```
OFFSET CALIBRATI
     YES/NO
```

When pressing the **ENTER** key the regulator shows the following calibration dialogue:

```
 TP4  TP3  TP2°C
p +1 –2 >5 ENT->
```

Temperature of zone 1 is on the green display, temperatures of zones 2 to 4 appear on the symbol display (TP2 – zone 2 temperature, TP3 – zone 3 temperature, TP4 – zone 4 temperature), on place p the number of the zone set is displayed. By pressing key **1** we shift the temperature in the zone p upwards and by pressing **2** we shift the temperature in zone p downwards. By pressing key **5** we switch over the zones. The calibration is ended by pressing the **ENTER** key. Afterwards, the regulator returns to the calibration menu.

After being connected to the controlled device, the regulator must be set at the ambient temperature, i.e. at the temperature of the place of thermocouple terminal connectors (to carry out so-called thermocouple line compensation) – to shift the temperature in individual zones. By the manufacturer the regulator is set at ambient temperature of 25°C and zero span at the supply terminal connectors of thermocouples. Setting the temperature shift can be affected with increased resistance of the compensation thermocouple line, and therefore it must be carried out at the specific system prior to new setting putting in operation.

Steepness calibration (key 4)

By pressing key **4** in the calibration menu the regulator asks for gradient calibration accomplishment:

```
STEEPNESS CALIBR
     YES/NO
```

When pressing the **ENTER** key, the regulator projects the following dialogue:

```
 TP4  TP3  TP2°C
p +1 -2 >5 ENT->
```

The zone 1 temperature is shown on the green display, on the symbol display we can see the temperatures of zones 2 - 4 (TP2 – zone 2 temperature, TP3 – zone 3 temperature, TP4 – zone 4 temperature), number of the zone being set is placed on p. By pressing key **1** we shift the temperature in zone p upwards, by pressing key **2** we shift the temperature p in the p zone downwards. We move between the zones by switching the **5** key over. Calibration is ended by pressing the **ENTER** key. The regulator then returns to the calibration menu.

Calibration of gradient is carried out after the ***temperature shift calibration.*** *. It is processed at temperature close to the maximum temperature, at which the device will be run. It enables us to set exactly this temperature..*

Zones setting (key 5)

By pressing key **5** in the calibration menu we get to set the controlled items of the device. The regulator asks about the number of the regulator zones:

```
NUMBER OF BAND p
```

On place p there is the existing number of zones set. The regulator can have 1 to 4 zones. The number of zones set by us must not exceed the number of the really connected ones. By pressing the **ENTER** key we will confirm the setting. When the number of zones is set, types of zones are set:

```
BAND TYPE SETTIN
3-change>5 ENT->
```

When pressing any key, the regulator shows setting dialogue for types of zones:

```
1-R 2-R 3-R 4-R
P  <>3 >5  ENT->
```

The regulator shows the actual zones setting. There is each zone ´s configuration at each zone after the dash. Letter **R** means that the zone is the regulation zone, **S** – the zone is intended for temperature monitoring only– the regulator only monitors the temperature measured in this zone. Unused zones are marked with letter **N**. According to the type of regulator, we can change the regulation zone to the monitoring one and oppositely. In case of basic design of the regulator, the first zone settings cannot be changed, the first zone is always regulation zone. Change of the zone type is proceeded by pressing key **3**, key **5** is used for moving among the zones and by pressing the **ENTER** key the changes are ended. Afterwards the regulator writes a question about confirming the correctness of the setting:

```
1-R 2-S 3-R 4-S
Type of BAND OK?
```

By pressing the **ENTER** key we confirm the setting and the regulator saves it into its memory. By pressing the **DEL** key the new setting is ignored.

WARNING

If the system was set at more regulation zones than are connected in reality, the regulator will not work properly, as the temperature in the unused zones does not reach the value set, and the cycle therefore does not move to the next phase. That is why the user should not change the system configuration without any serious reason. The zones set at the MONITORING mode will not affect the activity of the controlled system.

