SIEMENS

Infrastructure & Cities



# OpenAir™
# VAV compact controller G..B181.1E/3
# VAV modular controller ASV181.1E/3

## Technical Basics

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# 1 Introduction

## 1.1 Revision history

| Version | Date | Changes | Section | Pages |
|---|---|---|---|---|
| 1.0 | 26/02/2016 | EU and RCM Conformity,<br>European Directive 2012/19/EU | 8 Technical data,<br>10 Environmental compatibility and disposal | 38<br>41 |
| 1.0 | 12/12/2011 | Newly created for Series E | | |

## 1.2 Before you start

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## 1.3 Objectives of this basic documentation

This basic documentation covers the VAV compact controllers[1] GDB181.1E/3 and GLB181.1E/3 as well as the VAV modular controller ASV181.1E/3. These devices are designed for controlling variable or constant air volume flows.

This document describes the devices and their application, mounting, engineering/commissioning, and decommissioning. A references section lists technical data and parameters.

## 1.4 Abbreviations and naming conventions

### 1.4.1 Abbreviations

| Abbreviation | Description |
|---|---|
| HMI | Human-machine interface |
| VAV | Variable Air Volume |
| CAV | Constant Air Volume |
| OEM | Original Equipment Manufacturer |

### 1.4.2 Naming conventions

Throughout this documentation the term “VAV compact controller(s)” refers to the GDB181.1E/3 as well as to the GLB181.1E/3, and if not indicated otherwise, to the ASV181.1E/3.

GDB181.1E/3 and GLB181.1E/3 might be abbreviated as G..B181.1E/3 to indicate that information concerns both types without distinction.

## 1.5 Referenced documents


[1] G..B181.1E/3 – Datasheet for VAV compact controller (N3544)
[2] G..B181.1E/3 – Mounting instruction for VAV compact controller (M3544)
[3] ASV181.1E/3 – Datasheet VAV modular controller (N3545)
[4] ASV 181.1E/3 – Mounting instruction VAV modular controller (M3545)
[5] AST10 – Handheld tool for VAV compact controller (N5851 and B5851)
[6] AST11 – Interface converter (N5852)
[7] ACS931 – PC-Software for OEM (N5853)
[8] ACS941 – PC-Software for Service (N5854)


[1] The VAV compact controllers with KNX / PL-Link capability GDB181.1E/KN and GLB181.1E/KN are covered in the Technical Basics P3547.

# 2 Device

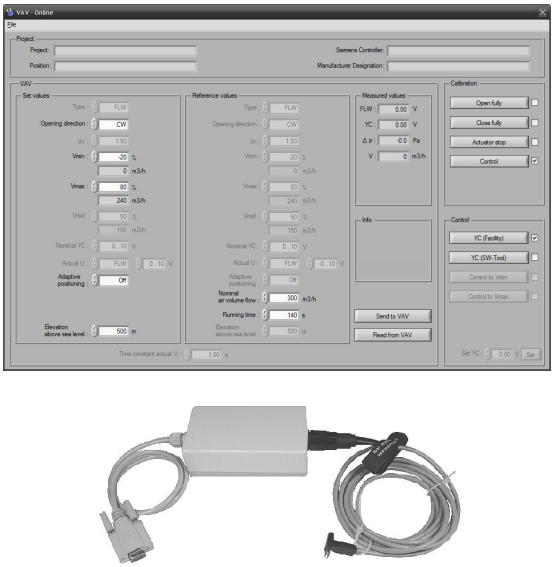
## 2.1 Type summary

### 2.1.1 Device variants, tools and accessories

**VAV compact and modular controllers**

| GDB181.1E/3 (5 Nm)<br>GLB181.1E/3 (10 Nm) | ASV181.1E/3 |
|---|---|
|  |  |

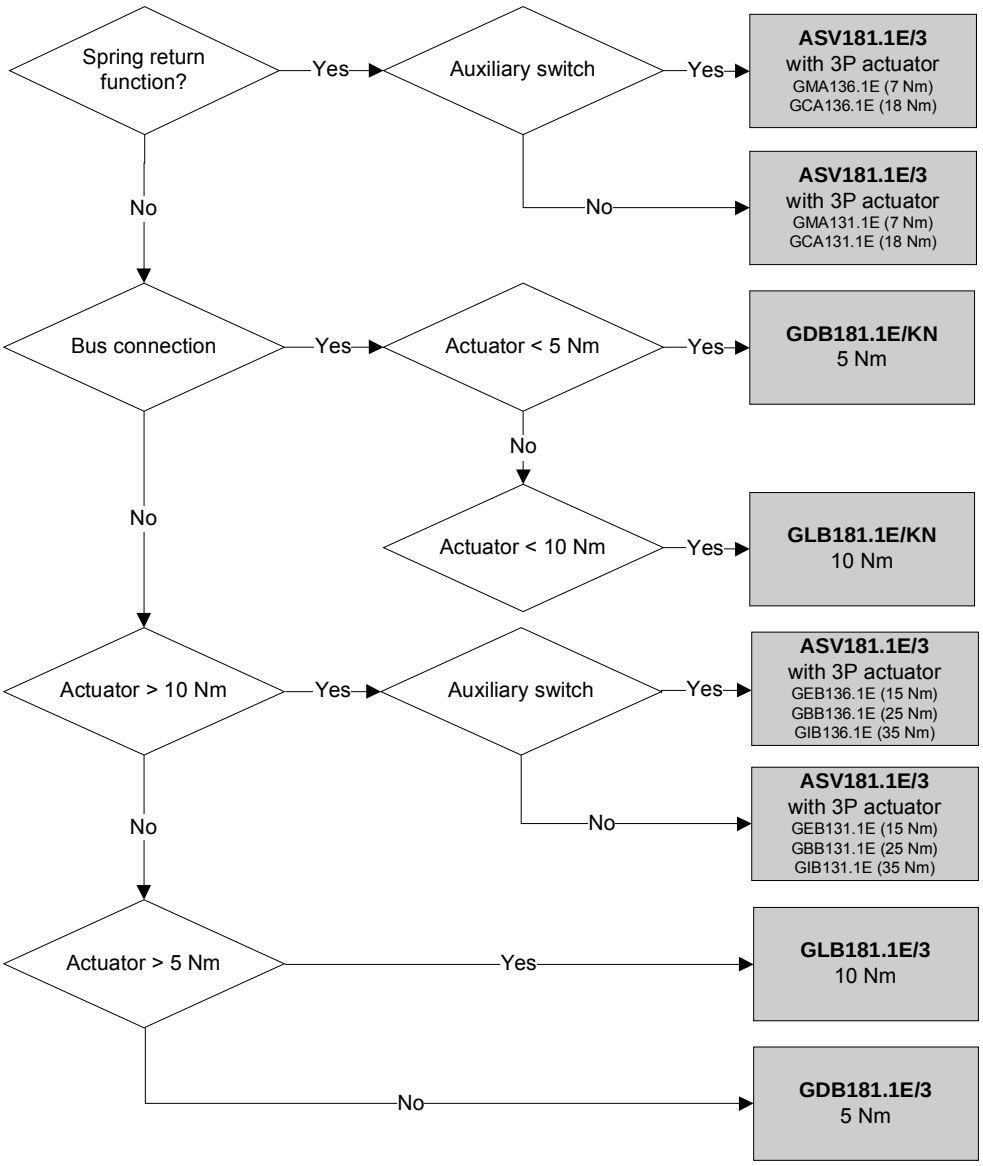
**Tools for commissioning and service**

| AST10 | ACS941 / AST11 |
|---|---|
|  |  |
| The handheld tool AST10 can be used with limitations for VAV compact controllers as of series E. Some parameters cannot be set, cf. section **9.2**. | The PC software for service ACS941 can be used for setting and reading a certain set of device parameters (values set by OEM and current configuration, and actual values), cf. section **9.2**.<br>For connecting to a PC with USB or RS232 interface, an interface converter AST11 is required. |
| Datasheet: N5851<br>Instructions: B5851 | Datasheet ACS941: N5854<br>Datasheet AST11: N5852 |

**Accessories**

For information regarding accessories and spare parts for VAV compact controllers, please refer to datasheet N4698.

### 2.1.2 Selection guide for all types



### 2.1.3 Version summary

| Version | Series E | Series D |
|---|---|---|
| Identification |  |  |
| Features | • DC 0/2 …10 V, 3 position control or STP control<br>• New differential pressure sensor<br>• Feedback signal selectable (volume flow or damper position)<br>• Optional adaptive damper position feedback (based on actual damper opening range)<br>• HMI with multicolor LED | • RoHS compliant |

| Version | Series C | Series B | Series A |
|---|---|---|---|
| Identification |  |  |  |
| Features | • Operating mode can be changed during operation<br>• Control perfor-mance further optimized (“con” mode)<br>• SW model for detection of position optimized | • Service tool connection facility (DIL switches replacement)<br>• Digital communi-cation via YC<br>• Control perfor-mance optimized (“con” mode)<br>• Measuring signal “U” slightly attenuated | • DIL switches<br>• Digital communication via UC |

## 2.2 Design and device parts

### 2.2.1 Design

The VAV compact controllers consist of a differential pressure sensor, actuator and digitally configurable control electronics. They are intended for mounting on damper shafts of a minimum length of 30 mm. They consist of base and 2-sectional housing.

Components contained in the **base**:

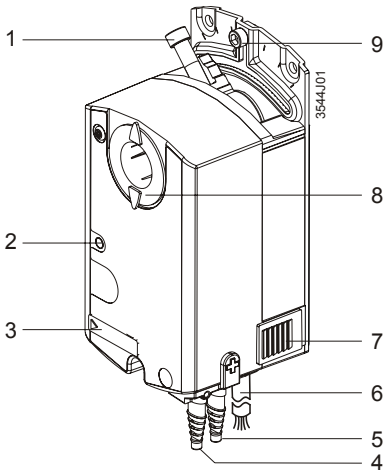
- Steel base plate with damper drive shaft fixing for different drive shaft diameters / cross-sectional areas (cf. section **2.3**) and angular rotation limiter,
- maintenance-free, low-noise gear train,
- magnetic hysteresis clutch with practically contact-free force transmission; this means that the actuator is locking- and overload-proof.

Components contained in the **housing** (Note: Housing cover must not be removed):

- Controller electronics,
- differential pressure sensor, and
- synchronous motor for the damper actuator.

