

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

**Controllers ELP14R18, ELP14R18L**

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



***Technical documentation***

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## 1. General information

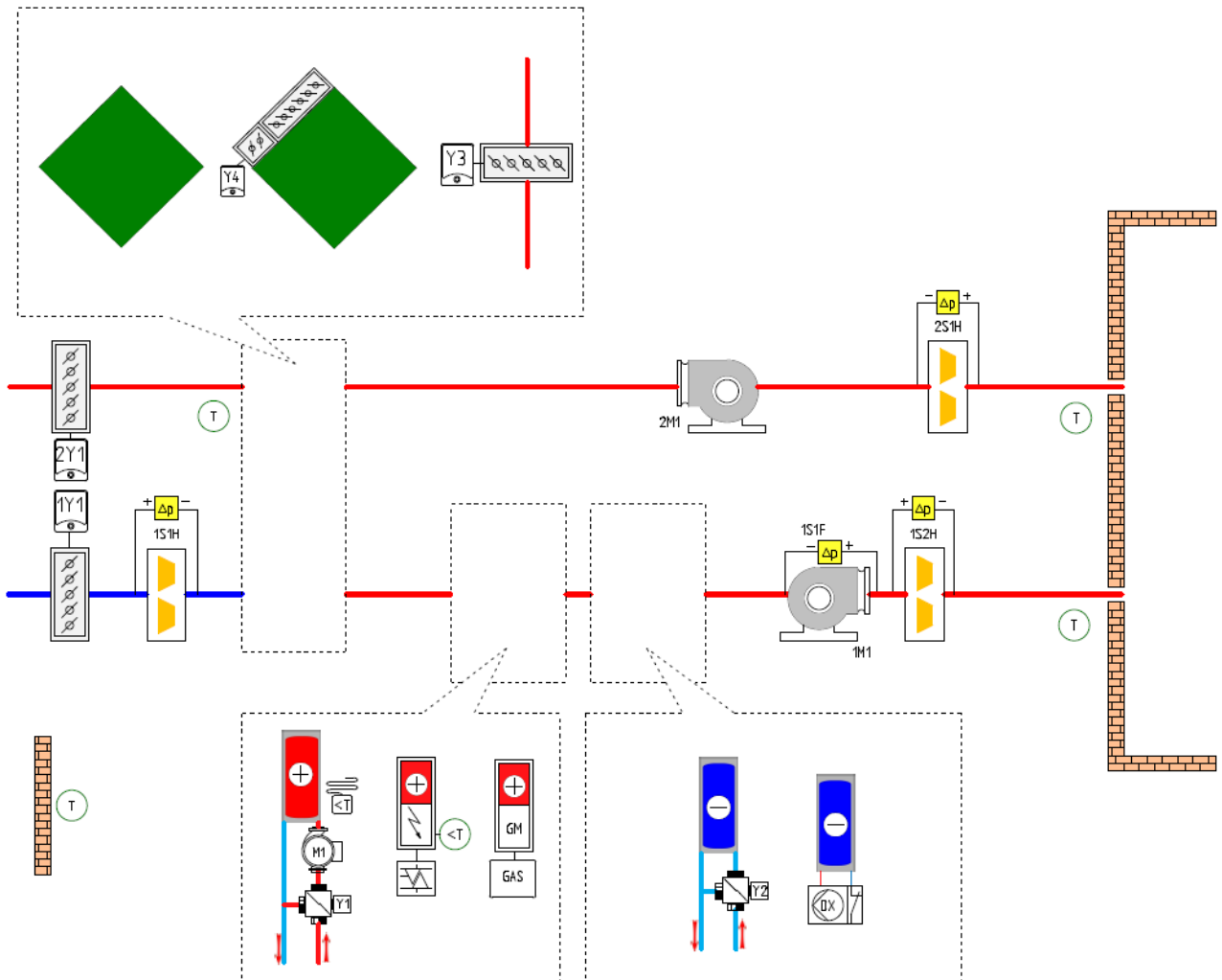


The control box can be handled by untrained personnel.

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



## 2. Encryption of control boxes

Type	Recovery	Heater	Cooler
N - supply NW - supply/exhaust	Kx - plate heat exchanger (without by-pass) M - mixing chamber KxM - plate heat exchanger and mixing chamber K 0-10 - plate heat exchanger (with by-pass)	W - water E - electric GAS - gas heater	W - water 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
2	N	-	-	-	-	F
3	N	-	-	-	W	-
4	N	-	-	-	W	-
5	N	-	-	-	W	-
6	N	-	-	-	E	-
7	N	-	-	-	E	-
8	N	-	-	-	E	-
9	N	-	-	-	GAS	-
10	N	-	-	-	GAS	-
11	N	-	-	-	GAS	-
12	N	-	M	-	-	-
13	N	-	M	-	-	-
14	N	-	M	-	-	-
15	N	-	M	-	W	-
16	N	-	M	-	W	-
17	N	-	M	-	W	-
18	N	-	M	-	E	-
19	N	-	M	-	E	-
20	N	-	M	-	E	-
21	N	-	M	-	GAS	-
22	N	-	M	-	GAS	-
23	N	-	M	-	GAS	-
24	NW	-	-	-	-	W
25	NW	-	-	-	-	F
26	NW	-	-	-	W	-
27	NW	-	-	-	W	-
28	NW	-	-	-	W	-
29	NW	-	-	-	E	-
30	NW	-	-	-	E	-
31	NW	-	-	-	E	-
32	NW	-	-	-	GAS	-
33	NW	-	-	-	GAS	-
34	NW	-	-	-	GAS	-
35	NW	-	K	-	-	-
36	NW	-	K	-	-	-
37	NW	-	K	-	-	-
38	NW	-	K	-	W	-
39	NW	-	K	-	W	-
40	NW	-	K	-	W	-
41	NW	-	K	-	E	-
42	NW	-	K	-	E	-
43	NW	-	K	-	E	-
44	NW	-	K	-	GAS	-
45	NW	-	K	-	GAS	-
46	NW	-	K	-	GAS	-
47	NW	-	KX	-	-	-
48	NW	-	KX	-	-	-
49	NW	-	KX	-	-	-
50	NW	-	KX	-	W	-
51	NW	-	KX	-	W	-
52	NW	-	KX	-	W	-
53	NW	-	KX	-	E	-
54	NW	-	KX	-	E	-
55	NW	-	KX	-	E	-
56	NW	-	KX	-	GAS	-
56	NW	-	KX	-	GAS	-
57	NW	-	KX	-	GAS	-
58	NW	-	KX	-	GAS	-
59	NW	-	M	-	-	-
60	NW	-	M	-	-	-
61	NW	-	M	-	-	-
62	NW	-	M	-	W	-
63	NW	-	M	-	W	-
64	NW	-	M	-	W	-
65	NW	-	M	-	E	-
66	NW	-	M	-	E	-
67	NW	-	M	-	E	-
68	NW	-	M	-	GAS	-
69	NW	-	M	-	GAS	-
70	NW	-	M	-	GAS	-
71	NW	-	KXM	-	-	-
72	NW	-	KXM	-	-	-
73	NW	-	KXM	-	-	-
74	NW	-	KXM	-	W	-
75	NW	-	KXM	-	W	-
76	NW	-	KXM	-	W	-
77	NW	-	KXM	-	E	-
78	NW	-	KXM	-	E	-
79	NW	-	KXM	-	E	-
80	NW	-	KXM	-	GAS	-
81	NW	-	KXM	-	GAS	-
82	NW	-	KXM	-	GAS	-

