Safety

Please read and keep in a safe place

Please read through these instructions carefully before installing or operating. Following the installation, pass the instructions on to the operator. This unit must be installed and commissioned in accordance with the regulations and standards in force. These instructions can also be found at www.docuthek.com.

Explanation of symbols

- 1, 2, 3... = Action

▷ = Instruction

Liability

We will not be held liable for damage resulting from non-observance of the instructions and non-compliant use.

Safety instructions

Information that is relevant for safety is indicated in the instructions as follows:

⚠️ DANGER

Indicates potentially fatal situations.

⚠️ WARNING

Indicates possible danger to life and limb.

⚠️ CAUTION

Indicates possible material damage.

All interventions may only be carried out by qualified gas technicians. Electrical interventions may only be carried out by qualified electricians.

Conversion, spare parts

All technical changes are prohibited. Only use OEM spare parts.

Changes to edition 03.17

The following chapters have been changed:
- Cert. version
- Installation
- Certification
Checking the usage

Intended use

Pressure regulators with solenoid valve VAD, VAG, VAV, VAH

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation of regulator type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAD</td>
<td>Pressure regulator with solenoid valve</td>
</tr>
<tr>
<td>VAG</td>
<td>Air/gas ratio control with solenoid valve</td>
</tr>
<tr>
<td>VAV</td>
<td>Variable air/gas ratio control with solenoid valve</td>
</tr>
<tr>
<td>VAH</td>
<td>Flow rate regulator with solenoid valve</td>
</tr>
</tbody>
</table>

Constant pressure governor VAD for shut-off and precise control of the gas supply to excess air burners, atmospheric burners or force draught gas burners. Air/gas ratio control VAG for shut-off and for maintaining a constant air/gas pressure ratio of 1:1 for modulating-controlled burners or with bypass valve for stage-controlled burners. Can be used as zero governor for gas engines. Variable air/gas ratio control VAV for shut-off and for maintaining a constant air/gas pressure ratio for modulating-controlled burners. Flow rate regulator VAH for maintaining a constant gas/air ratio for modulating-controlled and stage-controlled burners. The gas flow rate is controlled proportionally to the air flow rate. In addition, the flow rate regulator with gas solenoid valve shuts off the gas or air supply safely.

Flow rate regulator VRH

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation of regulator type</th>
</tr>
</thead>
<tbody>
<tr>
<td>VRH</td>
<td>Flow rate regulator</td>
</tr>
</tbody>
</table>

Flow rate regulator VRH for maintaining a constant gas/air ratio for modulating-controlled and stage-controlled burners. The gas flow rate is controlled proportionally to the air flow rate.

Pressure regulators with double solenoid valve VCD, VCG, VCV, VCH

<table>
<thead>
<tr>
<th>Type</th>
<th>Combination of gas solenoid valve + regulator with solenoid valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCD</td>
<td>VAS + VAD</td>
</tr>
<tr>
<td>VCG</td>
<td>VAS + VAG</td>
</tr>
<tr>
<td>VCV</td>
<td>VAS + VAV</td>
</tr>
<tr>
<td>VCH</td>
<td>VAS + VAH</td>
</tr>
</tbody>
</table>

Gas solenoid valves VAS for safeguarding gas or air on various appliances. Pressure regulators with double solenoid valve VCx are combinations of two gas solenoid valves with a pressure regulator. This function is only guaranteed when used within the specified limits – see page 15 (Technical data). Any other use is considered as non-compliant.

Type code

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAD</td>
<td>Pressure regulator with solenoid valve</td>
</tr>
<tr>
<td>VAG</td>
<td>Air/gas ratio control with solenoid valve</td>
</tr>
<tr>
<td>VAV</td>
<td>Variable air/gas ratio control with solenoid valve</td>
</tr>
<tr>
<td>VAH</td>
<td>Flow rate regulator with solenoid valve</td>
</tr>
<tr>
<td>VRH</td>
<td>Flow rate regulator</td>
</tr>
</tbody>
</table>

15–50 Nominal inlet and outlet diameter

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Rp internal thread</td>
</tr>
<tr>
<td>N</td>
<td>NPT internal thread</td>
</tr>
<tr>
<td>F</td>
<td>ISO flange</td>
</tr>
</tbody>
</table>

/N1 Quick opening, quick closing

K1 Mains voltage: 24 V DC

P1 Mains voltage: 100 V AC; 50/60 Hz

Q1 Mains voltage: 120 V AC; 50/60 Hz

Y1 Mains voltage: 200 V AC; 50/60 Hz

W1 Mains voltage: 230 V AC; 50/60 Hz

S1 Closed position switch and visual position indicator

G1 Closed position switch for 24 V and visual position indicator

R1 Viewing side (in flow direction): from the right

L1 Viewing side (in flow direction): from the left

Outlet pressure p_sub for VAD:

-25 2.5–25 mbar

-50 20–50 mbar

-100 35–100 mbar

A Standard valve seat

B Reduced valve seat

Connection kit for air control pressure p_sub:

