Ref. no.: 301 - 333

Volume flow controller

electronically or pneumatically regulating volume flow controller circular, type VRM

With Lip sealing coupling system

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Electronically or pneumatically regulating volume flow controller

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 regulating flap, which can also serve simultaneously as a shut-off damper, and a nozzle for volume flow measurement incorporated in the pipe body. The nozzle is designed according to the standards 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 adjusts the regulating flap resp. shut-off damper according to the corresponding guidelines via a servomotor. 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” servo-control.

Design

The pipe bodies are manufactured from galvanized steel sheet and are finished as laser-welded pipes. In its endeavour to raise quality levels and increase the airtightness of welded pipe bodies, AEROTECHNIK SIEGWART has been the first company to use laser welding on galvanized steel sheets in serial production. Laser welding has the advantage that the welding seam is airtight over the entire length of the seam and there is no burning of the peripheral areas of the welding seam. As a result, neither subsequent application of sealing compound nor corrosion protection is required. In addition, the laser-welded seam forms a smooth surface with no overlap, which is an important condition for an airtight connection between the push-fit end and the pipe. The pipe bodies are manufactured with Lip sealing. High rigidity is achieved via an all-round stop and stiffening bead. The Lip sealing makes additional sealing of the connection point unnecessary, which is a great advantage precisely in the case of ceiling, wall and corner oriented installation. This also results in a considerable reduction of installation time wherever the device may be connected. Likewise, no unsightly sealing tape is necessary when it is installed in a visible area. The dimensions of the pipe bodies comply with the standard for circular piping components. The diameters are graded in the series R20. As a result, no further size reductions, which could interfere with the piping scheme, are required. The regulating flap, which serves simultaneously as a shut-off damper, is designed as a double disc made from galvanized steel sheet. A continuous sealing disc made of non-ageing and hygienic silicone rubber, or alternatively of EPDM, is located between the steel sheet discs. The shaft runs on friction bearings and is protected against axial displacement by retaining rings. Owing to the design of the bearings, only low torques are required for operation of the regulating flap. Moreover, the axial bearings provide the controller with additional dimensional stability. The nozzle for volume flow measurement is pressed from galvanized steel. Drill holes are provided in the nozzle for recording pressure. The pressure recording points on the overpressure and negative pressure sides, with four respectively 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 with 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. Owing to the shape of the measuring nozzle, the inherent resistance remains low in spite of the high differential pressure. The nozzle is crimped into the pipe body, which, in addition to ensuring firm attachment of the nozzle, increases the rigidity of the pipe body. 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. Furthermore, the controller can be manufactured from stainless steel throughout (material no. 1.4301 and material no. 1.4571), with a polyurethane coating or with powder coating of the pipe body in all RAL-colours. The coated version in conjunction with the Lip sealing is ideal for creating a colourful architectural effect when the installation is visible.

Sealing

The pipe bodies, the axle bearings and the add-on components are designed in such a way that the seal complies with the DIN 12237 standard for circular components. This provides security against leakages and whistling noises. For the operating pressure of up to 1000 Pa and the valid temperature range, a seal according to the requirement of EN 1751 class 4 can be achieved by putting the shut-off disc in the “closed” position.

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Electronically or pneumatically regulating volume flow controller

Measurement principle for velocity recording

The flow rate is recorded via the measuring nozzle and a differential pressure sensor. Owing to the reduced 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 firstly the total pressure of the flow in the pipe and secondly 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 a dynamic version. In the dynamic version, owing to the difference in pressure, a small stream of air flows through the pressure sensor and, in a manner similar to that of a thermal anemometer, the flow rate is measured and processed further as 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.

