

OPERATION MANUAL



RK-2001UK

SOLID FUEL FIRED
BOILER TEMPERATURE CONTROLLER

Version 9217

1. Application..

RK-2001UK controller is a device designed for temperature control of solid fuel fired boilers. The temperature of the boiler is kept on level set by user, by controlling the speed of the pressure fan. The controller monitors temperature of water in the boiler, displays it on the display, and controls circulating pump. The controller is equipped with programmable input for room thermostat or combustion gases' temperature indicator, and multipurpose output which allows to connect alarm signal or additional gas or oil boiler.

2. Connection.

Before turning on the device by master switch, connect controller, pressure fan and circulating pump power cords to appropriate sockets in the rear of the controller. Boiler water's and combustion gases' temperature sensors should be placed in measurement holes. Pictures 2 and 3 show diagrams of electrical connection of the device.

CAUTION! Before plugging the device to the power source check if it is properly grounded and if the screws of the connector are properly screwed.

CAUTION! The maximum total power of devices connected to the controller mustn't exceed 450W.

CAUTION!! As additional option you can connect the UM-1 module to the controller that allows controlling the additional boiler or the alarm signal. It is necessary to protect the power supply of these devices with suitable cut-outs.

Not used power outs of the controller may remain unconnected.

3. Operation.

After turning the device on, all the elements of the display are lit for a while to check if they are working properly. The controller, when power appears, returns to its last state before turning off or power loss.

Front of the device (Pic 1) consist of:

- 1 – Master switch,
- 2 – Display, indicating boiler temperature and parameters,
- 3 – Boiler water temperature stabilization or room thermostat work indicator,
- 4 – Boiler thermostat knob,
- 5 – Central heating pump indicator,
- 6 – STOP/choose parameters/erase alarms button,
- 7 – START/choose parameters button,
- 8 – Start programming in service mode/confirm settings button.



Picture 1. Front of the device.

Basic operation of the device is done by setting desired temperature with boiler thermostat knob (4). Other functions are realized according to parameters programmed in service mode. While changing boiler temperature settings with the knob, the change is displayed on the display for a few seconds (for example [C 65]) and this value means the temperature, which the controller will be trying to achieve.

After pressing START button (7), the fan starts to work and the control process begins. STOP button (6) stops the fan, for example allowing to add fuel to the boiler. If the controller isn't in service mode, the display shows water temperature of the boiler and the last sign on the display defines mode, which controller currently is in:

for example:

- [50°-] – STOP mode
- [50°C] – WORK mode
- [50°c] – keeping fire in WORK mode

If the heating system contains combustion gases temperature sensor and boiler water temperature reaches temperature set on the thermostat, the controller switches to boiler temperature stabilization mode and this mode is indicated by indicator (3) lit. If the indicator is not lit, the controller is in combustion gases temperature stabilization mode.

If the heating system contains room thermostat, indicator (3) not lit means that circuit pins of the thermostat are open. In this case the controller keeps minimum boiler temperature. Shorting pins on the thermostat causes indicator to lit and the controller keeps boiler temperature as set on the room thermostat knob (4).

4. Viewing boiler desired temperature and combustion gases temperature.

Short pressing OK button causes switching the controller to temperature view mode. Entering into this mode is signalized by indicator (3) blinking quickly. Boiler desired temperature is shown on the display, e.g. [C 65]. If the heating system contains combustion gases' temperature sensor, by pressing +,- buttons you can

switch to combustion gases temperature view (e.g. [°160]). You can exit temperature view mode by selecting [End] option and pressing OK button; or you can wait one minute so that the controller exits from this mode automatically.

5. Setting up the parameters - service mode.

Holding OK button for more than 3 seconds causes change to service mode, where you can view and change programmed parameters. Service mode is indicated by flashing of the indicator (3). You can look through parameters with + and - buttons. After choosing desired parameter, you can switch to change mode of the parameter by pressing OK button - this mode is indicated by value of the parameter flashing. Change of the parameter is possible by pressing - or + buttons. You can confirm new settings by OK button and after that there is possible to choose another parameter (with +,- buttons). If you want to quit service mode , choose [End] option with + and - buttons and press OK; or wait 1 minute. The device will exit service mode and will start to indicate boiler temperature.

Table 1. Service parameter's list.

