

Krantz Components

Circular volume flow controller VRI-DN....
with built-in electronic control system

Air distribution systems

Circular volume flow controller

Construction design and measurement recording

Preliminary remarks

The volume flow controller (\dot{V} controller) VRI with built-in electronic control system is used in HVAC systems to control air volume flow rates. The field of application ranges from commercial buildings with high demands on room acoustics and thermal comfort, e.g. offices, hotels, assembly rooms or hospitals, to industrial facilities where attention is focused on volume flow control accuracy.

The VRI is factory-set to the volume flow rates required by the individual customers. The preset parameters can be subsequently changed or adjusted on site with an appropriate service tool, either direct at the mounted VRI or at the switch cabinet. Depending on control strategy the VRI can be operated as constant air volume (CAV) system or as variable air volume (VAV) system (see mode of operation on [pages 5 and 6](#)).

The maintenance-free \dot{V} controllers are equipped with control devices by Belimo, type LMV-D3-MP or NMV-D3-MP depending on size. Those belong to the category of compact controllers and combine the controller, the volume flow sensor and the electric actuator in a single housing.

In HVAC systems with highly polluted, aggressive or sticky air, it is advisable to use a different volume flow control system.

Construction design

The main components of the \dot{V} controller are the housing **1**, the damper blade **2**, the measuring cross **3** as differential pressure sensor, and the Belimo compact controller **4**. The compact controller combines the actuator **5**, the volume flow sensor and the built-in measurement recording device **6**. The circular housing of the \dot{V} controller is made of galvanized sheet metal and is suited for connection to ducts to EN 1506 as well as to flexible ducts to EN 13180. Optionally, the housing can be fitted with round flanges to EN 12220. The damper blade with internal silicone seal is airtight in compliance with EN 1751, category 3; the housing leak tightness fulfills category B.

The circular \dot{V} controller is available in 9 sizes ranging from DN 100 to DN 450. Depending on acoustic requirements, the \dot{V} controllers can be optionally fitted with an insulating shell **7** made of mineral wool with a galvanized sheet metal covering in order to reduce sound radiation (see [Fig. 2](#)).

Measurement recording

The actual volume flow rate is recorded via a measuring cross from which a very small partial volume flow rate is permanently conveyed to the measurement recording device via a bypass. The recorded values are transmitted to the controller which compares the actual volume flow rate to the preset volume flow rate. Then the controller sends a control signal to the actuator which adjusts the damper blade until the preset value is reached again.

The measurement recording is done by a heating element integrated into the controller housing and fitted with two temperature sensors in direction of air flow. The temperature difference between the two sensors serves as reference value for the pressure differential at the measuring cross. As the sensors are placed in direction of air flow, the compact controller can easily detect the flow direction; this enables to check whether it is correctly mounted (flow direction).

With the optimized sensor generation D3, the flow rate required for recording the actual volume flow rate is about 120 times lower than with the previous sensor generation D2. This significantly reduces sensor dirtying while considerably increasing the sensor's lifespan.

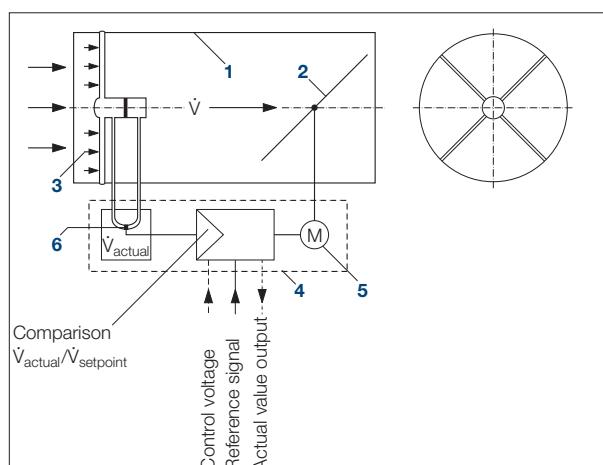


Fig. 1: Principle of operation

Key	3 Measuring cross	6 Measurement recording device
1 Housing	4 Compact controller	
2 Damper blade	5 Actuator	7 Insulating shell

Circular volume flow controller

Sizes, control functions and remarks on selection

Size DN	D _a mm	D _{a1} mm	L mm	L ₁ mm
100	99	180	350	270
125	124	205	350	270
160	159	240	370	290
200	199	280	430	350
224	223	304	460	380
250	249	330	500	420
315	314	395	580	500
400	399	480	670	590
450	449	530	730	650

Table 1: Dimensions of \dot{V} controller

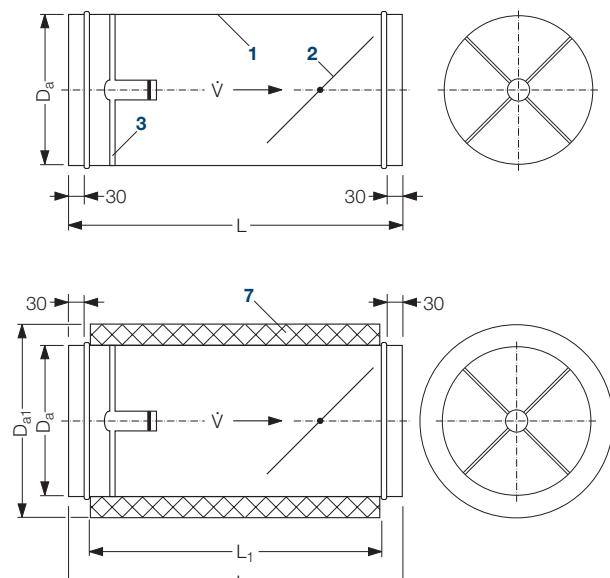


Fig. 2: Construction design of \dot{V} controller

Above: without insulating shell
Below: with insulating shell

Control functions

The VRI by Krantz Components can perform the following control functions:

- Maintaining constant the preset volume flow rate in constant air volume (CAV) systems,
mode switching: CLOSED – \dot{V}_{\min} – \dot{V}_{mid} 1) – \dot{V}_{\max} – OPEN
- Override control:
 - Damper 'CLOSED' ($\dot{V} = 0\%$), e.g. when windows are opened or if a room is unoccupied
(at 2 – 10 V operating range and < 0.1 V reference signal)
 - Damper 'OPEN', e.g. during heating-up
- Alteration of volume flow rate depending on control variable (e.g. CO₂ concentration, room temperature) in variable air volume (VAV) systems

1) \dot{V}_{mid} is the mean of \dot{V}_{\min} and \dot{V}_{\max} (factory-set value); mode available only with AC 24 V supply. The controller adjustment must then be compatible with NMV-D2M.

