



DK32 - DK34 - DK37 Handbook

Variable area flowmeters

Electronic revision ESK3x: ER 1.1.x

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1.1 Electronic revision DK32/ESK, DK34/ESK

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

Electronic revision	Explanation	Documentation
ER 1.1.x	Basic version	MA DK32-37 R07, R08, R09, R10

Table 1-1: Description of the electronic revision

1.2 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. 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.



INFORMATION!

- *The product may not contain any ferromagnetic particles or solids.*
- *The product must be sufficiently liquid and free of deposits.*
- *Avoid pressure surges and pulsing flows.*
- *Open valves slowly.*
- *Do not use solenoid valves.*
- *For accurate flow measurement, the application data should be consistent with the sizing data and calibration of the variable area flowmeter.*

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
- 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.

1.3 Conformity

The manufacturer certifies successful testing of the product by applying the conformity mark on the device.

This device fulfills the statutory requirements of the relevant directives and regulations.

For further information on directives, regulations, standards and certifications, please refer to the declaration of conformity which you can download from the manufacturer's website.



DANGER!

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



CAUTION!

*For devices used in SIL applications, additional safety notes apply.
For detailed information refer to the "Safety manual".*

1.4 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 conformity 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 vapours
1	Fluid group 1
4.3	Article 4.3 of the directive 2014/68/EU
SEP	Sound engineering practice

Table 1-2: Example of PED key

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 conformity 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 flow regulator.
- Implement appropriate measures to counteract external fire hazards.

1.5 Safety instructions from the manufacturer

1.5.1 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.

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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.

1.5.2 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.

1.5.3 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.

1.5.4 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 cannot 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.

1.5.5 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.

1.6 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.

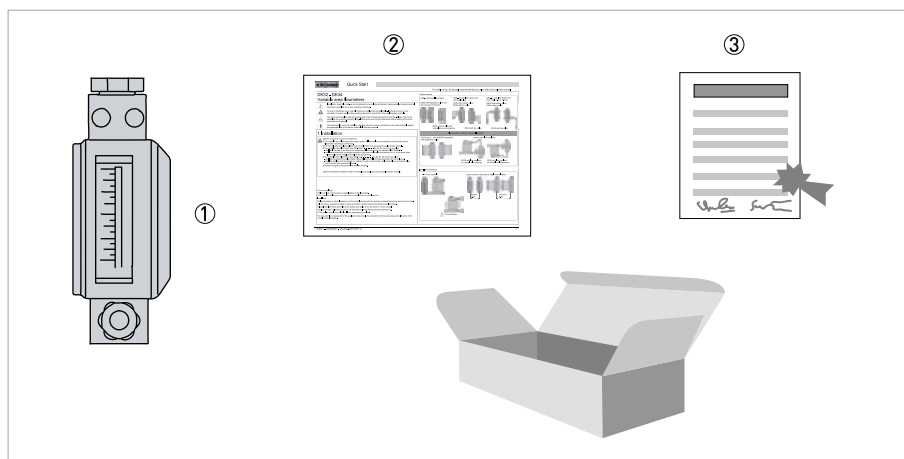


Figure 2-1: Scope of delivery

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

2.2 Device versions

- DK32 with top/bottom valve and rear process connection
- DK34 without valve and vertical process connection
- DK37 with top/bottom valve and rear process connection
- DK37 without valve and vertical process connection

The following designs are available as options:

- with flow regulator for variable inlet pressure
- with flow regulator for variable outlet pressure
- 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

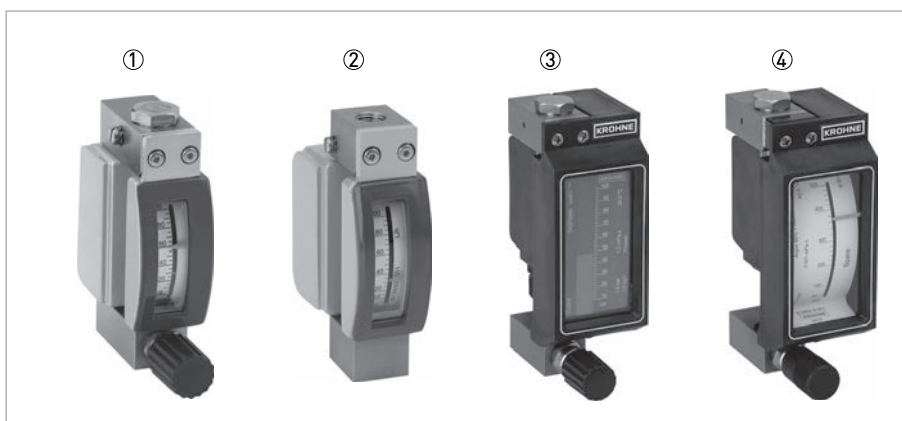


Figure 2-2: Examples of device versions

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

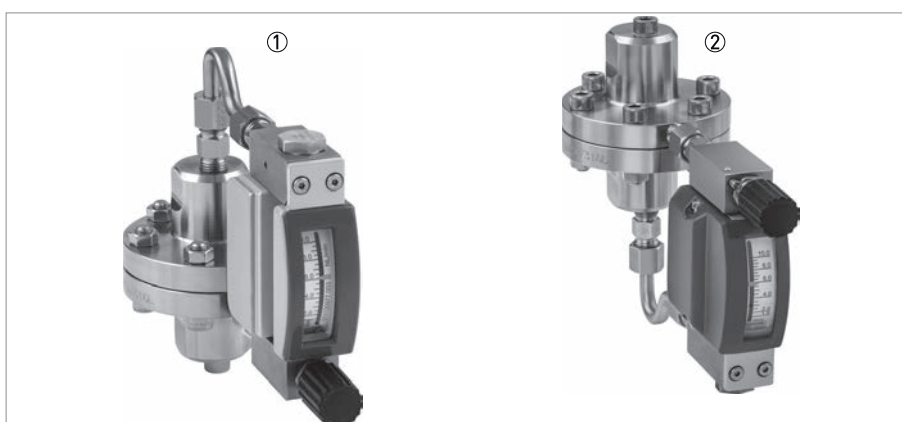


Figure 2-3: Versions with flow regulators

- ① DK32 with flow regulator for variable inlet pressure
- ② DK32 with flow regulator for variable outlet pressure



Figure 2-4: Versions with flange adapter

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

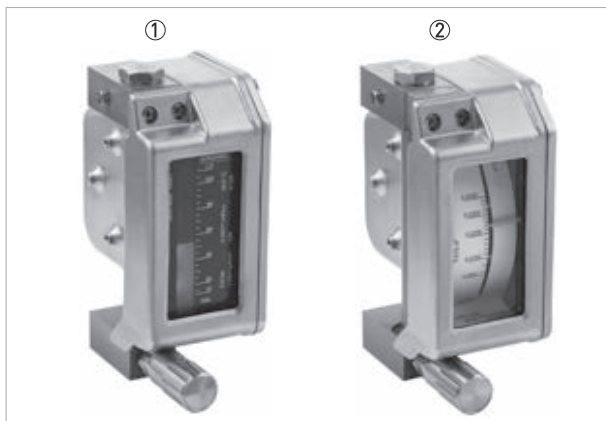


Figure 2-5: Version DK37 with stainless steel housing

- ① DK37/M8E/R
- ② DK37/M8M/R

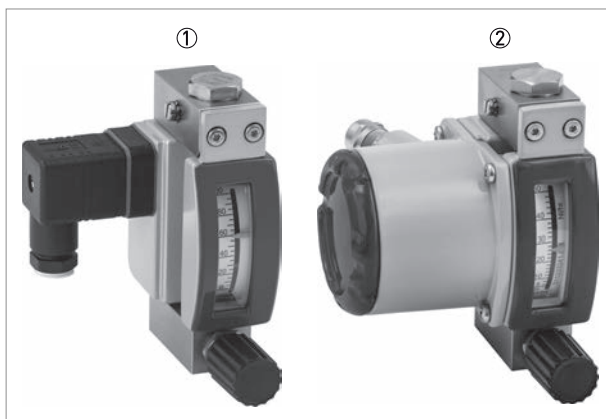


Figure 2-6: Versions DK32 with limit switches or 4...20 mA/HART signal output

- ① DK32 with NAMUR 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.

