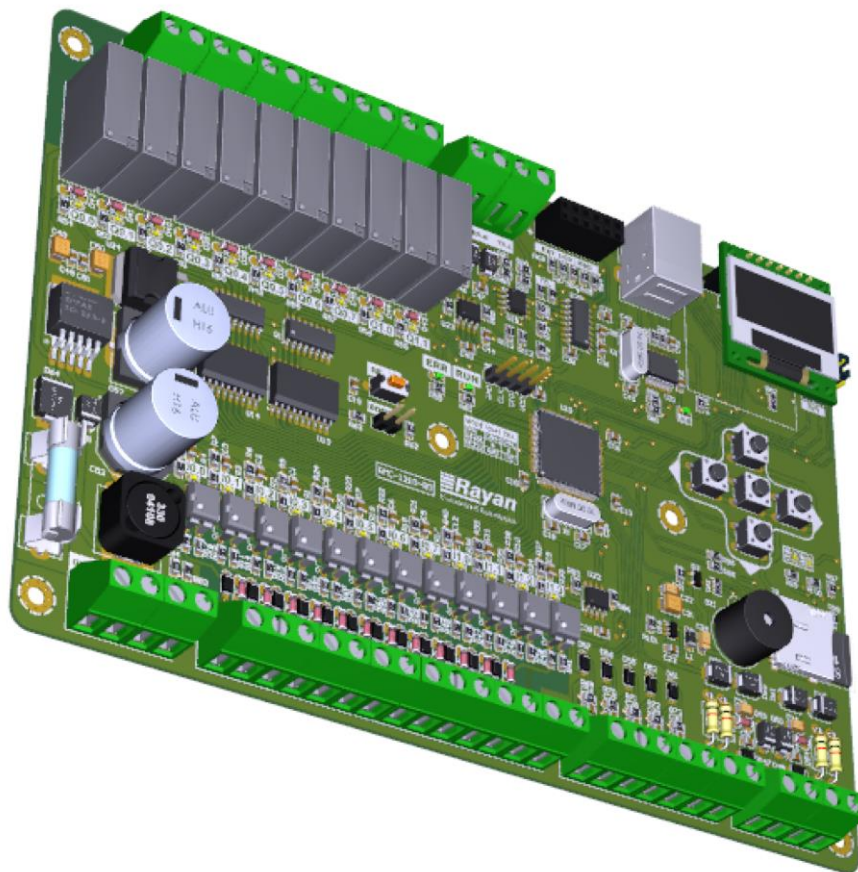




## Packaged Unit/Chiller Control Circuit REC-1210-R0



**Optimized electronic solution for 2-Circuits  
chillers, mini-chillers and packaged Units air  
conditioning systems.**

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## 1. System Specification

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- 1.1 The REC-1210-R0 controller circuit is designed to be utilized in air cooled chillers or packaged air conditioning systems.
- 1.2 Two independent refrigerant circuits are monitored and controlled based upon pre-configured program as well as some features which could be modified by user to obtain desired condition.
- 1.3 Automatic refrigerant circuits' status monitoring, automatic compressors work time balancing, minimum compressors off time (anti-recycling), water pump or AHU motor status monitoring and ac/dc power supply diversity are pre-defined in controller.
- 1.4 Unit supply temperature and ambient low temperature protection with automatic startup.
- 1.5 CAN protocol connection is available as an option in the circuit to expand I/O furthermore to attach portable display and keypad unit.
- 1.6 Inputs/Outputs LED status display will be helpful for diagnostics.
- 1.7 In-System USB configuration for default settings of manufacturer capability is available as option for diverse products.
- 1.8 Pressure transmitter's connection is available in the circuit in order to control two condenser fans in each refrigeration circuit (depends on firmware version) or only for displaying.

