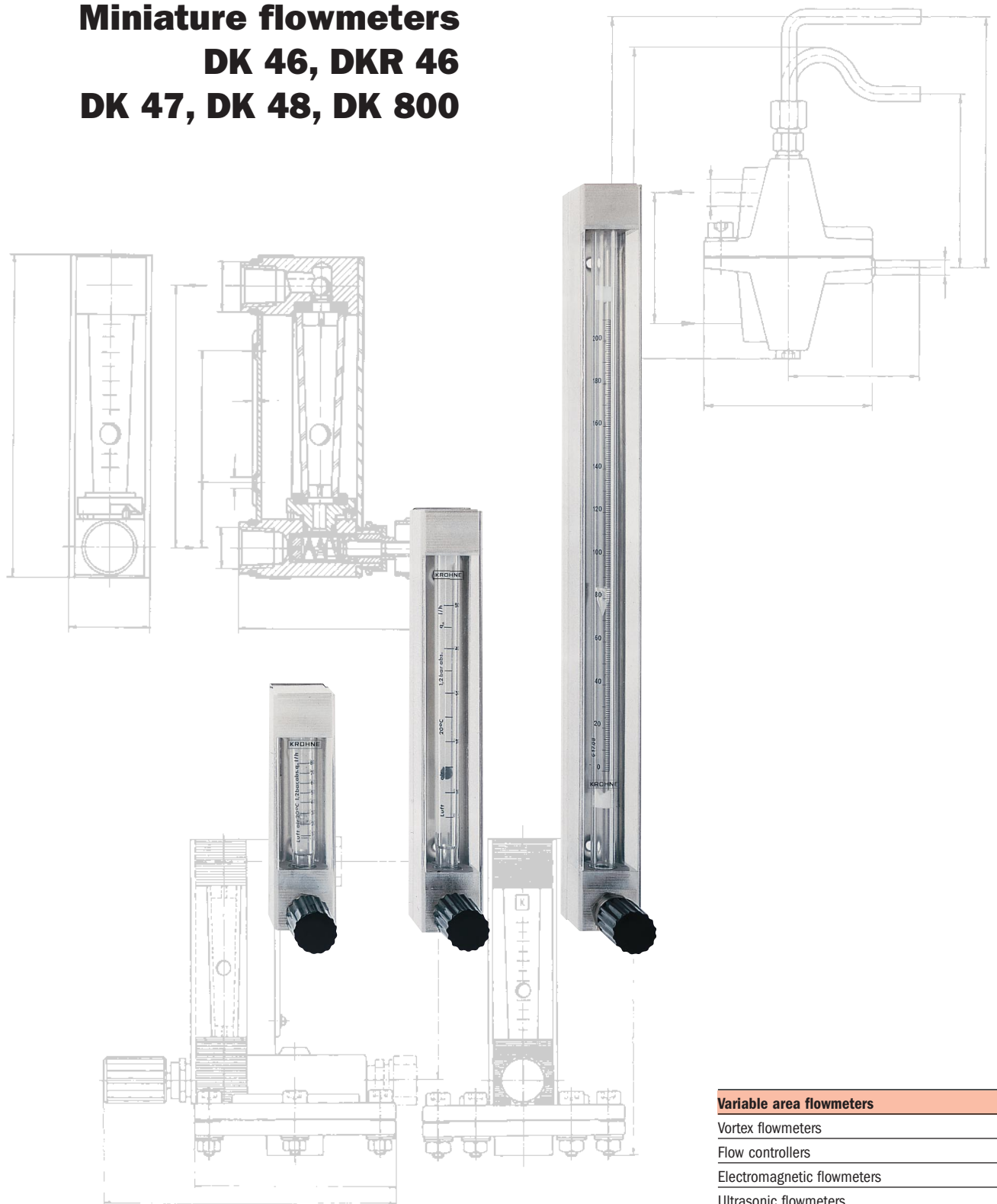


## Miniature flowmeters DK 46, DKR 46 DK 47, DK 48, DK 800



### Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications technology

Engineering systems & solutions



## Miniature flowmeters DK 46, DKR 46, DK 47, DK 48, DK 800

with glass metering cones

### Options

All flowmeters (apart from DKR 46) can be equipped with limit switches and differential pressure regulators (options).

Front plates and holding devices are available for panel mounting.

The flowmeters can be converted into bench instruments with the aid of a support base (option).

