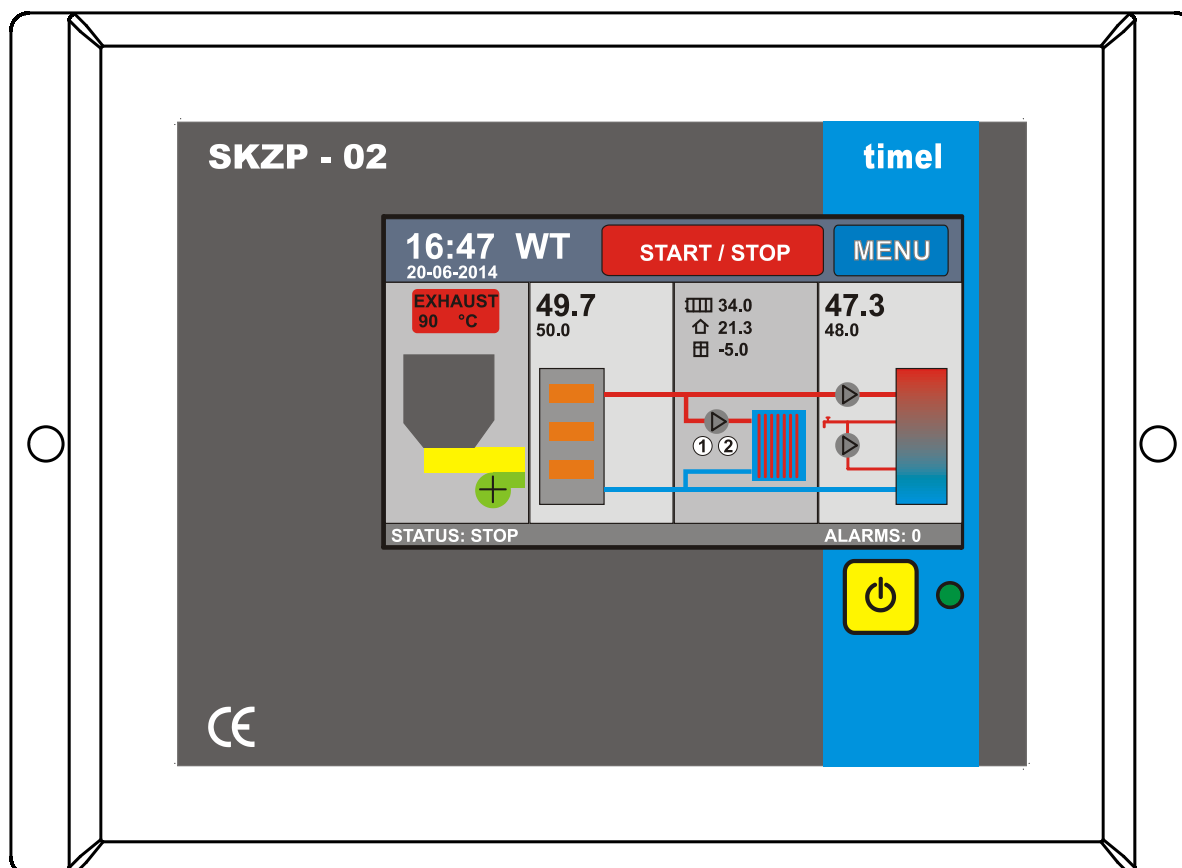# USER MANUAL REV. 1.60

## SKZP-02 CONTROLLER FOR BOILERS WITH FEEDER



**CAUTION!**

**PLEASE READ THE USER MANUAL CAREFULLY BEFORE INSTALLATION**

**CAUTION!**

**INSTALLATION OF THE CONTROLLER DOES NOT RELEASE THE USER FROM RESPONSIBILITY TO INSTALL THE SAFETY DEVICES INCLUDING SAFETY VALVES, COOLING VALVES ETC.**

 **Electrical equipment - do not dispose of with household waste.**

**Return the device to the manufacturer or to the electrical and electronic waste collection point.**

# CONTENTS

## DESCRIPTION AND INTENDED USE

SKZP-02 controller is a universal controller compatible with boilers with a screw feeder. The controller automates and monitors fuel combustion process, controls boiler temperature, return temperature, central heating temperature, domestic hot water temperature, room temperature and is compatible with a weather compensation unit.

The controller features an advanced design with high-efficiency 32-bit ARM microprocessor, 4.3" colour touch screen, heat emitter synchronization system and an intuitive user interface.

System features:

- advanced touch interface with 4.3" colour touch screen
- advanced ARM processor
- accurate temperature measurement with 12-bit ADC
- flue gas temperature measurement with PT-1000 sensor (optional)
- built-in room thermostat (optional)
- built-in weather compensation unit (optional)
- mixing valve control in the central heating system
- return temperature protection
- domestic hot water monitoring with or without priority
- fuel consumption meter
- stepless forced draught fan control
- two central heating and one domestic hot water pump control
- hot water circulating pump control
- built-in timer for room temperature control, domestic hot water control and circulating pump control
- event log
- built-in administrator mode to prevent unauthorized access
- burner modulation system
- non-volatile settings and parameters memory
- performance chart recorder for the last 12 hours of operation

**CAUTION! DISCONNECT POWER SUPPLY BEFORE INSTALLATION - RISK OF ELECTRIC SHOCK!**

**INSTALLATION IS TO BE CARRIED OUT BY AUTHORIZED PERSONNEL ONLY.**

**MECHANICAL**

The controller is available with metal angles for direct mounting on the boiler. Fasten the controller to the boiler with four sheet metal screws.

**ELECTRICAL**
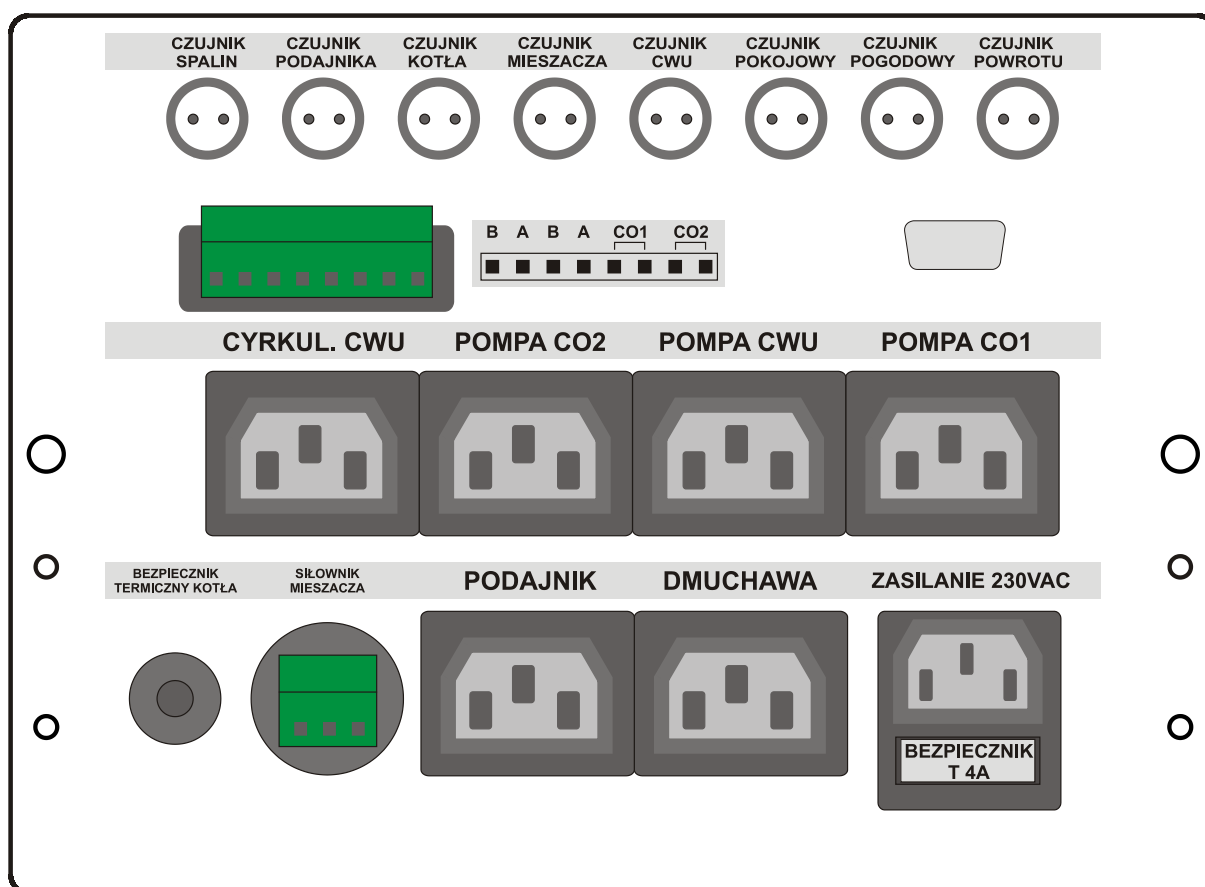


**CONNECTING PUMPS, FEEDER AND FAN**

Connect all accessories on the back panel.

