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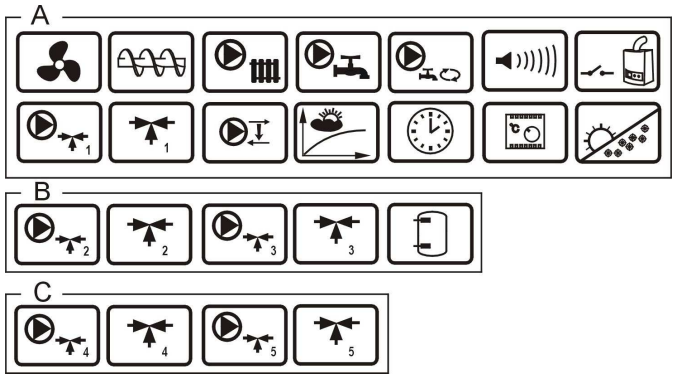
Návod k obsluze mikroprocesorového regulátoru **SPARK**



A, B, C – funkce na modulu A, B, C
* pokojivý panel SPARKSTER (modul B, C a SPARKSTER nejsou ve standardní výbavě

PRINCIPLES FOR USAGE OF Individual Fuzzy Logic CONTROLLED BOILER:

- **The regulator must be programmed individually for the given type of boiler and fuel, p. 22.1!**
- **It is inadmissible to change the type of gear-motor, fan, and to make other changes in the boiler fittings which can influence the burning process. The fittings should correspond to the components installed by the manufacturer, p. 21!**
- **It is recommended to operate boiler with maximally-opened fan flap.**
- **Activation of the fuzzy logic mode does not eliminate the necessity of regulating the SUPERVISION parameters, p. 7.8.**
- **In some cases, the fuzzy logic mode may require additional adjustment, as per p. 0.**

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2 RECOMMENDATIONS REGARDING SAFETY

Requirements concerning safety are described in detail in individual chapters of this manual. Apart from them, the following requirements should in particular be observed.

⇒ Before starting assembly, repairs or maintenance, as well as during any connection works, please make sure that the mains power supply is disconnected and that terminals and electric wires are devoid of voltage.

⇒ After the regulator is turned off using the keyboard, dangerous voltage still can occur on its terminals.

⇒ The regulator cannot be used at variance with its purpose.

⇒ Additional automatics which protect the boiler, central heating (CH) system, and domestic hot water system against results of malfunction of the regulator, or of errors in its software, should be applied.

⇒ Choose the value of the programmed parameters accordingly to the given type of boiler and fuel, taking into consideration all the operational conditions of the system. Incorrect selection of the parameters can cause malfunction of the boiler (e.g. overheating of the boiler, the flame going back to the fuel feeder, etc.),

⇒ The regulator is intended for boiler manufacturers. Before applying the regulator, a boiler manufacturer should check if the regulator's mating with the given boiler type is proper, and whether it can cause danger.

⇒ The regulator is not an intrinsically safe device, which means that in the case of malfunction it can be the source of a spark or high temperature, which in the presence of flammable dusts or liquids can cause fire or explosion. Thus, the regulator should be separated from flammable dusts and gases, e.g. by means of an appropriate body.

⇒ The regulator must be installed by a boiler manufacturer in accordance with the applicable safety standards.

⇒ The programmed parameters should only be altered by a person familiarized with this manual.

⇒ The device should only be used in heating systems in accordance with the applicable regulations.

⇒ The electric system in which the regulator operates must be protected by means of a fuse, selected appropriately to the applied loads.

⇒ The regulator cannot be used if its casing is damaged.

⇒ In no circumstances can the design of the regulator be modified.

⇒ Electronic isolation of the connected devices is applied in this regulator.

⇒ The regulator consists of two subassemblies. In the case of replacing one subassembly, make sure to maintain compatibility with the other one. More information on that issue can be found in the documentation intended for fitters

⇒ Keep the regulator out of reach of children.

3 General information

Boiler regulator SPARK model P1, version L, is a modern electronic device intended to control pellet boiler operation. The regulator is a multipurpose device:

- it automatically maintains a preset boiler temperature by controlling the fuel combustion process,
- it controls timing of feeding screw and fan,
- it automatically stabilizes a preset temperature of the domestic hot water tank,
- it automatically maintains preset temperature of several independent mixer heating cycles.

The preset temperature of heating cycles and boiler can be set on the basis of a weather sensor readouts. The regulator features an Individual Fuzzy Logic function. It allows to optimize the combustion process, which is in favour of natural preservation, decreases fuel consumption and relieves the user of the necessity of adjusting the burner parameters.
Possibility of cooperation with room thermostats, separate for each heating cycles, facilitates maintaining comfortable temperature in the heated rooms. Moreover, if need arises, the device enables a reserve boiler (gas- or oil-fired). The device has modular construction, consisting of control panel, main boiler control module (A), and module controlling mixer cycles and HUW (B). The device is operated in an easy and intuitive way. Regulator can cooperate with an additional control panel situated in living quarters. It can be used in a household and similar facilities, as well as in light industrialized facilities.

4 Information about documentation

The regulator manual is a supplement for the boiler manual. In particular, except for this manual, the boiler manual should also be observed.

The regulator manual is divided into two parts: for user and fitter. Yet, both parts contain important information, significant for safety issues, hence the user should read both parts of the manual.
We are not responsible for any damages caused by failure to observe these instructions.

5 Storage of documentation

This assembly and operation manual, as well as any other applicable documentation, should be stored diligently, so that it was available at any time. In the case of removal or sale of the device, the attached documentation should be handed over to the new user / owner.

6 Applied symbols

In this manual the following graphic symbols are used:

 - useful information and tips,

 - important information, failure to observe these can cause damage of property, threat for human and household animal health and life.

Caution: the symbols indicate important information, in order to make the manual more lucid. Yet, this does not exempt the user from the obligation to comply with requirements which are not marked with a graphic symbol.

7 Directive WEEE 2002/96/EG

Act on electrical and electronic equipment

⇒ Recycle the product and the packaging at the end of the operational use period in an appropriate manner.

⇒ Do not dispose of the product together with normal waste.

⇒ Do not burn the product.

SPARK

8. Operating the regulator

7.1 Buttons description

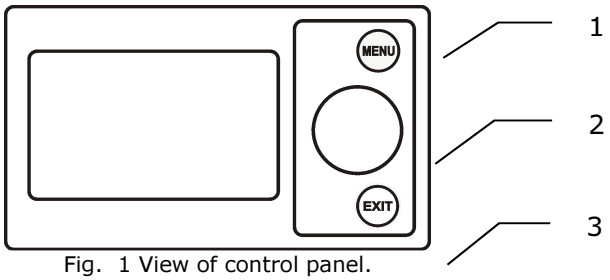

Fig. 1 View of control panel.

Legend:
1. MENU button
2. ,,TOUCH and PLAY" knob
3. EXIT button

Turning the "TOUCH and PLAY" knob increases or decreased the edited parameter. This is an element of quick operation of the regulator. Pushing this knob allows to enter the given parameter, or to confirm the selected value.

7.2 Main display window description

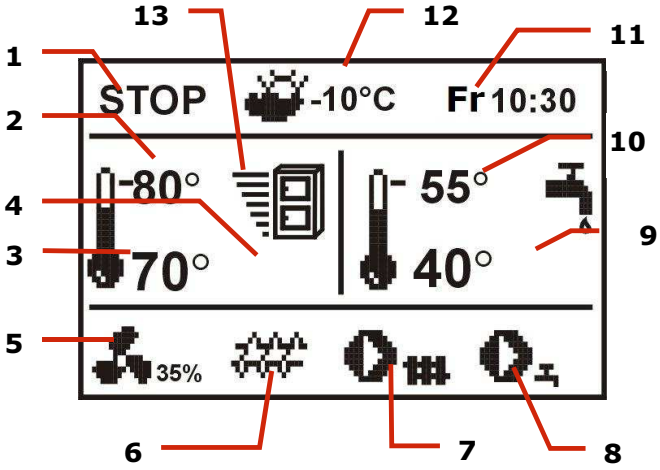

Fig. 2 Display main window

Legend:
1. Regulator operation modes: STOP, FIRING UP, OPERATION, SUPERVISION
2. preset boiler temperature,
3. measured boiler temperature,
4. field of factors influencing preset boiler temperature

 - symbol of decreasing preset boiler temperature from opening of room thermostat contacts;

 - Preset boiler temperature decrease due to thermostat disconnection (room temperature is reached);

 - Preset boiler temperature decrease due to activated time spans;

 – Boiler preset temperature during loading the hot water boiler (HW);

 – Boiler preset temperature increase from mixer circulation;

 – weather control switch on for boiler circulation,

– warning, HWU disinfection mode is is active,

– active return protection,

5. fan operation symbol,,
6. fuel feeder operation symbol,
7. central heating pump operations symbol,
8. domestic hot water pump operation symbol,
9. measured temperature of domestic hot water tank,
10. preset temperature of domestic hot water tank,
11. clock and day of the week
12. outside (weather) temperature
13. current boiler output level.

Right window on the main screen is customizable, the user can decide what information is to be presented there. It is possible to choose setup presenting info of HUW by rotating the TOUCH and PLAY knob.

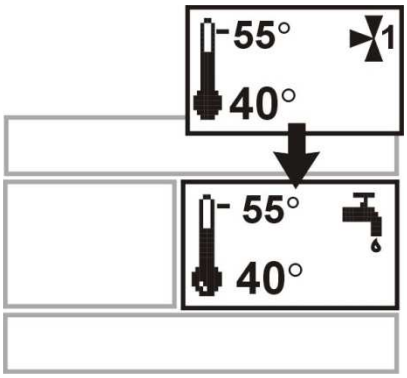

Fig. 3 Auxiliary window

The right window on the main screen can also present fuel level view, provided that the fuel level parameter is set properly. Details can be found in section 7.20. Note: the fuel level can be viewed also on room panel sparkster.

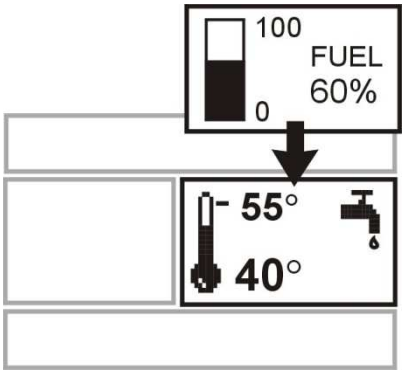

Fig. 4 Auxiliary window with fuel level indication

7.3 Regulator start-up

Press the knob to start-up the regulator.

7.4 Setting the preset boiler temperature

Set the preset boiler temperature in:

MENU → Boiler settings → *Preset boiler temperature* (*re-set boiler temperature*)

Note: Preset boiler temperature will be automatically increased to enable filling HUW container and heating circuits of mixers, if required.

7.5 STOP

Upon start-up the regulator remains in STOP mode. To activate STOP mode press the knob on main screen.

Upon activation of STOP mode, the boiler burner is OFF, while hydraulic system remains in normal operation.

7.6 FIRING UP

To activate FIRING-UP mode - press the knob and select FIRING-UP. This mode enables to control manually fan and fuel feeder. Follow strictly the instructions of the boiler manufacturer when firing-up the boiler.

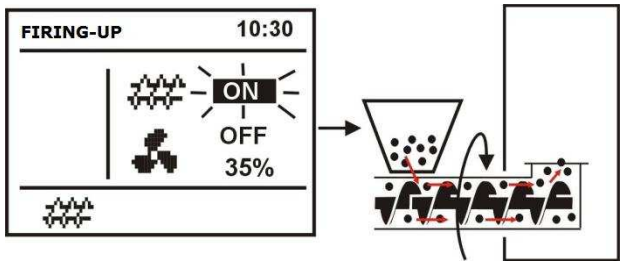

Fig. 5 Manual feeder start-up

The feeder starts once the knob has been pressed on a feeder symbol. Feed such amount of fuel so that it appears at the end of retort. Press the knob again to stop the feeder, and put firelighter (e.g. barbecue kindling-fuel) below the fuel layer and fire it.

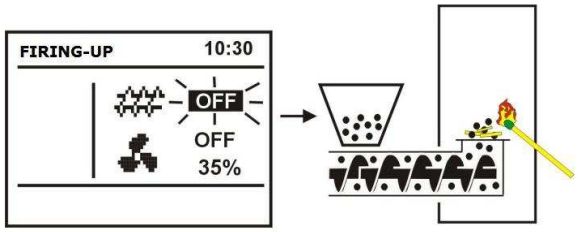

Fig. 6 Feeder stop in firing-up mode

Press the knob once on a fan symbol to start the fan and press again to stop it. Fire the fuel supplied, and feed next fuel dose, if required.

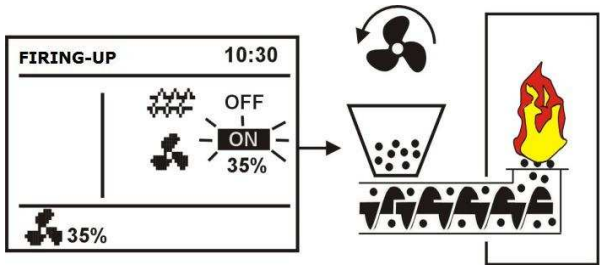

Fig. 7 Manual air-flow activation

Once you have made sure fire in the furnace is properly kindled - stop the fan and the feeder and press EXIT to leave FIRING-UP mode. Now, the regulator enters OPERATION mode and the word PRACA appears in the left upper corner. Regulator starts to work in automatic cycle.

If the user does not switch-over the regulator to OPERATION mode, the regulator will heat-up the boiler to *preset temperature* + 10°C, and will automatically enter OPERATION mode, and subsequently SUPERVISION because the preset boiler temperature has been reached.

In case actual boiler temperature is higher than *its preset value* + 10°C, FIRING -UP mode is inaccessible. In such a case wait until the boiler has been cooled down.

7.7 OPERATION – STANDARD mode

The regulator offers two modes of boiler burner control:

- *Standard* mode – without output modulation (described in this chapter),

- *Fuzzy logic* mode - with output modulation[1].

To activate *Standard* mode - click: MENU → Boiler Settings → Burner Settings → Regulation mode and Standard. This option is not available for regulators, which are provided with STANDARD mode of operation only.

In *Standard* mode the regulator operates in automatic cycle with parameters preset by the user. The preset values are available in: MENU → Boiler Settings → Burner Settings.

The fan works continuously with constant blow-in output preset in the parameter *Blow-in Output*. The feeder starts periodically and remains in operation for the duration set in *Feeding Time,* then it stops and remains off over the time set in *Feeder Interval*.

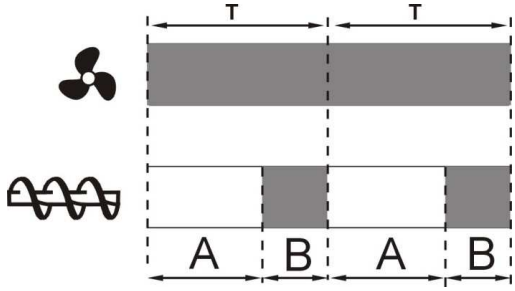

Fig. 8 Cycles of Blow-In and Feeder operation in OPERATION mode; A – Feeder Interval, B – Feeding Time.

These parameters should be properly selected subject to boiler output, and fuel type and quality. Usually, they are factory set by the boiler manufacturer.

AS THE FACTORY SETTINGS DO NOT ALWAYS COMPLY WITH THE GIVEN BOILER TYPE, THEY SHOULD BE ADAPTED TO THE GIVEN BOILER AND FUEL TYPE.

Burner adjustment instruction:
- set the parameters: *Feeding Time* and *Feeder Interval* so that the required boiler output (e.g. 15MW) has been reached. Boiler power is displayed in MENU → Information ,
- select the proper *blow-in output* to the set fuel stream.

Note: boiler power will be properly displayed provided that the values of service parameters: *Feeder Efficiency* and *Energy Density* have been properly entered!

[1] Fuzzy Logic mode of regulator operation has to be activated - see sec. 22.1

Feeding Time- OPERAT and Feeder Interval- OPERAT should be so selected that the furnace does not retrace to the fuel feeder.

Once the preset boiler temperature has been achieved, the regulator automatically enters SUPERVISION mode.

OPERATION–Fuzzy Logic mode

Upon change of boiler regulation mode from *Standard to Fuzzy Logic,* regulator works in OPERATION mode and modulates the boiler output to achieve constant preset boiler temperature.