Then there is a question about the number of furnace flaps which are to be controlled by the regulator:

```
NUMB. OF FLAPS x
```

On place x the regulator shows the existing setting, if the number of flaps was 0, then there is dot on the x place. The number of flaps can be in range 0 - 2. By pressing the respective numerical key we will select number of flaps and by pressing the **ENTER** key we will confirm the number of flaps. The regulator shows the setting of control relay of the fan:

```
    FAN YES
 3-change  ENT->
```

The setting is changed by pressing key **3**, if you press the **ENTER** key the setting is confirmed. If we do not use the relay, we shall set FAN NO , if we wish to use it, we shall set FAN YES. Or, we can select the PROG. END SIGNAL option, this setting will cause, that after moving to the **programme end** section the regulator will switch this relay and thus signals that the programme is finished.

```
PROG. END SIGNAL
  3-change ENT->
```

The regulator returns to the calibration menu.

Phases control setting - (key 6)

By pressing key **6** in the calibration menu we will get to the setting of phases control

```
POWER INSPECTION
3-change >5 ENT->
```

The dialogue shows the function keys to you. By pressing any key we will move to setting of individual phases:

```
phaseU-A V-N W-A
f <>3  >5  ENT->
```

Phases control is diagnostics which checks, if switched on, whether the current passes the phase when it is supposed to. To be able to carry out this revision, the regulator must have passing current sensing units at supply phases. The diagnostic device can be switched on for optional phases provided with a sensing unit. Setting is done by pressing key **3**, which switches over between **Yes** – the diagnostics are switched on, **No** – the diagnostics are switched off for the phase shown on place f. We switch over between individual phases using key 5, and the setting is finished by pressing the **ENTER** key. Then the regulator returns to the calibration menu.

If the phases control is switched on, and the regulator finds a failure it will turn all heating off, as well as the main switch, it will also stop the cycle in progress, write a report and start the sound signal system. See Auto test.

Programme Editing

Editing of the programme is proceeded first by editing 1 - 8 sections (a section-less programme cannot be worked out). The section comprises time and 1 – 4 temperatures, according to the number of regulator zones. When setting temperatures for the programme, the regulator does not distinguish between the regulation and the monitoring zones. The temperatures in the monitoring zones are used for temperature calculation only at the respective moment, and do not affect the regulation process itself in other zones (see also the **programme interruption menu / display switch-over**).

In order to set the individual programme sections, the regulator shows the following dialogues:

```
Px#u time ..h..m
   ..  ..  .. °C
```

The number of the programme is put on place x of the dialogue and number of section is put on place u.

```
Px#x time HHh MMm
 TP4  TP3  TP2 °C
```

Successively we set the time of the section duration in shape: hours HH (0 – 99), minutes MM (0 – 59), zone 1 temperature TP1, which is monitored on the green display, the second and fourth zone temperature (TP2 - 4), which are monitored on the dialogue display. Temperature is written on place of temperatures, always when the edited item is activated. When writing a new programme, it is the temperature of 25°C, which is taken as the starting temperature. The regulator does not allow to set higher temperatures than the maximum set temperature is, and it does not allow to set temperatures lower than 1.

WARNING:

The user sets the final temperature of the section, which is further used as the starting temperature of the following section.

The initial temperature of the first section is always 25°C, the regulator will specify gradient from this and the final temperature (temperature straight line slope). If the temperature at the starting moment is higher than 25°C, this section is finished sooner than in the time set (whilst keeping the worked-out gradient).

When all values of the section are set, the regulator asks about the data correctness:

```
Px#k OK? HHh MMm
 TP4  TP3  TP2 °C
```

By pressing the **DEL** key the section setting is repeated, when pressing the **ENTER** key, the section is written in the memory.

If the print is set at PRINT THE SET (**technical menu / other settings**,, the regulator will ask after the section validity is confirmed, whether the set section should be printed:

```
NO PRINT / PRINT
 3-change  ENT->
```

We use key 3 to set the desired printing option, by the **ENTER** key we will confirm the option. Then we continue in setting the next section, provided that the entire process repeats.