Standard C13 - C14 type outputs are available (i.e. computer cables).

If the pump cable type is different than C13, use standard computer cable or use the included C14 connectors. Connect the following cables on the pump side:

**CABLE COLOUR CODES:**

blue – **N**,        brown – **L**,        green-yellow - **EARTHING**

**SENSORS:**

The sensors are not suitable for immersion in liquids. Ensure good contact between the metal sensor tip and the measured surface.

Use copper or aluminium tape to increase the sensor diameter, if necessary.

**Boiler temperature sensor** – installed in a dedicated sensor pocket on the boiler. The measuring circuit is usually located at the top near the feed water outlet. ***Make sure the sensor is installed correctly!***
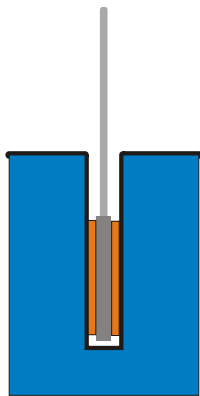


 Correctly installed boiler sensor. Sensor surface contacts the sensor pocket walls. Copper tape wound around the sensor.

**Feeder temperature sensor** – installed on the screw feeder. The feeder temperature sensors are usually installed in a dedicated sensor pocket. The sensor monitors feeder temperature. When the temperature rises over 70°C, the feeder is activated for a time set on EXTINCTION screen – EMBERS MOVING TIME parameter to move the embers to the firebox. It prevents accidental fuel fires. A feeder overheat alarm is generated. The controller switches to EXTINCTION mode, feeds the fuel and switches to STOP mode. Audible alarm is generated.

**Domestic hot water temperature sensor -** installed in the sensor pocket of the hot water storage tank.

**PT-1000 sensor (flue gas temperature sensor)** – flue gas temperature measurement. Installed at the flue gas outlet (breeching). Install the sensor inside the breeching. Drill a hole corresponding to the sensor diameter (5 mm) and install the sensor in the hole. The flue gas must contact the sensor directly. Insert the metal tip only up to the shoulder.

**Room temperature sensor** – room temperature measurement. Available in a wall mounted enclosure. Installed inside the room at a height of approx. 1.5 metre. Avoid direct sunlight and draughts. Use 2-conductor cable to connect the room temperature sensor and the controller. Connect the conductors in any order.

**Weather compensation unit** – outside temperature measurement. Install outside the building. Avoid direct sunlight and rain. Use 2-conductor cable to connect the room temperature sensor and the controller. Connect the conductors in any order.

**Central heating system temperature sensor -** installed on the central heating supply line downstream of the pump. Monitors central heating system temperature, with mixing valve (3 or 4-way valve) determines the system feed temperature.

**Return temperature sensor** – installed on the return line as close to the boiler as possible.

**Thermal cut-off (STB)** – cuts off fan and feeder power supply at increased boiler temperature >95°C. Installed with the boiler temperature sensor or at the hot water outlet (feed water). Ensure good contact with the outlet duct. Use copper or aluminium tape to change the sensor diameter. Power supply is restored after the temperature drops below 80°C.

**Caution! STB thermal cut-off must be installed to protect the system against overheating in case of a controller failure or other unforeseeable circumstances. It cuts-off power supply to the feeder and fan, independently from the controller.**

**POWER CABLE**

The controller is delivered with a 1.8 m power cable. Connect the cable to an earthed 230 V mains power socket. Maximum power input is 4A. The controller requires approx. 5 W, the rest is the total power input of connected auxiliary devices (pump, fan, mixer actuator and feeder)

**FUSE**

Time-lag 4A fuse is used. The fuse is installed in a fuse holder below the power cable. Disconnect power cable, open the fuse holder (BEZPIECZNIK T4A), remove the fuse and replace with the same type.

## EXAMPLE WIRING DIAGRAM
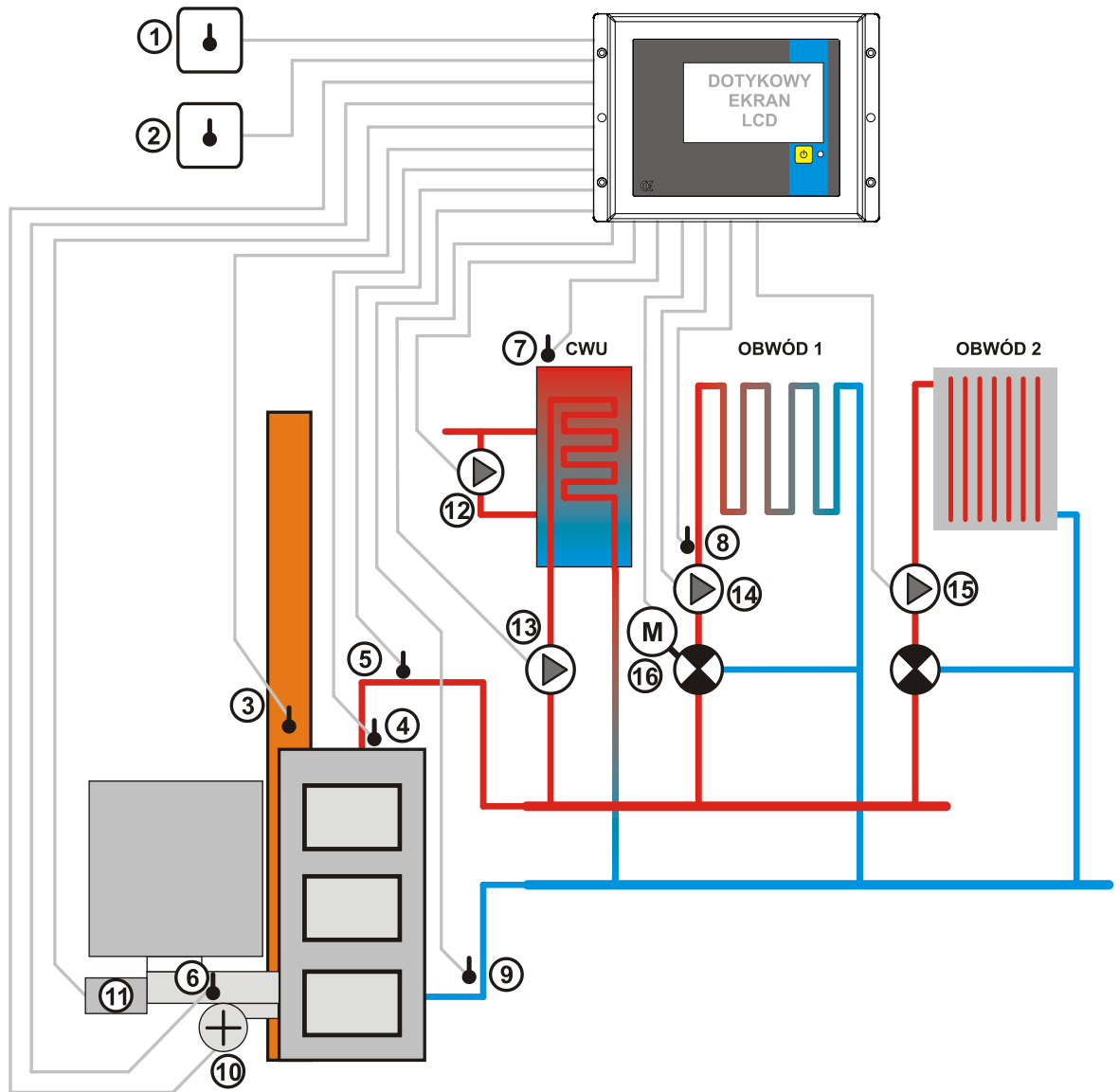


1. Room temperature sensor
2. Weather compensation unit sensor
3. Flue gas temperature sensor PT-1000 (breeching)
4. Boiler temperature sensor
5. Thermal cut-off
6. Feeder temperature sensor
7. Domestic hot water temperature sensor
8. Central heating temperature sensor (mixing valve)
9. Return temperature sensor
10. Fan
11. Screw feeder motor
12. Hot water circulating pump

13. Hot water charging pump
14. Central heating system 1 pump
15. Central heating system 2 pump
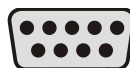16. Mixing valve actuator

## SIGNAL TERMINAL
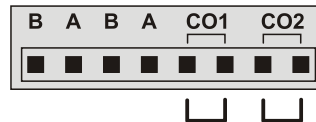
B,A – auxiliary equipment via RS485 interface

CO1, CO2 – permission for pump operation. Closed - pump on, open - pump off. Connect the external room thermostat with normally open contact, voltage-free.

