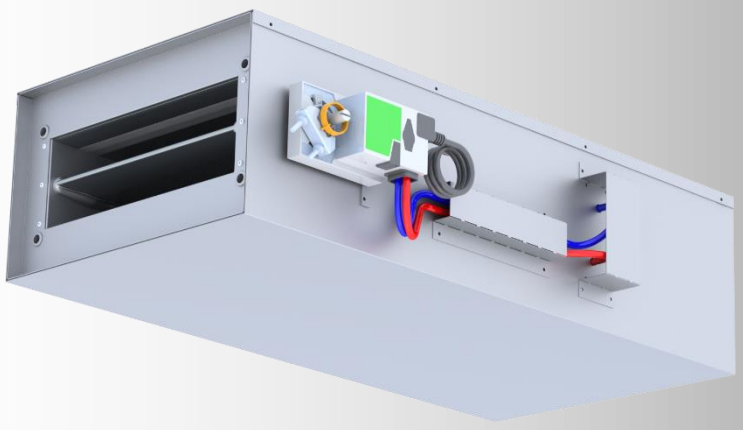
TECHNICAL DOCUMENTATION



VAS

Sound-damped volumetric flow controller

PERFORMANCE DATA

- Operating temperature: 10 - 40° C
- Difference pressure range 50 - 1000 Pa
- Connection voltage for VAS (electronic): 24V DC/AC, ±10%, 50/60 Hz
- Control signal: 0-10 V DC or 2-10 V DC

TESTS AND STANDARDS

- **VDI 6022, Sheet 1**: Hygienic requirements of ventilation and air-conditioning systems
- **DIN EN 13779 (2007):** Ventilation of non-residential buildings
- **Leakage air: DIN EN 1751 (2014-06)**

SPECIAL FEATURES

- Compact dimensions and low height
- Integrated high-performance silencer
- High precision, easy mode of operation and reliable control
- Low pressure losses
- No inflow or outflow distances required.

APPROVALS AND CERTIFICATES

- RoHS 2002/95/EC
- EMC 2004/108/EC
- Low voltage 2006/95/EC
- Machinery Directive 2006/42/EC

SCHAKO KG
Steigstrasse 25-27
D-78600 Kolbingen

Phone +49 (0) 7463-980-0
Fax +49 (0) 7463-980-200
schako.com | info@schako.de

TABLE OF CONTENTS

DESCRIPTION

The sound-damped volumetric flow controller VAS in rectangular design is suitable for use in supply or return air systems for constant and variable volumetric flows at high acoustic requirements. The VAS achieves high control accuracy at any inflow conditions. It can also be used for controlling room or duct pressure.

The VAS fulfills the most stringent tightness requirements as defined by DIN EN 1751. Housing leakage, class C and damper leaf leakage, class 4. The housing consists of galvanised steel with thermo-acoustic insulation and hygienic mineral wool to VDI 6022 and a damper made of extruded aluminium profile with a TPV rubber seal. The differential pressure signal is measured by a measuring cross made of aluminium profiles and is evaluated in the electronic controller.

The control mechanism is simple, robust and safe. It allows high precision, reliability and tightness by using the torque directly on the axis without transfer elements. This reduces the required maintenance activities.

The sound-damped volumetric flow controller type VAS with rectangular connection can be connected to rectangular ducts without special connection elements to DIN EN 1505 or to spiral ducts to DIN EN 1506 via a transition piece.

Due to its optimum aerodynamic flow characteristics, it does not require inflow or outflow distances. Due to the minimal pressure loss, the running operating costs of the ventilation system are also reduced.

The sound-damped volumetric flow controller type VAS-K/VAS-S can already be used at a static pressure difference of as little as 50 Pa, i.e., the duct network and the fan can be designed for small air velocities, This makes the VAS-K/VAS-S suitable for use in low-pressure systems. This makes the VAS-K/VAS-S suitable for use in low-pressure systems.

For reducing the flow generated noise, the type VAS-S can be used, which has an extended silencer unit of higher efficiency. Therefore, no additional silencer is required. The radiated noise can be reduced further by designing the VAS with an acoustic cladding at an extra charge.

The air flow is regulated by using an integrated pneumatic or electronic controller.

The VAS series consists of 5 nominal widths covering a wide range of volumetric flows (-NW 1, -NW 2, -NW 3, -NW 4, -NW 5).

FUNCTION

In VAV systems, the integrated volumetric flow controller VAS can regulate variable volumetric flows between V_{min} and V_{max} as a function of the supply air temperature. A controller compares this value with the setpoint, and the signal of the drive is adjusted, depending on how much it deviates. The actual value can be measured via the output signal.

Setpoints are initially set ex works. During this in-factory setting, the functions of all sound-damped volumetric flow controllers are checked. The maximum deviation of the volumetric flows is +/- 5%, relative to the nominal volumetric flow V_{nenn}, based on a calibration curve of 12 m/sec. At lower flow rates, the deviation in percent may increase.
The volumetric flow setpoints V_{min} and V_{max} can also be altered at the controller at a later stage, even after installation.

The integrated volumetric flow controller allows the volumetric flow in ducts to be kept constant or variable or to be regulated using positive control V_{min}, V_{max} or "CLOSED". The integrated aerodynamically flow-optimised closing profile can be completely opened to achieve a free flow cross-section of almost 100%. This free cross-section, which is as high as possible, reduces pressure losses and minimises flow generated noise.

For the measurement of the differential pressure, SCHAKO is using its measuring principle by means of a measuring cross. 12 measuring points are distributed on this measuring cross according to the median line method. Compared with measuring rods having only 4 measuring points or measuring orifices, this gives optimum measurement results.

FIELD OF APPLICATION

- For supply and return air systems for constant or variable volumetric flows
- Positive control V_{min}, V_{max} or "CLOSED"
- Suitable for constant and variable volumetric flow control, room and duct pressure control
- Differential pressure range from 50 to 1000 Pa
- For air velocities in the silencer gap from 2 - 12 m/s
- For temperature compensations of 10 - 40°C
- For ambient temperatures of 0 - 55°C
- Supply voltage for VAS (electronic): 24 V DC/AC ±10%, 50/60 Hz
- Control signal 0(2) - 10 V DC

ADVANTAGES

- Compact dimensions and low height
- Integrated high-performance silencer
- High precision, easy mode of operation and reliable control
- Optimised for systems of low velocities
- Low pressure losses
- Significant savings in operating costs during installation
- For rectangular and round duct connections
- Low mounting and maintenance expenditure
- No inflow or outflow distances required.

CONSTRUCTION

Housing:
- made of galvanised sheet steel, lined with mineral wool, abrasion-resistant up to an air velocity of 20 m/s in the duct, with textile finishing, hygienically tested according to VDI 6022.

Damper leaves:
- Aluminium profile of aerodynamic design for low pressure loss. Fitted with a TPV rubber seal in an aluminium profile of high resistance to deformation and high temperatures.

Measuring cross:
- made of aluminium round profile containing 12 measuring points

MODEL

VAS-K	-	Compact model (standard)
VAS-S	-	Extended model
VAS-…-1	-	Nominal width 1
VAS-…-2	-	Nominal width 2
VAS-…-3	-	Nominal width 3
VAS-…-4	-	Nominal width 4
VAS-…-5	-	Nominal width 5
VAS-…-Z	-	Supply air (standard)
VAS-…-A	-	Return air
VAS-…-R	-	Mounting direction, right-hand (standard)
VAS-…-L	-	Mounting direction, left-hand
VAS-…-A004	-	with NMV-D3-MP (standard)
VAS-…-A012	-	with VRD3-SO and SF24A-V
VAS-…-A106	-	with RLP100-F003 and AK31P1-F001

OVERVIEW OF PRODUCT VERSIONS

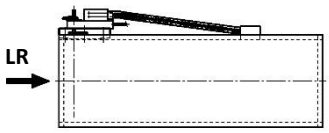


Figure 1: Supply air, left-hand model, top view

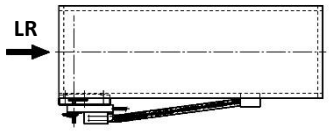


Figure 2: Supply air, right-hand model, top view

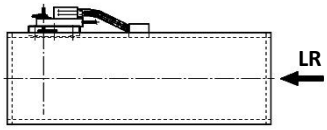


Figure 3: Return air, right-hand model, top view

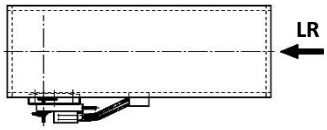


Figure 4: Return air, left-hand model, top view

LR= Air flow direction

ACCESSORIES

Flat-bed acoustic cladding (-FD1):
- Galvanised sheet steel, with sound-absorbing lining.

Heating register (-H2/-H4):
- with 2 or 4 rows of pipes, connection via external thread, operating pressure 8 bar, test pressure 16 bar.
  - Galvanised sheet steel frame
  - Copper pipes
  - Steel collector
  - Aluminium blades

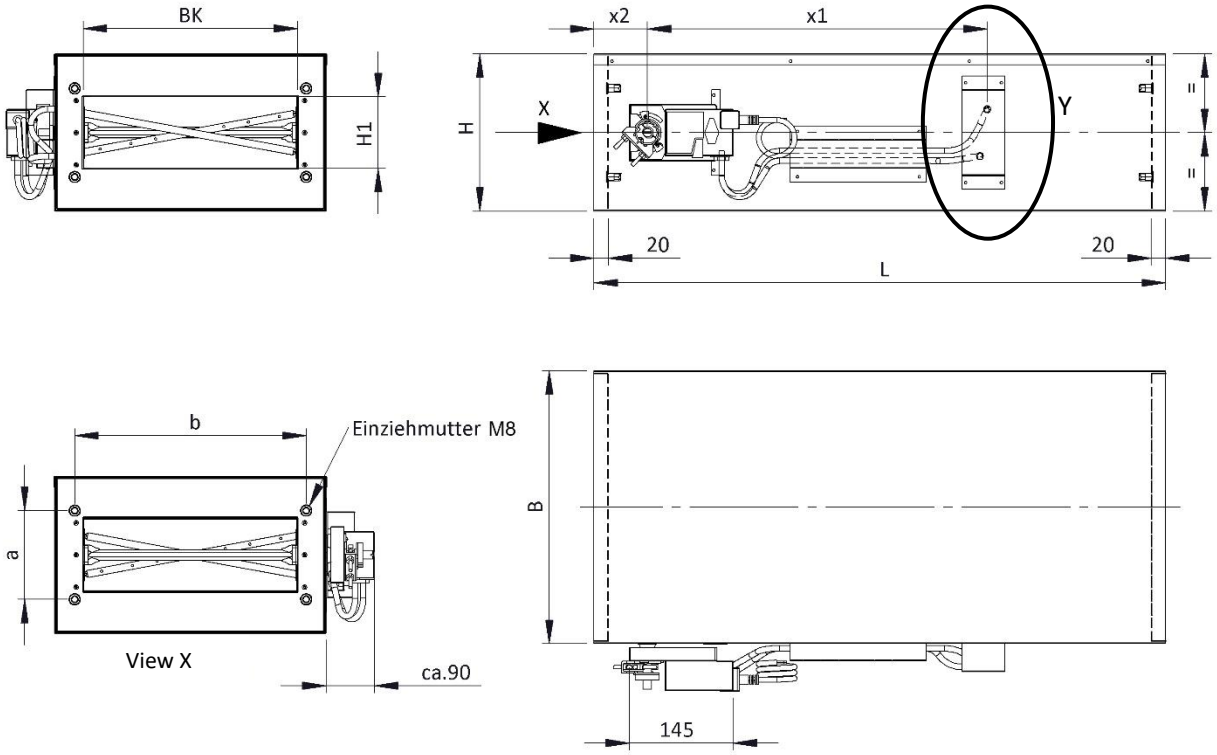
Transition piece:
- (-USR) for round ducts, high-pressure side, made of galvanised sheet steel
- (-USE) for rectangular ducts, high-pressure side, made of galvanised sheet steel

