

# MEDENUS

Gas Pressure Regulation



## Gas Pressure Regulator R101



Product information

EN



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### ATTENTION

Observe the following publications in relation to installation, start-up and maintenance:  
 DVGW - work sheets G 491 and G 600  
 Operating and Maintenance Instructions R 101

## List of abbreviations and formula symbols

AC	Accuracy class	$p_{ds\ o}$	Upper SSV response pressure	$W_{ds\ o}$	Upper adjustment range (SSV)
AG <sub>o</sub>	Upper response pressure group	$p_{ds\ u}$	Lower SSV response pressure	$W_{ds\ u}$	Lower adjustment range (SSV)
AG <sub>u</sub>	Lower response pressure group	$p_{f,max}$	Maximum closing pressure	$\Delta p$	Pressure difference from inlet pressure to outlet pressure
BV	Breather valve	PS	Maximum allowable pressure		
GPR	Gas pressure regulator	$p_u$	Inlet pressure		
HDS	High-pressure spindle	$Q_n$	Standard volumetric flow rate	$\Delta p_{wo}$	Min. re-engagement difference between upper response pressure and normal operating pressure
$K_G$	Valve flow rate coefficient	RE	Diaphragm assembly		
$p$	Pressure	RSD	Throttle valve		
$p_d$	Outlet pressure	SSV	Safety shut-off valve		
$p_{df}$	SRV closing pressure	SRV	Safety relief valve	$\Delta p_{wu}$	Min. re-engagement difference between lower response pressure and normal operating pressure
$p_{do}$	SRV opening pressure	SG	Closing pressure group		
$p_{ds}$	Setpoint of the response pressure	$t_{Gas}$	Gas inlet temperature		
		VS	Valve seat		
		$w_d$	Outlet gas velocity	$\rho_n$	Gas density
		$w_u$	Inlet gas velocity		

\*)  $K_G$  value for natural gas

# Application, characteristics, technical data

## Application

Gas pressure regulator (GPR), direct-acting (operating without auxiliary power), for systems acc. to DVGW Code of Practice G 491 (A) and G 600 (A) (TRGI)

Particularly suitable for dynamic regulation sections (e.g. gas fireplaces, burner circuits, gas motor operation).

Can be used as an equipment component on gas consumption facilities as defined in Regulation (EU) 2016/426.

Can be used for the gases defined in DVGW Code of Practice G 260 / G 262 and neutral non-aggressive gases.

(other gases on request)

## Characteristics

- Integral pressure-tight model (IS)
- Easy maintenance through replaceable functional units (modular design)
- Open-air model

## Type of models / Options (see page 12)

- Diaphragm assembly optionally with safety diaphragm
- With noise reduction
- With throttle valve (RSD) for impulse line of the regulator
- Oxygen model ( $p_u \leq 10$  bar)
- Hydrogen version
- Coating with epoxy resin in RAL colors

## Accuracy class AC / Closing pressure group SG

Outlet pressure range $P_d$ , minimum pressure differential 100 mbar	Diaphragm assembly							
	160	205	275	275-2	330	385	390	485
18 mbar to 100 mbar					10 / 20	10 / 20	10 / 20	5 / 10
90 mbar to 500 mbar			5 / 10					
100 mbar to 500 mbar					5 / 10	5 / 10	5 / 10	5 / 10
350 mbar to 500 mbar				10 / 20				
500 mbar to 1000 mbar	10 / 20	10 / 20						
> 500 mbar			2.5 / 10	5 / 10	2.5 / 10	2.5 / 10	2.5 / 10	
> 1000 mbar	5 / 10	5 / 10						

