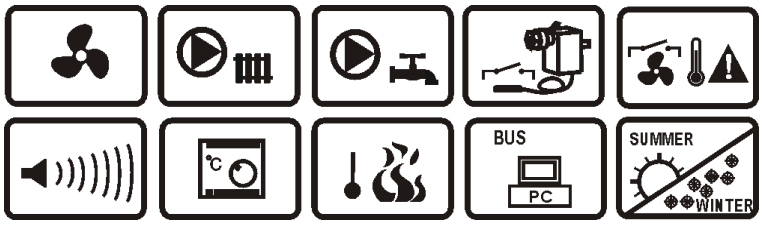
Dział Zintegrowanego
Systemu Zarządzania

Boiler regulator

ecoMAX 200 W

FOR SOLID FUEL BOILERS WITH A FAN



OPERATION AND MAINTENANCE MANUAL

ISSUE: 1.3

APPLICABLE TO SOFTWARE	10.034 10.035 10.036

2010-04-14

TABLE OF CONTENTS

1 Safety

Safety requirements are specified in individual sections of this manual. Apart from them, the following requirements should in particular 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.

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

⇒ Additional automatics which protects the boiler, central heating system, and hot utility water system against results of malfunction of the regulator, or of errors in its software.

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

⇒ The regulator is to be enclosed in a boiler, or near it.

⇒ The additional thermal safeguard, applied in the regulator, does not function as a safety temperature limiter. Therefore, it cannot be used instead of a safety temperature limiter!

⇒ The value of the programmable parameters should be selected appropriately to the parameters of the given boiler and the given fuel, considering all the system operation conditions. Incorrect selection of the parameters can cause malfunction of the boiler (e.g. overheating of the boiler, etc.).

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

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

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

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

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

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

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

⇒ It can be used in a household and similar facilities, as well as in slightly industrialized facilities.

⇒ Keep the regulator out of reach of children.

2 General information

The ecoMAX 200 series boiler regulator is an electronic device intended for solid fuel boilers. It performs the following functions:

- Automatic stabilization of a given temperature of the boiler cycle,
- Automatic stabilization of a given temperature of the hot utility water tank.

Combusting regulation is performed using three selectable methods:
- by linear reduction of the airflow power when the temperature approaches the preset boiler temperature (CLASSIC regulation),
- by smooth modulation of the airflow power (PID regulation without an emission sensor),
- by smooth regulation of the airflow power (PID regulation with an emission sensor)[1].

After equipping the regulator with an additional emission sensor, it is possible to quickly detect that the fuel is running out in any mode of the boiler regulation. This decreases heat losses related to the fan operating without any fuel, and extends the boiler's readiness for refuelling. The fuel needs not be added quickly, as fast detection of the lack of fuel maintains glow in the boiler furnace for a longer time.

The fan start is smooth. This decreases the risk of gas explosion in the boiler chamber, which is of particular significance in fine coal boilers.

The device is operated in an easy and intuitive way.

Possibility of cooperation with a room thermostat allows to maintain comfortable temperature in the heated rooms.

3 Information about documentation

The regulator manual is a supplement for the boiler manual. In particular, except for this manual, the boiler manual should also be observed. The regulator manual is divided into two parts: for user and fitter. Yet, both parts contain important information, significant for safety issues, hence the user should read both parts of the manual.

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

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. In the case of moving or selling the device, the attached documentation
should be forwarded to the new user/owner.

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 heath 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/EC

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.

[1] option – the emission sensor is not part of standard equipment

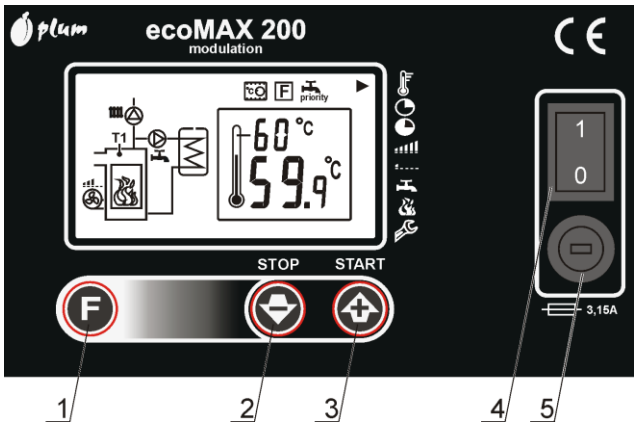
REGULATOR INSTRUCTION MANUAL

ecoMAX 200 W

7 Operating the regulator

This section briefly describes how the regulator should be operated.

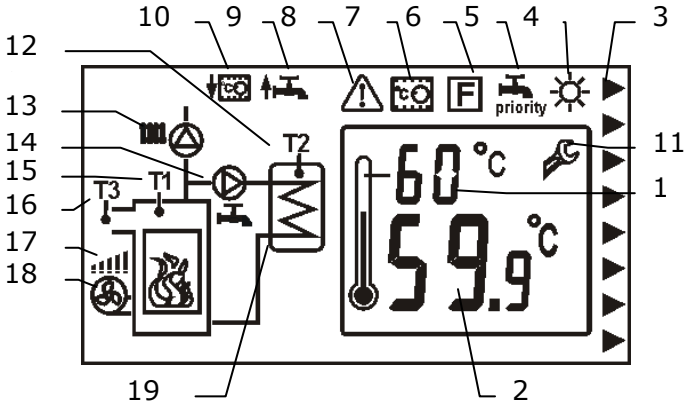
7.1 Description of buttons and display



Drawing 1. Keyboard view,

Legend:
1. menu item change button
2. STOP button, value decrease
3. START button, value increase
4. mains switch
5. fuse socket

After turning the regulator on, the START and STOP buttons are used to enable and disable airflow respectively.



Drawing 2. Main display window

Legend:
1. preset boiler or hot utility water tank temperature, or preset temperature of emission,
2. measured temperature of boiler, hot utility water tank, or emission,
3. signal arrow
4. SUMMER – hot utility water mode symbol
5. PRIORITY - hot utility water mode symbol
6. Boiler regulation mode – PID function,
7. Room thermostat - this symbol lights up when the temperature inside the room reaches the preset value contacts are disconnected)
8. alarm symbol
9. signal of increasing the preset boiler temperature due to hot utility water heating,
10. signal decreasing the preset boiler temperature due to operation of the room thermostat,
11. service menu symbol
12. hot utility water temperature sensor,
13. central heating pump symbol
14. hot utility water pump symbol
15. boiler temperature sensor,
16. emission temperature sensor,
17. airflow power
18. fan symbol it this is not visible – regulation is off, it is visible – regulation is on, if it flashes – the regulator is in the SUPERVISION mode
19. hot utility water tank symbol
20. icons:

 Temperature settings

 Blow-off time

 Blow-off interval

 Maximum revolutions

 Minimum revolutions

 Settings for hot utility water

 Boiler regulation mode

 Service menu symbol

7.2 First start-up of the regulator

Before the first start-up of the regulator, it should be programmed for the purposes of cooperation with the given boiler and heating system, in accordance with point 11.9. It is recommended that this performed by a person familiar with heating technology.

7.3 Start-up of the regulator

Caution: The combustion regulation methods described below will properly regulate the combustion process, as long as the boiler is operated in accordance with recommendations of the boiler manufacturer. You should pay special attention to the place of setting fire during firing up!

The regulator is started by pushing the mains switch (4) Drawing 1. First, an information window with the software version appears, then the regulator displays the main window.