## 2. Technical Data

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Supply voltage: .....	24Vdc -20% +10%
Number of digital inputs: .....	12 x Isolated 24Vac / 24Vdc
Number of digital outputs: .....	10 x NO Relay 5A Max.
Number of temperature sensors: .....	5 x NTC 10K
Number of pressure sensors: .....	2 x 0...30Bar, 4...20mA
Pressure Control Unit: .....	Available (Depends upon firmware version)
User interface: .....	OLED text display + on-board buttons Remote OLED text display + buttons
Electrical Connection: .....	Max. 1.5mm <sup>2</sup> Wires per Terminal
Environmental Condition: .....	Operating Condition: -5...50°C no condensation Storage Condition: -15...60°C
Degree of Protection: .....	Not Defined (exposed equipment)
CAN Protocol: .....	Available As Option
Bluetooth Unit: .....	Available As Option

### 3. Engineering notes

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The permissible cable length for sensors is limited. Try to use 10 meter cable for NTC sensors at maximum.

Screened and twisted pair cable is necessary for sensors in noisy environments. Cable screen shall be connected to earth node from controller side.

In case there is frequency inverter drive or high current switching device in panel, keep the instance at maximum (possible) to prevent malfunction.

Be aware of 24V supply voltage of the circuit. To minimize any unintentional high voltage connection, implement different color and size for 24V wires and terminals.

In extra warm environments (above 40°C) utilize sufficient cooling and ventilation.

Any debris remains during fabrication may cause harm to the circuit. Trained assembler persons shall cover the circuit while drilling and wiring the panel.

Prevent applying any voltage to temperature sensors inputs.

Prevent applying voltage greater than 24V to the pressure sensor inputs.

### 4. Inputs/Outputs

---

#### 4.1. Controller Inputs

Input No.	Function	Type	Remark
I0.0	Water/Air Flow Switch	Close-OK	10 Sec. Delay
I0.1	Circuit #1 High Pressure Cutout	Close-OK	
I0.2	Circuit #2 High Pressure Cutout	Close-OK	
I0.3	Circuit #1 Low Pressure Cutout	Close-OK	
I0.4	Circuit #2 Low Pressure Cutout	Close-OK	
I0.5	Compressors Start Switch	Close-Compressors Start	
I0.6	Circuit #1 Compressors Protection	Close-OK	
I0.7	Circuit #2 Compressors Protection	Close-OK	
I1.0	Water Pump/AHU Motor Protection	Close-OK	
I1.1	Evaporator Frost Protection	Close-OK	
I1.2	Safety Line	Close-OK	
I1.3	Water Pump/AHU Motor Start Switch	Close-Unit Start	

All Inputs are 24Vac/dc. Prevent applying extra voltage to the circuit.

4.2. Controller Relay Outputs (Firmware: HVAC-01)

<b>Output No.</b>	<b>Function</b>	<b>Remark</b>
Q0.0	Circuit #1 Compressor	
Q0.1	Circuit #2 Compressor	
Q0.2	Water Pump/AHU Motor	
Q0.3	Compressor #1 Unloader	
Q0.4	Compressor #2 Unloader	
Q0.5	Circuit #1 Fan#1	
Q0.6	Circuit #1 Fan#2	
Q0.7	Circuit #2 Fan#1	
Q1.0	Circuit #2 Fan#2	
Q1.1	General Alarm	Close for Error

4.3. Controller Relay Outputs (Firmware: HVAC-02)

<b>Output No.</b>	<b>Function</b>	<b>Remark</b>
Q0.0	Circuit #1 Compressor	
Q0.1	Circuit #2 Compressor	
Q0.2	Water Pump/AHU Motor	
Q0.3	Compressor #1 Unloader	
Q0.4	Compressor #2 Unloader	
Q0.5	Circuit #1 Fan#1	
Q0.6	Circuit #1 LLSV	
Q0.7	Circuit #2 Fan#1	
Q1.0	Circuit #2 LLSV	
Q1.1	General Alarm	Close for Error

