RVP-R-EX
FLOW REGULATORS VAV
IN EXPLOSION-PROOF EXECUTION

Intended use:
Flow regulators are used for automatic regulation of the stream flowing through the air ventilation ducts both in the supply and exhaust part of the system.

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Flow regulators are used for automatic regulation of the stream flowing through the air ventilation ducts both in the supply and exhaust part of the system. By changing the air consumption, they enable to create the individual climate for each of the rooms in the building, considering the occurrence of non-uniform loads in those rooms, depending on the number of people present in the room, as well as on variable external factors such as: heat gains through non-transparent and transparent partitions as a result of sun exposure.

Relative to the work environment, the regulators RVP-R-Ex may be executed in two versions. In the standard explosion-proof version, the regulator is designed for the adjustment of clean stream of filtered air, whereas in special version also with application for transporting the contaminated air or slightly aggressive air (pursuant to Corrosive Environment Classification in compliance with ISO 12944 max. class C3).

The devices RVP-R-Ex provide the high safety level and are designed to be used in the places, in which the explosive atmospheres are likely to occur, caused by gases, vapours, mist or air-dust mixtures.

The regulators RVP-R-Ex are designed in compliance with the directive ATEX 94/9/EC as the devices of group II category 2 and designed for using in the explosion-hazard zones 1,2,21 and 22.

The producer's ATEX certificate is available for the electric components.

ATEX: ExII -/2GD c IIC T6 (80°C).

Material

The casing and the volume control damper diaphragm are made out of the galvanised steel sheet or at special request out of the stainless steel 1.4301. The damper division is equipped with the rubber seal, thank to which it obtains the tightness at the division complete closing. The damper division axis is placed in the bearing made out of the anti-static plastics or brass. The piling-up and measuring element is an orifice or a measuring strip. The orifice is made out of the galvanised steel sheet. At its both sides there are built-in connector pipes for the pressure measurement. The strip is made out of the aluminium profile with the impulse holes accordingly arranged within its precincts. The adjustment-driving system of the flow regulator is the system consisting of the static sensor for differential pressure, the actuator and the controller (the controller is placed beyond the explosion-hazard zone n compliance with the scheme no. 5).

Principles of operation

The principle of operation is based on the measurement of the air stream flowing through the regulator. In the regulators, where the measuring orifice is used, the measurement is conducted by means of the measuring probes. In the regulators, where the measuring strip is used, the measurement is conducted by means of the impulse holes. Both the probes and the impulse holes are placed at both sides of the piling-up element.

While the air is flowing through the measuring instrument, the pressure difference is formed at its both sides, dependent on the flow stream. The signal from the piling-up elements is transmitted to the pressure sensor by means of the flexible impulse tubes. The pressure value on the piling-up element is transmitted to the regulator, where it is processed into the flow value and compared with the set value. If the measured value is different than the set value, the volume control diaphragm actuator adjusts it into such position, so that the difference between the measured value and the set value would not occur.

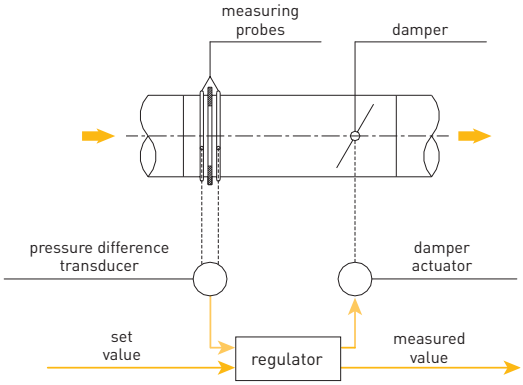
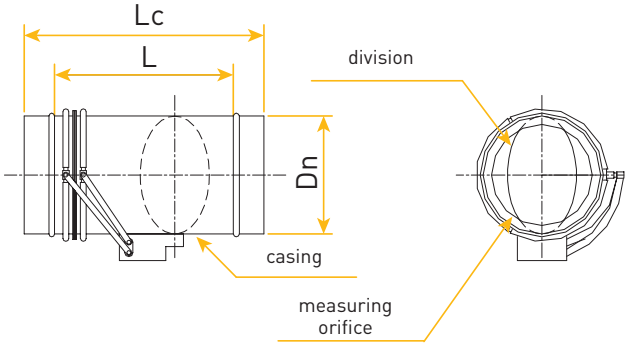


Figure 1. Regulator operation diagram.