7.4 Firing up – activation of airflow

In order to fire the boiler up, you should put fire under the fuel, in accordance with the boiler documentation, close the boiler door and activate airflow by pushing the START button. The fan will be activated. Pushing STOP turns the fan and the regulation process off.

7.5 Presetting boiler temperature

The boiler temperature can be preset by pushing the F button in the main menu. A signalling arrow next to the sign „Temperature setting" is lit, and the boiler preset temperature value in the upper part of the thermometer flashes. START and STOP buttons are used to increase and decrease the preset boiler temperature respectively.

7.6 Presetting hot utility water temperature

If the hot utility water temperature sensor is not connected, it is not possible to preset the hot utility water temperature.

The hot utility water temperature can be preset by pushing the F button in the main menu twice. A signalling arrow next to the sign „Temperature setting" is lit, and the hot utility water preset temperature value in the upper part of the thermometer flashes. START and STOP buttons are used to increase and decrease the preset hot utility water temperature respectively.

7.7 Combustion regulation methods

The regulator features three selectable methods of regulating the combustion process.

CLASSIC regulation (regulation mode 1)

In order to enable the CLASSIC mode of boiler regulations, set the *boiler regulation mode* to value 1. In order to do so, press the F button in the main window until the arrow is in the *boiler regulation mode* position. Use „+" or „-" buttons to set value

Three modes of combustion control are available: 1 - CLASSIC, 2 - PID, 3 – PID SALINES point 7.7.

The method is based on the T1 boiler indication, and consists in decreasing of the airflow power from *Maximum revolutions* to *Minimum revolutions* while achieving the preset boiler temperature. Revolutions start to be reduced at 5°C (service parameter n7) before the preset boiler temperature. After achieving the preset boiler temperature, the SUPERVISION mode is activated, where blow-offs are performed.

Before enabling this mode for the first time, it is recommended to program the regulator in accordance with point 11.9.

PID regulation (regulation mode 2)

After setting the parameter *boiler regulation mode* = 2.

This method is based on boiler temperature indications T1, it consists in constant, smooth modulation of the fan revolutions in order to stabilize the preset boiler temperature. The regulator itself selects the airflow power in such a way that the boiler generated minimum amount of heat necessary to satisfy the heat demand of the building. Transition to the SUPERVISION mode is rare and it happens during lack of heat demand.

Before enabling this mode for the first time, it is recommended to program the regulator in accordance with point 11.9.

PID EMISSION regulation (regulation mode 3) – new!

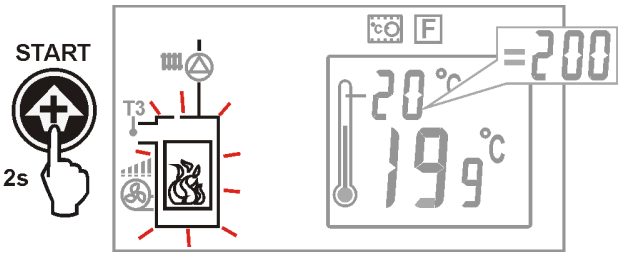
After setting the parameter *boiler regulation mode* = 3 (emission sensor must be connected).

This method is based on emission sensor indications T3. It consists in constant, smooth modulation of the fan revolutions in order to stabilize the preset emission temperature. As opposed to the *boiler regulation mode* = 2, the airflow operation is more stable, without excessive increasing of the airflow power, which makes that method more economical in respect of fuel saving.

After loading the fuel and pushing the START button, the fan operates with maximum revolutions . As the preset emission temperature is approached, the revolutions are automatically reduced. When the emission temperature reaches the preset temperature for the first time, a slight adjustment is made.

In the PID EMISSION mode, it is possible to temporarily increase the emission preset temperature. This facilitates firing the boiler up. Thanks to this, the temperature in the heated rooms will increase faster, without the necessity of going to the boiler room later on, in order to decrease the boiler power. To temporarily increase the boiler power, for e.g. 30 min, enable the fan using the START button, than push the START button again and hold it for 2 s. The boiler symbol at the display starts to flash Drawing 3. The preset emission temperature increases „covertly" to value = r7 (service parameter, by default = 300°C). After time r8 (service parameter), the preset emission temperature returns to the set value.

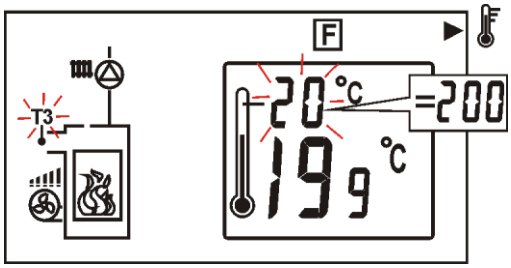
Setting emission temperatures lower than at about 160°C can involve the risk of water condensing out of the emission, which can necessitate chimney renovation. The same applies to presetting excessively high temperatures of water in the boiler. PLUM sp. z o.o. company recommends to operate the boiler at optimal parameters (optimal emission and boiler temperature), combined with storing of excessive energy in a thermal buffer.



Drawing 3. Temporary power increase in the PID EMISSION mode

Moreover, after equipping the regulator with an emission sensor, it is possible to enable very fast detection of fuel shortage. This provides additional saving of heat energy resulting from almost instantaneous deactivation of the fan when the fuel runs out. Also, the fuel needs not be added quickly, as fast detection of the lack of fuel maintains glow in the boiler furnace for a longer time.

In order to preset the emission temperature, press the "F" button until the following window appears:



Drawing 4. Presetting emission temperature

Use the „+" and „-" buttons to respectively increase or decrease the preset emission temperature; please note that the value in the upper part of the thermometer symbol, e.g.: 20°C, means 200°C. Unless the boiler manufacturer specified otherwise, the preset emission temperature should generally be between 160 and 300°C. Whereas in order to achieve higher boiler power, it might be necessary to set greater values (e.g. during very frosty weather).

The optimal preset emission temperature depends on the type of fuel and the boiler design, and it should be determined experimentally. When burning wood, the flame should be blue-yellow, and when burning coal – yellowish. For example, the optimal temperature for wood is between 190 and 260°C.

If optimal emission temperature causes excessive heating up of the boiler, it is best to store the surplus energy in a thermal buffer. If the central heating system does not feature a thermal buffer, you such find such preset emission temperature at which the temperature of water in the boiler is at the desired level. If it is too hot in a room, decrease the preset emission temperature, and increase it in the opposite case. The preset boiler temperature is in this method of secondary importance, it prevents exceeding undesirable temperature of the boiler. It is recommended to preset the boiler temperature as 10°C higher than the expected boiler temperature after the emission temperature settles. After the boiler reaches the preset temperature, the regulator switches to the SUPERVISION mode.

High emission temperature, even if the fan rotates slowly, can mean that the boiler is contaminated – in such case, it should be cleaned.

Before enabling this mode for the first time, it is recommended to program the regulator in accordance with point 11.9

Caution: the regulator will automatically switch from regulation mode 3 to mode 1, if the emission sensor is damaged or if the emission temperature exceeds the emission sensor measuring capacity. Therefore, it is important to set proper parameters for the regulator to operate in mode 1, without causing any danger.

7.8 SUPERVISION

The regulator switches to the SUPERVISION mode in the following circumstances:

a) In the case of CLASSIC and PID EMISSION modes of regulation – if the boiler temperature exceeds the preset boiler temperature,
b) In the case of PID mode of regulation – if the boiler temperature exceeds the preset boiler temperature by +10°C.

