DK32 - DK34 - DK37 Technical Datasheet

Variable area flowmeters

- Local measurement, setting and monitoring of very low flow rates
- Compact design, no inlet and outlet sections
- High resistance to pressure and temperature

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1.1 Variable area flowmeters in solid metal design

The solid metal DK flowmeters are suitable for measuring liquids and gases.
Because of their robust design the flowmeters are particularly suited for difficult operating and environmental conditions.
The extremely compact design and the elimination of inlet and outlet sections allows for simple and cost-effective integration into measuring systems such as process analysers.

Highlights

- DK32 with top/bottom valve and rear process connection
- DK34 without valve and vertical process connection
- DK37 with a higher measuring accuracy and larger indication
- Narrow design enabling a high packing density
- Easy installation and commissioning

Industries

- Chemical
- Petrochemical
- Oil & Gas
- Mechanical and plant engineering
- Analyser system building
- Compressor and pump technology

Applications

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

- Process or carrier gases
- Nitrogen, CO_2 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

1.2 Options for type DK metal

DK32

- Horizontal process connections, rear
- For flow rates of 0.15...150 l/h / 0.4...40 GPH liquid or 1.6...4800 l/h / 0.6...170 SCFH gas
- Design with valve at bottom, valve on top or without valve

DK34

- Vertical process connections
- For flow rates of 0.15...150 l/h / 0.4...40 GPH liquid or 1.6...4800 l/h / 0.6...170 SCFH gas
- Design without valve

DK32, DK34 with electrical signal outputs

Electrical options:

- 1 or 2 limit switches, NAMUR, SIL 2-compliant
- 1 limit switch, REED
- 4...20 mA current output and HART® communication

DK32, DK34 with flange connection adapter

Flange connection adapters with a standard length of 250 mm / 9.8" and DN15/DN25 flanges can be used for connection to the process instead of the NPT/G threads.

DK37/M8E

- Electronic bargraph indicator
- 4...20 mA current output and HART® communication
- For flow rates of 0.15...250 l/h / 0.4...67 GPH liquid or 1.6...8000 l/h / 0.6...300 SCFH gas
- Design with valve at bottom, valve on top or without valve

Standard housing M8E: PPS, conductive plastic
Optional housing M8E/R: stainless steel 1.4404/CF8M

DK37/M8M

- Max. two limit switches (NAMUR), SIL 2-compliant
- For flow rates of 0.15...250 l/h / 0.4...67 GPH liquid or 1.6...8000 l/h / 0.6...300 SCFH gas
- Design with valve at bottom, valve on top or without valve

Standard housing M8M: PPS, conductive plastic
Optional housing M8M/R: stainless steel 1.4404/CF8M

DK32, DK37 with flow regulator

The flow regulators are used to provide constant flow rates in the case of variable inlet or outlet pressures.

1.3 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

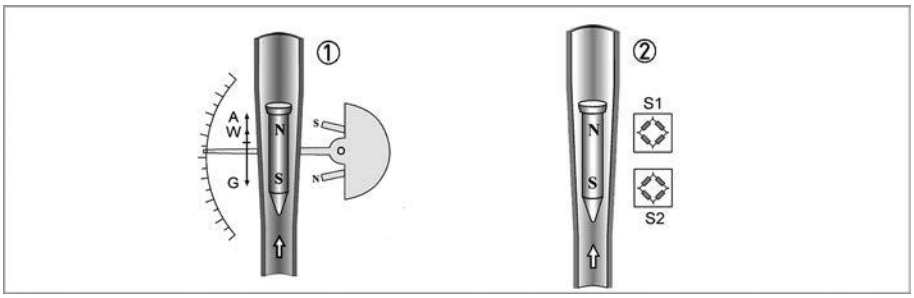


Figure 1-1: Functional principle

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.

2.1 Technical data

- *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 *Temperatures for all device versions* on page 10.
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 2-1: Technical data

2.1.1 Temperatures for all device versions

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 2-2: 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 2-3: 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 2-4: Permissible medium and ambient temperatures for high-temperature version DK32 HT/DK34 HT in °C and °F

2.1.2 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 2-5: Electrical connection data for indicator with limit switch

① Reduced values for Ex

2.1.3 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 2-6: Electrical connection data for transmitter ESK3x

2.1.4 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 2-7: Electrical connection data for indicator with electrical signal output

2.1.5 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.		

