Ref. no.: 401 - 432

Volume flow controller

Electronically or pneumatically regulating volume flow controller
Rectangular, model VRRM

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Operating principle

The electronic resp. pneumatic volume flow controller we have developed represents a logical extension of our product range. The volume flow controller consists of a multi-leaf damper and a measuring frame. One or more nozzles for volume flow measurement are integrated into a connection endplate, which is the main part of the measuring frame. The nozzles for volume flow measurement are designed according to DIN 1952 and ISO 5167, so that the differential pressure at the nozzle represents a definite physical quantity, on the basis of which the volume flow can be calculated directly. As a result, it has been possible to dispense with the empirical determination and arrangement of measurement holes for velocity measurement. This differential pressure is transmitted to the measurement sensor of the controller which, via a servomotor, adjusts the multi-leaf damper according to the given requirements. Depending on the make of the controller, the volume flow controller can perform different functions, e.g. using a command signal to adjust volume flow on a continuous scale between set minimum and maximum values, shutting off or implementing a ”master-slave” sequential control.

Design

The multi-leaf damper and the measuring frame are made of galvanized sheet steel. The frame connection profile is canted as a 30 mm C-profile (C30). The blades of the multi-leaf damper are designed as torsion-proof hollow profiles. They are guided via floating bearings. Owing to the design of the bearings, only low torques are required for turning the blades. The bearings are airtight. The multi-leaf damper can be delivered as model “Standard“ (no sealing) or as model “Airtight“. The blades of the model “Airtight“ are provided with sealing lips and side seals to obtain a high degree of tightness. The seals of the “airtight” multi-leaf damper are made of ageing-resistant EPDM or hygienic silicone rubber. The coupling of the blades is effected by aluminium gears. The multi-leaf dampers and the measuring frame are manufactured for each duct cross section (height and width) in steps of 1 mm as required by the customer. This means that there is no need for adapters, which can be disturbing for the air flow resp. the look of the duct. The nozzle for the volume flow measurement is pressed from galvanized sheet steel. Drill holes are provided in the nozzle for recording pressure. The pressure recording points on the overpressure and negative pressure sides, with four pieces distributed around the circumference, are each connected via a closed circuit, providing a mean value and ensuring that a sufficiently accurate velocity is measured even in case of disturbed velocity profiles. The surface ratio of the nozzle for volume flow measurement (the ratio of the free nozzle cross section to the pipe cross section) is designed in such a way that the flow rate in the nozzle is almost doubled and the differential pressure is therefore multiplied by four. As a result, even relatively low velocities can be recorded. Due to the shape of the measuring nozzle, the inherent resistance remains low in spite of the high differential pressure. The measuring nozzle is crimped into the connection endplate with welding spots, which results in a stable fixing of the nozzle and increases the rigidity of the measuring frame.

A corresponding bracket is arranged to provide a sturdy receptacle for the controller, servomotor and pressure sensor. Servomotors made by different manufacturers and of different types can be mounted on this bracket. Adjustment can be electric or pneumatic.

Tightness

The frames and the connected parts are designed in such a way that tightness according to DIN 24194 T2 (standard for rectangular components) resp. EN 1751 class 4 is attained. This provides security against leakages and whistling noises. For the operating pressure of up to 1000 Pa and the valid temperature range, in the “closed” position of the multi-leaf damper, tightness can be achieved according to EN 1751 class 4.

Measurement principle for the recording of velocity

The flow rate is recorded via the measuring nozzle and a differential pressure sensor. Owing to the diminished cross-section of the nozzle, the flow rate is increased and the static pressure in the nozzle decreases simultaneously. The measuring holes on the nozzle are positioned in such a way that on the one hand the total pressure of the flow in the pipe and on the other the static pressure at the narrowest point in the nozzle are recorded. The difference resulting from the overall pressure in the pipe and the static pressure in the nozzle is a measurement of the flow rate. This pressure difference (effective pressure) at the nozzle depends quadratically on the flow rate. The pressure difference is recorded via a differential pressure sensor and transmitted as a sensor signal to the control unit. The sensor signal is transformed within the control unit into a linear actual value (voltage signal). This differential pressure sensor is available in a static and in a dynamic version. In the dynamic version, a small stream of air flows through the pressure sensor due to the difference in pressure. In a manner similar to that of a thermal anemometer, the flow rate is measured and turned into a signal. In the static version, no air flows through the sensor. Here, the pressure difference is applied directly to a membrane, which is deformed as a result. This deformation is a measure of the pressure difference. The pneumatic controllers operate according to the static principle, except that a pressure signal is transmitted instead of a voltage signal.

Responsiveness and regulation accuracy

Due to the increase in the flow rate in the measuring nozzle and the resulting high differential pressure, high regulation accuracy and responsiveness are achieved. The

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controller operates in a stable range of control from the minimum response pressure up, which is a function of the volume flow (see diagram 1), to the maximum pressure difference of 1000 Pa. The flow rate variation over the entire pressure range is ±10%. The flow rates and variations depend, however, on the make of the controller and must be specified when ordering. The flow rate should be at least 2 m/s. Owing to the measuring nozzle and the manner in which pressure is recorded, the controller is almost insensitive to the flow stream, so that installation is possible where guarantee can be made for damages resulting from incorrect connection of the controller or from adjustment of the flow rate.

