TW-4 touchscreen 2-zone heating control

User's manual

Version: 1.4
12/12/2022

Contents

General instructions

Cautions

Read and understand this manual before assembling, starting or servicing the appliance. Incorrect wiring or use of the heating control may cause serious damages. Keep this manual for future reference.

The appliance contains sharp components which may cause injuries, therefore be very careful when performing work on the appliance.

Failure to comply with the precautions and instructions in the manual may result in serious injuries or material damages such as burns, explosions, electric shock or even death.

This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge. Children should be supervised to ensure that they do not play with the appliance. The appliance may only be used or serviced by persons who understand and follow the instructions in this manual.

Assistance or further information in connection with the appliance may be requested from the manufacturer.

Transport, storage, unpacking

- Make sure that all parts and accessories included in your order have been delivered.
- Make sure that the appliance has not been damaged and its type is the same as the type ordered.
- All appliances are shipped from the factory after testing, so if you notice any damage, please notify the transport company immediately.
- The delivery, unpacking and handling of the appliance must be carried out with special care in order to avoid possible damage. Do not use the appliance components as a handle.

Parts of the appliance consist of recyclable ABS plastic and non-recyclable electrical components. Electronic components are classified as hazardous waste and should be stored and disposed of accordingly.

Cleaning

The ABS plastic parts of the appliance may be cleaned using soft, slightly damp cloth, neutral and non-scratch detergents.

The touchscreen may only be cleaned after disconnecting from power supply, using a slightly damp, soft cloth. Be gentle as excessive pressure may cause damage to the touchscreen.

General information on heating controls

The TW heating control family

1. **TW-1** (9584): touchscreen, 1-zone, 2-point control

2. **TW-4** (9585): touchscreen, 2-zone, 2-point, can be extended on Modbus with TW-4Z2, heating and temperature data can be downloaded. Modulation control by IC-BOX.

3. **TW-4Z2 zone control** (9586): 2-zone, 2-point zone control unit, can only be programmed via Modbus, thus requires another TW-4 or TW-6 control.

4. **TW-6** (9587): Zone controls (TW-4, TW-4Z2) can be controlled via Ethernet, computer or web interface, or via separate devices (IC-BOX) using TW-6.

5. **IC-BOX** (9588): control unit mounted on the heating appliance that uses modulation (or 3-point) control on the given appliance. IC-BOX can be operated via Modbus.

TW-4 heating control main features

- Built-in 2-point 2-zone control
- 2 hours operation extension on the display or by a push button
- Display sleep mode enabling/disabling by a push button
- Setting of night (16 ℃) or safety (10 ℃) temperatures by zones
- Switching between heating or ventilating function for air heaters
- Weekly program, setting of certain dates by zones
- Adjustable hysteresis
- Correction of temperature sensors (–5 ° C– +5 ℃)
- Manual temperature control
- External temperature measurement (1 thermometer for each zone)
- Air heaters control (GTV and LH heater models)
- Radiant heaters control (Zenit and Variant heater models)
- Separately controllable ventilator for radiant heater (+0–15 min.)
- Language setting
- Reset function (restarting appliances)
- Operating hours counter (for chimney cleaning)
- Chimney sweeping mode (continuous operation at 100% for up to 40 minutes)
- Extension up to 240 zones in Modbus system (with 2-point controls)
- 2 hours operation extension via the control or remotely, after authorisation
- Setting access rights
- Zone renaming option
- Weekly, monthly and annual gas consumption diagram
- Connectivity to Modbus network via RS-485 cabling

General information

The TW-4 control is a touchscreen programmable clock to flexibly control the temperature to which the room is heated.

The lowest temperature is 0 ℃ (which is exceeded according to the safety temperature), while the highest is 40 ℃.

The control box has a rocker switch to disconnect the control and the entire zone from the power supply (all connected heating appliances), which disconnects the phase and the ground as well. After disconnecting, the control electronics will continue to operate for 30 minutes due to the built-in battery, but an error message is displayed as it cannot control the heating appliances and then the display also turns off.

If the rocker switch is ON and is lit, the control is energized. If the rocker switch is OFF and is not lit, the control is not energized. If the switch is ON and is not lit, the control unit is not energized.

The control panel has two push-buttons, the left push-button can be used to increase the cut-off time of the current heating program for a maximum of 2 hours every 30 minutes.

The right button (Screen) is the on/off switch for the screen.

The enclosed box provides IP21 protection, for which a key lock can be ordered as an option.

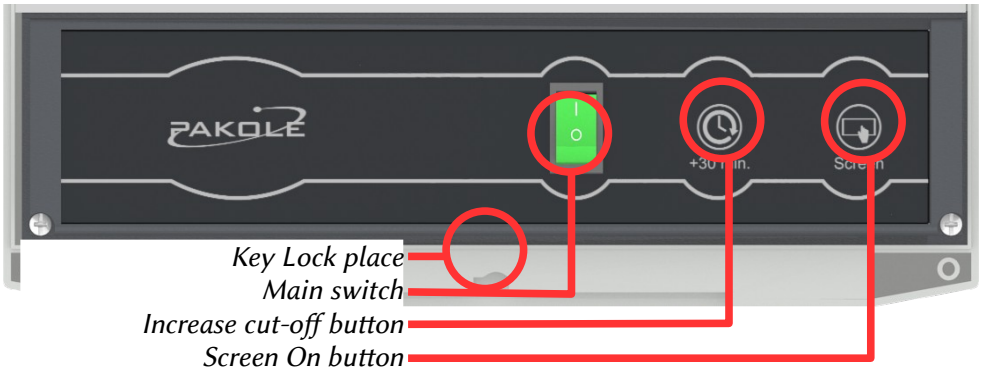


Figure 1: Push-buttons

Electrical connection

Before the first use, the control must be connected to the thermometer(s), the ground and phase wiring of the heater(s) and the mains.

The TW-4 only operates on 230 V 50 Hz alternating current. The control cannot be connected to protective ground.

The control must be connected to the mains via a double-pole isolating switch.

The maximum allowable current flowing through the TW-4 is 6 A, so it must be connected to the electric network with a flexible copper cable with a diameter of 0.75–1.5 mm^2, and the same type of cable is recommended for the connection to the heating appliances.

Three thermometers can be connected to the unit. If you want a result of 0.2 ℃ accuracy, connect a sensor to each of the three thermometers, because the electronics can only provide a very accurate temperature measurement this way. Blind plugs are connected to all three points but can be removed at will.

Electrical connection of the TW-4 control

Before connecting, make sure the power supply is switched off otherwise there is a risk of electric shock.

The box must be opened for electrical connection. Make sure the screws are kept for later use.

