



## DK32 - DK34 - DK37 Handbook

Variable area flowmeters

Electronic revision ESK3x: ER 1.0.x



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1	Safety instructions	5
1.1	Intended use	5
1.2	Certifications	6
1.3	Pressure equipment directive	6
1.4	Safety instructions from the manufacturer	8
1.4.1	Copyright and data protection	8
1.4.2	Disclaimer	8
1.4.3	Product liability and warranty	9
1.4.4	Information concerning the documentation	9
1.4.5	Warnings and symbols used	10
1.5	Safety instructions for the operator	10
2	Device description	11
2.1	Scope of delivery	11
2.2	Device versions	12
2.3	Nameplate	14
2.4	Description code	15
2.5	Electronic revision DK32/ESK, DK34/ESK	15
3	Installation	16
3.1	General notes on installation	16
3.2	Storage	16
3.3	Installation conditions	16
4	Electrical connections	17
4.1	Safety instructions	17
4.2	Electrical connection of the limit switches	18
4.3	Settings of limit switches of DK32, DK34	19
4.4	Electrical signal output ESK3x for DK32, DK34	20
4.4.1	Power supply	21
4.4.2	Load for HART communication	21
4.4.3	Configuration	21
4.5	Settings of limit switches for DK37/M8M	22
4.6	Electrical signal output for DK37/M8E	23
4.6.1	Power supply	24
4.6.2	Load for HART communication	24
4.6.3	Configuration	24
4.7	Grounding connections	25
4.8	Ingress protection	26
5	Start-up	27
5.1	Standard device	27

6 Service	28
<hr/>	
6.1 Maintenance .....	28
6.2 Spare parts availability .....	29
6.3 Availability of services .....	29
6.4 Returning the device to the manufacturer .....	29
6.4.1 General information .....	29
6.4.2 Form (for copying) to accompany a returned device .....	30
6.5 Disposal .....	30
6.6 Disassembly and recycling .....	31
6.6.1 Description of the device components .....	31
6.6.2 Indicator versions .....	32
7 Technical data	34
<hr/>	
7.1 Functional principle .....	34
7.2 Technical data .....	35
7.3 Dimensions and weight .....	41
7.3.1 DK32, DK34 .....	41
7.3.2 DK32, DK34 with transmitter housing ESK3x .....	43
7.3.3 DK37/M8M .....	44
7.3.4 DK37/M8E .....	45
7.3.5 Minimum distances when installing several measuring devices .....	46
7.4 Measuring ranges .....	47
7.5 Differential pressure regulators .....	49

## 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, CO<sub>2</sub> or other industrial gases
- Sample flows for process analysers
- Sealing gas or sealing liquid measurement on sealing systems
- Purge fluids for measuring systems
- Air or water
- Chemicals and additives
- Lubricating, cooling and anti-corrosive agents

**DANGER!**

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

**CAUTION!**

Do not use any abrasive media containing solid particles.

## 1.2 Certifications



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

- Pressure equipment directive
- For devices with electrical installations: 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 mark. The number of the notified body is also stated.

The PED key describes the rating of the devices:

Example: PED/G1/4.3/SEP

G	Gases and steam
1	Fluid group 1
4.3	Article 4.3 of the directive 2014/68/EU
SEP	Sound engineering practice

The PED key identification can be found on the nameplate of the device (for details refer to *Nameplate* on page 14).



### **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.

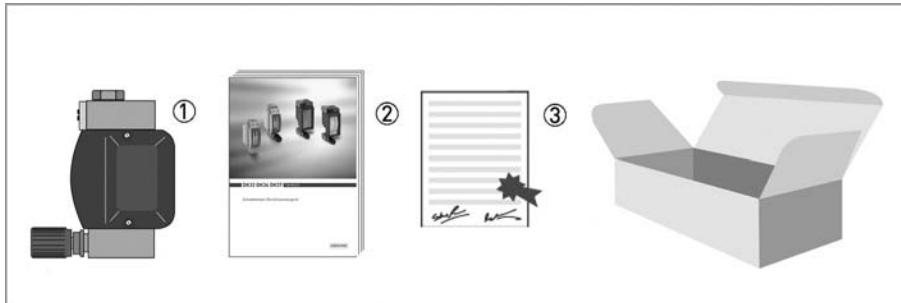


Figure 2-1: Scope of delivery

- ① Measuring device in ordered version
- ② Product documentation
- ③ Certificates, calibration report (supplied to order only)

## 2.2 Device versions

- DK32 with valve and horizontal connection
- DK34 without valve and vertical connection
- DK37 with valve and horizontal connection
- DK37 without valve and vertical connection

### The following designs are available as options:

- with inlet pressure regulator
- with outlet pressure regulator
- with flange adapter (total length: 250 mm / 9.8")
- with indicator housing DK37 in stainless steel
- with limit switches or 4...20 mA/HART signal output

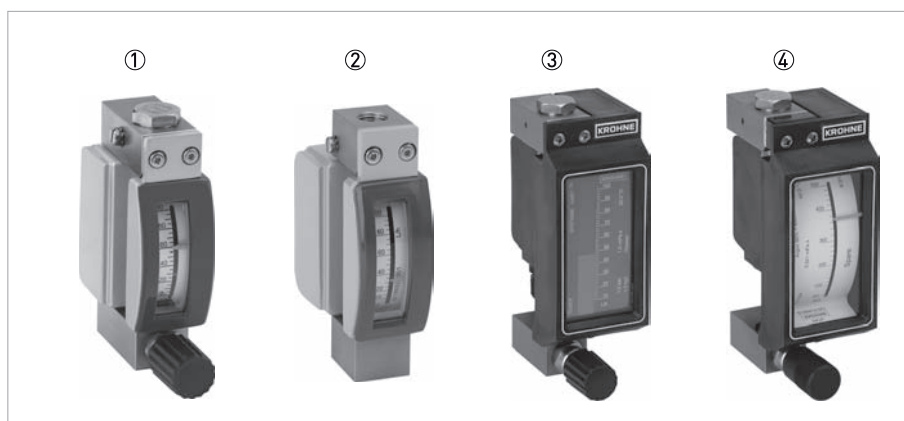


Figure 2-2: Device versions

- ① DK32 with valve and horizontal connection
- ② DK34 without valve and vertical connection
- ③ DK37/M8E with valve and electronic indicator
- ④ DK37/M8M with valve and mechanical indicator