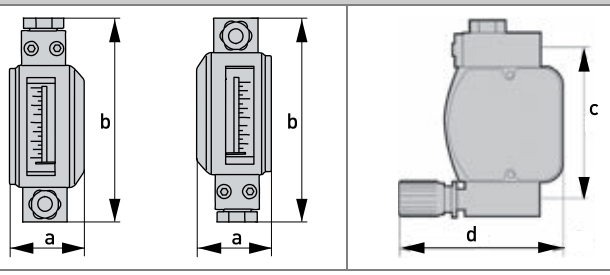
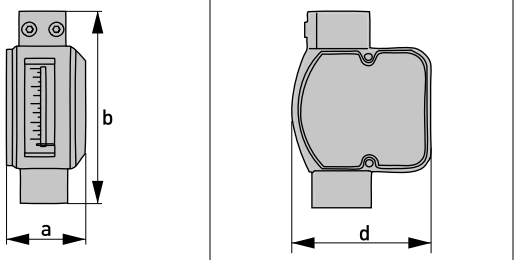
Table 2-8: Approvals for DK32, DK34

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 2-9: Approvals for DK37

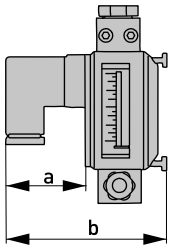
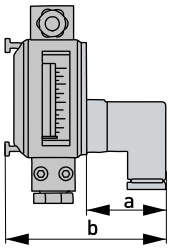
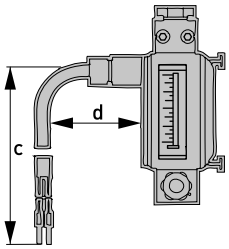
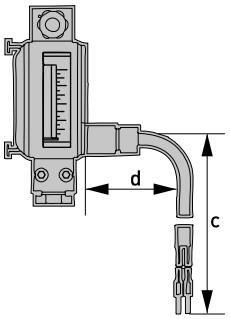
2.2 Dimensions and weight

2.2.1 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			
		[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

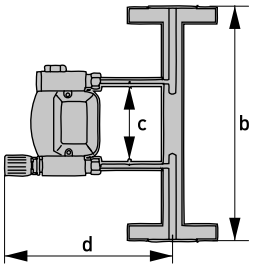
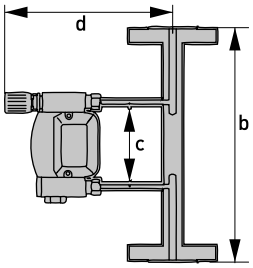
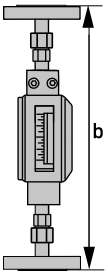
Table 2-10: Dimensions and weight

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			
		[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 2-11: Dimensions and weight

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

Version with flange adapter		
DK32 with bottom valve	DK32 with top valve	DK34 without valve
		
④		

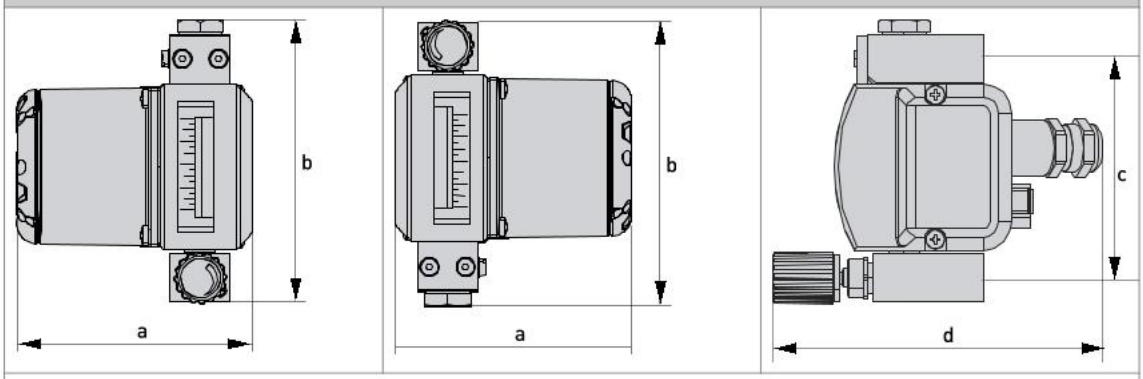
		Dimensions							
		a		b		c		d	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
④	DK32	-	-	250	10.2	90	3.55	approx. 195	approx. 7.68
	DK34	-	-	250	10.2	-	-	-	-