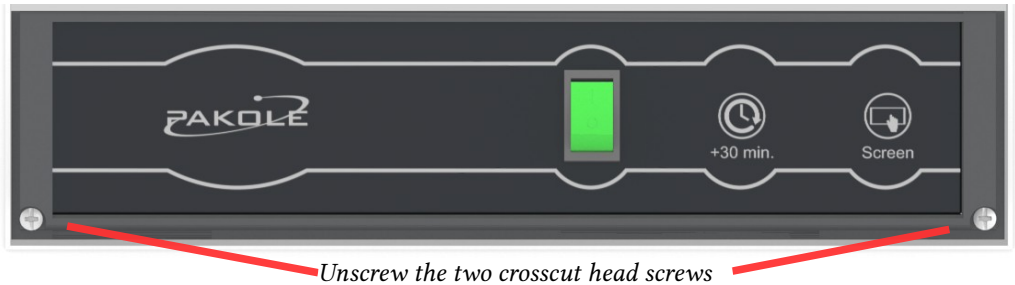


Figure 2: Opening the box

After unscrewing the two screws, carefully lift the membrane keypad backplane, making sure not to break or detach the ribbon cable.

Drill two or three holes on the side wall of the box to fit the supplied glands. It is recommended to route the 230V wires through the left side of the box, and the thermometer wires through the right side of the box.

Place the glands inside the area marked with red and make sure not to drill into the electrical parts when drilling the box wall.

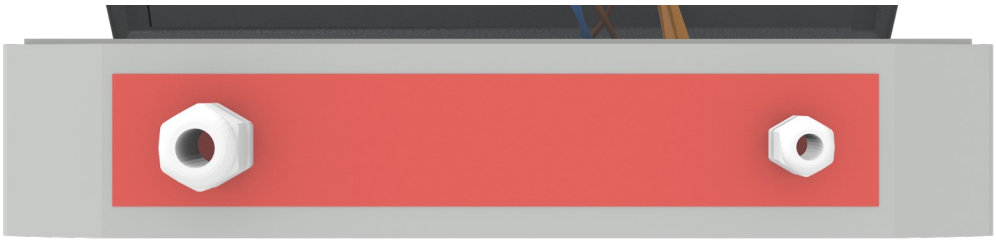


Figure 3: Example of glands locations

Operating modes

The control mode of the TW-4 control is set in the factory and it cannot be changed. Here is a short description of the operating modes of the two main control family:

1. For radiant heaters, the zone control activates a relay to turn the phase off or on. If there is no phase, heaters do not operate, when phase is turned on, they start automatically and heat

up at maximum power. Only one relay is installed for each zone, except for Vacurant appliances where the ventilating fan receives signal via a separate relay. The current and voltage of the output phase (**L1** and **L2**) correspond to those of the input phase ("**Input L**").

2. For air heaters, it is not the incoming phase that passes through the zone control relay but a control signal that can be either a plus or minus 110V voltage or a low current 230 V.

The minus 110 V signal means ventilation mode, the plus 110 V signal means heating mode. As long as there is a signal, the appliance operates in the given mode, if there is no signal, the appliance does not operate. The TW-4 control turns the appliance on or off depending on the temperature. If the output on L1 is 230 V for 5 seconds, Reset mode activates. The Reset signal can only be switched on in heating mode. The Reset signal is sent if the appliance does not work due to an error, and the appliance is reset after repair.

Electrical connection

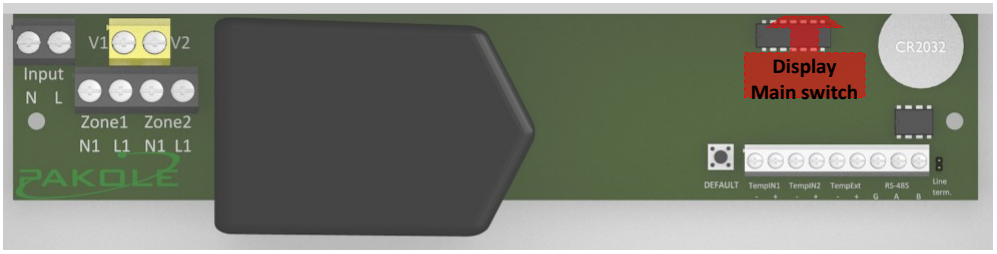


Figure 4: Cable connection

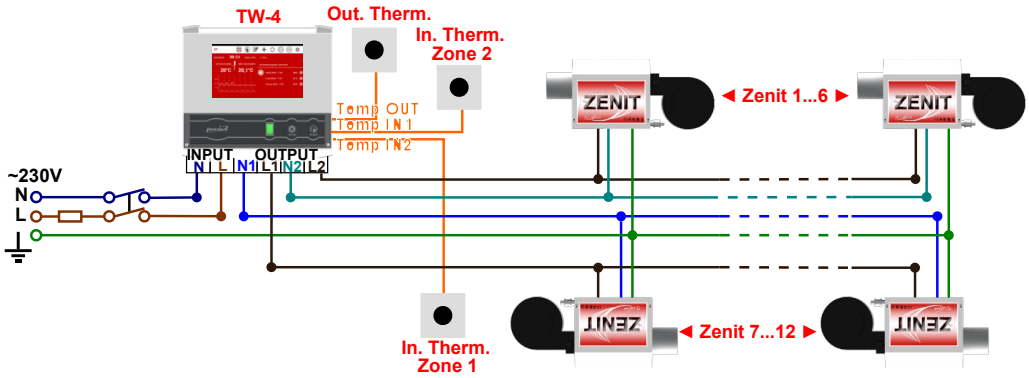
When connecting the regulating voltage connecting points (**N, L**), be sure to connect the neutral wire to the "**Input N**" terminal and the phase wire to the "**Input L**" terminal.

The zone control can also control tube radiant heaters and air heaters. The connection of heaters:

	Radiant heater	VACURANT heater	Air heater
Zone 1	**Zone 1 N1** (neutral) **Zone 1 L1** (phase)	**Zone 1 N1** (neutral +fan) **Zone 1 L1** (heating phase) **V1** (fan phase)	**Zone 1 L1** (control)
Zone 3	**Zone 2 N1** (neutral) **Zone 2 L1** (phase)	**Zone 2 N1** (neutral +fan) **Zone 2 L1** (heating phase) **V2** (fan phase)	**Zone 2 L1** (control)

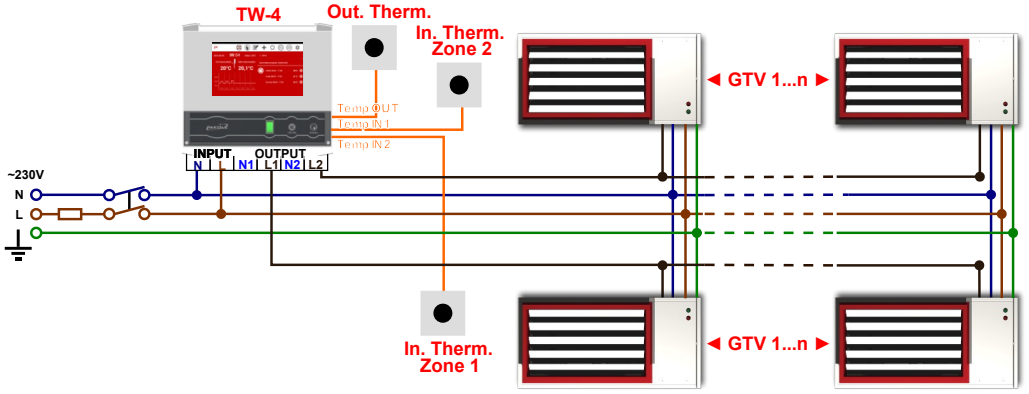
Electrical connection of tube radiant heaters

In the case of tube radiant heaters, the electric current of 230V required for operation is supplied to the appliances via the N1-L1 or N2-L2 neutral-phase output. The electronics of the zone control can transmit a maximum current of 6A, loads exceeding this value may damage the electronics. For this reason, do not connect more than 5 tube radiant heaters at a time to a TW-4 control. If you want to connect more heaters, use an auxiliary relay.



