Control components for VAV terminal units
Type Compact

With service interface and bus communication facility

Compact device for use with VAV terminal units

- Controller, differential pressure transducer, and actuator are fitted together in one casing
- Volume flow rates $\dot{V}_{min}$ and $\dot{V}_{max}$ are factory set as parameters
- Ideal for carrying out service from the switch cabinet or control panel
- Change of parameters using adjustment devices
- Suitable for constant and variable volume flows as well as for $\dot{V}_{min}$ / $\dot{V}_{max}$ switching
- Bus communication is possible due to MP bus or LonWorks interfaces

1

Description

Compact controller
LMV-D3-MP-F

Example

Application

– Electronic volume flow controllers
  of Type Compact are compact, all-in-one
  control devices for VAV terminal units
– Dynamic differential pressure transducer,
  electronic controller, and actuator are fitted
  together in one casing
– Suitable for different control tasks depending
  on how the input for the setpoint value signal
  is used
– The output signals of the room temperature
  controller, central BMS, air quality controller
  or similar units control the volume flow rate
  setpoint
– Override control by means of switches or relays
– Volume flow rate actual value is available
  as linear voltage signal
– Controller parameters are factory set

Standard filtration in comfort air conditioning
systems allows for use of the controller in
the supply air without additional dust protection.
Since a partial volume flow is passed through
the transducer in order to measure the volume
flow rate, please note:

– With heavy dust levels in the room,
  suitable extract air filters must be provided.
– If the air is polluted with fluff or sticky particles
  or contains aggressive media,
  Compact controllers cannot be used

Commissioning

– On-site adjusting is not required
– Integration of voltage signals
  into the central BMS
– If data transmission via bus interfaces
  is required, a system integrator should be
  involved in commissioning

Any attachments must be
defined with the order code
of the VAV terminal unit.

Compact controllers for VAV terminal units

Order code detail	Part number	Type	Type of VAV terminal unit
BC0	M466BA0	LMV-D3L-MP-F	①
BC0	A00000043141	LMV-D3-MP-F	②
BC0	A00000043140	LMV-D3-MP	④
BC0	A00000043142	NMV-D3-MP	③
BF0	A00000043140	LMV-D3-MP	⑤
BL0	M466ES7	LMV-D3LON	② ④
BL0	M466ES8	NMV-D3LON	③
XB0	M466DC1	227V-024-10	② ③ ④
XG0	M466DC1	227V-024-10	⑤
LN0	M466EG7	GLB181.1E/3	② ③ ④
LY0	M466EG7	GLB181.1E/3	⑤

① LVC
② TVR
③ TVJ, TVT
④ TZ-Silenzio, TA-Silenzio, TVZ, TVA
⑤ TVM

Function

Functional description

The volume flow rate is determined by measuring the differential pressure (effective pressure). For this purpose the VAV terminal unit is fitted with a differential pressure sensor. The integral differential pressure transducer transforms the effective pressure into a voltage signal. The volume flow rate actual value is hence available as a voltage signal. The factory setting is such that 10 V DC always corresponds to the nominal volume flow rate ($\dot{V}_{nom}$).

The volume flow rate setpoint value comes from a higher-level controller (e.g. room temperature controller, air quality controller, central BMS) or from switch contacts. Variable volume flow control results in a value between $\dot{V}_{min}$ and $\dot{V}_{max}$. It is possible to override the room temperature control, e.g. by a complete shut-off of the duct. The controller compares the volume flow rate setpoint value to the actual value and controls the integral actuator accordingly.

Volume flow rate parameters and voltage ranges are factory stored in the controller. Changes on the customer's site can easily be carried out using an adjustment device, a notebook with service tool, or a bus interface.

Volume flow control
– The volume flow controller works independent of the duct pressure
– Differential pressure fluctuations do not result in permanent volume flow rate changes
– To prevent the control from becoming unstable, a dead band is allowed within which the damper blade does not move.

Principle of operation – Easy and Compact controllers

① Differential pressure transducer
② Actuator
③ Volume flow controller
④ Setpoint value signal

1
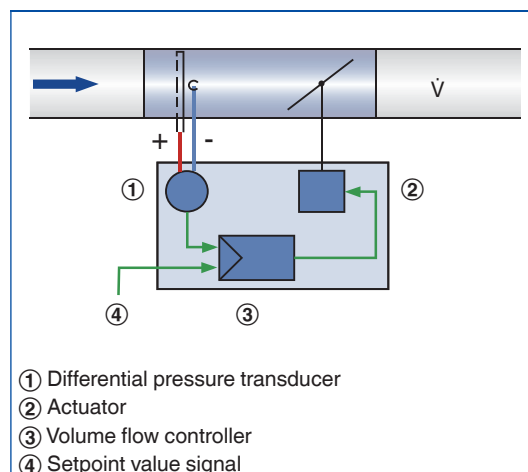
Description

… / **BC0** / …

Order code detail

… / **BF0** / …

Order code detail

For detailed information
on adjustment devices
see chapter K5 – 1.4

Application
– Electronic volume flow controller LMV-D3L-MP-F, LMV-D3-MP, LMV-D3-MP-F or NMV-D3-MP as Compact controller
– Variable air or constant air volume flow control
– The flow rate is measured using the dynamic measurement principle
– Voltage range for the actual and setpoint value signals 0 – 10 V DC or 2 – 10 V DC
– MP bus interface: Up to eight users can be addressed on an MP bus (LAN). This allows for the integration with higher-level systems (LonWorks, EIB-Konex, Modbus RTU and BACnet); as an alternative, a DDC controller with MP bus interface can control the Compact controller.
– Controller with NFC technology, i.e. settings and operating values can be read out using a smartphone app

Construction
– BC0: LMV-D3L-MP-F für LVC
– BC0: LMV-D3-MP-F for TVR
– BC0: NMV-D3-MP for TVJ, TVT
– BC0: LMV-D3-MP for TZ-Silenzio, TA-Silenzio, TVZ, TVA
– BF0: LMV-D3-MP for TVM

Useful additions
– AT-VAV-B: Adjustment device

Signal voltage range
– 0: 0 – 10 V DC
– 2: 2 – 10 V DC with shut-off function (< 0.1 V DC)

Operating modes
E: Single and M: Master
– $\dot{V}_{min}$: minimum volume flow rate
– $\dot{V}_{max}$: maximum volume flow rate

S: Slave
– $\dot{V}_{min}$: 0 %
– $\dot{V}_{max}$: Volume flow rate ratio to the master controller

F: Constant value
– $\dot{V}_{min}$: constant volume flow rate
– $\dot{V}_{max}$: 100 %

Parameters are factory set. The customer defines the required operating mode and the volume flow rates in the order code at the time of ordering.

Commissioning
– On-site adjusting is not required
– When installing the VAV terminal units it is important to assign each room the correct unit based on the ordered volume flow rates
– After successful installation and wiring the controller is ready for use on the analog interface
– If the MP bus interface is used, additional commissioning steps are required

Technical data

Compact controller LMV-D3L-MP-F

Compact controller
LMV-D3L-MP-F

Supply voltage (AC	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC –10/+20 %
Power rating (AC)	3.5 VA max.
Power rating (DC)	2 W max.
Torque	5 Nm
Running time for 90°	120 – 150 s
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC to 2004/108/EC, low voltage to 2006/95/EC
Weight	0.5 kg

Compact controller LMV-D3-MP und LMV-D3-MP-F

Supply voltage (AC	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC –10/+20 %
Power rating (AC)	4 VA max.
Power rating (DC)	2 W max.
Torque	5 Nm
Running time for 90°	110 – 150 s
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2004/108/EC
Weight	0.5 kg

Compact controller
LMV-D3-MP-F

Compact controller NMV-D3-MP

Supply voltage (AC	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC –10/+20 %
Power rating (AC)	5.5 VA max.
Power rating (DC)	3 W max.
Torque	10 Nm
Running time for 90°	110 – 150 s
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2004/108/EC
Weight	0.7 kg

Compact controller
NMV-D3-MP

1

Function

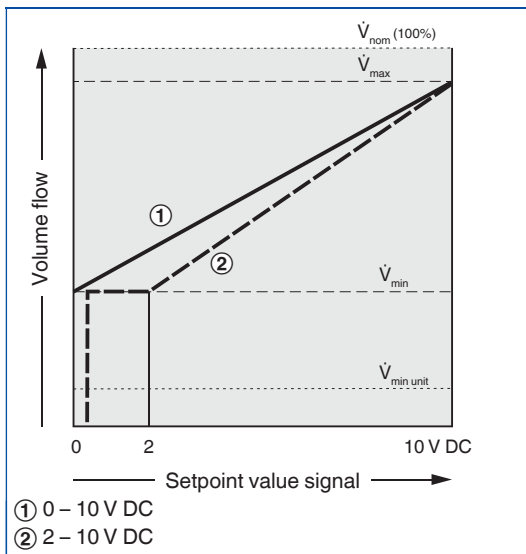### VAV-Compact

① VAV-Compact
② Gear release button
③ Connections for differential pressure sensor
④ Service socket
⑤ Blade shaft clamp
⑥ Rotation stop
⑦ Indicator lights
⑧ Connecting cable

Characteristics

Characteristic of the setpoint value signal
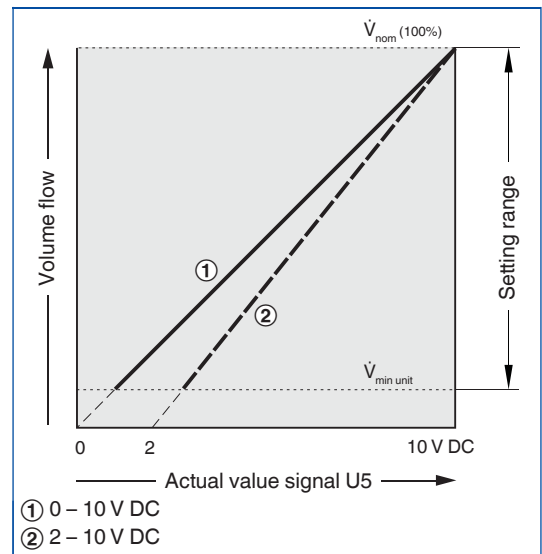

① 0 – 10 V DC
② 2 – 10 V DC

Characteristic of the actual value signal

① 0 – 10 V DC
② 2 – 10 V DC

0 – 10 V DC
$\dot{V}_{setpoint} = \dfrac{w}{10}\ (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$

0 – 10 V DC
$\dot{V}_{actual} = \dfrac{U5}{10}\ \dot{V}_{nom}$

2 – 10 V DC
$\dot{V}_{setpoint} = \dfrac{w - 2}{8}\ (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$