The programme section setting can be finished in the following ways:

- After setting dialogue of next section is shown by pressing the **ENTER** key
- We set zeros on places of hours and minutes
- By setting the 8th section of the programme

Next part of the programme is created by flaps closing and opening temperatures, provided they are set in the calibration:

Temperatures of closing the flaps:

```
OPENING  FLAP
    TZK2 TZK1°C
```

On place TZK1 we set temperature of closing the first flap, on place TZK2 temperature of second flap closing is set.

Next question is about flaps opening temperatures:

```
FLAPS OPENING
   TOK2   TOK1°C
```

We set temperature of first opening on place TOK1, on place TOK2 temperature of second flap opening is set.

If fan is connected, we are asked to set the temperature xxxx of fan start-up.

```
FAN START-UP.
TEMPERAT  xxxx°C
```

The last value is the method of ending the cycle:

```
EDING DROP
 3-change  ENT->
```

The cycle may end either with Drop or with Dwell (see **CYCLE ENDING**). The way of ending the cycle is changed by pressing key 3. When the **ENTER** key is pressed, confirmation of ending correctness is shown on the display:

```
ENDING  xxxx
ENDING  OK?
```

If the print is set at PRINT THE SET (**technical menu / other settings**), the regulator will ask after validity of ending confirmation, whether ending should be pressed:

```
NO PRINT / PRINT
 3-change  ENT->
```

By pressing key 3 we set the print option required, by pressing the **ENTER** key the selection is confirmed.

The last step of the programme editing is confirmation of its correctness:

```
 SET DATA OK?
```

By pressing the **DEL** key the entire programme setting repeats, by pressing the **ENTER** key the data is written in the memory. Then the programme can be used.

WARNING

If we do not finish the programme editing and we do not save the programme, or we miss the time limit for the keyboard (we do not press any key within the period of one minute) and editing is finished by time limit, the edited programme becomes invalid!!! This means that the programme does not exist.

Modes of regulator

START

The **START** mode is started by the regulator by asking about the programme start. The question is shown on the display, mentioning the number of the programme (n), actual time (d – day, hh – hour, mm – minute):

```
PROGRAM START?
Pn      d hh:mm
```

By pressing the **ENTER** key we confirm the decision and the regulator asks us about the starting time, by pressing any other key we return to the starting position.

```
STARTING TIME...
D=(1..7) d hh mm
```

If we wish the programme to be started immediately, we press either **ENTER** 4 times (by which we confirm the day, hour, minute and the time data correctness), or we press key **0** and then the **ENTER** key. If we want to start the programme later, we will write the day and the hour of the start. When the time is recorded, the regulator asks for its confirmation:

```
START TIME OK?
D=(1..7) d hh mm
```

By pressing the **DEL** key we will be asked to repeat the time setting again, by pressing the **ENTER** key we will confirm the starting time and the regulator will move to the **WAITING** mode.

WAITING

In the waiting mode the regulator shows the data on the set start time and actual temperature:

```
 TP4  TP3  TP2°C
WAITING- D:HH:MM
```

The regulator waits until the actual time is equal to all three data of the set start time (day in week, hour, minute). Then it moves to the **PROCESS** mode.

The **WAITING** mode can be interrupted by pressing the **DEL** key. After this key is pressed, the regulator shows the **cycle interruption menu.**

WARNING.

*The **WAITING** mode may be interrupted by electric power fall-out loss for unlimited period of time, regardless of the maximum allowed failure period set. If the set starting moment is not achieved at the moment of electric supply restart, the regulator continues in the **WAITING** mode till the **START** moment. If the selected moment was already exceeded during the electric power fall-out loss, the regulator moves to the **PROCESS** mode immediately after being restarted, and starts the cycle up.*

*The regulator moves to the **PROCESS** mode only if the scheduled day is identical to the actual day. This means, if waiting is programmed so that the start should be at 2:23:59, and if the electric supply falls out at 2:23:58. If supply starts to operate at 3:00:00 the programme will not be started.*

This "defect", however, enables programming of the regulator on Friday (5) to start working on Monday (1) night. That is why it is recommendable to set the regulator start-up so that the time is not close to midnight, for example 23:50 but at 0:0. You will avoid potential problems with the programme start-up.