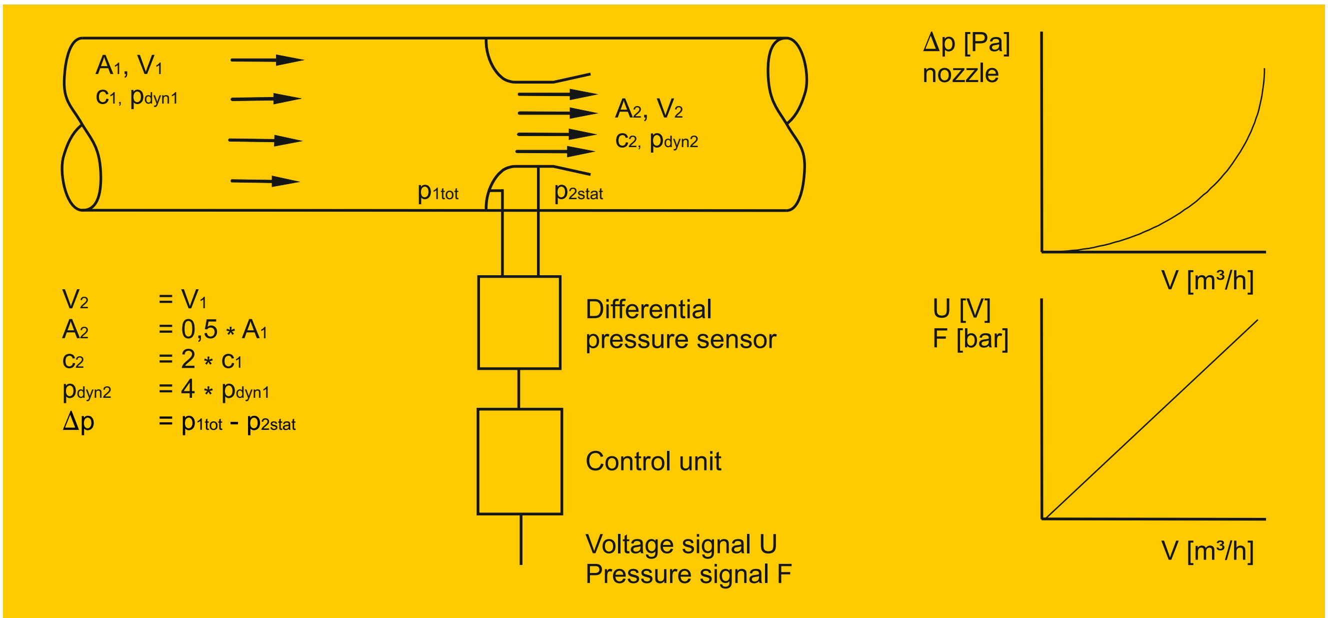

Figure 1: Scheme of velocity measurement

Sensitivity of response and accuracy of control

Owing to the increased flow rate in the measuring nozzle and the resulting high differential pressure, the device achieves great accuracy in control and great sensitivity in response. The controller operates in a stable range of control upwards of the minimum response pressure, which is a function of the volume flow (refer to Diagram 1), up to the maximum pressure difference of 1000 Pa. The flow rate variation over the entire pressure range is ±10 % (up to 100 m³/h ±10 m³/h). 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 redirection occurs or where junctions are made with short approach sections (2,5*NW).

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 expert personnel. 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 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 control components on the device.

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Locations suitable for controller use

Its compact construction guarantees that the air lines can be laid closely adjacent to one another and a uniform overall visual scheme attained precisely where 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 with short blower stream lengths. Greater flow rates can be accommodated by parallel switches.

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

VRME: electronic volume flow controller with analogue control signal

VRMP: pneumatic volume flow controller with pneumatic control signal

Acoustic insulation

For the volume flow controller our silencers can be produced. Combined with silencers the very favorable soothing flows can be created. In addition the insulation shell makes possible to reduce the radiating noise. The insulation shell consists of casing made of galvanized steel sheet and of insulation mat made of mineral wool.

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 piping system and the volume flow controller must be accessible for possible adjustment and maintenance. In addition, the respective manufacturer's instructions apply to the servomotors and controllers.

Installation and storage at building sites

The controller should be simply installed in the piping via the push-fit connector system. If the Lip sealing is used, additional sealing of the connection point will be unnecessary. Only if there are high pressures or volume flows or if piping is installed vertically will it also be necessary to secure the equipment along the axis by using screws or rivets. Consequently, considerable advantages accrue in terms of cost and time. One important prerequisite for trouble-free function is that the piping system be solidly attached and that flexible pipes do not exceed the length recommended in EN 1751 class 4 (VDI ventilation regulations), in order to prevent the pipe from flying where it is flexible and when rapid closing or opening of a shut-off device occurs. Care should likewise be taken during installation that the piping be free from dirt and loose objects, such as rags, newspapers, packaging materials, etc. The volume flow controllers must not be distorted or deformed. It must be ensured, via correct laying of piping, that no cross sectional distortions occur. The components should also be stored where they are protected from major soiling with sand or mortar. Instructions concerning installation and storage are contained in a technical document and should be followed.

Specifications

Electronic volume flow controller, manufactured by Aerotechnik Siegwart, circular construction, laser-welded pipe body with integrated measuring nozzle and top bracket to receive the actuator and controller, pipe body airtight according to DIN 12237, shut-off damper airtight according to EN 1751 class 4, corrosion-protected, with non-ageing rubber, maintenance-free, including factory adjustment and programming of the volume flows and conductance of the controller.

