Boiler regulator

ZAB-14

FOR BIOMASS BOILERS WITH TWO FEEDERS

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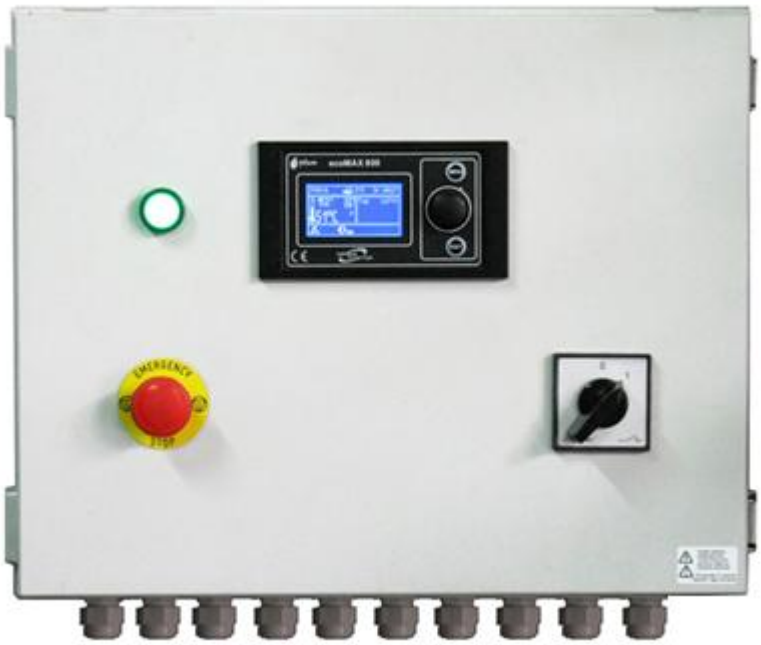
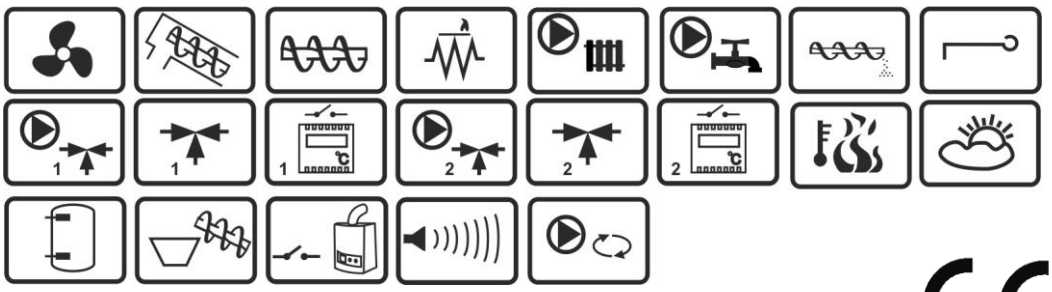




** room panel ecoSTER200- is not part of standard equipment

SERVICE AND ASSEMBLY MANUAL

EDITION: v1.2

APPLICABLE TO SOFTWARE:	MODULE A	PANEL
	v08.30.xx	v08.13.xx

11-2015

PRINCIPLES FOR USAGE OF Individual Fuzzy Logic CONTROLLED BOILER:

- **The regulator must be programmed individually for the given type of boiler and fuel, pkt.23.1!**
- **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, pkt.23!**
- **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.8.9**
- **In some cases, the fuzzy logic mode may require additional adjustment, as per p. 8.7**

TABLE OF CONTENTS

1. 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.

- ☞ Regulator is flush-mounted,
- ☞ Regulator is intended for boiler manufacturers,
- ☞ Regulator must be installed by boiler manufacturer in accordance with standards and regulations in force,
- ☞ Do not modify STB safety temperature limiter settings. These are set by the manufacturer.
- ☞ 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.
- ☞ 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.
- ☞ Any work within the electrical installation should be done by a qualified staff with appropriate permissions,
- ☞ 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.
- ☞ 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,
- ☞ Regulator cannot be used if its casing or cables are damaged. Withdraw the device from exploitation immediately in case damage to regulator cables is detected,
- ☞ In no circumstances can the design of the regulator be modified.
- ☞ Keep the regulator out of reach of children.

2. General information

ZAB-14 regulator is a device intended for controlling operation of biomass boilers. Supplied by one or three phases it controls operation of two worms. It is equipped with wiring and sensors.

ZAB-14 interior includes two execution modules A and B of the ecoMAX800P2-I series module, 10A C-type installation overcurrent switch, motor switches and relays. Outside (under the cover) there is a control panel for regulator modules, emergency button, signalling LED and installation switch.

ZAB-14 can be used within a household and in slightly industrialized buildings. Moreover, the regulator is intended to be enclosed on a boiler or in its vicinity by the boiler manufacturer.

3. Information about documentation

An integral part of **ZAB-14** device is operation and maintenance manual of enclosed ecoMAX800P2-I regulator, A and B module and STB temperature limiter manual.

We are not responsible for any damages caused by failure to observe these instructions.

4. 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.

5. 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!

6. 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.

REGULATOR INSTRUCTION MANUAL

ZAB-14

7. Structure – main menu

Main menu
Information
Boiler settings
HUW settings
*Mixer 2 settings
** Work according to schedule
Night-time decrease
General settings:
⇨ Clock
⇨ Brightness
⇨ Screen kontrast
⇨ Language
Manual control
** Extra feed. schedule
Service settings

** parameter is available only after activation of the function by the manufacturer

Boiler settings
Preset boiler temp.
*Weath. cntr. Boiler
*Heating curie
*Curve translation
*Room temp. factor
Output modulation
Burner clearing
* Adjustment mode
Fuel type
Fuel level
* Lambda calibration

Output modulation
100% Blow-in output
100% Feeder operations
100% Feeder interval
50% H2 hysteresis
50% Blow-in output
50% Feeder operations
50% Feeder interval
30% H1 hysteresis
30% Blow-in output
30% Feeder operation
30% Feeder interval
Boiler hysteresis Hk
*Blow-in out. correct. FL
*Min boiler output FL
*Max boiler output FL

HUW settings
HUW preset temp.
HUW operations mode
HUW tank hysteresis
HUW disingection
*Auto detect. SUMMER
*Activ temp SUMMER
*Deactiv temp SUMMER

*HUW operations mode
Off
Priority
No priori ty
Summer

*Mixer settings
Preset mixer temp.
Mixer room therm.
Weather contr. mixer
Heating curve mixer
Curve translation
Room temperature coefficient

Menu for all mixer cycles is identical

Night-time decrease
Boiler
*Mixer 1-4
HUW tank
Circ. Pump

Regulation mode
Standard
FuzzyLogic

Manual control
Fan
Feeder
Boiler pump
HUW pump
Lighter
*Feeder supply
Alarm
*Mixer 1-4 Pump
*Mixer 1-4 Open
*Mixer 1-4 Close
Res. Boiler*
Circul. pump

Fuel level
Alarm level
Fuel level calibration

*) Note: particular menu elements can be invisible in case appropriate sensor, module or setting is not present.

8. Operating the regulator

This section briefly describes how the regulator should be operated.

8.1 Description of buttons

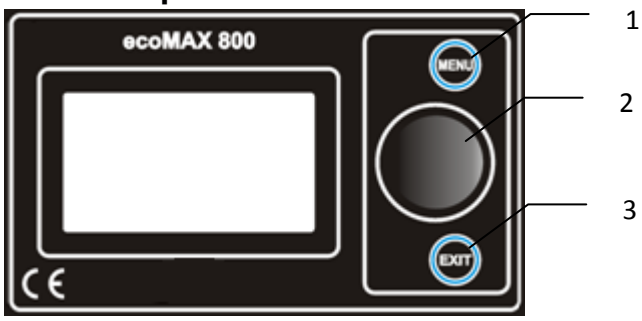


Fig. 1 View of control panel.

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.

8.2 Description of display main window

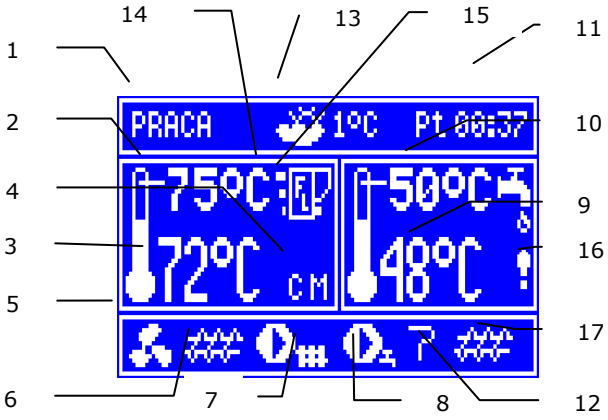


Fig. 2 Display main window.

Legend:

1. regulator operation modes: FIRING-UP, OPERATION, SUPERVISION, PUTTING OUT, PUTTING OUT ON DEMAND, STANDSTILL,
2. preset boiler temperature,
3. measured boiler temperature,
4. field of factors influencing preset boiler temperature: ,,**T**” - symbol of decreasing preset boiler temperature from opening of room thermostat contacts; ,,**S**” - symbol of decreasing preset boiler temperature according to decrease schedulle; ,,**C**” – symbol of increasing preset boiler temperature for the time of filling hot utility water tank HUW; ,,**M**” symbol of increasing the preset boiler temperature to fulfill mixer circuit demands; ,,**P**” – weather control for boiler cycle is active, „**B**” – increase in preset temperature in order to fill the buffer,
5. fan operation symbol,
6. fuel feeder operation symbol,
7. central heating pump operation 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. screen section shared by two icons: match - indicates active lighter, the digit next to it means the number of attempt to fire-up; poker - means that poker is active;
13. outside (weather) temperature,
14. current boiler output level,
15. *IndividualFuzzyLogic* activity,
16. warning symbol - disinfection of the hot utility water tank[1] is enabled,

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: mixer circuit monitor (1, 2, 3 or 4) or info of HUW by rotating the TOUCH and PLAY knob.

[1]This symbol is displayed not only during active HUW disinfection, but it also appears at the moment of enabling the HUW function.

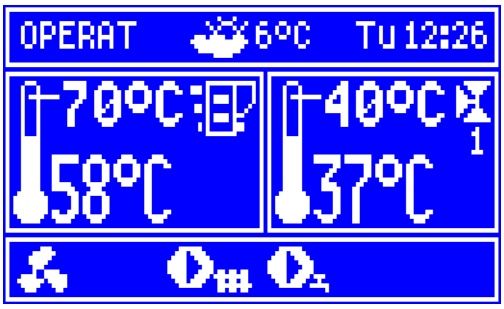


Fig. 3 Right window in mixer 1 view setup..

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 8.22. Note: the fuel level can be viewed also on room panel ecoSTER200.

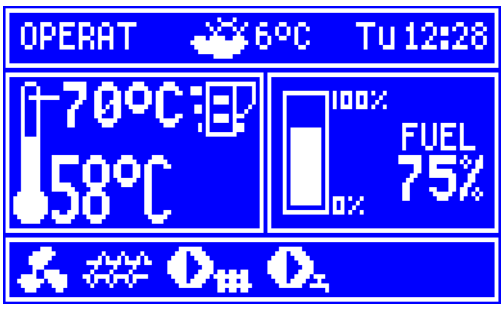


Fig. 4 Auxiliary window with fuel level view.

8.3 Activating the regulator

After enabling power supply, the regulator recalls its status at the moment of disconnecting the power supply. If the regulator was not active before, it will start in the "stand-by" mode. In this mode, the display is dimmed, and displays the current time, weather sensor temperature and information: "Boiler off".

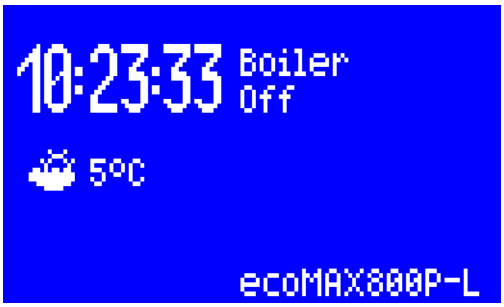


Fig. 5 Regulator screen with boiler off.

In this mode, the function of protecting the pumps against stagnation is carried out by activating the pumps periodically. Therefore, it is recommended for the power supply to be active during interruptions to boiler use, and the regulator should be in the "stand-by" mode described herein.

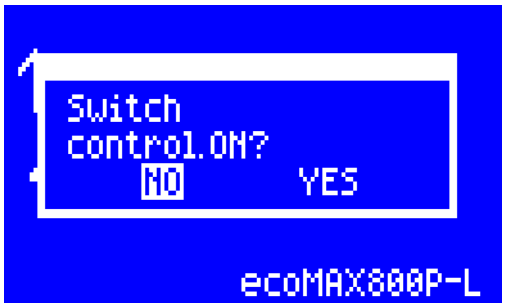


Fig. 6 Boiler activation screen.

It is possible to activate the boiler (press encoder knob and select setting), or to set its operation parameters (MENU button) without the need for turning it on. After making sure that there is fuel in the bin and that the bin flap is closed, you can turn the boiler on.

8.4 Setting preset boiler temperature

Preset boiler temperature, just like the preset mixer circuit temperature, can be set in the menu (possible settings of these temperatures are limited by the scope of their corresponding regulator service parameters).

Boiler settings > Preset boiler temp.
Mixer 1 settings > Preset mixer temp.
Mixer 2 settings > Preset mixer temp.
Mixer 3 settings > Preset mixer temp.
Mixer 4 settings > Preset mixer temp.

The value set as *Preset boiler temp.* is ignored by the regulator if the preset boiler temperature is controlled by weather sensor. Regardless of that, the preset boiler temperature is automatically increased in order to fill the hot utility water tank and feed heating mixer cycles.

8.5 FIRING-UP

FIRING-UP mode is used for automatic firing-up of furnace in the boiler.

Firing-up with manual control:

Boiler furnace can be fired up without the use of a burner when the regulator is in manual control mode. In such case boiler has to be deactivated.

If it is active, press Touch and Play button and activate the regulator.

- Feed the fuel manually by activating the feeder. Select: **Menu > Manual control > Feeder > ON**.
- Wait until the fuel gets into the boiler and deactivate the feeder by setting it to **OFF**. Put a kindling into the furnace and fire it up.
- Deactivate the fan by selecting **Menu > Manual control > Fan > ON**. Wait until it fires up.
- Deactivate the fan by setting it to **OFF**.
- Press EXIT key to deactivate the manual mode and activate the regulator with the use of encoder knob.

After activation, the regulator with burning furnace switches to WORK mode.

Automatic firing-up:

Total duration of the firing-up process depends on regulator settings (feeder operation time, heater operation time, etc.) and on the boiler's status before firing-up. All parameters which influence the firing-up process can be found in menu:

Service settings > Boiler settings > Firing-up

Description of firing-up cycle:

1st phase – ignition test:

- Ignition test does not occur at first firing-up. It occurs e.g. after banking in BANKING mode.
- Fan is activated with a power defined by *Blowthrough power* parameter.
- Small dose of fuel is fed,
- Furnace condition is checked by controlling the increase of fumes temperature – i.e. if from the moment of activating the fan, within a time defined by *Ignition test time* the increase of temperature exceeds a value defined by *Delta fumes* parameter, firing-up process will be finished. It means that firing-up is detected and the regulator switches to WORK mode. If detection criteria are not met, the regulator will attempt to clean and fire-up the furnace.