DD coating (-DD):
- for aggressive return air, coated with PUR paint on all sides

Rubber lip seal (-GD1):
- Rubber lip seal for connection spigot (for USR only) for sealed connection between device and duct.

DIMENSIONS AND WEIGHTS

Dimensions VAS



Detail Y

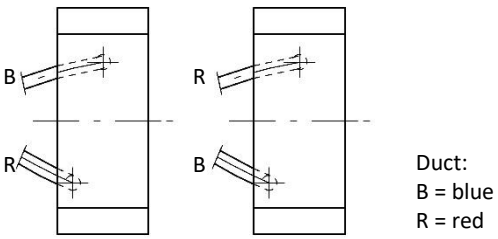


Figure 5: Dimensions VAS

NW	VAS-K (kg)	VAS-S (kg)	+FD1 VAS-K (kg)	+FD1 VAS-S (kg)
1	12.4	18.0	8.4	13.1
2	15.2	21.8	10.0	15.7
3	17.8	26.0	11.7	18.3
4	32.0	47.5	20.9	33.4
5	48.6	72.2	31.4	50.2

Table 1: Weights VAS-K/ VAS-S

NW	L (mm) VAS-K	L (mm) VAS-S	FQ (m^2)	B (mm)	BK (mm)	H (mm)	H1 (mm)	a (mm)	b (mm)	x1 (mm)	x2 (mm)	Number of longitudinal parts VAS-K	Number of longitudinal parts VAS-S
1	800	1250	0.02	284	200	224	100	124	224	480.5	74.5	1	1
2	800	1250	0.03	384	300	224	100	124	324	480.5	74.5	1	1
3	800	1250	0.04	484	400	224	100	124	424	480.5	74.5	1	1
4	1250	2000	0.08	484	400	324	200	224	424	771.5	124.5	1	1
5	1250	2000	0.16	884	800	324	200	224	824	771.5	124.5	1	2

Table 2: Dimensions VAS

DIMENSIONS OF ACCESSORIES

Transition piece (-USR)

Connection to round ducts on high-pressure side for supply air or return air (to DIN EN 1506).

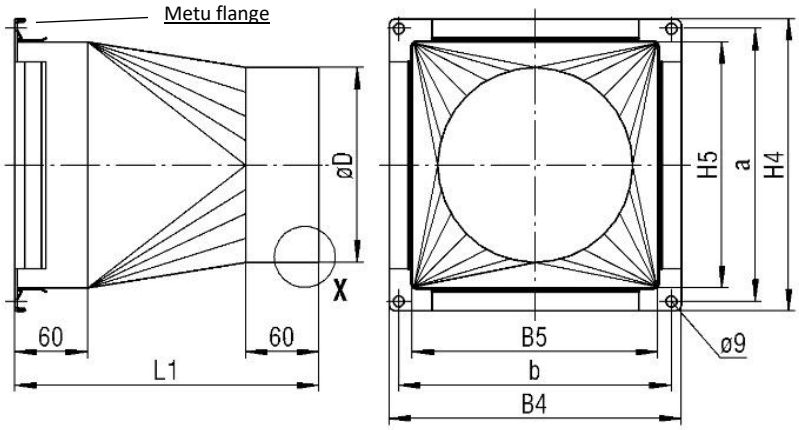


Figure 7: Connection to round ducts on high-pressure side

NW	a (mm)	b (mm)	B4 (mm)	H4 (mm)	B5 (mm)	H5 (mm)	L1 (mm)	ØD (mm)
1	124	224	240	140	200	100	270	160
2	124	324	340	140	300	100	300	200
3	124	424	440	140	400	100	340	250
4	224	424	440	240	400	200	370	355
5	224	824	840	240	800	200	570	500

Table 3: Connection to round ducts on high-pressure side

Rubber lip seal (-GD1, for -USR only)

Detail X:

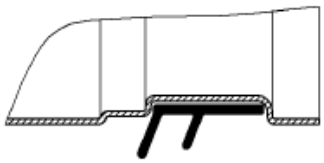


Figure 6 : Rubber lip seal (-GD1)

Transition piece (-USE)

Connection to rectangular ducts for supply air and return air (to DIN EN 1505).

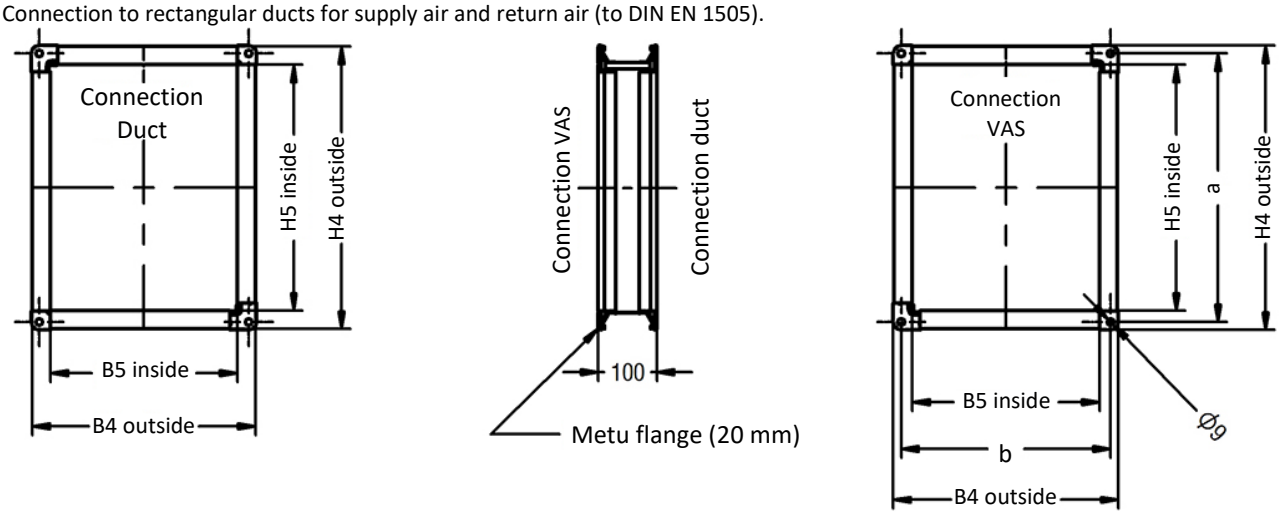


Figure 8: Connection to rectangular ducts

NW	a (mm)	b (mm)	B4 (mm)	H4 (mm)	B5 (mm)	H5 (mm)
1	124	224	240	140	198	98
2	124	324	340	140	298	98
3	124	424	440	140	398	98
4	224	424	440	240	398	198
5	224	824	840	240	798	198

Table 4: Connection to rectangular ducts

Flat-bed acoustic cladding (-FD1)

Integrated into VAS- / VAS-S housing

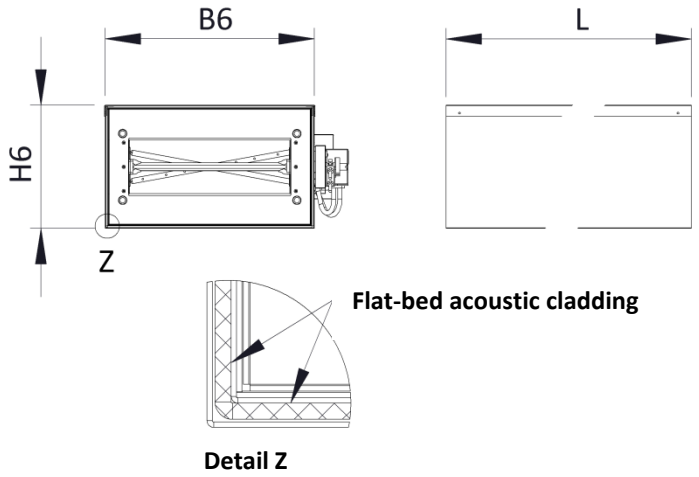


Figure 9: Flat-bed acoustic cladding (-FD1)

NW	L (mm)		B6 (mm)	H6 (mm)
	VAS-K	VAS-S		
1	800	1250	290	230
2	800	1250	390	230
3	800	1250	490	230
4	1250	2000	490	330
5	1250	2000	890	330

Tabel 5: Flat-bed acoustic cladding (-FD1)

Heating register (-H2/-H4)

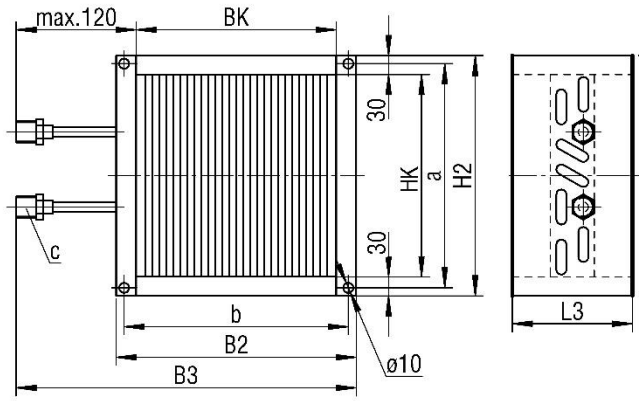


Figure 10: Heating register

NW	B2 (mm)	H2 (mm)	a (mm)	b (mm)	BK (mm)	HK (mm)	B3 (mm)	c (mm)		L3 (mm)		WK (St.)	
								-H2	-H4	-H2	-H4	-H2	-H4
1	260	160	124	224	200	100	380	½“	½“	120	180	1	1
2	360	160	124	324	300	100	480	½“	¾ “	120	180	1	2
3	460	160	124	424	400	100	580	½“	¾ “	120	180	1	2
4	460	260	224	424	400	200	580	¾ “	1“	120	180	2	3
5	860	260	224	824	800	200	980	¾ “	1“	120	180	2	3

