OpenAir™

VAV modular controller   ASV181.1E/3

Series E

- Modular controller for plants with variable or constant air volume flow
- Integrated high-accuracy differential pressure sensor and configurable digital air volume controller
- Operating voltage AC 24 V
- For connection to an OpenAir^{TM} family 3-position air damper actuator
- Prewired with one 0.9 m and one 0.3 m connecting cable

Note

– Please refer to the Technical Basics in document P3544 for a detailed description as well as information on safety, engineering notes, mounting and commissioning.

– **Series E or newer:** Configuration and maintenance interface with 7-pin terminal strip for connection cables with 7-pin connector (please refer also to datasheet AST10 / N5851).

Application

VAV modular controllers are used primarily to control a variable or a constant air volume flow.

VAV modular controllers are used for:

- Supply air control
- Extract air control
- Supply/extract air cascade control with
  - ratio control 1 : 1
  - ratio control (positive / negative pressure)
  - differential control (positive / negative pressure)

VAV modular controllers are not suitable for environments where the air is saturated with sticky or fatty particles or contain aggressive substances.

Type summary

Type	Application range	Operating voltage
ASV181.1E/3	0…300 Pa	AC 24 V

- For VAV compact controllers GDB181.1E/3 and GLB181.1E/3 cf. datasheet N3544.
- For networked types (KNX / PL-Link) GDB181.1E/KN and GLB181.1E/KN cf. datasheet N3547.
- For information on accessories and spare parts cf. datasheet N4698.

Equipment combinations

Device	Type	Datasheet
Controllers		
Room temperature controller	RCU5..	3045
	RCU6..	3046
	RDU5..	3065
Room thermostat	RDG4..	3182, 3192
Room controller	RX..	38xx
Universal controller	RLU2..	3101
	RMU7..	3144
Tools for configuration and service		
Handheld tool	AST10 *	5851
Interface converter	AST11	5852
PC software for service	ACS941**	5854

* limited functionality for VAV modular controller Series E

** The ACS941 PC software can be downloaded free of charge at www.siemens.com/openair

Design
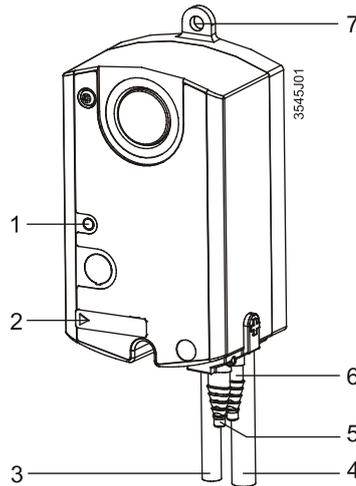
1 LED
2 Configuration and maintenance interface (below cover)
3 4-core connecting cable for OpenAir 3-position air damper actuator
4 6-core connecting cable (power and communications)
5 Connection nozzle for measuring differential pressure in the VAV box
6 Connection nozzle for measuring differential pressure in the VAV box ("+": Side with higher pressure)
7 Beltline hook

Settings and operating mode

The VAV modular controllers can be parameterized with configuration tools (cf. "equipment combinations")*.

Settings for setpoint signal YC

Parameter	Setting	Description	Siemens factory setting
YC	0…10 V	Setpoint for air volume flow	0…10 V (operating mode "con")
	2…10 V		

Settings for actual value signal U

Parameter	Setting	Description	Siemens factory setting
U	FLW	Actual value of air volume flow (measurement value)	FLW
	0…10 V		0…10 V
	2…10 V		
	0.05…5 s (Resolution 0.01 s)	Time constant actual value U	1 s

Setting elevation for sensor accuracy

Parameter	Setting	Description	Siemens factory setting
Elevation asl	0…5000 m (Resolution 500 m)	Elevation asl to increase pressure sensor accuracy	500 m

LED- state display

LED dark	No operating voltage
LED green	Faultless operation
LED flashes red	Connection tubes for sensor interchanged
LED red	Differential pressure sensor fault

