RVP-R
VAV REGULATORS

Intended use:
VAV regulators are used for automatic airflow regulation in the ventilation and air conditioning systems.

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VAV regulators are used for automatic airflow regulation in the ventilation and air conditioning systems. They adjust the amount of supply/exhaust air to control the climate individually for every room/zone served. By using the control elements they can adjust accordingly to different heat gain/loses in the zones served with respect to amount of people gathered in the zone and also other factors such as heat gains and loses through the windows.

RVP-R regulators may be produced in two types with respect to the acting time. In the standard version time necessary for the full cycle (open to close) is 150 seconds, while the fast acting drive can do that in 3 seconds. In the special type RVP-R regulators may also be applicable to work with contaminated air with light corrosive gases (according to Classification of Corrosive Environments ISO 12944 max. class C3)

In the special version, RVP-R regulators are also intended for transporting polluted or slightly aggressive air (according to the Classification of Corrosive Environment in accordance with ISO 12944, maximum class C3). The regulator in accordance with EN1751 has C2 tightness class (tightness of the casing C, tightness of the blade 2)

Material

The casing and air damper blade are made of galvanized steel sheet or on special orders it they can be made of stainless steel 1.4306. The damper blade has a rubber gasket, which assures air tightness at the fully closed position. The damper blade shaft is working on plastic or brass bearings. The measuring probe is an orifice or a linear. The orifice is made of galvanized steel sheet. On both sides tube nozzles are installed to measure differential pressure. The linear is made of aluminum profile with proper impulse holes distributed on it.

As an option RVP-R is made with thermal-acoustic insulation RVP-Rt.

The control driving mechanism of the air flow regulator is a compact unit consisting of static pressure differential sensor, digital controller PID and the actuator. The working principle depends on measuring air volume flowing through the regulator. In the regulators with orifices reading is made by measuring probes located on both sides of the orifice. In the regulators with linears, reading is made on impulse holes located on both sides of the linear. When the air is flowing through the measuring probe on both sides is created pressure difference which corresponds to the actual air volume. Then the pneumatic signal is transmitted by plastic tubes to the pressure sensor.

Pressure differential value is sent to the controller, where it is transduced to the air volume value and compared with the set point value. If the measured value is different that the set point, the actuator adjusts the air damper to the required position to eliminate the differences between measured and set point values.

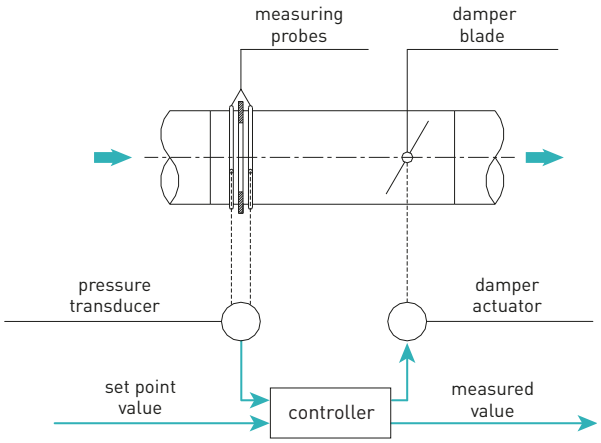


Figure 1. VAV regulator operation.

The device is programmed y the manufacturer and the parameters can not be changed by unauthorized people.

Dimensions

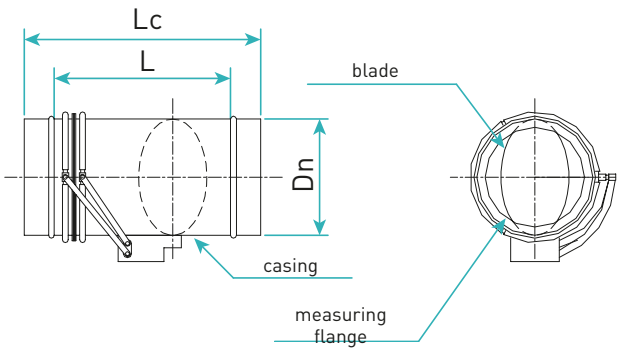


Figure 2. VAV regulator type: RVP-R.

