

KROHNE

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Installation and operating instructions

Miniature Flowmeters with glass metering cones

DK46, DKR 46 DK 47, DK 48, DK 800

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Order-No. 7.02102.24.00

Product liability and warranty

Responsibility as to suitability and intended use of our instruments rest solely with the operator.

Improper installation and operation of the flowmeters may lead to loss of warranty.

In addition, the "General conditions of sale" forming the basis of the purchase contract are applicable.

Should you need to return instruments for checkout or repair, please pay strict attention to the following points: Due to statutory regulations concerning protection of the environment and the health and safety of our personnel, Krohne may only handle, test and repair returned flowmeters that have been in contact with liquids or gases if it is possible to do so without risk to personnel and environment. This means that Krohne can only service your unit if it is accompanied by a certificate confirming that the flowmeter is safe to handle.

If a unit has been operated with toxic, caustic, flammable or water-endangering process products, you are kindly requested

- to check and ensure, if necessary by rinsing out or neutralizing, that all cavities are free from such dangerous substances,
- to enclose a certificate with the flowmeter confirming that it is safe to handle and stating the product used.

Krohne regret that they cannot service your flowmeter unless accompanied by such a certificate.

Items included with supply

Version as ordered:

- miniature flowmeter
- installation and operating instructions

Special certificates, supplied to order only

- Test certificates to DIN 50049 (EN 10204):
pressure test, leak-tightness test
- Calibration report

1. Installation

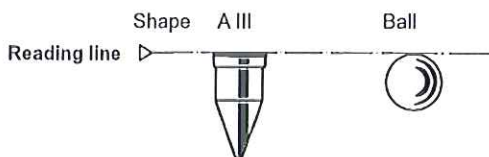
- The variable-area flowmeter **must** be installed **vertically** (float measuring principle), with flow from bottom to top.
- Before installing the flowmeter, blow or flush out the pipeline leading to the flowmeter.
- Use connectors appropriate to the flowmeter version. Align the pipes axially with the bolt holes on the flowmeter without incurring stresses. If necessary, support the pipeline on both sides of the flowmeter to prevent vibration from being transferred to the flowmeter.

Panel mounting

- Prepare the panel recess as shown in the drawing (see Dimensions and Weights, Section 9).
- To install in the panel, slacken the two screws (1) on the faceplate of the flowmeter, insert the device from the front into the recess, align and fasten with the two screws (1).

2. Start-up

- The actual system operating pressure and process temperature must not exceed the maximum values specified in the order.
- Ensure materials are compatible with the process product.
- Close needle valve at flowmeter.
- Open shut-off valves upstream and downstream of the meter.
- **On liquid service:** carefully vent the pipeline.
- **On gas service:** increase pressure slowly up to operating pressure. Avoid conditions in which the float can accelerate to the upper stop (risk of glass breakage).
- Open needle valve and set the required flowrate.
- The flow value is read off from the top edge of the float.



- Where operating parameters deviate from calibration data (flow range, product, pressure, density and temperature), the flowmeter can be adjusted to suit actual conditions:
 - by converting the flow value using the method defined in VDI/VDE Code 3513.

3. Limit switches

To signal specific flow values, the miniature flow-meters can be equipped with limit switches that initiate an electrical signal when preset values have been reached. One limit switch is required for each limit value. Suitable limit switches are either mono-stable RC 10-14-N0 (TG 10-1) and RC 15-14-N0 (TG 15-1) or bistable ring sensors RC 10-14-N3 (TG 10-1/bi) and RC 15-14-N3 (TG 15-1/bi). Bistable limit switches identify the direction of movement of the float as it passes through the sensor.

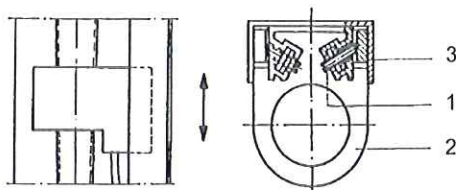
Bistable limit switches are supplied with junction box and built-in EMC filter EMV-Y 38132 or EMV-Y 38133.

AN EMC filter is not required for monostable limit switches.

EMC filters for bistable limit switches are only required in Europe (CE).

Retrofitting/Adjustment of the limit switches

- Remove the measuring glass as described under Section 5 "Maintenance".
- Slip the limit switches over the measuring glass. Be sure to mount correctly, flying lead at the bottom.
- After fitting the measuring glass, set the limit switch to the desired flowrate by sliding it along the glass.
- Fasten the limit switch (2) with the two attachment screws (1) to the mount (3) on the flowmeter.



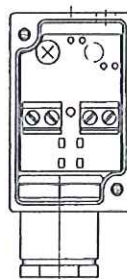
- Route the power cable for the limit switch through the hole in the base of the flowmeter.
- Bistable limit switches require an external EMC filter KC-EMV-Y 38134 in separate DIN rail housing.
Note the following:
 - EMC filter unit and mount on the flowmeter must be electrically connected (same potential).
 - Note details given in the Pepperl & Fuchs certificate of conformity (supplied).
- An isolation switching amplifier with intrinsically safe control circuit to DIN 19234 and NAMUR is required to operate the limit switch.
- Finally, replace the Plexiglass cover.

Application ranges for the limit switches

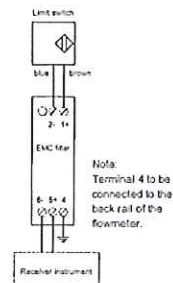
	DK 48	DK 46, DKR 46, DK 47, DK 800
	Cone No.	Ball dia.
RC 10-14-N0 RC 10-14-N3	G 15.07	4 mm (0.16")
	G 15.09	
	G 15.12	
	G 16.08	
	G 16.12	
RC 15-14-N0 RC 15-14-N3	G 17.08	6 mm (0.24")
	G 17.12	
RB 15-14-E2-Bi		

DK 800 flowmeters: upwards of a measuring range of 100 l/h (26.42 US GPH) water or 2400 l/h (89.32 SCFH) air, the RC 15-14-N0 and RC 15-14-N3 limit switches can only be used up to approx. 40% of the range.

PG junction box (with EMC filter)



Connection diagram for EMC filter



Limit switches					
Version	Function	Approval	Self-inductance	Self-capacitance	Type of protection
RC 10-14-N0 (TG 10-1)	monostable, dia. 10 mm (dia. 0.4")	PTB 99 ATEX 2128 X	100 µH	150 nF	EEx ia IIC T6 or
RC 15-14-N0 (TG 15-1)	monostable, dia. 15 mm (dia. 0.6")	PTB 99 ATEX 2128 X	100 µH	150 nF	EEx ia IIC T5 or
RC 10-14-N3 (TG 10-1 bi)	bistable, dia. 10 mm ¹⁾ (dia. 0.4") ¹⁾	PTB 99 ATEX 2128 X	120 µH	90 nF	EEx ia IIC T1 ... T4
RC 15-14-N3 (TG 15-1 bi)	bistable, dia. 15 mm ¹⁾ (dia. 0.6") ¹⁾	PTB 99 ATEX 2128 X	70 µH	90 nF	
RB 15-14-E2-Bi	bistable, dia. 15 mm (dia. 0.59")	non Ex-approval			3-wire connection

¹⁾ 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 ²⁾	Self-capacitance ²⁾	Type of protection
EMV-Y38620	EMC filter 1 Channel, internal ⁴⁾	DMT 99 ATEX E 104 X	600 µH	40 nF	EEx ia IIC T6 or
EMV-Y38622	EMC filter 2 Channel, internal ⁴⁾	DMT 99 ATEX E 104 X	600 µH ³⁾	40 nF ³⁾	EEx ia IIC T5 or
KC-EMV-Y38624	EMC filter 1 Channel, external ⁴⁾	DMT 99 ATEX E 104 X	600 µH	40 nF	EEx ia IIC T1 ... T4

