

# CAV controllers

## Type EN-Ex



### For the precise control of normal and high constant volume flows in potentially explosive atmospheres (ATEX)

Rectangular, mechanical self-powered volume flow controllers for the control of supply air or extract air in constant air volume systems, approved and certified for potentially explosive atmospheres (ATEX)

- ATEX-compliant construction
- Approved for gases, mists, vapours and dusts in zones 1, 2, 21 and 22
- Suitable for volume flow rates up to 12,096 m<sup>3</sup>/h or 3,360 l/s
- Volume flow rate can be set using an external scale, no tools required
- High control accuracy
- No on-site test measurements required for commissioning
- Suitable for airflow velocities up to 8 m/s
- Casing air leakage to EN 1751, up to class C

#### Optional equipment and accessories

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



Adjustment scale



ATEX-Zertifizierung

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## Application

### Application

- Rectangular EXCONTROL CAV controllers of Type EN-Ex for the precise supply air or extract air flow control in constant air volume systems
- For use in potentially explosive atmospheres (ATEX)
- Mechanical self-powered volume flow control without external power supply
- Simplified project handling with orders based on nominal size

### Special features

- ATEX mark and certification
- ATEX equipment group II, approved for zones 1, 2, 21 and 22

- Volume flow rate can be set using an external scale; no tools required
- High volume flow rate control accuracy
- Any installation orientation

### Classification

According to type examination certificate  
TUEV 05 ATEX 7159 X

- Zones 1 and 2 (atmosphere: gases):  
II 2 G c II T5/T6
- Zones 21 and 22 (atmosphere: dusts):  
II 2 D c II T 80 °C

### Nominal sizes

- 19 nominal sizes from 200 × 100 to 600 × 600

## Description

### Variants

- EN-Ex: Volume flow controller
- EN-Ex-D: Volume flow controller with acoustic cladding
- Units with acoustic cladding and/or secondary silencer Type TX for demanding acoustic requirements
- Acoustic cladding cannot be retrofitted

### Construction

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

### Parts and characteristics

- Ready-to-commission controller
- Damper blade with low-friction bearings
- Bellows that acts as an oscillation damper
- Cam plate with leaf spring
- Scale with pointer to set the volume flow rate setpoint
- Connection for equipotential bonding
- Aerodynamic functional testing of each unit on a special test rig prior to shipping
- Correct operation even under unfavourable upstream conditions (1.5 B straight section required upstream)

### Useful additions

- Secondary silencer Type TX

### Construction features

- Rectangular casing
- Construction and materials comply with the EU

directive for use in potentially explosive atmospheres (ATEX)

- Flanges on both sides, suitable for duct connection
- Volume flow controllers from H = 400 mm are fitted with two damper blades and two volume flow rate scales

### Materials and surfaces

Galvanised sheet steel construction

- Casing and damper blade made of galvanised sheet steel
- Leaf spring made of stainless steel
- Polyurethane bellows
- Plain bearings with PTFE coating

Powder-coated construction (P1)

- Casing and damper blade made of galvanised sheet steel, 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 A2, 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/EC

**Standards and guidelines**

- Directive 94/9/EC: Equipment and protective systems intended for use in potentially explosive atmospheres

- Casing air leakage to EN 1751, class C (B + H ≤ 400, class B)

