VT sistema®
CONTROL SYSTEMS TECHNOLOGIES

Address: Nuklono st. 12, LT – 78349 Siauliai
www.vtsistema.com
vtsistema@vtsistema.com
komercija@vtsistema.com
Mob:+37068720836
Mob:+37067109182

Control system for AHU with EC motors, plate heat exchanger, electric heater

Description

The control system is intended to be used for control of AHU with plate heat exchangers, supply and extract fans with EC motors, supply air electric heater, outside air damper, plate heat exchanger "Bypass" damper.

For the parameters settings and measured data monitoring remote control with touch screen is connected to the control board. The remote control with control board is connected using 4 wire cable and data transmitted in RS485 MODBUS mode.

For economic and accurate AHU control 4 temperature duct sensors are connected to the control board. The temperature sensors help quickly reach user settings.

For the fans motors control PCBs have 0-10VDC control outputs. Also PCBs have input for fans motors TACHO or NC feedback signal connection. With TACHO or NC system gets the fans fault signals.

The electric heater is controlled using PID algorithm and this allows to obtain good temperature control accuracy.

The control system has heat exchanger frost protection function. If exhaust air temperature drops below limit, set in the control panel (1-10), freezing risk of heat exchanger appears first pre-heater turns on, then "Bypass" damper opens if exhaust temperature does not rise. If the exhaust temperature still does not rise to above set point, supply and exhaust fan speeds are altered to rise exhaust air temperatures(supply air fan speed is gradually reduced to 30%, then exhaust air fan speed is increased gradually 100%).

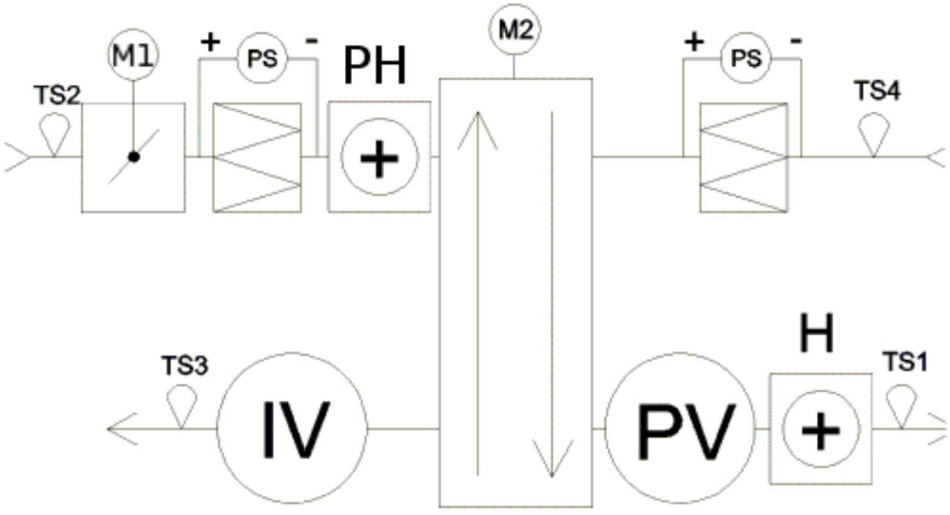
The system controls heat exchanger in heating recovery and free-cooling modes.

The control system also can check external signals status such as filter pollution from pressure switch, fire alarm from fire alarm system.

Technical data:

1. Power supply – 230 VAC, 50 Hz,
2. Remote control connection – RS485 MODBUS,
3. Temperature setpoint range – 5..30°C,
4. Fans rotation speed setpoint range – 0..100 %,
5. Air damper actuator control – 230 VAC,
6. Electric heater and pre-heater control – 230 VAC up to 3,6 kW(16A) combined, 0-10VDC output for heater,
7. Fans control signals – 0-10 VDC,
8. Fans motors failure signal – pulse,
9. Air damper actuators control – 230 VAC up to 1 A,
10. Temperature sensors quantity and type – 4 pcs, NTC10K,
11. Filter pollution alarm digital input – voltage free, NO,
12. Overheat signal input – voltage free, NC. If electrical heater manual thermostat contacts are open the unit stops.

