

GY-Y-LMV-BAC Series VAV Controller

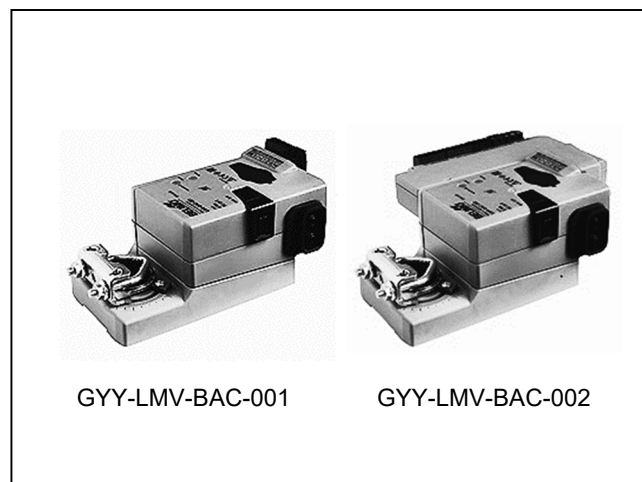
Overview

GY-Y-LMV-BAC series VAV controller features a 32bit micro-processor and an integral pressure sensor and an integral damper actuator for pressure-independent VAV Unit control.

The integral differential pressure sensor uses MEMS (Micro-electro-mechanical Systems) technology that makes the pressure sensor do to measure extremely small airflow rate of VAV unit, and less contamination in the pressure sensor, long-term stable, no influence for tube length, bidirectional flow measurement, excellent zero point stability, no zero point calibration required, position independent, maintenance-free.

The integral damper actuator uses BLDC (brushless DC) motor technology that makes the damper actuator do small size, light weight, long life, high efficiency, low noise, small vibration, no spark, high reliability, good stability, strong adaptability, simple maintenance and maintenance.

Using NFC (Near Field Communication) interface for VAV unit engineering setting. It saves a lot of human-power at factory and field engineering configuration.



Features

- BACnet® VAV controller
- Standardized Control Applications for all most VAV control applications.
- With an analog input for CO₂ sensor for energy saving control.
- NFC interface for VAV unit engineering configuration.
- MEMS technology based integral differential pressure sensor.
- BLDC motor technology based damper actuator.
- CE Marking certified product:
GY-Y-LMV-BAC series VAV controller and the Room Unit conform to all the applicable standards of CE Marking.

Safety Precautions

Please read instructions carefully and use the product as specified in this manual. Be sure to keep this manual nearby for quick reference.



Restrictions

As an electromagnetic wave equipment for office use (Class A), this equipment is intended to use in other than home area. Sellers or users need to take note of this.
 This product is targeted for general air conditioning. Do not use this product in a situation where human life may be affected. Azbil Corporation will not bear any responsibility for the results produced by the operators.







Recommended Design Life





It is recommended that this product be used within the recommended design life.
 The recommended design life is the period during which you can use the product safely and reliably based on the design specifications.
 If the product is used beyond this period, its failure ratio may increase due to time-related deterioration of parts, etc.
 The recommended design life during which the product can operate reliably with the lowest failure ratio and least deterioration over time is estimated scientifically based on acceleration tests, endurance tests, etc., taking into consideration the operating environment, conditions, and frequency of use as basic parameters.
 The recommended design life of this product is 5~8 years.
 The recommended design life assumes that maintenance, such as replacement of the limited life parts, is carried out properly.
 Refer to the section on maintenance in this manual.














Warnings and Cautions

	WARNING	Alerts users that improper handling may cause death or serious injury.
	CAUTION	Alerts users that improper handling may cause minor injury or material loss.

Signs

	Alerts users possible hazardous conditions caused by erroneous operation or erroneous use. The symbol inside  indicates the specific type of danger. (For example, the sign on the left warns of the risk of electric shock.)
	Notifies users that specific actions are prohibited to prevent possible danger. The symbol inside  graphically indicates the prohibited action. (For example, the sign on the left notifies that disassembly is prohibited.)
	Instructs users to carry out a specific obligatory action to prevent possible danger. The symbol inside  graphically indicates the actual action to be carried out. (For example, the sign on the left indicates general instructions.)

 WARNING	
	Before wiring and maintenance, be sure to turn off the power to the product. Failure to do so might cause electric shock.
	To control a VAV unit with electric heater, be sure to provide a circuit to prevent temperature rise. Failure to do so might cause fire or overheating.
	To control a VAV unit with electric heater, configure the system so that air conditioning unit will not stop when the VAV unit is turned off. This allows the electric heater to cool down after it is turned off. Failure to do so might cause fire or device damage.

 CAUTION	
	Installation and wiring must be performed by qualified personnel in accordance with all applicable safety standards.
	Install and use the product in a location that meets the operating conditions (temperature, humidity, power, vibration, shock, mounting direction, atmospheric condition, etc.) as listed in the specifications. Failure to do so might cause fire or device failure.
	All wiring must comply with applicable codes and ordinances.
	Make sure all the wires are tightly connected to the corresponding terminals. Failure to do so might cause device failure or overheating.
	For wiring, strip each wire insulation as specified in this manual. If the strip length is longer than the specified, the stripped part of the wires will be exposed, causing electric shock or short circuit between adjacent terminals. If it is shorter, the stripped part will not contact the connector.
	If more than the rated power voltage is applied to the product, replace the product with new one for your safety. Failure to do so might cause device failure or overheating.
	Be sure to provide a circuit breaker for the power to the product as the product does not have a power switch.
	Do not test the withstand voltage of the product. Doing so might cause accident or device failure.
	Do not disassemble the product. Doing so might cause electric shock or device failure.
	Do not touch the moving parts of the product. Doing so might cause injury.
	Do not incinerate the product for waste disposal. The cover will generate toxic gas when being incinerated. Do not reuse all or part of this product after disposal of the product.
	Dispose of the product as industrial waste in accordance with your local regulations. Do not reuse all or part of this product.

System Configuration

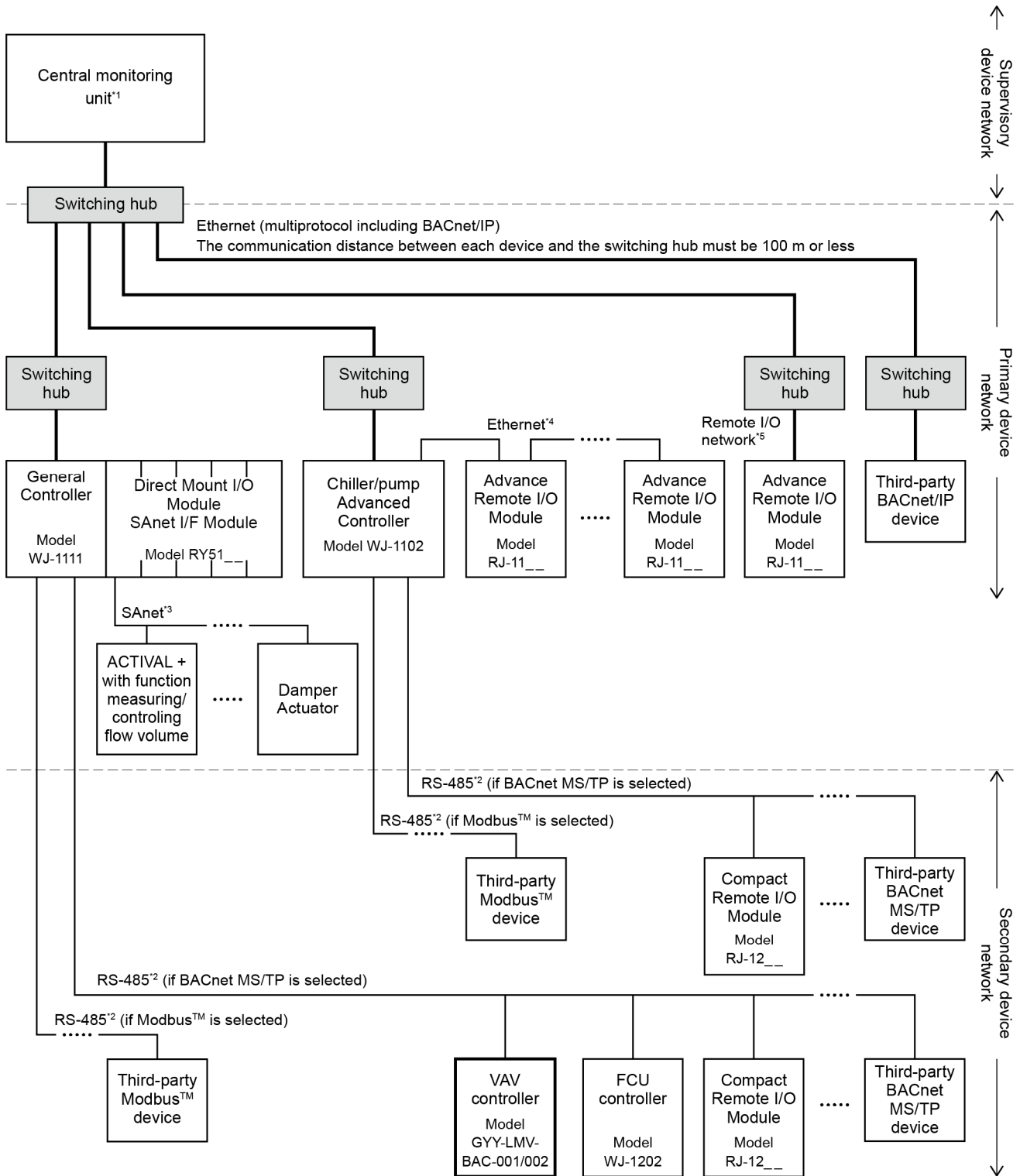


Figure 1. Example system configuration

*1 The system can be connected to Azbil Supervisory Controller (Model BH-101G0W0000) or a third-party central monitoring unit for BACnet/IP communications.

*2 The General Controller and Advanced Controller have two RS-485 communication channels. For each channel, communication protocol can be selected from BACnet MS/TP, Modbus™ RTU, or Modbus™ ASCII.

- The number of devices that can be connected for BACnet MS/TP

If only the Azbil devices are connected:

50 devices/channel (VAV/FCU controllers, Compact Remote I/O Modules, etc.)

The maximum number of the secondary devices that can be connected to one General Controller is 70, or 50 which is the sum of Azbil VAV and FCU Controllers. The Advanced Controller has no restrictions.

But for GYY-LMV-BAC series VAV controllers, a maximum of 31 devices/channel without other Azbil devices. If there are other Azbil devices on the same channel, for GYY-LMV-BAC series VAV controllers, a maximum of 20 devices/channel (In the case of baud rate 76.8 kbps and 30 objects/device). And the group management function of General Controller WJ-1111 cannot be used on GYY-LMV-BAC series VAV controllers.

If only the third-party devices are connected:


31 devices/channel (In the case of baud rate 76.8 kbps and 30 objects/device), and the group management function of General Controller WJ-1111 cannot be used.

- The number of devices that can be connected for Modbus™

31 devices/channel (when transmission speed is 76.8 kbps, 30 objects/device)

If the transmission speed and the number of objects are different among the third-party devices, or if the Azbil devices and third-party devices coexist on the same channel, the number of connected devices will vary. For details, please contact one of Azbil sales- persons.

- *3 By connecting the SAnet Interface Module, it is possible to connect Intelligent Component Series devices.

 For restrictions on the SAnet communication line, refer to AB-6713, Intelligent Component Series for SAnet Communication: Installation Manual.

- *4 A network that connects the Advanced Controller and Advanced Remote I/O Modules under its control is referred to as a local I/O network.

A switching hub is not required for the local I/O network since a daisy chain Ethernet is used between the Advanced Controller and the Advanced Remote I/O Modules under its control, as well as between the Advanced Remote I/O Modules and the I/O modules for the Advanced Controller.

- *5 A network that connects the Advanced Controller and Advanced Remote I/O Modules through a host network is referred to as a remote I/O network.

A switching hub is required to connect the Advanced Remote I/O Modules to the remote I/O network.

The number of the Advanced Remote I/O Modules connected to this network is up to 3 per Advanced Controller.