Disp.	Parameter	Min	Max	Step	Factory default
c---	Combustion gases temperature/combustion gases temperature sensor off.	---, 50	250	1°C	---
Ch10	Combustion gases temperature hysteresis.	1	99	1°C	10
Ct 5	Time constant of combustion gases temperature stabilization.	1	99	1min	5
Π100	Fan max work power or max power when Πr 1.	50	100	10%	100
n 40	Minimum fan power.	20	40	10%	40
Πh 5	Fan speed decrease coefficient.	2	10	1	5
Πr 0	Automatic fan speed control.	-, 0	10	1	0
Πn 5	Fan work time.	--, 5	60	1s	5
Πu 6	Fan pause time.	1	99	1min	6
P 60	Central heating pump launch temperature.	--, 20	70	1°C	60
Ph 2	Central heating pump hysteresis.	1	10	1°C	2
Pc 2	Pause time of central heating pump with 30 sec. work periods.	--, 1	99	1min	2
L 65	Minimum boiler temperature.	30	65	1°C	65
H 90	Maximum boiler temperature.	80	95	1°C	90
h 5	Boiler temperature hysteresis.	1	10	1°C	5
A 99	Boiler overheating temperature.	90	99	1°C	99
C 90	Combustion gases temperature if detected no fuel.	30	150	1°C	90
Fd60	Fuel shortage testing time with burning.	--, 1	99-4h	1min	60
Fb30	Fuel shortage testing time in WORK mode.	--, 1	99-4h	1min	30
Ar 0	Additional output: 0-FUEL, 1-ALARM.	0	1	1	0
Prod	Return to factory defaults after pressing OK.				
outP	Central heating pump testing, press OK - launch.	outP	out1		
outΠ	Fan output testing, press OK - launch.	outΠ	out2		
outr	Additional output testing, press OK - launch.	outr	out3		
End	Exit the service mode after pressing OK.				

In the table above, the first column represents example of display indications, in the next columns there are: parameter description, minimal amount, maximum amount allowed to set, step of the parameter during the setup, factory defaults, to which you can return by choosing [Prod] option.

5.1. Setting combustion gases temperature control settings.

Combustion gases temperature / combustion gases temperature sensor off [C---] – this parameter describes at what temperature of combustion gases the controller starts decreasing fan speed. Setting this parameter to „---“ turns off combustion gases temperature sensor. In this case room thermostat should be connected or thermostat circuit pins should be shorted. Since turning off combustion gases temperature sensor causes change of the way the fan works, this parameter can be programmed only after stopping the device.

Combustion gases temperature hysteresis [Ch10] – this parameter specifies what value the temperature has to be decreased by, to start increasing speed of the fan.

Time constant of combustion gases temperature stabilization [Ct 5] – this parameter defines time of fan speed change cycle during combustion gases temperature stabilization. If the temperature of combustion gases exceeds value set in parameter [C200], the controller will start cyclic reduction of fan speed, to the point where combustion gases temperature is below value set. If the combustion gases temperature decreases by the hysteresis value set, the controller will start cyclic increasing speed of the fan.

5.2. Pressure fan work parameters.

Maximum fan power [Π100] – maximum power the fan can work with.

Minimum fan power [n 40] – lowest power the fan can work with.

Fan speed decrease coefficient [Πh 5] – this parameter influences the way fan speed is reduced when boiler temperature is approaching its desired value. E.g. setting this parameter to 2 means that when the controller is in boiler water temperature stabilization mode or WORK mode (if the combustion gases sensor is turned off) and boiler temperature is 4°C lower than desired boiler temperature, the fan will work with its maximum power [Π100]. Further increase of boiler temperature will cause fan speed to be reduced gradually to its minimum power [n 40].

Automatic fan speed control [Πr 0] – setting this parameter to "0-10" causes automatic fan speed decrease when temperature of water in the boiler reaches desired temperature. If this parameter is set to "-", the fan automatic smooth speed control is disabled and the fan can work with power set by "Π" parameter. Setting parameter value in range from 0 to 10 mean time in minutes of the smooth fan speed increase from minimum value [n 40] to [Π100] value for smooth boiler

start.

Fan work time [Пн 5] – time of turning the fan on for a while, to remove accumulated gases. Setting the parameter to "-" turns this function off.

Fan pause time [Пу 6] - time between fan work periods.

5.3. Circulating pump parameters.

Circulating pump launch temperature [P 60] – temperature of water in the boiler, which causes start of the circulating pump. If the parameter is set to "--" value, circulating pump works together with the fan (if the combustion gases temperature sensor is connected) or when room thermostat circuit pins are shorted. Additionally, the pump is launched independently from the control process if water in the boiler exceeds 80°C.

