



ZoneEase™ VAV

Zone Control Application Manual

Rev. 2023-08/D

[Subject to Change]

BELIMO®

Contents

Introduction	3
The ZoneEase VAV System Solution	3
General Operating Principles.....	5
Application Overview.....	13
Air Quality and Flow Control Applications	14
8 Indoor Air Quality Control (CO ₂ -controlled)	14
9 Air Volume Flow Control (VAV or CAV)	15
Room Comfort Applications	16
2 Cooling only.....	16
3 Cooling or Heating.....	17
4 Cooling with 1-Stage Electrical Reheat.....	18
5 Cooling with 2-Stage Electric Reheat.....	19
6 Cooling with On-Off Hydronic Reheat.....	20
7 Cooling with Modulating Hydronic Reheat.....	21
Applications with Parallel Fan	22
10 Cooling with Parallel Fan	22
11 Cooling with Parallel Fan + 1-Stage Electric Reheat.....	23
12 Cooling with Parallel Fan + 2-Stage Electric Reheat.....	24
13 Cooling with Parallel Fan + On-Off Hydronic Reheat.....	25
14 Cooling with Parallel Fan + Modulating Hydronic Reheat.....	26
Applications with Series Fan.....	27
15 Cooling with Series Fan	27
16 Cooling or Heating with Series Fan.....	28
17 Cooling with Series Fan + 1-Stage Electric Reheat.....	29
18 Cooling with Series Fan + 2 Stage Electric Reheat	30
19 Cooling with Series Fan + On-Off Hydronic Reheat.....	31
20 Cooling with Series Fan + Modulating Reheat Valve	32

Introduction

The ZoneEase VAV System Solution

Belimo ZoneEase VAV is a VAV-based zone control solution with 19 selectable and configurable applications. The solution encompasses a cloud-based engineering and commissioning workflow with offline capabilities to support a seamless and error-free workflow.

VAV actuators with or without I/O module contain decentralized control logic and allow for standalone zone / room automation as well as systems with building management system integration over BACnet MS/TP or Modbus RTU. Applications can be realized with an optional 2nd VAV flow controller for supply/extract air or dual supply air control. Room temperature control applications can be combined with indoor air quality (CO₂) control.

Core Components

- VAV zone control actuators with 5 or 10 Nm nominal torque, with or without I/O module.
- VAV compact controllers with 5 or 10 Nm nominal torque for extract air or dual supply air control.
- Room operating units with e-paper display for room temperature, room temp. + rel. humidity, or for room temp., rel. humidity, and CO₂ measurement.
- Room operating units without e-paper display (with virtual display) for room temperature, room temp. + RH, or for room temp., RH, and CO₂ measurement.
- Room operating units (with / without display) can be used in combination with the Belimo Display app.



VAV zone control actuators 5 / 10 Nm
LMV/NMV-BAC-001 and LMV/NMV-BAC-002



Room Operating Units and Belimo Display App
P22RT..-1T00D1 and P22RT..-1T-1

Optional / supplementary components

- On/off or MP-Bus zone valve actuator for hydronic reheating coils.
- Duct CO₂ sensors 0-10V for installation in the extract air duct. Can be used for IAQ control or for monitoring purposes.
- Duct temperature sensors 0-10V / 0-160°C to support automatic heating / cooling changeover based on the supply air temperature, or for reheater monitoring.
- An occupancy sensor can be connected to the digital input (DI) of the Room operating unit.



2nd VAV controller 5 / 10 Nm
LMV/NMV-D3-MP-A7



Duct sensor CO₂ or temperature
22DC11 and 22DT-12L



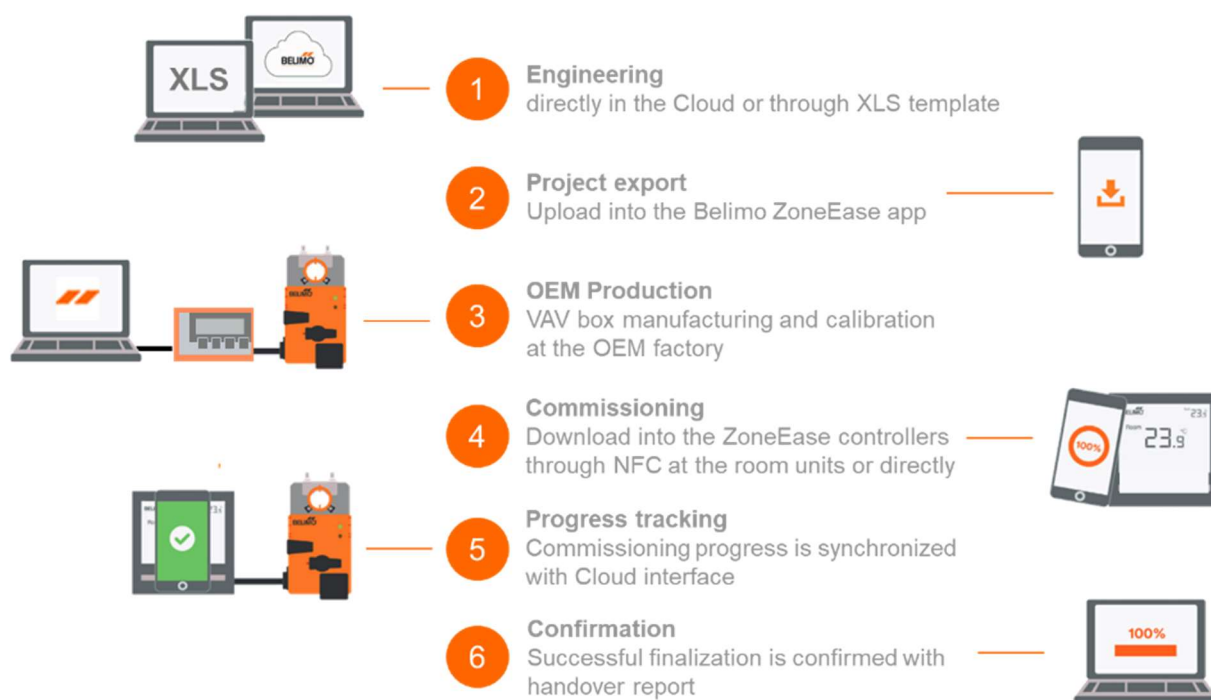
Reheat valve actuator
CQ24A-MPL-A8

Tooling environment

- Cloud-based project setup and management with commissioning and progress report.
- Offline project setup with an XLS template that can be uploaded to the cloud interface. Download at <https://www.belimo.com/zoneease-excel>
- Smartphone access (Android smartphones only) to VAV ZoneEase directly via NFC or Bluetooth (with ZIP-BT-NFC interface converter) or through the room units with NFC.
- OEM PC-Tool with ZTH EU interface converter and VAV ZoneEase configuration module.
- For more information, please visit <https://zoneease.cloud.belimo.com>

General workflow

1. The Project Engineer or System integrator enters and uploads the configuration data (excl. protected OEM parameters) at their office to the cloud system.
2. The project is published and released to the connected smartphones running the ZoneEase VAV app. When the installer logs in, configuration data are synchronized to his smartphone on site.
3. OEM calibration data is forwarded to the contracted OEM who manufactures and calibrates the project's VAV boxes at the OEM factory. The calibration parameters are protected against unauthorized modification with a customer-specific release code.
4. All components are installed in the building. Once done, the installer holds his smartphone to the room unit or actuator. This works while the ZoneEase VAV actuators are powered or unpowered.
5. The commissioning progress is synchronized with the Cloud project through the smartphone app, where the progress can be tracked. Changes made on site are synchronized back to the initial project data.
6. After completion of the commissioning process, a final report can be generated in the Cloud interface.



General Operating Principles

Reference to the BACnet / Modbus interface specification

The BACnet objects and Modbus registers are listed in detail in the BACnet PICS and the Modbus register list which can be downloaded at the Belimo website. For details regarding datapoints mentioned below, please refer to these documents.

Operating modes

ZoneEase VAV works with four basic operating / system modes. The availability of certain functions depends on the application, e.g., whether reheating aggregates or certain sensors are connected and configured.

The operating mode is either set by the system, which could be based on the input status of the presence sensor connected to the room operating unit or other criteria, or it can be set through the datapoint MV[1] / Reg. 150 System Mode with the enumeration [1:Off, 2:Active, 3:Eco, 4:Boost].

BACnet	Modbus	Designation	Description
MV[1]	150	System Mode [1:Off, 2:Active, 3:Eco, 4:Boost]	Setting the system mode over the bus

Off mode / frost protection

The Off mode is used for energy saving or when the room is unoccupied, e.g., during holidays. When active, an air flow of V_{min} is delivered to the zone and all supplementary in- and outputs are deactivated. The Off mode includes a frost protection function that can't be turned off. This function maintains a predefined minimum room temperature (default 4°C) with a non-modifiable hysteresis of 4K. This function is turned off when the room temperature rises above the frost protection setpoint under consideration of the hysteresis.

The following actions are taken by the system while the frost protection function is active (depending on the availability of the external aggregate):

- Reheat1/Reheat2/On/Off Valve (if available) is switched on.
- Parallel Fan (if available) is switched on.
- Heating Valve (if available) is fully opened.
- Damper is controlled to V_{min} .

Active mode

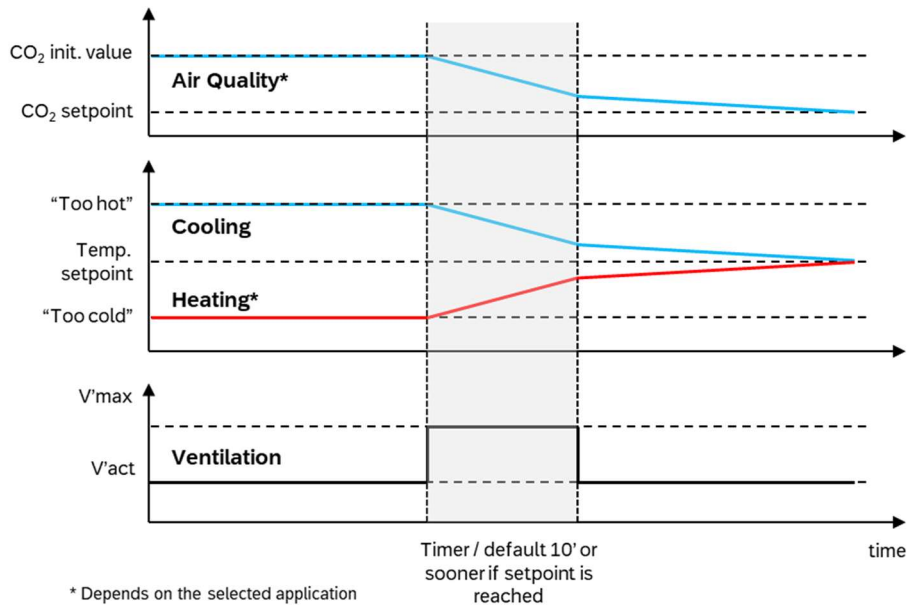
The active mode is the standard operating mode. In active mode, ZoneEase VAV controls the air flow and reheating aggregates to achieve the target temperature or indoor air quality. Both control targets can be active at the same, see "Combined room temperature / air quality control" below.

Eco mode

The Eco mode is an energy saving mode. When the room is temporarily unoccupied, e.g., at night times or during the weekend, the cooling or heating setpoint is overwritten with the Eco mode setpoint. The Eco mode can also be enabled by turning it on at the room unit.

Boost mode

The Boost mode is used to quickly reach the target room temperature, resp. for application no. 8, the target air quality by CO₂ level. When this mode is enabled, the air volume flow is set to V_{max} for a maximum of 10 minutes (default setting, adjustable) or automatically disabled if the target value is reached sooner than in 10 minutes.



This mode can be set by the room user or via the Building Management System by trigger or by a time scheduler event. The following conditions must be met to enable the boost mode:

- The room temperature is above the setpoint if there is a cooling demand or below the setpoint if there is a heating demand.
- The room temperature (based on the active mode temperature setpoint) is not within the dead band. If the room temperature is within the dead band, the boost mode can't be enabled.

Bypass Control

Application no. 3 supports bypass control by setting the parameter *Pressure dependence mode* = 0 during configuration. If activated, the damper position is not controlled for air volume flow, but for position between 0% ... 100%. The feedback signal is also to interpreted as actual damper position.

Datapoint	Designation	Description
MP 34	Pressure dependence mode [0: dependent, 1: independent] (Default: 1)	Needs to be set to 0 in application #3 during project configuration.

Supply and extract air control

All applications can be realized with one additional L/NMV-D3-MP-A7 as extract air or as second supply air VAV controller. More than one additional L/NMV-D3-MP-A7 are not supported.

Note: If a standard L/NMV-D3-MP is used, it needs to be set to MP-Buss address 7 to work properly.

The L/NMV-D3-MP-A7 need to be configured with the same dp@Vnom and Vnom as the supervisory controller (L/NMV-BAC-..). For Vmin and Vmax, the following settings must be applied: Vmin = 0 and Vmax = 100. The supervisory L/NMV-BAC-.. doesn't write any persistent parameters into the L/NMV-D3-MP, but exchanges process values during runtime, mostly the relative flow setpoint and actual values for flow and damper position.