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

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

Max. allowable ambient temperature for limit switches

Circuit with peak values of	U _i < 16V	I _i < 25 mA	P _i < 34 mW	U _i < 16V	I _i < 25 mA	P _i < 64 mW	U _i < 16V	I _i < 52 mA	P _i < 169 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)	55°C (131°F)	70°C (158°F)	90°C (194°F)

Max. allowable ambient temperature for EMC filters

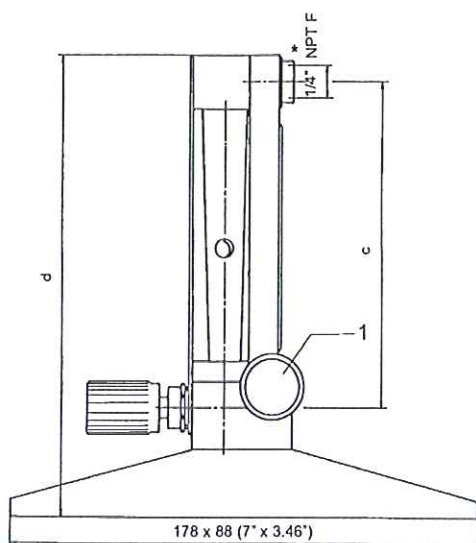
Max. allowable ambient temperature	65°C (149°F)	80°C (176°F)	100° (212°F)	65°C (149°F)	80°C (176°F)	100° (212°F)	65°C (149°F)	80°C (176°F)	100° (212°F)
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EMC filter	Version
EMV-Y38620	1 channel, for 1 limit switch, installed in DK terminal box
EMV-Y38622	2 channels, for 2 limit switches, installed in DK terminal box
KC-EMV-Y38624	1 channel, for 1 limit switch, DIN rail housing
Limit switch Type RB ...	
Connection technique	2-wire connection to DIN EN 50227
Rated voltage	8 V DC
Power consumption	3 mA (active area clear) 1 mA (active area obscured)
Ambient temperature	- 20°C to + 65°C (- 4°F to + 149°F)
Protection category to DIN 60529/IEC 529	IP 67, equivalent to NEMA 6
Electromagnetic compatibility (EMC)	to EN 60947-5-2
Connection	0.2 m (8") PVC cable (0.14 mm ²) (0.00022 sqin) or connecting housing PG11
Housing material	PBT
Electrical characteristics to DIN 19234 (NAMUR recommended circuitry)	

Version RB ...			
Connection technology	3-wire technology		
Operating voltage U_b	10 V to 30 V		
Operating current I_b	0 to 100 mA		
Output voltage U_a	below limit value	1 V	
	above limit value	$U_b - 3 \text{ V}$	
	after switching on	1 V	

4. Bench mount

The miniature flowmeters can be converted to bench instruments with the aid of a support base. Connection is e.g. by way of flexible tube nozzles. The flowmeter is secured by screw (1).



Meter type	Dimensions			
	c		d	
	mm	inches	mm	inches
DK 46	90	3.54	141	5.55
DK 47	175	6.89	226	8.90
DK 48	325	12.80	376	14.80
DK 800	125	4.92	175	6.89

6. Differential pressure regulators

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

Differential pressure regulators are not pressure reducing valves

- Minimum pressure levels are required to permit operation of the regulators (see regulator characteristics)
- 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, Gyrolok, 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)].

4

No-load current	20 mA
Ambient temperature	-25 to +70°C (-13 to +158°F)
Protection category	IP 67 (EN 60529)
Electromagnetic compatibility (EMC)	to EN 60947-5-2
Connection	2 m (6.56 ft) PUR cable (no terminal box on device)
Core cross-section	0.14 mm² (0.00022 sqin)
Housing material	PBT

5. Maintenance

Replacement of the measuring cone

Close valves upstream and downstream of the flowmeter!

Panel-mounted devices need to be dismantled for this purpose.

Close meter valve!

Miniature flowmeters feature a non-return valve in the top connection block to prevent runback of liquid product from the pipeline.
Exception: DK .../PV. The PVDF version is supplied without non-return valve in the top connection block.

Caution! It is absolutely necessary to ensure that the flowmeter is not in a pressurized condition and does not contain any aggressive or caustic product. If necessary, flush out the flowmeter thoroughly with a neutralizing agent before dismantling.

- Slide the Plexiglass cover upwards and then remove to the front.
- Turn the twist disc in the instrument base anticlockwise to release and remove the measuring glass.
- Instruments with top and bottom connection blocks made of PVDF (DK.../PV) feature in the top block an attachment screw (6 mm Allen key) which must be loosened, approx. 1 full turn.
- The measuring glass can subsequently be removed through the cut-out in the lower gasket.
- Install in the reverse order.
- To avoid breakage when refitting the measuring cone, insert the measuring glass centrally between the gaskets.

To order spares

Please specify the following when ordering spares:

- Inscription on scale on measuring cone.
- Designation of instrument version.
- Designation of spare part

Please send your orders to: see addresses.

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 .

Outlet pressure regulators supplied without check ball in the top connection block of the flowmeter.

Technical data of differential pressure regulators

Type	Identification	Material	Max. measuring range				Min. inlet pressure p ₁	
			Water 20°C (68°F)		Air **			
Inlet pressure regulators			l/h	US GPM	l/h	SCFM	p ₁ in bar	p ₁ in psig
RE-1000-R	RE 10	CrNi 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	CrNi 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	CrNi 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	CrNi steel	–		800	0.50	0.2	2.90
NRE-800-N	NRE 8	brass	–		800	0.50	0.2	2.90

Min. differential pressure*

Δp in bar

RA-1000-R	RA 10	CrNi 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	CrNi 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	CrNi steel	–	–	800	0.50	0.15	2.18
NRA-800-N	NRA 8	brass	–	–	800	0.50	0.15	2.18

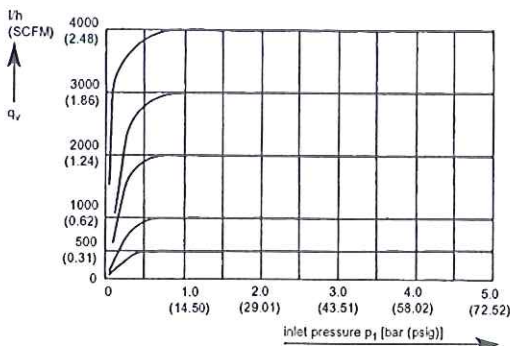
* Differential pressure between inlet and outlet pressures

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

Regulator characteristics

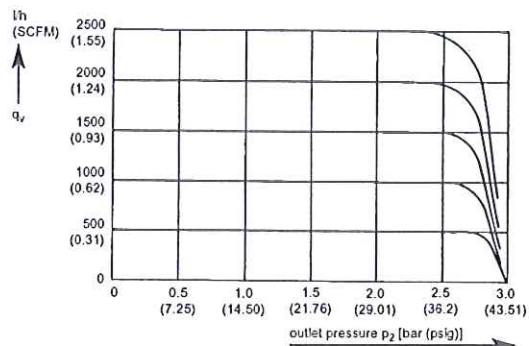
Inlet pressure regulators Type RE, NRE

Example: variable inlet pressure ≤ 5 bar (≤ 72.5 psig)
Air at 20°C (68°F), 1.013 bar abs. (14.7 psia)
 q_v = flow rate