### 3. System operations

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


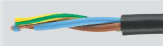



Functionality			Triggering condition	Description
Starting fans			- set the mode 1 gear, 2 gear, 3 gear STAND-BY, CALENDAR	- The opening external damper - Enabling the supply fan motor (air supply) fans or motors supply and exhaust fans (air supply exhaust)
Temperature control	Description		- Set the mode 1 gear, 2 gear, 3gear 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 - 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 - Activation of the antifreeze function the system temperature is too low for the heater (thermostat)
		Electric heater		- Continuous increase in power electric heater - Cooling of the heater during the transition from work mode to stop mode, the system - Study of overheating heater thermostat
		GAS heater		- Continuous increase in power gas heater - Cooling of the heater during the transition from work mode to stop mode, the system - 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) - 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 1 gear, 2 gear, 3gear Standby, Calendar - Outside temperature higher than the temperature of exhaust sensor 1 ° C	<b>Plate heat exchanger (without by-pass)</b> - 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 1 gear, 2 gear, 3gear Standby, Calendar - Outside temperature lower than the temperature of exhaust sensor 1 ° C	<b>Plate heat exchanger (with by-pass)</b> - Attaching the recovery the system (START / STOP) - Activation of the antifreeze function of the heat recovery system for low temperature in exhaust part of recovery (decrease recovery power)  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 1 gear, 2 gear, 3gear Standby, Calendar - Work in heating sequence	- regulation of opening damper of air on with controllers - 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 - 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 - 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 - blocking of the mixing chamber in the sequence of the cooling

#### 4. 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.

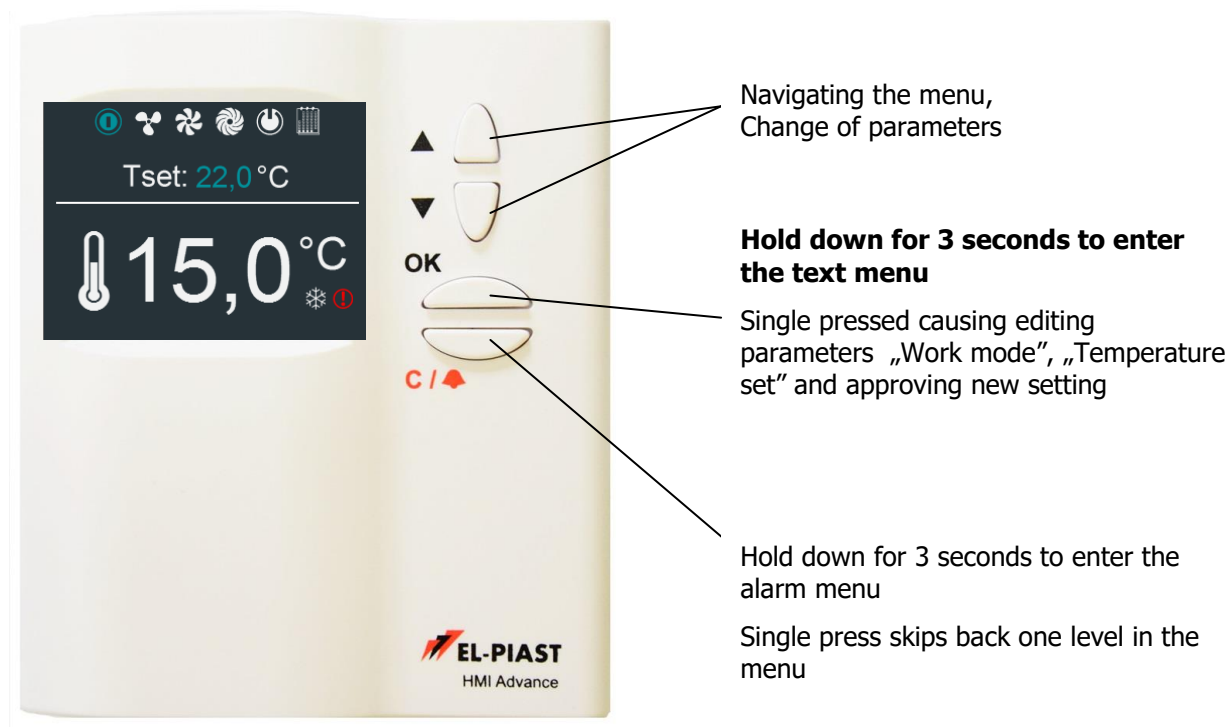
Symbol from the application scheme	Description	Type of the wire	Number of x cross - section in mm <sup>2</sup>
S1F	Cooperation with the station controller fire-protective	(2)	2x1
Y1	Actuator of the valve of the water heater	(4)	3x1
M1	Connecting of the circulation pump the water heater	(1)	3x1,5
FM1	Protecting the circulation pump of the water heater	-	-
KM1	Relay/contact 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	1x2x0,64/2,6
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	BUS	1x2x0,64/2,6

	frequency converter	O2YS(St)CY	
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









## 5. HMI and Controller specification

### HMI Advance



### Main menu icons:

		Setting the operating mode: „Stop“, „1 gear“, „2 gear“, „3 gear“, „Stand-by“, „Calendar“
		Setting the setpoint temperature
		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, then 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.

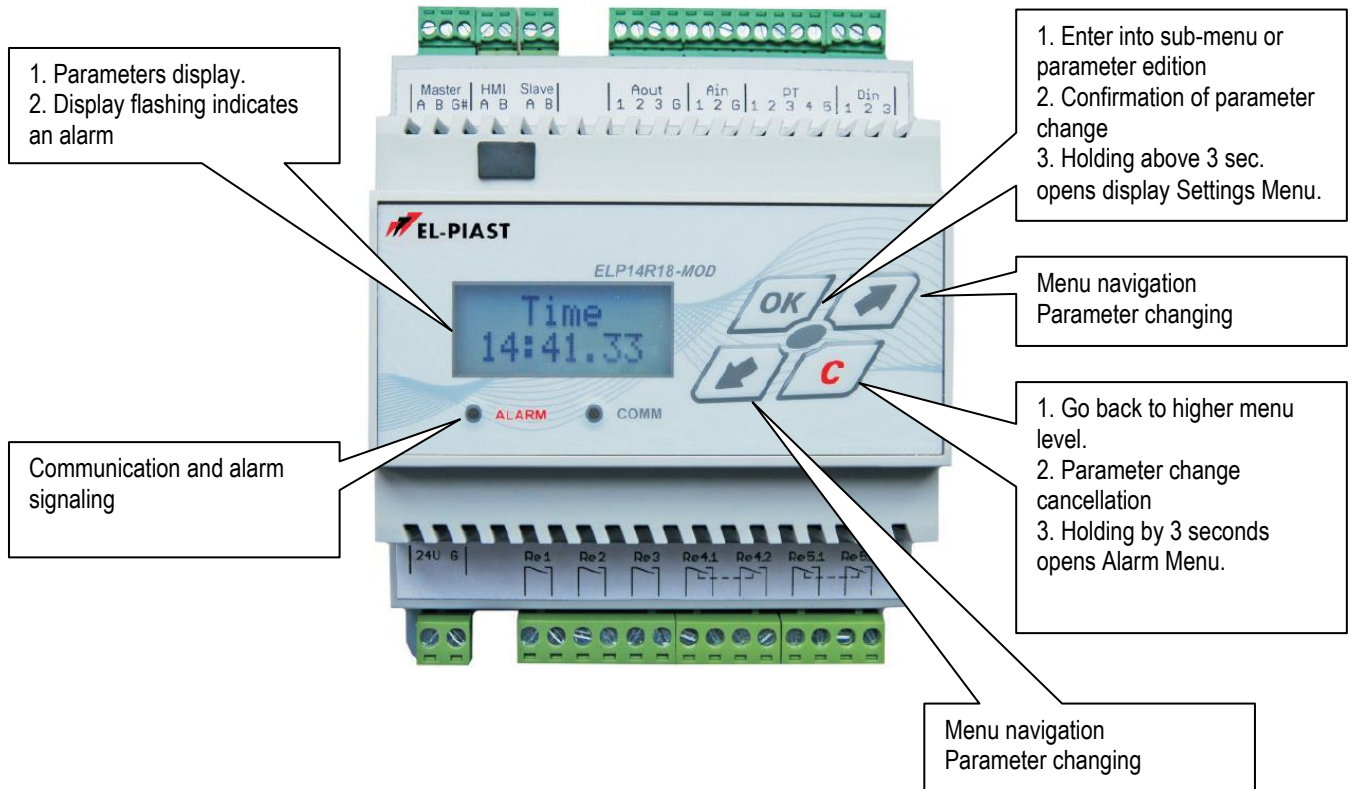
Panel HMI Advance has a jumper "simple/ext" which the opening causes the work for panel with the partly hidden menu, this function won't let the service of the object the entry in "service menu" where we are making the configuration of the ventilation arrangement in.

