S

OpenAir™
VAV compact controller KNX/PL-Link G..B181.1E/KN

Technical Basics

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Smart Infrastructure

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1 Introduction

1.1 Revision history

Version	Date	Changes	Section	Pages
2.0	23.03.2017	Update for Series G		
1.0	26.02.2016	EU and RCM Conformity, European Directive 2012/19/EU	8 Technical data, 10 Environmental compatibility and disposal	38 42

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1.3 Objectives of this basic documentation

This basic documentation covers the networked VAV compact controllers GDB181.1E/KN and GLB181.1E/KN. These devices are designed for controlling variable or constant air volume flows.

This document is structured along the according workflow. Following a description of the devices and their application, mounting, engineering, and commissioning are covered. A references section lists technical data, parameters, and data points.

1.4 Abbreviations and naming conventions

1.4.1 Abbreviations

Abbreviation	Description
Desigo TRA	Total Room Automation (Part of Desigo V5)
ABT	Automation Building Tool – part of Desigo XWP
SSA	Setup and Service Assistant
LTE	Logical Tag Extended (KNX Mode)
USS	Universal Serial Interface Protocol (industry automation protocol)
VSD	Variable Speed Drive

1.4.2 Naming conventions

Throughout this documentation the term “VAV compact controller(s)” refers to the GDB181.1E/KN as well as to the GLB181.1E/KN.

1.5 References

[1] G..B181.1E/KN – Datasheet for VAV compact controller (N3547)
[2] G..B181.1E/KN – Mounting instruction for VAV compact controller (M3547)
[3] AST20 – Handheld tool for VAV compact controller (A6V10631836)
[4] AST22 – Interface converter (A6V11236956)
[5] ACS931 – PC-Software for OEM (N5853)
[6] ACS941 – PC-Software for Service (N5854)
[7] Scan-to-HIT App for iOS devices (link)
[8] Scan-to-HIT App for Android devices (link)
[9] Desigo V5 Basic manual, chapter 21 “Room automation”
[10] Desigo XWP (ABT Online help)
[11] Desigo TRA Setup and Service Assistant (SSA) (CM111050en)
[12] Desigo TRA mounting and installation manual (CM111043en)
[13] Synco Communication over KNX Bus – Basic documentation (P3127)
[14] Synco 700 Universal controller RMU710B, RMU720B, RMU730B (P3150)
[15] Synco planning and commissioning protocol V2.6 (C3127)
[16] Synco KNX S-Mode datapoints (Y3110)

2 Device

2.1 Type summary

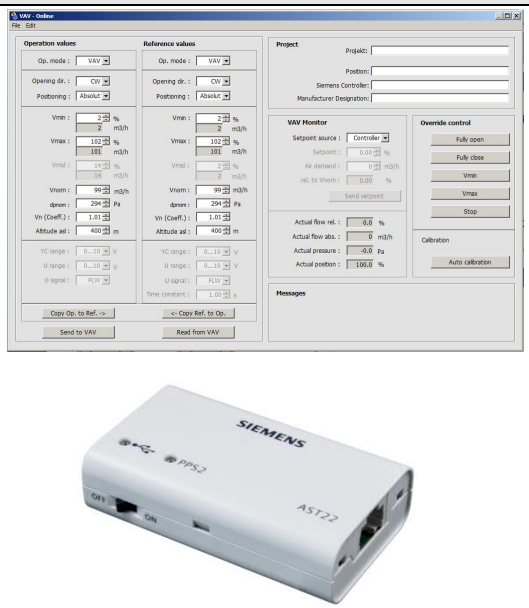
2.1.1 Device variants, tools and accessories

VAV compact controller KNX/PL-Link

GDB181.1E/KN (5 Nm)	GLB181.1E/KN (10 Nm)
	

Tools for commissioning and service

AST20	
	The handheld tool AST20 can be used to set the VAV and actuator parameters and supports access levels for service technicians and OEMs.
Datasheet: A6V10631836	

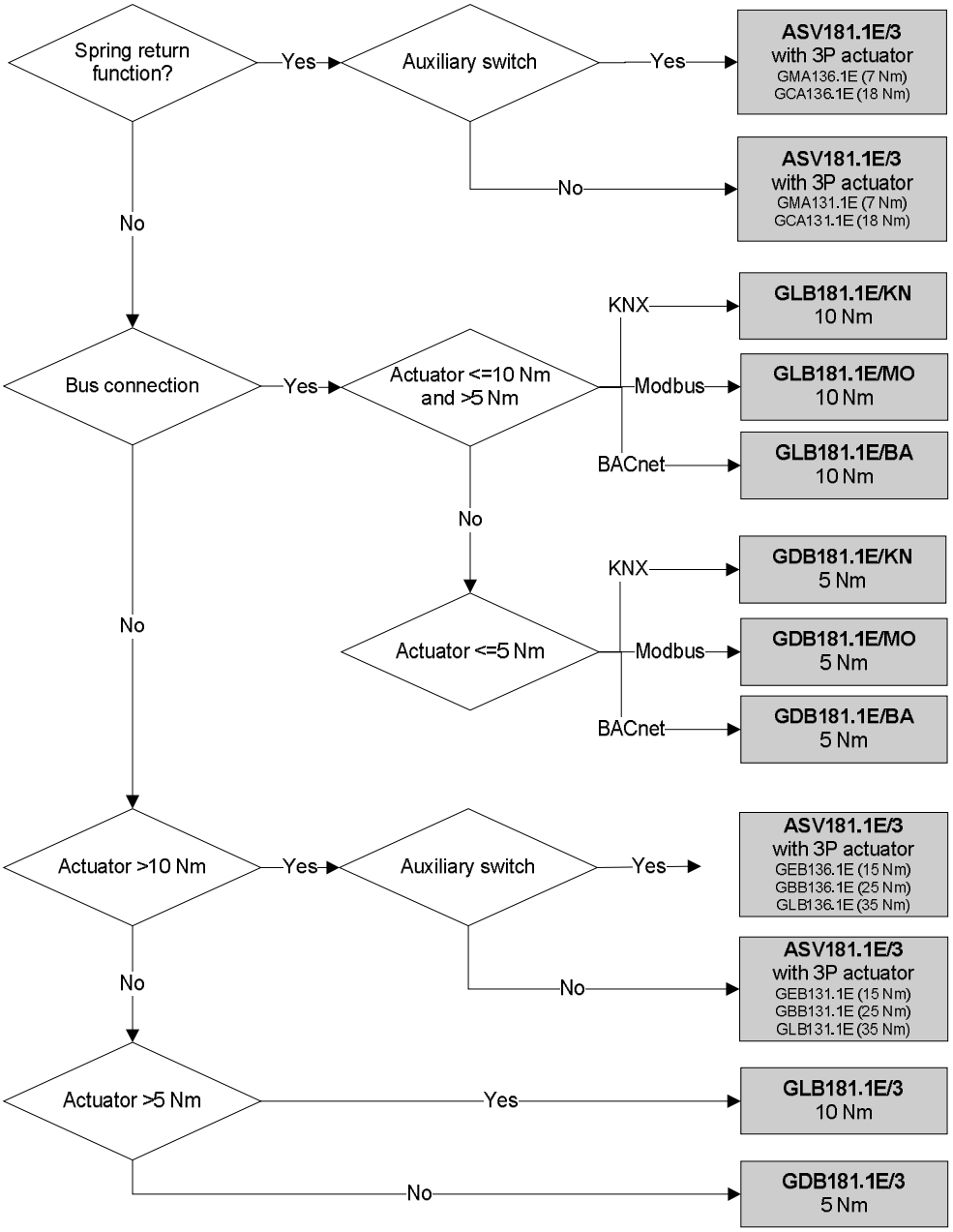
ACS941 / AST22	
	The PC software for service ACS941 can be used for setting and reading a certain set of device parameters (values set by OEM and current configuration, and actual values), cf. section **9.2**. For connecting to a PC with RS232 interface, an interface converter AST22 is required.
Datasheet: A6V11236956	

Scan-to-HIT App	
	The Scan-to-Hit App can be used to retrieve technical information about the actuator by scanning the DMC (data matrix code) in the top right corner of the actuator.
The app can be obtained free of charge at [7] resp. [8]	

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

Series identification and actuator data can be found in the top right corner of the product label. As of Series F, the device data is also stored in a DMC (data matrix code) in the top right corner. It can be read out with any QR Code / DMC scanner or the Scan-to-HIT app available at ([7] resp. [8]).

Version identification

Version	Series E	Series F	Series G
Identification			
Features	• Communication over Desigo PL-Link or KNX (LTE- and S-mode). • New differential pressure sensor. • Simultaneous feedback of actual values of damper position and air volume flow. • Optional adaptive opening range measurement (adaptive positioning). • HMI with push button and LED.	• Stability Improvements • Support for DMC (data matrix code) based workflows	• Improved ETS and Desigo ABT interfaces

Compatibility

VAV Compact Controllers series G are designed for using ETS device profile v2.x, however ETS device profile v1.x is supported for backward compatibility reasons.

Version	Series E	Series F	Series G
Production period	10/2011 – 03/2014	03/2014 – 01/2017	01/2017
FW version	4.16	4.18	4.24
ETS profile v1.x	supported	supported	supported
ETS profile v2.x	not supported	not supported	supported

2.2 Design and device parts

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.

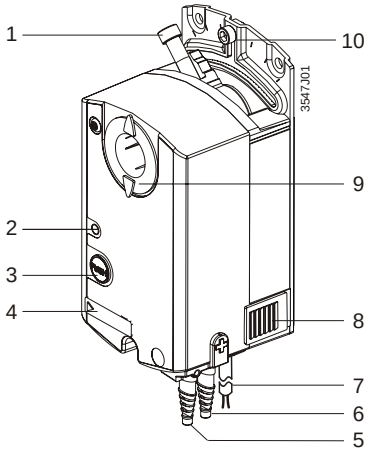
Components contained in the **base**:

- 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, also in continuous operation.