## RS232 CONNECTOR

RS 232 connector for controller software updates. Use RS232 cable with 1:1 connection (extension cable) for software updates. USB to RS232 adapter cables are available. Software update procedure, see the update file.

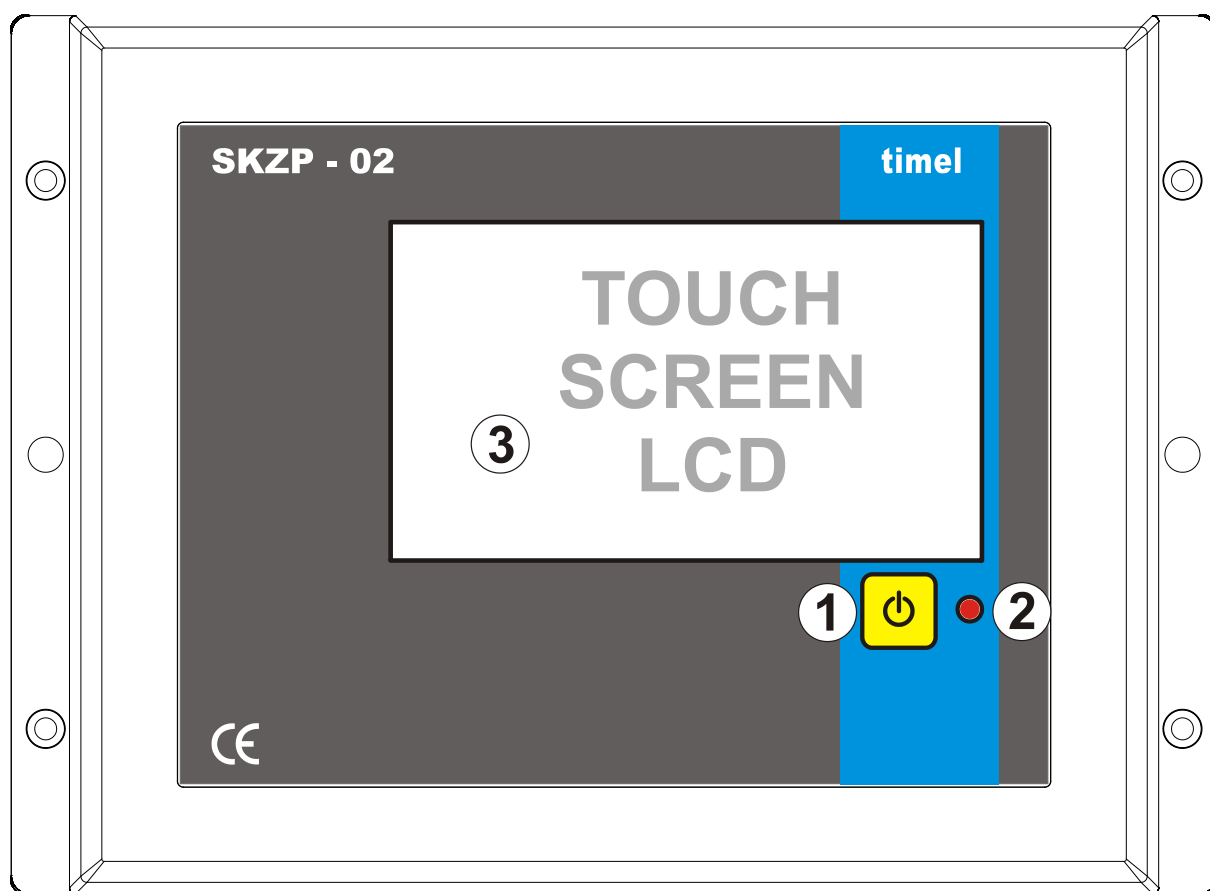## MIXING VALVE ACTUATOR

**Z N O**

Z – closing    N – neutral    O – opening

Use 3-point mixer valve actuator, e.g. AFRISO ARM 343.

Pull the green plug out of the enclosure with pliers, connect the cables and push in.

1. Controller ON/OFF switch
2. Power light, green - controller ON, red - controller OFF
3. Touch screen

## TURNING CONTROLLER ON/OFF

Press [⏻] on the controller to turn it on. The following screen is displayed:

| | QUIT |
|---|---|
| **TURN ON ?** | |
| **TURN ON** | |

Press **TURN ON** to switch the controller ON or press **QUIT** to cancel.

Press [⏻] on the controller to shut-down the burner. The following screen is displayed:

| | QUIT |
|---|---|
| **SHUT DOWN?** | |
| **TURN OFF** | |

Press **TURN OFF** to switch the controller OFF or press **QUIT** to cancel.
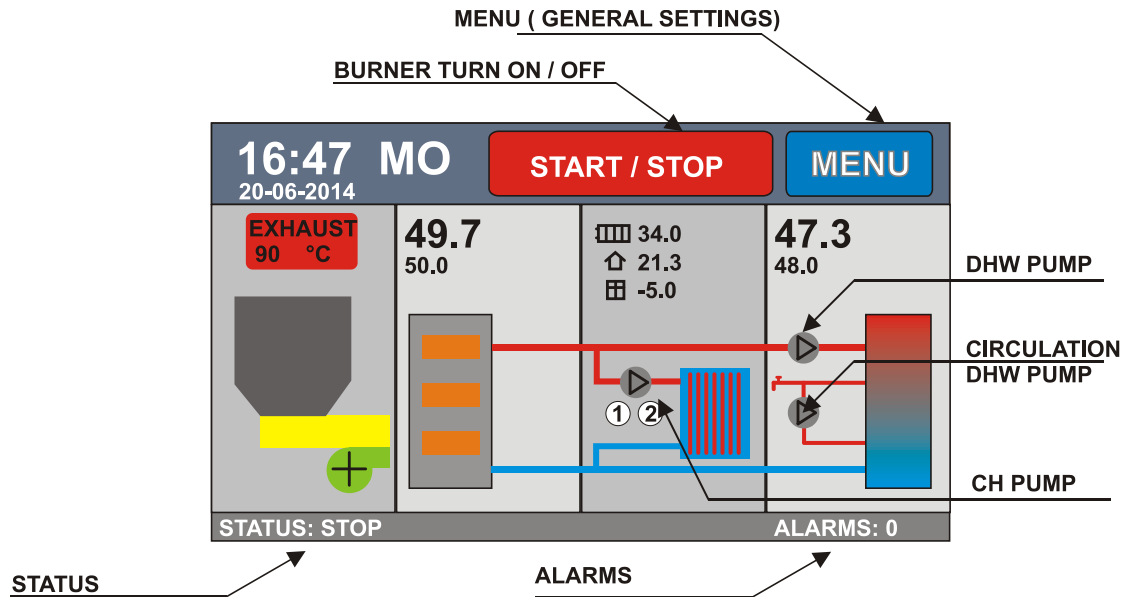
The controller stores the settings and restores the last state after power on.

The controller turned off using this procedure will turn on in STOP mode.

The embers maintain the temperature for many hours, and when the controller is disabled for maintenance it is not necessary to start-up the boiler again.

After a short controller off period and with embers still glowing, in **START** menu press **AFLAME** to resume normal operation.

MENU ( GENERAL SETTINGS)

BURNER TURN ON / OFF



DHW PUMP

CIRCULATION
DHW PUMP

CH PUMP

STATUS

ALARMS

The main screen consists of 4 panels (BURNER, BOILER, CH, DHW). Touch panel to access available settings. Press BURNER panel to open burner parameters screen. Press button (e.g. menu) to activate.

Press **START / STOP** - Open burner START/STOP screen

Press **MENU** - General settings screen.

Press [⏻] - Controller ON/OFF or return to main screen.

## CHANGING AND STORING PARAMETERS

The controller uses a non-volatile memory to store all parameters.

Green **SAVE** button is available in each parameter screen. If the parameter value has changed, the button colour changes to red. Press **SAVE** to store new value. Press **QUIT** to exit without any changes. Previous settings are restored.