Temperature range

The controller can be employed in its standard version at an ambient temperature of 0° C to +50° C, which takes into account the presence of electronic and pneumatic adjustment components on the device.

Locations suitable for use

Its compact construction guarantees plate. Greater flow rates can be accommodated by parallel switchings.

The following types of volume flow controllers are available for selection depending on the location of use and the plant system:

VRRME: electronic volume flow controller with analogue control signal

VRRMP: pneumatic volume flow controller with pneumatic control signal

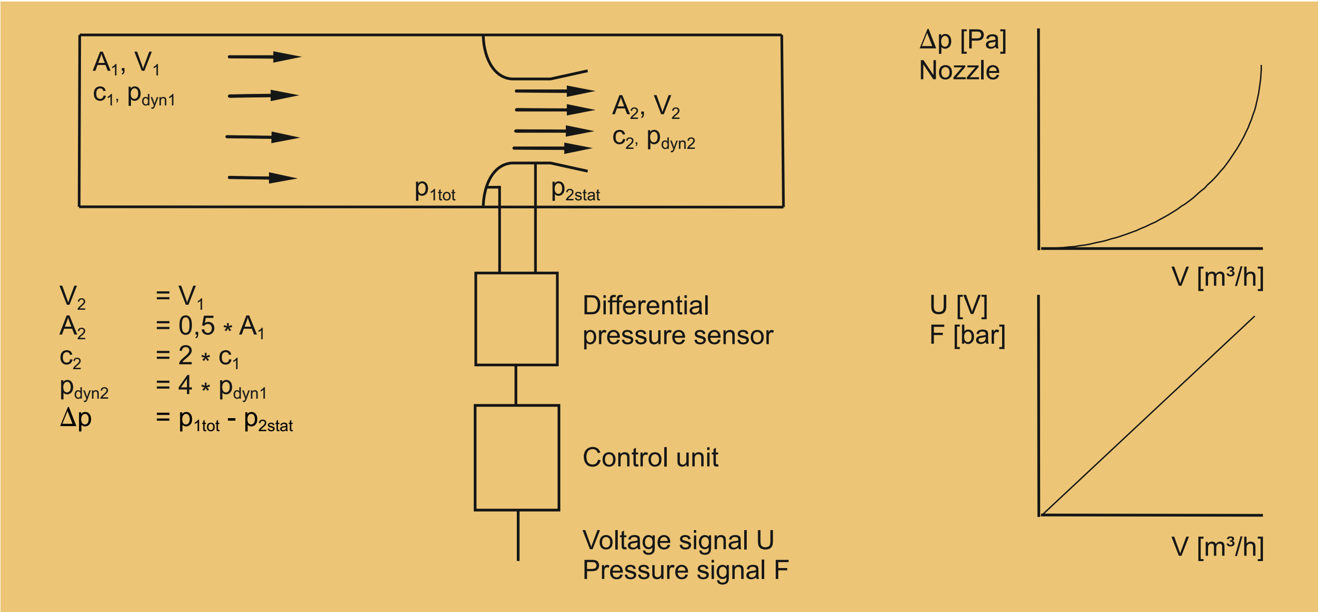

Figure 1: Scheme of velocity measurement

redirection occurs or where junctions are made with short approach sections (2,5*the diagonal).

Flow rate adjustment

All controllers will be adjusted at the factory to the flow rate required by the customer and will be checked. The customer can still adjust the set minimum and maximum flow rates subsequently. Any modifications in the settings must be performed only by specialist staff. When the control units are being adjusted and connected to an electrical supply, one must also follow the technical instructions given by the controller's manufacturer. No claims under the that the ducts can be installed closely adjacent to one another. The volume flow controller can be delivered for any duct cross section (height and width) in steps of 1 mm, so that there is no need for additional adapters, which can be disturbing for the air flow resp. the look of the duct. This makes the installation easier and provides a uniform overall visual scheme when the installation occurs in a visible area. The controller can be used universally for supply air and exhaust air in high and low pressure plants. Even under unfavourable blower stream conditions, safe functioning is guaranteed in case of short blower stream lengths. In this case we recommend installing a perforated

Acoustic insulation

There is the possibility of reducing the radiated noise via an insulating shell. The insulating shell consists of a galvanized sheet steel cladding and a mineral wool insulating mat.

Maintenance

All components are maintenance-free, non-ageing and corrosion-proof under normal conditions. According to the general regulations for ventilation technology EN 1751 class 4 (VDI ventilation regulations), the duct system and the volume flow controller must be accessible for possible adjustment and maintenance. In

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addition, the respective manufacturer's instructions apply to the servomotors and controllers.