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

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

Main device parts

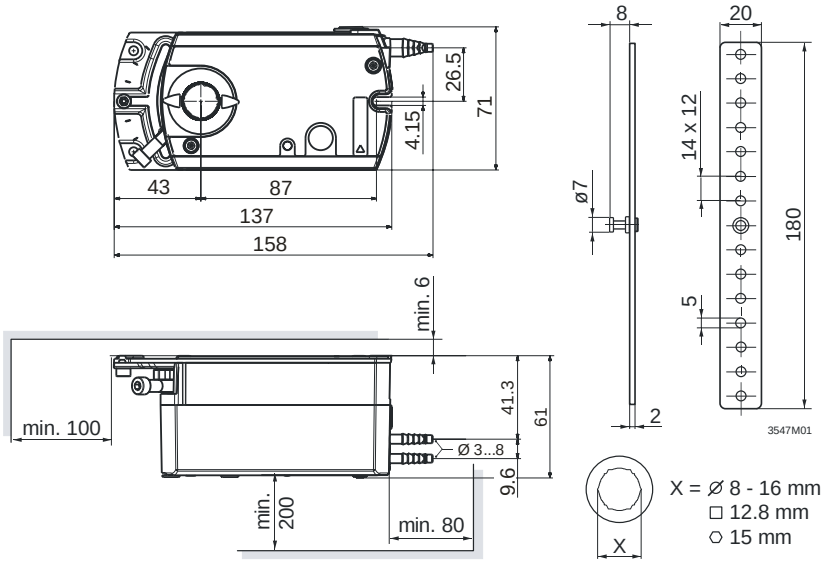


1 Shaft attachment screw
2 LED
3 Push button
4 Configuration and maintenance interface (below cover)
5 Connection nozzle for measuring differential pressure in the VAV box
6 Connection nozzle for measuring differential pressure in the VAV box ("+": Side with higher pressure)
7 Two connecting cables (power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

Gear train disengagement

Manual control of the air dampers is possible by gear train disengagement (8) when the VAV compact controller is **disconnected from the power supply**.

2.3 Dimensions



Measures in mm

2.4 Human-machine interface

User interaction with the VAV compact controllers' human-machine interface (HMI) (multicolor LED and push-button) is described below, cf. also section **6.3.1**.

Push button

Activity	Push-button operation	Confirmation
Enter / leave addressing mode	Press button < 1s	LED turns red or gets off
Reset to factory settings	Press button > 20s	LED flashes orange until device restarts
PL-Link connection test [1)]	Press key >2s and < 20s	LED flashes 1x orange

LED state display

Color	Pattern		Description
Off	---		Fault free operation or device not powered
Green	steady		Connection test successful [1)]
Orange	flashing	0.1 s on / 0.1 s off	Factory reset in progress
		0.25 s on / 1.75 s off	When a connection test was triggered: wait [1)]
Red	steady		Device is in programming/addressing mode
	flashing	0.5 s on / 2 s off	Internal error: Reset necessary
		1 s on / 1 s off	When a connection test was triggered: Connection test failed [1)]

[1)] Function or part of the function available in PL-Link operation only

Addressing and bus test with push button

The VAV compact controllers can be set into addressing/programming mode by push-button:

- Press push button (>0.1s and <1s)
- KNX bus wiring OK → LED turns red until addressing/programming is finished
- KNX bus wiring not OK → LED stays dark

Reset with push button

The VAV compact controllers can be reset by push-button:

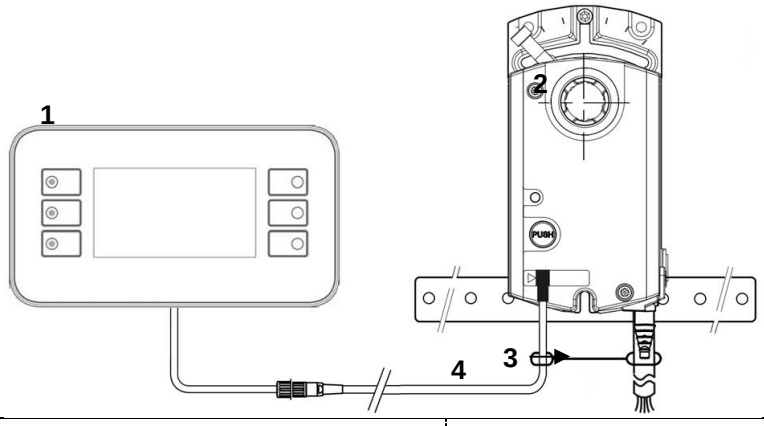
- Press push button > 20s
- LED flashes orange
- Device restarts

All parameters which can be set by the OEM are reset to the OEM default values.

PPS2 interface

For OEM factory programming or commissioning / maintenance tasks directly at the VAV compact controller, a suitable tool (cf. equipment combinations) can be connected to the PPS2 interface.

Connection to the PPS2 interface

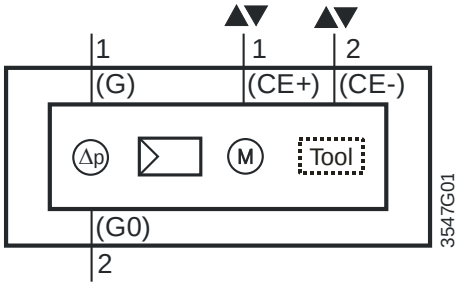


1 AST20 (or PC with ACS931 / ACS941 over AST22)
2 G..B181.1E/.. , or ASV181.1E/3
3 Strain release strip
4 Connection cable (7-pin)

2.5 Internal diagrams

The VAV compact controllers are supplied with two prewired connecting and communication cables.

Internal diagram
(Applies to all types)



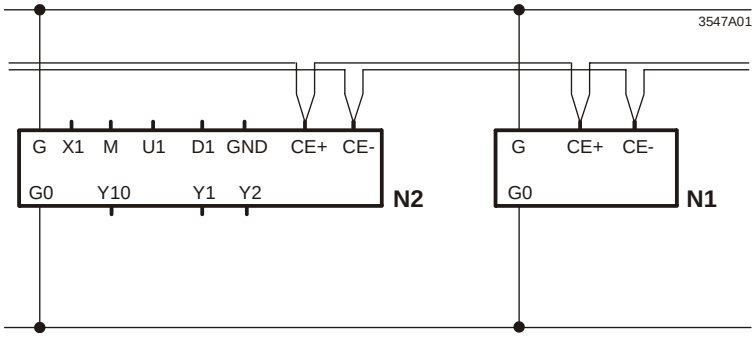
Tool = Configuration and maintenance interface
(Series E and newer: 7-pin)

Power supply and bus cable (color coded and labeled)

Core designation	Core color	Terminal code	Description
Cable 1: Power / black sheathing			
1	red (RD)	G	System voltage AC 24 V
2	black (BK)	G0	System neutral AC 24 V
Cable 2: Bus / green sheathing			
1	red (RD)	CE+	Bus (KNX / PL-Link)
2	black (BK)	CE-	Bus (KNX / PL-Link)

The VAV compact controllers are connected to the bus as KNX devices according to the KNX-TP1 standard. KNX-specific limitations regarding cable length, power supply, number of attachable devices, and distances apply. For more details please refer to [13] and [16] or to the KNX standard.

Wiring diagram VAV
Connection to the KNX TP1-Bus



N1 G..B181.1E/KN
N2 RDG400KN (Example for a VAV enabled room unit)

Note

Terminal layout may differ for each device. Devices with twin-terminals or internally connected terminals may be encountered as well as bus connection in junction boxes. Please refer to the technical basic documentation for product specific information.

- The operating voltage at terminals G and G0 must comply with the requirements under SELV or PELV.
- Safety transformers with twofold insulation as per EN 61558 required; they must be designed to be on 100 % of the time.

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.

Differential pressure sensor

The air volume flow is measured with a differential pressure sensor. The actual value of the air volume flow (absolute and/or relative value) can be transmitted over the bus together with the actual value of the damper position (relative, in %) to be used by a supervisory controller or for management purposes. The differential pressure sensor operates long-term stable and without recalibration.

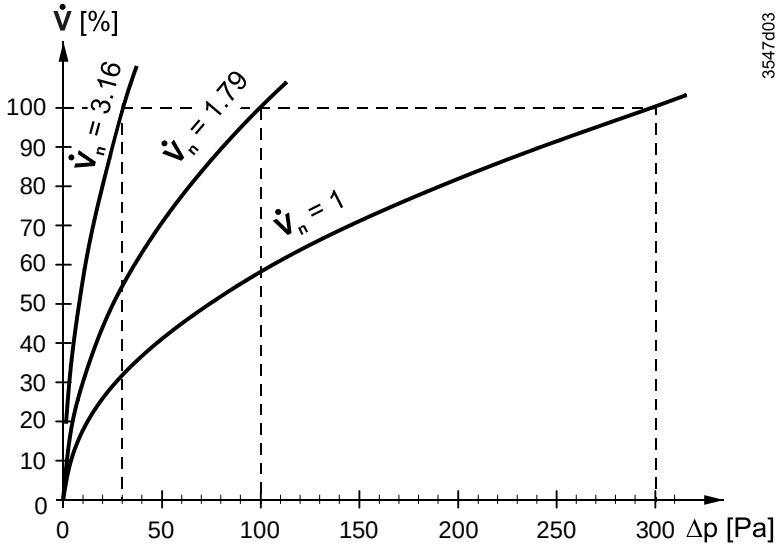
Note

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

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 Δp_nat the factory. The effect of V_n is illustrated in the diagram below.