Electrical connection of air heaters

The electric current required for operating air heaters has to be connected directly, the TW-4 control only sends an 110V low-current signal to the appliances at output L1 or L2. Do not connect more than 100 appliances to one zone.



Connecting temperature sensors

Three temperature sensors can be connected to the box: one for each zone and an external temperature sensor. The temperature sensor wires must be screwed into the grey terminal shown on the right side of Figure 4. Note that the TW-4 can only measure temperature with high accuracy if there is a sensor at the connection point of each of the three thermometers, therefore, test sensors are installed in place of unused temperature sensors. If you are installing a new temperature sensor (e.g. an external temperature sensor), you only need to remove the factory-installed test sensor and connect the temperature sensor wires in place. Connection of the temperature sensors:

	Thermometer connection 1	Thermometer connection 2
Zone 1	TempIN1 –	TempIN1 +
Zone 2	TempIN2 –	TempIN2 +
External thermometer	TempExt –	TempExt +

For radiant heaters, the temperature sensor must be installed at a height of 180-200 cm, to a place with optimal thermal convection (do not place it in an enclosed or hidden place where hot air cannot flow to or where it is exposed to direct sunlight).

Assembling

Replace the cover carefully, taking care not to pinch the wires. Tighten the screws, not too tight or else the box may not be closed properly or thread problems may occur.

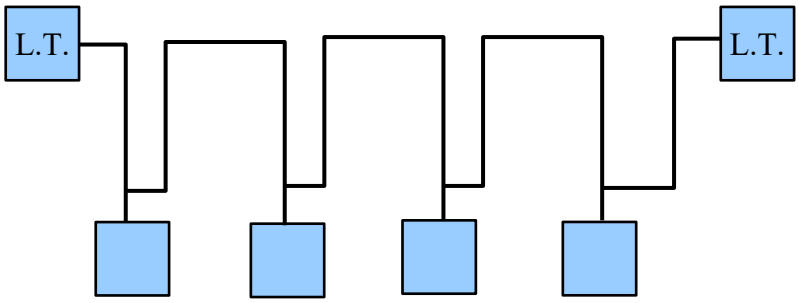
Network connection and regulation of TW-4Z2 zone controls using the TW-4

It is possible to program multiple zone controls with the TW-4 control to enable heating control in larger buildings from a central TW-4.

The wiring and physical installation of the network requires RS-485 standard. There are some physical limitations for the network: a maximum of 247 TW-4Z2 zone controls can be regulated (one TW-4Z2 zone control can handle two zones), the total length of wiring must be below 1200 meters, for larger networks, signal amplifiers should be used. It is recommended to use shielded copper CAT-5 cable for wiring.

The RS485 is a differential bus; at the physical end of the bus, reflections are generated when the bus is not closed with terminal impedance. For RS485 cables, the official cable and terminal impedance is 120 Ohm, but in practice Ethernet CAT-5 cables are used most often for cabling and Ethernet cables are designed for 100 Ohms, therefore, a terminal of 100 Ohm is required for CAT-5 cables.

It is recommended to connect the controls in a Daisy Chain arrangement, i.e. a wire connected to point "A" of a control unit is led to point "A" of the next control unit, and so on.



Drawing 1: Daisy Chain wiring scheme

On the first and last unit (marked with "L.T."), the two spikes should be terminated at the Line Terminal point with a jumper (see right side of Figure 4). Officially, termination is to be done for each 5 m cable lengths, but in practice the network will operate efficiently up to approximately 100 m cable lengths if there is no a strong electrical interference in the cabling area. The TW-4 central control can be any of the units in the above figure, while the rest will be TW-4Z2 zone controls.

After installing the network, it is advisable to check the signal shape with an oscilloscope and if it is not correct, you must re-test the network before the controls are switched on to check the connections and the presence of any disturbing electrical devices near the network.

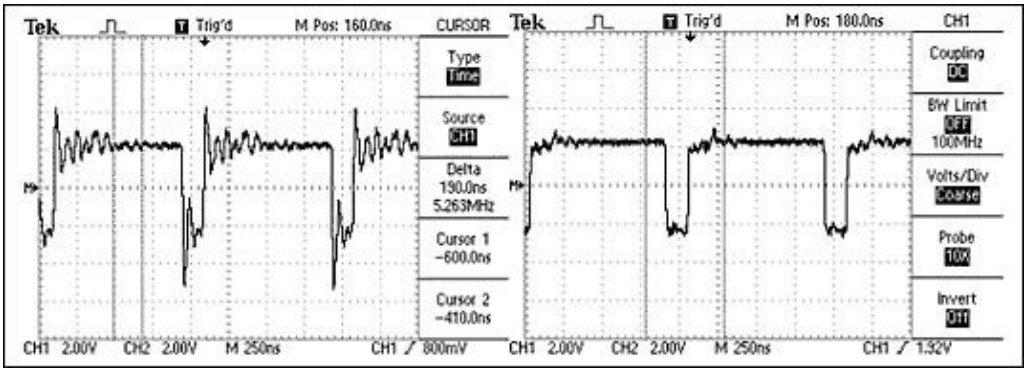


Figure 5: Incorrect signal on the left, correct signal on the right

Other suggestions for network construction:

– The only point that must be grounded in the TW-4 central control unit is the GROUND point. Failure to ground this point **may cause death** as touching the touchscreen in case of a phase fault may kill a person! If STP or FTP cables are used, its grounding must be earthed (but nothing else).

– The GROUND point is recommended to be connected in a star arrangement, connecting two strands (i.e. a twin-wire) to stand higher current levels. The current is generated by the presence of the mandatory EMI/RFI capacitor in the power supply of zone controls between the phase and the GND, which is 2.2 to 10 nF, with a current of several milliamperes towards the ground, which add up in the case of, for instance, 30 control units to 30-50 mA in the GROUND line. For connecting more than 20 zone controls to a network, 4 strands (i.e. 2 twin-wires) can also be used.

– For STP or FTP cables, shielding must ALWAYS be commoned in a star point arrangement so that the disturbance signal can get to the ground from any point of the network in the shortest possible way. The other end of shielding SHOULD NOT be connected to anywhere.