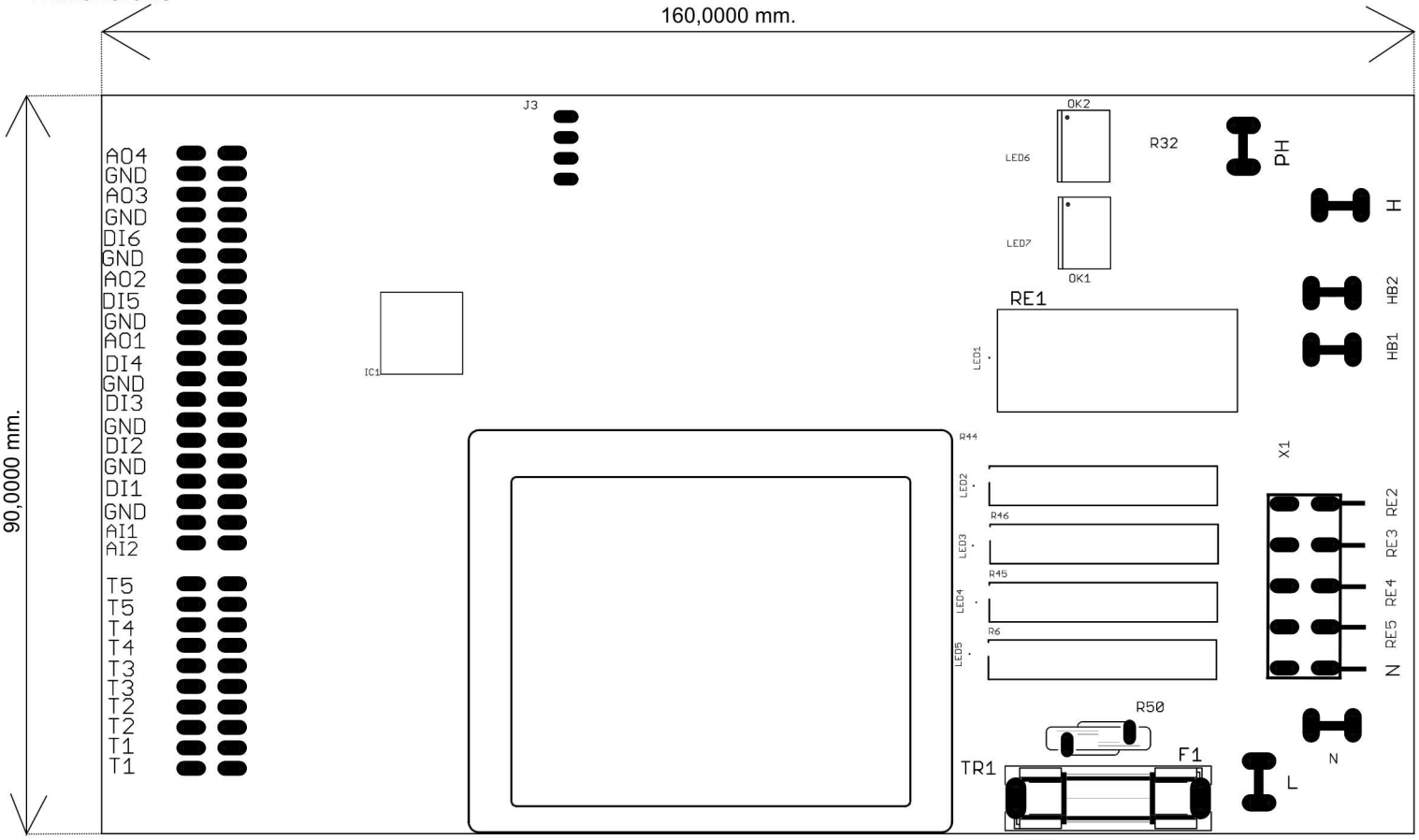
Control system components



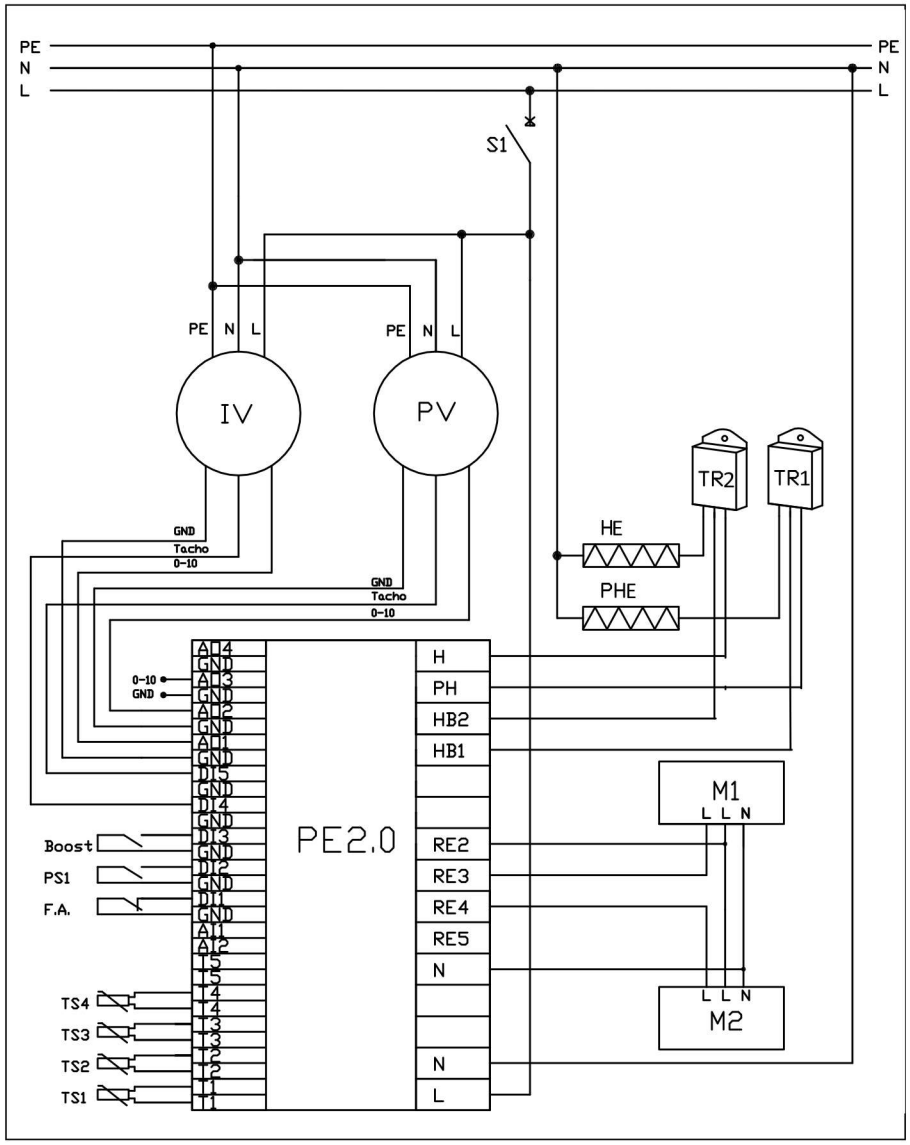
Marking and description:

PV – supply air fan,
IV – extract air fan,
H – supply air electric heater,
M1 – outside air damper actuator,
M2 – plate heat exchanger "Bypass" damper actuator,
PS – pressure switches for filters monitoring,
TS1 – supply air temperature sensor,
TS2 – outside air temperature sensor,
TS3 – exhaust air temperature sensor,
TS4 – extract air temperature sensor.

Dimensions



Electrcal connection circuit



Marking and description:

PE,N,L - 230VAC
M1 - Intake air valve actuator 230VAC.
M2 -Bypass valve actuator 230VAC.
RE4 - Bypass control signal 230VAC.
RE3- Intake air valve control signal 230VAC.
RE2- Intake and Bypass actuator supply 230VAC.
TR1,TR2 - Power triac.
S1 - overcurrent breaker.
IV - Extract air fan.
PV - Supply air fan.
HE - Preheater 230VAC.
PHE - Heater 230VAC.
PHE and H jointly MAX 16A of resistive load.