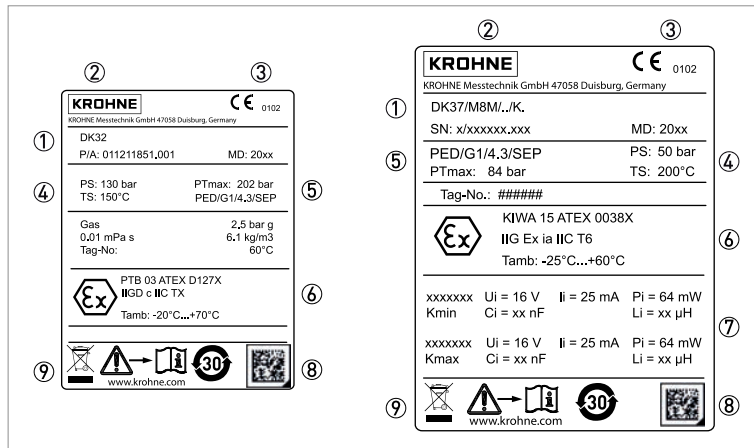


Figure 2-7: Examples of nameplates

- ① Device type
- ② Manufacturer
- ③ Identification number of the notified body
- ④ Rating data: temperature & pressure rating
- ⑤ Data according to the pressure equipment directive
- ⑥ Marking according to the notified body
- ⑦ Electrical connection data
- ⑧ Data 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 *:

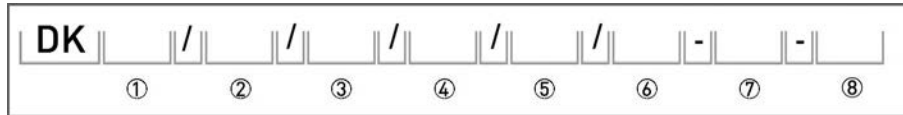


Figure 2-8: Designation code DK32, DK34

- ① 32 - with top/bottom valve and rear process connection
34 - without valve and vertical process connection
- ② RE - flow regulator for variable inlet pressure
RA - flow regulator for variable outlet pressure
- 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 - removable plug
L - cable entry with fixed cable
- ⑤ HT - high-temperature version
- ⑥ free
- ⑦ Ex - explosion-protected equipment
- ⑧ SK - SIL compliance of limit switches according to IEC 61508

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

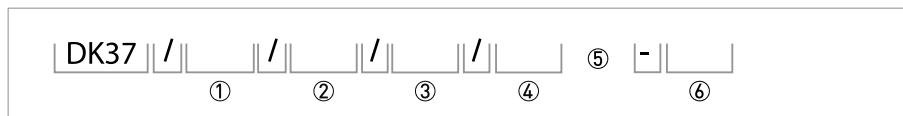


Figure 2-9: Designation code DK37

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

* 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!**

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 are: -40...+80°C / -40...+176°F

3.3 Transport

If possible, transport the device to the installation point in the original packaging.

3.4 Installation conditions

**CAUTION!**

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

- *The variable area flowmeter must be installed vertically (within 5° of the vertical).*
- *Flow direction from bottom to top.*
- *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 mounting several measuring devices next to each other or next to ferromagnetic system components or solenoid valves, a minimum lateral distance must be ensured. For further information refer to Minimum distances on page 47.*
- *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 limit switches

4.2.1 Electrical connection DK32 / DK34

The electrical connection of the limit switches is made for

- DK3.././S - via a connector plug
- DK3.././L - via a cable assembly

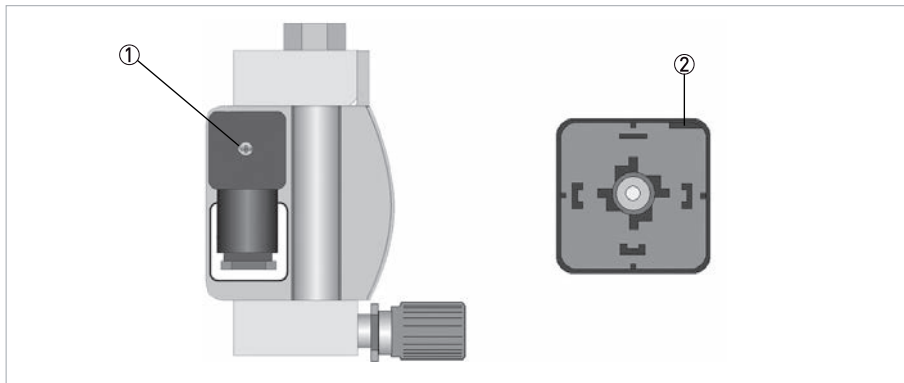


Figure 4-1: Electrical connection of NAMUR limit switches



The following procedures are to be performed (DK3.././S):

- Loosen the screw ① of the connector plug.
- Pull out the plug.
- Remove the screw ① completely from the plug.
- Insert a screwdriver in the marked opening ② (lift) and remove the terminal block.
- Lead the connection cable through the cable gland.
- Insert the cable (max. 1.5 mm²) and tighten it.

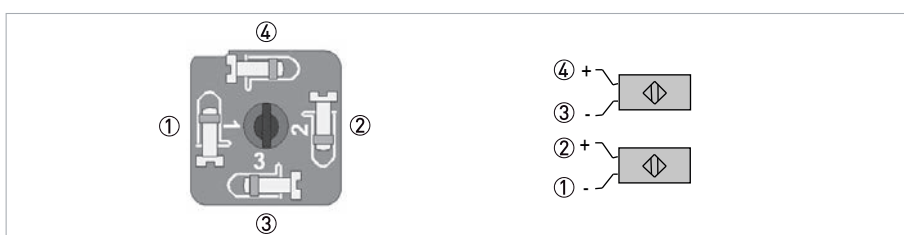


Figure 4-2: Electrical connection of NAMUR limit switches K1/K2

../S plug	Contact connections	../L cable
Terminal		Strand colour
①	MIN minus	white
②	MIN plus	yellow
③	MAX minus	green
④	MAX plus	brown

Table 4-1: Terminal assignment

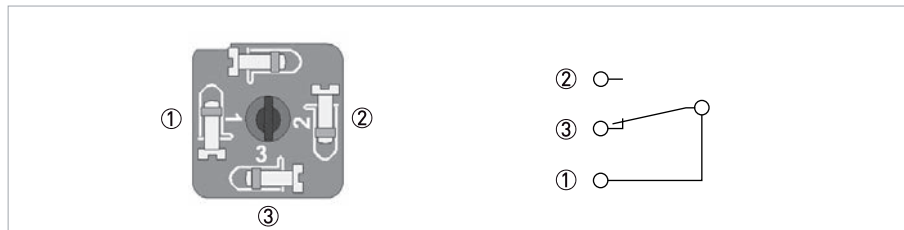


Figure 4-3: Electrical connection of REED limit switch R1

../S plug	Contact connections	../L cable
Terminal		Strand colour
①	Common	red
②	Normally open	brown
③	Normally closed	blue
④	Unused	-

Table 4-2: Terminal assignment

4.2.2 Electrical connection DK37 M8M

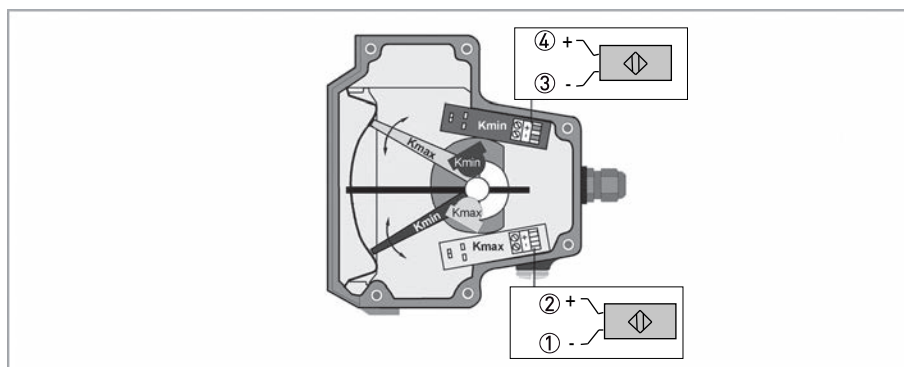


Figure 4-4: Electrical connection of NAMUR limit switches K1/K2

	Contact	Contact connection
④	Kmin +	MIN plus
③	Kmin -	MIN minus
②	Kmax +	MAX plus
①	Kmax -	MAX minus

Table 4-3: Contact connections

4.2.3 Settings of NAMUR limit switches for DK32, DK34, DK37 M8M

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

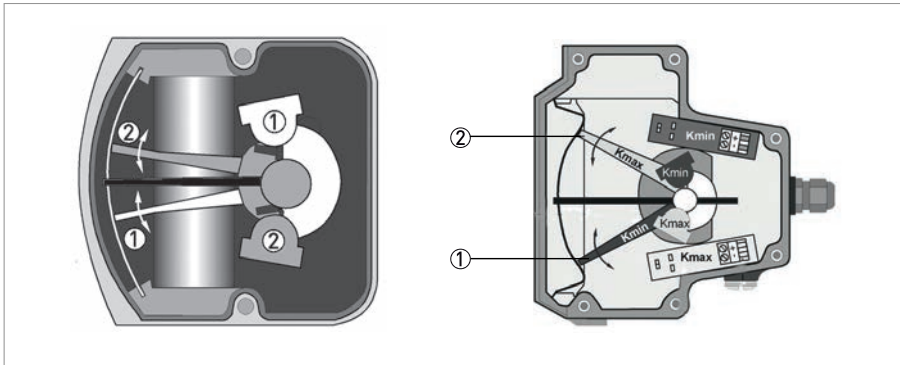


Figure 4-5: Settings of NAMUR limit switches for DK32, DK34, DK37 M8M

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.