E VAG, VAV, VAH, VRH: compression fitting

K VAG: plastic hose coupling

A VAG, VAV, VAH, VRH: NPT 1/8 adapter

N VAG: zero governor

1) Only available for VAD, VAG, VAV, VAH

Part designations
Solenoid actuator
Flow body
Connection box
Connection flange
Closed position switch
Connection parts
Sealing plug
Regulator

Mains voltage, electrical power consumption, ambient temperature, enclosure, inlet pressure and installation position: see type label.

www.kromschroeder.com
Osnabrück, Germany
VAx ...
.val/vario
.XXXX

Installation

CAUTION
Please observe the following to ensure that the unit is not damaged during installation and operation:
- Dropping the device can cause permanent damage. In this event, replace the entire device and associated modules before use.
- Important! The gas must be dry in all conditions and must not contain condensate.
- Sealing material and dirt, e.g. thread cuttings, must not be allowed to get into the valve housing. Install a filter upstream of every system.
- Always install an activated carbon filter upstream of the regulator when air is the medium. Otherwise, the ageing of elastomer materials will be accelerated.
- It is not permitted to install gas solenoid valve VAS downstream of flow rate regulator VAH/VRH and upstream of fine-adjusting valve VMV. The VAS would no longer be able to perform its function as a second safety valve if installed in the above-mentioned position.
- Do not store or install the unit in the open air.
- If more than three valVario controls are installed in line, the controls must be supported.
- Do not clamp the unit in a vice. Only secure the flange by holding the octagon with a suitable spanner. Risk of external leakage.
- Devices with overtravel switch and visual position indicator VAX..SR/SL: actuator cannot be rotated.
- In the case of double solenoid valves, the position of the connection box can only be changed by removing the actuator and reinstalling it rotated by 90° or 180°.

Cleaning work on the solenoid actuator may not be performed using high pressure and/or chemical cleaning agents. This can cause moisture to get into the solenoid actuator and may lead to a dangerous failure.

Note the inlet and outlet pressures, see page 15 (Technical data).

When using a non-return gas valve GRS, we recommend installing the non-return gas valve upstream of the regulator and downstream of the gas solenoid valves due to the permanent pressure loss on the GRS.

When joining two valves, determine the position of the connection boxes, push through the knock-outs in the connection boxes and install a cable gland set before installation in the pipework, see page 14 (Cable gland set for double solenoid valves).

Install the unit in the pipe free of mechanical stress.

For retrofitting a second gas solenoid valve, use the double block seal instead of O-rings. The double block seal is supplied with the seal set, see page 15 (Seal set for sizes 1 – 3).

Installation position:
VAD, VAG, VAH: black solenoid actuator in the vertical upright position or tilted up to the horizontal, not upside down.
VAG/VAH/VRH in the horizontal position: min. inlet pressure \( p_u \text{ min. } = 80 \text{ mbar (32 "WC)} \).
VAV: black solenoid actuator in the vertical position, not upside down.

The housing must not be in contact with masonry. Minimum clearance 20 mm (0.78").

To prevent vibrations, keep the volume between the regulator and burner small by using short pipes (\( \leq 0.5 \text{ m}, \leq 19.7" \)).

The inlet pressure \( p_u \) can be measured using pressure test points on the flow body on both sides.

The outlet pressure \( p_d \) (\( p_d \) and \( p_{d-} \)) and the air control pressure \( p_{sa} \) (\( p_{sa} \) and \( p_{sa-} \)) must only be measured at the designated places on the regulator using pressure test points.
A combustion chamber control line \((p_{sa})\) can be connected at connection \(p_{sa}\) to keep the burner capacity constant (1/8” coupling with compression fitting for 6 x 1 tube).

To increase the control accuracy, an external impulse line can be connected, instead of the pressure test point \(p_d\):

Gas impulse line \(p_d\): distance from flange \(\geq 3 \times \) DN, use a steel tube 8 x 1 mm and a G1/8.. coupling for D = 8 mm.

**CAUTION**

Do not bridge downstream VAS with external impulse line.

**Strainer**

A strainer must be fitted in the unit on the inlet side. If two or more gas solenoid valves are installed in line, then a strainer only needs to be fitted on the inlet side of the first valve.

**Differential pressure orifice**

An appropriate differential pressure orifice with rubber seals \((G)\) must be inserted at the outlet of the unit, depending on the pipe.

<table>
<thead>
<tr>
<th>Size</th>
<th>Pipe</th>
<th>Differential pressure orifice Colour/Outlet diameter Ø</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DN 15</td>
<td>yellow/Ø 18,5 mm</td>
</tr>
<tr>
<td>1</td>
<td>DN 20</td>
<td>green/Ø 25 mm</td>
</tr>
<tr>
<td>1</td>
<td>DN 25</td>
<td>transparent/Ø 30 mm</td>
</tr>
<tr>
<td>2</td>
<td>DN 40</td>
<td>transparent/Ø 46 mm</td>
</tr>
<tr>
<td>3</td>
<td>DN 50</td>
<td>transparent/Ø 58 mm</td>
</tr>
</tbody>
</table>

If pressure regulator VAD/VAG/VAV 1 is retrofitted upstream of gas solenoid valve VAS 1, a DN 25 differential pressure orifice with outlet opening \(d = 30 \text{ mm} (1.18")\) must be inserted at the outlet of the pressure regulator.

