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 06.14

The following chapters have been changed:
- Checking the usage
- Installing the gas/air control lines
- Commissioning
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</td>
</tr>
<tr>
<td>VAH</td>
<td>Flow rate regulator with solenoid valve</td>
</tr>
<tr>
<td>VAx..S</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. The transmission ratio of gas to air can be set from 0.6:1 to 3:1. Pressure fluctuations in the combustion chamber can be compensated via the combustion chamber control pressure $p_{sc}$.

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 safety.

Flow rate regulator VRH

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

<table>
<thead>
<tr>
<th>Size</th>
<th>Nominal inlet and outlet diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>Rp internal thread</td>
</tr>
<tr>
<td>R</td>
<td>NPT internal thread</td>
</tr>
<tr>
<td>N</td>
<td>ISO flange</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Mains voltage: 24 V DC</td>
</tr>
<tr>
<td>P</td>
<td>Mains voltage: 100 V AC; 50/60 Hz</td>
</tr>
<tr>
<td>Q</td>
<td>Mains voltage: 120 V AC; 50/60 Hz</td>
</tr>
<tr>
<td>Y</td>
<td>Mains voltage: 200 V AC; 50/60 Hz</td>
</tr>
<tr>
<td>W</td>
<td>Mains voltage: 230 V AC; 50/60 Hz</td>
</tr>
<tr>
<td>S</td>
<td>Position indicator and visual indicator</td>
</tr>
<tr>
<td>G</td>
<td>Position indicator for 24 V and visual indicator</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>Viewing side (in flow direction): from the right</td>
</tr>
<tr>
<td>L</td>
<td>Viewing side (in flow direction): from the left</td>
</tr>
<tr>
<td>A</td>
<td>Connection kit for air control pressure $p_{sa}$</td>
</tr>
<tr>
<td>E</td>
<td>VAG, VAV, VAH: compression fitting</td>
</tr>
<tr>
<td>K</td>
<td>VAG, VAV: plastic hose coupling</td>
</tr>
<tr>
<td>A</td>
<td>VAG, VAV, VAH: NPT 1/8 adapter</td>
</tr>
<tr>
<td>N</td>
<td>VAG: zero governor</td>
</tr>
</tbody>
</table>

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

Part designations

- Solenoid actuator
- Flow body
- Connection box

15 (Technical data)
Connection flange
Position indicator
Connection parts
Sealing plug
Regulator

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

[Diagram of valve]

**WARNING**
The actuator heats up during operation – depending on ambient temperature (max. 60°C/140°F) and intrinsic heating (approx. 40°C/104°F).

**CAUTION**
Please observe the following to ensure that the unit is not damaged during installation and operation:
- 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.
- A filter must be installed upstream of every system.
- 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.
- Solenoid valves with valve stem 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 offset 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).
▷ 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 $p_u \text{ min.} = 80 \text{ mbar} (32 "\text{WC})$.
  - 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")
▷ Keep the volume of the pipework 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 \( p_d \) (\( p_{d1} \) and \( p_{d2} \)) and the air control pressure \( p_{sa} \) (\( p_{sa1} \) and \( p_{sa2} \)) must only be measured at the designated places on the regulator using pressure test points.

VAD

A combustion chamber control line (\( p_{sc} \)) can be connected at connection \( p_{sa} \) to keep the burner capacity constant (1/8" coupling with compression fitting for 6 x 1 tube).

VAG

VAV

VAH, VRH

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.

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.

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 Outlet diameter ( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DN 15</td>
<td>17 mm</td>
</tr>
<tr>
<td>1</td>
<td>DN 20</td>
<td>25 mm</td>
</tr>
<tr>
<td>1</td>
<td>DN 25</td>
<td>30 mm</td>
</tr>
<tr>
<td>2</td>
<td>DN 40</td>
<td>46 mm</td>
</tr>
<tr>
<td>3</td>
<td>DN 50</td>
<td>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 \( d = 30 \) 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.

If pressure regulator VAD/VAG/VAV 1 – 3 is retrofitted upstream of gas solenoid valve VAS 1 – 3, a retaining frame must be retrofitted at the inlet of the gas solenoid valve to secure the differential pressure orifice at the outlet of the regulator.

Retaining frame for VAS 1: Order No. 74923029, retaining frame for VAS 2: Order No. 74923030, retaining frame for VAS 3: Order No. 74923031.