– In the case of a signal amplifier, the grounding of GRUND and shielding has to be restarted in the downstream direction, to a ground point there. In the incoming direction both must be free to float or, if the power supply is not grounded in the incoming direction, it must be commoned with its GND.

– Only the two ends of the network must be terminated, i.e. the jumper has to be installed on those two appliances. The signal amplifier is advisable to be installed next to a TW-4 unit and the jumper must be installed there, or a 100 Ohm resistor must be installed on the other side of the signal amplifier. For CAT-5 wiring, the two end points of each independent section must be terminated with 100 Ohm resistors (instead of 120 Ω).

Use and operation of TW-4 control

Turning on the control

If the device is switched on for the first time, or if it has not been switched on for several days, the battery of the display electronics may be completely discharged and then charging will start after power up. Allow the battery to charge for at least 6 minutes, then disconnect the controller (avoid the electric hazard) and remove the membrane keypad. Over the brown ribbon cable, the main switch button on the display electronics is located through the opening on the white tray (see Figure 4). Push this button approx. for 6-8 seconds, the display electronics will start separately, and then after close the keypad, switch on the controller with the green power switch.

If the control is already powered and the program is running, the lock screen will be displayed after the push-button is pressed.

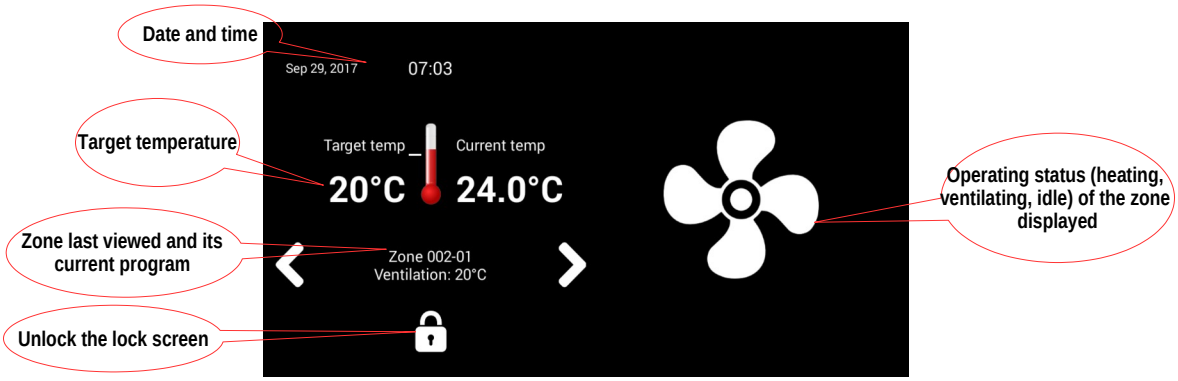


Figure 6: Lock screen

The lock screen prevents unauthorized persons from changing the settings, but shows all the important information about the current status.

You can scroll through the zones using the left-right arrows.

You can return to this screen at any time by pressing the (Screen) button on the membrane keypad, which blocks access to the control.

Unlocking the lock screen

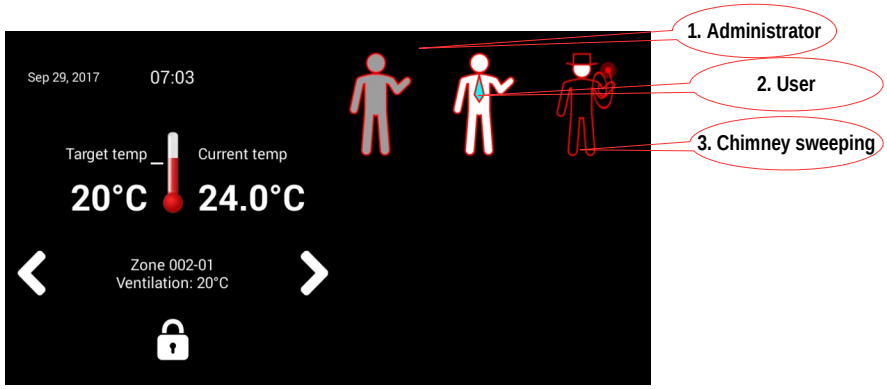


Figure 7: Unlocking the lock screen

When touching the lock symbol, the following access level symbols appear:

1. Administrator: has access to all the functions and settings after entering the relevant PIN code.
2. User: access to various functions is determined by the Administrator (generally, the User is authorised to control heating but cannot have access to system settings.
3. Chimney sweeping: this option starts the chimney sweeping mode. If protected by a PIN code, it has to be entered. If no PIN code is set to this mode, the chimney sweeping mode is started right after the symbol is selected.

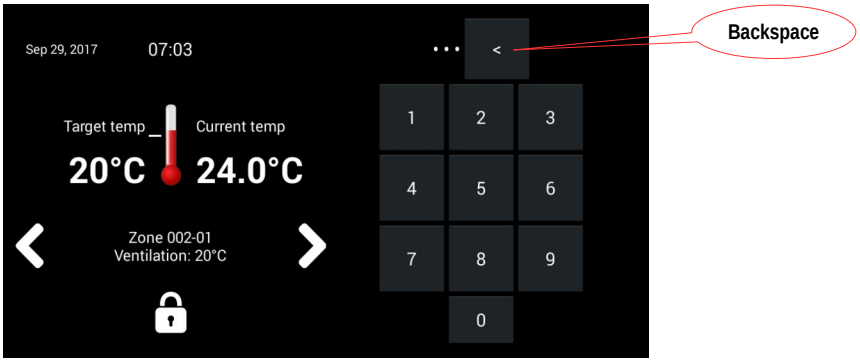


Figure 8: Entering the PIN code

If the selected access level is protected by a PIN code, a numeric keypad will be displayed and the 4 digit PIN code must be entered. If the code is correct, the keypad disappears, if the code is not correct, the keypad and the 4 dots symbolizing the 4 digits will remain on the screen. The Backspace key behind the dots can be used to delete the last digit.

Chimney sweeping mode

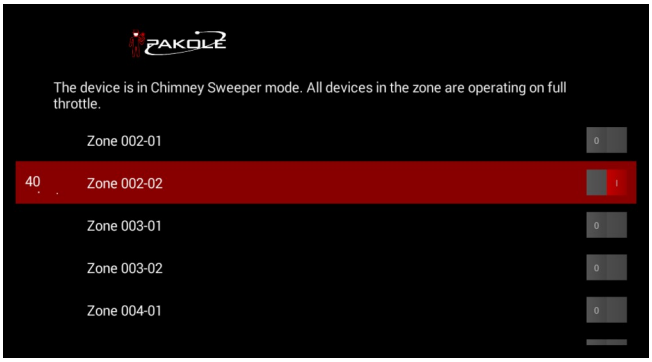


Figure 9: Chimney sweeping mode

In Chimney sweeping mode, use the button next to the zones to activate or deactivate zone heating, and the heating appliances in the zone will operate at 100% for 40 minutes, or until zones are switched off here. By default, the Chimney sweeping mode PIN code is set to 9999, but it can be changed or turned off under the General Settings.