- Sequential control of supply air and return air to ensure the desired excess or negative pressure

- Parallel connection of several \dot{V} controllers in the supply air or return air system of a room or control zone

Bus connection

The \dot{V} controller VRI can also be driven via an MP-bus and connected to up to 8 Belimo MP devices (damper actuators, valve actuators, flow controllers). Integration into LonWorks®, EIB/Konnex, Modbus RTU, BACnet MS/TP or DDC systems with MP interface is thus easily possible and at low cost. With an assigned MP address, the \dot{V} controller becomes a bus compatible controller with various applications.

Further information is contained in Belimo's technical documentation.

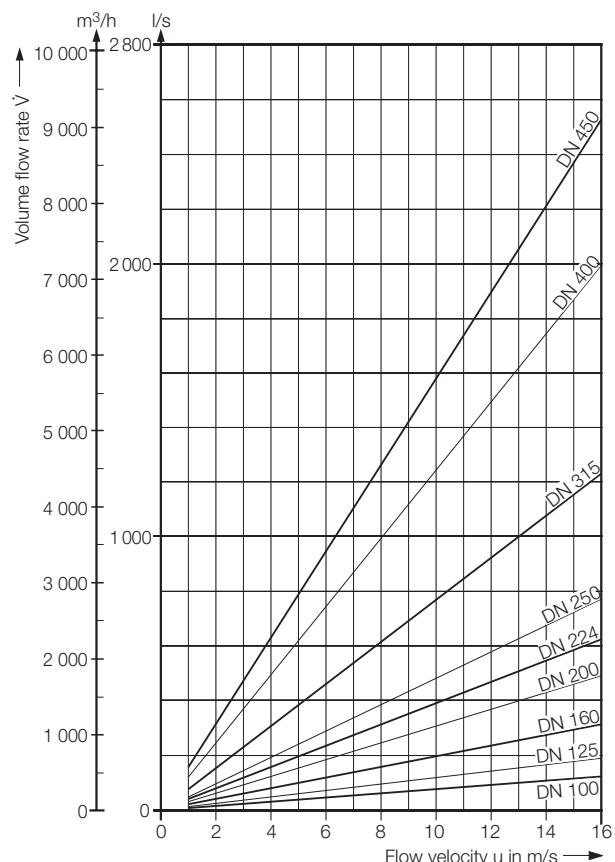


Fig. 3: Sizes and volume flow rates

Remarks on selection

When selecting the \dot{V} controller VRI, the main consideration is to be given to the acoustic requirements for the specific project. There are three performance ranges available for selection: L6, L10 and L13. L6 is recommended for high acoustic requirements, L10 for normal and L13 for low acoustic requirements respectively. The graph in Fig. 3 shows the volume flow rate in relation to the flow velocity for the different VRI sizes. The different performance ranges L6, L10 and L13 with the corresponding volume flow rates for the respective VRI sizes are given in Table 2.

Circular volume flow controller

Limit volume flow rates and function

The maximum volume flow rate allowable for each performance range is defined by the so-called limit volume flow rate \dot{V}_{limit} to which a reference pressure, which is recorded at the measuring cross, is assigned. The lowest controllable volume flow rate (Min. \dot{V}_{min}) is also given in [Table 2](#).

Limit volume flow rates

Size DN	Min. \dot{V}_{min} l/s	\dot{V}_{limit}					
		Performance range					
		L6 m ³ /h	L6 l/s	L10 m ³ /h	L10 l/s	L13 m ³ /h	L13 l/s
100	7	25	44	160	67	241	86
125	11	40	71	254	106	381	137
160	20	72	126	454	189	681	244
200	32	115	201	724	302	1 086	389
224	40	145	254	916	382	1 374	493
250	51	184	323	1 163	484	1 744	626
315	79	283	497	1 790	746	2 686	963
400	133	480	843	3 034	1 264	4 551	1 632
450	174	627	1 101	3 963	1 651	5 944	2 132
Reference pressure in Pa	—	40	90	150			

Table 2: Limit volume flow rate (\dot{V}_{limit}), lowest controllable volume flow rate (Min. \dot{V}_{min}) and reference pressure

Function

The \dot{V} controller VRI functions as an independent control loop, i.e. pressure variations in the ductwork are detected and automatically evened out.

Belimo compact controller LMV-D3-MP or NMV-D3-MP

The digital controller with PI control mode is factory-set to the required performance range L6, L10 or L13 (cf. [Table 2](#)). The operating range is set to 0 – 10 V or 2 – 10 V.

The setpoint is input via a linear signal (0/2 – 10 V) between the preset values for \dot{V}_{min} (0/2 V) and \dot{V}_{max} (10 V).

The actual value is indicated via a linear signal (0/2 – 10 V). As the limit volume flow rate is usually higher than the preset maximum volume flow rate, setpoint signal and actual value signal may differ depending on operating conditions.

For instance, for a setting of $\dot{V}_{\text{max}} = 80\%$ with reference signal w at the controller = 10 V and $\dot{V}_{\text{min}} = 0\%$, the actual value signal U_5 at the controller is

- 8 V in the operating range 0 – 10 V and
- 8.4 V in the operating range 2 – 10 V (see [Figs. 5 and 6](#)).

The actual value of the controlled volume flow rate is also available as output signal U_5 for other functions, e.g.

- for sequential and parallel operation of several \dot{V} controllers,
- for actuating the adjusting device of air outlets,
- as source of information in building management systems (BMS),
- setting and control functions without direct access to the \dot{V} controller.

The control accuracy depends on the volume flow rate.

