

## Medium Pressure Regulator



### Medium pressure regulator Type FRM

Direct acting pressure regulator with adjustable setpoint springs and modular mounted safety shutoff valve (SAV)

In compliance with EN 334 and EN 14382

- Inlet pressures up to 25 bar (2 500 kPa)
- High flow rate
- Stable, accurate and sensitive regulation of the outlet pressure
- Admission pressure compensation diaphragm for a high regulation accuracy
- External impulse
- Maintenance-friendly
- Flange connection according to DN 25 - DN 50

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**FRM**

Spring-loaded, pressure compensating regulator with adjustable setpoint springs for regulation of the regulator outlet pressure. External impulse of the regulator outlet pressure.

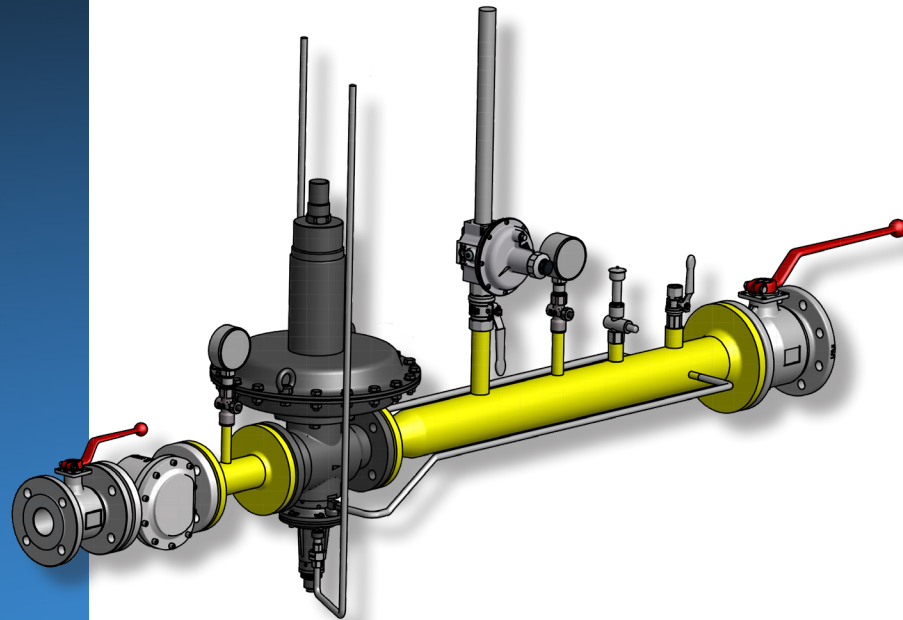
**Application**

Pressure regulation of industrial gas burners and gas heating appliances. Also for installation in the municipal and commercial gas supply.

Suitable for gases of gas families 1, 2, 3 and other neutral gases.

**Approval**

EC type testing certificate as per:  
• EC-Pressure Equipment Directive





### Spring-loaded medium pressure regulator in compliance with EN334

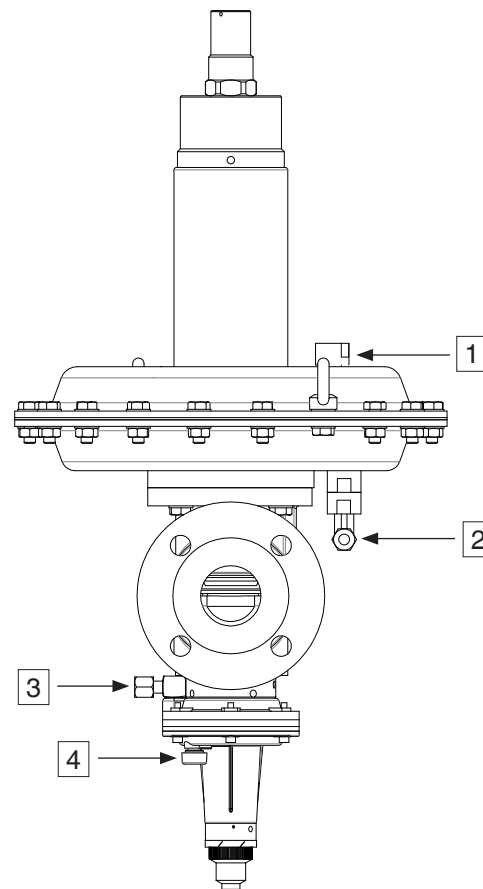
Type	FRM 100... IS (integral strength range) / FRM 250... DS (differential strength range)	
Type of gas	Family 1+2+3	
Nominal diameters Flanges	Connecting flange PN 25 according to EN1092-1 or ANSI 150 lbs (B16.5) DN 25 40 50	
Max. inlet pressure	FRM 100... 10 bar (1 000 kPa) / FRM 250... 25 bar (2 500 kPa)	
Outlet pressure range	30 mbar up to 4000 mbar (3-400 kPa)	
Minimum differential pressure (ND)	270 mbar (27 kPa)	
Minimum differential pressure (MD)	350 mbar (35 kPa)	
Minimum differential pressure (HD/UHD)	500 mbar (50 kPa)	
Accuracy class	up to AC 5 (see adjustment range, page 3)	
Lock-up pressure class	up to SG 10 (see adjustment range, page 3)	
Failure mode (diaphragm rupture)	fail-open	
Materials	Main body housing:	cast iron GGG 50 (GJS 400-18 on request)
	Diaphragm housing:	steel
	Diaphragms:	NBR
Ambient temperature	-20 °C to +60 °C	