Ordering key

Model:	**303** (or **307 - 333** with servomotor and controller make and model)	
Controller system:	**VRME** or **VRMP**	
NW:	______________________mm	
Volume flow setting:	**min:**__________________m³/h;	**max:** _________m³/h
Differential pressure at controller:	**min:**__________________Pa;	**max:** _________Pa
	Standard control (or **master-slave control)**	
	Dynamic (or **static) pressure sensor**	
Standard version (or **special version)**	(stainless steel, with polyurethane coating or with coloured, powder-coated pipe body)	
Accessories:	Insulating shell, flange connector, combination with attenuator	

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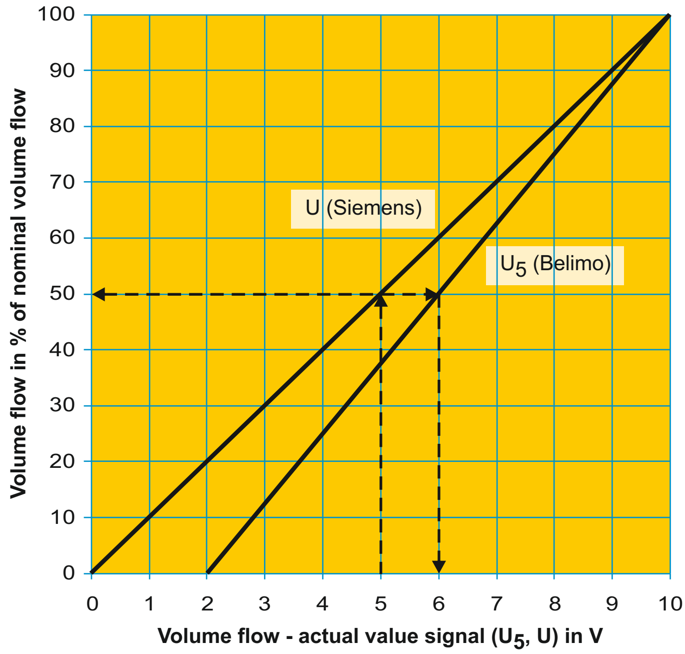

Diagram 2: Relationship between volume flow and actual value signal

Example 1:

Given: Volume flow controller
Model VRME 325
Nominal width 400 mm
Nominal volume flow 4500 m³/h
Actual volume flow 2250 m³/h
corresponding to 50 %

Required: Actual value signal U_5 (Belimo)

Solution according to diagram 2

U_5 = 6 V (Belimo)

Example 2:

Given: Volume flow controller
Model VRME 307
Nominal width NW 400 mm
Nominal volume flow 4500 m³/h
Actual value signal U = 5 V (Siemens)

Required: Actual volume flow

Solution according to diagram 2

Actual volume flow = 50 % of nominal volume flow

50 % of 4500 m³/h = 2250 m³/h

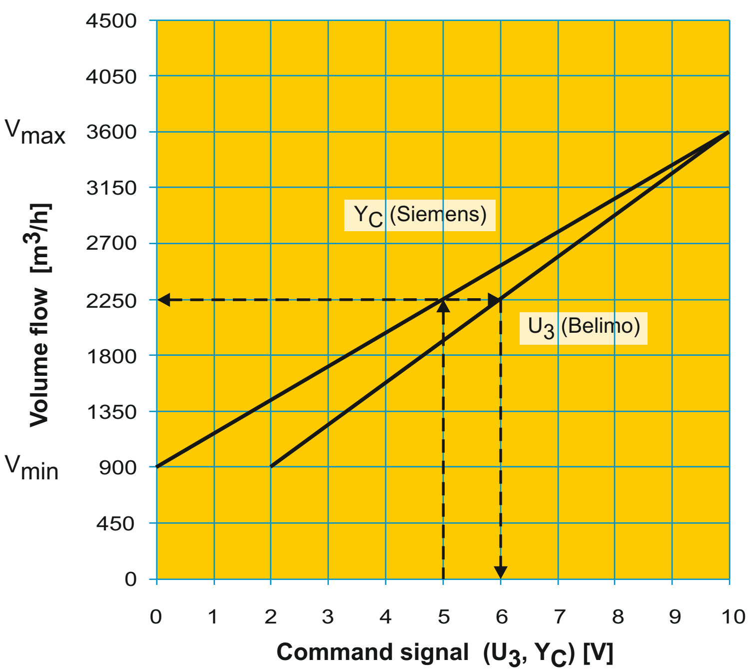

Diagram 3: Volume flow dependent on command signal

Example 3:

Given: Volume flow controller
Model VRME 325
Nominal width NW 400 mm
Maximum volume flow 3600 m³/h
Minimum volume flow 900 m³/h
Target volume flow 2250 m³/h

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

Solution according to diagram 3

U_3 = 6 V (Belimo)

Example 4:

Given: Volume flow controller
Model VRME 307
Maximum volume flow 3600 m³/h
Minimum volume flow 900 m³/h
Command signal Y_C= 5 V (Siemens)

Required: Target volume flow

Solution according to diagram 3

Target volume flow = 2250 m³h

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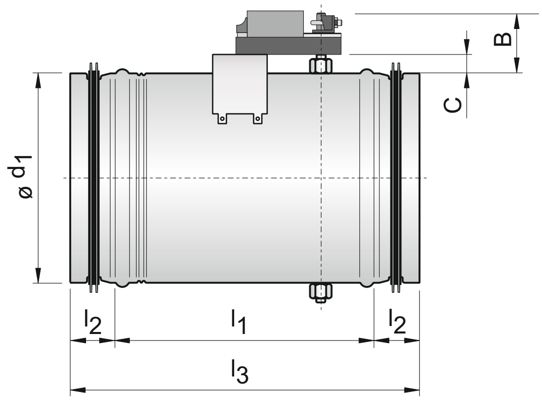
pipe body with male coupling and lip sealing (connection)

