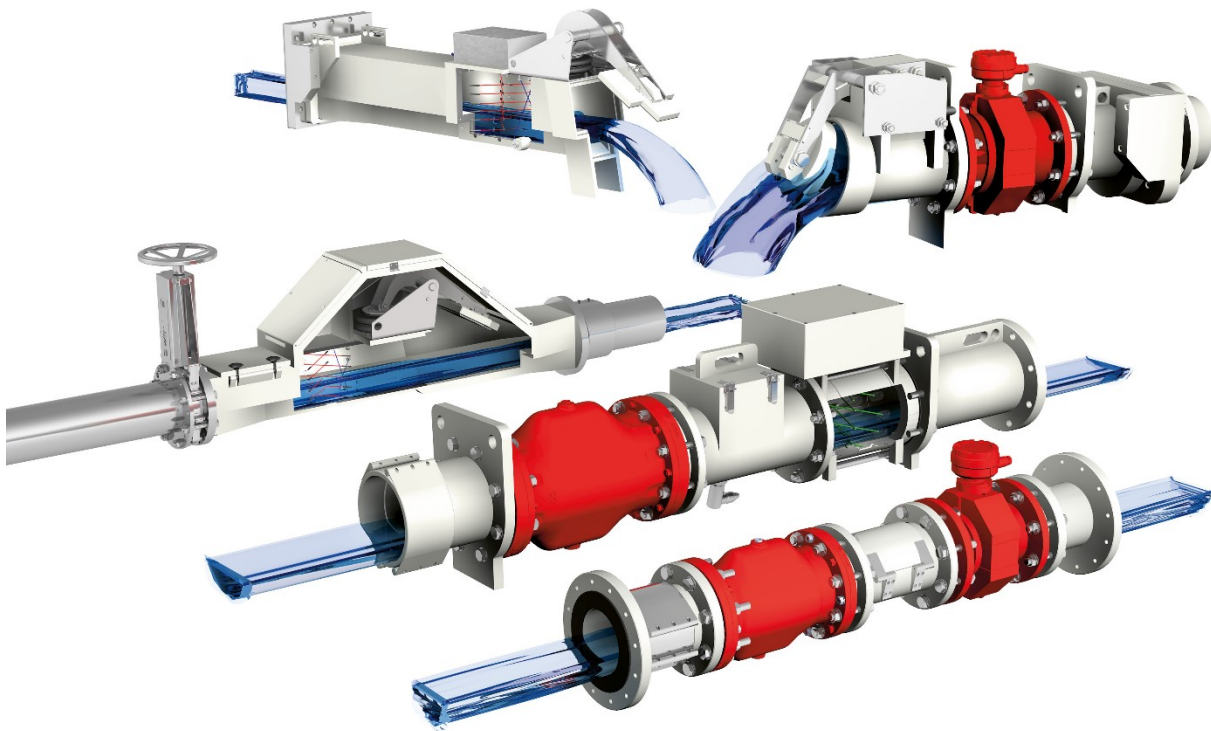


Technical information

Pneumatic outflow control

Pneumatically driven control elements for precise volume limitation of wastewater and rainwater



Imprint

STEBATEC AG
Mattenstrasse 6a
CH-2555 Brugg

Phone 032 366 95 95
E-mail info@stebatec.ch
Web <http://www.stebatec.ch>

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List of changes

| Date | Version | Description | Author |
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| | | | |
| | | | |

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1 Introduction



Attention

This technical information is no substitute for the operating instructions. In particular, the warning and safety instructions required in accordance with DIN EN 82079-1 (preparation of information for use (instructions for use) of products), which are necessary for installation, maintenance and troubleshooting on site, are missing.

Table 1: Marking of indications

This technical information is an abridged version of the operating instructions for the pneumatic outflow control. Contact STEBATEC if you wish to obtain the detailed operating instructions, which contain the necessary warnings and safety instructions as well as further information.

2 Device variants

The pneumatic outflow control can be supplied in many variants. The design and functionalities always depend on the area of application and the customer's needs.

In the following table, the abbreviations of the types are explained, as only the abbreviations are usually used in the instructions.

| Designation | Meaning |
|-------------|----------------------------------------------|
| B | Bellows |
| DS | Version with one pressure probe (Drucksonde) |
| ExZ2 | ATEX version Zone 2 |
| ExZ1 | ATEX version Zone 1 |
| gB | Closed construction (geschlossene Bauweise) |
| H | Lifting bag (Hebekissen) |
| iR | In the tube (im Rohr) |
| LDM | Transit time difference flow measurement |
| MID | Magnetic-inductive flow measurement |
| PNA | Pneumatic outflow control |
| POR | Portable flow measurement |
| QV | Pinch valve (Quetschventil) |
| RA | Version with radar |
| RVA | Control valve remote |
| SCH | Scissors |
| STA | Stationary |
| TF | Partly filled (Teilgefüllt) |
| VF | Fully filled (Vollgefüllt) |
| Wö | Maintenance opening (Wartungsöffnung) |

Table 2: Abbreviations Unit variants

3 Product description

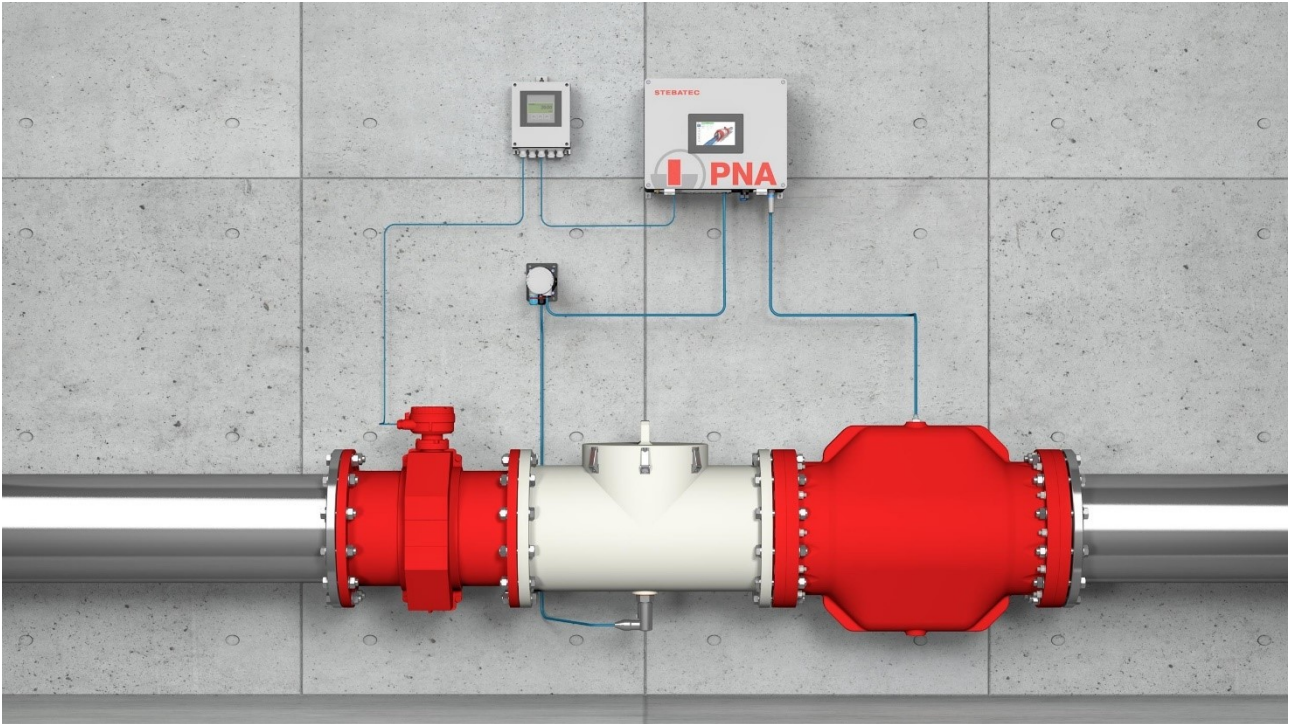


Figure 1: PNA with MID and QV

3.1 Short description

The pneumatic flow control is used to measure and control the flow of water or wastewater.

The pneumatic outflow control essentially consists of a flow measurement, a control device including a compressor and a control cabinet.

Flow measurement can be carried out using MID (electromagnetic flow measurement) or LDM (ultrasonic transit time differential measurement). Both systems can be operated partially or fully filled, whereby the LDM method should be used for partial filling and the MID technique for full filling, due to the respective advantages.

As a side effect, the flow measurements can also be used for cost accounting or for testing for extraneous water.

The system is suitable for water, wastewater, and raw sewage. With the help of a suspension adaptor, the pneumatic outflow control can be easily installed and removed again.

The pneumatic outflow control has the following features:

- Can be used in partly filled pipes in the water and wastewater industry
- Can be supplied for nominal diameters from DN 150 to DN 1200
- Has a high resistance to abrasion and chemicals
- Does not need to be calibrated on site, as this is done completely at the factory

The pneumatic flow control can be used for flow control of the following liquids:

- Water
- Rainwater
- Wastewater
- Raw sewage
- Biologically and chemically contaminated wastewater

3.2 Areas of application

Pneumatic outflow control is mainly used in structures with a storage function in sewers and drains. The aim is to avoid having to discharge part of the wastewater into the receiving waters when large amounts of wastewater are produced. So, if heavy rain occurs, the wastewater mixed with the rain can be partially or even completely retained in these retention basins. After the rain event, the wastewater can then be gradually fed to the treatment plant and purified there.

3.3 Operating modes

The pneumatically controlled flap ensures full filling of the MID and throttles the flow rate to an adjustable maximum value. With the LDM measuring method, no full filling is required.