### 2.2.2 Main device parts

G..B181.1E/3

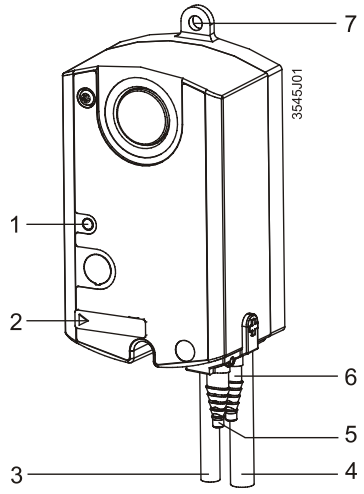



1 Shaft attachment screw
2 LED
3 Configuration and maintenance interface (below cover)
4 Connection nozzle for measuring differential pressure in the VAV box
5 Connection nozzle for measuring differential pressure in the VAV box ("+": Side with higher pressure)
6 6-core connecting cable (power and communications)
7 Disengagement of gear train
8 Rotation angle display
9 Rotation angle check screw

Gear train disengagement

Manual control of the air dampers is possible by gear train disengagement (7) when the VAV compact controller is **disconnected from the power supply**.

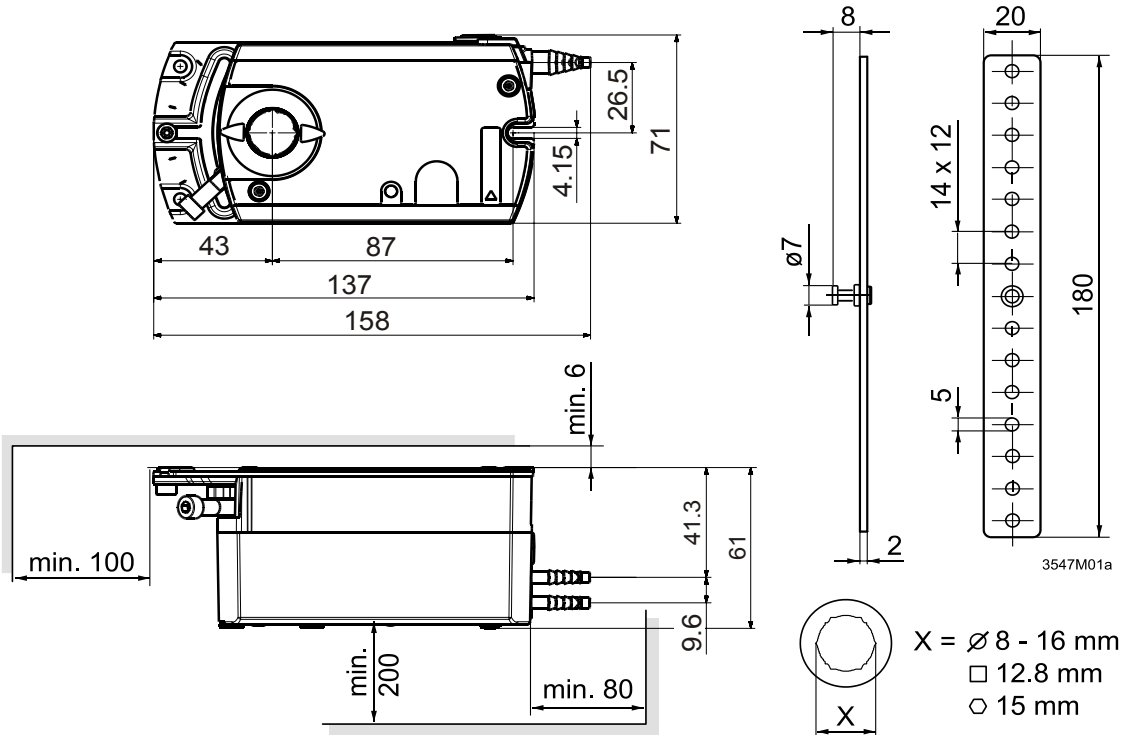
ASV181.1E/3




1 LED
2 Configuration and maintenance interface (below cover)
3 4- core connecting cable for OpenAir 3P 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

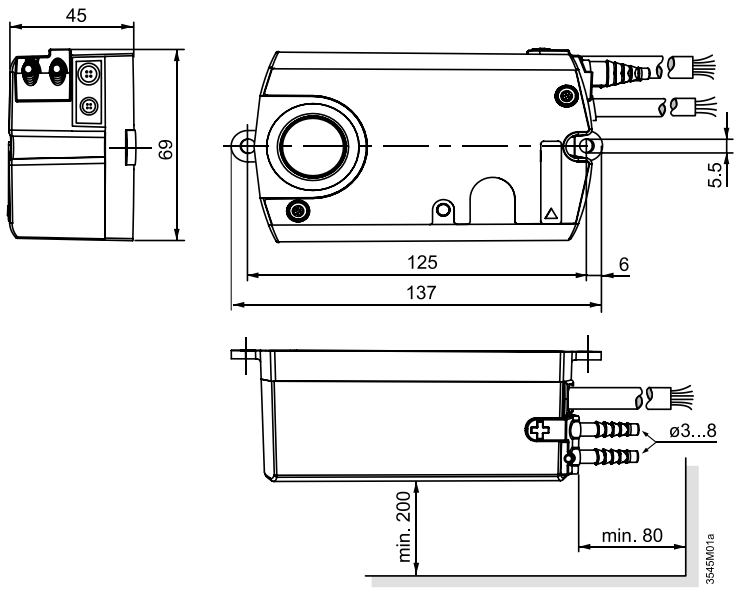
## 2.3 Dimensions

G..B181.1E/3




Measures in mm

ASV181.1E/3




Measures in mm

## 2.4 Human-machine interface

The multicolor LED states are described below.

LED state display

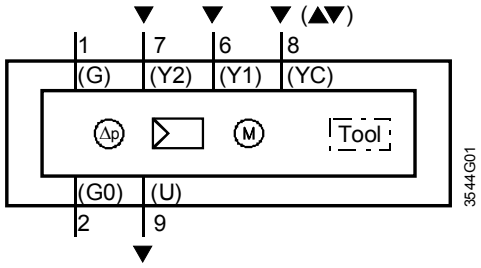
| LED display | Description |
|---|---|
| LED dark | No operating voltage |
| LED green | Faultless operation |
| LED flashes red | Connection tubes for sensor interchanged |
| LED red | Differential pressure sensor fault |

## 2.5 Internal diagrams

The VAV compact controllers are supplied with one prewired 6-core power supply and communication cable. The VAV modular controller is supplied with one prewired 6-core power supply and communication cable and one prewired 4-core connection cable for OpenAir 3P damper actuators.

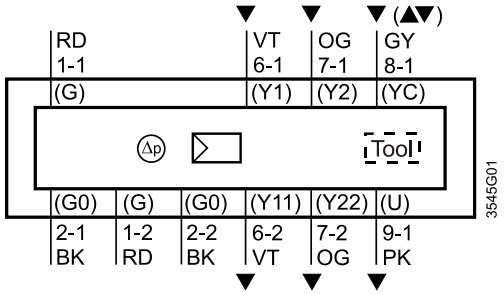
All interconnected devices must be connected to the same G0.

G..B181.1E/3




Tool = Configuration and maintenance interface
(Series A – D: 6-pin;
Series E: 7-pin)

ASV181.1E/3




Legend (G..B181.1E/3, ASV181.1E/3)

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

Additional legend (ASV181.1E/3)

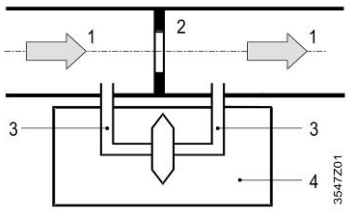
Connecting cable 2 (color-coded and labeled):

| Core designation | Core color | Terminal code | Description |
|---|---|---|---|
| 1 | red (RD) | G | System potential AC 24 V |
| 2 | black (BK) | G0 | System neutral AC 24 V |
| 6 | violet (VT) | Y11 | Positioning signal "rotation direction" (G0 switched) |
| 7 | orange (OG) | Y22 | |

[2] 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

## 2.6 Measuring principle

A measuring device for acquiring the differential pressure – usually a measuring cross, measuring orifice or Venturi tube in the airflow – represents the basis for air volume flow measurement.




*Legend*

1 Actual value of air volume flow
2 Flow resistance (schematically)
3 Measuring line
4 Differential pressure sensor

Differential pressure sensor

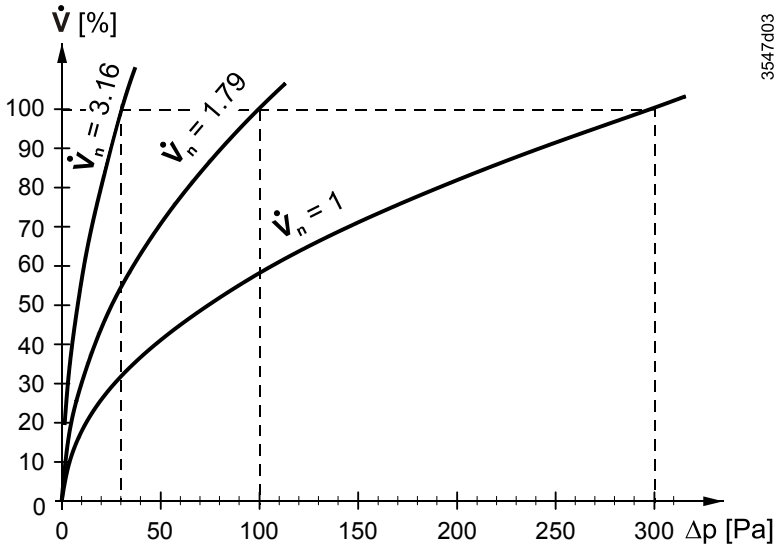
The air volume flow is measured with a differential pressure sensor. The differential pressure sensor operates long-term stable and without recalibration.

The feedback signal U can be switched between actual value of air volume flow and actual value of damper position.

**Setting the $\dot{V}_n$ characteristic value**

The VAV box manufacturer (OEM) uses the parameter $V_n$ to adjust the operating range of the differential pressure sensor (0…300 Pa) to the actual VAV box nominal pressure $\Delta p_n$at the factory. The effect of $V_n$ is illustrated in the diagram below.

Effect of $\dot{V}_n$




Calculation of $\dot{V}_n$ ($\Delta p_n$= nominal pressure)

$$\dot{V}_n = \sqrt{\frac{300\,\text{Pa}}{\Delta p_n\,\text{Pa}}}$$

Calculation example

Assume that a VAV box is designed for a nominal pressure of $\Delta p_n$ = 120 Pa. Then, $V_n$ has to be set to 1.58:

$$\dot{V}_n = \sqrt{\frac{300\ \text{Pa}}{120\ \text{Pa}}} = \sqrt{2.5} = 1.58$$

# 3 Application

## 3.1 Fields of application

**Application**

VAV compact controllers are primarily used for controlling a variable or constant air volume flow.