## Technical data

<b>Type</b>	R101
<b>Model</b>	Integral pressure-tight (IS)
<b>Max. allowable pressure PS</b>	8 bar
<b>Max. inlet pressure <math>p_{u,max}</math></b>	8 bar
<b>Nominal width</b>	DN 25, DN 40, DN 50, DN 65, DN 100
<b>Connection type</b>	DIN PN 16 flanges
<b>Material</b> Housing / actuator housing/ control device housing	Al cast alloy
<b>Corrosivity category</b> C1 to C5-I C5-M	DIN EN ISO 12944-2 without additional coatings an epoxy resin coating is recommended (see page13)
<b>Temperature range, Class 2</b> (operating/ambient temperature)	-20°C to +60°C
<b>Closing pressure zone group</b>	SZ 2.5
<b>Function, strength, and tightness CE mark to PED/ PIN number</b>	DIN EN 334 and DIN EN 14382 CE-0085-AQ0882 / CE-0085-AQ0883
<b>Ex protection</b>	The mechanical parts of the device do not have any potential ignition sources of their own and therefore do not fall within the scope of ATEX 95 (94/9/EC). Electrical components fitted to the device comply with the ATEX requirements.

### Preferred installation position

The gas pressure regulators R101 shall be installed in the pipeline preferably in horizontal position. For all nominal widths, the direction of flow is indicated by an arrow on the housing.



Overhead installation position only after consultation with Medenus GmbH

Note: Observe the following documents in relation to installation, start-up, and maintenance:

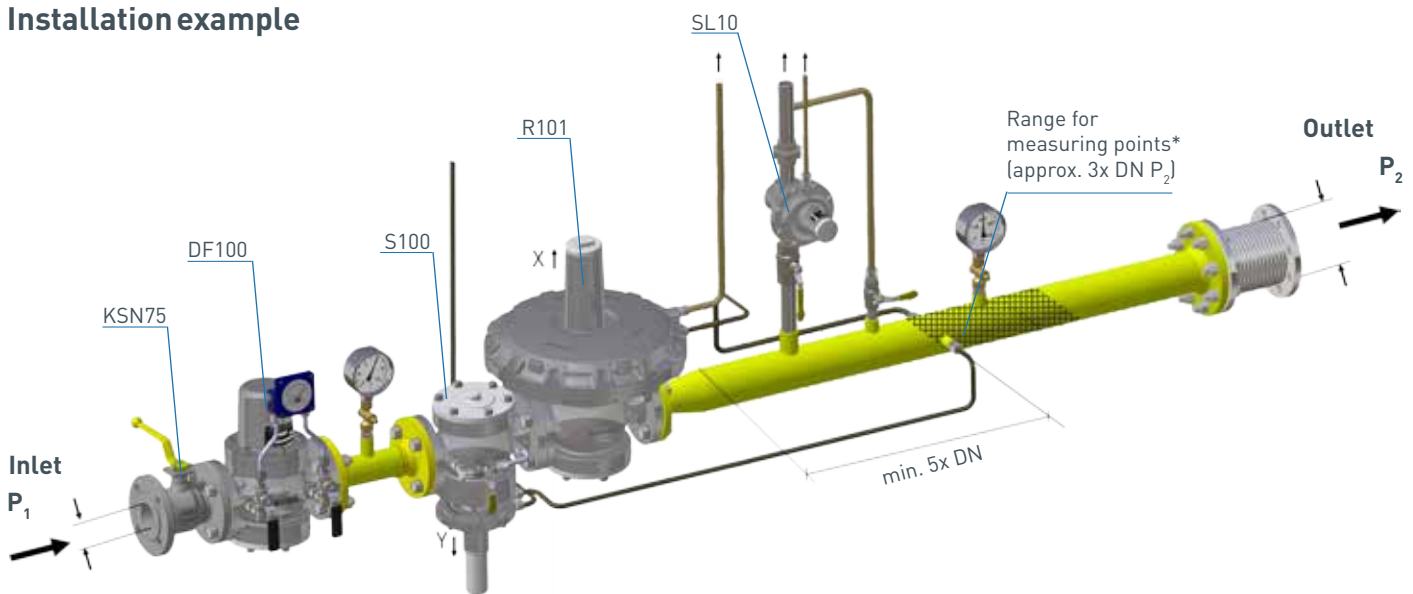
- DVGW - work sheets G 491 and G 600
- Operating and Maintenance Instructions R 101

## Structure and function

The spring-loaded gas pressure regulator R101 has the function of keeping the outlet pressure of a gaseous medium constant within allowable limit values in the connected regulation section on the outlet side, independently of the effect of interferences, such as changes in the inlet pressure and/or in the gas tap. The gas pressure regulator is composed of the actuator housing and the "diaphragm assembly plus actuator".