Outlet pressure regulators Type RA, NRA

Example: inlet pressure 3 bar (43.5 psig), variable outlet pressure ≤ 3 bar (≤ 43.5 psig)
Air at 20°C (68°F), 1.013 bar abs. (14.7 psia)
 q_v = flow rate

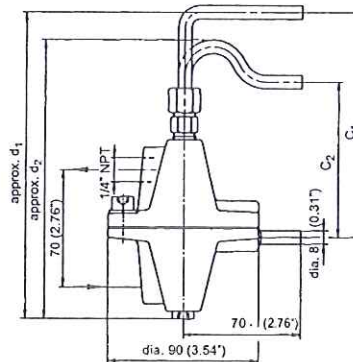


Dimensions in mm and inches

Flow regulators RA, NRA, RE, NRE

Instrument type	Dimensions					
	c_1		c_2		d_1	
	mm	inches	mm	inches	mm	inches
DK 46	—	—	90	3.54	—	—
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)



7. Technical data

Instrument type	DK 46 DKR 46	DK 47	DK 48	DK 800
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 1200* (0.19 to 44.66)	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				
Turn-down ratio	10 : 1	10 : 1	10 : 1	10 : 1
Accuracy class to VDI/VDE Code 3513, Sh. 2	4	2.5	1	2.5
Measuring cone				
Length in mm (inches)	65 (2.56")	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 max. allowable operating pressure specified in the order.				
Standard	10 bar (232 psig)	10 bar (232 psig)	10 bar (145 psig)	10 bar (232 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 (T ₁ - T ₄)	80°C (176°F)	80°C (176°F)	80°C (176°F)	80°C (176°F)
* Flow rate > 2400 l/h, air : 4 bar (> 89.32 SCFH, air : 58 psig)				
** At temperatures > 20°C (68°F) max. allowable operating pressure drops at the rate of 1% per degree C.				
Overall height and connection dimensions see Dimensions and Weights				
Connection				
Standard DK.../R, DK.../N	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT
DK.../PV	G 1/4	G 1/4	G 1/4	G 1/4
Adapters	Ermeto 6 and 8, Dilo, tubing nozzle 6 or 8 mm, Gyrolok and Swagelok			
Materials				
<u>Measuring cone</u>	borosilicate glass			
<u>Float</u>				
Standard				
DK 46, 47, 800	CrNi steel 1.4401 (316)			
DK 48	CrNi steel 1.4571 (316 Ti)			
<u>Options</u>				
DK 46, 47, 800	titanium, POM (polyoxymethylene), glass, etc.			
DK 48	aluminium, hard rubber, etc.			
<u>Float stop</u>				
DK 46, 47, 48, 800	PTFE			
<u>Valve spindle</u>	CrNi steel 1.4571 (316 Ti)			
<u>Gaskets</u>				
Standard	Viton			
Option	PTFE/FF KM (perfluorinated elastomer), PTFE (not for DK ... / PV), EPDM			
<u>Mount</u>				
DK 46, 47, 48, 800	Top/bottom connection block: CrNi steel 1.4581 (318 C17), brass or PVDF Rail: CrNi steel 1.4571 (316 Ti)			

8. Flow table

Standard float material

Reference conditions

DK 46, DKR 46, DK 47, DK 800: CrNi steel 1.4401 (316) Water at 20°C (68°F)
 DK 48: CrNi steel 1.4571 (316 Ti) Air at 20°C (68°F) DK 46, DKR 46, DK 47, DK 800, 1.2 bar abs. (17.4 psia)
 100% flow values DK 48, 1.013 bar abs. (14.7 psia)
 Turn-down ratio 10 : 1

Ball dia. mm	Cone No.	Water		Air		DK 46		DK 47		DK 48		DK 800		DK 46		DK 47		DK 48		DK 800	
		DK 46	DKR 46	DK 46	DKR 46	US GPH	I/h	US GPH	I/h	US GPH	I/h	US GPH	I/h	DK 46	DKR 46	US GPH	I/h	US GPH	I/h	US GPH	I/h
4	G13.11	2.5	0.66																		
4	G14.06																				
4	G14.08																				
4	G15.07																				
4	G15.09																				
4	G15.12																				
6	G16.08	5	1.32	2.5	0.66																
6	G16.12	12	3.17	5	1.32																
6	G17.08**	25	6.61	12	3.17																
6	G17.12**	40	10.57	25	6.61																
6	N18.07**	60*	15.85*	40	10.57																
6	N18.09**	100*	26.42*	60	15.85																
6	N18.13**			100	26.42																
6																					
6																					
6																					
8		120*	31.70*																		
8		160*	42.27*																		

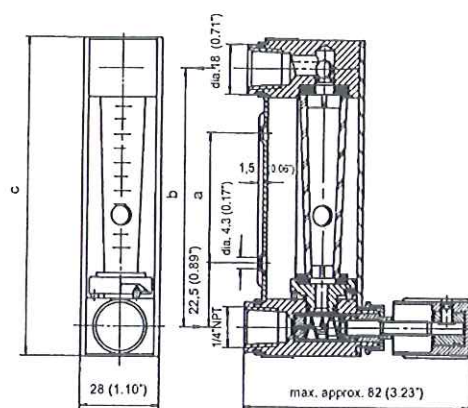
* (not DKR 46)

** (not for DK 48 PV)

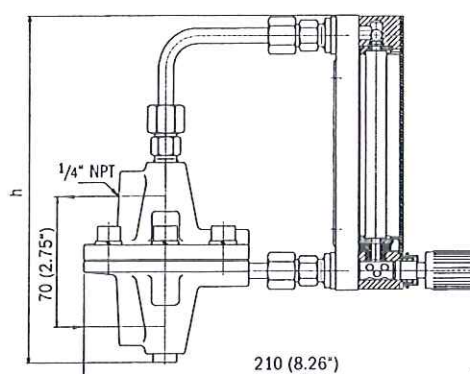
9. Dimensions and weights

Instrument type	Dimensions in mm and inches														Weight	
							Panel recess				Cover plate					
	a		b		c		d		e		f		g			
	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	mm	inches	kg	lbs
DK 46	45	1.77	90	3.54	111	4.37	32	1.26	128	5.04	40	1.57	145	5.71	0.5	1.10
DK 47	130	5.12	175	6.89	196	7.72	32	1.26	213	8.39	40	1.57	230	9.06	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	80	3.15	125	4.92	146	5.75	32	1.26	163	6.42	40	1.57	180	7.09	0.4	0.88
DKR 46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.2	4.85

DK 46, DK 47, DK 48, DK 800

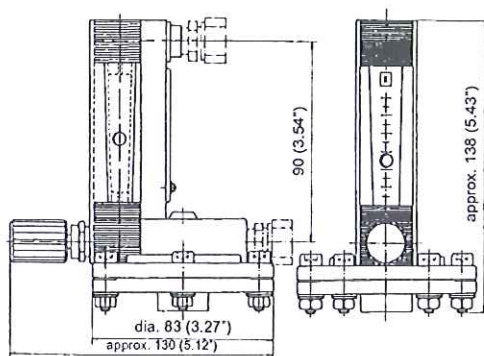


DK and differential pressure regulator



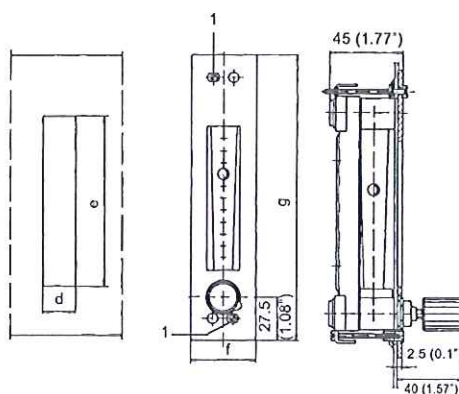
h	mm	inches
DK 46	148	5.83
DK 47	233	9.17
DK 48	383	15.08
DK 800	183	7.20