### Instrument designation

Instruments with top and bottom connection block of:

Stainless steel = DK ... / R

Brass = DK ... / N

PVDF = DK ... / PV

### DK 46, DK 47, DK 48, DK 800

All flowmeters are equipped with a needle valve in the base to facilitate precise setting of gas and liquid flow rates. On request, these valves can also be fitted in the top connection block.

The mounts are made of stainless steel, brass or PVDF and feature a specially designed fitting to take the glass cone. This device permits easy cone replacement without removal of the mount.

The top connection block features a non-return valve to prevent backflow of the product (exception: flowmeters with valve in top connection block).

### Compact flowmeter DKR 46

The DKR 46 is a DK 46 miniature flowmeter plus an RE flow regulator combined to form one compact unit.



**Technical data**

Instrument type	DK 46 DKR 46	DK 47	DK 48	DK 800
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**Measuring range** (100 % values)

Water at 20 °C, l/h; (68 °F, US GPH)	2.5 to 160* (0.66 to 42.27)*	2.5 to 100 (0.66 to 26.42)	0.4 to 100 (0.11 to 26.42)	2.5 to 160 (0.66 to 42.27)
Air at 1.2 bar abs. (17.4 psia), 20 °C, l/h; (68 °F, SCFH)	5 to 1600* (0.19 to 59.55)	16 to 800 (0.6 to 29.77)	16 to 3000 (0.6 to 111.65)	5 to 4300 (0.19 to 160.03)
DK 48: 1.013 bar abs. (14.7 psia), 20 °C (68 °F) air				

\* DKR 46: max. 40 l/h (10.57 US GPH) water or 800 l/h (29.77 SCFH) air

Select measuring range from flow table

<b>Turn-down ratio</b>	10 : 1	10 : 1	10 : 1	10 : 1
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<b>Accuracy class</b> to VDI/VDE Code 3513, Sh. 2	4	2.5	1	2.5
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<b>Measuring cone</b>				
Length in mm (inches)	65 (2.65")	150 (5.91")	300 (11.81")	100 (3.94")
Scale graduation	flow units, DK 48 also in mm			
Float shapes	Ball	Ball	A III	Ball

**Operating data**

max. allowable operating pressure at 20 °C (68 °F). Test pressure is 1.3 times the specified max. allowable operating pressure.\*

Standard	10 bar (145 psig)	10 bar (145 psig)	10 bar (145 psig)	10 bar (145 psig)
with PTFE gasket	10 bar (145 psig)	10 bar (145 psig)	10 bar (145 psig)	10 bar (145 psig)
DK ... / PV	6 bar (87 psig)	6 bar (87 psig)	6 bar (87 psig)	6 bar** (87 psig)
max. process temperature	100 °C (212 °F)	100 °C (212 °F)	100 °C (212 °F)	100 °C (212 °F)
with limit switches	80 °C (176 °F)	80 °C (176 °F)	80 °C (176 °F)	80 °C (176 °F)

\* At temperatures > 20 °C (68 °F) pressure drops at the rate of 1% per degree C

\*\* Flow > 2400 l/h, air: 4 bar

**Overall height and connection dimensions** see Dimensions and Weights

<b>Connection</b>				
Standard	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT
Adapters	Ermeto 6 and 8, Dilo, tubing nozzle 6 or 8 mm, Gyrolok and Swagelok			

<b>Materials</b>	
Measuring cone	borosilicate glass
Float	
Standard	
DK 46, 47, 800	Stainless steel 1.4401 (316)
DK 48	Stainless steel 1.4571 (316 Ti)
Options	
DK 46, 47, 800	titanium, POM (polyoxymethylene), glass
DK 48	steatite, aluminium, hard rubber
Float stop	
DK 46, 47, 48, 800	PTFE
Valve spindle	Stainless steel 1.4571 (316 Ti)
Gaskets	
Standard	Viton
Option	PTFE/FF KM (perfluorinated elastomer) PTFE (not for DK ... / PV)
Mount	
DK 46, 47, 48, 800	Top/bottom connection block: stainless steel 1.4581 (318 C17), brass or PVDF Rail: stainless steel 1.4571 (316 Ti)
<b>Ring initiators</b>	DK 46      available      available      available