Model Numbers

Model number		Description
GYY-LMV-BAC-		GYY-LMV-BAC series VAV controller
	001	with 1AI
	002	with 1AI, 3DO

Specifications

Item		Specification	
		GYG-LMV-BAC-001	GYG-LMV-BAC-002
Power supply		24 V AC (19.2 ~ 28.8 V AC), 50 Hz/60 Hz	
Power consumption		5 VA *1	7 VA *2
Power line cable		2-core solid cable or stranded wires with cable shoes, $\geq 0.5 \text{ mm}^2$, *3	
Processor		32-bit MCU (Memory Control Unit), 36 MHz	
Memory		Flash 768kB and RAM 80kB	
A/D converter		12-bit	
Input/Output terminal	AI	1 (0~10 V DC)	1 (0~10 V DC)
	DO	0	3 (Triac, 24VAC, max. 500 mA @ indoor air temperature)
Input/Output cable	AI	3-core solid cable or stranded wires with cable shoes, $\geq 0.5 \text{ mm}^2$, *4	
	DO	2 to 4-core solid cable or stranded wires with cable shoes, $\geq 0.5 \text{ mm}^2$, *5	
Differential pressure sensor		MEMS based	
DP sensor operating range		-20 ~ 500 Pa	
DP sensor accuracy		-20 Pa to 20 Pa (± 1 Pa), 20 Pa to 500 Pa ($\pm 5\%$ of measured value)	
DP sensor overload capability		± 3000 Pa	
Contact materials of DP sensor		Glass, epoxy resin, PA, TPE	
Actuator		Brushless, non-blocking actuator with power-save mode	
Rated torque		5 N·m	
Rotation angle		95°, adjustable mechanical	
Rotation speed		60s max full span (Boost, Manual mode), 150s max full span	
Sound power level		max. 35 dB (A) normal operation, max 50 dB (A) in boost or manual mode, adaptation / Synchronization	
Rotation direction		cw / ccw (configurable)	
Adaptation of actuator		Capture of setting range and resolution to control range	
Attachable damper shaft	Thickness	Spindle clamp, $\Phi 10$ mm to $\Phi 20$ mm (spindle round)	
	Length	Spindle clamp, 8 mm square to 16 mm square (spindle square)	
Connection		Pluggable terminals 0.5 mm^2 to 2.5 mm^2 , 0.33 mm^2 with bullet terminal or cable lug	
Communication		EIA-485 and MP-bus, NFC	
EIA-485	Protocol	BACnet MS/TP, not galvanically isolated	
	Number of nodes	Addressable from 1 to 127, 32 nodes per repeater (1 Unit load) *8	
	Baud rate	9600, 19200, 38400 (Default), 76800, 115200 bps	
	End of Line Termination Resistor	Required, 120 Ω typical	
MP-bus	Communication cable	BACnet Standard and recommendations *6 and other confirmed cables *7	
Operating environmental conditions	Temperature	0 °C to 50 °C	
	Humidity	5 %RH to 95 %RH (Non-condensing)	
Transport/storage conditions	Temperature	-20 °C to 80 °C	
	Humidity	5 %RH to 95 %RH (Non-condensing)	
Protection class		III Safety extra-low voltage	
Enclosure rating		IP20	
EMC		CE according to 89/336/EEC, EN60730-1:2000 + A2:2008, EN60730-2-14:1997 + A2:2008, EN61000-6-2:05 and EN61000-6-3:07 + A1:11, EN60730-2-9:2010	
Mode of operation		Type 1 (in acc. with EN 60730-1)	
Rated impulse voltage		0.8 kV (in accordance with EN 60730-1)	
Control pollution degree		2 (in accordance with EN 60730-1)	
Fire classification		UL94 V-0	
Weight		370 g	475 g
Appendant		Pan head drill screw (4.2 × 13) × 2, Anti-rotation bracket × 1	

- *1 GYY-LMV-BAC-001 with Room Unit.
- *2 GYY-LMV-BAC-002 with Room Unit, DO terminals are full load connected.
- *3 Cables with wire \varnothing 0.5 mm² : Max cable length 25 m for 7 VA.
- *4 Cables with wire \varnothing 0.5 mm² : Max cable length 10 m for 0-10V DC signal.
- *5 Cables with wire \varnothing 0.5 mm² : Max cable length 10 m for 24V AC triac digital output, max. 500 mA.
- *6 ANSI/ASHRAE Standard 135-2008 Addendum y, 9.2.1 Medium:
 - a. Shielded, twisted-pair cable
 - b. The maximum recommended length of an MS/TP segment is 1200 meters (4000 feet) with AWG 18 (0.82 mm² conductor area) cable.
- *7 CAT 5 or above cable (use only one single pair for one bus) less than 500 meters for each bus segment (76.8 kbps baud rate).
Belden 3106A (AWG 22) or equivalent cable less than 600 meters for each bus segment (76.8 kbps baud rate).
- *8 Entire BACnet internetwork address limited by 4194303 device, as according to BACnet Limitation.
- *9 Cables with wire \varnothing 0.75 mm² : Max cable length 30 m.

Cable size conversion

AWG	12	14	16	18	20	22	24	26
Area (mm ²)	3.3088	2.0809	1.3087	0.8230	0.5176	0.3255	0.2047	0.1288

Dimensions

GYY-LMV-BAC-001

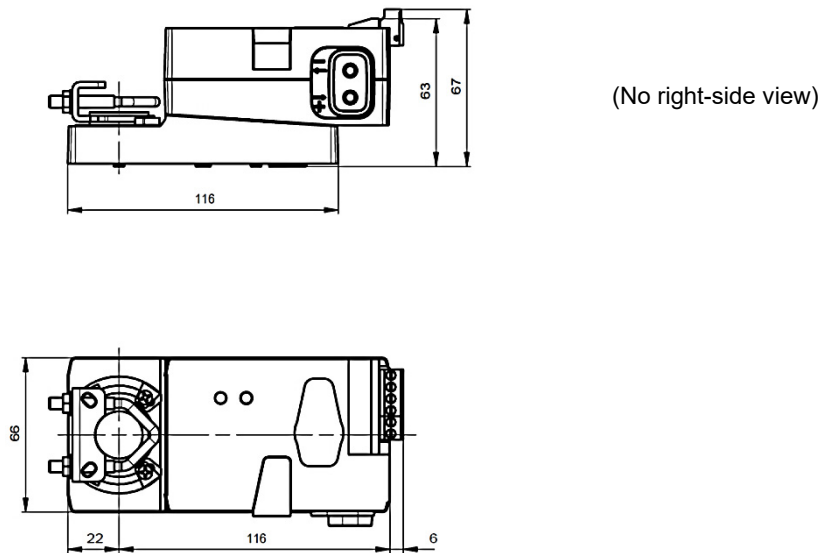


Figure 3. Dimensions: GYY-LMV-BAC-001 (mm)

AB-7620

GY-**LMV-BAC-002**

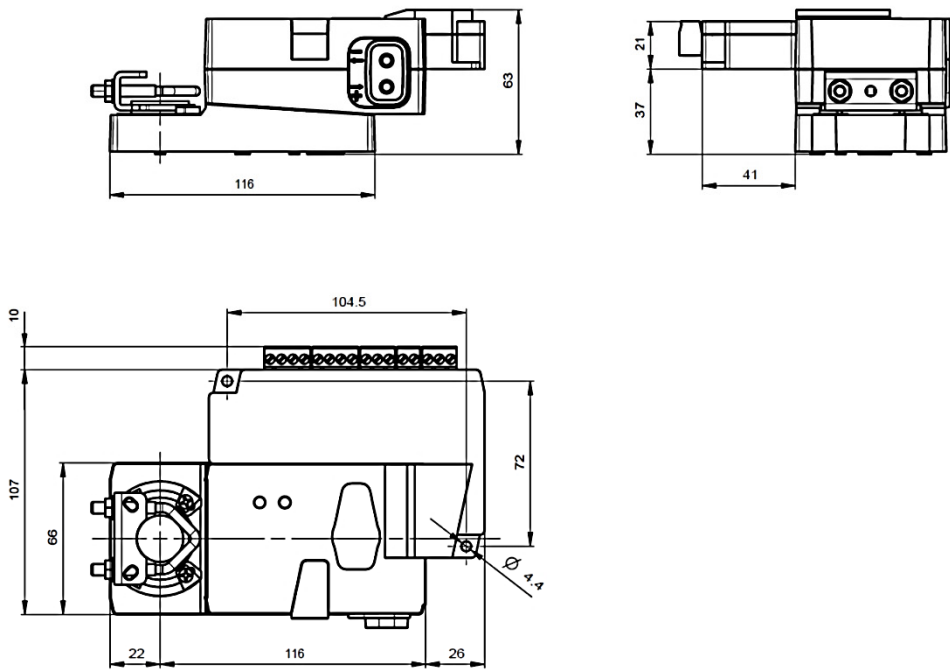


Figure 4. Dimensions: GYY-LMV-BAC-002 (mm)

Anti-rotation bracket

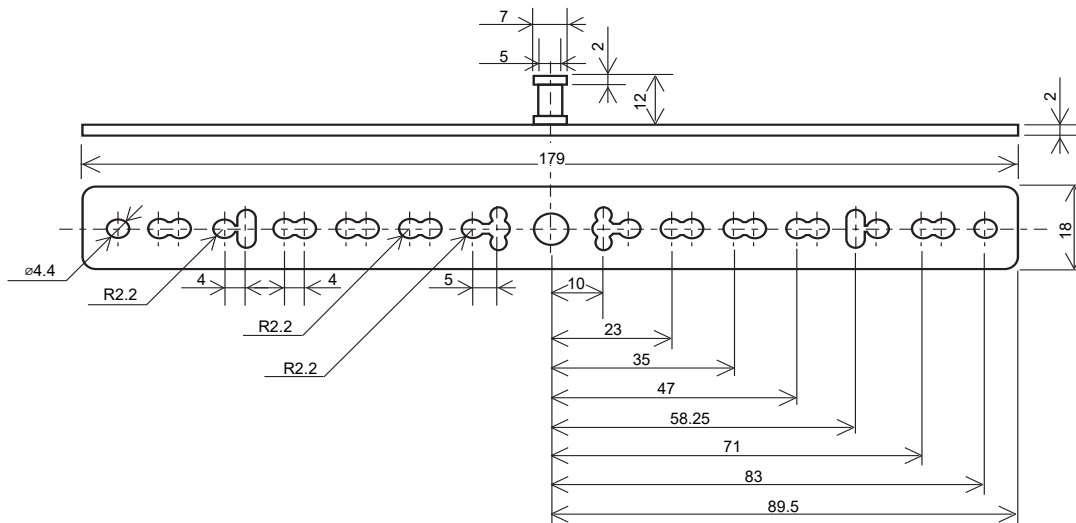
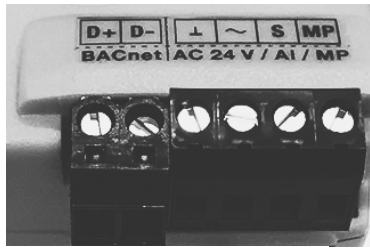


Figure 5. Dimensions: Anti-rotation bracket (mm)

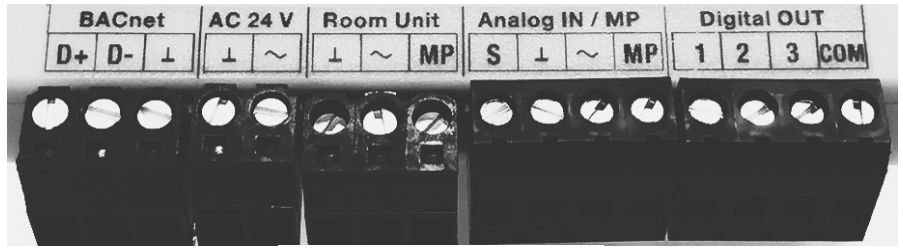
Wire Connection Indication

Connecting terminals

The connections are made using the pluggable terminals to the VAV controller.




GYY-LMV-BAC-001



GYY-LMV-BAC-002

Note

- Supply via safety isolating transformer!
- Connections (-) and (+) (24V AC) and MP (MP signal) must be routed to accessible terminals (Room Unit GYY-22RT-A001 or GYY-22RT-A002 or GYY-22RT-A003) for temperature sensing in order to enable access with the tool for diagnostic and service work.