#### 4.4. Controller Relay Outputs (Firmware: HVAC-03)

Output No.	Function	Remark
Q0.0	Compressor #1 Part-winding-1	
Q0.1	Compressor #1 Part-winding-2	
Q0.2	Compressor #2 Part-winding-1	
Q0.3	Compressor #2 Part-winding-2	
Q0.4	Water Pump/AHU Motor	
Q0.5	Compressor #1 Unloader	
Q0.6	Compressor #2 Unloader	
Q0.7	Circuit #1 LLSV	
Q1.0	Circuit #2 LLSV	
Q1.1	General Alarm	Close for Error

#### 4.5. Analog Inputs

Input No.	Function	Remark
NTC1	Chiller/AHU Supply Temperature	NTC 10K Thermistor
NTC2	Chiller/AHU Return Temperature	
NTC3	Ambient Temperature	
NTC4	Condenser-1 Temperature	
NTC5	Condenser-2 Temperature	
AI.1	Compressor #1 Discharge Pressure	0..30Bar, 4..20mA
AI.2	Compressor #2 Discharge Pressure	

Prevent applying any voltage to temperature sensor inputs.

## 5. Starting Procedure

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### A. Water Pump/AHU Motor On (I1.3) By User

1. Turn on AHU/Pump start (I1.3) switch.
2. "Water Pump/AHU Motor Protection (I1.0)" & "Safety Line (I1.2)" inputs are checked.
3. Water pump/AHU output will be activated after 10Sec. (if previous conditions were normal)
4. In case "Flow Switch (I0.0)" feedback is available within 10Sec. Pump/AHU will remain working otherwise output will be off and error LED goes blinking red and general alarm relay (Q1.1) will be activated.

### B. Compressors On (I0.5) By User

1. Turn on ACCU start (I0.5) switch.
2. For each refrigerant circuit "High Pressure Cutout", "Low Pressure Cutout" and "Compressors Protection" are checked.
3. In case refrigerant circuit status is normal, based upon return temperature and user-defined set point, compressors goes on.
4. Compressors "Min. off Time" (Default=5Min.) will prevent frequent start/stop of compressors.
5. "Min. Supply Temp." will prevent compressors start in low outlet temperatures.
6. "Min. ambient Temp." will prevent compressors start in low ambient temperatures.
7. "Frost protection" input (I1.1) cutout will turn compressors off.
8. AHU/Pump off status will turn compressors off.

Detailed process for compressors start varies based on firmware version. Refer to "Firmware version output type".

## 6. Firmware versions output type

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Firmware of controller is shown on booting.

Controller digital and analog inputs are the same in various firmware versions and only relay outputs are different. For description of inputs and outputs refer to "Controller Inputs and Outputs table".

A brief outputs differences are explained below.

### 6.1. Firmware: HVAC-01

This firmware program type is used for two 1-Stage compressors in two separated cooling circuits.

Each of compressors is assumed to be equipped to one unloader (reciprocating type compressors).

It is possible to utilize two separate scroll type compressors in each cooling circuit by interfacing controller "Unloader outputs" with a relay. In this case be assure of possibility to start each compressor of circuits separately unless Oil return shortage will damage compressors.

Due to lack of liquid line solenoid valve for each cooling circuit (it could be used by means of compressors contactor NO auxiliary), there is no capability to pump down compressors.

Two condenser fan stages are considered to be controlled based on compressors discharge pressure for each of cooling circuits.

A general alarm relay will be activated to announce existence of any alarm.

## **6.2. Firmware: HVAC-02**

This firmware program type is used for two 1-Stage compressors in two separated cooling circuits.

Each of compressors is assumed to be equipped to one unloader (reciprocating type compressors).

It is possible to utilize two separate scroll type compressors in each cooling circuit by interfacing controller “Unloader outputs” with a relay. In this case be assure of possibility to start each compressor of circuits separately unless Oil return shortage will damage compressors.

