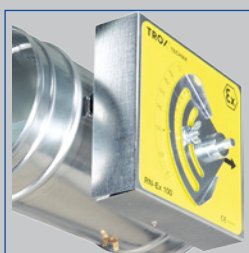


# CAV controllers

## Type RN-Ex



Adjustment scale



ATEX-Zertifizierung



Tested to VDI 6022

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

Circular, 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
- Volume flow rate can be set using an external scale, no tools required
- No on-site test measurements required for commissioning
- Suitable for airflow velocities of up to 12 m/s
- Any installation orientation
- 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 for the reduction of air-regenerated noise

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### Application

#### Application

- Circular EXCONTROL CAV controllers of Type RN-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
- Correct operation even under unfavourable upstream or downstream conditions (1.5 D straight section required upstream)

#### 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

- 80, 100, 125, 160, 200, 250, 315, 400

### Description

#### Variants

- RN-Ex: Volume flow controller
- RN-Ex-D: Volume flow controller with acoustic cladding
- Units with acoustic cladding and/or Type CA secondary silencers for demanding acoustic requirements
- Acoustic cladding cannot be retrofitted

#### Construction

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

#### 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 function testing of each unit on a special test rig prior to shipping

#### Accessories

- Lip seals on both ends (factory fitted)

#### Useful additions

- Secondary silencer Type CA

#### Construction features

- Circular casing
- Construction and materials comply with the EU directive for use in potentially explosive atmospheres (ATEX)
- Spigot suitable for circular ducts to EN 1506 or EN 13180
- Spigot with groove for lip seal (RN-P1/80 without groove)

#### Materials and surfaces

##### Galvanised sheet steel construction

- Casing made of galvanised sheet steel
- Interior parts, nominal sizes 80 – 125: stainless steel 1.4301, nominal sizes 160 – 400: galvanised sheet steel
- Polyurethane bellows
- Plain bearings with PTFE coating
- Leaf spring made of stainless steel

##### Powder-coated construction (P1)

- Casing made of galvanised sheet steel, powder-coated
- Interior parts, nominal sizes 80 – 125: stainless steel 1.4301, nominal sizes 160 – 400: galvanised sheet steel, powder-coated

##### Stainless steel construction (A2)

- Casing made of stainless steel 1.4301
- Interior parts made of stainless steel

##### 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/EC

#### Standards and guidelines

- Directive 94/9/EC: Equipment and protective systems intended for use in potentially explosive atmospheres
- Hygiene conforms to VDI 6022
- Casing air leakage to EN 1751, class C