**Maintenance**

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

### Functional description

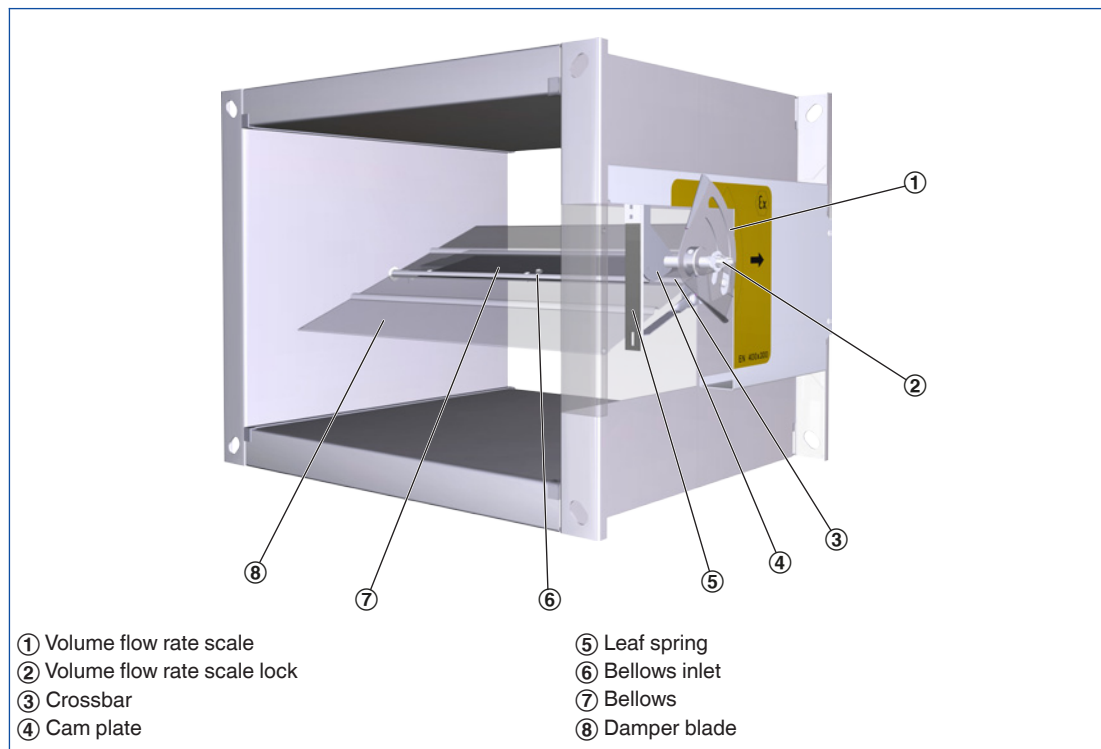
The volume flow controller is a mechanical self-powered unit and works without external power supply. A damper blade with low-friction bearings is adjusted by aerodynamic forces such that the set volume flow rate is maintained within the differential pressure range.

The aerodynamic forces of the airflow create a closing torque on the damper blade. The bellows extends and increases this force while at the same time acting as an oscillation damper. The closing force is countered by a leaf spring that unrolls over a cam plate. The shape of the cam plate is such that a change in the differential pressure leads to an adjustment of the damper blade in a way that the volume flow rate is maintained almost exactly.

### Efficient commissioning

The volume flow rate setpoint value can be set quickly and easily using the pointer on the external scale; no measurements are required. The advantage over flow adjustment dampers is that there is no need for repeat measurements or adjustments by an air conditioning engineer. Should the system pressure change, e.g. by opening or closing of duct sections, the flow rates in the entire system will also change if flow adjustment dampers are used; however, this is not the case with mechanical self-powered volume flow controllers. A mechanical self-powered controller reacts immediately and adjusts the damper blade such that the set constant volume flow rate is maintained.

### Schematic illustration of the EN-Ex



Nominal sizes	200 × 100 to 600 × 600 mm
Volume flow rate range	40 – 3360 l/s or 144 – 12096 m <sup>3</sup> /h
Volume flow rate control range	Approx. 25 to 100 % of the nominal volume flow rate
Scale accuracy	± 4 %
Minimum differential pressure	50 Pa
Maximum differential pressure	1000 Pa
Operating temperature	10 – 50 °C

#### Volume flow rate ranges

The minimum differential pressure of CAV controllers 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.