DKR 46



Panel mounting

Cover plate



KROHNE

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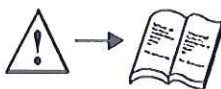
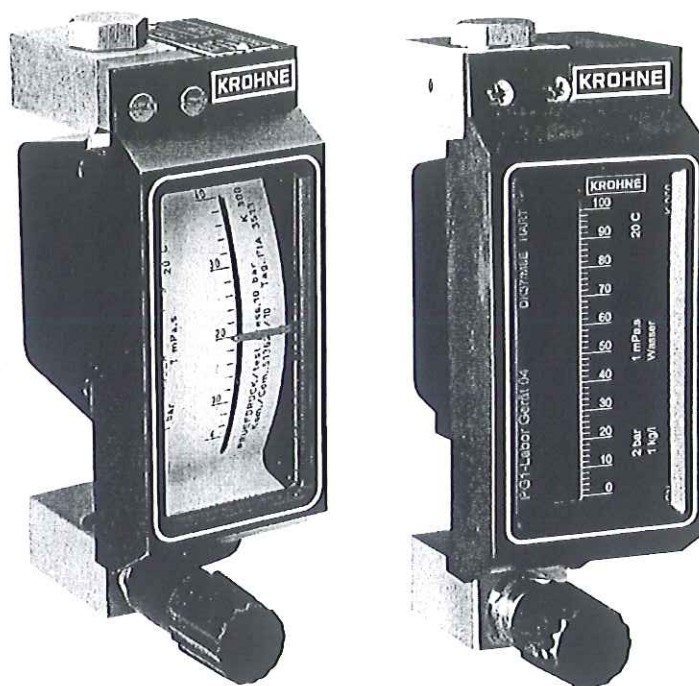
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GR

Installation and operating instructions

DK 37 M8

All-metal miniature flowmeters



**For hazardous-duty devices, please refer to
Supplementary Installation and Operating Instructions:**

DK37/M8...	Cat. II2G	with built-in electr. parts	Id. Nr. 702531##00
DK37/M8M	Cat. II2GD		
	Cat. II3GD	without built-in electr. parts	Id. Nr. 702271##00

Electromagnetic flowmeters

Variable area flowmeters

Mass flowmeters

Ultrasonic flowmeters

Vortex flowmeters

Flow controllers

Level measuring instruments

Pressure and temperature

Heat metering

Communications technology

Switches, counters, displays and recorders

Engineering systems & solutions

Contents

1	General	4
1.1	Designation code	4
1.2	Marking	5
1.3	Pressure Equipment Directive code	5
1.4	Functional principle	6
2	Installation and start-up	6
2.1	Requirements	6
2.2	Compliance with IP degree of protection for DK37/M8E and DK37/M8M with limit switches	6
2.3	Start-up	7
3	Flow table	7
4	Materials	8
5	Technical data	8
6	Process temperature	8
7	Dimensions and weights	9
8	DK37/M8M limit switch	9
8.1	Electrical connection	10
8.2	Setting the limit switches	11
8.3	Technical data for limit switches	11
9	DK37/M8E electrical signal output	12
9.1	Electrical connection	12
9.2	Parametrization	13
9.3	Technical data DK37/M8E	13
10	Differential-pressure regulators	14
10.1	Function	14
10.2	Regulator characteristics	15
10.3	Flow table, differential-pressure regulators	15
10.4	Dimensions of differential-pressure regulator	16
11	List of spare parts	17
12	Maintenance	18
	Returning a device for testing or repair to KROHNE	19

Product liability and warranty

The variable area flowmeter is suitable for measuring the volume flow rate of liquids, gases and vapour. Special regulations are applicable to their use in hazardous areas.

Responsibility for the suitability and intended use of these flowmeters rests solely with the operator.

Improper installation or improper operation of the flowmeters may lead to loss of warranty. In addition, the "General conditions of sale" forming the basis of the purchase contract are applicable.

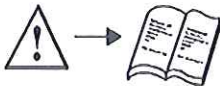
Calculation of pressurized parts is effected without allowance for corrosive wear, frictional wear or cavitation.

If the flowmeter needs to be returned to KROHNE Messtechnik, for example for repair, please note the information given at the end of these installation and operating instructions.

Items included with supply

The scope of supply of the variable area flowmeter in the version ordered includes:

- Installation and operating instructions, Ident. No. 702115##00



For hazardous-duty devices, please refer to Supplementary Installation and Operating Instructions:

- DK37/M8... Cat. II2G with built-in electr. parts Ident. No. 702531##00
- DK37/M8M Cat. II2GD II3GD without built-in electr. parts Ident. No. 702271##00
- Installation material not included
- DK37/M8E: with box level

Special certificates (supplied to order only)

- Report on factory settings
- Test certificate to EN 10204:
- Pressure test, leak test
- Cleaning to factory specification.

Software and accessories (DK37/M8E only)

The following documents and accessories are available on request for the M8E indicator. See also download center www.krohne.com.

HART - FDS	(Field Device Specification)	Document 7025052100
HART DD (AMS)	(Device Description)	M8E HART 0101 AMS 6.# DD
HART DD (PDM)	(Device Description)	M8E HART 0101 PDM 5.2 DD
HART DTM	(Device Type Manager)	M8E HART DTM

Conformity



The variable-area flowmeter DK37 / M8... complies with all applicable directives and NAMUR recommendations and bears the CE marking.
For declarations of conformity, see download center www.krohne.com.
All production shops and process sequences are certified to ISO 9001.

1 General

1.1 Designation code

The designation code consists of the following elements: *)

D	K	3	7	/	M	8		/		/		
		1				2	3		4			5

- 1 : Series: measuring unit DK37
- 2 : Series: indicator part M8
- 3 : Type of indicator
 - M : Mechanical indicator
 - E : Electronic indicator and signal output 4-20 mA
- 4 : Differential-pressure regulators
 - RE : Inlet pressure regulators
 - RA : Outlet pressure regulators
- 5 : Limit switches (for mechanical indicator only)
 - K1 : one limit switch
 - K2 : two limit switches

*) Places not needed may be omitted from the designation code

1.2 Marking




The type designation of the complete device is given on the indicator part by means of the nameplate reproduced below (see also designation code).

Example:

SN : Serial number
MD : Year of manufacture
PS : Max. allowable operating pressure at
max. allowable operating temperature TS
PTmax: Max. test pressure
TS : Max. operating temperature
PED: Pressure Equipment Directive code
Tag-No: Measuring point identifier

Additional internal marking:

SN: Serial number
SO: Sales order / item
KO: KROHNE order
V251...: Product configurator code
AC: Article code

KROHNE Duisburg Germany 	
DK37/M8M/RA/K2	
SN: 5/123456.001	MD: 2005
PED/G1/3.3/SEP	PS: xx bar
PTmax: xxbar	TS: xx °C
Tag-No.: #####	
SC.... Kmin1 SC.... Kmin2	
 	702213##00 www.krohne.com

1.3 Pressure Equipment Directive code

PED	/			/		/	
1		2	3		4		5

1 Pressure Equipment Directive

2 Fluid

G Gases, liquefied gases, gases dissolved under pressure, vapour, and those liquids whose vapour pressure at the maximum allowable temperature is **more than 0.5 bar** above normal atmospheric pressure (1013 mbar).

