OPERATION MANUAL

RK-2001U

SOLID FUEL FIRED
BOILER TEMPERATURE CONTROLLER

Version 8404

1. Application.

RK-2001U 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 controlls circulating pump. To enable more precise temperature control of heated rooms, the controller is equipped with input for room thermostat. The controller is equipped with additional multipurpose output which allows connecting mixing valve, 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. Temperature sensor should be placed in measurement hole in the boiler. Picture 2. shows diagram of electrical connection of the device.

WARNING! Before plugging the device to the power source check if it is proprerly 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 mixing valve and the hot water loading pump. 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 - Room thermostat indicator
4 - Boiler thermostat knob
5 - Circulating pump indicator
6 - STOP/choose parameters/erase alarms button
7 - START/choose parameters button
8 - Start programming in service mode/confirm settings button
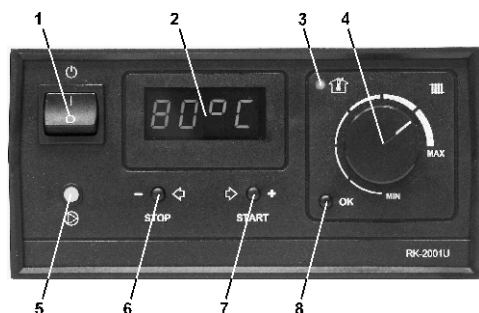
Picture 1. Front of the device.

Basic operation of the device is done by setting desired temperature with boiler thermostat knob, 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 55]**) and this value means the temperature, which the controller will be trying to achieve. You can check this value by pressing OK button. After pressing START button, the fan starts to work and the control process begins. STOP button 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: **[50º-]**   - STOP mode

[50ºC] - WORK mode

[50ºc] - keeping fire in WORK mode

4. 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 room thermostat indicator. 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.

4

Table 1. Service parameter's list

Disp.	Parameter	Min	Max	Skok	Factory default
$^{c}200$	Fume temperature.	---, 50	250	1°C	200
$^{c}h10$	Fume temperature hysteresis	1	99	1°C	10
$^{c}t\,5$	Fume temperature stabilization time.	1	99	1min	5
П100	Fan max work power or max power when Пr 0-10.	50	100	10%	100
n 40	Minimum fan power.	20	40	10%	40
Пh 5	Fan speed decrease coefficient.	2	10	1	5
Пr 0	Automatic fan speed control and time of fan start.	-, 0	10	1	0
Пn 5	Fan work time.	--, 5	60	1s	5
Пu 6	Fan pause time.	1	99	1min	6
P 20	Central heating pump launch temperature.	----, 20	70	1°C	20
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	90	1°C	85
h 5	Boiler temperature hysteresis.	1	10	1°C	5
A 99	Boiler overheating temperature.	90	99	1°C	99
$^{c}100$	Fume temperature with fuel shortage testing.	30	150	1°C	100
Fd60	Fuel shortage testing time with burning.	--, 1	99-4h	1min	60
Fb30	Fuel shortage testing time in WORK mode and burning out.	--, 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		
outП	Fan output testing, press OK - launch.	outП	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 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.

4.1. Pressure fan work parameters.

Fan power [П100] - this value defines power of the fan. When "Пr"parameter is set to "0-10" this is the maximum power of the fanwhich can be achieved during automatic fan control.

Minimum fan power [n 40] - lowest fan power which can be used when automatic fan speed control is on and when fan speed is gradually increased during boiler start.

Fan speed decrease coefficient [Пh 2] - this parameter influences the way fan speed is reduced when boiler tremperature is approaching its desired value. E.g. setting this parameter to 2 means that when the controller is in WORK mode and boiler temperature is 2°C lower than desired boiler temperature the fan will work with

its maximum power [П100]. Further increase of boiler temperature will cause fan speed to be reduced gradually to its minimum power [n 40].

Automatic fan speed control [Пr 0] - it is on, when this parameteris set to "0-10" and causes automatic fan speed decrease whentemperature of water in the boiler reaches desired temperature.If this parameter is set to "-", the fan automatic smooth speedcontrol is disabled and the fan can work with power set by "П" parameter. Setting parameter value in range from 0 to 10 meanstime in minutes of the smooth fan speed increase from 40% tovalue of "П" for smooth boiler start.

Fan work time [Пn 5] - time of turning the fan on for a while, to remove accumulated gases. Setting the parameter to "-" turns this function off. This function can be active in WORK mode.

Fan pause time [Пu 6] - time between fan work periods

4.2. Circulating pump parameters.

Circulating pump launch temperature [P 42] - temperature of water in the boiler, which causes start of the circulating pump. Circulating pump works independently from the control process and is launched additionally in case of boiler overheat.

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.

4.3. Boiler work temperature setting.

Minimal boiler temperature [L 40] - minimal temperature, which you can set with the boiler thermostat knob.

Maximum boiler temperature [H 85] - 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 turn the pressure fan on.

4.4. 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.

4.5. No fuel.

No-fuel testing time during fuel firing start [Fd60] - after switching to WORK mode, if 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 fuel firing is finished after the set temperature is achieved.

No-fuel testing time during work mode [Fb30] - in WORK mode, 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.

4.6. Additional output.

Additional output work mode [Ar 0] - the controller has been equipped with a multipurpose output that can work in one of following modes:

- mode [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 turnes 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.

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

- mode [Ar 2] - output may control the mixing valve servo-motor. Controlling the mixing valve requires room thermostat to be present. Mixing valve is being opened and closed depending on the room thermostat input. Additionally, mixing valve is opened in case of overheating or boiler temperature sensor malfunction.

