KROHNE

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7021242400

GM

Installation and Operating Instructions

H 250/M9

Variable area flowmeters

Note **In case of instruments which are explosion protected please observe the supplementary installation and operating instructions:**

H250/M9/...	Cat. II2G	with electr. internals	Id. No. 702242##00
H250/M9S/...	Cat. II3GD	with electr. internals	Id. No. 702256##00
H250/M9/...	Cat. II2GD Cat. II3GD	without electr. internals	Id. No. 702271##00

Product liability and warranty

The variable area flowmeter is suitable for measuring the volume flow of liquids, gases and vapor.

Special regulations apply for use in explosion-hazardous areas. (Refer to the section on the scope of delivery.)

Responsibility for the suitability and usage to the intended purpose of these flowmeters rests solely with the operator.

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

The calculation of the pressurized parts is effected with allowance for corrosion, erosion through abrasion or cavitation.

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

Scope of delivery

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

- Installation and operating instructions Ident. No.: 702124##00

  Additional Installation and Operating Instructions:
  H250/M9/... Cat. II2G with electr. internals Id. No. 702242##00
  H250/M9S/... Cat. II3G with electr. internals Id. No. 702256##00
  H250/M9/... Cat. II2GD / Cat. II3GD without electr. internals Id. No. 702271##00

- Supply without installation accessories (screw bolts, flange seal and cabling)

Special certificates (supplied to order only)

- Record on setting at factory
- Test certificate to EN 10204:
- Pressure test, paint penetration test, irradiation test, leak test, ultrasonic test, helium leakage test,
- Cleaning pursuant to works regulations
- Calibration certificate

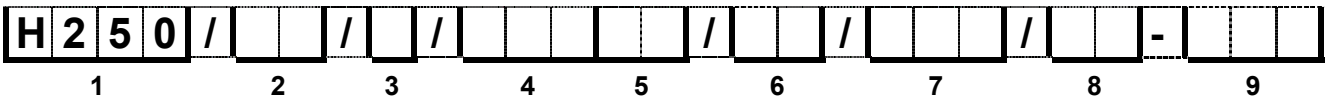
Note!
Connections which can be removed easily, such as threaded connections, screw-on reducers, clamp connections, are not permitted in case of flammable or readily flammable media.

Table of Contents

1 General

1.1 Description code

The description code consists of the following elements: *)



1 : Series measuring unit H 250

2 : Material of the parts coming into contact with the medium
- **RR** : Stainless steel
- **C** : PTFE liner, with ceramic float
- **HC** : Hastelloy
- **Ti** : Titanium
- **F** : Sterile design (food)

3 : Heating jacket design
- **B** : With heating jacket

4 : Display part series
- **M9** : Standard indicator
- **M9S** : with added corrosion prevention
- **M9R** : Stainless steel housing
- **M10** : Indicator M10
- **M8** : Indicator M8

5 : Indicator version of M8
- **MG** : Mechanical indicator
- **EG** : Electronical Indicator with linear output 4 ... 20 mA

6 : High-temperature design
- **HT** : Design with HT extension

7 : Electrical signal output
- **ESK** : ESK II with analog signal output 4 mA to 20 mA or ESK3-PA Field bus output PROFIBUS PA

8 : Limit switch
- **K1** : One limit switch
- **K2** : Two limit switches

9 : Explosion protection
- **EEx** : Explosion protected device to European Standard

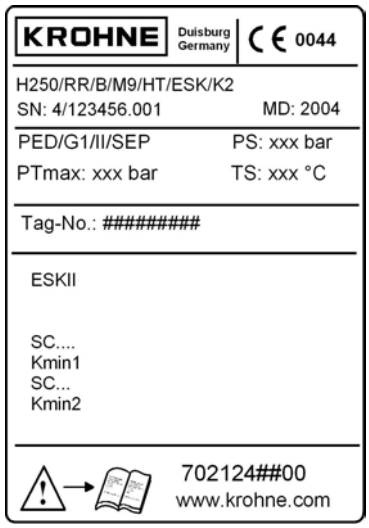
*) Positions which are not used in the description code are not required.