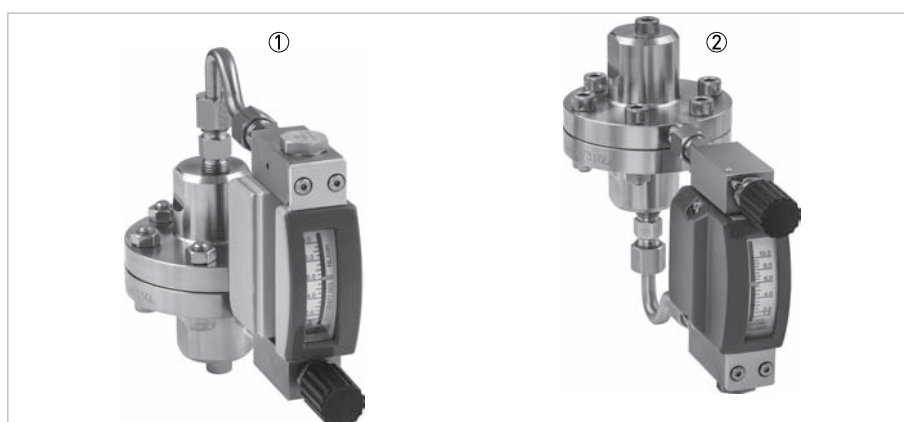


Figure 2-3: Versions with regulators

- ① DK32 with inlet pressure regulator
- ② DK32 with outlet pressure regulator



Figure 2-4: Versions with flange adapter

- ① DK34 with DN15/PN40 adapter
- ② DK32 with DN15/PN40 adapter

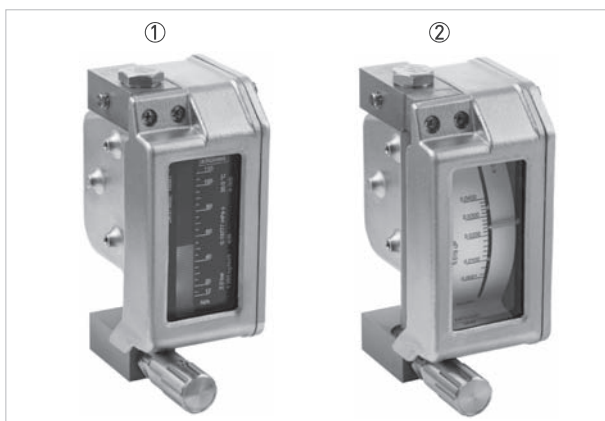


Figure 2-5: Version DK37 with stainless steel housing

- ① DK37/M8E/R
- ② DK37/M8M/R

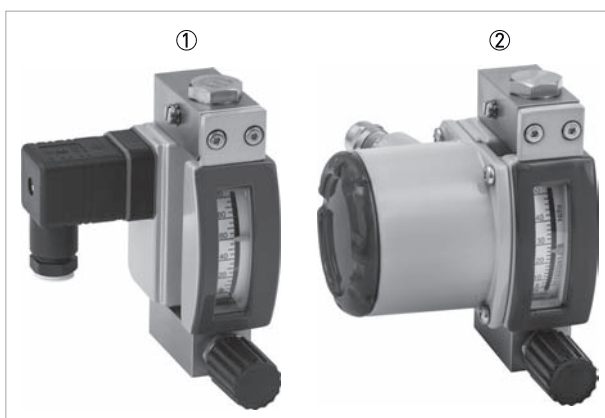


Figure 2-6: Versions DK32 with limit switches or 4...20 mA/HART signal output

- ① DK32 with limit switches
- ② DK32 with 4...20 mA/HART signal output

## 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.

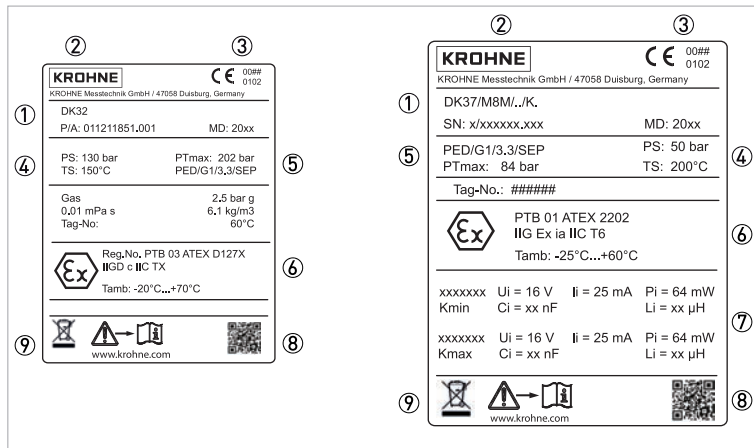


Figure 2-7: Examples of nameplates

- ① Device type
- ② Manufacturer
- ③ Identification number of the notified body ATEX & PED
- ④ Rating data: temperature & pressure rating
- ⑤ PED data
- ⑥ Ex data
- ⑦ Electrical connection data
- ⑧ Matrix code
- ⑨ Note to observe the documentation and for disposal

### Additional markings on the measuring device:

- SO - sales order / item
- PA - production order
- Vx - product configurator code
- AC - article code

## 2.4 Description code

The description code consists of the following elements\*:

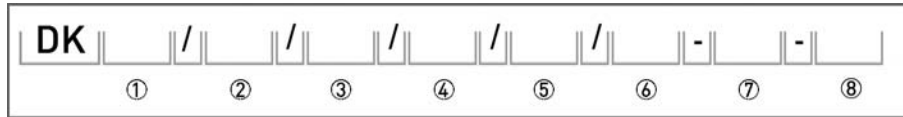


Figure 2-8: Description code DK32, DK34

- ① 32 - with valve and horizontal connection / 34 without valve and vertical connection
- ② RE - inlet pressure regulator / RA - outlet pressure regulator
- ③ K1 - one limit switch, type NAMUR / K2 - two limit switches, type NAMUR /  
R1 - one limit switch, type Reed / ESK - 4...20 mA/HART®
- ④ S - plug connector / L - cable entry including cable
- ⑤ HT - high-temperature version
- ⑥ free
- ⑦ Ex - Explosion-protected equipment
- ⑧ SK - SIL conformity according to IEC 61508 of the limit switch

\* positions which are not needed are omitted (no blank positions)

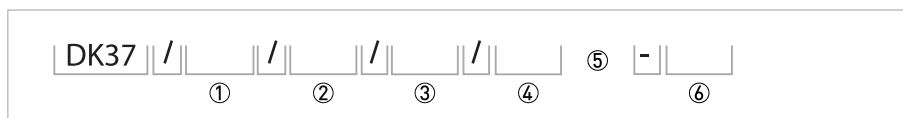


Figure 2-9: Description code DK37

- ① M8M - mechanical indicator / M8E - electronic indicator
- ② without - indicator housing in PPS  
R - indicator housing in stainless steel
- ③ RE - inlet pressure regulator / RA - outlet pressure regulator
- ④ K1 - one limit switch / K2 - two limit switches
- ⑤ Ex is not part of the description code
- ⑥ SK - SIL conformity according to IEC 61508 of the limit switch  
SE - SIL conformity according to IEC 61508 of the current output

\* positions which are not needed are omitted (no blank positions)

## 2.5 Electronic revision DK32/ESK, DK34/ESK

The electronic revision of the ESK3x indicates the respective hardware/software status of the electronics.

Electronic revision	Explanation
ER 1.0.x	Basic version

Table 2-1: Description of the electronic revision

### 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!**

*Check on the device nameplates, that the device is supplied according to your order.*

### 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

**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.*
- *Piping for gas flow need to be dried before the device is installed.*
- *Use connectors suitable for the particular device version.*
- *Align the piping centrally 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.*
- *When several devices are installed next to one another, a minimum distance between the devices is necessary (for details refer to chapter "Technical data").*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to an electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*



## 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 Electrical connection of the limit switches

The electrical connection of the limit switches is made for

- DK.././S - in connection plug
- DK.././L - via a cable assembly



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

- Loosen the screw ⑥ of the connector plug
- Pull out the plug.
- Remove the screw ⑥ completely from the plug.
- Insert a screwdriver in the marked opening ⑤ (lift) and remove the terminal block.
- Lead the connection cable through the cable gland.
- Insert the cable (max. 1.5 mm<sup>2</sup>) and tighten it.

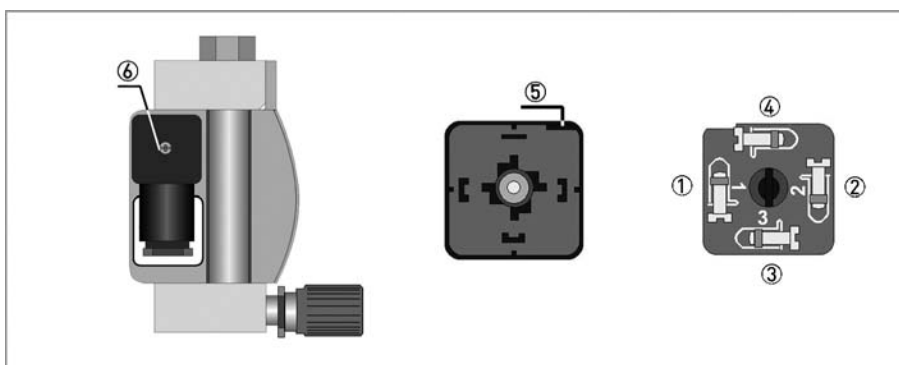


Figure 4-1: Electrical connection of the limit switches

⑤ Lift slot

⑥ Fastening screw of connection box

	Contact connection	Stranded wire colour for cable assembly
①	Min minus	white
②	Min plus	yellow
③	Max minus	green
④	Max plus	brown

Table 4-1: Contact connections

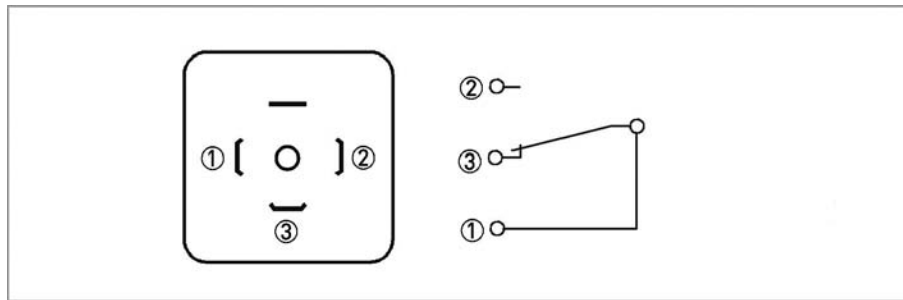


Figure 4-2: Connection of 3-wire reed contact

①	Silicone-insulated wire - yellow/green / FEP-insulated wire - red
②	Silicone-insulated wire - brown / FEP-insulated wire - brown
③	Silicone-insulated wire - blue / FEP-insulated wire - blue

Table 4-2: Stranded wire colour for devices with cable assembly

### 4.3 Settings of limit switches of DK32, DK34

Set the pointers to the desired limit values as a min. contact ① or max. contact ② along the scale.

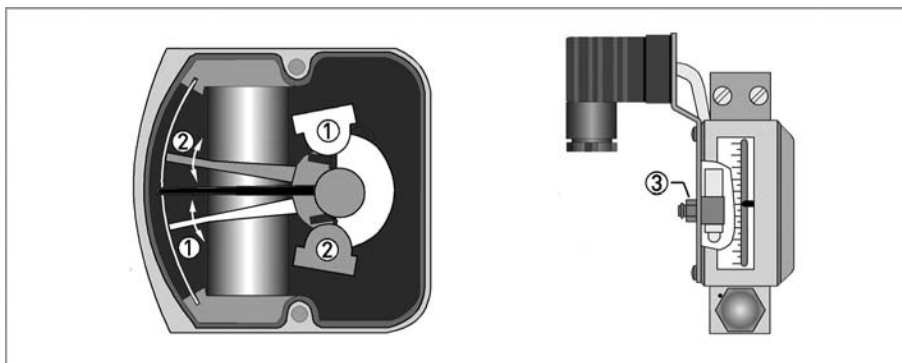


Figure 4-3: Settings of limit switches of DK32, DK34



#### Settings of limit switches with Reed contact:

- Loosen the nut ③.
- Set the reed cartridge to the desired value.
- Fix the nut ③.



#### **INFORMATION!**

The reed contact is actuated directly by the float magnet. The desired switching point can only be determined in measuring mode. A reference to the scale and/or pointer cannot be established.

