

R500 SERIES PROGRAMMABLE CONTROLLER DESCRIPTION AND OPERATING MANUAL

I. INTRODUCTION

R500 is a four-band programmable controller designed for program control of electric resistive furnaces and other assemblies through electromechanical contactors, semiconductor relays (SSR – Solid State Relay), or proportional actuators. The controller provides management of controlled systems with a controlled value indicated by thermoelectric elements, resistive thermometers or sensors with a current output. The controller can be delivered as two- to four-band type where each band can use a different type of input sensor and can be controlled by its own parameters. All measuring inputs are galvanically separated, functions of output relays, analog outputs and logic inputs are variable at program creation level. The controller is user-friendly by the means of a 12-key keyboard, two four-digit LED displays and a double-lined 16-digit illuminated LED display. This ensures displaying of necessary data about the state of controller and controlled system. The control of controller, settings of parameters and diagnostic functions are performed by clear menus displayed on an LCD screen. The real time clock with built-in battery enables program initiation at the required time, together with an independent program memory it enables finishing of the operated program cycle even in case of short-term power failure. The independent memory enables a long-term saving of important data concerning individual processes of controlled cycles and operations. In the memory of controller there can be saved up to 100 control cycles (programs), that can be edited in different ways and start them according to your request. The program equipment of controller provides a number of possibilities for quality control, e.g. five control methods with variable ratios that can work in conjunction with all used bands, or can be separately adjusted for each individual band.



Fig. 1. R500 Programmable Regulator Front Panel

II. R500 CONTROLLER GENERAL PARAMETERS

Inputs

- two to four galvanically separated inputs providing connection of thermocouple and resistive thermometers or other sensors with current output 0 to 20mA (including range 4 to 20mA). The type of input sensor can be selected in the service setting. Resistive inputs are connected via twin-wire lines, line resistance balancing is performed in the program menu. A requirement to place current inputs has to be introduced in the order
- four logic two-condition inputs with 0 / 5V levels (on/off)
- three inputs for connection with measuring transformers that are for indicating of the current flow in the control system power circuit

Outputs

- up to eight 230V/2A relays (five with normally open and three with double-throw contact) to control contactors and a protection contactor, clips, a cooler, an alarm start-up and other devices. Function, band assignment and condition of relay upon detection of error condition are optional
- 12V/50mA signals for the control of up to eight semiconductor relays. A 230V/2A internal relay or an external semiconductor relay (SSR – Solid State Relay) can be placed at each output. The number and type of outputs (internal relay or output to control SSR) has to be introduced in the order
- four 0 to 10V/1mA analog outputs to control linear power actuators
- a serial interface with 5 voltage logic to connect a printer or the RS232 serial interface for the connection of the controller to computer or the RS485 for connection of more controllers with a computer network

Operating conditions

Power supply	230V (+10, -15) % / (50, 60) Hz, 20VA
Dimensions	96 x 96 x 180mm (assembly hole 92 x 90mm)
Coverage	IP50, IP54 optional
Weight	approx 700 g
Operating temper.	0 to +40°C
Storage temper.	-40° to +65°C
Humidity	max. 80% within 20°C
Temp. meas. error	max. ± 2°C
Dustiness	max. 0,5mg/m ³ inflammable and non-conducting dust
Protection	T200mA/250V internal current fuse

III. CONTROLLER INSTALMENT

!Important warning!

The R500 controller connection can be performed only by a competent person with an equal electrical qualification, ventilation holes in the controller must not be covered and operating conditions have to comply with requirements mentioned above.

The controller has to be installed on the switchboard panel by inserting into the prepared 92 x 90mm assembly hole and by attaching by two clips that are delivered with controller. Clips have to snap to two pegs placed on the opposing sides of the regulator.

A connection of supply voltage, a control of contactors, auxiliary servo systems and other devices controlled by built-in relays, and the connection with input sensors are performed through detachable terminal plates on the controller back panel.

Control of semiconductor relays (SSR) and current transformers connection for checking passing flows is ensured by the Canon 15Z connector. Only inputs of phase conductors for individual contactors or semiconductor relays (SSR) controlled by controller can be connected through the passing current sensors. If the current flows in the system power circuits when the controller does not signalize to trigger contactors or semiconductor relays, the controller detects a failure, triggers an alarm and disconnects a protective contactor connected to the main power supply. This function should be influenced by connection of other devices behind the passing circuits sensors (e.g. motors, fluorescent lights or other devices equipped with over-voltage protection). The protective contactor is triggered within normal operation, otherwise it cuts off in case of controller malfunction or when exceeding limits setting by program.

Considering possible failure of the controller it is necessary to build another monitoring device into the protective contactor control circuits that is independent of the controller.

Input sensors connections shall be individual. If this is not possible on the ground of serious reasons, this should be realized as a shield connection and each band shield must be connected only at one point with appropriate band zero point (input terminals marked -).

When the inductive load is connected to output circuits, it must be interfered according to the related standards. If an interference element is not in the appliance, it is necessary to connect a properly rated outer interference element as close as possible to its terminals.

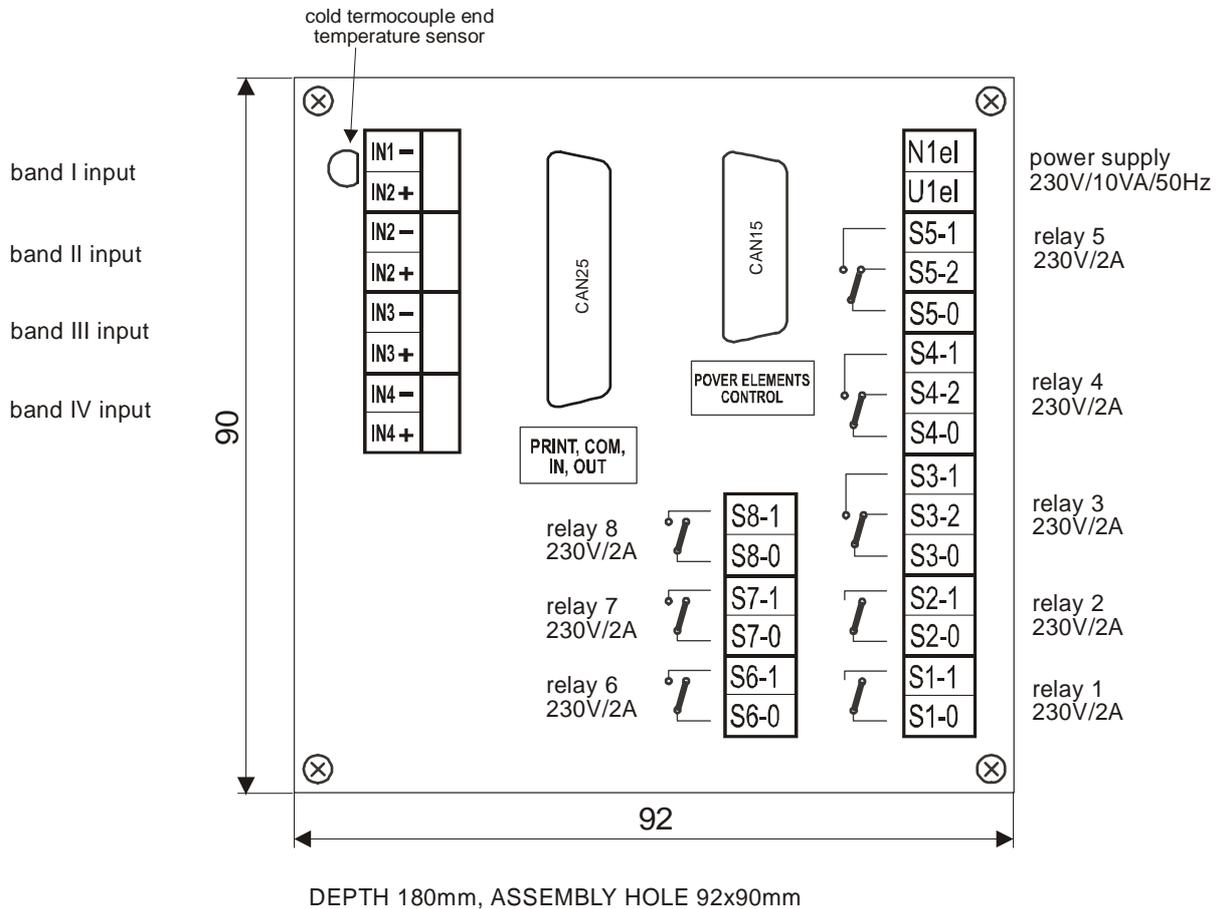


Fig. 2. Terminals connection on fully occupied controller back panel

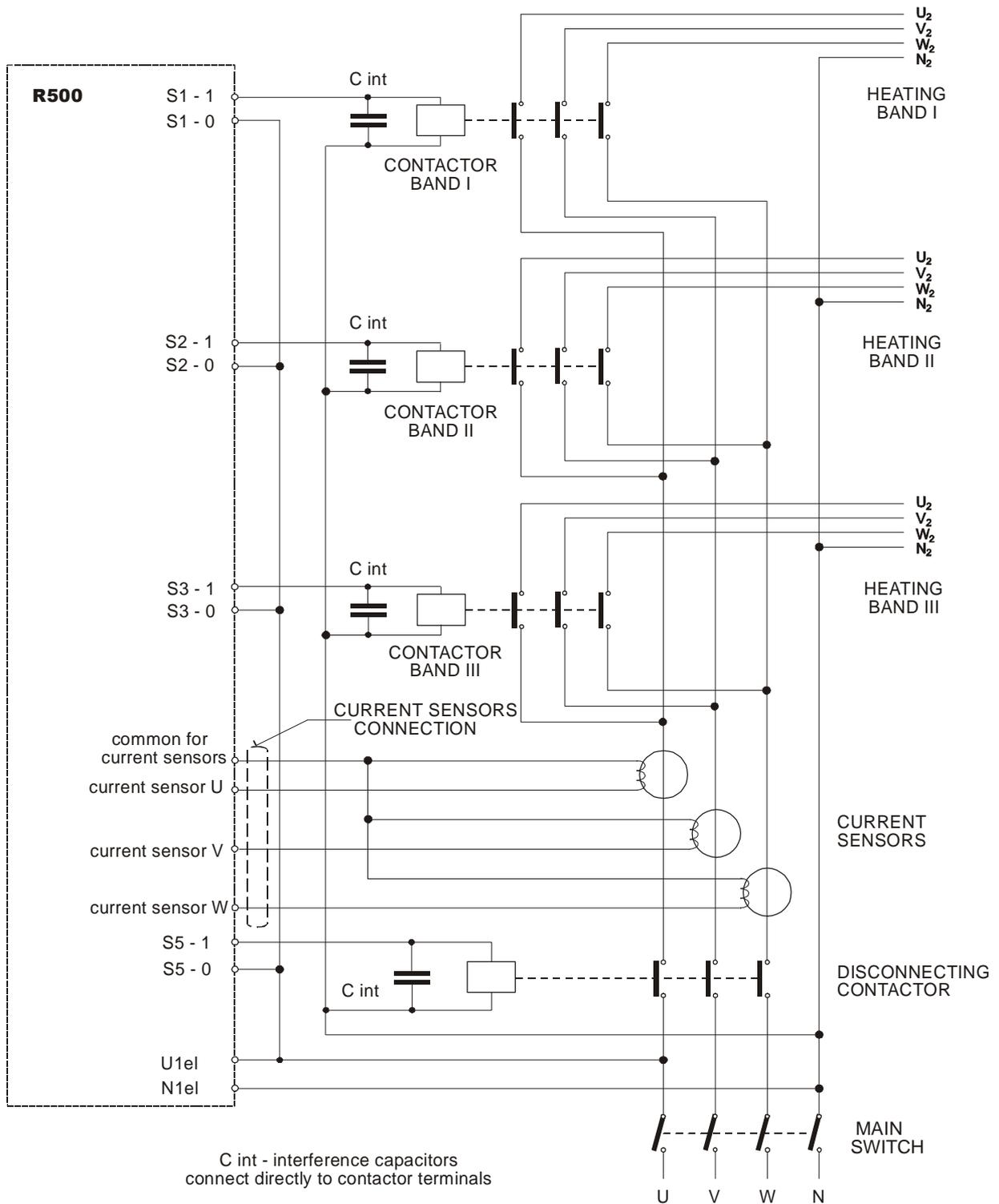


Fig. 3. Example of controller connection - heating triggered by contactors, passing current check

