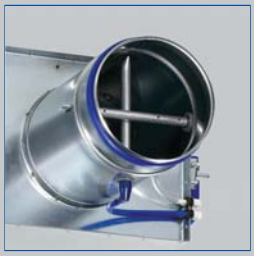
VAV terminal units
Type TVM

Variant TVM-S

Rectangular connection on the room end



Circular connection on the fan end

Tested to VDI 6022

For dual duct systems

VAV dual duct terminal units for dual duct systems
with variable volume flows in buildings with demanding acoustic requirements

- Individual temperature control for each room or zone
- Highly effective integral attenuator
- Electronic control components for different applications (Compact and Universal)
- Suitable for airflow velocities up to 13 m/s
- Closed blade air leakage to EN 1751, up to class 4
- Casing air leakage to EN 1751, class A

Optional equipment and accessories

- Acoustic cladding for the reduction of case-radiated noise
- Secondary silencer Type TS for the reduction of air-regenerated noise

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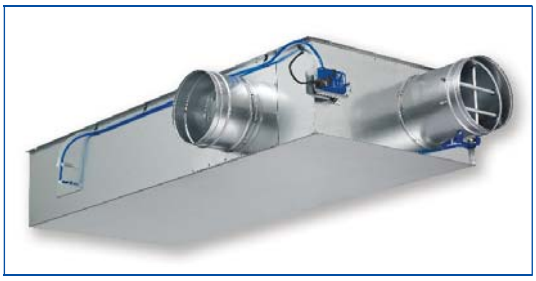
Variants

Product examples

VAV dual duct terminal unit, variant TVM-S

VAV dual duct terminal unit, variant TVM-S-D

VAV dual duct terminal unit, variant TVM



VAV dual duct terminal unit, variant TVM-D

Description

For detailed information on control components see Chapter K5 – 1.3.

Application
- VARYCONTROL VAV dual duct terminal units of Type TVM for the supply air control in dual duct variable or constant air volume systems
- Closed-loop volume flow control using an external power supply
- For maximum acoustic and thermal comfort
- Demand-based mixing of cold and warm air
- Shut-off by means of switching (equipment supplied by others)

Variants
- TVM-S Dual duct unit, 60° spigot arrangement
- TVM-S-D Dual duct unit with acoustic cladding, 60° spigot arrangement
- TVM: Dual duct unit, 90° spigot arrangement
- TVM-D: Dual duct unit with acoustic cladding, 90° spigot arrangement
- Units with acoustic cladding and/or secondary silencer Type TS for very demanding acoustic requirements
- Acoustic cladding cannot be retrofitted

Nominal sizes
- TVM-S: 125, 160, 200
- TVM: 125, 160, 200, 250, 315, 400

Attachments
- Compact controller: Compact unit consisting of controller, differential pressure transducer and actuator
- Universal controller: Controller, differential pressure transducer and actuators for special applications

Accessories
- Lip seals (factory fitted)

Useful additions
- Secondary silencer Type TS

Special characteristics
- Integral differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
- Integral attenuator with at least 26 dB insertion loss at 250 Hz
- Factory set-up or programming and aerodynamic function testing
- Volume flow rate can later be measured and adjusted on site; additional adjustment device may be necessary
- Inspection access for cleaning to VDI 6022

Parts and characteristics
- Ready-to-commission unit which consists of mechanical parts and control components
- Averaging differential pressure sensors for volume flow rate measurement, one in the cold air spigot and one in the silencer
- Damper blade
- Integral attenuator
- Inspection access
- Factory assembled control components complete with wiring and tubing
- Aerodynamic functional testing on a special test rig prior to shipping of each unit
- Set-up data is given on a label or volume flow rate scale affixed to the unit
- High control accuracy (even with upstream bend R = 1D)

Construction features
- Rectangular casing
- Spigot on the fan end suitable for circular ducts to EN 1506 or EN 13180
- Spigot with groove for lip seal
- Connection on the room end suitable for air duct profiles
- Baffle plate is fitted after the damper blade for optimum aerodynamic performance
- Position of the damper blade indicated externally at shaft extension
- Thermal and acoustic insulation (lining)

Materials and surfaces
- Casing and damper blade made of galvanised sheet steel
- Damper blade seal made of TPE plastic
- Lining is mineral wool
- Differential pressure sensor made of aluminium
- Plastic bearings

Variant with acoustic cladding (-D)
- Acoustic cladding made of galvanised sheet steel
- Lining is mineral wool
- Rubber elements for the insulation of structure-borne noise

Mineral wool
- To EN 13501, fire rating class A1, non-combustible
- RAL quality mark RAL-GZ 388
- Biosoluble and hence hygienically safe according to the German TRGS 905 (Technical Rules for Hazardous Substances) and EU directive 97/69/EG
- Faced with glass fibre fabric as protection against erosion through airflow velocities of up to 20 m/s
- Inert to fungal and bacterial growth

Installation and commissioning
- Any installation orientation
- Connecting spigots for warm and cold air arranged at an angle of 60° (TVM-S) or 90° (TVM)
- Return edges of the casing with drilled holes suitable for threaded rods

Standards and guidelines
- Hygiene conforms to VDI 6022
- VDI 2083, air cleanliness class 3, and US standard 209E, class 100
- Closed blade air leakage to EN 1751, class 4 (nominal sizes 125 and 160, class 3)
- Nominal sizes 125 and 160 meet the general requirements, nominal sizes 200 – 400 meet the increased requirements of DIN 1946, part 4, with regard to the acceptable closed blade air leakage
- Casing air leakage to EN 1751, class A

Maintenance
- Maintenance-free as construction and materials are not subject to wear

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Attachments: VARYCONTROL control components for Type TVM

Order code detail	Control function	Controller	Differential pressure transducer	Actuator
Compact controller				
BF0	Volume flow rate	Compact controller with MP bus interface TROX/Belimo	Dynamic, integral	Integral
XG0		Compact controller TROX/Gruner		
LY0		Compact controller Siemens		
Universal controller, dynamic				
B27	Volume flow rate	Universal controller TROX/Belimo	Dynamic, integral	Actuator