Ref. no. 310

$ød_1$ = 100 - 630 mm



Overview 1:

Nominal width ø d_1 [mm]	Selectable velocity V [m/s]	Nominal volume flow V_{nom} [m³/h]	Max. stat. pressure difference) p [Pa]	Dimensions l_1 [mm]	 l_2 [mm]	 l_3 [mm]	 B Ref. no. 325 [mm]	 C [mm]	Weight Ref no. 325 [kg]
100	1,5 - 8,8	250	1000	290	40	370	85	15	3,0
125	1,5 - 9,1	400	1000	290	40	370	85	15	3,3
140	1,5 - 9,9	550	1000	290	40	370	85	15	3,5
150	1,5 - 9,9	630	1000	290	40	370	85	15	3,6
160	1,5 - 9,7	700	1000	300	40	380	85	15	3,8
180	1,5 - 9,8	900	1000	310	40	390	85	15	4,1
200	1,5 - 9,7	1100	1000	320	40	400	85	15	4,5
224	1,5 - 9,9	1400	1000	345	40	425	85	15	5,0
250	1,5 - 9,6	1700	1000	355	40	435	85	15	5,6
280	1,5 - 9,9	2200	1000	385	60	505	85	15	7,3
300	1,5 - 9,3	2500	1000	415	60	535	85	15	8,0
315	1,5 - 10	2800	1000	415	60	535	85	15	8,6
355	1,5 - 9,8	3500	1000	485	60	605	85	15	10,3
400	1,5 - 10	4500	1000	505	80	665	85	15	12,1
450	1,5 - 7,9	4500	1000	582	80	742	85	15	13,7
500	1,5 - 7,2	5100	1000	692	80	852	85	15	15,2
560	1,5 - 7,5	6600	1000	732	80	892	85	15	17,3
630	1,5 - 7,5	8400	1000	792	80	952	85	15	20,3

Special finish in stainless steel, or with powder-coated pipi bodies in RAL-colours. See separate list for colours.

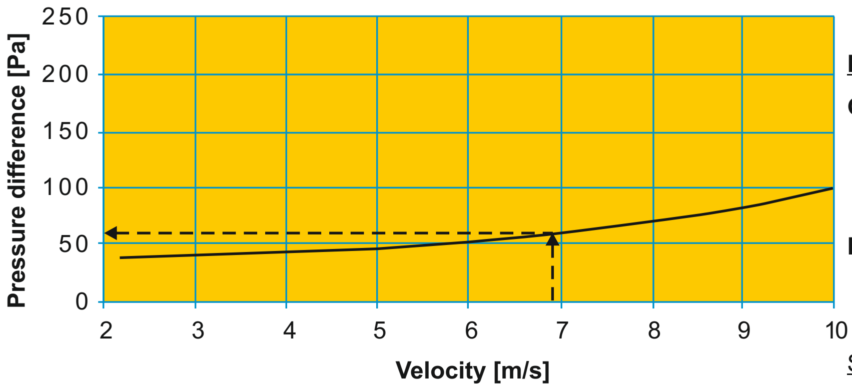


Diagram 1: Static minimum response pressure difference at volume flow controller

Example:

Given: Volume flow controller model VRME
Nominal width NW 160 mm
Volume flow 500 m³/h
(= velocity 6,9 m/s)

Required: static minimum pressure difference

Δp [Pa]

Solution according to diagram 1

Δp = 60 Pa

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Overview 2:

ref. no.	Model	Controller make (manufacturer) and model	Type of pressure sensor	Adjustable volume flow V_{min}	Adjustable volume flow V_{max}	Command signal
301	VRME	**Belimo** controller, sensor and actuator up to NW 355: LMV-M1-MP (5 Nm) from NW 400: NMV-M1-MP (10 Nm) compact controller	static	0% - 100%* V_{nom}	20% - 100% V_{nom}	2V-10V MP-Bus
302	VRME	**Belimo** controller, sensor and actuator up to NW 355: LMV-M1-MOD (5 Nm) from NW 400: NMV-M1-MOD (10 Nm) compact controller	static	0% - 100%* V_{nom} (Vmin ≤ Vmax)	20% - 100% V_{nenn}	2V-10V BACnet, Modbus, MP-Bus
303	VRME	**Sauter** controller, sensor and actuator up to NW 355: ASV205BF132E (5 Nm) from NW 400: ASV215BF132E (10 Nm) compact controller	static	20% - 80%* V_{nom}	30% - 100% V_{nom}	0V-10V BACnet
307	VRME	**Siemens** controller, sensor and actuator up to NW 355: GDB 181.1E/3 (5 Nm) from NW 400: GLB 181.1E/3 (10 Nm) compact controller	dynamic	0% - 100%* V_{nom}	20% - 100% V_{nom}	0V-10V
310	VRME	**Belimo** controller, sensor and actuator up to NW 355: LMV-D3-MP (5 Nm) from NW 400: NMV-D3-MP (10 Nm) compact controller	dynamic	0% - 100%* V_{nom}	20% - 100% V_{nom}	2V-10V MP-Bus
312	VRME	**Schischek** controller and sensor model ExReg-V300-A actuator ExMax-5.10-CY (5/10 Nm)	static	0% - 100%* V_{nom}	30% - 100% V_{nom}	0V-10V
314	VRME	**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
319	VRME	**Belimo** controller, sensor and actuator up to NW 355: LMV-D3-MOD (5 Nm) from NW 400: NMV-D3-MOD (10 Nm) compact controller	dynamic	0% - 100%* V_{nom} (Vmin ≤ Vmax)	20% - 100% V_{nenn}	2V-10V BACnet, Modbus, MP-Bus
325	VRME	**Belimo** controller and sensor VRU-D3-BAC up to NW 355: LM24A-VST (5 Nm, 120 s) from NW 400: NM24A-VST (10 Nm, 120 s) universal controller	dynamic	15% - 100%* V_{nom} (Vmin ≤ Vmax)	20% - 100% V_{nenn}	2V-10V BACnet, Modbus, MP-Bus
326	VRME	**Belimo** controller and sensor VRU-D3-BAC up to NW 355: LMQ24A-VST (4 Nm, 2,4 s) from NW 400: NMQ24A-VST (8 Nm, 4 s) universal controller	dynamic	15% - 100%* V_{nom} (Vmin ≤ Vmax)	20% - 100% V_{nenn}	2V-10V BACnet, Modbus, MP-Bus
327	VRME	**Belimo** controller and sensor VRU-M1-BAC up to NW 355: LM24A-VST (5 Nm, 120 s) from NW 400: NM24A-VST (10 Nm, 120 s) universal controller	static	15% - 100%* V_{nom} (Vmin ≤ Vmax)	20% - 100% V_{nenn}	2V-10V BACnet, Modbus, MP-Bus
328	VRME	**Belimo** controller and sensor VRU-M1-BAC up to NW 355: LMQ24A-VST (4 Nm, 2,4 s) from NW 400: NMQ24A-VST (8 Nm, 4 s) universal controller	static	15% - 100%* V_{nm} (Vmin ≤ Vmax)	20% - 100% V_{nenn}	2V-10V BACnet, Modbus, MP-Bus
332	VRMP	**Sauter** controller model RLP 10 up to NW 250: actuator Typ AK 31 P (1,8 Nm) from NW 280: actuator Typ AK 41 P (3 Nm) from NW 355: actuator Typ AK 42 P (10 Nm)	static	20% - 80%* V_{nom}	30% - 90% V_{nom}	0,2 bar - 1 bar
333	VRMP	**Sauter** controller model RLP 100F003 up to NW 250: actuator Typ AK 31 P (1,8 Nm) from NW 280: actuator Typ AK 41 P (3 Nm) from NW 355: actuator Typ 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 6)

Other controller makes and models are available on demand.

The model VRME 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 2 V - 10 V (Belimo)