1.2 Marking

The type marking of the complete instrument is carried out at the display part by means of the rating plates shown here (also refer to the description code).

MD:	Year of manufacturing
PS:	Max. permissible operating pressure at max. permissible operating temperature TS
PT max:	Maximum pressure tested
TS:	Max. operating temperature
PED:	Directive for Pressure Equipment
Tag No :	Measuring point tag
0044:	Identification number of the supervising office for EC Directive for Pressure Equipment 97/23/EC
SN:	Serial number
SO:	Sales order / item
KO:	KROHNE order
V251…:	Product configurator code
AC:	Article code

Example:



1.3 Key for Pressure Equipment Directive

PED	/			/		/	
1		2	3		4		5

1 **P**ressure **E**quipment **D**irective

2 **Fluid**

G Gases, liquefied gases, gases dissolved under pressure, vapors and those liquids whose vapor pressure lies **more than 0.5 bars** over the normal atmospheric pressure (1013 mbars) at the maximum permissible temperature

L Liquids whose vapor pressure lies a **maximum of 0.5 bars** above the atmospheric pressure at the maximum permissible temperature

3 **Fluid group**

1 Group 1: Explosion-hazardous, highly flammable, readily flammable, flammable (when the maximum permissible temperature lies above the flash point), highly toxic, toxic, fire stimulating

2 Group 2: All the fluids not specified in Group 1

4 **Category**

3.3 In accordance with Article 3.3 of Directive 97/23/EC
I Category I to 97/23/EC
II Category II to 97/23/EC
III Category III to 97/23/EC

5 **Conformity evaluation process**

SEP Solid engineering practice
A Module A internal process inspection
A1 Module A1 internal process inspection with supervision of the acceptance
H Module H Comprehensive quality assurance

The PED key marking is contained on the rating plate of the instrument.

1.4 Functional principle

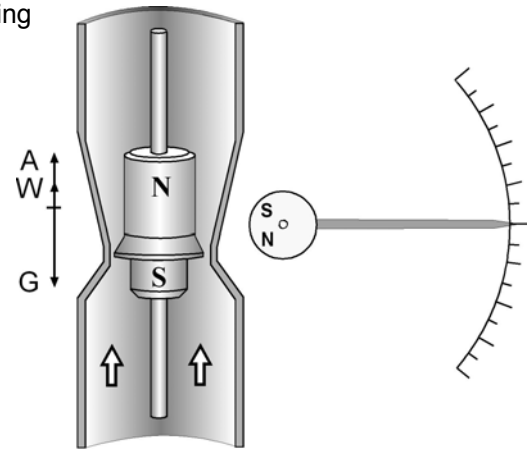
The flowmeter operates in accordance with the float measuring principle.

A metal cone or a ring orifice is installed in the measuring unit H 250, in which a suitably formed float can move freely up and down.

The flowmeter is inserted into a vertical pipeline and the medium flows through it from bottom to top.

The guided float adjusts itself so that the buoyancy force A acting on it, the wave resistance W and its weight G are in equilibrium (G = A + W).

An annular gap which depends on the flow rate results. The height of the float in the measuring unit, which depends on the flow, is transmitted by a magnetic coupling and displayed on a scale.



Strong magnetic fields can lead to deviations in the measured value. The installation of several instruments in immediate vicinity to each other does not cause notable influences.

2 Installation and Start-up

2.1 Prerequisite for the installation

The operating pressure of the plant may not exceed the value indicated on the rating plate.

Ensure that the parts coming into contact with the medium are compatible with the material. (For the list of the materials please refer to the chapter on the materials of the instrument designs.)

The ambient and medium temperatures may not exceed certain maximum values.

The variable area flowmeter has to be installed vertically (float measuring principle - flow direction from bottom to top).

In order to prevent distortions the connecting flanges have to face each other axially and in parallel.

2.2 Preparation of the pipeline

The pipeline is to be supported by suitable installation measures so that vibrations at the pipeline are prevented and axial stresses on the instrument are minimized.

