REMARK 96-6c

PROGRAMMABLE MICROCOMPUTER CONTROLLED REGULATOR:

Operating Instructions

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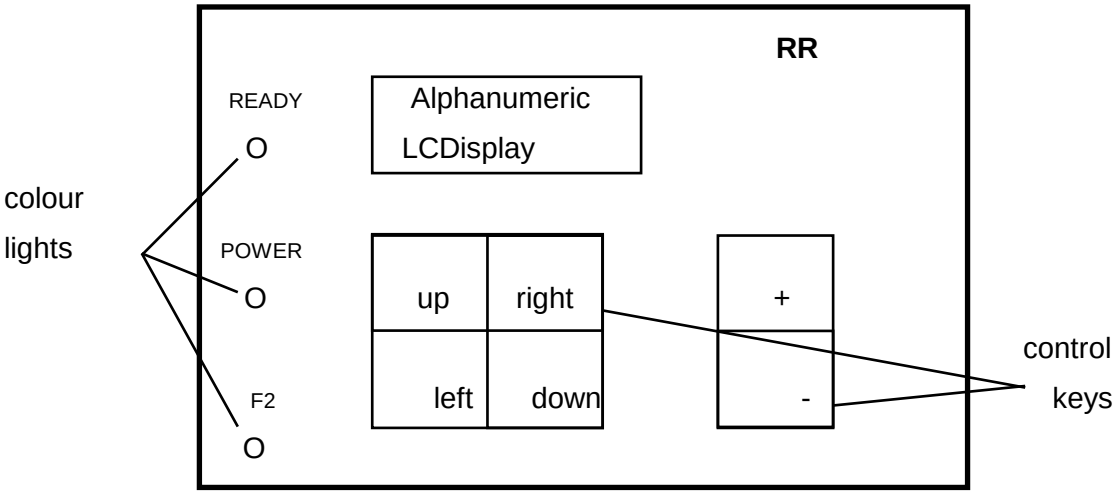
RR-96-6c

PROGRAMMABLE MICROCOMPUTER CONTROLLED REGULATOR:

DESCRIPTION:

RR-96-6c is an electronic digital temperature regulator, which scans the temperature in a given place by a thermocouple sensor and by the semiconductor switches controls power of the electric heaters. The regulator lets the user create quite complicated time courses of the temperature, keep them in the memory and regulate the temperature according to them. The system is resistant to a loss of the informations over the failures of the power supply and lets delayed start of user programs (function wake up).