If $\dot{V}_{\text{setpoint}}$ lies between 30% and 100% of \dot{V}_{limit} , control accuracy is $\pm 5\%$ of \dot{V}_{limit} . Under this range, accuracy is even less than $\pm 2.5\%$ of \dot{V}_{limit} .

The lowest controllable volume flow rate (Min. \dot{V}_{min}) is at an air velocity in the duct of approx. 1 m/s.

Operating volume flow rates \dot{V}_{max} and \dot{V}_{min}

The maximum volume flow rate \dot{V}_{max} can be set to values between 20% and 100%, referred to the limit volume flow rate \dot{V}_{limit} of the different performance ranges (see [Table 2](#)).

The minimum volume flow rate \dot{V}_{min} can be between 0% and 100%, referred to the limit volume flow rate \dot{V}_{limit} of the different performance ranges (see [Table 2](#)).

The factory-set operating volume flow rates and parameters can be changed or adapted anytime to existing user and room specifications using Belimo's service tools. These tools are connected to and supplied from the controller directly or the switch cabinet (via the actual value signal U_5).

Details on connection and operation are contained in Belimo's technical documentation.

To increase control accuracy, height compensation is possible. In this case the height above mean sea level (MSL) has to be stated.

Circular volume flow controller

Mode of operation

Mode of operation

Constant air volume (CAV) systems

In constant air volume applications, the volume flow controller maintains the required volume flow rate constant. Depending on requirements, single or several operating modes can be set.

The following operating modes are available:

CLOSED / \dot{V}_{\min} / \dot{V}_{mid} / \dot{V}_{\max} / OPEN¹⁾

- Shutoff operation – Damper CLOSED:

The damper is moved to the CLOSED position.

- Operating modes \dot{V}_{\min} / \dot{V}_{mid} / \dot{V}_{\max} :

The \dot{V} controller adjusts the volume flow rate to the selected value.

- Ventilation – Damper OPEN:

For maximum ventilation, the damper can be fully opened (100%); the volume flow control is then deactivated.

Operating modes of CAV system at operating range 2 – 10 V

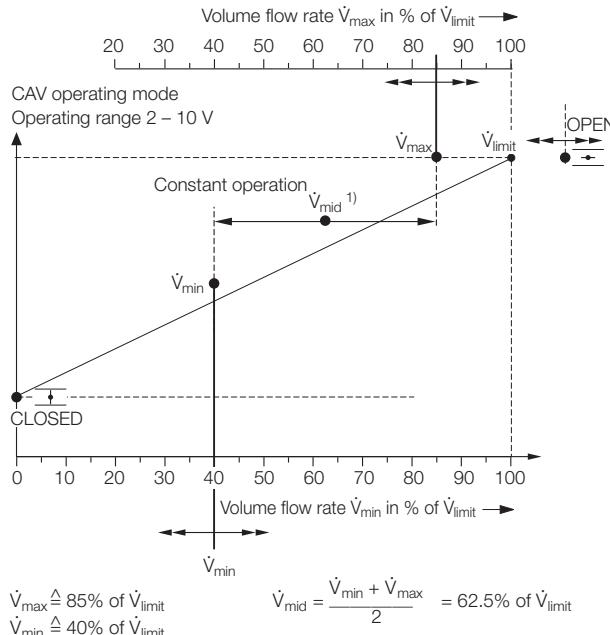


Fig. 4: Example of CAV system at operating range 2 – 10 V

1) The operating modes CLOSED, \dot{V}_{mid} and OPEN are not available with DC 24 V supply.
 \dot{V}_{mid} is the mean of \dot{V}_{\min} and \dot{V}_{\max} (factory-set value)

Variable air volume (VAV) systems

With variable volume flow control, the current requirements of every single consumer are adapted to. This considerably reduces energy costs. Further, as room air conditioning is adjusted to the requirements, thermal comfort is enhanced.

In variable air volume systems, the desired volume flow rate is set via a reference signal 0/2 – 10 V or via the bus system. The required volume flow rate is linearized within the setting \dot{V}_{\min} to \dot{V}_{\max} .

Control mode of VAV system at operating range 0 – 10 V

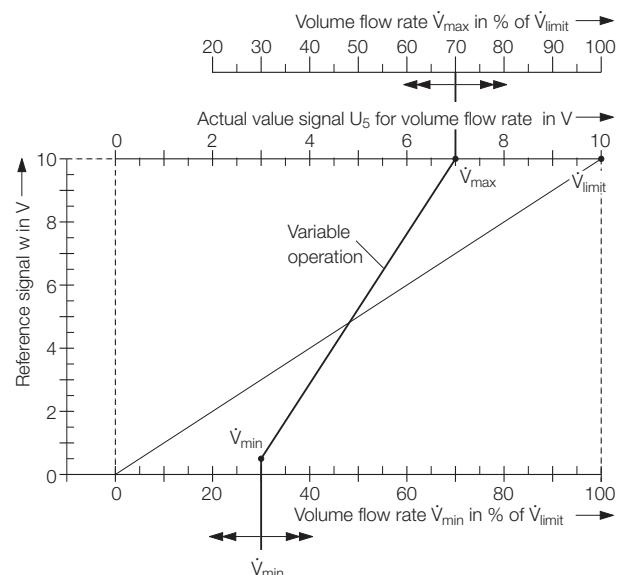


Fig. 5: Example of VAV system at operating range 0 – 10 V

Reference signal w	Volume flow rate	Function
< 0.5 V	\dot{V}_{\min}	Operating mode \dot{V}_{\min} active
> 0.5 – 10 V	\dot{V}_{\min} to \dot{V}_{\max}	Continuous operation \dot{V}_{\min} to \dot{V}_{\max}

Table 3: Operating range 0 – 10 V with $\dot{V}_{\min} > 0$

As long as the reference signal lies between 0 and 0.5 V, the minimum volume flow rate \dot{V}_{\min} is maintained constant. Once the reference signal is > 0.5 V, the control function starts according to the preset characteristic curve.

If \dot{V}_{\min} is set to 0%, the damper closes as soon as the reference signal is < 0.5 V.