Heater operates according PID algorithm, maintaining set supply temperature. Preheater operation is first stage of frost-protecion funcion, which activates when intake temperature drops below 0 °C and exhaust temperature drops below temperature which can be set from remote control panel from 1 °C to 10 °C. Note that exhaust air temperature must rise above set temperature for frost-protection +2 °C, there also is a 2 min. minimum operation time for frost-protection.

Bypass valve is used for second stage of frost-protection and optimal temperature maintainance. Bypass valve must be mounted in intake-supply air path, otherwise frost-protection may damage the heat exchanger. When intake temperature is below 15 °C bypass is active only for frost-protection. When intake temperature is above 15 °C bypass is opened of closed depending on extract, intake and set temperatures, to optimaly exploit heat exchanger.

AO3 - 0-10 - Control signal 0-10VDC.
GND - Low voltage signal ground.
Note: AO3 is control signal output for auxiliary or substitute heater.
TS1 - Supply air temperature sensor.
TS2 - Intake air temperature sensor.
TS3 - Exhaust air temperature sensor.
TS4 - Extract air temperature sensor.
J3 - Connection for remote control panel, Modbus RTU with RS485 physical layer.
LED1-LED7 corresponding output indication.

Boost - Switch NO for increased fan speed function.
PS1 - Air filter differential pressure switch. NO type(multiple switches can be connected in parallel).
F.A - Overheat signal input. NC type.

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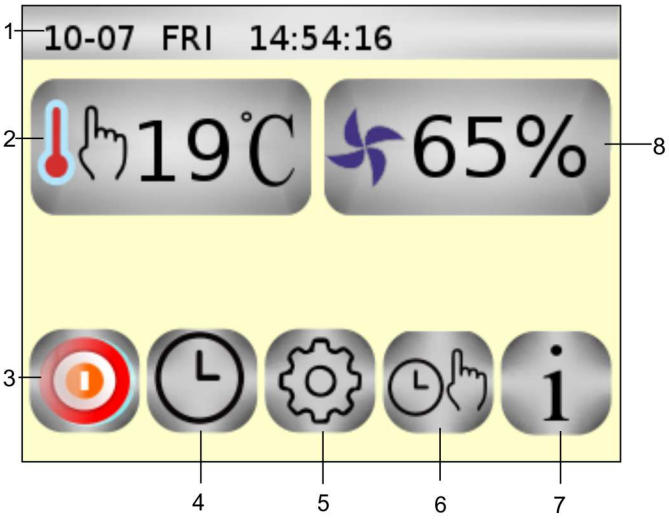
Remote control with touch screen

Working principles

User can set and monitor parameters of controlled device using remote control with touch screen. After connecting power supply touch screen turns on automatically.

When turn OFF key on window is pressed, the device turns on and displays the main menu screen. In the main menu screen you can turn off the device, set the temperature, fan speed, navigate to the information about controlled AHU, settings or weekly work mode schedule programming screen. In main screen by pressing a clock icon you can turn on weekly work programming mode. Press a settings button to open the settings screen.



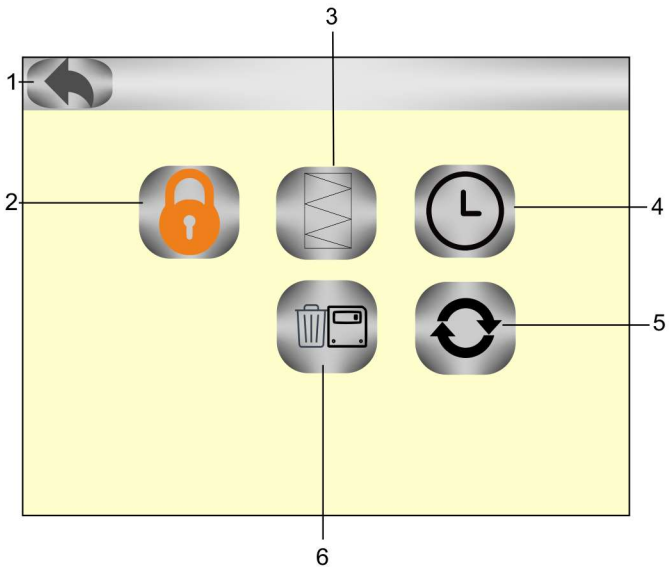
1. Date and time.
2. Temperature setting key.
3. Switch OFF key.
4. Weekly work mode programming key.
5. Settings key.
6. Work mode selection key. Manual or by weekly work mode.
7. Information about controlled unit key.
8. Fan speed setting key.

