

## DK46 - DK800 Technical Datasheet

### Variable area flowmeter

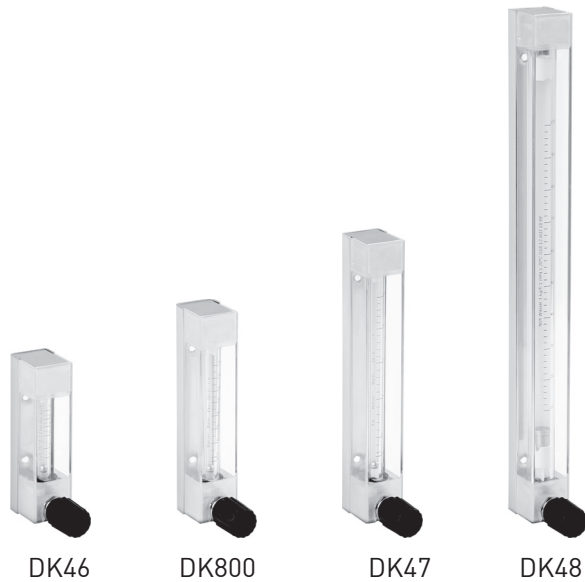
- Local measurement, setting and monitoring of very low flow rates
- Compact design, no inlet and outlet sections
- Visual control of medium



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## 1.1 Variable area flowmeter with glass cone

The DK46/47/48/800 flowmeters are suitable for measuring liquids and gases. 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.



DK46	Accuracy 4.0%
DK800	Accuracy 2.5%
DK47	Accuracy 2.5%
DK48	Accuracy 1.0%

**Highlights**

- Easy installation and commissioning
- Compact design
- Low maintenance
- Optional with limit switches
- All variants with high-quality needle valves
- No wearing parts
- Fragment protection

**Industries**

- Analyser system building
- Apparatus building
- Machine building
- Chemical and petrochemical
- Oil & Gas
- Pharma
- Iron, Steel and Metals

**Applications**

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

- Process or carrier gases
- Nitrogen, CO<sub>2</sub> or other industrial gases
- Sample flows for process analysers
- Purge fluids for measuring systems
- Air or water

## 1.2 Options and variants

### DK devices with contacts



The DK measuring devices can be equipped with a maximum of two limit switches in NAMUR or 3-wire technology.

### DK with flow regulator



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

### Device designation



Devices with ① top and ② bottom fittings made of

Stainless steel = DK.../R

Brass = DK.../N

PVDF = DK.../PV

### 1.3 Functional principle

The flowmeter operates in accordance with the float measuring principle.

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

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

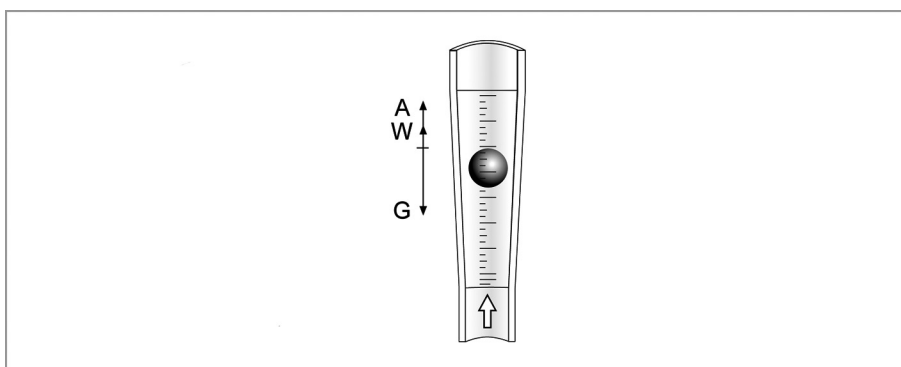


Figure 1-1: Operating principle

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

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

## 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 and gases
Function / Measuring principle	Variable area measuring principle
Measured value	
Primary measured value	Float position
Secondary measured value	Operating volume flow, standard volume flow or mass flow

