

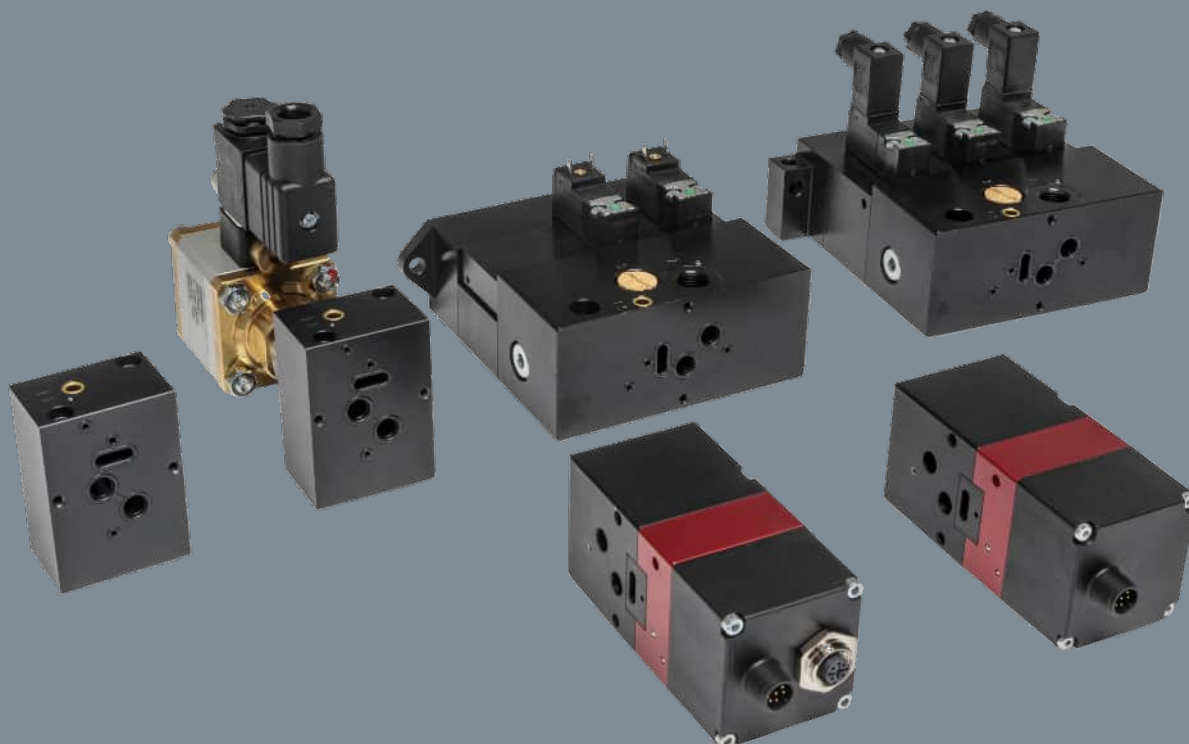
LasGAR Basic

Laser gas control valve with Piezo activation and upstream gas valves
LGRB type series analog and digital (EtherCAT/Profinet)

Operating instructions

Version 00

ID no.: PS31015A



Version: 00
Date: 2021

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1 Notes about using the operating instructions

1.1 About these instructions

These operating instructions serve to explain how to transport, assemble, and put the LasGAR into service, prevent personal injury and property damage, guarantee fault-free operation, and avoid damaging the environment. In addition, the operating instructions contain information for the operator of the machine in which the LasGAR is installed.

1. The operating instructions are part of the product. Keep the operating instructions carefully.
2. Transfer the operating instructions to any subsequent owner or user.

For additional information, contact the manufacturer at the following address:

HOERBIGER Flow Control GmbH
Südliche Römerstraße 15
86972 Altenstadt
Germany

Information on the Internet: www.hoerbiger.com

1.2 Warnings used

Warnings warn about dangers that can occur when handling the product. There are four danger levels with the following signal words:

Signal word	Meaning
DANGER	Identifies a danger with high risk that can cause death or severe injury.
WARNING	Identifies a danger with a medium risk that can cause death or severe injury.
CAUTION	Identifies a danger with a low risk that can cause slight or moderate injury.
NOTICE	Identifies a danger that can cause property damage.

1.3 Symbols



This symbol indicates useful and important information.

- ✓ This symbol stands for a prerequisite that must be fulfilled before performing an action.
- ⇒ This symbol stands for an individual action to be performed.
 1. Numbers indicate several steps to be performed in an action instruction: Step 1
 2. Step 2
 - ↳ This symbol stands for the intermediate result of an action.
 - ↳ This symbol stands for the result of an entire action instruction.

1.4 Abbreviations

Term / Abbreviation	Explanation
PDO	Process data object

2 Basic safety instructions

2.1 Intended use

The LasGAR serves to control the cutting gas pressure for switching laser welding gases on and off when laser cutting. The device may only be used within the specified power limits. For specification, see technical data sheet.

- ✓ All requirements for the safety of the device are fulfilled, see chapter *Technical requirements, page 9*.
 - ✓ All legal requirements are fulfilled for the machine in which the device is installed.
 - ✓ All safety equipment is properly installed and functional.
 - ✓ The operating personnel have received initial training from the machine manufacturer.
1. Ensure that employees working on the device have the required qualification.
 2. Only use the device in connection with laser cutting equipment.
 3. Only operate the device with the defined media, see technical data sheet.
 4. Only operate the device with dry, dust- and particle-free, pure gases, see technical data sheet.
 5. Do not reconfigure the device or change it in any way.

2.2 Personnel qualification

Unqualified personnel cannot detect risks and is therefore subject to greater dangers.

1. Only commission qualified personnel with the activities described in these instructions.
2. Make sure that the personnel adheres to the locally valid regulations and rules for safe and danger-conscious work.

The following target groups are addressed in these instructions:

Trained person: A trained person is somebody who has been trained extensively by the operator in his tasks in connection with the safe operation of the valves.

Training is conducted by specialized personnel.

Electrically-qualified person: An electrically-qualified person is somebody who, based on his specialized training, knowledge, and experience, as well as knowledge of the applicable regulations, can judge and perform the work with which he is commissioned and detect possible hazards independently.

Pneumatically-qualified person: A pneumatically-qualified person is somebody who, based on his specialized training, knowledge, and experience with respect to pneumatic components and systems as well as knowledge of the applicable regulations, can judge and perform the work with which he is commissioned and detect possible hazards – especially with respect to interactions between pneumatic, mechanical, electrical, and control-technical components – independently.

Activity	Authorization
<ul style="list-style-type: none"> ■ Assembly ■ Start-up 	<ul style="list-style-type: none"> ■ Trained person ■ Qualified person
<ul style="list-style-type: none"> ■ Installation incl. electrical connection 	<ul style="list-style-type: none"> ■ Electrically-qualified person
<ul style="list-style-type: none"> ■ Work on the pneumatic systems 	<ul style="list-style-type: none"> ■ Pneumatically-qualified person
<ul style="list-style-type: none"> ■ Operation 	<ul style="list-style-type: none"> ■ Trained person
<ul style="list-style-type: none"> ■ Service ■ Troubleshooting ■ Elimination of faults ■ Taking out of service 	<ul style="list-style-type: none"> ■ Qualified person

2.3 Duties of the machine manufacturer

2.3.1 Technical requirements



Damage due to carbon dust

Carbon dust from compressed air compressor can damage the valve.

- Avoid carbon dust.

-
1. For adherence to the media quality for cutting gases and control air prescribed in the chapter , suitable filters, compressed air dryers, and oil separators must be provided, if possible near the valve connections.
 2. Use screw connections with O-rings to connect pipes. **NOTICE! PTFE seals and liquid seals may not be used since parts can loosen and contaminate the valve.**
 3. Flush or pig compressed air and gas lines for the device before installation in order to remove all particles and deposits in the line completely, see chapter *Connecting gases*, page 24.
 4. Do not use the device as a safety valve for pressure limitation.
 5. Ensure that the construction surrounding the device can safely absorb the static and dynamic forces arising during operation.
 6. After assembly of the device, perform a sound measurement and take suitable sound protection measures if necessary.
 7. Set up the main switch and EMERGENCY STOP switch on the superior controller of the machine.
 8. Provide gas supply, gas lines, and connections according to the device's requirements; see chapter *Gas installation*, page 22.
 9. Make sure that the media pressures on the device do not cause any hazard, see technical data sheet.
 10. Only use suitable pressure lines.
 11. Adhere to the storage and operation duration for the line specified by the manufacturer of the pressure line.

2.3.2 Responsibility with regard to the operator

1. Complete operating instructions according to the results of the risk assessment and the safety measures taken.
2. Determine the relevant content of the operating instructions for the operator and transfer the operating instructions to the operator of the machine.

2.4 Responsibility of the operator

The assumed duties of the operator are:

1. Adherence to operational safety regulations.
2. Adherence to the valid national occupational safety regulations.
3. Adherence to the intended use of the valve.

2.5 Duties of the personnel

1. Carefully read and understand operating instructions before assembly and starting up the device.
2. Heed and follow all safety instructions, notes, requirements, and information.
3. Keep operating instructions in the immediate area during installation and start-up.

2.6 Behavior in case of emergency

1. Switch off main switch of the machine in order to de-energize the machine.
2. Switch off gas supply.
3. Secure machine against unintentional switching on.
4. Command all people to leave the danger zone.
5. Secure the danger zone.
6. Inform responsible supervisor.
7. Rescue injured persons from the danger zone as soon as it is possible to do this without endangering yourself.

2.7 Personal protective equipment

Flying parts, escaping liquids, and sharp edges can cause severe and life-threatening injuries.

1. When working on pneumatic systems, wear eye protection according to EN 166.
2. Wear work gloves according to EN 388.

3 Product description

3.1 Description

Devices in the LasGAR type series are used for efficient gas control in laser cutting machines and are typically composed of the following components:

1. Gas control valve for regulation of the cutting pressure
2. Digital or analog communication interface
3. Upstream valve unit with switching valves for gas selection
4. Input filter unit to protect against coarse dirt particles from the supply line

The structure is modular and can vary depending on the installation situation.

The following are available type series:

- LasGAR Basic: The entry-level device offers optimized pressure and flow for all machines with low and medium laser power up to approx. 10 kW.
- LasGAR Plus: The high-performance device offers increased pressure and flow for all machines with high laser power up to 30 kW.

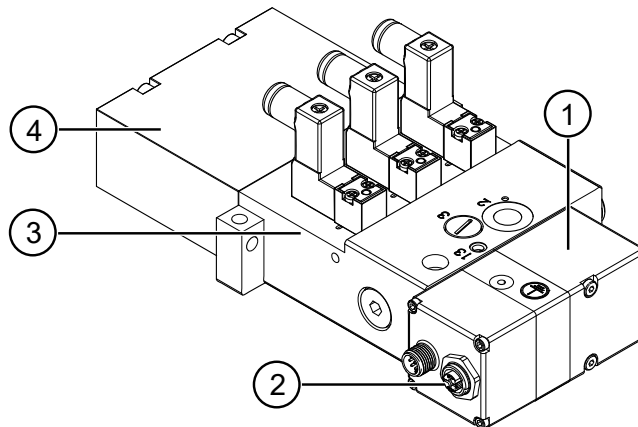


Fig. 1: Example: Gas control valve (for variants, see technical data sheet)

1	Gas control valve basic or plus	3	Upstream valve unit (option)
2	Communication interface	4	Input filter unit (option)

The compact, ready-to-use unit can be installed in laser cutting machines and connected using gas and electric connections.

3.2 Function

In the following, the general functional principle will be explained using the example of a LasGAR device with the filter unit, 3-gas upstream valve unit, and gas control valve components:

1. The input filter unit (option) protects devices against particles from the gas supply lines.
2. The upstream valve unit (option) switches gases applied to the inlet on or off.
3. The communication interface establishes the connection between the machine control and the gas control valve.
4. The gas control valve regulates the input pressure of an applied cutting gas and the required output pressure.