Rysunek 2. Flow regulator VAV type: RVP-R-Ex.

ZONE ENDANGERED EXPLOSION

SO SN

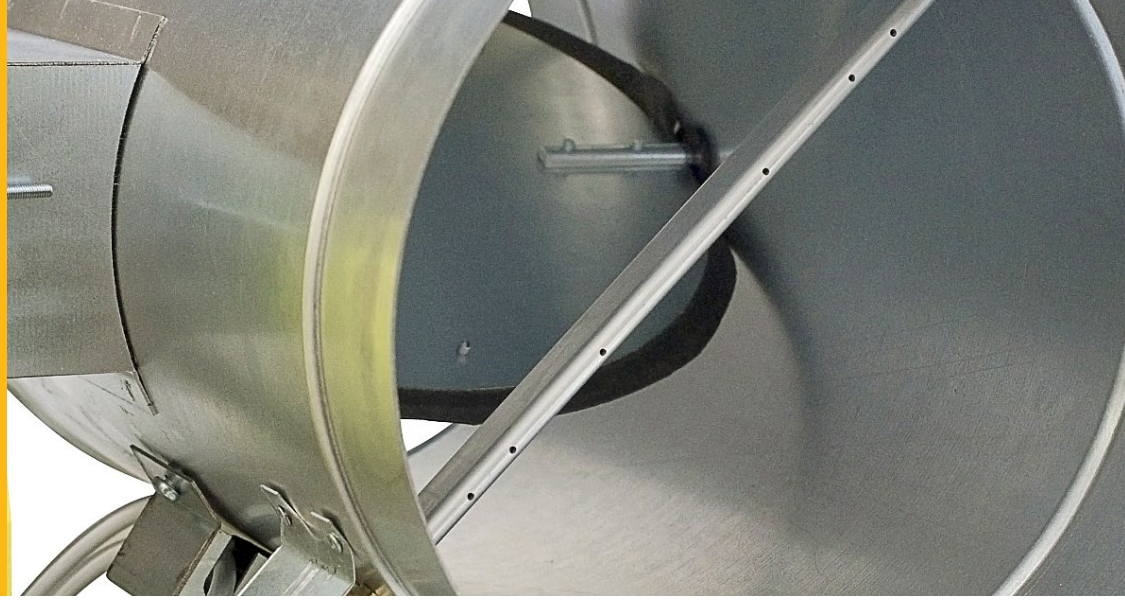


Table 1. Typical dimensions and the application range.

Dn [mm]	L [mm]	Lc [mm]	Air consumption [m³/h]
125	265	365	90-445
160	280	380	145-725
200	300	400	225-1130
250	350	450	350-1770
315	415	515	560-2800
400	500	600	900-4540
500	600	700	1400-7100

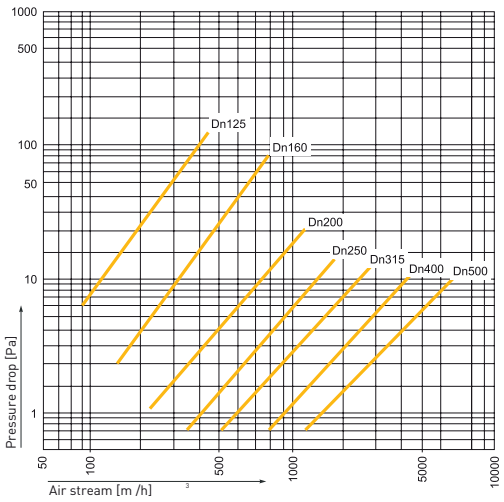
Assembly recommendations

To ensure the proper operation of the device it is recommended while assembling the regulators to keep the following principles:

- length of the straight section in front of the regulator 2D
- length of the straight section behind the regulator 1D

The electric connection of the measuring-controlling-executing unit should be made according to the diagram given in the documentation enclosed to the device by properly qualified person.

