INTIEL

THE ELECTRONICS ON YOUR SIDE

## Heating circuit controller - four channels
INT 0129-4

User's Manual

1. Application

The device is designed to control motor actuators of mixed valves, in accordance with the water temperature directed to the heating system. There is a possibility to manage three two way valves and one analogue actuator 0-10 V. It is suitable for buildings, where the installation is fulfilled with one to four heating circuits, like fan-coils, under-floor and radiator heating, as well domestic hot water preparation.

Application scheme:
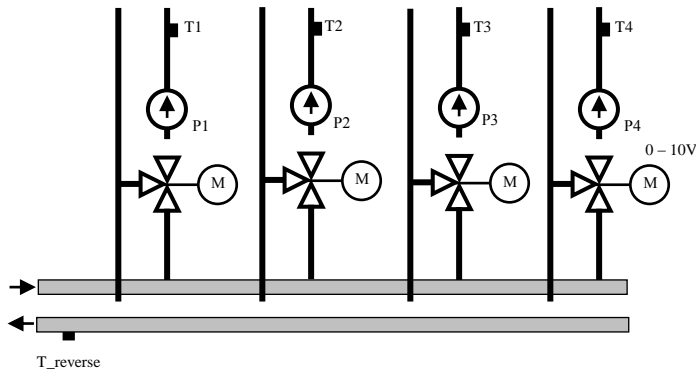
2. Operation

The device operates in heating or cooling mode, as it can be switched by the input for mode selection.

The water temperature assignation in heating circuit in heating mode can be done by one of the following ways: manually, from the controller, according the outdoor temperature or by means of a room thermostat. It can be selected only one of those three options (see part "Adjusting the assigned temperature").

The room thermostats is to be contacts type.

The water temperature assignation in the heating circuit in cooling mode can be done by one of the following ways: manually, from the controller or by means of a room thermostat.

The regulation can be provided by means of impact of the motor actuator installed on the mixed valve.

The device is equipped with a weekly timer, which affects to all four channels in order to keep a save /economic/ temperature.

2.1 Two positional motor actuators:

The Controller manage the operation of those actuators sending signals alternating operation and pause periods. The relation between the operation and pause signals relates to:
- Operation time period "Vper";
- The regulation zone "Zone_reg" and
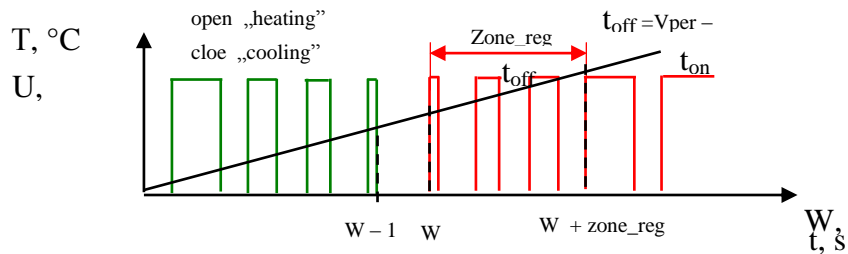- The temperature difference between the assigned and current measured water temperature.

Operation of the output concerning actuator "opening" in heating regime and "closing" in cooling regime

When the measured temperature of the heating water in mixed circle is less than the assigned one, then the operation direction in heating regime is "opening" and cooling regime is "closing". The zone of regulation "Zone_reg" is just before the assignation of the heating water "W". When the measured temperature is less than the temperature defined by the regulation zone, then the actuator works with minimal pauses of at about 3 seconds and duration of the operation impulse with a 3 seconds less than "Vper". When the temperature defined by the zone of operation is being reached then the operation impulses start decreasing, as the pauses start increasing. The operation impulses have their minimum value of at about 3 sec. as far as the assigned temperature "W" is being reached and the pauses are being reached their maximum value of "Vper"-3 sec. The actuator stops when the assigned and measured temperatures become equal as it remains at the same position until difference of 1°C between the assigned and measured temperature appears. In case the change relates to decreasing of the heating water temperature, then the same output remains active, but if it relates to increasing of the same temperature, then the output will be switched as "closing" one for heating and "opening" for cooling" will become active.
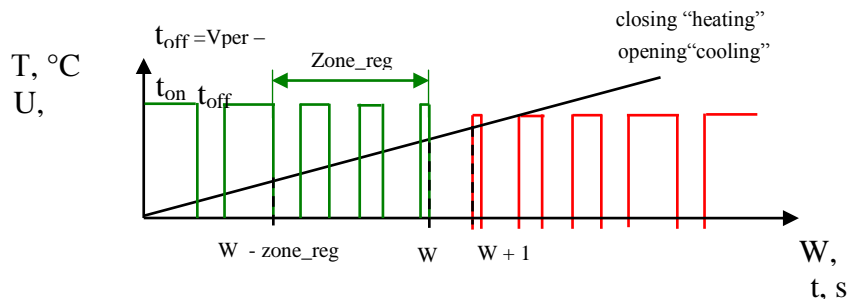
Operation of the output concerning actuator "closing" in heating regime and "opening" in cooling regime:

When the measured temperature of the heating water in mixed circle is grater than the assigned one, then the operation direction in heating regime is "closing" and cooling regime is "opening". The zone of regulation "Zone_reg" is just before the assignation of the heating water "W". When the measured temperature is grater than the temperature defined by the regulation zone, then the actuator works with minimal pauses of at about 3 seconds and duration of the operation impulse with 3 seconds less than "Vper". When the temperature defined by the zone of operation is being reached then the operation impulses start decreasing, as the pauses start increasing. The operation impulses have their minimum value of at about 3 sec. as far as the assigned temperature "W" is being reached and the pauses are being reached their maximum value of "Vper"-3 sec. The actuator stops when the assigned and measured temperatures become equal as it remains at the same position until difference of 1°C between the assigned and measured temperature appears. In case the change relates to increasing of the heating water temperature, then the same output remains active, but if it relates to decreasing of the same temperature, then the output will be switched as output "closing" will become active during heating and output "opening" during cooling.

Diagram labels: T, °C; U,; open „heating" / cloe „cooling"; Zone_reg; $t_{off} = V_{per} - t_{on}$; t_{off}; t_{on}; W − 1; W; W + zone_reg; W, t, s

2.2 Proportional actuators:

The zone of regulation "Zone_reg" is just before the assignation /'W"/ of the heating water in mixed circle in heating mode and just after the assignation /"W"/ of the heating water in mixed circle in cooling regime.

Heating mode. The controller sends to the actuator a maximum signal of 10V when the measured temperature of the heating water is less than the one defined within the regulation zone "Zone_reg", as with reaching the regulation zone the control signal will start changing (0-10V). The signal changing is active until the temperature is within the regulation zone. It is being sent a minimum control signal of 0V, when the measured temperature of the heating water is grater than the assigned one.

Cooling mode. The controller sends to the actuator a maximum signal of 10V when the measured temperature of the heating water is grater than the one defined within the regulation zone "Zone_reg", as with reaching the regulation zone the control signal will start changing (0-10V). The signal changing is active until the temperature is within the regulation zone. It is being sent a minimum control signal of 0V, when the measured temperature of the heating water is less than the assigned one.

Diagram labels: U,V; 1; zone_reg; zone_reg; heating; cooling; T,°C; W - zone_reg; W; W + zone_reg; W,
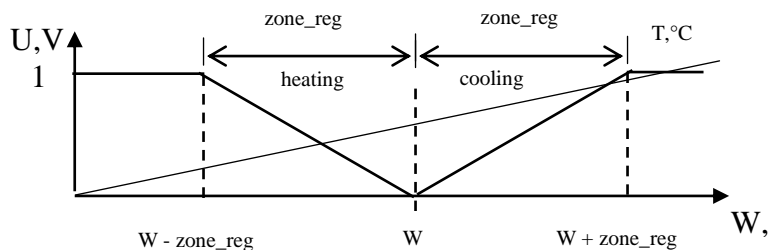
2.3 Temperature limitations:

- Minimum and maximum temperature assignation in heating mode **(WlimH);**
- Minimum and maximum temperature assignation in cooling mode **(WlimC);**
- Minimum temperature level of the return water in heating mode.

Minimum and maximum temperature of the heating water defines the temperature range within which the heating water is being sent to the heating system (see part programming "Service settings").

The minimum temperature level of the return water protects the heat-exchanger source of condensation. It is not being sent the complete capacity of the source to the heating systems until

the temperature of the return water it is not being increased above the assigned one. In this case a caution message occurs on the display (see part programming "Service settings").