BACnet MS/TP Connection

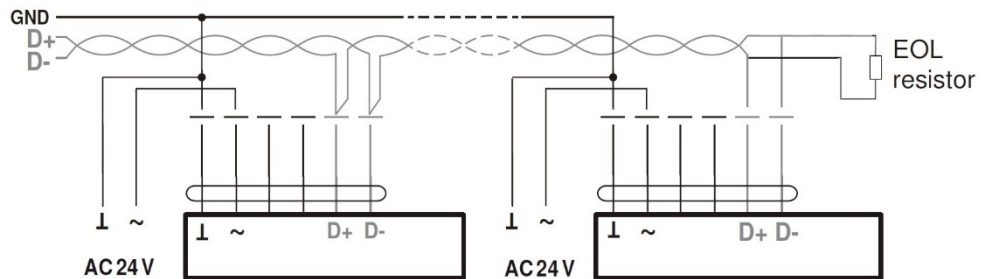


Figure 6. BACnet MS/TP connection

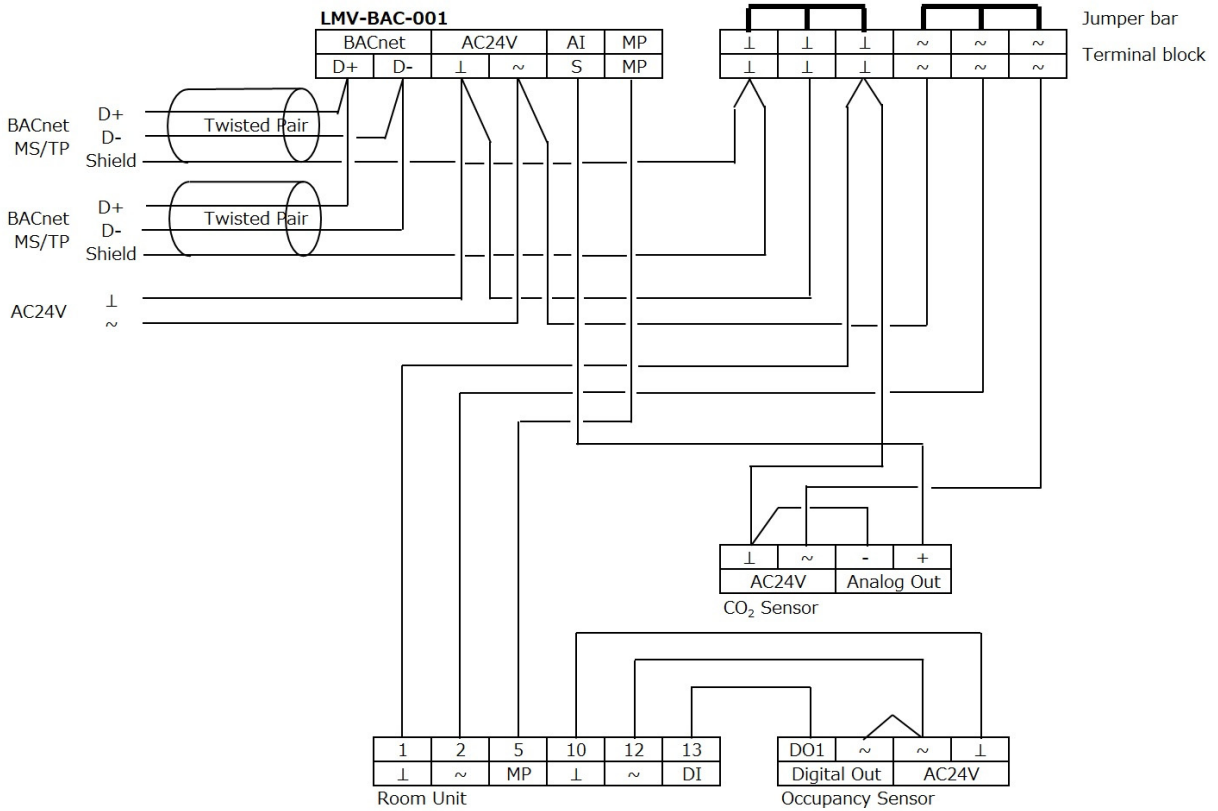


Figure 7. GYY-LMV-BAC-001 connection

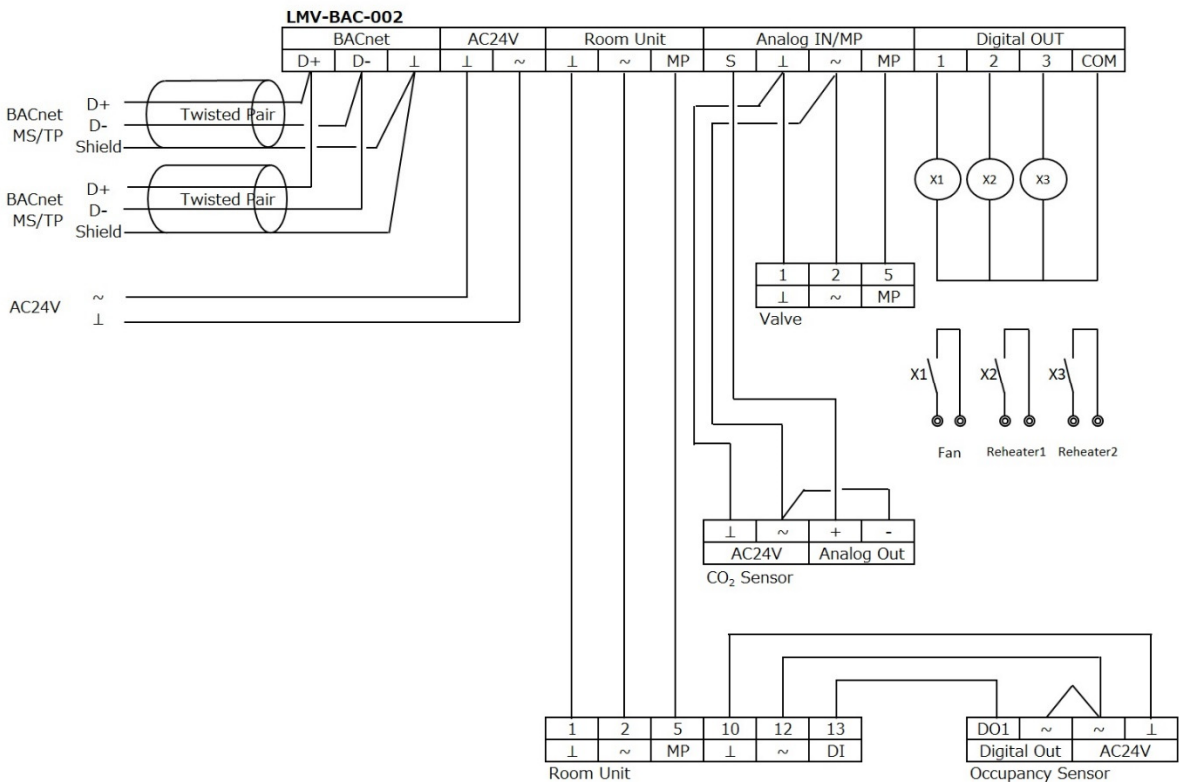
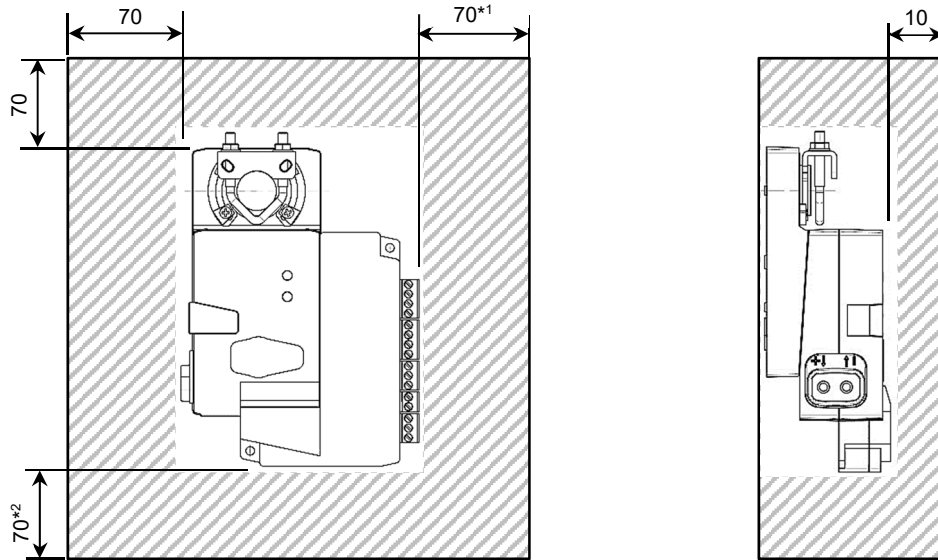


Figure 8. GYY-LMV-BAC-002 connection

Installation

Installation precautions

- In case GYY-LMV-BAC VAV controller is installed in the control panel (box) of a VAV unit, you need to leave enough space for the maintenance clearance. The recommended space as shown in the figure below.



*1 The wiring terminals of GYY-LMV-BAC-002 are on the right side.
 *2 The wiring terminals of GYY-LMV-BAC-001 are on the bottom.

Figure 9. Maintenance clearance (mm)

Installation procedure

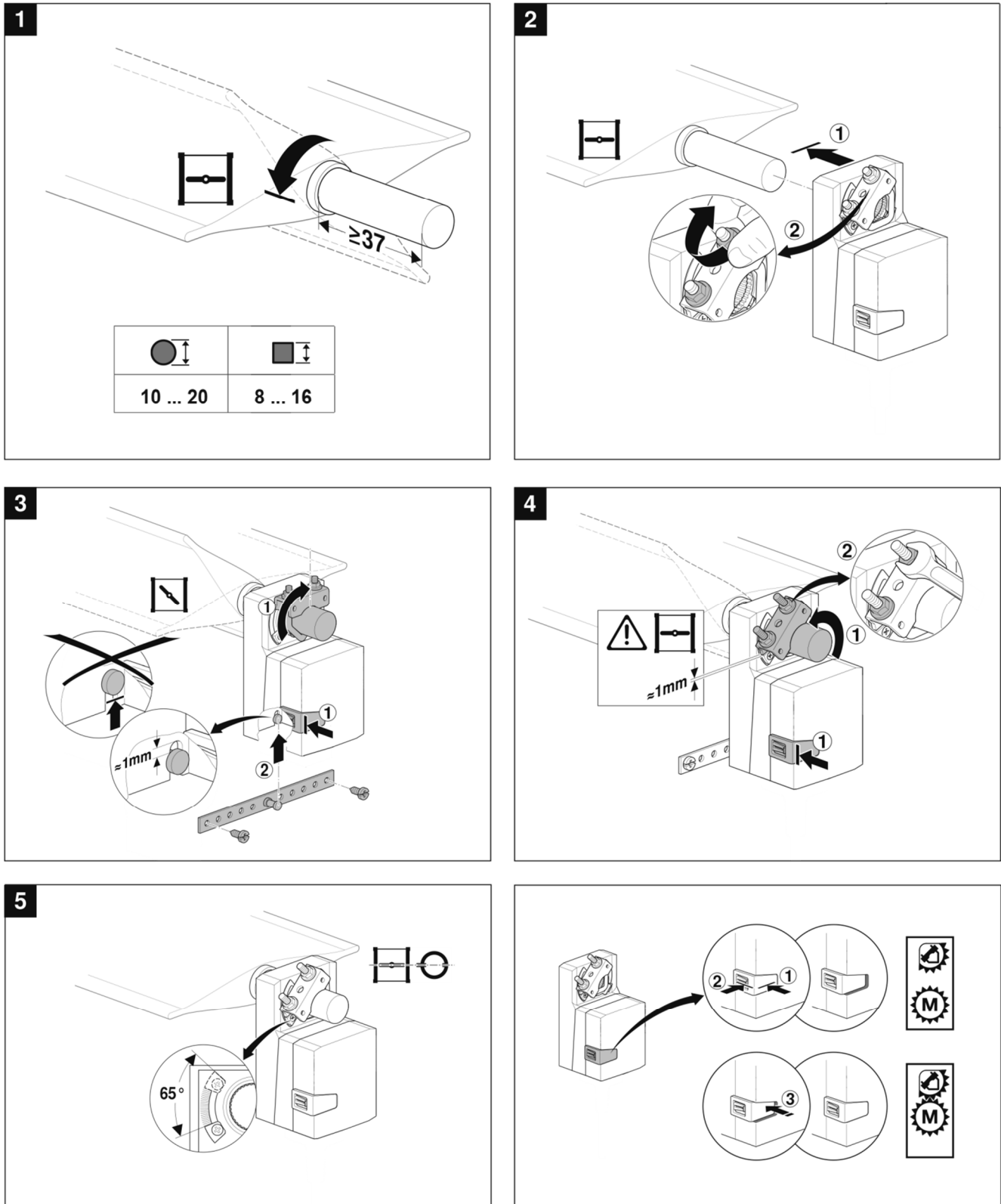
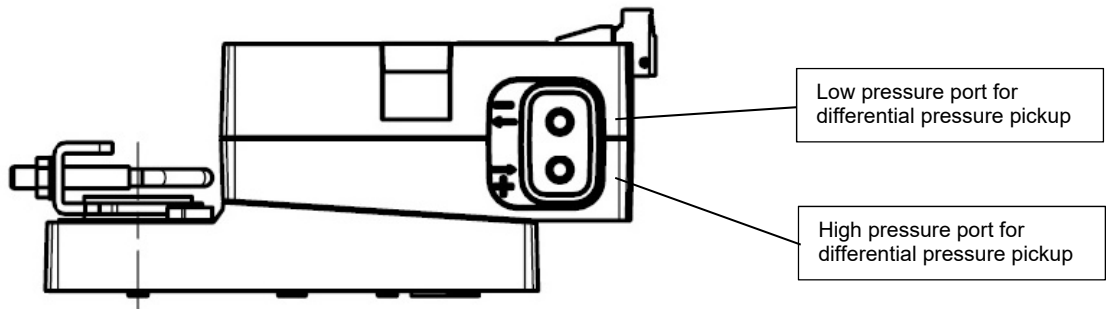