If you start the Chimney sweeping mode in a zone, the screen will remain active until you exit this mode. If the period of 40 minutes is finished, the given zone will return to the previous mode.

Managing the zones

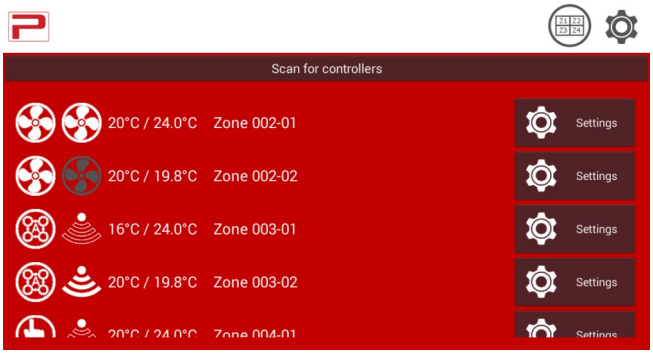


Figure 10: Zone management

Here you can select which zone you want to control. The two zones incorporated into the TW-4 control are also displayed here, just as the zones associated with the rest of the zone controls connected to the Modbus network.

In the first column, the icon indicates the current operating mode of each zone (automatic program mode, manual heating, manual ventilation).

The second column shows whether the appliances in the respective zones are operating or not.

The third column contains the names of the zones, which can be changed at any time by selecting the gear icon on the right.

By tapping any zone name, you activate the respective zone and can perform changes in heating settings.

If you tap the Scan for controllers button, the control starts searching for zone controls on the Modbus network and the found ones are listed here. Full search lasts for about 12 minutes, but it can be interrupted at any time and the screen will display the zone controllers found up to that time.

When searching, the program indicates the status of search in three colours. The white strip indicates that the zone if found but the data have not yet been read. When this white strip disappears, all the data in the zone control have been read and the zone has been processed. The grey strip indicates that the zone can be found in the database, but the control cannot find the zone in the network (for instance due to power failure or the Modbus wiring is broken).

The TW-4 reads the data previously set for the zone controls found and lists them. The read data are as follows: zone name, zone type (air heater or tube radiant heater control mode), night temperature, safety temperature, fan overrun time, hysteresis, sensor correction, zone control mode (automatic, manual, ventilation), automatic program list and target temperature.

All other data must be set again after each zone search in the zone's settings (for example, the total power of the zone or whether the external thermometer is connected).

Setting zone data

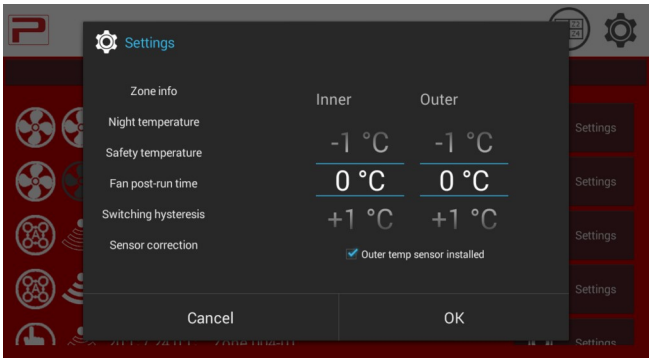


Figure 11: Zone settings

By tapping the gear icon behind a zone name in the Zone management screen, we can set the operating data for that zone:

Zone info	You can rename the zone, enter the total power of appliances connected to the zone, check the internal identification number (002) of the zone, the number of the zone managed (/1 or /2) and the hour meter showing the total duration of heating (in hours) in that zone since start-up.
Night temperature (16 °C)	In Automatic program mode, this temperature is maintained in the period between switch-off and the next switch-on.
Safety temperature (10 °C)	The control maintains this minimum temperature in all modes and under any circumstances. Temperatures below this value cannot be set in the control.
Fan post-run time (1 minute)	The fans are operated for 1 minute after the heating is switched off. Here you can increase this value in one minute increments. Only for Vacurant appliances.
Switching hysteresis (1 °C)	The delay in switching on and off the heating. For example, with a hysteresis of 1 °C and a target temperature of 20 °C, heating is switched on when the temperature in the room is 19 °C, and switched off when it is 21 °C.

Sensor correction (0 °C)	If the temperature sensor is not positioned optimally, you can increase or decrease the measured temperature here. For example, if the thermometer is in a poorly ventilated warm corner, it is recommended to reduce the measured temperature by 2-3 °C, or else it will always be cold in the hall as the thermometer has reached the target temperature for heating. The screen will now show the shifted value and this will be used by the program in the future. The presence and correction of external thermometers can also be set here.

The TW-4 touchscreen only uses a touchscreen keypad when entering a zone name and specifying total power. By default, a Hungarian keyboard is displayed, but you can switch to English, German, or French keyboard when the spacebar is pressed for a longer time. The keypad is not our own design but the touchscreen control's operating system keypad, accordingly, there are special keys on it that are not recommended to be used.

The keypad does not have a separate icon for hiding when you finish typing. The keypad disappears when you press the "Done" button on the right.

Special keys on the keypad:

The up arrow on the two sides of the keypad is the Shift key. Pressing it once will change the keypad to capital letters.

The "?123" key in the lower left corner can be used to switch to a numeric keypad with mathematical operators.

It is not recommended to press the special key showing three sliders next to the "?123" key as you cannot return to the application afterwards (you must switch the control off and then on again to restart the application).

The emoji key (smiley) in the lower right corner should also be avoided, as it is not possible to store such special characters in the name.