Application fields:

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

Note

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

In critical cases material compatibility tests should be made while giving consideration to harmful substances and concentrations.

## 3.2 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[3] | 5851 |
| Interface converter | AST11 | 5852 |
| PC software for service | ACS941[4] | 5854 |

[3] limited functionality for VAV compact controller Series E

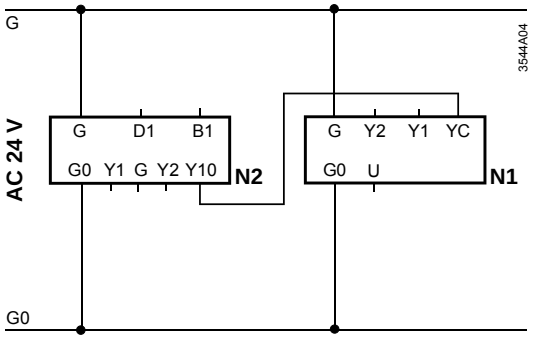
[4] download free of charge at www.siemens.com/openair

# 3.3 Application examples

## 3.3.1 Operating examples

**VAV**

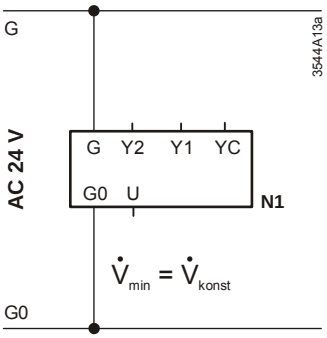
Supply / extract air control in operating mode “con”



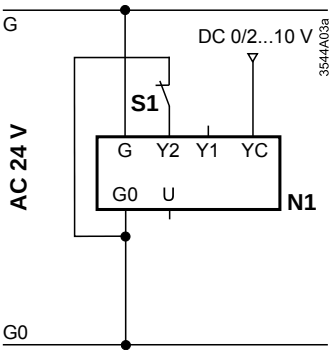

**N1** G..B181.1E/3
**N2** Supervisory controller, e.g. RCU5.. or RCU6..

**CAV**

Supply / extract air control in operating mode “con”



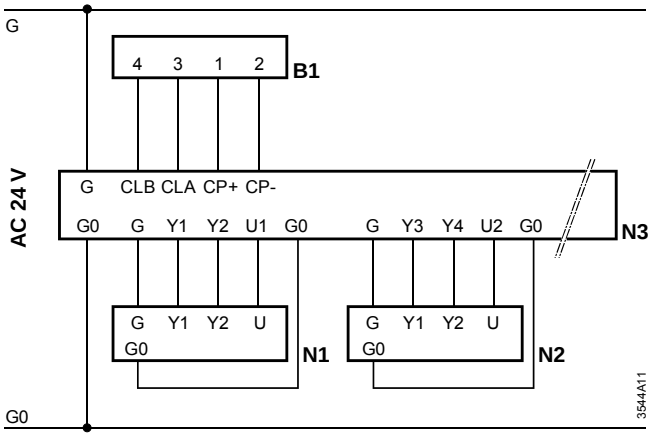

Complete shutoff in operating mode “con”




**N1** G..B181.1E/3
**S1** Window switch (Window closed – switch open)

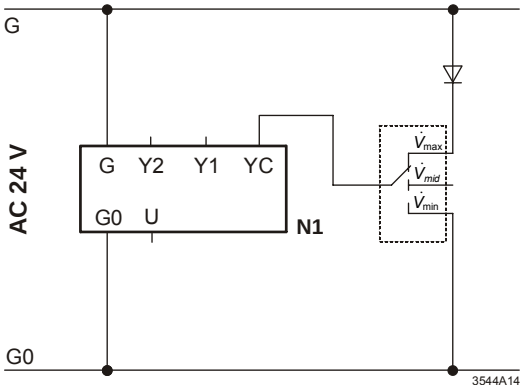
**Operating mode “3P”**

Supply / extract air control




**N1** G..B181.1E/3 –supply air–
**N2** G..B181.1E/3 –extract air–
**N3** Room temp. controller DESIGO™ RXC31.1
**B1** DESIGO™-room unit, e.g. QAX32.1

**Operating mode “STP”**




**N1** G..B181.1E/3

## 3.3.2 Connection diagrams

Legend to the connection diagrams 1 through 4

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

N2 Room temperature controller, e.g. **RCU61.1**

S1 Window switch (window closed = contact open)

Y1 OpenAir™ actuator, e.g. **GCA131.1E** (for non-spring return actuators, connection G0 is not used)

a) To actuator for "Heating"

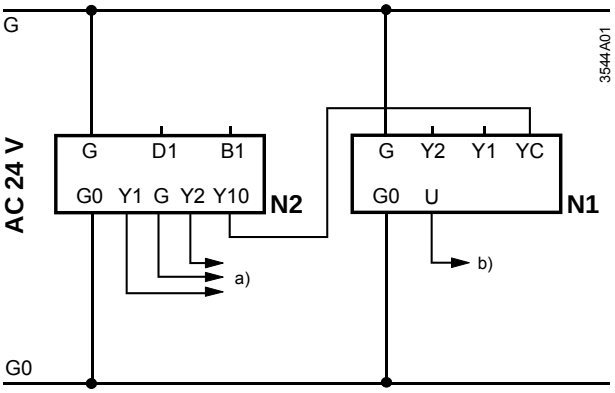
b) To slave controller

c) Crimping sleeve connection (4 x AMP butt joints are enclosed with the unit)

- 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 % on time

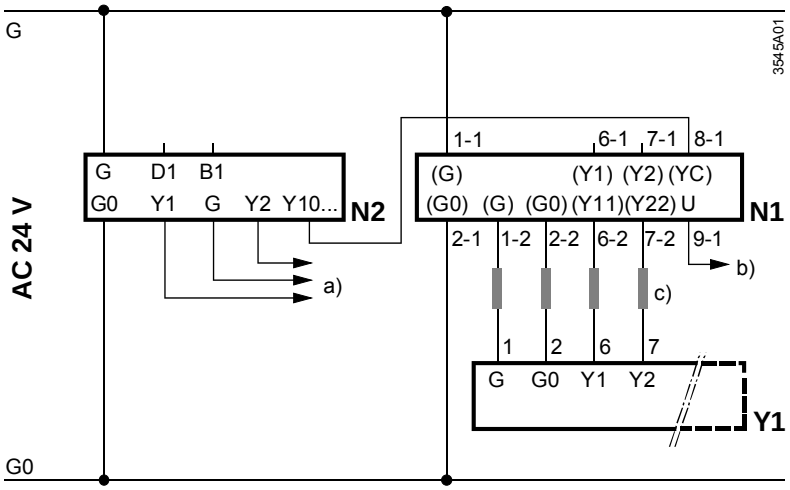
**Connection diagram 1 (G..B181.1E/3)**

Control loop without communication, e.g. with **G..B181.1E/3** “con” mode and room temperature controller **RCU61...**



**Connection diagram 2 (ASV181.1E/3)**

Control loop without communication, e.g. with **GCA131.1E** and room temperature controller **RCU61...**



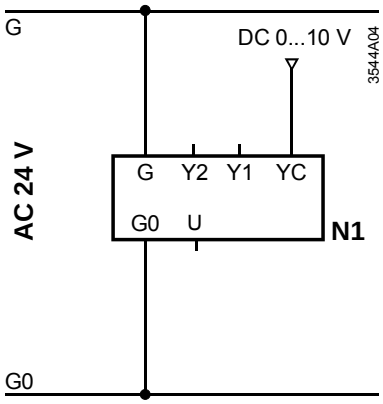

Note

**Outputs Y11, Y22, G and G0 are not short-circuit-proof!**

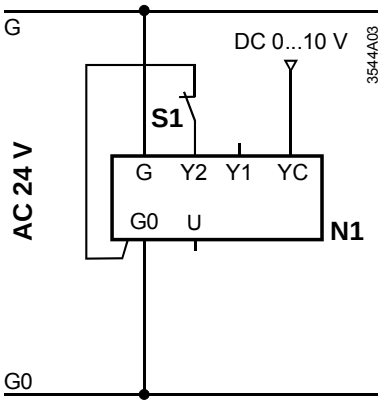
**Connection diagrams 3a through 3c**

**VAV** supply or extract air control (examples)

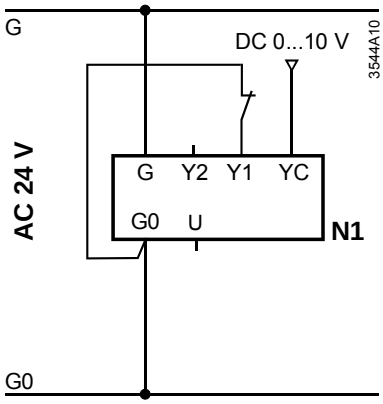
**3a:** Modulating control between $\dot{V}_{max}$ and $\dot{V}_{min}$




**3b:** Modulating control $\dot{V}_{max}$ and $\dot{V}_{min}$ and complete shutoff



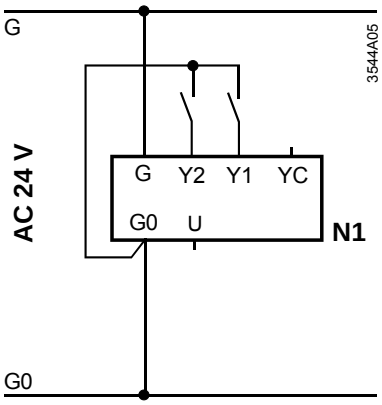

**3c:** Modulating control between $\dot{V}_{max}$ and $\dot{V}_{min}$ and fully open



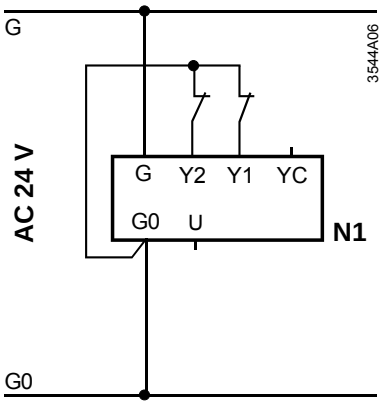
**Connection diagrams 4a through 4d**

**CAV** supply or extract air control (examples)

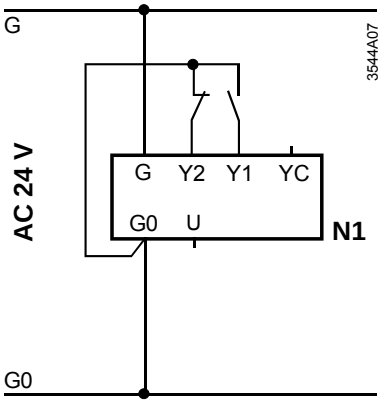
**4a:** Control to $\dot{V}_{min}$ value