## Needle valves for gases and liquids

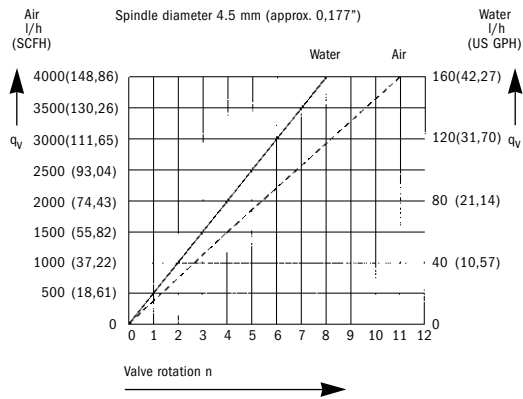
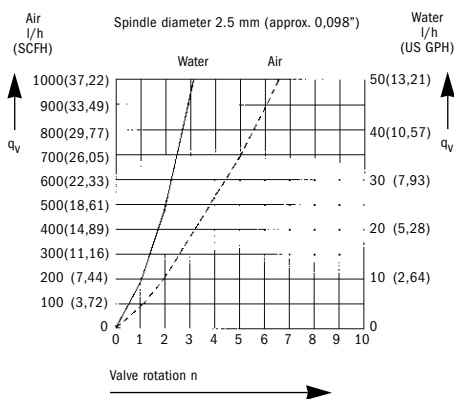
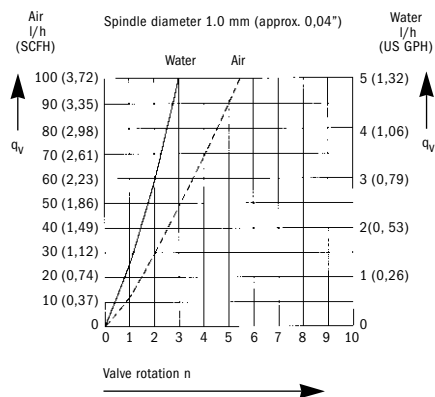
Needle valves allow precise setting of the flow rate.

Spindle dia. mm	(inches)	Max. flow rate ( $q_v$ )		Water* l/h (US GPH)		$K_v$ factor m <sup>3</sup> /h	$C_v$ factor US GPM
		Air* l/h	(SCFH)				
1.0	(0.04")	100	(3.72)	5	0(1.32)	0.018	0.021
2.5	(0.098")	1000	(37.22)	50	(13.21)	0.15	0.18
4.5	(0.177")	4300	(160.03)	160	(42.27)	0.48	0.56

$K_v$ ,  $C_v$  = valve characteristic

\* Reference conditions: 20 °C (68 °F), 1.013 bar abs. (14.7 psia).

### Valve characteristics



## Flow table

### Standard float materials

DK 46, DKR 46, DK 47, DK 800: stainless steel 1.4401 (316)  
 DK 48: stainless steel 1.4571 (316 Ti)  
 100% flow values  
 Turn-down ratio 10 : 1

### Reference conditions

Water at 20 °C (68 °F)  
 Air at 20 °C (68 °F) DK 46, DKR 46, DK 47, DK 800,  
 1.2 bar abs. (17.4 psia)  
 DK 48, 1.013 bar abs. (14.7 psia)

Ball dia. mm	Cone No.	Water								Air							
		DK 46 DKR 46		DK 47		DK 48		DK 800		DK 46 DKR 46		DK 47		DK 48		DK 800	
		l/h	US/GPH	l/h	US/GPH	l/h	US/GPH	l/h	US/GPH	l/h	SCFH	l/h	SCFH	l/h	SCFH	l/h	SCFH
4	G 13.11	2.5	0.66			0.4	0.11	2.5	0.66	5	0.19	16	0.60	16	0.60	5	0.19
4	G 14.06					0.6	0.16			8	0.30	40	1.49	25	0.93	8	0.30
4	G 14.08					1.6	0.26			16	0.60			40	1.49	16	0.60
4	G 15.07					1.6	0.42			40	1.49			60	2.23	40	1.49
4	G 15.09					2.5	0.66			60	2.23			90	3.35	60	2.23
4	G 15.12					4.6	1.06							140	5.21		
6	G 16.08	5.5	1.32	3	0.66	6.4	1.59	5	1.32	100	3.72	160	2.23	200	7.44	100	3.72
6	G 16.12	12.5	3.17	5	1.32	10.4	2.64	12	3.17	250	9.30	100	3.72	300	11.16	250	9.30
6	G 17.08	25.5	6.61	12	3.17	16.4	4.23	25	6.61	500	18.61	250	9.30	500	18.61	500	18.61
6	G 17.12	40.5	10.57	25	6.61	25.4	6.61	40	10.57	800	29.77	500	18.61	800	29.77	800	29.77
6	G 18.06	60*	15.85*	40	10.57	40.4	10.57	60	15.85	1600*	59.55*	800	29.77	1200	44.66	1000	37.22
6	G 18.08	100*	26.42*	60	15.85	63.4	16.64	100	26.42					2000	74.43	1800	66.99
6	G 18.12			100	26.42	100.4	26.42	120	31.70					3000	111.65	2400	89.32
6								160	42.27							3000	111.65
6																3500	130.26
6																4300	160.03
8		120*	15.85*														
8		160*	42.27*														