L Liquids whose vapour pressure at the maximum allowable temperature is **not more than 0.5 bar** above atmospheric pressure.

3 Fluid group

3 1 Group 1 : explosive, extremely flammable, highly flammable, flammable (where the maximum allowable temperature is above flash point), very toxic, toxic, oxidizing
2 Group 2 : all fluids not specified in Group 1

4 Category

3.3 in accordance with Article 3.3 of Directive 97/23/EC

5 Conformity assessment procedure

SEP sound engineering practice

The PED code marking is shown on the device nameplate.

1.4 Functional principle

The flowmeter operates on the float measuring principle.

The DK measuring unit consists of a tapered metal tube in which a float is allowed to move freely up and down.

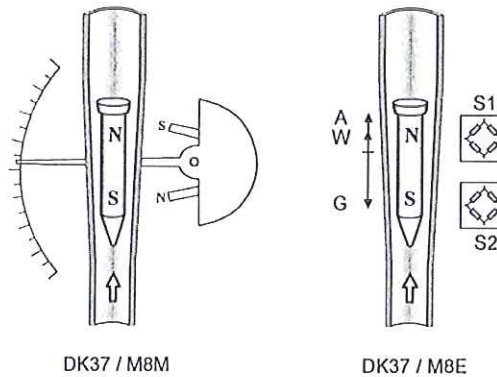
Flow is from bottom to top. The float adjusts such that

- buoyancy force A acting on it,
- form drag W , and
- weight G are in equilibrium ($G = A + W$).

DK37/M8M: the flow-dependent vertical position of the float is transmitted by a magnetic coupling and indicated on a scale.

DK37/M8E: the flow-dependent vertical position of the float is transmitted by a magnetic coupling to sensors S1 and S2 on the electronic indicator.

External magnetic fields can cause measuring errors



2 Installation and start-up

2.1 Requirements

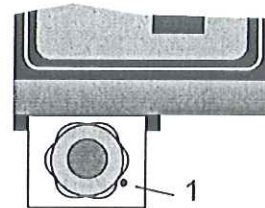
- The variable area flowmeter must be installed vertically. Vertical installation can be checked by means of the supplied box level (DK37/M8E only). For installation recommendations, please also refer to Guideline VDE/VDI 3513, Sheet 3.
- Before installing the flowmeter, clean the pipeline by blowing out or flushing.
- Connect the flowmeter using fittings appropriate to the device version. Align the pipes axially and free of stresses with the bolt holes on the flowmeter. If necessary, support the pipeline on both sides of the flowmeter to prevent vibration from being transferred to the flowmeter.
- Pipelines for gas flow to be dried before the flowmeter is installed.

2.2 Compliance with IP degree of protection for DK37/M8E and DK37/M8M with limit switches

- The diameter of the connecting cable must be appropriate to the cable gland used, e.g. M16x1.5 - cable diameter 8 ... 10 mm (standard)
- Tighten the outlet nut after inserting the connecting cable.
- All cable glands not used to remain closed off with blanking plugs.
- Do not kink cables directly at the cable entries.
- Provide a water drip point (U bend in cable).
- Incoming cables should not be subjected to mechanical stresses.

2.3 Start-up

- The actual system operating pressure and process temperature should be compared with the data on the nameplate (PS and TS) and should not be higher than these.
- Make sure that materials are compatible with the process product.
- Close needle valve at flowmeter DK 37.
- Slowly open shut-off valves upstream and downstream of the flowmeter.
- On liquid service: vent the pipeline carefully.
- On gas service: increase pressure slowly up to operating pressure. Avoid conditions in which the float could accelerate up to the stop (e.g. when using solenoid valves) thereby likely to damage the measuring unit and the float.
- Open the needle valve for flowmeter DK37 and set the required flow rate. The valve spindle is secured to prevent it from working loose (1).



3 Flow table

Reference conditions Water at 20°C
 Air at 20°C, 1.013 bar abs.

100% flow values, turndown ratio 10:1

Cone		Valve spindle diameter		Water		Air		max. pressure drop	
No.	Code	mm	inches	l/h	US GPM	l/h	SCFM	mbar	psig
K 005	K 7	1.0	0.039	–	–	50 / 16*	0.031 / 0.009*	31	0.45
K 010	K 5	1.0	0.039	3	0.013	100	0.062	66	0.96
K 015	K 9	2.5	0.079	5	0.022	150	0.093	19	0.28
K 040	K 4	2.5	0.098	10	0.044	400	0.248	27	0.39
K 080	K 1	2.5	0.098	25	0.110	800	0.496	55	0.80
K 125	K 2	4.5	0.177	40	0.176	1250	0.775	42	0.61
K 200	K 3	4.5	0.177	60	0.264	2000	1.241	85	1.23
K 300	K 6	4.5	0.177	80	0.352	2500	1.551	117	1.70
K 340	K 8	4.5	0.177	100	0.440	3400	2.109	166	2.41

* with titanium float

4 Materials

Top and base, cone, upper plug	CrNi-steel 1.4404 / 316 L
Float	CrNi-steel 1.4571, titanium
Valve	CrNi-steel 1.4404
Plug seal	PTFE
Gasket, dosing unit	FPM (Viton) and PTFE
Indicator housing	PPS, electrically conductive

5 Technical data

Accuracy class to VDI/VDE Guideline 3513, Sheet 2	2.5
Connections Adapters	1/4" NPT female thread Ermeto 6 or 8, Serto 6 or 8, Dilo, Gyrollok, Swagelok
Maximum allowable operating pressure PS	130 bar (higher pressures on request) Directive 97/23/ EC of the Council of April 29, 1999 on transportable pressure equipment (Pressure Equipment Directive) is applied. The maximum allowable operating pressure PS is calculated for the max. allowable operating temperature TS. Both limits (PS and TS) are listed on the rating plate. As a rule, PS is equal to the nominal pressure of the connection.
Pressure Tested PT	The test pressure is calculated in accordance with the Pressure Equipment Directive (97/23/EC) and/or AD 2000-HP30, taking into account the maximum allowable operating pressure and the maximum operating temperature.
Degree of protection to EN 60529 / IEC 60529	IP 65

6 Process temperature

Max. process temperature TS as a function of ambient temperature $T_{amb.}$

	$T_{amb.} < 40^{\circ}\text{C}$	$T_{amb.} < 50^{\circ}\text{C}$	$T_{amb.} < 60^{\circ}\text{C}$
Version	TS in $^{\circ}\text{C}$	TS in $^{\circ}\text{C}$	TS in $^{\circ}\text{C}$
DK37/M8M/K	150	125	100
DK37/M8E	135	110	85

TS values apply provided a heat-resistant cable is used with $\geq 70^{\circ}\text{C}$ thermostability

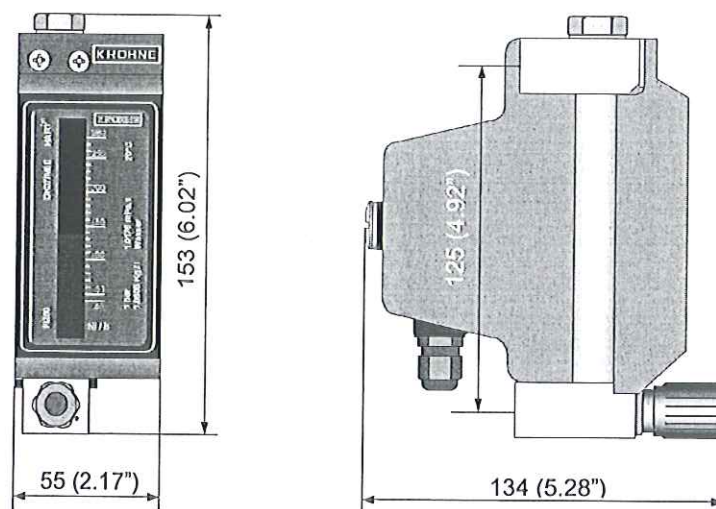
Min. process temperature TS as a function of the flowmeter version