### Measuring accuracy

Directive	VDI/VDE 3513, sheet 2 ( $q_G = 50\%$ )
DK46	4.0%
DK47	2.5%
DK48	1.0%
DK800	2.5%

### Operating conditions

<b>Temperature</b>	
Max. operating temperature TS	-5...+100°C / +23...+212°F
<b>Pressure</b>	
Operating pressure PS	Pressure equipment directive
Test pressure PT	Pressure equipment directive
Max. permitted operating gauge pressure PS at TS = +100°C / +212°F:	
DK.../R (stainless steel top and bottom fittings)	10 barg / 145 psig ①
DK.../N (brass top and bottom fittings)	10 barg / 145 psig ①
DK.../PV (PVDF top and bottom fittings)	4 barg / 58 psig

### Installation conditions

Inlet and outlet sections	None
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① Other pressures on request

### Materials

Top fitting, bottom fitting	CrNi steel 1.4404 / 316 L, nickel-plated brass, PVDF ①
Top fitting, bottom fitting (optional)	Hastelloy®
Measuring tube	Borosilicate glass
Float (ball)	CrNi steel 1.4401 / 316
Float options	Glass, POM, titanium, Hastelloy® C4
Float (AIII)	CrNi steel 1.4404 / 316 L, aluminium, Polypropylene (PP)
Dosing unit	CrNi steel 1.4571 / 316 Ti
Valve stem	CrNi steel 1.4404 / 316 L
Gaskets (standard)	PTFE / FPM
Gaskets (optional)	PTFE / FFKM, PTFE / EPDM
Gaskets (optional)	EPDM, FFKM
Protective cover	Polycarbonate

① Top and bottom fittings made of PVDF not for DK48

### Temperatures

Max. product temperature $T_m$	-5...+100°C	+23...+212°F
Max. $T_m$ with limit switches	-5...+65°C	+23...+149°F
Max. ambient temperature $T_{amb.}$	-20...+100°C	-4...+212°F
Max. $T_{amb.}$ with limit switches	-20...+65°C	-4...+149°F
Other temperatures on request.		

### Technical data of limit switches

Terminal connection	Connection box M16 x 1.5				
Clamping range	3...7 mm / 0.12...0.28"				
Limit switches	I7R2010-NL RC10-14-N3	I7R2015-NL RC15-14-N3	I7R2010-N RC10-14-N0	I7R2015-N RC15-14-N0	RB15-14-E2
Ring diameter	10 mm / 0.4"	15 mm / 0.6"	10 mm / 0.4"	15 mm / 0.6"	15 mm / 0.6"
Switching function	bistable	bistable	monostable	monostable	bistable
NAMUR	yes	yes	yes	yes	no
Connection technology	2-wire	2-wire	2-wire	2-wire	3-wire
Nominal voltage $U_0$	8 VDC	8 VDC	8 VDC	8 VDC	-
Current consumption	1 mA passage ↓ ①		3 mA - Float outside		-
Current consumption	3 mA passage ↑ ①		1 mA - Float in the limit switch		-
Operating voltage $U_{ext.}$	-				10...30 VDC
Operating current I	-				0...100 mA
No load current I	-				20 mA
Output $U_a$ - passage ↓	-				≤1 VDC ①
Output $U_a$ - passage ↑	-				≥ $U_b$ - 3 VDC ①