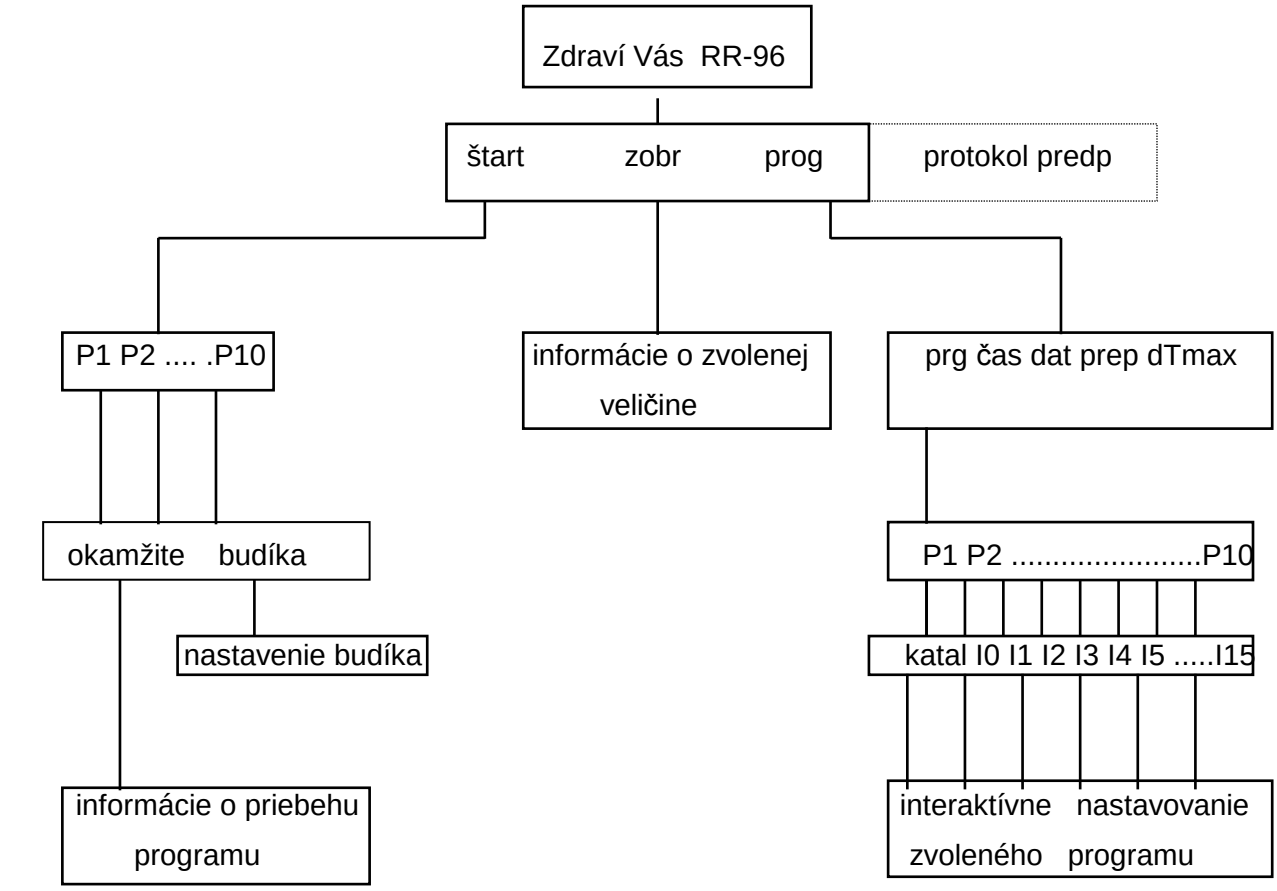


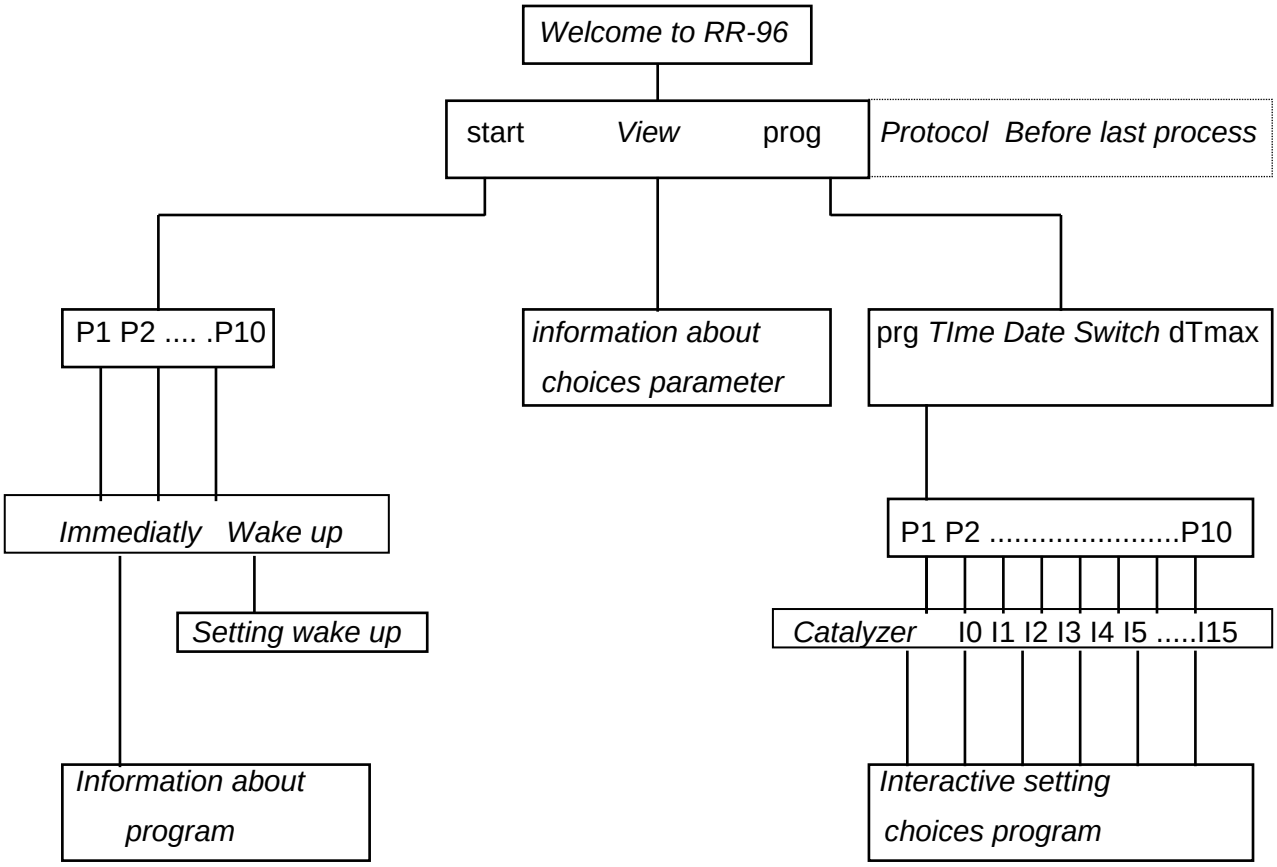
Pic.1. Placement of the control elements.