Technical data

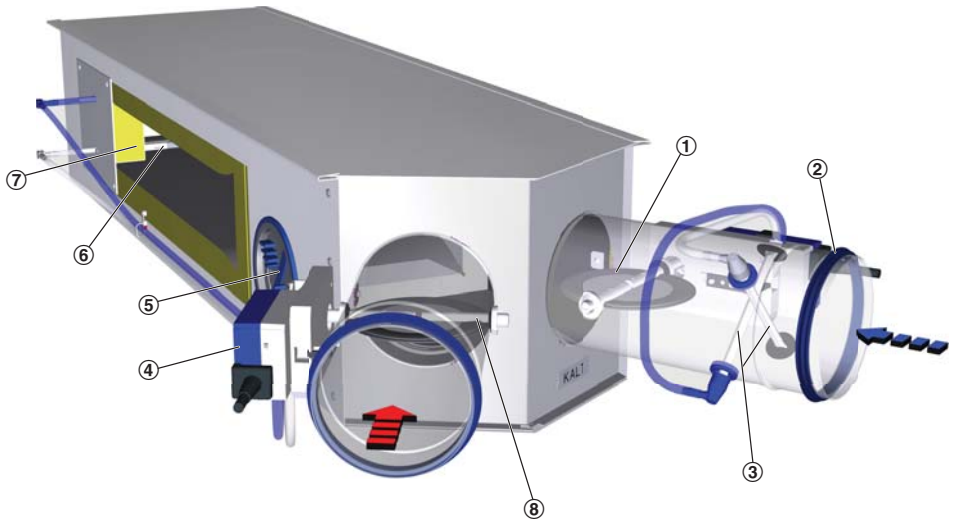
Nominal sizes	125 – 400 mm
Volume flow rate range	45 – 1680 l/s or 162 – 6048 m^3/h
Volume flow rate control range	Approx. 30 to 100 % of the nominal volume flow rate
Minimum differential pressure	120 Pa
Maximum differential pressure	1000 Pa
Operating temperature	10 – 50 °C

Function

Functional description

The VAV terminal unit is fitted with two differential pressure sensors for measuring the volume flow rates, one in the cold air flow and one in the total air flow. The control components (attachments) include two differential pressure transducers that transform the differential pressure (effective pressure) into an electric signal, two controllers, and two actuators; the control functions can be achieved with a Compact controller or with individual components. In most cases, the setpoint value for the dual duct terminal unit comes from a room temperature controller. The room temperature controller 'leads' the cold air volume flow controller and alters the setpoint for the cold air flow rate between 0 and the maximum volume flow $\dot{V}_{max}$. The controller compares the actual value with the setpoint value and alters the control signal of the damper actuator if there is a difference between the two values. The warm/total air controller is set to the minimum volume flow rate $\dot{V}_{min}$ and controls the warm air damper blade. As a consequence, a corresponding proportion of warm air is added. As the demand for cooling increases, the warm air damper blade closes such that eventually only cold air flows.
An integral attenuator reduces the noise that is created by the restriction of the airflow. The airflow velocity at the room end is, due to the larger rectangular cross section, about half the velocity in the circular duct.

Schematic illustration of the TVM-S



① Damper blade – cold air
② Lip seal
③ Differential pressure sensor – cold air
④ Control components, e. g. a Compact controller
⑤ Inspection access
⑥ Differential pressure sensor – total air
⑦ Acoustic insulation
⑧ Damper blade – warm air

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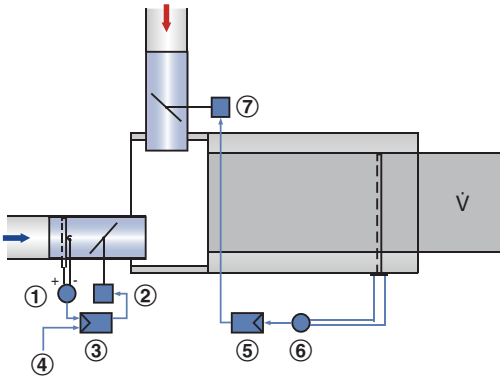
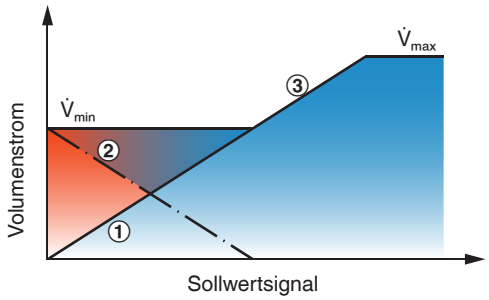
Control loop



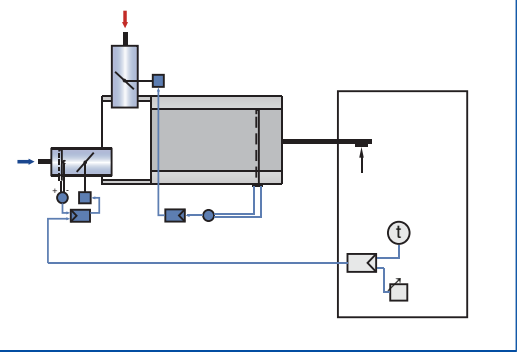
① Effective pressure transducer
④ Actuator for cold air duct
③ Volume flow controller
④ Setpoint value signal
⑤ Volume flow controller for $\dot{V}_{tot}$ ($\dot{V}_{warm}$)
⑥ Effective pressure transducer for $\dot{V}_{tot}$
⑦ Actuator for warm air duct

Control diagram

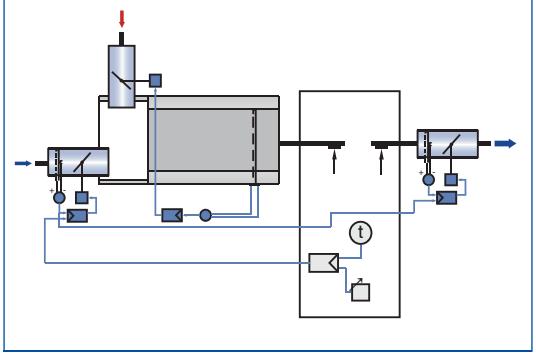


① Cold air supply
② Warm air supply
③ Total extract air at the unit outlet

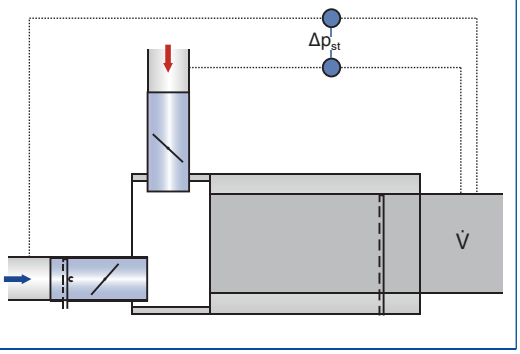
Single operation



Slave operation (master-slave)



Static differential pressure



Order code **TVM**

VARYCONTROL

TVM – S – D / 160 / D2 / B27 / E 0 / 300 – 900 / 0 – 900

1 2 3 4 5 6 7 8 9

1 Type
TVM Dual duct terminal unit

2 Spigot arrangement
No entry: 90°
S 60° (up to nominal size 200)

3 Acoustic cladding
No entry: none
D With acoustic cladding

4 Nominal size [mm]
125
160
200
250
315
400

5 Accessories
No entry: none
D2 Lip seal

6 Attachments (control component)
Example
BF0 Compact controller
B27 Universal controller

7 Operating mode
E Single
M Master
F Constant value

8 Signal voltage range
For the actual and setpoint value signals
0 0 – 10 V DC
2 2 – 10 V DC

9 Volume flow rates [m³/h or l/s]
$\dot{V}_{warm,\ min}$ – $\dot{V}_{warm,\ max}$ / $\dot{V}_{cold,\ min}$ – $\dot{V}_{cold,\ max}$
for factory setting

Order example **TVM/160/BF0/E0/300–900 m³/h/0–900 m³/h**

VARYCONTROL

Spigot arrangement	90°
Acoustic cladding	Without
Nominal size	160 mm
Attachment	Compact controller
Operating mode	Single
Signal voltage range	0 – 10 V DC
Volume flow rate, warm	300 – 900 m³/h
Volume flow rate, cold	0 – 900 m³/h

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Volume flow rate ranges

The minimum differential pressure of VAV terminal units is an 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 control units. The measurement points for fan speed control must be selected accordingly.