* For connections at the configuration and maintenance interface please consider that voltages >10 V at YC can't be processed.
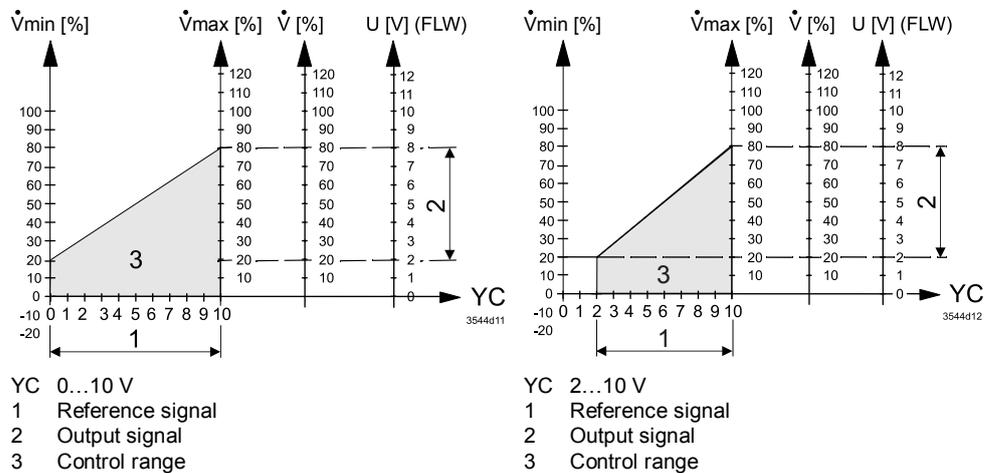
Operating mode "con"

The following parameters have to be set or checked in operating mode "con":

Parameter	Setting	Description	Siemens factory setting
Type	con	VAV or CAV mode	con
Setpoint "YC"	0…10 V 2…10 V	Air volume flow reference signal (setpoint)	0…10 V
$\dot{V}_n$	1…3.16	Characteristic value for nominal air volume flow, preset by manufacturer(OEM)	1
$\dot{V}_{max}$	20…120 %	Maximum air volume flow	100 %
$\dot{V}_{min}$	-20…100 %	Minimum air volume flow	0 %
Dir	**r** or **L**	Opening direction of air damper **r** = Clockwise (CW) **L** = Counterclockwise (CCW)	**r**

Variable air volume (VAV) control

The VAV modular controllers operate in VAV mode provided a DC 0…10 V or DC 2…10 V signal is fed into the input YC. The setpoint signal controls the operating range $\dot{V}_{min} … \dot{V}_{max}$.

YC 0…10 V
1   Reference signal
2   Output signal
3   Control range

YC 2…10 V
1   Reference signal
2   Output signal
3   Control range

Forced control in VAV mode

Using the Y1 and Y2 control signals, the damper of the air volume controller can be driven either to the fully open or fully closed position.

VAV operating mode (Type "con")

YC	DC 0/2…10 V			
Y1	open	G0	G0	open
Y2	open	open	G0	G0
Action	VAV control with DC 0/2…10 V setpoint compensation	Dir **r** → rotation CW Dir **L** → rotation CCW **"Damper fully open"**	VAV control with DC 0/2…10 V setpoint compensation	Dir **r** → rotation CCW Dir **L** → rotation CW **"Damper fully closed"**

Note

Setting $\dot{V}_{min} \leq 0$ % and YC = 0 V drives the actuator to position "fully closed"

Constant air volume (CAV) control	VAV modular controllers operate in CAV mode if input YC is **open**. $\dot{V}_{min}$ or $\dot{V}_{max}$ control can be accomplished with control signals Y1 and Y2.

Forced control in CAV mode

If inputs Y1 and Y2 are wired appropriately, different states can be reached according to the following table:

CAV mode (Type "con")

YC	open			
Y1	open	G0	G0	open
Y2	open	open	G0	G0
Action	$\dot{V}_{min}$ control	Dir **r** → rotation CW Dir **L** → rotation CCW **"Damper fully open"**	$\dot{V}_{max}$ control	Dir **r** → rotation CCW Dir **L** → rotation CW **"Damper fully closed"**

Notes

CAV mode is also possible when preselecting a constant setpoint via input YC. Setting $\dot{V}_{min} \leq 0$ drives the actuator to position "fully closed".