### Safety shut-off valve in compliance with EN14382, class A

Type	FRM 100... IS (integral strength range) / FRM 250... DS (differential strength range)
Response time	< 2 s
Lower adjustment range $W_{du}$	10 mbar up to 3 000 mbar (1-300 kPa)
Upper adjustment range $W_{do}$	40 mbar up to 5 000 mbar (4-500 kPa)
Materials	Main body housing: cast iron GGG 50 (GJS 400-18 on request) Diaphragm housing: aluminium Diaphragms: NBR

## Pressure taps



- 1 Vent line connection of the regulator, G $\frac{1}{2}$  ISO 228
- 2 External impulse line connection of the regulator, Ermeto screw connection GE 12-  $\frac{1}{2}$  for tubes 12 x 1.5
- 3 External impulse line connection of the SAV, Ermeto screw connection GE 12-  $\frac{1}{4}$  for tubes 12 x 1.5
- 4 Vent line connection of the SAV, G $\frac{1}{4}$  ISO 228

Nomenclature



Example FRM 100025 ND / SAV ND	FRM	100	025	ND	SAV	ND
<b>Type</b>	Spring-loaded medium pressure regulator					
<b>MOP</b>	100 ...	10 000 mbar				
	250 ...	25 000 mbar				
<b>Nominal diameter</b>	DN 25	025				
	DN 40	040				
	DN 50	050				
<b>Pressure range, outlet pressure</b>	ND	Low pressure				
	MD	Medium pressure				
	HD	High pressure				
	UHD	Ultra high pressure				
<b>Safety device</b>	SAV	Integrated shut-off valve				
<b>Pressure range, trip pressure</b>	ND	Low pressure				
	MD	Medium pressure				
	HD	High pressure				
	UHD	Ultra high pressure				
<b>Flange type</b>	ANSI	with standard PN-25 with ANSI 150 lbs				

## Adjustment range



Type	Connec- tion	Ver- sion	Accuracy class* [AC]	Lock-up pressure class* [SG]	Outlet pressure range $W_d$	Under pressure monitoring SAV		Over pressure monitoring SAV	
						$W_{du}$	AG	$W_{do}$	AG
FRM 100025 ND	DN 25	ND	AC 10	SG 20	30-100 mbar				
FRM 100025 MD	DN 25	MD	AC 5/10**	SG 20	90-420 mbar				
FRM 100025 HD	DN 25	HD	AC 5	SG 10	400-1500 mbar				
FRM 250025 UHD	DN 25	UHD	AC 5	SG 10	1000-4000 mbar				
FRM 100025 ND / SAV ND	DN 25	ND	AC 10	SG 20	30-100 mbar	10-115 mbar	AG 10	40-240 mbar	AG 10
FRM 100025 MD / SAV MD	DN 25	MD	AC 5/10**	SG 20	90-420 mbar	35-400 mbar	AG 10	180-800 mbar	AG 10
FRM 100025 HD / SAV HD	DN 25	HD	AC 5	SG 10	400-1500 mbar	150-1400 mbar	AG 5	500-3500 mbar	AG 5
FRM 250025 UHD / SAV UHD	DN 25	UHD	AC 5	SG 10	1000-4000 mbar	150-3000 mbar	AG 5	1300-5000 mbar	AG 5
FRM 100040 ND	DN 40	ND	AC 10	SG 20	30-100 mbar				
FRM 100040 MD	DN 40	MD	AC 5/10**	SG 20	90-420 mbar				
FRM 100040 HD	DN 40	HD	AC 5	SG 10	400-1500 mbar				
FRM 250040 UHD	DN 40	UHD	AC 5	SG 10	1000-4000 mbar				
FRM 100040 ND / SAV ND	DN 40	ND	AC 10	SG 20	30-100 mbar	10-115 mbar	AG 10	40-240 mbar	AG 10
FRM 100040 MD / SAV MD	DN 40	MD	AC 5/10**	SG 20	90-420 mbar	35-400 mbar	AG 10	180-800 mbar	AG 10
FRM 100040 HD / SAV HD	DN 40	HD	AC 5	SG 10	400-1500 mbar	150-1400 mbar	AG 5	500-3500 mbar	AG 5
FRM 250040 HD / SAV UHD	DN 40	UHD	AC 5	SG 10	1000-4000	150-3000 mbar	Ag 5	1300-5000 mbar	AG 5
FRM 100050 ND	DN 50	ND	AC 10	SG 20	30-100 mbar				
FRM 100050 MD	DN 50	MD	AC 5/10**	SG 20	90-420 mbar				
FRM 100050 HD	DN 50	HD	AC 5	SG 10	400-1500 mbar				
FRM 250050 UHD	DN 50	UHD	AC 5	SG 10	1000-4000 mbar				
FRM 100050 ND / SAV ND	DN 50	ND	AC 10	SG 20	30-100 mbar	10-115 mbar	AG 10	40-240 mbar	AG 10
FRM 100050 MD / SAV MD	DN 50	MD	AC 5/10**	SG 20	90-420 mbar	35-400 mbar	AG 10	180-800 mbar	AG 10
FRM 100050 HD / SAV HD	DN 50	HD	AC 5	SG 10	400-1500 mbar	150-1400 mbar	AG 5	500-3500 mbar	AG 5
FRM 250050 UHD / SAV UHD	DN 50	UHD	AC 5	SG 10	1000-4000 mbar	150-3000 mbar	AG 5	1300-5000 mbar	AG 5