Volume flow rate ranges and minimum differential pressure values

Nominal size	$\dot{V}$		① $\Delta p_{st\ min}$	② $\Delta p_{st\ min}$	$\Delta\dot{V}$	$\Delta\dot{V}_{warm}$
	l/s	m³/h	Pa		± %	
125	45	162	120	160	8	17
	60	216	120	160	7	15
	100	360	120	160	5	12
	150	540	120	160	5	7
160	75	270	120	140	8	17
	100	360	120	140	7	15
	170	612	120	140	5	12
	250	900	120	140	5	7
200	120	432	120	140	8	17
	180	648	120	140	7	15
	280	1008	120	140	5	12
	405	1458	120	140	5	7
250	185	666	120	145	8	17
	270	972	120	145	7	15
	470	1692	120	145	5	12
	615	2214	120	145	5	7
315	310	1116	120	160	8	17
	420	1512	120	160	7	15
	720	2592	120	160	5	12
	1030	3708	120	160	5	7
400	505	1818	120	160	8	17
	710	2556	120	160	7	15
	1250	4500	120	160	5	12
	1680	6048	120	160	5	7

① TVM, TVM-S
② TVM, TVM-S with secondary silencer TS

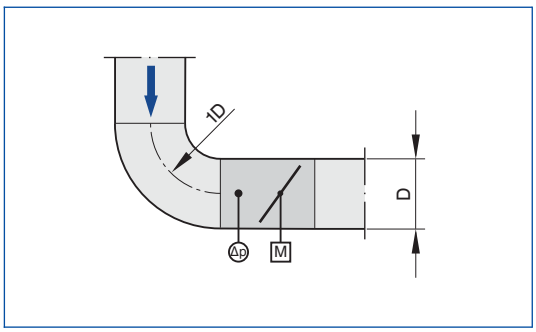
The volume flow rates given for VAV terminal units depend on the nominal size and on the control component (attachment) that is installed. The table gives the minimum and maximum values for a VAV terminal unit. Some control components may only have a limited volume flow rate range. This applies in particular to control components with a static differential pressure transducer. For volume flow rate ranges for all control components refer to our Easy Product Finder design programme.

Upstream conditions

The volume flow rate accuracy $\Delta\dot{V}$ applies to a straight upstream section of the duct. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505. Some installation situations require straight duct sections upstream.

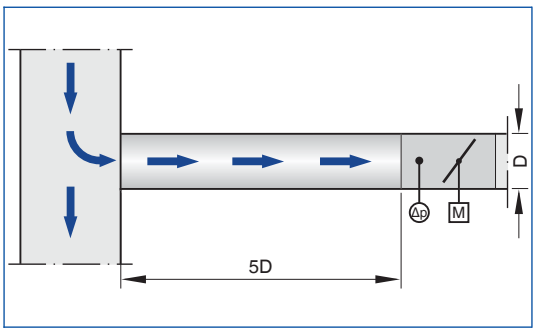
The upstream conditions shown apply to cold air. For warm air, no particular upstream conditions are required.

Bend



A bend with a centre line curvature radius of at least 1D – without an additional straight duct section upstream of the VAV terminal unit – has only a negligible effect on the volume flow rate accuracy.

Junction



A junction causes strong turbulence. The stated volume flow rate accuracy $\Delta\dot{V}$ can only be achieved with a straight duct section of at least 5D upstream. Shorter upstream sections require a perforated plate in the branch and before the VAV terminal unit. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

Air-regenerated noise

Quick sizing tables provide a good overview of the room sound pressure levels that can be expected. Approximate intermediate values can be interpolated. Precise intermediate values and spectral data can be calculated with our Easy Product Finder design programme.

The first selection criteria for the nominal size are the actual volume flow rates $\dot{V}_{min}$ and $\dot{V}_{max}$. The quick sizing tables are based on normally accepted attenuation levels. If the sound pressure level exceeds the required level, a larger VAV terminal unit and/or a silencer is required.

Quick sizing: Sound pressure level at differential pressure 150 Pa

Nominal size	$\dot{V}$		Air-regenerated noise		Case-radiated noise	
			①	②	①	③
			L_{PA}	L_{PA1}	L_{PA2}	L_{PA3}
	l/s	m³/h	dB(A)			
125	45	162	25	15	25	21
	60	216	28	19	28	24
	100	360	34	24	32	29
	150	540	38	29	36	33
160	75	270	25	16	35	26
	100	360	28	19	36	28
	170	612	34	25	39	33
	250	900	37	28	41	37
200	120	432	24	15	30	25
	180	648	28	18	33	28
	280	1008	31	21	36	33
	405	1458	34	25	39	37
250	185	666	18	8	25	20
	270	972	23	12	29	24
	470	1692	30	19	34	30
	615	2214	34	24	37	33
315	310	1116	21	8	30	27
	420	1512	24	11	32	30
	720	2592	31	18	35	33
	1030	3708	37	26	38	35
400	505	1818	18	6	28	25
	710	2556	23	9	32	29
	1250	4500	31	16	37	35
	1680	6048	37	21	40	38

① TVM, TVM-S
② TVM, TVM-S with secondary silencer TS
③ TVM-D, TVM-S-D

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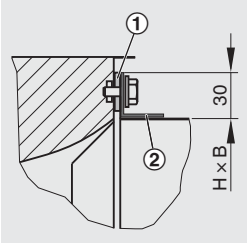
Description

VAV dual duct terminal unit, variant TVM-S

- VAV terminal unit for the control of variable supply air volume flows
- Connecting spigots for warm and cold air arranged at an angle of 60°