Circular volume flow controller

Mode of operation and mounting instructions

Control mode with shutoff operation (CLOSED) at operating range 2 – 10 V

If a shutoff is necessary in VAV operation, this can be done with the following parameters:

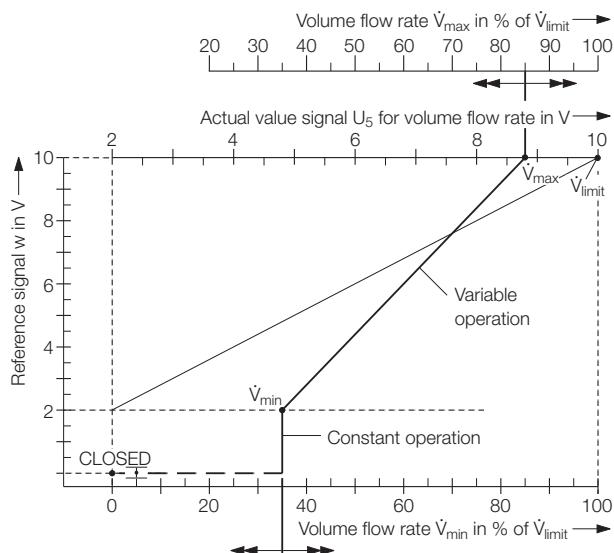


Fig. 6: Example at operating range 2 – 10 V

Reference signal w	Volume flow rate	Function
< 0.1 V ¹⁾	CLOSED	Damper CLOSED, control is inactive
> 0.1 – 2 V	\dot{V}_{\min}	Operating mode \dot{V}_{\min} active
> 2 – 10 V	\dot{V}_{\min} to \dot{V}_{\max}	Continuous operation \dot{V}_{\min} to \dot{V}_{\max}

Table 4: Operating range 2 – 10 V with $\dot{V}_{\min} > 0$

As long as the reference signal is < 0.1 V, the control function is inactive. The damper blade of the \dot{V} controller remains closed. If the reference signal is > 0.1 V, the minimum volume flow rate \dot{V}_{\min} is maintained constant until the reference signal reaches 2 V. Afterwards, the control function starts according to the preset characteristic curve.

Mounting instructions

Mounting position

The \dot{V} controllers VRI by Krantz Components can be mounted in any axial position into vertical, horizontal or inclined ducts.

Duct sections upstream and downstream of \dot{V} controller

In order not to impair control accuracy, a straight duct section of at least $2 \times DN$ is to be placed upstream of the \dot{V} controller and one of at least $1 \times DN$ downstream of the \dot{V} controller (Fig. 7). Each \dot{V} controller carries a nameplate indicating its size, the preset volume flow rate and the direction of flow. The \dot{V} controllers are to be mounted so that the nameplates can be easily read during commissioning and inspection.

The service port for connecting service and diagnosis tools to the Belimo compact controller is positioned on the face of the controller housing under an easy-to-open cap (see Fig. 8).

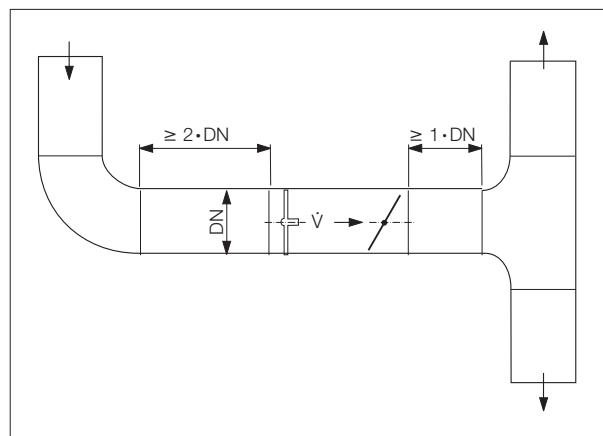


Fig. 7: Duct sections upstream and downstream of \dot{V} controller, shown here with a bend and a branch connection

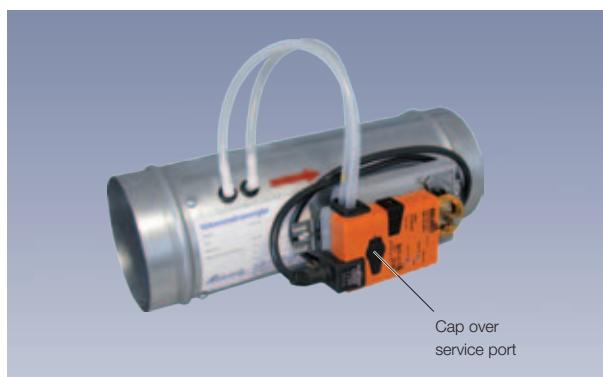


Fig. 8: \dot{V} controller VRI

¹⁾ On request, the reference signal can also be factory-set to 0.5 V

Circular volume flow controller

Connections and wiring diagrams

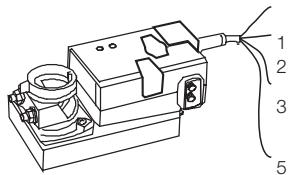


Fig. 9: Cable connections with numbers

The compact controller is connected via pre-mounted connection cables having different colours and being also identified by numbers. The controller can be supplied only via safety isolating transformers. Connections 1 and 2 (AC/DC 24 V) as well as 5 (actual

value signal U_5 or MP-bus connection) must be routed to accessible terminals (room temperature controller, floor distributor, switch cabinet, etc.) to enable access for service and diagnosis tools.