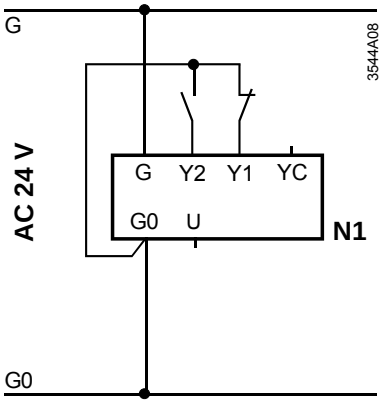

**4b:** Control to $\dot{V}_{max}$ value




**4c:** Complete shutoff

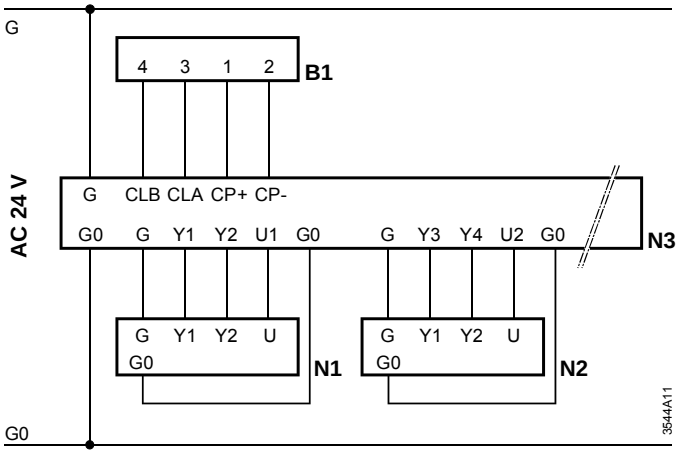



**4d:** Fully open




**Connection diagram 5**

Supply / extract air control, e.g. with **G..B181.1E/3** "3P" mode and room temperature controller DESIGO™ **RXC31.1**




*Legend to connection diagram 5*

N1 **G..B181.1E/3** – supply air –
N2 **G..B181.1E/3** – extract air –
N3 Room temperature controller DESIGO™ **RXC31.1**
B1 DESIGO™ room unit, e.g. **QAX32.1**

# 4 Electrical and mechanical installation

## 4.1 Mechanical installation / mounting

Mounting and mounting limitations

For mounting and limitations on mounting (location / position), consulting the mounting instruction M3544 ([2]) or M3545 ([4]) is mandatory.

Environmental conditions

The permissible ambient temperature and ambient humidity must be observed.

Manual control

The actuator may only be manually operated when **separated from power supply**.

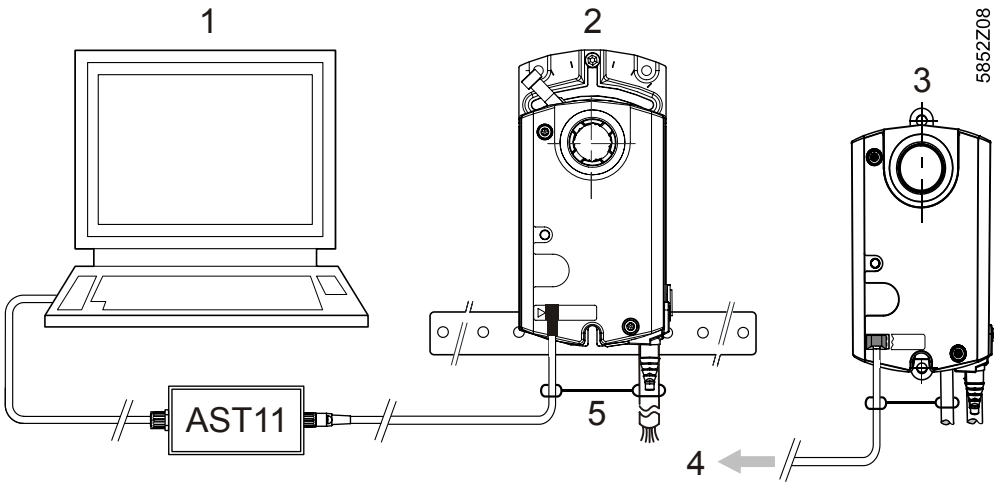
Mechanical limitation of angular rotation

If required, the angular rotation can be set by appropriate adjustment of the adjusting screw.

Strain release strip

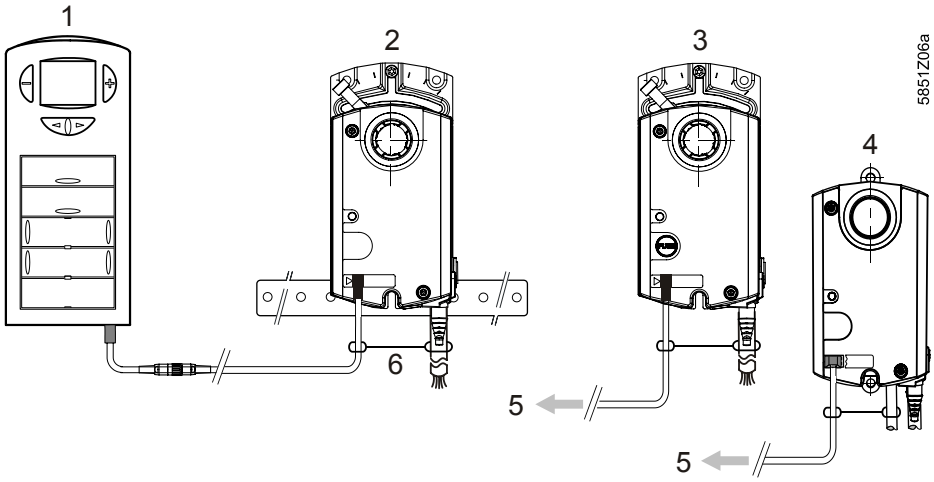
When using the connecting cable with **the 6- or 7-pin plug**, attach the strain relief strip at the cable to the VAV compact and modular controllers as shown in the following illustration.

Connection to PC with AST11




1 PC (with ACS931 or ACS941)
2 G..B181.1E/3
3 ASV181.1E/3
4 Connection to AST11
5 Strain relief strip

Connection to AST10




1 AST10
2 G..B181.1E/3
3 G..B181.1E/KN
4 ASV181.1E/3
5 Connection to AST10
6 Strain relief strip

## 4.2 Electrical installation / cabling

Introduction

Prior to wiring, observe all information in the following sections:

- „Safety notes" in section **7.1**
- „Device-specific regulation" in section **7.2**.
- „Notes on EMC optimization" in section **7.3**.

### 4.2.1 Power supply cabling

**Permissible cable lengths and cross-sectional areas**

The permissible cable lengths and cross-sectional areas depend on the VAV compact controllers' current draw and the voltage drop on the connecting lines to the actuators. The necessary cable lengths can be determined from the L/P chart (next page) or with the help of the formulas. Cf. also technical data in section **8**.

Note

When determining the cable length and the cross-sectional area, it is to ensure that the permissible tolerances of the VAV compact controllers' operating voltage are adhered to, in addition to the permissible voltage drop on the power supply and signal lines (table below).

Permissible voltage drop

The cables are to be sized depending on the type of VAV compact controller used and based on the following data:

| Type | Operating voltage | Line | Max. permissible voltage drop |
|---|---|---|---|
| G..B181.1E/3, ASV181.1E/3 | AC 24 V | G0, G | each 4 % (tot. 8 %) |

*Note on G0 line (G..B181.1E/3 and ASV181.1E/3)*

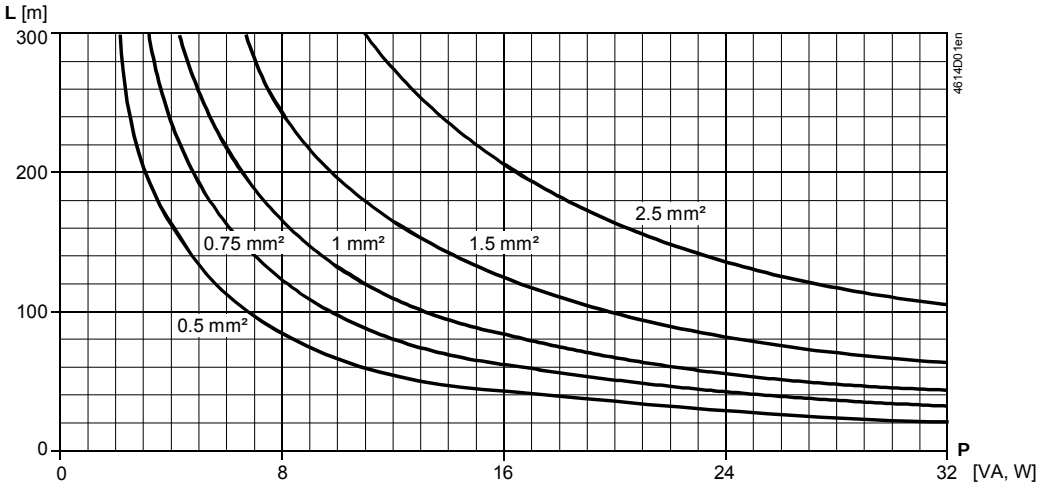
The following criteria are to be considered:

- For modulating control:
  The permissible positioning signal error, caused by the voltage drop on the G0 line, must not exceed 1 %
- The voltage drop on the G0 line, caused by surges in the actuator's rectifier circuit, must not exceed 2 Vpp
- If the G0 line is not correctly sized, actuator load changes can produce oscillations caused by changes in the DC voltage drop.
- The supply voltage loss at AC 24 V must not exceed 8 % (4 % over the G0 line)
- **The DC voltage drop on the G0 line** is caused by:
  - Unsymmetry in the internal actuator power supply (> DC 8 mA)
  - Positioning signal current DC 0.1 mA (from Y = DC 0…10 V) and
  - Output signal current DC 1 mA (from U = DC 0…10 V).

**The DC voltage drop can be ignored for the following considerations.**

**L/P chart for AC 24 V**

The chart below applies to AC 24 V operating voltage and shows the permissible cable length **L** as a function of power **P**, and the cross-sectional areas as a parameter.