Settings

In settings screen can be set date and time, turn on/off extra functions, navigate to the extra settings screen, to do system restart, delete data.

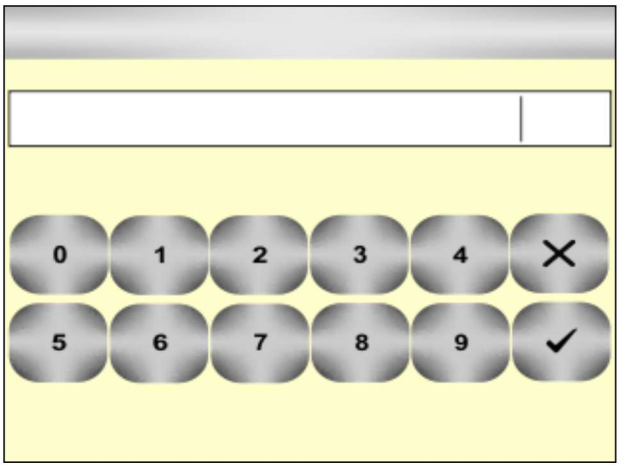
1. Return to the main screen key.
2. Locked settings.
3. Filter pollution level reset. If controlled unit works 6 moth on display will occur sign filter changing. After change of filter user should press this key to reset time to 0. Same action should be done if filter pollution signal will come from pressure switches.
4. Date and time setting key.
5. System restart key.
6. Data erase function key.

Data erase function key: set temperature, set fans speed, weekly work mode. Press key icon button to delete data. At the bottom will appear buttons to confirm or to cancel your selection. After confirmation you have to wait until the process will end. Until confirmation or cancel of the process, all remote controller of touch screen is inactive.



Date and time setting

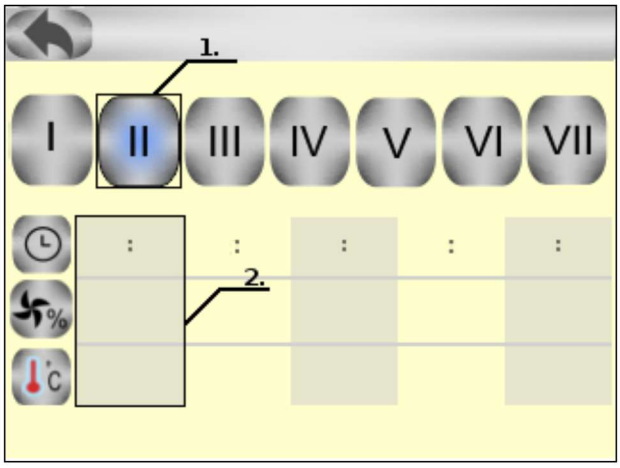
After pressing date and time setting key, user can set date and time (format YYYY:MM:DD:HH:MM:SS). The date is important to program the device, so it is important to enter the exact time! Date is confirmed by pressing tick or canceled by pressing cancel key.
Note: Entered date and time must be from 2000-01-01 00:00:00 to 2099-12-31 :23:59:59.