Figure 10. Installation procedure

Connection of the tubes to the air flow sensor

For differential pressure pickup, connect the total pressure measuring port of the VAV unit to the high pressure port (indicated with "+") of this product with a tube. Also connect the static pressure measuring port of the VAV unit to the low pressure port (indicated with "-") of this product with a tube.



Required specification of the air flow sensor tube

Type	Length	Inner diameter	Outer diameter	Material
Flexible tube	Max. 1 m	5 mm to 6 mm	Max. 10 mm	PVC, silicon rubber
Inflexible tube		5.5 mm to 6.5 mm		

PVC: Polyvinyl chloride

Notes:

- * Use the tube as specified in the above table.
- * If the tube of the differential pressure pickup (of the VAV unit) does not meet the required specification shown in the above table, use a joint to meet the specification.
- * Total tube length must be 1 m max. even if two tubes with different diameters are connected by the joint.

Figure 11. High and low pressure ports for differential pressure pickup

Application

The GYY-LMV-BAC-001/002 VAV Controller is pre-installed with 19 control applications to select from. User can select one of them for user's application.

Control Application Number	Control Application Name	GYY-LMV-BAC-001	GYY-LMV-BAC-002	Room Unit	CO ₂ Sensor	Modulating Valve ※	Occupancy Sensor
1	(Blank)						
2	Primary Air Cooling only	✓		✓	△		△
3	Primary Air Cooling / Heating	✓		✓	△		△
4	Primary Air Cooling with 1 Stage Electric Reheater		✓	✓	△		△
5	Primary Air Cooling with 2 Stages Electric Reheater		✓	✓	△		△
6	Primary Air Cooling with ON/OFF Valve of Reheater		✓	✓	△		△
7	Primary Air Cooling with Modulating Valve of Reheater	✓		✓	△	✓	△
8	Primary Air CO ₂ Demand Control	✓		△	✓		
9	Primary Air VAV Control (direct airflow rate control)	✓		△			
10	Primary Air Cooling with Parallel Fan		✓	✓	△		△
11	Primary Air Cooling with Parallel Fan + 1 Stage Electric Reheater		✓	✓	△		△
12	Primary Air Cooling with Parallel Fan + 2 Stages Electrical Reheater		✓	✓	△		△
13	Primary Air Cooling with Parallel Fan + ON/OFF Valve of Reheater		✓	✓	△		△
14	Primary Air Cooling with Parallel Fan + Modulating Valve of Reheater		✓	✓	△	✓	△
15	Primary Air Cooling with Serial Fan		✓	✓	△		△
16	Primary Air Cooling / Heating with Serial Fan		✓	✓	△		△
17	Primary Air Cooling with Serial Fan + 1 Stage Electrical Reheater		✓	✓	△		△
18	Primary Air Cooling with Serial Fan + 2 Stages Electric Reheater		✓	✓	△		△
19	Primary Air Cooling with Serial Fan + ON/OFF Valve of Reheater		✓	✓	△		△
20	Primary Air Cooling with Serial Fan + Modulating Valve of Reheater		✓	✓	△		△

✓ Required item for the application. (GYY-LMV-BAC-002 can do all control applications that GYY-LMV-BAC-001 can do.)

△ Optional item for the application

※ The modulating valve is controlled by GYY-LMV-BAC-001/002 with MP-bus communication.

Application Introduction

1. Modes of operation in every Control Application

Each Control Application has appropriate modes listed below. Each mode is selected on MV1: System Mode by BMS or selected by connected Room Unit.

On (Active) Mode

On (Active) mode of the VAV system activates all the requisite control parts for the selected Control Application. It is related to vice versa action of Off mode (see under).

Note: The On (active) mode is used by all Control Applications.

Off mode

In Off mode, the VAV unit system is providing Control Application only a minimum airflow rate into zone, V_{min} and all the controls such as temperature control, are turned off. The damper can be configured to the closed position. This is used in case of energy saving or in case the room is not occupied e.g. holidays.

Frost protection mode

When the VAV unit system is in the Off mode, an anti-frost protection setpoint (default setting 4°C) is maintained at all time to ensure that the current indoor air temperature doesn't descent below this setpoint. When the indoor air temperature rises 4°C (hysteresis not modifiable) above the anti-frost temperature setpoint, the frost protection mode is disabled.

At least one of the following actions is operated by the VAV system while active frost protection mode is working:

- Current airflow rate V_{min} is operating.
- Parallel fan or serial fan is switched on
- Reheat 1 (and reheater 2) is (are) switched on.
- Hot water reheater is switched on.
- Heating valve is opened to 100%.
- Damper is controlled to V_{min} .

Economy mode

The ECO mode is an energy saving mode. In case the room is not occupied, e.g. night times or weekend, indoor air temperature setpoint [SP] will be overwritten with the cooling/heating Eco temperature setpoint [ESP(Cooling)/ESP(Heating)] in Economy mode.

Boost mode

The Boost mode is used to immediately cool down or heat up the indoor air temperature to its setpoint [SP] and providing a boost of primary air.

This mode can be set by the room user or via the Building Management System by trigger or over a time schedule event.

When this mode is activated, in case of cooling (heating) demand, airflow rate of primary air will be adjusted to V_{max} temporarily for 10mins (default setting) or until the temperature setpoint, respectively Proportional-Band of setpoint, is reached. In case of reheating demand, the aggregates are turned on for a period of 10 mins.

The boost mode is enabled when the following conditions are met:

- The indoor air temperature is above the setpoint when there is a cooling demand or below the SP when there is a heating demand that is active.
- The indoor air temperature (based on the active mode temperature setpoint) is out of the dead band zone.

When the indoor air temperature is within the deadband zone, the boost mode can't be enabled.

2. Control Application specification

Control Application Number 2: Indoor air temperature control (Primary Air Cooling only)

With selected this Control Application, the VAV controller modulates the Primary Air damper of the VAV box for cooling. Cooling function will be operated when the indoor air temperature is above the indoor air temperature setpoint plus half the hysteresis (default setting 0.5°C). Hysteresis is also called deadband (default setting 1°C). Off mode, Economy mode, and Boost mode can be activated in this Control Application.

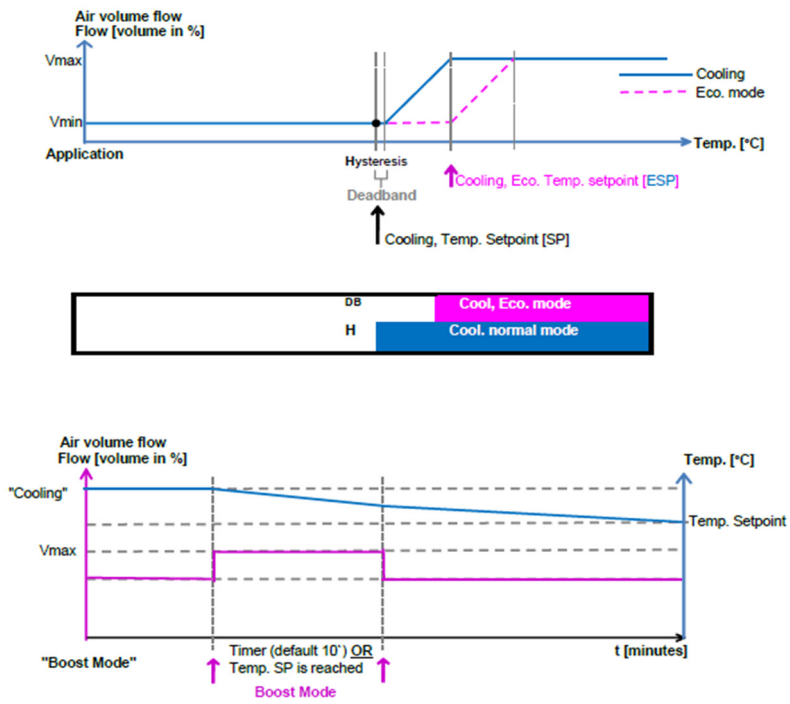


Figure 12. Control Application Number 2 sequences

Control Application Number 3: Indoor air temperature control (Primary Air Cooling / Heating)

With selected this Control Application, the VAV controller modulates the Primary Air damper of the VAV box for cooling or heating based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool or heated primary air.

Heating function will be operated when the indoor air temperature is lower than the basic cooling/heating setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. In addition, the Cooling / Heating mode needs to be activated (bit set to Cooling=0 chilled air is available / Heating=1 heated air is available) by Building Management System. This implies chilled or heated air is provided by the central air handling unit. Hysteresis is also called deadband (default setting 1°C).

Off mode, Economy mode, and Boost mod can be activated in this Control Application.

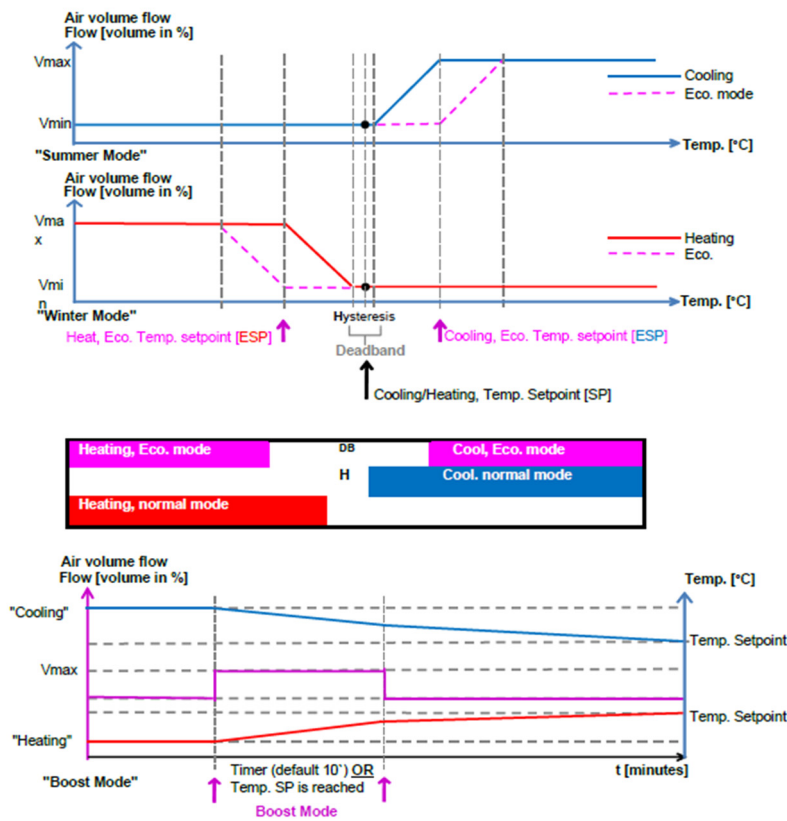


Figure 13. Control Application Number 3 sequences

Control Application Number 4: Indoor air temperature control (Primary Air Cooling with 1 Stage Electric Reheater)

With selected this Control Application, the VAV controller modulates the supply air damper of the VAV box for cooling. In order for it to work properly, the central air handling unit must provide cool primary air.