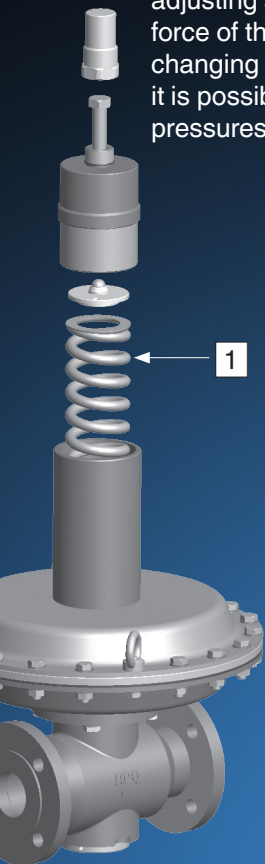
\*Accuracy class / Lock-up pressure class to EN 334

\*\* $p_g$  = 90-180 mbar: AC 10;  $p_g$  = 180-420 mbar: AC 5



## Selection of regulator springs

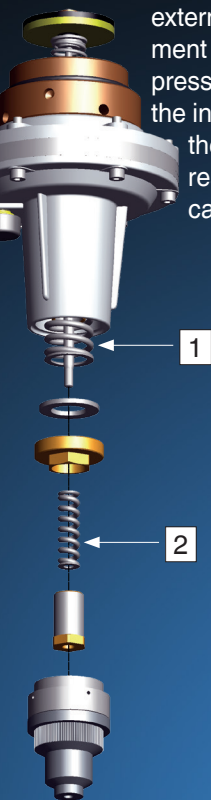
The response pressure results from the force of the installed adjusting spring and the weight force of the movable parts. By changing the setpoint **spring 1**, it is possible to set different outlet pressures.



Specific set range, outlet pressure $W_{ds}$								
Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]			
					ND	MD	HD	UHD
Silver	270341	5.5	300	60	30-40	90-110		
Green	270345	6.5	300	62	40-55	110-170		
Yellow	270346	7.0	300	63	55-80	170-240		
Blue	270347	8.0	300	65	80-100	240-330		
Black	270348	9.0	300	68		330-420	400-580	
Purple	270349	10.0	300	69			560-850	
Orange	270350	11.0	300	71			800-1200	1000-1600
Pink	270352	12.0	300	73			1100-1500	
White	271113	13.0	300	75				1500-2500
Red	271132	14.0	300	77				1900-3300
Red/Brown	276127	14.0/8.0	300	77/46				2900-4000

## Selection of SAV springs

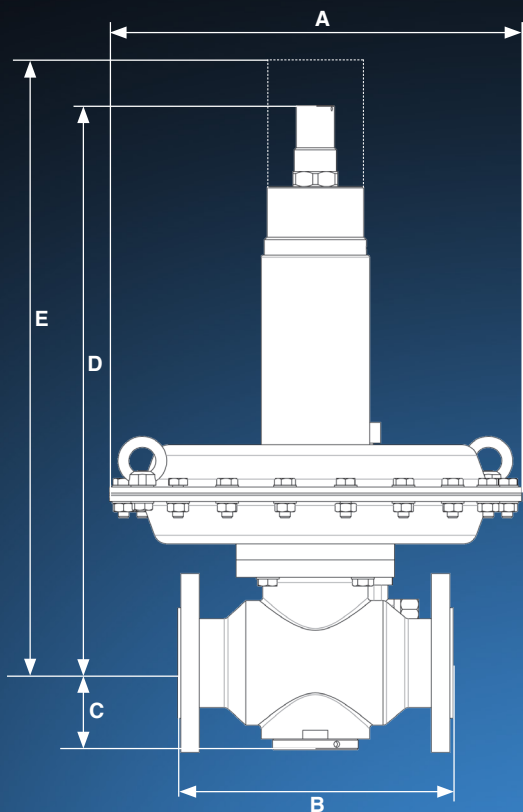
The response pressure results from the force of the installed adjusting spring. The upper response pressure (overpressure) is set on the external **spring 1** of the measurement device. The lower response pressure (vacuum) can be set on the internal **spring 2**. By changing the setpoint springs, different response pressures can be set.



