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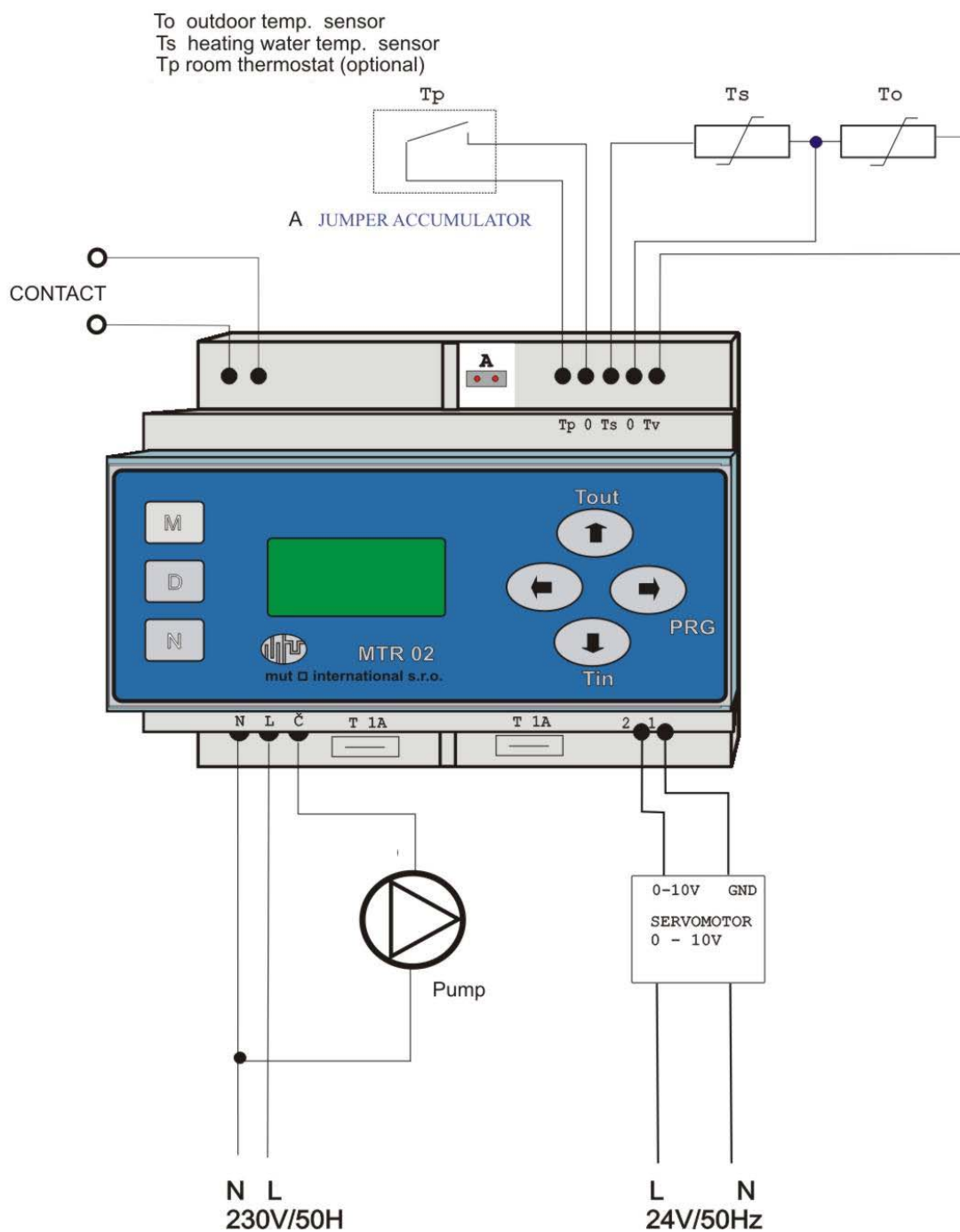
## **MTR02 Equithermal Heating Circuit Control Unit Installation and Operation Guide (Version 4.1)**

March 2006

*The manufacturer confirms that a Certificate of Conformity has been issued for this product in accordance with Act No. 22/97 and Government Decree Nos. 281 and 282*

**Important: Before starting to use the control unit, study the enclosed Guide carefully. The control unit must be installed in accordance with applicable regulations.**