Pressure drop in the regulator RVP-R-Ex (damper full opening)



Wykres 1. Pressure drop in the regulator RVP-R-Ex (damper full opening).

The regulators RVP-R underwent the analytical tests of the measuring elements arrangements in order to reduce the limit of calibration error of the adjusted air stream, which was confirmed in the master's thesis asserted in 2005 at AGH [University of Science and Technology] in Cracow

Technical specification

Table 2. Sound power level at the outlet of the regulator RVP-R-Ex.

	$L_{WA}[dB_{[A]}]$											
	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 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 to the surroundings of the regulator RVP-R-Ex.

	$L_{WA}[dB_{[A]}]$											
	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 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

The set parameters of the flow are set in the factory by the producer and must not be modified by unauthorised persons.

Control and drive system

The unit has the following control possibilities:

- **control – constant setting:** 2...10, 0...10 [V] – the regulator controls the air flow in the duct between the given settings V_{min}, V_{max}, depending on the continuous leading signal, within the range of programmed control voltag (0...10, 2...10 [V])
- **control – forced setting:**
  - **„Close"** – the damper diaphragm is in complete closed position – the damper closing at air supply or air exhaust to the unused rooms enables to save the energy.
  - **„Open"** - the damper diaphragm is in complete open position – it is used for supporting the room smoke-removal (intensive aeration) or the most frequently as the safe position.
  - **V_{min}** – minimum volume flow – depending on the needs or if there are no operators for the room, the particular zones are shifted into the readiness and therefore the significant reduction of energy consumption is possible.
  - **V_{mid}** – intermediate position – possible position for operation at the calculated air demand in the room.
  - **V_{max}** – maximum volume flow – single room or group of rooms must be supplied with maximum air stream for short time – it enables to aerate the room, to cool it in the evening or to warm it quickly in the morning.
- **control by means of LonWorks® system**

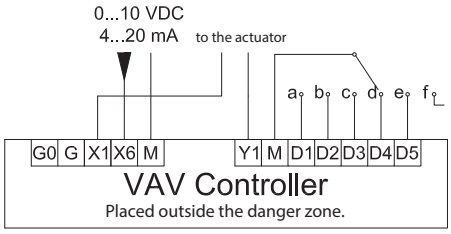
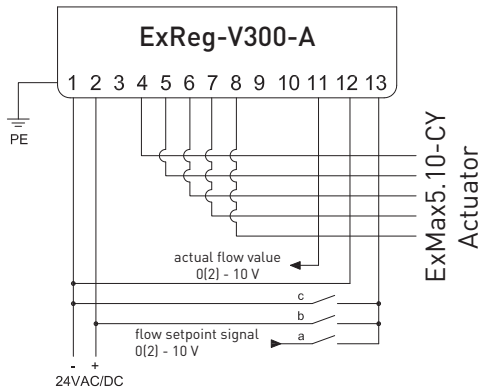


Diagram 1. Diagram of changing the VAV-Ex regulator mode with LonWorks® communication by means of the rotational switch from the regulator: a - close, b - open, c - V_{min}, d - V_{mid}, e - V_{max}, f - no forcing.



