

# VAV terminal units

## Type TVR



Universal controller



Compact controller



Easy controller



Tested to VDI 6022



### For the most diverse applications regarding standard volume flow rate ranges

Circular VAV terminal units for standard applications regarding the supply air or extract air control in variable air volume systems

- Suitable for the control of volume flow rate, room pressure or duct pressure
- Electronic control components for different applications (Easy, Compact, Universal, and LABCONTROL)
- High control accuracy even with upstream bend ( $R = 1D$ )
- 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 C

Optional equipment and accessories

- Acoustic cladding for the reduction of case-radiated noise
- Secondary silencer Type CA, CS or CF for the reduction of air-regenerated noise
- Hot water heat exchanger Type WL and electric air heater Type EL for reheating the airflow

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## Application

### Application

- Circular VARYCONTROL VAV terminal units of Type TVR for the precise supply air or extract air flow control in variable air volume systems
- Closed-loop volume flow control using an external power supply
- For controlling, restricting, or shutting off the airflow in air conditioning systems
- Shut-off by means of switching (equipment supplied by others)

- Integral differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
- Factory set-up or programming and aerodynamic function testing
- Volume flow rate can be measured and subsequently adjusted on site; additional adjustment tool may be necessary

### Nominal sizes

- 100, 125, 160, 200, 250, 315, 400

### Special characteristics

## Description

### Variants

- TVR: VAV terminal unit
- TVR-D: VAV terminal unit with acoustic cladding
- TVR-FL: VAV terminal unit with flanges on both ends
- TVR-D-FL: VAV terminal unit with acoustic cladding and flanges on both ends
- Units with acoustic cladding and/or a secondary silencer Type CA, CS or CF for demanding acoustic requirements
- Acoustic cladding cannot be retrofitted

- Easy controller: Compact unit consisting of controller with potentiometers, differential pressure transducer and actuator
- Compact controller: Compact unit consisting of controller, differential pressure transducer and actuator
- Universal controller: Controller, differential pressure transducer and actuators for special applications
- LABCONTROL: Control components for air management systems

### Construction

- Galvanised sheet steel
- P1: Powder-coated, silver grey (RAL 7001)
- A2: Stainless steel

### Accessories

- G2: Matching flanges for both ends
- D2: Lip seals on both ends (factory fitted)

### Parts and characteristics

- Ready-to-commission unit which consists of mechanical parts and control components.
- Averaging differential pressure sensor for volume flow rate measurement
- Damper blade
- Factory-assembled control components complete with wiring and tubing
- Aerodynamic function 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  $R = 1D$ )

### Useful additions

- Secondary silencer Type CA, CS or CF for demanding acoustic requirements
- Heat exchanger Type WL
- Electric air heater Type EL

### Construction features

- Circular casing
- Spigot suitable for circular ducts to EN 1506 or EN 13180
- Spigot with groove for lip seal
- Position of the damper blade indicated externally at shaft extension
- TVR-FL: Flanges to EN 12220

### Attachments

### Materials and surfaces

- Galvanised sheet steel construction
- Casing and damper blade made of galvanised sheet steel

- Damper blade seal made of TPE plastic
- Aluminium sensor tubes
- Plastic bearings

Powder-coated construction (P1)

- Casing made of galvanised sheet steel, powder-coated
- Damper blade and shaft made of stainless steel 1.4301
- Sensor tubes made of aluminium, powder-coated

Stainless steel construction (A2)

- Casing, damper blade and shaft made of stainless steel 1.4301
- Sensor tubes made of aluminium, powder-coated

Variant with acoustic cladding (-D)

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

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

**Standards and guidelines**

- Hygiene conforms to VDI 6022
- Closed blade air leakage to EN 1751, class 4 (nominal size 100, class 2; nominal sizes 125 and 160, class 3)
- Nominal sizes 100, 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 C

**Maintenance**

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

## Functional description

The VAV terminal unit is fitted with a differential pressure sensor for measuring the volume flow rate.

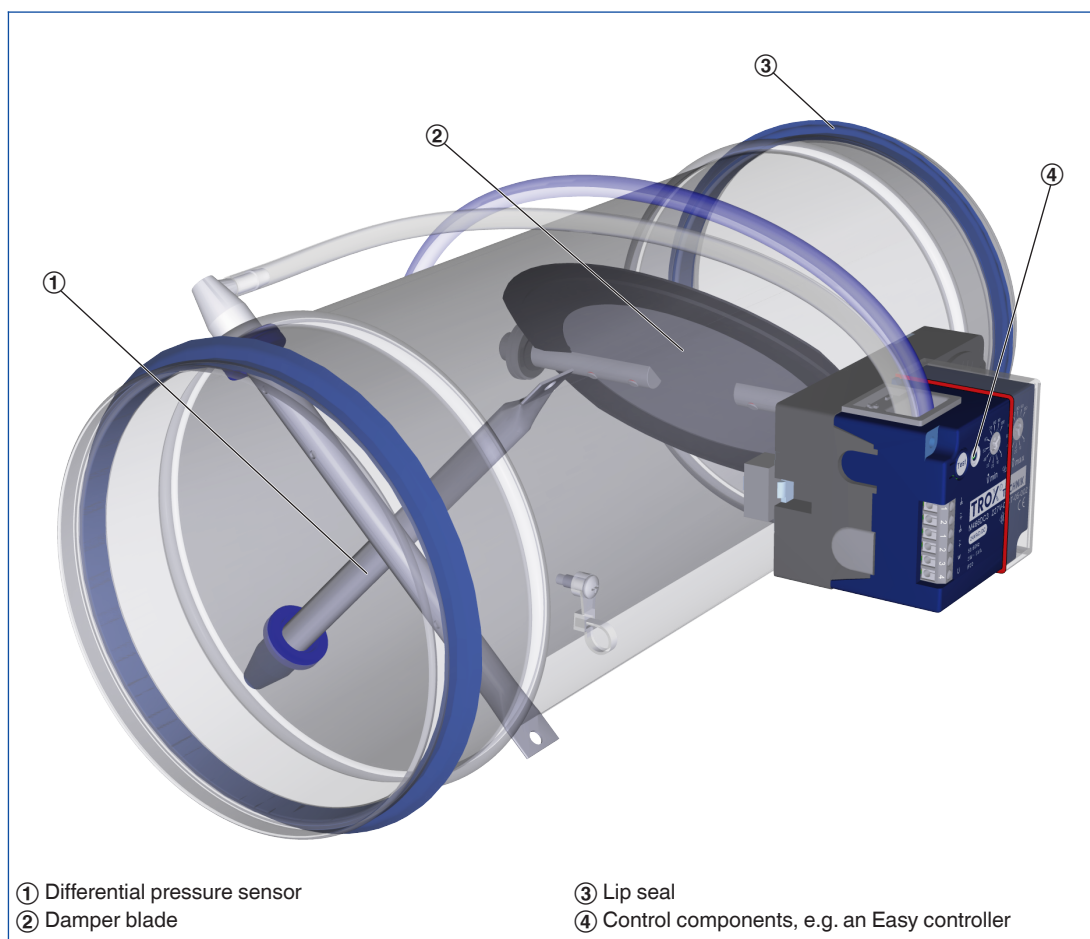
The control components (attachments) include a differential pressure transducer that transforms the differential pressure (effective pressure) into an electric signal, a controller, and an actuator; the control functions can be achieved with an Easy