Reheating function will be operated when the indoor air temperature is below the basic cooling/heating setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The output of electric reheater in this application will be operated when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow volume is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be activated in this Control Application.

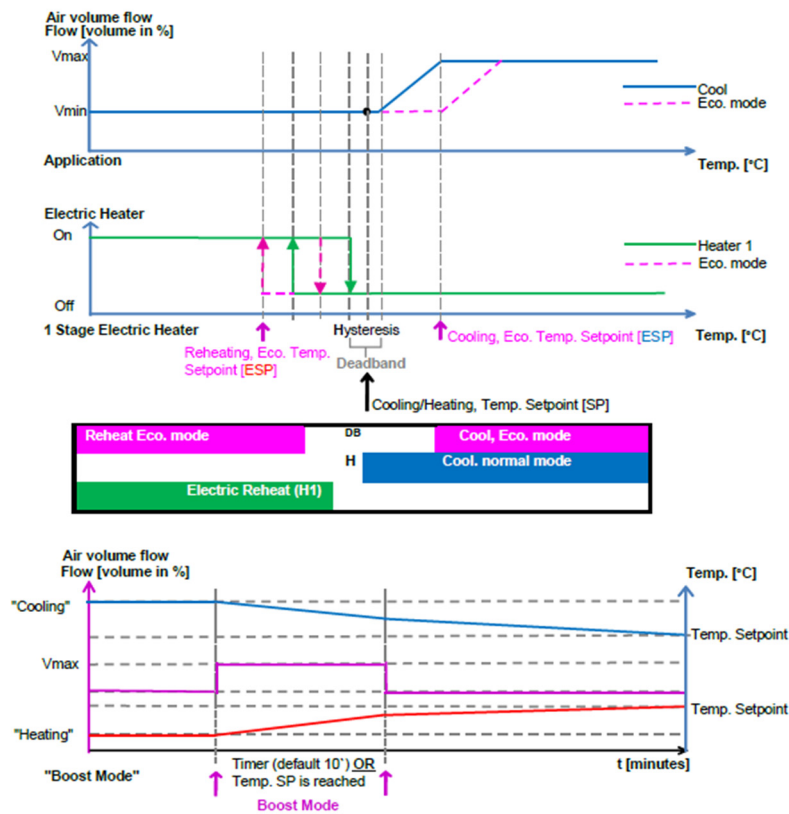


Figure 14. Control Application Number 4 sequences

Control Application Number 5: Indoor air temperature control (Primary Air Cooling with 2 Stages Electric Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the VAV unit for cooling with 2 stages electrical reheat based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The output of electric reheaters in this application will be operated increasingly stage by stage when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow volume, V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow volume is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be activated in this Control Application.

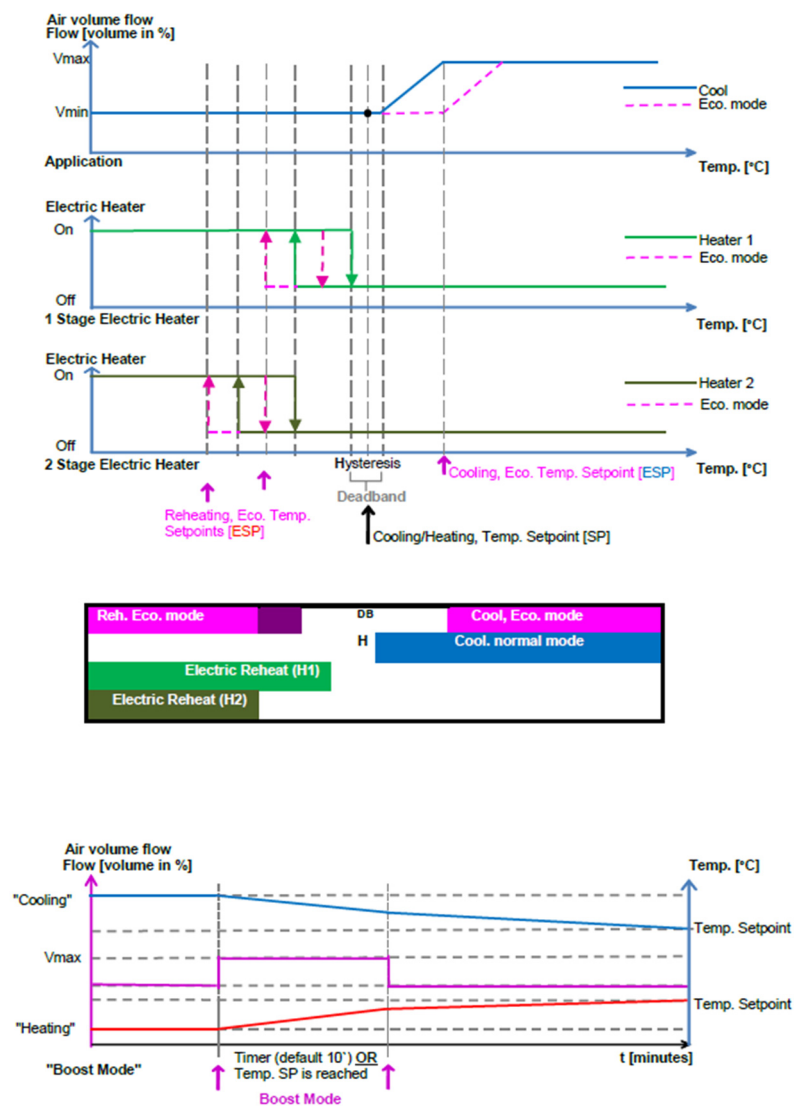


Figure 15. Control Application Number 5 sequences

Control Application Number 6: Indoor air temperature control (Primary Air Cooling with ON/OFF Valve of Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the VAV unit for cooling with an on/off valve of water reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint. Hysteresis is also called deadband (default setting 1°C).

The hot water reheater in this application will be operated when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current air flow volume V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be activated in this Control Application.

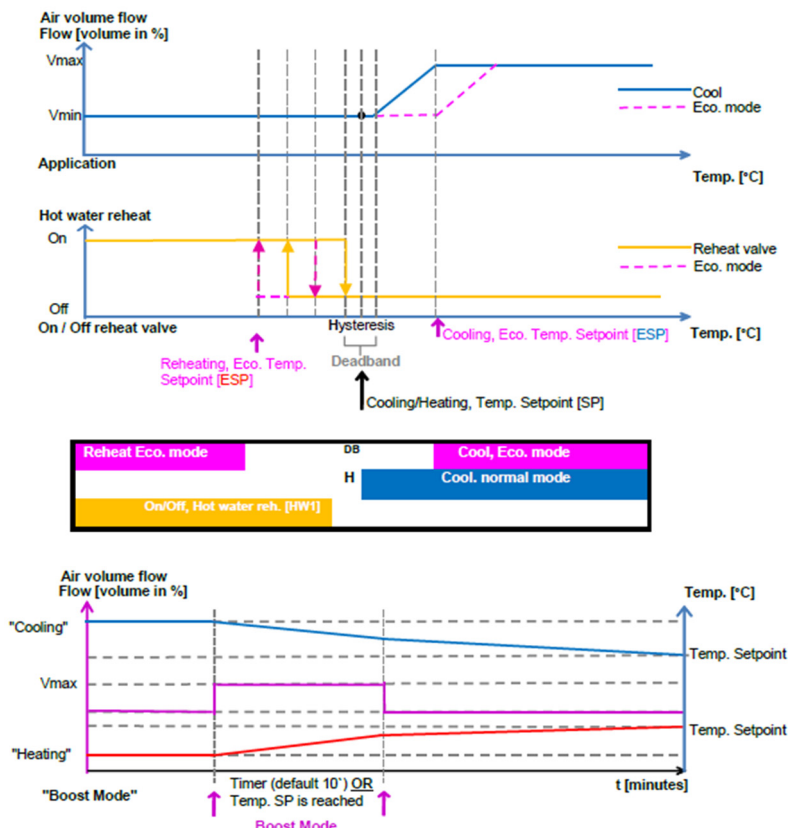


Figure 16. Control Application Number 6 sequences

Control Application Number 7: Indoor air temperature control (Primary Air Cooling with Modulating Valve of Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the VAV unit for cooling with modulating reheat valve based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

This application is modulating to common valve position if there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate, V_{min} is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be activated in this Control Application.

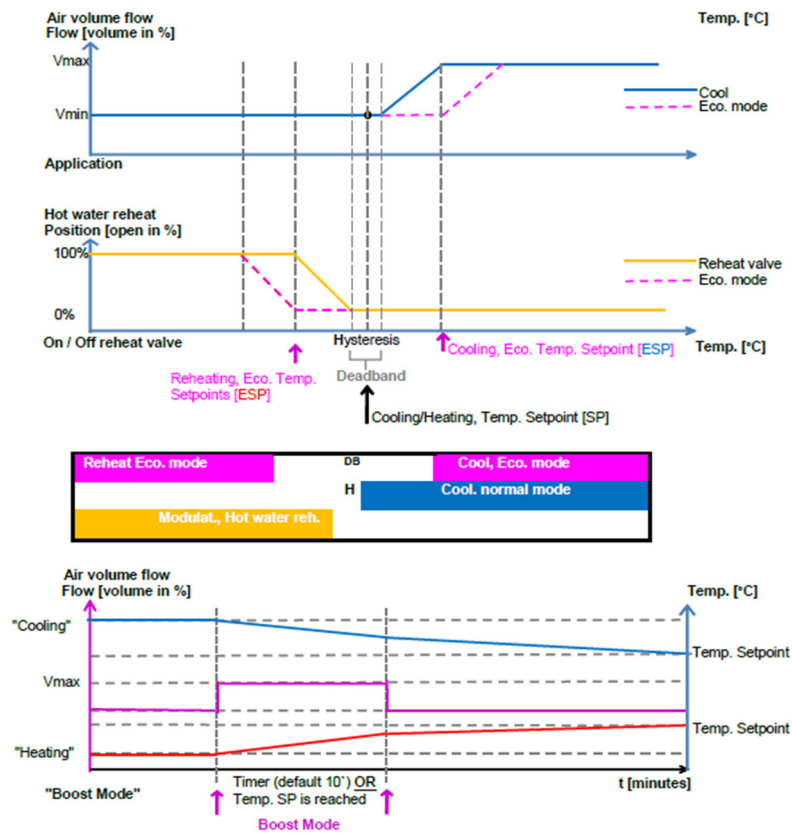


Figure 17. Control Application Number 7 sequences

Control Application Number 8: Primary air CO₂ demand Control

With selected this Control Application, the VAV controller will be operated in demand control ventilation depending from CO₂ concentration from the return-air (RA) duct of air handling unit and the desirable indoor air quality (CO₂ setpoint).

The VAV controller modulates the Primary Air damper of the VAV unit for fresh air into the zone. Modulation is based on the difference value between CO₂ setpoint and the measured value of CO₂ sensor that connected with the VAV controller.

Off mode can be executed in this Control Application.

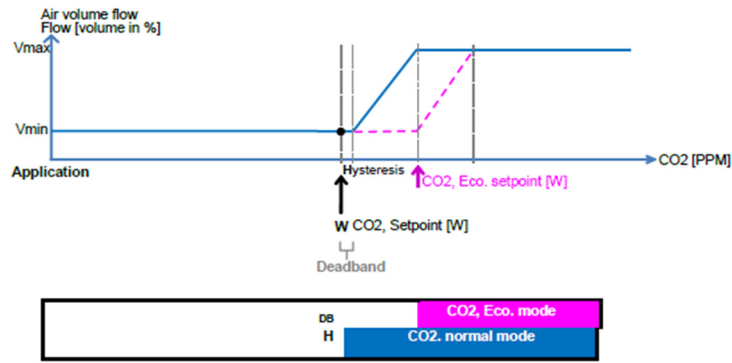


Figure 18. Control Application Number 8 sequences

Control Application Number 9: Primary air VAV control (direct airflow rate control)

With selected this Control Application, the VAV controller modulates the Primary Air damper of the VAV unit based on the airflow rate setpoint. Different than other Control Applications that control the primary airflow rate of the VAV unit based on the differential temperature or the differential concentration of CO₂, the Control Application Number 9 directly controls the primary airflow rate based on the primary airflow rate setpoint. The airflow rate setpoint can be setup at the BMS Central Station or the Room Unit by BMS administrator.