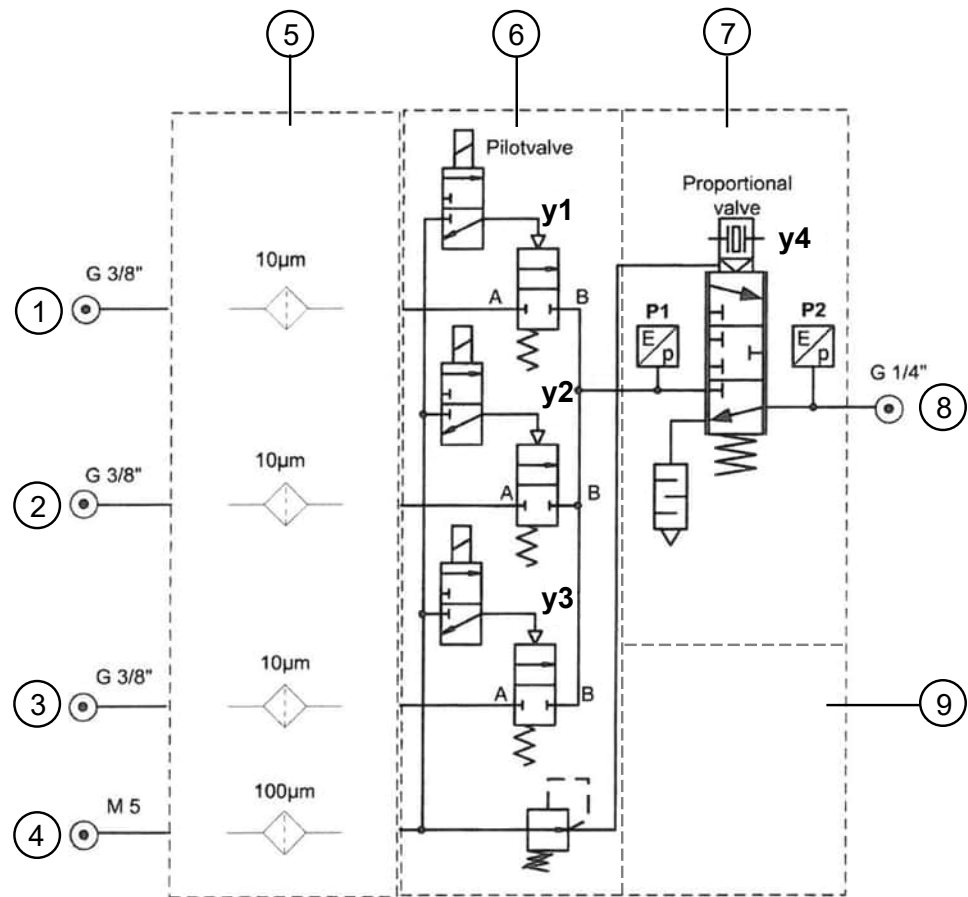


Fig. 2: Example: Pneumatic switching principle

1	Input gas 1	6	3-gas upstream valve unit
2	Input gas 2	7	Gas control valve
3	Input gas 3	8	Gas output
4	Input control pressure	9	Communication interface - analog or digital
5	Input filter unit		

3.2.1 Cutting gas selection

The cutting gases applied to the input of the upstream valve unit are fed by switching one of the integrated 2/2-way valves Y1, Y2, or Y3 to the input of the control valve Y4. The valves must be electrically locked against one another. Depending on the device model and options purchased, there are different variants for the valve control and locking, as shown in the following table:

LasGAR Basic	HOERBIGER Upstream valve	Activation of the upstream valves	Locking of the upstream valves
analog	with	provided by customer	provided by customer
	without	provided by customer	provided by customer
digital	with	Only with accessory Y-cable, then to connection X2	Via accessory Y-cable
	without	provided by customer	provided by customer

3.2.2 Cutting gas control

The control valve Y4 regulates the output pressure according to the target value specified by the machine control and provides the pressure to the laser cutting head.

The pressure sensor P1 measures the input pressure of the control valve. The current value is output as an analog signal for processing by the machine control.

The following functions can be implemented by the customer:

- Check whether the current pressure at the control valve input is higher than the selected pressure target value.
- Securing against gas mixing during cutting gas switching. The switching occurs only when the pressure P1 is lower than the pressure of the newly selected gas.

In addition, for the “digital communication” model, warnings are output if the input pressure is too low.

The pressure sensor P2 handles the electronic control for recording the actual pressure. The value is also output as an electric signal.

For quick pressure reduction, the control valve is able to ventilate the pressure at the output via integrated ventilation holes.

3.2.3 Communication

Depending on the model, the communication with the machine control is handled in analog (0 – 10 V, 4 – 20 mA) or digital (EtherCAT/Profinet) fashion.

3.2.4 Input filter unit

The optional input filter unit is a particle filter with 2 or 3 filter cartridges (10 µm apiece) on the cutting gas inputs and a filter screen (100 µm) at the control pressure input. The filter cartridges protect the upstream valves, the control valve, and downstream components such as the cutting heads against large dirt particles and can be changed out.

3.3 Scope of delivery

The scope of delivery includes:

- Laser gas valve according to model selected; see type key on the transport carton
- Accompanying card with link to product page (QR code)



Gas lines and connections are not included in the scope of delivery.



The detailed operating instructions can be downloaded from the Internet at www.hoerbiger.com.

3.4 Technical data

Technical data, see technical data sheet.

3.5 Type code

Type key, see technical data sheet.

3.6 Type plate

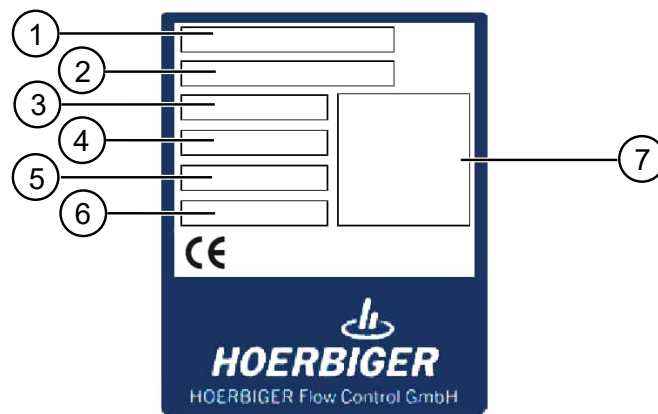


Fig. 3: Type plate

1	Product name	5	Software version number
2	ID number	6	Type designation
3	Serial number	7	Data matrix code The data matrix code includes the content of the type plate.
4	Date of manufacture (ww/yy)		

4 Transport and storage



Damage due to missing packaging!

The device can be damaged due to packaging missing during transport and storage.

- Only transport and store the device in the original packaging.
-

The LasGAR is packed in a carton. The device can be moved by hand.

1. Transport the device to the installation location and unpack it immediately prior to installation.
2. Place the packaging materials in the recycling container.
3. The pneumatic connections are secured with a protective film against dirt penetration. Only remove this protective film immediately before connecting the pneumatic lines.

5 Assembly and installation

5.1 Assembly



⚠ DANGER

Mortal danger due to flying parts!

Improperly fastened parts can fly around and cause life-threatening injuries.

- Ensure that the construction surrounding the device can safely absorb the static and dynamic forces arising during operation.
- Fasten the device as specified using 2 fastening holes at the rear or 3 fastening holes on the side.
- Use screw locking to fasten the device.
- Adhere to tightening torques.



⚠ CAUTION

Personal injury or property damage due to incorrect installation position!

Incorrect installation position can cause disturbances in the valve function. Personal injury and property damage can result.

- Be sure to heed the vertical installation position according to the following figures.



⚠ CAUTION

Personal injury or property damage due to covered ventilation openings!

Covered ventilation openings can cause severe injuries and damage to the valve.

- Make sure that the distance between the ventilation openings and the surrounding parts is at least equal to the opening diameter.

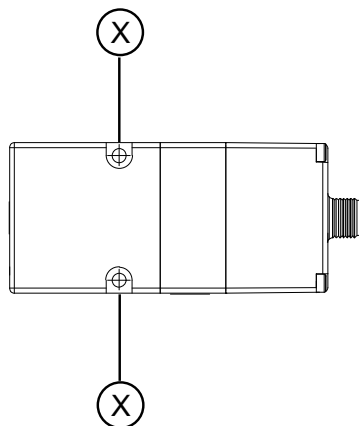


Fig. 4: Fastening controller without connection plate, through bore d 4.2

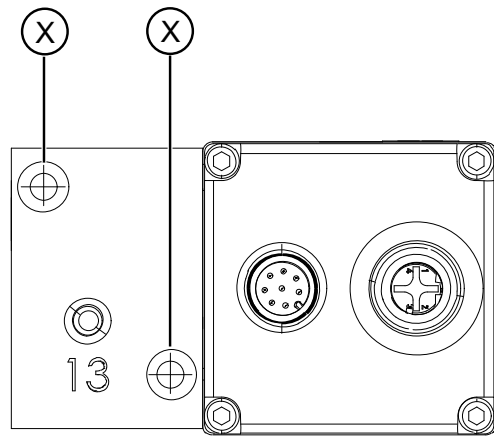


Fig. 5: Fastening single controller with connection plate, through bore d 4.2

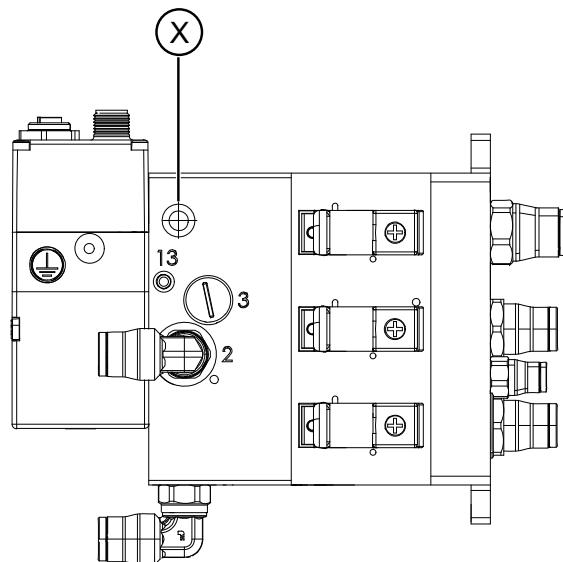


Fig. 6: 2- and 3-gas special model, fastening from above, through bore d 6.5

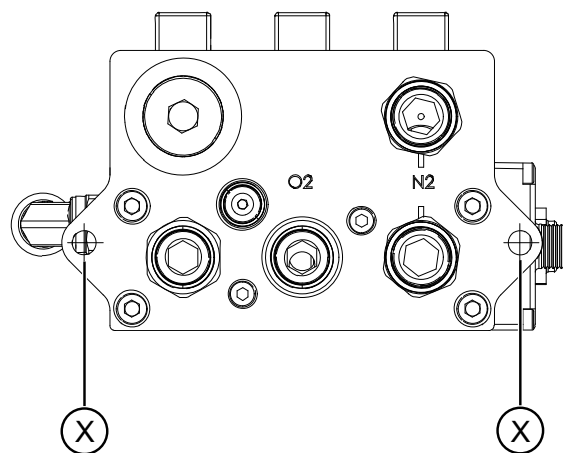


Fig. 7: 2- and 3-gas special model, fastening from front, through bore d 6.5

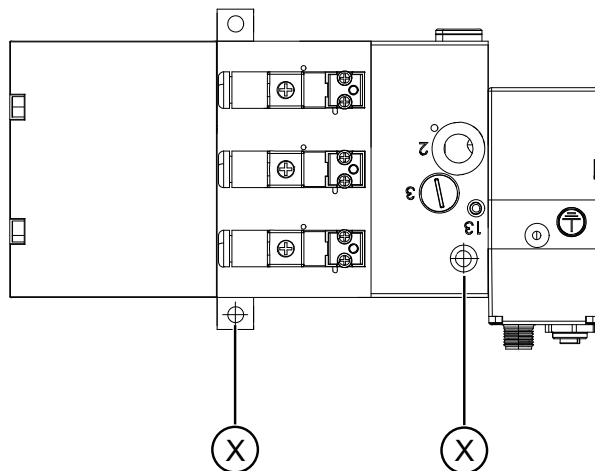


Fig. 8: 2- and 3-gas standard model with filter block, fastening from above, through bore d 6.5

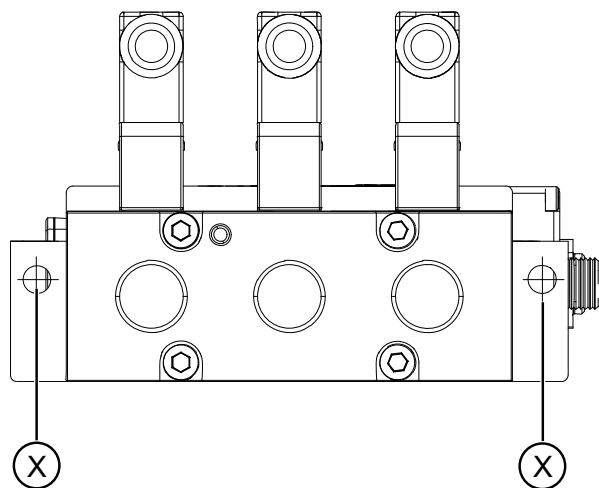


Fig. 9: 2- and 3-gas standard model with filter block, fastening from front, through bore d 6.5