PROCESS

The **PROCESS** mode begins at the programme start. Start of the programme proceeds in the following way. The regulator shows the following text on the display:

```
>>START<<
```

It will carry out the **TEST**, and starts to regulate, if no errors are found.

The programme selected proceeds. On the red display the regulator shows the worked-out temperature in the first zone (temperature which should be in the first zone at the respective moment). The green display shows the first-zone measured temperature, measured temperature for other zones is displayed (on TP2 – zone 2 temperature, TP3 - zone 3 temperature and TP4 – zone 4 temperature), number of the programme on place x, the programme section in progress on place k and passed time of the programme section on place hh:mm:

```
 TP4  TP3  TP2°C
Pn#s/time  hh:mm
```

Number of started programme **n**
Number of programme section in progress **s**
Passed time of the section in hours **hh** and minutes **mm**
Actual temperatures in zones 2 - 3 **TP4, TP3, TP2**
Programme section is either number 1 - 8 for section 1 - 8, when finishing the programme **V** is displayed for dwell**, P** for drop.
According to the temperature difference of the preceding section and the temperature of the section in progress a symbol is displayed, that indicates:

'**/**' - increase
'**-**' - dwell
'****' - drop

In this mode we can set the **cycle interruption menu** by pressing the **DEL** key. This menu enables to intervene into the running programme – see the **cycle interruption menu**.

If electric supply fall-out loss occurs during the PROCESS mode, the regulator is able to continue in the programme after electric supply restoration from the place at which it stopped due to the said electric supply fall-out loss. It still checks the period of the said fall-out loss duration with the supply fall-out loss set, (see the **technical menu / parameters of regulation**). If the actual period of the fall-out loss time exceeds the time scheduled/set, the programme will not be started but will be finished. To restart the programme no error must be found by the **TEST**.

In the course of the temperature cycle a failure may appear at the controlled device. The regulator does not register defects that do not have any direct influence on the cycle process (for example state of the clock battery).

Any substantial defect (thermocouple breaking, impossibility to turn off the current to heating coils, maximum temperature exceeding) is indicated by sound signal, the regulator ends the temperature cycle and turns the heating and the fan off and will also close the valves.

In case the maximum programmed temperature is exceeded, alarm is switched on and heating off. When the temperature is decreased to an already acceptable value, alarm is put off and the regulator continues in working (see the Alarm deviation).

ENDING

After all programmed sections are accomplished, the regulator moves, according to the programme, either to:

- drop the regulator measures temperatures, does not heat, shows passed time and when set temperatures are reached it starts the fan and open the valves. If the temperature of 100°C is achieved, fan is turned off and the programme is finished. The regulator returns to the starting position **SYSTEM OK**.

  or

- dwell the regulator keeps the last set temperature until we stop it from the keyboard.

WARNING.

*Switching the regulator off the supply must be carried out only if the regulator is in the starting position - **SYSTEM OK**. If the regulator was switched off in the waiting mode or in the course of the programme, the next turning on will be considered a restart after electric supply fall-out loss and the regulator would try to continue in the interrupted programme.*

Cycle interruption menu

We can get to the cycle interruption menu by pressing the **DEL** key in the WAITING or PROCESS modes.

The regulator will show the following:

```
0-< 2-> 4->> 7-T
3-E  8-/ DEL-end
```

restart of the section in progress - zeros the section-in-progress time (key **0-<**)
jump to next section - moves to the following programme section (key **2->**)
edit of programme in progress - edit of the running programme (key **3-E**)
jump to the last programme section – moves to the last section of the programme (key **4->>**)
test of regulator - test of the regulator (key **7-T**)
display switch-over - switches over the displayed data on the course of the programme (key **8-/**)
programme ending - ends the programme being processed (key **DEL-end**)

We will leave the menu by pressing the **ENTER** key or after the selected action is accomplished. Then the regulator returns to the mode in which it was interrupted.