Table 6: Heating register

TECHNICAL DATA

Volumetric flow range

NW	V_{ZU}/V_{AB}	electric controller		pneumatic controller	
		V_{min} 2 m/s	V_{max} 12 m/s	V_{min} 3 m/s	V_{max} 12 m/s
1	(m³/h)	144	864	216	864
	[l/s]	40	240	60	240
2	(m³/h)	216	1296	324	1296
	[l/s]	60	360	90	360
3	(m³/h)	288	1728	432	1728
	[l/s]	80	480	120	480
4	(m³/h)	576	3456	864	3456
	[l/s]	160	960	240	960
5	(m³/h)	1152	6912	1728	6912
	[l/s]	320	1920	480	1920

Table 7: Volumetric flow range

Attention, the following specifications are important for programming the volumetric flow controllers:

--- this table merely specifies the complete measuring range of the controller (volumetric flow range), calibration curve 12 m/s
--- If the customer absolutely wants a calibration curve different from 12 m/s, a test has to be made before accepting it!
--- When the air volume drops below the V_{min} shown in the chart, the correct functioning of the volumetric flow controller is no longer guaranteed!
--- If only one air volume is specified in the order (as V_{max} value), the volumetric flow controller will be delivered as variable volumetric flow controller. The V_{min} value will be set to the value specified in the catalogue.
--- If only one air volume is specified in the order (as V_{min} or $V_{konstant}$ value or without specifying a value), then the volumetric flow controller will be delivered as a constant volumetric flow controller. The volume specified in the order is set to the V_{min} value, and the V_{max} value is set to 100%.
--- The air volumes can be changed using setting devices specific for the controller make, depending on the calibration curve set ex works.
--- For the parameter setting of the control components, an air density of 1.2 kg/m³ has been taken into account.
--- The controller of the make Belimo, type VRP, equipped with aneroid diaphragm VFP 300 and the controller VRD3-SO are also delivered with calibration curves of 12 m/s.
--- Belimo compact controllers are height-compensated. They are calibrated ex works to the system height in question.
--- If no system height is given in the order, the controllers will be calibrated to the altitude of the delivery address.
--- If no volumetric flows are specified, they will be set to the values in table 7.

For correct operation of the controller, please note that an additional 5 Pa must be added to the static minimum pressure difference during parameter setting.

Static minimum pressure difference

NW	v_k (m/s)	V_{min}/V_{maz}		$\Delta p_{t\,min}$ (Pa)	
		(m³/h)	[l/s]	VAS-K	VAS-S
1	3	216	60	4	4
	6	432	120	13	15
	9	648	180	29	32
	12	864	240	50	54
2	3	324	90	3	3
	6	648	180	9	11
	9	972	270	20	23
	12	1296	360	35	39
3	3	432	120	2	2
	6	864	240	9	9
	9	1296	360	19	20
	12	1728	480	34	35
4	3	864	240	1	4
	6	1728	480	4	5
	9	2592	720	9	12
	12	3456	960	15	21
5	3	1728	480	2	2
	6	3456	960	6	7
	9	5184	1440	14	16
	12	6912	1920	24	29

Table 8: Static minimum pressure difference

Insertion loss

to DIN EN ISO 7235

NW		D_e (dB/Okt) f (Hz)							
		63	125	250	500	1000	2000	4000	8000
VAS-K	1	2	9	14	25	33	36	27	15
	2	2	7	12	24	30	33	25	15
	3	1	7	12	23	29	31	25	14
	4	1	5	12	28	32	32	31	20
	5	1	4	10	25	28	28	28	19
VAS-S	1	3	13	21	39	51	56	42	23
	2	2	11	19	37	47	51	40	23
	3	2	10	18	36	45	48	39	22
	4	1	8	19	44	50	51	49	32
	5	1	6	16	41	44	44	45	31

Flow generated noise

VAS-K-Z (supply air)

NW	v_K	V_{ZU}		Δp_t = 50 Pa									Δp_t = 150 Pa									Δp_t = 250 Pa								
				L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]
	(m/s)	(m³/h)	[l/s]	63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000	
1	3	216	60	42	35	26	15	<15	16	28	27	**32**	46	43	36	27	23	24	26	26	**34**	48	45	40	31	26	25	26	27	**36**
	6	432	120	51	45	37	29	23	24	26	26	**36**	53	52	44	34	28	25	26	27	**40**	54	55	48	37	30	26	26	27	**43**
	9	648	180	56	52	46	39	34	32	27	26	**43**	58	58	50	41	35	32	27	27	**46**	58	60	54	43	37	34	28	28	**49**
	12	864	240	---	---	---	---	---	---	---	---	**---**	62	62	55	48	42	40	35	28	**52**	62	65	58	49	43	41	35	30	**54**
2	3	324	90	44	36	28	21	22	24	25	26	**32**	46	43	36	28	24	24	25	26	**34**	49	44	39	34	30	25	26	28	**37**
	6	648	180	52	46	38	31	26	25	25	26	**36**	54	52	45	35	29	26	26	27	**41**	54	54	48	39	33	29	27	28	**44**
	9	972	270	57	53	46	39	35	33	28	27	**43**	60	58	51	42	37	34	28	27	**47**	60	61	54	44	39	36	30	30	**50**
	12	1296	360	60	59	53	47	43	42	35	30	**51**	65	63	56	49	45	43	36	32	**53**	65	66	59	50	46	44	37	35	**55**
3	3	432	120	47	38	32	22	23	24	25	26	**33**	55	45	39	32	28	25	19	18	**37**	59	47	42	36	33	29	22	25	**40**
	6	864	240	54	47	42	31	28	25	25	26	**38**	58	54	48	38	34	28	19	22	**44**	60	56	51	42	38	31	24	28	**47**
	9	1296	360	59	54	50	39	35	29	26	27	**45**	62	60	54	44	41	33	23	27	**50**	62	62	57	48	43	36	28	32	**52**
	12	1728	480	60	57	55	46	41	37	31	28	**50**	67	64	59	51	46	40	33	31	**55**	67	67	61	53	48	42	35	35	**57**
4	3	864	240	50	40	31	22	19	21	23	24	**31**	55	49	43	33	24	22	23	24	**39**	56	53	47	38	30	24	24	25	**42**
	6	1728	480	57	51	43	35	31	26	23	24	**40**	64	57	49	41	33	29	24	25	**46**	66	61	53	44	37	33	29	27	**50**
	9	2592	720	64	58	52	45	40	38	30	24	**49**	69	63	56	48	42	40	32	28	**52**	73	66	59	50	44	42	35	31	**55**
	12	3456	960	70	63	59	52	49	47	40	33	**56**	74	68	62	54	50	48	42	36	**59**	78	70	64	56	50	49	43	38	**60**
5	3	1728	480	53	45	35	26	20	21	23	24	**34**	57	53	46	38	29	23	24	26	**42**	58	57	51	43	36	27	29	32	**47**
	6	3456	960	65	56	47	38	33	30	23	24	**45**	68	60	52	43	38	34	29	30	**49**	69	64	56	47	41	38	34	35	**53**
	9	5184	1440	73	63	56	48	44	42	33	27	**54**	75	66	59	50	46	44	36	35	**56**	77	69	61	52	48	46	40	40	**58**
	12	6912	1920	79	69	64	56	54	57	52	40	**63**	81	71	67	59	54	52	48	38	**63**	83	72	66	58	53	50	46	45	**63**

--- = value below the static minimum pressure difference

<15 = Values below 15 dB

Table 9: Flow generated noise VAS-K-Z

Flow generated noise

VAS-K-A (return air)

NW	v_K	V_{ZU}		Δp_t = 50 Pa									Δp_t = 150 Pa									Δp_t = 250 Pa								
				L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]
	(m/s)	(m³/h)	[l/s]	63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000	
1	3	216	60	45	33	26	21	22	24	25	26	**32**	45	41	35	25	23	24	25	26	**34**	48	42	37	30	25	25	26	27	**35**
	6	432	120	50	39	32	23	24	25	25	26	**33**	53	47	38	29	24	24	26	26	**36**	52	52	42	33	26	24	26	27	**40**
	9	648	180	52	37	38	37	34	27	25	25	**39**	53	49	43	38	34	30	28	27	**41**	60	57	46	38	34	28	27	27	**44**
	12	864	240	---	---	---	---	---	---	---	---	**---**	46	40	49	46	43	40	31	30	**48**	57	56	50	46	42	36	35	33	**48**
2	3	324	90	46	33	26	21	22	24	25	26	**32**	51	42	35	26	23	24	25	26	**34**	54	44	37	33	29	26	26	26	**37**
	6	648	180	54	43	34	24	23	21	24	24	**34**	56	50	40	30	26	25	26	26	**38**	58	54	44	35	28	25	26	26	**42**
	9	972	270	50	41	40	37	33	30	26	25	**39**	57	52	45	38	35	32	29	28	**43**	62	59	48	40	35	32	29	28	**47**
	12	1296	360	59	51	48	46	44	42	36	34	**49**	54	44	51	48	46	45	39	36	**51**	61	59	52	47	44	42	36	35	**51**
3	3	432	120	46	37	30	22	23	24	26	26	**33**	54	44	38	34	26	25	26	26	**37**	58	46	41	38	31	26	26	27	**40**
	6	864	240	48	39	35	28	25	25	26	26	**34**	59	53	44	33	26	25	26	26	**41**	60	58	48	38	32	26	28	28	**45**
	9	1296	360	51	45	43	35	32	31	29	29	**40**	59	55	48	38	34	30	29	29	**44**	64	62	53	41	36	31	30	29	**49**
	12	1728	480	45	53	47	46	42	39	35	36	**48**	57	46	51	46	43	40	36	39	**49**	65	61	55	46	43	39	35	37	**52**
4	3	864	240	50	35	26	18	19	21	23	24	**30**	56	46	38	25	20	22	23	24	**36**	58	50	43	32	23	23	23	24	**39**
	6	1728	480	51	45	38	34	29	23	21	22	**36**	58	51	43	37	31	25	24	23	**41**	63	56	47	38	31	27	24	24	**44**
	9	2592	720	55	46	45	45	40	37	31	31	**46**	61	53	49	46	42	38	32	31	**48**	66	59	52	47	43	38	33	32	**50**
	12	3456	960	55	43	53	54	52	46	41	40	**56**	62	52	55	54	53	47	41	41	**57**	68	60	56	54	52	47	41	40	**56**
5	3	1728	480	52	41	34	26	21	21	23	24	**33**	55	50	43	30	23	21	23	24	**39**	58	54	48	35	26	22	24	25	**43**
	6	3456	960	58	50	41	37	33	25	21	21	**40**	63	55	47	40	34	28	24	24	**44**	66	59	52	41	36	28	27	27	**48**
	9	5184	1440	66	53	51	48	44	40	31	26	**50**	69	58	53	49	45	40	33	29	**52**	71	62	55	49	45	40	34	31	**53**
	12	6912	1920	70	59	63	51	52	47	46	37	**58**	73	62	62	56	55	49	45	46	**60**	75	62	60	59	53	51	45	38	**60**