Specific set range, underpressure $W_{dsu}$								
Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]			
					ND	MD	HD	UHD
White	270353	1.2	60	10.0	10-32			
Yellow	270355	1.5	55	12.3	24-40			
Blue	270356	2.0	55	12.3	30-115	35-110		
Black	270357	2.3	55	12.3		50-250		
Purple	270358	2.5	55	12.3		80-400	150-500	150-500
Orange	270359	2.8	55	12.3			300-1000	300-1000
Silver	270360	3.0	60	15.0			800-1400	800-1400
Pink	276126	3.5	60	15.0				1200-3000

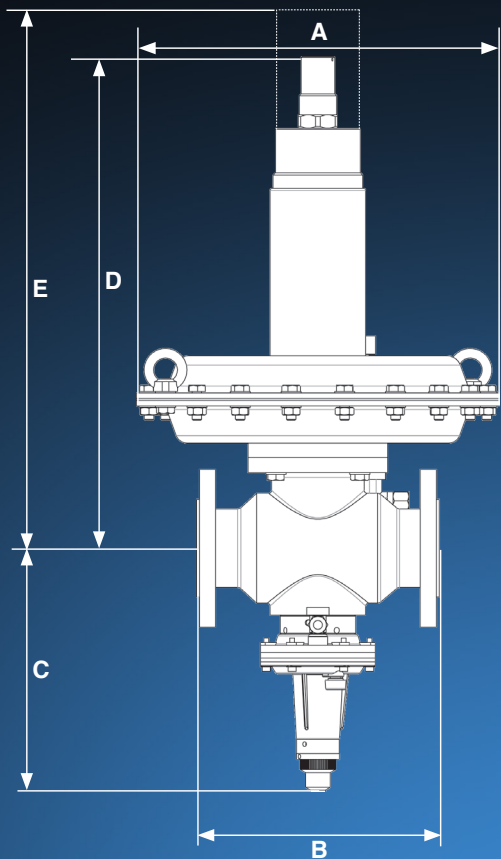
Specific set range, overpressure $W_{dso}$								
Spring colour	Order number	Wire diameter [mm]	Length [mm]	Diameter [mm]	Setpoint range [mbar]			
					ND	MD	HD	UHD
Silver	270361	2.2	60	30.0	40-130			
Green	270366	2.5	60	30.0	60-190	180-290		
Red	270367	2.7	60	30.0	90-240	230-370		
Yellow	270368	3.2	60	30.0		300-500		
Blue	270369	3.5	60	30.0		400-800	500-1000	
Black	270370	3.7	60	30.0			700-1300	
Purple	270371	4.0	60	30.0			1000-1800	
Orange	270372	4.5	60	30.0			1300-2500	1300-2500
Pink	270373	4.8	60	30.0			1800-3500	1800-3500
White	271115	5.0	60	30.0				2500-5000

Dimensions FRM



Type	Order number	p <sub>max.</sub> [bar / kPa]	DN	Dimensions					Weight [kg]
				A	B	C	D	E	
FRM 100025 ND	270272	10 / 1000	25	500	184	57	492	820	38
FRM 100025 MD	270273	10 / 1000	25	380	184	57	492	820	32
FRM 100025 HD	270274	10 / 1000	25	380	184	57	502	830	36
FRM 250025 UHD	271116	25 / 2500	25	380	184	57	502	830	36
FRM 100040 ND	270278	10 / 1000	40	500	223	69	505	830	42
FRM 100040 MD	270279	10 / 1000	40	380	223	69	505	830	36
FRM 100040 HD	270280	10 / 1000	40	380	223	69	515	840	40
FRM 250040 UHD	271118	25 / 2500	40	380	223	69	515	840	40
FRM 100050 ND	270284	10 / 1000	50	500	254	80	515	840	49
FRM 100050 MD	270285	10 / 1000	50	380	254	80	515	840	43
FRM 100050 HD	270286	10 / 1000	50	380	254	80	525	850	47
FRM 250050 UHD	271120	25 / 2500	50	380	254	80	525	850	47

