# Operation instructions

## Universal control box for air condition with the application MINI

**Controllers ELP14R18, ELP14R18L v5.2 2018**

**Inverters with Modbus control:**
**Danfoss FC51, Danfoss FC101, LG IC5, LG IG5, EC Blue, Eura Drive**



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**The device is manufactured in accordance with the European standard EN1886, EN13053**

**This documentation must always be handed over to the customer!**
**In case of non-compliance with the conditions stated in this documentation, VentiAir s.r.o.**
**reserves the right to refuse the warranty.**

Version 01/2022

# 1 CONTENTS

# 2 GENERAL INFORMATION

The control box can be handled by untrained personnel.

EL-…-…-…-…-… controller conforms with requirements of the following standards:
PN-EN 61439-1:2011, PN-EN 61439-3:2012, PN-EN 61000-6-1:2008, PN-EN 61000-6-3:2008

**Intended use:**
- Supply and Supply & Exhaust Air Handling Units
- Systems with water heaters, electric heaters, gas heaters
- Systems with water cooler, DX cooler
- Systems with plate heat exchanger (with by-pass),  plate heat exchanger (without by-pass) or mixing chamber
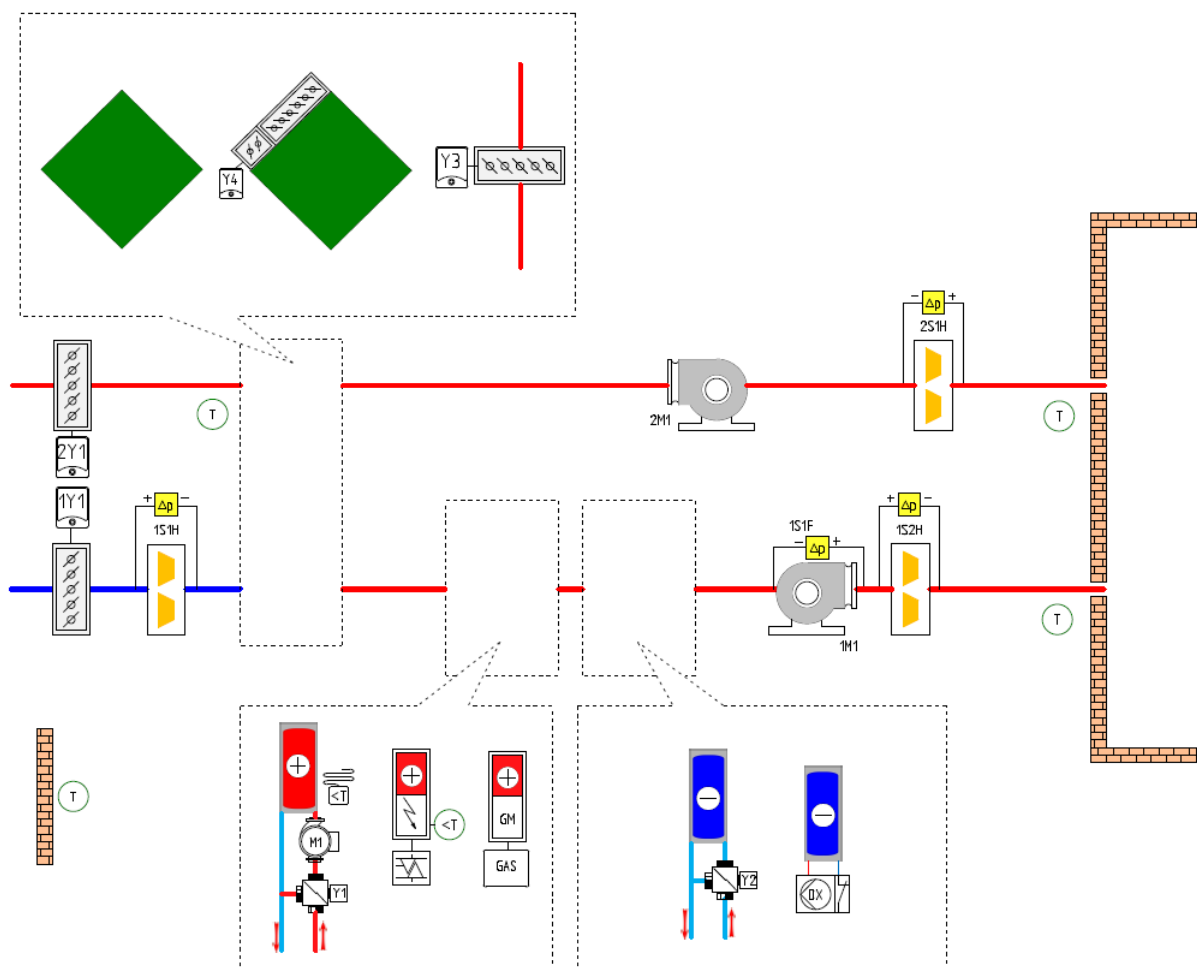
# 3 ENCRYPTION OF CONTROL BOXES

| Type | Recovery | Heater | Cooler |
|---|---|---|---|
| N - supply<br>NW - supply/exhaust | Kx – plate heat exchanger (without by-pass)<br>M - mixing chamber<br>KxM – plate heat exchanger and mixing chamber<br>K 0-10 – plate heat exchanger (with by-pass) | W – water<br>E – electric<br>GAS – gas heater | W - water<br>F - DX |

The universal control box MINI after the right configuration of the controller, offers the work one of the 82 ventilation systems introduced below arrangements for the guidance:

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | N | - | _ | - | _ | - | W | 29 | NW | - | _ | - | E | - | 56 | NW | - | KX | - | GAS | - |
| 2 | N | - | _ | - | _ | - | F | 30 | NW | - | _ | - | E | - | W | 57 | NW | - | KX | - | GAS | - | W |
| 3 | N | - | _ | - | W | - | _ | 31 | NW | - | _ | - | E | - | F | 58 | NW | - | KX | - | GAS | - | F |
| 4 | N | - | _ | - | W | - | W | 32 | NW | - | _ | - | GAS | - | 59 | NW | - | M | - | _ | - | _ |
| 5 | N | - | _ | - | W | - | F | 33 | NW | - | _ | - | GAS | - | W | 60 | NW | - | M | - | _ | - | W |
| 6 | N | - | _ | - | E | - | 34 | NW | - | _ | - | GAS | - | F | 61 | NW | - | M | - | _ | - | F |
| 7 | N | - | _ | - | E | - | W | 35 | NW | - | K | - | _ | - | _ | 62 | NW | - | M | - | W | - | _ |
| 8 | N | - | _ | - | E | - | F | 36 | NW | - | K | - | _ | - | W | 63 | NW | - | M | - | W | - | W |
| 9 | N | - | _ | - | GAS | - | 37 | NW | - | K | - | _ | - | F | 64 | NW | - | M | - | W | - | F |
| 10 | N | - | _ | - | GAS | - | W | 38 | NW | - | K | - | W | - | _ | 65 | NW | - | M | - | E | - |
| 11 | N | - | _ | - | GAS | - | F | 39 | NW | - | K | - | W | - | W | 66 | NW | - | M | - | E | - | W |
| 12 | N | - | M | - | _ | - | _ | 40 | NW | - | K | - | W | - | F | 67 | NW | - | M | - | E | - | F |
| 13 | N | - | M | - | _ | - | W | 41 | NW | - | K | - | E | - | 68 | NW | - | M | - | GAS | - |
| 14 | N | - | M | - | _ | - | F | 42 | NW | - | K | - | E | - | W | 69 | NW | - | M | - | GAS | - | W |
| 15 | N | - | M | - | W | - | _ | 43 | NW | - | K | - | E | - | F | 70 | NW | - | M | - | GAS | - | F |
| 16 | N | - | M | - | W | - | W | 44 | NW | - | K | - | GAS | - | 71 | NW | - | KXM | - | _ | - | _ |
| 17 | N | - | M | - | W | - | F | 45 | NW | - | K | - | GAS | - | W | 72 | NW | - | KXM | - | _ | - | W |
| 18 | N | - | M | - | E | - | 46 | NW | - | K | - | GAS | - | F | 73 | NW | - | KXM | - | _ | - | F |
| 19 | N | - | M | - | E | - | W | 47 | NW | - | KX | - | _ | - | _ | 74 | NW | - | KXM | - | W | - | _ |
| 20 | N | - | M | - | E | - | F | 48 | NW | - | KX | - | _ | - | W | 75 | NW | - | KXM | - | W | - | W |
| 21 | N | - | M | - | GAS | - | 49 | NW | - | KX | - | _ | - | F | 76 | NW | - | KXM | - | W | - | W |
| 22 | N | - | M | - | GAS | - | W | 50 | NW | - | KX | - | W | - | _ | 77 | NW | - | KXM | - | E | - |
| 23 | N | - | M | - | GAS | - | F | 51 | NW | - | KX | - | W | - | W | 78 | NW | - | KXM | - | E | - | W |
| 24 | NW | - | _ | - | _ | - | W | 52 | NW | - | KX | - | W | - | F | 79 | NW | - | KXM | - | E | - | F |
| 25 | NW | - | _ | - | _ | - | F | 53 | NW | - | KX | - | E | - | 80 | NW | - | KXM | - | GAS | - |
| 26 | NW | - | _ | - | W | - | _ | 54 | NW | - | KX | - | E | - | W | 81 | NW | - | KXM | - | GAS | - | W |
| 27 | NW | - | _ | - | W | - | W | 55 | NW | - | KX | - | E | - | F | 82 | NW | - | KXM | - | GAS | - | F |
| 28 | NW | - | _ | - | W | - | F | 56 | NW | - | KX | - | GAS | - | | | | | | | | |

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# 4 SYSTEM OPERATIONS

Tab. 1. The functions of the Air Handling Units.

| Functionality | | | Triggering condition | Description |
|---|---|---|---|---|
| Starting fans | | | - set the mode<br>1 gear, 2 gear, 3 gear<br>STAND-BY, CALENDAR | - The opening external damper<br>- Enabling the supply fan motor (air supply) fans or motors supply and exhaust fans (air supply exhaust) |
| Temperature control | | Description | - Set the mode<br>1 gear, 2 gear, 3gear<br>Standby, Calendar | - Comparing the current temperature measured by the sensor lead to a set point set on the controller or room unit and the activation of heat exchangers / cooling<br>- Reduction of the minimum and maximum air temperature |
| | Heating | Water heater | - Temperature of the primary control sensor is below the set temperature | - Increasing the flow of fluid (water or glycol solution) by the water heater<br>- Activation of the antifreeze function the system temperature is too low for the heater (thermostat) |
| | | Electric heater | | - Continuous increase in power electric heater<br>- Cooling of the heater during the transition from work mode to stop mode, the system<br>- Study of overheating heater thermostat |
| | | GAS heater | | - Continuous increase in power gas heater<br>- Cooling of the heater during the transition from work mode to stop mode, the system<br>- Alarm contact test of the gas heater automation |
| | Cooling | Water cooler | - Temperature of the primary control sensor is above the desired temperature | - Increasing the flow of fluid (water or glycol solution) through the cooler |
| | | Cooler with direct expansion | | - Activation of one, two stage compressor unit - used to block activation of the cooling system at low temperatures (factory setting 13 ° C)<br>- The minimum time the compressor is running (even if the switching signal is not fed) and minimum rest period (even if the switching signal is given) |
| Energy recovery systems | | Cooling recovery | - Set the mode<br>1 gear, 2 gear, 3gear<br>Standby, Calendar<br>- Outside temperature higher than the temperature of exhaust sensor 1 ° C | **Plate heat exchanger (without by-pass)**<br>- Activation of the antifreeze function of the heat recovery system for low temperature in exhaust part of recovery (low supply vent gear) |
| | | Heat recovery | - Set the mode<br>1 gear, 2 gear, 3gear<br>Standby, Calendar<br>- Outside temperature lower than the temperature of exhaust sensor 1 ° C | **Plate heat exchanger (with by-pass)**<br>- Attaching the recovery the system (START / STOP)<br>- Activation of the antifreeze function of the heat recovery system for low temperature in exhaust part of recovery (decrease recovery power)<br><br>Cooling recovery is disabled by default (to activate it you need to change the parameter Settings/Recovery/Work mode to Summer/Winter |

| Mixing chamber | - Set the mode<br><br>1 gear, 2 gear, 3gear<br><br>Standby, Calendar<br><br>- Work in heating sequence | - regulation of opening damper of air on with controllers<br><br>- the degree of mixing air blown off from the room with outside air blown in depends from the difference of the temperature measured by the sensor of the ventilation and the set temperature<br><br>- the regulation of the degree of mixing air is appearing before or after the adjustment of cooling and heating devices depending on placing the priority for the mixing chamber or the heater/cooler<br><br>- possible of activation of the function of heating up: in the event that the environmental temperature will be below the set temperature the arrangement is undergoing heating into the sequence, head offices with the recirculation will be working with the minimum quantity of fresh air (factory settings min 30% open the damper of outside air) and next the adjuster will start adjusting the temperature with the heater<br><br>- blocking of the mixing chamber in the sequence of the cooling |
|---|---|---|

# 5   SYMBOLS AND WIRING

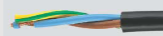The elements of automation should be installed in accordance with application scheme and the following standards:

- control cables type LIYY, LIYCY (do not use twisted-pair cable as control cables) and control cables type YLY and communication cables PROFIBUS DP typ BUS O2YS(St)CY 1×2×0,64/2,6 mm should be wired according the chart presented in electric chart and technical demands of this application,
- cables' cross-sections were chosen to be installed in 100m long metal cable tray,
- in order to communicate adjuster, inverter and BMS it has to be used wires type shielded - shielded twisted pair (each pair is twisted and shielded and all together are shielded), type PROFIBUS DP typ BUS O2YS(St)CY 1×2×0,64/2,6 mm,
- there is not allowed to put cables responsible for communication together with control cables and power supply cables. For communication cables needs to be provided separate cable routes,
- inverter should be installed not more than 100m away from the controller,
- HMI panel should be installed not more than 100m away from the controller,
- there is not allowed to use one cable simultaneously for more than one function/equipment. There is an obligation for each hardware/function to have autonomic cable,
- there is not allowed to use twisted-pair cable as control cables for signals
    - on/off 24V, 230V, 0-10VDC.

Tab. 3 Cables description.

| Type of the wire | Draw | Description | Description |
|---|---|---|---|
| (1) | | Multiple strand cable with copper strands in PVC jacket | Nominal voltage: 450/750V Operating temperature: -40 do 70°C |
| (2) | | Cables with multiple, flexible copper strands in PVC jacket | Nominal voltage: 450/750V Operating temperature: -40 do 70°C |
| (3) | | Communication cables (PROFIBUS DP typ BUS O2YS(St)CY 1×2×0,64/2,6 mm) with copper strands, screened with copper wires, in PVC jacket | Nominal voltage: 100V Operating temperature: - 30 do 70°C |
| (4) | | Cables with multiple, flexible copper strands, screened with copper wires, in PVC jacket | Nominal voltage: 450/750V Operating temperature: -40 do 70°C |
| (5) | | Power cable with copper strands, screened with copper wires, in PVC jacket | Nominal voltage: 450/750V Operating temperature: -40 do 70°C |

Power cables for the control box, pumps and fan motors shall be installed in accordance with the scheme and wiring list. Cable dimensions were selected based on long-term power load assumption accordance with the standard EN/PN-IEC 60364-5-523.