Effect of $\dot{V}_n$



Calculation of $\dot{V}_n$ (Δp_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 Δp_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 Functionality / application

3.1 Fields of application

Application

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

System environments:

- Building automation systems using the Siemens peripheral bus PL-Link (Desigo Total Room Automation)
- Building automation systems using KNX LTE-mode (Synco 700 Series C and newer)
- Building automation systems using KNX S-mode (third-party integration and freely programmable devices)

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)
- Air dampers with a nominal torque of up to 5 or 10 Nm

Note

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

3.2 Equipment combinations

VAV compact controllers are KNX-certified and may be connected to all KNX devices with compatible S-mode data points.

Device	Type	Data sheet
Controllers and room units		
Room thermostat with controller	RDG405KN	3192
Universal controller	RMU7..	3144
Web server	OZW7..	5702
Desigo Room Automation Station (modular)	PXC3..	9203
Desigo Room Automation Station (compact)	DXR2..	9204 9205 9206
Tools for configuration and service		
Handheld tool	AST20	A6V10631836
Interface converter	AST22	A6V11236956
PC software for service	ACS941 v3.0 or later*	5854

3.3 Application examples

Three typical basic application examples are presented to give an overview over the possibilities of the devices. These applications are supply air control, supply and extract air control, and supply and extract air control with demand control of the air-handling unit (AHU). The examples show the KNX part of the applications. Other devices such as electrical heaters with connection independent of the KNX bus configuration may not be shown.

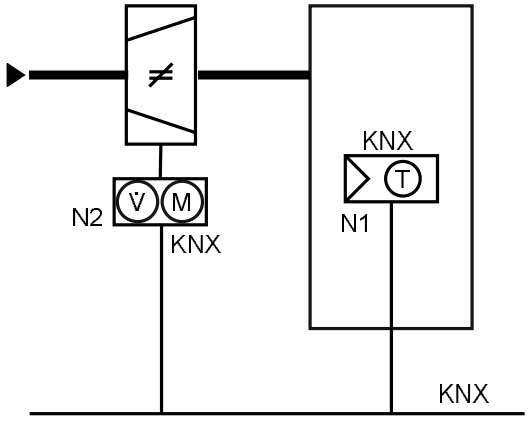
Control of air volume flow in supervisory controller

Fundamental of all applications realized with VAV compact controllers is the principle to control the air volume flow in the supervisory controller.

3.3.1 Application example 1: Supply air control

Example 1:
Supply air control, supervised by e.g. RDG400KN

The most basic application is room temperature control (cooling or heating) with one VAV compact controller. The building user sets a temperature setpoint in °C which is converted by a VAV-capable KNX thermostat (e.g. RDG400KN) into a 0...100 % setpoint for the air volume flow, taking into account the air volume flow temperature as delivered by the AHU.

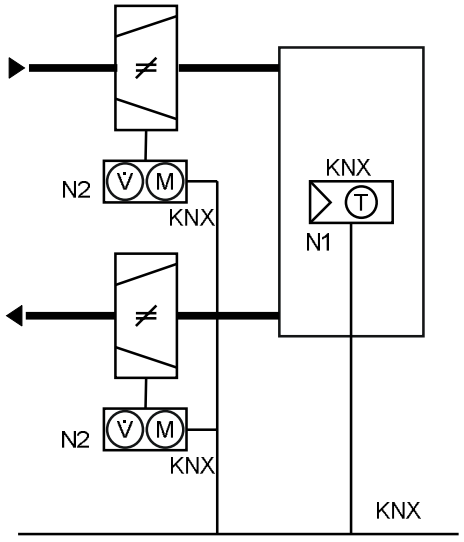


Legend:
N1 Room unit with temp. sensor
N2 VAV compact controller

3.3.2 Application example 2: Supply and extract air control

Example 2:
Supply / extract air control, supervised by e.g. RDG400KN

If one VAV compact controller is used for supply air and one for extract air, these are usually controlled individually by the supervisory controller. By setting their volume flow limits (V_{min} and V_{max}) according to the setting instructions in section **5.3**, constant, positive or negative pressure in a zone or a room can be achieved.



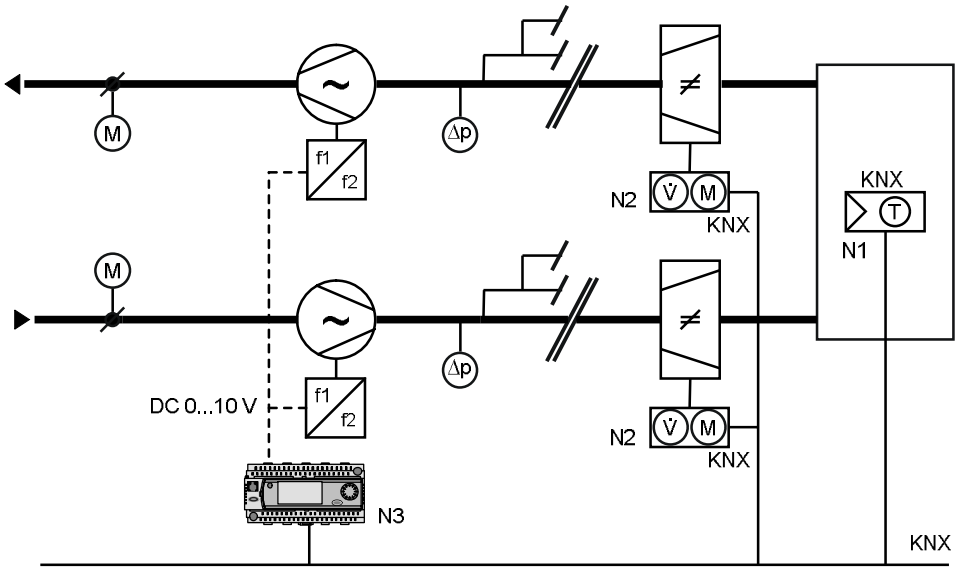
Legend:
N1 Room unit with temp. sensor
N2 VAV compact controllers
(supply air / extract air)

3.3.3 Application example 3: AHU optimization

Example 3
AHU control optimization

In combination with a suitable supervisory room controller, an AHU control optimization algorithm can be run using the actual value of the damper position feedback signal. This application is available e.g. with Synco 700 RMU7x0B (Series C or newer) universal controllers (as depicted below) or in Desigo PL-Link environments.

The control of variable speed drives (VSDs) can be accomplished by various means. Below depicted is DC 0...10 V control, but plants with USS- or Modbus-controlled VSDs are also possible, depending on the connector layout of the universal / primary controller.



Legend:

N1	Room unit with temp. sensor
N2	VAV compact controllers (supply / extract air)
N3	Universal / primary controller

For a detailed explanation of this application in a Synco 700 system, please refer to [14], chapter 23. For a detailed explanation of this application in a Desigo PL-Link system, please refer to [10].

3.4 Further application examples

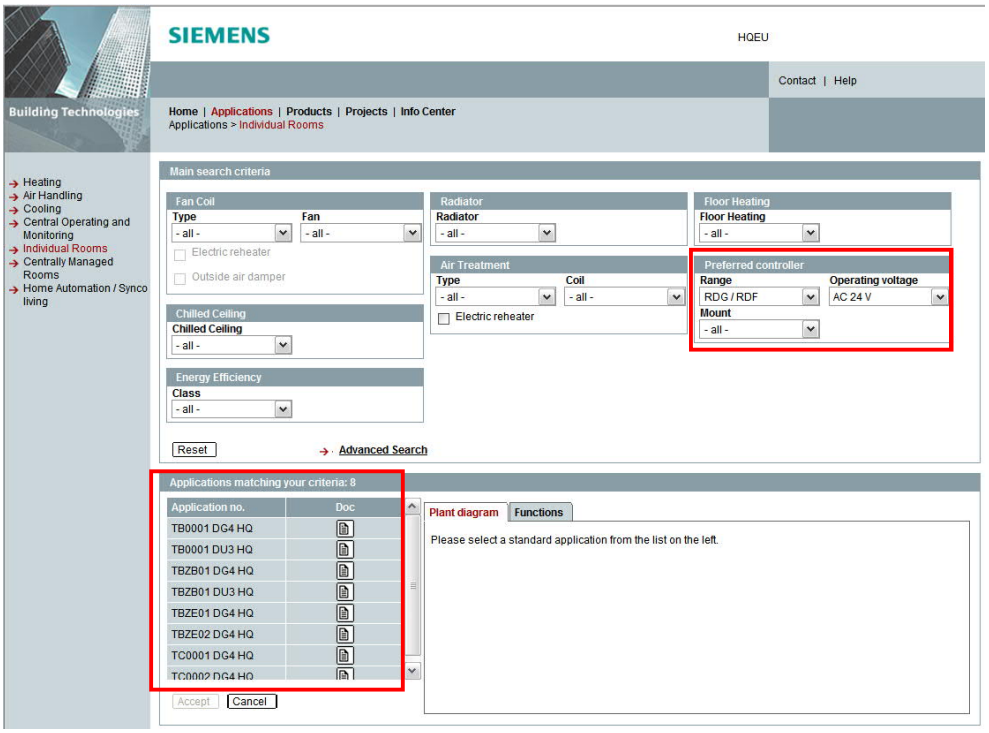
3.4.1 Application examples for Synco 700 (Series C or newer)

3.4.1.1 Application examples in HIT (HVAC Integrate Tool)

In HVAC Integrated Tool (HIT), application examples can be found for the use with room thermostats RDG400KN or RDF341.

Navigate to www.siemens.com/hit → HIT Start Center → Applications → Individual Rooms → “Preferred controller” / “Range”: select “RDG/RDF” in dropdown list and “Operating voltage” = AC 24 V.

In the bottom area, matching application examples appear.



(User interface is subject to changes)

3.4.1.2 Application examples in printed documents

Application examples in printed documents can be found in:

- RDG/RDF Application Guide 0-92173-DE/EN
- Basic Documentation RDF341 (P3172)
- Basic Documentation RDG400KN (P3192)

3.4.2 Application examples for Desigo Total Room Automation

Application examples for Desigo TRA will be made available as library in the Desigo XWP online help (for the engineering tool Desigo ABT, part of Desigo XWP), cf. [10].