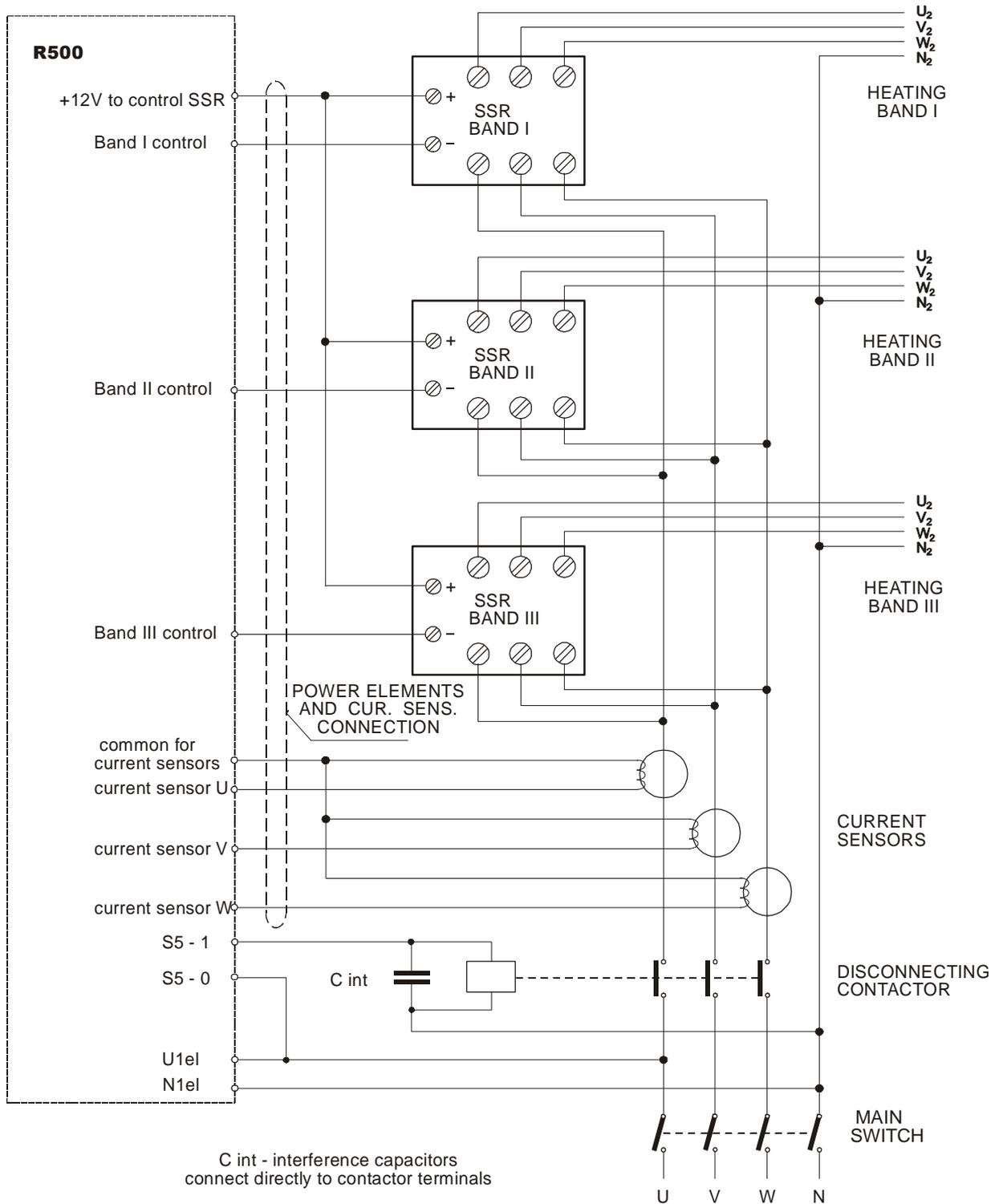


Fig. 4. Controller connection example - heating triggered with SSR, passing current check

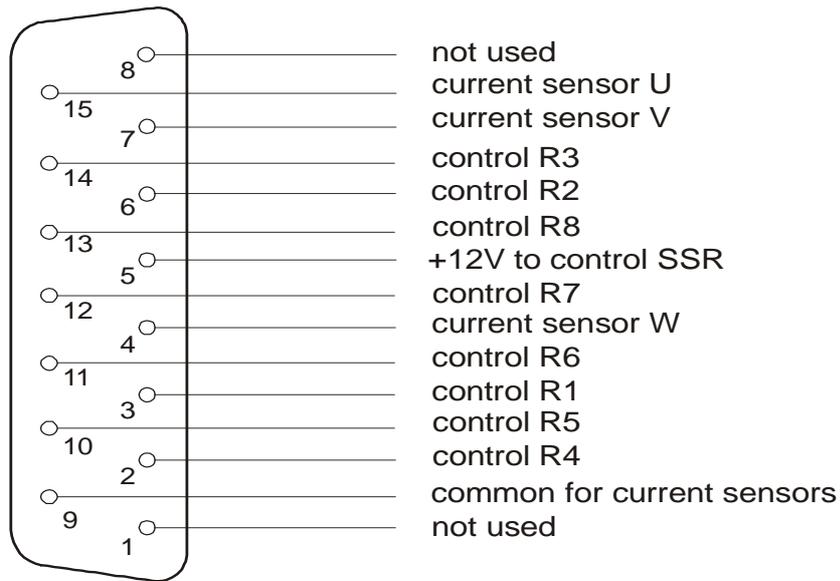


Fig. 5. Canon 15 connector connection to control actuators

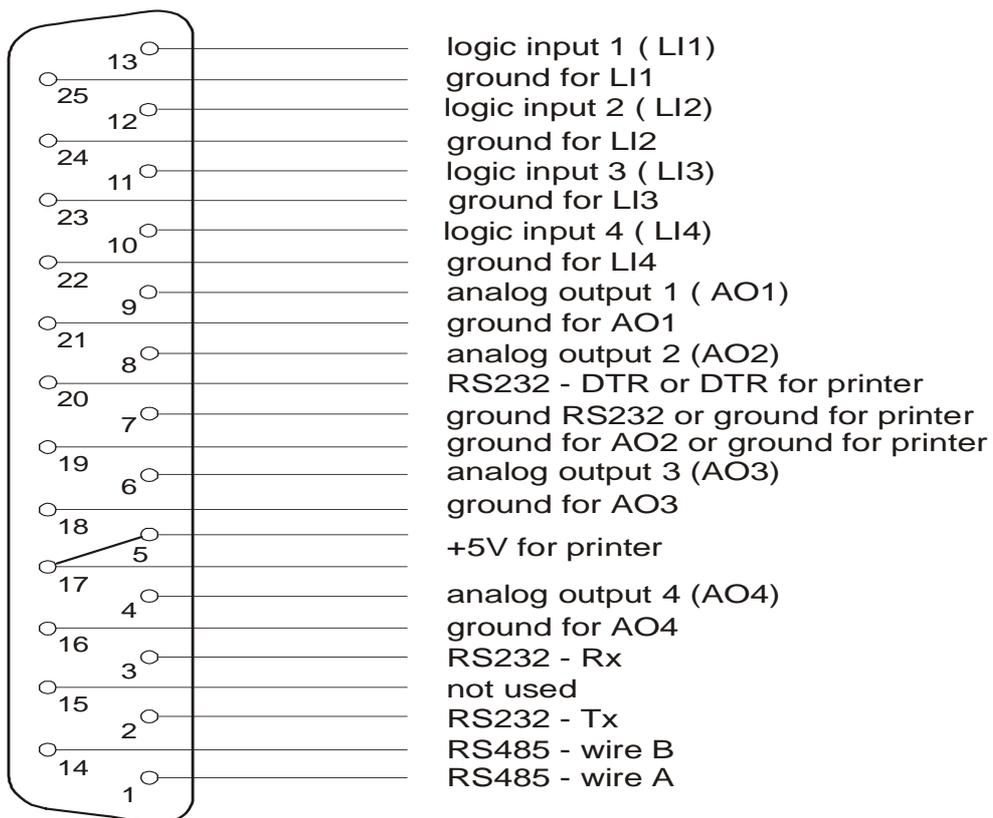


Fig. 6. Canon 25 connector connection for a printer, communication, additional inputs and outputs

IV. CONTROLLER OPERATION WITHIN A CONTROL CYCLE

Up to one hundred programs can be recorded in the controller memory. Each program can be created by one to fifteen control sections **and always by one section of program termination**. The control cycle process depends on the selected program types (in the program service setting). The controller can operate only with one type of program. When changing this type in the program service setting, all programs that do not match the selected type should be deleted.

IV.1. Programs controlled only by time

Individual sections are determined by the duration and controlled value at the end of the section. See the controller basic program diagram in the following figure.

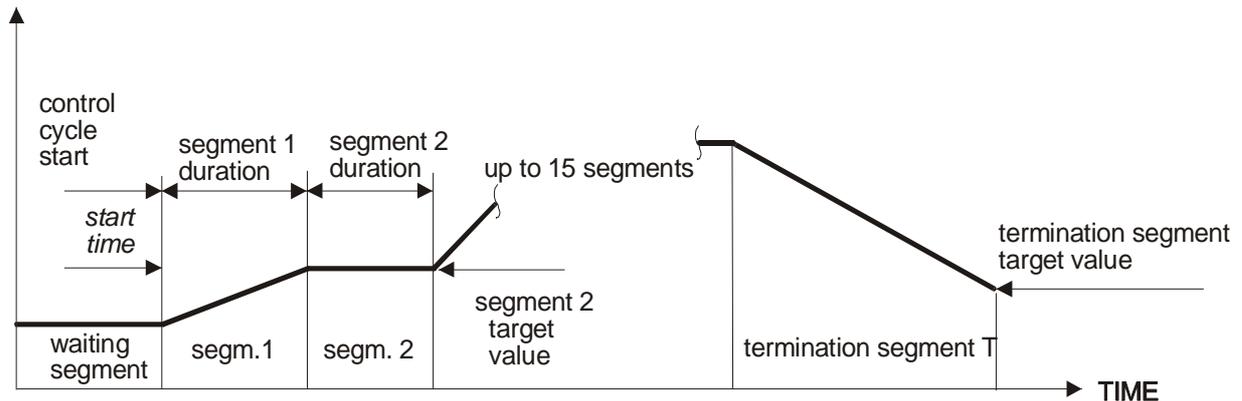


Fig. 7. Basic diagram for programs controlled only by time.

The section can take up to 99 hours and 59 minutes (where time unit is 1 minute) or up to 99 minutes and 59 seconds (where time unit is 1 second). Time units can be set in the controller service setting and is significant for all programs. **All existing programs can be affected if changing time units!** Required program initiation includes its initial check and if no failures are detected, the controller gets into the first section. Here it operates according to the start controlled value adjusted in the technological setting. If the start input value is different, the controller recounts the duration of first section to **keep the increase of the slope of the controlled value**. In a case when program requires too fast increase of the controlled value in any section and the controlled system cannot provide this increase, the duration of this section will be longer. **Jumping to another program section is allowed after reaching of the required value in all bands that are adjusted as control or decisive within the service level.** The close of each program is made up by program termination segment which can have three options.

- **infinite persistence** the controller keeps up the controlled values reached in the last program segment in all three controlled bands and stays in this status until the operator intervenes (manual program termination)
- **uncontrolled fall** the program defines the controlled values in each band and is terminated after reaching the values. Controlled value decrease is uncontrolled and depends only on features of the controlled system. Program termination is conditioned by decrease of controlled value to the required values for each controlled band
- **controlled fall** the program termination segment is defined by the controlled value and its duration at the end of the segment. Program termination is performed after the required value is reached in all bands that are adjusted as control and decisive at the service level.

IV.2. Programs controlled by time and slope

Every segment of this type of program consists of two parts. Required slope increase of the controlled value and required controlled value which has to be reached are entered in the first part. Considering the basic time unit of 1 minute the slope in the controlled value units features per hour (e.g. °C/h), considering the time unit of 1 second the slope in the controlled value units features per minute. Time of persistence at the reached value is entered in the second segment part. **In this type of program the setting parameters are valid for all controller bands.** See the program basic diagram in the following figure.

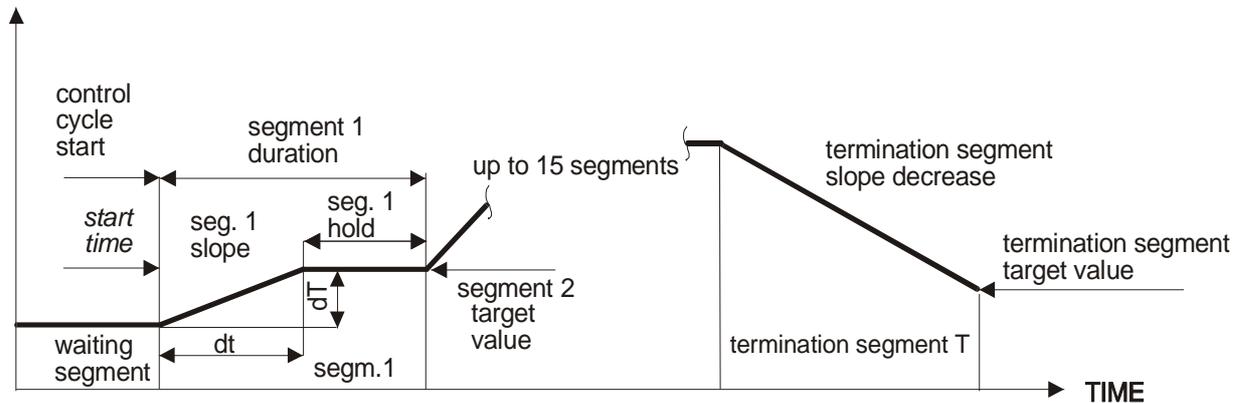


Fig. 8. Basic diagram for programs controlled by time and slope.

The persistence duration of every segment can last up to 99 hours and 59 minutes (where time unit is 1 minute) or up to 99 minutes and 59 seconds (where time unit is 1 second). The termination segment can have three options, too.

- **infinite persistence** the controller keeps up the controlled values reached in the last program segment in all three controlled bands and stays in this status until the operator intervenes (manual program termination)
- **Uncontrolled fall** controlled value decrease is uncontrolled and depends only on features of the controlled system. Program termination is conditioned by decrease of controlled value to the required values for each controlled band
- **controlled fall** the program termination segment is defined by the slope decrease and by the controlled value at the end of the segment. Program termination is performed after the required value is reached in all controlled bands

Operation of control relays, protective contactor, safety switch and signal relay depends on relation of immediate and required values of the controlled value in both programs. Considering the relays controlled by program segments, the relay with band function and the relay for controlling the servo, the cooler, the indication of reaching the segment and monitoring of maximum band value, their condition for every program section directly defines this program.

V. CONTROLLER SECURITY AND OPERATOR LEVELS

Every controller operation has assigned one of five security levels. If the password request is disabled on lower levels, login is performed automatically. After logging into the level all controller operations on this and lower levels are available. The password request within the three lowest levels can be disabled and the password can be changed, otherwise on the service and manufacturing level password usage is necessary and cannot be changed. The controller can occur in one of following states according to the login status.

Operator logged out (U)

In this mode the controller cannot be manipulated, you can only log on to the required level.