2 – 10 V DC
$\dot{V}_{actual} = \dfrac{U5 - 2}{8}\ \dot{V}_{nom}$

Electrical connection

Connecting cable core identification

BK	RD	WT		OR
○	○	○		○
1	2	3		5
⊥	~	w		U5/MP
−	+			Compact

1 ⊥, −:   Ground, neutral
2 ~, +:   Supply voltage
3 w: Setpoint value signal and override control
5 U5/MP: Actual value signal and communication
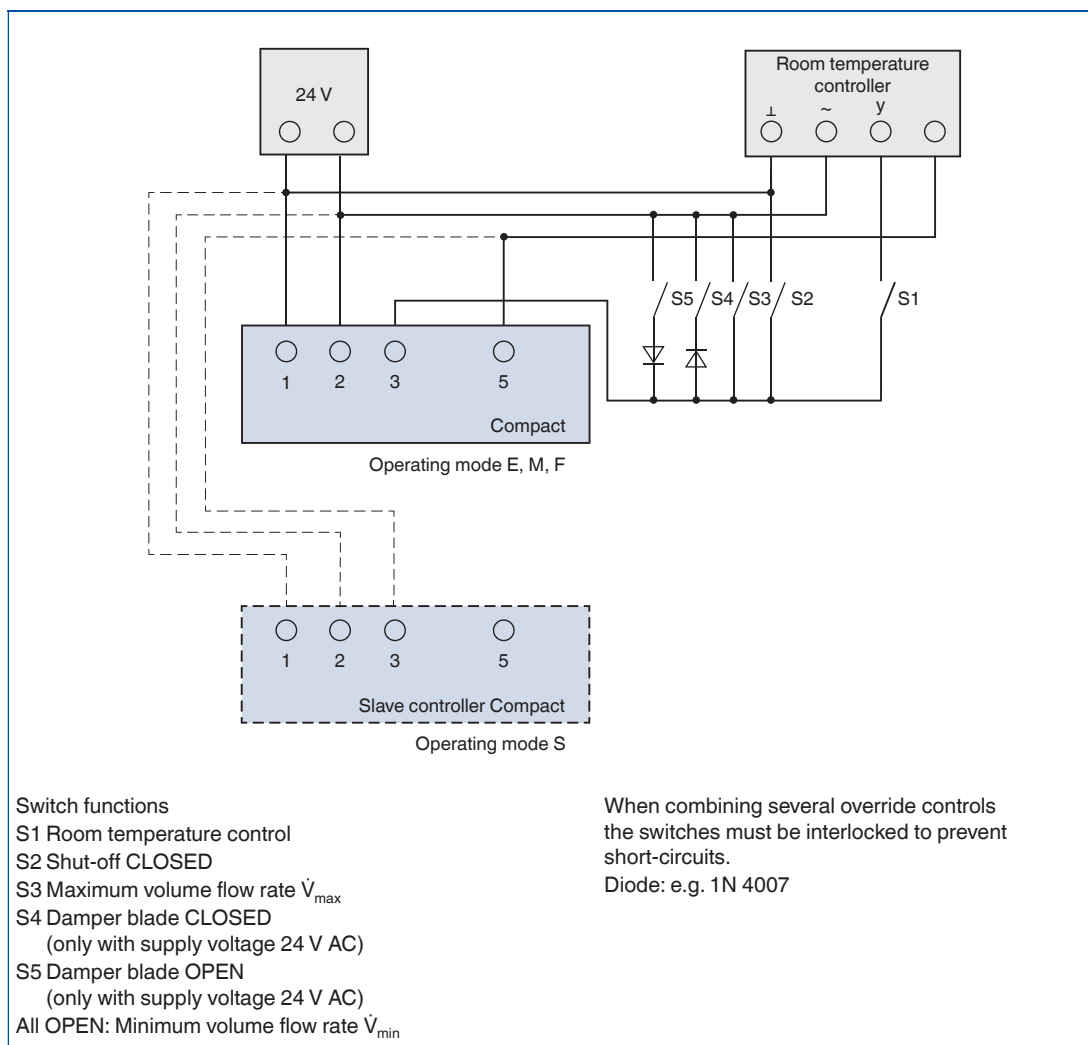
Compact: LMV-D3-MP, LMV-D3-MP-F,
          NMV-D3-MP, LMV-D3L-MP-F

... / BC0 / ...

Order code detail

Variable volume flow control and override control, voltage signal 0 to 10 V DC

Operating mode E, M, F

Slave controller Compact
Operating mode S

Switch functions
S1 Room temperature control
S3 Maximum volume flow rate $\dot{V}_{max}$
S4 Damper blade CLOSED
    (only with supply voltage 24 V AC)
S5 Damper blade OPEN
    (only with supply voltage 24 V AC)
All OPEN: Minimum volume flow rate $\dot{V}_{min}$

When combining several override controls
the switches must be interlocked to prevent
short-circuits.
Diode: e.g. 1N 4007
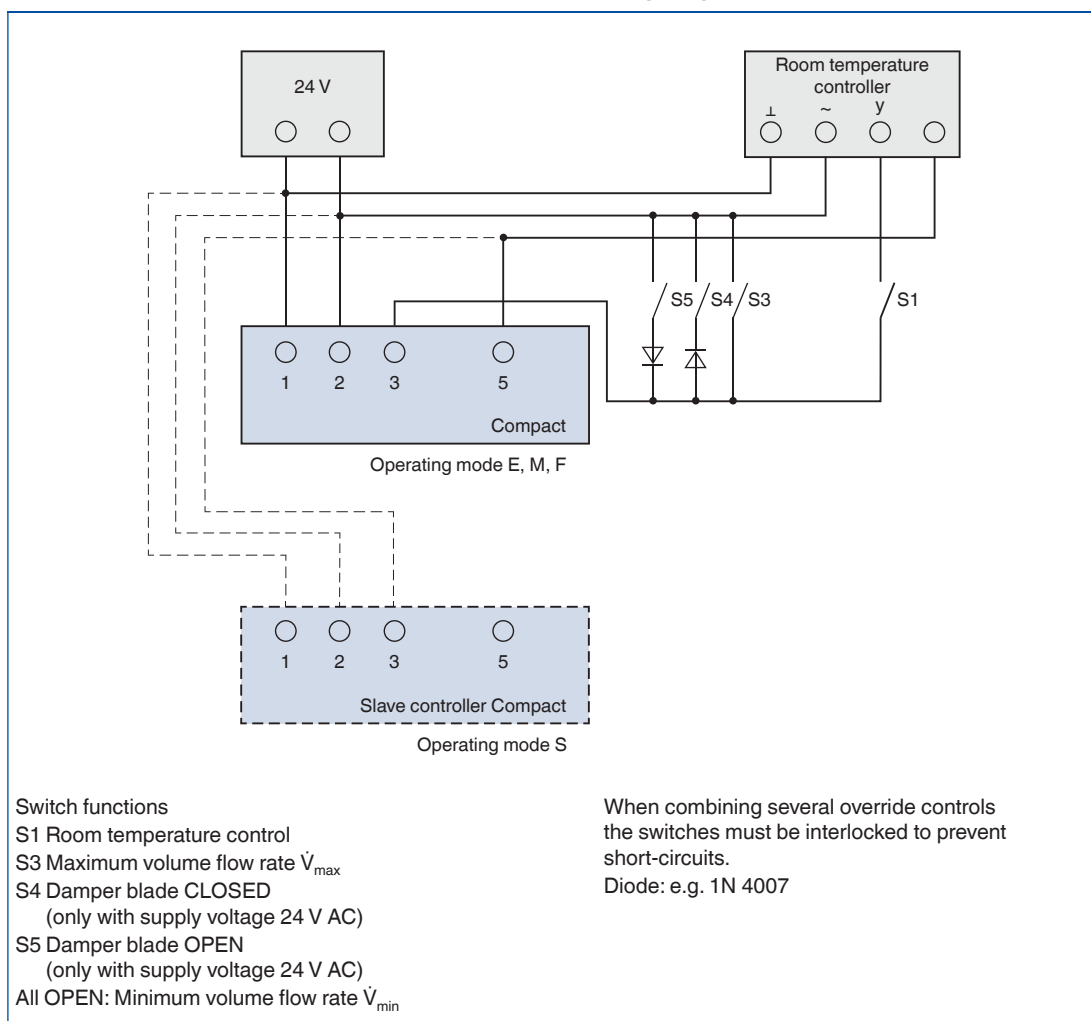
Compact: LMV-D3-MP, LMV-D3-MP-F, NMV-D3-MP, LMV-D3L-MP-F

1

... / **BC0** / ...

Order code detail

### Variable volume flow control and override control, voltage signal 2 to 10 V DC

Switch functions
S1 Room temperature control
S2 Shut-off CLOSED
S3 Maximum volume flow rate $\dot{V}_{max}$
S4 Damper blade CLOSED
    (only with supply voltage 24 V AC)
S5 Damper blade OPEN
    (only with supply voltage 24 V AC)
All OPEN: Minimum volume flow rate $\dot{V}_{min}$

When combining several override controls
the switches must be interlocked to prevent
short-circuits.
Diode: e.g. 1N 4007