Table 2-12: Dimensions and weight

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

2.2.2 DK32, DK34 with transmitter housing ESK3x

DK32 with ESK transmitter housing with top/bottom valve



①

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

Table 2-13: Dimensions

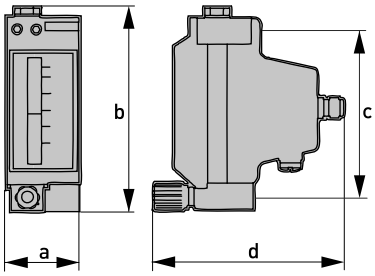
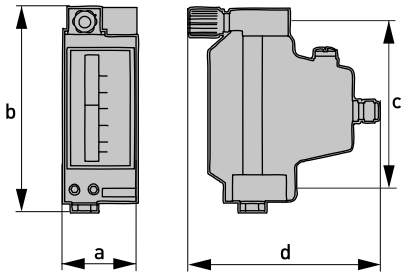
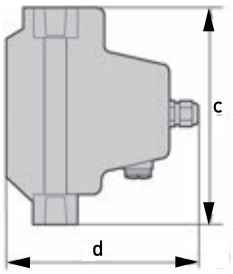
Total length of flange connection adapter:

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 2-14: Weight

2.2.3 DK37/M8M

With bottom valve and rear process connection	With top valve and rear process connection	Without valve and vertical process connection
		
①		②

		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 2-15: Dimensions

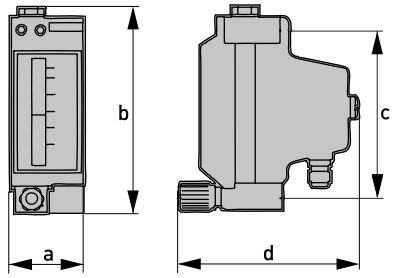
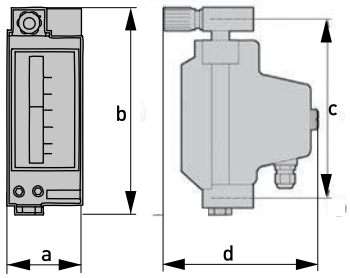
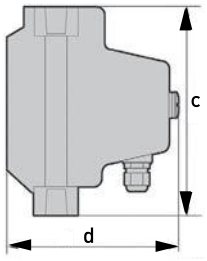
Total length of flange connection adapter:

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 2-16: Weight

2.2.4 DK37/M8E

With bottom valve and rear process connection	With top valve and rear process connection	Without valve and vertical process connection
		
①	②	③

		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 2-17: 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 2-18: Weight

2.2.5 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.

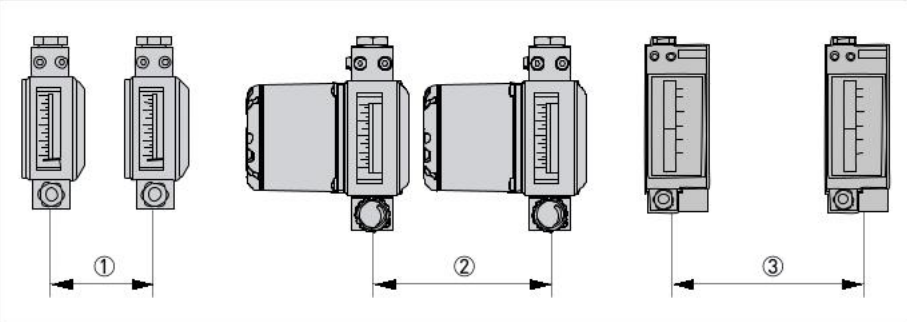


Figure 2-1: Minimum distances

	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 2-19: Minimum distances in mm and inch

2.3 Measuring ranges

2.3.1 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

		Flow, water		Flow, air		Pressure loss	
Cones	Float	[l/h]	[GPH]	[Nl/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 2-20: 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

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:

- Nl/h or Nm^3/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)

2.3.2 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

			Max. flow Qv				Valve characteristic value	
	Valve stem		Water		Air		Kv	Cv
Cones	Ø [mm]	Ø ["]	[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 2-21: Measuring ranges for valves (only DK32 and DK37)