Tab. 4 The standard cable list and symbols of schemes.

| Symbol from the application scheme | Description | Type of the wire | Number of x cross - section in mm$^2$ |
|---|---|---|---|
| S1F | Cooperation with the station controller fire-protective | (2) | 2x1 |
| Y1 | Actuator of the valve of the water heater | (4) | 3x1 |
| M1 | Connecting of the circulation pump the water heater | (1) | 3x1,5 |
| FM1 | Protecting the circulation pump of the water heater | - | - |
| KM1 | Relay/contactor of the circulation pump of the water heater | - | - |
| S2F | Thermostat frost-resistant of water heater on the side of air | (2) | 2x1 |
| Y2 | Actuator of the valve of the water cooler | (4) | 3x1 |
| Y3 | Actuator of the dumper of the recirculation | (4) | 3x1 |
| Y4 | Actuator of the cross exchanger | (4) | 3x1 |

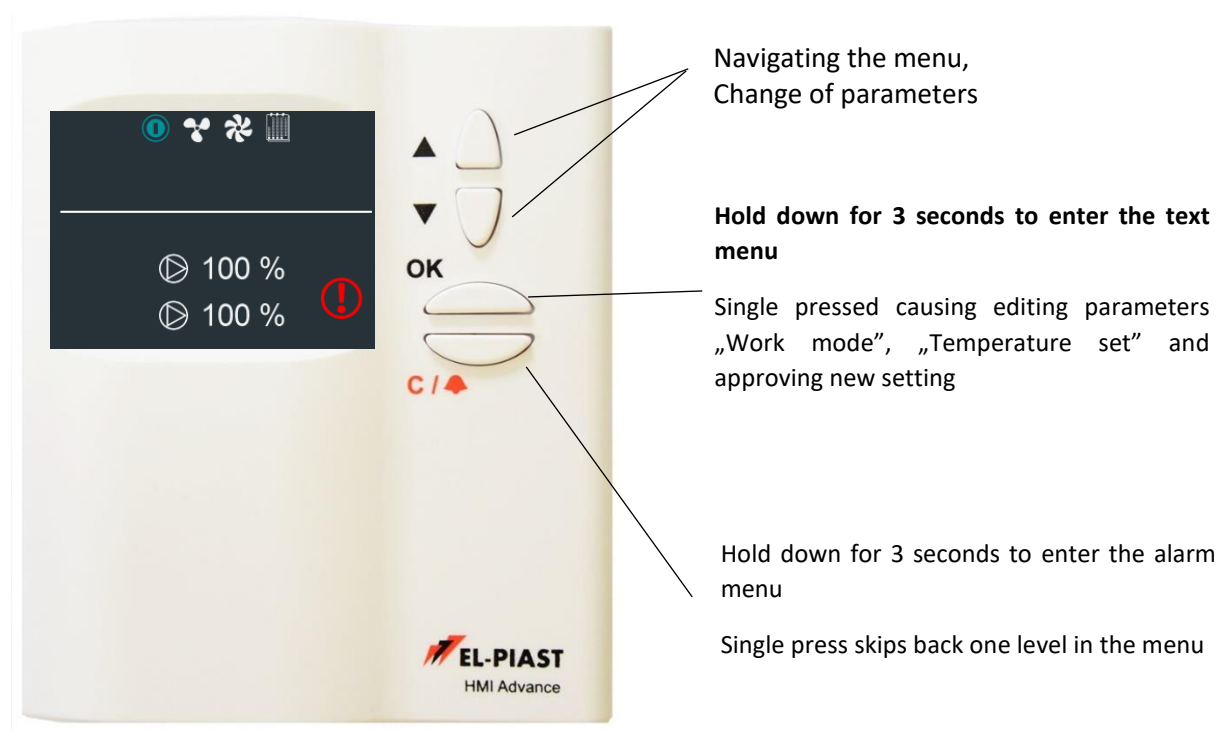| | | | |
|---|---|---|---|
| Y9 | Signal 0-10 V for the freon cooler | (4) | 3x1 |
| E1 | Signal of attaching the AHU cold | (2) | 2x1 |
| CX1 | Signal of the controller of the I step of the cold AHU dry contact NO | (2) | 2x1 |
| CX2 | Signal of the controller of the II step of the cold AHU dry contact NO | (2) | 2x1 |
| S.GAS | Alarm signal from gas heater | (2) | 2x1 |
| E.GAS | On-Off signal of the gas heater | (2) | 2x1 |
| Y.GAS | Signal 0-10 VDC for gas heater | (4) | 2x1 |
| S4F.NE 9,10 | Alarm signal of electric heater | (2) | 2x1 |
| Y.NE 3,4 | Signal 0-10 V for the electric heater | (3) | 2x1 |
| F1M1 | Protecting the engine of the air blowing | - | - |
| 1U1 | Connecting powering the ventilator for converters supply | (5) | Attachment B |
| 1M1 | Connecting powering the engine of the team of the fan inlet | (1) | Attachment B |
| RS1U1 | The control signal link RS485 for supply frequency converter | BUS O2YS(St)CY | 1×2×0,64/2,6 |
| E1U1 | START/STOP signal and change gears for supply frequency converter (if we don't use control RS485) | (2) | 4x1 |
| 1UA1 | Signal confirming supply frequency converter works | (2) | 2x1 |
| F2M1 | Protecting the exhaust engine | - | - |
| 2U1 | Connecting powering the ventilator for converters exhaust | (5) | Attachment B |
| 2M1 | Connecting powering the engine of the team of the fan outlet | (1) | Attachment B |
| RS2U1 | The control signal link RS485 for exhaust frequency converter | BUS O2YS(St)CY | 1×2×0,64/2,6 |
| E2U1 | START/STOP signal and change gears for exhaust frequency converter (if we don't use control RS485) | (2) | 2x1 |
| 2UA1 | Signal confirming exhaust frequency converter works | (2) | 2x1 |
| 1Y1 | Actuator of the dumper of air blown in | (2) or (4) when 0-10V | 3x1 |
| 2Y1 | Actuator of the dumper of air blown off | (2) or (4) when 0-10V | 3x1 |
| B1 | Temperature sensor of air blown in | (4) | 2x1 |
| B2 | Temperature sensor of air blown off | (4) | 2x1 |
| B3 | Sensor of the outdoor temperature | (4) | 2x1 |
| B4 | Sensor of the air temperature of the recuperation blown off behind the AHU | (4) | 2x1 |
| B5 | Leading the optional temperature sensor | (4) | 2x1 |
| B8 | Temperature sensor of the back water of the heater (optional) | (4) | 2x1 |

| B13 | Exhaust CO2 meter sensor (optional) | (4) | 3x1 |
|------|------|------|------|
| 1S1F | Differential pressure switch of fan of the air blowing (optional) | (2) | 2x1 |
| 2S1F | Differential pressure switch of fan of the outlet (optional) | (2) | 2x1 |
| 1S1H | Differential pressure switch of filter of the preliminary air blowing | (2) | 2x1 |
| 1S2H | Differential pressure switch of filter of the secondary air blowing | (2) | 2x1 |
| 2S1H | Differential pressure switch of filter of the preliminary outlet | (2) | 2x1 |
| E5 | Confirming the start – dry contact NO | (2) | 2x1 |
| E4 | Collective alerting signal – dry contact NO | (2) | 2x1 |
| N1 | Controller | - | - |
| N2 | Panel HMI Tiny | (3) | 7x1 |
| N3 | Panel HMI Advance - communication (max 100m) | BUS O2YS(St)CY | 1×2×0,64/2,6 |
| | Panel HMI Advance – power supply (max 100m) | (2) | 2x1 |
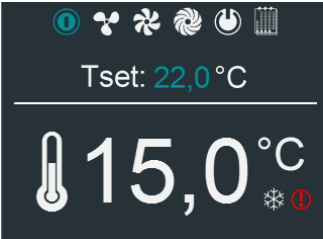
# 6 OHMI AND CONTROLLER SPECIFICATION

HMI Advance



Navigating the menu, Change of parameters

**Hold down for 3 seconds to enter the text menu**

Single pressed causing editing parameters „Work mode", „Temperature set" and approving new setting

Hold down for 3 seconds to enter the alarm menu

Single press skips back one level in the menu

Main menu icons:

| | | |
|---|---|---|
| Tset: 22,0 °C<br>15,0 °C | Setting the operating mode: „Stop", „1 gear", „2 gear", „3 gear", „Stand-by" „Calendar" | |
| | Tset: 22,0°C | Setting the setpoint temperature |
| | 15,0°C | Read the temperature from the leading sensor |
| | ❄ | Frost recovery active |
| | ⊘ | The summary alarm activated |

After pressing "OK" (about 1 second) display changes to the text menu of the operating system automation.

Single pressed causing editing parameters „Work mode", „Temperature set" and approving new setting.

After longer time holding down the keys „▲ " and „ ▼" at the same time (about 3 seconds), display changes to the display's setup menu.

HMI parameter description:
**Minimal brightness** – minimal brightness of the highlight
**Maximal brightness** – maximal brightness of the highlight
**Activity time** – time of activity, after this time the display is dimmed
**After activity time** – action undertaken after activity time (1. nothing, 2. if alarm occurred, than go to alarm menu, else go to the first chart of main menu).
**T sensor offset** – the adjustment of the temperature sensor measuring in the HMI
**Menu skin** – Skin selector of the HMI
**Communication settings** – communication settings menu of the HMI and RS485 Master interface settings of the ELP controller

To exit menu - press C key.

Panel Advance HMI can be connected to the input of the HMI CON (located at the upper side of the driver around the USB connector) or RS485 master (if it is not used to transfer information management system BMS). There is a possibility of simultaneous connecting two panels to the RJ45 connector and RS485 Master. If a sensor leading temperatures is a sensor in panel check HMI whether there is a chosen sensor leading Adjusting/temperature/sensor in accordance with connecting on the menu.

Panel HMI Advance has a jumper "simple/ext" which the opening causes the work for panel with the partly hidden menu, this function won't let the service of the object the entry in "service menu" where we are making the configuration of the ventilation arrangement in.
On the controller screen ELP... the function „simple/ext" is inactive.

        **The USB connection is used to download the application control.**
**If the application does not meet the control requirements of the customer, contact the manufacturer or supplier, you can adapt to the requirements of the application and upload it using any PC.**
ELP14R18-Mod, ELP14R18L-Mod – communication Modbus RTU with BMS through the RS485 (connector RS485 Master)

ELP14R18-Bac, ELP14R18L-Bac – communication with BMS through the BACnet MS-TP (connector RS485 Master)



1. Parameter's display.
2. Display flashing indicates an alarm.

1. Enter sub-menu or parameter edition.
2. Confirmation of parameter change

1. Menu navigation Parameter changing
2. Holding above 3 sec. opens display Settings Menu.

1. Go back to higher menu level.
2. Parameter change cancellation.
3. Holding by 3 seconds opens Alarm Menu.

Communication and alarm signaling

Menu navigation Parameter changing

Longer holding of "two arrows" at the same time (more than about 3 seconds) display enters Display Settings Menu.

Parameter description:
**Contrast** – display contrast
**Minimal brightness** – minimal brightness of the highlight
**Maximal brightness** – maximal brightness of the highlight
**Backlight time** – time of activity, after this time the display is dimmed
**After backlight time** – action undertaken after activity time (1. nothing, 2. if alarm occurred, than go to alarm menu, else go to the first chart of main menu).
**Master bus speed** – RS Master speed setting (9600)
**Modbus address** – MAC address of the Modbus

To exit menu - press C key.

Panel Advanced HMI can be connected to the input of the HMI CON (located at the upper side of the driver around the USB connector) or RS485 master (if it is not used to transfer information management system BMS). You can simultaneously connect two room units HMI CON connector and RS485 master - in this case we cannot connect the controller with the BMS facility.

Panel HMI Advanced has a jumper "simple / ext" the opening adjuster will work with partially hidden menu, this function will use the object to enter the "Service menu" in which we make the ventilation system configuration.
The menu driver is always visible in its entirety.

## 6.1 SERVICE MENU - CONFIGURATION

Panel HMI Advance has a jumper "simple/ext" which the opening causes the work for panel with the partly hidden diet, this function won't let the service of the object the entry in "service menu" which we are making the configuration of the ventilation arrangement in.

The access to the service menu protected is a password (default: **1111**).

The configuration of the arrangement with the service menu consists on:
1) change of the type of the Air Handling Unit (supply, supply/exhaust, water heater, electric heater, gas heater, water cooler, DX cooler, glycol – run around coils, plate heat exchanger, rotary heat exchanger, mixing chamber)
2) accessing menu and configuration:
    **Starting time** – the ability to set the time after which the system can start working
    **Fan inverter type** – the possibility of choose fan inverter type controlled by Modbus RS485 (LG IC5, IG5, Danfoss FC51, Danfoss FC101, EC Blue, Eura Drive)
    **EC Blue** – possibility of setting the Modbus address of the speed controller built into the EC motor.
    **Supply 0-10VDC** – the possibility of activation of one of the analog outputs as a signal 0-10VDC airflow rate of the supply air fan (make sure the output is not used for other purposes in the application)
    **Exhaust 0-10VDC** – the possibility of activation of one of the analog outputs as a signal 0-10VDC airflow rate of the exhaust air fan (make sure the output is not used for other purposes in the application)
    **HMI Tiny** – There is ability to active panel „HMI Tiny" which is using when the reference temperature is done by the knob in the HMI Tiny (for this purpose used the analog input Ain2), start/stop the system is realized by closing/ opening temperature sensor placed in the temperature of the room unit connected by adjuster switch to sensor input PT5 (using the panel HMI Tiny is not possible to work the system in standby mode due to the use of open sensor as STOP system)
    **Outside temperature sensor** – there is ability to deactivation outside temperature sensor, when the sensor is inactive function preheat the water heater and ability to run the freon cooler is based on the time of year selected in menu "Settings/ Season"
    **Exhaust temperature sensor** – there is ability to deactivation exhaust temperature sensor, when the exhaust sensor is inactive function Eco is inactive and is not possible to determine the possibility of heat recovery (mixing chamber opens whenever you need heating)
    **Alarm A_ColdRec** – when the alarm is active – alarm A_ColdRec frost of recovery visible in the alarm menu all the time during the freezing,
    **when is Inactive** – alarm A_ColdRec frost of the recovery invisible in the alarm menu, while the alarm in history is written with the moment of an alarm frost, and on graphical screen of HMI freezing icon appears during frost recovery.
    **Recovery sensor** – option of protection against frost recovery (temperature sensor or pressure switch)
    **HE control** – Option to select the type of electric heater control (applies to analog output 0-10VDC - Aout1), smooth control 0-10VDC or PWM control 0/10VDC
    **Contact work** – there is an ability to active one of the relay output as a confirmation of work (make sure that the output is not used for other purpose in the application).
    **Contact alarm** – there is an ability to active one of the relay output as a collective alarm (make sure that the output is not used for other purpose in the application).

**Tset change** – ramp change of setpoint temperature (elimination of sudden change of setting for smooth operation of temperature regulators)

**Regulator** - the possibility of activation one of the two types of control "1" sum of temperature controllers: the main, lim.min., lim.max., "2" new cascade control in which the start-up of the system taking place only with the supply air temperature controller for the time specified in "Settings/Temperature/Tset ramp" and after this time (when the leading sensor is different from the supply temperature sensor) an additional leading temperature controller is activating and generating temperature set setpoint of the supply controller.

**Analog outputs** – the possibility of rescale the output signal 0-10VDC to 2-10VDC (please check signals compliance with manuals of damper or valve actuators)

**Tcom** – communication time with one frequency inverter

**Twait** – response time for communication with all frequency inverters

After the configuration of the arrangement one should switch the service mode on DISABLED and to conduct the activating procedure of the arrangement.

1) connect and configure frequency inverters.
2) check the correctness of connections and the reaction of inputs/outputs to the state of sensors, detectors, switching inputs elements and executing outputs elements.
3) test selection of the leading sensor.
4) start up the unit and check the process of the temperature control.
5) check and select appropriate settings of temperature adjusters (in order to slow down one should reduce the Kp parametric or/and increase the parameter Ti )
6) fill up the activating card of the system and permanently fasten the copy of the card to the control box (attachment D)

The service menu has options of the emulation of inputs and forcing outputs. For the correct work of the system emulation and forcing functions must be disabled.

## 6.2 TUNING OF THE PI REGULATORS

Properly executed tuning of PI regulators, the work of the Air Handling Unit on the air flow rate specified in the selection card of the unit, proper selection of the unit's components (recommended analog control each of heating/cooling exchanger), the system operation on site where there are no sudden changes of temperature due to generation of large amount of heating/cooling by other devices, allow you to get a stable leading temperature control to an accuracy of ± 0.1 ° C.