The following datapoints must be set or can be monitored during runtime:

BACnet	Modbus	Designation	Description
BV[128]	211	Enable secondary damper	If set to ON but secondary VAV isn't connected, an alarm is sent out
AV[117]	136	Airflow gain of secondary	Range 0...2. Increase (1.01...2) or decrease (0...0.99) of flow setpoint to the secondary VAV
AV[120]	120	Nom. airflow in [m³/h] of secondary damper	
AV[122]	124	Max. Airflow in [m³/h] of secondary damper	
AV[124]	128	Min. Airflow in [m³/h] of secondary damper	
BV[3]	27	Operating state of secondary damper	Indicates whether the setpoint has been reached
MI[101]	138	Status VAV Standalone System	Enum. 9 indicates Vnom / Vmin deviation between primary and secondary
MI[109]	140	Status dp sensor and duct pressure	Enum. 5 indicates that the air flow demand from primary to secondary can't be reached
AI[15]	19	Rel. damper position in [%] of secondary damper	
AI[16]	20	Rel. airflow in [%] of secondary damper	

Combined room temperature / air quality control (CO₂)

All room temperature control applications (i.e., all except for #8 and #9) can be configured for *combined* room temperature and air quality control if both measurement values are available from sensors. A CO₂ measurement value can either be made available by the integrated sensor in the room unit / sensor P-22RTM-1T.. or as external sensor at the analogue input of the ZoneEase VAV actuator. The parameters *Control mode* and (in case of a duct sensor) *AI Sensor Configuration* need to be configured as follows:

BACnet	Modbus	Designation	Description
MV[6]	117	Control Mode [1: Temp. only; 2: Temp. and CO2 Analog Input; 3: Temp. and CO2 ROU]	Enum 2: CO ₂ is measured at the AI (duct sensor); Enum 3: CO ₂ is measured with the room op. unit.
MP 155 ^(*)		AI Sensor Configuration [1: none; 2: CO ₂ ; 3: RSA Temp. (0...160°C); 4: High Cut Input]	Needs to be set to Enum 2 if an analogue CO ₂ sensor is used.

^(*) Only available as MP-Bus parameter. Configuration in the Cloud interface or with XLS template.

Heating / Cooling Control and Changeover

In all applications except for #8 and #9, ZoneEase VAV is running either in heating or cooling operation, depending on the outside temperature, and depending on the air temperature from the AHU. In cooling operation, the reheating aggregates can't be accessed by the application.

The VAV application is parameterized with four basic air volume flow settings:

- Vnom is the design air flow for the VAV box the ZoneEase VAV is mounted on.
- Vmin is the minimum air flow for heating or cooling.
- Vmax is identical with VmaxC (Vmax cooling) and is the upper air flow limit in cooling operation.
- VmaxH (Vmax heating) is the upper air flow limit in heating operation.

Vmax (VmaxC or VmaxH) must be greater (or equal to) than Vmin, and Vmin and Vmax must be smaller than Vnom. In case Vmax exceeds Vnom, it is automatically set to Vnom.

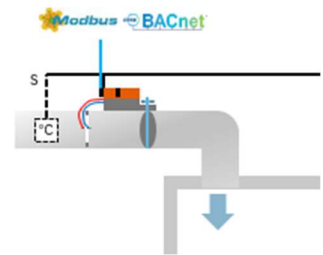
ZoneEase VAV supports two types of heating / cooling changeover. The changeover effects the damper opening behaviour, as opening the damper more leads to an in- or decrease of the cooling effect (or heating effect, respectively), depending on the air temperature from the AHU/RTU.

BMS Changeover

Heating / cooling changeover by the BMS is possible with a BACnet signal which is usually based on the outside temperature or a calendar. The ZoneEase VAV system doesn't check this signal for plausibility, i.e., doesn't verify by itself whether hot or cold air is provided by the AHU / RTU. This can only be achieved by using the automatic changeover.

Automatic Changeover

An automatic heating / cooling is active if a supply air duct temperature sensor (22DT-12L) is installed, and when a 0-10V duct temperature sensor with a measuring range of 0-160°C has been configured at the analogue input (AI) of the ZoneEase VAV actuator. The duct temperature sensor needs to be placed before a reheater (if present) to measure the supply air temperature coming from the AHU / RTU.



BACnet	Modbus	Designation	Description
BV[1]	153	BMS heating / cooling [0: Cooling, 1: Heating] (Default: 0)	Information from BMS whether hot or cold air is supplied by the AHU. Available for all applications except for #2, #8 and #9
MV[5]	154	Select in which mode (heating / cooling) reheat is allowed [1: Always allowed, 2: Allowed in heating mode only, 3: Allowed in cooling mode only, 4: Never allowed] (Default: 2)	
MP 155 ^(*)		AI Sensor Configuration [1: none; 2: CO2; 3: RSA Temp. (0...160°C); 4: High Cut Input]	Needs to be set to 3: RSA Temp. 0...160°C to enable Automatic Changeover (an installed duct sensor presupposed)

(*) Only available as MP-Bus parameter. Configuration in the Cloud interface or with XLS template.

Safety functions

In applications with reheating aggregates, ZoneEase VAV applies safety functions. These functions need to be considered in the planning, commissioning, and operation phase.

Reheat outputs operation in normal operation

Reheating aggregates can't be turned on if the actual air volume flow is $< 10\%$ of V_{max} . Example: if $V_{max} = 1200 \text{ m}^3/\text{h}$, the lower limit for being able to turn on the reheat aggregate is $V = 120 \text{ m}^3/\text{h}$.

Reheat outputs override by BMS

Reheating aggregates can't be turned on by a Building Management System (BMS) override command if the actual air volume flow is $< 15\%$ of V_{max} . The threshold of 15% can't be modified.

The status of the digital outputs can be monitored by the following datapoints:

BACnet	Modbus	Designation	Description
BI[10]	178	Electrical Heater 1 / On-Off Valve State [0: Off, 1: On]	Indicates the status of the reheating aggregate at DO2
BI[11]	179	Electrical Heater 2 [0: Off, 1: On]	Indicates the status of the reheating aggregate at DO3
BI[12]	181	Fan state [0: Off, 1: On]	Indicates the status of the fan at DO1

Monitoring of the electrical reheater status

If the safety guidelines for a project require that the status of the electrical reheaters is constantly being monitored directly at the reheater (not through the switching state of the ZoneEase VAV outputs), the system can be configured in two ways to achieve this monitoring. It is possible and recommended to connect and configure both signals at the same time for a good overheating protection.

Connecting the heater output to the ROU digital input

The digital output of the electrical reheater can be connected to digital input (DI) of the ZoneEase VAV room unit. If configured accordingly (see table below), the DI status can be read as follows:

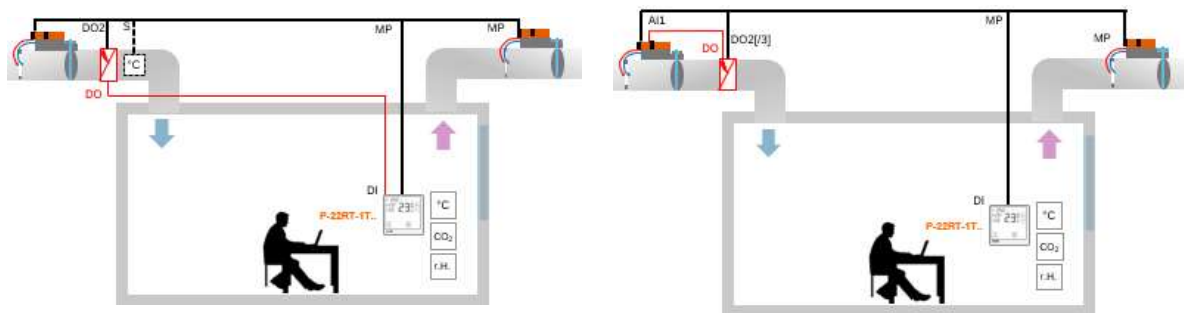
- DI closed: Reheater status = On [Digital Input ROU = On (1)]
- DI open: Reheater status = Off [Digital Input ROU = Off (0)]

Connecting the High-cut thermal fuse output to the ZoneEase VAV actuator input

If the electrical reheater of a VAV-box is protected by a High-cut thermal fuse which automatically cuts the reheater from power in case of overheating, the High-cut output can be connected to the analogue input (AI) of an L/NMV-BAC-... actuator. If configured accordingly (see table below), the DI status is read as follows:

- $< 2V \Rightarrow 0$, the contact is opened, normal status
- $\geq 2V \Rightarrow 1$, the contact is closed to 24 V- AC, high cut status

Information of the High-cut status is made available on the bus datapoint *High cut state* and is only available if the datapoint *AI Sensor Configuration* has been set to [4: High-cut Input]. Additionally, the following logic applies: If *AI Sensor Configuration* = High-cut Input and if *High cut state* = 1, then the el. heater outputs DO2 and DO3 are cut (no output). This serves as an additional safety function.



Heater status output is connected to the ROU input

High-cut output is connected to the analog input

BACnet	Modbus	Designation	Description
BI[5]	143	Digital Input ROU [0: Inactive, 1: Active] (Default: 0)	Status of the digital input of the Room Operating Unit. 0 = Heater off, 1 = Heater on.
BI[6]	144	High cut state [0: Inactive, 1: Active] (Default: 0)	In activated state, the connected reheat aggregate inside the VAV box will be monitored. 1: Digital input at room unit shows reheat state. 2: Analog input at ZoneEase VAV actuator, used as digital input (normally closed) supervises reheat.
MP 155 ^(*)		AI Sensor Configuration [1: none; 2: CO2; 3: RSA Temp. (0...160°C); 4: High Cut Input]	Needs to be set to 4: High Cut Input

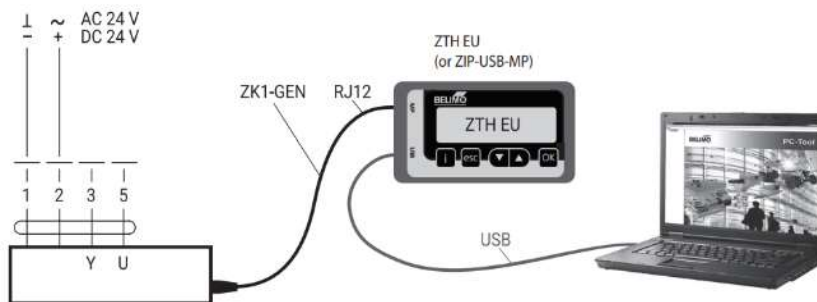
(*) Only available as MP-Bus parameter. Configuration in the Cloud interface or with XLS template.

OEM Calibration and Parameter Protection

Connection to the Belimo PC Tool

After initial specification of the zone control project, an OEM will be assigned the order to manufacture and calibrate the VAV boxes which are needed in the project, see "*General workflow*", step 3. The project engineer or ventilation planner has to forward the VAV box specification data from the project to the OEM.

The OEM calibrates the VAV boxes actively (under air) or passively by writing pre-defined parameters into the VAV boxes. For this purpose, the Belimo PC-Tool (version 3.16.7 or later) needs to be connected to the ZoneEase VAV actuators through the ZTH EU interface converter. The actuators need to be connected to a power supply during calibration and parameterization. The connection to the actuators must be made with ZK1-GEN cables at the service socket.



Since an OEM wants to make sure that the calibrated and parameterized VAV boxes are not manipulated after delivery, the core parameters are protected against access by unauthorized parties.

The protected parameters are:

- dp@Vnom
- Vnom
- Calibration Height

To get write access to these parameters, an OEM *release code* is required. It can be obtained through the local Belimo sales / support representative and will be individualized for a specific customer. The release code needs to be imported into the PC-Tool, into the Belimo ZoneEase app or into the Belimo Assistant app.

Note:

- A direct connection of wires from the ZTH EU to the screw terminals is not possible with L/NMV-BAC-..
- The ZTH EU can't be directly used as handheld tool at L/NMV-BAC-..
- ZoneEase VAV project data such as room designations or bus parameters can't be edited with the PC-Tool.

Use of the ZoneEase VAV configuration page

After connecting an LMV/NMV-BAC-001 or -002 via the ZTH interface converter to the Belimo PC-Tool, the following configuration dialogue is available.

[1] contains the VAV calibration section with the protected parameters which can be written only if a valid OEM release code has been entered. In this field, an active calibration (calibration under air) can be performed by clicking the "calibration" button, or parameters from the VAV box specification can be entered directly.

[2] the application settings field can be used for factory testing of ZoneEase VAV application functionality.

Note: All settings made this field will be overwritten by the application settings from the ZoneEase cloud project.

[3] For testing and maintenance, override control commands can be set and monitored in this field.

[4] Actual value (only valid in VAV mode) can be monitored in this field, usually for testing and maintenance purposes.