2nd phase – firing-up:

- Furnace is cleaned with the use of a fan. A blow is activated on a time defined by *Fir. clean time* parameter. During this time the fan works with a power set in *Cleaning blow* parameter. In some instances, the regulator extends cleaning time before firing-up in order to make sure that no smouldering fuel particles are present (e.g. after a blackout). It is done in order to minimize the risk of fuel gasification inside boiler chamber and related possibility of ignition of cumulated gases. The aforementioned parameters are available in a menu:
  Service settings > Boiler settings > Cleaning
- Basic fuel dose is fed for a time set in *Feeding time* parameter.
- A heater without a blow is activated for a time set in *Heat up time* before the fuel feeding is finished. After a time required for heater to heat up, the fan is activated with a power defined by *Firing-up blow* parameter. After a time defined by *Blowthrough delay* parameter, the fan increases its power to value defined by *Blowthrough power* parameter and the blow power is modulated.
- For a time defined by *Firing-up time* parameter, the regulator checks whether fuel inside a burner got fired-up. Fuel gets fired-up on condition that temperature of fumes exceeds the value defined by *Delta fumes parameter*. If firing-up is successful, the regulator switches to WORK mode.
- In case of unsuccessful firing-up, the regulator repeats the firing-up cycle from the very beginning, i.e. from the furnace cleaning procedure.

In case of unsuccessful firing-up of the furnace, a second trial is undertaken during which fuel dose (feeding time) is reduced to 50% of the basic dose.

Fig. 7 Signalling the FIRING-UP mode and number of current attempt.

After three unsuccessful attempts, an alarm *Failed firing-up attempt* is reported. In such case, the boiler operation is halted. Boiler

operation cannot be continued automatically - service crew must intervene. After removing causes of impossibility to fire-up, the boiler must be restarted.

8.6 OPERATION

In this mode, the regulator operates automatically, according to STANDARD, or *Individual Fuzzy Logic* algorithm.

Fig. 8 Main window view during operation.

The fan operates continuously, which is presented in Fig. 9. Fuel feeder is activated cyclically. A cycle consists of feeder operation time and duration of feeding interval. Fan power and feeder operation cycle are determined by one of the following control algorithms.

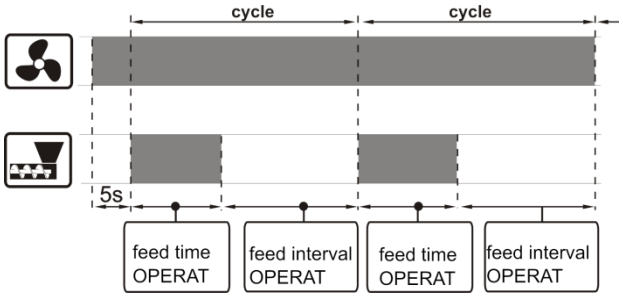


Fig. 9 Fan and feeder operation cycles.

If, in the OPERATION mode, it becomes necessary to fill the HUW tank at preset boiler temperature lower than temperature required to fill the tank, the regulator will automatically increase the preset boiler temperature for the time of filling the HUW tank.

In WORK mode, an ash removal process is activated in cycles for a time defined by *Ash removal time* parameter and then, it is suspended for a time defined by *Ash removal break* parameter.

8.7 OPERATION in the I.FuzzyLogic mode

This mode can be activated in the menu:

Regulation mode

The Individual Fuzzy Logic function, the parameters of which are selected individually to the given boiler, allows to obtain optimal combustion process, which favours environmental protection, savings of consumed fuel and in most cases releases the user from the necessity of adjusting regulator parameters.

During operation with Individual Fuzzy Logic algorithm, there is no need to set up the feeder operation parameters (feeding times, feeding intervals), and airflow power for the each boiler output level. 3-phase modulation is inactive - the regulator automatically and smoothly selects parameters for feeder and fan control.

In the Individual Fuzzy Logic mode, the regulator strives to avoid switching the boiler into the SUPERVISION mode, and to supply as much heat, as the CH system requires at the time. Switching into SUPERVISION is made only after exceeding the preset boiler temperature by 5°C.

One should bear in mind that the *Individual Fuzzy Logic* algorithm is selected individually to the given boiler and fuel type, and it can operate properly only with the specific fuel and boiler. For this reason, the *Individual Fuzzy Logic* mode must be activated by boiler manufacturer, in accordance with point pkt. 23.1. If this mode is not activated, attempt to change the mode will trigger message 'Function unavailable'.

Modifying parameters of the *Individual Fuzzy Logic* algorithm.

In some cases, depending on fuel quality, it may be necessary to fine-tune the airflow in the *Individual Fuzzy Logic* mode. The user can change:

Boiler settings > Output modulation > Blow-in out. correct. FL

Boiler settings > Output modulation > Min. boiler output in FL

Boiler settings > Power modulation > Max. boiler output in FL

The scope of settings adjustments is intentionally limited. **It is not recommended to change the *Airflow correction FL* parameter if the combustion is proper, i.e. there are no underburnt fuel particles.** If the fuel is of poor quality and there are underburnt particles, the provided amount of air can be increased. If the fuel is very dry, causing it to burn fast, and the furnace burns out too intensively, the value of *FL airflow correction* can be decreased.

When adjusting the *Individual Fuzzy Logic,* values of parameters concerning: airflow power, feeder operation and feeder intervals which can be found in the **Boiler settings > Output modulation** menu are not used in the regulator control algorithm. These settings are used only in STANDARD mode.

When using the *Individual Fuzzy Logic* control, the fan intake aperture should be open to the maximum and the boiler should be clean. Shall it be necessary to replace the fan or the feeder, use identical types thereof.

After exceeding the preset boiler temperature by 5 degrees, the regulator automatically switches into the SUPERVISION mode.

8.8 Operation in the Standard mode

The ZAB-14 boiler regulator is equipped with boiler output modulation mechanism, which allows to change its output gradually, as the boiler temperature approaches the preset value. In this mode, the controller uses an output modulation algorithm. The currently selected output level - one of three available - is presented on the display in the form of a three-bar indicator on the left side of the boiler icon.

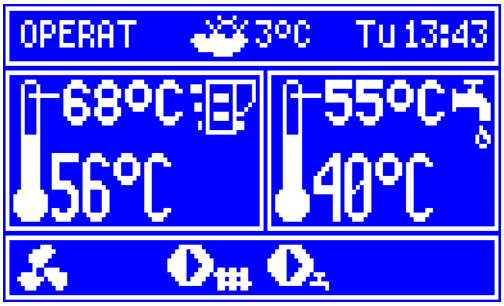


Fig. 10 Output level indicator in the main window.

Parameters for all output levels are available in the menu:
Boiler settings > Output modulation

Each of the levels - referred to as 100%, 50% and 30% respectively - can be attributed with different fuel feeding time and airflow power, which translates into actual boiler output level. When the boiler is supposed to operate at specific output level is determined by values called hysteresis, H1 and H2 respectively. Each of these values relates to measured boiler temperature relative to its preset value. The H1 and H2 values can be set in such a way that modulation will take place without intermediate stage, i.e. shift from 100% to 30%

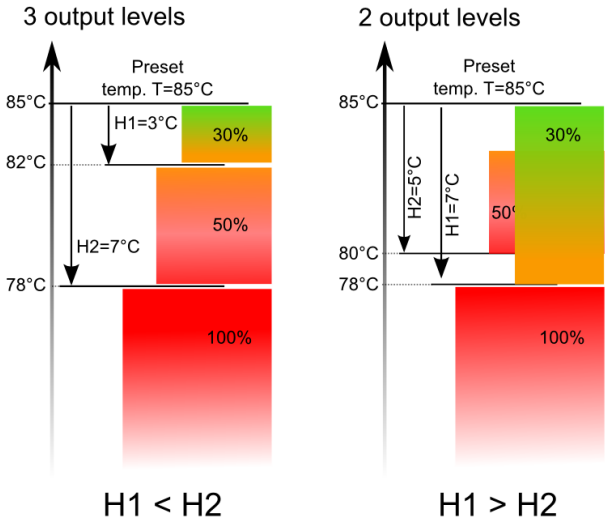


Fig. 11 Output modulation hystereses H1 and H2.

If the boiler temperature reaches the preset value, the regulator will switch into SUPERVISION mode.

8.9 SUPERVISION

The SUPERVISION mode occurs both during operation with STANDARD, as well as with *Individual Fuzzy Logic* control algorithm. The regulator switches into the SUPERVISION automatically, without the user's intervention:

- in the case of Standard control mode - upon reaching preset boiler temperature,
- during *Individual Fuzzy Logic* control - upon exceeding the preset boiler temperature by 5°C. In the *Individual Fuzzy Logic* mode, the regulator strives to avoid switching the boiler

into the SUPERVISION mode, and to supply as much heat, as the CH system requires at the time.
In the SUPERVISION mode, the regulator supervises the furnace, so that it would not go out. For this purpose, the airflow and the feeder are activated only for a while, rarer than in the OPERATION mode. Without causing further temperature increase.
The airflow does not work continuously, it is activated cyclically together with the fuel feeder, which prevents the flame from going out during boiler standstill.

Fig. 12 View of main window in the SUPERVISION mode.

All parameters regarding boiler setup in the SUPERVISION can be found in the menu:

Service settings > Boiler settings > Supervision
Parameters of the SUPERVISION mode should be set in accordance with boiler manufacturer's recommendations. They should be chosen in such a way, that the furnace did not go out during boiler standstill (at the same time, it should not fire up too intensively, as this will trigger increase in the boiler temperature). Duration of the feeder operation and interval in the SUPERVISION mode are set using parameters:
... > Supervision > Supervision feeding time
... > Supervision > Supervision feeder interval

The time of extending the airflow in order to ignite fuel after feeding thereof is set in:

... > Supervision >Airflow operation extend.

Parameters should be selected in such a way, that boiler temperature would gradually decrease when this mode is active. Improper settings can cause the boiler to overheat.

Airflow in the SUPERVISION mode operates with power set in the power modulation parameter *30% Airflow power*.
The regulator returns to the OPERATION mode automatically after boiler temperature decreases by the value of *boiler hysteresis* in relation to the preset temperature.

Maximum boiler operation time in the supervision mode is defined by parameter:

... > Supervision > Supervision time

If after lapse of this time from the moment of the regulator's entering the supervision mode, there is no need to reactivate the boiler, the regulator will commence the process of putting the boiler out.

8.10 PUTTING OUT
In the PUTTING OUT mode, remains of the pellet are burnt out and the boiler is prepared for standstill or deactivation.
All parameters which influence the process of putting out can be found in menu:
Service settings > Boiler settings > Putting out

Detailed description of the putting out cycle:
- Feeder operation is halted,
- Fuel remains are burnt out - Fan is activated for *Putting out time* and with power specified by parameter *Putting out airflow*,
- The furnace is cleared - the poker is activated.

After automatic putting out, the regulator switches into STANDSTILL mode.

8.11 STANDSTILL

In the STANDSTILL mode, the boiler is put out and awaits signal to resume heating.

A signal to start heating can be:

- decrease in preset boiler temperature below the preset temperature minus the value of boiler hysteresis (*Boiler hysteresis*),
- if the boiler is set to work with a buffer - decrease in upper buffer temperature below the preset value (Loading start temperature).

8.12 Operation on a GRID

In order to switch the regulator to GRID mode, select a menu:

Service settings > Boiler settings > GRID work mode

Fan starts to operate with a preset power. Feeder is not active. After achieving boiler preset temperature, the regulator switches to SUPERVISION mode.

In Supervision mode the fan is stopped. After a time defined by *Blowthrough break* parameter, the fan is activated for a time defined by *Blowthrough time* parameter operating with the same power as in normal operation mode. Parameters in Supervision mode have to be selected in a way to prevent from boiler temperature increase even when pumps are deactivated. These parameters are defined in a menu: **Service settings > Boiler settings > Supervision.**

Parameters in Supervision mode have to be selected in a way to prevent increase of boiler temperature, even at deactivated pumps.

If the boiler temperature is higher than the temperature of boiler pump activation, the regulator can be deactivated only after 10 minutes (in order to cool the boiler down) during operation on a grid. During this period, a DAMP.REQ. "Damping on request" message is displayed on a screen.

Do not deactivate the regulator when there is a burning fuel inside the boiler due to a risk of boiler overheat.

8.13 Hot utility water settings HUW

The device controls temperature of the hot utility water - HUW – tank, provided that a HUW temperature sensor is connected. If the sensor is disconnected, an information about lack thereof is displayed in the main window. The parameter:

HUW settings > HUW operation mode

allows the user to:

- *disable* filling of the tank, parameter **off,**
- set HUW priority, using the ***priority*** parameter - in this case, the CH pump is deactivated to speed up filling of the HUW tank.
- set simultaneous operation of the CH and HUW pump, using parameter ***no priority*,**
- enable the ***summer*** function.

8.14 Setting preset HUW temperature

Preset HUW temperature is defined by parameter:

HUW settings > HUW preset temp.

8.15 HUW tank hysteresis

Below temperature *HUW preset temp.* reduced by *HUW tank hysteresis,* the HUW pump is activated in order to fill the HUW tank.

When value of hysteresis is set too low, the HUW pump will start faster after decrease in HUW temperature.

8.16 Enabling the SUMMER function

In order to activate the SUMMER function, which enables to load the HUW tank in the summer, without the need for activating the CH system and mixer cycles, set the parameter *HUW pump operation mode* to *summer.*

The SUMMER function cannot be enabled if the HUW sensor is disconnected.

Do not enable the summer function if the HUW pump is disconnected or damaged.

The SUMMER function can be enabled automatically, on the basis of readouts from the weather sensor. This functionality is enabled with the following parameters:

HUW settings > Auto detect. SUMMER
HUW settings > Activ.temp.SUMMER
HUW settings > Deactiv.temp.SUMMER

8.17 HUW tank disinfection

The regulator has a function of automatic, periodic heating of the HUW tank to temperature of 70 °C. The purpose is to remove bacterial flora from the HUW tank.

The household members must definitely be informed about the fact of activating disinfection, as there is a hazard of scalding with hot utility water.

Once a week on Sunday night, at 02:00, the regulator increases the HUW tank temperature. After 10 minutes of keeping the tank at 70 °C, the HUW pump is deactivated and the boiler resumes normal operation. Do not enable the disinfection function if HUW support is deactivated.

8.18 Mixer circuits settings

Settings for the first mixer circuit can be found in the menu:
Mixer 1 settings
Settings for other mixers can be accessed in next menu items and they are identical for each circuit.

Settings for mixer without weather sensor
It is necessary to manually set the required water temperature in the heating mixer circuit using parameter *Preset mixer temp.*, e.g. at a value of 50°C. The value should allow to obtain the required room temperature.

After connecting room thermostat, it is necessary to set a value of decrease in preset mixer temperature by thermostat (parameters *Mixer room therm.)* e.g. at 5°C. This value should be selected by trial and error. The room thermostat can be a traditional thermostat (no/nc), or room panel ecoSTER200. Upon activation of the thermostat, the preset mixer circuit temperature will be decreased, which, if proper decrease value is selected, will stop growth of temperature in the heated room.

Settings for mixer with weather sensor (without room thermostat ecoSTER200)
Set parameter *Weather contr.mixer* to *on*.
Select weather curve as per point 8.19
Using parameter *Curve translation*, set preset room temperature following the formula:
Preset room temperature = 20°C + heating curve translation.
Example.
To obtain room temperature of 25°C, value of the heating curve translation must be set at 5°C. To obtain room temperature of 18°C, value of the heating curve translation must be set at -2°C.

In this setup, it is possible to connect a room thermostat which will equalize the inaccuracy of selecting heating curve, if the selected heating curve value is too high. In such case, it is necessary to set the value of preset mixer temperature decrease by thermostat, e.g. at 2°C. After opening of the thermostat contacts, the preset mixer circuit temperature will be decreased, which, if proper decrease value is selected, will stop growth of temperature in the heated room.

Settings for mixer with weather sensor and with room thermostat ecoSTER200)
Set parameter *Weather contr.mixer* to *on*.
Select weather curve as per point. 8.19
The ecoSTER200 regulator automatically translates the heating curve, depending on the preset room temperature. The regulator relates the setting to 20 °C, e.g. for preset room temperature = 22 °C, the regulator will translate the heating curve by 2°C, for preset room temperature = 18 °C, the regulator will translate the heating curve by -2 °C. In some cases described in point 8.19 it may be necessary to fine-tune the heating curve translation.