Dimensions

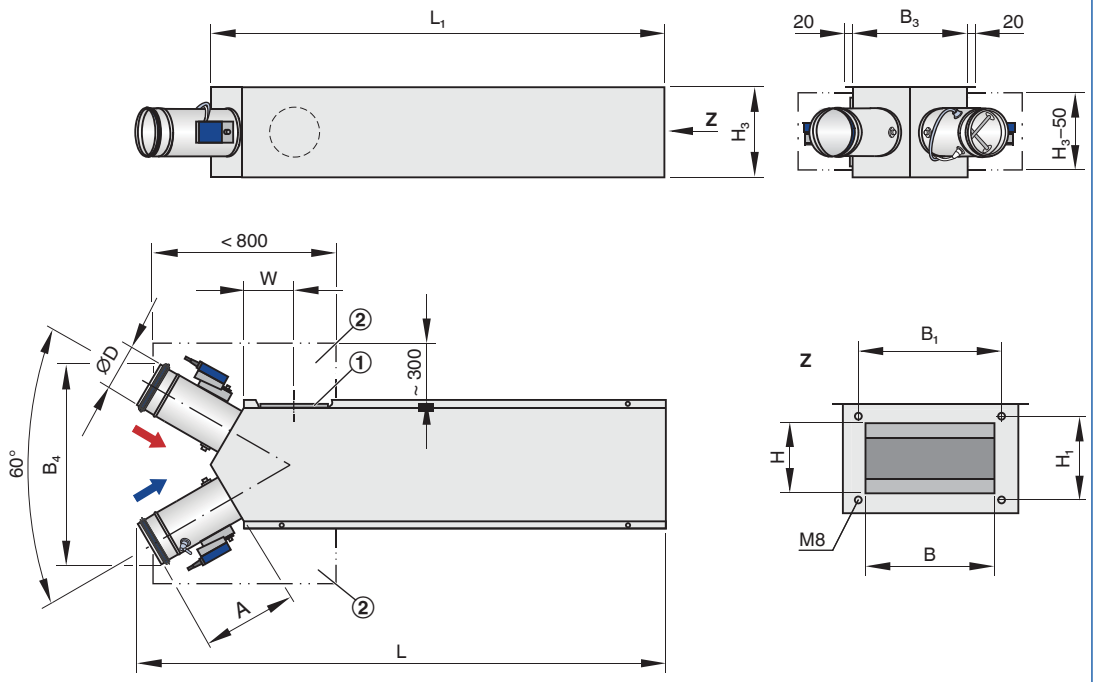


Detail of flange

① Compressible seal, to be provided by others

② Air duct profile

TVM-S



① Inspection access
② Keep clear to provide access to attachments

Dimensions [mm] and weight [kg]

Nominal size	ØD	L	B_3	H_3	L_1	B	B_1	H	H_1	A	B_4	W	m
	mm												kg
125	124	1385	300	236	1190	198	232	152	186	245	525	173	30
160	159	1630	410	236	1360	308	342	152	186	335	690	173	35
200	199	1920	560	281	1660	458	492	210	244	340	800	173	50

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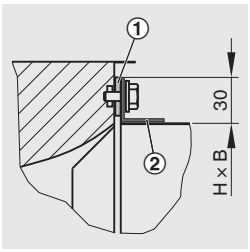
Description

VAV dual duct terminal unit, variant TVM-S-D

- VAV terminal unit with acoustic cladding for the control of variable supply air volume flows
- Connecting spigots for warm and cold air arranged at an angle of 60°
- For rooms where the case-radiated noise of the unit is not sufficiently reduced by a false ceiling
- The circular ducts for the room under consideration must have adequate acoustic insulation (provided by others) on the fan end
- Acoustic cladding cannot be retrofitted

Dimensions

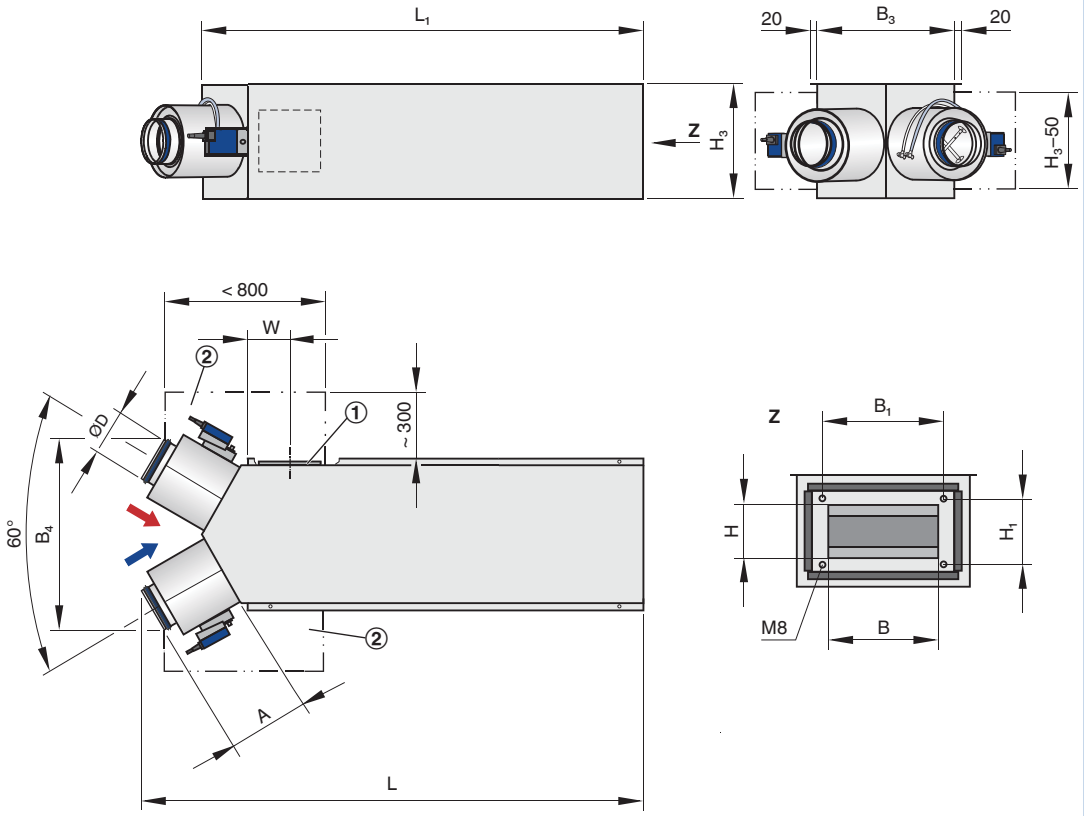


Detail of flange

① Compressible seal, to be provided by others

② Air duct profile

TVM-S-D



① Inspection access
② Keep clear to provide access to attachments

Dimensions [mm] and weight [kg]

Nominal size	ØD	L	B_3	H_3	L_1	B	B_1	H	H_1	A	B_4	W	m
	mm												kg
125	124	1385	380	316	1215	198	232	152	186	225	525	160	45
160	159	1630	490	316	1410	308	342	152	186	295	690	180	55
200	199	1920	640	361	1710	458	492	210	244	300	800	180	80

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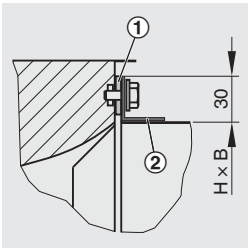
Description

VAV dual duct terminal unit, variant TVM

- VAV terminal unit for the control of variable supply air volume flows
- Connecting spigots for warm and cold air arranged at an angle of 90°