controller, with a Compact controller, or with individual components (Universal or LABCONTROL).

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 control signal of the actuator if there is a difference between the two values.

## Schematic illustration of the TVR



Nominal sizes	100 – 400 mm
Volume flow rate range	10 – 1680 l/s or 36 – 6048 m <sup>3</sup> /h
Volume flow rate control range (unit with dynamic differential pressure measurement)	Approx. 10 to 100 % of the nominal volume flow rate
Minimum differential pressure	5 – 90 Pa
Maximum differential pressure	1000 Pa
Operating temperature	10 – 50 °C

### 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.

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.

### TVR, Volume flow rate ranges and minimum differential pressures

Nominal size	①	②	③	④			$\Delta\dot{V}$ ± %
	$\dot{V}$		$\Delta p_{st\ min}$				
	l/s	m <sup>3</sup> /h	Pa	Pa	Pa	Pa	
100	10	36	5	5	5	5	15
	40	144	15	15	20	20	8
	65	234	35	40	45	50	7
	95	342	70	85	95	105	5
125	15	54	5	5	5	5	15
	60	216	15	20	20	20	7
	105	378	45	50	55	60	6
	150	540	90	100	110	115	5
160	25	90	5	5	5	5	15
	100	360	15	15	15	15	8
	175	630	35	40	45	45	7
	250	900	70	80	85	95	5
200	40	144	5	5	5	5	15
	160	576	15	15	15	15	7
	280	1008	35	35	40	40	5
	405	1458	65	70	75	80	5
250	60	216	5	5	5	5	15
	250	900	10	10	10	15	7
	430	1548	25	25	30	35	5
	615	2214	45	50	55	65	5
315	100	360	5	5	5	5	15
	410	1476	5	10	10	10	7
	720	2592	15	20	20	20	6
	1030	3708	30	35	40	40	5
400	170	612	5	5	5	5	15
	670	2412	5	5	5	5	7
	1175	4230	15	15	15	15	6
	1680	6048	25	30	30	35	5

① TVR

② TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 500 mm

③ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1000 mm

④ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1500 mm

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 generally accepted attenuation levels. If the sound pressure level exceeds the required level, a larger air terminal unit and/or a silencer is required.

**TVR, Sound pressure level at differential pressure 150 Pa**

Nominal size	$\dot{V}$	$\dot{V}$	Air-regenerated noise				Case-radiated noise	
			①	②	③	④	①	⑤
	L <sub>PA</sub>	L <sub>PA1</sub>			L <sub>PA2</sub>	L <sub>PA3</sub>		
	l/s	m <sup>3</sup> /h	dB (A)					
100	10	36	32	20	<15	<15	<15	<15
	40	144	45	36	28	26	25	18
	65	234	51	41	33	31	31	24
	95	342	54	42	33	31	36	27
125	15	54	33	22	<15	<15	<15	<15
	60	216	45	36	30	28	25	17
	105	378	49	40	34	32	31	21
	150	540	52	41	34	32	35	24
160	25	90	40	28	20	16	20	<15
	100	360	47	39	34	31	28	19
	175	630	50	42	37	34	32	23
	250	900	53	44	39	36	37	28
200	40	144	40	31	23	20	20	<15
	160	576	47	40	34	33	29	15
	280	1008	50	44	40	38	32	21
	405	1458	54	45	39	38	38	25
250	60	216	37	28	22	20	20	<15
	250	900	47	40	34	33	35	18
	430	1548	48	42	38	37	37	25
	615	2214	52	44	38	37	42	29
315	105	378	42	35	28	25	28	<15
	410	1476	47	42	35	34	39	21
	720	2592	49	44	39	38	42	28
	1030	3708	53	48	42	41	46	35
400	170	612	43	36	30	26	30	<15
	670	2412	44	38	32	30	37	21
	1175	4230	47	42	36	35	41	29
	1680	6048	50	44	38	37	46	33

- ① TVR
- ② TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 500 mm
- ③ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1000 mm
- ④ TVR with secondary silencer CS/CF, insulation thickness 50 mm, length 1500 mm
- ⑤ TVR-D

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

Circular VAV terminal units for variable and constant air volume systems, suitable for supply or extract air, available in seven nominal sizes. 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 an averaging differential pressure sensor for volume flow rate measurement and a damper blade. Factory assembled control components complete with wiring and tubing.

Differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)

Spigot with groove for lip seal, suitable for connecting ducts according to EN 1506 or EN 13180.

Position of the damper blade indicated externally at shaft extension.

Closed blade air leakage to EN 1751, class 4 (nominal size 100, class 2; nominal sizes 125 and 160, class 3).

Casing air leakage to EN 1751, class C.