## 4.4 Electrical signal output ESK3x for DK32, DK34

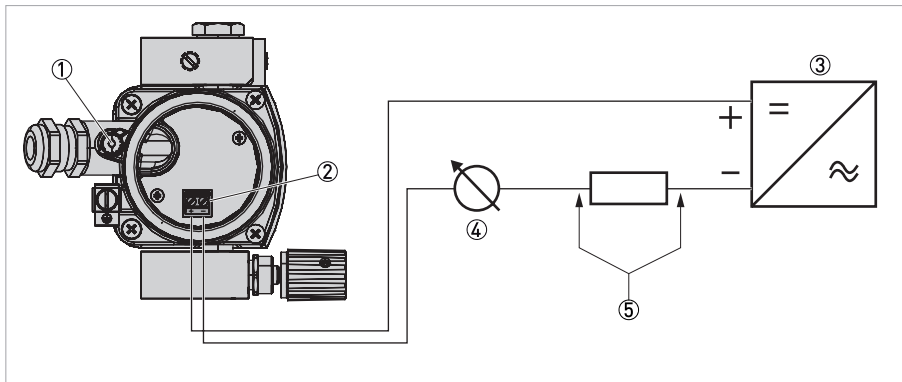


Figure 4-4: Electrical connection of ESK3x

- ① Lock screw
- ② Terminal block
- ③ Power supply 12...32 VDC
- ④ Measuring signal 4...20 mA
- ⑤ External load, HART® communication

**The following procedures are to be performed:**

- Loosen the lock screw ① on the locking mechanism using an Allen key (WS3).
- Unscrew the cover.
- Connect the connecting cables to the device terminals in the terminal block ② by ensuring the correct polarity.
- Screw on the cover.
- Tighten the lock screw on the locking mechanism using an Allen key (WS3).

**DANGER!**

*For devices intended for use in hazardous areas with dust-resistant housing and/or secondary pressure containment, the special conditions for sealing the electronic compartment and for the cable entry are available in the supplementary instructions.*

#### 4.4.1 Power supply



**INFORMATION!**

The supply voltage has to be between 12 VDC and 32 VDC. This is based on the total resistance of the measuring loop. To calculate this, the resistance of each component in the measuring loop (not including the device) must be added up.

The required supply voltage can be calculated using the following formula:

$$U_{\text{ext}} = R_L * 22 \text{ mA} + 12 \text{ V}$$

with

$U_{\text{ext}}$  = minimum supply voltage

$R_L$  = total measuring loop resistance



**INFORMATION!**

The power supply has to be able to supply a minimum of 22 mA.

#### 4.4.2 Load for HART communication



**INFORMATION!**

For HART<sup>®</sup> communication a load of at least 230  $\Omega$  is required.

The maximum load resistance is calculated as follows:

$$R_L = (U_{\text{ext}} - 12 \text{ V}) / 22 \text{ mA}$$



**DANGER!**

Use a twisted two-core cable to prevent electrical interference from impeding the DC output signal.

In some cases a shielded cable may be necessary. The cable shield may only be grounded (common ground connection) at one point (on the power supply unit).

#### 4.4.3 Configuration

The ESK3x electrical signal output can be configured via HART<sup>®</sup> communication. DDs (Device Description) and DTMs (Device Type Manager) are available for the configuration. They can be downloaded free of charge from our website.

The current flow rate can be transmitted using the integrated HART<sup>®</sup> communication. A flow counter can be configured. Two limit values can be monitored. The limit values are assigned either to flow values or to the counter overflow.

## 4.5 Settings of limit switches for DK37/M8M

The limit switches can be set over the entire measuring range using the maximum pointer. The set limit values are displayed on the scale. The pointers are set to the desired limit values using a slip coupling along the scale.

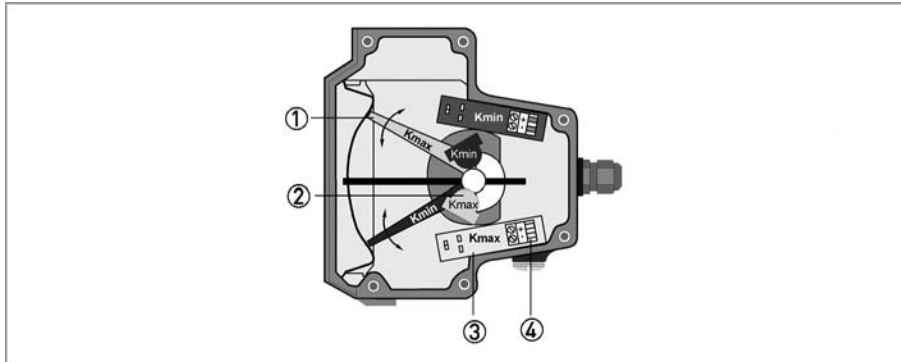


Figure 4-5: Position of the limit switch

- ① Maximum pointer, switching point indicator
- ② Limit switches
- ③ Connection board
- ④ Connection terminal

If the pointer vane goes into the slot, an alarm is triggered. An alarm is also triggered in the event of a cable break or short circuit if a suitable amplifier is used.

## 4.6 Electrical signal output for DK37/M8E

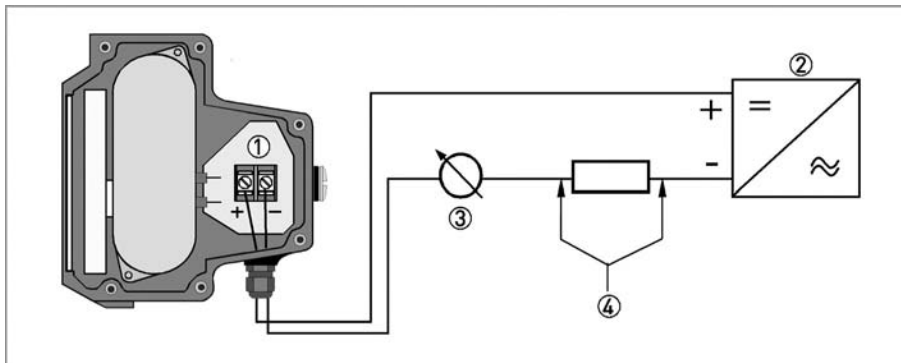


Figure 4-6: Electrical connection M8E

- ① Terminal connection
- ② Power supply 14.8...30 VDC
- ③ Measuring signal 4...20 mA
- ④ External load, HART<sup>®</sup> communication

Wiring must be planned with great care when it comes to connecting other devices such as evaluation units or process control. Internal connections in these devices (e.g. GND with PE, mass loops) may lead to non-permitted voltage potentials which could negatively affect the function of the device itself or that of a device connected to it. In such cases a protected extra-low voltage (PELV) is recommended.

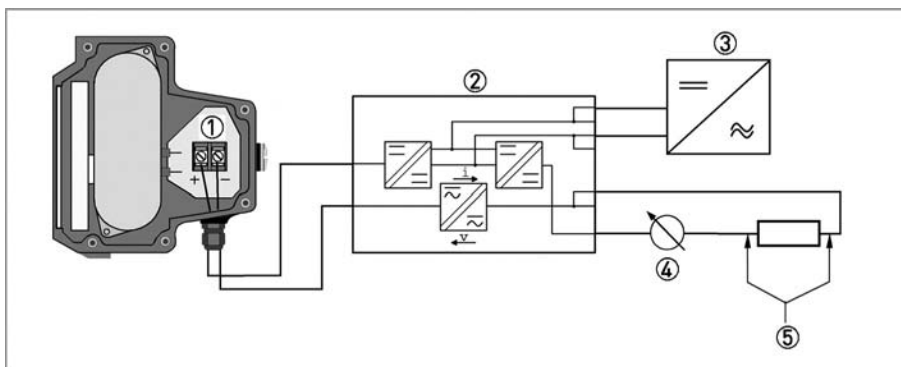


Figure 4-7: Electrical connection with galvanic isolation

- ① Terminal connection
- ② Signal converter isolator with galvanic isolation
- ③ Power supply (refer to isolator information)
- ④ Measuring signal 4...20 mA
- ⑤ External load, HART<sup>®</sup> communication

### 4.6.1 Power supply



**INFORMATION!**

The supply voltage has to be between 14.8 VDC and 30 VDC. This is based on the total resistance of the measuring loop. To calculate this, the resistance of each component in the measuring loop (not including the device) must be added up.

The required supply voltage can be calculated using the following formula:

$$U_{\text{ext}} = R_L * 22 \text{ mA} + 14.8 \text{ V}$$

with

$U_{\text{ext}}$  = minimum supply voltage

$R_L$  = total measuring loop resistance



**INFORMATION!**

The power supply has to be able to supply a minimum of 22 mA.

### 4.6.2 Load for HART communication



**INFORMATION!**

For HART<sup>®</sup> communication a load of at least 230  $\Omega$  is required.

The maximum load resistance is calculated as follows:

$$R_L = (U_{\text{ext}} - 14.8 \text{ V}) / 22 \text{ mA}$$



**DANGER!**

Use a twisted two-core cable to prevent electrical interference from impeding the DC output signal.

In some cases a shielded cable may be necessary. The cable shield may only be grounded (common ground connection) at one point (on the power supply unit).

### 4.6.3 Configuration

The M8E electronic indicator can be configured via HART<sup>®</sup> communication. DDs (Device Description) and DTMs (Device Type Manager) are available for the configuration. They can be downloaded free of charge from our website.

The current flow rate can be transmitted using the integrated HART<sup>®</sup> communication. A flow counter can be configured. Two limit values can be monitored. The limit values are assigned either to flow values or to the counter overflow. The limit values are not depicted on the display.



## 4.7 Grounding connections

The measuring unit is grounded on the top fitting ① (M4 threaded holes).  
Alternatively, the DK32 and DK34 with ESK3x transmitter can be grounded at the transmitter housing.