Version	TS in $^{\circ}\text{C}$
DK37 / M8M / ... without electrical limit switch	-40 (without valve -80)
DK37 / M8M /.../K . with electrical limit switch	-25
DK37/M8E/... with electrical indicator	-25

Ambient temperature $T_{amb.}$: -25°C to $+70^{\circ}\text{C}$ (standard; other temperatures on request)

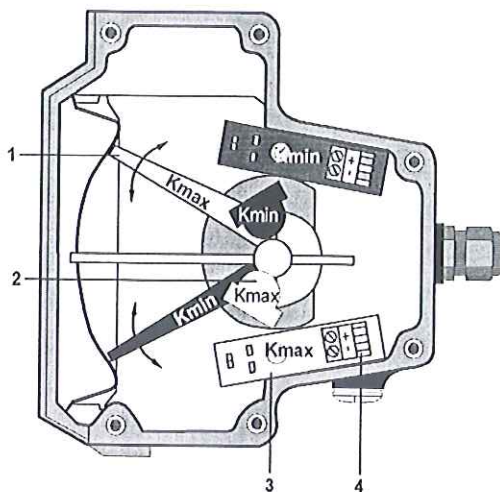
7 Dimensions and weights

Dimensions in mm and (inches)



Approx. weight: DK37/M8M 0.8 kg (1.76 lbs)
DK37/M8E 1.0 kg (2.2 lbs)

8 DK37/M8M limit switch



The limit switch is a slot sensor with built-in pre-amplifier. The sensor is activated by the dipping action of an aluminium vane that is mounted on the pointer shaft of the flowmeter.

The limit switches can be set across the entire measuring range. The set limits are indicated on the scale. The pointers are set to the limit value along the scale via a slip coupling.

Three slot sensors are available:

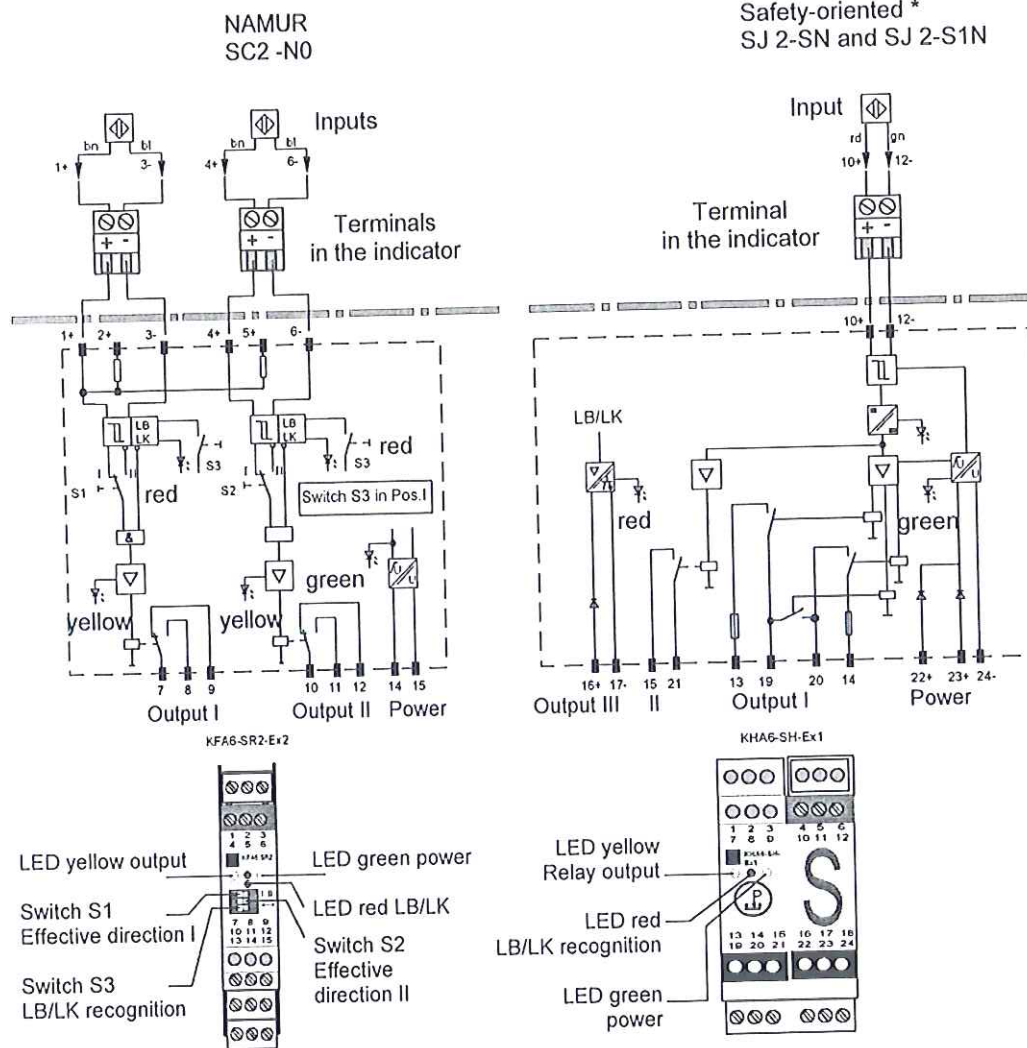
- SC 2-NO NAMUR NC contact
- SJ 2-SN NAMUR safety-oriented NC contact
- SJ 2-S1N NAMUR safety-oriented NO contact

- 1 Slave pointer, switching point indication
- 2 Limit switch
- 3 Connecting board
- 4 Terminal

8.1 Electrical connection

The limit switches are connected electrically in the device.
DK37/M8M/K. Terminal connection $\leq 1.5 \text{ mm}^2$

The terminals for Kmin and Kmax are marked with + and -.



LB : Line break
LK : Line short-circuit

* Safety-oriented isolation switching amplifier: single-channel only

8.2 Setting the limit switches

The pointers are set to the limit value along the scale by means of a slip coupling.

8.3 Technical data for limit switches

	SC 2-NO	SJ2-SN	SJ2-S1N
Switching function	NC contact	NC contact	NO contact
Nominal voltage U_0	8 V DC	8V	8V
Power consumption	Pointer vane not detected	$\geq 3 \text{ mA}$	$\leq 1 \text{ mA}$
	Pointer vane detected	$\leq 1 \text{ mA}$	$\geq 3 \text{ mA}$

Electrical characteristics to NAMUR

An isolation switching amplifier, e.g. Pepperl + Fuchs Series KF .. -SR2 ..., is required in order to operate the SC 2-NO limit switch.

SJ 2-SN and SJ 2-S1N limit switches, safety-oriented, are connected in accordance with EN 60079-14 / IEC 60079-14 to a safety-oriented isolation switching amplifier, e.g. Pepperl & Fuchs K... -SH- ...