PC-Tool --- Belimo

File Project Channel Tools Help

PCToolGUI V3.16

Project: VAV Compact

Channel: COM=17, (MP/PP, Every 10s)

DP PP: LMV-BAC-001

Type **LMV-BAC-001**

Designation --

Position --

SN 2232

Address PP

VAV Calibration 1

Vnom 0..99999 m3/h

dp@Vnom_Cal 38..500 Pa Calibration

Calibration Height 0..4000 m

Height Compensation

Application Settings 2

Application Type

Installation Height 0..4000 m

Vmax Cooling 0..0 m3/h

Vmax Heating 0..0 m3/h

Vmin 0..0 m3/h

Dir. of Rotation

Override 3

Control

Fan

Heater

Actual Values (only valid in VAV mode) 4

State VAV Control

Airflow absolute 0..99999 m3/h

Applied Setpoint Airflow 0..99999 m3/h

dp_actual -20..500 Pa

Damper Pos. rel. 0..100 %

Damper Pos. abs. 0.00..95.00 °

Read

Write

Store to file...

Load from file...

Enable Trend

Application Overview

Applications are grouped into basic applications (indoor air quality and air volume flow control) and room temperature control applications. Room temperature control applications are available with or without parallel / series fan.

All room temperature control applications can be used with combined room temperature / indoor air quality control if a CO₂ sensor is available. A CO₂ sensor can either be integrated in the room operating unit P-22RTM-1T.. or connected to the sensor input at the L/NMV-BAC-..

All applications can be configured with a secondary VAV controller L/NMV-D3-MP as extract air or as second supply air controller. This L/NMV-D3-MP needs to be set at MP-Bus address 7 and needs to have the same Vnom and Vmin / Vmax values as the L/NMV-BAC-.. controller which is supervising it.

Application name	Application ID	L/NMV-BAC-001	L/NMV-BAC-002	L/NMV-D3-MP-A7	P-22RT-1T..	P-22RTH-1T..	P-22RTM-1T..	22DC-11	22DT-12L	CQ24A-MPL-A8
Basic applications										
Indoor air quality control	8	■	□	□	□	□	■	■(*)	□	
Air volume flow control	9	■	□	□	■	□	□		□	
Room temperature control										
Cooling only	2	■	□	□	■	□	□	□	□	
Cooling or heating (changeover)	3	■	□	□	■	□	□		■	
Cooling + 1-stage electric reheat	4		■	□	■	□	□	□	□	
Cooling + 2-stage electric reheat	5		■	□	■	□	□	□	□	
Cooling + on/off hydronic reheat	6		■	□	■	□	□	□	□	
Cooling + modulating hydronic reheat	7	■	□	□	■	□	□	□	□	■
Parallel fan + room temperature control										
Cooling only	10		■	□	■	□	□	□	□	
Cooling + 1-stage electric reheat	11		■	□	■	□	□	□	□	
Cooling + 2-stage electric reheat	12		■	□	■	□	□	□	□	
Cooling + on/off hydronic reheat	13		■	□	■	□	□	□	□	
Cooling + modulating hydronic reheat	14		■	□	■	□	□	□	□	■
Series fan + room temperature control										
Cooling only	15		■	□	■	□	□	□	□	
Cooling or heating (changeover)	16		■	□	■	□	□	□	□	
Cooling + 1-stage electric reheat	17		■	□	■	□	□	□	□	
Cooling + 2-stage electric reheat	18		■	□	■	□	□	□	□	
Cooling + on/off hydronic reheat	19		■	□	■	□	□	□	□	
Cooling + modulating hydronic reheat	20		■	□	■	□	□	□	□	■

(*) CO₂ sensor in the room op. unit **or** as analogue sensor

Air Quality and Flow Control Applications

8 Indoor Air Quality Control (CO₂-controlled)

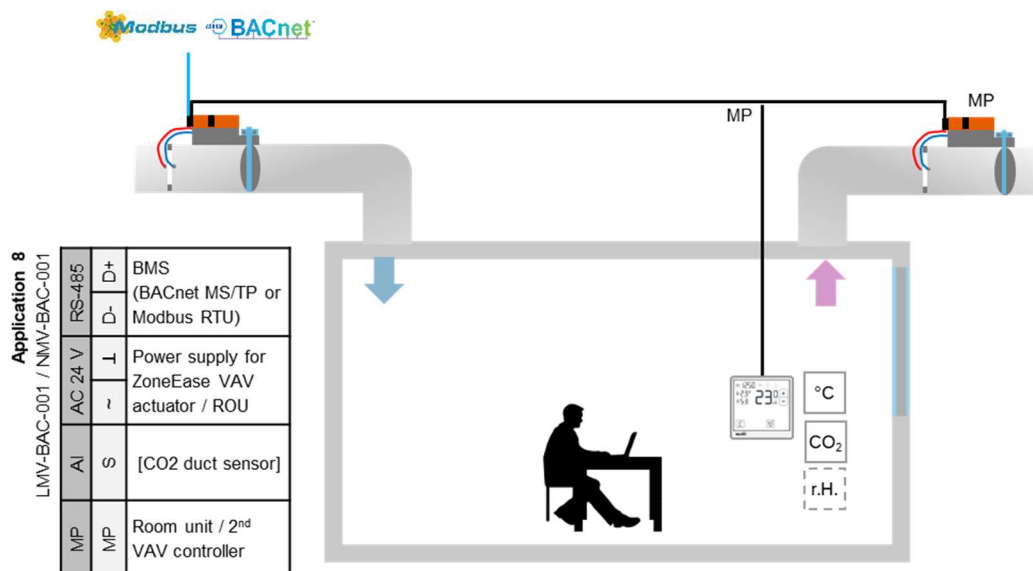
Application description

- The supply air volume is controlled by air quality.
- The air quality is measured as CO₂ value by a P-22RTM-1T.. room operating unit (alternatively by a duct sensor)

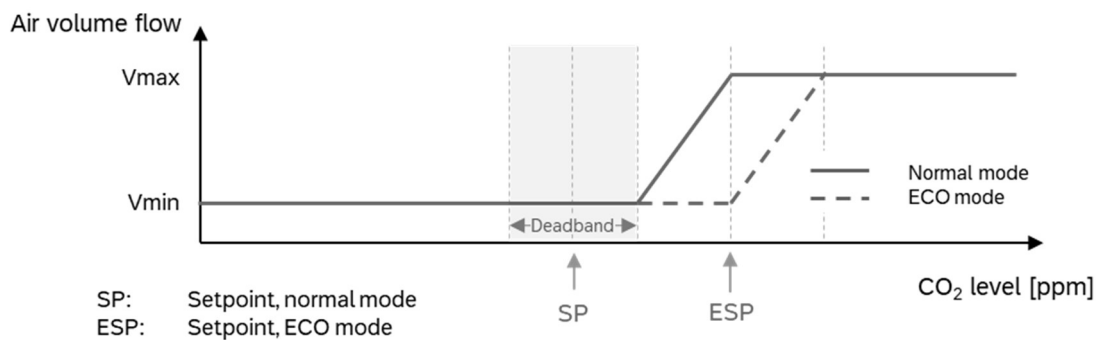
Required components:

- L/NMV-BAC-001 ZoneEase VAV actuator
- P-22RTM-1T.. Room operating unit

Application diagram



Sequence diagram



9 Air Volume Flow Control (VAV or CAV)

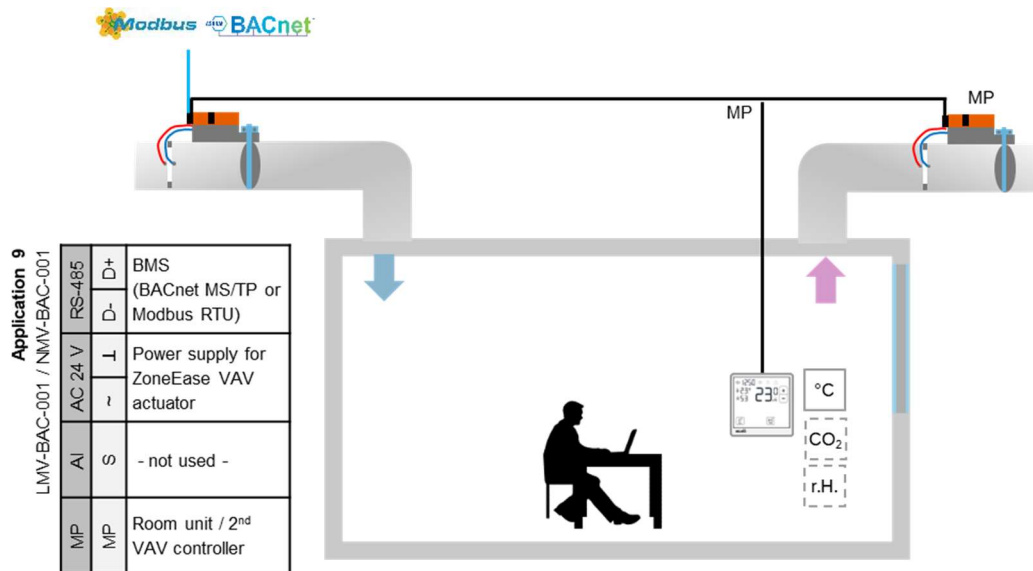
Application description

- The air volume flow is step-controlled
- The air volume flow setpoint ranges between 0...10 and can be selected at the room unit.
- Stage 0 corresponds to setpoint = V_{min} , and stage 10 corresponds to setpoint = V_{max} .

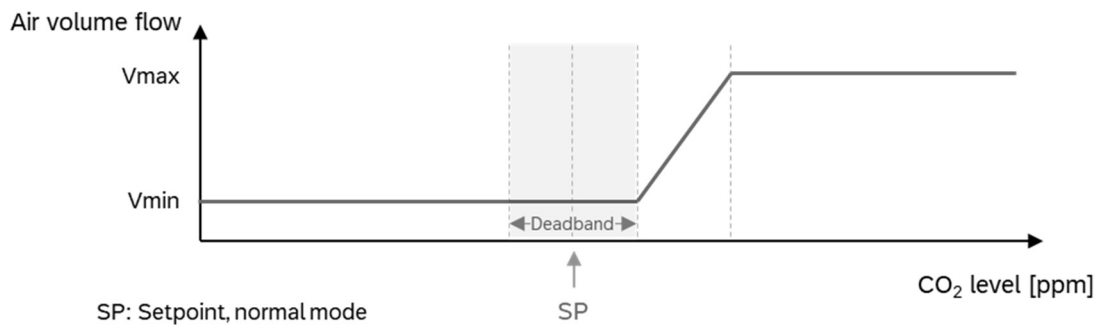
Required components:

- L/NMV-BAC-001 ZoneEase VAV actuator
- P-22RT...-1T.. Room operating unit

Application diagram



Sequence diagram



Room Comfort Applications

2 Cooling only

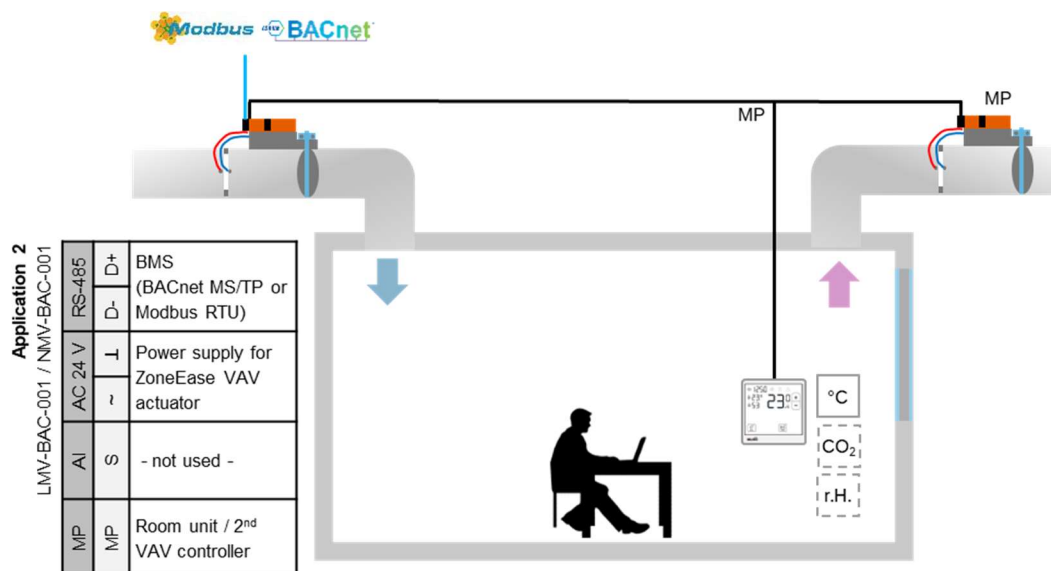
Application description

- Cooling or heating with supply air by modulating the air damper (based on the temperature setpoint).
- AHU / RTU must provide cool primary air.