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)



Longer holding of OK button (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.

### 5.1. 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.

## 5.2. 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  $\pm 0.1^\circ \text{C}$ .

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  $5^\circ \text{C}$  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 ( <b>recommended</b> )
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.**

### 5.3. Standard functions of controller's inputs/outputs

<b>Digital inputs</b> (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

<b>Analogue inputs devices</b> (Signal inputs devices 0-10VDC)	
Ain 1	CO2 sensor (optional)
Ain 2	HMI Tiny (optional)

<b>Temperature sensors PT1000</b>		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

<b>Digital outputs</b> , 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

<b>Analogue outputs</b> (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.**





## 6.1 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		
<b>A_StopSystem</b>	Blocking	<p>Cooperation with fire alarm control panel.</p> <p><b>Alarm is OFF</b> – lack of fire, on digital input appeared signal 24VAC  <b>Alarm is ON</b> – fire appeared, on digital input doesn't appeared signal 24VAC</p> <p>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).</p> <p>and</p> <p>The test proper operation of the supply fan with pressure switch contact:</p> <p>Normal state – 10 seconds after system start contact is closed, the digital input signal is 24VAC  Alarm conditions – 10 seconds after system start alarm contact is open, the digital input signal is not 24VAC</p> <p>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</p> <p style="text-align: right;"><b>Digital inputs Din1</b></p>
<b>A_ThHWair</b> <b>A_3xThHWair</b>	Declining Blocking	<p>Heater anti-frost protection is accomplished by anti-frost thermostat</p> <p><b>Alarm is OFF</b> – temperature measured right after the heater is higher than temperature set on thermostat, on input digital input is signal 24VAC  <b>Alarm is ON</b> – temperature measured right after the heater is lower than temperature set on thermostat, signal 24VAC doesn't appear on input digital</p>

		<p>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.</p> <p><b>Digital input: Din2</b></p>
<b>A_ThHE, A_3xThHE</b>	Declining Blocking	<p>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:</p> <p>Normal state - heater temperature is low, the digital input signal is 24VAC Alarm conditions - the temperature of the heater is too high, there is no 24VAC on the digital input</p> <p>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.</p> <p><b>Digital input: Din2</b></p>
<b>A_ThGAS, A_3xThGAS</b>	Declining Blocking	<p>Protection of the gas heater, the input is fed from the non-potential alarm relay of the gas heater control module:</p> <p>Normal state - the digital input signal is 24VAC Alarm conditions - there is no 24VAC on the digital input</p> <p>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.</p> <p>Able to change the NO to NC</p> <p><b>Digital input: Din2</b></p>
<b>A_Filter</b>	Declining	<p>Study the degree of contamination of the supply air filter with switch:</p> <p>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 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</p> <p>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</p>

		<b>Digital input Din3</b>
Sensor inputs PT1000		
<b>A_Tsup</b>	Declining	<p>The test proper operation of air temperature sensor:</p> <p>Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged</p> <p>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</p> <p><b>Sensor input PT1</b></p>
<b>A_Texh</b>	Declining	<p>The test proper operation of exhaust air temperature sensor:</p> <p>Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged</p> <p>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</p> <p><b>Sensor input PT2</b></p>
<b>A_Tout</b>	Declining	<p>The test proper operation of the outdoor temperature sensor:</p> <p>Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged</p> <p>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</p> <p><b>Sensor input PT3</b></p>
<b>A_Trec</b>	Declining	<p>The test proper operation of exhaust temperature sensor for recovery (or glycol contact sensor):</p> <p>Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged</p> <p>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</p> <p><b>Sensor input PT4</b></p>
<b>A_TbackWater</b>	Declining	<p>The test proper operation of return water temperature sensor with heater:</p> <p>Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged</p> <p>Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the</p>

		<p>cause of the error, and the cause of the alarm must be confirmed and the system started-up again</p> <p style="text-align: right;"><b>Sensor input PT5</b></p>
<b>A_Tmain</b>	Declining	<p>The test proper operation of the temperature sensor lead:</p> <p>Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged</p> <p>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</p> <p style="text-align: right;"><b>Entry depends on the choice of the leading sensor</b></p>
<b>Other alarms</b>		
<b>A_ComSupFC</b>	Declining	<p>The study proper communication between controller and inverter of the supply fan:</p> <p>Normal state - there is no alarm, correct communication Alarm conditions - an alarm occurs, communication is not correct</p> <p>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</p>
<b>A_ComExhFC</b>	Declining	<p>The study proper communication between controller and inverter of the exhaust fan:</p> <p>Normal state - there is no alarm, correct communication Alarm conditions - an alarm occurs, communication is not correct</p> <p>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</p>
<b>A_ColdRec</b>	Declining	<p>Study the possibility of appearing the recovery frost using exhaust air temperature sensor after recovery</p> <p>Normal state - there is no alarm, high temperature Alarm conditions - an alarm occurs, low temperature</p> <p>Responding to an alarm condition Plate heat exchanger (without by-pass) : decrease the supply power ventilator.</p> <p>Responding to an alarm condition Plate heat exchanger (with by-pass) : decrease the recovery efficiency, The system works with recovery or with reduced modulation</p> <p style="text-align: right;"><b>It is possible to use the pressure control switch (Service menu / Recovery sensor)</b></p> <p style="text-align: right;"><b>When the pressure switch is used, the PT4 and GND short-circuits initiate the anti-frost response</b></p>
<b>A_ThHWwater</b> <b>A_3xThHWwater</b>	Declining Blocking	<p>Heater protection against freezing by contact sensor B8 on the water heater return</p>

		<p>Normal state - temperature of the contact sensor is higher than the set on the controller or panel</p> <p>Alarm conditions- temperature of the contact sensor is lower than the set on the controller or panel</p> <p>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</p>
<b>A_Code</b>	Blocking	<p>The alarm indicating allowed configuration of air handling unit in service menu/type of air handling unit</p> <p><b>ATTENTION!!! IN CASE OF SUPPLY AHU SELECTION, SYSTEM RECOVERY MAY ONLY BE MIXING CHAMBER</b></p>
<b>A_In_Emul</b>	Declining	<p>Emulation of inputs:</p> <p>Normal state - there is no alarm, no input is in emulation mode</p> <p>Alarm state - at least one of the digital inputs, analog, PT1000 is in emulation mode</p> <p>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</p>
<b>A_OutForce</b>	Declining	<p>Forcing output:</p> <p>Normal state - there is no alarm, no output is in forcing</p> <p>Alarm state - at least one of the digital outputs, analog mode is forcing</p> <p>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</p>

**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.

## 7. Control operation

### 7.1 Main menu

Tab. 4 Main Menu

Name	Default value	Decription
State of the AHU	Service mode	<p><b>Service mode</b> – 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</p> <p><b>Stop</b> - the AHU is stopped, air dampers are closed , fans do not work, active protective functions of the AHU</p> <p><b>Alarm - stop</b> – 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</p> <p><b>Preliminary warming up</b> - in case of the low outdoor temperature preliminary warming up is taking place in AHU with the water heater</p> <p><b>Warming up</b> - in AHU with the water-heater at reporting the alert from the thermostat frost-resistant warming the water-heater up is taking place</p> <p><b>Cooling</b> - 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</p> <p><b>Work 1,2.3 step</b> - correct work on 1,2 or 3 step of fans</p>
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).