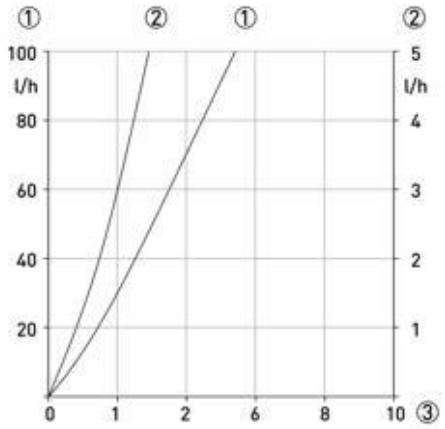
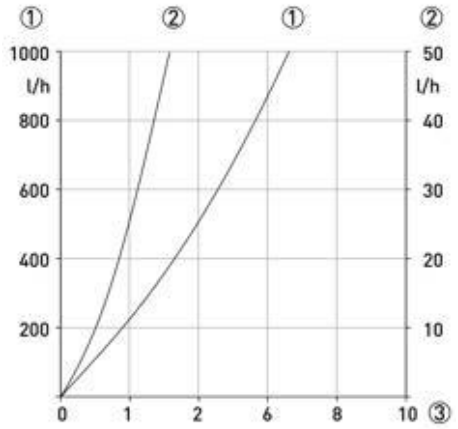
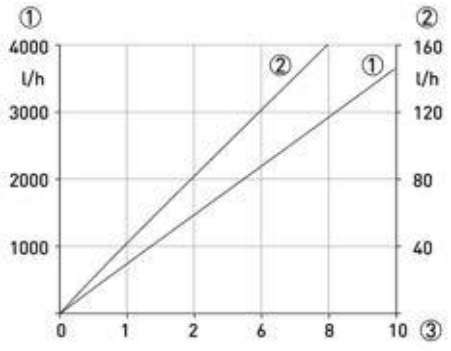
Spindle 1.0 mm / 0.039"	Spindle 2.5 mm / 0.098"
	
Spindle 4.5 mm / 0.177"	① Flow, air ② Flow, water ③ Spindle revolution n
	

Table 2-22: Valve characteristics

2.4 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).

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 2-23: 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 2-24: 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.

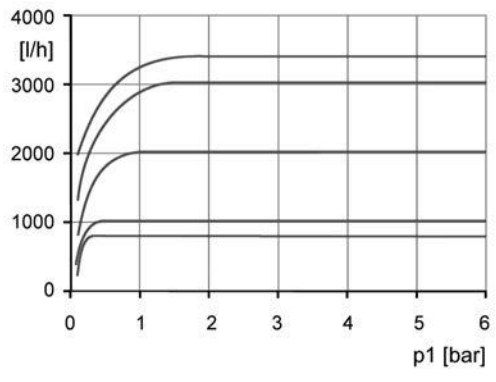
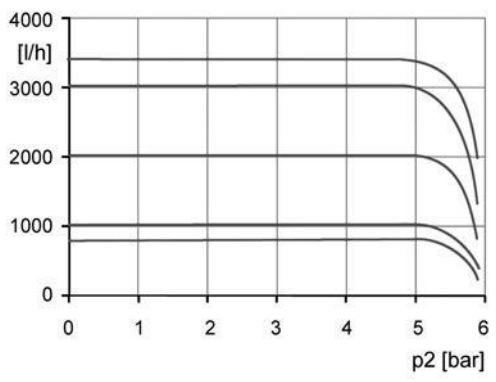
① Flow regulators for variable inlet pressure, type RE and NRE	② Flow regulators for variable outlet pressure, type RA and NRA
	

Table 2-25: Regulator characteristics

2.4.1 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]	[Nl/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 2-26: Control ranges for flow regulator for variable inlet pressure ①

	Max. flow rate				Min. inlet pressure		Min. pressure diff. *	
	Water		Air					
	[l/h]	[GPH]	[Nl/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 2-27: 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:

- Nl/h or Nm^3/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)

2.4.2 Technical data for flow regulators

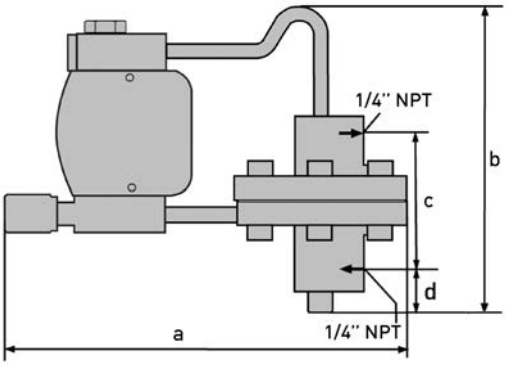
Connection, standard	1/4 NPT
Connection, option	Serto, Ermeto 6 or 8, hose nozzle 6 mm or 8 mm, Dilo, Gyrolok, Swagelok, G1/4
Max. operating gauge pressure (at +20°C / +68°F)	64 barg / 928 psig
Medium temperature	+150°C / +302°F
Material	Stainless steel 1.4404
Gasket	PTFE
Diaphragm	Carbon/graphite-filled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