## Equithermal heating circuit control unit – wiring diagram

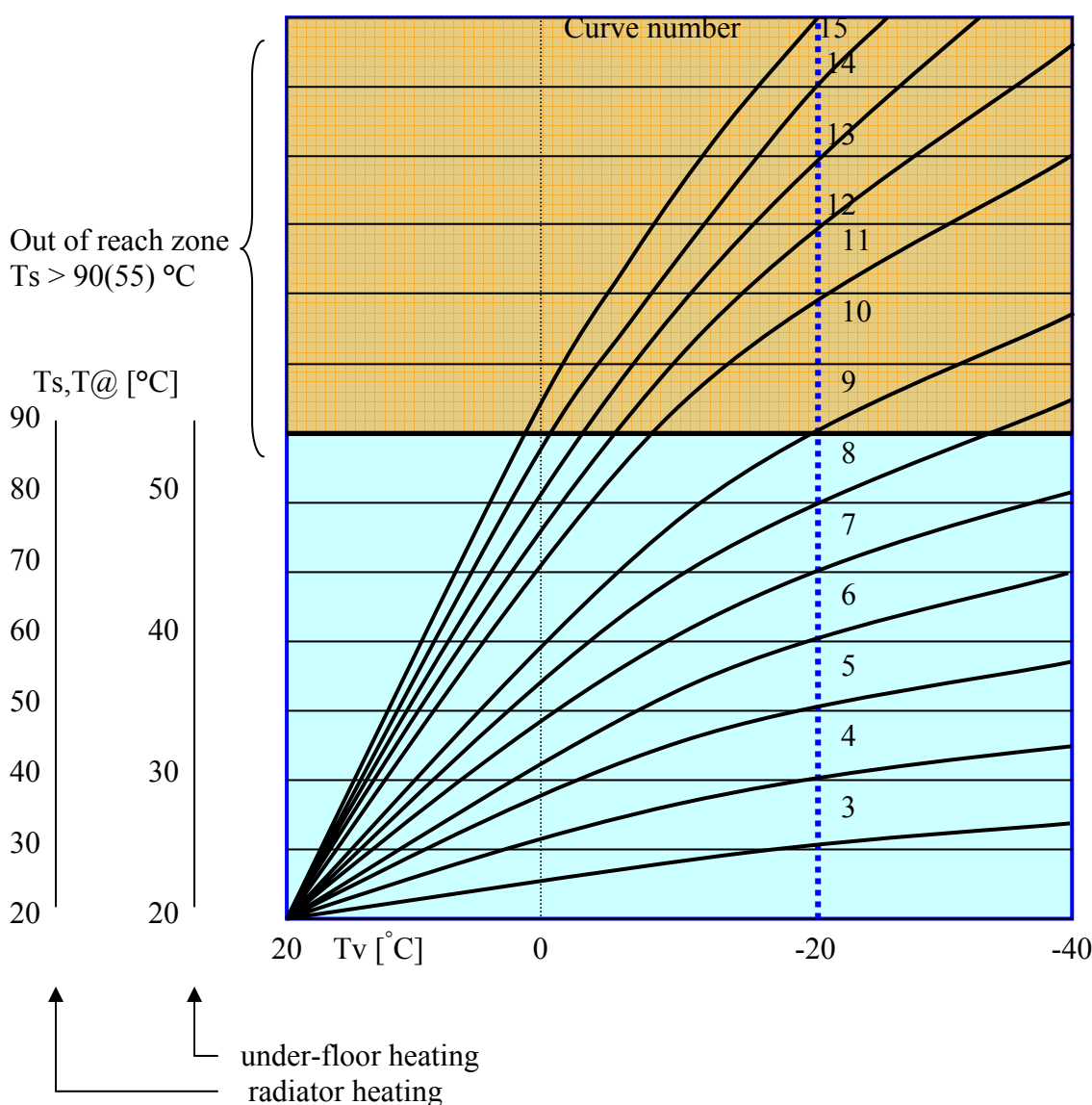


## Equithermal heating circuit control unit

The MTR02 is a PID control unit designed to control an 0 – 10 V actuator-controlled blending valve and pump in the heating circuit. The control unit can be used in all kinds of hot-water systems (radiators, under-floor heating) which are equipped with a blending valve.

Heating water temperature can be controlled by one of the following methods:

- **equithermal control** – the control unit determines the heating water temperature as a function of outdoor temperature and a selected equithermal curve
- **equithermal control in conjunction with reference space temperature** – the control quantity is a difference between the required room temperature and the actual room temperature. The control process also works in conjunction with the selected equithermal curve
- **control with programmed lowering of the equivalent heating water temperature** – the control unit switches at the programmed time to the selected lower equithermal curve
- **control with programmable attenuation of the space** – temperature and attenuation in the space is taken over by a programmable room thermostat. The control unit controls the heating water temperature according to the set equithermal curve



### Equipment protection

- outside of the heating season the pump and the actuator are protected by daily start-ups
- radiator and under-floor heating is protected by switching the pump off when outlet temperature  $T_s$  exceeds  $90^{\circ}\text{C}$  and  $55^{\circ}\text{C}$ , respectively / it is not an emergency function (Version 4.2 and later)
- by switching the pump off when  $T_s$  temperature sensor fails (lost contact, short circuit), and displaying an appropriate message on the display (Version 4.2 and later)
- by installation and user code to prevent unauthorised access

### Operation

- simple operation - 7 buttons
- displays status and program steps on an alphanumeric LCD display

### User

- temperature measurements
- switching the control unit ON/OFF
- setting the clock and calendar
- setting weekly heating program
- setting holiday mode
- setting equithermal curve correction (vertical shift  $+T_s$ )
- setting thermometer corrections

