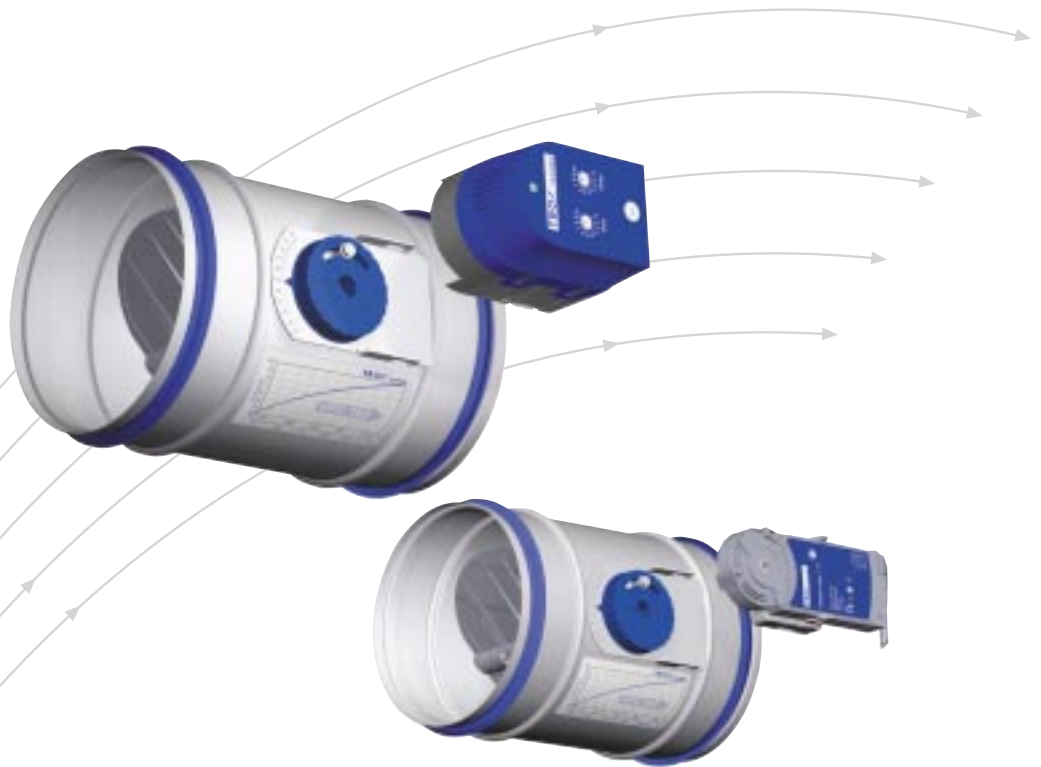


Volume Flow Controller

Type VFC
for low velocity systems



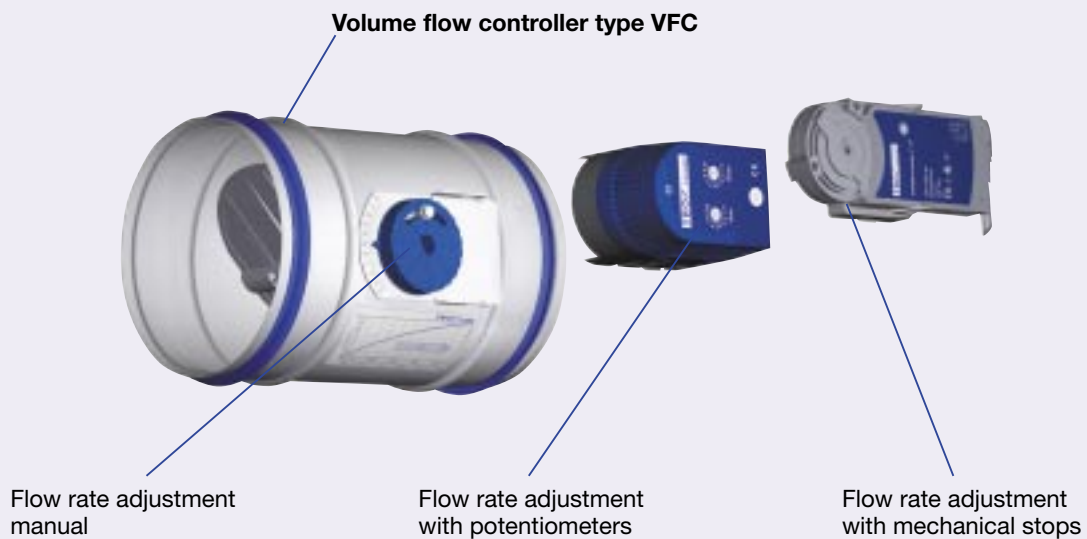
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Type VFC – The System