Special features of actuator operation during activation of low return water temperature (only in heating mode).
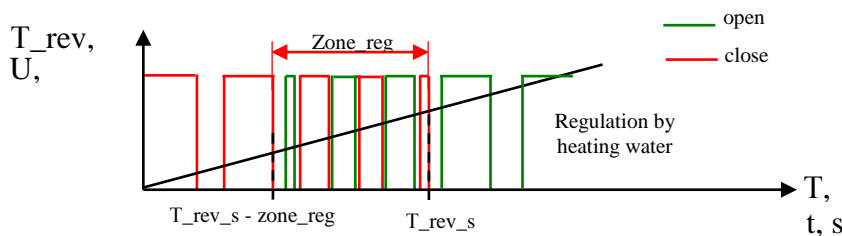If the measured temperature of the return water is lower than the assigned one a caution note appears and the actuator starts closing the mixed valve, decreasing the power sent to the premises. /**"ATTENTION! <Very low T_rev>"/**

Two positional valves:

The room thermostat can be equipped with a contact or analogue output, as the analogue one can be $0(4) – 20$ mA or $0 – 10$V /see part "Programming of the room thermostat"/.
The regulation is provided by influence on the motor actuator mounted on the mixed valve, as the motor actuators can be two positional or proportional ones with a control signal of $0 – 10$V.
The following control signals will be made in relation to the difference between the assigned and current temperature of the heating water:

Proportional actuators:
The controller sends to the actuator a maximum signal of 10V when the measured temperature of the heating water is less than the one defined within the regulation zone "Zone_reg", as with reaching the regulation zone the control signal will start changing (0-10V). The signal changing is active until the temperature is within the regulation zone. It is being sent a minimum control signal of 0V, when the measured temperature of the heating water is grater than the assigned one.
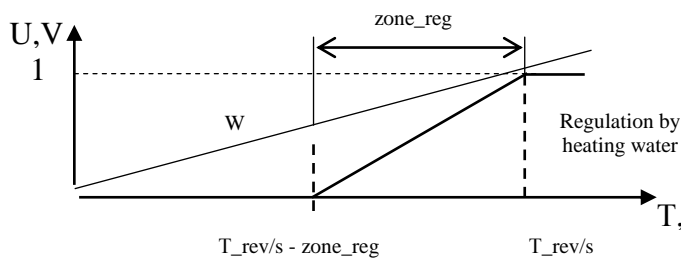
2.4 Adjusting the assigned temperature
A) Heating mode
**2.4.1 Manual setting of the heating water assignation (W_heat)**
In this case the assignation does not relates to other factors like outdoor and room temperature, as the selected value is being kept (see part "Setting of the mixed circuits").

2.4.2 Adjusting the heating water temperature assignation by means of outdoor temperature (equi-thermal regulation).

In order of faster heating of the building after first start or long stop of the heating system it can be switched to manual assignation until the comfort temperature is being reached (see part "Setting of the mixed circuits"). Then it can be switched again to outdoor temperature regulation.

- Selection of a temperature region

The temperature region selection fix the curve according which the assignation of the heating water will be changed in relation to the changes of the outdoor temperature. All curves have a common point at +20°C, which corresponds to minimum assignation of the heating water.

W_max

W_min

To, °C

-20   -10   0   10   20
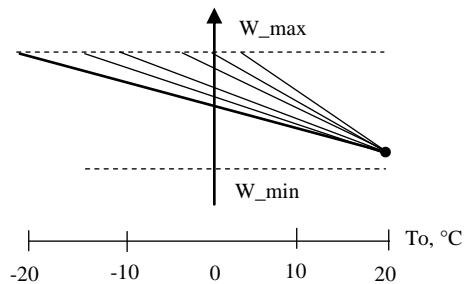
- Adjustment of reaction time for outdoor temperature regulation (Tod).

In this case it is being defined the period of time after which the changes of the heating water temperature calculated by means of the outdoor temperature will be proceeded. In this case it is being obtained an average value of the heating water assignation by means of the outdoor temperature for the selected period of time. (see part programming "Service settings")

For example: the selected curve is(-10+20°C), room delay is 5 hours, outdoor temperature is 10°C and we have current assignation of the heating water 40°C. The outdoor temperature is being changed as it goes to 7°C, as the temperature of the heating water is to become 46°C. Due to selected room delay, the heating water assignation will start increasing as the difference of 6°C will be reached at the end of the 5th hour.