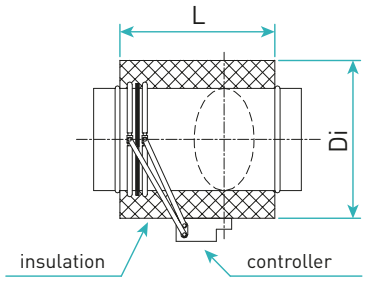


Figure 3. VAV regulator type: RVP-Rt (with insulation).

Typical dimensions and working range

Tabela 1. Typical dimensions and working range of the particular regulator sizes.

Dn [mm]	Di [mm]	L [mm]	Lc [mm]	First air stream [m³/h] [only strip]	Second air stream [m³/h] [strip or orifice]
100	200	265	365	28 - 226	55 - 339
125	225	265	365	44 - 353	90 - 530
160	260	280	380	72 - 579	145 - 869
200	300	300	400	113 - 905	225 - 1357
250	350	350	450	177 - 1414	350 - 2121
315	415	415	515	281 - 2244	560 - 3367
400	500	500	600	452 - 3619	900 - 5420
500	600	600	700	707 - 5655	1400 - 8482

Instalation guidelines

For the proper performance of the device the following rules should be maintained:

- keep the straight piece of ductwork on the regulator intake 2D,
- keep the straight piece of ductwork on the regulator discharge 1D.

Electrical wiring of the measuring-control-driving units should be done according to the supplied schematic with the device and it should be done by a professional.

Air pressure drop on the RVP-R regulator (air damper blade fully open)

The RVP-R regulators underwent analytical tests of the distribution of the measurement elements, aimed at reducing the error threshold of calibration of the regulated air stream, which was reflected in the MA thesis, which was defended in 2005 at the AGH in Krakow.

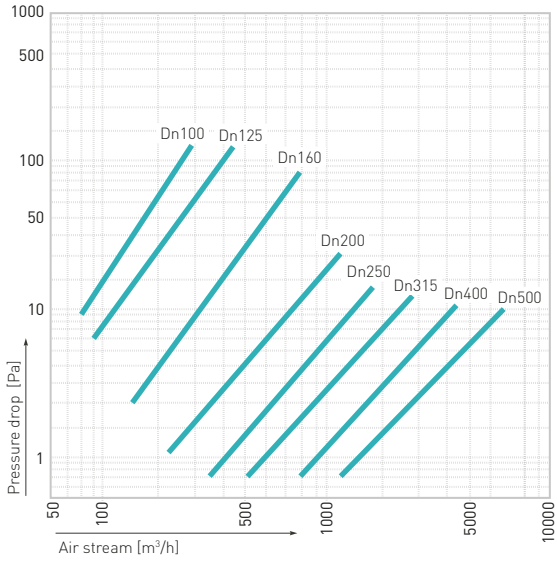


Chart 1. Air pressure drop on the RVP-R regulator.

Technical data

Table 2. Sound power level on the discharge of RVP-R regulator.

Sound power level on the discharge of RVP-R regulator
$L_{WA}[dB_{[A]}]$

	100 [Pa]				250 [Pa]				500 [Pa]			
	3	6	9	12	3	6	9	12	3	6	9	12
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Dn 100	42	50	59	63	55	63	65	70	61	66	70	71
Dn 125	42	49	58	63	55	63	65	69	60	66	70	71
Dn 160	43	53	60	65	54	64	67	72	62	66	71	72
Dn 200	42	52	59	63	55	60	65	71	62	65	70	73
Dn 250	44	55	61	66	55	62	66	72	62	62	70	74
Dn 315	41	56	62	71	57	62	67	75	61	61	73	78
Dn 400	45	54	60	70	58	64	69	75	64	64	75	79
Dn 500	44	56	61	72	58	63	68	73	63	63	74	78

Table 3. Sound power level emitted by RVP-R.