Device operator (O)

You are not entitled to influence the technological process. You can view information about controller and programs. You can select an existing program, initiate it, coordinate its operation or terminate it.

Program creation level (P)

In addition, you can carry out program operations, set the controller clock and delete the monitoring time of statistical data records about program cycles. When any failure is detected and the program is terminated, you can finish the program on this level manually on the emergency way.

Technological level (T)

Except for device control and program creation, this also enables adjustments of technological process. It deals with setting control type and constants, change the log on time, change parameters for print, records and outer communication settings. If the controller does not require a password on three lowest levels, automatic log on to this level is performed after its initiation. **Password protection is disabled by the manufacturer on the level of the device operator, program creation and technological level, so the controller will automatically log on to the operator's technological level.**

Service level (S)

This level enables you to perform basic controller adjustments according to the controlled system. This includes individual bands adjustment, sensor selection, minimum and maximum value adjustment, measured value shifting, passing current checks and line resistance balance adjustment. Output relay, logic inputs and analog outputs can be also adjusted. Program types, time units, failure signalization can be adjusted here, too. Password request elimination or change is disabled on this level.

Controller manufacturer level (M)

This level enables the placing of individual controller bands, input type selection, output relays, logic and analog outputs, communication, printer and memory record module placing. Input calibration and erasure of all record registers are performed here. Access to this level is protected by password but the manufacturer keeps this password in secret.

VI. USE AND CHANGES OF PASSWORDS

VI.1. Login to operate the controller – passwords not used

When the power supply is connected to the controller, initiation is performed and the controller shows the measured values. The first band measured value is displayed on the 4-digit red LED display and the other used bands measured values are displayed on the first LCD line, from left to right. Controller status and current time are displayed on the bottom line. **Password protection is disabled by the manufacturer on the level of the device operator, program creation and technological level, so the controller will automatically log on to the operator's technological level.** Press the **ENTER** key to display:

```
log on to sys.(T)
log out
```

Log out selection makes no sense on this level, the controller stays on the technological level. If you want to log on to a higher (service) level, change the log on time, change password usage or the password on a specific level, you can select the required level with the **↑** and **↓** keys.

```
log out           operator log out
operator level >  device operator level
program. level >  program creation level
technolog.level>  technological level
service level >   service level
manufact.level >  controller manufacturer level
```

When selected the required level, press **ENTER** to confirm. The selected level is displayed on the first line and its menu on the second line.

```
> log on to sys.    log on to selected operator level
> log on time >    log on time (0 to 29 minutes, 0 means unlimited time)
> use password >   use or not use password on selected operator level
>change passwr>    change password; on levels (O), (P) and (T) password 0000 is enabled by
                    manufacturer
```

The controller is automatically logged on to the technological level, and when passwords are disabled, it makes no sense to log on to a lower level. On the technological level you can change the log on time, password use and change the password within the technological and lower levels. You can log on to the service level after password confirmation.

```
service level >
> log on to sys.
```

After confirmation:

```
> log on to sys.
password: _
```

When entering the numbered password, * are displayed instead of numbers. The password can have up to eight characters and is confirmed by **ENTER**. If you enter the correct password, the controller performs login and displays the message:

```
> log on to sys.
<log on OK>
```

When you double click **DEL**, the controller gets to the measuring mode. When you press **ENTER**, you can log out of the service level or select the required lower level, and from the service level you can change its log on time, password use or change the password. If you enter a wrong service password:

```
> log on to sys.
<WRONG password>
```

Press any key and the controller returns to the default state and the login process should be repeated.

VI.2. Log on to operate the controller – passwords used

The controller always automatically logs on to the highest level where password use is disabled. When password use is selected for all controller operator levels, you cannot operate the controller without logging in. Press the **ENTER** key to display:

```
log on to sys(U)
operator lev. >
```

where the character in the brackets depends on the current login level (**U – logged out**). You can select one of the provided login levels displayed on the second line with the ↑ and ↓ keys.

```
log out                operator log out
operator level >      device operator level
program. level >     program creation level
technolog.level>     technological level
service level >      service level
manufact.level >     controller manufacturer level
```

When you select e.g. the device operator level, press **ENTER** and the message will change to:

```
operator level >
> log on to sys.
```

to confirm:

```
> log on to sys.
password: _
```

When entering the numbered password, * are displayed instead of numbers. The password can have up to eight characters and is confirmed by **ENTER**. If you enter the correct password the controller performs login and displays the message:

```
> log on to sys.
<log on OK      >
```

if you enter the wrong password:

```
> log on to sys.
<WRONG password>
```

Press any key and the controller returns to the default state and the login process should be repeated.

If you know the corresponding passwords, you can similarly log on to other controller security levels. After successful login when you double click the **DEL** key, the controller gets to the measuring mode and with the appropriate keys you can select individual operator menus related to the login level.

By pressing **ENTER** you can log out of the level or select another login level and the related required operation.

```
> log on to sys.      log on to another operator level
> log on time >     set log on time on selected login level (0 to 29min)
> use password >    use or not use password setting on selected operator level
>change passwrd>    change password on selected operator level
```

As well as with disabled passwords it makes no sense to log on from a higher level to a lower one. The controller requires the appropriate level password and after log on, the range of authorized controller operations is automatically reduced. Required log on time, password use and password changes concerning lower levels can be performed from a higher login level without the need for new login.

VI.3. Controller operator log out

The controller operator log out is performed automatically after log on time expiration which can be set from **0 to 29 minutes**. **When the log on time is set to 0, the log on time is not limited and eventual log out should be proceeded manually.** By pressing **ENTER** within the login process, the controller offers log out as the first possibility. Press **ENTER** to confirm and the log out is performed. With passwords disabled on lower levels the controller stays on the technological level, with passwords enabled on all levels the controller is logged out and you cannot operate it with the keyboard, you can only log on again. The log on time can be set differently on all operator levels.

VI.4. Password use and changes

Password use on the manufacturer and service level is obligatory. These passwords are fixed and cannot be changed. Password use on lower controller operator levels can be modified and individual passwords can be changed. **Passwords on the three lowest levels are set by the manufacturer as 0000 and their use is disabled.** To change the password or to change password use you should log on to the same or higher operator level where the password shall be changed. When you log on, press **ENTER** and a similar menu to within the login process appears, however, the brackets at the end of the first display line contain an abbreviation of the current operator level and the second line displays the log out menu. Using arrows you can set the level on the bottom display line where the required change shall be performed. Press **ENTER** to confirm selection. The upper line displays the level where the change shall be performed and the bottom line displays the following selections:

```
> log on to sys.
> log on time >
> use password >
>change passwr<
```

Password use

To change the password to password use on the same login level it is necessary to enter the original password first. To change the password on a lower level than the current login level the original password is not required. Using arrows you should select the required status (displayed on the bottom line) and confirm it,

```
>password use >
>>      used <
```

or

```
> password use >
>>      UNused <
```

The change in password use takes effect after new controller initiation.

Password change

Under this item you can change passwords on the device operator level, program creation level and technological level. Passwords on the service and manufacturer level are fixed and cannot be changed nor can their use be changed. If a password change is performed on the same login level, it is necessary to enter and confirm the original password first.

```
>change passwr<
original:
```

To change the password on a lower level than the current login level, the original password is not required. To change the password it is necessary to enter and confirm new password:

```
>change passwr<
new:
```

and repeat.

```
>change passwr<
repeat:
```

Successful password change is confirmed with the displayed message:

```
>change passwr<
PASSWORD changed
```

If you enter the wrong original password or the wrong repetition of the new password, the controller program goes one step back and you should repeat the process.

VI.5. Moving within controller menus

After log on to the required controller operator level you can press the appropriate keys and enter the controller operator menus.

1 to 5 keys	quick selection of one of five control parameters groups (if used)
6 key (KONF)	controller setting menu
7 key (TEST)	test start up
8 key (↑)	information about controller state
9 key (PROG)	program operations
0 key (START)	program initiation or termination
ENTER key	log on or log out from certain controller operation level
DEL key	one level back in menus, erasing character

You can move within menus with the ↑ and ↓ keys. Press the **ENTER** key to confirm the selected option. The character > before a menu item indicates another submenu, the same character behind the menu item indicates other available items within this menu item. These are indicated by the double character „>>“. The character < behind the item name indicates no other division (it is the lowest controller menu level). Within submenus you can also move with arrows, if the menu contains numbers (e.g. constants, durations, date and time), they are entered with the keyboard and confirmed with the **ENTER** key. **When you need to set a negative value with the controller keyboard you should press the 0 key twice.** Wrong number correction or one level back within the menu is performed with the **DEL** key.

VII. CONTROLLER SERVICE LEVEL

The service level enables basic controller settings. It includes functions adjustment of used bands, sensors selection, minimum and maximum controlled values adjustment, measured values shifting and a line resistance balance adjustment. Furthermore, you can set output relay functions, assign them to individual bands, adjust logic inputs and analog outputs, select program types and the controller time units. Other settings include delay of failure detection, passing current checks and delay among individual relay triggers. The password request elimination or change is disabled on the service level. General controller operation instructions, the log on and out process, and password use options are described in chapter VI, page 10.

Some controller operator menus and items introduced in this chapter are available even on lower operator levels according to their influence on the controlled system operation. Therefore, individual menus have brackets with information about the available level.

Operator levels and controller security are listed in chapter V on page 9, the following paragraphs contain only shortcuts given in brackets.

- (O) device operator level
- (P) program creation level
- (T) technological level
- (S) service level
- (M) controller manufacturer level

VII.1. Keys 1 to 5 – Controller parameters group selection (O)

The control cycle process is significantly influenced by adjusted control constants. Their values are given by the physical features of the controlled system. Proper constant values and a regulation type can be adjusted **from the technological operator level**. Regulated system features can change also due to other circumstances, e.g. stove-finished material amount and type concerning stoves.

That is why the term **controller parameters group** is used with the R500 controller. There can be up to five groups and each group can contain optimized regulation constants for specific conditions. Select the desired parameters group with the **1 to 5** keys. This option is available when at least two parameters groups are defined on the technological level. The selected parameters group is valid for all used controller bands.

```
active parameter
group is 1
```

By pressing the 2 key you can change the group number to 2

```
change group
from 1 to 2 Y/N?
```

after confirmation it is displayed:

```
change group
settings OK
```

VII.2. Key 6 (KONF) – Controller setting (P, T, S)

By pressing the **6 - KONF** key the following will be displayed

```
controller set.
control param. >
```

You can select one of the provided options displayed on the second line with the ↑ and ↓ keys

```
control param. > control parameters menu
bands > bands menu
logic inputs > logic inputs menu, if used
output relays > output relays menu
analog outputs > analog outputs menu, if used
service setting> service setting menu
power checks > power checks menu, if used
communication > communication menu, if used
print > print menu, if used
time and date > time and date menu
program setting> program parameters setting menu
manufacturer s.> manufacturer settings menu, only informative (cannot perform changes)
hand operation > controller hand operation menu
```

Regulation parameters setting - control param. (T)

The controller enables you to use up to five regulation parameters groups. You can set parameters groups, change their dimensions and copy parameters groups among them.

```
>group x A > parameters group menu number x; x can be 1 to 5; A - active group
>groups count > control parameters group number setting, can be 1 to 5
>groups dimens.> number of parameters groups dimensions, can be 1 to n. of bands
>copy group > copy parameters group to another one
```

Parameters group

There can be up to 5 parameters groups and their number is defined in the groups count. Character „**A**“ is displayed by the currently used active parameters group. An active parameters group can be quickly changed on all login levels using the **1 to 5** keys. In case only one group is used, quick selection is disabled because it makes no sense.

```
>>time const. > time constant setting
>>allowable dev> allowable deviation of controlled value setting
>>propor.const.> proportional constant setting
>>deriv. const.> derivation constant setting
>>integr.const.> integration constant setting
>>watching dev.> controlled value monitoring deviation setting
>>control type > control type setting
```

Constants of time, derivation, integration and proportional constant have the influence on the control process. **Controller constants can be changed from the technological security level even within the operation. Performed changes take effect after the program goes through the following control loop (next program initiation).**

Constant of time

You can set **1 to 250** seconds. It defines the time when the controller performs a regular action in the controlled system (e.g. heating trigger period concerning stoves). **The value of this constant should be derived from the controlled system delay. The slower the system is, the longer the time constant value may be.** Using electromechanical contactors to control the controlled system, it is not suitable to use time constants lower than 10 to 20 seconds due to their function reliability and lifetime. Constant of time is valid for all parameters groups dimensions (modifications), due to individual measuring bands synchronization the controller uses only one time line.

Allowable deviation of controlled value

You can set **1 to 250**. It defines the band around the required value where the controller keeps the real value of the controlled value. This band is called proportional. The larger the proportional band is, the larger the controlled value amplitude can be. When you select a low value of allowable deviation, you should properly set other control constants to enable the controller to hold the controlled value within the proportional band. If the controller with the given controlled constants setting cannot provide this, it is necessary to modify the setting, respectively enhance the allowable deviation of controlled value. Allowable deviation should be larger than twice the possible controlled value change caused by the action of controller in a time corresponding to the time constant. Allowable deviation also defines tolerance values of a controlled value when jumping to another program segment is performed.

Proportional constant

You can set **1 to 250**. It defines the influence of proportional band on control (increase). The lower the proportional constant is, the softer the controller action is, an increasing proportional constant value means stronger controller action. Recommended value for proportional constant is 100.

Constant of derivation

You can set **0 to 250**. The higher the constant of derivation is, the more the controller operation will be influenced by the speed of the change of controlled value. Recommended value is 50.

Constant of integration

You can set **0 to 250**. Integration factor provides long-term compensation of controlled system at minimal deviation. It is especially useful in the controlled cycle persistence stage, i.e. to keep the stable value. The higher the constant of integration is, the faster the compensation of controlled value at minimal deviation differing from the required value will be. The value of constant of integration should be set carefully because greater value can cause complete system vibration. Recommended value is 1 to 5.