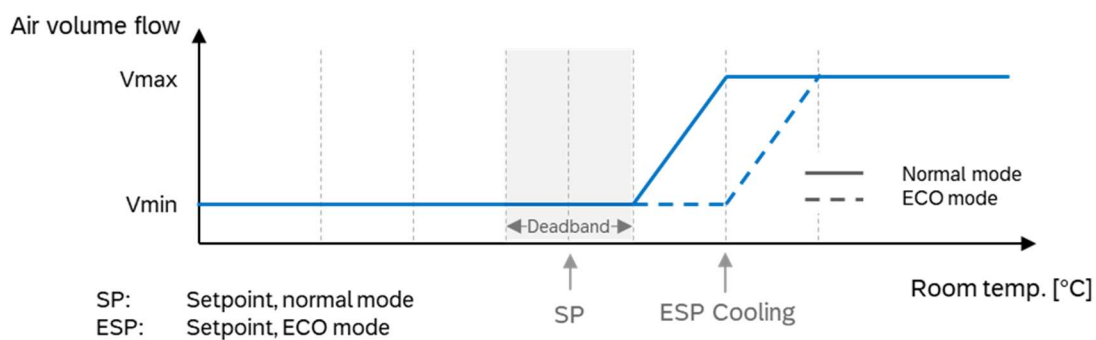
Required components:

- L/NMV-BAC-001 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Sequence diagram



3 Cooling or Heating

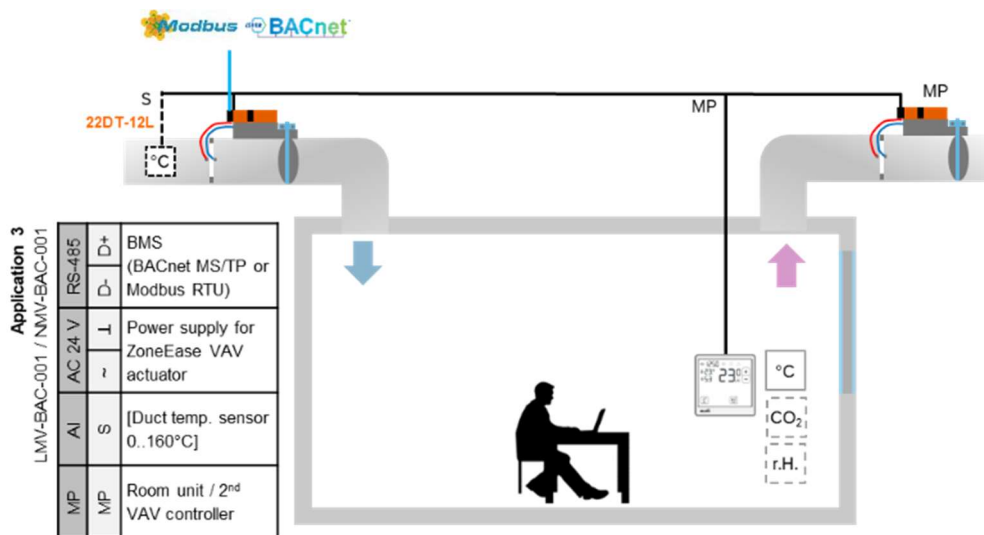
Application description

- Cooling or heating with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool or warm primary air.
- BMS heating / cooling changeover or automatic changeover if a supply air temp. sensor is used.
- Can be set to Bypass Control (position control 0..100% damper position).

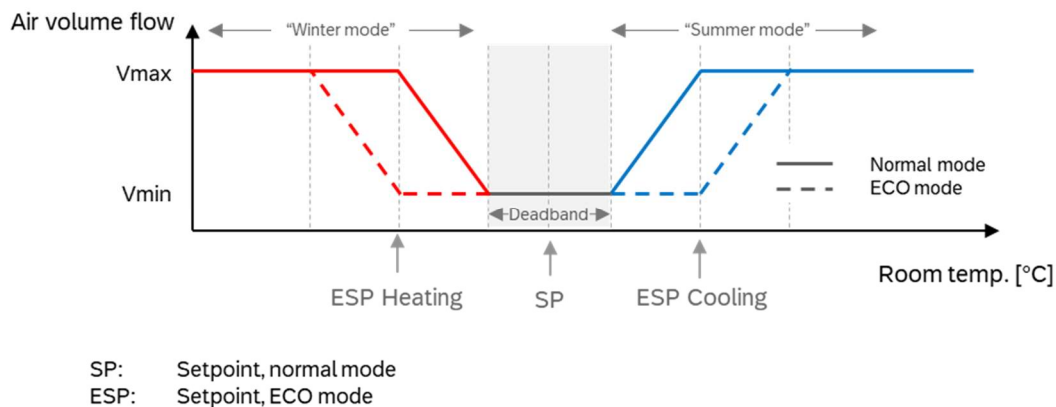
Required components:

- L/NMV-BAC-001 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Sequence diagram



4 Cooling with 1-Stage Electrical Reheat

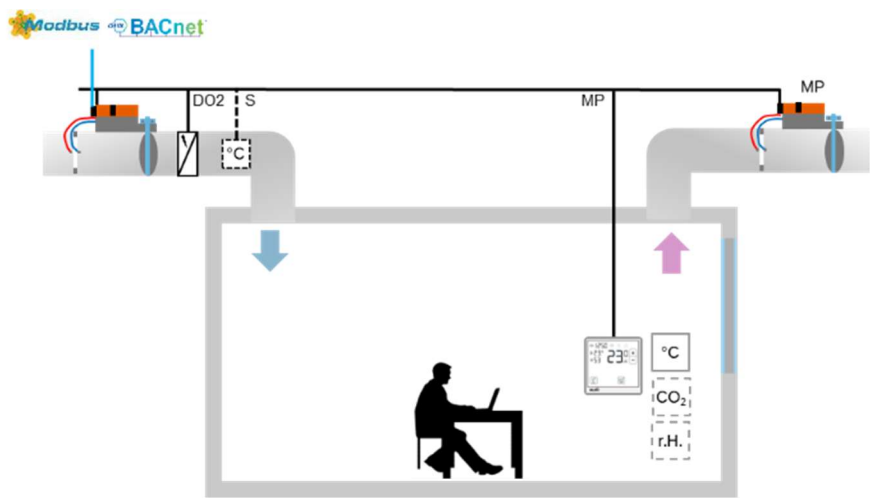
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheating with 1-stage electric reheater at digital output DO2.

Required components:

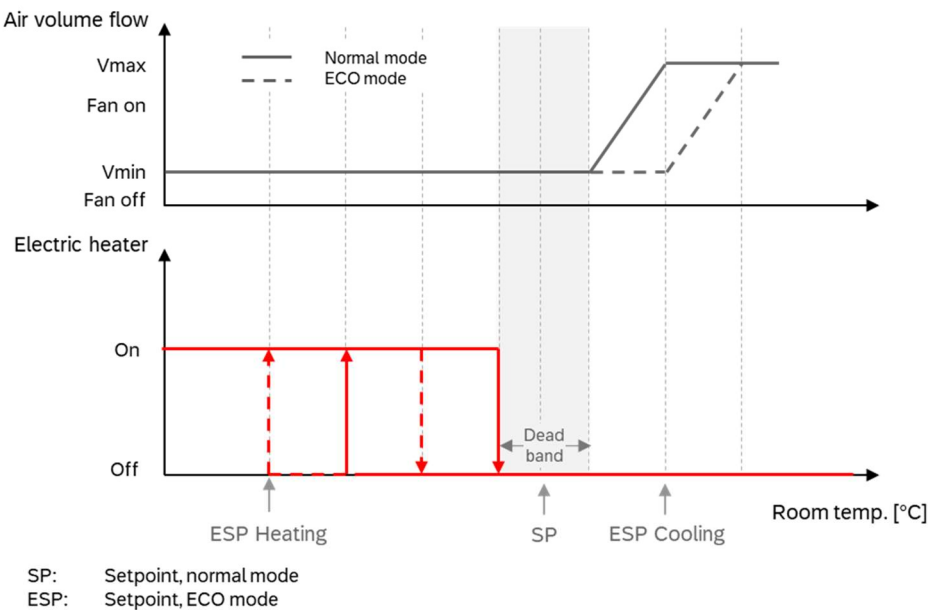
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Application 4 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
		D-	
	AC 24 V		Power supply for ZoneEase VAV actuator
	Room unit		Room unit power supply / MP-Bus
		MP	
	Analog IN / MP	S	[Duct temp. sensor 0..160°C]
	DigitalOUT	1	- not used -
		2	Electric heater stage 1
		3	- not used -
	COM		Fan / heater GND

Sequence diagram



5 Cooling with 2-Stage Electric Reheat

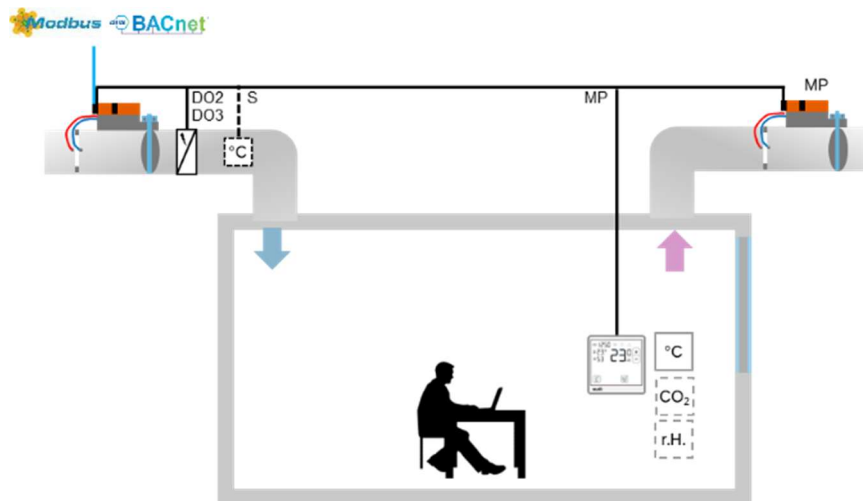
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheating with 2-stage electric reheater at DO2 + DO3

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room unit

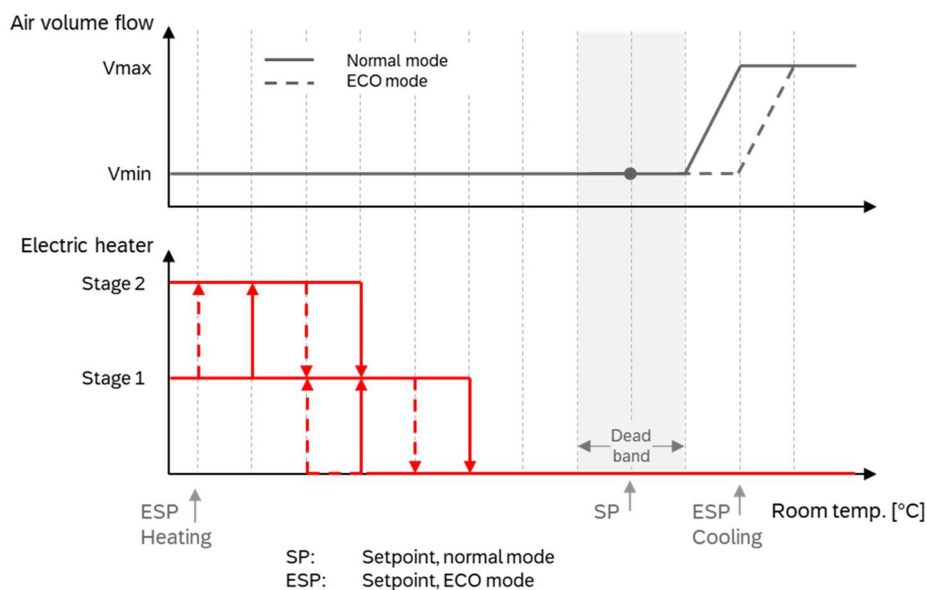
Application diagram



Application 5
LMV-BAC-002 / NMV-BAC-002

RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-	
AC 24 V	~	Power supply for ZoneEase VAV actuator
	~	
Room unit	~	Room unit power supply / MP-Bus
	MP	
Analog IN / MP	S	[Duct temp. sensor 0..160°C]
	~	
	~	
	MP	2nd VAV controller
Digital OUT	1	- not used -
	2	Electric heater stage 1
	3	Electric heater stage 2
	COM	Fan / heater GND

Sequence diagram



6 Cooling with On-Off Hydronic Reheat

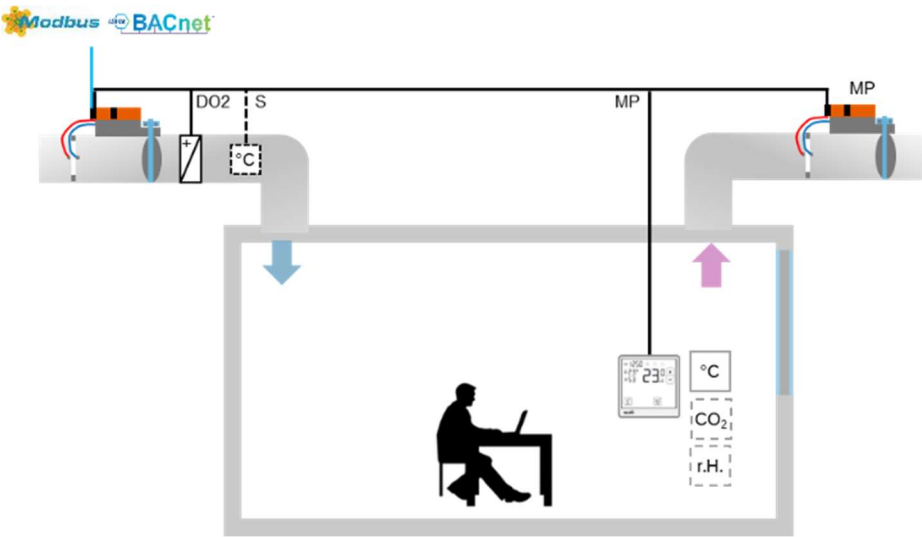
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheating with on/off reheat valve at DO2.