Compact: LMV-D3-MP, LMV-D3-MP-F, NMV-D3-MP, LMV-D3L-MP-F

Dual duct terminal units Type TVM

Compact: LMV-D3-MP, LMV-D3-MP-F, NMV-D3-MP, LMV-D3L-MP-F

1
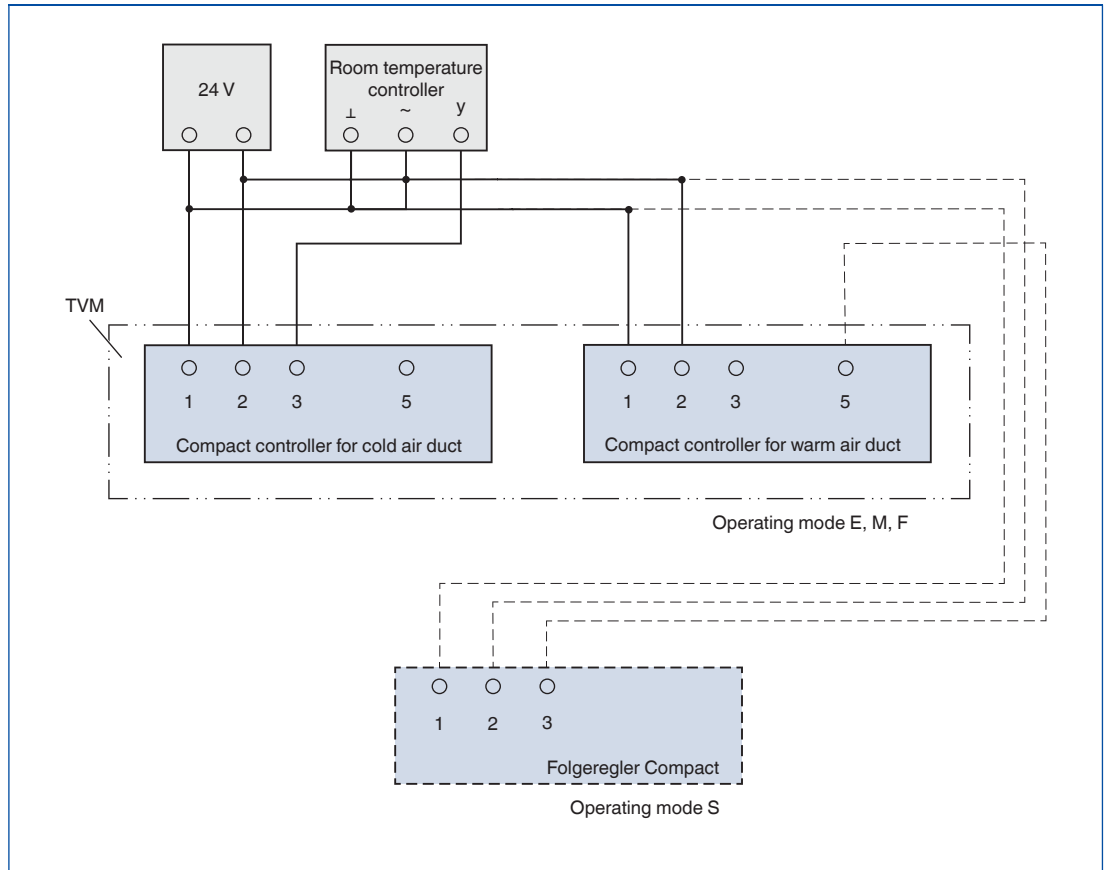
Description

... / **BL0**

Order code detail

For detailed information
on adjustment devices
see chapter K5 – 1.4

Application
– Electronic volume flow controller LMV-D3LON
  or NMV-D3LON as Compact controller
– Variable air or constant air volume flow control
– The flow rate is measured using the dynamic
  measurement principle
– Voltage range for the actual value signal
  2 – 10 V DC
– Volume flow controller
  with LonMark certification
– LonWorks interfaces for the transmission
  of standard network variables
– Functional profiles: Node-Object #0,
  Damper-Actuator-Object #8110,
  Open-Loop-Sensor-Object #1
  and Thermostat-Object #8060
– The Thermostat-Object #8060
  enables individual room control
– A plug-in for all LNS-based network integration
  tools (LNS version 3.3 and higher) is available
  for configuration

Construction
– BL0: LMV-D3LON for TVR, TZ-Silenzio,
  TA-Silenzio, TVZ, TVA
– BL0: NMV-D3LON for TVJ, TVT

Useful additions
– AT-VAV-B: Adjustment device

Signal voltage range
Actual value signal
– 2: 2 – 10 V DC

Commissioning
– A trained LonWorks systems integrator must
  carry out the integration into the overall system

Technical data

Compact controller
LMV-D3LON

Compact controller LMV-D3LON

Supply voltage (AC)	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC –10/+20 %
Power rating (AC)	4.5 VA max.
Power rating (DC)	2.5 W max.
Torque	5 Nm
Running time for 90°	110 – 150 s
Communication	LonWorks-Transceiver FTT-10A, free topology, twisted pair
Actual value signal output	2 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2004/108/EC
Weight	0.5 kg

Compact controller NMV-D3LON

Compact controller
NMV-D3LON

Supply voltage (AC)	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC –10/+20 %
Power rating (AC)	6 VA max.
Power rating (DC)	3,5 W max.
Torque	10 Nm
Running time for 90°	110 – 150 s
Communication	LonWorks-Transceiver FTT-10A, free topology, twisted pair
Actual value signal output	2 – 10 V DC, 0.5 mA max.
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2004/108/EC
Weight	0.7 kg

Function

VAV-Compact

① VAV-Compact
② Gear release button
③ Connections for differential pressure sensor
④ Service socket
⑤ Blade shaft clamp
⑥ Rotation stop
⑦ Indicator lights and LonWorks service button
⑧ Connecting cable
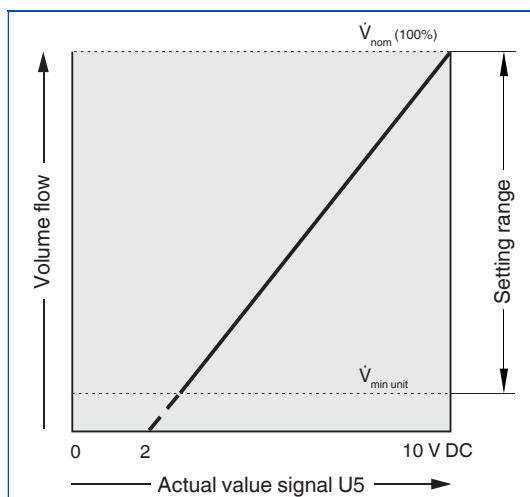
1
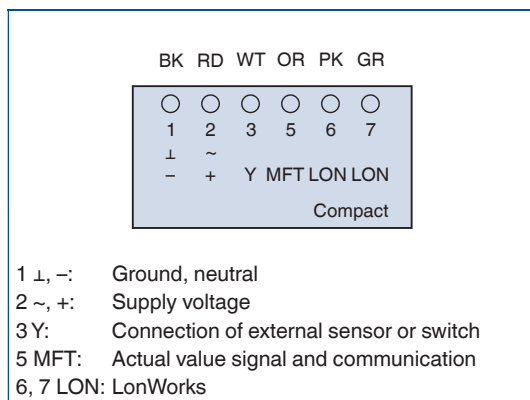
Characteristics

Characteristic of the actual value signal
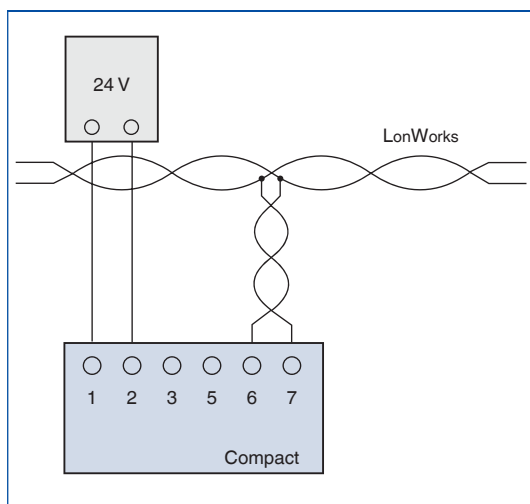

$$\dot{V}_{actual} = \frac{U5 - 2}{8} \, \dot{V}_{nom}$$

2 – 10 V DC

Electrical connection

Connecting cable core identification

BK	RD	WT	OR	PK	GR
1	2	3	5	6	7
⊥	~				
−	+	Y	MFT	LON	LON
				Compact	

1 ⊥, −:   Ground, neutral
2 ~, +:   Supply voltage
3 Y: Connection of external sensor or switch
5 MFT: Actual value signal and communication
6, 7 LON: LonWorks

Compact: LMV-D3LON, NMV-D3LON

Volume flow control

Compact: LMV-D3LON, NMV-D3LON

1

Description

```
...  /  XB0  /  ...
```
Order code detail

```
...  /  XG0  /  ...
```
Order code detail

For detailed information on adjustment devices see chapter K5 – 1.4

Application
– Electronic volume flow controller 227V-024-10 as Compact controller
– Variable air or constant air volume flow control
– The flow rate is measured using the dynamic measurement principle
– Voltage range for the actual and setpoint value signals 0 – 10 V DC or 2 – 10 V DC

Construction
– XB0: 227V-024-10 for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA
– BG0: 227V-024-10 for TVM

Useful additions
– AT-VAV-G: Adjustment device

Signal voltage range
– 0: 0 – 10 V DC
– 2: 2 – 10 V DC with shut-off function (< 0.8 V DC)

Operating modes
E: Single and M: Master
– $\dot{V}_{min}$: Minimum volume flow rate
– $\dot{V}_{max}$: Maximum volume flow rate

S: Slave operation
– $\dot{V}_{min}$: 0 %
– $\dot{V}_{max}$: Volume flow rate ratio to the master controller

F: Constant value
– $\dot{V}_{min}$: constant volume flow rate
– $\dot{V}_{max}$: 100 %

Parameters are factory set. The customer defines the required operating mode and the volume flow rates in the order code at the time of ordering.

Commissioning
– On-site adjusting is not required
– When installing the VAV terminal units it is important to assign each room the correct unit based on the ordered volume flow rates
– After successful installation and wiring the controller is ready for use
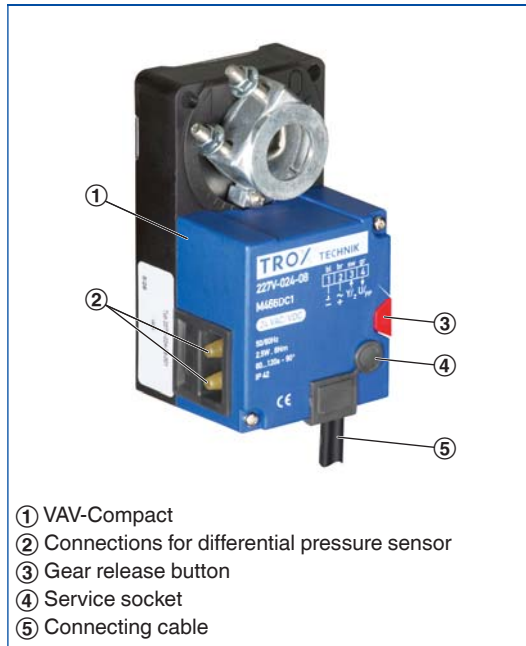
Technical data

Compact controller 227V-024-10

Compact controller 227V-024-10

Supply voltage (AC)	24 V AC ± 20 %, 50/60 Hz
Supply voltage (DC)	24 V DC ±20 %
Power rating (AC)	5.5 VA max.
Power rating (DC)	3 W max.
Torque	10 Nm
Running time for 90°	100 s
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, max. 0.5 mA
IEC protection class	III (protective extra-low voltage)
Protection level	IP 42
EC conformity	EMC according to 2004/108/EC
Weight	0.570 kg

Function

VAV-Compact

① VAV-Compact
② Connections for differential pressure sensor
③ Gear release button
④ Service socket
⑤ Connecting cable