TROX type VFC Volume Flow Controller – the innovative solution

- Selection according to nominal size of the duct system
- Flow rate adjustment without special tools
- For low velocity systems
- Suitable for constant and variable volume flow systems and for $\dot{V}_{\min}/\dot{V}_{\max}$ changeover
- Lip seal included
- Retrofit of actuator easily possible

Functional Description

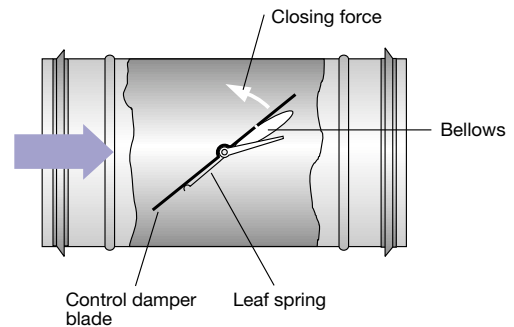
TROX type VFC volume flow controllers are mechanical system-powered controllers and were developed for the control of flow rates in constant and variable volume systems with low velocities. The controllers are suited for both supply and extract air use. Each controller has been subjected to an aerodynamic function test. The required flow rate can be easily set using a scale.

There are 3 configurations of controllers:

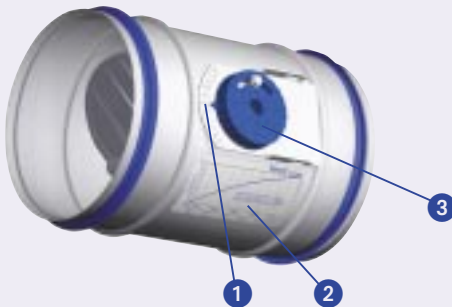
- Constant flow rate
- Variable flow rate, with potentiometers
- Variable flow rate, with mechanical stops

The controller operates without external power supply. A control damper blade mounted in bearings is adjusted by the aerodynamic forces such that the preset flow rate is held constant over the entire differential pressure range. Aerodynamic forces from air flow create a closing force on the damper blade. Self-inflating bellows amplify this force, acting simultaneously as an oscillation damper. This closing force is counteracted by a leaf spring. The result is that as the pressure differential changes, the damper blade adjusts to keep a constant flow rate within close tolerances.

On the internet there is an on-line programme “Air terminal units” for the design and selection of our units.

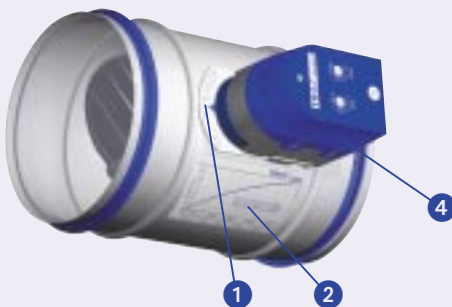


VFC, Constant flow rate



- For constant flow rate
- Flow rate adjustment with hand wheel

VFC, Variable flow rate, actuator with potentiometers



- For variable flow rates or $\dot{V}_{min}/\dot{V}_{max}$ changeover
- Flow rate adjustment with potentiometers
- Actuator height 85 mm

VFC, Variable flow rate, actuator with mechanical stops



- For variable flow rates or $\dot{V}_{min}/\dot{V}_{max}$ changeover
- Flow rate adjustment with mechanical stops
- Compact installation height of actuator 35 mm

- | | |
|----------------------------------|--|
| 1 Flow rate scale | 4 Actuator, flow rate adjustment with potentiometers |
| 2 Flow rate characteristic curve | 5 Actuator, flow rate adjustment with mechanical stops |
| 3 Hand wheel | |

Construction · Dimensions

Characteristics

- Mechanical system-powered, without external power supply
- Suitable for supply or extract air
- Volume flow range maximum 10 : 1
- Tolerances on flow rate approx. $\pm 10\%$ relative to \dot{V}_{nom}
- Flow rate adjustment using pointer on external scale
- Differential pressure range 30 to 500 Pa
- Correct operation even under unfavourable upstream and downstream conditions (straight length required upstream 1D)
- Independent of orientation
- The damper blade mechanisms maintenance free
- Operating temperature range 10 to 50 °C

