SIEMENS

OpenAir™

VAV compact controller   GDB181.1E/3
GLB181.1E/3

Series E

- **Compact controllers for plants with variable or constant airflow**
- **Integrated high-accuracy differential pressure sensor, actuator, and configurable digital air volume controller**
- **Operating voltage AC 24 V**
- **Nominal torque 5 or 10 Nm, angular rotation of air damper mechanically adjustable between 0 and 90°**
- **Optional configuration as a VAV compact controller or as a combined actuator / differential pressure sensor**
- **Prewired with a 0.9 m connecting cable**

Note

– Please refer to the "Technical Basics" in document P3544en for a detailed description as well as information on safety, engineering notes, mounting and commissioning

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

Building Technologies

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

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

Type summary

Type	Torque	Application range	Operating voltage
GDB181.1E/3	5 Nm	0...300 Pa	AC 24 V
GLB181.1E/3	10 Nm	0...300 Pa	AC 24 V

For torques >10 Nm and/or special functions (e.g. auxiliary switch or spring return) cf. datasheet ASV181.1E/3 (N3545).

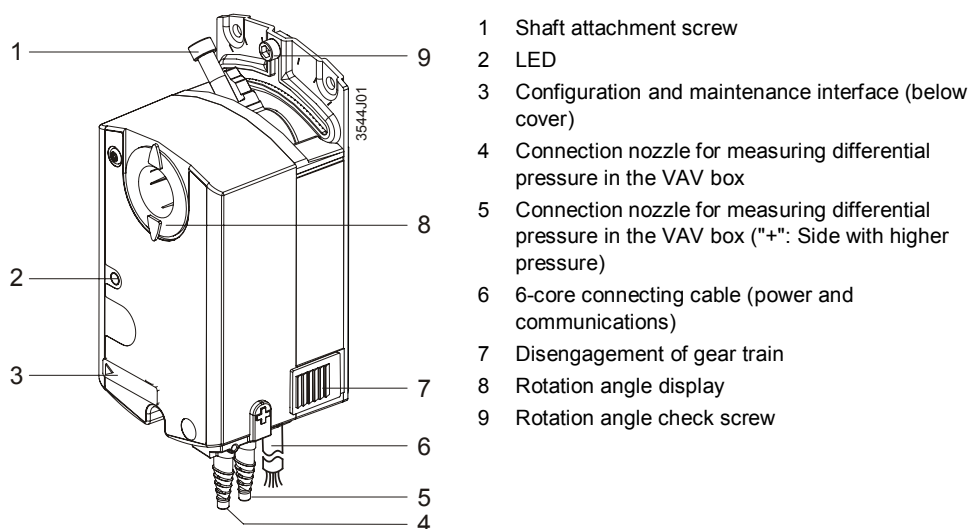For networked types (KNX / PL-Link) cf. datasheet GxD181.1E/KN (N3547).

For information on accessories and spare parts cf. datasheet N4698.

Equipment combinations

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

* limited functionality for VAV compact controller Series E

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

Design

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

Settings and operating mode

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

Settings for setpoint signal YC

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

Settings for actual value signal U

Parameter	Setting	Description	Siemens factory setting
U	FLW	Actual value of air volume flow (measurement value)	FLW
	POS	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	Off	Default op. mode for position display of air damper (mapping 0°…90° → 0…100 %)	Off
	On	Adaptive op. 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 dark	No operating voltage
LED green	Faultless operation
LED flashes red	Connection tubes for sensor interchanged
LED red	Differential pressure sensor fault