Weekly work mode programming

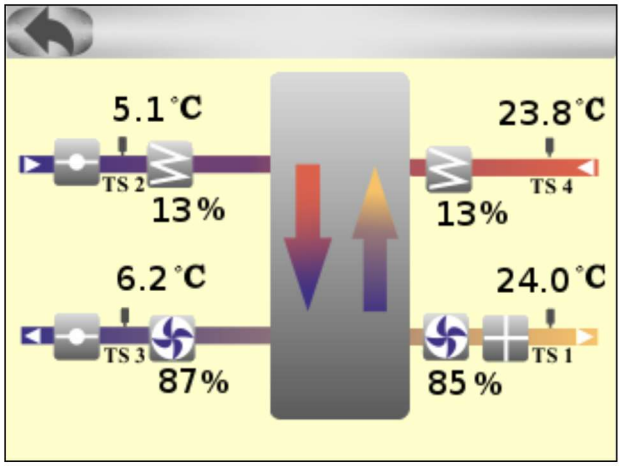
1. Select week day.
2. Event column.

The user can set 5 working mode periods with different settings. After week day is selected first should be set period start time after fans speed and temperature. Then all needed periods are set press return key to confirm.



The information window

In this window you can monitor supply, extract, exhaust, intake temperatures, dampers position, filters pollution level, fans mode and other information related with AHU.



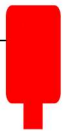
Alarms

Remote control displays alarm symbol if a failure disturbs the work of the device. The sign, that indicates a specific problem will appear in information window.

- The lost connection between touch screen remote control and control board.

Check remote controller if it is connected to the control board. If the line was disconnected or wasn't connected at all, after maintenance works you have restart the system.
The function is not active if so selected in “Locked settings”.

- Disconnected temperature sensor.



Check if a temperature sensor is connected to the control board. Not working sensor will be indicated in the information window. After checking a sensor you need to restart the system.

- Fans fault.

This fault means that there is no feedback signal from fans motor. Check if:

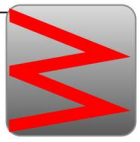
- •fans not blocked.
- •feedback of signal (Tacho or NC) wires transmit data to the controller board. In “Locked setting” signal type can be selected between Tacho (pulse), NC (normally close contact).
- •fan controlling signal from the board transmits to the fan.

If everything works fine do the system restart.

- Overheating alarm signal.

This alarm means that electrical heater manual thermostat contacts are open the unit stops.

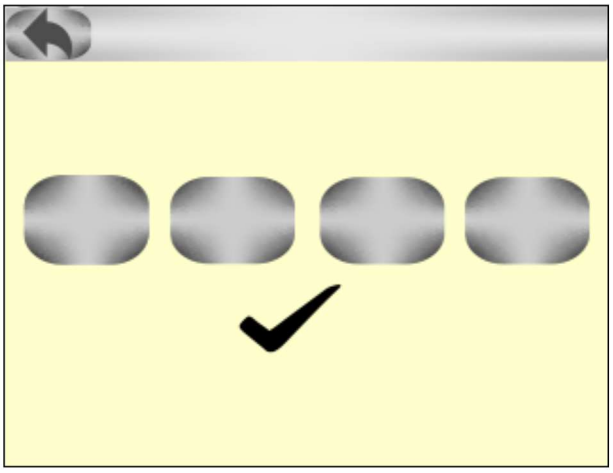
- Filter pollution warning.



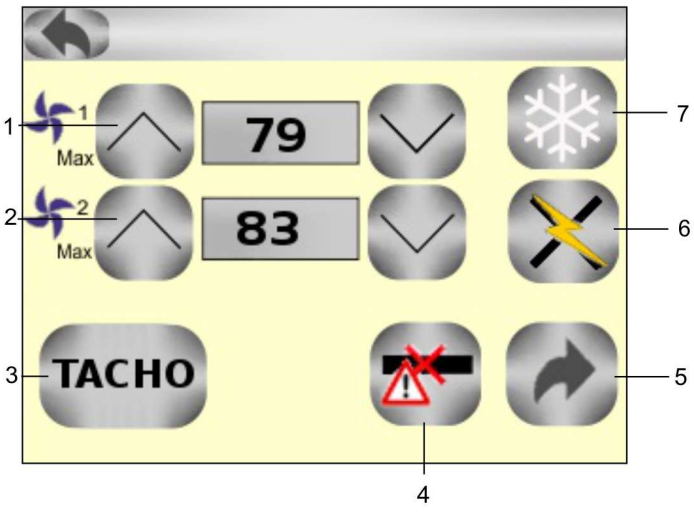
This caution means that there is high level of pollution in air filters. There are 2 ways to monitor filters. One is by time and calculation period is 6 month. Other is if pressure switches connected to PCB.
In both cases warning should be reset in settings window.

