

# OPERATION MANUAL



## RK-2001AT2

SOLID FUEL FIRED  
BOILER TEMPERATURE CONTROLLER

Version AC22

**Product history:**

<b>Date</b>	<b>Version</b>	<b>Changes</b>
2010-08-03	A803	Exhaust gas thermostat is used solely for „no fuel” detection.
2010-09-13	A913	Exhaust gas temperature drop below value set with thermostat knob will stop the fan and central heating pump. This will not work if boiler temperature is below minimum temperature.
2010-12-10	AC10	After pressing STOP, START again the controller starts in HEATING UP mode. This mode turns off influence of exhaust gas thermostat on the fan and central heating pump. HEATING UP is active until exhaust gas temperature achieves temperature set with thermostat knob. Protection against too high exhaust gas temperature has been added.
2010-12-20	AC20	In FC1 mode central heating pump is turned off after FUEL alarm.
2010-12-22	AC22	If boiler temperature is less than set temperature and is within hysteresis, then after pressing STOP, START again the controller starts in WORK mode (it was SUSTAIN mode in previous versions).

## 1. Application.

RK-2001AT2 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 has been equipped with additional thermostat and sensor input. This thermostat can be used to set room temperature or desired exhaust gas temperature. Depending on chosen solution, room temperature sensor or exhaust gas temperature sensor should be connected to the additional sensor input. The device also design allows for connecting external contact thermostat instead of room temperature sensor.

## 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 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 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 (Picture 1) consist of:

- 1 - Master switch,
- 2 - Display, indicating boiler temperature and parameters,
- 3 - Room thermostat or exhaust gas thermostat indicator,
- 4 - Boiler thermostat knob,
- 5 - Additional thermostat knob,
- 6 - STOP/choose parameters/erase alarms button,
- 7 - START/choose parameters button,
- 8 - Start programming in service mode/confirm settings button,
- 9 - Circulating pump indicator,



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 75]) and this value means the temperature, which the controller will be trying to achieve. This value can be checked in temperature viewing mode. Depending on heating installation type and service settings, additional thermostat can be used to set desired room temperature, or desired exhaust gas temperature. Additional thermostat knob position change is signaled for several seconds on the display e.g.: [ 20°]. Current value of this setting can also be viewed in temperature viewing mode.

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: [70°-] - STOP mode
- [70°C] - WORK mode
- [70°c] - keeping fire in WORK mode

When the device displays boiler temperature, the function of indicator (3) depends on function performed by additional thermostat. If the thermostat is used to set room temperature, indicator (3) is continuously lit when room temperature is too low. If the thermostat is used to set desired exhaust gas temperature, the indicator (3) signals low exhaust gas temperature with quick blinking. If exhaust gas temperature is too high, the controller turns off the fan and shows [Hot ] on the display.

#### 4. Manual fan operation.

During boiler operation user may need to turn on the fan manually (for example, to remove gases from the boiler before removing the fuel). Pressing START button and holding it down for 3 seconds will turn the fan on. The fan will keep working for time set by the service or until STOP button is pressed.

## 5. Temperature viewing mode.

To enter temperature viewing mode press OK. Entering this mode will be signaled by fast blinking of room thermostat indicator. Use < and > buttons to move between viewing different temperatures. To exit temperature viewing mode select **[End ]** option and press OK button or wait for 1 min.

Table 1. List of temperatures available in temperature viewing mode.

Display	Parameter
C 45	Boiler desired temperature.
20°	Temperature set with additional thermostat knob.
18°	Current room or exhaust gas temperature.
End	Exit temperature viewing mode.

**The desired boiler temperature [C 45]** – is the temperature which the controller will try to achieve in WORK mode. It is set by direct turning of the knob and is indicated by a short display.

**Temperature set with additional thermostat knob [ 20°]** - this parameter displays temperature set with additional thermostat knob.

**Current room or exhaust gas temperature [ 18°]** - this parameter displays current measured room or exhaust gas temperature.

## 6. 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.

In the table 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.