Characteristics

Characteristic of the setpoint value signal

Setpoint value signal Y ⟶

① 0 – 10 V DC
② 2 – 10 V DC

Characteristic of the actual value signal

Actual value signal U ⟶
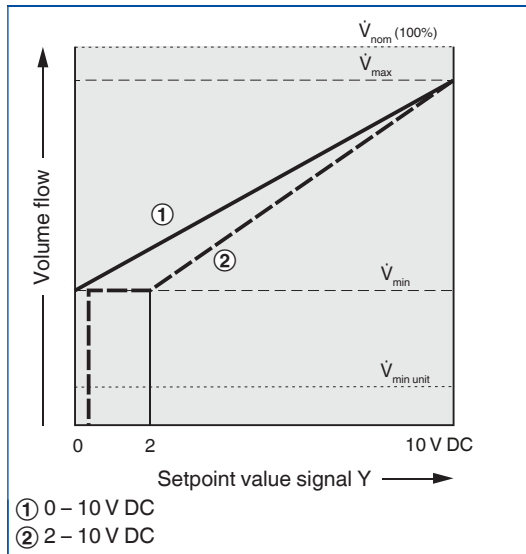
① 0 – 10 V DC
② 2 – 10 V DC

0 – 10 V DC
$\dot{V}_{setpoint} = \dfrac{Y}{10}\ (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$

0 – 10 V DC
$\dot{V}_{actual} = \dfrac{U}{10}\ \dot{V}_{nom}$

2 – 10 V DC
$\dot{V}_{setpoint} = \dfrac{Y-2}{8}\ (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$

2 – 10 V DC
$\dot{V}_{actual} = \dfrac{U-2}{8}\ \dot{V}_{nom}$

Electrical connection

Connecting cable core identification

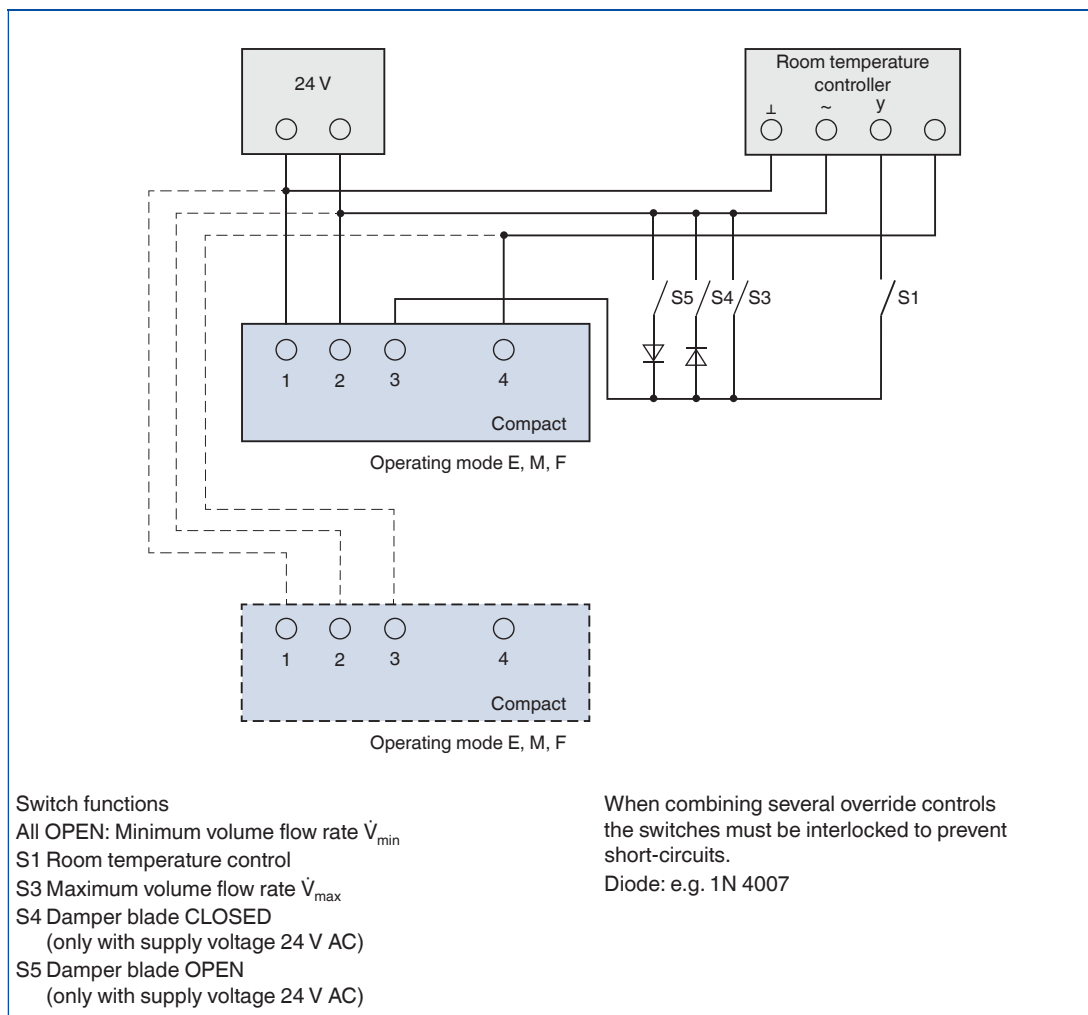| BL	BR	BK	GR
○ 1	○ 2	○ 3	○ 4
−	+		
⊥	~	Y/Z	U/pp
			Compact

1 ⊥, −:   Ground, neutral
2 ~, +:   Supply voltage
3 Y/Z: Setpoint value signal and override control
4 U/pp: Actual value signal and communication

Compact: 227V-024-10

... / **XB0** / ...

Order code detail
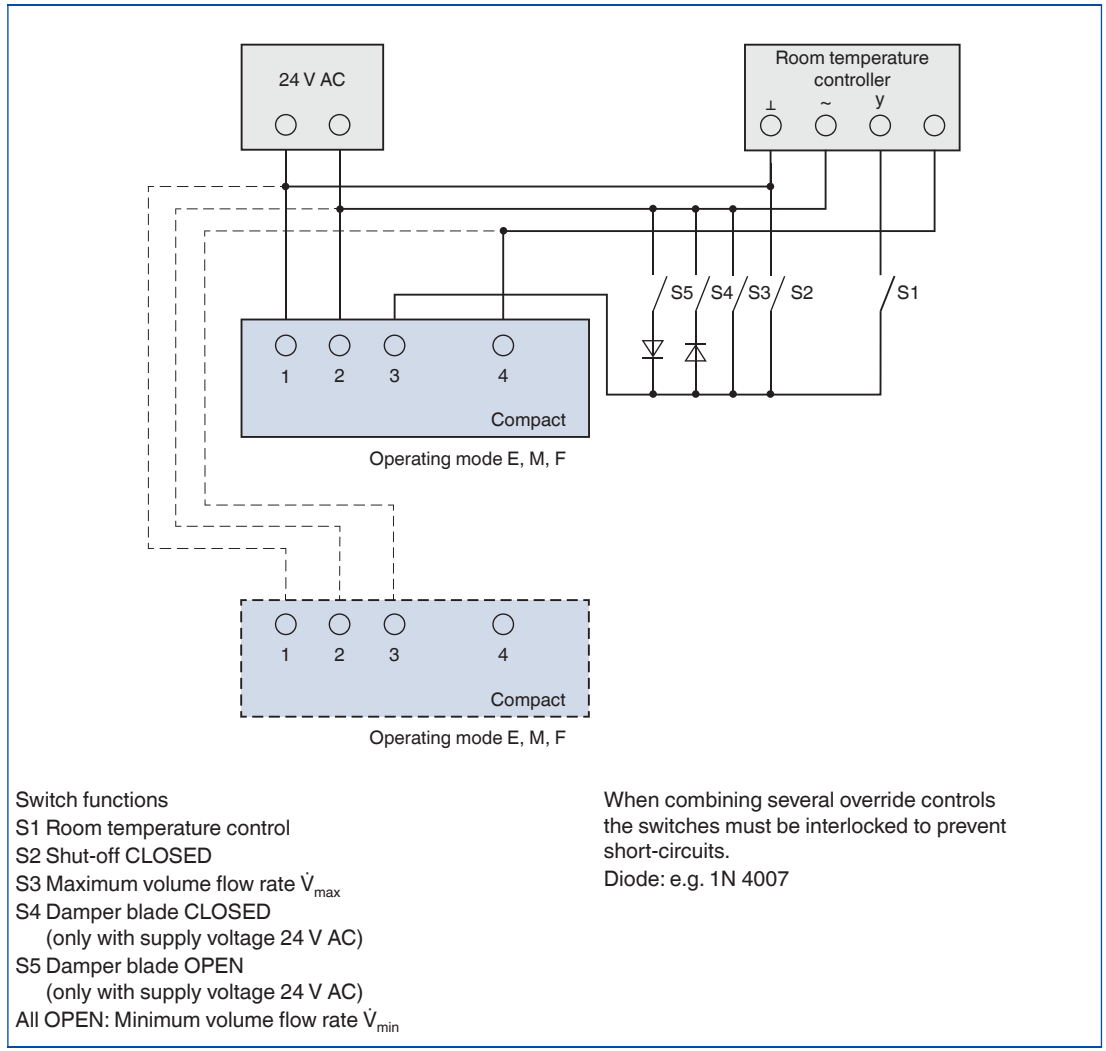
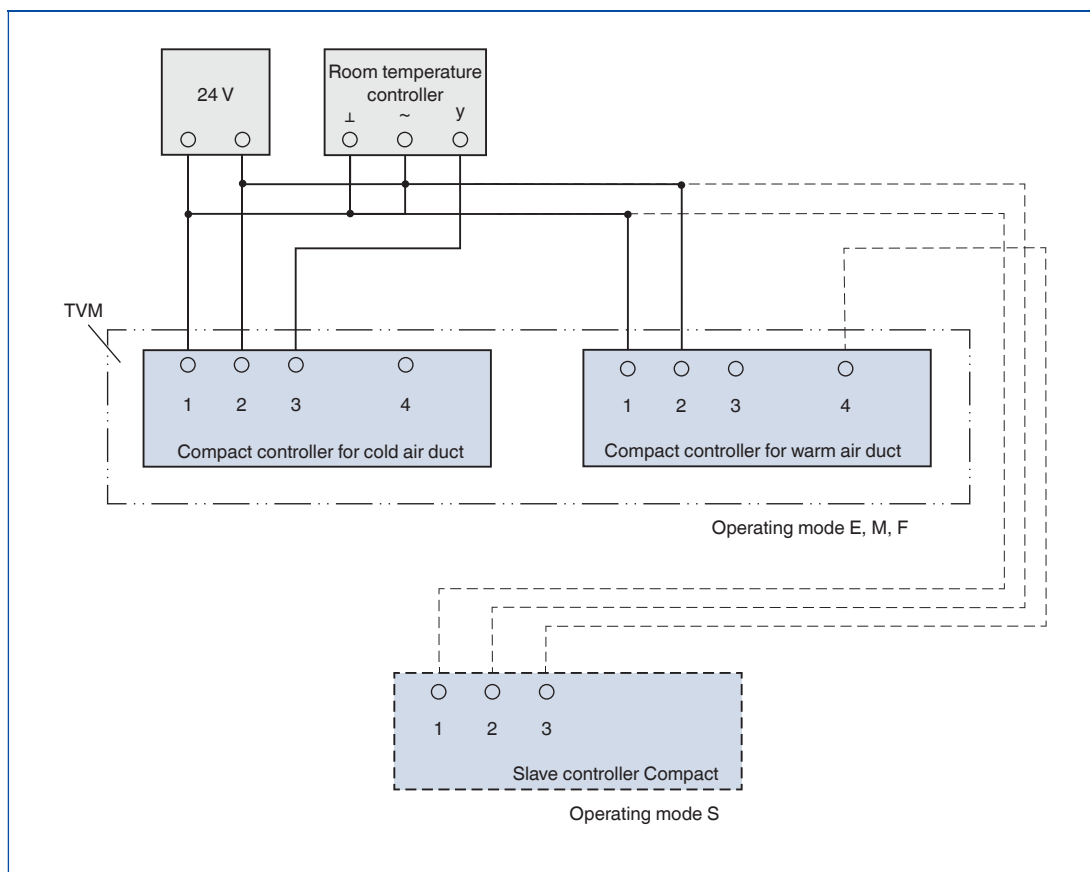### Variable volume flow control and override control, voltage signal 0 to 10 V DC