Required components:

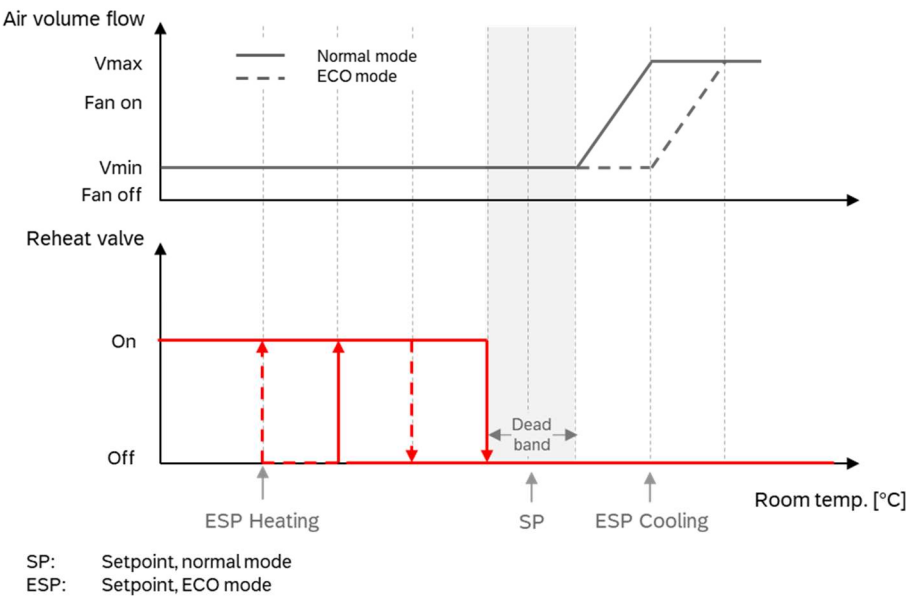
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit
- CQ24A On/Off reheat valve actuator

Application diagram



Application 6 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-		
	AC 24 V		Power supply for ZoneEase VAV actuator
	Room unit		Room unit power supply / MP-Bus
	MP		
	Analog IN/MP	S	[Duct temp. sensor 0..160°C]
	MP		2 nd VAV controller
	Digital OUT	1	- not used -
		2	On/Off reheat valve actuator
		3	- not used -
	COM		Fan / heater GND

Sequence diagram



7 Cooling with Modulating Hydronic Reheat

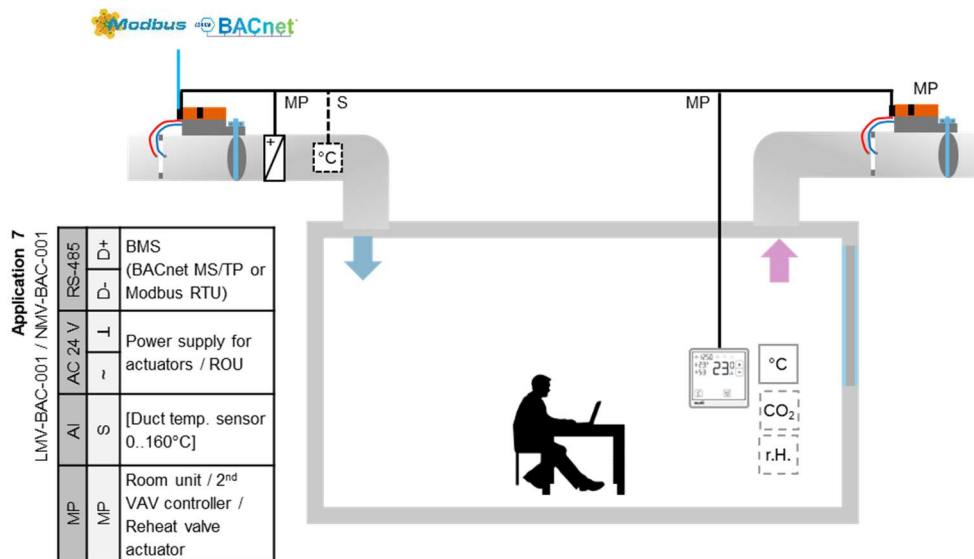
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheat with modulating reheat valve.

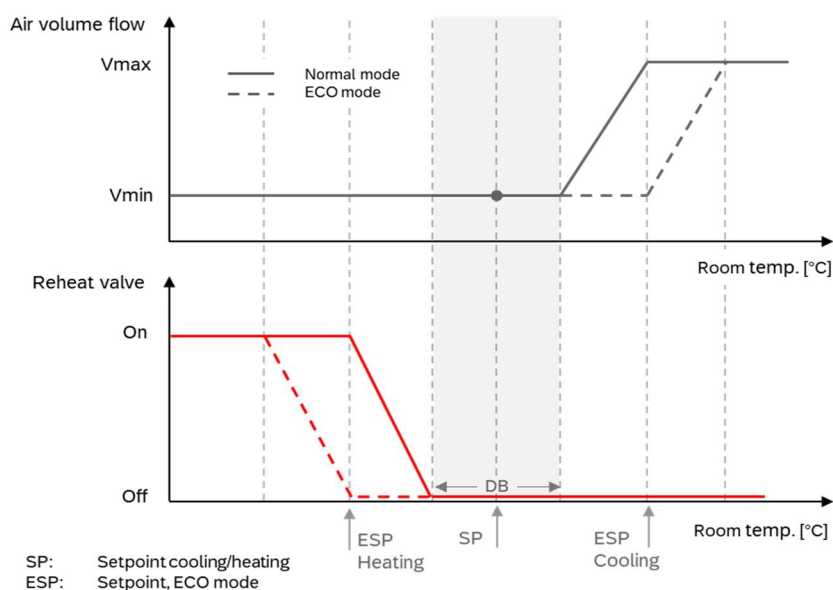
Required components:

- L/NMV-BAC-001 ZoneEase VAV actuator
- P-22RT-1T.. Room operating unit
- CQ24A-MPL-A8 Modulating valve actuator

Application diagram



Sequence diagram



Applications with Parallel Fan

10 Cooling with Parallel Fan

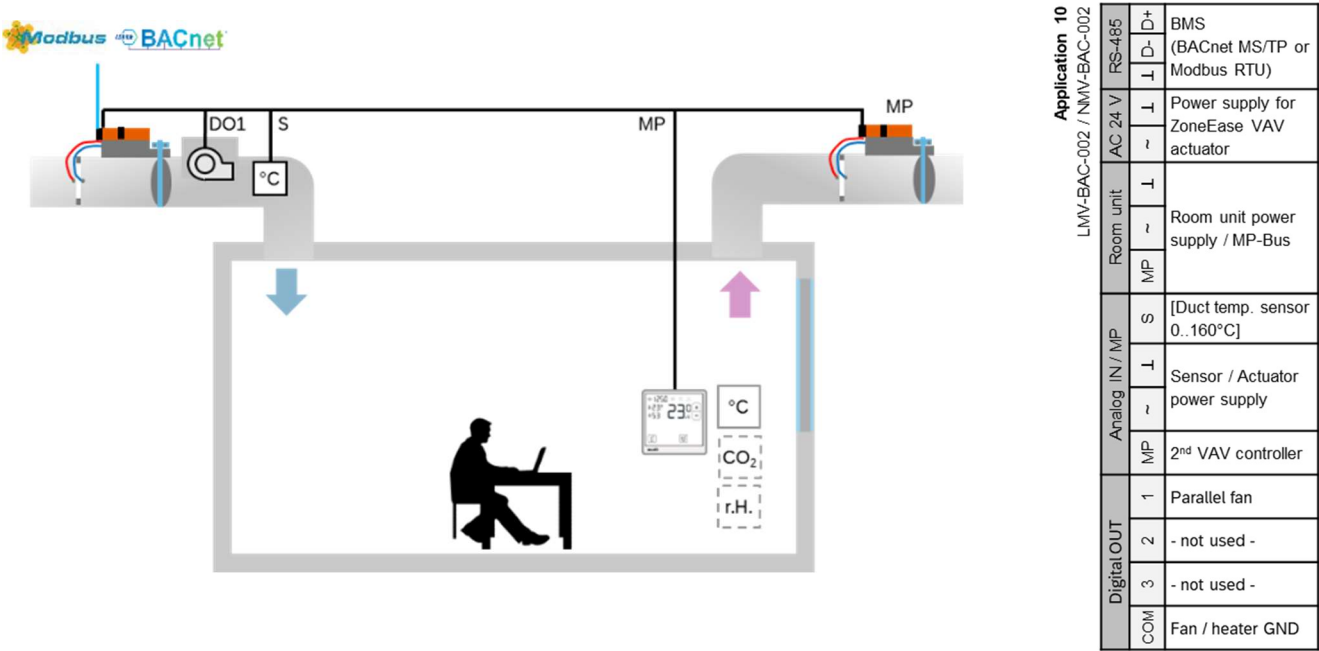
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheat with recirculated extract air through the parallel fan at DO1.

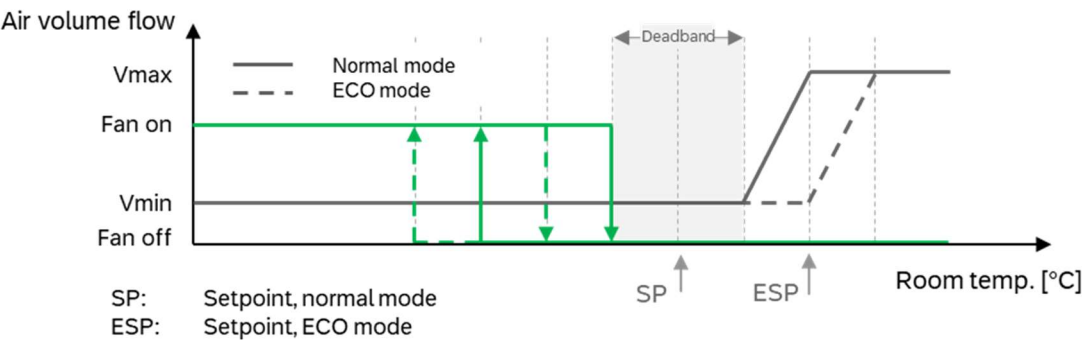
Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Sequence diagram



11 Cooling with Parallel Fan + 1-Stage Electric Reheat

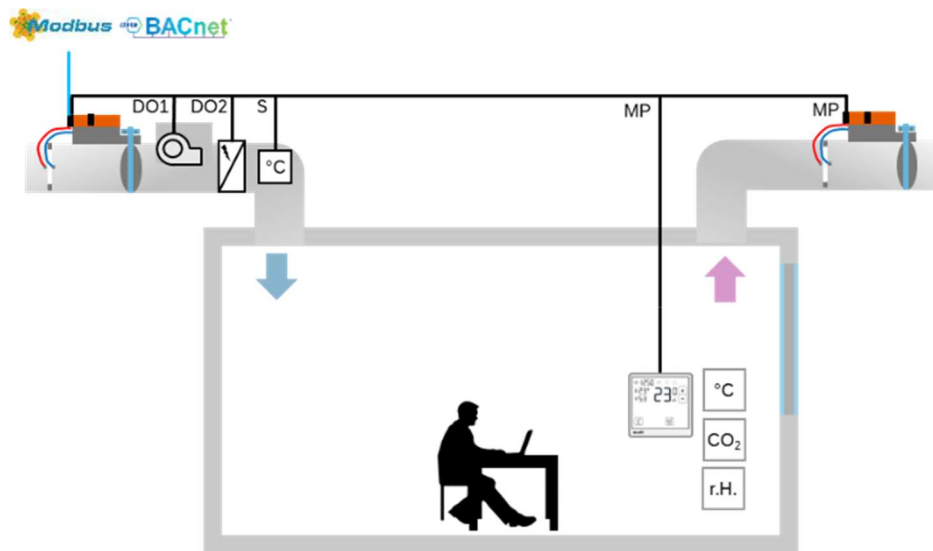
Application description

- Cooling with supply air by modulating the air flow damper (based on the room temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- First stage reheating with recirculated extract air through the parallel fan at DO1.
- Second stage reheating with 1-stage electric heater at DO2.