The control flap is actuated by a pneumatic pressure cushion (or lifting cushion). When the lifting bag is inflated, the flap closes via a lever arm. In the depressurised state, the flap remains open. This is to ensure that no backpressure is produced if the compressor is defective.

If the pneumatic outflow control is supplied with a pinch valve, the flow cross-section is reduced for throttling the flow by means of two laterally closing bladders. In the depressurised state, there is no throttling by the bubbles.

The following illustration shows the principle of the operating states, provided the operating mode is not batch operation:

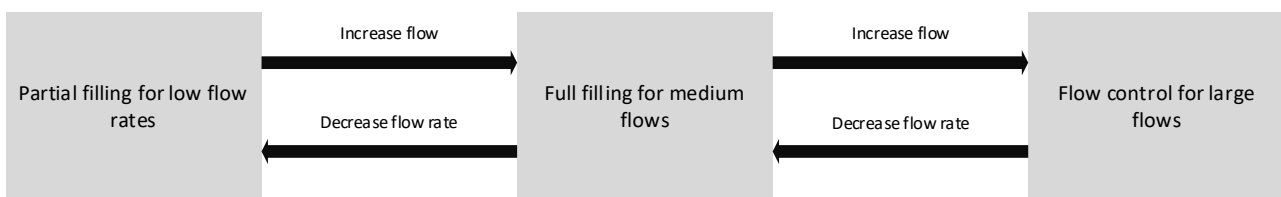


Figure 2: Principle of the operating modes

However, not all operating modes have to be possible. The transition between the operating modes occurs via threshold values of the liquid level or the flow rate as well as by means of corresponding delay times. However, the flow control can also be considered as a variant of full filling, as this is activated. In addition, however, the flow is limited to that of the flow control. As an effect of this, the flow (or the flow rate) is regulated instead of the level. As soon as the flow falls below that of the limit value of the flow control, but the switchover condition to partial filling has not yet been fulfilled, the pneumatic flow control is again in the operating mode of full filling.

In batch mode, the liquid is retained for a certain time and then drained off in a controlled manner.

There were still two possibilities for self-purification: The flush push and the bed load discharge. The flush push is intended to prevent sedimentation in the tube of the pneumatic outflow control. The bedload discharge is intended to prevent the control valve from being blocked by bedload.

Finally, the pneumatic drain control can be operated in remote mode on the one hand and in manual mode on the other (or in a combination of the two states).

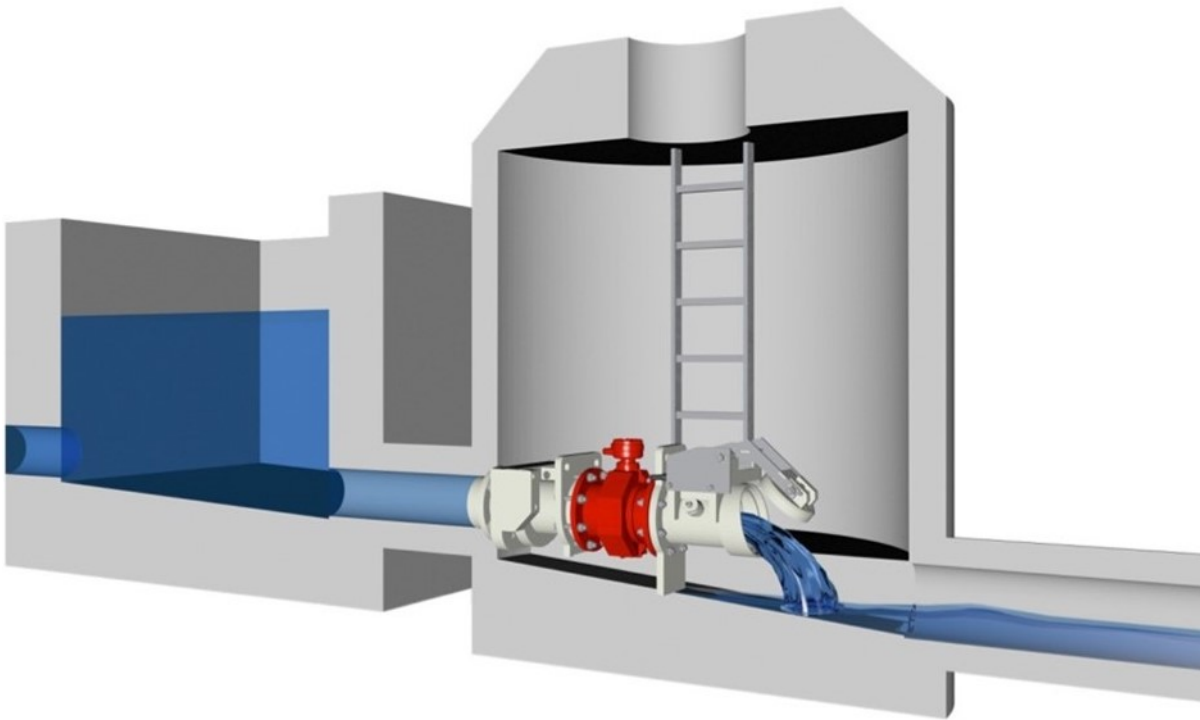


Figure 3: Example of a MID-controlled pneumatic outflow control system (PNA)

3.4 Full filling control

The terms “full fill” (VF) as well as “full fill control” (VR) are considered synonymous.

Full-fill control is possible precisely if the type of measurement of the flow is not LDM (i.e., “ultrasonic transit time differential measurement”).

If full-fill control is possible and the throttle quantity is undercut due to dry weather, the control switches to automatic full-fill after a corresponding time has elapsed. Controlled by the signal of the integrated pressure probe, the control damper opens only so far that the sensor is always fully filled. The advantage of the full-fill control is that the measuring sensor (magnetic-inductive flow measurement for full filling) thereby provides the highest measuring accuracy.

The next illustration shows the principle of full-fill control graphically. In this case, the control takes place with a control damper:

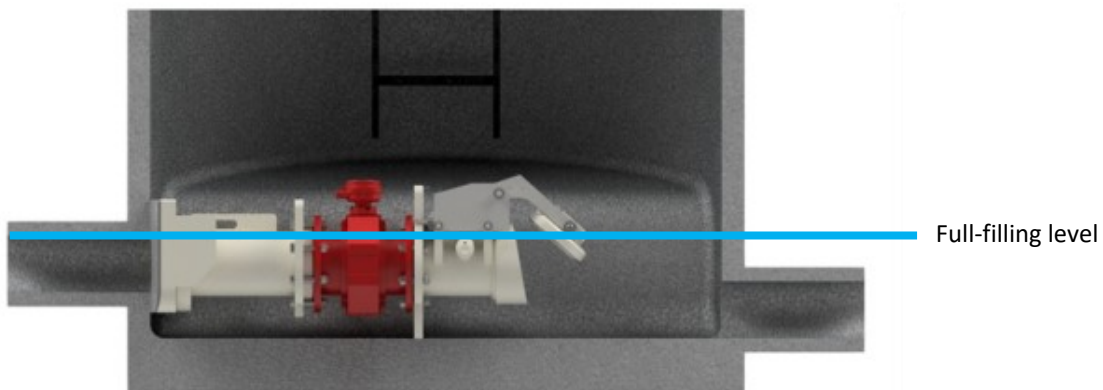


Figure 4: Full fill level MID

3.4.1 Example MID with QV

In a system with an MID measuring system and a pinch valve as the regulating organ, full filling works as follows:

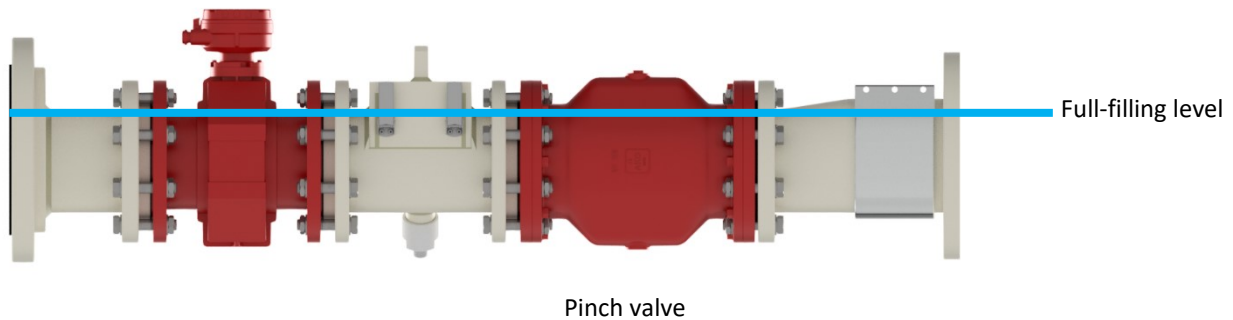


Figure 5: Full-fill level MID with QV

The pinch valve regulates the flow rate accordingly so that the full filling level is always reached around the MID measuring system. The full filling is important for the measurement to be able to record precise data.

System behaviour

- The flap works steadily to regulate the liquid level to full fill
- The measured values flow measurement are valid
- There is a risk of deposits because the flow rate of the liquid is permanently throttled to a small value
- The regulation takes place according to level
- Flush pushes are possible
- Bedload discharges are possible

3.5 Volume regulation

Continuous flow control is activated by the corresponding configuration.

If continuous flow control is possible and the parameterised throttle flow is exceeded, the operating mode is switched to flow control after the corresponding delay time has elapsed. In this case, the control is controlled according to the signal of the flow measurement. The flow rate control limits the flow rate accordingly.

System behaviour

- The flap works steadily
- The measured values flow measurement are valid
- If the measurement is correctly dimensioned (flow rate [Q] not too low), there should hardly be any deposits.
- The control takes place according to flow
- Flush pushes are not possible
- Bedload discharges are possible

3.6 Flush push

Flush pushes are only possible if they are enabled accordingly in the pre-setting's, otherwise they are blocked. In addition, the pneumatic flow control must not be used for flow control in batch mode.