Recommended values for the Room delay:
0 – 3 hours for light constructions and halls;
**4 – 10 hours for solid built houses;**
11 – 30 hours for solid built houses with a good insulation;

2.4.3 Adjustment of the heating water by means of room thermostat (see part Programming, "Setting mixed circuits")

The device operates only with a contact type room thermostat equipped with an independent output.

- Optimization time for contact type room thermostat.

Using the optimization time provides decreasing of variations in heating water assignation, which provides better regulation of the heating water. It can be chosen from 0 up to 60 min., with a step of 5 minutes. (see part programming "Service settings")
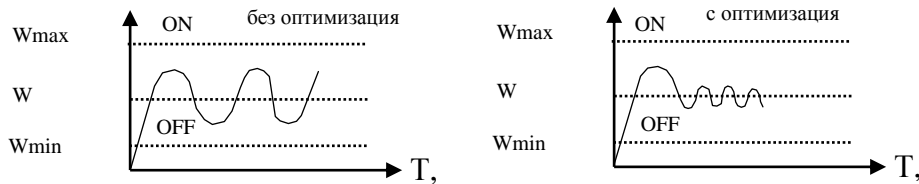

In terms of not using an optimization (0) the room thermostat switches on or switches off, as the assignation of the heating water become:
- maximum, when it is switched on;
- minimum, when it is switched off.

Using an optimization of 5-60 min., in case of room thermostat switching on or switching off, then the assignation of the heating water is being changed in the following way:
- switching on – start increasing as the maximum assignation is being reached at the end off the optimization time period and it happens only if during that time switching off does not appear;
- switching off – start decreasing as the minimum assignation is being reached at the end off the optimization time period and it happens only if during that time switching on does not appear;

For example: a contact type thermostat is being chosen, optimization time 15 min., state of the regulator is switched off. The current value of the heating water is 40°C, which means the regulator will be switched on. Due to entered optimization time the assignation will start increasing. At the 5th minute the desired temperature is being reached as the regulator is being switched off. The assignation of the heating water will be increased with 1/3(Wmax-40) and it will start decreasing, as the decreasing will go on until the regulator will be switched on again.
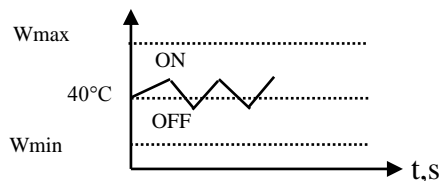
The choice of the optimization time depends on the heating water speed (pipeline, radiators), the system for a room control, the capacity of the heating source (boiler) and the building insulation.

Recommendations:
1. Room contact thermostats are to be with a hysteresis of 0.5 – 1 °C
2. The optimization time is to be with 5-10 min. grater of the time between two switching of the room thermostat in the fixed mode. Practically the times can be adjusted according heating system inertness:
- **low inertness systems – (5 – 20) min.**
- **middle inertness systems – (25 – 40) min.**
- **high inertness systems – (45 – 60) min.**

B) Cooling mode

In this mode the assignation can be made manual or by means of a room thermostat.

In case the assignation is made by means of a room thermostat the operation of the controller is similar as during heating mode. The difference is that when the room thermostat contact is closed, then starts room temperature decreasing, as when it is opened increasing of that temperature. The assigned temperature is being changed within the one adjusted with WlinC /see part "Setting of mixed circuits"/.

2.4.5 Operation of the pump output:
Heating mode

- operation by force when the water temperature is less than 10 °C.

- stops the pump operation by force in case the temperature of the heating water exceeds its maximum level with 10 °C, thus protecting the heating circuit against overheating. The same state is being kept until it occurs a necessity for more capacity in the heating circuit.

- stops in case of no heated water at the heating circuit inlet. The pump output is being switched off in case the measured temperature of the heating water is lower than the assigned minimum one in 1 hour. Then, the controller goes into test mode as every 15 minutes the pump is being switched on for 5 minutes. The previous mentioned state goes on until the heating water exceeds the assignation for the minimum water temperature level.

During both Heating and Cooling modes:

- normal operation in case of necessity of sending power to the heating circuits;

- it stops in case of no need of sending power to the heating circuits. If the mixed valve is being closed for more than one hour, then the pump is being stopped. The state goes on until a necessity of power does not arise.