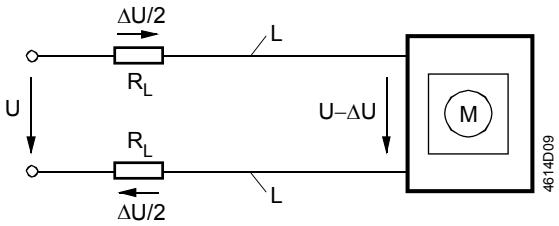



Note on chart

The values in [VA, W] on the P-abscissa are allocated to the permissible voltage drops (∆U/2U = 4 %) on line length L as per the above table and the basic diagram.

P is the decisive power consumption of all VAV compact controllers connected in parallel.

Basic diagram: Voltage drop on the supply lines




**Formulas for cable length**

The following formulas can be used to calculate the maximum cable lengths.

| Operating voltage | Permissible voltage drop per line | Formula for cable length |
|---|---|---|
| AC 24 V | 4 % of AC 24 V | $L = \frac{1313 \bullet A}{P}$ [m] |
| | 1 % of DC 10 V | $L = \frac{5.47 \bullet A}{I(DC)}$ [m] |

A Cross-sectional area in [$mm^2$]
L Permissible cable length in [m]
P Power consumption in [VA] or [W];
refer to the VAV compact controllers' type field
I(DC) DC current portion on G0 line in [A]

**Example:** Power consumption and permissible voltage drop (1 VAV compact controller)

| Operating voltage | Power consumption | Perm. voltage drop for line... 1 (G), 2 (G0) |
|---|---|---|
| AC 24 V | 3 VA | 4 % of AC 24 V |

**Example:** Parallel connection of 4 VAV compact controllers

Determine the cable lengths for 4 VAV compact controllers operating on AC 24 V. Decisive for sizing the cable are only the AC currents on lines 1 (G) and 2 (G0). Maximum permissible voltage drop = **4 % per line**.

- Consumption = 4 x 3 VA = 12 VA
- Line current = 4 x 0.125 A = 0.5 A

Permissible single cable length for G and G0:

- 164 m with a cross-sectional area of 1.5 $mm^2$
- 274 m with a cross-sectional area of 2.5 $mm^2$

# 5 Parameterization and operating modes

## 5.1 Settings and user interaction

The VAV compact controllers can be parameterized with configuration tools (cf. “equipment combinations”)[5].

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 |
| | POS [6] | Position display of air damper | |
| | 0…10 V | | 0…10 V |
| | 2…10 V | | |
| | 0.05…5 s (Resolution 0.01 s) | Time constant actual value U | 1 s |

Settings for adaptive positioning (for special opening ranges)

| Parameter | Setting | Description | Siemens factory setting |
|---|---|---|---|
| ADP [7] | Off | Default operating mode for position display of air damper (mapping 0°…90° → 0…100 %) | Off |
| | On | Adaptive operating mode for position display of air damper (mapping e.g. 0°…60° → 0…100 %) | |

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

[5] For connections at the configuration and maintenance interface please consider that voltages >10 V at YC can’t be processed.

[6] Not applicable for ASV181.1E/3

[7] Not applicable for ASV181.1E/3

## 5.2 Operating modes

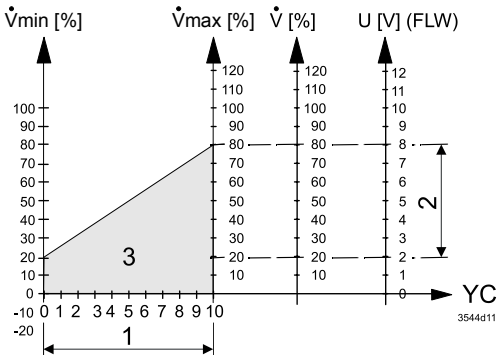
**Operating mode “con”**

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

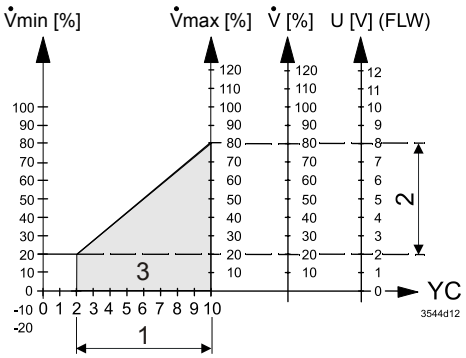
| Parameter | Setting | Description | Siemens factory setting |
|---|---|---|---|
| Type | con | VAV or CAV mode | con |
| Setpoint YC | 0…10 V<br>2…10 V | Air volume flow reference signal (setpoint) | 0…10 V |
| $\dot{V}_n$ | 1.00…3.16 | Characteristic value for nominal air volume flow, set by manufacturer (OEM) | 1.00 |
| $\dot{V}_{max}$ | 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<br>**r** = Clockwise (CW)<br>**L** = Counterclockwise (CCW) | **r** |

Variable air volume (VAV) control

The VAV compact 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<br>Dir **L** → rotation CCW<br>**“Fully open“** | VAV control with DC 0/2…10 V setpoint compensation | Dir **r** → rotation CCW<br>Dir **L** → rotation CW<br>**“Fully closed“** |

Note

Setting $\dot{V}_{min}$ ≤0 % and YC = 0 V drives the actuator to position “fully closed”.

**Constant air volume (CAV) control**

VAV compact 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 operating mode (Type "con")** | | | | |
|---|---|---|---|---|
| YC | open | | | |
| Y1 | open | G0 | G0 | open |
| Y2 | open | open | G0 | G0 |
| Action | $\dot{V}_{min}$ control | Dir **r** → rotation CW<br>Dir **L** → rotation CCW<br>**"Fully open"** | $\dot{V}_{max}$ control | Dir **r** → rotation CCW<br>Dir **L** → rotation CW<br>**"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 compact 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<br>**r** = Clockwise (CW)<br>**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 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 of the VAV compact controllers is deactivated.

The air damper 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<br>Dir **L** → rotation CCW<br>**Damper opens** | Dir **r** → rotation CCW<br>Dir **L** → rotation CW<br>**Damper closes** | Dir **r** → rotation CCW<br>Dir **L** → rotation CW<br>**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<br>Dir **L** → rotation CCW<br>**"Fully open"** | CAV step mode | Dir **r** → rotation CCW<br>Dir **L** → rotation CW<br>**"Fully closed"** |

Note

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

### 5.2.1 Calculation formulas

The parameters are based on the following formulas:

Calculation $\dot{V}_n$ ($\Delta p_n$= nominal pressure)

$$\dot{V}_n = \sqrt{\frac{300\ Pa}{\Delta p_n\ Pa}}$$

300 Pa is the upper limit of the operating range of the differential pressure sensor. The nominal pressure is the differential pressure in the VAV box at the given nominal volume flow, determined by the OEM specification, cf. also section **2.6**.

Min. and max. values

$$V_{min}\ [\%] = \frac{\text{min. volume flow}\ [m^3/h]}{\text{nom. volume flow}\ [m^3/h]} \cdot 100\ [\%]$$

$$V_{max}\ [\%] = \frac{\text{max. volume flow}\ [m^3/h]}{\text{nom. volume flow}\ [m^3/h]} \cdot 100\ [\%]$$

Actual value as function of setpoint and min. / max. limits

$$\text{Actual value}\ [\%] = \frac{\text{Setpoint}\ [\%] \cdot (V_{max} - V_{min})[\%]}{100\ [\%]} + V_{min}\ [\%]$$

Actual value as function of differential pressure

$$FLW\ [\%] = f(\Delta p) = 100\ [\%] \cdot Vn \cdot \sqrt{\frac{\Delta p\ [Pa]}{300\ [Pa]}}$$

Differential pressure as function of actual value

$$\Delta p\ [Pa] = f(FLW) = 300\ [Pa] \cdot \left(\frac{FLW\ [\%]}{100 \cdot Vn}\right)^2$$

## 5.3 Configuration and maintenance tools

Configuration and retrieval of device parameters can be accomplished with the following tools:

- Using the PC software ACS941 [6] or ACS931 [5] together with the interface converter AST11 [6] via the configuration and maintenance interface of the VAV compact controller or
- Using the handheld tool AST10 [5].

### 5.3.1 PC software ACS941 and ACS931

Areas of use

The PC software ACS941 is designed for service and maintenance staff and is used for setting and displaying the parameter values on a PC. Instructions for use of this software can be found in datasheet N5854 ([8]). The software is available free of charge at www.siemens.com/openair.

The PC software ACS941 allows to set or to display the parameters as listed in section **9.2**. The software supports trend functions and allows comparing the values set by the OEM with the values currently stored in the device. Thus, manipulations by parties other than the OEM can be detected.

Main window of ACS941


Next to the PC software ACS941, an OEM version ACS931 ([7]) with extended functionality is available as well. ACS931 allows setting the parameter $V_n$.

### 5.3.2 Handheld tool AST10

Functionality

Using the handheld tool AST10, a limited set of parameters ($V_{min}$, $V_{max}$, DIR) can be set or retrieved. Instructions for use of the handheld tool AST10 can be found in data sheet N5851 and in the manual B5851 ([5]). For VAV compact controllers Series E, some limitations apply: Adaptive Positioning or setting the elevation is not supported by the AST10.

Design

The device is designed for portable use on-site. Power supply and establishing the communication between AST10 and a VAV compact controller are accomplished with a 3-core connection cable.

# 5.4 Setting examples

## 5.4.1 Symbols and parameters

Volume symbols with “point” ( $\dot{V}$ ) and without point (V) shall have the same meaning, i.e., they all shall refer to volume flows.

Legend to the setting examples

| | |
|---|---|
| $\dot{V}$ | Volume flow [%] |
| $\dot{V}_{min}$ | Minimum volume flow [%] |
| $\dot{V}_{max}$ | Maximum volume flow [%] |
| $\dot{V}_{supply\_air}$ | Volume flow of supply air controller [%] |
| $\dot{V}_{extract\_air}$ | Volume flow of extract air controller [%] |
| $\dot{V}_{master}$ | Volume flow of supply air controller (Master) [%] |
| $\dot{V}_{slave}$ | Volume flow of extract air controller (Slave) [%] |

## 5.4.2 Min/max control by the supervisory controller

When setting the minimum / maximum air volume flow in the supervisory controller, the VAV compact controller has to be configured with $\dot{V}_{min}$ = 0% and $\dot{V}_{max}$ = 100 %.