Sound power level emitted by RVP-R Regulator without acoustic insulation
$L_{WA}[dB_{[A]}]$

	100 [Pa]				250 [Pa]				500 [Pa]			
	3	6	9	12	3	6	9	12	3	6	9	12
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Dn 100	24	29	36	43	31	38	43	51	32	39	47	53
Dn 125	24	29	36	43	32	38	43	51	33	39	47	53
Dn 160	24	32	38	45	33	40	44	53	41	44	48	55
Dn 200	25	31	42	48	36	44	47	52	42	46	52	54
Dn 250	30	41	44	49	39	46	47	55	48	51	54	59
Dn 315	33	46	47	53	45	51	53	55	49	56	57	59
Dn 400	36	49	50	53	48	55	56	58	54	56	61	64
Dn 500	35	50	51	53	47	55	57	59	53	55	61	63

Table 4. Sound power level emitted by RVP-R.

Sound power level emitted by RVP-R Regulator with acoustic insulation
$L_{WA}[dB_{[A]}]$

	100 [Pa]				250 [Pa]				500 [Pa]			
	3	6	9	12	3	6	9	12	3	6	9	12
	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s	m/s
Dn 100	20	23	31	38	29	31	36	41	28	30	36	46
Dn 125	20	23	31	38	30	31	36	41	29	30	36	46
Dn 160	20	25	32	40	30	32	37	44	35	38	39	44
Dn 200	22	25	34	42	29	34	39	42	33	38	40	45
Dn 250	23	30	36	44	37	39	42	47	38	42	44	48
Dn 315	23	35	39	46	40	44	46	49	44	46	47	51
Dn 400	25	39	44	50	43	48	49	50	44	51	53	54
Dn 500	25	40	44	51	44	49	50	52	44	51	54	55

Control and driving compartment

Regulators are produced in two variants:

A) Standard performance – standard version of RVP-R (for regulation of clean air with full control timing cycle open/close of 150 seconds):

VAV – Compact

In this variant control and driving compartment consists of dynamic differential pressure sensor, controller and damper actuator integrated as one compact unit with:

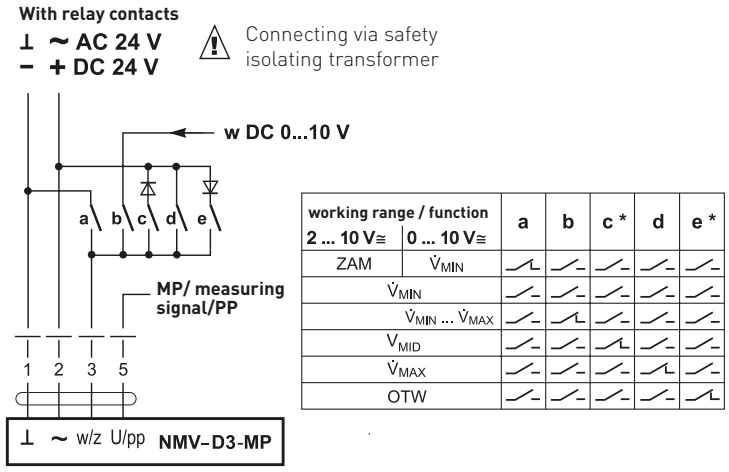
- NMV-D3-MP, LMV-D3-MP – Belimo,
- GDB 181.1, GLB181.1 – Siemens,

symbols and they are attached to the RVP regulator respectively to its nominal diameters Dn.

This unit has the following control sequences possible:

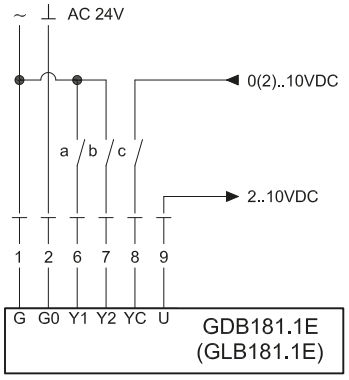
- control - signal in the range between 2 ... 10V, 0 ... 10V - regulator controls the flow of air in the duct between the desired or capacities, Vmin, Vmax, as the continuous signal from the lead in terms of programmed control voltage (0 ... 10V, 2 ... 10V),
- control - fixed signal:
  - **„Close"** – the air damper fully closed – closing the air damper on air supply or air exhaust ducts to unoccupied rooms let to conserve energy.
  - **„Open"** - the air damper fully open – it is used to help in smoke evacuation from the rooms (heavy ventilating) or quite often as a safe position.
  - **V_{min}** – min. air volume – regarding the actual needs or during the unoccupied time particular building zones may be switched to stand by mode and system is providing only minimum required air for ventilation purposes and in such layout it gives additional energy savings.
  - **V_{mid}** – indirect air damper position – possible position of the air damper based on mathematical load calculations for the room/zone served.
  - **V_{max}** – max. air volume – single room or a group of rooms must temporarily receive maximum air volume – this sequence lets to ventilate, evening cooling or morning warm up of the rooms.
  - **V_{nom}** – reference flow for the voltage value returned by the controller (for Vnom, the reverse voltage, on terminals 1-5 is 10V).
- control through the digital communication protocol:
  - MOD-BUS,
  - EIB Konnex (KNX),
  - BACnet*,
  - MP-BUS**,
  - LonWorks®**,

* only Siemens
** only Belimo



working range / function 2 ... 10 V≅	0 ... 10 V≅	a	b	c *	d	e *
ZAM	$\dot{V}_{MIN}$					
$\dot{V}_{MIN}$						
$\dot{V}_{MIN}$ ... $\dot{V}_{MAX}$						
V_{MID}						
$\dot{V}_{MAX}$						
OTW						

Diagram 1. Diagram of connecting the regulator with a compact actuator NMV-D3-MP or LMV-D3-MP.



Control function	a (Y1)	b (Y2)	c (YC)
Close			
Vmin			
Smooth Vmin ..Vmax			
Vmax			
Open			

Diagram 2. Diagram of connection between the regulator and the compact cylinder GDB 181.1 or GLB181.1.

Table 5. Control and driving compartment.

Technical data:		LMV-D3-MP (NMV-D3-MP)	GDB 181.1 (GLB181.1.)
Nominal voltage		24 V AC/DC, 50/60 Hz	24 V AC/DC, 50/60 Hz
Power suply range		19,2...28,8 V AC 21,6...26,4 V DC	19,2...28,8 V AC
Rated power		5 Vamax. 5A@ 5ms [5,5 VA max. 5A@5ms]	3 VA
Power consumption	In operation At rest For wire sizing	3 W [3,5 W] 1,25[W] 5,5[VA]	2,5 W 0,5 W 3 VA
Torque (nominal torque)		5 Nm [10 Nm]	5 Nm (100m)
Direction of rotation		Can be selected with 0/1 switch	set to ACS
Angle of rotation		Max.95°, can be limited at both ends with adjustable mechanical end stops	
Protection class		II I [safety extra - low voltage]	
Sound power level		Maks. 35dB	-
Casing protection		IP54	
Ambient temperature range		0...+50[°C]	
Non-operating temperature range		-20...+80[°C]	-20...+70[°C]
Ambient humidity range		5...95 rH. non-condensating	
Maintenance		Maintenance-free	
Weight		500 g [700 g]	600 g
Classic control			
Tryb z sygnałem wiodącym		terminal 3 - 2...10VDC - 0...10VDC	YC 2-10VDC 0-10VDC
Mode for actual value signal U5		terminal 5 - 2...10VDC - max.05mA - 0...10VDC - max.05mA - Adjustable: volumetric flow	U 2-10VDC
Operating modes for constant air volume		CLOSE / Vmin / Vmid / Vmax / OPEN (only with AC 24V supply)	
MP-BUS function			
Address in bus operation		MP 1...8 / classic control: PP	-
LonWorks®/EIB Konnex		With BELIMO UK24LON / UK24EIB interface, 1...8 BELIMP MP devices	-
DDC controller		DDC Controller / PLC, with integrated MP interface	-
Fan optimiser		Optimiser Belimo COU24-A-MP	-

By pressing a button on the actuator casing, it is possible to disengage the transmission. As long as the button is pressed, it is possible to manually change the throttle.