A straight unimpeded inflow section of ≥ 5 x DN before the instrument and a straight outflow section of ≥ 3 x DN behind the instrument are recommended.

Shutoff and control devices are to be positioned in the flow direction behind the measuring unit. For installation recommendations please also refer to the Directive VDE/VDI 3513, Sheet 3.

2.3 Installation in the pipeline

The instrument may not be subjected to tensile or compressive stresses through the pipelines.

Immediately before carrying out the installation check whether the instrument is free of foreign particles.

Screws, bolts and seals (provided by customer) are to be selected in accordance with the pressure stage of the connecting flange or the operating pressure.

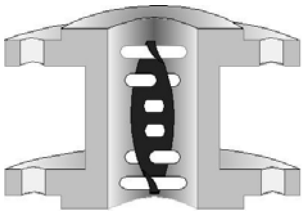
The inside diameter of the flange deviates from the standard dimensions.
Flange seal standard DIN 2690 (ASME B16.21) can be applied without any limitation.

Align the seals. Tighten the nuts with the tightening torques of the corresponding pressure stage.

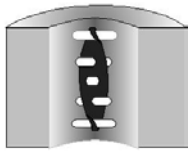
2.4 Magnetic filters

Magnetic filters are used when the medium contains particles which can be influenced magnetically. The magnetic filter is to be installed in the flow direction before the flowmeter. Magnetic bars are positioned helically in the filter so that an optimal efficiency at a low pressure loss is achieved. All the magnets are coated individually with PTFE to protect against corrosion. Two models are available:

Type F
Fitting part with flange
Overall length 100 mm (3.94")



Type FS
Fitting part without flange
Overall length 50 mm (1.97")



Materials 1.4571 (316 Ti)

2.5 Fastening torque

The flange bolts are to be tightened with the following maximum torques in case of measuring units with PTFE liner or of measuring units with ceramic lining and PTFE sealing surface:

Nominal size to				Bolts			Max. tightening torque			
EN 1092 - 1		ASME B 16.5		EN 1092 - 1	ASME		EN 1092 - 1		ASME 150 lbs	
DN	PN	Inch	lbs		150 lbs	300 lbs	Nm	ft·lbf	Nm	ft·lbf
15	40	½"	150/300	4 x M 12	4 x ½"	4 x ½"	9.8	7.1	5.2	3.8
25	40	1"	150/300	4 x M 12	4 x ½"	4 x $^{5}/_{8}$"	21	15	10	7.2
50	40	2"	150/300	4 x M 16	4 x $^{5}/_{8}$"	8 x $^{5}/_{8}$"	57	41	41	30
80	16	3"	150/300	8 x M 16	4 x $^{5}/_{8}$"	8 x ¾"	47	34	70	51
100	16	4"	150/300	8 x M 16	8 x $^{5}/_{8}$"	8 x ¾"	67	48	50	36

2.6 Observance of the IP degree (NEMA Type) of protection

The following instructions are to be observed in order to observe the IP degree (Nema Type) of electrical built-in parts:

- After the connecting cable has been introduced, tighten the outlet nut.
- All the cable glands which are not used remain closed with blanking plugs.
- Do not kink lines directly at the cable gland.
- Provide a drain bend
- The feed lines may not be subjected to mechanical strains. Refer to the description of the electrical supplementary components for this device.

Cable glands / screwed glands:

Thread	Material	Line diameter	Degree of protection*	Remark
M 16x1.5	PA	5 - 10 mm	IP 68 - 5 bars	Standard
M 20x1.5	PA	8 - 13 mm	IP 68 - 5 bars	
M 16x1.5	Nickel-plated brass	5 - 9 mm	IP 68 - 5 bars	
M 20x1,5	Nickel-plated brass	10 - 14 mm	IP 68 - 10 bar	

* Degree of protection is limited here to the cable screwed gland

2.7 Start-up

A minimum operating pressure (pre-pressure) is required to operate the instrument.