In the SUPERVISION mode the fan is enabled cyclically for short periods, in order to prevent the fire from going out and to remove accumulated combustible gases from the boiler furnace chamber. The fan is enabled for *blow-off time* at every *blow-off interval.* These times must be selected in such a way that the boiler furnace did not go out and, at the same time, to prevent the boiler temperature from increasing.

Incorrect selection of blow-off parameters can cause boiler overheating.

7.9 Settings for hot utility water

The device regulates the temperature of the hot utility water tank, provided that a hot utility water temperature sensor is connected. Using the *hot utility water mode* parameter , the user can:

- set the hot utility water priority (*HUW mode* =1) – the central heating pump is disabled to fill the hot utility water tank faster
- set simultaneous operation of central heating and hot utility water pump (*HUW mode* = 2),
- enable the SUMMER function (*HUW* mode = 3),
- disable tank filling (*HUW* mode =4),

If the hot utility water sensor is disconnected, the *hot utility water mode* user parameter cannot be changed.

7.10 Enabling the SUMMER function

In order to enable the SUMMER function, which allows to fill the hot utility water tank in the summer without the need of warming the central heating system, set the parameter *hot utility water mode* = 3.

Do not enable the SUMMER function if the hot utility water pump is disconnected.

The SUMMER function cannot be enabled if the hot utility water sensor is disconnected.

The SUMMER function can be enabled only after making sure that the boiler will not overheat. If the SUMMER function is enabled, the heat consumption is much lower, because the central heating pump is inactive. The method of decreasing the boiler overheating is described in point

12.15

Do not enable the SUMMER function in a hydraulic system with a thermal buffer

7.11 Operation without airflow

Unless the START button is pressed in the main display window (right after turning the regulator on via the mains switch), the device controls only the pumps.

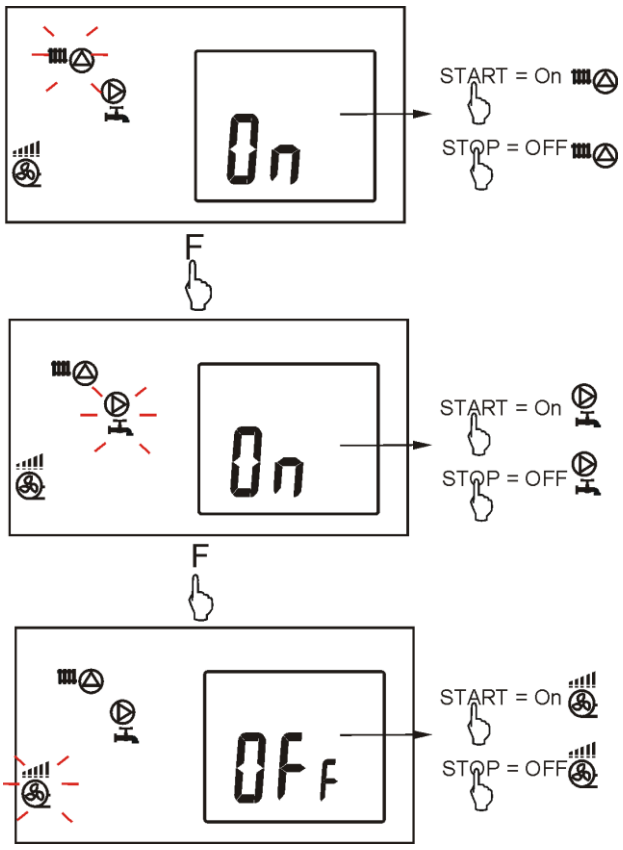
The central heating pump and the hot utility water pump operate in accordance with their algorithm. They are activated if appropriate conditions are met. The conditions for pump activation are described in individual sections of the manual.

If the boiler is cold, the pumps do not work. The pumps can start working only after the boiler exceeds the *Central heating pump activation temperature n0* [by default 40°C]

In order to use the regulator without active fan, press the STOP button in the main display window.

7.12 Manual control

Press both F and START buttons and hold them for 4 seconds to enable manual control of the regulator outputs. The window shown at Drawing 5 appears and the central heating pump symbol flashes first:



Drawing 5 Manual control

Press START and STOP to change the status of the given output: START – ON, STOP – OFF. Pressing F switches between outputs of central heating pump, hot utility water pump, and fan. E.g. if you select the hot utility water pump, its symbol flashes. The fan starts up with the *Maximum revolutions* power.

Exit from manual control is made automatically after a period of idleness, or after holding the F button.

7.13 Restoring default settings

In order to restore default settings, set the value of service parameter r9 (*Service default settings*) to "1" and press the F button.

Default settings of user and service parameters will be restored.

REGULATOR INSTALLATION AND SERVICE SETTINGS MANUAL

ecoMAX 200 W

8 Technical data

Feed	230V~; 50Hz;
Current consumed by regulator	I = 0,02 A[2]
Maximum rated current	3(3) A
Regulator protection rating	IP40, IP00[3]
Ambient temperature	0...50 °C
Storage temperature	-15...60 °C
Relative humidity	5 - 85% without condensation of vapour
Temperature measurement	0...100 °C
Combustion temperature	50...450 °C
Temperature measurement accuracy	2°C
Combustion temperature measurement accuracy	5°C
Terminals	Screw terminal on the mains voltage side 2,5mm^2 Screw terminals on the control side 1,5mm^2
Display	Backlit LCD
External dimensions	Control panel: 160x90x80 mm
Total weight	0,5 kg
Norms	PN-EN 60730-2-9 PN-EN 60730-1
Software class	A
Protection class	To be built into class I devices

Tabela 1 Technical data

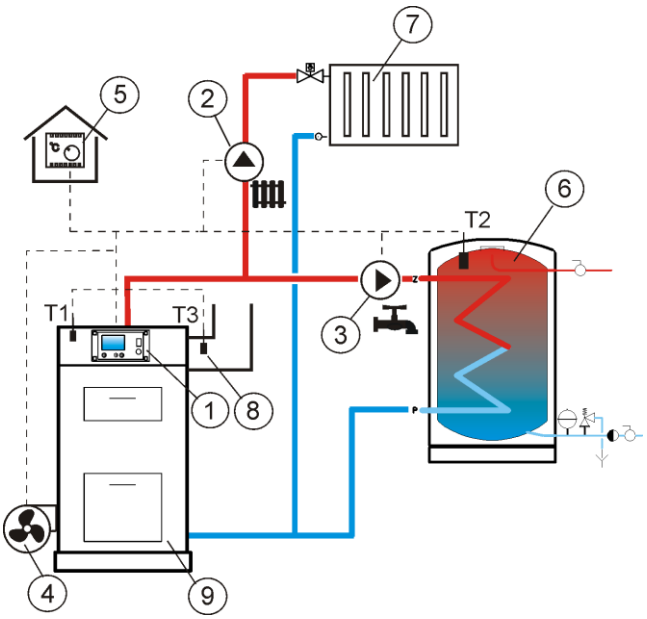
The set includes:

- regulator ecoMAX 200 — 1 piece
- boiler temperature sensor — 1 piece
- panel hole plugs — 4 pieces
- manual — 1 piece
- warranty — 1 piece

[2] This is the current consumed by the regulator itself. The total power consumption depends on the devices connected to the regulator.