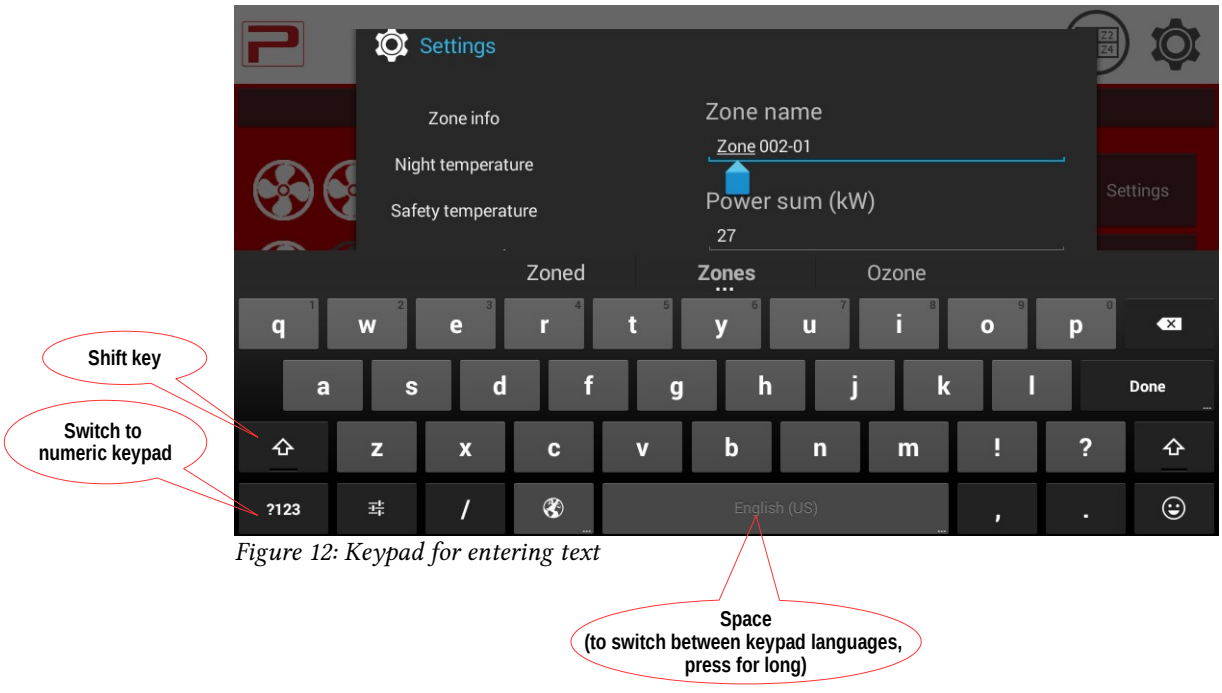


Figure 12: Keypad for entering text

Main screen

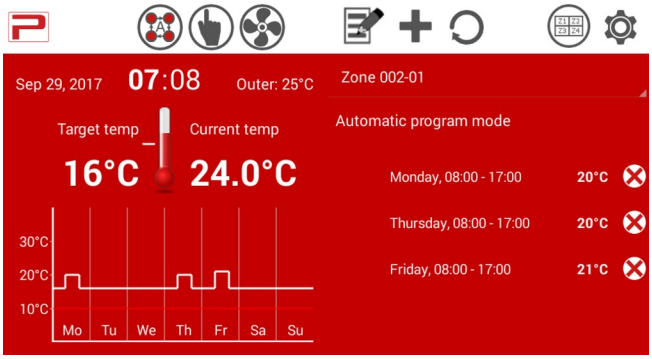


Figure 13: Main screen

Icons on the main screen (the active icon is coloured, the others are grey):

	Company logo (“About” box)
	Automatic program mode: the room is heated to the set temperatures at the times listed on the right side of the display.
	In manual heating mode the set target temperature is held continuously, overriding even the night temperature until control is switched over.
	Ventilation function for air heaters. When the measured temperature is above the target value, the fan is operated until the temperature decreases below the target value, or until control is switched over.
	In automatic program mode specific heating times can be set for certain dates by using the (+) sign.
	When automatic program mode is used, new weekly repeated times can be added to the automatic mode list.
	Restarts the heating appliances connected to the control.
	If performance and gas type were defined in zone settings, gas consumption is calculated and displayed.
	Zones can be checked, selected and set here.
	General Settings dialogue box appears.
	The switch-off time of the ongoing heating program may be extended in 15 minutes increments up to 2 hours when increase is started again. 1-2 hours of delay in switching off heating is useful e.g. when working overtime.
	Deletes the respective heating program.

Adding new program items, editing existing items

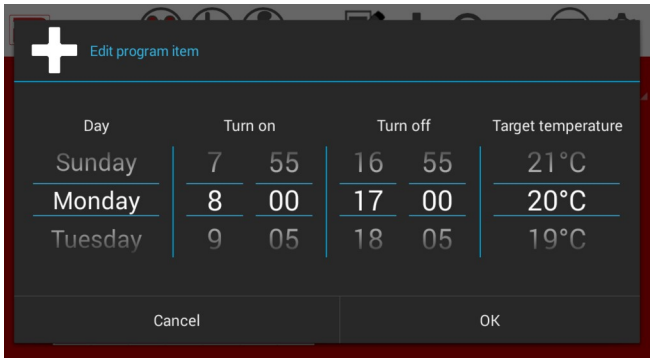


Figure 14: Adding new program items, editing existing items

You can set the switch-on and switch-off times and target temperatures for each day of the week. Intervals can be set in 5 minutes increments. When adding a new program item, be sure not to overlap the periods.

The control maintains the set temperature between the on and off times. The heater itself is turned earlier to reach the target temperature by the time defined. The time required to reach the target temperature is calculated on the basis of the external, internal and target temperatures, and the control uses previous data for this calculation in a self-learning way.

Heating control on certain dates

Figure 15: List of extraordinary programs

You can set heating programs for specific dates. For example, if you need heating on 29 September but this day is not included in the automatic mode programs, you can program it beforehand. Values set for the fixed dates override the temperature set in automatic mode and are deleted automatically afterwards. Fixed dates are taken into account only in automatic mode, but not in manual control or ventilation mode.

Deleting program items

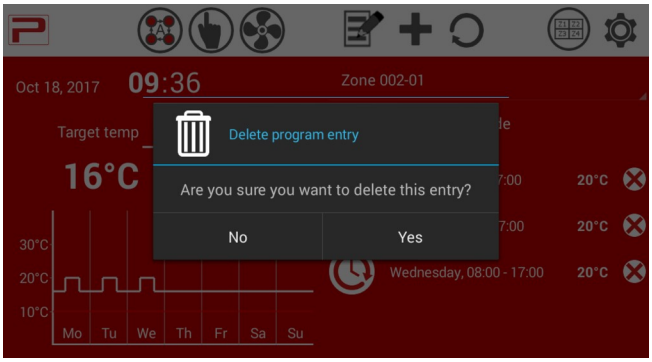


Figure 16: Deleting program items

When deleting a program item, the control requests you to confirm whether you want to delete the item. Tapping the "Yes" option will irrevocably delete the selected program item.

Manual control

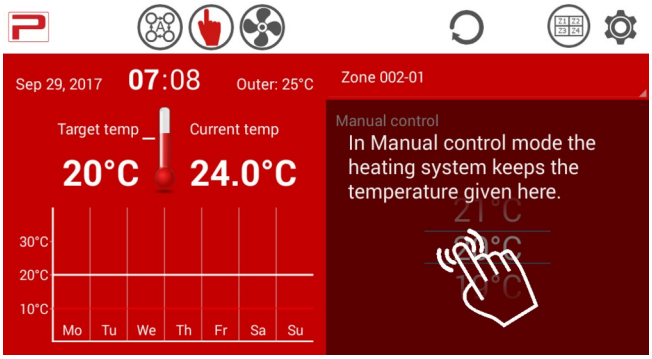


Figure 17: Manual control

When switching to manual control, one temperature value must be entered and the control maintains that within the hysteresis limits. Manual control continues until the control is switched to another mode or until the heating system is disconnected from the power supply. This mode is recommended to maintain a certain temperature for several days (e.g. for continuous shifts or several days' downtime).