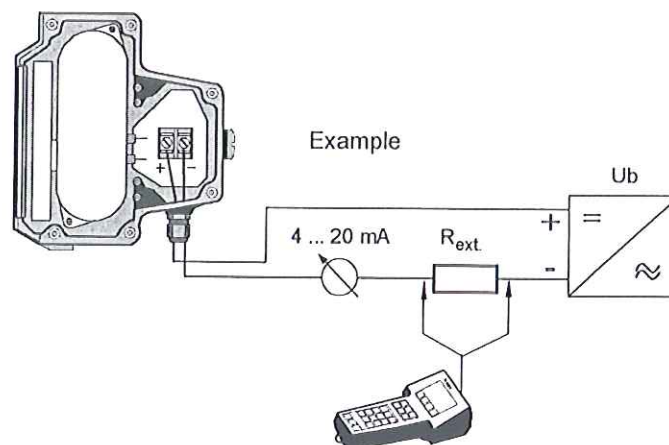
Max. values for hazardous areas:

	SC 2-NO	SJ2-SN	SJ2-S1N
Open-circuit voltage U_i	16V	16V	16V
Short-circuit current I_i	25 mA	25 mA	25 mA
Power P_i	64 mW	64 mW	64 mW
Self-inductance (L_i)	150 μH	100 μH	100 μH
Self-capacitance (C_i)	165 nF	45 nF	45 nF

9 DK37/M8E electrical signal output

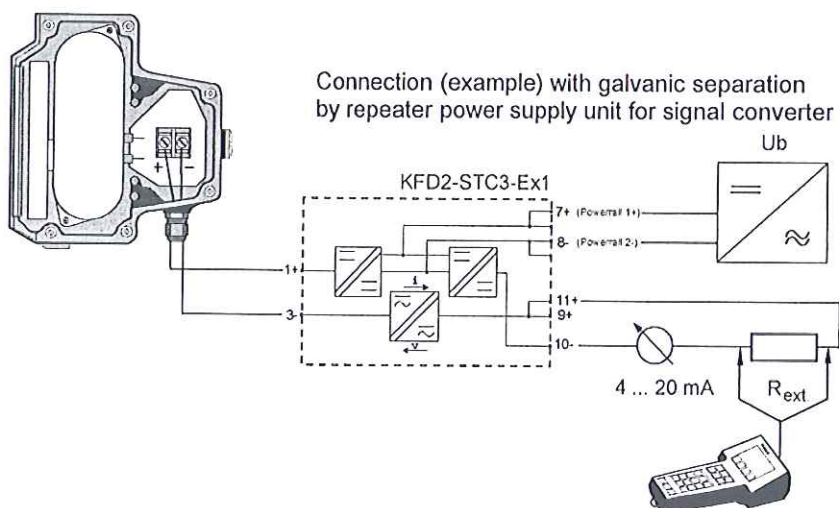
9.1 Electrical connection

Cable gland M16x1.5 – cable diameter 8 to 10 mm (standard)
cable gland M20x1.5 – cable diameter 8 to 13 mm.
Terminal connection $\leq 4 \text{ mm}^2$



Circuitry to be designed with extra-special care when other devices (e.g. power unit, digital evaluators, process control system) are also connected.

It is possible that internal connections in such devices (e.g. GND with PE, grounding loops) will generate voltage peaks that will affect the functioning of the flowmeter itself or a connected device. In such cases, a functional extra-low voltage with protective galvanic separation (PELV) is recommended.



9.2 Parametrization

The electronic indicator M8E is parameterized via a HARTTM communication. Device Description (DD) for AMS 6.x and PDM 5.2 and Device Type Manager (DTM) are available at the download center under www.krohne.de.

The integrated HARTTM communication allows the current flow value to be transmitted. One flow totalizer can be parameterized, and two limit values can be monitored. The limit values are assigned either to flow values or to the totalizer overflow. The limit values are not displayed.

Device data (HARTTM)

Name of manufacturer (code)	KROHNE Messtechnik (69)
Name of model	M8E (230)
HART TM protocol revision	5.1
Device revision	1
Physical layer	FSK
Device category	Transmitter

Process variable - flow

Linear	Value [%]	Signal output [mA]
Overrange	+105 (± 1%)	20.64 .. 20.96
Device error detection	> 110	> 21.60
Maximum	112.5	22.00
Multidrop operation	–	4.5

9.3 Technical data DK37/M8E

Current output	4 ... 20mA
Power supply	14.8 ... 30 V DC
Temperature influence	< 10µA / K
External resistance R _{ext.}	< 640 ohms (30 V DC)
Load R _{ext.} for HART TM	> 230 ohms
Degree of protection (EN 60529)	IP65

Assuming power U_b is known, the maximum load impedance (line resistance + loads) can be calculated as follows:

$$R_{\text{ext. max.}} = (U_B - 14.8 \text{ V}) / 22 \text{ mA}$$

HARTTM communication requires a minimum of 230 ohms for an external resistance.

10 Differential-pressure regulators

Differential-pressure regulators are used to ensure constant flow rates at varying inlet and outlet pressures.



Note:

Differential-pressure regulators are not pressure-reducing valves!

- Minimum pressure levels are required to operate the regulators (see regulator characteristics)
- Max. flow rate: 3400 l/h (2.11 SCFM) air and 100 l/h (0.44 US GPM) water.
- Standard connections: 1/4" NPT
- Max. allowable operating pressure (at 20°C): 64 bar
- Max. temperature: 80°C
- Material: CrNi steel 1.4404

10.1 Function

Inlet pressure regulators type RE NRE

Types RE and NRE maintain the flow rate of gases and liquids constant at variable inlet pressures and constant outlet pressures.

Example: Regulator RE 1000:

Actual flow rate: 1000 NI air

Outlet pressure constant: 1.013 bar abs.

Given a variable inlet pressure greater than 0.5 bar, the flow rate in the device stays constant.

Outlet pressure regulators type RA, NRA

Types RA and NRA maintain the flow rate of gases and liquids constant at variable outlet pressures and constant inlet pressures.

There must be a minimum pressure difference between inlet and outlet pressure in order for the outlet pressure regulator to function.

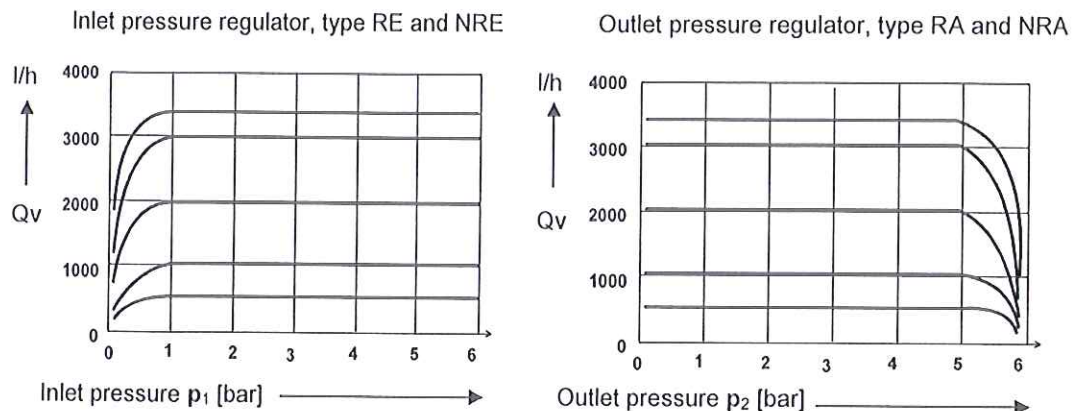
Example: Regulator NRA 800

Actual flow rate: 800 NI air

Inlet pressure constant: 3 bar

Given a variable outlet pressure of 0 ... 2.9 bar, the flow rate in the device stays constant.