Installation and storage on the site

The volume flow controller can be installed easily and in any position with the flange profile. One important condition for trouble-free function is a solidly constructed duct system. That helps prevent the duct from flying up where it is flexible due to rapid closing or opening of a shut-off device. The components should be protected against soiling by such things as sand or mortar. During installation, care should likewise be taken that the duct be free of dirt and loose objects, such as rags, newspapers, packaging materials etc. The volume flow controllers must not be distorted or deformed. To prevent damage by loose objects resp. to prevent injury through contact with the multi-leaf damper, it might be reasonable to install a protective grille. The duct should be installed only by specialist staff to avoid obstruction of the cross section. Instructions concerning installation and storage are contained in a technical document and should be followed.

Specifications:

Electronic volume flow controller, manufactured by Aerotechnik Siegwart, rectangular, with integrated measuring nozzle and top bracket to receive the actuator and controller, airtight according to DIN 24194 T2, multi-leaf damper "Standard" or "Airtight" (according to EN 1751 class 4), corrosion-protected, with non-ageing seals, including factory adjustment and programming of the volume flows and the conductance of the controller.

Ordering key

Type:	**40**3 with actuator and controller make and model (resp. **403 - 432**)	
Controller system:	**VRRME** or **VRRMP**)	
Dimensions:	**Width**__________mm	**Height**________mm
Volume flow setting:	**min:**___________m³/h;	**max:** _________m³/h
Differential pressure at controller:	**min:**___________Pa;	**max:** _________Pa
	Standard control (resp. master-slave control)	
	Dynamic (resp. **static) pressure sensor**	
Model with flange profile:	**C30**	
Model "Standard" or model "Airtight" (according to EN 1751 class 4), made of galvanized steel or stainless steel with polyurethane coating or with coloured, powder - coated housing		
Accessories:	**Add. charge insulation**	

Example:

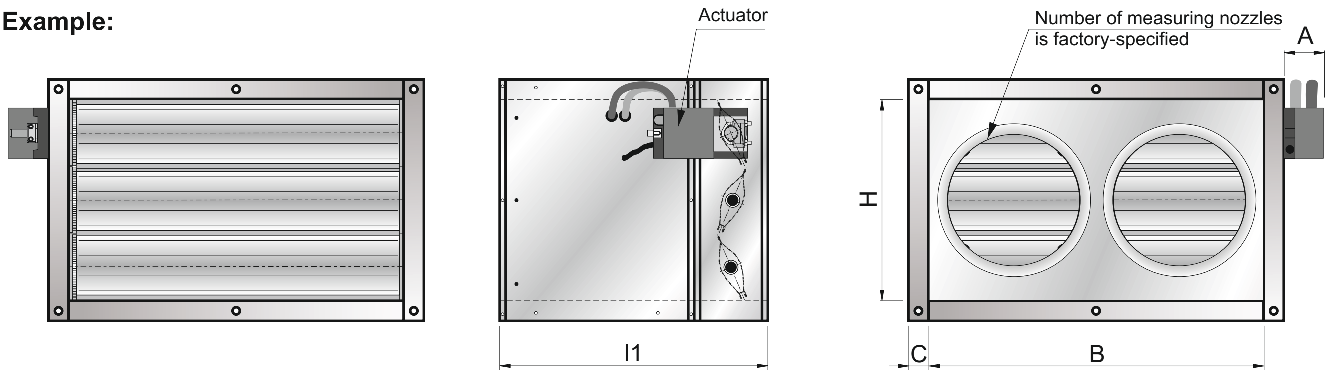

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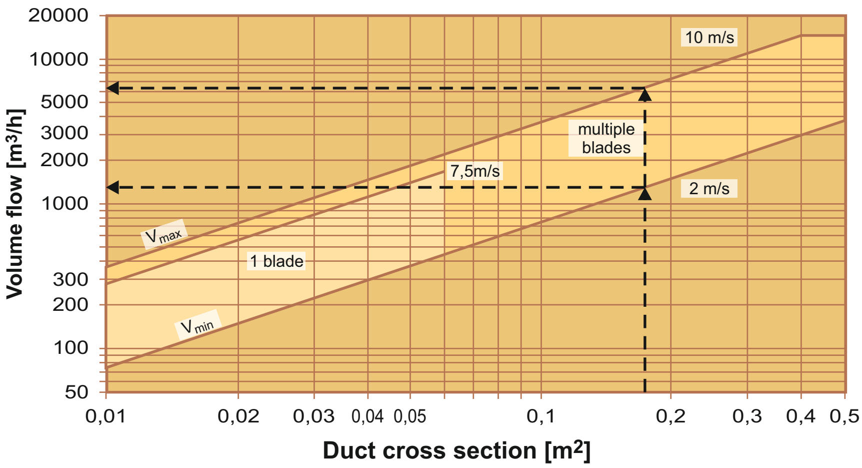
Table 1:

Width B [mm]	Height[1] H [mm]	Number of blades	Selectable velocity V [m/s]	max. stat. pressure difference Δp [Pa]	Dimensions: Total length[2] l_1 [mm]	Frame width C [mm]	Blade width W_B [mm]	A Ref. no. 425 [mm]
100 - 500	100 - 109	1	1,5 - 7,0	1000	400	30	100	70
110 - 550	110 - 119	1	1,5 - 5,3	1000	400	30	100	70
120 - 600	120 - 130	1	1,5 - 7,1	1000	400	30	100	70
180 - 900	180 - 189	2	1,5 - 7,3	1000	400	30	100	70
190 - 1000	190 - 219	2	1,8 - 8,8	1000	400	30	100	70
220 - 1000	220 - 330	3	1,6 - 8,8	1000	400	30	100	70
380 - 1200	380 - 430	4	1,5 - 7,5	1000	400	30	100	70

[1] Height H ≤ width W, other dimensions on request.
[2] Models in stainless steel: Multi-leaf dampers have a linkage instead of gears and the total length l is 430 mm



Example:

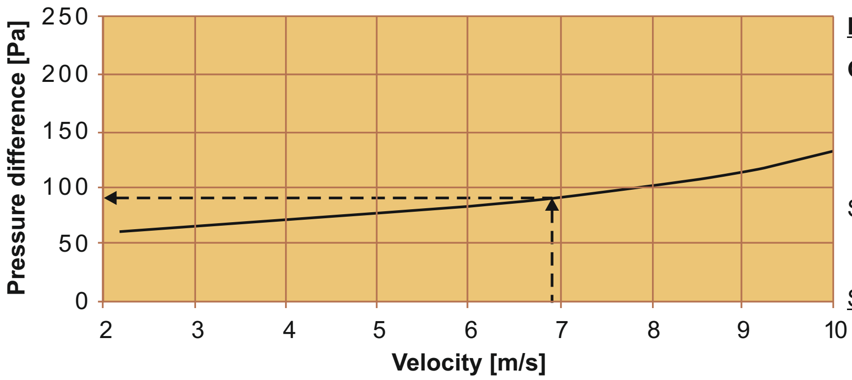
Given: Volume flow controller model VRRME
Dimensions 600 mm x 300 mm
(3 blades)
(duct cross section 0,18 m²)

Adjustable volume flow V_{min} and V_{max}?

Solution according to diagram 1:

V_{max} = 6480 m³/h
V_{min} = 1300 m³/h

Diagram 1: Choosing of V_{max} and V_{min} via the duct cross section



Example:

Given: Volume flow controller model VRRME
Dimensions 600 mm x 300 mm
Volume flow 4500 m³/h
(= velocity 6.9 m/s)

Static minimum pressure difference

Δp [Pa]

Solution according to diagram 2:

Δp = 80 Pa

Diagram 2: Static minimum response pressure difference at the volume flow controller

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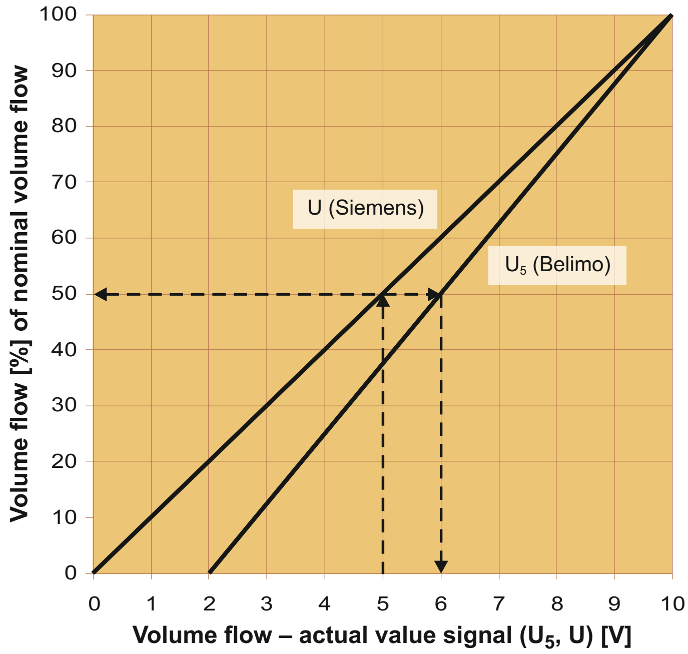

Diagram 3: Ratio of the volume flow to the actual value signal

Example 1:

Given: Volume flow controller
Model VRRME 425
Dimensions 400 mm x 400 mm
Nominal volume flow 4500 m³/h
Actual volume flow 2250 m³/h
corresponding to 50 %

Actual value signal U_5 (Belimo)?

Solution according to diagram 3
U_5 = 6 V (Belimo)

Example 2:

Given: Volume flow controller
Model VRRME 407
Dimensions 400 mm x 400 mm
Nominal volume flow
0,9 x 4500 m³/h = 4050 m³/h
(refer to table 1 and table 2)
Actual value signal U = 5 V(Siemens)

Actual volume flow?