Display switch-over (key 8)

Normally the regulator shows the following data in the course of the programme:

```
 TP4   TP3   TP2°C
Pn#s/TIME  hh:mm
```

Number of programme started **n**
Number of the programme section in progress **s**
Passed time of the section in hours **hh** and minutes **mm**
Actual temperatures in zones 2 - 3 **TP4, TP3, TP2**

If we switch over the display by key **8** in the cycle interruption menu, the regulator will show the following on the display:

```
 TP4   TP3   TP2°C
TPV4 TPV3 TPV2°C
```

Then the regulator shows the following:

Actual temperatures in zones 2 - 3 **TP4, TP3, TP2**
Calculated temperatures (temperatures that should be in the zones according to the programme) **TPV4, TPV3, TPV2**

By repeated displaying the **cycle interruption menu** and pressing key **8** we can switch over between these two displays.

Errors of device indicated by regulator

The regulator checks the device regularly in order to minimise the risk of the device damage due to an already occurred defect.

It checks whether the maximum set temperature is not exceeded and if phases control is switched on (see ZONES SETTING – CONTROL OF PHASES) it checks whether the heating is OK. If the regulator finds an error during the said revision, it will start the sound signal system and carries out correcting measures according to the type of the error so that damage of the device is avoided and allows to start the programme after the errors are removed.

The regulator indicates the below listed error conditions:

Maximum temperature exceeding

This error may occur if some of the thermocouples is not connected, or if one of them is damaged. In addition, this error may also occur as a result of heating failure – the heating still heats and the temperature exceeds the maximum value set. The regulator indicates with sound signal and it shows the following report on the display:

```
 TP4  TP3  TP2°C
!TEMPER.! HH:MM
```

The error is indicated if it lasts more than 1 hour. The regulator switches all heating and the main switch off. If the programme is in process, the regulator will stop it. After the error is removed (the temperature is reduced below the maximum temperature), the regulator switches the sound signal system off, and **SYS ERROR!** appears on the display. Now the **TEST** must be started so that the regulator moves to the **SYSTEM OK** mode.

Alarm deviation exceeding during regulation

During regulation, the maximum temperature alarm deviation may be exceeded in the section in process. This error is indicated immediately with sound signal and the following report appears on the display:

```
 TP4  TP3  TP2°C
Px#s MaxT! HH:MM
```

Usually the error occurs due to incorrect setting the regulation parameters. The regulator stops heating in the zone with exceeded temperature and when it drops to the allowed limit the regulator puts the sound signal system off and continues in regulation. This error, however, may be a warning of other errors, as it is reported immediately.

Temperature exceeding revisions are carried out only in zones that are set as regulation zones!

Heating failures

Failures in heating indicate breaking the switching elements of furnace. Breaking the switching element which remains in a connected state may cause serious damage to the furnace. That is why this error is considered the most serious one and the regulator stops the programme when this error occurs, it turns the main switch off, starts the sound signal and writes the following report on the display:

```
PHASES ERROR !
SWITCHES X X X !
```

Where the following values may be on places of X:

0	Phase switched off
8	Phase switched on

The report informs about the broken phase - **number 8 appears at the broken phase**. When pressing the **ENTER or DEL** keys, the regulator moves to the **SYS ERROR** mode. At this moment the test must proceed, which localises the error – determines broken zones and phases.

During the programme run, such case may occur when some heating does not heat. If this error occurs, the regulator just indicates it to warn the operator:

```
 TP4  TP3  TP2°C
Px#y NoHe! HH:MM
```

The above described error is not taken as a serious one by the regulator in order to enable finishing regulation and protect the charge . But if the programme is being started, the regulator will not allow to start it up with this error.

