Universal control box for air condition with the application MED (2N,NR)

Controllers ELP14R18, ELP14R18L

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

Technical documentation

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1. General information

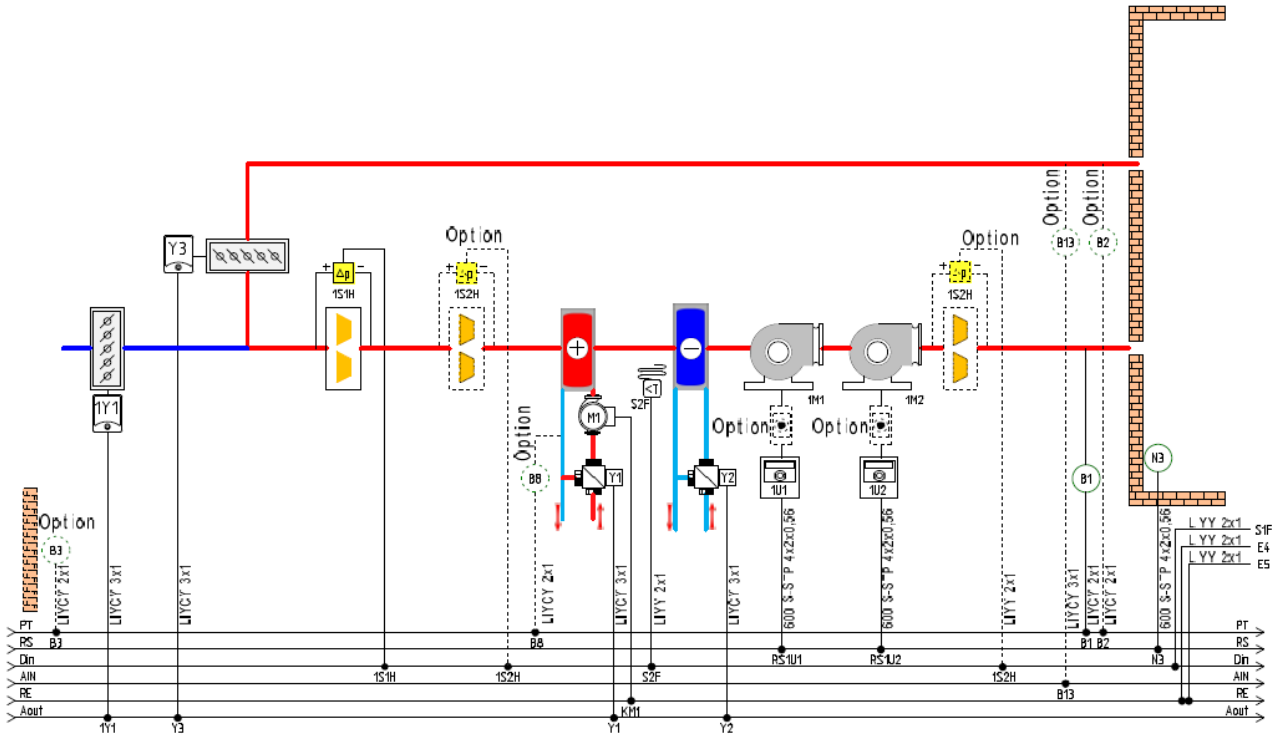
The control box can be handled by untrained personnel.

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, Double Supply or Supply and Reserve Supply Air Handling Units
- Systems with water heaters, electric heaters, gas heater
- Systems with water cooler, DX cooler
- Systems with mixing chamber

Example: MED-2N-W-W



2. Encryption of control boxes

Type	Recovery	Heater	Cooler
2N – double supply	M - mixing chamber	W - water E - electric GAS - gas	W - water F - freon
NR – supply + reserve supply			

The universal control box MED (2N,NR) after the right configuration of the controller, offers the work one of the 46 ventilation systems introduced below arrangements for the guidance:

1	2N	-	_	-	_	-	W
2	2N	-	_	-	_	-	F
3	2N	-	_	-	W	-	_
4	2N	-	_	-	W	-	W
5	2N	-	_	-	W	-	F
6	2N	-	_	-	E	-	
7	2N	-	_	-	E	-	W
8	2N	-	_	-	E	-	F
9	2N	-	_	-	GAS	-	
10	2N	-	_	-	GAS	-	W
11	2N	-	_	-	GAS	-	F
12	2N	-	M	-	_	-	_
13	2N	-	M	-	_	-	W
14	2N	-	M	-	_	-	F
15	2N	-	M	-	W	-	_
16	2N	-	M	-	W	-	W
17	2N	-	M	-	W	-	F
18	2N	-	M	-	E	-	
19	2N	-	M	-	E	-	W
20	2N	-	M	-	E	-	F
21	2N	-	M	-	GAS	-	
22	2N	-	M	-	GAS	-	W
23	2N	-	M	-	GAS	-	F

24	NR	-	_	-	_	-	W
25	NR	-	_	-	_	-	F
26	NR	-	_	-	W	-	_
27	NR	-	_	-	W	-	W
28	NR	-	_	-	W	-	F
29	NR	-	_	-	E	-	
30	NR	-	_	-	E	-	W
31	NR	-	_	-	E	-	F
32	NR	-	_	-	GAS	-	
33	NR	-	_	-	GAS	-	W
34	NR	-	_	-	GAS	-	F
35	NR	-	M	-	_	-	_
36	NR	-	M	-	_	-	W
37	NR	-	M	-	_	-	F
38	NR	-	M	-	W	-	_
39	NR	-	M	-	W	-	W
40	NR	-	M	-	W	-	F
41	NR	-	M	-	E	-	
42	NR	-	M	-	E	-	W
43	NR	-	M	-	E	-	F
44	NR	-	M	-	GAS	-	
45	NR	-	M	-	GAS	-	W
46	NR	-	M	-	GAS	-	F

3. System operations

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

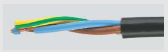
Functionality			Triggering condition	Description
Starting fans			- set the mode 1 gear, 2 gear, 3 gear STAND-BY, CALENDAR	- The opening external damper - Enabling the supply fan motor
Temperature control	Description		- Set the mode 1 gear, 2 gear, 3gear STAND-BY, CALENDAR	- Comparing the current temperature measured by the sensor lead to a setpoint 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)
Mixing chamber			- Set the mode 1 gear, 2 gear, 3 gear STAND-BY, CALENDAR - Work in heating sequence - optional work in sequence regulation of CO2	- regulation of opening damper of air on with controlers - 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 heatings 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.

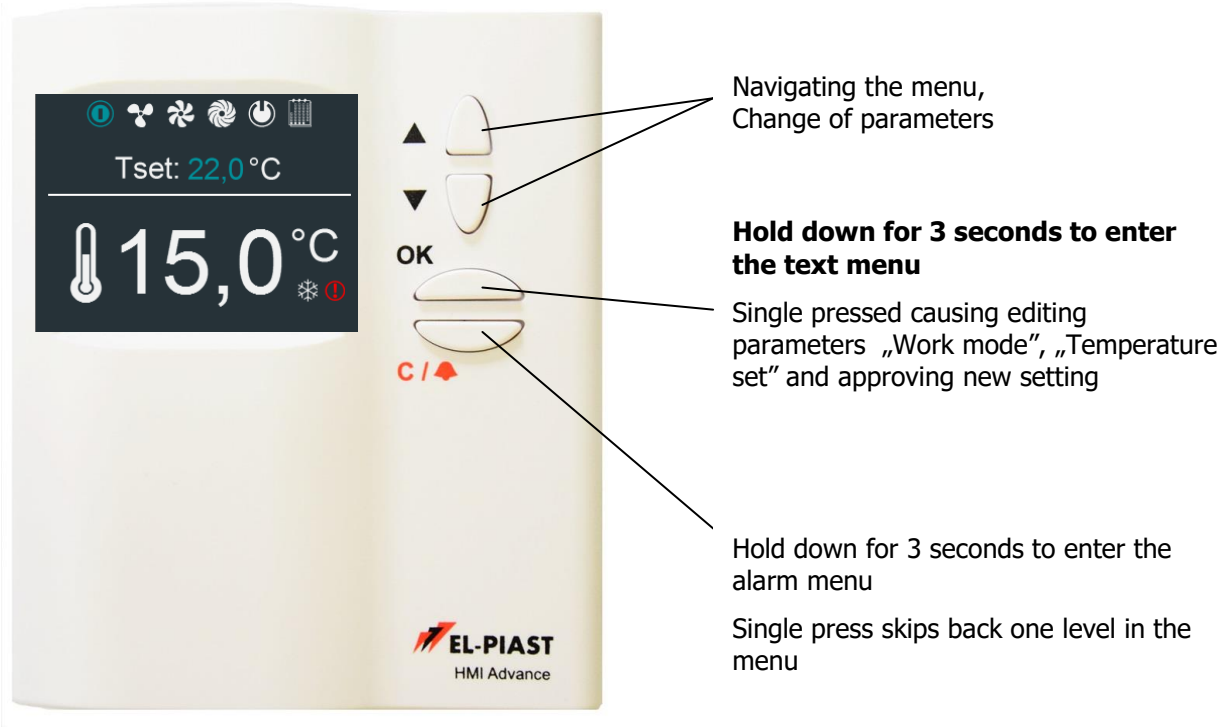
Tab. 4 The standard cable list and symbols of schemes.

