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1.1 Intended use

**CAUTION!**
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

**INFORMATION!**
This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

**INFORMATION!**
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The variable area flowmeters are suitable for measuring gases and liquids.

The devices are particularly suitable for the measurement of small quantities of:

- Process or carrier gases
- Nitrogen, CO₂ or other industrial gases
- Sample flows for process analysers
- Purge fluids for measuring systems
- Air or water

**DANGER!**
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

**CAUTION!**
Do not use any abrasive or highly viscous media.
1.2 Certifications

**CE marking**

The device fulfils all applicable statutory requirements of the EU directives:

- Pressure equipment directive
- Devices with contacts: EMC directive
- Devices for use in hazardous areas: ATEX directive

The manufacturer certifies successful testing of the product by applying the CE marking. An EU declaration of conformity regarding the directives in question and the associated harmonised standards can be downloaded from our website.

1.3 Pressure equipment directive

A conformity assessment in accordance with pressure equipment directive has been carried out for the devices described. Conformity is certified by applying the CE marking. The number of the notified body is also stated.

The PED key describes the rating of the devices:

Example: PED/G1/4.3/SEP

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Gases and vapours</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Fluid group 1</td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Article 4.3 of the directive 2014/68/EU</td>
<td></td>
</tr>
<tr>
<td>SEP</td>
<td>Sound engineering practice</td>
<td></td>
</tr>
</tbody>
</table>

The PED key identification can be found on the nameplate of the device (for details refer to Nameplate on page 13).

**INFORMATION!**

The stated pressures (PS) and temperatures (TS) only apply as refers to the pressure resistance of the sensor body. As regards the functionality of the entire device, further restrictions of the maximum temperature may need to be observed (e.g. ATEX approval). Devices rated below category I due to their size, do not receive the CE mark in the scope of the PED. These devices are subject to applicable sound engineering practice (SEP).
Residual risk

A risk analysis in accordance with the pressure equipment directive has been carried out for the devices. The residual risk is described as follows:

- The devices are designed according to the valid and applicable rules and standards for static operation and their pressure resistance is calculated for the declared maximum pressure and temperature [no calculation for cyclical change].
- Responsibility for the use of the measuring devices with regard to corrosion resistance of the used materials against the measured fluid lies solely with the operator.
- Avoid abrasion.
- Avoid pulsation and cavitation.
- Protect devices from vibration and high-frequency oscillation.
- Draining [backflow] may be delayed due to the float in the measuring tube. Expect residue around the valve and in the differential pressure regulator.
- Implement appropriate measures to counteract external fire hazards
1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer’s documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.
1.4.3  Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective “Standard Terms and Conditions” which form the basis for the sales contract shall also apply.

1.4.4  Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.
1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

**DANGER!**
This warning refers to the immediate danger when working with electricity.

**DANGER!**
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

**DANGER!**
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

**DANGER!**
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator’s plant.

**WARNING!**
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator’s plant.

**CAUTION!**
Disregarding these instructions can result in damage to the device or to parts of the operator’s plant.

**INFORMATION!**
These instructions contain important information for the handling of the device.

**LEGAL NOTICE!**
This note contains information on statutory directives and standards.

- **HANDLING**
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

- **RESULT**
  This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator

**WARNING!**
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel. This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.
2.1 Scope of delivery

**INFORMATION!**
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**
Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

Figure 2-1: Scope of delivery

① Measuring device in ordered version
② Manual
③ Certificates, calibration report (supplied to order only)
2.2 Device versions

Figure 2-2: Standard versions
① DK46 with valve and an overall length of 111 mm / 4.4"
② DK800 with valve and an overall length of 146 mm / 5.7"
③ DK47 with valve and an overall length of 196 mm / 7.7"
④ DK48 with valve and an overall length of 346 mm / 13.6"

Figure 2-3: Optional versions
① DK device with flow regulator for fluctuating inlet and outlet pressures
② DK device with limit switch and connection box
③ DK device with valve at top and calibrated to inlet pressure
2.3 Nameplate

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

![Figure 2-4: Nameplates (examples)](image)

Additional markings on the measuring device
- SN - serial number
- SO - sales order / item
- Tag No. - measuring point identifier
- MD - manufacturing date
- PA - production order
- Vx - product configurator code
- AC - article code
2.4 Description code

The description code consists of the following elements*:

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>R - with integrated inlet pressure regulator (DKR46 only)</td>
</tr>
<tr>
<td>2</td>
<td>Device type</td>
</tr>
<tr>
<td></td>
<td>46 - Overall length of measuring cone 65 mm / 2.6&quot;</td>
</tr>
<tr>
<td></td>
<td>47 - Overall length of measuring cone 150 mm / 5.9&quot;</td>
</tr>
<tr>
<td></td>
<td>48 - Overall length of measuring cone 300 mm / 11.8&quot;</td>
</tr>
<tr>
<td></td>
<td>800 - Overall length of measuring cone 100 mm / 3.9&quot;</td>
</tr>
<tr>
<td>3</td>
<td>Material for top and bottom fittings</td>
</tr>
<tr>
<td></td>
<td>N - brass</td>
</tr>
<tr>
<td></td>
<td>R - stainless steel</td>
</tr>
<tr>
<td></td>
<td>PV - PVDF</td>
</tr>
<tr>
<td>4</td>
<td>Differential pressure regulators</td>
</tr>
<tr>
<td></td>
<td>RE - inlet pressure regulator</td>
</tr>
<tr>
<td></td>
<td>RA - outlet pressure regulator</td>
</tr>
<tr>
<td>5</td>
<td>K1 - one limit switch / K2 - two limit switches</td>
</tr>
</tbody>
</table>

* positions which are not needed are omitted (no blank positions)
3.1 General notes on installation

**INFORMATION!**
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**
Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Storage

- Store the device in a dry, dust-free location.
- Avoid lasting direct exposure to the sun.
- Store the measuring device in the original packaging.
- The permissible storage temperatures for standard devices are: -40...+80°C / -40...+176°F
3.3 Installation conditions

3.3.1 Installation in the pipeline

**CAUTION!**
*When installing the device in the piping, the following points must be observed:*

- The variable area flowmeter must be installed vertically (measuring principle). Flow direction from bottom to top. For installation recommendations please refer also to directive VDI/VDE 3513, sheet 3.
- Before connecting, blow or flush out the pipes leading to the device.
- The piping for gas flow need to be dried before the device is installed.
- Use connectors suitable for the particular device version.
- Align the piping centrically with the connection bores on the measuring device so they are free of stresses.
- If necessary, the piping has to be supported to avoid the vibrations transmitted to the measuring device.
- Do not lay signal cables directly next to cables for the power supply.

3.3.2 Panel mounting

Prepare the panel cut-out as shown in the drawing (refer to section "Technical data - Dimensions").

For installation in the panel, slightly loosen the two screws ① on the front panel of the measuring device. The measuring device is inserted into the panel cutout from the front. Align the meter and fix it with the two screws ①.
4.1 Safety instructions

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

**DANGER!**
Observe the national regulations for electrical installations!

**DANGER!**
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

**WARNING!**
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Limit switches

The flowmeters can be equipped with a maximum of two limit switches. The switching function of the limit switch can be designed as monostable or bistable.

Monostable function: Switching pulse as float passes through switching point, independent of direction of movement.

Bistable function: Stable changeover as float passes through switching point.

Example (bistable): Above limit: switching point “High”
Below limit: switching point “Low”

For switching performance and electrical data refer to section "Technical data".

Connection of limit switch - 2 wire NAMUR

1. Lower limit switch to terminal 1
2. Upper limit switch to terminal 2

The connection box includes an EMC filter unit.
Connection of limit switch - 2-wire NAMUR, without connection box

1. Limit switch (without connection box)
2. Blue cable -
3. Brown cable +
4. External EMC filter
5. Receiver device

When connecting to an EMC filter, the ground terminal must be connected to the back rail of the flowmeter.

Connection of limit switch - 3-wire (transistor)

bn - brown: supply voltage +
bk - black: switch
bu - blue: supply voltage -
4.3 Limit switch settings

The following procedures are to be performed (DK../../K):

- Remove both clamping screws ①.
- Slide the limit switch over the measuring glass.
- Use the two clamping screws ① to fasten the limit switch ③ to the back rail ② of the measuring device.
- Re-install the protective cover following installation.

For installation after the fact, the measuring glass must be removed. Refer to chapter “Service”.

**CAUTION!**

*When setting the limit switch, be careful to lay the cable so that it does not get damaged. Avoid canting of the limit switch during installation: glass breakage*

The connecting lead of the limit switch is guided through a hole in the base of the device and sealed.

Observe the following for bistable limit switches with external EMC filters in separate DIN rail housing:

The EMC filter unit and the back rail of the meter must be galvanically connected and grounded.