NO PARAMETER CHANGE (GREEN)

**BOILER**　　　QUIT　　SAVE

NEED TO SAVE (RED)

**BOILER**　　　QUIT　　SAVE
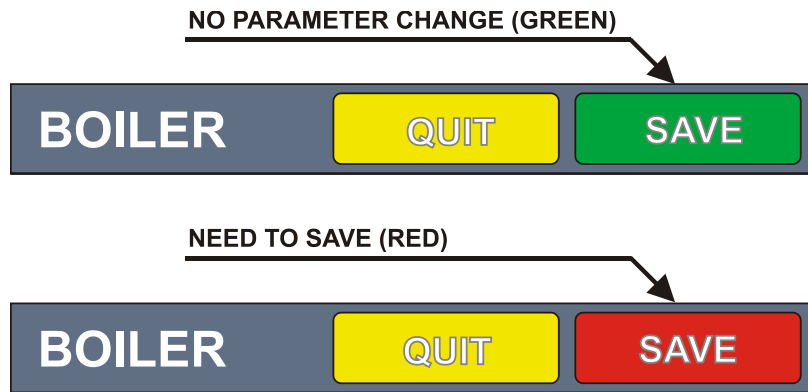
Combustion parameters and event log are stored automatically.
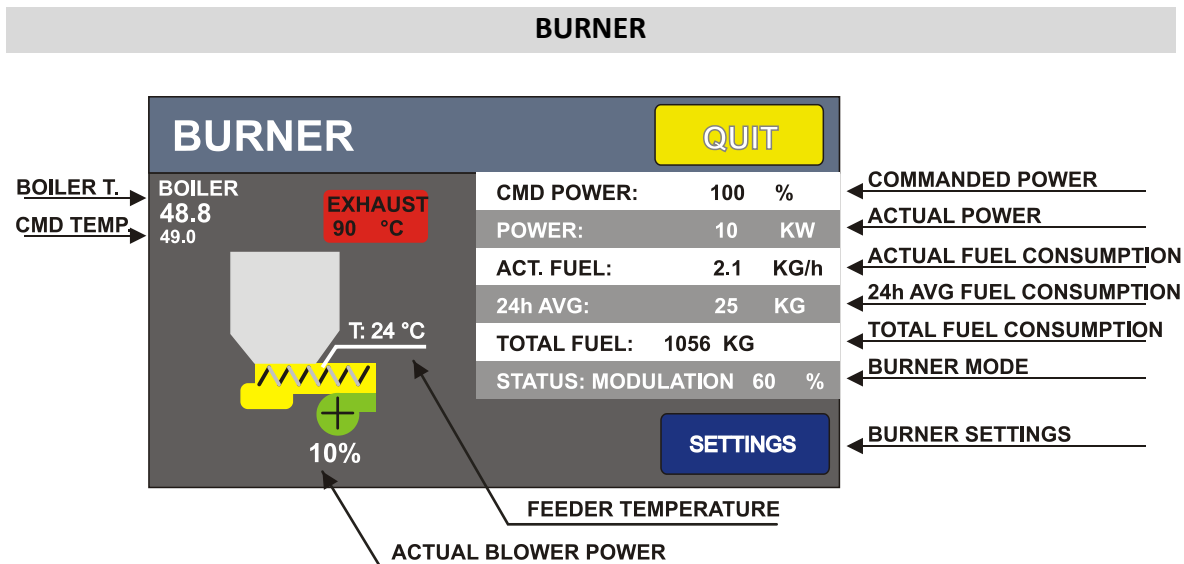
Graphic symbols in the burner screen. Graphic symbols in the burner screen are used for visualization of the system operation. E.g. during fan operation, the graphic representation of the fan rotates.

Set and current boiler temperature and flue gas temperature are also displayed.

Parameters:

- CMD POWER – permissible allowable power set in MODULATION menu
- POWER -  actual burner power (stabilization and modulation)
- ACT. FUEL -  actual fuel consumption per hour
- 24h AVG - average fuel consumption per 24 hours
- TOTAL FUEL -  total fuel consumption from last reset (no reset at power off) - reset via MENU - DEFAULTS – RESET USED FUEL CNTR
- STATUS – burner operation mode (stage)
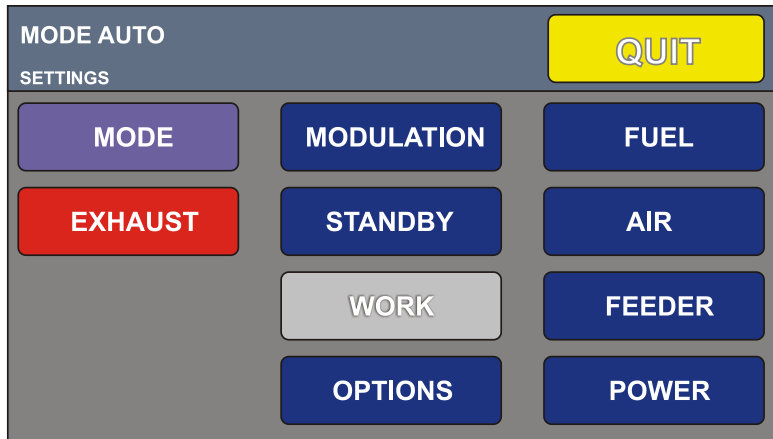
The following stages are available:

1. *LIGHTING* – boiler start-up procedure.
2. *MODULATION* – (automatic mode only) burner power is adjusted to the heat demand. The power is determined based on the following parameters: MODULATION -> MIN POWER to MODULATION -> MAX POWER.
3. *WORK* – (interval mode only) - WORK and STANDBY menu settings are used.
4. *EXTINCTION.* Boiler shut-down procedure. The feeder continues operation to move the embers to the firebox.

Other available modes: STOP and STANDBY.

*STOP* – burner stopped. E.g. emergency or burner not started.

*STANDBY* – preset temperature exceeded for time set in SETTINGS - MODULATION menu. If the minimum boiler temperature is reached, the controller switches to MODULATION mode.

**BURNER - SETTINGS**

| | | |
|---|---|---|
| **MODE AUTO** SETTINGS | | QUIT |
| **MODE** | **MODULATION** | **FUEL** |
| **EXHAUST** | **STANDBY** | **AIR** |
| | WORK | **FEEDER** |
| | **OPTIONS** | **POWER** |

Burner parameters:

MODE

- AUTO
- MANUAL
- FEEDER  - ACTIVE or STOP (for emergency grating only)

EXHAUST

- ENABLE SENSOR – flue gas temperature sensor enabled/disabled. Turn off to disable flue gas temperature monitoring.
- MAX EXHAUST TEMP. IN MANUAL MODE – set maximum flue gas temperature. The controller will reduce the boiler power not to exceed set value, even if the boiler temperature is not reached. Do not set the value too low. Otherwise the set boiler temperature will not be reached.
Flue gas temperature limit can be used in the interval mode only. Optimum flue gas temperature is selected in automatic mode.

MODULATION (automatic burner power modulation)

- MIN POWER – minimum power maintained by the controller in modulation mode (%)
- MAX POWER – maximum burner power (%)
- OVERHEATING MAX TIME – time to switch to standby mode after the boiler temperature is exceeded.

STANDBY

- PAUSE TIME – time between blowdown in standby mode
- BLOWER TIME – forced draught duration in standby mode
- AIR – forced draught air volume in standby mode
- FEEDING TIME – feeder time in standby mode

WORK (interval mode only)

- FEEDING TIME – feeder time (fuel feeding)
- PERIOD – interval between fuel feeding
- AIR – forced draught air volume

OPTIONS

- EMBERS MOVING TIME – time to **NO FUEL** alarm if the controller cannot reach set boiler temperature.
  Time starts when the boiler temperature is lower than set temperature by 3 degrees.
  If the flue gas temperature sensor is available, the time starts when the boiler temperature is lower than set temperature by 3 degrees and the flue gas temperature increases.
  The controller switches to STOP mode.

FUEL

- CALORIFIC VALUE – enter fuel calorific value in kWh/kg or MJ
- FUEL CORRECTION – fuel quantity correction. Add to increase fuel quantity (e.g. 10%), subtract to decrease fuel quantity (e.g. -10%).

POWER

- POWER – set boiler power in KW (e.g. 19 KW)

AIR

- MINIMAL AIR – forced draught air volume at maximum power
- MAXIMAL AIR – forced draught air volume at minimum power

FEEDER

- EFFICIENCY – hourly feeder output. If the feeder output is not known it can be determined experimentally.
  It is usually 15 kg/h for up to 30 kW boilers. Enter correct value to display accurate fuel consumption.

## AUTOMATIC MODE

The controller in automatic mode modulates the burner power to achieve set boiler temperature. The power can change within the range set in **MODULATION** menu – MIN POWER and MAX POWER parameters. MIN POWER is set to maintain the glowing embers in the firebox. MAX POWER (permissible maximum power) is set depending on the heat demand. E.g. it can be reduced to 50% in the spring and summer. Set air volume in **AIR** menu.