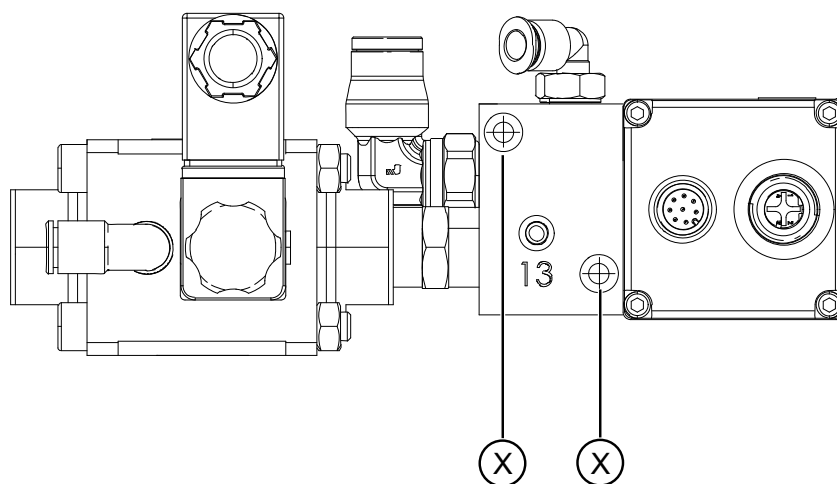


Fig. 10: 1-gas model, fastening from above, through bore d 4.2

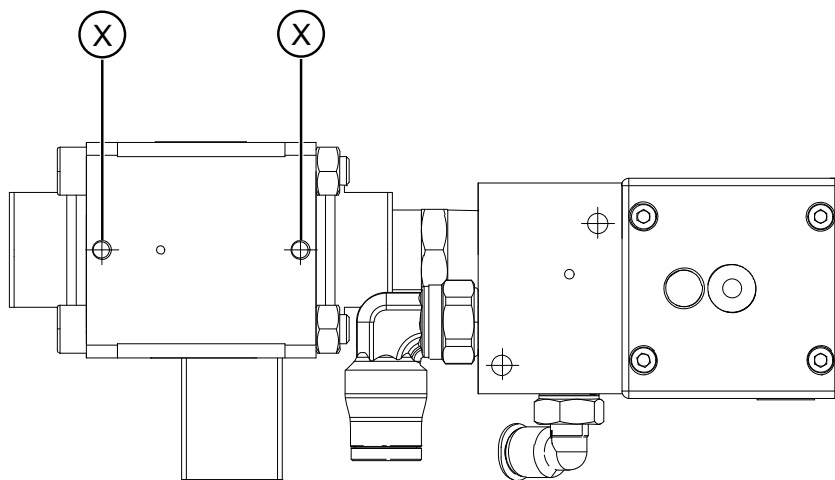


Fig. 11: 1-gas model, fastening switching valve (optional), M4 thread

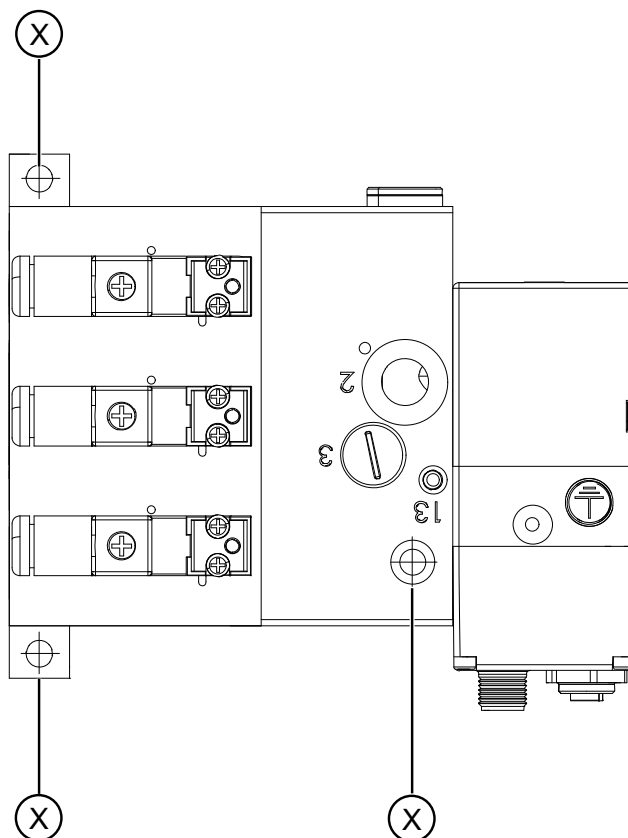


Fig. 12: 2- and 3-gas standard model, fastening from above, through bore d 6.5

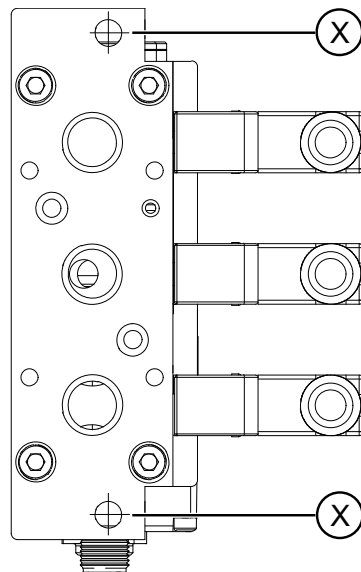


Fig. 13: 2- and 3-gas standard model, fastening from front, through bore d 6.5

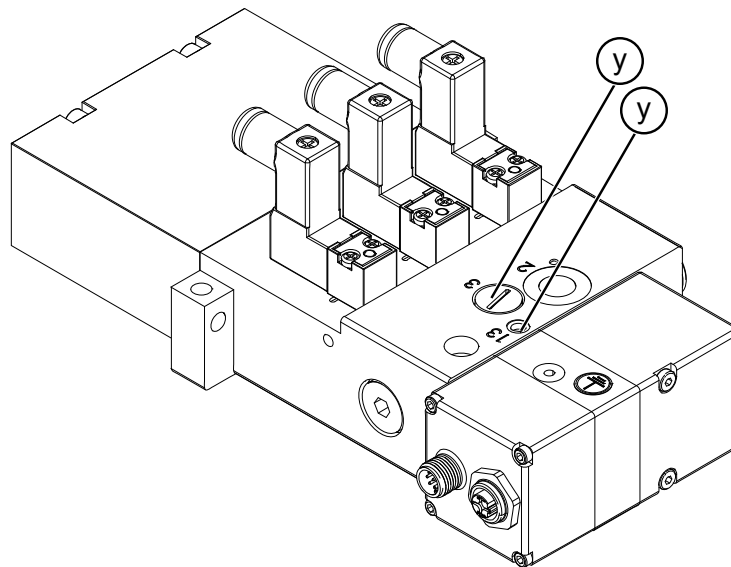


Fig. 14: Ventilation openings

1. Fasten devices via the fastening bores securely and vibration-free.
2. For the single controller with and without connection plate, use M4 screws, tightening torque 2.8 ± 0.5 Nm.
3. Fasten all other models with M6 screws, tightening torque 9.5 ± 0.5 Nm.
4. Use screw locks.
5. Make sure that the ventilation openings are always free and not partially or completely covered. Only then is correct operation guaranteed.

5.2 Gas installation

5.2.1 Gas connections

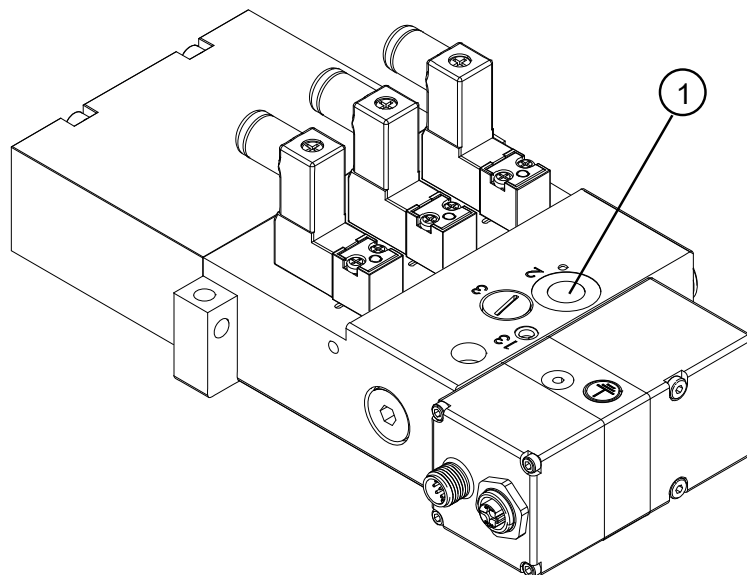


Fig. 15: Gas connection

1	Cutting gas output G $\frac{1}{4}$		
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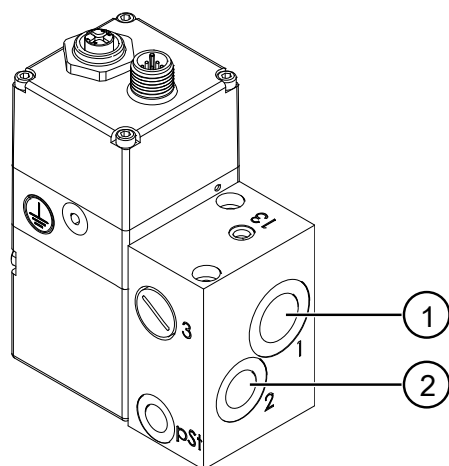


Fig. 16: Gas connection single controller

1	Cutting gas input 1 G $\frac{3}{8}$	2	Cutting gas output 1 G $\frac{1}{4}$
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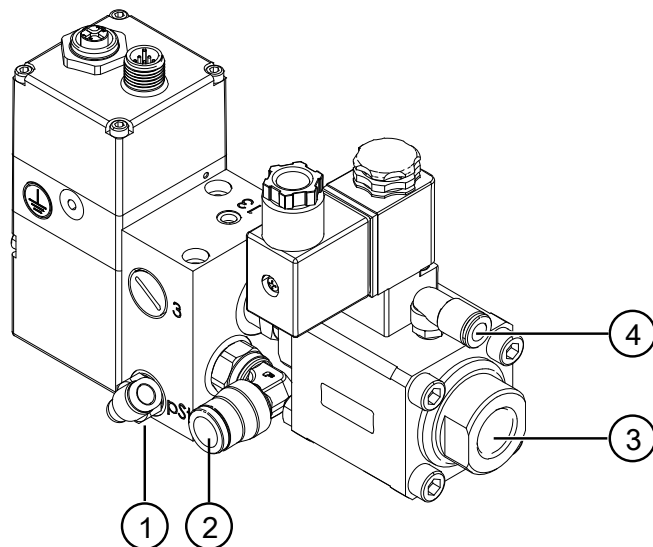


Fig. 17: Gas connection 1-gas variant

1	Proportional valve input G $\frac{1}{8}$ (PST)	3	Cutting gas input G $\frac{3}{8}$
2	Cutting gas output G $\frac{1}{4}$	4	Switching valve input M5

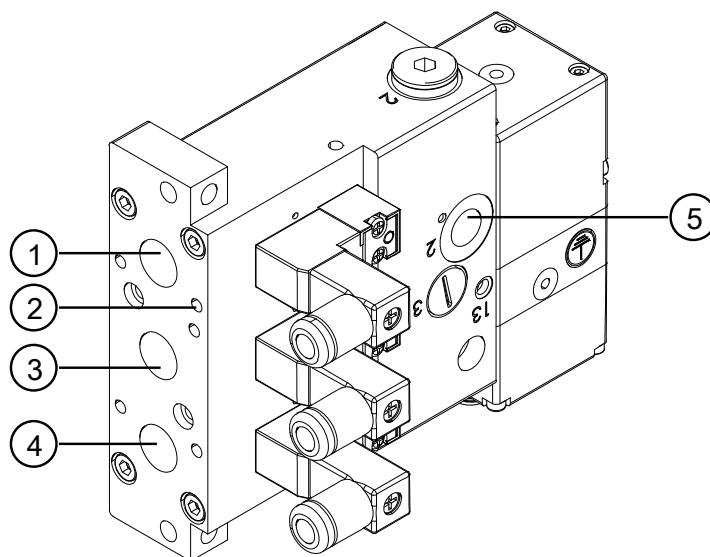


Fig. 18: Gas connection 2- and 3-gas variant with or without filter

1	Cutting gas input G $\frac{3}{8}$	4	Cutting gas input G $\frac{3}{8}$
2	Control air input M5	5	Cutting gas output G $\frac{1}{4}$
3	Cutting gas input G $\frac{3}{8}$		

5.2.2 Connecting gases



⚠ DANGER

Mortal danger due to improperly connected pressure lines!