Symbol from the application schema	Description	Typ of the wire	Number of x cross - section in mm^2
S1F	Cooperation with the station controller fire-protective	-	
Y1	Actuator of the valve of the water heater	(4)	3x1
M1	Connecting of the circulation pump the water heater	(1)	3x1,5
FM1	Protecting the circulation pump of the water heater	-	-
KM1	Relay/contactor of the circulation pump of the water heater	-	-
S2F	Thermostat frost-resistant of water heater on the side of air	(2)	2x1
Y2	Actuator of the valve of the water cooler	(4)	3x1
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	Control signal 0-10V and alarm signal of electric heater	(4)	2x1
F1M1,2	Protecting the engine of the air blowing	-	-
1U1,2	Connecting powering the ventilator for inverters supply	(5)	Attachment B
1M1,2	Connecting powering the engine of the team of the fan inlet	(1)	Attachment B
RS1U1,2	Modbus RS485 signal for supply inverters	BUS O2YS(St)CY	1×2×0,64/2,6
F2M1,2	Protecting the exhaust engine	-	-
2U1,2	Connecting powering the ventilator for inverters exhaust	(5)	Attachment B
2M1,2	Connecting powering the engine of the team of the fan outlet	(1)	Attachment B
RS2U1,2	Modbus RS485 signal for exhaust inverters	BUS O2YS(St)CY	1×2×0,64/2,6
1Y1	Actuator of the dumper of air blown in	(2) or (4) when 0-10V	3x1
1Y2	Actuator of the dumper of air blown in (reserve part)	(2) or (4) when 0-10V	3x1
2Y1	Actuator of the dumper of air blown off	(2) or (4) when 0-10V	3x1

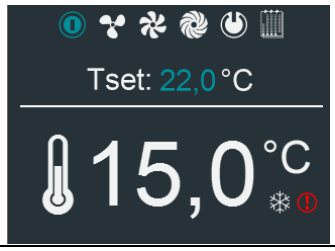
2Y2	Actuator of the dumper of air blown off (reserve part)	(2) or (4) when 0-10V	3x1
Y3	Actuator of the dumper of the recirculation	(4)	3x1
1Y3	Actuator of the dumper of air blown in (shared part)	(2) or (4) when 0-10V	3x1
B1	Temperature sensor of air blown in	(4)	2x1
B2	Temperature sensor of air blown off	(4)	2x1
B3	Sensor of the outdoor temperature	(4)	2x1
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 (option)	(4)	3x1
1S1F	Differential pressure switch of supply ventilator	(2)	2x1
1S1H	Differential pressure switch of filter of the preliminary 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	(4)	7x1
N3	Panel HMI - 216 Advance (max 100m) – communication	BUS O2YS(St)CY	1×2×0,64/2,6
	Panel HMI - 216 Advance (max 100m) – power supply	(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"
	Tset: 22,0 °C	Setting the setpoint temperature
	15,0 °C	Read the temperature from the leading sensor
	❄	Frost recovery active
	!	The summary alarm activated

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

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

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

HMI parameter description:

Minimal brightness – minimal brightness of the highlight
Maximal brightness – maximal brightness of the highlight

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

To exit menu - press C key.

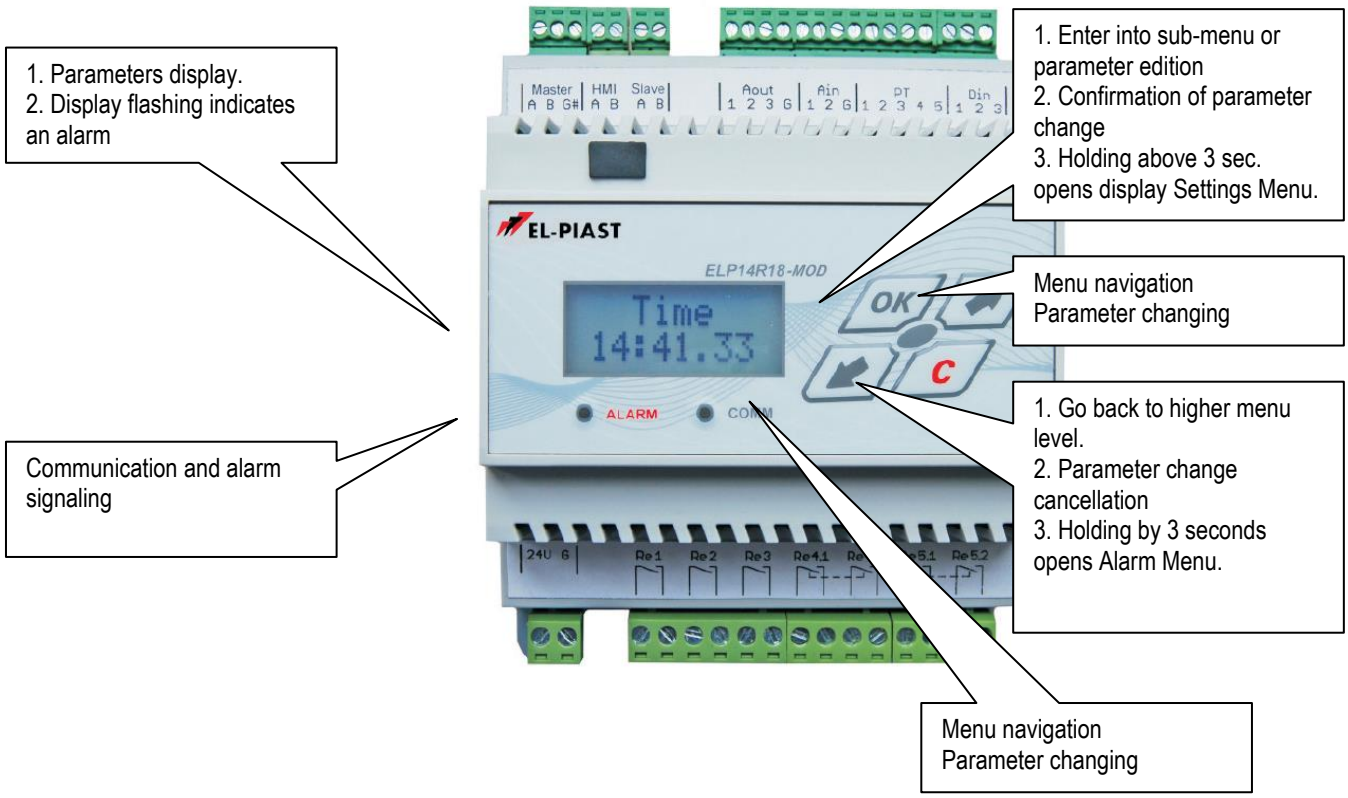
Panel Advance HMI can be connected to the input of the HMI CON (located at the upper side of the driver around the USB connector) or RS485 master (if it is not used to transfer information management system BMS). There is a possibility of simultaneous connecting two panels to the RJ45 connector and RS485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

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

The USB connection is used to download the application control.
If the application does not meet the control requirements of the customer, contact the manufacturer or supplier, you can adapt to the requirements of the application and upload it using any PC.

ELP14R18-Mod, ELP14R18L-Mod – communication Modbus RTU with BMS through the RS485 (connector RS485 Master)

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



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 can not 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.

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.

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 (inlet, inlet+reserve, water heater, electric heater, gas heater, water cooler, freon cooler, mix 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, EBM)
   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)
   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)
   HE control – Option to select the type of electric heater control (applies to analog output 0-10VDC - Aout1), smoothg 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 ± 0.1 ° C.

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

If you do not achieve a satisfactory effect of the temperature control process you should:

- check that the system is working at full airflow rate (compare the fans inverter frequency with frequency of operation specified in the Selection Card of the AHU or with the data obtained from the results of air flow rate measurements)
- check the correct operation of actuators and control systems of the heaters, coolers, heat recovery systems,
- check the correct operation of the air dampers,
- check the installation of temperature sensors,
- check the tuning of PI regulators.

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

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

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

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

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

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

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

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

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

Supply PI regulator type "2" may be faster or slower than the heating and cooling PI, the slower the smaller oscillations at the minimum and maximum supply temperature but slower response to the limit.

Limit temperature parameters „Tmin supply”, Tmax supply” may be close to the temperature set.

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

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

5.3. Standard functions of controller's inputs/outputs

Digital inputs (State of the NC access - giving for accessing DIN... enclosing the digital input causes stretching 24 VAC)		During the correct work of the arrangement	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 inlet filter	obtuse	A_SupExhFilter

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

Temparature sensors PT1000		The damaged temperature sensor is causing alarm
PT1	Inlet	A_Tsup
PT2	Outlet	A_Texh
PT3	Outside	A_Tout
PT4	-	-
PT5	Return water of water heater (option when is not using HMI Tiny)	A_TbackWater
	Room (there is in optional panel HMI Tiny)	Stop system

Digital outputs, excluded state - ReC/ReA exit obtuse, attached state - ReC/ReA exit compact		
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	Damper of the inlet 1	relay
Re4.2	Damper of the inlet 3 (shared part in reserve system)	relay
Re5.1	Damper of the inlet 2	relay
Re5.2	Damper of the inlet 3 (shared part in reserve system)	relay

Analogue outputs devices (Signal outputs devices 0-10VDC)	
Aout1	Heater (water or electric)
Aout2	Cooler (water or freon)
Aout3	Mixing chamber (10-0V), damper inlet/outlet (0-10V)

In the service menu you can activate any relay outputs as proof of works or collecting alarm. When activated, make sure that the output is not used in the application.

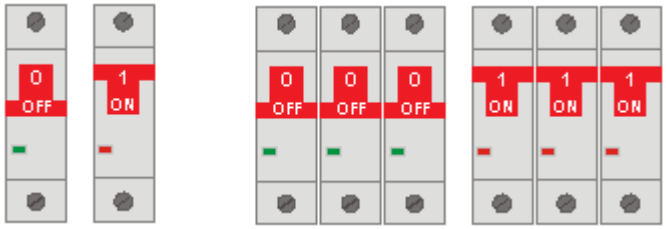
6. Control service

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

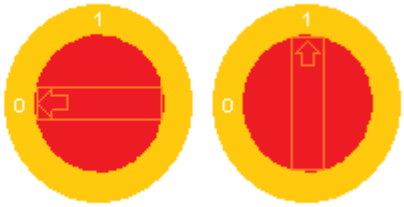
Start-up of the device

Operate Switch Q1M into position ON.

„1-ON” (synthetic switchboard)



„1” (metal switchboard)

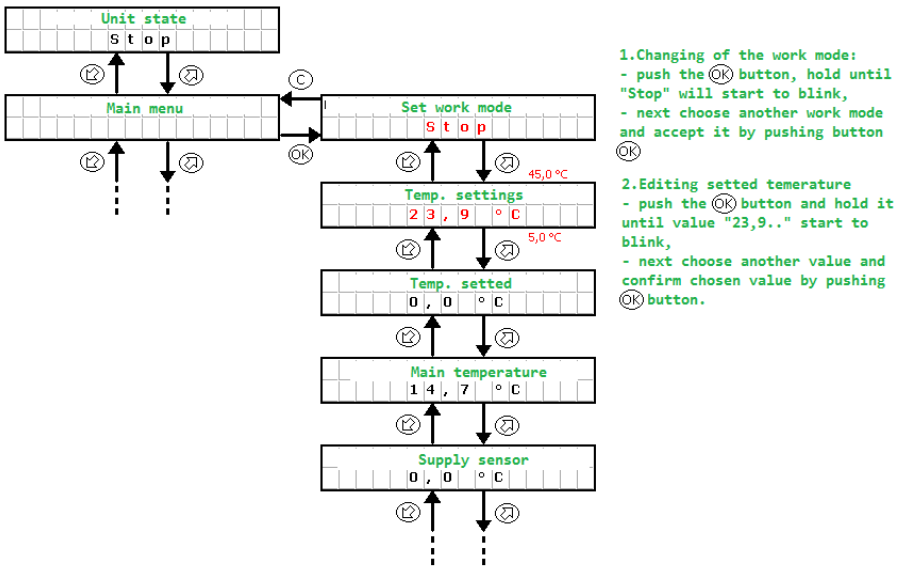


The device is starting-up if:
- isn't appear neither of the alarms of the locking operation of the system
and
- parameter ***„Set work mode”*** on the controller or on the HMI is set to any option other than ***Stop***.