#### Special characteristics

- Integral differential pressure sensor with 3 mm measuring holes (resistant to dust and pollution)
- Factory set-up or programming and aerodynamic function testing
- Volume flow rate can be measured and subsequently adjusted on site; additional adjustment tool may be necessary

#### Materials and surfaces

Galvanised sheet steel construction

- Casing and damper blade made of galvanised sheet steel
- Damper blade seal made of TPE plastic
- Aluminium sensor tubes
- Plastic bearings

Powder-coated construction (P1)

- Casing made of galvanised sheet steel, powder-coated
- Damper blade and shaft made of stainless steel 1.4301
- Sensor tubes made of aluminium, powder-coated

Stainless steel construction (A2)

- Casing, damper blade and shaft made of stainless steel 1.4301
- Sensor tubes made of aluminium, powder-coated

Variant with acoustic cladding (-D)

- Acoustic cladding made of galvanised sheet steel
- Rubber profile for the insulation of structure-

- borne noise
- Lining is mineral wool

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

#### Construction

- Galvanised sheet steel
- P1: Powder-coated, silver grey (RAL 7001)
- A2: Stainless steel

#### Technical data

- Nominal sizes: 100 to 400 mm
- Volume flow rate range: 10 to 1680 l/s or 36 to 6048 m<sup>3</sup>/h
- Volume flow rate control range (unit with dynamic differential pressure measurement): approx. 10 to 100 % of the nominal volume flow rate
- Minimum differential pressure: 5 – 90 Pa
- Maximum differential pressure: 1000 Pa

#### Attachments

Variable volume flow control with electronic Easy controller to connect an external control signal; actual value signal can be integrated into the central BMS.

- Supply voltage 24 V AC/DC
- Signal voltages 0 – 10 V DC
- Possible override controls with external switches using volt-free contacts: CLOSED, OPEN,  $\dot{V}_{\min}$  and  $\dot{V}_{\max}$
- Potentiometers with percentage scales to set the volume flow rates  $\dot{V}_{\min}$  and  $\dot{V}_{\max}$
- The actual value signal relates to the nominal volume flow rate such that commissioning and subsequent adjustment are simplified
- Volume flow rate control range: approx. 10 – 100 % of the nominal volume flow rate
- Clearly visible external indicator light for signalling the functions: Set, not set, and power failure

Electrical connections with screw terminals.

Double terminals for looping the supply voltage, i.e. for the simple connection of voltage transmission to the next controller.

#### Sizing data

- $\dot{V}$  \_\_\_\_\_  
[m<sup>3</sup>/h]
- $\Delta p_{st}$  \_\_\_\_\_  
[Pa]

Air-regenerated noise



-  $L_{PA}$  \_\_\_\_\_  
[dB(A)]  
Case-radiated noise

-  $L_{PA}$  \_\_\_\_\_  
[dB(A)]



TVR, TVR/.../Easy

<b>TVR – D – ... – FL / 160 / G2 / B1B / E 0 / 200 – 900 / NO</b>										
↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
1	2	3	4	5	6	7	8	9	10	11
<hr/>										
<b>TVR – D / 200 / D2 / Easy</b>										
↓	↓	↓	↓	↓						
1	2	5	6	7						

**1** Type

**TVR** VAV terminal unit

**2** Acoustic cladding

No entry: none

**D** With acoustic cladding

**3** Material

No entry: galvanised sheet steel

**P1** Powder-coated (RAL 7001), silver grey

**A2** Stainless steel

**4** Flange

No entry: none

**FL** Both ends (not for TVR-D-P1)

**5** Nominal size [mm]

**100**

**125**

**160**

**200**

**250**

**315**

**400**

**6** Accessories

No entry: none

**D2** Lip seals on both ends

**G2** Matching flanges for both ends

**7** Attachments (control component)

Example

**Easy** Compact controller

**BC0** Compact controller

**B13** Universal controller

**8** Operating mode

**E** Single

**M** Master

**S** Slave

**F** Constant value

**A** Differential pressure control – extract air

**Z** Differential pressure control – supply air

**9** Signal voltage range

For the actual and setpoint value signals

**0** 0 – 10 V DC

**2** 2 – 10 V DC

**10** Volume flow rates [m<sup>3</sup>/h or l/s], differential pressure [Pa]

$\dot{V}_{\min} - \dot{V}_{\max}$  for factory setting

$\Delta p_{\min}$  for factory setting (operating modes A, Z)

**11** Damper blade position

Only with spring return actuators

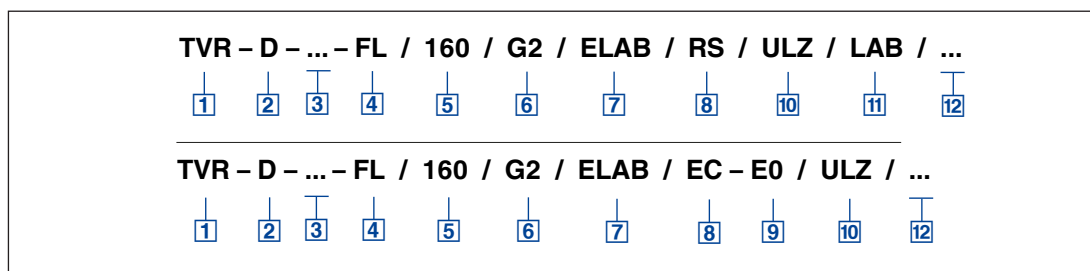
**NO** Power off to open

**NC** Power off to close

**Order example: TVR/200/D2/BC0/E0/500–1200 m<sup>3</sup>/h**

<b>Acoustic cladding</b>	Without
<b>Material</b>	Galvanised sheet steel
<b>Flange</b>	Without
<b>Nominal size</b>	200 mm
<b>Accessories</b>	Lip seals on both ends
<b>Attachment</b>	Compact controller
<b>Operating mode</b>	Single
<b>Signal voltage range</b>	0 – 10 V DC
<b>Volume flow rate</b>	500 – 1200 m <sup>3</sup> /h

