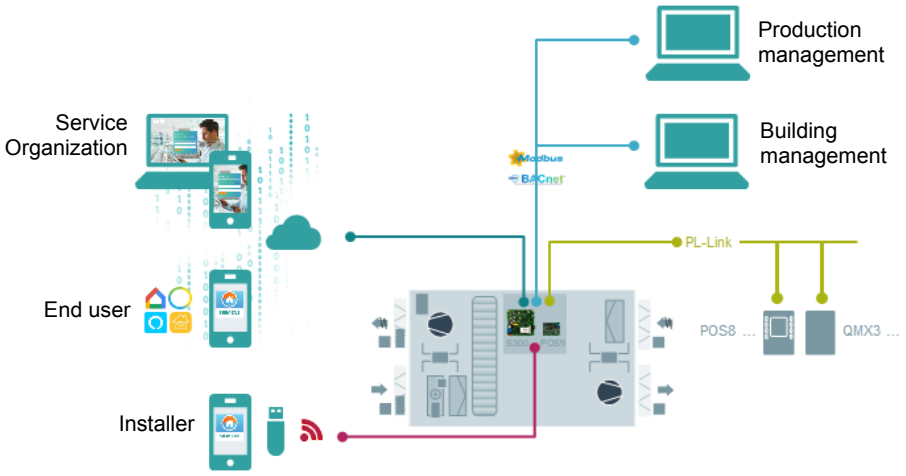
SIEMENS



Climatix™

Heat Recovery Ventilation with S300 HRV controllers

Application Guide

A6V10733786_en_d
2021-05-10

Smart Infrastructure

Table of contents

1 Safety

1.1 Legal note

Legal note concept

This guide includes notes that must be followed to prevent damage to property.

Notes dealing only with damage to property use the signal word NOTICE and an exclamation point.

They are depicted as follows:

!	***NOTICE***
	Type and source of hazard Consequences in the event the hazard occurs ● Controls/prohibitions to prevent the hazard

Qualified personnel

Only qualified personnel may commission the device/system. Qualified personnel for purposes refer to qualified due to training and experience to recognize and avoid risks when working with this device/system.

Proper use

The device/system described here may only be used in building technical plants and for the described applications only.

The trouble-free and safe operation of the device/system described here requires proper transportation, correct warehousing, mounting, installation, commissioning, operation, and maintenance.

You must comply with permissible ambient conditions. You must comply with the information provided in the Section "Technical data" and notes in the associated documentation.

Fuses, switches, wiring and grounding must comply with local safety regulations for electrical installations. Observe all local and currently valid laws and regulations.

Exemption from liability

The content of this document was reviewed to ensure it matches the hardware and firmware described herein. Deviations cannot be precluded, however, so that we cannot guarantee that the document fully matches the actual device/system. The information provided in this document is reviewed on a regular basis and any required corrections are added to the next edition.

2 About this document

2.1 Document conventions

Depiction of text markups

Special text markups are displayed as follows in this document:

▻	Prerequisite for an instruction
⇨	Interim result of an instruction
⇨	Final result of an instruction
Text	Hyperlink, reference
"Text"	Term that has a standing definition in the program

Depiction information/tips

The "i" symbol identifies supplemental information and tips to simplify procedures.

2.2 Revision history

Version	Date	Changes	Section
d	2021-05-10	**New features, changes, corrections…**	
		• Shut off dampers	Whole document
		• Mixing air damper	Whole document
		• Change over coil	Whole document
		• New BACnet objects in ‘Available parameters’	Whole document
		• ‘Control functions’ added	Choosing the functions [➙ 30]
		• Schematic plant diagram revised	Schematic plant diagram [➙ 17]
		• Note added	Ebm-papst supply air fan [➙ 166] Ebm-papst exhaust air fan [➙ 168]
		• ‘Device information’ added	Device information [➙ 185]
c	2020-12-16	**New features, changes, corrections…**	
		• New chapter added	Password security
		• Info on password added	Accessing the device [➙ 28]
		• ‘Output A21’ enhanced	Extension module [➙ 47]
		• Additional information on ‘Fan speed monitoring’	Linear fan speed (VntCtl23y, FanSu23y, FanEh23y) [➙ 63] Constant air flow regulation (VntCtl21y, FanSu21y, FanEh21y) [➙ 67] Constant duct pressure (VntCtl22y, FanSu22y, FanEh22y) [➙ 73]
		• Additional information on ‘Air temperature control’	Supply air temperature control (TSuCtlH21y) [➙ 91] Supply air regulation with outdoor temperature compensation [➙ 95] Fan heating/cooling influence [➙ 99]
		• New chapter added	Recirculating air damper (DmpMx21y) [➙ 129]
		• Additions to ‘Start-up sequences’	Start-up / shut-down sequence [➙ 145]
		• Changes to ‘Alarm class settings’	General [➙ 150]
		• Changes to ‘Alarm class’ and ‘Influence of alarm’	Alarm codes [➙ 154]

Version	Date	Changes	Section
		• ‘BAcnet objects’ revised	Air pressure sensor #2 QBM97.. [➙ 165]
		• ‘Remark’ enhanced	Ebm-papst supply air fan [➙ 166]
		• ‘Remark’ enhanced	Ebm-papst exhaust air fan [➙ 168]
		• New BACnet object property	Port adjustments [➙ 170]
		• Chapters revised	Encoding of data types [➙ 175] Mapping application parameters to Modbus registers [➙ 178]
		• New chapter added	Edit schedule [➙ 183]
		• New chapter added	Device information [➙ 185]
b	2020-07-16	• **Device changes…**	
		• Controller POS3.3515/100 deleted • WLAN stick POL903 introduced • 2. QBM97 #2 introduced	different sections
		• **New features, changes, corrections…**	
		Information restructured; exhaust air temp. is "The"; ranges changed	Controller board [➙ 38]
		• Several corrections	3.5.x
		• New sections	Controller configuration: password protected access by user roles [➙ 55], Factory Reset [➙ 55]
		• Modbus objects introduced	4.5.x
		• Several corrections	4.5.3
		• Several corrections	4.6.2
		• Corrections and function extensions	Energy Recovery [➙ 100]
		• Functions extension	Filter supervision (FilAMon21y) [➙ 131]
		• Several corrections	4.14, 4.15
		• Several corrections	4.21.2
		• Restructured, extended, corrected	Modbus components [➙ 162]
		• New sections	Ebm-papst supply air fan [➙ 166], Ebm-papst exhaust air fan [➙ 168]
		• New large section	Modbus slave [➙ 170]
		• Cloud connectivity is documented in the S300 cloud documentation	
		• First edition	
a	2019-10-18		

2.3 Validity

This document applies to the following application:

Application	Version	Hardware (ASN)
Climatix heat recovery ventilation application	2.473 and above	POS3.5715/100

2.4 Before you start

2.4.1 Trademarks

The trademarks used in this document are listed together with their legal owners in the following table. The use of these trademarks is subject to international and national statutory provisions.

Trademarks	Legal owner
BACnet™	American National Standard (ANSI/ASHRAE 135-1995)
KNX®	Konnex Association, B - 1831 Brussels-Diegem Belgium http://www.konnex.org/
MODBUS®	The Modbus Organization, Hopkinton, MA, USA

All the product names listed are trademarks (™) or registered trademarks (®) of their respective owners, as listed in the table. Further to the notes in this section, and to facilitate the reading of the text, these trademarks will not be indicated elsewhere in the text (e.g. by use of symbols such as ® or ™).

2.4.2 Copyright

This document may only be duplicated and distributed with the express permission of Siemens and may be passed only to authorized persons or companies with the required technical knowledge.

2.4.3 Target readers

Target audience for this manual are development departments of HVAC manufacturers (OEM) as well as installers of the S300 HRV.

2.4.4 Purpose of the document

This document describes the Siemens Standard Heat Recovery Ventilation (HRV) application. It provides an overview for the configuration and operation of the application, as well as descriptions of the functionalities.

!	***NOTICE***
	Depicted application are exemplary This document is not intended to provide detailed information about possible required parameters, configuration, device combinations, hardware options, etc. If some of them are shown, they are intended as examples only.

2.5 Abbreviations

The following abbreviations are used throughout the document:

AQ	Air quality
CO2	Carbon dioxide
Configured BI	A configured binary input can be used as a rudimentary user interface
DP switch	Differential pressure switch
ERC	Energy recovery
FB	Feedback
HRV	Heat Recovery Ventilation
I/O	Input / Output
MAN	Manual operation mode
Max	Maximum
Min	Minimum
NC	Normally closed
NO	Normally open
PM	Particulate matter
R/RW	Read only / Read and writable value
rH	Relative Humidity
TSP	Time Switch Program
VAV	Variable Air Volume

2.6 Documentation and short description of compatible devices

Application documents

Document title	Document type	Document ID
Climatix S300 Heat Recovery Ventilation	Application guide	A6V11417931 (this document)
S300 HRV End User Climatix App (see also “Apps, access...”)	Quick Guide	A6V11841954
Climatix IC remote monitoring and intelligent diagnostics (see also “Remote access...”)	Guide: Getting started	A6V11858804
	Guide: Service and Enduser	A6V11849163

Basic controller

Document title	Document type	Document ID
S300 Heat Recovery Ventilation Controller, POS3.3515/100; POS3.5715/100	Datasheet	A6V11417931

Type number	Stock number	Application	Inputs	Outputs	Comm. Bus	MOQ
POS3.5715/100	S55393-C571-F100	Controller for heat recovery ventilation, standard application, with KNX PL-Link interface	10	8	KNX, Modbus, BACnet	1

Connectors

Type number	Stock nr.	Product description, application	Pole	Area	Phoenix type ¦ Phoenix key	MOQ
POL005.15/STD	S55843-Z151-F100	2-pole connector orange, power supply	2	230 V	Phoenix:1773879 MVSTBW 2,5/2-ST OG	100
POL005.25/STD	S55843-Z152-F100	2-pole connector	2	230 V	Phoenix:1792524 MVSTBW 2,5/2-ST	100
POL005.35/STD	S55843-Z152-F100	3-pole connector	3	230 V	Phoenix:1792537 MVSTBW 2,5/3-ST	100
-	-	4-pole	-	-	Note: use 2-pole connectors	-
POS0.3325/100	S55844-Z332-F100	2-pole connector	2	SELV	FK-MC 0,5/2-ST-2,5 1881325	100
POS0.3335/100	S55844-Z333-F100	3-pole connector	3	SELV	FK-MC 0,5/3-ST-2,5 1881338	100
POS0.3345/100	S55844-Z334-F100	4-pole connector	4	SELV	FK-MC 0,5/4-ST-2,5 1881341	100
POS0.3365/100	S55844-Z336-F100	6-pole connector	6	SELV	FK-MC 0,5/6-ST-2,5 1881367	100
POS0.3375/100	S55844-Z337-F100	7-pole connector	7	SELV	FK-MC 0,5/7-ST-2,5 1881370	100
POS0.3385/100	S55844-Z338-F100	8-pole connector	8	SELV	FK-MC 0,5/8-ST-2,5 1881383	100

Modbus I/O extension modules with air pressure sensors

Document title	Document type	Document ID
Modbus I/O extension module for POS3.., POS9.1515/100	Datasheet	A6V11725998
Modbus air pressure sensor with I/O extension, QBM97..	Datasheet	A6V11478118
	Mounting instructions	A6V11478123

Type number	Stock number	Product description, application	Sensor element	Inputs	Outputs	Com	MOQ
POS9.1515/100	S55663-J351-F100	Modbus air pressure sensor with I/O extension, **on PCB**	• Pressure (2)	2	2	Modbus slave	20
QBM97..	See datasheet	Modbus air pressure sensor with I/O extension, **with housing**, piezo-resistive pressure sensing element	• Pressure (1 or 2)	2	2	Modbus slave	20

Room operator units with sensors

Document title	Document type	Document ID
Room operator units POS8.4420/109; POS8.4440/109	Basic documentation	A6V11471220
	Data sheet	A6V11519429
	Mounting instructions	A6V10733764

Type number	Stock number	Product description, application	Sensor element	Display	Com	MOQ
POS8.4420/109	S55625-H422-A100	Room operator unit with temperature sensor	• Temperature	LCD with backlight	KNX PL-Link	20
POS8.4440/109	S55625-H444-A100	Room operator unit with temperature and humidity sensor	• Temperature • Humidity	LCD with backlight	KNX PL-Link	20

Room sensors

Document title	Document type	Document ID
Wall-mounted sensors and room operator units QMX3.P..	Data sheet	N1602
Room sensors for relative humidity and temperature QFA20..	Datasheet	CE1N1857
Fine Dust Room Sensors QSA2700D / QSA2700 / AQS2700	Datasheet	A6V11160938

Type number	Stock number	Product description, application	Sensor element	Display	Com	MOQ
QMX3.P30	S55624-H103	Room sensors with different sensor combinations	• Temperature	-	KNX PL-Link	1
QMX3.P40	S55624-H116		• Temperature • Humidity	-	KNX PL-Link	1
QMX3.P70	S55624-H104		• Temperature • Humidity • CO_2 • Air quality	LED for air quality	KNX PL-Link	1

Note: the listed devices are compatible with POS3.5715/ 100.

Type	Stock number	Product description	Sensor element	Display	Signal	MOQ
QFA20..	See Datasheet	Room sensor with different sensor combinations	• Temperature • Air quality • CO_2, • VOC • Humidity	Optional	DC 0… 10 V	1
QSA2700..	See Datasheet	Room fine dust sensor	Fine dust PM2.5-10	Optional	DC 0… 10 V	1

Note: the listed devices are compatible with POS3.3515/100 or POS3.5715/100.

Duct sensors

Document title	Document type	Document ID
Duct Temperature Sensors QAM21	Datasheet	CE1N1761
Duct sensors QFM31..	Datasheet	CE1N1882
Duct Air Quality Sensors QPM11.., QPM21..	Datasheet	CE1N1962

Type	Product description	Sensor element	Display	Output	MOQ
QAM21..	Duct sensors, temperature	• Temperature	-	NTC 10k	1
QFM31..	Duct sensors, rel. humidity / temp. for demanding requirements	• Temperature • Humidity	Optional	0..10 VDC	1
QPM11..	Duct air quality sensor VOC	• VOC	-	0..10 VDC	1
QPM21..	Duct air quality sensor, CO2 / temperature / rel. humidity / VOC	• CO2 • Humidity • Temperature	Optional	0..10 VDC	1

Damper actuators

Type number	Document ID	Product description, application	Output	Com	MOQ
GSD..6	N4606	Damper actuator 2 Nm **without** spring return	DC 0..10 V	-	20

Note: the listed devices are compatible with POS3.3515/100 or POS3.5715/100

The GSD..6 damper actuators can only be used for heat exchanger (bypass).

WLAN USB stick

Type number	Stock number	Document ID	Product description, application	Com	MOQ
POL903.00/100	S55803-Y130-A100	CC1N7219	WLAN Stick for POS3.xx	WiFi	1

Apps, access and services

Name	Product description, application	Provider	Access
ABT Site	Configuration software for Hardware and software settings	Siemens Free download	Windows
ABT Go *	Commissioning app for installation, servicing, configuration, settings, parameter copy, file share	Siemens free download Customizable upon request	Android: Google Play iOS: App store
End-user Climatix app	Operation app for end-user including scheduler	Customizable start code from Siemens available. Please address to local sales representative.	In the responsibility of the customer

* ABT Go contains a comprehensive online documentation.

Cloud-based remote monitoring and intelligent diagnostics system

Document title	Document type	Document ID
Climatix IC20 Remote Servicing	Data sheet DE, EN	A6V10449189

Type number	Product description, application	Remote access
IC20.xxx	Cloud based remote monitoring and intelligent diagnostics	• Location plant overview • Plant Dashboards • Web graphics • Monitoring trending alarming • Remote FW upgrade • API *

*API = Application Programming Interface for third party integration (clouds, applications, business software)

Notes

- MOQ: Minimum order quantity
- For ordering, check the device datasheets, for type number, stock number and quantity. Make sure the number of devices in one package equals MOQ (minimum order quantity).

3 Short description of application

S300 HRV application

The S300 configurable OEM controller for HVAC controlling, switching and monitoring comes with pre-engineered applications, and is optimized for heat recovery ventilation.

The purpose of this integrated and ready to use solution is to control residential heat recovery ventilation appliances in various market areas and needs.

For customer-friendly configuration and commissioning of the controllers, Siemens provides an application that can be conveniently operated on all standard smartphones and tablets.

In addition, the controllers have an IP interface, which allows integration into higher-level automation systems. A simple and extended integration of field devices or sensors from the Siemens portfolio or from third parties is made possible by the open communication interfaces.

For maximum convenience and minimum energy consumption, HMIs or smartphone apps are available to the end-customer for operation. Thanks to the integration in Climatix IC, our customers have the opportunity to use diagnostic and remote maintenance functions.

This documentation describes the pre-loaded HRV application in the context of the S300 ecosystem.

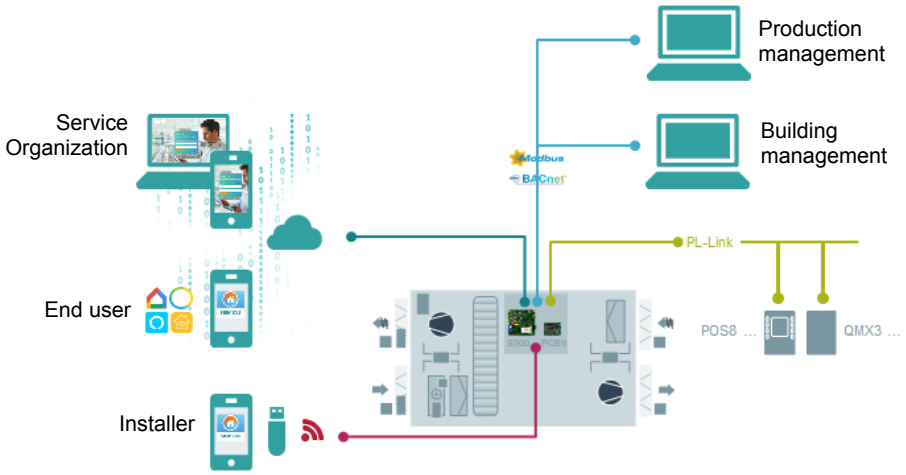
Highlights

- Configurable controller with dedicated I/O mix
- Pre-engineered and tested ventilation application
- Modbus RTU communication
- BACnet / IP communication: BACnet profile ASC and KNX PL-Link bus communication for room units and sensors
- USB interface with power supply for fast FW upgrade and compatibility with Siemens WLAN stick
- Climatix IC for remote access, monitoring and predictive maintenance
- Commissioning app for installers
- End-user app for operation
- I/O extension board with pressure sensors

3.1 System overview - Topology

A selection of interfaces allows the controller to be connected to various configuration, operating and monitoring options.

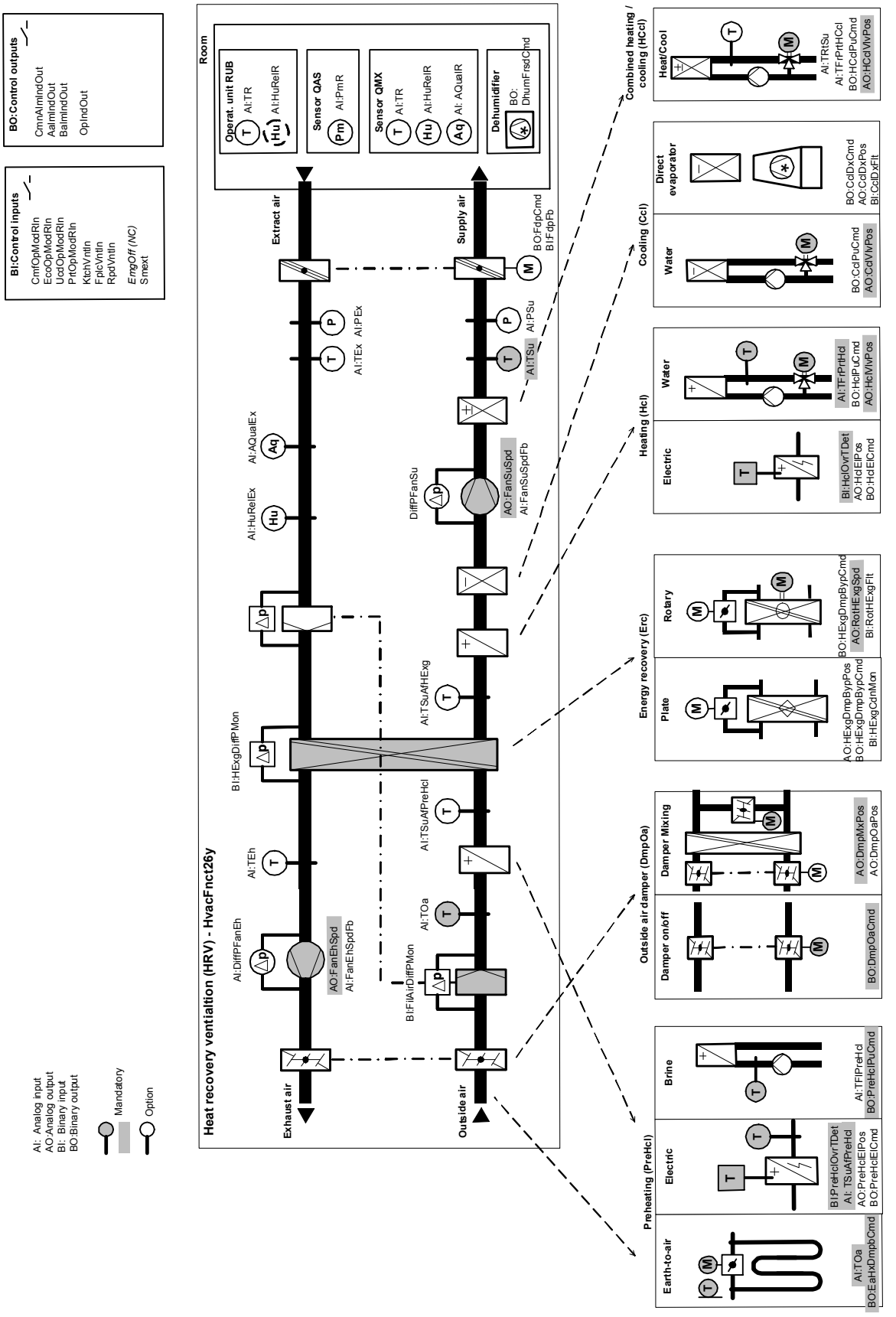
Connectivity for different work roles



Service organization Remote monitoring and diagnostics via connection to the Climatix IC cloud.	**Production management** Monitoring via BACnet or Modbus connection.
End user Autonomous operation of the heat recovery ventilation system via End User app.	**Building management** Monitoring via BACnet or Modbus connection.
Installer Installation and configuration via WLAN stick and ABT Go app.	**Room operator unit and sensors** Configurable via PL-Link.

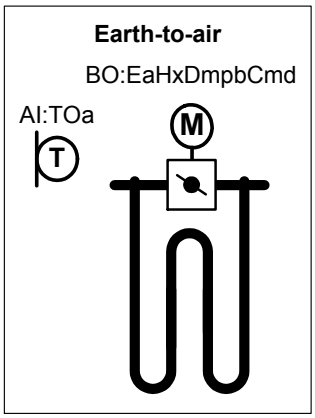
Communication in detail

3.2 Schematic plant diagram

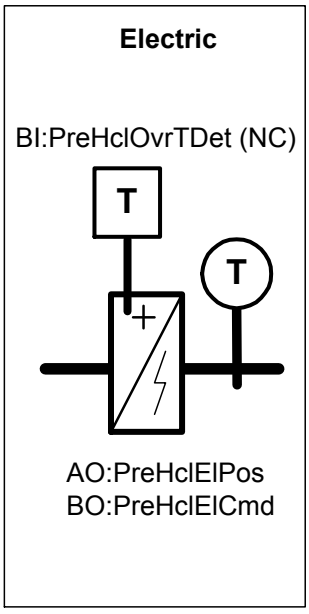


AqualEx	Extract air quality
AQualR	Room air quality
DiffPFanEh	Differential pressure exhaust air fan
DiffPFanSu	Differential pressure supply air fan
DmpOaCmd	Outside air damper command
FanEhSpd	Exhaust air fan speed
FanEhSpdFb	Exhaust air fan speed feedback
FanSuSpd	Supply air fan speed
FanSuSpdFb	Supply air fan speed feedback
FdpCmd	Fire damper command
FdpFb	Fire damper feedback
FilAirDiffPMon	Air filter differential pressure monitor
HExgDiffPMon	Heat exchanger diff. pressure monitor
HuRelEx	Relative humidity for extract air
HuRelR	Relative humidity for room
PEx	Extract air pressure
PmR	Particulate matter in room
PSu	Supply air pressure
TEx	Extract air temperature
TEh	Exhaust air temperature
TOa	Outside temperature
TR	Room temperature
TSu	Supply air temperature
TSuAfHExg	Supply air temp. after heat exchanger
TSuAfPreHcl	Supply air temp. after preheating coil

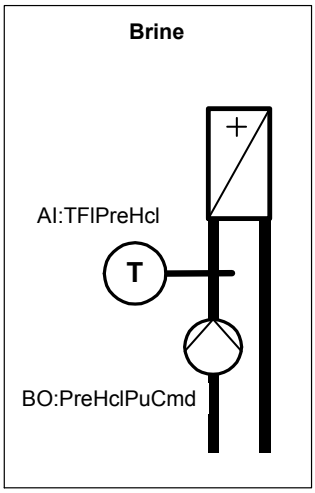
3.2.1 Preheating (PreHcl)



EaHxDmpbCmd	Earth-to-air heat exch.byp.damp.command
TOa	Outside temperature

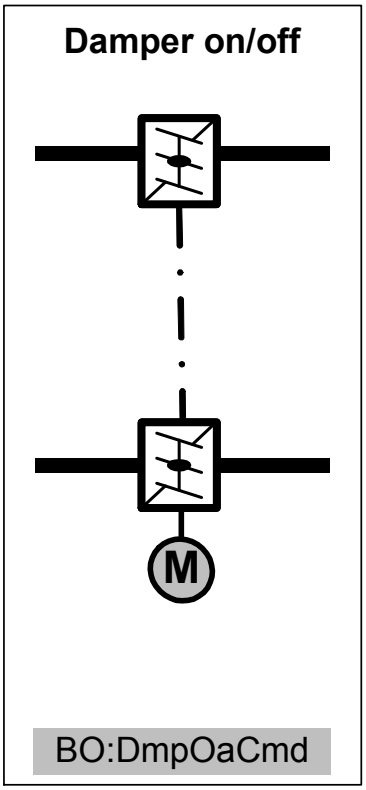


PreHclOvrTDet	Preheating coil overtemperature detector
PreHclElPos	Preheating coil electric position
PreHclElCmd	Preheating coil electric command

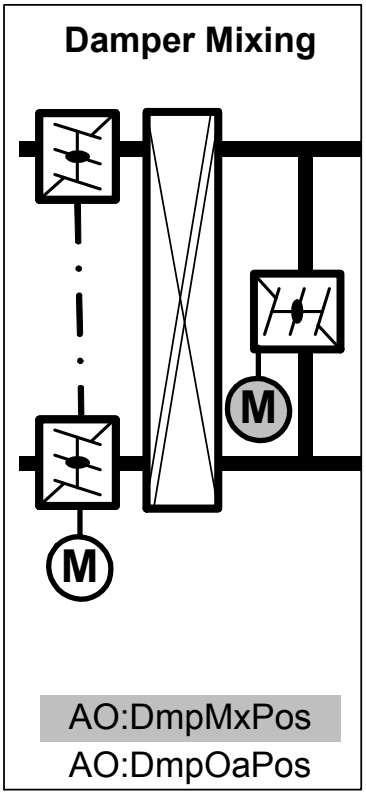


TFlPreHcl	Flow temperature preheating coil
PreHclPuCmd	Preheating coil pump command

3.2.2 Dampers (Dmp)



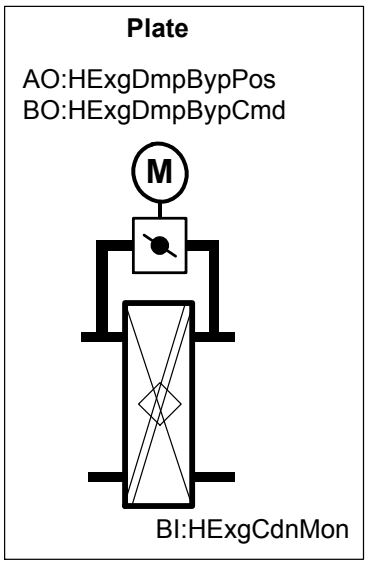
DmpOaCmd Outside air damper command



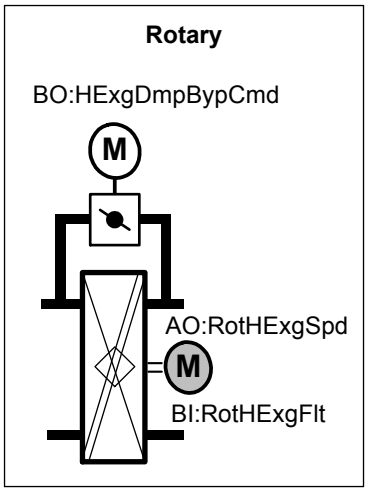
DmpMxPos Mixing air damper position

DmpOaPos Outside air damper position

3.2.3 Energy recovery (Erc)

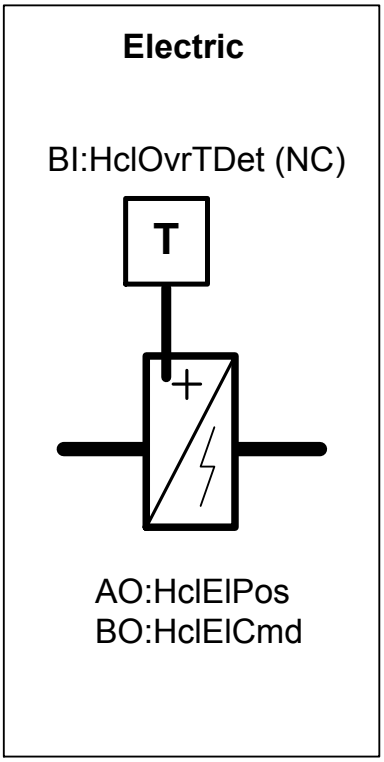


HExgDmpBypPos	Heat exchanger bypass damper position
HExgDmpBypCmd	Heat exchanger bypass damper command
HExgCdnMon	Heat exchanger condensation monitor
HExgDiffPMon	Heat exchanger diff.pressure monitor

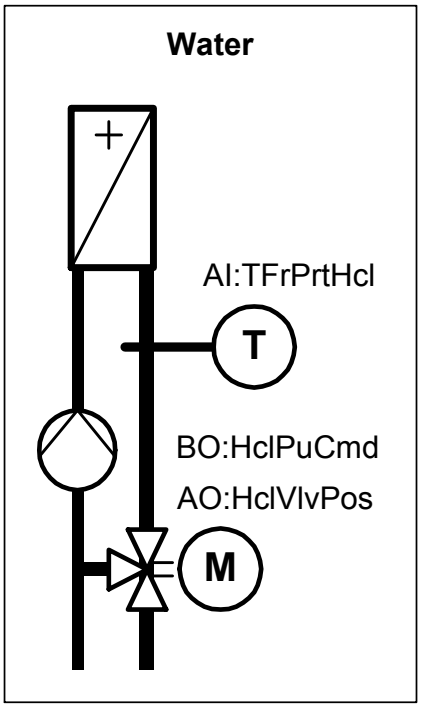


HExgDmpBypCmd	Heat exchanger bypass damper command
RotHExgSpd	Rotary heat exchanger speed
RotHExgFlt	Rotary heat exchanger fault

3.2.4 Heating (Hcl)

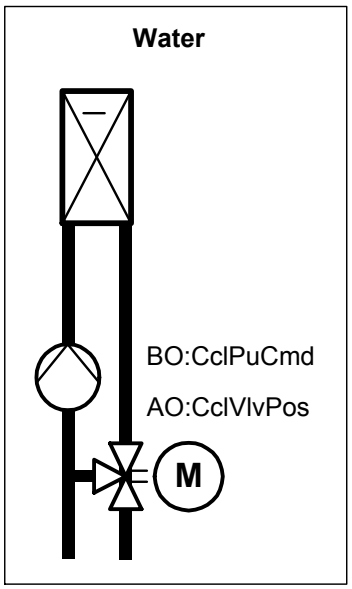


HclOvrTDet	Heating coil overtemperature detector
HclElPos	Heating coil electric position
HclElCmd	Electric heating coil command

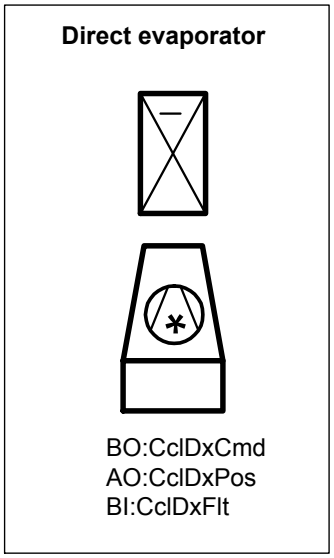


TFrPrtHcl	Frost protection temp.for heating coil
HclPuCmd	Heating coil pump command
HclVlvPos	Heating coil valve position

3.2.5 Cooling (Ccl)

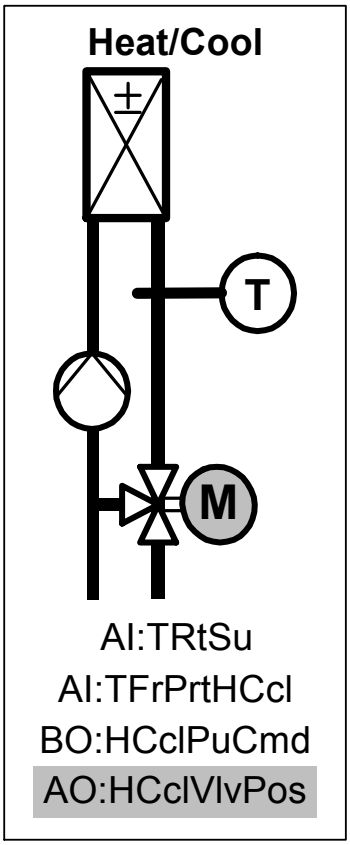


CclPuCmd	Cooling coil pump command
CclVlvPos	Cooling coil valve position



CclDxCmd	Cooling coil DX evaporator command
CclDxPos	Cooling coil DX evaporator position
CclDxFlt	Cooling coil DX evaporator fault

3.2.6 Combined heating / cooling coil (HCcl)



TRtSu	Return temperature heating / cooling supply
TFrPrtHCcl	Frost protection temperature heating / cooling coil
HCclPuCmd	Heating / cooling coil pump command
HCclVlvPos	Heating / cooling coil valve position

3.2.7 Control inputs / outputs

BI: control inputs

CmfOpModRIn	Input room operating mode comfort
EcoOpModRIn	Input room operating mode economy
UcdOpModRIn	Input room operating mode unoccupied
PrtOpModRIn	Input room operating mode protection
KtchVntIn	Kitchen hood ventilation input
FplcVntIn	Fireplace ventilation input
RpdVntIn	Rapid ventilation input value
EmgOff	Emergency off
Smext	Smoke extraction
USBPowerIn	USB power input

BO: control outputs

CmnAimIndOut	Common alarm indication output
AalmIndOut	A-Alarm indication output
BalmIndOut	B-Alarm indication output
OpIndOut	Operation indication output
DhumFrsdCmd	Dehumidifier free-standing command

4 Configuration

The configuration of the application can be executed in the configuration mode of the ABT Go app. or in the configuration part of ABT Site.

4.1 Wireless connection with POL903

The WLAN USB stick dongle POL903 offers wireless access to the controller, for example, via ABT Go.

The WLAN dongle can only be used temporarily since it is not been designed to be used 24/7. Use the Ethernet port for a permanent wireless connection.

TIP: In those cases where the WLAN dongle is always plugged in the controller, switch off USB power via BACnet, Modbus or Onboard input.

Available parameters

Actual values	BACnet object	R/RW	Note
USB supply power switch	USBPowerIn BI,148 (D1) BI,149 (D2)	R	Push button
IP address	NwkPortIP	RW	

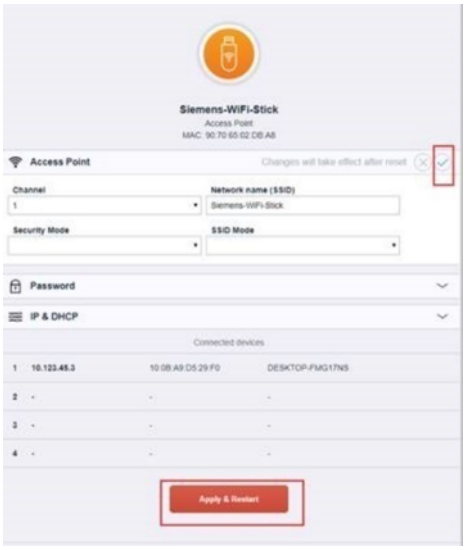
Basic settings	BACnet object	R/RW	Note
USB supply power setting	USBPower BVAL, 352	RW	

Initial configuration

1. Connect POL903 with POS3.5715 device on the USB port.
2. Power on POS3.5715 device
3. The WLAN signal is available after 5 minutes (phone or PC).
4. The default WLAN name is *Siemens-WLAN-Stick* and default password is *SIBPAdmin*
5. The address for the WLAN Stick configuration is https://10.123.45.1:441
6. After connecting the WLAN, change the password and remember it.

Note: Click "Save" when making changes to "Settings" page, and then "Apply & Restart".

Restart the POL903 for the configuration to take effect.



4.2 ABT Go configuration

The concept for the configuration of the controller is split into 2 parts:

Basic configuration: choosing the functions

Select the desired control functions for the heat recovery ventilation system.

The applications depend on the installed devices and intended use.

Extended configuration: configuring the hardware

Set the required input and output signals at the desired terminals according to the application choices made in the first step. This includes the controller as well as peripheral devices.

Setting and changing control parameters is possible with the system running.

During basic and extended configuration, the controller will stop the application. When leaving the configuration mode, the device will restart.

To access the BACnet registers that are listed in this document, a BACnet explorer can be used.

To set up the communication to the controller, the Ethernet port can be used.

Note the following facts:

- Application choice and hardware configuration are completely independent.
- There is no automatism that selects input/output signals according to application choices or that activates application functions depending on hardware settings.
- The controller provides a limited check, reporting configuration error if any mandatory input or output selections are missing.
- Input and output signal that are optional are not checked.

4.2.1 Accessing the device

In this example, the S300 HRV controller is accessed via connected WLAN router and ABT Go.

Other connection types and configuration tool are possible.

▷ A WLAN router is connected to the S300 HRV controller.

▷ ABT Go is installed on your mobile device.

1. In the WLAN settings of you mobile device, connect to the router that is connected to the controller.
2. Open the app ABT Go.
3. Navigate to the menu "Connection".
4. Choose "Network" and push the button "Connect".
   ⇨ The controller is listed with some basic documentation.
5. Select your listed controller.
   ⇨ The login dialog opens.
6. Fill in username and password of the S300 HRV controller.

⇨ Now you can navigate to the desired menus.

The default user name the first time you connect to ABT Go is:
Administrator
The default password is:
OneBT

Once the Siemens default password has been entered, a new password has to be defined. This password has to comply with the following rules:

- At least 8 characters.
- 3 out of 4 of the following conditions must be satisfied:
  – At least one uppercase alphabetic character.
  – At least one lowercase alphabetic character.
  – At least one digit.
  – At least one non-alphabetic character.

4.2.2 Basic configuration

To change the device configuration online in ABT Go:

1. Go to **Device** > **Configuration** > **Online configuration basic**
   NOTICE: Entering the Configuration mode stops the application!
   Cancel aborts without changes.
2. Tap **OK**.
   ⇨ The device is set to the Configuration mode.
   NOTE: If you want to leave this mode without having any changes applied, you have to manually set the setpoints back.
3. Select your choices and modify the values according the requirements of the customer plant.
4. Tap **Apply - Restart application.**
   ⇨ The device restarts and processes the new configuration.
   ⇨ After a successful restart the device state is set to Operational.

⇨ The settings of the choices are applied, data points and parameters are set accordingly.