No.	Designation	Wire colour	Function	
1	--- - ⊥	black	⊥ -	} AC/DC 24 V supply
2	--- + ~	red	~ +	
3	→ Y	white	Entry for - sensor interface - override control	
5	→ U	orange	Actual value signal / MP-bus connection	

Table 5: Cable connections

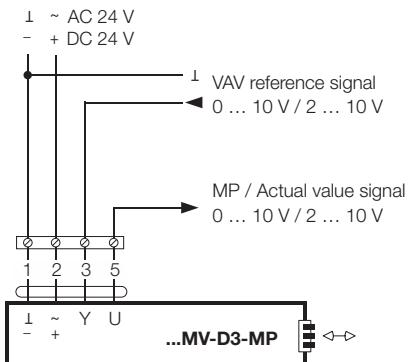


Fig. 10: VAV with analogue reference signal

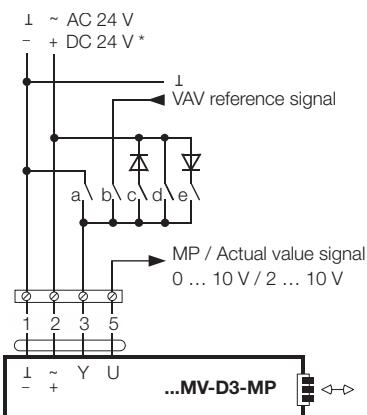


Fig. 12: CAV / Contacts

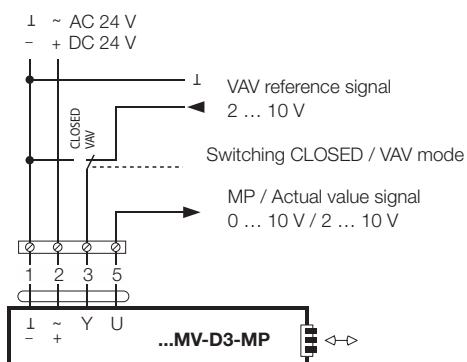


Fig. 11: VAV with shutoff (CLOSED), operating range 2 – 10 V DC

Note:

Detailed information on wiring and control functions (master/slave sequence control, parallel connection, etc.), especially regarding the possibilities of override control and MP-bus wiring, can be found in Belimo's technical documentation.

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	2 – 10 V
Signal	⊥ —	0 – 10 V 2 – 10 V	~	~ +	~
Function	3	3	3	3	3
Damper CLOSED	a) CLOSED		c) CLOSED 1)		
\dot{V}_{\min} to \dot{V}_{\max}	b) VAV				
CAV – \dot{V}_{\min}	All open – \dot{V}_{\min} active				
CAV – \dot{V}_{\max}					e) OPEN 1)
Damper OPEN					d) \dot{V}_{\max}
CAV – \dot{V}_{\max}					

Key

- [Light Gray Box] Contact closed, function active
- [Dark Gray Box] Contact closed, function active, only in 2 – 10 V mode
- [White Box] Contact open

1) Not available with DC 24 V supply

Fig. 13: CAV / Selection of functions

Circular volume flow controller

Sound power level of air flow noise

Size DN	Volume flow rate l/s m³/h	Air flow velocity m/s	Static differential pressure Δp in Pa																																
			100								300								500																
			Sound power level L_W in dB Octave band centre frequency in Hz L_{WA} in dB(A)								Sound power level L_W in dB Octave band centre frequency in Hz L_{WA} in dB(A)								Sound power level L_W in dB Octave band centre frequency in Hz L_{WA} in dB(A)																
DN	l/s m³/h	m/s	125	250	500	1 000	2 000	4 000	8 000	L_{WA} in dB(A)	125	250	500	1 000	2 000	4 000	8 000	L_{WA} in dB(A)	125	250	500	1 000	2 000	4 000	8 000	L_{WA} in dB(A)									
100	15	55	2	46	38	33	29	24	20	16	36	48	47	44	45	43	35	26	49	53	53	49	51	51	40	39	56	57	58	58	56	50	48	62	
	30	110	4	54	43	42	39	34	29	24	44	58	53	51	51	47	41	34	55	59	58	56	57	54	46	44	61	61	61	62	62	58	52	48	66
	47	170	6	58	46	47	44	42	33	28	49	62	55	54	53	50	43	37	58	62	60	59	58	56	49	47	63	63	63	64	63	60	54	50	68
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	50	180	4	47	44	41	40	36	30	24	44	57	54	51	51	48	43	36	56	60	59	56	56	54	48	45	61	64	63	62	62	59	54	51	66
	74	265	6	57	47	47	44	42	34	27	49	61	56	56	53	51	46	40	59	62	61	61	58	57	50	48	64	65	65	65	63	62	56	52	69
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	311	1 120	4	51	48	42	43	40	33	27	48	58	56	53	51	52	48	42	58	65	63	59	57	57	52	48	64	72	68	65	64	63	59	53	70
	467	1 680	6	52	52	53	49	45	38	29	54	62	62	59	54	55	54	49	62	66	65	64	59	61	56	51	67	73	69	67	66	65	61	55	72
	622	2 240	8	57	55	56	52	50	43	40	58	64	64	61	57	57	55	50	64	69	67	67	61	62	57	54	69	75	73	69	68	67	64	58	74
	778	2 800	10	60	60	59	53	54	47	42	61	66	66	65	59	60	55	51	67	72	70	70	63	64	59	56	71	77	76	70	69	69	67	61	76
400	250	900	2	46	41	37	32	31	26	23	40	53	50	48	47	46	42	35	53	64	59	54	52	53	49	45	60	70	66	59	58	59	56	49	66
	500	1 800	4	52	49	43	44	42	34	28	49	59	57	54																					

Circular volume flow controller

Sound power level of housing sound radiation (without insulating shell)