EN-Ex, Volume flow rate ranges and minimum differential pressures

Nominal size	Ṽ		①	②	ΔṼ ± %
			Δp <sub>st min</sub>		
	l/s	m³/h	Pa	Pa	
200 × 100	40	144	50	60	13
	80	288	50	80	9
	120	432	50	115	6
	160	576	50	160	5
300 × 100	65	234	50	60	13
	130	468	50	80	9
	195	702	50	120	6
	260	936	50	170	5
300 × 150	105	378	50	60	13
	210	756	50	80	9
	315	1134	50	115	6
	420	1512	50	160	5
300 × 200	130	468	50	60	13
	260	936	50	80	9
	390	1404	50	110	6
	520	1872	50	160	5
400 × 200	210	756	50	60	13
	420	1512	50	80	9
	630	2268	50	115	6
	840	3024	50	160	5
500 × 200	230	828	50	60	13
	460	1656	50	80	9
	690	2484	50	115	6
	920	3312	50	160	5
600 × 200	255	918	50	60	13
	510	1836	50	80	9
	765	2754	50	115	6
	1020	3672	50	160	5
400 × 250	220	792	50	60	13
	440	1584	50	80	9
	660	2376	50	115	6
	880	3168	50	160	5
500 × 250	300	1080	50	60	13
	600	2160	50	80	9
	900	3240	50	115	6
	1200	4320	50	160	5
600 × 250	320	1152	50	60	13
	640	2304	50	80	9
	960	3456	50	115	6
	1280	4608	50	160	5
400 × 300	315	1134	50	60	13
	630	2268	50	80	9
	945	3402	50	115	6
	1260	4536	50	160	5
500 × 300	375	1350	50	60	13
	750	2700	50	80	9
	1125	4050	50	115	6
	1500	5400	50	160	5

① EN-Ex

② EN-Ex with secondary silencer TX

EN-Ex, Volume flow rate ranges and minimum differential pressures

Nominal size	Ṡ		①	②	ΔṠ
			Δp <sub>st min</sub>		
	l/s	m³/h	Pa	Pa	
600 × 300	420	1512	50	60	13
	840	3024	50	75	9
	1260	4536	50	110	6
	1680	6048	50	150	5
400 × 400	420	1512	50	60	13
	840	3024	50	85	9
	1260	4536	50	120	6
	1680	6048	50	175	5
500 × 400	460	1656	50	60	13
	920	3312	50	80	9
	1380	4968	50	115	6
	1840	6624	50	160	5
600 × 400	510	1836	50	60	13
	1020	3672	50	80	9
	1530	5508	50	115	6
	2040	7344	50	160	5
500 × 500	600	2160	50	60	13
	1200	4320	50	80	9
	1800	6480	50	115	6
	2400	8640	50	160	5
600 × 500	640	2304	50	55	13
	1280	4608	50	70	9
	1920	6912	50	95	6
	2560	9216	50	130	5
600 × 600	840	3024	50	60	13
	1680	6048	50	75	9
	2520	9072	50	105	6
	3360	12096	50	145	5

① EN-Ex

② EN-Ex with secondary silencer TX

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.



**Quick sizing: Sound pressure level at differential pressure 150 Pa**

Nominal size	$\dot{V}$	$\dot{V}$	Air-regenerated noise		Case-radiated noise	
			①	②	①	③
	l/s	m³/h	L <sub>PA</sub>	L <sub>PA1</sub>	L <sub>PA2</sub>	L <sub>PA3</sub>
			dB(A)			
200 × 100	40	144	35	19	21	<15
	80	288	41	28	28	21
	120	432	44	34	33	26
	160	576	46	38	35	30
300 × 100	65	234	38	22	24	16
	130	468	44	30	32	24
	195	702	45	35	36	29
	260	936	47	38	39	32
300 × 150	105	378	41	24	28	19
	210	756	44	31	34	26
	315	1134	46	35	39	32
	420	1512	47	38	41	35
300 × 200	130	468	45	24	31	21
	260	936	46	29	35	26
	390	1404	46	33	38	29
	520	1872	47	35	40	32
400 × 200	210	756	42	23	30	20
	420	1512	43	27	35	26
	630	2268	44	31	38	30
	840	3024	44	33	40	33
500 × 200	230	828	40	21	28	18
	460	1656	40	26	33	24
	690	2484	41	29	36	28
	920	3312	42	31	38	31
600 × 200	255	918	38	20	27	17
	510	1836	39	24	31	23
	765	2754	39	28	35	27
	1020	3672	40	31	37	31
400 × 250	220	792	44	23	32	22
	440	1584	45	28	37	27
	660	2376	45	31	39	30
	880	3168	45	34	41	33
500 × 250	300	1080	41	21	31	21
	600	2160	42	26	36	27
	900	3240	43	30	39	30
	1200	4320	43	33	41	33
600 × 250	320	1152	40	20	30	20
	640	2304	40	25	34	25
	960	3456	41	28	37	29
	1280	4608	42	31	39	32
400 × 300	315	1134	45	25	53	25
	630	2268	46	29	40	30
	945	3402	47	34	43	34
	1260	4536	47	36	45	36
500 × 300	375	1350	43	22	34	23
	750	2700	44	28	38	29
	1125	4050	44	31	41	32
	1500	5400	45	33	43	35