Watching deviation

You can set **0 to 250**, when **set to 0, the monitoring deviation is disabled**. It defines a deviation from the required controlled value. If the controlled value is exceeded, the protective contactor is disconnected and the running program is terminated. It serves only for bands with **"monitoring"** operation (i.e. control, controlled, deciding and monitoring bands).

Type of control

Enables type of control selection that should be used for control.

- **OFF** the controller does not influence the controlled system, only displays measured values
- **discont.** discontinuous control, due to dependency on the ratio between the immediate and required controlled value individual controller output relays are directly triggered
- **P** proportional control, it is continuous control where the influence of factors of derivation or integration on controller operation is not used, the influence of controller on the controlled system is equal to the control deviation value
- **PD** proportionally derivative control, due to the factor of derivation the controller reacts faster to changes of controlled value
- **PD&I** proportionally derivative control with integration in sections of persistence. Owing to the factor of derivation the controller reacts to controlled value changes faster. Within the sections of persistence the influence of the constant of integration for compensation of system on minimal deviation is employed
- **PID** proportionally derivative and integrative control. It is continuous and proper control created by the PID algorithm in all sections. It is sensitive to control constants setting. Constant of integration is used in all sections, due to large controlled value changes the control can be more inclinable to overshooting
- **PI** proportionally integrative control. In contrast to PID control, the speed effect of controlled value changes on the controller operation is not performed. The factor of integration performs long-term compensation of the controlled system at minimal deviation

Dimension setting of control parameters groups

Parameters groups dimension can be **from 1 up to the amount of the controller placed bands**. It enables you to modify control parameters groups for the individual controller bands. It can be significant when the individual controller bands control the controlled system parts with different features or control different physical quantities. E. g. one band can control amount of certain substance, another one the temperature and third one the press. In such case, the parameters groups dimensions can be defined when each band has one parameters group dimension. Thereafter, all parameters are set in every parameters group (except for the time constant), while the number of values corresponds to the selected number of parameters groups dimensions. They will be gradually displayed on the bottom LCD line (from right to left). After setting or control parameters group dimension change, it is necessary to assign individual measuring bands with the corresponding control parameters group dimension in the controller bands setting menu.

Copy parameters group to another group

Enables you to select the required parameters group and copy it to another selected group.

Bands setting – bands (T, S)

First you have to choose the required band and press **ENTER** to open the menu.

>> function	>	band function setting
>> sensor	>	used input sensor type setting
>> lower bound	>	setting of minimum value of displayed quantity corresponding to minimum value of input physical quantity (current, resistance or voltage), this is not set at thermocouples or resistive thermometers
>> upper bound	>	setting of maximum value of displayed quantity corresponding to maximum value of input physical quantity (current, resistance or voltage), this is not set at thermocouples or resistive thermometers
>>minim. value	>	minimum allowable controlled value setting
>>maxim. value	>	maximum allowable controlled value setting
>> printable	>	print band value setting
>> recordable	>	record band value setting
>>contr.dimens.>		control parameters group dimension (modification) setting
>>value offset	>	measured value offset setting
>>compen. cable>		compensation cable setting (only for the resistive inputs)
>>conversion t.>		conversion type of measured quantity on displayed quantity setting, this is not set at thermocouples or resistive thermometers

Band functions (S)

Every band function contains several operations that the band provides.

- **measures** the controller measures the value of the input quantity and according to the set parameters it recounts it and displays it. Exceeding the controller input measuring range is detected as a failure
- **controls** according to the scheduled program the controller influences the controlled system in a way **that the immediate controlled value in a band corresponds to the required value** (continuous control) or the controller tries **to set the required value as soon as possible** (jump control). Using jump control it is necessary to disable the allowable delay of the controlled value (setting 0 value) and at the same time to set higher allowable and monitoring deviation for the controlled value
- **monitors** the controller monitors whether the measured input value is within the operating range of the band, exceeding the operating range is detected as a failure
- **controls jumps** the controller controls program jumps to another program segment. Jumps to another program segment are performed after the required value is reached in all bands that are adjusted as control or decisive, i.e. that contain the jump control process

For correct controller operation every process has to be included at least in one band, if this condition is not met, the controller detects the state as a setting failure!

The mutual combination of the given processes shows the possible band functions.

>>> master cont<	this item measures, continuously regulates, monitors and controls jumps between program sections
>>> master step<	this item measures, suddenly regulates, monitors and controls jumps between program sections
>>> driven cont<	this item measures, continuously controls and monitors
>>> driven step<	this item measures, suddenly controls and monitors
>>> control con<	this item measures and continuously controls
>>>control step<	this item measures and suddenly controls
>>> deciding <	this item measures, monitors and controls jumps between program sections
>>> watching <	this item measures and monitors whether the measured value stays in the operating range
>>> monitoring <	this item only measures input values
>>> unused <	this item has no function and displays nothing

Input sensor type (S)

The manufacturer controller setting **of each band input is to measure voltage and resistances or to measure current**. This setting cannot be changed in the service settings.

Voltage and resistance input

>>> Pt	100 <	-200 to 500 °C
>>> Pt	500 <	-200 to 500 °C
>>> Pt	1.000 <	-200 to 500 °C
>>> Ni	1.000 <	-50 to 200 °C, 6 180 ppm
>>> Ni	1.000 5<	-50 to 200 °C, 5 000 ppm
>>> Ni	10.000 5<	-50 to 200 °C, 5 000 ppm
>>> R	100 o<	0 to 300,0 Ω, displayed in tenths of Ω (0 to 3000)
>>> R	500 o<	0 to 1 500 Ω
>>> R	1.000 o<	0 to 3 000 Ω
>>> R	10.000 o<	0 to 30 000 Ω, displayed in tenths of Ω (0 to 3000)
>>> B	1.600"C<	-50 to 1 820 °C
>>> C	2.300"C<	-50 to 2 315 °C
>>> E	900"C<	-100 to 1 000 °C
>>> J	750"C<	-100 to 1 200 °C
>>> K	1.000"C<	-100 to 1 372 °C
>>> N	1.300"C<	-100 to 1 300 °C
>>> R	1.300"C<	-50 to 1 768 °C
>>> S	1.300"C<	-50 to 1 768 °C
>>> T	350"C<	-100 to 400 °C
>>> U	39 mV<	0 to 39.00 mV, displayed in hundredths of mV (0 to 3900)
>>> U	78 mV<	0 to 78.00 mV, displayed in hundredths of mV (0 to 7800)

Current input

At current input you can select:

>>> I	0-20 mA<	0 to 20,00 mA, resolution 0,01mA (0 to 2000)
>>> I	4-20 mA<	4,00 to 20,00 mA, resolution 0,01mA (400 to 2000)

Lower bound limit (S)

This defines the lower bound limit of the controlled value corresponding to the minimum value of the measured physical quantity (current 0 or 4mA, resistance 0 ohms or voltage 0mV). You can set **-9999 to +9999**.

Upper bound limit (S)

This defines the upper bound limit of the controlled value corresponding to the maximum value of the measured physical quantity (current 20mA, resistance 300, 1 500, 3 000 or 30 000 ohms, voltage 39 or 78mV). You can set **-9999 to +9999**. Upper and lower bound is not set at thermocouples or resistive thermometers.

Minimum allowable value of input (S)

Minimum allowable value of input band. If a band performs monitoring (control, controlled, deciding and monitoring band), the controller detects a failure when the value of input band falls below the set minimum allowable value of input. **Considering inputs where also range limits are set (i.e. current inputs 0-20mA and 4-20mA, resistive inputs R100 to 10.000 and voltage inputs 39mV and 78mV), the minimum allowable value of input must be higher or equal to the bottom input range limit. Considering thermocouple inputs and inputs for resistive thermometers these values are equivalent and only the minimum allowable value of input is set.**

Maximum allowable value of input (S)

Maximum allowable value of input. If a band performs monitoring (control, controlled, deciding and monitoring band), the controller detects a failure when the input band value increases above the set maximum input value. **Considering inputs where also range limits are set (i.e. current inputs 0-20mA and 4-20mA, resistance inputs R100 to 10.000 and voltage inputs 39mV and 78mV), the maximum allowable value of input must be smaller or equal to the set upper input range limit. Considering thermocouple inputs and inputs for resistance thermometers these values are equivalent and only the maximum allowable value of input is set.**

Band value print setting (T)

You can choose whether selected values should be printed,

```
>> print >
>>> print <
```

or not.

```
>> print >
>>> print OFF <
```

The item is available only when a print module is placed in the controller.

Band value record setting (T)

You can choose whether selected band values should be recorded,

```
>> record >
>>> record <
```

or not.

```
>> record >
>>>record OFF <
```

The item is displayed only when a record module is placed in the controller.

Control of parameter groups dimensions (T)

Different parameter groups dimension (modification) can be assigned to each band. If the count of dimensions is 1, control constants are equivalent for all used controller bands. At maximum count of dimensions (dependent on number of controller bands) different control constants can be assigned to each band.

Measured value offset (S)

This enables measured value offset by $\pm 1/4$ band range.

Setting of resistance compensation (S)

You can set the input cable value of a resistive thermometer from **0 to 99,99 Ω by 0,01 Ω** .

Type of input conversion (S)

Conversion type defines the way how to convert the measured physical quantity on the displayed value (temperature, flow, pressure, etc.). This is not set at thermocouples or resistive thermometers.

```
>>> none < no conversion
>>> linear < linear value conversion
>>> sqr < squared value
>>> sqrt < extracted value
```

No conversion

Measured value is recounted according to calibrated constants, the immediate measured value is displayed (voltage, resistance or current).

Linear value conversion

Measured value is recounted according to calibrated constants and standardized, i.e. it is linear recounted to the range between the minimum and maximum displayed band value.

Squared value

Measured value is recounted according to calibrated constants, standardized and squared.

Extracted value

Measured value is recounted according to calibrated constants, standardized and extracted.

Logic inputs setting – logic inputs (S)

This option is available when logic inputs are placed in the controller. After input selection the setting menu is displayed.

```
>> function    >    input function
>> logic       >    input logic
```

Input function

You can choose from the following logic input functions

```
>>> unused     <    input unused
>>> start prog.<    program startup
>>> stop prog. <    program stop
>>>prog.running<    program running
>>> start when <    start program when
```

Input unused

Logic input unused, level change at its input has no effect on the controller operation.

Program startup

Jumping to active level at this input runs a selected program. The quiescent (inactive) level of logic input can be chosen in the **logic** menu.

Program stop

If the program is running, jump to active level at this input terminates the running program. The quiescent (inactive) level of logic input can be chosen in the **logic** menu.

Program running

Jumping to active level at this input runs the program. All the time the program is running, the input must be in active level, jumping to inactive level interrupts the program running. If program interruption is caused by a logic level change shorter than the set time of mains failure (in the program settings menu), the program continues after active logic input level recovery. In the opposite case the program is terminated. The quiescent level of logic input can be chosen in the **logic** menu.

Start program when

Program startup is conditioned by logic inputs that have this condition enabled. All logic inputs should be in active level to initiate the program. The quiescent (inactive) level of logic input can be chosen in the **logic** menu.

Input logic

You can select the quiescent, i.e. inactive level of the logic input. No change in the controller operation conditioned by logic inputs is performed at this level. At the change of selected level the controller performs the appropriate operation according to the input function setting (program startup, program stop, etc.).

```
>>> direct     <    resting level is at open input (level H at input)
>>> inverted   <    resting level is at shortened input (level L at input)
```

Output relays setting – output relays (S)

The menu is available if at least one relay or output to control the semiconductor relay (SSR) is placed in the controller. It contains several items to set functions and other relay parameters.

```
> relay x >
```

After relay selection the setting menu is displayed.

```
>> function > relay function setting
>> control band> assign relay to the band
>> logic > relay logic setting
>> servo funct.> servo function specification (if the relay has this function selected)
>>current check> switch on the flowing current check that is triggered by this relay
>> hysteresis > trigger relay hysteresis setting
```

Relay function

Each relay must have assigned a function that specifies its operation.

```
>>> unused < relay unused
>>> control +0 < control relay of controlled value increase, if any failure occurs, the
relay stays off
>>> control +1 < control relay of controlled value increase, if any failure occurs, the
relay stays on
>>> control -0 < control relay of controlled value decrease, if any failure occurs, the
relay stays off
>>> control -1 < control relay of controlled value decrease, if any failure occurs, the
relay stays on
>>> guarding < guarding relay (to control the protective contactor)
>>> errors sig.< relay to signalize controller and controlled system errors
>>> safe.switch< relay operating as a safety switch
>>> running sig< relay to signalize program running
>>> segments < relay controlled directly by program segments
>>> bands < relay with band function
>>> servo < relay with servo function
>>> watching < monitoring relay
>>> cooler < relay to control the cooler
>>> sect# reach< relay to signalize the reach of selected program segment
```

Unused relay

The relay is not controlled by the controller, its state is undefined.

Control relay of increase, if an error occurs, the relay stays off

The relay triggers at the requirement for controlled value increase, if an error is detected, the relay cuts off.

Control relay of increase, if an error occurs, the relay stays on

The relay triggers at the requirement for controlled value increase, if an error is detected, the relay triggers.

Control relay of decrease, if an error occurs, the relay stays off

The relay triggers at the requirement for controlled value decrease, if an error is detected, the relay cuts off.

Control relay of decrease, if an error occurs, the relay stays on

The relay triggers at the requirement for controlled value decrease, if an error is detected, the relay triggers.

Guarding relay

If no error is detected, it triggers after the controller initiation (**even without the running program**). If an error which takes longer than set errors duration is detected, it cuts off. After the error removal the relay triggers again, although with some errors you have to manually run the appropriate tests using the 7 key (TEST).

Controller and controlled system errors signalization

The relay is off in the resting state and triggers when an error occurs, the function is the opposite to the guarding relay.

Safety switch

The relay triggers at program set up. When the first error occurs, it cuts off. Regardless of error duration it stays off until program termination.