FRONT PANNEL, CONTROL ELEMENTS.

The placement of the control elements is illustrated on the picture 1.

The appliance is turned on by the main switch. When it's turned on, the main switch itself is lit up, the device beeps and the display shows the system status. The system of the regulator itself is controlled by six keys and the alphanumeric LCDisplay.


Zdraví Vás RR-96
štart zobr prog
protokol predp
P1 P2 .... .P10
informácie o zvolenej veličine
prg čas dat prep dTmax
okamžite budíka
nastavenie budíka
P1 P2 .....P10
katal I0 I1 I2 I3 I4 I5 .....I15
informácie o priebehu programu
interaktívne nastavovanie zvoleného programu


Welcome to RR-96
start View prog
Protocol Before last process
P1 P2 .... .P10
information about choices parameter
prg TIme Date Switch dTmax
Immediatly Wake up
Setting wake up
P1 P2 .....P10
Catalyzer I0 I1 I2 I3 I4 I5 .....I15
Information about program
Interactive setting choices program

Pic.2. System tree of RR-96-6c.

THE MEANING OF THE SIGNAL LIGHTS:

1.READY

- green light: the user program is running.

- blinking green light: DELAYED START (the program will be started on the wake up).

- red light: ERROR. The type of the error is showed on the display(during the course of program or in the view mode.

2.POWER

- green light: voltage on the heaters. The safety contactor is turned on.

- yellow light: The semiconductor switches are turned on - the heaters are powered.

3.F2 the user function status

- green light: powered fan

- red light: the filter (catalyst) is turned on (needs the safety contactor to be turned on).

- yellow light: the fan and the catalyst are both turned on.

INSTRUCTIONS

The regulator is controlled by four arrow keys and two helping keys (+ and -). The four basic keys make possible the move in the regulator system tree (pic.2.), the two helping keys are determined to change the numerical values. The alphanumeric display informs the user about the another proceeding possibilities, or about the running activity of the regulator in each status of the program.

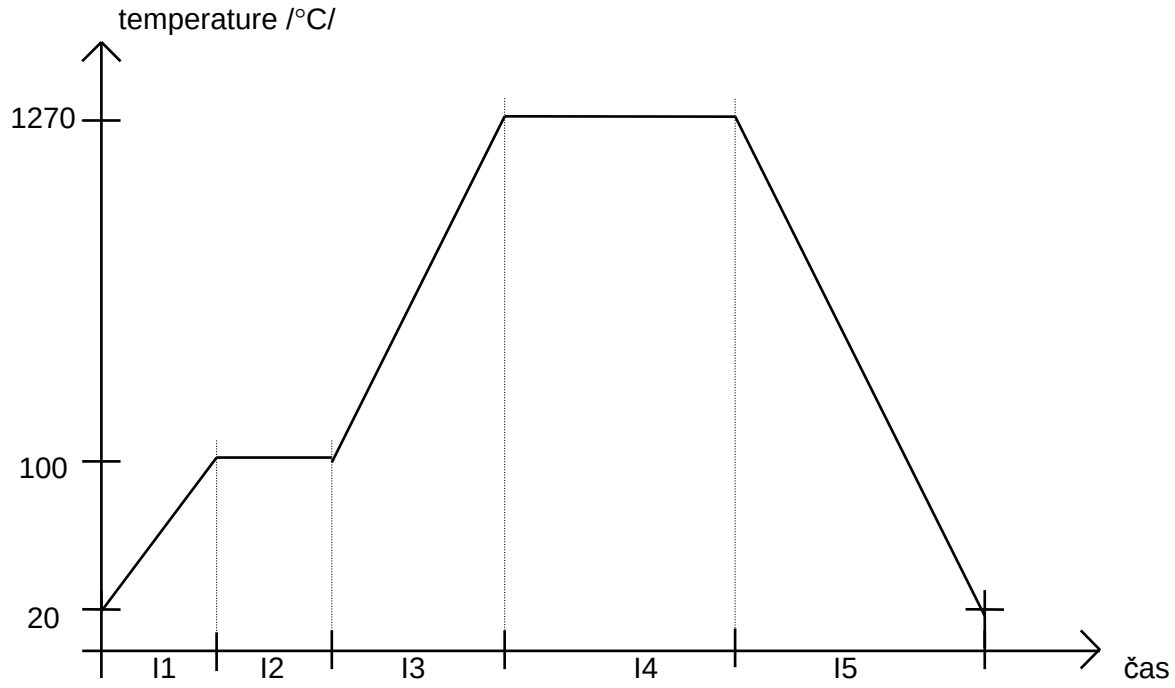
CREATING THE USER PROGRAMS.