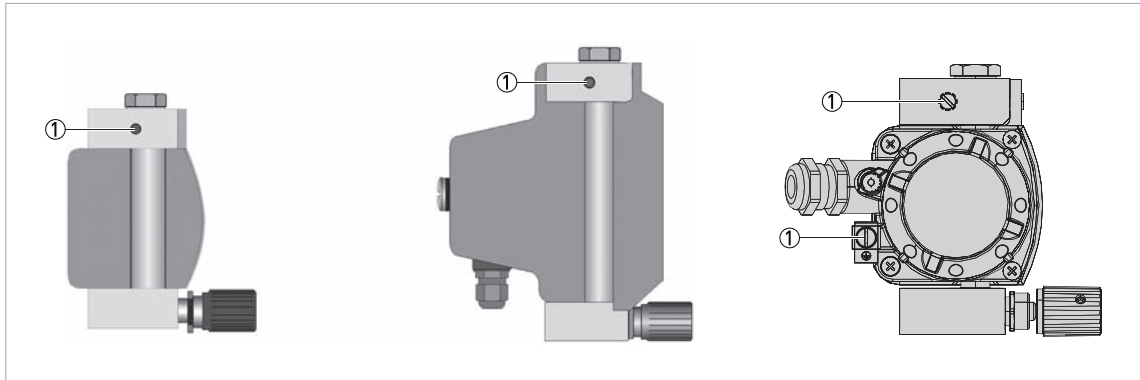


Figure 4-8: Grounding connections

① Grounding connection at measuring unit



**DANGER!**

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

## 4.8 Ingress protection

The variable area flowmeters DK32 / DK34 / DK37 have been tested for IP protection in accordance with EN 60529. The following protection categories have been achieved:

Device variant	Ingress protection according to EN 60529
DK32, DK34 mechanical	IP66/IP68
DK32, DK34 with limit switches K1/K2	IP65
DK32, DK34 with transmitter ESK3x	IP66/IP68
DK37 with PPS indicator	IP66
DK37 with stainless steel indicator	IP66/IP67



### **DANGER!**

*After all servicing and maintenance work on the measuring device, the specified ingress protection category must be ensured again.*



### 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 ③ upstream of the measuring device to prevent water from getting into the housing.
- The cable feedthroughs ② must be tightened.
- Close the unused cable feedthroughs using blind plugs ①.
- Do not remove the required cable bushing from the cable feedthrough.



Figure 4-9: Cable feedthrough

- ① Use blanking plugs if no cable is routed through
- ② Tighten the protection cap
- ③ Lay the cable in a loop

## 5.1 Standard device



**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.*
- *Make sure materials are compatible.*
- *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.*

## 6.1 Maintenance

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

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

The device must be removed from the pipeline before cleaning.

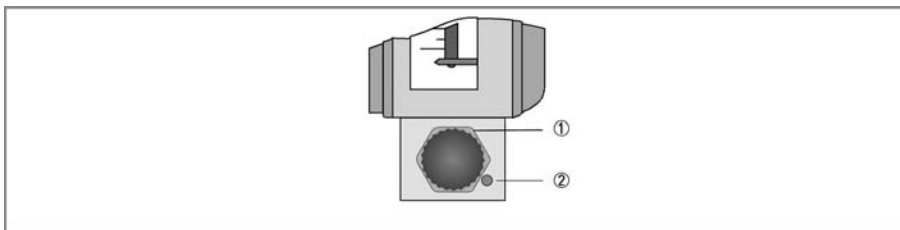


**CAUTION!**

*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 ① must be tightened for this. It may be necessary to push the locking pin ② back against its internal spring.*

*Comply with a maximum torque of 4 Nm.*



**CAUTION!**

*Valves that have not been used for a longer period of time may exhibit a higher actuating torque.*

## 6.2 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.

## 6.3 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.*

## 6.4 Returning the device to the manufacturer

### 6.4.1 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.



### **WARNING!**

*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.*



### **WARNING!**

*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 it is safe to handle and stating the product used.*

### 6.4.2 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.*

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no. and/or Email address:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	<input type="checkbox"/>	radioactive	
	<input type="checkbox"/>	water-hazardous	
	<input type="checkbox"/>	toxic	
	<input type="checkbox"/>	caustic	
	<input type="checkbox"/>	flammable	
	<input type="checkbox"/>	We checked that all cavities in the device are free from such substances.	
<input type="checkbox"/>	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:			

### 6.5 Disposal



**LEGAL NOTICE!**

*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.

## 6.6 Disassembly and recycling

This section describes how to handle and disassemble the device in order to dispose of it following end of use. The information provided enables the end user to identify and separate the main components of the device for the purpose of recycling.



### **INFORMATION!**

- *Wear personal protective equipment*
- *Make sure to use a stable workstation / bench to disassemble*

### 6.6.1 Description of the device components

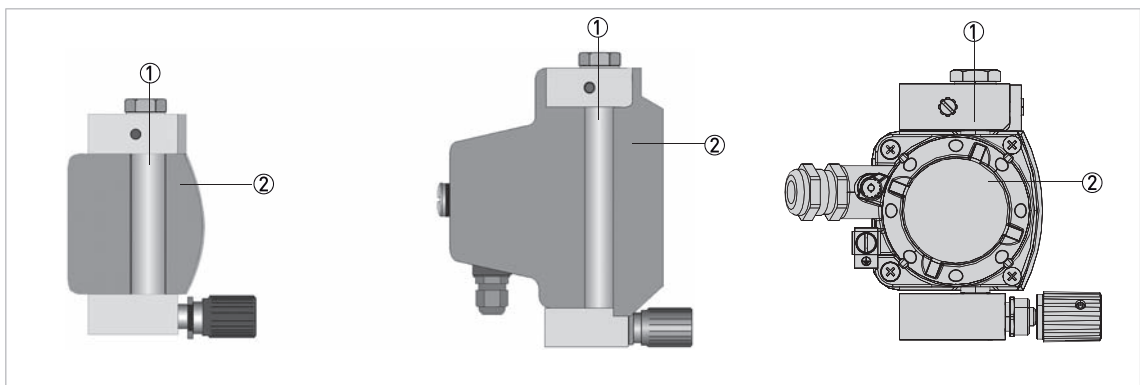


Figure 6-1: Description of the device components

- ① Measuring unit
- ② Indicator housing

The variable area flowmeter consists of a mechanical, metallic measuring unit ① and an indicator housing attached to it ②, which may contain electronic components. The metallic measuring unit can be sent to metal recycling after the indicator housing has been removed. Depending on the version, the measuring unit may weigh between 0.5...5 kg / 1.1...11 lb.



### **CAUTION!**

*Check and ensure that the measuring units, including all cavities, are free of hazardous substances by rinsing or neutralising if required. This should be done especially in the case of devices that have been operated with toxic, corrosive, radioactive, flammable or water-contaminating products to protect both the environment and the health and safety of staff.*

## 6.6.2 Indicator versions

The following discusses the indicator housing and optional electronics in more detail.

### Indicator DK37/M8x and DK37/M8x/R

The indicator housing consists of the following components:

Approx. information	Weight / size	
	DK37/M8x/R Stainless steel housing	DK37/M8x Plastic housing
Glass panel	45 cm <sup>2</sup> / 6.98 in <sup>2</sup>	45 cm <sup>2</sup> / 6.98 in <sup>2</sup>
PPS (housing including cover)	-	300 g / 0.66 lb
Stainless steel (housing including cover)	1550 g / 3.42 lb	-
Other metal parts as scale, pointer system, screws	50 g / 0.1 lb	50 g / 0.1 lb
Insert profile made of PA	40 g / 0.09 lb	-

Table 6-1: Indicator DK37/M8x and DK37/M8x/R

The indicator housing can be equipped either with an electronic transmitter DK37/M8E or with one or two limit switches DK37/M8/K1 or DK37/M8/K2. They become visible after opening the cover. These can be removed from the housing in order to send them to electronics recycling/disposal.

The electronic components consist of the following main components:

All information is approximate	DK37/.../M8E	DK37/.../M8M/K.
PCB-CPU potted	67 cm <sup>2</sup> / 10.39 in <sup>2</sup>	< 1 cm <sup>2</sup> / < 0.16 in <sup>2</sup>
PCB-I/O not potted	45 cm <sup>2</sup> / 6.98 in <sup>2</sup>	-
PCB connection board	17 cm <sup>2</sup> / 2.64 in <sup>2</sup>	5 / 10 cm <sup>2</sup> / 0.78 / 1.55 in <sup>2</sup>
Potting (silicone)	95 g / 0.21 lb	5 g / 0.01 lb
Batteries	-	-
Electrolytic capacitors	-	-
LC display	24 cm <sup>2</sup> / 3.72 in <sup>2</sup>	-

Table 6-2: Main components of the electronic components



#### **INFORMATION!**

*The PCBs are partially potted with silicone. It is thus not easy to separate the components by hand.*



### Indicator DK32, DK34

The indicator housing consists of the following components:

Approx. information	Weight / size	
	DK3./K.	DK3./ESK
Glass panel	9 cm <sup>2</sup> / 1.40 in <sup>2</sup>	9 cm <sup>2</sup> / 1.40 in <sup>2</sup>
Aluminium housing	170 g / 0.37 lb	460 g / 1.01 lb
Other metal parts as scale, pointer system, screws	50 g / 0.1 lb	50 g / 0.1 lb

Table 6-3: Indicator DK3./K. und DK3./ESK

The indicator housing can be equipped either with an electronic transmitter DK3./ESK or with one or two limit switches DK3./K. These can be removed from the housing in order to send them to electronics recycling/disposal.

The electronic components consist of the following main components:

All information is approximate	DK3./ESK	DK3./K.
PCB	25 cm <sup>2</sup> / 3.88 in <sup>2</sup>	1 cm <sup>2</sup> / 0.16 in <sup>2</sup>
Potting (silicone)	28 g / 0.06 lb	5 g / 0.01 lb
Batteries	-	-
Electrolytic capacitors	-	-
LC display	-	-

Table 6-4: Main components of the electronic components



#### **INFORMATION!**

*The PCBs are partially potted with silicone. It is thus not easy to separate the components by hand.*

## 7.1 Functional principle

The flowmeter operates in accordance with the float measuring principle.