Operating mode "3P"

To use VAV modular controllers as differential pressure sensor for air volume flow measurement with a 3-position actuator, the operating mode parameter must be set to "3P".

Parameter setting

In operating mode "3P", the following parameters must be set or checked:

Parameter	*Setting*	*Description*	*Siemens factory setting*
Type	3P	3P mode	con
$\dot{V}_n$	1…3.16	Characteristic value for nominal air volume flow, set by manufacturer (OEM)	1
Dir	**r** or **L**	Opening direction of air damper **r** = Clockwise (CW) **L** = Counterclockwise (CCW)	**r**

In operating mode "3P", $\dot{V}_{min}$ and $\dot{V}_{max}$ are of no relevance since air volume flow control in this operating mode is ensured by the higher level room controller (typically cascade of room temperature and air volume flow). In this operating mode, air volume flow control by the VAV modular controller is deactivated.

The air damper's opening direction is determined by the connection of signal inputs Y1 (core 6, violet) and Y2 (core 7, orange).

Differential pressure sensor with 3-position actuator (Type = "3P")

YC	N/A			
Y1	open	G0	G0	open
Y2	open	open	G0	G0
Action	Damper holds position	Dir **r** → rotation CW Dir **L** → rotation CCW **Damper opens**	Dir **r** → rotation CCW Dir **L** → rotation CW **Damper closes**	Dir **r** → rotation CCW Dir **L** → rotation CW **Damper closes**

Operating mode "STP"   CAV step mode: CLOSE / $\dot{V}_{min}$ / $\dot{V}_{mid}$ / $\dot{V}_{max}$ / OPEN

CAV step mode (Type "STP")

YC				
	<1 V → $\dot{V}_{min}$			
	open → $\dot{V}_{mid}$			
	>9 V → $\dot{V}_{max}$			
Y1	open	G0	G0	open
Y2	open	open	G0	G0
Action	CAV step mode	Dir **r** → rotation CW Dir **L** → rotation CCW **"Damper fully open"**	CAV step mode	Dir **r** → rotation CCW Dir **L** → rotation CW **"Damper fully closed"**

Note   Setting $\dot{V}_{min}$ ≤ 0 drives the actuator to position "fully closed".

N1 ASV181.1E/3 or G..B181.1E/3

3544A14
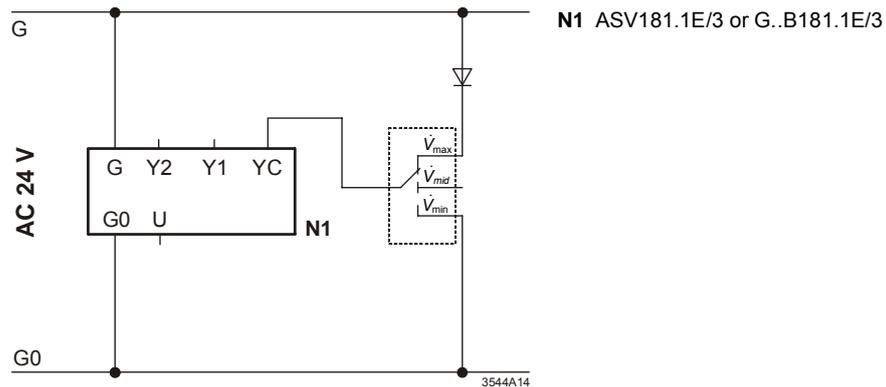
Ordering through the VAV box manufacturer (OEM)

As a rule, documentation provided by VAV box manufacturers (OEM) contains detailed information on VAV modular controller ordering.