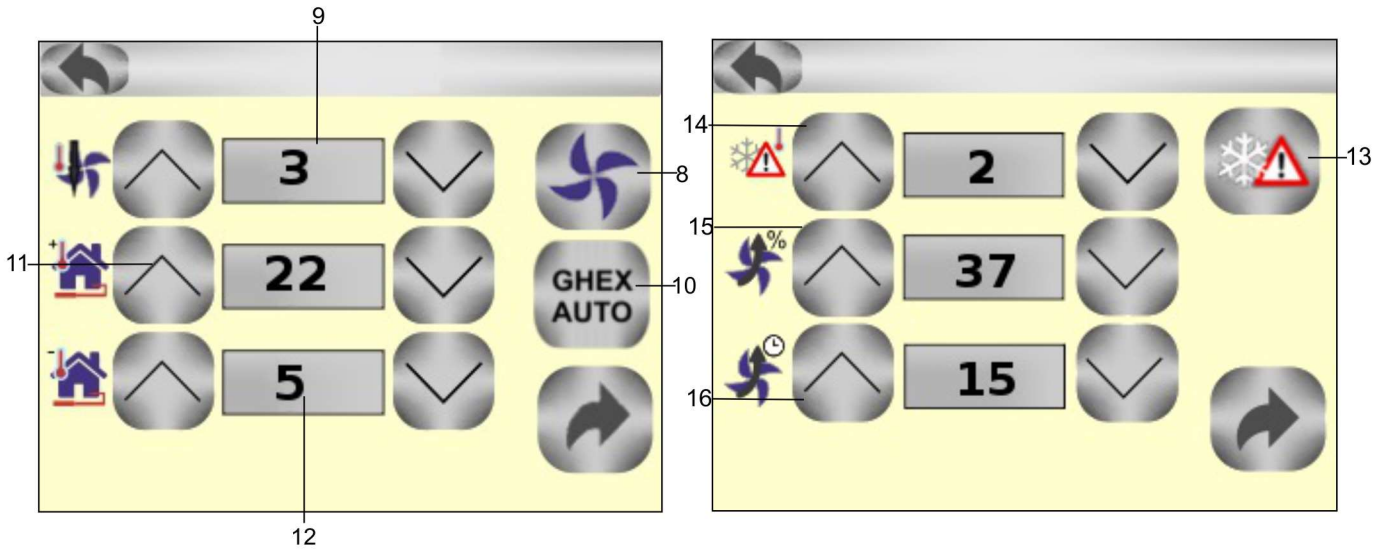
Locked settings

Enter a correct password (3971) and confirm it in this window. It is possible to set max the supply (fan number 1) and extract (fan number 2) fans air speed, feedback signal type, remote control work mode, AHU status after power supply fault, room antifreeze function in locked settings window. When is used data delete function, data isn't removed, which is described in data erase function chapter.



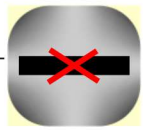
1. The supply air fan control signal level maximum setpoint.
2. The exhaust air fan control signal level maximum setpoint.
3. The fans motors feedback signal type section “TACHO” or “NC”.
4. The control system work mode selection key than lost connection or disconnected remote control.





Alarm if remote control is disconnected and AHU will stop.

AHU will not stop and continue work with last settings or with defaults 50% and 20°C after power fault restart if is active 6° item function.



5. The next page open key.
6. The AHU status selection key after power supply fault.

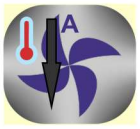
AHU will not restart after power fault and will need to switch ON manually.

AHU will restart with previous settings after power fault.