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.

Regulator without flanges

1. Note direction of flow.

▷ O-ring and strainer (Fig. 4) must be fitted.

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.

▷ 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.

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

▷ VAV..K: 2 plastic hose couplings (internal dia. 3.9 mm (0.15"); external dia. 6.1 mm (0.24")) available.

▷ 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.

▷ 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 $p_d$.

▷ 3 1/8” couplings with compression fitting for 6 x 1 tube.

1 To measure the differential air pressure, install a measuring orifice in the air line, ensuring that the inlet and outlet section is ≥ 5 DN.

2 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.

▷ $p_d$ is an internal hole/feedback in the unit.

VAH

![Diagram of VAH](image)

VRH

![Diagram of VRH](image)

3 We recommend installing a fine-adjusting valve VMV directly downstream of the regulator in the gas line. See “Filter module VMF, measuring orifice VMO, fine-adjusting valve VMV” operating instructions. The instruction manual can also be found at www.docuthek.com.

4 Connect the gas control line $p_{d-}$ to the VMV or to the measuring orifice.

Wiring

VAD, VAG, VAV, VAH

▷ Use temperature-resistant cable (> 80°C).

1 Disconnect the system from the electrical power supply.

2 Shut off the gas supply.

▷ Wiring to EN 60204-1.

▷ 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.

2,5 mm

▷ If, instead of installing a VMV, a measuring orifice is installed in the gas line, ensure that the inlet and outlet section is ≥ 5 DN.
M20 cable gland

Plug
LV1v1 (+) = black, LV1v2 (+) = brown, N (-) = blue

Position indicator
▷ VAx open: contacts 1 and 2 closed,
   VAx closed: contacts 1 and 3 closed.
▷ Visual indicator of position indicator: red = VAx closed, white = VAx open.

CAUTION
Danger of interference between valve voltage and position indicator voltage. Route valve and position indicator cables separately through M20 cable glands or use two separate plugs.
▷ To make wiring easier, the connection terminal for the position indicator can be removed.
▷ if a plug with socket is fitted, only one position indicator can be connected. LV1V1 (+) = black, N (–) = blue

▷ Label the plugs to avoid confusion. 1 = N (–), 2 = LV1V1 (+)

▷ Ensure that the connection terminal for the position indicator 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.
3. 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.

#### Commissioning

▷ Ensure that the length of the tube is as short as possible for the determining of the pressures during the measurement process.

### 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, °C</th>
<th>( p_d ) [mbar]</th>
<th>( p_d ) [&quot;WC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-25</td>
<td>2.5–25</td>
<td>1–10</td>
</tr>
<tr>
<td>-50</td>
<td>20–50</td>
<td>8–20</td>
</tr>
<tr>
<td>-100</td>
<td>35–100</td>
<td>14–40</td>
</tr>
</tbody>
</table>

1. Switch on the burner.
2. Breathing orifice \( A \) must remain open.
3. Set the regulator to the required outlet pressure.

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

**Setting the low-fire rate**
1. Set the regulator to the required outlet pressure.
2. Close off the test point again once the pressure has been set.

**Setting the high-fire rate**
1. 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**
1. If the burner operates at low-fire rate, the gas/air mixture can be changed by adjusting the adjusting screw “N”.

**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**

**DANGER**
Risk of explosion! If the control capacity is insufficient, the system may not be operated.

**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!

**CAUTION**
- $p_{sa} - p_{sc} \geq 0.4$ mbar ($\geq 0.15 \text{ "WC}$).
- Controller acting time for the reference variable (air butterfly valve): min. to max. $> 5$ s, max. to min. $> 5$ s.

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

**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!

**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**

**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 $p_d$ drops.

$>$ The gas outlet pressure $p_d$ should not drop as well. Otherwise, the setting should be rechecked and adjusted.
VAH, VRH

\[ p_u = \text{inlet pressure} \]
\[ p_d = \text{outlet pressure} \]
\[ \Delta p_d = \text{differential gas pressure (outlet pressure)} \]
\[ p_{sa} = \text{air control pressure} \]
\[ \Delta p_{sa} = \text{differential air pressure (air control pressure)} \]

▷ 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 \( p_{sa}, p_{sa-}, p_d-, p_d \) must be laid correctly.