The measuring unit consists of a metal cone in which a float can move freely up and down. The medium flows through the flowmeter from bottom to top.

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

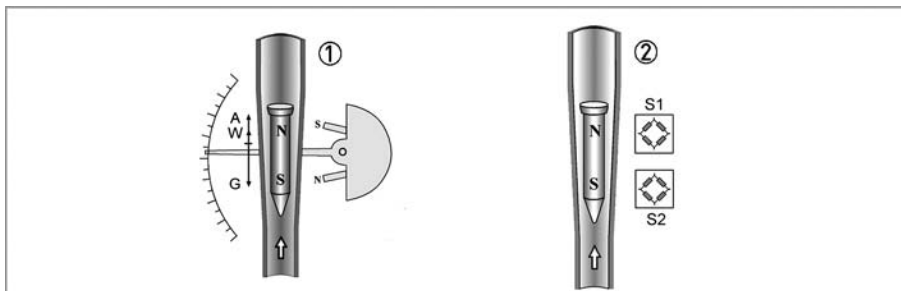


Figure 7-1: Functional principle

For DK32, DK34 and DK37/M8M ① the flow-dependent height of the float in the measuring unit is transmitted by means of a magnetic coupling on a scale.

For DK37/M8E, DK32/ESK and DK34/ESK ② the flow-dependent height of the float in the measuring unit is transmitted to the electronic display by means of a magnetic coupling on sensors S1 and S2.

## 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

Application range	Flow measurement of liquids or gases
Function / Measuring principle	Float measuring principle

### Measured value

Primary measured value	Float position
Secondary measured value	Operating volume flow, nominal volume flow or mass flow

### Measuring accuracy

Directive	VDI/VDE 3513, sheet 2 (q <sub>G</sub> = 50%)
DK32, DK34	4.0%
DK37	2.5%

### Operating conditions

Max. operating temperature TS	Depending on the version (refer to nameplate)
	Standard version: up to +150°C / +221°F
	HT version: up to +200°C / +392°F
Max. operating pressure PS	Depending on the version (refer to nameplate)
	Standard version: 130 barg / 1885 psig ①
Max. test pressure PT	Depending on the version (refer to nameplate)
	Standard version: 202 barg / 2930 psig ①

### Ingress protection

DK32, DK34 mechanical	IP66/IP68
DK32, DK34 with limit switches K1/K2	IP65
DK32, DK34 with transmitter ESK3x	IP66/IP68
DK37 with PPS indicator	IP66
DK37 with stainless steel indicator	IP66/IP67

### Installation conditions

Inlet and outlet sections	None
Protect devices from vibration and high-frequency oscillation	Use in accordance with IEC 61298-3 in control room or field with medium vibration level

① Higher pressures on request

## Materials

Top fitting, bottom fitting, cone	CrNi steel 1.4404 / 316 L
Lock screw	CrNi steel 1.4404 / 316 L
Float, standard	CrNi steel 1.4404 / 316 L or titanium
Dosing unit	CrNi steel 1.4571 / 316 Ti
Valve stem	CrNi steel 1.4404 / 316 L
Gasket of lock screw	PTFE
Gasket of dosing unit	FPM/PTFE, PTFE, FFKM ①
Indicator housing of DK32, DK34	Die-cast aluminium with powder coating
Indicator housing of DK37/M8_/	PPS
Indicator housing of DK37/M8_/R/	Stainless steel 1.4408/CF8M

① Other gasket materials on request

## Other options on request:

- Surface passivation of all metallic, wetted parts
- Special materials: e.g. Hastelloy<sup>®</sup>, Monel<sup>®</sup>, Inconel<sup>®</sup>, titanium a.o.

## Process connection

Standard	1/4 NPT (female)
Option	G1/4, Ermeto, Serto, Gyrolok, Swagelok, flanges ①

① Other connections on request

## Temperatures

Max. product temperature at $T_{amb.} < +40^{\circ}\text{C} / +104^{\circ}\text{F}$ ①	[°C]	[°F]
DK34, DK32, DK37 without valve	-80...+150	-112...+302
DK32, DK37 with valve FPM/PTFE	-25...+150	-13...+302
DK32, DK37 with valve FFKM	-20...+150	-4...+302
DK32, DK37 with valve PTFE	-40...+150	-40...+302
DK32 HT, DK34 HT high-temperature with FFKM	-20...+200	-4...+392
DK32, DK34 with transmitter ESK3x	-40...+140	-40...+284

Permissible ambient temperature ①	[°C]	[°F]
DK32, DK34, DK37/M8M without electrical built-ins	-40...+70	-40...+158
DK32, DK34, DK37/M8M with limit switch I7S2002-N or SJ2-SN	-40...+70	-40...+158
DK32, DK34, DK37/M8M with limit switch SC2-N0	-25...+70	-13...+158
DK32, DK34 with transmitter ESK3x	-40...+70	-40...+158
DK37/M8E	-40...+70	-40...+158
DK32 HT, DK34 HT high-temperature	-25...+200	-13...+392

① For restrictions in hazardous areas refer to the temperature tables in the supplementary Ex instructions

## Indicator DK32, DK34, DK37/M8M with limit switch

DK32 - 34 /K./S DK37/M8M	Cable gland: M16 x 1.5	
	Terminal connection: 1.5 mm <sup>2</sup>	
DK32 - 34 /K./S	Clamping range: 4.5...10 mm / 0.18...0.4"	
DK37/M8M	Clamping range: 3...7 mm / 0.12...0.28"	
DK32 - 34/K./L	Ø Connecting cable: 6.3 mm / 0.25"; 0.75 mm <sup>2</sup>	
	Cable length: approx. 1.7 m / 5.6 ft (other lengths on request)	
Limit switches	<b>SC2-N0 I7S2002-N</b>	<b>SJ2-SN (safety-oriented)</b>
Connection type NAMUR	2-wire	2-wire
Switching element function	Normally closed	Normally closed
Nominal voltage U <sub>0</sub>	8 VDC	8 VDC
Pointer vane not detected	≥ 3 mA	≥ 3 mA
Pointer vane detected	≤1 mA	≤1 mA
DK32 - DK34 with Reed contact	Type: SPDT (3-wire, normally closed and normally open)	
	Switching reproducibility: < 5% of full scale range	
	Switching capacity: 12 VA ①	
	Max. switching capacity: 30 VDC ①	
	Max. switching current: 0.5 A ①	

① Reduced values for Ex

**Transmitter ESK3x for DK32, DK34**

Cable entry	M16 x 1.5 or 1/2" NPT
Clamping range of cable gland	3...7 mm / 0.12...0.28" (PA gland) or 5...10 mm / 0.2...0.39" (stainless steel gland)
Terminal connection	1.5 mm <sup>2</sup>
Measuring signal	4...20 mA = 0...100% flow value in 2-wire technology
Power supply	12...32 VDC (non-Ex)
Power supply influence	< 0.1%
Dependence on load impedance	< 0.1%
Temperature influence	<0.3%/10 K
Max. external resistance / load	500 Ω (24 VDC), 800 Ω (32 VDC)
Min. load for HART®	250 Ω
NAMUR type test acc. to NE 95	Fulfills NE 21, NE 43, NE 107

**ESK3x - electrical characteristics**

Process variable flow rate	Values [%]	Signal output [mA]
Upper range limit	+103.125	20.5
Device error identification	< -2.5 or > 106.25	<3.6 or > 21
Maximum	118.75	23.0
Multi-Drop operation	-	4.0
Min. U <sub>ext.</sub>	12 VDC	
Capacitance number (CN)	2	

**ESK3x HART Device**

Manufacturer name (code)	KROHNE Messtechnik (0x0045)
Model name	ESK3x (0x45BA)
HART® protocol	Revision 7.6
Device revision	1
Equipment category	Transmitter

**Indicator DK37/M8E**

Cable gland	M16 x 1.5
Clamping range	3...7 mm / 0.12...0.28"
Terminal connection	2.5 mm <sup>2</sup>
Measuring signal	4...20 mA = 0...100% flow value in 2-wire technology
Power supply	14.8...30 VDC
Min. power supply for HART®	20.5 VDC
Power supply influence	<0.1%
Dependence on load impedance	<0.1%
Temperature influence	<10 µA/K
Max. external resistance / load	640 Ω (30 VDC)
Min. load for HART®	250 Ω
Software firmware version	01.15
Identification number	3204090400
NAMUR type test acc. to NE 95	Fulfills NE 21, NE 43

**M8E HART® configuration**

Manufacturer name (code)	KROHNE Messtechnik (69)
Model name	M8E (230)
HART® protocol	Revision 5.1
Device revision	1
Physical Layer	FSK
Equipment category	Transmitter

**M8E process variable**

Process variable flow rate	Values [%]	Signal output [mA]
Upper range limit	+102.5 (±1%)	20.24...20.56
Device error identification	>106.25	≥21.00
Maximum	112.5	22
Multi-Drop operation	-	4.5
Min. U <sub>ext.</sub>	14.8 VDC	

## Approvals for DK32, DK34

Standard	Device version	Marking
ATEX	Mechanical, without electrical built-ins	II2G Ex h IIC T6...T3 Gb II2D Ex h IIIC T150°C Db
	NAMUR limit switch K1/K2	II2G Ex ia IIC T6 Gb II2D Ex ia IIIC T75°C Db II3G Ex nA/ec IIC T6 Gc
	Reed limit switch R1	II2G Ex ia IIC T6 Gb
	4...20 mA / HART signal output ESK3x	II2G Ex d IIC T6 Gb II2G Ex ia IIC T6 Gb II2D Ex ia IIIC T75°C Db II3G Ex nA/ec IIC T6 Gc II2D Ex tb IIIC 75° Db
IECEX	NAMUR limit switch K1/K2	Ex ia IIC T6 Gb Ex ia IIIC T75°C Db Ex nA/ec IIC T6 Gc
	Reed limit switch R1	Ex ia IIC T6 Gb
	4...20 mA / HART signal output ESK3x	Ex d IIC T6 Gb Ex ia IIC T6 Gb Ex ia IIIC T75°C Db Ex nA/ec IIC T6 Gc Ex tb IIIC 75° Db
FM (US)	NAMUR limit switch K1/K2	IS/I/1/ABCD; T6 NI/I/2/ABCD; T6
	Reed limit switch R1	IS/I/1/ABCD; T6
QPS (US/C) (pending)	4...20 mA / HART signal output ESK3x	XP/I/1/ABCD; T6 IS/I/1/ABCD; T6 NI/I/2/ABCD; T6 DIP/II,III/1EFG;T6
Other approvals as NEPSI, INMETRO, KCS, CCOE, EAC on request.		