24 V

Room temperature controller
⊥   ~   y

S5 S4 S3   S1

○ 1   ○ 2   ○ 3   ○ 4
Compact
Operating mode E, M, F

○ 1   ○ 2   ○ 3   ○ 4
Compact
Operating mode E, M, F

Switch functions
All OPEN: Minimum volume flow rate $\dot{V}_{min}$
S1 Room temperature control
S3 Maximum volume flow rate $\dot{V}_{max}$
S4 Damper blade CLOSED
    (only with supply voltage 24 V AC)
S5 Damper blade OPEN
    (only with supply voltage 24 V AC)

When combining several override controls
the switches must be interlocked to prevent
short-circuits.
Diode: e.g. 1N 4007

Compact: 227V-024-10

Variable volume flow control and override control, voltage signal 2 to 10 V DC

24 V AC

Room temperature controller

⊥ ~ y

S5 S4 S3 S2 S1

1 2 3 4

Compact

Operating mode E, M, F

1 2 3 4

Compact

Operating mode E, M, F

Switch functions
S1 Room temperature control
S2 Shut-off CLOSED
S3 Maximum volume flow rate $\dot{V}_{max}$
S4 Damper blade CLOSED
    (only with supply voltage 24 V AC)
S5 Damper blade OPEN
    (only with supply voltage 24 V AC)
All OPEN: Minimum volume flow rate $\dot{V}_{min}$

When combining several override controls
the switches must be interlocked to prevent
short-circuits.
Diode: e.g. 1N 4007

Compact: 227V-024-10

1

... / **XG0** / ...

Order code detail

Dual duct terminal units Type TVM

Compact: 227V-024-10

Description

... / **LN0** / ...

Order code detail

... / **LY0** / ...

Order code detail

For detailed information on adjustment devices see chapter K5 – 1.4

Application

– Electronic volume flow controller GLB181.1E/3 as Compact controller
– Variable air or constant air volume flow control
– The flow rate is measured using the dynamic measurement principle
– Voltage range for the actual and setpoint value signals 0 – 10 V DC
– For room temperature controllers with output signal 0 – 10 V DC

Construction

– LN0: GLB181.1E/3 for TVR, TVJ, TVT, TZ-Silenzio, TA-Silenzio, TVZ, TVA
– LY0: GLB181.1E/3 for TVM

Useful additions

– AT-VAV-S: Adjustment device

Signal voltage range

– 0: 0 – 10 V DC

Operating modes

E: Single and M: Master
– $\dot{V}_{min}$: Minimum volume flow rate
– $\dot{V}_{max}$: Maximum volume flow rate

S: Slave
– $\dot{V}_{min}$: 0 %
– $\dot{V}_{max}$: Volume flow rate ratio to the master controller

F: Constant value
– $\dot{V}_{min}$: constant volume flow rate
– $\dot{V}_{max}$: 100 %

Parameters are factory set. The customer defines the required operating mode and the volume flow rates in the order code at the time of ordering.

Commissioning

– On-site adjusting is not required
– When installing the VAV terminal units it is important to assign each room the correct unit based on the ordered volume flow rates
– After successful installation and wiring the controller is ready for use

Technical data

Compact controller GLB 181.1E/3

Compact controller GLB181.1E/3

Supply voltage (AC)	24 V AC ± 20 %, 50/60 Hz
Power rating (AC)	3 VA max.
Torque	10 Nm
Running time for 90°	125 – 150 s
Setpoint value signal input	0 – 10 V DC, R_a > 100 kΩ
Actual value signal output	0 – 10 V DC, max. 1 mA
IEC protection class	III (protective extra-low voltage)
Protection level	IP 54
EC conformity	EMC according to 2004/108/EC
Weight	0.6 kg

1

Function

VAV-Compact

① Rotation stop
② Blade shaft clamp
③ Position indicator
④ Service socket
⑤ Gear release button
⑥ Connections for differential pressure sensor
⑦ Connecting cable

Characteristics

Characteristic of the setpoint value signal
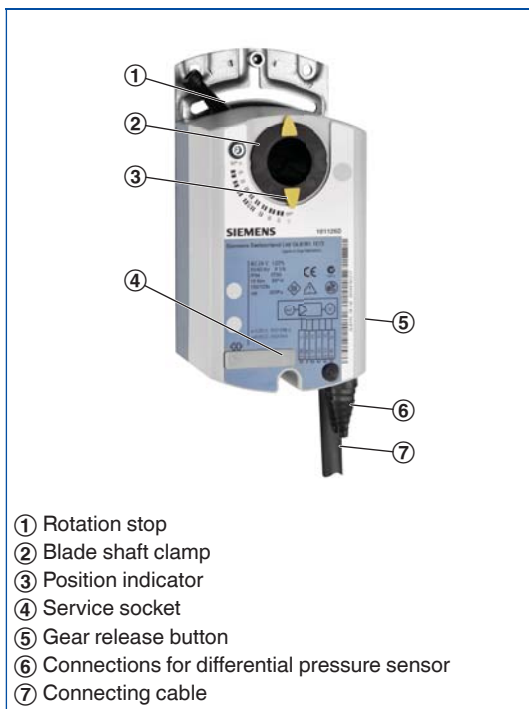
① 0 – 10 V DC

Characteristic of the actual value signal
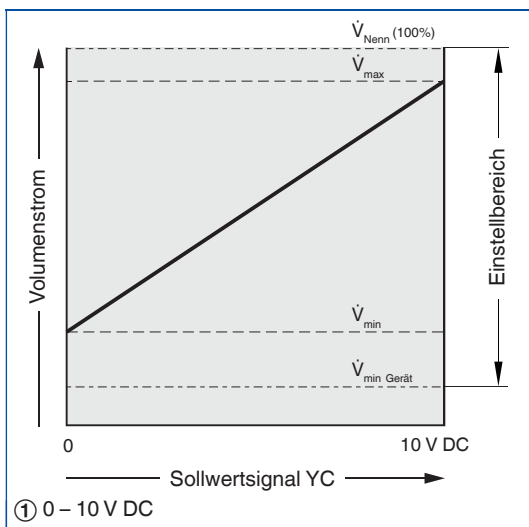
① 0 – 10 V DC

0 – 10 V DC
$\dot{V}_{setpoint} = \dfrac{YC}{10} \; (\dot{V}_{max} - \dot{V}_{min}) + \dot{V}_{min}$
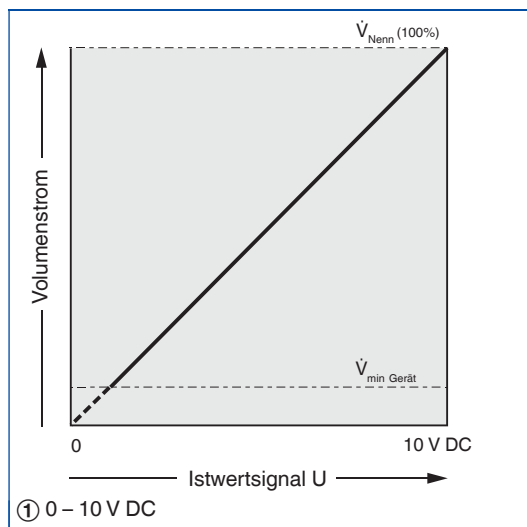
0 – 10 V DC
$\dot{V}_{actual} = \dfrac{U}{10} \; \dot{V}_{nom}$

Electrical connection

Connecting cable core identification

RD	BK	VI	OR	GR	PK
1	2	6	7	8	9
G	G0	Y1	Y2	YC	U

Compact

1 G:	Supply voltage
2 G0:	Ground, neutral
6 Y1:	Override control
7 Y2:	Override control
8 YC:	Setpoint value signal and communication
9 U:	Actual value signal
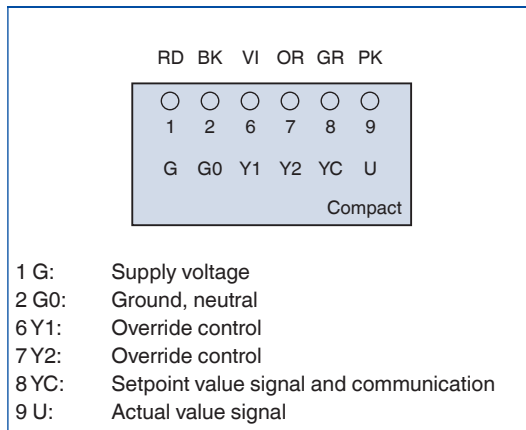
Compact: GLB181.1E/3

... / **LN0** / ...