--- = value below the static minimum pressure difference

<15 = Values below 15 dB

Table 10: Flow generated noise VAS-K-A

Flow generated noise

VAS-S-Z (supply air)

NW	v_K	V_{ZU}		Δp_t = 50 Pa									Δp_t = 150 Pa									Δp_t = 250 Pa								
				L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]
	(m/s)	(m³/h)	[l/s]	63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000	
1	3	216	60	42	35	28	18	20	22	22	23	**29**	46	40	33	24	21	21	22	23	**32**	48	42	36	29	25	21	22	23	**34**
	6	432	120	49	43	34	27	23	21	22	23	**33**	51	49	40	30	24	21	22	23	**37**	51	51	45	34	27	21	22	23	**40**
	9	648	180	54	49	41	36	33	29	22	23	**40**	56	55	47	38	35	31	23	23	**44**	57	58	50	40	35	31	24	23	**46**
	12	864	240	---	---	---	---	---	---	---	---	**---**	61	60	52	44	42	40	32	25	**50**	60	62	55	45	42	39	32	25	**51**
2	3	324	90	43	36	27	18	19	21	23	23	**29**	46	42	34	23	20	22	23	24	**32**	51	43	37	29	24	22	23	23	**34**
	6	648	180	51	44	36	28	23	21	22	23	**34**	54	50	42	31	25	21	23	25	**38**	54	52	45	35	27	22	22	23	**41**
	9	972	270	56	50	44	36	33	29	25	23	**41**	60	56	48	38	34	29	25	26	**45**	59	59	51	40	35	30	24	24	**47**
	12	1296	360	60	55	50	44	42	40	32	25	**48**	65	61	54	45	42	40	32	25	**51**	64	63	55	46	43	39	32	25	**52**
3	3	432	120	49	36	29	19	19	21	23	23	**30**	56	42	36	27	23	22	23	23	**35**	61	47	40	32	29	24	23	24	**39**
	6	864	240	56	45	37	26	21	21	22	23	**35**	59	51	43	31	25	21	23	23	**40**	61	54	47	36	31	24	24	24	**43**
	9	1296	360	60	52	47	35	31	28	24	23	**42**	63	57	50	38	34	29	24	24	**46**	63	60	53	40	36	31	26	24	**48**
	12	1728	480	61	56	55	43	41	39	32	25	**50**	69	62	57	45	41	39	32	25	**52**	68	65	58	46	42	39	33	26	**53**
4	3	864	240	50	40	31	23	20	22	23	24	**32**	57	50	41	30	22	22	23	24	**38**	58	53	46	35	26	22	23	24	**42**
	6	1728	480	58	50	41	31	23	21	23	24	**38**	64	56	48	35	26	22	23	24	**44**	68	60	51	39	30	23	24	24	**48**
	9	2592	720	64	57	49	39	34	31	25	24	**46**	70	62	53	42	35	31	25	24	**50**	74	65	56	44	36	32	26	25	**53**
	12	3456	960	70	62	56	47	42	40	34	27	**52**	74	66	59	49	43	41	35	28	**55**	79	69	61	51	43	40	35	28	**58**
5	3	1728	480	52	46	34	26	21	22	24	24	**34**	56	52	44	33	25	23	24	25	**40**	57	56	49	38	29	23	24	25	**44**
	6	3456	960	64	56	47	34	28	22	23	24	**44**	67	60	50	37	30	25	24	25	**47**	70	63	54	41	33	27	25	26	**50**
	9	5184	1440	72	63	55	42	39	35	28	25	**52**	75	65	57	44	40	36	28	26	**54**	78	68	59	46	42	38	30	28	**56**
	12	6912	1920	79	68	58	51	44	43	43	27	**58**	81	69	64	55	51	57	37	27	**63**	85	71	64	53	54	56	42	31	**64**

--- = value below the static minimum pressure difference

<15 = Values below 15 dB

Table 11: Flow generated noise VAS-S-Z

Flow generated noise

VAS-S-A (return air)

NW	v_K	V_{ZU}		Δp_t = 50 Pa									Δp_t = 150 Pa									Δp_t = 250 Pa								
				L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]
	(m/s)	(m³/h)	[l/s]	63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000	
1	3	216	60	45	38	29	17	<15	18	22	17	**29**	49	39	32	23	20	21	22	23	**31**	48	40	34	28	25	23	23	23	**33**
	6	432	120	51	35	30	24	23	21	23	23	**32**	52	44	36	28	24	21	22	23	**34**	52	50	40	32	26	22	23	23	**38**
	9	648	180	47	36	39	35	34	28	26	26	**39**	54	46	41	38	35	31	27	25	**41**	58	54	43	38	35	31	27	25	**43**
	12	864	240	---	---	---	---	---	---	---	---	**---**	56	45	48	44	40	38	40	36	**48**	59	53	48	46	43	39	35	34	**49**
2	3	324	90	43	31	24	17	19	21	23	23	**29**	49	39	31	22	19	21	22	23	**31**	52	41	33	29	27	23	23	23	**34**
	6	648	180	54	40	33	27	25	22	22	23	**33**	55	46	37	30	26	22	22	23	**36**	56	51	40	33	27	23	23	23	**39**
	9	972	270	47	36	41	40	33	29	26	25	**40**	55	48	43	39	36	31	27	26	**42**	61	56	46	40	35	31	27	26	**44**
	12	1296	360	50	48	47	48	39	35	34	35	**48**	56	43	51	50	43	39	35	35	**50**	60	55	50	49	45	41	36	34	**51**
3	3	432	120	46	34	27	19	19	21	23	23	**30**	53	42	37	29	23	22	20	23	**34**	56	44	39	35	30	24	23	24	**38**
	6	864	240	55	43	33	25	22	18	21	22	**33**	56	50	41	32	26	22	<15	23	**38**	58	54	47	37	30	23	23	23	**43**
	9	1296	360	47	42	42	37	34	30	27	25	**40**	58	51	46	40	36	32	28	26	**44**	64	58	50	41	37	32	28	26	**47**
	12	1728	480	42	33	48	47	44	40	36	35	**49**	55	48	53	48	44	41	37	38	**51**	64	58	53	48	44	41	36	35	**51**
4	3	864	240	51	39	29	19	17	19	22	23	**31**	55	44	36	26	21	23	23	24	**35**	59	48	41	31	24	24	24	24	**38**
	6	1728	480	52	42	36	33	29	22	22	23	**36**	58	48	41	36	30	25	24	24	**39**	62	53	45	37	31	27	25	24	**43**
	9	2592	720	55	46	45	43	38	36	32	32	**45**	61	51	47	45	40	36	32	32	**47**	66	55	49	46	42	37	33	32	**48**
	12	3456	960	60	48	51	52	50	43	39	39	**54**	64	53	54	53	51	45	40	40	**55**	68	57	54	52	50	46	40	41	**55**
5	3	1728	480	54	41	29	23	21	23	24	24	**33**	55	47	38	28	22	22	24	24	**36**	57	51	42	32	25	23	24	25	**39**
	6	3456	960	62	50	43	40	34	26	24	24	**43**	64	53	45	40	35	27	24	24	**44**	66	57	48	41	35	28	25	25	**46**
	9	5184	1440	69	57	53	49	46	33	31	26	**52**	70	59	54	50	45	39	34	30	**52**	71	62	55	50	45	39	34	31	**53**
	12	6912	1920	74	62	59	50	53	39	42	29	**57**	75	65	64	58	54	49	45	48	**61**	76	65	62	57	56	49	43	45	**61**