4.2.3 Extended configuration

To change the device configuration online in ABT Go:

1. Go to **Device** > **Configuration** > **Online configuration extended**
   NOTICE: Entering the Configuration mode stops the application!
   Cancel aborts without changes.
2. Tap **OK**.
   ⇨ The device is set to the Configuration mode.
   NOTE: If you want to leave this mode without having any changes applied, you have to manually set the setpoints back.
3. Select your choices and modify the values according the requirements of the customer plant.
4. Tap **Apply - Restart application.**
   ⇨ The device restarts and processes the new configuration.
   ⇨ After a successful restart the device state is set to Operational.

⇨ The settings of the choices are applied, data points and parameters are set accordingly.

4.3 Choosing the functions

Refer to the list below to set the functions of the application accordingly. Some of the functions may require certain hardware (peripheral devices).

Control functions

Control function	BACnet object	Selection	Note
Ventilation control	STR_VIEW, 402	Ventilation control 21y, air volume flow	Controls the measured air flow to values depending on the operating mode and air quality
		Ventilation control 22y, air duct pressure	Controls supply and extract air duct pressure to values depending on the operating mode and air quality
		Ventilation control 23y, fan speed	Controls supply and extract fan speed to values depending on the operating mode and air quality (default)
Temperature control	STR_VIEW, 103	Supply air temperature control 21y	Controls supply air temperature to a value depending on the outside air temperature modulating the available actuators (default)
		Temperature cascade control 21y	Controls room or extract air temperature to a value depending on the outside air temperature modulating the supply air temperature setpoint
Kitchen hood ventilation operation	STR_VIEW, 168	None	No kitchen extract fan available (default)
		Active	Kitchen extract fan available (default)
Fireplace ventilation operation	STR_VIEW, 112	None	No open fireplace available
		Active	Open fireplace available (default)
Dehumidification control	STR_VIEW, 115	None	No humidity control available (default)
		Active	Dehumidification control via fan speed and / or stand-alone dehumidifier
Particulate matter control	STR_VIEW, 324	None	No particulate matter control available (default)
		Active	Particulate matter control available
Air quality control	STR_VIEW, 352	None	No air quality control available (default)
		Active	Air quality control available
Room air humidity evaluation	STR_VIEW, 539	None	No evaluation of the humidity (default)
		Active	Room humidity is evaluated from the temperatures before and after the heat exchanger; no sensor is required. This option automatically sets the option ‘Dehumidification control’.

Plant components

Plant component	BACnet object	Selection	Note
Preheating coil	STR_VIEW, 122	None	No preheating device available (default)
		Electric preheating coil 21y	Electric preheating coil available (default)
		Brine preheating coil 21y	Preheating coil using energy from the surrounding earth via brine
		Earth to air heat exchanger 21y	Heat exchanger using energy from the surrounding earth directly
Outside air damper	STR_VIEW,127	None	No outside air damper available
		Shutoff damper outside air 21y	Shutoff damper for outside air (default)
		Mixing air damper 21y	Controlled outside and mixing air dampers
Energy recovery	STR_VIEW,130	Rotating heat exchanger 21y	Heat recovery wheel
		Passive heat exchanger 21y, with bypass damper	Passive heat exchanger with on/off or modulating control (default)
		Passive heat exchanger 22y, without bypass damper	Passive heat exchanger without control
Heating coil	STR_VIEW,138	None	No heating coil available (default)
		Electric heating coil 21y	Electric heating coil, modulating
		Hot water heating coil 21y	Hot water heating coil, modulating with frost protection
Cooling coil	STR_VIEW,142	None	No cooling coil available (default)
		Chilled water cooling coil 21y	Cooling coil, modulating, with chilled water from external source
		DX evaporator cooling coil 21y	Cooling device with direct evaporator, modulating or on/off control
Combined coil	STR_VIEW,530	None	No combined coil available (default)
		Active	Combined heat/cool coil, modulating
Fire damper	STR_VIEW,146	None	No motorized fire damper available (default)
		Fire damper 11y	Motorized fire damper incl. test function
Dehumidifier free-standing	STR_VIEW,277	None	No dehumidifier available (default)
		Active	Stand-alone humidifier

4.4 Selecting the device connections

Peripheral devices as well as room operating units and additional room sensors must be activated (set to "Active") in the basic configuration before they can be used in the application. As soon as a device is set to active, it can be connected and further configured.

Activated KNX / PL-Link devices must be connected before powering the controller, otherwise the device will not be recognized.

Modbus devices can be connected any time before power up or during run time.

Because of auto-connect and KNX power supply the number of room operator unit and room sensors is limited, see "PL-Link [→ 161]".

4.4.1 Peripheral devices

Available devices

- POS9.1515/100 Modbus input/output extension module with 2 pressure sensors, 2 inputs, 2 outputs.
- 2 x QBM97 Modbus (duct) air pressure sensors with 2 pressure sensors, 2 inputs, 2 outputs each.

Activating the devices

Peripheral devices	BACnet object	Selection	Note
Selection for I/O extension device POS9	Pos9Sel, STR_VIEW, 341	None (default)	No device
		Active	Modbus device POS9 connected. (communication is monitored)
Selection for duct pressure device QBM97 #1	Qbm97Sel1, STR_VIEW, 344	None (default)	No device
		Active	Modbus device QBM97 connected. (communication is monitored)
Selection for duct pressure device QBM97 #2	Qbm97Sel2, STR_VIEW, 413	None (default)	No device
		Active	Modbus device QBM97 connected. (communication is monitored)
Selection for EBM Papst modbus fans	MdbsFanSel, STR_VIEW, 469	None (default)	No device
		Active	Modbus device Supply and exhaust air fans connected (communication is monitored)

If the communication with the device can’t be established or gets lost, individual alarm is triggered.

4.4.2 Room operating unit / Monitoring devices POS8

Available devices

One device of type POS8.4420 (room temperature) or POS8.4440 (room temperature and humidity) can be connected to controller board using KNX / PL-Link.

Activating the device

Room operator unit	BACnet object	Selection	Note
Selection for room operator unit POS8	ROpUnSel, STR_VIEW, 403	None	No operator unit
		POS8.4420 (default)	PL-Link room operator unit POS8.4420 connected.
		POS8.4440	PL-Link room operator unit POS8.4440 connected.

Available parameters

Actual value	BACnet object	Device
Room temperature	TR, AI,99	POS8.4420
Room temperature	TR, AI,120	POS8.4440
Relative humidity for room	HuRelR, AI,119	

NOTICE

Alarm in case of communication error

The communication with the room operator unit is monitored. If the communication can't be established or gets lost, a collective B-Alarm is triggered: "3101: Room sensor, KNX PL-Link communication error".

4.4.3 QMX room sensors

Available devices

One device of each type of QMX3 can be connected to the controller board using KNX / PL-Link.

- QMX3.P30 with a room temperature sensor
- QMX3.P40 with room temperature and room humidity sensor
- QMX3.P70 with room temperature, room humidity and room air quality sensor

Activating the devices

Room sensors	BACnet object	Selection
Selection for room sensor QMX3.P30	Qmx3p30Sel, STR_VIEW, 196	None / Active
Selection for room sensor QMX3.P40	Qmx3p40Sel, STR_VIEW, 220	None / Active
Selection for room sensor QMX3.P70	Qmx3p70Sel, STR_VIEW, 222	None /Active

NOTICE

Alarm in case of communication error

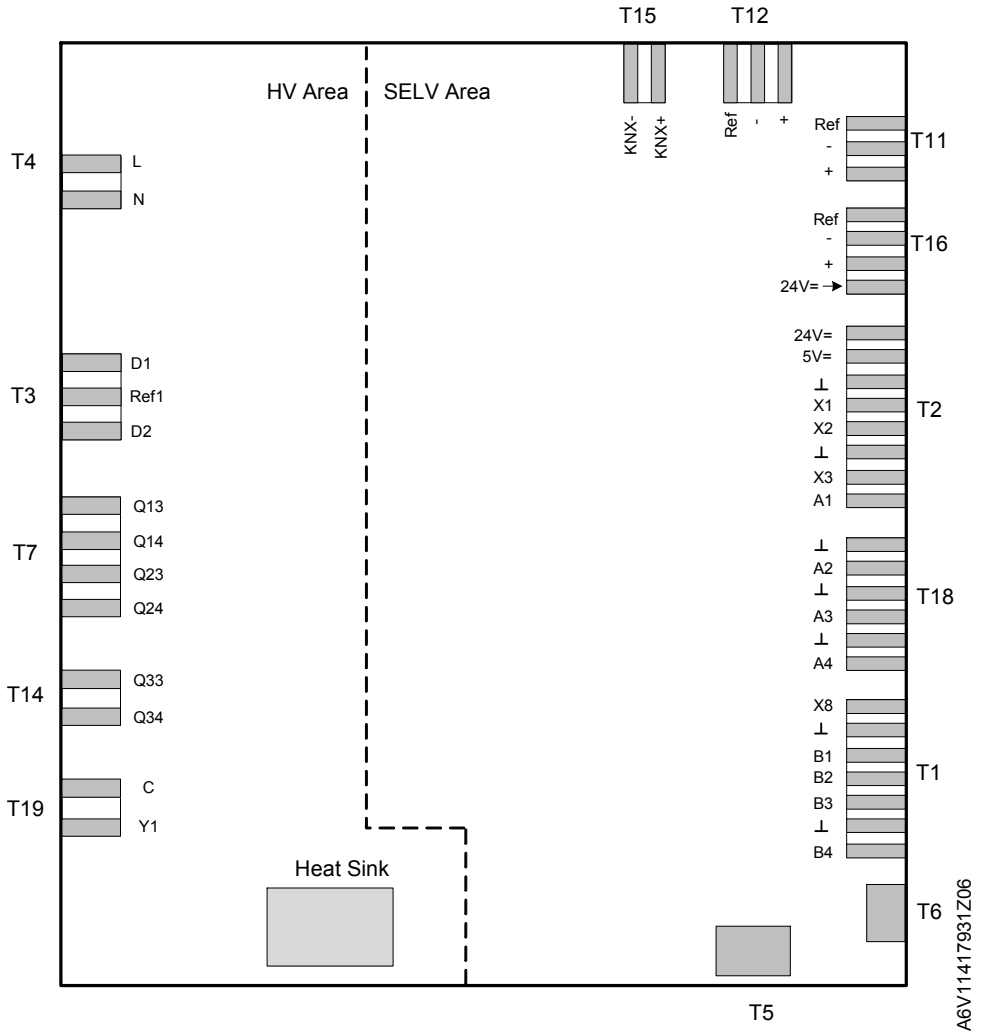
If a communication with the room sensor can't be established or gets lost, a collective B-Alarm is triggered: "3101: Room sensor, KNX PL-Link communication error".

4.5 Configuring the hardware

The I/Os on the controller board and peripheral devices do not have a designated function. Only for the controller board, the I/Os for default functions are set (see “Default configuration [➙ 49]”).

Depending on the application and the functions selected in Basic configuration, the required I/O signals must be set at the desired terminals.

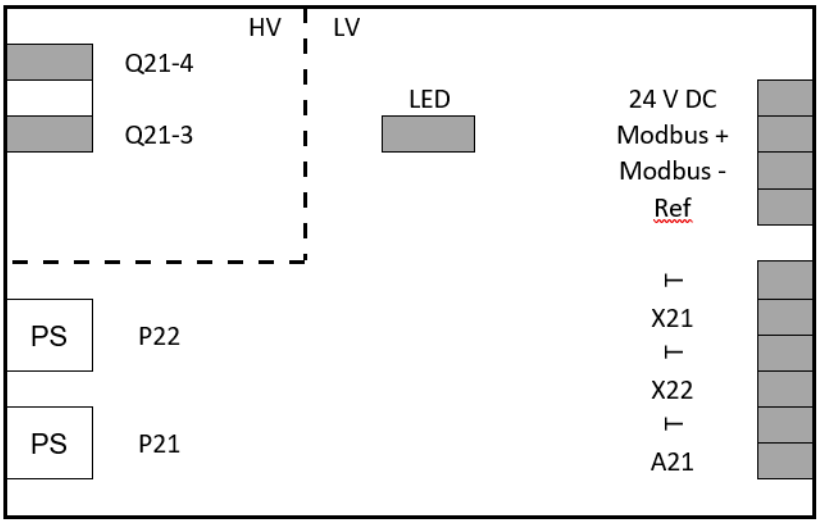
Controller board



Controller board	
4 x analog inputs (resistor) 2 x digital inputs 4 x multi-type inputs	3 x digital outputs (relay) 4 x analog outputs 1 x digital output (triac)

Interface	**Type**	**Note**
B1, B2, B3, B4	Analog Input 1) Resistor NTC10k	AI
X1, X2	Analog Input 1) Measuring 0…10V 2) Tacho pulse (max. 300Hz)	AI
X3	Analog / Digital (Binary) Input 1) Measuring 0…10V 2) Potential free contact (NO or NC)	AI, BI
A1, A2, A3, A4	Analog Output 1) Signal 0…10V	AO
X8	Analog / Digital (Binary) Input 1) Resistor NTC10k 2) Potential free contact (NO or NC)	AI, BI
D1, D2	Digital (Binary) Input 1) Potential free contact (NO or NC)	BI
Q1, Q2, Q3	Relay (Binary) Output 1) Potential free contact (NO)	BO
Y1	Digital (Binary) / Analog Output Triac VAC 1) Signal On/Off 2) Signal PWM (constant period)	BO, AO

Extension module



Extension module (POS9)	
2 x analog inputs (pressure) 1 x analog input (resistor) 1 x analog input	1 x digital output (relay) 1 x analog output

Interface	**Type**	**Note**
P21, P22	Differential pressure input	-
X21	Analog Input 1) Resistor NTC10k	AI
X22	Analog Input 1) Measuring 0…10V	AI
A21	Analog Output 1) Signal 0…10V	AO
Q21	Relay (Binary) Output 1) Potential free contact (NO)	BO

In- and output settings are always visible in "Extended configuration" even if the device is not activated.

Air pressure sensor

Air pressure sensor (QBM97) 2 x analog inputs (pressure) 1 x analog input (resistor) 1 x analog input		2 x analog outputs
Interface	**Type**	**Note**
P1, P2	Air pressure input	-
AI1	Analog Input 1) Resistor NTC10k	AI
AI2	Analog Input 1) Measuring 0…10V	AI
AO1,AO2	Analog Output 1) Signal 0…10V	AO

In- and output settings are always visible in "Extended configuration" even if the device is not activated.

4.5.1 Input settings

4.5.1.1 Controller board

The following functions can be selected for input signals on the controller board:

Input B1, B2, B3, B4

Parameter	BACnet object
Selection for B1	B1Sel, STR_VIEW,41
Selection for B2	B2Sel, STR_VIEW,43
Selection for B3	B3Sel, STR_VIEW,45
Selection for B4	B4Sel, STR_VIEW,47

Selection	BACnet object	R/W	Signal type	Range
None				
Supply air temperature	TSu	R	NTC10k	-50…80 °C
Outside air temperature	Toa	R	NTC10k	-50…50 °C
Extract air temperature	TEx	R	NTC10k	-50…80 °C
Exhaust air temperature	TEh	R	NTC10	-50…80 °C
Supply air temperature after heat exchanger	TSuAfHExg	R	NTC10k	-50…80 °C
Supply air temperature after preheating coil	TSuAfPreHcl	R	NTC10k	-50…80 °C
Flow temperature preheating coil	TFlPreHcl	R	NTC10k	-50…80 °C
Frost protection temperature for heating coil	TFrPrtHcl	R	NTC10k	-50…80 °C
Frost protection temperature for combined coil	TFrPrtHCcl	R	NTC10k	-50…80 °C
Primary chilled water temperature	TChwPm	R	NTC10k	-50…80 °C

Input X1

Parameter	BACnet object
Selection for X1	X1Sel, STR_VIEW,53

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Supply air fan speed feedback pulse	FanSuSpdFb	R	0…300Hz	0…100 %
Supply air fan speed feedback voltage	FanSuSpdFb	R	0…10V	0…100 %
Extract air quality	AQualEx	R	0…10V	0…2000 ppm
Relative humidity for extract air	HuRelEx	R	0…10V	0…100 %
Particulate matter in room	PmR	R	0…10V	0…500 µg/m3

Input X2

Parameter	BACnet object
Selection for X2	X2Sel, STR_VIEW,55

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Exhaust air fan speed feedback pulse	FanEhSpdFb	R	0…300Hz	0…100 %
Exhaust air fan speed feedback voltage	FanEhSpdFb	R	0…10V	0…100 %
Extract air quality	AQualEx	R	0…10V	0…2000 ppm
Relative humidity for extract air	HuRelEx	R	0…10V	0…100 %
Particulate matter in room	PmR	R	0…10V	0…500 µg/m3

Input X3

Parameter	BACnet object
Selection for X3	X3Sel, STR_VIEW,57

Selection	BACnet object	R/W	Signal type	Note
None	-	-	-	
Extract air quality	AQualEx	R	0…10V	0…2000 ppm
Relative humidity for extract air	HuRelEx	R	0…10V	0…100 %
Particulate matter in room	PmR	R	0…10V	0…500 µg/m3
Rapid ventilation input	RpdVntIn	R	Contact	NO
Kitchen hood ventilation input	KtchVntIn	R	Contact	NO
Fireplace ventilation input	FplcVntIn	R	Contact	NO
Air filter differential pressure monitor	FilAirDiffPMon	R	Contact	NO
Fire damper feedback	FdpFb	R	Contact	NO
Preheating coil overtemperature detector	PreHclOvrTDet	R	Contact	NC
Heat exchanger condensation monitor	HExgCdnMon	R	Contact	NO
Rotary heat exchanger fault	RotHExgFlt	R	Contact	NO
Heat exchanger differential pressure monitor	HExgDiffPMon	R	Contact	NO
Heating coil overtemperature detector	HclOvrTDet	R	Contact	NC
Cooling coil DX evaporator fault	CclDxFlt	R	Contact	NO
Emergency off	EmgOff	R	Contact	NC
Smoke extraction	Smext	R	Contact	NO
Input room operating mode comfort	CmfOpModRIn	R	Contact	NO
Input room operating mode economy	EcoOpModRIn	R	Contact	NO
Input room operating mode unoccupied	UcdOpModRin	R	Contact	NO
Input room operating mode protection	PrtOpModRIn	R	Contact	NO
Combined coil cooling indication input	HCclCStaIn	R	Contact	NO

Input X8

Parameter	BACnet object
Selection for X8	X8Sel, STR_VIEW,59

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Extract air temperature	TEx	R	NTC10k	-50…80 °C
Exhaust air temperature	TEh	R	NTC10k	-50…80 °C
Supply air temperature after heat exchanger	TSuAfHExg	R	NTC10k	-50…80 °C
Supply air temperature after preheating coil	TSuAfPreHcl	R	NTC10k	-50…80 °C
Flow temperature preheating coil	TFlPreHcl	R	NTC10k	-50…80 °C
Frost protection temperature for heating coil	TFrPrtHcl	R	NTC10k	-50…80 °C
Primary chilled water temperature	TChwPm	R	NTC10k	-50…80 °C
Frost protection temperature for combined coil	TFrPrtHCcl	R	NTC10k	-50…80 °C
Rapid ventilation input	RpdVntIn	R	Contact	NO
Kitchen hood ventilation input	KtchVntIn	R	Contact	NO
Fireplace ventilation input	FplcVntIn	R	Contact	NO
Air filter differential pressure monitor	FilAirDiffPMon	R	Contact	NO
Fire damper feedback	FdpFb	R	Contact	NO
Preheating coil overtemperature detector	PreHclOvrTDet	R	Contact	NC
Heat exchanger condensation monitor	HExgCdnMon	R	Contact	NO
Rotary heat exchanger fault	RotHExgFlt	R	Contact	NO
Heat exchanger differential pressure monitor	HExgDiffPMon	R	Contact	NO
Heating coil overtemperature detector	HclOvrTDet	R	Contact	NC
Cooling coil DX evaporator fault	CclDxFlt	R	Contact	NO
Emergency off	EmgOff	R	Contact	NC
Smoke extraction	Smext	R	Contact	NO
Input room operating mode comfort	CmfOpModRIn	R	Contact	NO
Input room operating mode economy	EcoOpModRIn	R	Contact	NO
Input room operating mode unoccupied	UcdOpModRin	R	Contact	NO
Input room operating mode protection	PrtOpModRIn	R	Contact	NO
Combined coil cooling indication input	HCclCStaIn	R	Contact	NO

Input D1, D2

Parameter	BACnet object
Selection for D1	D1Sel, STR_VIEW,49
Selection for D2	D2Sel, STR_VIEW,51

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Rapid ventilation input	RpdVntIn	R	Contact	NO
Kitchen hood ventilation input	KtchVntIn	R	Contact	NO
Fireplace ventilation input	FplcVntIn	R	Contact	NO
Air filter differential pressure monitor	FilAirDiffPMon	R	Contact	NC / NO
Fire damper feedback	FdpFb	R	Contact	NC / NO
Preheating coil overtemperature detector	PreHclOvrTDet	R	Contact	NC / NO
Heat exchanger condensation monitor	HExgCdnMon	R	Contact	NC / NO
Rotary heat exchanger fault	RotHExgFlt	R	Contact	NC / NO
Heat exchanger differential pressure monitor	HExgDiffPMon	R	Contact	NC / NO
Heating coil overtemperature detector	HclOvrTDet	R	Contact	NC / NO
Cooling coil DX evaporator fault	CclDxFlt	R	Contact	NC / NO
Emergency off	EmgOff	R	Contact	NC / NO
Smoke extraction	Smext	R	Contact	NC / NO
Input room operating mode comfort	CmfOpModRIn	R	Contact	NO
Input room operating mode economy	EcoOpModRIn	R	Contact	NO
Input room operating mode unoccupied	UcdOpModRin	R	Contact	NO
Input room operating mode protection	PrtOpModRIn	R	Contact	NO
USB power switch input	USBPowerIn	R	Contact	NO
Combined coil cooling indication input	HCclCStaIn	R	Contact	NO
Supply air fan fault	FanSuFlt	R	Contact	NC / NO
Exhaust air fan fault	FanEhFlt	R	Contact	NC / NO

4.5.1.2 Extension module

The following functions can be selected for pressure sensors and input signals on the I/O extension module POS9.

Input P21

Parameter	BACnet object
Selection for P21	P21Sel, STR_VIEW,73

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Differential pressure supply air fan	DiffPFanSu	R	Integrated sensor	0…3000 Pa
Supply air pressure	PSu	R	Integrated sensor	-3000…3000 Pa

Input P22

Parameter	BACnet object
Selection for P22	P22Sel, STR_VIEW,74

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Differential pressure exhaust air fan	DiffPFanEh	R	Integrated sensor	0…3000 Pa
Extract air pressure	PEx	R	Integrated sensor	-3000…3000 Pa

Input X21

Parameter	BACnet object
Selection for X21	X21Sel, STR_VIEW,181

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Extract air temperature	TEx	R	NTC10k	-50…80 °C
Exhaust air temperature	TEh	R	NTC10k	-50…80 °C
Supply air temperature after heat exchanger	TSuAfHExg	R	NTC10k	-50…80 °C
Supply air temperature after preheating coil	TSuAfPreHcl	R	NTC10k	-50…80 °C
Flow temperature preheating coil	TFlPreHcl	R	NTC10k	-50…80 °C
Frost protection temperature for heating coil	TFrPrtHcl	R	NTC10k	-50…80 °C

Input X22

Parameter	BACnet object
Selection for X22	X22Sel, STR_VIEW,183

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Extract air quality	AQualEx	R	0…10V	0…2000 ppm
Relative humidity for extract air	HuRelEx	R	0…10V	0…100 %
Particulate matter in room	PmR	R	0…10V	0…500 µg/m3

4.5.1.3 Air pressure sensors

The following functions can be selected for pressure sensors and input signals on the air pressure sensors QBM97 # 1 and /or #2.

Input P1

Parameter	BACnet object
Selection for P1	P1Sel, QBM97#1: STR_VIEW,329 QBM97#1: STR_VIEW,424

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Differential pressure supply air fan	DiffPFanSu	R	Integrated sensor	0…3000 Pa
Supply air pressure	PSu	R	Integrated sensor	-3000…3000 Pa
Diff. press. supply air filter	DiffPFilSu	R	Integrated sensor	-3000…3000 Pa
Differential pressure exhaust air fan	DiffPFanEh	R	Integrated sensor	0…3000 Pa
Extract air pressure	PEx	R	Integrated sensor	-3000…3000 Pa
Diff. press. exhaust air filter	DiffPFilEh	R	Integrated sensor	-3000…3000 Pa

Input P2

Parameter	BACnet object
Selection for P2	P2Sel, QBM97#1: STR_VIEW,331 QBM97#1: STR_VIEW,426

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Differential pressure exhaust air fan	DiffPFanSu	R	Integrated sensor	0…3000 Pa
Supply air pressure	PSu	R	Integrated sensor	-3000…3000 Pa
Diff. press. supply air filter	DiffPFilSu	R	Integrated sensor	-3000…3000 Pa
Differential pressure exhaust air fan	DiffPFanEh	R	Integrated sensor	0…3000 Pa
Extract air pressure	PEx	R	Integrated sensor	-3000…3000 Pa
Diff. press. exhaust air filter	DiffPFilEh	R	Integrated sensor	-3000…3000 Pa

Input AI1

Parameter	BACnet object
Selection for AI1	AI1Sel, QBM97#1: STR_VIEW,333 QBM97#1: STR_VIEW,429

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Outside air temperature	TOa	R	NTC10k	-50…50 °C
Extract air temperature	TEx	R	NTC10k	-50…80 °C
Exhaust air temperature	TEh	R	NTC10k	-50…80 °C
Supply air temperature after heat exchanger	TSuAfHExg	R	NTC10k	-50…80 °C
Supply air temperature after preheating coil	TSuAfPreHcl	R	NTC10k	-50…80 °C
Flow temperature preheating coil	TFlPreHcl	R	NTC10k	-50…80 °C
Frost protection temperature for heating coil	TFrPrtHcl	R	NTC10k	-50…80 °C

Input AI2

Parameter	BACnet object
Selection for AI2	AI2Sel, QBM97#1: STR_VIEW,335 QBM97#1: STR_VIEW,460

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Extract air quality	AQualEx	R	0…10V	0…2000 ppm
Relative humidity for extract air	HuRelEx	R	0…10V	0…100 %
Particulate matter in room	PmR	R	0…10V	0…500 µg/m3

4.5.2 Output settings

4.5.2.1 Controller board

The following functions can be selected for output signals on the controller board:
Outputs Q1, Q2, Q3

Parameter	BACnet object
Selection for Q1	Q1Sel, STR_VIEW,61
Selection for Q2	Q2Sel, STR_VIEW,62
Selection for Q3	Q3Sel, STR_VIEW,63

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Outside air damper command	DmpOaCmd	R/W	Relay	NO
Fire damper command	FdpCmd	R/W	Relay	NO
Preheating coil electric command	PreHclElCmd	R/W	Relay	NO
Preheating coil pump command	PreHclPuCmd	R/W	Relay	NO
Earth-to-air heat exchanger bypass damper command	EaHxDmpbCmd	R/W	Relay	NO
Heat exchanger bypass damper command	HExgDmpBypCmd	R/W	Relay	NO
Electric heating coil command	HclElCmd	R/W	Relay	NO
Heating coil pump command	HclPuCmd	R/W	Relay	NO
Cooling coil pump command	CclPuCmd	R/W	Relay	NO
Cooling coil DX evaporator command	CclDxCmd	R/W	Relay	NO
Dehumidifier free-standing command	DhumFrsdCmd	R/W	Relay	NO
A-Alarm indication output	AalmIndOut	R/W	Relay	NO
B-Alarm indication output	BalmIndOut	R/W	Relay	NO
Common alarm indication output	CmnAlmIndOut	R/W	Relay	NO
Operation indication output	OpIndOut	R/W	Relay	NO
Heat exchanger bypass piston damper Open*	HExgDmbCmdOp BO,104 (only on Q1)	R/W	Relay	NO
Heat exchanger bypass piston damper Close*	HExgDmpbCmdCls BO,105 (only on Q2)	R/W	Relay	NO
Combined coil pump command	HCclPuCmd	R/W	Relay	NO

*Heat exchanger bypass piston damper Open / Close are co-dependent and cannot be selected separately. For further details refer to chapter Passive Heat Exchanger, controlled (PltHExg21y) [➙ 108].

Outputs A1, A2, A3, A4

Parameter	BACnet object
Selection for A1	A1Sel, STR_VIEW,264
Selection for A2	A2Sel, STR_VIEW,266
Selection for A3	A3Sel, STR_VIEW,268
Selection for A4	A4Sel, STR_VIEW,270

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Supply air fan speed	FanSuSpd	R/W	0…10V	0…100 %
Exhaust air fan speed	FanEhSpd	R/W	0…10V	0…100 %
Preheating coil electric position	PreHclElPos	R/W	0…10V	0…100 %
Heat exchanger bypass damper position	HExgDmpBypPos	R/W	0…10V	0…100 %
Rotary heat exchanger speed	RotHExgSpd	R/W	0…10V	0…100 %
Heating coil electric position	HclElPos	R/W	0…10V	0…100 %
Heating coil valve position	HclVlvPos	R/W	0…10V	0…100 %
Cooling coil valve position	CclVlvPos	R/W	0…10V	0…100 %
Cooling coil DX evaporator position	CclDxPos	R/W	0…10V	0…100 %
Recirculating air damper position	DmpMxPos	R/W	0…10V	0…100 %
Outside air damper position	DmpOaPos	R/W	0…10V	0…100 %
Combined coil valve position	HCclVlvPos	R/W	0…10V	0…100 %

Output Y1

Parameter	BACnet object
Selection for Y1	Y1Sel, STR_VIEW,68

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Preheating coil electric position	PreHclElPos	R/W	PWM Triac (pulse period 10s)	0…100 %
Heating coil electric position	HclElPos	R/W	PWM Triac (pulse period 10s)	0…100 %
A-Alarm indication output	AalmIndOut	R/W	DO Triac	NO
B-Alarm indication output	BalmIndOut	R/W	DO Triac	NO
Common alarm indication output	CmnAlmIndOut	R/W	DO Triac	NO
Operation indication output	OpIndOut	R/W	DO Triac	NO

4.5.2.2 Extension module

The following functions can be selected for output signals on the extension module POS9:

Output Q21

Parameter	BACnet object
Selection for Q21	Q21Sel, STR_VIEW,71

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Outside air damper command	DmpOaCmd	R/W	Relay	NO
Fire damper command	FdpCmd	R/W	Relay	NO
Preheating coil electric command	PreHclElCmd	R/W	Relay	NO
Preheating coil pump command	PreHclPuCmd	R/W	Relay	NO
Earth-to-air heat exchanger bypass damper command	EaHxDmpbCmd	R/W	Relay	NO
Heat exchanger bypass damper command	HExgDmpBypCmd	R/W	Relay	NO
Electric heating coil command	HclElCmd	R/W	Relay	NO
Heating coil pump command	HclPuCmd	R/W	Relay	NO
Cooling coil pump command	CclPuCmd	R/W	Relay	NO
Cooling coil DX evaporator command	CclDxCmd	R/W	Relay	NO
Dehumidifier free-standing command	DhumFrsdCmd	R/W	Relay	NO
A-Alarm indication output	AalmIndOut	R/W	Relay	NO
B-Alarm indication output	BalmIndOut	R/W	Relay	NO
Common alarm indication output	CmnAlmIndOut	R/W	Relay	NO
Operation indication output	OpIndOut	R/W	Relay	NO

Output A21

Parameter	BACnet object
Selection for A21	A21Sel, STR_VIEW,272

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Supply air fan speed	FanSuSpd	R/W	0…10V	0…100 %
Exhaust air fan speed	FanEhSpd	R/W	0…10V	0…100 %
Preheating coil electric position	PreHclElPos	R/W	0…10V	0…100 %
Heat exchanger bypass damper position	HExgDmpBypPos	R/W	0…10V	0…100 %
Rotary heat exchanger speed	RotHExgSpd	R/W	0…10V	0…100 %
Heating coil electric position	HclElPos	R/W	0…10V	0…100 %
Heating coil valve position	HclVlvPos	R/W	0…10V	0…100 %
Cooling coil valve position	CclVlvPos	R/W	0…10V	0…100 %
Cooling coil DX evaporator position	CclDxPos	R/W	0…10V	0…100 %
Recirculating air damper position	DmpMxPos	R/W	0…10V	0…100 %
Outside air damper position	DmpOaPos	R/W	0…10V	0…100 %

4.5.2.3 Air pressure sensors

The following functions can be selected for output signals on the duct pressure sensor QBM97 #1 and / or #2.

Outputs AO1, AO2

Parameter	BACnet object
Selection for AO1	AO1Sel, QBM97#1: STR_VIEW,337 QBM97#1: STR_VIEW,460
Selection for AO2	AO2Sel, QBM97#1: STR_VIEW,339 QBM97#1: STR_VIEW,462

Selection	BACnet object	R/W	Signal type	Range
None	-	-	-	
Supply air fan speed	FanSuSpd	R/W	0…10V	0…100 %
Exhaust air fan speed	FanEhSpd	R/W	0…10V	0…100 %
Preheating coil electric position	PreHclElPos	R/W	0…10V	0…100 %
Heat exchanger bypass damper position	HExgDmpBypPos	R/W	0…10V	0…100 %
Rotary heat exchanger speed	RotHExgSpd	R/W	0…10V	0…100 %
Heating coil electric position	HclElPos	R/W	0…10V	0…100 %
Heating coil valve position	HclVlvPos	R/W	0…10V	0…100 %
Cooling coil valve position	CclVlvPos	R/W	0…10V	0…100 %
Cooling coil DX evaporator position	CclDxPos	R/W	0…10V	0…100 %
Recirculating air damper position	DmpMxPos	R/W	0…10V	0…100 %
Outside air damper position	DmpOaPos	R/W	0…10V	0…100 %

4.5.3 Default configuration

The controller's I/O are preconfigured for the following applications:

- Supply and exhaust fan speed control (with feedback signal 0...10V)
- Heat exchanger (plate type) with on/off bypass
- Pre-electric heating coil (modulation control)
- Contact input for rapid ventilation (Fan boost) and unoccupied operating mode
- Common alarm output

Pin	Description	BACnet object	Signal type	Note
B1	Outside air temperature	TOa	NTC10k	
B2	Supply air temperature	TSu	NTC10k	
B3	Exhaust air temperature	TEh	NTC10k	
B4	Extract air temperature	TEx	NTC10k	
D1	Rapid ventilation input	RpdVntIn	Contact	NO
D2	Input room operating mode unoccupied	UcdOpModRIn	Contact	NO
X1	Supply air fan speed feedback voltage	FanSuSpdFb	0…10V	
X2	Exhaust air fan speed feedback voltage	FanEhSpdFb	0…10V	
X3	Heating coil overtemperature detector	PreHclOvrTDet	Contact	NC
X8	Supply air temperature after preheating coil	TSuAfPreHcl	NTC10k	
Q1	Heat exchanger bypass damper command	HExgDmpBypCmd	Relay	
Q2	Common alarm indication output	CmnAlmIndOut	Relay	
Q3	Outside air damper command	DmpOaCmd	Relay	
A1	Supply air fan speed	FanSuSpd	0…10V	
A2	Exhaust air fan speed	FanEhSpd	0…10V	
A3	Preheating coil electric position	PreHclElPos	0…10V	
A4	None	-	-	
Y1	None	-	-	

For the peripheral devices, the I/Os are not pre-configured.

4.5.4 Required I/Os

If an I/O that is required for a functionality is missing, ABT Go / ABT Site indicate this with a configuration check message.

If the required I/Os cannot be detected, ABT Go / ABT Site prompts with a message e.g. "Output required Supply air fan speed".

Check if all required I/Os for the selected functionalities are defined. Compare your defined I/Os with the list of required I/Os per functionality below.

Functionalities not mentioned in the list do not require any specific I/O.

Control Functions

Control Functions	Selection	IO required
Always required		Output for supply air fan speed (FanSuSpd)
		Output for exhaust air fan speed (FanEhSpd)
		Input for supply air temperature (TSu)
		Input for outside air temperature (TOa)
Ventilation control	Ventilation control 21y, air volume flow	Inputs for differential pressure supply air fan (DiffPFanSu) and exhaust air fan (DiffPFanEh)
	Ventilation control 22y, air duct pressure	Input for supply (PSu) or extract (PEx) air duct pressure
Temperature control	Temperature cascade control 21y	Input for extract air temperature (TEx) or POS8/QMX3 value for room temperature (TR)
Dehumidification control	Active	Input for extract air humidity (HuRelEx) or POS8/QMX3 value for room air humidity (HuRelR) or room air humidity evaluation, if no humidity sensor is available
Kitchen hood ventilation operation	Active	Input for kitchen hood ventilation (KtchVntIn)
Particulate matter control	Active	Input for particulate matter in room (PmR)
Air quality control	Active	Input for extract air quality (AQualEx) or QMX3 value for room air quality (AQualR)

Plant components

Plant Component	Selection	IO required
Preheating coil	Electric preheating coil 21y	Inputs for supply air temperature after preheating coil (TSuAfPreHcl) and preheating coil overtemperature detector (PreHclOvrT). Output for preheating coil electric (PreHclElPos or PreHclElCmd)
	Brine preheating coil 21y	Input for flow temperature preheating coil (TFlPreHcl). Output for preheating coil pump (PreHclPuCmd)
	Earth to air heat exchanger 21y	Output for earth to air heat exchanger bypass command (EaHxDmpbCmd)
Outside air damper	Shutoff damper for outside air 21y	Output for outside air damper command (DmpOaCmd)
	Mixing air damper 21y	Output for mixing air damper position (DmpMxPos)
Energy recovery	Rotating heat exchanger 21y	Output for rotary heat exchanger speed (RotHExgSpd)
	Plate heat exchanger 21y, with bypass damper	Output for heat exchanger bypass damper (HExgDmpBypPos or HExgDmpBypCmd)
Heating coil	Electric heating coil 21y	Input for heating coil overtemperature detector (HclOvrTDet). Output for heating coil electric (HclElPos or HclElCmd)
	Hot water heating coil 21y	Input for frost protection temperature for heating coil (TFrPrtHcl). Output for heating coil water (HclVlvPos or HclPuCmd)
Cooling coil	Chilled water cooling coil 21y	Output for cooling coil chilled water (CclVlvPos)
	DX evaporator cooling coil 21y	Output for cooling coil DX evaporator (CclDxPos or CclDxCmd)

Plant Component	Selection	IO required
Combined coil	Heat/Cool coil 21y	Output for combined coil valve position (HCclVlvPos)
Fire damper	Fire damper 21y, motorized	Input for fire damper feedback (FdpFb). Output for fire damper command (FdpCmd)
Dehumidifier free-standing	Active	Output for dehumidifier free-standing (DhumFrsdCmd)

Parameters

Parameter	BACnet object	Configuration check
I/O config. check for ventilation	IOCnfCkVnt, STR_VIEW, 84	Messages for ventilation related functions
I/O config. check for heat exchanger and damper	IOCnfCkHxDmp, STR_VIEW, 85	Messages for heat exchanger and damper related functions
I/O config. check for heating	IOCnfCkH, STR_VIEW, 243	Messages for heating related functions
I/O config. check for cooling	IOCnfCkC, STR_VIEW, 244	Messages for cooling related functions
I/O config. check for air quality	IOCnfCkAQual, STR_VIEW, 363	Messages for particulate matter, humidity and air quality related functions

4.6 General settings

4.6.1 Actual configuration

The configuration parameters are only accessible and thus visible in controller stop mode.

However, the selected configuration is copied to information parameters - called actual configuration - that are visible in every controller state and can also be checked via ABT Go / ABT Site.

Note

Inputs/outputs or devices marked as active indicate only that the corresponding functionality or device is enabled, but not that the sensor or device is physically connected and operational.