Constructional features

- Circular spigot on both ends with lip seal, suitable for circular connecting ducts to DIN EN 1506 or DIN EN 13180
- Damper blade shaft supported in bearings
- Casing air leakage complies with DIN EN 1751, class A
- Casing made of galvanized sheet steel
- Stainless steel leaf spring

- Polyurethane bellows
- Plastic damper blade

Actuators

- For setpoint readjustment or for variable volume flow
- 24 V or 230 VAC power
- Potentiometers or mechanical stops
- Factory fitted, retrofit of actuator easily possible

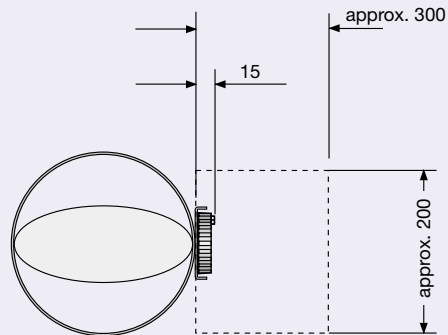
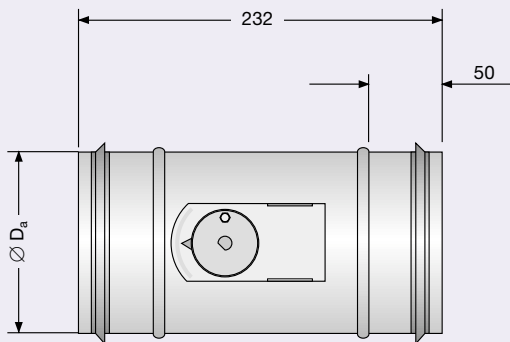
Secondary silencer

- Suitable for VFC
- Rigid circular silencer type CS
- Flexible circular silencer type CF
- See leaflet 6/5/EN/... for dimensions and technical data

Air heater

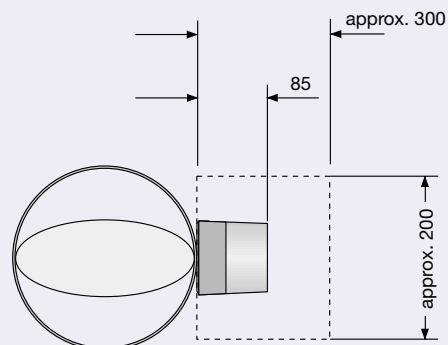
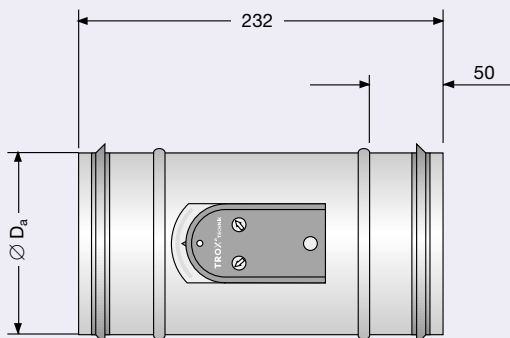
- Suitable for VFC
- See leaflet 5/20/EN/... for dimensions and technical data

Manual flow rate adjustment



--- Keep clear to provide access for setting

Actuator flow rate adjustment, \dot{V}_{min} and \dot{V}_{max} setting with potentiometers



--- Keep clear to provide access to the actuator

Nomenclature · Construction · Dimensions

Nomenclature

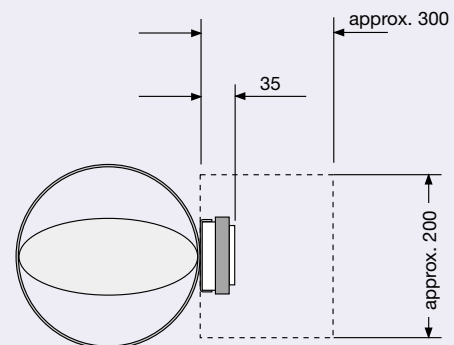
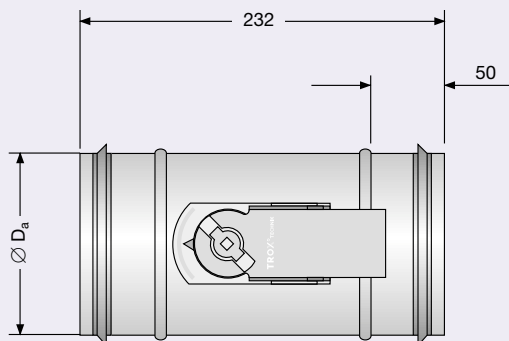
f_m	in Hz:	Octave band centre frequency
L_W	in dB:	Sound power level of air-regenerated noise in the room (low pressure) side ducting
L_{W2}	in dB:	Sound power level of case radiated noise
L_{pA}	in dB(A):	A-weighted sound pressure level of air-regenerated noise in the room, system attenuation taken into account
L_{pA1}	in dB(A):	A-weighted sound pressure level of air-regenerated noise in the room with CS050/CF050 circular silencer, system attenuation taken into account
L_{pA2}	in dB(A):	A-weighted sound pressure level of case radiated noise in the room, system attenuation taken into account
\dot{V}_{nom}	in m ³ /h or l/s:	Nominal flow rate (100 %)
\dot{V}	in m ³ /h or l/s:	Flow rate