Function A (Menu 7.1: 0/2.. 10V/12+)

Control function	a	b	c
Close	⌐	⌐	⌐
Vmin	⌐	⌐	⌐
Smooth Vmin ..Vmax	⌐	⌐	⌐
Vmax	---	---	---
Open	⌐	⌐	⌐

Function B (Menu 7.1: 0/2.. 10V/12+)

Control function	a	b	c
Close	---	---	---
Vmin	⌐	⌐	⌐
Smooth Vmin ..Vmax	⌐	⌐	⌐
Vmax	⌐	⌐	⌐
Open	---	---	---

Diagram 2. Diagram of controller mode change, forced control in case of communication 0/2 ...10V

Actuator: ExMax-5.10-Y (ExMax-5.10-CY)

- ExMax-5.10-Y – used for LonWorks communication
- ExMax-5.10-CY – used for 0/2...10V communication

Technical data:	
Power supply:	24[V] AC/DC
Torque:	5Nm/10[Nm]
Direction of rotation:	chosen by the switch
Angle of rotation:	(grounded)
Time of movement:	7,5/15/30/60/120 [s] (from 0 to 90°)
Protection class:	III [safe voltage - low]
Casing protection category:	IP66
Ambient temperature range:	-40...+40[°C]
Storage temperature range:	-40...+70[°C]
Maintenance:	service-free
Dimensions:	210 x 95 x 80 mm
Weight:	3,5 [kg]

Conformity certificates:	
Tested in PTB:	PTB 04 ATEX 1028X
According to the directive ATEX:	94/9/EC (ATEX)
Approved for gases:	II2G EEx d [ia] IIC T6/T5 do stref 1, 2
Approved for dust:	II2D IP66 T80°C do stref 21, 22
Identyfication:	CE Nr 0158
EMC:	89/336/EC directive EMC
Low voltage:	72/23/EC low-voltage directive
Type of protection:	IP 66 in compliance with EN 60529
Potential compensation:	External terminal PA, 4 mm²

The parameter selection for the power supply sources in the facility depends on the selected time of rotation and the supply voltage rate. The connected current rates are the approximate values, because due to the unit construction the power dissipation within the electronics may occur. The power input in the lockout position, regardless of the time, amounts max. 20 W. The power consumption, because of the heater, fluctuates within the range from 5 to 12 W.

The heater is switched on when the engine does not work. At the time of starting up, the current value taken by the actuator amounts ca. 4,5A for 1sec (please take it into account while choosing the cables and power supply).

Table 4. The current input depending on the set time for the actuator rotation.

	7,5s	15s	30s	60s	120s
24 V	4,7 A	1,45 A	0,52 A	0,4 A	0,4 A

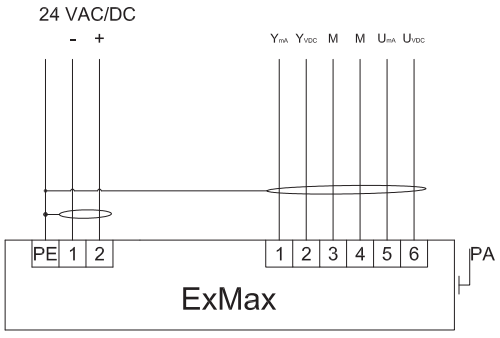


Diagram 3. The general connection diagram for the actuator ExMax.

Pressure transducer: ExCos - P

Technical specification:	
Power supply:	24 VAC/DC ± 20% (19,2...28,8 VAC/DC) 50... 60 Hz
Intensity, power consumption:	150 mA, - 4 W, internal fuse 500 mA, with no clamp, irremovable
Electric isolation:	Power supply - analogue output 1,5 kV (Ex 60 V)
Electric connection:	Terminals 0,14... 2,5 mm in the integrated switchbox Ex
Movement time:	7,5/15/30/60/120 [s] (od 0 do 90°)
Protection class:	Class I (earthed)
Display:	2 x 16 digits, dot matrix with highlighting
Casing protection:	IP66 in compliance with IEC 60529
Casing material:	Aluminium casting, coated
Sensor:	Piezoelectric pressure transducer
Sensor reaction time:	T90 / 5 sec.
Sensor accuracy:	± 2% value +/- 1 Pa
Non-linearity and hysteresis:	Usually ± 0,05 %, max. 0,25% value
Output:	Voltage U(V) or intensity I (mA) to be selected in menu in situ
Voltage U at output:	From 0...10 VDC adjustable, reversible, load <1kO, influence <0,05 % /100 O
Intensity I at output:	From 0...20 mA adjustable, reversible, load <500 O, influence <0,1 % /100 O, open circuit < 24V