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.

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 \( N \).

![2,5 mm](image)

▷ Factory setting: zero point \( N = -1.5 \) mbar

\[ \Delta p_{sa} = p_{sa} - p_{sa-} \geq 0.6 \text{ mbar} \geq 0.23 \text{ "WC}. \]

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

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

VAD, VAG, VAV, VAH

▷ The actuator adapter set is enclosed with new actuators.

![VAX 1 VAX 2/3](image)

▷ The seals of the actuator adapter set are covered with a non-stick coating. No additional grease is required.
1. Disconnect the system from the electrical power supply.
2. Shut off the gas supply.
3. Remove the M20 cable gland or other type of connection.
Depending on the construction stage of the unit, there are two different methods for replacing the actuator:

If the unit concerned has no O-ring in this place (arrow), replace the actuator as described here. Otherwise, go to the next note.

If the unit concerned has an O-ring in this place (arrow), replace the actuator as described here:

VAx 1: use all seals from the actuator adapter set.
VAx 2/3: use the small seal from the actuator adapter set and only one of the large seals.

Once the seals have been replaced, refit the strainer and the differential pressure orifice and install the pressure regulator in the pipeline again.

Reattach control line(s) to the regulator.

The pressure regulator remains closed.

Then check the unit for internal and external tightness, see page 8 (Tightness test).

Maintenance

⚠️ CAUTION
In order to ensure smooth operation, check the tightness and function of the pressure regulator:

- Once per year, twice per year in the case of biologically produced methane; 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 3 (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. Fit the M20 cable gland or plug and socket.
5. Connect the VAx to the electrical power supply, see page 3 (Wiring).
Accessories

Pressure switch for gas DG..VC

- The pressure switch for gas monitors the inlet pressure $p_u$, the outlet pressure $p_d$ and the interspace pressure $p_z$.

- When using two pressure switches on the same side of the double solenoid valve, only the combination DG..C..1 and DG..C..9 may be used for design reasons.

- When retrofitting the pressure switch for gas, see enclosed operating instructions “Pressure switches for gas DG..C”, section entitled “Mounting the DG..C..1, DG..C..9 on Vario gas solenoid valves”.

- The switching point is adjustable via hand wheel.

<table>
<thead>
<tr>
<th>Adjusting range (adjusting tolerance = ± 15% of the scale value)</th>
<th>Mean switching differential at min. and max. setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mbar]</td>
<td>[&quot;WC&quot;]</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%.

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.
4. Turn the actuator so that the side on which the bypass/pilot gas valve is to be installed is accessible.

VBY for VAX 1

Scope of delivery

<table>
<thead>
<tr>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAX 1</td>
<td>VBY 8</td>
</tr>
</tbody>
</table>

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

- Grease O-rings B.

- Tighten the retaining screws alternately so that VBY and the main valve are flush.
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 14 (Checking the bypass/pilot gas valve for tightness).

VAS 1 for VAx 1, VAx 2, VAx 3
Scope of delivery

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1 x bypass/pilot gas valve VAS 1</td>
<td>C</td>
</tr>
<tr>
<td>B</td>
<td>4 x O-rings</td>
<td>C</td>
</tr>
<tr>
<td>C</td>
<td>4 x double nuts for mounting to VAS 1</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>or 4 x spacer sleeves for mounting to VAS 2/3</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>4 x connection parts</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>1 x mounting aid</td>
<td></td>
</tr>
</tbody>
</table>

Bypass valve VAS 1
F 2 x connection pipes, if the bypass valve has a blind flange at 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 at 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.

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.

VAS 1 for VAx 2 or VAx 3
▷ The connection parts of the main valve remain mounted.
11 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. For VAx 2 and VAx 3, the connection parts consist of self-tapping screws.

Self-tapping screws.

12 Wire the bypass/pilot gas valve VAS 1, see page 6 (Wiring).
13 Check for tightness, see page 14 (Checking the bypass/pilot gas valve for tightness).

17 Wire the bypass/pilot gas valve VAS 1, see page 6 (Wiring).
18 Check for tightness, see page 14 (Checking the bypass/pilot gas valve for tightness).

15 Wire the bypass/pilot gas valve VAS 1, see page 6 (Wiring).
16 Check for tightness, see page 14 (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.

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.

- 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 offset 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.