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 M3547 ([2]) is mandatory.

Environmental conditions

The permissible ambient temperature and ambient humidity must be observed.

Manual control

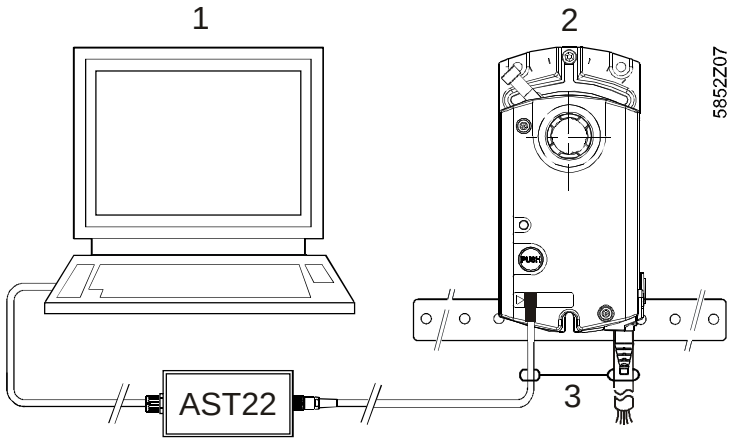
The actuator may only be manually operated when **separated from power supply**.

Mechanical limitation of angular rotation

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

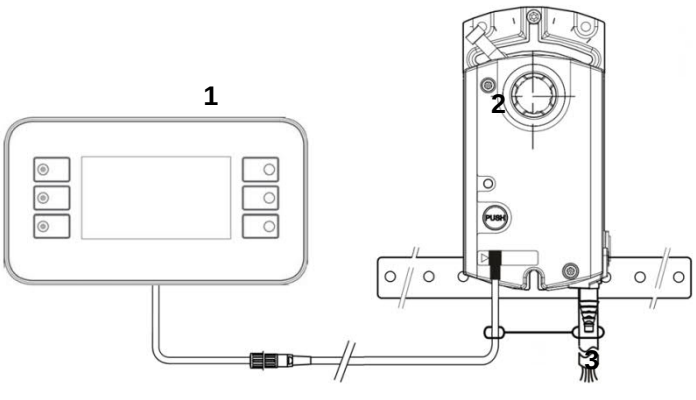
Configuration and maintenance interface

Connection of PC tool ACS931 / ACS941 to G..B181.1E/KN



1 PC (with ACS931 or ACS941)
2 G..B181.1E/KN
3 Strain release strip

Connection of handheld tool AST20 to G..B181.1E/KN



1 AST20
2 G..B181.1E/KN

4.2 Electrical installation / cabling

4.2.1 Power supply cabling

Permissible cable lengths and cross-sectional areas

The permissible cable lengths and cross-sectional areas depend on the actuators' current draw and the voltage drop on the connecting lines to the actuators. The necessary cable lengths can be determined from the following chart or with the help of the formulas. Cf. also to 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 actuators' operating voltage are adhered to, in addition to the permissible voltage drop on the power supply and signal lines (see table below).

Permissible voltage drop

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

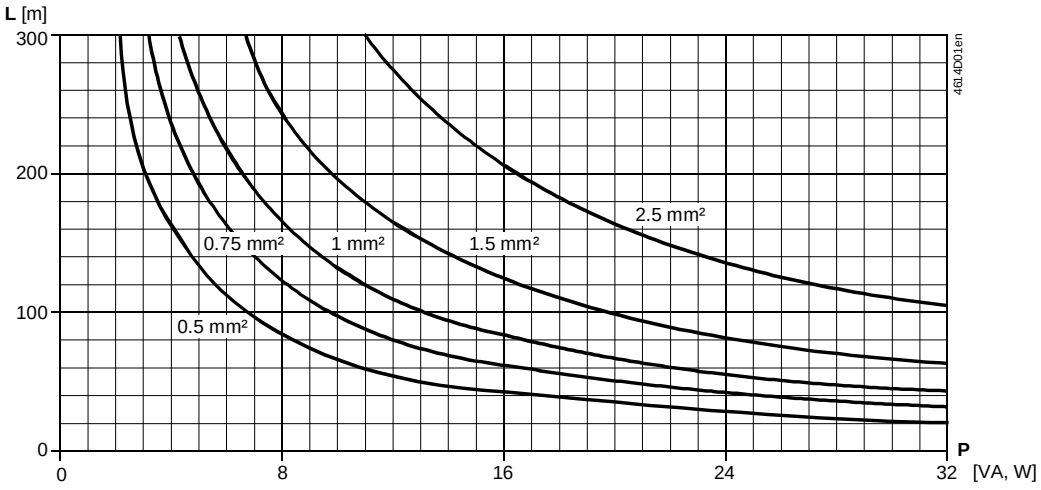
Type	Operating voltage	Line	Max. permissible voltage drop
GDB181 / GLB181	AC 24 V	G0, G	each 4 % (tot. 8 %)

Note

The power supply voltage drop at AC 24 V must not exceed 8 % (4 % over the G0).

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.

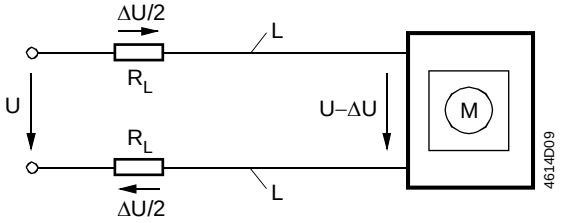


Note on chart

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

P is the decisive power consumption of all actuators connected in parallel.

Basic diagram: Voltage drop on the supply lines



Formula for cable length

The following formula 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]

A Cross-sectional area in [mm^2]
L Permissible cable length in [m]
P Power consumption in [VA] or [W];
refer to the actuator's type field

Example: Power consumption and permissible voltage drop (1 VAV 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 actuators

Determine the cable lengths for 4 actuators 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

4.2.2 Bus cabling

Instructions regarding topology and addressing in KNX networks can be found in the documents [13] and [16]. The following sections presuppose electrical installations that conform to the KNX-TP1 standard

5 Parameterization and operating modes

5.1 Settings and user interaction

5.1.1 Device parameters

Parameterization

The OEM generally provides the basic configuration to VAV Compact Controllers, esp. the parameter V_n. The basic configuration is independent of the system environment where the VAV Compact Controllers are to be used.

For parameter setting, configuration and maintenance tools as described in section **5.2** are available. Depending on the networking environment (PL-Link, KNX LTE or KNX S-Mode), further settings are available (cf. sections **9.2** and **9.3**).

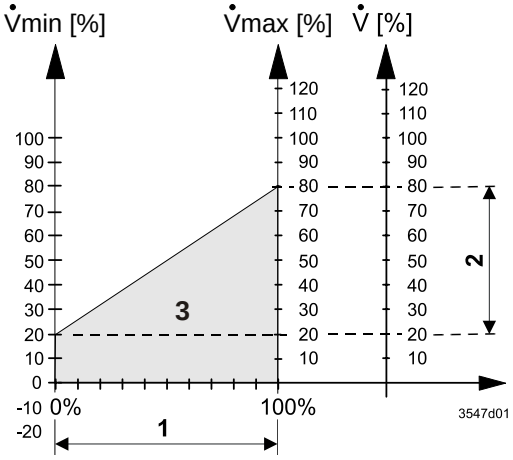
The following parameters must be checked or set prior to commissioning. Settings and changes have to be documented in the plant documentation.

Parameter	Range	Description	Factory setting
Operating mode	VAV (flow ctrl.) / POS (position ctrl.)	Interpretation of setpoint VAV = Setpoint commands volume flow [%] POS = setpoint commands damper position [%]	VAV
Opening direction	CW (R) / CCW (L)	Opening direction of air damper	CW (R)
Adaptive positioning	Off / On	Adaption of actual opening range to position feedback Off = No adaption / mapping 0°...90° → 0…100 % On = Pos. adaption / mapping e.g. 0°...60° → 0...100 %	Off
Vmax	20…120%	Maximum air volume flow	100 %
Vmin	-20…100%	Minimum air volume flow	0 %
Vnom	0…60‘000 m^3/h	Nominal air volume flow [1)]	100 m^3/h
Vn	1.00…3.16	Characteristic value for the air volume flow; set by the manufacturer (OEM)	1.00
Altitude / Elevation asl.	0…5000m in 500m steps	Altitude level correction factor for differential pressure sensor (select n*500m value closest to real altitude)	500 meters

[1)] Value used for displaying / not used for volume flow control loop

Variable air volume control (VAV)

VAV Compact Controllers operate in VAV mode when connected to the specified power supply. The setpoint signal determines the operating range $\dot{V}_{min} \ldots \dot{V}_{max}$.



1 Setpoint
2 Actual value
3 Control range

Constant air volume control (CAV)

The VAV Compact Controllers can be operated in CAV mode by setting the setpoint value accordingly, i.e. setting the supervisory controller to send a constant setpoint.

Position control

VAV Compact Controllers can also be operated as damper actuators, i.e. the 0...100% setpoint is interpreted as position setpoint, cf. section **2.6**.

5.1.2 Calculation formulas

The parameters are based on the following formulas:

Calculation of Vn (Δp_n= nominal pressure)

$$V_n = \sqrt{\frac{300\,Pa}{\Delta p_n\,Pa}}$$

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 a 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

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

5.2 Configuration and maintenance tools

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

1. Using the PC software ACS941or ACS931 together with the interface converter AST22 via the configuration and maintenance interface of the VAV Compact Controller or
2. Using the handheld tool AST20.

5.2.1 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 ([6]).

The PC software ACS941 allows to set or to display the parameters as listed in section **5.1**. The software supports trend functions and allows comparing the values set by the OEM with the values currently stored in the device. Thus, changes by parties other than the OEM can be detected.