The required time course of the temperature has to be approximated by the linear stretches. These stretches will be from now on reminded as the " intervals". Each of the intervals is characterised by two values: - the length of the duration

- the temperature at the end of the interval.

When the program is started, the regulator makes the temperature follow the line connecting the initial point with the final point of some interval. The initial temperature in the first interval is always 20 , in the other intervals it is identical with the final temperature of the previous interval (pic.3.). The programmer lets keep 7 programs like this in its memory and if it is needed, to choose one of them. The programs are signed as P1, P2 till P7. The programs contain maximally 12 intervals. In the system, the intervals are signed as I1 till I12.

This is the concrete example. We want to programme the course of the temperature according to pic.3.



Lengths of the intervals

I1: 1 hour

I2: 1 hour

I3: 1 hour

I4: 1,5 hour

I5: 3 hours

Now it is needed to remind also the interval signed as I0. This makes warm up the catalyst , not the stove. If there is " non-falling temperature ", in the regulated interval, and so if the final temperature is not smaller than the initial temperature, we have to adjust these parameters too:

- the activity of the cooling fan (Turned on or turned off)

- position of the valve α (0 till 100%) - position of the valve β (0 till 100%)

If the appropriate interval is adjusted as the falling, the activity of the fan and the valves is not programmed, the system automatically jumps over this setting and then during the course of the interval controls them to reach the programmed temperature course as exactly as it gets.

Fan is turned off in the interval I0 and both valves are adjusted into a position 0%.

Now the programming itself can be started. When the regulator is turned on, it beeps and shows this inscription:

Zdraví Vás RR-96	Welcome to RR-96
09:43 12.07.2001	Time Date

This inscription tells that we are on the top of the system tree (pic.2.).

Štart Zobr Prog	Start View Prog
■	

Blinking character ■ (cursor) can be moved all over the display by the arrow keys and choose one of the three possibilities. Let us pay attention to the possibility **prog.**

The " down" arrow key is pushed two times, the cursor is moved under the inscription **prog,**

Štart Zobr Prog	how it shows this picture.
■	

Then we can confirm our choose by pushing the arrow key "down". Then this inscription appears:

prg čas dat prep	prg time date switch
■	

The item **čas** (means time) lets set the system clock, if it is needed. The item **dat** (means date **)** date, the item **prep** (switch) lets choose the temperature which provides limited power.

Now we will talk about the item **prg.**This item is determined to create the user programs. If the cursor points at it (the previous picture), we confirm it with the arrow key "down". Now there appears on the display:

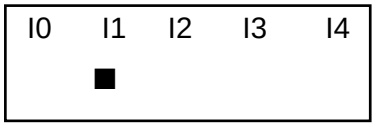
P1 P2 P3 P4 P5
■

That means, we can choose one of the user program that we are going to programme, by the cursor. Pay attention to the fact that on the display there are offered only 5 programs. If you want to programme the programs P6 till P10, you have to push the arrow key "right' 5 times. Now the "hidden possibilities" are showed.

P6 P7 P8 P9 P10
■

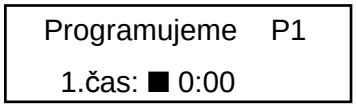
The cursor is " rotating" that means we can get from P10 to P1 by the arrow key "right" and from P1 to P10 by the arrow key "left".

When the cursor is already set on the chosen program, for example P1, we confirm the arrow key "down" again. Now the regulator offers us by this inscription:



a possibility to choose which one of the twelve (eventually thirteen) possible intervals of the program we want to set. We apply this possibility only when we want to modify the already complete programs. Now we only confirm the interval I1.

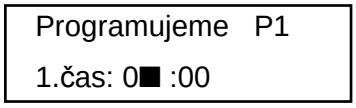
Then the new inscription appears, for example:



We are programming P1

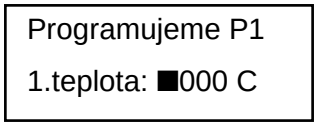
The first time: 0:00

Now we have to set the duration of the first interval of our program in the hours and the minutes. In our example it is 01:00 (1 hour). We set it like this: First, we move the cursor one place to the right (arrow key "right"):



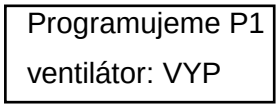
Now we push the helping key plus (+). That makes the value on the cursor position increment by 1. In our example 01:00. We wanted to set this value so we can confirm by the arrow key "down" and then it is written into the memory.