Dimensions FRM with SAV

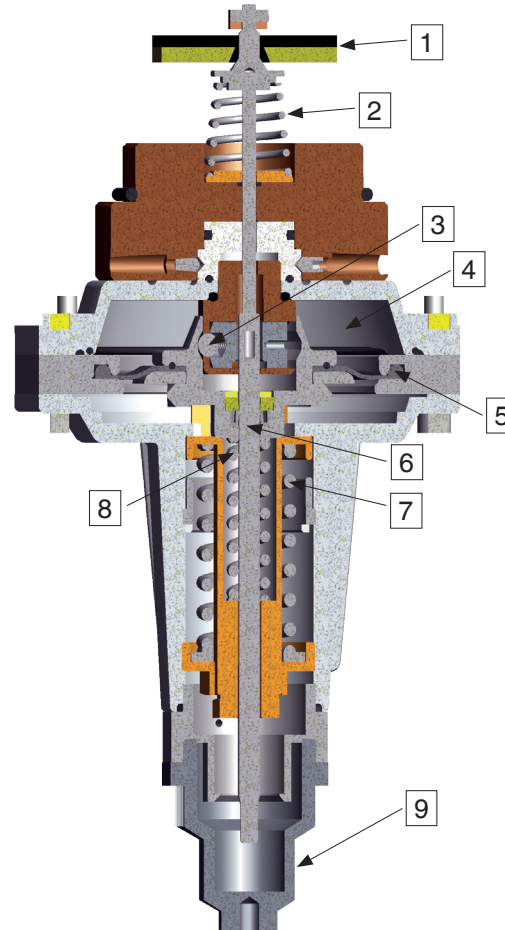


Type	Order number	p <sub>max.</sub> [bar / kPa]	DN	Dimensions					Weight [kg]
				A	B	C	D	E	
FRM 100025 ND/SAV ND	270275	10 / 1000	25	500	184	232	492	1070	40
FRM 100025 MD/SAV MD	270276	10 / 1000	25	380	184	229	492	1070	34
FRM 100025 HD/SAV HD	270277	10 / 1000	25	380	184	236	502	1080	38
FRM 250025 UHD/SAV UHD	271117	25 / 2500	25	380	184	236	502	1080	38
FRM 100040 ND/SAV ND	270281	10 / 1000	40	500	223	243	505	1080	44
FRM 100040 MD/SAV MD	270282	10 / 1000	40	380	223	239	505	1080	38
FRM 100040 HD/SAV HD	270283	10 / 1000	40	380	223	247	515	1090	42
FRM 250040 UHD/SAV UHD	271119	25 / 2500	40	380	223	247	515	1090	42
FRM 100050 HD/SAV ND	270287	10 / 1000	50	500	254	252	515	1090	51
FRM 100050 HD/SAV MD	270288	10 / 1000	50	380	254	248	515	1090	45
FRM 100050 HD/SAV HD	270289	10 / 1000	50	380	254	256	525	1100	49
FRM 250050 UHD/SAV UHD	271121	25 / 2500	50	380	254	256	525	1100	49



Function

Sectional drawing SAV  
Device in the closed position



Chamber 4 is connected to the outlet pressure via an impulse line. The pressure being monitored acts on the working diaphragm 5. The force of the setpoint springs 7 and 8 acts as counterforce. In case of an unbalance of forces (overpressure or underpressure), the SAV is actuated and the gas supply is blocked.

- 1 Valve disc
- 2 Closing spring
- 3 Ball catch / trigger mechanism
- 4 Chamber with the pressure to be monitored
- 5 Working diaphragm
- 6 Push rod
- 7 Setpoint spring for  $pd_o$
- 8 Setpoint spring for  $pd_u$
- 9 Protective cap

Flow rate tables

Device selection

The following flow rate tables can be used to select the device. The maximum indicated volume flow refers to the air with a standard density of 1.24 kg / m<sup>3</sup> at a temperature of 15 °C. In case of different types of gases, a conversion of the volume flow according to the equation on page 18 is carried out. It is possible to determine the maximum flow volume of the corresponding regulator at the operating point defined using p<sub>d</sub> and p<sub>u</sub>. This corresponds to the maximum power of the regulator at which an accuracy class of AC 10 is observed.



Design a straight stabilisation section with the equal diameter.



Impulse connection at a distance of > 5 x DN.



Maximum flow velocity in the stabilisation section of <= 30 m/s.



FRM with SAV max. flow of 2.500 Nm<sup>3</sup>/h (Air).

FRM 100025... DN25 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 10)

FRM ...	ND				MD					HD					
p <sub>d</sub> [bar] \ p <sub>u</sub> [bar]	0,03	0,05	0,075	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,5	0,75	1	1,25	1,5
0,5	186	217	229	235	192	186	173	161							
0,75	198	266	285	297	235	240	224	223	210						
1	210	297	346	359	273	306	308	325	313	297	285				
1,5	223	322	433	458	371	377	396	371	384	384	371	384	396		
2	235	346	507	532	445	445	445	445	483	445	445	445	445	458	470
2,5	247	371	569	594	507	507	582	594	606	557	557	557	557	557	557
3	272	396	631	656	557	582	681	693	730	643	643	643	643	643	643
3,5	297	421	693	705	594	656	779	779	841	705	755	792	792	792	792
4	309	445	755	755	631	718	866	866	940	792	891	940	940	940	940
4,5	322	470	804	804	656	767	953	965	1039	866	990	1052	1076	1076	1089
5	334	495	841	854	681	817	1027	1052	1126	928	1064	1151	1175	1175	1237
6	346	507	866	891	718	891	1114	1175	1287	1052	1237	1336	1423	1423	1423
7	346	520	891	940	742	977	1175	1336	1411	1163	1373	1509	1608	1608	1608
8	359	532	916	977	767	1052	1237	1398	1509	1274	1485	1658	1732	1732	1732
9	359	544	940	1015	792	1089	1287	1460	1621	1349	1596	1794	1794	1794	1794
10	371	557	965	1052	817	1138	1312	1509	1695	1411	1707	1881	1881	1881	1881