Solution according to diagram 3
Actual volume flow = 50 % of the nominal volume flow
50 % of 4050 m³/h = 2025 m³/h

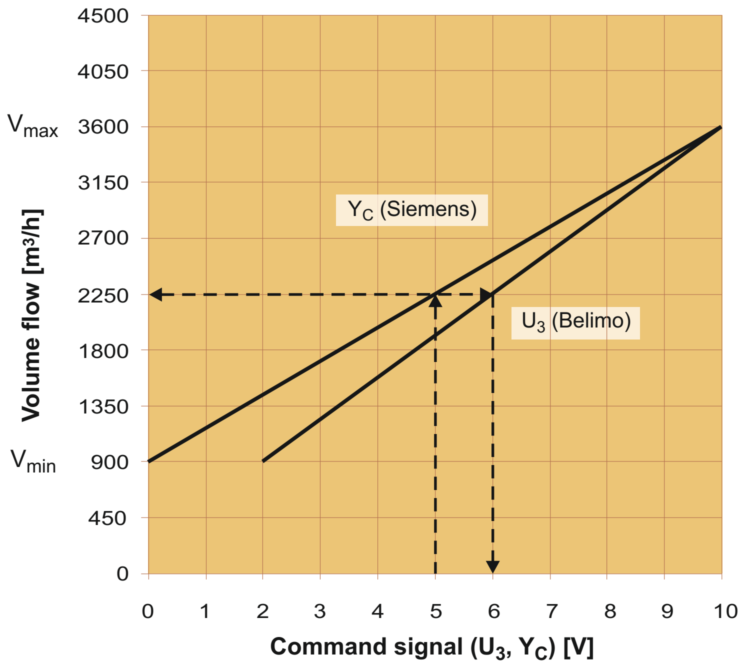

Diagram 4: Volume flow depending on the command signal

Example 3:

Given: Volume flow controller
Model VRRME 425
Dimensions 400 mm x 400 mm
Maximum volume flow 3600 m³/h
Minimum volume flow 900 m³/h
Theoretical volume flow 2250 m³/h

Command signal U_3 (Belimo) (dependent on maximum and minimum volume flow)?

Solution according to diagram 4
U_3 = 6 V (Belimo)

Example 4:

Given: Volume flow controller
Model VRRME 407
Dimensions 400 mm x 400 mm
Maximum volume flow 3600 m³/h
Minimum volume flow 900 m³/h
Command signal Y_C = 5 V(Siemens)

Theoretical volume flow?

Solution according to diagram 4

Theoretical volume flow = 2250 m³/h

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Table 2:

Ref. no.	Model	Controller make (manufacturer) and model	Type of pressure sensor	Adjustable volume flow V_{min}	V_{max}	Command signal
401	VRRME	**Belimo** Controller, sensor and actuator LMV-M1-MP (5 Nm) NMV-M1-MP (10 Nm) Compact controller	static	0% - 100%* V_{nom}	20% - 100% V_{nom}	2V-10V MP-Bus
402	VRRME	**Belimo** Controller, sensor and actuator LMV-M1-MOD (5 Nm) NMV-M1-MOD (10 Nm) Compact controller	static	0% - 100%* V_{nom}	20% - 100% V_{nom}	2V-10V BACnet, Modbus, MP-Bus
403	VRRME	**Sauter** Controller, sensor, and Actuator model ASV205BF132E (5 Nm) ASV215BF132E (10 Nm) Compact controller	static	20% - 80%* V_{nom}	30% - 100% V_{nom}	0V-10V BACnet
407	VRRME	**Siemens** Controller, sensor and actuator GDB 181.1E/3 (5 Nm) GLB 181.1E/3 (10 Nm) Compact controller	dynamic	0% - 100%* V_{nom}	20% - 100% V_{nom}	0V-10V
410	VRRME	**Belimo** Controller, sensor and actuator LMV-D3-MP (5 Nm) NMV-D3-MP (10 Nm) Compact controller	dynamic	0% - 100%* V_{max}	20% - 100% V_{nom}	2V-10V MP-Bus
412	VRRME	**Schischek** Controller and sensor model ExReg-V300-A Actuator model ExMax-5.10-CY (5/10 Nm)	static	0% - 100%* V_{nom}	30% - 100% V_{nom}	0V-10V
414	VRRME	**Sauter** Controller, sensor and actuator ASV215BF152E (10 Nm) Compact controller (3-15 sec)	static	20% - 80%* V_{nom}	30% - 100% V_{nom}	0V-10V BACnet
419	VRRME	**Belimo** Controller, sensor and actuator LMV-D3-MOD (5 Nm) NMV-D3-MOD (10 Nm) Compact controller	dynamic	0% - 100%* V_{nom} ($V_{min} \leq V_{max}$)	20% - 100% V_{nom}	2V-10V BACnet, Modbus, MP-Bus
425	VRRME	**Belimo** controller and sensor VRU-D3-BAC LM24A-VST (5 Nm, 120 s) NM24A-VST (10 Nm, 120 s) *or* SM24A-VST (20 Nm, 120 s) **universal controller**	dynamic	15% - 100%* V_{nom} ($V_{min} \leq V_{max}$)	20% - 100% V_{nom}	2V-10V BACnet, Modbus, MP-Bus
426	VRRME	**Belimo** controller and sensor VRU-D3-BAC LMQ24A-VST (4 Nm, 2,4 s) *or* NMQ24A-VST (8 Nm, 4 s) universal controller	dynamic	15% - 100%* V_{nom} ($V_{min} \leq V_{max}$)	20% - 100% V_{nom}	2V-10V BACnet, Modbus, MP-Bus
427	VRRME	**Belimo** controller and sensor VRU-M1-BAC LM24A-VST (5 Nm, 120 s) NM24A-VST (10 Nm, 120 s) *or* SM24A-VST (20 Nm, 120 s) **universal controller**	static	15% - 100%* V_{nom} ($V_{min} \leq V_{max}$)	20% - 100% V_{nom}	2V-10V BACnet, Modbus, MP-Bus
428	VRRME	**Belimo** controller and sensor VRU-M1-BAC up to NW 355: LMQ24A-VST (4 Nm, 2,4 s) *or* from NW 400: NMQ24A-VST (8 Nm, 4 s) universal controller	static	15% - 100%* V_{nom} ($V_{min} \leq V_{max}$)	20% - 100% V_{nom}	2V-10V BACnet, Modbus, MP-Bus
432	VRRMP	**Sauter** Controller type RLP 10 Actuator model AK 41 P (3 Nm) *or* Actuator model AK 42 P (10 Nm)	static	20% - 80%* V_{nom}	30% - 90% V_{nom}	0,2 bar - 1 bar