4.2.4 Settings of REED limit switch

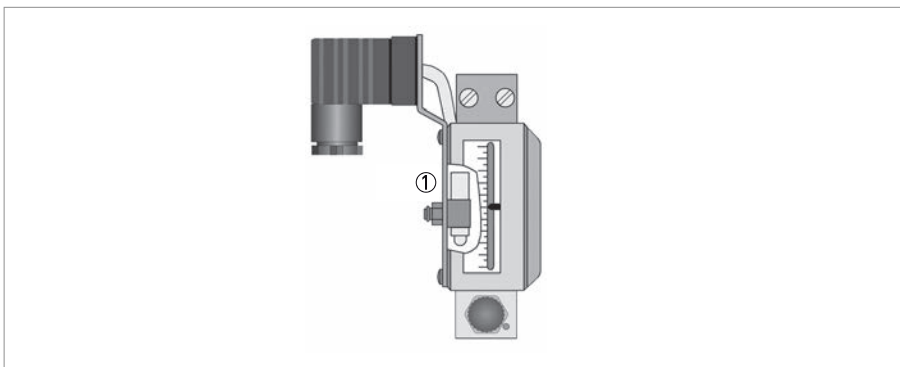


Figure 4-6: Settings of REED limit switch



- Loosen the nut ①.
- Set the REED cartridge to the desired value.
- Fix the nut ①.



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.

4.3 Electrical signal output ESK3x for DK32, DK34

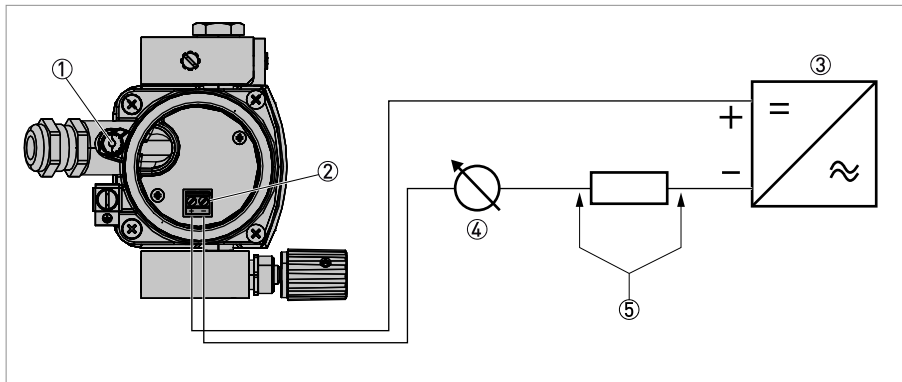


Figure 4-7: Electrical connection of ESK3x

- ① Lock screw in case of Ex d/XP device version
- 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 Ex d/XP 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 Ex d/XP 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.

4.3.1 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_{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.

4.3.2 Load for HART communication

**INFORMATION!**

For HART[®] communication a load of at least 250 Ω 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).

4.3.3 Configuration

The ESK3x electrical signal output can be configured via HART[®] 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[®] 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.

4.4 Electrical signal output for DK37/M8E

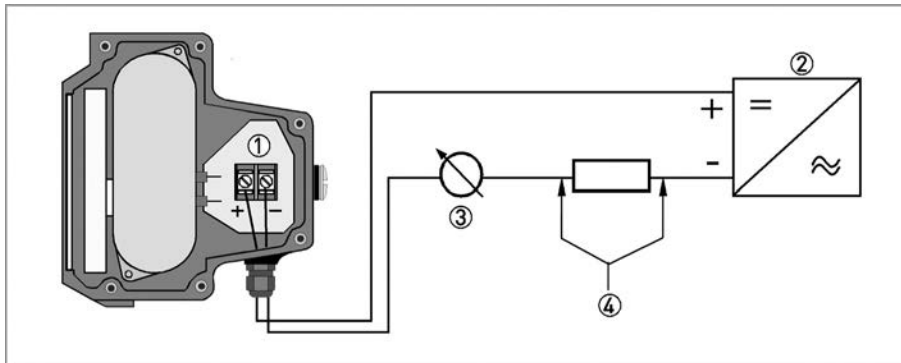


Figure 4-8: Electrical connection M8E

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

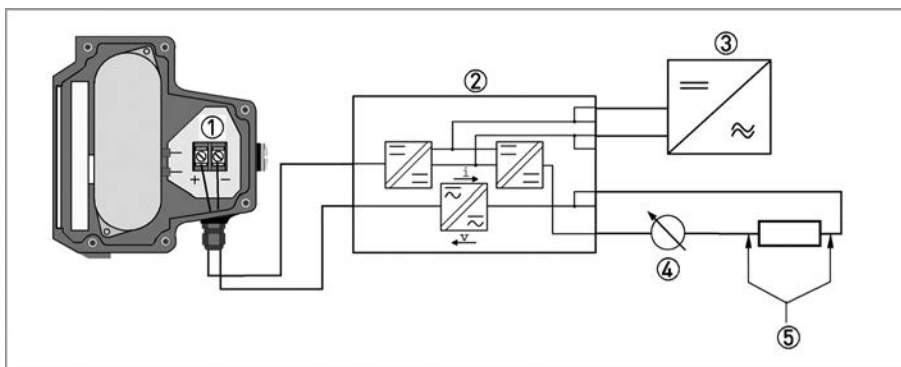


Figure 4-9: Electrical connection with galvanic isolation

- 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® communication

4.4.1 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_{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[®] communication a load of at least 250 Ω 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).

4.4.3 Configuration

The M8E electronic indicator can be configured via HART[®] 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[®] 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.

4.5 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.

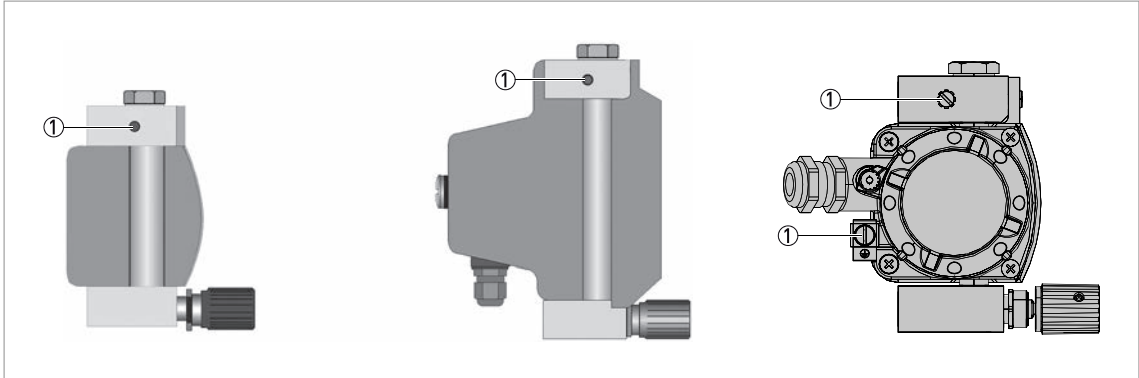


Figure 4-10: Grounding connections

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.*

4.6 Ingress protection

The variable area flowmeters DK32 / DK34 / DK37 have been tested for IP protection in accordance with EN 60529 and NEMA 250.

The following protection categories have been achieved:

Device variant	Ingress protection according to	
	EN 60529	NEMA 250
DK32, DK34 mechanical	IP66/IP68	NEMA 4X
DK32, DK34 with limit switches K1/K2	IP65	NEMA 4X
DK32, DK34 with limit switch R1	IP65	-
DK32, DK34 with transmitter ESK3x	IP66/IP68	NEMA 4X
DK37 with PPS indicator	IP66	-
DK37 with stainless steel indicator	IP66/IP67	NEMA 4X

Table 4-4: Ingress protection



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 with blanking plugs ①.
- Do not remove the required cable bushing from the cable feedthrough.



Figure 4-11: 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 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.*
- *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.