FRM 100040... DN40 - max. flow volume [Nm³/h] natural gas of density 0,81 kg/m³ (AC 10)

FRM...	ND					MD					HD				
$p_d$ [bar] \ $p_u$ [bar]	0,03	0,05	0,075	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,5	0,75	1	1,25	1,5
0,5	297	359	359	371	334	334	334	334							
0,75	322	396	445	557	421	433	433	433	433						
1	346	433	569	705	495	507	507	544	582	582					
1,5	396	557	681	804	569	656	656	668	730	755	767	779	916		
2	433	656	779	891	681	767	767	792	866	903	953	1015	1039	1039	1089
2,5	513	718	866	990	761	866	866	928	990	1039	1076	1262	1274	1274	1361
3	569	779	965	1101	829	953	953	1027	1101	1163	1163	1423	1608	1608	1608
3,5	625	829	1064	1200	885	1039	1039	1151	1225	1274	1287	1646	1757	1769	1856
4	668	866	1175	1274	934	1114	1114	1262	1361	1398	1411	1745	1905	1967	2103
4,5	705	928	1299	1361	977	1188	1188	1361	1485	1509	1522	1905	2054	2140	2351
5	755	990	1398	1460	1015	1262	1262	1448	1584	1608	1621	2066	2215	2326	2536
6	866	1114	1534	1670	1114	1386	1411	1633	1794	1794	1856	2351	2462	2660	2846
7	977	1225	1646	1831	1213	1460	1559	1794	1967	1955	2079	2623	2747	2969	3093
8	1076	1324	1745	1918	1287	1509	1670	1943	2165	2091	2252	2846	2994	3217	3279
9	1151	1411	1794	1955	1336	1547	1757	2091	2326	2215	2413	3093	3217	3403	3464
10	1175	1472	1819	2004	1373	1571	1831	2202	2475	2239	2487	3229	3403	3526	3600





FRM 100050... DN50 - max. flow volume [Nm³/h] natural gas of density 0,81 kg/m³ (AC 10)

FRM...	ND				MD					HD					
$p_d$ [bar] \ $p_u$ [bar]	0,03	0,05	0,075	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,5	0,75	1	1,25	1,5
0,5	198	210	285	285	260	260	260	260							
0,75	247	272	334	334	371	396	396	396	396						
1	272	322	408	408	483	495	507	507	544	470	470				
1,5	303	371	483	483	594	656	656	693	829	582	582	656	761		
2	334	408	569	569	705	779	779	866	1076	742	742	866	866	866	928
2,5	365	445	668	668	804	903	903	1015	1237	916	953	1089	1114	1114	1163
3	396	495	718	718	891	1027	1027	1138	1361	1064	1213	1287	1336	1336	1386
3,5	427	532	767	767	965	1101	1151	1274	1460	1188	1349	1485	1534	1534	1608
4	452	582	792	792	1052	1175	1250	1386	1559	1287	1485	1633	1707	1707	1881
4,5	470	631	854	854	1138	1213	1336	1485	1608	1386	1596	1782	1856	1856	2029
5	507	674	916	916	1213	1287	1411	1571	1670	1460	1670	1893	1955	2004	2153
6	582	742	990	990	1312	1398	1534	1707	1794	1596	1806	1943	2054	2202	2425
7	643	817	1064	1076	1411	1497	1646	1794	1918	1707	1905	1980	2140	2400	2673
8	705	878	1126	1151	1485	1571	1732	1881	2042	1794	1980	2017	2239	2635	2895
9	767	928	1175	1213	1547	1633	1819	1930	2165	1856	2029	2054	2314	2772	3007
10	841	977	1225	1299	1608	1707	1868	1967	2289	1893	2079	2079	2351	2895	3106

Device selection



Flow rate tables

FRM 250025 UHD... DN25 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 10)

FRM ...	UHD				
$p_d$ [bar]	1	1,5	2	3	4
$p_u$ [bar]					
8	1423	1423	1485	1837	1485
10	1670	2143	1794	2220	1794
12	1918	1980	2103	2103	2165
16	2475	3215	2722	2722	2784
18	2536	2660	2846	2908	3031
20	2598	3444	2969	3093	3279
25	2846	3031	3279	3526	3836

FRM 250025 UHD... DN25 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 5)