In order to check the current accuracy of temperature control you can go to the "Service Menu/History of leading temperature" which is written the last 15 measurements from the leading temperature sensor in the selected period of recording) and is given "deviation" which is the maximum difference of actual set point temperature and the last 15 measurements of the leading temperature sensor.

If you do not achieve a satisfactory effect of the temperature control process you should:
- check that the system is working at full airflow rate (compare the fans inverter frequency with frequency of operation specified in the Selection Card of the AHU or with the data obtained from the results of air flow rate measurements)
- check the correct operation of actuators and control systems of the heaters, coolers, heat recovery systems

- check the correct operation of the air dampers
- check the installation of temperature sensors
- check the tuning of PI regulators

Using the "Service Menu/Configuration/Regulator" check the currently selected type of temperature regulator (**recommended type "2"**).

**Regulator type „1"** - sum of temperature controllers: the main, lim.min., lim.max.,

| The name in menu: | Factory settings | Recommended settings |
|---|---|---|
| Heating PI | Kp = 1 | Kp = 1 |
| | Ti = 60s | Ti = 60s |
| Cooling PI | Kp = 1 | Kp = 1 |
| | Ti = 60s | Ti = 60s |
| Supply PI (limit Tmin sup, Tmax sup) | Kp = 1 | Kp = 1 |
| | Ti = 90s | Ti = 45s |

Supply PI of the controller type „1" has to be always faster than Heating and Cooling PI.

Limit temperature parameters „Tmin supply", Tmax supply" have to be different by at least 5°C from the temperature set.

In the lack of stabilization using recommended settings, increase Ti setting of each of the controller by 10 seconds may be preferred (max. up to 120 seconds).

**Lack of stabilization of the such selected settings may indicate an error in the selection of heating/cooling exchangers, their improper operation, lack of required in accordance with the AHU selection card, thermal parameters of the heating/cooling exchangers.**

**Regulator type „2"** - a new cascade regulator in which the start-up of the system taking place only with the supply air temperature regulator for the time specified in menu "Settings/Temperature/Tset ramp" and after this time (when the leading sensor is different from the supply temperature sensor) an additional leading temperature regulator is activating and generating temperature setpoint of the supply regulator.

| The name in menu: | Factory settings **(recommended)** |
|---|---|
| Heating PI | Kp = 1 |
| | Ti = 60s |
| Cooling PI | Kp = 1 |
| | Ti = 60s |
| Supply PI (limit Tmin sup, Tmax sup) | Kp = 1 |
| | Ti = 90s |

Supply PI regulator type "2" may be faster or slower than the heating and cooling PI, the slower the smaller oscillations at the minimum and maximum supply temperature but slower response to the limit.
Limit temperature parameters „Tmin supply", Tmax supply" may be close to the temperature set.
In the lack of stabilization using recommended settings, increase Ti setting of each of the controller by 10 seconds may be preferred (max. up to 120 seconds).

**Lack of stabilization of the such selected settings may indicate an error in the selection of heating/cooling exchangers, their improper operation, lack of required in accordance with the AHU selection card, thermal parameters of the heating/cooling exchangers.**

## 6.3 STANDARD FUNCTIONS OF CONTROLLER'S INPUTS/OUTPUTS

| **Digital inputs** (State of the NC access - giving for accessing DIN... enclosing the digital input causes stretching 24 VAC) | | During the correct work of the system | The lack of the required state is causing alarm |
|---|---|---|---|
| Din 1 | Fire central and confirmation of fans work (and supply ventilator pressure switch at systems with electric heater) | compact | A_StopSystem |
| Din 2 | Thermostat frost-resistant water heater | compact | A_ThHWair, A_3xThHWair |
| | Alarm of the electric heater | compact | A_ThHE, A_3xThHE |
| | Alarm of the gas heater | compact | A_ThGAS, A_3xThGAS |
| Din 3 | Differential pressure switch of filters | obtuse | A_Filter |

| **Analogue inputs devices** (Signal inputs devices 0-10VDC) | |
|---|---|
| Ain 1 | CO2 sensor (optional) |
| Ain 2 | HMI Tiny (optional) |

| Temperature sensors PT1000 | | The damaged temperature sensor is causing alarm |
|---|---|---|
| PT1 | Supply | A_Tsup |
| PT2 | Exhaust (optional) | A_Texh |
| PT3 | Outside | A_Tout |
| PT4 | Exhaust after recovery | A_Trec |
| PT5 | Return water of water heater (option when is not using HMI Tiny) | A_TbackWater |
| | Room (there is in optional panel HMI Tiny) | Stop system |

| **Digital outputs**, state OFF - ReC/ReA output obtuse, ON state - ReC/ReA output shorted | | |
|---|---|---|
| Re1 | Pump of the water heater | relay |
| | Electric heater | relay |
| | Gas heater | relay |
| Re2 | Pump of the water cooler | relay |
| | 1 step of a refrigerating unit | relay |
| Re3 | 2 step of a refrigerating unit | relay |
| Re4.1 | Air dampers of the Supply/Exhaust | relay |
| Re4.2 | Fans Start/Stop | relay |
| Re5.1 | Group alarm | relay |
| Re5.2 | Group alarm | relay |

| **Analogue outputs** (Signal outputs 0-10VDC) |
|---|

| | |
|---|---|
| Aout1 | Heater (water or electric) |
| Aout2 | Cooler (water or DX) |
| Aout3 | Mixing chamber (10-0V), air dampers supply/exhaust (0-10V), plate exchanger (0-10V) |

**In the service menu you can activate any relay outputs as a confirmation of work or group alarm. When activated, make sure that the output is not used in the application.**

# 7 CONTROL SERVICE

Before start-up by the user the control box should be connected and checked by authorized personnel.

**Start-up of the device:**
Operate Switch Q1M into position ON.

„1-ON" (synthetic switchboard)                    „1" (metal switchboard)
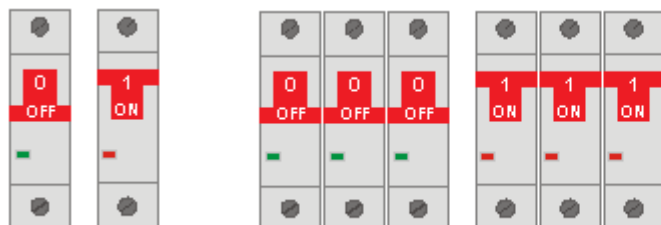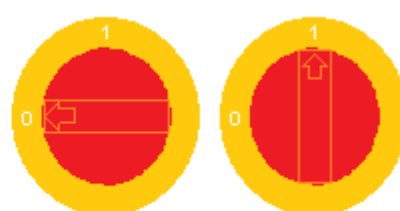
The device is starting-up if:
- isn't appear neither of the alarms of the locking operation of the system
and
- parameter „Set work mode"  on the controller or on the HMI is set to any option other than Stop.

**ATTENTION:** After the power supply disruption, the system automatically returns to work with the last used settings (settings before the power supply disruption).

**Changing the temperature set if as panel a "menu" was chosen:**
Parameter **"Set temperature"** in the main menu of controller or HMI.

Unit state
S t o p

Main menu

Set work mode
S t o p

Temp. settings
2 3 , 9 ° C
45,0 °C
5,0 °C

Temp. setted
0 , 0 ° C

Main temperature
1 4 , 7 ° C

Supply sensor
0 , 0 ° C

1.Changing of the work mode:
- push the (OK) button, hold until "Stop" will start to blink,
- next choose another work mode and accept it by pushing button (OK)

2.Editing setted temerature
- push the (OK) button and hold it until value "23,9.." start to blink,
- next choose another value and confirm chosen value by pushing (OK) button.

Handling of the HMI has been described in point 5 of this manual.

## 7.1 ALARMS

Alarms are indicated by display flashing and red continuous lighting LED on the controller or HMI, Re8 relay output of the controller is set ON.

Information on the alarm can be read from „Alarm Menu". Entering Alarm menu – by holding pressed of „C" key during about 3 second.

In case of blocking alarm, it is necessary to reset the alarm before restart of automation system will be possible. To reset the alarm one should enter Alarm Menu, choose proper alarm and hold OK. button for some time. If the source of the alarm is still active, the alarm will be supported and „*" symbol will appear at its description, denoting confirmation of the alarm. If source of the alarm have passed or will pass after confirmation of the alarm, alarm will be reset.

**List of alarms**

| ALARMS | Alarm type | Reaction of the system, proceeding |
|---|---|---|
| | | Digital inputs |
| **A_StopSystem** | Blocking | Cooperation with fire alarm control panel. <br><br> **Alarm is OFF** – lack of fire, on digital input appeared signal 24VAC <br><br> **Alarm is ON** – fire appeared, on digital input doesn't appeared signal 24VAC <br><br> Reaction on alarm ON: system is stopped until the fire won't be eliminated; after the fire is extinguished system is coming back to the working mode (state before alarm). <br><br> and <br><br> The test proper operation of the supply fan with pressure switch contact: |

| | | |
|---|---|---|
| | | Normal state – 10 seconds after system start contact is closed, the digital input signal is 24VAC<br>Alarm conditions – 10 seconds after system start alarm contact is open, the digital input signal is not 24VAC<br><br>Responding to an alarm condition: the system is stopped, check the inverter and how to connect the controller and the fan, determine the cause of the error, and the cause of the alarm must be acknowledged and operate the system<br><br>**Digital inputs Din1** |
| **A_ThHWair**<br><br>**A_3xThHWair** | Declining Blocking | Heater anti-frost protection is accomplished by anti-frost thermostat<br><br>**Alarm is OFF** – temperature measured right after the heater is higher than temperature set on thermostat, on input digital input is signal 24VAC<br><br>**Alarm is ON** – temperature measured right after the heater is lower than temperature set on thermostat, signal 24VAC doesn't appear on input digital<br><br>Reaction on Alarm is ON: system is stopped, heater efficiency will stay on 100% level, until thermostat is warm enough. After thermostat is warmed up, in alarm menu user has to be confirm that process is finished. After conformation in alarm menu and lack of low temperature of thermostat, system comes back to the state of work. If during one hour, alarm A_ThHWair will appear 3 times, system is stopped and alarm A_3xThHWair will be displayed which needs to be confirmed as well.<br><br>**Digital input: Din2** |
| **A_ThHE,**<br>**A_3xThHE** | Declining Blocking | Protection against overheating of the electric heater on the input signal is input to the alarm relay HE module mounted on the control box power and control electric heater:<br><br>Normal state - heater temperature is low, the digital input signal is 24VAC<br>Alarm conditions - the temperature of the heater is too high, there is no 24VAC on the digital input<br><br>Responding to an alarm condition: the system operates without heating until resolution of overheating, after the disappearance of overheating alarm disappears and takes the work out of the heater, and three times in one hour speech A_ThHE alarm system will stop working and display A_3xThHE alarm that requires confirmation.<br><br>**Digital input: Din2** |
| **A_ThGAS,**<br>**A_3xThGAS** | Declining Blocking | Protection of the gas heater, the input is fed from the non-potential alarm relay of the gas heater control module:<br><br>Normal state - the digital input signal is 24VAC<br>Alarm conditions - there is no 24VAC on the digital input<br><br>Responding to an alarm condition: the system operates without heating until resolution of overheating, after the disappearance of overheating alarm disappears and takes the work out of the heater, and three times |

| | | |
|---|---|---|
| | | in one hour speech A_ThGAS alarm system will stop working and display A_3xThGAS alarm that requires confirmation.<br><br>Able to change the NO to NC<br><br>**Digital input: Din2** |
| **A_Filter** | Declining | Study the degree of contamination of the supply air filter with switch:<br><br>Normal state - dirty limit, the pressure difference before and after the filter is below the set on the pressure switch, there is no 24VAC on the digital input signal<br><br>Alarm conditions - dirt unacceptable pressure difference before and after the filter is above the set on the pressure switch, the digital input signal is 24VAC<br><br>Responding to an alarm condition: the system works, it is a dirty filter alarm is displayed in the case of an alarm should immediately replace the filter with a new one, work with a dirty filter reduces the expenditure control and may cause it to rupture which can lead to contamination and damage to the heat exchanger / cooling from the customer's fault<br><br>**Digital input Din3** |
| | Sensor inputs PT1000 | |
| **A_Tsup** | Declining | The test proper operation of air temperature sensor:<br><br>Normal state - there is no alarm, sensor connected<br>Alarm conditions - an alarm occurs, the sensor disconnected or damaged<br><br>Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be confirmed and the system started-up again<br><br>**Sensor input PT1** |
| **A_Texh** | Declining | The test proper operation of exhaust air temperature sensor:<br><br>Normal state - there is no alarm, sensor connected<br>Alarm conditions - an alarm occurs, the sensor disconnected or damaged<br><br>Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be confirmed and the system started-up again<br><br>**Sensor input PT2** |
| **A_Tout** | Declining | The test proper operation of the outdoor temperature sensor:<br><br>Normal state - there is no alarm, sensor connected<br>Alarm conditions - an alarm occurs, the sensor disconnected or damaged |

| | | |
|---|---|---|
| | | Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be confirmed and the system started-up again<br><br>**Sensor input PT3** |
| **A_Trec** | Declining | The test proper operation of exhaust temperature sensor for recovery (or glycol contact sensor):<br><br>Normal state - there is no alarm, sensor connected<br>Alarm conditions - an alarm occurs, the sensor disconnected or damaged<br><br>Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be confirmed and the system started-up again<br><br>**Sensor input PT4** |
| **A_TbackWater** | Declining | The test proper operation of return water temperature sensor with heater:<br><br>Normal state - there is no alarm, sensor connected<br>Alarm conditions - an alarm occurs, the sensor disconnected or damaged<br><br>Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be confirmed and the system started-up again<br><br>**Sensor input PT5** |
| **A_Tmain** | Declining | The test proper operation of the temperature sensor lead:<br><br>Normal state - there is no alarm, sensor connected<br>Alarm conditions - an alarm occurs, the sensor disconnected or damaged<br><br>Responding to an alarm condition: the system is stopped, check the sensor lead and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be confirmed and the system started-up again<br><br>**Entry depends on the choice of the leading sensor** |
| | **Other alarms** | |
| **A_ComSupFC** | Declining | The study proper communication between controller and inverter of the supply fan:<br><br>Normal state - there is no alarm, correct communication<br>Alarm conditions - an alarm occurs, communication is not correct<br><br>Responding to an alarm condition: the system is stopped, check the inverter and how to connect to the controller, determine the cause of the error, and the cause of the system automatically returns to normal |

| | | |
|---|---|---|
| | | operation |
| **A_ComExhFC** | Declining | The study proper communication between controller and inverter of the exhaust fan: <br><br> Normal state - there is no alarm, correct communication <br> Alarm conditions - an alarm occurs, communication is not correct <br> Responding to an alarm condition: the system is stopped, check the inverter and how to connect to the controller, determine the cause of the error, and the cause of the system automatically returns to normal operation |
| **A_ColdRec** | Declining | Study the possibility of appearing the recovery frost using exhaust air temperature sensor after recovery <br><br> Normal state - there is no alarm, high temperature <br> Alarm conditions - an alarm occurs, low temperature <br><br> Responding to an alarm condition Plate heat exchanger (without by-pass) : decrease the supply power ventilator. <br><br> Responding to an alarm condition Plate heat exchanger (with by-pass) : decrease the recovery efficiency, The system works with recovery or with reduced modulation <br><br> **It is possible to use the pressure control switch** <br><br> **(Service menu / Recovery sensor)** <br><br> **When the pressure switch is used, the PT4 and GND short-circuits initiate the anti-frost response** |
| **A_ThHWwater** <br><br> **A_3xThHWwater** | Declining <br> Blocking | Heater protection against freezing by contact sensor B8 on the water heater return <br><br><br> Normal state - temperature of the contact sensor is higher than the set on the controller or panel <br><br> Alarm conditions– temperature of the contact sensor is lower than the set on the controller or panel <br><br><br> Responding to an alarm condition: the system STOP, the heater 100% until the temperature on the water heater return rise above setpoint. After crossing the temperature measured by the contact sensor, system backs to work, after 3 times occurrence of the alarm A_ThHWwater within an hour, system stopping the operation and alarm A_3xThHWwater is displayed, alarm requires confirmation |
| **A_Code** | Blocking | The alarm indicating allowed configuration of air handling unit in service menu/type of air handling unit <br><br> **ATENTION!!! IN CASE OF SUPPLY AHU SELECTION, SYSTEM RECOVERY MAY ONLY BE MIXING CHAMBER** |

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| A_In_Emul | Declining | Emulation of inputs:<br><br>Normal state - there is no alarm, no input is in emulation mode<br>Alarm state - at least one of the digital inputs, analog, PT1000 is in emulation mode<br><br>Responding to an alarm: controller does not react to physical changes emulated input, the system works with the value of the emulator in the service menu |
|---|---|---|
| A_OutForce | Declining | Forcing output:<br><br>Normal state - there is no alarm, no output is in forcing<br>Alarm state - at least one of the digital outputs, analog mode is forcing<br><br>Responding to an alarm condition: the system works, however, forced output does not respond to the control algorithm, is set by the "force outputs" in the service menu |

**Attention: Working in forcing or emulation mode can cause damage to the ventilation system caused by the user. Changes I/O in emulation or forcing mode should only be done by qualified and trained personnel.**

**Alarm reset:**
In case of blocking alarm, it is necessary to reset the alarm before restart of automation system will be possible. To reset the alarm one should enter Alarm Menu, choose proper alarm and hold OK. button for some time. If the source of the alarm is still active, the alarm will be supported and „*" symbol will appear at its description, denoting confirmation of the alarm. If source of the alarm have passed or will pass after confirmation of the alarm, alarm will be reset.