Circulating pump launch hysteresis [Ph 2] – this parameter defines what value should temperature decrease by, below circulating pump launch temperature, to turn the pump off.

Pause time between circulating pump 30 second work periods [Pc 2] – in STOP mode or when room thermostat circuit is open, the circulating pump is launched for 30 seconds, to mix water in heating circulation. This parameter defines time between launches of the pump. Setting the parameter to "-" turns this function off.

5.4. Boiler work temperature setting.

Minimal boiler temperature [L 65] – minimal temperature, which you can set with the boiler thermostat knob.

Maximum boiler temperature [H 90] – maximum temperature, which you can set with the boiler thermostat knob.

Boiler temperature hysteresis [h 2] – this parameter defines what value should temperature of water in the boiler decrease by, below temperature set with the thermostat knob, to switch the controller into combustion gases temperature stabilization mode or WORK mode, with combustion gases temperature sensor turned on.

5.5. Boiler overheating protection.

Boiler overheating temperature [A 99] – value, exceeding which causes permanent turn off of the pressure fan and launch of the circulating pump, to prevent boiler overheating. Overheating mode is indicated by boiler overheating indicator and by displaying error [E 2] on the display. It can be turned off by pressing STOP button, but only when temperature decreases below boiler overheating temperature. Pressure fan turning off occurs also in case of damage of the boiler temperature sensor, which is displayed on the display by error [E 1].

STB – the controller has also additional protection from overheating, which is independent from the processor, . In case of temperature increase over 95°C, the control process is turned off by turning the fan off and launching the circulating pump. The fan and the pump are joined to the control process again, when temperature reaches 89°C. STB circuit enables more precise boiler work control and reduces overheating possibility.

5.6. No fuel.

Combustion gases temperature if detected no fuel [C 90] – this parameter defines temperature of the combustion gases, below which the controller starts counting no-fuel testing time. This parameter is taken into account only if combustion gases sesnsor if turned on.

No-fuel testing time during fuel firing start [Fd60] – after switching to WORK mode, if combustion gases temperature does not exceed [C 90] in programmed time, the control process will be turned off and the display will show message: **[FUEL]**. In heating system without combustion gases temperature sensor, if after setting the controller to WORK mode the water temperature does not increase by 2°C in programmed time, the control process will be turned off and the display will show the message: **[FUEL]**. You can return to previous mode by pressing STOP button.

No-fuel testing time during work mode [Fb30] – if temperature of combustion gases goes below programmed [C 90] value and is below that value for programmed time, the control process will be turned off and the display will show message: **[FUEL]**. In heating system without combustion gases temperature sensor, if temperature of water in the boiler decreases below temperature set with the thermostat, by hysteresis value, and does not increase by 2°C in the programmed time, the control process will be turned off and the display will show the message: **[FUEL]**. You can cancel the alarm by pressing STOP button.

5.7 Multifurpose output.

Multifurpose output work mode [Ar 0] – the controller has been equipped with additional multipurpose output that can work in one of following modes:

[Ar 0] – output may control the oil or gas boiler if such boiler exists in the heating circuit. After switching the controller on with the main power switch the additional boiler is turned off and it turns on again when there is no fuel in the solid fuel boiler. This function is useful in heating systems where a solid fuel boiler is used to cut the heating costs. After erasing the no fuel alarm by pressing STOP button the additional boiler is again turned off and the controller works again.

[Ar 1] – output may control the additional alarm signaling system. Boiler temperature sensor malfunction, overheating and no fuel alarm swill turn on the alarm.

NOTICE. Additional devices can be connected to multipurpose output using UM-1 module. Connection schemes are shown on picture 4.

5.8. Testing of device's outputs.

To make checking the controller work easier, it is possible to test output circuits which control the fan and the pump, and the circuit which controls additional boiler. This function is available in service mode, only if the control process is off, i.e. the controller was in STOP mode before switching to service mode. By choosing **[outP]** on the display and pressing OK button you can turn on the circulating pump for a while, by choosing **[outΠ]** and pressing OK you can turn on the pressure fan and by choosing **[outr]** and pressing OK you can turn the additional boiler or the alarm signaling system on (if the additional module is connected).

5.9. Factory defaults.

You can return to standard settings, set by the producer, by choosing **[Prod]** option in service mode and pressing OK button. After activating this function, the device sets each parameter showed in the table 1 to default.