Order code detail

Variable volume flow control and override control

Switch functions
S1 Damper blade OPEN
S2 Damper blade CLOSED
S1 und S2   Maximum volume flow rate $\dot{V}_{max}$
All OPEN: Room temperature control
or minimum volume flow rate $\dot{V}_{min}$
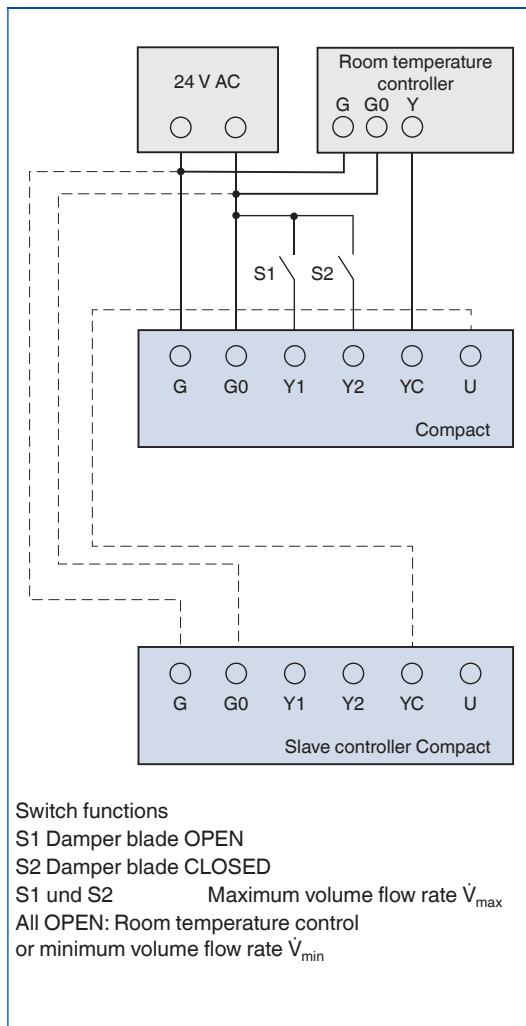
Compact: GLB181.1E/3

1

... / **LN0** / ...

Order code detail

Dual duct terminal unit Type TVM
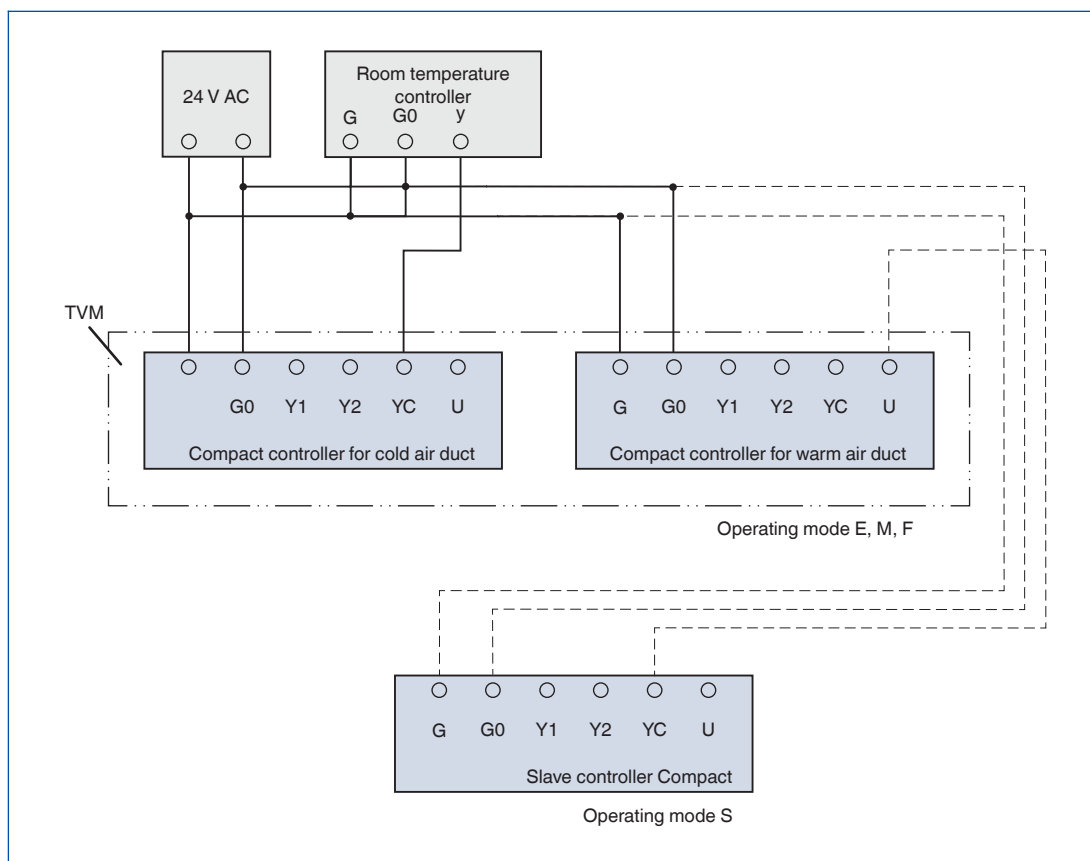
Compact: GLB181.1E/3

Variable volume flow control – VARYCONTROL

1

Basic information and nomenclature

- Product selection
- Principal dimensions
- Nomenclature
- Construction
- Correction values for system attenuation
- Measurements
- Sizing and sizing example
- Function
- Operating modes

Basic information and nomenclature

1

Product selection

		Type										
	LVC	**TVR**	**TVJ**	**TVT**	**TZ-Silenzio**	**TA-Silenzio**	**TVZ**	**TVA**	**TVM**	**TVRK**	**TVLK**	**TVR-Ex**
Type of system												
Supply air	●	●	●	●	●		●			●		●
Extract air	●	●	●	●		●		●		●	●	●
Dual duct (supply air)									●			
Duct connection, fan end												
Circular	●	●					●	●	●	●	●	●
Rectangular			●	●	●	●						
Volume flow rate range												
Up to [m³/h]	1080	6050	36360	36360	3025	3025	6050	6050	6050	6050	1295	6050
Up to [l/s]	300	1680	10100	10100	840	840	1680	1680	1680	1680	360	1680
Air quality												
Filtered	●	●	●	●	●	●	●		●	●	●	●
Office extract air	●	●	●	●		●		●		●	●	●
Polluted		○	○	○		○		○		●	●	○
Contaminated										●	●	
Control function												
Variable	●	●	●	●	●	●	●	●	●	●	●	●
Constant	●	●	●	●	●	●	●	●	●	●	●	●
Min/Max	●	●	●	●	●	●	●	●	●	●	●	●
Pressure control		○	○	○	○	○	○	○		○		○
Master/Slave	●	●	●	●	●	●	●	●	Master	●	●	●
Shut-off mode												
Leakage			●									
Low leakage	●	●		●	●	●	●	●	●	●	●	●
Acoustic requirements												
High < 40 dB(A)			○	○	●	●	●	●	○			
Low < 50 dB (A)	●	●	●	●	●	●	●	●	●	●	●	●
Other functions												
Volume flow rate measurement	●	●	●	●	●	●	●	●	●	●	●	●
Special areas												
Areas with explosive atmospheres												●
Labs, clean rooms, operating theatres (EASYLAB, TCU-LON II)		●	●	●			●	●		●	●	

●	Possible
○	Possible under certain conditions: Robust unit variant and/or specific control component (attachment) or useful additional product
	Not possible

Principal dimensions

ØD [mm]
VAV terminal units made of stainless steel:
Outside diameter of the spigot
VAV terminal units made of plastic:
Inside diameter of the connecting spigot

ØD$_1$ [mm]
Pitch circle diameter of flanges

ØD$_2$ [mm]
Outside diameter of flanges

ØD$_4$ [mm]
Inside diameter of the screw holes of flanges

L [mm]
Length of unit including connecting spigot

L$_1$ [mm]
Length of casing or acoustic cladding

B [mm]
Duct width

B$_1$ [mm]
Screw hole pitch of flange (horizontal)

B$_2$ [mm]
Outside dimension of flange (width)

B$_3$ [mm]
Width of device

H [mm]
Duct height

H$_1$ [mm]
Screw hole pitch of flange (vertical)

H$_2$ [mm]
Outside dimension of flange (height)

H$_3$ [mm]
Unit height

n [ ]
Number of flange screw holes

T [mm]
Flange thickness

m [kg]
Unit weight including the minimum required attachments (e.g. Compact controller)

Nomenclature

Acoustic data

f$_m$ [Hz]
Octave band centre frequency

L$_{PA}$ [dB(A)]
A-weighted sound pressure level
of air-regenerated noise of the VAV terminal unit, system attenuation taken into account

L$_{PA1}$ [dB(A)]
A-weighted sound pressure level
of air-regenerated noise of the VAV terminal unit with secondary silencer, system attenuation taken into account

L$_{PA2}$ [dB(A)]
A-weighted sound pressure level
of case-regenerated noise of the VAV terminal unit, system attenuation taken into account

L$_{PA3}$ [dB(A)]
A-weighted sound pressure level
of case-regenerated noise of the VAV terminal unit with acoustic cladding, system attenuation taken into account

All sound pressure levels are based on 20 µPa.

Definition of noise

L_{PA}

① Air-regenerated noise
② Case-radiated noise

1
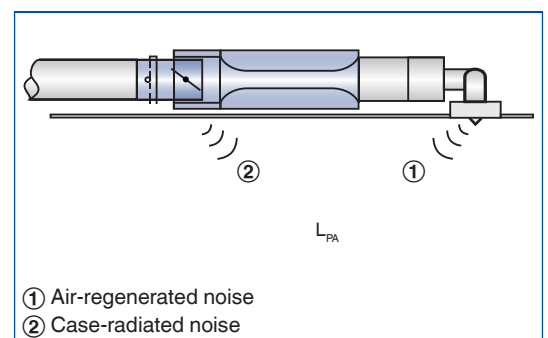
Volume flow rates

$\dot{V}_{nom}$ [m³/h] and [l/s]
Nominal volume flow rate (100 %)
– The value depends on product type
  and nominal size
– Values are published on the internet
  and in technical leaflets, and stored
  in the Easy Product Finder design software.
– Reference value for calculating percentages
  (e.g. $\dot{V}_{max}$)
– Upper limit of the setting range
  and maximum volume flow rate setpoint
  value for the VAV terminal unit

$\dot{V}_{min\ unit}$ [m³/h] and [l/s]
Technically possible minimum volume flow rate
– The value depends on product type, nominal
  size and control component (attachment)
– Values are stored
  in the Easy Product Finder design software
– Lower limit of the setting range and minimum
  volume flow rate setpoint value
  for the VAV terminal unit
– Depending on the controller,
  setpoint values below $\dot{V}_{min\ unit}$
  (if $\dot{V}_{min}$ equals zero) may result
  in unstable control or shut-off

$\dot{V}_{max}$ [m³/h] and [l/s]
Upper limit of the operating range
for the VAV terminal unit that can be
set by customers
– $\dot{V}_{max}$ can only be smaller than or equal to $\dot{V}_{nom}$
– In case of analog signalling to volume flow
  controllers (which are typically used),
  the set maximum value ($\dot{V}_{max}$) is allocated
  to the setpoint signal maximum (10 V)
  (see characteristic)

$\dot{V}_{min}$ [m³/h] and [l/s]
Lower limit of the operating range for the VAV
terminal unit that can be set by customers
– $\dot{V}_{min}$ should be smaller than or equal to $\dot{V}_{max}$
– Do not set $\dot{V}_{min}$ smaller than $\dot{V}_{min\ unit}$,
  otherwise the control may become unstable
  or the damper blade may close
– $\dot{V}_{min}$ may equal zero
– In case of analog signalling to volume flow
  controllers (which are typically used),
  the set minimum value ($\dot{V}_{min}$) is allocated
  to the setpoint signal minimum (0 or 2 V)
  (see characteristic)