Fuzzy logic regulation mode may be set in: MENU → Boiler Settings → Burner Settings → Regulation Mode

Please note *Fuzzy Logic* program is adapted individually to the given boiler and fuel type and may work properly only with this boiler and fuel. Therefore, *Fuzzy Logic* mode requires special settings and has to be activated by the boiler manufacturer in accordance with sec. 22.1. In case this mode has not been activated, it will not be available.

Fuzzy Logic correction
In some instances, Fuzzy Logic mode has to be adjusted to the fuel quality. To make the correction, use the following parameters: *FL fuel correction* and *FL airfl. correction* which are available in: MENU → Boiler Settings → Burner Settings.
At first adjust *FL fuel correction.* If the fuel is of poor quality and incompletely burnt fuel particles are present in ash, reduce the rate of supplied fuel; in the contrary case - proceed in analogical manner.
Note: incompletely burnt fuel particles or lowered furnace may be also caused by improper boiler operation in SUPERVISION mode. Therefore, prior to correcting *Fuzzy logic* it is recommended to adjust parameters of SUPERVISION mode in accordance with sec. 7.8.

Activation of *Fuzzy Logic* mode of regulation does not release from the requirement to adjust the parameters of SUPERVISION mode – risk of screw feeder damage.

Switching off output modulation in Fuzzy Logic
In case the regulator works in SUMMER mode of operation or with a little heat demand (in Spring and Autumn), modulation of boiler output is not justified. To switch-off the boiler output modulation in *Fuzzy Logic* mode of regulation - set both parameters: *Min. boiler output FL* and Max. boiler output FL at the same value - e.g. 80%. The boiler starts operation without output modulation and upon achievement of preset temperature enters SUPERVISION mode.

Boiler output in *Fuzzy Logic*
In case of boiler operation in conditions of little heat demand, fuel consumption may increase. It is a result of the fact that the output modulation algorithm reduces boiler output to the minimum, at which boiler efficiency is much lower than in case of the rated output. In such instances, it is recommended to reduce permitted range of boiler output so that it will not work at the minimum output. The range of boiler output is defined by the parameters: *Min.boiler output FL* and *Max.boiler output FL* available in: MENU → Boiler Settings → Burner Settings.
E.g.:
Min.boiler output FL (Min. moc kotła FL)=40% (factory setting: 0%)
Max.boiler output FL =100%(factory setting: 100%)

7.8 SUPERVISION

SUPERVISION mode is available for both modes of regulation: with manual and automatic settings (*Fuzzy Logic)*. Regulator automatically enters SUPERVISION mode without any user's intervention, namely:
- in case of *Standard* mode of regulation– upon achievement of boiler preset temperature,

- in case of *Fuzzy logic* – once actual temperature has exceeded the boiler preset temperature by 5°C.

In SUPERVISION mode, the regulator supervises that the fire in the furnace has not damped. For this purpose, the fan and the feeder work intermittently and operate for a certain time, less frequently than in OPERATION mode. This does not cause any further temperature increase.
The fan does not work continuously, and is switched on along with the fuel feeder periodically, which prevents fire damping in the furnace during boiler shut-down.

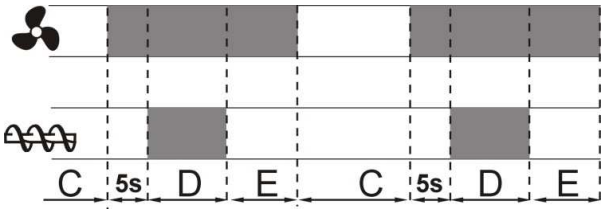

Fig. 9 Cycles of fan and feeder operation in SUPERVISION mode; C – *Feeder Interval - Superv.* , D – *Feeding Time-Superv.*, E – *Blow-in operation extending- Superv*.

Duration of break in fan and feeder operation is defined by the parameter: *Feeder Interval - Superv.*, which is available in:

MENU → Boiler Settings → Burner Settings .

This time should be set in accordance with the recommendations of the boiler manufacturer, and so selected that (i) the furnace does not lower during boiler shut-down and (i) the time is sufficient to prevent increase of boiler temperature. Other parameters are available in:

MENU → Service Settings → Boiler Settings → Burner Settings .

Parameters related with SUPERVISION mode should be so selected that the boiler temperature in this mode gradually drops. Improper settings may cause boiler overheating or flash back to the feeder.

Regulator returns to OPERATION mode once actual boiler temperature has achieved preset value less boiler hysteresis.
Examples of SUPERVISION mode settings (fuel: hard coal):
- *Feeder Interval - Superv.* = 15-30min.
- *Feeding Time-Superv.* = 12s,
- *Blow-in operation extending- Superv.* = 1s,
- *Blow-In Output - Superv.* = 25%.

7.9 Selection of fuel

The fuel selection is available only in case the boiler manufacturer has memorized various types of fuel. Type of fuel may be set in: MENU → Boiler Settings → Burner Settings .

7.10 HUW settings

The equipment controls the temperature of HUW container if HUW temperature sensor is connected. Using the parameter of *HUW pump mode* the user can:

- switch-off HUW container filling by setting this parameter at ***OFF***,
- set HUW priority (***Priority*** parameter)– boiler pump is OFF and mixer closed to fill HUW water faster.

set simultaneous (parallel) operation of HUW and boiler pumps using the parameter ***"No priority"***

7.11 Setting the preset HUW temperature

Preset HUW temperature may be set in:

MENU → HUW settings

7.12 Activation of SUMMER function

To activate the SUMMER function, which allows filling the HUW container in summer without having to heat up the central heating system, set the parameter *SUMMER* mode.

MENU → SUMMER mode

In SUMMER mode, all heat recipients may be OFF, therefore, make sure the boiler will not be overheated.

If weather sensor is connected, the SUMMER function may be automatically activated using the parameters: *AUTO Summer mode , SUMMER switch-on temperature and SUMMER switch-off temperature .*

7.13 Disinfection of HUW container

The regulator has a function of automatic, periodic heating of HUW container to 70 °C to eliminate bacterial flora from the HUW container.

Keep the tenants informed of activating disinfection function as there is a risk of being burnt with hot utility water.

7.14 Mixer circle settings

Settings of first mixer circle are in the menu:
Menu → Mixer 1 settings
Settings for other mixers are in following sections of the menu and are identical in each cycle.

Mixer settings (without weather sensor) It is required to set manually desired temperature in mixer's heating cycle using parameter *Preset mixer temperature,*e.g. 50 degrees C. Such should be a value to provide required room temperature. .

After connecting a room thermostat, value of decline in preset mixer temperature from thermostat should be set. (parameters *mixer room thermostat* e.g. 5 degrees C. This value should be chosen experimentally. A room thermostat can be a traditional one or a room panel sparkster. After activating the thermostat, mixer preset temperature will be reduced. When this value is reduced correctly then room temperature increase will be stopped.

Mixer with weather sensor setting
(without room panel sparkster) Set parameter *mixer weather control* in position on. Adjust weather curve according to point 8.16

Using parameter *paralel curve movement* set required room temperature according to formula:
Required room temperature = 20°C + heating curve paralel movement.
Example.
To reach room temperature 25°C value of heating curve movement must be set for 5°C. To reach room temperature 18°C value of heating curve paralel movement must be set for -2°C.

In this configuration a thermostat can be connected. It will level inaccuracy of heating curve adjustement in case when its value will be too big. In such case value of decrease of preset mixer room temperature from thermostat should be set i.e. for 2°C.After discontecting thermostat plugs preset mixer cycle temperature will be reduced. By correct adjustement of this reduction will stop temperature increase of temperature in heated room.

Mixer with weather sensor and room panel sparkster settings
Set parameter *Mixer weather control*. In position off.

Adjust weather curve according to point 8.16

Controller sparkster automatically moves the heating curve depending on preset room temperature. The controller relates adjustements to 20 degrees C, i.e. for preset room temperature = 22 degrees C the controller will move heating curve by 2 degrees C, for preset room temperature = 18 degrees C the controller will move heating curve by -2 degrees C. In some cases described in point 8.16 it can be necessary to adjust heating curve movement.

In this configuration room thermostat sparkster is able to:
reduce temperature of heating cycle by a constant value, when preset temperature in a room will be reached. Similarly like it was described in previous point (not recommended), or
automatically, constantly correct heating cycle temperature.
It is not recommended to use both these possibilities at the same time.

Automatic correction of room temperaturę is done according to formula:

Correction = (preset room temperature – measured room temperature) x room temperature factor / 10
Example.
Preset temperature in heating room (set in sparkster) = 22 degrees C. Measured temperature in room (using sparkster) = 20 degrees C. *room temperature factor* = 15
Preset mixer temperature will be increased by (22 degrees C – 20 degrees C) x 15/10 = 3 degrees C. Correct value of parameter must be found room temperature factor. Scope: 0…50. The bigger value of factor the bigger correction of preset boiler temperature factor. When set on value "0" preset mixer temperature is not corrected. Attention: setting too high value of room temperature factor may cause cyclic room temperature fluctuations.

7.15 Weather control

Weather control may be activated for both, boiler and mixer circuits. Once the heating curve has been properly selected, preset boiler or mixer temperature is automatically computed on the basis of ambient temperature. Owing to this feature, if the heating curve is properly selected for the given building, in-door temperature will remain constant irrespective of the out-door temperature. Therefore, proper selection of heating curve is essential.

Note: when identifying the heating curve - eliminate influence of room thermostat on regulator operation (irrespective whether room thermostat is connected or not) by setting the parameter:

- For mixer circuit: MENU → Mixer Settings → Room thermostat → *Reduce preset mixer temperature to thermostat* = 0.
- For boiler circuit: MENU → Boiler Settings → Room thermostat → *Reduce preset mixer temperature to thermostat* = 0.

In case of connected sparkster room control panel - additionally, set the parameter: *Room temperature coefficient* = 0.

Guidelines for proper settings of heating curve :

- underfloor heating	0.2 -0.6
- radiator heating	1.0 - 1.6
- boiler	1.8 - 4

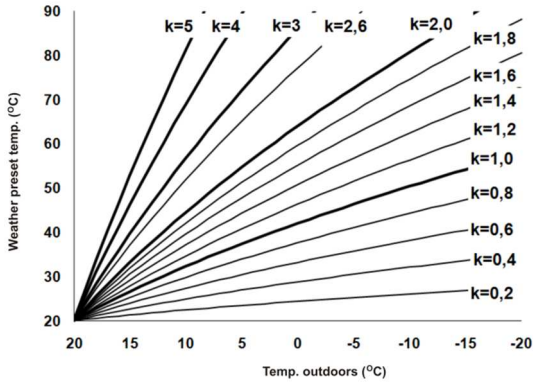

Fig. 10 Heating curves; temperature set using weather control vs. out-door temperature

for choosing proper heating curve:

- If by falling outer temperature room temperature is increasing, then value of chosen heating curve is too big,
- If by decreasing outer temperature, room temperature is also decreasing, then value of chosen heating curve is too low,
- If by frosty weather room temperature is appropriate and in warmer time is too low – it is recommended to increase parameter *heating curve parallel shift* and then choose lower heating curve.
- If by frosty weather room temperature is too low and in warmer time too high – it is recommended to reduce *parameter heating curve parallel shift* and choose higher heating curve.

Buildings which are poorly isolated require setting heating curve with higher values, and for better isolated buildings heating curve will have lower value.

Preset temperature, counted according to heating curve can be decreased or increased by controller when it goes beyond scope of limits of temperatures for given cycle.

7.16 Description of night time decrease settings

The regulator offers possibility to select the time intervals for boiler, heating circuits, HUW container and HUW circulating pump, at which lower preset temperature may be set e.g. for a night time or when the user is not at home (e.g. he/she left for work).

This feature enables automatic reduction of preset temperature, which improves heat comfort and reduces fuel consumption. It is indicated with a sign .

Select temperature reduction and beginning and end of respective time interval.

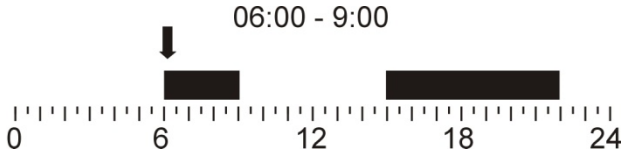

Fig. 11 Time intervals

7.17 Control of HUW circulating pump

Settings of HUW circulation are available in:

MENU → Circulating Pump

HUW circulating pump enables quick delivery of hot utility water to rooms located far away from HUW container without a need to drain off the water. Time-based control settings of circulating pump are analogical to the settings of night time decrease. In the defined time intervals designated as , circulating pump will start and remain in operation for the period of time set in *Circulating Pump Operation Time* , then will stop and remain out of operation for the period of time set in *Circulating pump standstill time*. The circulating pump does not operate in the time intervals designated as . To keep the pump in continuous operation, set all time intervals within the whole day (24 hours) at and the parameter *Circulating pump standstill time* = 0.

Switch on the operation of circulating pump using the parameter: *HUW Circulation Support* in MENU → Pump Service Settings .

7.18 Grate

In case the boiler is adapted to burn fuel on additional grate, the feeder or the fan with the feeder may be switched off. The settings are available in: MENU → Boiler Settings .

Note: When the fan goes OFF, the same time the feeder stops.

7.19 Manual control

Regulator offers possibility to manual start of working equipment such like pump, feeder motor or fan. This feature enables checking whether the equipment is fault-free and properly connected.

Note: Long-term operation of the fan, the feeder or other working equipment may lead to occurrence of hazardous conditions.

Item: **Mix 1 close/Circul (Miesz1 Zam/Cyrkul)** means the mixer servo is closed (if used), or - in case it is not used i.e. the service parameter *Mixer support* is set at *OFF* or at "*Pump only* " it means the circulating pump connected to terminals 14-15 is running

7.20 Fuel level configuration

Fuel level indicator activating

To activate displaying fuel level following parameters are to be set

Menu – Boiler setting – Fuel level – alarm level

On value bigger than "0", i.e. 10%

Twisting "TOUCH and PLAY" knob in main window fuel level is displayed in main window.

Tip: fuel level can also be seen in room panel sparkster

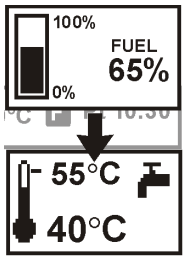

Fig. 12 Auxiliary window with fuel level indication

Fuel level indicator service

Each time when fuel silo is filled to required level it is necessary to press and keep the knob in main window. Following info will appear:

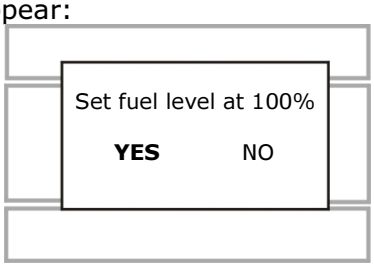

Fig. 13 Operation of fuel level indicator

Once YES has been selected and confirmed, fuel level is set at 100%. Fuel may be replenished at any time without a need to wait for complete empty fuel tank. Replenish fuel always to the level corresponding to 100% and confirm achieved 100% level by keeping the knob pressed for a while!

Description of activity

The controller measured fuel level on the basis of its current consumption. Factory settings will not always correspond to actual fuel consumption , so to work correctly this method needs level calibration by controller's user. No additional fuel sensors are required.

Calibration

If the service parameters of the boiler: *Feeder Efficiency* and *Tank Capacity* are properly set, calibration is not necessary - regulator should properly calculate fuel level.

But, if the fuel level calculations are wrong, calibration has to be performed. For this purpose, fill the fuel tank to the level corresponding to its full load and set the parameter *Fuel level calibration* at 100%. This parameter is available in MENU → Fuel Level → Fuel level calibration .

Indicator in the main window is now set at 100%. Pulsating fuel level indicator means calibration process is in progress. The indicator keeps pulsating until minimum fuel level has been set. Check regularly the decreasing fuel level in the tank. Once the level dropped to the minimum - set the value of *Fuel level calibration* at 0%.

Change of service parameter: *Tank Capacity* cancels the calibration of fuel level - then, the level is calculated on the basis of the parameters: *Feeder Efficiency* and *Tank Capacity* .