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

Changing the temperature set if as panel a “menu” was chosen

Parameter ***“Set temperature”*** in the main menu of controller or HMI.



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

6.1 Alarms

Alarms are indicated by display flashing and red continuous lighting LED on the controller or HMI.

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	System reaction
		Digital input
A_StopSystem	Blocking	Cooperation with fire alarm control panel. **Alarm is OFF** – lack of fire, on digital input appeared signal 24VAC **Alarm is ON** – fire appeared, on digital input doesn't appeared signal 24VAC 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). and The test proper operation of the supply fan with pressure switch contact: Normal state – 10 seconds after system start contact is closed, the digital input signal is 24VAC Alarm conditions – 10 seconds after system start alarm contact is open, the digital input signal is not 24VAC 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 **Digital inputs Din1**
A_ThHWair **A_3xThHWair**	Declining Blocking	Heater anti-frost protection is accomplished by anti-frost thermostat **Alarm is OFF** – temperature measured right after the heater is higher than temperature set on thermostat, on input digital input is signal 24VAC **Alarm is ON** – temperature measured right after the heater is lower than temperature set on thermostat, signal 24VAC doesn't appear on input digital 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. **Digital input: Din2**
A_ThHE, A_3xThHE	Declining Blocking	Protection against overheating of the electric heater on the input signal is input to the alarm relay module mounted on the tiller HE power and control electric heater: Normal state - fuser temperature is low, the digital input signal is 24VAC Alarm conditions - the temperature of the heater is too high, the digital input signal is not 24VAC Responding to an alarm condition: the system operates without heating until resolution of overheating, after the resignation 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 acknowledgment. **Digital input: Din2**
A_ThGAS, A_3xThGAS	Declining Blocking	Protection of the gas heater, the input is fed from the non-potential alarm relay of the gas heater control module: Normal state - the digital input signal is 24VAC Alarm conditions - there is no 24VAC on the digital input 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. Able to change the NO to NC **Digital input: Din2**
A_Filter	Declining	Study the degree of contamination of the supply air filter with switch: Normal state - dirty limit, the pressure difference before and after the filter is below the set on the pressure switch, the digital input signal is not 24VAC 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 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 **Digital inputs Din3**
Sensor inputs PT1000		
A_Tsup	Blocking	The test proper operation of air temperature sensor: Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be acknowledged and operate the system **Sensor input PT1**
A_Texh	Blocking	The test proper operation of exhaust air temperature sensor: Normal state - there is no alarm, sensor connected

		Alarm conditions - an alarm occurs, the sensor disconnected or damaged Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be acknowledged and operate the system **Sensor input PT2**
A_Tout	Blocking	The test proper operation of the outdoor temperature sensor: Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be acknowledged and operate the system **Sensor input PT3**
A_TbackWater	Blocking	The test proper operation of return water temperature sensor with heater: Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged Responding to an alarm condition: the system is stopped, check the sensor and how to connect to the controller, determine the cause of the error, and the cause of the alarm must be acknowledged and operate the system **Sensor input PT5**
A_Tmain	Blocking	The test proper operation of the temperature sensor lead: Normal state - there is no alarm, sensor connected Alarm conditions - an alarm occurs, the sensor disconnected or damaged 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 acknowledged and operate the system **Entry depends on the choice of the leading sensor**
Alarms different		
A_FC1,2	Blocking	The test proper operation of the inverter supply fan with inverter alarm contact (confirmation of work by Modbus RS485 communication): Normal state - immediately after the power is not an alarm inverter Alarm conditions - directly after the power inverter alarm occurs 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 **Modbus RS485 Slave communication**
A_ThHWwater	Blocking	Heater protection against freezing by contact sensor B8 to return the water heater Normal state - temperature of the contact sensor is higher than the set on the controller or panel

		Alarm conditions– temperature of the contact sensor is lower than the set on the controller or panel Responding to an alarm condition : the system STOP, the heater 100% until the temperature of the contact sensor rise above setpoint. After crossing the temperature measured by the contact sensor system back to work.
A_In_Emul	Declining	Emulation of inputs: Normal state - there is no alarm, no input is in emulation mode Alarm state - at least one of the digital inputs, analog, PT1000 is in emulation mode Responding to an alarm: the driver does not react to physical changes emulated input, the system works to the value of the emulator in the service menu
A_OutForce	Declining	Forcing output: Normal state - there is no alarm, no output is in forcing Alarm state - at least one of the digital outputs, analog mode is forcing 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

Atention: 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

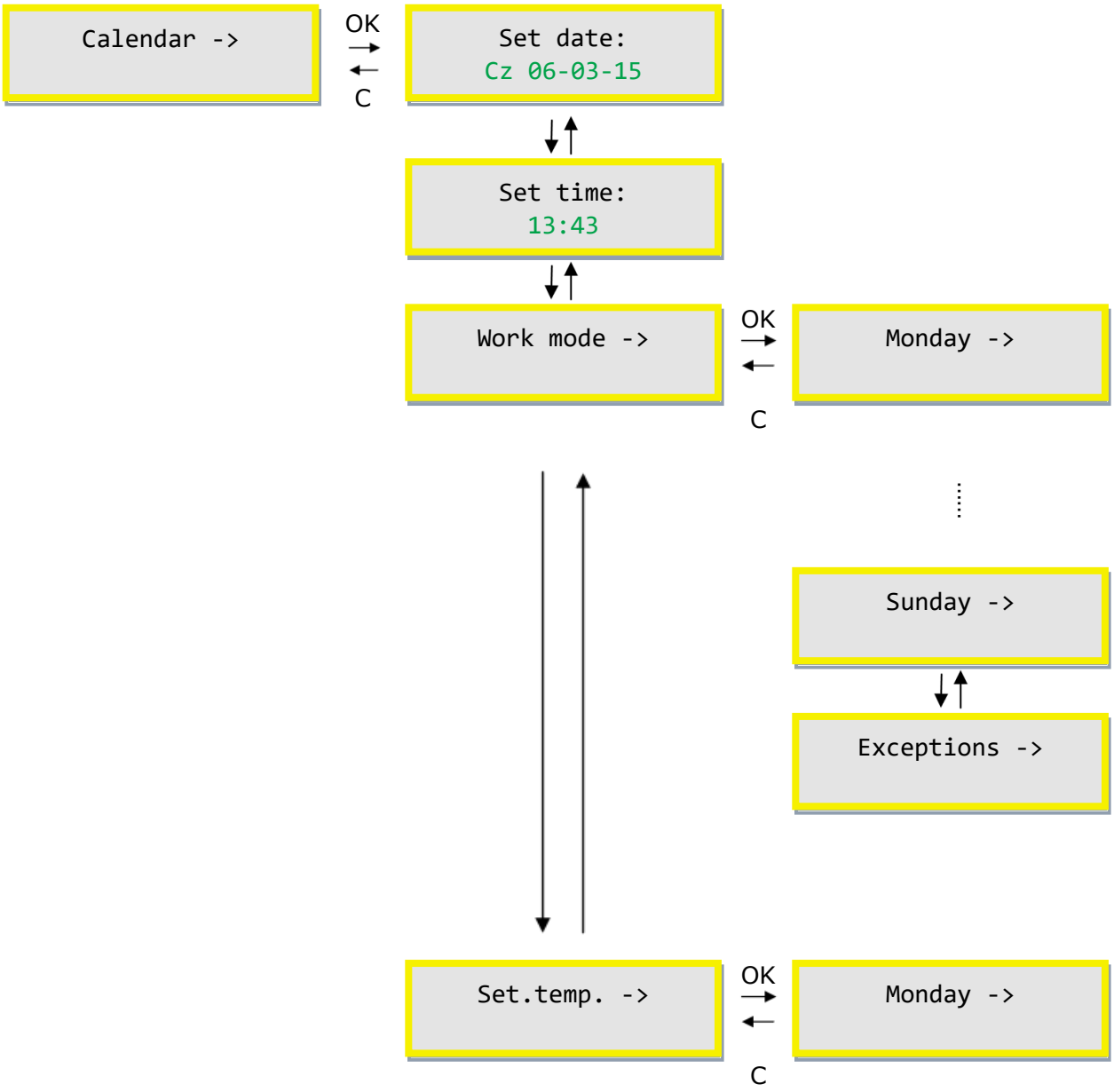
Name	Default value	Decription
State of the AHU	Service mode	**Service mode** – the arrangement is in the course of the configuration, lack of ability of the start of the arrangement, active protective functions of chosen exchangers heating/cooling **Stop -** the AHU is stopped, air dampers are closed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

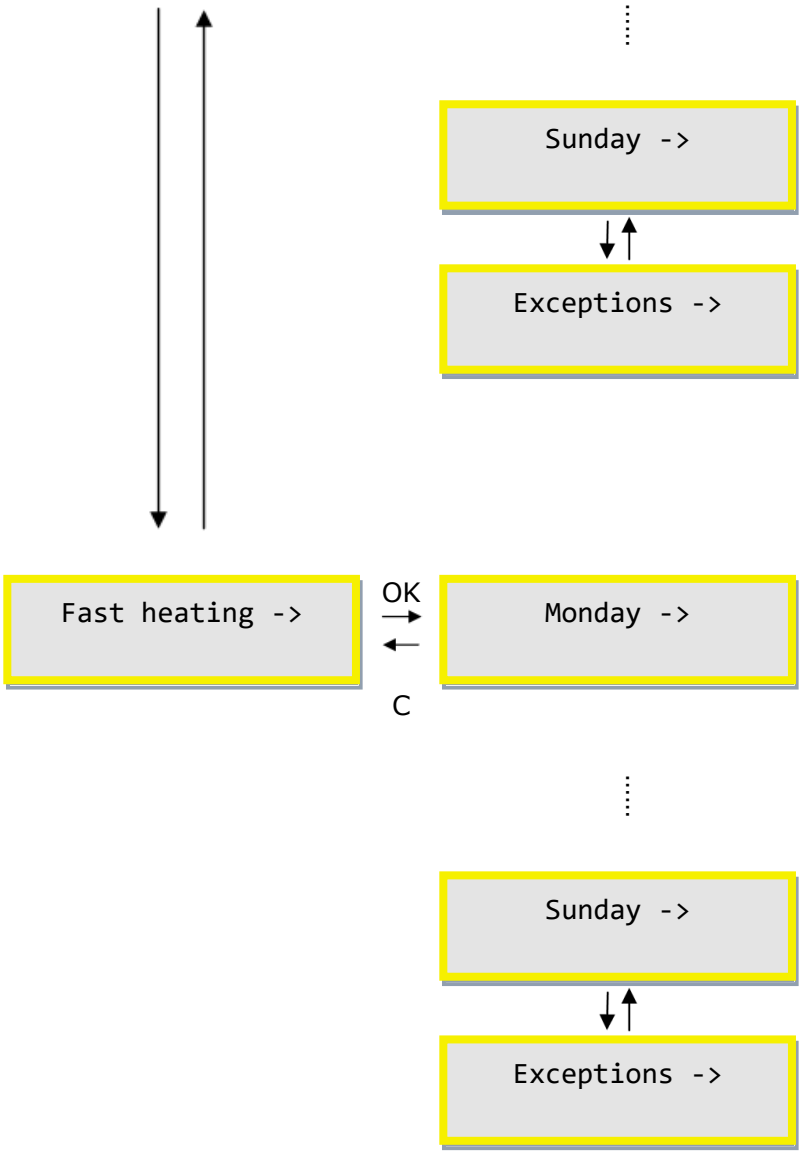
7.2 Calendar

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.

