



Volumetric flow controller VARS®



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Volumetric flow controller VARS®

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Volumetric flow controller VARS®

Description

The VARS® volumetric flow controller impresses with its simple design, high measuring precision and short length, meeting the majority of customary requirements of volumetric flow controllers.

- simple design in accordance with the nominal size of the air duct.

This simple design saves a lot of time and provides planning safety.

- its short length reduces problems of space. Its short length and its position-independent mounting allow the VARS® volumetric flow controller also to be mounted in situations where little space is available.

- high controlling precision

Due to its high controlling precision, the controller requires a straight flow section of only $1 \times D$ even after bends.

- Sealing airtight to DIN EN 1751 Class 2 (NW 100), Class 3 (NW 125 - 400).

- in-factory presetting of the controllers

The controllers have been calibrated and preset in factory: this in-factory presetting eliminates later setting operations on-site. However, if a change must be made later on, the V_{\min} and V_{\max} settings can be simply adjusted using the ZTH-EU setting device.

The controller is calibrated to a flow rate of 12 m/s. With a calibration curve of 12 m/sec., the V_{\max} value can also be 100%. For constant-volume volumetric flow controllers, the V_{\min} value will be set to the desired constant-volume value.

- Tamper-proof

Since an on-site change in the volumetric flows can only be done via the ZTH-EU device, the controller is tamper-proof. Simple rotary potentiometers are not tamper-proof!

- no later on-site volumetric flow controller setting necessary. By virtue of the in-factory presetting, the on-site builder saves the time required for on-site setting of the volumetric flow controllers. Accordingly, the responsibility for setting the volumetric flow controllers is not just passed on to the on-site builder. This also reduces the on-site time pressure, since the controllers do not have to be set on-site.

- Functional check possible via the ZTH-EU device.

The VARS® volumetric flow controllers have already been checked in-factory for their function. When the amount of air changes on-site, a functional check can simply be carried out by using the ZTH-EU device.

- Simple to connect

The controller contains the electrical wiring information. This avoids wiring faults.

- simple change in the amount of air via the ZTH-EU setting device

If the amounts of air preset in-factory must be adapted on-site, this can be simply done by using the ZTH-EU device. When the controllers are mounted in false ceilings, the ZTH-EU can be simply inserted, and the setting and check can be done comfortably inside the room. This is an advantage compared with changing the settings of potentiometers, because the potentiometers in false ceilings are often hard to get to and difficult to see. If the changes in air volume are so large that the calibration curve must be changed, the controllers must either be recalibrated in-factory or the calibration curve must be changed on-site by the customer service of Schako.

- Covers the majority of customary requirements

V_{\min} , V_{\max} and V_{konstant} controls possible, as well as positive control "Closed" or positive control "Open".

- The damper axle is supported in maintenance-free brass bearings.

- Protection type IP 54

The controllers have the protection type IP 54. A strain relief for the cables has been integrated. For plates of lower protection type, e.g. IP 20, mounting into ventilation systems or central units is not recommended.

The volumetric flow controller allows the volumetric flow in ducts to be kept constant or to be regulated using positive control V_{\min} , V_{\max} , "OPEN" or "CLOSED". The volumetric flow controller can also be used as a room or duct pressure regulator. In VAV systems the volumetric flow controller can regulate variable volumetric flows between V_{\min} and V_{\max} as a function of the supply air (room temperature controller). The volumetric flow setpoints V_{\min} and V_{\max} can also be altered at the controller at a later stage, even after installation. Setpoints are initially set in-factory according to the customer's requirements. If these values are set ex factory, the functions of the volumetric flow controller are also checked. The V_{\min} and V_{\max} values can range from 10 to 100 %. 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. Volumetric flow controllers are in general insensitive to the inflow, owing to the built-in measuring rods. 6 measuring points are distributed on these measuring rods according to the median line method. In comparison with measuring rods having only four measuring points or measuring orifices, this gives optimum measurement results. When using the controllers in systems with heavy dust contamination, suitable filters must be connected upstream. For polluted air, the 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 volumetric flow controllers are not suitable for air containing sticky and greasy components.

For maintenance, service, retrofitting, etc., inspection openings in sufficient number and size must be provided on site.

Volumetric flow controller VARS®

Field of application

- for supply and return air systems
- for constant or variable volumetric flows
- Positive control V_{min} , V_{max} , "OPEN" or "CLOSED"
- Suitable for constant and variable volumetric flow or duct pressure control
- differential pressure range from 20 to 1000 Pa
- for duct velocities of 1 - 12 m/s
- for ambient temperatures of 0 - 50°C

When installing volumetric flow controllers, for example in roof central units, in extreme cases, condensation can build up in the measuring pipes of the volumetric flow controller as a result of the large temperature differences between the air flowing through the volumetric flow controller and the surrounding air. This condensation can affect the measuring results. In these cases, care must be taken that the casing of the volumetric flow controller and the measuring pipes are insulated, thus avoiding condensation.

Installation

Installation information

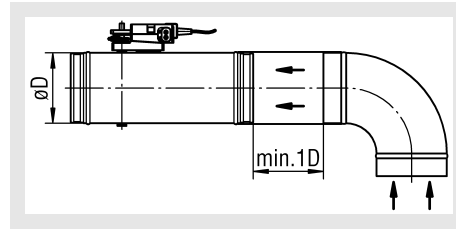
To avoid unnecessary controller errors, the min. distances according to the following table / drawings must be observed. For combinations of several connection pieces or pieces with fire dampers or silencers, the larger minimum distances must be observed.

All volumetric flow controllers can be assembled with horizontal or vertical damper axis.

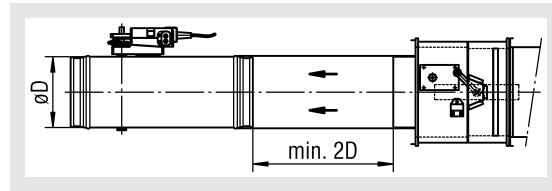
Distance to:	VARs®
Connection piece with bend	1 x D
other connection pieces: (e.g. T-junction, branching piece, reduction piece, etc.)	2 x D
Fire damper:	2 x D
Silencers:	2 x D

Installation information for VARs®

Distance to a bent connection spigot

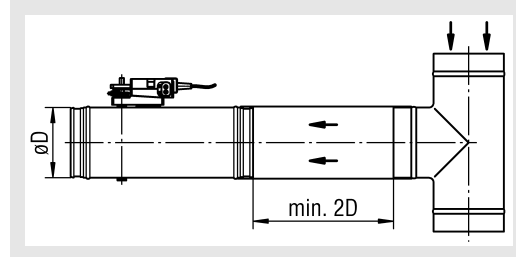


Distance to a fire damper

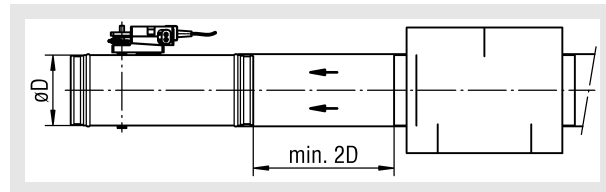


Distance to other connection pieces

(e.g. branching piece, reducing piece, T-junction, etc.)



Distance to a silencer with intermediate baffle



D = Diameter

Volumetric flow controller VARS®

Construction

Housing

- Galvanised sheet steel
- Galvanized sheet steel with DD coating
- Stainless steel 1.4301 (V2A) or 1.4571 (V4A)

Damper

- Galvanised sheet steel

Damper leaf seal

- made of PUR, silicone-free
- for airtight design to DIN 1751

Damper bearing

- Brass

Measuring rods

- Extruded aluminium profile (also for stainless steel design, but with DD coating)

Model

VARs®

- Round model, for spiral duct connection to DIN EN 1506, with damper leaf seal (NW 100 sealing airtight to DIN EN 1751 Class 2, NW 125 - 400 sealing airtight to DIN EN 1751 Class 3)
- with electric controller LMV-D3-MF, not MP-bus-capable
- Control voltage 24 V AC 50/60 Hz
- Temperature compensation from 10 - 40°C
- Housing tightness, class B, to DIN EN 1751

Accessories

Flat-bed acoustic cladding (-FD1)

- made of sound-absorbing, insulating 3 mm material with sheet steel casing made of galvanised sheet steel (standard)

Acoustic cladding (-DS 2)

- made of sound-absorbing, insulating 20 mm material with sheet steel covering made of galvanised sheet steel, non-flammable according to DIN 4102-17.

Flat flange (-FF1/-FF2)

- on both sides, according to DIN 24 154/5

Rubber lip seal (-GD1)

- Special rubber

Metu flange (-MF1/-MF2)

- on both sides, duct flange type AF

Counter flange (-GF) (pair), loose

- on both sides, to Metu flange

Tension ring (-SR) (pair), loose

- to connect Metu flange to counter flange

Duct silencer (-RS)

- outer jacket and perforated sheet made of galvanised sheet steel
- Mineral wool lining

Setting and diagnostic device (-ZTH-EU, Belimo)

Please note!

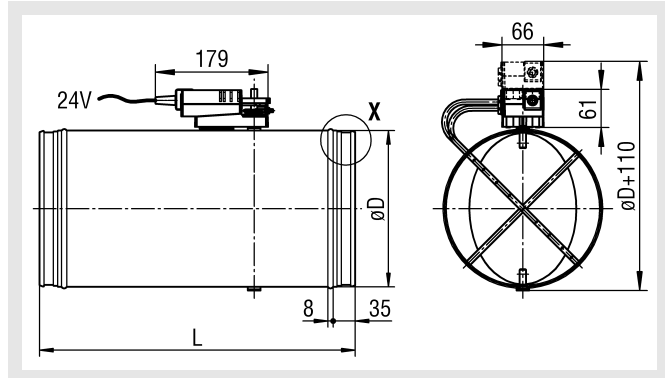
Tension rings, counter flanges and duct silencers must be ordered separately and are supplied loose!