In this setup, the ecoSTER200 room thermostat can:

- decrease the heating cycle temperature by a constant value when the preset room temperature is reached. Analogously, as specified in the previous point (not recommended), or

- automatically, continuously correct the heating cycle temperature.

It is not recommended to use both options at the same time.

Automatic correction of room temperature is carried out in accordance with the following formula:

Correction = (Preset room temperature - measured room temperature) x room temperature coefficient /10

Example.

Preset temperature in the heated room (set at ecoSTER200) = 22 °C. Temperature measured in the room (by ecoSTER200) = 20 °C. *Room temp. coeff.* = 15.

Preset mixer temperature will be increased by (22 °C - 20 °C) x 15/10 = 3 °C.

It is necessary to find appropriate value of the *Room temp. coeff.* Range: 0…50. The higher the coefficient, the greater the correction of preset boiler temperature. If the setting is "0", the preset mixer temperature is not corrected. Note: setting a value of the room temperature coefficient too high may cause cyclical fluctuations of the room temperature!

8.19 Weather controlled operation

Depending on the temperature measured outside the building, both preset boiler temperature and temperatures of mixer circuits can be controlled automatically. If proper heating curve is selected, the temperature of the circuits is calculated automatically, depending on the outdoor temperature. Thus, if the selected heating curve is appropriate for the given building, the room temperature stays more or less the same, regardless of the temperature outside.

Note: during trial and error selection of appropriate heating curve, it is necessary to exclude influence of the room thermostat on regulator operation (regardless of whether the room thermostat is connected or not), by setting the parameter:

- **Mixer 1 settings > Mixer room therm.** to "0".

If a room panel ecoSTER200 is connected, it is also necessary to set the parameter *Room temp. coeff.* to "0".

Guidelines for proper setting of the heating curve:

- floor heating 0,2 -0,6
- radiator heating 1,0 - 1,6
- boiler 1,8 - 4

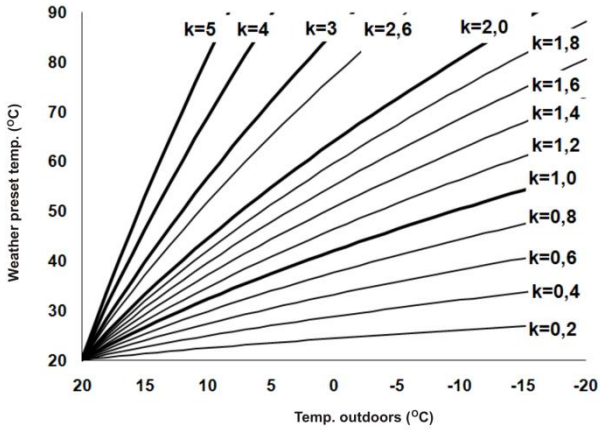


Fig. 13 Heating curves

Guidelines for selection of appropriate heating curve:

- if the outdoor temperature drops, and the room temperature increases, the selected heating curve value is too high,

- if the outdoor temperature drops, and the room temperature drops as well, the selected heating curve value is too low,

- if during frosty weather the room temperature is proper, but when it gets warmer - it is too low, it is recommended to increase the *Curve translation* and to select a lower heating curve,

- if during frosty weather the room temperature is too low, and when it gets warmer - it is too high, it is recommended to decrease the *Curve translation* and to select a higher heating curve.

Buildings with poor thermal insulation require higher heating curves, whereas for buildings which have good thermal insulation, the heating curve can have lower value.

The regulator can increase or decrease the preset temperature, calculated in accordance with the heating curve, if it exceeds the temperature range for the given circuit.

8.20 Description of settings for night-time decreases

The regulator allows to set intervals for decreasing preset temperature of boiler, heating curves, hot utility water tank, and operation time of the circulating pump.

The intervals allow to decrees the preset temperature at specified periods of time – e.g. at night, or when the users leave the heated rooms (e.g. when the household members got to work/school). This allows to decrease the preset temperature automatically, without losing thermal comfort and with decreased fuel consumption.

In order to activate the intervals, set parameter *Night-time decrease* for the given heating circuit to on.

Night-time decreases can be defined separately for weekdays, Saturdays and Sundays.

Fig. 14 Interval selection window.

It is necessary to specify beginning and end of the given interval, as well as the value by which the preset temperature is to be decreased. Three intervals per day are available.

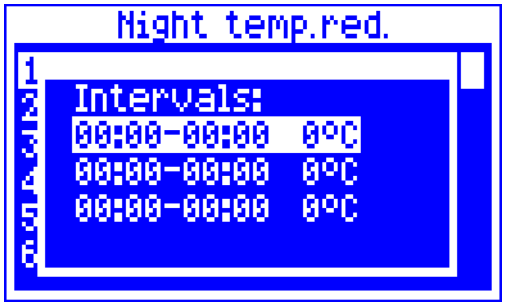


Fig. 15 Editing intervals.

Below is an example of night-time decrease in preset room temperature, lasting from 22:00 till 06:00, as well as another decrease between 09:00 and 15:00.

Start defining intervals for the given day from 00:00

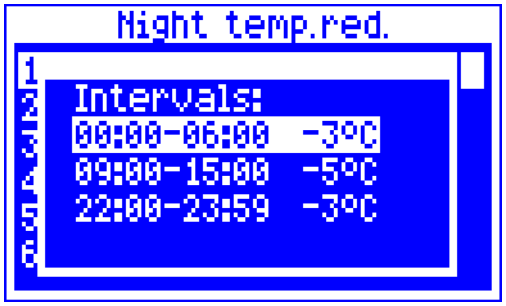


Fig. 16 Example of defining intervals.

In the presented example, the regulator will decrease the preset boiler temperature by 3 °C between 00:00 and 06:00. Between 06:00 and 09:00, the regulator will be retaining the regular preset boiler temperature (no decrease). From 09:00 till 15:00, the regulator will keep the preset boiler temperature decreased by 5 °C. Between 15:00 and 22:00, the regulator will be retaining the regular preset boiler temperature (no decrease). From 22:00 till 23:59, the regulator will keep the preset boiler temperature decreased by 3 °C.

An interval is ignored if the decrease value is set to "0", even if its range of hours was specified.

Decrease in the boiler preset temperature by interval is signalled with a letter "S" in the main display window.

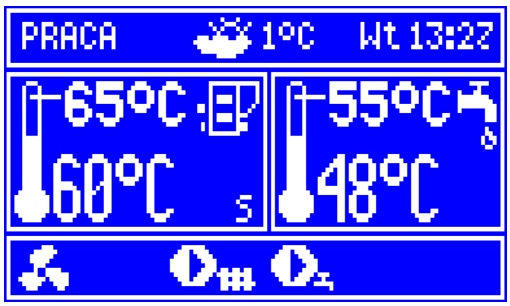


Fig. 17 Signalling active scheduled reduction.

8.21 Circulating pump control

Note: circulation pump functionality is available only after connecting an additional mixing expansion module to the ZAB-14 regulator.

The settings can be found in:

Night-time decrease > Circ. pump

and

Service settings>(Password)>CH & HUW settings

Setting for temporal control of the circulating pump are the same as for night-time decreases. At specified intervals, the circulating pump is off. Otherwise, the circulating pump is activated for *circ. pump operation time* every *circ. pump standstill time.* Detailed settings can be found in point 17.7.

8.22 Fuel level setup

Activating the fuel level gauge

In order to enable display of the fuel level, set value of parameter

Fuel level > Alarm level

to a value greater than zero, e.g. 10%

Rotate the TOUCH and PLAY knob in the main window to open the fuel level window.

Tip: the fuel level can be viewed in the room panel ecoSTER200. The room panel is not standard equipment of the regulator.

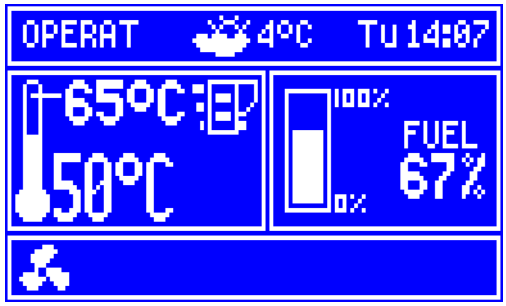


Fig. 18 Auxiliary window with fuel level gauge view.

Using the fuel level gauge

Every time after filling the fuel bin to the required level, press and hold the knob while in the main window to open the prompt:

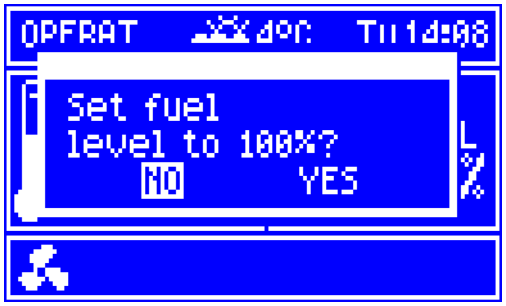


Fig. 19 Fuel level service.

Select and confirm "YES" to set the fuel level to 100%.

Caution: The fuel can be replenished at any time, i.e. you do not have to wait until the fuel bin becomes empty. Nonetheless, the fuel should always be replenished to the level equal 100% and conform by press-holding the knob.

Description of operation

The regulator calculates the fuel level basing on the current fuel consumption. Default settings do not always correspond to the actual consumption of fuel by the given boiler, therefore, for proper operation this method requires the regulator user to perform level calibration. No additional fuel level sensors are required.

Calibration

Fill in the fuel bin to the level corresponding to full load, and set the parameter:

Fuel level >Fuel level calibration > Fuel level 100%

The indicator in the main window will be set to 100%. On-going calibration process is signalled by flashing fuel level gauge. The gauge will flash until the time of marking the point corresponding to minimal fuel level. One must systematically control the decreasing level of fuel in the bin. When the level reaches the requested minimum, set the value of the parameter:

Fuel level >Fuel level calibration > Fuel level 0%

Fuel type selection

The regulator is also equipped with a function of selecting fuel type, i.e. its calorific value expressed in kW. Fuel type is suited to a particular type of boiler which the regulator is connected to.

Boiler settings >Fuel selection > RECO 36kW

8.23 Cooperation with secondary feeder

The regulator can cooperate with a fuel batch sensor, which is an element of the boiler equipment.

On the basis of secondary feeder operation schedule, specified in the menu:

Extra feeder schedule

and signals from fuel level sensor, the regulator controls fuel replenishment in the boiler bunker.

At the moment of activation specified by the scheduled interval, the secondary feeder starts operation in accordance with algorithms. During operation of secondary feeder, signal from bunker batch sensor is used.

8.24 Cleaning the furnace

The regulator enables to remove ashes developed during the combustion process from the furnace. It utilizes the fan for this purpose. Parameters responsible for cleaning the furnace are included in the menu:

Service settings > Boiler settings > Furnace cleaning

Furnace is cleaned in FIRING-UP and EXTINGUISHING mode. In case when the boiler operates in WORK or SUPERVISION mode for a long time, it is possible to clean the boiler automatically using the parameter:

Boiler settings > Furnace cleaning

8.25 Mobile grid automatics control

The regulator controls automatics of the mobile grid which enables to enhance conditions of combusting lower quality fuel and removing ashes from the furnace. The furnace is cleaned by a mobile grid in WORK mode. In case when the boiler operates in WORK or SUPERVISION mode for a long time, it is possible to clean the boiler automatically with the use of the parameter:

Service settings > Boiler settings > Furnace cleaning

Pt. 16 includes service parameters concerning the mobile grid.

8.26 Lambda probe calibration

If the regulator is used by a lambda probe module, it can be necessary to periodically calibrate indications of the lambda probe. In order to perform probe calibration it is necessary to extinguish the boiler. Proper calibration depends on a fully extinguished furnace in the boiler. Calibration can be started with the use of the parameter:

Boiler settings > Lambda probe calibr.

Calibration process lasts for approx. 8 minutes.

8.27 Information

The information menu allows to view measured temperatures and to check which devices are currently active. You can switch between screens turning the TOUCH and PLAY knob

After connecting a mixer extension module, windows with information about secondary mixers are activated.

Sign "**CAL**" in the information window at valve opening value indicates that its calibration is active. Please wait until valve servo calibration is completed to see its current status.

8.28 Manual control

The regulator enables manual activation of executive devices, such as pumps, feeder motor or blower. This allows to check whether the given devices are operational and properly connected. The manual control menu can only be entered in the STOP mode, i.e. when the boiler is deactivated.

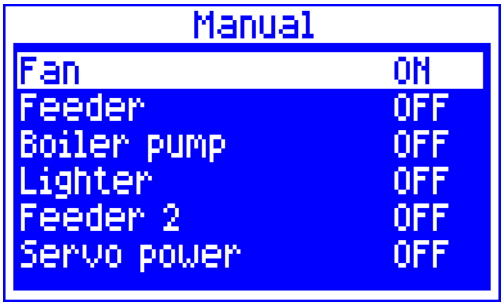


Fig. 20 View of manual control window, where OFF means that the device is off, and ON - that it is on.

Note: prolonged activity of fan, feeder or other executive device can cause a hazard.

8.29 Work according to a schedule

The boiler can be deactivated in time intervals which are predefined in:
Menu > Work acc. to a schedule

Note: **Work acc. to a schedule** position can be unavailable if the boiler manufacturer has not included this function in a particular boiler.

8.30 Restoring user settings

It is possible to restore default parameter of settings which are available in the main menu.

Fig. 21 Restoring user settings.

Note: service parameters will not be restored.

REGULATOR INSTALLATION AND SERVICE SETTINGS MANUAL

ZAB-14

9. Hydraulic diagrams

9.1 Scheme 1

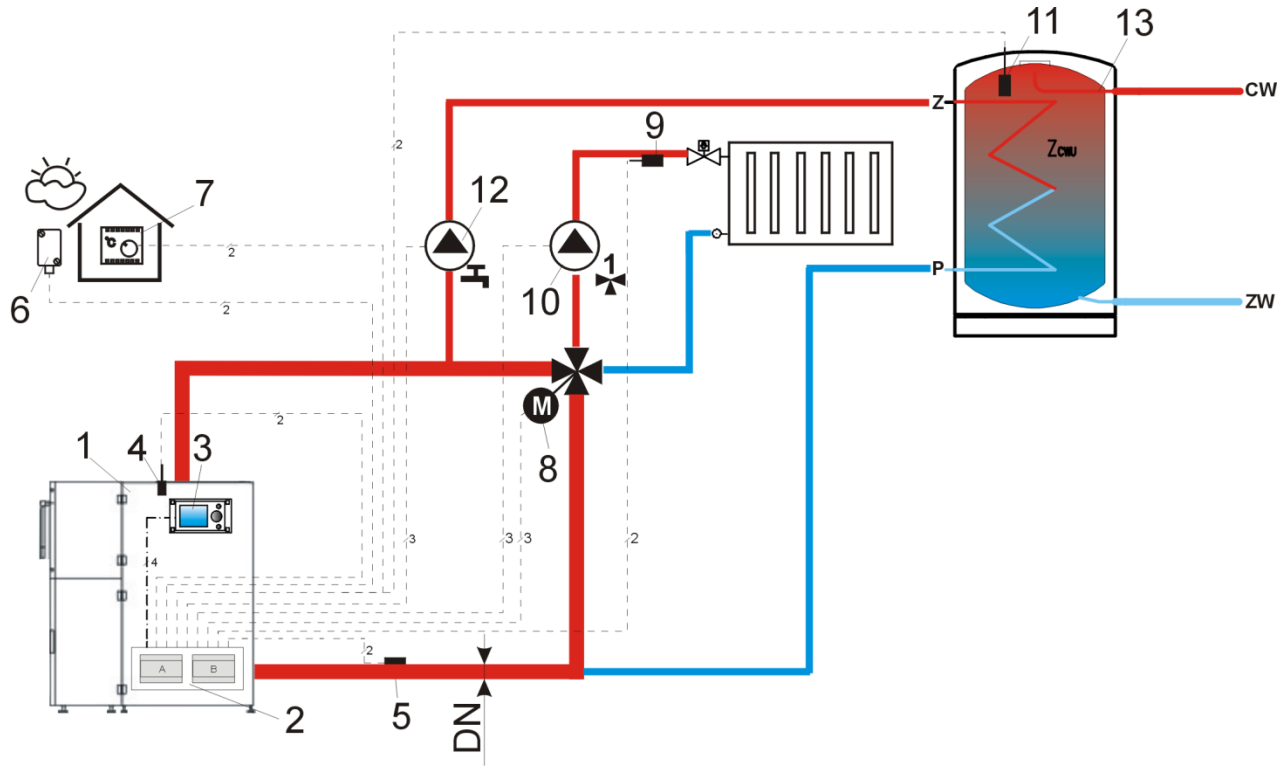


Fig. 22 **Diagram with four-way valve controlling the central heating cycle[2],** where: 1 – boiler with feeder, 2 – ZAB-14 regulator, 3 – regulator control panel, 4 – boiler temperature sensor, 5 – return temperature sensor, 6 -temperature sensor—weather, 7 – room thermostat, 8 –mixer servo, 9 - temperature sensor – mixer, 10 –mixer pump, 11 – domestic hot water temperature sensor, 12 – domestic hot water pump, 13 – domestic hot water tank.