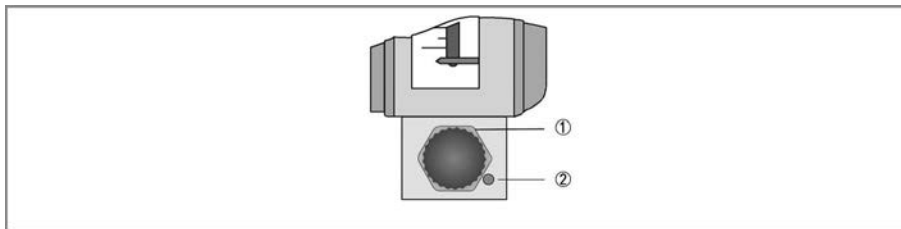


Figure 6-1: Valve lock



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:	
Telephone number:		Email address:	
Fax number:			
Manufacturer order number or serial number:			
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 caused by any residual media contained in this 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):



According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, 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

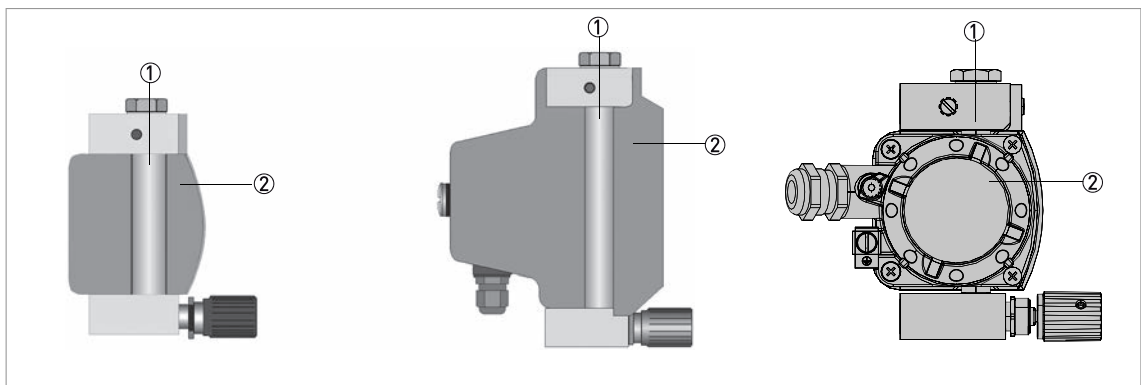


Figure 6-2: Description of the device components

- 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 ² / 6.98 in ²	45 cm ² / 6.98 in ²
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:

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

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 ² / 1.40 in ²	9 cm ² / 1.40 in ²
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. and 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:

Approx. information	Weight / size	
	DK3./K.	DK3./ESK
PCB	1 cm ² / 0.16 in ²	25 cm ² / 3.88 in ²
Potting (silicone)	5 g / 0.01 lb	28 g / 0.06 lb
Batteries	-	-
Electrolytic capacitors	-	-
LC-display	-	-

Table 6-4: Main components of the electronic components



INFORMATION!

The PCBs are 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: $G = A + W$

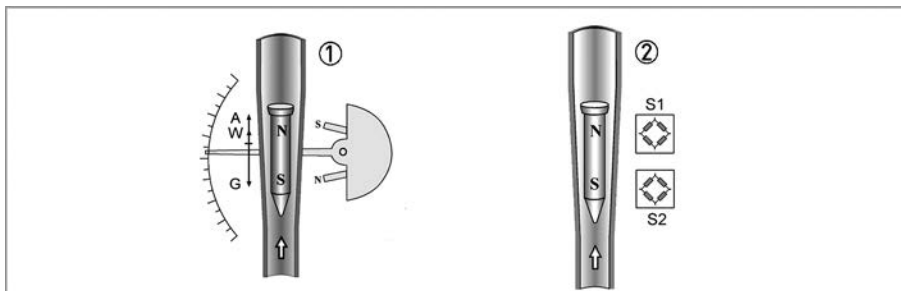


Figure 7-1: Functional principle

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.

With DK37/M8E, DK32/ESK and DK34/ESK ② the flow-dependent height position of the float in the measuring unit is electronically detected with the magnetic field 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

Measurement accuracy

Max. permissible error DK32 / DK34	3.0% of full scale range
	4.0% of measured value according to VDI/VDE 3513-2 ($q_G = 50\%$)
Max. permissible error DK37	2.0% of full scale range
	2.5% of measured value according to VDI/VDE 3513-2 ($q_G = 50\%$)
Measurement repeatability DK32 / DK34 / DK37	0.5%

Operating conditions

Temperature	
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
	For detailed information on product and ambient temperatures refer to <i>Temperatures for all device versions</i> on page 37.
Pressure	
Max. operating pressure PS	Depending on the version (refer to nameplate)
	Standard version: 130 barg / 1885 psig
	Higher pressures on request
Max. test pressure PT	Depending on the version (refer to nameplate)
	Standard version: 202 barg / 2930 psig
	Higher pressures on request

Ingress protection according to EN 60529 and NEMA 250	
DK32, DK34 mechanical	IP66/IP68 and NEMA 4X
DK32, DK34 with limit switches K1/K2	IP65 and NEMA 4X
DK32, DK34 with limit switch R1	IP65
DK32, DK34 with transmitter ESK3x	IP66/IP68 and NEMA 4X
DK37 with PPS indicator	IP66
DK37 with stainless steel indicator	IP66/IP67 and NEMA 4X

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.

Materials

Top fitting, bottom fitting, cone	Stainless steel 1.4404 / 316 L
Lock screw	Stainless steel 1.4404 / 316 L
Float, standard	Stainless steel 1.4404 / 316 L or titanium
Dosing unit	Stainless steel 1.4571 / 316 Ti
Valve stem	Stainless steel 1.4404 / 316 L
Gasket of lock screw	PTFE
Gasket of dosing unit	FPM/PTFE, PTFE, FFKM
	Other gasket materials on request
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
Other options on request	
Special materials	e.g. Titanium Grade 2, Hastelloy [®] C276/2.4819, Monel [®] /2.4360, Inconel [®] /2.4856,...
Options	Surface passivation of all metallic, wetted parts e.g. SilcoNert [®] 2000 or Dursan [®] , material certificates, NACE MR0175 / MR0103, non-destructive material tests, pressure/leakage tests, final cleaning

Process connections

Standard	1/4 NPT female
Option	G1/4, Ermeto, Serto, Gyrolok, Swagelok, flanges
	Other connections on request

Table 7-1: Technical data

7.2.1 Temperatures for all device versions



DANGER!

For devices to be used in hazardous areas, special temperature ranges apply. These can be found in the Ex supplementary instructions.

Device variant	Permissible ambient temperatures			
	[°C]		[°F]	
Max. medium temperature	150	100	302	212
DK32, DK34, DK37/M8M without electrical built-ins	-40...+70	-40...+90	-40...+158	-40...+194
DK32, DK34, DK37/M8M with limit switch I7S2002-N or SJ2-SN	-40...+40	-40...+90	-40...+104	-40...+194
DK32, DK34, DK37/M8M with limit switch SC2-N0	-25...+40	-40...+90	-25...+104	-40...+194
DK32, DK34 with transmitter ESK3x	-40...+40	-40...+70	-40...+104	-40...+158
DK37/M8E	-40...+40	-40...+70	-40...+104	-40...+158

Table 7-2: Permissible ambient temperatures for electronics variants in °C and °F

Device variant	Permissible medium temperatures	
	[°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

Table 7-3: Permissible medium temperatures for gasket variants in °C and °F

Device variant	Permissible medium and ambient temperatures					
	[°C]			[°F]		
Max. ambient temperature	150	180	200	302	356	392
DK32 HT with FPM/PTFE, DK34 HT (optional Reed contact)	-25...+150	-	-	-13...+302	-	-
DK32 HT with FFKM with Reed contact	-20...+200	-20...+180	-	-4...+392	-4...+356	-
DK32 HT with FFKM without Reed contact	-20...+200	-20...+200	-20...+200	-4...+392	-4...+392	-4...+392

Table 7-4: Permissible medium and ambient temperatures for high-temperature version DK32 HT/DK34 HT in °C and °F

7.2.2 Electrical connection data for 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 ²		
DK32 - 34 /K./S	Clamping range: 4.5...10 mm / 0.18...0.4"		
DK37/M8M	Clamping range: 4...8 mm / 0.16...0.31"		
DK32 - 34/K./L	Ø Connecting cable: 6.3 mm / 0.25"; 0.75 mm ²		
	Cable length: approx. 1.7 m / 5.6 ft (other lengths on request)		
Limit switch	I7S2002-N	SC2-N0	SJ2-SN
SIL 2-compliant according to IEC 61508	no	yes	yes
Connection type NAMUR	2-wire	2-wire	2-wire
Switching element function	Normally closed	Normally closed	Normally closed
Nominal voltage U ₀	8 VDC	8 VDC	8 VDC
Pointer vane not detected	≥ 3 mA	≥ 3 mA	≥ 3 mA
Pointer vane detected	≤ 1 mA	≤ 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		