Volumetric flow controller VARS®

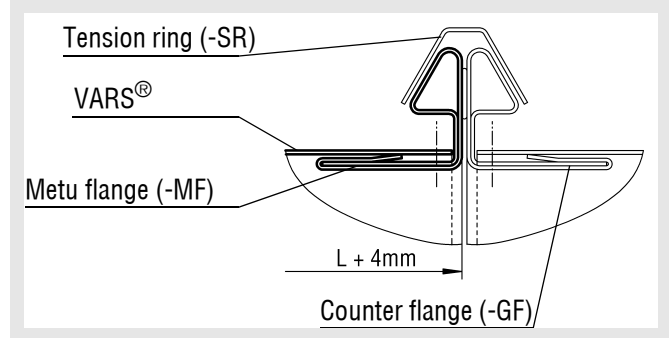
Models and dimensions

Dimensions

VARs®



Metu flange (-MF1/-MF2) / counter flange (-GF) (pair, loose), on both sides, loose / tension ring (-SR) (pair), on both sides, loose

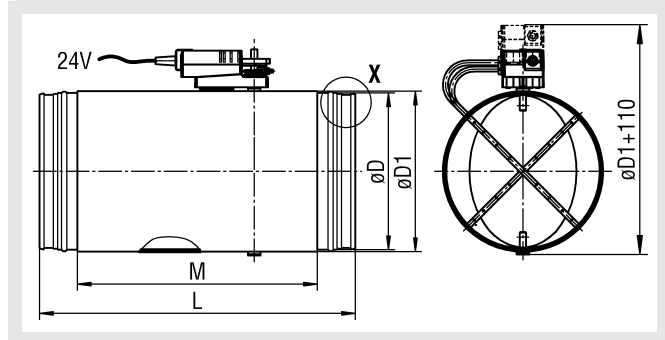


Please note!

Tension rings and counter flanges must be ordered separately and are supplied loose!

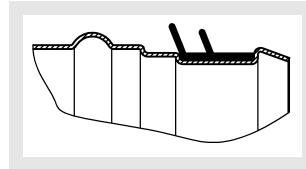
Dimensions of accessories

Flat-bed acoustic cladding (-FD1, insulation 3mm)

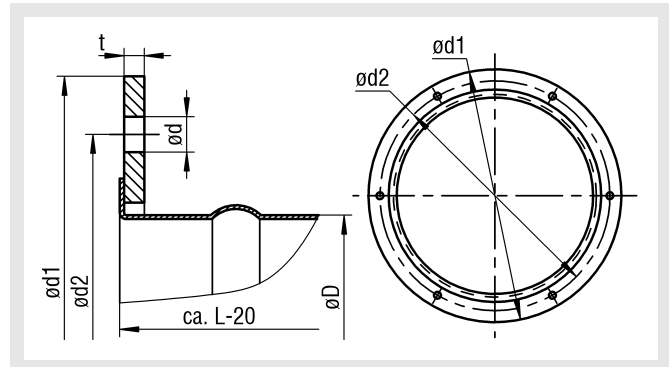


Rubber lip seal (-GD1)

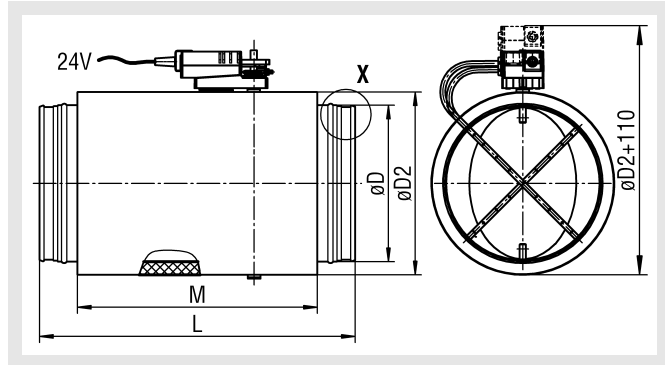
Detail X



Flat flange (-FF1/-FF2), on both sides to DIN 24 154/5



Acoustic cladding (-DS2, insulation 20mm)



Available sizes flat flange (-FF1/-FF2)

NW	øD	ød1	ød2	ød	L	LOA	t
100	98	154	129	7	300	4	3
125	123	177	155	7	300	4	3
160	158	222	194	7	300	6	4
200	198	263	235	7	400	6	4
225	223	287	259	7	400	6	4
250	248	313	286	7	400	6	4
280	278	353	322	9,5	500	8	5
315	313	388	356	9,5	500	8	5
355	353	428	395	9,5	500	8	5
400	398	474	438	9,5	500	12	5

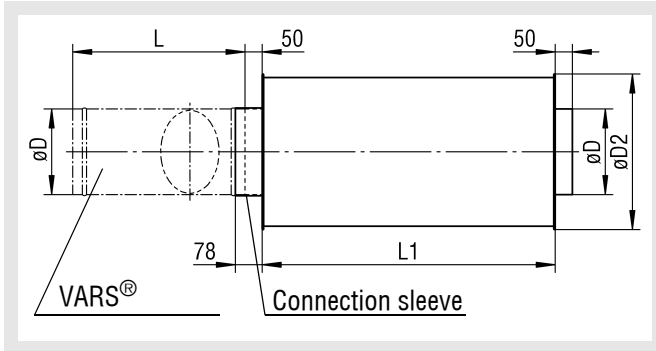
LOA = Number of holes

Available sizes VARS® / ...-FD1 / ...-DS2

NW	øD	ød1	ød2	L	M
100	98	104	140	300	220
125	123	129	165	300	220
160	158	164	200	300	220
200	198	204	240	400	320
225	223	229	265	400	320
250	248	254	290	400	320
280	278	284	320	500	420
315	313	319	355	500	420
355	353	359	395	500	420
400	398	404	440	500	420

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Duct silencer (-RS)



Available sizes duct silencer (-RS)

NW	øD	øD2	L	L1
100	98	200	300	950
125	123	225	300	
160	158	360	300	
200	198	400	400	1450
225	223	425	400	
250	248	450	400	
280	278	580	500	1950
315	313	615	500	
355	353	655	500	
400	398	700	500	

Insertion loss

Duct silencer (-RS)

NW	D _e [dB/Okt]																								
	L=950mm								L=1450mm								L=1950mm								
	f _m (Hz)								f _m (Hz)								f _m (Hz)								
	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	
100	5	12	23	36	50	50	34	21	8	22	44	50	50	50	46	28	9	30	50	50	50	50	50	50	38
125	4	11	21	33	50	50	32	19	7	20	39	50	50	50	39	25	8	26	50	50	50	50	5	33	
160	4	10	18	28	41	48	26	16	6	17	30	47	50	49	30	18	8	23	39	50	50	50	41	25	
200	3	9	15	24	35	41	22	13	5	14	26	42	50	46	28	16	7	19	34	50	50	50	37	21	
225	3	8	14	22	33	38	21	12	5	13	24	38	49	44	26	15	7	17	32	50	50	50	35	20	
250	3	7	13	20	31	35	20	11	4	12	22	36	46	43	25	14	6	16	29	48	50	49	33	18	
280	3	6	11	19	30	34	19	10	4	11	20	33	42	37	22	12	6	15	26	43	50	43	29	16	
300	3	6	10	18	28	31	18	9	3	10	19	32	40	35	21	11	5	14	25	41	50	41	28	15	
315	3	6	10	17	27	31	17	9	3	10	18	31	39	34	21	11	5	14	24	39	50	39	28	14	
355	3	5	9	15	24	28	16	8	3	9	17	28	36	31	20	10	5	12	22	37	48	38	26	13	
400	3	5	9	14	23	27	15	7	3	8	15	25	33	29	18	9	5	11	20	33	45	33	24	12	

Volumetric flow controller VARS®

Technical data

Volumetric flow range

NW	V _{min} at 1m/s		V _{max} at 12m/s	
	(m ³ /h)	[l/s]	(m ³ /h)	[l/s]
100	27	7	319	89
125	42	12	505	140
160	70	19	836	232
200	110	30	1317	366
225	140	39	1672	464
250	173	48	2070	575
280	217	60	2603	723
315	275	76	3303	918
355	351	97	4204	1168
400	446	124	5348	1486

- 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 value specification), 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.
- Belimo compact controllers are height-compensated. They are calibrated ex works to the system height in question of the specified installation site.
- If no system height is given in the order, the controllers will be calibrated to the altitude of the delivery address.
- If the customer does not specify whether the "Parallel" or "Master/Slave" operating mode is desired, the controller is set for the parallel operation (Master/Slave mode only upon customer request).
- If the volume drops below the air volume given in the table, the function of the volumetric flow controller is no longer guaranteed.
- this table merely specifies the complete measuring range of the controller (volumetric flow range)

Static minimum pressure difference

NW	v _k (m/s)	V		ΔP _{t min} (Pa)
		(m ³ /h)	[l/s]	
100	2	53	15	15
	6	160	44	20
	9	239	66	45
	12	319	89	65
125	2	84	23	15
	6	252	70	15
	9	379	105	35
	12	505	140	55
160	2	139	39	15
	6	418	116	15
	9	627	174	30
	12	836	232	50
200	2	219	61	5
	6	658	183	15
	9	987	274	20
	12	1316	366	45
225	2	279	78	15
	6	836	232	20
	9	1253	348	20
	12	1671	464	35
250	2	345	96	15
	6	1034	287	15
	9	1552	431	20
	12	2069	575	25
280	2	434	121	15
	6	1301	361	15
	9	1952	542	20
	12	2602	723	25
315	2	550	153	15
	6	1651	459	15
	9	2476	688	20
	12	3301	917	25
355	2	701	195	15
	6	2101	584	15
	9	3151	875	20
	12	4202	1167	25
400	2	891	248	15
	6	2672	742	15
	9	4009	1114	20
	12	5345	1485	25