Table 2-28: Technical data

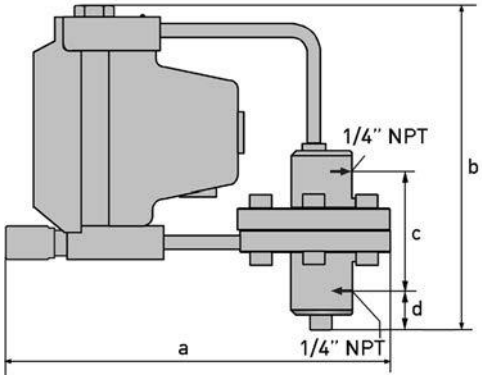
Higher pressures and temperatures, other connections or materials on request.

2.4.3 Dimensions with flow regulator

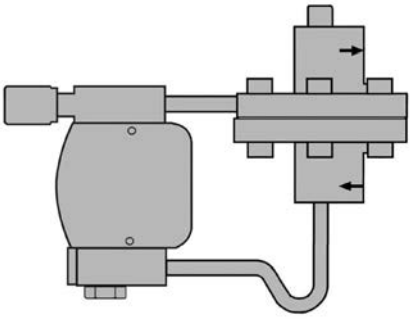
DK32 with flow regulator for variable inlet pressure



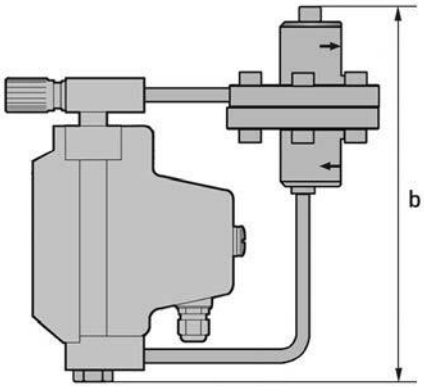
DK37/M8M and M8E flow regulator for variable inlet pressure



DK32 with flow regulator for variable outlet pressure



DK37/M8E flow regulator for variable outlet pressure



	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 2-29: Dimensions in mm and inch

① With flow regulator for variable outlet pressure

3.1 Intended use

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.

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.

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 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, CO_2 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

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

Do not use any abrasive media containing solid particles.

3.2 Installation conditions

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 centrically with the connection bores on the measuring device so they are free of stresses.*
- *If necessary, the piping has to be supported to avoid the vibrations transmitted to the measuring device.*
- *Do not lay signal cables directly next to cables for the power supply.*
- *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 20.
- *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 Electrical connection of limit switches

4.1.1 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

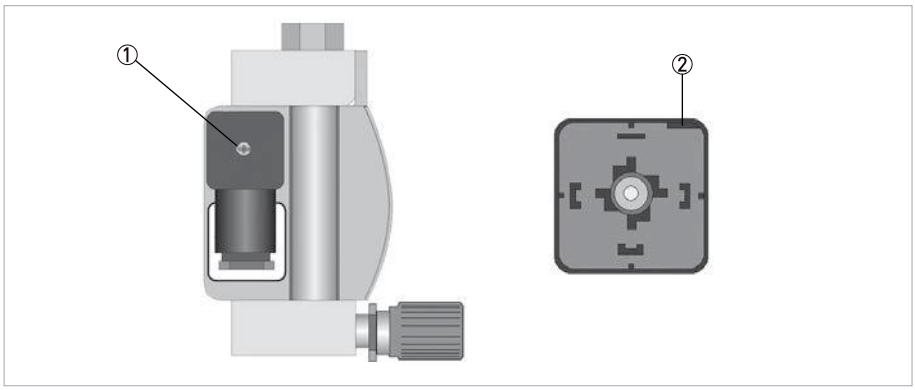


Figure 4-1: Electrical connection of NAMUR limit switches

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 mm^2) and tighten it.