The setpoint will be setup on BMS Central Station from Vmin to Vmax at range 0.01~ 99999.

The setpoint will be selected and shown on the Room Unit at stage 0~10, which means Vmin to Vmax. For example, Vmin = 100, Vmax = 1100, then

Stage	Setpoint	Indication range
0	100	≤149
1	200	150 ~ 249
2	300	250 ~ 349
3	400	350 ~ 449
4	500	450 ~ 549
5	600	550 ~ 649
6	700	650 ~ 749
7	800	750 ~ 849
8	900	850 ~ 949
9	1000	950 ~ 1049
10	1100	≥1050

The last setpoint written by the BMS Central Station or the Room Unit will be retained, i.e. LWW (Last Write Wins).

In order for it to work properly, the central air handling unit must provide primary air.

Off mode can be executed in this Control Application.

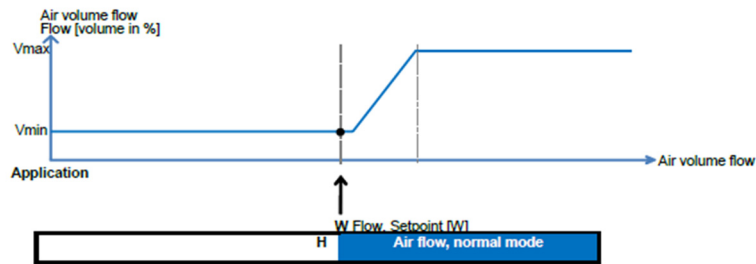


Figure 19. Control Application Number 9 sequences

Control Application Number 10: Indoor air temperature control (Primary Air Cooling with Parallel Fan)

With selected this Control Application, the VAV controller modulates the primary air damper of the parallel fan powered VAV unit for cooling based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The parallel fan in this application will be switched to state "On" if there is a heating demand.

Cooling function will be operated when the indoor air temperature is above the indoor air temperature setpoint plus half the hysteresis (default setting 0.5°C). Heating function will be operated when the indoor air temperature is below the indoor air temperature setpoint minus half the hysteresis (default setting 0.5°C). Hysteresis is also called deadband (default setting 1°C). Off mode, Economy mode, and Boost mode can be executed in this Control Application.

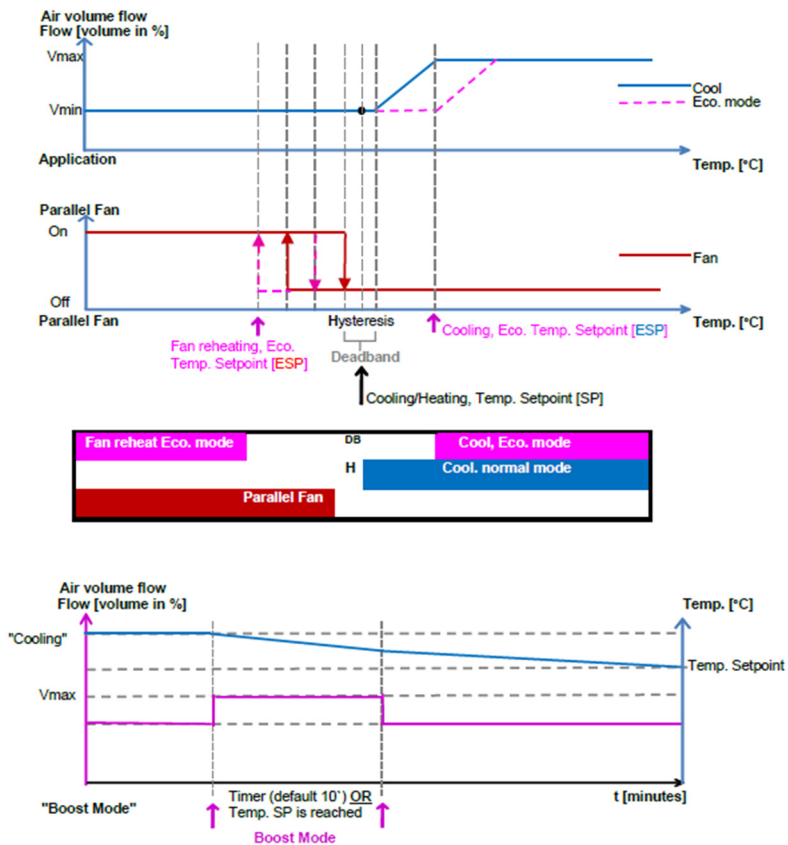


Figure 20. Control Application Number 10 sequences

Control Application Number 11: Indoor air temperature control (Primary Air Cooling with Parallel Fan + 1 Stage Electric Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the parallel fan powered VAV unit for cooling with 1 stage electrical reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The parallel fan in this application will be switched to state "On" if there is a heating demand and reheating aggregate needs to be operated too.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The electric reheater in this application will be operated when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow volume, V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

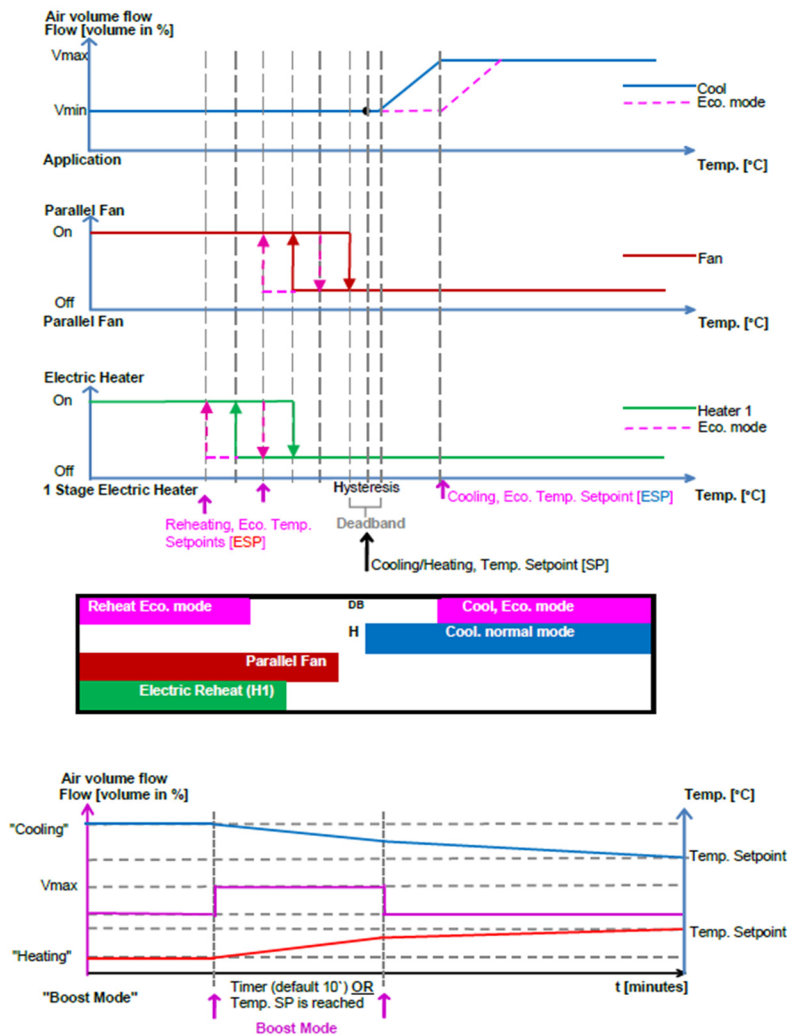


Figure 21. Control Application Number 11 sequences

Control Application Number 12: Indoor air temperature control (Primary Air Cooling with Parallel Fan + 2 Stages Electrical Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the parallel fan powered VAV unit for cooling with 2 stages of electrical reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The parallel fan in this application will be switched to state "On" if there is a heating demand.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The electrical reheaters in this application will be operated increasingly stage by stage when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

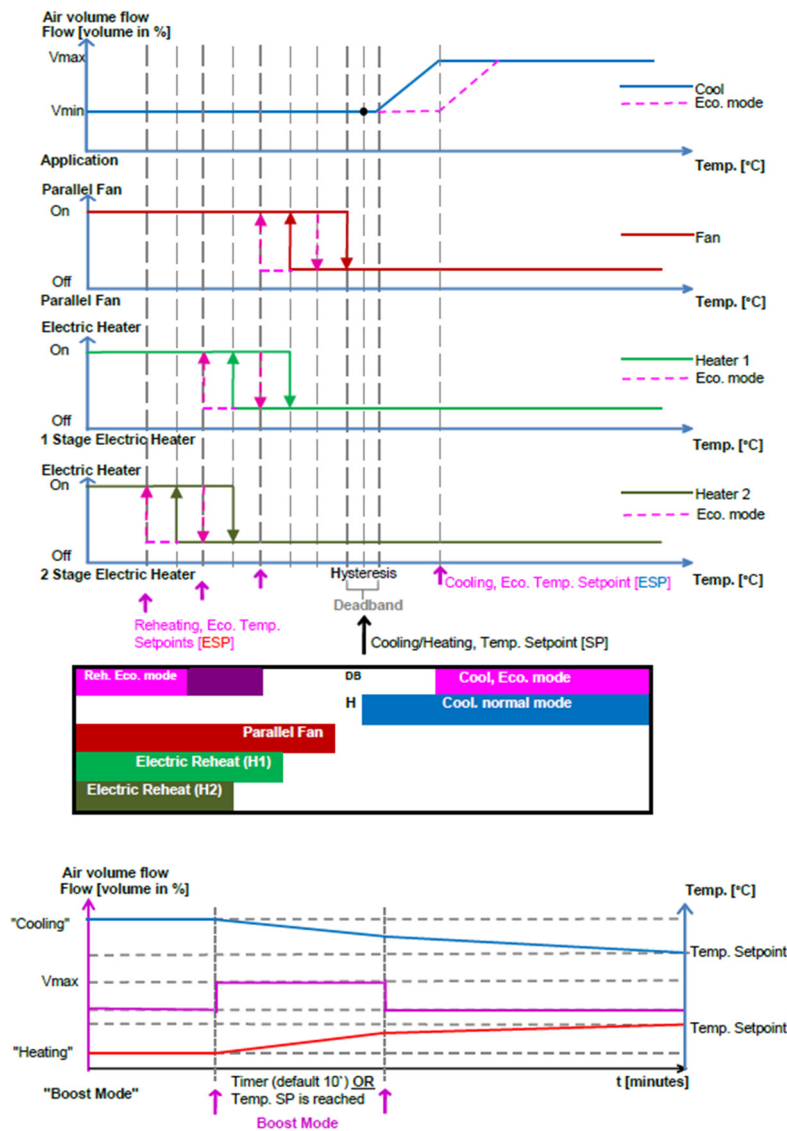


Figure 22. Control Application Number 12 sequences

Control Application Number 13: Indoor air temperature control (Primary Air Cooling with Parallel Fan + ON/OFF Valve of Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the parallel fan powered VAV unit for cooling with an on/off valve of water reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The parallel fan in this application will be switched to state "On" if there is a heating demand.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The hot water reheater in this application will be operated when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