Due to existence of liquid line solenoid valve for each cooling, there is capability to pump down compressors. Maximum pump down time could be set by user to avoid extra evacuation of compressors suction side. Be assure of “Low pressure switches” safe operation before applying pump down capability.

One condenser fan stage is considered to be controlled based on compressors discharge pressure for each of cooling circuits.

A general alarm relay will be activated to announce existence of any alarm.

## **6.3. Firmware: HVAC-03**

This firmware program type is used for two part-winding compressors in two separated cooling circuits.

A 0.6 second delay is between each compressors part 1 and part 2 windings.

Each of compressors is assumed to be equipped to one unloader (reciprocating type compressors).

Due to existence of liquid line solenoid valve for each cooling, there is capability to pump down compressors. Maximum pump down time could be set by user to avoid extra evacuation of compressors suction side. Be assure of “Low pressure switches” safe operation before applying pump down capability.

Pressure sensors are only for displaying compressors discharge pressure and there is no capability to stage condenser fans on and off.

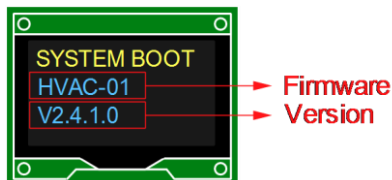
A general alarm relay will be activated to announce existence of any alarm.



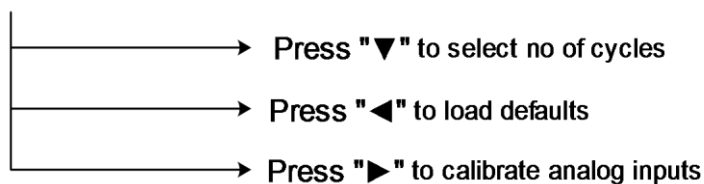
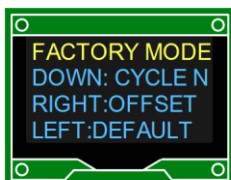
## 7. Menu and Settings

### 7.1. Boot and factory settings

After power on or reset of controller, boot screen is displayed. Firmware of controller is shown for 1 second. It is mandatory for users to connect controller outputs in accordance with Firmware type and relevant wiring diagram, unless otherwise the system will have wrong functioning.



It is possible to enable/disable compressors rotation, calibrate NTC sensors and load default settings by holding the “OK” button down for 3 seconds while booting the controller (boot screen is shown). In this case the screen below will be displayed.



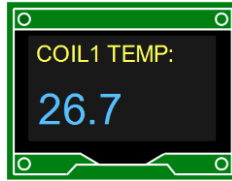
- After pressing “▼” button, if “1 CYCLES” is selected then rotation of compressors based on working time for total work balancing will be disabled. i.e. the compressor #1 will start first. If “2 CYCLES” is selected then the compressor with lower work time will start first. Press “OK” button after selecting, to save any change.
- After pressing “◀” button, default values stored to controller as below table.

Ambient MIN Temp-ON	10.5 °C
Ambient MIN Temp-OFF	6.5 °C
Supply MIN Temp-ON	10.5 °C
Supply MIN Temp-OFF	6.5 °C
Return Temp Set point	23.5 °C
Return Temp Hysteresis	1.5 °C
Condenser fans set point	200 PSI
Condenser fans hysteresis	30 PSI

- After pressing “▶” button, an offset value could be added to each of analog inputs by resolution of 0.1 by pressing “▲” and “▼” buttons. Press “OK” after each sensor calibration to move on the next.  
Offsets range are limited to +/-5.

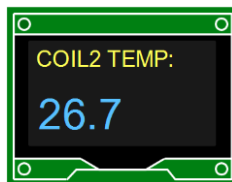
## 7.2. Menus and normal operation

After starting, the screens below will be shown. By pressing the '▶' button, screens will be replaced with the order of below pictures.