Volumetric flow controller VARS®

Flow generated noise

Pressure loss 125 Pa and 250 Pa

NW	v _K (m/s)	V (m ³ /h) [l/s]		Δp _t = 125 Pa									Δp _t = 250 Pa										
				L _w [dB/oct]									L _{WA} [dB(A)]	L _w [dB/oct]									L _{WA} [dB(A)]
				f _m (Hz)										f _m (Hz)									
				63	125	250	500	1000	2000	4000	8000			63	125	250	500	1000	2000	4000	8000		
100	3	80	22	33	40	37	35	34	33	32	33	39	37	43	43	41	39	38	37	31	46		
	6	160	44	41	54	49	45	40	36	35	34	45	43	57	54	50	46	44	43	36	53		
	9	239	66	45	55	51	45	40	37	25	35	49	48	63	59	57	51	48	46	39	56		
	12	319	89	51	56	55	51	45	40	37	35	52	58	67	63	58	53	49	47	42	59		
125	3	126	35	40	42	39	37	36	35	34	36	41	45	45	45	43	41	40	39	39	48		
	6	252	70	48	56	51	48	42	38	37	37	47	51	59	56	52	48	46	45	44	55		
	9	379	105	52	57	53	47	42	39	37	38	51	56	65	61	59	53	50	48	47	58		
	12	505	140	58	58	57	53	47	42	39	38	54	66	69	65	60	55	51	49	56	61		
160	3	209	58	43	44	41	39	38	37	36	37	45	48	47	47	45	43	42	41	38	50		
	6	418	116	51	58	53	49	44	40	39	38	49	54	61	58	54	50	48	47	42	57		
	9	627	174	55	59	55	49	44	41	39	39	53	59	67	63	61	55	52	50	45	60		
	12	836	232	61	60	59	55	49	44	41	39	56	69	71	67	62	57	53	51	48	63		
200	3	329	91	49	46	43	41	40	39	38	37	45	54	49	49	47	45	44	43	44	52		
	6	658	183	57	60	55	51	46	42	41	39	51	60	63	60	56	52	50	49	49	59		
	9	987	274	61	61	57	51	46	43	41	40	55	65	69	65	53	67	54	52	52	62		
	12	1316	366	67	62	61	57	51	46	43	40	58	75	73	69	64	59	55	53	55	65		
225	3	418	116	51	47	44	42	41	40	39	38	46	55	50	50	48	46	45	44	44	53		
	6	836	232	59	51	56	52	47	43	42	38	52	61	64	61	58	53	51	50	49	60		
	9	1253	348	63	62	58	52	47	44	42	39	56	66	70	66	64	58	55	53	52	63		
	12	1671	464	69	63	62	58	52	47	44	40	59	76	74	70	65	60	56	54	44	66		
250	3	517	144	53	48	45	43	42	41	40	39	47	57	51	51	49	47	46	45	45	54		
	6	1034	287	61	62	57	53	48	44	43	40	53	63	65	52	58	54	52	51	50	61		
	9	1552	431	65	53	59	53	48	45	43	41	57	68	71	67	65	59	56	54	53	64		
	12	2069	575	71	64	63	59	53	48	54	51	60	78	75	71	66	61	57	55	56	67		
280	3	651	181	54	49	46	44	43	42	41	37	47	57	52	52	50	48	47	46	46	55		
	6	1301	361	62	63	58	54	49	45	44	41	57	64	66	63	59	55	53	52	51	62		
	9	1952	542	66	64	60	54	49	46	44	41	58	69	72	68	66	60	57	55	54	65		
	12	2602	723	72	65	64	60	54	49	46	42	61	79	76	72	67	62	58	56	57	68		
315	3	825	229	55	50	47	45	44	43	42	39	49	57	47	42	44	45	47	40	45	56		
	6	1651	459	63	64	59	55	50	46	45	41	55	63	61	53	53	52	53	46	50	63		
	9	2476	688	67	65	61	55	50	47	45	42	49	68	67	64	61	58	56	54	53	66		
	12	3301	917	73	66	65	61	55	50	47	42	62	78	71	62	60	58	57	56	56	69		
355	3	1050	292	56	51	48	46	45	44	43	41	50	61	54	54	52	50	49	48	48	57		
	6	2101	584	64	65	60	56	51	47	46	41	56	57	58	54	51	57	55	54	53	64		
	9	3151	875	68	66	62	56	51	47	46	42	60	72	74	70	68	62	59	57	56	67		
	12	4202	1167	74	67	66	62	56	51	48	43	63	82	78	74	69	64	60	58	59	70		
400	3	1336	371	57	52	49	47	46	45	44	42	51	64	55	55	53	51	50	49	49	58		
	6	2672	742	65	66	61	57	52	48	47	43	57	70	69	66	62	58	56	55	54	65		
	9	4009	1114	69	67	63	57	52	49	47	44	61	75	75	71	69	63	60	58	57	68		
	12	5345	1485	75	68	67	63	57	52	49	44	64	85	79	75	70	65	61	59	60	71		

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Flow generated noise

Pressure loss 500 Pa and 1000 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]		Δp _t = 500 Pa										Δp _t = 1000 Pa											
				L _w [dB/oct]										L _{WA} [dB(A)]	L _w [dB/oct]										L _{WA} [dB(A)]
				f _m (Hz)											f _m (Hz)										
63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000		
100	3	80	22	41	48	47	46	45	44	41	41	52	58	55	52	52	53	52	50	50	57	64			
	6	160	44	45	61	58	56	63	52	47	46	58	62	61	61	60	59	58	56	57	64	70			
	9	239	66	53	69	66	61	57	54	51	50	62	69	69	68	65	64	64	59	59	70	76			
	12	319	89	56	71	67	63	59	56	54	52	65	73	70	71	70	68	67	63	63	76	82			
125	3	126	35	49	50	49	48	47	46	43	42	54	60	57	54	54	55	54	52	51	59	66			
	6	252	70	53	63	60	58	55	54	49	47	60	64	63	63	62	61	60	58	58	66	72			
	9	379	105	61	71	68	63	59	56	53	51	64	71	71	70	67	66	66	61	60	72	78			
	12	505	140	64	73	69	65	61	58	56	53	67	75	74	73	72	70	69	65	64	78	84			
160	3	209	58	55	52	51	50	49	48	45	46	56	62	59	56	56	57	56	54	53	61	68			
	6	418	116	59	65	62	60	57	56	51	51	62	66	65	65	64	63	62	60	60	68	74			
	9	627	174	67	73	70	65	61	58	55	55	66	73	73	72	69	68	68	63	62	74	80			
	12	836	232	70	75	71	67	63	60	58	57	69	77	76	75	74	72	71	67	66	80	86			
200	3	329	91	60	54	53	52	51	50	47	47	58	64	61	58	58	59	58	56	55	63	70			
	6	658	183	64	67	64	62	49	48	43	42	64	68	67	67	66	65	64	62	62	70	76			
	9	987	274	72	75	72	67	63	60	57	56	68	75	75	74	71	70	70	65	64	76	82			
	12	1316	366	75	77	73	69	65	62	60	59	71	79	78	77	76	74	73	69	68	82	88			
225	3	418	116	61	55	54	53	52	51	48	48	59	65	62	59	59	60	59	57	56	64	71			
	6	836	232	65	68	65	63	60	59	54	53	65	69	68	68	67	66	65	63	63	71	77			
	9	1253	348	73	76	73	68	64	61	58	57	69	76	76	75	72	71	71	66	65	77	83			
	12	1671	464	76	78	74	70	66	63	61	59	72	80	79	78	77	75	74	70	69	83	89			
250	3	517	144	63	56	55	54	53	52	49	49	60	66	63	60	60	61	60	58	57	65	72			
	6	1034	287	67	69	66	64	61	60	55	54	66	70	69	69	68	67	66	64	64	72	78			
	9	1552	431	75	77	74	69	65	62	59	58	70	77	77	76	73	72	72	67	66	78	84			
	12	2069	575	78	79	75	71	67	64	62	60	73	81	80	79	78	76	75	71	70	84	90			
280	3	651	181	64	57	56	55	54	53	50	50	61	67	64	61	61	62	61	59	58	66	73			
	6	1301	361	68	70	67	65	62	61	56	55	67	71	70	70	69	68	67	65	65	73	79			
	9	1952	542	76	78	75	70	66	63	60	59	71	78	78	76	74	73	73	68	67	79	85			
	12	2602	723	79	80	76	72	68	65	63	61	74	82	81	79	79	77	76	72	71	85	91			
315	3	825	229	66	58	57	56	55	54	51	51	62	68	65	62	62	63	62	60	59	67	74			
	6	1651	459	70	71	68	66	63	62	57	56	68	72	71	71	70	69	68	66	66	74	80			
	9	2476	688	78	79	76	71	67	64	61	60	72	79	79	78	75	74	74	69	68	80	86			
	12	3301	917	81	81	77	73	69	66	64	62	75	83	82	81	80	78	77	73	72	86	92			
355	3	1050	292	67	59	58	57	56	55	52	52	63	69	66	63	63	64	63	61	60	68	75			
	6	2101	584	71	72	69	67	64	63	58	57	69	73	72	72	71	70	69	67	67	75	81			
	9	3151	875	79	80	77	72	68	65	62	61	73	80	80	79	76	75	75	70	69	81	87			
	12	4202	1167	82	82	78	74	70	67	65	63	78	84	83	82	81	79	78	74	73	87	93			
400	3	1336	371	59	60	59	58	57	56	53	53	64	70	67	64	64	65	64	62	61	69	76			
	6	2672	742	73	73	70	68	65	64	59	58	70	74	73	73	72	71	70	58	58	76	82			
	9	4009	1114	81	81	78	73	69	66	63	62	74	81	81	80	77	76	76	71	71	82	88			
	12	5345	1485	84	83	79	75	71	68	66	64	77	85	84	83	82	80	79	75	75	88	94			