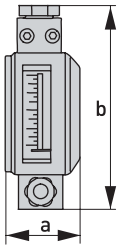
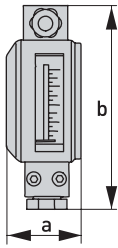
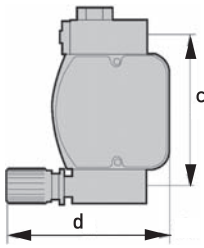
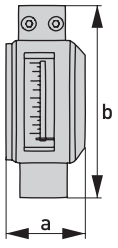
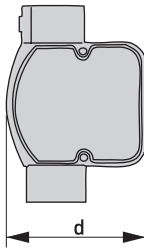
## Approvals for DK37

Standard	Device version	Marking
ATEX	Mechanical, without electrical built-ins	II2G Ex h IIC T6...T3 Gb II2D Ex h IIIC T150°C Db
	Electrical	II2G Ex ia IIC T6 Gb II2D Ex ia IIIC T75°C Db
IECEX	Electrical	Ex ia IIC T6 Gb Ex ia IIIC T75°C Db
QPS (US/C)	Electrical	IS/I/1/ABCD; T6
Other approvals as NEPSI, INMETRO, KCS, CCOE, EAC on request.		

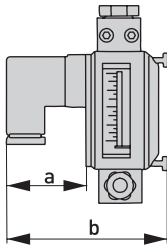
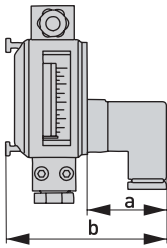
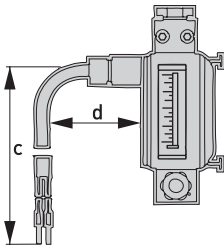
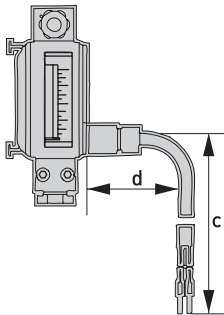


### 7.3 Dimensions and weight

#### 7.3.1 DK32, DK34

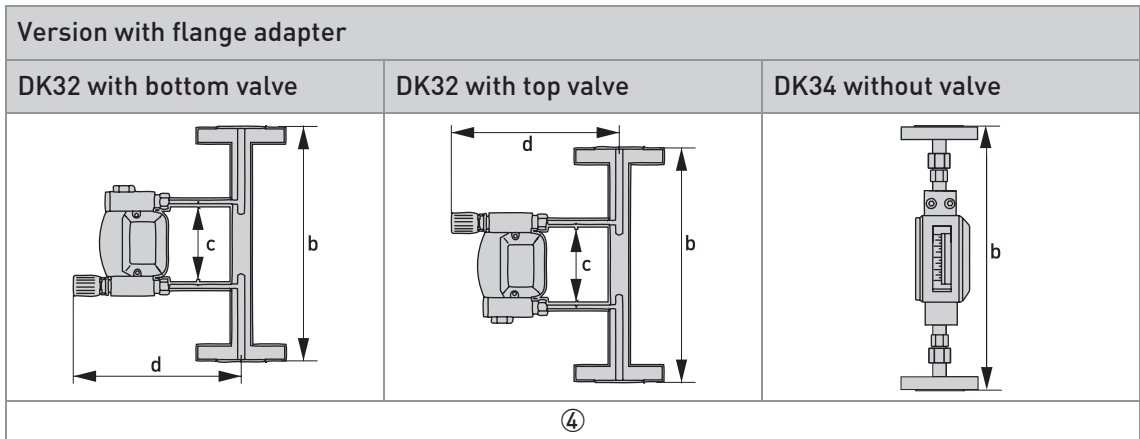
DK32 with top/bottom valve and rear process connection			DK34 without valve and vertical process connection		
					
①			②		

		Dimensions								Weight approx.	
		a		b		c		d		g	lb
		[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]		
①	DK32	42	1.66	118	4.65	90	3.55	100	3.94	700	1.54
②	DK34	42	1.66	110	4.33	-	-	75	3.07	600	1.32

Version with limit switch with connector		Version with limit switch with cable end	
DK32 with bottom valve / DK34 without valve	DK32 with top valve	DK32 with bottom valve / DK34 without valve	DK32 with top valve
			
③			

		Dimensions								Weight approx.	
		a		b		c		d		g	lb
		[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]		
③	DK32	46	1.81	approx. 90	approx. 3.55	1500	59	approx. 50	approx. 1.97	700	1.54
	DK34										

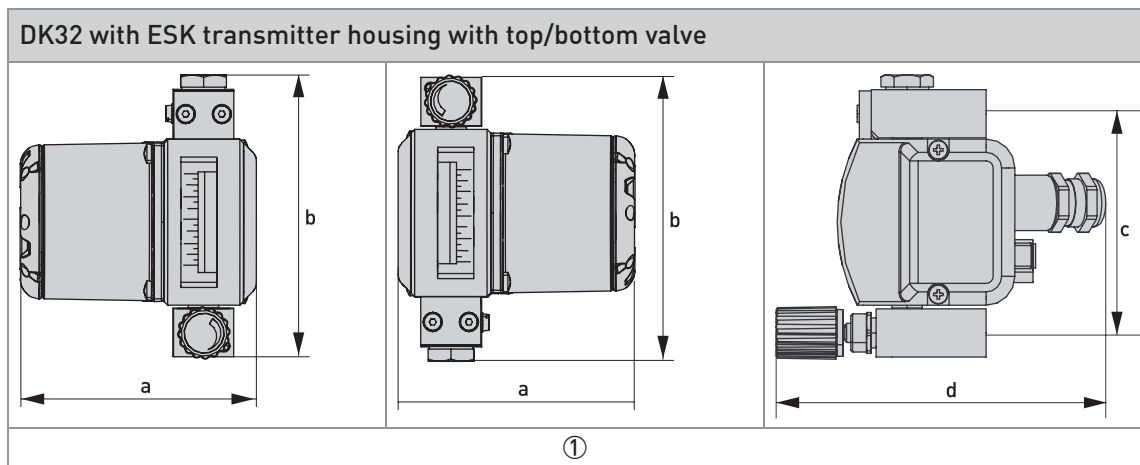
Weight for DK32 with differential pressure regulator: 2500 g / 5.51 lb



		Dimensions							
		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
④	DK32	-	-	250	10.2	90	3.55	approx. 195	approx. 7.68
	DK34	-	-	250	10.2	-	-	-	-

Extra weight for flange adapter dependent on pressure rating of flange: approx. 1.5...9 kg / 3.3...19.8 lb

## 7.3.2 DK32, DK34 with transmitter housing ESK3x



## Dimensions

		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
①	DK32	100	3.94	118	4.65	90	3.55	140	5.51

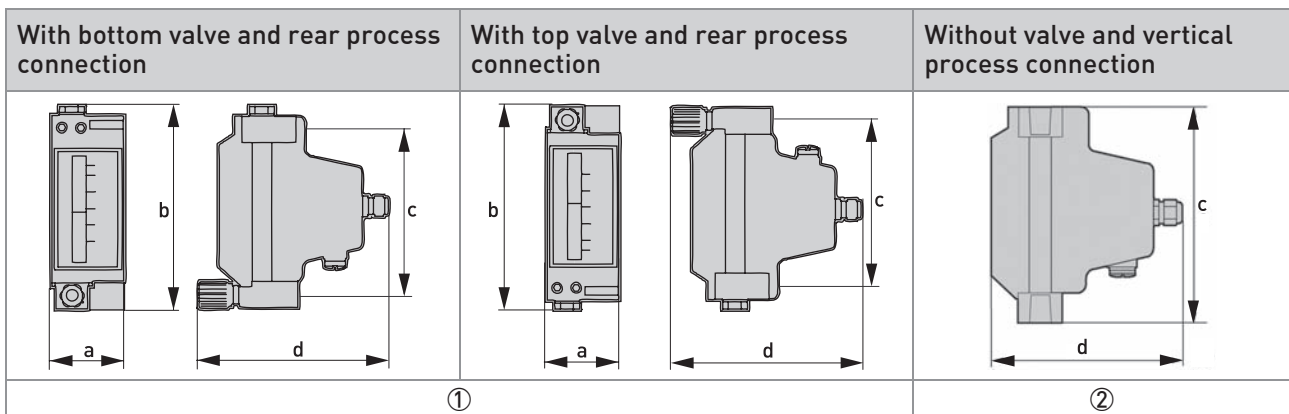
## Total length of flange connection adapter:

DK32/ESK with top or bottom valve: 250 mm / 9.8"

## Weights

	approx. g	approx. lb
DK32 with transmitter ESK3x	1100	2.43
DK34 with transmitter ESK3x	1000	2.21

## 7.3.3 DK37/M8M



## Dimensions

		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
①	With valve	56	2.21	153	6.03	125	4.92	approx. 144	approx. 5.67
②	Without valve	56	2.21	145	5.71	145	5.71	approx. 144	approx. 5.52

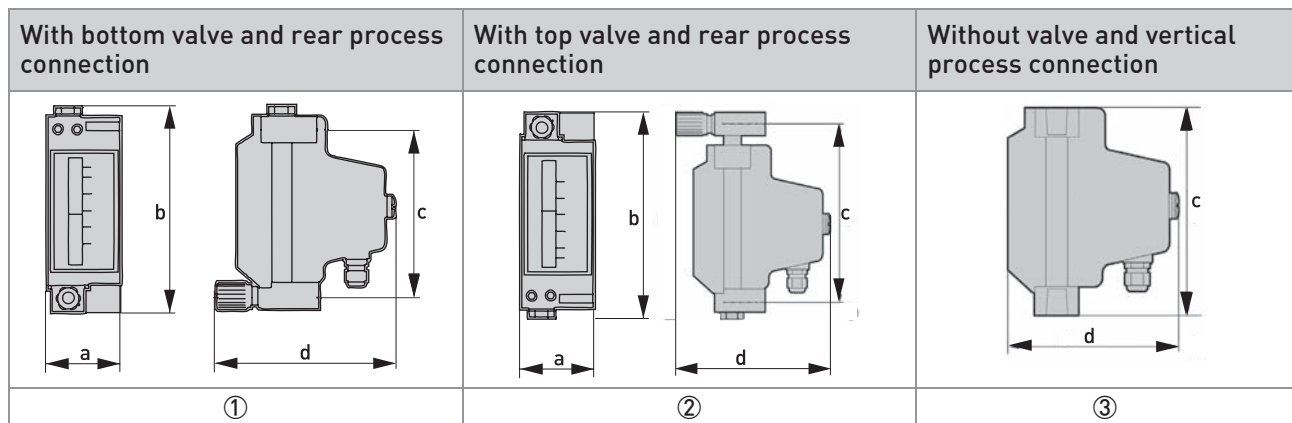
## Total length of flange connection adapter:

DK37/M8M with top/bottom valve: 250 mm / 9.8"

## Weights

	approx. g	approx. lb
DK37/M8M	800	1.76
DK37/M8M with differential pressure regulator	2600	5.73
DK37/M8M/R	2100	4.63
DK37/M8M/R with differential pressure regulator	3900	8.60

## 7.3.4 DK37/M8E



## Dimensions

		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
①	With bottom valve	56	2.21	153	6.03	125	4.92	approx. 144	approx. 5.67
②	With top valve	56	2.21	183	7.21	155	6.11	approx. 144	approx. 5.67
③	Without valve	56	2.21	145	5.71	145	5.71	approx. 121	approx. 4.77

**Total length of flange connection adapter:**

DK37/M8E with bottom valve: 250 mm / 9.8"

DK37/M8E with top valve: 300 mm / 11.8"

**Weights**

	approx. g	approx. lb
DK37/M8E	1000	2.21
DK37/M8E with differential pressure regulator	2800	6.18
DK37/M8E/R	2300	5.07
DK37/M8E/R with differential pressure regulator	4100	9.04

### 7.3.5 Minimum distances when installing several measuring devices

When installing several measuring devices side by side, a minimum distance between them has to be observed.

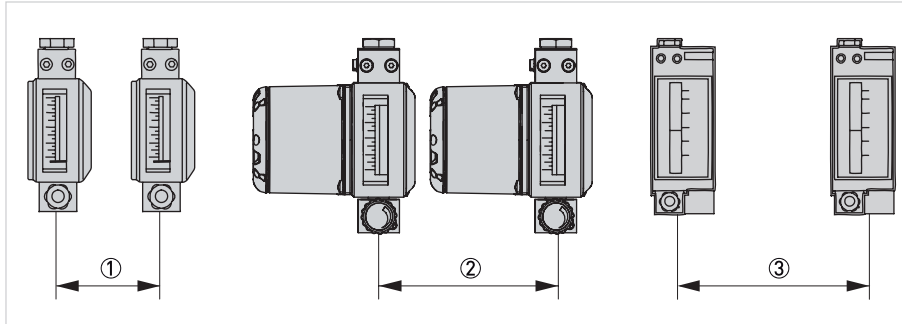


Figure 7-2: Minimum distances when installing several measuring devices

	Device	[mm]	["]
①	DK32, DK34	60	2.36
②	DK32/ESK, DK34/ESK	140	5.51
③	DK37/M8M	100	3.94
③	DK37/M8E	120	4.73

## 7.4 Measuring ranges

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

Cones	Float	Flow, water		Flow, air		Pressure loss	
		[l/h]	[GPH]	[Nm <sup>3</sup> /h]	[SCFH]	[mbar]	[psi]
K 005	N3 titanium ①	-	-	16	0.6	17	0.25
K 005	N1 titanium ①	-	-	25	1		
K 005	N1 Stainless steel	-	-	50	2	31	0.45
K 010	N1 titanium ①	1.5	0.4	70	2.6	31	0.45
K 010	N1 Stainless steel	3	0.8	100	4	38	0.55
K 015	N1 titanium ①	3	0.8	100	4	17	0.25
K 015	N1 Stainless steel	5	1.3	150	6	19	0.28
K 040	N2 titanium ①	7	1.8	250	10	17	0.25
K 040	N2 Stainless steel	10	2.6	400	15	27	0.39
K 080	N2 titanium ①	16	4.2	550	20	32	0.47
K 080	N2 Stainless steel	25	6.6	800	30	55	0.8
K 125	N2 titanium ①	25	6.6	-	-	45	0.65
K 125	N2 Stainless steel	40	11	1250	50	42	0.61
K 200	N2 Stainless steel	60	16	2000	75	85	1.23
K 300	N2 Stainless steel	80	21	2500	100	117	1.7
K 340	N2 Stainless steel	100	26	3400	125	166	2.4
K 340	N2 Triamet	150	40	4800	180	210	3.01
K 340 ②	Special Stainless steel	200	53	6000	225	462	6.7
K 340 ②	Special Triamet	250	66	8000	300	722	10.5

① Titanium components are not suitable for use in oxygen applications (media with an oxygen content that is significantly higher than the oxygen content in the earth's atmosphere)!

② DK37 only



### 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:

- Nm<sup>3</sup>/h or Nm<sup>3</sup>/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

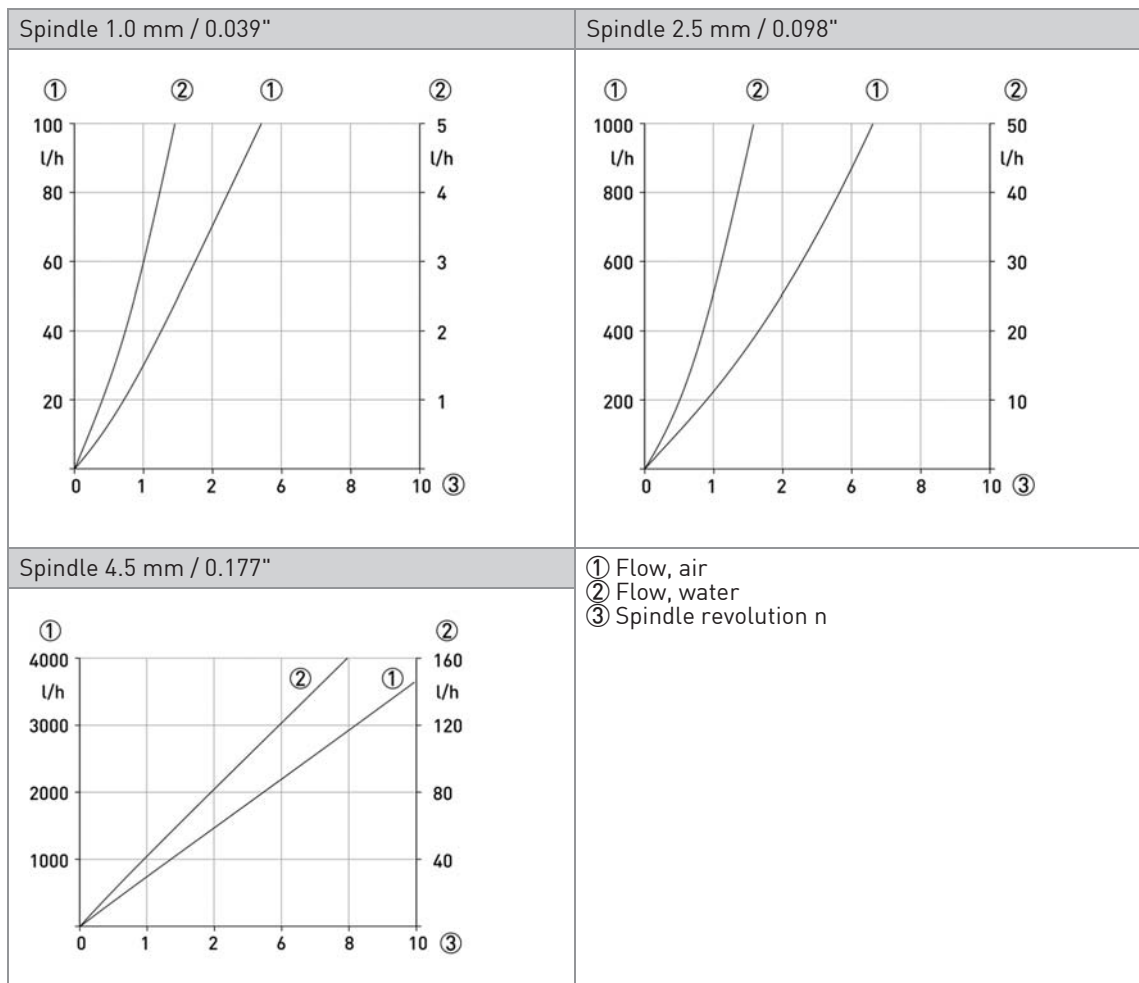
- SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)