The pressure lines are under high pressure. Improperly connected lines can loosen under pressure, whip around, and cause life-threatening injuries.

- Only have the device started up by trained personnel.
- Only have faults on the device eliminated by trained personnel.
- Before start-up and troubleshooting, check the connections.
- Only have compressed air supply and cutting gases connected by trained personnel.
- Before installation, depressurize all lines and lock them against switching on again.
- Only operate the device within the prescribed power limits, see technical data sheet.
- Do not use any grease when mounting the lines (e.g. threaded connections).



⚠ DANGER

Mortal danger with use of oxygen as cutting gas!

Using oxygen as a cutting gas can cause life-threatening injuries and damage to the device.

- Heed maximum operating pressure; see technical data sheet.
- When changing filter cartridges in the input filter unit, only use greases that are suitable for oxygen.



⚠ WARNING

Personal injury and property damage due to undefined machine states!

Undefined machine states can cause severe injuries and damage to the valve.

- Wear prescribed protective equipment.



⚠ CAUTION

Personal injuries and property damage due to contaminated compressed air or gas lines!

Contaminated compressed air or gas lines can cause injuries and damage to the valve.

- Only use dry, clean compressed air and gases. Adhere to the media quality; see technical data sheet.
- Before each gas connection, place a filter with max. 10 µm mesh size upstream. Do not use filters based on sintering material.
- Only supply compressed air and gases through clean lines free of particles and dust.
- Flush compressed air and gas lines before connection to the valve or clean them with a brush (cleaning scraper) in order to remove particles and deposits (see Fig. *Cleaning the gas line with cleaning scraper*, page 25 below).
- Only use O-ring seals for compressed air and gas connections (see Fig. *Screwing with O-ring seal*, page 25 below); do not use PTFE sealing tape, pastes, adhesive threaded seals, or hemp.

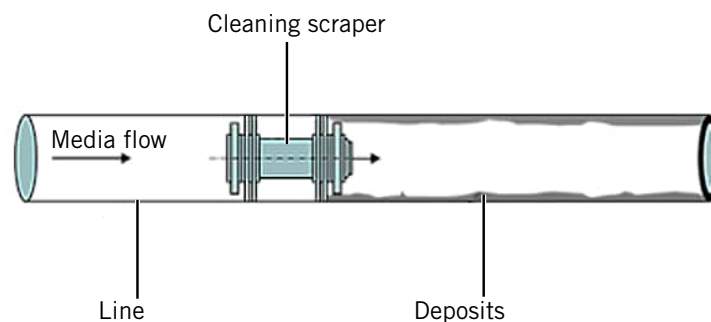


Fig. 19: Cleaning the gas line with cleaning scraper



Fig. 20: Screwing with O-ring seal

1. Remove protective films from the connections.
2. Connect gas lines according to drawings in chapter Gas connections.
3. Connect control air supply to the control air connection.
4. Connect argon, compressed air, oxygen, or nitrogen supply to the connections Gas 1, Gas 2, or Gas 3.
5. Check connections for tight fit and leaks.

5.3 Electrical installation

For the electrical installation, 2 device variants are distinguished:

- LasGAR Basic analog (0 – 10 V or 4 – 20 mA)
- LasGAR Basic digital (EtherCAT or Profinet)

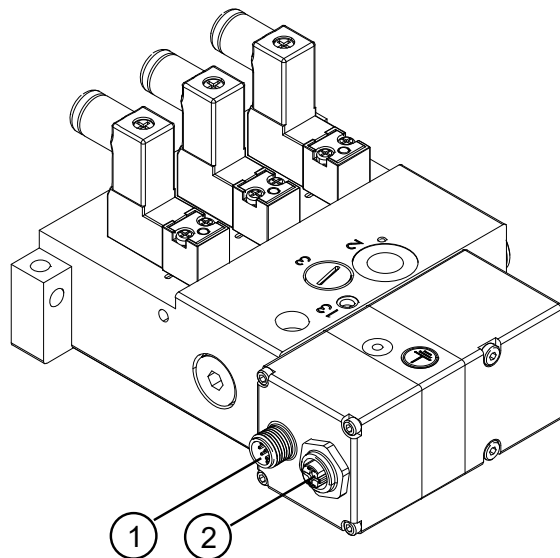


Fig. 21: Electrical connections

1	Analog input/power supply X1	2	Digital input/communication interface
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5.3.1 Analog device variant

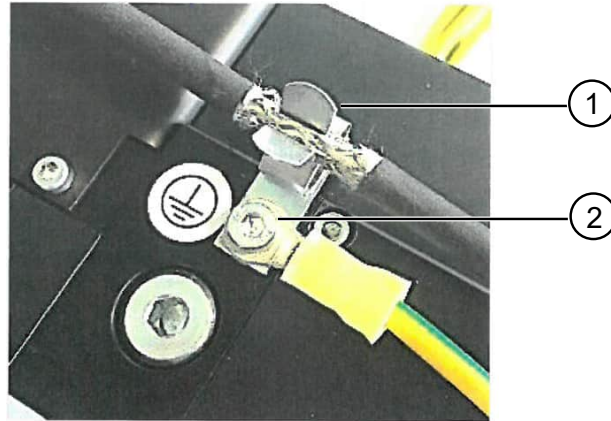


Fig. 22: Connection of cable screen

1	Screen line to connection X1	2	Connection to machine body
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If necessary, the screening clamps can be moved to the opposite housing side.

1. Connect the 24 V power supply to X1.
2. Check plug connection for correct fit.
3. Connect the screen of the connection line to the machine body.
4. To improve the immunity to EMC interference, strip the cable to plug connection X1 approx. 150 mm away from the plug to approx. 20 mm and fasten it in the screen clamp (1).
5. To improve the immunity to EMC interference, connect the valve via one of the two grounding connections on the housing to the machine body (2) using a line with as large a cross section as possible.

Plug connection	Connection	Pin assignment
X1	Control signals M12x1 A-coded 8-pin plug 	1: 24 V 2: Target value 3: GND 4: Input pressure P1 5: Output pressure P2 6: Ready/pressure reached 7: UART RxD 8: UART TxD