By the next inscription



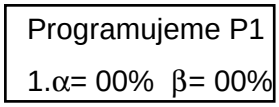
1. Temperature 000 C

the regulator lets us set the temperature at the end of the appropriate interval. In our example 0100 ℃. When this value is set (by the ar row keys "left", "right", plus and minus) , we confirm it with the arrow key " down". The system writes the value into the memory and asks another parameter of the interval I1 (it was the non-falling interval).



Fan : Turn off

The "turn off" or the "turn on" value is switched by the keys PLUS or MINUS. When the setting is right, we confirm with the arrow key "down". And finally is needed to set the valve positions for this interval.



The positions can be set by the step 2 % with the keys PLUS or MINUS. We can move the cursor from α to β with the arrow key "left" , eventually "right". After the set values are confirmed, the system goes automatically to the setting of the successive interval.

Programujeme P1
2.čas: 0:00

2.time: 0:00

In our example the interval I2 has the same length of the duration (01:00) and the same final temperature (100℃) as the interval I1. We programme these values in the well-known way. In the I2 interval is the final temperature the same as the initial temperature, so it is non-falling. That means that we have to set the fan for turning on or turning off and the positions of the valves. After they are programmed, we can start the setting of the I3 interval, where we set

Programujeme P1
3.čas: 01:00

and

Programujeme P1
3.teplota: 0270 °C

and the same way interval I4:

Programujeme P1
4.čas: 01:30

(takes 1,5 hours)

and

Programujeme P1
4.teplota: 0270° C

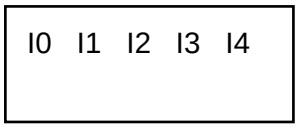
Now take a look at the interval I5. In this interval the temperature falls. We use it only when we go on the controlled cooling, that means the cooling has to run during the set time and not more often.

In our example, we set the time 03:00 and the temperature for example ℃. After the setting and confirming of these values the system jumps over the setting of the fan and the valves and offers the programming of the next, or the 6^{th} interval. In this case we already do not want to use it, that is why we set the time 00:00 on it. This is understood by the system as the end of the program. When this value is confirmed, the controlling inscription appears:

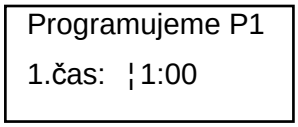
P1 obsahuje	P1 contains
5 intervalov	5 intervals

Now we can say that our user program is completed. Now we shall return to the top of the tree system by the arrow key "up". It would be appropriate to inspect our each new created program. We will make it like this:

When some key is pushed, the system in the system tree returns to the previous point and it writes:



We place the cursor (if it isn't already placed) under I1 and confirm. Then the well-known inscription appears:



We check whether the value is correct. If it is not, we fix it by the arrow keys "right", "left" , PLUS and MINUS. If it is correct, we just confirm it by the arrow key "down". Now the regulator writes the value of the temperature at the end of I1, etc. Until we haven't checked the whole program that way.

INTERVAL I0.

Like we have said before, this interval is used for warming up the filter. We set only these two parameters on it :

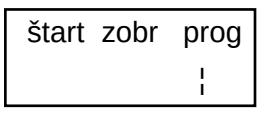
- the length of the duration (in hours and minutes). This parameter determines the duration of the interval I0, or the time from turning on the filter until turning on the heaters.

- the temperature Tk. This parameter determines the furnace temperature, by which the filter can be turned off.

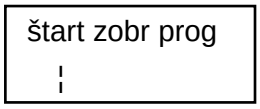
STARTING THE USER PROGRAM

The program created in the previous example can be started like this:

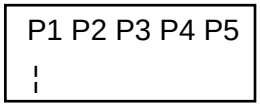
The first of all, we have to get almost to the top of the system tree while pushing the arrow key "up". Now this inscription appears:



When it is completed, we set the cursor under the inscription **start** (with the arrow key "left").

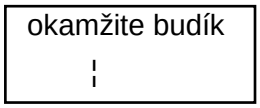


After we confirm, the regulator lets us choose, which of the programs we want to start:



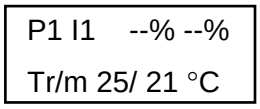
We set the cursor under the chosen program (in our example P1), and we confirm with the arrow key "down" .

Then this inscription appears:



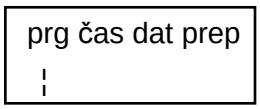
Immediately the wake up

If we choose the item **immediately,** right after we confirm it the program starts. The system announces it to us with this inscription:



The regulator gives us the notations about its activity on the first line of the display. The inscription P1I1 together with the luminous green signal light READY means the course of the interval I1.In the right part of the line is the position of the valves α and β depicted. Right after the start of the program the system searches for the basic position just for control. This activity can be on for 50 seconds. Until then, the position of the valves is unknown and this fact is depicted by the dashes instead of the concrete number. When the system sets the valve into the appropriate position, there appears the angle of opening the valve in 0 till 100% instead of the dashes. If the basic position of the valve cannot be set during these 50seconds,the system announces the valve error, then waits several seconds and ends the program.