Dimensions

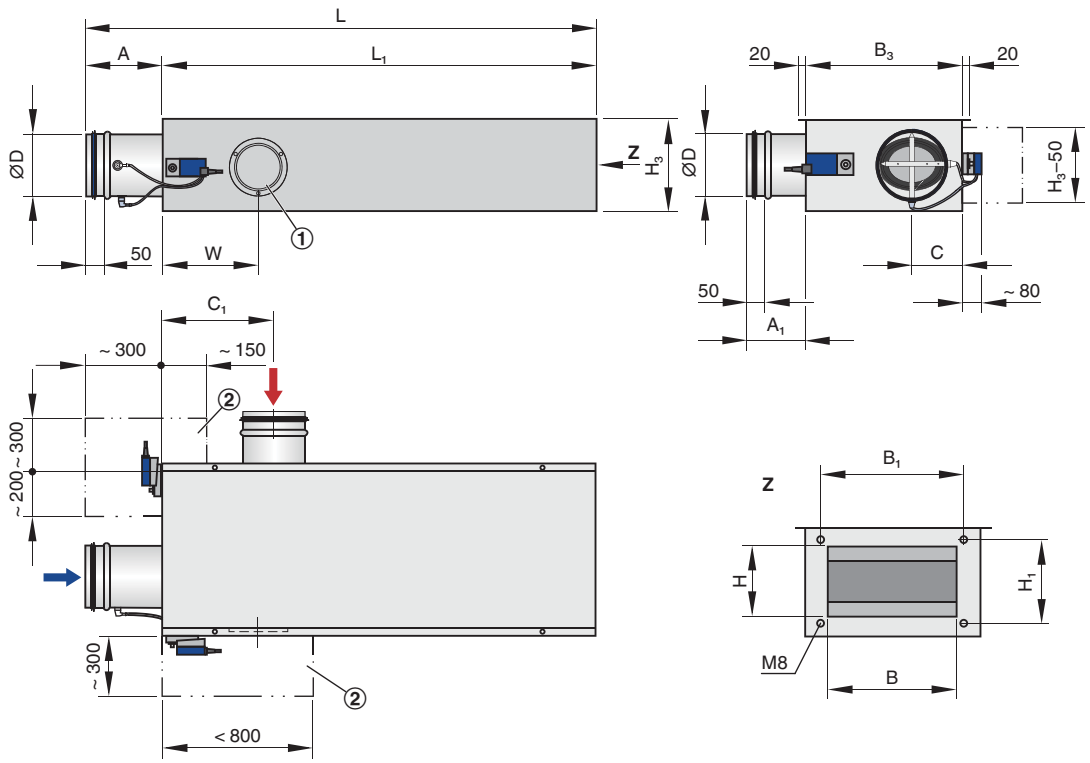


Detail of flange

① Compressible seal, to be provided by others

② Air duct profile

TVM



① Inspection access
② Keep clear to provide access to attachments

Dimensions [mm] and weight [kg]

Nominal size	ØD	L	B_3	H_3	L_1	B	B_1	H	H_1	A	A_1	C	C_1	W	m
	mm														kg
125	124	1355	300	236	1205	198	232	152	186	150	170	125	240	265	28
160	159	1455	410	236	1255	308	342	152	186	200	150	145	295	265	34
200	199	1790	560	281	1590	458	492	210	244	200	125	170	350	265	50
250	249	2015	700	311	1765	598	632	201	235	250	160	200	415	540	65
315	314	2575	900	361	1840	798	832	252	286	250	130	240	535	540	90
400	399	2090	1000	446	2325	898	932	354	388	250	180	290	625	540	130

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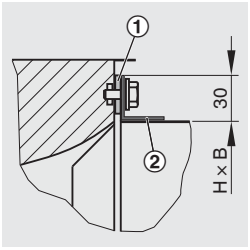
Description

VAV dual duct terminal unit, variant TVM-D

- VAV terminal unit with acoustic cladding for the control of variable supply air volume flows
- Connecting spigots for warm and cold air arranged at an angle of 90°
- For rooms where the case-radiated noise of the unit is not sufficiently reduced by a false ceiling
- The circular ducts for the room under consideration must have adequate acoustic insulation (provided by others) on the fan end
- Acoustic cladding cannot be retrofitted

Dimensions

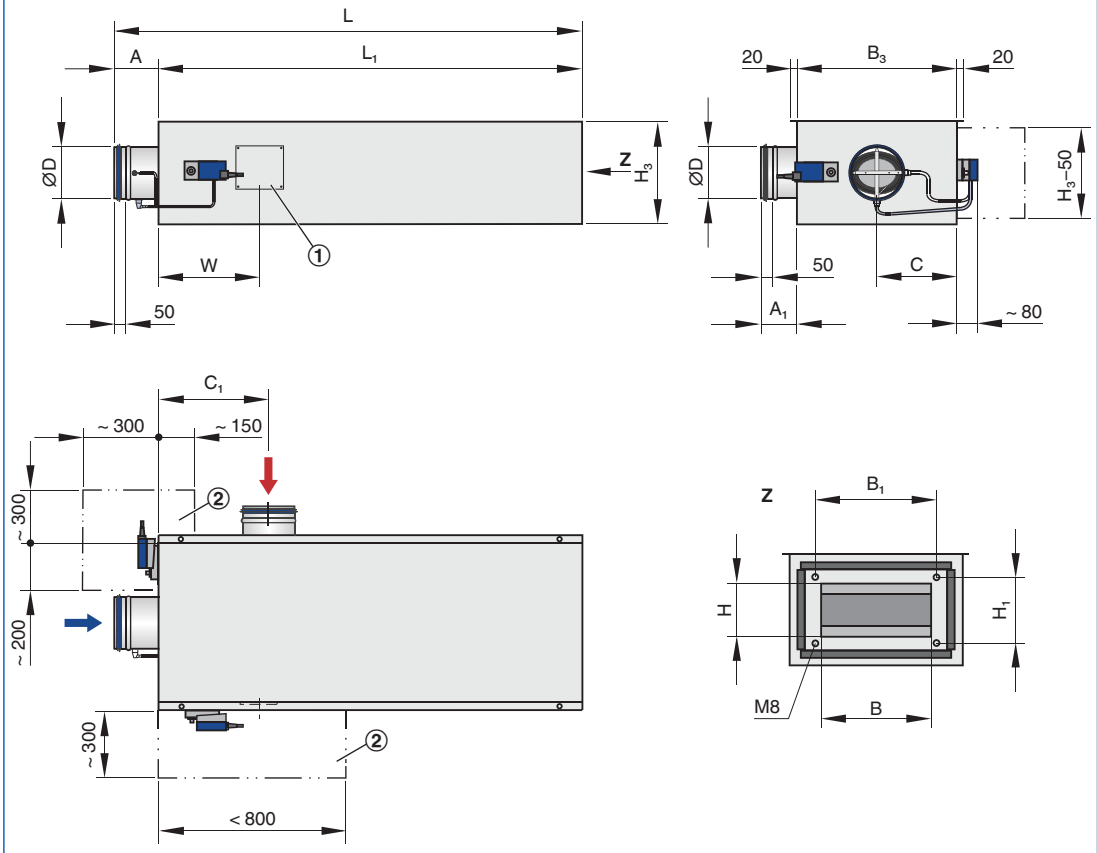


Detail of flange

① Compressible seal, to be provided by others

② Air duct profile

TVM-D



① Inspection access
② Keep clear to provide access to attachments

Dimensions [mm] and weight [kg]

Nominal size	ØD	L	B_3	H_3	L_1	B	B_1	H	H_1	A	A_1	C	C_1	W	m
	mm														kg
125	124	1355	380	316	1245	198	232	152	186	110	130	165	280	305	42
160	159	1455	490	316	1295	308	342	152	186	160	110	185	335	305	51
200	199	1790	640	361	1630	458	492	210	244	160	85	210	390	305	78
250	249	2015	780	391	1805	598	632	201	235	210	120	240	455	580	105
315	314	2575	980	441	1880	798	832	252	286	210	90	280	575	580	140
400	399	2090	1080	526	2365	898	932	354	388	210	140	330	665	580	200

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Standard text

This specification text describes the general properties of the product. Texts for variants can be generated with our Easy Product Finder design programme.