V. WORKING WITH CONNECTED PRINTER

The regulator can be added with serial 40-symbol printer. The printer enables printing of the regulation process.

Connection of printer and setting

The printer is connected to the regulator through 9-pin connector CANON. After the connection we will set the printing interval in the **technical menu / other settings**. We can set also print options – then we will always be asked during the **programme editing**, whether to print the respective section or not. The printing interval corresponds with the time period in minutes between temperatures of individual zones printing. To be able to print, the set interval must not be zero and must be within the range 1 - 60.

Warning:

Connecting the printer connector is different from connecting the serial PC connector. Trying to connect the regulator adjusted for printer to PC may result in the serial port PC damaging !!! (A regulator with special adjustment for these purposes must be used)

If we set zero print interval (0), the printer will not print !

Activity of printer

If printer is connected, it will ask to set the number of the order after the programme is started (after setting the start time):

```
ORDER NUMBER
```

We can set up to 16 figures as the number of order. Setting is finished by pressing the **ENTER** key, by pressing the **DEL** key we can delete the already set figures.

At each printing more than one line, the regulator always shows the following printing dialogue on the display:

```
   WAIT PLEASE
    PRINTING  !
```

It will print the report heading:

```
***   SETTING   * dd:mm:yy * hh:mm ***          - date and time of setting
*  Order noomber : xxxxxxxxxx        *                - order no. set by us
* Program number : x                 *          - number of selected process
                                                (programme)
* Number of sect.: x                 *    - number of sections in programme
* Print interval : x                 *          - interval of printing temperatures
**********   D E V I C E   **********
* PROGR. REGULATOR TEPL. TEMPREG400  *          - name of regulator
*   serial number : xxxxxx           *    - number of regulator series
*************  N O T E   *************          - space for notes
*                                     *
*                                     *
*                                     *
*************************************
```

Further, the regulator reacts in the same way as without the printer till the programme is started (after the tests of the regulator are finished), when the programme is printed:

```
************ S T A R T *************
*    Start date : dd:mm:yy           *          - date of programme start
*    Start time : hh:mm              *          - time of programme start
****** PROGRAMME PRINTING ******
* SECTION hh:min T1°  T2°  T3°  T4°   *          - all programme is written
          …..
          ….
*************************************
```

The regulator starts to regulate and writes each section temperatures successively

```
***********  SECTION  x ************          - number of section being processed
* TIME      TEMPERATURES             *
*hh:min    T1°    T2°    T3°    T4°   *
          …                     - temperatures and time of their substraction ….
```

When the programme has ended, the regulator writes end of date and time of the programme ending.

```
************************************
*** E N D * dd:mm:yy * hh:mm  ********
************************************
```

In case of electric supply fall-out loss, after being restarted the regulator will print information about the time of the supply failure, before the programme is restarted.:

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!! SUPPLY FAILURE! x min          !!!   - time of electric supply failure in minutes
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

In case of the programme run arrangement, the whole programme is written again, including the date and time of the said arrangement:

```
*PROGRAMME has been arranged dd:mm:yy * hh:mm*  - date and time of arrangement
* SECTION hh:min    T1°  T2°  T3°  T4°   *       - all programme is written in here
          …..
          ….
************************************
```

When the printer is disconnected, the regulator reacts without any errors. Only if you use serial communication between the regulator and PC, it is recommendable to set the print interval to zero. You will avoid potential problems with communication.

VI. MAINTENANCE AND REPAIR

The regulator does not require any maintenance, except actual time integrated circuit replacement and memory of programmes with built-in battery, which has 10-year service life guaranteed by the manufacturer. If you find a defect, send the apparatus to the manufacturer for repair. There are no elements that can be set by the user inside the apparatus.

The manufacturer recommends preventive revision of the condition of the regulator and new calibration after max. 3-year run or adequately sooner, according to the demanding character of use.

The manufacturer shall provide the user with the recently used version of standard software during the above mentioned preventive revision.