#### Maintenance

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

### Functional description

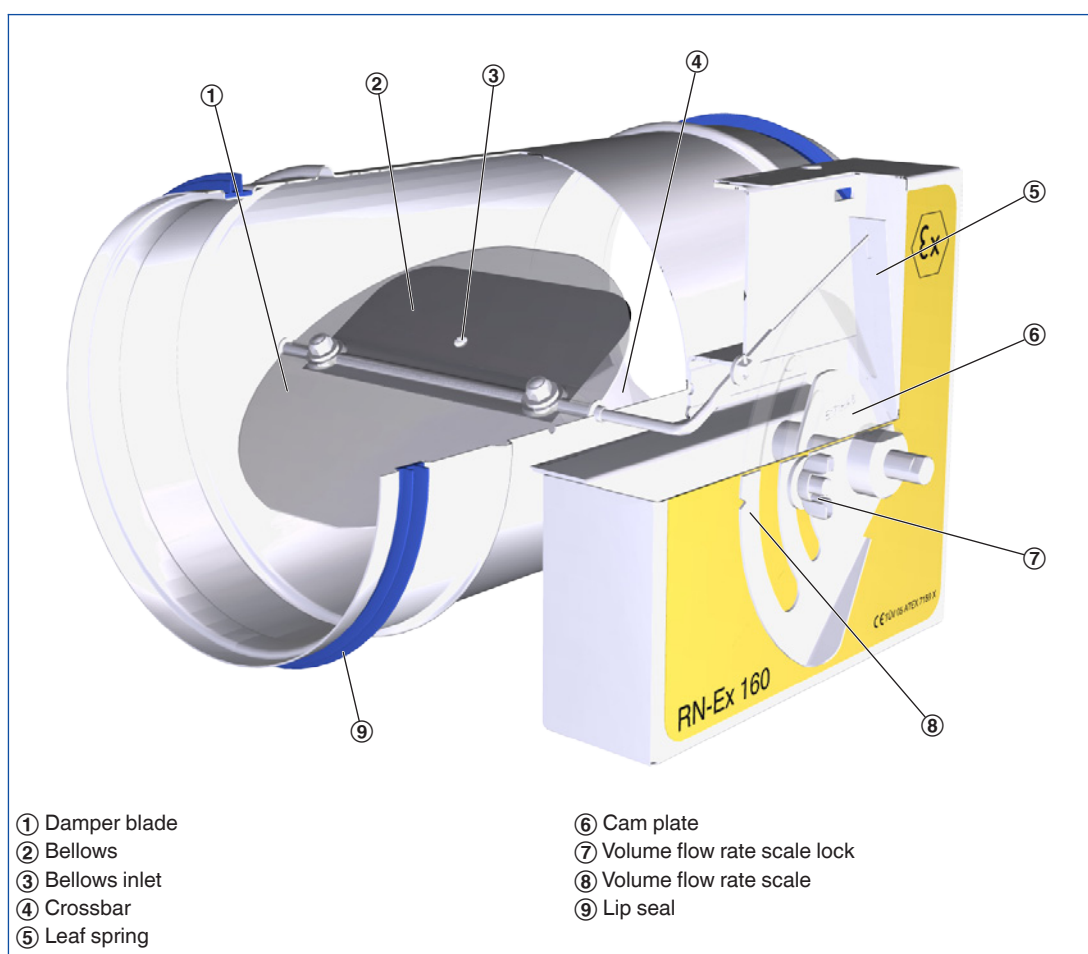
The volume flow controller is a mechanical self-powered unit and works without external power supply. A damper blade with low-friction bearings is adjusted by aerodynamic forces such that the set volume flow rate is maintained within the differential pressure range.

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 RN-Ex



Nominal sizes	80 – 400 mm
Volume flow rate range	11 – 1400 l/s or 40 – 5040 m³/h
Volume flow rate control range	Approx. 25 to 100 % of the nominal volume flow rate
Scale accuracy	± 4 %
Minimum differential pressure	50 Pa (nominal size 80: 100 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.

#### RN-Ex, Volume flow rate ranges and minimum differential pressures

Nominal size	V̇		①	②	③	④	ΔV̇
			Δp <sub>st min</sub>				
	l/s	m³/h	Pa	Pa	Pa	Pa	± %
80	11	40	100	105	105	105	20
	20	72	100	105	105	105	15
	40	144	100	110	115	120	10
	45	162	100	110	120	125	8
100	22	79	50	55	55	55	10
	40	144	50	55	55	60	8
	70	252	50	60	65	70	6
	90	324	50	60	70	80	5
125	35	126	50	55	55	55	10
	60	216	50	55	55	55	8
	115	414	50	60	65	70	6
	140	504	50	60	70	80	5
160	60	216	50	55	55	55	10
	105	378	50	55	55	55	8
	190	684	50	55	60	60	6
	240	864	50	55	65	70	5
200	90	324	50	55	55	55	10
	160	576	50	55	55	55	8
	300	1080	50	55	60	65	6
	360	1296	50	55	60	65	5
250	145	522	50	55	55	55	10
	255	918	50	55	55	55	8
	470	1692	50	55	60	60	6
	580	2088	50	55	60	65	5
315	230	828	50	55	55	55	10
	400	1440	50	55	55	55	8
	750	2700	50	55	60	60	6
	920	3312	50	55	60	65	5
400	350	1260	50	55	55	55	10
	610	2196	50	55	55	55	8
	1130	4068	50	55	55	55	6
	1400	5040	50	55	55	60	5

① RN-Ex

② RN-Ex with secondary silencer CS/CF, insulation thickness 50 mm, length 500 mm

③ RN-Ex with secondary silencer CS/CF, insulation thickness 50 mm, length 1000 mm

④ RN-Ex 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.