Rectangular VAV dual duct terminal units for dual duct systems with variable and constant volume flows, available in 6 nominal sizes.
Connecting spigots for warm and cold air arranged at an angle of 90°. Up to nominal size 200 an angle of 60° is also possible, hence ideal for for the refurbishment of older systems with dual duct units.
High control accuracy (even with upstream bend R = 1D).
Ready-to-commission unit which consists of the mechanical parts and the electronic control components. Each unit contains two averaging differential pressure sensors for volume flow rate measurement, one in the cold air flow and one in the total air flow, two damper blades, and an integral attenuator. Factory-assembled control components complete with wiring and tubing. Differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
On the fan end, spigot with groove for lip seal, suitable for connecting ducts to EN 1506 or EN 13180.
Room end suitable for the connection of air duct profiles.
Two baffle plates, one fitted after each damper blade for optimum acoustic and aerodynamic performance.
Casing with acoustic and thermal insulation.
Position of the damper blade indicated externally at shaft extension.
Closed blade air leakage to EN 1751, class 4 (nominal sizes 125 and 160, class 3).
Casing air leakage to EN 1751, class B.
Complies with VDI 2083, clean room class 3, and US standard 209E, class 100.
Hygiene complies with VDI 6022, DIN 1946, part 4, as well as EN 13779 and VDI 3803.

Special characteristics

- Integral differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
- Integral attenuator with at least 26 dB insertion loss at 250 Hz
- Factory set-up or programming and aerodynamic function testing
- Volume flow rate can later be measured and adjusted on site; additional adjustment device may be necessary
- Inspection access for cleaning to VDI 6022

Materials and surfaces

- Casing and damper blade made of galvanised sheet steel
- Damper blade seal made of TPE plastic
- Lining is mineral wool
- Differential pressure sensor made of aluminium
- Plastic bearings

Variant with acoustic cladding (-D)

- Acoustic cladding made of galvanised sheet steel
- Lining is mineral wool
- Rubber elements for the insulation of structure-borne noise

Mineral wool

- To EN 13501, fire rating class A1, non-combustible
- RAL quality mark RAL-GZ 388
- Biosoluble and hence hygienically safe according to the German TRGS 905 (Technical Rules for Hazardous Substances) and EU directive 97/69/EG
- Faced with glass fibre fabric as protection against erosion through airflow velocities of up to 20 m/s
- Inert to fungal and bacterial growth

Technical data

- Nominal sizes: 125 to 400 mm
- Volume flow rate range: 45 to 1680 l/s or 162 to 6048 m^3/h
- Volume flow rate control range: approx. 30 – 100 % of the nominal volume flow rate
- Minimum differential pressure: 120 Pa
- Maximum differential pressure: 1000 Pa

Attachments

Variable volume flow control with electronic Compact controller to switch an external control signal and an actual value signal for integration into the central BMS.

- Supply voltage 24 V AC/DC
- Signal voltages 0 – 10 V DC or 2 – 10 V DC
- Possible override controls with external switches using volt-free contacts: CLOSED, OPEN, $\dot{V}_{min}$ and $\dot{V}_{max}$
- Volume flow rate control range: approx. 30 – 100 % of the nominal volume flow rate

Sizing data

- $\dot{V}_{warm,\ min}$ – $\dot{V}_{warm,\ max}$[m^3/h]
- $\dot{V}_{cold,\ min}$ – $\dot{V}_{cold,\ max}$[m^3/h]
- Δp_{st}[Pa]
- L_{PA} air-regenerated noise[dB(A)]
- L_{PA} Case-radiated noise[dB(A)]

Order options

VARYCONTROL

1 Type
TVM Dual duct terminal unit

2 Spigot arrangement
No entry: 90°
☐ **S** 60° (up to nominal size 200)

3 Acoustic cladding
No entry: none
☐ **D** With acoustic cladding

4 Nominal size [mm]
☐ **125**
☐ **160**
☐ **200**
☐ **250**
☐ **315**
☐ **400**

5 Accessories
No entry: none
☐ **D2** Lip seal

6 Attachments (control component)
Example
☐ **BF0** Compact controller
☐ **B27** Universal controller

7 Operating mode
☐ **E** Single
☐ **M** Master
☐ **F** Constant value

8 Signal voltage range
For the actual and setpoint value signals
☐ **0** 0 – 10 V DC
☐ **2** 2 – 10 V DC

9 Volume flow rates [m³/h or l/s]
$\dot{V}_{warm,\ min} - \dot{V}_{warm,\ max}$ / $\dot{V}_{cold,\ min} - \dot{V}_{cold,\ max}$
for factory setting

Variable volume flow control – VARYCONTROL

Basic information and nomenclature

1

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

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 [m^3/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

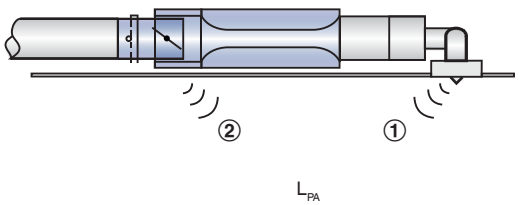
L_{PA1} [dB(A)]
A-weighted sound pressure level of air-regenerated noise of the VAV terminal unit with secondary silencer, system attenuation taken into account

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



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)

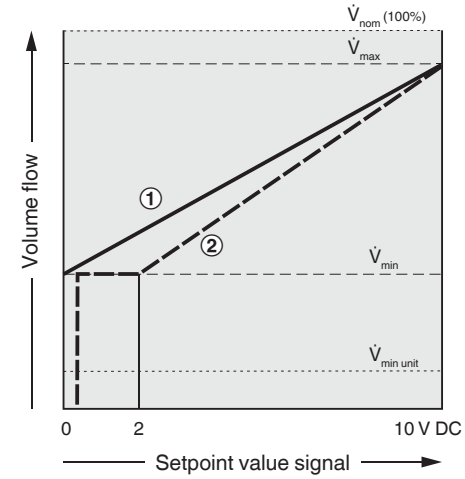
$\dot{V}_{min}$ [m³/h] and [l/s]
Lower limit of the operating range for the VAV terminal unit that can be set by customers
- $\dot{V}_{min}$ should be smaller than or equal to $\dot{V}_{max}$
- Do not set $\dot{V}_{min}$ smaller than $\dot{V}_{min\ unit}$, otherwise the control may become unstable or 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