8 Hydraulic diagrams

8.1 Diagram 1

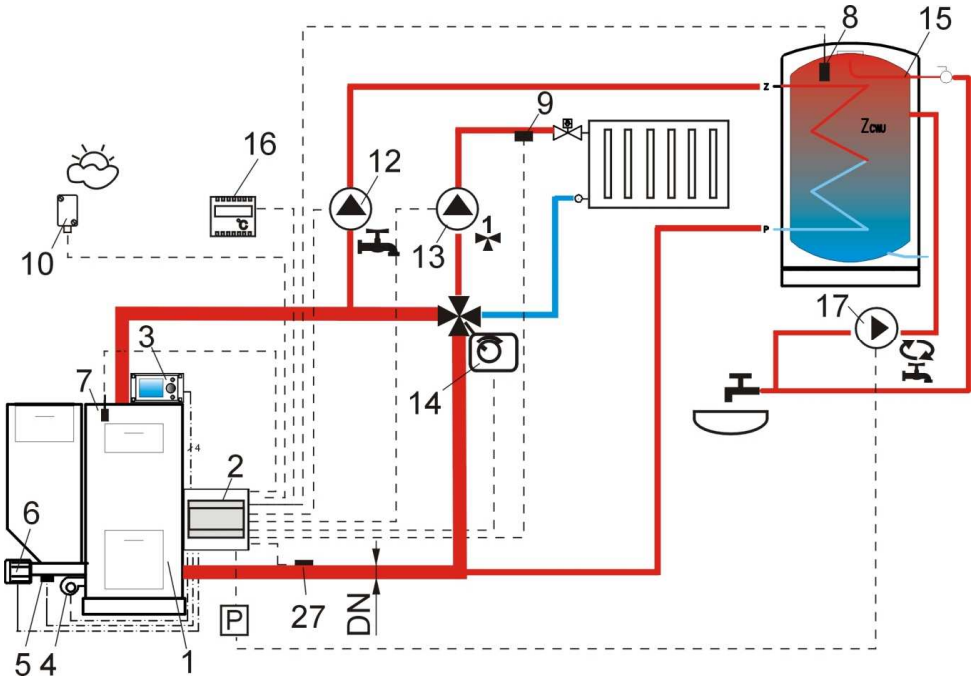

Fig. 14 Diagram with 4-way control valve for central heating circuit[2], where: 1 – boiler, 2 – SPARKX regulator – module A, 3 – SPARKX regulator – control panel, 4 – fan, 5 – feeder temperature sensor, 6 - gear-motor, 7 – boiler temperature sensor, 8 – HUW temperature sensor, 9 - mixer temperature sensor, 10 – temperature (weather) sensor 12 – HUW circuit pump, 13 – mixer circuit pump, 14 – electric servo of valve, 15 – HUW container, 16 – room thermostat or sparkster, 17 – HUW circulating pump, 27 – return temperature sensor (does not affect combustion process control), P – electric relay.

As there is not mechanically forced water flow in boiler return circuit - this method of protection of boiler return circuit from cold water is not efficient. Use of other method is recommended. To improve water flow in gravitational circuit of the boiler (the circuit is indicated on the diagram with a bold line) it is necessary to: (i) use pipes and 4-way valve of large DN value, (ii) avoid using excessive number of elbows and cross section reductions, and (iii) apply other rules of gravitational circuit construction - e.g. keeping of gradients, etc. In case the return temperature sensor is of contact type - provide the sensor with heat insulation to isolate it from the environment and improve its thermal contact with the pipe by application of thermal paste. Set the preset boiler temperature at so high value that heat output required to the heating circuit and to heat-up return water to the boiler is guaranteed.

RECOMMENDED SETTINGS:

	Parameter	Setting	MENU
	OPERATION mode: Return Protection	ON	Service Settings → Boiler Settings → Return Protection 4D
	Min. return temp	45°C	
	Return temp. hyst.	2°C	
	Valve closing	0%	
	Min. preset boiler temperature	70°C	Service Settings → Boiler Settings
	Mixer support 1	ON (włącz.) CO	Service Settings →Mixer Settings 1
	Max. preset temperature of mixer 1	75°	Service Settings →Mixer Settings 1
	Heating curve. mixer 1	0.8 – 1.4	Service Settings →Mixer Settings 1
	Weather control mix.1	ON	Menu→ Mixer Settings 1
	Output H	Circulating Pump	Menu→ Service Settings
	Circulation support	ON	Menu→ Pump Service Settings →

[2] The presented hydraulic diagram does not replace central heating engineering design and may be used for information purposes only.

8.2 Diagram 2

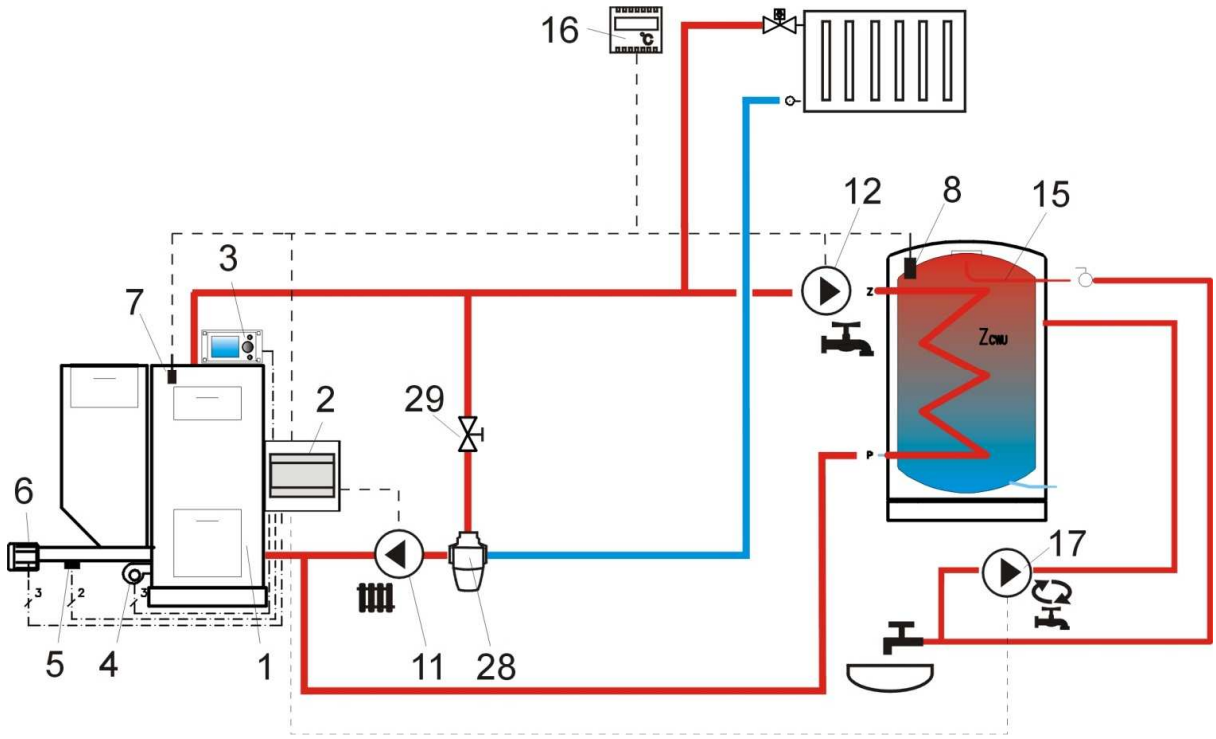

Fig. 15 Diagram with 3-way thermostatic valve to secure return water temperature[3], where: 1 – boiler, 2 – SPARKX regulator – module A, 3 – SPARKX regulator – control panel, 4 – fan, 5 – feeder temperature sensor, 6 - gear-motor, 7 – boiler temperature sensor, 8 – HUW temperature sensor, 9 - mixer temperature sensor, 10 – temperature (weather) sensor, 11 – CH circuit pump, 12 – HUW circuit pump, 13 – mixer circuit pump, 15 – HUW container, 16 – room thermostat or sparkster, 17 – HUW circulating pump, 27 –return temperature sensor (does not affect combustion process control), 28 – thermostatic 3-way valve, 29 – throttle (mushroom) valve.

RECOMMENDED SETTINGS:

	Parameter	**Setting**	**MENU**
	OPERATION mode: Return Protection	wyłączona	Service Settings → Boiler Settings → Return Protection 4D (if mixer sensor in not provided - this option is not available)
	Mixer support 1	*OFF* or *Pump only*	Service Settings →Mixer Settings 1 (if mixer sensor in not provided - this option is not available)
	Circulation support	ON	Pump Service Settings →

[3] The presented hydraulic diagram does not replace central heating engineering design and may be used for information purposes only.

8.3 Diagram 3

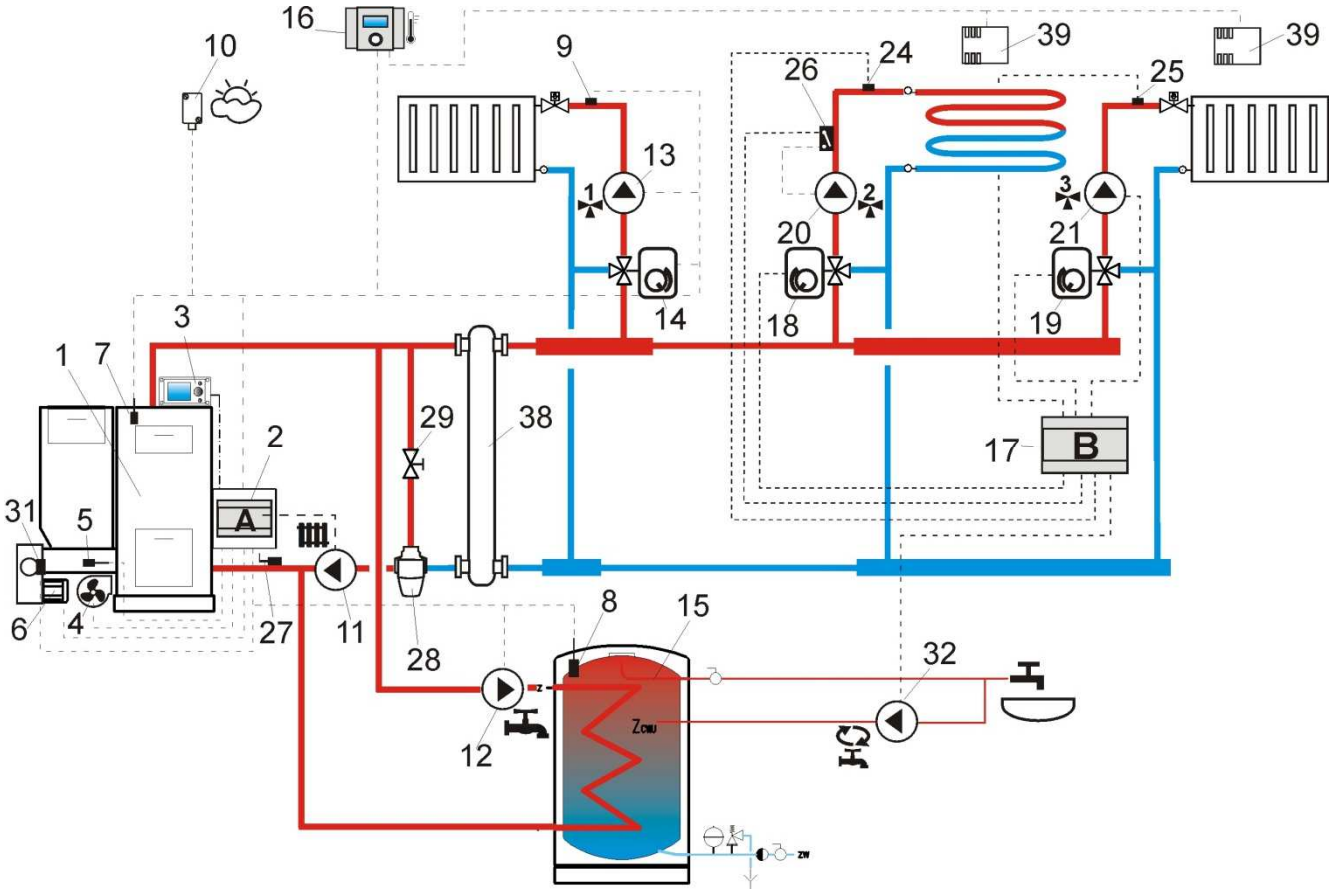

Fig. 16 Diagram with two additional mixer circuits upon connection of additional Module B[4], where: 1 – boiler, 2 – SPARKX regulator – module A, 3 – SPARKX regulator – control panel, 4 – fan, 5 – feeder temperature sensor, 6 - gear-motor, 7 – boiler temperature sensor, 8 – HUW temperature sensor, 9 - mixer 1 temperature sensor, 10 – temperature (weather) sensor, 11 – boiler pump, 12 – HUW circuit pump, 13 – mixer 1 circuit pump 14 – mixer 1 servo, 15 – HUW container, 16 – room thermostat or sparkster, 17 – extension module B, 18 – mixer 2 servo 19 – mixer 3 servo, 20 – mixer 2 pump, 21 – mixer 3 pump 22 – mixer 2 room thermostat, 23 – mixer 3 room thermostat, 24 – mixer 2 temperature sensor, 25 – mixer 3 temperature sensor, 26 – autonomous thermostat to protect underfloor heating - max. temp. 55°C (it cuts off power supply to the mixer pump once the maximum temperature has been exceeded; thermostat is not included in the regulator supply), 27 – return temperature sensor (recommended mounting location: bottom section of boiler water jacket), 28 – thermostatic 3-way valve (to protect boiler return), 29- throttle mushroom valve, 32 – HUW circulating pump, P – electric relay, 38 – hydraulic coupling, 39 – room temperature sensor CT7.

RECOMMENDED SETTINGS:

	Parameter	Setting	MENU
1,3	Mixer support	ON (włącz.) CO	Service Settings →Mixer Settings
	Max. preset mixer temperature	75°	Service Settings →Mixer Settings
	Heating curve. mixer	0.8 – 1.4	Service Settings →Mixer Settings
	Weather control mix.	ON	Menu→ Mixer Settings
2	Mixer support	Floor ON (włącz. podłoga)	Service Settings →Mixer Settings
	Max. preset mixer temperature	50°C	Service Settings →Mixer Settings
	Heating curve. mixer	0.2 – 0.6	Service Settings →Mixer Settings
	Weather control mix.	ON	Menu→ Mixer Settings
	Circulation support	ON	Pump Service Settings serwisowe→
	OPERATION mode: Return Protection	OFF	Service Settings → Boiler Settings → Return Protection 4D

8.4 Schemat 4

[4] The presented hydraulic diagram does not replace central heating engineering design and may be used for information purposes only.

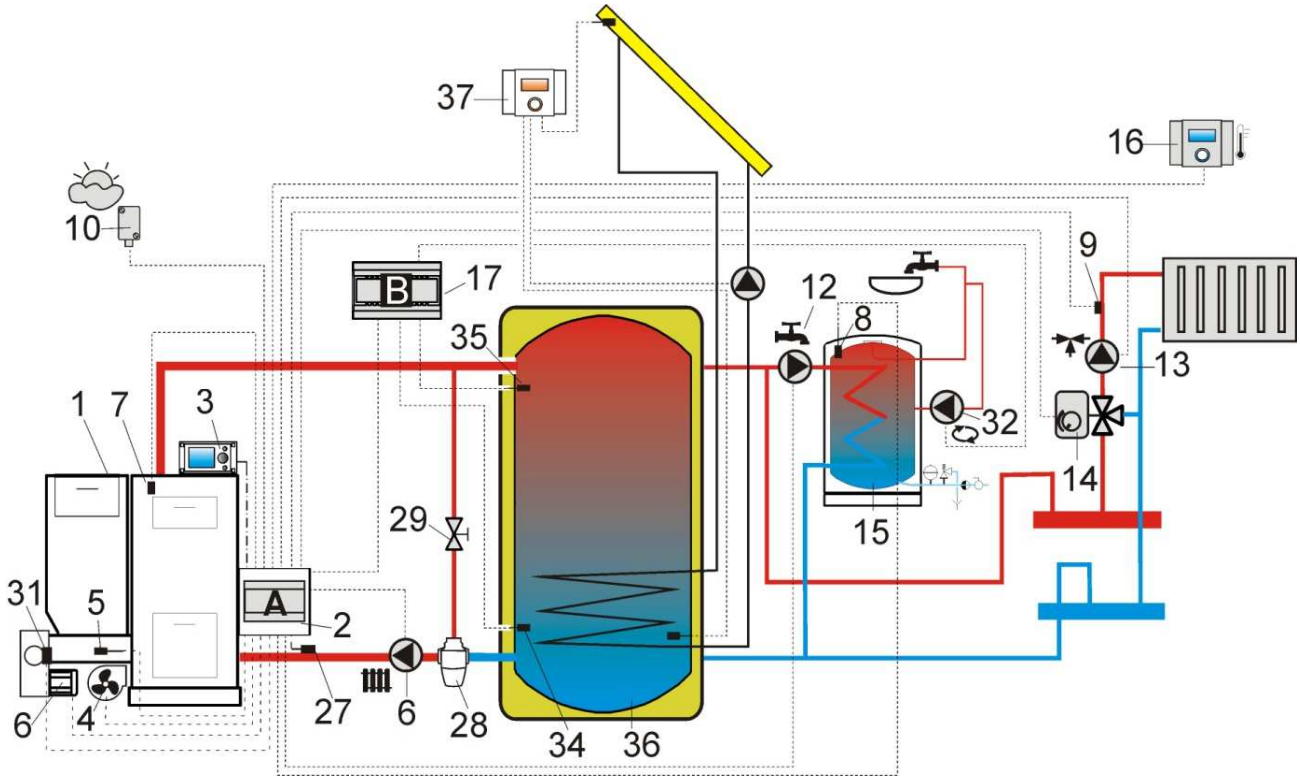

Fig. 17 Diagram with heat buffer and additional module B[5], where: 1 – boiler, 2 – SPARKX regulator – module A, 3 – SPARKX regulator – control panel, 4 – fan, 5 – feeder temperature sensor, 6 - gear-motor, 7 – boiler temperature sensor, 8 – HUW temperature sensor, 9 - mixer 1 temperature sensor, 10 – temperature (weather) sensor, 12 – HUW circuit pump, 13 – mixer 1 circuit pump, 14 – mixer 1 servo, 15 – HUW container, 16 – sparkster room control panel with room thermostat function, 17 – extension module B, 27 – return temperature sensor, 28 – thermostatic 3-way valve (to protect boiler return), 29 - throttle mushroom valve, 32 – HUW circulating pump, 34 – lower buffer sensor, 35 – upper buffer sensor, 36 – heat buffer, 37 – additional solar ecoSOL regulator.