Tab. 1: Analog connection

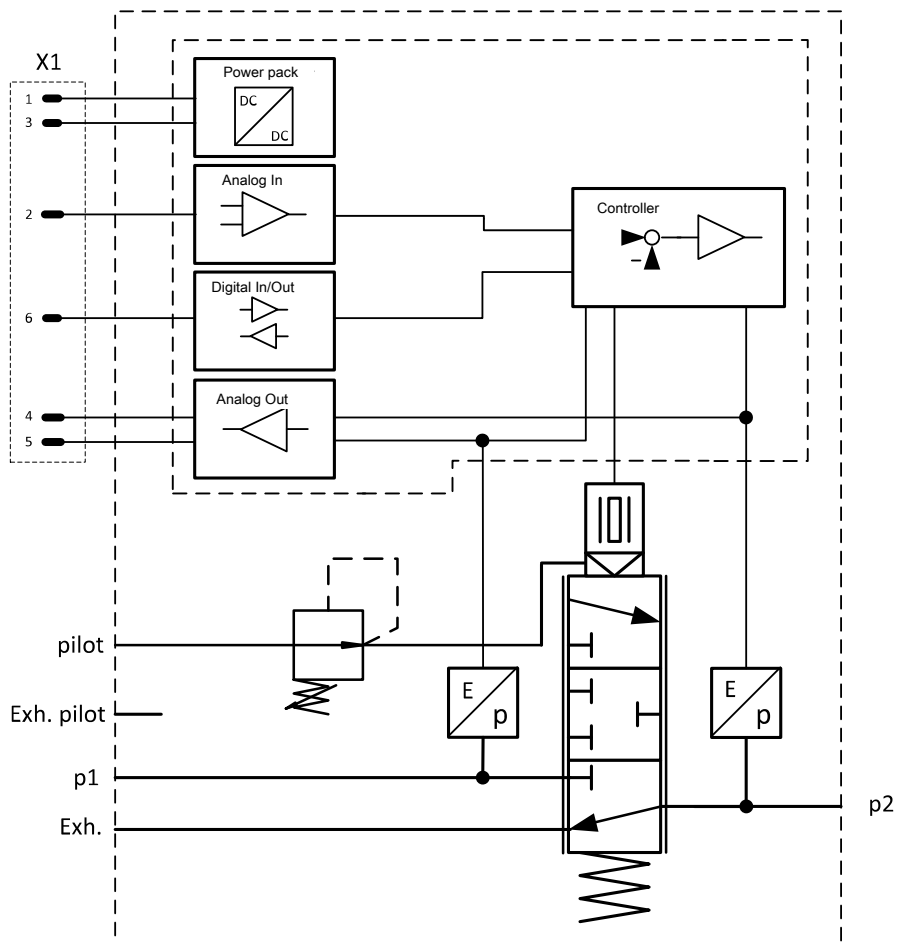


Fig. 23: Block switching diagram, single controller, analog

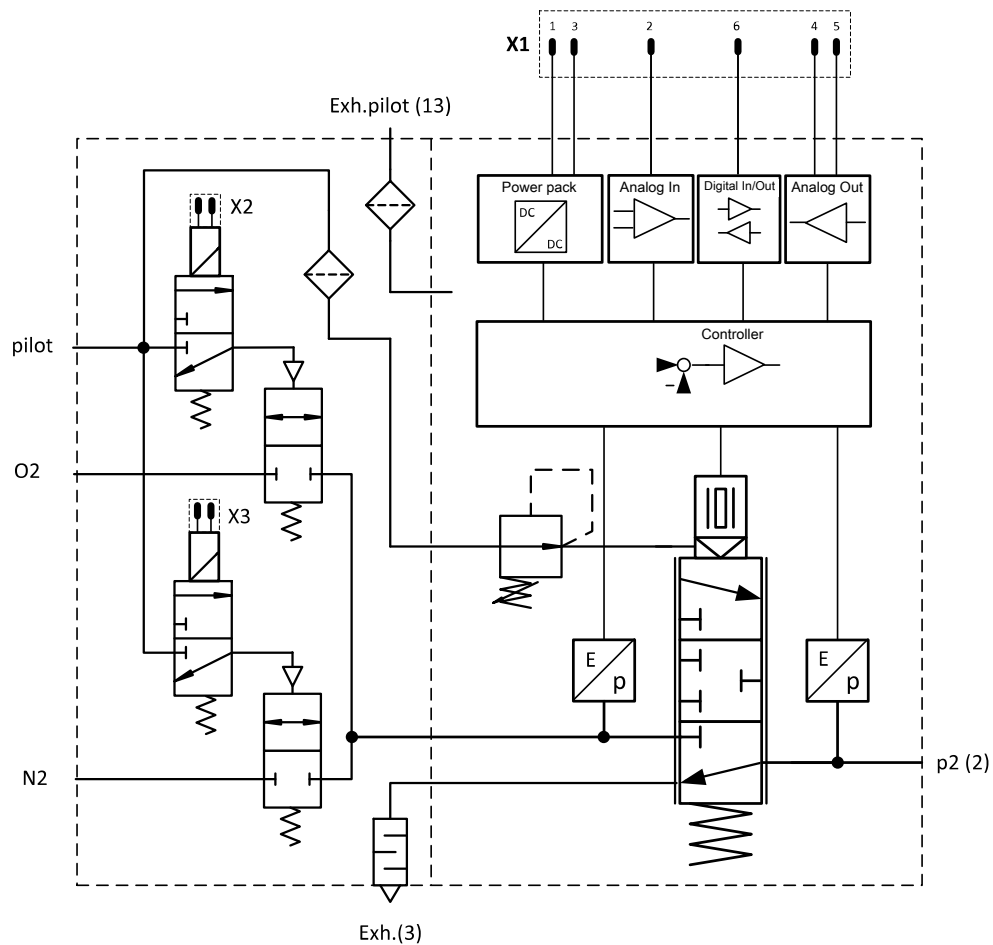


Fig. 24: Block switching diagram, 2-gas variant, analog

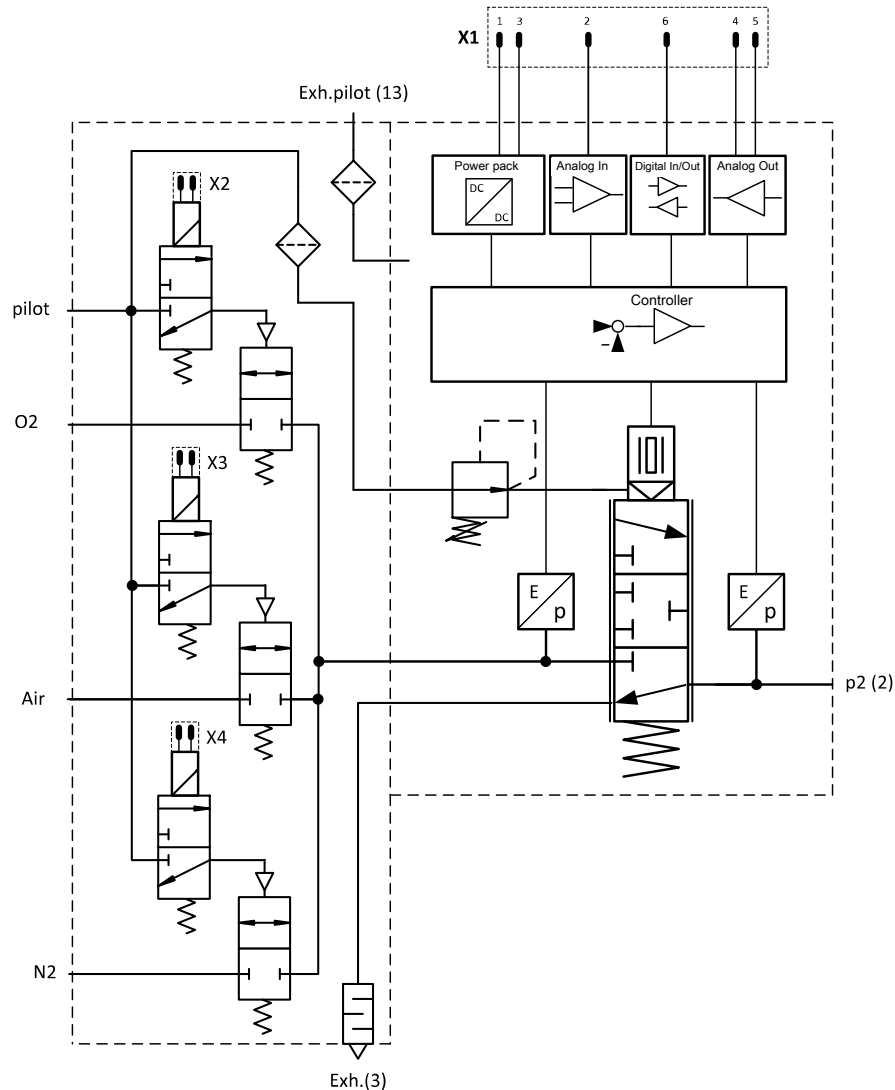
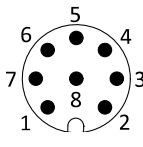
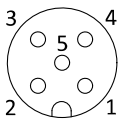


Fig. 25: Block switching diagram, 3-gas variant, analog

5.3.2 Digital device variant

1. Connect 24 V power supply to X1. **NOTICE! Do not connect pin 2!**
2. Connect input cable to X2 EtherCAT or Profinet.
3. Check plug connection for correct fit.
4. Connect the screen of the connection lines X1 and X2 to the machine body.
5. In order to improve the immunity to EMC interference, strip the insulation from the cable on the plug side and fasten the cable screen to the machine body with a grounding clip.

Plug connection	Connection	Pin assignment
X1	Power supply M12x1 A-coded 8-pin plug 	1: 24 V 2: Do not connect! 3: GND 4: Gas output 1 5: Gas output 2 6: Gas output 3 7: UART RxD 8: UART TxD
X2	EtherCAT/Profinet input M12x1 D-coded 4-pin socket 	1: TD+ 2: RD+ 3: TD- 4: RD-