Table 2. Service parameter's list

Disp.	Parameter	Min	Max	Step	Factory default
Π100	Fan max work power or max power when Πr 0-10.	50	100	1%	100
n 40	Minimum fan power.	20	40	1%	40
Πh10	Fan speed decrease coefficient.	2	10	1	10
Πr 1	Automatic fan speed control and time of fan start.	--, 0	10	1	1
Πn 5	Fan work time.	--, 5	60	1s	5
Πu 6	Fan pause time.	1	99	1min	6
Πd 3	Fan work time in manual mode	--, 1	99	1min	3
P 65	Central heating pump launch temperature.	60	70	1°C	65
Ph 5	Central heating pump hysteresis.	1	10	1°C	5
Pr 1	Central heating pump work mode: 0- automatic, 1- the pump work depends on room temperature or room thermostat contacts, 2- the pump work depends on controller work mode.	0	2	1	1
Pc--	Central heating pump pause time.	--, 1	99	1min	--
Pd 2	Central heating pump turn off delay.	--, 1	99	1min	2
L 65	Minimum boiler temperature.	60	65	1°C	65
H 90	Maximum boiler temperature.	80	95	1°C	90
h 5	Boiler temperature hysteresis.	1	10	1°C	5
A105	Boiler overheating temperature.	95	105	1°C	105
Fc 1	Additional thermostat work mode: 0 - room thermostat, 1 - exhaust gas thermostat.	0	1	1	1
F300	Maximum exhaust gas temperature.	---, 250	320	1°C	300
Fh20	Maximum exhaust gas temperature hysteresis.	5	50	1°C	20
Fd60	Fuel shortage testing time during boiler start.	--, 1	99, 4h	1min	60
Fb30	Fuel shortage testing time in work mode.	--, 1	99, 4h	1min	30
Ar 0	Work mode of extra output: 0- output turning on extra boiler, 1- alarm output, 2- output controlling emergency cooling system, 3- output controlling extra devices turning on during work of blow-in fan.	0	3	1	0
Prod	Return to factory defaults.				
outP	Central heating pump testing.	outP	out1		
outΠ	Fan output testing.	outΠ	out2		
outr	Additional output testing.	outr	out3		
End	Exit the service mode.				

## 6.1. Pressure fan work parameters.

**Fan power [Π100]** - this value defines power of the fan. When „Πr” parameter is set to „0-10” this is the maximum power of the fan which 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 [Πh10]** - 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 WORK mode and boiler temperature is 2°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 1]** - it is on, when this parameter is set to „0-10” and 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 means time in minutes of the smooth fan speed increase from 40% to value of „Π” for smooth boiler start.

**Fan work time [Πn 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 [Πu 6]** - time between fan work periods

**Fan work time in manual mode [Πd 3]** – this parameter defines how long the fan will work when started manually. Setting this parameter to „-” will disable manual fan operation.

## 6.2. Central heating pump parameters.

**Central heating pump launch temperature [P 65]** - 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.

**Central heating pump hysteresis [Ph 5]** - this parameter defines what value should temperature decrease by, below circulating pump launch temperature, to turn the pump off.

**Central heating pump work mode [Pr 1]** - central heating pump, independently of work mode, is always turned off when boiler temperature drops below temperature set with [P 65] parameter and is always turned when boiler temperature exceeds 90°C, boiler is overheated or boiler temperature sensor is damaged. In remaining cases, central heating pump works in mode set with [Pr ] parameter:

- mode **[Pr 0]** – continuous work.

- mode **[Pr 1]** - pump work depends on additional thermostat work mode. In **[Fc 0]** mode central heating pump is turned on when room temperature is too low (additional thermostat connection shorted or room temperature lower than temperature set with additional thermostat knob). The pump is turned off when room temperature reaches desired value. In **[Fc 1]** mode central heating pump is turned on when measured exhaust gas temperature is higher than temperature set with additional thermostat knob. The pump is turned off when exhaust gas temperature drops below the set temperature.

- mode **[Pr 2]** – in this mode the central heating pump will turn on only when the controller is in WORK mode.

**Central heating pump pause time [Pc--]** – when boiler temperature exceeds temperature set with **[P 65]** parameter and pump work mode doesn't allow turning the pump off (e.g. thermostat contacts open) the pump can be periodically turned on for 30 seconds in order to move water in heating installation. This parameter sets pause time in minutes between pump work periods. Setting this parameter to „--“ disables this function.

**Central heating pump turn off delay [Pd 2]** – central heating pump stopping too early can cause temperature rise in the boiler and cause its overheating. This parameter allows setting central heating pump turn off delay. Setting this parameter to „--“ means that the pump will be stopping without delay.

### **6.3. 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 5]** - 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.

### **6.4. Boiler overheating protection.**

**Boiler overheating temperature [A105]** - 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.

## 6.5. Additional thermostat work mode.

**Additional thermostat work mode [Fc 1]** - the controller is equipped with additional thermostat and temperature sensor connection. This parameter selects work mode of the additional thermostat and additional sensor connection.