5.10. Exiting service mode.

By choosing **[End]** option on the display and pressing OK button you can quit service mode. The device also quits service mode, when no buttons are pressed for 1 minute.

6. Device failures.

The controller is constantly testing if its internal circuits and temperature sensors are working correctly. After detection of fault or damage, it displays information about detected errors and in takes appropriate action in response to these errors.

When **[E 1]** error appears on the display, it means fault (short-circuit) in the boiler sensor circuit or temperature below -9°C. **[E 2]** is displayed if boiler overheats. If any of these errors occur, the controller stops the fan and turns on central heating pump.

[E 3] error means fault and overheating at the same time. Appearing of **[E 1]** error on the display without ability to cancel it by pressing STOP button, in spite of temperature below 90°C, may mean permanent damage of boiler temperature sensor (e.g. if the boiler overheated above 150°C).

[E128] error means damage in combustion gases temperature sensor's circuit. In case of this problem, the controller continues to work in boiler temperature stabilization mode (fan speed is determined by boiler water temperature).

[Hot] message, displayed alternately with temperature of combustion gases (e.g. [°410]) indicated that combustion gases temperature exceeded 400°C. In such case the controller turns off the fan (the fan is working only during fan work periods to remove accumulated gases). The controller returns back to normal work as soon as combustion gases temperature is below 250°C.

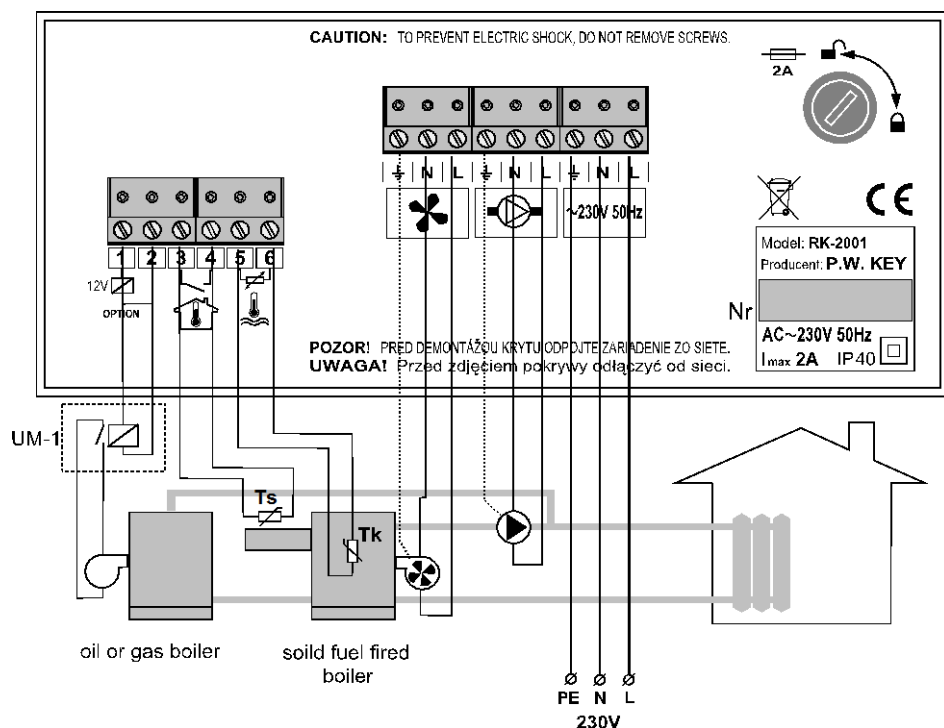
7. Device removal.

In case of need to remove the controller from the system:

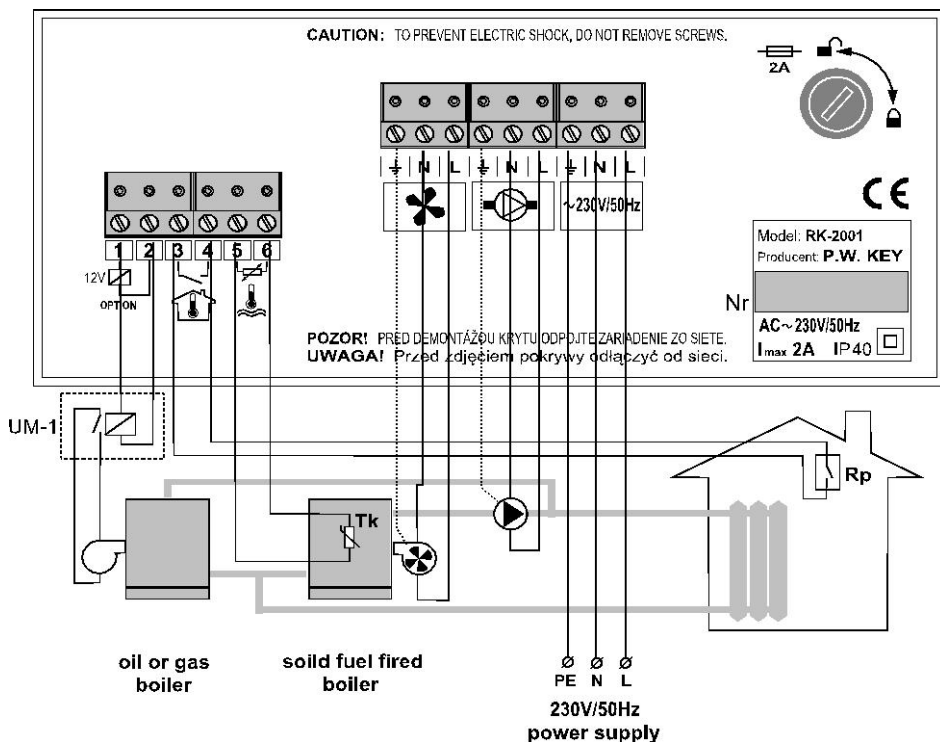
- turn the master switch off,
- disconnect the power of the boiler,
- remove the controller from the slot in the boiler,
- disconnect all connectors with cords from the controller.

8. Specifications.

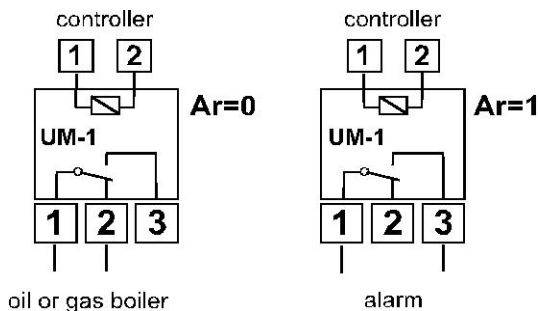
Voltage:	230V $\pm$ 10%, 50Hz
Power consumption:	< 4VA
Boiler water temperature measurement range:	-9 $\div$ 109°C $\pm$ 1°C
Combustion gases temperature measurement range:	-30 $\div$ 500°C $\pm$ 1°C
Boiler temperature adjustment range	65 $\div$ 90°C $\pm$ 1°C
Programmable boiler overheating protection:	90 $\div$ 99°C $\pm$ 1°C
Hardware boiler overheating protection:	>95°C $\pm$ 1°C
Circulating pump launch temperature:	20 $\div$ 65°C $\pm$ 1°C
Fan out:	max 2A/230V
Dimensions:	80 x 170 x 100 mm



Picture 2. Connection diagram of RK-200UK in heating system with combustion gases sensor.



Picture 3. Connection diagram of RK-2001UK in heating system with room thermostat.



Picture 4. Connection diagrams of UM-1 module.

9. Notes.

Disp.	Parameter	Factory default
c_---	Combustion gases temperature/combustion gases temperature sensor off.	
Ch10	Combustion gases temperature hysteresis.	
Ct 5	Time constant of combustion gases temperature stabilization.	
Π100	Fan max work power or max power when Πr 1.	
n 40	Minimum fan power.	
Πh 5	Fan speed decrease coefficient.	
Πr 0	Automatic fan speed control.	
Πn 5	Fan work time.	
Πu 6	Fan pause time.	
P 60	Central heating pump launch temperature.	
Ph 2	Central heating pump hysteresis.	
Pc 2	Pause time of central heating pump with 30 sec. work periods.	
L 65	Minimum boiler temperature.	
H 90	Maximum boiler temperature.	
h 5	Boiler temperature hysteresis.	
A 99	Boiler overheating temperature.	
⊆ 90	Combustion gases temperature if detected no fuel.	
Fd60	Fuel shortage testing time with burning.	
Fb30	Fuel shortage testing time in WORK mode.	
Ar 0	Additional output: 0-FUEL, 1-ALARM.	

Producer:

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