# 8 CONTROL OPERATION

## 8.1 MAIN MENU

Tab. 4 Main menu

| Name | Default value | Description |
|---|---|---|
| State of the AHU | Service mode | **Service mode** – the arrangement is in the course of the configuration, lack of ability of the start of the arrangement, active protective functions of chosen exchangers heating/cooling<br>**Stop -** the AHU is stopped, air dampers are closed , fans do not work, active protective functions of the AHU<br>**Alarm - stop** – the AHU is stopped, an at least one blocking alarm is appearing, check the list of alarms, describe the reason for the failure, after repairing erase the blocking alarm<br>**Preliminary warming up -** in case of the low outdoor temperature preliminary warming up is taking place in AHU with the water heater<br>**Warming up -** in AHU with the water-heater at reporting the alert from the thermostat frost-resistant warming the water-heater up is taking place<br>**Cooling -** in AHU with the electric or gas heater and the DX cooler stopping the functioning of fans is taking place late cooling from stopping the functioning of the electric heater or/and the DX cooler<br>**Work 1,2.3 step -** correct work on 1,2 or 3 step of fans |
| Main menu | - | Choice of the work mode of AHU, the set temperature of the leading sensor, the reading of temperatures and states of the functioning of the fans and heating/cooling exchangers |
| Calendar | - | Enables the programming of the calendar. Thorough description in the 7.2 subsection Calendar. |
| Settings | - | Parameters of the control system. Thorough description in the 7.3 subsection Settings. |
| Service menu | - | Enables the configuration of the AHU. |
| PL/EN/DE | - | Choice of the language menu (Polish/English/Dutch). |

## 8.2 CALENDAR

In Calendar options one can set date and time of real time clock. When operating mode is set at „**Calendar**" control will be realized according to recorded programs. Programs can cover a day or exceptions.

Program includes parameters:
**Work mode** – possible selections: Stop, Start 1 step, Start 2 step Start 3 step and the Stand-by.

**Temperature set** – temperature setting
**Fast heating** - there is possibility of activate fast heating using a mixing chamber (there is in system with mixing chamber)

**Calendar menu:**

```
Calendar ->        OK →        Set date:
                      ←         Cz 06-03-15
                   C
```

```
                              Set time:
                              13:43
```

```
Work mode ->       OK →       Monday ->
                      ←
                   C
```

```
                              Sunday ->
```

```
                              Exceptions ->
```

```
Set.temp. ->       OK →       Monday ->
                      ←
                   C
```

```
                              Sunday ->
```
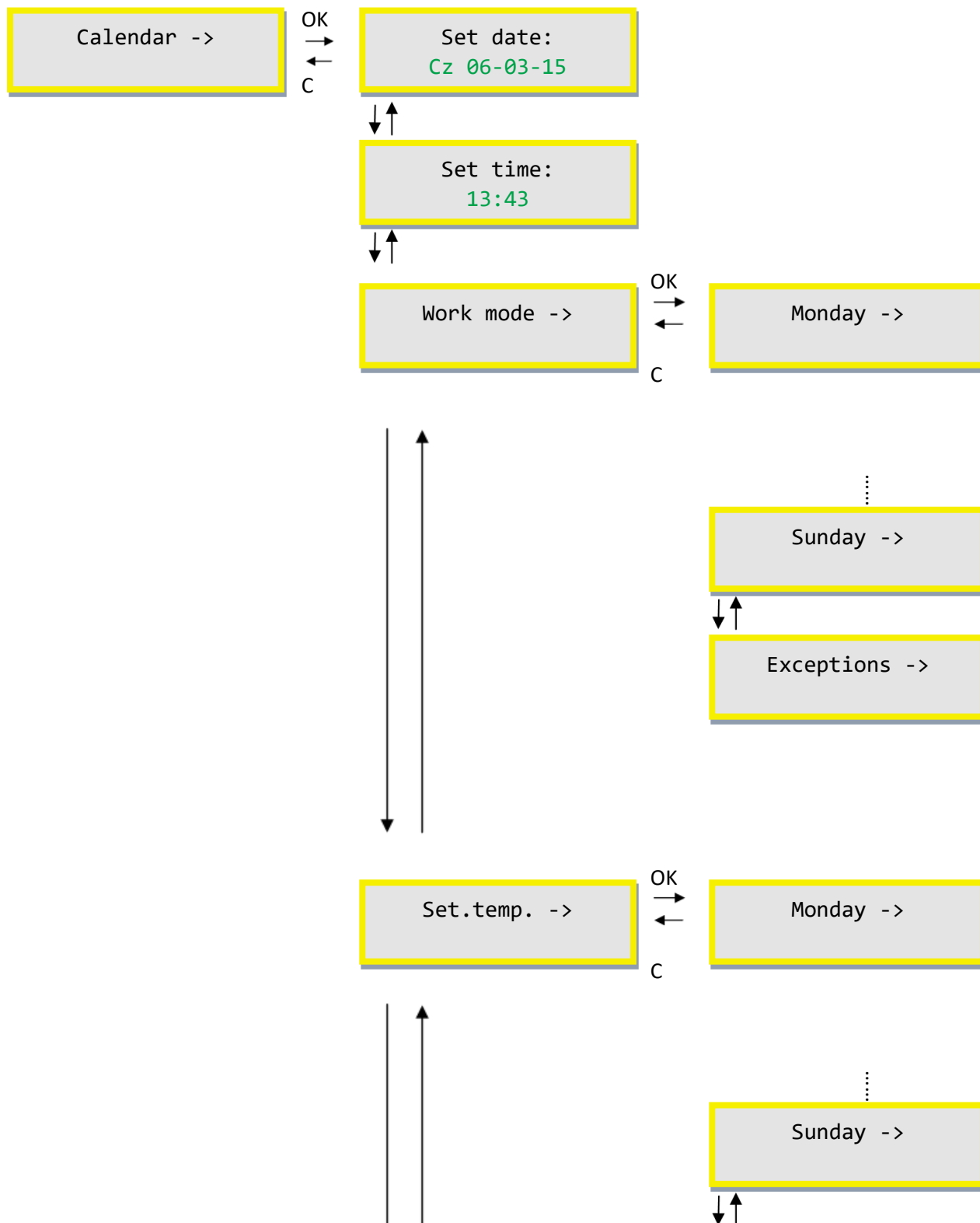
```
Exceptions ->
```

```
Fast heating ->    OK →    Monday ->
                      ←
                      C
```

```
Sunday ->
```
↓↑
```
Exceptions ->
```

**Work mode:**

```
Monday ->    OK →    New ->    OK →    Time from:
                ←             ←          8:00
                C             C
```

```
Set work mode
   1 gear
```

OK – saving program

```
Save
```

```
New ->
```

```
Time from:
  10:00
```

```
Set work mode
   3 gear
```

| Monday -> | C – back to higher level menu without saving | Save |

**Temperature setting::**

| Thuesday -> | OK → ← C | New -> | OK → ← C | Time from: 6:00 |

| | | | | Set temp. 26°C |

OK – saving program

| | | New -> | | Save |

| | | | | Time from: 20:00 |

| | | | | Set temp. 22°C |

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| Monday -> | C – back to higher level menu without saving | Save |
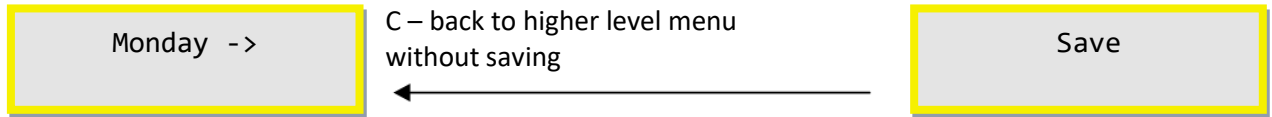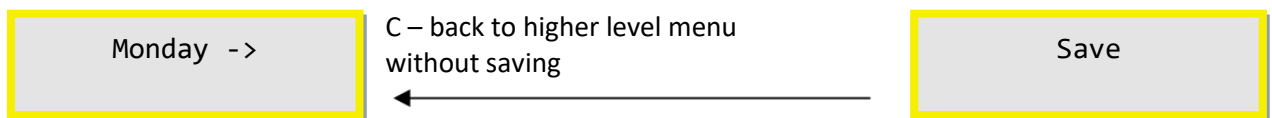
## 8.3 SETTINGS

Access to the this settings is password protected (by default: **1111**).

Tab. 5 Settings menu.

| Group | Name | Default | Description |
|---|---|---|---|
| Temperatures | Main sensor | Supply | **HMI CON** - temperature control according to the temperature sensor in the room unit HMI terminal connected by HMI CON<br>**HMI RS485** - temperature control by temperature sensor HMI room unit connected via RS485 interface<br>**Supply** - temperature control by temperature sensor supply<br>**Exhaust** - temperature control by the exhaust temperature sensor<br>**PT5** - temperature control by temperature sensor connected to sensor input PT5 |
| | Eco temp. difference | 15°C | **Eco temp. difference** – this is used both for heating and cooling, which does not allow the heating/cooling when the outdoor temperature is higher/lower the set point temperature of the exhaust sensor (the function is only active in the supply and exhaust systems) |
| | Start time | 300 s | **Start time** - fall time increased setpoint (and activation delay of the cascade temperature regulator, if it is active) |
| | Tset correction | 5°C | **Tset correction** - adjustment to increase the set point and minimum air temperature at the start of the system |
| | Offset | - | adjustment of the temperature sensors measuring |
| Season | Mode | Auto | Important to preheat the water heater and possibility to freon cooler work<br>**Auto** – season determined automatically based on the outside temperature sensor<br>**Winter** – manual setting winter mode<br>**Summer**– manual setting summer mode |
| | Summer since | March | Set the month from which recognize SUMMER |
| | Summer to | November | Set the month from which recognize WINTER |
| | Summer temperature | 20°C | **Summer temperature** - setting the outside temperature threshold above which the system is operating in summer mode |

| | | | |
|---|---|---|---|
| | - | 4°C | **Hysteresis -** *hysteresis setpoint for "Temp.summer" threshold, outdoor temperature drop below the "Temp.summer" - "hysteresis" difference causes the system to operate in winter mode* |
| Standby mode | Main sensor | HMI CON | **HMI CON** - *enabling the system to operate the sensor in the room unit HMI terminal connected by HMI CON* <br> **HMI RS485 Master** - *enabling the system to operate the sensor in the room unit HMI connected via RS485 Master* <br> **Exhaust** - *enabling the system to operate the exhaust temperature sensor* <br> **PT5** - *enabling the system to operate the temperature sensor connected to sensor input PT5* |
| | Active for | Heating and cooling | **Heating** – *system will start when the sensor temperature falls below the leading standby mode, the set temperature of the hysteresis mode* <br> **Cooling** – *system will start when the temperature sensor exceeds a leading standby mode, the set temperature of the hysteresis mode* <br> **Heating and cooling** – *system will start when the temperature sensor lead stand will rise or fall below or above the melting point of the hysteresis mode, standby* |
| | Standby hysteresis | 4°C | **Standby hysteresis** – *the difference in temperature sensor mode and set point temperature below which the system will be enclose when in standby mode* |
| Vent. | - | 10 s | **Starting delay** - *the time from the start throttle operation of the fans* |
| | | 15 s | **Damp.off delay** - *The time from switching on operation mode "Stop" and start stopping fans to start closing the air dampers actuators of the AHU* |
| | | 30 s | **Pressure delay** - *the time of operation of the fans after the pressure test on the filters.* |
| | | 180 s | **Cooling time** - *the time from the operating mode "1,2,3 gear" in the operating mode "Stop" and stopping the electric heater and/or DX cooler to stop the fans (cooling is at the lowest efficiency).* |
| | Supply | ... % | *Setting efficiency supply fan for 1,2,3 gear and defrost mode* |
| | Exhaust | ... % | *Setting efficiency exhaust fan for 1,2,3 gear* |

| | | | |
|---|---|---|---|
| | | Active | **Sup. via RS485** - activate communication with inverter supply fan |
| | | Active | **Exh. Via RS 485** - activation of communication with the exhaust fan inverter |
| | | 0 Hz | **Sup.freq.min.** – setting the minimum frequency of the supply air fan, corresponding setting performance 0% |
| | | 60 Hz | **Sup.freq.max.** - setting the maximum frequency of the supply air fan, corresponding setting performance 100% (the maximum frequency should be chosen according to DTR and performance measurement) |
| | RS485 | 0 Hz | **Exh.freq.min.** - setting the minimum frequency of the supply air fan, corresponding setting performance 0% |
| | | 60 Hz | **Exh.freq.max.** - setting the maximum frequency of the supply air fan, corresponding setting performance 100% (the maximum frequency should be chosen according to manual and performance measurement) |
| | | 1 | **Sup.inv.address** – address of the inverter supply fan |
| | | 2 | **Exh.inv.address** – address of the inverter exhaust fan |
| | | 60 s | **T.acc.** - start time inverters |
| | | 60 s | **T.dec.** - the time to stop the inverter |
| Part of regulation | - | 15% | **Recovery** – Involved in the regulation of recovery (parameter editable) |
| | | 15% | **Mixing chamber** - Involved in the regulation of the mixing chamber (parameter editable) |
| | | …% | **Heater/cooler** – participation in the regulation of the heater/cooler (read parameter) |
| Temperature regulators | PI heating | 1 | **Kp** - heating regulator gain |
| | | 60s | **Ti** – integration constant of the heating regulator |
| | PI cooling | 1 | **Kp** – cooling regulator gain |
| | | 60s | **Ti** – integration constant of the cooling regulator |
| | | Summer / Winter | **PI cooling** – activation of the cooling regulator only in summer or summer and winter |
| | | 30s | **Start delay** - can be set for the delayed start of the cooling regulator |