⚠	In order to improve water circulation in the boiler gravity circulation circuit (marked as bold in the drawing), do as follows: use large nominal sections DN of the pipe and the four-way valve, avoid numerous elbows and narrowings of the section, apply other rules regarding structure of gravity systems, such as observing drops, etc. If the return sensor is clip-on, insulate it thermally from the surroundings and improve thermal contact with the pipe by using thermal grease. The boiler pre-set temperature must be high enough to provide thermal power for the mixer circuit, while heating the water which returns to the boiler.

SUGGESTED SETTINGS:

Parameter	Setting	MENU
Return protection	on	service settings -> boiler settings
Min. return temp.	42°C	service settings -> boiler settings
Return temp. hysteresis	2°C	service settings -> boiler settings
Valve closing	0%	service settings -> boiler settings
Increasing pre-set boiler temp.	5-20°C	service settings -> CH and HUW settings
Min. pre-set boiler temperature	65°C	service settings -> boiler settings
Mixer support 1	CH on	service settings -> mixer 1 settings
Max. preset mixer temp.	75°	service settings -> mixer 1 settings
Mixer heating curve	0.8 – 1.4	service settings -> mixer 1 settings
Out. temp. control	on	service settings -> boiler settings

[2]The presented hydraulic diagram does not replace the central heating system design and is provided solely for the purposes of demonstration!

Brief description: The DHW pump (12) can start its operation only after the boiler exceeds the *CH activation temp.* (by default 40°C) Mixer pump (10) and servo (8) start operation regardless of the value of the parameter *CH activation temp.* The mixer servo (8) founds such valve opening stage at which the temperature at sensor (9) will be equal to the *preset mixer temperature 1.* When the temperature on sensor (5) drops below the value *Min. return temp.*, the servo (8), closes to the value *close valve for return protect.* After the temperature on sensor (5)increased buy the value *Return temp. hyst.*, the servo switches into stabilization of *preset mixer temperature 1*. The setting *Mixer 1 operation = CH on* guarantees that even in the case of the boiler (1) overheating, the mixer (8) will open maximally, and the mixer pump (10) will not be disabled at the moment of exceeding the *Max.mixer temp.* Return protection is available only for mixer 1 circuit.

9.2 Scheme 2

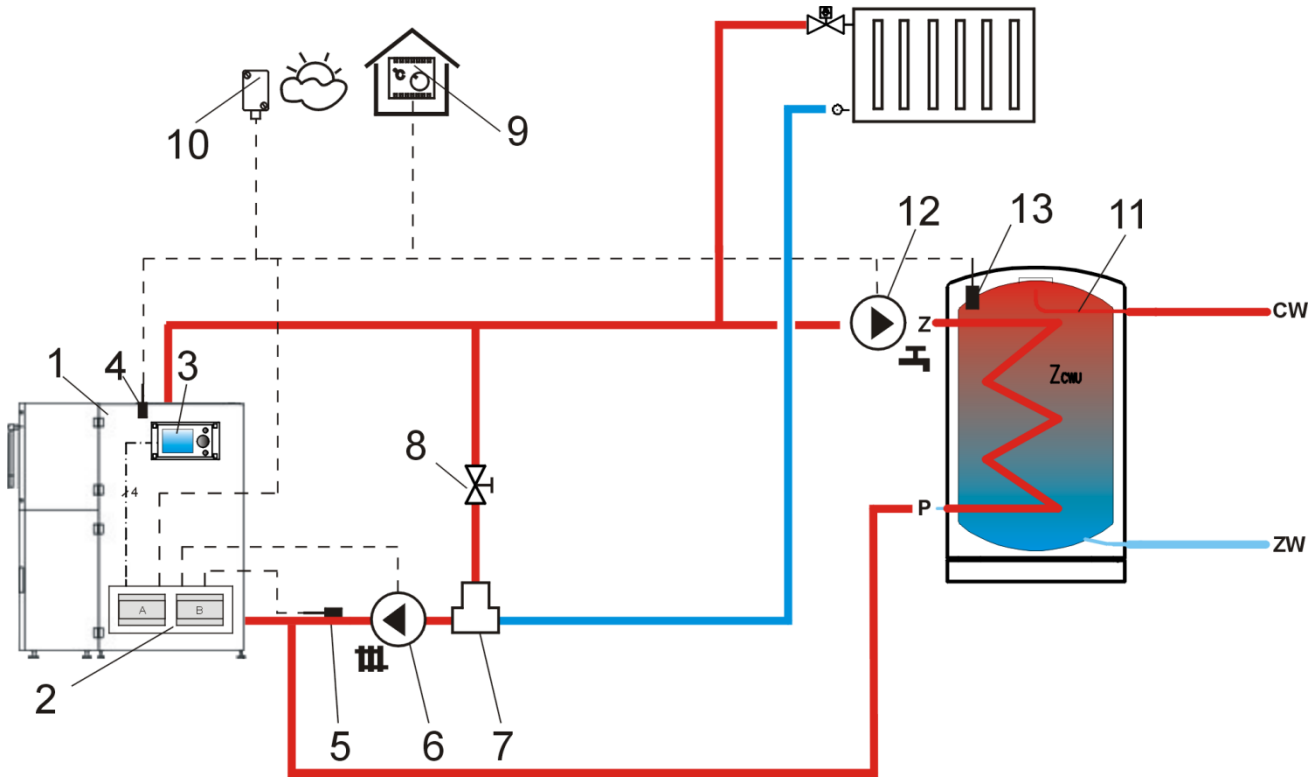


Fig. 23 **Diagram with thermostatic three-way valve which protects the temperature of return water[3],** where:1 – boiler with feeder, 2 – ZAB-14 regulator, 3 – regulator control panel, 4 –boiler temperature sensor, 5 – return temperature sensor, 6 – central heating cycle pump, 7 – thermostatic three-way valve, 8 –throttle (poppet) valve, 9 – room thermostate, 10 – temperature sensor-weather, 11 – domestic hot water tank, 12 – domestic hot water pump, 13 – domestic hot water temperature sensor.

SUGGESTED SETTINGS:

Parameter	Setting	MENU
Return protection	off	service settings -> boiler settings
Mixer operation 1	off	service settings -> mixer 1 settings

Brief description: The CH pump (6), and the DHW pump (12) can start their operation only after the boiler exceeds the *CH activation temp.* (by default 40°C). The thermostatic valve (7) closes at

[3]The presented hydraulic diagram does not replace the central heating system design and is provided solely for the purposes of demonstration!

the initial stages of heating, when the water getting into the boiler is cold. This causes the boiler water to flow in a short cycle: boiler (1) – throttle valve (8) - thermostatic valve (7) – pump (6). The thermostatic valve (7) opens after the temperature returning to the boiler increases, directing the boiler water to the central heating system. When the temperature measured by sensor (13) drops below the preset DHW temperature, the DHW pump (12) is enabled. The DHW pump (12) will be disabled after the DHW tank (11) is filled, i.e. when the temperature on sensor (13) is equal to the preset DHW temperature.

9.3 Scheme 3

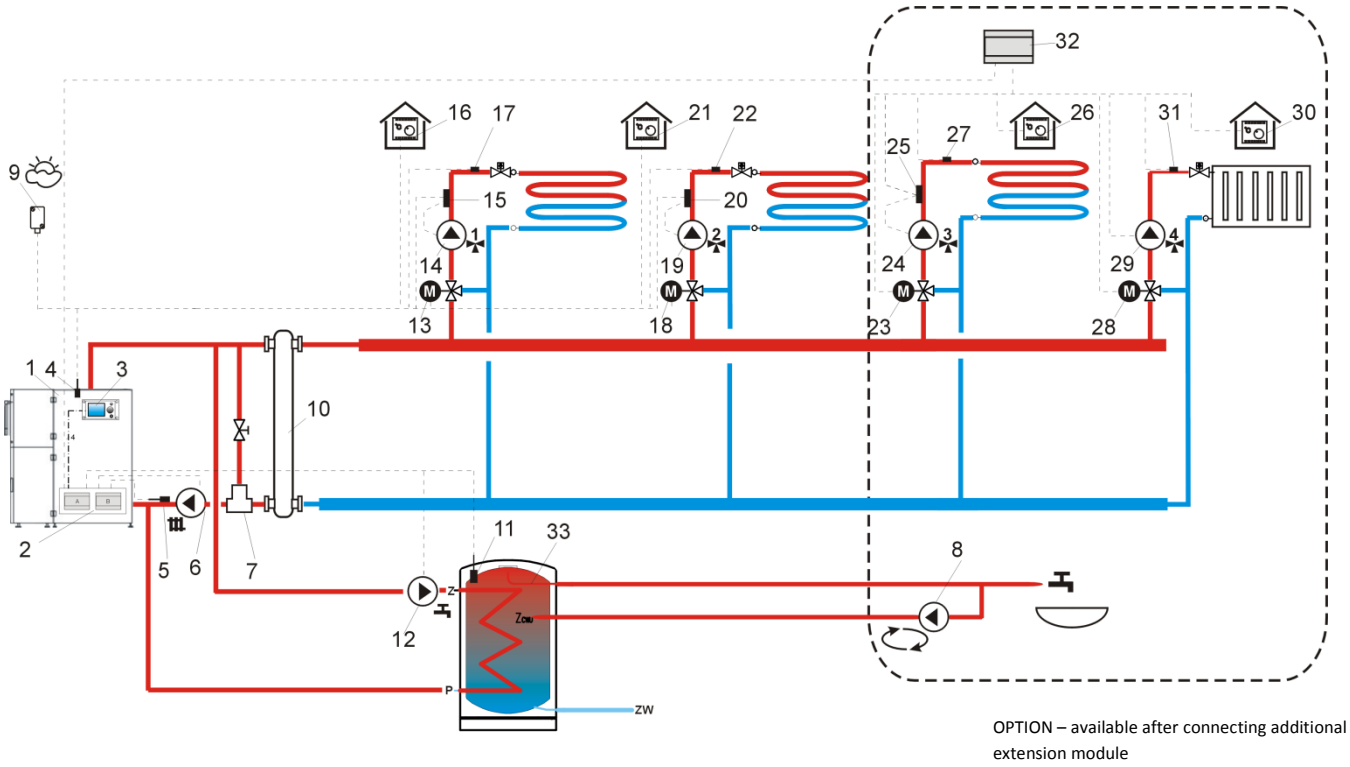


Fig. 24 **Diagram with thermostatic three-way valve which protects return water temperature, and two three-way valves which feed floor heating, as well as with two additional mixer cycles after connecting an extension module[4],** where:1 – boiler, 2 – ZAB-14 regulator, 3 – control panel, 4 – boiler temperature sensor, 5 – return temperature sensor, 6- central heating cycle pump, 7 – thermostatic three-way valve (protecting boiler return), 8 – circulating pump, 9 –temperature sensor-weather, 10 – fluid coupling (eliminates necessity of balancing the pumps' flows), 11 – domestic hot water temperature sensor, 12 – domestic hot water pump, 13 – mixer servo 1, 14 – mixer pump 1, 15 – external thermostat protecting floor heating 55 ºC (it cuts off electricity supply for mixer pump after exceeding maximum temperature - the thermostat is not included in the regulator), 16 –room thermostat of mixer 1, 17 – mixer temperature sensor 1,18 –mixer servo 2, 19 – mixer pump 2, 20 – external thermostat protecting floor heating 55 ºC, 21 – mixer room thermostat 2, 22 – mixer temperature sensor 2,23 – mixer servo 3, 24 – mixer pump 3, 25 – external thermostat protecting floor heating 55 ºC, 26– room thermostat of mixer 3, 27 – mixer temperature sensor 3,28 –mixer servo 4, 29 – mixer pump 4, 30 – room thermostat of mixer 4, 31 – mixer temperature sensor 4, 32 – extension mixer module, 33 – domestic hot water tank.

SUGGESTED SETTINGS:

Parameter	Setting	MENU
Return protection	off	service settings -> boiler settings
Mixer support 1	on, floor	service settings -> mixer 1 settings
Max. pre-set mixer temp. 1	50 °C	service settings -> mixer 1 settings

[4]The presented hydraulic diagram does not replace the central heating system design and is provided solely for the purposes of demonstration!

CONTINUED SUGGESTED SETTINGS:

Mixer weather control 1, 2, 3, 4	on	menu→ mixer settings 1,2,3,4
Mixer heating curve 1	0.2 – 0.6	service settings -> mixer 1 settings
Mixer support 2	on, floor	service settings -> mixer 2 settings
Max. pre-set mixer temp. 2	50 °C	service settings -> mixer 2 settings
Mixer heating curve 2	0.2 – 0.6	service settings -> mixer 2 settings
Mixer support 3	on, floor	service settings -> mixer 3 settings
Max. pre-set mixer temp. 3	50 °C	service settings -> mixer 3 settings
Mixer heating curve 3	0.2 – 0.6	service settings -> mixer 3 settings
Mixer support 4	CH on	service settings -> mixer 4 settings
Max. pre-set mixer temp. 4	80 °C	service settings -> mixer 4 settings
Mixer heating curve 4	0.8 – 1.4	service settings -> mixer 4 settings
Boiler weather control	off	service settings -> boiler settings

10. Technical data

Single-phase / three phase supply	~230V/400V; 50Hz;
Regulator current consumption	I = 0.08 A[5]
ZAB-14: Maximum rated current:	
Upper feeder	2.5A(2.5)A
Lower feeder	1.6(1.6)A
Igniter	8(8)A } connecting max. 6(6)A
Alarm	3(3)A } connecting max. 6(6)A
Fan	2(2)A } connecting max. 6(6)A
CH pump	3(2.6)A
HUW pump	3(2.6)A
Circulating pump	3(2.6)A } connected max. 6(6)A
Mixer pump	2(2)A } connected max. 6(6)A
Mobile grid ON	3(2.6)A } connected max. 6(6)A
Mobile grid OFF	3(2.6)A } connected max. 6(6)A
Ash removal	2(2)A } connected max. 6(6)A
Mixer servo ON	3(2.6)A } connected max. 6(6)A
Mixer servo OFF	3(2,6)A } connected max. 6(6)A
Regulator protection rating	IP20
Ambient temperature	0...50°C
Storage temperature	0...65 °C
Relative humidity	5 - 85%, without condensation
CT4 sensors temperature measurement range	0...100 °C
CT4-P sensors temperature measurement range	-35...40 °C
Accuracy of temperature measurement with CT4 and CT4-P sensors	2°C
Connectors assembled on DIN35 bus: web, control and protective	Screw terminal, cable cross-section up to 2,5mm^2
Cable glands	Web, protective: PG11 (6-10mm cable), PG13,5 (6-12mm cable) Control: PG07 (4-6mm cable)
Display	Graphic 128x64
External dimensions	Control panel: 164x90x40 mm Execution module: 495x400x205 mm
Total weight of the set	10,3kg
Standards	PN-EN 60730-2-9 PN-EN 60730-1
Protection rating	To be built in devices of I class
Rated surge voltage	2500Vrms/50Hz

[5] It is a current consumed by the regulator itself. Total current consumption depends on devices connected to the regulator.