Flush pushes have the following characteristics:

- Removal of deposits around the pneumatic outflow control system
- Can be carried out up to four times a day over fixed adjustable times
- Manual, via remote mode, triggerable
- Can be triggered automatically via blockage detection

If a flush push is carried out, the first thing that happens is that the flap is completely closed. The accumulation lasts either for the maximum accumulation time set or, if this event occurs earlier, until the level inside the measuring pipe exceeds the maximum accumulation level.

After the damming process is finished, the flap is fully opened. The flush push is terminated if the level in the measuring tube falls below the minimum accumulation level and the minimum duration of the flush push is reached.

If the liquid level is permanently higher than the minimum accumulation level, the flush push is stopped when the maximum emptying time has elapsed.

The flush push can also be aborted if the measured flow is greater than the set value of the flow rate control. A prerequisite for this type of flush push termination is that the flow control is not blocked.

3.7 Bedload discharge

The bed load discharge must be activated in the default settings so that a blockage of the control damper is checked and activated. The interval time between two discharges must have elapsed before a bedload discharge can be carried out.

The bedload discharge is carried out by opening the flap completely for a short time to remove any blockage of the control flap.

3.8 Partial filling

The terms “partial filling”, “partial filling control” and “partial filling mode” are considered synonymous in these operating instructions.

The partial fill mode is permanently activated in systems with a partial fill capable flow measurement. The unit automatically switches to flow control when the maximum flow is reached.

In the version with electromagnetic flow metering (MID), the control damper automatically keeps the system full. This leads to a basic build-up in the preceding pipe. The partial fill mode now allows the control damper to remain open in dry weather and only switch to full fill and flow control mode when the water level rises. Without a basic backwater, the risk of deposits in the sewer system is reduced. If the MID is later to be used again for measuring the flow, the partial filling mode can simply be suppressed with one click. The configuration of the behaviour of the pneumatic outflow control regarding partial filling and the calculation of the flow rate is described in the following chapters, which deal with the configuration of the PNA.

3.9 Manual operation

Manual operation allows the flap to be operated manually, for example for testing or troubleshooting purposes.

3.10 Remote mode

By means of remote mode, the pneumatic outflow control can be operated externally or connected to other systems in an automated manner, for example for higher-level control of the discharge.

3.11 Self-checking

The pneumatic outflow control is equipped with a self-check. This is used to check whether it is working correctly. The following measured values are used for the self-check:

- Flow rate [l/s]
- Impoundment height [mm]
- Pneumatic control pressure [mbar]

3.12 Compressor, drainage, and monitoring

Condensate accumulates in the compressor's pressure accumulator over time. The compressor can be drained up to four times a day for an adjustable period. When the emergency position is activated, the condensate drain is suppressed so that the pressure accumulator can maintain the pressure for as long as possible.

The compressor can be monitored with the help of a current measurement. With the help of the monitoring, the maximum running time of the compressor and the minimum pause time of the compressor can be monitored. This monitoring can be used to detect leaks in the compressed air system or "nervous regulation". An unfavourable control setting causes unnecessary wear of the control unit of the pneumatic outflow control.

Elements that can be monitored or controlled on the compressor:

- Drainage
- Runtime monitoring
- Current measurement
- Voltage monitoring
- Switch-off behaviour in the event of a fault

4 Designs

If necessary, the pneumatically controlled regulating flap ensures that the measuring sensor is fully filled and throttles the flow rate to an adjustable maximum value. The control damper is pneumatically controlled, the upstream pressure defines the position of the throttle damper. In the depressurised state, the control damper opens. The following subsections describe the different designs of pneumatic flow control.

4.1 Control damper fully filled

For all installation locations where it is possible and permissible to throttle the supply flow until the supply pipe is full, flow measurement can be carried out by means of MID (electromagnetic inductive flow measurement). The main advantages of MID measurement are the low system costs and good measurement accuracy compared to other measurement methods, as well as the robust and largely maintenance-free design.

Flow measurement and control on the fully filled pipe cause a low flow velocity at low flow rates. These favours increased deposits in the inlet pipe or channel.

If no precise flow control is required at low flow rates, this disadvantage can be countered by using the partly filled mode. In this case, at low flow rates, the control damper is open to a preselected opening angle (set via the cushion pressure) and the liquid flows out unrestricted. If a preselected liquid level (accumulation height) in the pipe or a calculated flow value is exceeded, the system switches over to full-fill control, provided the corresponding delay time has elapsed. If the measured flow exceeds the corresponding value of the flow control, the operating mode of the pneumatic flow control is switched to flow control. Correspondingly, it is switched back to full filling if the measured flow falls below the set value of the flow control. Since the flow control can be considered a variant of the full fill, the mechanical system is not stressed by a quick change from full fill to flow control and back again.

The partial filling control can be suppressed at any time via the corresponding parameter.

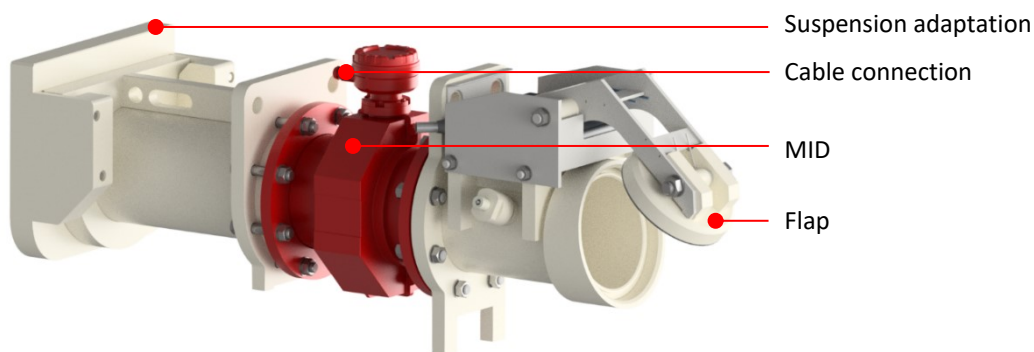


Figure 6: Fully filled MID-controlled discharge control, flap open

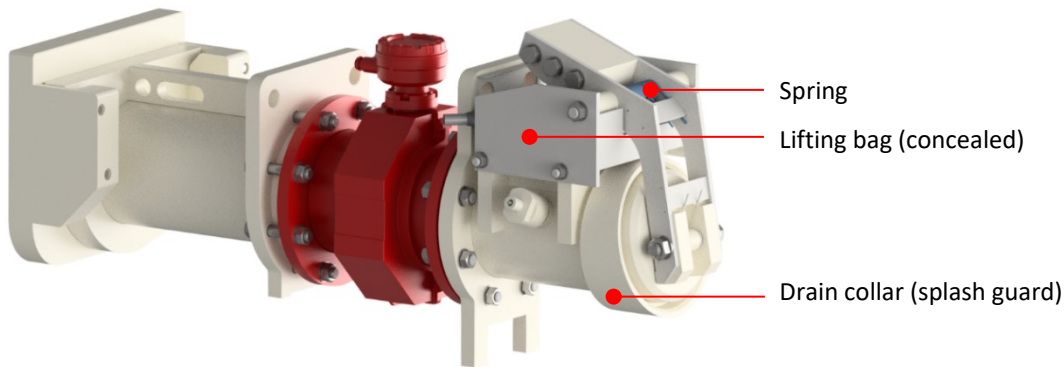


Figure 7: Fully filled MID-controlled discharge control, flap closed

4.2 Control damper partly filled

An ultrasonic transit time differential measuring system (LDM) is used as standard for flow measurement and control in the partly filled channel. This system measures the flow velocity in several (usually six) horizontal planes arranged one above the other and calculates the flow rate very accurately from this, linked to the liquid level. The reduction of the channel cross-section due to the shaping of a dry weather channel leads to an increase in the flow velocity at low flows, to an increase in the measuring accuracy and to a reduction in deposits on the channel bottom. The functional principle and design of the ultrasonic transducers ideally require channel walls that are parallel and opposite each other. To ensure the smoothest possible laminar flow in the measuring device, the transition between different channel cross-sections takes place by means of a specially shaped transformation section.

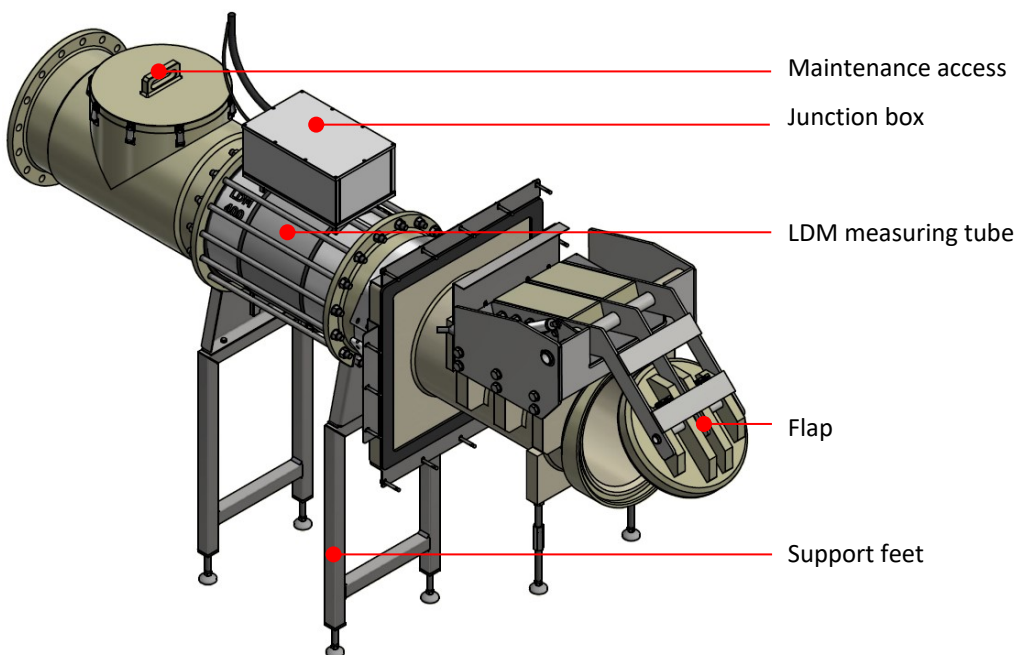


Figure 8: Partially filled LDM-controlled discharge control, flap open

4.3 Pinch valve fully filled

As an alternative to the control damper, a pneumatically controlled pinch valve can also be used. In this configuration, the flow is measured by means of MID (electromagnetic flow measurement), which is preferably used for fully filled pipes.