## 7.2 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.

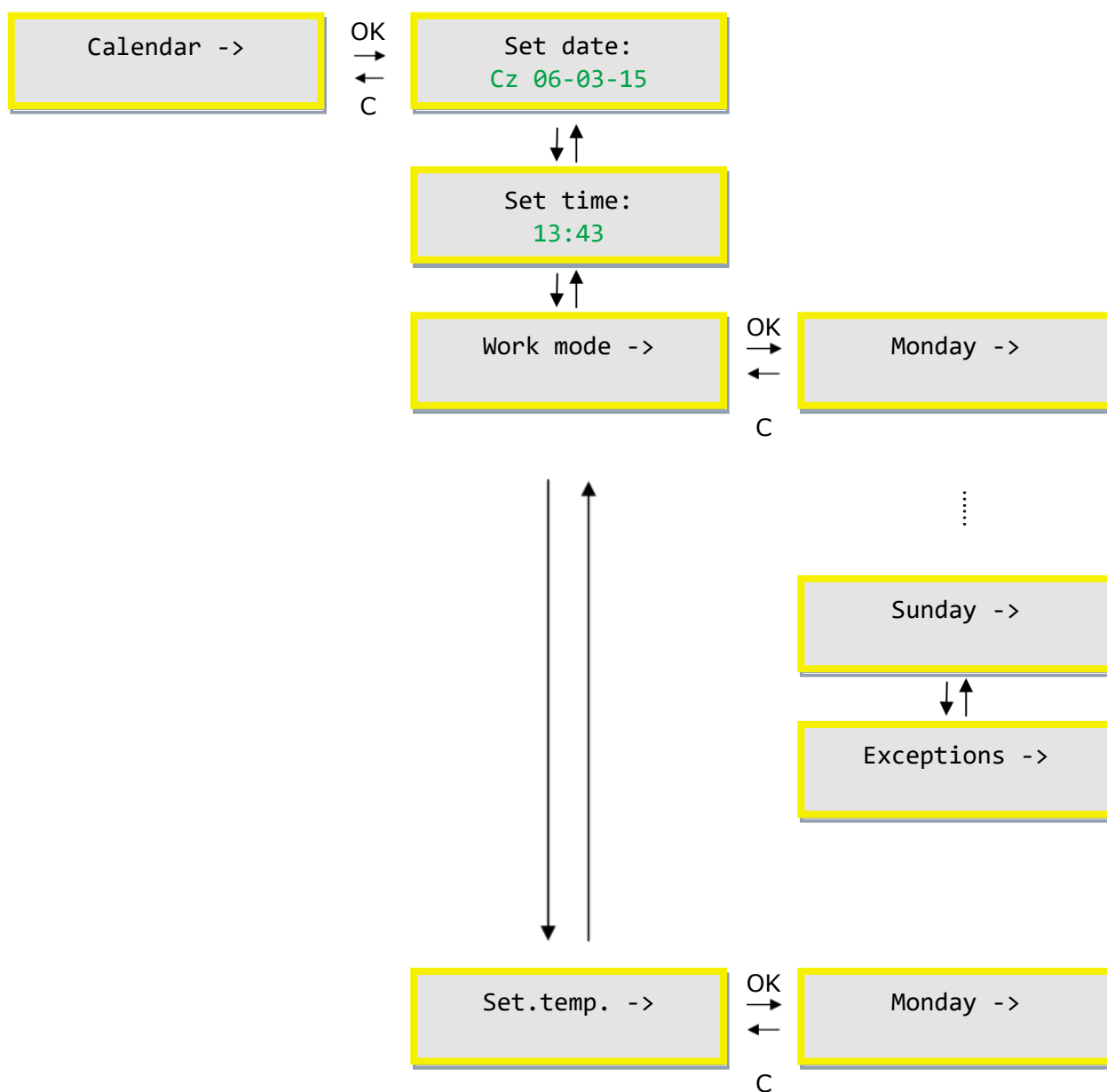
Program includes parameters:

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

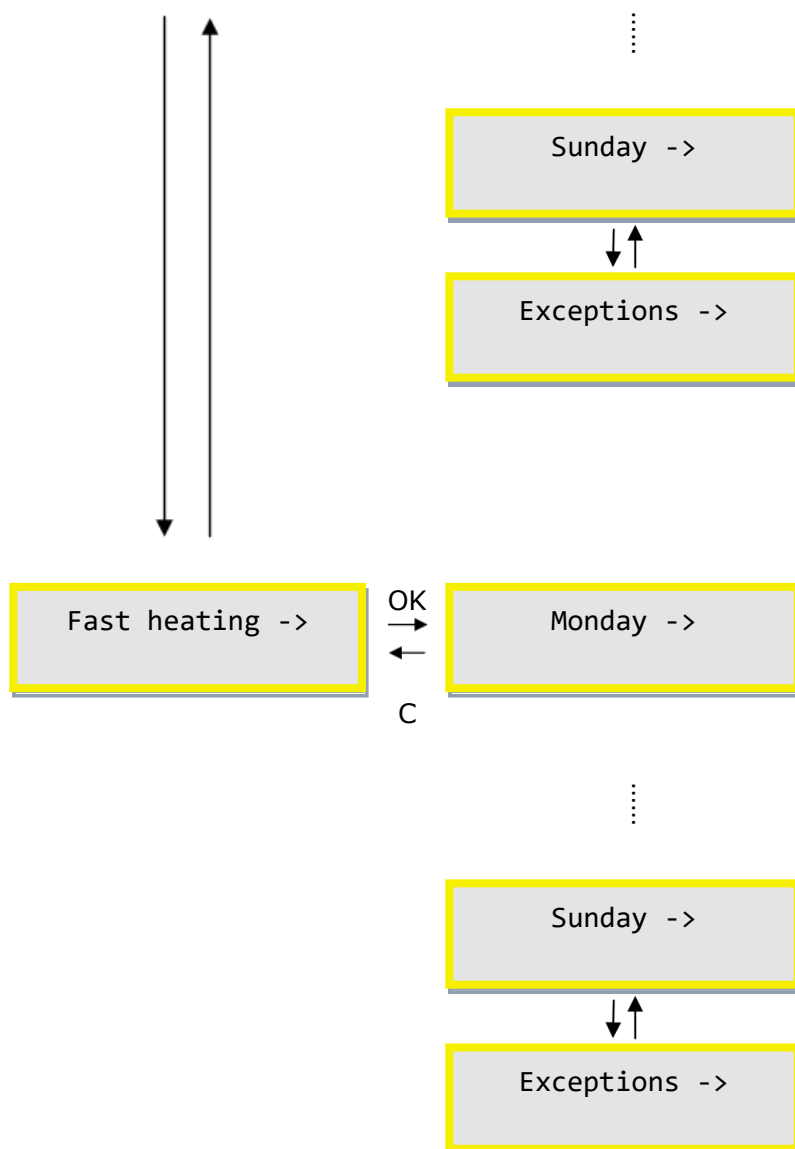
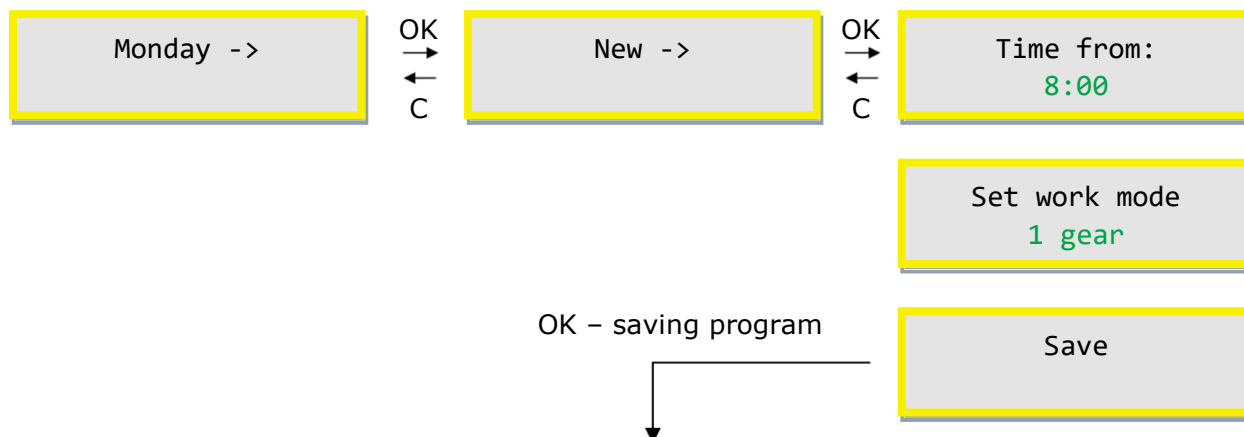
**Temperature set** – temperature setting

