Application data sheet A\_RH-02\_4.16\_HQ

Ventilation plant, heating room supply air cascade control

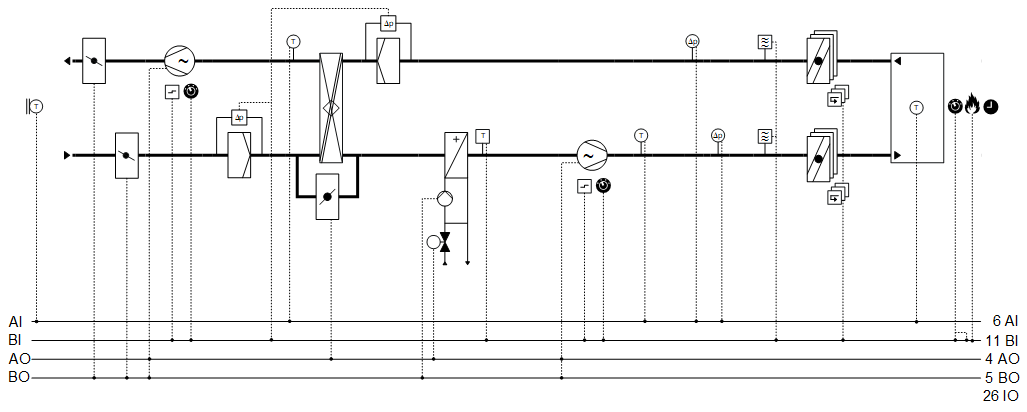
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The plant has variable speed fans, energy recovery with plate heat exchanger, and hot water heating coil.

The most important functions:

* Temperature control with room / supply air cascade control (minimum and maximum limitation)
* Fan pressure control

Plant diagram



Function diagrams / sequence diagrams

|  |  |  |
| --- | --- | --- |
| Temperature cascade control | | |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/9007215738417419__Web.png | TSu SpTSuMax PrSpLoTSu PrSpHiTSu SpTSuMin PrSpLoT PrSpHiT TR | Supply air temperature Maximum supply air temperature setpoint Present setpoint low for supply air temperature Present setpoint high for supply air temperature Minimum supply air temperature setpoint Present setpoint low for room temperature Present setpoint high for room temperature Room temperature |

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| --- | --- | --- |
| Supply air temperature control | | |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17789852555__Web.png | Vlv-Pos  Actg=1  Actg=0  Hcl'Vlv'Pos  Erc'Mdlt  PrSpLoTSu PrSpHiTSu | Valve position Control action for the heat exchanger is heating.  Control action for the heat exchanger is cooling.  Heating coil valve position  Position energy recovery plate heat exchanger Present setpoint low for supply air temperature Present setpoint high for supply air temperature |

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| Seasonal temperature compensation | | |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/9007215734045451__Web.png | SpTR PrSpHiT PrSpShftHi PrSpLoT PrSpShftLo TOa | Room temperature setpoint Present setpoint high for room temperature Present setpoint shift high Present setpoint low for room temperature Present setpoint shift low Outside air temperature |

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| Pressure control | | |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17699304715__Web.png | Fan'Spd  SpP P | Fan speed  Pressure setpoint Pressure |

Function description

|  |
| --- |
| Temperature cascade control (Room / supply air temperature cascade)  Calculates the high and low supply air setpoint per the outside temperature.  See Function diagram Temperature cascade control. |
| Basic setpoints for temperature control  Setpoints for upper and lower room temperature  See Function diagram Seasonal temperature compensation. |
| Seasonal temperature compensation  Corrects the high and low room temperature setpoint per the outside temperature.  See Function diagram Seasonal temperature compensation. |
| Present operating mode  Reports the present operating mode: Off | On |
| Reason for present operating mode  Reports the reason for the present operating mode:  Exception | Operating mode switch | Manual operating mode | Scheduler | Switching action operating |
| Manual operating mode selection  Switches the plant to: Auto | Off | On |
| Night cooling (Freecooling)  Switches on the fans, if the conditions are met to cool the room air (outside the operating mode On). |
| Common fault (Fault indicators)  Displays on HMI/PXM. |

| Component | Function |
| --- | --- |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696421899__Web.png | Fire detector contact (Fire control panel)  Switches the plant off. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696419083__Web.png | External manual Operating mode switch  Switches the plant to: Auto | Off | On |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696537867__Web.png | Scheduler program  Switches the plant to: Off | On |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17728916491__Web.png | Room temperature sensor  Measures room temperature (°C).  Sustained mode: Switches on the plant when the setpoint is breeched. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696540683__Web.png | Fire dampers  Visualizes the state (state message): Close | Open  Switches the plant to Off, if the plant is operating and the dampers are not open. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696508171__Web.png | Smoke detector (in supply air and extract air)  Switches the plant to: Off  Both smoke detector contacts are switched in series. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696445963__Web.png | Supply air differential pressure sensor  Measures the differential pressure between duct and environment. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696443147__Web.png | Extract air differential pressure sensor  Measures the differential pressure between duct and environment. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696513803__Web.png | Supply air temperature sensor  Measures the supply air temperature. |