FRM ...	UHD				
$p_d$ [bar]	1	1,5	2	3	4
$p_u$ [bar]					
8	990	1175	1175	1531	1299
10	1361	1423	1547	1990	1670
12	1732	1794	1918	2449	2042
16	2475	3215	2722	2722	2784
18	2536	2660	2846	2908	3031
20	2598	3444	2969	3093	3279
25	2784	3751	3279	3526	3836

Device selection



Flow rate tables

FRM 250040 UHD... DN40 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 10)

FRM ...	UHD				
$p_d$ [bar]	1	1,5	2	3	4
$p_u$ [bar]					
8	2660	2908	3217	4133	3464
10	3031	4210	3774	3836	3959
12	3464	3836	4269	5358	4392
16	4207	5894	5320	5320	5382
18	4578	6430	5815	5939	6125
20	4949	6965	6310	8190	6929
25	5877	6558	7424	8104	8847

FRM 250040 UHD... DN40 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 5)

FRM ...	UHD				
$p_d$ [bar]	1	1,5	2	3	4
$p_u$ [bar]					
8	1608	1794	2042	2679	2289
10	1732	2042	2413	3138	2660
12	1856	2832	2722	2846	3031
16	2165	2722	3341	4440	3836
18	2289	3598	3526	3836	4207
20	2475	3827	3712	4145	4640
25	2846	3464	4145	6047	5630

Device selection



Flow rate tables

**FRM 250050 UHD... DN50 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 10)**

FRM ...	UHD				
$p_d$ [bar]	1	1,5	2	3	4
$p_u$ [bar]					
8	2103	2227	2413	2784	3217
10	2413	3291	2908	4440	4269
12	2784	3031	3341	5358	5320
16	3464	3836	4269	7272	7486
18	3836	5205	4578	6186	7857
20	4269	5664	4887	6558	8290
25	5197	6736	5691	6583	4949

**FRM 250050 UHD... DN50 - max. flow volume [Nm<sup>3</sup>/h] natural gas of density 0,81 kg/m<sup>3</sup> (AC 5)**

FRM ...	UHD				
$p_d$ [bar]	1	1,5	2	3	4
$p_u$ [bar]					
8	1547	1423	1361	2067	1980
10	1547	1485	1485	1918	2413
12	1485	1914	1608	2756	2846
16	1423	1608	1856	3444	3712
18	1670	2296	2042	2969	3959
20	1980	2042	2165	3155	4207
25	2660	2598	2598	4669	4949

Calculation of gas types



$\dot{V}_{\text{used gas}} = \dot{V}_{\text{air}} \times f$

$f = \sqrt{\frac{\text{air density}}{\text{spec. weight of the gas used}}}$

Type of gas	Spec. Wgt. [kg/m <sup>3</sup> ]	dv	f
Natural gas	0.81	0.65	1.24
City gas	0.58	0.47	1.46
NDG	2.08	1.67	0.77
Air	1.24	1.00	1.00

Device selection

System data

Medium: natural gas

Natural gas specific density: 0.81 kg/m<sup>3</sup>

Volume flow  $\dot{V}_{\text{natural gas system}}$ : 550 Nm<sup>3</sup>/h

Inlet pressure  $p_u$ : 4 bar (400 kPa)

Outlet pressure  $p_d$ : 150 mbar (15 kPa)



Design example

FRM 100025... DN25 - max. air flow volume (AC 10)

FRM ...	ND				MD					HD						
$p_u$ [bar]	0,03	0,05	0,075	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,5	0,75	1	1,25	1,5	
0,5	150	175	185	190	155	150	140	130								
0,75	160	215	230	240	190	194	181	180	170							
1	170	240	280	290	221	247	249	263	253	240	230					
1,5	180	260	350	370	300	305	320	300	310	310	300	310	310	320		
2	190	280	410	430	360	360	360	360	390	360	360	360	360	370	380	
2,5	200	300	460	480	410	410	470	480	490	450	450	450	450	450	450	
3	220	320	510	530	450	470	550	560	590	520	520	520	520	520	520	
3,5	240	340	560	570	510	530	630	630	680	570	610	640	640	640	640	
4	250	360	610	610	510	580	700	700	780	640	720	760	760	760	760	
4,5	260	380	650	650	530	620	770	780	840	700	800	850	850	870	880	
5	270	400	680	690	550	660	830	850	910	750	860	930	950	950	1000	
6	280	410	700	720	580	720	900	950	1040	850	1000	1080	1150	1150	1150	
7	280	420	720	760	600	790	950	1080	1140	940	1110	1220	1300	1300	1300	
8	290	430	740	790	620	850	1000	1130	1220	1030	1200	1340	1400	1400	1400	
9	290	440	760	820	640	880	1040	1180	1310	1090	1290	1450	1450	1450	1450	
10	300	450	780	850	660	920	1060	1220	1370	1140	1380	1520	1520	1520	1520	