An isolation switching amplifier with intrinsically safe circuit controls is necessary to operate the NAMUR limit switches.
4.4 Minimum clearance between two limit switches

Where two limit switches are used in one device and also where meters with limit switches are in close proximity of each other, minimum clearances must be maintained in order to avoid mutual influence of the switches.

<table>
<thead>
<tr>
<th>Minimum clearance</th>
<th>2-wire</th>
<th>3-wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) 16 mm</td>
<td>0.63&quot;</td>
<td>45 mm</td>
</tr>
<tr>
<td>(2) 6 mm</td>
<td>0.24&quot;</td>
<td>30 mm</td>
</tr>
</tbody>
</table>

4.5 Switching performance

2-wire limit switch NAMUR, monostable
Float outside of the limit switch: signal ≥3 mA
Float inside of the limit switch (centre): signal ≤1 mA

2-wire limit switch NAMUR, bistable
Independent of the float position and passage (1): signal ≥3 mA
Prerequisite: the float is outside the limit switch.

3-wire limit switch, transistor
Independent of the float position and passage (2): signal ≤1 V
Prerequisite: the float is outside the limit switch.
4.6 Reversed function of limit switch

The bistable limit switches can be changed from closers to openers.

The pre-fabricated connection cable must be long enough to do this.

When installing and setting, make sure the cable is not damaged when laid.

- Loosen terminal screw ①.
- Turn turnbuckle ② counter-clockwise to loosen.
- Pull out the measuring glass along with the limit switch.
- Turn limit switch 180°.
- Install the measuring glass.
- Tighten turnbuckle ② by hand.
- Use a 3 mm pin to tighten the turnbuckle by turning 4 or max. 5 times in 120° increments ③ in a clockwise direction.

CAUTION!
To avoid breakage, the measuring glass must be positioned centrically between the gaskets.

Test the leak tightness by suitable means prior to start up.
4.7 Grounding connection

The measuring unit is grounded on the back rail (M4 thread). This connection only ensures electrostatic grounding of the device and does not meet the requirements for equipotential bonding.

DANGER!
The grounding wire may not transfer any interference voltage. Do not use this grounding cable to ground any other electrical devices.

4.8 Protection category

The limit switches with connection housing meet all requirements of ingress protection IP65.

Therefore it is essential to observe the following points:
- Use only original gaskets. They must be clean and free of any damage. Defective gaskets must be replaced.
- The electrical cables used must be undamaged and must comply with regulations.
- The cables must be laid with a loop upstream of the measuring device to prevent water from getting into the housing.
- The cable feedthroughs must be tightened.
- Close the unused cable feedthroughs using blanking plugs.

DANGER!
After all servicing and maintenance work on the measuring device, the specified protection class must be ensured again.
5.1 Start-up

**CAUTION!**
When starting up the device, the following points must be observed:
- Compare the actual operating pressure and the product temperature of the system with the specifications on the nameplate (PS and TS). These specifications may not be exceeded.
- Ensure the material compatibility.
- Close the needle valve at the flowmeter.
- Slowly open the shut-off valve.
- When measuring liquids ensure that the pipelines are carefully evacuated.
- When measuring gases, increase pressure slowly.
- Avoid float impact (e.g. caused by solenoid valves), as this is likely to damage the measuring unit or float.
- Open needle valve at the flowmeters and set the required flow rate.
- The top edge of the float, marks the reading line for flow values.

![Figure 5-1: Reading line](image)

1. Reading line
2. Float shape “Alll”
3. Float shape “ball”
6.1 Maintenance

Within the scope of routine maintenance of the system and pipelines, the flowmeter should also be inspected for signs of dirt, corrosion, mechanical wear and leaks, as well as damage to the measuring device.

We advise that inspections are carried out at least once per year.

The device must be removed from the pipeline before cleaning.

**CAUTION!**
Pressurised pipes have to be depressurised before removing the device.
In the case of devices used for measuring aggressive or hazardous media, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.
New gaskets have to be used when re-installing the device in the piping.

**CAUTION!**
The packing seal for the valve may have to be adjusted during the service life. The union nut must be tightened for this.
Comply with a maximum torque of 5 Nm.

**CAUTION!**
Valves that have not been used for a longer period of time may exhibit a higher actuating torque.
6.2 Changing the measuring cone

- Close the valves located upstream and downstream of the device.
- Close the needle valve.
- Push the protective cover upwards and remove it towards the front.
- Turn turnbuckle ① counter-clockwise to loosen.