Required components:

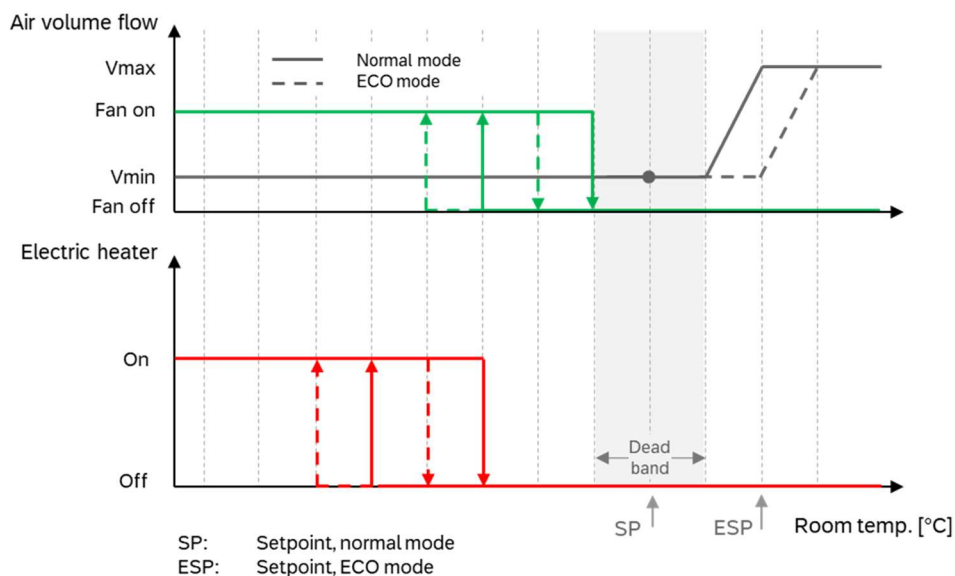
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Application 11 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
		D-	
	AC 24 V	⌋	Power supply for ZoneEase VAV actuator
		⌋	
	Room unit	⌋	Room unit power supply / MP-Bus
		⌋	
		S	[Duct temp. sensor 0..160°C]
	Analog IN / MP	⌋	Sensor / Actuator power supply
		⌋	
	MP	MP	2 nd VAV controller
Digital OUT	1		Parallel fan
	2		Electric heater stage 1
	3		- not used -
	COM		Fan / heater GND

Sequence diagram



12 Cooling with Parallel Fan + 2-Stage Electric Reheat

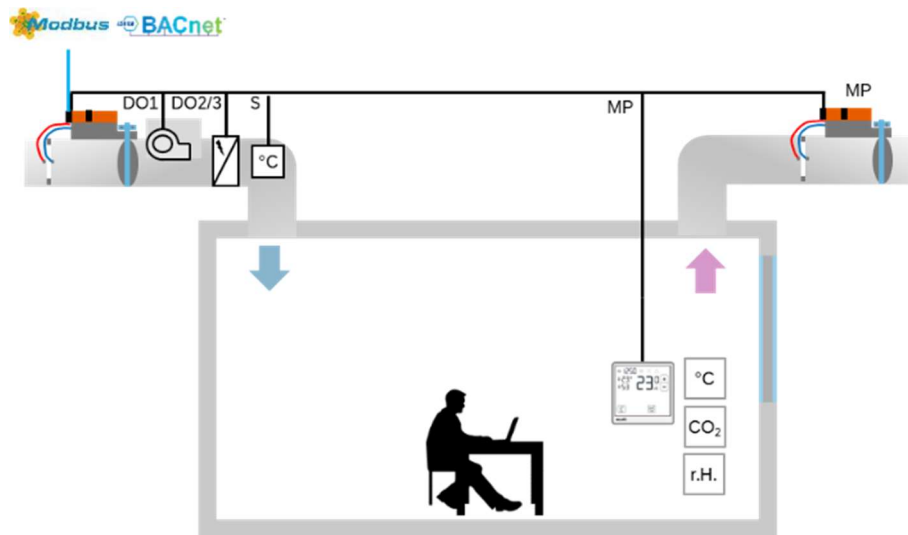
Application description

- Cooling with supply air by modulating the air flow damper (based on the room temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- First stage reheating with recirculated extract air by parallel fan at DO1.
- Second/third stage reheating with 2-stage electric heater at DO2 and DO3

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. Room operating unit

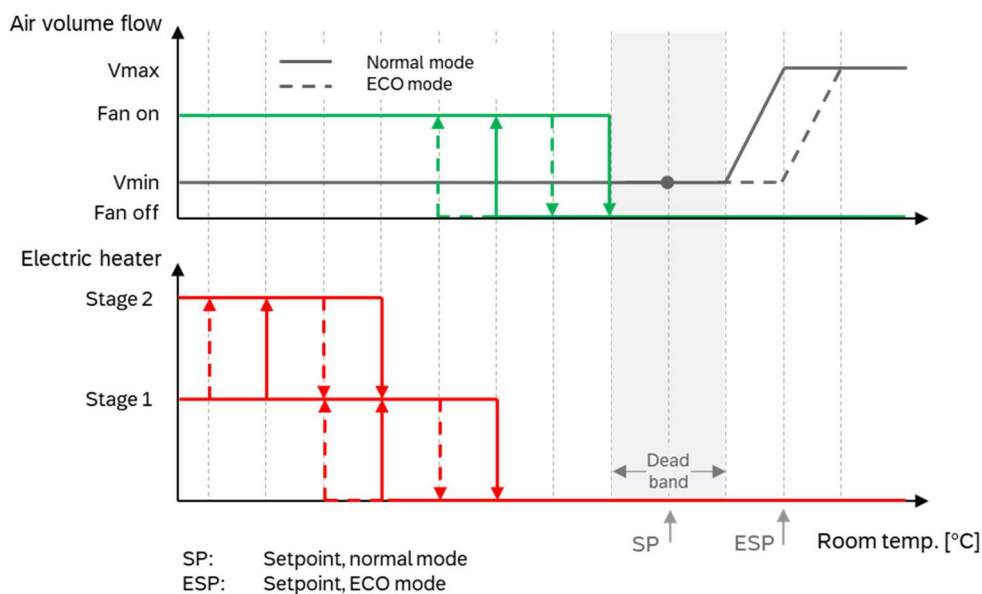
Application diagram



Application 12

LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	RS-485	D-	
	AC 24 V	⏏	Power supply for ZoneEase VAV actuator
	Room unit	⏏	
	MP	⏏	Room unit power supply / MP-Bus
	Analog IN / MP	S	[Duct temp. sensor 0..160°C]
	MP	⏏	
	MP	⏏	2nd VAV controller
	Digital OUT	1	Parallel fan
	Digital OUT	2	Electric heater stage 1
COM	Digital OUT	3	Electric heater stage 1
	COM		Fan / heater GND

Sequence diagram



13 Cooling with Parallel Fan + On-Off Hydronic Reheat

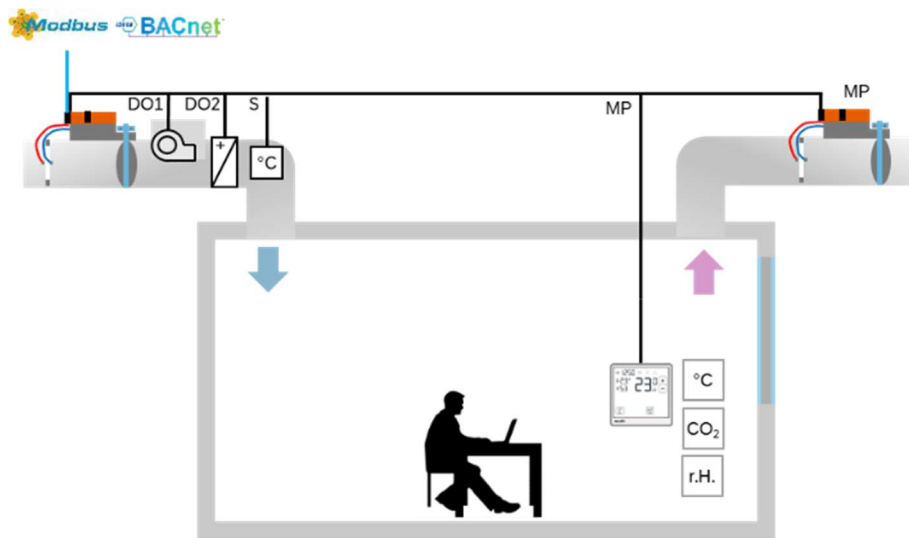
Application description

- Cooling with supply air by modulating the air flow damper (based on the room temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- First stage reheating with recirculated extract air by parallel fan at DO1.
- Second stage reheating with On/Off hydronic reheat at DO2

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit.

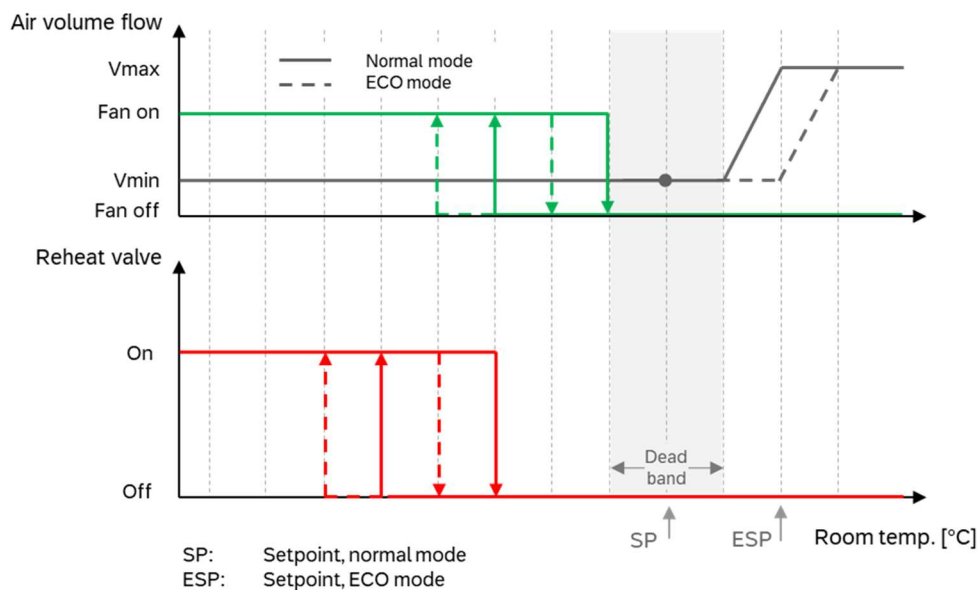
Application diagram



Application 13
LMV-BAC-002 / NMV-BAC-002

RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-	
AC 24 V	L	Power supply for ZoneEase VAV actuator
	N	
Room unit	L	Room unit power supply / MP-Bus
	MP	
Analog IN / MP	S	[Duct temp. sensor 0..160°C]
	L	
	N	
	MP	2 nd VAV controller
Digital OUT	1	Parallel fan
	2	On/Off reheat valve actuator
	3	- not used -
	COM	Fan / heater GND

Sequence diagram



14 Cooling with Parallel Fan + Modulating Hydronic Reheat

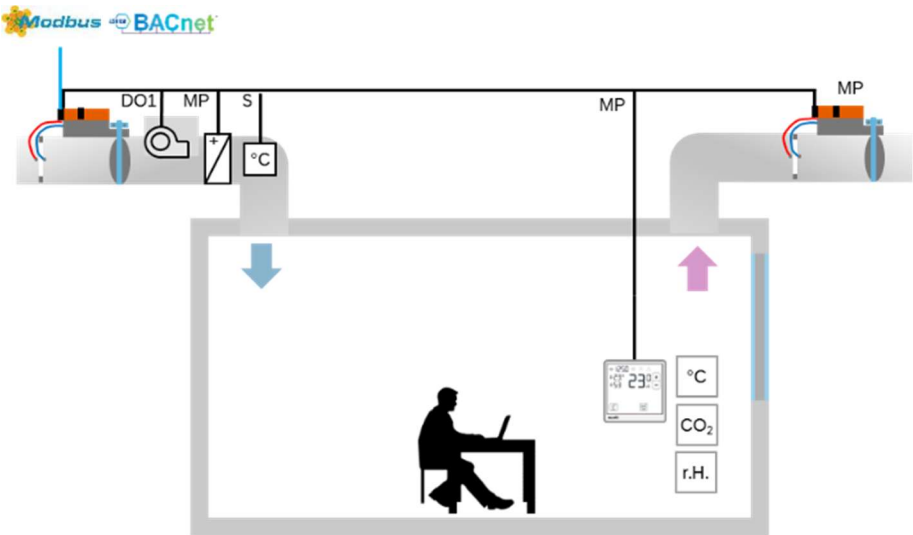
Application description

- Cooling with primary supply air by modulating the air damper.
- Central AHU / RTU must provide cool primary air.
- First stage reheating with recirculated extract air by parallel fan at DO1.
- Second stage reheating with On/Off hydronic reheat at DO2.