Size	DN	Volume flow rate l/s m³/h	Air flow velocity m/s	Static differential pressure Δp in Pa																															
				100						300						500						1 000													
				Sound power level L_W in dB Octave band centre frequency in Hz						Sound power level L_W in dB Octave band centre frequency in Hz						Sound power level L_W in dB Octave band centre frequency in Hz						Sound power level L_W in dB Octave band centre frequency in Hz													
				125	250	500	1 000	2 000	4 000	8 000	125	250	500	1 000	2 000	4 000	8 000	125	250	500	1 000	2 000	4 000	8 000	125	250	500	1 000	2 000	4 000	8 000				
100	15	55	2	28	21	16	10	10	9	8	20	34	29	24	17	17	16	16	27	38	33	28	22	21	19	18	32	41	37	32	30	27	24	23	37
	30	110	4	31	26	20	14	14	14	12	23	36	33	26	21	21	19	18	30	39	36	30	26	26	24	20	35	42	40	34	33	30	27	25	39
	47	170	6	35	31	25	19	19	18	16	28	39	36	29	25	25	23	20	34	40	39	33	30	30	29	23	38	43	42	37	36	33	30	28	42
	61	220	8	36	36	30	25	25	21	19	33	40	41	34	30	29	26	22	38	43	44	38	34	33	31	25	41	47	46	41	39	38	35	32	46
	78	280	10	37	41	35	30	30	25	21	38	41	47	39	34	33	29	24	42	46	49	42	37	37	33	29	45	51	50	46	42	43	39	36	50
125	25	90	2	29	21	16	10	10	9	9	20	37	31	26	19	18	17	17	29	40	34	29	24	23	20	19	33	44	39	34	32	30	27	26	39
	50	180	4	32	24	19	13	13	12	12	23	38	35	29	23	22	20	19	32	42	37	33	28	27	25	22	36	45	41	36	35	32	29	28	41
	74	265	6	36	29	24	18	18	17	16	28	39	38	33	27	26	24	21	36	44	40	36	31	31	29	25	39	46	44	39	38	35	32	30	44
	100	360	8	37	35	30	24	24	21	19	33	41	42	36	35	30	27	23	40	46	43	39	35	34	33	27	42	49	48	44	43	39	36	32	48
	122	440	10	38	41	36	31	30	25	23	38	42	45	40	36	34	31	26	43	47	46	42	38	38	37	30	46	53	52	48	45	44	40	37	52
160	40	145	2	30	23	16	10	10	9	9	20	40	33	27	22	20	19	18	31	42	37	34	30	27	24	21	37	46	40	37	35	33	29	28	41
	80	290	4	33	24	21	16	16	14	13	24	41	36	30	26	24	22	21	34	44	40	37	34	31	28	24	40	47	42	39	37	36	32	30	43
	121	435	6	35	26	26	21	21	18	17	29	42	39	34	30	28	26	23	38	45	43	39	37	35	31	27	43	49	43	41	40	39	35	32	46
	161	580	8	37	33	31	27	26	22	21	33	43	42	38	34	32	30	25	41	47	44	41	39	37	34	29	45	51	48	45	44	42	38	35	49
	201	725	10	40	40	37	32	31	27	25	39	44	45	41	36	35	33	28	44	48	45	42	39	38	37	31	46	53	53	49	47	45	42	38	53
200	63	225	2	31	24	17	12	10	10	9	21	41	33	28	24	22	20	19	33	44	39	36	32	30	26	23	39	49	42	39	37	35	30	29	43
	125	450	4	34	27	20	16	15	15	13	25	42	36	31	29	27	24	27	36	46	41	38	36	33	30	27	42	51	45	42	40	38	32	32	45
	189	680	6	38	31	23	21	20	20	16	30	44	38	35	34	32	28	26	40	48	43	41	40	36	34	31	45	52	48	45	43	41	35	35	48
	250	900	8	42	35	31	28	27	25	22	35	46	40	39	36	35	33	29	43	49	49	42	41	37	36	33	46	52	50	48	46	43	39	38	51
	314	1 130	10	45	39	39	34	34	29	28	41	48	43	43	38	38	37	33	46	50	45	44	41	40	39	35	48	55	53	50	48	46	44	40	54
224	78	280	2	35	27	19	14	13	13	12	24	44	37	29	27	25	22	21	35	46	42	39	34	32	28	25	41	51	46	43	41	37	33	31	46
	156	560	4	38	30	25	19	18	17	16	28	46	42	33	30	29	26	25	39	48	44	41	37	36	33	29	44	52	48	45	42	40	37	34	48
	236	850	6	40	34	30	24	24	21	20	33	48	43	37	34	33	30	29	42	49	45	43	40	40	37	33	47	54	50	47	46	42	40	37	51
	311	1 120	8	44	39	36	31	31	27	26	39	50	44	42	38	34	33	45	50	46	43	41	42	40	36	48	55	52	49	48	45	43	40	53	
	394	1 420	10	48	43	43	38	38	33	32	45	51	45	45	40	40	39	36	48	51	47	44	42	44	43	38	50	56	54	50	47	46	42	55	
250	97	350	2	37	29	23	17	16	16	15	27	44	39	31	30	26	24	22	37	47	44	42	37	35	30	28	44	52	50	48	44	41	35	33	50
	194	700	4	39	31	28	24	23	21	19	31	44	39	36	34	32	30	25	41	47	44	43	39	39	37	33	47	54	52	50	46	44	39	37	52
	294	1 060	6	40	33	33	30	30	26	23	36	44	39	38	36	33	30	29	42	49	45	43	41	43	44	38	50	56	54	51	49	47	43	41	55
	389	1 400	8	44	38	37	34	34	30	27	40	47	41	38	40	39	32	46	51	47	45	42	44	44	39	51	57	55	51	50	48	46	43	56	
	492	1 770	10	49	43	43	38	38	34	31	45	51	46	46	41	41	40	37	49	53	48	46	44	46	45	40	52	58	56	52	51	49	48	45	57
315	156	560	2	40	33	26	20	20	18	17	31	50	42	35	35	30	28	24	41	52	46	45	40	39	33	30	47	54	50	49	45	42	37	35	51
	311	1 120	4	43	36	29	26	26	23	21	35	51	44	39	39	34	32	28	44	54	48	47	43	42	38	35	50	56	52	51	48	45	40	38	53
	467	1 680	6	47	39	33	33	32	29	26	40	52	47	43	43	39	36	32	48	56	50	49	47	45	44	39	53	58	54	52	51	49	43	42	56
	622	2 240	8	48	41	38	36	36	32	29	43	52	48	45	43	41	39	35	49	56	51	50	47	46	45	40	54	59	55	52	51	50	46	43	57
	778	2 800	10	50	43	44	39	39	36	32	46	53	49	48	43	43	42	38	51	57	51	50	47	46	46	42	55	60	56	53	51	50	49	45	58
400	250	900	2	44	37	29	23	23	21	19	34	54	45	39	39	33	32	28	44	56	48	47	43	43	37	34	50	57	52	52	47	46	41	38	54
	500	1 800	4	47	40	35	30</td																												

Circular volume flow controller

Sound power level of housing sound radiation (with insulating shell)