TVR with EASYLAB for room control and single operation



**1** Type

**TVR** VAV terminal unit

**2** Acoustic cladding

No entry: none

**D** With acoustic cladding

**3** Material

No entry: galvanised sheet steel

**P1** Powder-coated (RAL 7001), silver grey

**A2** Stainless steel

**4** Flange

No entry: none

**FL** Both ends (not for TVR-D-P1)

**5** Nominal size [mm]

$D_N$

**6** Accessories

No entry: none

**D2** Lip seals on both ends

**G2** Matching flanges for both ends

**7** Attachments (control component)

**ELAB** EASYLAB controller TCU3 with fast-running actuator

**8** Equipment function

Room control

**RS** Supply air control (Room Supply)

**RE** Extract air control (Room Exhaust)

**PC** Differential pressure control

Single operation

**SC** Supply air controller

**EC** Extract air controller

**9** External volume flow rate setting

Only for single operation

**E0** Voltage signal 0 – 10 V DC

**E2** Voltage signal 2 – 10 V DC

**2P** On-site switch contacts for 2 switching steps

**3P** On-site switch contacts for 3 switching steps

**F** Volume flow rate constant value, without signalling

**10** Module expansions

Option 1: Power supply

No entry: 24 V AC

**U** EM-TRF-USV for 230 V AC, provides uninterruptible power supply

Option 2: Communication interface

No entry: none

**L** EM-LON for LonWorks FTT-10A

**B** EM-BAC-MOD-01 for BACnet MS/TP

**M** EM-BAC-MOD-01 for Modbus RTU

**I** EM-IP for BACnet/IP, Modbus/IP and webservice

**R** EM-IP with real time clock

Option 3: Automatic zero point correction

No entry: none

**Z** EM-AUTOZERO with solenoid valve

**11** Additional functions

Only for room control (equipment function)

RMF has been deactivated

**LAB** Extract air led system (laboratories)

**CLR** Supply air led system (clean rooms)

Raum management function is active

**LAB-RMF** Extract air led system (LAB)

**CLR-RMF** Supply air led system (CLR)

**12** Operating values [ $m^3/h$  or  $l/s$ , Pa]

For equipment function 'room control' with additional function RMF

Total room extract air/supply air

$\dot{V}_1$ : Standard mode

$\dot{V}_2$ : Reduced operation

$\dot{V}_3$ : Increased operation

$\dot{V}_4$ : Constant room supply air

$\dot{V}_5$ : Constant room extract air

$\dot{V}_6$ : Supply air/extract air difference

$\Delta p_{set}$ : Setpoint (only with pressure control)

For equipment function 'single operation'

$E0, E2: \dot{V}_{min} / \dot{V}_{max}$

$2P: \dot{V}_1 / \dot{V}_2$

$3P: \dot{V}_1 / \dot{V}_2 / \dot{V}_3$

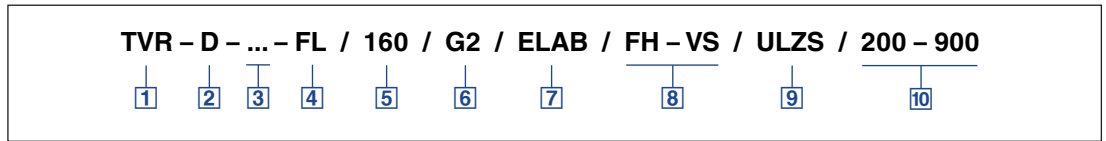
$F: \dot{V}_1$

**Useful additions**

Room control panel

**BE-LCD-01** 40-character display

TVR with EASYLAB for fume cupboard control



1 Type

**TVR** VAV terminal unit

2 Acoustic cladding

No entry: none

**D** With acoustic cladding

3 Material

No entry: galvanised sheet steel

**P1** Powder-coated (RAL 7001), silver grey

**A2** Stainless steel

4 Flange

No entry: none

**FL** Both ends (not for TVR-D-P1)

5 Nominal size [mm]

**100**

**125**

**160**

**200**

**250**

**315**

**400**

6 Accessories

No entry: none

**D2** Lip seals on both ends

**G2** Matching flanges for both ends

7 Attachments (control component)

**ELAB** EASYLAB controller TCU3 with fast-running actuator

8 Equipment function

With face velocity transducer

**FH-VS** Face velocity control

With sash distance sensor

**FH-DS** Linear control strategy

**FH-DV** Safety-optimised control strategy

With switching steps for on-site switch contacts

**FH-2P** 2 switching steps

**FH-3P** 3 switching steps

Without signalling

**FH-F** Volume flow rate constant value

9 Expansion modules

Option 1: Supply voltage

No entry: 24 V AC

**T** EM-TRF for 230 V AC

**U** EM-TRF-USV for 230 V AC, provides uninterruptible power supply (UPS)

Option 2: Communication interface

No entry: none

**L** EM-LON for LonWorks FTT-10A

**B** EM-BAC-MOD-01 for BACnet MS/TP

**M** EM-BAC-MOD-01 for Modbus RTU

**I** EM-IP for BACnet/IP, Modbus/IP and webserver

**R** EM-IP with real time clock

Option 3: Automatic zero point correction

No entry: none

**Z** EM-AUTOZERO Solenoid valve for automatic zero point correction

Option 4: Lighting

No entry: none

**S** EM-LIGHT Wired socket for the connection of lighting and for switching the lighting on/off using the control panel (only with EM-TRF or EM-TRF-USV)

10 Operating values [m<sup>3</sup>/h or l/s]

Depending on the equipment function

VS:  $\dot{V}_{\min} - \dot{V}_{\max}$

DS:  $\dot{V}_{\min} - \dot{V}_{\max}$

DV:  $\dot{V}_{\min} - \dot{V}_{\max}$

2P:  $\dot{V}_1 / \dot{V}_2$

3P:  $\dot{V}_1 / \dot{V}_2 / \dot{V}_3$

F:  $\dot{V}_1$

Useful additions

Control panel for fume cupboard controller, for displaying the functions of the control system according to EN 14175