\* (not DKR 46)

## Differential pressure regulators

Differential pressure regulators are used to help maintain constant flow rates at fluctuating operating pressure.

- Minimum pressure levels are required to permit operation of the regulators (see regulator characteristics)
- Differential pressure regulators are not pressure reducing valves
- Max. flow rate: 4000 l/h (148.86 SCFH) air or 160 l/h (42.27 US GPH) water.
- Connections:  
Standard: 1/4" NPT  
Special version: Serto 6 or 8, tubing nozzles 6 or 8 mm, Ermeto 6 or 8, Dilo, Gyrollok, Swagelok
- Max. allowable operating pressure [at 20 °C (68 °F)]:  
16 bar (232 psig)
- Temperatures up to max. 80 °C (176 °F)  
[option 100 °C (212 °F)].

### Application ranges

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

The RE and NRE regulators help maintain a constant flow rate for gases and liquids at variable inlet pressure and constant outlet pressure.

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

For gaseous products, the RA and NRA regulators help maintain a constant flow rate at variable outlet pressure and constant inlet pressure.

For liquids, the RE and NRE inlet pressure regulators can also be used to help maintain a constant flow rate at variable outlet pressure and constant inlet pressure.

In order to function, the outlet pressure regulator requires a specific minimum pressure difference between inlet and outlet pressures.

Inlet pressure  $p_1$  must always be greater than outlet pressure  $p_2$ .

Flowmeters with outlet pressure regulators are supplied without check ball.

## Technical data

Type	Identifi- cation	Material	Max. measuring range		Air**		Min. inlet pressure p1	
Inlet pressure regulators			Water** l/h	US GPM	l/h	SCFM	p1 in bar	p1 in psig
RE-1000-R	RE 10	stainless steel	40	0.18	1000	0.62	0.5	7.25
RE-1000-N	RE 10	brass	40	0.18	1000	0.62	0.5	7.25
RE-4000-R	RE 40	stainless steel	160	0.70	4000	2.48	1	14.50
RE-4000-N	RE 40	brass	160	0.70	4000	2.48	1	14.50
NRE-100-R	NRE 1	stainless steel	-	-	100	0.062	0.06	0.87
NRE-100-N	NRE 1	brass	-	-	100	0.062	0.06	0.87
NRE-800-R	NRE 8	stainless steel	-	-	800	0.50	0.2	2.90
NRE-800-N	NRE 8	brass	-	-	800	0.50	0.2	2.90
Outlet pressure regulators							Min. differential pressure* $\Delta p$ in bar	
RA-1000-R	RA 10	stainless steel	-	-	1000	0.62	0.4	5.80
RA-1000-N	RA 10	brass	-	-	1000	0.62	0.4	5.80
RA-2500-R	RA 25	stainless steel	-	-	2500	1.55	0.8	11.60
RA-2500-N	RA 25	brass	-	-	2500	1.55	0.8	11.60
NRA-800-R	NRA 8	stainless steel	-	-	800	0.50	0.15	2.18
NRA-800-N	NRA 8	brass	-	-	800	0.50	0.15	2.18

\* Differential pressure between inlet and outlet pressures

\*\* Reference conditions: 20 °C (68°F), 1.013 bar abs. (14.7 psia)