Devices with a top and bottom fitting made of PVDF (DK.../PV) have a turnbuckle in the device head (6 mm Allen key). This can be loosened with approx. one full turn. The measuring glass can be removed to the front.

- Install in the reverse order.
- Tighten turnbuckle ① by hand.
- Use a 3 mm pin to tighten the turnbuckle by turning 4 or max. 5 times in 120° increments ② in a clockwise direction.

**CAUTION!**
Residual liquid or gas may leak out!

**CAUTION!**
To avoid breakage, the measuring glass must be positioned centrically between the gaskets.

Test the leak tightness by suitable means prior to start up.
6.3 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.4 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

6.5 Returning the device to the manufacturer

6.5.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

CAUTION!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

• Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.

• This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.

CAUTION!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

• to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,

• to enclose a certificate with the device confirming that is safe to handle and stating the product used.
6.5.2 Form (for copying) to accompany a returned device

**CAUTION!**
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

<table>
<thead>
<tr>
<th>Company:</th>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department:</td>
<td>Name:</td>
</tr>
<tr>
<td>Tel. no.:</td>
<td>Fax no. and/or Email address:</td>
</tr>
</tbody>
</table>

Manufacturer’s order no. or serial no.:

The device has been operated with the following medium:

This medium is:  radioactive  water-hazardous  toxic  caustic  flammable

We checked that all cavities in the device are free from such substances.

We have flushed out and neutralized all cavities in the device.

We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.

Date:  Signature:  Stamp:

6.6 Disposal

**CAUTION!**
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**. The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.
7.1 Functional principle

The flowmeter operates in accordance with the float measuring principle.

The measuring unit consists of a glass cone in which a float can move freely up and down. The flow goes from bottom to top.

The float adjusts itself so that the buoyancy force $A$ acting on it, the form drag $W$ and weight $G$ are in equilibrium: $G = A + W$.

![Figure 7-1: Operating principle](image)

The height of the float is read on the scale of the measuring glass and indicates the flow rate.

The top edge of the float marks the reading line for flow values.
7.2 Technical data

**INFORMATION!**  
- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.  
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website [Downloadcenter].

### Measuring system

<table>
<thead>
<tr>
<th>Application range</th>
<th>Flow measurement of liquids and gases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function / Measuring principle</td>
<td>Variable area measuring principle</td>
</tr>
<tr>
<td>Measured value</td>
<td></td>
</tr>
<tr>
<td>Primary measured value</td>
<td>Float position</td>
</tr>
<tr>
<td>Secondary measured value</td>
<td>Operating volume flow, standard volume flow or mass flow</td>
</tr>
</tbody>
</table>

### Measuring accuracy

<table>
<thead>
<tr>
<th>Directive</th>
<th>VDI/VDE 3513, sheet 2 (q_G = 50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK46</td>
<td>4.0%</td>
</tr>
<tr>
<td>DK47</td>
<td>2.5%</td>
</tr>
<tr>
<td>DK48</td>
<td>1.0%</td>
</tr>
<tr>
<td>DK800</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

### Operating conditions

**Temperature**

| Max. operating temperature TS | -5...+100°C / +23...+212°F |

**Pressure**

<table>
<thead>
<tr>
<th>Operating pressure PS</th>
<th>Pressure equipment directive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test pressure PT</td>
<td>Pressure equipment directive</td>
</tr>
</tbody>
</table>

Max. permitted operating gauge pressure PS at TS = +100°C / +212°F:

- DK.../R [stainless steel top and bottom fittings]: 10 barg / 145 psig ①
- DK.../N [brass top and bottom fittings]: 10 barg / 145 psig ①
- DK.../PV [PVDF top and bottom fittings]: 4 barg / 58 psig

### Installation conditions

<table>
<thead>
<tr>
<th>Inlet and outlet sections</th>
<th>None</th>
</tr>
</thead>
</table>