### Technician

- all user functions
- setting control parameters
- testing

### Control unit

- |                              |   |
|------------------------------|---|
| - power supply               | 230 V + 10% -15%, 50 – 60 Hz                                    |
| - permissible excess voltage | category II by IEC 664  |
| - input                      | 1.8 VA (separate control unit)                                  |
| - outlet pump                | 230 V, 50 Hz / 1 A max  |
| - nominal current            | 5 mA.....1 A ( $\cos \varphi > 0.6$ )                           |
| - outlet pump fuse           | T 1 A   |
| - outlet CONTACT 36, 35      | galv. isolated contact, max 230 VAC/30 VDC/1 A<br>min 5 V/10 mA |
| - modulated output           | 0 – 10V   |
| - max. operating temperature | 5 to $40^{\circ}\text{C}$                                       |
| - maximum humidity           | 80%   |
| - cover                      | IP20  |
| - dimensions                 | 90 x 106 x 60 mm <sup>3</sup>                                   |
| - weight                     | 400 g   |
| - temperature sensors        | NR355 thermistor, 20 k $\Omega$ / $25^{\circ}\text{C}$          |
| - memory backup              | 1 month (at max. temperature $25^{\circ}\text{C}$ )             |
| - battery                    | NiCd 3.6 V 65 mAh   |

Contains cadmium, when disposing, do not throw into communal waste containers, only sorted waste

## Description

The control unit performs all standard functions of an equithermal control unit designed to control heating program in buildings equipped with a hot water boiler and a blending valve:

- measures outdoor temperature ( $T_v$ )
- computes the required heating water temperature according to selected temperature ( $T@$ )
- measures and controls heating water temperature ( $T_s$ ) with PID characteristic  
(gradual step-by-step resetting of the blending valve according to heating temperature difference)
- parallel shifts in characteristics
- is equipped with a real time clock and calendar for years 2005 – 2099
- programming of week schedule mode and holiday mode
- daily short-time switching on motors outside of heating season
- manual of remote control setting of modes DAY, NIGHT, MAX output

Other control unit's functions:

- displays outdoor temperature  $T_v$ , computed equivalent temperature  $T@$  and temperature inside the system  $T_s$
- two-code protection against unauthorised access (technician, user)
- outlet tests (outlet function test, actuator and pump connection and function test)
- controls temperature in reference space according to a connected room thermostat by controlling the circulation pump
- limits temperature by switching the pump off when the outlet water temperature  $T_s$  exceeds 90°C and 55°C, respectively (Version 4.2 and later)
- multilingual menu

## Installing the control unit

The control unit is placed in a plastic case of 90 x 106 x 60mm dimensions. Controls are situated on the front wall and consist of an LCD display, four foil control pushbuttons and four buttons for emergency control of the control unit's functions.

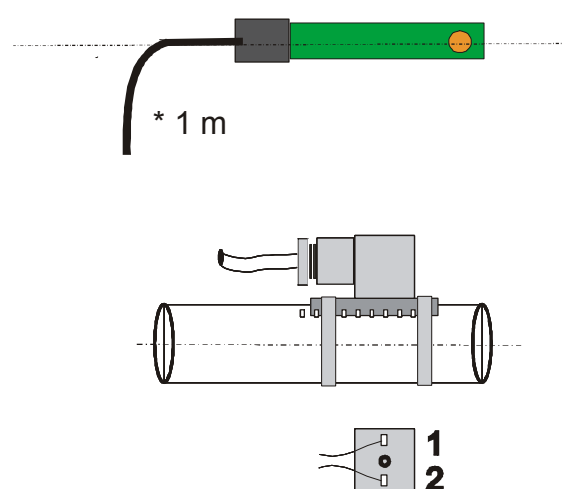
The box is designed for upright mounting on a DIN board of the terminal box. The rear wall of the control unit is shaped for mounting on the board without any fasteners. The instrument is mechanically secured on the DIN board by a flexible lock which is part of the control unit box.

The MRT01 control unit must be installed by a technician with applicable electrical engineering qualification. All applicable regulations must be observed. The control unit is wired to screw-on terminals as shown in the wiring diagram on page 2. Power must be supplied by a cable with a minimum cross-section  $3 \times 0.75 \text{ mm}^2$ , the rating of fuse  $P_o$  must not be greater than T 1 A.

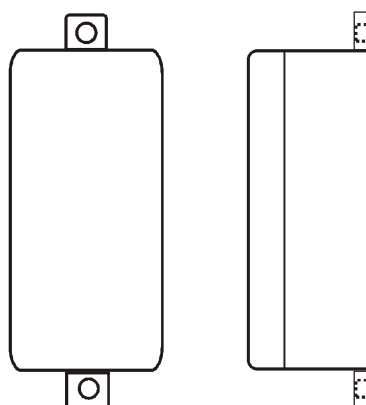
### Installing outdoor temperature sensor - Tv

The outdoor temperature sensor must be located in a plastic box of protective cover IP 54 and dimensions 76 x 76 x 36. The box is mounted on the building's external wall (preferably northern or north-western) at the height of about 4 m in such a way that it is not affected by heat escaping from the building and/or by sunshine. It is wired to the controlled unit by a two-core cable. Do not lay the connection cable in parallel with power cables.