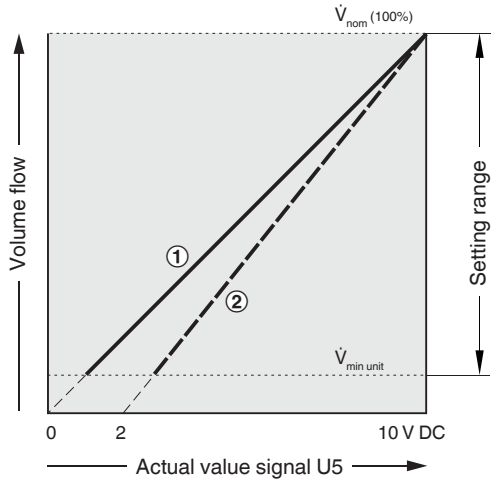
$\Delta\dot{V}_{warm}$ [± %]
Volume flow rate tolerance for the warm air flow of dual duct terminal units

Characteristic of the setpoint value signal



① 0 – 10 V DC
② 2 – 10 V DC

Characteristic of the actual value signal



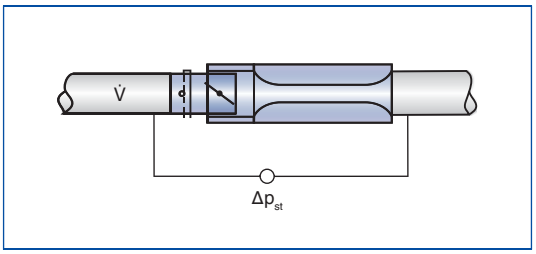
① 0 – 10 V DC
② 2 – 10 V DC

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

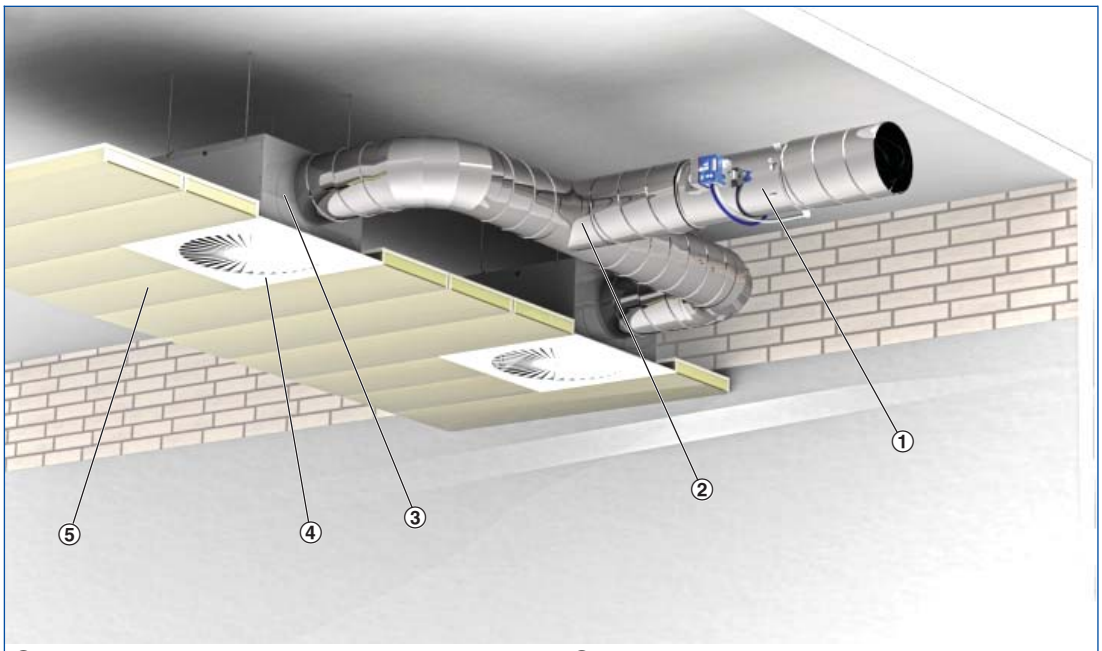
Powder-coated surface (P1)
- Casing made of galvanised sheet steel, powder-coated RAL 7001, silver grey
- Parts in contact with the airflow are powder-coated or made of plastic
- Due to production, some parts that come into contact with the airflow may be stainless steel or aluminium, powder-coated
- 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 m^3/h), no correction is necessary.

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

$\dot{V}$ in [m^3/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

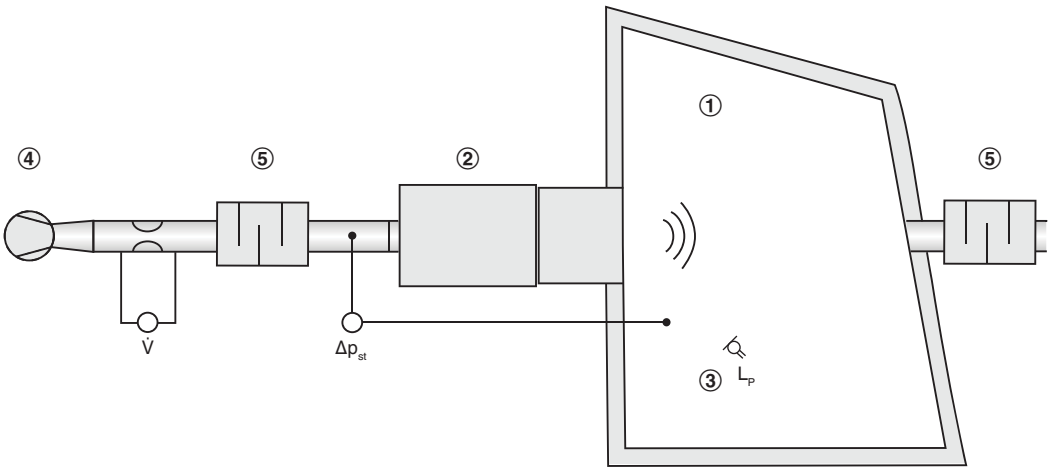
Octave correction for the calculation of case-radiated noise

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.

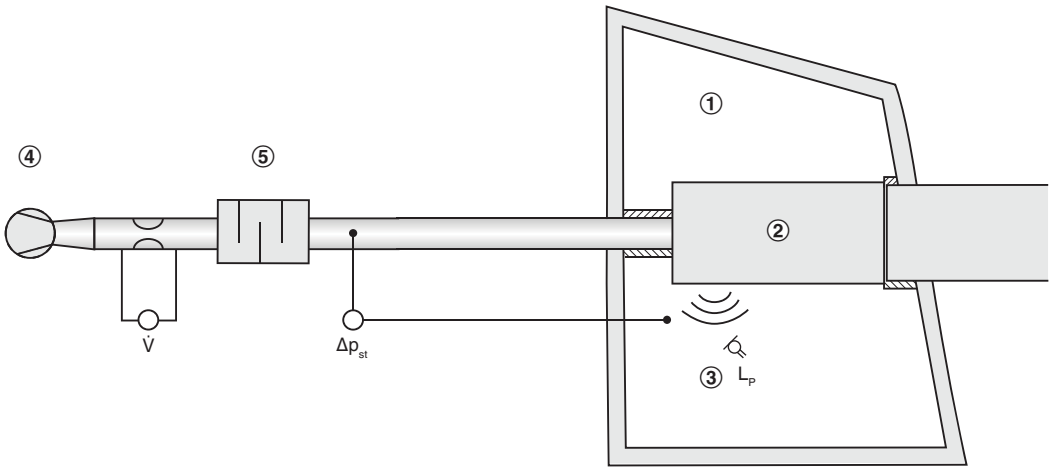
Measuring the air-regenerated noise



① Reverberation chamber
② VAV terminal unit
③ Microphone
④ Fan
⑤ Sound attenuator

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
② VAV terminal unit
③ Microphone
④ Fan
⑤ Sound attenuator

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}.