B) Special enforcement – quick version of RVP-R (with full control timing cycle open/close of 3 seconds) applicable for use in environments with light chemical contaminations Control driving compartment of the vav regulator is the Belimo device which consists of static pressure differential sensor, digital controller PID VAV and actuator.

In the control and driving compartment there are the following items:

1.Controller PID VAV with the following options control:

- control - signal in the range between 2...10V, 0...10V,
- control - fixed signal : „Close" , „Open", Vmin , Vmid, Vmax,
- control through the digital communication protocol – possibility to integrate with:
  - systemami EIB Konnex KNX (UK-24EIB),
  - systemami LonWorks® (UK-24LON),
  - systemami BACnet (UK-24BAC),
  - systemami MOD-BUS (UK-24MOD),
  - Fan optimiser systems.

2. Static pressure differentia sensor – is applicable for pressure differential readings in air ducts or in rooms. They are adapted to work with contaminated air with light chemical aggressive gases. Solid design makes them available for use in laboratories, GMP rooms and in the industry.

Table 6.

Type	Reading ranges	Protection against high presures	Temperature dependance	Weight
VFP-300	0...300[Pa]	Maks. 5000[Pa]	±0,05%/K	Approx. 280g

3.Actuator NM24A-V-ST – 10[Nm] - standard application

Table 7.

Technical data:		
Nominal voltage		24[V] AC/DC (from VRP-... controller]
Power consumption	In operation At rest For wire sizing	3,5[W] 1,25[W] 5,5[Va]
Torque (nominal torque)		Min. 10[Nm] at nominal voltage
Direction of rotation		Can be selected with 0/1 switch
Angle of rotation		Max.95°, can be limited at both ends with Adjustable mechanical end stops
Running time		150[s]
Protection class		III [safety extra - low voltage]
Sound power level		Max. 35 [dB]
Degree of protection		IP54
Ambient temperature range		-30...+50[°C]
Non-operating temperature range		-40...+80[°C]
Maintenance		Maintenance-free
Dimensions		146/80/75[mm]
Weight		710[g]

Table 8. Actuator LMQ24A-SRV-ST – 4[Nm] - application for fast acting devices.

Technical data:		
Nominal voltage		24[V] AC/DC (from VRP-... controller]
Power consumption	In operation At rest For wire sizing	12[W] 1,5[W] 18[Va]
Torque (nominal torque)		Min. 4[Nm] at nominal voltage
Direction of rotation		Can be selected with 0/1 switch
Angle of rotation		Max.95°, can be limited at both ends with adjustable mechanical end stops
Protection class		III [safety extra - low voltage]
Running time		2,5[s]/90°
Degree of protection		IP54
Sound power level		52[dB] [A]
Ambient temperature range		-30...+50[°C]
Non-operating temperature range		-40...+80[°C]
Maintenance		Maintenance-free
Dimensions		146/80/75[mm]
Weight		810[g]

Table 9. Actuator NMQ24A-SRV-ST – 8[Nm] - application for fast acting devices.

Technical data:		
Nominal voltage		24[V] AC/DC (from VRP-... controller]
Power consumption	In operation At rest For wire sizing	12[W] 1,5[W] 18[Va]
Torque (nominal torque)		Min. 8[Nm] at nominal voltage
Direction of rotation		Can be selected with 0/1 switch
Angle of rotation		Max.95°, can be limited at both ends with adjustable mechanical end stops
Protection class		III [safety extra - low voltage]
Running time		4[s]/90°
Degree of protection		IP54
Sound power level		52[dB] [A]
Ambient temperature range		-30...+50[°C]
Non-operating temperature range		-40...+80[°C]
Maintenance		Maintenance-free
Dimensions		156/88/77[mm]
Weight		930[g]

Any orders regarding regulators with fast acting drives must be discussed with and accepted by Smay technical department.
The control and driving compartment is all connected by the manufacturer, but the customer must bring the power supply and do the control wiring himself. Electrical wiring of the VRP-M unit should be done according to the supplied schematic and it should be done by a professional.