① Other pressures on request
### Materials

<table>
<thead>
<tr>
<th>Component</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top fitting, bottom fitting</td>
<td>CrNi steel 1.4404 / 316 L, nickel-plated brass, PVDF</td>
</tr>
<tr>
<td>Top fitting, bottom fitting (optional)</td>
<td>Hastelloy®</td>
</tr>
<tr>
<td>Measuring tube</td>
<td>Borosilicate glass</td>
</tr>
<tr>
<td>Float (ball)</td>
<td>CrNi steel 1.4401 / 316</td>
</tr>
<tr>
<td>Float options</td>
<td>Glass, POM, titanium, Hastelloy® C4</td>
</tr>
<tr>
<td>Float (AllII)</td>
<td>CrNi steel 1.4404 / 316 L, aluminium, Polypropylene [PP]</td>
</tr>
<tr>
<td>Dosing unit</td>
<td>CrNi steel 1.4571 / 316 Ti</td>
</tr>
<tr>
<td>Valve stem</td>
<td>CrNi steel 1.4404 / 316 L</td>
</tr>
<tr>
<td>Gaskets (standard)</td>
<td>PTFE / FPM</td>
</tr>
<tr>
<td>Gaskets (optional)</td>
<td>PTFE / FFKM, PTFE / EPDM</td>
</tr>
<tr>
<td>Gaskets (optional)</td>
<td>EPDM, FFKM</td>
</tr>
<tr>
<td>Protective cover</td>
<td>Polycarbonate</td>
</tr>
</tbody>
</table>

① Top and bottom fittings made of PVDF not for DK48

### Temperatures

<table>
<thead>
<tr>
<th>Temperature Type</th>
<th>Max. Temperature Tm</th>
<th>Max. Temperature with limit switches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. product temperature Tm</td>
<td>-5...+100°C</td>
<td>+23...+212°F</td>
</tr>
<tr>
<td>Max. Tm with limit switches</td>
<td>-5...+65°C</td>
<td>+23...+149°F</td>
</tr>
<tr>
<td>Max. ambient temperature T_amb.</td>
<td>-20...+100°C</td>
<td>-4...+212°F</td>
</tr>
<tr>
<td>Max. T_amb. with limit switches</td>
<td>-20...+65°C</td>
<td>-4...+149°F</td>
</tr>
</tbody>
</table>

Other temperatures on request.
Technical data of limit switches

**Connection box M16 x 1.5**

**Clamping range**
3...7 mm / 0.12...0.28”

**Limit switches**
- I7R2010-NL
- I7R2015-NL
- I7R2010-N
- I7R2015-N
- RB15-14-E2
- RC10-14-N3
- RC15-14-N3
- RC10-14-N0
- RC15-14-N0

**Ring diameter**
- 10 mm / 0.4”
- 15 mm / 0.6”
- 10 mm / 0.4”
- 15 mm / 0.6”
- 15 mm / 0.6”

**Switching function**
- bistable
- bistable
- monostable
- monostable
- bistable

**NAMUR**
- yes
- yes
- yes
- yes
- no

**Connection technology**
- 2-wire
- 2-wire
- 2-wire
- 2-wire
- 3-wire

**Nominal voltage U₀**
- 8 VDC
- 8 VDC
- 8 VDC
- 8 VDC
- -

**Current consumption**
- 1 mA passage ↓ (1)
- 3 mA - Float outside
- -
- 1 mA - Float in the limit switch
- -

**Operating voltage Uₑxₜ**
- -
- 10...30 VDC

**Operating current I**
- -
- 0...100 mA

**No load current I**
- -
- 20 mA

**Output Uₐ - passage ↓**
- -
- ≤1 VDC (1)

**Output Uₐ - passage ↑**
- -
- ≥ U₀ - 3 VDC (1)

(1) For devices with the valve at the top in the output and devices with outlet pressure regulators, the function is inverted!

**Ring diameter**
- Ø4 mm / 0.16”
- Ø6 mm / 0.24”
- Ø8 mm / 0.32”
- G13.11
- G14.06
- G14.08
- G15.07
- G15.09
- G15.12
- G16.08
- G16.12
- G17.08
- G17.12
- G18.06
- G18.08
- G18.12

**For devices with ring diameters of 15 mm / 0.6” as max. contact can only be used up to 60 l/h / 15.8 GPH water or 2400 l/h / 89.3 SCFH air [outer diameter of the measuring glass].**
## TECHNICAL DATA