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

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Nominal width ø d_1 [mm]	Velocity [m/s]	Volume flow [m^3/h]	Static pressure at controller in Pa																										
			100 Pa								Summation Lwtotal A-weighted [dB(A)]	250 Pa								Summation Lwtotal A-weighted [dB(A)]	500 Pa								Summation Lwtotal A-weighted [dB(A)]
			Oktave power level* Lw [dB/Oktave]									Oktave power level* Lw [dB/Oktave]									Oktave power level* Lw [dB/Oktave]								
			63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
100	2	57	59	53	47	41	35	29	21	17	43	64	58	52	46	41	35	27	22	49	68	62	57	51	45	39	31	26	53
	5	141	68	62	56	50	44	39	33	26	52	74	68	62	56	50	44	38	31	58	78	72	66	60	54	48	42	36	62
	7,5	212	72	66	60	54	49	41	35	30	57	78	72	66	60	54	48	42	36	62	82	76	70	64	58	52	47	40	66
	10	283	75	69	63	57	52	46	40	33	60	81	75	69	63	57	51	45	39	65	85	79	73	67	61	55	50	43	69
125	2	88	60	54	48	42	37	31	23	18	45	66	60	54	48	42	36	28	24	50	70	64	58	52	46	40	33	28	54
	5	221	69	64	58	52	46	40	34	27	54	75	69	63	57	51	46	40	33	60	79	73	67	62	56	50	44	37	64
	7,5	331	74	68	62	56	50	42	38	31	58	79	73	67	62	56	50	44	37	64	83	77	72	66	60	54	48	41	68
	10	442	77	71	65	59	53	47	41	34	61	82	76	70	64	59	53	47	40	67	86	80	75	69	63	57	51	44	71
140	2	111	61	55	49	43	37	31	24	19	45	66	61	55	49	43	37	29	24	51	71	65	59	53	47	41	33	29	55
	5	277	70	64	58	53	47	41	35	28	55	76	70	64	58	52	46	41	34	60	80	74	68	62	56	51	45	38	65
	7,5	416	74	68	63	57	51	45	39	32	59	80	74	68	62	56	51	45	38	64	84	78	72	66	61	55	49	42	69
	10	554	77	71	66	60	54	48	42	35	62	83	77	71	65	59	53	48	41	67	87	81	75	69	64	58	52	45	72
150	2	127	61	55	50	44	38	32	24	19	46	67	61	55	49	43	37	30	25	51	71	65	59	53	48	42	34	29	56
	5	318	71	65	59	53	47	41	35	29	55	76	70	64	59	53	47	41	34	61	80	75	69	63	57	51	45	38	65
	7,5	477	75	69	63	57	51	45	39	33	59	80	74	69	63	57	51	45	38	65	85	79	73	67	61	55	49	43	69
	10	636	78	72	66	60	54	48	43	36	62	83	77	72	66	60	54	48	41	68	88	82	76	70	64	58	52	45	72
160	2	145	62	56	50	44	38	32	25	20	46	67	61	56	50	44	38	30	25	52	71	66	60	54	48	42	34	29	56
	5	362	71	65	59	53	48	42	36	29	56	77	71	65	59	53	47	41	35	61	81	75	69	63	57	51	46	39	65
	7,5	543	75	69	63	58	52	46	40	33	60	81	75	69	63	57	51	46	39	65	85	79	73	67	62	56	50	43	70
	10	724	78	72	66	61	55	49	43	36	63	84	78	72	66	60	54	49	42	68	88	82	76	70	64	59	53	46	73
180	2	183	62	57	51	45	39	33	25	20	47	68	62	56	50	45	39	31	26	53	72	66	61	55	49	43	35	30	57
	5	458	72	66	60	54	48	42	37	30	56	77	72	66	60	54	48	42	35	62	82	76	70	64	58	52	46	40	66
	7,5	687	76	70	64	58	53	47	41	34	61	82	76	70	64	58	52	46	40	66	86	80	74	68	62	56	51	44	70
	10	916	79	73	67	61	55	50	44	37	64	85	79	73	67	61	55	49	42	69	89	83	77	71	65	59	54	47	73
200	2	226	63	57	51	46	40	34	26	21	48	69	63	57	51	45	39	32	27	53	73	67	61	55	49	44	36	31	58
	5	565	73	67	61	55	49	43	37	30	57	78	72	66	61	55	49	43	36	63	82	76	71	65	59	53	47	40	67
	7,5	848	77	71	65	59	53	47	42	35	61	82	76	71	65	59	53	47	40	67	87	81	75	69	63	57	51	44	71
	10	1131	80	74	68	62	56	50	44	38	64	85	79	74	68	62	56	50	43	70	89	84	78	72	66	60	54	47	74
224	2	284	64	58	52	46	40	35	27	22	49	70	64	58	52	46	40	32	27	54	74	68	62	56	50	44	37	32	58
	5	709	73	67	62	56	50	44	38	31	58	79	73	67	61	55	50	44	37	63	83	77	71	65	60	54	48	41	68
	7,5	1064	77	72	66	60	54	48	42	35	62	83	77	71	65	60	54	48	41	68	87	81	76	70	64	58	52	45	72