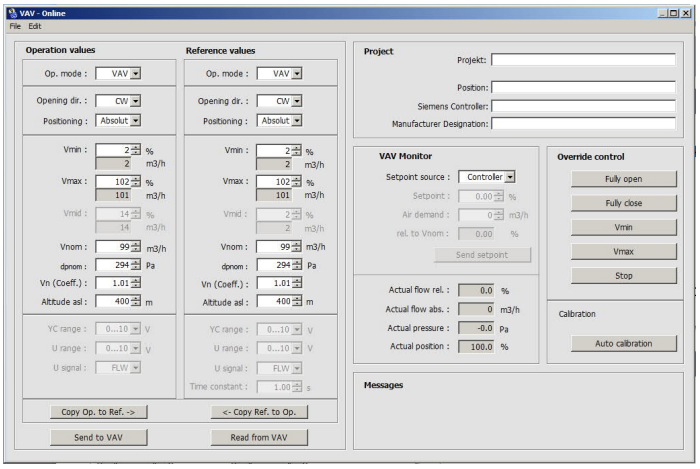


Figure 1: ACS941 with VAV configuration pane

Next to the PC software ACS941, an OEM version ACS931 ([5]) with extended functionality is available as well. ACS931 allows setting the parameter V_n.

5.2.2 Handheld tool AST20

Functionality

Using the handheld tool AST20, VAV and Modbus RTU parameters can be set or retrieved. Instructions for use of the handheld tool AST20 can be found in data sheet [3].

Design

The AST20 is designed for portable use on-site. Power supply and establishing the communication between AST20 and a VAV Compact Controller are realized with one of the connection cables which are shipped with the AST20.

5.3 Setting examples

5.3.1 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) [%]

5.3.2 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 %.

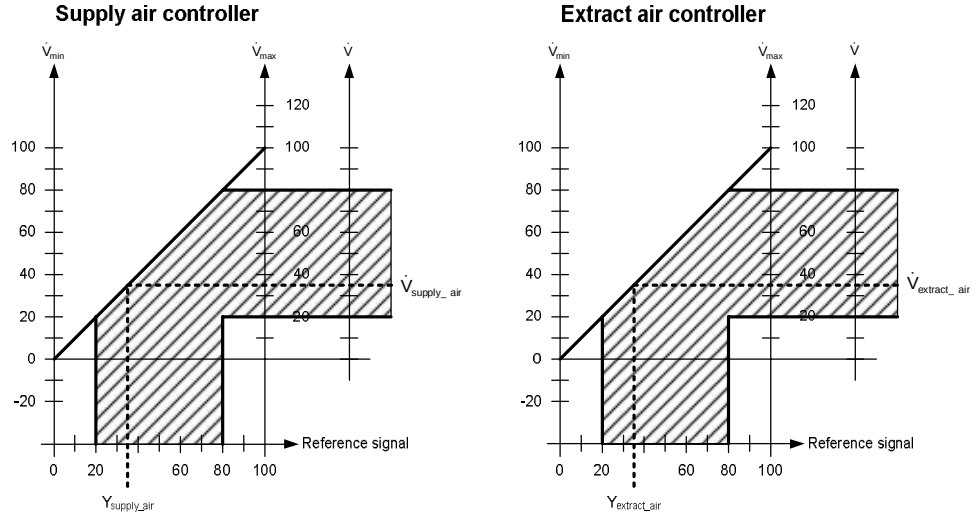
Setting example A1

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



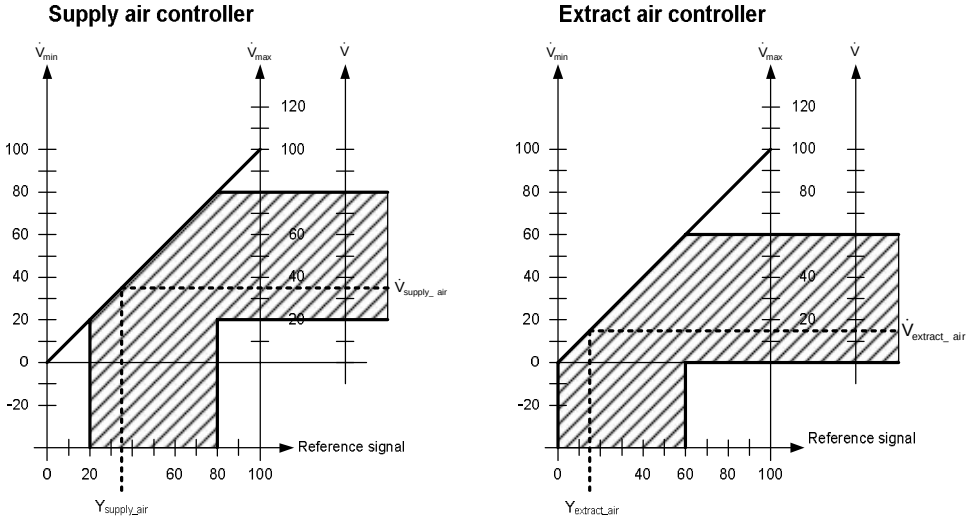
Setting example A2

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 %



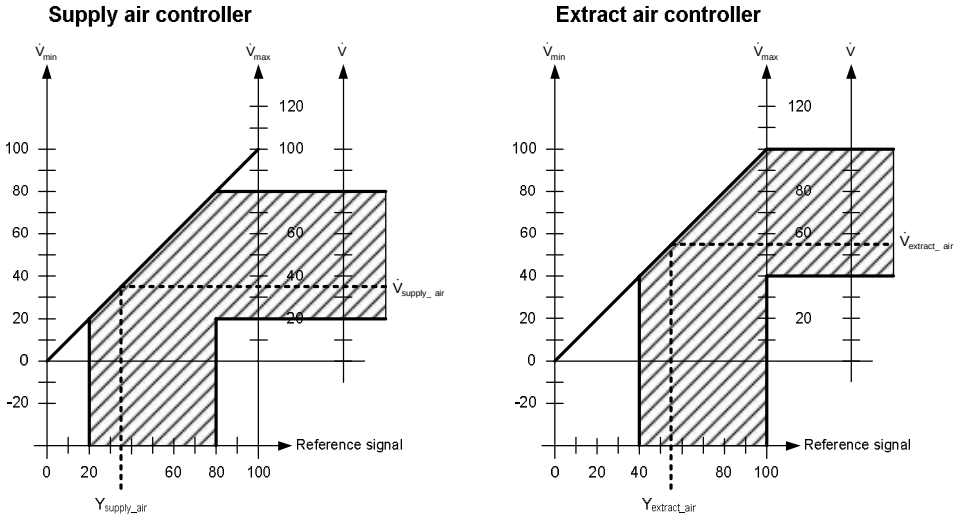
Setting example A3

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 %



5.3.3 Min/max control by the VAV compact controller

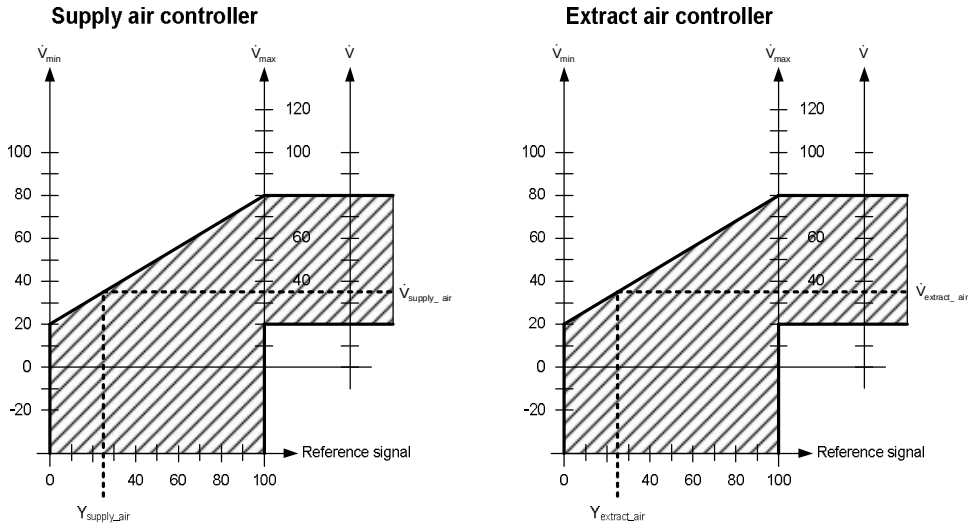
When setting the minimum / maximum air volume flow in the VAV compact controller, the supervisory controller must be set to V_{min}= 0 % und V_{max} = 100 %. With this setting, the supervisory controller reference signal for both the supply air and extract air controller is the same. Thus, supply air / 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: $V_{supply\_air} = V_{extract\_air} = 35$ %

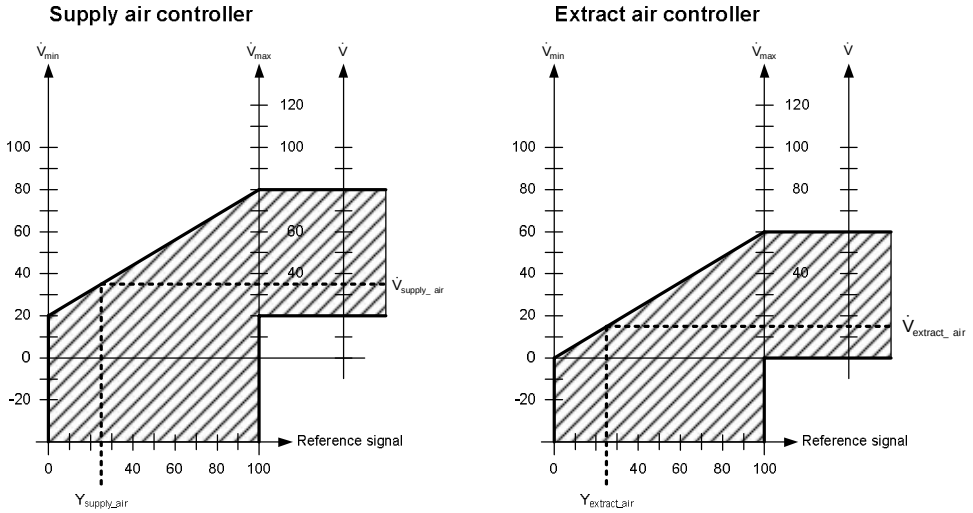


Setting example B2 **VAV ratio control, 20 % constant excess supply air volume flow (positive pressure in the room)**