Advantages of pinch valves compared to conventional knife gate valves are:

- Pinch valve enables venting in the pipe apex, which prevents the formation of air bubbles in the controlled system that interfere with the flow measurement
- Highly accurate control with shortest reset times and no runtime limitation
- Pneumatic drive in the wet ATEX environment instead of electric drive
- Compact flow measuring and control system incl. calming sections with minimum space requirement
- Continues to throttle in the event of mains or equipment failure with an emergency programme
- Is easy to maintain and can be opened for cleaning without tools

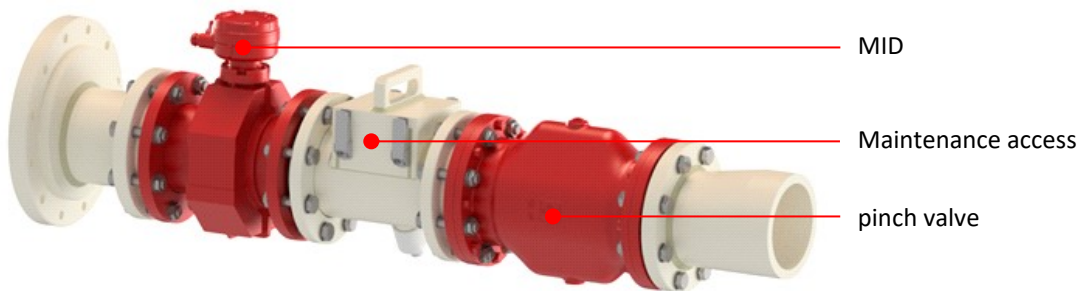


Figure 9: Fully filled MID-controlled discharge control with pinch valve

4.4 Pinch valve partly filled

Instead of the MID, the measuring point can also be equipped with an LDM. The advantages of the pinch valve and the characteristics of the LDM are already described in the previous chapters.

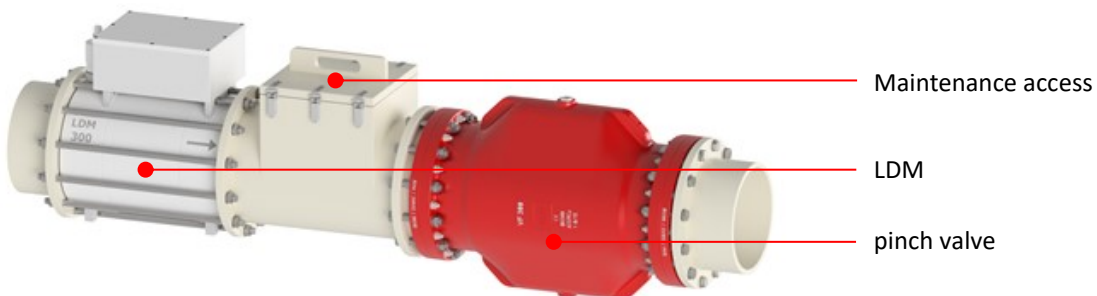


Figure 10: Partially filled LDM-controlled drain control with pinch valve

4.5 Wet set up, open construction

The term “wet installed” means that the liquid can flow freely from the measuring and control system into the surrounding shaft structure.

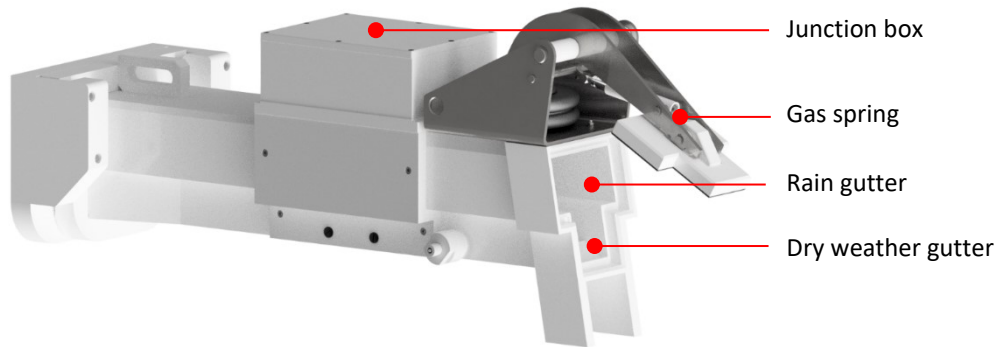


Figure 11: Wet-installed partly filled pneumatic outflow control, flap open

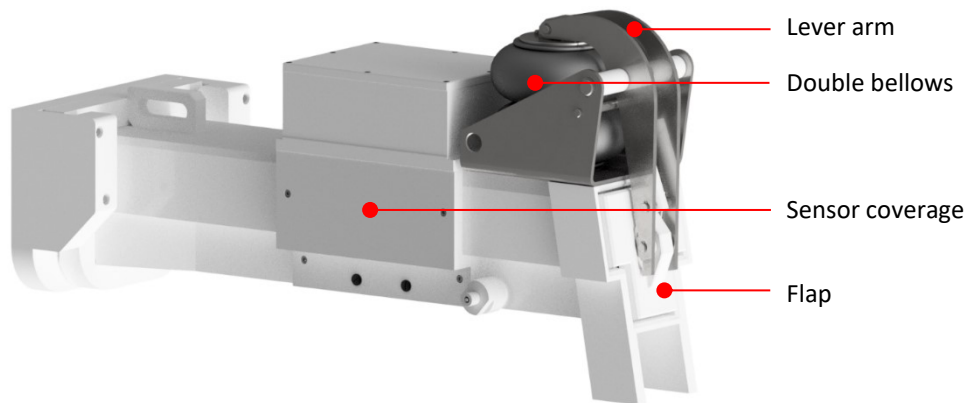


Figure 12: Wet-installed partly filled pneumatic outflow control, flap closed

4.6 Dry-installed, closed construction

Due to the complete encapsulation of all components of the measuring and control system located in the shaft, it can be installed dry in the shaft. This means that no liquid from the capsule mounted between the inlet and outlet enters the surrounding shaft structure, so that it remains largely free of aggressive gases and liquids.

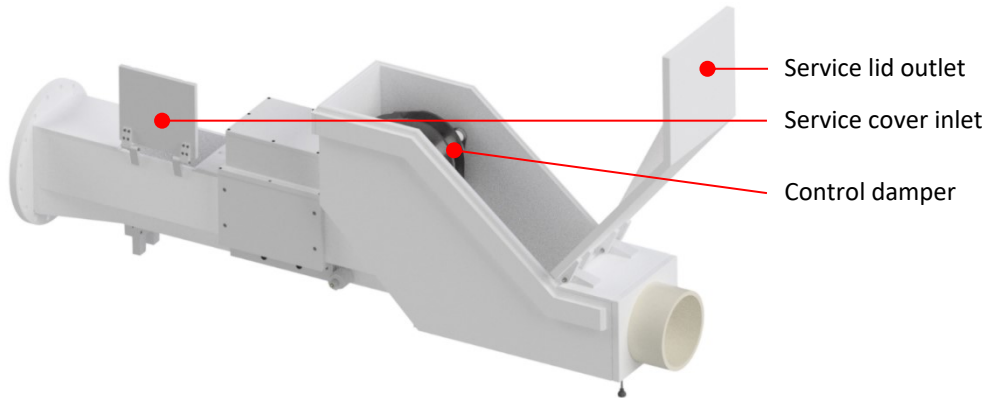


Figure 13: Wet-installed partly filled pneumatic outflow control, flap open

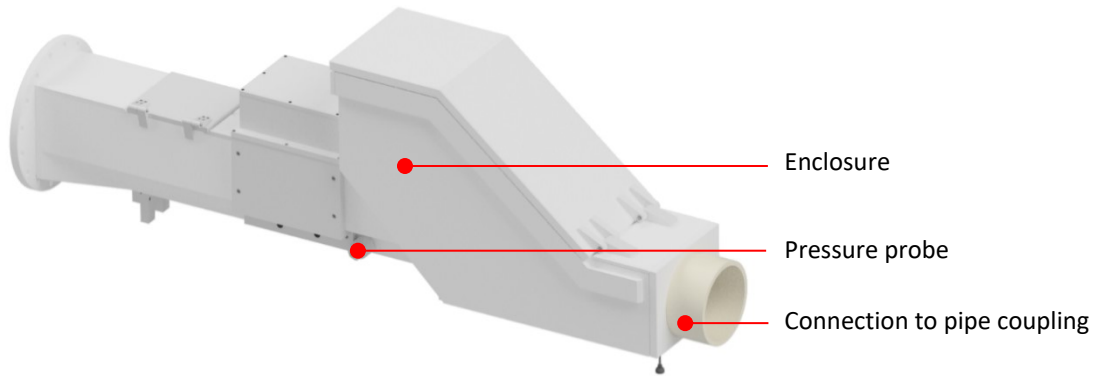


Figure 14: Wet-installed partly filled pneumatic outflow control, flap closed

5 Compressed air

The control damper of the pneumatic outflow control is operated with compressed air. The following subsections describe the components.