#### RN-Ex, Sound pressure level at differential pressure 150 Pa

Nominal size	Ṽ	Ṽ	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	m³/h	dB(A)					
80	11	40	37	24	17	15	22	<15
	20	72	39	27	19	17	24	<15
	40	144	47	34	24	22	31	<15
	45	162	48	35	25	24	32	<15
100	22	79	37	24	17	15	22	<15
	40	144	40	47	22	20	21	<15
	70	252	47	47	27	26	29	<15
	90	324	50	50	30	29	33	<15
125	35	126	37	27	21	18	15	<15
	60	216	43	34	27	25	19	<15
	115	414	50	41	35	33	27	<15
	140	504	52	44	39	37	30	<15
160	60	216	40	32	26	24	29	<15
	105	378	45	37	32	29	33	<15
	190	684	49	41	35	33	39	<15
	240	864	50	41	36	34	41	16
200	90	324	40	31	24	22	28	<15
	160	576	43	35	28	26	32	<15
	300	1080	48	40	33	32	40	17
	360	1296	49	41	35	33	42	20
250	145	522	41	32	24	22	29	15
	255	918	42	34	28	26	33	<15
	470	1692	46	39	33	31	40	19
	580	2088	48	41	35	34	43	22
315	230	828	39	33	26	23	30	<15
	400	1440	42	35	29	27	35	<15
	750	2700	44	38	32	31	40	19
	920	3312	46	41	35	34	43	23
400	350	1260	46	39	33	29	45	<15
	610	2196	48	42	36	32	49	18
	1130	4068	50	44	38	35	54	24
	1400	5040	51	45	40	37	56	27

① RN-Ex

② RN-Ex with secondary silencer CS/CF, insulation thickness 50 mm, length 500 mm

③ RN-Ex with secondary silencer CS/CF, insulation thickness 50 mm, length 1000 mm

④ RN-Ex with secondary silencer CS/CF, insulation thickness 50 mm, length 1500 mm

⑤ RN-Ex-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 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 8 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). Spigot with groove for lip seal, suitable for connecting ducts according to EN 1506 or EN 13180. Casing air leakage to EN 1751, class C.

#### 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
- Correct operation even under unfavourable upstream or downstream conditions (1.5 D straight section required upstream)

#### Materials and surfaces

- Galvanised sheet steel construction
- Casing made of galvanised sheet steel
  - Interior parts, nominal sizes 80 – 125: stainless steel 1.4301, nominal sizes 160 – 400: galvanised sheet steel
  - Polyurethane bellows
  - Plain bearings with PTFE coating
  - Leaf spring made of stainless steel

#### Powder-coated construction (P1)

- Casing made of galvanised sheet steel, powder-coated
- Interior parts, nominal sizes 80 – 125: stainless steel 1.4301, nominal sizes 160 – 400: galvanised sheet steel, powder-coated

#### Stainless steel construction (A2)

- Casing made of stainless steel 1.4301
- Interior parts made of stainless steel

#### 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/EC

#### Construction

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

#### Technical data

- Nominal sizes: 80 to 400 mm
- Volume flow rate range: 11 to 1400 l/s or 40 to 5040 m<sup>3</sup>/h
- Volume flow rate control range: approx. 25 – 100 % of the nominal volume flow rate
- Minimum differential pressure: 50 Pa (nominal size 80: 100 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)]

