

Miniature Flowmeters with glass metering cones

Installation and operating instructions

**DK 46, DKR 46
DK 47
DK 48
DK 800**

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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

Installation in the pipeline

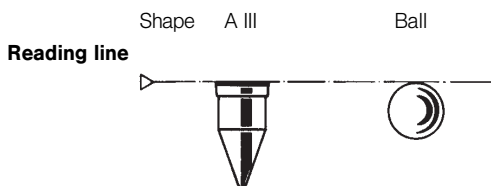
- The variable-area flowmeter **must** be installed **vertically** (float measuring principle), with flow from bottom to top.
- Before installing the flowmeter, blow or flush out the pipeline leading to the flowmeter.
- Use connectors appropriate to the flowmeter version. Align the pipes axially with 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.



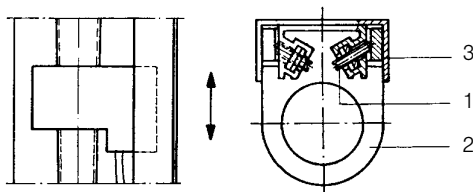
- Where operating parameters deviate from calibration data (flow range, product, pressure, density and temperature), the flowmeter can be adjusted to suit actual conditions:
 - by converting the flow value using the method defined in VDI/VDE Code 3513.

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).

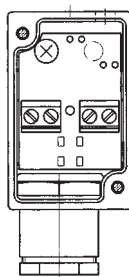
- An isolation switching amplifier with intrinsically safe control circuit to DIN 19234 and NAMUR is required to operate the limit switch.
- Finally, replace the Plexiglass cover.

Application ranges for the limit switches

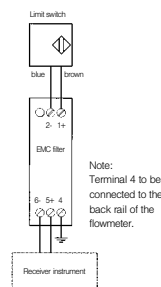
	DK 48	DK 46, DKR 46, DK 47, DK 800
	Cone No.	Ball dia.
RC 10-14-N0 RC 10-14-N3	G 15.07	4 mm (0.16")
	G 15.09	
	G 15.12	
	G 16.08	
	G 16.12	
RC 15-14-N0 RC 15-14-N3	G 17.08	6 mm (0.24")
	G 17.12	

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



Technical data

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 No. Ex-89.C.2135	100 µH	150 nF	EEx ia IIC T6 or
RC 15-14-N0 (TG 15-1)	monostable, dia. 15 mm (dia. 0.6")	PTB No. Ex-89.C.2135	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 No. Ex-94.C.2010	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 No. Ex-94.C.2010	70 µH	90 nF	

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
EMC-Y38620	EMC filter 1 Channel, internal ⁴⁾	BVS.96.D.2083X	600 µH	40 nF	EEx ia IIC T6 or
EMC-Y38622	EMC filter 2 Channel, internal ⁴⁾	BVS.96.D.2083X	600 µH ³⁾	40 nF ³⁾	EEx ia IIC T5 or
KC-EMC-Y38624	EMC filter 1 Channel, external ⁵⁾	BVS.96.D.2083X	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 < 20 mA	P _i < 64 mW	U _i < 16V	I _i < 52 mA	P _i < 169 mW	U _i < 16V	I _i < 76 mA	P _i < 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

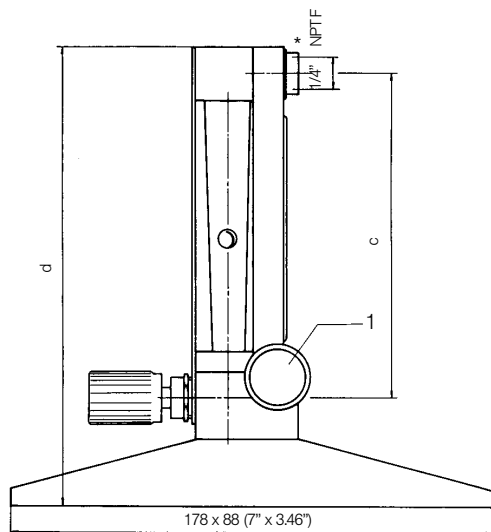
Max. allowable ambient temperature	-	-	-	-	-	70°C (158°F)	85°C (185°F)	100°C (212°F)
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EMC filter	Version
EMC-Y38620	1 channel, for 1 limit switch, installed in DK terminal box
EMC-Y38622	2 channels, for 2 limit switches, installed in DK terminal box
KC-EMC-Y38624	1 channel, for 1 limit switch, DIN rail housing
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
Electromagnetic compatibility (EMC)	IP 67, equivalent to NEMA 6
Connection	to EN 50081-1, EN 50082-2
Housing material	0.5 m (20") PVC cable (0.14 mm ²)
	PBTP

Electrical characteristics to DIN 19234 (NAMUR recommended circuitry)

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)].