$\dot{V}$ [m³/h] and [l/s]
Volume flow rate

$\Delta\dot{V}$ [± %]
Volume flow rate tolerance from setpoint value
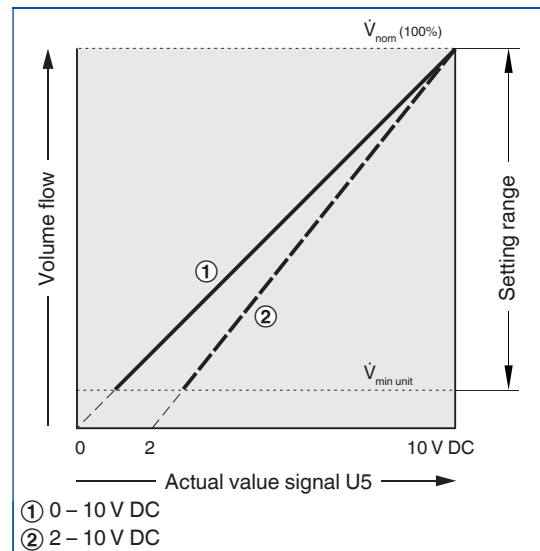
$\Delta\dot{V}_{warm}$ [± %]
Volume flow rate tolerance
for the warm air flow of dual duct terminal units

Characteristic of the setpoint value signal

① 0 – 10 V DC
② 2 – 10 V DC

Characteristic of the actual value signal

① 0 – 10 V DC
② 2 – 10 V DC
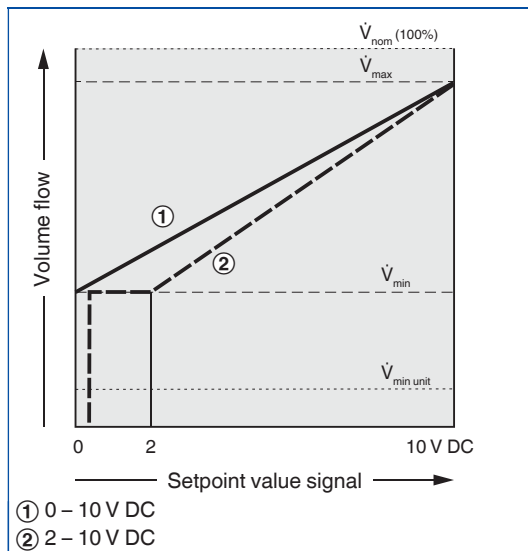
Differential pressure

Δp_{st} [Pa]
Static differential pressure

$\Delta p_{st\,min}$ [Pa]
Static differential pressure, minimum
– The static minimum differential pressure
  is equal to the pressure loss of the VAV terminal
  unit when the damper blade is open,
  caused by flow resistance
  (sensor tubes, damper mechanism)
– If the pressure on the VAV terminal unit
  is too low, the setpoint volume flow rate may
  not be achieved, not even when the damper
  blade is open
– Important factor in designing the ductwork
  and in rating the fan including speed control
– Sufficient duct pressure must be ensured for all
  operating conditions and for all terminal units,
  and the measurement point or points for speed
  control must have been selected accordingly
  to achieve this

Static differential pressure
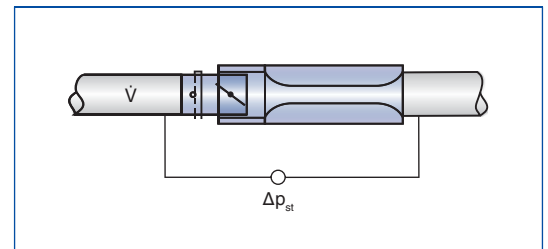
Constructions

Galvanised sheet steel
– Casing made of galvanised sheet steel
– Parts in contact with the airflow as described
  for the product type
– External parts, e.g. mounting brackets
  or covers, are usually made of galvanised
  sheet steel

Powder-coated surface (P1)
– Casing made of galvanised sheet steel,
  powder-coated RAL 7001, silver grey
– Parts in contact with the airflow
  are powder-coated or made of plastic
– Due to production, some parts that come
  into contact with the airflow may be stainless
  steel or aluminium, powder-coated
– External parts, e.g. mounting brackets
  or covers, are usually made of galvanised
  sheet steel

Stainless steel (A2)
– Casing made of stainless steel 1.4201
– Parts in contact with the airflow
  are powder-coated or made of stainless steel
– External parts, e.g. mounting brackets
  or covers, are usually made of galvanised
  sheet steel

1

The quick sizing tables show the sound pressure levels that can be expected in a room both for the air-regenerated noise and for the case-radiated noise. The sound pressure level in a room results from the sound power level of the products – for a given volume flow rate and differential pressure – and the attenuation and insulation on site. Generally accepted attenuation and insulation values have been taken into account.
The distribution of air across the ductwork, changes of direction, end reflection, and room attenuation all affect the sound pressure level of the air-regenerated noise. Ceiling insulation and room attenuation influence the sound pressure level of the case-radiated noise.

Reducing the sound pressure level of the air-regenerated noise

① VAV terminal unit
② Distribution in the ducting
③ Change of direction
④ End reflection
⑤ Ceiling insulation
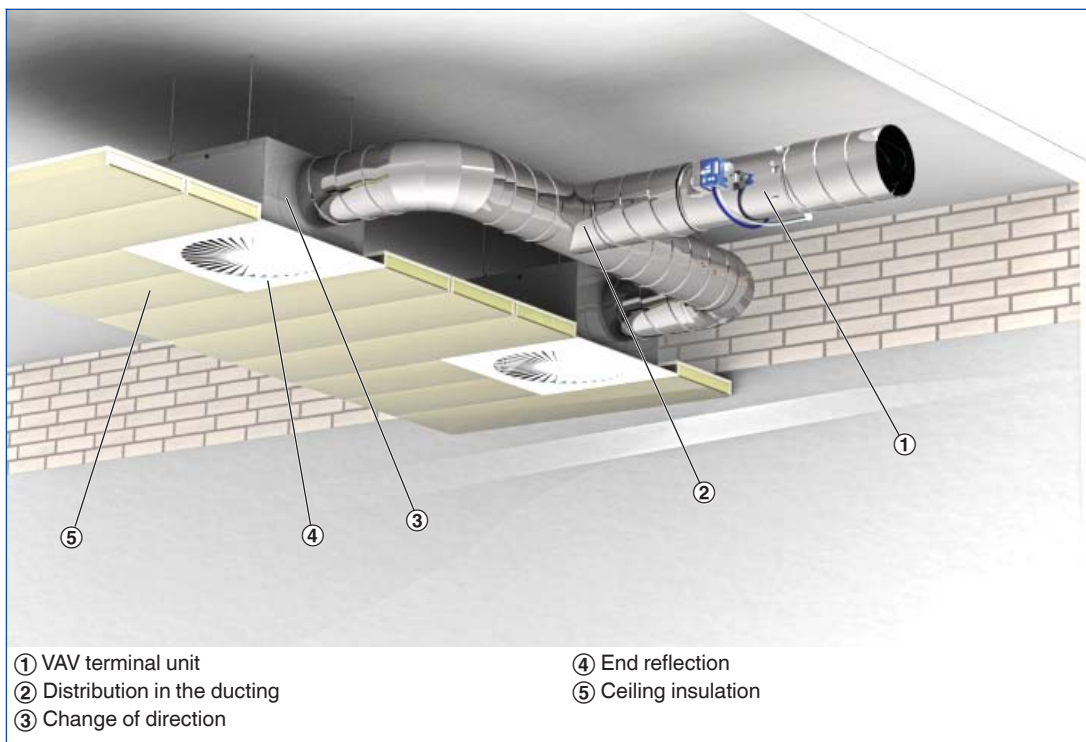
Correction values for acoustic quick sizing

The correction values for the distribution in the ducting are based on the number of diffusers assigned to any one air terminal unit.
If there is just one diffuser (assumption: 140 l/s or 500 m³/h), no correction is necessary.

Octave correction for the distribution in the ducting, used to calculate the air-regenerated noise

V̇ in [m³/h]	500	1000	1500	2000	2500	3000	4000	5000
[l/s]	140	280	420	550	700	840	1100	1400
[dB]	0	3	5	6	7	8	9	10

One change of direction, e.g. at the horizontal connection of the diffuser plenum box, has been taken into consideration for the system attenuation values. Vertical connection of the plenum box does not result in a system attenuation. Additional bends result in lower sound pressure levels.

System attenuation per octave to VDI 2081 for the calculation of the air-regenerated noise

Centre frequency [Hz]	63	125	250	500	1000	2000	4000	8000
					ΔL			
					dB			
Change of direction	0	0	1	2	3	3	3	3
Mündungsreflexion	10	5	2	0	0	0	0	0
Room attenuation	5	5	5	5	5	5	5	5

The calculation is based on the end reflection for nominal size 250

Octave correction for the calculation of case-radiated noise

| Centre frequency [Hz]	63	125	250	500	1000	2000	4000	8000
					ΔL			
					dB			
Ceiling insulation	4	4	4	4	4	4	4	4
Room attenuation	5	5	5	5	5	5	5	5

Measurements

The acoustic data for the air-regenerated noise and case-radiated noise are determined according to EN ISO 5135. All measurements are carried out in a reverberation chamber to EN ISO 3741.