Required components:

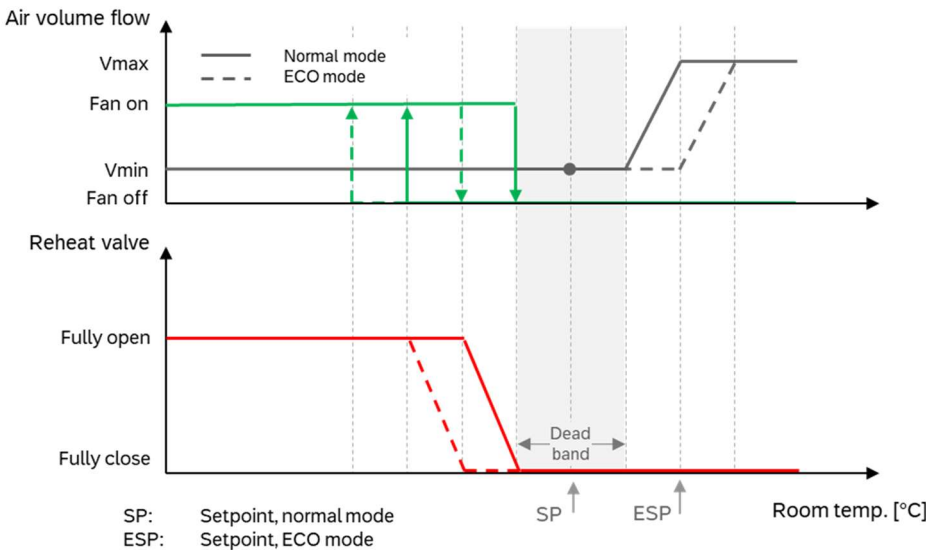
- L/NMV-BAC-002 ZoneEase VAV actuator.
- P-22RT-1T.. room operating unit.
- CQ24A-MPL-A8 Modulating valve actuator.

Application diagram



Application 14 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-		
	AC 24 V	I	Power supply for ZoneEase VAV actuator
		I	
	Room unit	I	Room unit power supply / MP-Bus
		I	
	MP		
	S		[Duct temp. sensor 0..160°C]
	Analog IN / MP	I	
		I	
Digital OUT	1	MP	2 nd VAV controller / Reheat valve act.
	2		Parallel fan
	3		- not used -
COM			- not used -
			Fan / heater GND

Sequence diagram



Applications with Series Fan

15 Cooling with Series Fan

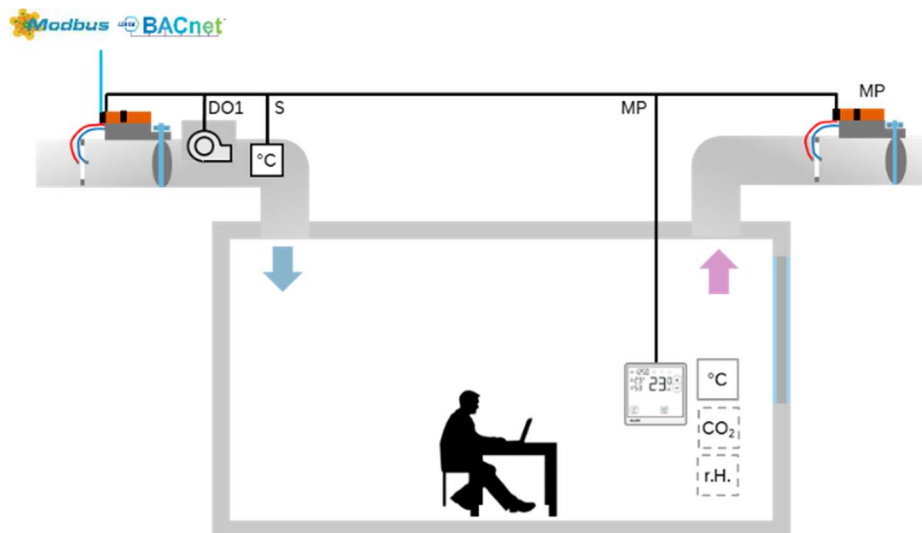
Application description

- Cooling with primary supply air by modulating the air damper.
- Central AHU / RTU must provide cool primary air.
- Series fan at DO1.

Required components:

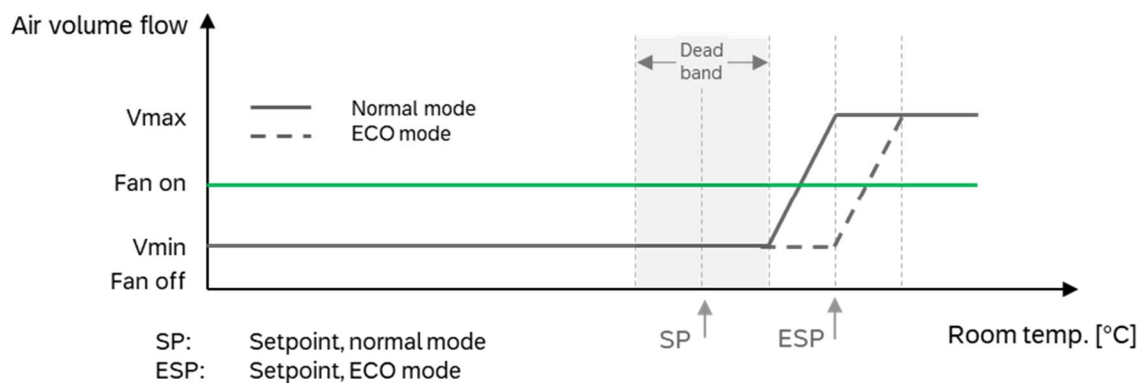
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Application 15 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
		D-	
	AC 24 V	⌋	Power supply for ZoneEase VAV actuator
		⌋	
	Room unit	⌋	
		⌋	Room unit power supply / MP-Bus
		MP	
	Analog IN / MP	S	[Duct temp. sensor 0..160°C]
		⌋	
DigitalOUT		⌋	
	1		Series fan
	2		- not used -
	3		- not used -
	COM		Fan / heater GND

Sequence diagram



16 Cooling or Heating with Series Fan

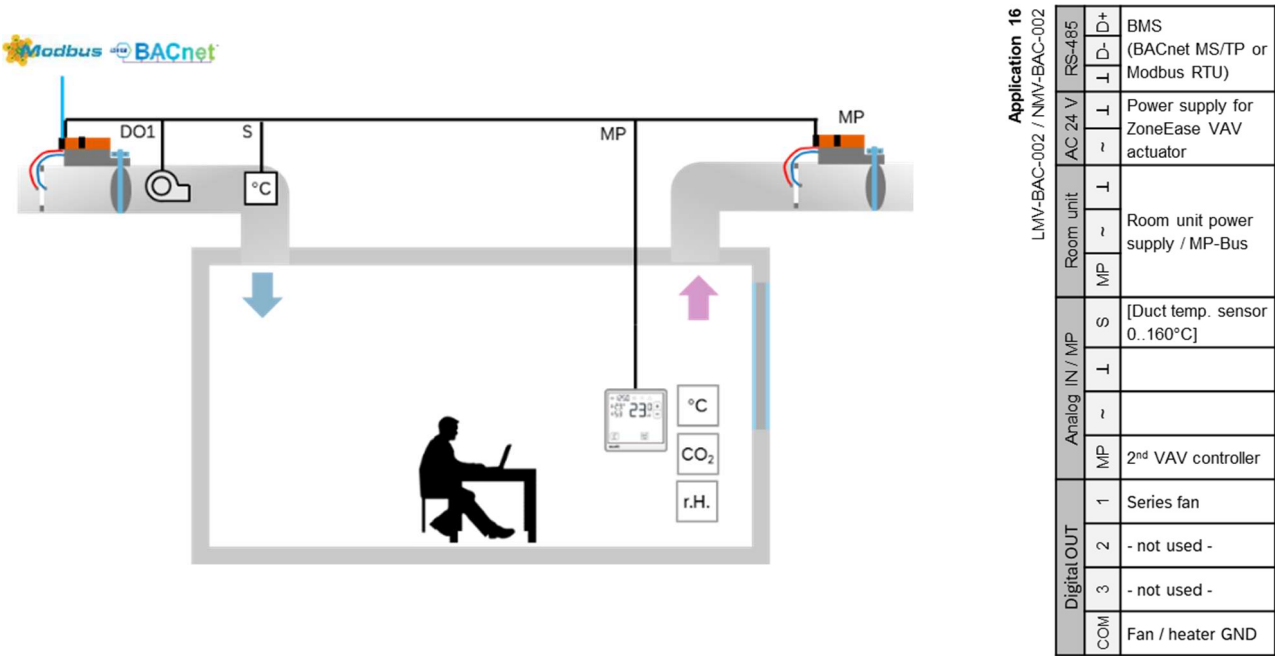
Application description

- Cooling or heating with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool or warm primary air.
- Series fan at DO1.

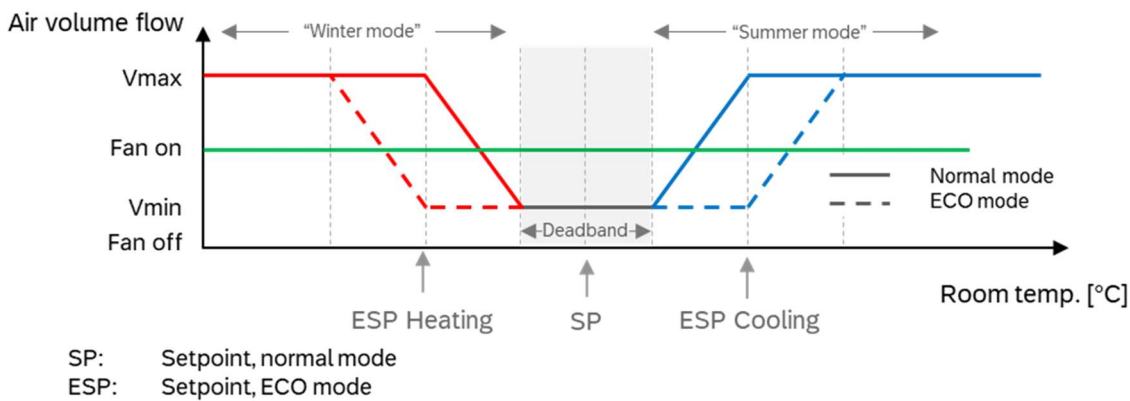
Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator.
- P-22RT-1T.. room operating unit.

Application diagram



Sequence diagram



17 Cooling with Series Fan + 1-Stage Electric Reheat

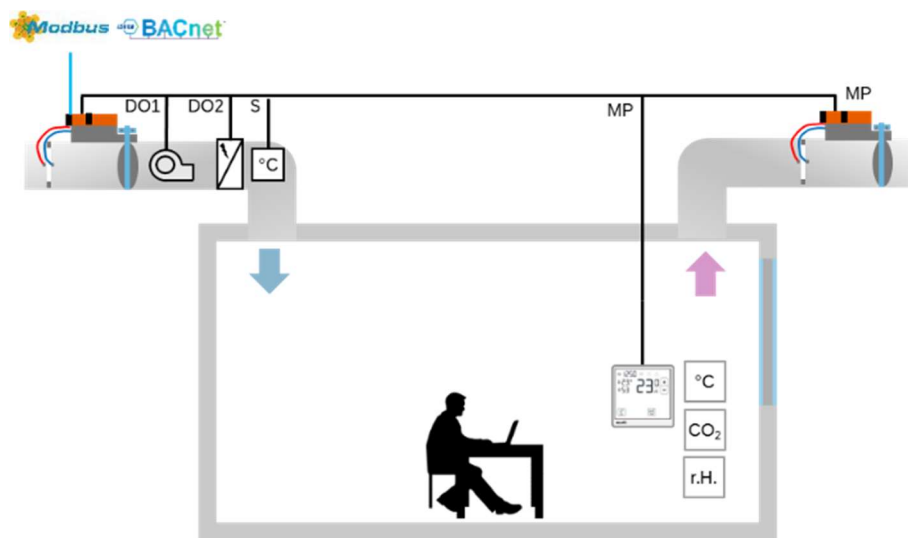
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool or warm primary air.
- Series fan at DO1.
- First stage reheating with electric heater at DO2.