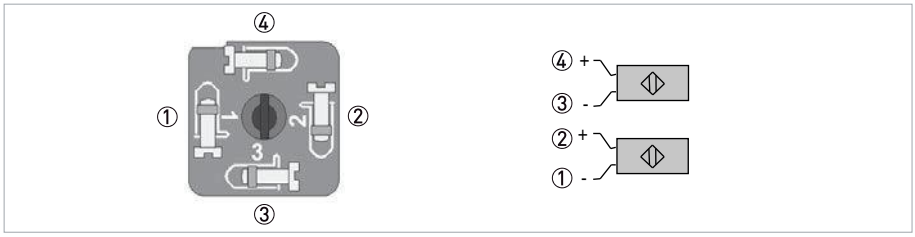


Figure 4-2: Electrical connection of NAMUR limit switches K1/K2

../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

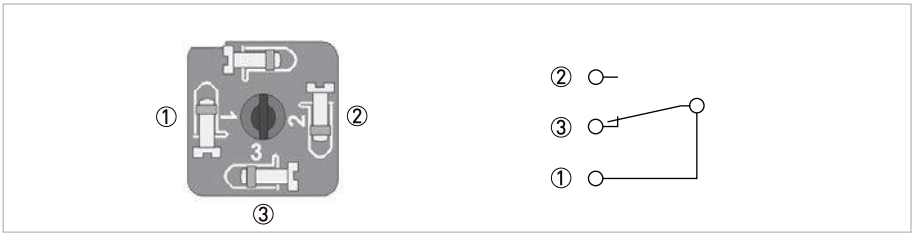


Figure 4-3: Electrical connection of REED limit switch R1

../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

4.1.2 Electrical connection DK37 M8M

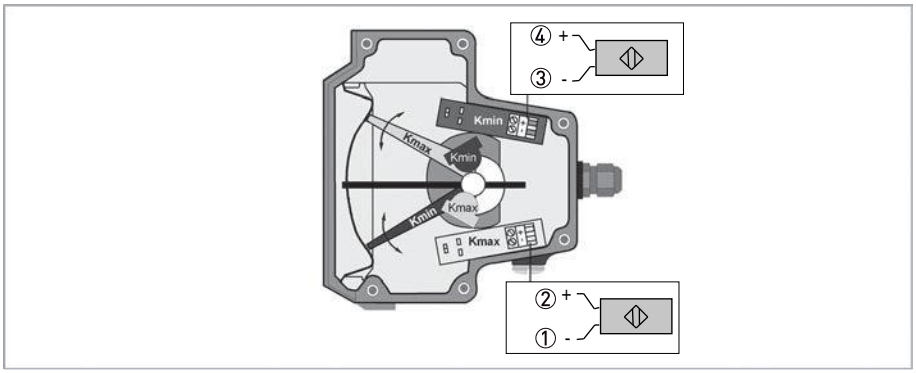


Figure 4-4: Electrical connection of NAMUR limit switches K1/K2

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

Table 4-3: Contact connections

4.1.3 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.

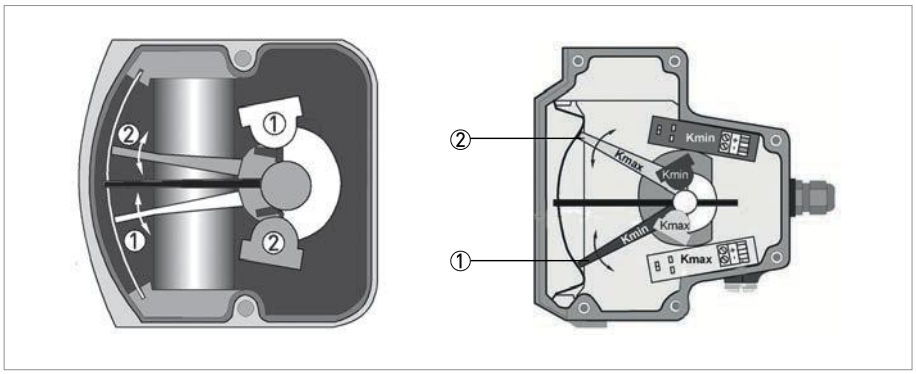


Figure 4-5: Settings of NAMUR limit switches for DK32, DK34, DK37 M8M

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.