Program running signalization

The relay triggers at program set up and cuts off at program termination.

Controlled by segments

The relay is directly controlled by the program segments which contain its specified state. If the relay is controlled by segments, it is necessary to enter the required state in each program segment when the program is written.

Band

The relay with a band function is **off** in the selected program segments if the controlled value moves within the given band about the required value corresponding to the controller band and **triggers** when the controlled value moves out of this band. The band is specified with a positive and negative deviation from the required value and is set within the program writing.

Servo

When the required value is reached, the relay triggers, otherwise at different values the relay cuts off. A detailed setting is available in the **servo function** item in the relay setting.

Watching

The relay triggers if the controlled value increase exceeds its defined maximum band value for defined hysteresis size and cuts off if the value falls below the defined value reduced of hysteresis size.

Cooler

The relay triggers when the controlled value falls **within the program termination segment** below the defined value and **stays on until the program terminates**.

Reach of program segments

You can select, as with relays controlled by segments, the relay status at reach of all existing program segments (including termination segment). On the contrary to relays controlled by segments, reach of program segment signalization can be stopped in the running program operations menu, in the item of program segment reach signalization off.

Band controlled

Each relay must have a specified measuring band to be controlled by.

```
> relay x      >
>>> band      y
```

The character „ **x** “ substitutes relay number, „ **y** “ is the selected band number.

Relay logic

```
>>> direct    <      normal relay operation, direct logic of relay triggering
>>> inverted  <      inversion relay operation, inversion logic of relay triggering
```

Servo function

When the required value is reached, the servo triggers, otherwise at different values the relay cuts off. Here you can define it to trigger (cut off) the servo upon reaching the defined values in the increase segment or decrease of the controlled value.

```
>>> rise-rise  it triggers and cuts off when defined values in increase segments
                are reached
>>> rise-fall  it triggers when defined values in the increase segment and
                defined values in the decrease segment are reached
>>> fall-fall  it triggers and cuts off when defined values in decrease segments
                are reached
```

Check current flow

You can define whether circuits controlled by the relay should be covered by the check or not.

```
>>  off      <      check is not performed
>>  on       <      check is performed
```

Hysteresis

This enables you to set the relay insensitivity band on a soft oscillation of the controlled value. A value corresponding to **0 to 1/4 band range** is defined. The controlled value of the deciding level should exceed over this size of hysteresis to trigger the relay, on the contrary, when the controlled value of the deciding level decreases by the size of hysteresis, the relay cuts off.

Analog outputs setting – analog outputs (S)

This option is available when these outputs are placed in the controller. First you have to choose the appropriate output.

```
>analo.output x>
```

After output selection the setting menu is displayed.

```
>>function    >      analog output function setting
>>logic      >      analog output logic setting
>>control band>    analog output to controller band assignment
```

Analog output functions

```
>>>unused < unused analog output
>>>control +0 < control output of control. value increase, if any failure occurs, it is 0V
>>>control +1 < control output of control. value increase, if any failure occurs, it is +10V
>>>control -0 < control output of control. value decrease, if any failure occurs, it is 0V
>>>control -1 < control output of control. value decrease, if any failure occurs, it is +10V
```

Unused output

Analog output is unused and stays permanently off.

Control output of increase, if any failure occurs, it is 0V

Output voltage rises at the requirement for controlled value increase, if a failure is detected, it is zero.

Control output of increase, if any failure occurs, it is +10V

Output voltage rises at the requirement for controlled value increase, if a failure is detected, it is maximum (+10V).

Control output of decrease, if any failure occurs, it is 0V

Output voltage falls at the requirement for controlled value increase, if a failure is detected, it is zero.

Control output of decrease, if any failure occurs, it is +10V

Output voltage falls at the requirement for controlled value increase, if a failure is detected, it is maximum (+10V).

Analog output logic

You can select the resting analog output level.

```
>>> direct < the quiescent (inactive) level of an analog output is 0V, the voltage rises
               at increase of controlled value deviation, maximum deviation
               corresponds to +10V
>>> inverted < the quiescent (inactive) level of an analog output is +10V, the voltage
               falls at increase of controlled value deviation, maximum deviation
               corresponds to 0V
```

Analog output to measuring band assignment

Each analog output should have defined which band it is controlled by.

```
>analo.output x>
>>> band y
```

Parameters service setting – service setting (S)

> program type >	program type selection
> time units >	controller time units selection
>time to alarm >	minimum error duration setting to switch signalization on

Program type selection

It defines whether programs are controlled only by time or by slope and time. **Time and required target values at the end of the segment should be defined at programs controlled by time only. Slope, target value and duration on the target value should be defined at programs controlled by slope and time.**

>> only time <	programs controlled by time only
>> slope +time <	programs controlled by slope and time (e.g. to control annealing)

The change of program type is confirmed by the displayed message.

```
program TYPE
HAS BEEN CHANGED
```

After confirmation the request to delete all programs is displayed.

```
DELETE ALL prog.
> DO IT Y/N <
```

Press **ENTER** to confirm operation, any other key to refuse. If you refuse, programs are saved in the original version and after initiation each program runs in the same way as it was written. If you confirm program deletion, the controller deletes all saved programs.

```
DELETE ALL prog.
working
```

After completion of the operation the following is displayed.

```
DELETE ALL prog.
< DONE >
```

Press any key to confirm this message and the controller returns to the program setting menu.

Controller time units selection

Controller time units can be set in this item. The basic controller time unit can be one **minute**,

```
> time units >
>>minutes (h:m)<
```

or one **second**.

```
> time units >
>>seconds (m:s)<
```

After **minutes selection** all controller time data are in the format **hh: mm** and **a time from 1 minute to 99 hours and 59 minutes can be set**, after **seconds selection** time data are in the format **mm : ss**. After the change of time units the following is displayed:

```
TIME UNITS >
HAVE BEEN CHANG.
```

After confirmation the request to delete all programs is displayed.

```
DELETE ALL prog.
> DO IT Y/N <
```

Press **ENTER** to confirm operation, any other key to refuse. **If you refuse, programs are saved in the original version but run with different time units after initiation!**

If you confirm the deletion of program, the controller deletes all saved programs.

```
DELETE ALL prog.
working
```

After the operation the following is displayed.

```
DELETE ALL prog.
< DONE >
```

Press any key to confirm this message and the controller returns to the program setting menu.

Minimum error duration to switch signalization on

0 to 250 seconds can be set. It defines the error duration time after which the program interrupts and the protective contactor is disconnected. The controller does not react to an error taking shorter than the defined time. The occurred error can cause uncontrollable increase of controlled value and within the defined error duration time the controller does not react to this status. If you define too long error duration in a quickly reacting system, you can exceed the maximum allowable values and the device or processed material can be damaged. If you set error duration to **0**, the controller immediately reacts to the occurred error.

Power checks – power checks (S)

You can define the current flow check in individual power levels. For this setting the controller must be equipped with current flows sensors and the current flows check must be required at least at one relay. When opening the item, the given status is displayed and with the ↑ and ↓ keys you can enable or disable the current flow check. With the ← and ⇒ keys you can move between powers.

```
>power checks >
>> U-x V-x W-x <
```

where **x** substitutes either **Y** – **active** or **N** – **inactive**.

Communication setting – communication (T)

This is available when a communication module is placed and activated in the controller. It enables you to change communication parameters, to search, connect and disconnect subjected controllers.

```
> net.address > controller network address
> baud rate > controller baud rate setting
```

Controller network address

0 to 240 can be set. This is the controller address setting that will be used in network. power supply disconnection (i.e. turning these devices off).

Controller baud rate setting

```
>> 2400 bauds<
>> 9600 bauds<
>> 19200 bauds<
>> 38400 bauds<
>> 57600 bauds<
>> 115200 bauds<
```

Print setting – print (O, T)

This is available only when a module for a printer connection is placed.

> order number >	number of order setting
>print interval>	print interval setting
> print header >	print header setting
>print order. #>	print number of order setting
> #.note lines >	number of note lines setting
>print program >	print program report setting
>#.lines in end>	number of lines at the end of the print report (gap setting)
>baud rate >	baud rate with printer setting

Number of order (O)

This enables you to define up to 16 figured number that will be printed on the report header.

```
> order number >
xxxxxxxxxxxxxxxxxxxx
```

Print interval (T)

1 to 60 controller time units (minutes or seconds) can be selected. The controlled values of selected bands will be printed together with the current time.

Print header (T)

You can define whether the report header will be

```
> print header >
>> print <
```

or will be not printed after program initiation.

```
> print header >
>> print OFF <
```

Print order number (T)

You can define whether the number of order will be

```
>print order # >
>> print <
```

or will be not printed after program initiation.

```
>print order # >
>> print OFF <
```

Number of note lines (T)

0 to 15 can be selected. You can select the number of note lines that will be printed in the header after program initiation.

Print program report (T)

You can define whether the program specification will be printed at first

```
>print program >
>> print <
```

or will be not printed after program initiation.

```
>print program >
>> print OFF <
```

Number of end lines (T)

The number of lines (**0 to 15**) that will be printed at the end of the report (gap setting) can be selected.

Baud rate with printer (T)

```
>> 2400 bauds<
>> 9600 bauds<
>> 19200 bauds<
>> 38400 bauds<
>> 57600 bauds<
>> 115200 bauds<
```

Time and date – time and date (P)

The time and date can be defined.

```
time and date >
hh:mm dd.mm.yyyy
```

Individual characters substitute time and date. Data are defined step by step with the keyboard. After entering and confirming of time the cursor moves to the minutes position, when selected and confirmed it, it moves further. When you confirm the year, the time and date is stored in the memory and the controller starts operation with these data.

Programs setting – program setting (P)

This enables you to define programs parameters and presettings of several parameters that will be preferentially displayed within program writing.

>supply failure>	duration of maximum allowable supply failure setting
> display >	selection of values to be displayed on controller
>terminate prg.>	presetting of method of program termination
>start repeatet>	cyclic (repeated) initiation of selected program, option YES / NO
> record >	presetting of records of program segments
>record interv.>	record interval setting
> print >	presetting of print of program segments
>sound signal. >	sound signalization of controller failures on / off

Duration of maximum allowable supply failure

0 to 250 minutes can be set, **when 251 is without time limit**. This value defines the duration of supply failure in a running controlled cycle, after its expiration the controller continues in the existing cycle. In case of longer supply failure the controller terminates the supply cycle after recovery and turns to the default mode.

Display values

One of three values can be chosen to display on the controller display.

```
> display >
>> time <
```

or

```
> display >
>> calculated v<
```

or

```
> display >
>> target value<
```

Preset method of program termination

You can set the preferentially offered method of program termination.

```
>>control.fall< the program termination value and the decrease time (the
decrease slope at programs controlled by slope and time) are
defined
>>noncont.fall < after reaching the defined value the program terminates
>>never-endhold< the controller holds the target value of the last program segment
```

Repeated program initiation

If you select YES, the specified program will be continuously initialized, i.e. after termination it is initialized again. This repeats until operator intervenes.

Selection of program segments record

The controller enables you to preset segments to be or not to be recorded. Option **all** sets automatic recording of all written programs segments. Option **selected** causes the controller to ask for recording for each segment of program writing.

```
>> all < all program segments are recorded automatically
>> selected < controller asks to record for program writing
```

Record interval

It defines the interval for recording measured values within the running program. At program initiation with recording this value is saved in recording information, the interval change does not take effect in a running program due to holding validity of recorded data.

```
> interval >
xx
```

An interval from **1 to 250** controller time units (minutes or seconds) can be defined.

Selection of program segments print

The controller enables you to preset segments to be or not be printed in program writing. If you require all segments to be printed, with the option **all** you can select automatic printing of all written programs segments. Option **selected** causes the controller to ask for printing in each segment program writing.

```
>> all          <    all segments are printed automatically
>> selected    <    controller asks to print in program writing
```

Sound signalization

You can turn on,

```
>sound signal. >
>>   on       <
```

or turn off the controller alarm.

```
>sound signal. >
>>   off      <
```

Manufacturer setting – manufacturer s. (M)

This menu is accessible only informatively on the service level, you can view individual items but you cannot change any settings.

```
> band count    >
> inputs range  >
> map log.inputs >
> map relays    >
>map an. outputs.>
> record memory >
> communication >
> printer       >
```

Controller manual operation – hand operation (P)

This enables to control controller outputs through its keyboard. The fully placed controller menu contains listed options, in case any inputs or outputs are not placed, the option does not appear.

```
>output relays >      output relays manual control
>analog outputs>     analog outputs manual control
> logic inputs >     displaying logic inputs state
> power state >      displaying power state status
>contr.temperat>     temperature display on controller terminals (related end temperature)
```

Output relays manual control

A list of used relays and outputs to control the semiconductor relays – SSR can be seen on the display. The relay status is described with the characters **f – off** and **n – on**. With the \uparrow and \downarrow keys you can change the selected relay status and with the \Leftarrow and \Rightarrow keys you can select another relay. The relay status is held only during displaying review and after **ENTER** or **DEL** is pressed, the controller leaves this menu item and the relay returns to the normal status.

```
1-f 2-f 3-f 4-f
5-f 6-f 7-f 8-f
```

Analog outputs manual control

Behind an output number its level in tens of percent of the maximum value is introduced.

```
1- xxx% 2 -xxx%
3- xxx% 4 -xxx%
```

With the \uparrow and \downarrow keys you can change the range of 0 to 100% by 10% and with the \Leftarrow and \Rightarrow keys you can select another output. Defined output levels are held only during displaying review.

Displaying logic inputs state

Review and status of used controller logic inputs are displayed (**n – on, f – off**).

```
1-n 2-n 3-f 4-f
```

Displaying power state status

Detection state of the current flowing through power circuits of the controlled system is displayed. The displaying is conditioned by the flowing current check enabled on the service level and has the following form:

```
power state >
>> U-x V-x W-x <
```

where x substitutes **Y – flowing current** or **N – current does not flow**.