2.4.6 Operation of the week timer.

There are two programs for economical temperature (**Teco**) with time periods of 0 – 24h, concerning each day of the week. **The weekly timer affects to all channels at the same time**.

If the timer operation is allowed when the relevant hour and day in the week comes, the assigned temperature (W) is being changed depends on the assignation way as:

	heating	cooling
Ctrl Man.	WminH	WmaxC
Ctrl Rreg	Does not affect	Does not affect
Ctrl Tout	W – 10°C	Does not affect

Example: let fix economic temperature during every workday within 18:30 – 06:00, as during the weekend concerning the whole days.

Setting Programm1   *Setting Programm2*

```
<Weekly timer >
Prog1 Teco from
* 18:30  to  06:00
 MoTuWeThFr – –
```

```
<Weekly timer >
Prog2 Teco from
* 00:00  to  24:00
 – – – – –  SaSu
```

Then the timer is to be switched on
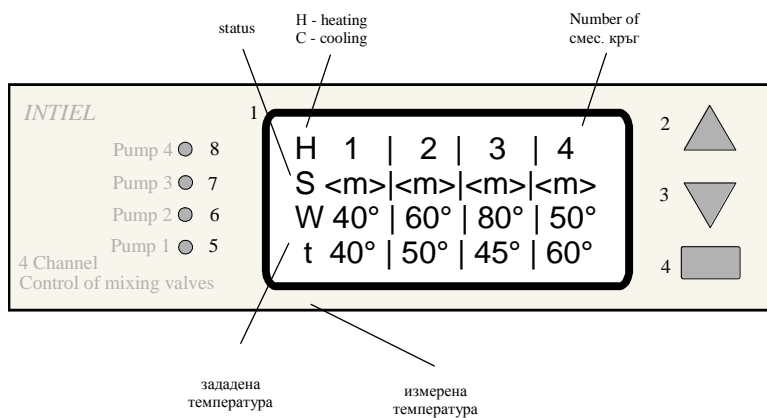
```
<Weekly timer >
time&d 10:00 Mo
*Timer      Enable
       EXIT
```

(see part programming "week timer")
In case of setting same end and start time, the program is not active

3. Front panel

1 – display;
2 – Button „forward";
3 – Button „backward";
4 – Button for entering/escaping programming mode;
5 – indication about circulation pump operation 1;
6 – indication about circulation pump operation 2;
7 – indication about circulation pump operation 3;
8 – indication about circulation pump operation 4;

Description of the status row:
"<" opening direction;
">" closing direction;
"m" manual assignation
"r" assignation by a room thermostat;
"o" outdoor temperature assignation;
"h" assignation changing by the weekly timer;

4. Programming

4.1 Manual adjustment of the mixed circuits. Press buttons „▲" or „▼" until it is being shown on the indication "Settings for mixing circuits" and press button „■":

```
* <Mix Cir. No 1 >       <Mix Cir. No 1>          <Mix Cir. No 1>
   W_heat     50°C      * Ctrl_cool    Man.      * Zone_reg    5°C
   W_cool     20°C        WlimH 15 – 80 °C         Vper        15s
   Ctrl_heat  Man.        WlimC 10 – 30 °C             EXIT
```

By means of buttons „▲" or „▼" you can move indicator „*"Press button „■" in order to confirm. The value assignation starts blinking. By means of buttons „▲" or „▼" can be made changes. After that choose "EXIT" and press button „■" to confirm the changes.

Description	Symbols	Limitations	Factory settings	Current value(notes)
Heating circuit number	Mix Cir. No	1 – 4	-	
Heating assignation	W_heat	WlimH	60 °C	
Cooling assignation	W_cool	WlimC	15 °C	
Adjusting heating assignation	Ctrl_heat	Man.(manual) Rreg(room thermostat) T_out(outdoor temperature) OFF	Man.	
Adjusting heating assignation	Ctrl_cool	Man.(ръчно) Rreg(стаен рег.) OFF(изкл.)	Man.	
Min.and max. heating assignation	WlimH	5 – 90 °C	10 – 80 °C	
Min.and max. cooling assignation	WlimC	5 – 35 °C	10 – 30 °C	
Regulation zone	Zone_reg	2 – 20 °C	5 °C	
Mixed valve operation time	Vper.	15 – 180 s	15 s	