Medium	Pressure loss : Operating pressure
Liquids	1 : 2
Gases (without damping)	1 : 5
Gases (with damping)	1 : 2

For the pressure losses please refer to the flow tables

2.8 Measurement of liquids

Vent the pipeline during starting-up in order to avoid liquid beats.

Open valves slowly!

2.9 Measurement of gases

Pulsations of the medium are to be kept away from the instrument.

In case of gases increase the operating pressure slowly.

The flow is to be varied by means of adjusting valves so that the float is not subjected to blows (e.g. through solenoid valves) thus ensuring that damage to the measuring unit cannot occur.

Instruments for measuring the flow rate of gases can be equipped with a gas damping in order to avoid possible compression vibrations of the float.

If vibrations nevertheless occur at the float, these can be eliminated by installing a throttle valve or a suitable aperture hole (on request) behind the instrument.

A float damping is recommended for gas measurement.

2.10 Float damping

Float damping is recommended:

- Generally when CIV and DIV floats are used for gas measurement
- For TIV floats (only for H250/RR and H250/HC) with an operating pressure (pre-pressure):

Nominal size to		Max. operating pressure
EN 1092 - 1	ASME B 16.5	
DN mm	Inch	bar
15	½	$\leq$ 0.3
25	1	$\leq$ 0.3
50	2	$\leq$ 0.2
80	3	$\leq$ 0.2
100	4	on request

The damping is characterized by high endurance and self-centering.
Depending on the medium and the application, the sleeve consists of high-tech ceramics (Al_2O_3), PEEK or stainless steel.

A float damping can also be retrofitted to the measuring unit H250 at the user (refer to the Service section).

3 Flow tables

General

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

The conversion to other media or operating data (pressure, temperature, density, viscosity) is carried out by means of the KROHNE calculation procedure KroVaCal on the basis of the VDE /VDI Guideline 3513. The specified flow values amount to 100% values of the measuring range.

The turn-down range amounts to 10 : 1

The specified pressure losses apply for water and air at the maximum flow rate.

3.1 H 250/RR, H 250/HC (Hastelloy C4)

Float material CrNi steel, Hastelloy C4
Float form Water: CIV, DIV
Air: TIV, DIV

Nominal size		**Cone No.**	**Water** l/h		**Air** m^3/h		**Max. pressure loss** mbar		
EN	**ASME**								
DN	Inch		CIV	DIV	TIV *	DIV	CIV	TIV	DIV
15	1/2"	K 15.1	25	-	0.7	-	26	21	-
		K 15.2	40	-	1.0	-	26	21	-
		K 15.3	63	-	1.5	-	26	21	-
		K 15.4	100	-	2.2	-	26	21	-
		K 15.5	160	-	3.6	-	26	21	-
		K 15.6	250	-	5.5	-	26	21	-
		K 15.7	400	-	10	18	28	21	38
		K 15.8	630	1000	14	28	32	22	50
25	1"	K 25.1	630	-	14	-	32	24	-
		K 25.2	1000	-	22	-	33	24	-
		K 25.3	1600	-	35	-	34	25	-
		K 25.4	2500	-	50	110	38	26	78
		K 25.5	4000	6300	80	170	45	30	103**
50	2"	K 55.1	6300	-	80	230	74	13	60
		K 55.2	10000	-	110	350	77	13	69
		K 55.3	16000	25000	150	600	84	13	104
80	3"	K 85.1	25000	-	350	-	68	16	-
		K 85.2	40000	-	400	-	89	16	-
100	4"	K105.1	63000	100000		-	120	-	220

* Not for instruments with heating
* * 300 mbar with damping (gas measurement)