The OEM generally configures and assembles VAV modular controllers as VAV box units. This facilitates commissioning at the construction site considerably. Should changes be necessary, the use of PC software for service ACS941 (download free of charge at www.siemens.com/openair) and interface converter AST11 is recommended.

OEM always sets $\dot{V}_n$ (characteristic value for nominal air volume flow) as a matter of principle.

Configuration for operating mode "3P"   For configuration for operating mode **"3P"**, supply and extract air volume controllers are each connected to separate 3P outputs and DC 0/2…10 V inputs of a suitable DDC room controller, e.g. RXC31.1.

Configuration for operating mode "con"   When **"con"** is configured, a differentiation is to be made as to how VAV modular controllers are wired in relation to the relevant controller:

In the case of **parallel control,** the controller controls all VAV modular controllers in a star-like (parallel) manner. I.e., the DC 0/2…10 V output signal is the reference variable for all VAV modular controllers. The OEM adjusts the minimum and maximum air volume flow limit values $\dot{V}_{min}$ and $\dot{V}_{max}$ individually on each controller.

Parallel control is in particular suitable to design large rooms with several air volume controllers.

With **master/slave control,** the DC 0/2…10 V output signal of the controller is fed into the supply air volume controller (master controller) as the reference variable. The extract air volume controller (slave controller) receives the master controller's actual value signal of the air volume flow as the reference variable (setpoint).

Minimum and maximum limitation of air volume flow

Operating mode "3P" The limitation to $\dot{V}_{min}$ or $\dot{V}_{max}$ is made on the relevant controller. This means that the OEM does not set these limit values on the VAV modular controllers. The factory settings made by Siemens are 0 % and 100 % and will not be changed.

Operating mode "con"" Here, a differentiation is to be made between two cases, which must be considered when ordering the air volume controller with the OEM:

- The OEM sets the limit values ($\dot{V}_{min}$ and $\dot{V}_{max}$) on the VAV modular controllers
- The limit values ($\dot{V}_{min}$ and $\dot{V}_{max}$) are set on the assigned room temperature controller, provided the controller used offers this facility

Disposal

The device is considered an electronics device for disposal in terms of European Directive 2012/19/EU and may not be disposed of as domestic garbage.

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

Technical Data

|		
⚠ **Power supply AC 24 V** (SELV/PELV) G (core 1, red) and G0 (core 2, black)	Operating voltage / frequency	AC 24 V ±20 % / 50/60 Hz
	Power consumption	1 VA / 0.5 W
Signal inputs		
Air volume flow reference or communication signal YC (core 8)	Input voltage	DC 0/2…10 V
	Max. perm input voltage	DC 35 V
Reference signals Y1 (core 6) and Y2 (core 7)	Contact sensing	
	Contact sensing	DC 30 V contact voltage
	Contact closed	DC 0 V, 8 mA contact current
Signal outputs		
Air volume flow measuring signal U (core 9)	Output voltage	DC 0/2…10 V limited to DC 12 V
	Max. output current	DC ± 1 mA
	Time constant (actual value U)	0.05…5 s
	Resolution 0.01 s / factory setting 1 s	
Configuration and maintenance interface	Series A-D	**6-pin**, grid 2.54 mm
	Series E	**7-pin**, grid 2.00 mm
Connection cable 1	Cable length	0.9 m
	Number of cores	6
	Core diameter	6 x 0.75 mm^2
Connection cable 2	Cable length	0.3 m
	Number of cores	4
	Core diameter	4 x 0.34 mm^2
⚠ **Degree of protection and safety class**	Degree of protection acc. to EN 60529 (cf. mounting instruction)	IP54
	Safety class acc. to EN 60730	III