Heating water sensor - Ts



Outdoor sensor - TV



Minimum sensor wire cross-sections depending on the wire length:  
 $\leq 20 \text{ m: } 2 \times 0.5 \text{ mm}^2$ ,  $\leq 50 \text{ m: } 2 \times 1 \text{ mm}^2$

### Installing heating water sensor - Ts

Heating water sensor is installed on the outlet piping beyond the blender and circulation pump, fastened with the provided flexible strips. The contact surface must be clean (remove paint). The sensor must be fastened to the surface firmly. Use thermally conductive paste and prevent any effects of foreign heat sources.

### Wiring actuator 1 2

Any actuator with proportional control 0 – 10 V can be connected to the control unit.

Outlet terminal 1 ... signal earth

terminal 2 ... voltage signal 0 – 10 V

### Contact 36 35

Galvanically isolated contact outlet for controlling the heat supply and/or for transmitting information to the master system. The contacts close together with the pump, and open when the thermostat contacts open and when Tmax is exceeded.

### Wiring the pump

Any circulation pump with 230 VAC power supply and maximum consumption 1 A can be connected to the control unit.

### Room thermostat, remote control -Tp

Any room thermostat with contact outlet and function of switching the circulation pump ON/OFF can be connected to the control unit (the room temperature contacts open when the room temperature exceeds the set value and close when the temperature drops below the set value). **Using a room thermostat with MUT remote control will enables manual setting of the control unit to normal day mode regardless of the just running programmed weekly or daily mode (room thermostat switch PRG – NIGHT – DAY).**

## Putting the control unit in service

**Start** – when the control unit is connected to power mains, the value **00 : 00** will appear on the display (00 hours, 00 minutes, date 1.1.2006), and start counting the time (incremented in one-minute steps).

**Backup battery** – is wired with jumper **A**. The battery then assures that all set values and real time are saved in the event of power failure, or when the control unit is disconnected for a short time (up to about a month).

Important: power supply should not therefore be disconnected for a protracted period of time – e.g. for the entire summer season.

**Control** – now the control unit is ready to function. It controls according to equithermal curve 9 (heating water temperature 90°C at outdoor temperature –20°C) and other parameters – see “Factory setting” in chapter Programming. All parameters can be reprogrammed.

**Resetting the control unit to factory (default) setting** is done by disconnecting the unit from power supply for about 10 s and then reconnecting it again. When switching the power on, button ▼ must be held pressed until a text appears on the display – then confirm the reset by pressing ►, or by pressing ◀ switch the control unit back to the last setting.