Table 7-5: Electrical connection data for indicator with limit switch

① Reduced values for Ex

7.2.3 Electrical connection data for transmitter ESK3x for DK32, DK34

Cable entry	M16 x 1.5 or 1/2" NPT
Clamping range of cable gland	4...8 mm / 0.16...0.31" (PA gland) or 5...10 mm / 0.2...0.39" (stainless steel gland)
Terminal connection	1.5 mm ²
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	112.5	22.0
Multidrop operation	-	4.0
Min. U _{ext.}	12 VDC	

ESK3x HART Device

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

Table 7-6: Electrical connection data for transmitter ESK3x

7.2.4 Electrical connection data for indicator DK37/M8E with electrical signal output

Cable gland	M16 x 1.5
Clamping range	4...8 mm / 0.16...0.31"
Terminal connection	2.5 mm ²
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
Multidrop operation	-	4.5
Min. U _{ext.}	14.8 VDC	

Table 7-7: Electrical connection data for indicator with electrical signal output

7.2.5 Approvals

Standard	Device version	
ATEX / IECEx / UKEx	Mechanical, without electrical built-ins	II2G Ex h IIC T6 Gb II2D Ex h IIIC 150°C Db
	NAMUR switches K1/K2	II2G Ex ia IIC T6 Gb II2D Ex ia IIIC T85°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 T85°C Db II3G Ex nA/ec IIC T6 Gc II2D Ex tb IIIC T85°C Db
QPS (US/C)	NAMUR switches K1/K2	IS Class I,II,III Div 1 / Zone 1/21 AEx ia/Ex ia NI Class I Div 2 / Zone 2 AEx nA/Ex nA
	REED limit switch R1	IS Class I Div 1 / Zone 1 AEx ia/Ex ia
	4...20 mA / HART signal output ESK3x	IS Class I,II,III Div 1 / Zone 1/21 AEx ia/Ex ia NI Class I Div 2 / Zone 2 AEx nA/Ex nA XP Class I Div 1 / Zone 1 AEx db/Ex db DIP Class II, III Div 1 / Zone 21 AEx tb/Ex tb
	K1/K2, R1, ESK3x	Certified electrical safety for ordinary location / general purpose
Other approvals as NEPSI, INMETRO, KCS, CCOE, EAC on request.		

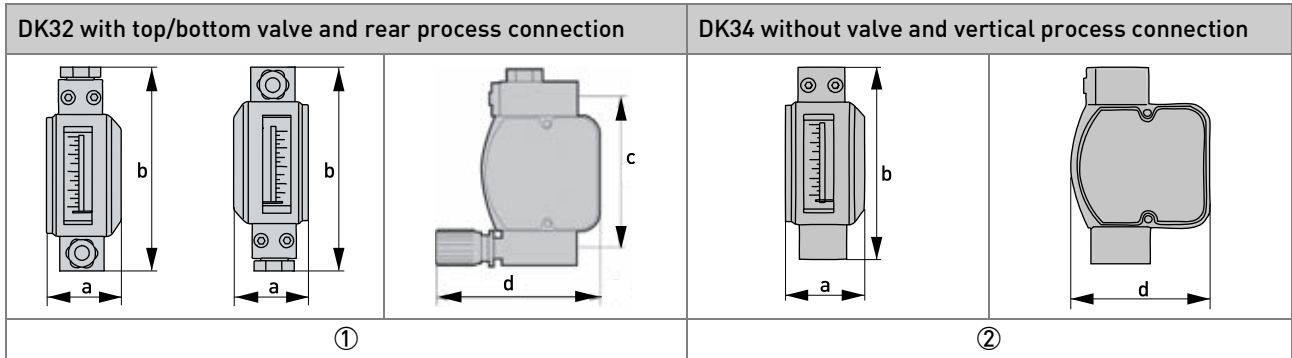
Table 7-8: Approvals for DK32, DK34

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

Table 7-9: Approvals for DK37

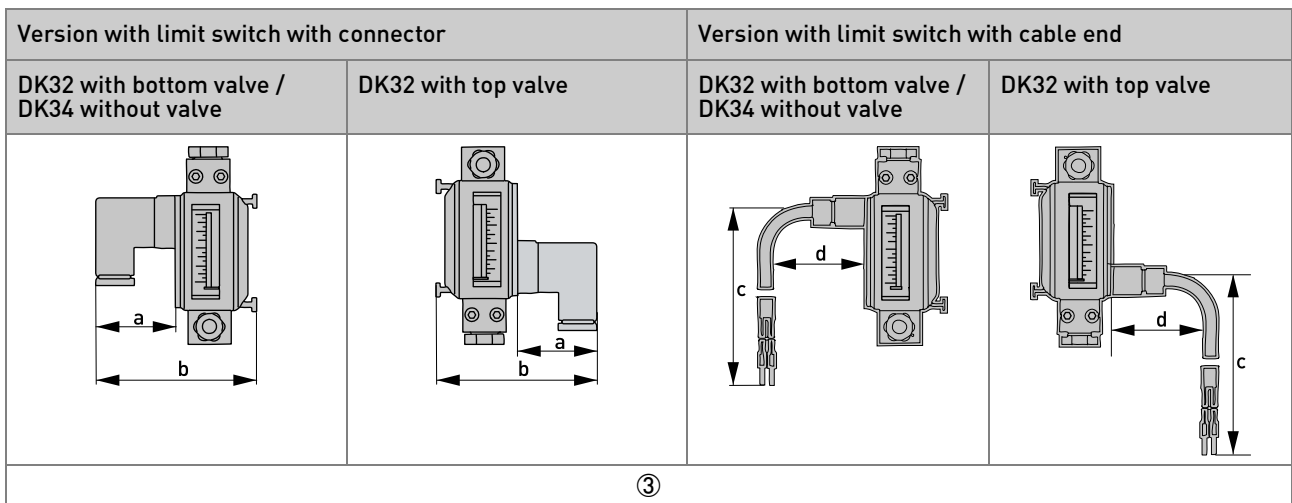
7.3 Dimensions and weight

7.3.1 DK32, DK34



		Dimensions								Weight approx.	
		a		b		c		d			
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]	g	lb
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

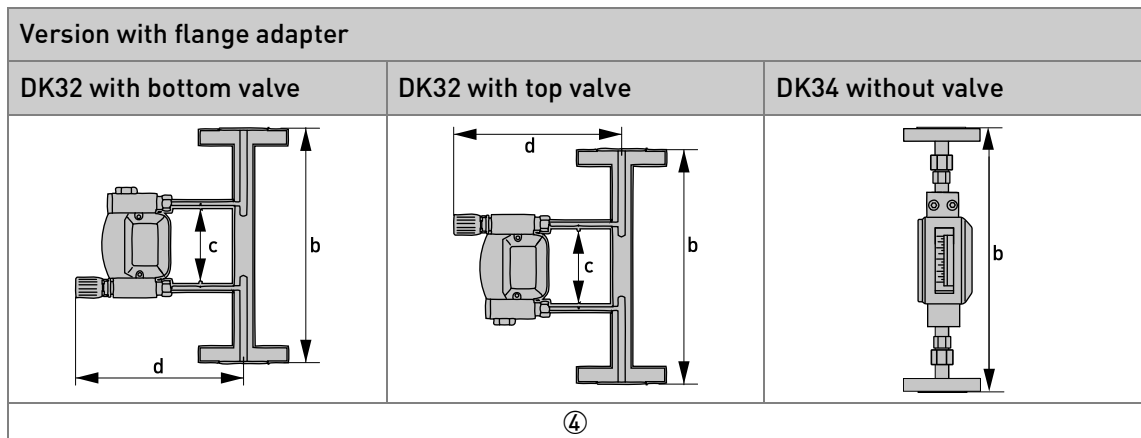
Table 7-10: Dimensions and weight



		Dimensions								Weight approx.	
		a		b		c		d			
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]	g	lb
③	DK32	46	1.81	approx. 90	approx. 3.55	1500	59	approx. 50	approx. 1.97	700	1.54
	DK34									600	1.32

