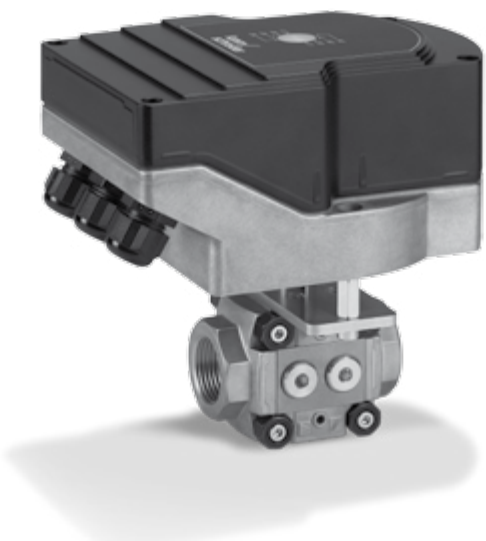
Linear flow control with actuator IFC

Technical Information · GB
3 Edition 01.14

CE

- Linear relationship between adjustment angle and flow rate
- Large control ratio of 25:1
- EC type-tested and certified
- Actuators IC 20 or IC 40 mounted directly
- For gas and air
- Low leakage rates
- High control accuracy



krom//schroder

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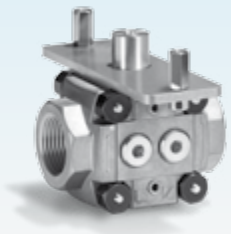
▼ = To be continued

1 Application

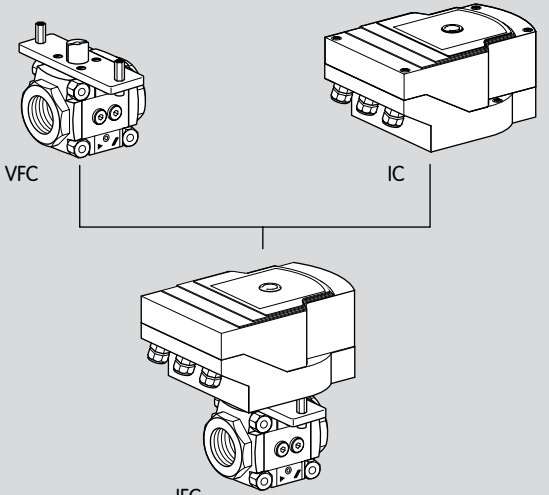


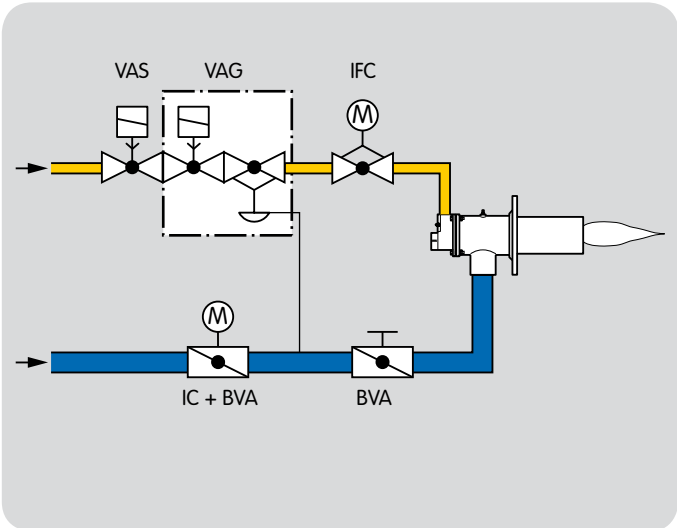
VFC

IFC

The IFC is composed of linear flow control VFC and actuator IC 20 or IC 40. It is designed to adjust volumes of gas and cold air on various appliances. The IFC is designed for control ratios up to 25:1 and is suitable for regulating flow rates for modulating or stage-controlled combustion processes.

Actuator IC 20 is controlled by a modulating signal or three-point step signal. Actuator IC 40 offers additional functions. It can be adjusted using the BCSoft programming software via an optical interface. The control type (two-point signal, three-point step signal or continuous control), running times, angles of rotation and intermediate positions can thus be programmed.