5.1 STEBair compressors

Oil-free compressors are used to provide compressed air. If required, low-noise compressors can also be used. For a long and trouble-free operation, regular maintenance according to the operating instructions as well as cleaning of the intake area and the cooling air ducts are important prerequisites. Drainage of condensate from the air receiver should be carried out at least every three months. The runtime monitoring and drainage can be carried out automatically if desired. With this automatic drainage, the time of day as well as the drainage duration can be set.

There are basically three versions of the oil- and maintenance-free STEBair compressors.

STEBair silenzio Mini



STEBair silenzio Standard



STEBair silenzio Grande



Figure 15: Designs of the pneumatic outflow control compressors

5.2 Remote control unit

If the distance between the PNA control unit and the PNA control box is more than 15 metres, the control valve is placed in a separate box as close as possible to the control unit, but outside the hazardous area. In addition to the control valve, this box also contains a 24VDC supply. For use inside the Ex-zone, the system is available in an ATEX version for zone 2.

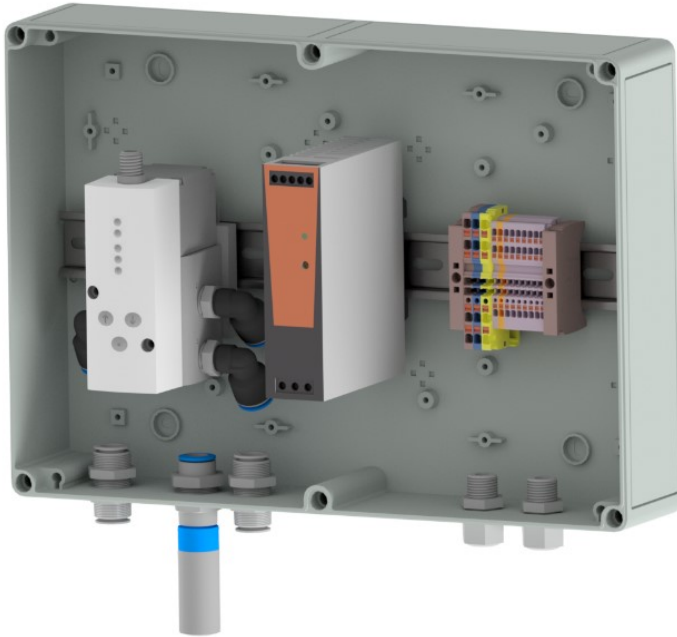


Figure 16: Remote control unit

6 Scope of delivery

- Complete, according to customer specification, pre-assembled pneumatic outflow control system
 - Incl. adapter elements for connections to customer installation
- Associated transmitters
- Connecting cable between discharge control and transmitter
-

6.1 Optional

- Remote control unit
- Compressor
- Emergency throttle unit
-

7 Technical data

The configuration for the pneumatic outflow control is always adapted to the customer's requirements. Due to the wide range of delivery options, only the most important generally applicable technical data are listed below.

| | |
|-----------------------|-------------------------------------------------------|
| Measuring range | 0.2 - 5000 l/s (depending on the nominal system size) |
| Control range | from 0.2 l/s |
| Nominal widths | 100 mm - 1500 mm |
| Materials | Polypropylene; metal V4A or according to requirement |
| Sealing material | EPDM (Ethylene propylene diene monomer rubber) |
| Temperature | 0 - 45 °C |
| pH range | 6 - 9 |
| Protection class | IP 68 |
| Compressed air supply | Compressor with automatic drainage |
| Power supply | 230 V / 50 Hz / 10 A |

The standard configuration includes a modem for establishing an Internet connection using all mobile networks up to 4G/LTE and VPN technology.

The following digital and analogue inputs and outputs as well as communication protocols can be used and configured:

| | Type | Description |
|-------------------------|-----------|-------------------------------------------------|
| Signal outputs | 4 - 20 mA | Instantaneous flow |
| | 4 - 20 mA | Set control value |
| | Digital | Quantity counter |
| | Digital | 2 x malfunction |
| Signal inputs | 4 - 20 mA | Set value of the controller |
| | Digital | Open (Remote) |
| | Digital | Close (Remote) |
| | Digital | Automatic |
| | Digital | Manual start cleaning |
| Communication protocols | RS 485 | ModBus RTU/ASCII |
| | RS232 | |
| | Ethernet | ModBus TCP |
| | VPN | Via internet / remote maintenance with STEBATEC |

Table 3: Overview data exchange

8 Possible sizes

8.1 Partially filled wet-installed construction method

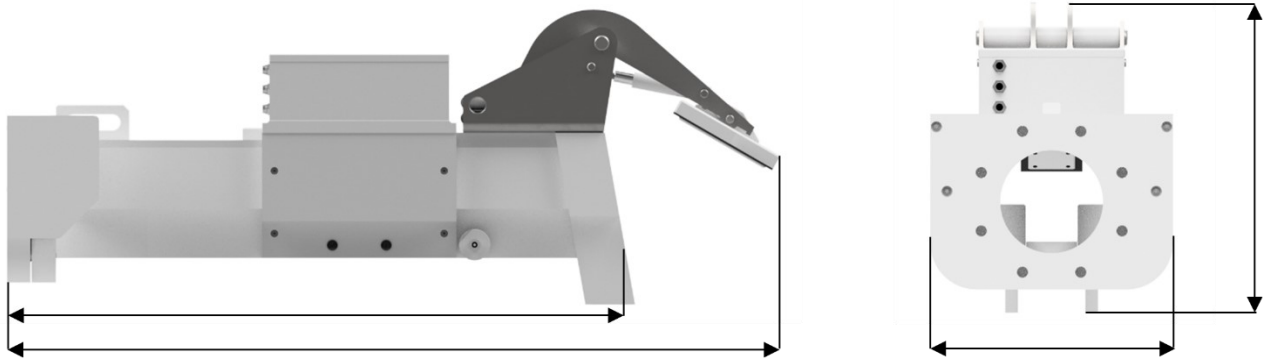


Figure 17: Dimension drawing Partially filled wet-laid construction method

| NW | Total length with open flap | Total length with closed flap | Total length with shortened design and open flap | Wide | Height |
|-----|-----------------------------|-------------------------------|--------------------------------------------------|------|--------|
| 200 | 1800 | 1460 | 1450 | 470 | 560 |
| 250 | 2180 | 1750 | 1570 | 530 | 700 |
| 300 | 2440 | 2000 | 1650 | 580 | 800 |
| 350 | 2780 | 2290 | 1800 | 650 | 860 |
| 400 | 3360 | 2580 | 2190 | 695 | 1000 |
| 500 | 4020 | 3160 | 2490 | 780 | 1200 |
| 600 | 4650 | 3720 | 2760 | 870 | 1450 |
| 700 | 5300 | 4300 | 3060 | 950 | 1795 |
| 800 | 6070 | 4970 | 3330 | 1050 | 2000 |

Table 4: Dimension table [mm] Partially filled wet-installed construction method

Additional space is required if the slide valve is mounted in front. Other sizes, shortened versions and solutions for special hydraulic conditions on request.

8.2 Partly filled dry-installed construction method

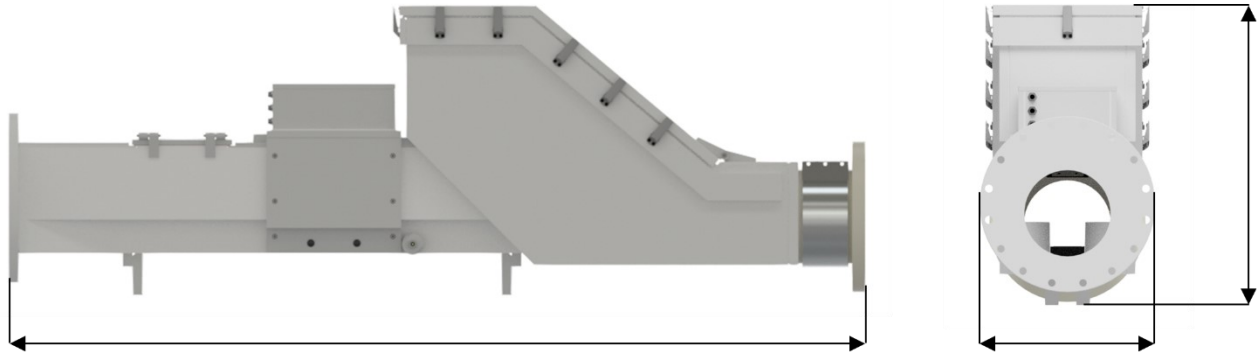


Figure 18: Dimension drawing Partly filled dry-installed construction method

| NW | Total length | Total length with shortened construction | Wide | Height |
|-----|--------------|------------------------------------------|------|--------|
| 200 | 2120 | 1690 | 450 | 700 |
| 250 | 2670 | 1980 | 520 | 790 |
| 300 | 2950 | 2080 | 550 | 880 |
| 350 | 3440 | 2370 | 620 | 950 |
| 400 | 3990 | 2720 | 700 | 1150 |

Table 5: Dimension table [mm] Partly filled dry-installed construction method

Additional space is required if the slide valve is mounted in front. Other sizes, shortened versions and solutions for special hydraulic conditions on request.