**MAXIMAL AIR** – air volume at maximum power.

**MINIMAL AIR** – air volume at minimum power.

The air volume is set depending on the fuel type, boiler type and natural draught. Select air volume to obtain light orange flame. Very light flame, pea coal sintered - reduce air volume. Red flame, black sot - increase air volume.

Set the calorific value (**FUEL** menu), feeder output (to ensure correct operation time) and boiler power for the boiler to determine correct fuel quantity.

The boiler maintains set temperature in automatic mode. Boiler temperature will fluctuate above and below the set value. **OVERHEATING MAX TIME** parameter is available in **MODULATION** menu. The parameter determines time to switch to standby mode when the boiler temperature is exceeded (by 0.2°C).

## MANUAL MODE

All parameters for manual mode can be set in WORK menu.

The boiler uses standard settings (feeding time, interval time and forced draught). The controller switches to standby mode after the set boiler temperature is reached (+0.3 degree hysteresis). The controller switches to normal operation mode after the temperature decreases below set value.

Select feeding time 3x lower than the interval time.

E.g. set feeding time to 6 seconds and interval time to 18 seconds; with a correctly set feeder output and fuel calorific value, the controller will display accurate power and fuel consumption.
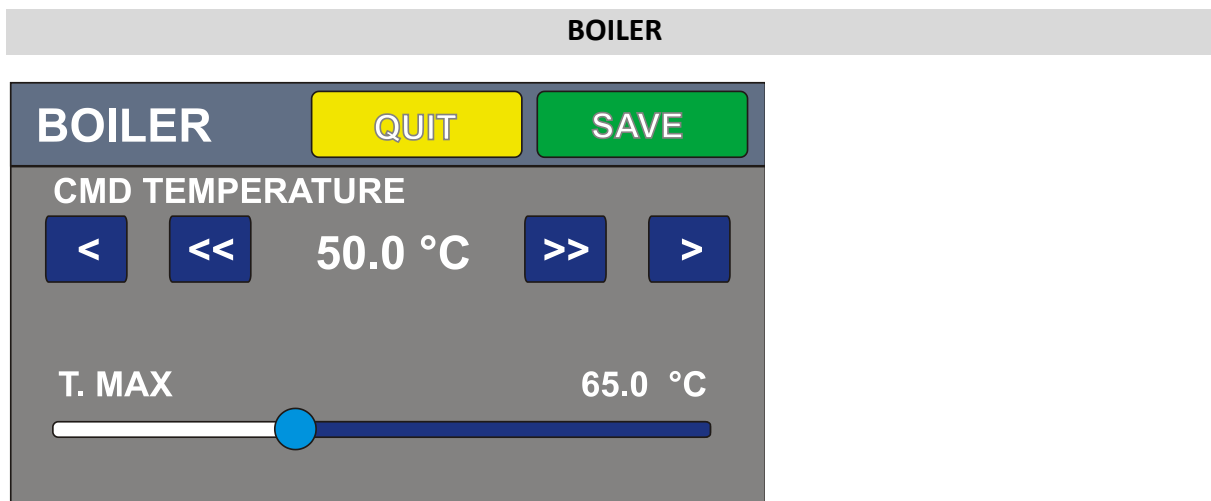
CMD TEMPERATURE – set boiler temperature. Press < << >> > to change temperature.

T. MAX - maximum permissible boiler temperature (enter administrator password to change). The controller switches to standby mode after the maximum temperature is reached.
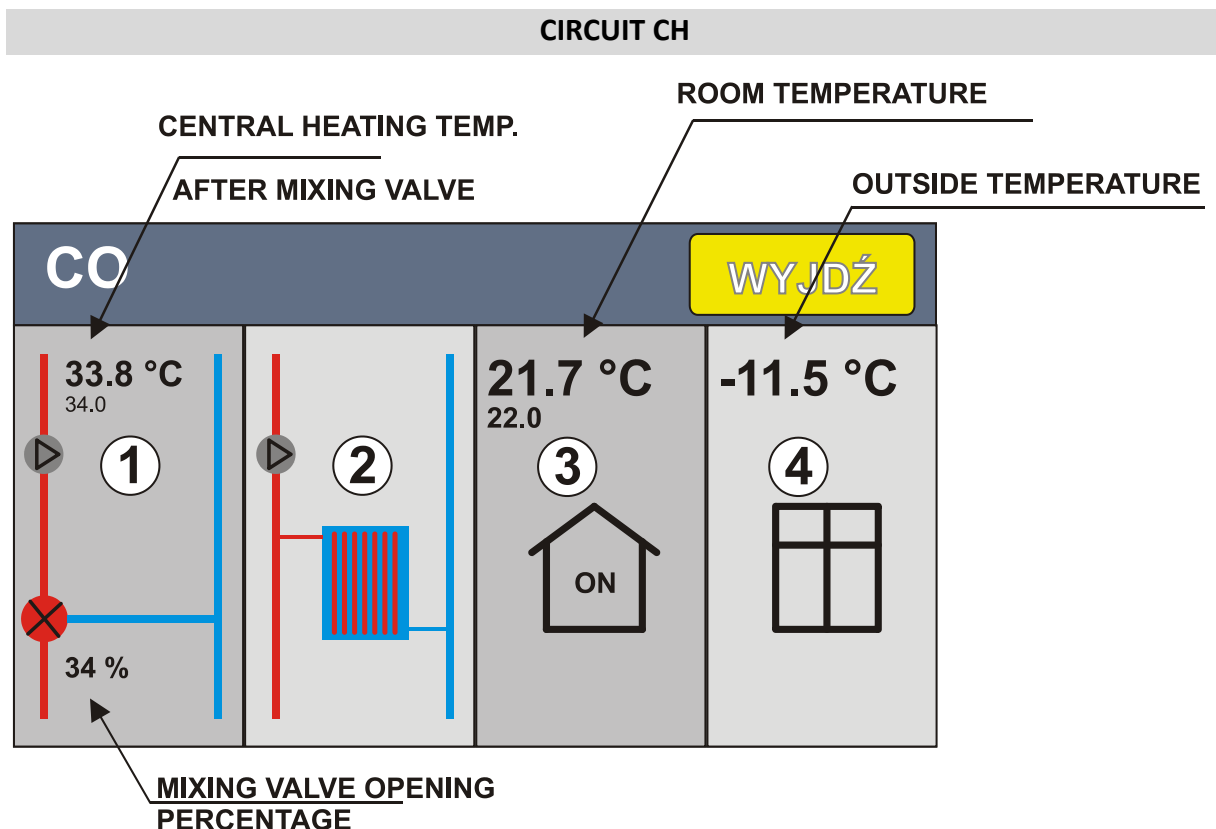
Boiler temperature is also displayed on the main screen:
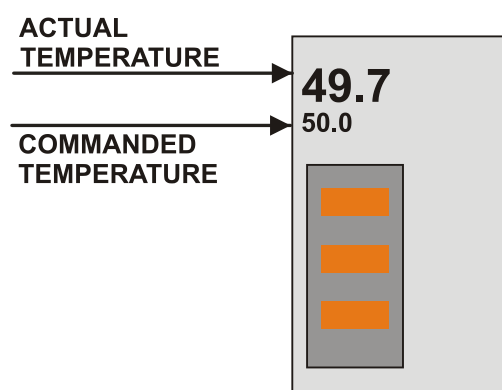


Actual and set temperature are displayed.

If set temperature value is red, the boiler temperature has been increased for domestic hot water heating.

If set temperature value is blue, the boiler temperature has been corrected by the weather compensation unit.

**CIRCUIT CH**



CENTRAL HEATING TEMP.
AFTER MIXING VALVE

ROOM TEMPERATURE

OUTSIDE TEMPERATURE

MIXING VALVE OPENING
PERCENTAGE

1. CENTRAL HEATING CIRCUIT 1 PANEL (PUMP, MIXING VALVE)
2. CENTRAL HEATING CIRCUIT 2
3. BUILT-IN ROOM THERMOSTAT (OPTIONAL)
4. BUILT-IN WEATHER COMPENSATION UNIT

The controller controls two central heating pumps and one domestic hot water mixing valve. The CH1 circuit temperature can be determined based on the room temperature. The temperature is controlled by changing the mixing valve settings. When the mixing valve is not installed, the temperature is controlled at the pump only.

CH1 CIRCUIT VARIANTS:

1. Mixing valve, built-in room thermostat.
   The system controls the mixing valve to reach the temperature calculated for the CH circuit.
   CH circuit temperature is calculated based on the difference between set and actual temperature.

