Constant Volume Flow Control
CAV Controllers
Type VFC

Variant with rotary knob

Actuator with mechanical stops

Actuator with potentiometers

Tested to VDI 6022

For low airflow velocities

Circular mechanical self-powered volume flow controllers for the control of supply air or extract air in constant air volume systems with low airflow velocities

- Suitable for airflow velocities from 0.8 m/s (157 FPM)
- Very simple commissioning
- Volume flow rate can be set using a rotary knob and a scale on the outside of the casing
- Simple retrofit of an actuator for variable volume flows
- Any installation orientation; maintenance-free
- Casing air leakage to EN 1751, class

C Optional equipment and accessories

- Circular silencer CA (for Germany and Switzerland), CAH (for EMEA) or CF for the reduction of air-regenerated noise
- Hot water heat exchanger WL and electric air heater EL for reheating the airflow
- Actuator for variable volume flows or for q_{vmin}-q_{vmax}switching

TROX® TECHNIK

The art of handling air

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General information

Application
- Circular CAV controllers of Type VFC for the precise supply air or extract air flow control in constant air volume systems
- Mechanical self-powered volume flow control without external power supply
- For low airflow velocities
- Simplified project handling with orders based on nominal size

Special features
- The volume flow rate can be set using an external scale; no tools required
- Simple retrofitting of an actuator
- Correct operation even under unfavourable upstream or downstream conditions (1.5 D straight section required upstream)
- Any installation orientation
- Aerodynamic functional testing of each unit on a special test rig before shipping

Nominal sizes
- 80, 100, 125, 160, 200, 250 mm (3, 4, 5, 6, 6.5, 8, 10 in)

Parts and characteristics
- Ready-to-commission controller
- Damper blade with low-friction bearings
- Bellows that acts as an oscillation damper
- Leaf spring
- Rotary knob with pointer for setting the volume flow rate
- Lip seal

Attachments
- Min/Max actuators: Actuators for switching between minimum and maximum volume flow rate setpoint values
- Modulating actuators: Actuators for varying volume flow rates

Useful additions
- Circular silencers CA (for Germany and Switzerland) and CAH (for EMEA)
- Heat exchanger WL
- Electric air heater EL
- Useful additions have to be ordered separately

Construction features
- Circular casing
- Spigot with lip seal, for circular connecting ducts to EN 1506 or EN 13180
- Damper blade with low-friction bearings and special bellows

Materials and surfaces
- Casing made of galvanised sheet steel
- Damper blade and other parts made of high-quality plastic, to UL 94, V1; to DIN 4102, fire rating class B2
- Leaf spring made of stainless steel
- Polyurethane bellows

Standards and guidelines
- Meets the hygiene requirements of VDI 6022
- Casing air leakage to EN 1751, class C