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

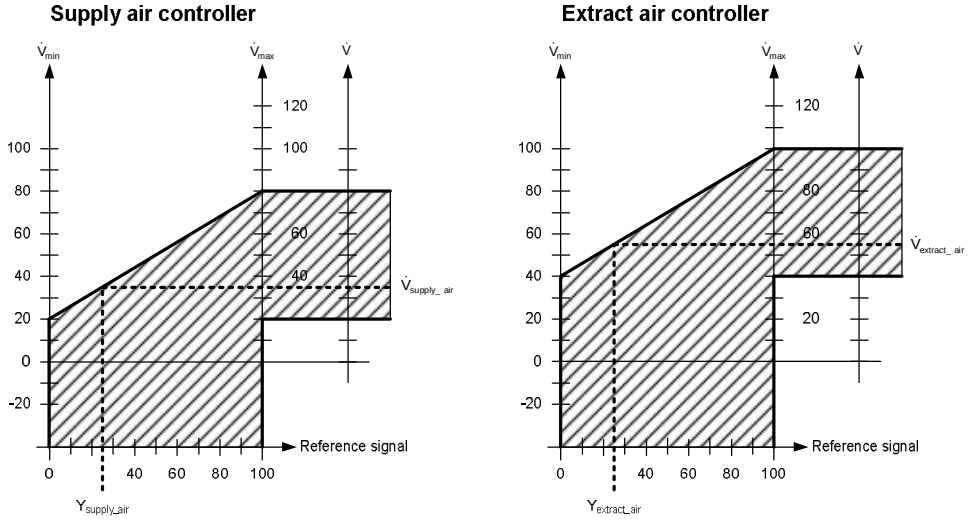


Setting example B3 **VAV ratio control, 20 % constant excess extract air volume flow (negative pressure in the room)**

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



5.3.4 Master/Slave operating mode

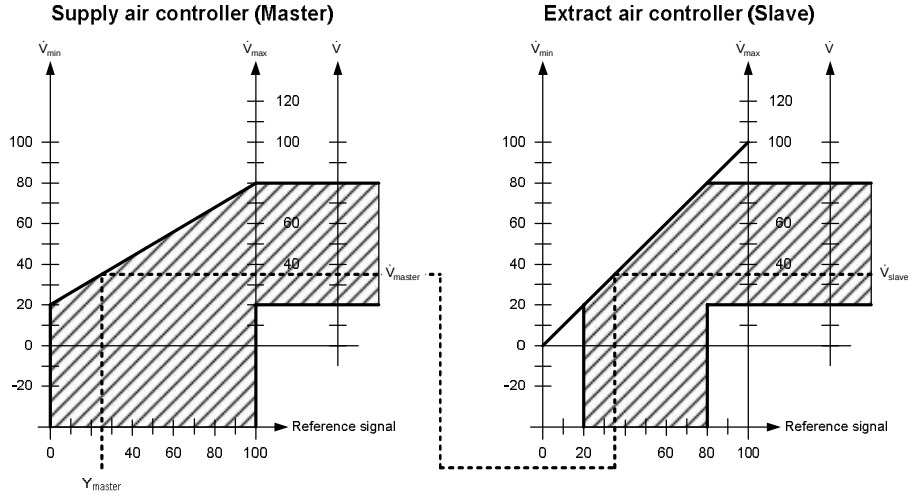
To control supply air and extract air in KNX LTE-mode environments (Synco 700 Series C or newer), master/slave operating mode is required. In this mode, the actual value signal of the master controller (supply air) is the reference signal for the slave controller (extract air), cf. also section **6.2.2**.

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 %

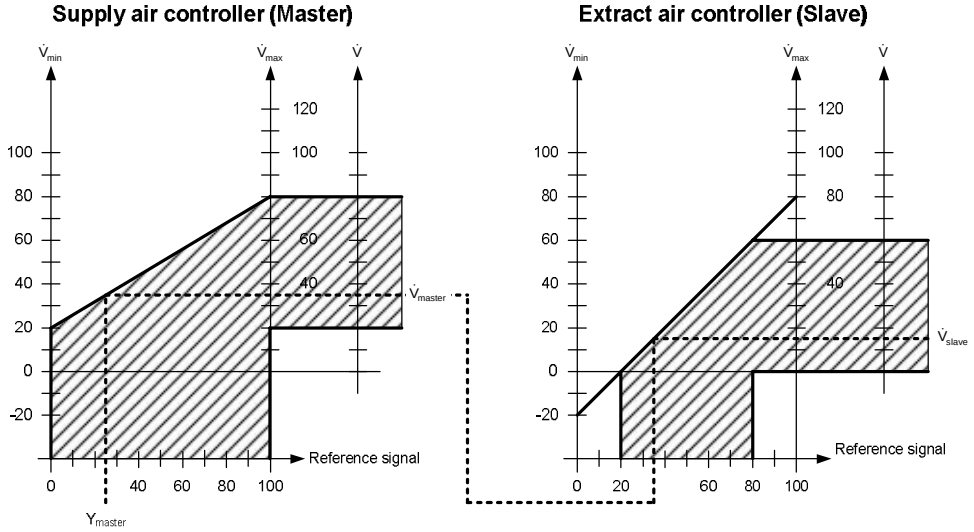


Setting example C2 **VAV ratio control, 20 % constant excess supply air volume flow (positive pressure in the room)**

	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 %

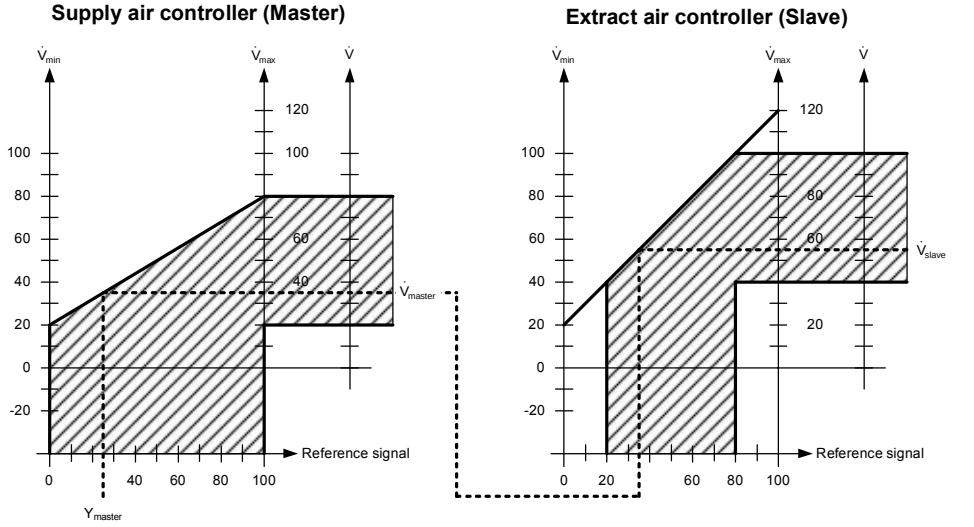


Setting example C3 **VAV ratio control, 20 % constant excess extract air volume flow (negative pressure in the room)**

	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 Engineering and commissioning

6.1 Fundamentals

6.1.1 System environments

Preconditions

For this chapter, sound knowledge about KNX networks and, depending on the systems environment, sufficient knowledge about operating ETS4 / ETS5, ACS790 or Desigo ABT are presupposed.

Supported system / network environments and available engineering and commissioning tools are:

System environment	Engineering and commissioning tools	Further information
Desigo PL-Link	Desigo ABT, SSA	Online help
KNX LTE-mode	Synco ACS790	Technical basics P3127 Datasheet N3127
KNX S-mode	ETS4, ETS5	Documentation Y3110

- To connect a PC with USB interface to a KNX network, an interface converter (e.g. OCI700, contained in OCI700.1) is required.
- Other ways to connect to a network are IP interfaces, as made available by the PXC3.. automation station.
- The VAV compact controllers are delivered with the default KNX address 0.2.255
- Since the VAV compact controllers do have a separate AC 24 V power supply, their bus load is only 5 mA.
- Desigo PL-Link systems do not support the use of line couplers.

6.1.2 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. For KNX LTE-mode systems, the engineering and commissioning protocol C3127 ([15]) is available. For KNX S-mode systems, this functionality can be covered by ETS.

6.1.3 Address labels

The VAV compact controllers are delivered with a removable address label which contains the unique KNX ID in alphanumeric and barcode representation.

Facilitating engineering and commissioning

This label can be removed from the device during installation and attached to e.g. a building plan. The building plan, containing the device locations and their addresses (IDs) then facilitates further engineering and commissioning remarkably. This procedure is essential for the recommended engineering and commissioning workflows below. If the label gets lost, the ID is printed on the device housing as well.

6.2 Engineering

6.2.1 KNX S-mode engineering

For engineering in KNX S-mode, good command in operating the ETS3 / ETS4 is required. Basic knowledge about KNX standards is presupposed as well. The parameters and S-mode datapoints are documented in chapter 9.

Certified KNX product

The VAV compact controllers are certified KNX devices, thus the usual ETS workflows in KNX projects apply.

Obtaining the KNX product data

For KNX S-mode engineering, the required product data (*.vd5 or *.knxprod) have to be downloaded from the Siemens website and imported into the ETS device catalog. To obtain the product data, navigate to www.siemens.com/hvac-td or www.siemens.com/openair and locate the “Downloads” section.