Measuring the air-regenerated noise

① Reverberation chamber ④ Fan
② VAV terminal unit ⑤ Sound attenuator
③ Microphone
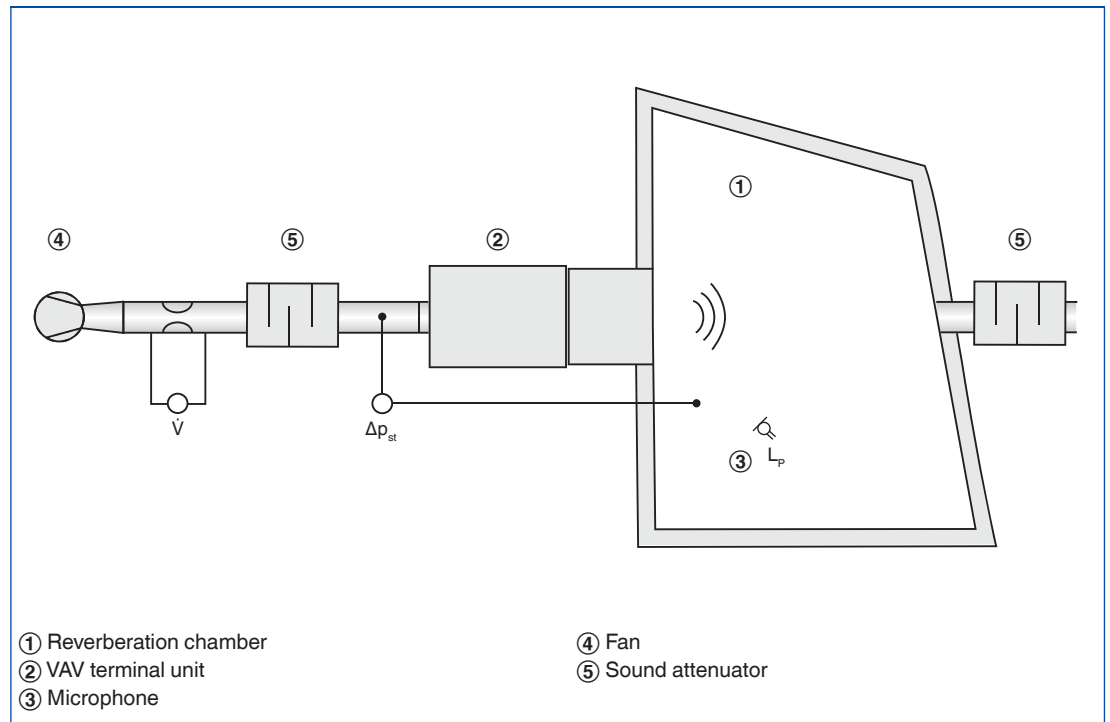
The sound pressure levels for air-regenerated noise L_{PA} given by us result from measurements in a reverberation chamber. The sound pressure L_P is measured for the entire frequency range. The evaluation of the measurements, including system attenuation and A-weighting, results in the sound pressure level L_{PA}.

Measuring the case-radiated noise

① Reverberation chamber ④ Fan
② VAV terminal unit ⑤ Sound attenuator
③ Microphone
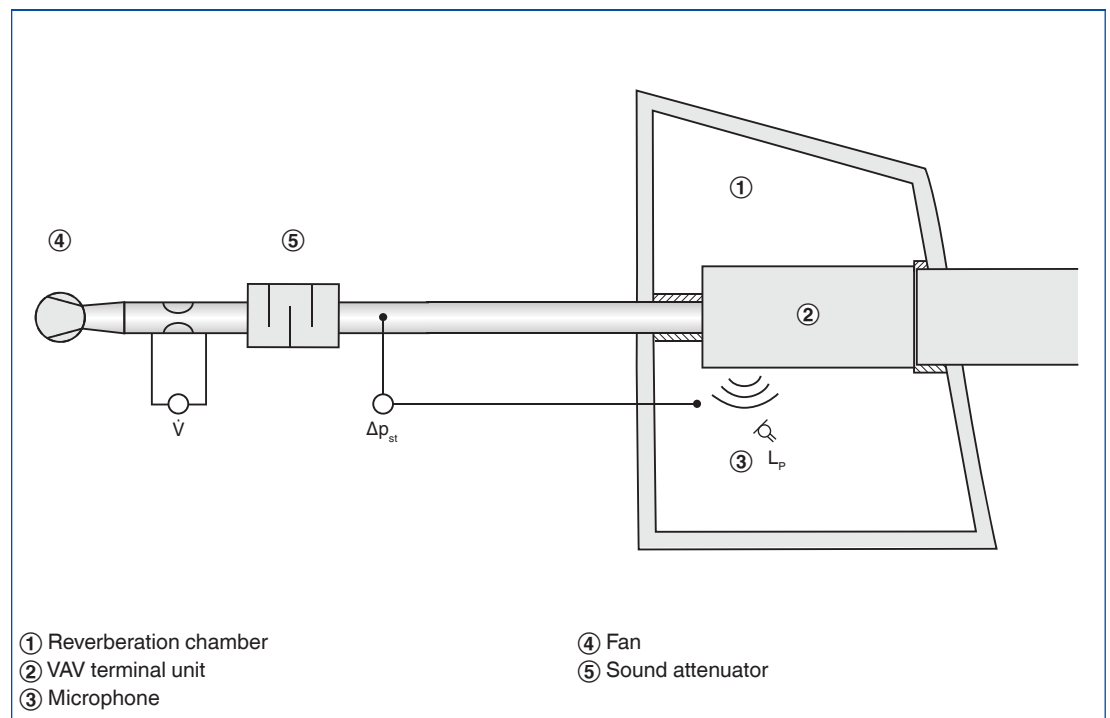
The sound pressure levels for case-radiated noise L_{PA2} given by us result from measurements in a reverberation chamber. The sound pressure L_P is measured for the entire frequency range. The evaluation of the measurements, including system attenuation and A-weighting, results in the sound pressure level L_{PA2}.

1

**Sizing with
the help of this catalogue**

This catalogue provides convenient quick sizing tables for VAV terminal units. The sound pressure levels for air-regenerated noise and for case-radiated noise are provided for all nominal sizes. In addition, generally accepted attenuation and insulation values have been taken into account. Sizing data for other volume flow rates and differential pressures can be determined quickly and precisely using the Easy Product Finder design programme.

Sizing example

Given data
$\dot{V}_{max}$ = 280 l/s (1010 m³/h)
Δp_{st} = 150 Pa
Required sound pressure level in the room 30 dB(A)

Quick sizing
TVZ-D/200
Air-regenerated noise L_{PA} = 23 dB(A)
Case-radiated noise L_{PA3} = 24 dB(A)

Sound pressure level in the room = 27 dB(A)
(logarithmic addition since the terminal unit is installed in the suspended ceiling of the room)

Easy Product Finder

The Easy Product Finder allows you to size products using your project-specific data.

You will find the Easy Product Finder on our website.

1

Function

Volume flow control

The volume flow rate is controlled in a closed loop. The controller receives from the transducer the actual value that results from the effective pressure. For most applications, the setpoint value comes from a room temperature controller. The controller compares the actual value with the setpoint value and alters the command signal of the actuator if there is a difference between the two values.

Correction of duct pressure changes

The controller detects and corrects changes of the duct pressure that may occur, for example, due to volume flow rate changes from other units. Pressure changes will therefore not affect the room temperature.

Variable volume flow

If the input signal is changed, the controller adjusts the volume flow rate to the new setpoint. The variable volume flow rate range is limited, i.e. there is a minimum value and a maximum value. This control strategy can be overridden, e.g. by shutting off the duct.
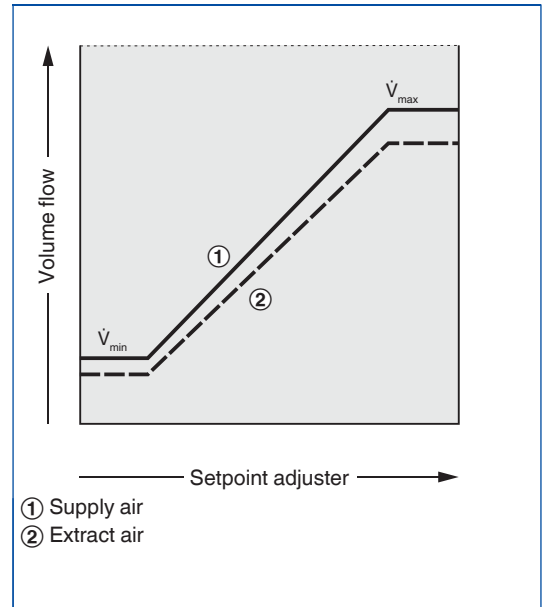
Supply/extract air tracking control

In individual rooms and closed-off office areas, where the balance between supply and extract air flow rate has to be maintained. Otherwise, annoying whistling noises can occur at door gaps, and the doors can be difficult to open. For this reason, the extract air should also have variable control in a VAV system. The supply air actual value (for dual duct terminal units the actual value signal of the warm air controller) is signalled to the extract air controller (slave controller) as setpoint signal. As a consequence, the extract air always follows the supply air.

Control loop
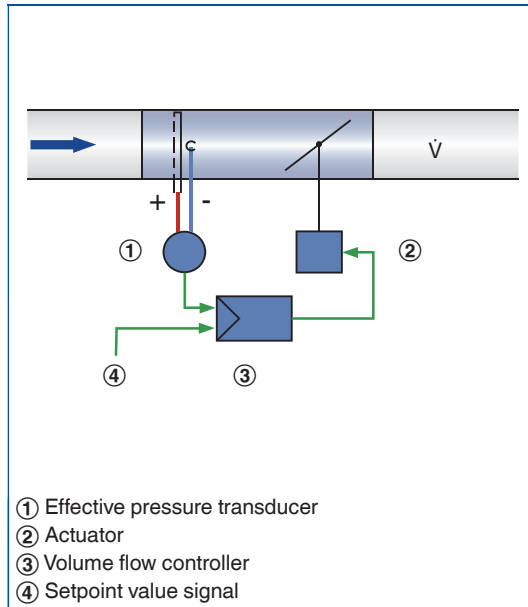
① Effective pressure transducer
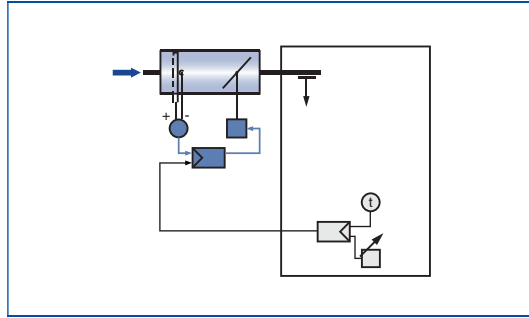② Actuator
③ Volume flow controller
④ Setpoint value signal

Control diagram

① Supply air
② Extract air

1

Operating modes

Single operation
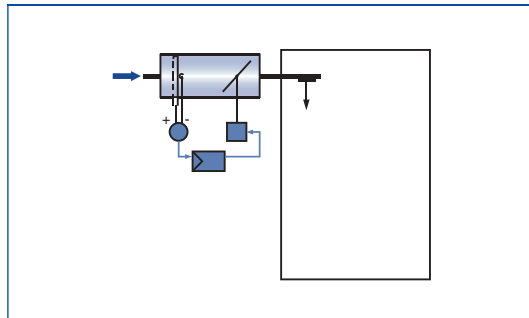

Slave operation (master)
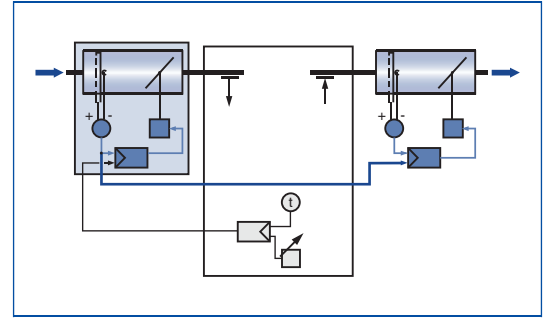
Constant value

Slave operation (slave)