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

### Field of application for limit switches

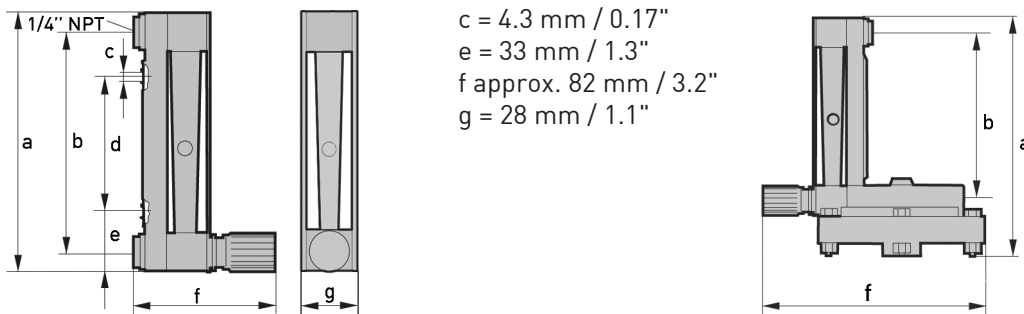
DK46, DK47, DK800		DK48	
Float	Ring diameter	Cone no.	Ring diameter
Ø4 mm / 0.16"	10 mm / 0.4"	G13.11	-
Ø6 mm / 0.24"	15 mm / 0.6"	G14.06	-
Ø8 mm / 0.32"	-	G14.08	-
		G15.07	10 mm / 0.4"
		G15.09	10 mm / 0.4"
		G15.12	10 mm / 0.4"
		G16.08	10 mm / 0.4"
		G16.12	10 mm / 0.4"
		G17.08	15 mm / 0.6"
		G17.12	15 mm / 0.6"
		G18.06	-
		G18.08	-
		G18.12	-

The limit switches with ring diameters of 15 mm / 0.6" as max. contact can only be used up to 60 l/h / 15.8 GPH water or 2400 l/h / 89.3 SCFH air (outer diameter of the measuring glass).

## 2.2 Dimensions and weight

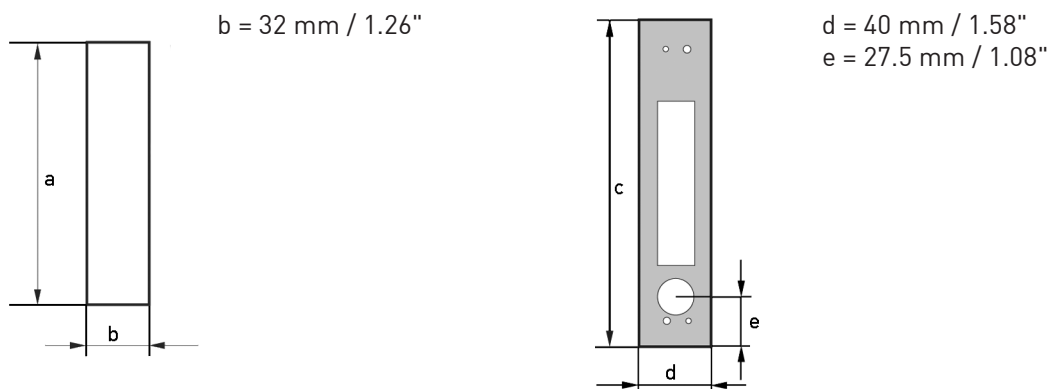
### Dimensions

Device	a		b ± 0.25		d		f approx.	
	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
DK46	111	4.37	90	3.55	45	1.77	82	3.2
DKR46	136	5.36	90	3.55	-	-	125	4.92
DK800	146	5.75	125	4.92	80	3.15	82	3.2
DK47	196	7.72	175	6.89	130	5.12	82	3.2
DK48	346	13.6	325	12.8	280	11.0	82	3.2



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

Device	a		c	
	[mm]	["]	[mm]	["]
DK46	128	5.04	145	5.71
DK800	163	6.42	180	7.09
DK47	213	8.39	230	9.06
DK48	363	14.3	380	15.0



### Weights

	DK46		DK800		DK47		DK48	
	[kg]	[lb]	[kg]	[lb]	[kg]	[lb]	[kg]	[lb]
Weight	0.4	0.88	0.5	1.1	0.6	1.3	0.7	1.5
Weight with regulator	2.1	4.6	2.2	4.9	2.3	5.1	2.4	5.3

### Process connection

Standard	1/4" NPT female
Options	G1/4, Ermeto 6 or 8, tube connection 6 mm or 8 mm, Dilo, Gyrolok, Swagelok ①

① Other connection on request.