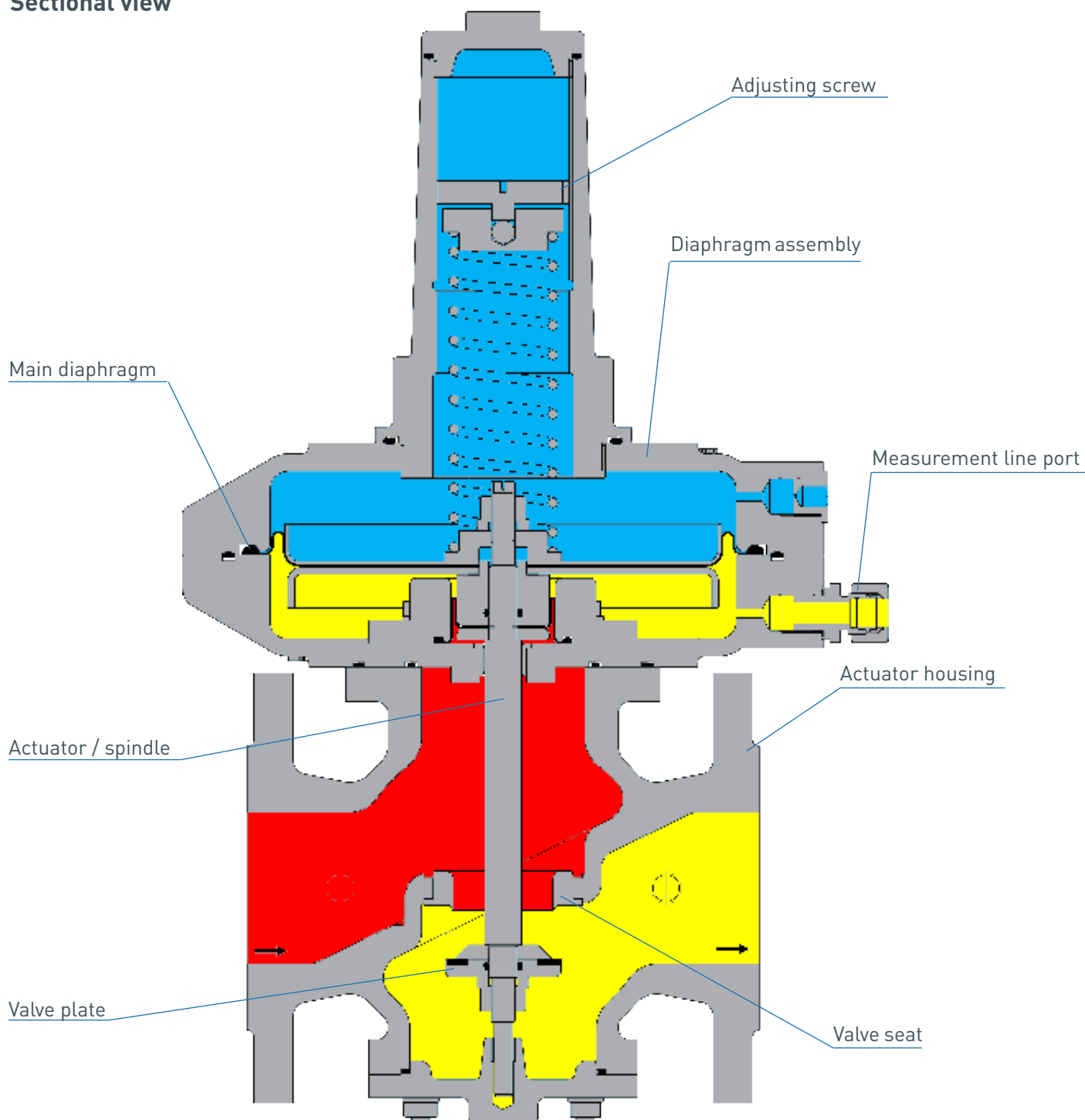
The actuator for the diaphragm assembly can be produced in various valve seat diameters to suit different nominal widths. The gas flows through the actuator housing in the direction of the arrow. The external measurement line port is used to pass the outlet pressure to be regulated to the bottom of the main diaphragm of the diaphragm assembly. It compares the actual value with the command variable preset by the force of the setpoint spring. The setpoint required in each case is set via the setting screw. Any deviation from the setpoint is transmitted by the screw spindle to the actuator, which is adjusted in a way that the actual value is adjusted to the setpoint. In case of zero tap, the actuator will close tight, causing the closing pressure to be established.