[3] IP40 –from the face side after enclosing, IP00 – from the terminal side, detailed information in point 11.2

9 Hydraulic diagram

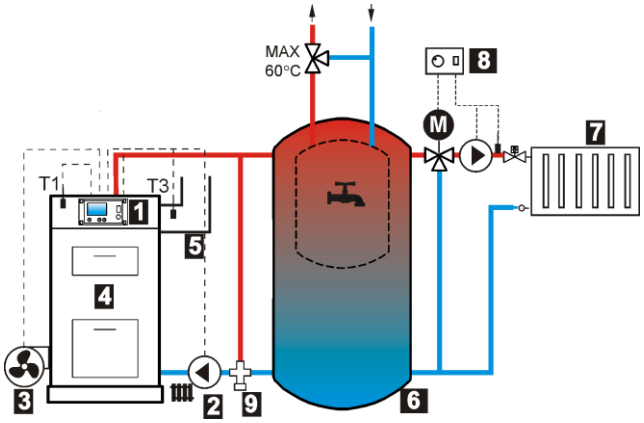


Drawing 6. Hydraulic diagram supported by the regulator, where: 1 – ecoMAX 200 regulator, 2 –central heating pump, 3 – hot utility water pump, 4 – fan, 5 – room thermostat 6 – hot utility water tank, 7 – central heating system, 8 – chimney duct, 9 –boiler, T1 – boiler temperature sensor, T2 – hot utility water temperature sensor, T3 – emission temperature sensor (optional, not required for normal operation).

The presented hydraulic diagram does not replace the central heating system design and it can be used for reference purposes only.

Brief description of the system functioning: after firing the boiler up, the central heating pump is activated after the boiler exceeds the *central heating pump activation temperature* (service parameter n0, by default n0 = 40°C). The hot utility water pump is activated when the tank temperature (6) drops below the preset value. If at this time the preset boiler temperature is lower than the preset hot utility water temperature, the regulator increases the preset boiler temperature in order to fill the hot utility water tank. After filling the hot utility water tank, the hot utility water pump can continue work for a preset time, in order to collect heat from the boiler. After the room thermostat (5) operates, the regulator decreases the preset boiler temperature and/or temporarily disables the central heating pump (2). Fitting an emission temperature sensor (8) in the boiler flue enables very fast detection of fuel

depletion and turns the fan off. Moreover, it allows operation in the PID-EMISSION boiler regulation mode, and preview of the emission temperature.



Drawing 7. Hydraulic diagram with a thermal buffer, where: 1 – ecoMAX 200 regulator, 2 – central heating pump, 3 – fan, 4 - boiler, 5 - chimney duct, 6 – thermal buffer with integrated hot utility water tank, 7 – central heating system, 8 – external regulator of heating cycle, 9 – thermostatic valve safeguarding the boiler return, T1 – boiler temperature sensor, T3 – emission temperature sensor.

Brief description of the system functioning: the CH pump (2) is activated after the boiler exceeds the *central heating pump activation temperature* (service parameter n0, by default n0 = 40°C). After detecting shortage of fuel in the boiler (4), the CH pump (2) is disabled, which protects the buffer (6) against heat loss. The heat cycle (7) must be controlled by an external regulator (8), which is to be purchased separately.

Recommended settings:

r6=1
n9=2

The presented hydraulic diagram does not replace the central heating system design and it can be used for reference purposes only.

10 Storage conditions and transport

The regulator cannot be exposed to direct effects of weather, i.e. wind and sunrays. Storage and transport temperature cannot exceed the scope of -15…60 °C.

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

11 Regulator installation

11.1 Environmental conditions

Due to the risk of explosion or fire, it is prohibited to operate the regulator in explosive gas and flammable dust atmosphere (e.g. coal dust). In such cases, it is necessary to apply additional measures protecting the regulator against penetration by flammable dusts and gases (tight body), or to prevent their emergence.

On account of risk of shock, the regulator has been designed to be used in an environment marked as pollution level 3, acc. to PN-EN 60730-1.

Moreover, the regulator cannot be used in the presence of vapour condensation, and be exposed to water.

11.2 Conditions of enclosing

The regulator must be enclosed. The regulator should be installed by a qualified and authorised fitter, in accordance with the applicable norms and regulations.

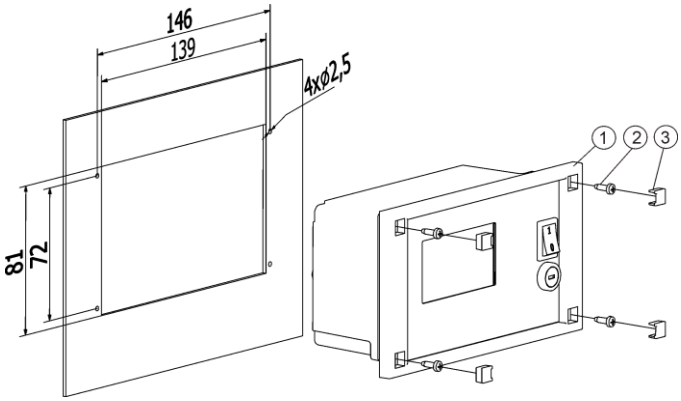
The manufacturer bears no responsibility for damages caused by failure to observe this manual.

The regulator cannot be used as a stand-alone device. The temperature of the ambient and the fitting surface cannot exceed the range of 0 - 50°C.

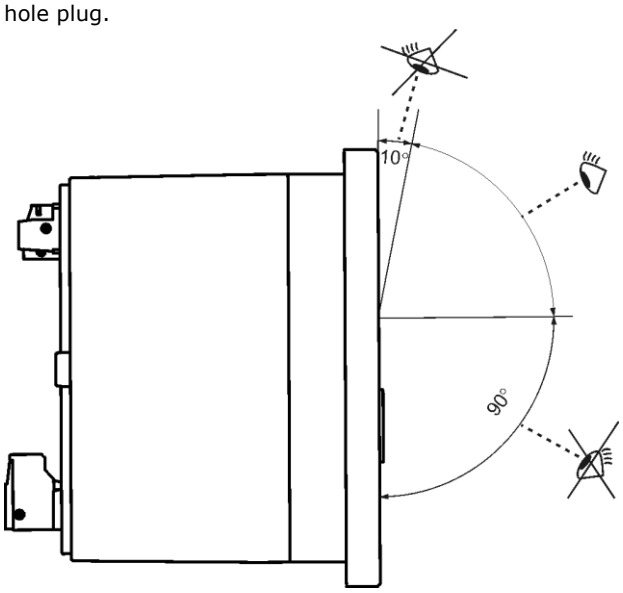
The regulator is designed to be fitted in a mounting plate. Proper thermal insulation between hot boiler walls and the regulator must be provided.

A hole must be made in the mounting plate, in accordance with Drawing 8.

The space required for the regulator is shown in Drawing 10.

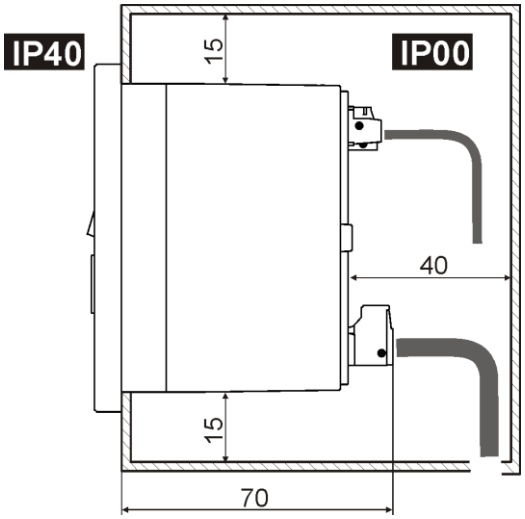


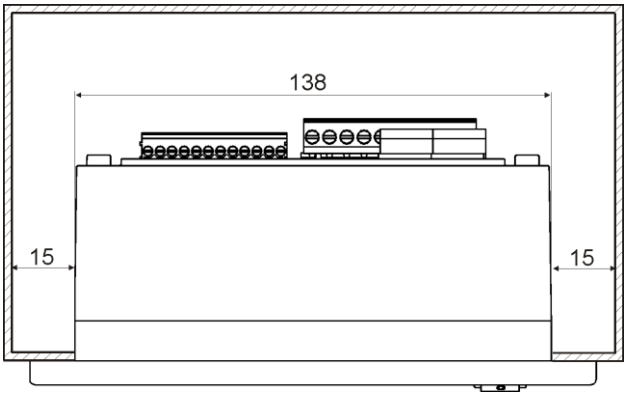
Drawing 8. Fitting the regulator in a mounting plate, where: 1 - regulator, 2 – sheet metal screw 2.9x9, 3 – hole plug.