## 2.3 Measuring ranges

### Measuring ranges DK(R)46 - DK47 - DK800

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

Float shapes:



Ball



AIII 4-H

Float: CrNi steel

Float Ø ▼		Water						Air					
		DK(R)46		DK47		DK800		DK(R)46		DK47		DK800	
[mm]	[""]	[l/h]	[GPH]	[l/h]	[GPH]	[l/h]	[GPH]	[NI/h]	SCFH	[NI/h]	SCFH	[NI/h]	SCFH
4	0.158	2.5	0.65	-	-	2.5	0.65	5 ①	0.22 ①	-	-	5 ①	0.18 ①
		-	-	-	-	-	-	8 ①	0.3 ①	-	-	8 ①	0.3 ①
		-	-	-	-	-	-	16	0.6	16 ①	0.6	16	0.6
		-	-	-	-	-	-	40	1.5	40	1.5	40	1.5
		-	-	-	-	-	-	60	2.2	100	3.8	60	2.2
6	0.236	5	1.3	5	1.3	5	1.3	100	3.8	250	9.5	100	3.8
		12	3.0	12	3.0	12	3.0	250	9.5	500	19	250	9.5
		25	6.5	25	6.5	25	6.5	500	19	800	30	500	19
		40	11	40	11	40	11	800	30	-	-	800	30
		60 ②	16 ②	60	16	60	16	1200 ②	45 ②	-	-	1000	38
		100 ②	25 ②	100	25	100	25	-	-	-	-	1800	65
		-	-	-	-	120	30	-	-	-	-	2400	90
		-	-	-	-	160	42	-	-	-	-	3000	110
		-	-	-	-	-	-	-	-	-	-	4000	140
8	0.315	120 ②	30 ②	-	-	-	-	-	-	-	-	-	-
		160 ②	42 ②	-	-	-	-	-	-	-	-	-	-

① with float AIII 4-H

② not for DKR46

*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

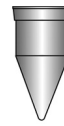
NI/h or Nm<sup>3</sup>/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

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

**Measuring ranges DK48**

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

Float shapes:



All

Float Material ▶	Water		Air					
	Stainless steel		Polypropylene (PP)		Aluminium		Stainless steel	
Cone no. ▼	[l/h]	[GPH]	[NI/h]	[SCFH]	[NI/h]	[SCFH]	[NI/h]	[SCFH]
G13.11 ①	0.4	0.1	-	-	7	0.25	16	0.6
G14.06	0.6	0.16	-	-	12	0.45	25	0.95
G14.08	1	0.25	-	-	20	0.75	40	1.5
G15.07	1.6	0.4	-	-	30	1.1	60	2.2
G15.09	2.5	0.65	-	-	40	1.5	90	3.5
G15.12	4	1.0	-	-	60	2.2	140	5.0
G16.08	6	1.6	-	-	100	3.7	200	7.5
G16.12	10	2.5	-	-	160	6.0	300	11
G17.08	16	4.0	-	-	250	9.0	500	19
G17.12	25	6.5	-	-	400	15	800	30
G18.06	40	10	400	15	600	22	1200	45
G18.08	63	16	600	22	1000	37	2000	75
G18.12	100	25	1000	37	1600	60	3000	110