$\dot{V}_{min \text{ unit}}$	in m ³ /h or l/s:	Minimum unit flow rate
Δp_g	in Pa:	Total pressure differential

All sound power levels based on 1pW, all sound pressure levels on 20 µPa.

All noise levels measured in a reverberation chamber. The sound power data was determined and corrected according to DIN EN ISO 5135, February 1999.

Actuator flow rate adjustment, \dot{V}_{min} and \dot{V}_{max} setting with mechanical stops



--- Keep clear to provide access to the actuator

Dimensions in mm		Weight in kg	
Nominal size	Ø D _a	Flow rate	
		constant	variable
80	79	0.5	0.8
100	99	0.6	0.9
125	124	0.7	1.0
160	159	0.8	1.1
200	199	1.0	1.3
250	249	1.3	1.6

Aerodynamic and Acoustic Quick Selection

System attenuation in dB/Oct. acc. to VDI 2081 (values incorporated into the quick selection table)

f_m in Hz	63	125	250	500	1000	2000	4000	8000
Duct attenuation	0	0	1	2	3	3	3	3
Room attenuation	5	5	5	5	5	5	5	5
End reflection	10	5	2	0	0	0	0	0

Correction for distribution into the duct system (values incorporated into the quick selection table)

\dot{V}	l/s	150	200	250	300	360
	m ³ /h	540	720	900	1080	1296
dB per octave		0	2	3	3	4

Correction for other pressure differentials (averaged values)

Δp_g in Pa	50	100	200	400	500
dB	-6	0	6	12	16

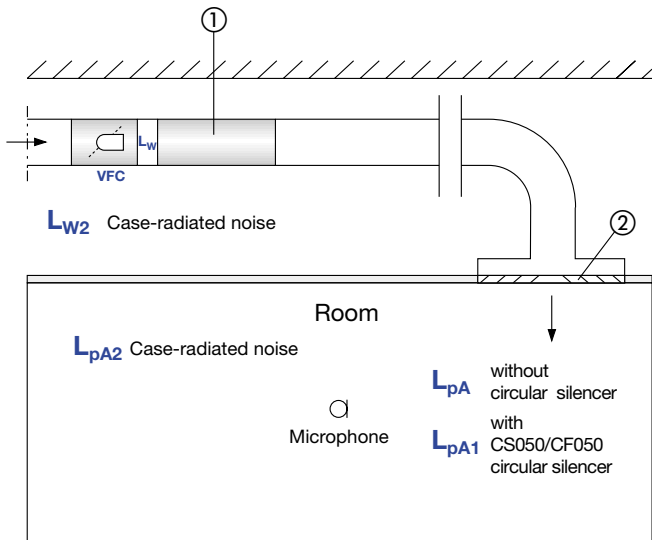
Quick selection of sound pressure level in dB(A) with $\Delta p_g = 100$ Pa

Nominal size	\dot{V}_1		Air-regenerated noise				Case-radiated noise ²⁾
			without circular silencer	with circular silencer type CS050/CF050			
	l/s	m ³ /h		L_{pA}	L_{pA1} Length in mm		
80	6	22	31	17	10	8	13
	10	36	34	20	12	10	15
	20	72	39	26	17	16	18
	42	151	44	31	21	19	23
100	6	22	34	19	9	6	17
	15	54	38	24	15	13	20
	30	108	41	29	21	19	22
	65	234	46	36	29	27	25
125	10	36	27	15	6	4	5
	20	72	33	21	13	10	10
	45	162	39	29	22	20	15
	100	360	46	38	32	30	21
160	18	65	32	22	14	11	20
	45	162	38	28	22	19	25
	85	306	42	33	28	25	28
	185	666	46	38	34	31	33
200	25	90	33	22	14	11	18
	60	216	38	28	20	18	23
	120	432	42	32	26	24	28
	250	900	44	35	30	28	32
250	37	133	37	27	18	15	23
	100	360	41	32	24	22	28
	185	666	43	34	26	24	31
	370	1332	44	36	29	27	34

1) The smallest value stated for each nominal size is referred to as $\dot{V}_{\min \text{ unit}}$; the largest value as \dot{V}_{nom} .