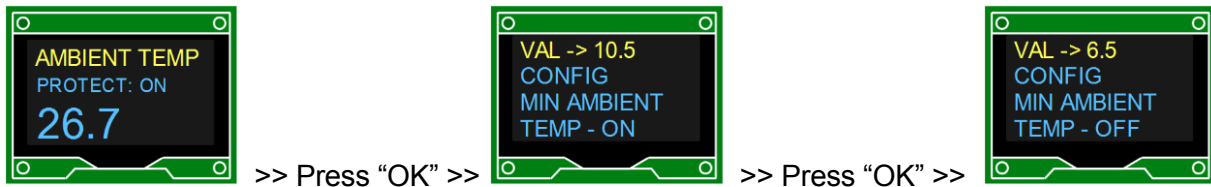
COIL1 TEMP screen shows temperature of NTC4 sensor which shall be installed on condenser surface of cooling circuit #1.

In case the NTC4 sensor cut out, the message "ERROR" is displayed in this screen and error LED on the controller starts to blink and alarm relay (Q1.1) will be activated.



COIL2 TEMP screen shows temperature of NTC5 sensor which shall be installed on condenser surface of cooling circuit #2.

In case the NTC5 sensor cut out, the message "ERROR" is displayed in this screen and error LED on the controller starts to blink and alarm relay (Q1.1) will be activated.



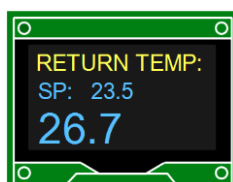
AMBIENT TEMP screen shows temperature of NTC3 sensor which shall be installed exposed to outdoor ambient air. Try to minimize any effect of condensers air movement or direct sunlight radiation on this sensor by appropriate placement.

Due to low ambient protection feature on ambient temperature, (if it is activated by user) false sensing may cause malfunction.

By pressing "OK" button in ambient temperature screen the value in which if temperature falls down will turn the compressors off (MIN AMBIENT TEMP-OFF) and consequently the value in which temperature shall rise up to let the compressors to start again could be set by user. By pressing "▲" and "▼" button settings are changed 1 unit and by pressing "▶" and "◀" button settings are changed 0.1 unit. Setting will be saved after the button "OK" is pressed.

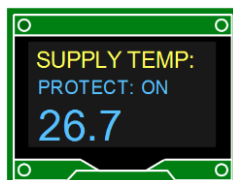
- Default value for "MIN AMBIENT TEMP-OFF" is 6.5 °C. It means if the ambient temperature falls below 6.5 °C, the compressors output will go off.
- Default value for "MIN AMBIENT TEMP-ON" is 10.5 °C. It means if the ambient temperature falls below "MIN AMBIENT TEMP-OFF" and compressors outputs are in off status, the temperature value shall rise up over this value to let the compressors to start up again.

- Minimum difference between “MIN AMBIENT TEMP-ON” and “MIN AMBIENT TEMP-OFF” is 4°C.
- To disable the ambient temperature protection, change both values to 0. Then the message “PROTECTION: OFF” will be displayed.
- In case the NTC3 sensor cut out, the message “ERROR” is displayed in this screen and error LED on the controller starts to blink and alarm relay (Q1.1) will be activated.
- In case the “PROTECTION: ON” for ambient temperature sensor (protection is active) and the NTC3 is cutout, the compressors don't have permission to start.



RETURN TEMP screen shows temperature of NTC2 sensor which shall be installed to measure unit inlet temperature. The unit inlet temperature value is criteria for loading and unloading the capacity of compressors. User-defined set point and hysteresis for staging compressors are compared to “Return Temp.” value and according to the result, controller stages compressors up or down. The sensor for return temperature is installed on return water pipe (in chillers) or on return air duct (on air handling units).

In case the NTC2 sensor cut out, the message “ERROR” is displayed in this screen and error LED on the controller starts to blink and alarm relay (Q1.1) will be activated and compressors don't have permission to start.