In the case of pressure regulator VAx 115 or VAx 120, the DN 25 differential pressure orifice must be ordered separately and retrofitted, Order No. 74922240.

The retaining frame must be fitted to secure the differential pressure orifice at the outlet of the regulator.

**Retaining frame**

If two controls (regulators or valves) are assembled, a retaining frame with double block seal must be fitted, see page 13 (Seal set for sizes 1–3).

The seals in some gas compression fittings are approved for temperatures of up to 70°C (158°F). This temperature limit will not be exceeded if the flow through the pipe is at least 1 m³/h (35.31 SCFH) of gas and the maximum ambient temperature is 50°C (122°F).
Regulator with flanges
1 Note direction of flow.

2
3

Regulator without flanges
1 Note direction of flow.

2
3

Installing the gas/air control lines

! CAUTION
Please observe the following to ensure that the unit is not damaged during operation:
– Fit control lines so that no condensation can enter the unit.
– The control lines must be as short as possible. Internal diameter ≥ 3.9 mm (0.15”).
– Any bends, restriction points, deviations or air control valves must be at a distance of at least 5 x DN from the connection.
– Pressures, adjusting range, transmission ratio and pressure differentials, see page 15 (Technical data).

VAG
Installing the air control line $p_{sa}$
1 Install the connection for the air control line in the centre of a straight pipeline which is at least 10 x DN long.

$\triangleright$ VAG..K: 1 1/8” coupling for plastic hose (internal dia. 3.9 mm (0.15”), external dia. 6.1 mm (0.24”)) or VAG..E: 1 1/8” coupling with compression fitting for 6 x 1 tube.

$\triangleright$ VAG..N: connection $p_{sa}$ must remain open.

VAV
Installing the air control line $p_{sa}$ and the combustion chamber control line $p_{sc}$

$\triangleright$ VAV..K: 2 plastic hose couplings (internal dia. 3.9 mm (0.15”); external dia. 6.1 mm (0.24”)) available.

$\triangleright$ Do not remove the couplings or replace them with other types of coupling.

1 Route air control line $p_{sa}$ and combustion chamber control line $p_{sc}$ to the test points for air and combustion chamber pressure.

$\triangleright$ If $p_{sc}$ is not connected, do not plug the opening!

2 Install the connection for the air control line in the centre of a straight pipeline which is at least 10 x DN long.
VAH/VRH

Installing the air control lines $p_{sa}/p_{sa-}$ and the gas control line $p_d$.

1. 3 1/8” couplings with compression fitting for 6 x 1 tube.
2. To measure the differential air pressure, install a measuring orifice in the air line, ensuring that the inlet and outlet section is $\geq 5$ DN.
3. Connect the air control line $p_{sa}$ to the inlet of the measuring orifice and the air control line $p_{sa-}$ to the outlet of the measuring orifice.
4. $p_d$ is an internal hole/feedback in the unit.

VAH

VRH

Wiring

**WARNING**

Please observe the following to ensure that no damage occurs:

- Electric shocks can be fatal! Before working on possible live components, ensure the unit is disconnected from the power supply.
- The solenoid actuator heats up during operation. Surface temperature approx. 85°C (approx. 185°F).

VAD, VAG, VAV, VAH

- Use temperature-resistant cable (> 90°C).
1. Disconnect the system from the electrical power supply.
2. Shut off the gas supply.
3. Wiring to EN 60204-1.
4. UL requirements for the NAFTA market. To maintain the UL environmental rating Type 2, the enclosure openings shall be closed with fittings rated UL Type 2; 3; 3R; 3RX; 3S; 3SX; 3X; 4X; 5; 6; 6P; 12; 12K or 13. Gas solenoid valves shall be protected by a branch circuit protective device not exceeding 15 A.
When joining two valves, install a cable gland set, see page [14 (Cable gland set for double solenoid valves) between the connection boxes.

First push through the knock-out – then unscrew the cover!

If the M20 cable gland or plug is already fitted, it is not necessary to push through the knock-out.

M20 cable gland

Socket
1 = N (–), 2 = LV1V1 (+), 3 = LV1V2 (+)

Plug
LV1V1 (+) = black, LV1V2 (+) = brown, N (–) = blue

Closed position switch

V Ax open: contacts 1 and 2 closed,
V Ax closed: contacts 1 and 3 closed.
Indicator of closed position switch: red = V Ax closed, white = V Ax open.
Double solenoid valve: if a plug with socket is fitted, only one proof of closure switch can be connected.
**CAUTION**

Please observe the following to ensure smooth operation:

- The proof of closure switch is not suitable for frequent cycling operation.
- Route valve and proof of closure switch cables separately through M20 cable glands or use two separate plugs. Otherwise, there is a risk of interference between valve voltage and proof of closure switch voltage.

▷ To make wiring easier, the connection terminal for the closed position switch can be removed.

LV1$_{V1}$ (+) = black, N (−) = blue

▷ Label the plugs to avoid confusion.

1 = N (−), 2 = LV1$_{V1}$ (+)

▷ Ensure that the connection terminal for the closed position switch has been reconnected.