Ventilation mode

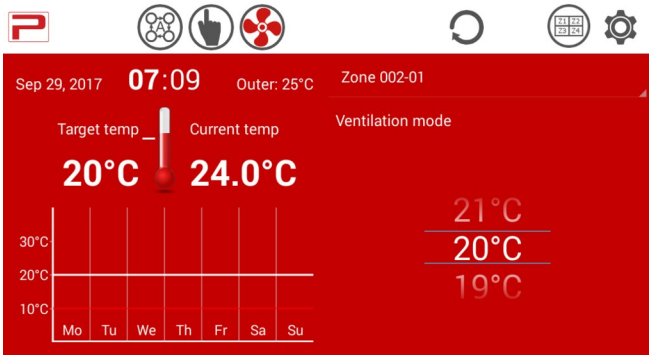


Figure 18: Ventilation mode

Ventilation mode is only available for air heaters (e.g. GTV, LH models).

In this mode there is no heating, only the fan is operated when and while the temperature exceeds the target temperature. In the picture above, for example, 20 ℃ is set and the measured temperature is higher, so the fan will operate because ventilation/cooling is required.

Restarting the appliances in a zone

Figure 19: Restarting a zone

This command restarts the appliances in the selected zone. For air heaters, the RESET signals are sent, for radiant heaters, power supply is interrupted for 5 seconds.

Statistics

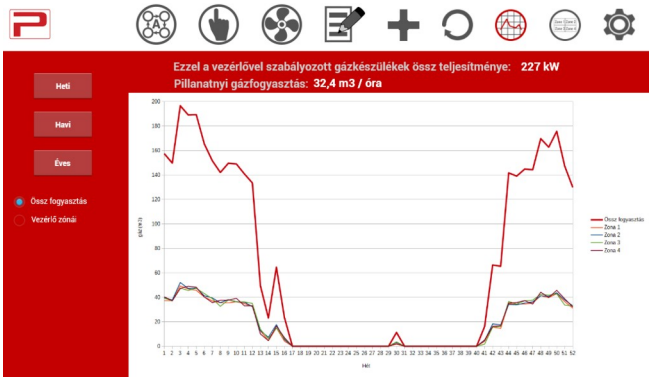


Figure 20: Statistics

You can check gas consumption by zones, also broken down for days, weeks or months. Statistical data are calculated from three data: the nominal power of the heaters used in that zone, the type of gas and the duration of heating. The power of the appliances can be specified in the Zone settings, while time is measured by the zone control.

General settings

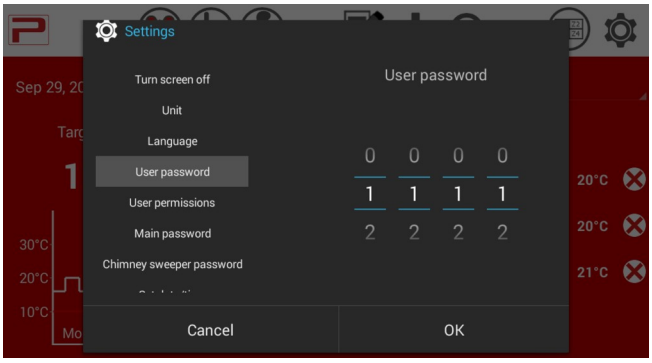


Figure 21:General settings

Here, you can set the control's operating parameters. The following values can be set (the default value is shown in brackets):

Turn screen off (1 minute)	The duration of inactivity (in minutes) after which the screen is switched off .
Unit (°C)	Temperature scale
Language (English)	Here you can select between the available languages
User password (1111)	Access to certain functions can be restricted by password
User permissions	Here you can set the functions the user can access
Main password (1234)	Here you can set the PIN code for unrestricted access
Chimney sweeping password (-)	Here you can set a 4-digit PIN code for chimney sweeping mode
Set date/time	Here you can set the date and time
Modbus Settings	The parameters of network communication can be set here for the TW-4Z2
Modulation settings	The parameters of the modulation controllers

Error message in case of power outage or connection failure

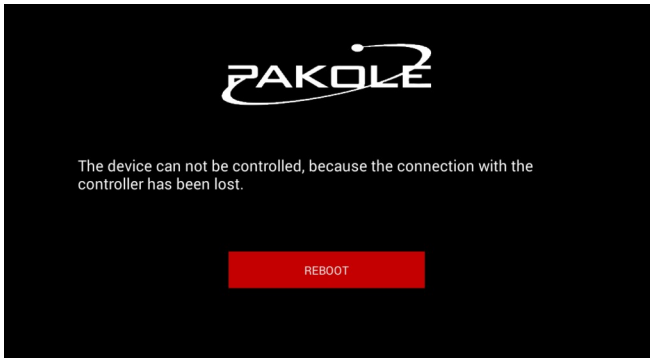


Figure 22: Error message

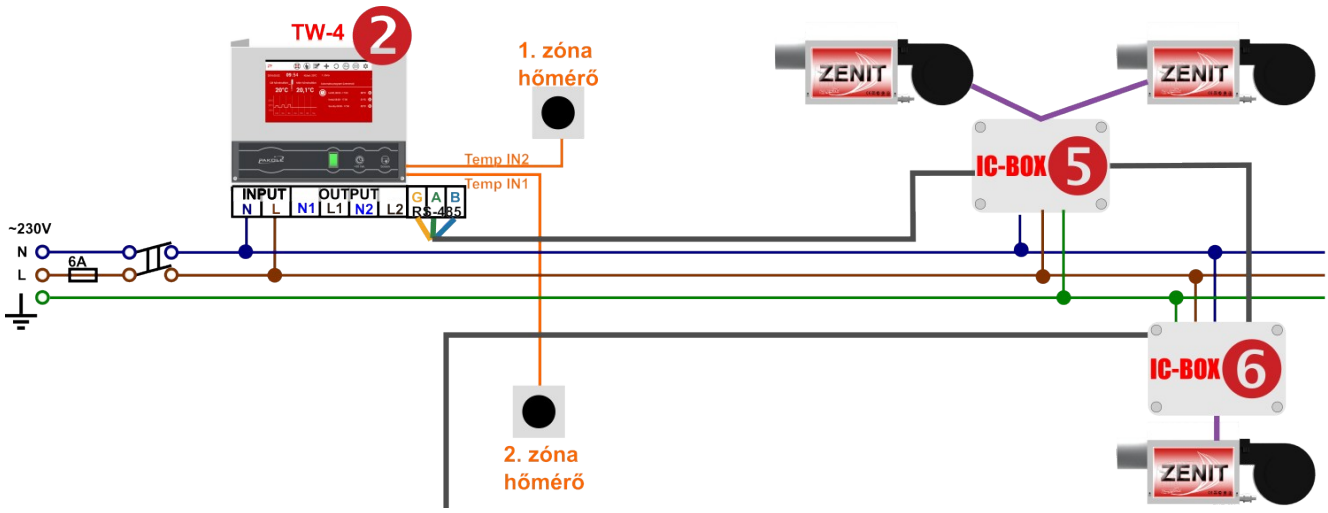
This error message is displayed in two cases:

1. during a power outage before the battery goes flat,
2. when the display electronics is disconnected from the heater switching electronics in the control box.
   In the first case, wait until the power supply is restored, in the second case, contact us to have the control repaired.