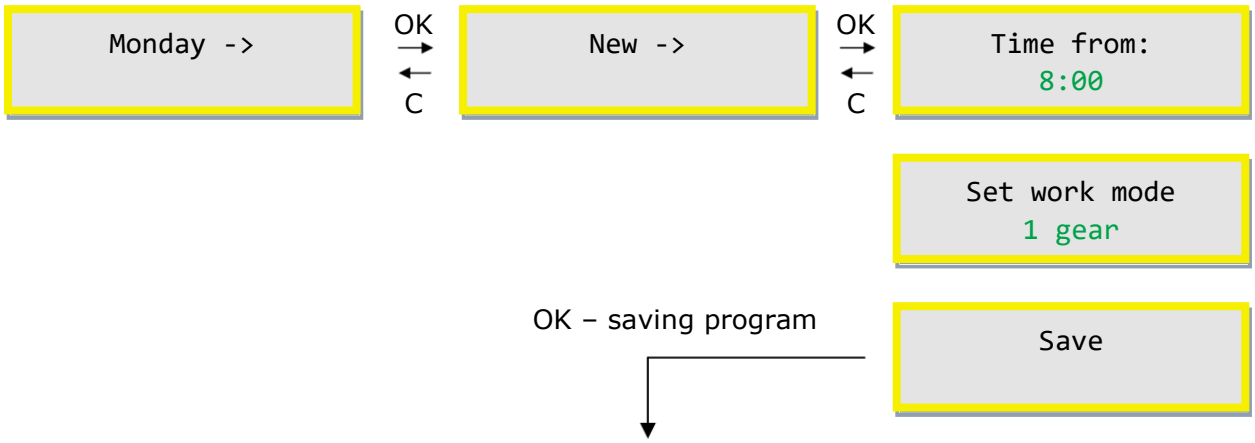
Program includes parameters:
Work mode – possible selections: Stop, Start 1 step, Start 2 step Start 3 step and the Stand-by.
Temperature set – temperature setting
Fast heating - there is possibility of activate fast heating using a mixing chamber (there is in system with mixing chamber)

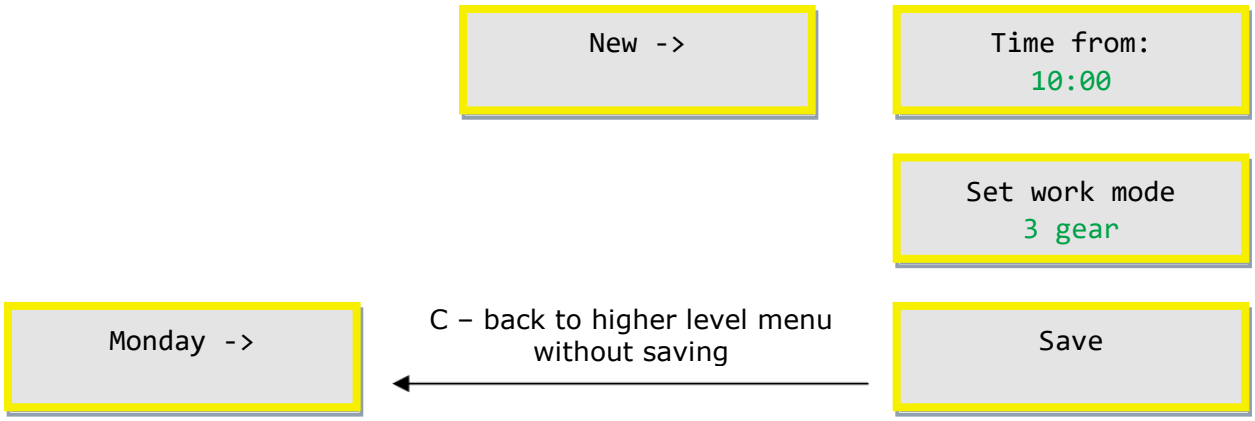
Calendar menu:



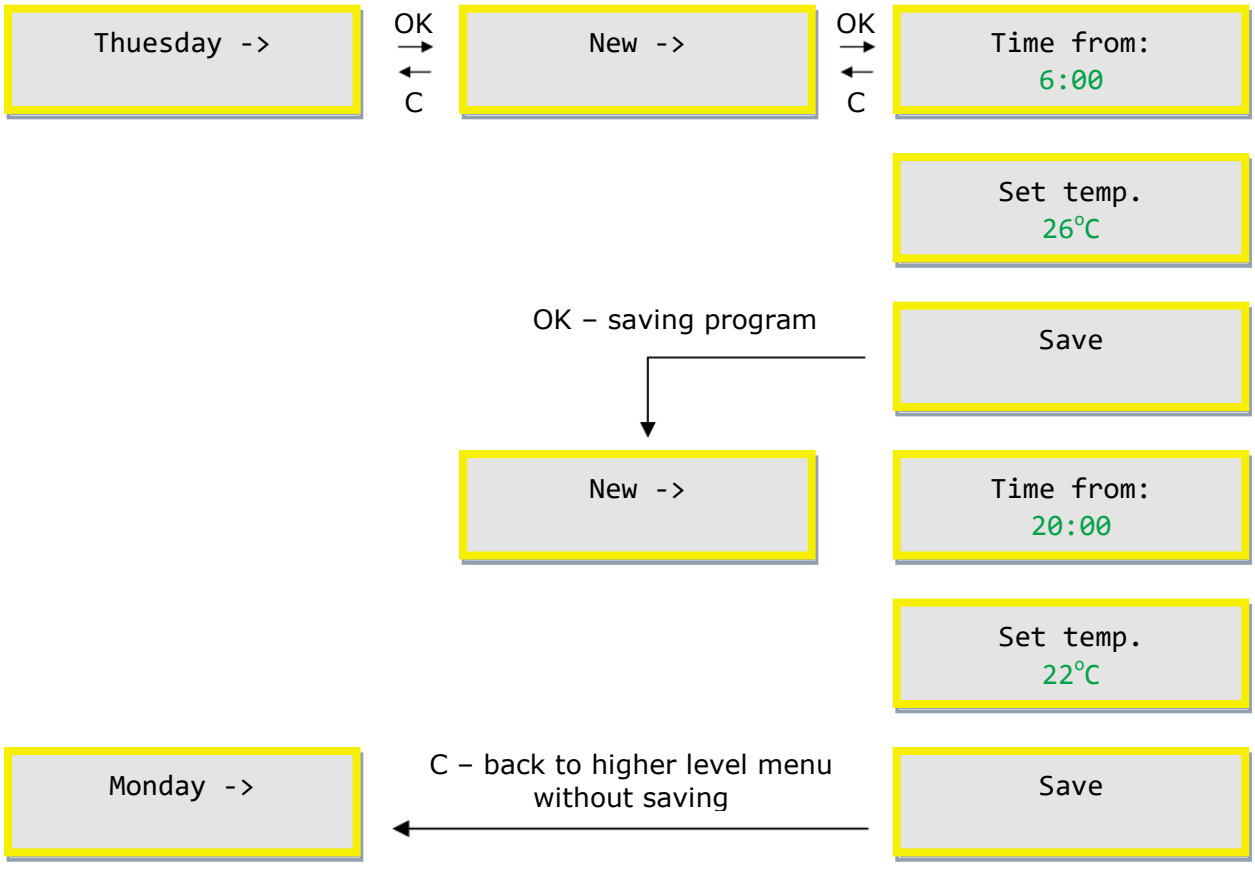

Sunday ->
Exceptions ->
Fast heating ->
OK
C
Monday ->
Sunday ->
Exceptions ->

Work mode:


Monday ->
OK
C
New ->
OK
C
Time from:
8:00
Set work mode
1 gear
OK – saving program
Save



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	***HMI CON*** *- temperature control according to the temperature sensor in the room unit HMI terminal connected by HMI CON* ***HMI RS485*** *- temperature control by temperature sensor HMI room unit connected via RS485 interface* ***Supply*** *- temperature control by temperature sensor supply* ***Exhaust*** *- temperature control by the exhaust temperature sensor* ***PT5*** *- temperature control by temperature sensor connected to sensor input PT5*
	Eco temp. difference	15°C	***Eco temp. difference*** *– this is used both for heating and cooling, which does not allow the heating/cooling when the outdoor temperature is higher/lower the set point temperature of the exhaust sensor (the function is only active in the supply and exhaust systems)*
	Start time	300 s	***Start time*** *- fall time increased setpoint (and activation delay of the cascade temperature regulator, if it is active)*
	Tset correction	5°C	***Tset correction*** *- adjustment to increase the set point and minimum air temperature at the start of the system*
	Offset	-	*adjustment of the temperature sensors measuring*
Season	Operating mode	Auto	*Important for activation of the cooling regulator* ***Auto*** *- the season automatically determined on the basis of the outdoor temperature sensor* ***Winter*** *- manual setting of winter operating mode* ***Summer*** *- manual setting of summer operating mode*