11. Conditions of storage and transport

The regulator cannot be exposed to direct effects of weather, i.e. rain and sunlight. Storage and transport temperature cannot exceed the range of -15…65 °C.

During transport, the device cannot be exposed to vibrations greater than those typical of normal road transport.

12. REGULATOR INSTALLATION

This chapter is intended for boiler manufacturers and qualified servicemen. Boiler manufacturer and serviceman should also get acquainted with other chapters of the manual.

Housing has to be protected against opening the cover by unauthorized persons.

12.1 Environmental conditions

The regulator is developed to be used in areas of 2nd degree of pollution acc. to PN-EN 60730-1 standard.
Do not use the regulator in gas and dust explosive atmospheres (e.g. carbon dust).

12.2 Enclosure conditions

The regulator is intended to be assembled on a stiff and fixed surface. Leave the following spaces when assembling the regulator:

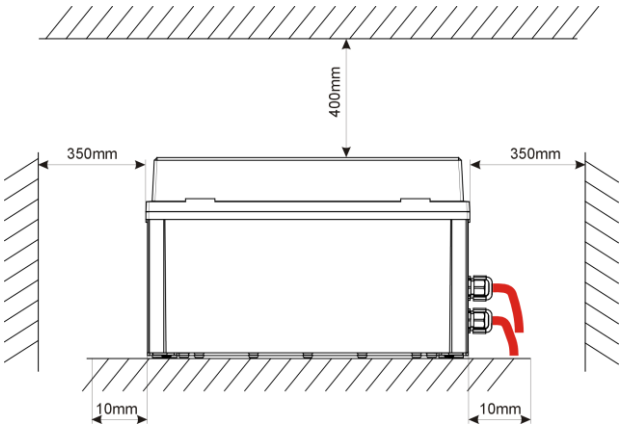
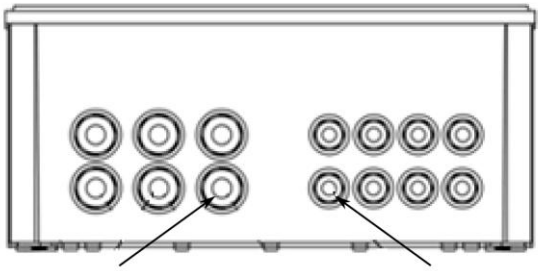


Fig. 25 Enclosure conditions

Outlet of signal cables should be made in a form of cable glands on a right side of the enclosure. Cable glands on a left side of the enclosure should be used in case of cables with a voltage of 230V/400V~. Make sure that there is no possibility of pulling the cables out from tightened glands. Enclose the cables subjected to mechanical loads in a way to prevent them from external stresses (e.g. lead them in trays).



PG13.5 cable gland, 4 pcs.
cable with diameter of 6-12mm
PG11 cable gland, 10 pcs.
cable with diameter of 6-10mm,

PG07 cable gland, 14 pcs.
cable with diameter of 4-6mm,

Fig. 26 Allowable range of diameters of cables assembled in cable glands.

12.3 Ambient temperature

The regulator can operate only within the range of ambient temperatures of 0-50°C. It is recommended to measure the temperature in a place intended for enclosing the regulator.

12.4 Protective connection

Connect the boiler enclosure, PE cables on peripherals and other available connective parts to terminals marked on a HV plate as ⏚ inside the enclosure.

12.5 Control module disassembly

To disassemble the control module (3), shift latches (1) with the use of z flat screwdriver (2).

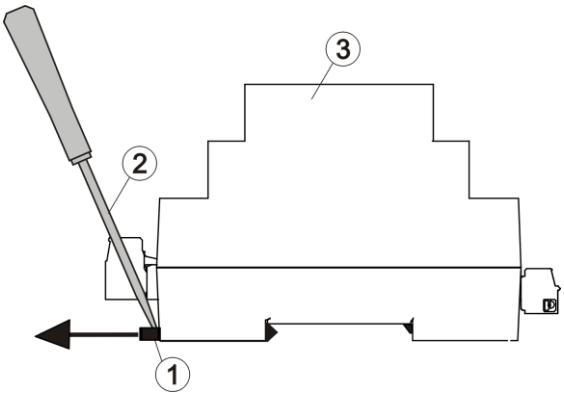


Fig. 27 Enclosure conditions.

12.6 Exchanging parts and subassemblies

In case of ordering spare parts or subassemblies, please provide the supplier with necessary data read out from the ZAB-14 regulator rating plate.

12.7 Replacing mains fuse

The mains fuses protects the regulator along with connected devices. Please use time-delay fuses, porcelain, 5x20 mm, of nominal burnout current 6,3A.

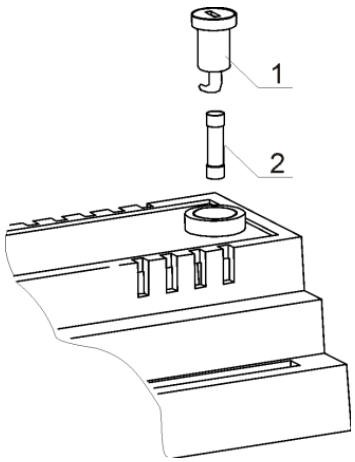


Fig. 28 Fuse replacement, where: 1 – fuse, 2 – fuse socket.

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

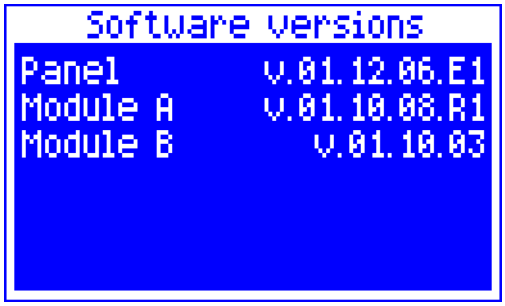
12.8 Control panel replacement

When replacing the whole control panel, check compatibility of the new panel software with the executive panel A software. Compatibility is maintained if the first number of software in the control panel and in the executive module is identical. In the example below, the software versions are compatible, as the first number ,,01" is the same for both subassemblies.

Examples of software numbers:

Control panel	Executive module
01.12.06.E1	**01**.10.90.R1

The software numbers can be read on the rating plates of the subassemblies, or in the menu Information.



The regulator can operate improperly if the control panel is incompatible with the executive module.

12.9 Executive module replacement

The requirements are the same as those for replacement of the control panel.

12.10 Other requirements

Before using the regulator in the boiler, verify whether the regulator meets the boiler requirements defined in valid regulations. Check whether the regulator can properly and safely cooperate with particular boiler type.

13. Connecting electrical installation

The regulator is intended to be supplied with the following voltages:

- single-phase ~230V/, 50Hz
- three-phase ~400V/, 50Hz

Installation should:

- include three-wire cables (with a protective wire) for single-phase,
- include five-wire cables (with a protective wire) for three-phase,
- meet the regulations in force.

Device starts to be supplied in a moment of screwing cable cables in **HV** terminal to connectors and switching the installation switch to **1** (outside in a housing cover). GZ1 silicone breaker and CLS6 overcurrent switch in the cover should be set to **1**. Emergency switch should be pulled out.

Disconnect supply source prior to disassembly of ZAB-14 or opening enclosure cover.

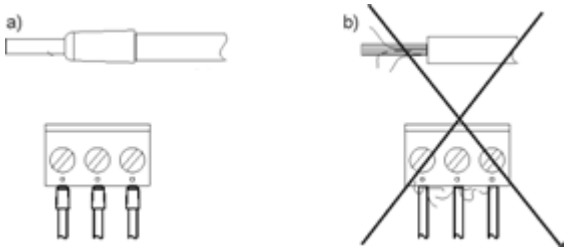
13.1 Current-carrying capacity of the regulator

A maximum network current consumed by the regulator along with its peripherals cannot exceed 6A. It does not include heater current which is supplied with integrated relay, nor a current consumed by alarm module supplied by another integrated relay. The regulator was designed to cooperate with heaters of power lower than 1.5KW (8A). Total consumed current also does not include a current consumed by two motors of upper and lower feeder supplied by two voltage contactors inside the enclosure.

13.2 Connecting HV and LV cables

HV cables for controlled devices are introduced inside the device through glands and connected with appropriate screw terminals. Cables should be connected in accordance with information on plates fixed next to terminals. Tighten gland nuts and pull the cable in order to make sure that it does not come out. Cables with dangerous voltages can be led only through appropriate glands. They cannot be led directly net to each other. It is forbidden to mix cables with dangerous voltages 230/400V~ with LV cables (e.g. from sensors).

Wires of connected cables have to be protected against delamination with the use of insulated collets in accordance with the following figure (a – proper protection with a collet, b – improper protection).



13.3 Description of strip terminals

HV terminals (controlled devices) 230/400V~

Terminal	PE/N/L	Function
50	L1	Mains supply ~230/400VAC
51	L2	
52	L3	
53	N	
54	PE	
55	AL1	HIGH upper feeder
56	AL2	
57	AL3	
58	PE	
59	BL1	LOW lower feeder
60	BL2	
61	BL3	
62	PE	
63	CL	Igniter
64	CN	
65	PE	
66	DL	CH pump
67	DN	
68	PE	
69	EL	HUW pump
70	EN	
71	PE	
72	EL	FAN
73	EN	
74	PE	
75	FL (OFF)	Mobile grate
76	FN	
77	FL (ON)	
78	GL	Circulation pump
79	GN	
80	PE	

Continued HV terminals (controlled devices) 230/400V~

81	HL (OFF)	Mixer 1 servo
82	HN	
83	HL (ON)	
84	IL	Mixer 1 pump
85	IN	
86	PE	
87	JL	Alarm
88	JN	
89	PE	
90	KN	STB
91	KN	
92	PE	
93	ML	Ash removal
94	MN	
95	PE	

LV terminals (sensors)

Terminal	Function	
96	Boiler temp. sensor	
97		
98	Feeder temp. sensor	
99		
100	Return temp. sensor	
101		
102	HUW temp. sensor	
103		
104	Weather sensor	
105		
106	Exhaust temp. sensor	
107		
108	Room thermostat 1	
109		
110	Mixer temp. sensor	
111		
112	GND	Capacity sensor
113	OUT	
114	+5V	
115	Buffer temp - up	
116		
117	Buffer temp. down	
118		
119	Fuel level sensor ceramic head	
120		
121	Room thermostat 2	
122		

Additional functional description of terminals for mobile grate and mixer servo.

Terminal	PE/N/L	Function
75	FL (OFF)	Grate stroke
76	FN	
77	FL (ON)	Grate stroke
81	HL (OFF)	Valve closing
82	HN	
83	HL (ON)	Valve opening

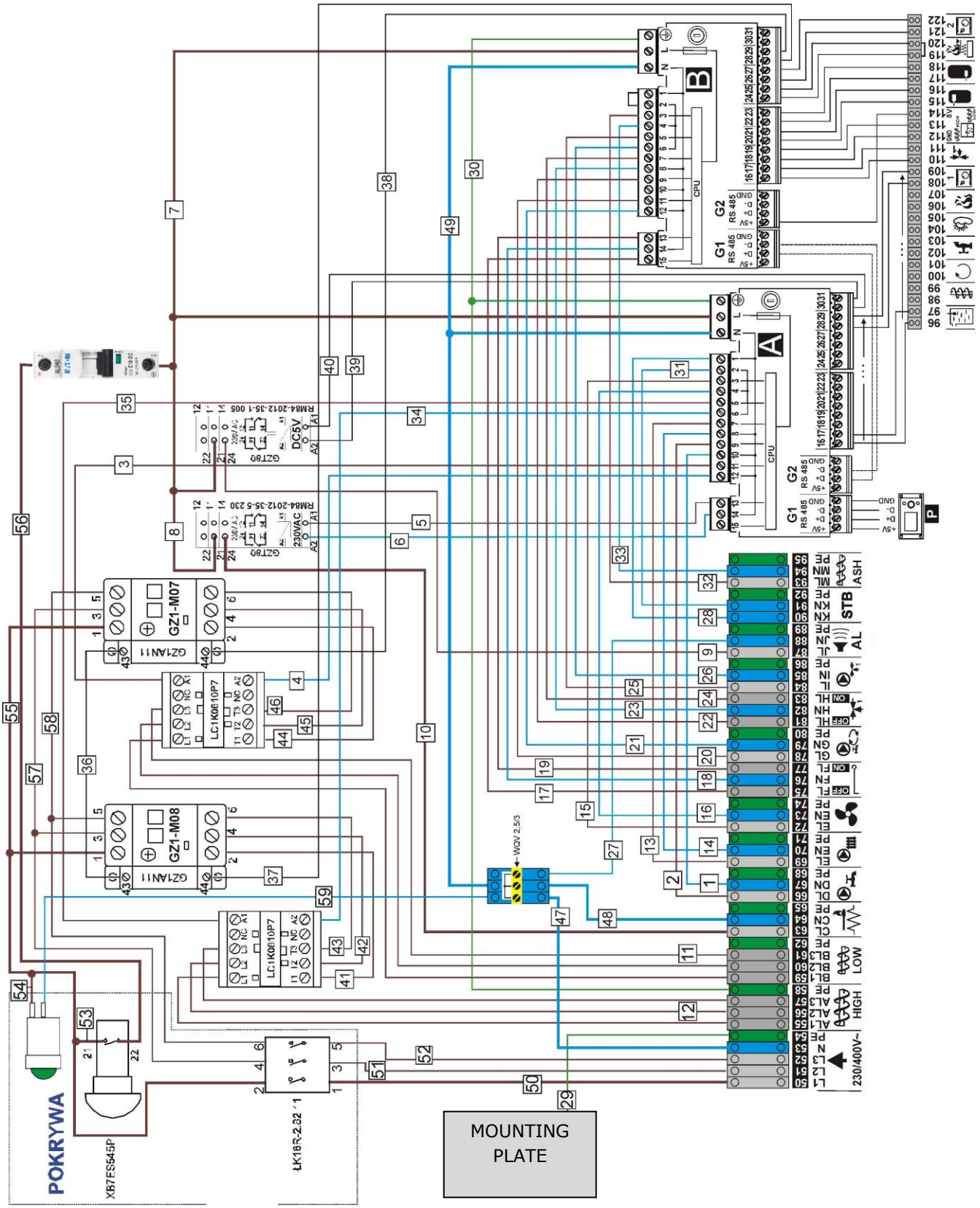


Fig. 29 ZAB-14 Diagram for electric connections.

13.4 Connecting temperature sensors

The regulator cooperates only with CT4i and CT2S sensors. It is forbidden to use different sensors.

Sensor leads can be extended with wires with section of at least 0,5mm^2. Total length of the sensor leads cannot exceed 15 m.

The boiler temperature sensor should be fitted in the thermometric pipe, situated in the boiler shell. The feeder temperature sensor must be fitted on the surface of the feeder screw pipe. The domestic hot water temperature sensor - in the thermometric pipe welded into the tank. It is best to fit the mixer temperature sensor in a tube (sleeve) placed in the stream of water flowing in the pipe, but it is also possible to clip it onto the pipe, covering the sensor and the pipe with thermal insulation.

The sensors must be secured against coming loose from the measured surfaces.