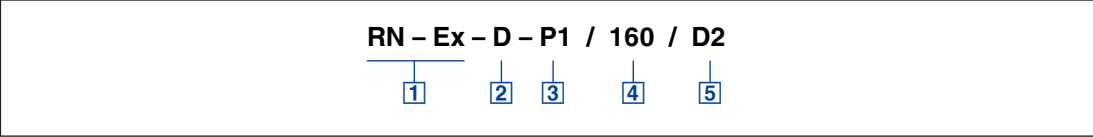
#### Case-radiated noise

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

Notes on the order code

- RN-EX/80: no flange (FL), no matching flange (G2)
- RN-EX-A2/80: no lip seal (D2)

RN-Ex





### **RN-Ex**

- Volume flow controller for constant air volume

flow control

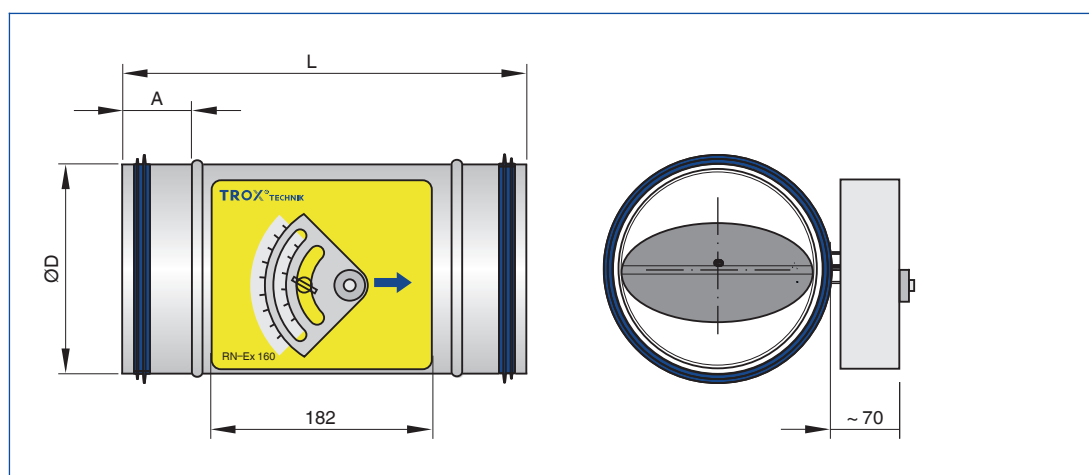
- Spigot to make connections to the ducting
- 

### **RN-Ex-D**

- Volume flow controller with acoustic cladding for constant air volume flow control
- Spigot to make 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

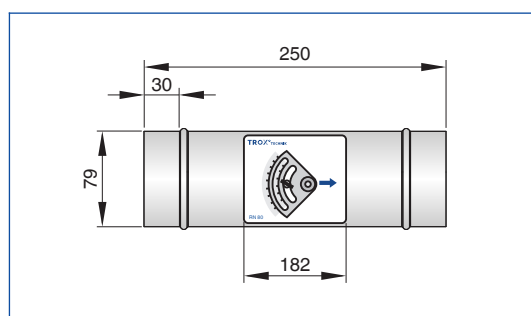
RN-Ex



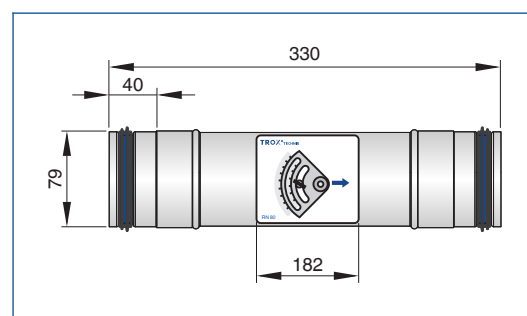
RN-Ex

Nominal size	ØD mm	L mm	A mm	m kg
80	79	310	50	1.4
100	99	310	50	1.8
125	124	310	50	2.0
160	159	310	50	2.5
200	199	310	50	3.0
250	249	400	50	3.5
315	314	400	50	4.8
400	399	400	50	5.7