SUPPLY TEMP screen shows temperature of NTC1 sensor which shall be installed to measure unit outlet temperature. The value of “Supply Temp.” sensor is used to protect the unit from excessive cooling by turning off compressors below the set value (if it is activated by user).

Due to low supply protection feature on outlet temperature, (if it is activated by user) false sensing may cause malfunction.

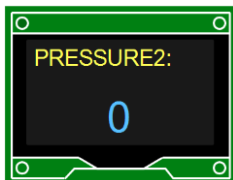
By pressing “OK” button in supply temperature screen the value in which if temperature falls down will turn the compressors off (MIN SUPPLY TEMP-OFF) and consequently the value in which temperature shall rise up to let the compressors to start again could be set by user. By pressing “▲” and “▼” button settings are changed 1 unit and by pressing “▶” and “◀” button settings are changed 0.1 unit. Setting will be saved after the button “OK” is pressed.

- Default value for “MIN SUPPLY TEMP-OFF” is 6.5 °C. It means if the outlet temperature falls below 6.5 °C, the compressors output will go off.
- Default value for “MIN SUPPLY TEMP-ON” is 10.5 °C. It means if the outlet temperature falls below “MIN SUPPLY TEMP-OFF” and compressors outputs are in off status, the temperature value shall rise up over this value to let the compressors to start up again.

- Minimum difference between “MIN SUPPLY TEMP-ON” and “MIN SUPPLY TEMP-OFF” is 4°C.
- To disable the supply temperature protection, change both values to 0. Then the message “PROTECTION: OFF” will be displayed.
- In case the NTC1 sensor cut out, the message “ERROR” is displayed in this screen and error LED on the controller starts to blinks and alarm relay (Q1.1) will be activated.
- In case the “PROTECTION: ON” for supply temperature sensor (protection is active) and the NTC1 is cutout, the compressors don't have permission to start.

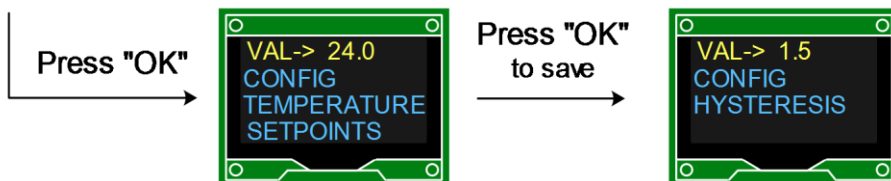


Indicating the pressure sensor value of compressor-1 discharge which is connected to AI.1 and it is used for sequencing condenser fans of circuit #1.



Indicating the pressure sensor value of compressor-2 discharge which is connected to AI.2 and it is used for sequencing condenser fans of circuit #2.

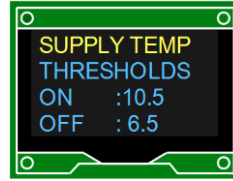
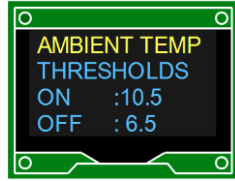
1	24.0	22.5
2	25.5	24.0
3	27.0	25.5
4	28.5	27.0



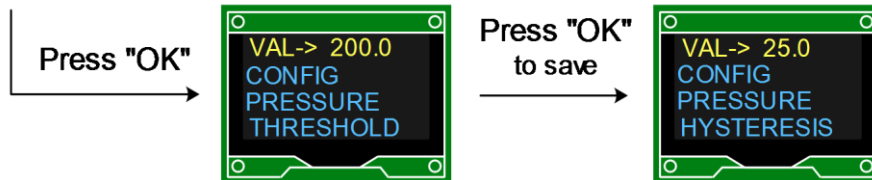
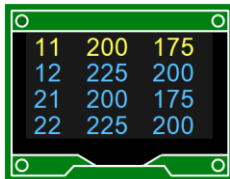
The numbers shown in the picture above are compressors and its relevant unloaders On and Off values which are sorted automatically based on user-defined set point and hysteresis. These values are compared to Return Temp sensor and based up on the result, appropriate number of stages are produced in outputs.