3.2 H 250/C ceramics

Float material PTFE, ceramics
Float form Type E

Nominal size		Float Number	**Water** [l/h]		**Air** [m^3/h]	**Max. pressure loss** [mbar]			**Ring orifice** Diameter mm
EN	ASME					Water		Air	
DN	Inch		PTFE	Ceramics	Ceramics	PTFE	Ceramics	Ceramics	
15	½"	E 17.2	25	30	-	65	62	62	12
		E 17.3	40	50	1.8	66	64	64	
		E 17.4	63	70	2.4	66	66	66	
		E 17.5	100	130	4.0	68	68	68	
		E 17.6	160	200	6.5	72	70	70	
		E 17.7	250	250	9.0	86	72	72	
		E 17.8	400	-	-	111	-	-	
25	1"	E 27.1	630	500	18	70	55	55	25.6
		E 27.2	1000	700	22	80	60	60	
		E 27.3	1600	1100	30	108	70	70	
		E 27.4	2500	1600	50	158	82	82	
		E 27.5	-	2500	75	-	100	100	
50	2"	E 57.1	4000	4500	140	81	70	70	46.4
		E 57.2	6300	6300	200	110	80	80	
		E 57.3	10000	11000	350	170	110	110	
80	3"	E 87.1	16000	16000	-	81	70	-	72
		E 87.2	25000	25000	-	95	85	-	
100	4"	E 107.1	40000	-	-	100	-	-	84

4 Materials

Design H 250	**Materials** [1]				
	Measuring tube	**Flange / sealing strip**	**Float**	**Stop / Guide**	**Ring orifice**
H 250 / RR	CrNi steel 1.4404 *	CrNi steel 1.4404 * solid	CrNi steel 1.4404*	CrNi steel 1.4404*	-
H 250 / HC	Hastelloy C4 (2.4610)	CrNi steel 1.4571* with Hastelloy C4 (2.4610) clad	Hastelloy C4 (2.4610)	Hastelloy C4 (2.4610)	-
H 250 / C	CrNi steel 1.4571 with lining made of PTFE **	CrNi steel 1.4571 with lining made of PTFE **	HC4, PTFE or Al_2O_3 with seal: Kalrez KLR 6375***	Al_2O_3 or PTFE	Al_2O_3
H 250 / F [2]	CrNi steel 1.4435	CrNi steel 1.4435	CrNi steel 1.4435	CrNi steel 1.4435	-

Note: PTFE lining is electrically non-conductive.

Available on request:
* CrNi steel 1.4571; at clamp connections CrNi steel 1.4435
** PTFE-TFM
*** Sealing ring 2035 (Kalrez) or 4079

1) Special material on request: e.g. SMO 254, Titanium, 1.4435
2) Surfaces coming into contact with medium Ra = 0.8 µm

Float damping Liquids: Hastelloy
Gases: Ceramics or Hastelloy
Oxygen PEEK

Seal at female thread O-Ring FPM / FKM (e.g. Viton)

5 Technical Data of measuring unit

Accuracy class to VDI/VDE Directive 3513, Sheet 2 H250 / RR H250 / HC H250 / F H 250 / C (ceramics, PTFE)		1.6 2.5	
Connections H 250 Flange (H250 / RR /HC /C)	Connection dimensions to	EN-1092-1 ASME B 16.5 JIS B 2238	DN15-100, PN16-100 1/2" - 4", 150 - 600 lbs LR 15-100, 10K-20K
Clamp connections (H 250 /RR /F)	Connection dimensions to	DIN 32676 ISO 2852	DN15 - 100, 10-16 bars Size 25-139.7 10-16 bars
Screw connections (H 250 /RR /HC /F)	Connection dimensions to	DIN 11851 SMS1146	DN15 - 100, 25-40 bars 1"- 4", 6 bars
Female thread welded (RR, HC)	Connection dimensions to	ISO 228 ASME B1.20.1	G3/4" -, G1" PN 50 3/4" NPT
Female thread screwed (RR, HC) (with insert and outlet nut)	Connection dimensions to PN 40 - 50	ISO 228 ASME B 1.20.1	G1/2" - 1", 1/2" - 1" NPT,
Sterile screw connection (H 250 /F) Sterile flange (H 250 /F)	Connection dimensions to Connection dimensions to	DIN 11864 - 1 DIN 11864 -2	DN 15 - 50 : PN 40 DN 80 - 100 : PN 16 DN 15 - 50 : PN 40 DN 80 - 100 : PN 16
Connection for heating (H 250 /RR /HC)			
	Flange connection Pipe connection for Ermeto	EN1092-1 ASME B 16.5	DN 15; PN 40 1/2"; 150 lbs / RF E12, PN 40
Higher pressure stages and other connection designs on request			
Measuring tube	H 250 / RR H250/HC (Hastelloy C4) H 250 / C (ceramics / PTFE)	Metal tube with conic measuring section Metal tube with conic measuring section Measuring tube with ring orifice	
Float forms	H250/RR, H250/HC (Hastelloy C4) H250/C (ceramics, PFTE):	Liquids Gases Liquids, Gases	CIV, DIV (damping possible) TIV, DIV DIVT (damping possible) conic, Type E
Overall height With flange connection (without seals) With special connections		250 mm (9.85") 300 mm (H 250 /RR) (11.8")	
Operating pressure PS (Pressure Specified)	Directive 97/23/ EC of the Council of April 29, 1999 on mobile pressurized equipment (Directive for Pressure Equipment) is applied. The maximum permissible operating pressure PS is calculated for the maximum operating temperature TS. Both limits (PS and TS) are listed on the rating plate. As a rule PS corresponds to the nominal pressure of the connection.		