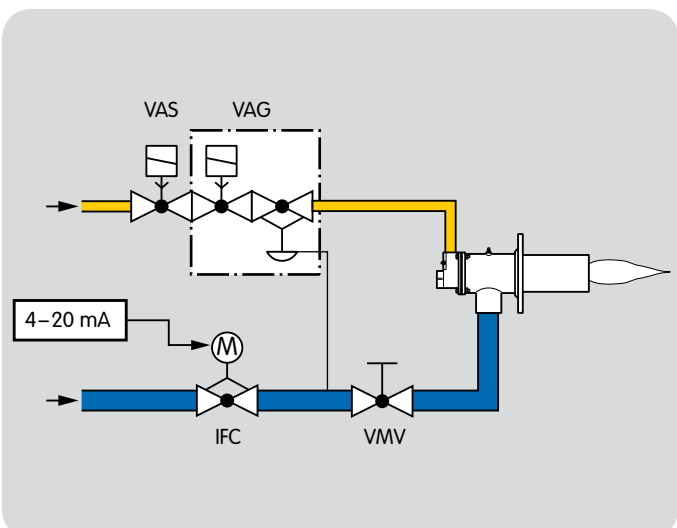




1.1 Examples of application

1.1.1 Lambda control

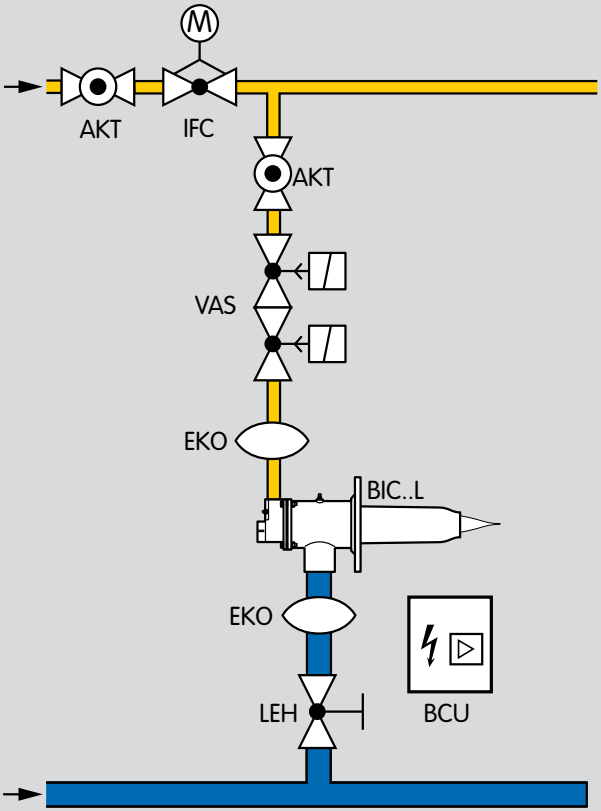
If the burner is to be operated with different lambda values for process reasons, the IFC can be used to correct the lambda value.



1.1.2 Adjusting the burner capacity

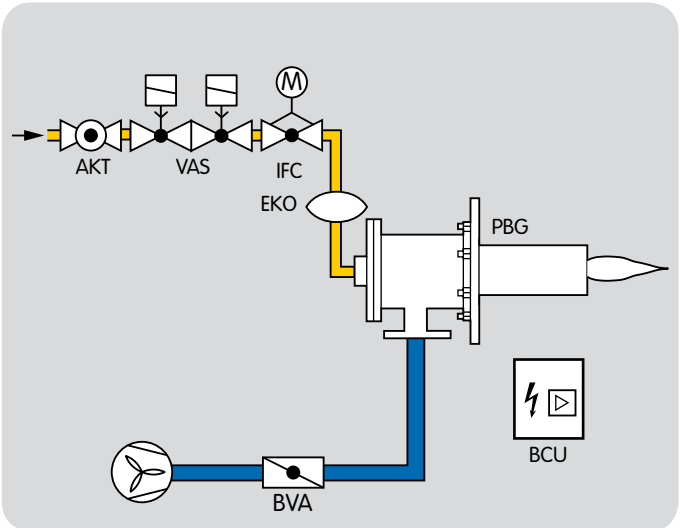
In pneumatic ratio control systems, the IFC with actuator IC 20..E determines the air volume for the required burner capacity.

The fine-adjusting valve VMV is used to adjust the high-fire rate.



1.1.3 Zone control

After initiating the burner control unit, the gas solenoid valves open and the IFC is set to ignition position. The burner is ignited by the burner control unit BCU. The gas flow rate can be adjusted continuously using the IFC. The air flow rate remains constant.



1.1.4 Excess air burner

After initiating the burner control unit, the IFC moves to ignition position. The burner is ignited by the burner control unit BCU. The gas flow rate can be adjusted continuously using the IFC. The air flow rate remains constant.