Size DN	Volume flow rate l/s m ³ /h	Air flow velocity m/s	Static differential pressure Δp in Pa																																
			100						300						500						1 000														
			Sound power level L_W in dB Octave band centre frequency in Hz						Sound power level L_W in dB Octave band centre frequency in Hz						Sound power level L_W in dB Octave band centre frequency in Hz						Sound power level L_W in dB Octave band centre frequency in Hz														
			125	250	500	1 000	2 000	4 000	8 000	125	250	500	1 000	2 000	4 000	8 000	125	250	500	1 000	2 000	4 000	8 000	125	250	500	1 000	2 000	4 000	8 000	L_{WA} in dB(A)				
100	15	55	2	23	16	13	10	10	9	8	18	29	24	20	12	11	10	10	22	33	28	23	17	13	11	11	25	36	32	27	23	16	17	13	29
	30	110	4	26	20	17	11	11	11	10	20	31	28	21	14	13	12	11	24	34	31	24	18	14	14	12	27	37	35	28	24	19	17	14	31
	47	170	6	30	26	19	14	14	14	12	24	34	31	23	16	15	16	11	27	35	34	27	21	16	16	15	30	38	37	31	27	21	18	16	34
	61	220	8	31	31	24	20	20	14	10	28	35	36	28	22	17	17	12	31	38	39	32	25	21	17	15	34	42	41	35	30	25	23	18	37
	78	280	10	32	36	29	21	20	17	12	31	36	42	33	25	20	18	13	36	41	44	36	28	24	20	17	38	46	45	40	33	30	26	22	41
125	25	90	2	24	18	13	10	10	9	9	18	32	26	21	15	13	11	10	24	35	29	22	18	15	12	11	26	39	34	27	23	18	13	13	30
	50	180	4	27	19	14	11	11	11	10	20	33	30	22	17	15	13	12	26	37	32	26	19	18	14	13	29	40	36	29	26	19	15	14	32
	74	265	6	31	24	18	15	14	11	10	23	34	33	26	19	17	17	12	29	39	35	29	22	19	15	14	31	41	39	32	29	22	17	15	35
	100	360	8	32	30	23	17	17	15	13	27	36	37	29	26	22	19	14	33	41	38	32	26	21	18	15	34	44	43	37	34	26	21	18	40
	122	440	10	33	36	29	22	22	19	15	32	37	40	33	27	23	21	16	36	42	41	35	29	25	22	17	37	48	47	41	36	31	25	22	43
160	40	145	2	25	20	13	10	10	9	9	19	35	27	20	13	12	10	10	24	37	31	27	21	14	13	12	29	41	34	30	26	20	15	13	32
	80	290	4	28	21	15	12	11	10	10	20	36	30	23	17	15	13	13	27	39	34	30	25	18	16	14	32	42	36	32	28	23	18	15	34
	121	435	6	30	22	19	14	12	11	10	22	37	33	27	21	16	15	13	29	40	37	32	28	22	20	18	34	44	37	35	31	26	22	18	37
	161	580	8	32	27	25	18	13	13	11	26	38	36	31	25	19	18	16	33	42	38	34	30	24	22	21	36	46	43	38	35	29	26	22	41
	201	725	10	35	34	30	23	17	16	12	31	39	39	34	27	22	20	18	36	43	39	35	30	25	23	22	37	48	47	42	38	32	28	23	44
200	63	225	2	26	20	15	10	10	10	9	19	36	27	20	14	12	12	10	24	39	33	28	22	15	14	11	30	44	36	31	27	20	15	12	33
	125	450	4	29	22	16	12	11	11	10	21	37	30	23	19	14	14	11	27	41	35	30	26	18	16	13	32	46	39	34	30	23	17	14	36
	189	680	6	35	25	18	17	14	12	10	24	39	32	27	24	17	15	12	30	43	37	33	30	21	18	13	34	47	42	37	33	26	19	15	38
	250	900	8	37	25	23	20	19	17	14	27	41	34	31	26	20	16	14	33	44	43	34	31	22	19	15	37	47	44	40	36	28	20	18	42
	314	1 130	10	40	33	31	26	26	21	20	34	43	37	35	28	23	17	15	36	45	39	36	31	25	20	16	38	50	37	42	38	31	24	20	43
224	78	280	2	30	21	16	11	11	11	10	21	39	31	22	15	13	13	12	27	41	36	32	24	18	15	14	33	46	40	36	31	23	16	15	38
	156	560	4	33	24	18	14	13	13	12	23	41	36	26	20	15	14	13	30	43	38	34	27	22	14	13	35	47	42	38	32	26	17	14	39
	236	850	6	35	28	23	18	16	14	13	26	43	37	30	24	19	15	14	33	44	39	36	30	26	17	13	37	49	44	40	36	28	20	17	42
	311	1 120	8	39	33	29	22	20	18	16	31	45	38	36	28	21	19	18	36	45	40	36	31	28	20	18	38	50	46	42	38	31	23	20	43
	394	1 420	10	43	37	36	28	27	20	18	37	46	39	38	30	26	23	21	38	46	41	37	32	30	23	21	39	51	48	43	40	33	26	22	45
250	97	350	2	33	24	17	12	12	12	10	22	40	34	25	21	13	13	12	30	43	39	36	28	22	13	13	36	48	45	42	35	28	17	14	42
	194	700	4	35	26	22	15	14	14	12	24	40	34	30	25	19	14	12	32	43	39	37	30	26	19	13	37	50	47	44	37	31	21	17	44
	294	1 060	6	36	28	27	21	17	14	13	28	40	34	32	27	25	19	13	34	43	40	37	32	30	26	18	39	52	49	45	40	34	25	21	46
	389	1 400	8	40	33	31	25	21	16	13	31	43	42	35	29	27	21	13	38	47	42	39	33	31	26	19	40	53	50	45	41	35	28	23	47
	492	1 770	10	45	38	37	29	25	18	14	37	47	41	40	32	28	22	17	40	49	43	40	35	32	27	20	42	54	51	46	42	36	30	25	48
315	156	560	2	36	28	20	12	11	11	11	24	46	37	29	26	17	13	10	34	48	41	39	31	26	15	10	40	50	45	43	36	29	19	15	43
	311	1 120	4	39	31	23	17	14	14	11	28	47	39	33	30	21	17	11	36	50	43	41	34	29	20	15	42	52	47	45	39	32	22	18	46
	467	1 680	6	43	34	27	24	19	14	11	32	48	42	37	34	26	18	12	38	52	45	43	38	32	26	19	44	54	49	46	42	36	25	22	48
	622	2 240	8	44	36	32	27	23	15	12	34	48	43	39	34	28	21	15	41	52	46	44	38	33	27	20	45	55	50	46	42	37	28	23	48
	778	2 800	10	46	38	38	30	26	18	14	38	49	44	42	34	30	24	18	42	53	46	44	38	33	28	22	45	56	51	47	42	37	31	25	49
400	250	900	2	40	32	23	14	12	11	11	28	50	40	33	30	20	13	11	38	52	43	41	34	30	19	14	42	53	47	46	38	33	23	18	46
	500	1 800	4	43	35	29																													