Favorite	BACnet object	Description
Actual configuration	ActlCnf, STR_VIEW,80	Favorite structure containing the actual configuration info/objects

Actual configurations for control functions

Control functions and HVAC components	BACnet object
Actual configuration for ventilation control	ActlVntCtlCnf, MVAL,398
Actual configuration for temperature control	ActlTCtlCnf, MVAL,393
Actual configuration for kitchen hood ventilation	ActlKtchVntCnf, MVAL,394
Actual configuration for fireplace ventilation	ActlFplcVntCnf, MVAL,395
Actual configuration for dehumidification control	ActlDhuCtlCnf, MVAL,396
Actual configuration for air quality control	ActlAqCtlCnf, MVAL,664
Actual configuration for particulate matter control	ActlPmCtlCnf, MVAL,572
Actual configuration for outside air damper	ActlDmpOaCnf, MVAL,403
Actual configuration for preheating coil	ActlPreHclCnf, MVAL,401
Actual configuration for energy recovery	ActlErcCnf, MVAL,402
Actual configuration for heating coil	ActlHclCnf, MVAL,399
Actual configuration for cooling coil	ActlCclCnf, MVAL,400
Actual configuration for combined coil	ActlHCclCnf, MVAL,990
Actual configuration for fire damper	ActlFdpCnf, MVAL,404
Actual configuration for dehumidifier	ActlDhumCnf, MVAL,487

Actual configuration for controller board

I/O	BACnet object
Actual configuration for B1	ActlB1Cnf, MVAL,351
Actual configuration for B2	ActlB2Cnf, MVAL,352
Actual configuration for B3	ActlB3Cnf, MVAL,353
Actual configuration for B4	ActlB4Cnf, MVAL,354
Actual configuration for D1	ActlD1Cnf, MVAL,355
Actual configuration for D2	ActlD2Cnf, MVAL,356
Actual configuration for X1	ActlX1Cnf, MVAL,357
Actual configuration for X2	ActlX2Cnf, MVAL,358
Actual configuration for X3	ActlX3Cnf, MVAL,359
Actual configuration for X8	ActlX8Cnf, MVAL,360
Actual configuration for Q1	ActlQ1Cnf, MVAL,365
Actual configuration for Q2	ActlQ2Cnf, MVAL,366
Actual configuration for Q3	ActlQ3Cnf, MVAL,367
Actual configuration for A1	ActlA1Cnf, MVAL,432

I/O	BACnet object
Actual configuration for A2	ActIA2Cnf, MVAL,433
Actual configuration for A3	ActIA3Cnf, MVAL,434
Actual configuration for A4	ActIA4Cnf, MVAL,435
Actual configuration for Y1	ActIY1Cnf, MVAL,372

Actual configuration for POS9.. extension module

I/Os	BACnet object
Actual configuration for P21	ActIP21Cnf, MVAL,361
Actual configuration for P22	ActIP22Cnf, MVAL,362
Actual configuration for X21	ActIX21Cnf, MVAL,363
Actual configuration for X22	ActIX22Cnf, MVAL,364
Actual configuration for Q21	ActIQ21Cnf, MVAL,373
Actual configuration for A21	ActIA21Cnf, MVAL,436

Actual configuration for QBM97 duct pressure sensor #1

I/Os	BACnet object
Actual configuration for P1	ActIP1Cnf, MVAL,578
Actual configuration for P2	ActIP2Cnf, MVAL,579
Actual configuration for AI1	ActIAI1Cnf, MVAL,580
Actual configuration for AI2	ActIAI2Cnf, MVAL,581
Actual configuration for AO1	ActIAO1Cnf, MVAL,582
Actual configuration for AO2	ActIAO2Cnf, MVAL,583

Actual configuration for QBM97 duct pressure sensor #2

I/Os	BACnet object
Actual configuration for P1	ActIP1Cnf(2), MVAL,888
Actual configuration for P2	ActIP2Cnf(2), MVAL,889
Actual configuration for AI1	ActIAI1Cnf(2), MVAL,890
Actual configuration for AI2	ActIAI2Cnf(2), MVAL,891
Actual configuration for AO1	ActIAO1Cnf(2), MVAL,886
Actual configuration for AO2	ActIAO2Cnf(2), MVAL,887

Actual configuration for room operator unit, room sensors and peripheral devices

Devices	BACnet object
Actual configuration room operator unit POS8	ActIPos8Cnf, MVAL,747
Actual configuration for room sensor QMX3.P30	ActIQmx3p30Cnf, MVAL,412
Actual configuration for room sensor QMX3.P40	ActIQmx3p40Cnf, MVAL,413
Actual configuration for room sensor QMX3.P70	ActIQmx3p70Cnf, MVAL,414
Actual configuration I/O extension device POS9	ActIPos9Cnf, MVAL,576
Actual configuration duct pressure device QBM97#1	ActIQbm97Cnf1, MVAL,577
Actual configuration duct pressure device QBM97#2	ActIQbm97Cnf2, MVAL,881
Actual configuration modbus fans	ActIMdbsFanCnf, MVAL,920

4.6.2 Language selection

The controller supports the following languages:

- English
- German
- French
- Italian
- Spanish

Languages can be selected in the client (e.g. Climatix IC, ABT Go, ABT Site or End user app). All translated objects will be shown in the selected language.

4.6.3 Device Description

The “Device Description” text string (BA property 28) can be displayed.

Object Name (HvacFnct26y_A) can be displayed and changed in the ABT Go via configuration\Network configuration.

Available parameters

Basic settings	BACnet object	R/RW	Note
Device Description	Device	R	(Read only in Cloud / Facility manager); changeable in BACnet Browser
Object Name	Device	R/RW	

4.6.4 Controller configuration: password protected access by user roles

The controller configuration can be backed up and/or restored. The handling is safe and flexible:

- The controller configuration can be accessed by different user roles.
- The controller/plant configuration can be password-protected for each of these user roles.
- An Administrator can set the password in ABT Go or ABT Site.
- Users can backup/restore their **own** configuration file.

The controller has 3 default users (see table below). A total of 6 users are possible.

Example of allowed operations by different user roles.

User role	Role name in ABT Site	Configuration operations via ABT Go
Administrator	Administrator	• Firmware upgrade • Configuration backup • Configuration restore
Installer	Advanced engineer	• Firmware upgrade • Configuration backup • Configuration restore
Field Support	Standard engineer	• Configuration backup • Configuration restore

4.6.5 Factory Reset

A Special BIN file can reset the controller to Siemens factory default settings (including a password reset).

You must request the BIN file.

The controller must be reset to factory settings on site.

Download the BIN file, for example, via ABT Go and set input DI1 to 1 (for example via a closed contact). Once completed, the controller starts the factory reset and restarts automatically.

Note: This BIN file does not include normal HRV functions, it can only be used for the factory reset.

5 Application functionalities

5.1 Application use cases

The application can be operated in two different use cases that

1. HRV system as the only influence on air flow:

Characteristics:

- Changes in fan speed have a direct influence on the air flow in the multiple rooms.
- The fan speed is depending on fan speed control, special fan speed control, temperature-, humidity- and air quality control.
- Commonly used with linear fan speed or air flow control.

Advantages:

- This configuration allows the full functionality described in chapter "Configuration [➙ 26]".

2. Independent secondary controls maintain dampers or VAV boxes:

Characteristics:

- Changes in fan speed might have no influence on the air flow in the rooms, as they can be compensated by the secondary controls.
- Commonly used with HRV duct pressure control.

Advantages:

- The influence of the room conditions on the HRV air flow can be limited depending on the system's functionality.
- 4 modes are available, in which the available functions and thus control choices vary from mode to mode. For example, mode 4 can be selected for VAV supply and extract:

Secondary control / Function	Mode 1	Mode 2	Mode 3	Mode 4
Fan boost	X	X		
Fireplace mode	X	X	X	
Kitchen hood mode	X	X	X	
Temperature control	X			
Humidity control	X			
Air quality control	X			

Configuration parameters

Basic settings	BACnet object	R/RW	Note
Room influence to fan speed configuration	FanSpdCtlCnf MVAL, 392	RW	Room influence to fan speed configuration

In ABT Go this parameter can be found under "Favorites > Favorite operation > Temperature control".

5.2 Controlling of operating modes

Three control modes, Auto, Manual or Temporary, are available for the operation of the plant.

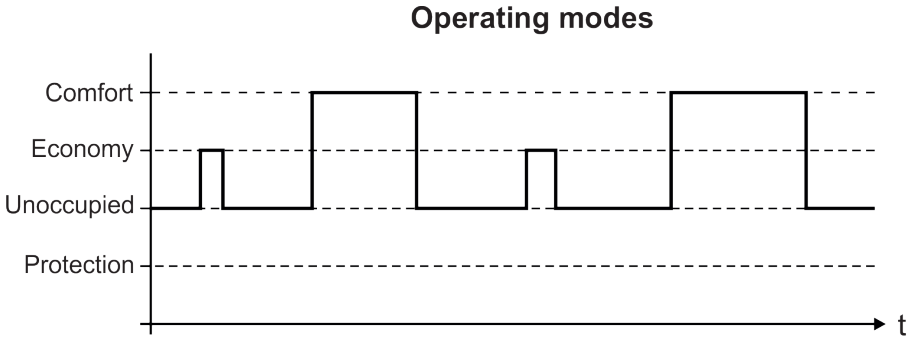
The system modes control whether the system switches between different operating modes automatically or whether the user sets the operating modes himself (for Operating modes see "Operating mode categories [➙ 58]").

In ABT Go the parameter can be found in the plant scheduler.

Auto mode

In Auto mode, the operating modes are controlled via time switch program (TSP).

The set time switch program changes between operating modes Comfort, Economy, and Unoccupied depending on the TSP. A TSP can be set via POS8.44X0 or smart phone app (both ABT Go or End User App). For TSP mode, 3 normal operating modes are supported, each with individual setpoints.



Default time switch programs are

Mo- Fr

00:00 – 06:00 = Economy
06:00 – 09:00 = Comfort
09:00 – 12:00 = Unoccupied
12:00 – 14:00 = Comfort
14:00 – 18:00 = Unoccupied
18:00 – 22:00 = Comport
22:00 – 24:00 = Economy

Sa- So

00:00 – 06:00 = Economy
06:00 – 22:00 = Comfort
22:00 – 24:00 = Economy

Manual mode

In Manual mode, the operating mode is switched manually between Comfort, Economy and Unoccupied. The end user activates the desired operating mode via POS8.44x0, configured digital input or End User app.

Temporary mode

The Temporary mode is used to run the special operating modes (e.g. Fan boost, Fire place). It can be activated in order to run the application in a special mode for a limited, configurable time.

The end user activates the desired special mode manually via POS8.44X0, configured digital input or End User app.

5.3 Operating mode categories

The following selectable operating modes belong to operating mode categories:

Operating mode	Category	Operating via	Duration	Activation signal
Protection	Off mode	APP, DI	Permanent	
Unoccupied	Normal or Away mode	APP, POS8, DI	Permanent or TSP	
Economy	Normal mode	APP, POS8, DI	Permanent or TSP	
Comfort	Normal or Home mode	APP, POS8, DI	Permanent or TSP	
Fan boost (Rapid ventilation)	Temporary mode	APP, POS8, DI	Temporary	Continuous or pulse signal (duration can be parameterized)
Fire place	Temporary mode	APP, POS8, DI	Temporary	Continuous or pulse signal (duration can be parameterized)
Kitchen hood	Temporary mode	DI	Temporary	Continuous signal

5.3.1 Normal modes

The normal modes Unoccupied, Economy and Comfort are the main operating modes that can be applied for a constant and, if desired, infinite time. For each one, certain settings are defined, which sensibly apply to the corresponding state of the system.

Unoccupied The building is unoccupied and the system is operated with the most essential settings needed.

Economy The building is occupied, but the system is operated with economical, energy-efficient settings.

Comfort The building is occupied and the system is operated according to the needs of the user.

For the normal modes, individual values for all settings, including relative humidity (r.H.), air quality (AQ) and temperature can be defined.

Available parameters Normal modes

Description	BACnet object	R/RW
Comfort operation mode input	CmfOpModRIn D1: BI,82 D2: BI,99 X3: BI,116 X8: BI,133	R
Economy operation mode input	EcoOpModRIn D1: BI,83 D2: BI,100 X3: BI,117 X8: BI,134	R
Unoccupied operation mode input	UcdOpModRIn D1: BI,84 D2: BI,101 X3: BI,118 X8: BI,135	R

5.3.2 Temporary modes

The modes Fan Boost, Fire Place and Kitchen Hood are temporary modes that can only be activated for a certain, settable time.

The temporary modes are activated either via POS8.44X0 or configured digital input as an impulse button or, when pressed longer, as an "egg timer".

Once activated, they override all normal operating mode and for the set time, the dedicated settings for the temporary mode apply, which mostly concerns the fan speed.

Signal for Fire Place and Fan Boost

- **If the duration of the signal is < 5 seconds:**
  The signal is interpreted as an impulse: The temporary mode is started and only stopped when the timer has expired.
- **If the duration of the signal is > 5 seconds:**
  The signal is interpreted as an “egg timer”: Temporary mode is started when the signal is active and stopped when the signal is inactive.

Signal for Kitchen Hood

The signal is interpreted as a feedback from the kitchen hood: The temporary mode is started when the signal is active and stopped when the signal is inactive.

The temporary operating modes have no dedicated r.H., AQ and temperature settings. For these settings, the Economy values apply.

5.3.3 Special modes (At home / Away)

“At home”-mode and “Away”-mode are preset special modes that the end user can switch between via End User app or POS8.44x0.

- If the application is switched to **Away**, operating mode is set to **Unoccupied**.
- If the application is switched to **At home**, operating mode is set back to **the normal operation**.

The “Away” mode has priority over normal and temporary modes in both AUTO and MANUAL operation (except for configured digital input and binary input signals). This means that one can switch to “Away” and return to “At home” mode anytime.

Examples

- In AUTO operation:
  - Switching to “Away” sets the operating mode to Unoccupied.
  - Switching back to "At home" returns the controller to AUTO operation and selects the operating mode currently defined by the TSP (can be Economy or Comfort or even Unoccupied).
- In MANUAL operation:
  - Switching to “Away” sets the operating mode to Unoccupied.
  - Switching back to “At home” returns the controller to MANUAL operation and the previous operating mode (can be Economy or Comfort or even Unoccupied).

Delay time for Unoccupied

The Unoccupied mode can be set with a delay time that starts when the device is switched from any operating mode to Unoccupied.

This is useful, for example, when the end user leaves the house immediately after cooking or showering without command to the application. The switch to Unoccupied mode takes then place after the timer has elapsed.

Parameter	Detail information	BACnet object	R/RW	State
Unoccupied delay timer duration		DlyOnUnOcc	RW	

5.3.4 Off mode

The operating mode Protection switches the system into a form of "Off" mode in which the fans no longer run. However, the system is not switched off completely, individual pumps can continue to operate and the frost protection strategy continues to run for as long as has been set.

The protection mode can only be set in the configuration and cannot be set by the end user themselves (neither via app nor POS8.44X0).

5.4 Operating mode settings

The settings for the operating modes define the specific settings for the **supply and exhaust fans** for all operating modes and for the speed, flow and pressure control strategies. These settings are configured by the installer. The end user has no option to change the values for the operating modes.

For Comfort, Economy and Unoccupied modes, dedicated settings for **relative humidity (r.H.), air quality (AQ) and temperature** can be defined.

The temporary operating modes Fan boost, Fire place and Kitchen hood have no dedicated r.H., AQ and temperature settings. For these modes, the settings for Economy mode apply.

Available parameters

Parameter	Detail information	BACnet object	R/RW	State
Current operating mode (constant, for end-user)	**Prio 7**: Request from digital inputs: *Comfort, Economy, Unoccupied, Protection* **Prio 10**: Periodic maintenance or maintenance shutdown **Prio 12**: Away: *Unoccupied* **Prio 13**: Manual: *Comfort, Economy, Unoccupied, Protection* **Prio 15**: TSP: *Comfort, Economy, Unoccupied*	ROpMod MVAL,168	RW	1: Protection 2: Unoccupied 3: Economy 4: Comfort
Current ventilation operating mode		HrvSta MVAL,166	R	1: Protection 2: Unoccupied 3: Economy 4: Comfort 5: Kitchen hood 6: Fire place 7: Fan boost

Configuration parameter

Description	BACnet object	R/RW	State
TSP overrides manual operation upon a change	SchedRstManCnf BVAL,218	RW	0: manual operation is permanent 1: manual operation is overridden with the next change

Analysis

Parameter	Detail information	R/RW	State
Present plant operating mode	Plant operating mode including protection functions **Prio 3**: Emergency **Prio 4:** A-Alarm or power-up **Prio 9**: De-icing **Prio 12**: Request from digital inputs, also temporary boost **Prio 13**: If in temporary mode	RW	1: Off by A-Alarm 2: Protection 3: Economy 4: Pre-Comfort 5: Comfort 6…9: Not used 10: Free Cooling 11: Not used 12: Boost, fireplace or kitchen 13: Not used 14: Off by emergency 15: Smk positive press 16: Smk negative press 17: Smk Purge 18: Frost water 19: Startup/Shup down 20: De-icing with fans

5.5 Fan speed control

The controller supports three different types of fan control strategies:

- Linear fan speed
- Constant air flow control
- Constant duct pressure control.

See "Choosing the functions [➙ 30]".

Only one type of control strategy can be active at a time and the same strategy must be used for both the supply and exhaust fan.

The change from one control strategy to another can be made only during commissioning.

Strategy	Unit
Linear fan speed	%
Constant air flow control	m3/h
Constant duct pressure control	Pa

Note: For the sake of simplicity, the term "fan speed" is used for all three strategies throughout the document.

5.5.1 Linear fan speed (VntCtl23y, FanSu23y, FanEh23y)

Fan speed control

Supply fan and exhaust fan setpoints have defined setting for each operating mode level. Individual percentage value is used between 0…100 %. These settings only define the fan speed used in various operating modes and they have no effect on other functions like de-icing or AQ/r.H. control.

During active AQ/r.H. control, values set here are used as minimum speed. During active temperature control, values set here are used as maximum speed. Depending on deviations to setpoint, temperature, AQ/r.H. control can freely increase/decrease the speed of both fans simultaneously with symmetrical control signal which then keeps the set supply / exhaust ratio in every situation.

Fan speed monitoring

Fan spend can be monitored to detect the actual speed of the fans or possible device problems if fans with tacho signal output are used, or a separate analog input for fan speed is available, or if Modbus fans are used, the fan speed can be monitored to detect the actual speed of the fans or possible device problems. The tacho input signal is mapped to a 0...100% value and each fan has a configurable minimum fan speed and a minimum feedback signal assigned to the minimum fan speed value. A fan speed feedback fault is detected if fan speed output is higher than the minimum fan speed and the fan speed feedback drops below the fan speed feedback fault limit for longer than an allowed tolerance time.

The allowed tolerance time (limited to a maximum of 60 sec) is the time, after switching on, that it has built up the correct air flow. The same conditions apply for the startup procedure. The startup configuration is also used for the fan speed monitoring.

Fan speed feedback fault is combined with the fan error signal to create a fan fault alarm.

For Modbus fans, Modbus communication is also supervised.

The alarm category of all fan alarms for both fans can be configured as

- A-Alarm (shutting down the plant) or
- B-Alarm (only indication, no shutdown function) or
- None (no fault supervision. Use only when no feedback signal exists and do not use on Modbus fans).

Available parameters for linear fan speed

Unit configuration	BACnet object	R/RW	Unit
Minimum fan speed	FanSpdMinRel AVAL,210	RW	%
Fan speed feedback fault limit	FanSpdFbFltLm AVAL,209	RW	% if no feedback signal available, see alarming
Allowed tolerance time fan speed feedback fault supply fan = startup delay time step 7	TiSttUpSpdVnt PINTVAl,104	RW	Tolerance time = TiSttUpSpdVnt – 5 sec, maximal 60 sec
Allowed tolerance time fan speed feedback fault exhaust fan = startup delay time step 6	DlyOnAflEhSta PINTVAL,129	RW	Tolerance time = DlyOnAflEhSta – 5 sec, max. 60 sec
Ramp up/down time fans	TiRmpFanSuSpd PINTVAL,105	RW	s

5.5.1.1 Available parameters for supply fan (linear fan speed)

Available parameters for supply fan

Current state	BACnet object	R/RW	Unit
Present ventilation setpoint for air quality control	PrSpAQual AVAL,50	R	ppm
Supply fan speed Prio 2: Fire / Smoke Prio 5: Protection	FanSuSpd A1: AO,102 A2: AO,111 A3: AO,120 A4: AO,129 Modbus: AO,149 POS9: AVAL,750 QBM1AO1: AVAL,711 QBM1AO2: AVAL,712 QBM2AO1: AVAL,713 QBM2AO2: AVAL,718	RW	%
Supply fan speed feedback	FanSuSpdFb Tacho:AI,65 0~10V:AI,96 Modbus: AI,163	R	%
Supply fan fault	FanSuFlt D1: BI, 174 (NO) BI, 175 (NC) D2: BI, 176 (NO) BI, 177 (NC) X3: BI, 178 (NO) X8: BI, 180 (NO) Modbus: BI,144	R	

Operating mode settings	BACnet object	R/RW	Unit
Unoccupied: supply	SpFanSuSpdUcd AVAL,290	RW	%
Economy: supply	SpFanSuSpdEco AVAL,289	RW	%
Comfort: supply	SpFanSuSpdCmf AVAL,288	RW	%
Fire place: supply	SpFanSuSpdFplc AVAL,87	RW	%
Kitchen hood: supply	SpFanSuSpdKtch AVAL,291	RW	%
De-icing fan speed supply	SpFanSuSpdDeic AVAL,208	RW	%
Boost: supply	SpFanSuSpdBoost AVAL,787	RW	%

Special settings	BACnet object	R/RW	Note
Tacho signal mapping Pulses/sec for 100% fan speed	FanSuSpdFb AI,65	RW	Property 4965 Range 0...300 pulse/s

Testing and debugging	BACnet object	R/RW	State
Fan device mode Prio 2: Fire / Smoke Prio 5: Protection	FanSuDevMod MVAL,151	RW	1: Off 2: Control mode 3: Max.air vol.flow 4: Min.air vol.flow 5: Manual speed 6: Smoke ctrl. air flow 7: De-icing air vol.flow 8: Startup

5.5.1.2 Available parameters for exhaust fan (linear fan speed)

Available parameters for exhaust fan

Current state	BACnet object	R/RW	Unit
Exhaust fan speed Prio 2: Fire / Smoke Prio 5: Protection	FanEhSpd A1: AO,103 A2: AO,112 A3: AO,121 A4: AO,130 Modbus: AO,150 POS9: AVAL,751 QBM1AO1: AVAL,714 QBM1AO2: AVAL,715 QBM2AO1: AVAL,716 QBM2AO2: AVAL,717	RW	%
Exhaust fan speed feedback	FanEhSpdFb Tacho:AI,69 0~10V:AI,97 Modbus: AI,164	R	%
Exhaust fan fault	FanEhFlt D1: BI, 182 (NO) BI, 183 (NC) D2: BI, 184 (NO) BI, 185 (NC) X3: BI, 186 (NO) X8: BI, 187 (NO) Modbus: BI,145	R	

Operating mode settings	BACnet object	R/RW	Unit
Unoccupied: exhaust	SpFanEhSpdUcd AVAL,294	RW	%
Economy: exhaust	SpFanEhSpdEco AVAL,293	RW	%
Comfort: exhaust	SpFanEhSpdCmf AVAL,292	RW	%
Fire place: exhaust	SpFanEhSpdFplc AVAL,92	RW	%
Kitchen hood: exhaust	SpFanEhSpdKtch AVAL,528	RW	%
De-icing fan speed exhaust	SpFanEhSpdDeic AVAL,295	RW	%
Boost: exhaust	SpFanEhSpdBoost AVAL,788	RW	%

Special settings	BACnet object	R/RW	Note
Tacho signal mapping Pulses/sec for 100% fan speed	FanSuSpdFb AI,69	RW	Property 4965 Range 0…300 pulse/s

Testing and debugging	BACnet object	R/RW	State
Fan device mode Prio 2: Fire / Smoke Prio 5: Protection	FanEhDevMod MVAL,163	RW	1: Off 2: Control mode 3: Max.air vol.flow 4: Min.air vol.flow 5: Manual speed 6: Smoke ctrl. air flow 7: De-icing air vol.flow

5.5.2 Constant air flow regulation (VntCtl21y, FanSu21y, FanEh21y)

Fan speed control

Supply fan and exhaust fan setpoints have defined air flow settings for each operating mode level. Setpoint used in the controller is m^3/h.

These settings only define the flow used in various operating modes and they have no effect on other functions like de-icing, AQ/r.H. control.

During active AQ/r.H. control, values set here are used as minimum level. During active temperature control, the values are used as maximum levels. Depending on deviations to setpoint, temperature, AQ, r.H. control can freely modulate the speed of both fans simultaneously with symmetrical control signal which then keeps the set supply / exhaust ratio in every situation.

By measuring either the dynamic pressure via pitot tube or the pressure drop over a flow resistance (or a combination of both) air flow at these points can be calculated by using a fan specific K-value. The following formulas are used and only m^3/h values can be set.

$$Supply\ airflow\ \left(m^3/_h\right) = \sqrt{\Delta P_1} \times K1$$

$$Extract\ airflow\ \left(m^3/_h\right) = \sqrt{\Delta P_2} \times K2$$

Range for setpoints depends on the ventilation unit's capacity. K-value is a constant and unique for each fan type.

If a pressure sensor becomes faulty and flow control can no longer be guaranteed, the fan control of the fan with a faulty sensor is automatically switched to linear fan speed control. Setpoints used for the linear fan speed control are then calculated by using the unit's nominal air flow value as 100 % and setting the actual flow setpoint proportionally according to the maximum value.

Example: If the air flow nominal is 100 m^3/h and the flow for the Away-setting is set to 35 m^3/h, a fan speed of 35 % (3.5 V) is used in the event of a fault.

Fan speed monitoring

The fan speed can be monitored to detect the actual speed of the fans or possible device problems if fans with tacho signal output are used, or a separate analog input for fan speed is available, or Modbus fans are used. The tacho input signal is mapped to a 0…100 % value with each fan configurable to a minimum fan speed and a minimum feedback signal assigned to the minimum fan speed value. A fan speed feedback fault is detected if fan speed output is higher than the minimum fan speed and the fan speed feedback drops below fan speed feedback fault limit for longer than an allowed tolerance time.

The allowed tolerance time (limited to a maximum of 60 sec) is the time after switch-on that the fan has built up the correct air flow. The same conditions apply for the startup procedure The startup configuration is also used for fan speed monitoring.

Fan speed feedback fault is combined with the fan error signal to create a fan fault alarm.

For Modbus fans, Modbus communication is also supervised.

The alarm category of all fan alarms for both fans can be configured as

- A-Alarm (shutting down the plant) or
- B-Alarm (only indication, no shutdown function) or
- None (no fault supervision. Use only when no feedback signal exists and do not use on Modbus fans).

Available parameters for air flow control

Unit configuration	BACnet object	R/RW	Unit
Air flow nominal	AirFlNom AVAL,187	RW	m^3/h Maximum air flow of the unit
Air flow minimum	AirFlMin AVAL,186	RW	m^3/h Minimum air flow of the unit
Minimum fan speed	FanSpdMinRel AVAL,192	RW	%
Fan speed feedback fault Limit	FanSpdFbFltLm AVAL,190	RW	% if no feedback signal available, see alarming
Allowed tolerance time fan speed feedback fault supply fan = startup delay time step 7	TiSttUpSpdVnt PINTVAl,104	RW	Tolerance time = TiSttUpSpdVnt – 5 sec, maximal 60 sec
Allowed tolerance time fan speed feedback fault exhaust fan = startup delay time step 6	DlyOnAflEhSta PINTVAL,129	RW	Tolerance time = DlyOnAflEhSta – 5 sec, max 60 sec
Ramp up / down time fans	TiRmpFanSuSpd PINTVAL,93	RW	s

5.5.2.1 Available parameters for the supply fan (constant air flow)

Available parameters supply fan

Current state	BACnet object	R/RW	Unit
Present flow setpoint supply	SpAirFlSu AVAL,182	R	m^3/h
Present flow supply	AirFlSu AVAL,183	R	m^3/h
Supply fan pressure diff.	DiffPFanSu POS9: AVAL,17 QBM1P1: AVAL,459 QBM1P2: AVAL,701 QBM2P1: AVAL,643 QBM2P2: AVAL,707	R	Pa
Supply fan speed Prio 2: Fire / Smoke Prio 5: Protection	FanSuSpd A1: AO,102 A2: AO,111 A3: AO,120 A4: AO,129 Modbus: AO,149 POS9: AVAL,750 QBM1AO1: AVAL,711 QBM1AO2: AVAL,712 QBM2AO1: AVAL,713 QBM2AO2: AVAL,718	RW	%
Supply fan speed feedback	FanSuSpdFb Tacho:AI,65 0~10V:AI,96 Modbus: AI,163	R	%
Supply fan fault	FanSuFlt D1: BI, 174 (NO) BI, 175 (NC) D2: BI, 176 (NO) BI, 177 (NC) X3: BI, 178 (NO) X8: BI, 180 (NO) Modbus: BI,144	R	

Operating mode settings	BACnet object	R/RW	Unit
Unoccupied: supply	SpAirFlSuUcd AVAL,272	RW	m^3/h
Economy: supply	SpAirFlSuEco AVAL,271	RW	m^3/h
Comfort: supply	SpAirFlSuCmf AVAL,270	RW	m^3/h
Fire place: supply	SpAirFlSuFplc AVAL,57	RW	m^3/h
Kitchen hood: supply	SpAirFlSuKtch AVAL,273	RW	m^3/h
De-icing air flow	SpAirFlSuDeic AVAL,181	RW	m^3/h
Boost: supply	SpAirFlSuBoost AVAL,789	RW	m^3/h

Special settings	BACnet object	R/RW	Unit
Supply fan Kp	TnAirFlSuCtr PINTVAL,97	RW	% / (m^3/h)
Supply fan Tn	GainAirFlSuCtr AVAL,191	RW	s
K-factor, supply fan	AirFlSuCoef AVAL,188	RW	m^3/h per Pa
Tacho signal mapping Pulses/sec for 100% fan speed	FanSuSpdFb AI,65	RW	Property 4965 Range 0…300 pulse/s

Testing and debugging	BACnet object	R/RW	State
Fan device mode Prio 2: Fire / Smoke Prio 5: Protection	FanSuDevMod MVAL,146	RW	1: Off 2: Control mode 3: Max.air vol.flow 4: Min.air vol.flow 5: Manual speed 6: Smoke ctrl. air flow 7: De-icing air vol.flow 8: Startup

5.5.2.2 Available parameters for exhaust fan (constant air flow)

Available parameters for exhaust fan

Current state	BACnet object	R/RW	Unit
Present flow setpoint exhaust	SpAirFlEh AVAL,227	R	m^3/h
Present flow exhaust	AirFlEh AVAL,228	R	m^3/h
Exhaust fan pressure diff.	DiffPFanEh POS9: AVAL,20 QBM1P1: AVAL,689 QBM1P2: AVAL,461 QBM2P1: AVAL,704 QBM2P2: AVAL,645	R	Pa
Exhaust fan speed Prio 2: Fire / Smoke Prio 5: Protection	FanEhSpd A1: AO,103 A2: AO,112 A3: AO,121 A4: AO,130 ModbusFan: AO,150 POS9: AVAL,751 QBM1AO1: AVAL,714 QBM1AO2: AVAL,715 QBM2AO1: AVAL,716 QBM2AO2: AVAL,717	RW	%
Exhaust fan speed feedback	FanEhSpdFb Tacho:AI,69 0~10V:AI,97 Modbus: AI,164	R	%
Exhaust fan fault	FanEhFlt D1: BI, 182 (NO) BI, 183 (NC) D2: BI, 184 (NO) BI, 185 (NC) X3: BI, 186 (NO) X8: BI, 187 (NO) Modbus: BI,145	R	

Operating mode settings	BACnet object	R/RW	Unit
Unoccupied: exhaust	SpAirFlEhUcd AVAL,276	RW	m^3/h
Economy: exhaust	SpAirFlEhEco AVAL,275	RW	m^3/h
Comfort: exhaust	SpAirFlEhCmf AVAL,274	RW	m^3/h
Fire place: exhaust	SpAirFlEhFplc AVAL,62	RW	m^3/h
Kitchen hood: exhaust	SpAirFlEhKtch AVAL,277	RW	m^3/h
De-icing air flow	SpAirFlEhDeic AVAL,226	RW	m^3/h
Boost: exhaust	SpAirFlEhBoost AVAL,790	RW	m^3/h

Special settings	BACnet object	R/RW	Unit / Note
Exhaust fan Kp	GainAirFlEhCtr AVAL,231	RW	% / (m3/h)
Exhaust fan Tn	TnAirFlEhCtr PINTVAL,122	RW	s
K-factor, exhaust fan	AirFlEhCoef AVAL,229	RW	m^3/h per Pa
Tacho signal mapping Pulses/sec for 100% fan speed	FanEhSpdFb AI,69	RW	Property 4965 Range 0…300 pulse/s

Testing and debugging	BACnet object	R/RW	State
Fan device mode Prio 2: Fire / Smoke Prio 5: Protection	FanEhDevMod MVAL,161	RW	1: Off 2: Control mode 3: Max.air vol.flow 4: Min.air vol.flow 5: Manual speed 6: Smoke ctrl. air flow setp 7: De-icing air vol.flow 8: Startup

5.5.3 Constant duct pressure (VntCtl22y, FanSu22y, FanEh22y)

Fan speed control

Supply fan and exhaust fan have defined duct pressure setpoints for each operating mode, Pascal value is used. By using PSu and PEx pressure sensors, the function controls fan speed to maintain duct pressure at a constant level.

These settings only define the pressure used in various operating modes and they have no effect on other functions, like de-icing or AQ/r.H. control.

If AQ/r.H. control is active, the values set here are used as the minimum level. With active temperature control, the values are used as maximum values. Depending on deviations from setpoint, temperature, the AQ/r.H. control can freely increase or decrease the speed of both fans simultaneously with a symmetrical control signal, which then maintains the setpoint ratio in any situation.

Special operation with only one pressure sensor

In some situations, it might be sufficient to select the use of only one pressure sensor in a duct. In this case, the pressure control is made with that fan which is in the same duct as the pressure sensor. The other fan always follows the “master” fan according to the following formula:

$$FanSpd_{Follow} = FanSpd_{Master} + \frac{SpP_{Follow} - SpP_{Master}}{PSuNom}$$

If the pressure sensor becomes faulty and control can no longer be guaranteed, fan control of the duct with faulty sensor is automatically switched to linear fan speed control. Setpoints used for the linear fan speed control are then calculated by using the maximum unit pressure value as 100% and setting the actual pressure setpoint proportionally according to the maximum value.

Example: When maximum unit pressure is 100 Pa and AWAY pressure is set to 35 Pa then fan speed of 35 % is used in case of a fault.

Fan speed monitoring

The fan speed can be monitored to detect the actual speed of the fans or possible device problems if fans with tacho signal output are used, or a separate analog input for fan speed is available, or Modbus fans are used. The tacho input signal is mapped to a 0…100 % value with each fan configurable to a minimum fan speed and a minimum feedback signal assigned to the minimum fan speed value. A fan speed feedback fault is detected if fan speed output is higher than the minimum fan speed and the fan speed feedback drops below fan speed feedback fault limit for longer than an allowed tolerance time.

The allowed tolerance time (limited to a maximum of 60 sec) is the time, after switch-on that the fan has built up the correct air flow. The same conditions apply for the startup procedure: The startup configuration is also used for fan speed monitoring.

Fan speed feedback fault is combined with the fan error signal to create a fan fault alarm.

For Modbus fans, Modbus communication is also supervised.

The alarm category of all fan alarms for both fans can be configured as

- A-Alarm (shutting down the plant) or
- B-Alarm (only indication, no shutdown function) or
- None (no fault supervision. Use only when no feedback signal exists and do not use on Modbus fans).

Available parameters for constant duct pressure

Unit configuration	BACnet object	R/RW	Note
Duct pressure nominal	PSuNom, AVAL,119	RW	Pa; Maximum duct pressure of the unit
Duct pressure minimum	PDuctMin AVAL,198	RW	Pa
Minimum fan speed	FanSpdMinRel AVAL,201		%
Fan speed feedback fault limit	FanSpdFbFltLm AVAL,197	RW	%
Allowed tolerance time fan speed feedback fault supply fan = startup delay time step 7	TiSttUpSpdVnt PINTVAl,104	RW	Tolerance time = TiSttUpSpdVnt – 5 sec, maximal 60 sec
Allowed tolerance time fan speed feedback fault exhaust fan = startup delay time step 6	DlyOnAflEhSta PINTVAL,129	RW	Tolerance time = DlyOnAflEhSta – 5 sec, max. 60 sec
Selection of active sensor	PSenCnf MVAL,150		1 = Both sensors (default) 2 = P4 supply air 3 = P5 exhaust air
Ramp up / down time of fans	TiRmpFanSuSpd PINTVAL,98	RW	s

5.5.3.1 Available parameters for the supply fan (constant duct pressure)

Available parameters for supply fan

Current state	BACnet object	R/RW	Unit/Note
Present pressure setpoint supply	SpPSu AVAL,193	R	Pa
Present pressure supply	PSu POS9: AVAL,456 QBM1P1: AVAL,460 QBM1P2: AVAL,702 QBM2P1: AVAL,644 QBM2P2: AVAL,708	R	Pa
Supply fan speed Prio 2: Fire / Smoke Prio 5: Protection	FanSuSpd A1: AO,102 A2: AO,111 A3: AO,120 A4: AO,129 ModbusFan: AO,149 POS9: AVAL,750 QBM1AO1: AVAL,711 QBM1AO2: AVAL,712 QBM2AO1: AVAL,713 QBM2AO2: AVAL,718	RW	%

Current state	BACnet object	R/RW	Unit/Note
Supply fan speed feedback	FanSuSpdFb Tacho:AI,65 0~10V:AI,96 Modbus: AI,163	R	%
Supply fan fault	FanSuFlt D1: BI, 174 (NO) BI, 175 (NC) D2: BI, 176 (NO) BI, 177 (NC) X3: BI, 178 (NO) X8: BI, 180 (NO) Modbus: BI,144	R	
Present flow supply	AirFlSu AVAL,204	R	m3/h, available, if DiffPFanSu is configured
Supply fan pressure diff.	DiffPFanSu POS9: AVAL,17 QBM1P1: AVAL,459 QBM1P2: AVAL,701 QBM2P1: AVAL,643 QBM2P2: AVAL,707	R	Pa, available, if DiffPFanSu is configured

Oper. mode settings	BACnet object	R/RW	Note
Unoccupied: supply	SpPSuUcd AVAL,281	RW	Pa
Economy: supply	SpPSuEco AVAL,280	RW	Pa
Comfort: supply	SpPSuCmf AVAL,279	RW	Pa
Fire: supply	SpPSuFplc AVAL,71	RW	Pa
Kitchen hood: supply	SpPSuKtch AVAL,282	RW	Pa
Boost: supply	SpPSuBoost AVAL,791	RW	Pa

Special settings	BACnet object	R/RW	Unit
Supply fan Kp	GainPSuCtr AVAL,200	RW	%/Pa
Supply fan Tn	TnPSuCtr PINTVAL,102	RW	s
K-factor, supply fan	AirFlSuCoef AVAL,203	RW	m3/h per Pa
Tacho signal mapping Pulses/sec for 100% fan speed	FanSuSpdFb AI,65	RW	Property 4965 Range 0…300 pulse/s

Testing / debugging	BACnet object	R/RW	State
Fan device mode Prio 2: Fire / Smoke Prio 5: Protection	FanSuDevMod MVAL,148	RW	1: Off 2: Control mode 3: Max.air vol.flow 4: Min.air vol.flow 5: Manual speed 6: Smoke ctrl. duct pressure De-icing air 7: Vol.flow 8: Startup

5.5.3.2 Available parameters for the exhaust fan (constant duct pressure)

Available parmeters for exhaust fan

Current state	BACnet object	R/RW	Unit
Present pressure setpoint exhaust	SpPEx AVAL,234	R	Pa
Present pressure exhaust	PEx POS9: AVAL,457 QBM1P1: AVAL,669 QBM1P2: AVAL,699 QBM2P1: AVAL,705 QBM2P2: AVAL,646	R	Pa
Exhaust fan speed Prio 2: Fire / Smoke Prio 5: Protection	FanEhSpd A1: AO,103 A2: AO,112 A3: AO,121 A4: AO,130 ModbusFan: AO,150 POS9: AVAL,751 QBM1AO1: AVAL,714 QBM1AO2: AVAL,715 QBM2AO1: AVAL,716 QBM2AO2: AVAL,717	RW	%
Exhaust fan speed feedback	FanEhSpdFb Tacho:AI,69 0~10V:AI,97 Modbus: AI,164	R	%
Exhaust fan fault	FanEhFlt D1: BI, 182 (NO) BI, 183 (NC) D2: BI, 184 (NO) BI, 185 (NC) X3: BI, 186 (NO) X8: BI, 187 (NO) Modbus: BI,145	R	
Present flow exhaust (Available if DiffPFanSu is configured)	AirFlEh AVAL,223	R	m3/h
Exhaust fan pressure diff (Available if DiffPFanSu is configured)	DiffPFanEh POS9: AVAL,20 QBM1P1: AVAL,689 QBM1P2: AVAL,461 QBM2P1: AVAL,704 QBM2P2: AVAL,645	R	Pa

Operating mode settings	BACnet object	R/RW	Unit
Unoccupied: extract	SpPExUcd AVAL,285	RW	Pa
Economy: extract	SpPExEco AVAL,284	RW	Pa
Comfort: extract	SpPExCmf AVAL,283	RW	Pa
Fire: exhaust	SpPExFplc AVAL,76	RW	Pa
Kitchen hood: extract	SpPExKtch AVAL,286	RW	Pa
Boost: exhaust	SpPExBoost AVAL,792	RW	Pa

Special settings	BACnet object	R/RW	Unit
Exhaust fan Kp	GainAirFlEhCtr AVAL,231	RW	%/Pa
Exhaust fan Tn	TnAirFlEhCtr PINTVAL,122	RW	S
K-factor, exhaust fan	AirFlEhCoef AVAL,236	RW	M3/h per Pa
Tacho signal mapping Property 4965	FanSuSpdFb AI,65	RW	Pulses/sec for 100% fan speed Range 0…300 pulse/s

Testing and debugging	BACnet object	R/RW	State
Fan device mode Prio 2: Fire / Smoke Prio 5: Protection	FanEhDevMod MVAL,162	RW	1: Off 2: Control mode 3: Max.air vol.flow 4: Min.air vol.flow 5: Manual speed 6: Smoke ctrl. duct pressure 7: De-icing air vol.flow 8: Startup

5.5.4 Fan speed control for temporary modes

5.5.4.1 Fan boost

The Fan boost mode can be activated as a temporary mode to temporarily increase ventilation, e.g. after a bath or in a sauna. In this case, Fan boost is activated directly and kept active until the set time has elapsed.