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

Function

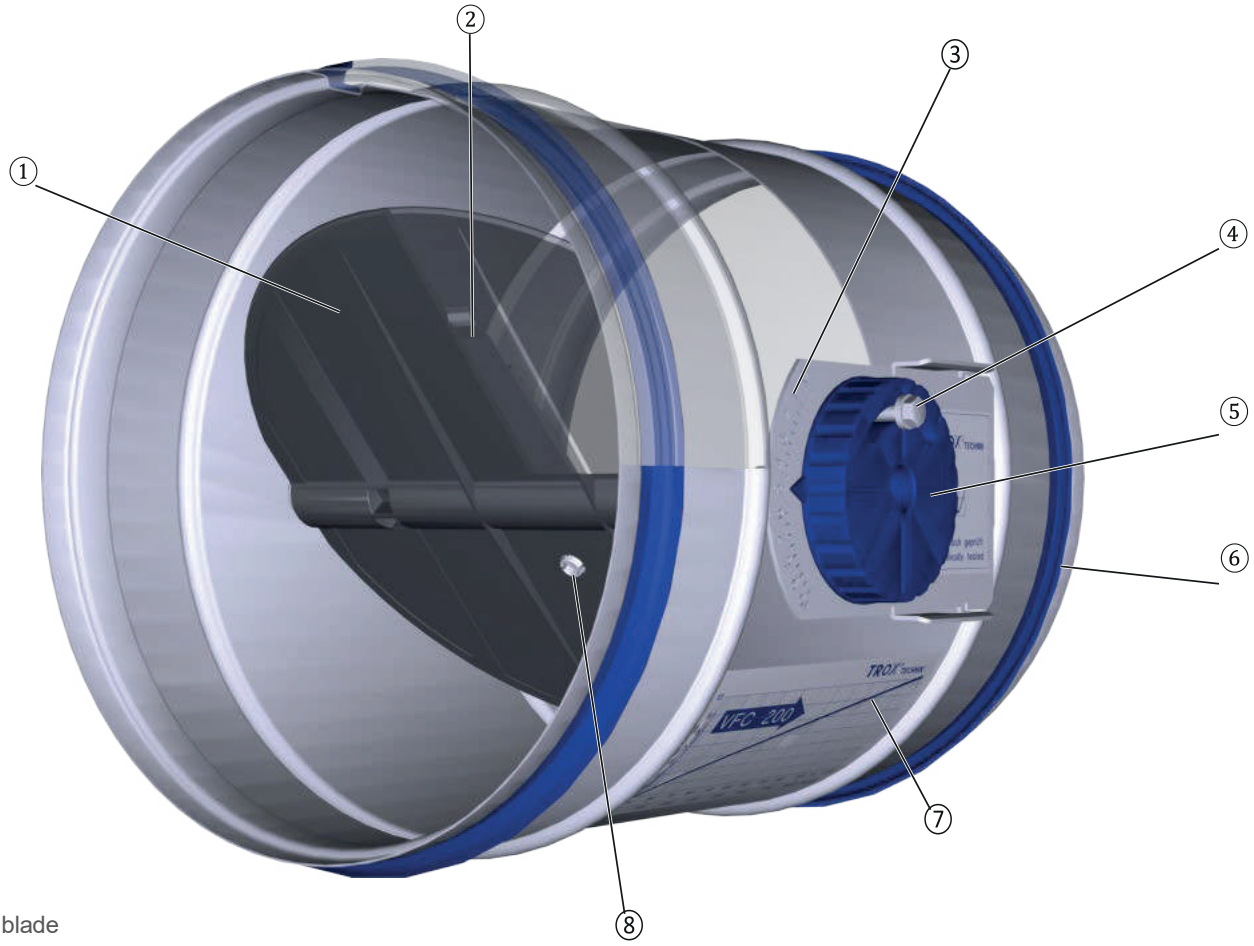
Functional description

The volume flow controllers work without an external power supply.
A damper blade with low-friction bearings is adjusted by aerodynamic forces such that a 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. As the differential pressure changes, the leaf spring adjusts the position of the damper blade such 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 VFC



① Damper blade
② Leaf spring
③ Volume flow rate scale
④ Rotary knob locking screw
⑤ Rotary knob
⑥ Lip seal
⑦ Diagram with setting values
⑧ Bellows inlet

Technical data

Nominal sizes	80 – 250 mm (3, 4, 5, 6, 6.5, 8, 10 in)
Volume flow rate range	6 – 370 l/s or 22 – 1332 m³/h (13 - 784 CFM)
Volume flow rate control range	Approx. 10 – 100 % of the nominal volume flow rate
Volume flow rate accuracy	Approx. ± 10 % of the nominal volume flow rate
Minimum differential pressure	30 Pa (0,12 in w.g.)
Maximum differential pressure	500 Pa (2,01 in w.g.)
Operating temperature	10 to 50 °C (50 – 122 °F)

Quick sizing

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 $q_{v_{min}}$ and $q_{v_{max}}$. 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.