2) 4 dB/octave ceiling reduction and 5 dB/octave room attenuation have been allowed for in the calculation of case-radiated noise.

Air-regenerated Noise



Nomenclature, see page 5

Air-regenerated noise																										
Nominal size	\dot{V}		$\Delta p_g = 100 \text{ Pa}$								$\Delta p_g = 200 \text{ Pa}$								$\Delta p_g = 500 \text{ Pa}$							
			L_w in dB								L_w in dB								L_w in dB							
			f_m in Hz								f_m in Hz								f_m in Hz							
	l/s	m ³ /h	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
80	6	22	57	42	39	36	34	28	24	25	58	46	44	42	41	36	35	37	60	52	50	49	50	45	49	53
	10	36	57	47	44	40	37	31	25	25	59	51	48	46	43	38	36	37	61	56	54	53	52	48	50	53
	20	72	58	52	50	45	40	34	26	25	59	57	54	51	47	42	37	37	61	62	60	58	56	51	51	53
	42	151	58	58	56	50	44	38	27	24	60	62	61	56	50	45	38	36	62	68	67	64	59	55	52	52
100	6	22	52	39	39	40	38	32	30	27	53	42	43	44	43	39	38	37	55	46	48	50	51	48	50	51
	15	54	55	48	46	44	41	35	31	28	56	51	50	48	47	42	39	38	58	55	55	54	54	51	51	52
	30	108	57	56	51	47	44	38	32	29	58	59	55	52	49	45	40	39	60	63	60	57	56	54	52	53
	65	234	60	64	56	51	46	41	33	30	61	67	60	55	52	48	41	40	63	71	65	61	59	57	53	54
125	10	36	47	34	32	33	30	24	22	21	49	37	36	38	36	32	32	34	51	42	42	45	44	43	46	50
	20	72	51	43	40	39	35	30	26	24	53	47	44	44	41	38	36	37	56	52	49	50	50	49	50	54
	45	162	56	54	48	45	41	36	30	28	58	57	52	50	47	44	41	40	61	62	58	56	56	55	55	57
	100	360	61	64	57	51	47	42	35	31	63	68	61	56	53	51	45	44	66	73	66	62	62	62	59	61
160	18	65	47	41	38	38	34	30	28	28	49	44	42	43	41	38	37	38	52	48	47	50	50	49	50	52
	45	162	53	50	46	43	40	35	32	31	55	53	50	48	47	43	41	41	57	57	55	55	56	54	53	54
	85	306	57	57	51	47	44	38	34	33	59	60	55	52	51	47	43	43	61	64	60	59	60	58	56	56
	185	666	62	64	58	52	49	43	37	35	64	67	62	57	56	51	47	45	66	71	67	64	65	62	59	59
200	25	90	44	39	37	39	37	32	26	24	47	43	42	44	43	40	35	34	51	48	49	51	52	50	48	48
	60	216	51	48	44	43	41	38	31	27	53	51	49	48	47	46	41	38	57	56	55	55	56	56	54	52
	120	432	56	54	49	46	44	43	35	30	58	58	54	51	51	51	45	41	62	63	60	58	60	61	58	55
	250	900	61	61	54	49	48	48	39	34	64	65	59	55	55	56	49	44	67	70	66	62	63	66	62	58
250	37	133	46	37	39	43	40	36	31	27	48	41	43	47	46	43	40	37	52	45	50	53	55	53	52	52
	100	360	54	45	45	46	44	42	36	31	56	49	49	50	50	50	45	42	60	53	55	56	58	60	58	56
	185	666	59	50	48	48	46	46	39	34	61	53	53	52	52	54	48	45	65	58	59	58	60	64	61	59
	370	1332	64	55	53	50	48	51	42	37	67	59	57	55	55	58	52	48	70	64	63	61	63	68	64	63

Case-radiated Noise

Example

Given: $\dot{V}_{max} = 45 \text{ l/s}$ or $162 \text{ m}^3/\text{h}$
 $\Delta p_g = 200 \text{ Pa}$
 Required sound pressure level in the room 35 dB(A)
 For further assumptions, see calculation procedure