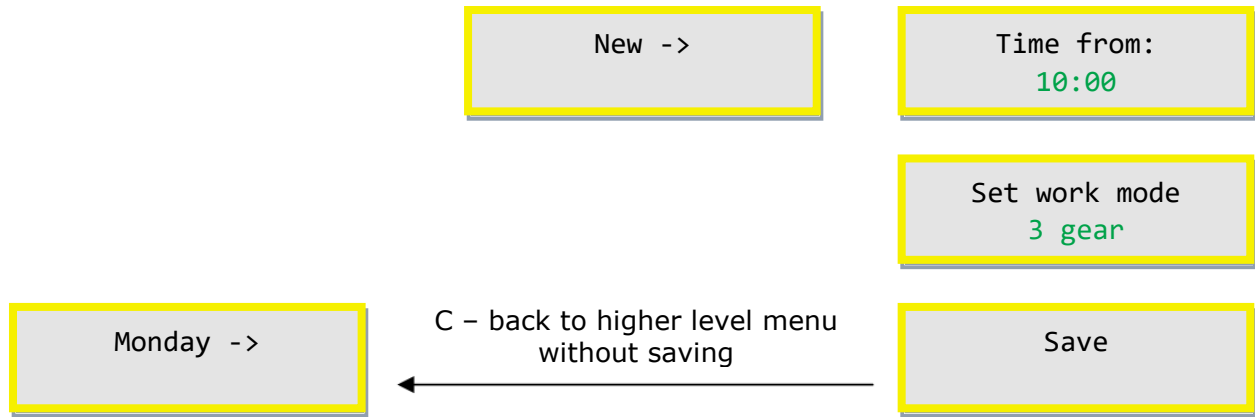
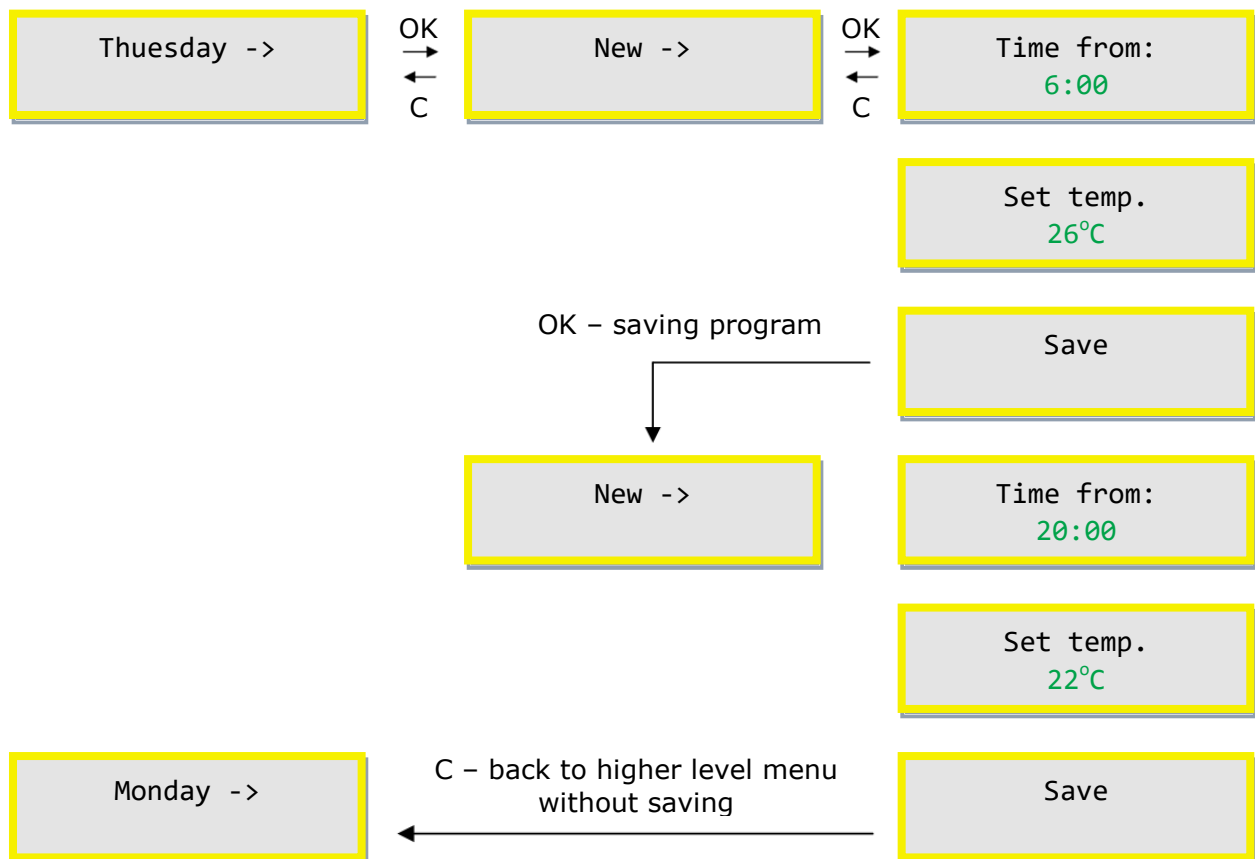
**Fast heating** - there is possibility of activate fast heating using a mixing chamber (there is in system with mixing chamber)

### Calendar menu:






**Work mode:**



**Temperature setting:**


### 7.3 Settings

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

Tab. 5 Settings menu.

Group	Name	Default	Description
Temperatures	Main sensor	Supply	<b>HMI CON</b> - temperature control according to the temperature sensor in the room unit HMI terminal connected by HMI CON <b>HMI RS485</b> - temperature control by temperature sensor HMI room unit connected via RS485 interface <b>Supply</b> - temperature control by temperature sensor supply <b>Exhaust</b> - temperature control by the exhaust temperature sensor <b>PT5</b> - temperature control by temperature sensor connected to sensor input PT5
	Eco temp. difference	15°C	<b>Eco temp. difference</b> – 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	<b>Start time</b> - fall time increased setpoint (and activation delay of the cascade temperature regulator, if it is active)
	Tset correction	5°C	<b>Tset correction</b> - 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 <b>Auto</b> – season determined automatically based on the outside temperature sensor <b>Winter</b> – manual setting winter mode <b>Summer</b> – 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	<b>Summer temperature</b> - setting the outside temperature threshold above which the system is operating in summer mode
	-	4°C	<b>Hysteresis</b> - 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	<b>HMI CON</b> - enabling the system to operate the sensor in the room unit HMI terminal connected by HMI CON <b>HMI RS485 Master</b> - enabling the system to operate the sensor in the room unit HMI connected via RS485 Master <b>Exhaust</b> - enabling the system to operate the exhaust temperature sensor <b>PT5</b> - enabling the system to operate the temperature sensor connected to sensor input PT5
	Active for	Heating and cooling	<b>Heating</b> – system will start when the sensor temperature falls below the leading standby mode, the set temperature of the hysteresis mode <b>Cooling</b> – system will start when the temperature sensor exceeds a leading standby mode, the set temperature of the hysteresis mode <b>Heating and cooling</b> – 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	<b>Standby hysteresis</b> – the difference in temperature sensor mode and set point temperature below which the system will be enclose when in standby mode
Vent.	-	10 s	<b>Starting delay</b> - the time from the start throttle operation of the fans

		15 s	<b>Damp.off delay</b> - The time from switching on operation mode "Stop" and start stopping fans to start closing the air dampers actuators of the AHU
		30 s	<b>Pressure delay</b> - the time of operation of the fans after the pressure test on the filters.
		180 s	<b>Cooling time</b> - 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
	RS485	Active	<b>Sup. via RS485</b> - activate communication with inverter supply fan
		Active	<b>Exh. Via RS 485</b> - activation of communication with the exhaust fan inverter
		0 Hz	<b>Sup.freq.min.</b> - setting the minimum frequency of the supply air fan, corresponding setting performance 0%
		60 Hz	<b>Sup.freq.max.</b> - 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)
		0 Hz	<b>Exh.freq.min.</b> - setting the minimum frequency of the supply air fan, corresponding setting performance 0%
		60 Hz	<b>Exh.freq.max.</b> - 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	<b>Sup.inv.address</b> - address of the inverter supply fan
		2	<b>Exh.inv.address</b> - address of the inverter exhaust fan