Tab. 2: EtherCAT and Profinet connections

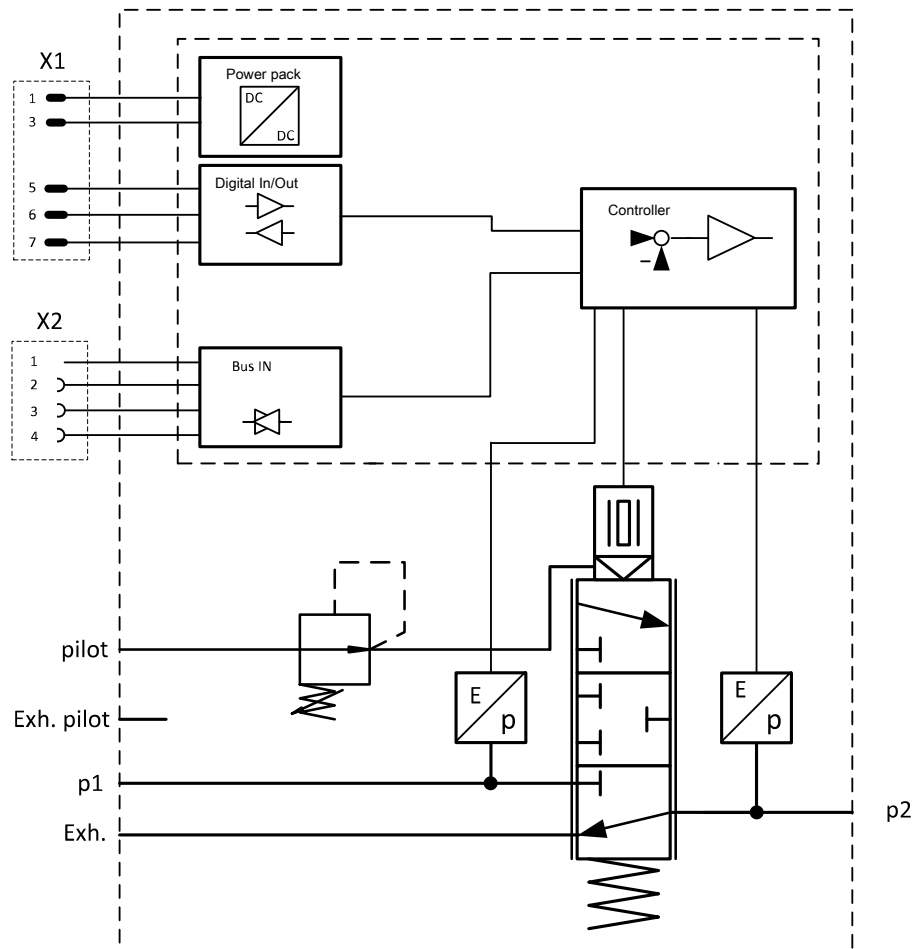


Fig. 26: Block switching diagram, single controller, digital

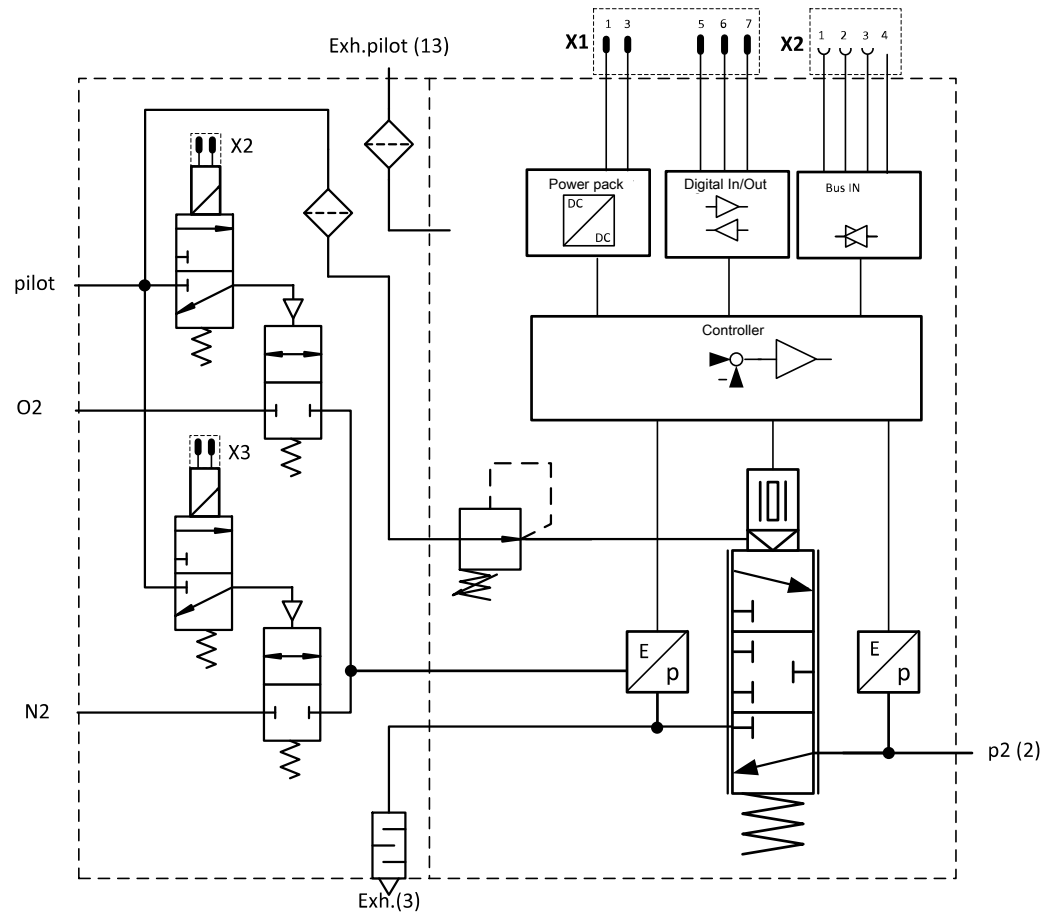


Fig. 27: Block switching diagram, 2-gas variant, digital

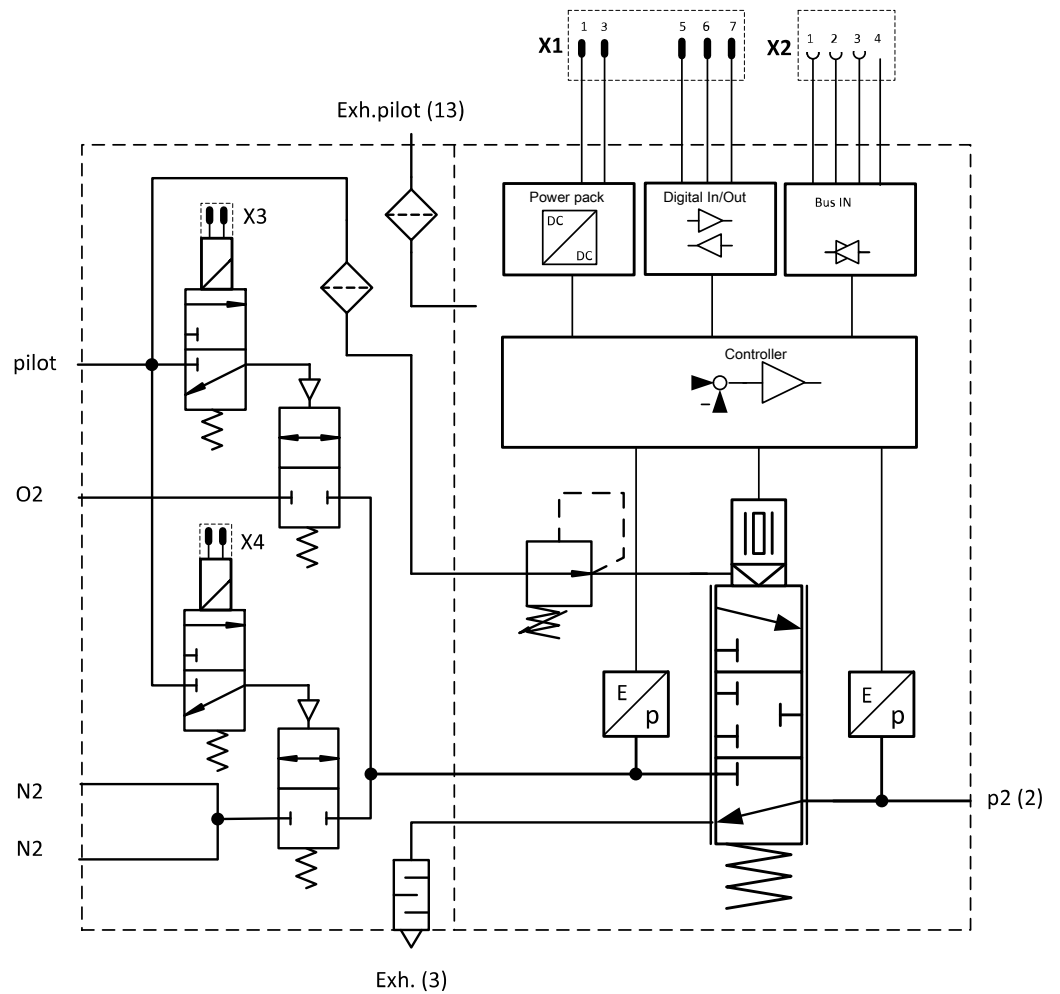


Fig. 28: Block switching diagram, 2-gas variant with double N2 input, digital

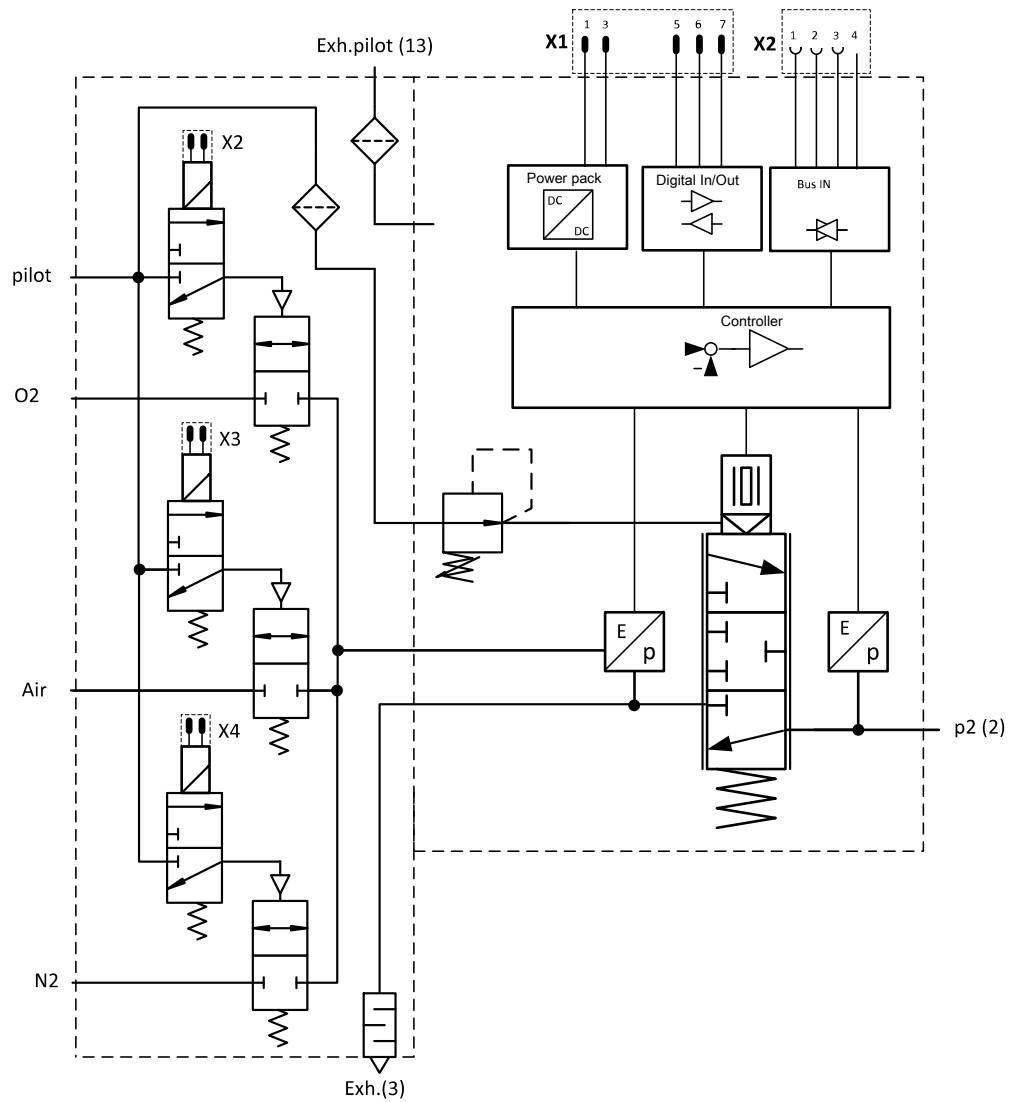


Fig. 29: Block switching diagram, 3-gas variant, digital

5.3.3 Connection of upstream valves (gas selection)

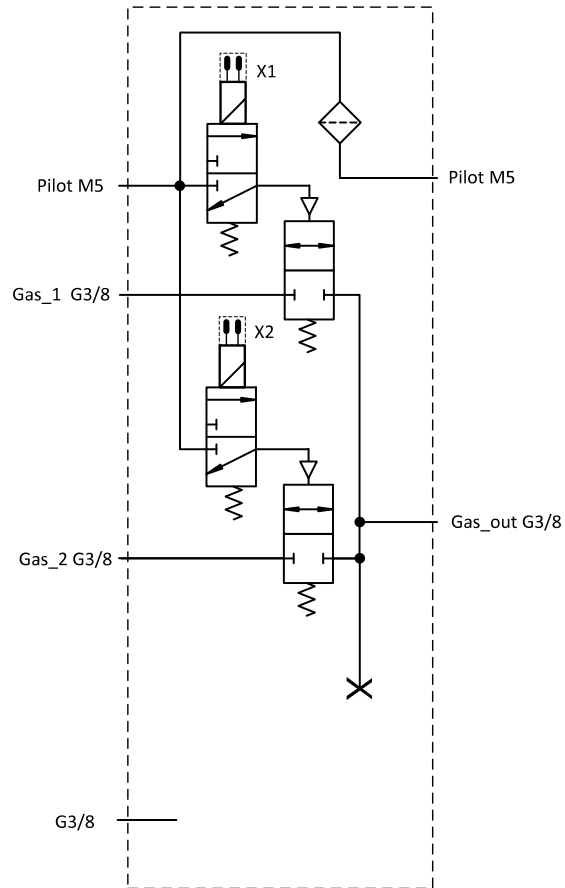


Fig. 30: 2-Gas upstream valve block

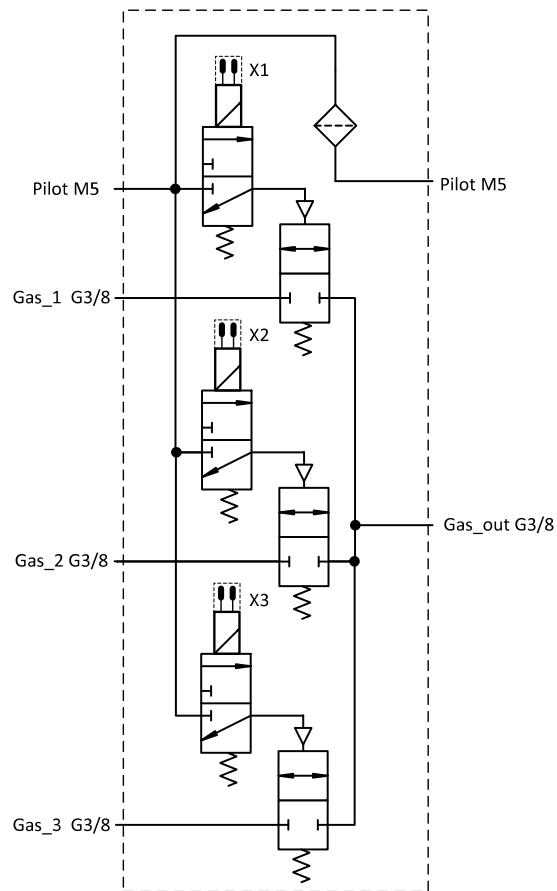


Fig. 31: 3-Gas upstream valve block

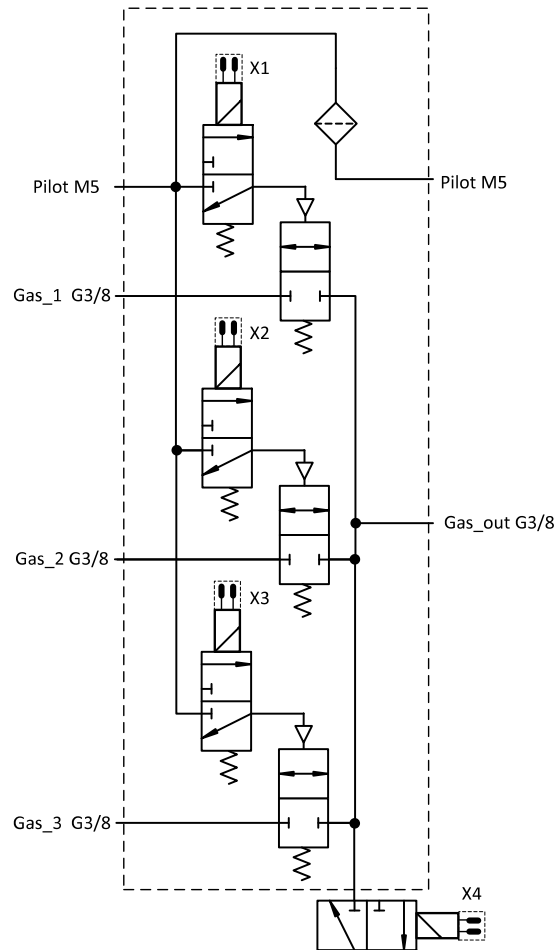


Fig. 32: 3-Gas upstream valve block with quick ventilation valve

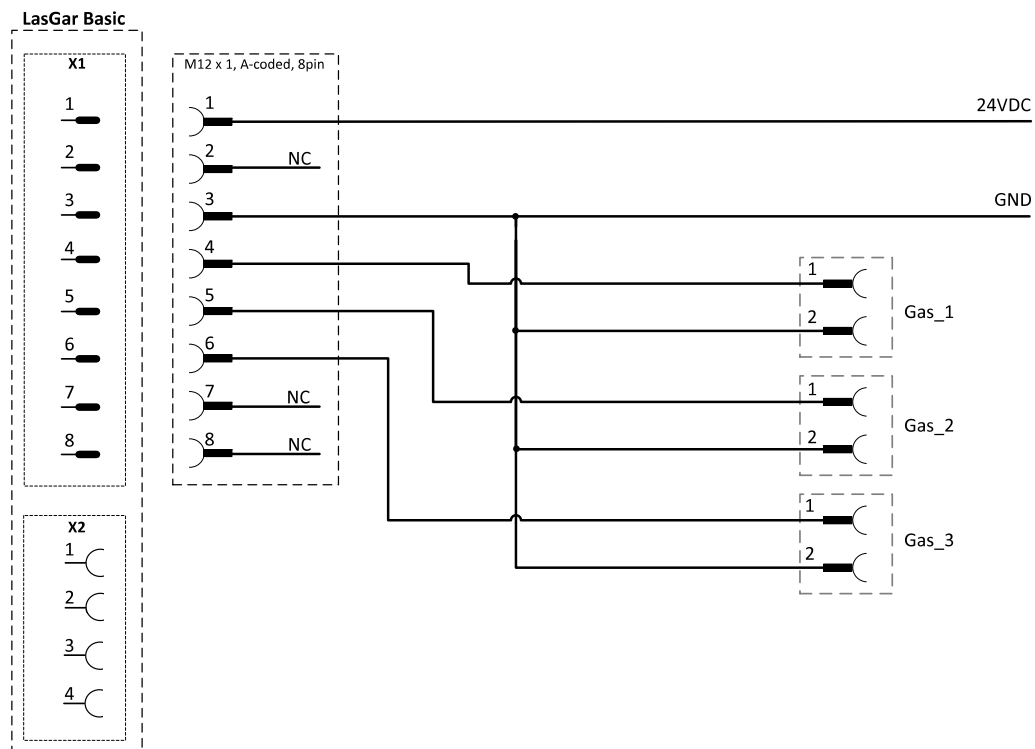


Fig. 33: Electrical connection schema LasGAR Basic digital with activation of upstream valves via Y-cable

6 Start-up

6.1 Start-up



⚠ DANGER

Mortal danger due to improperly connected pressure lines!

The pressure lines are under high pressure. Improperly connected lines can loosen under pressure, whip around, and cause life-threatening injuries.

- Only have the device started up by trained personnel.
- Only have faults on the device eliminated by trained personnel.
- Before start-up and troubleshooting, check the connections.
- Only have compressed air supply and cutting gases connected by trained personnel.
- Before installation, depressurize all lines and lock them against switching on again.
- Only operate the device within the prescribed power limits, see technical data sheet.
- Do not use any grease when mounting the lines (e.g. threaded connections).



⚠ WARNING

Personal injury and property damage due to undefined machine states!

Undefined machine states can cause severe injuries and damage to the valve.

- Wear prescribed protective equipment.
1. Check whether electrical cables and gas lines are connected correctly as described in the chapters *Gas installation, page 22* and *Electrical installation, page 26*.
 2. Connect compressed air supply, control air, and cutting gases to superior air and gas supply.
 3. Switch on 24 V power supply.

7 Operation

7.1 Switching on

- ⇒ Switch on the 24 V power supply for the device.
 - ↳ The initialization starts.
 - ↳ After a few seconds, the device is ready for operation and goes into the operating state specified by the input signals:
 - Analog variant: Connection X1, digital output “Ready”
 - Digital variant: via PDO `GAS_STA` Bit 1

7.2 Switching off

- ⇒ Switch off 24 V power supply of the device.
 - ↳ The cutting gas output of the device is ventilated.