**BE-SEG-\*\*** OLED display

**BE-LCD-01** 40-character display

Order example: TVR/200/D2/ELAB/FH-2P/200-700

Acoustic cladding	Without
Nominal size	200 mm
Accessories	Lip seals on both ends
Attachments	EASYLAB controller TCU3 with fast-running actuator
Equipment function	Two switching steps

VAV terminal unit, variant TVR



**TVR**

- VAV terminal unit for the control of variable air

VAV terminal unit, variant TVR-D



volume flow rates

- Spigot to make connections to the ducting

**TVR-D**

- VAV terminal unit with acoustic cladding for the control of variable air volume flows
- 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 and room ends
- Acoustic cladding cannot be retrofitted

**TVR-FL**

- VAV terminal unit for the control of variable air volume flow rates

- With flanges on both ends to make detachable connections to the ducting

**TVR-D-FL**

- VAV terminal unit with acoustic cladding for the control of variable air volume flows
- With flanges on both ends to make detachable connections to the ducting
- 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 and room ends
- Acoustic cladding cannot be retrofitted
- Powder-coated surface (P1) or stainless steel construction (A2) not possible

**Materials**

Order code detail	Part	Material	Notes
-	Casing	Galvanised sheet steel	
	Damper blade	Galvanised sheet steel	
	Damper blade seal	Thermoplastic elastomer (TPE)	
	Shaft	Galvanised steel	
	Sensor tubes	Aluminium	
	Plain bearings	Plastic	
D	Acoustic cladding	Galvanised sheet steel	
	Rubber profile for the insulation of structure-borne noise	Rubber	
	Lining	Mineral wool	
P1	Casing	Galvanised sheet steel	
	Damper blade	Stainless steel, material no. 1.4301	
	Shaft	Stainless steel, material no. 1.4301	
A2	Casing	Stainless steel, material no. 1.4301	
	Damper blade	Stainless steel, material no. 1.4301	
	Shaft	Stainless steel, material no. 1.4305	

**Surfaces**

Order code detail	Part	Surface	Notes
-	Casing	Untreated	
	Sensor tubes	Untreated	
P1	Casing	Powder-coated, RAL 7001, silver grey	
	Sensor tubes	Powder-coated, RAL 7001, silver grey	
A2	Casing	Untreated	
	Sensor tubes	Powder-coated, RAL 7001, silver grey	

TVR, VARYCONTROL control components

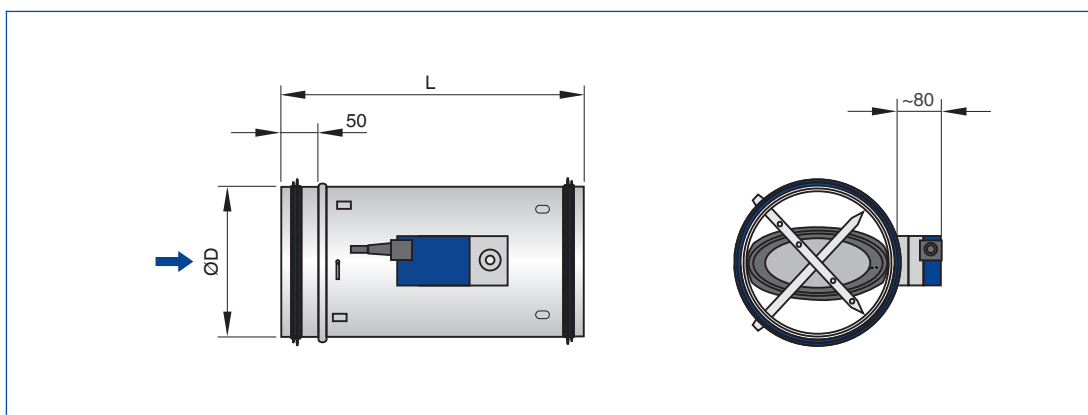
Order code detail	Controlled variable	Controller	Differential pressure transducer	Actuator
<b>Easy controller</b>				
Easy	Volume flow rate	Easy controller TROX	Dynamic, integral	Integral
<b>Compact controller, dynamic</b>				
BC0	Volume flow rate	Compact controller with MP bus interface TROX/Belimo	Dynamic, integral	Integral
BL0		Compact controller with LonWorks interface TROX/Belimo		
BM0		Compact controller with Modbus RTU interface (with connecting cable) TROX/Belimo		
BM0-J6		Compact controller with Modbus RTU interface (with socket) TROX/Belimo		
XB0		Compact controller TROX/Gruner		
LN0		Compact controller Siemens		
LK0		Compact controller with KNX interface Siemens		
<b>Compact controller, static</b>				
SA0	Volume flow rate	Compact controller with SLC interface Sauter	Static, integral	Integral
SC0				Fast-running actuator, integral
<b>Universal controller, dynamic</b>				
B13	Volume flow rate	Universal controller TROX/Belimo	Dynamic, integral	Actuator
B1B				Spring return actuator
XC3		Universal controller TROX/Gruner		
<b>Universal controller, static</b>				
BP3	Volume flow rate	Universal controller with MP bus interface TROX/Belimo	Static	Actuator
BPB				Spring return actuator
BPG				Fast-running actuator
BB3		Universal controller TROX/Belimo		Actuator
BBB				Spring return actuator
XD1				Actuator
XD3	Universal controller TROX/Gruner	Static, integral	Spring return actuator	
BR3	Differential pressure	Universal controller with MP bus interface TROX/Belimo	Static, integral 100 Pa	Actuator
BRB				Spring return actuator
BRG				Fast-running actuator
BS3			Static, integral 600 Pa	Actuator
BSB				Spring return actuator
BSG		Fast-running actuator		
BG3		Differential pressure controller TROX/Belimo	Static, integral 100 Pa	Actuator
BGB				Spring return actuator
BH3			Static, integral 600 Pa	Actuator
BHB		Spring return actuator		
XE1		Differential pressure controller TROX/Gruner	Static, integral 100 Pa	Actuator
XE3				Spring return actuator
XF1			Static, integral 600 Pa	Actuator
XF3				Spring return actuator