4.1.4 Settings of REED limit switch

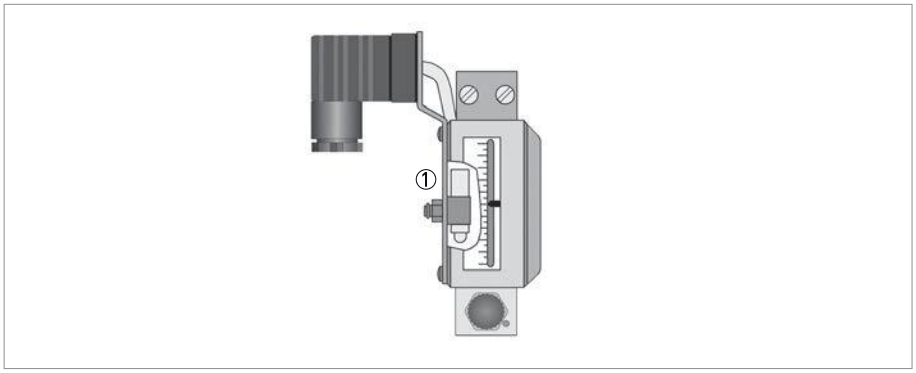


Figure 4-6: Settings of REED limit switch

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

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.

4.2 Electrical signal output ESK3x for DK32, DK34

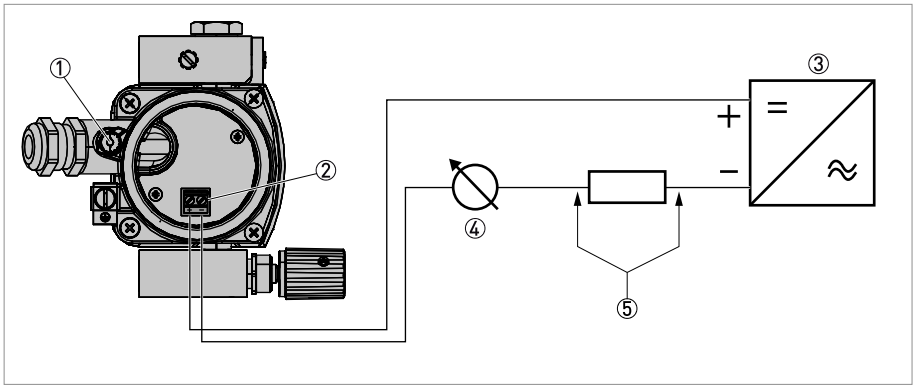


Figure 4-7: Electrical connection of ESK3x

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).

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.

4.2.1 Power supply

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:

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

with
U_{ext} = minimum supply voltage
R_L = total measuring loop resistance

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

4.2.2 Load for HART communication

For HART® communication a load of at least 250 Ω is required.

The maximum load resistance is calculated as follows:

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

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).

4.2.3 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.

4.3 Electrical signal output for DK37/M8E

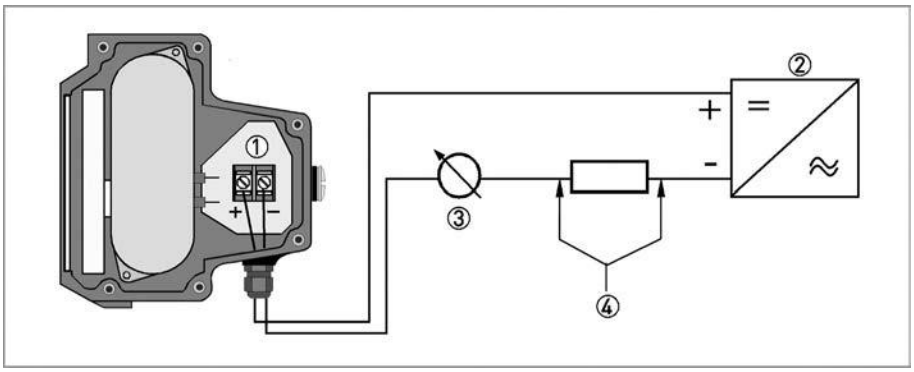


Figure 4-8: Electrical connection M8E

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.

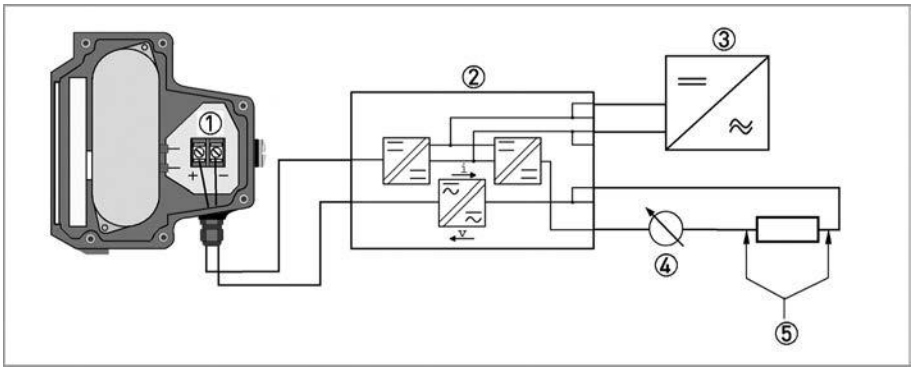


Figure 4-9: Electrical connection with galvanic isolation

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

4.3.1 Power supply

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:

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

with
U_{ext} = minimum supply voltage
R_L = total measuring loop resistance

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

4.3.2 Load for HART communication

For HART® communication a load of at least 250 Ω is required.

The maximum load resistance is calculated as follows:

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

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 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.

4.4 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.

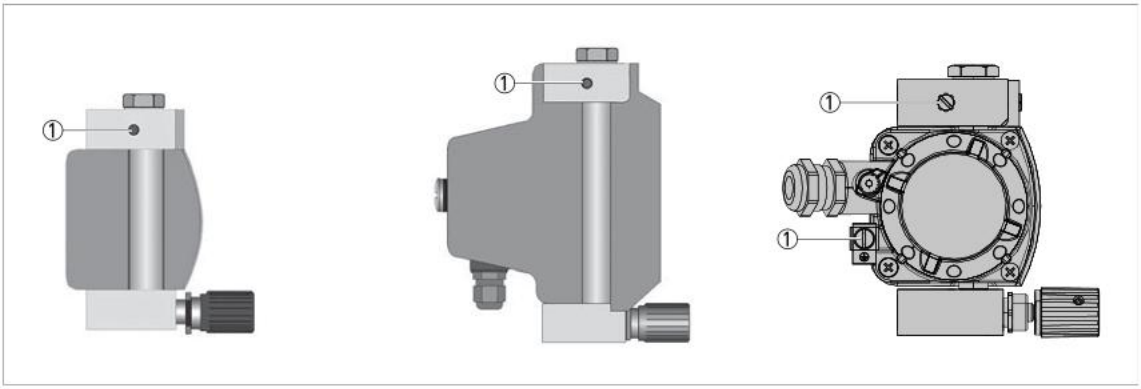


Figure 4-10: Grounding connections

① Grounding connection at measuring unit

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

4.5 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

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.

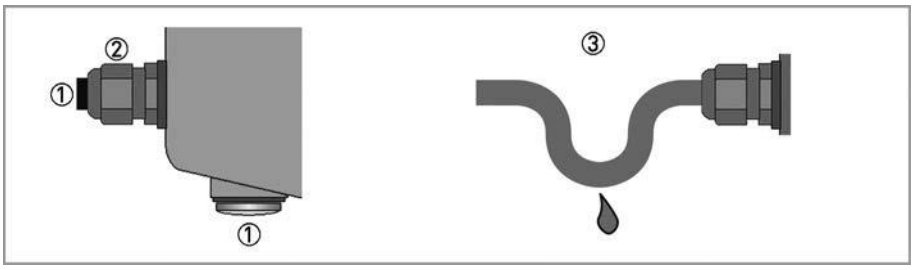


Figure 4-11: Cable feedthrough

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

Please provide us with the missing information so that we can be of help to you as quickly as possible.

Then please send this page to the appropriate sales associate. We will then contact you as soon as possible.

Device data

Connection type:	_ 1/4 NPT	_ (others)		
Connection:	_ Horizontal	_ Vertical		
Pressure rating:				
Indicator:	_ DK32	_ DK34	_ DK37/M8M	_ DK37/M8E
Indicator options:	_ K1 ① _ K2 ① _ R1 ② _ ESK ③	_ K1 ① _ K2 ① _ R1 ② _ ESK ③	_ K1 ① _ K2 ①	_ ESK ③
Flow regulators:	_ for variable inlet pressure	_ for variable outlet pressure		
Approval:	_ None	_ ATEX	_ QPS (US/C)	_ NEPSI
		_ IECEx	_ Others:_____	

① NAMUR limit switch
② REED limit switch
③ 4...20 mA / HART®

Rating data

Medium:			
Operating pressure:		_ Absolute pressure	_ Gauge pressure
Rated pressure:			
Operating temperature:			
Rated temperature:			
Density:		_ Standard density	_ Operating density
Viscosity:			
Flow range:			
Comments:			

Contact data

Company:	
Contact person:	
Telephone number:	
Fax number:	
E-mail:	

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