2 Certification

EC type-tested and certified

CE

VFC

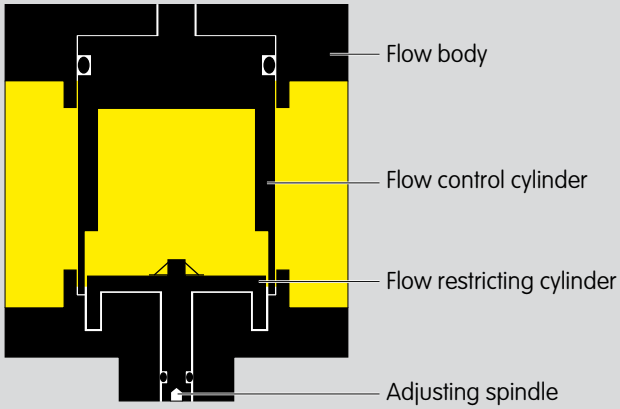
pursuant to

– Gas Appliances Directive (2009/142/EC) in conjunction with EN 13611

IC

Meets the requirements of the

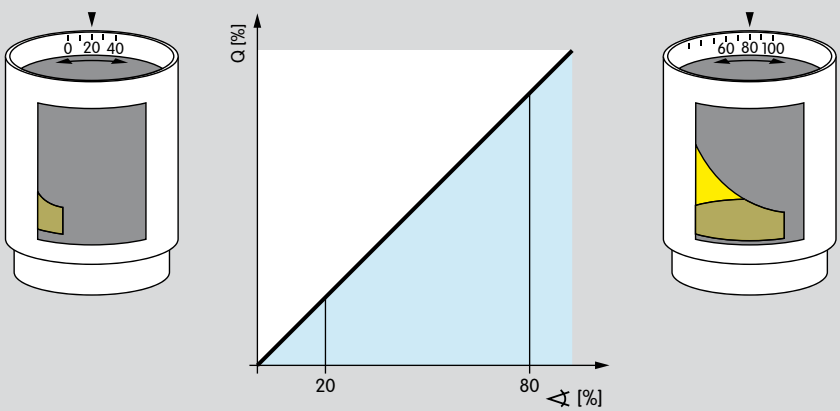
– Low Voltage Directive (2006/95/EC) on the basis of EN 60730-1
– Electromagnetic Compatibility Directive (2004/108/EC) on the basis of EN 50082-2 and EN 50081-1



3 Function of the linear flow control VFC

The linear flow control VFC uses the rotary valve principle. A flow control cylinder with an opening specially designed for linear flow is installed in the flow body. This flow control cylinder sets the desired flow rate by being turned. The maximum flow can be limited in broad ranges by means of a flow restricting cylinder. This allows optimum adaptation to the capacity required, without limiting control quality. Adjustment is carried out using an adjusting spindle.

Flow control cylinder



4 Replacement possibilities

Linear flow control LFC is to be replaced by VFC or IFC

LFC		VFC	
Type designation	Order No.	Type designation	Order No.
LFC 108/10R05	2 581 025 0	VFC 110/10R05-08PPPP	88300221
LFC 108/15R05	2 581 024 0	VFC 115/15R05-08PPPP	88300222
LFC 108/20R05	2 581 023 0	VFC 120/20R05-08PPPP	88300223
LFC 108/25R05	2 581 022 0	VFC 125/25R05-08PPPP	88300224
LFC 115/10R05	2 581 020 0	VFC 110/10R05-15PPPP	88300226
LFC 115/15R05	2 581 019 0	VFC 115/15R05-15PPPP	88300227
LFC 115/20R05	2 581 018 0	VFC 120/20R05-15PPPP	88300228
LFC 115/25R05	2 581 017 0	VFC 125/25R05-15PPPP	88300229
LFC 120/10R05	2 581 015 0	VFC 110/10R05-20PPPP	88300218
LFC 120/15R05	2 581 014 0	VFC 115/15R05-20PPPP	88300231
LFC 120/20R05	2 581 013 0	VFC 120/20R05-20PPPP	88300232
LFC 120/25R05	2 581 012 0	VFC 125/25R05-20PPPP	88300233
LFC 232/25R05	2 581 032 0	LFC size 2 cannot be replaced by VFC 1	
LFC 232/40R05	2 581 033 0	LFC size 2 cannot be replaced by VFC 1	

When replacing LFC with VFC, please note the overall length. Installation situation and dimensions modified.

4.1.1 Search for order number or type

LFC Order No. LFC type designation

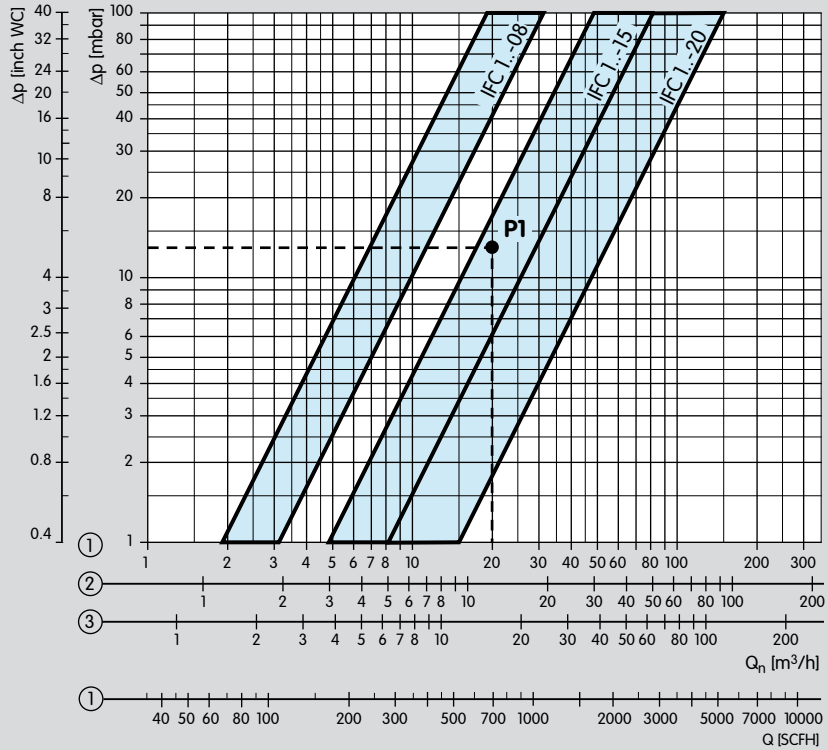
Hits:
0

LFC is to be replaced by VFC/IFC

VFC/IFC Order No.