**TVR, LABCONTROL control components**

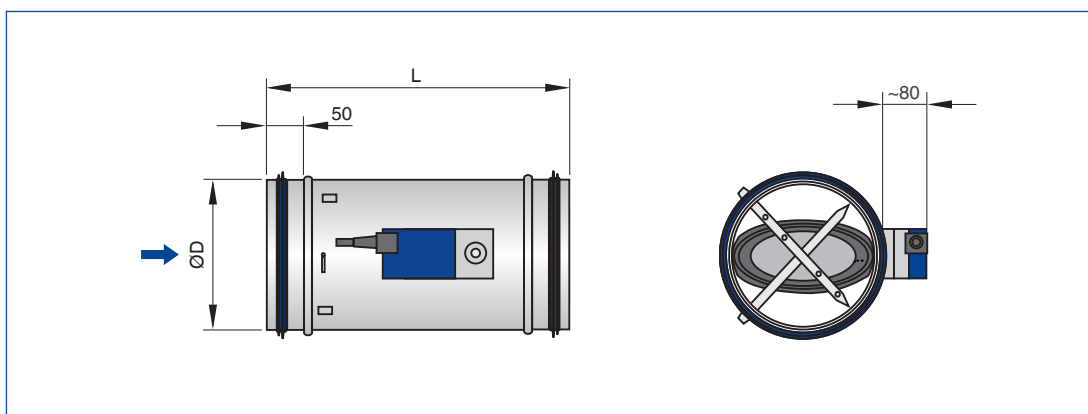
Order code detail	Controlled variable	Controller	Differential pressure transducer	Actuator
<b>EASYLAB</b>				
<b>ELAB</b>	Room supply air Room extract air Room pressure Single controller	EASYLAB controller TCU3	Static, integral	Fast-running actuator



TVR, Compact



TVR, Universal



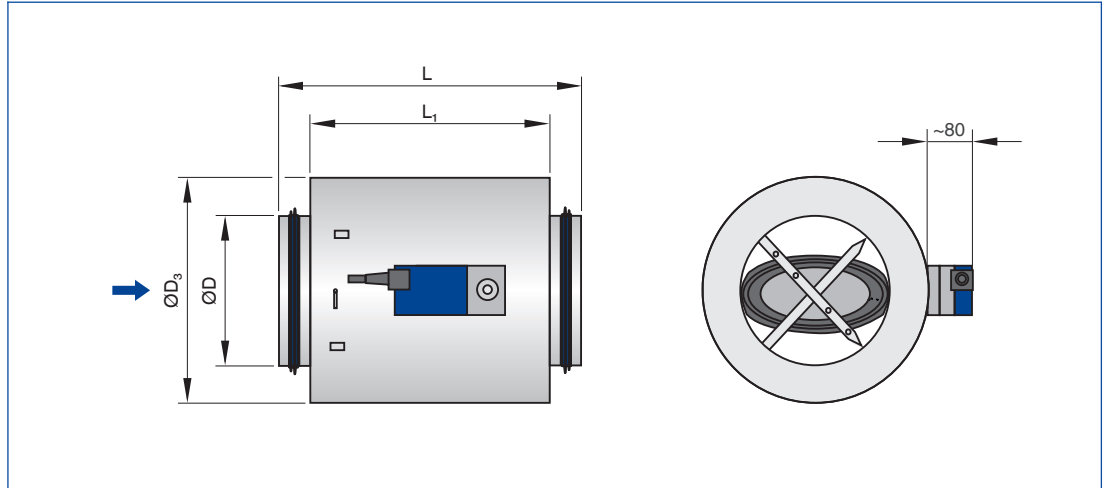
TVR

Nominal size	Easy Compact	Universal LABCONTROL	ØD mm	m kg
	L			
	mm	mm		
100	310	600	99	3.3
125	310	600	124	3.6
160	400	600	159	4.2
200	400	600	199	5.1
250	400	600	249	6.1
315	500	600	314	7.2
400	500	600	399	9.4

Compact: Easy and Compact controllers

Universal: All control components except Easy and Compact controllers

TVR-D



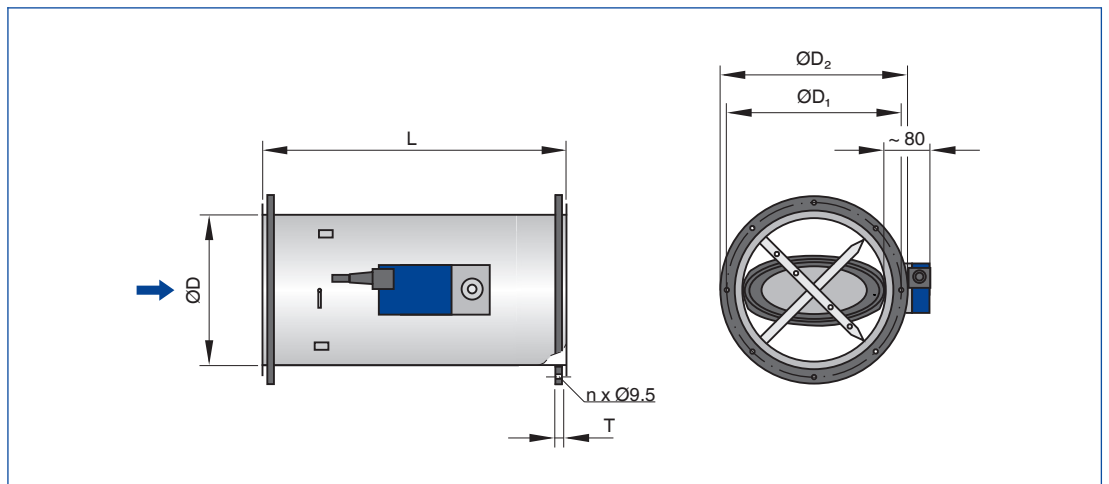
TVR-D

Nominal size	Easy Compact		Universal LABCONTROL		$\text{ØD}$ mm	$\text{ØD}_3$ mm	m kg
	L	$L_1$	L	$L_1$			
	mm	mm	mm	mm			
100	310	232	600	517	99	198	7.2
125	310	232	600	517	124	223	8.5
160	400	312	600	517	159	258	11.0
200	400	312	600	517	199	298	13.9
250	400	312	600	517	249	348	15.9
315	500	417	600	517	314	413	18.0
400	500	417	600	517	399	498	22.6