**Finishing the wiring**

**Tightness test**

1. Close the gas solenoid valve.
2. To be able to check the tightness, shut off the downstream pipeline close to the regulator.

▷ On the VAH/VRH, the control line $p_d$ leads to gas-filled space in the regulator. It must be connected before the tightness test.

3. Open the pressure regulator.

4. $\leq 1.5 \times p_{\text{u max}}$

5. $\leq 1.5 \times p_{\text{u max}}$

6. Open the pressure regulator.

7. Pipeline leaking: replace O-ring on flange, see page 15 (Seal set for sizes 1–3). Then check for tightness once again.

8. Unit leaking: remove the pressure regulator and return it to the manufacturer.

Commissioning

▷ During the measurement process, ensure that the length of the tube is as short as possible for the determining of the pressures.

**VAD**

Setting the outlet pressure $p_d$

▷ The outlet pressure is set to $p_d = 10 \text{ mbar}$ at the factory.

<table>
<thead>
<tr>
<th>VAD..25</th>
<th>[mbar]</th>
<th>$p_d$ [“WC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5–25</td>
<td></td>
<td>1–10</td>
</tr>
<tr>
<td>20–50</td>
<td></td>
<td>8–19.7</td>
</tr>
<tr>
<td>35–100</td>
<td></td>
<td>14–40</td>
</tr>
</tbody>
</table>

1 Switch on the burner.
▷ Breathing orifice $A$ must remain open.

2 Set the regulator to the required outlet pressure.

3 Close off the test point again once the pressure has been set.

**VAG**

$p_d$ = outlet pressure
$p_{sa}$ = air control pressure

▷ Factory setting: $p_d = p_{sa} - 1.5 \text{ mbar}$ (0.6 “WC); actuator pointing upwards and an inlet pressure of 20 mbar (7.8 “WC).

1 Switch on the burner.

Setting the low-fire rate

▷ In applications with excess air, the values for $p_d$ and $p_{sa}$ may be below the limit, see Technical data, page 16 [VAG]. No situation which would jeopardize safety must arise. Avoid CO formation.

2 Set the regulator to the required outlet pressure.

3 Close off the test point again once the pressure has been set.

Setting the high-fire rate

▷ Set the high-fire rate using restricting orifices or adjustment elements on the burner.

**VAV**

$p_d$ = outlet pressure
$p_{sa}$ = air control pressure
$p_{sc}$ = combustion chamber control pressure

Setting the low-fire rate

▷ If the burner operates at low-fire rate, the gas/air mixture can be changed by adjusting the adjusting screw “N”.

1 Set zero point $N$ and transmission ratio $V$ to scale in accordance with burner manufacturer’s specifications.

2 Measure gas pressure $p_d$.

3 Gradually increase the burner to high fire and, if necessary, adjust the gas pressure at $V$.

4 Set the minimum and maximum capacity on the air control valve in accordance with burner manufacturer’s specifications.

! CAUTION

$p_{sa} - p_{sc} \geq 0.4 \text{ mbar}$ ($\geq 0.15 \text{ “WC}$).

Controller acting time for the reference variable (air butterfly valve): min. to max. $> 5 \text{ s}$, max. to min. $> 5 \text{ s}$.

▷ Factory setting for transmission ratio of gas to air: $V = 1:1$, zero point $N = 0$. 

Pre-setting

1 Set zero point $N$ and transmission ratio $V$ to scale in accordance with burner manufacturer’s specifications.

2 Measure gas pressure $p_d$.

3 Start the burner at low-fire rate. If the burner does not start, turn $N$ slightly in direction + and repeat start.

4 Gradually increase the burner to high fire and, if necessary, adjust the gas pressure at $V$.

5 Set the minimum and maximum capacity on the air control valve in accordance with burner manufacturer’s specifications.
Final adjustment
6 Set the burner to low fire.
7 Conduct a flue gas analysis and set the gas pressure at \( N \) to the desired analysis value.
8 Set the burner to high fire and set the gas pressure at \( V \) to the desired analysis value.
9 Repeat the analysis at low and high fire and correct \( N \) and \( V \) if necessary.
10 Close off all test points. Do not close off connection \( p_{sc} \) if not used!
▷ It is advisable to start the burner at a level higher than the minimum setting (start gas rate) to ensure reliable flame formation.

Calculation
If the combustion chamber control pressure \( p_{sc} \) is not connected:
\[
p_d = V \times p_{sa} + N
\]
If combustion chamber control pressure \( p_{sc} \) is connected:
\[
(p_d - p_{sc}) = V \times (p_{sa} - p_{sc}) + N
\]

Testing control capacity

\[\text{DANGER}\]
Risk of explosion! If the control capacity is insufficient, the system may not be operated.
11 Set the burner to high fire.
12 Measure the gas pressure at the inlet and outlet.
13 Slowly close the manual valve upstream of the regulator until the gas inlet pressure \( p_u \) drops.
▷ The gas outlet pressure \( p_d \) should not drop as well. Otherwise, the setting should be re-checked and adjusted.
14 Reopen the manual valve.