### 7.3 Dimensions and weight

#### Dimensions

<table>
<thead>
<tr>
<th>Device</th>
<th>a</th>
<th>b ± 0.25</th>
<th>d</th>
<th>f approx.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[&quot;]</td>
<td>[mm]</td>
<td>[&quot;]</td>
</tr>
<tr>
<td>DK46</td>
<td>111</td>
<td>4.37</td>
<td>90</td>
<td>3.55</td>
</tr>
<tr>
<td>DKR46</td>
<td>136</td>
<td>5.36</td>
<td>90</td>
<td>3.55</td>
</tr>
<tr>
<td>DK800</td>
<td>146</td>
<td>5.75</td>
<td>125</td>
<td>4.92</td>
</tr>
<tr>
<td>DK47</td>
<td>196</td>
<td>7.72</td>
<td>175</td>
<td>6.89</td>
</tr>
<tr>
<td>DK48</td>
<td>346</td>
<td>13.6</td>
<td>325</td>
<td>12.8</td>
</tr>
</tbody>
</table>

\[c = 4.3 \text{ mm} / 0.17"\]
\[e = 33 \text{ mm} / 1.3"\]
\[f \text{ approx. } 82 \text{ mm} / 3.2"\]
\[g = 28 \text{ mm} / 1.1"\]

#### Dimensions of panel cut-out and orifice plate

<table>
<thead>
<tr>
<th>Device</th>
<th>a</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[mm]</td>
<td>[&quot;]</td>
</tr>
<tr>
<td>DK46</td>
<td>128</td>
<td>5.04</td>
</tr>
<tr>
<td>DK800</td>
<td>163</td>
<td>6.42</td>
</tr>
<tr>
<td>DK47</td>
<td>213</td>
<td>8.39</td>
</tr>
<tr>
<td>DK48</td>
<td>363</td>
<td>14.3</td>
</tr>
</tbody>
</table>

\[b = 32 \text{ mm} / 1.26"\]
\[d = 40 \text{ mm} / 1.58"\]
\[e = 27.5 \text{ mm} / 1.08"\]
### Weights

<table>
<thead>
<tr>
<th></th>
<th>DK46</th>
<th>DK800</th>
<th>DK47</th>
<th>DK48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td>0.88</td>
<td>1.1</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Weight with regulator</td>
<td>2.1</td>
<td>2.2</td>
<td>2.3</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>4.6</td>
<td>4.9</td>
<td>5.1</td>
<td>5.3</td>
</tr>
</tbody>
</table>

### Process connection

<p>| | | | | |</p>
<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>1/4” NPT female</td>
<td>1/4”, Ermeto 6 or 8, tube connection 6 mm or 8 mm, Dilo, Gyrolok, Swagelok ①</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

① Other connection on request.
7.4 Measuring ranges

Measuring ranges DK(R)46 - DK47 - DK800

Measuring span: 10 : 1
Flow values: Values = 100%
Water: +20°C / +68°F
Air: +20°C / +68°F, 1.2 bara / 17.4 psia

Float: CrNi steel

<table>
<thead>
<tr>
<th>Float Ø</th>
<th>Water</th>
<th>Air</th>
</tr>
</thead>
<tbody>
<tr>
<td>[mm]</td>
<td>[°]</td>
<td>[l/h]</td>
</tr>
<tr>
<td>4</td>
<td>0.158</td>
<td>2.5</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>0.236</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>3.0</td>
<td>12</td>
</tr>
<tr>
<td>25</td>
<td>6.5</td>
<td>25</td>
</tr>
<tr>
<td>40</td>
<td>11</td>
<td>40</td>
</tr>
<tr>
<td>60</td>
<td>②</td>
<td>16</td>
</tr>
<tr>
<td>100</td>
<td>②</td>
<td>25</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
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</tr>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>0.315</td>
<td>120</td>
</tr>
<tr>
<td>160</td>
<td>②</td>
<td>42</td>
</tr>
</tbody>
</table>

① with float AIII 4-H
② not for DK(R)46

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. The indicated pressure losses are valid for water and air at maximum flow rate. Other flow ranges on request. Conversion of other media or operating data is performed using the calculation method in accordance with VDI/VDE directive 3513.

Reference condition for gas measurements:
Flow measurements for gases are attributed to
NI/h or Nm³/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)
Measuring ranges DK48

Measuring span: 10 : 1
Flow values: Values = 100%
Water: +20°C / +68°F
Air: +20°C / +68°F, 1.013 bara / 14.7 psia