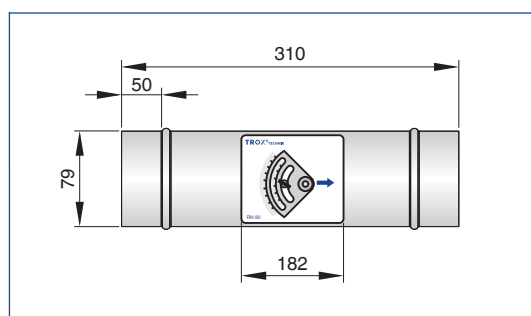
RN-Ex-P1/80



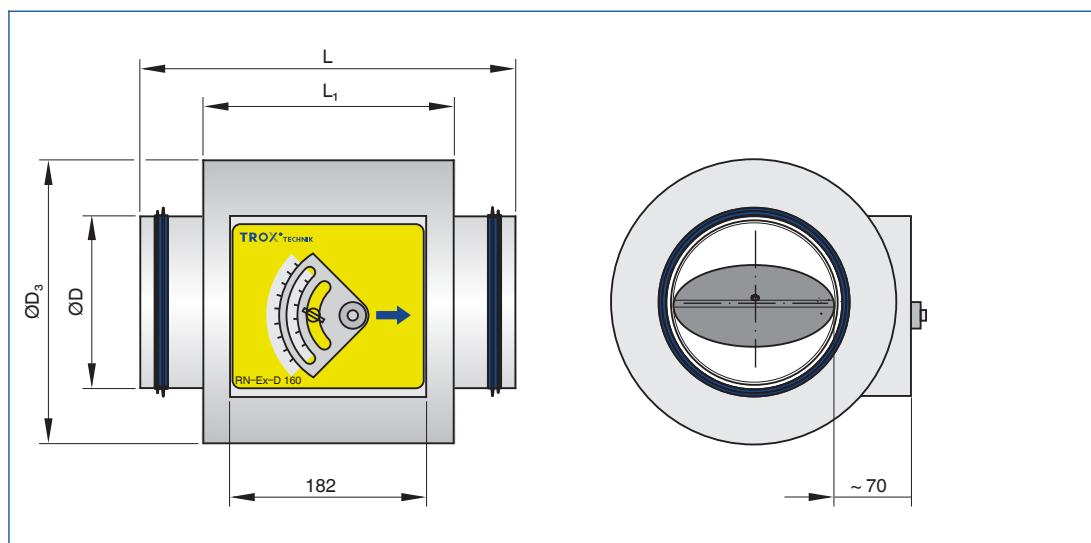
RN-Ex-P1/80/D2



RN-Ex-A2/80



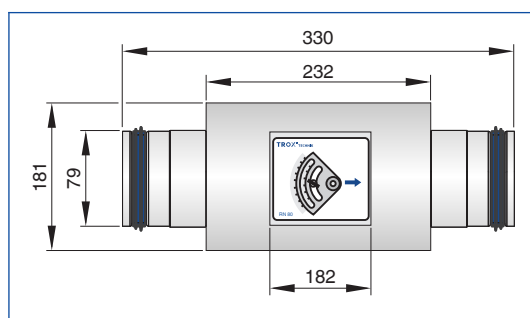
**RN-Ex-DRN-Ex-D**



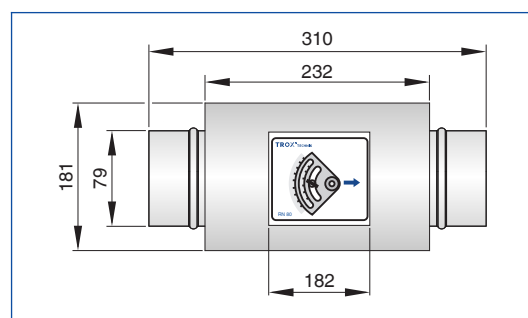
**RN-Ex-D**

Nominal size	ØD mm	L mm	ØD <sub>3</sub> mm	L <sub>1</sub> mm	m kg
80	79	310	181	232	2.2
100	99	310	200	232	3.6
125	124	310	220	232	4.0
160	159	310	262	232	5.0
200	199	310	300	232	6.0
250	249	400	356	312	7.3
315	314	400	418	312	9.8
400	399	400	500	312	11.8