Pressure Tested PT
The pressure tested is calculated in accordance with the Directive for Pressure Equipment (97/23/EC) or AD 2000-HP30 under consideration of the maximum permissible operating pressure as well as the maximum operating temperature.

Degree of protection of the display M9 in accordance with EN 60529 / IEC 60529 IP 67, NEMA 4X

6 Medium Temperatures

6.1 Maximum temperature of medium TS

H250 / .. / M9 (without electrical built-in components) (TS = Temperature Specified)

Design	Material	Max. temperature of medium TS [°C]	at Ambient Temperature $T_{amb.}$ [°C]
H250 / RR	Stainless steel	300	≤ 120
H250 / HC	Hastelloy C4	300	≤ 120

	Float	Lining		
H250 / C	PTFE	PTFE	70	≤ 70
H250 / C	Ceramics	PTFE	150	≤ 70
H250 / C	Ceramics	TFM	250	≤ 120

Minimum temperature of medium **TS** = - 80°C
Ambient temperature $\mathbf{T_{amb.}}$ = - 40°C to + 90°C (Standard version)
$\mathbf{T_{amb.}}$ = - 20°C to + 90°C (Female thread screwed version)

Other temperatures on request

6.2 M9 with electrical built-in components

Max. medium temperatures TS against ambient temperatures $T_{amb.}$

Without heating jacket		With heating jacket			$T_{amb.}$ <40°C		$T_{amb.}$ < 60°C			
EN	ASME	EN	ASME		TS °C		TS °C (1)		TS °C (2)	
				Design	Standard	**HT**	Standard	**HT**	Standard	**HT**
DN15	1/2"	DN15	½"	ESK II, ESK-S, ESK3-PA	200	300	180	300	150	235
DN25	1"			ESK II with counter	200	200	80	130	80	130
				Limit switch SC.. SJ..	200	300	200	300	150	235
				Limit switch SB..	200	300	130	295	130	235
DN 50	2“	DN 25	1“	ESK II, ESK-S, ESK3-PA	200	300	165	300	125	170
				ESK II with counter	180	300	75	100	75	100
				Limit switch SC.. SJ..	200	300	200	300	125	170
				Limit switch SB..	200	300	120	195	120	170
DN 80	3“	DN 50	2“	ESK II, ESK-S, ESK3-PA	200	300	150	250	105	145
DN 100	4"	DN 80	3"	ESK II with counter	150	270	70	85	70	85
				Limit switch SC.. SJ..	200	300	200	300	105	145
				Limit switch SB..	190	300	110	160	105	145

(1) A heat-resistant cable is required if no heat insulation measures are implemented
(continuous operating temperature of the wire: 100°C)
(2) No heat-resistant cable required

Short term:

HT	- High Temperature version
ESK II	- current output transmitter in 2-wire technology 4 … 20 mA
ESK-S	- current output transmitter in 3-wire technology 0 … 20 mA
ESK3-PA	- PROFIBUS-transmitter
SC	- limit switch type NAMUR
SJ	- limit switch type NAMUR safety-oriented
SB	- limit switch type 3-wire technology, open collector