8.3 MID-controlled pneumatic outflow control with pinch valve

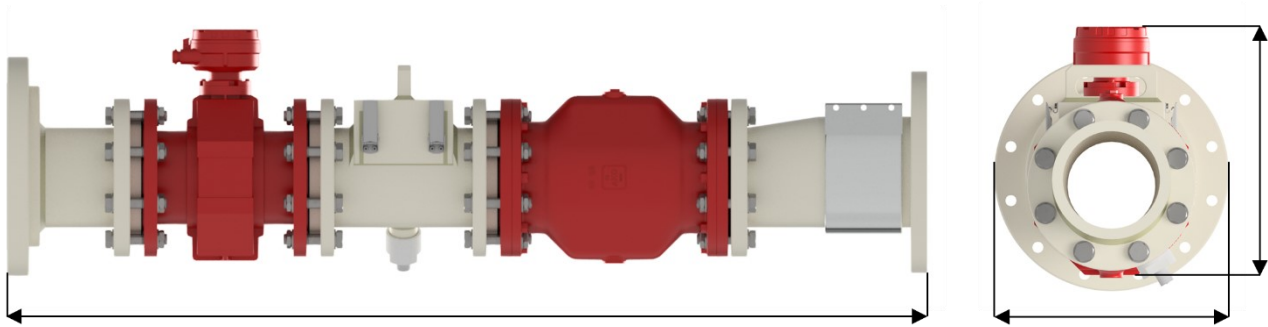


Figure 19: Dimension drawing MID-controlled pneumatic drain control with pinch valve

| NW | Total length | Total length with shortened construction | Wide | Height |
|-----|--------------|------------------------------------------|------|--------|
| 125 | 1545 | 810 | 310 | 420 |
| 150 | 1740 | 930 | 340 | 420 |
| 200 | 2125 | 1120 | 400 | 480 |
| 250 | 2495 | 1340 | 460 | 530 |
| 300 | 2880 | 1530 | 510 | 580 |

Table 6: Dimension table [mm] MID-controlled pneumatic outflow control with pinch valve

8.4 MID-controlled pneumatic outflow control

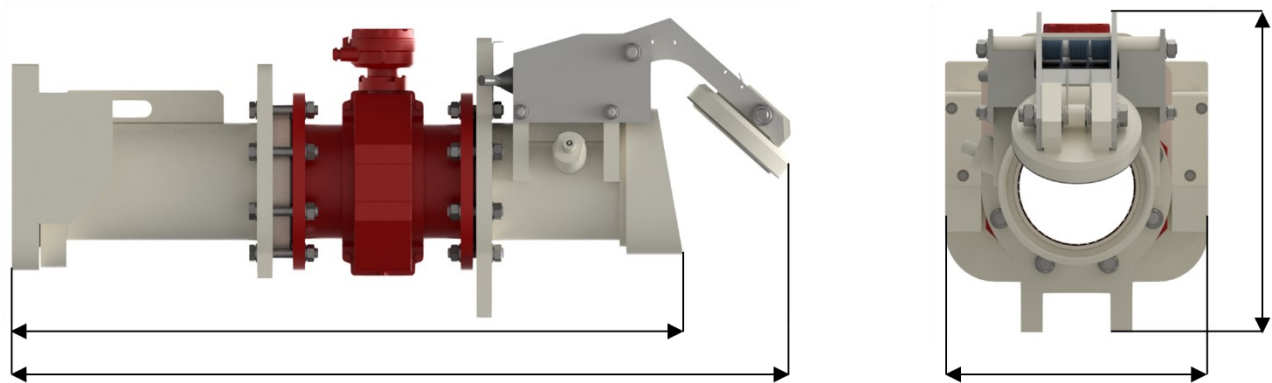


Figure 20: Dimension drawing MID-controlled pneumatic outflow control

| NW | Total length with open flap | Total length with closed flap | Total length with short-ened design and open flap | Wide | Height |
|-----|-----------------------------|-------------------------------|---------------------------------------------------|------|--------|
| 80 | 830 | 640 | - | 295 | 450 |
| 100 | 935 | 735 | - | 295 | 490 |
| 150 | 1170 | 960 | 1120 | 395 | 520 |
| 200 | 1475 | 1255 | 1260 | 480 | 570 |
| 250 | 1815 | 1565 | 1510 | 520 | 720 |
| 300 | 2200 | 1860 | 1770 | 575 | 810 |
| 350 | 2415 | 2045 | 1870 | 645 | 860 |
| 400 | 2700 | 2300 | 2040 | 720 | 910 |
| 500 | 3325 | 2825 | 2400 | 850 | 1080 |

Table 7: Dimension table [mm] MID-controlled pneumatic outflow control

Additional space is required if the slide valve is mounted in front. Other sizes, shortened versions and solutions for special hydraulic conditions on request.

8.5 LDM-controlled pneumatic drain control with pinch valve



Figure 21: Dimension drawing LDM-controlled pneumatic drain control with pinch valve

| NW | Total length | Total length with short-ened construction | Wide | Height |
|-----|--------------|-------------------------------------------|------|--------|
| 150 | 1980 | 1440 | 350 | 470 |
| 200 | 2470 | 1700 | 400 | 540 |
| 250 | 2940 | 1970 | 460 | 620 |
| 300 | 3420 | 2230 | 510 | 690 |

Table 8: Dimension table [mm] LDM-controlled pneumatic outflow control with pinch valve

If the cross-section and gradient of the inlet pipe remain the same, a shortened design with service cover can be used.

9 HMI / Operation

The pneumatic outflow control can be operated either via the touch panel on site or via a web interface. This is called up in the local network or optionally via the Internet.

The displays differ from each other in their presentation due to the periphery. However, the functionality of the software is the same for both versions.

9.1 Touch panel view

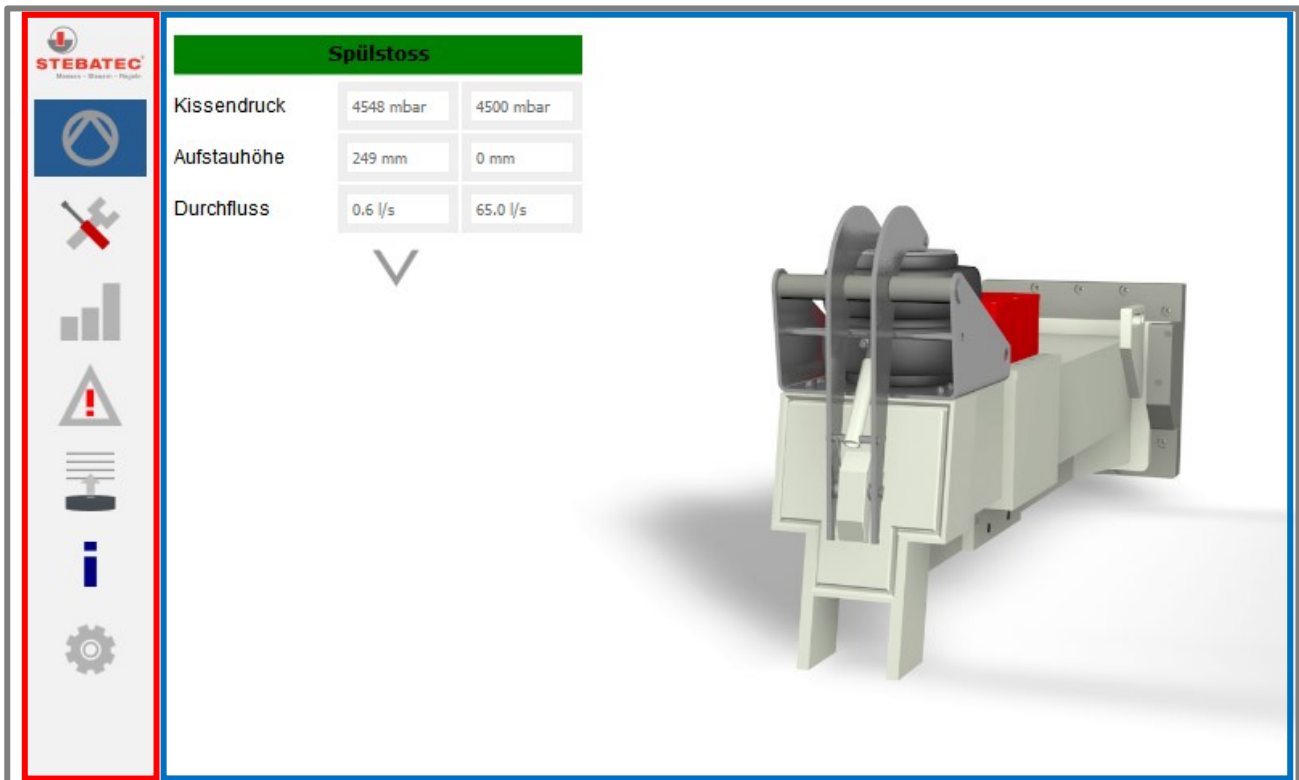


Figure 22: Touch panel basic screen

The navigation bar of the control panel is shown on the left side (red frame). The right side (blue frame) shows the respective detailed view of a menu or submenu item.

9.2 View WEB Interface

9.2.1 Normal state

The WEB interface is structured similarly to the HMI on the touch panel. The navigation menu is always displayed on the left side of the screen and the details of the currently selected menu item are displayed on the right side.