2. Mixing valve, built-in room thermostat disabled (MODE -> OFF)
   The mixing valve maintains constant temperature in the CH circuit set in
   - MIXER -> CMD TEMPERATURE – base CH circuit temperature

   CH circuit pump can be controlled by a standard room thermostat with a make-brake contact (voltage-free).

3. No mixing valve, room thermostat enabled (built-in).
   The system maintains set room temperature by controlling CH1 pump operation.

4. No mixing valve, built-in room thermostat disabled (MODE -> OFF)
   The CH1 circuit pump can be controlled by a standard room thermostat with a make-brake contact (voltage-free).



**CH1 CIRCUIT SETTINGS**

**TEMPERATURES**

- CMD TEMPERATURE – base CH circuit temperature, e.g. 30°C for floor heating, 45°C for radiators
- T. MIN -  minimum CH circuit temperature
- T.MAX – maximum CH circuit temperature

**PUMP CH**

- TURN ON PUMP TEMP. – boiler temperature required to activate the CH pump
- ALWAYS ON – if enabled, the pump will not be activated after set room temperature is reached (mixing valve only)

**MIXER**

- **OPENING TIME** – time to full opening of the mixing valve (see rating plate)
- **GAIN** – set the CH circuit temperature calculation method with built-in room thermostat
  *CH CIRCUIT TEMP>=*
  *SET TEMP. + (SET ROOM TEMP.  –  ACTUAL ROOM TEMP.)\*GAIN*
  The higher the gain value, the more the mixing valve reacts to the changes in room temperature.
  E.g. SET TEMP. of the CH circuit = 30°C, ACTUAL ROOM TEMP. =  20°C, SET ROOM TEMP. = 22 °C. GAIN = 3.

The circuit temperature is:  30 °C +  2 * 3  = 36°C.

- **ACTIVE** – set to 1 if the mixing valve is installed.
- **CLOSE WHEN PUMP OFF –** closes the mixing valve if the pump is disabled (prevents natural flow of the heat to the heat emitters)
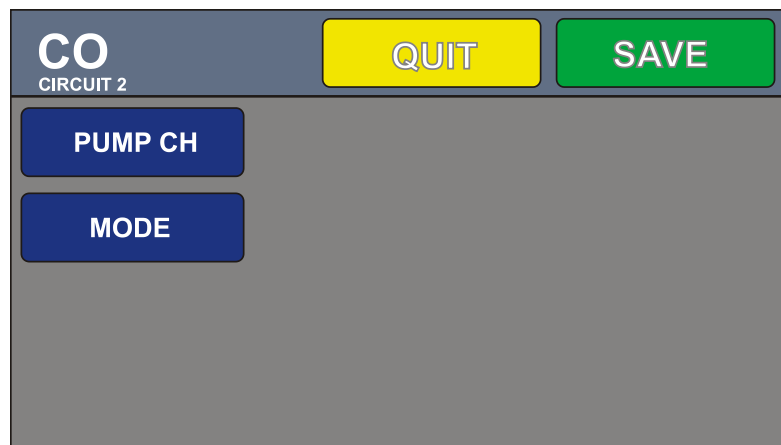
**MODE**

- **ACTIVE / STOP –** circuit ON/OFF

**RETURN PROT.**

- **MIN RETURN TEMP. –** minimum return temperature. The controller will control the mixing valve actuator to maintain set temperature. The return protection has a priority over the CH circuit temperature downstream of the mixing valve. If the return temperature is too low, the mixing valve will reduce the heat to the CH heat emitters until the return temperature increases.
- **PROTECT –** enable/disable return temperature protection.
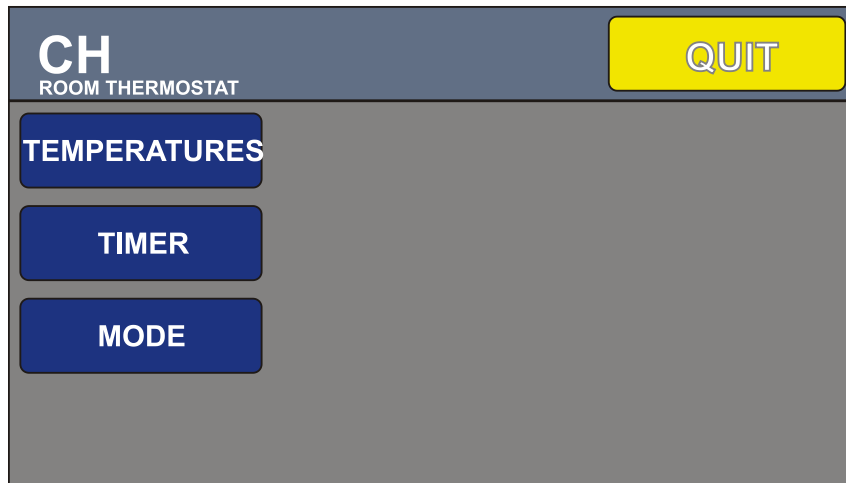
| CH2 CIRCUIT SETTINGS |
|---|



**PUMP CH**

- **TURN ON PUMP TEMP. –** boiler temperature to activate the CH2 pump

**MODE**

- **ACTIVE / STOP –** circuit ON/OFF

**CH**
ROOM THERMOSTAT

QUIT

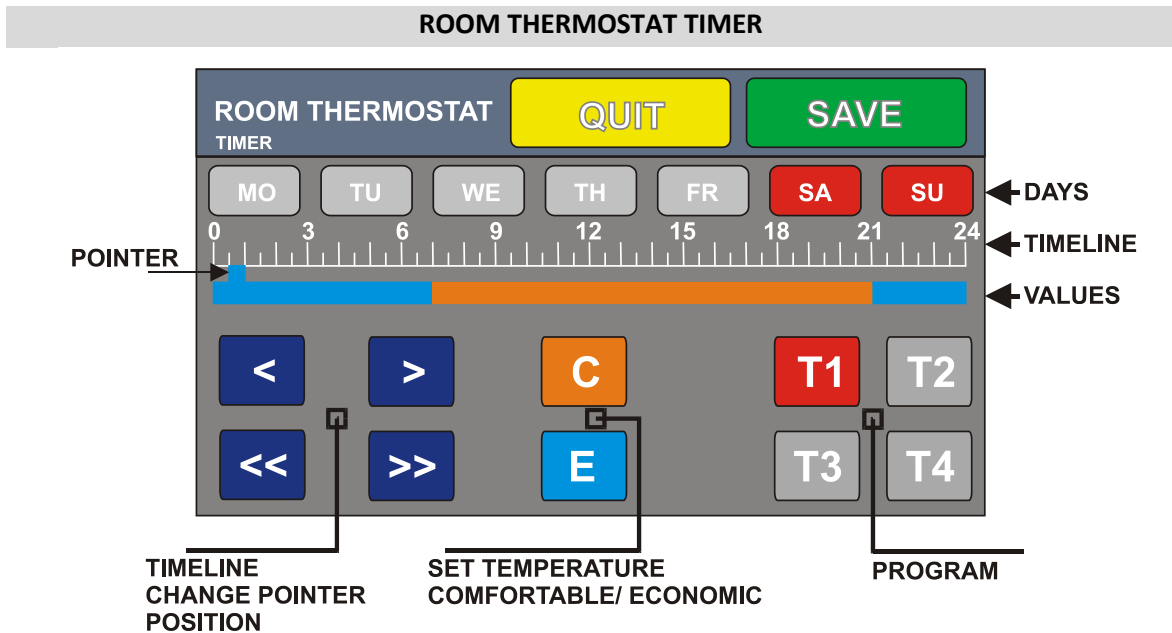TEMPERATURES

TIMER

MODE

**TEMPERATURES**

- COMFORTABLE T. – comfort temperature
- ECONOMY T. – economy temperature
- HYSTERESIS – room temperature hysteresis (+/-)

**TIMER**

- Set room temperature changes in time. Set day and time for comfort and economy temperature settings.
  *Detailed description below*

**MODE**

- ECONOMY T. - room thermostat will maintain economy temperature at all times
- COMFORTABLE T. - room thermostat will maintain comfort temperature at all times
- TIMER – operation with selected timer settings
- OFF – controller disabled

Set room temperature programs for any time or day.

Set economy (E) or comfort (C) temperature for any time or day. You can set up to 4 programs.

Press T1, T2, T3 or T4 to select program. Selected program name will turn red.

 Select hour with a slider (30 minute interval). Press C or E to set comfort (orange) or economy (blue) temperature.

Assign comfort or economy temperature setting as required. Days covered by the program are marked red.