Float: CrNi steel

<table>
<thead>
<tr>
<th>Cone no.</th>
<th>[l/h]</th>
<th>[GPH]</th>
<th>[Nl/h]</th>
<th>[SCFH]</th>
<th>[Nl/h]</th>
<th>[SCFH]</th>
<th>[Nl/h]</th>
<th>[SCFH]</th>
</tr>
</thead>
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<tr>
<td>G13.11 1</td>
<td>0.4</td>
<td>0.1</td>
<td>-</td>
<td>7</td>
<td>0.25</td>
<td>16</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>G14.06</td>
<td>0.6</td>
<td>0.16</td>
<td>-</td>
<td>-</td>
<td>12</td>
<td>0.45</td>
<td>25</td>
<td>0.95</td>
</tr>
<tr>
<td>G14.08</td>
<td>1</td>
<td>0.25</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>0.75</td>
<td>40</td>
<td>1.5</td>
</tr>
<tr>
<td>G15.07</td>
<td>1.6</td>
<td>0.4</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>1.1</td>
<td>60</td>
<td>2.2</td>
</tr>
<tr>
<td>G15.09</td>
<td>2.5</td>
<td>0.65</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>1.5</td>
<td>90</td>
<td>3.5</td>
</tr>
<tr>
<td>G15.12</td>
<td>4</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>60</td>
<td>2.2</td>
<td>140</td>
<td>5.0</td>
</tr>
<tr>
<td>G16.08</td>
<td>6</td>
<td>1.6</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>3.7</td>
<td>200</td>
<td>7.5</td>
</tr>
<tr>
<td>G16.12</td>
<td>10</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>160</td>
<td>6.0</td>
<td>300</td>
<td>11</td>
</tr>
<tr>
<td>G17.08</td>
<td>16</td>
<td>4.0</td>
<td>-</td>
<td>-</td>
<td>250</td>
<td>9.0</td>
<td>500</td>
<td>19</td>
</tr>
<tr>
<td>G17.12</td>
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<td>6.5</td>
<td>-</td>
<td>-</td>
<td>400</td>
<td>15</td>
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<td>30</td>
</tr>
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<td>G18.06</td>
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<td>10</td>
<td>400</td>
<td>15</td>
<td>600</td>
<td>22</td>
<td>1200</td>
<td>45</td>
</tr>
<tr>
<td>G18.08</td>
<td>63</td>
<td>16</td>
<td>600</td>
<td>22</td>
<td>1000</td>
<td>37</td>
<td>2000</td>
<td>75</td>
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<td>G18.12</td>
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<td>1000</td>
<td>37</td>
<td>1600</td>
<td>60</td>
<td>3000</td>
<td>110</td>
</tr>
</tbody>
</table>

1 reduced accuracy: 2.5%

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. The indicated pressure losses are valid for water and air at maximum flow rate. Other flow ranges on request. Conversion of other media or operating data is performed using the calculation method in accordance with VDI/VDE directive 3513.

Reference condition for gas measurements:
Flow measurements for gases are attributed to
NI/h or Nm³/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia [DIN 1343]
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia [ISO 13443]
Valves

Flow values:
- Water: +20°C / +68°F
- Air: +20°C / +68°F, 1.013 bara / 14.7 psia

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.039</td>
<td>5</td>
<td>1.3</td>
<td>100</td>
<td>3.7</td>
<td>0.018</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>0.98</td>
<td>50</td>
<td>13</td>
<td>1000</td>
<td>37</td>
<td>0.15</td>
<td>0.17</td>
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<td>4.5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Valve characteristics

Spindle Ø 1.0 mm / 0.039"

Spindle Ø 2.5 mm / 0.098"

Spindle Ø 4.5 mm / 0.177"

1. Flow, air
2. Flow, water
3. Spindle revolution n
7.5 Differential pressure regulators

Differential pressure regulators are used to guarantee constant flow during fluctuating inlet and outlet pressure. Minimum pressures are required to operate the regulators (refer to regulator characteristics).

Differential pressure regulators are not equivalent to pressure reducing valves!

1. **Inlet pressure regulators, type RE, NRE**
   The regulators keep the flow rate constant in the case of a variable inlet pressure and a constant outlet pressure.

<table>
<thead>
<tr>
<th>Example of inlet pressure regulator RE-1000:</th>
<th>Current flow rate:</th>
<th>1000 l/h air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outlet pressure p2 constant:</td>
<td>1.013 bara / 14.7 psia</td>
<td></td>
</tr>
</tbody>
</table>

   The flow rate in the device remains constant with a fluctuating inlet pressure greater than 0.5 bar / 7.25 psi.

2. **Outlet pressure regulator, type RA, NRA**
   The regulators keep the flow rate constant in the case of a constant inlet pressure and a variable outlet pressure. There must be a pressure differential between the inlet and the outlet pressure for the outlet pressure regulators to function. The inlet pressure p1 must always be greater than the outlet pressure p2.