Environmental conditions	Operation / transport	IEC 721-3-3 / IEC 721-3-2
	Temperature	0...50 °C / −25...70 °C
	Humidity (non-condensing)	<95% r.h. / <95% r.h.
Standards and Regulations	Product safety	
	Automatic electric controls for household and similar use	EN 60730-2-14 (mode of action type 1)
	Electromagnetic compatibility (Application)	For residential, commercial and industrial environments
	EU Conformity (CE)	A5W00004387 [1]
	RCM Conformity	A5W00004388 [1]
Environmental compatibility	The product environmental declaration CM2E3545 [1] contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).	
Dimensions	B x H x T	68 x 135 x 45 mm
Weight	Without packaging	0.280 kg
Air volume controller	3-position controller with hysteresis	
	$\dot{V}_{max}$, adjustable (resolution 1 % / factory setting 100 %)	20…120 %
	$\dot{V}_{min}$, adjustable (resolution 1 % / factory setting 0 %)	-20…100 %
	$\dot{V}_{mid}$, adjustable (resolution 1 % / factory setting 50 %)	0…100 %
	$\dot{V}_{n}$, adjustable (resolution 0.01 / factory setting 1.00)	1…3.16
	$\dot{V}_{n}$ = 1 ≙ 300 Pa at nominal air volume flow	
	$\dot{V}_{n}$ = 3.16 ≙ 30 Pa at nominal air volume flow	
Differential pressure sensor	Connection tubes (interior diameter)	3…8 mm
	Measuring range	0…500 Pa
	Operating range	0…300 Pa
	Precision at 23 °C, 966 mbar and optional mounting position	
	Zero point	± 0.2 Pa
	Amplitude	± 4.5 % of the measured value
	Drift	± 0.1 Pa / Year
	Max. permissible operating pressure	3000 Pa
	Max. permissible overload on one side	3000 Pa

[1] The documents can be downloaded from http://siemens.com/bt/download

Diagrams

The VAV modular controllers are supplied with two pre-wired connecting cables.
The devices connected to it must use the same G0.

Internal diagram
(applies to all types)
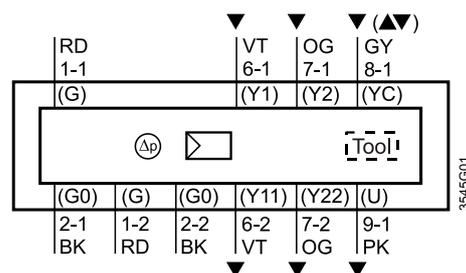
Tool = Configuration and maintenance interface (Series E: 7-pin)

Terminal label	Color code	Terminal code	Description
Connection cable 1 (color coded and labeled)			
1	red (RD)	G	System potential AC 24 V
2	black (BK)	G0	System neutral AC 24 V
6	violet (VT)	Y1	Positioning signal "Actuator's direction of rotation" (G0 switched) dependent on the setting of direction
7	orange (OG)	Y2	Positioning signal "Actuator's direction of rotation" (G0 switched) dependent on the setting of direction
8	grey (GY)	YC[1]	Air volume flow reference signal DC 0/2...10 V (setpoint) or communication signal
9	pink (PK)	U	Air volume flow measuring signal DC 0/2 ... 10 V (actual value)

1) To ensure the functions at YC, only one cable may be connected at the time, either the cable for the air volume flow reference signal DC 0/2...10 V (setpoint) or the cable for the communication signal.

Terminal label	Color code	Terminal code	Description
Connection cable 2 (color coded and labeled)			
1	red (RD)	G	System potential AC 24 V
2	black (BK)	G0	System neutral AC 24 V
6	violet (VT)	Y11	Positioning signal "Actuator's direction of rotation" (G0 switched) dependent on the setting of direction
7	orange (OG)	Y22	Positioning signal "Actuator's direction of rotation" (G0 switched) dependent on the setting of direction