## Installation example



\*) Recommended max. velocity at the measurement line port 25 m/s

## Sectional view



## K<sub>G</sub>\* value and diaphragm assemblies

		R 101				
Nominal width		DN 25	DN 40	DN 50	DN 65	DN 100
Diaphragm assembly Ø		160	160	205	205	275-2
		205	205	275	275	385
Valve seat Ø		330	330	390	390	485
17.5 mm		200	220			
27.5 mm		460	600			
32.5 mm			750	1000	1000	
42.5 mm				1500	1500	
52.5 mm				1800	1800	
65.0 mm						3500
95.0 mm						5800
Connection type		DIN 1092 - PN16				

\*) K<sub>G</sub> value for natural gas:  $\rho_n = 0.83 \text{ kg/m}^3$ ,  $t_u = 15^\circ\text{C}$

## RE - Diaphragm assembly

Regulator type Nominal width	Nominal width	Diaphragm assembly	Outlet pressure ranges [mbar]	Outlet pressure range with high-pressure spindle HDS [mbar] (illustration with HDS on p. 12)
R101	DN 25	RE 330	22 - 200	200 - 800
		RE 205	200 - 750	750 - 3000
		RE 160	750 - 1200	-
	DN 40	RE 330	22 - 200	200 - 800
		RE 205	200 - 750	750 - 3000
		RE 160	750 - 1200	-
	DN 50	RE 390	22 - 130	130 - 450
		RE 275	130 - 400	400 - 1100
		RE 205	400 - 750	750 - 3000
	DN 65	RE 390	22 - 130	130 - 450
		RE 275	130 - 400	400 - 1100
		RE 205	400 - 750	750 - 3000
	DN 100	RE 485	22 - 150	150 - 450
		RE 385	150 - 350	350 - 850
		RE 275-2	350 - 850	850 - 3000



## Diaphragm assembly setpoint spring table

Spring data		Specific command range $W_{ds}$ [mbar]				
Spring no.	Color [RAL]	RE 160	RE 205	RE 275	RE 320 / 330	RE 390
FA 01	blank	61 - 70	36 - 39	23 - 25	10 - 12	8 - 10
FA 02	9006	66 - 80	38 - 45	24 - 28	11 - 13	9 - 12
FA 03	5015	77 - 98	44 - 52	27 - 31	14 - 18	11 - 13
FA 04	4002	91 - 121	51 - 64	30 - 37	17 - 22	12 - 15
FA 05	7037	111 - 158	62 - 81	35 - 46	21 - 29	14 - 19
FA 06	9005	143 - 213	78 - 107	43 - 59	28 - 39	18 - 24
FA 07	3020	191 - 297	103 - 147	55 - 80	38 - 54	23 - 32
FA 08	9010	262 - 422	140 - 205	73 - 110	53 - 77	31 - 45
FA 09	7016	369 - 611	195 - 295	100 - 156	76 - 111	42 - 64
FA 10	6010	533 - 899	280 - 430	141 - 225	110 - 166	59 - 94
FA 11	2002	802 - 1371	419 - 653	208 - 339	165 - 250	88 - 142
FA 12*	7035	1143 - 1968	595 - 935	293 - 484	239 - 361	124 - 203
FA 13*	5010	1714 - 2971	819 - 1408	436 - 726	360 - 544	185 - 305
FA 14*	1028	2400 - 4176	1245 - 1976	607 - 1017	506 - 765	258 - 428
FA 15*	6018	-	1212 - 2553	699 - 1333	535 - 978	297 - 568
FA 16*	3020	-	1330 - 3012	785 - 1580	602 - 1157	333 - 673