Dedicated fan speeds can be set for fan boost mode.

Fan boost is blocked if the configuration of the room influence on the fan speed is in mode 3 or 4.

Available parameters

Current values	BACnet object	R/RW	Unit / Note
Activation input status	RpdVntIn D1:BI,69 D2:BI,86 X3:BI,103 X8:BI,120	R	Pulse or 'egg timer' signal
Rapid ventilation status and operation	RpdVntOp BVAL,166	RW	
Duration	TiRnRpdVnt PINTVAL,70	RW	Min

5.5.4.2 Fire place function (Fire place)

The Fire place mode can be activated to generate an overpressure with the ventilation for a certain period of time. This overpressure helps to light the fireplace by creating draughts through the chimney.

In Fire place mode, the supply fan speed is always higher or equal to the exhaust fan speed.

Fire place operation is blocked if the configuration of the room influence on the fan speed is in mode 4.

Available parameters

Current values	BACnet object	R/RW	Note
Activation input status	FplcVntIn D1: BI,71 D2: BI,88 X3: BI,105 X8: BI,122	R	
Duration	TiRnFplcVnt PINTVAL,75	RW	s
Fire place status and operation	FplcVnt BVAL,172	RW	1: Active 0: Inactive

5.5.4.3 Kitchen hood function (Kitchen hood)

The Kitchen hood mode can be activated to create a suitable imbalance with the ventilation or the increase of the ventilation level. Depending on the solution, whether the kitchen hood has its own exhaust fan or not, the Kitchen hood operating mode can be set to maintain the overall ventilation balance while effectively extracting cooking fumes. Activation overwrites other active operating modes that are set in the timer program.

For the Kitchen hood mode, a dedicated fan speed can be set.

The Kitchen hood mode is blocked when the configuration of the room influence on the fan speed is done in mode 4.

Available parameters

Current values	BACnet object	R/RW	Note
Activation input status	KtchVntIn D1: BI,138 D2: BI,139 X3: BI,140 X8: BI,141	R	
Kitchen hood status and operation	KtchVnt BVAL,240	RW	1: Active 0: Inactive

5.6 Air quality control (VntCtl11y, 12y, 13y)

5.6.1 CO2 / carbon dioxide, (AQualCtl21y)

By using a CO_2 sensor as an input from room and / or extract duct, this function controls the fan speeds to keep the set ppm-level. Fan Boost, Kitchen Hood and Fire Place have priority, so that the air quality control does not influence the fan speed. Comfort operating mode already runs with maximum fan speed for the system, so that AQ control does not have any influence. For Economy and Unoccupied, separate setpoints can be specified.

The air quality controller increases the fan speed to supply more fresh air and prevent the degree of air pollution from exceeding the setpoint. The calculation is performed by a PI-controller. Maximum speed is the setting for Comfort operating mode, minimum speed is defined by the active operating mode.

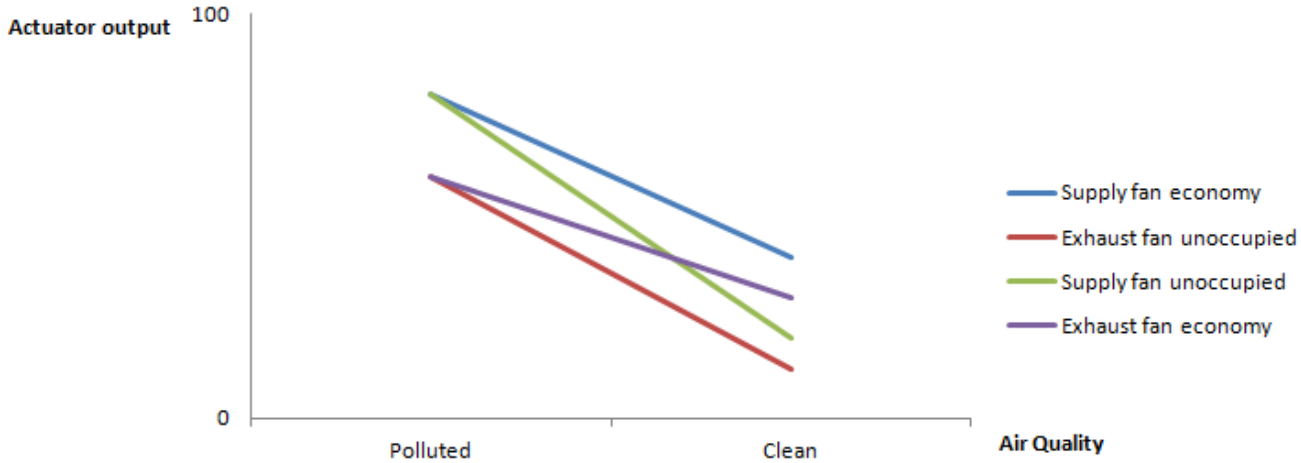
During active air quality control, the speed of both fans will be increased and decreased linearly between the maximum and minimum vales. When the ppm value drops below the setpoint, air quality controlling reduces the fan speed until the defined level for the active operating mode is reached.

It is possible to use one extract air sensor (0…10V), and one room air quality sensor QMX3.P70. In this case, the highest value of all valid sensors is used for fan controlling.

Sensor measuring range (default 0…2000ppm) can be set for the linear signal 0… 10 V to enable the use of various types of sensors. Min and max values are settable in the field via APP.

In duct pressure operation (see Basic configuration [→ 29]), air quality control is blocked if the configuration of the room influence to fan speed is in mode 2, 3 or 4.

Air Quality controller, actuator output diagram



Available parameters

Current value	BACnet object	R/RW	Unit
Air quality value Extract	AQualEx AI,67 (X1) AI,71 (X2) AI,73 (X3) AVAL,318 (POS9) AVAL,469 (QBM1) AVAL,673 (QBM2)	R	ppm
Air quality value Room	AQualR AI,105 (QMX.P70)	R	ppm
Present ventilation setpoint for air quality control (flow)	PrSpAQual AVAL,50	RW	Ppm Actual setpoint given by operating mode

Parameters for VntCtl11y	BACnet object	R/RW	Unit
Unoccupied: AQ setpoint	SpAQualRUcd AVAL,269	RW	ppm
Economy: AQ setpoint	SpAQualREco AVAL,53	RW	ppm
Comfort: AQ setpoint	SpAQualRCmf AVAL,51	RW	ppm
Ventilation Kp	GainVntCtr AVAL,64	RW	%/ppm
Ventilation Tn	TnVntCtr PINTVAL,71	RW	s

Special settings	BACnet object	R/RW	Note
Sensor ppm for 0V signal	AQualExPrcv1 AVAL,533 (X1) AVAL,534 (X2) AVAL,535 (X3) PINTVAL,609 (POS9) PINTVAL,610 (QBM)	R	
Sensor ppm for 10V signal	AQualExPrcv2 AVAL,536(X1) AVAL,537 (X2) AVAL,538 (X3) PINTVAL,611 (POS9) PINTVAL,612 (QBM)	R	

Testing and debugging	BACnet object	R/RW	Unit
Air quality controller output	FanVntReq AVAL,184 (Air flow) AVAL,194 (Duct press) AVAL,205 (Lin. Fan spd)	R	%

5.6.2 Fine dust (PmCtl21y)

By using a PM (particulate matter) sensor as an input from room, this function controls the fan speeds to keep the set concentration level. Separate setpoints can be specified for each normal operating mode.

At higher concentrations, the fan speed is increased to supply more fresh air and to prevent the concentration from exceeding the set value (according to PI-control). Fan speed is controlled dynamically to a higher value, if necessary up to the highest supply fan speed value of all defined modes (normal and special). Minimum speed is defined by the active operating mode.

If the air quality concentration exceeds the set point, the supply pressure is set to a higher value than the exhaust pressure.

With active air quality control, the speed of both fans is increased and decreased linearly and simultaneously with a symmetrical control signal (up to the set operating mode level), which then maintains the target ratio in every situation and the air quality at the target value.

It is possible that more than one AQ input is used simultaneously from different rooms. In this case, highest value wins and is used for fan controlling.

Sensor measuring range (concentration or indicators level) can be set for the linear signal 0…10 V to enable use of various types of sensors. Minimum and maximum values can be set via ABT Go.

Activation of the PM control requires configuration.

	***NOTICE***
	• Particulate matters control is blocked if the configuration of the room influence to fan speed is in mode 2, 3 or 4, for example in duct pressure mode • In the settings for pressure or airflow, it can be determined whether dampers are installed in the duct or not. Depending on this, fan speed control can be disabled for this mode

Available parameters

Current value	BACnet object	R/RW	Note
PM value in room	PmR AI,107 (X1) AI,108 (X2) AI,109 (X3) AVAL,458 (POS9) AVAL,471 (QBM1) AVAL,675 (QBM2)	R	µg/m3
Present ventilation setpoint particulate matters control	PrSpPmR AVAL,449	RW	µg/m3 Actual setpoint depending on operating mode

VntCtl11y parameters (flow)	BACnet object	R/RW	Note
Unoccupied: PM setpoint	SpPmRUcd AVAL,450	RW	µg/m3
Economy: PM setpoint	SpPmREco AVAL,451	RW	µg/m3
Comfort: PM setpoint	SpPmRCmf AVAL,452	RW	µg/m3
Ventilation Kp	GainPmCtr AVAL,453	RW	%/µg/m3
Ventilation Tn	TnPmCtr PINTVAL,561	RW	s

Special settings	BACnet object	R/RW	Note
Run time Pm controller	TiRnPmCtl PINTVAL,562	RW	s
Interruption time Pm controller	TiIrptPmCtl PINTVAL,563	RW	s
Sensor µg/m3 for 0V signal	PmRPrcv1 AVAL,539 (X1) AVAL,540 (X2) AVAL,541 (X3) PINTVAL,613 (POS9) PINTVAL,614 (QBM)	RW	BACnet property 4999
Sensor µg/m3 for 10V signal	PmRPrcv2 AVAL,542 (X1) AVAL,543 (X2) AVAL,544 (X3) PINTVAL,615 (POS9) PINTVAL,616 (QBM)	RW	BACnet property 4998

Testing and debugging	BACnet object	R/RW	Note
PM controller output	PrSpPmR AVAL,449	R	%

5.7 Fan humidity control (DhuCtl11y)

Dehumidification control in wintertime reduces the fan speed settings to a lower speed. Humidity control only increases fan speed when room load is strong, i.e. humidity is increasing, and increases the speed until the maximum humidity is maintained.

It is possible to use one extract air sensor (0…10V), and up to two room humidity sensors QMX.P40, QMX.P70 and a POS8 with room humidity sensor. In this case, the highest value of all valid sensors is used for humidity control. For Comfort, Economy and Unoccupied operating modes, specific setpoint values can be given. Air humidification is not possible.

Dehumidification tries to maintain the set humidity level by modulating the following actuators:

1. Preheating coil brine, if existing and dehumidification enabled and possible
2. Increasing fan speed, if dehumidification is enabled
3. External dehumidifier

Preheating coil brine

Used as a first actuator, if the brine coil is configured for use with humidity control.

The brine coil is released for dehumidification, if the flow temperature is lower than the room dewpoint (minus configurable offset) and the outside air temperature is higher than the brine flow temperature. The brine pump is switched on with the idea to condensate water in the outside air. A 2-point control with configurable hysteresis is used.

Fan speed

Fan speed increase is used a second actuator.

If relative humidity exceeds the limit value, the speed for both fans is increased (according to PI-control) up to Comfort fan speed. During active humidity control, the speed of both fans will be increased and decreased linearly between the maximum and minimum vales. If the r.H. value drops below the setpoint, humidity control reduces the fan speed until the defined level for active operating mode is reached.

Boost, kitchen hood and fireplace have priority, so that humidity control does not influence the fan speed. Comfort operating mode already runs with maximum fan speed for the system, so that humidity control does not have any influence.

Since increased ventilation alone cannot lower the humidity level in every situation, the dew point temperature is used to define if outside air temperature is sufficient for lowering the humidity level in the room. In case the outside air temperature is low enough to assure dehumidification, the PI-control works continuously. Otherwise, the PI works periodically with configurable on and off times for the function.

The function is deactivated when the relative humidity drops below the current setpoint.

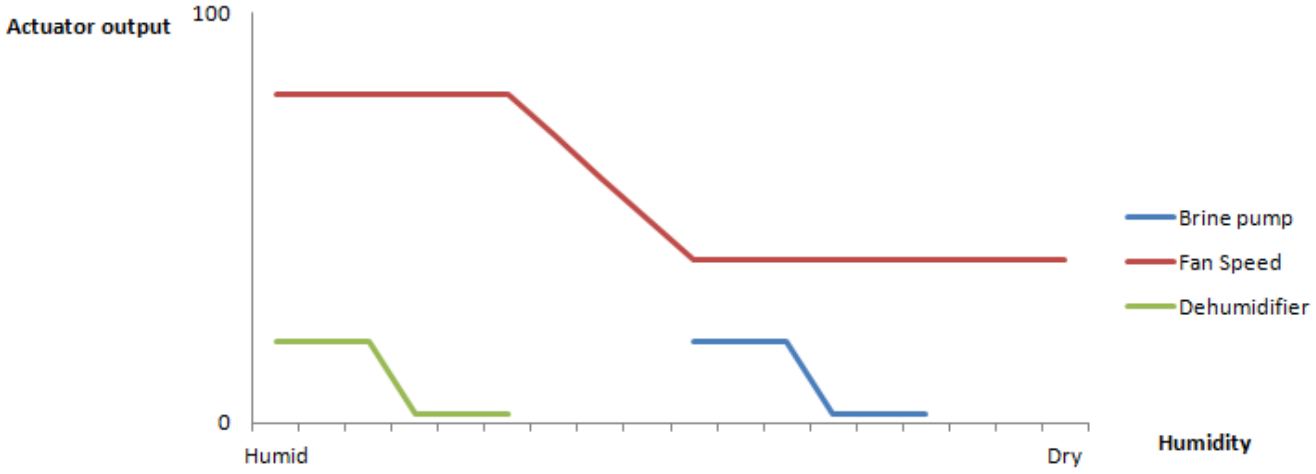
Humidity control with fan speed is blocked if the configuration of the room influence to fan speed is in mode 2, 3 or 4, for example in duct pressure mode, see "Application use cases [➙ 56]".

External dehumidifier

An external dehumidifier can also be used. It can be installed in the room or in the supply air duct. Depending on the design of the dehumidifier, it can have an integrated controller with sensor or be controlled by the CU as part of humidity control. In this case, a 2-point controller with configurable hsysteresis is used and the humidifier is switched on if the brine coil and the fans are not able to maintain the humidity setpoint or are not present.

When the external dehumidifier is installed in the room, it can run independently of the air handling unit. In this case, only room sensors are used and extract sensors are ignored.

Humidity controller, actuator output diagram



Available parameters

Current value	BACnet object	R/RW	Unit
Duct air humidity value	HuRelEx X1:AI,68 X2:AI,72 X3:AI,74 POS9: AVAL,319 QBM1: AVAL,470 QBM2: AVAL,674	R	% r.H.
Room air humidity value (QMX.3 P40)	HuRelR AI,102	R	% r.H.
Room air humidity value (QMX3. P70)	HuRelR AI,104	R	% r.H.
r.H. setpoint	PrSpDhu AVAL,148	R	% r.H.

Basic settings	BACnet object	R/RW	Unit
Unoccupied: r.H. setpoint	SpHuRelRUcd AVAL,311	RW	% r.H.
Economy: r.H. setpoint	SpHuRelREco AVAL,151	RW	% r.H.
Comfort: r.H. setpoint	SpHuRelRCmf AVAL,149	RW	% r.H.

Special settings	BACnet object	R/RW	Unit
Dehumidification Kp	GainDhuCtr AVAL,152	RW	% / % r.H.
Dehumidification Tn	TnDhuCtr PINTVAL,76	RW	s
On time for fan control	TiRnDhuCtl PINTVAL,77	RW	s
Off time for fan control	TiIrptDhuCtl PINTVAL,78	RW	s
Hysteresis for preheating coil and external dehumidifier	HysDhuCtr AVAL,341	RW	% r.H.

Testing and debugging	BACnet object	R/RW	Unit
Fan dehumidification request	FanDhuReq AVAL,185 (AirFl) AVAL,195 (DuctP) AVAL,206 (Lin.fanspd)	R	%
Preheater dehumidification request	EnPreHclDhu BVAL,298	R	On/off
External dehumidifier request	DhumDhuReq BVAL,315	R	On/off

5.8 Humidity evaluation with temperature sensors (HuREvl21y)

If no room or extract air humidity sensor is configured, the room humidity can be estimated based on temperature sensors before and after heat recovery in the supply air and in the extract air ducts.

The calculated humidity can be used for monitoring and for dehumidification control.

!	***NOTICE***
	The humidity calculation cannot be used during periods of high humidity during the summer. A humidity sensor is required to detect high humidity during the summer.

Preconditions

The HRV plant must fulfill the following conditions:

- The heat recovery is sensitive (i.e. it does not transfer humidity).
- Supply and extract air have the same flow rates.
- Humidity load is expected in the room, for example caused by people.
- Four temperature sensors are installed before and after the heat exchanger.
  - If a preheating coil is installed: A dedicated sensor before heat recovery is required (TSuAfPreh).
  - For no preheating coil: Outside air sensor can be used (TOa).
  - If a heating coil, a cooling coil, or a mixing air damper exists afterr the heat exchanger: A dedicated sensor after the heat exchanger is required (TSuAfHExg).
  - For no such coil or mixing air damper: The supply sensor can be used (TSu).
- The room is relatively small, so that the HRV is the main source of fresh air.

Humidity calculation can be performed, if

- Heat recovery is active (bypass damper closed / opened less than 70% or rotary heat exchanger active with speed >30%, fixed values).
- The plant is running on Ucd, Eco, Cmf or temporary high mode and has been running for more than 2 minutes (configurable) and fireplace mode or kitchen hood mode are not active.
- The room has heating demand and the ERC is in heating mode.
- Outside air temperature is low, i.e.:
  - lower than the room dewpoint
  - and more than 3°C lower than the supply temperature
- There is humidity load in the room.
- There is condensation in the extract air over the heat exchanger.

These conditions are fulfilled during the winter, for example, if the room is occupied and the outside air temperature is below 5°C.

Evaluation

Humidity calculation is released if there is condensation in the heat exchanger. In the event of condensation, the temperature ratio of extract air to supply air is below the permissible condensation monitoring rate:

- (TEx – TEh) / (TSu – TOa) < CdnMonRate.

The difference in the specific enthalpy between outside and supply air is calculated and matches the difference between extract air and exhaust air. The specific enthalpy for exhaust air is calculated based on the expected relative humidity in the event of condensation (configurable, HuRelEhExp) and the exhaust air temperature:

- EnthEh = enthalpy(TEh, HuRelEhExp)

Adding the enthalpy difference outside/supply air to the exhaust air enthalpy provides the extract air enthalpy:

- EnthEx = EnthEh + cp * (TSu – TEh)

The absolute extract air humidity is calculated together with the extract air temperature:

- HuAbsEx = absHum(EnthEx, TEx)

The relative extract air humidity is calculated:

- HuRelRCalc. = HuAbsEx / absHum(TEx, 100%)

The value is used by the humidity controller if there is no humidity sensor in the room or in extract air. The humidity controller operates as described above using this value.

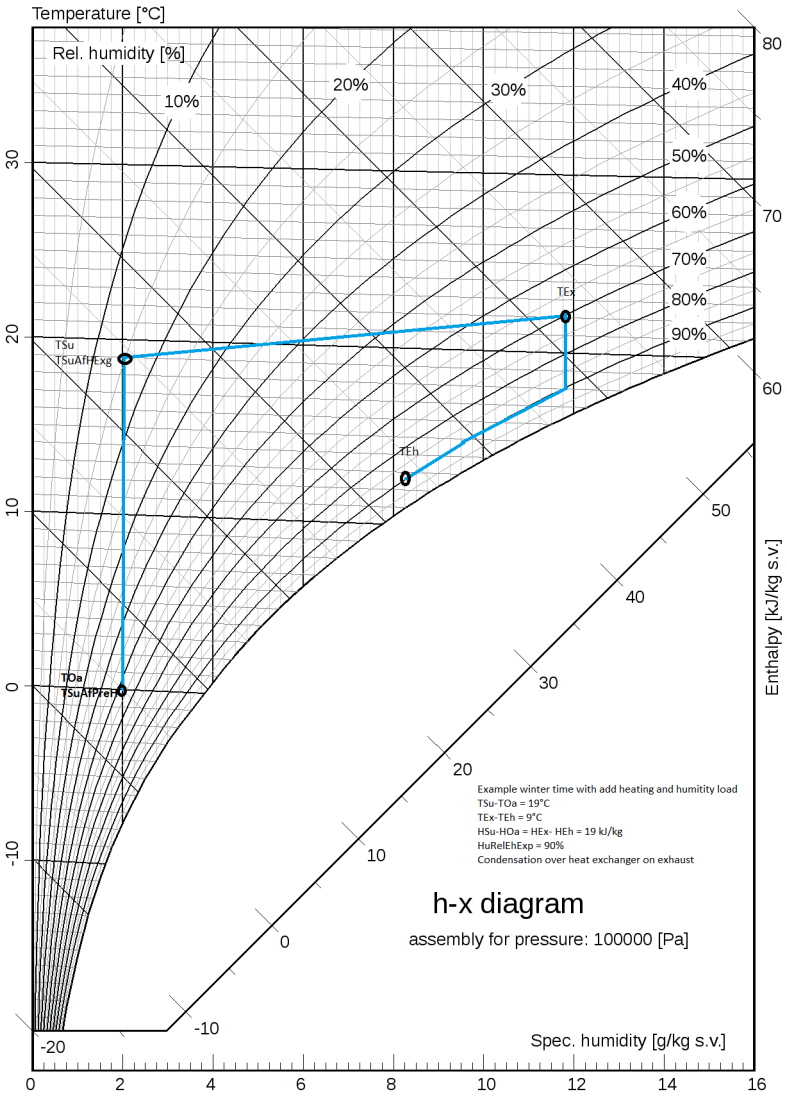
Example of temperatures and humidity over the heat exchanger in an HX diagram:

TOa : incoming air 0°C, 50%r.h., 2g/kg, 5 kJ/kg (incoming air humidity is not relevant to the calculation)

TSu or TSuAfHexg: outgoing air warmed up by the heat exchanger to maintain absolute humidity. 19°C, 2 g/kg, 24kJ/kg

TEx: 22°C, 70%r.H., 53 kJ/kg. In the room, the air is warmed up, for example by floor heating. Humidity increases in occupied rooms.

TEh: 13°C, 90%r.H., 34 kJ/kg. Extract air is cooled down in the heat exchanger using cold incoming air. As TOa is below the dewpoint of the extract air, condensation occurs and absolute humidity decreases. The enthalpy subtracted from the extract air matches the enthalpy added to the supply air.


Temperature [°C]
Rel. humidity [%]
10%
20%
30%
40%
50%
60%
70%
80%
90%
TEx
TSu
TSuAfHExg
TEh
TOa
TSuAfPreH
Example winter time with add heating and humitity load
TSu-TOa = 19°C
TEx-TEh = 9°C
HSu-HOa = HEx- HEh = 19 kJ/kg
HuRelEhExp = 90%
Condensation over heat exchanger on exhaust
h-x diagram
assembly for pressure: 100000 [Pa]
Spec. humidity [g/kg s.v.]
Enthalpy [kJ/kg s.v.]
-20
-10
0
10
20
30
40
50
60
70
80
0
2
4
6
8
10
12
14
16

Available parameters

Current value	BACnet object	R/RW	Unit
Calculated relative room humidity	HuRelRCalc AVAL,793	R	% r.H.
Specific enthalpy exhaust air	EnthEh AVAL,795	R	kJ/kg
Specific enthalpy extract air	EnthEx AVAL,796	R	kJ/kg
Extract air absolute humidity	HuAbsEx AVAL,798	R	g/kg

Special settings	BACnet object	R/RW	Unit
Condensation monitoring rate. Condensation over the heat exchanger is expected below this rate.	CdnMonRate AVAL,794	RW	-
Relative humidity exhaust air is expected in the event of condensation over the heat exchanger.	HuRelEhExp AVAL,797	RW	% r.H.
Delay for switching on the plant before starting the humidity calculation.	DlyOnAflDhuReq PINTVAL,707	RW	s

5.9 Air temperature control

The application supports 2 different ventilation temperature controlling strategies:

- Constant supply air temperature (TSu) control
- Extract (TEx) temperature/room temperature control

The temperature setpoint page can be enabled or disabled on the POS8.44x0.

Current value	BACnet object	R/RW	Unit / Note
Enable temperature setpoint page for room operator unit	EnSpTPageRu BVAL,372	RW	0: not visible 1: visible

5.9.1 Supply air temperature control (TSuCtlH21y)

The supply temperature is controlled in accordance to the TSu value to the specified supply temperature setpoint by using available and commissioned heating and cooling components.

Separate supply air temperature setpoints (SpT…) can be defined for the operating modes Unoccupied, Economy and Comfort. Individual tolerances before heating coils (DSpH…) and cooling coils (DSpC…) are used can be defined for Unoccupied, Economy and Comfort.

If the supply air temperature sensor is defective, an A alarm is triggered and the ventilation unit switches itself off.

Mixing air damper, heat recovery and heating/cooling coil are alternatively used for heating or cooling. The changeover criterium depends on the device and configuration.

Heating mode (TSuCtlH21y)

When (TSu) drops below setpoint (SpT…), the mixing air damper is used as first heating sequence. The mixing air damper is only used if it can provide heating and is not overridden by air quality control.

ERC is used for the 2nd heating sequence if the mixing air damper reaches the maximum position; it be able to provide heating and cannot be overridden by the deicing function.

Heating with additional energy is released when (TSu) drops below the setpoint minus tolerance (SpT… - …DSpH…).

Electric heating coil or warm water heating coil is used for the 3rd heating sequence if ERC has been fully activated.

A combined heating/cooling coil is used for the 4th sequence if the heating coil is fully activated and the heating/cooling coil is in winter mode.

Fans can be used for the 5th heating sequence if configured for temperature control. The fan speed is reduced to maintain the temperature by decreasing the air flow.

Cooling mode (TSuCtlC21y)

If (TSu) exceeds the setpoint (SpT…), the mixing air damper (Mix) is used for the first cooling sequence. The mixing air damper is only used if it is able to provide cooling and if not overridden by air quality control.

ERC is used for the 2nd cooling sequence if the mixing air damper has reached the maximum position and is able to provide cooling.

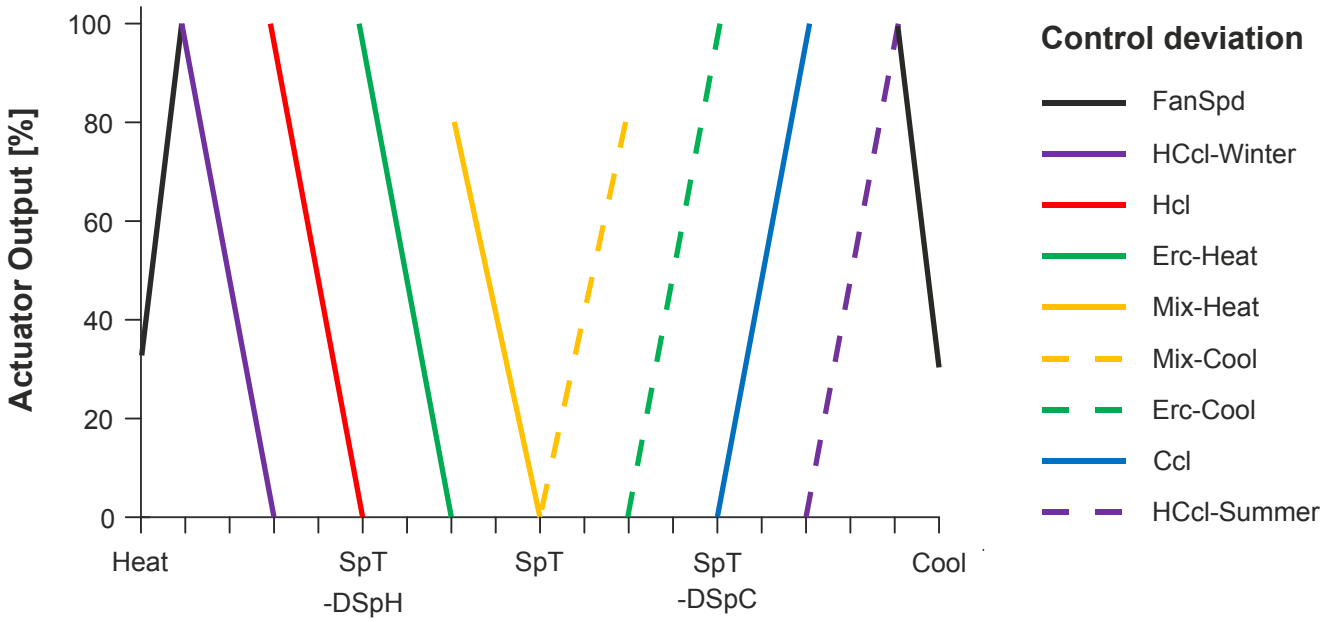
Cooling with additional energy is released when (TSu) raises above the setpoint +tolerance (SpT… + DSpC…).

Electric cooling or chilled water cooling coil is used for the 3rd cooling sequence if ERC has been fully activated.

A combined heating/cooling coil is used for the 4th sequence if the cooling coil is fully activated and the heating/cooling coil is in summer mode.

Fans can be used for the 5th cooling sequence if configured for temperature control. The fan speed is reduced to maintain the temperature by decreasing the air flow.

Temperature controller, actuator output diagram



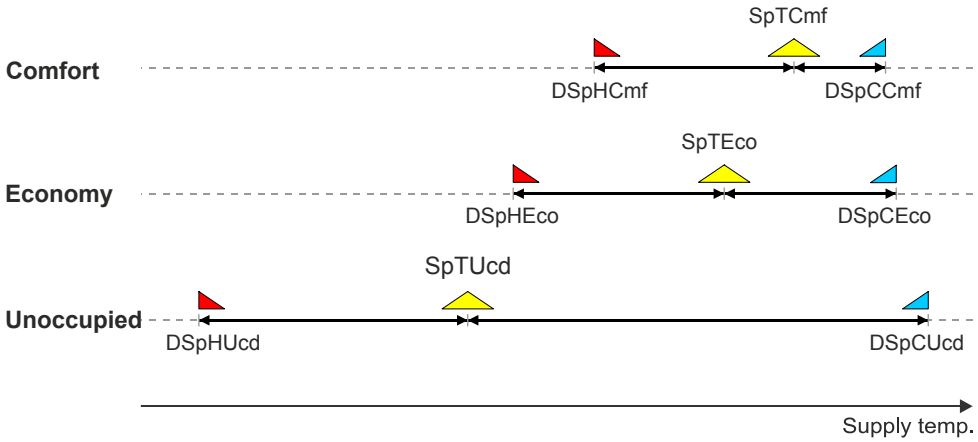
If an actuator is not available, not configured, not released, in error or cannot deliver the required heating / cooling function, it is skipped and the next actuator in the sequence is used.

Further information regarding the function of the different actuators for temperature control can be found in the description of the actuators.

The diagram above does not include ‘Extra cooling sequence when no cooling coil is configured’.

See chapter Fan heating/cooling influence [➙ 99].

Setpoint and operating mode diagram



Available parameters

Current values	BACnet object	R/RW	Unit / Note
Supply air temperature	TSu AI,134 (B1) AI,52 (B2) AI,137 (B3) AI,138 (B4)	R	°C
Outside air temperature	TOa AI,51 (B1) AI,129 (B2) AI,130 (B3) AI,131 (B4) AVAL,719 (QBM1) AVAL,720 (QBM2)	R	°C
Present temperature setpoint	TSuAfHExg AI,145 (B1) AI,146 (B2) AI,55 (B3) AI,61 (B4) AI,77 (X8) AVAL,465 (QBM1) AVAL,649 (QBM2)	RW	°C includes weather compensation
Present setpoint shift heating	PrSpShftH AVAL,96	R	K shows winter compensation
Present setpoint shift cooling	PrSpShftC AVAL,128	R	K shows summer compensation

Standard parameters	BACnet object	R/RW	Unit
Setpoint supply air temperature comfort	SpTCmf AVAL,97	RW	°C
Setpoint difference cooling for comfort	DSpCCmf AVAL,392	RW	K
Setpoint difference heating comfort	DSpHCmf AVAL,390	RW	K
Setpoint supply air temperature economy	SpTEco AVAL,296	RW	°C
Setpoint difference cooling economy	DSpCEco AVAL,306	RW	K
Setpoint difference heating economy	DSpHEco AVAL,299	RW	K
Setpoint supply air temperature unoccupied	SpTUcd AVAL,297	RW	°C
Setpoint difference cooling for unoccupied	DSpCUcd AVAL,307	RW	K
Setpoint difference for heating unoccupied	DSpHUcd AVAL,300	RW	K

Special settings	BACnet object	R/RW	Unit
TOa limitation for heating release	HLmCmf AVAL,105	RW	°C
TOa limitation for cooling release	CLmCmf AVAL,132	RW	°C
Setpoint heating protection	SpHPrt AVAL,100	RW	°C
Setpoint cooling protection	SpCPrt AVAL,129	RW	°C

Testing and debugging	BACnet object	R/RW	State
Heating / cooling state	HCSta MVAL,128	R	1: Neither 2: Heating 3: Cooling
Delay heating cooling changeover	DlyOnHCChovr PINTVAL, 68	RW	

5.9.2 Supply air regulation with outdoor temperature compensation

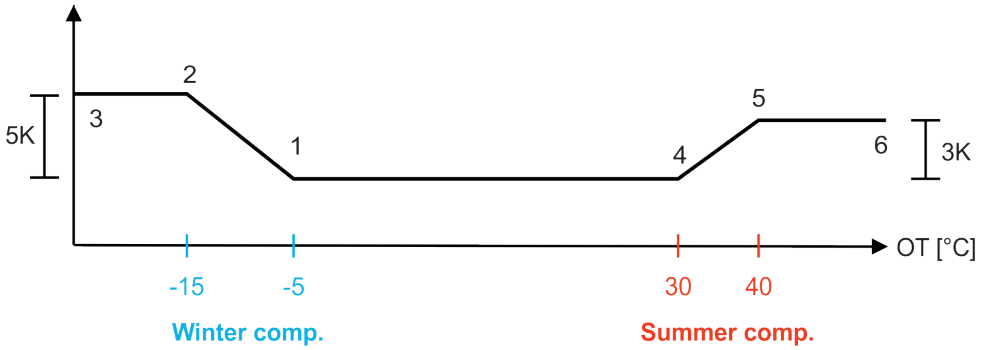
During hot summer periods or cold winter times, supply air temperature setpoint may be weather compensated to increase comfort and cost-optimize the operation.

Compensation can be activated individually for summer and/or winter with dedicated supply air setpoint increase/decrease. The function is activated when positive or negative setpoint shift (points 3 and 6) is set.

Outdoor temperature compensation is active when shift (3 or 6) is set to a value other than 0. Outdoor-compensation affects both constant and cascade temperature control.

Outdoor compensation affects the supply air temperature setpoint when used with supply air temperature control.

It affects the room or extract temperature setpoint when used with cascade temperature control.



Available parameters

Winter compensation	BACnet object	R/RW	Note
Starting point	SttSpShftH AVAL,106 (Supply) AVAL,121 (Cascade)	RW	Compensation point 1
Ending point	EndSpShftH AVAL,107 (Supply) AVAL,122 (Cascade)	RW	Compensation point 2
Setpoint shift	SpShftH AVAL,108 (Supply) AVAL,123 (Cascade)	RW	Compensation point 3

Summer compensation	BACnet object	R/RW	Note
Starting point	SttSpShftC AVAL,133 (Supply) AVAL,142 (Cascade)	RW	Compensation point 4
Ending point	EndSpShftC AVAL,134 (Supply) AVAL,143 (Cascade)	RW	Compensation point 5
Setpoint shift	SpShftC AVAL,135 (Supply) AVAL,144 (Cascade)	RW	Compensation point 6

5.9.3 Extract (room) temperature cascade control (TCasCtl-H21y and TCasCtlC21y)

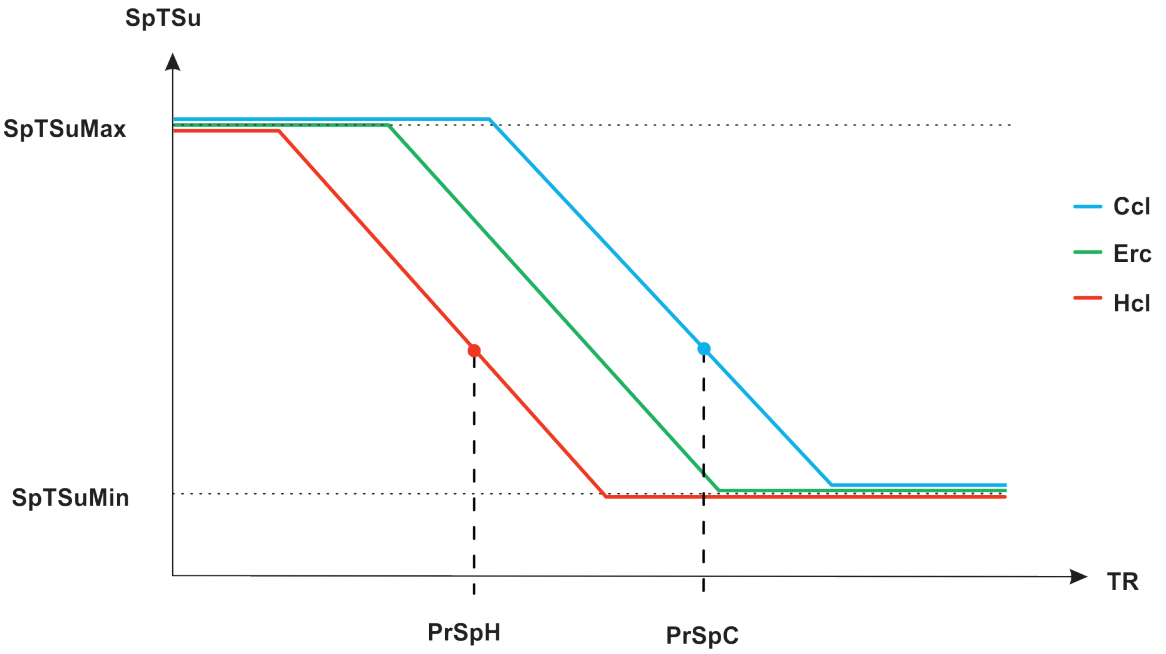
Cascade control is useful for controlling the room temperature in situations with strong heat fluctuations in the room, e.g. due to internal heat gains. The basic room temperature level is controlled with a standard heating system (radiator, floor heating, etc.) to its own, slightly lower setpoint value and at the same time the ventilation temperature control aims to keep the room temperature at its setpoint value by balancing the internal heat fluctuations.

In cascade control, the preset control variable is the extract temperature sensor (TEx). If TEx is not connected or a room temperature control is preferred, the room temperature TR can be selected.