CAUTION. Equipment should be connected to additional output using UM-1module. Connection schemes are shown on picture 3.

4.7. 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 **[outП]** and pressing OK you can turn on the pressure fan and by choosing **[outr]** and pressing OK you can turn the additional boiler, the alarm signaling system or the mixing valve servo-motor on (if the additional module is connected).

4.8. 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 to default.

4.9. 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.

5. Additional functions.

To improve comfort in heated rooms, the device is equipped with input allowing to connect any kind of room thermostat with contact output. When temperature in the room is below desired temperature, the circulating pump is turned on and the room thermostat indicator is lit. It means that the boiler should keep temperature set by the room thermostat. After reaching desired temperature in the room, the room thermostat indicator turns off, the circulating pump is turned off and the boiler switches to mode, in which it's keeping minimal temperature.

CAUTION. In case of not having room thermostat in the system, the room thermostat input contacts must be short-circuited.

6. Device failures.

The controller is constantly testing if its internal circuits and temperature sensor are working correctly. After detection of fault, it stops the pressure fan, turns on the circulating pump and shows proper error message on the display. In case of failure please turn off the controller, plug the circulating pump to the power source, bypassing the controller, ensure appropriate fuel firing in the boiler and contact the service. 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. **[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).

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 ± 10%, 50Hz
Power consumption:	<4VA
Temperature measurement range:	-9–109°C ± 1°C
Boiler temperature adjustment range:	30–90°C ± 1°C
Programmable boiler overheating protection:	90 –99°C ± 1°C
Hardware boiler overheating protection:	>95°C ± 1°C
Circulating pump launch temperature:	30–70°C ± 1°C
Fan out:	total max 2A/230V
Dimensions:	80 x 170 x 100 mm

Producer: P.W. KEY   www.pwkey.com
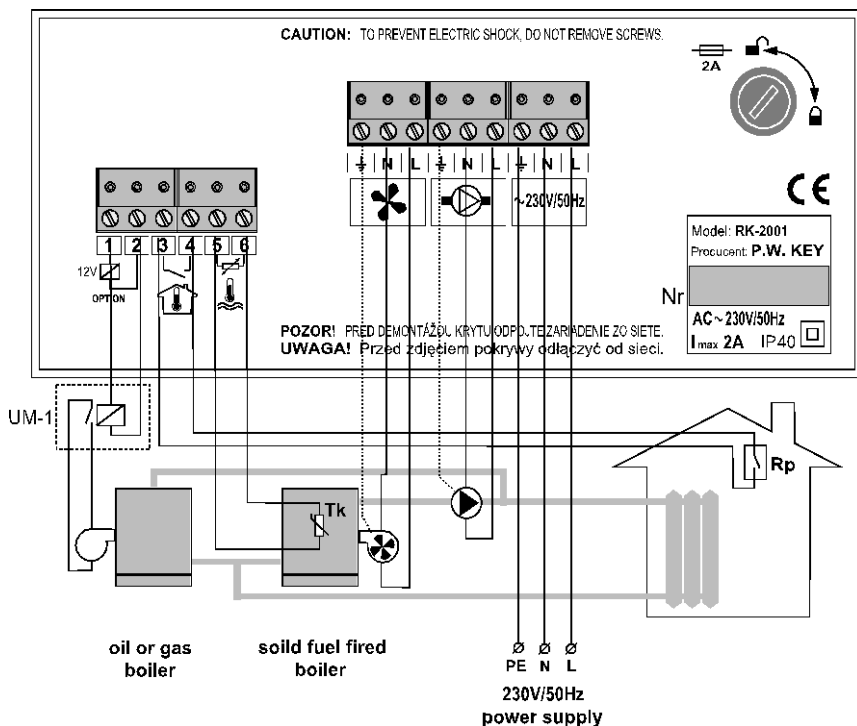
Picture 2. RK-2001U connection scheme
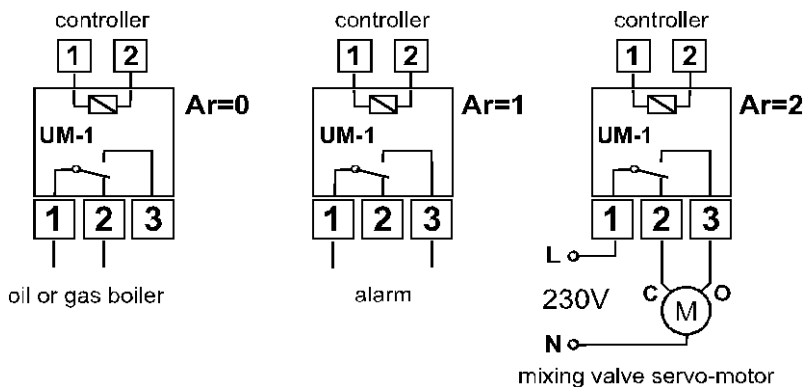
Picture 3. UM-1 module connection scheme.

9. Notes.

Disp.	Parameter	User
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ch10	Fume temperature hysteresis	
ct 5	Fume temperature stabilization time.	
П100	Fan max work power or max power when Пr 0-10.	
n 40	Minimum fan power.	
Пh 5	Fan speed decrease coefficient.	
Пr 0	Automatic fan speed control and time of fan start.	
Пn 5	Fan work time.	
Пu 6	Fan pause time.	
P 20	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.	
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A 99	Boiler overheating temperature.	
c̲100	Fume temperature with fuel shortage testing.	
Fd60	Fuel shortage testing time with burning.	
Fb30	Fuel shortage testing time in WORK mode and burning out.	
Ar 0	Additional output: 0-FUEL, 1-ALARM.	