① EN

② EN with secondary silencer TX

③ EN-D

**Quick sizing: Sound pressure level at differential pressure 150 Pa**

Nominal size	$\dot{V}$	$\dot{V}$	Air-regenerated noise		Case-radiated noise	
			①	②	①	③
			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)			
600 x 300	420	1512	41	21	33	22
	840	3024	42	26	37	28
	1260	4536	42	30	40	31
	1680	6048	43	32	42	34
400 x 400	420	1512	47	27	39	29
	840	3024	49	32	44	34
	1260	4536	49	36	47	37
	1680	6048	50	38	49	40
500 x 400	460	1656	45	24	37	27
	920	3312	46	29	42	32
	1380	4968	47	33	44	35
	1840	6624	47	35	46	37
600 x 400	510	1836	43	22	36	25
	1020	3672	44	27	40	30
	1530	5508	44	31	43	33
	2040	7344	45	33	45	36
500 x 500	600	2160	47	26	40	30
	1200	4320	48	31	45	35
	1800	6480	49	35	48	39
	2400	8640	49	37	50	41
600 x 500	640	2304	45	24	39	28
	1280	4608	46	29	43	33
	1920	6912	46	32	46	36
	2560	9216	46	35	48	39
600 x 600	840	3024	46	26	41	31
	1680	6048	47	30	46	36
	2520	9072	48	35	49	39
	3360	12096	48	37	51	42

① EN

② EN with secondary silencer TX

③ EN-D

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

Rectangular volume flow controllers for constant air volume systems in potentially explosive atmospheres, mechanical self-powered, without external power supply, suitable for supply or extract air, available in 19 nominal sizes. Ready-to-commission unit consists of the casing containing a damper blade with low-friction bearings, bellows, external cam plate with leaf spring, and parts for equipotential bonding and for protection in potentially explosive atmospheres. Volume flow controllers are factory set to a reference volume flow rate (customers can set the required volume flow rate on site). Both ends suitable for the connection of ducts. Casing air leakage to EN 1751, class C ( $B + H \leq 400$ , class B)

#### Special features

- ATEX mark and certification
- ATEX equipment group II, approved for zones 1, 2, 21 and 22
- Volume flow rate can be set using an external scale; no tools required
- High volume flow rate control accuracy
- Any installation orientation

#### Materials and surfaces

- Galvanised sheet steel construction
- Casing and damper blade made of galvanised sheet steel
  - Leaf spring made of stainless steel
  - Polyurethane bellows
  - Plain bearings with PTFE coating

#### Powder-coated construction (P1)

- Casing and damper blade made of galvanised sheet steel, 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 A2, 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/EC

#### Construction

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

#### Technical data

- Nominal sizes:  $200 \times 100$  to  $600 \times 600$
- Volume flow rate range: 40 to 3360 l/s or 144 to 12096 m<sup>3</sup>/h
- Volume flow rate control range: approx. 25 – 100 % of the nominal volume flow rate
- Minimum differential pressure: 50 Pa
- Maximum differential pressure: 1000 Pa