Separate room/exhaust air temperature setpoints can be defined for the UNOCCUPIED, ECONOMY and COMFORT operating modes. Individual tolerances before using heating and cooling coils can be defined for UNOCCUPIED, ECONOMY and COMFORT. Special operating modes use the same setpoint as the normal operating mode shortly before activation

Depending on whether the current extract air (room) temperature TR is above or below the extract air (room) setpoint, the supply air temperature setpoint is shifted a few degrees up or down to compensate for heat gains or deficits in the rooms. Adjustable limits for maximum and minimum supply air temperature setpoint ensure that the user does not feel uncomfortable when the room is heated up or cooling down.

Determination of the supply air setpoint



Setpoint calculation, weather compensation and actuator's output are the same as described for the supply air temperature before

Available parameters

Current values	BACnet object	R/RW	Unit
Extract air temperature	TEx AI,139 (B1) AI,140 (B2) AI,53 (B3) AI,59 (B4) AI,75 (X8) AVAL,312 (POS9) AVAL,463 (QBM1) AVAL,647 (QBM2)	R	°C
Room temperature	TR AI,99 (POS4420) AI,120 (POS4440) AI,103 (QMX.P70) AI,101 (QMX.P40) AI,100 (QMX.P30)	R	°C
Supply air temperature	TSu AI,134 (B1) AI,52 (B2) AI,137 (B3) AI,138 (B4)	R	°C
Outside air temperature	TOa AI,51 (B1) AI,129 (B2) AI,130 (B3) AI,131 (B4) AVAL,719 (QBM1) AVAL,720 (QBM2)	R	°C
Supply air temperature after heat exchanger	TSuAfHExg AI,145 (B1) AI,146 (B2) AI,55 (B3) AI,61 (B4) AI,77 (X8) AVAL,465 (QBM1) AVAL,649 (QBM2)	R	°C
Present temperature setpoint	SpT AVAL,598	RW	°C includes weather compensation
Present setpoint shift heating	PrSpShftH AVAL,111	R	K shows winter compensation
Present setpoint shift cooling	PrSpShftC AVAL,137	R	K shows summer compensation

Standard parameters	BACnet object	R/RW	Unit
Setpoint room / extract temperature comfort	SpTCmf AVAL,112	RW	°C
Setpoint difference cooling for comfort	DSpCCmf AVAL,393	RW	K
Setpoint difference heating for comfort	DSpHCmf AVAL,391	RW	K
Setpoint room / extract temperature economy	SpTEco AVAL,301	RW	°C
Setpoint difference cooling for economy	DSpCEco AVAL,308	RW	K
Setpoint difference for heating economy	DSpHEco AVAL,304	RW	K
Setpoint room / extract temperature unoccupied	SpTUcd AVAL,302	RW	°C
Setpoint difference cooling for unoccupied	DSpCUcd AVAL,309	RW	K
Setpoint difference for heating unoccupied	DSpHUcd AVAL,305	RW	K
Max setpoint for supply air temperature	SpTSuMax AVAL,126	RW	°C
Min. setpoint for supply air temperature	SpTsuMin AVAL,125	RW	°C

Special settings	BACnet object	R/RW	Unit
TOa limitation for heating release	HLmCmf AVAL,120	RW	°C
TOa limitation for cooling release	CLmCmf AVAL,141	RW	°C
Setpoint heating protection	SpHPrt AVAL,115	RW	°C
Setpoint cooling protection	SpcPrt AVAL,138	RW	°C
Gain extract temperature control	GainTRCtr AVAL,124	RW	%/K
Tn Extract temperature control	TnTRCtr PINTVAL,74	RW	s
Use Extract temp. instead of room	EnTExCtl BVAL,159	RW	0: TR 1: TEx

5.9.4 Fan heating/cooling influence

These functions can be deactivated if required, for example in case of duct pressure control, see fan speed control 3.1

Extra heating sequence:

It may happen (e.g. due to device malfunction) that all activated/available heating sequences are not sufficient to reach the TSu setpoint. In this case, the speed of the exhaust and supply air fans can be reduced to introduce less cold air into the heating elements. However, when all sequences are fully active and the setpoint is still above the limits the speed is decreased to “unoccupied speed” level.

Extra cooling sequence when a cooling coil is configured:

It may happen (e.g. due to device malfunction) that all activated/available cooling sequences are not sufficient to reach the TSu setpoint. In this case, the speed of the exhaust and supply air fans can be reduced to introduce less warm air into the cooling elements. However, when all sequences are fully active and the setpoint is still above the limits the speed is decreased to “unoccupied speed” level.

Extra cooling sequence when no cooling coil is configured:

In case ventilation unit does not have any cooling coils configured, ERC cooling is not released, and the TSu setpoint cannot be reached, then speed of exhaust and supply fans is increased in order to maximize cooling effect. Fan speed deviation is held, speed is increased up to maximum parameterized ventilation level.

5.10 Energy Recovery

5.10.1 Rotational Heat Exchanger (RotHExg21y)

The purpose of energy recovery is to absorb heat/cold from the exhaust air and transfer it back to the supply air side. Energy recovery is usually used as the first heating/cooling element. The control of the energy recovery can be advantageous in the off-season depending on the required supply air temperature. Depending on the setting and temperature conditions, the energy recovery unit can also be selected so that it is only used for heating or for heating and cooling.

ERC is an active element that uses 0..10 V signal for wheel speed control. To limit the PI control of the acceleration and deceleration of the ERC speed too slow or too fast, the ramp-up/ ramp-down time can be set.

When configured, the bypass damper is automatically used to reduce the system pressure differential at times when ERC is off (< 1% speed). The delay time to activate the bypass after ERC is 1 min (fixed).

Available parameters

Current values	BACnet object	R/RW	Note
ERC speed Prio2: Fire / Smoke Prio5: Protection	RotHExgSpd AO,106 (A1) AO,115 (A2) AO,124 (A3) AO,133 (A4) AVAL,385 (POS9) AVAL,474 (QBM1AO1) AVAL,481 (QBM1AO2) AVAL,655 (QBM2AO1) AVAL,662 (QBM2AO2)	RW	%
External fault detection for ERC	RotHExgFlt BI,110 (X3) BI,127 (X8) BI,76 (D1 NO) BI,93 (D2 NO) BI,158 (D1 NC) BI,159 (D2 NC)	R	
Bypass damper Prio2: Fire / Smoke Prio5: Protection	HExgDmpBypCmd BO,55 (Q1) BO,70 (Q2) BO,85 (Q3) BVAL,246 (POS9)	RW	%
Setpoint supply air temperature for heating	SpTSuHHExg AVAL,159	R	°C
Setpoint supply air temperature for cooling	SpTSuCHExg AVAL,160	R	°C
Heat exchanger heating / cooling state Prio 8, 13: manual override Prio 15: automatic change	HExgEcmSta BVAL,181	RW	0: Heating 1: Cooling

Basic settings	BACnet object	R/RW	Note
Minimum ERC speed	RotHExgSpdMin AVAL,162	RW	%

Special settings	BACnet object	R/RW	Note
Ramp up/down time, ERC speed	TiRmpRotHExg PINTVAL,83	RW	s
ERC Kp	GainHExgCtr AVAL,165	RW	%/K
ERC Tn	TnHExgCtr PINTVAL,85	RW	s
Min.diff.room temp./outs.air temp.f.cool	DiffTRTOaMinC AVAL,164	RW	K

Testing and debugging	BACnet object	R/RW	Note
Heat exchanger device mode Prio 2: Fire / Smoke Prio 4: Protection stuck / broken Prio 5: Protection plant control	HExgDevMod MVAL,145	RW	1: Off 2: Control mode 3: Max speed 4: Min speed 5: Bypass only

5.10.1.1 ERC De-Icing (rotational)

Active Energy ReCovery units are essentially heat exchangers. They receive warm and humid air on one side and cold air on the other. Under suitable conditions this can lead to cumulations of ice on the surface.

Detecting ice on the heat exchanger or in the ductwork

Detecting ice on the heat exchanger or in the duct work is possible by:

- with the exthaust air temperature sensor TEh. This is not a real indicator, but an expectation that ice will form.
  - De-icing with TEh sensor starts when TEh is below the limit.
  - The end of the de-icing phase cannot be detected and is estimated via timer.
- with a differential pressure switch over the heat exchanger. This possibility does not detect icethat has built up in the duct work and does not work reliably on all types of heat exchangers. If the exhaust air temperature sensor and differential pressure switch are installed, the differential pressure switch is used to start de-icing.
  - De-icing is active as long as the differential pressure switch is active.
- with the outside air sensor TOa. This is used when no exhaust air sensor and no differential pressure switch are available. It is also only an expectation that ice has formed.
  - De-icing with TOa sensor starts when TOa is below the limit.
  - The end of the de-icing phase cannot be detected and is estimated via timer.

De-icing the heat exchanger

De-icing is possible by:

- reducing the speed of the heat recovery, so that the exhaust temperature increases.
- reducing the supply fan speed, so that the load of incoming cold air is reduced, increasing the exhaust air temperature.
- PI control exhaust temperature to maintain a mimimum exhaust temperature
- preheating the outside air, increasing the exhaust air temperature

De-icing modes

The de-icing mode can be configured as:

- No de-icing
- Reduce ERC speed to a fix value
- Reduce ERC and fan speed
- Reduce ERC speed and increase preheating
- Reduce ERC speed and fan speed and inrcease preheating
- ERC maintain minimum exhaust temperature
- Maintain exhaust temperature and reduce fan speed
- Maintain exhaust temperature and increase preheating
- Maintain exhaust temperature, reduce fan speed and increase preheating

De-icing with ERC and with preheater are running in parallel. De-icing with fan speed is running in parallel or with 2 stage, see below.

Time based de-icing started by TEh or TOa

The sensor is not suitable for detecting the end of the de-icing phase. Therefore, a fix de-icing time is used. After de-icing is finished, an off time is started until the next de-icing phase can be started again. The duration of the off time depends on the measured temperature at the start of a de-icing phase. De-icing time, maximum off time with assigned temperature and minimum off time with assigned temperature can be configured.

Humidity influence for TEh or TOa

If an extract air humidity sensor is available, the de-icing limit can be lowered, because icing is reduced due to dry extract air. Configured de-icing limit refers to a room / extract humidity value of 80% or higher. This value will be reduced continuously by a configurable temperature drop until the room / extract humidity value reaches 20% or lower.

De-icing with increased preheating

In case of possible de-icing, brine coil or ground collector are activated by the outside air conditions. So they automatically assist the de-icing process.

Preheating with electric heater can be used to assist de-icing. This reduces the efficiency of the heat recovery and uses electrical energy instead.
Especially when no reheating is available, it is recommended to use the electric preheater, as otherwise reduced heat exchanger function will result in very low supply air temperature.

As for normal preheating control, TSuAfPreHcl sensor is used. Electrical heater is modulated to reach SpPreHDeicng setpoint. The preheater control runs in this mode until de-icing is finished and switches back to normal operation running with normal setpoint.

De-icing with reduced ERC speed

During de-icing, the speed of the ERC is reduced down to a configurable value.

De-icing with reduced fan speed started by differential pressure switch

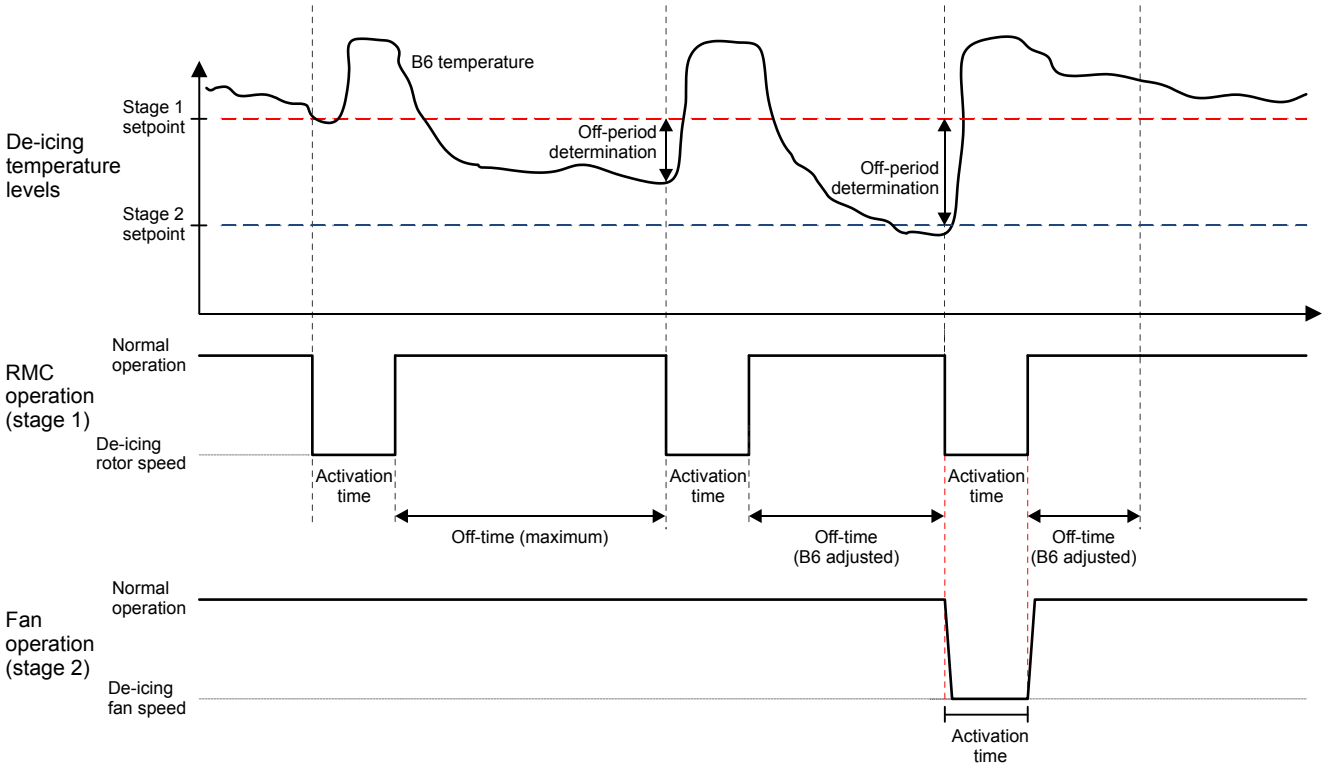
During de-icing fan speed for supply fan and exhaust fan are reduced to configurable values. For faster de-icing, it is possible to set the supply fan speed setpoint even to 0%. In this case electric heaters in the supply air are blocked.

De-icing with reduced fan speed started by TEh or TOa

The temperatures have 2 adjustable limits. The higher limit (stage 1) starts de-icing with ERC only, while the lower limit (stage 2) starts de-icing with ERC and fan speed in parallel (2 stage approach).

During de-icing, fan speed for supply fan and exhaust fan are reduced to configurable values. For faster de-icing, it is possible to set the supply fan speed setpoint even to 0%. In this case electric heaters in the supply air are blocked.

Example diagram of stage 1 and stage 2 behavior



Available parameters

Actual values	BACnet object	R/RW	Note
De-icing request for heat exchanger	DeicReqHExg BVAL,182	R	
De-icing request for fan	DeicReqFan BVAL,183	R	
Heat exchanger differential pressure monitor	HExgDiffPMon BI, 77 (D1 NO) BI, 160 (D1 NC) BI, 94 (D2 NO) BI, 161 (D2 NC) BI, 111 (X3) BI, 128 (X8)	R	

Basic settings	BACnet object	R/RW	Note
De-icing mode configuration	DeicModCnf MVAL,408	RW	1: None 2: Erc fix 3: Erc fix + Fans 4: Erc fix + Preh 5: Erc fix + Fans + Preh 6: Erc TEh 7: Erc TEh + Fans 8: Erc TEh + Preh 9: Erc TEh + Fans + Preh
De-icing, stage1 limit, heat exchanger	SpTDeicHExg AVAL,177	RW	°C
De-icing, stage2 limit, fan	SpTDeicFan AVAL,173	RW	°C
Activation time de-icing	TiDeic PINTVAL,90	RW	sec.
De-icing rotor speed	HExgSpdDeic AVAL,178	RW	%
De-icing supply fan flow	SpAirFlSuDeic AVAL,181	RW	m3/h
De-icing exhaust fan flow	SpAirFlEhDeic AVAL,226	RW	m3/h
De-icing supply fan pressure	SpPSuDeic AVAL,196	RW	Pa
De-icing exhaust fan pressure	SpPExDeic AVAL,232	RW	Pa
De-icing supply fan speed	SpFanSuSpdDeic AVAL,208	RW	%
De-icing exhaust fan speed	SpFanEhSpdDeic AVAL,238	RW	%

Special settings	BACnet object	R/RW	Note
Temperature drop for room extract humidity of 20% r.h.	DiffTHuCmpDeic AVAL,176	RW	K
Temperature for maximum off time	TDeicTiOffStt AVAL,179	RW	°C
Maximum off time	TiOffDeicMax PINTVAL,91	RW	sec.
Temperature for minimum off time	TDeicTiOffEnd AVAL,180	RW	°C
Minimum off time	TiOffDeicMin PINTVAL,92	RW	sec.

5.10.1.2 ERC supervision (rotational)

A mechanical failure on the ERC (e.g. belt broken, wheel stuck, heat exchanger dirty etc) can be detected via the efficiency of the heat exchanger. For this, the temperature difference between extract air / room air and exhaust air is used. If the difference drops below set value and stays below during set delay time, an alarm is triggered.

The detection function is only active if the temperature difference between outside air and extract air exceeds the set limit value and the actual ERC control signal is more than 95 % (fixed) of the set maximum speed. An electrical failure of the ERC can be detected via BI signal.

Extract or room temperature sensor and exhaust temperature sensor are mandatory for efficiency supervision

When extract air temperature and exhaust air temperature or the fault signal are not available, the supervision of the ERC is not possible. The alarm class of these alarms can be configured as A-Alarm, B-Alarm or none.

Available parameters

Actual values	BACnet object	R/RW	Note
Heat exchanger fault	RotHExgFlt BI,110 (X3) BI,127 (X8) BI,76 (D1 NO) BI,93 (D2 NO) BI,158 (D1 NC) BI,159 (D2 NC)	R	

Basic settings for efficiency alarm	BACnet object	R/RW	Note
Min difference between extract and outside air temperature	DiffTExTOaMin AVAL,169	RW	K
Min difference between extract and exhaust temperature	TDHExgTErr AVAL,168	RW	K
Belt broken delay time	TiDlyHExgTErr PINTVAL,84	RW	sec.

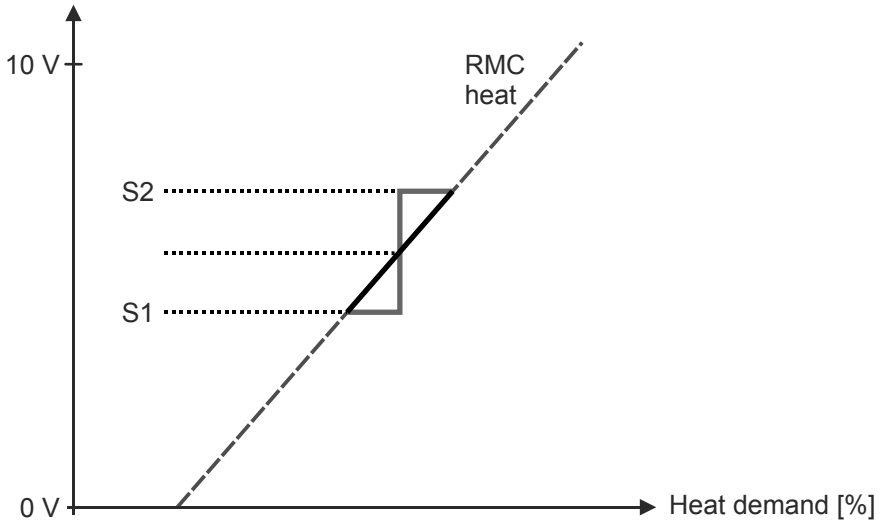
Rotating heat exchanger – Skip speed function

In some situations, ERC may cause vibrations or harmful sounds in a certain speed-range. One skip-speed range can be defined with start and stop limits [%, resolution 0.1] to prevent the control signal from staying in this harmful range longer than ramp up/down times define.

When the function control output signal increases up to start limit S1, the corresponding analog output will be put ”on hold”. After the internal control output signal has reached the calculated middle point of the skip speed area analog output signal will increase up to the end limit S2 speed. Analog output signal increase will be limited by max ramp-up limitation. Analog output signal may stay at the higher value for a while and continue to increase after internal control signal has reached the end limit value S2 also.

When the control signal comes down, the function works in the opposite direction. Same function is active also when ERC is used for cooling.

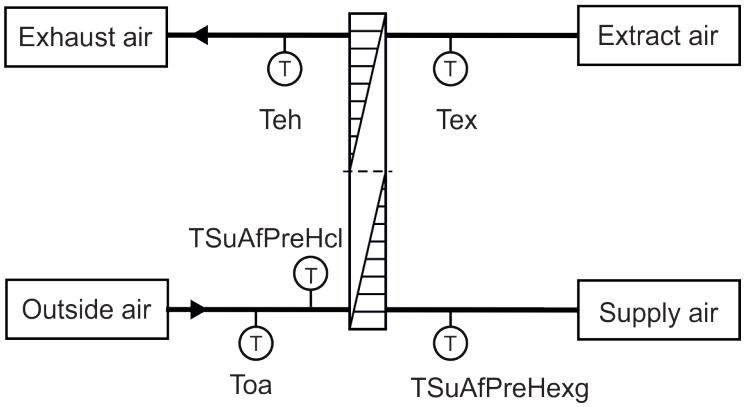
The function can be deactivated by setting start and end settings as zero.



Available parameters

Basic settings	BACnet object	R/RW	Note
Skip-speed start	RotHxSkipSpdLo AVAL,172	RW	Setpoint S1
Skip-speed end	RotHxSkipSpdHi AVAL,171	RW	Setpoint S2

ERC efficiency calculation



TOa	Outside air [°C]	TEh	Exhaust air temperature [°C]
TEx	Extract air temperature [°C]	TSuAfPreHcl	Supply temperature after preheating coil [°C]
TSuAfHexg	Supply temperature after heat exchanger [°C]		

Exhaust side

Efficiency n is calculated on the exhaust side by the following formula:

n = (TEx – TEh) / (TEx – TOa)

In case the preheating coil is active, TSuAfPreHcl is used instead of TOa. If the sensor is not available while the preheating coil is active, the efficiency is unreliable.

Supply side

If an additional supply air sensor after the heat exchanger is available, the efficiency n is calculated on supply and exhaust side as:

n = 0.5 * (TEx – TEh) / (TEx – TOa) + 0.5 * (TSuAfHexg – TOa) / (TEx – TOa)

Efficiency calculation requires at least outside temperature, extract temperature and exhaust temperature sensors.

Available parameters

Current values	BACnet object	R/RW	Note
ERC efficiency	PrHExgEfcy AVAL,161	R	%

5.10.2 Passive Heat Exchanger, controlled (PltHExg21y)

The purpose of energy recovery is to absorb heat/cold from the exhaust air and transfer it back to the supply air side. Energy recovery is usually used as the first heating/cooling element. The control of the energy recovery can be advantageous in the off-season depending on the required supply air temperature. Since the passive heat exchanger itself cannot be modulated, a bypass damper (open/closed or modulating) is used to control the supply air temperature.

Be aware, that the bypass damper closed position means maximum heat exchange while open position means no heat exchange.

Depending on settings and prevailing temperature conditions, energy recovery unit may also be selected to be used only heating or cooling energy recovery.

If the bypass damper is equipped with a binary output, it is closed, when the controller output raises above 60% and opened when the controller output falls below 30% (fix values).

Specific functionality for piston air dampers

Until now normal and 0..10 V dampers were supported. Now also piston air dampers can be controlled.

This function controls a thermal actuator for a free cooling bypass damper. Both relays Q1 and Q2 are used: When one relay opens, the second is always off, i.e. they never operate simultaneously.

Specific operation sequence:

To open the bypass, relay Q1 closes and the motor piston is powered for 150 seconds, the bypass is considered completely open and the relay is deactivated.

To close the bypass, relay Q2 closes and the motor is powered for 150 seconds, the bypass is considered completely open and the relay is deactivated.

To avoid overheating the bypass motor, the relays are not activated again for 300 seconds to allow the piston motor to cool down.

Available parameters

Current values	BACnet object	R/RW	Note
Heat exchanger bypass damper position Prio2: Fire / Smoke Prio4: Heat exchanger fault Prio5: Protection	HExgDmpBypPos AO,105 (A1) AO,114 (A2) AO,123 (A3) AO,132 (A4) AVAL,384 (POS9) AVAL,473 (QBM1AO1) AVAL,480 (QBM1AO2) AVAL,654 (QBM2AO1) AVAL,661 (QBM2AO2)	RW	%
Heat exchanger bypass damper command Prio2: Fire / Smoke Prio4: Heat exchanger fault Prio5: Protection	HExgDmpBypCmd BO,55 (Q1) BO,70 (Q2) BO,85 (Q3) BVAL,246 (POS9) BVAL,353 (Piston)	RW	0: closed, 1: opened
Heat exchanger bypass piston damper Open	HExgDmpbCmdOpn BO,104 (Q1)	RW	Prio5
Heat exchanger bypass piston damper Close	HExgDmpbCmdCls BO,105 (Q2)	RW	Prio5
Setpoint supply air temperature for heating	SpTSuHHexg, AVAL,355	R	°C
Setpoint supply air temperature for cooling	SpTSuCHexg, AVAL, 356	R	°C

Special settings	BACnet object	R/RW	Note
ERC heating / cooling selection Prio 15 : automatic selection	HExgEcmSta BVAL,304	RW	0: Heating only 1: Cooling only
ERC Kp	GainHExgCtr AVAL,359	RW	% / K
ERC Tn	TnHExgCtr PINTVAL,140	RW	s
Min.diff.room temp./outs.air temp.f.cool	DiffTRTOaMinC AVAL,358	RW	K

Testing and debugging	BACnet object	R/RW	Note
Heat exchanger device mode Prio2: Fire / Smoke Prio5: Protection plant control	HExgDevMod MVAL,409	RW	1: Off 2: Control mode 3: Maximum 4: Minimum 5: Bypass only

5.10.2.1 ERC De-Icing (passive, controlled)

Passive Energy ReCovery units are basically just heat exchangers. They receive warm and humid air on one side and cold on the other which will eventually cumulate ice on the surfaces when the conditions are suitable for that. Passive element usually starts to cumulate ice already close to zero Celsius degree

Detecting ice on the heat exchanger or in the ductwork

Detecting ice on the heat exchanger or in the ductwork is possible:

- with exthaust air temperature sensor TEh. This is not a real indication, but an expectation that ice is expected to build up.
  Deicing with TEh sensor starts when TEh is below the limit.
  The end of the de-icing phase cannot be detected and is estimated via timer.
- with a differential pressure switch over the heat exchanger. This possibility does not detect ice built up in the ductwork and does not safely work on all types of heat exchanger. If exhaust air temperature sensor and differential pressure switch are installed, the differential pressure switch is used to start de-icing.
  - Deicing is active as long as the differential pressure switch is active.
- with outside air sensor TOa. This is used when no exhaust air sensor and no differential pressure switch are available. It is also only an expectation that ice has built up.
  - Deicing with TOa sensor starts when TOa is below the limit.
  - The end of the de-icing phase cannot be detected and is estimated via timer.

De-icing the heat exchanger

De-icing is possible by:

- Opening the bypass damper, so that the exhaust temperature increases
- Reducing the supply fan speed, so that the load of cold air incoming is reduced, increasing the exhaust air temperature.
- PI control exhaust temperature to maintain a minimum exhaust temperature
- Preheating the outside air, increasing the exhaust air temperature

De-icing modes

The deicing mode can be configured as:

- No deicing
- Increase bypass damper position to a fix value
- Increase damper and reduce fan speed
- Increase damper and increase preheating
- Increase damper, reduce fan speed and increase preheating
- ERC maintain minimum exhaust temperature *
- Maintain exhaust temperature and reduce fan speed *
- Maintain exhaust temperature and increase preheating *
- Maintain exhaust temperature, reduce fan speed and increase preheating*

*: Modes shall not be used if the damper is equipped with open / close control.

Deicing with ERC and with preheater are running in parallel. Deicing with fan speed is running in parallel or with 2 stage, see below.

Time based De-icing started by TEh or TOa

The sensor is not suitable for detecting the end of the deicing phase. Therefore, a fix deicing time is used. After deicing is finished, an off time is started until the next deicing phase can be started again. The duration of the off time depends on the measured temperature at the start of a deicing phase. Deicing time, maximum off time with assigned temperature and minimum off time with assigned temperature can be configured.

Humidity influence for TEh or TOa

If an extract air humidity sensor is available, the de-icing limit can be lowered, because icing is reduced due to dry extract air. Configured de-icing limit refers to a room / extract humidity value of 80% or higher. This value will be reduced continuously by a configurable temperature drop until the room / extract humidity value reaches 20% or lower.

De-icing with increased preheating

In case of possible de-icing, brine coil or ground collector are activated by the outside air conditions. So they automatically assist the de-icing process.

Preheating with electric heater can be used to assist de-icing. This reduces the efficiency of the heat recovery and uses electrical energy instead.
Especially when no preheating is available, it is recommended to use the electric preheater, as otherwise reduced heat exchanger function will result in very low supply air temperature.

As for normal preheating temperature control, TSuAfPreHcl sensor is used. Electrical heater is modulated to reach SpPreHDeicng setpoint. The preheater control runs in this mode until de-icing is finished and switches back to normal operation running with normal setpoint.

De-icing by increasing the bypass damper position

During deicing, the bypass damper is opened to a configurable value. For open/close controlled dampers, the value should be set to 100%.

De-icing by reducing fan speed started by differential pressure switch

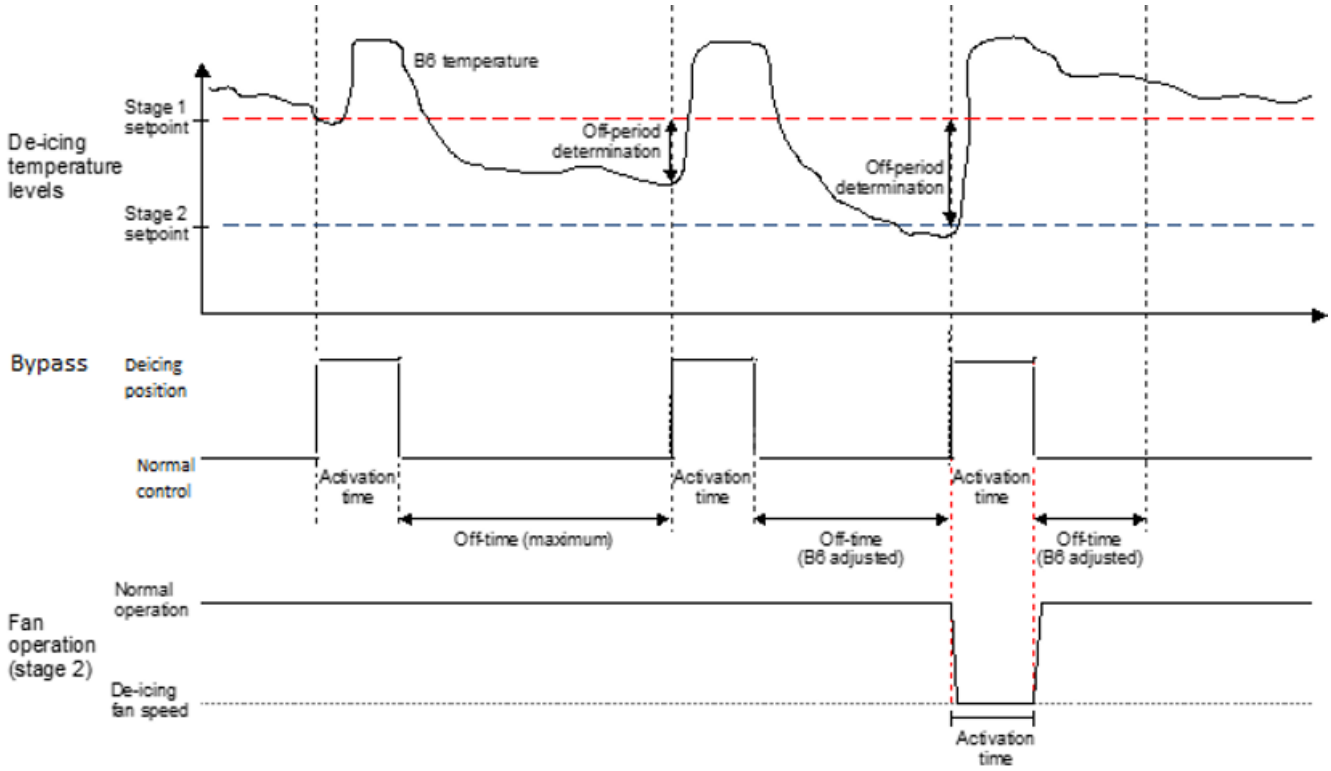
During deicing the bypass damper, fan speed for supply fan and exhaust fan are set to configurable values. For faster deicing, it is possible to set the supply fan speed setpoint even to 0%. In this case electric heaters in the supply air are blocked.

De-icing with reduced fan speed started by TEh or TOa

The temperatures have 2 adjustable limits. The higher limit SpTDeicHExg (stage 1) starts deicing with the bypass damper only, while the lower limit SpTDeicFan(stage 2) starts deicing with bypass damper and fan speed in parallel (2 stage approach).

During deicing, fan speed for supply fan and exhaust fan are reduced to configurable values. For faster deicing, it is possible to set the supply fan speed setpoint even to 0%. In this case electric heaters in the supply air are blocked.

Example diagram of stage 1 and stage 2 behavior



Available parameters

Actual values	BACnet object	R/RW	Note
Deicing request for heat exchanger	DeicReqHExg BVAL,305	R	
Deicing request for fan	DeicReqFan BVAL,306	R	
Heat exchanger differential pressure monitor	HExgDiffPMon BI, 77 (D1 NO) BI, 160 (D1 NC) BI, 94 (D2 NO) BI, 161 (D2 NC) BI, 111 (X3) BI, 128 (X8)	R	

Basic settings	BACnet object	R/RW	Note
De-icing mode configuration (for differential pressure indication only)	DeicModCnf MVAL,410	RW	1: None 2: Erc fix 3: Erc fix + Fans 4: Erc fix + Preh 5: Erc fix + Fans + Preh 6: Erc TEh 7: Erc TEh + Fans 8: Erc TEh + Preh 9: Erc TEh + Fans + Preh
De-icing, stage1 limit, heat exchanger only	SpTDeicHExg AVAL,367	RW	°C
De-icing, stage2 limit, fan	SpTDeicFan AVAL,363	RW	°C
Activation time deicing	TiDeic PINTVAL,142	RW	sec.
De-icing bypass damper position	HxDmpbPosDeic AVAL,368	RW	% , for open damper configure 100%
De-icing supply fan flow	SpAirFlSuDeic AVAL,181	RW	m3/h
De-icing exhaust fan flow	SpAirFlEhDeic AVAL,226	RW	m3/h
De-icing supply fan pressure	SpPSuDeic AVAL,196	RW	Pa
De-icing exhaust fan pressure	SpPExDeic AVAL,232	RW	Pa
De-icing supply fan speed	SpFanSuSpdDeic AVAL,208	RW	%
De-icing exhaust fan speed	SpFanEhSpdDeic AVAL,295	RW	%

Special settings	BACnet object	R/RW	Note
Temperature drop for room / extract humidity <= 20%	DiffTHuCmpDeic AVAL,366	RW	K
Temperature for maximum off time	TDeicTiOffStt AVAL,369	RW	°C
Maximum off time	TiOffDeicMax PINTVAL,143	RW	sec.
Temperature for minimum off time	TDeicTiOffEnd AVAL,370	RW	°C
Minimum off time	TiOffDeicMin PINTVAL,144	RW	sec.

5.10.2.2 ERC supervision (passive, controlled)

A mechanical failure on the ERC (e.g. bypass damper blocked, heat exchanger dirty etc.) can be detected via the efficiency of the heat exchanger. Therefore, the temperature difference between extract air / room air and exhaust air is used. When the difference drops below set value and stays below during set delay time, alarm is generated.

The detection function is only active if the temperature difference between fresh air and extract air exceeds the set limit value and the actual position of the bypass damper is more than 95 % (fixed).

Extraction or room temperature sensor and exhaust gas temperature sensor are mandatory for efficiency monitoring.

If the exhaust air temperature and the exhaust air temperature are not available, monitoring of the ERC is not possible.

The error message of the condenser pump can be configured for the unit.

The pump itself operates autonomously and does not require its own logic. The resulting error message must be connected to a digital, potential-free input on the controller. When an error message is received, the bypass damper is closed.

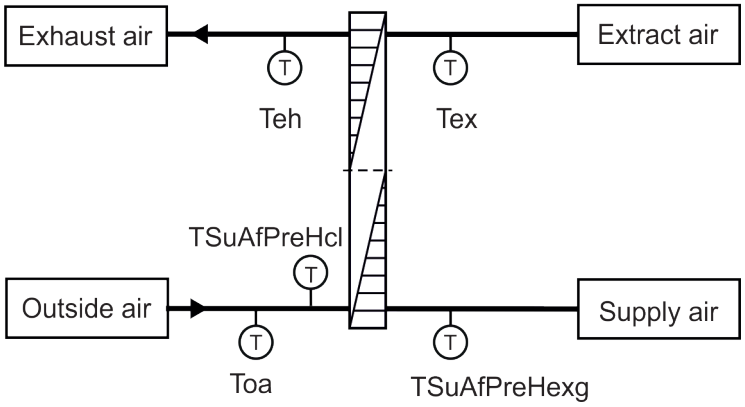
The alarm class of these alarms can be configured as A-alarm, B-alarm or none.

Available parameters

Actual values	BACnet object	R/RW	Note
Heat exchanger condensation monitoring	HExgCdnMon BI,75 (D1 NO) BI,160 (D1 NC) BI,92 (D2 NO) BI,161 (D2 NC) BI,109 (X3) BI,126 (X8)	R	off/on

Basic settings for efficiency alarm	BACnet object	R/RW	Note
Min difference between extract and outside air temperature	DiffTExTOaMin AVAL,362	RW	K
Min difference between extract and exhaust temperature	TDHExgTErr AVAL,361	RW	K
Efficiency supervision delay time	TiDlyHExgTErr PINTVAL,139	RW	sec.

ERC efficiency calculation



TOa	Outside air [°C]	TEh	Exhaust air temperature [°C]
TEx	Extract air temperature [°C]	TSuAfPreHcl	Supply temperature after preheating coil [°C]
TSuAfHexg	Supply temperature after heat exchanger [°C]		

Exhaust side

Efficiency n is calculated on the exhaust side by the following formula:

n = (TEx – TEh) / (TEx – TOa)

In case the preheating coil is active, TSuAfPreHcl is used instead of TOa. If the sensor is not available while the preheating coil is active, the efficiency is unreliable.

Supply side

In case the preheating coil is active, TSuAfPreHcl is used instead of TOa. If the sensor is not available while the preheating coil is active, the efficiency is unreliable.

If an additional supply air sensor after the heat exchanger is available, the efficiency n is calculated on supply and exhaust side as:

n = 0.5 * (TEx – TEh) / (TEx – TOa) + 0.5 * (TSuAfHexg – TOa) / (TEx – Toa)

Efficiency calculation requires at least outside temperature, extract temperature and exhaust temperature sensors.

Available parameters

Current values	BACnet object	R/RW	Note
ERC efficiency	PrHExgEfcy AVAL,357	R	%

5.10.3 Passive Heat Exchanger, uncontrolled (PltHExg22y)

The purpose of energy recovery is to absorb heat/cold from the exhaust air and transfer it back to the supply air side.

The control of the energy recovery is not possible, the ERC always works with maximum capacity. With this solution, the outside air cannot be used for heating or cooling even if the outside air is closer to the setpoint than the exhaust air (e.g. in rooms with a high internal load or when heating up after cold nights).

5.10.3.1 ERC De-Icing (passive, uncontrolled)

Passive Energy Recovery units are essentially heat exchangers. They receive warm and humid air on one side and cold on the other which will eventually cumulate ice on the surfaces when the conditions are suitable for that. Passive element usually starts to cumulate ice already close to zero Celsius degree.