\* High-pressure spindle HDS required (illustration p. 12)

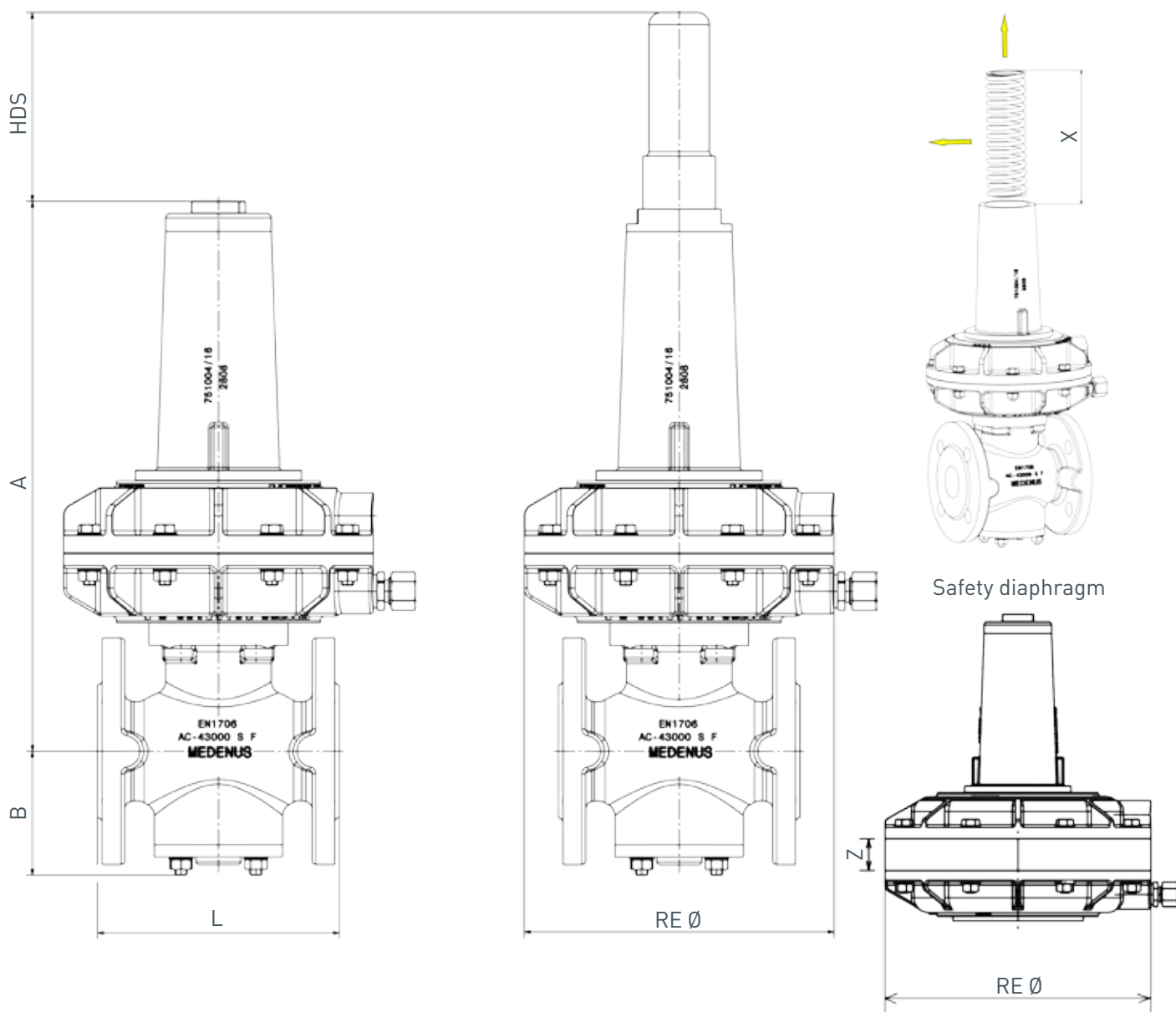
Spring data		Specific command range $W_{ds}$ [mbar]		
Spring no.	Color [RAL]	RE 275-2	RE 385-2	RE 485
FB 701	6018	59 - 69	31 - 35	19 - 22
FB 702	9006	68 - 83	34 - 41	21 - 25
FB 703	5015	80 - 105	40 - 51	24 - 31
FB 704	4002	96 - 127	50 - 61	28 - 36
FB 705	7037	112 - 156	60 - 77	33 - 44
FB 706	9005	146 - 207	76 - 100	41 - 56
FB 707	3020	184 - 266	98 - 127	51 - 71
FB 708	9010	238 - 358	125 - 167	65 - 94
FB 709	7016	302 - 450	165 - 215	82 - 118
FB 710	6010	397 - 596	212 - 285	105 - 155
FB 711	2002	542 - 814	280 - 390	140 - 209
FB 712	7035	742 - 1078	385 - 520	188 - 275
FB 713*	5010	977 - 1442	515 - 671	246 - 369
FB 714*	1028	1245 - 1878	661 - 873	311 - 479
FB 715*	6018	1547 - 2469	712 - 1186	393 - 618
FB 716*	3020	2136 - 3008	975 - 1514	517 - 752