		60 s	<b>T.acc.</b> - start time inverters
		60 s	<b>T.dec.</b> - the time to stop the inverter
Part of regulation	-	15%	<b>Recovery</b> – Involved in the regulation of recovery (parameter editable)
		15%	<b>Mixing chamber</b> - Involved in the regulation of the mixing chamber (parameter editable)
		...%	<b>Heater/cooler</b> – participation in the regulation of the heater/cooler (read parameter)
Temperature regulators	PI heating	1	<b>Kp</b> - heating regulator gain
		60s	<b>Ti</b> – integration constant of the heating regulator
	PI cooling	1	<b>Kp</b> – cooling regulator gain
		60s	<b>Ti</b> – integration constant of the cooling regulator
		Summer / Winter	<b>PI cooling</b> – activation of the cooling regulator only in summer or summer and winter
		30s	<b>Start delay</b> - can be set for the delayed start of the cooling regulator
	PI air blow	1	<b>Kp</b> – air regulator gain
		90s	<b>Ti</b> – integration constant of the supply air regulator
		15°C	<b>Tmin air blow</b> - minimum supply temperature (related to setting of the supply PI regulator)
		40°C	<b>Tmax air blow</b> - maximum temperature of the supply (related to setting of the supply PI regulator)
		...	<b>TsetBlowAct</b> – the current value of the supply air temperature regulator in the cascade regulator.
Recovery	-	450 s	<b>Starting ramp</b> - 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	<b>Work mode:</b> <b>Summer</b> –possible cooling recovery <b>Winter</b> –possible heating recovery <b>Summer/Winter</b> – possible heating and cooling recovery
		2°C	<b>Frost limit</b> - temperature below (sensor B4) which the function is acting frost-resistant
		1	<b>Kp frost.prot</b> - gain of anti-frost function
		60s	<b>Ti frost.prot</b> - integration constant of the anti-frost function
Heater	Preheating	15s	<b>Preh.100% time</b> - Time of preliminary with 100% open valve, irrespective of Tmin, Tmax scale
		30s	<b>Preh.scale time</b> - 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	<b>Falling ramp</b> – the possibility to activate / deactivate the function of the falling ramp valve opening degree after preliminary heating
		30s	<b>Fall ramp</b> - time of decrease after preliminary heating
		0°C	<b>Min T.out</b> – maximum temperature scale to pre-heat
		75%	<b>Min.Tout valve</b> – scale of the valve relative to the outside temperature
		10°C	<b>Max T.out</b> – maximum temperature scale to pre-heat
		15%	<b>Max.Tout.valve</b> – scale of the valve relative to the outside temperature
	Pump work temp.	5°C	<b>Pump work temp.</b> - the temperature below which the pump is running all the time
	Min.valve open	10%	<b>Min.valve open</b> - The minimum heating valve opening
	Water frost	Inactive	<b>B8 sensor</b> – activation of protection heater the sensor on return water

		10°C	<b>Frost temp.out.</b> – activation of Frost protection on the water side to the outdoor temperature which is lower than this parameter
		5°C	<b>Frost - Stop</b> – the setting of return temperature below the system is working in Frost heating mode (during the stop)
		10°C	<b>Frost - Start</b> – the setting of return temperature below the system is working in Frost heating mode (during the work)
		10°C	<b>Regulation - Stop</b> – 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	<b>Regulation - Start</b> – 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	<b>Kp</b> – regulator gain of the setpoint temperature on the water return
		30s	<b>Ti</b> – integration constant of the setpoint temperature on the water return regulator
	Pump protect	Active	<b>Set protection</b> – a recurring feature of the pump
		7days	<b>Period</b> – active when the protective function is active pump,
		30s	<b>Run time</b> – active when protective function is active pumps,
GAS alarm	-	NC	<b>Alarm pin</b> – the possibility of choice the type of contact alarm DX cooler NO/NC
DX cooler	-	30s	<b>Break time min.</b> – minimal stop time refrigerating unit
		30s	<b>Work time min.</b> - the minimal working hours of a refrigerating unit
		13°C	<b>Temp.out work min.</b> – the minimal outdoor temperature by which the functioning of a refrigerating unit is active
		Inactive	<b>Stage 2</b> – the possibility of activation II step cooling



		Inactive	<b>Cascade</b> – 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%	<b>Stage 2</b> – the possibility of adjust threshold control signal level at which the II step of cooling is attached
		75%	<b>Stage 3</b> – 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	<p><b>Hand</b> - the mixing chamber isn't participating in the process of the temperature control, CO2, the opening degree in main menu of the controller</p> <p><b>Temperature</b> – 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)</p> <p><b>Temperature/CO2</b> – 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)</p>
	Priority for	Mix chamber	<p><b>Heating/cooling</b> – 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</p> <p><b>Mix chamber</b> - 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</p>
	Min. fresh air	30%	<b>Min. fresh air</b> – establishing minimal opening air dampers of the supply/exhaust of AHU in the automatic mode

	Max. fresh air	100%	<b>Max. fresh air</b> – establishing maximum opening air dampers of the supply/exhaust of AHU in the automatic mode
	Fast heating	Inactive	<b>Fast heating</b> – 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
		20°C	<b>Temperature set point</b> - demanded temperature for the function of the fast heating
		4°C	<b>Hysteresis</b> - Hysteresis of the Temperature set point
	CO <sub>2</sub> regulation	600 ppm	<b>Set CO<sub>2</sub></b> – demanded value of concentration CO <sub>2</sub> in exhaust air
		0,1	<b>Kp</b> – gain of the fresh air regulator
		90s	<b>Ti</b> – integration constant of the fresh air regulator
		-	<b>Sensor range</b> – the ability to set the measurement range of the CO <sub>2</sub> sensor

## 7.4 Service menu

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

Tab. 6 Service menu

Name	Name	Default value	Description
Service mode	-	Active	<p><b>Active</b> – possible configuration of the AHU, lack of ability of the start of AHU, protective functions of the chosen arrangement active</p> <p><b>Not active</b> – configuration of the AHU is not possible, the possibility of the AHU start-up</p>
AHU type	Type	Supply	<p><b>Supply</b> – Supply Air Handling Units</p> <p><b>Supply/exhaust</b> – Supply and Exhaust Air Handling Units</p>
	Recovery	None	<p><b>None</b> – in the AHU a system of the recovery exchanger wasn't applied</p> <p><b>Cross</b>– AHU equipped with the Plate heat exchanger without by-pass</p> <p><b>Mix chamber</b> – 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))</p> <p><b>Cross / Mix chamber</b> – AHU equipped with plate heat exchanger and mixing chamber</p> <p><b>Cross 0-10</b> – AHU equipped with the Plate heat exchanger with by-pass</p>
	Heater	None	<p><b>None</b> – in the AHU heater wasn't applied</p> <p><b>Electric</b> – AHU equipped with the electric heater, controlled by signal 0-10 VDC, start/stop signal and with reflexive alarm signal.</p> <p><b>Water</b> – AHU equipped with the water-heater, controlled by the valve actuator and pump</p> <p><b>GAS</b> – AHU equipped with the GAS heater, controlled by signal 0-10 VDC, start/stop signal and with reflexive alarm signal.</p>

	Cooler	None	<p><b>None</b> – in the AHU cooler wasn't applied</p> <p><b>DX</b> – 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</p> <p><b>Water</b> – AHU equipped with the water-heater, controlled by the valve actuator and pump</p>
Configuration	Start time	10s	<b>Start time</b> – 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	<b>Current address</b> - setting of the address currently set on the EC Blue fan
		-	<b>Destination address</b> - setting of the address required for the EC Blue fan (see Settings/Fans/RS485 table)
		No	<b>Set address</b> - 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	<p><b>Status OK</b> – loading settings successful</p> <p><b>Loading in progress</b> - the system while loading settings, with correct communication the loading takes about 2 seconds</p> <p><b>Alarm</b> – problem loading settings (addresses, communication error)</p>
	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	<b>Active</b> – alarm A_ColdRec frost of recovery visible in the alarm menu all the time during the freezing, <b>Inactive</b> – 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	<b>Temperature</b> – 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 <b>Pressure switch</b> – 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	<b>0-10VDC</b> – control of the electric heater by means of smooth signal 0-10VDC <b>PWM</b> – 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	<b>Change of Tset</b> – 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:  „1“ - sum of temperature regulators: 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 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	<b>Tcom</b> – communication time with one frequency inverter
	Twait	2s	<b>Twait</b> – 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.
-	-	-	<i>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.</i>
Change the password	-	-	<i>Change of password of the access to the advanced options. Default password: 1111 Attention: losing, forgetting the password will cause loss of the possibility of amending of advanced parameters.</i>
Restore the default setting	-	-	<i>Restoring the initial values of all settings.</i>

## 8. 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 slot of the controller. The Modbus address is being placed on ELP14R18 display as **MAC Address**. Longer holding of OK button (more than about 3 seconds) display enters Display Settings Menu.