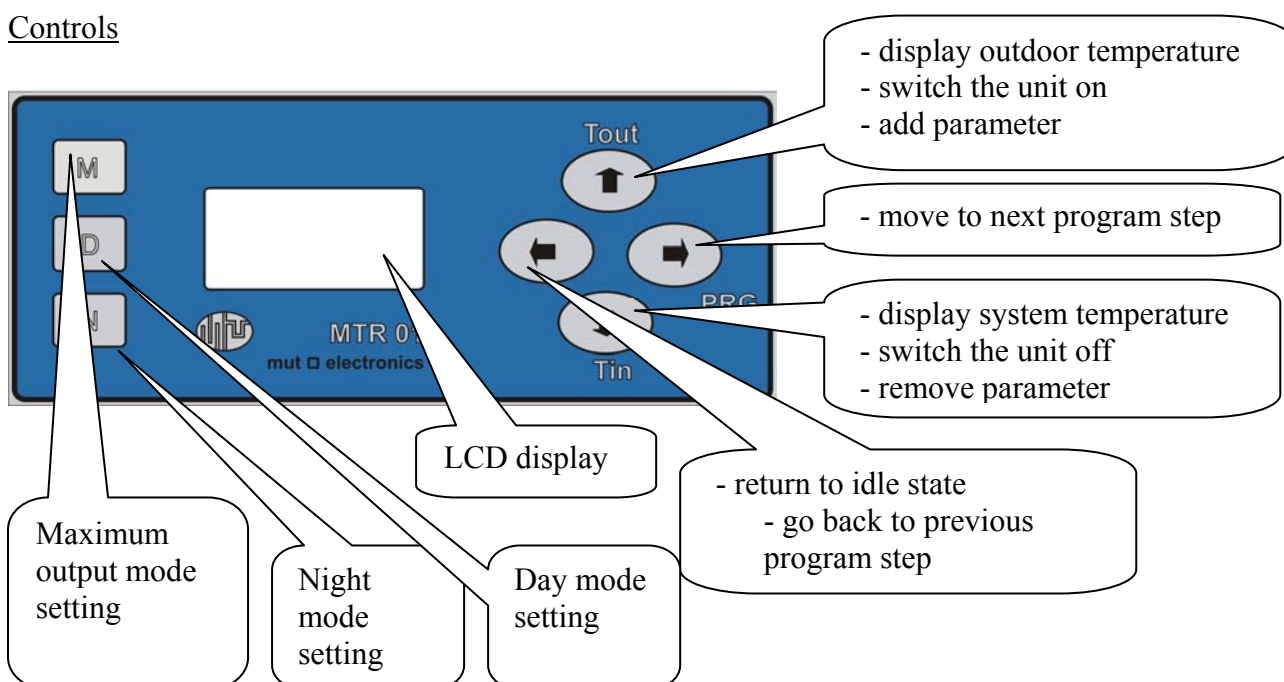
reset ?  
no< >yes

Important: In a similar procedure by keeping the button depressed you can display the program version and serial number of the control unit, for example:

ver. 5.31  
12345678

## Programming the equithermal control unit

### Controls





## Idle state

Displays      time    (HH hours MM minutes)  
                  Heating mode day or Night (D / N)  
                  Outdoor temperature Tv (press ▲)  
                  System temperature Ts (press ▼)  
                  Computed equithermal temperature T@ (press ▼ repeatedly)  
                  Please note: T@ is computed and hence a changed  
                  value displayed only if the control unit is ON and  
                  only at control intervals (otherwise the last value  
                  remains displayed)

HH:MM    D/N  
 Tv/Ts/T@

Switch to Max. heating output by pressing **M**  
 Set running time at max. output with ▲ ▼

max                    **M**  
                              .... h

Switch to Day mode by pressing **D** (outside of set program)  
 Set running time in D mode with ▲ ▼

day                    **D**  
                              .... h

Switch to Night mode by pressing **N** (outside of set program)  
 Set running time in N mode with ▲ ▼

night                   **N**  
                              .... h

Override Max, Day and Night mode ends when the set time is reached  
 (the system switches to Day or Night mode in line with the programmed  
 time schedule); the override mode can be prematurely terminated by  
 pressing ◀.

HH:MM    D/N  
 Tv                    ... °C

## Programming mode

▶                    select code with. ▲ ▼, confirm by pressing ▶

code  
                              .....

Invalid code set

code  
 ?????

PLEASE NOTE: in Programming mode the control unit is in an idle state (i.e. outputs are disabled)  
 irrespective of whether the unit is ON or OFF (except for manually started tests)

## **Programming at technician level**

Entering a valid technician code will allow access to all sections

## **§ Programming at user level**

Entering a valid user code will allow access to items marked with symbol §

Switching between menu options ▶ ◀

## CONTROL

- §► Select **Control (Winter mode)** ON / OFF  
▲▼ ON / OFF

Regul  
**ON/OFF**

**Start control functions** – enter “ON”(at the beginning of winter season) and enter “OFF” (at the end of winter season)

**PLEASE NOTE:** use these functions to switch the control unit on and off. Do not disconnect the control unit from power supply outside of heating season, as after about a month the memory backup battery will be flat and all programmed information will be lost. When you switch the control unit on again, it will return to the factory setting and will have to be reprogrammed!

- §► **Correct (shift) equithermal curve** ▲▼  
– vertical shift +Ts within range from 20 to 40°C  
for radiator heating and from 20 do 30°C  
for under-floor heating

Shift  
.... °C

- **Correction of thermometer reading Tv** ▲▼  
within the range +3 to -3°C

Corr. Tv  
.... °C

- **Correction of thermometer reading Ts** ▲▼  
within the range +3 to -3°C

Corr. Ts  
.... °C

(This function allows the reading of both thermometers to be programmatically corrected by  $\pm 3^{\circ}\text{C}$  if the sensors are situated on an unsuitable place)

## TESTS

- **Actuator test**

servo  
test

Actuator opens the valve (1 step) ▲

servo  
open

Actuator closes the valve (1 step) ▼

servo  
close

- **Pump test**

Pump ON/OFF ▲▼

Pump  
test **ON/OFF**

## CODES

**Protection against unauthorised access** – the system allows two codes to be used:

Installation code secures that only the technician who installed the system and who enters in this mode a two-digit code (factory setting 01) has access to the programming sections

User code allows the system to be controlled by an authorised operator only – in this mode a two-digit user code can be entered (factory setting 02)

When losing (forgetting) the user code, a new user code can be set by a technician

When losing (forgetting) the technician code, the control unit can be reprogrammed only by resetting it to the factory setting and then reprogramming it again.

► Overwriting **technician code**

§► Overwriting **user code** ▲▼

install/user  
code ....