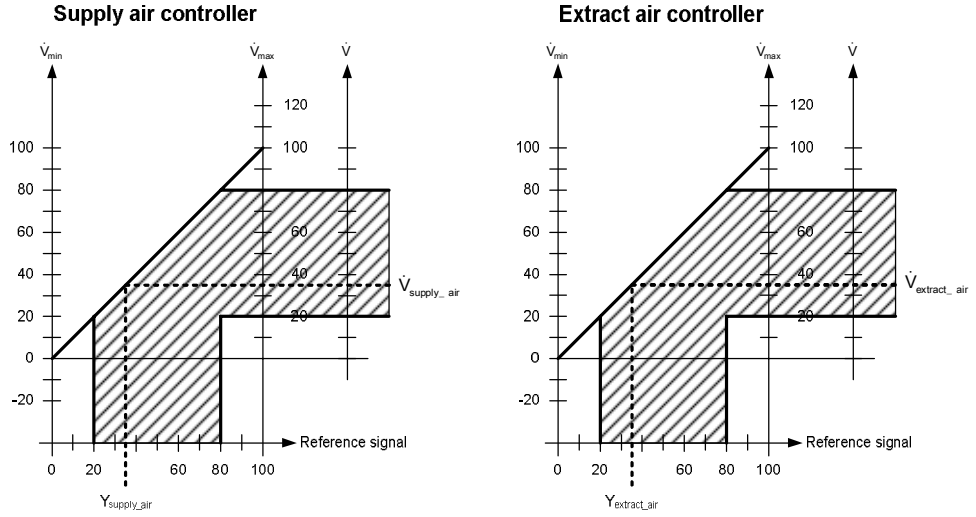
**Setting example A1**

**VAV ratio control 1 : 1**

| | **Supply air** | | **Extract air** | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | **20 %** | **80 %** | **20 %** | **80 %** |
| VAV compact controller | 0 % | 100 % | 0 % | 100 % |

Reference signal: $Y_{supply\_air} = Y_{extract\_air} = 35$ %

Result: $V_{supply\_air} = V_{extract\_air} = 35$ %



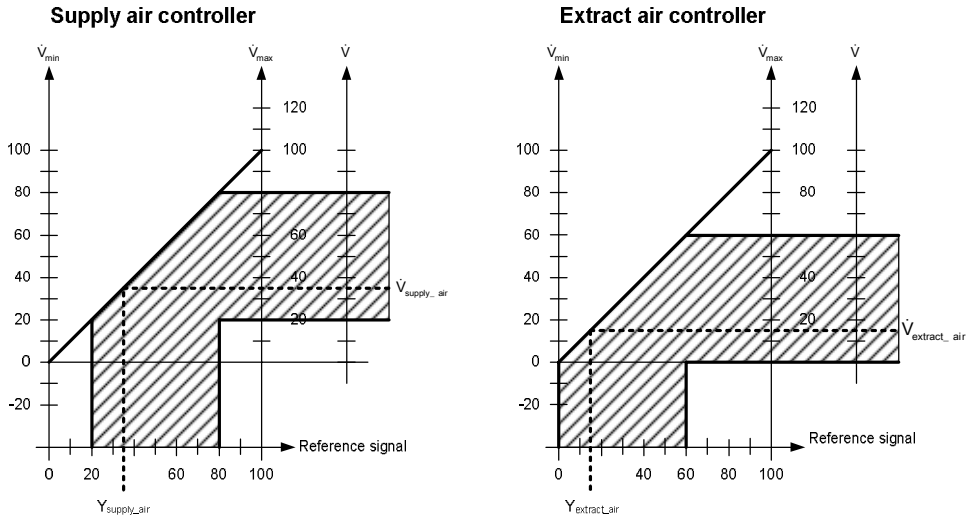
**Setting example A2**

**VAV ratio control, 20 % constant excess supply air volume flow (positive pressure in the room)**

| | Supply air | | Extract air | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | **20 %** | **80 %** | **0 %** | **60 %** |
| VAV compact controller | 0 % | 100 % | 0 % | 100 % |

Reference signal: $Y_{supply\_air}$ = 35 %, $Y_{extract\_air}$ = $Y_{supply\_air}$ - 20 % = 15 %

Result: $V_{supply\_air}$ = 35 %, $V_{extract\_air}$ = 15 %



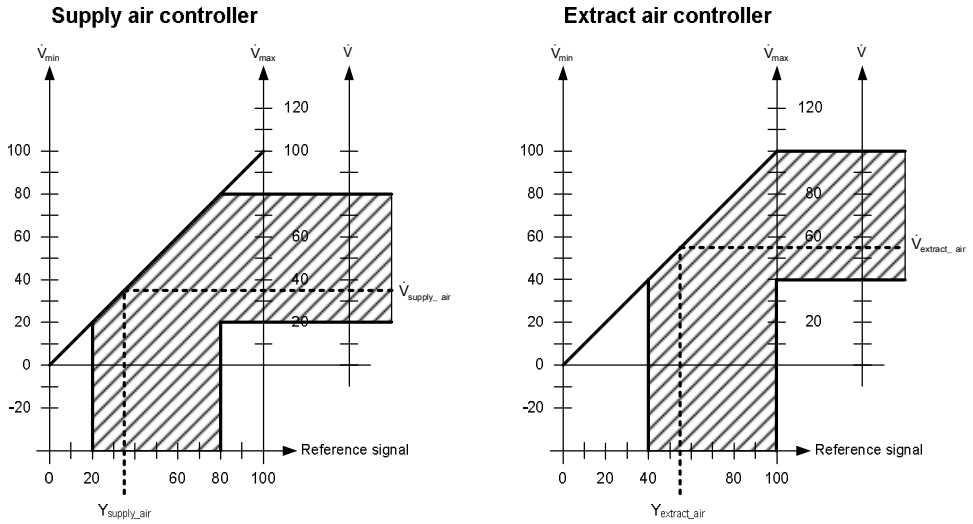

**Setting example A3**

**VAV ratio control, 20 % constant excess extract air volume flow (negative pressure in the room)**

| | Supply air | | Extract air | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | **20 %** | **80 %** | **40 %** | **100 %** |
| VAV compact controller | 0 % | 100 % | 0 % | 100 % |

Reference signal: $Y_{supply\_air}$ = 35 %, $Y_{extract\_air}$ = $Y_{supply\_air}$ + 20 % = 55 %

Result: $V_{supply\_air}$ = 35 %, $V_{extract\_air}$ = 55 %



### 5.4.3 Min/max control by the VAV compact controller

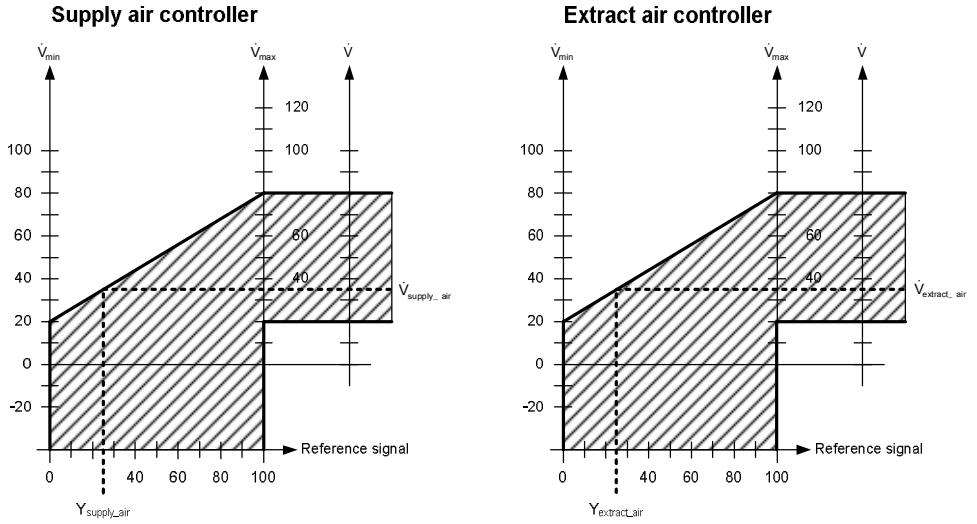
When setting the minimum / maximum air volume flow in the VAV compact controller, the supervisory controller must be set to $V_{min}$= 0% und $V_{max}$ = 100 %. With this setting, the supervisory controller reference signal for both the supply air and extract air controller is the same. Thus, supply air / extract air control with a single reference signal is possible.

**Setting example B1** **VAV ratio control 1 : 1**

| | **Supply air** | | **Extract air** | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | 0 % | 100 % | 0 % | 100 % |
| VAV compact controller | **20 %** | **80 %** | **20 %** | **80 %** |

Reference signal: $Y_{supply\_air} = Y_{extract\_air} = 25$ %

Result: $V_{supply\_air} = V_{extract\_air} = 35$ %

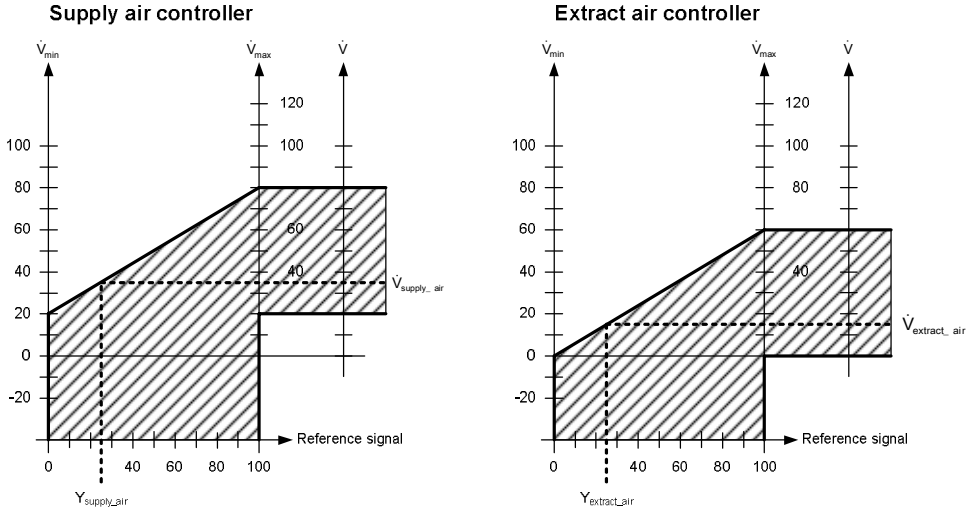


**Setting example B2** **VAV ratio control, 20 % constant excess supply air volume flow (positive pressure in the room)**

| | Supply air | | Extract air | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | 0 % | 100 % | 0 % | 100 % |
| VAV compact controller | **20 %** | **80 %** | **0 %** | **60 %** |