Conformity certificates:	
Tested in PTB:	PTB 04 ATEX 1028X
According to the directive ATEX:	94/9/EC (ATEX)
Approved for gases:	II2(1)G Ex e ma [ia] IIC T6 for zones 1, 2
Approved for dust:	II2(1)D Ex tD A21 [iaD] IP66 T80°C for zones 21,22
Identification:	CE Nr 0158
EMC:	89/336/EC directive EMC
Low voltage:	72/23/EC low-voltage directive
Type of protection:	IP 66 in compliance with EN 60529
Potential compensation:	External terminal PA, 4 mm²

Pressure transducer: ExReg-V300-A

Technical specification:	
Power supply:	24 VAC/DC ± 20% (19,2...28,8 VAC/DC) 50... 60 Hz
Intensity, power consumption:	150 mA, - 4 W, internal fuse 500 mA, with no clamp, irremovable
Electric isolation:	Power supply - analogue output 1,5 kV (Ex 60 V)
Electric connection:	Terminals 0,14... 2,5 mm in the integrated switchbox Ex
Movement time:	7,5/15/30/60/120 [s] (od 0 do 90°)
Protection class:	Class I (earthed)
Display:	2 x 16 digits, dot matrix with highlighting
Casing protection:	IP66 in compliance with IEC 60529
Casing material:	Aluminium casting, coated
Sensor:	Piezoelectric pressure transducer
Sensor reaction time:	T90 / 5 sec.
Sensor accuracy:	± 2% value +/- 1 Pa
Non-linearity and hysteresis:	Usually ± 0,05 %, max. 0,25% value
Output:	Voltage U(V) or intensity I (mA) to be selected in menu in situ
Voltage U at output:	From 0...10 VDC adjustable, reversible, load <1kO, influence <0,05 % /100 O
Intensity I at output:	From 0...20 mA adjustable, reversible, load <500 O, influence <0,1 % /100 O, open circuit < 24V

Conformity certificates:	
According to the directive ATEX:	EPS 11 atex 1 380 94/9/EG
Approved for gases:	II2G Ex e mb ib[ia] IIC T6 for zones 1, 2
Approved for dust:	II2D Ex tb [iaD] IIIC T80 C for zones 21, 22
According to the directive IECEx:	IECEx EPS 12.0028
Identification:	CE Nr 0158
EMC:	89/336/EC directive EMC
Low voltage:	72/23/EC low-voltage directive
Type of protection:	IP 66 in compliance with EN 60529
Potential compensation:	External terminal PA, 4 mm²

Table 5. Technical specification for the pressure transducer and regulator.

	ExCos-P250 commuication LonWorks	ExReg-V300-A communication 0/2..10 V
Sensor	Pressure/ pressure difference	Regulator
Power supply	24VAC/DC	24VAC/DC
Scope	+/- 250 Pa	+/- 300 Pa
Scope min	50 Pa	60 Pa
Pressure max	25000 Pa	25000 Pa
Output	(0) 4...20 m/0..10V	(0) 4...20 m/0..10V