7.3 Selecting cutting gas input

Depending on the model, the cutting gases are selected via already-existing external upstream valves or via the upstream valves provided by HOERBIGER.

For correct functionality and to prevent a mixing of the gases, a special activation logic must be used. Below is an example for a safe activation of the different cutting gases.



Activation of the cutting gases must be done via the machine control. For the digital variant, with a Y-cable (option), activation is also possible via the bus communication, see Fig. *Electrical connection schema LasGAR Basic digital with activation of upstream valves via Y-cable, page 38*.

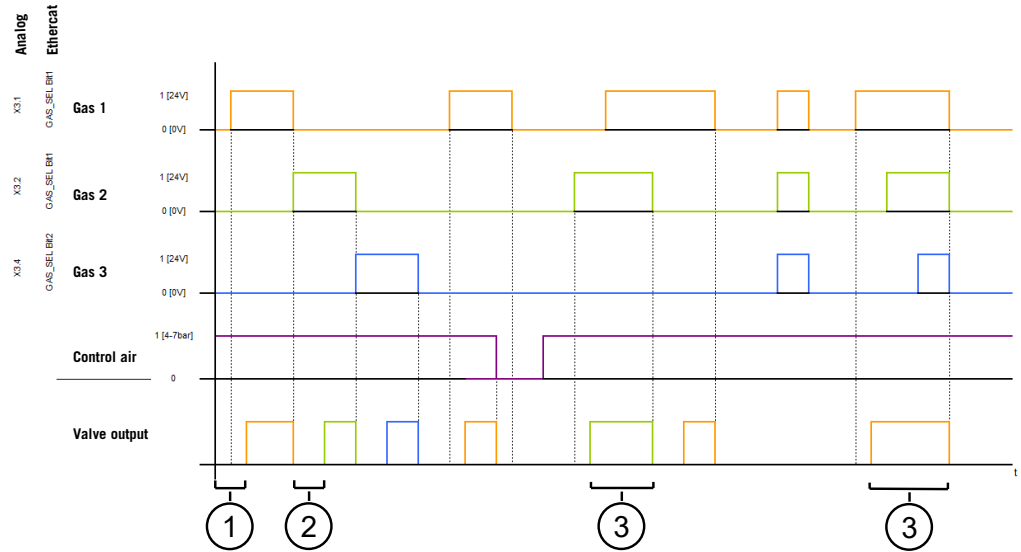


Fig. 34: Example activation logic of upstream valves – valve output

1	Switch-on time cutting gases t_{ON} : approx. 80 ms ¹⁾	3	Electric control inputs interlocking ³⁾
2	Switching time for cutting gases in case of gas change t_{CHANGE} : approx. 230 ms ^{1) 2)}		

- 1) The time from switching on the upstream valve until gas is available at the input of the control valve.
- 2) After switching off a gas, all control inputs for the gas selection are locked for 150 ms (t_{LOCK}). As soon as the time has elapsed, the inputs are active again; that is, with delay-free switching of the gases, the selected gas is available at the output after 230 ms.
- 3) To protect against the simultaneous selection of several gases, the electric control inputs for gas selection are interlocked.

7.4 Querying the target value

The output pressure is regulated according to the target value specification that comes from the machine control. Here, the following inputs are used:

- Analog variants: X1, Pin 2
- Digital variants: 0 ... 20000 digits, process data object (PDO) P_SOLL

7.5 Changing cutting gas

The type of installation behind the cutting gas output of the valve is crucial for the selection of a time-optimal procedure for the cutting gas change.

If necessary, the optimal procedure must be determined via tests.

The use of pressure sensors for input and output pressure allows quick gas change times.

With use of a large cutting nozzle or a small hose and cutting head volume:

Variant 1

From low output pressure to higher output pressure (e.g. gas 1: 0.6 bar to gas 2: 10 bar).

1. Switch off the active upstream valve through the machine's control signals.
2. Set target value to P2max:
Analog variant: 10 V DC or 20 mA (depending on the variant)
Digital variant: 20000
↳ The input pressure on the proportional valve is reduced via the still-present target value.
3. Switch on the upstream valve for the desired cutting gas, see chapter *Selecting cutting gas input*, page 40.

Variant 2

From high output pressure to lower output pressure (e.g. gas 1: 10 bar to gas 2: 0.6 bar).

1. Switch off the active upstream valve through the machine's control signals.
2. Set target value to P2max:
Analog variant: 10 V DC or 20 mA (depending on the variant)
Digital variant: 20000
↳ The input pressure on the proportional valve is reduced via the still-present target value
3. Wait until the value of the input pressure sensor on the device is lower than the bottle pressure of the new desired gas.
4. Switch on the upstream valve for the desired cutting gas, see chapter *Selecting cutting gas input*, page 40.
5. Specify the new target value through the machine's control signals.

Changing the cutting gas when using a small cutting nozzle or a large hose/ cutting head volume

Variant 1

From low output pressure to higher output pressure (e.g. gas 1: 0.6 bar to gas 2: 10 bar).

1. Switch off the active upstream valve through the machine's control signals.
2. Set target value to 0 bar:
Analog variant: 10 V DC or 20 mA (depending on the variant)
Digital variant: 00000
↳ The input pressure on the proportional valve is reduced via the ventilation connection of the valve.
3. Switch on the upstream valve for the desired cutting gas, see chapter *Selecting cutting gas input*, page 40.

Variant 2

From high output pressure to lower output pressure (e.g. gas 1: 10 bar to gas 2: 0.6 bar).

1. Switch off the active upstream valve through the machine's control signals.
2. Set target value to 0 bar:
Analog variant: 10 V DC or 20 mA (depending on the variant)
Digital variant: 00000
↳ The input pressure on the proportional valve is reduced via the still-present target value.
3. Wait until the value of the input pressure sensor on the device is lower than the bottle pressure of the new desired gas.
4. Switch on the upstream valve for the desired cutting gas, see chapter *Selecting cutting gas input*, page 40.
5. Specify the new target value through the machine's control signals.



For optimal ventilation times, the option QEV – quick exhaust valve can be ordered, see type code. If only 2 cutting gases are used with the 3-gas variant, the third, free switching valve can be used as a quick exhaust valve. If 3 cutting gases are used, the quick exhaust valve is a separate screw-in valve.

7.6 Calibration and function check

The LasGAR Basic analog initializes automatically with each input process and then reports the operating state “ready”. If the “ready” signal does not come, there is a fault, see chapter *Troubleshooting*, page 47.

The LasGAR Basic digital has a calibration of the sensors, whereby the sensor values are zeroed. This can be triggered via the digital communication interface without disconnecting the valve from the power supply.

Calibration procedure for LasGAR Basic digital:

1. Set the input pressure in front of the proportional valve to 0 bar.
2. Trigger calibration process: `GAS_SEL` bit 3 = 1, see chapter *Process data objects*, page 45.
3. Wait for response: `GAS_STA` bit 4, value = 1 (successful), value = 0 (error)

7.7 Additional functions

For the process logging and monitoring by a superior control, the following responses are available via the valve outputs. Depending on the variant, this information can be queried directly or via the digital interface, see chapter *Electrical installation*, page 26.

LasGAR Basic analog and digital

- Input pressure p1 of the currently selected cutting gas, measured with pressure sensor P1
- Output pressure p2 of the currently selected cutting gas, measured with pressure sensor P2

LasGAR Basic analog

- Ready signal (pin 6) includes the following status: Power supply, controller output and sensors. Error messages, see chapter *Troubleshooting*, page 47.
Switching conditions for “ON” = pressure reached:
(actual pressure-target pressure) < 4 % of pressure target value + 0.1 bar (stored fixed in the controller, can only be adjusted via Bluetooth app in level 2/3 > Analyze/Optimize)
- Automatic target value compensation: In order to compensate for voltage drops in the signal line, the target value is set to 0 automatically when the controller is switched on.
Prerequisite: When switching on the controller, the machine controller must output the pressure target value 0 bar (0 V DC).

LasGAR Basic digital

- Pressure reached signal `GAS_STA` Bit 0 output, value = 1 (pressure reached). Error messages as for analog variant on `GAS_STA` Bit 0.
- Ready signal via `GAS-STA` Bit 1 output, value = 1 (Ready).
Switching conditions for “ON” = pressure reached:
(actual pressure-target pressure) < 4 % of pressure target value + 0.1 bar, adjustable via `PR_RE` in the range ± 17 %

7.8 Process data objects

Objects	Function	Size	Value	Description
PR_RE: Pressure reached [%]	Output	1 Word	Target value	Measurement window pressure reached Format: 0x0000
P_IST: actual value		1 Word	Actual value	Response actual pressure 0 to 20000 [mbar]
PV_IST: pre-pressure		1 Word	Pre-pressure	Response pre-pressure 0 to 30000 [mbar]
GAS_STA: gas status		1 Word	Bit 0: Pressure reached	Response pressure reached 1 = ready
			Bit 1: Controller status	Response controller ready 1 = ready
			Bit 2: Gas warning	Response supply gas <110 %* target Gas warning: input pressure < set value *1.1 1 = fault
			Bit 3: Gas warning	Response supply gas <105 %* target Gas error: input pressure < set value *1.05 1 = fault
			Bit 4: Calibration running	Self-calibration (offset output pressure) is executed 1 = running 0 = calibration ready
REG_ST: set value D-controller		1 Word	Controller output pressure control circuit	Set value pressure control circuit 0 to 10000
SER_NR		1 Word	Serial number	Serial number: Device format decimal 1 to 9999
SW_VER	1 Word	Software version	Software version Format hexadecimal	
DATA_1	1 Word	Reserve	No data content	
PAR_SEL	1 Word	Control parameter	Response of selected parameter	
DATA_3	1 Word	Reserve	No data content	

Objects	Function	Size	Value	Description
PR_RE	Input	1 Word	Higher byte (0xFF00)	0 to 17.0 % of target value Pressure reached above 0 to 170 (or 0xAA)
			Lower byte (0x00FF)	0 to 17.0 % of target value Pressure reached below 0 to 170 (or 0xAA)
P_SOLL		1 Word	Target value	Selection target value 0 to 20000 [mbar]
GAS_SEL		1 Word	Bit 0: Gas selection 1	Selection upstream valve 1 0= OFF, 1 = ON
			Bit 1: Gas selection 2	Selection upstream valve 2 0= OFF, 1 = ON
			Bit 2: Gas selection 3	Selection upstream valve 3 0= OFF, 1 = ON
			Bit 3: Calibration query	Request of the self-calibration (offset output pressure) 0 = OFF, 1 = START
			Bit 8 – 15: Parameter list	Selection controller parameter list

Tab. 3: EtherCAT/Profinet process data objects

8 Troubleshooting



⚠ DANGER

Mortal danger due to improperly connected pressure lines!

The pressure lines are under high pressure. Improperly connected lines can loosen under pressure, whip around, and cause life-threatening injuries.

- Only have the device started up by trained personnel.
- Only have faults on the device eliminated by trained personnel.
- Before start-up and troubleshooting, check the connections.
- Only have compressed air supply and cutting gases connected by trained personnel.
- Before installation, depressurize all lines and lock them against switching on again.
- Only operate the device within the prescribed power limits, see technical data sheet.
- Do not use any grease when mounting the lines (e.g. threaded connections).



⚠ DANGER

Mortal danger due to improper troubleshooting!

Improper elimination of faults can cause life-threatening injuries.

- Only eliminate faults that are described in the chapter *Troubleshooting, page 47*.
- For all other faults, contact HOERBIGER.

Fault/message	Possible cause	Remedy
No cutting gas pressure	Failure of the electrical or pneumatic power supply	⇒ See chapter <i>Restoring the power supply, page 50</i> .
	Soiling in the valve	1. Only supply dry and pure gases in clean, particle- and dust-free lines. 2. If necessary, replace device.
	Soiling of the input filter unit (only LGRPF model)	⇒ Change filter cartridges, see chapter <i>Filter change in the input filter unit, page 52</i> .
	Control air supply of upstream valve unit drops below minimum pressure 4.5 bar	1. Check control air pressure. 2. Increase control air pressure to 6 – 7 bar if necessary.