VFC/IFC type designation

5 Flow rate



① = natural gas, dv = 0.62, ② = LPG, dv = 1.56,
③ = air, dv = 1.00.

The characteristic curves are measured at 15°C (59°F) with a measurement set-up in accordance with the standards EN 13611/EN 161.

This involves measuring the pressure 5 × DN upstream and downstream of the unit under test. The pressure drop of the pipe is also measured but is not compensated for.

Left curve:
Max. flow rate limited by flow restricting cylinder.

Right curve:
Max. flow rate with no limitation.

5.1 k_V value

The size of the flow control cylinder is determined using the flow rate diagram or by calculation using the k_v value.

$Q_{(n)}$ = flow rate (standard state) [m^3/h]

k_v = valve coefficient

Δp = pressure loss [bar]

p_d = outlet pressure (absolute) [bar]

ρ_n = density [kg/m^3] (air 1.29/natural gas 0.83/propane 2.01/ butane 2.71)

T = medium temperature (absolute) [K]

$$k_v = \frac{Q_{(n)}}{514} \cdot \sqrt{\frac{\rho_n \cdot T}{\Delta p \cdot p_d}} \qquad Q_{(n)} = 514 \cdot k_v \cdot \sqrt{\frac{\Delta p \cdot p_d}{\rho_n \cdot T}}$$

$$\Delta p = \left(\frac{Q_{(n)}}{514 \cdot k_v}\right)^2 \cdot \frac{\rho_n \cdot T}{p_d}$$

Type	k_v value	
	without restrictor	with restrictor
IFC 1..-08	2.84	1.67
IFC 1..-15	7.60	4.33
IFC 1..-20	14.5	7.27

The maximum flow rate can be set using the integrated restrictor.

Example

We want to find the size of the flow control cylinder for a linear flow control with actuator IFC.

We have the maximum flow rate $Q_{(n)\ max.}$, the inlet pressure p_u and the temperature T for the medium of natural gas.

$Q_{(n)\ max.}$ = 20 m^3/h

p_u = 43 mbar = 0.043 bar ➔

$p_{u\ absolute}$ = 0.043 bar + 1.013 bar = 1.056 bar

$\Delta p_{max.}$ = 0.013 bar (desired)

$p_{d\ absolute} = p_{u\ absolute} - \Delta p_{max.}$

$p_{d\ absolute}$ = 1.056 bar - 0.013 bar = 1.043 bar

T = 27°C ➔

$T_{absolute}$ = 27 + 273 K = 300 K

$$k_v = \frac{20}{514} \cdot \sqrt{\frac{0{,}83 \cdot 300}{0{,}013 \cdot 1{,}043}} = 5{,}27$$

The IFC with the next higher k_v value is to be selected (see table on the left): IFC 1..-15.

6 Selection

6.1 Selection table

6.1.1 IFC

	Outlet flange nominal size*											Accessories on right-hand side equivalent to those on left-hand side																													
												Inlet						Outlet																							
Type	/-	/10	/15	/20	/25	R	N	05	-08	-15	-20	P	M	1	2	3	4	P	M	1	2	3	4	/20	/40	-07	-15	-30	-60	W	Q	A	2	3	T	E	D	A	R10		
IFC 1-	●	○	○	○	○	○	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 110	○	●	○	○	○	●	○	●	●	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 115	○	○	●	○	○	●	○	●	○	●	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 120	○	○	○	●	○	●	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 125	○	○	○	○	●	●	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 1T-	●	○	○	○	○	○	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 1T10	○	●	○	○	○	○	●	●	●	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 1T15	○	○	●	○	○	○	●	●	○	●	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 1T20	○	○	○	●	○	○	●	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	
IFC 1T25	○	○	○	○	●	○	●	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	●	●	○	○	○	●	●	○	○	○	○	

** Only in conjunction with Rp thread.*

● = *standard*, ○ = *available*

Order example

IFC 115/15R05-15PPPP/20-60W3T

6.1.2 VFC

	Outlet flange nominal size*											Accessories, right												Accessories, left											
												Inlet						Outlet						Inlet						Outlet					
Type	/-	/10	/15	/20	/25	R	N	05	-08	-15	-20	P	M	1	2	3	4	P	M	1	2	3	4	P	M	1	2	3	4	P	M	1	2	3	4
VFC 1-	●	○	○	○	○	○	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 110	○	●	○	○	○	●	○	●	●	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 115	○	○	●	○	○	●	○	●	○	●	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 120	○	○	○	●	○	●	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 125	○	○	○	○	●	●	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 1T-	●	○	○	○	○	○	○	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 1T10	○	●	○	○	○	○	●	●	●	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 1T15	○	○	●	○	○	○	●	●	○	●	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 1T20	○	○	○	●	○	○	●	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
VFC 1T25	○	○	○	○	●	○	●	●	○	○	●	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○