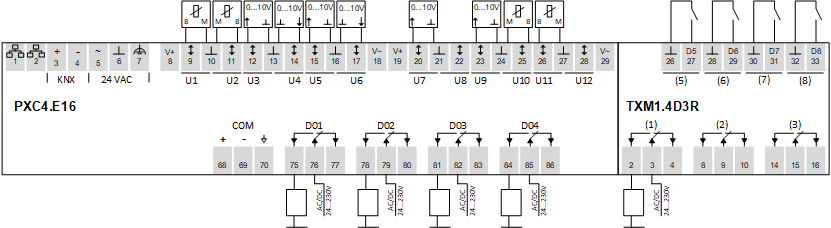
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| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696519435__Web.png | Supply air fan  Controls the supply air pressure. |
| Maintenance switch  Switches off the fan and the plant.  The fan outputs are blocked locally at a high priority. |
| Fault message  Fault messages, e.g. from the external motor control (variable speed drives).  Switches off the fan and the plant. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696481291__Web.png | Heating coil  Controls the supply air temperature. |
| Reports hot water demand to heat distribution. |
| Pump run when the outside air temperature is low  Pump always operates at low outside temperatures. |
| Frost protection  Prevents the hot water heating coil from freezing.  If the frost protection monitor triggers:   * The plant switches off. * The valve fully opens (100%) and the pump is also switched on. Both at high priority (Prio 4). |
| Purge optimization  Purges the heating coil with hot water at cold outside temperature prior to switching on fans.  Duration and valve opening are optimized using function [PURGE] purge optimization. |
| Kick function  Prevents the pump from seizing during long idle periods. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17728919307__Web.png | Extract air filter  Maintenance message after reaching the limit value for operating hours or differential pressure monitoring. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17730217355__Web.png | Energy recovery (Plate heat exchanger).  Reuses sensible energy from extract air for supply air by transferring heat.  Heating / cooling changeover  Determines whether it can be heated or cooled using extract air:   * Energy recovery can be used to heat if the extract air temperature is higher than the outside temperature. * Energy recovery can be used to cool if the extract air temperature is lower than the outside temperature. |
| Temperature controller  Controls the supply air temperature.  The supply air setpoint is the result of the average of the high setpoint for supply air temperature and the low setpoint for supply air temperature. |
| Position  Modulates power of energy recovery: 0...100 [%] |
| Anti-icing protection  The temperature sensor measures the exhaust air temperature after energy recovery.  The anti-icing protection controller holds the exhaust air temperature sufficiently high by lowering the power. It prevents freezing of any condensation and icing on the exchanger surface. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17728922507__Web.png | Outside air filter  Maintenance message after reaching the limit value for operating hours or differential pressure monitoring. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696516619__Web.png | Exhaust air fan  Controls extract air pressure. |
| Maintenance switch  Switches off the fan and the plant.  The fan outputs are blocked locally at a high priority. |
| Fault message  Fault messages, e.g. from the external motor control (variable speed drives).  Switches off the fan and the plant. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696478475__Web.png | Outside air damper  Opens and closes the outside air damper.  Adjustable damper runtime in the program. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696475659__Web.png | Exhaust air damper  Opens and closes the exhaust air damper.  Adjustable damper runtime in the program. |
| D:\SCHEMA\st4.ais\work\publishingserver\52d89320-ca47-4522-99ed-bfa69bd25e15\Images/png/17696119051__Web.png | Outside air temperature sensor  Measures outside temperature. |