	Summer temperature	*20°C*	***Summer temperature** - setting the outside temperature threshold above which the system is operating in summer mode*
	-	*4°C*	***Hysteresis -** hysteresis setpoint for "Temp.summer" threshold, outdoor temperature drop below the "Temp.summer" - "hysteresis" difference causes the system to operate in winter mode*
	Summer of	*March*	*Set the month from which recognize SUMMER*
	Summer to	*November*	*Set the month from which recognize WINTER*
Standby mode	*Main sensor*	*HMI CON*	***HMI CON** - enabling the system to operate the sensor in the room unit HMI terminal connected by HMI CON* ***HMI RS485 Master** - enabling the system to operate the sensor in the room unit HMI connected via RS485 Master* ***Exhaust** - enabling the system to operate the exhaust temperature sensor* ***PT5** - enabling the system to operate the temperature sensor connected to sensor input PT5*
	Active for	*Heating and cooling*	***Heating** – system will start when the sensor temperature falls below the leading standby mode, the set temperature of the hysteresis mode* ***Cooling** – system will start when the temperature sensor exceeds a leading standby mode, the set temperature of the hysteresis mode* ***Heating and cooling** – system will start when the temperature sensor lead stand will rise or fall below or above the melting point of the hysteresis mode, standby*
	Standby hysteresis	*4°C*	***Standby hysteresis** – the difference in temperature sensor mode and set point temperature below which the system will be enclose when in standby mode*
Vent.	*-*	*10 s*	***Starting delay** - the time from the start throttle operation of the fans*

		15 s	***Damp.off delay*** *- The time from switching on operation mode "Stop" and start stopping fans to start closing the air dampers actuators of the AHU*
		30 s	***Pressure delay*** *- the time of operation of the fans after the pressure test on the filters.*
		180 s	***Cooling time*** *- the time from the operating mode "1,2,3 gear" in the operating mode "Stop" and stopping the electric heater and/or DX cooler to stop the fans (cooling is at the lowest efficiency).*
	Supply	*... %*	*Setting efficiency supply fan for 1,2,3 gear*
	RS485	*Active*	***Inv. via RS485*** *- activate communication with inverter fan 1*
		Active	***2. Inv. via RS485*** *- activate communication with inverter fan 2*
		0 Hz	***Sup.freq.min.*** *– setting the minimum frequency of the supply air fan, corresponding setting performance 0%*
		60 Hz	***Sup.freq.max.*** *- setting the maximum frequency of the supply air fan, corresponding setting performance 100% (the maximum frequency should be chosen according to DTR and performance measurement)*
		1	***Inv.adress*** *– address of the inverter 1 fan*
		2	***2.Inv.adress*** *– address of the inverter 2 fan*
		60 s	***T.acc.*** *- start time inverters*
		60 s	***T.dec.*** *- the time to stop the inverter*
Part of regulation	*-*	*15%*	***Mixing chamber*** *- Involved in the regulation of the mixing chamber (parameter editable)*
		…%	***Heater/cooler*** *– participation in the regulation of the heater/cooler (read parameter)*
Temperature regulators	*PI heating*	*1*	***Kp*** *- heating regulator gain*
		60s	***Ti*** *– integration constant of the heating regulator*

	PI cooling	1	***Kp*** *– cooling regulator gain*
		60s	***Ti*** *– integration constant of the cooling regulator*
		Summer / Winter	***PI cooling*** *– activation of the cooling regulator only in summer or summer and winter*
		30s	***Start delay*** *- can be set for the delayed start of the cooling regulator*
	PI air blow	1	***Kp*** *– air regulator gain*
		90s	***Ti*** *– integration constant of the supply air regulator*
		15°C	***Tmin air blow*** *- minimum supply temperature (related to setting of the supply PI regulator)*
		40°C	***Tmax air blow*** *- maximum temperature of the supply (related to setting of the supply PI regulator)*
		…	***TsetBlowAct*** *– the current value of the supply air temperature regulator in the cascade regulator.*
Heater	Preheating	15s	***Preh.100% time*** *- Time of preliminary with 100% open valve, irrespective of Tmin, Tmax scale*
		30s	***Preh.scale time*** *- Time of preliminary with proportional open valve, depending on the Tmin, Tmax scale and temperature of return water (if the sensor B8 is active)*
		Active	***Falling ramp*** *– the possibility to activate / deactivate the function of the falling ramp valve opening degree after preliminary heating*
		30s	***Fall ramp -*** *time of decrease after preliminary heating*
		0°C	***Min T.out*** *– maximum temperature scale to pre-heat*
		75%	***Min.Tout valve*** *– scale of the valve relative to the outside temperature*
		10°C	***Max T.out*** *– maximum temperature scale to pre-heat*
		15%	***Max.Tout.valve*** *– scale of the valve relative to the outside temperature*

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

		30s	***Work time min.*** *- the minimal working hours of a refrigerating unit*
		13°C	***Temp.out work min.*** *– the minimal outdoor temperature by which the functioning of a refrigerating unit is active*
		Inactive	***Stage 2*** *– the possibility of activation II step cooling*
		Inactive	***Cascade*** *– the possibility of activation cascade control two-stage DX cooler (1 – I step, 2 – II step, 3 – I i II step), use for two coolers of different efficiency*
		50%	***Stage 2*** *– the possibility of adjust threshold control signal level at which the II step of cooling is attached*
		75%	***Stage 3*** *– the possibility of adjust threshold control signal level at which the III step of cooling is attached (only on cascade)*
Mixing chamber	*Work mode*	*Temperature*	***Hand*** *- the mixing chamber isn't participating in the process of the temperature control, CO2, the opening degree in main menu of the controller* ***Temperature*** *– the mixing chamber is participating in the process of the temperature control (when is the demand for heating there is increase in modulation of the mixing chamber and reducing the fresh air)* ***Temperature/CO2*** *– the mixing chamber is participating in the process of the temperature control (when is the demand for heating there is increase in modulation of the mixing chamber and reducing the fresh air, (In case of low level of fresh air in exhaust starts to increase level of fresh air)*

	Priority for	*Mix chamber*	***Heating/cooling*** *– in the process of the temperature control in the automatic mode of the mixing box, are holding shares one by one: 1. recovery, 2. heater/cooler, 3. mixing box* ***Mix chamber*** *- in the process of the temperature control in the automatic mode of the mixing box, are holding shares one by one: 1. recovery, 2. mixing box, 3. heater/cooler*
	Min. fresh air	*30%*	***Min. fresh air*** *– establishing minimal opening air dampers of the supply/exhaust of AHU in the automatic mode*
	Max. fresh air	*100%*	***Max. fresh air*** *– establishing maximum opening air dampers of the supply/exhaust of AHU in the automatic mode*
	Fast heating	*Inactive*	***Fast heating*** *– function enabling fast heating up the AHU to the set temperature. When the mode of the fast heating is active and a need of starting his action will appear air dampers entirely are closing the inflow of the fresh air to the moment of reaching the demanded temperature*
		20°C	***Temperature set point -*** *demanded temperature for the function of the fast heating*
		4°C	***Hysteresis*** *- Hysteresis of the Temperature set point*
	CO2 regulation	*600 ppm*	***Set CO2 –*** *demanded value of concentration CO2 in exhaust air*
		0,1	***Kp*** *– gain of the fresh air regulator*
		90s	***Ti*** *– integration constant of the fresh air regulator*
		-	***Sensor range*** *– the ability to set the measurement range of the CO2 sensor*

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*	***Active*** *– possible configuration of the AHU, lack of ability of the start of AHU, protective functions of the chosen arrangement active* ***Not avtive*** *– configuration of the AHU is not possible, the possibility of the AHU start-up*
AHU type	*Type*	*2N*	***2N*** *– doubled supply ventilator air control unit* ***NR*** *– supply + reserve supply ventilator air control unit*
	Recovery	*None*	***None*** *– in the AHU a system of the recovery exchanger wasn't applied* ***Mix chamber*** *– AHU equipped with the mixing chamber, controlled with one signal 0-10 VDC damper actuators of supply, exhaust and mixing chamber (0V-supply/exhaust OFF (closed), mixing chamber ON (open)*
	Heater	*None*	***None*** *– in the AHU heater wasn't applied* ***Electric*** *– AHU equipped with the electric heater, controlled by signal 0-10 VDC, start/stop signal and with reflexive alarm signal.* ***Water*** *– AHU equipped with the water-heater, controlled by the valve actuator and pump* ***Gas*** *– AHU equipped with the gas heater, controlled by signal 0-10 VDC, start/stop signal and with reflexive alarm signal.*
	Cooler	*None*	***None*** *– in the AHU cooler wasn't applied* ***DX*** *– AHU equipped with the DX cooler, controlled by signal 0-10VDC and digital signals being used for switching 1 and 2 of degree of the cooling, from a refrigeration unit we are taking the failure signal* ***Water*** *– AHU equipped with the water-heater, controlled by the valve actuator and pump*

Configuration	*Start time*	*10s*	***Start time** – the ability to set the time after which the system can start working*
	Fan inverter type	-	*The possibility of choose fan inverter type controlled by Modbus RS485 (LG iC5, LG iG5A, Danfoss FC51, Danfoss FC101, EC Blue, EBM, Eura Drive)*
	EC Blue	*247*	***Current address** - setting of the address currently set on the EC Blue fan*
		-	***Destination address** - setting of the address required for the EC Blue fan (see Settings/Fans/RS485 table)*
		No	***Set address** - load new address to the currently connected EC Blue fan (when performing this function, only one EC Blue fan should be turned ON, and after loading the settings, turn the EC Blue fan OFF and on again to enable the new address !!!)*
		Ok	***Status OK** – loading settings successful* ***Loading in progress** - the system while loading settings, with correct communication the loading takes about 2 seconds* ***Alarm** – problem loading settings (addresses, communication error)*
	EBM	*1*	***Current address** - setting of the address currently set on the EBM fan*
		-	***Destination address** - setting of the address required for the EBM fan (see Settings/Fans/RS485 table)*
		No	***Set address** - load new address to the currently connected EBM fan (when performing this function, only one EBM fan should be turned ON, and after loading the settings, turn the EBM fan OFF and on again to enable the new address !!!)*
		Ok	***Status OK** – loading settings successful* ***Loading in progress** - the system while loading settings, with correct communication the loading takes about 2 seconds* ***Alarm** – problem loading settings (addresses, communication error)*

	Inverter 0-10VDC	*Inactive*	*The possibility of activation one of the analog outputs as a signal 0-10VDC airflow rate of the 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)*
	HE control	*0-10VDC*	***0-10VDC** – control of the electric heater by means of smooth signal 0-10VDC* ***PWM** – control of the electric heater by means of PWM signal 0-10VDC*
	Work - contact	*Inactive*	*Optional activation of the one of the relay outputs as work conformation (make sure that output is not already used by application)*
	Alarm – contact	*Inactive*	*Optional activation of the one of the relay outputs as a group alarm (make sure that output is not already used by application)*
	Outside temperature sensor	*Inactive*	*There is ability to deactivation outside temperature sensor, when the sensor is inactive function preheat the water heater and ability to run the freon cooler is based on the time of year selected in menu "Settings/ Season"*
	Exhaust temperature sensor	*Inactive*	*there is ability to deactivation exhaust temperature sensor, when the exhaust and outside sensor is inactive function Eco is inactive and is not possible to determine the possibility of heat recovery (mixing chamber opens whenever you need heating)*