Calculation procedure

Quick selection: VFC 125
 Air-regenerated noise $L_{pA} = 39 + 6 = 45 \text{ dB(A)}$
 Specification is not met, so circular silencer required
 VFC 125 with CF050/125 x 500
 Air-regenerated noise $L_{pA1} = 29 + 6 = 35 \text{ dB(A)}$
 Case-regenerated noise $L_{pA2} = 15 + 6 = 21 \text{ dB(A)}$

Case-radiated noise calculation procedure

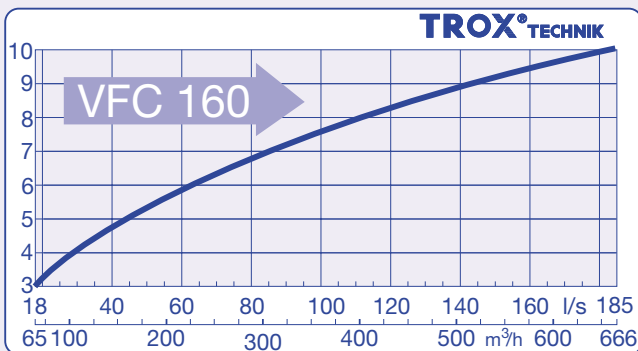
f_m	63	125	250	500	1000	2000	4000	8000
L_{W2} (Page 8)	32	27	22	26	25	24	25	28
Ceiling reduction	4	4	4	4	4	4	4	4
Room attenuation	6	6	6	5	5	5	5	5
A-weighting	-26	-16	-9	-3	0	1	1	-1
Corrected level	-4	1	3	14	16	16	17	18

Result: L_{pA2} approx. **23 dB(A)**

Case-radiated noise																										
Nominal size	\dot{V}		$\Delta p_g = 100 \text{ Pa}$								$\Delta p_g = 200 \text{ Pa}$								$\Delta p_g = 500 \text{ Pa}$							
			L_{W2} in dB								L_{W2} in dB								L_{W2} in dB							
			f_m in Hz								f_m in Hz								f_m in Hz							
			63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
80	6	22	20	8	6	14	16	16	12	15	21	12	11	20	23	24	23	27	23	18	17	27	32	33	37	43
	10	36	20	13	11	18	19	19	13	15	22	17	15	24	25	26	24	27	24	22	21	31	34	36	38	43
	20	72	21	18	17	23	22	22	14	15	22	23	21	29	29	30	25	27	24	28	27	36	38	39	39	43
	42	151	21	24	23	28	26	26	15	14	23	28	28	34	32	33	26	26	25	34	34	42	41	43	40	42
100	6	22	17	7	8	19	21	20	18	17	18	10	12	23	26	27	26	27	20	14	17	29	34	36	38	41
	15	54	20	16	15	23	24	23	19	18	21	19	19	27	30	30	27	28	23	23	24	33	37	39	39	42
	30	108	22	24	20	26	27	26	20	19	23	27	24	31	32	33	28	29	25	31	29	36	39	42	40	43
	65	234	25	32	25	30	29	29	21	20	26	35	29	34	35	36	29	30	28	39	34	40	42	45	41	44
125	10	36	21	4	2	9	8	4	6	9	23	7	6	14	14	12	16	22	25	12	12	21	22	23	30	38
	20	72	25	13	10	15	13	10	10	12	27	17	14	20	19	18	20	25	30	22	19	26	28	29	34	42
	45	162	30	24	18	21	19	16	14	16	32	27	22	26	25	24	25	28	35	32	28	32	34	35	39	45
	100	360	35	34	27	27	25	22	19	19	37	38	31	32	31	31	29	32	40	43	36	38	40	42	43	49
160	18	65	22	18	18	20	24	21	19	24	24	21	22	25	31	29	28	34	27	25	27	32	40	40	41	48
	45	162	28	27	26	25	30	26	23	27	30	30	30	30	37	34	32	37	32	34	35	37	46	45	44	50
	85	306	32	34	31	29	34	29	25	29	34	37	35	34	41	38	34	39	36	41	40	41	50	49	47	52
	185	666	37	41	38	34	39	34	28	31	39	44	42	39	46	42	38	41	41	48	47	46	55	53	50	55
200	25	90	23	22	22	24	23	21	17	15	26	26	27	29	29	29	26	25	30	31	34	36	38	39	39	39
	60	216	30	31	29	28	27	27	22	18	32	34	34	33	33	35	32	29	36	39	40	40	42	45	45	43
	120	432	35	37	34	31	30	32	26	21	37	41	39	36	37	40	36	32	41	46	45	43	46	50	49	46
	250	900	40	44	39	34	34	37	30	25	43	48	44	40	41	45	40	35	46	53	51	47	49	55	53	49
250	37	133	27	22	25	29	27	25	22	18	29	26	29	33	33	32	31	28	33	30	36	39	42	42	43	43
	100	360	35	30	31	32	31	31	27	22	37	34	35	36	37	39	36	33	41	38	41	42	45	49	49	47
	185	666	40	35	34	34	33	35	30	25	42	38	39	38	39	43	39	36	46	43	45	44	47	53	52	50
	370	1332	45	40	39	36	35	40	33	28	48	44	43	41	42	47	43	39	51	49	49	47	50	57	55	54