#### 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)]

EN-Ex

EN – Ex – D – P1 / 400×200			
1	2	3	4

1 Type  
EN-Ex Volume flow controller for potentially explosive atmospheres

3 Material  
No entry: galvanised sheet steel  
P1 Powder-coated (RAL 7001), silver grey

2 Acoustic cladding  
No entry: none  
D With acoustic cladding  
Order example: EN-Ex-D/200×100

4 Nominal size [mm]  
B × H

Acoustic cladding	With
Material	Galvanised sheet steel
Nominal size	200 × 100 mm

**EN-Ex**

- Volume flow controller for constant air volume

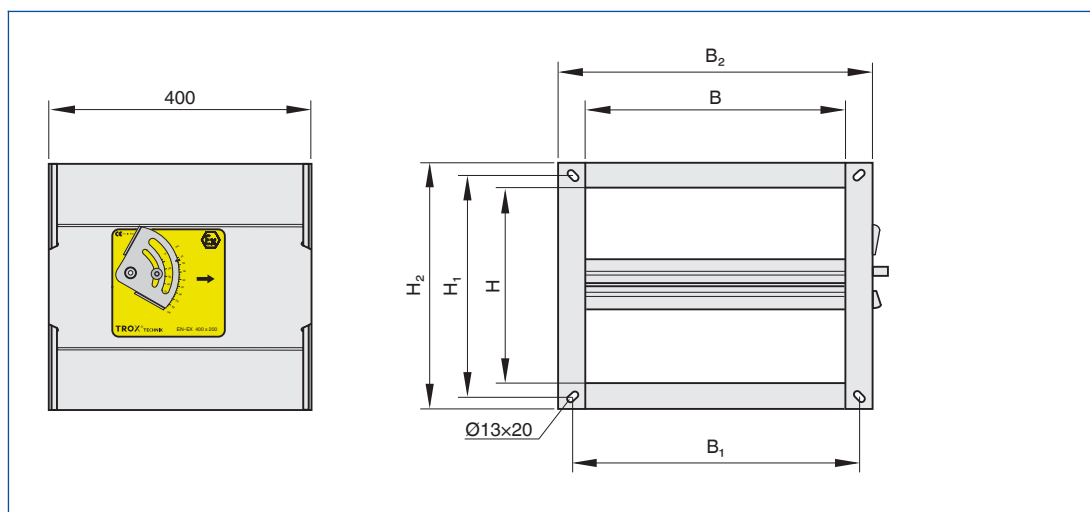
flow control

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**EN-Ex-D**

- Volume flow controller with acoustic cladding for constant air volume flow control
  - For rooms where the case-radiated noise of the unit is not sufficiently reduced by a false ceiling
- The rectangular 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