	Parameter	**Setting**	**MENU**
	OPERATION mode: Return Protection	OFF	Service Settings → Boiler Settings → Return Protection 4D (if mixer sensor in not provided - this option is not available)
	Mixer support 1	ON (włącz.) CO	Service Settings → Mixer Settings 1
	Max. preset temperature of mixer 1	75°	Service Settings → Mixer Settings 1
	Heating curve. mixer 1	0.8 – 1.4	Service Settings → Mixer Settings 1
	Weather control mix.1	ON	menu→ Mixer Settings 1
	Circulation support	ON	Pump Service Settings →
	Buffer Support	ON	Buffer service Settings
	Buffer loading start temp.	40°	Buffer Service Settings
	Buffer loading end temp.	60°	Buffer Service Settings
	Min. buffer temp.	23°	Buffer Service Settings

Once the heat buffer (36) has been loaded, the regulator stops the pump (6) and enters SUPERVISION mode. The pump (6) starts in-spite of loaded buffer (36) once the boiler temperature has exceeded the preset value by 10°C. Pumps (12) and (13) are stopped, and servo (14) is closed once the buffer temperature has dropped to below *Min. buffer temp.*

9 Technical Data

Power supply	230V~; 50Hz;
Current consumption by the regulator	I = 0.02 A[6]
Max. rated current	6 (6) A

[5] The presented hydraulic diagram does not replace central heating engineering design and may be used for information purposes only.

[6] It is the current consumed by the regulator only. Total current consumption depends on the equipment connected with the regulator.

IP rating of the regulator	IP20, IP00[7]
Ambient temperature	0...50 °C
Storage temperature	0...65°C
Relative humidity	5 - 85% without steam condensation
Temperature measurement range of sensors CT4	0...100 °C
Temperature measurement range of sensors ZW-C4-EQ	-35...40 °C
Accuracy of temperature measurement using sensors CT4 and ZW-C4-EQ	2°C
Connectors	Screw terminals at supply voltage side - 2.5mm^2 Screw terminals at control voltage side - 1.5mm^2
Graphical display	128x64
Overall dimensions	Control panel: 164x90x40 mm Operating Unit: 140x90x65 mm
Total weight	0.5 kg
Standards	PN-EN 60730-2-9 PN-EN 60730-1
Software class	A
Protection class	suitable to built-into Class I devices
Pollution degree	2nd pollution degree

Table 1 **Technical Data**

10 Storage and transport conditions

The controller can not be exposed to immediate effects of atmospheric conditions i.e. rain or sunrays. Temperature of storage and transport should be within scope -15…65 degrees C.
During transport the controller can not be exposed to vibrations bigger than typical for transport of boilers.

11 REGULATOR INSTALLATION

11.1 Environmental conditions

Due to fire risk it is forbidden to use the controller in proximity of explosive gases or dust. Moreover the controller can not be used in conditions of water steam condensation or be exposed to effects of water.

11.2 Mounting requirements

Regulator should be installed by qualified and authorized technician with observance of applicable standards and regulations. The manufacturer disclaims any liability for damage caused by non-observance of instructions specified in this manual. Regulator is intended to build into other equipment, and may not be used as a stand-alone device.
Ambient temperature and temperature of mounting base should be within the range of 0 - 50°C. Regulator is composed of two modules: control panel and operating unit, connected with electric wire.

11.3 Installation of control panel

The control panel is to be enclosed on a mounting plate. Proper thermal insulation between hot boiler walls and the panel and the connecting tape must be provided. The space required for the control panel is shown in rys 20. During installation, follow the guidelines below.

STEP 1

[7] IP20 -from the front side of Operating Unit, IP00 – from the side of Operating Unit terminals; details -see 11.5

A hole must be made in the mounting plate, in accordance with the drawing below.

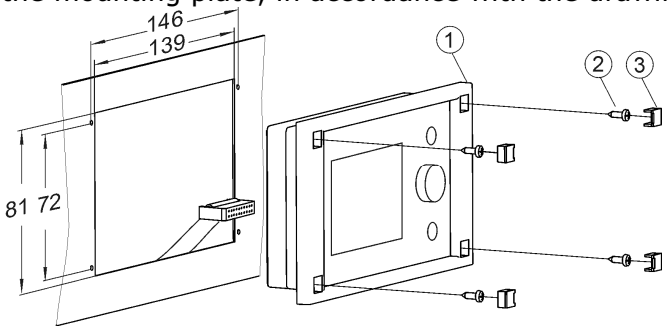

Fig. 18 Fitting the regulator in a mounting plate, where: 1 – control panel, 2 – sheet metal screw 2.9x13, 3 – hole plug.

STEP 2

Remove the lid (5), plug the cable (6) and put the lid (5) back on, securing it with screws (4). The cable should be lead out through the round groove in the enclosure.

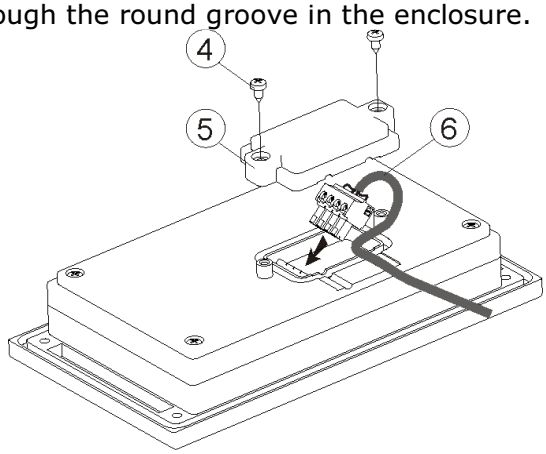

Fig. 19 Connecting lead to the panel, where: 4- B3x6 screw for thermoplastic materials, 5 – lid, 6 – lead connecting the control panel with the executive panel

Maximum length of the lead (6) is 5m with gauge of 0,5mm^2

STEP 3

Screw the panel to the mounting plate using sheet metal screws, insert the hole plugs.

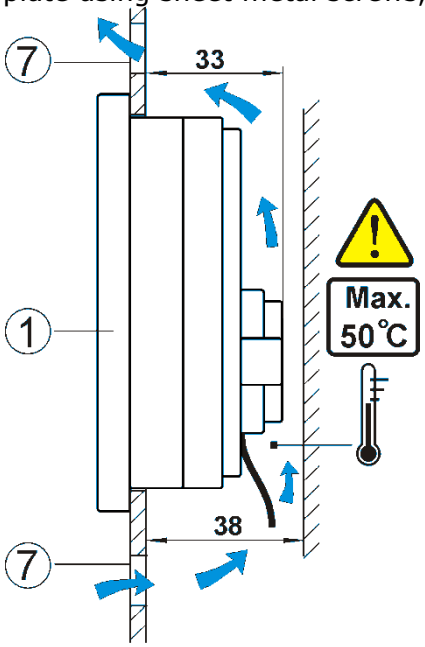

Fig. 20 Conditions of enclosing the panel, where 1 – panel, 2 –ventilation holes for air circulation (note: the holes cannot decrease the required IP protection rate; ventilation holes are not required if the limiting temperature of the panel surroundings is not exceeded; the ventilation holes do not always guarantee that the temperature of the panel surroundings will be lowered, in such case use other methods).

11.4 Mounting of Operating Unit

Operating Unit has to be built into master equipment. The assembly shall assure IP rating appropriate to the environment conditions, in which the regulator will operate. Moreover, access of the user to live parts under hazardous voltage (e.g. terminals) shall be prevented. Standard installation housing of a width of 8 modules as shown in **Chyba! Nenalezen zdroj odkazů.**a may be used. In such case the user will have access to front surface of operating unit. Housing may be also formed by boiler elements surrounding the whole unit- see **Chyba! Nenalezen zdroj odkazů.**b. Space required for operating unit is shown in **Chyba! Nenalezen zdroj odkazů.** and **Chyba! Nenalezen zdroj odkazů.**. The unit housing does not assure dust- or-waterproofness. To provide the required protection, appropriate operating unit cover should be provided.
Operating unit is designed to mount on standard DIN TS35 rail. Fasten the rail firmly to a rigid surface. Prior to placing the unit on the rail (2) - lift up catches (3) using screwdriver - see **Chyba! Nenalezen zdroj odkazů.**. Now, place the unit on the rail and press the catches (3) to bring them to original position. Make sure the device is firmly fastened and cannot be easily removed from the rail without use of tools. Connect cable (4) between operating unit and control panel.

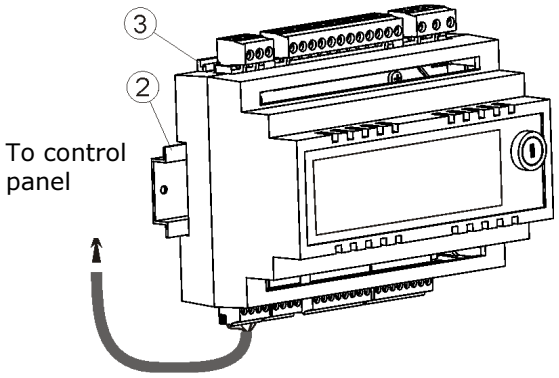

Fig. 21 On-rail-mounted regulator. 1- Operating Unit, 2 – DIN TS35 rail, 3 – catches.

For safety reasons, assure the safe distance between live parts of operating unit terminals and conductive (metallic) elements of housing (min. 10 mm) is kept.
Protect connecting wires from tearing, loosening and tensioning.

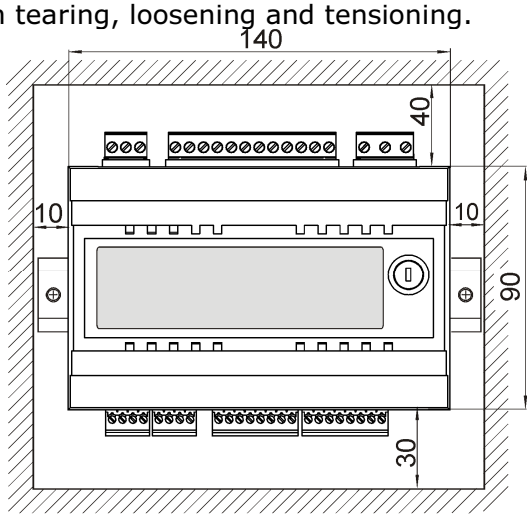

Fig. 22 Space requirements for Operating Unit mounting

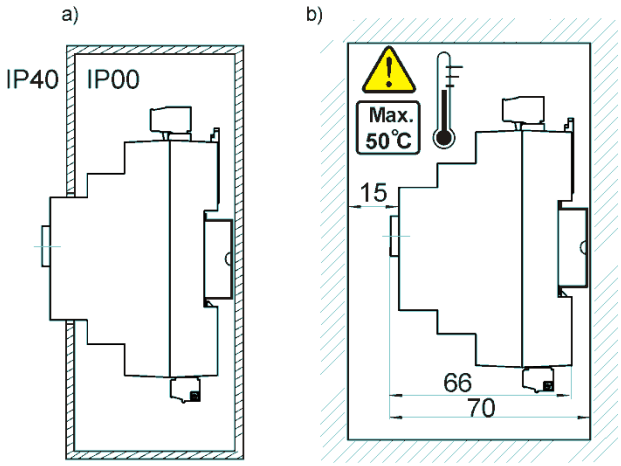

Fig. 23 Methods of operating unit installation: a – in modular housing with access to front surface, b – in the cover without access to front surface.

11.5 IP protection rate

Enclosure of the regulator's executive module provides various IP protection rates, depending on the method of installation. Rys 23a provides and explanation. After enclosing in accordance with this drawing, the device has protection rate IP 20 from the front side of the executive module enclosure (specified on the rating plate). From the side of the terminals, the casing has protection rate IP00, thus the terminals of the executive module must unconditionally be enclosed, in order to prevent access to this part of the casing.
If it is necessary to access the part with the terminals, disconnect the mains supply, make sure that there is no voltage on terminals and leads, and remove the executive module enclosure.

11.6Electric connection

Regulator is designed to be fed with 230V~, 50Hz voltage. The electrical system should be:

- three core (with protective wire),

in accordance with applicable regulations.

Caution: After the regulator is turned off using the keyboard, dangerous voltage can occur on the terminals. Before starting any assembly works, you must disconnect the mains supply and make sure that there is no dangerous voltage on the terminals and the leads.

The connection wires should not have contact with surfaces of temperature exceeding the nominal temperature of their operation.
Terminals number 1-15 are intended only for connecting devices with mains supply 230V~.
Terminals 16-31 are intended for cooperation with low voltage devices (below 12 V).

Connecting mains supply 230V~ to terminals 16-31 and to transmission connectors RS485 will damage the regulator and creates risk of an electric shock!

Tips of the connected wires, especially power leads, must be secured against splitting by means of insulated clamp sleeves.

The feeder cable should be connected to the terminals marked with an arrow.

All peripherals (such like: pumps, RE-marked relays and connected recipients) may be connected only by qualified persons in accordance with applicable regulations. Safety precautions to prevent electrocution shall be observed.

Regulator shall be equipped with a set of pins connected to 230V AC mains.

The protective conductor of the feeder cable should be connected to a neutral strip contacted with the metal casing of the regulator. The fitting should be connected to the regulator terminal marked with symbol

⏚ and with grounding terminals of the devices connected to the regulator. (Fig. 25).