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

Restore the default setting	-	-	*Restoring the initial values of all settings.*

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 slat 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

Addres 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	B8	Back water sensor	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R

10	20	CO2exh	Exhaust CO2	1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600)	AV	Register	R/W
11	22	Vent1	Vent.1	0: Off, 1: On	MSV	Coil 352	R
12	24	Pwr1	Vent.1	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
13	26	Vent2	Vent.2	0: Off, 1: On	MSV	Coil 416	R
14	28	Pwr2	Vent.2	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
15	30	I1	Current	1A = 256 (22A = 22*256 = 5632 = 0x1600)	AV	Register	R
16	32	F1	Frequency	1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600)	AV	Register	R
17	34	RPM1	RPM	1rpm = 256 (22rpm = 22*256 = 5632 = 0x1600)	AV	Register	R
18	36	U1	Voltage	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
19	38	Fault1	Alarm code	1A = 1A (HEX) **www.el-piast.com/alarms-decoder**	AV	Register	R
20	40	Com1	Communication	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
21	42	I2	Current	1A = 256 (22A = 22*256 = 5632 = 0x1600)	AV	Register	R
22	44	F2	Frequency	1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600)	AV	Register	R
23	46	RPM2	RPM	1rpm = 256 (22rpm = 22*256 = 5632 = 0x1600)	AV	Register	R
24	48	U2	Voltage	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
25	50	Fault2	Alarm code	1A = 1A (HEX) **www.el-piast.com/alarms-decoder**	AV	Register	R
26	52	Com2	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	896	R
29	58	HePwr	Electric heater	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
30	60	GasP\wr	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	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	SetMix	Set mixing ratio	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
36	72	ThrMCh	Mixing chamber	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
37	74	ThrSuEx	Fresh air ratio	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
38	76	Thr1	Fresh air ratio 1	0: Off, 1: On	MSV	Coil 1216	R
39	78	Thr2	Fresh air ratio 2	0: Off, 1: On	MSV	Coil 1248	R

Settings menu

Addres DEC		Variable name	HMI Name	States	Type		Read [R] /Write [W]
BacNet	Modbus				BacNet	Modbus	
40	80	Ch_Tmain	Main sensor	1: HMI (CON), 2: HMI (RS485), 3: Supply, 4: Exhaust, 5: PT5	AV	Register	R/W
41	82	EcoDiff	Eco temp.difference	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W

42	84	TsetDownTime	Start reg.	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
43	86	TsetCor	Tset correction	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
44	88	OfsPT1	PT1	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
45	90	OfsPT2	PT2	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
46	92	OfsPT3	PT3	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
47	94	OfsPT4	PT4	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
48	96	OfsPT5	PT5	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
49	98	OfsHMICon	HMI (CON)	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
50	100	OfsHMIRS	HMI (RS485 Master)	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
51	102	Season	Season	0: Auto, 1: Winter, 2: Summer	MSV	Register	R/W
52	104	Tsummer	Summer temp	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
53	106	HistSum	Hysteresis	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
54	108	From	Summer from	1: January, 2: February, 3: March, 4: April, 5: May, 6: June, 7: July, 8: August, 9: September, 10: October, 11: November, 12: December	MSV	Register	R/W
55	110	To	Summer to	1: January, 2: February, 3: March, 4: April, 5: May, 6: June, 7: July, 8: August, 9: September, 10: October, 11: November, 12: December	MSV	Register	R/W
56	112	Ch_Tstd	Main sensor	1: HMI (CON), 2: HMI (RS485), 3: Exhaust, 4: PT5	MSV	Register	R/W
57	114	TstdbyAct	Main sensor	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
58	116	StdMode	Active for	1: Heating, 2: Cooling, 3: Heating/cooling	MSV	Register	R/W
59	118	StdHis	Standby hyster.	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
60	120	v1_t	Starting delay	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
61	122	DelThr	Damp.off delay	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
62	124	PresDel	Pressure delay	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
63	126	CoolingTime	Cooling time	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
64	128	G1	Minimum	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
65	130	G2	Medieval	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
66	132	G3	Maximum	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
67	134	RS1	1.Inv.via RS485	0: Inactive, 1: Active	MSV	Coil 2144	R/W
68	136	RS2	2.Inv.via RS485	0: Inactive, 1: Active	MSV	Coil 2176	R/W
69	138	Fmin	Freq.min.	1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600)	AV	Register	R/W
70	140	Fmax	Freq.max.	1Hz = 256 (22Hz = 22*256 = 5632 = 0x1600)	AV	Register	R/W
71	142	Adr1	1.inv.adress	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
72	144	Adr2	2.inv.adress	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
73	146	TaccVent	T.acc.	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W

74	148	TdecVent	T.dec.	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
75	150	MIXproc	Mixing chamber	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
76	152	h_c_proc	Heating/cooling	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R
77	154	Kp_Heat	Kp	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
78	156	Ti_Heat	Ti	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
79	158	Kp_Cool	Kp	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
80	160	Ti_Cool	Ti	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
81	162	PIcoolingAct	PI cooling	0: Summer, 1: Summer/Winter	MSV	Register	R/W
82	164	DelOnPIcool	Starting delay	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
83	166	Kp_Blow	Kp	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
84	168	Ti_Blow	Ti	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
85	170	TminBlow	Tmin air blow	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
86	172	TmaxBlow	Tmax air blow	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
87	174	TsetBlowAct	TsetBlowAct	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
88	176	InitT100	Preh.100% time	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
89	178	InitTscale	Preh.scale time	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
90	180	RampEn	Falling ramp	0: Inactive, 1: Active	MSV	Coil 2880	R/W
91	182	RampTime	Fall ramp	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
92	184	Init_Tmin	Min T.out	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
93	186	InitVTmin	Min.Tout valve	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
94	188	Init_Tmax	Max T.out	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
95	190	InitVTmax	Max.Tout.valve	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
96	192	Tlim1	Pump work temp.	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
97	194	MinValve	Min.valve open	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
98	196	TbActive	B8 sensor	0: Inactive, 1: Active	MSV	Coil 3136	R/W
99	198	Tlim2	Frost temp.out.	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
100	200	TbStopFrost	Stop	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
101	202	TbStartFrost	Start	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
102	204	TbStopReg	Stop	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
103	206	TbStartReg	Start	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
104	208	KpBack	Kp	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
105	210	TiBack	Ti	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
106	212	HW_Sec	Set protection	0: Inactive, 1: Active	MSV	Coil 3392	R/W
107	214	HW_SecDP	Stop period	1dzień = 256 (22dni = 22*256 = 5632 = 0x1600)	AV	Register	R/W
108	216	HW_SecT	Run time	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W

109	218	GasAl	GAS alarm	0 - NC, 1 - NO	MSV	Coil 3488	R/W
110	220	mBreakDX	Break time min.	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
111	222	mWorkDX	Work time min.	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
112	224	Tout_minDX	Temp.out work min.	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
113	226	II_IIIactiveDX	Stage 2	0: Inactive, 1: Active	MSV	Coil 3616	R/W
114	228	CascadeDX	Cascade	0: Inactive, 1: Active	MSV	Coil 3648	R/W
115	230	IistageDX	Stage 2	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
116	232	IIistageDX	Stage 3	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
117	234	ModeMix	Work mode	0: Manual, 1: Temperature, 3: Temp./CO2	MSV	Register	R/W
118	236	PrioMH	Priority to	0: Mix chamber, 1: Heating/cooling	MSV	Coil 3776	R/W
119	238	MinFresh	Min.fresh air	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
120	240	MaxFresh	Max.fresh air	1% = 256 (22% = 22*256 = 5632 = 0x1600)	AV	Register	R/W
121	242	FHEn	Fast heating	0: Inactive, 1: Active	MS	Register	R/W
122	244	TlimMCH	Temp.setpoint	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
123	246	HistMCH	Hysteresis	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
124	248	SetCO2	Set CO2	1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600)	AV	Register	R/W
125	250	Kp_CO2	Kp	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
126	252	Ti_CO2	Ti	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
127	254	ppmMin	0 V	1ppm = 256 (22 ppm = 22*256 = 5632 = 0x1600)	AV	Register	R/W
128	256	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	
129	258	ServiceMode	Service mode	0: Inactive, 1: Active	MSV	Coil 4128	R/W
130	260	TYPE	Type	1: 2N, 2: N(R)	MSV	Register	R/W
131	262	RECOVERY	Recovery	0: None, 1: Mix chamber	MSV	Register	R/W
132	264	COOL	Cooler	0: None, 1: DX, 2: Water	MSV	Register	R/W
133	266	HEAT	Heater	0: None, 1: Electric, 2: Water, 4: GAS	MSV	Register	R/W
134	268	PowOnTime	Start time	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
135	270	FanInverters	Fan inverter type	1: IC5,IG5, 2: FC51, 4: FC101, 8: EC Blue, 16: EBM	MSV	Register	R/W
136	272	ActualAdrECB	Actual adress	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
137	274	AdrToSetECB	Adress to set	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
138	276	ActiveConfigECB	Set adress	0: No, 1: Yes	MSV	Coil 4416	R/W
139	278	StatusConfECB	Status	0: Com Ok, 1: In progress, 2: A_Com, 3: A_Com	MSV	Coil 4448	R
140	280	ActualAdrEBM	Actual adress	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W
141	282	AdrToSetEBM	Adress to set	1 = 256 (22 = 22*256 = 5632 = 0x1600)	AV	Register	R/W