**Valves**

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

Only DK32 and DK37	Max. flow Qv						Valve characteristic value	
	Valve stem		Water		Air		Kv	Cv
	Cones	∅ [mm]	∅ ["]	[l/h]	[GPH]	[NI/h]	[SCFH]	[m <sup>3</sup> /h]
K 005 - K 010	1	0.039	5	1.32	100	3.72	0.018	0.021
K 015 - K 040 - K 080	2.5	0.98	50	13.2	1000	37.2	0.15	0.175
K 125 - K 340	4.5	0.177	160	42.3	4300	160	0.48	0.552

**Valve characteristics**





## 7.5 Differential pressure regulators

Differential pressure regulators are used (only DK32 and DK37) to guarantee constant flow during fluctuating inlet and outlet pressure. Minimum pressures are required to operate the regulators (refer to regulator characteristics).



### INFORMATION!

*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.

Example of inlet pressure regulator RE-1000	Current flow rate:	1000 l/h air
	Outlet pressure p2 constant:	1.013 bara / 14.7 psia

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

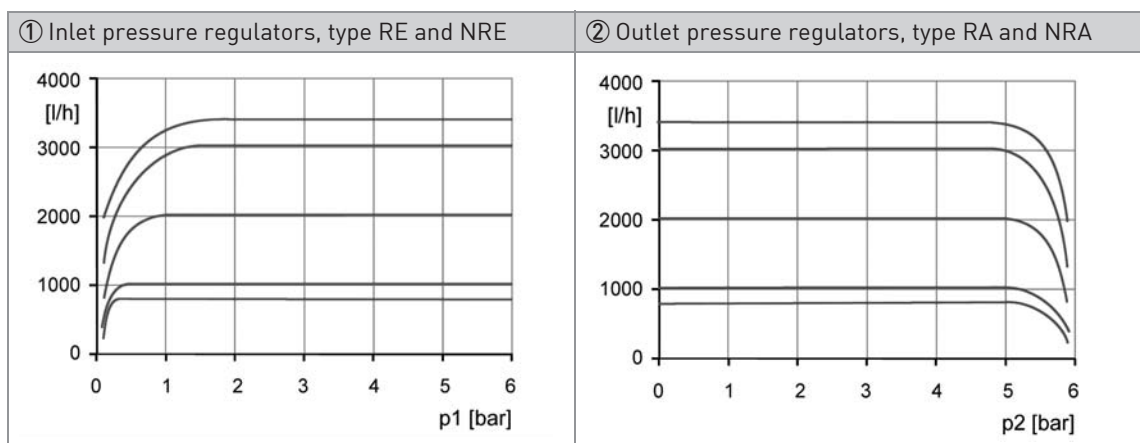
The regulators keep the flow rate constant in the case of a constant inlet pressure and a variable outlet pressure.

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.

Example for outlet pressure regulator NRA-800	Current flow rate:	800 l/h air
	Inlet pressure p1 constant:	6 bar / 87 psi

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



**Control ranges**

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

**Inlet pressure regulator ①**

	Max. flow rate				Min. inlet pressure	
	Water		Air			
	[l/h]	[GPH]	[NI/h]	[SCFH]	p1 [bar]	p1 [psi]
RE-1000	...40	...11	...1000	...37	0.5	7.25
RE-4000	...80	...20	...2000	...75	1	14.5
	...100	...25	...3000	...110	1.5	21.8
	...160	...42	...4000	...150	2	29
NRE-100	...2.5	...0.6	...100	...3.7	0.1	1.45
NRE-800	-	-	...250	...9.0	0.1	1.45
	-	-	...800	...30	0.2	2.9
	...25	...6.6	-	-	0.4	5.8

**Outlet pressure regulator ②**

	Max. flow rate				Min. inlet pressure		Min. pressure diff. *	
	Water		Air					
	[l/h]	[GPH]	[NI/h]	[SCFH]	p1 [bar]	p1 [psi]	Δp [bar]	Δp [psi]
RA-1000	...40	...11	...1000	...37	0.5	7.25	0.4	5.8
RA-4000	...100	...25	...2000	...75	1.5	21.8	1.2	17.4
	-	-	...3000	...110	1.5	21.8	1.2	17.4
	...160	...42	...4000	...150	2	29	1.5	21.8
NRA-800	...1	...0.25	...250	...9.0	0.1	1.45	0.05	0.73
	-	-	...500	...19	0.2	2.9	0.1	1.45
	-	-	...800	...30	0.4	5.8	0.2	2.9
	...25	...6.6	-	-	0.4	5.8	0.4	5.8

\* Differential pressure between inlet and outlet pressure

**Reference condition for gas measurements:**

Flow measurements for gases are attributed to:

- NI/h or Nm<sup>3</sup>/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

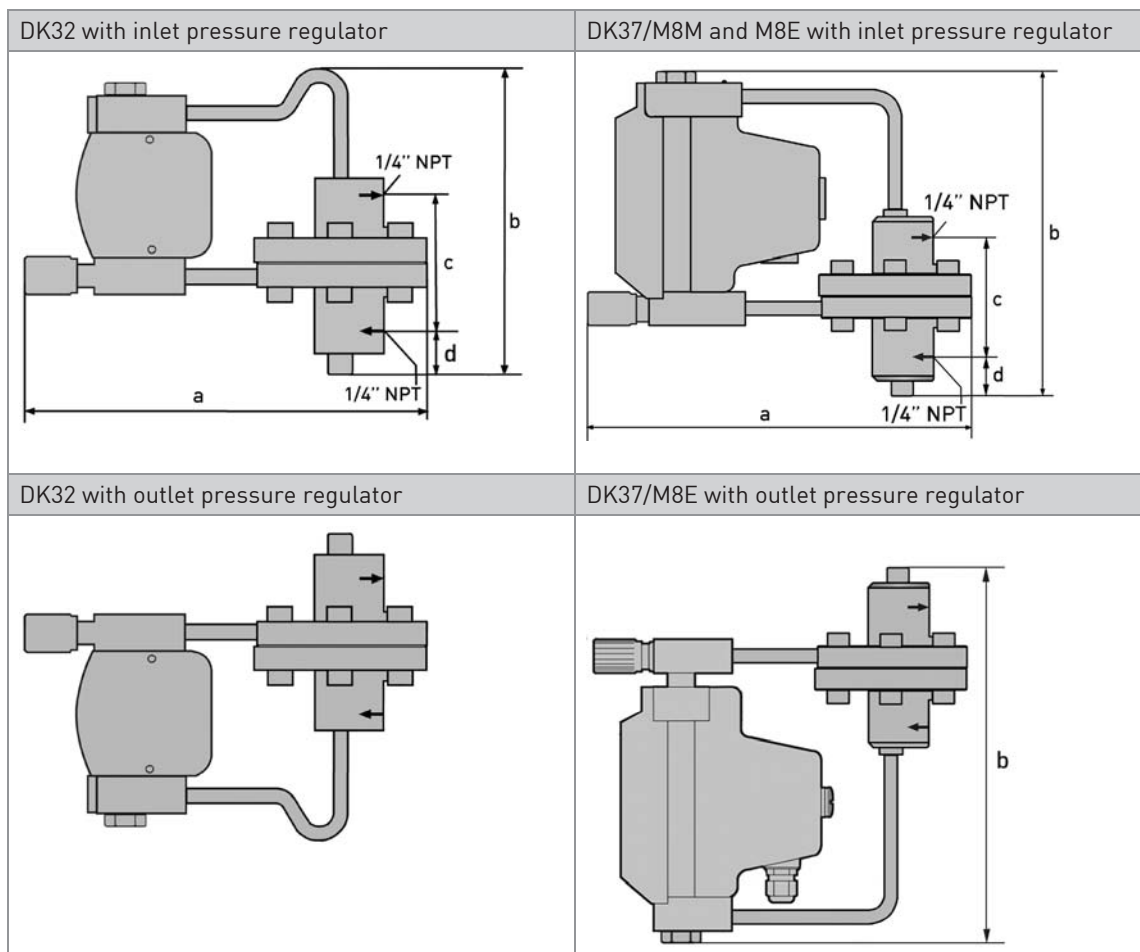
Connection, standard	1/4" NPT
Connection, option	Serto, Ermeto 6 or 8, hose nozzle 6 mm or 8 mm, Dilo, Gyrolok, Swagelok, G1/4
Max. operating gauge pressure (at +20°C / +68°F)	64 barg / 928 psig
Product temperature	+150°C / +302°F
Material	CrNi steel 1.4404
Gasket	PTFE
Diaphragm	Carbon/graphite-filled PTFE
O-ring	FPM or FFKM

Higher pressures and temperatures, other connections or materials on request

### Dimensions with differential pressure regulator

	approx. a		approx. b		c		d	
	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]
DK32	230	9.1	163	6.4	70	2.8	23	0.91
DK37	230	9.1	200	7.9	70	2.8	23	0.91
DK37/M8E ①	230	9.1	230	9.1	70	2.8	23	0.91

① with outlet pressure regulator





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