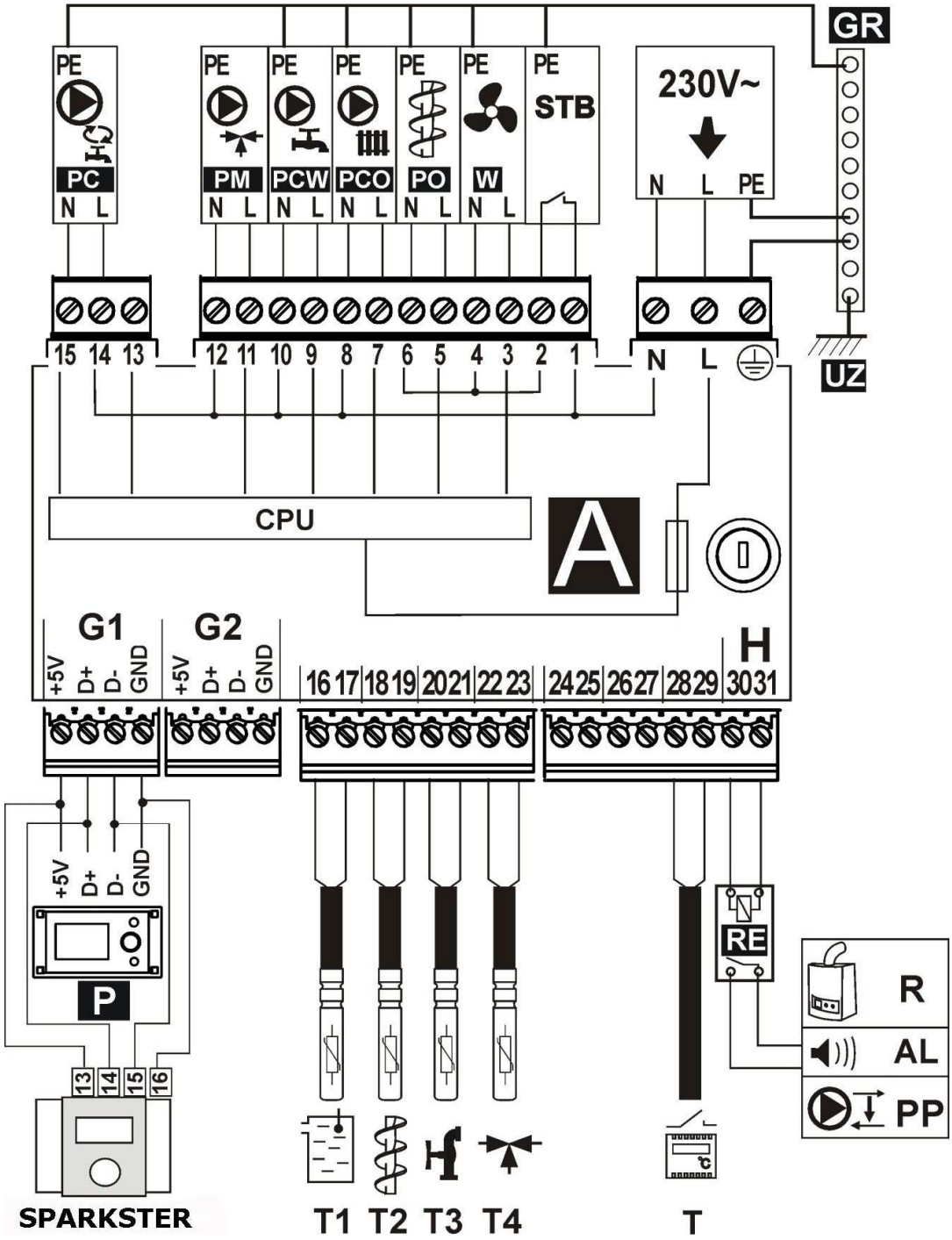

Fig. 24 Wiring diagram - four pumps T1 – boiler temperature sensor CT4, T2 – fuel feeder temperature sensor CT4, T3 – HUW temperature sensor, T4 – underfloor heating circuit sensor (thermostatic valve without electric servo), T – room thermostat, R – reserve boiler, AL – alarm annunciator, PP – boiler shunt pump to protect boiler return , P – boiler control panel, power supply cable, 230V AC , STB – safety temperature limiter (disconnects feeder and blow-in), W – fan, PO-fuel feeder motor, PCO – boiler pump, PCW – HUW pump, PM – thermostatic mixer circuit pump (without electric servo) to underfloor heating, GR – ground strip, UZ – earthing of metal regulator housing, PC – HUW circulating pump (instead of mixer servo), RE – relay (5÷6V, max 80mA),

Condition of PM pump operation is the setting: Service Settings →Mixer 1 Settings → Mixer support = pump only (in case mixer sensor T4 is not installed, this option is not available)

Condition of PC pump operation is the setting: Service Settings →Mixer 1 Settings → Mixer support =pump only or = OFF (in case mixer sensor T4 is not installed, this option is not available)

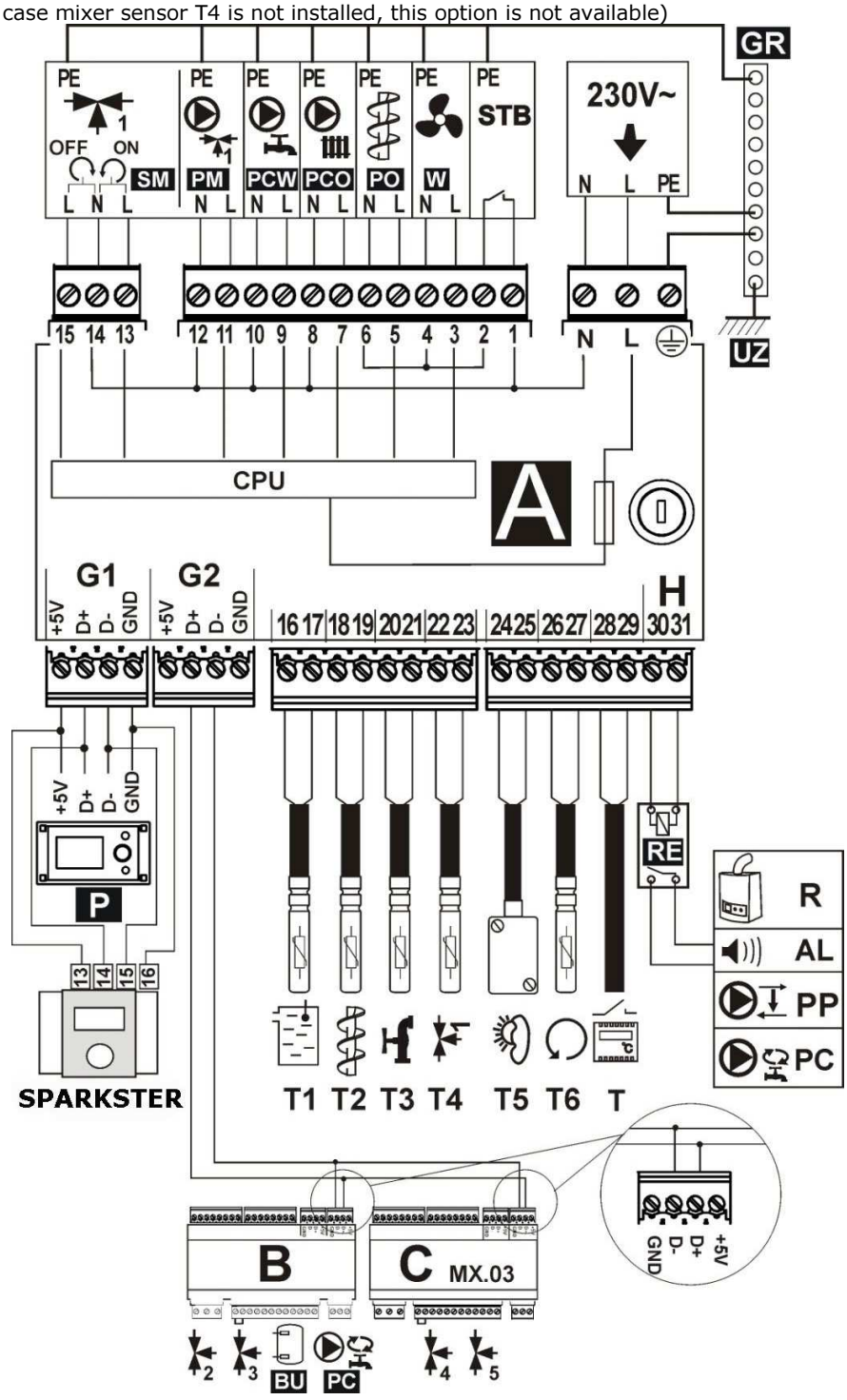

Fig. 25 Wiring diagram – with electric servo of valve T1 – boiler temperature sensor CT4, T2 – fuel feeder temperature sensor CT4, T3 – HUW temperature sensor, T4 – mixer 1 temperature sensor CT4, T5 – out-door temperature sensor - type ZW-C4-EQ, T6 – boiler return water temperature sensor, RE – relay (5÷6V, max 80mA) to connect reserve boiler R, alarm AL, boiler shunt pump PP, or HUW circulating pump PC , T – room thermostat, R – reserve boiler, AL – alarm annunciator, PP – boiler shunt pump to protect boiler return , PC – HUW circulating time, P – boiler control panel, B – extension module (two heating circuits, heat buffer, HUW circulating time), C MX.03 – extension module (two additional heating circuits), power supply cable, 230V AC , STB – safety temperature limiter (disconnects feeder and blow-in), W – fan, PO - fuel feeder motor, PCO – boiler pump, PCW – HUW pump, PM – no.1 mixer pump, SM – mixer servo, GR – ground strip, UZ – earthing of metal regulator housing.

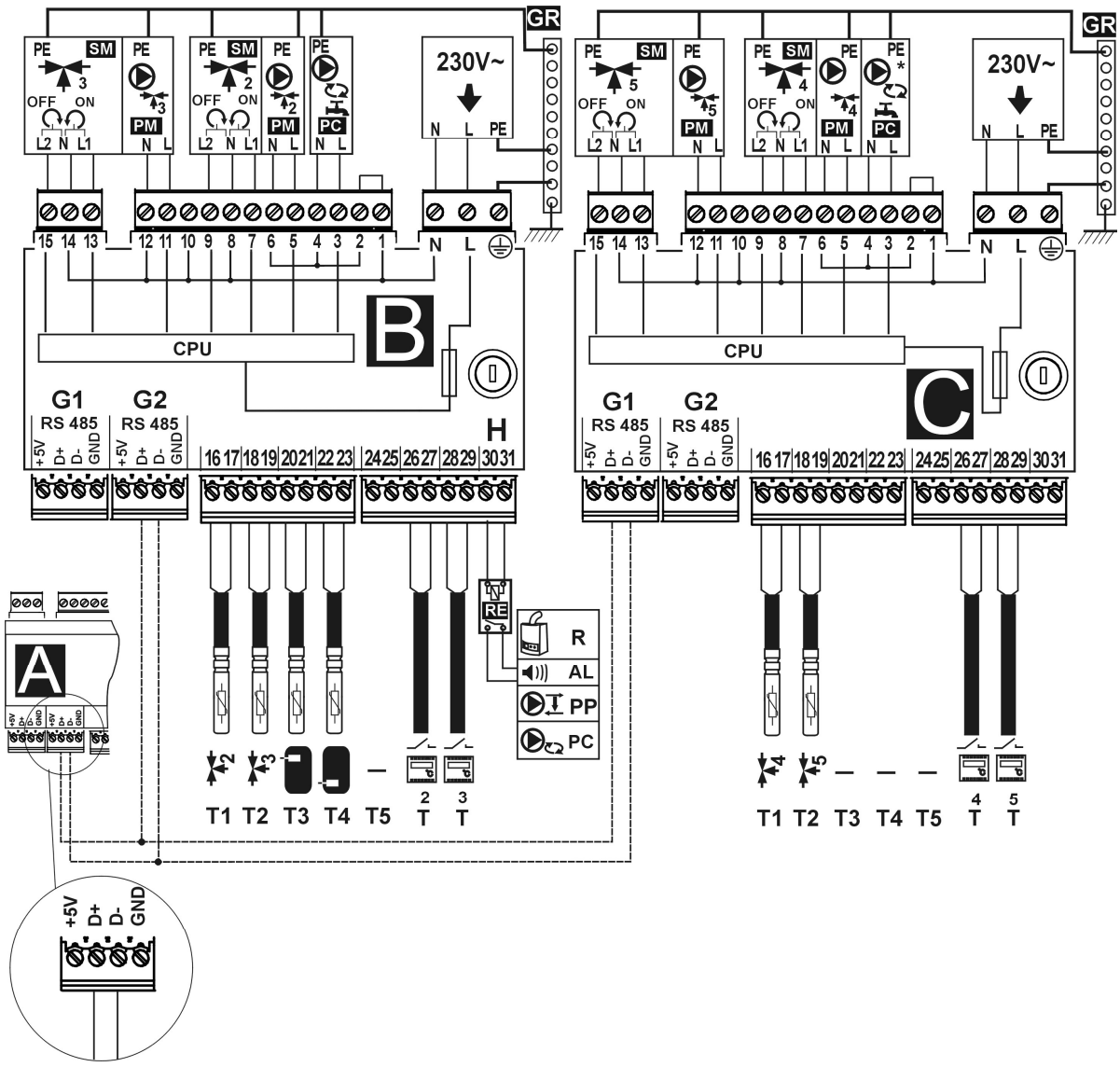

Fig. 26 Wiring diagram - modules B and C: T1 – mixer 2 or 4 temperature sensor CT4, T2 – mixer 3 or 5 temperature sensor CT4, T3 – upper temperature sensor of the buffer, T4 – lower temperature sensor of the buffer CT4, T5 – reserve, RE – relay (5÷6V, max 80mA) to connect reserve boiler R, alarm AL, boiler shunt pump PP, or HUW circulating pump PC , T – room thermostat, R – reserve boiler, AL – alarm annunciator, PP – boiler shunt pump to protect boiler return , PC – HUW circulating time, B – extension module (two heating circuits, heat buffer, HUW circulating time), C (MX.03) – extension module (two additional heating circuits), power supply cable, 230V AC , PM – mixer pump, SM – mixer servo, PC – HUW circulating time, * - HUW circulating pump available in module C from software version mod_A_v.01.31.21, GR – ground strip.

11.6 Temperature sensors connection

Wires of the sensors can be extended by wires with diameter not smaller than 0,5mm^2. Total lenght of wires in each sensor should not exceed 15m.

Boiler temperature sensor should be installed in thermostatic pipe installed in boiler. Temperature sensor of hot water silo should be installed in thermostatic pipe welded into the silo. Mixer temperature sensor should be installed in sleeve located in stream of running water in pipe, but also it can be installed on the pipe, on condition that it is thermo isolated from the pipe

Sensor must be protected from getting loose from the surfaces to which they are connected.

Good thermo contact should be maintained between sensors and measured surface. To this purpose thermoleading paste should be used. It is not acceptable to lubricate sensors with water or oil. Wires of sensors should be separated from network electrical wires. In such a case wrong readings of temperature may be shown. Minimum length between those wires should be 10 cm. It is not acceptable to allow for contact betweens wires of the sensors and hot parts of the boiler and heating installation. Wires of the sensors are resistant to temperature not exceeding 100 degrees C.

11.7 Weather sensors connection

The controller cooperates solely with weather sensor type ZW-C4-EQ. The sensor should be installed on the coolest wall of the building. Usually it is the northern wall, under the roof. The sensor should not be exposed to direct sunrays and rain. The sensor should be installed at least 2 m above the ground far away from windows, chimneys and other sources of heat.

To connect use wire with diameter at least 0,5mm2 up to 25m long. Polarization of wires is not essential. Second end should be connected to terminals of controller according to Pic. 19 or properly to used kind of controller.
The sensor should be screw to the wall. Acces to assembly holes is possible after unscrewing the cover of the sensor.

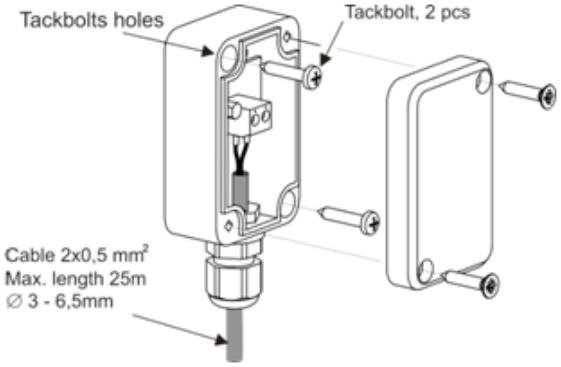

Fig. 1 Weather sensor connection ZW-C4-EQ.

11.8 Testing of temperature sensors

CT4 temperature sensor may be tested by measuring its resistance at the given temperature. In case of significant differences between measured resistance and the values indicated in the table below - replace the sensor.

CT4			
Temp. °C	Min. Ω	Nom. Ω	Max. Ω
0	802	**815**	828
10	874	**886**	898
20	950	**961**	972
25	990	**1000**	1010
30	1029	**1040**	1051
40	1108	**1122**	1136
50	1192	**1209**	1225
60	1278	**1299**	1319
70	1369	**1392**	1416
80	1462	**1490**	1518
90	1559	**1591**	1623
100	1659	**1696**	1733

Table of CT4 temperature sensor resistance values

ZW-C4-EQ (weather)			
Temp. °C	Min. Ω	Nom. Ω	Max. Ω
-30	609	**624**	638
-20	669	**684**	698
-10	733	**747**	761
0	802	**815**	828
10	874	**886**	898
20	950	**961**	972

Table of ZW-C4-EQ temperature sensor resistance values

11.9 Connection of boiler's room thermostat

Note: the boiler's room thermostat should be switched off if the whole central heating system of the building is supplied through a mixing valve equipped with electric servo.

The regulator may work with mechanical or electronic room thermostat, which opens the contacts once the preset temperature has been achieved. Connect the thermostat acc. Fig. 25.