We choose and confirm the item **prog.** There appears:



We can depict the time reading in hours and minutes instead of the valve positions in the right upper part of the display. This is possible while using the arrow keys "left" or "right". We can also return to the depiction of the valve positions with the same arrow keys.

The second line of the display is used for the depiction of the controlling (Tr) and measured (Tm) temperature.

The regulator controls the heater activity according to the set program. But at all, we have to perceive that during its activity it is limited by the technical parameters (power, mass, temperature isolation).The regulator lets us programme, for example, the raising of the temperature to 1000℃\1 minute. But of course, it i s not possible for the heater to realise something like that. We have to remember this thing when we create the user programs.

When the program is finished, the system announces:

P1I1 K 00% 00%
Tr/m 0/ 85 °C

A letter K (koniec - end) was added to the upper line, the green signal light READY was turned off. In the bottom line, the depiction of the temperatures still runs. (the controlling temperature is now). Now we can return to the top of the system tree with the arrow key "up".

PREMATURE FINISH OF THE PROGRAM

The asserting user program can be ended:

- By the interference of the heater service
- by the regulator itself, in a case that an error was found.

If we want to end the program, we do it by pushing the arrow key "up". The system verifies our demand with this inscription, so we will not push the arrow key "up" accidentally:

koniec pokračuj ¦	Finish go on

If we really want to end the program, we must place the cursor under the inscription **koniec** (finish) and confirm with the arrow key "down". That leads the program to the end and we return to the top of the system tree. If it is not so, the program will go on his activity.

RR-96 still controls its intern and extern subsystems during the activity. In a case that an important error was found, the premature finish of the program is needed.

For example, in a case that RR-96 finds an error on the temperature sensor, announces it to us by a sound signal and an inscription:

P1I1 00% 00% chyba snímača	error on the sensor

If it is a perm error, the regulator ends the running program prematurely, finishes warming up and writes:

P1 nedokončený, chyba snímača	P1 unfinished error on the sensor

Now we have to expel the error and when the arrow key "up" is pushed, the system gets to the top of the system tree, to its basic status.

SETTING THE CLOCK.

In a case that the time reading of the regulator is not correct, we set the clock like this:

From the top of the system tree:

```
štart  zobr  prog
                ¦
```

Now we choose the item **čas (** time), and the system reacts with this inscription:

```
Nastavujeme čas
hod:min   ¦ 2:38
```

We are setting the time
hours: minutes

For moving the cursor, we use the arrow keys "left" and "right". For changing the digits the arrow keys PLUS and MINUS. When the depicted value is already correct, we confirm it by the arrow key "down". Mind! If we use the arrow key "up", the system returns to its basic status without accepting the new setting. It keeps the same time reading, and writes this inscription:

```
Zostane bývalá
hodnota !
```

Keeping the previous
value!

DELAYED STARTING THE USER PROGRAM

We learned to start the program immediately, but RR96 lets start it belatedly, too, when the service is missing (function wake up). Now we will remind the process that goes on during starting the program. On the inscription

```
okamžite budík
     ¦
```

immediately the wake up

we will choose the item **budík** (wake up). After we confirm it by the arrow key "up", there appears:

Nastav budík! hod:min 2:00	Set the time to wake up!

We set the wake up in our well - known way (the same way we set the clock), that means the time when starts the program chosen by us.

When the wake up is started, the system leads the work voltage to the warming - up solids for 5 seconds by the safety conductor. This happens to let it make the basic controls. That is why is needed to watch the display during this short time, because we want to be sure that everything is correct. The most often error in this case is the heater door opened or a failure of some power supply phase. At the same time, the system starts the test of the valves α and β, which can go on for 50 seconds. If there is found an error of some valve, the system announces it with an acoustic signal and an error announcement. If there is not found any error, the system will now wait until the chosen time comes and then starts the appropriate program.

This waiting is signalised by the blinking green signal light (signed as READY) and the inscription on the display:

P1 00% 00% Tr/m 0/ 28 °C

MEASURING THE FAILURE OF THE POWER SUPPLY.

Until recently, the system depicted the temperature only in a case that some user program was started. If we want just to measure the temperature we choose in the system tree an item **zobr**.(view). The regulator answers for example:

Meranie Teplota: 456 °C	Measuring Temperature:

In this regime of work, we can switch the depicted values the temperature, the time, the controlling temperature, the temperature of the cooler and the relative temperature.

FIXING THE FAILURE OF THE POWER SUPPLY.