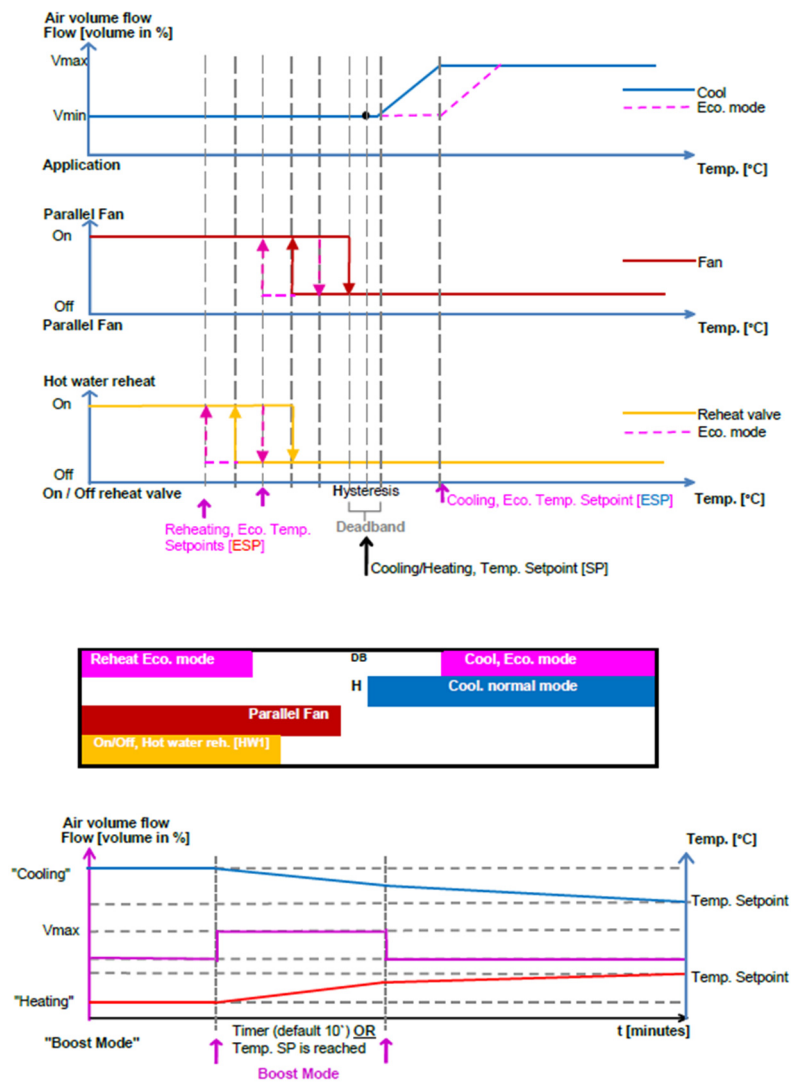


Figure 23. Control Application Number 13 sequences

Control Application Number 14: Indoor air temperature control (Primary Air Cooling with Parallel Fan + Modulating Valve of Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the parallel fan powered VAV unit for cooling with a modulating valve of water reheat based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The parallel fan in this application will be switched to state "On" if there is a heating demand.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

Hot water reheat valve in this application is modulating to common valve position when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheat in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

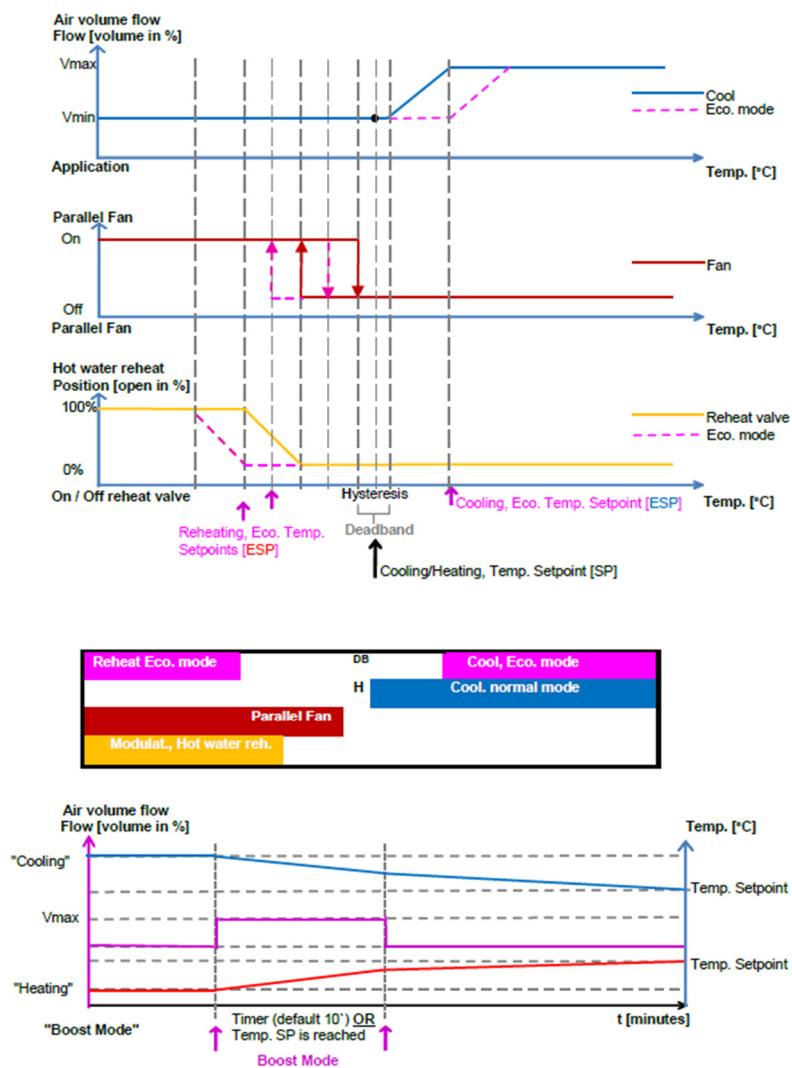


Figure 24. Control Application Number 14 sequences

Control Application Number 15: Indoor air temperature control (Primary Air Cooling with Serial Fan)

With selected this Control Application, the VAV controller modulates the primary air damper of the serial fan powered VAV unit for cooling based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The serial fan in this application will be switched to state "On" continuously when the main air handle unit is running, regardless of whether there is a heating demand.

Cooling function will be operated when the indoor air temperature is above the indoor air temperature setpoint plus half the hysteresis (default setting 0.5°C). Hysteresis is also called deadband (default setting 1°C).

Off mode, Economy mode, and Boost mode can be executed in this Control Application.

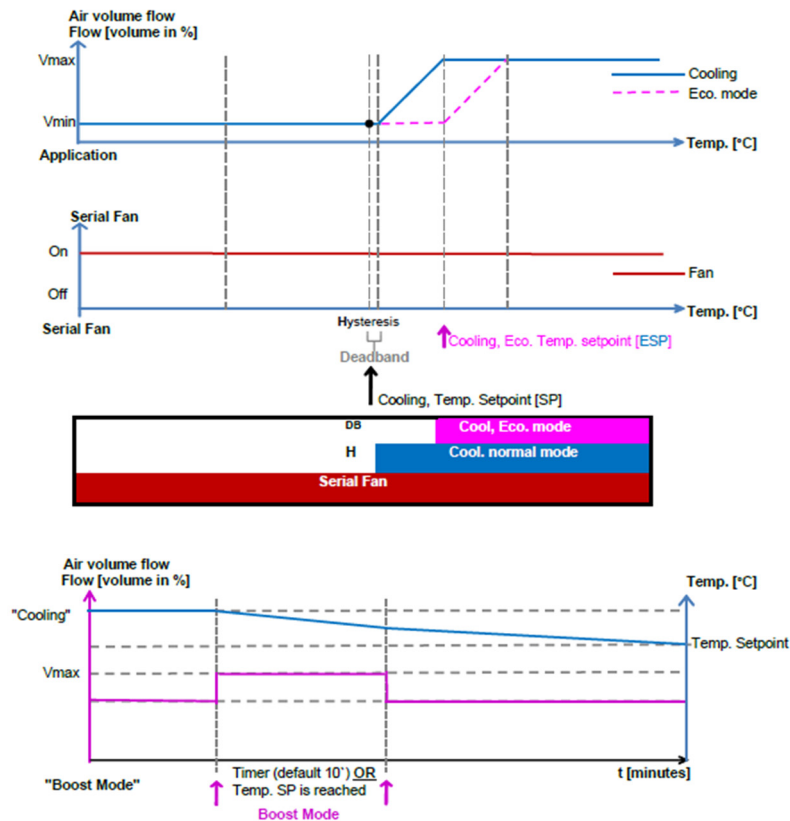


Figure 25. Control Application Number 15 sequences

Control Application Number 16: Indoor air temperature control (Primary Air Cooling / Heating with Serial Fan)

With selected this Control Application, the VAV controller modulates the primary air damper of the serial fan powered VAV unit for cooling or heating based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool or heated primary air.

The serial fan in this application will be switched to state "On" continuously when the main air handle unit is running, regardless of whether there is a cooling or heating demand.

Cooling function will be operated when the indoor air temperature is above the indoor air temperature setpoint plus half the hysteresis (default setting 0.5°C). Heating function will be operated vice versa if the indoor air temperature is lower the indoor air temperature setpoint minus half the hysteresis (default setting 0.5°C). Hysteresis is also called deadband (default setting 1°C). Off mode, Economy mode, and Boost mode can be executed in this Control Application.

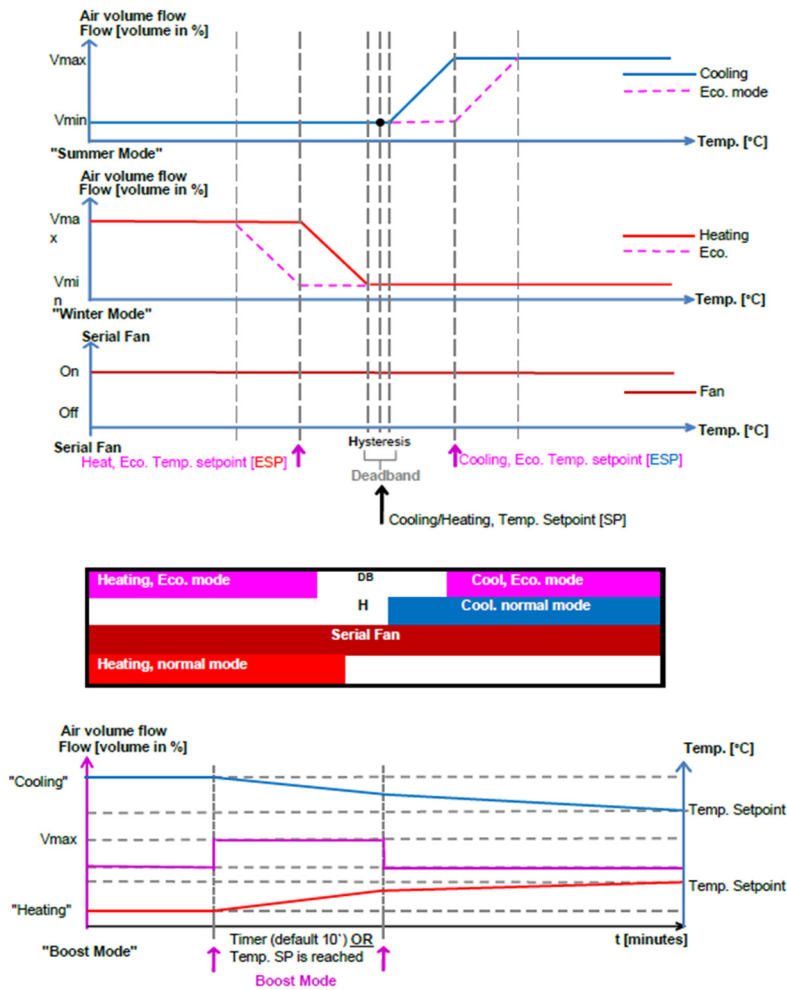


Figure 26. Control Application Number 16 sequences

Control Application Number 17: Indoor air temperature control (Primary Air Cooling with Serial Fan + 1 Stage Electrical Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the serial fan powered VAV unit for cooling with 1 stage electrical reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The serial fan in this application will be switched to state "On" continuously when the main air handle unit is running, regardless of whether there is a cooling or heating demand.