Detecting ice on the heat exchanger or in the ductwork

Detecting ice on the heat exchanger or in the ductwork is possible:

- With exhaust air temperature sensor TEh. This is not a real indication, but an expectation that ice is expected to build up.
  - Deicing with TEh sensor starts when TEh is below the limit.
  - The end of the de-icing phase cannot be detected and is estimated via timer.
- With a differential pressure switch over the heat exchanger. This possibility does not detect ice built up in the ductwork and does not safely work on all types of heat exchanger. If exhaust air temperature sensor and differential pressure switch are installed, the differential pressure switch is used to start de-icing.
  - Deicing is active as long as the differential pressure switch is active.
- With outside air sensor TOa. This is used when no exhaust air sensor and no differential pressure switch are available. It is also only an expectation that ice has built up.
  - Deicing with TOa sensor starts when TOa is below the limit.
  - The end of the de-icing phase cannot be detected and is estimated via timer.

De-icing the heat exchanger

De-icing is possible by:

1. Reducing the supply fan speed, so that the load of cold air incoming is reduced, increasing the exhaust air temperature.
2. Preheating the outside air, increasing the exhaust air temperature

De-icing modes

The deicing mode can be configured as:

- No deicing
- Reduce fan speed
- Increase preheating
- Reduce fan speed and increase preheating

Deicing with fan speed is running in parallel or with 2 stage, see below.

Time based Deicing started by TEh or TOa

The sensor is not suitable for detecting the end of the deicing phase. Therefore, a fix deicing time is used. After deicing is finished, an off time is started until the next deicing phase can be started again. The duration of the off time depends on the measured temperature at the start of a deicing phase. Deicing time, maximum off time with assigned temperature and minimum off time with assigned temperature can be configured.

Humidity influence for TEh or TOa

If an extract air humidity sensor is available, the de-icing limit can be lowered, because icing is reduced due to dry extract air. Configured de-icing limit refers to a room / extract humidity value of 80% or higher. This value will be reduced continuously by a configurable temperature drop until the room / extract humidity value reaches 20% or lower.

Deicing with increased preheating

In case of possible de-icing, brine coil or ground collector are activated by the outside air conditions. So they automatically assist the de-icing process.

Preheating with electric heater can be used to assist de-icing. This reduces the efficiency of the heat recovery and uses electrical energy instead.
Especially when no reheating is available, it is recommended to use the electric preheater, as otherwise reduced heat exchanger function will result in very low supply air temperature.

As for normal preheating control, TSuAfPreHcl sensor is used. Electrical heater is modulated to reach SpPreHDeicng setpoint. The preheater control runs in this mode until de-icing is finished and switches back to normal operation running with normal setpoint.

Deicing by with reduced fan speed started by differential pressure switch

During deicing fan speed for supply fan and exhaust fan are set to configurable values. For faster deicing, it is possible to set the supply fan speed setpoint even to 0%. In this case electric heaters in the supply air are blocked.

Deicing with reduced fan speed started by TEh or TOa

The temperatures have 2 adjustable limits. The higher limit SpTDeicHExg (stage 1) starts deicing with the bypass damper only, while the lower limit SpTDeicFan (stage 2) starts deicing with bypass damper and fan speed in parallel (2 stage approach).

During deicing, fan speed for supply fan and exhaust fan are reduced to configurable values. For faster deicing, it is possible to set the supply fan speed setpoint even to 0 %. In this case electric heaters in the supply air are blocked.

Available parameters

Actual values	BACnet object	R/RW	Note
Deicing request for fan	DeicReqFan BVAL,308	R	
Heat exchanger differential pressure monitor	HExgDiffPMon BI, 77 (D1 NO) BI, 160 (D1 NC) BI, 94 (D2 NO) BI, 161 (D2 NC) BI, 111 (X3) BI, 128 (X8)	R	

Basic settings	BACnet object	R/RW	Note
De-icing mode configuration	DeicModCnf MVAL,411	RW	1: None 2: Not used 3: Fans 4: Preh 5: Fans + Preh
De-icing, stage1 limit, preheat only	SpTDeicHExg AVAL,378	RW	°C
De-icing, stage2 limit, fan	SpTDeicFan AVAL,373	RW	°C

Basic settings	BACnet object	R/RW	Note
Activation time deicing	TiDeic PINTVAL,146	RW	sec.
De-icing supply fan flow	SpAirFlSuDeic AVAL,181	RW	m3/h
De-icing exhaust fan flow	SpAirFlEhDeic AVAL,226	RW	m3/h
De-icing supply fan pressure	SpPSuDeic AVAL,196	RW	Pa
De-icing exhaust fan pressure	SpPExDeic AVAL,232	RW	Pa
De-icing supply fan speed	SpFanSuSpdDeic AVAL,208	RW	%
De-icing exhaust fan speed	SpFanEhSpdDeic AVAL,295	RW	%

Special settings	BACnet object	R/RW	Note
Temperature drop for room / extract humidity <= 20%	DiffTHuCmpDeic AVAL,376	RW	K
Temperature for maximum off time	TDeicTiOffStt AVAL,379	RW	°C
Maximum off time	TiOffDeicMax PINTVAL,147	RW	sec.
Temperature for minimum off time	TDeicTiOffEnd AVAL,380	RW	°C
Minimum off time	TiOffDeicMin PINTVAL,148	RW	sec.

5.10.3.2 ERC supervision (passive, uncontrolled)

A mechanical failure on the ERC (heat exchanger dirty etc.) can be detected via the efficiency of the heat exchanger. Therefore, the temperature difference between extract air / room air and exhaust air is used. When the difference drops below set value and stays below during set delay time, alarm is generated.

Detection function is active only when temperature difference between outside air and extract air is more set limit.

When extract air temperature and exhaust air temperature are not available, the supervision of the ERC is not possible.

Condenser pump fault signal can be configured to the unit.

Pump itself works autonomous and does not require any own logic. The fault signal from this shall be connected to a digital potential free input at the controller. When fault signal is received, bypass damper is closed.

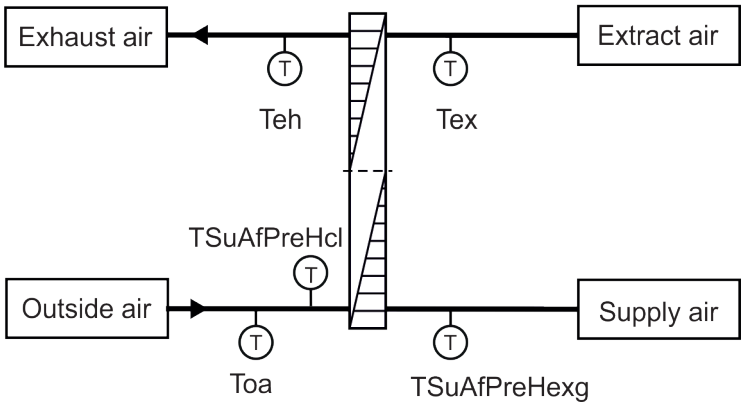
The alarm class of these alarms can be configured as A-Alarm. B-Alarm or none.

Available parameters

Actual values	BACnet object	R/RW	Note
Heat exchanger condensation monitoring	HExgCdnMon BI,75 (D1 NO) BI,160 (D1 NC) BI,92 (D2 NO) BI,161 (D2 NC) BI,109 (X3) BI,126 (X8)	R	

Basic settings for efficiency alarm	BACnet object	R/RW	Note
Min difference between extract and outside air temperature	DiffTExTOaMin AVAL,382	RW	K
Min difference between extract and exhaust temperature	TDHExgTErr AVAL,381	RW	K
Efficiency supervision delay time	TiDlyHExgTErr PINTVAL,149	RW	sec.

ERC efficiency calculation



TOa	Outside air [°C]	TEh	Exhaust air temperature [°C]
TEx	Extract air temperature [°C]	TSuAfPreHcl	Supply temperature after preheating coil [°C]
TSuAfHexg	Supply temperature after heat exchanger [°C]		

Exhaust side

Efficiency n is calculated on the exhaust side by the following formula:

n = (TEx – TEh) / (TEx – TOa)

In case the preheating coil is active, TSuAfPreHcl is used instead of TOa. If the sensor is not available while the preheating coil is active, the efficiency is unreliable.

Supply side

If an additional supply air sensor after the heat exchanger is available, the efficiency n is calculated on supply and exhaust side as:

n = 0.5 * (TEx – TEh) / (TEx – TOa) + 0.5 * (TSuAfHexg – TOa) / (TEx – TOa)

Efficiency calculation requires at least outside temperature, extract temperature and exhaust temperature sensors.

Available parameters

Current values	BACnet object	R/RW	Note
ERC efficiency	PrHExgEfcy AVAL,372	R	%

5.11 Heating

An additional heater is used when the ERC is not available for heating or is available for heating but has reached its maximum position. To release the heating, the supply air temperature must fall below the setpoint - heating difference.

The heating is supported by preheating if possible, but preheating functions are not included in the supply air temperature sequence.

5.11.1 Water based heating with frost protection (HclHw21y)

If ERC cannot maintain the supply air temperature setpoint, water heating coil can be activated and controlled as second heating sequence.

After activation, heating coil pump is activated and heating coil valve is controlled to keep the supply air temperature at its setpoint. During normal operation the pump runs depending on the valve position (fix switching on point 5%), when the plant is switched off, the pump is continuously running to ensure reliable measuring oft the return temperature.

Available parameters

Current value	BACnet object	R/RW	Unit
Supply setpoint for heating coil	SpTSuHcl AVAL,215	RW	°C
Return temperature value	TFrPrtHcl AI,152 (B1) AI,153 (B2) AI,58 (B3) AI,64 (B4) AI,80 (X8) AVAL,317 (POS9) AVAL,468 (QBM1) AVAL,652 (QBM2)	R	°C
Heating valve position Prio2: Fire / Smoke Prio5: Protection Frost / plant control	HclVlvPos AO,108 (A1) AO,117 (A2) AO,126 (A3) AO,135 (A4) AVAL,387 (POS9) AVAL,476 (QBM1AO1) AVAL,483 (QBM1AO2) AVAL,657 (QBM2AO1) AVAL,664 (QBM2AO2)	RW	%
Heating pump status Prio2: Fire / Smoke Prio5: Protection Frost / plant control	HclPuCmd BO,57 (Q1) BO,72 (Q2) BO,87 (Q3) BVAL,248 (POS9)	RW	

Special settings	BACnet object	R/RW	Unit
Heater Kp	GainHclTSuCtrH AVAL,221	RW	% / K
Heater Tn	TnHclTSuCtrH PINTVAL,110	RW	sec.

Testing and debugging	BACnet object	R/RW	Unit
Heating coil device mode Prio 2: Fire / Smoke Prio 5: Protection from plant control	HclDevMod MVAL,154		1: Off with idle frost 2: Control Mode 3: Full Open 4: Off with runtime frost

Water coil frost protection

To always minimize the risk of freezing of the water heating coil, 2-stage frost protection and additional idle time frost protection functions are available.

Frost protection function while unit is in operation

The application uses a two-stage antifreeze with 2 special setpoints, which is intended to prevent freezing while the ventilation is still normally active, and to protect the device when prevention has not been sufficient. The temperature sensor TFrPrtHcl is required for this function and must be located at the coldest point of the water heating coil.

Stage 1 - Frost risk:

If the temperature of TFrPrtHcl falls below the set frost risk setpoint (e.g. 10°C), the pump is switched on (if not already switched on) and the valve is controlled according to the temperature of TFrPrtHcl at risk of frost. When the temperature of TFrPrtHcl reaches the frost hazard set point, the frost protection function is automatically terminated.

Stage 2 – Frost protection:

If the temperature at TFrPrtHcl falls below the set frost protection setpoint (e.g. 4°C), the pump is switched on (if not already switched on), the valve is opened 100%, the ventilation is switched off, any fresh air dampers are closed and the A alarm is activated.

A restart can only take place, after the alarm is acknowledged, the temperature is higher than SpFrPltOnHcl and the plant is reset.

Frost protection while the unit is not in operation

During the times when the ventilation unit is switched off for any reason (must still be connected to power supply), the temperature of TFrPrtHcl has an additional setpoint (e.g. +25°C) to secure the start-up situation. If the heating coil is constantly kept warm, it will not drop to the frost protection limit during start-up, even in cold outdoor conditions.

The pump runs constantly during the non-productive times of the ventilation unit. If the temperature of TFrPrtHcl falls below the set temperature limit during the device failure times, the valve is PI-controlled to reach the idle setpoint. The alarm is not activated until the temperature at the TFrPrtHcl drops below the frost protection set point.

If one of the frost protection parts is active, the standard temperature control has no priority (constant or cascaded).

The function is activated automatically when HclHw11y is commissioned.

Available parameters

Current value	BACnet object	R/RW	Note
Return temperature setpoint for frost	SpFrPrt AVAL,216	R	°C
Return temperature value	TFrPrtHcl AI,152 (B1) AI,153 (B2) AI,58 (B3) AI,64 (B4) AI,80 (X8) AVAL,317 (POS9) AVAL,468 (QBM1) AVAL,652 (QBM2)	R	°C

Basic settings:	BACnet object	R/RW	Note
Frost protection limit	FrPrtLm AVAL,217	RW	°C, plant shutdown, valve open, pump on
Setp.frost prot.if plant on, heat.coil	SpFrPltOnHcl AVAL,218	RW	°C
Setp.frost prot.if plant off, heat.coil	SpFrPltOffHcl AVAL,219	RW	°C
Max.delay frost protection for startup When passed, startup is stopped and frost alarm is raised	DlyMaxFrpSttUp PINTVAL,109	RW	sec.

5.11.2 Electrical heater (HclEl21y)

After ERC has reached its full output but TSu setpoint is not reached, electrical heating coil can be activated and controlled as second heating sequence to raise the supply air temperature TSu.

Safety functions

Some electric heaters include an output for an overheating safety thermostat. The input for receiving this information can be activated on the controller and after the active signal, the electrical heater is turned off and the ventilation unit is turned off.

The fan speed must be above the set minimum speed to activate the electric heater.

The overtemperature detector must be connected to the electric heater via hardware unless local regulations allow software interlock.

It can be selected whether the fans must be stopped immediately after the safety thermostat has been triggered or whether the fans may run for at least the delay time for the cooldown of the electric heaters (see also Start-up / shut-down sequence [➙ 145]).

Available parameters

Current value	BACnet object	R/RW	Note
Current supply air temperature setpoint for heating	SpTSuHcl AVAL,211	RW	°C
Electrical heater output signal Prio2: Fire / Smoke Prio5: Protection	HclElPos AO,64 (Y1) AO,107 (A1) AO,116 (A2) AO,125 (A3) AO,134 (A4) AVAL,386 (POS9) AVAL,475 (QBM1AO1) AVAL,482 (QBM1AO2) AVAL,656 (QBM2AO1) AVAL,663 (QBM2AO2)	RW	%
Electrical heater command	HclElCmd BO,56 (Q1) BO,71 (Q2) BO,86 (Q3)	RW	
Over temperature detection	HclOvrTDet BI,112 (X3) BI,129 (A1) BI,78 (D1 NO) BI,95 (D2 NO) BI,162 (D1 NC) BI,163 (D2 NC)	R	

Basic settings	BACnet object	R/RW	Note
Enable electric heating coil	EnHclEl BVAL,197	RW	
Fan switch-off delay	DlyOffAflHldH PINTVAL,107	RW	s
Minimum heater output before fan switch off delay is activated	SwiOnAirFlHldH AVAL,213	RW	%

Special settings	BACnet object	R/RW	Note
Heater Kp	GainHclTSuCtrH AVAL,214	RW	% / K
Heater Tn	TnHclTSuCtrH AVAL,108	RW	sec.
Pulse period electrical heater	HclElPlsPrd (Y1) PINTVAL,617	RW	BACnet property 4984
Minimum switch on time	HclElTiOnMin (Y1) PINTVAL,618	RW	BACnet property 4994
Minimum switch off time	HclElTiOffMin (Y1) PINTVAL,619	RW	BACnet property 4995
Alarm configuration for overtemperature	AlmCnfOvrT PINTVAL,573	RW	

Testing and debugging	BACnet object	R/RW	Note
Heating coil device mode Prio2: Fire / Smoke Prio4: Overtemperature protection Prio5: Protection from plant control	HclDevMod MVAL,153		1: Off 2: Control Mode 3: Full Open

5.12 Cooling

Additional cooling is used when the ERC is not available for cooling, is locked for cooling, or is available for cooling but has reached its maximum position. To release cooling, the supply air temperature must rise above the setpoint plus the cooling difference.

With free cooling, the room can be cooled without energy consumption.

If possible, cooling is supported by a brine winding or a ground collector.

5.12.1 Cooling coil chilled water (CclChw21y)

If ERC cannot maintain the supply air temperature setpoint, chilled water cooling coil can be activated and controlled as second cooling sequence.

After activation, the cooling coil pump is activated and the cooling coil valve is controlled so that the supply air temperature is kept at the setpoint. The pump runs depending on the valve position (fixed switch-on point 5 %).

Available parameters

Current value	BACnet object	R/RW	Note
Setpoint supply air temp. cooling for cooling coil	SpTSuCcl AVAL,222	R	°C
Cooling valve position Prio2: Fire / Smoke Prio5: Protection from plant control	CclVlvPos AO,109 (A1) AO,118 (A2) AO,127 (A3) AO,136 (A4) AVAL,388 (POS9) AVAL,477 (QBM1AO1) AVAL,484 (QBM1AO2) AVAL,658 (QBM2AO1) AVAL,665 (QBM2AO2)	RW	%
Cooling pump command Prio2: Fire / Smoke Prio5: Protection from plant control	CclPuCmd BO,58 (Q1) BO,73 (Q2) BO,88 (Q3) BVAL,249 (POS9)	RW	

Special settings:	BACnet object	R/RW	Note
Cooling Kp	GainCclTSuCtrC AVAL,223	RW	% / K
Cooling Tn	TnCclTSuCtrC PINTVAL,111	RW	s

Testing and debugging	BACnet object	R/RW	Note
Cooling coil device mode Prio2: Fire / Smoke Prio4: Overtemperature protection Prio5: Protection from plant control	CclDevMod MVAL,156		1: Off 2: Control Mode 3: Full Open

5.12.2 DX based cooling (CclDx21y)

If ERC cannot maintain the supply air temperature setpoint, direct expansion cooling coil can be activated and controlled as second cooling sequence.

Activation and operation of DX cooling differs from water based cooling so that cooling valve request must first rise above 10 % (fix) before activation command to DX unit is given. DX activation command is also removed at 5 % (fix) valve position before the valve is completely closed. New activation command can be given earliest after set off-time has elapsed.

The monitoring function can be enabled via value EnMonAirFlSta to avoid overcooling and icing if there is no air flow.

Available parameters

Current value	BACnet object	R/RW	Note
Supply air temperature setpoint for cooling	SpTSuCcl AVAL,224	R	°C
Cooling valve position	CclDxPos AO,110 (A1) AO,119 (A2) AO,128 (A3) AO,137 (A4) AVAL,389 (POS9) AVAL,478 (QBM1AO1) AVAL,485 (QBM1AO2) AVAL,659 (QBM2AO1) AVAL,666 (QBM2AO2)	RW	%
Cooling DX status	CclDxCmd BO,59 (Q1) BO,74 (Q2) BO,89 (Q3) BVAL,250 (POS9)	RW	
Cooling coil DX fault	CclDxFlt BI,113 (X3) BI,130 (X8) BI,79 (D1 NO) BI,96 (D2 NO) BI,166 (D1 NC) BI,165 (D2 NC)	R	

Special settings	BACnet object	R/RW	Note
Cooling Kp	GainCclTSuCtrC AVAL,225	RW	% / K
Cooling Tn	TnCclTSuCtrC PINTVAL,112	RW	s
DX off time delay	CclDxTiOffMin PINTVAL,116	RW	s
DX min run time	CclDxTiOnMin PINTVAL,115	RW	s
Enable monitoring for air flow	EnMonAirFlSta BVAL, 210	RW	s

Testing and debugging	BACnet object	R/RW	Note
Cooling coil device mode	CclDevMod MVAL,158		1: Off 2: Control Mode 3: Full Open

5.12.3 Free cooling (FreeCDtr11y)

The purpose of the 'Free cooling' function is to ensure that overheated living area can be cost efficiently cooled down by using the lower outside temperatures just by increasing the air circulation.

Activation of the function occurs, when

- Outside air (TOa) is sufficiently low compared to the apartment temperature (extract or room), **and**
- Apartment temperature is above its actual setpoint + configurable hysteresis, **and**
- Outside temperature is above set minimum limit, **and**
- Free cooling is configured

For de-activation a hysteresis of 2K (fix) is used.

During activation, the operating mode is set to Comfort and kept there until one of the activation criteria is no longer fulfilled.

In case of cascade control, the actual room temperature setpoint (depending on the operating mode) is used.

As there is no room temperature setpoint available for supply air control, a configurable virtual room temperature setpoint is used.

Available parameters

Current values	BACnet object	R/RW	Note
Present plant operating mode	PrPltOpMod MVAL,164	R	10: Free Cooling
Actual setpoint from cascade control	SpTR AVAL,30	R	°C
Configurable virtual room setpoint for supply control	SpTRFreeC AVAL,109	RW	°C
Hysteresis TR for free cooling	HysSpTR AVAL,32	RW	K

Basic settings	BACnet object	R/RW	Note
Enabling the free cooling function	EnFreeC BVAL,162	RW	
Outside air minimum limit for activation	TOaLm AVAL,33	RW	°C
Min difference room – outside air temp. For free cooling start	DiffTRTOaSwiOn AVAL,35	RW	K
Minimum on time	TiPreCoolMin PINTVAL,69	RW	s

5.13 Dampers

5.13.1 Outside air shut off dampers (DmpShoffOa11y)

When ventilation is active the outside air dampers are always open. Both dampers are controlled open/close from one binary output.

Delay time for outside air damper opening can be defined to secure that dampers are fully open before fans are started.

Damper monitoring

When the outside air damper is manually closed (overridden) the air handling unit is shut down after a delay time, as the air flow is blocked.

Available parameters

Actual values	BACnet object	R/RW	Note
Outside air damper command Prio 2: Fire / Smoke Prio 5: Protection from plant control	DmpOaCmd BO,50 (Q1) BO,65 (Q2) BO,80 (Q3) BVAL,241 (POS9)	RW	Outside air damper

Basic settings	BACnet object	R/RW	Note
Outside damper delay time	DlyOnAflVntReq PINTVAL,81	RW	s

5.13.2 Recirculating air damper (DmpMx21y)

Recirculating dampers (mixed air dampers) reuse energy from room air as much as possible. Extract air is mixed with outside air where additional heating/cooling devices are in the room and extract air is efficient enough. This controls the supply air temperature and saves energy. It assumes control over the heating/cooling sequence prior to the heat exchange device.

At the highest priority, air quality, fine dust, or dehumidification control the recirculating air damper. Once maintained, the recirculating air damper is controls the temperature as the first heating / cooling sequence.

A minimum outside air damper position can be configured to ensure a minimum outside air flow

- For TEx > TOa + DiffTRTOaDmpMx, room air can be considered for heating. The recirculating damper is controlled to fully open if the plant is also in heating mode. The function is disabled for TEx < TOa.
- For TEx < TOa - DiffTRTOaDmpMx, room air can be considered for cooling. The recirculating damper is controlled to fully open if the plant is also in cooling mode. The function is disabled for TEx < TOa.
- TSuAfPreHcl is used instead of Toa when the preheating coil is active.
- The dehumidify / CO_2 / fine dust function fully opens the outside air damper to improve ventilation (i.e. air quality) when heating/cooling conditions are not met for the recirculating damper.
- The free-cooling and smoke control function fully closes the recirculating damper and fully opens the outside air damper.
- The recirculating air damper fully opens and outside air damper closes if the plant is stopped or in emergency off mode.

The function requires at least one 0-10 V output for the recirculating damper command.

The outside air damper command can be selected but is not required when there is a mechanical rod connected to the recirculating damper.

The recirculating air damper operates in the opposite direction as the outside air damper.

Heat recovery ventialtion (HRV) - HvacFnct26y

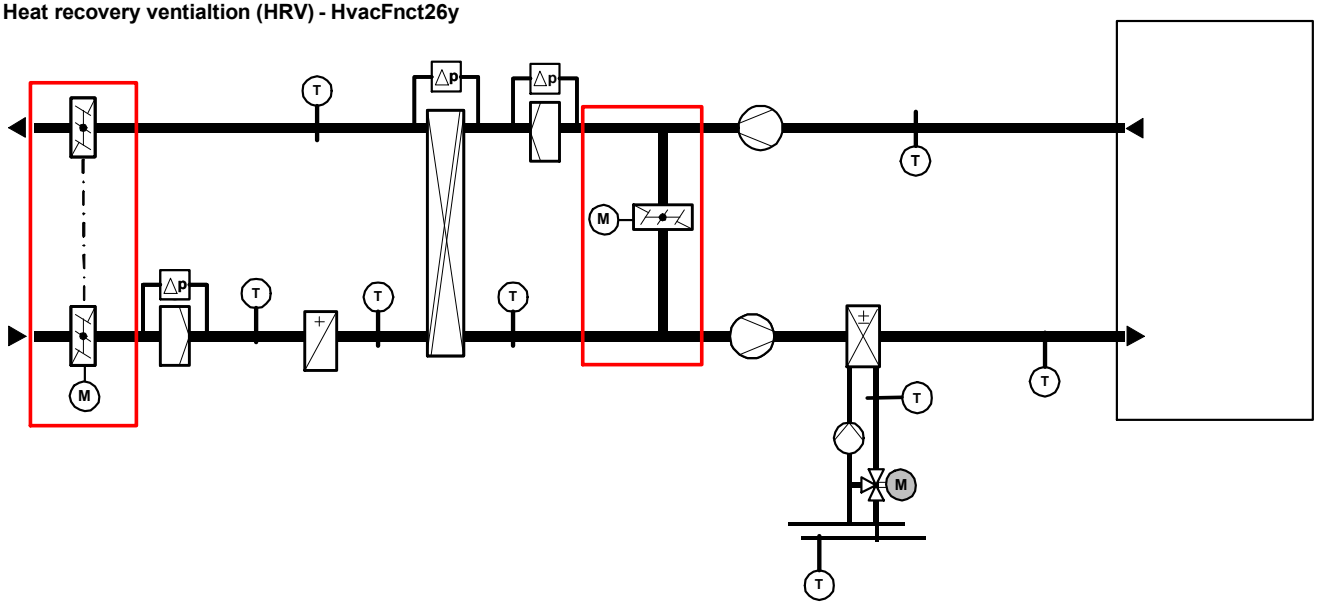


Diagram of a recirculating air damper and outside air dampers (red boxes) as part of an air handling unit.

Available parameters

Actual values	BACnet object	R/RW	Note
Outside air damper position Prio 2: Fire / Smoke Prio 5: Protection from plant control	DmpOaPos AO,163 (A1) AO,166 (A2) AO,168 (A3) AO,169 (A4) AVAL,752 (POS9) AVAL,741 (QBM1AO1) AVAL,745 (QBM1AO2) AVAL,747 (QBM2AO1) AVAL,749 (QBM2AO2)	RW	Outside air damper
Mixing air damper position Prio 2: Fire / Smoke Prio 5: Protection from plant control	DmpMxPos AO,162 (A1) AO,165 (A2) AO,167 (A3) AO,170 (A4) AVAL,753 (POS9) AVAL,740 (QBM1AO1) AVAL,744 (QBM1AO2) AVAL,746 (QBM2AO1) AVAL,748 (QBM2AO2)	RW	Recirculating air damper
Recirculating damper heating/ cooling state	DmpMxHCSta MVAL,943	R	1: Neither 2: Heating 3: Cooling

Basic settings	BACnet object	R/RW	Note
Outside damper delay time	DlyOnAflVntReq PINTVAL,667	RW	S
Minimum position outside air damper	DmpOaPosMin PINTVAL,729	RW	Default 30%

Special settings	BACnet object	R/RW	Note
Damper TSu Kp	GainDmpCtr AVAL,735	RW	%/K
Damper TSu Tn	TnDmpCtr PINTVAL,668	RW	S
Min difference room – outside air temp.	DiffTRTOaDmpMx AVAL,778	RW	K

5.14 Filter supervision (FilAMon21y)

Supply and extract duct air filters are getting dirty when the unit is in operation and they need to be changed in relatively regular service intervals.

Service indication with timer

Maintenance interval timer is set on the controller. When the operating hours reach the runtime limit, the contamination level is assumed to be high enough and it's time to schedule a filter change.

Service indication with pressure differential switch input

Optionally, filters are equipped with dP switches which send a signal to controller when the set contamination level is reached and it's time to schedule a filter change.

Service indication with differential pressure sensors

Pressure sensors QBM97 can be used instead of dP switches. A sensor and a switching point can be defined for each filter to indicate the level of filter contamination. A fixed delay time of 5 minutes is used to avoid alarming caused by short-term pressure changes.

When the filter timer is elapsed or the pressure differential input requires a filter change, a B-Alarm is activated.

Filter runtime can be reset via BACnet object RstTiOpFil or by acknowledge the alarm 1020 'Air Filter dirty'.

Before switching off the unit for filter replacement, it is recommended to execute a shut down for maintenance, see Start-up / shut-down sequence [➙ 145].

Available parameters

Actual values	BACnet object	R/RW	Note
Differential pressure, filter clogged	FilAirDiffPMon BI,72 (D1 NO) BI,89 (D2 NO) BI,150 (D1 NC) BI,151 (D2 NC) BI,106 (X3) BI,123 (X8)	R	
Differential pressure filter supply	DiffPFilSu AVAL,669 (QBM1P1) AVAL,703 (QBM1P2) AVAL,667 (QBM2P1) AVAL,709 (QBM2P2)	R	Pa
Differential pressure filter exhaust	DiffPFilEh AVAL,701 (QBM1P1) AVAL,670 (QBM1P2) AVAL,706 (QBM2P1) AVAL,668 (QBM2P2)	R	Pa
Actual runtime filter since last maintenance	TiOpFil AVAL,158	R	hrs

Basic settings	BACnet object	R/RW	Note
Runtime limit for air filter replacement	TiOpFilRpc AVAL,157	RW	H
Filter time reset	FilTiOpFil MVAL,350	RW	1: Ready 2: Reset
Max differential pressure for supply air filter	SpDiffPFilSu AVAL,671	RW	Pa
Max differential pressure for exhaust air filter	SpDiffPFilEh AVAL,672	RW	Pa

5.15 Preheating Functions

Optional preheating functions optimize operation of the HRV especially in winter conditions. An earth to air heat exchanger or a brine coil allow the use of environmental energy from the ground, warming up or cooling down the outside air before reaching the heat exchanger. Alternatively, an electric heating coil can be used as additional heat source. All preheating functions reduce the danger of icing on the heat exchanger by increasing the incoming air temperature in winter times. This is especially recommended, when using a heat exchanger without humidity transfer (plate heat exchanger).

5.15.1 Earth to Air Heat Exchanger (EaHExg21y)

Earth to air heat exchanger include a damper to force or to bypass the air flow through the earth duct. The control depends on an estimated earth temperature which can be configured for winter (heating) and summer (cooling) conditions. A hysteresis of 1 °C (fix) and a minimum time of 1 min (fix) for damper open / bypass prevent the damper from moving too frequently.

If there is no demand for heating or cooling, the bypass damper remains in its last state in order to use free energy as much as possible.

Temperature conditions	Supply air conditions	Damper position
TOa < TEarth Winter	Heating requested	closed
TOa > TEarth Winter	Heating requested	bypass
TOa < TEarth Summer	Cooling requested	bypass
TOa > TEarth Summer	Cooling requested	closed

Available parameters

Actual values	BACnet object	R/RW	Note
Bypass damper position	EaHxDmpbCmd BO,54 (Q1) BO,69 (Q2) BO,84 (Q3) BVAL,245 (POS9)	RW	

Basic settings	BACnet object	R/RW	Note
Estimated earth temperature in winter (TOa < 10°C)	TEaWinEst AVAL,353	RW	°C
Estimated earth temperature in summer (TOa > 20°C)	TEaSumEst AVAL,354	RW	°C

Testing and debugging	BACnet object	R/RW	Note
Preheater device mode	PreHclDevMod MVAL,407		1: Off 2: Control mode 3: Fully open

5.15.2 Brine Coil (PreHclBne21y)

The brine coil includes a pump and a brine flow temperature sensor. The control depends on the brine flow temperature. A hysteresis of 1 °C (fix) and a minimum run / pause time of 1 min (fix) for the pump prevent it from switching too frequently. In case the temperature sensor is not configured, a configurable estimated brine temperature for summer (cooling) and winter (heating) is used instead.

As the brine flow temperature is not measured correctly, when the pump has stopped, the last value measured while the pump is running is taken instead.

The preheating coil can also be used for dehumidification, if dehumidification is requested. Dehumidification is only possible, if the brine flow temperature is below the dewpoint temperature of the room minus a configurable offset, depending on the coil design.

Temperature conditions	Supply air conditions	Pump command
TOa < TFlPreHcl	Heating requested	On
TOa > TFlPreHcl	Heating requested	Off
TOa < TFlPreHcl	Cooling requested	Off
TOa > TFlPreHcl	Cooling requested	On
TOa > TFlPreHcl and Dewpoint - Offset > TFlPreHcl	Dehumidification requested. In case of conflicts, dehumidification request overrules heating or cooling	On
	No dehumidification requested and no heating or cooling request	Off

Available parameters

Actual values	BACnet object	R/RW	Note
Brine pump command	PreHclPuCmd BO,53 (Q1) BO,68 (Q2) BO,83 (Q3) BVAL,244 (POS9)	RW	
Flow temperature brine	TFlPreHcl AI,149 (B1) AI,151 (B2) AI.57 (B3) AI,63 (B4) AI,79 (X8) AVAL,316 (POS9) AVAL,467 (QBM1) AVAL,651 (QBM2)	RW	

Basic settings	BACnet object	R/RW	Note
Estimated brine temperature in winter (TOa < 10°C)	TeaWinEst AVAL,350	RW	
Estimated brine temperature in summer (TOa > 20°C)	TeaSumEst AVAL,351	RW	
Offset brine flow temperature to dewpoint temperature	SpTBneDhu AL,454	RW	
Enable dehumidification via brine preheater	EnPrhDhuCnf BVAL,314	RW	0: No dehumidification 1: Dehumidification released, if required

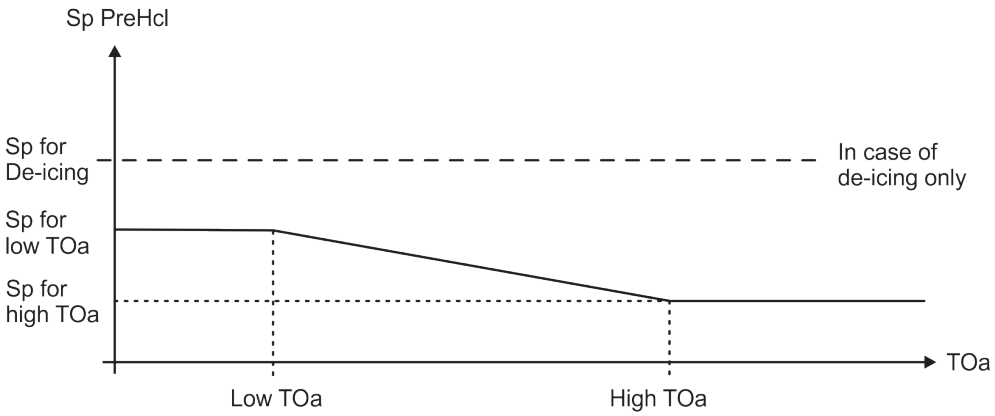
Testing and debugging	BACnet object	R/RW	Note
Preheater device mode	PreHclDevMod MVAL,406		1: Off 2: Control mode 3: Fully open

5.15.3 Electric Preheating Coil (PreHclEl21y)

The electrical preheating coil contains a temperature sensor TSuAfPreHcl before heat recovery and an overtemperature detector. The control is carried out continuously via an analog output, pulsed via a triac output or switched via a binary output. The setpoint for TSuAfPreHcl is influenced by the outdoor air temperature TOa. The curve settings can be configured. If the ERC is defrosted, the setpoint can be increased to a configurable defrost setpoint.

For safety reasons, the overtemperature detector switches off the electric heater and the entire HRV plant (A alarm).

The overtemperature detector must be connected to the electric heater via hardware unless local regulations allow software interlock.



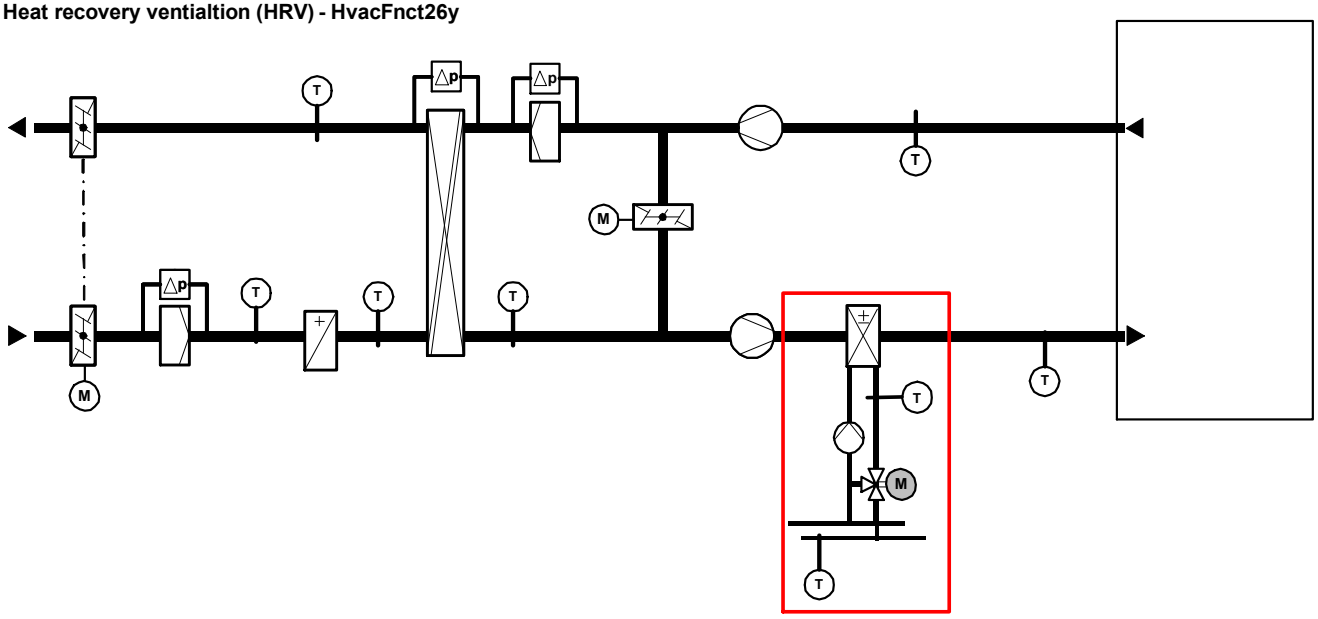
Available parameters

Actual values	BACnet object	R/RW	Note
Electric preheater position	PreHclElPos AO,63(Y1) AO,104 (A1) AO,113 (A2) AO,122 (A3) AO,131 (A4) AVAL,383 (POS9) AVAL,472 (QBM1AO1) AVAL,479 (QBM1AO2) AVAL,653 (QBM2AO1) AVAL,660 (QBM2AO2)	RW	
Electric preheater command	PreHclElCmd BO,52 (Q1) BO,67 (Q2) BO,82 (Q3) BVAL,243 (POS9)	RW	
Supply air temperature after preheater	TSuAfPreHcl AI,147 (B1) AI,148 (B2) AI,56 (B3) AI,62 (B4) AI,78 (X8) AVAL,315 (POS9) AVAL,446 (QBM1) AVAL,650 (QBM2)	R	
Preheating coil overtemperature detector	PreHclOvrTDet BI,74 (D1 NO) BI,91 (D2 NO) BI,154 (D1 NC) BI,155 (D2 NC) BI,108 (X3) BI,125 (X8)	R	

Basic settings	BACnet object	R/RW	Note
Kp for temperature control before heat exchanger	GainPrhTCtr AVAL,347	RW	
Tn for temperature control before heat exchanger	TnPrhTCtr PINTVAL,138	RW	
Pulse period electrical heater	PreHclElPlsPrd (Y1) PINTVAL,620	RW	BACnet property 4984
Minimum switch on time	PrhElTiOnMin (Y1) PINTVAL,621	RW	BACnet property 4994
Minimum switch off time	PrhElTiOffMin (Y1) PINTVAL,622	RW	BACnet property 4995

5.16 Combined heating / cooling coil (HCcl21y)

Heat recovery ventialtion (HRV) - HvacFnct26y



The combined coil is a water based 2-pipe coil that can be used either as a heating coil when supplied with hot water or as a cooling coil when supplied with chilled water.