① reduced accuracy: 2.5%

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

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

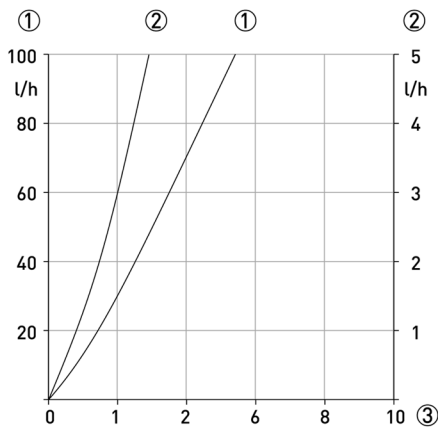
**Valves**

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

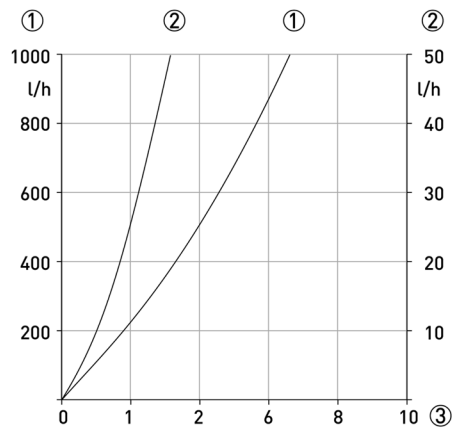
Valve stem		Max. flow rate				Valve characteristic value	
		Water		Air		Kv	Cv
Ø [mm]	Ø ["]	[l/h]	[GPH]	[NI/h]	[SCFH]	[m <sup>3</sup> /h]	[GPM]
1	0.039	5	1.3	100	3.7	0.018	0.02
2.5	0.98	50	13	1000	37	0.15	0.17
4.5	0.177	160	42	4300	160	0.48	0.55

**Valve characteristics**

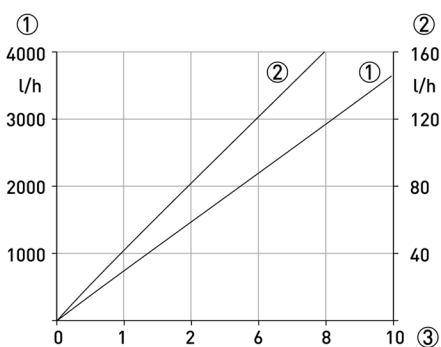
Spindle Ø 1.0 mm / 0.039"



Spindle Ø 2.5 mm / 0.098"



Spindle Ø 4.5 mm / 0.177"



- ① Flow, air
- ② Flow, water
- ③ Spindle revolution n

## 2.4 Differential pressure regulators

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

Differential pressure regulators are not equivalent to pressure reducing valves!

### ① Inlet pressure regulators, type RE, NRE

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

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

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

### ② Outlet pressure regulator, type RA, NRA

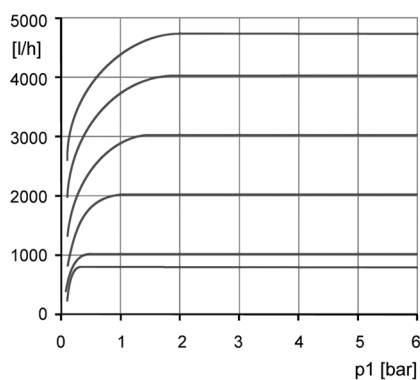
The regulators keep the flow rate constant in the case of a constant inlet pressure and a variable outlet pressure. There must be a pressure differential between the inlet and the outlet pressure for the outlet pressure regulators to function. The inlet pressure p1 must always be greater than the outlet pressure p2.

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

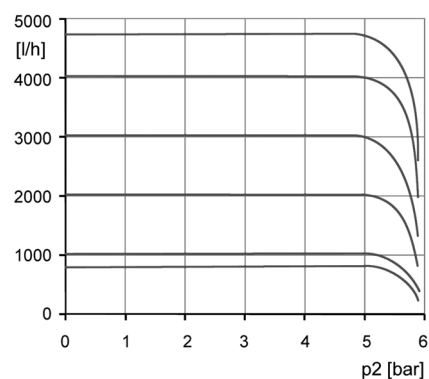
The flow rate in the device remains constant with a fluctuating outlet pressure greater than 0...5.5 bar / 0...79.8 psi.

### Regulator characteristics

#### ① Inlet pressure regulators, type RE and NRE



#### ② Outlet pressure regulators, type RA and NRA



**Control ranges**

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

**Inlet pressure regulator ①**

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

**Outlet pressure regulator ②**

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

**Reference condition for gas measurements:**

Flow measurements for gases are attributed to

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

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

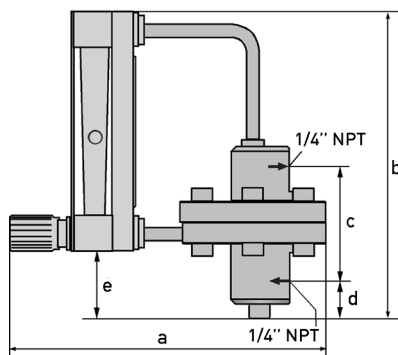
### Technical data for differential pressure regulator