**VAH, VRH**
\[
\begin{align*}
p_u &= \text{inlet pressure} \\
p_d &= \text{outlet pressure} \\
\Delta p_d &= \text{differential gas pressure (outlet pressure)} \\
p_{sa} &= \text{air control pressure} \\
\Delta p_{sa} &= \text{differential air pressure (air control pressure)} \\
\end{align*}
\]
▷ A gas/air mixture may be applied at the \( p_{sa} \) connection for the air control pressure.
▷ Inlet pressure \( p_u \): max. 500 mbar
▷ Air control pressure \( p_{sa} \): 0.6 to 100 mbar
▷ Differential air pressure \( \Delta p_{sa} \) \((p_{sa} - p_{sa}^-)\) = 0.6 to 50 mbar
▷ Differential gas pressure \( \Delta p_d \) \((p_d - p_d^-)\) = 0.6 to 50 mbar
▷ The impulse lines \( p_{sa}, p_{sa}^- \), and \( p_d \) must be laid correctly.

Setting the high-fire rate
4 Slowly increase the burner to high fire and set the differential gas pressure on the fine-adjusting valve VMV in accordance with burner manufacturer’s specifications.

Setting the low-fire rate
▷ If the burner operates at low-fire rate, the gas/air mixture can be changed by adjusting the adjusting screw \( N \).

\[\text{CAUTION}\]
\[
\Delta p_{sa} = p_{sa} - p_{sa}^- \geq 0.6 \text{ mbar (} \geq 0.23 \text{ "WC). Controller acting time for the reference variable (air butterfly valve): min. to max. } > 5 \text{ s, max. to min. } > 5 \text{ s.}
\]

Pre-setting
1 Set the minimum and maximum capacity on the air control valve in accordance with burner manufacturer’s specifications.
2 Switch on the burner.
3 Open the fine-adjusting valve VMV slowly, from the ignitable mixture with excess air to the required value.

5 Set the burner to low fire.
6 Conduct a flue gas analysis and set the gas pressure at \( N \) to the desired analysis value.
7 Set the burner to high fire and set the differential gas pressure to the desired analysis value.
8 Repeat the analysis at low and high fire and correct if necessary.
9 Close off all test points.
Replacing the actuator
See operating instructions enclosed with spare part or see www.docuthek.com.

Maintenance

! CAUTION
In order to ensure smooth operation, check thetightness and function of the pressure regulator:
– Once per year, twice per year in the case of biogas; check for internal and external tightness, see page 8 [Tightness test].
– Check electrical installations once a year in line with local regulations; pay particular attention to the PE wire, see page 5 [Wiring].

▷ If more than one vaVario control is installed in series: the controls may only be removed from the pipeline and reinstalled on the inlet and outlet flange all at once.
▷ We recommend replacing the seals, see page 15 [Seal set for sizes 1–3].
▷ If the flow rate has dropped, clean the strainer and the differential pressure orifice.
1 Disconnect the system from the electrical power supply.
2 Shut off the gas supply.
3 Detach control line(s).
4 Adjusting range
(adjusting tolerance = ± 15% of the scale value)

<table>
<thead>
<tr>
<th></th>
<th>Mean switching differential at min. and max. setting</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mbar]</td>
</tr>
<tr>
<td>DG 17VC</td>
<td>2–17</td>
</tr>
<tr>
<td>DG 40VC</td>
<td>5–40</td>
</tr>
<tr>
<td>DG 110VC</td>
<td>30–110</td>
</tr>
<tr>
<td>DG 300VC</td>
<td>100–300</td>
</tr>
</tbody>
</table>

▷ Deviation from the switching point during testing pursuant to EN 1854 Gas pressure switches: ± 15%.

12 Once the seals have been replaced, refit the strainer and the differential pressure orifice and install the pressure regulator in the pipeline again.
13 Reattach control line(s) to the regulator.
14 Then check the unit for internal and external tightness, see page 3 [Tightness test].
Bypass/pilot gas valves

1 Disconnect the system from the electrical power supply.
2 Shut off the gas supply.
3 Prepare the installed main valve.
   ▶ Turn the actuator so that the side on which the bypass/pilot gas valve is to be installed is accessible.

4 VBY for VAx 1

Scope of delivery

Bypass valve VBY..I
A 1 x bypass valve VBY..I
B 2 x retaining screws with 4 x O-rings: both retaining screws have a bypass orifice
C Grease for O-rings
   ▶ The screw plug at the outlet remains in place.

Pilot gas valve VBY..R
A 1 x pilot gas valve VBY..R
B 2 x retaining screws with 5 x O-rings: one retaining screw has a bypass orifice (2 x O-rings), the other does not (3 x O-rings)
C Grease for O-rings
   ▶ Remove the screw plug at the outlet and connect the Rp ¼ pilot gas line.

Mounting the VBY
7 Grease O-rings B.

8

Setting the flow rate
▶ The flow rate can be set by turning the flow rate restrictor (4 mm hexagon socket) ¼ of a turn.

▶ Only adjust the flow rate restrictor in the marked range, otherwise the required gas volume will not be reached.

12 Wire the socket, see page 6 (Wiring).
13 Check for tightness, see page 13 (Checking the bypass/pilot gas valve for tightness).