There are four methods to select heating or cooling mode for the combined coil:

1. Outside air temperature, 3-day average (TOaAvrg3Day)
2. If selected, the controller starts to record TOa every 3 hours and calculates the average value of the last three days. It goes to cooling mode if TOaAvrg3Day > outside air temperature for cooling limit (HCclTWPmLmC). Otherwise, it is used in heating mode. After switching to cooling mode, TOa must fall below cooling limit setpoint-hysteresis (HCclTOaAveCHys) before switching back to heating mode.
3. Calendar
4. User can define (month and day) the start and end of cooling mode. The combined coil is operated in cooling mode if the controller's local date is within this range; otherwise it is operated in heating mode.
5. Primary chilled water temperature.
6. The combined coil is operated on cooling mode for primary water temperature (TChwPm) < primary water temperature limit cooling (HCclTWPmLmC). After switching to cooling mode, TChwPm must rise above temperature limit cooling + hysteresis (HCclTWPmHys) before switching back to heating mode.
7. Position the source water temperature sensor where there is continuous water flow throughout the year.
8. 4: DI contact
9. A DI signal defines the source that provides chilled water if the combined coil water supply comes from a source that can provide hot or chilled water such as heat pump.

In cooling mode, the combined coil operates as detailed for the chilled water cooling coil CclChw21y.

In heating mode, the combined coil operates as detailed for the hot water heating coil in HclHw21y. The only difference is that combined coil frost protection is optional, but required for the heating coil.

Temperature control first uses other available heating or cooling coils. The combined coil is used only if the other coils are unable to maintain the setpoint.

If enabled, the combined coil pump is activated and the coil valve is controlled to maintain the supply air temperature setpoint. During normal operation the pump runs based on the valve position (fixed switch on at 5%). The pump operated continuous if the plant is switched off and the combined coil is in heating mode; this ensures that the return temperature is reliably measured.

Available parameters

Current value	BACnet object	R/RW	Note
Supply air temperature setpoint for heating mode	SpTSuHHCcl AVAL,761	R	°C
Supply air temperature setpoint for cooling mode	SpTSuCHCcl AVAL,776	R	°C
Primary chilled water temperature	TChwPm AI,173 (B1) AI,174 (B2) AI,175 (B3) AI,176 (B4) AI,177 (X8)	R	°C
Cooling indication input	HCclCStaIn BI,170 (D1) BI,171 (D2) BI,172 (X3) BI,173 (X8)	R	
Combined coil valve position	HCclVlvPos AO,177 (A1) AO,178 (A2) AO,179 (A3) AO,180 (A4)	RW	%
Prio2: Fire / Smoke	HCclPuCmd BO,106 (Q1) BO,107 (Q2) BO,108 (Q3)	RW	
Prio5: Protection Frost / plant control	TOaAvrg3Day AVAL,768	R	
Coil pump status	HCclHCSta BVAL,361	R	0: Heat 1: Cool

Basic settings:	BACnet object	R/RW	Note
Heat cool mode configuration		RW	1: Outside air temperature 2: Calendar 3: Suouce water temperature 4: DI cooling indicationl
Cooling limit for average TOa		RW	°C
Outside air temperature for cooling hysteresis		RW	K
Month of start cooling		RW	
Day of start cooling		RW	
Month of end cooling		RW	
Day of end cooling		RW	
Heating/cooling coil primary water temperature limit cooling		RW	
Heating/cooling coil primary water temperature hysteresis		RW	

Special settings:	BACnet object	R/RW	Note
Heater Kp	GainHCclTSuCtrH AVAL,767	RW	% / K
Heater Tn	GainHCclTSucH PINTVAL,670	RW	sec.
Cooler Kp	GainHCclTSucC AVAL,775	RW	% / K
Cooler Tn	TnHCclTSuCtrC PINTVAL,675	RW	sec.

Testing and debugging	BACnet object	R/RW	Unit
Heating coil device mode Prio 2: Fire / Smoke Prio 5: Protection from plant control	HCclDevMod MVAL,154		1: Off with idle frost 2: Control Mode 3: Full Open 4: Off with runtime frost
Outside air temperature average fast test mode	TOaAvrgFastTst BVAL,360	RW	Record every 5 s instead every 3 hours for testing only, provides 2-minute instead of a 3-day average.

Water coil frost protection

Frost protection is enabled automatically if the combined coil is in heating mode and the return water coil temperature sensor is valid.

Available parameters

Current value	BACnet object	R/RW	Note
Return temperature setpoint for frost	SpFrPrtHCcl AVAL,762	R	°C
Return temperature value	TFrPrtHCcl AI,168 (B1) AI,169 (B2) AI,170 (B3) AI,171 (B4) AI,172 (X8)	R	°C

Basic settings	BACnet object	R/RW	Note
Frost protection limit	FrPrtLmHCcl AVAL,763	RW	°C, plant shutdown, valve open, pump on
Setp.frost prot.if plant on, heatcool.coil	SpFrPltOnHCcl AVAL,764	RW	Default 10°C
Setp.frost prot.if plant off, heatcool.coil	SpFrPltOffHCcl AVAL,765	RW	Default 15°C
Max.delay frost protection for startup If exceeded, startup stops and frost alarm is triggered.	DlyMaxFrpSttUpHCcl PINTVAL,669	RW	sec.

5.17 External dehumidifier

Optionally an external dehumidifier can be used.

The following control modes can be selected:

Mode	Design of dehumidifier	Running	Controls
1	Room installation with integrated control	Always, except emergency or maintenance	Internally by dehumidifier
2	Room installation and part of humidity control sequence	Always, except emergency or maintenance	Humidity control sequence
3	Duct installation with integrated control	Only when plant in normal operation	Internally by dehumidifier
4	Duct installation and part of humidity control sequence	Only when plant in normal operation	Humidity control sequence

In any mode, the external dehumidifier is switched off in case of emergency control (fire / smoke) and in case of a controlled shutdown for maintenance.

If used within the humidity control sequence (Mode 2 and 4), a 2-point controller is used with a minimum on / off time of 5 minutes (fix).

Available parameters

Current values	BACnet object	R/RW	Note
External dehumidifier Prio 2: Fire / Smoke Prio 5: Protection from plant control	DHumFrsdCmd BO,60 (Q1) BO,75 (Q2) BO,90 (Q3) BVAL,251 (POS9)	RW	

Basic settings	BACnet object	R/RW	Note
Dehumidifier control mode	DHumCtlModCnf MVAL,489	RW	1: Room, integrated ctrl. 2: Room, control sequence 3: Duct, integrated control 4: Duct, control sequence

Testing and debugging	BACnet object	R/RW	Note
Dehumidifier device mode	DHumDevMod MVAL,488	RW	1: Off 2: Control 3: Max

5.18 Fire damper (Fdp11y)

The ventilation unit can be equipped with fire dampers that close automatically when a fire alarm is triggered by duct temperatures. During normal operation with the power switched on, the dampers are always open. In the event of a power failure, the dampers close automatically. After closing the fire dampers due to an alarm situation, normal operation can only be resumed if the fault is acknowledged and reset manually.

The fire dampers are equipped with their own release thermostat, so the fire dampers close automatically during the fire situation and the feedback signal from the closed dampers generates an A alarm for the fire situation with emergency shutdown.

Some fire situations are not covered by the built-in release thermostat. The fire damper will be closed by the control program, if

- The duct air temperature supervision has exceeded the fire alarm limit.
- A smoke alarm is raised and smoke alarm mode is set to "Both fans off".

!	***NOTICE***
	● Local fire safety regulations may require that the fire dampers are being tested periodically to secure correct operation. ● Fire damper testing is part of the periodical maintenance.

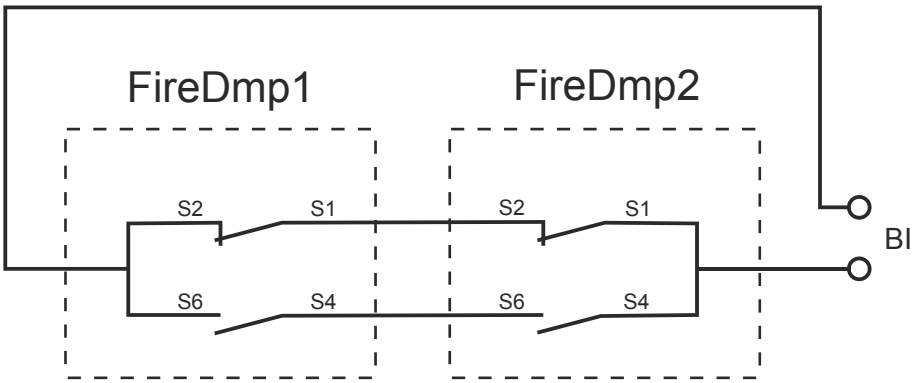
- During the fire damper operation test the ventilation is first shut down, then the dampers close and then open again, before the ventilation can be resumed.
- Fire dampers have inbuilt auxiliary switches on both open and closed positions which signalize that the movement was successful.
- If one of these signals is missing, an A-alarm is generated and the unit is stopped.

Performing a fire damper test

1. Set output to "1".
   ⇨ At the latest after 130% of the opening time, the damper must be opened and the FB signal must be "1" for damper opened.
2. Set output to "0".
   ⇨ The damper closes. Between 40...60% of the closing time, the FB signal must be "0".
3. **Wait** for the damper to close completely.
   ⇨ Damper continues closing. Between 90...130% of the closing time, FB signal must change from "0" to "1" for damper closed.
4. Set output to "1".
   ⇨ Damper opens. Between 40...60% of the opening time, FB signal must be "0".
5. **Wait** for the damper to open completely.
   ⇨ Damper continues opening. Between 90% and 130% of the opening time, the FB signal must change from "0" to "1" for damper opened.

After switching on the controller, it can be assumed that the fire damper has closed due to a power failure. The output is set to "0", 130% of the closing time is waited and the test procedure is carried out from step 4.

After a test failure or after unexpected closing of the fire damper, acknowledge and reset of the alarm is required. After reset, the output is set to “0”, 130 % of the closing time is waited, and the test procedure is executed from step 4 onwards.



Available parameters

Current values	BACnet object	R/RW	Note
Fire damper status	FdpSta MVAL,160	R	1 = moving 2 = closed 3 = open 4 = no move 5 = no close 6 = no open
Fire damper feedback	FdpFb DI,73 (D1 NO) BI,90 (D2 NO) BI,152 (D1 NC) BI,153 (D2 NC) BI,107 (X3) BI,124 (X8)	R	0 : one or more dampers not opened or closed 1: all fire dampers in open or closed end position
Fire damper open Prio2: Fire / Smoke Prio5: Protection from plant control	FdpCmd BO,51 (Q1) BO,66 (Q2) BO,81 (Q3) BVAL,242 (POS9)	RW	
Fire damper alarm	FdpAlm BVAL,165	R	Fire damper closes unexpectedly or test failed
Fire damper test active	FdpTst BVAL,212	R	Fire damper test actually running

Basic settings	BACnet object	R/RW	Note
Activate fire damper test	MntnSched SCHED,3		Activation via weekly maintenance with BACnet scheduler
Damper opening time	TiOpnFdp PINTVAL,117	RW	sec.
Damper closing time	TiClsFdp PINTVAL,118	RW	sec.

Testing and debugging	BACnet object	R/RW	Note
Fire damper closed by control program	FireAlm BVAL,163	R	

5.19 Priority list

Different functions require priorities over other functions so that logical/critical operation can be guaranteed.

Example

Safety functions	
1	Off by smoke detector, emergency, supply air temperature or extract air temperature
2	Off by fire damper closed
3	Purge or smoke extract by smoke detector
Protection functions	
4	Off by water heating coil frost
5	A-Alarms for plant protection
6	ERC deicing function
Switch or push button operations	
7	Rapid ventilation mode (Configured BI, POS8)
8	Comfort mode (Conf. BI), Fireplace (Conf. BI), Off mode (Conf. BI), Eco mode (Conf. BI)
9	Kitchen ventilator (Conf. BI)
10	Maintenance function
User operation	
11	Temporary fireplace (POS8)
12	Present / Away button
13	Manual operation
Automatic function	
14	Scheduler operation mode

5.20 Start-up / shut-down sequence

For safe and optimum operation of the ventilation unit, special switch-on and switch-off sequences are used to switch the ventilation off and on again.

The ventilation unit is normally not "switched off", but can be switched off for maintenance work or in emergency situations.

The start-up sequence is used every time except in emergency situations. The start-up sequence applies also for fire damper test function which is performed automatically.

Start-up sequences:

1. Startup is initiated.
2. *Only after power return*: Delay time step 2 (to secure start-up time for valves, fire dampers and ERC).
3. *Only with water heating coil*: Heating coil pump switches on and valve drives to fully open position.
4. *Only with water heating coil*: TFrPrtHcl temperature level is checked.
   If TFrPrtHcl > "Setpoint frost protection if plant on", the start-up may continue.
   If not, start-up will wait until setpoint is reached or until set timeout step 4 has finished.
   If TFrPrtHcl is not reached until timeout, an A-alarm is activated, the startup process is stopped.
5. Open the outside air dampers.
   Delay time step 5 (to secure dampers fully open).
   If damper output cannot be switched, an A-Alarm is activated, the startup process is stopped.
6. ERC ramps up to maximum speed.
   Heat exchanger bypass closes.
   Exhaust fan starts and ramps up to Comfort mode speed.
   If fan speed is configured as A-Alarm, and the feedback signal is not received within the delay time, an A-Alarm is activated, the starting process is stopped.
   Delay time step 6 (to secure “heating up” of heat exchanger)
7. Supply fan starts and ramps up to “unoccupied” mode speed
   Delay time step7.
   If fan speed is configured as A-Alarm, and the feedback signal is not received within the delay time, an A-Alarm is activated, the starting process is stopped.
8. Both fans ramp to required operating mode speed.
   Delay time step 8 preparing for normal operation.
9. Normal operating mode is started.

Shut-down sequences:

Executed after normal operation or if startup is interrupted after step 6 is finished. Shutdown sequence is not used in emergency situations.

1. Shutdown is initiated.
2. *Only with electric heater*: Electrical heaters are switched off.
   Delay time step 2.
3. Both fans ramp down to stop.
4. Close the outside air dampers, same time as in start-up step 5.
5. ERC ramps down to stop.
6. Plant is "Off".
   Only with water heating coil: Heating coil is controlled to "Setpoint frost protection if plant off".

Shut-down for Maintenance

The air conditioner can be switched off, e.g. for maintenance work, using BI or the BACnet object. In this case, the shutdown sequence is started and the system performs a controlled shutdown. The stop sequence is executed by activating the input PrtOpModRIn or the BACnet object PltShD. These functions override all other influences except the emergency control, protection control and operation via BI.

Available parameters

Current values	BACnet object	R/RW	Note
Plant start / stop state	PltSttStpSta MVAL,397	R	1: off 2: Purge heating coil 3: Open dampers 4: Startup exhaust fan 5: Startup supply fan 6: Prepare normal operation 7: Normal operation 8: Cooldown el. Heater 9: Ramp down fans 10: Close dampers 11: Ramp down ERC 12: Power up delay
Initiate controlled shutdown	PltShdn BVAL,266	RW	0:Inactive 1: Active
BI controlled shutdown	PrtOpModRIn BI,85 (D1) BI,102 (D2) BI,119 (X3) BI,136 (X8)	R	0: Inactive 1: Active

Basic settings	BACnet object	R/RW	Note
Delay time after power-on, startup step 2	DlyPwrUpHrv PINTVAL,130	RW	s [min value 120 sec, if fire dampers are used]
Timeout for water heating coil purge, startup step 4	DlyMaxFrpSttUp PINTVAL,109	RW	sec.
Runtime for outside air dampers, startup step 5	DlyOnAflVntReq PINTVAL,81	RW	sec.
Delay time for exhaust fan only, startup step 6	DlyOnAflEhSta PINTVAL,129	RW	sec.
Delay time supply fan ramp up, startup step 7	TiSttUpSpdVnt PINTVAl,104	RW	sec.
Delay time before normal operation, startup step 8	DlyOnAirFlSta PINTVAL,103	RW	sec.
Delay time cooldown electric heaters, shutdown step 2	DlyOffAflHldH PINTVAL,107	RW	sec.

5.21 Safety functions (SftyCtl11y)

Ventilation unit can be equipped with various kinds of hazard indicators such as smoke, carbon monoxide detectors or human interaction (push button).

Four different situations are implemented:

- Smoke extract, DI signal with configurable plant reaction
- Emergency off, DI signal always shutting down the plant, but not closing fire dampers
- Temperature supervision, always shutting down the plant and closing the fire dampers, if existing.
- Fire dampers, described above, always shutting down the plant.

5.21.1 Duct temperature supervision

Maximum duct temperatures are monitored with sensors supply air temperature TSu, with temperature after preheating TSuAfPreHcl (if installed) and extract air temperature TEx (if installed).

If duct temperature rises over set fire alarm value it, an A-alarm is raised, and an immediate shutdown is activated, fire dampers are closed, if existing.

Additionally a B-Alarm for maintenance is raised, if supply air temperature exceeds a maximum maintenance limit or falls below a minimum maintenance limit during normal operation.

Available parameters

Basic settings	BACnet object	R/RW	Note
Supply air temperature fire alarm limit	TSuFireAlmLm AVAL,37	RW	°C
Extract air temperature fire alarm limit	TExFireAlmLm AVAL,40	RW	°C
Supply air temperature max maintenance limit	TSuHiAlmLm AVAL,38	RW	°C
Supply air temperature min maintenance limit	TSuLoAlmLm AVAL,39	RW	°C

5.21.2 Fire / smoke / emergency off

Configured binary input: Smoke extract

Within first phase of a fire situation, it can be assumed that ventilation may be used to help the prevailing situation, thus functionality is different from temperature driven fire alarm coming from temperature measurement, fire damper indication, or dedicated emergency off signal.

Depending on the requirements, ventilation unit can be set to react on an active signal 4 different ways:

- Both fans would be switched to 100% speed in case of active alarm, fire dampers remain open.
- Both fans would be switched to 0% speed in case of active alarm, fire damper is closed.
- Supply fan would be switched to 100% speed and exhaust fan to 0% speed.
- Supply fan would be switched to 0% speed and exhaust fan to 100% speed.

Configured binary input: Emergency off

- Switches off both fans and closes the outside air dampers immediately.

Since ventilation operation is a reaction to A-Alarm situation, the defined function will only be stopped after A-Alarm is reset and acknowledged. Or the controlling components are destroyed.

Available parameters

Current values	BACnet object	R/RW	Note
Fire/smoke alarm status	Smext BI,81 (D1 NO) BI,98 (D2 NO) BI,168 (D1 NC) BI,169 (D2 NC) BI,115 (X3) BI,132 (X8)	R	Reaction as configured in SmextMod
Emergency off status	EmgOff BI,80 (D1 NO) BI,97 (D2 NO) BI,166 (D1 NC) BI,167 (D2 NC) BI,114 (X3) BI,131 (X8)	R	Plant shutdown

Basic settings	BACnet object	R/RW	Note
Smoke extract plant operation	SmextMod MVAL,125	RW	1: Both fans 100% 2: Both fans 0% 3: Supply 100%, exhaust 0% 4: Supply 0%, exhaust 100%

5.22 Time counters

Various time counters are running automatically on the background depending on which operating mode is active. Counters can be reset by manually setting the value to zero.

Available parameters

Operation time	BACnet object	R/RW	Note
Power-up time of controller	OphDev AVAL,156	RW	hrs
Operation time in protection mode	OphPrt AVAL,256	RW	hrs
Operation time in unoccupied mode	OphUcd AVAL,266	RW	hrs
Operation time in economy mode	OphEco AVAL,267	RW	hrs
Operation time in comfort mode	OphCmf AVAL,268	RW	hrs
Operating time fireplace ventilation	OphFplcVnt ACAL,146	RW	hrs
Operating time kitchen ventilation	OphKtchVnt AVAL,310	RW	hrs
Operating time ERC heating	OphErcH AVAL,398 AVAL,402	RW	hrs
Operating time ERC cooling	OphErcC AVAL,399 AVAL,401	RW	hrs
Operating time electric heating coil	OphHcl AVAL,212	RW	hrs
Operating time water heating coil	OphHcl AVAL,220	RW	hrs
Operating time preheating brine	OphPreHcl AVAL,396	RW	hrs
Operating time preheating earth	OphPreHcl AVAL,397	RW	hrs
Operating time electric preheater	OphPreHcl AVAL,348	RW	hrs
Operating time DX cooling	OphCcl AVAL,404	RW	hrs
Operating time water cooling coil	OphCcl AVAL,403	RW	hrs
Operating time combined heating / cooling coil	OphHCcl AVAL,766	RW	hrs

5.23 Alarm functions

5.23.1 General

The application uses 2 different alarm classes:

- An **A-Alarm** indicated an important and urgent situation. If an A-Alarm is triggered, the unit shuts down. An A-Alarm must be acknowledged and can only be reset after cause of alarm is eliminated.
- A **B-Alarm** indicates a less urgent maintenance incident and during active B-alarm, the unit runs either normally or is still in acceptable condition to run (without major problems).

The installer can configure alarm for certain errors and can choose between A-Alarm, B-Alarm or no alarm.

Alarms must be acknowledged and as soon as the cause for each alarm is eliminated , normal operation is resumed. If one or more reasons still exist, acknowledgement does not reset that specific alarm and operation might not continue normally.

All alarms are shown with a time stamp and entry to non volatile storage for each “change of state”.

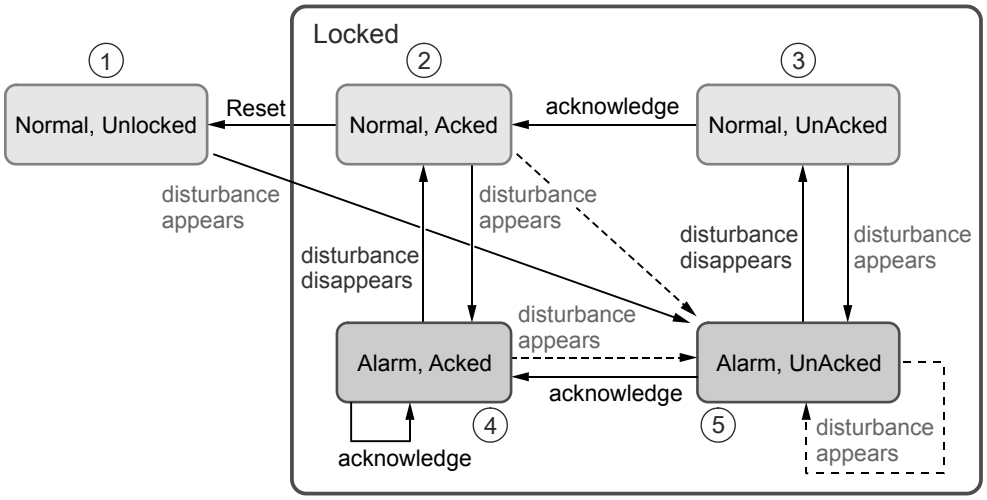
Alarm states

5 different alarm states are used in the application and they are valid for both A and B-Alarms. These different states are meant to give additional information for different users and different situations. Relay operation is depending on actual configuration.

State	Situation	Alarm relay
Normal	Everything works normally	Open
Alarm, unacknowledged	Problem detected by controller and alarm activated (e.g. new alarm)	Closed
Alarm, acknowledged	Problem still existing, service man acknowledged the active alarm	Open
Normal, acknowledged	Problem fixed / eliminated, alarm is acknowledged. ● For A-Alarm: Reset pending to unlock unit. ● For B-Alarm: Works normal.	Open
Normal, unacknowledged	Problem fixed / eliminated, but alarm is not acknowledged	Closed

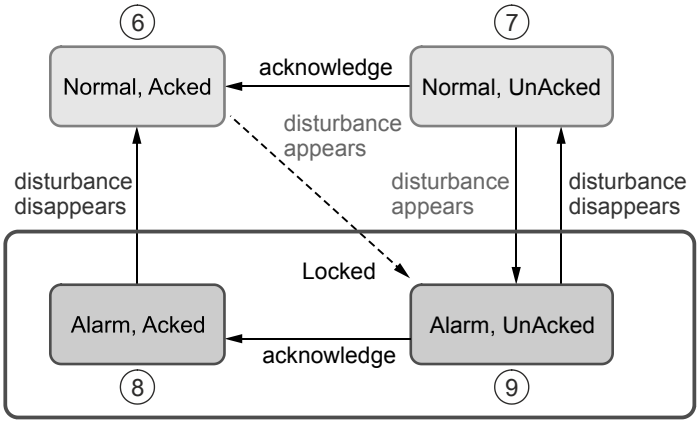
In the case of critical A-Alarms, the application operation is locked in shut down mode until the alarm is acknowledged and reset.

A-Alarms



1	Alarm: 0 Locked: 0 Unacknowledged: 0	2	Alarm: 0 Locked= 1 Unacknowledged: 0
3	Alarm: 0 Locked: 1 Unacknowledged: 1	4	Alarm: 1 Locked: 1 Unacknowledged: 0
5	Alarm: 1 Locked: 1 Unacknowledged: 1		

B-Alarms



6	Alarm: 0 Unacknowledged: 0	7	Alarm: 0 Unacknowledged: 1
8	Alarm: 1 Unacknowledged: 0	9	Alarm: 1 Unacknowledged: 1

Available parameters

Alarm indication	BACnet object	R/RW	Note
	AalmIndOut BO,61 (Q1) BO,76 (Q2) BO,91 (Q3) BO,95 (Y1) BVAL,252 (POS9)	RW	-
	BalmIndOut BO,62 (Q1) BO,77 (Q2) BO,92 (Q3) BO,96 (Y1) BVAL,253 (POS9)	RW	-
	CmnAlmIndOut BO,63 (Q1) BO,78 (Q2) BO,93 (Q3) BO,97 (Y1) BVAL,254 (POS9)	RW	-
	OpIndOut BO,64 (Q1) BO,79 (Q2) BO,94 (Q3) BO,98 (Y1) BVAL,255 (POS9)	RW	-

Acknowledge and Reset	BACnet object	R/RW	Note
A-Alarm acknowledgement and reset	AalmAck MVAL,137	RW	1: Ready 2: Acknowledge 3: Reset Automatic return to 1
B-Alarm acknowledgement	BalmAck MVAL,133	RW	1: Ready 2: Acknowledge Automatic return to 1

A-Alarms	BACnet object	R/RW	Note
A-Alarm state	AalmSta MVAL,135	R	1: Acknowledged, unlocked 2: Unacknowledged 3: Locked
A-Alarm indication	AalmInd MVAL,136	R	1: Normal 2: Alarm
A-Alarm code	AalmCode AVAL,49	R	0...9999

B-Alarms	BACnet object	R/RW	Note
B-Alarm state	BalmSta MVAL,132	R	1: Acknowledged, unlocked 2: Unacknowledged 3: Locked
B-Alarm indication	BalmInd MVAL,131	R	1: Normal 2: Alarm
B-Alarm code	BalmCode AVAL,43	R	0...9999

Alarm class settings	BACnet object	R/RW	Note
Alarm configuration for outside air temperature	AlmCnfTOa MVAL,141	RW	1: A-Alarm 2: B-Alarm
Alarm configuration for exhaust air temperature	AlmCnfTEh MVAL,932	RW	1: A-Alarm 2: B-Alarm
Alarm configuration for supply air temperature after preheater	AlmCnfTSuAfPrh MVAL,931	RW	1: A-Alarm 2: B-Alarm
Alarm configuration for overtemperature	AlmCnfOvrT MVAL,573	RW	1: Immediate shutdown 2: Controlled shutdown with delay
Alarm configuration for heat exchanger	AlmCnfHExg MVAL,348	RW	1: A-Alarm 2: B-Alarm 3: None
Alarm configuration for all fan errors (feedback fault, error signal or Modbus interrupted)	AlmCnfFanFb MVAl,349	RW	1: A-Alarm 2: B-Alarm 3: None (No fan error supervision. – Do not use ‘None’ for Modbus fans)

5.23.2 Alarm codes

Error codes are divided in different groups for easier recognition of the alarm source. Those groups are:

Error code	Error source
1000…1999	Hardware related errors
2000…2999	Application related errors
3000…3999	Communication errors
9000…9999	3rd party related errors

Code	Alarm Class	Name/Description	Source	Plant lock	BACnet object / Comment	Influence of alarm
Code range for - Hardware (AHU)						
1001	A	Supply air temperature, sensor fault	System	Stop	TSu	Shutdown AHU
1002	A/B	Exhaust air temperature, sensor fault	System	Run	TEh, active only if sensor available	Shutdown AHU / No heat exchanger supervision possible
1003	B	Extract air temperature, sensor fault	System	Run	TEx, active only if sensor available	Fallback to room temperature control or supply air control
1004	A/B	Outside air temperature, sensor fault	System	Conf.	TOa	Shutdown AHU / fallback to default
1005	A	Frost protection temperature for heating coil, sensor fault	System	Stop	TFrPrtHcl, active only if HclHw selected	Shutdown AHU, Frost protection mode
1006	B	Relative humidity for extract air, sensor fault	System	Run	HuRelEx, active only if sensor available	Stop Humidity control if all sensors fail
1009	A	Fire damper, position feedback fault	Process	Stop	FdpFb, active only if Fdp selected. Plausibility check of fire damper position feedback	Shutdown AHU
1012	B	Room temperature, sensor fault	System	Run	TR with POS8/QMX3	Fallback to extract temperature control or supply air control
1013	B	Room air quality, sensor fault	System	Run	AQualR with QMX3 or PmR	Stop air quality control if all sensors fail
1014	B	Extract air quality, sensor fault	System	Run	PmR or AQualR, Particulate matters, Air quality	Stop control if all sensors fail
1015	B	Cooling coil DX evaporator fault	Process	Run	CclDxFlt (BI, active only if CclDx selected	Switch off cooling device
1017	B	Room air humidity, sensor fault	System	Run	HuRelR, if configured on QMX	Stop Humidity control if all sensors fail
1018	A/B	Supply air temp. after preheating coil, sensor fault	System	Run	TSuAfPreHcl, active only if sensor available	Shutdown AHU / Shutdown electric preheating coil, fallback value for heat exchanger efficiency
1019	B	Flow temperature preheating coil, sensor fault	System	Run	TFlPreHcl, active only if sensor available	Fallback to default value
1020	B	Air filter, dirty	Process	Run	Operating hours of air filter exceeds limit or delta P, active only if FilA selected	No reaction
1021	B	Supply air temperature after heat exchanger, sensor fault	System	Run	TsuAfHExg, active only if sensor available	Fallback value for Hexg efficiency calculation
1031	A/B/n	Heat Exchanger fault	Process	Run	RotHExgFlt or HExgCdnMon (BI)	Shutdown AHU / Bypass or shutdown HExg / no reaction
1032	B	Supply air pressure, sensor fault	System	Run	PSu, active only if VntCtl12 selected	Fallback to extract air control, linear fan speed if all sensors fail

Code	Alarm Class	Name/Description	Source	Plant lock	BACnet object / Comment	Influence of alarm
1033	B	Extract air pressure, sensor fault	System	Run	PEx, active only if VntCtl12 selected	Fallback to supply air control, linear fan speed if all sensors fail
1034	B	Differential pressure supply air fan, sensor fault	System	Run	DiffPFanSu, active only if sensor available	Fallback to linear fan speed, if in air flow control
1035	B	Differential pressure exhaust air fan, sensor fault	System	Run	DiffPFanEh, active only if sensor available	Fallback to linear fan speed, if in air flow control
1037	A/B/n	Supply air fan fault	Process	conf.	FanSuSpdFb, FanSuFlt Check of fan speed feedback or fault signal	Shutdown AHU / No reaction / No reaction
1038		Exhaust air fan fault	Process	conf.	FanSuSpdFb, FanSuFlt, Check of fan speed feedback or fault signal	Shutdown AHU / No reaction / No reaction
1041	A	Frost protection temperature for combined coil, sensor fault	System	Stop	TFrPrtHCcl, active only if sensor available	Shutdown AHU, Frost protection mode
1042	B	Combined coil supply water temperature, sensor fault	System	Run	TRtSu, active only if sensor available	Fallback to default heating mode
Code range for - Application						
2001	A	Emergency off	Process	Stop	EmgOff (BI)	AHU off
2002	A	Smoke detector	Process	Stop	Smext (BI)	Smoke extract mode
2004	A	Fire alarm	Process	Stop	Supply (TSu) or extract (TEx) air temperature exceeds max. limit	Shutdown AHU
2005	B	Supply air temperature, exceeds operating limits	Process	Run	Supply air temperature (TSu) exceeds min/max limits	No reaction
2007	A	Heating coil, frost warning	Process	Stop	Temperature (TFrPrtHcl) below frost protection limit , active only if HclHw selected	Shutdown AHU, Frost protection mode: Switch on pump, open valve
2010	A	Heating coil, over temperature	Process	Stop	HclOvrTDet (BI), active only if HclEl selected	Shutdown AHU
2012	A	Preheating coil, overtemperature	Process	Stop	PreHclOvrTDet, active only if PreHclEl selected	Shutdown AHU
2013	A	Outside air damper stops air flow	Process	Stop		Shutdown AHU
2017	A/B/n	Heat exchanger efficiency supervision	Process	Conf.	Plausibility check of air temperatures	Shutdown AHU / Bypass or shutdown / no reaction
2020	A	Combined coil, frost warning	Process	Stop	Temperature (TFrPrtHCcl) below frost protection limit, active only if TFrPrtHCcl selected and HCcl in heating mode	Shutdown AHU, frost protection mode: Switch on pump, open valve
Code range for - Communication						
3005	B	I/O extension modul, Modbus communication fault	System	Run	POS9, active only if device configured	Same reaction as for each connected input
3011	B	Duct pressure sensor, Modbus communication error	System	Run	QBM, active only if device configured	Fallback to linear Fan speed
3012	A/B	Supply air fan, Modbus communication fault	System	Conf.	Active only if Modbus fan configured	A: Shutdown AHU / B: EHeater & DxCcl stop Reaction of fan based on fan device configuration
3013	A/B	Supply air fan, Modbus communication fault	System	Conf.	Active only if Modbus fan configured	A: Shutdown AHU / B: No reaction Reaction of fan based on fan device configuration

Code	Alarm Class	Name/Description	Source	Plant lock	BACnet object / Comment	Influence of alarm
3101	B	Room sensor, KNX PL-Link communication error	System	Run	Common fault for all PL-Link room devices: POS8.4420/4440, QMX3.P30/P40/P70, active only if device configured	

5.23.3 Error presentation in Cloud

All Errors are also reported to the Cloud. Active alarms can trigger messages / reports via the Cloud (f.e. messages via e-mail). The Cloud uses the following alarm classes:

- Class 1 = A-Alarm
- Class 2 = B-Alarm
- Class 4 = Communication interruption to Cloud

For more information on the use of the alarm classes, refer to the documentation for remote servicing via cloud, see
"Documentation and short description of compatible devices [➙ 11]".

5.24 Periodical maintenance function

Certain maintenance functions of the ventilation unit must be performed at regular intervals, e.g. fire protection test or valve/pump kick function. For some functions, the ventilation unit must always be stopped to complete the entire process. Others can be made during operation, e.g. cooling valve/pump kick in winter.

In order to perform these functions efficiently and inconspicuously, all periodic functions can be performed in one period and thus the ventilation (if necessary at all) can only be switched off once in a certain time.

The functions are automatically linked to the periodic maintenance function during commissioning.

The following functions are operated in the order shown:

Fire damper test (only if existing)

After ventilation is shut down, dampers are driven open and close to check that they are working correctly

Valve and pump kick

When ventilation shutdown is required due to fire damper test, valve and pump kick function is carried out during shutdown. Otherwise the kick function is executed while the plant is running.
Each valve and pump which is not otherwise operated within the last 7 days, is part of the kick function.

- Valves are opened fully for 30 seconds, then closed again.
- After 20 seconds, valves are moved to 6% position and the pumps are switched on for 30 seconds.

After all functions have been operated, ventilation start-up is made and normal operation is resumed.

Available parameters

Current values	BACnet object	R/RW	Note
Maintenance function status	PrMntnSta MVAL,165	R	1: None 2: Shutdown plant 3: Fire damper test 4: Kick function 5: Restart plant
Trigger maintenance functions Prio 8, 13: manual triggering Prio15: trigger via scheduler	MntnCmd BVAL,213	RW	Trigger, reset after 60 sec.

Basic settings	BACnet object	R/RW	Note
Interval for automatic maintenance function	MntnSched SCHED,3	RW	BACnet scheduler

5.25 Analysis functions

The application includes some analysis points. A test can be done by activating the item to test and then reading the result. The result is a 5-digit coded number.

These following items are available for HVAC components:

Item	Diagnosis Item-No	Result	Note
Supply fan	2	Digits 4...5 Controller state duct pressure / air flow	1: off 3: active modulating 4: minimum output 5: maximum output
		Digits 1...3 Additional influence	1: cooling 2: heating 4: air quality 5: cooling + air quality 6: heating + air quality 8: humidity 9: cooling + humidity 10: heating + humidity 12: AQ + humidity 13: Cooling + AQ + humidity 14: heating + AQ + humidity
Exhaust fan	3	Controller state duct pressure / air flow	1: off 3: active modulating 4: minimum output 5: maximum output
Heating coil	4	Digits 4..5 Controller state supply air	1: off 3: active modulating 4: minimum output 5 :maximum output
		Digits 1...3 Controller state frost controller	1: off 3: active modulating 4: minimum output 5 :maximum output
Cooling coil	5	Controller state supply air controller	1: off 3: active modulating 4: minimum output 5:maximum output
Energy recovery	6	Digits 4...5 Controller state cooling controller	1: off 3: active modulating 4: minimum output 5:maximum output
		Digits 1...3 Controller state heating controller	1: off 3: active modulating 4: minimum output 5: maximum output
Preheating coil	7	Controller state temperature after preheating	1: off 3: active modulating 4: minimum output 5:maximum output

Testing and debugging	BA-object	R/RW	Note
Select diagnostics for HVAC component	DiagHvacCpSel PINTVAl,131	RW	1...7, See above
Diagnostic value for HVAC components	DiagHvacCpVal AVAL,239	R	Coded value, 00001 ... 32767, see above

These following items are available for overall plant functions:

Item	Diagnosis Item-No	Result	Note
Cascade controller heating	1	Digits 4...5 Controller extract air controller	1: off 3: active modulating 4: minimum output 5: maximum output
		Digits 1...3 Controller output extract air controller	0..100% output signal
Cascade controller cooling	2	Digits 4...5 Controller state re-extract air controller	1: off 3: active modulating 4: minimum output 5: maximum output
		Digits 1...3 Controller output extract air controller	0..100% output signal
Dehumidification controller	3	Digit 5 Controller state Fan	1: off 3: active modulating 4: minimum output 5: maximum output
		Digit 4 Controler state Preheater	1: off 3: active modulating 4: minimum output 5: maximum output
		Digits 1...3 Controller state dehumidifier	1: off 3: active modulating 4: minimum output 5: maximum output
Air quality controller	4	Controller state	1: off 3: active modulating 4: minimum output 5: maximum output
Fan boost / rapid ventilation	5	Status	2: temporarily active 3: constantly active
Fireplace ventilation	6	Status	2: constantly active 3: temporarily active
Particulate matters controller	7	Digit 4 Controller state	0: Interrupt time active 1: Off 3: Active modulating 4: Minimum output 5: Maximum output
		Digits 1…3 Controller output	0…100% output signal

Testing and debugging	BA-object	R/RW	Note
Select diagnostics for plant functions	DiagPltFnctSel PINTVAl,67	RW	1...7, see above
Diagnostic value for plant functions	DiagPltFnctVal AVAL,29	R	Coded value, see above

6 Engineering of communicative devices

Only **one** type of each device as described below can connect to S300 controllers.

6.1 PL-Link

General rules

- Via PL-link **1** room operating unit POS8.4420 (T) or **1** POS8.4440 (T, rH) can be connected to the controller unit.
- Additionally it's possible to connect PL-link room sensors (QMX3..) to acquire additional information from rooms.

Because of auto-connect and KNX/PL-Link power supply the number of room operator units and room sensors is limited.

Limits for PL-Link devices

1 device	2 devices plus...	3 devices plus…	Example
POS8.4420	any QMX3.P..	a different type of QMX3.P..	POS8.4420 + QMX3.P30 + QMX3.P70
POS8.4440	any QMX3.P..	a different type of QMX3.P..	
QMX3.P30	QMX3.P40 **or** QMX3.P70	a different type of QMX3.P..	
QMX3.P40	QMX3.P70	a different type of QMX3.P..	
QMX3.P70	QMX3.P30 **or** QMX3.P40	a different type of QMX3.P..	QMX3.P30 + QMX3.P40 + QMX3.P70

For more information about configuring the connection, see "Selecting the device connections [→ 32]".