	10	1419	80	75	69	63	57	51	45	38	65	86	80	74	68	62	57	51	44	71	90	84	78	73	67	61	55	48	75
250	2	353	65	59	53	47	41	35	27	23	49	70	64	59	53	47	41	33	28	55	74	69	63	57	51	45	37	32	59
	5	884	74	68	62	56	51	45	39	32	59	80	74	68	62	56	50	44	38	64	84	78	72	66	60	54	49	42	68
	7,5	1325	78	72	66	61	55	49	43	36	63	84	78	72	66	60	54	49	42	68	88	82	76	70	65	59	53	46	73
	10	1767	81	75	69	64	58	52	46	39	66	87	81	75	69	63	57	52	45	71	91	85	79	73	67	62	56	49	76
280	2	443	65	60	54	48	42	36	28	23	50	71	65	59	53	48	42	34	29	56	75	69	63	58	52	46	38	33	60
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	7,5	1663	79	73	67	61	55	50	44	37	64	85	79	73	67	61	55	49	42	69	89	83	77	71	65	59	54	47	73
	10	2217	82	76	70	64	58	53	47	40	66	87	82	76	70	64	58	52	45	72	92	86	80	74	68	62	56	50	76
300	2	509	66	60	54	48	42	37	29	24	50	71	66	60	54	48	42	34	29	56	76	70	64	58	52	46	38	34	60
	5	1272	75	69	64	58	52	46	40	33	60	81	75	69	63	57	51	46	39	65	85	79	73	67	62	56	50	43	70
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	10	2545	82	77	71	65	59	53	47	40	67	88	82	76	70	64	59	53	46	73	92	86	80	75	69	63	57	50	77
315	2	561	66	60	55	49	43	37	29	24	51	72	66	60	54	48	42	35	30	56	76	70	64	58	53	47	39	34	61
	5	1403	76	70	64	58	52	46	40	34	60	81	75	69	64	58	52	46	39	66	85	80	74	68	62	56	50	43	70
	7,5	2104	80	74	68	62	56	50	45	38	64	85	79	74	68	62	56	50	43	70	90	84	78	72	66	60	54	47	74
	10	2806	83	77	71	65	59	53	47	41	67	88	82	77	71	65	59	53	46	73	93	87	81	75	69	63	57	50	77
355	2	713	67	61	55	49	44	38	30	25	52	73	67	61	55	49	43	35	31	57	77	71	65	59	53	47	40	35	61
	5	1782	76	71	65	59	53	47	41	34	61	82	76	70	64	58	53	47	40	67	86	80	74	69	63	57	51	44	71
	7,5	2672	81	75	69	63	57	51	45	38	65	86	80	74	69	63	57	51	44	71	90	84	79	73	67	61	55	48	75
	10	3563	84	78	72	66	60	54	48	41	68	89	83	77	71	66	60	54	47	74	93	87	82	76	70	64	58	51	78
400	2	905	68	62	56	50	44	38	31	26	52	73	68	62	56	50	44	36	31	58	78	72	66	60	54	48	40	36	62
	5	2262	77	71	65	60	54	48	42	35	62	83	77	71	65	59	53	48	41	67	87	81	75	69	63	58	52	45	72
	7,5	3393	81	75	70	64	58	52	46	39	66	87	81	75	69	63	58	52	45	72	91	85	79	74	68	62	56	49	76
	10	4524	84	78	73	67	61	55	49	42	69	90	84	78	72	66	60	55	48	74	94	88	82	76	71	65	59	52	79
450	2	1145	69	63	57	51	45	39	31	27	53	74	68	62	57	51	45	37	32	59	78	73	67	61	55	49	41	36	63
	5	2863	78	72	66	60	55	49	43	36	63	84	78	72	66	60	54	48	41	68	88	82	76	70	64	58	53	46	72
	7,5	4294	82	76	70	65	59	53	47	40	67	88	82	76	70	64	58	53	46	72	92	86	80	74	68	63	57	50	77
500	2	1414	69	63	58	52	46	40	32	27	54	75	69	63	57	51	46	38	33	59	79	73	67	61	56	50	42	37	64
	5	3534	79	73	67	61	55	49	43	37	63	84	78	73	67	61	55	49	42	69	89	83	77	71	65	59	53	46	73
	7,5	5301	83	77	71	65	59	53	48	41	67	88	83	77	71	65	59	53	46	73	93	87	81	75	69	63	57	51	77
560	2	1773	70	64	58	52	47	41	33	28	55	76	70	64	58	52	46	38	34	60	80	74	68	62	56	50	43	38	64
	5	4433	79	74	68	62	56	50	44	37	64	85	79	73	67	62	56	50	43	70	89	83	78	72	66	60	54	47	74
	7,5	6650	84	78	72	66	60	54	48	42	68	89	83	77	72	66	60	54	47	74	93	88	82	76	70	64	58	51	78
630	2	2244	71	65	59	53	47	41	34	29	55	76	71	65	59	53	47	39	34	61	81	75	69	63	57	51	43	39	65
	5	5611	80	74	69	63	57	51	45	38	65	86	80	74	68	62	56	51	44	70	90	84	78	72	67	61	55	48	75
	7,5	8417	84	79	73	67	61	55	49	42	69	90	84	78	72	66	61	55	48	75	94	88	82	77	71	63	57	52	79