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) <a href="http://www.el-piast.com/alarms-decoder">www.el-piast.com/alarms-decoder</a>	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) <a href="http://www.el-piast.com/alarms-decoder">www.el-piast.com/alarms-decoder</a>	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 = 5632 = 0x1600)	AV	Register	R
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 = 5632 = 0x1600)	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 - latem, 1 - latem i zimą	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	1dzień = 256 (22dni = 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_IIInactiveDX	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	IlistageDX	Stage 2	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
129	258	IIlistageDX	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: Heating/cooling	MSV	Coil 4192	R/W
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

Addres 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 adress	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
150	300	AdrToSetECB	Adress to set	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
151	302	ActiveConfigECB	Set adress	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 adress	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
154	308	AdrToSetEBM	Adress 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
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#### Alarms

Addres 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 + glycol, 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 thermostat electric heater	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 8032	R
252	504	A_3xThHE	Alarm of the thermostat 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 thermostat GAS heater	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 8096	R
254	508	A_3xThGAS	Alarm of the thermostat 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 controller	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 8480	R
266	532	A_OutForce	Alarm of pushing exits of the controller	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

### 9. 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)

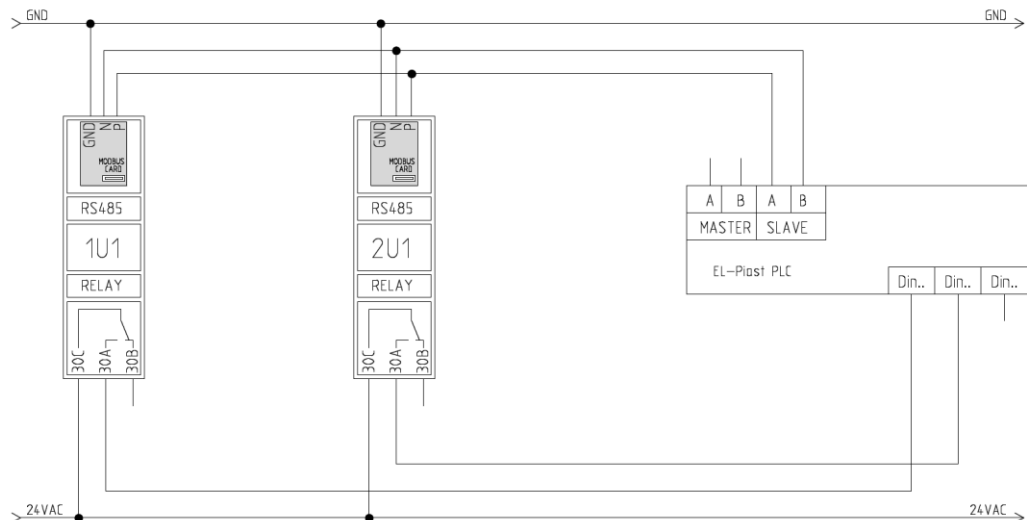


## 10. Communication RS485 Slave, Modbus RTU with inverters LG IC5

<http://www.aniro.pl/do-pobrania/do-pobrania/finish/31-instrukcja-eng/16-ig5a-manual-v2-4-110131-1/0.html>



Example for system with supply, exhaust



Configuration drive LG IC5 control RS485:

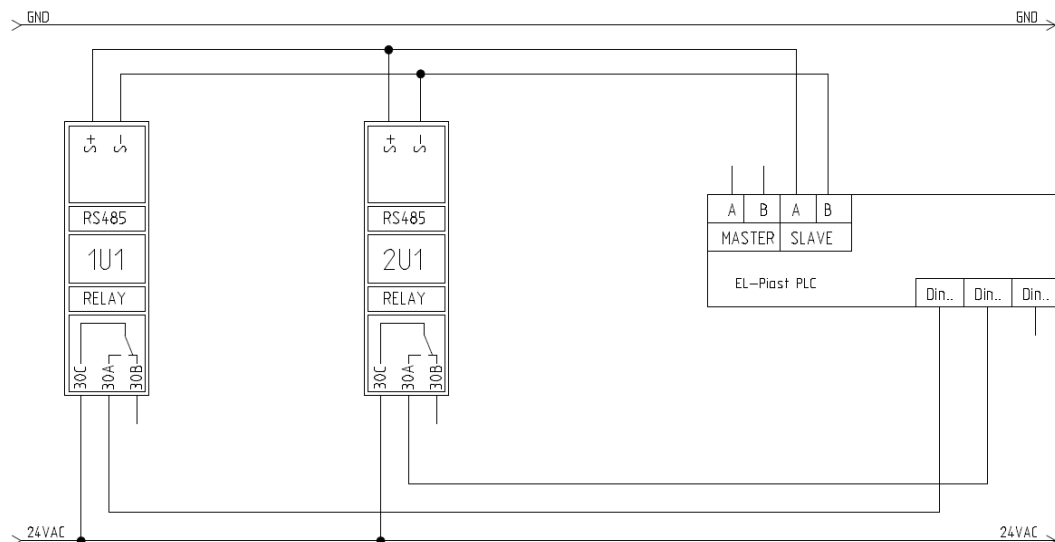
Code	Name	Value to be set	Description
drv	Control mode	3	Communication RS485
Frg	The method of frequency	8	Communication Modbus-RTU
F21	Maximum output frequency	<b>Fz max</b>	<b>Set individual</b>
F22	Rated motor frequency	...Hz	<b>Set individual</b>
F23	The minimum frequency reference	0.000	<b>Always enter the value</b>
F30	Characteristic U/F	<b>0</b>	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.**

## 11. Communication RS485 Slave, Modbus RTU with inverters LG IG5

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	<b>Fz max</b>	<b>Set individual</b>
F22	Rated motor frequency	...Hz	<b>Set individual</b>
F23	The minimum frequency reference	0.000	<b>Always enter the value</b>
F30	Characteristic U/F	<b>0</b>	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	

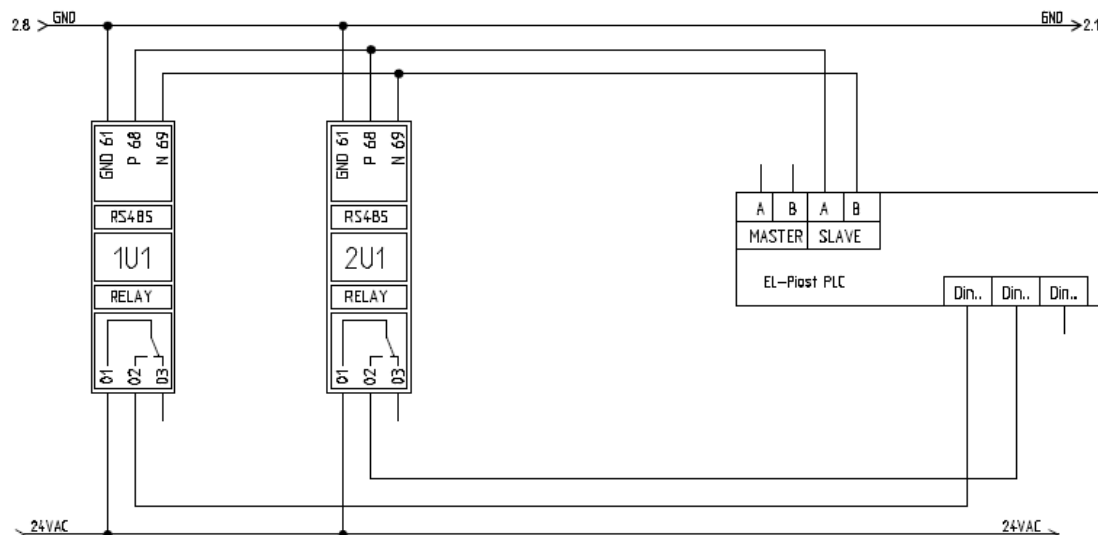
**Fz max** - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.