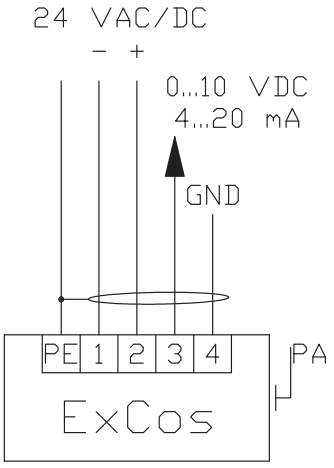
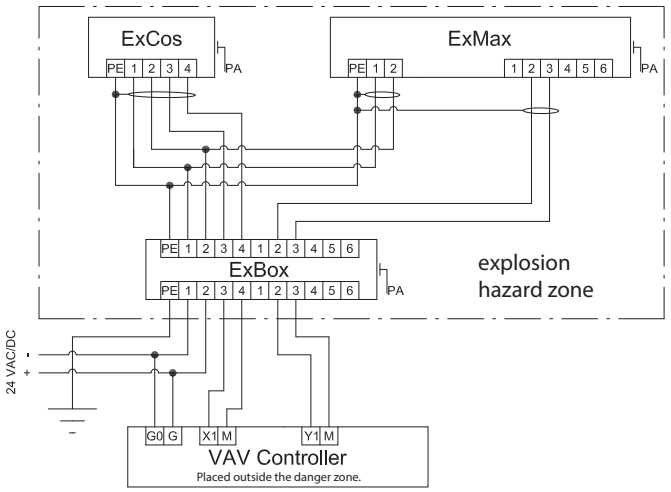
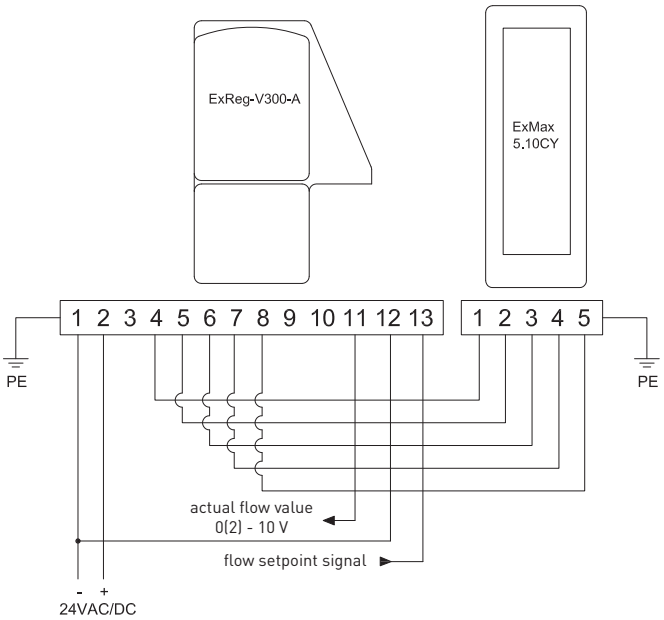


Diagram 4. The general connection diagram for the pressure transducer ExCos-P.



Schemat 5. The general connection diagram for the automatics VAV Ex with LonWorks communication.



Schemat 6. The general connection diagram for the automatics VAV Ex with 0/2...10V communication.

The drive and control system is connected by wires by the manufacturer, while the buyer is obliged to bring the controller and power supply and control signals from the controller to the controller..

The electrical connection of the units should be made in accordance with the automation diagram attached to the documentation of the designed system by a suitably qualified person.

RVP-R-EX - Flow regulators VAV

While ordering, please provide the information using the following method:

RVP-R-Ex - <D> - <V_{MAX}> / <V_{MIN}> - <K> - <P>

Where:

D	diameter [mm]
V_{MAX}	maximum flow stream [m³/h]
V_{MIN}	minimum flow stream [m³/h]
K	communication*
	none - 2...10[V]
	1 - 0...10[V]
	Lon - LonWorks (SmayLab)
P	material*
	none - galvanised steel
	SN - stainless steel**

* optional values - default values will be used if optional values are not specified
** the damper blades are made out of aluminium

Order example: **RVP-R-Ex-315-1300/1100/700**