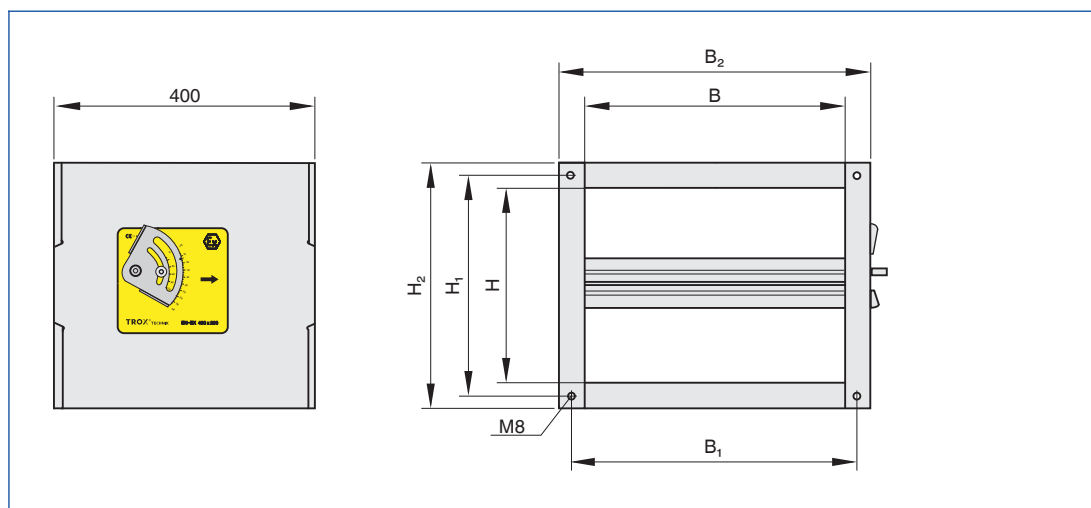
EN-Ex



EN-Ex

Nominal size	Nominal width	Nominal height	B <sub>1</sub>	B <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>	m
	mm	mm	mm	mm	mm	mm	kg
200 x 100	200	100	234	276	134	176	5
300 x 100	300	100	334	376	134	176	6
300 x 150	300	150	334	376	184	226	7
300 x 200	300	200	334	376	234	276	7
400 x 200	400	200	434	476	234	276	9
400 x 250	400	250	434	476	284	326	10
400 x 300	400	300	434	476	334	376	12
400 x 400	400	400	434	476	434	476	18
500 x 200	500	200	534	576	234	276	11
500 x 250	500	250	534	576	284	326	12
500 x 300	500	300	534	576	334	376	13
500 x 400	500	400	534	576	434	476	18
500 x 500	500	500	534	576	534	576	19
600 x 200	600	200	634	676	234	276	13
600 x 250	600	250	634	676	284	326	14
600 x 300	600	300	634	676	334	376	15
600 x 400	600	400	634	676	434	476	18
600 x 500	600	500	634	676	534	576	19
600 x 600	600	600	634	676	634	676	20

EN-Ex-D



EN-Ex-D

Nominal size	Nominal width	Nominal height	B <sub>1</sub>	B <sub>2</sub>	H <sub>1</sub>	H <sub>2</sub>	m
	mm	mm	mm	mm	mm	mm	kg
200 × 100	200	100	234	280	134	180	8
300 × 100	300	100	334	380	134	180	10
300 × 150	300	150	334	380	184	230	11
300 × 200	300	200	334	380	234	280	12
400 × 200	400	200	434	480	234	280	15
400 × 250	400	250	434	480	284	330	17
400 × 300	400	300	434	480	334	380	18
400 × 400	400	400	434	480	434	480	26
500 × 200	500	200	534	580	234	280	17
500 × 250	500	250	534	580	284	330	18
500 × 300	500	300	534	580	334	380	19
500 × 400	500	400	534	580	434	480	26
500 × 500	500	500	534	580	534	580	28
600 × 200	600	200	634	680	234	280	20
600 × 250	600	250	634	680	284	330	22
600 × 300	600	300	634	680	334	380	22
600 × 400	600	400	634	680	434	480	26
600 × 500	600	500	634	680	534	580	29
600 × 600	600	600	634	680	634	680	30

### Installation and commissioning

- Any installation orientation
- Connect the equipotential bonding to the ductwork
- Volume flow rate can be set using an external scale; no tools required
- No repeat measurements or adjustments by an air conditioning engineer are necessary
- EN-Ex-D: For constructions with acoustic cladding, ducts on the room side should have cladding up to the acoustic cladding of the controller

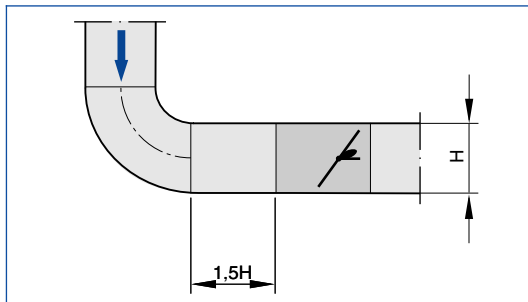
### Upstream conditions

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. Free air intake only with a straight duct section of 1D 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.

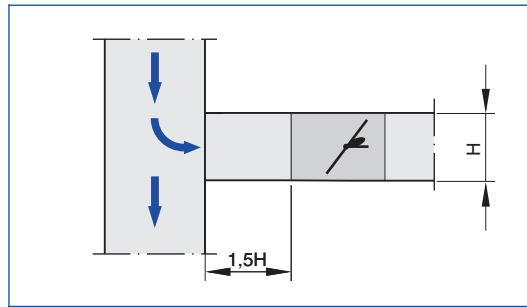
### Bend, vertical



The stated volume flow rate accuracy  $\Delta \dot{V}$  can only be achieved with a straight duct section of at least 1.5H upstream between any bend and the controller.