Table 7-11: Dimensions and weight

Weight for DK32 with flow regulator: 2500 g / 5.51 lb

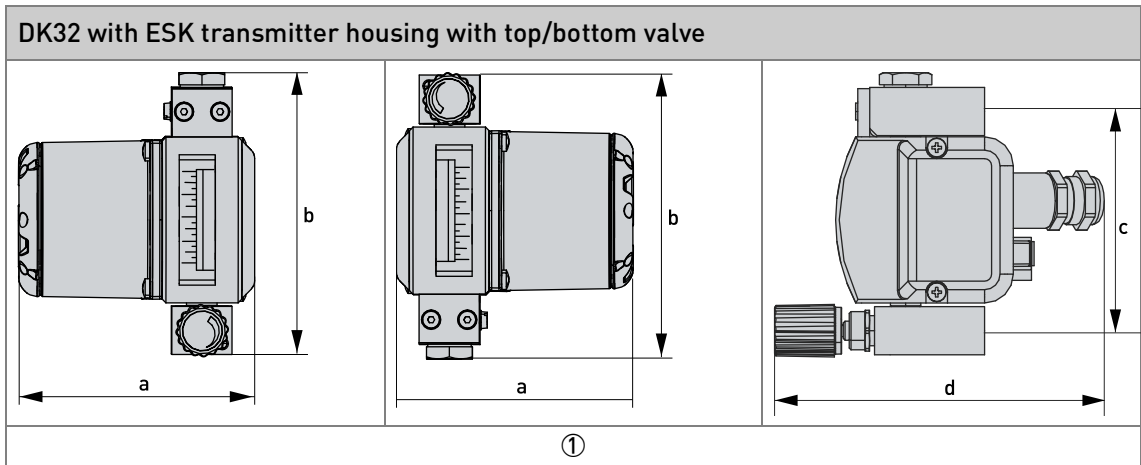


		Dimensions							
		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
④	DK32	-	-	250	10.2	90	3.55	approx. 195	approx. 7.68
	DK34	-	-	250	10.2	-	-	-	-

Table 7-12: Dimensions and weight

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



		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
①	DK32, DK34	100	3.94	118	4.65	90	3.55	140	5.51

Table 7-13: Dimensions

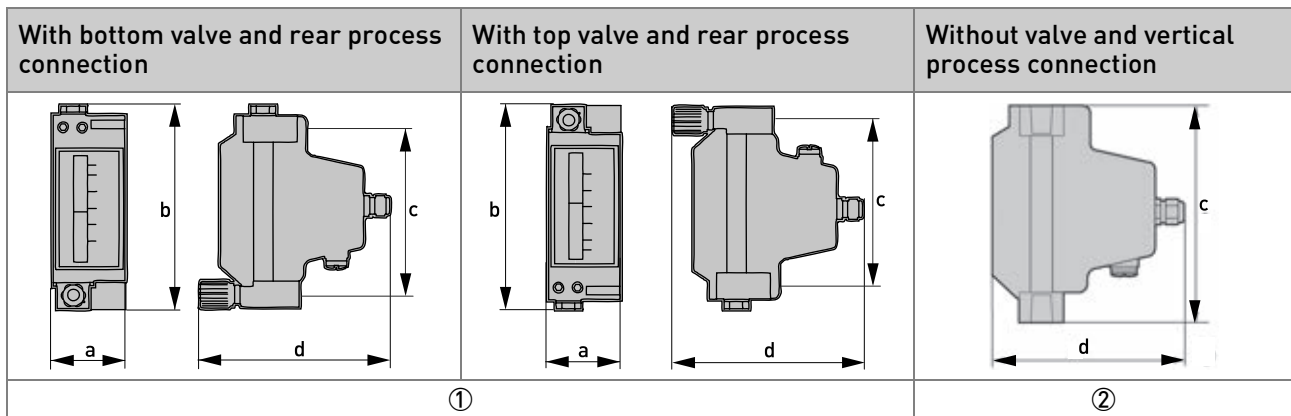
Total length of flange connection adapter:

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

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

Table 7-14: Weight

7.3.3 DK37/M8M



		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

Table 7-15: Dimensions

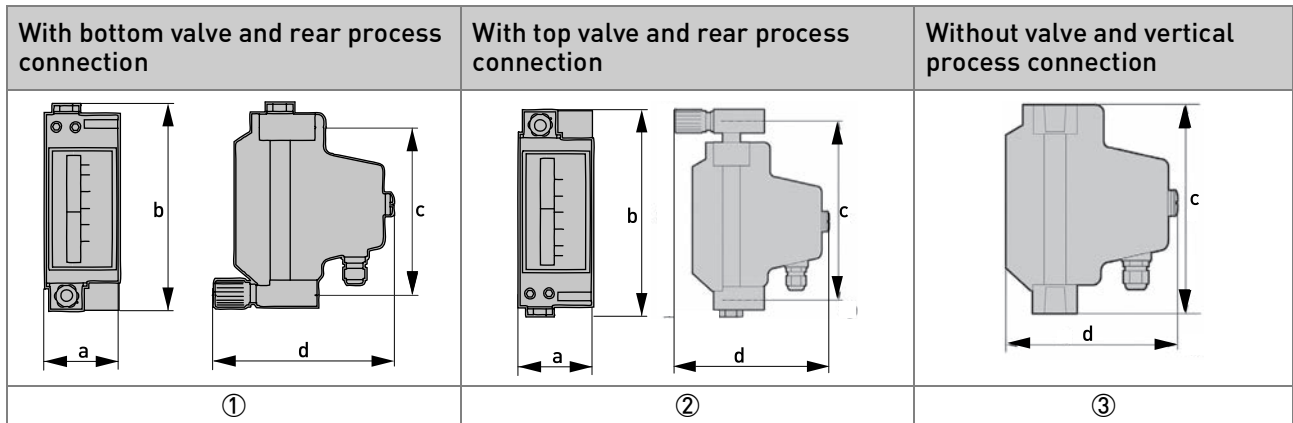
Total length of flange connection adapter:

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

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

Table 7-16: Weight

7.3.4 DK37/M8E



		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

Table 7-17: Dimensions

Total length of flange connection adapter:

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

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

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

Table 7-18: Weight

7.3.5 Minimum distances

When mounting several measuring devices next to each other or next to ferromagnetic system components or solenoid valves, a minimum lateral distance must be ensured.

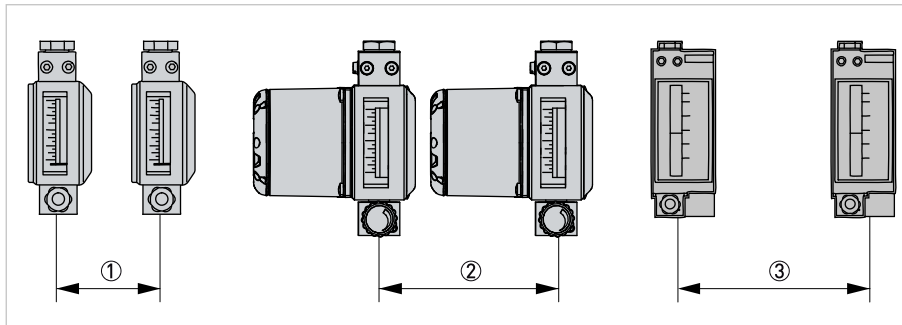


Figure 7-2: Minimum distances

	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

Table 7-19: Minimum distances in mm and inch

7.4 Measuring ranges

7.4.1 Float

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]	[NI/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

Table 7-20: Measuring ranges for floats

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:

- 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)

7.4.2 Valves (only DK32 and DK37)

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	Valve stem		Max. flow Qv				Valve characteristic value	
	Ø [mm]	Ø ["]	Water		Air		Kv	Cv
			[l/h]	[GPH]	[NL/h]	[SCFH]	[m ³ /h]	[GPM]
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

Table 7-21: Measuring ranges for valves (only DK32 and DK37)