In the illustration, the comfort temperature is set on Saturday and Sunday between 7 a.m. and 9 p.m. Economy temperature is set for the remaining times and days. Use T2 program to set temperature during working days.
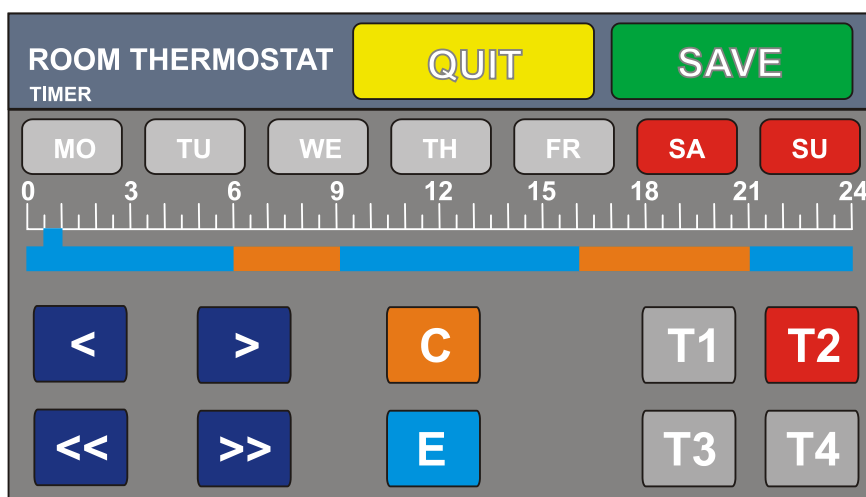
## WEATHER COMPENSATION UNIT

Built-in weather compensation unit adjusts CH circuit temperature to the outside temperature via a mixing valve or the boiler temperature settings.

Install the weather compensation unit in dry place and avoid direct sunlight.
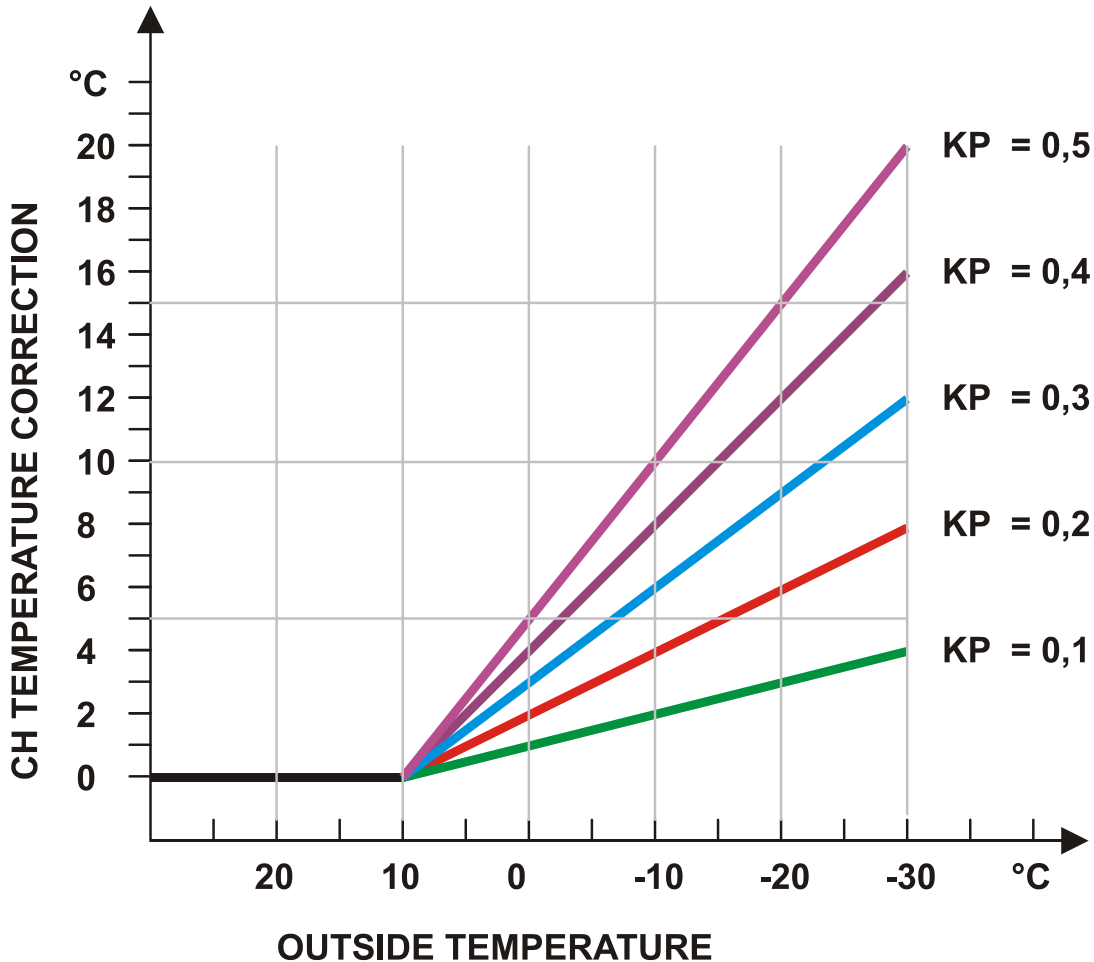


Weather compensation performance chart.

The compensation value is added to set CH circuit temperature or boiler temperature.

**WEATHER CORRECTION** – set weather compensation sensitivity, see illustration. Set to zero to disable weather compensation.

The controller monitors domestic hot water temperature. DHW pump is activated when the temperature is too low.
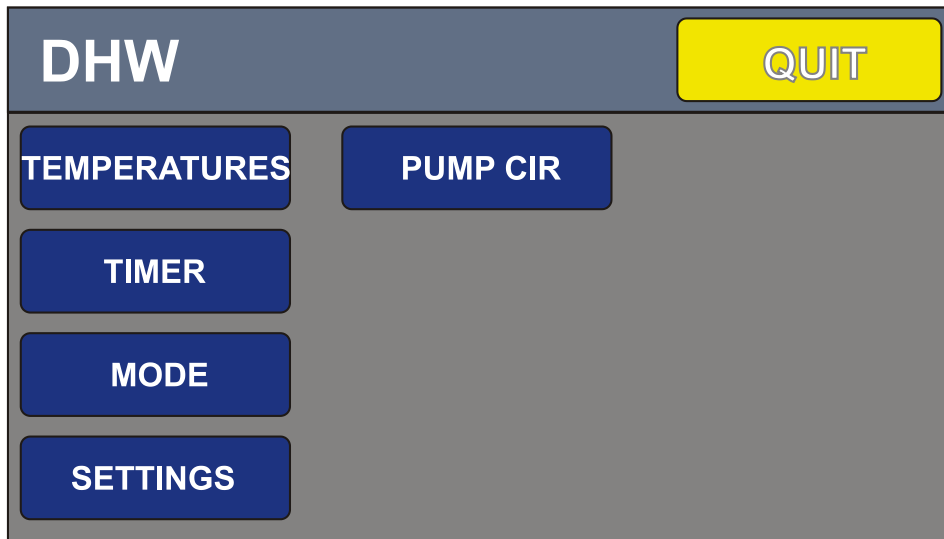


### TEMPERATURES

- CMD TEMPERATURE – set DHW temperature
- HYSTERESIS – DHW temperature hysteresis

**TIMER** operation with selected timer settings - program DHW operation hours (procedure, see room thermostat settings)

### MODE

- ALWAYS ON – DHW circuit is always enabled
- TIMER – operation with selected timer settings
- OFF – DHW circuit disabled

### SETTINGS

- DHW PRIORITY – If enabled (1), DHW circuit has a priority over the CH circuit. If the CH circuit is enabled and the DHW temperature drops, CH circuit is disabled and DHW circuit is enabled only. If disabled, the DHW circuit will not interrupt CH circuit operation.
- BOILER OVERTEMPERATURE – boiler temperature increase in relation to set DHW temperature; only if DHW heating and DHW priority are enabled.