\* High-pressure spindle HDS required (illustration p. 12)

# Dimensions, connection, and weight

## Dimensional drawing

Dismounting dimensions for springs



## Dimensions and weight

Dimensions	Nominal width RE Ø	R 101				
		DN 25	DN 40	DN 50	DN 65	DN 100
A [mm]	160	356	356	-	-	-
	205	364	364	408	376	-
	275	-	-	408	376	661
	320	346	346	-	-	-
	385/390	-	-	408	376	661
	485	-	-	-	-	661
HDS [mm]		125	125	125	125	205
B [mm]		84	84	115	101	188
L [mm]		160	160	250	220	350
X [mm]		210	210	210	210	410
Z [mm]		32.5	32.5	32.5	32.5	32.5
Weight						
Weight [kg]	160	6.5	7.5	-	-	-
	205	8	9	16	16	-
	275	-	-	18	18	38
	320	10.5	11	-	-	-
	385/390	-	-	22	22	43
	485	-	-	-	-	53
SM safety diaphragm weight [kg]	205	2	2	2	2	-
	275	-	-	3	3	3.3
	320	3	3	-	-	-
	385/390	-	-	5	5	6
HDS weight [kg]		0.6	0.6	0.6	0.6	1.6
Connection		DIN 1092 - PN16				

**Example:** R101/050/390 with HDS and safety diaphragm

Weight (regulator + HDS + SM): 16 kg + 0.6 kg + 5 kg = 21.6 kg

Dimensions (A + HDS + SM): 408 mm + 125 mm + 32.5 mm = 565.5 mm

## Connection of the measuring lines and breather lines

Nominal width	Diaphragm assembly	
	Measurement line	Breather line
DN 025	Connection* for: Tube 12 x 1.5 (thread G 3/8)	
DN 040		
DN 050		
DN 065		
DN 100		

## Types of models / Options

### Safety diaphragm

In the model with safety diaphragm, the safety diaphragm is located above the main diaphragm. When the main diaphragm is damaged, the safety diaphragm makes contact with the top cover of the diaphragm assembly and limits any inadmissible escape of gas into the surrounding atmosphere to a maximum of 30l/h (air).

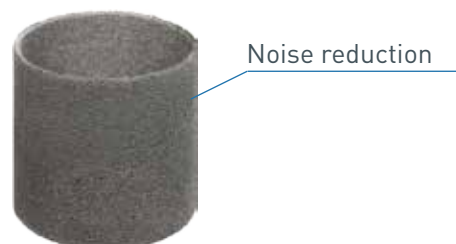


**(Option not available for hydrogen version H<sub>2</sub>)**

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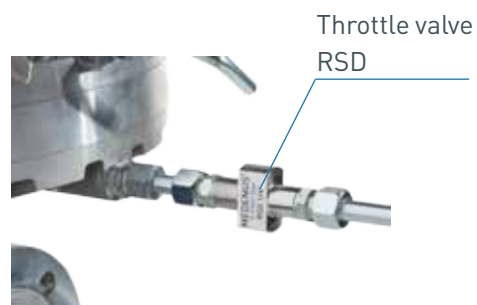
### Noise reduction

The noise reduction made of metallic foam reduces noise in the gas pressure regulator produced by the flow rate by up to -15 dB (±3 dB).