Volumetric flow controller VARS®

Radiated noise

Pressure loss 125 Pa and 250 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]		Δp _t = 125 Pa									Δp _t = 250 Pa								
				L _w [dB/oct]								L _{WA} [dB(A)]	L _w [dB/oct]								L _{WA} [dB(A)]
				f _m (Hz)									f _m (Hz)								
63	125	250	500	1000	2000	4000	8000	L _{WA} [dB(A)]	63	125	250	500	1000	2000	4000	8000	L _{WA} [dB(A)]				
100	3	80	22	8	22	21	22	18	20	21	22	24	19	25	27	28	23	25	26	20	31
	6	160	44	23	36	33	32	24	23	24	23	31	25	39	38	37	30	31	32	25	38
	9	239	66	27	37	35	32	24	24	24	23	34	30	45	43	44	35	35	35	28	42
	12	319	89	33	38	39	38	29	27	26	24	37	40	49	47	45	37	36	36	31	44
125	3	126	35	22	24	23	20	20	22	25	27	26	27	27	29	26	25	27	30	30	33
	6	252	70	30	38	35	30	26	25	28	28	33	33	41	40	35	32	33	36	35	40
	9	379	105	34	39	37	30	26	26	28	29	36	37	47	45	42	37	37	39	38	44
	12	505	140	40	40	41	36	31	29	30	29	39	48	51	49	43	39	38	40	38	46
160	3	209	58	25	26	27	21	23	24	27	28	28	30	29	33	27	28	29	32	30	35
	6	418	116	33	40	39	31	29	27	30	29	35	36	43	44	36	35	35	38	33	42
	9	627	174	37	41	41	31	29	28	30	30	38	41	49	49	43	40	39	41	36	46
	12	836	232	43	42	45	37	34	31	32	32	41	51	53	53	44	42	40	42	39	48
200	3	329	91	36	33	30	24	25	28	30	30	32	41	36	36	30	30	33	35	36	39
	6	658	183	45	47	42	34	31	31	33	31	38	47	50	47	39	37	39	41	41	46
	9	987	274	48	48	44	34	31	32	33	32	42	52	56	52	46	42	43	44	44	49
	12	1316	366	54	49	48	40	36	35	35	32	45	62	60	56	57	44	44	45	47	52
225	3	418	116	41	37	31	27	30	30	31	30	35	45	40	37	33	35	35	36	36	42
	6	836	232	50	51	43	37	36	33	34	30	41	51	54	48	42	42	41	42	41	49
	9	1253	348	53	52	45	37	36	34	34	31	45	56	60	53	49	47	45	45	44	52
	12	1671	464	60	53	49	43	41	37	36	32	48	66	64	57	50	49	46	46	47	55
250	3	517	144	45	40	30	27	28	30	32	31	35	49	43	36	33	33	35	37	37	42
	6	1034	287	54	54	42	37	34	33	35	32	41	55	57	47	42	40	41	43	42	49
	9	1552	431	57	55	44	37	34	34	35	33	45	60	63	52	49	45	45	46	45	52
	12	2069	575	63	56	48	43	39	37	37	33	48	70	67	56	50	47	46	47	48	55
280	3	651	181	46	41	33	31	33	32	32	29	37	50	44	39	37	38	37	37	37	44
	6	1301	361	55	55	45	41	39	35	35	32	43	56	58	50	46	45	43	43	42	51
	9	1952	542	58	56	47	41	39	36	35	32	47	61	64	55	53	50	47	46	45	54
	12	2602	723	64	57	51	47	44	39	37	33	50	71	68	59	54	52	48	47	48	57
315	3	825	229	47	42	32	29	30	33	34	31	37	45	32	27	28	31	37	32	37	44
	6	1651	459	55	56	44	39	36	36	37	33	43	48	46	38	37	38	43	38	42	51
	9	2476	688	59	57	46	39	36	37	37	34	47	53	52	49	45	44	46	46	45	54
	12	3301	917	65	58	50	45	41	40	39	34	50	63	56	47	44	44	47	48	48	57
355	3	1050	292	48	43	35	31	35	38	36	34	40	53	46	41	37	40	43	41	41	47
	6	2101	584	56	57	47	41	41	41	39	34	46	59	60	52	46	47	49	47	46	54
	9	3151	875	60	58	49	41	41	42	39	35	50	64	66	57	53	52	53	50	49	57
	12	4202	1167	66	59	53	47	46	45	41	36	53	74	70	61	54	54	54	51	50	60
400	3	1336	371	47	42	37	33	36	33	37	35	40	54	45	43	39	41	38	42	42	47
	6	2672	742	55	56	49	43	42	36	40	36	46	60	59	54	48	48	44	48	47	54
	9	4009	1114	59	57	51	43	42	37	40	37	50	65	65	59	55	53	48	51	50	57
	12	5345	1485	65	58	55	49	47	40	52	37	53	75	69	63	56	55	49	52	53	60

Volumetric flow controller VARS®

Radiated noise

Pressure loss 500 Pa and 1000 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]		Δp _t = 500 Pa										Δp _t = 1000 Pa											
				L _w [dB/oct]										L _{WA} [dB(A)]	L _w [dB/oct]										L _{WA} [dB(A)]
				f _m (Hz)											f _m (Hz)										
				63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000					
100	3	80	22	23	30	31	33	29	31	30	30	37	40	37	36	39	37	39	39	39	39	42			
	6	160	44	27	43	42	43	37	39	36	35	43	44	43	45	47	43	45	45	46	46	49			
	9	239	66	35	51	50	48	41	41	40	39	47	51	51	52	53	48	51	48	49	49	55			
	12	319	89	38	53	51	50	43	43	43	41	50	55	54	55	58	52	56	52	53	53	61			
125	3	126	35	31	32	33	31	31	33	34	33	39	42	39	38	37	39	41	43	42	42	44			
	6	252	70	35	45	44	41	39	41	40	38	45	46	45	47	45	45	47	49	49	49	51			
	9	379	105	43	53	52	46	43	43	44	42	49	53	53	54	51	50	53	52	52	52	57			
	12	505	140	46	55	53	48	45	45	47	44	52	57	56	57	56	54	58	56	56	56	63			
160	3	209	58	37	34	37	32	34	35	36	37	41	47	44	42	39	41	44	46	45	45	47			
	6	418	116	41	47	48	42	42	43	42	42	47	51	50	51	47	47	50	52	52	52	54			
	9	627	174	49	55	56	47	46	45	46	46	51	58	58	58	53	52	56	55	55	55	60			
	12	836	232	52	57	57	49	48	47	49	48	54	62	61	61	58	56	61	59	59	59	66			
200	3	329	91	47	41	40	35	36	39	39	39	45	51	48	45	41	44	47	48	47	47	50			
	6	658	183	51	54	51	45	44	47	45	44	51	55	54	54	49	50	53	54	54	54	57			
	9	987	274	59	62	59	50	48	49	49	48	55	62	62	61	55	55	59	77	57	57	63			
	12	1316	366	62	64	60	52	50	51	52	51	58	66	65	64	60	59	64	61	61	61	69			
225	3	418	116	51	45	41	38	41	41	40	40	48	55	52	46	44	49	49	49	48	48	53			
	6	836	232	55	58	52	48	49	49	46	45	54	49	58	55	52	55	55	55	55	55	60			
	9	1253	348	65	66	60	53	53	51	50	49	58	66	66	62	58	60	61	58	58	58	66			
	12	1671	464	66	68	61	55	55	53	53	51	61	70	69	65	63	64	66	62	62	62	72			
250	3	517	144	55	48	40	38	39	41	41	41	48	58	55	45	44	47	49	50	49	49	53			
	6	1034	287	59	61	51	48	47	49	47	46	54	62	61	54	52	53	55	56	56	56	60			
	9	1552	431	67	69	59	53	51	51	51	50	58	69	69	61	58	58	61	59	59	59	66			
	12	2069	575	70	71	60	55	53	53	54	52	61	73	72	64	63	62	66	63	63	63	72			
280	3	651	181	56	49	43	42	44	43	41	41	50	59	56	48	48	52	51	50	49	49	55			
	6	1301	361	60	62	54	52	52	51	47	46	56	63	62	57	56	58	57	56	56	56	62			
	9	1952	542	68	70	62	57	56	53	51	50	60	70	70	64	62	63	63	59	59	59	68			
	12	2602	723	71	72	63	59	58	55	54	52	63	74	73	67	67	67	68	63	63	63	74			
315	3	825	229	58	50	42	40	41	44	43	43	50	60	57	47	46	49	52	52	51	51	55			
	6	1651	459	62	63	53	50	49	52	49	48	56	64	63	56	54	55	58	58	58	58	62			
	9	2476	688	70	71	61	55	53	54	53	52	60	71	71	63	60	60	64	61	61	61	68			
	12	3301	917	73	73	62	57	55	56	56	54	63	75	74	66	65	64	69	65	65	65	74			
355	3	1050	292	59	51	45	42	46	49	45	45	53	61	58	50	48	54	57	54	53	53	58			
	6	2101	584	63	64	56	52	54	57	51	50	59	65	64	59	56	60	63	60	60	60	65			
	9	3151	875	71	72	64	57	58	59	55	54	63	72	72	66	62	60	69	63	63	63	71			
	12	4202	1167	74	74	65	59	60	61	58	56	66	76	75	69	67	64	74	67	67	67	77			
400	3	1336	371	59	50	47	44	47	44	46	46	53	62	57	52	50	55	52	55	54	54	58			
	6	2672	742	63	63	58	54	55	52	52	51	59	66	63	61	58	61	58	61	61	61	65			
	9	4009	1114	71	71	66	59	59	54	56	55	63	73	72	68	64	66	64	64	64	64	71			
	12	5345	1485	74	73	67	61	61	56	59	57	66	77	75	71	69	70	69	68	68	68	77			

Volumetric flow controller VARS®

Flow generated noise with duct silencer L= 950

Pressure loss 125 Pa and 250 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]		Δp _t = 125 Pa									Δp _t = 250 Pa									
				L _w [dB/oct]								L _{WA} [dB(A)]	L _w [dB/oct]								L _{WA} [dB(A)]	
				f _m (Hz)									f _m (Hz)									
63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000	L _{WA} [dB(A)]						
100	3	80	22	28	28	<15	<15	<15	<15	<15	<15	<15	15	32	31	20	<15	<15	<15	<15	<15	18
	6	160	44	36	42	26	<15	<15	<15	<15	<15	<15	26	38	45	31	<15	<15	<15	<15	15	30
	9	239	66	40	43	28	<15	<15	<15	<15	<15	<15	28	43	51	36	21	<15	<15	<15	18	35
	12	319	89	46	44	32	15	<15	<15	<15	<15	<15	30	53	55	40	22	<15	<15	<15	21	40
125	3	126	35	36	31	18	<15	<15	<15	<15	17	19	41	34	24	<15	<15	<15	<15	20	23	
	6	252	70	44	45	30	<15	<15	<15	<15	18	30	47	48	35	19	<15	<15	<15	25	34	
	9	379	105	48	46	32	<15	<15	<15	<15	19	31	52	54	40	26	<15	<15	16	28	39	
	12	505	140	54	47	36	20	<15	<15	<15	19	34	62	58	44	27	<15	<15	17	27	43	
160	3	209	58	39	34	23	<15	<15	<15	<15	21	23	44	37	29	17	<15	<15	15	21	26	
	6	418	116	47	48	35	21	<15	<15	<15	22	33	50	51	40	26	<15	<15	21	26	37	
	9	627	174	51	50	41	27	<15	<15	<15	23	35	55	57	45	33	<15	<15	24	29	43	
	12	836	232	57	50	41	27	<15	<15	15	23	37	65	61	49	34	16	<15	25	32	47	
200	3	329	91	46	37	28	17	<15	<15	16	25	28	51	40	34	23	<15	<15	21	31	33	
	6	658	183	54	51	40	27	<15	<15	19	26	37	57	54	45	32	17	<15	27	36	42	
	9	987	274	58	52	42	27	<15	<15	19	27	39	62	60	50	39	22	<15	30	39	47	
	12	1316	366	64	53	46	33	16	<15	21	27	42	72	64	54	40	24	<15	31	42	52	
225	3	418	116	48	39	30	20	<15	<15	18	26	30	52	42	36	26	<15	<15	23	32	35	
	6	836	232	56	53	42	30	<15	<15	21	26	39	58	56	47	35	20	<15	29	37	44	
	9	1253	348	60	54	44	30	<15	<15	21	27	41	63	62	52	42	25	17	32	40	49	
	12	1671	464	66	55	48	36	19	<15	23	28	44	73	66	56	43	27	18	33	43	53	
250	3	517	144	50	41	32	23	<15	<15	20	28	32	54	44	38	29	16	<15	25	34	37	
	6	1034	287	58	55	44	33	17	<15	23	29	41	60	58	49	38	23	17	31	39	46	
	9	1552	431	62	56	46	33	17	<15	23	30	43	65	64	54	45	28	21	34	42	51	
	12	2069	575	68	57	50	39	22	<15	25	30	47	75	68	58	46	30	22	35	45	55	
280	3	651	181	51	43	35	25	<15	<15	22	28	33	55	46	51	31	18	<15	27	36	39	
	6	1301	361	59	57	47	35	19	<15	25	31	44	61	60	52	40	25	19	33	41	48	
	9	1952	542	63	58	49	35	16	<15	25	31	45	66	66	57	47	30	23	36	44	53	
	12	2602	723	69	59	53	41	24	15	27	32	49	76	70	61	48	32	24	37	47	58	
315	3	825	229	52	44	37	28	17	<15	25	30	35	54	51	32	27	18	16	23	36	37	
	6	1651	459	60	58	49	38	23	15	28	32	45	60	55	43	36	25	22	29	41	44	
	9	2476	688	64	59	51	38	23	16	28	33	47	65	61	54	44	31	25	37	44	50	
	12	3301	917	70	60	55	44	28	19	30	33	50	75	67	52	43	31	26	39	47	54	
355	3	1050	292	53	46	39	31	21	16	27	33	37	58	49	45	37	26	21	32	40	43	
	6	2101	584	61	60	51	51	27	19	30	33	47	64	63	56	46	33	27	38	45	52	
	9	3151	875	65	61	53	41	27	20	30	34	49	69	69	61	53	38	31	41	48	57	
	12	4202	1167	71	62	57	47	32	23	32	35	52	79	73	65	54	40	32	42	51	61	
400	3	1336	371	54	47	40	33	23	18	29	35	39	61	50	46	39	28	23	34	42	45	
	6	2672	742	62	61	52	43	29	21	32	36	48	67	64	57	48	35	29	40	47	53	
	9	4009	1114	62	61	52	43	29	21	32	36	50	72	70	62	55	40	33	43	50	69	
	12	5345	1485	66	62	54	43	29	22	32	37	53	82	74	66	56	42	34	44	53	63	