Fault/message	Possible cause	Remedy
“Ready” signal does not come after switching on the 24 V power supply	Insufficient power supply	⇒ Check power supply.
	Pressure sensor fault	⇒ Replace device.
“Ready” signal does not come after start of self-calibration	Missing or insufficient pneumatic control air pressure	⇒ Check control air supply. NOTICE! Self-calibration was not completed.
	Pressure sensor fault	⇒ Replace device.
“Ready” signal goes out during operation	Failure of the electrical supply or excessive or insufficient supply voltage	⇒ Check power supply, see technical data sheet.
	Calibration activated and running	⇒ Wait until the calibration has ended.
	Calibration not completed successfully	1. Start calibration again. 2. Check control air pressure. 3. Replace device.
Output pressure lower than selected with target value or No “Pressure reached” signal	Control air pressure or cutting gas pressure too low	⇒ See chapter <i>Restoring the power supply</i> , page 50.
	Soiling in the valve	1. Only supply dry and pure gases in clean, particle- and dust-free lines. 2. If necessary, replace device.
	Tolerance window for “Pressure reached” signal set too low	⇒ Check tolerance window and set higher if necessary (only for "digital" version), see chapter <i>Process data objects</i> , page 45.
	Soiling of the input filter unit (only LGRPF model)	⇒ Change filter cartridges, see chapter <i>Filter change in the input filter unit</i> , page 52.
	Nozzle diameter too large, input pressure too low	⇒ Select smaller nozzle or higher input pressure.

Fault/message	Possible cause	Remedy
Output pressure higher than selected with target value	Soiling in the valve	⇒ If necessary, replace device.
Error message “gas warning” or gas error (only with digital version)	Control air pressure or cutting gas pressure too low	⇒ See chapter <i>Restoring the power supply</i> , page 50.
	Soiling in the valve	1. Only supply dry and pure gases in clean, particle- and dust-free lines. 2. If necessary, replace device.
	Soiling of the input filter unit (only LGRP model)	⇒ Change filter cartridges, see chapter <i>Filter change in the input filter unit</i> , page 52.
Gas mixture after gas change	Gas change times too short	⇒ Adjust the gas change times, see chapter <i>Selecting cutting gas input</i> , page 40.
Gas mixture without gas change	Upstream valve soiled or defective	⇒ If necessary, replace device.
Cutting pressure not stable	Target value fluctuations	⇒ Check target value signal.
	Soiling in the valve	⇒ If necessary, replace device.
Output pressure stops	Supply voltage missing, upstream valve not switched off	⇒ Apply supply voltage or switch off upstream valve.
Power supply: Output signal flashes with 1 Hz	Input voltage outside of 24 V DC ± 10 %	⇒
Controller output: Output signal flashes with 2 Hz	Input pressure too low or lacking control pressure (pilot air)	1. Check input pressure, min. 5 bar. 2. Check control air pressure, min. 4 bar.
Offset of the sensors: Output signal flashes with 3 Hz	Calibration of sensors not successful	⇒ Switch valve on and off.

Tab. 4: Faults

8.1 Restoring the power supply

With failure of the electric or pneumatic power supply, the output of the device is ventilated within 200 ms in order to prevent an escape of the process gases. There is no pressure on the output and further gas escape on the output is prevented.

1. Switch control signals of the upstream valves and the target value of the gas output to "OFF".
 - ↳ When the pneumatic control air supply is restored, the device goes into the operating state specified by the input signals.
2. As soon as the pneumatic control air supply is available again, activate the control signals of the upstream valves and the target value of the gas output.
 - ↳ Once the electric power supply is restored, the device automatically starts an initialization that takes 5 – 15 s. During this time, there is no pressure on the gas output. After that, the device goes into the operating state specified by the input signals.
3. As soon as the ready signal "ON" is indicated, activate control signals of the upstream valves and the target value of the gas output.

9 Service



⚠ WARNING

Personal injury and property damage due to improper servicing

Malfunctions can result.

- In case of fault, do NOT service the device.
- In case of fault, shut the device down immediately.
- Remove the complete valve and send it to the manufacturer's local agent for servicing.

9.1 Inspection and maintenance plan

Work to be performed	ir	d	w	¼ y	y	oh
<ul style="list-style-type: none"> ■ Check compressed air and gas connections for leaks. 				X		
<ul style="list-style-type: none"> ■ Check electrical cable for cracks, kinks, and damage to the cable insulation. ■ Replace damaged cables. 				X		
<ul style="list-style-type: none"> ■ Check electrical plug connection and union nuts to ensure they are tight. ■ If necessary, tighten union nuts. 				X		
<ul style="list-style-type: none"> ■ Check fixed clamping of the screen on the screening clamp. ■ If necessary, fix or replace clamp. 				X		
<ul style="list-style-type: none"> ■ Check body connection between LGR and machine body. ■ If necessary, tighten screws. 				X		
<ul style="list-style-type: none"> ■ Check screws to ensure they are tight, tighten if necessary. 				X		
<ul style="list-style-type: none"> ■ Check type plates to ensure they are present, visible, legible, and complete; replace if necessary. 					1	
<ul style="list-style-type: none"> ■ Check filter cartridges in input filter unit for soiling and replace if necessary. (Only for LGRPF model) 	ir				1	
Legend: ir = if required, d = daily, w = weekly, ¼ = quarterly, y = annually, oh = operating hours						

9.2 Filter change in the input filter unit



⚠ DANGER

Mortal danger due to unsuitable components!

The use of unsuitable components can cause life-threatening injuries.

- Use only the manufacturer's filter sets since these are suitable for oxygen use.



⚠ DANGER

Mortal danger due to incorrect greases!

The O-rings of the filter elements are pre-greased with oxygen-suitable grease. The use of other greases can cause life-threatening injuries.

- Never re-grease O-rings.



A filter change can only be done in the models LGRPF (LasGAR Plus), LGRBF (LasGAR Basic), and for the LASFIL Compact.

The input filter unit is equipped with one filter per gas input and one filter for the control air connection. Soiled filter elements can be changed out.

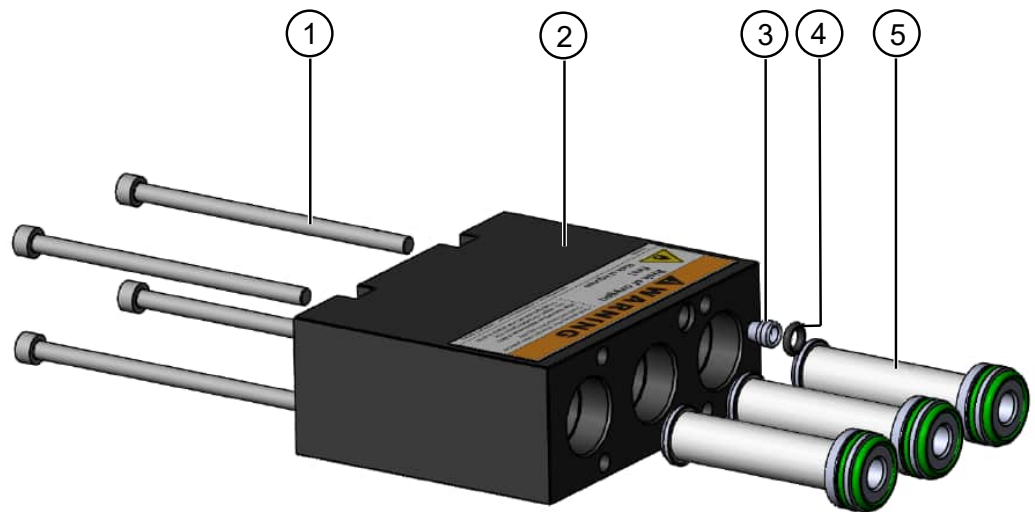


Fig. 35: Filter unit with replacement filters

1	Fastening screws	4	O-ring
2	Filter housing	5	Filter cartridge cutting gases
3	Filter use control air		

Replacement filters can be ordered using the following item numbers:

Filter	Item number	Scope of delivery
Filter set for cutting gas inputs	PS12739A	1 filter cartridge with O-rings mounted and pre-greased with oxygen grease
Filter set for control lift input	PS12740A	1 filter element 1 O-ring

Tab. 5: Replacement filter

9.2.1 Taking device out of service



⚠ DANGER

Mortal danger due to residual energies!

After switching off, there are residual electrical and pneumatic energies on the device that have to be reduced slowly and can cause life-threatening injuries if the device is touched.

- Disconnect the device from electrical and pneumatic power supplies before dismantling.
- Wait 10 seconds until residual energies in the system have been reduced completely.



⚠ WARNING

Risk of injury due to pressure

- Do not perform any work on the valve when it is pressurized.

1. De-energize and depressurize the device.
2. Lock and ventilate the gas and compressed air supply.
3. Wait 10 seconds until residual energies in the device have been reduced completely.
4. Check whether the gas and pressure supplies are depressurized.

9.2.2 Changing the gas filter

1. Loosen the 4 fastening screws (1) in order to loosen the filter unit from the LasGAR or the connection plate.
2. Pull the filter cartridge (5) out of the filter housing (2) using an M8 screw.
3. In the filter housing (2), check the installation space of the filter cartridge (5) for soiling and clean if necessary.
4. Push the new filter cartridge into the filter housing (2) and press it in by hand up to the stop. In the process, heed the correct position of the two pre-mounted O-rings.
5. Screw the filter unit with 4 fastening screws (1) to the LasGAR or the connection plate, tightening torque $6 \text{ Nm} \pm 0.5 \text{ Nm}$.

9.2.3 Changing the control air filter

1. Loosen the 4 fastening screws (1) in order to loosen the filter unit from the LasGAR or the connection plate.
2. Remove O-ring (4) from the control air connection.
3. Remove the filter insert (3) from the filter housing (2).
4. In the filter housing (2), check the installation space of the filter insert (3) for soiling and clean if necessary.
5. Insert the new filter insert (3) into the filter housing (2).
6. Insert the O-ring (4).
7. Screw the filter unit with 4 fastening screws (1) to the LasGAR or the connection plate, tightening torque $6 \text{ Nm} \pm 0.5 \text{ Nm}$.

10 Decommissioning and disposal

10.1 Decommissioning/dismantling



⚠ WARNING

Risk of injury due to pressure

- Do not perform any work on the valve when it is pressurized.



⚠ DANGER

Mortal danger due to residual energies!

After switching off, there are residual electrical and pneumatic energies on the device that have to be reduced slowly and can cause life-threatening injuries if the device is touched.

- Disconnect the device from electrical and pneumatic power supplies before dismantling.
 - Wait 10 seconds until residual energies in the system have been reduced completely.
1. De-energize and depressurize the device.
 2. Lock and ventilate the gas and compressed air supply.
 3. Wait 10 seconds until residual energies in the device have been reduced completely.
 4. Check whether the gas and pressure supplies are depressurized.
 5. Loosen electrical cabling.
 6. Loosen gas lines.
 7. Take device components apart.
 8. Dispose of components, see chapter *Disposal*, page 55.

10.2 Disposal

The disposal of the packaging and used parts is the customer's responsibility.

- ⇒ Dispose of the product according to the local regulations at approved collection points or have removed by approved disposal companies.

11 Appendix

11.1 Product observation

Our goal is continuous enhancement of our products and close cooperation with the customer. Please tell us about faults or problems with the valve.

11.2 Material defects and defects of title

These operating instructions and technical details with respect to the specifications and figures in these operating instructions are subject to change without notice.

The company HOERBIGER Flow Control GmbH makes no quality or durability guarantees, and also no guarantees about suitability for a particular purpose. These must be agreed upon expressly in writing. Public statements, promotions, and advertising do not constitute quality specifications for the product.

The operator's claims relating to material defects and defects of title assume that he presses this claim in writing immediately, at the latest within two working days. HOERBIGER Flow Control GmbH is in no case responsible for damage to the product itself or consequential damages caused by the product that are caused by improper handling of the product.

Insofar as HOERBIGER Flow Control GmbH is responsible for a defect, HOERBIGER Flow Control GmbH will, at its option, provide rectification or substitute performance.

Liability of HOERBIGER Flow Control GmbH – regardless of the legal justification – exists only in case of intention or gross negligence, negligent injury of life, body, health for defects that were fraudulently concealed or whose absence was guaranteed expressly in writing. Furthermore, according to the product liability law for personal injury or property damage to privately used objects.

In case of negligent injury of essential contract duties, HOERBIGER Flow Control GmbH is also liable, also in case of slight negligence, however limited to the contract-typical, foreseeable damages. Additional claims are excluded.

In case individual regulations of these operating instructions, the applicable legal regulations or other instructions of HOERBIGER Flow Control GmbH are disregarded, material defects and defects of title are terminated.

In particular, HOERBIGER Flow Control GmbH is not responsible for failures or faults that are caused by modifications by the customer or other persons. In such cases, the repair costs due will be invoiced. These will also be invoiced for the checking of the device if no fault could be found on the device.

There are no claims to the availability of previous versions and to the ability to refit devices delivered to the respective current series state.

11.3 Declaration of conformity

The current declaration of conformity is included in the scope of delivery and it can be found in the download area on the company's website:

<http://www.hoerbiger.com/>