### RSD throttle valve

The RSD is a restrictor valve that affects the volumetric flow in the measurement line from outside by means of a continuously adjustable narrowing of the cross-section. The adjustment is done by means of an Allen key (4 mm).



### High-pressure spindle HDS

The high pressure spindle (HDS) is used to adjust the control spring at high outlet pressure. (See spring tables p. 9)



### Epoxy resin coating in RAL colors

To protect the gas pressure regulator from external influences, starting from a corrosivity category C5-M we recommend an epoxy resin coating.



## Types of models

Oxygen model O<sub>2</sub>

Hydrogen version H<sub>2</sub> (with helium leak test)

The Medenus gas pressure regulators are suitable for use with hydrogen as a medium up to a proportion of 100%.

Further information can be found in the special edition (10/2019) of gwf Gas+Energie and on our homepage at ([www.medenus.de](http://www.medenus.de)).



# Design

**Note** All calculated pressures are absolute pressures. (p+1 bar)  
 The required KG value for a gas pressure regulator is determined with the smallest inlet pressure or lowest pressure drop.

## Calculation of the required K<sub>G</sub> value

$p_d / p_u > 0.5$   
 K<sub>G</sub> value at  
 a subcritical pressure ratio  
 $K_G = Q_n / \sqrt{p_d \cdot (p_u - p_d)}$

$p_d / p_u \leq 0.5$   
 K<sub>G</sub> value at  
 a supercritical pressure ratio  
 $K_G = 2 \cdot Q_n / p_u$

**Note** For spring-loaded devices, a capacity reserve of 10-20% is recommended in order to comply with the accuracies given.  
 The device is selected on the basis of its K<sub>G</sub> value from the table of flow rate coefficients (page 8)

## Device selection

**Note** Closing pressure zone group: SZ 2.5

For the small load Q<sub>min</sub> with SZ this yields 2.5:  $Q_{min} = 0.025 \cdot K_G \cdot p_{u\ max}$

Small load Q<sub>min</sub> - When burner is started or at Q<sub>min</sub> a K<sub>G</sub> utilization level of at least 1% should be reached.  
 Selection of the diaphragm assembly from the diaphragm assembly setpoint spring table (page 9)

Selection of the closing pressure group from the closing pressure group table (page 4)

$p_{f\ max} = p_{ds} \cdot (1 + SG/100)$

## Checking the gas velocities

$w = 380 \cdot Q_n / (DN^2 \cdot p_{abs})$

**Note** The factor 380 refers to an operating gas temperature from approx. 15°C to 20°C. For other temperatures, the velocity must be corrected as follows:  
 $w_{corr} = w \cdot (t_{gas} + 273.15) / 290$

Recommended max. gas velocity at the inlet flange:  
 50 - 70 m/s lower value for redirections upstream of the control valve, 20 m/s for upstream filters

Recommended max. gas velocity at the outlet flange:  
 100 - 200 m/s lower value to reduce noise emissions

Recommended max. gas velocity on impulse tap: 15 - 25 m/s  
 15 m/s max. value for outlet pressures below 100 mbar

The device selected in the example of nominal width DN 50 can be operated under these conditions.

p<sub>u</sub> Inlet pressure (bar)  
 p<sub>d</sub> Outlet pressure (bar)  
 Q<sub>n</sub> Standard volumetric flow rate (Nm<sup>3</sup>/h)

**Example:** Overpressure Absolute pressure

p<sub>u min</sub> 5.0 bar 6.0 bar  
 p<sub>d min</sub> 0.5 bar 1.5 bar  
 Q<sub>n min</sub> 1500 m<sup>3</sup>/h