## § CLOCK

**Setting the clock real time** – including calendar data, i.e. year, month and day, is important when using automatic weekly or holiday switch to saving mode

► enter **date** ▲▼ (DD day, MM month, YY year)

date  
**DD.MM.YY**

► enter **time** ▲▼ (HH hour, MM minute)

time  
**HH:MM**

## SETTING CONTROL PARAMETERS

► select the heating system ▲▼

The control unit is designed for both, classic radiator heating (max. temperature in the system 90°C), and under-floor heating (max. temperature in the system 55°C)

radiator/floor

► Setting **system temperature** in Day mode ▲▼

(curves 3 - 15) within range 30 to 90°C (at outdoor temperature -20°C). Select an equithermal curve which the control unit will use in conjunction with outdoor temperature  $T_v$  to compute the required system temperature  $T_{@}$ , to which it is then controlled ( $T_s$ ). The parameter is set in respect of building's thermal losses and the heating system output (factory setting – curve 9)

radiator/floor  
day ...

► Setting **Night saving temperature** ▲▼ (curves 3 - 15)

within range 30 to 90°C (at outdoor temperature -20°C). Select a lower equithermal curve to be used to control

radiator/floor  
night ...

the temperature during the night saving mode (factory setting Curve 8).

► Setting actuator **switching periods** ▲ ▼ 1 to 30 min – switching period is the time after which a control action will repeatedly take place. The value should be selected in terms of the maximum time the valve is reset and in view of the assumed dynamic behaviour of the heating system (time constants of the system, delivery delay) – factory setting is 2 minutes

Please note: the state of the room thermostat is detected also at this period and hence also the circulation pump reacts to the changes in the room thermostat with this delay

period  
.... min

► Select **room thermostat** in system ▲ ▼ :

**no** ... none (circulation pump runs all the time)  
**yes** ... circulation pump is controlled by room thermostat  
**optim** ... optimised mode (Version 4.3 and later)

Thermost.  
yes/no/optim

If the system uses a room thermostat for detecting temperature in the reference space, in normal heating mode the thermostat switches the circulation pump on and off (when selecting “no” – without a room thermostat, the circulation pump runs all the time) – factory setting is “no” (no room thermostat).

Optimised mode can be selected when a room thermostat is connected – then the control unit optimises in a long term the equithermal curve setting so that the control unit works in optimal mode and the building has a maximum temperature comfort (Version 4.3 and later).

Please note: when the circulation pump is switched off, the heating water temperature is not controlled (the actuator does not reset the blending valve).

► Selecting **direction of actuator rotation** ▲ ▼ :

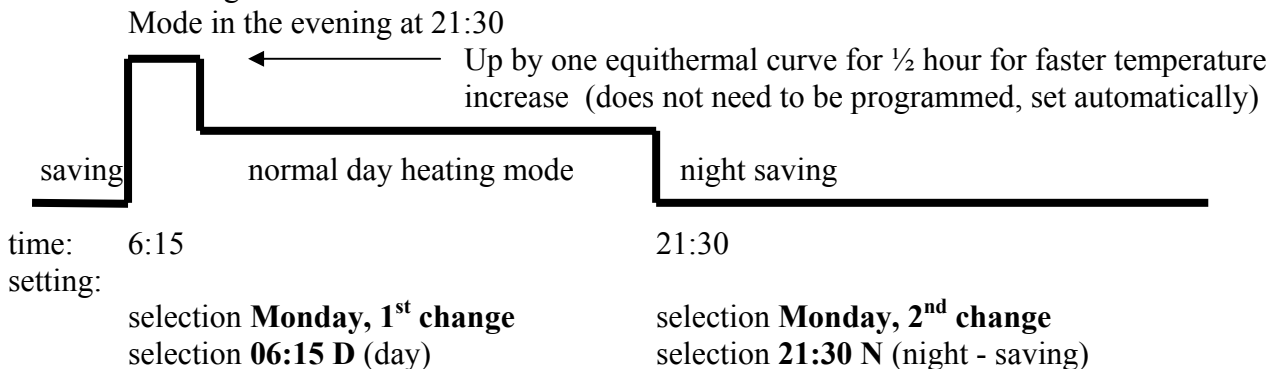
Changes the direction of actuator rotation – L (anticlockwise) and R (clockwise)

Servo  
L/R

## § PROGRAMMING SAVING MODE (max 4 changes per day)

**Programming weekly schedule** of times switching between saving and normal modes.

Example: Switch from saving to normal mode in the morning at 6:15 and back to saving in the evening at 21:30



Please note: setting “00 hours 00 min D-normal mode” is interpreted as empty setting (item deletion), i.e. a switch to normal mode at 00:00 cannot be programmed.