*Because of the control accuracy it is important to make sure, that the flow velocity will be kept inside the tube. (see table „Overview 1“, page 5)

Other makes and models are available on demand.

The model VRRME delivers a linear current signal (U_5 or U) to show the actual volume flow.

The calculation of the volume flow on the basis of the signal is performed according to the following formulas:

$$V = \frac{U_5 - 2}{8} * V_{nom}$$ for the command signal 2V – 10V (Belimo)

$$V = \frac{U}{10} * V_{nom}$$ for the command signal 0V – 10V (Siemens)

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Width [mm]	Height [mm]	Velocity [m/s]	Volume flow [m^3/h]	Static pressure at controller – 250 Pa – Octave power level* L_W [dB/octave]							Summation $L_{w\,sum}$ A-weighted in dB(A)	500 Pa – Octave power level* L_W [dB/octave]							Summation $L_{w\,sum}$ A-weighted in dB(A)	1000 Pa – Octave power level* L_W [dB/octave]							Summation $L_{w\,sum}$ A-weighted in dB(A)
				125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
200	100	2	144	42	40	35	29	24	22	25	37	45	42	38	33	29	29	39	42	47	45	41	36	34	37	44	46
		5	360	51	48	44	38	33	31	34	46	53	51	47	41	37	38	47	50	55	53	49	45	42	45	53	54
		6,9	500	54	51	47	41	36	34	37	49	56	54	50	44	40	41	51	54	58	56	52	48	45	48	64	64
200	200	2	288	47	45	40	34	29	27	30	42	49	47	43	38	34	34	44	46	52	49	46	41	38	42	49	51
		5	720	56	53	49	43	38	36	39	50	58	56	51	46	42	43	52	55	60	58	54	49	47	50	58	59
		7,6	1100	60	57	53	47	41	39	43	54	62	59	55	50	46	46	56	59	64	62	58	53	51	54	62	63
400	100	2	288	47	45	40	34	29	27	30	42	49	47	43	38	34	34	44	46	52	49	46	41	38	42	49	51
		5	720	56	53	49	43	38	36	39	50	58	56	51	46	52	43	52	55	60	58	54	49	47	50	58	59
		7	1000	59	56	52	46	41	39	42	54	61	59	55	49	45	46	56	59	63	61	57	52	50	53	69	69
400	200	2	576	52	49	45	39	34	32	35	47	54	52	48	42	39	39	49	51	57	54	51	46	43	46	54	56
		5	1440	61	58	54	48	42	40	44	55	63	60	56	51	47	48	57	60	65	63	59	54	52	55	63	64
		7,6	2200	64	62	58	52	46	44	47	59	67	64	60	55	51	51	61	64	69	67	63	58	56	59	75	74
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		5	2160	63	61	56	50	45	43	46	58	66	63	59	54	50	50	60	63	66	66	62	57	55	58	65	67
		8,1	3500	68	65	61	55	50	48	51	63	70	68	64	58	54	55	64	68	72	70	66	62	59	62	78	78
400	400	2	1152	57	54	50	44	39	37	40	52	'59	57	53	47	43	44	54	56	61	59	55	51	48	51	59	60
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		7,8	4500	70	67	63	57	51	49	53	64	72	69	65	60	56	57	66	69	74	72	68	63	61	64	80	79
600	100	2	432	50	47	43	37	32	53	33	45	52	50	46	40	37	37	47	49	55	52	49	44	41	44	52	54
		5	1080	59	56	52	46	40	58	42	53	61	58	54	49	45	46	55	58	63	61	57	52	50	53	61	62
		6,9	1500	62	59	55	49	43	41	45	56	64	61	57	52	48	49	58	61	66	64	60	55	53	56	72	71
600	200	2	864	55	52	48	42	37	35	38	50	57	55	51	45	41	42	51	54	59	57	53	49	46	49	57	58
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		7,5	3200	67	65	60	54	49	47	50	62	70	67	63	58	54	54	64	67	72	70	66	61	59	62	78	77
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		10	6480	73	70	66	60	55	53	56	67	75	72	68	63	59	60	69	72	77	75	71	66	64	67	75	76
600	400	2	1728	60	57	53	47	42	40	43	54	62	60	56	50	46	47	56	59	64	62	58	53	51	54	62	63