Drawing 9. Recommended display viewing angle

It is recommended to fit the regulator on the boiler in such a way, that the user viewed the regulator at the angle shown in Drawing 9. Green shows optimal viewing angle for the display.





Drawing 10. Conditions of enclosing the regulator

The regulator enclosure must provide degree of protection appropriate for the environmental conditions in which the regulator will be used. Moreover, it must prevent the user from accessing dangerous live parts, e.g. the terminals. The regulator enclosure does not provide resistance to dust and water. In order to secure the device against these factors, the module must be equipped with appropriate body.

Due to thermal conditions and safety issues, a safe distance between active parts of the terminals and the conductive (metal) elements of the enclosure must be kept – Drawing 10. Metal elements of the regulator enclosure must be connected with the protective wire of the feeding cable Drawing 12.

Connecting wires must be protected against being torn out, loosened, or they must be enclosed in a way which prevents any tensions in relation to the wires.

11.3 IP protection rate

The regulator casing provides various rates of IP protection in various places. Drawing 10 provides and explanation. After enclosing the device, in accordance with the drawing from the face of the regulator, it has protection rate IP 40. From the side of the terminals, the regulator has protection rate IP00, therefore the terminals must be unconditionally enclosed, thus preventing access to this part of the regulator.

11.4 Connecting electrical system

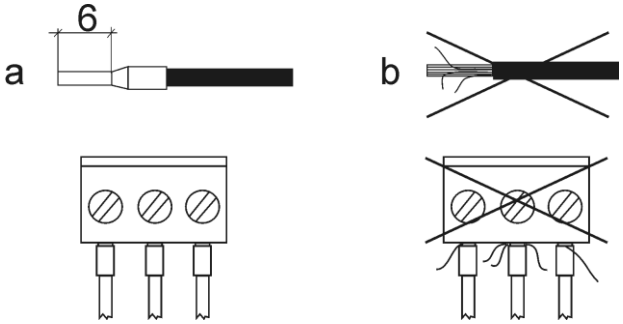
He regulator is designed to be fed with 230V~, 50Hz voltage. The electrical system should be:

- three core (with protective wire),
- in accordance with applicable regulations.

Diagram of electrical connections is presented in Drawing 12. The connection wires should not have contact with surfaces of room temperature exceeding the nominal temperature of their operation.
Terminals L, N and number 1-8 are intended only for connecting devices with mains supply 230V~.
Terminals 9-20 are intended for cooperation with low voltage devices (below 12 V).

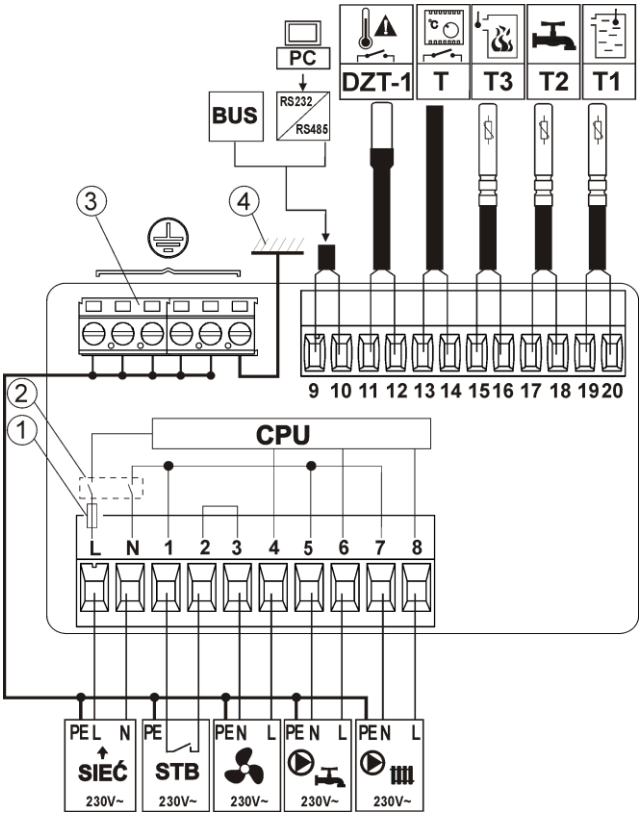
Connecting mains supply 230V~ to terminals 9-10 will damage the regulator and creates risk of an electric shock.

Tips of the connected wires, especially power leads, must be secured against splitting by means of insulated clamp sleeves, in accordance with the drawing below:



Drawing 11. Securing wire tips: a) right, b) wrong

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



Drawing 12. Diagram of electric connections with external devices,
where: T1 – boiler temperature sensors (type CT4), T2 – hot utility water temperature sensors (type CT4), T3 – emission temperature sensors (type CT2s), T – room thermostat, DZT-1 – additional thermal safeguard (type DZT-1 85°C or 90°C), RS232/RS485 – converter, BUS – connector for digital communication with a computer (optional) , 1 – mains fuse in the regulator, 2 – mains switch in the regulator, 3 – protective terminals PE, 4 – metal enclosure of the regulator, MAINS – mains lead, STB – safety temperature limiter,

The following isolations are used in the regulator:

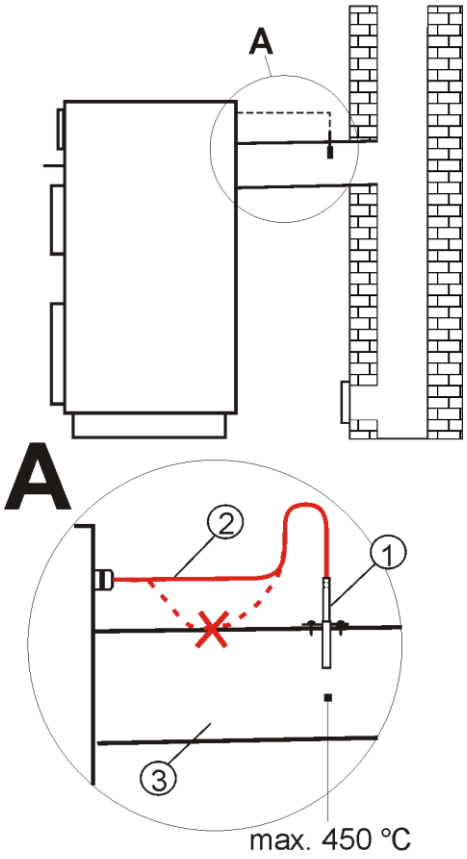
- electronic for fan output, terminals 1-2 (action type 2.Y in accordance with PN-EN 60730-1), does not provide safe isolation – despite isolation on terminals, dangerous voltage can occur!