Good thermal contact between the sensors and the measured surface must be ensured. For this purpose, use thermally conductive paste. Do not pour oil or water over the sensors.
The sensor cables should be separated from mains leads. Otherwise, the temperature indications can be incorrect. Minimum distance between these leads should be at least 10 cm.

The sensor leads cannot have contact with hot elements of the boiler and heating system. The temperature sensors' leads are resistant to temperature up to 100 °C.

13.5 Connecting weather sensor

The regulator cooperates only with a weather sensor of the CT4-P type. The sensor should be installed on the coldest wall of the building, usually this is the northern wall, under a roof. The sensor should not be exposed to direct sunlight and rain. The sensor should be fitted at least 2 m above the ground, far from windows, chimneys and other heat sources which could disturb the temperature measurement (at least 1,5 m).

Connect the sensor using cable of 0,5 mm^2 cross-section, up to 25 m long. Polarity of the leads is insignificant. Connect the other end of the cable to the regulator.
Attach the sensor to the wall using tackbolts. To access the tackbolts holes, unscrew the sensor lid.

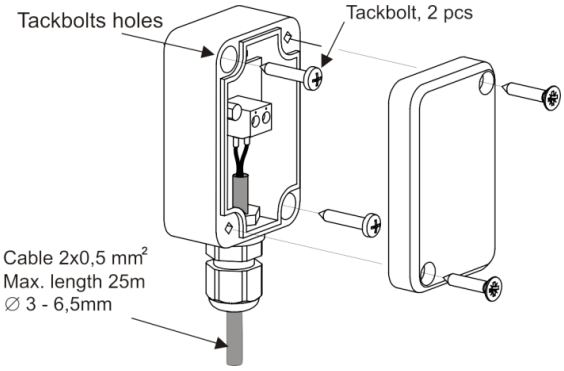


Fig. 30 Connecting weather senor CT4-P.

13.6 Checking temperature sensors

Temperature sensors CT4/CT4-P/CT2S can be checked by measuring their resistance at the given temperature. In the case of finding significant differences between the value of measured resistance and the values presented in the table below, the sensor must be changed.

The regulator cooperates only with an exhaust temperature sensor type CT2S. In order to inspect the sensor, it is necessary to use a very precise multimeter – otherwise, the sensor can only be checked roughly.

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

CT4-P			
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

CT2S			
Temp. °C	Min. Ω	Nom. Ω	Max. Ω
0	999,7	**1000,0**	1000,3
25	1096,9	**1097,3**	1097,7
50	1193,4	**1194,0**	1194,6
100	1384,2	**1385,0**	1385,8
125	1478,5	**1479,4**	1480,3
150	1572,0	**1573,1**	1574,2

13.7 Connecting room thermostat for mixer circuits

Room thermostats connected to executive module B as per influences mixer 1 and mixer 2 circuits. If the entire building heating system is fed by the mixer circuit, all room thermostat settings for boiler should be disabled.

After opening of the contacts, the room thermostat decreases the preset mixer circuit temperature by the value of preset mixer temperature decrease from thermostat. This parameter can be found in:

Mixer 1 settings > Mixer room therm.

The value of this parameter should be chosen in such a way, that after activation of room thermostat (opening of contacts), the temperature in the room decreased.

13.8 Connecting reserve boiler

The regulator can control operation of a reserve (gas or oil) boiler. In such case it is not necessary to activate and deactivate the boiler manually. Reserve boiler will be activated when temperature of the biomass boiler drops and deactivated if appropriate temperature of the biomass boiler is reached. Only a qualified installer is allowed to connect a reserve (e.g. gas) boiler. Such operation should be executed in accordance with technical documentation of this boiler.
Connecting a reserve boiler eliminates a possibility of connecting alarm signalling. Reserve boiler should be connected to 87-88 terminals through a relay in accordance with the figure below.

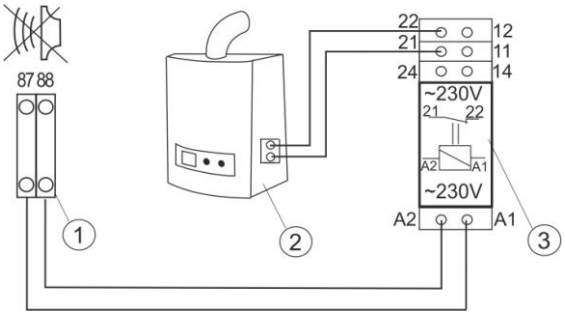


Fig. 31 Example of connection of a reserve boiler to ZAB-14 regulator, where: 1 – ZAB-14, 2 – reserve (gas or oil) boiler, 3 – Relay with a coil ~230V.

The regulator is not equipped with relay 3 by default.

Relay (3) can be selected, assembled and installed only by a person with appropriate certificates compliant with the regulations in force.

To enable control of a reserve boiler, set the temperature of the CH system at which the reserve boiler is to be disabled:

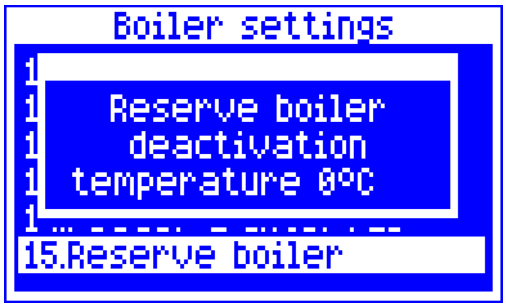


Fig. 32 Enabling control of a reserve boiler.

Service settings > Boiler settings > Reserve boiler

Reserve boiler control is deactivated by setting value of its deactivation temperature to zero.
When the boiler is fired up, and its temperature exceeds a preset value, e.g. 25°C, the ZAB-14 regulator will disable the reserve boiler (will feed constant 6V to terminals 87-88). This will cause release of the U3 module relay coil, and its contacts will be disconnected. After the boiler temperature drops below the parameter *auxiliary boiler off temperature*, the regulator ceases to supply voltage to the terminalsi 87-88 , which will activate the reserve boiler.

Switching the ZAB-14 regulator into OFF mode causes activation of reserve boiler.

It is recommended to switch the ZAB-14 regulator in the OFF mode, if the pellet boiler gets damaged and there is a need of operation with reserve boiler. In the OFF mode, CH system control is inactive (mixer HUW and boiler pumps, as well as mixer control - are inactive).

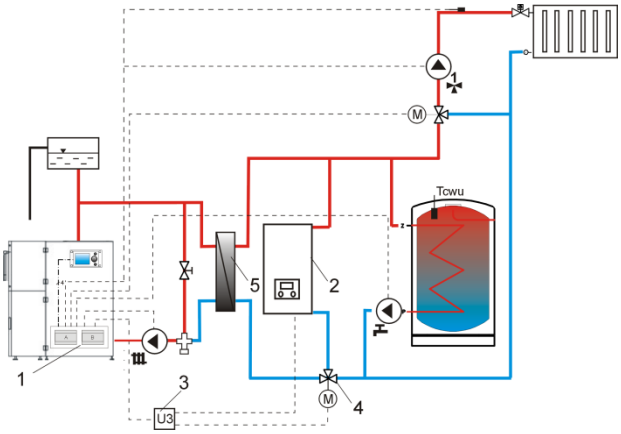


Fig. 33 Hydraulic diagram with a reserve boiler, connection of an open circuit with a closed one, where: 1 – ZAB-14 regulator, 2 – reserve boiler, 3 – U3 module, 4 –switching valve (with limit switches), 5 – heat exchanger, recommended setting *DHW priority = off. CH pump = boiler pump = YES.*

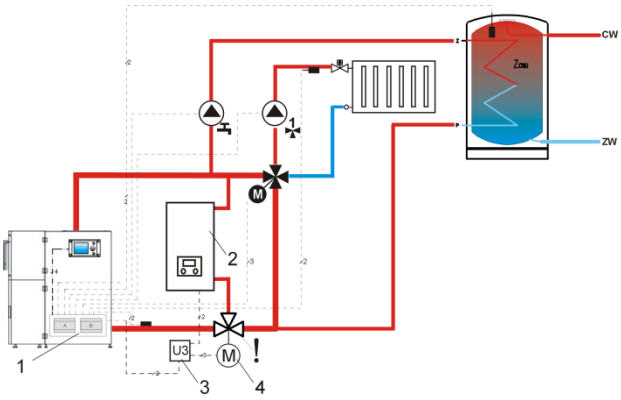


Fig. 34 Hydraulic diagram with reserve boiler and four-way valve in closed cycle, where: 1 – ZAB-14 regulator , 2 – reserve boiler, 3 – U3 module, 4 – switching valve servo (with limit switches).

Note: in order to provide smooth gravitational water flow in the boiler circuit, collision cross-section of the switching valve (4) must be greater than or equal to cross section of the boiler circuit pipe. Use high cross sections of gravitational boiler circuit pipes.

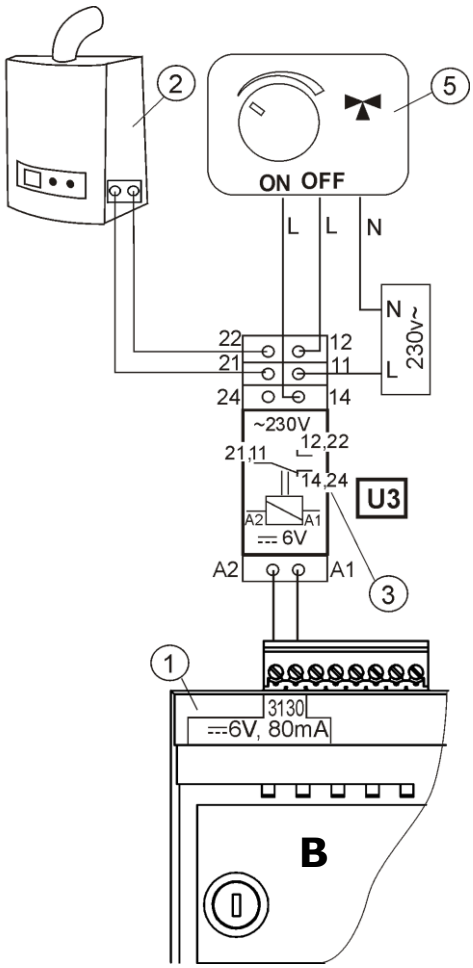


Fig. 35 Electric diagram for switching valve of the reserve boiler, where: 1 – ZAB-14 regulator module B, 2 – reserve boiler, 3 – U3 module, 5 – servo of switching valve (with limit switches), note: contacts 22, 21, 24 must have galvanic separation from contacts 12,11,14.

13.9 Connecting alarm signalling

The regulator can signal alarm states by activating a peripheral device, e.g. a buzzer or a GSM device for sending an SMS - short messages.

Alarm signalling device should be connected directly to HV terminals marked as 87-89 on a plate.

In order to provide proper operation, set appropriate value of code for signalling active alarms in the menu:

Service settings>Boiler settings>Alarms

Selecting a value of "127" will cause occurrence of voltage between terminals 30-31 (alarm output activation) if any alarm occurs. Setting this value to "0" will prevent the boiler from activating the output in the case of alarm.

It is also possible to set up the alarm output in such a way, that it was activated when one or several selected alarms occur. The value to which this parameter should be set for individual alarms is presented in the following table:

Emission sensor damage	Boiler overheated	Exceeding feeder temp.	CH boiler temperature sensor damage	Feeder temperature sensor damage	Unsuccessful firing-up attempt
AL 1	AL 2	AL 3	AL 4	AL 5	AL6
1	**2**	**4**	**8**	**16**	**32**

Example: if you set the value of the parameter to „8", the voltage will be supplied to the contact only if alarm AL4 occurs.

Setting "1" will cause the contact to signalize only alarm AL1.

If the output is to signal activity of several, freely selected alarm states, e.g. alarms AL2 or AL4, set this parameter as value which is the sum of the table-listed values for individual alarms (2+8=10). If any of alarms AL1, AL2, AL3 is to be signalled, set the value to "7".

13.10 Connecting mixer

The regulator cooperates only with servos of mixing valves equipped with limit switches. It is prohibited to use different servos. Permitted servos are those which make a full revolution in 30 - 255 s.
Description of connecting a mixer:

- disable power supply to the regulator,

- determine the direction in which the servo opens/closes and make an electric connection between the mixer and the regulator, in accordance with the documentation provided by the valve servo manufacturer (do not confuse the valve direction of opening with the direction of closing),
- connect mixer temperature sensor and mixer pump,
- activate the regulator and specify appropriate valve opening time in the mixer service settings, in accordance with the servo documentation. **Service settings > Mixer 1 settings > Valve opening time**,
- disable and enable power supply to the regulator, wait until the servo is calibrated. During the calibration, the servo is closed by the *valve opening time.* Calibration is signalled in the menu **Information** in individual mixers' tab, with message ,,CAL",
- make sure that the servo opens in the correct direction (to do so, open menu **Information** and go to tab info-mixer or enable manual control of devices connected to the regulator).

13.11 Connecting circulating pump

The circulating pump can be connected to the ZAB-14 boiler regulator only after purchasing an extension executive module.

13.12 Connecting temperature limiter STB

In order to prevent the boiler from overheating due to the regulator malfunction, an STB safety temperature limiter, or any other appropriate for the given boiler and heating system, should be fitted.
Limiter should be connected to 93-95 HV terminals. In case limiter is activated, a blow and STB fuel feeder motor will be disconnected.

The STB must have nominal operating voltage of at least ~230V, and have the applicable certifications.

If the limiter is not installed, terminals 90, 91 should be bridged. A bridge should be made on insulated cable with a cross-section of at least 0.75 mm^2 and insulation of such thickness that boiler safety requirements are met.

Regulations demand STB usage!

13.13 Connecting room panel

The regulator can be equipped with room panel ecoSTER200, which can serve as:

- room thermostat (supporting up to 3 - boiler control panel,
- alarm signalling device,
- fuel level indicator.

Four-conductor connection:

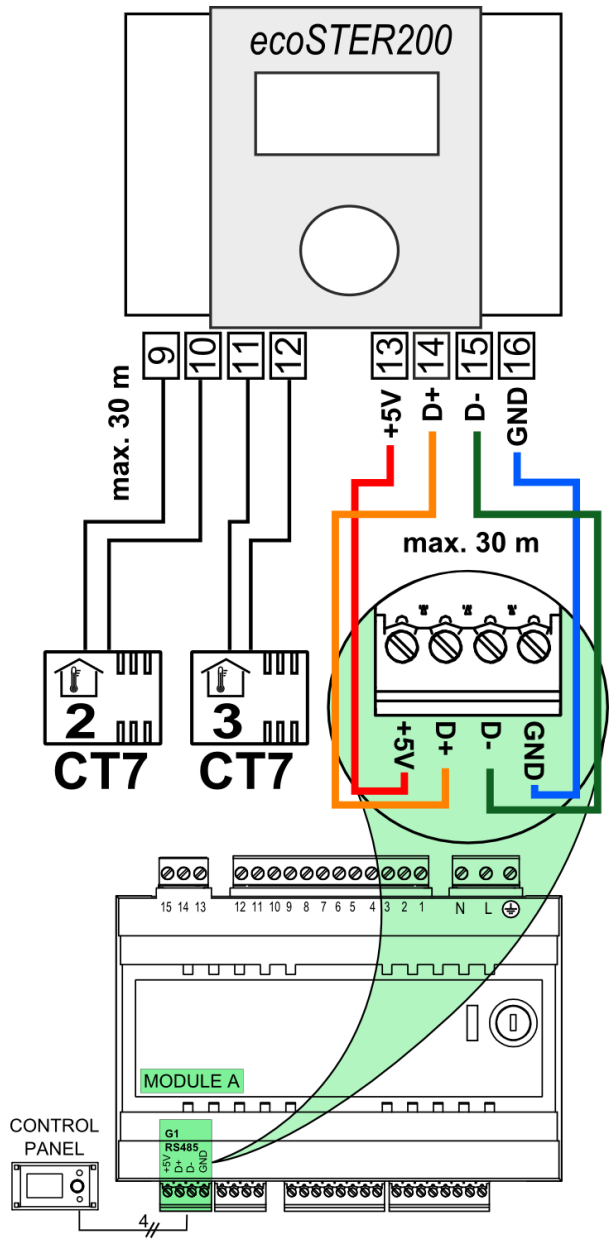


Fig. 36 Electric connections diagram (four-conductor) ecoSTER200 with module A for regulator ZAB-14.