Set-up the operation of room thermostat in:
MENU → Boiler Settings → Room thermostat → Thermostat Selection → Universal

Once the preset room temperature has been reached, thermostat opens its contacts and the display shows: ⊟

Once the temperature in the room, in which the room thermostat is installed, has reached the preset value, regulator reduces the preset boiler temperature by the value set in *Inc. p. b. temp.thermostat* and the display shows ↓⊟. This will cause longer breaks in boiler operation (the boiler will remain in SUPERVISION mode) and the same, temperature in heated rooms will drop. Moreover, the boiler pump (CH pump) may be interlocked for a certain time by opening the contacts of the room thermostat in heated rooms. To activate this function - enter:

MENU → Boiler Settings → Room thermostat → *CH pump standstill*

and set the value of this parameter >0. Setting the value of e.g. ,,5" causes the pump will be stopped by the room thermostat for 5 min. When ,,0" is set, CH pump will not be stopped by the room thermostat. Once this time has elapsed, the regulator switches on CH pump for a time set in *CH pump op t. th. on* e.g. 30s. This feature prevents from excessive cooling of the system caused by pump stop.

Pump interlock by opening the contacts of the room thermostat may be activated only upon making sure the boiler will not be overheated.

11.10 Connection of mixer's room thermostat

This parameter is available in:
MENU → Mixer Settings no. 1,2,3,4,5
Mixer pump does not stop upon opening the contacts of the room thermostat unless other settings have been made in Service Menu. Select the value of this parameter so that once the room thermostat has responded (its contacts have opened), the temperature in the room drops. Other settings - see sec. 7.14

11.11 Connection of reserve boiler

The regulator can control a reserve boiler (gas- or oil-fired), eliminating the necessity of enabling or disabling this boiler manually. The reserve boiler will be enabled if the temperature of the pellet boiler drops, and disabled when the pellet boiler reaches an appropriate temperature. Connection to a reserve boiler, e.g. oil-fired one, should only be made by a qualified fitter, in accordance with the technical documentation of this boiler.

The reserve boiler should be connected via relay to terminals 30-31 as per drawing Fig. 25 oraz Fig. 27.

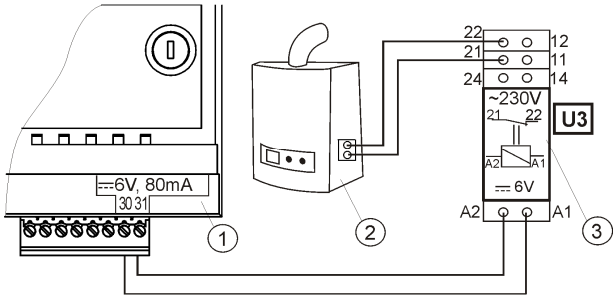

Fig. 27. Model diagram of layout for connecting a reserve boiler to the SPARK800P1-L regulator, where: 1- regulator SPARK800P1-L module B 2 – reserve boiler (gas- or oil-fired), 3 – Module U3, consisting of relay RM 84-2012-35-1006 and base GZT80 RELPOL

In a standard version, the regulator is not equipped with the U3 module.

You have to perform assembly and installation of the module by yourself, in conformity with the applicable standards..

Set the temperatures of reserve boiler switch on/off:
MENU → SERVICE SETTINGS → BOILER SETTINGS → Reserve Boiler → *Reserve boiler deactivation temperature .* Control of reserve boiler is off upon setting this parameter at ,,0". Now, set-up Output H on reserve boiler:

MENU → Service Settings → OUTPUT H = *reserve boiler*
Once the retort boiler has been fired up, and its temperature has exceeded the preset value (e.g. 25°C), SPARK regulator switches off the reserve boiler and applies voltage 6V DC at Output H, which causes release of coil of U3 module relay and opening its contacts. Once the boiler temperature has dropped below the value set in the parameter of *Reserve boiler deactivation temperature , the* regulator stops to supply voltage to Output H, and the reserve boiler switches on.

Entry of SPARK regulator to STAND-BY conditions causes the reserve boiler switches on.

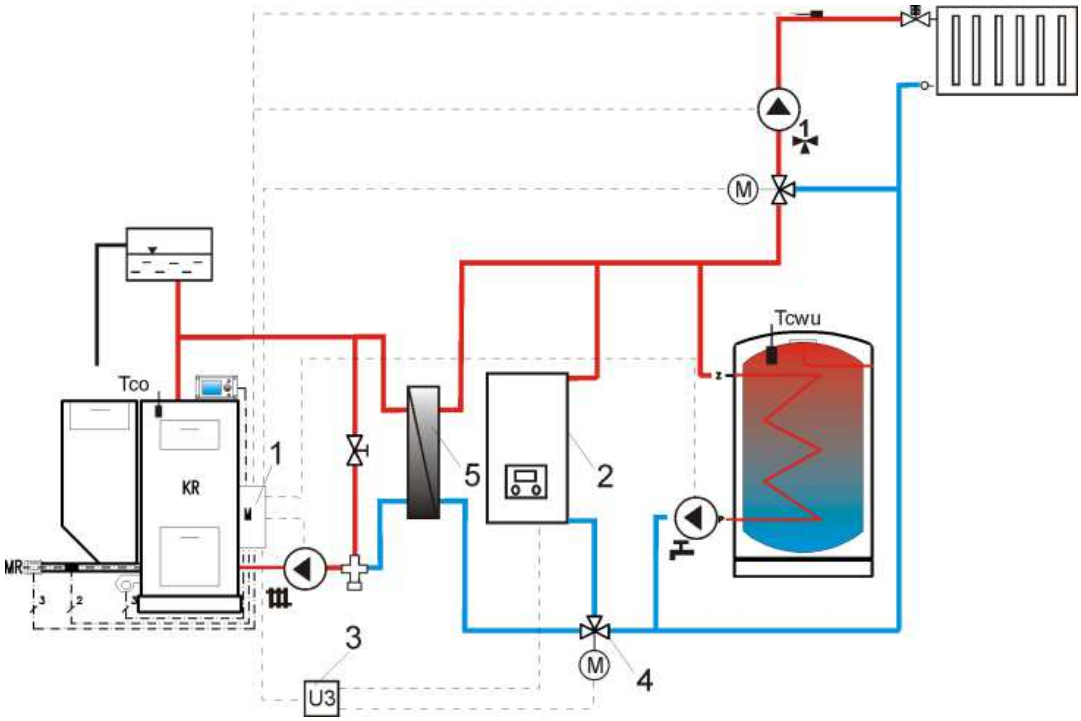

Fig. 28 [8]. . Hydraulic diagram with reserve boiler; connection of open and close circuits 1 –SPARKX regulator , 2 – reserve boiler, 3 – U3 module (2 pcs), 4 – switching valve (with limit switches), 5 – heat exchanger (recommended settings: *HUW mode = no priority, heat exchanger = ON* (Menu → Pump Service Settings → .

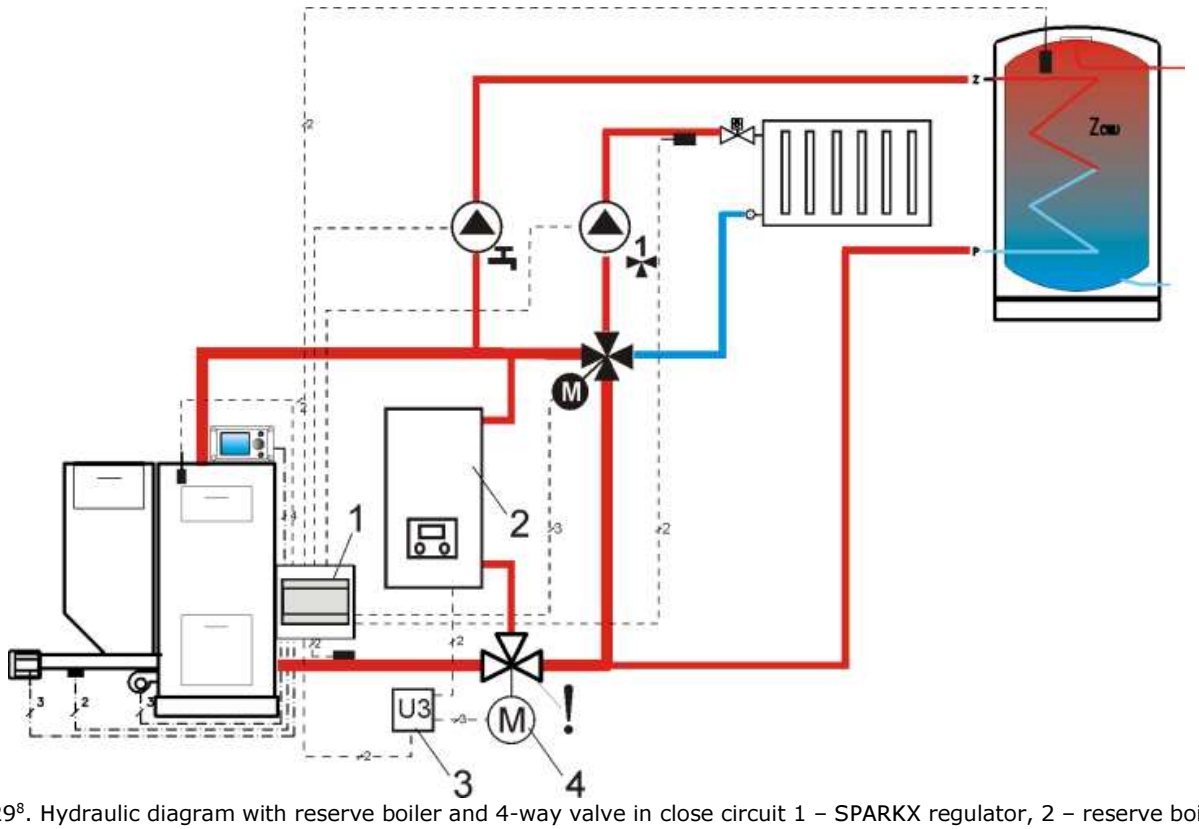

Fig. 29[8]. Hydraulic diagram with reserve boiler and 4-way valve in close circuit 1 – SPARKX regulator, 2 – reserve boiler, 3 – U3 module, 2 pcs., 4 – switching valve servo (with limit switches) - to ensure free gravitational flow of water in boiler circuit, active cross-section of switching valve (4) has to be larger than or equal to cross-section of boiler circuit pipes. Use pipes of large cross section for gravitational boiler circuit.

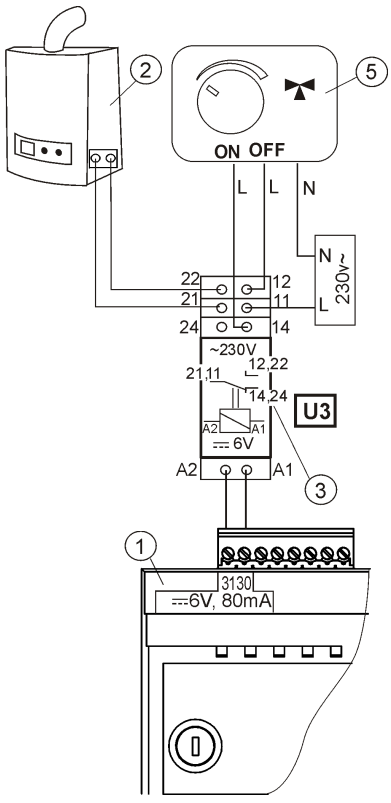

Fig. 30. Electric diagram for switching valve of the reserve boiler, where: 1 – regulator SPARK800P1-L module B, 2 – reserve boiler, 3 – U3 module, 5 – servo of switching valve (with limit switches), note: contacts 22, 21, 24 must have galvanic separation from contacts 12,11,14.

[8] The presented hydraulic diagrams do not replace central heating engineering design and may be used for information purposes only.

11.12 Connection of alarm signalling

The regulator may announce alarm condition by activating external device (e.g. bell or GSM device to send SMS). Alarm signalling and reserve boiler control use the same terminals, therefore, setting of output H at alarm signalling deactivates the function of reserve boiler control. Connect alarm annunciator as shown in Fig. 31 through U3 module.

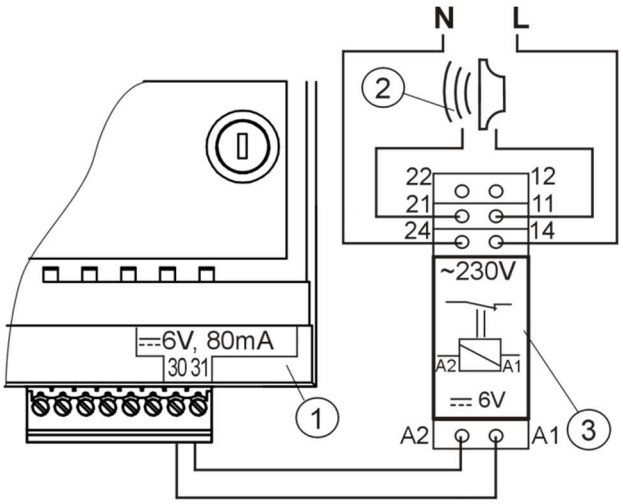

Fig. 31 Connection of external alarm annunciator 1- SPARK. regulator - module A, 2 –external alarm annunciator, 3 –relay RM 84-2012-35-1006 RELPOL and base GZT80 RELPOL,

For proper operation, set proper value of the parameter: *Active alarm signal code* in:

MENU → Service Settings → Boiler Settings → Alarms → *Active alarm signal code*

When "31" has been set - in case of any alarm occurred, voltage is applied at contact 30-31. Setting this parameter at "0" causes the regulator does not apply voltage upon occurrence of any alarm. Contact 30-31 may be so set up that the voltage will be applied at it upon occurrence of one or few alarms. The values of this parameter to be set for respective alarms are given in the table below:

Boiler overheating	Flash back	CH boiler temperature sensor damage	Feeder temperature sensor damage	No fuel
AL 1	AL 2	AL 3	AL 4	AL 5
1	**2**	**4**	**8**	**16**

Example: when this parameter is set at ,"8", voltage will be applied at the contact only upon occurrence of AL4 alarm. In case of ,"1" setting, only alarm ,"1" will be announced. In case the contact should signal few alarms (e.g. AL2 and AL4 alarms) - sum-up the values indicated in the table for individual alarms (i.e. 2 + 8 = 10) and set so calculated sum. For signalling alarms: AL1, AL2 and AL3 - set ,"7" because the sum of 1 + 2 + 4 = 7.

11.13 Connection of mixer servo

When connecting electric servo of the mixer take due care to prevent boiler overheating, which may occur when the flow of boiler water is limited. You are advised to get familiar with the position of the valve corresponding to its maximum opening before commencement of work so that you may ensure heat collection from the boiler at any time it is required.

The regulator works only with mixing valve servos equipped with limit switches. Use of other servos is not allowed. The servos of full turn time from 80 to 255 s may be used.
Description of mixer servo connection:
- connect mixer temperature sensor,
- switch on the regulator and select proper *mixer support* in service menu: MENU → Service Settings → PASSWORD→ Mixer Settings - e.g. "CH ON ".
- enter proper *Valve Opening Time (Valve Opening Time*) in Service Settings (this time should be indicated on servo rating plate e.g. 120s),
- disconnect power supply of the regulator,
- determine direction of servo closing/ opening. For this purpose, set the selector located on the housing of electric servo at manual control and find the positions of the valve in which the temperature in mixer circuit is maximum and minimum (it corresponds to the setting of the regulator of "100% ON" and "0% OFF", respectively). Write down these positions.
- connect mixer pump,
- wire mixer servo with the regulator,
- connect power supply to the regulator,
- check whether wires to mixer closing and opening are not interchanged. To do this, enter MENU →*Manual Control* and open the mixer by selection of *Mix1 open = ON*. When opening, temperature on mixer sensor should increase. In other case, disconnect power supply to the regulator and interchange the wires (Note: other reason of this fault may be incorrect mechanical connection of the valve! – refer to the documentation of valve manufacturer and check whether the valve is properly connected),
- calibrate % factor of mixer valve opening. To do this, disconnect power supply to the regulator and set the selector on housing of electric servo at manual control. Turn the valve head to fully closed position, and set the selector on housing of electric servo at AUTO again. Connect power supply to the regulator. Now, % factor of mixer valve opening has been calibrated. Note: Calibration in mixers no. 2,3,4,5 starts automatically upon connection of power supply. In case of these mixers
- wait until % factor of mixer valve opening has been calibrated. During calibration, servo is closed for the time set in *Valve Opening Time* . Running calibration is indicated by "KAL" in MENU Information , tab "Mixer-Info" .
- set other parameters of the mixer.