Circular volume flow controller

Sound power level of air flow noise and housing sound radiation

Size	Volume flow rate	Air flow velocity	Static differential pressure Δp in Pa												
			Sound power level of air flow noise in dB(A) ref. 10^{-12} W				Sound power level of housing sound radiation in dB(A) ref. 10^{-12} W without insulating shell				Sound power level of housing sound radiation in dB(A) ref. 10^{-12} W with insulating shell				
			100	300	500	1 000	100	300	500	1 000	100	300	500	1 000	
100	94	340	12	59	65	68	72	41	46	48	54	36	39	42	45
	110	395	14	62	66	69	73	47	50	53	57	40	43	46	48
	138	495	16	64	68	70	74	51	54	57	62	43	47	50	52
125	147	530	12	60	66	69	74	42	47	50	56	36	39	42	46
	172	620	14	63	67	71	75	47	52	54	60	39	43	45	49
	197	710	16	65	69	72	76	52	56	58	63	43	46	49	52
160	242	870	12	61	67	70	74	43	47	50	55	36	39	42	47
	282	1 015	14	53	69	71	76	47	51	53	58	39	43	45	50
	322	1 160	16	66	70	72	77	51	55	57	62	43	46	48	53
200	378	1 360	12	62	67	70	75	44	49	51	57	37	40	42	48
	440	1 585	14	64	69	72	76	48	52	54	59	41	43	46	50
	503	1 810	16	66	70	73	77	51	55	57	62	44	46	48	53
224	472	1 700	12	62	68	71	75	46	50	53	58	38	41	43	48
	551	1 985	14	65	69	72	76	51	53	55	60	42	43	46	50
	630	2 270	16	67	71	73	77	54	56	58	63	45	46	48	53
250	589	2 120	12	63	68	71	76	47	52	55	59	40	43	46	50
	688	2 475	14	65	69	73	77	52	54	56	61	43	45	48	52
	786	2 830	16	68	71	74	78	55	57	59	63	46	48	50	54
315	935	3 365	12	64	69	72	77	48	52	57	60	41	45	48	51
	1 092	3 930	14	66	70	74	78	52	54	58	62	44	47	50	54
	1 247	4 490	16	69	72	75	79	55	57	60	63	47	49	52	56
400	1 508	5 430	12	65	70	74	78	52	56	60	63	45	48	51	55
	1 760	6 335	14	67	71	75	79	55	58	62	64	47	50	53	56
	2 011	7 240	16	70	73	77	80	57	60	63	66	49	52	55	57
450	1 908	6 870	12	67	71	75	79	56	58	62	65	49	51	53	56
	2 226	8 015	14	69	73	77	80	58	60	63	66	51	53	55	57
	2 544	9 160	16	72	75	78	81	60	61	65	68	53	55	56	58

Table 9: Sound power level of air flow noise and housing sound radiation in dB(A) ref. 10^{-12} W for $u = 12 - 16 \text{ m/s}$

Circular volume flow controller

Type code and tender text

Type code			
Volume flow controller	Size	Adjustment	Insulation
VRI	-	-	-
Accessory			
Size			
100 = DN 100	250 = DN 250		
125 = DN 125	315 = DN 315		
160 = DN 160	400 = DN 400		
200 = DN 200	450 = DN 450		
224 = DN 224			

Tender text

.... units

Volume flow controller with built-in electronic control system for use in circular supply air and return air ducts of HVAC systems,

consisting of:

- circular housing suitable for two-side connection to ducts to EN 1506 and flexible ducts to EN 13180; also suitable for flange connection to EN 12220; damper blade with internal silicone seal ¹⁾ for full shutoff,
- air tightness category 3 to EN 1751
- housing leak tightness fulfils category B to EN 1751
- optional insulating shell to reduce sound radiation and for thermal insulation
- Belimo compact controller, type LMV-D3-MP (up to DN 250) or NMV-D3-MP (from DN 315 upwards), with integrated volume flow sensor, actuator and measurement recording device
 - performance range either L6, L10 or L13
 - operating range either 0 – 10 V or 2 – 10 V ²⁾
 - service port for connecting service and diagnosis tools

Factory-setting of required volume flow rates; resetting possible.

For use in CAV systems or VAV systems with

\dot{V}_{\max} : l/s [m^3/h] ³⁾
 \dot{V}_{\min} : l/s [m^3/h] ³⁾

Adjustment

C1 = Belimo compact controller, type LMV-D3-MP (up to DN 250)
C2 = Belimo compact controller, type NMV-D3-MP
(from DN 315 upwards)

Insulation

O = no insulation
D = with insulating shell

Accessory

O = smooth pipe end for connection to ducts to EN 1506
and to flexible ducts to EN 13180
F = flange connection to EN 12220

Material:

- Housing made of galvanized sheet metal
- Measuring cross made of aluminium/plastic (PS)
- Damper blade seal made of silicone
- Insulating material is mineral wool, covering is made of galvanized sheet metal

Make:

Krantz Components

Type:

VRI – DN _____ - _____ - _____ - _____

Subject to technical alterations.

¹⁾ Other material on request

²⁾ Standard setting 2 – 10 V.

If you wish 0 – 10 V, please specify it in your order.

³⁾ Unless otherwise specified in the order, the setting $\dot{V}_{\min} = 0$ and $\dot{V}_{\max} = \dot{V}_{\text{limit}}$ will be supplied.



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