6.2.2 KNX LTE-mode / Synco 700 engineering

Engineering in KNX LTE-mode environments (Synco 700 Series C or newer) is executed with the tool ACS790. Use of this tool is explained in [13].

Required ACS790 version

When using ACS790, it is important to make sure that the latest version but at least version 8.00 is installed.

Recommendation: collect address labels during mounting

During mounting of the VAV compact controllers, the address labels can be removed from the devices and attached to e.g. the building/floor plan to map KNX-IDs and physical location of the devices.
After mounting and installation is completed, the installed devices are found when the ACS790 device list is refreshed. In the device list, the collected IDs can be used to identify the devices and to assign physical addresses according to the intended plant topology. With this approach, commissioning can be done without much effort. For an alternative commissioning procedure, cf. section **6.3.3**.

Special settings for Master/Slave configuration

Plants with supply air and extract air control in KNX LTE-mode environments with Synco 700 (Series C or newer) have to be realized as a Master/Slave configuration (cf. section **5.3.4**). All devices have to be in the same air distribution zone which has to be set to “8” in Synco 700 systems.

The Slave-VAV compact controller’s air volume flow limits (V_{min} and V_{max}) have to be set to 0 % and 100 %. The VAV compact controllers have to be configured as Master and Slave in ACS790 (in “Plant engineering”, navigate to VAV compact controller / “Operation settings”).

The Master-VAV compact controller must be associated with “Supply air”, and the Slave-VAV compact controller must be associated with “Extract air”.

Parameter	RDG400KN	Supply air (Master)	Extract air (Slave)
Minimum and maximum volume flow	$V_{min} = x_1$ % $V_{max} = x_2$ % x_1, x_2 = Project values	$V_{min} = y_1$ % $V_{max} = y_2$ % y_1, y_2 = Project values	$V_{min} = 0$ % $V_{max} = 100$ %
Air distrib. zone	8	8	8
Master/Slave	-	Master	Slave
Type of air	-	Supply air	Extract air

6.2.3 Desigo PL-Link / Desigo PXC3.. engineering

Engineering in Desigo PL-Link environments is accomplished with the Desigo XWP component ABT (Automated Building Tool). The webserver-based tool SSA (Setup and Service Assistant) is used for datapoint tests during commissioning.

Plug&play commissioning

To enable “plug&play” commissioning with Desigo PL-Link, the recommended engineering workflow has to be followed. At the core of this workflow is the preparation of the supervisory VAV-enabled automation station (e.g. PCX3..).

Recommended engineering workflow

The following (idealized) workflow is a recommendation to benefit from the features of the VAV compact controllers.

1. The **design engineer (DE)** plans the system using the engineering tool **Desigo XWP (ABT)**. Design data for an entire project is stored on an Engineering Data Server.
2. According to the plan, orders are released to OEMs and suppliers. **VAV box OEMs** order VAV compact controllers from the distribution center. The OEM manufactures the VAV boxes and adjusts the VAV compact controllers mainly by setting the parameter V_n (cf. section **2.6**). The preconfigured VAV boxes are then delivered to the construction or renovation site.
3. The **electrical installer (EI)** mounts the VAV boxes and removes the **address labels**. He attaches them to a building plan (or something comparable). This building plan is then forwarded to the DE.
4. The **DE** can now preconfigure the **automation station** (e.g. PXC3..) offline in **Desigo XWP (ABT)** as follows: After adding the required number of VAV compact controllers to an automation station, he can access the configuration panel of each VAV compact controller and enter the ID either by typing the alphanumeric code or – if supported – by scanning the barcode representation. This configuration is then compiled to a **pack&go file** for download into the physical automation station.
5. This pack&go file is forwarded to the **EI** who downloads it into the automation station. The EI or the **commissioning engineer (CE)** can do a first testing with the **SSA** tool.
6. The **CE** can use the design data and **Desigo XWP (ABT)** to complete the commissioning.

6.3 Commissioning

6.3.1 Preconditions

Commissioning requirements

Type and number of parameters that can be set may vary. Prior to commissioning, all VAV compact controllers must be mounted according to the mounting instruction M3547 as well as all other devices as per the corresponding mounting instructions. All devices must be connected to the power supply and bus cabling. Power supply and bus cabling must be tested.
For KNX installations with multiple lines, it is recommended to do the commissioning line by line.

Operating mode and display

After power-up, the device can assume the following states:

State / intended behavior	User action	Device response (LED)
Functionality available in all system environments		
Power-up / device starts up	Connect device to power supply	LED is *orange* / goes off after power-up is completed
Faultless operation	none	LED is off
Set device to programming / addressing mode	Short key press (<0.5 s)	LED is *red* (no time limit)
Reset device to factory settings	Long key press (>20 s)	LED flashes *orange* until reset is completed
Additional functionality available in PL-Link environments only		
Execute connection test	Middle key press (>2 s and <20 s)	LED flashes *orange* Then (each for 60 seconds or prior cancellation by key press): a) LED is green → connection test successful b) LED flashes *red* (1s – interval) → connection test *failed*
Acknowledge connection test	Short key press (<0.5 s)	LED is off

6.3.2 KNX S-mode commissioning

For KNX S-mode, the usual S-mode commissioning procedures apply for ETS3 or ETS4. The HMI (push button and LED) conforms to the KNX standard. A short key press sets the device into programming mode (cf. section **2.4**).

6.3.3 KNX LTE-mode commissioning

VAV compact controllers, KNX LTE-mode controller and operating units are connected to the power supply. Refresh, and then open the **ACS790 device list**.

→ **variant 1 (with collected address labels)**

1. Select a VAV compact controller from the device list by ID (IDs are collected during mounting),
2. Double click the selected row to open the dialog box *"Address assignment"*,

or

→ **variant 2**

1. Set a VAV compact controller to addressing mode (Push button on device → LED shines red)
2. In ACS790, click button "Programming mode" → Address assignment → enter physical address → click "Write"

→ Enter a physical address and short description for the selected VAV compact controller,

→ Click *"Write"* to close dialog box,

→ Repeat steps for all VAV compact controllers for commissioning.

Continue: Further configuration with ACS790.

6.3.4 PL-Link commissioning

Multiple VAV compact controllers can be connected simultaneously to the power supply or individually. For plug&play commissioning, the PL-Link capable automation station must be preconfigured as described in section **6.2.3**.

The PL-Link automation station is online.
The VAV compact controllers are not connected to the power supply.

→ Simultaneously connect all VAV compact controllers to the power supply (or individually as applicable)

→ PL-Link automation station and VAV compact controllers execute registration and address assignment. Configuration is uploaded from the automation station to the VAV compact controllers.

→ Optional: Middle key press for connection test (>2 sec and <20 sec).

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: • 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 • Determine the transformer's output by adding up the power consumption in VA of all actuators used • For efficiency reasons, the power drawn from the transformer should amount to at least 50 % of the nominal load • 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: • According to the effective load of all connected devices • Line G (system potential) must always be fused • 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 is possible, provided the required operating voltage tolerance is observed. The **voltage drops of the supply lines** must be taken into consideration.

KNX bus powering

When planning and installing room controllers and field devices with KNX bus connection, the permissible cable lengths, power supply and topologies have to be followed. Planning should take into account possible future extensions of a plant.

Note

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...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 (core 1, red) and G0 (core 2, black)	Operating voltage / frequency	AC 24 V ±20 % or AC 24 V class 2 (US) / 50/60 Hz	
	Power consumption at		
	Actuator holds	1 VA/0.5 W	
	Actuator rotates	3 VA/2.5 W	
Damper actuator	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)	
	Opening direction (adjustable with tool or over bus)	Clockwise / counter clockwise	
KNX-Bus	Connection type	KNX, TP1-256 (el. insulated)	
	Bus load	5 mA	
Configuration and maintenance interface	Terminal strip	7-pin, grid 2.00 mm	
Connection cable	Cable length	0.9 m	
	Number of cores and cross-sectional area	2 x 0,75 mm^2	
⚠ **Degree of protection and safety class**	Degree of protection acc. to EN 60529 (Refer to 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	
		GDB181.1E/KN	GLB181.1E/KN
	EU Conformity (CE)	A5W00003842 [1]	A5W00000176 [1]
		GDB181.1E/KN	GLB181.1E/KN
	RCM Conformity	A5W00003843 [1]	A5W00000177 [1]
Environmental compatibility	The product environmental declaration CM2E4634E [1] contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).		
Dimensions	W x H x D	71 x 158 x 61 mm	
Suitable drive shafts	Type of drive shaft		
	Round	8...16 mm	
	Round, with centering element	8...10 mm	
	Square	6...12.8 mm	
	Min. drive shaft length	30 mm	
	Max. shaft hardness	<300 HV	
Weight	Without packaging	0.6 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 %	
	$\dot{V}_n$, 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 and datapoints

9.1 Parameter description

Parameter	Description
Nominal volume flow [m^3/h]	Nominal air volume flow for ventilating a zone or a room.
Hysteresis (COV) [4] volume flow [m^3/h] / Hysteresis (COV) [4] actuator position [%]	Parameter to define which threshold has to be exceeded that the respective actual value is broadcast over the bus. This value should be set in a way to avoid high busload, but to achieve still sufficiently frequent actual values (cf. “min. repetition time” below).
Min. repetition time volume flow [s] / Min. repetition actuator position [%]	If a COV [4] exceeding the threshold defined by the “Hysteresis (COV)” parameter occurs, the actual value is broadcast after this min. repetition time. If no change of value exceeding the threshold occurs, an actual value is broadcast each 15 minutes (heartbeat).
Minimum / maximum volume flow [%]	Values to limit the nominal volume flow. Their effect is described in section 5.3.
Elevation above sea level [m]	Correction factor for diff. pressure sensor (select n*500m value closest to local altitude)
Opening direction	Opening direction of the 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°. If set to “On” (adaptive positioning enabled), the actuator determines the actual opening angle after the parameter has been written into the VAV compact controller. The actual range (e.g. 15°...75°) is then mapped to the 0...100 % positioning signal. If set to “Off”, 0...100 % is interpreted as 0…90°.
Backup mode / Backup position	If no setpoint has been received for the time interval defined by the parameter “Backup timeout”, the actuator can assume a predefined behavior. When “Backup mode” is enabled, the damper drives to the defined “Backup position” or keeps the last known damper position. When “Backup mode” is disabled, the VAV compact controller controls to the last known setpoint until it receives a new setpoint.
Backup timeout	Time interval to detect communication interruption. If disabled, the actuator drives to the last received setpoint until a new setpoint is received.
Override position 1 / Override position 2	Damper position to which the VAV compact controller drives if the associated group object is triggered (override priority).
VAV operating mode	Operating mode to determine whether the setpoint signal (0…100 %) from the supervisory controller is interpreted as volume flow control or as damper position control.
Vn (Coefficient)	Characteristic value for nominal differential pressure for a defined air volume flow, preset by manufacturer (OEM). This parameter is described in section 2.6.
Type of air	Type of air according to EN13779:2007.
Master/Slave	The output signal of the supply air VAV compact controller is the reference signal for the extract air VAV compact controller. This might be necessary if a supervisory controller can provide only one reference signal, which is used to control the master VAV compact controller, cf. 6.2.2.