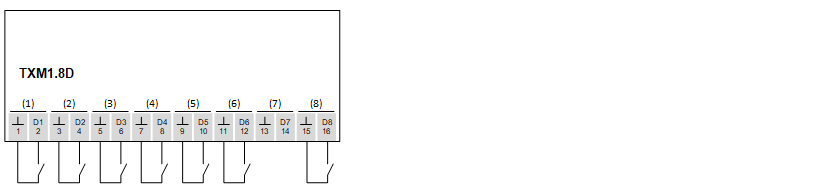
Device list

| Key | Device type | Data sheet | Type | No. |
| --- | --- | --- | --- | --- |
| Automation station | Automation station with 16 inputs/outputs, BACnet/IP communication | A6V11646018\_en | PXC4.E16-2 | 1 |
| TXM1.\_ Module | I/O module with 4 digital inputs and 3 relay outputs | A6V12027167 | TXM1.4D3R | 1 |
| TXM1.\_ Module | Digital input module with 8 data points | A6V10068525 | TXM1.8D | 1 |
| TXA1.\_address key | Address key 1...12 and a deletion key | A6V10365858 | TXA1.K12 | 1 |
| Touch panel | BACnet/IP touch panel 7.0" with integrated web server | A6V11664137 | PXM40.E | 1 |
| Room temperature sensor | Room temperature sensor LG-Ni1000 | N1721 | QAA24 | 1 |
| Supply air pressure sensor | Air duct differential pressure sensor, 0...200 Pa, 0...250 Pa, 0...500 Pa | N1910 | QBM2030-5 | 1 |
| Extract air pressure sensor | Air duct differential pressure sensor, 0...200 Pa, 0...250 Pa, 0...500 Pa | N1910 | QBM2030-5 | 1 |
| Supply air temperature sensor | Air duct sensor for temperature (LG-Ni1000) | N1761 | QAM2120.040 | 1 |
| Frost temperature,  Frost protection monitor | Frost protection monitor, 2-position, capillary 3000 mm | N1284 | QAF81.3 | 1 |
| Exhaust air temperature sensor | Air duct sensor for temperature (LG-Ni1000) | N1761 | QAM2120.040 | 1 |
| Filter detector,  outside and extract air | Differential pressure switch | N1552 | QBM81-... | 2 |
| Outside air temperature | Air duct sensor for temperature (LG-Ni1000) | N1761 | QAM2120.040 | 1 |
| Fire dampers, supply air | Actuator for fire dampers, 2-position, spring return 90/15 s, 2 auxiliary switches | + | G.A.26.1E/T1… | 1 |
| Fire damper, extract air | Actuator for fire dampers, 2-position, spring return 90/15 s, 2 auxiliary switches | + | G.A.26.1E/T1… | 1 |
| Air damper actuator, outside air | Air damper rotary actuators, 2-point | + | G......1. | 1 |
| Air damper actuator, exhaust air | Air damper rotary actuators, 2-point | + | G......1. | 1 |
| Heating coil valve | 2-port or 3-port valve.  Modulating actuator for valves, AC 24 V, DC 0...10 V | + | VV.. / VX.. / M.. / VP.. / EV.. S..6... | 1  1 |

|  |  |
| --- | --- |
| + | Refer to product catalog on selection of actuators and valves. |

Connection diagram





Designations inputs/outputs

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PXC4.E16-2 |  | TXM1.4D3R (Address 1) |  | TXM1.8D (Address 2) |
| U1 | Supply air temperature | (1) | Exhaust air damper, command | (1) | Fire dampers, supply air / extract air |
| U2 | Room temperature | (2) |  | (2) | Smoke detector, supply air and extract air |
| U3 | Heating coil, valve position | (3) |  | (3) | Supply air fan, maintenance switch |
| U4 | Supply air fan, supply air pressure | (5) | Frost protection monitor | (4) | Supply air fan, fault |
| U5 | Supply air fan, speed | (6) | Fire detection contact | (5) | Exhaust air fan, maintenance switch |
| U6 | Exhaust air fan, extract air pressure | (7) | Operating mode switch [Off] | (6) | Exhaust air fan, fault |
| U7 | Exhaust air fan, speed | (8) | Operating mode switch [On] | (7) |  |
| U8 |  |  |  | (8) | Filter detector, outside and extract air |
| U9 | Energy recovery, position |  |  |  |  |
| U10 | ERC exhaust air temperature |  |  |  |  |
| U11 | Outside temperature |  |  |  |  |
| U12 |  |  |  |  |  |
| DO1 | Supply air fan, command |  |  |  |  |
| DO2 | Exhaust air fan, command |  |  |  |  |
| DO3 | Heating coil, pump command |  |  |  |  |
| DO4 | Outside air damper, command |  |  |  |  |
|  |  |  |  |  |  |