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

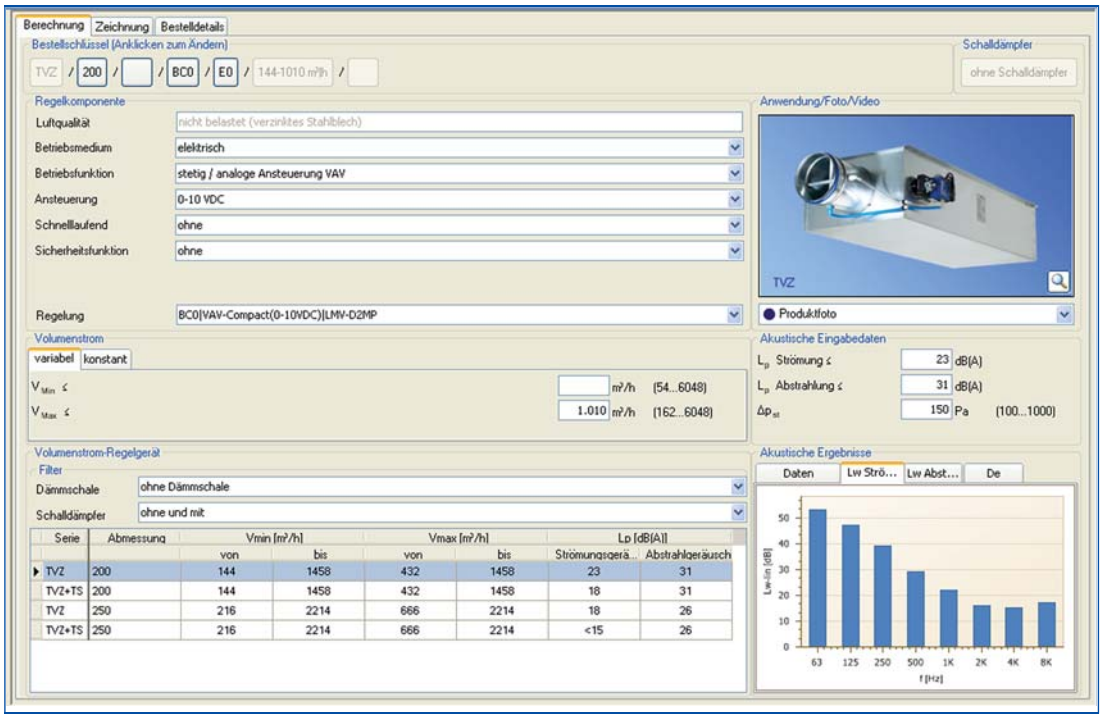
TVZ-D/200
Air-regenerated noise L_{PA} = 23 dB(A)
Case-radiated noise L_{PA3} = 24 dB(A)

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.



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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.

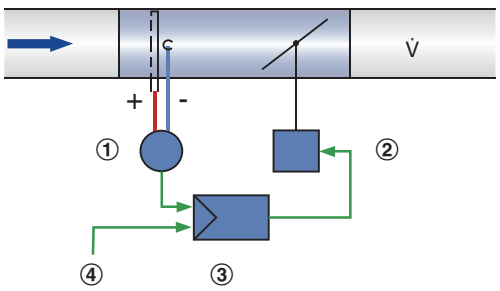
Variable volume flow

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

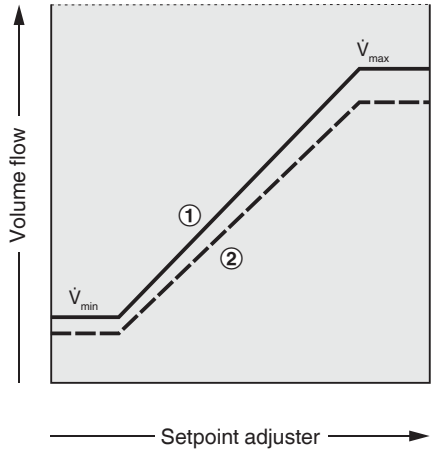
In individual rooms and closed-off office areas, where the balance between supply and extract air flow rate has to be maintained. Otherwise, annoying whistling noises can occur at door gaps, and the doors can be difficult to open.
For this reason, the extract air should also have variable control in 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

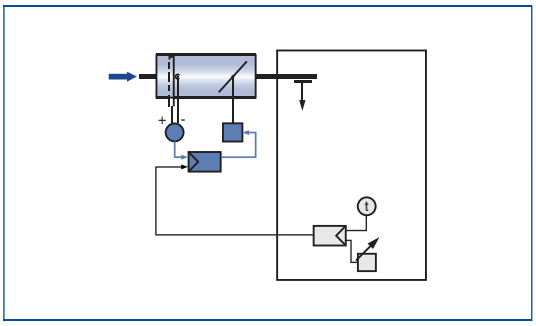
Control diagram



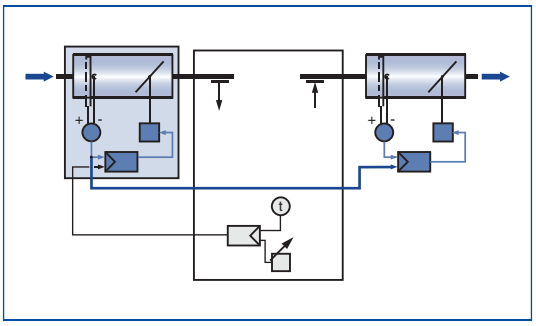
① Supply air
② Extract air

Operating modes

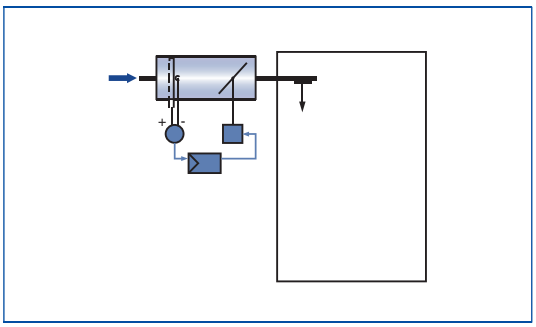
Single operation



Slave operation (master)



Constant value



Slave operation (slave)