► switch to next menu or

select ▲ **day (Monday, Tuesday,...)**  
 ▼ **and change sequence number (1 – 4)**

► enter **hours, minutes** (plus 15 min)

select **night saving mode N**

or **normal day mode D** ▲ ▼

► enter another day and other changes (next change is offered)

◀ return back to **prg week** and ► switch to next menu

prg  
week:

**Mon/Tue/...1/2/3/4**

**Mon/Tue /... 1/2/3/4**  
**D/N HH:MM**

## § COPYING DAYS

**Copying** – rewriting data from one day to another day in the week

► **copying** day programs

► switch to next menu, or

Enter day **from which to copy** ▲

Enter day **to which to copy** ▼

► enter next copy (next day is offered)

◀ return to the beginning of **copy** and ► switch to next menu

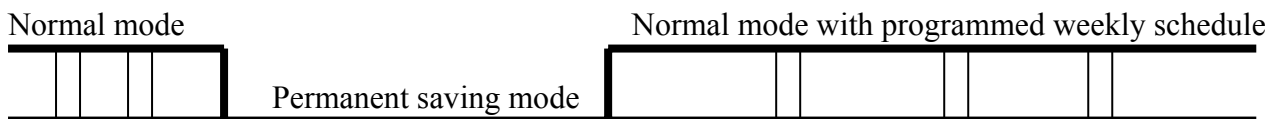
copy  
from to

Monday  
Monday

## § PROGRAMMING HOLIDAY SAVING MODE

**Programming holiday saving mode** – enter the date (day, month) when to switch to a permanent saving mode and the date when to return back to normal mode (during the holiday mode the system does not perform any programmed switches to normal heating mode, but stays in the saving mode).

Example: switch to permanent saving mode on 20.12. and back to normal heating mode on 3.1.



Date: 20.12.

3.1.

Setting: **from 20.12.**

**to 03.01.**

Please note: entering “00” for day or for month is interpreted as empty entry (thus set beginning or end of the holiday saving will not be carried out). Premature termination of the holiday mode and return back to normal heating mode (premature return from holiday) must be programmed in all points as **00**

► enter **holiday** time

prg  
holiday

► enter **holiday beginning** - “from” day **DD**, month **MM**  
enter **holiday end** - “from” day **DD**, month **MM** ▲ ▼