10.2 Regulator characteristics

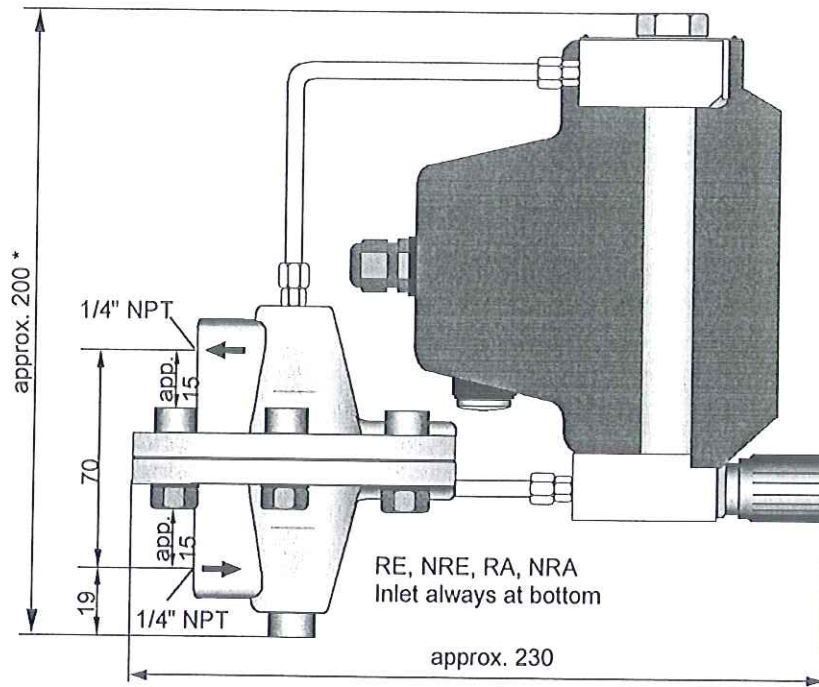


10.3 Flow table, differential-pressure regulators

Reference conditions: Air 20°C, 1.013 bar abs.
Water 20°C

Regulator type	Maximum flow rate					
	Water		Air		Min. inlet pressure p_1	
RE inlet	l/h	US GPM	l/h	SCFM	bar	psig
RE-1000	3...40	0.013...0.18	100...1000	0.062...0.62	0.5	7.26
RE-4000	50...80	0.22...0.35	1500...2000	0.93...1.24	1.0	14.5
	100	0.44			1.5	21.8
	120...160	0.53...0.7	3000...3400	1.86...2.11	2.0	29.0
NRE-100	1...2.5	0.004...0.011	60...100	0.037 ... 0.062	0.1	1.45
NRE-800	25	0.11	250	0.15	0.1	1.45
			500...800	0.31...0.5	0.2	2.90
RA outlet					Min. diff. press Δp [bar]	
RA-1000	3...40	0.013...0.18	100...1000	0.062...0.62	0.5	7.26
RA-4000	60...100	0.26...0.44			1.0	14.5
			2000...3000	1.24...1.86	1.5	21.8
	120...160	0.53...0.7	3400	2.11	2.0	29.0
NRA-800	1	0.004	60...250	0.037 ... 0.15	0.1	1.45
			500	0.31	0.2	2.90
	20...25	0.09...0.11	800	0.5	0.4	5.80

10.4 Dimensions of differential-pressure regulator



* with outlet pressure regulator approx. 230 mm

Differential-pressure regulators are supplied as standard without pipe elbows on the process connection side.

11 List of spare parts

Description		Article No.
Differential-pressure regulator "standard"		
Inlet pressure regulators		
Regulator RE 1000 R, stainless steel	.....	XG30091100
Regulator RE 4000 R, stainless steel	.....	XG30091300
Outlet pressure regulators		
Regulator RA 1000 R, stainless steel	.....	XG30092100
Regulator RA 4000 R, stainless steel	.....	XG30092300
Differential-pressure regulator "low-pressure"		
Inlet pressure regulators		
Regulator NRE 100 R, stainless steel	.....	XG30093100
Regulator NRE 800 R, stainless steel	.....	XG30093300
Outlet pressure regulators		
Regulator NRA 800 R, stainless steel	.....	XG30094100
Slot sensor SC 2 N0 - ATEX	.....	XG46021100
Slot sensor SJ 2 SN - ATEX	.....	XG46021200
Needle valve for DK instruments - new version		
Drive spindle	gasket: Viton / PTFE	XG46030100
Drive spindle	gasket: FFKM	XG46030300
Dosing unit diameter 1.0	gasket: Viton	XG46030500
< 100 NI/h air, < 5 l/h water	gasket: PTFE	XG46030600
	gasket: FFKM	XG46030700
Dosing unit diameter 2.5	gasket: Viton	XG46030800
< 1000 NI/h air, < 50 l/h water	gasket: PTFE	XG46030900
	gasket: FFKM	XG46031000
Dosing unit diameter 4.5	gasket: Viton	XG46031100
< 3400 NI/h air, < 100 l/h water	gasket: PTFE	XG46031200
	gasket: FFKM	XG46031300
Dosing valve, 1.0 mm "rigid version"	gasket: Viton	XG46032100
Dosing valve, 2.5mm "rigid version"	gasket: Viton	XG46032200
Dosing valve, 4.5mm "rigid version"	gasket: Viton	XG46032300
Dosing valve PEEK, 2.5mm "rigid version"	gasket: Viton	XG46033100
Isolation switching amplifier:		
KFA6-SR2-Ex1.W	230 V AC	1 channel..... 5015262000
KFA5-SR2-Ex1.W	115 V AC	1 channel..... 5015262100
KFD2-SR2-Ex1.W	24 V DC	1 channel..... 5015262200
KFA6-SR2-Ex2.W	230 V AC	2 channels..... 5015262300
KFA5-SR2-Ex2.W	115 V AC	2 channels..... 5015262400
KFD2-SR2-Ex2.W	24 V DC	2 channels..... 5015262500

12 Maintenance

Within the scope of routine maintenance of the system and pipelines, the flowmeter should be inspected for soiling, signs of corrosion and mechanical wear, for leak-tightness, and for signs of damage to the measuring tube and indicator. We recommend that such inspections be carried out at least once a year. To clean, the device should be removed from the pipeline.



Note :

Pressurized pipes to be depressurized before removing the flowmeter. Where devices are used for flow measurement of aggressive or hazardous media, take appropriate safety precautions in respect of residual liquids in the measuring section. Always use new gaskets when re-installing the flowmeter in the pipeline.

Returning a device for testing or repair to KROHNE

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems. 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 our personnel, KROHNE may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.

This means that KROHNE can only service this device if it is accompanied by the following certificate confirming that the device is safe to handle.

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,
- to enclose a certificate with the device confirming that is safe to handle and stating the product used.

We cannot service this device unless accompanied by such a certificate.

SPECIMEN certificate

Company: Address:

Department: Name:

Tel. No.: Fax No.:

The enclosed device

Type:

KROHNE Order No. or Series No.:

has been operated with the following liquid:

Because this liquid is ☐ water-hazardous ☐ toxic ☐ caustic ☐ flammable

we have ☐ checked that all cavities in the instrument are free from such substances /

☐ flushed out and neutralized all cavities in the device

We confirm that there is no risk to humans or environment through any residual liquid contained in this device.

Date: Signature:

Company stamp:

KROHNE

Installation and operating instructions DK 37/M8

19