--- = value below the static minimum pressure difference

<15 = Values below 15 dB

Table 12: Flow generated noise VAS-S-A

Radiated noise

VAS-...-Z / -...-A

NW	v_K	V_{ZU}		Δp_t = 50 Pa									Δp_t = 150 Pa									Δp_t = 250 Pa								
				L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]
	(m/s)	(m³/h)	[l/s]	63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000	
1	3	216	60	42	36	25	19	17	19	19	20	**27**	51	41	33	27	22	19	19	20	**32**	54	44	37	32	29	22	19	20	**36**
	6	432	120	51	45	34	24	18	18	19	20	**33**	55	50	42	32	26	21	19	20	**38**	57	52	45	36	32	24	19	20	**41**
	9	648	180	57	53	41	33	23	19	19	20	**40**	59	57	48	37	30	22	19	20	**44**	60	59	51	41	35	27	20	20	**47**
	12	864	240	60	59	49	41	29	21	19	20	**46**	61	62	52	43	34	26	20	20	**49**	63	62	55	46	39	30	21	20	**51**
2	3	324	90	45	33	24	18	18	18	19	20	**27**	52	36	31	27	23	19	19	20	**31**	56	41	36	34	27	25	19	20	**36**
	6	648	180	53	38	29	21	17	18	19	20	**31**	56	45	40	30	24	19	19	20	**36**	58	47	44	35	29	24	19	20	**39**
	9	972	270	59	46	40	29	21	18	19	20	**37**	60	51	46	35	27	22	19	20	**41**	61	53	49	39	32	25	19	26	**44**
	12	1296	360	64	52	47	37	30	22	19	20	**43**	64	56	50	40	33	26	20	20	**46**	65	57	53	43	36	28	21	28	**48**
3	3	432	120	46	34	28	19	18	18	19	20	**28**	55	38	35	28	24	22	19	20	**33**	57	43	38	33	31	26	21	20	**37**
	6	864	240	53	39	35	23	19	18	19	20	**32**	55	46	43	32	26	21	20	20	**38**	58	49	46	37	31	26	20	20	**41**
	9	1296	360	54	45	44	30	22	19	20	21	**38**	59	51	48	37	28	22	20	21	**43**	61	54	51	41	33	25	20	20	**46**
	12	1728	480	56	50	50	37	25	19	19	20	**43**	62	55	53	44	33	24	21	21	**47**	63	58	55	46	36	26	20	20	**49**
4	3	864	240	48	39	28	22	18	18	19	20	**29**	55	48	40	33	26	19	20	20	**37**	59	50	44	37	32	25	20	20	**41**
	6	1728	480	55	48	36	28	22	18	22	20	**36**	63	54	45	37	29	21	20	20	**42**	64	58	50	41	34	24	20	21	**46**
	9	2592	720	62	53	43	36	25	19	20	20	**41**	69	59	50	41	32	24	20	21	**48**	72	63	54	45	37	28	20	21	**52**
	12	3456	960	68	58	50	44	33	26	21	21	**48**	74	63	54	47	36	28	21	21	**53**	77	66	58	50	40	31	22	21	**56**
5	3	1728	480	48	44	34	26	18	18	19	20	**32**	54	51	45	38	28	22	19	20	**41**	61	55	50	42	35	27	21	21	**46**
	6	3456	960	58	51	43	32	29	23	19	21	**40**	63	56	49	39	31	25	20	21	**45**	64	61	55	45	37	27	21	21	**50**
	9	5184	1440	65	57	50	42	39	35	23	21	**47**	67	59	50	43	39	35	23	21	**48**	71	65	56	47	40	36	23	21	**53**
	12	6912	1920	71	62	52	46	50	38	21	22	**53**	60	61	47	47	45	43	28	19	**51**	77	68	55	50	46	43	28	22	**56**

Table 13: Radiated noise VAS-K-Z / VAS-S-Z / VAS-K-A / VAS-S-A

Radiated noise

VAS-…-Z-FD1 / -…-A-FD1

NW	v_K	V_{ZU}		Δp_t = 50 Pa									Δp_t = 150 Pa									Δp_t = 250 Pa								
				L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]	L_w (dB/Okt) f_m (Hz)								L_{wA} [dB(A)]
	(m/s)	(m³/h)	[l/s]	63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000	
1	3	216	60	42	34	22	17	17	18	19	20	**27**	51	37	28	22	18	17	19	20	**30**	55	41	31	27	25	19	19	20	**33**
	6	432	120	52	41	29	19	17	17	19	20	**30**	55	47	37	26	22	18	19	20	**35**	57	50	40	31	27	20	19	20	**38**
	9	648	180	57	50	37	27	15	18	19	20	**37**	58	54	43	32	26	19	19	20	**41**	60	56	46	36	31	22	19	20	**43**
	12	864	240	60	57	43	35	19	19	19	20	**43**	62	60	48	37	30	21	19	20	**46**	63	60	50	41	35	26	20	20	**47**
2	3	324	90	43	30	23	17	16	17	19	20	**26**	52	35	28	24	20	18	19	20	**30**	55	41	31	31	24	22	19	20	**34**
	6	648	180	52	37	28	19	17	17	19	20	**30**	54	43	36	26	22	18	19	20	**34**	57	47	39	32	27	22	19	20	**37**
	9	972	270	56	46	36	25	21	18	19	20	**35**	57	50	41	31	26	21	19	20	**38**	59	52	44	35	30	22	19	20	**41**
	12	1296	360	61	51	41	32	26	21	19	20	**40**	61	55	46	36	30	24	20	20	**43**	62	56	49	39	33	26	21	20	**45**
3	3	432	120	49	32	25	19	17	18	19	20	**28**	54	37	28	25	22	21	20	21	**32**	56	42	31	31	28	24	20	20	**35**
	6	864	240	52	37	28	20	18	18	19	20	**30**	55	45	36	28	24	20	19	20	**35**	58	48	39	34	29	25	20	20	**38**
	9	1296	360	55	44	35	25	20	19	19	20	**34**	58	50	42	33	26	20	20	20	**39**	59	53	45	37	31	23	20	20	**42**
	12	1728	480	57	47	42	31	23	19	19	20	**38**	62	55	46	39	31	20	20	20	**43**	62	57	49	42	34	24	20	20	**46**
4	3	864	240	49	36	25	19	17	18	20	20	**29**	55	45	36	29	22	18	20	20	**35**	58	48	41	34	29	22	20	20	**39**
	6	1728	480	55	46	32	23	19	19	20	20	**34**	63	50	41	31	25	19	20	20	**40**	65	55	46	37	30	20	20	20	**44**
	9	2592	720	62	49	39	30	23	19	20	20	**39**	69	55	45	36	28	20	20	20	**45**	72	59	49	41	32	23	20	21	**49**
	12	3456	960	67	54	45	37	30	23	20	20	**44**	73	59	48	42	32	25	20	21	**49**	77	62	52	45	35	26	21	21	**53**
5	3	1728	480	48	41	27	24	21	19	20	21	**31**	55	49	40	36	25	20	20	21	**38**	62	54	46	39	33	25	20	21	**43**
	6	3456	960	58	48	37	33	29	23	21	21	**37**	62	51	43	37	30	22	20	21	**41**	64	58	51	42	34	25	21	21	**47**
	9	5184	1440	64	55	46	42	40	34	25	22	**46**	69	58	48	43	39	34	25	21	**48**	71	63	52	44	39	35	23	21	**51**
	12	6912	1920	69	60	55	50	50	44	39	23	**54**	75	64	52	49	47	44	29	18	**54**	77	66	53	48	53	45	28	20	**57**

Table 14: Radiated noise VAS-K-Z-FD1 / VAS-S-Z-FD1 / VAS-K-A-FD1 / VAS-S-A-FD1

Heating register (-H2), two-row

				T_E = 15°C, T_W = 70-50 °C		
NW	V_{min}/V_{max}		PA_L	Q	Pa_W	V_W
	(m³/h)	[l/s]	(Pa)	(kW)	(kPa)	[l/h]
1	216	60	28	0.9	0.2	38
	432	120	87	1.2	0.3	54
	648	180	169	1.5	0.5	64
	864	240	270	1.6	0.6	72
2	324	90	28	1.5	0.6	65
	648	180	87	2.1	1.1	91
	972	270	169	2.5	1.5	109
	1296	360	270	2.8	1.9	122
3	432	120	28	2.1	1.3	92
	864	240	87	3.0	2.4	130
	1296	360	169	3.5	3.4	155
	1728	480	270	4.0	4.1	174
4	864	240	28	4.2	1.3	185
	1728	480	87	6.0	2.5	261
	2592	720	169	7.1	3.4	312
	3456	960	270	7.9	4.1	349
5	1728	480	28	9.2	8.6	402
	3456	960	87	13.0	16.2	572
	5184	1440	169	15.6	22.4	685
	6912	1920	270	17.5	27.6	769

Table 15: Heating register (-H2)

Heating register (-H4), four-row

				T_E = 15°C, T_W = 45-35 °C		
NW	V_{min}/V_{max}		PA_L	Q	Pa_W	V_W
	(m³/h)	[l/s]	(Pa)	(kW)	(kPa)	[l/h]
1	216	60	56	1.0	1.7	85
	432	120	174	1.5	3.4	126
	648	180	337	1.8	4.9	154
	864	240	540	2.0	6.2	175
2	324	90	56	1.4	0.5	122
	648	180	174	2.1	1.1	180
	972	270	337	2.5	1.5	219
	1296	360	540	2.8	1.9	249
3	432	120	56	2.0	1.2	171
	864	240	174	2.9	2.4	254
	1296	360	337	3.6	3.4	310
	1728	480	540	4.0	4.3	352
4	864	240	56	4.1	2.8	356
	1728	480	174	6.1	5.8	530
	2592	720	337	7.4	8.4	648
	3456	960	540	8.5	10.5	737
5	1728	480	56	8.5	7.5	742
	3456	960	174	12.7	15.5	1107
	5184	1440	337	15.6	22.4	1358
	6912	1920	540	17.8	28.3	1546

Table 16: Heating register (-H4)

CONTROLLER SELECTION

Type	Control	Product
NMV-D3-MP	electrical	Belimo
VRD3-SO	electrical	Belimo
VRP	electrical	Belimo
RLP100 F003	pneumatic	Sauter

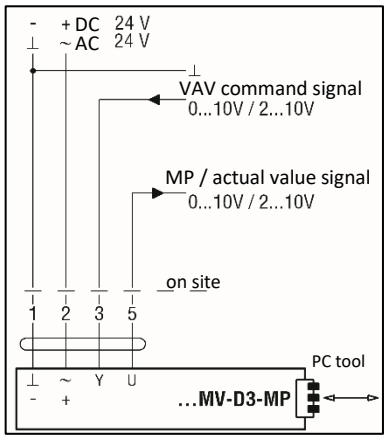
Other controllers available on request.
Makes Belimo, Gruner, Sauter, Siemens possible.

Table 17: Controller selection

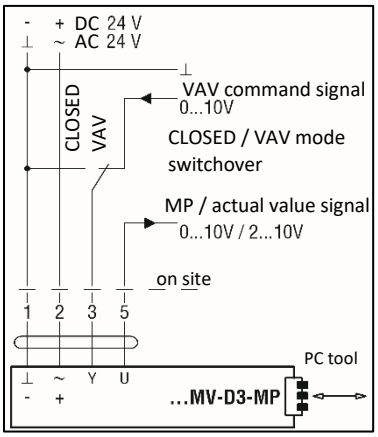
CIRCUIT DIAGRAMS

Circuit diagram standard controller
Compact controller NMV-D3-MP (make Belimo)

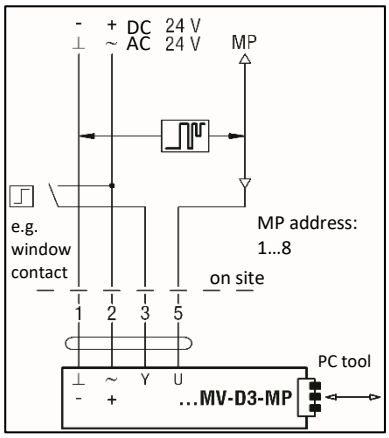
VAV with analogue command signal switch



VAV with lock (CLOSED) model 2-10V DC



MP-Bus activation with integrated

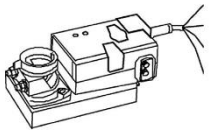


Lock mode (CLOSED): In the 2...10 V mode, the following function can be carried out with a 0 - 10 V signal:

Command signal Y	Volumetric flow	Function
< 0.1 V **	0	Damper CLOSED, VAV control inactive
0.2...2 V	V_{min}	Operating stage V_{min} active
2...10 V	V_{min} ... V_{max}	continuous operation V_{min} ... V_{max}

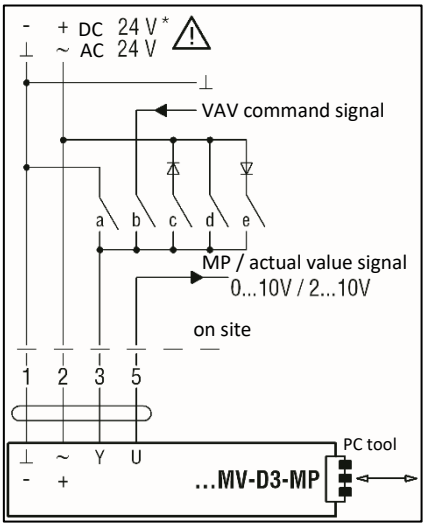
**Attention: Controller/DDC must be able to pull the command signal to 0 V.