11.14 Connection of mixer pump

HUW circulating pump may be connected with the regulator in a few ways:
- to the output "H" through relay acc. Fig. 25 and as described in sec. 11.15. The condition to work is setting the service parameter *Output H = circulating pump* .
- to terminals 14-15 instead of electric servo of the mixer (the condition to work is disconnecting the mixer sensor and setting the service parameter *Mixer support = OFF* or *Pump only*), Fig. 25.
- to additional module B, Fig. 26.

11.15 Connection of boiler shunt pump

Boiler shunt pump should be connected to output H through relay. The condition to work is setting the service parameter *Output H = boiler shunt pump.*

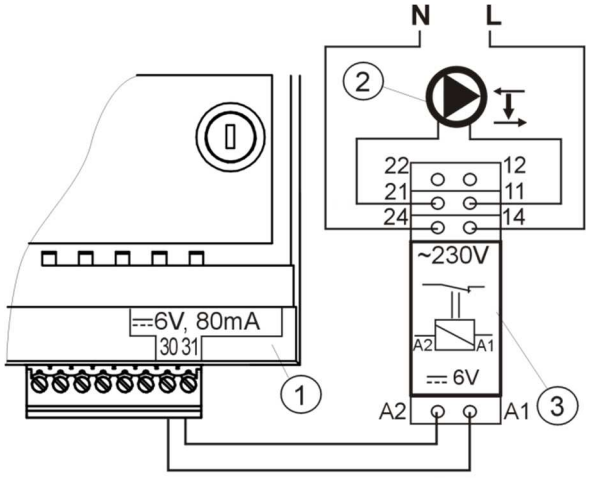

Fig. 32 Connection of boiler shunt pump 1- SPARK. regulator - module A, 2 – boiler shunt pump, 3 –relay RM 84-2012-35-1006 RELPOL and base GZT80 RELPOL

Boiler shunt pump may operate basing upon the read-out of:
- return temperature sensor - the pump starts once the temperature at boiler return sensor has dropped to below the value set in the parameter *CH pump activation temperature* available in main menu. It is recommended to set this value at min.50°C,
- return temperature sensor and boiler temperature sensor - the pump starts once the temperature difference has exceeded the value of H1 parameter and stops once it has dropped to below H2 value. Those parameters are available in: M menu → Service Settings → Pumps. The condition: H1>H2 has to be fulfilled.

For proper operation of hydraulic system with boiler shunt pump, control valve to limit the flow has to be installed and adjusted.

It is recommended to connect the regulator (1) and the pump (2) to one common source of power supply. This solution will enable disconnecting power supply to both equipment at the same time.

11.16 Connection of temperature limiter

To avoid boiler overheating in case of regulator failure, provide STB or other appropriate safety temperature limiter. Connect STB limiter to terminals 1-2 shown in Fig. 25. Once the limiter has tripped, fan and fuel feeder motor are OFF.

Safety temperature limiter should be suitable to operate at rated voltage min. 230V AC and holdrequired certificates of approval.

In case the limiter is not installed- bridge the terminals 1-2 using wire of cross-section area of min. 1 mm^2 and with insulation enough thick to meet safety requirements for the boiler.

11.17 Connection of room control panel

sparkster room control panel may be installed. Main functions of the panel are following:
- room thermostat (3 thermostat units),
- boiler control,
- alarm annunciator,
- fuel level indication.

4-wire connection:

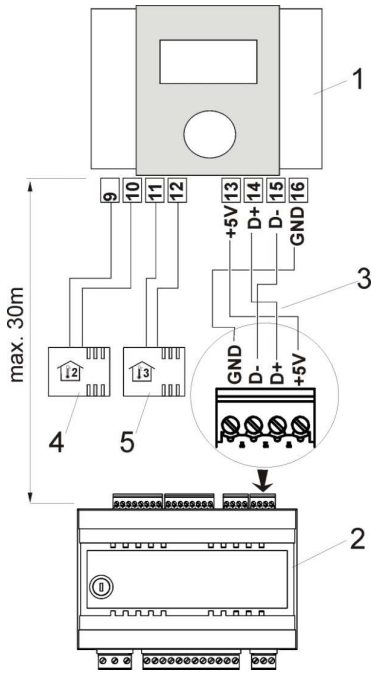

Fig. 33 Wiring diagram (4 wires): 1 – sparkster room control panel, 2 – SPARK regulator, 3 – connecting wire, 4 sensor of room thermostat 2- type CT7, 5 – sensor of room thermostat 3 - type CT7.

2-wire connection:

For two-wire connection, power supply of 5V DC and rated current of min. 200mA is required. Disconnect GND and +5V wires from the module (2) and re-connect them to external power supply unit arranged near sparkster (1). PS unit is not included in the regulator supply. Max. length of wires to sparkster control panel depends on cross-section area of a wire, and e.g. for a wire of cross-section of 0.25 mm^2 it should not exceed 30m. The cross-section area of the wire should not be less than 0.25 mm^2.

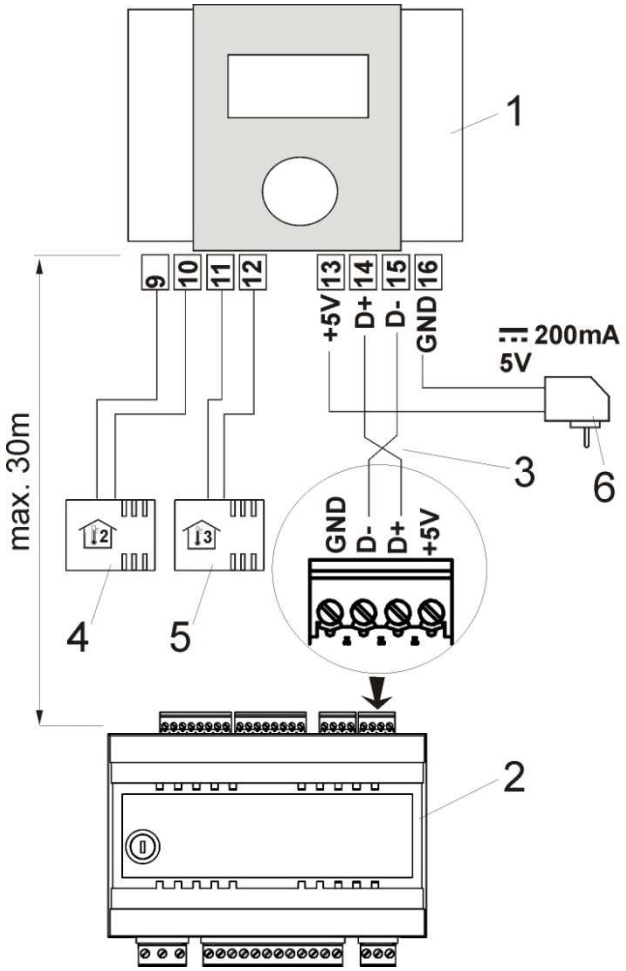

Fig. 34 Wiring diagram (2 wires) 1 – sparkster room control panel, 2 – SPARK. regulator, 3 – connecting wire, 4 sensor of room thermostat 2 - type CT7, 5 – sensor of room thermostat 3 - type CT7, 6 – 5V PS unit.

12 BOILER SERVICE SETTINGS

Burner Settings	
→Blow in output SUPERV.	Power of the fan in SUPERVISION mode - too high value may cause boiler overheating or flash back to the feeder; too low value - may result in fuel pouring.
→Feeding Time SUPERVISION	Time of fuel feeding in SUPERVISION mode; Too high value may cause boiler overheating or fuel pouring; too low - fuel return to the feeder.
→Airflow oper.extend. SUPERV	In SUPERVISION mode of boiler operation, once the fuel dose has been supplied and the feeder stopped, the fan remains in operation for a time set in "*Airflow oper.extend.* to fire-up the fuel dose supplied. Value of this parameter may not be too high because it may lead to boiler overheating
→Fan in SUPERV.	Enable to start and stop the fan in SUPERVISION mode
→Min. blow-in output	Min. blow-in output which may be set in the parameters related with the fan power available in the User's menu.
→Cycle order OPERATION	Setting this parameter at "Feeding-break" causes the OPERATION mode will start from a feeding of fuel dose. Setting this parameter at ,"Break - Feeding" causes the OPERATION mode will start from break in fuel feeding. This parameter is helpful in case of frequent boiler change-over from SUPERVISION to OPERATION mode, where fuel pouring or furnace lowering may occur.
→Fuzzy Logic	Fuzzy Logic settings are available only for boiler manufacturers
Min. preset boiler temperature	This parameter prevents the user to set too low value of boiler preset temperature. Boiler operation at too low temperature may cause its quick damage, corrosion, dirt, etc.
Max. preset boiler temperature	This parameter prevents the user to set too high value of boiler preset temperature.
Reduction value	This parameter determines the temperature at which the boiler will return from SUPERVISION to OPERATION mode
No fuel detection time	It is the time after which the regulator starts the procedure of detecting lack of fuel.
No fuel Del T	Difference between preset boiler temperature and actual boiler temperature, at which the boiler starts the procedure of detecting lack of fuel.
Maximum feeder temperature	It is the temperature at which the protection against flashback to fuel feeder activates.
Boiler cooling temp.	Temperature at which boiler cooling down described in sec. 18.2 occurs.
Return Protection4D	A list of settings for boiler return protection function performed using 4-way valve with electric servo. This function is not active if return sensor is disconnected or Mix1 support is OFF. Activation of this function causes all mixers close.

→ OPERATION mode	This parameter switches ON and OFF the boiler return protection function performed using mixing valve with electric servo. Note: do not switch on this function if the valve is not provided with electric servo!
→ Min. return temp	Boiler return temperature below the value at which electric servo closes mixing valve.
→ Return temp. hyst.	Electric servo returns to normal operation at the return temperature ≥ *min.return temperature* + *Return temp. hyst.*
→ Valve closing	It is % opening of mixing valve during active return protection function. Note: the valve closes with accuracy of +/-1%.
Reserve boiler	The temperature of retort boiler at which reserve boiler (e.g. gas fired boiler) will be OFF is set using this parameter. Details - see sec. 11.11
Alarms	Details - see sec. 11.12
Feeder Efficiency	Parameter used to rough calculation of boiler output (displayed in INFO window) and of fuel level and it has no effect on control of combustion process [kg/h].
Energy Density	Parameter used to rough calculation of boiler output; it has no effect on control of combustion process. Its value for hard coal amounts to approx. 6.5 [kWh/kg]
Tank Capacity	Parameter used to calculate fuel level [kg]. Note: Change and confirmation of the value using the knob replaces previously completed fuel level calibration with calculation of fuel level using *Tank Capacity and Feeder Efficiency* parameters.

13 SERVIS SETTINGS OF PUMPS

CH pump standstill at HUW supply	Parameter available upon connection of HUW sensor. Too long time of HUW container filling at active HUW priority may lead to excessive cooling down of CH system because boiler pump (CH pump) is switched off at this time. Parameter of *CH pump standstill time during HUW filling* prevents it by periodic CH pump switch-on during HUW container filling. After that time, CH pump will switch on for a fixed time set at 30s.
Min. HUW temperature	This parameter is available upon connection of HUW sensor and prevents the user to set too low preset HUW temperature.

Max. HUW temperature	This parameter is available upon connection of HUW sensor. It defines max. temperature to which HUW container will be heated-up during discharge of excess heat from the boiler in emergency conditions. This parameter is important, because setting of too high value may cause the risk of burning the user with hot utility water. On the other hand, too low value of this parameter will cause that in case of boiler overheating excessive heat cannot be removed to HUW container. When designing HUW system, possibility of regulator failure should be considered. In case of regulator failure, water in HUW container may be heated-up to hazardous temperature, which may create the risk of user's burning. Therefore, some other protection (e.g. thermostatic valves) should be used.
Incr. boil.temp. for HUW and mixer	This parameter determines by how many degrees the preset boiler temperature will be increased to fill HUW container, buffer and mixer circuit. Temperature is increased only if required. Once the preset boiler temperature has reached sufficient value to fill HUW container, buffer and mixer circuit, the regulator stops its further increase.
HUW operation ext.	This parameter is available upon connection of HUW sensor. Once HUW container has been filled and HUW pump has been stopped, a boiler overheating risk may occur. It occurs in case the preset HUW temperature is higher than the preset boiler temperature. This issue refers particularly to the operation of HUW pump in SUMMER mode, when CH pump is OFF. To cool down the boiler, duration of HUW pump operation may be extended by the time set in *HUW pump operation extension time.*
Circulation support	This parameter switches on/ off operation of circulating pump. Upon activation in the user menu, the position of HUW circulating pump is displayed. Note: this function is available only in case Output H is set at circulating pump or mixer 1 support = *OFF* or *pump only*.
Boiler shunt pump H1	Difference between temperature of the boiler and boiler return at which boiler shunt pump switches on has to meet the condition: H1>H2. To have this parameter available, Output H has to be set at ”Boiler Shunt Pump”.
Boiler shunt pump H2	Difference between temperature of the boiler and boiler return at which boiler shunt pump switches off has to meet the condition: H1>H2. To have this parameter available, Output H has to be set at ”Boiler Shunt Pump”.
Heat exchanger	It refers only to hydraulic systems with heat exchangers connected between open and close circuit. Available options: • YES (boiler pump is in continuous operation in a limited circuit: boiler - heat exchanger; it is not exclusive e.g. from SUMMER function or HUW priority), • NO (boiler pump in operation as usual).

14 SERVICE SETTINGS OF MIXER

Mixer support	
→ Off	Mixer servo and mixer pump are OFF
→ CH ON	It is used when the mixer circuit supplies CH radiator system. Max. temperature of mixer circuit is not limited, mixer is fully opened during alarms e.g. boiler overheating. Note: do not activate this option if the pipes used are not high-temperature resistant. In such conditions it is recommended to set "MIXER SUPPORT " at "FLOOR".
→ Floor On	It is used when the mixer circuit supplies underfloor heating system. Max. temperature of mixer circuit is limited to the value of the parameter of "*Max. preset mixer temp.*" Note: upon selection of the option of "*FLOOR ON*" set the max. preset mixer temperature at such value, which prevents the floor destruction and occurrence of burn risk.
→ Pump only	Once the mixer temperature has exceeded *a "mixer preset value*", power supply to mixer pump stops. Once the mixer temperature has dropped by 2 ºC, the pump switches on again. This option is mainly used to control the underfloor heating pump in case it works with thermostatic valve without servo.
Min. mixer temperature	This parameter is used to prevent the user to set too low preset value of mixer circuit temperature.
Max. mixer temperature	This parameter has two functions: - it enables preventing the user to set too high value of preset mixer temperature, - when the parameter *"Mixer support "* is set at "*FLOOR ON,* it determines the limit value of mixer temperature at which the mixer pump will stop. For underfloor heating set this parameter at the value not exceeding 45°C - 50°C unless the manufacturer of materials used to complete the floor or CH system designer has recommended other values.
Valve opening time	Enter the time of full valve opening taken from the rating plate of valve servo (e.g. 140s)
Pump OFF by thermostat	Once this parameter has been set at "YES", mixer servo closes and mixer pump stops upon opening thermostat contacts (the room has been heated). Performance of this operation is not recommended because the heated room may be cooled down too much.
Operat. in SUMMER	Upon setting of *Operat. in SUMMER = ON* , mixer is not closed in SUMMER mode.
Mixer input dead zone	Parameter setting, which determines the value of temperature dead zone of mixer control system. The regulator controls the mixer in the manner assuring that actual temperature value measured by the mixer sensor is equal to the preset value. Nevertheless, in order to avoid too frequent servo motions, which may unnecessarily reduce its lifetime, regulation starts once the measured temperature of the mixer circuit has been higher or lower than the preset value by the value set in *Mixer input dead zone.*

Emergency valve opening	It is a % valve opening during active boiler overheating alarm. This parameter is used for cast-iron boilers, and is available in some regulators only.
Proportional range	This parameter influences the range of mixer servo motion. Increase of its value causes actual mixer temperature reaches faster the preset value, but too high value set causes temperature overshoot and unnecessary servo motions. Correct value should be determined experimentally. Recommended settings of this parameter should be within the range of 2 – 6 [3].
Integr. time const.	The higher the value of this parameter is the slower the response of servo on temperature off-set is. Setting too low value may cause unnecessarily servo motions, while too high setting will increase time of finding preset temperature value. Correct value should be determined experimentally. Recommended settings of this parameter should be within the range of 100 – 180 [160].