142	284	ActiveConfigEBM	Set adress	0: No, 1: Yes	MSV	Coil 4544	R/W
143	286	StatusConfEBM	Status	0: Com Ok, 1: In progress, 2: A_Com, 3: A_Com	MSV	Coil 4576	R
144	288	Vent1_0_10	1.Supply 0-10VDC	0: Inactive, 1: Aout1, 2: Aout2, 4: Aout3	MSV	Register	R/W
145	290	Vent2_0_10	2.Supply 0-10VDC	0: Inactive, 1: Aout1, 2: Aout2, 4: Aout3	MSV	Coil 4640	R
146	292	Tiny	HMI Tiny	0: Inactive, 1: Active	MSV	Coil 4672	R/W
147	294	HEcontrol	HE control	0: 0-10VDC, 1: PWM	MSV	Coil 4704	R/W
148	296	Re_Work	Work - contact	0: Inactive, 1: Re1, 2: Re2, 4: Re3, 8: Re4, 16: Re5	MSV	Register	R/W
149	298	Re_Alarm	Alarm - contact	0: Inactive, 1: Re1, 2: Re2, 4: Re3, 8: Re4, 16: Re5	MSV	Register	R/W
150	300	ToutAct	External sensor	0: Inactive, 1: Active	MSV	Coil 4800	R/W
151	302	TexhAct	Exhaust sensor	0: Inactive, 1: Active	MSV	Coil 4832	R/W
152	304	TsetChT	Tset change	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
153	306	RegType	Regulator	0: "1", 1: "2"	MSV	Coil 4896	R/W
154	308	Ao1scale	Aout1	0: 0-10VDC, 1: 2-10VDC	MSV	Coil 4928	R/W
155	310	Ao2scale	Aout2	0: 0-10VDC, 1: 2-10VDC	MSV	Coil 4960	R/W
156	312	Ao3scale	Aout3	0: 0-10VDC, 1: 2-10VDC	MSV	Coil 4992	R/W
157	314	Tcom	Tcom	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
158	316	Twait	Twait	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
159	318	MaxDiff	Difference	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
160	320	T1	T1	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
161	322	T2	T2	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
162	324	T3	T3	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
163	326	T4	T4	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
164	328	T5	T5	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
165	330	T6	T6	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
166	332	T7	T7	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
167	334	T8	T8	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
168	336	T9	T9	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
169	338	T10	T10	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
170	340	T11	T11	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
171	342	T12	T12	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
172	344	T13	T13	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
173	346	T14	T14	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
174	348	T15	T15	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
175	350	HistPeriod	Period	1s = 256 (22s = 22*256 = 5632 = 0x1600)	AV	Register	R/W
176	352	Reset	Reset	0: Off, 1: On	MSV	Coil 5632	R/W
177	354	_DIN1	Din1	0: Opened, 1: Closed	MSV	Coil 5664	R
178	356	_DIN2	Din2	0: Opened, 1: Closed	MSV	Coil 5696	R
179	358	_DIN3	Din3	0: Opened, 1: Closed	MSV	Coil 5728	R

180	360	Ain_1	AIN1	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
181	362	Ain_2	AIN2	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
182	364	PT_1	PT1	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
183	366	PT_2	PT2	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
184	368	PT_3	PT3	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
185	370	PT_4	PT4	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
186	372	PT_5	PT5	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
187	374	HMI_Con	HMI (CON)	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
188	376	HMI_RS	HMI (RS485 Master)	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R
189	378	Re1	Re1	0: Off, 1: On	MSV	Coil 6048	R
190	380	Re2	Re2	0: Off, 1: On	MSV	Coil 6080	R
191	382	Re3	Re3	0: Off, 1: On	MSV	Coil 6112	R
192	384	Re4	Re4	0: Off, 1: On	MSV	Coil 6144	R
193	386	Re5	Re5	0: Off, 1: On	MSV	Coil 6176	R
194	388	AO1	AOU1	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
195	390	AO2	AOU2	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
196	392	AO3	AOU3	1V = 256 (22V = 22*256 = 5632 = 0x1600)	AV	Register	R
197	394	F_DIN1	Din1	0: No emulation, 1: Set opened, 3: Set closed	MSV	Register	R/W
198	396	F_DIN2	Din2	0: No emulation, 1: Set opened, 3: Set closed	MSV	Register	R/W
199	398	F_DIN3	Din3	0: No emulation, 1: Set opened, 3: Set closed	MSV	Register	R/W
200	400	Em_Ai1	AIN1 emulation	0: Disabled, 1: Enabled	MSV	Coil 6400	R/W
201	402	E_Ai1	AIN1	1V = 256 (10V = 10*256 = 2560 = 0xA00)	AV	Register	R/W
202	404	Em_Ai2	AIN2 emulation	0: Disabled, 1: Enabled	MSV	Coil 6464	R/W
203	406	E_Ai2	AIN2	1V = 256 (10V = 10*256 = 2560 = 0xA00)	AV	Register	R/W
204	408	Em_PT1	PT1 emulation	0: Disabled, 1: Enabled	MSV	Coil 6528	R/W
205	410	E_PT1	PT1	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
206	412	Em_PT2	PT2 emulation	0: Disabled, 1: Enabled	MSV	Coil 6592	R/W
207	414	E_PT2	PT2	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
208	416	Em_PT3	PT3 emulation	0: Disabled, 1: Enabled	MSV	Coil 6656	R/W
209	418	E_PT3	PT3	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
210	420	Em_PT4	PT4 emulation	0: Disabled, 1: Enabled	MSV	Coil 6720	R/W
211	422	E_PT4	PT4	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
212	424	Em_PT5	PT5 emulation	0: Disabled, 1: Enabled	MSV	Coil 6784	R/W
213	426	E_PT5	PT5	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
214	428	Em_Hcon	Emul. HMI (CON)	0: Disabled, 1: Enabled	MSV	Coil 6848	R/W
215	430	E_Hcon	HMI (CON)	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W
216	432	Em_Hrs	Emul. HMI (RS485 Master)	0: Disabled, 1: Enabled	MSV	Coil 6912	R/W
217	434	E_Hrs	HMI (RS485 Master)	1°C = 256 (22 °C = 22*256 = 5632 = 0x1600)	AV	Register	R/W

218	436	F_Re1	Re1	0: No force, 1: Force off, 3: Force on	MSV	Register	R/W
219	438	F_Re2	Re2	0: No force, 1: Force off, 3: Force on	MSV	Register	R/W
220	440	F_Re3	Re3	0: No force, 1: Force off, 3: Force on	MSV	Register	R/W
221	442	F_Re4	Re4	0: No force, 1: Force off, 3: Force on	MSV	Register	R/W
222	444	F_Re5	Re5	0: No force, 1: Force off, 3: Force on	MSV	Register	R/W
223	446	FoAO1	Aout1 Forcing	0: Disabled, 1: Enabled	MSV	Coil 7136	R/W
224	448	F_AO1	Aout1	1V = 256 (10V = 10*256 = 2560 = 0xA00)	AV	Register	R/W
225	450	FoAO2	Aout2 Forcing	0: Disabled, 1: Enabled	MSV	Coil 7200	R/W
226	452	F_AO2	Aout2	1V = 256 (10V = 10*256 = 2560 = 0xA00)	AV	Register	R/W
227	454	FoAO3	Aout3 Forcing	0: Disabled, 1: Enabled	MSV	Coil 7264	R/W
228	456	F_AO3	Aout3	1V = 256 (10V = 10*256 = 2560 = 0xA00)	AV	Register	R/W

Alarms

Addres DEC		Variable name	HMI Name	States	Type		Read [R] /Write [W]
BacNet	Modbus				BacNet	Modbus	
229	458	ResetAlarms	ResetAlarms	0 - no reset, 1 - reset	MSV	Coil 7328	R/W
230	460	A_StopSystem	Fire or ventilator alarm	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7360	R
231	462	A_ThHWair	Alarm of the thermostat frost-resistant	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7392	R
232	464	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 7424	R
233	466	A_ThHWwater	Low temperature alarm of return water water heater	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7456	R
234	468	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 7488	R
235	470	A_ThHE	Alarm of the themrostat electric heater	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7520	R
236	472	A_3xThHE	Alarm of the termostat electric heater (3 times appearance of the alarm within an hour)	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7552	R
237	474	A_ThGAS	Alarm of the themrostat GAS heater	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7584	R
238	476	A_3xThGAS	Alarm of the termostat GAS heater (3 times appearance of the alarm within an hour)	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7616	R
239	478	A_Filter	Alarm of the dirty filter	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7648	R
240	480	A_FC1	Alarm of the fan of the air blowing	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7680	R
241	482	A_FC2	Alarm of the fan of the air blowing 2	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7712	R
242	484	A_ComFC1	Alarm lock of communication with the inverter supply	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7744	R
243	486	A_ComFC2	Alarm lock of communication with the secondary inverter supply	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7776	R
244	488	A_Tsup	Alarm of the temperature sensor of the air blowing	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7808	R

245	490	A_Texh	Alarm of the temperature sensor of the outlet	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7840	R
246	492	A_Tout	Alarm of the temperature sensor outside	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7872	R
247	494	A_TbackWater	Alarm of the contact temperature sensor return water heater	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7904	R
248	496	A_Tmain	Alarm of the temperature sensor leading	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7936	R
249	498	A_InEmul	Alarm of the emulation of entries of the controler	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 7968	R
250	500	A_OutForce	Alarm of pushing exits of the controler	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 8000	R
251	502	Alarm	Collective alarm	0 - an alarm is missing, 1 - an alarm is appearing	BV	Coil 8032	R

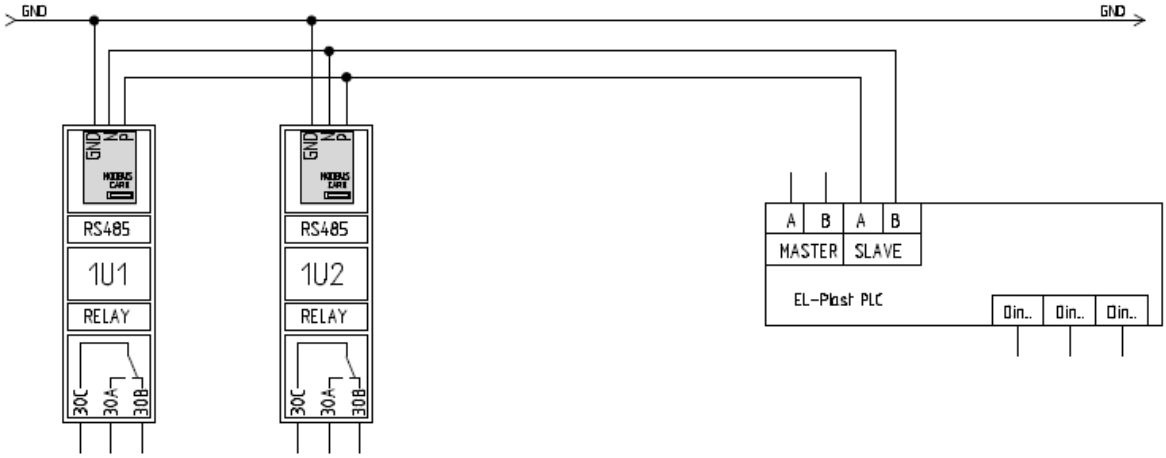
9. Communication Bacnet MS-TP with BMS system