There are often the power supply failures. Their duration may have the values from several milliseconds to several hours. Of course, the regulator cannot work during the power failure. The program is influenced by this. When the supply is correct again, the system evaluates, how long did the failure take and according to it decides how to proceed on.

In a case of very short failures, max. several seconds, the program simply goes on.

In a case of a longer failure, the thing is more complicated. It depends on the character of the last active interval (raising or falling or constant temperature) and on the actual furnace temperature.

In a case of intervals with a raising temperature, the performance of the program "goes back" for several values, and then the controlling temperature compares to the actual temperature. If was the falling of the temperature during the failure bigger, the program can go back on several intervals, or even to its start. The final effect is, the performance of the program goes on longer because of the failure.

In a case of controlled cooling (the falling temperature intervals) the moving of the program is made frontward.

Then is the program made quicker than how it was demanded.

If is the failure longer than 4 hours or the rate of the failures crosses the value 16, the performance of the program will be definitely stopped.

In a case that the program is only waiting for its time starting (the wake up) or in a case that the program is already finished, the failures will not influence the activity of the regulator.

For example, at 15 o'clock we set the start of the program P3 for 22 o'clock. The eventual failures before the start of the program don't matter. The regulator will remember the predvoľbu and the wake up and start the program P3 at 22 o clock.

A small accumulator is used for supplying the clock. This accumulator is charging automatically if the power supply is present. In a case that the regulator is not used for a longer time, the accumulator may be not charged. If this happens, after the regulator is turned on, the system announces:

Porucha batérie	Error on the battery

And beeps repeatedly.

In this case it is needed to lead the system into its basic status with the arrow key "down". If nothing happened, we have to try to push it again. The a we have to set the clock because after the power supply can be the time reading incorrect. The accumulator will charge automatically when the regulator is used.

An announcement "Porucha batérie" appears also when the system has got a suspicion that the time readings could be incorrect and under the influence of a strong electric interference. In such a case it is appropriate to check the time reading and if it is needed, to set it correctly.

FUNCTION "DOSAH" (reach the set temperature)

This function disables the time limit of the now programmed interval. It also causes this fact: the only one criteria for its ending is the reaching of the set temperature. The example: We want the temperature to reach the value 300℃ an d as quickly as it gets. Then we need this temperature to stay on this value for 1 hour. The program for such a course will look like this:

- we set the time in the first interval, for example:

Programujeme P2 I1 čas: 01:00

- until recently, the time was set for 1 hour. If we want to use the function reach, at first we have to set zero time value (Key MINUS)

Programujeme P2 I1 čas: 00:00

- when the time is already set to zero value, we push the key MINUS once again, the system answers :

Programujeme P2 I1 čas: dosah	time: reach

- now we just confirm (arrow key "down"), and set the temperature in our well known way (in our example 300℃).

Programujeme P2 I1 teplota: 300 C °

- while setting the 2.interval we set the time 1:00 o clock and the temperature 300℃ in the well known way.

After a performance of a program like this, the system will do like this : set the controlling value (the wanted temperature) in the first interval on 300℃ and still warm up until the wanted temperature is not reached. Then goes to the second interval and that means: during the one hour it will keep the temperature value 300℃.

PROTOCOL ABOUT THE LAST MADE PROGRAM

If we get to this part, we can gather many important facts about the course of the last running program (we see the placement of this item on the tree system picture).

An example again :

We set the cursor at the item **protokol** and after we confirm, there appears one item of the protocol:

Záznam o P7 Max.tepl:1100 °C	Protocol about P7 Max. temperature:1100℃

In the whole protocol, the upper line does not change. It gives us the informations about which program was the last started (in our example P7). The bottom line gives us the information about the max. temperature that was reached during the last working process. We can find the other items with the arrow key "right".

Záznam o P7 Začal:23.04.96	Protocol about P7

This is the second item, which announces the date of the last working process. While using the arrow key "right", we get to the 3rd item, which notices the last made interval.

Záznam o P7 Posl.interval:7	Protocol about P7 Last interval : 7

The 4th and the 5th item speak about the rate of the power supply failures during the course of the program and about the length of the biggest one.

Záznam o P7 Výpadky: 2	Protocol about P7 Power supply failures: 2

Záznam o P7 najdl.výp: 12min	Protocol about P7 THE LONGEST FAILURE : 12min

(Attention! If the failure was longer than 250 minutes, there will be noticed just the time reading, **4hours,** not its real length.)

The other items notice the way that was the program ended, and the time when it was ended.