** Only in conjunction with Rp thread.*

● = *standard*, ○ = *available*

Order example

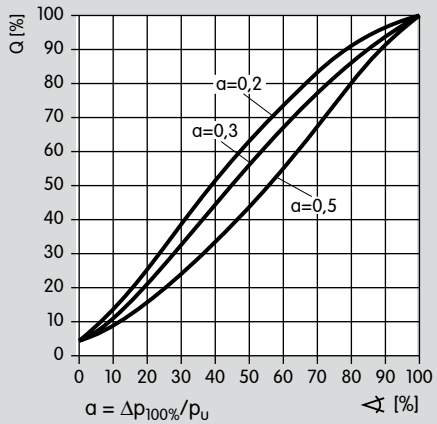
VFC 115/15R05-15PPPP

6.2 IFC, VFC type code

Code	Description
VFC	Linear flow control
IFC	Linear flow control with actuator
1	Size 1
T	T-product
10, 15, 20, 25	Inlet flange nominal size
-	No inlet flange
/10, /15, /20, /25	Outlet flange nominal size
/-	No outlet flange
R	Rp internal thread
N	NPT internal thread
05	$p_{U\ max.}$ 500 mbar
-08	Cylinder
-15	
-20	
	Accessories, right, inlet
P	Plug
M	Pressure test point
1	Pressure switch for gas DG 17VC
2	Pressure switch for gas DG 40VC
3	Pressure switch for gas DG 110VC
4	Pressure switch for gas DG 300VC
-	No accessories
	Accessories, right, outlet
P	Plug
M	Pressure test point
1	Pressure switch for gas DG 17VC
2	Pressure switch for gas DG 40VC
3	Pressure switch for gas DG 110VC
4	Pressure switch for gas DG 300VC
-	No accessories
The same accessories can be selected for the left- or right-hand side.	

Code	Description
/20	Actuator IC 20
/40	Actuator IC 40
-07	Running time: 7.5 s/90°
-15	Running time: 15 s/90°
-30	Running time: 30 s/90°
-60	Running time: 60 s/90°
W	Mains voltage: 230 V AC, 50/60 Hz
Q	Mains voltage: 120 V AC, 50/60 Hz
A	Mains voltage: 100 – 230 V AC, 50/60 Hz
2	Torque: 2.5 Nm
3	Torque: 3 Nm
T	Three-point step control
E	Continuous control 0 (4) – 20 mA, 0 – 10 V
D	Digital input
A	Analogue input 4 – 20 mA
R10	Feedback potentiometer: 1000 Ohm

6.3 Control characteristics



In order for the IFC to be able to influence the flow rate, a proportion of the pressure loss Δp of the entire system has to be caused by the linear flow control. Taking into consideration the fact that the overall pressure loss Δp should be kept to a minimum, a control characteristic/valve authority a = 0.3 is recommended for the IFC. This means that of the overall inlet pressure, there is a 30% drop on the fully opened IFC.

Example

We want to find the IFC for gas to be used for modulating control of a gas burner:

Δp on the IFC is determined using the control characteristic a and the outlet pressure p_d.

Recommended control characteristic a = 0.3.

$$\Delta p = \frac{a \times p_d}{1 - a}$$

Outlet pressure: p_d = 30 mbar

Gas flow rate: $Q_{(n)}$ = 20 m³/h

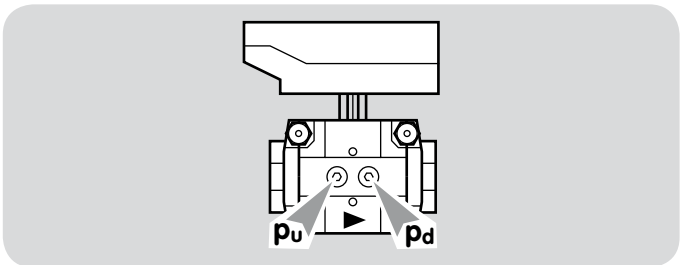
Control characteristic: a = 0.3

$$\Delta p = \frac{0.3 \times 30 \text{ mbar}}{1 - 0.3} = 12.9 \text{ mbar} \approx 13 \text{ mbar}$$

Select the appropriate IFC for the required flow rate $Q_{(n)}$ = 20 m³/h and the calculated Δp = 13 mbar: IFC 1..-15 – see **P1** in the flow rate diagram (page 10).

7 Project planning information

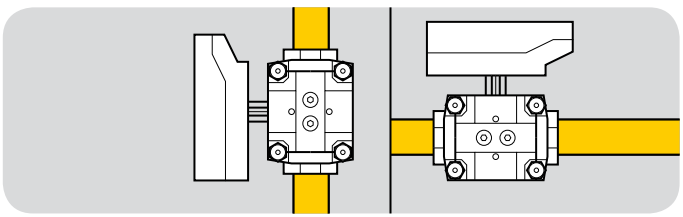
The inlet pressure p_u and the outlet pressure p_d can be measured at the pressure test points.