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	Identifi- cation	Material	Max. measuring range				Min. inlet pressure p ₁	
			Water **		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*

Outlet pressure regulators

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

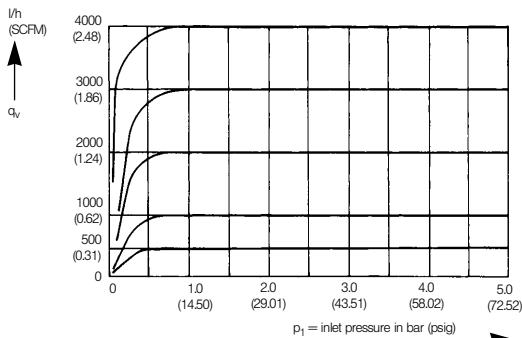
Regulator characteristics

Inlet pressure regulators Typ 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

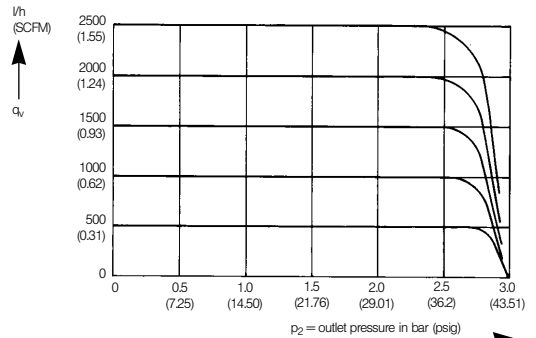


Outlet pressure regulators Type RA, NRA

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

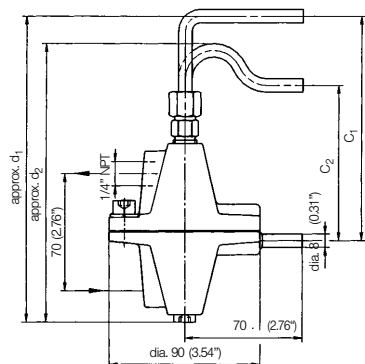


Dimensions in mm and inches

Flow regulators RA, NRA, RE, NRE

Instrument type	Dimensions							
	c ₁		c ₂		d ₁		d ₂	
	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)



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 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				
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	16 bar (232 psig)	16 bar (232 psig)	10 bar (145 psig)	16 bar (232 psig)
with PTFE gasket	10 bar (145 psig)	10 bar (145 psig)	10 bar (145 psig)	10 bar (145 psig)
DK ... / PV	10 bar (145 psig)	6 bar (87 psig)	6 bar (87 psig)	10 bar* (145 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)
* Flow rate > 2400 l/h, air : 6 bar (> 89.32 SCFH, air : 87 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	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			
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	seatite, 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/FFKM (perfluorinated elastomer) (PTFE not for DK ... / PV)			
<u>Mount</u>				
DK 46, 47, 48, 800	Top/bottom connection block: CrNi steel 1.4581 (316 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: C/Ni steel 1.4401 (316)

Water at 20°C (68°F)

C/Ni 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)

DK 48, 1,013 bar abs. (14.7 psia)

100% flow values

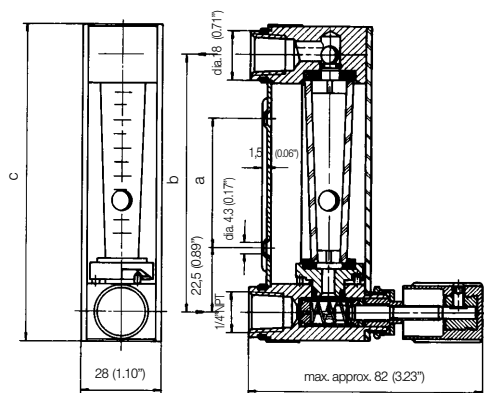
Turn-down ratio 10 : 1

Ball dia. mm		Cone No.		Water		Air											
DK 46, 47 DK 800	DK 48	DK 46		DK 47		DK 48		DK 800		DK 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	US/GPH	l/h	US/GPH	l/h	US/GPH	l/h	US/GPH
4	G13.11	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	G14.06			0.6	0.16					8	0.30	25	0.93	25	0.93	8	0.30
4	G14.08			1	0.26					16	0.60	40	1.49	40	1.49	16	0.60
4	G15.07			1.6	0.42					40	1.49	60	2.23	60	2.23	40	1.49
4	G15.09			2.5	0.66					60	2.23			90	3.35	60	2.23
4	G15.12			4	1.06									140	5.21		
6	G16.08	5	1.32		0.66	6	1.59	5	1.32	100	3.72	60	2.23	200	7.44	100	3.72
6	G16.12	12	3.17		1.32	10	2.64	12	3.17	250	9.30	100	3.72	300	11.16	250	9.30
6	G17.08	25	6.61		3.17	16	4.23	25	6.61	500	18.61	250	9.30	500	18.61	500	18.61
6	G17.12	40	10.57		6.61	25	6.61	40	10.57	800	29.77	500	18.61	800	29.77	800	29.77
6	G18.07	60*	15.85*		10.57	40	10.57	60	15.85	1600*	59.55*	800	29.77	1200	44.66	1000	37.22
6	G18.09	100*	26.42*		15.85	63	16.64	100	26.42					2000	74.43	1800	66.99
6	G18.13			100	26.42	100	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*														

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



DKR 46

Panel mounting

Cover plate