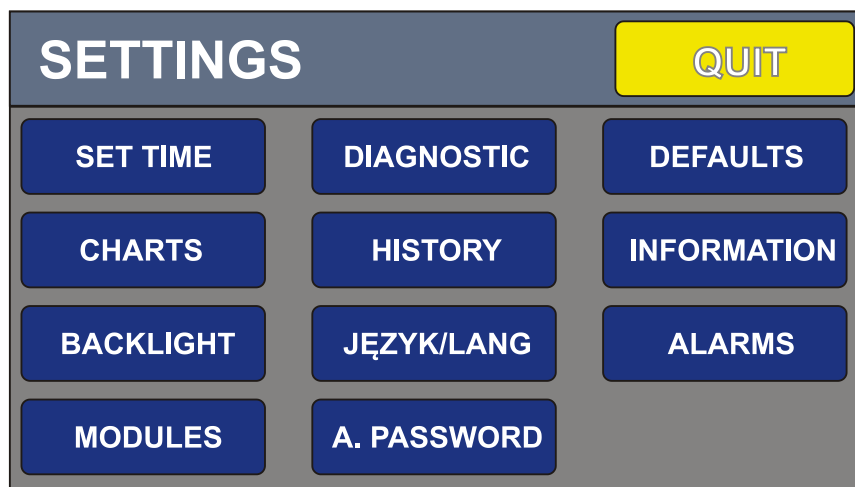**PUMP CIR** - DHW circulating pump menu
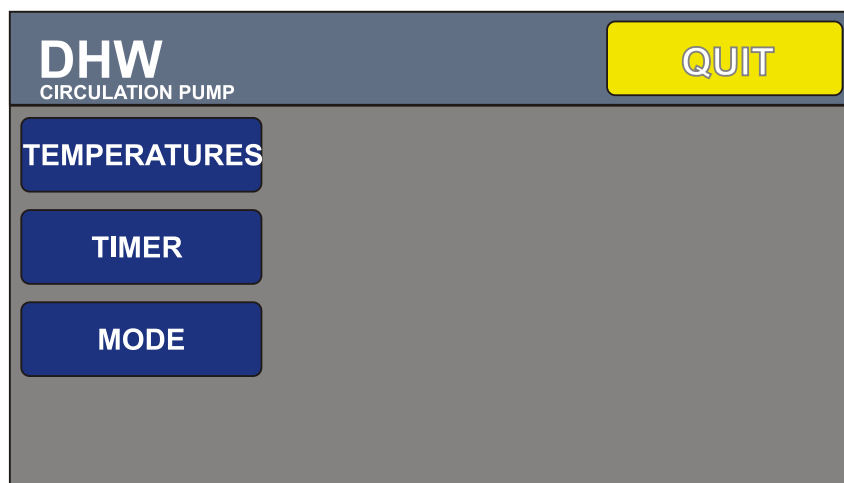
**TEMPERATURES**

- **TURN ON TEMP. –** minimum hot water storage tank temperature to activate the circulating pump
- **ALWAYS ON –** circulating pump is always on irrespective of the hot water storage tank temperature

**TIMER -** set times and days to activate the DHW circulating pump Programming method, see the DHW pump procedure.

**MODE**

- ALWAYS ON – pump always on
- TIMER – operation with selected timer settings
- STOP – pump disabled

| SETTINGS | | QUIT |
|----------|------------|-------------|
| SET TIME | DIAGNOSTIC | DEFAULTS |
| CHARTS | HISTORY | INFORMATION |
| BACKLIGHT | JĘZYK/LANG | ALARMS |
| MODULES | A. PASSWORD | |

SET TIME -  set current date and time.

**CHARTS** – boiler temperature, flue gas temperature and boiler power performance charts for the last 12 hours.

**BACKLIGHT** – LCD brightness and sleep mode. Set sleep time to zero to disable sleep mode.

**MODULES** – communication settings for expansion modules

**DIAGNOSTIC** – diagnostics screen - enable/disable devices, sensor operation status

**HISTORY** – event logs. Read only. Faults and administrator access events are logged.

**JĘZYK/LANG** – change menu language.

**A. PASSWORD** – enter password to access advanced settings

**DEFAULTS** – restore factory settings and reset fuel consumption meter

**INFORMATION** – software and controller version

**ALARMS** – Controller alarm screen. Press CLEAR to reset the alarm.

**CAUTION!   Remedy the cause of all alarms before reset.**

Start-up is manual in the pea coal boilers without an automatic igniter. Turn the feeder on to feed the fuel to the firebox. Use lighter fluid or kindling wood and start the fire. Set forced draught (it must not extinguish the flame). When the flame is stable and the embers fill the retort, switch the controller to normal operation mode.

Press [START / STOP] on the main screen.

The following menu is displayed:
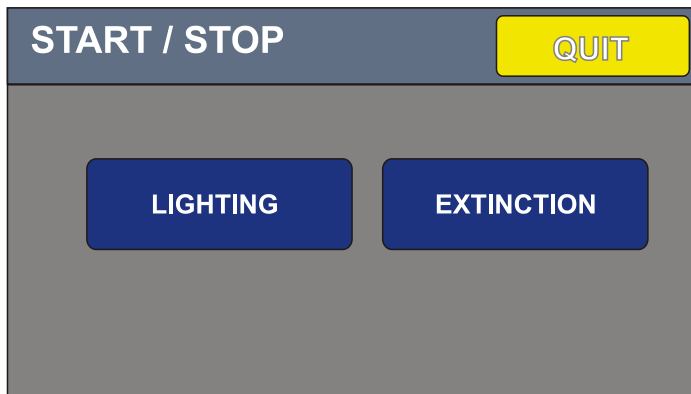


Press LIGHTING. The following screen is displayed:
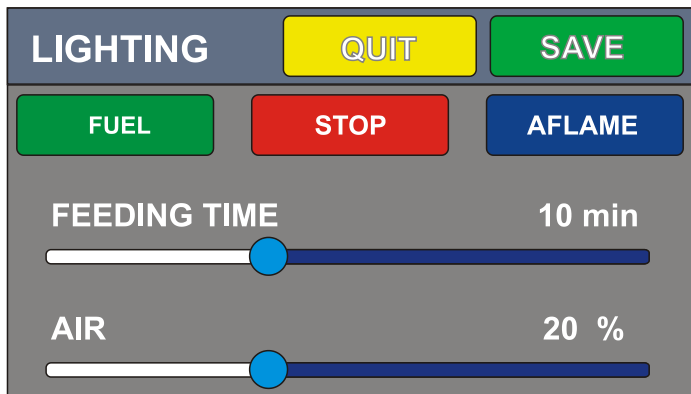


Press FUEL to feed the fuel. The feeder will operate for the time set (FEEDING TIME slider). Press STOP to stop the feeder at any time. Set force draught air volume (AIR slider). Press AFLAME when the flame is stable. The controller will start automatic operation and maintain set boiler temperature.

## STOP/SHUT-DOWN

The embers maintain the temperature in the retort for several hours. To shut-down the boiler, disable forced draught and enable feeder to move the embers to the firebox.

EXTINCTION MENU.
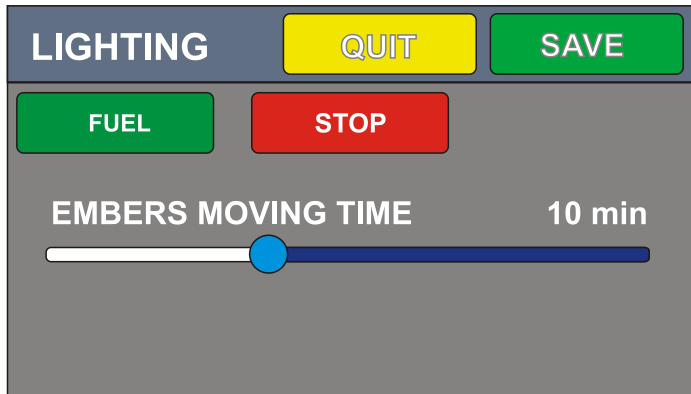


Press FUEL to activate the feeder for a time set (EMBERS MOVING TIME slider). The forced draught is disabled.

In most boilers, there is no need to move the embers after turning the controller off and the remaining fuel will burn out safely.  **CONSULT BOILER MANUAL.**

**EMBERS MOVING TIME** parameter determines feeder time after the maximum feeder temperature is exceeded (>70$^{o}$C).

## TOUCH SCREEN CALIBRATION

Calibrate the touch screen if it does not work properly.

Press  10 times in 1 second intervals to display red touch screen calibration screen. A blinking dot is displayed. Touch the dot. Two dots are displayed. Press all dots to finish calibration.

## SPECIFICATIONS

Dimensions: 200 x 160 x 75 mm

Weight: 2 kg

Power supply: AC 230 V 50 Hz

Controller power input:  <5 W

Temperature sensors: 8

Sensor type: KTY81-210 and PT-1000 (flue gas temperature sensor)

Fans: 1

Pumps: 4

Maximum fan power: 120 W

Maximum pump power: 100 W

Maximum feeder motor power: 300 W

Memory: non-volatile, no batteries required

**ADMINISTRATOR PASSWORD**

The password is required to access advanced settings. Select SETTINGS - A. PASSWORD.

Password: timel**MM**, where **MM** - minutes on the clock

 E.g. at 12:45 the password is "timel45". Press > to confirm. The administrator mode is enabled for 30 minutes. The controller switches to user mode automatically after 30 minutes.