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 2N, NR



Configuration drive LG IC5 control RS485:

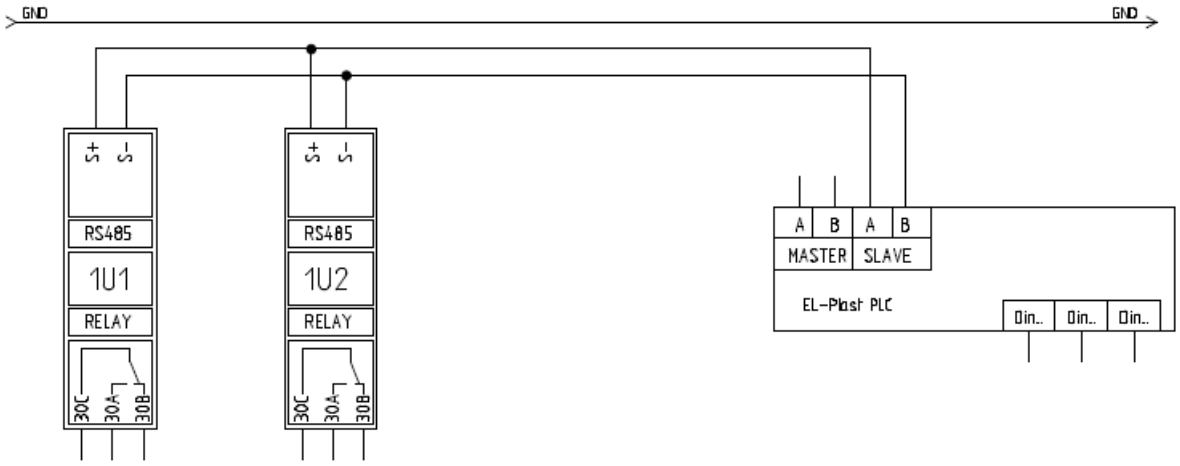
Code	Name	Value to be set	Description
drv	Control mode	3	Communication RS485
Frq	The method of frequency	8	Communication Modbus-RTU
F21	Maximum output frequency	**Fz max**	Set individual
F22	Rated motor frequency	...Hz	Set individual
F23	The minimum frequency reference	0.000	**Always enter the value**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



Configuration drive LG IG5 control RS485:

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

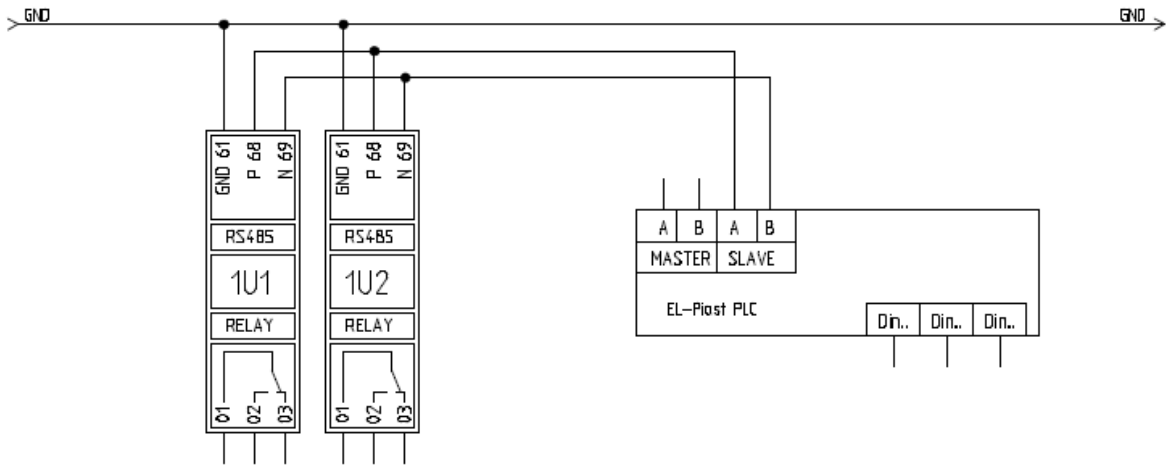
Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.

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 2N, NR



Configuration drive Danfoss FC51 control RS485

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

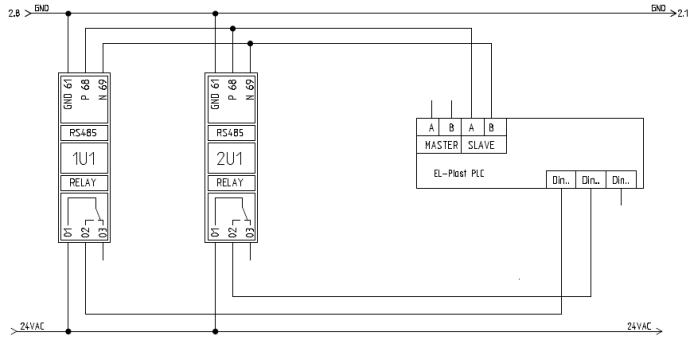
Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.

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 double supply

:



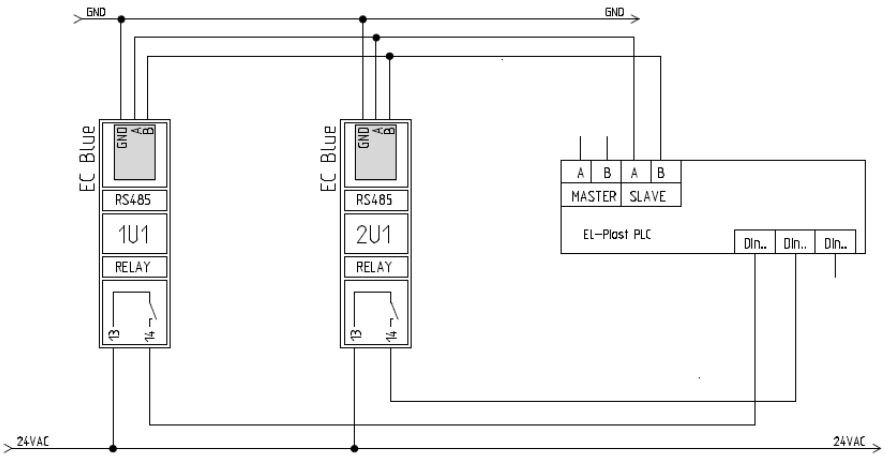
In addition, the DANFOS FC101 inputs must be shorted with numbers 12 and 27

Configuration drive Danfoss FC101 control RS485

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

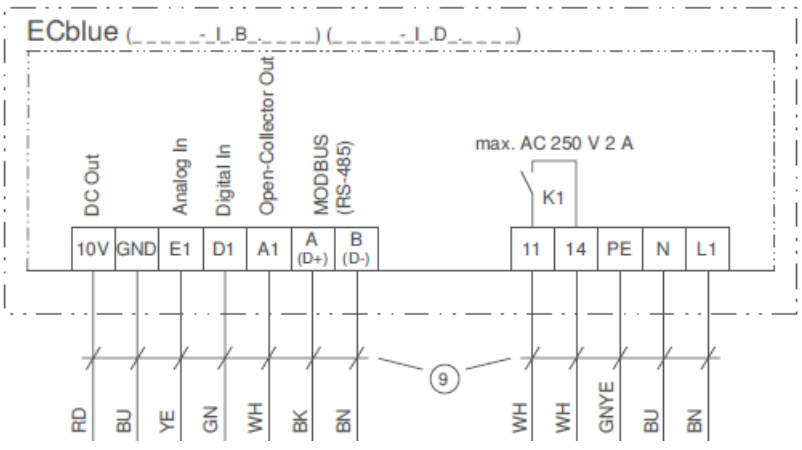
Fz max - frequency inverter for work at maximum fan efficiency (resulting from the adjustment of air distribution system). Initially, enter the frequency from the Air Handling Unit documentation.

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



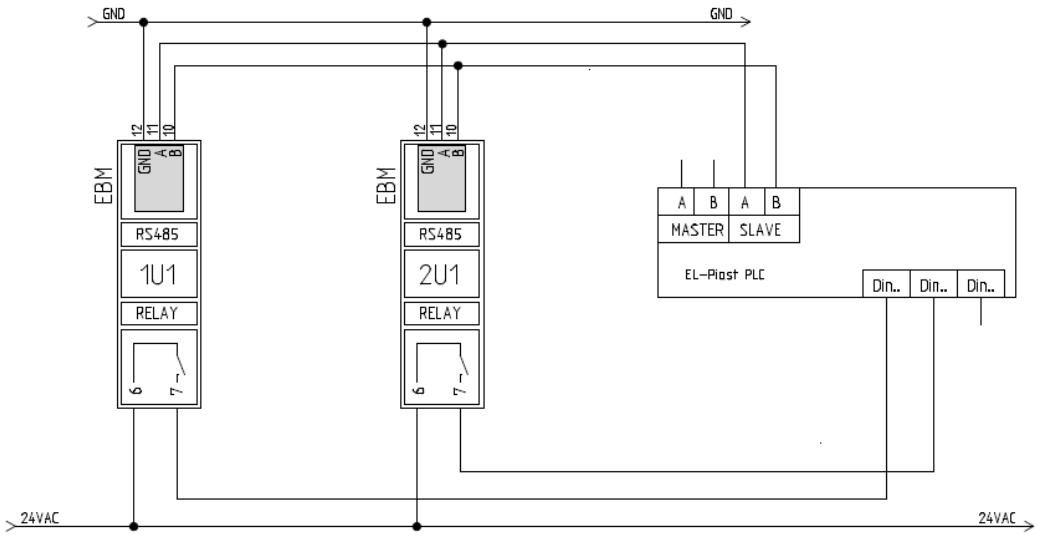
Wiring connection of EC Blue fan

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



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

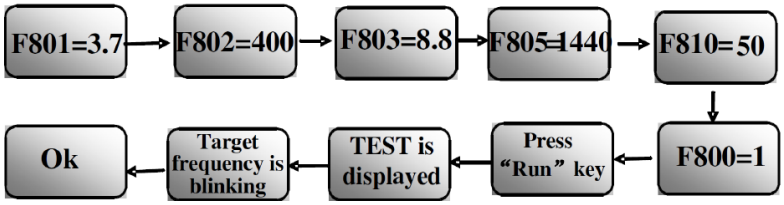
EBM Fan Controller Configuration - Service Menu/Fans/EBM Address

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	**Fz max**	Individual setting
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	**Before autotuning, it is necessary to enter the above parameters**

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 fan 1
		2	Inverter fan 2
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.