Wiring diagram
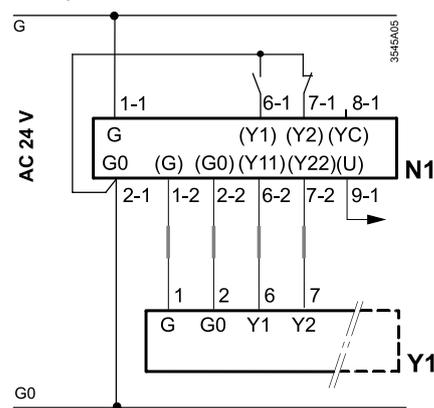**VAV**
Supply / extract air control in operating mode "con"
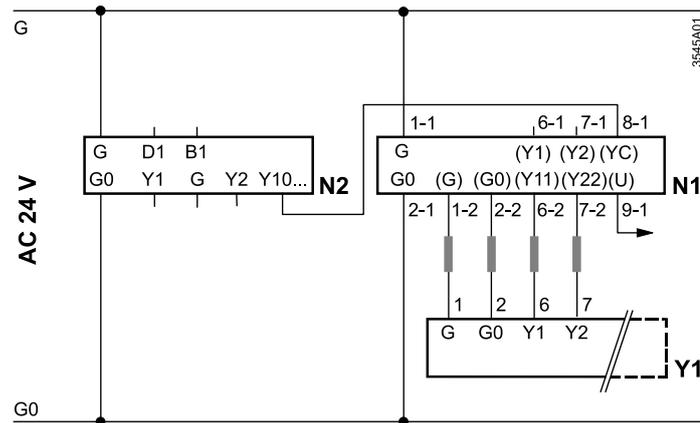
CAV
Supply / extract air control in operating mode "con"

$$\dot{V}_{min} = \dot{V}_{const.}$$
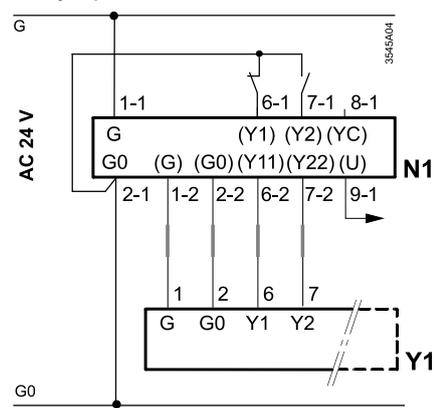
$$\dot{V}_{max} = \dot{V}_{const.}$$
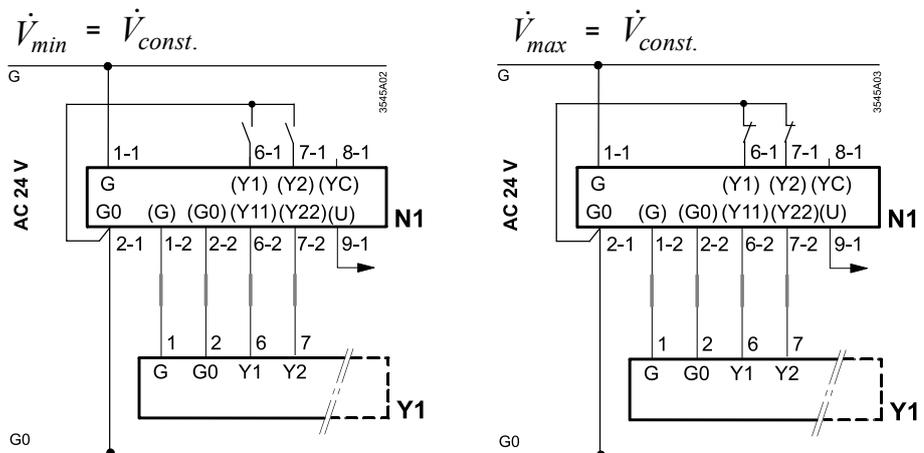
Modulating control $\dot{V}_{max}$ and $\dot{V}_{min}$ and complete shutoff and fully open operating mode "con"
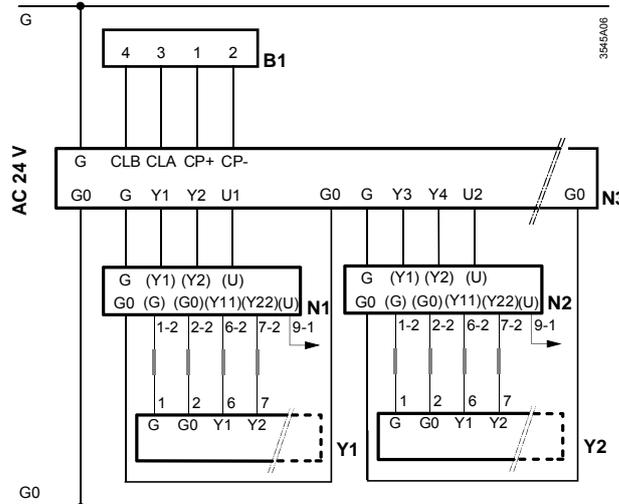
Complete shutoff