VII. POSSIBILITIES OF FUNCTION SPREADING

If customer orders a higher number of pieces, the manufacturer can supply regulators of various designs. The basic software delivered with the regulator (ca 30 KByte) was developed for temperature control in ceramic furnaces. If this software does not fully satisfy the user´s requirements, the manufacturer can modify it or manufacture a different version upon the customer´s request, up to a maximum size of 64 KByte.

Optional (non-standard) design of regulators

Serial input-output for communication with external device

a) Simple unidirectional output for the cycle course monitoring and its archiving in connected PC, including the programme equipment for PC, or for panel 40-column printer connection.
b) Data setting and regulator control from PC – programme equipment manufactured upon special order according to the user´s specification.

Analogue output 0 ÷ 10V / 1 mA for proportional external output member control (for example **NOREG**) or for analogue recorder control. Output voltage is adequate to the actual temperature deviation from the temperature required, and reaches the maximum value if the deviation is equal to higher than the value set (see the CONFIGURATION). The analogue output is classified for the first zone.

Galvanic separated input for blocking the regulator function (e.g. the door switch) – controlled by current 10 ÷ 20 mA.

Record on the last cycle process into the RAM reserve memory with possibility of subsequent data transmission and displaying on PC.

Monitoring the regulation loop process on PC report on the course of controlled process.

VIII. GUARANTEE TERMS

The apparatus must be installed by an authorised person only, according to the manufacturer´s instructions.

The manufacturer guarantees the errorless function of the regulator for the period of 12 months from the date of putting the regulator into operation, however, at the latest 15 months from the date of selling the device to the customer. In the said period, the manufacturer is obliged to accomplish any repairs of failures, which were caused by material defects or by hidden manufacture defect, free of charge.

The guarantee does not include defects caused by mechanical damage of the regulator, incorrect connection or use for another purpose than the product is designed for, breaching the working or storing conditions and not respecting the instructions given by the manufacturer.

In the guarantee period, the manufacturer shall remove the defects of the product within the term of two working days, the place of service is the manufacturer´s plant.

In case there is a necessity to repair the regulator at the user´s premises, the manufacturer shall repair it within the term of ten working days. Any other conditions must be stated in a separate service contract concluded by the manufacturer.

WARNING

In case of failure in the thermocouple input circuit function (short-circuit at the thermocouple line), failure of input amplifier or converters, the regulator may indicate incorrect temperature of the furnace. The regulator manufacturer is not liable for any secondary damages caused by the regulator failure.

The manufacturer recommends that the regulated system be protected with another independent circuit that will disconnect the furnace heating in case the maximum allowed temperature is exceeded.

IX. WORKING CONDITIONS

The regulator must operate in an area protected against direct weather conditions, radiating heat, coarse impurities and aggressive vapours, e.g. in laboratories.

The information about the temperature is calibrated against the ambient temperature measured on clamps for thermocouples connection. If the compensation line of the thermocouples is not lead to the terminal board of the regulator, the data on temperature is loaded with the temperatures variation error between the area surrounding the regulator and the place of the compensation line terminal. This error can be eliminated by placing the external ambient temperature sensor to the place of the compensation line terminal. With regards to the fact that the ambient temperature sensor is common for all zones, the compensation line terminal must have the same temperature for all zones. Standard placing of the temperature sensor is at the terminal board of the regulator for thermocouples connection.

feeding:	230V/50Hz +10%, -15%
operation temperature:	0°C - 40°C
storing temperature:	-40°C - 65°C
relative air humidity:	max. 80% at 20°C
dustiness:	max. 0.5 mg/m^3 of incombustible and non-conducting powder:

Production number

In case you have any queries of a technical nature or if any problem occurs with your regulator would you please inform the manufacturer about the above written data.

Address of manufacturer, orders, technical information:

SMART spol. s r.o.
Purkyňova 45
612 00 BRNO
CZECH REPUBLIC

tel: **420 541 590 639**
fax: **420 549 246 744**
420 541 241 706
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