| | | 1 | **Kp** – air regulator gain |
|---|---|---|---|
| | PI air blow | 90s | **Ti** – integration constant of the supply air regulator |
| | | 15°C | **Tmin air blow** - minimum supply temperature (related to setting of the supply PI regulator) |
| | | 40°C | **Tmax air blow** - maximum temperature of the supply (related to setting of the supply PI regulator) |
| | | … | **TsetBlowAct** – the current value of the supply air temperature regulator in the cascade regulator. |
| Recovery | - | 450 s | **Starting ramp** - after the start-up, system operates with recovery of 100% with the ramp descent to the current drive the recovery resulting from the process control |
| | | Winter | **Work mode:** **Summer** –possible cooling recovery **Winter** –possible heating recovery **Summer/Winter** – possible heating and cooling recovery |
| | | 2°C | **Frost limit** - temperature below (sensor B4) which the function is acting frost-resistant |
| | | 1 | **Kp frost.prot** - gain of anti-frost function |
| | | 60s | **Ti frost.prot** - integration constant of the anti-frost function |
| Heater | Preheating | 15s | **Preh.100% time** - Time of preliminary with 100% open valve, irrespective of Tmin, Tmax scale |
| | | 30s | **Preh.scale time** - Time of preliminary with proportional open valve, depending on the Tmin, Tmax scale and temperature of return water (if the sensor B8 is active) |
| | | Active | **Falling ramp** – the possibility to activate / deactivate the function of the falling ramp valve opening degree after preliminary heating |
| | | 30s | **Fall ramp -** time of decrease after preliminary heating |
| | | 0°C | **Min T.out** – maximum temperature scale to pre-heat |
| | | 75% | **Min.Tout valve** – scale of the valve relative to the outside temperature |
| | | 10°C | **Max T.out** – maximum temperature scale to pre-heat |
| | | 15% | **Max.Tout.valve** – scale of the valve relative to the outside temperature |

| | Pump work temp. | 5°C | **Pump work temp.** - the temperature below which the pump is running all the time |
|---|---|---|---|
| | Min.valve open | 10% | **Min.valve open** - The minimum heating valve opening |
| | Water frost | Inactive | **B8 sensor** – activation of protection heater the sensor on return water |
| | | 10°C | **Frost temp.out.** – activation of Frost protection on the water side to the outdoor temperature which is lower than this parameter |
| | | 5°C | **Frost - Stop** – the setting of return temperature below the system is working in Frost heating mode (during the stop) |
| | | 10°C | **Frost - Start** – the setting of return temperature below the system is working in Frost heating mode (during the work) |
| | | 10°C | **Regulation - Stop** – temperature setting of the return water of the water heater, when the temperature in low the valve is opening, regardless of main control signal heater (during the stop) |
| | | 15°C | **Regulation - Start** – temperature setting of the return water of the water heater , when the temperature in low the valve is opening, regardless of main control signal heater (during the work) |
| | | 1 | **Kp** – regulator gain of the setpoint temperature on the water return |
| | | 30s | **Ti** – integration constant of the setpoint temperature on the water return regulator |
| | Pump protect | Active | **Set protection** - a recurring feature of the pump |
| | | 7days | **Period** - active when the protective function is active pump, |
| | | 30s | **Run time** - active when protective function is active pumps, |
| GAS alarm | - | NC | **Alarm pin** – the possibility of choice the type of contact alarm DX cooler NO/NC |
| DX cooler | - | 30s | **Break time min.**– minimal stop time refrigerating unit |
| | | 30s | **Work time min.** - the minimal working hours of a refrigerating unit |

| | | | |
|---|---|---|---|
| | | 13°C | **Temp.out work min.** – the minimal outdoor temperature by which the functioning of a refrigerating unit is active |
| | | Inactive | **Stage 2** – the possibility of activation II step cooling |
| | | Inactive | **Cascade** – the possibility of activation cascade control two-stage DX cooler (1 – I step, 2 – II step, 3 – I i II step), use for two coolers of different efficiency |
| | | 50% | **Stage 2** – the possibility of adjust threshold control signal level at which the II step of cooling is attached |
| | | 75% | **Stage 3** – the possibility of adjust threshold control signal level at which the III step of cooling is attached (only on cascade) |
| Mixing chamber | Work mode | Temperature | **Hand** - the mixing chamber isn't participating in the process of the temperature control, CO2, the opening degree in main menu of the controller<br>**Temperature** – the mixing chamber is participating in the process of the temperature control (when is the demand for heating there is increase in modulation of the mixing chamber and reducing the fresh air)<br>**Temperature/CO2** – the mixing chamber is participating in the process of the temperature control (when is the demand for heating there is increase in modulation of the mixing chamber and reducing the fresh air, (In case of low level of fresh air in exhaust starts to increase level of fresh air) |
| | Priority for | Mix chamber | **Heating/cooling** – in the process of the temperature control in the automatic mode of the mixing box, are holding shares one by one: 1. recovery, 2. heater/cooler, 3. mixing box<br>**Mix chamber** - in the process of the temperature control in the automatic mode of the mixing box, are holding shares one by one: 1. recovery, 2. mixing box, 3. heater/cooler |
| | Min. fresh air | 30% | **Min. fresh air** – establishing minimal opening air dampers of the supply/exhaust of AHU in the automatic mode |
| | Max. fresh air | 100% | **Max. fresh air** – establishing maximum opening air dampers of the supply/exhaust of AHU in the automatic mode |

| | | Inactive | **Fast heating** – function enabling fast heating up the AHU to the set temperature. When the mode of the fast heating is active and a need of starting his action will appear air dampers entirely are closing the inflow of the fresh air to the moment of reaching the demanded temperature |
|---|---|---|---|
| | Fast heating | 20°C | **Temperature set point -** demanded temperature for the function of the fast heating |
| | | 4°C | **Hysteresis** - Hysteresis of the Temperature set point |
| | | 600 ppm | **Set CO2 –** demanded value of concentration CO2 in exhaust air |
| | CO2 regulation | 0,1 | **Kp** – gain of the fresh air regulator |
| | | 90s | **Ti** – integration constant of the fresh air regulator |
| | | - | **Sensor range** – the ability to set the measurement range of the CO2 sensor |

### 8.4 SERVICE MENU

Access to these settings is password protected (default: **1111**).

Tab. 6 Service menu

| Name | Name | Default value | Description |
|---|---|---|---|
| Service mode | - | Active | **Active** – possible configuration of the AHU, lack of ability of the start of AHU, protective functions of the chosen arrangement active<br>**Not active** – configuration of the AHU is not possible, the possibility of the AHU start-up |
| AHU type | Type | Supply | **Supply –** Supply Air Handling Units<br>**Supply/exhaust –** Supply and Exhaust Air Handling Units |

| | | | |
|---|---|---|---|
| | Recovery | None | **None** – in the AHU a system of the recovery exchanger wasn't applied<br><br>**Cross**– AHU equipped with the Plate heat exchanger without by-pass<br><br>**Mix chamber** – AHU equipped with the mixing chamber, controlled with one signal 0-10 VDC damper  actuators of supply, exhaust and mixing chamber (0V- supply/exhaust OFF (closed), mixing chamber ON (open)<br><br>**Cross / Mix chamber** – AHU equipped with plate heat exchanger and mixing chamber<br><br>**Cross 0-10** – AHU equipped with the Plate heat exchanger with by-pass |
| | Heater | None | **None** – in the AHU heater wasn't applied<br><br>**Electric** – AHU equipped with the electric heater, controlled by signal 0-10 VDC, start/stop signal and with reflexive alarm signal.<br><br>**Water** – AHU equipped with the water-heater, controlled by the valve actuator and pump<br><br>**GAS** – AHU equipped with the GAS heater, controlled by signal 0-10 VDC, start/stop signal and with reflexive alarm signal. |
| | Cooler | None | **None** – in the AHU cooler wasn't applied<br><br>**DX** – AHU equipped with the DX cooler, controlled by signal 0-10VDC and digital signals being used for switching 1 and 2 of degree of the cooling, from a refrigeration unit we are taking the failure signal<br><br>**Water** – AHU equipped with the water-heater, controlled by the valve actuator and pump |
| Configuration | Start time | 10s | **Start time** – the ability to set the time after which the system can start working |
| | Fan inverter type | - | The possibility of choose fan inverter type controlled by Modbus RS485 (LG iC5, LG iG5A, Danfoss FC51, Danfoss FC101, EC Blue, EBM, Eura Drive) |
| | EC Blue or EBM | 247 | **Current address** - setting of the address currently set on the EC Blue fan |
| | | - | **Destination address** - setting of the address required for the EC Blue fan (see Settings/Fans/RS485 table) |

| | | No | **Set address** - load new address to the currently connected EC Blue fan (when performing this function, only one EC Blue fan should be turned ON, and after loading the settings, turn the EC Blue fan OFF and on again to enable the new address !!!) |
|---|---|---|---|
| | | Ok | **Status OK** – loading settings successful <br> **Loading in progress** - the system while loading settings, with correct communication the loading takes about 2 seconds <br> **Alarm** – problem loading settings (addresses, communication error) |
| | Supply 0-10VDC | Inactive | The possibility of activation one of the analog outputs as a signal 0-10VDC airflow rate of the supply air fan (make sure the output is not used for other purposes in the application) |
| | Exhaust 0-10VDC | Inactive | The possibility of activation one of the analog outputs as a signal 0-10VDC airflow rate of the exhaust air fan (make sure the output is not used for other purposes in the application) |
| | HMI Tiny | Inactive | There is ability to active panel „HMI Tiny" which is using when the reference temperature is done by the knob in the HMI Tiny (for this purpose used the analog input Ain2), start/stop the system is realized by closing/ opening temperature sensor placed in the temperature of the room unit connected by adjuster switch to sensor input PT5 (using the panel HMI Tiny is not possible to work the system in standby mode due to the use of open sensor as STOP system) |
| | Alarm A_ColdRec | Inactive | **Active** – alarm A_ColdRec frost of recovery visible in the alarm menu all the time during the freezing, <br> **Inactive** – alarm A_ColdRec frost of the recovery invisible in the alarm menu, while the alarm in history is written with the moment of an alarm frost, and on graphical screen of HMI freezing icon appears during frost recovery. |
| | Recovery sensor | Temperature | **Temperature** – study of the frost recovery is carried out by means of a temperature sensor B4, which is installed in the exhaust recovery part, connected to the PT4 - GND input <br> **Pressure switch** – study of the frost recovery is carried out by means of a pressure switch 2S1R, which is installed in the exhaust recovery part, connected to the PT4 - GND input |

| | | | |
|---|---|---|---|
| | HE control | 0-10VDC | **0-10VDC** – control of the electric heater by means of smooth signal 0-10VDC<br>**PWM** – control of the electric heater by means of PWM signal 0-10VDC |
| | Work - contact | Inactive | Optional activation of the one of the relay outputs as work conformation (make sure that output is not already used by application) |
| | Alarm – contact | Inactive | Optional activation of the one of the relay outputs as a group alarm (make sure that output is not already used by application) |
| | Outside temperature sensor | Inactive | There is ability to deactivation outside temperature sensor, when the sensor is inactive function preheat the water heater and ability to run the freon cooler is based on the time of year selected in menu "Settings/ Season" |
| | Exhaust temperature sensor | Inactive | there is ability to deactivation exhaust temperature sensor, when the exhaust and outside sensor is inactive function Eco is inactive and is not possible to determine the possibility of heat recovery (mixing chamber opens whenever you need heating) |
| | Change of Tset | 20s | **Change of Tset** – ramp change of setpoint temperature (elimination of sudden change of setting for smooth operation of temperature regulators) |
| | Regulator | „2" | The possibility of activation one of the two types of regulation:<br><br>**„1"** - sum of temperature regulators: the main, lim.min., lim.max.,<br><br>**„2"** - new cascade control in which the start-up of the system taking place only with the supply air temperature regulator for the time specified in "Settings/Temperature/Tset ramp" and after this time (when the leading sensor is different from the supply temperature sensor) an additional leading temperature regulator is activating and generating temperature set setpoint of the supply regulator. |
| | Analog outputs | - | The possibility of rescale the output signal 0-10VDC to 2-10VDC (please check signals compliance with manuals of damper or valve actuators) |

| | Tcom | 0,3s | **Tcom** – *communication time with one frequency inverter* |
|---|---|---|---|
| | Twait | 2s | **Twait** – *response time for communication with all frequency inverters* |
| History of leading temperature | - | - | History of leading temperature which is written the last 15 measurements from the leading temperature sensor in the selected period of recording) and is given "deviation" which is the maximum difference of actual set point temperature and the last 15 measurements of the leading temperature sensor. |
| - | - | - | *Reading inputs, outputs of the controller, possibility of the emulation of inputs and forcing outputs of the controller during normal operation of the AHU, during the emulation or forcing activities alarm is reported but AHU is still normally working.* |
| *Change the password* | - | - | *Change of password of the access to the advanced options. Default password: 1111* <br> *Attention: losing, forgetting the password will cause loss of the possibility of amending of advanced parameters.* |
| *Restore the default setting* | - | - | *Restoring the initial values of all settings.* |

# 9   COMMUNICATION MODBUS RTU

The controller has implementations of the Modbus RTU protocol. In order to make the network interface one should connect RS-485 trunk lines to the MASTER port on the slat of the controller. The modbus address is set using the MAC address parameter, which is available on the ELP14R18 controller display after long pressing the arrows at the same time.

Default parameters of the communication:
   ● MAC address 1
   ● transmission speed 9600 bps (possibility of amending from the level of inbuilt HMI or outside HMI)
   ● 8 bits of frame
   ● 2 bits of stop
   ● without parity

All variables are 32-bits with values of the type Holding Register. Modbus registers are 16-bits therefore one 32-bits variable is filling two 16-bits variables. The reading of variables is causing itself

with Modbus 0x03 command, however writing single variable of the 16-bits using command of 0x06 or many variables with 0x10 command.

Read and write data type Input and Coil:
Each variable is a 32-bit value. For example, a variable with the address in the table 0x0008 provides bits at binary addresses 8*32 … 9*32-1 for Input and Coil in Modbus standard.
Reading and writing data types Holding Register and Input Register:
The variables in this form for ease of integration with the BMS systems, are available in different address spaces.

- 0x0000 … 0x1000 – traditional representation according information below
  • Multistate – listed integer variable values correspond to the states described
  • Decimal – 32-bit value of the variable is treated as an integer type with sign,
  • Fixed – where the 8 least significant bits are used for fractional part, while the remaining 24 bits are part of a signed integer. It follows that the accuracy of Fixed value is 1/256. To scale the value represented in the Fixed form to the target (right), multiply it by 1/256 = 0,00390625.
- 0x1000 … 0x2000 – variable in Fixed format presented as an integer values without a fraction
- 0x2000 … 0x3000 – variable in Fixed format presented as a values with accuracy to one decimal place in decimal format. The value of 20.67 is shown as 206
- 0x3000 … 0x4000 – variable in Fixed format presented as a values with accuracy to tow decimal places in decimal format. The value of 20.67 is shown as 2067
- 0x4000 … 0x5000 – just like in the 0x0000 … 0x1000 but the variables are treated as 16-bit values. This means that the older 16-bit are not included. Addresses must be divided by two. For example, a variable from table with the address 0x0124 is available in 16-bit format at Modbus address 0x4092
- 0x5000 … 0x6000 – just like in the 0x1000 … 0x2000 but the variables are treated as 16-bit values. This means that the older 16-bit are not included. Addresses must be divided by two. For example, a variable from table with the address 0x0124 is available in 16-bit format at Modbus address 0x4092
- 0x6000 … 0x7000 – just like in the 0x2000 … 0x3000 but the variables are treated as 16-bit values. This means that the older 16-bit are not included. Addresses must be divided by two. For example, a variable from table with the address 0x0124 is available in 16-bit format at Modbus address 0x4092
- 0x7000 … 0x8000 – just like in the 0x2000 … 0x3000 but the variables are treated as 16-bit values. This means that the older 16-bit are not included. Addresses must be divided by two. For example, a variable from table with the address 0x0124 is available in 16-bit format at Modbus address 0x4092

Variables in the representation of Multistate and Decimal do not use in the address spaces 0x1000 ... 0x4000 and 0x5000 … 0x8000 because it loses the least significant 8 bits of each of the variables.
Addresses in the table are converted to the Modbus protocol as follows:

| Address space | Calculating an address |
| --- | --- |
| 0x0000 … 0x1000 | Modbus Address = Address. |
| 0x1000 … 0x2000 | Modbus Address = 0x1000 + Address |
| 0x2000 … 0x3000 | Modbus Address = 0x2000 + Address |
| 0x3000 … 0x4000 | Modbus Address = 0x3000 + Address |
| 0x4000 … 0x5000 | Modbus Address = 0x4000 + (Address / 2) |
| 0x5000 … 0x6000 | Modbus Address = 0x5000 + (Address / 2) |

| 0x6000 … 0x7000 | Modbus Address = 0x6000 + (Address / 2) |
|---|---|
| 0x7000 … 0x8000 | Modbus Address = 0x7000 + (Address / 2) |

NOTE: You can not make a record of a single 16-bit register at address spaces 0x1000 … 0x4000. In this case, write the registers in pairs using command Preset Multiple Registers (0x10) which consists of a full value of the 32-bit variable. This means that the address of the start of the recording and the number of registers must be an even number.