Fully open

Legend for operating mode "con"

N1   ASV181.1E/3
N2   Supervisory controller
Y1   OpenAir™ 3 - position actuator
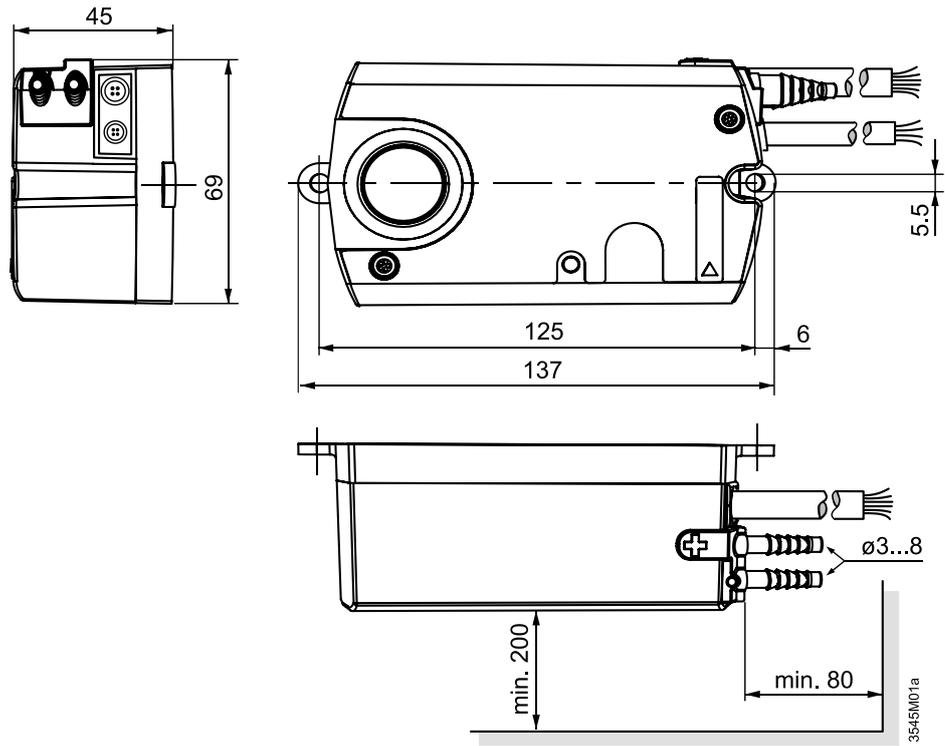
Operating mode "3P"

Supply / extract air control

N1   **ASV181.1E/3** –supply air–
N2   **ASV181.1E/3** –Extract air–
Y1   OpenAir™ 3-position actuator
Y2   OpenAir™ 3-position actuator
N3   Room temperature controller DESIGO™ **RXC31.1**
B1   DESIGO™-room unit, e. g. **QAX32.1**

⚠

- The operating voltage fed to terminals G and G0 must comply with the requirements for SELV or PELV
- Use safety isolating transformers with double insulation conforming to EN 61558; they must be suited for 100 % of operating time

10 / 12

Siemens
Building Technologies

VAV modular controller ASV181.1E/3

CE1N3545en
2016-01-29

Dimensions

45

69

125

137

5.5

6

min. 200

min. 80

ø3...8

3545M01a

Measurements in mm

VAV modular controller ASV181.1E/3

Siemens
Building Technologies

VAV modular controller ASV181.1E/3

CE1N3545en
2016-01-29