15 BUFFER

Buffer Support	Switches ON/OFF buffer support.
Buffer loading start temp.	Temperature measured by upper buffer sensor at which buffer loading starts.
Buffer loading end temp	Temperature measured by lower buffer sensor at which buffer loading ends..
Min. buffer temp.	Temperature measured by upper buffer sensor at which the pumps are switched off and the mixer servos are closed.
Note: these parameters are available upon connection of additional module B.	

16 Output H

Output H	This parameter determines the function being executed at Output H (terminals 30-31). Following options are available: - Reserve boiler; - Alarms; - Circulating pump ; - Boiler Shunt Pump ;

18 ALARM DESCRIPTION

18.1 No fuel

In case the boiler temperature dropped in OPERATION mode by the value of *DelT lack of fuel* below the *boiler preset temperature,* the regulator starts counting *No fuel detection time.*

MENU → Service Settings → Boiler Settings → *No fuel detection time*

If, upon elapsing this time, the boiler temperature has not increased by 1 °C, the regulator switches off heat recipients and starts counting *No fuel detection time* again. If temperature has not increased after this time by 1 °C, the regulator enters STOP mode and generates alarm "No fuel". To reset the alarm - switch OFF and ON the regulator.

In case the regulator erroneously detected lack of fuel - increase the value of parameter of *No fuel detection time* - see sec. 1 or decrease the value of *DelT lack of fuel.*

18.2 Max.boiler temp. excess

Protection against boiler overheating comprises two stages. In first instance i.e. once the *Boiler cooling temp.* has been exceeded, the regulator attempts to reduce the boiler temperature by activation of the boiler pump, HUW pump and opening the mixer servo (only in case mixer circuit = CH ON). Has the temperature dropped - the regulator returns to normal operation. Is the temperature still increasing (and has reached 95°C), power supply to the fuel feeder and the fan is off and permanent boiler overheating alarm with sound signal is produced. If, during boiler overheating time, temperature measured by HUW sensor is higher than *Max. HUW temperature*, HUW pump goes off. In this manner, users of hot utility water are protected from burning. Alarm is reset by regulator switching off and on.

Note: arrangement of temperature sensor outside the boiler water jacket (e.g. at the outlet pipe) is not recommended because boiler overheating may be detected with delay.

If the regulator is SUMMER mode, the regulator attempts in first instance to discharge excess heat to HUW container. HUW pump goes OFF if the temperature measured by HUW sensor is in excess of *max HUW temperature .*

18.3 Exceeding max. feeder temperature

This alarm will occur after the feeder temperature exceeds the service parameter:

Service settings> Boiler settings> Max. feeder temperature

If the feeder temperature exceeds this value, the regulator will enable the feeder for a constant, programmed time and will activate the poker. The airflow is disabled and the pumps are enabled. After „pushing the fuel out", the regulator disables the feeder and does not activate it again, even if the feeder temperature is still high.

This alarm can be cancelled only after the feeder temperature decreases, by pressing the encoder knob or by restarting the regulator.

The function of protection against flame recession is inoperative if the feeder sensor is disconnected or damaged.

The function of protection against flame recession is inoperative if the regulator is not powered.

The SPARK800P1-L regulator cannot be used as the only protection against flame recession in a boiler. Use additional protective automatics.

18.4 Feeder temp. sensor damaged

This alarm occurs in case of boiler temperature sensor damage and excess of its measurement range. Upon occurrence of this alarm, boiler, HUW and mixer pumps start to possibly cool down the boiler. To reset the alarm - switch OFF and ON the regulator. Check the sensor and replace, if necessary.

☞ See sec. 11.8

18.5 Feeder temp sensor damaged

This alarm occurs in case of damage of fuel feeder temperature sensor and excess of its measurement range. To reset the alarm -switch OFF and ON the regulator. Check the sensor and replace, if necessary.

☞ See sec. 11.8

18.6 No communication

Control panel is connected with Operating Unit by means of digital interface RS485. In case of damaged connecting cable to this interface, a message "No communication" is displayed. Regulator does not go off and works normally with preset parameter values.
Check the cable connecting control panel with the operating unit and repair or replace, if necessary.

19 ADDITIONAL FUNCTIONS

In addition to the foregoing functions, the regulator performs also various other functions.

19.1 Power supply decay

In the cases of power supply failure, the regulator will resume the operation mode in which it was before the failure.

19.2 Protection against freezing

If the boiler temperature drops below 5 °C, the CH pump will be enabled, thus forcing circulation of the boiler water. This will delay the process of water freezing, yet in the case of great frost or shortage of power, it will not protect the system against freezing.

19.3 Preventive cooling down

Using this function, the regulator attempts to cool down the boiler before entering permanent boiler overheating alarm. Details - see sec. 18.2.

19.4 Protection of pumps against locking

Regulator performs the function of boiler, HUW and mixer pumps and servo protection from locking caused by scale deposit. To do this, these components are periodically (every 167 h) switched on for few seconds. In this way the pumps are protected from immobilization caused by scale deposits. Therefore, during boiler shut-down, power supply to the regulator should be on, and the regulator should be in STOP mode.

20 REPLACEMENT OF PARTS AND COMPONENTS

20.1 Replacement of mains fuse

Mains fuse is located in Operating Unit. It protects the regulator and other equipment.

In case of replacement, use 6.3 A ceramic time fuse.

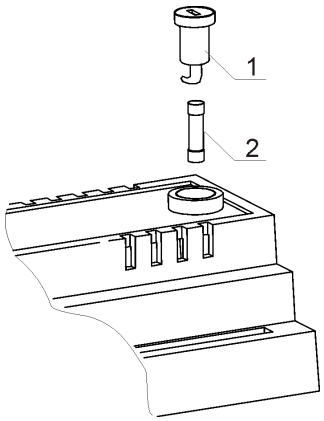

Fig. 35 Fuse replacement 1 – fuse, 2 – fuse holder

In order to remove the fuse, push in its socket with a flat screwdriver and turn it counter clockwise.

20.2 Control panel replacement

In case of replacement of control panel only - make sure the software used in new panel is compatible with the software of operating unit. Compatibility is guaranteed if first component of software ID number of the panel and of the operating unit is the same. In following example, software is compatible because first component of its ID number ("01") is the same for both components.

Example of software ID number:

Control panel:	Operating Unit:
01.10.010	**01**.11.026

Software ID number may be taken from the rating plate of respective component or from the screen in Menu Information

21 Troubleshooting

Faults	Hints
1. The display is blank despite connection to power supply.	Check: ▪ if the main fuse is burnt-out, replace if so, ▪ if the lead connecting the panel with the module is properly plugged in, and if it's not damaged.
2. Preset CH temperature on the display is different than the programmed one.	Check, if: ▪ HUW container is being filled and preset HUW temperature is set at the value higher than boiler preset temperature. If YES - read-out variations will disappear once HUW container has been pre-heated, or reduce preset value of HUW container. ▪ room thermostat is ON – set the service parameter *Red. preset b. temp.* at ,"0" ▪ night time decrease is ON; if YES- switch it off
3. CH pump is inoperative.	Check, whether: ▪ boiler temperature has exceeded the value set in *CH pump activation temperature* (MENU → boiler pump). If YES- wait or reduce the value set in this parameter, ▪ room thermostat prevents start of CH pump. If YES - set the parameter *CH pump standstill time* – at ,"0". See-sec.29 ▪ HUW priority to prevent CH pump start is ON. If YES- disable it by setting *HUW pump mode* at *No priority. See sec*.12 ▪ HUW pump is damaged or locked.
4. The fan is inoperative.	▪ If YES, and the boiler temperature is lower than the preset value by *DelT lack of fuel* - it is a normal condition related to detection of lack of fuel.
5. Fuel feeder inoperative/ fails to feed.	▪ blow-in output is too low - increase it, ▪ check whether connecting terminals 1-2 of STB safety temperature limiter are bridged (jumper should be provided only in case temperature limiter is not connected). ▪ if the boiler is equipped with STB temperature limiter with manual return to home position - release the limiter. To do this, remove the lid and press push-button acc. documentation provided by boiler manufacturer, ▪ check the setting of "*Fuel Feeder and Blow-In* and set at ON in MENU → Boiler Settings , ▪ check the fan and replace, if necessary,
6. When the Individual Fuzzy Logic mode is on, the fuel is not completely burned, there are unburned particles of fuel in the ash.	▪ check whether feeder wires are correctly connected to the terminals, ▪ if STB temperature limiter is connected to terminals 1-2 - check whether power supply has not been cut off due to boiler overheating, ▪ check whether feeder motor is not faulty, ▪ check the setting of "*Fuel Feeder and Blow-In* and set at ON in MENU → Boiler Settings , ▪ in case motor is running and fuel is not supplied - replace cotter pin in coupling of fuel feeder acc. boiler manual.

7. When the Individual Fuzzy Logic mode is on, the fuel burns out too intensively.paliwa	▪ reduce fuel feeding rate by lower setting of the parameter *Fuel correction in Fuzzy Logic* mode. See sec. 0, ▪ check whether incompletely burnt fuel comes from operation in SUPERVISION mode. If YES- adjust this mode acc. sec. 11, ▪ check whether incompletely burnt fuel is produced by frequent change-over from SUPERVISION to OPERATION mode and V/V, *Cycle order OPERATION* acc. sec. 36, ▪ if the regulator has the option of fuel type selection - make sure the correct fuel type has been selected (see sec. 7.9 – Fuzzy Logic mode does not allow burning a blend of fine coal and ECO-pea coal), ▪ check whether correct type of boiler/ burner has been selected. See sec. 22.1 ▪ open fully fan baffle and/ or return flap ▪ clean off ducts supplying air to the furnace ▪ change Fuzzy Logic settings in: MENU → Service Settings → Boiler Settings → Burner Settings → Fuzzy Logic (accessible to boiler manufacturers only)
8. When Fuzzy Logic mode is active, combustion is too intensive and the furnace lowers into retort.	▪ increase fuel feeding rate by higher setting of the parameter *Fuel correction in Fuzzy Logic* mode. See sec. 0 ▪ check whether too intensive combustion occurs in SUPERVISION mode. If YES - adjust this mode acc. sec. 11, ▪ check whether too intensive combustion is caused by the setting *Cycle order OPERATION - see* sec. 36, ▪ if the regulator has the option of fuel type selection - make sure the correct fuel type has been selected (see sec. 7.9), ▪ check whether correct type of boiler has been selected. See sec. 22.1. ▪ change Fuzzy Logic settings in: MENU → Service Settings → Boiler Settings → Burner Settings → Fuzzy Logic (accessible only to boiler manufacturers only)
9. The temperature is measured incorrectly	▪ Check if there is a good thermo contact between the temperature sensor and measured surface, ▪ Check if sensor wire not goes too closely to network wire, ▪ Check if sensor is connected to terminal, ▪ Check if sensor is not broken – check with point 11.8
10. In the DHW=SUMMER mode, the radiators are hot and the boiler overheats.	▪ increase the setting of the parameter: *HUW pump operation extension time* to cool down the boiler. See sec. 37, ▪ increase the setting of the parameter: *max. HUW temperature* to enable excessive heat discharge to HUW container. See sec. 41, Note: inform the users of high temperature of hot utility water!
11. the DHW pump is active even if the DHW tank has been filled.	▪ Set the parameter *HUW pump operation time extension = 0*
12. The boiler overheats despite disabled airflow.	▪ the reason may be boiler defect or improper chimney design - lack of protection against too excessive flue draught.

13. In hydraulic system with mixing valve and servo - mixer is closed	▪ The reason may be response of return protection function - see sec.36. If the return protection function is active, i.e. *Return Protection 4D* = ON - check whether the sensor of water return to the boiler is thermally isolated from environment and apply thermal paste to improve thermal contact between the sensor and the pipe. Increase preset boiler temperature to have enough power to heat return water. Check whether hydraulic system is properly made - upon valve closing, return temperature should increase to above the value set in the parameter *"Min.return temperature + Return temp. hyst.*

	▪ the reason may be filling HUW container at active HUW priority. Wait until completed HUW container filling or deactivate *HUW priority,* ▪ the reason may be active SUMMER function,
14. In hydraulic system with mixing valve and servo – preset boiler/mixer temperature is not stable - servo performs unnecessary movements	▪ Adjust the parameters: *Mixer input dead zone* or *Proportional range* or I*ntegr. time const.* acc. sec. **Chyba! Záložka není definována.**

22 Regulator setting by boiler manufacturer.

CAUTION: THE INDIVIDUAL FUZZY LOGIC PROGRAM IS SELECTED INDIVIDUALLY TO THE GIVEN BOILER TYPE. MAKE SURE THAT THE FITTINGS FOR BOILERS TESTED IN THE KOVARSON LABORATORIES ARE COMPATIBLE WITH FITTINGS FOR SOLD BOILERS. IT IS INADMISSIBLE TO REPLACE THE FEEDER AND FAN TO OTHER TYPES AS WELL AS MAKING OTHER CONSTRUCTIONAL MODIFICATIONS WHICH CAN HAVE IMPACT ON COMBUSTION PROCESS.

22.1 Activating Individual Fuzzy Logic and changing boiler type

To activate Fuzzy Logic mode - enter hidden MENU:

MENU→Service Settings → Enter special password.

Special password is made available to boiler manufacturers and authorized installer contractors only.

Select proper boiler/ burner type in which the regulator will be mounted from the menu. If a given boiler type is not specified - set the option ,"Fuzzy logic = OFF". With this setting, the regulator may be used in STANDARD mode only, and Fuzzy Logic function will be disabled. Return the regulator to factory settings to activate the changes.

Note: selection of improper type of the boiler, which has not been tested in test house of KOVARSON sp. z o.o., may cause incorrect boiler operation

Settings for individual boilers have to be agreed between the boiler manufacturer and KOVARSON sp. z o.o.

Boiler manufacturer may set Fuzzy Logic function by himself. These parameters are available in: MENU → Service Settings → Boiler Settings → Burner Settings → Fuzzy Logic. List of available settings is usually hidden and accessible upon setting the parameter *Show hidden parameters = YES.* This parameter is available in separate menu upon entry of special password.

23 Change record

V1.1 – change of Fig. 33 and Fig. 34.V1.2 – change of Fig. **16 Diagram with two additional mixer circuits upon connection of additional Module B,** where: 1 – boiler, 2 – SPARKX regulator – module A, 3 – SPARKX regulator – control panel, 4 – fan, 5 – feeder temperature sensor, 6 - gear-motor, 7 – boiler temperature sensor, 8 – HUW temperature sensor, 9 - mixer 1 temperature sensor, 10 – temperature (weather) sensor, 11 – boiler pump, 12 – HUW circuit pump, 13 – mixer 1 circuit pump 14 – mixer 1 servo, 15 – HUW container, 16 – room thermostat or sparkster, 17 – extension module B, 18 – mixer 2 servo 19 – mixer 3 servo, 20 – mixer 2 pump, 21 – mixer 3 pump 22 – mixer 2 room thermostat, 23 – mixer 3 room thermostat, 24 – mixer 2 temperature sensor, 25 – mixer 3 temperature sensor, 26 – autonomous thermostat to protect underfloor heating - max. temp. 55°C (it cuts off power supply to the mixer pump once the maximum temperature has been exceeded; thermostat is not included in the regulator supply), 27 – return temperature sensor (recommended mounting location: bottom section of boiler water jacket), 28 – thermostatic 3-way valve (to protect boiler return), 29- throttle mushroom valve, 32 – HUW circulating pump, P – electric relay, 38 – hydraulic coupling, 39 – room temperature sensor CT7.

RECOMMENDED SETTINGS:

	Parameter	Setting	MENU
1,3	Mixer support	ON (włącz.) CO	Service Settings →Mixer Settings

	Max. preset mixer temperature	75°	Service Settings →Mixer Settings
	Heating curve. mixer	0.8 – 1.4	Service Settings →Mixer Settings
	Weather control mix.	ON	Menu→ Mixer Settings
 2	Mixer support	Floor ON (włącz. podłoga)	Service Settings →Mixer Settings
	Max. preset mixer temperature	50°C	Service Settings →Mixer Settings
	Heating curve. mixer	0.2 – 0.6	Service Settings →Mixer Settings
	Weather control mix.	ON	Menu→ Mixer Settings
	Circulation support	ON	Pump Service Settings serwisowe→
	OPERATION mode: Return Protection	OFF	Service Settings → Boiler Settings → Return Protection 4D

, Fig. 24, Fig. 26. Description of operation of the plant with heat buffer added on page 19.
V1.2 – change of Fig.25
V1.3 – note of connecting peripherals added on page 25, change of Fig.32, 33.

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