Volumetric flow controller VARS®

Flow generated noise with duct silencer L= 950

Pressure loss 500 Pa and 1000 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]		Δp _t = 500 Pa									Δp _t = 1000 Pa								
				L _w [dB/oct]								L _{WA} [dB(A)]	L _w [dB/oct]								L _{WA} [dB(A)]
				f _m (Hz)									f _m (Hz)								
63	125	250	500	1000	2000	4000	8000		63	125	250	500	1000	2000	4000	8000					
100	3	80	22	36	36	24	<15	<15	<15	<15	20	23	53	43	29	16	<15	<15	16	29	32
	6	160	44	40	49	35	20	<15	<15	<15	25	34	57	49	38	24	<15	<15	22	36	39
	9	239	66	48	57	43	25	<15	<15	17	29	42	64	57	45	29	<15	<15	25	38	44
	12	319	89	51	59	44	27	<15	<15	20	31	44	68	58	48	34	18	17	29	42	47
125	3	126	35	45	39	28	15	<15	<15	<15	23	27	56	46	33	21	<15	<15	20	32	35
	6	252	70	49	52	39	25	<15	<15	17	28	37	60	52	42	29	<15	<15	26	39	42
	9	379	105	57	60	47	30	<15	<15	21	32	45	67	60	49	34	16	16	29	41	48
	12	505	140	60	62	48	32	<15	<15	24	34	47	71	63	52	39	20	19	33	45	51
160	3	209	58	51	42	33	22	<15	<15	19	30	33	58	49	38	28	16	<15	28	37	40
	6	418	116	55	55	44	32	16	<15	25	35	42	62	55	47	36	22	<15	34	44	46
	9	627	174	63	63	52	37	20	<15	29	39	49	69	63	54	41	27	20	37	46	51
	12	836	232	66	65	53	39	22	<15	32	41	51	73	66	57	46	31	23	41	50	55
200	3	329	91	57	45	38	28	16	<15	25	34	37	61	52	43	34	24	17	34	42	44
	6	658	183	61	58	49	38	24	17	31	39	46	65	48	52	42	30	23	40	49	51
	9	987	274	69	66	57	43	28	19	35	43	53	72	66	59	47	35	29	43	51	56
	12	1316	366	72	68	58	45	30	21	38	46	55	76	69	62	52	39	32	47	55	59
225	3	418	116	58	47	40	31	19	<15	27	36	39	62	54	45	37	27	21	26	44	46
	6	836	232	62	60	51	41	27	21	33	41	48	66	60	54	45	33	27	42	51	53
	9	1253	348	70	68	59	46	31	23	37	45	55	73	68	64	50	38	33	45	53	58
	12	1671	464	73	70	60	48	33	25	40	47	57	77	71	64	55	42	36	49	57	61
250	3	517	144	60	49	42	34	22	17	29	38	41	63	56	47	40	30	25	38	46	48
	6	1034	287	64	62	53	44	30	25	35	43	50	67	62	56	48	36	31	44	53	55
	9	1552	431	72	70	61	49	34	27	39	47	57	74	70	63	53	41	37	47	55	60
	12	2069	575	75	72	62	51	36	29	42	49	59	78	73	66	58	45	40	51	59	64
280	3	651	181	61	51	45	36	24	19	31	40	43	64	58	50	42	32	27	40	48	50
	6	1301	361	65	64	56	46	32	27	37	45	52	68	64	59	50	38	33	46	55	57
	9	1952	542	73	72	64	51	36	29	41	49	59	75	72	65	55	43	39	49	57	62
	12	2602	723	76	74	65	53	38	31	44	51	61	79	75	68	60	47	42	53	61	65
315	3	825	229	63	52	57	39	28	23	34	42	45	65	59	52	45	36	31	43	50	52
	6	1651	459	67	52	47	39	28	23	34	42	54	69	65	61	53	42	37	49	57	59
	9	2476	688	75	73	66	54	40	33	44	51	61	76	73	68	58	47	43	52	59	64
	12	3301	917	78	75	67	56	42	35	47	53	63	80	76	71	63	51	46	56	63	68
355	3	1050	292	64	54	49	42	32	27	36	44	48	66	61	54	48	40	35	45	52	54
	6	2101	584	68	67	60	52	40	35	42	49	56	70	67	63	56	46	41	51	59	62
	9	3151	875	76	75	68	57	44	37	46	53	63	77	75	70	61	51	47	54	61	66
	12	4202	1167	79	77	69	59	46	39	49	55	65	81	78	73	66	55	50	58	65	70
400	3	1336	371	56	55	50	44	34	29	38	46	49	67	62	55	50	42	37	47	54	56
	6	2672	742	70	68	61	54	42	37	44	51	58	71	68	64	58	48	43	53	61	63
	9	4009	1114	78	76	69	59	46	39	48	55	65	78	76	71	63	53	49	56	64	68
	12	5345	1485	81	78	70	61	48	41	51	57	66	82	79	74	68	57	52	60	68	72

Volumetric flow controller VARS®

Flow generated noise with duct silencer L= 1450

Pressure loss 125 Pa and 250 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]		Δp _t = 125 Pa								L _{WA} [dB(A)]	Δp _t = 250 Pa								L _{WA} [dB(A)]
				L _w [dB/oct]									L _w [dB/oct]								
				f _m (Hz)									f _m (Hz)								
63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000						
100	3	80	22	25	18	<15	<15	<15	<15	<15	<15	7	29	21	<15	<15	<15	<15	<15	<15	8
	6	160	44	33	32	<15	<15	<15	<15	<15	<15	16	35	35	<15	<15	<15	<15	<15	<15	19
	9	239	66	37	33	<15	<15	<15	<15	<15	<15	18	40	41	15	<15	<15	<15	<15	<15	25
	12	319	89	43	34	<15	<15	<15	<15	<15	<15	20	50	45	19	<15	<15	<15	<15	<15	30
125	3	126	35	33	22	<15	<15	<15	<15	<15	<15	13	38	25	<15	<15	<15	<15	<15	<15	16
	6	252	70	41	36	<15	<15	<15	<15	<15	<15	21	44	39	17	<15	<15	<15	<15	19	36
	9	379	105	45	37	<15	<15	<15	<15	<15	<15	23	49	45	22	<15	<15	<15	<15	22	30
	12	505	140	51	38	18	<15	<15	<15	<15	<15	27	59	49	26	<15	<15	<15	<15	21	36
160	3	209	58	37	27	<15	<15	<15	<15	<15	19	20	42	30	17	<15	<15	<15	<15	19	22
	6	418	116	45	41	23	<15	<15	<15	<15	20	27	48	44	28	<15	<15	<15	17	24	30
	9	627	174	49	42	25	<15	<15	<15	<15	21	28	53	50	33	<15	<15	<15	20	27	35
	12	836	232	55	43	29	<15	<15	<15	<15	21	32	63	54	37	15	<15	<15	21	30	41
200	3	329	91	44	32	17	<15	<15	<15	<15	22	24	49	35	23	<15	<15	<15	15	28	29
	6	658	183	52	46	29	<15	<15	<15	<15	23	32	55	49	34	<15	<15	<15	21	33	37
	9	987	274	56	47	31	<15	<15	<15	<15	24	34	60	55	39	21	<15	<15	24	36	41
	12	1316	366	62	48	35	15	<15	<15	15	24	38	70	59	43	22	<15	<15	25	39	47
225	3	418	116	46	34	20	<15	<15	<15	<15	23	25	50	37	26	<15	<15	<15	18	29	30
	6	836	232	54	48	32	<15	<15	<15	16	23	34	56	51	37	19	<15	<15	24	34	38
	9	1253	348	58	49	34	<15	<15	<15	16	24	36	61	57	42	26	<15	<15	27	37	43
	12	1671	464	64	50	38	20	<15	<15	18	25	40	71	61	46	27	<15	<15	28	40	49
250	3	517	144	49	36	23	<15	<15	<15	15	25	28	53	39	29	<15	<15	<15	20	31	33
	6	1034	287	57	50	35	17	<15	<15	18	26	36	59	53	40	22	<15	<15	26	36	41
	9	1552	431	61	51	37	17	<15	<15	18	27	38	64	59	45	29	<15	<15	29	39	45
	12	2069	575	67	52	41	23	<15	<15	20	27	43	74	63	49	30	15	<15	30	42	51
280	3	651	181	50	38	26	<15	<15	<15	19	26	29	54	41	32	17	<15	<15	24	34	35
	6	1301	361	58	52	38	21	<15	<15	22	29	38	60	55	43	26	<15	16	30	39	43
	9	1952	542	62	53	40	21	<15	<15	22	29	40	65	61	48	33	18	20	33	42	48
	12	2602	723	68	54	44	27	<15	<15	24	30	44	75	65	52	34	20	21	34	45	53
315	3	825	229	52	40	29	<15	<15	<15	21	28	31	54	37	24	<15	<15	<15	19	34	35
	6	1651	459	60	54	41	24	<15	<15	24	30	40	60	51	35	22	<15	19	25	39	41
	9	2476	688	64	55	43	24	<15	<15	24	31	42	65	57	46	30	19	22	33	42	46
	12	3301	917	70	56	47	30	16	16	26	31	46	75	61	44	29	19	23	35	45	51
355	3	1050	292	53	42	31	18	<15	<15	23	31	34	58	45	37	24	<15	18	28	38	39
	6	2101	584	61	56	43	28	15	16	26	31	42	64	59	48	33	21	24	34	43	47
	9	3151	875	65	57	45	28	15	17	26	32	44	69	65	53	40	26	28	37	46	52
	12	4202	1167	71	58	49	34	20	20	28	33	48	79	69	57	41	28	29	38	49	57
400	3	1336	371	54	44	34	22	<15	16	26	33	36	61	47	40	28	18	21	31	40	42
	6	2672	742	62	58	46	32	19	19	29	34	44	67	61	51	37	25	27	38	45	50
	9	4009	1114	66	59	48	32	19	20	29	35	46	72	67	56	44	30	31	40	48	54
	12	5345	1485	72	60	52	38	24	23	31	35	50	82	71	60	45	32	32	41	51	60