Flow Rate Adjustment

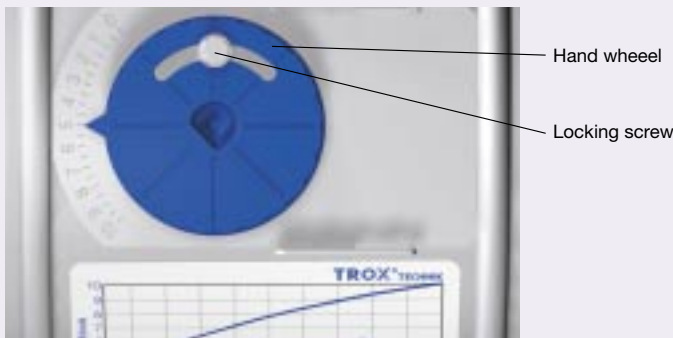
Characteristic curve for determination of flow rate



On each VFC, a flow rate characteristic curve is shown in order to determine the settings on site (see example nominal size 160 opposite).

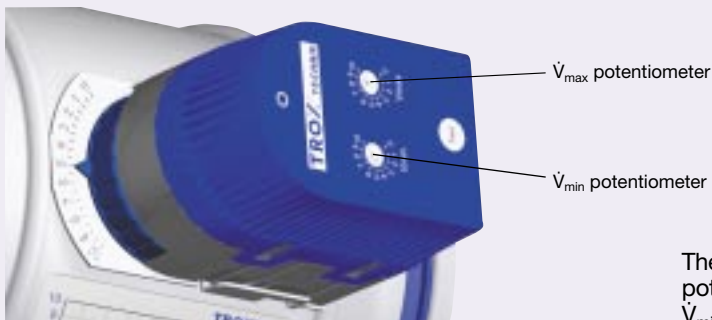
\dot{V}_{\min} values of less 3 cause a system pressure-dependent, uncontrolled flow rate which does not exceed $\dot{V}_{\min \text{ unit}}$.

Constant flow rate control, flow rate adjustment with hand wheel



The required flow rate must be set by the customer using the hand wheel. For delivery, setting is a value of 5.

Variable flow rate control, flow rate control with actuator, \dot{V}_{\min} and \dot{V}_{\max} setting with potentiometers



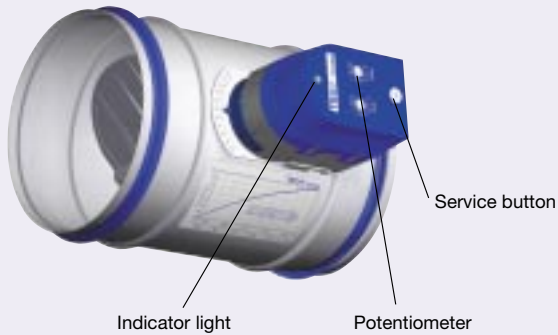
The flow rate range must be set at the actuator \dot{V}_{\min} and \dot{V}_{\max} potentiometers by the customer. For delivery, settings are $\dot{V}_{\min} = 4$ and $\dot{V}_{\max} = 8$.

Variable flow rate control, flow rate control with actuator, \dot{V}_{\min} and \dot{V}_{\max} setting with mechanical stops

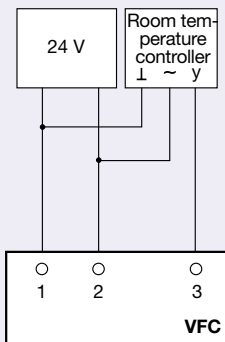


To adjust the flow rate range the mechanical stops of the actuator are set corresponding to the values determined from the characteristic curve. For delivery, settings are $\dot{V}_{\min} = 4$ and $\dot{V}_{\max} = 8$.