Compact: Easy and Compact controllers

Universal: All control components except Easy and Compact controllers

TVR-FL



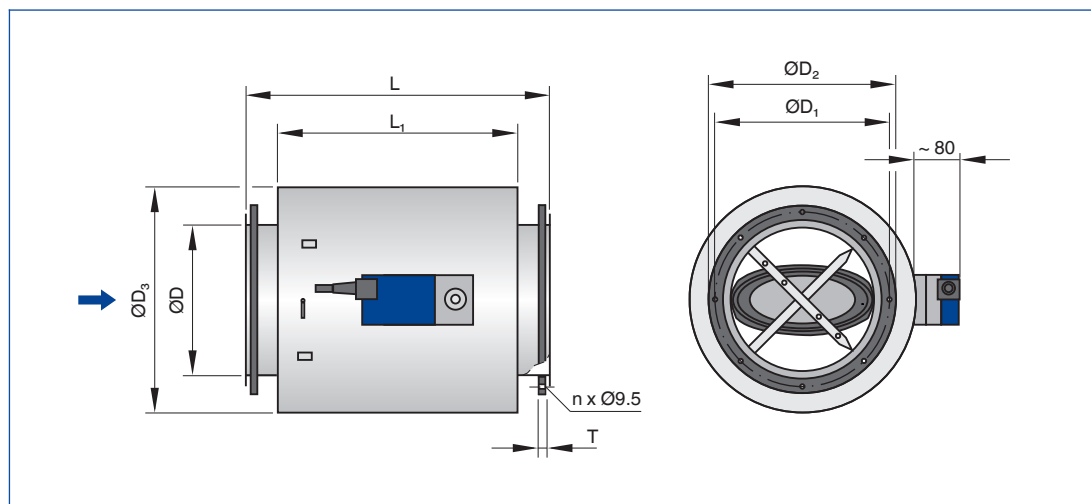
TVR-FL

Nominal size	Easy Compact	Universal LABCONT ROL						
	L		ØD	ØD <sub>1</sub>	ØD <sub>2</sub>	n	T	m
	mm	mm	mm	mm	mm		mm	kg
100	290	580	99	132	152	4	4	3.9
125	290	580	124	157	177	4	4	4.2
160	380	580	159	192	212	6	4	5.3
200	380	580	199	233	253	6	4	6.5
250	380	580	249	283	303	6	4	7.8
315	480	580	314	352	378	8	4	10.3
400	480	580	399	438	464	8	4	13.3

Compact: Easy and Compact controllers

Universal: All control components except Easy and Compact controllers

TVR-D-FL



TVR-D-FL

Nominal size	Easy Compact		Universal LABCONTROL								
	L	L <sub>1</sub>	L	L <sub>1</sub>	ØD	ØD <sub>1</sub>	ØD <sub>2</sub>	ØD <sub>3</sub>	n	T	m
	mm	mm	mm	mm	mm	mm	mm	mm		mm	kg
100	290	232	580	517	99	132	152	198	4	4	7.8
125	290	232	580	517	124	157	177	223	4	4	9.1
160	380	312	580	517	159	192	212	258	6	4	12.1
200	380	312	580	517	199	233	253	298	6	4	14.3
250	380	312	580	517	249	283	303	348	6	4	17.6
315	480	417	580	517	314	352	378	413	8	4	21.2
400	480	417	580	517	399	438	464	498	8	4	26.5

Compact: Easy and Compact controllers

Universal: All control components except Easy and Compact controllers

#### Installation and commissioning

- Any installation orientation (except units with static differential pressure transducer)
- TVR-D: For constructions with acoustic cladding, ducts on the room side should have cladding up to the acoustic cladding of the controller

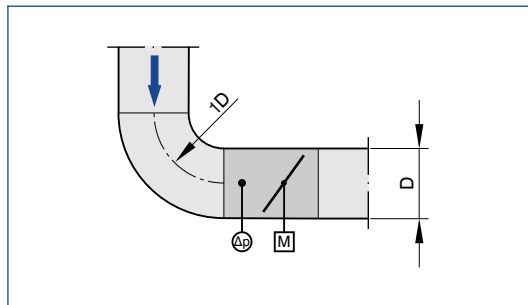
#### Upstream conditions

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.

#### Space required for commissioning and maintenance

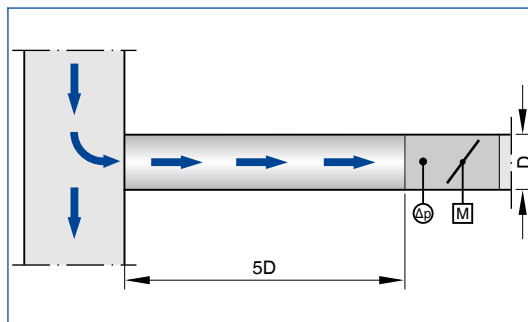
Sufficient space must be kept clear near any attachments to allow for commissioning and maintenance. It may be necessary to provide sufficiently sized inspection access openings.

#### Bend



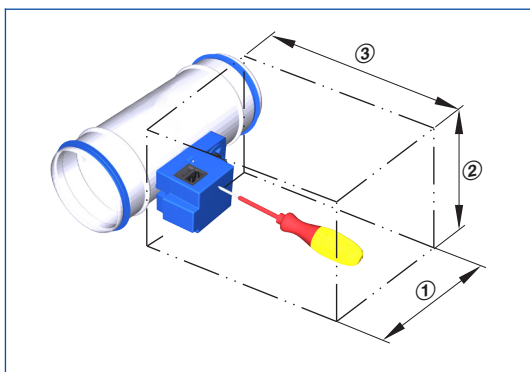
A bend with a centre line curvature radius of at least  $1D$  – without an additional straight duct section upstream of the VAV terminal unit – has only a negligible effect on the volume flow rate accuracy.