<table>
<thead>
<tr>
<th>Example for outlet pressure regulator NRA-800:</th>
<th>Current flow rate:</th>
<th>800 l/h air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet pressure constant:</td>
<td>6 bar / 87 psi</td>
<td></td>
</tr>
</tbody>
</table>

   The flow rate in the device remains constant with a fluctuating outlet pressure greater than 0...5.5 bar / 0...79.8 psi.

**Regulator characteristics**

1. **Inlet pressure regulators, type RE and NRE**

2. **Outlet pressure regulators, type RA and NRA**

![Graphs of regulator characteristics](image-url)
Control ranges
Flow values: Values = ...100%
Water: +20°C / +68°F
Air: +20°C / +68°F, 1.013 bara / 14.7 psia

Inlet pressure regulator ①

<table>
<thead>
<tr>
<th></th>
<th>Max. flow rate</th>
<th>Min. inlet pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water</td>
<td>Air</td>
</tr>
<tr>
<td></td>
<td>[l/h]</td>
<td>[GPH]</td>
</tr>
<tr>
<td>RE-1000</td>
<td>0.5</td>
<td>7.25</td>
</tr>
<tr>
<td>RE-4000</td>
<td>1</td>
<td>14.5</td>
</tr>
<tr>
<td>RE-4000</td>
<td>1.5</td>
<td>21.8</td>
</tr>
<tr>
<td>NRE-100</td>
<td>1.5</td>
<td>29</td>
</tr>
<tr>
<td>NRE-800</td>
<td>2</td>
<td>29</td>
</tr>
</tbody>
</table>

Outlet pressure regulator ②

<table>
<thead>
<tr>
<th></th>
<th>Max. flow rate</th>
<th>Min. inlet pressure</th>
<th>Min. pressure diff. *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water</td>
<td>Air</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[l/h]</td>
<td>[GPH]</td>
<td>[Nl/h]</td>
</tr>
<tr>
<td>RA-1000</td>
<td>0.5</td>
<td>7.25</td>
<td>0.4</td>
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<tr>
<td>RA-4000</td>
<td>1.5</td>
<td>21.8</td>
<td>1.2</td>
</tr>
<tr>
<td>NRA-800</td>
<td>0.1</td>
<td>1.45</td>
<td>0.05</td>
</tr>
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</table>

Reference condition for gas measurements:
Flow measurements for gases are attributed to
Nm³/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia
(DIN 1343)
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia
(ISO 13443)
Technical data for differential pressure regulator

<table>
<thead>
<tr>
<th>Standard connection</th>
<th>1/4” NPT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option</td>
<td>Serto, Ermeto 6 or 8, hose nozzle 6 mm or 8 mm, Dilo, Gyrolok, Swagelok, G1/4; Other connections on request.</td>
</tr>
<tr>
<td>Max. operating gauge pressure PS</td>
<td>10 barg / 145 psig / 4 barg / 58 psig for DK.../PV; Higher pressures on request.</td>
</tr>
<tr>
<td>Product temperature</td>
<td>TS = +100°C / +212°F; Higher temperatures on request.</td>
</tr>
<tr>
<td>Material</td>
<td>CrNi steel 1.4404</td>
</tr>
<tr>
<td>Gasket</td>
<td>PTFE; Other materials on request.</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>Carbon / graphite-filled PTFE</td>
</tr>
<tr>
<td>O-ring</td>
<td>FPM; Other materials on request.</td>
</tr>
</tbody>
</table>

Dimensions with differential pressure regulator

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<tr>
<th></th>
<th>a (mm)</th>
<th>b (°)</th>
<th>c (mm)</th>
<th>d (°)</th>
<th>e (mm)</th>
<th>f (°)</th>
<th>Approx.</th>
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<tr>
<td>DK46</td>
<td>210</td>
<td>8.27</td>
<td>163</td>
<td>6.42</td>
<td>70</td>
<td>2.76</td>
<td>19 0.75</td>
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<td>233</td>
<td>9.18</td>
<td>70</td>
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<td>383</td>
<td>15.1</td>
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<td>183</td>
<td>7.21</td>
<td>70</td>
<td>2.76</td>
<td>19 0.75</td>
</tr>
</tbody>
</table>

① DK with inlet pressure regulator

② DK with outlet pressure regulator
KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 203 301 0
Fax: +49 203 301 10389
info@krohne.com

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com