VFC, sound pressure level at differential pressure 50 Pa

Nom. size		qv [l/s]	qv [m³/h]	qv [m³/h]	Air-regenerated noise				Case-radiated noise
					①	②	③	④	①
[mm]	[in]				L_{PA} [dB(A)]	L_{PA1} [dB(A)]			L_{PA2} [dB(A)]
80	3	6	22	13	25	<15	<15	<15	<15
80	3	10	36	21	28	16	<15	<15	<15
80	3	20	72	42	33	21	<15	<15	<15
80	3	42	151	89	39	27	18	16	17
100	4	6	22	13	29	15	<15	<15	<15
100	4	15	54	32	33	20	<15	<15	15
100	4	30	108	64	37	26	18	17	18
100	4	65	234	138	41	33	26	25	21
125	5	10	36	21	22	<15	<15	<15	<15
125	5	20	72	42	27	16	<15	<15	<15
125	5	45	162	95	34	25	18	16	<15
125	5	100	360	212	41	34	29	27	16
160	6 ½	18	65	38	25	16	<15	<15	<15
160	6 ½	45	162	95	32	24	18	16	18
160	6 ½	85	306	180	36	29	24	22	22
160	6 ½	185	666	392	41	35	30	28	27
200	8	25	90	53	27	16	<15	<15	<15
200	8	60	216	127	31	22	16	<15	18
200	8	120	432	254	35	27	21	19	22
200	8	250	900	530	37	30	25	24	26
250	10	37	133	78	31	21	<15	<15	18
250	10	100	360	212	35	25	18	16	22
250	10	185	666	392	36	28	21	19	25
250	10	370	1332	784	37	29	23	22	29

① VFC without silencer
② VFC with circular silencer CF, insulation thickness 50 mm (2 in), length 500 mm (20 in)
③ VFC with circular silencer CF, insulation thickness 50 mm (2 in), length 1000 mm (40 in)
④ VFC with circular silencer CF, insulation thickness 50 mm (2 in), length 1500 mm (60 in)

Specification text

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

Circular volume flow controllers for constant and variable air volume systems with low airflow velocities, mechanical self-powered, without external power supply, suitable for supply or extract air, available in 6 nominal sizes.
Ready-to-commission unit consists of the casing containing a damper blade with low-friction bearings, bellows, leaf spring, and a rotary knob to set the volume flow rate setpoint.
Differential pressure: 30 – 500 Pa (0,12 – 2,01 in w.g.)
Volume flow rate: max. 10 : 1
Spigot with lip seal, for circular connecting ducts to EN 1506 or EN 13180.
Casing air leakage to EN 1751, class C.

Special features

- The volume flow rate can be set using an external scale; no tools required
- Simple retrofitting of an actuator
- Correct operation even under unfavourable upstream or downstream conditions (1.5 D straight section required upstream)
- Any installation orientation
- Aerodynamic functional testing of each unit on a special test rig before shipping

Materials and surfaces

- Casing made of galvanized sheet steel
- Damper blade and other parts made of high-quality plastic, to UL 94, V1; to DIN 4102, fire rating class B2
- Leaf spring made of stainless steel
- Polyurethane bellows

Technical data

- Nominal sizes: 80 to 250 mm
- Volume flow rate range: 6 – 370 l/s or 22 – 1332 m³/h (13 - 784 CFM)
- Volume flow rate control range: approx. 10 – 100 % of the nominal volume flow rate
- Volume flow rate accuracy: approx. ± 10 % of the nominal volume flow rate
- Minimum differential pressure: 30 Pa (0,12 in w.g.)
- Maximum differential pressure: 500 Pa (2,01 in w.g.)

Sizing data

- qv [m³/h]; [CFM]
- Δp_{st} [Pa]; [in w.g.]

Air-regenerated noise

- L_{PA} [dB(A)]

Case-radiated noise

- L_{PA} [dB(A)]

Order code

VFC / 100 / E03
1 2 3

1 Type
VFC Volume flow controller

2 Nominal size [mm] [in]
80, 100, 125, 160, 200, 250
3”, 4”, 5”, 6”, 6.5”, 8”, 10”

3 Actuator
No entry: manual adjustment
E01 24 V AC/DC, 3-point (min/max), potentiometer
E03 24 V AC/DC, modulating 0 – 10 V DC, potentiometer
M01 24 V AC/DC, 3-point (min/max), mechanical stops

Order example: VFC/100/E03

Type	VFC
Nominal size [mm];[in]	100 mm (4 in)
Actuator	24 V AC/DC, modulating 0 – 10 V DC, potentiometer