Cable designation



No.	Designation	Wire colour	Function		
1	- ⊥	black	⊥ -	}	Supply
2	+ ~	red	~ +	}	AC/DC 24 V
3	Y	white	VAV / CAV command signal		
5	U	orange	- Actual value signal - MP bus connection		

CAV operation / positive contacts



Note:
Please ensure mutual locking of the contacts!

CAV function for ...-NMV-D3-MP

Mode setting	---	0...10 V	0...10 V	0...10 V	0...10 V
	2...10 V	2...10 V	2...10 V	2...10 V	2...10 V
Signal	⊥	0...10 V	~	~	~
	-	2...10 V		+	
	⌀	⌀	⌀	⌀	⌀
Function	3	3	3	3	3
Damper CLOSED	**a) CLOSED**		**c) CLOSED***		
V_{min}...V_{max}		**b) VAV**			
CAV - V_{min}	**everything open - V_{min} active**				
Damper OPEN					**e) OPEN***
CAV - V_{max}				**d) V_{max}**	

	Contact closed, function active
	Contact closed, function active, in mode 2...10 V only
	Contact open

* not available for DC 24 V supply

LED table of functions for NMV-D3-MP

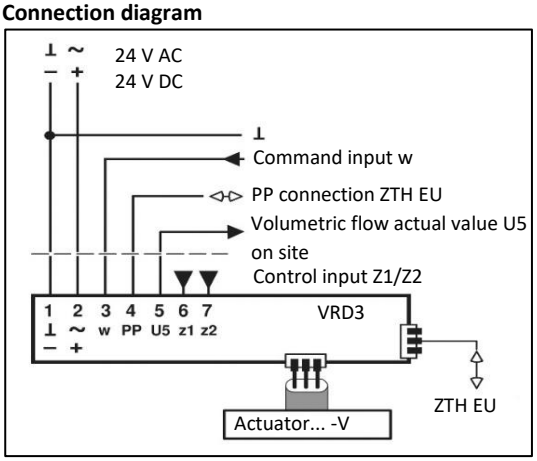
Application	Function	Description / action	LED pattern Adaptation ⊕ LED 1 power Address ⊕ LED 2 status
N1 operation	Status display	- 24V power supply o.k. - VAV-Compact ready for operation	LED 1 LED 2
S1 service function	Synchronisation	Synchronisation started by: a) Operating / service unit b) Manual trigger device at the VAV-Compact c) Power ON behaviour	LED 1 Start 1.) → LED 2
S2 service function	Adaptation	Adaptation started by: a) Operating / service unit b) Key on the VAV-Compact	LED 1 Start 2.) → LED 2
V1 VAV service	VAV service active	a) Press both keys «Adaptation» & «Address» simultaneously b) VAV service will be activated: - until 24V supply is switched off - until both keys are pressed again - after 2 hours have passed	LED 1 LED 2
	Lack of air	Damper opens as actual volume is too low	LED 1 LED 2
	Target volume reached	Control circuit balanced	LED 1 LED 2
	Air excess	Damper closes as actual volume is too high	LED 1 LED 2
B1 bus operation	Addressing via MP master (Acknowledgement at the VAV-Compact)	a) Addressing has been triggered at the MP master	LED 1 LED 2
		b) Press addressing key LED will switch to the communication display as soon as the addressing process is complete.	LED 1 ◀ On event ▶ MP communication LED 2
B2 bus operation	Addressing via MP master (with serial number)	Addressing at the MP master was triggered, LED will switch to the communication display as soon as the addressing process is complete.	LED 1 ◀Not address. ▶ MP communication LED 2
B3 bus operation communication	MP-PP display Communication	Communication display via MP master or operating / service unit	LED 1 MP communication LED 2

green LED (power) is lit
yellow LED (status) is lit
yellow LED (status) is flashing

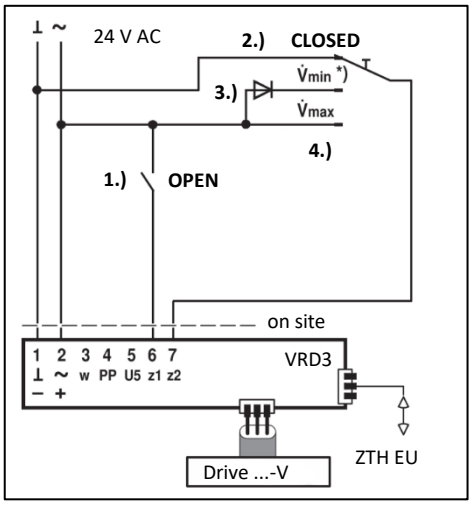
1.) Synch time
2.) Adaptation time

Circuit diagram controller VRD3-SO (make Belimo)

Connection diagram



Positive control



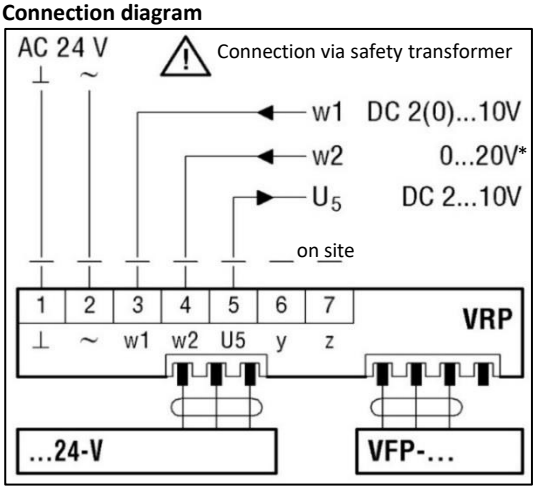
Overview control signals / functions

Signal terminal Function	Priority	GND	pos HW	neg HW	24 V AC	OPEN
Forced contact Z1 - Terminal 6	1	-	OPEN **1.)**	-	OPEN **1.)**	-
Forced contact Z2 - Terminal 7	2	CLOSED **2.)**	V_{min} **3.)**	-	V_{max} **4.)**	-
Tool (PPCmd)-> ZTH EU	3	CAV stages (Auto, OPEN, CLOSED, V_{min}, V_{max}, Stop)				
Command signal w - Terminal 3 Jumper: VRD3	4	CLOSED **5.)** Mode: 2 ... 10 V	OPEN **6.)**	CLOSED **7.)** Mode: 0 ... 10 V	V_{max} **8.)**	V_{min} **9.)**

*) No supply 24 V AC necessary.

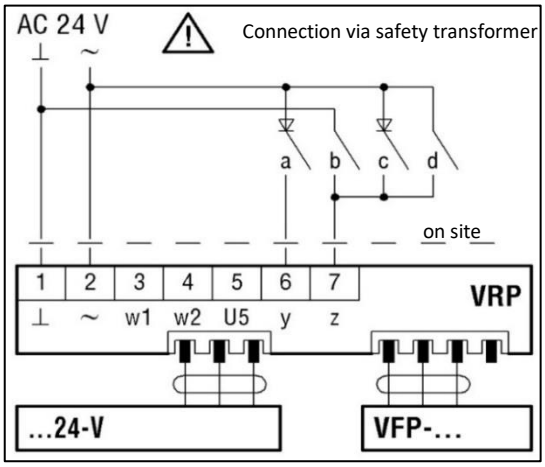
Circuit diagram controller VRP (make Belimo)

Connection diagram



*Phase crossover

Positive control



Function	a	b	c	d
CLOSED				
V_{min}				
V_{max}				
OPEN				

TECHNICAL DATA OF THE CONTROLLERS

Controller standard

NMV-D3-MP (make Belimo)
Compact controller with integrated pressure sensor and damper actuator

Measuring principle:	Pressure reading with volumetric flow
Measuring range sensor:	2...~450 Pa
Supply voltage:	AC 24 V 50/60 Hz; DC 24 V
Functional range:	AC 19.2...28.8 V; DC 21.6...28.8 V
Power consumption:	3 W
Dimensioning:	5 VA
Torque:	min. 10 Nm at the rated voltage
Control function:	VAV/CAV/Open-Loop; Supply/return air or stand-alone operation; master/slave parallel circuit; Mixing box control
Setting range V_{min}/V_{max}:	V_{min}=0...100 % of set V_{nenn} volumetric flow V_{max}=20...100 % of set V_{nenn} volumetric flow
Command variable w/Y: (input resistance min. 100 kΩ)	DC 2-10 V (4...20mA with 500 Ω input resistance) DC 0-10 V (0...20mA with 500 Ω input resistance) adjustable DC 0...10 V
Setting range Actual value signal U5:	DC 2...10 V DC 0...10 V
MP bus function	
Address in bus mode:	1 ... 8 (standard operation: PP)
LONWORKS®/EIB-Konnex/MODBUS RTU/BACnet:	with BELIMO interface UK24LON / UK24EIB, 1 ...8 BELIMO MP devices (VAV / damper drive / valve)
DDC controller:	DDC controller / PLC from different manufacturers, with integrated MP interface
Fan Optimiser:	with BELIMO Optimiser COU24-A-MP
Sensor connection:	Passive (Pt1000, Ni1000, etc.) and active sensors (0...10 V), for example temperature, humidity, 2-point signal (switching power 16 mA @ 24 V), for example switch, presence detector
Protection class:	III (safety extra low voltage)
Degree of protection:	IP 54 (hose-connected)
EMC:	CE according to 39/336/EEC
Measuring air and ambient temperatures:	0° C...+50 °C, 5...95% rH, non-condensing
Storage temperature:	-20° C...+80° C
Sound power level:	max. 35dB(A)
Operation and service:	plug-in via service socket / PC-Tool (from V3.1) / ZTH-EU
Communication:	PP/MP bus, max. DC 15V, 1200 baud
Connection:	Cable, 4x0.75 mm², terminals
Weight:	approx. 700 g