Two-conductor connection:

The two-conductor connection requires a 5V DC power supply with rated current of at least 200 mA. ecoSTER200 supply points: connect GND and +V to external power supply.

The power supply is not included with the regulator.

Connect lines D+ and D- as shown in the diagram.

Maximum length of leads to the additional panel should not exceed 30 m, whereas their gauge should be at least 0,5 mm^2.

13.14 Internet connection

ZAB-14 regulator can be connecter with the Internet via an additional ecoNET300 module. Detailed information are available on regulator manufacturer's website.

14. Structure – service menu

Service settings

- Boiler setting
- Grate
- CH and HUW settings
- *Buffer settings
- *Mixer 1-4 settings
- Restore service settings

Boiler settings

- Firing-up
- Putting out
- Cleaning
- Supervision
- Return protection
- Thermostat selection
- Min. boiler temp
- Max.boiler temp
- Min. airflow output
- Fuel detection time
- Ex. temp. w. no fuel
- Poker cycle time
- Feeder 2-extended operation
- * Additional feeder-operation
- Reserve boiler
- Alarms
- Boiler cooling temp.
- *Parameter A FL
- *Parametr B FL
- *Parameter C FL
- *Grate
- Pump off by therm.

Firing-up

- Ignition test time
- Feeding time
- Firing-up airflow
- Firing-up time
- Ex. temp delta
- Ex. temp for fired-up
- Air flush intensity
- Air flush delay
- Igniter period
- Worktime with minimal power

Putting out

- Putting out time
- Putting out airflow

Cleaning

- Poker period before inflame
- Poker period after bufning off
- Cleaning airflow
- Ash removal working period
- Ash removal interval

Supervision

- Supervision time
- Supervision feeding time
- Supervision feeder interwal
- Blow-in SUPERV

Return protection

- Operation mode
- Min. return temp.
- Return temp. hysteresis
- Valve closing

Thermostat selection
Off
*ecoSTER 1-2
Universal

Grate
Operation time
Full opening time

CH & HUW settings
CH activation temp.
*CH standstill when filling HUW
*Min temp. HUW
*Max. temp. HUW
*Boiler increase from HUW and M.
*HUW operations extend.
Circulation pump standstill time
Circulation pump operation time
*Boiler pump
*Pump hysteresis

*Buffer settings
Activate operations
Loading start temperature
Loading start temperature

*Mixer 1-4 settings
Mixer support
Thermostat selection
Min. mixer temp.
Max. mixer temp.
Proportionality range
Integration time constant
Valve opening time
Pump deact. by time
Mixer input dead zone

*Menu for mixer cycles is identical

*) Note: some menu elements can be invisible in case appropriate sensor, module or preset is not present.

15.BOILER SERVICE SETTINGS

15.1 Firing-up

All parameters which influence the firing-up process can be found in menu:

Service settings >
Boiler settings > Firing-up

Detailed information about parameters responsible for the firing-up process can be found in point 8.5.

15.2 Putting out

All parameters which influence the process of putting out can be found in menu:

Service settings > Boiler settings > Putting out

Detailed information about parameters responsible for the putting out process can be found in point 8.10.

15.3 Cleaning

All parameters influencing cleaning process are included in a menu:
Service settings > Boiler settings > Cleaning
Detailed information concerning parameters responsible for cleaning are included in pt. 8.5, pkt. 8.6 and 8.10.

15.4 Supervision time

This is the maximum time in which the regulator remains in the SUPERVISION mode. If after lapse of this time from the moment of initiating supervision, there is no need to resume heating, the regulator automatically switches into the putting out mode (point 8.9).

Setting the parameter value to "0" will disable the supervision mode. The regulator will go directly from operation mode into putting out mode.

15.5 SUPERVISION feeding time

This is the time of feeding fuel and airflow operation in the SUPERVISION mode (point 8.9).

Setting the parameter value to "0" will cause only the airflow to be activated during supervision.

The value of this parameter cannot be too high, as it can cause the boiler to overheat in the SUPERVISION mode. In the SUPERVISION mode, the boiler temperature should slowly decrease.

15.6 SUPERVISION feeding interval

is the duration of fuel feeding interval in the SUPERVISION mode (point 8.9).

The value of this parameter cannot be too low as it can cause the boiler to overheat in the SUPERVISION mode. In the SUPERVISION mode, the boiler temperature should slowly decrease.

15.7 Airflow operation extension time (SUPERVISION)

In the SUPERVISION mode of boiler operation, after feeding a dose of fuel and disabling the feeder, the fan continues to work for a time of airflow operation extension time, in order to light up the provided dose of fuel.

Setting the parameter value to "0" will cause prevent the airflow from being activated during supervision.

The value of this parameter cannot be too high, as it can cause the boiler to overheat in the SUPERVISION mode. In the SUPERVISION mode, the boiler temperature should slowly decrease.

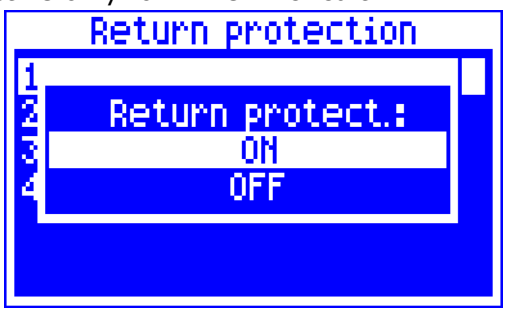
15.8 Return protection

Caution: the return protection function protects the boiler against operation with cold return water. This function will not work properly if the hydraulic system is faulty. The system should be designed in such a way, that at the time of closing the mixing valve, the boiler return temperature can exceed the pre-set threshold.

If the boiler cooperates with a mixing valve and valve servo, and if return temperature sensor is connected, the function of protection against return of cold water to the boiler can be enabled. To do so, activate protection in the menu:

Service settings > Boiler settings > Return protection > Operation mode

Note: the return protection function is active only for mixer 1 circuit.



If the return temperature sensor is disconnected or damaged, the regulator will automatically disable the return protection. In order to operate properly, the clip-on return sensor must be thermally insulated from the surroundings.

15.9 Min. return temperature

This parameter specifies temperature of water returning to the boiler, below which the four-way valve servo is closed. After the return temperature exceeds the value of this parameter + *return temperature hysteresis*, the servo resumes normal operation.

15.10 Return temperature hysteresis

This parameter defines the return temperature hysteresis.

15.11 Valve closing

This parameter specifies percentage of closing the four-way valve after drop in temperature of water returning to the boiler below the set value. Set such closing extent, at which the boiler return temperature increases the fastest. Recommended value: 0%.

15.12 Thermostat selection

Service settings > Boiler settings > Thermostat selection

This option allows to select room thermostat for boiler circuit if a room panel ecoSTER200 is connected, or if mechanical thermostats connected to executive module B are used. Available options:

- *Off,*

-*Universal 1* - standard no/nc thermostat connected to terminals 26-27 of module B,

- *Universal* 2 - standard no/nc thermostat connected to terminals 28-29 of module B,

- *ecoSTER1* – thermostat 1 in ecoSTER 200,

- *ecoSTER2* – thermostat 2 in ecoSTER 200,

- *ecoSTER3* – thermostat 3 in ecoSTER 200,

If ecoSTER200 is not connected, the menu features only options for cooperation with universal room thermostats.

15.13 Minimum preset boiler temperature

This parameter can be used to prevent the user from setting too low preset boiler temperature. If the boiler operates at too low temperature, it can cause its accelerated degradation, corrosion, soiling, etc. Algorithms which automatically decrease temperature will also not cause decrease in preset boiler temperature below its minimum value, specified with this parameter.

Set the value in accordance with the boiler manufacturer's recommendations.

15.14 Maximum preset boiler temperature

This parameter can be used to prevent the user from setting too high preset boiler temperature.

Algorithms which automatically increase temperature (correction in accordance with heating curve or from required HUW temperature) will also not cause increase in preset boiler temperature above its maximum value, specified with this parameter.

Set the value in accordance with the boiler manufacturer's recommendations

15.15 Minimum fan power

When the regulator is turned on for the first time, it is necessary to set the user-defined parameter Minimum fan power.

Service settings > Boiler settings> Min. airflow output

This parameter prevents the fan against being damaged due to too low rotary speed. The minimum fan power should be determined with some reserve after observing the fan behaviour.

After setting a value of e.g. 20%, the user will not be able to set fan speed lower than 20%.

15.16 Fuel detection time

The regulator can detect lack of fuel in the main tank of the boiler on the basis of exhaust gases temperature. If, for a time exceeding one programmed in parameter:

Service settings > Boiler settings > Fuel detection time, the emission temperature is lower than one set in parameter:

Service settings > Boiler settings > Ex.temp.w.no fuel,

the regulator will switch from OPERATION mode into FIRING-UP mode. If there is no fuel in the bunker, the firing-up will end with a message of impossibility to fire the furnace up.

15.17 Maximum feeder temperature

This is the temperature at which the function which prevents the flame from going back to the fuel feeder is activated.

Setting the *max. feeder temp.* to „0" allows to disconnect the feeder sensor and lets the regulator operate without it. Nonetheless, such settings are not recommended, as they will disable the function of preventing flame recession.

15.18 Additional feeder operation time

This parameter defines time for which an additional (bunker) feeder is activated after low fuel level is detected by the fuel level sensor. Additional feeder operation is described in pt. 8.23.

15.19 Reserve boiler

This parameter defines a temperature of the biomass boiler at which the reserve (e.g. gas) boiler is deactivated.

15.20 Boiler cooling temperature

Temperature at which preventive boiler cooling is performed.

It is recommended to set the *Boiler cooling temperature* below the value triggering safety temperature limiter. This will prevent from breaks in boiler operation caused by overheat.

15.21 GRATE work mode

Work mode is selected in a menu:

Service settings > Boiler settings > GRATE work mode

Detailed information concerning operation in GRATE mode are included in pt. 8.12.

15.22 Disconnecting a pump from thermostat

If this parameter is set to "NO", opening room thermostat contacts will cause the boiler to switch first to supervision and next to banking mode provided that HUW tank loading is not in progress. Boiler pump remains constantly active.
Setting this parameter to "YES" will prevent the boiler from switching to supervision and banking mode in case room thermostat contacts are opened. Only boiler pump will be deactivated.

15.23 Parameter A, B and C Individual Fuzzy Logic

Parameters A, B and C *Individual Fuzzy Logic* influence the rate of controlling the boiler temperature to the preset value and stability of maintaining the preset boiler temperature in the *Individual Fuzzy Logic* mode. These parameters do not influence quality of burning in the *Individual Fuzzy Logic* mode, as this is controlled automatically

It is not recommended to change these parameters if the rate of boiler power change is at the required level.

Parameter **A**	Increasing its value speeds up increment in the boiler output. The higher the value, the faster the boiler reaches the pre-set temperature. Value too high can destabilize maintenance of the pre-set boiler temperature. Settings range 6…8, recommended value: 6.
Parameter **B**	Increasing its value slows down increment in the boiler output. The higher the value, the slower the boiler reaches the pre-set temperature. Setting higher value guarantees that the pre-set boiler temperature will not fluctuate. Value too low can destabilize maintenance of the pre-set boiler temperature. Settings range 20…30, recommended value: 30.
Parameter **C**	Proper selection of this parameter will allow to increase stability of maintaining the preset boiler temperature. Nonetheless, too high value thereof can cause high fluctuation of boiler temperature. It is not recommended to change the default setting..

16. Mobile grate SERVICE SETTINGS

Work parameters are included in a menu:

Service settings > Mobile grate

Apart from default settings made depending on the boiler work modes, operation is influenced by *Operation time* parameter used for pulling out the mobile grate and *Full opening time* parameter. When all *Operation times = Full opening time*, the mobile grate returns to its position for a time equal to *Full opening time*.

17. CH and DHW SERVICE SETTINGS

17.1 CH activation temperature

This parameter specifies the temperature at which the central heating pump is activated. After reaching the temperature equal to the *CH activation temp.* parameter, the central heating pump is activated. This protects the boiler against retting caused by its being cooled down by hot water returning from the system.

Disabling the CH pump on its own does not guarantee protecting the boiler against retting, and the resulting corrosion of the boiler. Use additional automatics, e.g. a four-way valve.

17.2 CH pump standstill during HUW filling

Prolonged filling of the HUW tank when HUW priority is enabled can cause excessive cooling of the CH system, because with these settings, the CH pump is disabled.

The parameter *CH standstill when filling HUW* prevents this by enabling periodic activation of the CH pump during filling of the HUW tank. After this time, the CH pump will be activated for constant, pre-programmed time of 30 s.

17.3 Minimum HUW temperature

This parameter allows to prevent the user from setting too low a preset temperature of HUW.

17.4 Maximum HUW temperature

This parameter specifies the maximum temperature of heating the HUW tank when dropping excessive heat from the boiler during emergencies. This parameter is of great significance, as setting it at too high can put the users at risk of being scalded with the utility water. Too low a value thereof will make it impossible to carry excessive heat away to the HUW tank if the boiler overheats.

When designing the hot utility water system, it is necessary to provide for the possibility of regulator failure. As a result of the regulator failure, the water in the hot utility water tank can overheat to a dangerous temperature, putting the users at risk of being scalded.

ALWAYS APPLY ADDITIONAL SAFEGUARD IN THE FORM OF THERMOSTATIC VALVES.

17.5 Increase in boiler temperature from HUW, mixer circuit and buffer status

This parameter specifies the number of degrees by which the preset boiler temperature can be increased in order to fill the HUW tank, supply buffer and mixer circuit. The temperature is increased only if necessary. If the preset boiler temperature is sufficient, the regulator will not change it due to necessity of filling the HUW tank, supplying buffer, or mixer circuit.

Increasing the preset boiler temperature during filling of the HUW tank is signalled by letter "C" displayed in the main window.

17.6 Extending HUW pump operation

After filling the HUW tank and disabling the HUW pump, there is often a problem of the boiler overheating. It occurs if the preset domestic hot water temperature is higher than the preset boiler temperature. In particular, this problem occurs in the HUW pump mode: "SUMMER", when the CH pump is disabled. In order to cool the boiler down, operation of the HUW pump can be extended by the time of *HUW operation extend*.

☞ It is not recommended to set the time of *HUW operation extend.* to a value different than zero if the preset HUW temperature is higher than the preset boiler temperature.

17.7 Circulation standstill and operation time

Circulating pump operates cyclically for *circulation pump operation time.* (the recommended setting is 60-120 s.). The interval between its period of operation is defined by the value of parameter *circulation pump standstill time* (recommended setting: 15-40 min.).

17.8 Boiler pump

If the *CH pump = boiler pump* parameter is set to "*YES*", the CH pump is not stopped with HUW priority and in the HUW SUMMER mode. This parameter is intended only for hydraulic systems with a heat exchanger, where the HUW tank is installed on the closed system side, and the heat exchanger separates the boiler open system from the CH closed system. Thanks to continuous operation of the pump, the heat can be exchanged from the boiler through the heat exchanger to the HUW tank.

18. BUFFER SERVICE SETTINGS

18.1 Activate operation

This parameter is used to activate the mode of operation with the buffer.

18.2 Loading start and stop temperatures

This parameter defines the upper buffer temperature, below which the buffer filling process starts. The buffer filling process is concluded at the moment when the lower buffer temperature reaches the value defined in parameter *Buffer filling stop temperature.*

19. MIXER SERVICE SETTINGS

19.1 MIXER OPERATION

The following options are available:

OFF – mixer servo and mixer pump are inoperative

CH ON **-** choose this option if the mixer circuit feeds radiator system of central heating. The maximum temperature of mixer circuit is unlimited, the mixer is fully opened during alarms, e.g. boiler overheat.