- Supply via safety isolation tranfsormer!
- Connection 1, 2 (AC/DC 24V) and 5 (MP signal) must be routed to accessible terminals (room temperature controller, floor distribution, control cabinet, etc.) in order to simplify access with the PC-Tool for diagnostic and service work.

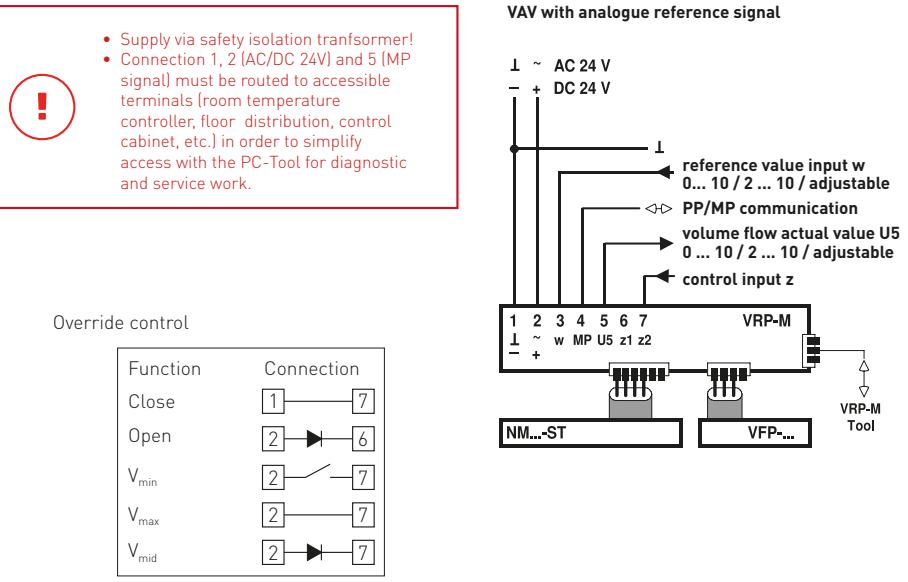


Diagram 3. Connection diagram of the regulator with fast automatic control (VRP-M).

RVP-R - Regulator przepływu VAV

While ordering please provide information according to the following method:

<RVP-P> <X> - <I> - <A> x <B> - <V_{MAX}> / <Za> <V_{MIN}> <Ta> - <Ts> - <Tp> - <K> - <N> - <S> - <P>

Where:

X	measuring element*	
	none	**- flange**
	L	- measuring strip
I	insulation*	
	none	**- not insulated**
	t	- insulated
A	inner width of the regulator [mm]	
B	Inner height of theregulator [mm]	
V_{MAX}	max. air volume [m³/h]	
Za	Does the controller (regulator) have the full closure feature?*	
	none	**- no**
	(0)	- Yes (closing option available)
V_{MIN}	min. air volume [m³/h]	
Ta	the type of automation*	
	none	**- Standard (Belimo)**
	Sim	- Siemens
Ts	the type of drive*	
	none	**- standard**
	Q	- quick (only Belimo)

Tp	connection type*	
	none	**- clasic**
	MST	- Master/Slave communication with function Master
	SLV	- Master/Slave funkcja Slave
K	communication*	
	none	**- 2...10V (with the option to force the CLOSE position)**
	1	- 0...10V
	MP	- general value MP BUS (only Belimo)
	MOD	- Modbus
	LON	- LonWorks (only Belimo)
	KNX	- KNX
	BAC	- BACnet (only Siemens)
N	number of the regulator in the system - applies only for MP-BUS communication	
S	environment*	
	none	**- clean air**
	C3	- environment with class C3
P	material*	
	SO	**- galvanised steel**
	SN	- stainless steel

*optional values - default values will be used if optional values are not specified

Order example: **RVP-Rt-315-1100/700-Q-MP BUS-7**