Variable flow rate control, flow rate control with actuator, \dot{V}_{\min} and \dot{V}_{\max} adjustment with potentiometers



Example: Variable flow rate control



Actuator 24 V, $\dot{V}_{\min}/\dot{V}_{\max}$ changeover

Supply voltage : 24 VAC \pm 20 %, 50/60 Hz
or 24 VDC \pm 10 %
Power rating : max. 3 VA (for a.c. voltage)
max. 3 W (for d.c. voltage)
Control signal : 1- or 2-wire control
Protection level: IP 42

Actuator 24 V, variable flow rate

Supply voltage and power rating as above.
Control signal : 0 to 10 VDC, $R_i > 100 \text{ k}\Omega$
Protection level: IP 42

Actuator 230 VAC, $\dot{V}_{\min}/\dot{V}_{\max}$ changeover

Supply voltage : 230 VAC \pm 20 %, 50/60 Hz
Power rating : 3 VA
Control signal : 1- or 2-wire control
Protection level: IP 42

Functional testing

- Press service button
- Actuator turns towards \dot{V}_{\min}
- Actuator turns towards \dot{V}_{\max}
- Actuator returns to control mode

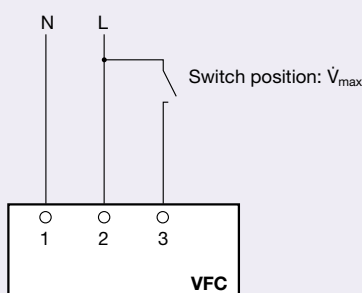
Indicator light provides functional information

- permanently on : Position set
- blinking once a second : Actuator operating
- blinking twice a second: Actuator is stationary
- off : No supply voltage

Variable flow rate control, flow rate control with actuator, \dot{V}_{\min} and \dot{V}_{\max} adjustment with mechanical stops



Example: $\dot{V}_{\min}/\dot{V}_{\max}$ changeover, single-wire-control



Actuator 24 V, $\dot{V}_{\min}/\dot{V}_{\max}$ changeover

Supply voltage : 24 VAC \pm 20 %, 50/60 Hz
or 24 VDC \pm 20 %
Power rating : max. 1 VA (for a.c. voltage)
max. 0.5 W (for d.c. voltage)
Protection level: IP 54

Actuator 230 VAC, $\dot{V}_{\min}/\dot{V}_{\max}$ changeover

Supply voltage : 110 ... 230 VAC \pm 20 %, 50/60 Hz
Power rating : 3 VA
Control signal : 1- or 2-wire control
Protection level: IP 54

Specification text*

Circular volume flow controllers for constant or variable volume flow low velocity systems, mechanical system-powered (external power supply not required), for supply or extract air, in 6 nominal sizes. Consists of casing with a control damper blade shaft mounted, supported on bearings with a bellows, leaf spring and adjustment mechanism.

Special features:

- For constant or variable volume flow systems
- Flow rate adjustment without special tools
- Independent of orientation and maintenance free
- Retrofit of actuator easily possible

Spigots suitable for ducts complying with DIN EN 1506 or DIN EN 13180, with lip seal.

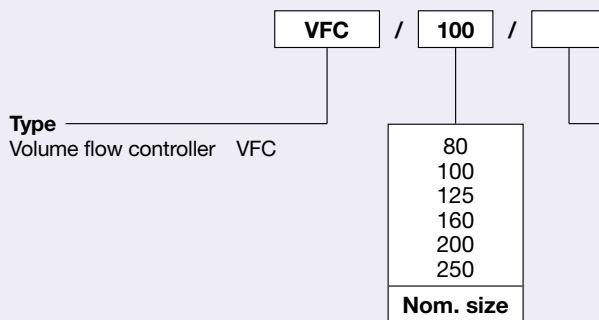
Differential pressure range 30 to 500 Pa, flow rate range maximum 10 : 1.

Materials:

Casing in galvanized sheet steel, control damper blade and other components in plastic, polyurethane bellows.

* Text for basic construction

Order code



Control function

Basic construction (manual setting), no entry required

E01 24 V, $\dot{V}_{min}/\dot{V}_{max}$ changeover, with potentiometers

E02 230 VAC, $\dot{V}_{min}/\dot{V}_{max}$ changeover, with potentiometers

E03 24 V, variable volume flow, with potentiometers, control signal 0 to 10 VDC

M01 24 V, $\dot{V}_{min}/\dot{V}_{max}$ changeover, with mechanical stops

M02 230 VAC, $\dot{V}_{min}/\dot{V}_{max}$ changeover, with mechanical stops

Order example

Make: TROX
 Type: VFC / 100