## Main menu

| Address DEC | | Variable name | HMI Name | States | Type | | Read [R] /Write [W] |
|---|---|---|---|---|---|---|---|
| BacNet | Modbus | | | | BacNet | Modbus | |
| 0 | 0 | UnitState | Unit state | 0: Stop, 1: Work 1 gear, 2: Work 2 gear, 4: Work 3 gear, 8: Preheating, 16: Cooling, 32: Heating, 64: Alarm stop, 128: Service mode | MSV | Register | R |
| 1 | 2 | SeasonAct | Season | 0: Transitional, 1: Winter, 2: Summer | MSV | Register | R |
| 2 | 4 | WorkMode | Set work mode | 0: Stop, 1: 1 gear, 2: 2 gear, 4: 3 gear, 8: Standby, 16: Calendar | MSV | Register | R/W |
| 3 | 6 | Tset | Temp.setting | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 4 | 8 | TsetActual | Temp.setted | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 5 | 10 | Tmain | Main temperature | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 6 | 12 | B1 | Supply sensor | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 7 | 14 | B2 | Exhaust sensor | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 8 | 16 | B3 | External sensor | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 9 | 18 | B4 | Recov.sens | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 10 | 20 | B8 | Back water sensor | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 11 | 22 | CO2exh | Exhaust CO2 | 1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 12 | 24 | Vent | Vent. | 0: Off, 1: On | MSV | Coil 384 | R |
| 13 | 26 | PwrSup | Supply/Exhaust | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 14 | 28 | PwrExh | Exhaust | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 15 | 30 | Isup | Current | 1A = 256 (22A = 22*256 = 5632 = 0x1600) | AV | Register | R |

| 16 | 32 | Fsup | Frequency | 1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600) | AV | Register | R |
|----|----|------|-----------|-------------------------------------------|-----|----------|---|
| 17 | 34 | RPMsup | RPM | 1rpm = 256 (22rpm = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 18 | 36 | Usup | Voltage | 1V = 256 (22V = 22*256 5632 = 0x1600) | AV | Register | R |
| 19 | 38 | FaultSup | Alarm code | 1A = 1A (HEX) **www.el-piast.com/alarms-decoder** | AV | Register | R |
| 20 | 40 | ComSup | Communication | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 21 | 42 | Iexh | Current | 1A = 256 (22A = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 22 | 44 | Fexh | Frequency | 1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 23 | 46 | RPMexh | RPM | 1rpm = 256 (22rpm = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 24 | 48 | Uexh | Voltage | 1V = 256 (22V = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 25 | 50 | FaultExh | Alarm code | 1A = 1A (HEX) **www.el-piast.com/alarms-decoder** | AV | Register | R |
| 26 | 52 | ComExh | Communication | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 27 | 54 | Y1 | Water heater | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 28 | 56 | M1 | Heater-pump | 0: Off, 1: On | MSV | Coil 896 | R |
| 29 | 58 | HePwr | Electric heater | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 30 | 60 | GasPwr | GAS heater | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 31 | 62 | Y2 | Water cooler | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 32 | 64 | E1 | Water cooler | 0: Off, 1: On | MSV | Coil 1024 | R |
| 33 | 66 | Y9 | DX cooler | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 34 | 68 | DXstate | DX cooler | 0: Stop, 1: 1 stage, 2: 2 stage, 3: 1,2 stage | MSV | Register | R |
| 35 | 70 | YRec | Recovery | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | MSV | Register | R |
| 36 | 72 | RecState | Recovery | 0: Off, 1: On, 2: Defrosting, 3: Defrosting | AV | Register | R |
| 37 | 74 | SetMix | Set mixing ratio | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 38 | 76 | ThrMCh | Mixing chamber | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 39 | 78 | ThrSuEx | Fresh air ratio | 1% = 256 (22% = 22*256 = | AV | Register | R |

| | | | | 5632 = 0x1600) | | | |
|---|---|---|---|---|---|---|---|
| 40 | 80 | Throt | Fresh air ratio | 0: Off, 1: On | MSV | Coil 1280 | R |

**Settings menu**

| Addres DEC | | Variable name | HMI Name | States | Type | | Read [R] /Write [W] |
|---|---|---|---|---|---|---|---|
| BacNet | Modbus | | | | BacNet | Modbus | |
| 41 | 82 | Ch_Tmain | Main sensor | 1: HMI (CON), 2: HMI (RS485), 3: Supply, 4: Exhaust, 5: PT5 | AV | Register | R/W |
| 42 | 84 | EcoDiff | Eco temp.difference | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 43 | 86 | TsetDownTime | Start reg. | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 44 | 88 | TsetCor | Tset correction | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 45 | 90 | OfsPT1 | PT1 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 46 | 92 | OfsPT2 | PT2 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 47 | 94 | OfsPT3 | PT3 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 48 | 96 | OfsPT4 | PT4 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 49 | 98 | OfsPT5 | PT5 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 50 | 100 | OfsHMICon | HMI (CON) | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 51 | 102 | OfsHMIRS | HMI (RS485 Master) | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 52 | 104 | Season | Season | 0: Auto, 1: Winter, 2: Summer | MSV | Register | R/W |
| 53 | 106 | Tsummer | Summer temp | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 54 | 108 | HistSum | Hysteresis | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 55 | 110 | From | Summer from | 0 - January…12 - December | MSV | Register | R/W |
| 56 | 112 | To | Summer to | 0 - January…12 - December | MSV | Register | R/W |
| 57 | 114 | Ch_Tstd | Main sensor | 1: HMI (CON), 2: HMI (RS485), 3: Exhaust, 4: PT5 | MSV | Register | R/W |
| 58 | 116 | TstdbyAct | Main sensor | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 59 | 118 | StdMode | Active for | 1: Heating, 2: Cooling, 3: Heating/cooling | MSV | Register | R/W |
| 60 | 120 | StdHis | Standby hyster. | 1°C = 256 (22 °C = 22*256 = | AV | Register | R/W |

| 61 | 122 | v1_t | Starting delay | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
|---|---|---|---|---|---|---|---|
| 62 | 124 | DelThr | Damp.off delay | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 63 | 126 | PresDel | Pressure delay | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 64 | 128 | CoolingTime | Cooling time | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 65 | 130 | minFrost | Sup.power during frost recovery | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 66 | 132 | Sup1 | Sup/exh min. | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 67 | 134 | Sup2 | Sup/exh med. | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 68 | 136 | Sup3 | Sup/exh.max. | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 69 | 138 | Exh1 | Exh.min. | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 70 | 140 | Exh2 | Exh.med. | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 71 | 142 | Exh3 | Exh.max. | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 72 | 144 | RSsup | Sup.via RS485 | 0: Inactive, 1: Active | MSV | Coil 2304 | R/W |
| 73 | 146 | Rsexh | Exh.via RS485 | 0: Inactive, 1: Active | MSV | Coil 2336 | R/W |
| 74 | 148 | FminS | Sup.freq.min. | 1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 75 | 150 | FmaxS | Sup.freq.max. | 1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 76 | 152 | FminE | Exh.freq.min. | 1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 77 | 154 | FmaxE | Exh.freq.max. | 1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 78 | 156 | AdrSup | Sup.inv.adress | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 79 | 158 | AdrExh | Exh.inv.adress | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 80 | 160 | TaccVent | T.acc. | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 81 | 162 | TdecVent | T.dec. | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 82 | 164 | RECproc | Recovery | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 83 | 166 | MIXproc | Mixing chamber | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |

| 84 | 168 | h_c_proc | Heating/cooling | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 85 | 170 | Kp_Heat | Kp | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 86 | 172 | Ti_Heat | Ti | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 87 | 174 | Kp_Cool | Kp | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 88 | 176 | Ti_Cool | Ti | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 89 | 178 | PIcoolingAct | PI cooling | 0 - Summer, 1 – Winter and summer | MSV | Register | R/W |
| 90 | 180 | DelOnPIcool | Starting delay | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 91 | 182 | Kp_Blow | Kp | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 92 | 184 | Ti_Blow | Ti | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 93 | 186 | TminBlow | Tmin air blow | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 94 | 188 | TmaxBlow | Tmax air blow | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 95 | 190 | TsetBlowAct | TsetBlowAct | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 96 | 192 | RecMode | Work mode | 0: Inactive, 1: Winter, 2: Summer, 3: Winter/summer | MSV | Register | R/W |
| 97 | 194 | RecDown | Starting ramp | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 98 | 196 | TlimRec | Frost limit | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 99 | 198 | KpRec | Kp frost.prot | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 100 | 200 | TiRec | Ti frost.prot | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 101 | 202 | InitT100 | Preh.100% time | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 102 | 204 | InitTscale | Preh.scale time | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 103 | 206 | RampEn | Falling ramp | 0: Inactive, 1: Active | MSV | Coil 3296 | R/W |
| 104 | 208 | RampTime | Fall ramp | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 105 | 210 | Init_Tmin | Min T.out | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 106 | 212 | InitVTmin | Min.Tout valve | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |

| 107 | 214 | Init_Tmax | Max T.out | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
|---|---|---|---|---|---|---|---|
| 108 | 216 | InitVTmax | Max.Tout.valve | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 109 | 218 | Tlim1 | Pump work temp. | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 110 | 220 | MinValve | Min.valve open | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 111 | 222 | TbActive | B8 sensor | 0: Inactive, 1: Active | MSV | Coil 3552 | R/W |
| 112 | 224 | Tlim2 | Frost temp.out. | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 113 | 226 | TbStopFrost | Stop | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 114 | 228 | TbStartFrost | Start | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 115 | 230 | TbStopReg | Stop | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 116 | 232 | TbStartReg | Start | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 117 | 234 | KpBack | Kp | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 118 | 236 | TiBack | Ti | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 119 | 238 | HW_Sec | Set protection | 0: Inactive, 1: Active | MSV | Coil 3808 | R/W |
| 120 | 240 | HW_SecDP | Stop period | 1day = 256 (22days = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 121 | 242 | HW_SecT | Run time | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 122 | 244 | GasAl | GAS alarm | 0: NC, 1: NO | MSV | Coil 3904 | R/W |
| 123 | 246 | mBreakDX | Break time min. | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 124 | 248 | mWorkDX | Work time min. | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 125 | 250 | Tout_minDX | Temp.out work min. | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 126 | 252 | II_IIIactiveDX | Stage 2 | 0: Inactive, 1: Active | MSV | Coil 4032 | R/W |
| 127 | 254 | CascadeDX | Cascade | 0: Inactive, 1: Active | MSV | Coil 4064 | R/W |
| 128 | 256 | IistageDX | Stage 2 | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 129 | 258 | IIistageDX | Stage 3 | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 130 | 260 | ModeMix | Work mode | 0: Manual, 1: Temperature, 3: Temp./CO2 | MSV | Register | R/W |
| 131 | 262 | PrioMH | Priority to | 0: Mix chamber, 1: | MSV | Coil 4192 | R/W |

| BacNet | Modbus | Variable name | HMI Name | States | BacNet | Modbus | R/W |
|---|---|---|---|---|---|---|---|
| | | | | Heating/cooling | | | |
| 132 | 264 | MinFresh | Min.fresh air | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 133 | 266 | MaxFresh | Max.fresh air | 1% = 256 (22% = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 134 | 268 | FHEn | Fast heating | 0: Inactive, 1: Active | MS | Register | R/W |
| 135 | 270 | TlimMCH | Temp.setpoint | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 136 | 272 | HistMCH | Hysteresis | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 137 | 274 | SetCO2 | Set CO2 | 1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 138 | 276 | Kp_CO2 | Kp | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 139 | 278 | Ti_CO2 | Ti | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 140 | 280 | ppmMin | 0 V | 1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 141 | 282 | ppmMax | 10 V | 1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600) | AV | Register | R/W |

**Service menu**

| Address DEC | | Variable name | HMI Name | States | Type | | Read [R] /Write [W] |
|---|---|---|---|---|---|---|---|
| BacNet | Modbus | | | | BacNet | Modbus | |
| 142 | 284 | ServiceMode | Service mode | 0: Inactive, 1: Active | MSV | Coil 4544 | R/W |
| 143 | 286 | TYPE | Type | 1: Supply, 2: Supply/exhaust | MSV | Register | R/W |
| 144 | 288 | RECOVERY | Recovery | 0: None, 1: Cross/mix chamb., 2: Mix chamber, 4: Cross, , 8: Cross 0-10 | MSV | Register | R/W |
| 145 | 290 | COOL | Cooler | 0: None, 1: DX, 2: Water | MSV | Register | R/W |
| 146 | 292 | HEAT | Heater | 0: None, 1: Electric, 2: Water, 4: GAS | MSV | Register | R/W |
| 147 | 294 | PowOnTime | Start time | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 148 | 296 | FanInverters | Fan inverter type | 1: IC5,IG5, 2: FC51, 4: FC101, 8: EC Blue, 16: EBM, 32: Eura Drive | MSV | Register | R/W |
| 149 | 298 | ActualAdrECB | Actual address | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 150 | 300 | AdrToSetECB | Address to set | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 151 | 302 | ActiveConfigECB | Set address | 0: No, 1: Yes | MSV | Coil 4832 | R/W |

| 152 | 304 | StatusConfECB | Status | 0: Com Ok, 1: In progress, 2: A_Com, 3: A_Com | MSV | Coil 4864 | R |
|---|---|---|---|---|---|---|---|
| 153 | 306 | ActualAdrEBM | Actual address | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 154 | 308 | AdrToSetEBM | Address to set | 1 = 256 (22 = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 155 | 310 | ActiveConfigEBM | Set adress | 0: No, 1: Yes | MSV | Coil 4960 | R/W |
| 156 | 312 | StatusConfEBM | Status | 0: Com Ok, 1: In progress, 2: A_Com, 3: A_Com | MSV | Coil 4992 | R |
| 157 | 314 | Sup0_10 | Supply 0-10VDC | 0: Inactive, 1: Aout1, 2: Aout2, 4: Aout3 | MSV | Register | R/W |
| 158 | 316 | Exh0_10 | Exhaust 0-10VDC | 0: Inactive, 1: Aout1, 2: Aout2, 4: Aout3 | MSV | Coil 5056 | R |
| 159 | 318 | Tiny | HMI Tiny | 0: Inactive, 1: Active | MSV | Coil 5088 | R/W |
| 160 | 320 | FrostAlarm | Alarm A_ColdRec | 0: Inactive, 1: Active | MSV | Coil 5120 | R/W |
| 161 | 322 | RecFrostProt | Recovery sensor | 0: Pressure switch, 1: Temperature | MSV | Coil 5152 | R/W |
| 162 | 324 | HEcontrol | HE control | 0: 0-10VDC, 1: PWM | MSV | Coil 5184 | R/W |
| 163 | 326 | Re_Work | Work - contact | 0: Inactive, 1: Re1, 2: Re2, 4: Re3, 8: Re4, 16: Re5 | MSV | Register | R/W |
| 164 | 328 | Re_Alarm | Alarm - contact | 0: Inactive, 1: Re1, 2: Re2, 4: Re3, 8: Re4, 16: Re5 | MSV | Register | R/W |
| 165 | 330 | ToutAct | Outside sensor | 0: Inactive, 1: Active | MSV | Coil 5280 | R/W |
| 166 | 332 | TexhAct | Exhaust sensor | 0: Inactive, 1: Active | MSV | Coil 5312 | R/W |
| 167 | 334 | TsetChT | Tset change | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 168 | 336 | RegType | Regulator | 0: "1", 1: "2" | MSV | Coil 5376 | R/W |
| 169 | 338 | Ao1scale | Aout1 | 0 - "0-10VDC", 1 - "2-10VDC" | MSV | Coil 5408 | R/W |
| 170 | 340 | Ao2scale | Aout2 | 0 - "0-10VDC", 1 - "2-10VDC" | MSV | Coil 5440 | R/W |
| 171 | 342 | Ao3scale | Aout3 | 0 - "0-10VDC", 1 - "2-10VDC" | MSV | Coil 5472 | R/W |
| 172 | 344 | Tcom | Tcom | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 173 | 346 | Twait | Twait | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 174 | 348 | MaxDiff | Difference | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 175 | 350 | T1 | T1 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 176 | 352 | T2 | T2 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 177 | 354 | T3 | T3 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |

| 178 | 356 | T4 | T4 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
|---|---|---|---|---|---|---|---|
| 179 | 358 | T5 | T5 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 180 | 360 | T6 | T6 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 181 | 362 | T7 | T7 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 182 | 364 | T8 | T8 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 183 | 366 | T9 | T9 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 184 | 368 | T10 | T10 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 185 | 370 | T11 | T11 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 186 | 372 | T12 | T12 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 187 | 374 | T13 | T13 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 188 | 376 | T14 | T14 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 189 | 378 | T15 | T15 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 190 | 380 | HistPeriod | Period | 1s = 256 (22s = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 191 | 382 | Reset | Reset | 0: Off, 1: On | MSV | Coil 6112 | R/W |
| 192 | 384 | _DIN1 | Din1 | 0: Opened, 1: Closed | MSV | Coil 6144 | R |
| 193 | 386 | _DIN2 | Din2 | 0: Opened, 1: Closed | MSV | Coil 6176 | R |
| 194 | 388 | _DIN3 | Din3 | 0: Opened, 1: Closed | MSV | Coil 6208 | R |
| 195 | 390 | Ain_1 | AIN1 | 1V = 256 (22V = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 196 | 392 | Ain_2 | AIN2 | 1V = 256 (22V = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 197 | 394 | PT_1 | PT1 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 198 | 396 | PT_2 | PT2 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 199 | 398 | PT_3 | PT3 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 200 | 400 | PT_4 | PT4 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 201 | 402 | PT_5 | PT5 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |

| 202 | 404 | HMI_Con | HMI (CON) | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
|---|---|---|---|---|---|---|---|
| 203 | 406 | HMI_RS | HMI (RS485 Master) | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 204 | 408 | Re1 | Re1 | 0: Off, 1: On | MSV | Coil 6528 | R |
| 205 | 410 | Re2 | Re2 | 0: Off, 1: On | MSV | Coil 6560 | R |
| 206 | 412 | Re3 | Re3 | 0: Off, 1: On | MSV | Coil 6592 | R |
| 207 | 414 | Re4 | Re4 | 0: Off, 1: On | MSV | Coil 6624 | R |
| 208 | 416 | Re5 | Re5 | 0: Off, 1: On | MSV | Coil 6656 | R |
| 209 | 418 | AO1 | AOU1 | 1V = 256 (22V = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 210 | 420 | AO2 | AOU2 | 1V = 256 (22V = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 211 | 422 | AO3 | AOU3 | 1V = 256 (22V = 22*256 = 5632 = 0x1600) | AV | Register | R |
| 212 | 424 | F_DIN1 | Din1 | 0: No emulation, 1: Set opened, 3: Set closed | MSV | Register | R/W |
| 213 | 426 | F_DIN2 | Din2 | 0: No emulation, 1: Set opened, 3: Set closed | MSV | Register | R/W |
| 214 | 428 | F_DIN3 | Din3 | 0: No emulation, 1: Set opened, 3: Set closed | MSV | Register | R/W |
| 215 | 430 | Em_Ai1 | AIN1 emulation | 0: Disabled, 1: Enabled | MSV | Coil 6880 | R/W |
| 216 | 432 | E_Ai1 | AIN1 | 1V = 256 (10V = 10*256 = 2560 = 0xA00) | AV | Register | R/W |
| 217 | 434 | Em_Ai2 | AIN2 emulation | 0: Disabled, 1: Enabled | MSV | Coil 6944 | R/W |
| 218 | 436 | E_Ai2 | AIN2 | 1V = 256 (10V = 10*256 = 2560 = 0xA00) | AV | Register | R/W |
| 219 | 438 | Em_PT1 | PT1 emulation | 0: Disabled, 1: Enabled | MSV | Coil 7008 | R/W |
| 220 | 440 | E_PT1 | PT1 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 221 | 442 | Em_PT2 | PT2 emulation | 0: Disabled, 1: Enabled | MSV | Coil 7072 | R/W |
| 222 | 444 | E_PT2 | PT2 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 223 | 446 | Em_PT3 | PT3 emulation | 0: Disabled, 1: Enabled | MSV | Coil 7136 | R/W |
| 224 | 448 | E_PT3 | PT3 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 225 | 450 | Em_PT4 | PT4 emulation | 0: Disabled, 1: Enabled | MSV | Coil 7200 | R/W |
| 226 | 452 | E_PT4 | PT4 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 227 | 454 | Em_PT5 | PT5 emulation | 0: Disabled, 1: Enabled | MSV | Coil 7264 | R/W |
| 228 | 456 | E_PT5 | PT5 | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |

| 229 | 458 | Em_Hcon | Emul. HMI (CON) | 0: Disabled, 1: Enabled | MSV | Coil 7328 | R/W |
|-----|-----|---------|-----------------|-------------------------|-----|-----------|-----|
| 230 | 460 | E_Hcon | HMI (CON) | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 231 | 462 | Em_Hrs | Emul. HMI (RS485 Master) | 0: Disabled, 1: Enabled | MSV | Coil 7392 | R/W |
| 232 | 464 | E_Hrs | HMI (RS485 Master) | 1°C = 256 (22 °C = 22*256 = 5632 = 0x1600) | AV | Register | R/W |
| 233 | 466 | F_Re1 | Re1 | 0: No force, 1: Force off, 3: Force on | MSV | Register | R/W |
| 234 | 468 | F_Re2 | Re2 | 0: No force, 1: Force off, 3: Force on | MSV | Register | R/W |
| 235 | 470 | F_Re3 | Re3 | 0: No force, 1: Force off, 3: Force on | MSV | Register | R/W |
| 236 | 472 | F_Re4 | Re4 | 0: No force, 1: Force off, 3: Force on | MSV | Register | R/W |
| 237 | 474 | F_Re5 | Re5 | 0: No force, 1: Force off, 3: Force on | MSV | Register | R/W |
| 238 | 476 | FoAO1 | Aout1 Forcing | 0: Disabled, 1: Enabled | MSV | Coil 7616 | R/W |
| 239 | 478 | F_AO1 | Aout1 | 1V = 256 (10V = 10*256 = 2560 = 0xA00) | AV | Register | R/W |
| 240 | 480 | FoAO2 | Aout2 Forcing | 0: Disabled, 1: Enabled | MSV | Coil 7680 | R/W |
| 241 | 482 | F_AO2 | Aout2 | 1V = 256 (10V = 10*256 = 2560 = 0xA00) | AV | Register | R/W |
| 242 | 484 | FoAO3 | Aout3 Forcing | 0: Disabled, 1: Enabled | MSV | Coil 7744 | R/W |
| 243 | 486 | F_AO3 | Aout3 | 1V = 256 (10V = 10*256 = 2560 = 0xA00) | AV | Register | R/W |

## Alarms

| Address DEC | | Variable name | HMI Name | States | Type | | Read [R] /Write [W] |
|-------------|--------|---------------|----------|--------|--------|--------|------|
| BacNet | Modbus | | | | BacNet | Modbus | |
| 244 | 488 | ResetAlarms | ResetAlarms | 0 - no reset, 1 - reset | MSV | Coil 7808 | R/W |
| 245 | 490 | A_Code | Wrong central type code (do not set supply + glicol, rotary or cross recovery) | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 7840 | R |
| 246 | 492 | A_StopSystem | Fire-prevention alarm or ventilator alarm | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 7872 | R |
| 247 | 494 | A_ThHWair | Alarm of the thermostat frost-resistant | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 7904 | R |
| 248 | 496 | A_3xThHWair | Alarm of the thermostat frost-resistant (3 times appearance of the alarm within an hour) | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 7936 | R |
| 249 | 498 | A_ThHWwater | Low temperature alarm of return water water heater | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 7968 | R |

| 250 | 500 | A_3xThHWwater | Low temperature alarm of return water water heater (3 times appearance of the alarm A_ThHWwater within an hour) | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8000 | R |
|---|---|---|---|---|---|---|---|
| 251 | 502 | A_ThHE | Alarm of the themrostat electric heater | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8032 | R |
| 252 | 504 | A_3xThHE | Alarm of the termostat electric heater (3 times appearance of the alarm within an hour) | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8064 | R |
| 253 | 506 | A_ThGAS | Alarm of the themrostat GAS heater | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8096 | R |
| 254 | 508 | A_3xThGAS | Alarm of the termostat GAS heater (3 times appearance of the alarm within an hour) | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8128 | R |
| 255 | 510 | A_ColdRec | Alarm of frosting the recuperation | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8160 | R |
| 256 | 512 | A_Filter | Alarm of the dirty filter of the air blowing or outlet | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8192 | R |
| 257 | 514 | A_ComSupFC | Alarm lock of communication with the inverter supply | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8224 | R |
| 258 | 516 | A_ComExhFC | Alarm lock of communication with the inverter exhaust | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8256 | R |
| 259 | 518 | A_Tsup | Alarm of the temperature sensor of the air blowing | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8288 | R |
| 260 | 520 | A_Texh | Alarm of the temperature sensor of the outlet | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8320 | R |
| 261 | 522 | A_Tout | Alarm of the temperature sensor outside | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8352 | R |
| 262 | 524 | A_Trec | Alarm of the temperature sensor behind the recuperation | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8384 | R |
| 263 | 526 | A_TbackWater | Alarm of the contact temperature sensor return water heater | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8416 | R |
| 264 | 528 | A_Tmain | Alarm of the temperature sensor leading | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8448 | R |
| 265 | 530 | A_InEmul | Alarm of the emulation of entries of the controler | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8480 | R |
| 266 | 532 | A_OutForce | Alarm of pushing exits of the controler | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8512 | R |
| 267 | 534 | Alarm | Collective alarm | 0 - an alarm is missing, 1 - an alarm is appearing | BV | Coil 8544 | R |

# 10 COMMUNICATION BACNET MS-TP WITH BMS SYSTEM

Variables BacNet should look after connecting the powered controller and the introduction of appropriate BacNet network settings (see item5).
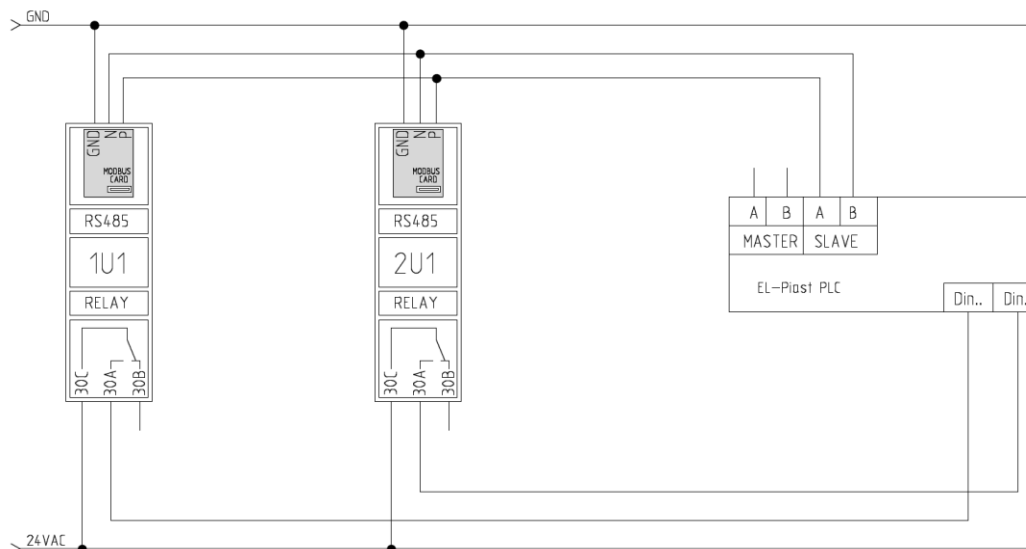
# 11 COMMUNICATION RS485 SLAVE, MODBUS RTU WITH INVERTERS LG IC5

http://www.aniro.pl/images/com_download/14/Falownik%20iC5%20instrukcja%20pl.pdf

Example for system with supply, exhaust



Configuration drive LG IC5 control RS485:

| Code | Name | Value to be set | Description |
|------|------|-----------------|-------------|
| drv | Control mode | 3 | Communication RS485 |
| Frq | The method of frequency | 8 | Communication Modbus-RTU |
| F21 | Maximum output frequency | **Fz max** | Set individual |
| F22 | Rated motor frequency | …Hz | Set individual |
| F23 | The minimum frequency reference | 0.000 | **Always enter the value** |
| F30 | Characteristic U/F | **0** | Linear |
| F50 | Motor overload protection | 1 | active |
| H30 | Rated motor power | …kW | With the motor nameplate |
| H33 | Rated motor current | …A | With the motor nameplate |
| I55 | Relay function | 12 | Work witout alarm |
| I60 | Drive address | 1 | Inverter supply fan |
| | | 2 | Inverter exhaust fan |
| I61 | transmission speed | 3 | 9600 |
| I62 | Reaction to loss of communication | 2 | stop |
| I63 | Communication time | 10.0 | |

**Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.**
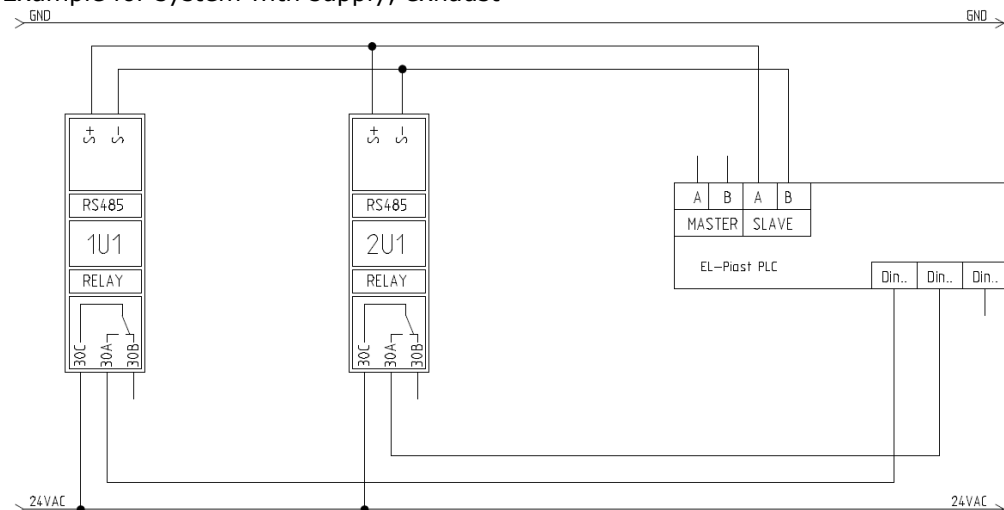
**NOTE: The settings in the controller (Settings/Fan/RS485/Maximum frequency) must be at least 0.1Hz lower than Fzmax, otherwise the inverter may show control errors.**

# 12 COMMUNICATION RS485 SLAVE, MODBUS RTU WITH INVERTERS LG IG5

http://www.aniro.pl/images/com_download/22/Falowniiki%20LS%20iG5A%20instrukcja%20pl.pdf