Variants

CAV controller variant VFC, with rotary knob

CAV controller variant VFC/.../E0*, with actuator (potentiometer)

CAV conotroller variant VFC/.../M0* with actuator (mechanical stops)

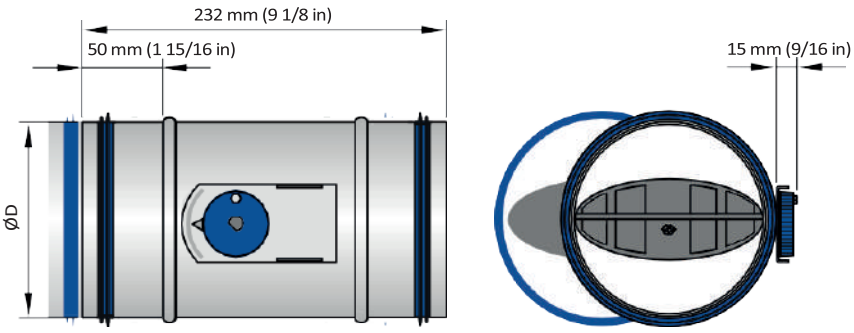
Attachments

VFC, actuators

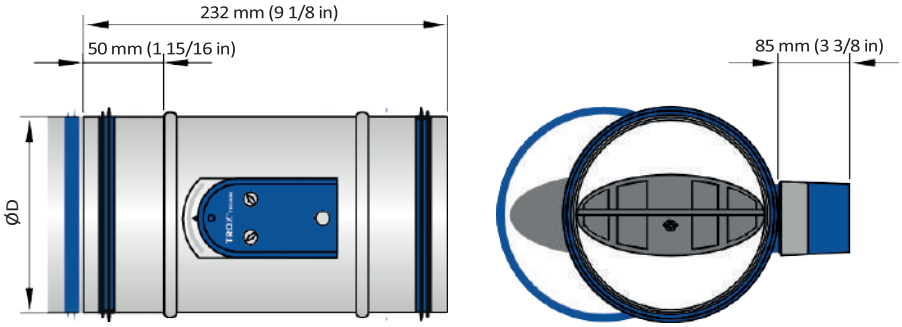
Order code detail	Actuator	Supply voltage
Min/Max actuators		
E01	Actuator with potentiometers, TROX/ Gruner	24 V AC/DC
E02	Actuator with potentiometers, TROX/ Gruner	230 V AC
M01	Actuator with mechanical stops, TROX/ Belimo	24 V AC/DC
M02	Actuator with mechanical stops, TROX/ Belimo	230 V AC
Modulating actuators		
E03	Actuator with potentiometers, TROX/ Gruner	24 V AC/DC

Dimensions and weight

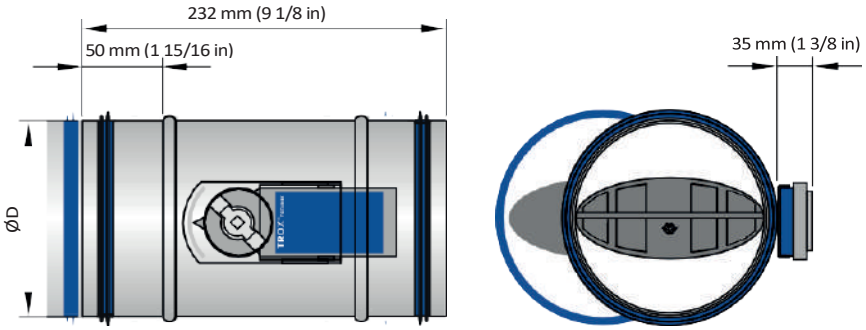
VFC



VFC/.../E0*



VFC/.../M0*



Dimensions and weight

VFC

NS		VFC		VFC/.../E0*		VFC/.../M0*		ØD	
[mm]	[in]	m [kg]	m [lb]	m [kg]	m [lb]	m [kg]	m [lb]	[mm]	[in]
80	3	0,5	1,1	0,8	1,8	0,7	1,5	79	3 1/8
100	4	0,6	1,3	0,9	2,0	0,8	1,8	99	3 7/8
125	5	0,7	1,5	1	2,2	0,9	2,0	124	4 7/8
160	6 1/2	0,8	1,8	1,1	2,4	1	2,2	159	6 1/4
200	8	1	2,2	1,3	2,9	1,2	2,6	199	7 13/16
250	10	1,3	2,9	1,6	3,5	1,5	3,3	249	9 13/16