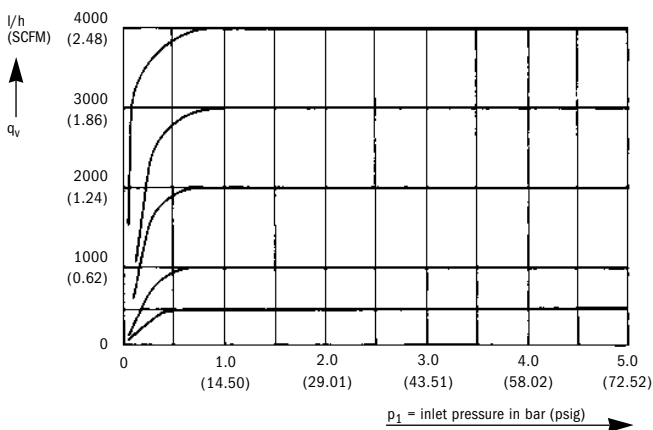
## Regulator characteristics

Inlet pressure regulators Typ RE, NRE

Example: variable inlet pressure  $\leq 5$  bar ( $\leq 72.5$  psig)

Air at 20 °C (68 °F), 1.013 bar abs. (14.7 psia)

$q_v$  = flow rate



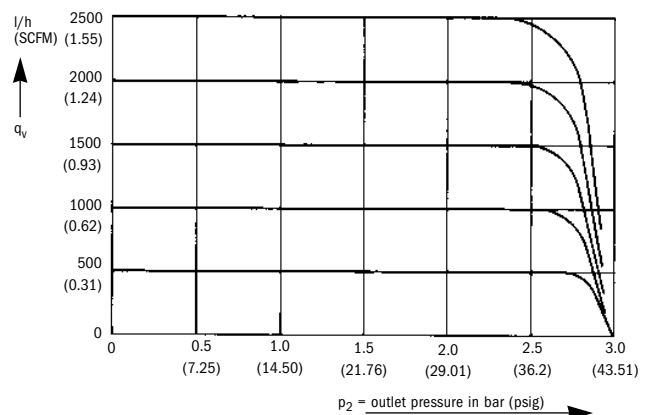
Outlet pressure regulators Typ RA, NRA

Example: inlet pressure 3 bar (43.5 psig), variable

outlet pressure  $\leq 3$  bar ( $\leq 43.5$  psig)

Air at 20 °C (68 °F), 1.013 bar abs. (14.7 psia)

$q_v$  = flow rate



## Limit switches

To signal specific flow rates, the miniature flowmeters can be equipped with limit switches that initiate an electrical signal when a preset flow value has been reached. One limit switch is required for each limit value.

Limit switches are only suitable for flowmeters fitted with stainless steel floats.

The limit switches are inductive ring sensors designed to be slipped over the glass cone of DK flowmeters. An electrical signal is initiated when the metal float passes through the sensor.

Monostable limit switches (see Table "Limit Switches") act as pulse contacts. Bistable limit switches detect the direction of movement of the float. Therefore a clear differentiation can be made between "above" or "below" the ring sensor.

2-wire limit switches have electrical values according to DIN EN 50227 (Namur wiring recommendations). Disconnect diodes are required. 3-wire limit switches can be wired in without disconnect.

Function boxes with PG gland can be fitted to the flowmeters for connection to the limit switches. For bistable limit switches an EMC filter is needed in the junction box. Alternatively the filter unit can be mounted on a TS 32 rail.

Ring sensors function in the same way as pulse contacts.

RC 10-14-N3 (TG 10-1/bi) and RC 15-14-N3 (TG 15-1/bi) are bistable ring sensors. The bistable ring sensors are supplied with an EMC filter either in a PG 11 junction box or in the form of a filter unit in a DIN rail housing. This arrangement enables the direction of movement of the float to be identified, thus providing a clear indication of the float position – whether above or below the ring sensor.

Isolation switching amplifiers are required to operate the ring sensors.

Junction boxes with PG screw connection can be fitted to the flowmeters for connection of the limit switches.

## Application ranges for the limit switches

	DK 48	DK 46, DK 47, DK 800
	Cone No.	Ball dia.
RC 10-14-N0 RC 10-14-N3	G 15.07 G 15.09 G 15.12	4 mm (0.16")
RC 15-14-N0 RC 15-14-N3 RB 15-14-E2-Bi	G 16.08 G 16.12 G 17.08 G 17.12	6 mm (0.24")

From a measuring range of 100 l/h (26.42 US GPH) water and 2400 l/h (89.32 SCFH) air onwards, the RC 15-14-N0 and RC 15-14-N3 limit switch can only be used as a minimum contact up to approx. 40% of the range.