- micro-insulation for central heating and hot utility water pumps' outputs, terminals 6-6 and 7-8 (action type 2.B in accordance with PN-EN 60730-1),

11.5 Protective connections

Protective leads should be connected to terminal marked with ⏚.

11.6 Connecting emission sensor



Drawing 13 . Connecting emission sensor, where: 1 – emission temperature sensor type CT2s-2, 2 – sensor lead, 3 – flue.

The emission sensor should be fitted in the boiler flue (3). The gap between the sensor and the flue should be sealed. The sensor should be installed by a qualified fitter, while observing regulations applicable for chimney systems. The emission sensor should be connected to the sensor terminals acc. to The emission sensor lead cannot touch hot elements of the boiler and the flue, the temperature of which exceeds 350°C. The emission sensor should be installed in such distance from the boiler at which it is not directly exposed to flames, and where the emission temperature does not exceed 450°C

Caution: Opening the boiler door can cause the emission temperature to exceed the sensor's thermal resistance, which can burn the sensor out.

11.7 Connecting temperature sensors

The regulator is compatible only with sensors type CT4 (sensor of boiler and hot utility water) and CT2s (emission sensor). It is prohibited 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 CT4 should be fitted in the thermometric pipe, situated in the boiler shell. Hot utility water temperature sensors CT4 - in the thermometric pipe welded into the tank.

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 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.

11.8 Checking temperature sensors

The temperature sensors can be controlled by measuring their resistance in a 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.

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

100	1659	1696	1733

Table 1. Values of resistance of temperature sensors CT4.

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

Table 2. Values of resistance of emission temperature sensors CT2s-2.

11.9 First start-up of the regulator

The regulator should be programmed to cooperate with the given type of boiler and central heating system.
Preparation for cooperation with the boiler:

⇒ Set the value of service parameter minimal fan revolutions n2 in accordance with point 12.3,

⇒ Preset minimum boiler temperature n3 in accordance with point 12.4.

⇒ Preset maximum boiler temperature n4 in accordance with point 12.15.

⇒ Select method of detecting fuel shortage in accordance with point 12.21 and 12.10.

⇒ Select boiler regulation mode in accordance with point 7.7
For *boiler regulation mode – 1*: select value of parameters *Maximum revolutions* and *Minimum revolutions*, as well as value of the n7 parameter as specified in point 12.8
For *boiler regulation mode* = 2 and 3 *(PID and PID - EMISSION):* select value of *Maximum revolutions* and *Minimum revolutions*.

⇒ Set the fan starting time P5, especially in the case of fine coal boilers, as specified in point 13.
Preparation for cooperation with central heating system:

⇒ Set central heating pump activation temperature, defined by parameter n0, as specified in point 12.1,

⇒ If the hot utility water tank is to be filled via hot utility water pump, select the hot utility water pump operation mode, acc. to point 7.9.

11.10 Connecting room thermostat

To make the boiler more economical, and the temperature in the heated rooms more stable, install a room thermostat.
The regulator is compatible with a mechanical or electronic room thermostat, which disconnects its contact after a preset temperature has been reached. The thermostat should be connected in accordance with Drawing 12.

After installing a room thermostat, you must enable its support. To do so, set the service parameter *Room thermostat* (service parameter n8 = 1).

After reaching the preset temperature in the room, the room thermostat disconnects its contacts, and a symbol appears on the display (symbol 7, Drawing 2)

When the temperature in the room in which the room thermostat has been installed reaches the preset value (the room thermostat disconnects its contacts), then:

a) the ecoMAX 200 regulator lowers the preset boiler temperature by the value *Boiler preset temperature decrease by thermostat* (service parameter r0), which is signalled by symbol 10, Drawing 2.

b) the ecoMAX 200 regulator will block the central heating pump for 30 s at intervals *Central heating pump down-time by thermostat* (service parameter n8). If n8 = 0, there is no central heating pump blockade.

It is not recommended to block the central heating pump if the PID mode of regulation is selected, in such case it suffices to lower the boiler preset temperature. The regulator will automatically reduce its revolutions.

Central heating pump blockade by thermostat can be enabled only after making sure that the boiler will not overheat.

11.11 Connecting temperature limiter STB

In order to prevent the boiler from overheating due to the regulator malfunction, a safety temperature limiter, appropriate for the given boiler and heating system, should be fitted.
The limiter can be connected to terminals 1-2, as specified in Drawing 12 . When the limiter activate, the fan power supply will be disconnected.

The temperature limiter must have nominal operating voltage of at least ~230V, and it should have the applicable permits.

If the limiter is not connected to terminals 1-2, a bridge should be made. The bridge should be made of wire the section of which is at least 0,75 mm^2, with insulation thick enough to comply with the boiler safety requirements.

The current regulations demand that a safety temperature limiter is used.

11.12 Connecting additional thermal protection

The ecoMAX 200 regulator can be equipped with additional thermal protection, type DZT-1. This is an optional equipment, available to special order. It cuts off the fan power supply. Sensor of the additional thermal protection, which operates on low safe voltage, should be placed in the thermometric pipe of the water jacket. You should provide good thermal contact of the DZT-1 sensor, and secure it against coming loose from the measured surface.
If the boiler temperature exceeds the DZT-1 sensor activation temperature (85°C or 90°C ±5 depending on the DZT-1 type), the fan power supply is cut off. The fan power supply will be automatically restored after the boiler temperature drops by 10-20 degrees Celsius.
If a DZT-1 sensor is not connected, an electric bridge should be made at terminals 11-12.

The additional thermal protection cannot be used instead of the mandatory safety temperature limiter!

11.13 Smooth fan start

During every activation of the fan, the regulator gradually increases the airflow power, which decreases the risk of explosion of gases accumulated in the boiler. This advantage is of particular significance in the case of fine coal boilers.

The fan starts smoothly from *Minimum revolutions* **:----** to power resulting from the algorithm within the P5 time (manufacturer's parameter – fan starting time).

12 Service settings

Enter the service settings by holding the „F" button in the main window for 8 seconds.
Exit from service settings is made automatically after a period of idleness, or after holding the F button.

name	symbol	range	unit	typical value
Pump activation temperature	**n0**	0…80	°C	40
Boiler temperature hysteresis	**n1**	1…5	°C	2
Min. airflow power	**n2**	10…99	%	14
Min. boiler temperature	**n3**	40…55	°C	50
Max. boiler temperature	**n4**	70…90	°C	85
Fuel shortage detection time	**n5**	2…250	Min.	20
Screen brightness	**n6**	0…100	%	80
Fan revolutions' reduction temperature	**n7**	1…30	°C	5
Central heating pump down-time by thermostat	**n8**	0…99	min.	0
Extinguishment detection method	**n9**	1,2		1
Boiler preset temperature decrease by thermostat	**r0**	0,1…20	°C	0
Hot utility water temperature hysteresis	**r1**	1…20	°C	5
Boiler preset temperature increase by hot utility water	**r2**	0…20	°C	5
Max. hot utility water temp.	**r3**	20…85	°C	65
Extending hot utility water pump operation	**r4**	0,1…30	min.	0
Fuel shortage detection – emission temperature	**r5**	20…250	°C	90
Disabling the CH pump -operation with a buffer	**r6**	0…1		0
Emission temperature - firing up mode 3	**r7**	10…40 (x10)	°C	30 (300)
Firing up time mode3	**r8**	0, 250	min	30
Restoring service parameters	**r9**	1,0	-	0

12.1 Central heating pump activation temperature n0

The (n0) parameter specifies the temperature at which the central heating pump is activated. After reaching the temperature equal to the *Central heating pump activation temperature* 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 central heating pump on its own does not guarantee protecting the boiler against retting, and resulting corrosion of the boiler. Additional automatics should be applied, e.g. four-way valve, or thermostatic three-way valve.