1.25 bar / 6 bar = 0.25 < 0.5  
 → Supercritical pressure ratio  
 $K_G = 2 \cdot 1500 / 6 = 500 \text{ m}^3/(\text{h} \cdot \text{bar})$

## Selected device

Type R 101  
 DN - Nominal width 050  
 D - Nozzle V 32.5  
 K<sub>G</sub> value 750 m<sup>3</sup>/(h\*bar)

$Q_{min} = 0.025 \cdot 750 \cdot 9 = 169 \text{ m}^3/\text{h}$

Selected diaphragm assembly

RE - Diaphragm assembly 330  
 Setpoint spring FA13  
 (W<sub>ds</sub> 300-600)

AC 5/SG 10 (for RE 330 D - Nozzle 32.5)

Nominal width of input and output of pipeline according to the selected device: 50 mm  
 Selected widening of outlet pipeline: 150 mm

$w_u = 380 \cdot 1500 / (50^2 \cdot 14) = 38 \text{ m/s}$

$w_d = 380 \cdot 1500 / (50^2 \cdot 1.5) = 152 \text{ m/s}$

$w_{impulse} = 380 \cdot 1500 / (200^2 \cdot 1.5) = 17 \text{ m/s}$

# Properties of gases

- for natural gas ( $\rho_n = 0.83 \text{ kg/m}^3$ ;  $t = 15^\circ\text{C}$ )
- f - natural gas L conversion factor

Gas	f	Hs,n [kWh/m <sup>3</sup> ]	Gas	f	Hs,n [kWh/m <sup>3</sup> ]
Acetylene	0.84	16.25	Sewage gas	0.84	
Ammonia	1.04	4.83	Carbon monoxide	0.81	3.51
Butane	0.55	37.23	Carbon dioxide	0.65	-
Chlorine	0.51	-	Air	0.80	-
Landfill gas	approx. 0.80		Methane	1.08	11.06
Natural gas L	1.00	9.77	Propane	0.64	28.03
Natural gas H	1.03	11.45	Oxygen	0.76	-
Ethane	0.78	19.55	Sulphur dioxide	0.53	-
Ethylene	0.97	16.516	Nitrogen	0.81	-
Mine gas (30% CH <sub>4</sub> )		0.86	Hydrogen	3.04	13.43
Helium	2.15	-			

## Notes

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## Notes

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## Order data

(In every selection group, only one option can be selected in each case)

### Example:

Gas pressure regulator: R101/050/205/32.5/HDS/links/SR/SM/RSD/WAZ/So

		Order code:											
		R 101	050	-	205	32.5	HDS	left	SR	SM	RSD	WAZ	So
Order selection	Designation												
<b>Type</b>													
R 101	R 101	R 101											
<b>DN - Nominal width</b>	Table p. 14		050										
<b>Flange model</b>													
PN 16	-			-									
Class 150	C												
<b>RE - Diaphragm assembly</b>	Table p. 15				205								
<b>D - Nozzle (valve seat diameter)</b>	Table p. 15					32.5							
<b>High-pressure spindle</b>	Fig. p. 12												
without high-pressure spindle	-												
with high-pressure spindle	HDS						HDS						
<b>Direction of flow</b>													
Right (from left to right)	-												
Left (from right to left)	left							left					
<b>Noise reduction</b>	Fig. p. 12												
without noise reduction	-												
with noise reduction	SR								SR				
<b>Additional unit, diaphragm assembly</b>	Fig. p. 12												
without additional unit, diaphragm assembly	-												
Safety diaphragm	SM									SM			
<b>Throttle valve</b>	Fig. p. 12												
without throttle valve	-												
with throttle valve	RSD										RSD		
<b>Acceptance test certificate to EN 10204/3.1</b>													
without acceptance test certificate	-												
with acceptance test certificate	WAZ											WAZ	
<b>Special model</b>	So												So
- Coating with epoxy resin in RAL colors Oxygen model													



## Contact

If you want to know more about solutions from MEDENUS for the gas industry, please contact your local contact person or go to our internet site at [www.medenus.de](http://www.medenus.de)



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