Temperature display on controller terminals

Controller related temperature in °C is displayed.

```
contr.temperat >
                xx
```

VII.3. Key 7 (TEST) - Controller tests (O)

Press the **7 key (TEST)** and the test menu appears.

```
controller tests
runtime test >
```

You can select one of the provided group of tests displayed on the second line with the \uparrow and \downarrow keys

```
runtime test > controller runtime test
setting test > controller setting test
outputs test > controller outputs test
```

If the selected group of tests proceeds without errors, the name of the groups of tests is displayed on the upper line and a message **without errors** on the bottom line. If an error is found during tests, a detailed error specification is displayed on the upper line and its number on the bottom line.

When you disable the error condition detection after appropriate error removal, it is necessary to run manually a suitable group of tests (dependent on the error specification).

Controller runtime tests

Controller runtime tests are performed continually. If any failure which takes longer than the defined error duration is detected, it is signaled. In case of running the program, the program is terminated. Existing errors in the measuring bands are signaled separately in each band. The error is detected as a **band problem** and if it takes longer than the defined error duration, it is indicated as a **band failure**. If any error is found, details are displayed on the upper line and error code on the bottom line.

runtime test >			
	with no errors		
	>time and date >	1	real time clock does not run
		2	wrong time data
	>contr.temperat>	3	controller temperature is lower than -50°C, or internal temperature sensor damaged
		4	controller temperature is higher than +150°C, or internal temperature sensor damaged
	>failure pas x >	1	band converter x exceeding of minimum value
		2	band converter x exceeding of maximum value
		3	band minimum value x exceeding
		4	band maximum value x exceeding
		5	interrupted thermocouple of band x
		7	band x exceeding alarm deviation
		8	allowable band value x exceeding delay

If a clock failure is detected, no delayed start can be performed and validity of the printed and recorded time data is not provided. Clock failures can appear due to a dead spare battery or a clock circuit failure. At remedying the clock failure the proper time and date should be set and a new test should be performed. If the failure persists, the clock circuit is probably destroyed and the repair can be performed only by the controller manufacturer or by an authorized dealer. If the failure occurs at each turning on of controller, the spare battery is dead and the repair can be performed only by the controller manufacturer or by an authorized dealer. In case of delayed program start, this failure causes nullification of the requirement to start the program, a running program is terminated.

In case of an internal temperature sensor failure, the controller can finish the running program, thermocouple sensors have fixed temperature of cold end **25°C**.

Controller setting tests

If the tests proceed without errors, a message **with no errors** is displayed. When an error is found, details are displayed on the upper line and the error code on the bottom line. Setting errors can occur only in case of controller memory malfunction, inspection by the manufacturer is necessary.

setting test >			
>manufacturer s>		1	wrong number of placed bands
		2	wrong range of bands inputs
		3	wrong setting of logic inputs
		4	wrong setting of relay
		5	wrong setting of analog outputs
		6	wrong communication setting
		7	wrong printer setting
		8	wrong EEPROM setting
>control param.>		1	wrong number of parameter groups
		2	wrong groups dimension
		3	wrong setting of active group of control parameters
>activeparameter>		1	wrong time constant setting
		2	wrong allowable deviation setting
		3	wrong proportional constant setting
		4	wrong derivation constant setting
		5	wrong integration constant setting
		6	wrong monitoring deviation setting
		7	wrong allowable delay setting
		8	wrong control type setting
> bands >		1	wrong setting of band function
> logic inputs >		1-4	number defines wrong setting of logic input
>analog outputs>		1-4	number defines wrong setting of analog output
>times and sign>		1	wrong setting of failure duration
		2	wrong setting of flowing current check delay
		3	wrong setting of time delay between relay triggering
		4	wrong setting of keys repeat or inactivity
		5	wrong setting of sound signalization
		6	wrong setting of display view
>communication >		1	wrong setting of network address
		2	wrong setting of controller operation type in network
		3	wrong setting of other connected controllers
		4	wrong setting of controller baud rate
> print >		1	wrong print interval setting
		2	wrong print header setting
		3	wrong setting of print order number
		4	wrong setting of number of note lines
		5	wrong setting of program report print
		6	wrong setting of printer baud rate

> power checks >	1-8	wrong setting of power checks (without specification)
>program seting>	1	wrong setting of program type
	2	wrong setting of program termination
	3	wrong setting of program segments recording
	4	wrong setting of program segments print
	5	wrong setting of controller time units
	6	wrong setting of supply failure duration
> band x >	1	wrong setting of existing band x sensor
	2	wrong setting of band x function
	3	wrong use of band x parameters group dimension
	4	wrong setting of band x values print or record
	5	wrong setting of minimum, maximum or start input band x value
	6	wrong setting of measured band x value move
	7	wrong setting of band x line resistance compensation
	8	wrong setting of band x conversion type
>calibration x >	1	wrong band x calibration
> relay x >	1	wrong assignment of relay x to a band
	2	wrong setting of relay x function
	3	wrong setting of servo control logic (relay x)
	4	wrong setting of relay x triggering logic
	5	wrong setting of current flow check at relay x
	6	wrong setting of relay x hysteresis
>program record>	1	wrong setting of record interval
>program state >	1	wrong information about running program
	2	exceeding of allowable supply failure duration
>access levels >	1	wrong setting of log on time
	2	wrong setting of password use
	3	wrong password

Overshooting of allowable duration of controller supply failure when the program runs is an error as well. When the supply is restored the error is indicated and after initialization of a setting check it is displayed as follows:

```

> program state
  2
```

When this information is confirmed by pressing the **ENTER** key the controller returns back to the default state.

Controller output tests

If the controller is equipped with current flow sensors (toroid transformers) and checks are enabled (power checks), a complete test of the controller output circuits is performed after each controller and program initiation. In addition, in measuring mode (quiescent status) the current not flowing through the power circuits where a check is prescribed is permanently tested. Within a running program the current flowing at triggering of the appropriate circuit, and at all cut off outputs (except for the guarding relay) the current not flowing is tested.

Only phase conductor inputs for individual contactors or controller controlled semiconductor relays (SSR) can be connected through the passing current sensors. If the current flows in the system power circuits when the controller does not signalize triggering of contactors or semiconductor relays, the controller detects a failure, triggers the alarm and disconnects the protective contactor connected to the main power supply. Other device connections behind the passing circuits sensors can influence this function (e.g. motors, fluorescent lights or other devices equipped with over-voltage protection).

If tests proceed without errors, a message **with no errors** is displayed on the upper line. If any error is detected, details are displayed on the upper LCD line and on the bottom line there is the stage where the error was detected. Controller outputs failure is detected and the protective contactor cuts off if the failure state takes longer than the preset failure duration.

To cancel the failure state you must manually run controller outputs tests after removal of the failure (key 7 - **TEST, output tests** menu).

outputs test >				
	without errors			
	p.supply failure U-xx V-xx W-xx	where xx	oo	adequate phase test without errors
			no	current does not flow at right time (power switch circuit interrupted)
			ot	current flows at wrong time (short on power switch)
	safety switch f. U-xx V-xx W-xx	where xx	oo	adequate phase test without errors
			no	current does not flow at right time (power switch circuit interrupted)
			ot	current flows at wrong time (short on power switch)
	relay x failure U-xx V-xx W-xx	where xx	oo	adequate phase at relay x test without errors
			no	current does not flow at right time (power switch circuit interrupted)
			ot	current flows at wrong time (short on power switch)

All output relays (or SSR) including the protective contactor are tested in the power check. In the protective relay check only the protective relay (or SSR) is tested, other relays are on. In an individual relay check the protective contactor is triggered. The current flowing at time only the tested relay is on is tested, and not flowing of current when all relays except for the protective one are disconnected is tested.

VII.4. Key 8 (↑) – Information about controller operation (O)

By pressing the **8** - ↑ key the following will be displayed

```
controller info
version          >
```

You can select one of the provided options displayed on the second line with the ↑ and ↓ keys

```
version          >  this displays controller program version, serial number and manufacture date
max. values      >  this displays maximum value measured during monitoring time
min. values      >  this displays minimum value measured during monitoring time
contr. temperat>  this displays maximum achieved internal temperature during monitoring time
heating times    >  this displays heating time (individual relays trigger time) during monitoring time
clr.monitoring   >  this clears all monitoring registers
```

Program version and controller serial number - version

The program version and the controller serial number are displayed.

```
version x.xx.xx
serial xxxxxx
```

Press any key to display the production time and date.

```
production date
hh:mm dd.mm.yyyy
```

Press any key to display the program language version and input sensor table standard.

```
culture - CZ
tables ITS 90
```

Maximum values – max. values

This displays maximum value measured during monitoring time. If you open the menu max. values, the controller asks for the time within the selected values should be reached.

```
> last cycle    >  values achieved within the last program cycle
> monitoring    >  values reached from the time of clearing monitoring registers
>at production >  values reached from the time of controller production
>clr.monitoring> clearing of monitoring registers of selected item
```

Values achieved within the last program cycle

The values reached during the last program cycle are displayed on the controller display.

Values reached from the time of clearing monitoring registers

Values reached from the time of clearing monitoring registers are displayed, i.e. from the last register (accumulator) clearing. Registers can be cleared individually on the programmer or a higher level.

Values reached from the time of controller production

Values reached during the time of total controller operation are displayed, i.e. from the controller production.

Clear item monitoring registers

Clearing of monitoring registers of individual items can be done on the program creation level or a higher one.

Minimum values – min. values

This displays minimum value measured during monitoring time, display is equal as with max. values.

Controller temperature – contr. temperat

This displays maximum achieved internal controller temperature during monitoring time, display is equal as with max. values.

Heating times

This displays heating time (individual relays trigger time) during monitoring time, display is equal as with max. values.

Clear all monitoring registers – clr.monitoring

This enables you to clear all monitoring registers of the controller.

VII.5. 9 (PROG) Key – Program operations (O, P)

This key enables working with existing programs. Programs can be displayed, copied, moved and cleared. Programs can be protected against clearing by using program lock. Press the **9 (PROG)** key to display:

program numbr xx	
show	>

where **xx** substitutes a number of program which will be used in individual options (active program). If the active program is **locked**, after the word **number** there is displayed the character „ ~ “. To display the item you should accomplish all conditions.

<code>show</code>	>	show program	must exist
<code>edit</code>	>	edit program	must exist, unlocked
<code>new</code>	>	create new program	
<code>copy</code>	>	copy program	must exist
<code>delete</code>	>	delete program	must exist, unlocked, not running
<code>program record</code>	>	program record menu	must be placed
<code>select program</code>	>	program selection	
<code>run</code>	>	immediate program start	

Show program – show (O)

This enables to show selected program. The show depends on program type; programs can be controlled by time or by slope and time. The upper LCD line displays (left to right) the program number, the segment sequence number and its duration. The required controlled value of the first controller band is displayed on a green LCD, required values of other used bands are displayed on the bottom LCD line, from right to left. In addition, the states of relays that are controlled by program segment (relay to control servo, cooler, segment reach signalization and maximum band value monitoring) can be displayed.

Existing program modification – edit (P)

Program modification is similar to a recording of new program. In contrast to the recording you do not have to pass through a complete program, you can select only items to be changed. At the end of the program up to eight new segments can be added, or the last segment can be deleted. The first and last segments cannot be cleared. Recording program menu contains these items:

> section x	>	existing segment of program number x (1 to F)
> new section x>		add new segment at the end of the program (if it contains less than 15 segments)
> termination	>	segment of program termination – this must be in each program!
> relay x	>	program controlled relay parameters setting
> save changes	>	saving changes and program record termination. If you do not save the program or its changes, the program stays in the original form!
> quit	>	quit program record menu without saving
> delete last s>		delete last prog. seg. – only if program contains more than one segment

Recording of new program – new (P)

When you log on to the program creation level and after the **9 (PROG)** key is pressed, the program operations menu appears. Select **new** to enter a new program record.

```
program numbr xx
new >
```

The character „**xx**“ substitutes a program number. If the program exists, the controller offers to select a different program number. Select the required program number or confirm the request to overwrite the current program and the controller goes to a new program record.

```
program numbr xx
new section 1 >
```

The upper LCD line displays the program and segment number after confirmation. Further steps depend on the selected program type (in the parameters service setting, page 28). Considering **programs controlled by time only** you must enter **first segment duration, first band required controlled value** at the end of the first segment (green LED display) and sequentially remaining bands values (sequentially bottom LCD line, from right to left). When you need to enter a negative value with the keyboard, you should delete the displayed number and double click the „**0**“ key to enter the negative sign. Considering **programs controlled by slope and time** you must enter the common slope increase of the controlled value in units per hour (e.g. °C/h) for all bands, the required value to be reached and endurance of this value.

If a record or print module is placed in the controller and the item **record** or **print** in the program setting menu has been **selected**, the controller asks you to confirm recording of the last data for the first program segment,

```
record section
>>> record <
```

or not recording it.

```
record section
>>> record OFF <
```

Similarly asks you to print the segment,

```
print section
>>> print <
```

or not.

```
print section
>>> print OFF <
```

After confirmation the controller offers to record up to 15 other program segments where the character „ u “ substitutes a segment number (1 to F).

```
program numbr xx
>new section u >
```

If the program should not contain the full number of segments, you should press the ↓ key to select the program termination after the last required segment has been recorded.

```
program numbr xx
> termination >
```

The first program termination method chosen in the **program setting** menu in the option **program termination** appears. With the ↓ and ↑ keys you can select a different program termination method.

```
>>neverend hold<    infinite hold
>>control. fall<    controlled fall
>>noncontr. fal<    uncontrolled fall
```

When you select a termination method, the controller asks for parameters according to the selected termination method.

never-end hold	hold value is specified from last program segment
controlled fall	on the green LED display you can define the termination segment duration, on the bottom LCD line the controlled values in each band for the program termination when reached can be defined. The slope decrease of the controlled value in units per hour and the required time expiration to terminate the program have to be defined in programs controlled by slope and time
uncontrolled fall	only time expiration to terminate the program is defined

After selection of a program termination method and entering its parameters the controller moves to the status of program controlled relay setting. If some of the following relay features are set in the controller service setting, the required parameters in program writing should be defined.

control. by segments	program directly specifies relay status in every segment
band	relay operation is controlled by selected measuring band
servo	relay operation is controlled by selected measuring band
watching	relay operation is controlled by selected measuring band
cooler	relay operation is controlled by selected measuring band
segment reach	program segments reach

Setting controlled by selected measuring band means that the relay triggers and cuts off according to the band value. You can assign the measuring band to the relay in the relay setting on the service level. Individual relays parameters setting starts with a relay selection.

```
program numbr xx
> relay x >
```

After confirmation of the relay selection you get to the following relay setting.