7.1 Installation

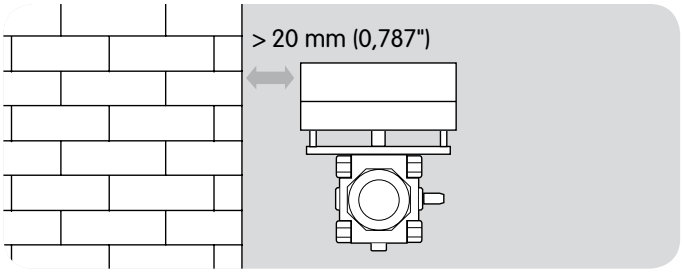
Linear flow control VFC and actuators IC 20 and IC 40 can be supplied separately or assembled. Easy assembly with the actuator using 2 screws can be carried out either before or after installation of the linear flow control in the pipework.

Installation position of actuators IC 20, IC 40: vertical or horizontal, not upside down.

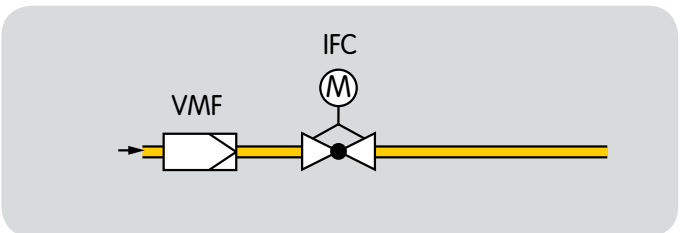


Actuators IC 20 and IC 40, and the linear flow control VFC must not be in contact with masonry. Minimum clearance 20 mm (0,787 inches).

Do not store or install the unit in the open air.

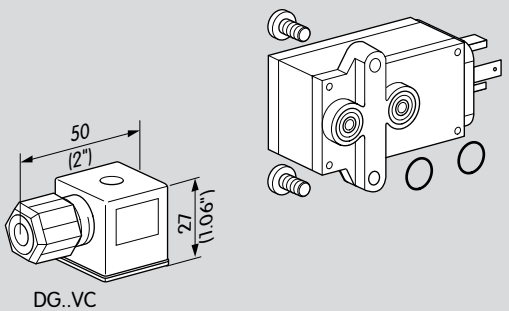


Sealing material and thread cuttings must not be allowed to get into the valve housing. A filter or dirt trap must be installed upstream of every system.



8 Accessories

8.1 Pressure switches for gas



8.1.1 DG..VC for IFC

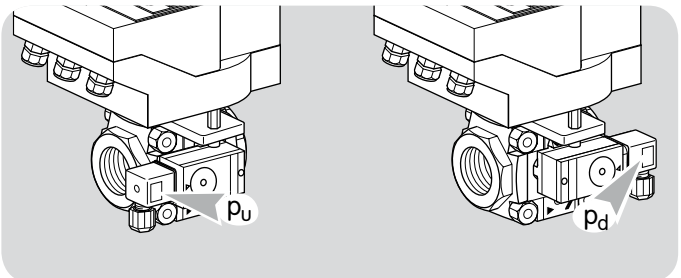
Type	Identification No. (see Selection table)	Adjusting range [mbar/hPa]
DG 17/VC-6W	1	2 – 17
DG 17/VC-6WG	1	2 – 17
DG 40/VC-6W	2	5 – 40
DG 40/VC-6WG	2	5 – 40
DG 110/VC-6W	3	30 – 110
DG 110/VC-6WG	3	30 – 110
DG 300/VC-6W	4	100 – 300
DG 300/VC-6WG	4	100 – 300

Scope of delivery:
1 x pressure switch for gas,
2 x retaining screws,
2 x sealing rings.

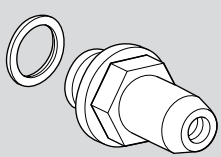
8.1.2 Attachment to IFC

Monitoring the inlet pressure p_u: the electrical plug of the pressure switch for gas points towards the inlet flange.

Monitoring the outlet pressure p_d: the electrical plug of the pressure switch for gas points towards the outlet flange.



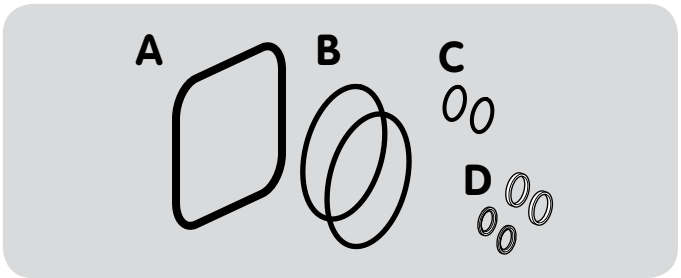
8.2 Pressure test points



Test points to check the inlet pressure p_u and outlet pressure p_d.

Scope of delivery: 1 x test point with 1 x profiled sealing ring, Order No. 74923390

8.3 Seal set VA 1

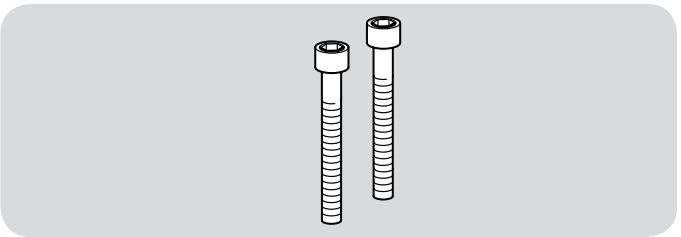


VA 1, Order No. 74921988

Scope of delivery:

A 1 x double block seal,
B 2 x O-rings (flange),
C 2 x O-rings (pressure switch),
for pressure test point/screw plug:
D 2 x sealing rings (flat sealing) and 2 x profiled sealing rings.