**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.**

## 12. 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

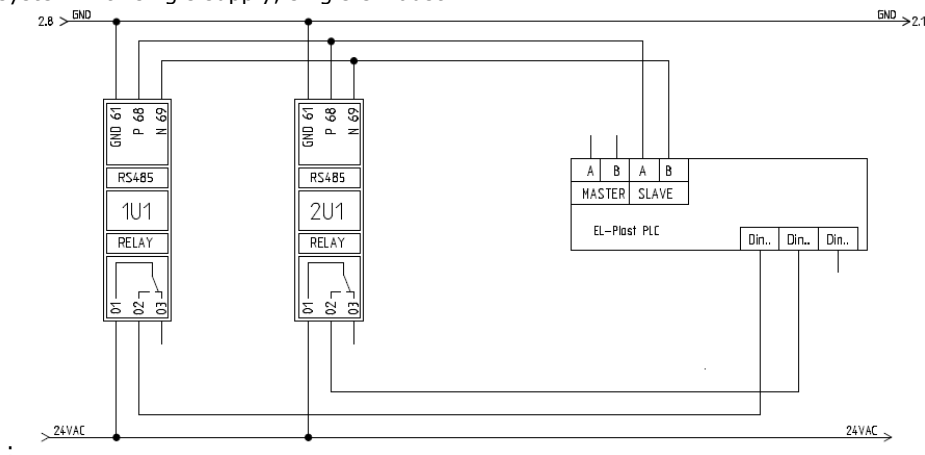
Code	Name	Value to be set	Description
1-03	Characteristic U/F	0	Linear
1-20	Rated motor power	...kW	With the motor nameplate
1-24	Rated motor current	...A	With the motor nameplate
1-25	Rated motor speed	...rpm	With the motor nameplate
1-90	Motor overload protection	4	Emergency off ETR
3-02	The minimum frequency reference	0.000	<b>Always enter the value</b>
3-03	The maximum frequency reference	<b>Fz max</b>	Set individual
3-17	Control input	11	Modbus
4-14	Maximum output frequency	<b>Fz max</b>	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.

### 13. 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



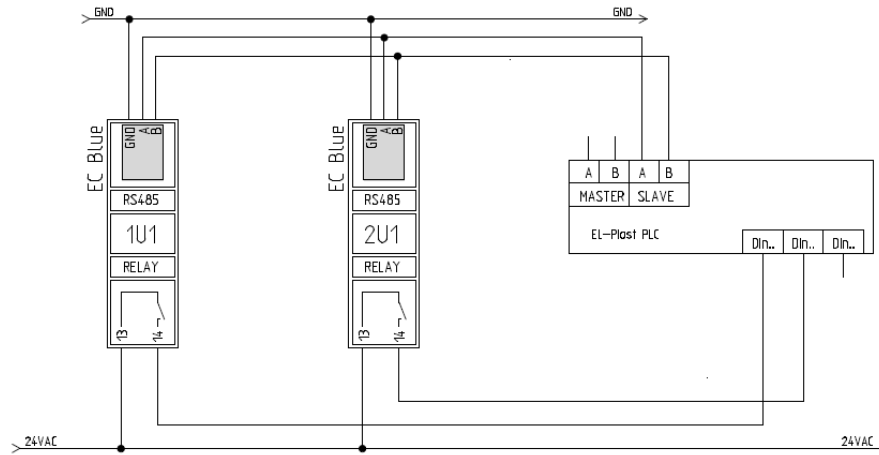
**In addition, the DANFOS FC101 inputs must be shorted with numbers 12 and 27**

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	<b>Always enter the value</b>
3-03	The maximum frequency reference	<b>Fz max</b>	Set individual
3-17	Control input	11	Modbus
4-14	Maximum output frequency	<b>Fz max</b>	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.

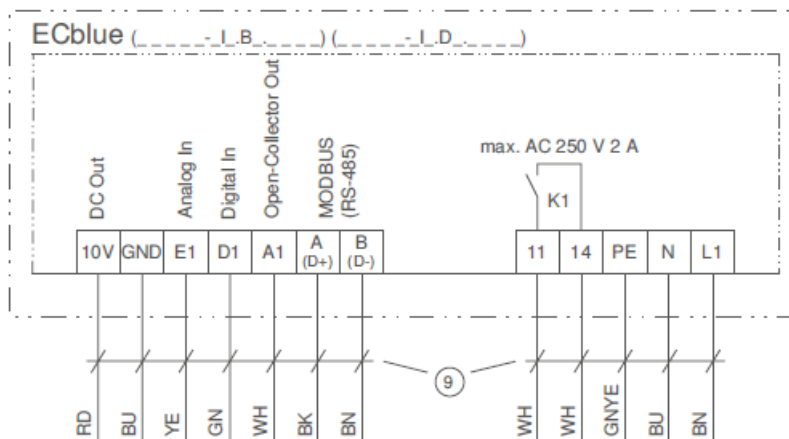
## 14. Communication RS485 Slave, Modbus RTU with EC Blue motors



Example for single supply, single exhaust.

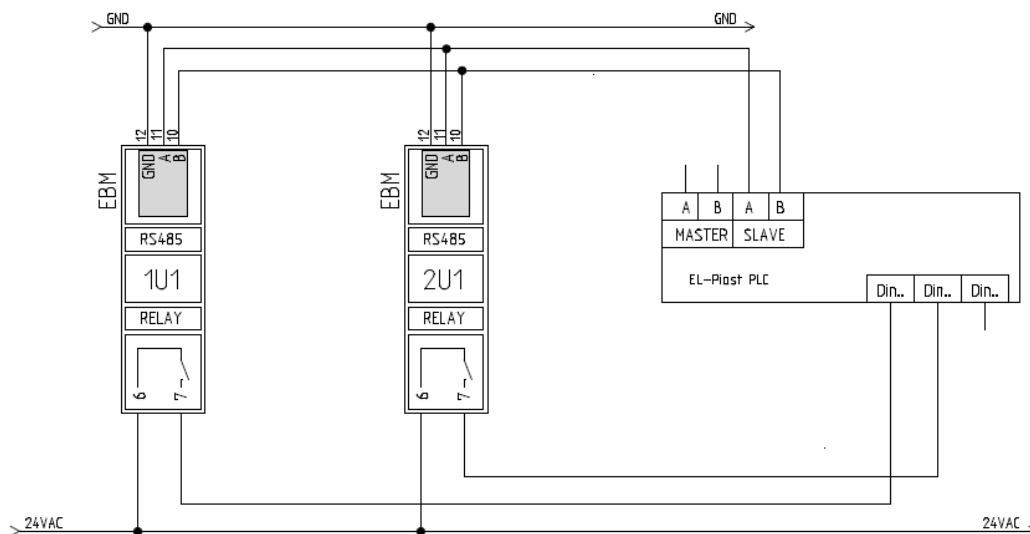
### Wiring connection of EC Blue fan

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

## 15. 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

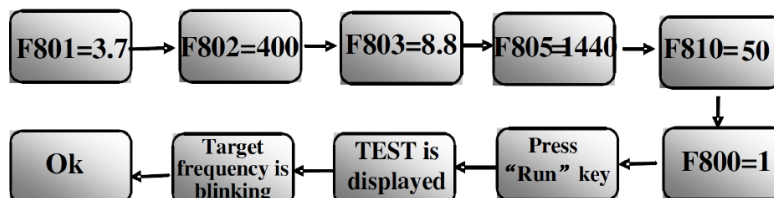
**EBM Fan Controller Configuration - Service Menu/Fans/EBM Address**

## 16. 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	<b>Fz max</b>	<b>Individual setting</b>
F118	Nominal frequency of the motor	...Hz	From the motor rating plate (50Hz / 60Hz)
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	<b>Before autotuning, it is necessary to enter the above parameters</b>

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



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.**