Controlled by segments

Every program segment has defined a status where the relay stays for all segment duration.

```
123456789ABCDEFT
xxxxxxxxxxxxxxxxxxxx
```

There are program segment numbers on the first LCD line (**1 to F and termination segment marked T**). Under individual segment numbers the status of the relay in all segment duration is defined. Possible relay status is **cut off "f"** or **triggered "n"**. The desired relay setting is performed with the ↑ and ↓ keys, the desired segment selection is performed with the ← and → keys, and the setting must be confirmed by **ENTER**.

Band

First you must choose the program segments where the function **"band"** shall be valid.

```
123456789ABCDEFT
xxxxxxxxxxxxxxxxxxxx
```

There are existing program segment numbers on the first LCD line (**1 to F** and termination segment marked **T**). Under each segment number you can define whether the relay will be controlled within the segment duration according to the required value deviation or whether it will be off. Possible relay status is **permanently cut off "f"** or **controlled "n" (triggers)**. The desired relay setting is performed with the \uparrow and \downarrow keys, the desired segment selection is performed with the \Leftarrow and \Rightarrow keys, and the setting must be confirmed. The relay is **off** in the controlled program segments, if the controlled value moves within the given band about the required value corresponding to the controller band, and **triggers** when the controlled value goes out of this band. The band is specified with a positive and negative deviation from the desired value.

```
deviation + xxx
deviation - yyy
```

Both deviations can be defined within **0 to 250** units of the controlled value.

Servo

You can define the controlled values corresponding to the controller band when the relay triggers and cuts off.

```
off          xxxx
on           yyyy
```

See details in chapter VII, on page 25.

Watching

The monitoring value is specified. In case the current measuring band value exceeds this value by more than the specified hysteresis, the relay triggers. In case the current measuring band value falls below the monitoring value by more than the specified hysteresis, the relay cuts off. Hysteresis defines the band of insensitivity and avoids chaotic triggering of relay when controlled values oscillate closely around the monitoring value.

```
watching value
xxxxx
```

Cooler

In the desired band you can specify the reach value when the relay triggers during the **program termination segment** and stays on until the program terminates.

```
cooler switch on
xxxxx
```

Program segments reach

The relay status in all existing program segments reach (including termination segment), like with relays controlled by segments, can be selected. In contrast to relays controlled by segments, program segment reach signalization can be stopped in the running program operations menu, in the item Program segment reach signalization off.

```
123456789ABCDEFT
xxxxxxxxxxxxxxxxxxxx
```

With the \uparrow and \downarrow keys select the relay status in the desired \downarrow segment instead of character **"x"**. Relay can be **on - "n"** or **off - "f"**.

Program memory save

When all program segments are written and all used relays are specified, you should save the program so it is ready to be used for control. Use the option **"save changes"** and press **ENTER** to save the program.

```
program numbr xx
> save changes >
```

If you do not want to save the changes, press **DEL** to finish the writing operation or select the option **"quit"**. **The performed program changes are saved only by choosing the option "save changes" and pressing ENTER!**

```
program numbr xx
> quit >
```

After saving the program is ready for initiation and can be used for control.

Copy program - copy (P)

This enables you to copy the program to a different place, the original program stays without changes. After confirmation of the option the controller asks you to choose a target program number. Confirm and the system checks whether a program exists under this number. If the position is free, copying is performed and this message is displayed.

```
copy >
< DONE >
```

Then the controller returns to the program operations menu. If you choose an existing program, the controller checks whether the program is running. If the program is running, the controller displays a message that the running program cannot be overwritten in this way and after confirmation it returns to the target number selection.

```
running prg. xx
CAN'T rewrit it
```

Further the controller checks program lock. If the program is locked, the controller displays a message that the program cannot be overwritten and after confirmation it returns to the target number selection.

```
prg. x is locked
CAN'T rewrit it
```

If the program is unlocked, the request to overwrite appears.

```
prg. xx exist
rewrite? Y/N ?
```

After confirmation of rewriting the controller checks whether the target number differs from the active number. If the number is different, the controller performs the operation and displays a message about successful finish. In case of similar numbers this message appears.

```
source is same
as target !
```

Program copy does not include the program lock, therefore the copied program is always unlocked!

Delete program – delete (P)

This enables you to delete an active program. When the option delete is selected, the controller asks you to confirm the operation.

```
delete      >
> MAKE IT Y/N ?<
```

Press **ENTER** to confirm the operation, any other key to refuse. When confirmed by **ENTER**, the controller deletes the active program and displays a message about operation finish.

```
delete      >
<  DONE    >
```

Press any key to confirm this message and the controller returns to the program operations menu.

Program record (O)

If a memory for records is not installed, this option will not appear. Program records are saved in eight directories. This option enables you to view, print and delete program records in individual directories. You can also find out information about available memory space and specify a time interval to save records. Entering the record menu the controller displays:

```
>R# a-y l xxxxx>
>  show      >
```

The first line contains information about the selected record directory "**R#** ", where **#** is the directory number, it can be **1 to 8**, "**a-y**" is an indication about record status (a - activity) where the character y substitutes the record status.

- F** free – record is free
- R** running – the controller is executing a program whose process is recording, this record cannot be deleted
- D** Done – the record is valid, you can view, print, delete and lock the record

If a record exists, information about record lock "**I**" and the number of record items "**xxxxx**" is displayed. Record lock "**I**" contains the following options (same options as for programs are valid):

- U** unlocked – you can delete and overwrite the record
- O** locked on operator level
- P** locked on program creation level
- T** locked on technological level
- S** locked on service level

Program record options always operate with the record whose number is displayed on the first line.

```
> show      >  show record          cannot be free
> print out >  print record          cannot be free and any program need not run
> clear     >  clear program       cannot be running or locked
> free space >  remaining free space in record memory
> lock      >  record lock           must be finished
>select another>  select another record directory
```

If there is no other record in the memory, this option contains only **free space** and **select another**.

Show record

This enables you to view segments and individual items of an existing record.

Print record

This enables you to print an existing program record. **To avoid collision with the appropriate printing of the running program, the record cannot be printed if the program is running.** Information about the print record procedure is displayed during printing.

```
>R# a-y l xxxxxx>
printing is busy
```

After the program header is printed the number of printed items is displayed after the message "printing is busy". Printing ends when the message "done" appears.

```
>R# a-y l xxxxxx>
< DONE >
```

Press any key and confirm with **ENTER** to interrupt the proceeding print.

```
>R# a-y z xxxxxx>
interrupt Y/N
```

Clear record

This performs clearing of unlocked existing record.

```
> clear >
> MAKE IT Y/N? <
```

Press the **ENTER** key to confirm and the record is cleared, then press any key to return to the record menu.

Remaining free space in record memory

The controller counts and displays free space in the record memory. On the first line there is the free space in bytes and on the second line the recalculated value in controller time units.

```
record xxxxx B
time yyyy u
```

Record lock

Record lock is performed after completion, unlocking is possible on the same or higher level.

```
> lock >
> unlocked <
```

Select another record directory

```
> R# a-V >
< free >
```

or existing.

```
>R# a-ylz xxxxxx>
hh:dd dd.mm.yyyy
```

Finish time and date are displayed at the existing record.

Selection of a program – select program (O)

It enables to choose different program than the last used. By pressing the **9 (PROG)** key the following will be displayed

```
program number x
show           >
```

By pressing the **3 (↓)** key again

```
program number x
select program >
```

By pressing the **ENTER** key

```
select program >
> prog. number >
```

By means of the ↓ and ↑ keys on a second row of the display it is possible to choose different means of the program selection.

- > prog. number > After confirmation of this item it is possible to enter directly the number of the chosen program
- > free > To choose the number under which there is no program saved
- > existing > To select an existing program

After confirmation of the program selection according to the program number it is displayed

```
select program
                xx
```

where on the place of the last **x** symbol the cursor is blinking over the number of the program last used. After writing and confirming the selected program number a list of operations which can be done with a newly chosen program is displayed. Its form depends on if the selected program already exists (then the full list of operations with the program is available) or not (only creating of a new program is available).

When choosing the program according to remaining criteria, i.e. **free** or **existing**, the controller searches programs memories and on the display it subsequently ranges corresponding programs according to their numbers. **A recent program (last used) is marked with the „ *symbol.** In the list of the programs it is possible to move by means of ↑ and ↓ keys.

Immediate program start – run (O)

Program is initialized immediately after successful controller test procedure.

9 (PROG) key with running program (P)

When the program runs and the **9 (PROG)** key is pressed the controller offers only a possibility of adjustment or display of the running program. Simultaneously it continues in its activity. At the adjustment of the program

```
program number x
edit           >
```

Adjustment of the running program is performed in the same way as in the case of stopped program. It is possible to adjust individual program sections, add new sections up to the total amount of fifteen sections or it is possible to delete the last program section (**it is not enabled to delete first and ending section, these sections has to be in all programs!**). When all required adjustments are done and the adjusted program is saved the controller asks if the saved changes shall be used with the running program.

```
run.prog.changed
accept now ? Y/N
```

After confirmation by pressing the **ENTER** key (**choice YES**) the controller continues in the activity with the adjusted program. By pressing any other key (**choice NO**) the changes will be applied after next start of the program.

Key 0 (START) – Program start (O)

This key function depends on the program running status. If no program is running, press the **0 (START)** key and the controller offers to run the last used program.

```
start prg. xx
now >
```

According to the controller equipment (programs runtime record module or printer module installed) you can choose other options of selected starts of program. The controller remembers the last selected program start method for easy operation.

```
now > immediate program start
delayed > delayed program start
now + Record > immediate program start with record
delayed + Rec. > delayed program start with record
now + Print > immediate program start with print
delayed + Print> delayed program start with print
now+Print+Rec. > immediate program start with print and record
delay+Print+Rec> delayed program start with print and record
select other pr> select another program
```

Immediate program start - now

Program is initialized immediately after successful controller test procedure.

Delayed program start - delayed

Before you specify the required time and datum of program start, it is suitable to verify whether the entered data are real and correct possible errors.

```
prog. start time
hh:mm dd.mm.yyyy
```

Data can be entered with a keyboard, after confirmation the start time and datum are recorded and the controller waits for the required time. During the waiting period the program number intermittently appears with the time remaining to start and the entered time and datum of the program start on the bottom display line. The controller normally works, the **0 (START)** key has the same function as for a running program.

Program start with print – now + Print

If an order number print is submitted, the controller requires its specification and confirmation.

```
>order number >
xxxxxxxxxxxxxxxxxxxx
```

Program start with record – now + Record

Firstly, the controller offers the option to select the current record directory where the record will be saved. Select the record directory in the list of records. By each record it is displayed if it is free,

```
> R# a-F      >
< free       >
```

or existing.

```
>R# a-y l xxxxx>
hh:mm dd.mm.yyyy
```

By an existing record the finish time and date are displayed. If you select a locked record directory, the controller displays a message that the directory cannot be overwritten and offers another directory selection.

```
record x is lock
CAN'T rewrite !
```

After confirmation of the selection the controller deletes this directory and writes in information about the recorded program and record interval.

Another program selection – select other pr

This enables selection of another program for initiation and define it as current. The selection proceeds in the same manner as in the program selection menu on page 46.

VII.6. Key 0 (START) – Running program control (O)

If a program is running or the system is waiting for the delayed start, the controller offers termination of the running program after the **0 (START)** key is pressed.

```
running prg. xx
terminate prg. >
```

With the ↑ and ↓ keys other running program control options can be selected, the menu is available on all operator levels.

<code>finish signal</code>	finish signalization of program segment reach (if used and it is active)
<code>terminate prg.</code>	running program is terminated and controller returns to measuring mode
<code>go to next</code>	controller goes to next program segment
<code>go to xx</code>	controller goes to program segment number xx
<code>stop / start</code>	pauses / continues (after this item reselection) program running, running program time is paused / started

The running program pause

After confirmation the running time of the program is stopped, by this an increase of a temperature required is stooped at a reached value. At the same time a notice **! Paused !** is blinking on the LCD display. In all controlled bands the controller will keep the temperature, which shall be reached at the moment of pausing the running of the program. By pressing the **0 (START)** key again the controller offers as a first option to continue in the program running (notice **start / stop**).

VII.7. COMMUNICATION PROGRAM

If the R500 controller is equipped with a module for communication with a computer, the communication program RxCommander is also supplied. The program ensures communication of several controllers with a computer through a serial port. When the controller is equipped with the RS485 module, it is necessary to use the suitable RS485 / RS232 (not supplied) converter. The RxCommander directory should be copied to a suitable space on the computer disk. If the program **Microsoft.NET Framework** is not installed on the computer, you should install it from the supplied disc. Windows 98 or later must be installed on the computer.

Program RxCommander can be started by means of an icon on the screen of the computer, which shall be created at the program installation, or from the menu Start of the computer. When the program starts the window with buttons for basic control of the program is opened.

file	this enables only termination of running communication program
connection	this provides controller connection and change its address using computer
setting	this enables basic RxCommander program setting
R500.x	this enables read and write controller parameters, create, modify and initialize saved programs. This button displays after establishment of successful connection between the R500 controller and a computer. Several devices can be simultaneously connected to the PC via the RxCommander program (controllers R500, R251 or MR51, "x" displays sequence number of connected controller – e.g. R500.0; R500.1; R251.2 etc.)