## Technical data

### Limit switches

Version	Function	Approval	Self-inductance	Self-capacitance	Type of protection	Connection
RC 10-14-NO (TG 10-1)	monostable, dia. 10 mm (dia. 0.4")	PTB No. Ex-89.C.2135	100 µH	150 nF	EEx ia IIC T6	DIN EN 50227
RC 10-14-N3 (TG 10-1 bi)	bistable, dia. 10 mm <sup>1)</sup> (dia. 0.4") <sup>1)</sup>	PTB No. Ex-94.C.2010	120 µH	190 nF	EEx ia IIC T1 ... T4	DIN EN 50227
RC 15-14-NO (TG 15-1)	monostable, dia. 15 mm (dia. 0.6")	PTB No. Ex-89.C.2135	100 µH	150 nF	EEx ia IIC T5	DIN EN 50227
RC 15-14-N3 (TG 15-1 bi)	bistable, dia. 15 mm <sup>1)</sup> (dia. 0.6") <sup>1)</sup>	PTB No. Ex-94.C.2010	170 µH	90 nF	-	DIN EN 50227
RB 15-14-E2	bistable, dia. 15 mm <sup>1)</sup> (dia. 0.6") <sup>1)</sup>	PTB No. Ex-94.C.2010	70 µH	90 nF	-	3-wire

<sup>1)</sup> One of the EMC filters specified below is required for operation of bistable limit switches in Europe.

### EMC filters for limit switches

Version	Function	Approval	Self-inductance <sup>2)</sup>	Self-capacitance <sup>2)</sup>	Type of protection
EMC-Y38620	EMC filter 1 Channel, internal <sup>4)</sup>	BVS.96.D.2083X	600 µH	140 nF	EEx ia IIC T6 or
EMC-Y38622	EMC filter 2 Channel, Internal <sup>4)</sup>	BVS.96.D.2083X	600 µH <sup>3)</sup>	140 nF <sup>3)</sup>	EEx ia IIC T5 or
KC-EMC-Y38624	EMC filter 1 Channel, external <sup>5)</sup>	BVS.96.D.2083X	600 µH	140 nF	EEx ia IIC T1 ... T4

<sup>2)</sup> the effective inner inductance and capacitance of the EMC filter additionally need to be taken into account.

<sup>3)</sup> per channel, <sup>4)</sup> filter built into the DK terminal box, <sup>5)</sup> filter in external DIN rail housing

### Max. allowable ambient temperature for limit switches

Circuit with peak values of	Ui < 16V	Ii < 20 mA	Pi < 64 mW	Ui < 16V	Ii < 52 mA	Pi < 169 mW	Ui < 16V	Ii < 76 mA	Pi < 242 mW
Temperature class	T6	T5	T4 ... T1	T6	T5	T4 ... T1	T6	T5	T4 ... T1
Max. allowable ambient temperature	75°C (167°F)	90°C (194°F)	100°C (212°F)	70°C (158°F)	85°C (185°F)	100°C (212°F)	65°C (149°F)	80°C (176°F)	100°C (212°F)

### Max. allowable ambient temperature for EMC filters

Max. allowable ambient temperature	-	-	-	-	-	-	70°C (158°F)	85°C (185°F)	100°C (212°F)
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EMC filter	Version
EMC-Y38620	1 channel, for 1 limit switch, installed in DK terminal box
EMC-Y38622	2 channels, for 2 limit switches, installed in DK terminal box
KC-EMC-Y38624	1 channel, for 1 limit switch, DIN rail housing
<b>Rated voltage</b>	8 V DC
<b>Power consumption</b>	3 mA (active area clear) 1 mA (active area obscured)
<b>Ambient temperature</b>	- 20°C to + 65°C (- 4°F to + 149°F)
<b>Protection category</b> to DIN 60529/IEC 529	IP 67, equivalent to NEMA 6
<b>Electromagnetic compatibility (EMC)</b>	to EN 50081-1, EN 50082-2
<b>Connection</b>	0.5 m (20") PVC cable (0.14 mm <sup>2</sup> )
<b>Housing material</b>	PBTP
Electrical characteristics to DIN EN 50227 (NAMUR recommended circuitry)	