VRD3-SO (make Belimo)
Universal controller with integrated dynamic differential pressure sensor

Measuring principle:	Pressure reading with volumetric flow
Measuring range sensor:	2...300Pa
Supply voltage:	24 V AC, 50 -60 Hz , 24 V DC
Functional range:	19.2 ... 28.8 V AC / 21.6 ... 28.8 V DC
Power consumption:	2W
Dimensioning:	3.5 VA, without actuator
Setting range V_{min} / V_{max} :	V_{max}= 30 ... 100 % of set V_{nenn} volumetric flow
	V_{min}= 0 ... 100 % of set V_{nenn} volumetric flow
Protection class:	III (safety extra low voltage)
Degree of protection:	IP40
EMC:	CE to 2004/108/EC
Measuring air and ambient temperature:	0 ... +50°C / 5 ... 90% r.h., non-condensing
Storage temperature:	–20 ... +80°C
Weight:	440 g

VRP (make Belimo)
Universal controller can be combined with static differential pressure sensors VFP-100, -300, -600

Measuring principle:	Pressure measurement with metal membrane
Measuring range sensor:	0...100 Pa, 0...300 Pa, 0...600 Pa
Supply voltage:	24 V AC, 50/60 Hz
Power consumption:	1.3 W (incl. sensor VFP-..., without actuator)
Dimensioning:	2.6 VA (incl. sensor VFP-..., without actuator)
Setting range V_{min} / V_{max} :	V_{max}= 30 ... 100 % of set V_{nenn} volumetric flow V_{min} = 0...80 % of set V_{max} volumetric flow
Command variable w1:	2-10 V DC (input resistance 100 kΩ)
Command variable w2:	0-20 V phase crossover (input resistance 8 kΩ)
Actual value signal U_5:	2...10 V DC (0.5 mA)
Ambient temperature:	0...+50°C
Storage temperature:	-20...+80°C
EMC:	CE to 108/2004/EC
Protection class:	III (safety extra low voltage)
Degree of protection:	IP42
Weight:	400 g (without pressure sensor)

Pneumatic volumetric flow controller RLP100-F003
(make Sauter)
Volumetric flow controller for VAV systems. When used in combination with a static differential pressure transmitter and a pneumatic damper actuator, it is suitable for accurate control of laboratory fume hoods, laboratories and room pressures.

Measuring range Δp (factory setting):	6.4...160 Pa; (reducible to 1...25 Pa)
Low-pressure connections:	3000 Pa
Feed pressure:	1.3 bar ± 0.1
Application range P_{stat}	0...3000 P
Response sensitivity:	0.1 Pa
Air flow pressure:	0.2...1.0 bar
Allowed ambient temperature:	0...55 °C
Setting range for setpoint:	20...100% V
Degree of protection	IP30

Pneumatic actuator AK31-P1 F001 (make Sauter) actuator for RLP100-F003

Control pressure:	0…1.2 bar
Max. pressure:	1.5 bar
Effective surface:	30 cm^2
Stroke:	50 mm
Lever length for 90°:	35 mm
Running time for 100% ke:	5 s
Allowed ambient tempera-:	-5…60°C
Degree of protection:	IP20

Damper actuators for VRD3 SO, VRP

NM24A-V
Actuator, ready to be plugged in for VRD3 SO, VRP

Supply voltage:	AC 24 V 50/60 Hz, DC 24 V
Functional range:	AC 19…29 V, DC 19…29 V
Power consumption:	3.5 W (in motion)
Dimensioning:	5.5 VA
Torque:	mind. 10 Nm (at the rated voltage)
Running time for 90°:	150 sec.
Activation:	6 ± 4 VDC (from controller)
Protection class:	III (Safety extra low voltage)
Degree of protection:	IP54
Ambient temperature	-30 to 50 °C, 5-95% of relative humidity non-condensing
Storage temperature:	-30 °C to +80 °C
Sound power level:	max. 35 dB(A)
Manual adjustment:	Gears are disengaged by pushbutton, self-restoring
Connection:	Cable 500 mm with 3-pin plug (fits controller)
Dimensions:	146 x 62 x 80 mm
Weight:	approx. 710 g
Maintenance:	maintenance-free

SF24A-V
Spring return actuator, ready to be plugged in for VRD3 SO, VRP

Supply voltage:	AC 24 V 50/60 Hz, DC 24 V
Functional range:	AC 19…29 V, DC 19…29 V
Power consumption:	7.5 W (in motion)
Dimensioning:	10 VA
Torque:	min. 20 Nm (at the rated voltage)
Spring torque:	mind. 20 Nm
Running time for 90°:	≤ 150 sec. (motor)
Running time for 90°:	≤ 20 sec. (spring)
Activation:	6 ± 4 VDC (from controller)
Protection class:	III (Safety extra low voltage)
Degree of protection:	IP54
Ambient temperature	-30 to 50 °C, 5-95 % relative humidity, non-condensing
Storage temperature:	-40 °C to +80 °C
Sound power level:	≤ 40 dB(A) (motor)
Sound power level:	≤ 62 dB(A) (spring)
Manual adjustment:	Manual winding with lock
Direction of rotation:	selectable via switch (motor) selectable via mounting (return)
Connection:	Cable 500 mm with 3-pin plug (fits controller)
Dimensions:	214 x 98 x 93 mm
Weight:	approx. 2,300 g
Maintenance:	maintenance-free

STARTUP USING PC-TOOL

Direct connection to switch cabinet or socket (traditional application)

ZTH EU as MP level converter

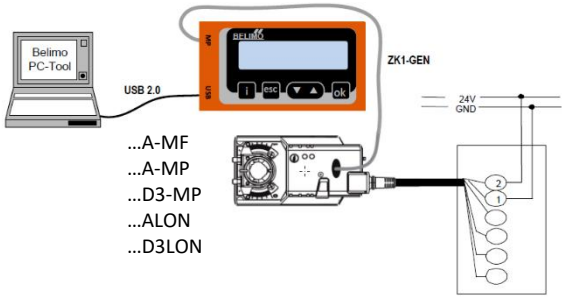
Description
The ZTH EU is also a potential-free interface between the USB port of a PC and the Belimo MP bus. It is used to connect the Belimo PC-Tool directly to the MP bus or directly to a programmable MFT drive.

Power supply
The ZTH EU is supplied with power by the USB port. The MP bus voltage is obtained internally by means of DC/DC converter. This is why no external power supply is necessary.

Driver
To be able to work with the ZTH EU, a suitable driver must be installed on the PC. The driver can be downloaded from the Belimo website (download section). After installation of the driver, the ZTH EU device will log in to the PC as a virtual COM interface.

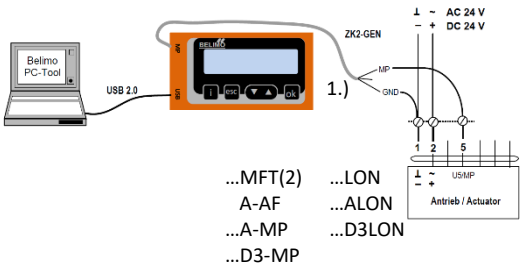
Note
For connection to USB ports of PCs and BELIMO-24 V drives only (to safety extra low voltage SELV or US class 2 feeds).

Connection diagram 1



Local connection via a service socket of the MF/MP or LON drive using a ZK1-GEN cable.

Connection diagram 2



Local connection via a connecting cable of the MF/MP or LON drive using a ZK2-GEN cable.

1.) white = GND
green = MP
blue = not connected

STARTUP USING THE SETTING AND DIAGNOSTIC DEVICE ZTH EU (BELIMO)

ZTH EU (Belimo)

Brief description

The VAV setting device ZTH EU allows efficient testing of VAV and CAV installations. Installations fitted with the Belimo VAV controller can be simply adapted to the room and user requirements.
The VAV setting device ZTH EU replaces the previous setting device ZTH-GEN (2007-2014).
All standard Belimo VAV controllers with integrated PP communication (from 1992) that are sold in the EU can be set using the ZTH EU.

Specifications

easy, quick setting of the VAV boxes parameters
diagnostic function
one tool for all VAV units
voltage supplied by VAV controllers - no batteries required!
service socket VAV / CR24 controller, PP connection
includes connecting cable RJ12 6/4, 6-pin plug
New generation, MP bus tester
for functional test of MP bus
backward compatible with all Belimo PP / MP units from 1992
efficient handling, can be operated with one hand
Selection of stages for test (OPEN/CLOSE/MIN/MAX/STOP)
Damper position indicator for diagnostics
Display of the setpoint / actual volume and $V_{min}/_{max}$ setting in m^3/s (l/s).

Keys / Display:

2 x 16-digit LCD with background lighting

▼▲	Forwards / Backwards Change value / status
OK	Confirm input
ESC	Cancel input / Leave submenu / Discard changes
i	shows additional information if available

Connection:
Locally via service socket

Dimensions:
85x65x23 (WxHxD)

Connection and supply

Stand-alone operation:
Connection including supply takes place via the service socket at the VAV controller or via the terminals.
Bus operation:
The ZTH EU can be used in the following units while the bus is running if it is connected via the local service socket: VAV-Compact L/N/SMV-D3-MP, NMVAX-D3-MP, L/NMV-D3LON.
With the VRP-M, L/NMV-D3-M and NMVAX-D3-MP, the MP bus must be disconnected when the service socket is used.

Restriction:
Direct connection in an MP network or via an MP bus master is not possible.

The ZTH EU comes with a quick start guide de/en to be affixed to the back of the unit.

SMARTPHONE – BELIMO ASSISTANT APP

The NFC antenna area of the VAV Compact is located between the Belimo or OEM logo and the NFC label.
Align NFC-capable android smartphone with loaded Assistant app on the VAV-Compact such that the two antennae are above one another.

The Belimo Assistant app can be downloaded from the Google Play Store.

NFC-capable devices:	
-	LMV-D3-MP, NMV-D3-MP, SMV-D3-MP and LHV-D3-MP with printed NFC label.
Non-NFC-capable devices	
-	All devices without NFC label
-	LMV-D3-MF
-	LMV-D3-LON and NMV-D3-LON

INSTALLATION

Upon reception of the volumetric flow controller VAS-K/ VAS-S , the components must be carefully checked, in order to guarantee that no transport damage has taken place. Moreover, all components must be checked as to whether they match the order. Should the device exhibit production-related damage, please contact your local sales office prior to installation.