Overview of inputs and outputs

| Designation input/output | Short name | Type | Signal/connection | Unit | Alarm | Trend | Device  duct number |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Fire detection contact | FireDetCont | BI | NO contact |  | Yes |  | TXM1.4D3R, (6) |
| Operating mode switch | OpModSwi | MI  (2 BI) | NO contact NO contact |  |  |  | TXM1.4D3R, (7) TXM1.4D3R, (8) |
| Room temperature | TR | AI | LG-Ni1000 | [°C] | Yes1) | Yes2) | PXC4.E16-2, U2 |
| Fire dampers, supply air and extract air | Fdps'Fbopnd | BI | NO contact |  |  |  | TXM1.8D, (1) |
| Smoke detector, supply air and extract air | Su'Ex'SmkDet | BI | NC contact |  |  |  | TXM1.8D, (2) |
| Supply air temperature | TSu | AI | LG-Ni1000 | [°C] | Yes1) | Yes3) | PXC4.E16-2, U1 |
| Supply air pressure sensor | FanSu'Psu | AI | 0...10 [V] | [Pa] | Yes |  | PXC4.E16-2, U4 |
| Supply air fan, speed | FanSu'Spd | AO | 0...10 [V] | [%] |  |  | PXC4.E16-2, U5 |
| Supply air fan, command | FanSu'Cmd | BO | NO contact |  |  |  | PXC4.E16-2, DO1 |
| Supply air fan, maintenance switch | FanSu'MntnSwi | BI | NO contact |  | Yes |  | TXM1.8D, (3) |
| Supply air fan, fault | FanSu'Flt | BI | NO contact |  | Yes |  | TXM1.8D, (4) |
| Frost protection monitor | Hcl'FrPrtMon | BI | NO contact |  | Yes |  | TXM1.4D3R, (5) |
| Heating coil, valve position | Hcl'Vlv'Pos | AO | 0...10 [V] | [%] |  |  | PXC4.E16-2, U3 |
| Heating coil, pump command | Hcl'Pu'Cmd | BO | NO contact |  |  |  | PXC4.E16-2, DO3 |
| Energy recovery, position | Erc'Pos | AO | 0...10 [V] | [%] |  |  | PXC4.E16-2, U9 |
| Energy recovery, exhaust air temperature | Erc'TEhAfErc | AI | LG-Ni1000 | [°C] | Yes1) |  | PXC4.E16-2, U10 |
| Extract air pressure sensor | FanEh'PEx | AI | 0...10 [V] | [Pa] | Yes |  | PXC4.E16-2, U6 |
| Exhaust air fan, speed | FanEh'Spd | AO | 0...10 [V] | [%] |  |  | PXC4.E16-2, U7 |
| Exhaust air fan, command | FanEh'Cmd | BO | NO contact |  |  |  | PXC4.E16-2, DO2 |
| Exhaust air fan, maintenance switch | FanEh'MntnSwi | BI | NO contact |  | Yes |  | TXM1.8D, (5) |
| Exhaust air fan, fault | FanEh'Flt | BI | NO contact |  | Yes |  | TXM1.8D, (6) |
| Filter detector, outside and extract air | FilDet | BI | NO contact |  | Yes |  | TXM1.8D, (8) |
| Outside air damper, command | DmpOa'Cmd | BO | NO contact |  |  |  | PXC4.E16-2, DO4 |
| Exhaust air damper, command | DmpEh'Cmd | BO | NO contact |  |  |  | TXM1.4D3R, (1) |
| Outside air temperature | TOa | AI | LG-Ni1000 | [°C] | Yes1) |  | PXC4.E16-2, U11 |

1) An alarm is generated in the event of a short circuit or interruption  
2) Trending every 15 minutes  
3) Trending every minute

| Device | Total inputs and outputs per device | Planned number of inputs/outputs in use | | | |
| --- | --- | --- | --- | --- | --- |
|  |  | Analog inputs | Analog outputs | Binary inputs | Binary outputs |
| PXC4.E16-2 | 16 | 6 | 4 |  | 4 |
| TXM1.4D3R | 7 |  |  | 4 | 1 |
| TXM1.8D | 8 |  |  | 7 |  |
| Amount | 31 | 6 | 4 | 11 | 5 |

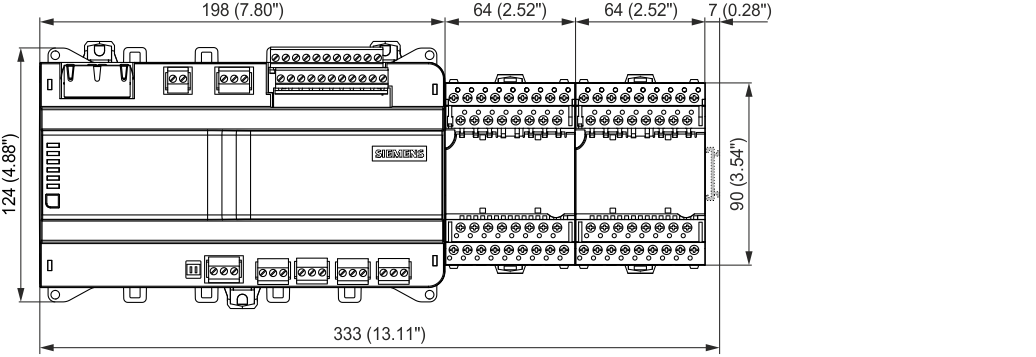
|  |  |
| --- | --- |
| Reserve inputs and outputs: | 2 universal inputs and outputs (see Connection diagram) 1 binary input 2 relay outputs |

Mechanical dimensions

Automation station PXC4.E16-2

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Automation station PXC4.E16-2 with 2 TXM modules



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