Example for system with supply, exhaust



Configuration drive LG IG5 control RS485:

| Code | Name | Value to be set | Description |
|------|------|-----------------|-------------|
| drv | Control mode | 3 | Communication RS485 |
| Frq | The method of frequency | 7 | Communication Modbus-RTU |
| F21 | Maximum output frequency | **Fz max** | Set individual |
| F22 | Rated motor frequency | …Hz | Set individual |
| F23 | The minimum frequency reference | 0.000 | **Always enter the value** |
| F30 | Characteristic U/F | **0** | Linear |
| F50 | Motor overload protection | 1 | active |
| H30 | Rated motor power | …kW | With the motor nameplate |
| H33 | Rated motor current | …A | With the motor nameplate |
| I55 | Relay function | 12 | Work without alarm |
| I60 | Drive address | 1 | Inverter supply fan |
| | | 2 | Inverter exhaust fan |
| I61 | transmission speed | 3 | 9600 |
| I62 | Reaction to loss of communication | 2 | Stop |
| I63 | Communication time | 10.0 | |

**Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.**
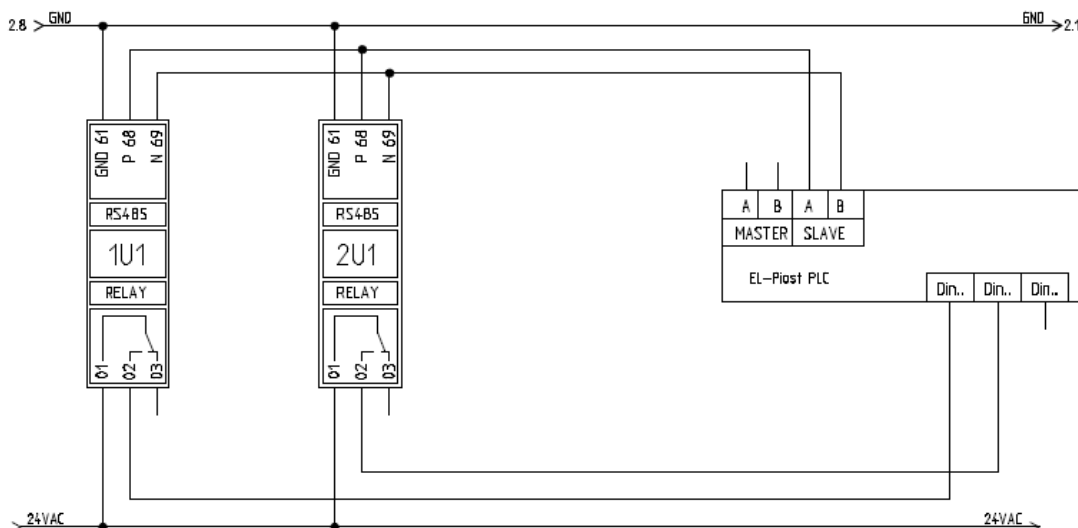
**NOTE: The settings in the controller (Settings/Fan/RS485/Maximum frequency) must be at least 0.1Hz lower than Fzmax, otherwise the inverter may show control errors.**

# 13 COMMUNICATION RS485 SLAVE, MODBUS RTU WITH INVERTERS DANFOSS FC51

http://www.danfoss.com/poland/businessareas/drivessolutions/frequency+converters/vlt+micro+drive.htm

Example for system with supply, exhaust:



Configuration drive Danfoss FC51 control RS485:

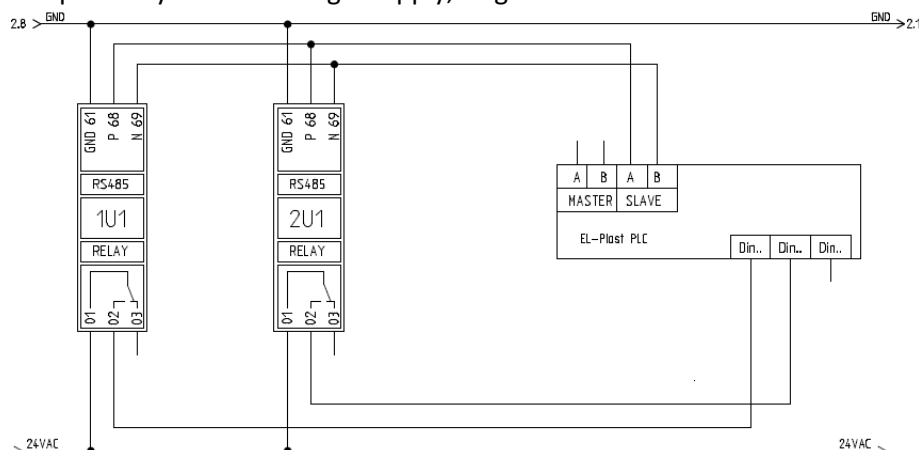| Code | Name | Value to be set | Description |
|------|------|-----------------|-------------|
| 1-03 | Characteristic U/F | 0 | Linear |
| 1-20 | Rated motor power | ...kW | With the motor nameplate |
| 1-24 | Rated motor current | ...A | With the motor nameplate |
| 1-25 | Rated motor speed | ...rpm | With the motor nameplate |
| 1-90 | Motor overload protection | 4 | Emergency off  ETR |
| 3-02 | The minimum frequency reference | 0.000 | **Always enter the value** |
| 3-03 | The maximum frequency reference | **Fz max** | Set individual |
| 3-17 | Control input | 11 | Modbus |
| 4-14 | Maximum output frequency | **Fz max** | Set individual |
| 4-16 | Output current limitation | 150,0 | - |
| 5-40 | Relay function | 6 | Work without alarm |
| 8-01 | Control | 0 | Digital and communication |
| 8-02 | Control | 1 | FC RS485 |
| 8-03 | Wait to communication | 10.0s | - |
| 8-04 | Lost communication reaction | 2 | Stop |
| 8-30 | Choose communication protocol | 2 | Modbus RTU |
| 8-31 | Drive address | 1 | Inverter supply fan |
| | | 2 | Inverter exhaust fan |
| 8-32 | Transmission speed | 2 | 9600 |
| 8-33 | Parity FV port | 3 | No parity, 2 stop bits |

**Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.**

# 14 COMMUNICATION RS485 SLAVE, MODBUS RTU WITH INVERTERS DANFOSS FC101

http://drives.danfoss.us/products/vlt/low-voltage-drives/vlt-hvac-basic-drive-fc-101/#/

Example for system with single supply, single exhaust:



**In addition, the DANFOS FC101 inputs must be shorted with numbers 12 and 27**
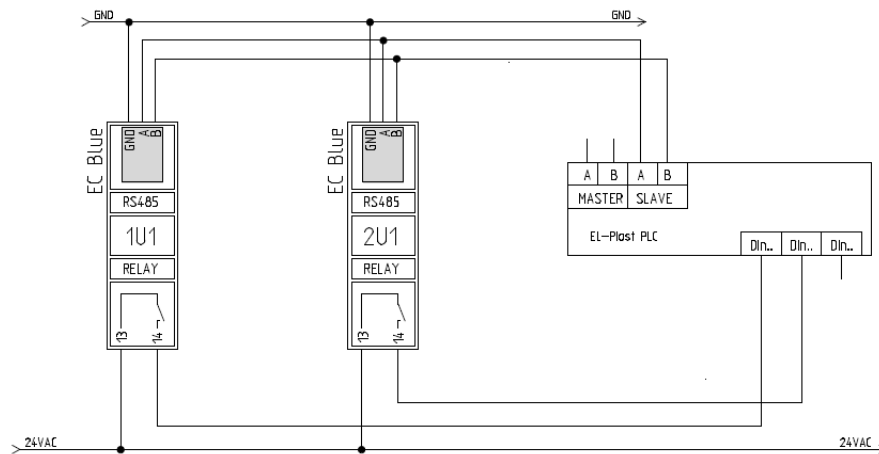
Configuration drive Danfoss FC101 control RS485:

| Code | Name | Value to be set | Description |
|------|------|-----------------|-------------|
| 1-03 | Characteristic U/F | 3 | - |
| 1-20 | Rated motor power | ...kW | According to motor nameplate |
| 1-24 | Rated motor current | ...A | According to motor nameplate |
| 1-25 | Rated motor speed | ...rpm | According to motor nameplate |
| 1-90 | Motor overload thermal protection | 4 | Emergency off  ETR |
| 3-02 | The minimum frequency reference | 0.000 | **Always enter the value** |
| 3-03 | The maximum frequency reference | **Fz max** | Set individual |
| 3-17 | Control input | 11 | Modbus |
| 4-14 | Maximum output frequency | **Fz max** | Set individual |
| 4-18 | Output current limitation | 150,0 | - |
| 5-40 | Relay function | 06 | Work without alarm |
| 8-01 | Control | 0 | Digital and communication |
| 8-02 | Control | 1 | FC PORT |
| 8-03 | Wait to communication | 10.0s | - |
| 8-04 | Lost communication reaction | 2 | Stop |
| 8-30 | Choose communication protocol | 2 | Modbus RTU |
| 8-31 | Drive address | 1 | Inverter supply fan |
| | | 2 | Inverter exhaust fan |
| 8-32 | Transmission speed | 2 | 9600 |
| 8-33 | Parity FV port | 3 | No parity, 2 stop bits |

**Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.**
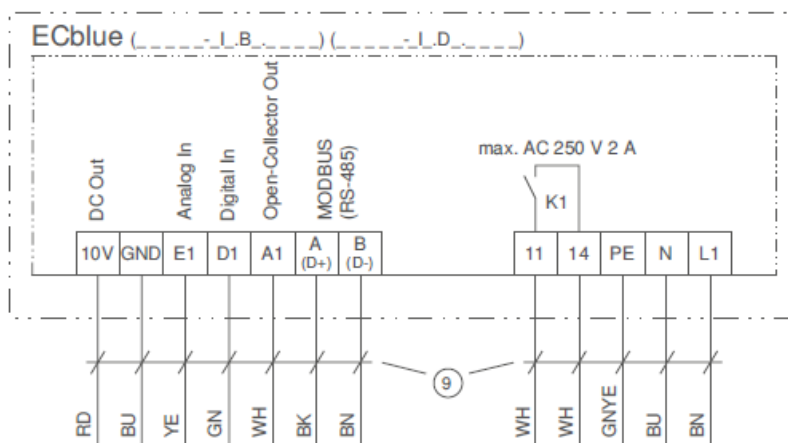
Example for single supply, single exhaust.

Wiring connection of EC Blue fanprzewodów wentylatora EC Blue

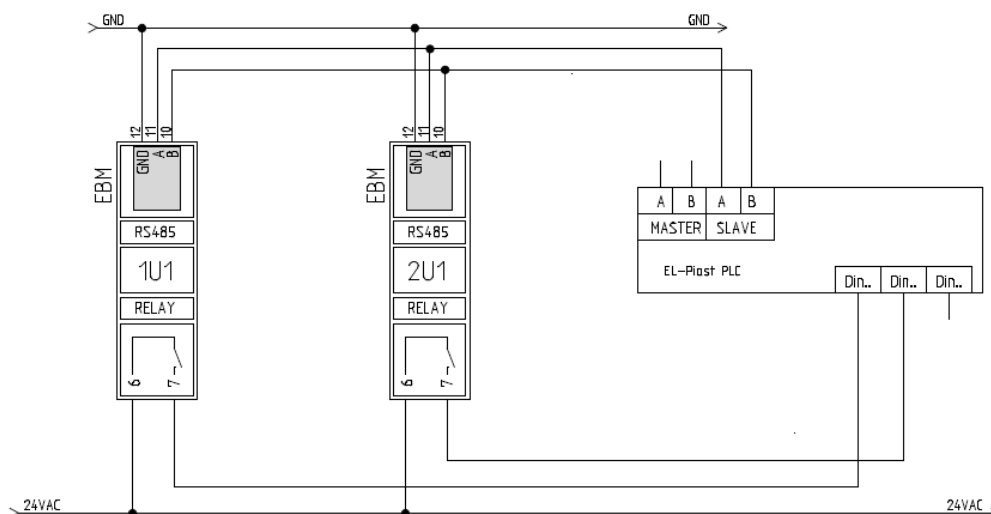| Connection | Color of cable | Cable function |
|---|---|---|
| PE | yellow/green | Ground |
| N | blue | Power supply –„0" |
| L | brown | Power supply – phase |
| 11 | white 1 | Motor status relay – closed -> work confirmation |
| 12 | white 2 | |
| B | brown | RS-485 MODBUS |
| A | black | |
| GND | blue | „0" for control signal |



EC Blue Fan Controller Configuration - Service Menu/Fans/EC Blue Address

## 16 COMMUNICATION RS485 SLAVE, MODBUS RTU WITH INVERTERS EBM MOTORS



Example for single supply, single exhaust.

Wiring connection of EC Blue fan

| Cable nr. | Connection | Color of cable | Cable function |
|---|---|---|---|
| 1,2 | PE | yellow/green | Ground |
| 3 | N | blue | Power supply –„0" |
| 5 | L | black | Power supply – phase |
| 6 | NC | white 1 | Motor status relay – closed -> work confirmation |
| 7 | COM | white 2 | |
| 10 | RSB | brown | RS485 MODBUS |
| 11 | RSA | white | RS 485 MODBUS |
| 12 | GND | blue | „0" for control signal |

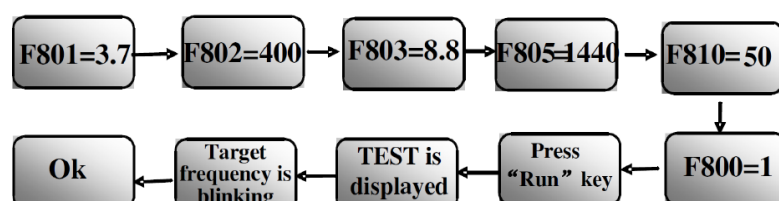**EBM Fan Controller Configuration - Service Menu/Fans/EBM Address**

## 17 COMMUNICATION RS485 SLAVE, MODBUS RTU WITH INVERTERS EURA E800,E1000, E2000

Configuration drive EURA E800, E1000, E2000 control RS485:

| Code | Name | Value to be set | Description |
|---|---|---|---|
| F106 | Control mode | 2 | Scalar U/F |
| F111 | The maximum output frequency | **Fz max** | Individual setting |
| F118 | Nominal frequency of the motor | …Hz | From the motor rating plate (50Hz |

VentiAir s.r.o. Adolfovice 512 - Bělá pod Pradědem Czech Republic, IČ: 06935320

| F200 | The source of the start command | 4 | Keyboard + terminal + Modbus RS485 |
|---|---|---|---|
| F201 | The source of the stop command | 4 | Keyboard + terminal + Modbus RS485 |
| F203 | The main source of frequency | 10 | Modbus RS485 |
| F300 | Relay function | 5 | Operation without alarm |
| F607 | Current protection | 1 | Enabled |
| F608 | Limit current% | 130 | Limit current |
| F613 | Flying start | 1 | Enabled |
| F801 | Rated engine power | ...kW | From the motor rating plate |
| F802 | Rated motor voltage | **... V** | From the motor rating plate |
| F803 | Rated motor current | ...A | From the motor rating plate |
| F805 | The rated speed of the engine | ... obr/min | From the motor rating plate |
| F810 | Nominal frequency of the motor | ...Hz | From the motor rating plate (50Hz/60Hz) |
| F800 | Motor autotuning | 1 | **Before autotuning, it is necessary to enter the above parameters** |

*(top row above F200 reads: "/ 60Hz)")*

**Example of engine parameterization 3,7kW, 400V, 1440 obr/min, 8,8A, 50Hz**

F801=3.7 → F802=400 → F803=8.8 → F805=1440 → F810=50

F810=50 → F800=1 → Press "Run" key → TEST is displayed → Target frequency is blinking → Ok

After entering the motor parameters from the nameplate, press the green RUN button, the word TEST will appear. After the measurement, which should last up to about 1 minute, the drive is ready for operation.

| F900 | Drive address | 1 | Inverter supply fan |
|---|---|---|---|
| | | 2 | Inverter exhaust fan |
| F901 | Transmission type | 2 | RTU |
| F904 | Transmission speed | 3 | 9600 |
| F905 | Time to wait for communication | 10.0 | Response to the disappearance of communication - stop |

**Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.**

**NOTE: The settings in the controller (Settings/Fan/RS485/Maximum frequency) must be at least 0.1Hz lower than Fzmax, otherwise the inverter may show control errors.**