4.2 Common settings

Review the menu by means of „▲" or „▼" buttons until on the display appears "Common Set", as afterwards button „■" is to be pressed

```
┌─────────────────────┐   ┌─────────────────────┐
│  <Common Set >      │   │  <Common Set>       │
│  *To  15° / Tod  5h │   │  * Rreg_avr  10 min │
│  Tcur  -10 ÷ 20°C   │   │   Over Tmax P ---   │
│  Trev/s  30 / 40°C  │   │        EXIT         │
└─────────────────────┘   └─────────────────────┘
```

Symbol "*" is to be moved by means of „▲" or „▼" buttons in order to select the parameter which is to be adjusted. To confirm the changes and return to settings button „■" is to be pressed. Setting which is being changed starts blinking, as by means of „▲" or „▼" buttons the value can be changed. After the settings are being completed "Exit" is to be selected and button „■" is to be pressed to save the changes.

Description	Symbols	Limitations	Factory settings	Current value(notes)
Outdoor temperature/ reaction time	To /Tod	0 – 30 h	0 h	
Temperature curve	Tcur	-20 ÷ 20 °C	- 10 °C	
Return water temperature assignation	Trev/s	20 – 70 °C	30 °C	
Room thermostat optimization time	Rreg _opt	0 – 60 min	15 min	
Ccirculation pump stopping if the heating water exceeds its assignation with 10C	Over_Tma x P	---(forbidden) OFF(разрешено)	---	

4.3 Weekly timer. By means of buttons „▲" or „▼" the menu can be reviewed until on the indication appears "weekly timer", as afterwards button „▄" is to be pressed.
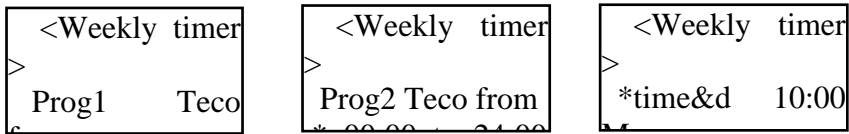
<Weekly timer	<Weekly timer	<Weekly timer
>	>	>
Prog1 Teco	Prog2 Teco from	*time&d 10:00

Symbol "*" is to be moved by means of „▲" or „▼" buttons in order to select the parameter which is to be adjusted. To confirm the changes and return to settings button „▄" is to be pressed. Setting which is being changed starts blinking, as by means of „▲" or „▼" buttons the value can be changed. After the settings are being completed "Exit" is to be selected and button „▄" is to be pressed to save the changes.

Setting program 1 (Prog1) and program 2 (Prog2) – it can be adjusted period from 00 to 24 h, with a step of 15 minutes. It can be chosen every day of the week from Monday to Friday or Saturday or Sunday.

Setting the clock (time&d) – it is being adjusted current time (hour: minutes) and day of the week.

Timer switching on – it can be selected from Enable/Disable.

4.4. Messages

The following messages can be reviewed on the display, according the situation:
- The devise is stopped from the control input - **"Stopped from switch ON/OFF";**
- The measured return temperature water is lower than the assigned one **"ATTENTION! <Very Low Trev>"**
- **Normal state - "<Status is OK!>"**
- Room thermostat staus – from **"<Status is OK!>"** button „▄" is to be pressed as the following message appear

Room
regulators
1 | 2 | 3 |
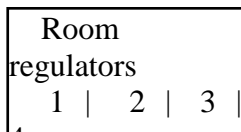
Press the same „▄" button again to return.