Communication monitoring

Communication with room operator unit and sensors is constantly monitored. The monitoring is activated as soon as the device is selected (basic configuration).

If the communication with one of the devices cannot be established or gets lost, a collective B-alarm is triggered: "3101 Room sensor, KNX PL-Link communication error".

NOTICE

Unsuccessful detection of devices

Selected KNX / PL-Link devices must be connected before powering the controller, otherwise the devices will not be recognized.

6.2 Modbus components

General rule

Devices that can be connected to Modbus master Interface

Device	Description	Address	Note
POS9.1515	IO extension	41	
QBM97 (1)	Air pressure sensor # 1	40	DIP switch setting required
QBM97 (2)	Air pressure sensor # 2	42	DIP switch setting required
FanSu	EBM Papst supply air fan	1	Configuration with EBM Papst tool required. Must be used together with EBM Papst exhaust air fan
FanEh	EBM Papst exhaust air fan	2	Configuration with EBM Papst tool required. Must be used together with EBM Papst supply air fan

Protocol parameters

Baud rate	19200
Parity	Even
Stop bits	1

Communication monitoring

Communication with the slave devices is constantly monitored. The monitoring is activated as soon as the device is selected (basic configuration).

If the communication with the device cannot be established or gets lost, individual alarm is triggered:

- B-Alarm "3005: I/O extension module, Modbus communication error"
- B-Alarm "3011: Duct pressure sensor, Modbus communication error"
- Configurable "3012: Supply air fan, Modbus communication error"
- Configurable "3013: Exhaust air fan, Modbus communication error"

An adjustable delay time to avoid false alarms due to short disturbances can be configured.

Available parameters

Actual values	BA-object	R/RW	Note
Delay for communication error	DlyComErr, PINTVAL, 80	RW	The alarm is triggered as soon the set time has elapsed. Default = 120s

6.2.1 I/O extension module POS9..

Slave address: 41

Note The slave address is already set in the extension module. It cannot be changed.

BA-object / device register assignment

Actual I/O values	BACnet object	R/W	Note	Register Address	Function code
Differential pressure P21	DiffPP21 AI,110	R	-3000…3000 Pa	5	03: Read holding Pooling=4s
Differential pressure P22	DiffPP22 AI,113	R	-3000…3000 Pa	7	03: Read holding Pooling=4s
Temperature input X21	TInX21 AI,112	R	-40…80°C	9	03: Read holding Pooling=16s
Analog input X22	AInX22 AI,111	R	0…100.0%	13	03: Read holding Pooling=16s
Relay output Q21	RlyOutQ21 BO,100	R/W	Inactive / Active	24	06: Write single HB=20s / on change
Analog output A21	AOutA21 AO,139	R/W	0…100.0%	21	HB=20s / COV=2%

I/O reliability & control	BACnet object	R/W	Note	Register address	Function code
Reliability of differential pressure P21	DiffPP21Rlb MVAL,624	R	BACnet reliability definitions	4	03: Read holding Pooling=16s
Reliability of differential pressure P22	DiffPP22Rlb MVAL,625	R	BACnet reliability definitions	6	03: Read holding Pooling=16s
Reliability of temperature input X21	TInX21Rlb MVAL,626	R	BACnet reliability definitions	8	03: Read holding Pooling=16s
Reliability of analog input X22	AInX22Rlb MVAL,629	R	BACnet reliability definitions	12	03: Read holding Pooling=16s
Device mode	DevMod MVAL,627	W	Standby / Normal operation	3	06: Write single HB=20s / on change

Setting	BACnet object	R/W	Note	Register address	Function code Polling / heartbeat / COV
Signal type of input X21	X21InSigTyp MVAL,630	W	None / NTC10k	102	06: Write single On change
Signal type of input X22	X22InSigTyp MVAL,631	W	None / 0…10V	103	06: Write single On change
Signal type of output A21	A21OutSigTyp MVAL,632	W	None / 0…10V / PWM (default=0…10V)	104	06: Write single On change
PWM frequency output A21	A21OutPwmFq PINTVAL,574	W	500…3000Hz (default=2500Hz)	105	06: Write single On change

For additional information, refer to the POS9.1515 datasheet, see “Documentation and short description of compatible devices [➙ 11]“.

6.2.2 Air pressure sensor #1 QBM97..

Slave address: 40 (factory default)

Notes

- The slave address must be set with dip switches.
- The first QBM97 must have slave address 40.
- Verify the DIP settings on the QBM97 as per the description on the QBM97 cover.

BACnet object / device register assignment

Actual I/O values	BACnet object	R/W	Note	Register address	Function code
Differential pressure P1	DiffPP1(1) AI,114	R	-3000…3000 Pa	5	03: Read holding Pooling=4s
Differential pressure P2	DiffPP2(1) AI,115	R	-3000…3000 Pa	7	03: Read holding Pooling=4s
Analog input AI1	AInAI1(1) AI,116	R	-40…80°C	21	03: Read holding Pooling=16s
Analog input AI2	AInAI2(1) AI,117	R	0…100.0%	51	03: Read holding Pooling=16s
Analog output AO1	AOutAO1(1) AO,140	R/W	0…100.0%	27	06: Write single HB=20s / COV=2%
Analog output AO2	AOutAO2(1) AO,141	R/W	0…100.0%	57	06: Write single HB=20s / COV=2%

I/O reliability & control	BACnet object	R/W	Note	Register address	Function code, Polling / heartbeat / COV
Reliability of differential pressure P1	DiffPP1Rlb(1) MVAL,636	R	BACnet reliability definitions	4	03: Read holding Pooling=16s
Reliability of differential pressure P2	DiffPP2Rlb(1) MVAL,637	R	BACnet reliability definitions	6	03: Read holding Pooling=16s
Reliability of analog input AI1	AInAI1Rlb(1) MVAL,639	R	BACnet reliability definitions	20	03: Read holding Pooling=16s
Reliability of analog input AI2	AInAI2Rlb(1) MVAL,641	R	BACnet reliability definitions	50	03: Read holding Pooling=16s

Setting	BACnet object	R/W	Note	Register address	Function code Polling / heartbeat / COV
Signal type of input AI1	AI1InSigTyp(1) MVAL,640	W	None / Pt1000 / LG-Ni1000 / NTC10k / Ni1000	22	06: Write single On change
Signal type of input AI2	AI2InSigTyp(1) MVAL,642	W	None / 0…10V	52	06: Write single On change

For additional information, refer to the QBM97.. datasheet, see "Documentation and short description of compatible devices [➙ 11]".

6.2.3 Air pressure sensor #2 QBM97..

Slave address: 42

Notes

- The slave address must be set with dip switches.
- The first QBM97 must have slave address 40.
- Verify the DIP settings on the QBM97 as per the description on the QBM97 cover.

BA-object / device register assignment

Actual I/O values	BAcnet object	R/W	Note	Register Address	Function code
Differential pressure P1	DiffPP1(2) AI,155	R	-3000…3000 Pa	5	03: Read holding Pooling=4s
Differential pressure P2	DiffPP2(2) AI,156	R	-3000…3000 Pa	7	03: Read holding Pooling=4s
Analog input AI1	AInAI1(2) AI,157	R	-40…80°C	21	03: Read holding Pooling=16s
Analog input AI2	AInAI2(2) AI,158	R	0…100.0%	51	03: Read holding Pooling=16s
Analog output AO1	AOutAO1(2) AO,145	R/W	0…100.0%	27	06: Write single HB=20s / COV=2%
Analog output AO2	AOutAO2(2) AO,146	R/W	0…100.0%	57	06: Write single HB=20s / COV=2%

I/O reliability & control	BAcnet object	R/W	Note	Register address	Function code, Polling / heartbeat / COV
Reliability of differential pressure P1	DiffPP1Rlb(2) MVAL,788	R	BACnet reliability definitions	4	03: Read holding Pooling=16s
Reliability of differential pressure P2	DiffPP2Rlb(2) MVAL,789	R	BACnet reliability definitions	6	03: Read holding Pooling=16s
Reliability of analog input AI1	AInAI1Rlb(2) MVAL,791	R	BACnet reliability definitions	20	03: Read holding Pooling=16s
Reliability of analog input AI2	AInAI2Rlb(2) MVAL,793	R	BACnet reliability definitions	50	03: Read holding Pooling=16s

Setting	BAcnet object	R/W	Note	Register address	Function code Polling / heartbeat / COV
Signal type of input AI1	AI1InSigTyp(2) MVAL,792	W	None / Pt1000 / LG-Ni1000 / NTC10k / Ni1000	22	06: Write single On change
Signal type of input AI2	AI2InSigTyp(2) MVAL,794	W	None / 0…10V	52	06: Write single On change

For additional information, refer to the QBM97.. datasheet, see "Documentation and short description of compatible devices [➙ 11]".

6.2.4 Ebm-papst supply air fan

Slave address: 1

Notes

- The fan configuration must be set with ebm-papst tool "EC Control"
- The configuration depends on the specific use case
- The following settings are required or recommended

Setting	Parameter	Value
Communication parameters	Device address (required)	1
	Communication speed (required)	19200
	Communication parity (required)	8E
Device status	Source of set value (required)	RS485/Bus
	Save set value to EEPROM (required)	No
Fail-safe function	Fail-safe mode (recommended)	Fail safe speed value
	Set fail safe speed % (recommended)	0
	Time lag fail safe speed s (recommended, must be higher than default heartbeat: 20 s)	26

For additional information please refer to the manufacturer's web site https://www.ebmpapst.com.

You can contact a local representative, access downloads and get more technical information for the fan.

BACnet object / device register assignment

Actual I/O values	BACnet object	R/W	Note	Register address	Function code
Supply air fan speed	FanSuSpd AO,149	RW		53250	06: Write single
Supply air fan fault	FanSuFlt BI,144	R		53266	04: Read input Bit 4
Supply air fan speed feedback	FanSuSpdFb AI,163	R		53265	04: Read input
Suppyl air fan total operating hours	FanSuOphTot AI,161	R		53258	03: Read holding

I/O reliability & control	BACnet object	R/W	Note	Register address	Function code Polling / heartbeat / COV
Supply fan error code	FanSuErrCode AVAL,682	R	0: No error > 0: see EBM Papst	53266	04: Read input
Supply fan warning code	FanSuWarnCode AVAL,683	R	0: No error > 0: see EBM Papst	53267	4: Read input
Supply fan reset	FanSuRst BO,102	RW	Pulse, executed by acknowledge or reset	53249	06: Write single Bit 0

Remark

The above information is available for all ebm-papst Modbus fans with interface version >= 5.0 (2012). Depending on the type of fan, additional information is available. The application does not read this additional information, as reading causes malfunction on some types of fans.

Error and warning codes are shown as decimal value, for example error code ‘17’. They must be converted into a bit string, for example ‘0000 0000 0001 0001’. According to EBM Papst documentation, this means FB (General fan fault) and PHA (Phase error).

When using a Modbus fan, both fans must be Modbus fans.

6.2.5 Ebm-papst exhaust air fan

Slave address: 2

Notes

- The fan configuration must be set with ebm-papst tool "EC Control"
- The configuration depends on the specific use case
- The following settings are required or recommended

Setting	Parameter	Value
Communication parameters	Device address (required)	1
	Communication speed (required)	19200
	Communication parity (required)	8E
Device status	Source of set value (required)	RS485/Bus
	Save set value to EEPROM (required)	No
Fail-safe function	Fail-safe mode (recommended)	Fail safe speed value
	Set fail safe speed % (recommended)	0

For additional information please refer to the manufacturer's web site https://www.ebmpapst.com.

You can contact a local representative, access downloads and get more technical information for the fan.

BACnet object / device register assignment

Actual I/O values	BA-objects	R/W	Note	Register Address	Function code
Exhaust air fan speed	FanEhSpd AO,150	RW		53250	06: Write single
Exhaust air fan fault	FanEhFlt BI,145	R		53266	04: Read input Bit 4
Exhaust air fan speed feedback	FanEhSpdFb AI,164	R		53265	04: Read input
Exhaust air fan total operating hours	FanEhOphTot AI,162	R		53258	03: Read holding

I/O reliability & control	BA-object	R/W	Note	Register address	Function code Polling / heartbeat / COV
Exhaust fan error code	FanEhErrCode AVAL,688	R	0: No error > 0: see ebm-papst	53266	04: Read input
Exhaust fan warning code	FanEhWarnCode AVAL,689	R	0: No error > 0: see ebm-papst	53267	4: Read inpu
Exhaust fan reset	FanEhRst BO,103	RW	Pulse, executed by acknowledge or reset	53249	06: Write single Bit 0

Remark: Above information is available for all ebm-papst Modbus fans with interface version >= 5.0.

Error and warning codes are shown as decimal value, for example error code ‘17’. They must be converted into a bit string, for example ‘0000 0000 0001 0001’. According to EBM Papst documentation, this means FB (General fan fault) and PHA (Phase error).

When using a Modbus fan, both fans must be Modbus fans.

6.2.6 Zero pressure calibration

- Both devices (POS9.., QBM97..) have integrated pressure sensors and therefore also inbuilt zero-pressure-calibration mechanisms.
- To perform calibration, all pressure hoses must be disconnected and exposed to the same ambient pressure.
- The calibration process can be manually initiated by activating the calibration parameter.

Available parameters

Parameter	BACnet object	R/RW	Note
Zero pressure calibration trigger POS9	ZePClbTrgPos9 MVAL, 628	RW	1: Ready 2: Trigger (initiates calibration)
Zero pressure calibration trigger QBM #1	ZePClbTrgQbm MVAL, 638	RW	1: Ready 2: Trigger (initiates calibration)
Zero pressure calibration trigger QBM #2	ZePClbTrgQbm(2) MVAL, 790	RW	1: Ready 2: Trigger (initiates calibration)

6.3 Modbus slave

6.3.1 Use cases for Modbus slave engineering

The 'Modbus Slave BAcnet Adapter' allows to modify parameters during runtime and supports the following use cases:

- Read/write data items for operation and monitoring by a third party HMI.
- Read/write data items for automation and control functions by a third party Building Automation and Control System (BACS).

6.3.2 Port description and default settings

The 2 Modbus slave interfaces:

Modbus Slave Port1	Modbus Slave Port2
Terminal: T12	Terminal: T16
Address: 1	Address: 2

The default settings are the same for both interfaces:

Baudrate	19200 Bd
Data	8 Bit
Parity	Even
Stop bit	1

6.3.3 Port adjustments

The 2 ports are preconfigured. You can make any required changes to the configuration via a BACnet browser, e.g. YABE browser. Choose the following BAcnet objects for Modbus slave configuration:

Setting (long name)	BACnet object
Infra'NwkPortI P_1	NwkPort,2 Object type 264
Infra'NwkPortI P_2	NwkPort,3 Object type 264

Both BACnet objects have the following properties:

Setting, long name	Property #, short name	Description
Line termination	4698: LnTrmnt	On board line termination can be switched on (TRUE) / off (FALSE).
Inter-Char-Timeout-Scale	4773: IntFrmTime	Maximum delay between characters within a Modbus frame Standard timeout depends on configured baud rate and is normally 1.5 x characters times. Standard timeout corresponds to 100% and is set as default
Inter-Frame-Time-Scale	4774: IntChrTiout	Minimum delay time between two Modbus frames Standard wait time depends on configured baud rate and is normally 3.5 x characters times. Standard wait time corresponds 100% and is set as default
Stop Bit definition	4775: StopBits	
Parity definition	4776: Parity	
Baud rate selection	4777: Baud	Baud rates of 9600 and 19200 baud must be supported as per Modbus standard. Additional supported baud rates must be tested to ensure full functionality.
Send command	4894: Command	Apply changes of Modbus slave configuration. Controller will automatically reboot. After restarting, new settings will take effect.

Entry values in BACnet browser tools, e.g. Yabe

The following relationships apply for stop bit, parity and baud rate:

Application parameter value	BACnet browser entry
Stop bits	
1	1
2	2
Parity	
No	1
Even	2
Odd	3
Mark	4
Space	5
Baud rate	
300	0
600	1
1200	2
2400	3
4800	4
9600	5
19200	6
38400	7
57600	8
76800	9
115200	10

6.3.4 R/W communication functions (supported function codes)

The controller supports the following function codes (FCs):

Read Input Registers, FC=04

Request

Function code	1 Byte	**0x04**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Input Registers	2 Bytes	0x0001 to 0x007D

Response

Function code	1 Byte	**0x04**
Byte count	1 Byte	2 x **N***
Input Registers	N* x2 Bytes	

*N = Quantity of Input Registers

Error

Error code	1 Byte	**0x84**
Exception code	1 Byte	01 or 02 or 03 or 04

- A block of contiguous input registers is read in one step.
  Quantity of input registers n = 1…125.
- The register data in the response message is packed as 2 bytes per register. The first byte contains the high order bits and the second contains the low order bits of the register.
- In the request message the 2 bytes of the first register (Starting Address) are sent first.

Read Holding Registers, FC=03

Request

Function code	1 Byte	**0x03**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	1 to 125 (0x7D)

Response

Function code	1 Byte	**0x03**
Byte count	1 Byte	2 x **N***
Register value	N* x 2 Bytes	

*N = Quantity of Input Registers

Error

Error code	1 Byte	**0x83**
Exception code	1 Byte	01 or 02 or 03 or 04

- A block of contiguous holding registers is read in one step.
  Quantity of holding registers n = 1…125.
- The register data in the response message is packed as 2 bytes per register. The first byte contains the high order bits and the second contains the low order bits of the register.
- In the request message the 2 bytes of the first register (Starting Address) are sent first.

Write Single Register, FC=06

Request

Function code	1 Byte	**0x06**
Register Address	2 Bytes	0x0000 to 0xFFFF
Register Value	2 Bytes	0x0000 to 0xFFFF

Response

Function code	1 Byte	**0x06**
Register Address	2 Bytes	0x0000 to 0xFFFF
Register value	2 Bytes	0x0000 to 0xFFFF

Error

Error code	1 Byte	**0x86**
Exception code	1 Byte	01 or 02 or 03 or 04

Write Multiple Register, FC=16

Request

Function code	1 Byte	**0x10**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	0x0001 to 0x007B
Byte Count	1 Byte	2 x **N***
Registers Value	**N*** x 2 Bytes	value

*N=Quantity of Registers

Response

Function code	1 Byte	**0x10**
Starting Address	2 Bytes	0x0000 to 0xFFFF
Quantity of Registers	2 Bytes	1 to 123 (0x7B)

Error

Error code	1 Byte	**0x90**
Exception code	1 Byte	01 or 02 or 03 or 04

- A block of contiguous registers is written in one step.
  Quantity of registers n = 1...123.
- The requested written values are specified in the request data field.
  Data is packed as 2 bytes per register, i.e. byte count = 2 x n.
- In the request message the 2 bytes of the first register (Starting Address) are sent first.

More information

The **write request** contains:

- Address of the Modbus slave
- Function code (FC)
- Start Address
- Depending on FC:
  additional control information to define the amount of data to be written (NO. of elements, ByteCount).
- Data to be written

A **positive response** contains:

- Response FC = Request FC
- Response start address = Request start address
- Depending on FC:
  - written data:
    response data is read back from the BA-object to indicate e.g. min/max truncation (no simple echo of the request).
  - or:
    information to indicate the number of written data elements

An **exception** response, if the server is unable to process the write request.

The objective is to provide to the client relevant information concerning the error detected during processing:

- The exception FC = request FC + 0x80.
- An exception code is provided to indicate the reason of the error.

Code	Name	Meaning
01	ILLEGAL FUNCTION	Function code received in the request is not supported by the server. Or: Server is currently unable to process the request, e.g. because it is un-configured.
02	ILLEGAL DATA ADDRESS	The register address/starting address received in the request is not an allowable address for the server. Or: The combination of starting address and quantity of registers is invalid, e.g. for a controller with 100 registers, the PDU addresses the first register as 0, and the last one as 99. If a request is submitted with a starting address of 96 and the quantity of registers is 4, the request succeeds (address-wise at least) on registers 96, 97, 98, 99. If a request is submitted with a starting address of 96 and the quantity of registers is 5, the request fails with exception code 0x02 "Illegal Data Address" since it attempts to operate on registers 96, 97, 98, 99 and 100, and there is no register with address 100. In the event of bulk read/write if there is address gap between data items in the given address range.
03	ILLEGAL DATA VALUE	A data type contained in the write data is not an allowable value for the server. This indicates a fault in the structure of the remainder of a complex request, such as that the implied data length is incorrect (data type mismatch). However, it specifically does NOT mean that a data item submitted for storage in a register has a value outside the allowed min / max range, since the Modbus protocol is unaware of the significance of any particular value of any particular register.
04	SERVER DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action, e.g. ● Master tries to write read-only data item ● Access to unsupported BA-Object type, mapping is not possible ● Master tries to write data fragments, illegal data, etc.

6.3.5 Encoding of data types

Data is provided as Big Endian without swapping.

Binary value encoding with one Register:

Each binary BA present value will occupy 1 register

Data type	Byte order
Binary value, bitstring1, bitstring8, bitstring16, unsigned8 or unsigned16	00 aa, with aa = 0x00 or 0x01

Multistate value encoding with one Register:

Each multistate BA present value will occupy 1 register

Data type	Byte order
Multistate value (8 bit), unsigned8	00 aa, with 1:1 BACnet encoding
Multistate value (16 bit), unsigned16	bb aa, with 1:1 BACnet encoding

Unsigned integer value encoding with 2 registers

Each unsigned BA present value will occupy 2 registers. Use FC16 for consistent writing.

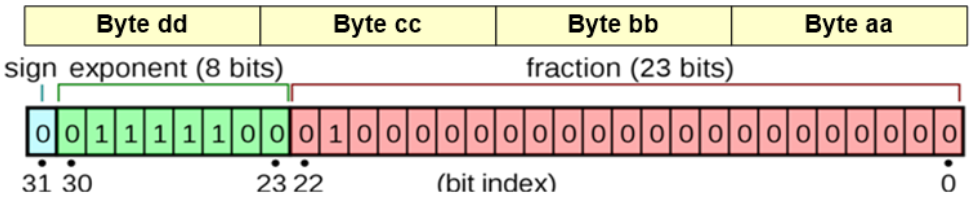
Data type	Byte order	
Unsigned integer (32 bit), unsigned32	dd cc bb aa	
	dd cc	Register address x
	bb aa	Register address x+1

Real value encoding with 2 registers

Each analog BA present value will occupy 2 registers. Use FC16 for consistent writing.

Data type	Byte order	
Real value (32 bit), Float32	dd cc bb aa	
	dd cc	Register address x
	bb aa	Register address x+1

With:



IEEE-754 32-bit float encoding

Encoding of text string with multiple Registers

- BA-Properties representing text information are encoded as UTF8 text string.
- Pair wise mapping of two bytes of the text string to one MODBUS Register.
- The first byte of the text string is mapped to the MSB of the 1st MODBUS Register (with the lowest Register address).
- On MODBUS the string is NUL terminated. Unused Registers or the LSB of the last used Register shall contain the value NUL.

Example: BA-property, max. string length 20 byte, containing the string “hello world” would be mapped to 10 MODBUS Registers as follows:

Register address	Register data	
x	h	e
x+1	l	l
x+2	o	
x+3	w	o
x+4	r	l
x+5	d	NUL
x+6	NUL	NUL
x+7	NUL	NUL
x+8	NUL	NUL
x+9	NUL	NUL

Encoding of Date, Time information with multiple Registers

Register address	Date	
x	Year (100…199)	Month (1…12)
x+1	DayOfMonth (1…31)	DayOfWeek (1…7)
	Time	
x+2	Hours (00…23)	Minutes (00…59)
x+3	Seconds (00…59)	HundredthsOfASecond (00…99)

Date:
- Date encoding uses 2 MODBUS Registers.

Date.Year:
- Represents year minus 1900.
- Note: Date information can only be from 2000.1.1 to 2099.12.31.
- 1:1 mapping of BA-Date.Year (1 octet) to Register bit15…bit8.

Date.Month:
- Represents month 1...12.
- 1:1 mapping of BA-Date.Month (1 octet) to Register bit7…bit0.

Date.DayOfMonth:
- Represents day of month 1…31.
- 1:1 mapping of BA-Date.DayOfMonth (1 octet) to Register bit15…bit8.

Date.DayOfWeek:
- Represents day of week 1...7 and
- 1:1 mapping of BA-Date.DayOfWeek (1 octet) to Register bit7…bit0.

Time:
- Time encoding uses 2 MODBUS Registers.

Time.Hours:
- Represents hours 0…23.
- 1:1 mapping of BA-Time.Hours (1 octet) to Register bit15…bit8.

Time.Minutes:
- Represents minutes 0...59.
- 1:1 mapping of BA-Time.Minutes (1 octet) to Register bit7…bit0.

Time.Seconds:
- Represents seconds 0...59.
- 1:1 mapping of BA-Time.Seconds (1 octet) to Register bit15…bit8.

Time.HundredthsOfASecond:
- Represents hundredths of a second 0...99.
- 1:1 mapping of BA-Time.HundredthsOfASecond (1 octet) to Register bit7…bit0.

Example:

Date				**Time**			
Date Value	**1997018885 =0x77081705**	**—**		**Date Value**	**303312128 =0x12142D00**	**—**	
Year Result (Year +1900)	Month	Day	DayofWeek (1~7)	Hour	Minute	Second	Millisecond (Reserved)
bit31~bit24	bit23~bit16	bit15~bit8	bit7~bit0	bit31~bit24	bit23~bit16	bit15~bit8	bit7~bit0
2019	8	23	5	18	8	10	

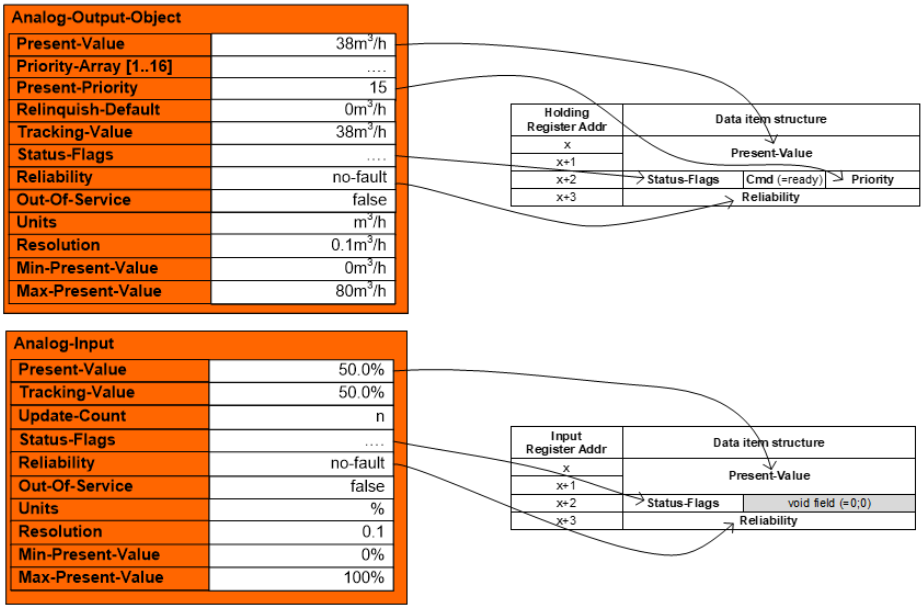
6.3.6 Mapping application parameters to Modbus registers

Applications parameters support either extended or basic read/write mechanism.

Extended read/write

The following **extended mapping** examples illustrate:

- BA analog output object represented on Modbus by 4 holding registers
- BA analog input object represented on Modbus by 4 input registers
- Data item size is 4 in both cases



Example of an analog input object (extended read):

Input register address	Data item structure	
X X+1	Present value	
X+2	Status flags	Voidfield(=0:0)
X+3	Reliability	

Example of an analog output or value object (extended read/write):

Holding register address	Data item structure		
X X+1	Present value		
X+2	Status Flags	Cmd(=Ready)	Priority
X+3	Reliability		

Register address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
x	**Present value**															
x+1																
x+2	r(0)	r(0)	r(0)	r(0)	**Status flags**				**Cmd**			**Priority**				
x+3	**Reliability**															

Data item structure for 32bit data and Mapping=Extended

For analog output / value objects, MODBUS Master is expected to send one of the following MODBUS write requests, all three options are accepted:

- WriteMultipleReg.req (FC=16, StartAddr, QuantityOfReg=4, ByteCount=8, data=(2 Registers with 32bit real value; 1 Register with Cmd and Priority field; 1 Register with void value))
- WriteMultipleReg.req (FC=16, StartAddr, QuantityOfReg=3, ByteCount=6, data=(2 Registers with 32bit real value; 1 Register with Cmd and Priority field))
- WriteMultipleReg.req (FC=16, StartAddr, QuantityOfReg=2, ByteCount=4, data=(2 Registers with 32bit real value)).
  In this case, Default-Priority 13 is used

Example of a binary/multistate **input** object (extended read):

Input register address	**Data item structure**	
X	Present value	
X+1	Status flags	Voidfield(=0:0)
X+2	Reliability	

Example of a binary/mutistate **output** object (extended read/write):

Holding register address	**Data item structure**		
X	Present value		
X+1	Status Flags	Cmd(=Ready)	Priority
X+2	Reliability		

Register Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
x	**Present value**															
x+1	r(0)	r(0)	r(0)	r(0)	**Status flags**				**Cmd**			**Priority**				
x+2	**Reliability**															

Data item structure for 16bit data and Mapping=Extended

For binary and multistate output and value objects, the MODBUS Master is expected to send one of the following MODBUS write requests, all four options are accepted:

- WriteMultipleReg.req (FC=16, StartAddr, QuantityOfReg=3, ByteCount=6, data=(1 Register with 16bit multistate value; 1 Register with Cmd and Priority field; 1 Register with void value))
- WriteMultipleReg.req (FC=16, StartAddr, QuantityOfReg=2, ByteCount=4, data=(1 Register with 16bit multistate value; 1 Register with Cmd and Priority field))
- WriteMultipleReg.req (FC=16, StartAddr, QuantityOfReg=1, ByteCount=2, data=(1 Register with 16bit multistate value)).
  In this case, Default-Priority 13 is used.
- WriteSingleReg.req (FC=06, StartAddr, 16bit multistate value).
  In this case, Default-Priority 13 is used.

Status flags:

- Read only bitset with BACnet encoding of status flags 'In-Alarm', 'Fault', 'Overridden' and 'Out-of-Service' in case of Modbus read response.
- Void field (0;0;0;0) in case of Modbus write request to be ignored by the Modbus Slave BA adapter.

b3	b2	b1	b0
Status flags			

- b0: In Alarm
- b1: Fault
- b2: Overridden
- b3: Out of service

Status flag is an exception, see table below with a comparison on parameters read from Modbus and BACnet.

Object and property			Comparison
O&M	**basic**	Present value	**Same value**
	extend	Present value	**Same value**
		status flag	Bit swapped
		priority	**Same value**
		reliability	**Same value**
Device		System-Status	**Same value**
		(0:operational; 2:download required)	**Same value**
		Local-Date	**Same value**
		Local-Time	**Same value**
		Equipment-ID	**Same value**
		Serial-Number	**Same value**
		Model-Information	**Same value**
		Firmware-Revision	**Same value**
		Application-Software-Version	**Same value**
		Supported-Languages	**Same value**
		MODBUS-Session-Language	**Same value**
Schedule		Entry	**Same value**
		Schedule default	**Same value**
		present value	**Same value**
		status flag	Bit swapped
		reliability	**Same value**

- **Cmd**: Multistate command in combination with priority field (for BA output objects and process value objects only) for commanding / writing present value
  - Cmd = 0: Ready
  - Cmd = 1: Command new value
  - Cmd = 2: Relinquish

  - Cmd = 3…7: Reserved Cmd values
- **Priority**: to write or relinquish the BA priority slot (for BA output objects and process value objects only)
  - Represents BA present priority (1…17) in case of Modbus read response
  - Contains the priority of the priority slot to be written or relinquished in case of Modbus write request, only prio 1, 8, 13 can be written.
    NOTICE! Operators need to be aware of the risk of override physical outputs by prio1.
  - Priority field is void for BA object types without priority array support.
- Modbus write request: Allowed combinations of **Cmd** and **Priority**
  - for BA output objects and process value objects:

Cmd	Priority	Description
0: ready, or >2: reserved values	Don't care	Not allowed, to be discarded by the server
1: command new value	1...16	To write the BA priority slot according to the priority field
	0 or >16	Not allowed, to be discarded by the server
2: relinquish	1..16	To relinquish the priority slot according to the priority field
	0 or >16	Not allowed, to be discarded by the server

  - for BA object types without priority array support, e.g. Config (Ref) value object:

Cmd	Priority	Description
0: Ready, or >2: reserved values	Don't care	Not allowed, to be discarded by the server
1: Command new value	Don't care (0)	To write BA present value. Priority field is ignored by the server. We recommend that the client sets the priority field to zero in the request message
2: Relinquish	Don't care	Not allowed, to be discarded by the server

- Modbus read response: Allowed combinations of **Cmd** and **Priority**
  - for BA output objects and process value objects:

Cmd	Priority	Description
0: Ready	1..17	Field **Cmd** is reset to ‘ready’ by the Modbus Slave BA Adapter after the write command is executed. Field **Priority** represents property present priority
other values	Don't care	Not allowed

  - for BA object types without priority array support, e.g. Config Ref value object:

Cmd	Priority	Description
0: Ready	Don't care (0)	Field **Cmd** is reset to ‘ready’ by the Modbus Slave BA Adapter after the write command is executed Field **Priority** is void. We recommend that the server sets the priority field to zero in the response message
other values	Don't care	Not allowed

  - Reliability:
    - 16 bit enumeration with BACnet reliability encoding for a Modbus read response.
    - Void field (0) for a Modbus write request: To be ignored by the 'Modbus Slave BA Adapter'.
  - Reserved fields r(0) are set to zero by the sender and ignored by the receiver.

Basic read/write

The mapping mechanisms are the same as for extended mapping, but without the 2 registers to map BA-Status-Flags, Priority and Reliability.

Example of a binary/multistate input object with basic read:

Input register address	Data item structure
X	Present value

Example of an analog/unsigned object with basic read:

Input register address	Data item structure
X	Present value
X+1	

The address distribution is based on the following rule:

Command	Object type	Mapping	Address range
Read	Analog/Unsigned	Extend	3x0000~3x0999
		Basic	3x1000~3x1999
	Binary/Multistate	Extend	3x2000~3x2999
		Basic	3x3000~3x3999
Read/write	Analog/Unsigned	Extend	4x0000~4x0999
		Basic	4x1000~4x1999
	Binary/Multistate	Extend	4x2000~4x2999
		Basic	4x3000~4x3999
Read/write	Schedule	-	4x6000~
Read/write	Device information	-	4x9000~

6.3.7 Edit schedule

A BA-weekly schedule has 7 daily schedules (corresponding to Monday – Sunday).

Each daily schedule includes a list of [Time, Value] in pairs. The list describes the sequence of scheduled actions for a given day of the week.

The data structure of each [Time, Value] pair is encoded in 2 MODBUS holding registers with the following structure:

Register Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
x	**NULLVal**	**Hours (00…23; 0x7F)**							**Minutes (00…59; 0xFF)**							
X+1	**Value**															

MODBUS structure for [Time, Value] pair (16bit)

- Mapped time information on MODBUS does not support encoding in seconds and hundredths of a second.
- Flag **NULLVal** = 1: Encode Value= NULL, i.e. it disables this entry.
- Flag **NULLVal** = 0: Field value is a valid value ≠ NULL, i.e. this enables this time entry.
- Void [Time, Value] pair is encoded with Hours = 0x7F and Minutes = 0xFF. In this case, the field value is interpreted as a void value.
- Depending on the schedule type, the register value can be:
  - A multistate Value >0, encoded at 16 bit
  - Or a binary where only the values 0x0000 or 0x0001 are allowed.
  - Example: multistate ROpMod encoding.

Register Address	Register Value		
X	**NULLVal :0**	**Hours: 00**	**Minutes 00**
X+1	**Unoccupied (Value=2)**		
X+2	**NULLVal :0**	**Hours: 06**	**Minutes 00**
X+3	**Economy (Value=3)**		
X+4	**NULLVal :0**	**Hours: 22**	**Minutes 30**
X+5	**Unoccupied (Value=2**		
X+6	**NULLVal :1**	**Hours: 0x7F**	**Minutes 0xFF**
X+7	**--**		
…	**…**		
X+30	**NULLVal :1**	**Hours: 0x7F**	**Minutes 0xFF**
X+31	**---**		

MODBUS structure for daily-schedule for 16bit OpMode value

X=Schedule register address

- MODBUS mapping of the BA-daily-schedule reserves a fixed number of 16 [Time, Value] pairs.
- The [Time, Value] entries are sorted (by time, ascending).
- We recommend starting the 1st entry at [00:00,Value] for a clear value definition after midnight (the BA schedule default may otherwise be active).

- The last valid entry (by time, ascending) with a valid schedule entry (i.e. valid time info) defines the value to the end of the day (23:59:59.99).
- Additional void entries (if any) with NULLVal=F, Hour = 0x7F and Minutes = 0xFF are applicable until the 16th and last entry at the end of the list.

MODBUS mapping of one daily schedule thus occupies a fixed size of 32 registers, which easily fit in one MODBUS Read Holding register response message or Write Holding register request message.

- The MODBUS Master can read part of a daily schedule, or even one register representing Time or OpMod information.
- We recommend, however, reading the entire daily schedule for consistency reasons as well as the corresponding 32 registers in one pass.
- The MODBUS Master CANNOT write parts of a daily schedule, or even only one register representing a data fragment with Time or OpMod information!

To maintain consistency of daily schedule information, the master must write the entire daily schedule including void entries at the end of the list and the corresponding 32 registers in one pass.

The MODBUS Master writes the entire daily schedule with 16 sorted [Time, Value] entries (by time in ascending order).

The BA weekly schedule consists of 7 daily schedules corresponding to Monday – Sunday and additional BA-Properties.

Data-Item-Size is therefore a **fixed 256 registers** per the weekly schedule.

Register Address	Mapped BA-Schedule information
x	Daily-Schedule Mo
x+32	Daily-Schedule Tu
x+64	Daily-Schedule We
x+96	Daily-Schedule Th
x+128	Daily-Schedule Fr
x+160	Daily-Schedule Sa
x+192	Daily-Schedule Su
x+224 … x+255	Reserved Registers
Register Address	
x+256 … x+511	Another Weekly-Schedule

MODBUS structure for Data-Type=WeeklySched16bit

X=Schedule register address

- 7x16 daily schedule entries for Mo – Su are mapped to MODBUS Holding registers, with 7 x 32 registers, i.e. 224 registers.
- Mapping starts with the first 32 registers for the daily schedule Monday.
- The last 32 used registers are allocated to map daily schedule Sunday.
- 32 spare register addresses are reserved and unused at the upper end of the data item address space.

6.3.8 Device information

The device information occupies a total 1024 registers, starting with holding registers 4x9000.

4x9000~4x9767: Are reserved for basic device information such as Local Date, Local Time, Device ID, Language selection, etc.

Register Address	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0	Read/ Write
9001	System-Status																
	Local-Date																Write access
9002	Year (100…199, 0xFF)								Month (1…12, 0xFF)								
9003	DayOfMonth (1…31, 0xFF)								DayOfWeek (1…7, 0xFF)								
	Local-Time																
9004	Hours (00…23; 0xFF)								Minutes (00…59; 0xFF)								
9005	Seconds (00…59; 0xFF)								HundrethsOfASecond (00…99; 0xFF)								
9006 … 9037	Equipment-ID (string -> 32 Registers)(Property:4895) Name of the equipment. Can be used by the manufacturer to define the name of the unit during the production process (as it is a R/W BACnet object).																Read only
9038 … 9069	Serial-Number (string -> 32 Registers) (Property:5100)																
9070 … 9101	Model-Information (string -> 32 Registers) (Property:4827)																
9102 … 9165	Firmware-Revision (string -> 64 Registers) (Property:44)																
9166 … 9229	Application-Software-Version (string -> 64 Registers) (Property:12) Description of internal HRV application data. The label ‘AP=xxx’ can be used by the manufacturer to define the type of the unit in ABT Site (‘Template name’)																
9230 … 9233	Supported-Languages (bitset, 64 bits) (Property:4948)																
9234	Active-Language (enum) (Property:4949)																
9235 … 9767	Reserved registers (532) for future extensions (additional data items for the Device-Object or other infrastructure related objects)																

6.3.9 Delivery of the application parameter list

The application parameter list is accessible via the delivery package on SIOS (Siemens Industry Online Support) at: https://support.industry.siemens.com/cs/us/en/view/109776501.

Note: the list is part of the complete package and therefore always compatible.

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