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

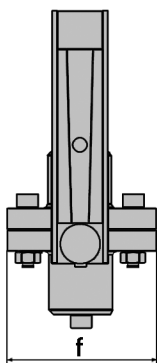
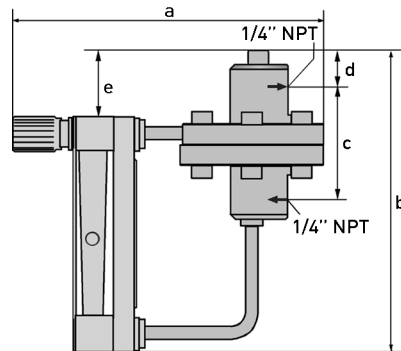
### Dimensions with differential pressure regulator

	a		b		c		d		e		f	
	Approx.										Approx.	
	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]
DK46	210	8.27	163	6.42	70	2.76	19	0.75	39	1.54	90	3.55
DK47	210	8.27	233	9.18	70	2.76	19	0.75	39	1.54	90	3.55
DK48	210	8.27	383	15.1	70	2.76	19	0.75	39	1.54	90	3.55
DK800	210	8.27	183	7.21	70	2.76	19	0.75	39	1.54	90	3.55

① DK with inlet pressure regulator



② DK with outlet pressure regulator



## 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 CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.*

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

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

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

- Process or carrier gases
- Nitrogen, CO<sub>2</sub> or other industrial gases
- Sample flows for process analysers
- Purge fluids for measuring systems
- Air or water

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

*Do not use any abrasive or highly viscous media.*

## 3.2 Installation conditions

### 3.2.1 Installation in the pipeline

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

- *The variable area flowmeter must be installed vertically (measuring principle). Flow direction from bottom to top. For installation recommendations please refer also to directive VDI/VDE 3513, sheet 3.*
- *Before connecting, blow or flush out the pipes leading to the device.*
- *The piping for gas flow need to be dried before the device is installed.*
- *Use connectors suitable for the particular device version.*
- *Align the piping 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.*

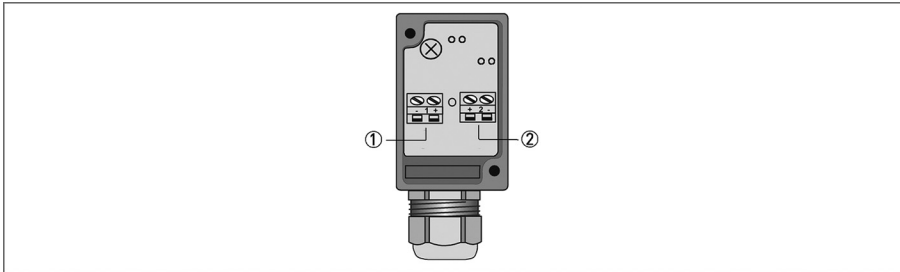
## 4.1 Limit switches

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

- Monostable function: Switching pulse as float passes through switching point, independent of direction of movement.
- Bistable function: Stable changeover as float passes through switching point.
- Example (bistable): Above limit: switching point "High"  
Below limit: switching point "Low"

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

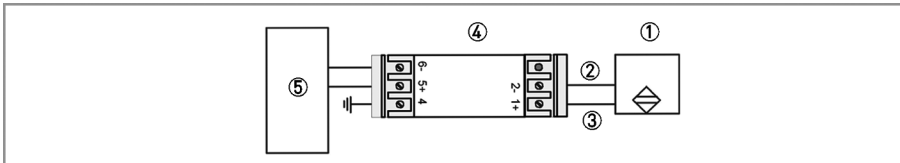
### Connection of limit switch - 2 wire NAMUR



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

The connection box includes an EMC filter unit.