Záznam o P7 Koniec: 3:30hod	Protocol about P7 Finish: 3:30o clock

Záznam o P7 skončil: normálne	Protocol about P7 Finish: normal

The program can be finished - **normálne** -normally , scanned with no failures

- **príkazom** - by the command, the program was ended by the keyboard command

- **chy.sním** - error on the sensor, the program was ended because of the error on the sensor

- **chy.term** - the error of the thermocouple cool end temperature sensing termistor

- **chy.chld** - the cooling error (fan)
- **ochranou** - by the influence of the independent safety protection
- **ot.dvere** - opened door on the furnace
- **chy.fázy** - the failure of some power supply phase
- **výpadky** - the failure rate more than 16
- **výpadok** - the power supply failure longer than 250 minutes
- **chy.EEPR** - was ended prematurely -too high temperature was set or it was the internal regulator error

The next item expresses the time during which the heaters were under power:

Záznam o P7	Protocol about P7
čistý čas: 4,5h	clear time: 4,5hours

Next are the items which describe the intervals, that is the measured temperature at the end of each interval, for example:

Záznam o P7	Protocol about P7
k.tep.I1: 300 ° C	end temperature of I1

and exact time of the start of the interval:

Záznam o P7	Protocol about P7
I1 začal 22:00	I1 started 22:00

When there at some of these items appear the dashes instead of the time reading, for example:

Záznam o P7	Protocol about P7
k.tep.I5: ---	end temperature of I5

it means that this interval was not ended normally.

Protocol about the before last working process.

The same protocol is noticed under the item **"predp"** about the working process before last It is next to the last PROTOCOL right under the sign PREDP. The viewing is the same as it is at the last protocol.

OTHER FUNCTIONS.

The function **počet - rate** is placed near the item **predp**. It notices the rate of the work hours of the warming up solids. It lets rating their status in view of their nominal lifetime.

Function **chladič** - **cooler** is placed right next to the item **počet.** It notices the highest reached temperature of the semiconductor power switches cooler. It is used for the diagnostic system needs.

On the pic.2 we can see also the part of the system signed by the little star. This part is determined just for the maker and you have to know the code to get into it. Changes of the already set parameters in this part could cause a very dangerous accident of the furnace.

CURTAILEMENT OF THE 1.INTERVAL.

To keep the highest possible shape of the furnace temperature course, the controlling value (wanted temperature) is counted according to "the starting point " (time 0, temperature 20℃) and the ending point of the first interval given always by the user program. If the ambient temperature in the furnace was higher than 20℃,there happen the unnecessary time losses, as the program waited for the time when the controlling value reaches the real temperature in the furnace. The newer versions of the program pass over this "deaf" part to keep the set temperature ramp in the first interval consistently. That can be exhibited like this : the 1st interval runs for shorter time than how we have programmed. Of course, if the measured temperature at the start of the 1st interval is smaller than 20℃, the 1st interval will run longer.

MOST OFTEN ERRORS AND HOW TO EXPEL THEM .

If the system finds some error, it announces it to us in more ways:

- a red signal light signed with the inscription READY

- if some program is running right now, or the system is in the regime **zobr,** the error is indicated also by the acoustic signal (beep) and the description of the error itself in the bottom line of the display. In such a case it is needed to expel this error according its description:

Error description	Possible causes
Chyba snímača **(Sensor error)**	**Damaged thermocouple** - this device is exposed to the extreme temperatures and this fact causes its damaging and then it is needed to change. Without a careful manipulation in the furnace it can be damaged mechanically. **Damaged compensating line** - some types of the compensating lines are quite brittle, they hate the sharp forms.
Chyba mer.tepl. **Temperature** **error**	**Thermocouple cool end measured thermistor error** in a case that it is led out of the regulator, it is needed to expel its damage. If the intern is used, let the maker fix it
Chyba chladenia **Cooling error**	that means the power switches overheating. It can be caused by: **A covered input of the cooling air** **An error on the cooling fan** **overload of the regulator by connecting the extreme load**
Nezavisla **ochrana** **Independent** **Protection**	most often cause is the same as in the case of the sensor error Sometimes it can be evoked by the strong electromagneticinterference. In this case it is needed to turn off the device and turn it on again.
Chyba klapky **Valve error** **α , β**	This error is indicated when the system does not get the note about the basic position of the valve until 50 seconds from the start of the servomotor. The cause is probably in the incorrect mechanical setting of the basic position switch. Except it, the error can be in the electric lines to the servomotor or the switch.

IMPORTANT WARNING!!!!!!!!!!

This device may be operated by the instructed person only!

GUARANTEE

Výrobok: Programovateľný regulátor teploty **REMARK**

Doba záruky do

Výrobné číslo:

Typ snímača:

Max.pracovná teplota:

Výstup:

Servis phone / fax: 00421-42-4431345

e-mail: mrk@stonline.sk

www.mrksk.sk

This device do not need daily service.

During the regular revisions it is needed to consolidate the power screw connections and clean the cooling holes.