Volumetric flow controller VARS®

Flow generated noise with duct silencer L= 1450

Pressure loss 500 Pa and 1000 Pa

NW	v _k (m/s)	V (m ³ /h) [l/s]			Δp _t = 500 Pa								Δp _t = 1000 Pa									
					L _w [dB/oct]							L _{WA} [dB(A)]	L _w [dB/oct]							L _{WA} [dB(A)]		
					f _m (Hz)								f _m (Hz)									
63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000							
100	3	80	22	33	26	<15	<15	<15	<15	<15	<15	15	50	33	<15	<15	<15	<15	<15	<15	22	26
	6	160	44	37	39	<15	<15	<15	<15	<15	18	24	54	39	17	<15	<15	<15	<15	<15	29	32
	9	239	66	45	47	22	<15	<15	<15	<15	22	31	61	47	24	15	<15	<15	<15	<15	31	37
	12	319	89	48	49	23	<15	<15	<15	<15	24	33	65	48	27	20	18	17	17	17	35	41
125	3	126	35	42	30	<15	<15	<15	<15	<15	17	20	53	37	15	<15	<15	<15	<15	<15	26	30
	6	252	70	46	43	21	<15	<15	<15	<15	22	28	57	43	24	<15	<15	<15	19	33	35	
	9	379	105	54	51	29	<15	<15	<15	<15	26	36	64	51	31	17	16	16	22	35	41	
	12	505	140	57	53	30	15	<15	<15	17	28	38	68	54	34	22	20	19	26	39	44	
160	3	209	58	49	35	21	<15	<15	<15	15	28	29	56	42	26	<15	<15	<15	24	35	36	
	6	418	116	53	48	32	<15	<15	<15	21	33	36	60	48	35	17	<15	<15	30	42	43	
	9	627	174	61	56	40	18	<15	<15	25	37	42	67	56	42	22	18	19	33	44	47	
	12	836	232	64	58	41	20	<15	<15	28	39	45	71	59	45	27	22	22	37	48	50	
200	3	329	91	55	40	27	<15	<15	<15	19	31	33	59	47	32	16	<15	<15	28	39	40	
	6	658	183	59	53	38	20	<15	<15	25	36	40	63	53	41	24	15	18	34	46	47	
	9	987	274	67	61	46	25	<15	<15	29	40	47	70	61	48	29	20	24	37	48	51	
	12	1316	366	70	63	47	27	15	16	32	43	50	74	64	51	34	24	27	41	52	54	
225	3	418	116	56	42	30	15	<15	<15	22	33	35	60	49	35	21	<15	15	31	41	42	
	6	836	232	60	55	41	25	<15	15	28	38	42	64	55	44	29	17	21	37	48	49	
	9	1253	348	68	63	49	30	15	17	32	42	49	71	63	51	34	22	27	40	50	53	
	12	1671	464	71	65	50	32	17	19	35	44	51	75	66	54	39	26	30	44	54	56	
250	3	517	144	59	44	33	18	<15	<15	24	35	37	62	51	38	24	15	17	33	43	44	
	6	1034	287	63	57	44	28	15	17	30	40	45	66	57	47	32	21	23	39	50	51	
	9	1552	431	71	65	52	33	19	19	34	44	52	73	65	54	37	26	29	42	52	55	
	12	2069	575	74	67	53	35	21	21	37	46	54	77	68	57	42	30	32	46	56	58	
280	3	651	181	60	46	36	22	<15	16	28	38	40	63	53	41	28	20	24	37	46	47	
	6	1301	361	64	59	47	32	20	24	34	43	47	67	59	50	36	26	30	43	53	54	
	9	1952	542	72	67	55	37	24	26	38	47	54	74	67	45	41	31	36	46	55	57	
	12	2602	723	75	69	56	39	26	28	41	49	56	78	70	59	46	35	39	50	59	61	
315	3	825	229	63	48	39	25	16	20	30	40	42	65	55	44	31	24	28	39	48	49	
	6	1651	459	67	61	50	35	24	28	36	45	49	69	61	53	39	30	34	45	55	56	
	9	2476	688	75	69	58	40	28	30	40	49	56	76	69	60	44	35	40	48	57	60	
	12	3301	917	78	71	59	42	30	32	43	51	58	80	72	63	49	39	43	52	61	63	
355	3	1050	292	64	50	41	29	20	24	32	42	44	66	57	46	35	28	32	41	50	51	
	6	2101	584	68	63	52	39	28	32	38	47	51	70	63	55	43	34	38	47	57	58	
	9	3151	875	76	71	60	44	32	34	42	51	58	77	71	62	48	39	44	50	59	62	
	12	4202	1167	79	73	61	46	34	36	45	53	60	81	74	65	53	43	47	54	63	65	
400	3	1336	371	56	52	44	33	24	27	35	44	45	67	59	49	39	32	35	44	52	53	
	6	2672	742	70	65	55	43	32	35	41	49	54	71	65	58	47	38	41	50	59	60	
	9	4009	1114	78	73	63	48	36	37	45	53	60	78	73	65	52	43	47	53	62	64	
	12	5345	1485	81	75	64	50	38	39	48	55	62	82	76	68	57	47	50	57	66	68	

Volumetric flow controller VARS®

Technical data for Belimo components

Measured value collection and control function

The measured values are collected by two measuring rods favourable to the flow. The measuring openings are distributed over the measuring rods according to the median line method. The pressure differential formed on the measuring rods is determined by means of a dynamic or static measuring sensor. From these measuring results the middle value is formed, which gives a measured variable for the volume flow. The controller compares the actual value signal with the set point and sends a start signal to the electric actuator which adjusts the controller deviation independent of pressure changes in the duct network.

Attention:

The volumetric flow controllers equipped with the Belimo control type LMV-D3-MF are delivered as standard with a SCHAKO 2 - 10 V DC drive (w-signal). Upon activation with 2 V DC, the V_{\min} volume is set. The V_{\min} volumes can be seen from the V_{\min} / V_{\max} tables. When the V_{\min} volume drops below the values shown in the V_{\min} / V_{\max} table, then the control function and the output of the U 5 signal is no longer guaranteed for metrology reasons. Airtight sealing can only be achieved by means of the positive control "CLOSED". The positive control "CLOSED" must be implemented on-site via a switch contact.

Upon customer request, the volumetric flow controller equipped with the Belimo control type LMV-D3-MF can also be delivered with the drive 0-10 V DC. However, please note that in this case the positive control "CLOSED" can be implemented via a diode, see page 18.

Operating control Belimo components

Positive control damper "CLOSED"

Energy saving in areas not in use by closing the supply and return air volumetric flow controller. If the input W1 is connected via an on-site switch for the **operating range 2-10 V DC**, the drive will move the damper to the **CLOSED position**. The drive will also close the flap if the setpoint value for the minimum volumetric flow V_{\min} has been set to 0%, and the control signal corresponds to the value V_{\min} . This function does not correspond to the function of positive control "CLOSED" via the switch contact.

Positive control damper "OPEN"

Supports smoke extraction or is used as a safety position. The volumetric flow controller is in this case inactive, and the damper is driven to the mechanical open position.

V_{\min} control to min. volumetric flow

Depending on requirement or by not assigning them, individual areas can be set to stand-by operation. In this way, minimum room flushing with greatly reduced energy expenditure is achieved.

V_{\max} control to max. volumetric flow

Individual or several rooms are supplied for a short period with a maximum volumetric flow. This allows airing, night cooling and quick morning heating to be implemented.

Continuous operation

As a function of the continuous command signal and the programmed operating range (2 - 10 V; 0 - 10 V) the LMV-D3-MF will regulate the volumetric flow between the set setpoints V_{\min} and V_{\max} .

Constant operation

If terminal 3 (Y signal) has not been assigned, the air volume set on the V_{\min} potentiometer will be set to a constant volume.

VAV-Compact (LMV-D3-MF)

The operation control is effected via the drive input w/z. The possible functions depend on the selected operating mode "2-10 V" or "0-10 V" The diagrams below show the possible settings.