1. Disconnect the system from the electrical power supply.
2. Shut off the gas supply.

- 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.

Bypass valve

Pilot gas valve
Connect the valves to the electrical power supply, see section entitled "Wiring".

**Attachment block**

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

- Order No. 74922228
- Disconnect the system from the electrical power supply.
- Shut off the gas supply.
- Use the enclosed self-tapping screws for installation.

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

**Seal set for sizes 1–3**

- When retrofitting accessories or a second valve 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 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), 2 x profiled sealing rings.

**Technical data**

Gas types: natural gas, LPG (gaseous), biologically produced methane (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 $p_u$: 10–500 mbar (1–200 "WC).

FM approved, non operational pressure: 700 mbar (10 psig).

ANSI/CSA approved: 350 mbar (5 psig).

Opening times:
- VAx../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.

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>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.
Position indicator 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>

Position indicator 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.
Air flow rate $Q$

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

![Diagram of air flow and pressure loss](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>Air flow rate $Q$ [m$^3$/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>

<table>
<thead>
<tr>
<th>Type</th>
<th>Air flow rate $Q$ [m$^3$/h]</th>
<th>$Q$ [SCFH]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass valve VAS 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.2</td>
<td>7.8</td>
</tr>
<tr>
<td>2</td>
<td>0.5</td>
<td>17.7</td>
</tr>
<tr>
<td>3</td>
<td>0.8</td>
<td>28.2</td>
</tr>
<tr>
<td>4</td>
<td>1.5</td>
<td>53.1</td>
</tr>
<tr>
<td>5</td>
<td>2.3</td>
<td>81.2</td>
</tr>
<tr>
<td>6</td>
<td>3.1</td>
<td>109.5</td>
</tr>
<tr>
<td>7</td>
<td>3.9</td>
<td>137.7</td>
</tr>
<tr>
<td>8</td>
<td>5.1</td>
<td>180.1</td>
</tr>
<tr>
<td>9</td>
<td>6.2</td>
<td>218.9</td>
</tr>
<tr>
<td>10</td>
<td>7.2</td>
<td>254.2</td>
</tr>
<tr>
<td>Pilot gas valve VAS 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>8.4</td>
<td>296.6</td>
</tr>
</tbody>
</table>

**Type**

**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>Switching cycles: 500,000</td>
</tr>
<tr>
<td>VAx 232 to 365</td>
<td>Switching cycles: 200,000</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.

**Logistics**

**Transport**

Protect the unit from external forces (blows, shocks, vibration). On receipt of the product, check that the delivery is complete, see page 2 (Part designations). Report any transport damage immediately.

**Storage**

Store the product in a dry and clean place.

Storage temperature: see page 15 (Technical data).

Storage time: 6 months in the original packaging before using for the first time. If stored for longer than this, the overall service life will be reduced by the corresponding amount of extra storage time.

**Packaging**

The packaging material is to be disposed of in accordance with local regulations.

**Disposal**

Components are to be disposed of separately in accordance with local regulations.
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.

Certification

Declaration of conformity

We, the manufacturer, hereby declare that the products VAD/VAG/VAV/VAH/VRH, marked with product ID No. CE-0063BO1580, comply with the essential requirements of the following Directives:

- 2009/142/EC in conjunction with EN 13611, EN 161, EN 88-1, EN 126 and EN 1854,
- 2006/95/EC,
- 2004/108/EC.

The relevant product corresponds to the type tested by the notified body 0063.

The production is subject to the surveillance procedure pursuant to Directive 2009/142/EC Annex II paragraph 3.

Elster GmbH
Scan of the Declaration of conformity (D, GB) – see www.docuthek.com

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/category B, 1, 2, 3, 4, high demand mode, CCF > 65, $\beta \geq 2$.

\[ \text{PFHD} = \lambda_D = \frac{1}{\text{MTTF}_d} = 0.1 \times \text{B}_{10d} \times \text{n}_{op} \]

<table>
<thead>
<tr>
<th>VAD/VAG/VAV/VAH</th>
<th>B10d 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, VAV, VAV: AGA approved*

Australian Gas Association

Eurasian Customs Union

The product VAD/VAG/VAV/VAH/VRH/VCS meets the technical specifications of the Eurasian Customs Union (the Russian Federation, Belarus, Kazakhstan).

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