**RN-Ex-D-P1/80/D2**



**RN-Ex-D-A2/80**



### Installation and commissioning

- Connections for equipotential bonding: Suitable cables must be connected by others
- Any installation orientation
- 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
- RN-Ex-D: For constructions with acoustic cladding, ducts on the room side should have cladding up to the acoustic cladding of the controller

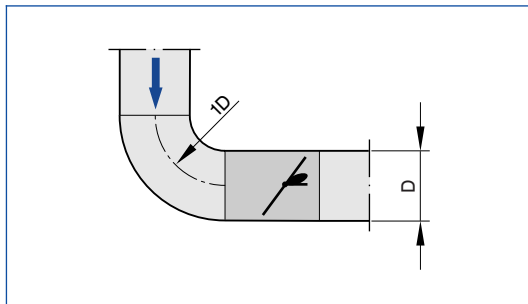
### Upstream conditions

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

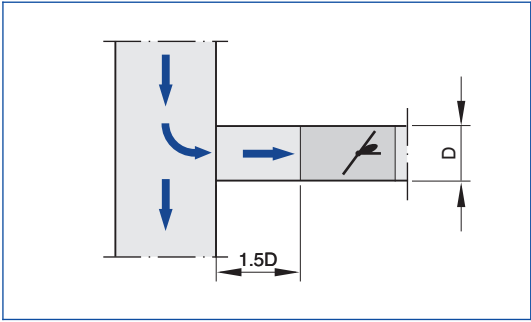
Sufficient space must be kept clear near any attachments to allow for commissioning and maintenance. It may be necessary to provide sufficiently sized inspection access openings.

### Bend



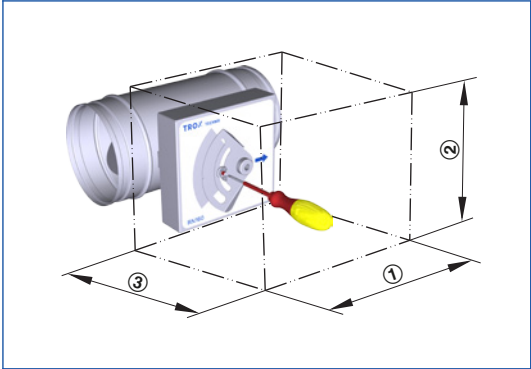
A bend with a curvature radius of at least 1D – without an additional straight duct section upstream of the CAV controller – has only a negligible effect on the volume flow rate accuracy.

**Junction**



A junction causes strong turbulence. The stated volume flow rate accuracy  $\Delta V$  can only be achieved with a straight duct section of at least 1.5D 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	200	200

### 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)]

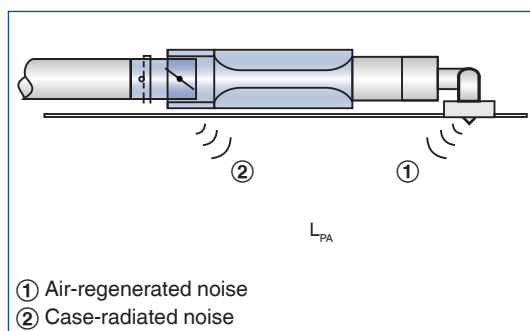
A-weighted sound pressure level of case-regenerated noise of the VAV terminal unit, system attenuation taken into account

#### $L_{PA3}$ [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]

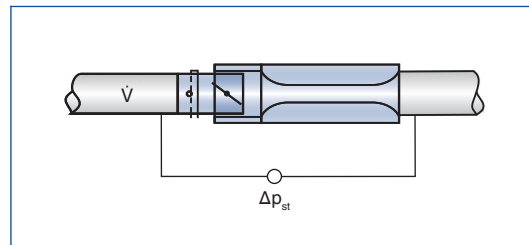
Static differential pressure, minimum

- 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,

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

### 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 steel