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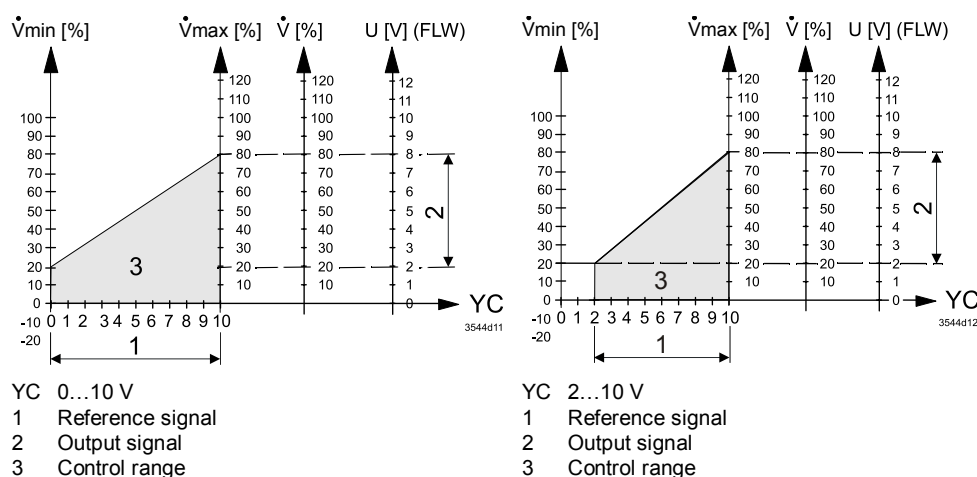
Operating mode "con"

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

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

Variable air volume (VAV) control

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

Forced control in VAV mode

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

VAV operating mode (Type "con")

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

Note

• Setting $\dot{V}_{min} ≤ 0$ % 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 mode (Type "con")

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

Notes

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

Operating mode "3P"

To use VAV 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 **r** = Clockwise (CW) **L** = Counterclockwise (CCW)	**r**

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

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

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

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

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

CAV step mode (Type "STP")

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

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

N1 GDB181.1E/3 or GLB181.1E/3
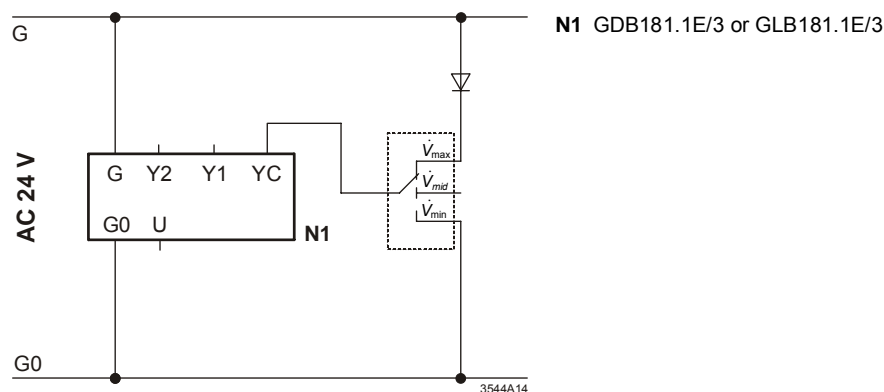
Ordering through the VAV box manufacturer (OEM)

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

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

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

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

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

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

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

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

Minimum and maximum limitation of air volume flow

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

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

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

Disposal

	The device is considered an electronics device for disposal in terms of European Directive 2012/19/EU and may not be disposed of as domestic garbage. • Dispose of the device through channels provided for this purpose. • Comply with all local and currently applicable laws and regulations.

Technical Data

⚠ **Power supply AC 24 V** (SELV/PELV) G (core 1, red) and G0 (core 2, black)	Operating voltage / frequency	AC 24 V ±20 % / 50/60 Hz
	Power consumption 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)
	Direction of rotation (adjustable with e.g. **ACS941**)	Clockwise / counterclockwise
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
Connection cable	Cable length	0.9 m
	Number of cores and cross-sectional area	6 x 0.75 mm^2
⚠ **Degree of protection and safety class**	Degree of protection acc. to EN 60529 (cf. mounting instruction)	IP54
	Safety class acc. to EN 60730	III
Environmental conditions	Operation / transport	IEC 721-3-3 / IEC 721-3-2
	Temperature	0...50 °C / −25…70 °C
	Humidity (non-condensing)	<95% r.h. / <95% r.h.
Standards and Regulations	Product safety	
	Automatic electric controls for household and similar use	EN 60730-2-14 (mode of action type 1)
	Electromagnetic compatibility (Application)	For residential, commercial and industrial environments

		GDB181.1E/3	GLB181.1E/3
	EU Conformity (CE)	A5W00003842 [1]	A5W00000176 [1]
		GDB181.1E/3	GLB181.1E/3
	RCM Conformity	A5W00003843 [1]	A5W00000177 [1]
	Product environmental declaration [2]	CM2E4634E [1]	