## DK 46, 47, 48, 800

### Dimensions and weights

Instrument type	Dimensions in mm and inches						Panel recess				Cover plate				Weight	
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	kg	lbs
DK 46	045	01.77	090	03.54	111	04.37	32	1.26	128	05.04	40	1.57	145	05.71	0.5	1.10
DK 47	130	05.12	175	06.89	196	07.72	32	1.26	213	08.39	40	1.57	230	09.06	0.6	1.32
DK 48	280	11.02	325	12.80	346	13.62	32	1.26	363	14.29	40	1.57	380	14.96	0.7	1.54
DK 800	080	03.15	125	04.92	146	05.75	32	1.26	163	06.42	40	1.57	180	07.09	0.4	0.88
DKR 46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	4.85

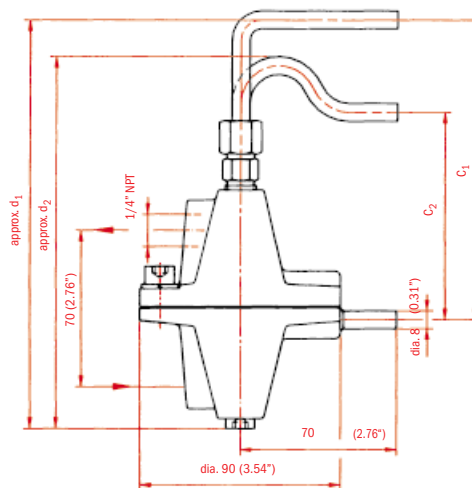
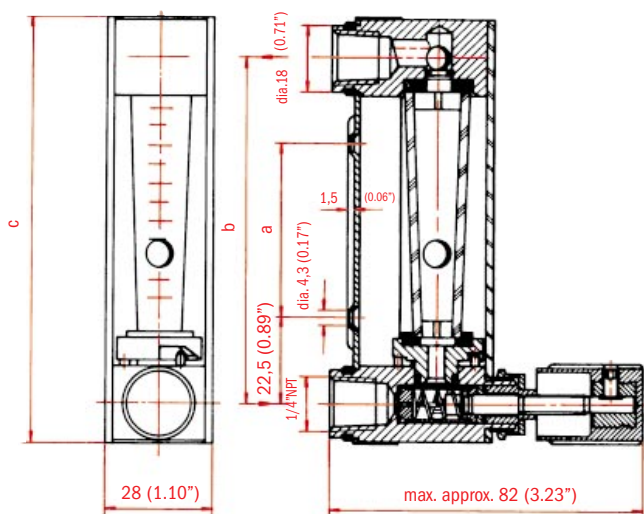
### DK 46, DK 47, DK 48, DK 800

### Dimensions in mm and inches

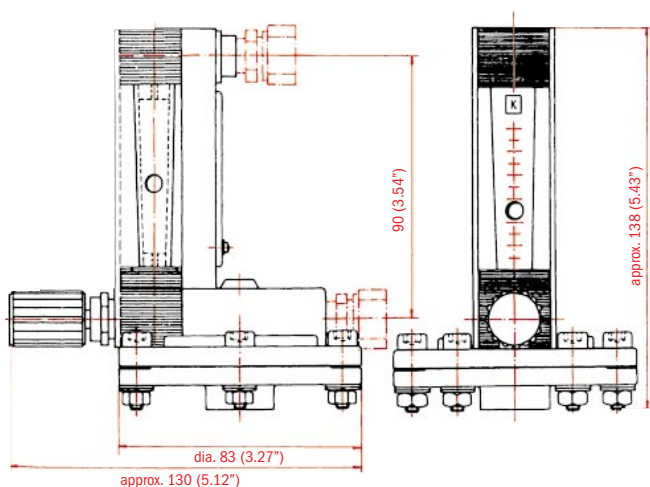
#### Flow regulators RA, NRA, RE, NRE

Instrument type	c <sub>1</sub>		c <sub>2</sub>		d <sub>1</sub>		d <sub>2</sub>	
	mm	inches	mm	inches	mm	inches	mm	inches
DK 46	-	-	90	3.54	-	-	163	6.42
DK 47	175	6.89	-	-	223	8.78	-	-
DK 48	325	12.8	-	-	373	14.7	-	-
DK 800	125	4.92	-	-	173	6.81	-	-

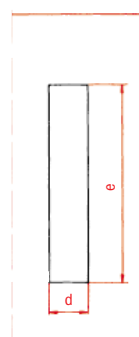
Weight: 1.5 kg (3.31 lbs)



### DKR 46



### Panel mounting



### Cover plate