$$\dot{V}_{\text{FRM DN 25}} = 510 \text{ m}^3/\text{h air}$$

Conversion  $\dot{V}_{\text{FRM DN 25 air}}$  in  $\dot{V}_{\text{FRM DN 25 natural gas}}$ :

$$\dot{V}_{\text{FRM DN 25 natural gas}} = 510 \text{ m}^3/\text{h} * \sqrt{(1.24/0.81)}$$

$$\dot{V}_{\text{FRM DN 25 natural gas}} = 631 \text{ m}^3/\text{h}$$

$$\dot{V}_{\text{FRM DN 25 natural gas}} > \dot{V}_{\text{natural gas system}}$$

$$631 \text{ m}^3/\text{h} > 550 \text{ m}^3/\text{h}$$

Since the effective operating point of the system (550 m<sup>3</sup>/h natural gas) should correspond as closely as possible to the maximum power of the regulator, for this design example a FRM 100025 DN 25 is used. In this way optimum regulation behaviour can be guaranteed.

FRM 100040... DN40 - max. air flow volume (AC 10)

FRM ...	ND				MD					HD						
$p_u$ [bar]	0,03	0,05	0,075	0,1	0,15	0,2	0,25	0,3	0,35	0,4	0,5	0,75	1	1,25	1,5	
0,5	240	290	290	300	270	270	270									
0,75	260	320	360	450	340	350	350	350	350							
1	280	350	460	570	400	410	410	440	470	470						
1,5	320	450	550	650	480	530	530	540	590	610	620	630	740			
2	350	530	630	720	550	620	620	640	700	730	770	820	840	840	880	
2,5	415	580	700	800	615	700	700	750	800	840	870	1020	1030	1030	1100	
3	460	630	780	890	670	770	770	830	890	940	940	1150	1300	1300	1300	
3,5	505	670	880	970	735	840	840	930	990	1030	1040	1320	1420	1430	1500	
4	540	700	950	1050	755	900	900	1020	1100	1130	1140	1410	1540	1590	1700	
4,5	570	750	1050	1100	790	960	960	1100	1200	1220	1230	1540	1660	1730	1900	
5	610	800	1130	1180	820	1020	1020	1170	1280	1300	1310	1670	1790	1880	2050	
6	700	900	1240	1350	900	1120	1140	1320	1450	1450	1500	1900	1990	2150	2300	
7	790	990	1330	1480	980	1180	1260	1450	1590	1580	1680	2120	2220	2400	2500	
8	870	1070	1410	1550	1040	1220	1350	1570	1750	1690	1820	2300	2420	2600	2650	
9	930	1140	1450	1580	1080	1250	1420	1690	1880	1790	1950	2500	2600	2750	2800	
10	950	1190	1470	1620	1110	1270	1480	1780	2000	1810	2010	2610	2750	2850	2910	

$$\dot{V}_{\text{FRM DN 40}} = 755 \text{ m}^3/\text{h air}$$

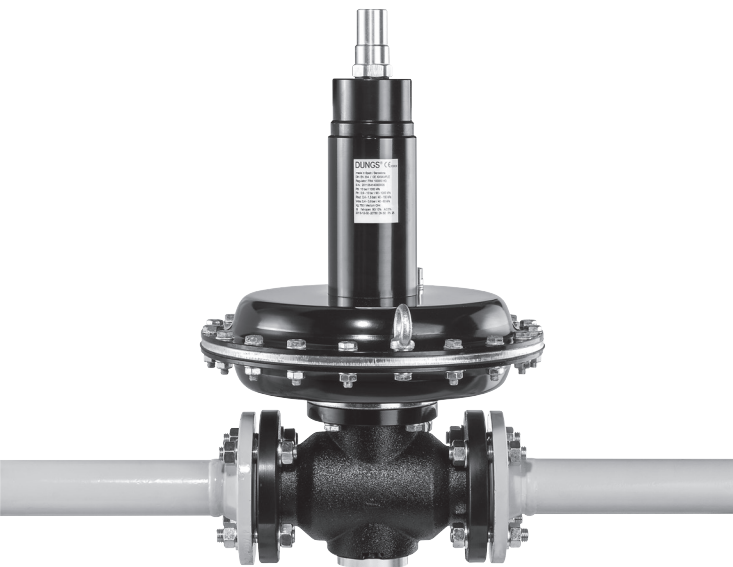
Conversion  $\dot{V}_{\text{FRM DN 40 air}}$  in  $\dot{V}_{\text{FRM DN 40 natural gas}}$ :

$$\dot{V}_{\text{FRM DN 40 natural gas}} = 755 \text{ m}^3/\text{h} * \sqrt{(1.24/0.81)}$$

$$\dot{V}_{\text{FRM DN 40 natural gas}} = 934 \text{ m}^3/\text{h}$$

$$\dot{V}_{\text{FRM DN 40 natural gas}} > \dot{V}_{\text{natural gas system}}$$

$$934 \text{ m}^3/\text{h} > 550 \text{ m}^3/\text{h}$$



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