6. Electrical connections and technical data
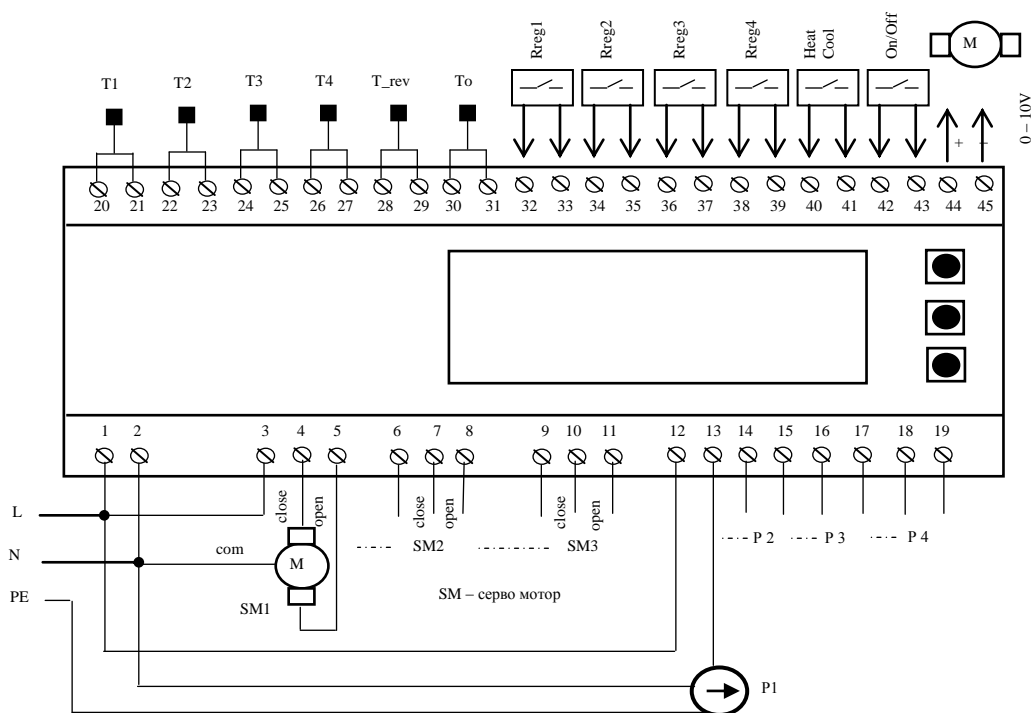
- Input "ON/OFF" is to be closed for normal operation. In case that input is not being used, a bridge is to be placed between terminals 42 and 43.
- input "Heat/Cool". If the contact is open the active mode is "Heating", when it is closed the active one is "Cooling"
- Room thermostats inputs. If the contact is closed the state is ON and if it is open the state is OFF.

Recommendation with the installation::

- sensor for heating water T1-T4 it is to be mounted on the outlet pipe after the mixed valve.

- return water sensor T_rev – it is to be mounted on the inlet pipe of the heat exchanger (boiler). The sensor is not to be connected to the controller in case there is no necessity of observing the return water temperature.

- outdoor temperature sensor To – it is to be mounted on the north outer wall of the building protected by direct sun shine and wind. It is not recommended to be installed close to heating sources (chimney, windows, doors, etc.), as well under eaves and balconies.

- room thermo regulator Rreg1 – Rreg4– it is to be installed at the most occupied room at a place protected of direct sunshine and internal heating sources (stoves, other electrical appliances, etc.)

- Synchronization of the motor actuator with the valve. Turn into heating regime, separate the valve and the actuator and disconnect the heating water sensor T. Turn the valve manually in close direction to complete closed position. Check the actuator out if it moves in the same direction in which the valve was tuned, as it has to be corrected in case of not matching the same direction. It has to be waited for until the actuator fulfills its complete move, as afterwards it is to be mounted on the valve and connected heating water sensor T.

Technical data:

Power supply	~230V/50Hz
Temperature sensors	Pt 1000 (-50 до +250 °C)
Room thermostat input	independent contact
Two way actuator output	simistor max~230V/0,25A/50Hz
Circulation pump output	switching contact ~220V/3A
Control signal	0 – 10V/max.20mA
Measurement range	-30 +130 °C
Unit of measurement	1 °C
Humidity	up to 80%
Protection	IP20

7. Warranty

The warranty period is 24 months following the purchase date of the unit or its installation by a qualified staff, but not exceeding 28 months after the production date. The warranty is extended to the malfunctions that occur during the warranty period and are result of the production reasons or defective used parts.

The warranty does not relate to malfunctions corresponding to not-qualified installation, activities directed to the product body interference, not regular storage or transport.

The repairs during the warranty period can be done after correct filling of the manufacturer warranty card

Warranty Card

Manufacturer: *INTIEL*	
Product type	
Production number	
Production date	
Dealer's confirmation	
Purchase date	
Invoice number	
Dealer's name, address and stamp	
Seller's name and signature	
Installation date	
Date	
Company (address, stamp)	
Installer's name and signature	