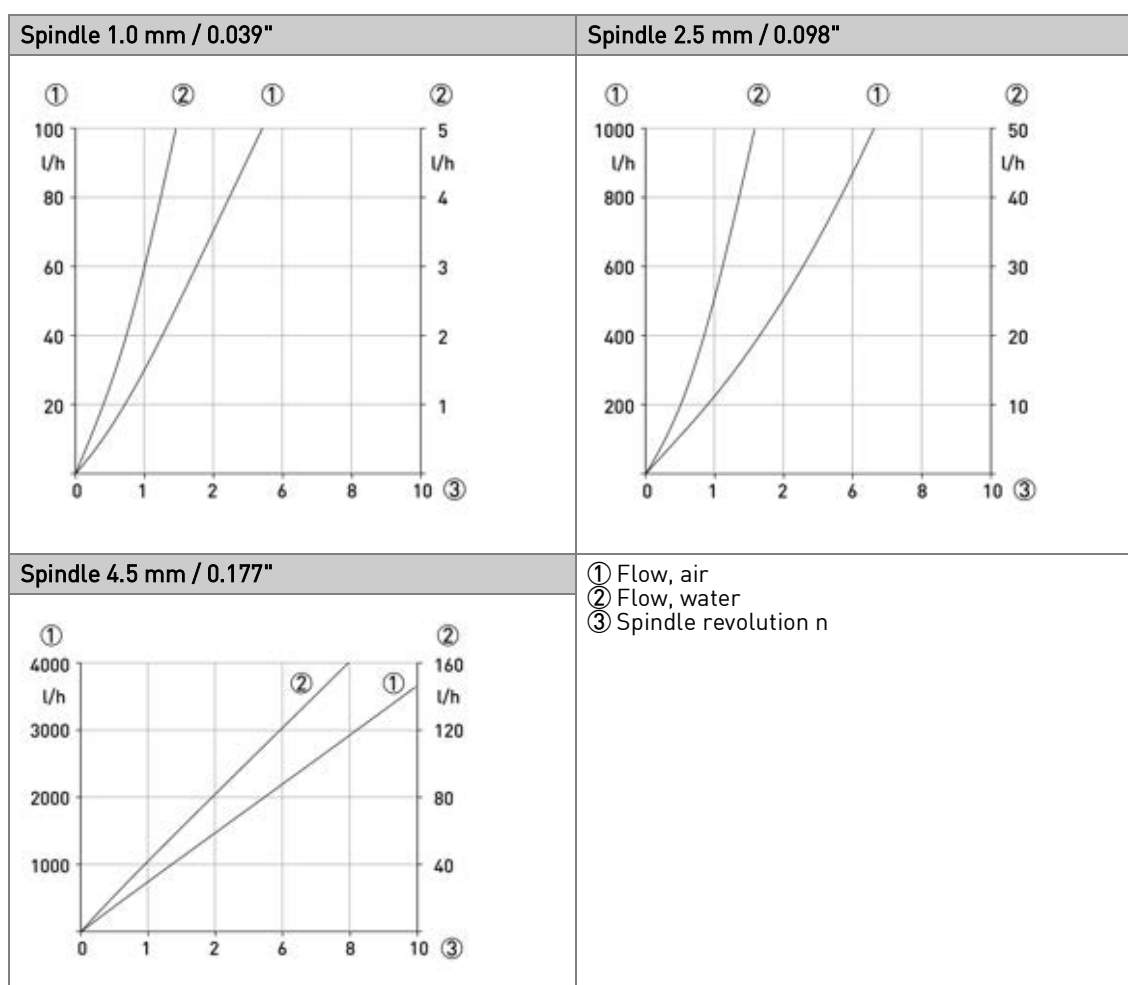


Table 7-22: Valve characteristics

7.5 Flow regulators for variable pressure (only DK32 and DK37)

Flow 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!

Flow regulators are not equivalent to pressure regulators / pressure reducing valves!

① Flow regulator for variable inlet pressure, type RE, NRE

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

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

Table 7-23: Example for flow regulator for variable inlet pressure

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

② Flow regulator for variable outlet pressure, 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 flow regulators to function. The inlet pressure p1 must always be greater than the outlet pressure p2.

RA-1000	Current flow rate:	800 l/h air
	Inlet pressure p1 constant:	6 bar / 87 psi

Table 7-24: Example for flow regulator for variable outlet pressure

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

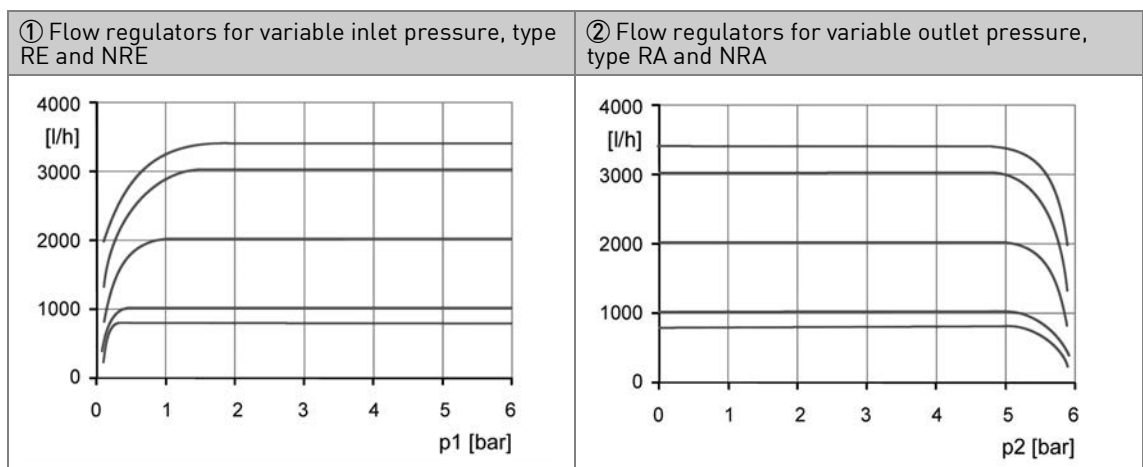


Table 7-25: Regulator characteristics

7.5.1 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

	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

Table 7-26: Control ranges for flow regulator for variable inlet pressure ①

	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

Table 7-27: Control ranges for flow regulator for variable outlet pressure ②

* Differential pressure between inlet and outlet pressure

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)

7.5.2 Technical data for flow regulators

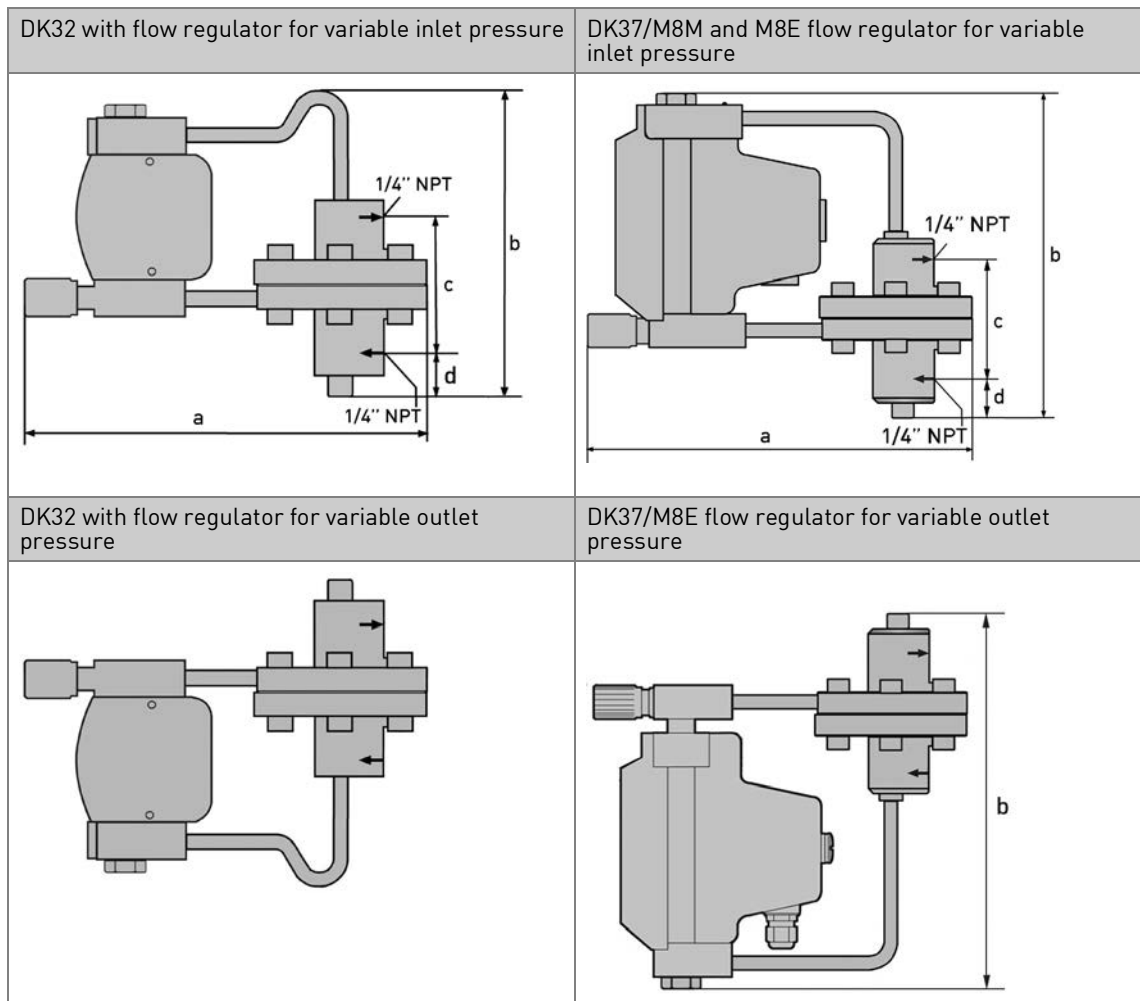
Connection, standard	1/4 NPT
Connection, option	Serto, Ermeto 6 or 8, hose nozzle 6 mm or 8 mm, Dilo, Gyrolok, Swagelok, G1/4
Max. operating gauge pressure (at +20°C / +68°F)	64 barg / 928 psig
Medium temperature	+150°C / +302°F
Material	Stainless steel 1.4404
Gasket	PTFE
Diaphragm	Carbon/graphite-filled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

Table 7-28: Technical data

**INFORMATION!**

Higher pressures and temperatures, other connections or materials on request.