Product details

VFC system

① CAV controller with rotary knob
② Actuator E0* with potentiometers
③ Actuator M0* with mechanical stops

Installation details

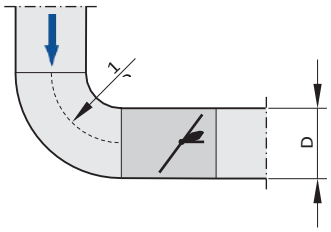
Installation and commissioning

- Any installation orientation
- Take the adjustment value from the characteristic on the sticker (on each volume flow controller)
- Volume flow rate setpoint can be set on external scale

Upstream conditions

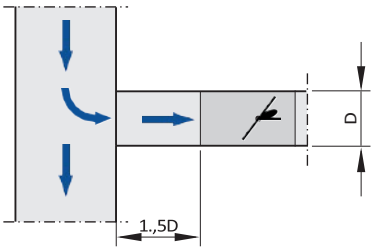
The volume flow rate accuracy ΔV applies to a straight upstream section of the duct. Bends, junctions or a narrowing or widening of the duct cause turbulence that may affect measurement. Duct connections, e.g. branches off the main duct, must comply with EN 1505. Some installation situations require straight duct sections upstream. Free air intake only with a straight duct section of 1D upstream.

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

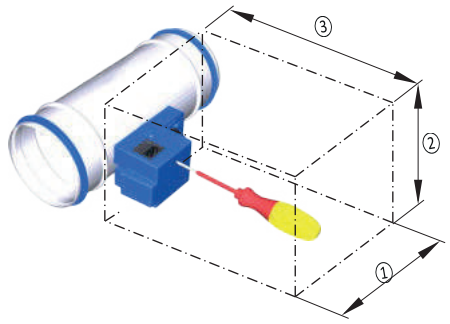


A junction causes strong turbulence. The stated volume flow – rate accuracy ΔV can only be achieved with a straight duct section of at least 1.5D upstream. Shorter upstream sections require a perforated plate in the branch and before the CAV controller. If there is no straight upstream section at all,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

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.

Access to attachments, mounted on one side



Schematic illustration of required installation space

Space required

Attachments	①		②		③	
	[mm]	[in]	[mm]	[in]	[mm]	[in]
Without actuator	200	7 7/8	200	7 7/8	200	7 7/8
With actuator E0*	200	7 7/8	200	7 7/8	300	11 3/4
With actuator M0*	200	7 7/8	200	7 7/8	230	9

Nomenclature

ØD [mm]; [in]
Outer diameter of the spigot

L [mm]; [in]
Length of unit including connecting spigot

L_1 [mm]; [in]
Length of casing or acoustic cladding

m [kg]; [lb]
Weight

f_m [Hz]
Octave band centre frequency

L_{PA} [dB(A)]
A-weighted sound pressure level of air-regenerated noise of the CAV controller, system attenuation taken into account

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

L_{PA2} [dB(A)]

A-weighted sound pressure level of case-regenerated noise of the CAV controller, system attenuation taken into account

q_{vNenn} [m³/h]; [l/s]; [CFM]
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

q_v [m³/h]; [l/s]; [CFM]
Volume flow rate

Δq_v [± %]
Volume flow rate accuracy in relation to the setpoint (tolerance)

Δp_{st} [Pa]; [in w.g.]
Static differential pressure

$\Delta p_{st\ min}$ [Pa]; [in w.g.]
Static minimum differential pressure: The static minimum differential pressure is equal to the pressure loss of the terminal unit when the damper blade is open, caused by flow resistance (damper blade).

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 differential 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.

Galvanized 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