Reheating function will be operated when the indoor air temperature is below its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above its setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The electric reheater in this application will be operated when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow volume, V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

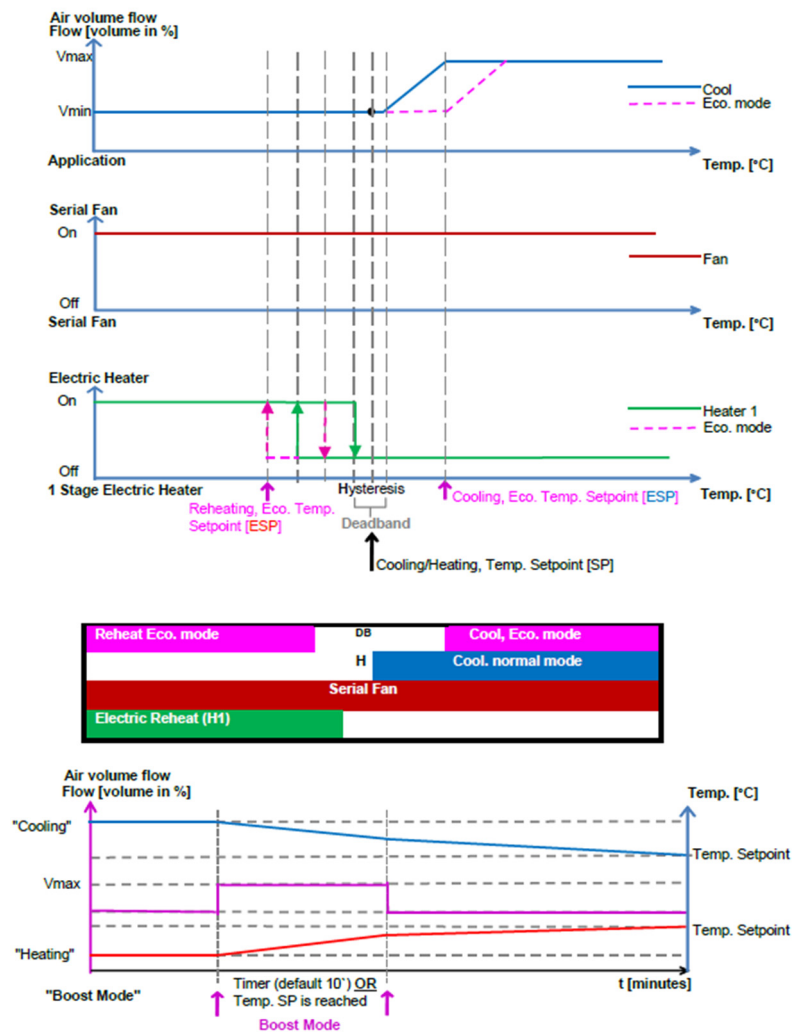


Figure 27. Control Application Number 17 sequences

Control Application Number 18: Indoor air temperature control (Primary Air Cooling with Serial Fan + 2 Stages Electric Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the serial fan powered VAV unit for cooling with 2 stages of electrical reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The serial fan in this application will be switched to state "On" continuously when the main air handle unit is running, regardless of whether there is a cooling or heating demand.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The electrical reheaters in this application will be operated increasingly stage by stage when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

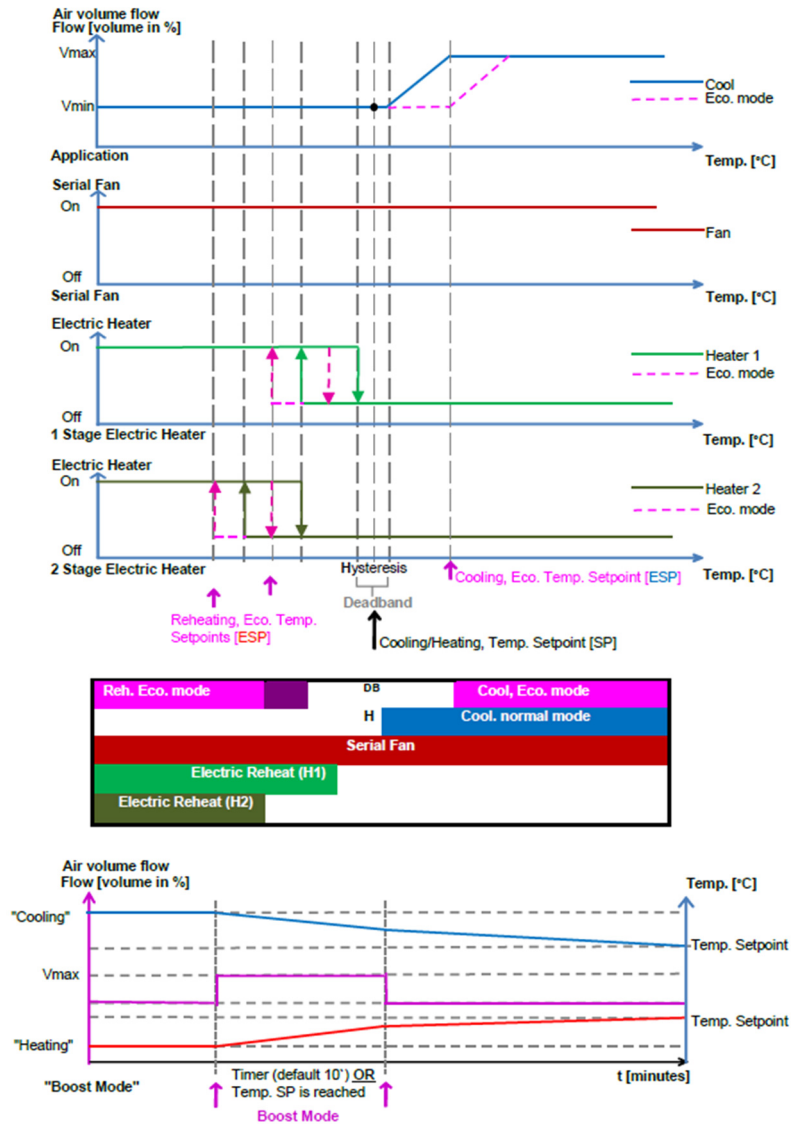


Figure 28. Control Application Number 18 sequences

Control Application Number 19: Indoor air temperature control (Primary Air Cooling with Serial Fan + ON/OFF Valve of Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the serial fan powered VAV unit for cooling with an on/off valve of water reheater based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The serial fan in this application will be switched to state "On" continuously when the main air handle unit is running, regardless of whether there is a cooling or heating demand.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

The hot water reheater in this application will be operated when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheater in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

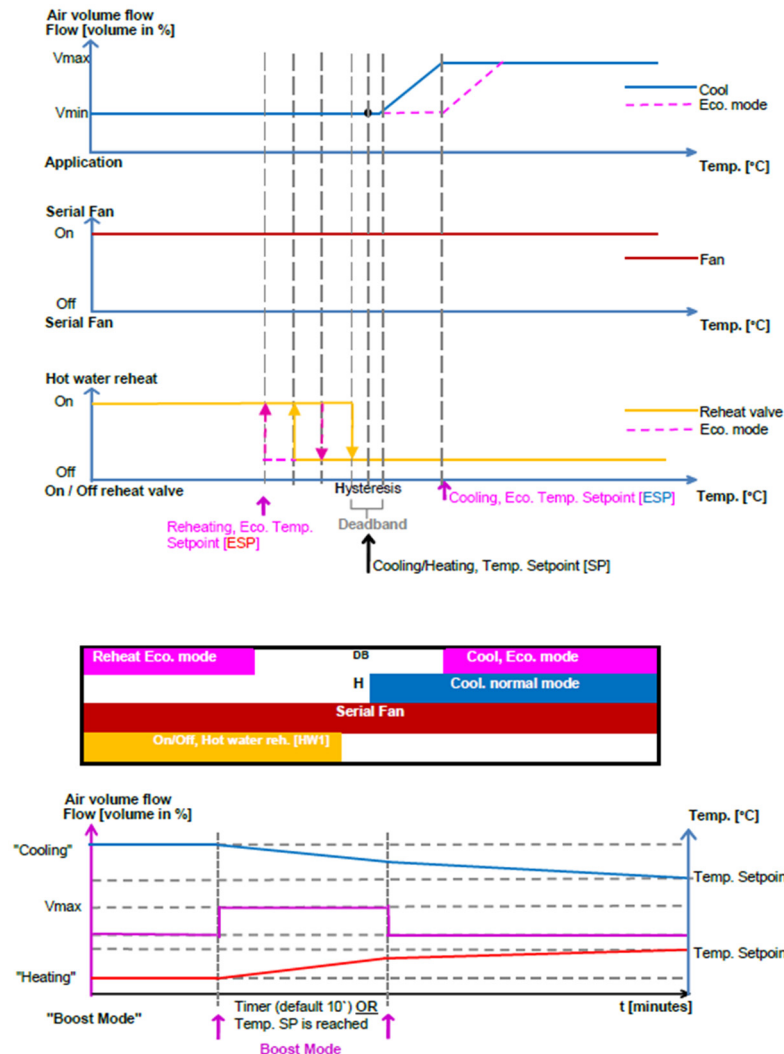


Figure 29. Control Application Number 19 sequences

Control Application Number 20: Indoor air temperature control (Primary Air Cooling with Serial Fan + Modulating Valve of Reheater)

With selected this Control Application, the VAV controller modulates the primary air damper of the serial fan powered VAV unit for cooling with a modulating valve of water reheat based on indoor air temperature setpoint. In order for it to work properly, the central air handling unit must provide cool primary air.

The serial fan in this application will be switched to state "On" continuously when the main air handle unit is running, regardless of whether there is a cooling or heating demand.

Reheating function will be operated when the indoor air temperature is below the its setpoint minus half the hysteresis (default setting 0.5°C) or cooling function will be operated vice versa if indoor air temperature is above setpoint plus half the hysteresis. Hysteresis is also called deadband (default setting 1°C).

Hot water reheat valve in this application is modulating to common valve position when there is a heating demand. That is when the indoor air temperature is lower than its setpoint. Reheating function only is ready for action if current airflow rate V_{min} is operating to ensure safe operation with heating aggregates.

The electric and water reheat in all applications are not able to switch to state "On" by Building Management System override if current airflow rate is lower than 15% (not modifiable) of V_{max} . This is to ensure safe operation with electrical and hot water heaters. This information is important to consider in certain cases while commissioning the VAV unit system with V_{min} and V_{max} parameters.

Off mode, Frost protection mode, Economy mode, and Boost mode can be executed in this Control Application.

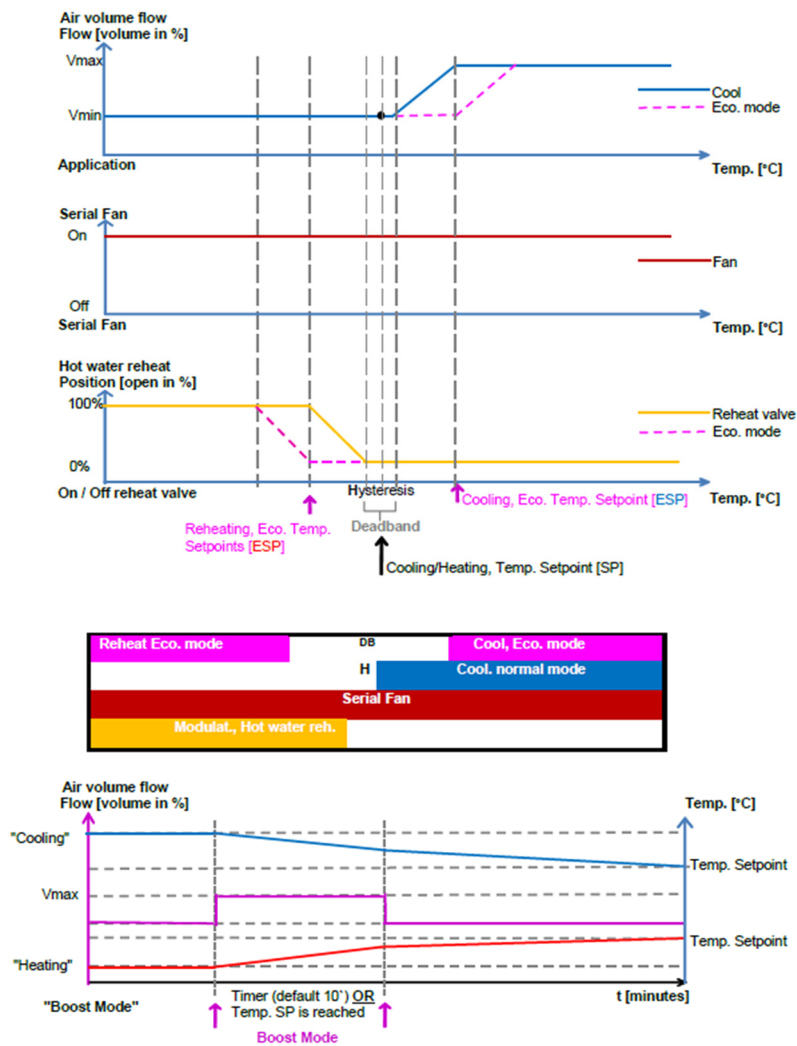


Figure 30. Control Application Number 20 sequences

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CE according to 89/336/EEC, EN60730-1:2000 + A2:2008, EN60730-2-14:1997 + A2:2008, EN61000-6-2:05 and EN61000-6-3:07 + A1:11, EN60730-2-9:2010



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