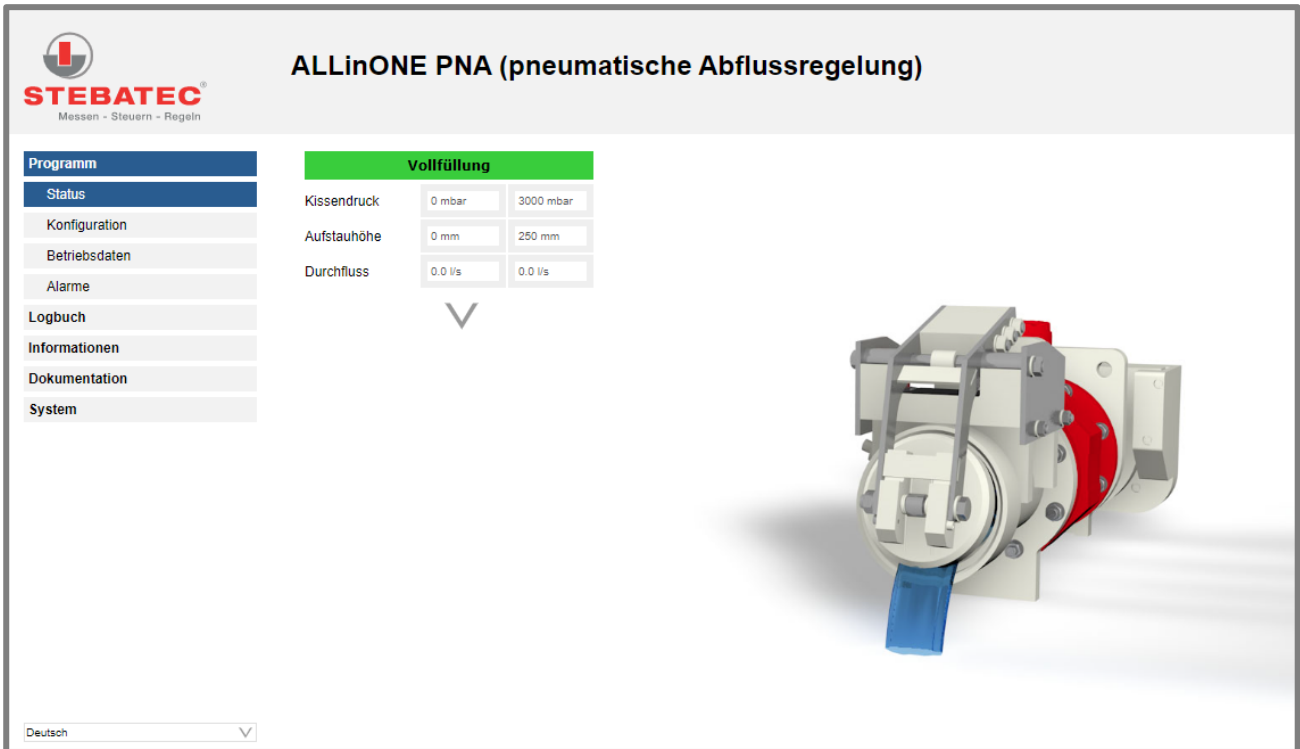


Figure 23: Basic WEB interface

10 Installation and commissioning

The installation and commissioning of STEBATEC products is carried out exclusively by STEBATEC fitters or by a partner qualified by STEBATEC.

10.1 Initial commissioning

The initial commissioning takes place after the STEBATEC installation team has completed and prepared the installation. According to the checklist, the agreed services of the installation are checked and accepted with the operator and the engineering office. This is followed by training for the persons to be instructed.

10.2 Configuration

The parameterisation of the factory settings is largely carried out during the initial commissioning and tests in STEBATEC's hydraulic laboratory. Other parameters are defined and set together with the customer on site.

11 Maintenance

STEBATEC products are designed in such a way that they do not require special tools for installation and removal during maintenance work.

11.1 Cleaning

The use of cleaning agents must be tested on non-visible test surfaces or on equivalent sample materials. STEBATEC accepts no liability for “test cleanings” carried out.

Depending on the degree of soiling, the unit must be removed and cleaned at least twice a year, if possible.

11.1.1 Cleaning recommendation

It should only be cleaned with pure water. If the soiling is increased, small amounts of neutral cleaning agents can be added. Sponges or cloths can be used for manual cleaning, but never use abrasive or scouring agents. If cleaning agents have been used, then rinse with clean water in any case.

The following means should be avoided in any case:

- Solvent
- Abrasive liquids
- Strongly acidic or alkaline remedies
- Detergents which have an unknown composition

11.2 Compressor

The compressors used are largely maintenance-free. For proper operation, the seal set must be replaced at regular intervals.

A preventive replacement is due after 5000 operating hours or after 7 operating years at the latest. If the tank filling time has increased by approx. 15-20% before these values, the seals must also be replaced.

11.3 Removal and installation



Caution

Protect the entire measuring and control equipment from damage with a protective coating.

To ensure that the removal and reinstallation of the pneumatic drain control functions smoothly, the following points must be observed:

- For safe installation in shafts and channels, a lifting device is recommended (e.g., cable winch, pulley block or crane). This enables the operating personnel to manoeuvre the unit safely in the channel or manhole.
- Avoid placing the unit on the floor or bumping it too hard, as this will damage the protective coating and the system. Cables and hoses must be secured against pulling or kinking.
- In case of visible damage, it is strongly recommended to take photos of the damage and inform STEBATEC immediately. Sharp edges or other pointed objects protruding into the duct must be removed in advance.
- When using a suspension adapter, the unit is precisely aligned during the first installation. Any further installation and removal for maintenance can be done without tools. Re-alignment is normally not necessary, but the alignment must be checked.

| Description of the work step | Visualisation of the work step |
|------------------------------|--------------------------------|
|------------------------------|--------------------------------|

The figure on the right shows the situation before the expansion.



Figure 24: Situation before expansion of the PNA

The hoist is attached to the hangers provided and the load of the PNA is taken up. The PNA is lifted a little from the suspension.

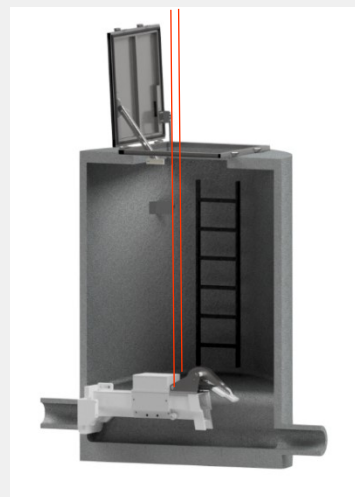


Figure 25: Record the load of the PNA

The fastenings of the PNA are loosened.
The PNA wedging in the suspension adaptation are loosened.
The PNA is pulled upwards.

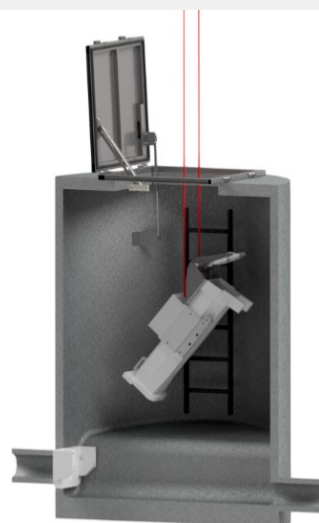


Figure 26: Loosening the fasteners of the PNA



| Description of the work step | Visualisation of the work step |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The PNA is lifted out of the shaft.</p> <p>The installation is carried out analogously in reverse order.</p> |  <p data-bbox="922 846 1337 873"><i>Figure 27: Lifting the PNA out of the shaft</i></p> |

Table 9: Removal of PNA from shaft



Caution

If the PNA has support feet, these are adjusted during initial installation so that the PNA is aligned exactly horizontally. This is essential for measurement accuracy.

The position must be checked with a spirit level each time the unit is reinstalled. If necessary, readjust the support feet.

If the PNA is mounted by means of a suspension adaptation, the following mounting procedure must be observed:

- Place PNA horizontally
- Carefully drive into the suspension adaptation without wedging
- Lower the PNA until the upper edge of the wedge plate is flush with the hook-in adaptation
- Check horizontal position with spirit level and correct position with support feet if necessary

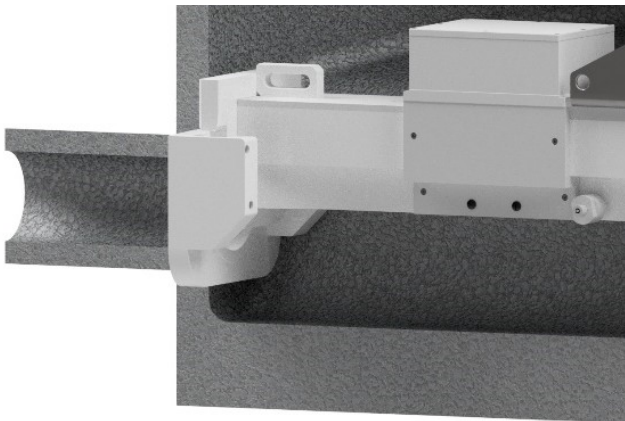


Figure 28: Suspension adapter with mounted PNA

12 Emergency

In the event of a mains / voltage failure and if configured accordingly in the event of a system malfunction, the control damper of the pneumatic outflow control is set to the predefined position by an emergency throttle or emergency opener.

12.1 Emergency throttling



Attention

The defined opening angle can be maintained if the compressor's boiler pressure is greater than the set target cushion pressure.

In an emergency, the control flap is moved to the appropriate position with the pressure set on the pressure reducer.

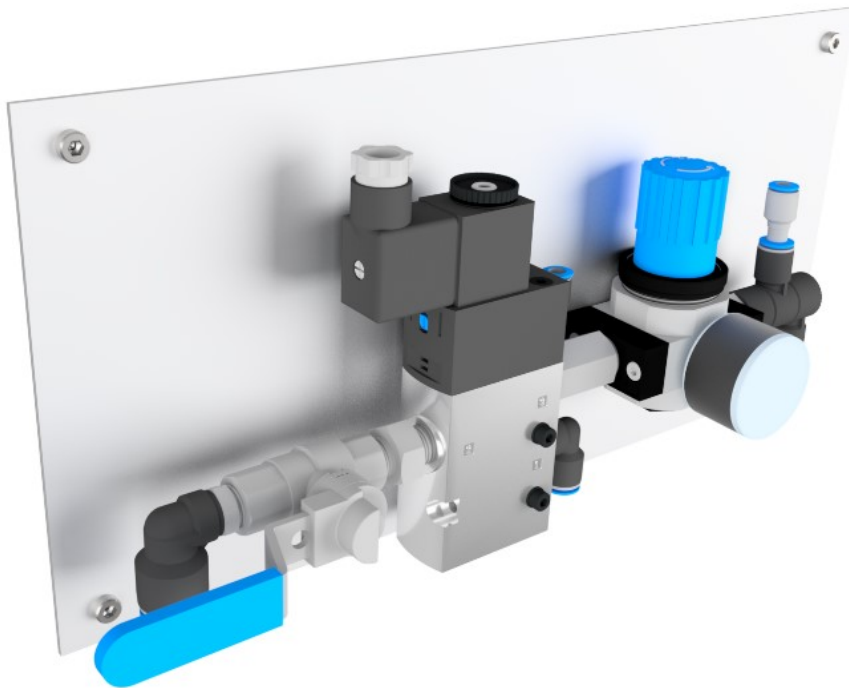


Figure 29: Emergency choke with stopcock and pressure reducer

The set pressure for emergency operation is displayed on the pressure gauge.