		5	4320	68	66	61	55	50	48	51	63	70	68	64	59	55	55	65	68	73	70	67	62	59	63	70	72
		8,1	7000	73	70	66	60	55	53	56	67	75	73	69	63	59	60	69	72	77	75	71	66	64	67	83	83
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		5	2880	65	63	58	52	47	45	48	60	68	65	61	56	52	52	62	65	70	68	64	59	57	60	67	69
		7,6	4400	69	67	62	56	51	49	52	64	72	69	65	60	56	56	66	69	74	72	68	63	61	64	80	79
800	300	2	1728	60	57	53	47	42	40	43	54	62	60	56	50	46	47	56	59	64	62	56	53	51	54	62	63
		5	4320	68	66	61	55	50	48	51	63	70	68	64	59	55	55	65	68	73	70	67	62	59	63	70	72
		8,1	7000	73	70	66	60	55	53	56	67	75	73	69	63	59	60	69	72	77	75	71	66	64	67	83	83
800	400	2	2304	62	59	55	49	44	42	45	56	64	62	58	52	48	49	58	61	66	64	60	55	53	56	64	65
		5	5760	70	68	63	57	52	50	53	65	73	70	66	61	57	57	67	70	75	72	69	64	61	65	72	74
		7,8	9000	74	72	67	61	56	54	57	69	77	74	70	65	61	61	71	74	79	77	73	68	65	69	85	84
1000	200	2	1440	58	56	52	45	40	38	41	53	61	58	54	49	45	45	55	58	63	61	57	52	50	53	61	62
		5	3600	67	64	60	54	49	47	50	62	69	67	63	57	53	54	64	66	71	69	65	61	58	61	69	71
		7,5	5500	71	68	64	58	53	51	54	66	73	71	67	61	57	58	68	71	75	73	69	65	62	65	81	81
1000	400	2	2880	63	61	56	50	45	43	46	58	66	63	59	54	50	50	60	63	68	66	62	57	55	58	65	67
		5	7200	72	69	65	59	54	52	55	66	74	62	68	62	58	59	68	71	76	74	70	65	63	66	74	75
		7,3	10500	75	73	68	62	57	55	58	70	78	75	71	66	62	62	72	75	80	78	74	69	67	70	86	85
1200	200	2	1728	60	57	53	47	42	40	43	54	62	60	56	50	46	47	56	59	64	62	58	53	51	54	62	63
		5	4320	68	66	61	55	50	48	51	63	70	68	64	59	55	55	65	68	73	70	67	62	59	63	70	72
		7,6	6600	72	70	65	59	54	52	55	67	74	72	68	63	59	59	69	72	77	74	71	66	63	67	82	82
1200	400	2	3456	65	62	58	52	46	44	48	59	67	64	60	55	51	52	61	64	69	67	36	58	56	59	67	68
		5	8640	73	71	66	60	55	53	56	68	75	73	69	63	60	60	70	72	78	75	72	67	64	67	75	77
		7,5	12960	77	74	70	64	59	57	60	72	79	77	73	67	63	64	73	76	81	79	75	71	68	71	79	80

*Sound level in dB/octave in relation to 10^{-12}W

Chart 1: Flow noise

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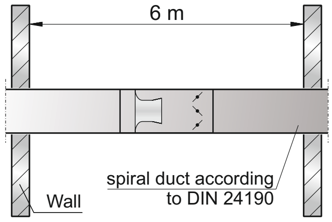
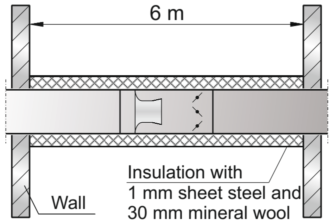
Ref. no.: 401 - 432

Electronically or pneumatically regulating volume flow controller





Width [mm]	Height [mm]	Spiral duct: Corretion value [dB/ocatve]							Summation A-weighted dB(A)	Insulated duct: Corretion value [dB/ocatve]							Summation A-weighted dB(A)
		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
200	100	2	3	4	6	7	8	7	3	4	7	12	16	18	18	16	7
200	200	2	2	3	4	6	7	8	3	4	6	11	14	17	17	17	7
400	100	5	6	8	9	11	10	9	4	7	10	16	19	22	20	18	8
400	200	4	5	6	8	9	11	11	5	6	9	14	18	20	21	20	9
400	400	3	4	5	6	8	9	11	6	5	8	13	16	19	19	20	10
600	100	6	7	9	10	11	11	10	8	8	11	17	20	22	21	19	12
600	200	4	6	7	9	10	12	12	7	6	10	15	19	21	22	21	11
600	300	4	4	6	7	9	10	12	7	6	8	14	17	20	20	21	11
600	400	4	4	6	7	9	10	10	7	6	8	14	17	20	20	19	11
800	200	3	5	6	9	11	13	13	6	5	9	14	19	22	23	22	10
800	300	3	4	5	7	9	11	13	5	5	8	13	17	20	21	22	9
800	400	3	4	5	7	9	11	11	5	5	8	13	17	20	21	20	9
1000	200	3	4	6	11	13	14	13	5	5	8	14	21	24	24	22	9
1000	400	3	4	7	9	12	11	11	6	5	8	15	19	23	21	20	10
1200	200	3	4	6	11	13	14	13	6	5	8	14	21	24	24	22	10
1200	400	3	4	7	9	12	11	11	6	5	8	15	19	23	21	20	10