VAS 1 for VAx 1, VAx 2, VAx 3

Scope of delivery

Bypass valve VAS 1
A 1 x bypass/pilot gas valve VAS 1
B 4 x O-rings
C 4 x double nuts for mounting to VAS 1
   or
   4 x spacer sleeves for mounting to VAS 2/3
D 4 x connection parts
E 1 x mounting aid

Pilot gas valve VAS 1
F 2 x connection pipes, if the bypass valve has a blind flange on the outlet side.

Pilot gas valve VAS 1
F 1 x connection pipe, 1 x sealing plug, if the pilot gas valve has a threaded flange on the outlet side.
Mounting the bypass/pilot gas valve VAS 1
▷ Always use a connection pipe F at the inlet of the main valve.
▷ For a bypass valve: use connection pipe F Ø 10 mm (0.39") at the outlet of the main valve if the bypass valve’s outlet flange is designed as a blind flange.
▷ For the pilot gas valve: insert sealing plug F at the outlet of the main valve if the pilot gas valve’s outlet flange is designed as a threaded flange.

10 Remove the sealing plugs on the mounting side of the bypass valve.

VAS 1 to VAx 1
11 Remove the nuts from the connection parts on the mounting side of the main valve.
12 Remove the connection parts of the bypass/pilot gas valve.
▷ Use the new connection parts C and D from the scope of delivery for the bypass/pilot gas valve.

15 Wire the bypass/pilot gas valve VAS 1, see page 6 (Wiring).
16 Check for tightness, see page 13 (Checking the bypass/pilot gas valve for tightness).

Checking the bypass/pilot gas valve for tightness
1 To be able to check the tightness, shut off the downstream pipeline as close as possible to the valve.
2 Close the main valve.
3 Close the bypass/pilot gas valve.

! CAUTION
If the actuator of the VBY is rotated, the tightness can no longer be guaranteed. To ensure that there are no leaks, check the actuator of the VBY for tightness.

Check the bypass/pilot gas valve for tightness at the inlet and outlet.
1. Disconnect the system from the electrical power supply.
2. Shut off the gas supply.

Bypass valve

In both connection boxes, push through the knock-out for the cable gland set – then remove the covers. The covers must not be taken off before pushing through the knock-outs as it prevents damage to the connection boxes.

Pilot gas valve

Open the bypass or pilot gas valve.

Cable gland set for double solenoid valves

When wiring a double solenoid valve, the connection boxes are to be connected using a cable gland set.

 VCx 1 VCx 2 VCx 3

Order No. for size 1: 74921985, size 2: 74921986, size 3: 74921987.

We recommend preparing the connection boxes before the double solenoid valve is installed in the pipework. Alternatively, one of the actuators must be dismantled as described below and reinstalled rotated by 90° in preparation for installation of the double solenoid valve.

The cable gland set can only be used if the connection boxes are at the same height and on the same side.
**Attachment block**

▷ For locked installation of pressure gauge or other accessories, the attachment block is mounted to the solenoid valve.

▷ Order No. 74922228

1. Disconnect the system from the electrical power supply.
2. Shut off the gas supply.
3. Use the enclosed self-tapping screws for installation.

9. Shut off the downstream gas pipeline close to the pressure regulator.
10. Open the pressure regulator.

**Seal set for sizes 1–3**

▷ When retrofitting accessories or a second Vario control or when servicing, we recommend replacing the seals.

▷ Order No. for size 1: Order No. 74921988, size 2: Order No. 74921989, size 3: Order No. 74921990.

▷ Scope of delivery:
  A 1 x double block seal,
  B 1 x retaining frame,
  C 2 x O-rings (flange),
  D 2 x O-rings (pressure switch),
  E 2 x sealing rings (flat sealing), 2 x profiled sealing rings.

**Cable gland with pressure equalization element**

▷ To avoid the formation of condensation, the cable gland with pressure equalization element can be used instead of the standard M20 cable gland. The diaphragm in the gland is designed to ventilate the device, without allowing water to enter.

▷ 1 x cable gland, Order No.: 74924686

**Technical data**

Gas types: natural gas, LPG (gaseous), biogas (max. 0.1 % by-vol. H₂S) or clean air; other types of gas on request.
The gas must be clean and dry in all temperature conditions and must not contain condensate.
CE and FM approved and UL listed, max. inlet pressure p\textsubscript{i}: 10–500 mbar (1–200 "WC).
FM approved, non operational pressure: 700 mbar (10 psig).
ANSI/CSA approved:
350 mbar (5 psig).
Opening times:
V\textsubscript{x}/N quick opening: ≤ 1 s,
closing time: quick closing: < 1 s.
Medium and ambient temperatures:
-20 to +60°C (-4 to +140°F),
VBY: 0 to +60°C (32 to 140°F).
No condensation permitted.
Long-term use in the upper ambient temperature range accelerates the ageing of the elastomer materials and reduces the service life (please contact manufacturer).
Storage temperature:
-20 to +40°C (-4 to +104°F).
Enclosure:
VAD, VAG, VAV, VAH: IP 65,
VBY: IP 54.
Valve housing: aluminium, valve seal: NBR.
Connection flanges with internal thread:
Rp to ISO 7-1, NPT to ANSI/ASME.
Class A, Group 2 safety valve pursuant to EN 13611 and EN 161, 230 V AC, 120 V AC,
24 V DC:
Factory Mutual (FM) Research Class:
7400 and 7411, ANSI Z21.21 and CSA 6.5,
ANSI Z21.18 and CSA 6.3.
Control class A to EN 88-1.
Control range: up to 10:1.
Mains voltage:
230 V AC, +10/-15%, 50/60 Hz;
200 V AC, +10/-15%, 50/60 Hz;
120 V AC, +10/-15%, 50/60 Hz;
100 V AC, +10/-15%, 50/60 Hz;
24 V DC, ±20%.
Cable gland: M20 x 1.5.
Electrical connection: electrical cable with max. 2.5 mm² (AWG 12) or plug with socket to EN 175301-803.
Power consumption:

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAx 1</td>
<td>24 V DC</td>
<td>25 W</td>
</tr>
<tr>
<td></td>
<td>100 V AC</td>
<td>25 W  (26 VA)</td>
</tr>
<tr>
<td></td>
<td>120 V AC</td>
<td>25 W  (26 VA)</td>
</tr>
<tr>
<td></td>
<td>200 V AC</td>
<td>25 W  (26 VA)</td>
</tr>
<tr>
<td></td>
<td>230 V AC</td>
<td>25 W  (26 VA)</td>
</tr>
<tr>
<td></td>
<td>24 V DC</td>
<td>36 W</td>
</tr>
<tr>
<td></td>
<td>100 V AC</td>
<td>36 W  (40 VA)</td>
</tr>
<tr>
<td></td>
<td>120 V AC</td>
<td>40 W  (44 VA)</td>
</tr>
<tr>
<td></td>
<td>200 V AC</td>
<td>40 W  (44 VA)</td>
</tr>
<tr>
<td></td>
<td>230 V AC</td>
<td>40 W  (44 VA)</td>
</tr>
<tr>
<td></td>
<td>24 V DC</td>
<td>8 W</td>
</tr>
<tr>
<td></td>
<td>120 V AC</td>
<td>8 W</td>
</tr>
<tr>
<td></td>
<td>230 V AC</td>
<td>9.5 W</td>
</tr>
</tbody>
</table>

Duty cycle: 100%.
Power factor of the solenoid coil: cos ϕ = 0.9.
Closed position switch contact rating:

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>Min. current (resistive load)</th>
<th>Max. current (resistive load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAX..S</td>
<td>12–250 V AC, 50/60 Hz</td>
<td>100 mA</td>
<td>3 A</td>
</tr>
<tr>
<td>VAX..G</td>
<td>12–30 V DC</td>
<td>2 mA</td>
<td>0.1 A</td>
</tr>
</tbody>
</table>

Closed position switch switching frequency: max. 5 x per minute.

<table>
<thead>
<tr>
<th>Switching current [A]</th>
<th>Switching cycles*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cos ϕ = 1</td>
</tr>
<tr>
<td>0.1</td>
<td>500,000</td>
</tr>
<tr>
<td>0.5</td>
<td>300,000</td>
</tr>
<tr>
<td>1</td>
<td>200,000</td>
</tr>
<tr>
<td>3</td>
<td>100,000</td>
</tr>
</tbody>
</table>

* Limited to max. 200,000 cycles for heating systems.

VAD
Outlet pressure p_d:
VAD..25: 2.5–25 mbar (1–10 "WC),
VAD..50: 20–50 mbar (8–19.7 "WC),
VAD..100: 35–100 mbar (14–40 "WC).
Combustion chamber control pressure p_sc (connection p_sc): -20 to +20 mbar (-7.8 to +7.8 "WC).

VAG
Outlet pressure p_d:
0.5–100 mbar (0.2–40 "WC).
Air control pressure p_sa:
0.5–100 mbar (0.2–40 "WC).
In applications with excess air, p_d and p_sa may be below the limit of 0.5 mbar. No situation which would jeopardize safety must arise. Avoid CO formation.
Adjusting range at low fire: ±5 mbar (±2 "WC).
Transmission ratio of gas to air: 1:1.
▷ The inlet pressure must always be higher than the air control pressure p_sa + pressure loss Δp + 5 mbar (+ 2 "WC).
Connection options for air control pressure p_sa:
VAG..K: 1 1/8" coupling for plastic hose (internal dia. 3.9 mm (0.15"), external dia. 6.1 mm (0.24")],
VAG..E: 1 1/8" coupling with compression fitting for 6 x 1 tube,
VAG..A: 1 NPT 1/8 adapter,
VAG..N: zero governor with breathing orifice.