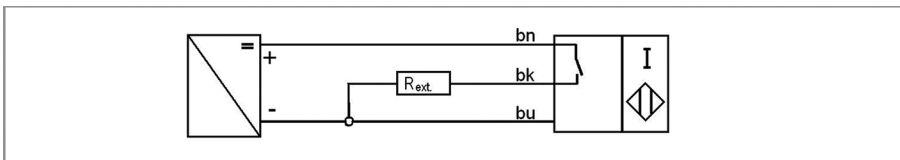
### Connection of limit switch - 2-wire NAMUR, without connection box



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

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

### Connection of limit switch - 3-wire (transistor)



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

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

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

### Device data

Connection type:	<input type="checkbox"/> 1/4" NPT	<input type="checkbox"/> (others)		
Connection:	<input type="checkbox"/> Horizontal	<input type="checkbox"/> Vertical		
Pressure rating:				
Display:	<input type="checkbox"/> DK46	<input type="checkbox"/> DK47	<input type="checkbox"/> DK48	<input type="checkbox"/> DK800
Display options:	<input type="checkbox"/> K1 ① <input type="checkbox"/> K2 ②	<input type="checkbox"/> K1 ① <input type="checkbox"/> K2 ②	<input type="checkbox"/> K1 ① <input type="checkbox"/> K2 ②	<input type="checkbox"/> K1 ① <input type="checkbox"/> K2 ②
Differential pressure regulators:	<input type="checkbox"/> Inlet pressure regulator		<input type="checkbox"/> Outlet pressure regulator	
Approval:	<input type="checkbox"/> None	<input type="checkbox"/> ATEX		

① 1 limit switch

② 2 limit switches

### Rating data

Medium:			
Operating pressure:		<input type="checkbox"/> Absolute pressure	<input type="checkbox"/> Gauge pressure
Rated pressure:			
Operating temperature:			
Rated temperature:			
Density:		<input type="checkbox"/> Standard density	<input type="checkbox"/> Operating density
Viscosity:			
Flow range:			
Comments:			

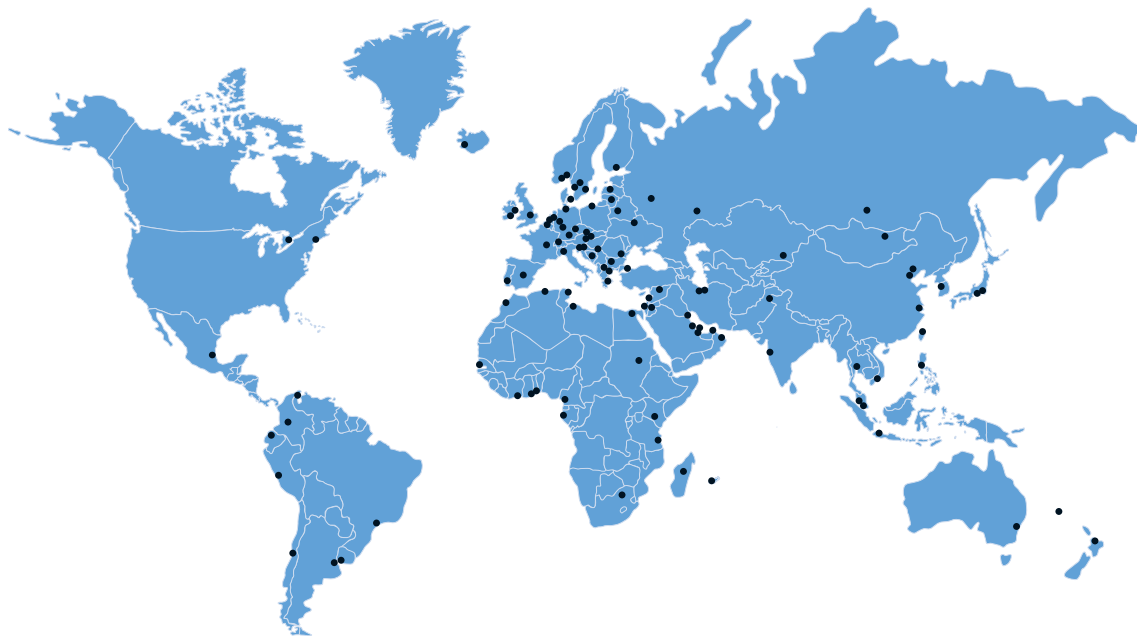
### Contact data

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









## KROHNE – Process instrumentation and measurement solutions

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