By pressing “OK” button, set point screen will appear. Press “▲” and “▼” button to change set point with coefficient of 1 and press “▶” and “◀” button to change set point with coefficient of 0.1 unit. Press “OK” to save modifications.

Minimum value for hysteresis is limited to 0.3 °C.



Ambient and supply temperature set points for low protection are displayed as above pictures. The exact temperature values in which compressors are enable/disable are clearly mentioned.



The numbers shown in the picture above are condenser fans on and off values which are sorted automatically based on user-defined set point and hysteresis. These values are compared to pressure sensors and based up on the result, appropriate number of stages are produced for each cycle fans in outputs. Be care that there is two stage of fans for each cycle. By pressing "OK" button, set point screen will appear. Press "▲" and "▼" button to change set point with coefficient of 1 and press "▶" and "◀" button to change set point with coefficient of 0.1 unit. Press "OK" to save modifications. Minimum value for hysteresis is limited to 25 PSI.

## 8. Errors



Any error number or error code will be shown in ERROR screen.

**Error tables**

<b>Error Code</b>	<b>Error Description</b>	<b>Remedy</b>	<b>Cause</b>
SE	Supply temperature sensor (NTC1) is not connected while supply protection is ON.	Disable Supply protection if it is not needed or connect suitable sensor.	Stops Compressor #1 & Compressor #2.
	Supply temperature is below "MIN SUPPLY TEMP OFF".	Check unit air/water flow and load.	
AE	Ambient temperature sensor (NTC3) is not connected while ambient protection is ON.	Disable Ambient protection if it is not needed or connect suitable sensor.	Stops Compressor #1 & Compressor #2.
	AMBIENT temperature is below "MIN AMBIENT TEMP OFF".	Consult manufacturer to check the conditions.	
1	AHU/Pump output is turned off because of "Flow Switch" input (I0.0) malfunction.	Check correct function of "Flow switch" and restart AHU/Pump start switch. (I1.2)	Stops AHU/Pump and compressors.
2	Compressor #1 High pressure switch (I0.1) cut out.	Error automatically clears after the input connecting.	Stops Compressor #1.
3	Compressor #2 High pressure switch (I0.2) cut out. This code is only exist in firmware HVAC-01.	Error automatically clears after the input connecting.	Stops Compressor #2.
4	Compressor #1 Low pressure switch (I0.3) cut out. This code is only exist in firmware HVAC-01.	Error automatically clears after the input connecting.	Stops Compressor #1.
5	Compressor #2 Low pressure switch (I0.4) cut out.	Error automatically clears after the input connecting.	Stops Compressor #2.

### Error tables

Error Code	Error Description	Remedy	Cause
6	Compressor #1 Protection (I0.6) cut out.	Check electrical protecton for Compressor #1.	Stops Compressor #1.
7	Compressor #2 Protection (I0.7) cut out.	Check electrical protecton for Compressor #2.	Stops Compressor #2.
8	Pump/AHU Motor Protection (I1.0) cut out.	Check Pump/AHU electrical protection and restart AHU/Pump start switch. (I1.2)	Stops AHU/Pump and compressors.
9	Frost protection (I1.1) cut out.	Check unit air/water flow and load. Check frost protection thermostat. and restart compressors start switch. (I0.5)	Stops Compressor #1 & Compressor #2.
10	Safety line (I1.2) cut out.	Check electrical safty chain and restart AHU/Pump start switch. (I1.2)	Stops AHU/Pump and compressors.

## 9. Disposal



These devices are considered electronics devices for disposal in terms of European Directive 2012/19/EU and may not be disposed of as domestic waste.

Dispose of the device via the channels provided for this purpose.  
Comply with all local and currently applicable laws and regulations.