7. The heater function ON/OFF. The “Snowflake” - ON, the “Sun” - OFF.
8. The room antifreeze function key.

The room antifreeze function is not active.

The room antifreeze function is active and supply air fan will reduce rotation speed gradually, if supply air temperature is lower or equal setpoint of this function till temperature will rise.



9. The room antifreeze temperature setpoint 0..5°C.
10. The “GHEX” (ground heat exchanger) function key.

The function is not active.

The intake air always goes through ground heat exchanger.

The function work according lower and upper temperature setpoints.

11. The upper GHEX temperature setpoint 19..25°C. If outside temperature is higher of setpoint GHEX damper will open air intake through ground heat exchanger.
12. The lower GHEX temperature setpoint 2..7°C. If outside temperature is lower of setpoint GHEX damper will open air intake through ground heat exchanger.
13. The control system work mode if exhaust air temperature do not rise than antifrost function is ON some time.

AHU will stop if exhaust temperature will not rise.

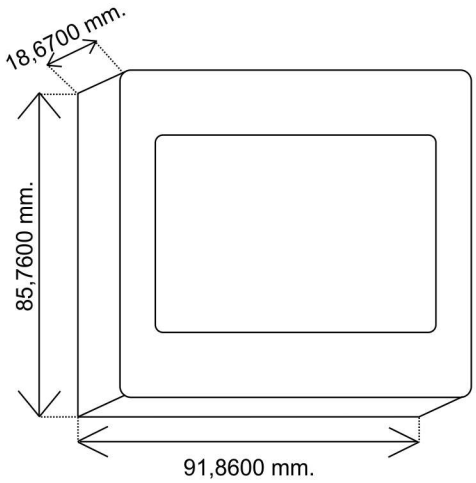
AHU will not stop if exhaust temperature will not rise.

14. The heat exchanger antifrost temperature setpoint 1..10°C..
15. Fans boost add to current setpoint. Range 0..100%.. Active boost function is indicated on the screen.
16. Fans boost time setpoint 0...180 minutes. When set 0 minutes, boost is ON only than external contact is closed.

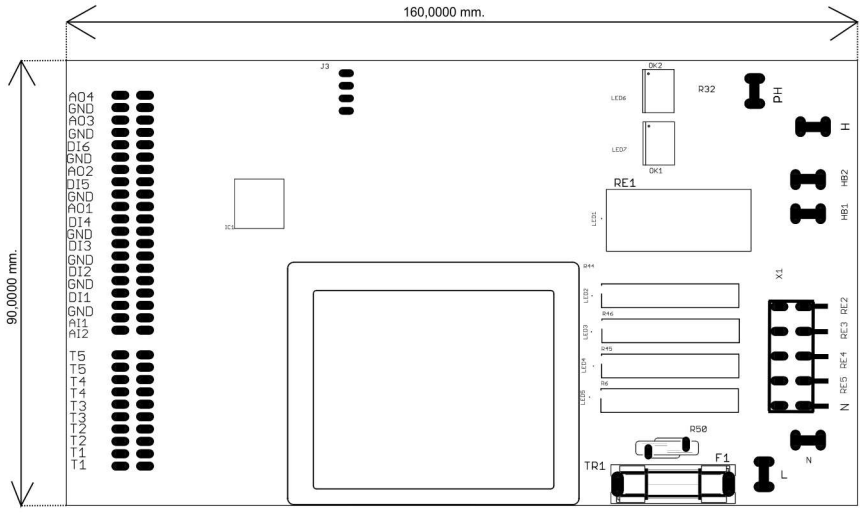
Remote controller touch screen calibration

After 40 clicks in 5 seconds, the calibration mode of touch screen is possible in inactive screen (touch doesn't make any changes). The white crosses which are in corner of blue window help you to calibrate a screen correctly. After calibration, you will be returned to the window, where you was before.

Dimensions of control board and remote control



Remote control



Control board

*This control system has one of few modification versions. Other versions of control system can be modificated according to client's technical data of recuperation system i.e. exchanger type, with electric heater, preheater or water heater, "BYPASS type" etc.