Reference signal: $Y_{supply\_air} = Y_{extract\_air} = 25\ \%$

Result: $V_{supply\_air} = 35\ \%$, $V_{extract\_air} = 15\ \%$

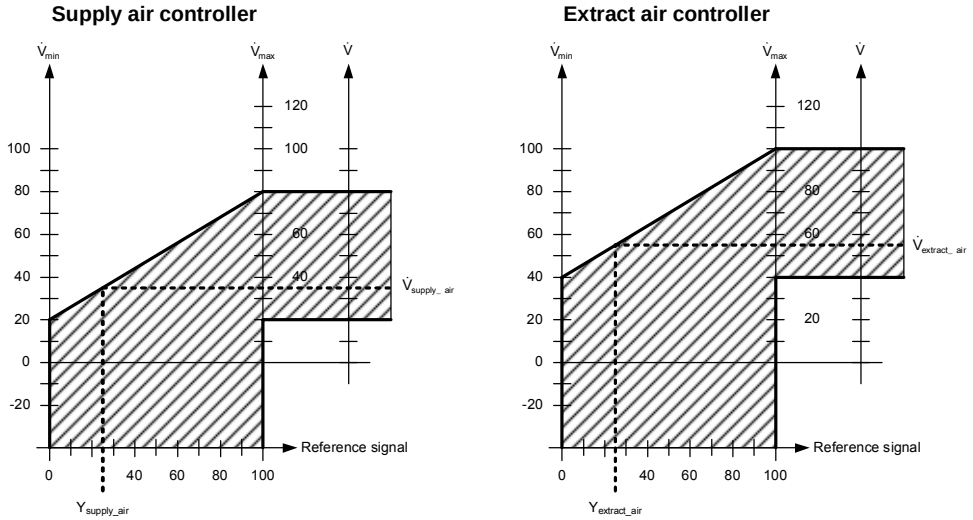



**Setting example B3** **VAV ratio control, 20 % constant excess extract air volume flow (negative pressure in the room)**

| | Supply air | | Extract air | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | 0 % | 100 % | 0 % | 100 % |
| VAV compact controller | **20 %** | **80 %** | **40 %** | **100 %** |

Reference signal: $Y_{supply\_air} = Y_{extract\_air} = 25\ \%$

Result: $V_{supply\_air} = 35\ \%$, $V_{supply\_air} = 55\ \%$



### 5.4.4 Master/Slave operating mode

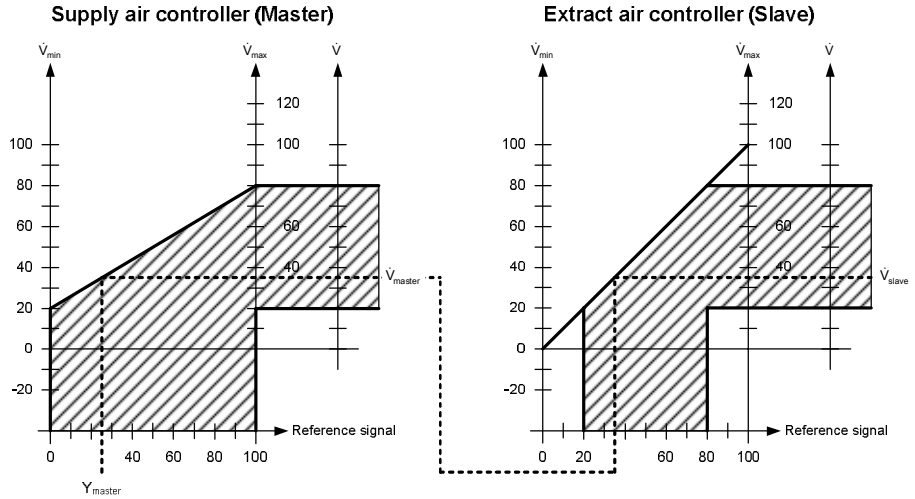
To control supply air and extract air in master/slave operating mode, the actual value signal of the master controller (supply air) is the reference signal for the slave controller (extract air).

**Setting example C1** **VAV ratio control 1 : 1**

| | **Supply air (Master)** | | **Extract air (Slave)** | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | 0 % | 100 % | 0 % | 100 % |
| VAV compact controller | **20 %** | **80 %** | **0 %** | **100 %** |

Reference signal: $Y_{master}$ = 25 %

Result: $V_{master} = V_{slave}$ = 35 %



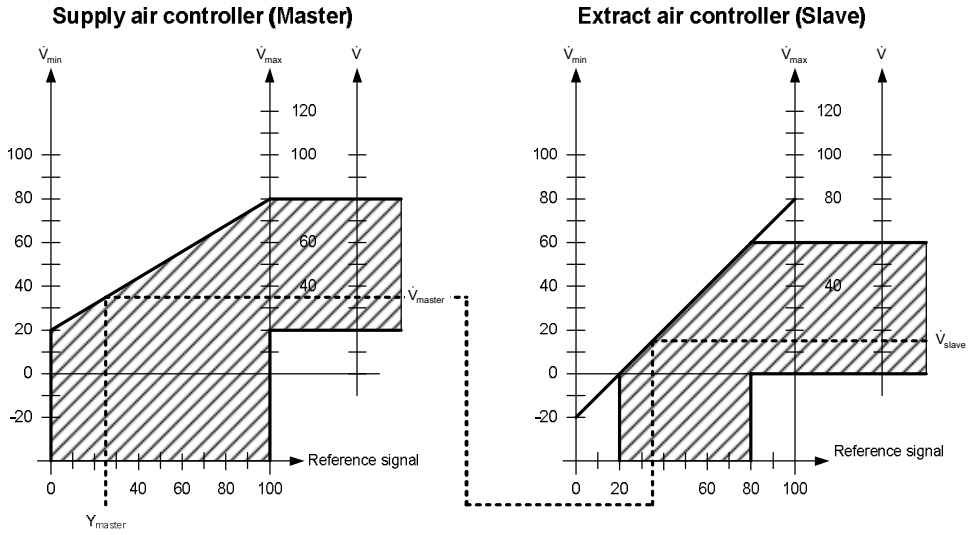
**Setting example C2**

**VAV ratio control, 20 % constant excess supply air volume flow (positive pressure in the room)**

| | Supply air (Master) | | Extract air (Slave) | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | 0 % | 100 % | 0 % | 100 % |
| VAV compact controller | **20 %** | **80 %** | **-20 %** | **80 %** |

Reference signal: $Y_{master}$ = 25 %

Result: $V_{master}$ = 35 %, $V_{slave}$ = 15 %



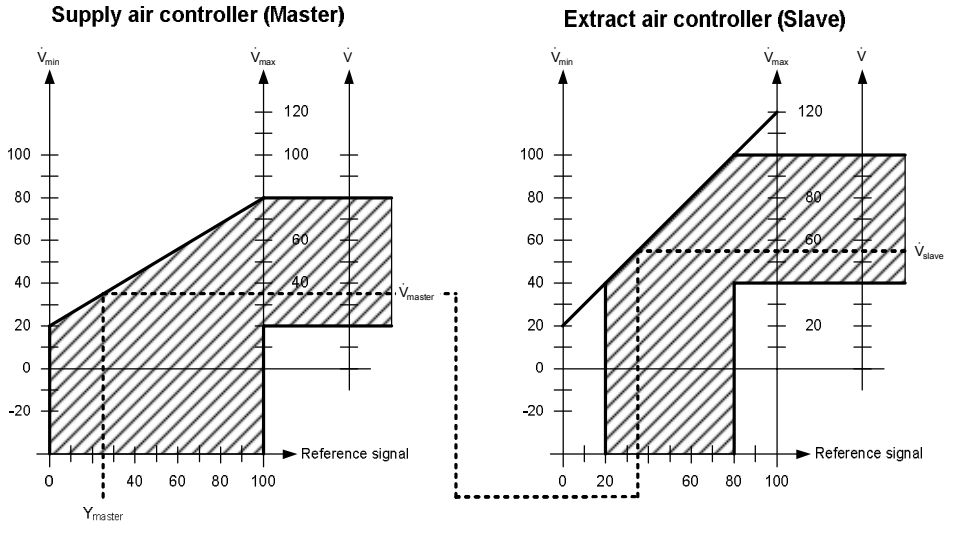

**Setting example C3**

**VAV ratio control, 20 % constant excess extract air volume flow (negative pressure in the room)**

| | Supply air (Master) | | Extract air (Slave) | |
|---|---|---|---|---|
| | $\dot{V}_{min}$ | $\dot{V}_{max}$ | $\dot{V}_{min}$ | $\dot{V}_{max}$ |
| Supervisory controller | 0 % | 100 % | 0 % | 100 % |
| VAV compact controller | **20 %** | **80 %** | **20 %** | **120 %** |

Reference signal: $Y_{master}$ = 25 %

Result: $V_{master}$ = 35 %, $V_{slave}$ = 55 %



# 6 Commissioning

## 6.1 Documentation of engineering and commissioning

Use of planning and commissioning protocol recommended

It is highly recommended to document all planning data and settings in a way that is easily accessible after a long interval. Especially if special calculated parameters or plant-specific adaptations had to be made during engineering and commissioning, these should be clearly noted.

## 6.2 Commissioning

The type field on the VAV box usually provides information about the configuration made in the factory.

The following notes are intended to help in the case of malfunctioning of VAV compact controller or if parameters were changed on site:

- Check mechanical settings according to the data specified for the plant in question, especially whether the dampers are airtight in their fully closed position
- Check direction of rotation (opening direction).
- Dampers or actuator can be manually overridden by moving the red slider for disengaging the gear train, but only when power is turned off.
- Make certain the actuator cannot be twisted and that it cannot jam.
- Check to ensure that the tubes for measuring the differential pressure are correctly connected.
- To check the setting values of $\dot{V}_n$, $\dot{V}_{max}$, $\dot{V}_{min}$, the operating mode (“con”, “3P” or “STP”) and the actuator’s opening direction (counterclockwise or clockwise), the **AST10** setting unit or **ACS941** software with **AST11** interface converter is required.
  If digital setpoints or control command (on, stop, off) are predefined via AST10 or ACS941, wait one minute after disconnecting the **AST10** or **AST11** from the VAV compact controller for YC, Y1 and Y2 to work as specified.

Devices series A and B (as of series C, disconnection is no longer required)

- If the “Operating mode” parameter is changed, the supply of power (AC 24 V) to the VAV compact controller must be disconnected for a short moment, enabling the change to become effective.

Devices until index D

- The sensor output signal only becomes valid 2 minutes after supplying power (AC 24 V) or after a power cut. During this time, the VAV compact controller performs a zero-point calibration of the differential pressure sensor .