TRANSPORT, LIFTING AND HANDLING

The sound-damped volumetric flow controller types must not be carried on the regulation components, measuring cross or the damper leaf, but only on the housing.

STORAGE

The units must be carefully stored on site. They must be protected from dust, dirt and from direct weather effects.

MOUNTING

--- The installation site must have sufficient space and the necessary resources for carrying out mounting and maintenance activities of all device components.

--- The devices are suspended by means of U-profiles (on site).
--- For polluted air, the sound-damped volumetric flow controllers must be used with an integrated controller with a static membrane pressure sensor. In this case, it is absolutely necessary to observe the mounting position. The sound-damped volumetric flow controllers are not suitable for air containing sticky and oily particles. When using the controllers in systems with heavy dust contamination, suitable filters must be connected upstream.

--- Inspection, mounting and start-up must be carried out by trained personnel, observing the current regulations.
--- If a fire damper or a baffle silencer is mounted in front of the return air model, a minimum distance of 300 mm must be maintained.

For maintenance and inspection purposes, a sufficient number of openings with an appropriate size must be provided to ensure access to all components.

The VAS units must be mounted via suitable, commercially available mounting rails and approved dowels only.
Their dimensioning must be performed on site.

MAINTENANCE

Cleaning of the dynamic differential pressure sensor

The dynamic differential pressure sensor integrated into the NMV-D3-MP and VRD3-SO requires little maintenance. However, if, depending on the degree of pollution of the air, unexpected volumetric flow deviations occur, then the following procedure is recommended.

1. Pull off the pressure hoses from the sensor connection spigot of the NMV-D3-MP or the VRD3.
   Attention! Make a note of the (+) and (-) assignments.
2. Using a suitable hand pump, blow air into the (-) connection spigot of the sensor (this will blow any dirt deposited inside the sensor out of the (+) connection spigot).
3. Remove any dirt that may have formed from the spigots and hose ends.
4. Reconnect pressure hoses, (+) and (-) as before.
5. Carry out a functional check of the controller.

Zero adjustment of the static pressure sensors VFP-...

The pressure probe is based on a static pressure meter. Great care must be taken to ensure correct transport and correct assembly. The volumetric flow controllers have been adjusted in-factory by the OEM manufacturer according to their mounting position. If the controllers are installed in a different position, the sensors can be adjusted as follows:

1. Sensor VFP-... must be installed.
2. Connect VFP-... to VRP and supply VRP with 24 V AC mains voltage.
3. Remove lid from VFP... .
4. Move damper to the "OPEN" position.
5. Pull damper drive plug from the VRP.
6. Remove the pressure hoses from the connection spigots.
   Attention! Make a note of the (+) and (-) assignments.
7. The membrane position is considered balanced when both LEDs are dark (OFF). If the position of the meter is not aligned, then one of the two LEDs light up and it must be adjusted at the potentiometer in the VFP-....
8. Slowly turn the zero point adjustment of the potentiometer (non-painted potentiometer), until both LEDs are dark (OFF).
9. Assemble lid of VFP-....
10. Reconnect pressure hoses (+) and (-) as before.
11. Reconnect the plug of the damper drive.

LEGEND

V	(m³/h) [l/s]	=	Air volume
V_{ZU}	(m³/h) [l/s]	=	Supply air volume
V_{AB}	(m³/h) [l/s]	=	Return air volume
V_W	[l/s]	=	Water flow volume
V_{min}	(m³/h) [l/s]	=	Minimum volumetric flow
V_{max}	(m³/h) [l/s]	=	Maximum volumetric flow
$V_{konstant}$	(m³/h) [l/s]	=	Constant volumetric flow
V_{nenn}	(m³/h) [l/s]	=	Nominal volumetric flow
f_m	(Hz)	=	Octave centre frequency
f	(Hz)	=	Frequency
L_{WA}	[dB(A)]	=	A-weighted sound power level
L_W	[dB/Okt]	=	Sound power level/octave
LR	(-)	=	Air flow direction
Δp_t	(Pa)	=	Pressure loss
$\Delta p_{t\,min}$	(Pa)	=	Minimum static pressure difference
Pa_L	(Pa)	=	Air-side pressure loss
Pa_W	(kPa)	=	Water-side pressure loss
P	(kg/mm³)	=	Density rho
T_W	(°C)	=	Water inlet/outlet temperature
T_E	(°C)	=	Air inlet temperature
V	(m³/h)	=	Volumetric flow
v_K	(m/s)	=	Duct velocity
v_{min}	(m/s)	=	Minimum end velocity of jet
v_{max}	(m/s)	=	Maximum end velocity of jet
Q	(kW)	=	Power
NW	(-)	=	Nominal size
WK	(St.)	=	Water circuits
FQ	(m²)	=	Free cross-section (-FQ) with damper leaf open
ρ	(kg/m³)	=	Density

ORDER CODE

01	02	03	04	05	06	07	08
Type	Model	Nominal size	Material	Air throw	Mounting direction	Attachment assembly	Mode
Example							
VAS	-K	-3	-SV	-Z	-R	-A004	-2

09	10	11	12	13	14	15
Volumetric flow V-min	Volumetric flow V-max	Duct connection	Acoustic cladding	Transition piece	Heating register	Damper position
-0400	-1200	-KA0	-DS0	-US0	-H0	-NA

Sample

VAS-K-3-SV-Z-R-A004-2-0400-1200-KA0-DS0-US0-H0-NA

Sound-damped volumetric flow controller VAS| compact model| NW 3| galvanised sheet steel | air throw supply air | mounting direction, right-hand | with electronic controller BELIMO NMV-D3-MP | V_{min} 400 m³/h | V_{max} 1200 m³/h | without rubber lip seal | without flat-bed acoustic cladding | without transition piece | without heating register | without spring return actuator

Order details

01 - Type
VAS = Sound-damped volumetric flow controller

02 - Model
K = compact model (standard)
S = Extended model

03 - Nominal width
1 = NW 1
2 = NW 2
3 = NW 3
4 = NW 4
5 = NW 5

04 - Material
SV = Galvanised sheet steel (standard)
DD = Galvanised sheet steel with DD coating

05 - Air throw
Z = Supply air (standard)
A = return air

06 - Mounting direction
R = Right (standard)
L = Left

07 - Attachment assembly *
A004 = with electronic controller BELIMO NMV-D3-MP (standard)
A009 = with electronic controller BELIMO VRD3-SO and actuator NM24A-V
A012 = with electronic controller BELIMO VRD3-SO and actuator SF24A-V
A017 = with electronic controller BELIMO VRP/VFP300 and actuator NM24A-V
A020 = with electronic controller BELIMO VRP/VFP300 and actuator SF24A-V
A106 = with pneumatic controller SAUTER RLP100 F003 and actuator AK31P1 F001
*Other controllers available on request.

08 - Mode
0 = 0-10 V
2 = 2-10 V (standard)

09 - Volumetric flow setting values V_{min}/V_{kon}
0000 = ex works, see table p. 8 (standard)
xxxx = 4-digit value in m³/h

10 - Volumetric flow setting values V_{max}
0000 = ex works, see table 8 (standard)
xxxx = 4-digit value in m³/h

11 - Duct connection
KA0 = without rubber lip seal (standard)
GD1 = with rubber lip seal (for-USR only)

12 - Acoustic cladding
DS0 = without flat-bed acoustic cladding (standard)
FD1 = with flat-bed acoustic cladding

13 - Transition piece
US0 = without transition piece (Standard)
USE = for rectangular ducts
USR = for round ducts

14 - Heating register
H0 = without heating register (standard)
H2 = Heating register with 2 rows of pipes
H4 = Heating register with 4 rows of pipes

15 - Damper position
NA = no spring return actuator (standard)
NO = currentless OPEN - normally open
NC = currentless CLOSED - normally closed
(only for drives with spring return)

SPECIFICATION TEXT

Sound-damped volumetric flow controller for use in supply or return air systems. Connection to rectangular duct connections to DIN EN 1505 without reduction or transition piece; connection to ductwork to DIN EN 1506 is possible using a transition piece. Volumetric flow controller for controlling constant or variable volumetric flows and for room or duct pressure regulation. With positive control V_{min}, V_{max} or "CLOSED". Available as right-hand and left-hand models. Allowed ambient temperatures: 0 - 55°C. It is possible to subsequently adjust the manufacturer-set operating volumetric flow at any time. The actual throughput of the volumetric flow can be measured via the U5 signal. The output signal can be used for master/slave or parallel operation of several controllers or for actual value display 2-10 V DC (0-10 V DC), which corresponds to 0-100 % of the set V_{nenn} in DDC/ZLT systems.
The VAS fulfills the most stringent tightness requirements as defined by DIN EN 1751. Housing leakage, class C and damper leaf leakage, class 4. The housing consists of galvanised steel (-SV) with thermo-acoustic insulation and hygienic mineral wool to VDI 6022 and a damper made of extruded aluminium profile with a TPV rubber seal. The differential pressure signal is measured by a measuring cross made of aluminium profiles and is evaluated in the electronic controller.

- For use in supply air systems, with electric controller NMV-D3-MP SO, control voltage 24 V AC, 50 / 60 Hz, temperature compensation of 10-40°C, wired and adjusted in-factory.
  Product: SCHAKO **type VAS-K-…-Z** or **type VAS-S-…-Z** with extended silencer unit

- For use in return air systems, with electric controller NMV-D3-MP SO, control voltage 24 V AC, 50 / 60 Hz, temperature compensation of 10-40°C, wired and adjusted in-factory.
  Product: SCHAKO **type VAS-K-…-A** or **type VAS-S-…-A** with extended silencer unit

Mounting direction:
- right (-R) (standard)
- left (-L)

Accessories (at an extra charge):

- Flat-bed acoustic cladding (-FD1), for reducing the radiated noise, made of sound-absorbing material arranged inside the housing, thus same outer dimensions.

- Heating register (-H2/-H4): with connection via an external thread, operating pressure 8 bar, test pressure 16 bar, consisting of galvanised sheet steel frame, copper pipes, steel collector, aluminium blades.
  - with 2 rows of pipes (-H2)
  - with 4 rows of pipes (-H4)

- DD coating (-DD) against aggressive return air

- Transition piece, high-pressure side, made of galvanised sheet steel
  - for connection to round ducts (-USR)
  - for connection to rectangular ducts (-USE)

- Rubber lip seal (-GD1) made of special rubber (for USR only).