- mode **[Fc 0]** - means that room temperature sensor is connected to the additional sensor connection. RK-2001AT2 will compare measured room temperature with temperature set with additional thermostat knob. When room temperature is lower than the desired temperature, room thermostat indicator will be lit meaning that boiler should keep temperature set with boiler thermostat knob. When room temperature reaches desired temperature, room thermostat indicator will be switched off and boiler enters fire keeping mode at minimum boiler temperature. Device design allows for connecting any external contact thermostat in place of room temperature sensor. Shorting the contacts when temperature is low will start the heating procedure described above. When contacts are open, the controller will keep minimum boiler temperature. **Attention!** When external thermostat is connected in place of room temperature sensor, the temperature set with room thermostat knob on the device will not affect the controlling process and room temperature will depend solely on temperature set on external contact thermostat.

- mode **[Fc 1]** - means that exhaust gas temperature sensor is connected to the additional sensor connection. In this case the value set with additional thermostat knob specifies desired exhaust gas temperature. If the controller is in WORK mode and boiler water temperature has reached value set with [P 65] parameter, then exhaust gas temperature drop below temperature set with additional thermostat knob will stop the fan. If central heating pump is in [Pr 1] mode, the pump will also stop in this case. Additionally, if exhaust gas temperature is below desired temperature, this will also be signaled with quick blinking of thermostat indicator.

## 6.6. High exhaust gas temperature protection .

If exhaust gas temperature sensor is connected to additional input ([Fc 1]), the controller can protect from too high exhaust gas temperature. Next two parameters control this function.

**Maximum exhaust gas temperature [F300]** – this parameter controls maximum temperature which exhaust gas is allowed to achieve. If exhaust gas temperature is higher than programmed value, the controller displays [Hot ] and turns off the fan. Normal work resumes after the temperature drops by value of hysteresis. Setting this parameter to „---“ turns off high exhaust gas temperature protection.

**Maximum exhaust gas temperature hysteresis [Fh20]** – this parameter describes how much exhaust gas temperature should drop in relation to maximum temperature for the controller to stop [Hot ] alarm and resume normal work.

### **6.7. Fuel shortage testing.**

If central heating installation is equipped with exhaust gas temperature sensor ([Fc 1]), then fuel shortage testing starts when exhaust gas temperature falls below temperature set with additional thermostat knob. If there is no exhaust gas temperature sensor ([Fc 0]), then fuel shortage testing starts when boiler water temperature falls below value of [L 65]. If temperature tested during fuel shortage testing stays below threshold for specified time, the controller will stop regulation process and will show [FUEL] message on the display. This alarm can be erased with STOP button.

**Fuel shortage testing time during boiler start [Fd60]** – time set with this parameter is used when testing fuel shortage during boiler start. Boiler is considered starting from the time when the controller is switched from STOP mode to WORK mode and ends when boiler temperature reaches minimum temperature (set with [L 65] parameter). Setting [Fd60] parameter to „-“ disables fuel shortage checking during boiler start.

**Fuel shortage testing time in work mode [Fb30]** – time set with this parameter is used when testing fuel shortage after boiler has started. Setting this parameter to „-“ disables fuel shortage checking in WORK mode.

### **6.8. Additional output.**

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

- **[Ar 0] mode** - output may control 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 the solid fuel boiler is used to cut heating costs. After erasing no fuel alarm by pressing STOP button, the additional boiler is again turned off and the controller works again.

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

- **[Ar 2] mode** - output may control boiler emergency cooling system (e.g. pump). In this mode the additional output is turned on in case of boiler overheating or boiler temperature sensor error alarm.

- **[Ar 3] mode** - output may control devices working together with blow-in fan.

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

## 6.9. 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. 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, the alarm signaling system or the mixing valve servo-motor on (if the additional module is connected).

## 6.10. 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.

## 6.11. 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.

## 7. 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). **[E 8]** error on the display indicated malfunction in exhaust gas sensor circuit. In this case the controller disables exhaust gas thermostat (it will behave as if exhaust gas temperature was always higher than temperature set with additional thermostat knob).