12.2 Boiler hysteresis n1

The (n1) parameter determined the temperature at which the boiler returns from the SUPERVISION mode to the OPERATION mode. The regulator returns to the OPERATION mode at the temperature *preset boiler temperature – boiler hysteresis.*

12.3 Minimum airflow power n2

When the regulator is turned on for the first time, it is necessary to set the user-defined parameter *Minimum airflow power.* After setting a value of e.g. 14%, the user will be able to set airflow power of at least 14%. The *minimum airflow power* should be determined after observing the fan behaviour. You must determine minimum value of revolutions at which the fan can rotate properly, i.e. freely, without rattling.

Set *boiler regulation mode = 1* Maximum revolutions and Minimum revolutions to the value of revolutions you want to test. For most fans, this will be 12 – 15%.

12.4 Minimum boiler temperature n3

This parameter can be used to prevent the user from setting too low preset boiler temperature. If the boiler operates at too low a temperature, it can cause its rapid damage, corrosion, soiling, etc.

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

12.5 Maximum boiler temperature n4

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

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

12.6 Fuel shortage detection time n5

This is the time after which the regulator will produce the fuel shortage alarm.

If the regulator produces the "No fuel" alarm too fast, increase the value of this parameter.

Recommended settings of the n5 parameter depending on the method of detecting fuel shortage:

Detection method	n5 value
1 – boiler sensor	20min
2 – emission sensor	10min

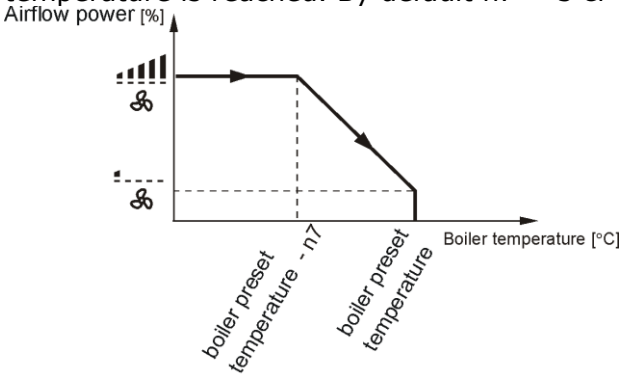
Methods of detection are specified in point 12.21.

12.7 Screen brightness n6

Increases or decreases the brightness of display backlight.

12.8 Fan revolutions' reduction temperature n7

This parameter is applicable only if the boiler regulation mode = 1 – CLASSIC is enabled. After the boiler reaches the *boiler preset temperature – n7*, the fan starts reducing its revolutions until the boiler preset temperature is reached. By default n7 = 5°C.



Drawing 14 Fan revolutions' reduction with classic regulation

12.9 Central heating pump down-time by thermostat n8

This parameter determines the central heating pump down-time after it is blocked by disconnected room thermostat, at the moment of reaching preset room temperature (point 11.10). As a result of blocking the central heating pump, the temperature in the heated rooms will drop, and the boiler will reach the preset temperature faster and switch to the SUPERVISION mode. Yet, too long a blockade of the central heating pump will cause the system to cool down, which is disadvantageous for maintaining the room temperature at constant level. The heating medium accumulated in the system has high thermal inertia, and heating it after the thermostat contacts are shorted can take too long. Thus, it is not recommended to set excessively long central heating pump down-times. After the *central heating pump down-time by thermostat* (service parameter n8), the regulator will enable it for a constant, pre-programmed time of 30 s.

12.10 Fuel shortage detection methods n9

This parameter determines the method of detecting fuel shortage. If:
n9 = 1, fuel shortage is detected on the basis of the boiler temperature readings T1, point 14.1,
n9 = 2, fuel shortage is detected on the basis of emission sensor T3 readings. Do not set n9=2 if emission sensor is disconnected.

12.11 Lowering the preset boiler temperature r0

Settings of lowering the preset boiler temperature r0 are described in point 11.10.

12.12 Hot utility water tank hysteresis r1

This is a drop of temperature below which the hot utility water pump is restarted in order to fill the hot utility water tank.

After setting a low value, the hot utility water pump will start faster, yet this is disadvantageous due to frequent activation of the pump.

12.13 Boiler preset temperature increase r2

Boiler preset temperature increase by hot utility water r2. This parameter specifies by how many degrees the boiler preset temperature will be increased in order to fill the hot utility water tank. Yet, this action will be performed only when such need arises. When the boiler temperature is high enough, the regulator will not change it for the purposes of filling the hot utility water tank.

Increasing the boiler preset temperature for the time of filling the hot utility water tank is signalled by symbol no. 9 in the main display window - Drawing 2

12.14 Maximum hot utility water temperature r3

This parameter specifies the maximum temperature of the hot utility water tank at danger levels. The hot utility water tank is used to drop excessive heat if the boiler overheats. In order to protect the hot utility water users against burns, the maximum temperature of the hot utility water tank should be limited.

Except for the software safeguard against too high a temperature of the hot utility water tank, additional protective automatics should be used, e.g. a mechanical thermostat which disables the hot utility water pump feeding.

12.15 Extending hot utility water pump operation r4

After filling the hot utility water tank and disabling the hot utility water pump, there is often a problem of boiler overheating. It occurs if the preset hot utility water temperature is higher than the preset boiler temperature. This problem is particularly common in the SUMMER mode of the hot utility water pump, when the central heating pump is disabled. In order to cool the boiler down, operation of the hot utility water pump can be extended by the time r4 E*xtending hot utility water pump operation.*

12.16 Fuel shortage detection – emission temperature r5

The value of the r5 parameter determines the temperature of emission below which fuel shortage detection will be made on the basis of the T3 sensor readings. If the regulator causes too high a consumption of fuel, which makes the furnace go out completely, the r5 temperature should be increased. Act analogically in the opposite case.

On how to enable fuel shortage detection – see point 12.10

12.17 Disabling the CH pump r6

Operation with a buffer.
The r6 parameter specified the central heating pump operation status after detecting fuel shortage. If r6=0, then the central heating pump operates during fuel shortage. If r6=1, the CH pump is disabled when the regulator detects fuel shortage. If a thermal buffer is connected, it is recommended to set r6=1.

12.18 Emission temperature during firing up r7

This is the preset temperature of emission after holding the START button for 2 seconds when the regulation mode = 3 PID EMISSION is active. Value set at, for example, 30 means temperature of 300°C.

12.19 Firing up time r8

This is the time for which the emission preset temperature is increased to the r7 value, after holding the START button for 2 seconds when the regulation mode = 3 PID EMISSION is active.

12.20 Restoring service settings r9

In order to restore default settings, set the value of service parameter r9 to "1" and press the F button.

Default settings of user and service parameters will be restored.

12.21 Methods of detecting fuel shortage

Fast detection of fuel shortage decreases losses of heat caused by the fan operating with no fuel, and it allows to sustain fire for a longer time, during which the boiler can be refuelled without the need of firing it up again.

1-first method – based on the boiler temperature sensor readings T1 (factory parameter S9=1). After the boiler temperature drops below the n0 parameter *Pump activation time*, the *fuel shortage detection time* n5 is counted out (see point 12.6). If after that time the boiler temperature does not rise, the AL1 alarm is produced and the fan is disabled.