VAV
Outlet pressure p_d:
0.5–30 mbar (0.2–11.7 "WC).
Air control pressure p_sa:
0.4–30 mbar (0.15–11.7 "WC).
Combustion chamber control pressure p_sc:
-20 to +20 mbar (-7.8 to +7.8 "WC).
Min. control pressure differential p_sa - p_sc:
0.4 mbar (0.15 "WC).
Min. pressure differential p_d - p_sc:
0.5 mbar (0.2 "WC).
Adjusting range at low fire:
±1.5 mbar (±0.6 "WC).
Transmission ratio of gas to air: 0.6:1 – 3:1.
▷ The inlet pressure p_d must always be higher than the air control pressure p_sa x transmission ratio V + pressure loss Δp + 1.5 mbar (0.6 "WC).
Connection of air control pressure p_sa and combustion chamber control pressure p_sc:
VAV..K: 2 plastic hose couplings (internal dia. 3.9 mm (0.15")); external dia. 6.1 mm (0.24") fitted.
VAH, VRH

- The inlet pressure must always be higher than the differential air pressure $\Delta p_{sa} + \text{max. gas pressure on burner} + \text{pressure loss } \Delta p + 5 \text{ mbar} (+2 \text{ "WC})$.

Differential air pressure $\Delta p_{sa} (p_{sa} - p_{sa}) = 0.6 - 50 \text{ mbar} (0.24 - 19.7 \text{ "WC})$.

Differential gas pressure $\Delta p_d (p_d - p_d) = 0.6 - 50 \text{ mbar} (0.24 - 19.7 \text{ "WC})$.

Adjusting range at low fire: ±5 mbar (±2 "WC).

Connection of air control pressure $p_{sa}$: 3 1/8" couplings with compression fitting for 6 x 1 tube.

**Air flow rate $Q$**

Air flow rate $Q$ for a pressure loss of $\Delta p = 10 \text{ mbar} (4 \text{ "WC})$

![Diagram of air flow rate](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>Air flow rate $Q$ [m³/h]</th>
<th>$Q$ [SCFH]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass valve VBY</td>
<td>0.85</td>
<td>30.01</td>
</tr>
<tr>
<td>Pilot gas valve VBY</td>
<td>0.89</td>
<td>31.43</td>
</tr>
</tbody>
</table>

### Designed lifetime

This information on the designed lifetime is based on using the product in accordance with these operating instructions. Once the designed lifetime has been reached, safety-relevant products must be replaced.

Designed lifetime (based on date of manufacture) in accordance with EN 13611, EN 161 for $Vxx$:

<table>
<thead>
<tr>
<th>Type</th>
<th>Designed lifetime</th>
</tr>
</thead>
<tbody>
<tr>
<td>$VAx$ 110 to 225</td>
<td>500,000 10</td>
</tr>
<tr>
<td>$VAx$ 232 to 365</td>
<td>200,000 10</td>
</tr>
<tr>
<td>VRH</td>
<td>–</td>
</tr>
</tbody>
</table>

You can find further explanations in the applicable rules and regulations and on the afecor website (www.afecor.org).

This procedure applies to heating systems. For thermoprocessing equipment, observe local regulations.
SIL, PL
The devices VAD/VAG/VAV/VAH 1–3 are suitable for single-channel systems (HFT = 0) up to SIL 2/PL d, and up to SIL 3/PL e when two redundant solenoid valves are installed in a double-channel architecture (HFT = 1), provided that the complete system complies with the requirements of EN 61508/ISO 13849. The safety function value which is actually achieved is derived by taking all components into account (sensor – logic – actuator). For this, the demand rate and structural measures to avoid/detect nonconformity are to be observed (e.g. redundancy, diversity, monitoring).

Characteristic values for SIL/PL: HFT = 0 (1 device), HFT = 1 (2 devices), SFF > 90, DC = 0, type A/categor-
y B, 1, 2, 3, 4, high demand mode, CCF > 65, β ≥ 2.

\[
PFH_D = \lambda_D = \frac{1}{MTTF_d} = 0.1 \times \frac{B_{10d}}{n_{op}}
\]

<table>
<thead>
<tr>
<th>VAD/VAG/VAV/VAH</th>
<th>B_{10d} value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size 1</td>
<td>10,094,360</td>
</tr>
<tr>
<td>Size 2</td>
<td>8,229,021</td>
</tr>
<tr>
<td>Size 3</td>
<td>6,363,683</td>
</tr>
</tbody>
</table>

VAD, VAG, VAV, VAH: FM approved*

Factory Mutual (FM) Research Class: 7400 and 7411
Safety overpressure slam shut valves.
Designed for applications pursuant to NFPA 85 and NFPA 86.

VAD, VAG: ANSI/CSA approved*

Canadian Standards Association – ANSI Z21.21 and CSA 6.5, ANSI Z21.18 and CSA 6.3

VAD, VAG, VAV: UL listed (for 120 V only)

Underwriters Laboratories – UL 429
“Electrically operated valves”.

VAD, VAG, VAV: AGA approved*

* Approval does not apply for 100 V AC or 200 V AC.

Eurasian Customs Union

The product VAD/VAG/VAV/VAH/VRH/VCS meets the technical specifications of the Eurasian Customs Union.

Directive on the restriction of the use of hazardous substances (RoHS) in China
Scan of the Disclosure Table China RoHS2 – see certificates at www.docuthek.com

Contact

If you have any technical questions, please contact your local branch office/agent. The addresses are available on the Internet or from Elster GmbH.

We reserve the right to make technical modifications in the interests of progress.