Using IC-BOX modulation units

In addition to controlling on-off devices, the TW-4 can also control Zenit or GTV modulation devices equipped with IC-BOX. With modulation unit, the output of the appliances is gradually reduced as the room temperature approaches the setpoint, resulting in a more even room temperature and more economical heating.

The wiring diagram of the controllers is shown in the figure below:



As shown in the figure above, the devices are not connected directly to the TW-4 (or TW-4Z2) controller, but to the IC-BOXes that will control the devices. The IC-BOXes will continuously receive the control signal from the TW-4 via Modbus network to operate the heaters at what power, and the TW-4 will calculate the heating power based on the measured temperature. The heating power can be between 50 and 100%, or in a shutdown state. A maximum of 2 units can be controlled with one IC-BOX and a maximum of 127 IC-BOXes can be connected to one TW-4 (or TW-4Z2).

One TW-4 can divide the connected IC-BOXes into 2 zones, if more zones are desired, a TW-4Z2 zone controller can be used to extend the number of zones by 2 additional zones. A maximum of 250 TW-4Z2 can be connected to one TW-4.

The IC-BOXes are displayed in the zone list and from there they must be assigned to the zone through which you want to control their operation.

Figure 23.: Unassigned IC-BOX in the Zone list

If you click on the IC-BOX Settings button, you can rename the IC-BOX unit or assign the IC-BOX to a zone.

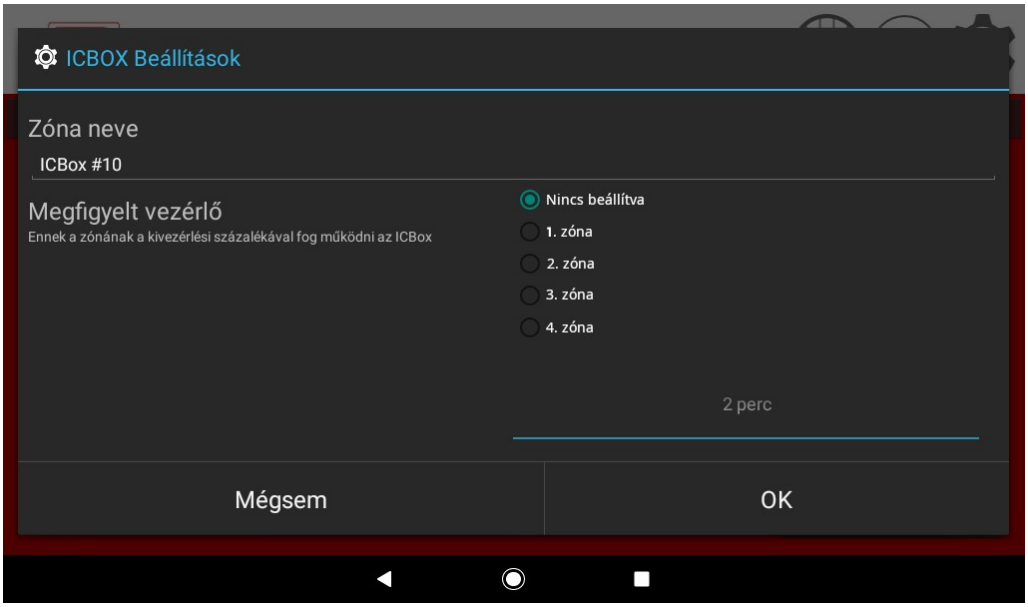


Figure 24.: IC-BOX Settings

If you assign the IC-BOX to a zone, it will disappear from the Zone List.

If for some reason you want to change the settings of an assigned IC-BOX (rename it, move it to another zone) you can do it in the Zone Settings. Select the Zone Settings of the zone to which the IC-BOX is assigned from the Zone List. Then click on the Controlled IC-BOXes item at the bottom of the list to get a list of which IC-BOXes are assigned to this zone. By clicking on the IC-BOXes Settings button, you can change the settings of the IC-BOX.

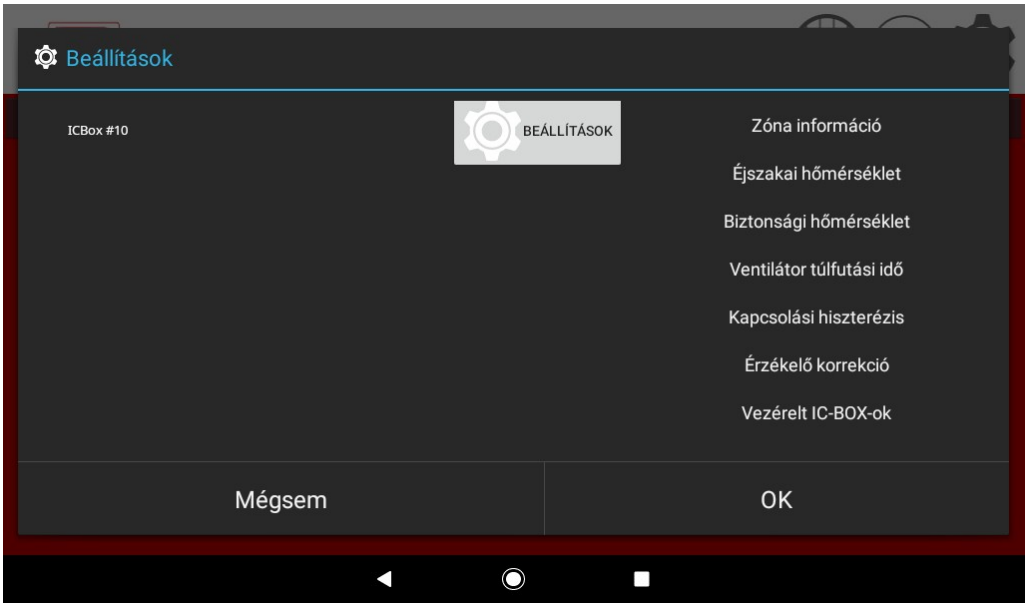


Figure 25.: Controlled IC-BOX in the Zone settings

Warranty service

Keep this warranty card

Type: TW-4

Serial number:

Date of purchase:

LIMITED WARRANTY *

The manufacturer warrants to the buyer that the product and its components are free of material and manufacturing defects. The manufacturer assumes a 1-year warranty on the device from the date of purchase, if it is used properly. This warranty applies to the first original retail purchaser.

The warranty covers the costs of laboratory tests and the parts required for proper operation. Shipping and unforeseen costs are also included in repair costs, and do not involve compensation.

Warranty repair is only possible via authorized resellers or workshops.

The warranty does not cover malfunctions caused by improper use, damage, negligence, accidents, lack of maintenance, normal wear, modifications, alterations, factors influencing operation, contaminated fuel, installing incorrect components, repair not performed by authorized workshops or resellers.

Regular maintenance is the responsibility of the owner.

The manufacturer is not responsible for any damages that may arise or are caused directly or caused by improper operation.

* We reserve the right to change the specifications without notice. The warranty can be applied on the basis of the above data. No further warranties are provided.