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
	Hexagonal	<15 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 %
	$\dot{V}_{mid}$, adjustable (resolution 1 % / factory setting 50 %)	0…100 %
	$\dot{V}_{n}$, adjustable (resolution 0.01 / factory setting 1.00)	1…3.16

$\dot{V}_n = 1 \triangleq 300$ Pa at nominal air volume flow

$\dot{V}_n = 3.16 \triangleq 30$ 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
[2] The product environmental declarations contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

Diagrams

The VAV compact controllers are supplied with a pre-wired connecting cable. The devices connected to it must use the same G0.

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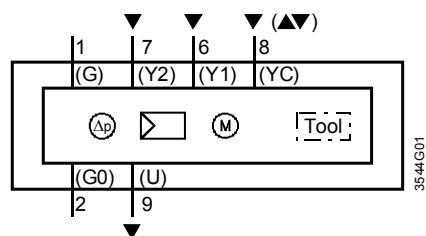
Tool = Configuration and maintenance interface
(Series E: 7-pin)

Siemens
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VAV compact controllers GDB181.1E/3 and GLB181.1E/3

CE1N3544en
2016-01-29

Connection cable
(color coded and labeled)

Terminal label	Color code	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 "Actuator's direction of rotation" (G0 switched) dependent on the setting of direction
7	orange (OG)	Y2	Positioning signal "Actuator's direction of rotation" (G0 switched) dependent on the setting of direction
8	grey (GY)	YC[1]	Air volume flow reference signal DC 0/2...10 V (setpoint) or communication signal
9	pink (PK)	U	Air volume flow measuring signal DC 0/2 ... 10 V (actual value)

[1] To ensure the functions at YC, only one cable may be connected at the time, either the cable for the air volume flow reference signal DC 0/2...10 V (setpoint) or the cable for the communication signal.
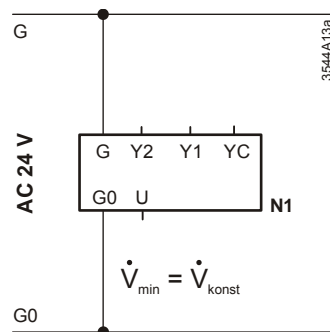
Wiring diagram
VAV
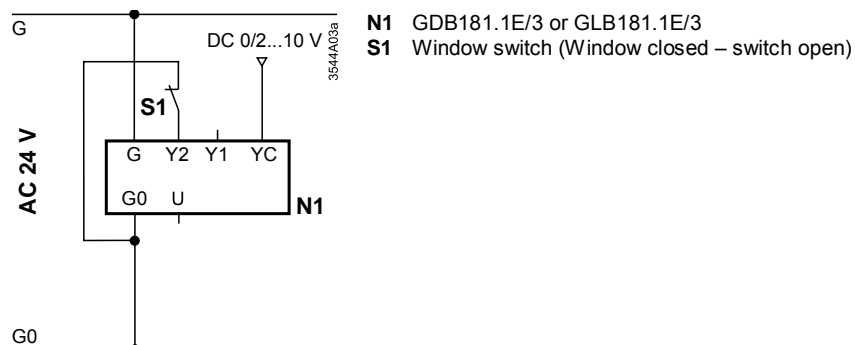Supply / extract air control in operating mode "con"

N1 GDB181.1E/3 or GLB181.1E/3
N2 Supervisory controller, e.g. RCU5.. or RCU6..
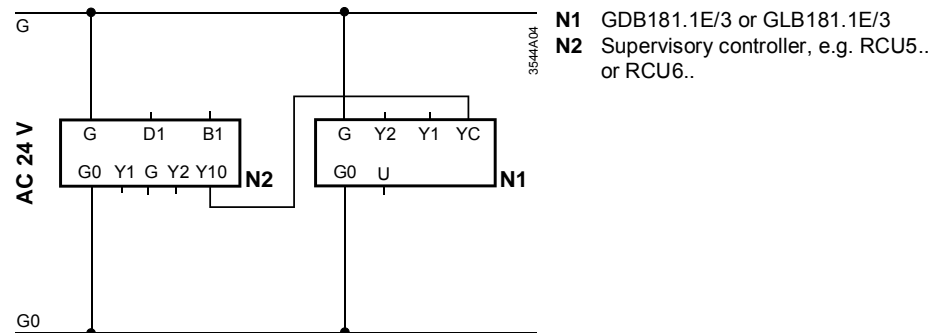
CAV
Supply / extract air control in operating mode "con"

$$\dot{V}_{min} = \dot{V}_{konst}$$

Complete shutoff in operating mode "con"