12.2 Emergency opening

In an emergency, the cushion pressure is released at the control flap so that the flap remains permanently fully open.

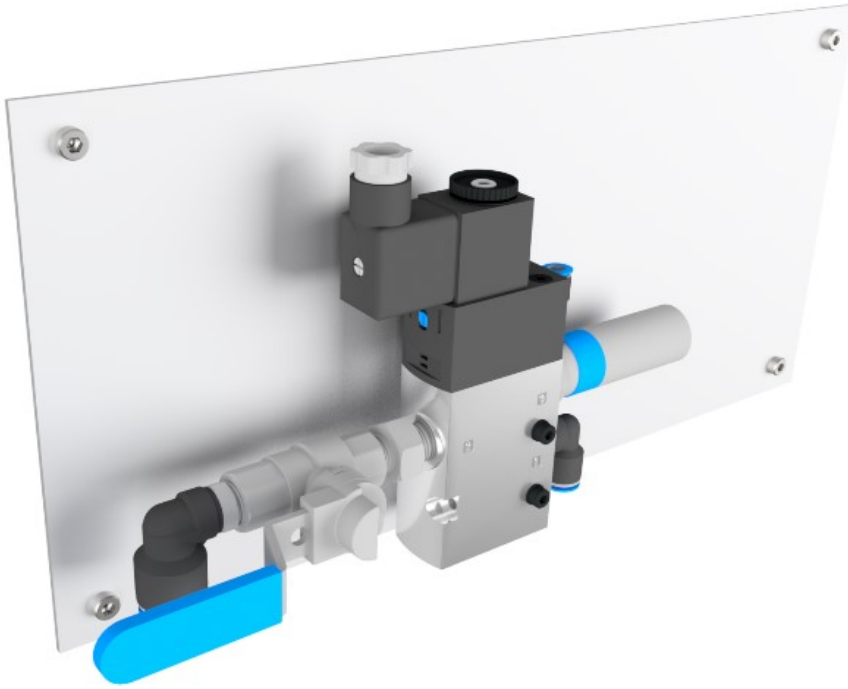


Figure 30: Emergency choke with stopcock without pressure reducer

12.3 Emergency operation in case of mains failure and unit malfunction



Attention

If the shut-off valve of the emergency throttle unit is closed, the movement of the control damper is blocked.

The emergency position is activated from the automatic mode if the necessary measuring signals are no longer available. By means of the manual control, the PNA can still be operated in emergencies.

In the de-energised state, the damper is open in the normal version. This may not be suitable for some applications, as the flow value could be exceeded in the event of a power failure. The emergency throttle maintains the set control pressure in the event of a power failure, thereby moving the damper to a pre-set, static position. Should the damper be moved, the stopcock must be turned back in the horizontal direction.

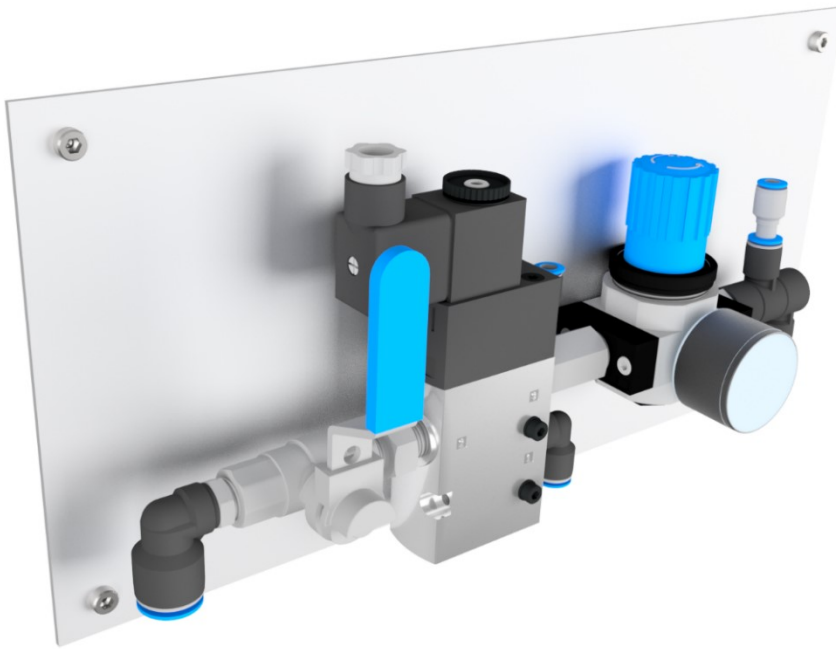


Figure 31: Emergency choke with shut-off valve (closed) and pressure reducer

13 Glossary

| Abbreviation / term | |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AI | Analog Input |
| ALLinONE | ALLinONE is a product line from STEBATEC that makes it possible to control and/or regulate different parts of a plant. It is operated with standardised software and has a modular design. |
| AO | Analog Output |
| ATEX | French designation "Atmosphères Explosibles" and refers to two directives for products and their operation in explosive environments. |
| Default Gateway | In the context of the Internet Protocol (IP), a default gateway forwards all network requests whose recipient address is not contained in a subnet to another subnet. Specifically, a "default gateway" is the router for access to other networks (such as the Internet). |
| DI | Digital Input |
| DN | Abbreviation for the French term "diamètre nominal" meaning the inner diameter of a pipe or hose. |
| DO | Digital Output |
| ESD | Electrostatic discharge Avoid charges and rapid discharges → Equip workplace accordingly |
| Flag | Flag is a binary variable of the type of Boolean (True / False) |
| H | Level height |
| HMI | Human-Machine Interface |
| I/O | Input / Output |
| IP | International Protection The degree of protection indicates the suitability of electrical equipment for various environmental conditions, in addition to the protection of people against potential hazards when using it. |
| IP address | Is an address of computers in networks, which is based on the data transmission standard IP (Internet Protocol). |
| LDM | (Ultrasonic) transit time difference measuring method for flow measurement of liquid media |

| Abbreviation / term | |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Measuring sensor | The measuring sensors of the LDM consist of the ultrasonic transducers, the level measurement, and the full-fill sensor. |
| TF/ LDM transmitter | Transmitter partly filled (teilgefüllt) / transit time difference measurement Enclosure with built-in measuring electronics and communication to other controls or control systems. |
| MID | MID is the abbreviation for "electromagnetic inductive flow measurement", which is based on the electromagnetic induction law. (Magnetisch-Induktive Durchflussmessung) |
| Modbus | Data transmission standard (protocol) for data transmission in industry and technology. |
| Modbus TCP | Modbus operating mode in which the data is transmitted via TCP (standard for the transmission of data on the Internet). |
| MR | MR is the abbreviation for "flow control". This means that the flow is to be regulated to a fixed value. (Mengenregelung) |
| Network settings | The network settings of the transmitter include the IP address, the subnet mask in suffix notation and the IP address of the gateway. |
| Level probe | Measuring device to determine the level of the liquid in the LDM. |
| PE | Protective Earth |
| PN | Pressure Nominal Here, "PN 1" means that the maximum permissible pressure of a fluid in a pipe must not exceed 1 bar, provided the temperature of the fluid is 20°C. |
| PNA | Pneumatic outflow control from STEBATEC AG, which can be used to control the discharge rates of water, wastewater and raw sewage in pipes or sewers. |
| Q | Flow rate [m ³ /s] |
| PLC | Programmable logic controller |
| Subnet | In the internet protocol (IP), a subnet is a subnet that contains specific, consecutive addresses. |
| Suffix spelling | The suffix notation in the context of subnets is used to efficiently describe subnets with a single number. |
| TF | Partial filling (teilgefüllt) This term is used in connection with the term pneumatic outflow control (abbreviation PNA), which is also manufactured and distributed by STEBATEC. |

| Abbreviation / term | |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ultrasonic sensor | Equipment with which ultrasonic waves (sound waves with a frequency higher than 16 kHz) can be generated or recorded. |
| v.M. | from measured value (vom Messwert) Specification for the measurement accuracy, related to the measured value (in contrast to the measurement accuracy related to the largest measured value). |
| v1 - v10 | Velocity of the liquid, which is measured by means of the measuring paths 1 to 10 by the corresponding ultrasonic sensors of the LDM. |
| VF | VF is the abbreviation for "fully filled". (Vollfüllung) This means that the entire inside of the measuring tube of the flow measurement is filled with liquid. It should be noted that the MID (see above for explanation) requires a fully filled measuring tube for optimal measurement. |
| v_m | Average velocity of the medium [m/s] measured in the measuring tube of the LDM. |
| VPN | VPN is the abbreviation of the English term "Virtual Private Network". With the help of encryption technology and access control, an attempt is made to create a network in a public network that is secure against unauthorised access. |
| VR | VR is the abbreviation for "Full Filling Control" (Vollfüllregelung) |
| webUI | Integrated web visualisation, which can be opened using a web browser. |

Table 10: Glossary

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