8.4 Fastening set



To attach an IC 20 or IC 40 to the linear flow control. The fastening set is delivered enclosed as an additional item.

IC–BVG/BVA/BVH/VFC /B, Order No. 74921082

9 Technical data

9.1 VFC

Gas types: natural gas, LPG (gaseous), biologically produced methane (max. 0.1 %-by-vol. H_2S) or clean air; other types of gas on request. The gas must be dry in all temperature conditions and must not contain condensate.

Control ratio: 25:1.

Leakage rate: < 2% of k_{VS} value.

Max. inlet pressure $p_{u\ max.}$: 500 mbar.

Running times:
IC 20: 7.5 s, 15 s, 30 s, 60 s,
IC 40: 4.5 s – 76.5 s.

Connection flanges: Rp internal thread to ISO 7-1.

Housing material: aluminium,
control cylinder: POM,
seal: NBR.

Ambient temperature: -20 to +60°C (-4 to +140°F).

Installation position: any; in conjunction with IC in the vertical upright position or tilted up to the horizontal, not upside down.

9.2 IC 20, IC 20..E

Mains voltage:
120 V AC, -15/+10%, 50/60 Hz,
230 V AC, -15/+10%, 50/60 Hz.

Screw terminals using the elevator principles for cables up to 4 mm² (single core cables) and for cables up to 2.5 mm² with wire end ferrules.

Angle of rotation: 0 – 90°, adjustable.

Holding torque = torque.

Control by three-point step signal to terminals 1 and 2:
minimum pulse duration: 100 ms,
minimum pause between 2 pulses: 100 ms.

Switching capacity of the position switches:

Voltage	Resistive load	Incand. lamp load	Inductive load
125 V AC	2 A	0.5 A	2 A
250 V AC	2 A	0.5 A	2 A
< 30 V DC	2 A	2 A	2 A
< 50 V DC	1 A	0.4 A	1 A
< 75 V DC	0.75 A	0.3 A	0.75 A
< 125 V DC	0.5 A	0.2 A	0.03 A
< 250 V DC	0.25 A	0.1 A	0.03 A
12 – 30 V AC/DC	10 – 100 mA	–	10 – 100 mA

Enclosure: IP 65 pursuant to IEC 529.

Safety class: I pursuant to EN 60335.

Line entrance for electrical connection:
3 × M20 plastic cable glands.

Ambient temperature: -20 to +60°C (-4 to +140°F), no condensation permitted.

9.2.1 IC 20

Power consumption:
4.9 VA at 50 Hz, 5.8 VA at 60 Hz.

9.2.2 IC 20..E

Power consumption:
terminals 1, 2 and 5:
4.9 VA at 50 Hz, 5.8 VA at 60 Hz,

terminal 3:
8.4 VA at 50 Hz, 9.5 VA at 60 Hz,
in total not exceeding:
8.4 VA at 50 Hz, 9.5 VA at 60 Hz.

Position feedback output:
4 – 20 mA, electrically isolated, max. 500 Ω load impedance. The output is always active when supply voltage is applied to terminals 3 and 4.

Input:
electrically isolated,
0 (4) – 20 mA: load impedance switchable between 50 Ω and 250 Ω,
0 – 10 V: 100 kΩ input resistance.

9.3 IC 40

Mains voltage:
IC 40: 100 – 230 V AC, ±10%, 50/60 Hz; the actuator automatically adjusts to the respective mains voltage.

Power consumption: 8.4 W,
switch-on peak current: max. 8 A for max. 10 ms.

Screw terminals using the elevator principles for cables up to 4 mm^2 (single core cables) and for cables up to 2.5 mm^2 with wire end ferrules.

Angle of rotation: 0 – 90°.

Holding torque = torque as long as permanent supply voltage is applied.

2 digital inputs:
IC 40: 24 V DC or 100 – 230 V AC each.
Current requirement of digital inputs: 3 mA ± 1.5 mA.

1 analogue input (optional): 4 – 20 mA (internal load impedance: max. 500 Ω at 20 mA)).

Potentiometer (optional):
1000 Ohm +/- 20%,
linearity tolerance +/- 2%,
max. capacity 0.25 W,
conductive plastic element.

Important: tap wiper at high resistance.

2 digital outputs:
Signalling contacts designed as relay change-over contacts. Contact current of digital outputs: min. 5 mA (resistive) and max. 2 A.

The relay contacts can be connected to 100 – 230 V AC or 24 V DC. If the contacts have been connected with a voltage > 24 V and a current > 0.1 A once, the gold plating on the contacts will have been burnt through. This contact can then only be connected with this power rating or higher power rating.

2 LED status displays:

- Blue LED for operation "ON";
  drive in motion = slow flashing light;
  manual operation = fast flashing light;
  drive stopped = permanent light.
- Red LED for warnings and faults;
  warning = permanent light;
  fault = flashing light.
- Red and blue LED simultaneously,
  calibration in progress = flashing light.