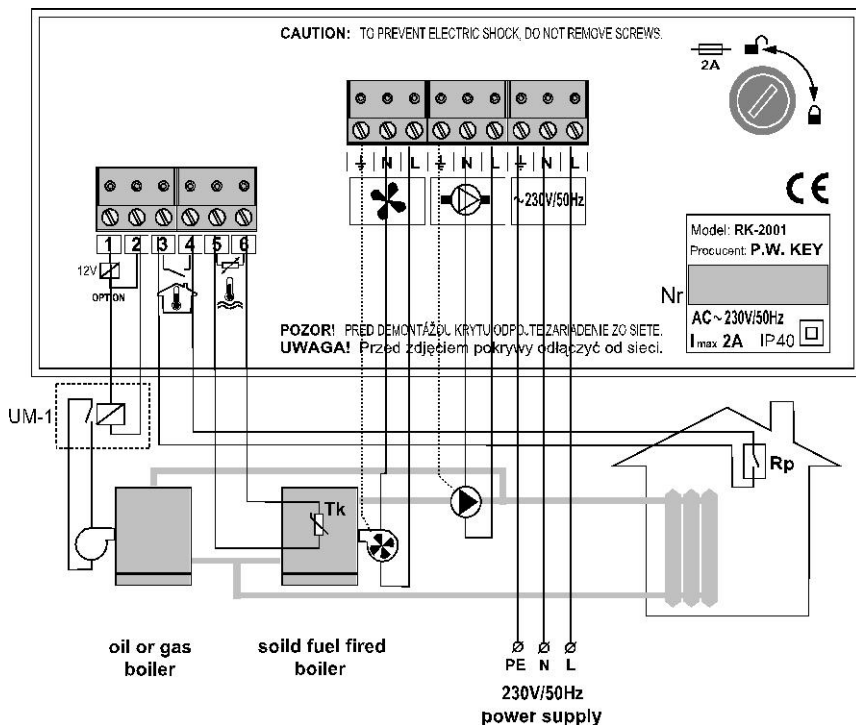
## 8. Device removal.

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

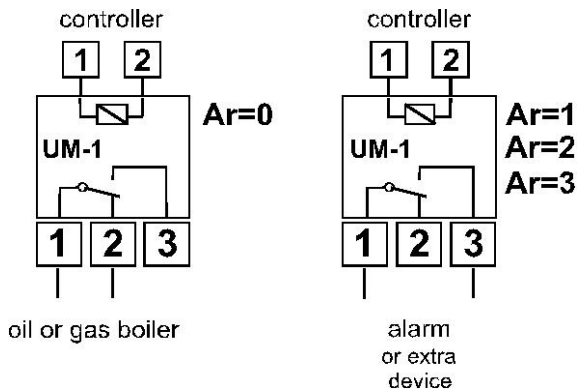
- turn the master switch off,
- disconnect the power of the boiler,
- remove the controller from the slot in the boiler,
- disconnect all connectors with cords from the controller.

## 9. Specifications.

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



Picture 2. RK-2001AT2 connection scheme



Picture 3. UM-1 module connection scheme.

## 10. Notes.

Disp.	Parameter	User
Π100	Fan max work power or max power when Πr 0-10.	
n 40	Minimum fan power.	
Πh10	Fan speed decrease coefficient.	
Πr 1	Automatic fan speed control and time of fan start.	
Πn 5	Fan work time.	
Πu 6	Fan pause time.	
Πd 3	Fan work time in manual mode	
P 65	Central heating pump launch temperature.	
Ph 5	Central heating pump hysteresis.	
Pr 1	Central heating pump work mode: 0- automatic, 1- the pump work depends on room temperature or room thermostat contacts, 2- the pump work depends on controller work mode.	
Pc--	Central heating pump pause time.	
Pd 2	Central heating pump turn off delay.	
L 65	Minimum boiler temperature.	
H 90	Maximum boiler temperature.	
h 5	Boiler temperature hysteresis.	
A105	Boiler overheating temperature.	
Fc 1	Additional thermostat work mode: 0 - room thermostat, 1 - exhaust gas thermostat.	
F300	Maximum exhaust gas temperature.	
Fh20	Maximum exhaust gas temperature hysteresis.	
Fd60	Fuel shortage testing time during boiler start.	
Fb30	Fuel shortage testing time in work mode.	
Ar 0	Work mode of extra output: 0- output turning on extra boiler, 1- alarm output, 2- output controlling emergency cooling system, 3- output controlling extra devices turning on during work of blow-in fan.	



Producer:

P.W. KEY

11-200 Bartoszyce, ul. Bohaterów Warszawy 67

tel. (89) 763 50 50, fax. (89) 763 50 51

[www.pwkey.pl](http://www.pwkey.pl) e-mail: [pwkey@onet.pl](mailto:pwkey@onet.pl)