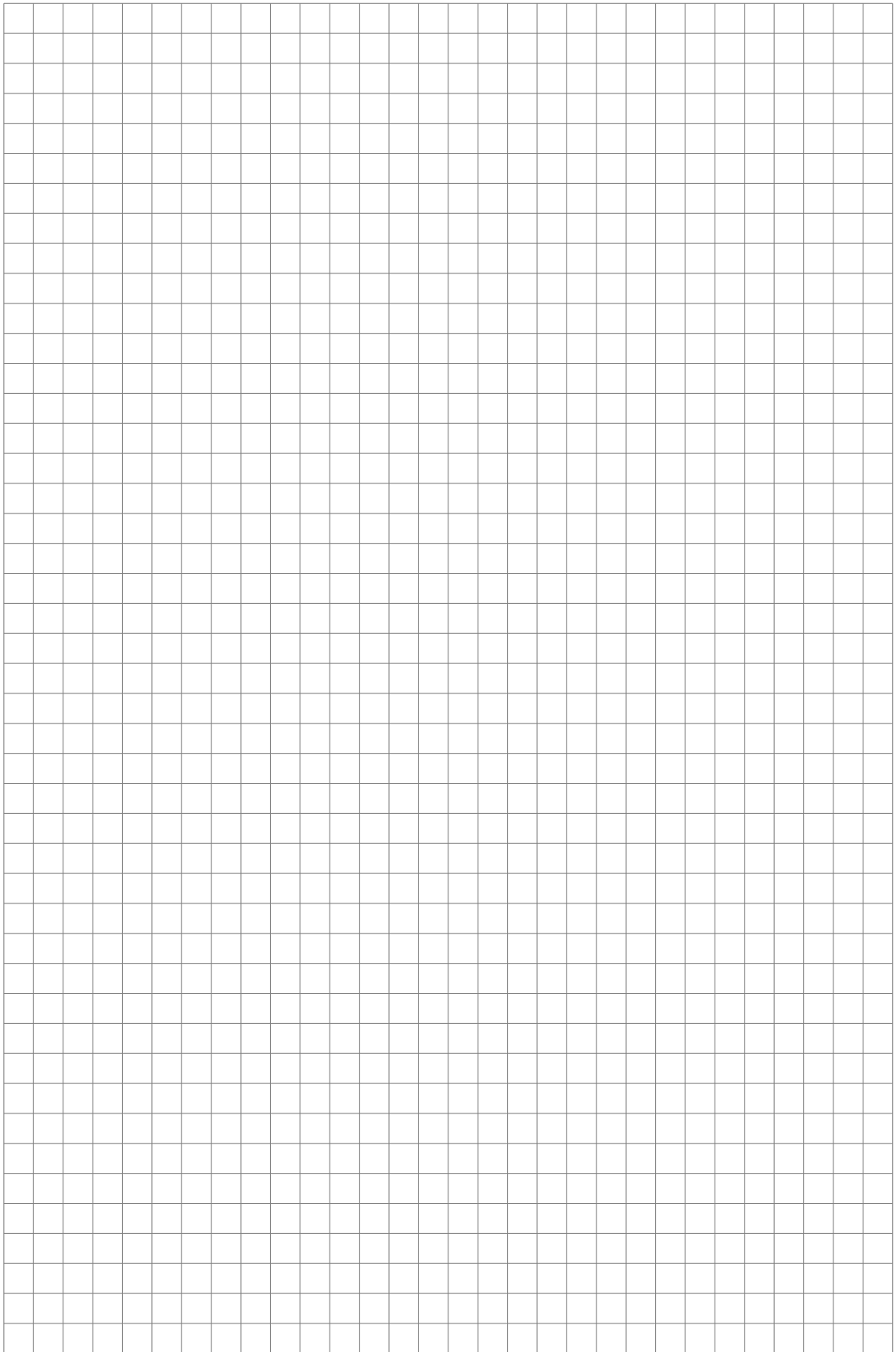
7.5.3 Dimensions with flow regulator

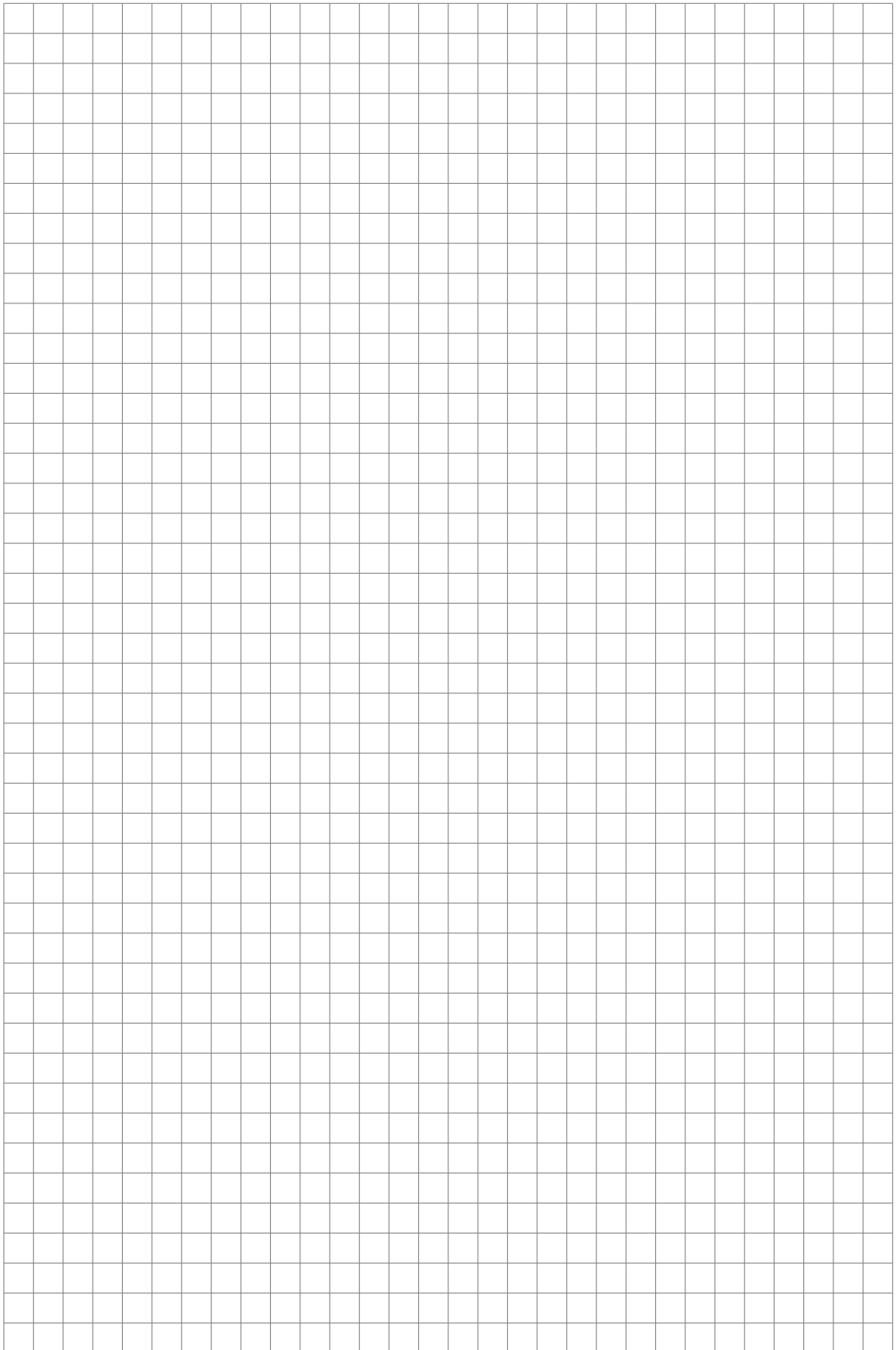


	approx. a		approx. b		c		d	
	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
DK32	230	9.1	163	6.4	70	2.8	23	0.91
DK37	230	9.1	200	7.9	70	2.8	23	0.91
DK37/M8E ①	230	9.1	230	9.1	70	2.8	23	0.91

Table 7-29: Dimensions in mm and inch

① With flow regulator for variable outlet pressure





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