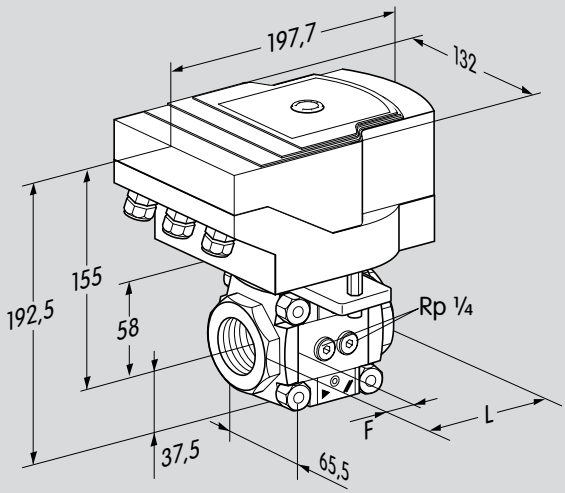
Enclosure: IP 65 pursuant to IEC 529.

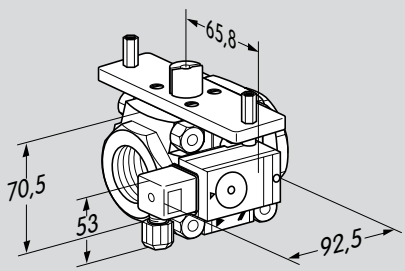
Safety class: I pursuant to EN 60335.

Line entrance for electrical connection:
3 × M20 plastic cable glands.

Ambient temperature: -20 to +60°C (-4 to +140°F), no condensation permitted.

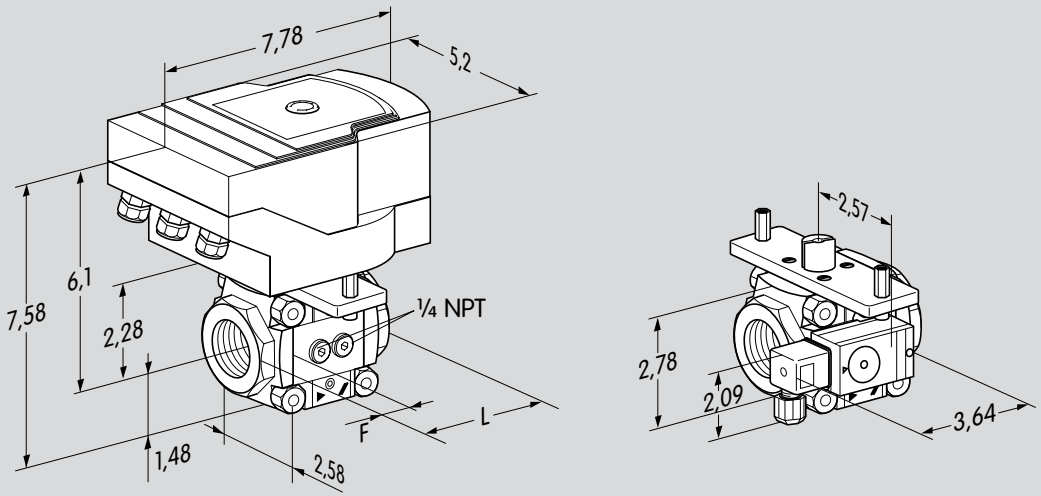
9.4 Dimensions [mm]





Type	Connection		L	F	Weight
	Rp	DN	mm	mm	kg
IFC 110	3/8	10	75	15	2.65
IFC 115	1/2	15	75	15	2.60
IFC 120	3/4	20	91	23	2.75
IFC 125	1	25	91	23	2.65

9.5 Dimensions [inch]



Type	Connection		L	F	Weight
	NPT	DN	inch	inch	lbs
IFC 1T10	3/8	10	2.95	0.59	5.83
IFC 1T15	1/2	15	2.95	0.59	5.72
IFC 1T20	3/4	20	3.58	0.91	6.05
IFC 1T25	1	25	3.58	0.91	5.83

Feedback

Finally, we are offering you the opportunity to assess this "Technical Information (TI)" and to give us your opinion, so that we can improve our documents further and suit them to your needs.

Clarity

- ○ Found information quickly
- ○ Searched for a long time
- ○ Didn't find information

  What is missing?
- ○ No answer

Comprehension

- ○ Coherent
- ○ Too complicated
- ○ No answer

Scope

- ○ Too little
- ○ Sufficient
- ○ Too wide
- ○ No answer

Use

- ☐ To get to know the product
- ☐ To choose a product
- ☐ Planning
- ☐ To look for information

Navigation

- ○ I can find my way around
- ○ I got "lost"
- ○ No answer

My scope of functions

- ○ Technical department
- ○ Sales
- ○ No answer

Remarks

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www.adobe.com

Contact

Elster GmbH
Postfach 2809 · 49018 Osnabrück
Strotheweg 1 · 49504 Lotte (Büren)
Germany

T +49 541 1214-0
F +49 541 1214-370
info@kromschroeder.com
www.kromschroeder.com

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