- If communication with the **AST10** / **AST11** is made via the YC core, the relevant cores of parallel wired VAV compact controllers must be disconnected for the period of time communication is active!
- For more detailed information, please refer also to AST10 Operating Instructions B5851 ([5]).

# 7 Safety and EMC optimization

## 7.1 Safety notes


This section contains general regulations and the regulations for mains and operating voltage. It also provides important information regarding your own safety and that of the entire plant.

⚠ Safety note

The warning triangle to the left means that observance of all relevant regulations and notes is mandatory. If ignored, injury to persons or damage to property may result.

⚠ General regulations

Observe the following regulations during engineering and project execution:

- Electrical and high-voltage directives of the respective country
- Other country-specific regulations
- House installation regulations of the respective country
- Regulations issued by the utility
- Diagrams, cable lists, disposition drawings, specifications and instructions as per the customer or the contractor in charge
- Third-party regulations issued by general contractors or building operators

Safety

The electrical safety of building automation and control systems supplied by Siemens depends primarily on the use of **extra low-voltage with safe isolation from mains voltage.**

SELV, PELV

Depending on the type of extra low-voltage earthing, a distinction is to be made between SELV and PELV as per HD 384, “Electrical plants in buildings“:
**Unearthed** = **SELV** (**S**afety **E**xtra **L**ow Voltage)
**Earthed** = **PELV** (**P**rotective **E**xtra **L**ow **V**oltage)

⚠ Earthing of G0 (system neutral)

Observe the following for grounding G0:
As a rule, earthing and non-earthing of G0 is permissible for AC 24 V operating voltage. Decisive are the local regulations and customary procedures. For functional reasons, earthing may be required or not permissible.

Recommendation on earthing G0

**AC 24 V systems should always be earthed** if this does not contradict the manufacturer’s specification.
To avoid earth loops, systems with **PELV may only be earthed at one point of the system,** normally by the transformer, unless otherwise specified.

Operating voltage AC 24 V

With regard to AC 24 V operating voltage, the following regulations must be complied with:

| | **Regulation** |
|---|---|
| Operating voltage AC 24 V | The operating voltage must comply with the requirements for SELV or PELV:<br>• Permissible deviation of AC 24 V nominal voltage at the actuators: +/–20 % |
| Specification on AC 24 V transformers | • Safety isolating transformers as per EN 61558, with double insulation, designed for 100 % on time to power SELV or PELV circuits<br>• Determine the transformer's output by adding up the power consumption in VA of all actuators used<br>• For efficiency reasons, the power drawn from the transformer should amount to at least 50 % of the nominal load<br>• The transformer's nominal capacity must be at least 25 VA. With smaller transformers, the ratio of no-load voltage and full load voltage becomes unfavorable (> + 20 %) |
| Fusing of AC 24 V operating voltage | Secondary side of transformer:<br>• According to the effective load of all connected devices<br>• Line G (system potential) must always be fused<br>• Where required, line G0 (system neutral) also |

## 7.2 Device-specific regulations

⚠ Device safety

Among other aspects, the safety of devices is ensured by extra low-voltage power supply (AC 24 V) as per **SELV** or **PELV**.

**Electrical parallel connection**

Electrical parallel connection of VAV compact controllers provided the required operating voltage tolerance is observed. The **voltage drops of the supply lines** must be taken into consideration.

Mechanical coupling of the devices is not permitted.


Warning, maintenance

**Do not open the actuator!**
The device is maintenance-free. Only the manufacturer may carry out any repair work.

## 7.3 Notes on EMC optimization

Running cable in a duct

Make sure to separate high-interference cables from equipment susceptible to interference.

Cable types

- Cable causing interference: Motor cables, especially motors used with VSDs, energy cables
- Cables susceptible to interference: Control cables, low-voltage cables, interface cables, LAN cables, digital and analog signal cables

Cable segregation

- You can run both types of cable in the same duct, but in different compartments
- If ducting with 3 closed sides and a partition is not available, separate the interference-emitting cables from other cables by a minimum of 150 mm, or route in separate ducting
- Cross high-interference cables with equipment susceptible to interference only at right angles
- If, in exceptional cases, signal and interference-emitting power cables are run in parallel, the risk of interference is high. In that case, limit the cable length of the DC 0/2...10 V positioning signal line for modulating actuators

Unshielded cables

In general, the use of unshielded cables is recommended. When selecting unshielded cables, the manufacturer's installation recommendations have to be followed. In general, **unshielded twisted pair cables** for building services plant (including data lines) offer adequate EMC characteristics, plus the advantage that no provision is required for coupling to earth.

# 8 Technical data

| | | |
|---|---|---|
| ⚠ **Power supply AC 24 V** (SELV/PELV) G and G0 | | |
| G..B181.1E/3, ASV181.1E/3 | Operating voltage / frequency | AC 24 V ±20 % / 50/60 Hz |
| G..B181.1E/3 | Power consumption at | |
| | Actuator holds | 1 VA / 0.5 W |
| | Actuator rotates | 3 VA / 2.5 W |
| ASV181.1E/3 | Power consumption | 1 VA / 0.5 W |
| **Damper actuator (G..B181.1E/3)** | | |
| | Nominal torque | 5 Nm (GDB) / 10 Nm (GLB) |
| | Maximum torque | <7 Nm (GDB) / <14 Nm (GLB) |
| | Nominal rotation angle / maximum rotation angle | 90° / 95° ±2° |
| | Running time for nominal rotation angle 90° | 150 s (50 Hz) / 125 s (60 Hz) |
| | Direction of rotation (adjustable with e.g. **ACS941**) | Clockwise / counter clockwise |
| **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 open | 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 or later | **7-pin**, grid 2.00 mm |
| **Power / communication cable** | | |
| **Connection cable** | Cable length | 0.9 m |
| (G..B181.1E/3, ASV181.1E/3) | Number of cores and cross-sectional area | 6 x 0.75 mm$^2$ |
| **Actuator control cable** | Cable length | 0.3 m |
| (ASV181.1E/3) | Number of cores and cross-sectional area | 4 x 0.75 mm$^2$ |
| ⚠ **Degree of protection and safety class** | | |
| | Degree of protection acc. to EN 60529 | IP54 |
| | (cf. mounting instructions M3544 / M3545) | |
| | 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 | |

| | GDB181.1E/3 | GLB181.1E/3 | ASV181.1E/3 |
|---|---|---|---|
| EU Conformity (CE) | A5W00003842 [1)] | A5W00000176 [1)] | A5W00004387 [1)] |
| | GDB181.1E/3 | GLB181.1E/3 | ASV181.1E/3 |
| RCM Conformity | A5W00003843 [1)] | A5W00000177 [1)] | A5W00004388 [1)] |
| Environmental compatibility | CM2E4634E [1)] | | CM2E3545 [1)] |
| | The product environmental declaration contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal). | | |

| | | |
|---|---|---|
| **Dimensions** | | |
| G..B181.1E/3 | W x H x D | 71 x 158 x 61 mm |
| ASV181.1E/3 | W x H x D | 68 x 135 x 45 mm |
| **Suitable drive shafts** | | |
| Type of drive shaft | Round | 8...16 mm |
| | Round, with centering element | 8...10 mm |

| | | |
|---|---|---|
| | Square | 6...12.8 mm |
| | Hexagonal | <15 mm |
| | Min. drive shaft length | 30 mm |
| | Max. shaft hardness | <300 HV |
| **Weight** | | |
| G..B181.1E/3 | Without packaging | 0.6 kg |
| ASV181.1E/3 | Without packaging | 0.28 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

# 9 Parameters

The VAV compact controllers can be accessed via the configuration and maintenance tool ACS931, ACS941, and AST10.

## 9.1 Parameter description

| Parameter | Description |
|---|---|
| Nominal volume flow [$m^3$/h] | Nominal air volume flow for ventilating a zone or a room. This value is determined by size, occupation etc. of a zone or room. VAV boxes are ordered through an OEM according to this nominal volume flow and min. / max. volume flow settings. |
| Minimum / maximum volume flow [%] | These values limit the nominal volume flow. Their effect is described in section **5.4**. |
| Elevation above sea level [m] | This value enhances the accuracy of the differential pressure sensor. |
| Opening direction | Device-specific parameter, to be set by the OEM. It indicates the opening direction of air damper (Clockwise (CW) or counterclockwise (CCW)). |
| Adaptive positioning | This function is intended for VAV boxes with a damper opening range other than 0°..90°.<br>If set to "On" (adaptive positioning enabled), the actuator determines the actual opening angle during start-up. The actual range (e.g. 15°..75°) is then mapped to the 0..100 % positioning signal.<br>If set to "Off", 0..100 % is interpreted as 0..90°. |
| Vn | Characteristic value for nominal air volume flow, preset by manufacturer (OEM). This parameter is described in section **2.6**. |

## 9.2 Device parameters (ACS931 / ACS941 / AST10)

| Designation* | Setting | Factory setting | Can be set with |
|---|---|---|---|
| Maximum air volume flow (Vmax) | 20...120 % | 100 % | ACS931, ACS941, AST10 |
| Minimum air volume flow (Vmin) | -20...100 % | 0 % | ACS931, ACS941, AST10 |
| Opening direction (DIR) | r or L<br>(CW or CCW) | r<br>(CW) | ACS931, ACS941, AST10 |
| Adaptive positioning | Off or on | Off | ACS931, ACS941 |
| Nominal air volume flow | 0 …. 65'535 $m^3$/h | 0 $m^3$/h | ACS931, ACS941 |
| Elevation above sea level | 0…5000 m<br>(in 500 m steps) | 500 m | ACS931, ACS941 |
| Running time | 30 … 150 s | 150 s | ACS931, ACS941 |
| Vn | 1.00 ... 3.16 | 1.00 | ACS931 |

*in brackets: designation for AST10, if different

# 10 Environmental compatibility and disposal

General notes

The products were developed and manufactured by using environmentally compatible materials and by complying with environmental standards.
For disposal, please remember the following at the end of product life or in case of defects:

- The products consist of plastics and materials such as steel, ferrite magnetic core, etc. and must not be disposed of together with domestic waste; this applies particularly to the printed circuit boards.

  See also European Directive 2012/19/EU
- As a rule, dispose of all waste in an environmentally compatible manner and in accordance with the latest developments in environmental, recycling and disposal techniques.
  **Local and currently valid legislation must be observed.**
- The aim is to achieve maximum recyclability of the basic materials while ensuring minimum strain on the environment. To do this, note the various material and disposal notes printed on specific components

Environmental declaration

The Environmental Declarations on these products contain detailed information about the materials and volumes used. If you need a copy, please contact your Siemens sales office.

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