#### 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.

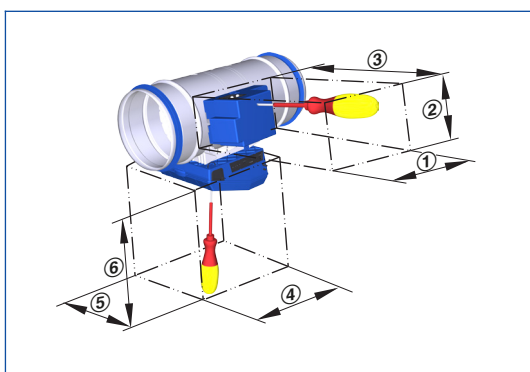
Access to attachments, attached on one side



Space requirement, control component on one side

Attachments	①	②	③
	mm		
<b>VARYCONTROL</b>			
Easy controller	250	200	300
Compact controller	250	200	250
Universal controller, dynamic	520	250	250
<b>LABCONTROL</b>			
EASYLAB	550	350	400

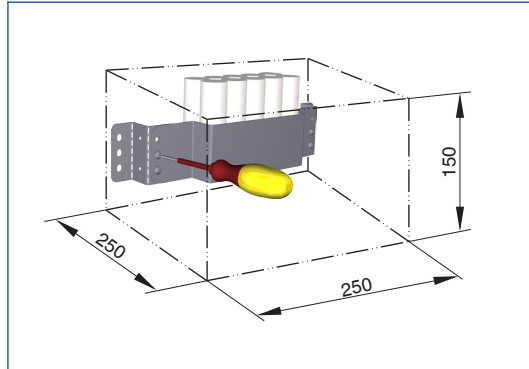
Access to attachments, attached on two sides



Space requirement, control components on two sides

Attachments	①	②	③	④	⑤	⑥
	mm					
<b>VARYCONTROL</b>						
Universal controller, static	520	250	250	250	150	250

Access to battery pack



Separate space for fixing and accessing the battery pack (LABCONTROL EASYLAB accessory)

### 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<sub>1</sub> [mm]

Pitch circle diameter of flanges

#### ØD<sub>2</sub> [mm]

Outside diameter of flanges

#### ØD<sub>4</sub> [mm]

Inside diameter of the screw holes of flanges

#### L [mm]

Length of unit including connecting spigot

#### L<sub>1</sub> [mm]

Length of casing or acoustic cladding

#### B [mm]

Duct width

#### B<sub>1</sub> [mm]

Screw hole pitch of flange (horizontal)

#### B<sub>2</sub> [mm]

Outside dimension of flange (width)

#### B<sub>3</sub> [mm]

Width of device

#### H [mm]

Duct height

#### H<sub>1</sub> [mm]

Screw hole pitch of flange (vertical)

#### H<sub>2</sub> [mm]

Outside dimension of flange (height)

#### H<sub>3</sub> [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)

### Acoustic data

#### f<sub>m</sub> [Hz]

Octave band centre frequency

#### L<sub>PA</sub> [dB(A)]

A-weighted sound pressure level of air-  
regenerated noise of the VAV terminal unit, system  
attenuation taken into account

#### L<sub>PA1</sub> [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<sub>PA2</sub> [dB(A)]

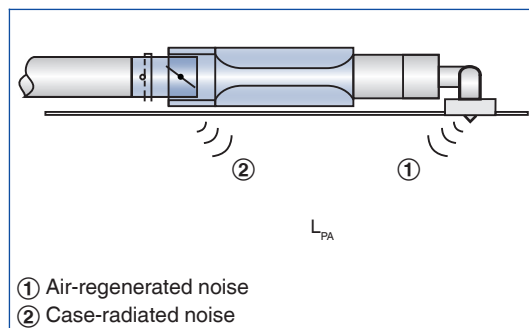
A-weighted sound pressure level of case-  
regenerated noise of the VAV terminal unit, system  
attenuation taken into account

#### L<sub>PA3</sub> [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



### Volume flow rates

#### $\dot{V}_{nom}$ [m<sup>3</sup>/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

#### $\dot{V}_{\min \text{ unit}}$ [ $\text{m}^3/\text{h}$ ] and [ $\text{l/s}$ ]

- 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  $\dot{V}_{\min \text{ unit}}$  (if  $\dot{V}_{\min}$  equals zero) may result in unstable control or shut-off

#### $\dot{V}_{\max}$ [ $\text{m}^3/\text{h}$ ] and [ $\text{l/s}$ ]

- 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  $\dot{V}_{\text{nom}}$
  - 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)

#### $\dot{V}_{\min}$ [ $\text{m}^3/\text{h}$ ] and [ $\text{l/s}$ ]

- 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  $\dot{V}_{\min \text{ unit}}$ , 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)

#### $\dot{V}$ [ $\text{m}^3/\text{h}$ ] and [ $\text{l/s}$ ]

Volume flow rate

#### $\Delta\dot{V}$ [ $\pm \%$ ]

Volume flow rate tolerance from setpoint value

#### $\Delta\dot{V}_{\text{warm}}$ [ $\pm \%$ ]

Volume flow rate tolerance for the warm air flow of dual duct terminal units

### Differential pressure

#### $\Delta p_{\text{st}}$ [Pa]

Static differential pressure

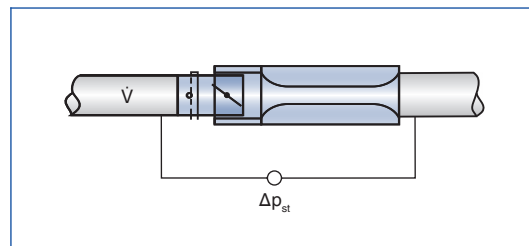
#### $\Delta p_{\text{st min}}$ [Pa]

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



### Construction

#### 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