2-second method (recommended) – based on emission temperature sensor readings (factory parameter S9=2). This method allows very fast detection of the fuel shortage. It can be used only if an emission sensor T3, placed in the boiler flue, is connected. After the emission temperature drops below the factory parameter P8 (*Fuel shortage detection – emission temperature*), the *fuel shortage detection time n5* is counted out (see point 12.6). If after this time the temperature does not increase, AL1 alarm is produced.

The AL1 alarm will be cancelled after:
- pushing the START button, or after
- disabling and enabling the regulator via mains switch.

Recommended settings of the n5 parameter (fuel shortage detection time) depending on the method of detecting:

Detection method	n5 value
1 – boiler sensor	20min
2 – emission sensor	10min

12.22 Power supply decay

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

13 Firmware

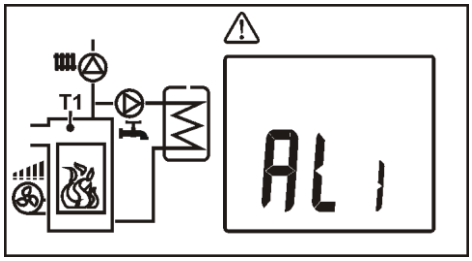
WARNING!!! Values of the following parameters can be modified only by qualified staff of the boiler manufacturer
There is a menu of factory parameters in the regulator. These are advanced settings. After restoring default settings, the following parameter values are not restored! Therefore, before changing any parameter it is recommended to write down its default value, in order to be able to restore it.
The manufacturer's menu can be accessed by activating the regulator via the mains switch while pressing the F button, and holding it for 12 seconds.

Name	symbol	range		typical value
Boiler overheating alarm temperature	**P0**	50…99	°C	90
Central heating pump operation time with blockade by room thermostat	**P1**	1…250	s	30
Central heating and hot utility water pump hysteresis	**P2**	1…10	°C	2
Central heating and hot utility water pump hysteresis – AL3 alarm end	**P3**	1…30	°C	15
Central heating pump down-time by priority	**P4**	1…250	min	0
Fan start time	**P5**	0…60	s	2
Temperature 1 of extending blow-off interval	**P6**	-	°C	10
Temperature 2 of extending blow-off interval	**P7**	-	°C	15
Amplification factor – regulation mode 2	**P8**	1...999	-	180
Integration time – regulation mode 2	**P9**	1…999	-	350
Differentiation time – regulation mode 2	**S0**	1…999	-	25
Amplification factor – regulation mode 3	**S1**	1...999	-	11
Integration time – regulation mode 3	**S2**	1…999	-	120
Differentiation time – regulation mode 3	**S3**	1…999	-	5

14 Description of alarms

14.1 No fuel AL1

After detecting fuel shortage, the following message will appear on the display



Drawing 2 AL1 alarm

No sound signal will be given.
The way and methods of detecting fuel shortage are described in point 12.21.

14.2 Boiler temperature sensor damage AL2

This alarm will be produced in the case of damage to the boiler sensor, and after exceeding its measuring range. The alarm sauces shut-down of the central heating and hot utility water pumps, in order to cool the boiler down, if applicable. A sound signal is also activated.
The alarm is cancelled after returning to the sensor measurement range, and after disabling and enabling the regulator via the mains switch.
In such case, check the sensor, and possibly replace it.

☞ The method of checking the temperature sensor is described in point 11.8

14.3 Exceeding the maximum boiler temperature AL3

This alarm will occur after the boiler exceeds temperature determined by the factory parameter *Boiler overheating alarm temperature P0.* By default, this parameter is set to 90°C. In such case, the fan is turned off, and the central heating and hot utility water pumps are activated. A sound signal is also activated. The hot utility water pump works only until the hot utility water tank exceeds the maximum temperature r3 (service parameter). This protects the users against possible scalding.
After the boiler temperature drops, the regulator resumes normal operation.

☞ It is suggested to set the P0 value below the safety temperature limiter actuation threshold. Thanks to this, a momentary exceeding of the boiler temperature will not cause stoppage of the boiler.

☞ Before the boiler reaches the P0 temperature, the regulator will attempt to drop the excessive heat to the hot utility water tank. If the hot utility water tank reaches the maximum temperature permitted by the r3 parameter, the hot utility water pump is turned off, and the AL3 alarm is produced.

⚠ Note: placing the temperature sensor beyond the boiler water jacket, e.g. on the outlet pipe, is not recommended, as it can delay detection of the boiler overheating.

14.4 Exceeding maximum emission temperature

The regulator warns the user of a danger of emission temperature sensor damage if the emission temperature exceeds 450°C. Such situation can occur if the wrong regulator parameters are set, or if the boiler door are left open.
The alarm is signalled visually, by a warning triangle symbol, and with a sound – short warning signals.

15 Replacement of parts and subassemblies

When ordering parts and subassemblies, please specify necessary information read off the rating plate. It is best to give the regulator serial number. If the serial number is not known, please specify the model and type of the regulation, as well as the year of its production.

15.1 Replacing mains fuse

The mains fuse can be found in the regulator front panel. It protects the regulator and the devices fed by it. Please use time-delay fuses, porcelain, 5x20mm, of nominal burnout current 3,15A, e.g. 02153.15P made by LittelFuse.
In order to remove the fuse, push in its socket with a flat-tip screwdriver and turn it counter clockwise.

16 Description of possible faults

Signs of a fault	Hints
1. The display is blank despite connection to the supply network.	Check: ▪ if the main fuse is burnt-out, replace if so,
2. Preset boiler temperature on the display is different than the programmed one	Check: ▪ whether the hot utility water tank is filled at the time and the preset hot utility water temperature is higher than the boiler preset temperature; if so, the difference of readouts will disappear after the hot utility water is filled, or after decreasing the preset hot utility water temperature. ▪ whether the room thermostat is on – set the service parameter *Decreasing boiler preset temperature by thermostat r0 = 0*
3. central heating pump is inoperative	Check: ▪ whether the boiler exceeded the parameter *Pump activation temperature (n0)* – wait or decrease this parameter, ▪ if the room thermostat is not blocking the central heating pump - set the parameter *central heating pump down-time (n8)* to "0"*.* ▪ if the hot utility water priority, which blocks the central heating pump, is enabled – disable the priority by setting the *hot utility water mode* = 2 (*Without priority),* ▪ whether the central heating pump is not damaged or clogged.
4. the fan is inoperative	▪ check the value of the parameter *Minimum airflow power (n2)* ▪ check if the safety temperature limiter STB input jumper is on terminals 1-2 (the jumper should be placed only if no temperature limiter is connected). ▪ check if the additional thermal protection sensor input jumper is on terminals 11-12 (the jumper should be placed only if no DZT-01 sensor is connected) ▪ if the boiler manufacturer equipped it with a temperature limiter STB with manual return to the 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
5. 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 11.8
6. in the hot utility water – SUMMER mode, the heaters are hot and the boiler overheats	▪ Increase the parameter *Extending hot utility water pump operation (r4) in order to cool down the boiler*
7. the hot utility water pump is active even after the hot utility water tank has been filled	▪ Set the parameter *Extending hot utility water pump operation (r4= 0)*
8. the boiler overheats despite enabled fan	▪ The reason can be a constructional defect of the boiler, consisting in lack of protection against too high chimney draught (no back shutter in the fan, or damaged shutter), or the boiler is not tight.

PLUM sp. z o.o.

Ignatki 27a 16-001 Kleosin
tel. +48 85 749-70-00
fax +48 85 749-70-14
plum@plum.pl, www.plum.pl
POLAND