Required components:

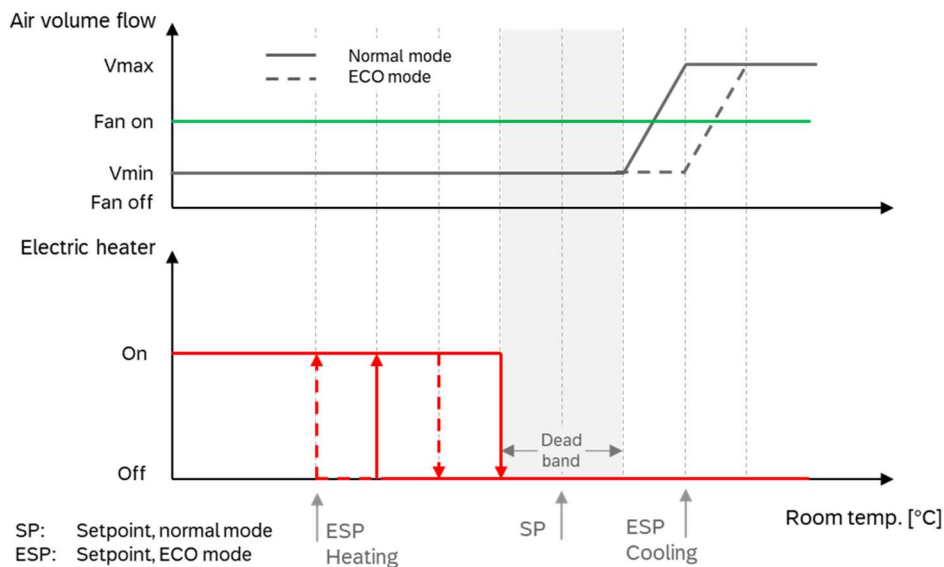
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Application 17 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	AC 24 V	⊥	Power supply for ZoneEase VAV actuator
	Room unit	⊥	Room unit power supply / MP-Bus
	MP	⊥	
	Analog IN / MP	S	[Duct temp. sensor 0..160°C]
		⊥	
		⊥	
	Digital OUT	MP	2 nd VAV controller
		1	Series fan
		2	Electric heater stage 1
		3	- not used -
	COM		Fan / heater GND

Sequence diagram



18 Cooling with Series Fan + 2 Stage Electric Reheat

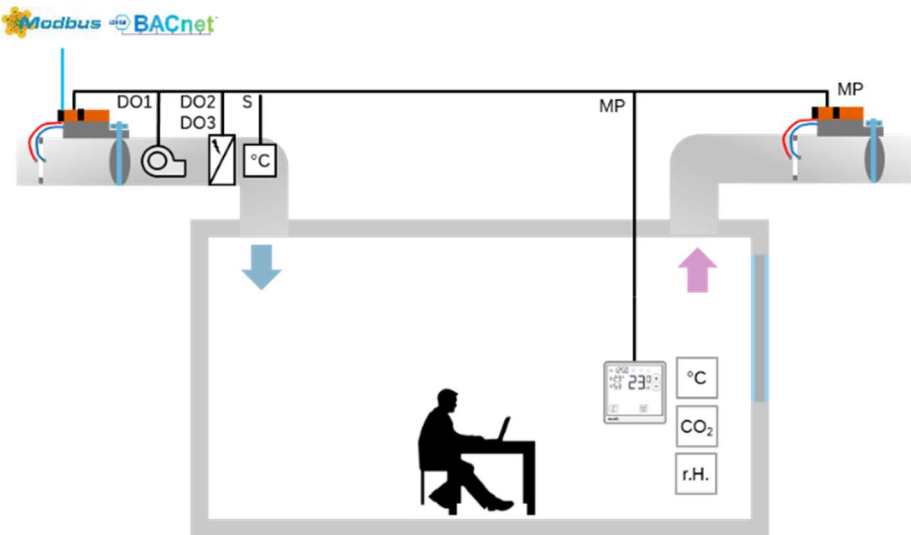
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool or warm primary air.
- Series fan at DO1.
- First / second stage reheating with electric heater at DO2 and DO3.

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator.
- P-22RT-1T.. room operating unit.

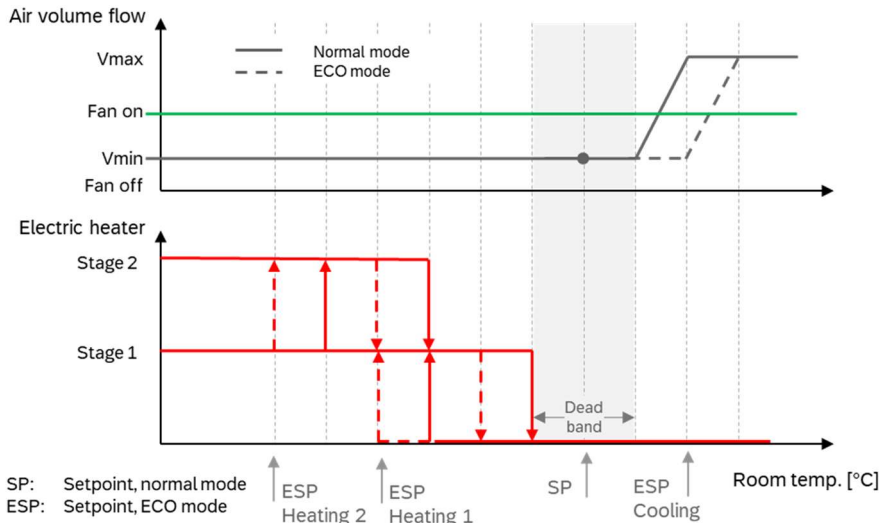
Application diagram



Application 18
LMV-BAC-002 / NMV-BAC-002

Room unit	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-		
	I		
Room unit	AC 24 V	I	Power supply for ZoneEase VAV actuator
		I	
		I	
Room unit	MP		Room unit power supply / MP-Bus
Analog IN / MP	S		[Duct temp. sensor 0..160°C]
	I		
	I		
Digital OUT	MP		2 nd VAV controller
	1		Series fan
	2		Electric heater stage 1
COM	3		Electric heater stage 2
	COM		Fan / heater GND

Sequence diagram



19 Cooling with Series Fan + On-Off Hydronic Reheat

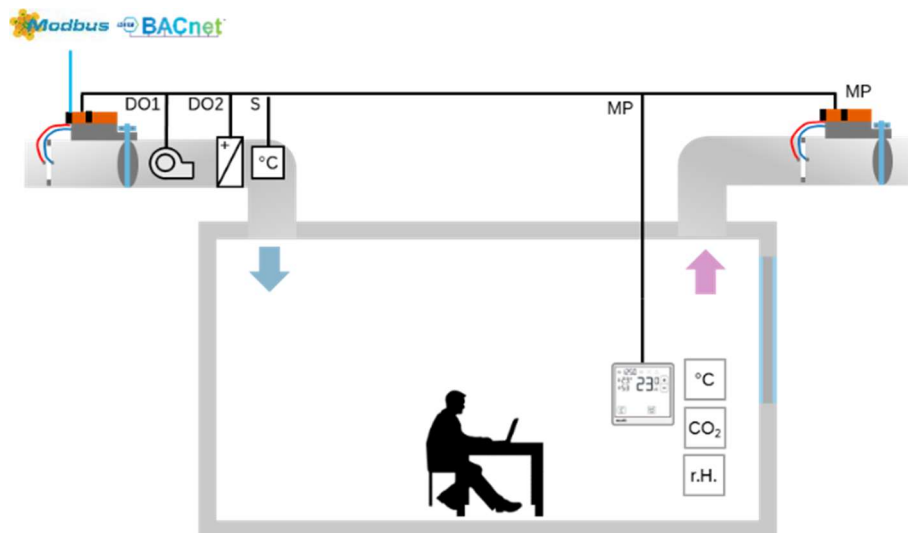
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool or warm primary air.
- Series fan at DO1.
- First stage reheating with On/Off hydronic reheat at DO2.

Required components:

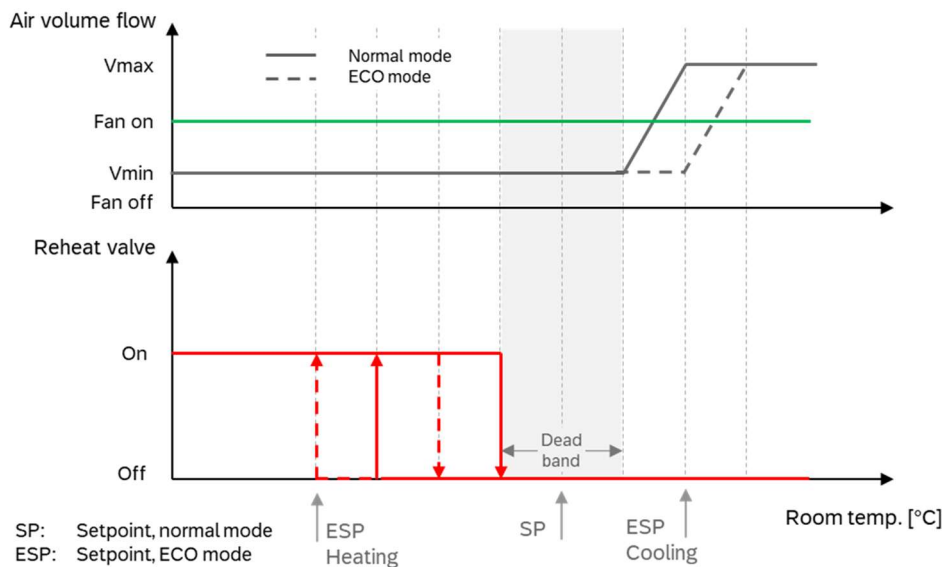
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

Application diagram



Application 19 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
		D-	
	AC 24 V	⌵	Power supply for ZoneEase VAV actuator
		⌶	
	Room unit	⌵	Room unit power supply / MP-Bus
		⌶	
	MP		
	Analog IN / MP	S	[Duct temp. sensor 0..160°C]
		⌵	
		⌶	
Digital OUT	MP		2 nd VAV controller
	1		Series fan
	2		On/off reheat valve actuator
	3		- not used -
COM			Fan / heater GND

Sequence diagram



20 Cooling with Series Fan + Modulating Reheat Valve

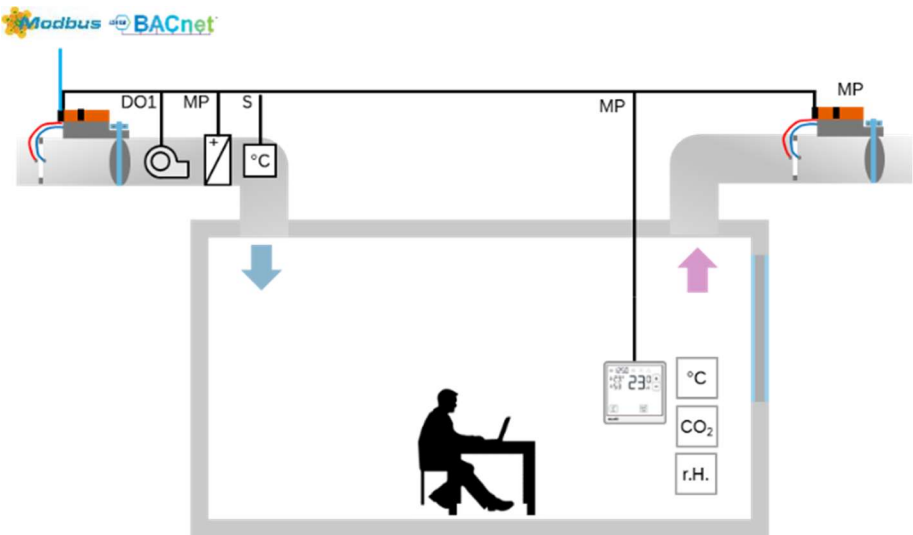
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Series fan at DO1.
- First stage reheating with modulating hydronic reheat.

Required components:

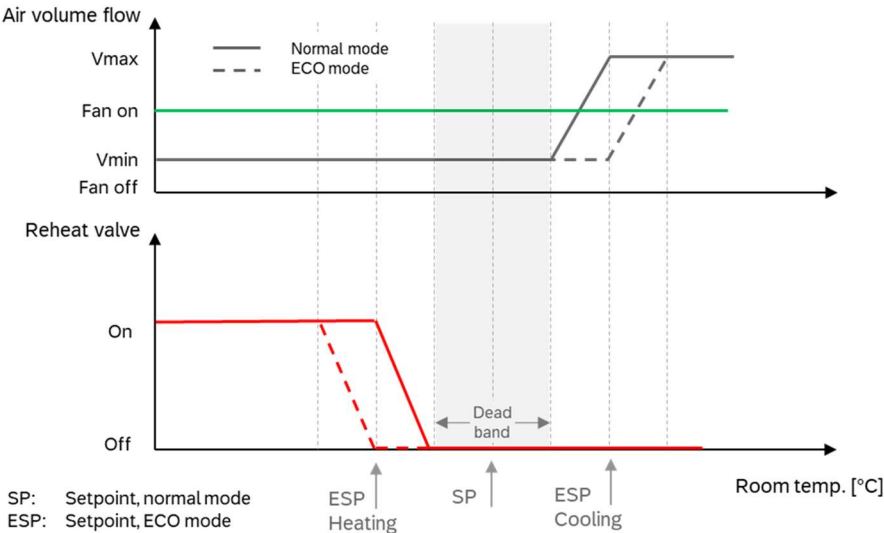
- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit
- CQ24A-MPL-A8 Modulating valve actuator.

Application diagram



Application 20 LMV-BAC-002 / NMV-BAC-002	RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	AC 24 V	I	Power supply for ZoneEase VAV actuator
	Room unit	I	Room unit power supply / MP-Bus
	MP	I	
	Analog IN / MP	S	[Duct temp. sensor 0..160°C]
		I	
		I	
		MP	2 nd VAV controller / Reheat valve act.
	Digital OUT	1	Series fan
		2	- not used -
COM		S	- not used -
			Fan / heater GND

Sequence diagram



All inclusive.

Belimo as a global market leader develops innovative solutions for the controlling of heating, ventilation and air-conditioning systems. Actuators, valves and sensors represent our core business.

Always focusing on customer added value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The “small” Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.



5-year warranty



On site around the globe



Complete product range



Tested quality



Short delivery times



Comprehensive support



BELIMO Automation AG

Brunnenbachstrasse 1, 8340 Hinwil, Switzerland

+ 41 43 843 61 11, info@belimo.ch, www.belimo.com