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

Table 1: Flow noise

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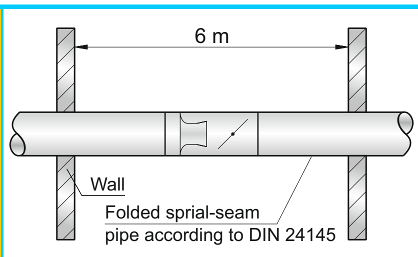
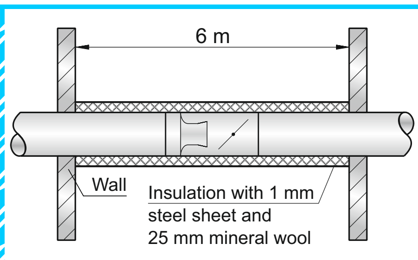
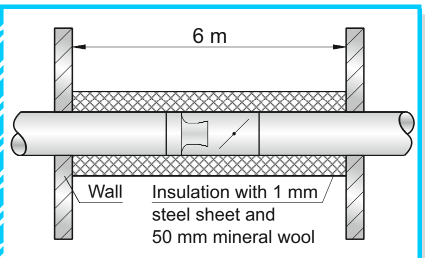
Electronically or pneumatically regulating volume flow controller







Folded sprial-seam pipe according to DIN 24145:

Nominal width ø d1 [mm]	Correction value in db/Oktav 63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Summation A-weighted [dB(A)]
100	15	17	17	17	16	15	14	11	16
125	16	17	18	18	17	16	15	11	16
140	16	17	18	18	18	16	15	12	17
150	16	17	18	18	18	17	16	14	17
160	16	17	19	19	18	17	16	16	17
180	16	17	19	19	18	17	16	14	17
200	16	17	18	18	18	17	16	13	17
224	16	17	18	18	19	16	16	12	17
250	15	16	18	18	18	16	15	13	17
280	15	16	17	17	18	16	15	12	17
300	14	16	17	17	18	16	15	12	16
315	14	15	17	17	18	16	15	12	16
355	13	14	16	16	17	15	14	12	15
400	12	13	14	14	16	14	13	12	14
450	10	11	12	12	15	12	11	11	13
500	8	9	10	10	13	10	9	11	11
560	5	6	7	7	10	7	6	9	7
630	3	5	5	5	7	6	6	8	5

Insulation with 1 mm steel sheet and 25 mm mineral wool:

Nominal width ø d1 [mm]	Correction value in db/Oktav 63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Summation A-weighted [dB(A)]
100	15	18	21	25	24	26	24	20	21
125	16	18	19	18	24	24	25	22	21
140	16	18	20	21	25	25	23	21	22
150	16	18	20	22	26	26	24	23	22
160	17	18	21	21	27	25	26	24	22
180	17	18	21	23	26	26	26	23	22
200	17	18	20	23	26	26	27	21	21
224	17	18	20	23	27	29	24	20	21
250	16	17	20	23	26	28	23	20	21
280	15	16	19	21	26	25	25	21	20
300	14	16	21	21	25	25	24	22	20
315	14	15	20	19	26	25	25	21	19
355	13	14	19	18	25	23	22	20	19
400	13	15	15	16	24	22	21	20	17
450	11	12	14	16	23	20	20	20	17
500	8	10	12	14	21	18	18	19	15
560	5	7	9	11	18	15	14	17	11
630	3	6	7	9	15	15	16	17	9

Insulation with 1 mm steel sheet and 50 mm mineral wool:

Nominal width ø d1 [mm]	Correction value in db/Oktav 63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Summation A-weighted [dB(A)]
100	15	20	23	30	39	38	41	36	33
125	17	20	24	30	37	36	37	34	32
140	17	20	24	29	37	37	35	33	34
150	17	20	25	31	39	37	36	29	34
160	17	20	25	32	38	40	38	31	35
180	18	20	25	32	38	42	32	34	34
200	19	20	24	35	38	37	36	33	34
224	19	20	24	35	39	36	36	32	35
250	17	19	24	35	38	41	35	33	35
280	16	19	23	29	38	36	35	32	35
300	15	19	23	29	38	36	35	32	33
315	14	18	24	29	38	36	35	32	33
355	13	17	22	28	37	36	34	32	33
400	13	16	20	26	36	35	33	32	32
450	11	14	18	24	35	33	31	31	29
500	9	12	16	22	33	30	30	31	28
560	6	9	13	19	30	27	26	30	23
630	4	8	11	17	27	27	26	28	21

Table 2: Correction values for calculation of the radiating noise of a pipe 6 m in length with built-in volume flow controller

Frequency →	Sound level [db/Oktav] 63 Hz	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	71	65	59	53	48	42	36	29	56
Correction value to be deducted according to table 2	17	18	21	21	27	25	26	24	22
Attenuation to be deducted according to VDI 2081	4	4	4	4	4	4	4	4	4
required radiating noise	50	43	34	28	17	13	6	1	30

Example:

Given: Volume flow controller type VRME
Nominal width 160 mm
Volume flow 360 m³/h
(=velocity 5 m/s)
static pressure difference Δp 100 Pa

Required: radiating noise of a distance pipe 6 m in length with built-in volume flow controller and 25 mm insulation

For room attenuation, the specifications according to VDI 2081 are valid.

If air is blown into a room, additional attenuation occurs as a result of the pipe outlet attenuation and room attenuation, thereby resulting in a reduction in 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 very heavily dependent on the local conditions, the radiating pipe length behind the sound absorber and the acoustic insulation and therefore the given data, calculated in the laboratory, can provide only a reference value.

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Electronically or pneumatically regulating volume flow controller

VRM with pneumatic actuation (explosion-proof Ex)

VRM with electronic actuation

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Update status 01.2024