Caution: Do not enable this option if the system is made of pipes vulnerable to high temperature; in such case, it is recommend to set the mixer to *FLOOR h.ON* setting.

FLOOR h.ON **-** choose this option if the mixer cycle feeds a floor system. The maximum temperature of the mixer circuit is limited to the parameter *max. mixer temp.*

Caution: after choosing the option *on FLOOR*, set the parameter *max. mixer temp.* to such value that the floor would not be damaged, and the floor heating users would not be burned.

Pump only **–** upon exceeding the *pre-set mixer temperature*, supply of the mixer pump is disabled. When the temperature drops by 2 °C, it is enabled again. Usually, this option is used to control the floor heating pump if it cooperates with a thermostatic valves without a servo. Nonetheless, such action is not recommended. It is recommended to provide floor heating with a standard heating cycle, consisting of a valve, a servo, and a mixer pump. Another application can be to use the mixer pump to protect the return temperature, using a pump connecting the feeding with the boiler return. In such case, it is impossible to use the mixer control.

19.2 Thermostat selection

This option allows to change room thermostat for the mixer cycle, provided that room panel ecoSTER200 is connected. The following options are available:

- - *universal* - standard no/nc thermostat, connected to terminals 26-27 for mixer 1 or 28-29 for mixer 2,

- ecoSTER1 - thermostat 1 in ecoSTER 200,

- ecoSTER2 - thermostat 2 in ecoSTER 200,

- ecoSTER3 - thermostat 3 in ecoSTER 200.

If the ecoSTER200 is not connected, the regulator cooperates with a standard room thermostat..

19.3 Min. preset mixer temperature

This parameter can be used to prevent the user from setting too low preset mixer temperature. Automatic regulation (e.g. temporary temperature decrease) will also no cause decrease in the preset temperature value below the value of this parameter.

19.4 Max. preset mixer temperature

This parameter serves two purposes:

- can be used to prevent the user from setting too high preset mixer temperature. Automatic regulation (correction in accordance with heating curve) also will not cause increase in the preset temperature value above the value of this parameter,
- if the parameter *mixer operation* = *FLOOR h.ON* is enabled, it is additionally the limit temperature of the mixer circuit, at which the mixer pump is disabled.

For floor heating, set the value within the range of 45°C - 50°C, unless the manufacturer of the floor materials or the designer of the CH system specified otherwise.

19.5 Range of proportionality

Caution: it is recommended not to modify this parameter.

This is the mixer step value. Increasing its value will speed up reaching of the preset mixer temperature, yet too high a value of this parameter will cause over-regulation of temperature and unnecessary movement of the servo, thus shortening its life-span.

It is recommended to set this parameter within the range of 2 – 6 [by default: 3].

19.6 *Integration time constant*

Caution: it is recommended not to modify this parameter.

This parameter influences the mixer standstill time if the temperature measured by the mixer sensor is close to the preset mixer temperature. Greater value will cause longer standstills of the servo. Too high a value extends the time by which the servo can find the preset temperature. Setting too low values can cause over-regulation of temperature and faster wear of the servo.

It is recommended to set this parameter within the range of 80 – 140 [by default: 110].

19.7 Valve opening time

Enter the time of full valve opening, which can be found on the rating plate of the valve servo, e.g. 140 s.

19.8 Pump deactivation by thermostat

Setting this value to "YES" will cause closing of the mixer servo and deactivation of the mixer pump when contacts of the room thermostat open (the room is heated). Nonetheless, this is not recommended, as the heated room will be excessively cooled.

20. RESTORING SERVICE SETTINGS

Restoration of the factory settings will also restore user settings!

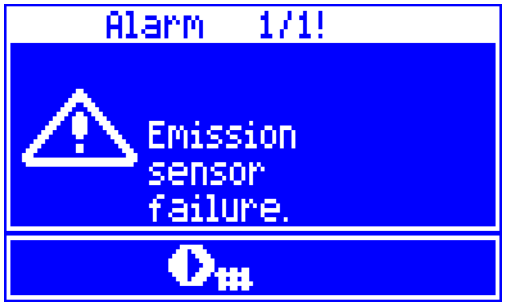
21. DESCRIPTION OF ALARMS

21.1 *Exhaust temperature sensor damage*

This alarm will be triggered in the case of damaging the exhaust temperature sensor, or upon exceeding this sensor's measurement range. If this alarm occurs, automatic boiler operation is disabled, only the CH pump is active.

Cancel this alarm by pressing the TOUCH and PLAY button, or by restarting the regulator. Inspect the sensor and replace it if necessary.

See how to check the temperature sensor in point 13.6



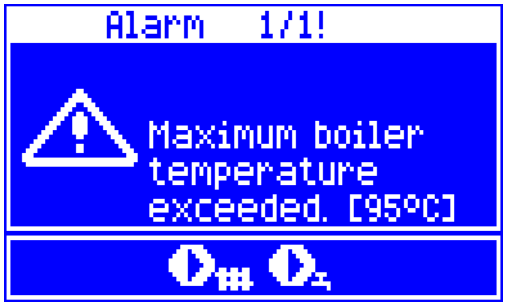
21.2 Exceeding max. boiler temperature

Protection against boiler overheating is twofold. First, after exceeding the *boiler cooling temp*, the regulator tries to decrease the boiler temperature by dropping the excessive heat to the HUW tank and by opening the mixer servo (only if mixer cycle = on CH).

If the temperature measured by the HUW sensor exceeds the value of *Max. HUW temp.*, the HUW pump will be disabled in order to protect the users against scalding. If the boiler temperature drops, the regulator will resume normal operation. Whereas is the temperature continues to rise (reaches 95 °C), fuel feeder and fan are disabled and a permanent boiler overheating alarm – with sound signalling – is activated.

Cancel this alarm by pressing the TOUCH and PLAY button, or by restarting the regulator.

Caution: placing the sensor beyond the boiler water jacket is not recommended, as it can delay detection of the boiler overheating!



21.3 Exceeding max. feeder temperature

This alarm will occur after the feeder temperature exceeds the service parameter:
Service settings> Boiler settings> Max. feeder temperature
If feeder temperature exceeds this value, the regulator will start the extinguishing procedure.
Alarm is automatically deleted after feeder temperature drops by 10°C.

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

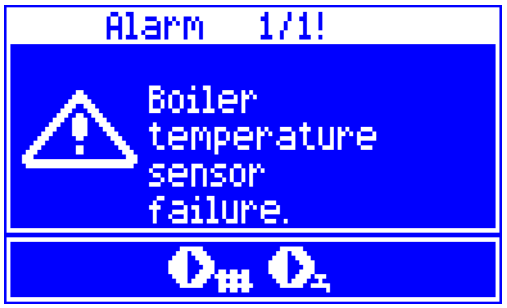
The function of protection against flame recession is inoperative if the regulator is not powered.

The ZAB-14 regulator cannot be used as the only protection against flame recession in a boiler. Use additional protective automatics.

21.4 Damage to boiler temp. sensor

This alarm will be produced in the case of damage to the boiler sensor, or after exceeding its measuring range. The alarm activates the CH and HUW pumps, as well as the mixer pump, in order to cool the boiler down.
Cancel the alarm by pressing the TOUCH and PLAY button, or by restarting the regulator. Check the sensor, and possibly replace it.

The method of checking the temperature sensor is described in point 13.6



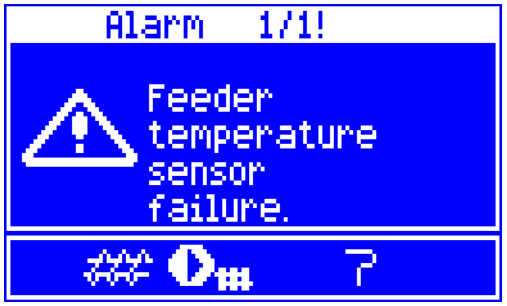
21.5 Feeder temperature sensor damage

This alarm will occur in the case of damage to the feeder sensor, or after exceeding its measuring range. The alarm causes activation of the CH and DHW pumps in order to cool the boiler down.

Cancel the alarm by pressing the TOUCH and PLAY button, or by restarting the regulator. Check the sensor, and possibly replace it.

The method of checking the temperature sensor is described in 13.6

The regulator can operate if the feeder temp. sensor is disconnected, after setting the parameter *max. feeder temp. =0*. Nonetheless, it is not recommended, as in this case the function of protection against the flame recession into the fuel hopper is disabled.



21.6 Feeder motor lock

This alarm will occur if upper or lower feeder motion is locked. An internal motor supplying fuse will be tripped disconnecting supply from the motor. The regulator will display the alarm which can be deleted by pressing TOUCH and PLAY button or by disconnecting and connecting regulator supply. Check the cause of feeder motor lock.

21.7 Overfilling a chamber between feeders

This alarm will occur in case a chamber mounted in enclosure of the upper feeder separating both feeders is overfilled with fuel. If the sensor detects too high fuel level in a chamber, the regulator will deactivate the upper feeder. Lower feeder will remain operating and be responsible for removing a fuel surplus from the chamber. If few cycles are not enough for such removal, an alarm will be displayed. Upper feeder is re-activated when fuel level returns within allowable limits.

The alarm can be deleted by pressing TOUCH and PLAY button or by restarting the regulator supply.

21.8 No communication

The control panel is connected with the executive module via digital communication link RS485. If this link is damaged, the following alarm will be displayed:

„Caution! No communication."

The regulator does not disable regulation and operates as usual, with the pre-programmed parameters. If any other alarm occur, it will take action in accordance with the given alarm.

Check the connection the control panel and repair or replace it respectively.

21.9 Unsuccessful firing-up attempt

This alarm will occur after third unsuccessful attempt to automatically fire up the furnace. In the case of this alarm, all pumps are deactivated in order to avoid excessive cooling of the boiler.

Cancel this alarm by pressing the TOUCH and PLAY button, or by restarting the regulator. This alarm can be caused by, e.g.: faulty lighter or lack of fuel in the tank.

21.10 Unsuccessful attempt to fill the tank

This is a so-called noiseless alarm prompt. It is triggered after second unsuccessful attempt to add fuel from the auxiliary tank (bunker). It is displayed if the boiler tank cannot be filled within an hour of the secondary feeder operation. This signal does not disable automatic boiler operation, merely display of a warning on the panel. Cancel this alarm by pressing the TOUCH and PLAY button, or by restarting the regulator.

22.Troubleshooting

Faults	Hints
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.
Preset CH temperature on the display is different than the programmed one.	Check: ▪ if the HUW tank is not being filled, and if the preset HUW temperature is set higher than the preset boiler temperature; if so, the difference in readings will disappear after filling the HUW tank alternatively - decrease the preset HUW temperature, ▪ if the time periods are on – disable Night-time decreases.
CH pump is inoperative.	Check: ▪ whether the boiler temperature exceeded the parameter *CH activation temp.* – wait or decrease the *CH activation temp.* ▪ if the HUW priority, which blocks the central heating pump, is enabled – disable the priority by setting the *HUW mode* to *No priority*, ▪ whether the central heating pump is not damaged or clogged.
The fan is inoperative.	▪ increase the fan speed (parameters for blow-in output), ▪ check if the safety temperature limiter STB jumper is on terminals 1-2 (the jumper should be placed only if no proper STB temperature limiter is connected), ▪ if the boiler manufacturer equipped it with a temperature limiter STB with manual return to its initial position, unlock it by removing the lid and pushing the button, in accordance with the documentation provided by the boiler manufacturer, ▪ check the fan and replace it if necessary.
Fuel feeder inoperative/ fails to feed.	▪ Check if the feeder leads are properly connected to terminals ▪ If temperature limiter STB is connected to terminals 90-91, check if the circuit is not cut off due to boiler overheating, ▪ Check if the feeder motor is in working order, ▪ If you can hear the motor running, but the fuel is not fed, check the feeder in accordance with the boiler manual.
When the Individual Fuzzy Logic mode is on, the fuel is not completely burned, there are unburned particles of fuel in the ash.	▪ Increase Individual Fuzzy Logic airflow correction, ▪ See if the unburned fuel comes from operation in the SUPERVISION mode - adjust the SUPERVISION mode parameters, ▪ Check if the unburned fuel is caused by frequent switching from SUPERVISION to OPERATION, ▪ Make sure if correct type of boiler is selected, ▪ Open the fan flap and/or fan return flap to the maximum, ▪ Check the ducts which feed air into the furnace, ▪ Unseal the window in the boiler room to provide sufficient amounts of air.
When the Individual Fuzzy Logic mode is on, the fuel burns out too intensively.	▪ Decrease Fuzzy Logic airflow correction, ▪ See if the excessive burning of fuel comes from operation in the SUPERVISION mode - adjust the SUPERVISION mode, ▪ Make sure if correct type of boiler is selected,

The temperature is measured incorrectly.	▪ Check if there is good thermal contact between the temperature sensor and the measured surface, ▪ Whether the sensor lead is not placed too close to the mains cable, ▪ If the sensor is connected to the terminal, ▪ Whether the sensor is not damaged – check it in accordance with point 13.6
in the DHW=SUMMER mode, the radiators are hot and the boiler overheats.	▪ Increase the parameter *HUW operation extend.* in order to cool down the boiler.
the DHW pump is active even if the DHW tank has been filled.	▪ Set the parameter *HUW operation extend* to *0*.
The boiler overheats despite disabled airflow.	▪ The reason can be faulty chimney installation (no protection against excessive chimney draught).
In a hydraulic system with a mixing valve and servo - the mixer fails to open.	▪ The reason may be activity of the return protection function. If the return protection function is active, check if the sensor for water returning to the boiler is thermally insulated from its surroundings, and improve contact with the pipe by applying thermally conductive paste. Increase the pre-set boiler temperature in order to provide power reserve needed to heat the return water. Check if the hydraulic system is properly made, i.e. after closing the valve, the return temperature must be able to exceed the parameter *Min. return temp.* value. ▪ The reason can be that the HUW tank is being filled with *HUW priority* enabled. Wait until the HUW is filled, or disable the *HUW priority*. ▪ The reason can be active SUMMER function. ▪ The reason can be an on-going calibration of the mixer valve, wait until the calibration is complete. Active calibration is signalled with a "CAL" message in the menu INFORMATION – MIXER INFO.

23.Regulator setup 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 PLUM 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.

23.1 Activating Individual Fuzzy Logic and changing boiler type

In order to activate the Individual Fuzzy Logic mode, enter MENU:
MENU > Regulation mode In this menu, find and confirm Individual Fuzzy Logic mode If the boiler operation modes list is unavailable, and clicking the aforementioned menu triggers a message "Function unavailable", it means that the regulator operates only in the STANDARD mode, Individual Fuzzy Logic control is disabled and unavailable for the given setup of a boiler.

To change the type of boiler, furnace, enter hidden MENU:
MENU> Service settings > (enter special password)

The special password is made available only to boiler manufacturers and authorized fitters.

Only boilers and fuels tested in PLUM sp z o.o. laboratory are available in the regulator.

Caution: selecting an incorrect boiler type, which was not examined in the PLUM laboratories, can damage the boiler during its operation.

Settings for individual boilers require arrangements between the boiler manufacturer and the PLUM sp. z o.o. company.

In order to apply the changes, it is necessary to disconnect and reconnect the regulator mains supply.

Register of changes:
V1.1 – general proofread,
V1.2 - changing the type of sensors in the table with a description of the terminals, page 34, clamps: 106-107, 119-120

ul. Wspólna 19, Ignatki
16-001 Kleosin, Poland
tel. +48 85 749-70-00
fax +48 85 749-70-14
plum@plum.pl
www.plum.pl
www.plumelectronics.eu