Table 2: Correction values for calculation of the radiating noise of a pipe 6 m in length

Frequency →	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Summation A-weighted dB(A)
Flow noise according to table 1	60	64	59	53	48	46	43	61
Correction value according to table 2	6	8	14	17	20	20	21	11
Room attenuation according to VDI 2081	4	4	4	4	4	4	4	4
Radiating noise	56	52	41	32	24	22	24	46

Example:

Given: Volume flow controller model VRRME

Width: 600 mm, height: 300 mm

Volume flow 3240 m³/h (= velocity 5 m/s)

Static pressure difference Δp 250 Pa

Radiating noise of a duct (length: 6 m) with integrated volume flow controller and 30 mm insulation?

For room attenuation, the specifications according to VDI 2081 apply.

If air is blown into a room, additional attenuation occurs as a result of the duct outlet attenuation and room attenuation, which results in a reduction of the sound level. The room and outlet attenuation can be calculated according to VDI 2081. As a rough estimate, approx. 8 dB can be deducted. The flow noise is heavily dependent on local conditions, e.g. dimensions of the duct (height, width, length) behind the sound attenuator and the insulation of the duct. The specified data above, which has been acquired in the laboratory, can provide only a reference figure.

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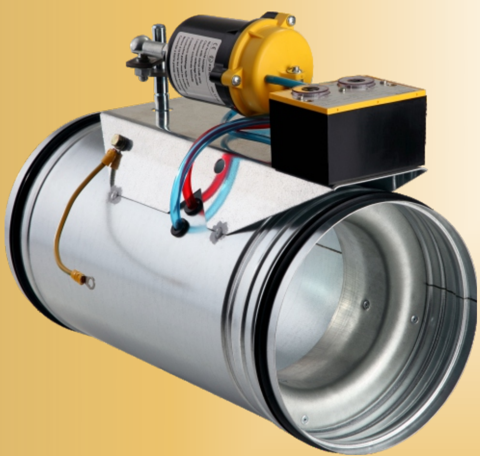
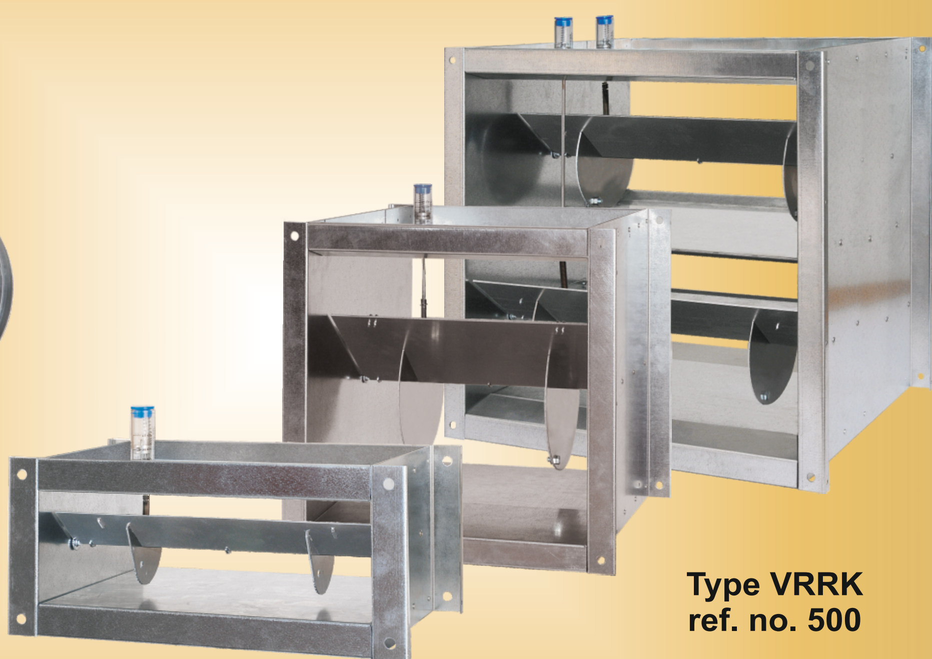
Electronically or pneumatically regulating volume flow controller circular, type VRM



Type VRME
ref. no. 301 - 332

Constant volume flow controller circular and rectangular, self-regulating

Type VRK
ref. no. 233



Type VRRK
ref. no. 500

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