from **DD.MM.**  
to **DD.MM.**

## § SELECTING LANGUAGE

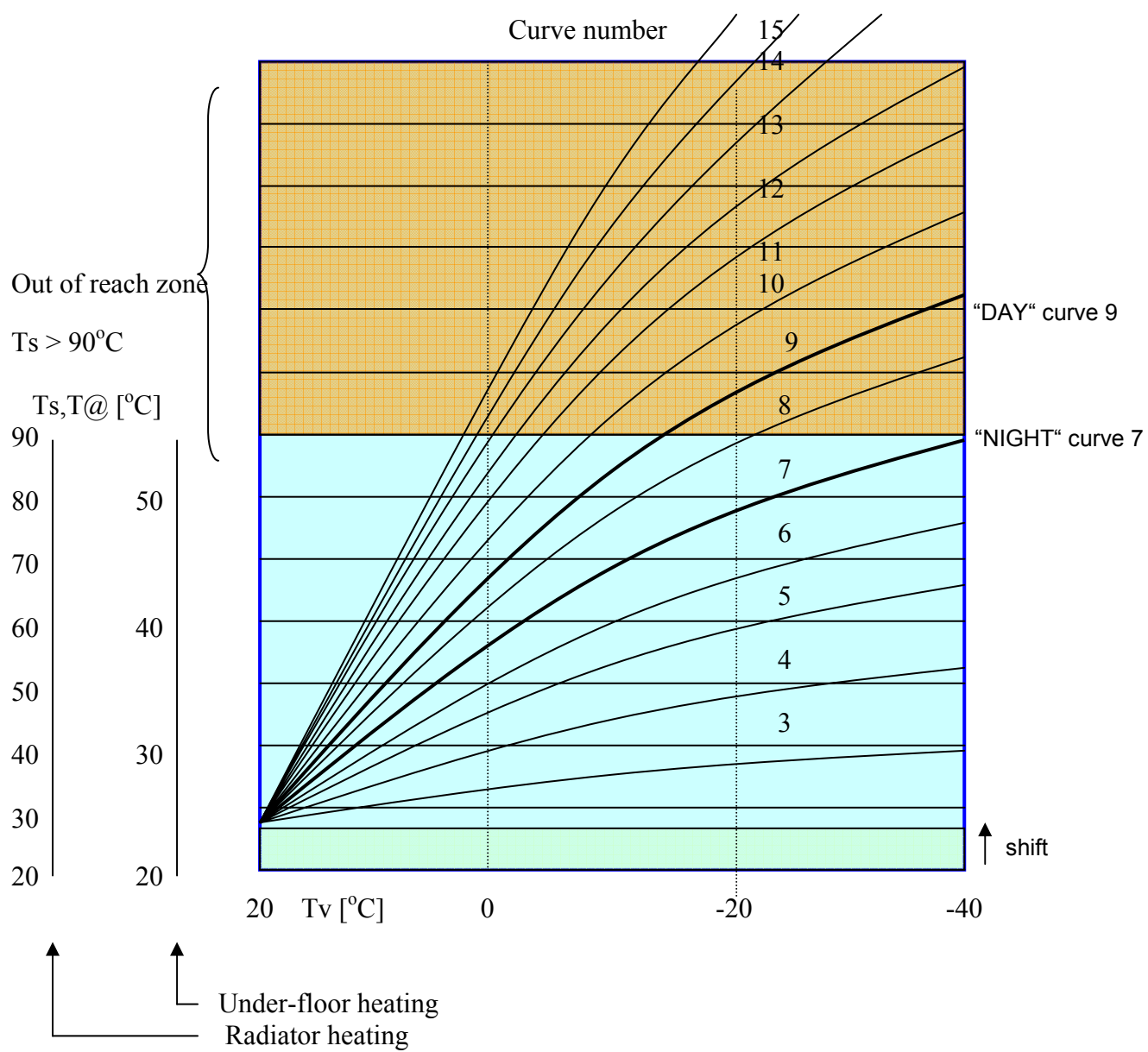
► select language ▲ ▼

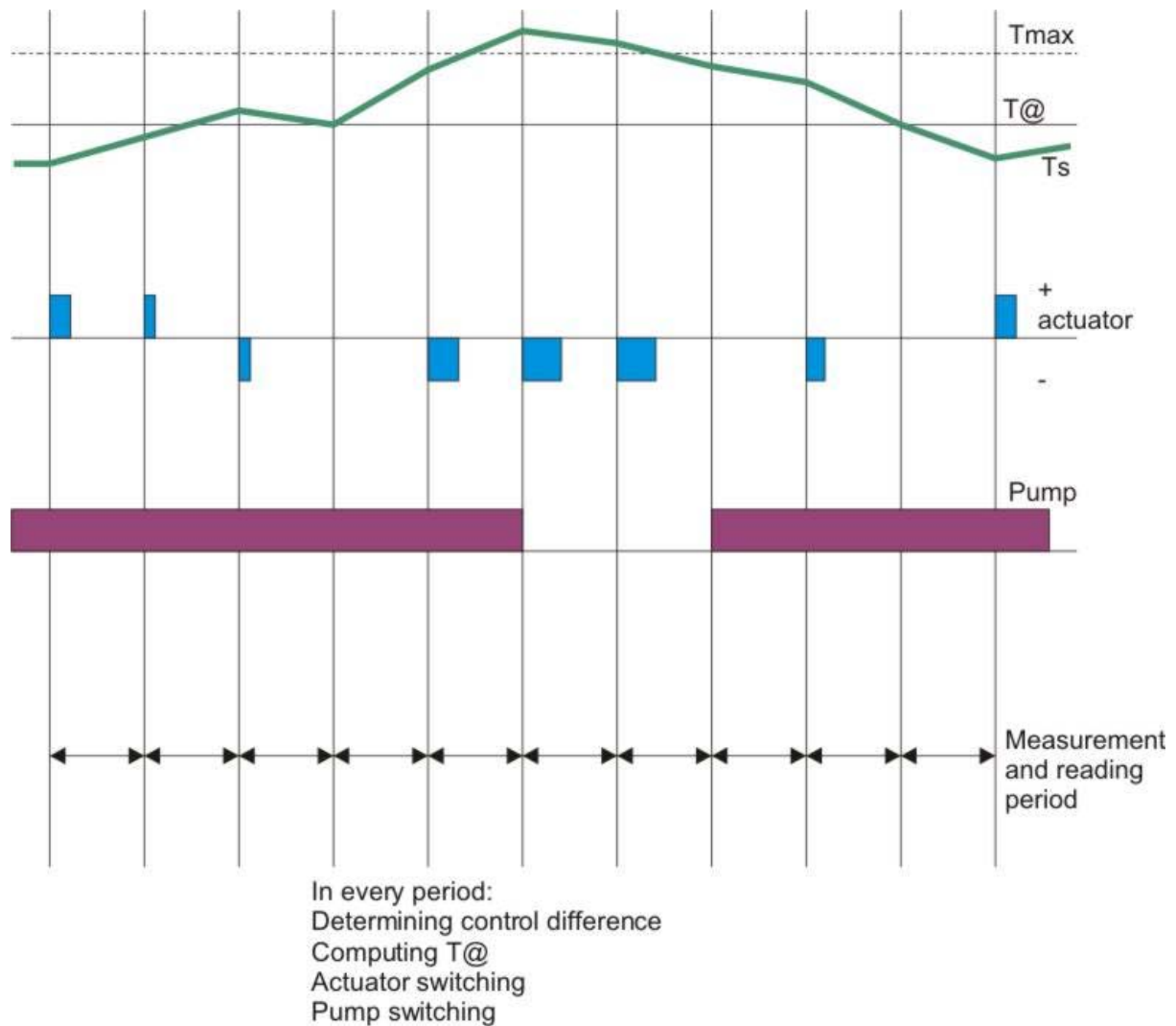
Language  
English

jazyk  
cestina

etc

► close menu

**Example**

**CONTROL ALGORITHM**

**The manufacturer reserves the right to make design changes in the control unit aimed at improving the instrument's properties**