N1 GDB181.1E/3 or GLB181.1E/3
S1 Window switch (Window closed – switch open)
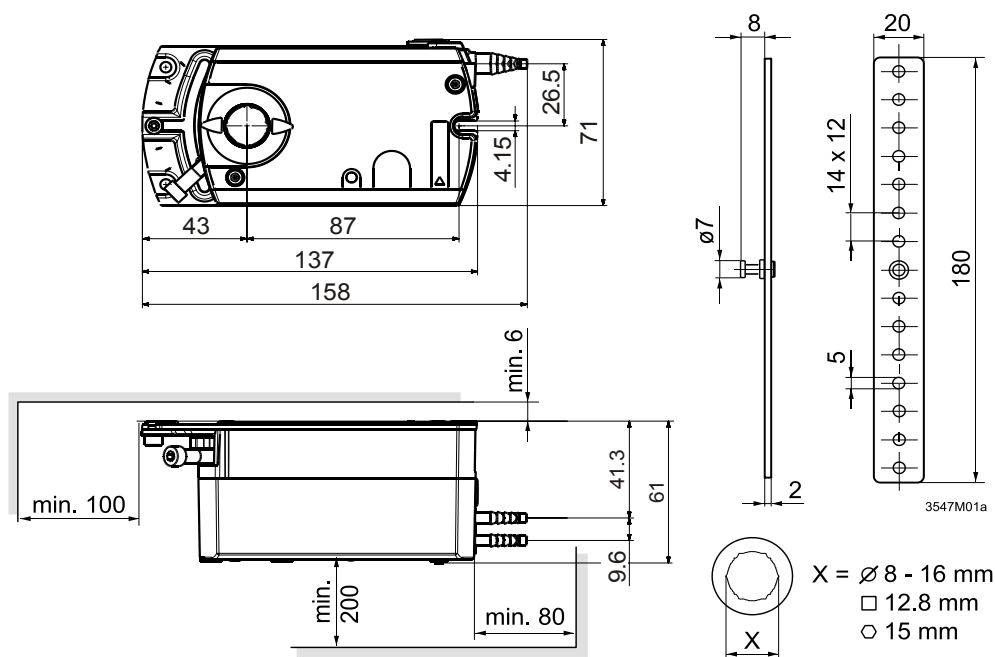
Operating mode "3P"

Supply / extract air control
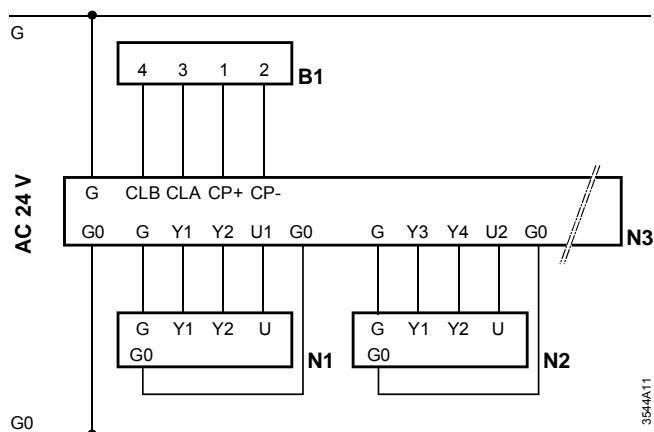
N1 GDB181.1E/3 or GLB181.1/E3 –supply air–
N2 GDB181.1E/3 or GLB181.1/E3 –extract air–
N3 Room temp. controller DESIGO™ RXC31.1
B1 DESIGO™-room unit, e.g. QAX32.1

⚠

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

Dimensions

Measurements in mm

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VAV compact controllers GDB181.1E/3 and GLB181.1E/3

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