File

This enables only the option to terminate the running RxCommander communication program (key **Terminate**).

Connection

This provides controller connection and network address setting.

connect	this ensures controller connection to a computer
address setting	this enables controller network address setting using a computer

Connect

After pressing the **Connect** key a window opens with a selection of used computer serial ports and a controller network address (you can define 1 to 240). The address can be changed from the technological level using a keyboard (**6 (KONF)** key), select **communication**, item **network address**. After changing the controller address connection of controller to a new address is needed. If the correct address and port number are defined, press the **connect** key. The controller connects to the computer. If the message **R500.x** appears in the program window, measured values and the controller current (running) time are displayed. Further, the message **system OK** appears. The controller must be in the measuring mode during communication with the computer. Within the utility state, i.e. when the controller is controlled via its keyboard, communication is interrupted and restored after jumping to the measuring mode (**DEL** key). By pressing any other key with the connected controller the communication interrupts and displays the message: **r500.x – unable to get data**.

Address setting

This item enables setting of controller network address using a computer. After entering the controller serial number a new network address can be defined. When the address is changed, the controller stops communicating with the original address, should be disconnected (**R500 x** menu, **disconnect** key) and connected to the new address.

Setting

This is designed for basic RxCommander setting. Either Czech or English program version, automatic controller connection at initiation and the interval of automatic reading of measured values and controller time (in seconds, minimum value is 5) can be chosen in this item.

R500.x

This menu is available after controller connection to a computer and contains the following items. Instead of **x** the sequence number of the connected controller is displayed.

setting	basic controller parameters reading or writing
login	parameters to login, operator log on and log out setting
information	reading of controller statistical information
programs	control programs reading, writing and initiation (termination)
tests	controller setting and running tests
program records	displaying of records about control programs execution
version	this displays controller type, version, serial number and manufacture date
refresh	Immediate restoration of measur. values and time of the controller in the window of the program RxCommander (except an interval of an automatic reading selected in Settings)
disconnect	R500 controller disconnection from computer
monitoring	Graphic display of the controlling program running

Setting

This enables reading controller parameters and even changing them which is depending on the operator level. By pressing the **Read** key you can display controller settings, edit them and by pressing **Set** key record them on the controller. To perform controller changes using a computer it is necessary to log on to the suitable operator level in the **log on** menu. Successful operation performance is always confirmed by the message "**Operation successfully performed**", if the login level does not correspond to the required level, the message "**Access denied**" is displayed. Details about individual items including possible values are described in the operating manual.

control parameters	setting of control parameters	available from level T
bands	setting of control bands	available from level S
logic inputs	setting of logic inputs	available from level S
output relays	setting of output relays	available from level S
analog outputs	setting of analog outputs	available from level S
service setting	setting of parameters service	available from level S
power checks	setting of current power checks	available from level S
communication	controller communication setting	available from level T
print	print setting	available from level T
time and date	setting of controller clock	available from level P
program setting	setting of program parameters	available from level P
manufacturer setting	controller manufacturer setting	available from level M
export/import sett	export/import setting controller	available from level S

Log on

This enables you to log the controller on to the PC and set login parameters to log on to particular operator levels. The login, password use and password change are similar to the manual operation described in chapter VI on page 10. Changes in settings can be performed after adequate level login, options

dependant on the log on level only are available. Therefore, firstly you should log on to the desired level and then perform the required setting. Similar to manual control you can change settings on a lower level than the current log on level even without knowledge of the level password, to change the password or its use on the current level you should know the original password. In login settings using the **Read** key, read the current setting, the **password** key opens a dialog for password change and its use change, the **Set** key confirms the performed changes.

log on this enables you to log the controller on to the PC on the required level. During first log on you should enter the required parameters in the **setting** menu

setting setting parameters to log on to individual operator levels. It enables you to define the log on time and the password use on the three lowest operator levels (device operator, program creation level and technological level). **On the service and manufacturer level password use is obligatory and the password cannot be changed.** The listed parameters setting can be different for manual control using controller keyboard and for remote control using PC.

If the utilization of passwords is not necessary, it is recommended to log in on a servis level after the installation of the program (button **R500.x**, menu **přihlašování (login)**, item **přihlásit se (login)**), then to choose setting item (button **R500.x**, menu **přihlašování (login)**, item **nastavení (settings)**) and disable step by step at three lowest level the utilization of passwords. Even if the utilization of passwords at three lowest levels is disabled it is convenient to set at these levels some simple and easy-to-remember password, e.g. 0000. If the password is inserted by inadvertency, it is possible to log in using this password and disable its utilization. At servicing and production level the utilization of the password is obligatory and the password cannot be changed.

Set time of login validity determinates how long inactivity leads to the automatic logout. **If the set time of login validity is 0 the login is not limited by the time and possible logout has to be performed manually.**

Information

This item enables displaying data about the controller operation within the last control cycle, the monitoring period (from the last appropriate register clearing) or since its manufacture, see page 41 in the operating manual. Furthermore, displaying the number of controller turns on and the number of program starts is available in the option **Global**, at the last four controller initiations turn on and off time are displayed.

Programs

This item enables you to select, read or edit control programs saved in the controller memory. You can start or terminate the selected program using the computer if necessary. When opening this option, a program editor to perform the desired operations opens. There are keys for the program number (0 to 99) selection in the upper part of the editor. In the bottom part there are **Lock**, **Run** (in running program changes to **Terminate**), **Read** and **Set** keys to control the selected program. Individual program segments including the termination segment and one field for a new segment record (with the message **not existing**) are displayed in the middle part. If some relays are controlled by program, i.e. with the feature **segments controlled, band, servo, monitoring, cooler** and **segment reach**, their setting is displayed. Parameters to be set in relays controlled by program are listed on page 41 (new program record). After choosing the corresponding program the program is read at first and it can be operated afterwards.

Considering the existing program segments, opening the edit menu for this segment (**change** or **new**) or deleting them (**delete** key) is available after selection of existing program segments and right mouse button clicking. Using the **change** key sequentially change of the selected segment parameters (e.g. change only one value) can be done, by pressing the **new** key all segment parameters are cleared and new parameters should be entered. Each program has to obtain at least one segment and the termination segment, both cannot be deleted. Therefore, in a program consisting of one segment and the termination segment only the change option is displayed. At field for the new segment record the option to create a new segment appears (**new** key) after clicking the right mouse button. If the change of a program segment setting without deleting is needed, entering to editing segment is available even after double clicking the left mouse button. If the change of setting of relay controlled by program is required, mark the proper relay using the left mouse button and click the right mouse button to open a setting dialog window after highlighting.

By pressing **OK** the performed changes in individual segments and relays are written into the program editor, after all desired program segments editing and relays setting the changes are saved in the controller memory using the **Set** key. **Without this saving the new setting is written only in the program editor and after closing the editor without saving in the controller the new setting is deleted!**

Press **Run** to run the selected program, if any program is running, the key is changed to **Terminate** and it enables terminating of the running program. After closing the program editor within the running control program, the data about the running control program (program number, processing segment, each band required value, individual bands measured values and running time of given segment) are displayed in the RxCommander program window.

Press the **Lock** key to open a window with the program records locks setting. First you have to log on to the required level to perform changes. Therefore, firstly log on to the desired level and afterwards perform the necessary settings. Similarly with manual control, you can change the settings of a lower level.

Tests

This enables running controller tests and displaying their results, this option is not currently available yet.

Program records

If the regulator is provided with a recording program unit it can save records of a controlling program running to up to eight directories of its internal memory. Menu **programs records** enables to display these records. At the program start it is necessary to select **program start with recording** and by means of arrow keys on the keyboard to choose the directory for recording. At opening the item for reading of recorded data from the controller a window of records is displayed. By means of eight bookmarks it is possible to open the data from single directories of the controller. After opening the data from selected record are displayed in an opened window and by means of the button **File** it is possible to export them to a file (**Export**) or display a controlling cycle process in the program RxCommander (**Monitoring**). The last function of the **Soubor** button is a possibility to close the window for reading of recorded data (**Close**). In the bottom part of the window there are buttons for locking a record (**Lock**) and for deletion of a chosen record (**Delete**). File format enables to import the file to the program Microsoft Excel. **TAB** keys is used as a separator.

Version

This enables you to display the connected device type (R500, R251, MR51), its program version, the serial number and the production date.

Refresh

A menu enables to read measured values of controlled quantity and time of the controller beyond set interval of automatic reading (button **Settings** of a basic program window).

Disconnect

Exit option to work with selected devices R500x, (R5251x) where x substitutes the connected controller sequence number. RxCommander will not be closed, only the selected controller is disconnected. The RxCommander program is closed using **File** and **Exit**, this disconnects all connected devices and closes the program.

Monitoring

Graphic display of the controlling program running.

VIII. CONTROLLER SETTING SUMMARY

Key	Menu	Other	Items	Setting	Note
6-KONF	control param. (T)	group x A	time const.	1 - 250	page 16
			allowable dev	1 - 250	
			propor. const.	1 - 250	
			deriv. const.	0 - 250	
			integr const	0 - 250	
			watching dev	0 - 250	
			control type		page 17
	groups count	1 - 5			
	groups dimens.	1- band c.			
		copy group			
	bands (S)	band x	function		page 18
			sensor		page 19
			lower bound		page 20
			upper bound		
			minim. value		
			maxim. value		
			printable		
			recordable		page 21
			contr.dimens.		
			value offset		
compen.cable					
conversion t.					
logic inputs (S)	logic input x	function		page 22	
		logic			
output relays (S)	relay x	function		page 23	
		driven band		page 25	
		logic			
		servo funct			
		current check			
hysteresis					
analog outputs (S)	analog outpt x	function		page 26	
		logic			
		driven band			
service setting (S)	program type	only time		page 27	
		slope + time			
	time units	minutes (h:m)			
		seconds (m:s)			
time to alarm		0- 250s	page 28		
power checks (S)		current flows check			

6-KONF	communication (T)	net. address		0 – 240	page 28	
		find connected				
		show connected				
		unplug all noc.				
		operation mode				
		baud rate				
	print (T)	order number		do 16 ch.	page 29	
		print interval		1 – 60		
		print header				
		print order. #				
		#.note lines		0 – 15		
		print program				page 30
		#.lines in end		0 – 15		
	time and date (P)	Controller clock setting				
	program setting (P)	supply failure		0-250	page 31	
		display	time			
			counted v			
			target values			
		terminate prg.	neverend hold			
			noncontr. fall			
			control. fall			
		start repeatly	NO			
			YES			
		record	all			
			selectet			
		record interv		1-250		
	print	all		page 32		
selestet						
sound signal	on					
	off					
manufact setting (M)	band count	Only informatively				
	input range					
	map log inputs					
	map relays					
	map an. outputs					
	record memory					
	communication					
	printer					
hand operation (P)	output relays	page 33				
	analog outputs					
	logic inputs					
	power state					
	contr. temp.					

7-TEST	controller tests (O)	runtime test		page 34
		setting test		page 35
		output tests		page 37
8- ↑	controller info (O)	version		page 38
		max. values		page 39
		min. values		
		contr.temperat.		
		heating time		
		clr.monitoring	Available from (T, M)	
9-PROG	program number x (O, P)	show		page 40
		edit		
		new		
		copy		page 43
		delete		page 44
		program record		
		select other pr		
9-PROG	program number x (O, P)	show	Only at running program !	page 46
		edit		
0-START	start program x (O)	now		page 47
		delayed		
		now + Print		
		delayed+Print		page 48
		now + Record		
		delayed+Record		
		now+Print+Rec.		
		delay+Print+Rec		
		select other pr		
0-START	terminate prog x (O)	finish signal	Only at running program !	page 48
		terminate prg.		
		go to next		
		go to xx		
		stop / start		
1 to 5	active parameter (O)	Parameters group quick selection (if used)		page 14

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X. WARRANTY

The manufacturer provides warranty for failure free controller function for 24 months from the date of putting the controller into service, however the longest warranty period is 27 months from the date of sale to the customer. Within this period the manufacturer performs all repairs of failures caused owing to defects in materials or latent defects for free.

The warranty does not cover failures caused owing to mechanical damage of the controller, incorrect connection or improper use that the product is not designed for, breakdown in operation or storage conditions and not respecting the manufacturer's instructions. This device should be installed by authorized person only and has to follow the manufacturer's guidelines.

During the warranty, the manufacturer usually repairs failures within three working days, place of service is the manufacturer's workshop. Different conditions should be agreed with the manufacturer.

! Important notice !

In case of input sensor failure (e.g. thermocouple circuit), input amplifier or converter failure, the controller can indicate an incorrect controlled value (e.g. stove temperature). The controller's manufacturer is not responsible for connected losses. The manufacturer recommends protection of the controlled system using a second independent circuit that disconnects e.g. heating in case of exceeding maximum allowable temperature.

XI. OPERATING CONDITIONS

The controller can be operated in an environment protected against weather conditions, radiating heat, coarse contamination and aggressive vapors.

At thermocouple inputs the temperature value is measured against the ambient temperature detected by the temperature sensor placed at terminals for thermocouple connection. If thermocouple compensation leads are not at the controller terminal plate, the temperature value is influenced by the error of the temperature difference between this place and the end of the compensation leads.

Supply:	230V (+10, -15)% / 0,1A /(50 , 60)Hz
Dimension:	96 x 96 x 180mm (assembly hole 92 x 90mm)
Coverage:	IP50, IP54 optional
Operating temperature:	0 to +40°C
Storage temperature:	-40° to +65°C
Humidity:	max. 80% within 20°C
Dustiness:	max. 0,5mg/m3 inflammable and non-conducting dust

Production number:

Manufacturer's address, orders, technical specifications:

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