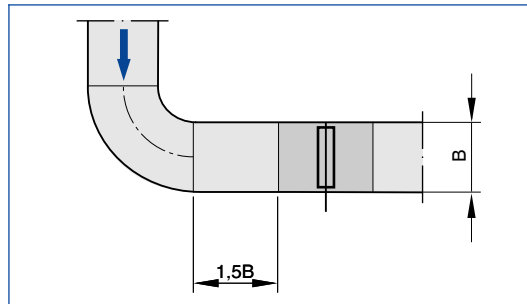


#### Junction, vertical



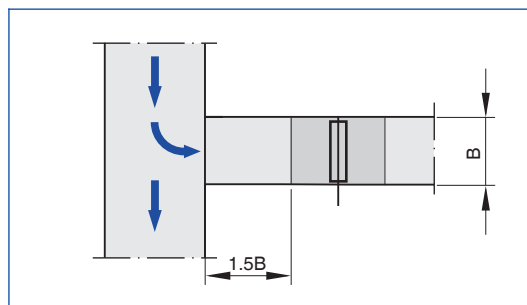
A junction causes strong turbulence. The stated volume flow rate accuracy  $\Delta\dot{V}$  can only be achieved with a straight duct section of at least 1.5H upstream. Shorter upstream sections require a perforated plate in the branch and before the CAV controller. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

#### Bend, horizontal



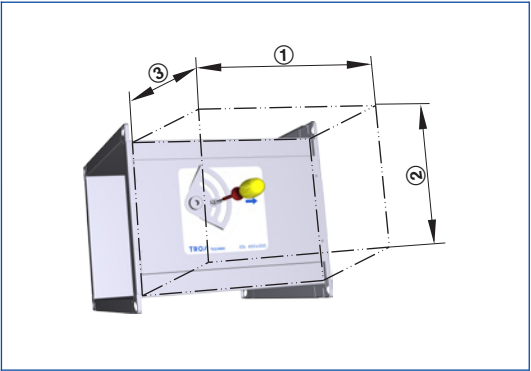
The stated volume flow rate accuracy  $\Delta\dot{V}$  can only be achieved with a straight duct section of at least 1.5B upstream between any bend and the controller.

#### Junction, horizontal



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 1.5B upstream. Shorter upstream sections require a perforated plate in the branch and before the CAV controller. If there is no straight upstream section at all, the control will not be stable, even with a perforated plate.

Access for commissioning and maintenance



Space required

Attachments	①	②	③
	mm		
Without actuator	200	H	200

H: Unit height

### Principal dimensions

#### $\varnothing D$ [mm]

Outside diameter of the spigot

#### $\varnothing D_1$ [mm]

Pitch circle diameter of flanges

#### $\varnothing D_2$ [mm]

Outside diameter of flanges

#### $\varnothing D_4$ [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 for manual adjustment

### 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)]

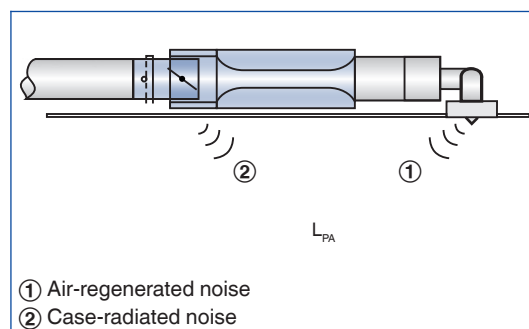
A-weighted sound pressure level of case-regenerated noise of the VAV terminal unit, system attenuation taken into account

#### $L_{PA3}$ [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  $\mu$ Pa.

### Definition of noise



### 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.
- Upper limit of the setting range and maximum

volume flow rate setpoint value for the CAV controller

$\dot{V}$  [m³/h] and [l/s]

Volume flow rate

$\Delta\dot{V}$  [± %]

Volume flow rate tolerance from setpoint value

### Differential pressure

$\Delta p_{st}$  [Pa]

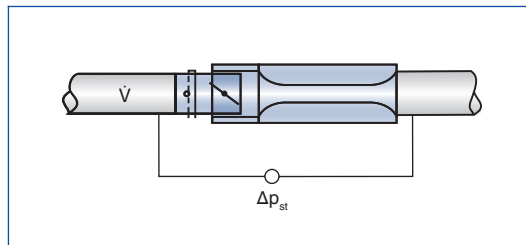
Static differential pressure

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

Static differential pressure, minimum

- The static minimum differential pressure is equal to the pressure loss of the CAV controller when the damper blade is open, caused by flow resistance (bellows, crossbar)
- If the pressure on the CAV controller is too low,

### Static differential pressure



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 controllers, and the measurement point or points for speed control must have been selected accordingly to achieve this

### 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 steel