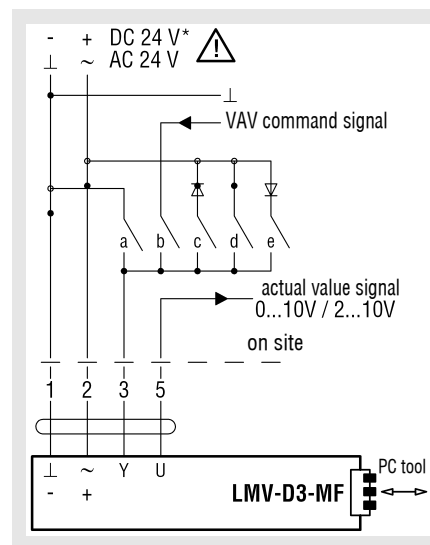
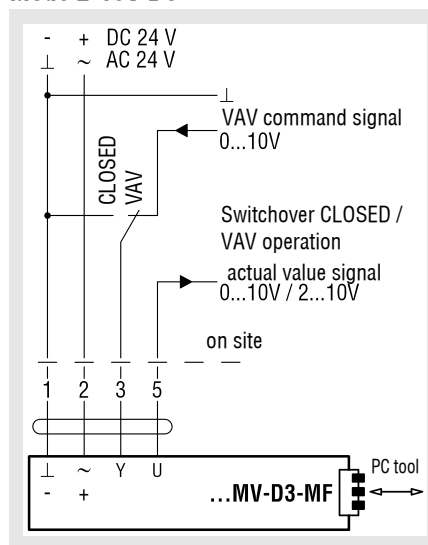
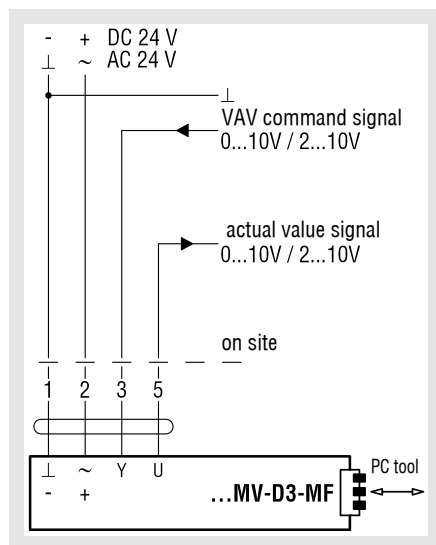
Volumetric flow controller VARS®

Circuit diagrams

Compact controller Belimo make LMV-D3-MF - Attention: not MP-bus-capable VAV with analogue command signal

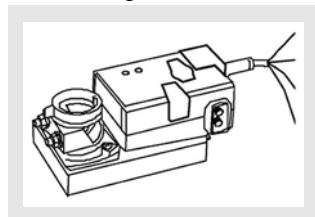
VAV with lock (CLOSED) Mode 2-10V DC

CAV operation / positive contacts



Note: Please ensure mutual locking of the contacts!

Cable designations



No.	Designation	Wire colour	Function
1	- ⊥	black	} Feed AC/DC 24 V
2	+ ~	red	
3	← Y	white	VAV / CAV command signal
5	→ U	orange	actual value signal

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}	V_{min} operating stage active
2...10 V	$V_{min} \dots V_{max}$	Continuous operation $V_{min} \dots V_{max}$

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


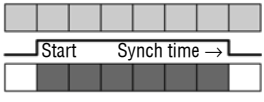
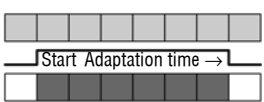
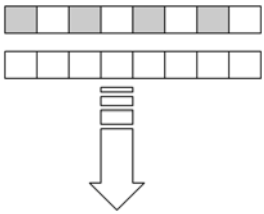
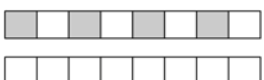
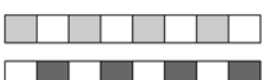

CAV function for LMV-D3-MF



Mode setting	---	0...10 V	0...10 V	0...10 V	0...10 V
Signal	⊥ -	0...10 V 2...10 V	~	~ +	~
Function					
Damper CLOSED	a) CLOSE D		c) CLOSE D*		
$V_{min} \dots V_{max}$ CAV - V_{min}		b) VAV			
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

Volumetric flow controller VARS®

LED table of functions for LMV-D3-MF

Application	Function	Description / action	LED Sample	Adaptation Address	⊕ LED 1 power ⊕ 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 LED 2		
S2 service function	Adaptation	Adaptation started by: a) Operating / service unit b) Key on the VAV-Compact	LED 1 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		

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

Volumetric flow controller VARS®

Setting the operating potentiometers / calculation formulae

Set value for V_{max}

$$EW_{V_{max}} = \frac{V_{max}}{V_{nenn}} \times 100\%$$

The required volumetric flow that is to flow at the 10 V DC command signal at terminal 3 (Y) or with positive control V_{max} is set in % at the V_{max} potentiometer of the controller, the ZTH-EU or PC-Tool. This value refers to the set V_{nenn} nominal volumetric flow.

Set value for V_{min}

$$EW_{V_{min}} = \frac{V_{min}}{V_{nenn}} \times 100\%$$

The required volumetric flow that is to flow at the 0 V DC command signal (operating mode 0-10 V DC) or at the 2 V DC command signal (operating mode 2 - 10 V DC) at terminal 3 (Y) or with positive control V_{min} is set in % at the V_{min} potentiometer of the controller, the ZTH-EU or PC-Tool. This value refers to the set V_{nenn} volumetric flow.

Calculation of the U_5 voltage value

Operating mode: 2 - 10 V DC:

$$U_5 = \frac{V_{max}}{V_{nenn}} \times 8V + 2V \quad V_{max} \text{ values}$$

$$U_5 = \frac{V_{min}}{V_{nenn}} \times 8V + 2V \quad V_{min} \text{ values}$$

Operating mode: 0 - 10 V DC:

$$U_5 = \frac{V_{max}}{V_{nenn}} \times 10V \quad V_{max} \text{ values}$$

$$U_5 = \frac{V_{min}}{V_{nenn}} \times 10V \quad V_{min} \text{ values}$$

Calculation of the V_{nenn} volumetric flow

$$V_{nenn} = EK \times F \times 3600$$

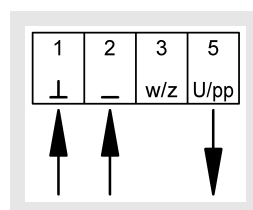
Attention: The V_{nenn} value changes as a function of the set calibration curve.

Depending on the required V_{max} volumetric flow, the calibration curve will be selected specifically by Schako during programming. This guarantees maximum accuracy of the actual value of the volumetric flow.

EW (%) = Set value
 EK (m/s) = Calibration curve
 U_5 (V DC) = U_5 signal
 F (m²) = Area

Actual value measurement via feedback signal U_5 using a voltmeter or PC-Tool

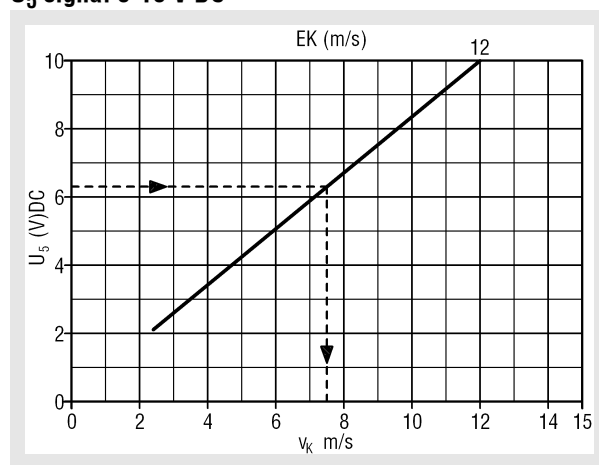
LMV-D3-MF



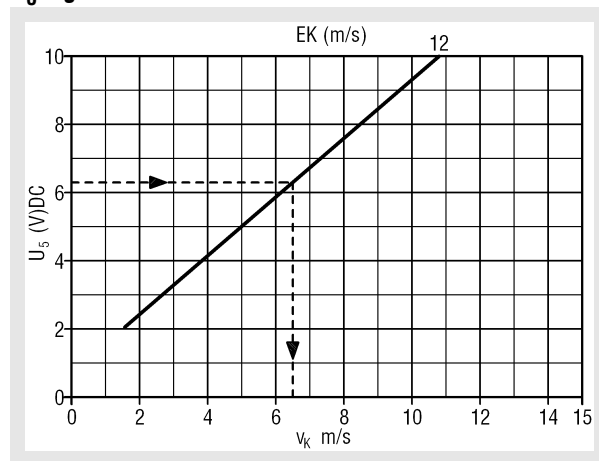
Supply voltage: 24 V AC/DC (Terminals 1+2)
 Measurement output 2 - 10 V DC (Terminals 1+5)
 Measurement output 0 - 10 V DC (Terminals 1+5)

The actual value signal U_5 is a real feedback of the volumetric flow actual value for monitoring and controlling the air throughput volume.

U_5 signal 0-10 V DC



U_5 signal 2-10 V DC



Example

Assume: Measurement output signal $U_5 = 6.3$ V DC
 Calibration value VARS = 12 m/sec

Measured value:

0-10 V DC \Rightarrow Duct velocity = 7.5 m/s

2-10 V DC \Rightarrow Duct velocity = 6.5 m/s

Air volume: Duct velocity x area m² x 3600 = m³/h

Volumetric flow controller VARS®

Technical data of the controller

LMV-D3-MF (make Belimo)

Dynamic pressure sensor, digital actuator as VAV-Compact solution

Measuring principle :	Pressure reading with volumetric flow
Measuring range of the 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...28.8V
Power consumption:	2 W
Dimensioning :	3.5 VA
Torque :	min. 5 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 $V_{\max} = 30...100\%$ of set V_{nenn} volumetric flow
Command variable Y: (Input resistance min. 100 k Ω)	DC 2-10 V (4...20 mA with 500 Ω input resistance) DC 0-10 V (0...20 mA with 500 Ω input resistance) adjustable DC 0...10 V
Setting range actual value signal U_5 :	DC 2...10 V DC 0...10 V
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. 35 dB (A)
Operation and service :	plug-in via service socket / PC-Tool (from V3.1) / ZTH-EU
Communication:	PP, max. DC 15V, 1200 Baud
Connection :	Cable, 4 x 0.75mm ² , terminals
Weight:	approx. 500 g

Functional control

LMV-D3-MF: Functional control

Electrical connection

Apply supply voltage 24 V AC ($\pm 10\%$) to terminals 1 + 2.

Is the polarity of system neutral conductor correct?

⇒ **No:** Check the wiring according to the diagram. Check transformer power.

→ LMV-D3-MF 5 VA

⇒ **Yes:** **LMV-D3-MF / ZTH-EU**

↓

LMV-D3-MF / ZTH-EU :

Has the LMV-D3-MF been set to the correct operating mode? (Check using the connected setting device ZTH EU!)

⇒ **No:** Set the operating mode on the ZTH-EU and save it.