9.2 Device parameters (ACS931 / ACS941 / AST20)

Designation	Setting	Factory setting	Can be set with
Maximum air volume flow (Vmax)	20...120 %	100 %	ACS931, ACS941, AST20
Minimum air volume flow (Vmin)	-20...100 %	0 %	ACS931, ACS941, AST20
Opening direction (DIR)	r or L	r	ACS931, ACS941, AST20
Adaptive positioning (ADP)	Off or on	Off	ACS931, ACS941
Nominal air volume flow (Vnom)	0 …. 65'535 m^3/h	0 m^3/h	ACS931, ACS941
Elevation above sea level	0…5000 m (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

9.3 Parameters for engineering tools

ETS = ETS3 or ETS4.0.6 (or newer); ACS = ACS790 version 8.00 or newer

Designation	Setting	Factory setting	Can be set with
Nominal volume flow	0…214'000 m^3/h	100 m^3/h	ETS, ACS, ABT
Hysteresis volume flow	1…214'000 m^3/h	1 m^3/h	ETS, ACS, ABT
Min. repetition time volume flow	10 s … 900 s	10 s	ETS, ACS, ABT
Minimum volume flow	-20…100 %	0 %	ETS, ACS, ABT
Maximum volume flow	20 …120 %	100 %	ETS, ACS, ABT
Elevation above sea level	0…5000 m (in 500 m steps)	500 m	ETS, ACS, ABT
Opening direction	CW / CCW	CW	ETS, ACS, ABT
Adaptive positioning	On / off	Off	ETS, ACS, ABT
Backup mode	Backup value, Keep last state	Backup value	ETS, ACS, ABT
Backup position	0…100 %	0 %	ETS, ACS, ABT
VAV operating mode	Volume flow control Position control	Volume flow control	ETS
Type of air	Outside air, Primary supply air, Supply air, Extract air	Outside air	ACS
Master/Slave	Autonomous, Master, Slave	Autonomous	ACS

9.4 S-mode datapoints

Nr.	Name in ETS	Object function	Flags					Data point type KNX				Range
			C	R	W	T	U	ID	DPT_Name	Format	Unit	
1	Fault information	Transmit	1	1	0	1	0	219.001	_AlarmInfo	6 Byte	---	[0...255] = Log Nr. [0...2] = Alarm priority [0...14] = Application area [0...4] = Error class [0...7] = Attributes [0...7] = Alarm status
2	Fault state	Transmit	1	1	0	1	0	1.005	_Alarm	1 bit	---	0 = No alarm 1 = Alarm
3	Fault transmission	Receive	1	0	1	0	1	1.003	_Enable	1 bit	---	0 = Disable 1 = Enable
4	Setpoint	Receive	1	1	1	0	1	5.001	_Scaling	1 Byte	%	0...100%
5	Damper position	Transmit	1	1	0	1	0	5.001	_ Scaling	1 Byte	%	0...100%
6	Volume flow relative	Transmit	1	1	0	1	0	5.001	_ Scaling	1 Byte	%	0...100%
		Transmit	1	1	0	1	0	8.010	_Percent_V16	2 Bytes	%	-327.68...327.67%
		Transmit	1	1	0	1	0	5.004	_ Percent_U8	1 Byte	%	0…255%
7	Volume flow absolute [1]	Transmit	1	1	0	1	0	9.009	_Value_Airflow	2 Bytes	m^3/h	-670 760...670 760 m3/h
		Transmit	1	1	0	1	0	14.077	_ Volume_Flux	4 Bytes	m^3/s	$0...(2^{32}-1)$
8	Fault	Transmit	1	1	0	1	0	1.005	_Alarm	1 bit	---	0 = No alarm 1 = Alarm
9	Overridden	Transmit	1	1	0	1	0	1.002	_Bool	1 bit	---	0 = False 1 = True
10	Override position 1	Receive	1	1	1	0	1	1.003	_Enable	1 bit	---	0 = Disable 1 = Enable
11	Override position 2	Receive	1	1	1	0	1	1.003	_Enable	1 bit	---	0 = Disable 1 = Enable
12	Balancing mode	Receive	1	1	1	0	0	1.003	_Enable	1 bit	---	0 = Disable 1 = Enable
13	Vmin	Receive	1	1	1	0	1	8.010	_Percent_V16	2 Bytes	%	-327.68...327.67%
14	Vmax	Receive	1	1	1	0	1	8.010	_Percent_V16	2 Bytes	%	-327.68…327.67%
15	Vnom	Read-only	1	1	0	0	0	9.009	_Value_Airflow	2 Bytes	m3/h	-670 760...670 760 m3/h
16	Opening direction	Read-only	1	1	0	0	0	1.012	_Invert	1 bit	---	0 = Not Inverted 1 = Inverted
17	Diff. pressure [2]	Read-only	1	1	0	0	0	9.006	_Value_Pres	2 Bytes	Pa	0..670 760 Pa
		Read-only	1	1	0	0	0	14.058	_Value_Pressure	4 Bytes	Pa	$0...(2^{32}-1)$
18	Coefficient	Read-only	1	1	0	0	0	14.*	4-Byte Float	4 Bytes	---	0...3.16
19	OEM-Reset	Receive	1	0	1	0	0	1.017	_Trigger	1 bit	---	0, 1 = Trigger

[1] For some group objects, alternative data point types (DPT) can be selected in ETS. The first entry indicates the default setting.

Group Objects Description

1 Fault information

If group object #3 ”fault transmission” is set to “on”, the following faults can be transmitted if they occur. In that case, group object #2 value changes to “alarm”.

Error	Group obj. #1 *	Description	Resolution
Device jammed	XX 00 0A 03 0C 05	Target position can’t be reached due to blockage.	Remove blockage (visual inspection required) or invert Opening direction, if it is set wrongly Or switch on adaptive positioning, if mechanical limits are intended.
Backup mode entered	XX 01 01 02 0C 05	Actuator is in backup mode (cf. respective parameter setting)	Actuator leaves Backup mode when receiving a setpoint.
Pressure sensor tubes inverted	XX 01 0A 01 0C 05	Pressure sensor measures the lower pressure on the input marked with “+”.	Correct the tubes connection
Pressure sensor malfunction	XX 01 0A 01 0C 05	Malfunction of internal communication to dp sensor (200 ms timeout)	1) Check tubes connection, or 2) reboot device, or 3) replace device
Operating hours notification	XX 01 0A 04 0C 05	Appears after a cumulated motor running time of 365 days	Check device status and control loop sensitivity

* “XX” designates a counter which starts at “00” and is incremented by 1 with each occurrence.

2 Fault state — Indicates whether the actuator is in fault state. If yes, read out group object #1.

3 Fault transmission — Enabling/ disabling the fault transmission. Fault transmission is disabled by default; therefore no faults are transmitted from the actuator over the KNX bus.

4 Setpoint — Setpoint 0…100% for volume flow or position, depending on the operating mode.

5 Damper position — Relative damper position 0…100%. An opening range less than 0..90° can be normalized to 0..100% if adaptive positioning is set to “on”.

6 Volume flow relative — Volume flow relative to the settings of Vnom, Vmin, and Vmax.

7 Volume flow absolute — Volume flow in m^3/h or m^3/s depending on the selected data type.

8 Fault — Same function as group object #2 (available for compatibility reasons).

9 Overridden — Indicates whether the VAV compact controller is in override control either by a programming tool connected to the HMI or by objects #10 / #11.

10 Override position 1 — Drives the actuator to the override position 1 defined by the respective ETS parameter.

11 Override position 2 — Drives the actuator to the override position 2 defined by the respective ETS parameter.

12 Balancing mode — Drives the actuator to Vmax for air balancing purposes.

13 Vmin — Minimum air volume flow relative to Vnom.

14 Vmax — Maximum air volume flow relative to Vnom.

15 Vnom — Nominal air volume flow (absolute).

16 Opening direction — Opening direction of the air damper.

17 Diff. pressure — Actual value of the differential pressure over the VAV box measuring cross.

18 Coefficient — VAV box characteristic value to map a nominal differential pressure to the corresponding nominal volume flow.

19 OEM-Reset — Resets all parameters to the value specified by the OEM.

9.5 Communication object priorities

The communication objects are prioritized as listed in the table below. An override signal is active until it is disabled or the HMI/tool is disconnected from the VAV compact controller. The backup gets disabled when a new setpoint is received or a power reset is done.

Priority	Communication object
1	Local override (HMI/tool)
2	Remote override “Override position 1” (group object #10)
3	Balancing mode (group object #12)
4	Remote override “Override position 2” (group object #11)
5	Setpoint (group object #4)
6	Backup mode

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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