→ Operating modes: 0-10 V, 2-10 V

⇒ **Yes:** **Drive**

↓

Drive:

Use the ZTH-EU to set operating mode 2-10 V and connect terminals 1+3 of the LMV-D3-MF.

Does the drive move to the "CLOSED" position?

⇒ **No:** Contact the VARS manufacturer

⇒ **Yes:** **V_{\max}**

↓

V_{\max} :

Connect terminals 2+3 of the LMV-D3-MF and disconnect U_5 connection to the ZTH-EU.

If the LMV-D3-MF controls to V_{\max} - Check actual value signal U_5 .

⇒ **No:** Check the V_{\max} potentiometer on the ZTH-EU and compare the settings with the technical data on the VAV device.

→ If the drive moves to the "OPEN" position, and the maximum volume is not reached, then the duct pressure is too low.

⇒ **Yes:** Set system-specific operating mode using the ZTH-EU.

Functional check during startup and service

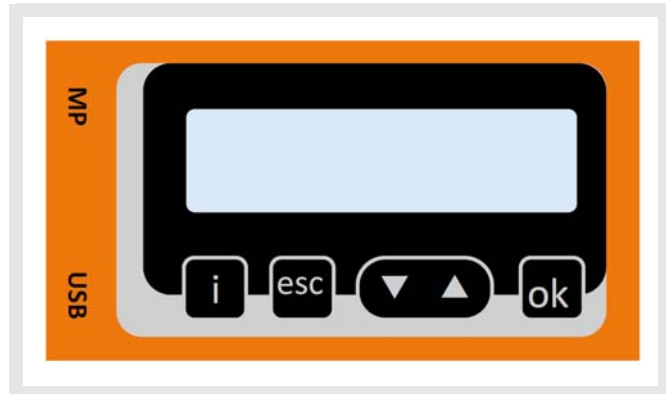
If required, easily accessible setting potentiometers and connections allow set values and the correct operation of the volumetric flow controllers to be reliably and quickly checked on-site.

Volumetric flow controller VARS®

Startup using PC-Tool

Direct connection in the 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.

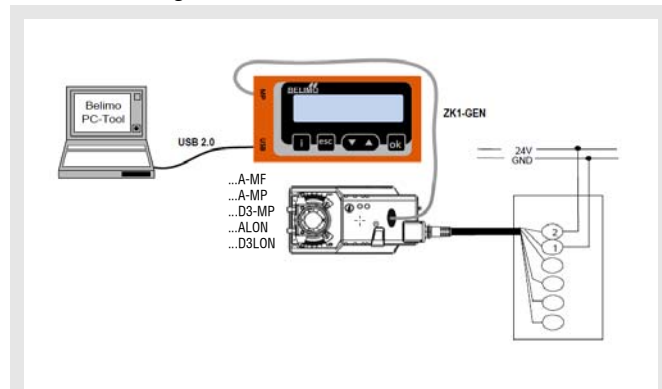
Driver

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

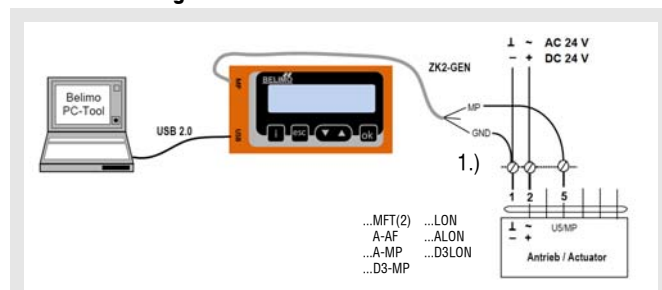
For connection to USB ports of PCs and BELIMO 24 V drives only (to safety extra low voltage SELV or US class 2 feeds).

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

Volumetric flow controller VARS®

Startup using the setting and diagnostic device ZTH EU (Belimo)



Short 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

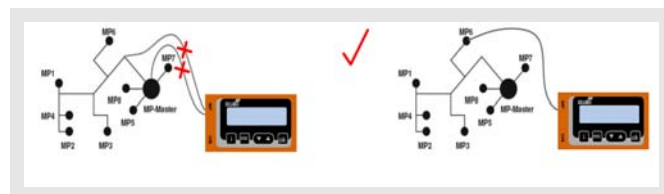
Stand-alone operation:

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.

Volumetric flow controller VARS®

Maintenance and service

Assembly and maintenance instructions

1. When the device is delivered, check whether the controllers are complete and have been delivered without damage. Complaints have to be communicated immediately and directly to the transporter and SCHAKO.
2. The volumetric flow controller must not be carried on the regulation components, measuring cross or the damper leaf, but only on the housing.
3. The controllers must be carefully stored on-site. They must be protected from dust, dirt and from direct weather effects.
4. The controllers must be assembled in a way to allow inspection.
5. Assembly must be carried out by expert personnel, observing recognised technical rules and regulations.
6. **For polluted air, the 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 volumetric flow controllers are not suitable for air containing sticky and greasy particles.**

Cleaning of the dynamic differential pressure sensor

The dynamic differential pressure sensor integrated in the **LMV-D3-MF** 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 pipe of the LMV-D3-MF.
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 connecting pieces and hose ends.
4. Reconnect pressure hoses, (+) and (-) as before.
5. Carry out a functional check of the controller.

Legend

V	(m ³ /h) [l/s]	= Air volume
V _{min}	(m ³ /h)	= Minimum air volume
V _{max}	(m ³ /h)	= Maximum air volume
EW _{Vmax}	(m ³ /h)	= Set value of maximum air volume
V _{Nenn}	(m ³ /h)	= Nominal air volume
v _K	(m/s)	= Duct velocity
D _e	[dB/Oct]	= Insertion loss
Δp _t	(Pa)	= Pressure loss
Δp _{t min}	(Pa)	= Minimum static pressure difference
L _W	[dB/Oct]	= Sound power level / octave
L _{WA}	[dB(A)]	= A-weighted sound power level
f _m	(Hz)	= Octave band centre frequency
U5	(V) DC	= Measurement output (electric voltage)
NW	(-)	= Nominal width
EK	(m/s)	= Calibration curve

Volumetric flow controller VARS®

Order details

01	02	03	04	05	06	07
Type	Nominal width	Material	Attachment assembly	Mode	Volumetric flow V _{min}	Volumetric flow V _{max}
Example						
VARS	-125	-SV	-A006	-0	-0100	-0300

08	09	10
-Duct connection	-Acoustic cladding	-Damper position
-GD1	-DS2	-NA

Sample

VARS-125-SV-A006-0-0100-0300-GD1-DS2-NA

Volumetric flow controller type VARS, round design | NW 125 mm | galvanised sheet steel | with LMV-D3-MF-F SO | 0-10 V | V_{min}=100 m³/h | V_{max}=300 m³/h | with rubber lip seal | with acoustic cladding 20 mm | no spring return actuator

Order details

01 - Type

VARS = Volumetric flow controller type VARS, round design

02 – Nominal width

100 = NW 100 mm
 125 = NW 125 mm
 160 = NW 160 mm
 200 = NW 200 mm
 225 = NW 225 mm
 250 = NW 250 mm
 280 = NW 280 mm
 315 = NW 315 mm
 355 = NW 355 mm
 400 = NW 400 mm

03 - Material

SV = Galvanised sheet steel (standard)
 V2 = stainless steel 1.4301 (V2A)
 V4 = Stainless steel 1.4571 (V4A)
 DD = DD-coating on the inside with galvanised sheet steel

04 - Attachment assembly

A006 = LMV-D3-MF SO (standard)
 Other modules available upon request

05 - Mode

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

06 - Volumetric flow - Set value V_{min} / V_{kon}

0000 = ex-works according to table
 xxxx = 4-digit customer value in m³/h

07 - Volumetric flow set value V_{max}

0000 = ex-works according to table
 xxxx = 4-digit customer value in m³/h

08 - Duct connection

KA0 = without rubber lip seal / without flange (standard)
 GD1 = with rubber lip seal
 FF1 = flat flange, galvanised steel
 FF2 = flat flange, stainless steel V2A 1.4301
 MF1 = METU flange, galvanised steel
 MF2 = METU flange, stainless steel V2A 1.4301

Please note!

Tension rings, counter flanges and duct silencers must be ordered separately and are supplied loose!

09 - Acoustic cladding

DS0 = without acoustic cladding (standard)
 DS2 = Acoustic cladding with 20 mm
 FD1 = Flat-bed acoustic cladding

10 - Damper position

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

Volumetric flow controller VARS®

Specification texts

Volumetric flow controller in round design, for spiral duct connection to DIN EN 1506, for use in supply and return air systems for constant or variable volumetric flow, room or duct pressure regulation. With positive control V_{\min} , V_{\max} or "CLOSED". Allowed pressure difference range: 20-1000 Pa, allowed ambient temperature 0-50°C. Suitable for use with duct velocities of 1-12 m/s.

It is possible to subsequently adjust the manufacturer set operation volume flow. 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_{\max} in DDC/ZLT systems.

Housing made of galvanised sheet steel with silicone-free damper leaf seal made of PUR (airtight to DIN EN 1751 (NW100 Class 2 / NW125 - 400 Class 3), housing leakage class B to DIN EN 1751), measuring rods made of extruded aluminium profile, damper bearing made of brass. With electric controller LMV-D3-MF, control voltage 24 V AC, 50 / 60 Hz, temperature compensation of 10-40°C, wired and adjusted in-factory.

Product: SCHAKO **type VARS®**

Housing (at an extra charge):

- galvanised sheet steel with DD coating (-DD)
- Stainless steel (-V2A)
- Stainless steel (-V4A)

Accessories (at an extra charge):

- Flat-bed acoustic cladding (-FD1), made of 3 mm sound-absorbing material with sheet metal casing made of galvanised sheet steel.
- Acoustic cladding (-DS2) made of 20 mm sound-absorbing material with sheet metal casing made of galvanised sheet steel, non-flammable according to DIN 4102-17.
- Metu flange (-MF1/-MF2), on both sides, duct flange AF.
- Counter flange, on both sides, to Metu flange (pair), loose.
- Tension ring (-SR) to connect Metu flange to counter flange (pair), loose.
- Flat flange (-FF1/-FF2), on both sides, to DIN 24 154 / 5.
- Rubber lip seal (-GD1), made of special rubber.
- Duct silencer (-RS), casing and perforated sheet made of galvanised sheet steel with mineral wool filling
- Setting and diagnostic device ZTH-EU (Belimo)
- Electric controller with MP bus capability

Please note!

Tension rings, counter flanges and duct silencers must be ordered separately and are supplied loose!