7 Dimensions and weights

7.1 H 250/RR, H 250/Hastelloy C4

Flange connections for the measuring unit
EN 1092 - 1 (=BS 4504) DN15, DN25, DN50 PN40
DN80, DN100 PN16
ASME B 16.5 1/2" to 4" 150lbs/RF or 300lbs/RF

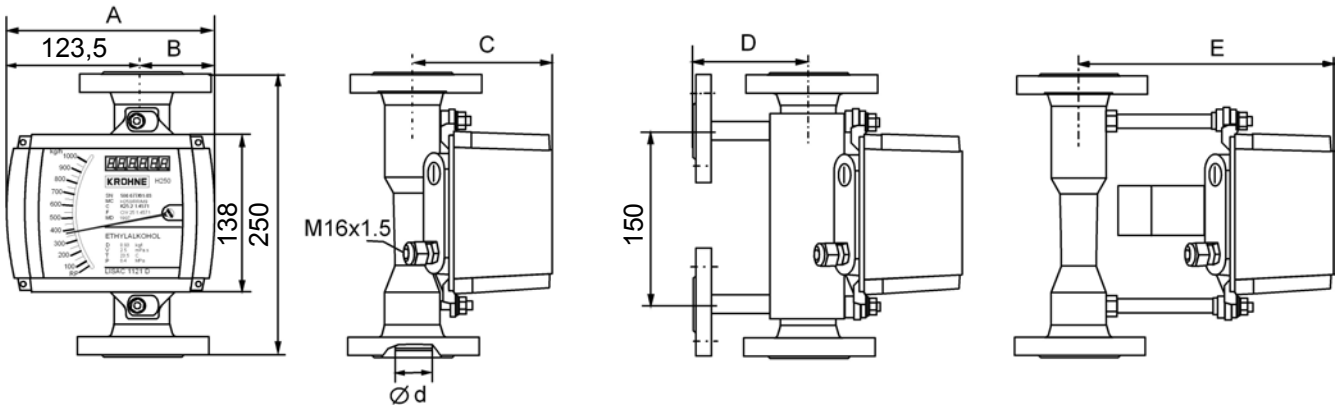
Connections for the heating jacket
Flange to EN 1092 - 1 (=BS4504) DN15, DN25 PN 40
Flange to ASME B 16.5 1/2", 1" 50lbs/RF
Pipe for Ermeto 12

Standard design

Nominal widths		**Dimensions in mm**						**Approx. weight *** [kg]	
DN	PN	A	B	C	D	E	∅ d	EN flanges	with heating
15	40	70,5	194	107	100	187	20	3.5	4.8
25	40	70,5	194	119	106	199	32	5.0	6.7
50	40	57,5	181	132	120	212	65	8.2	10.4
80	16	57,5	181	148	160	228	89	12.2	14.0
100	16	57,5	181	158	150	232	114	14.0	16.6

* At heating with flange connection DN 25 plus 0.75 kg
At heating with Ermeto 12 connection minus 0.9 kg

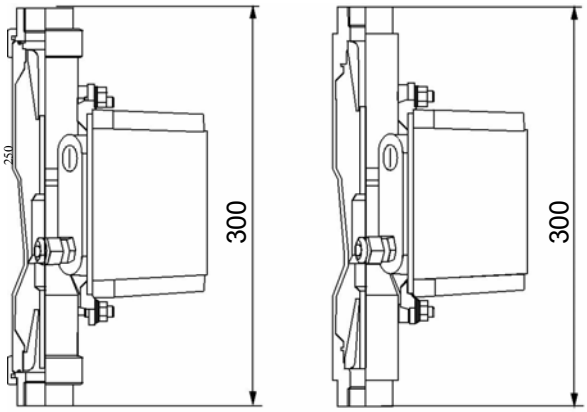
H 250 with flange connections **Measuring unit with heating** **High-temperature design ***



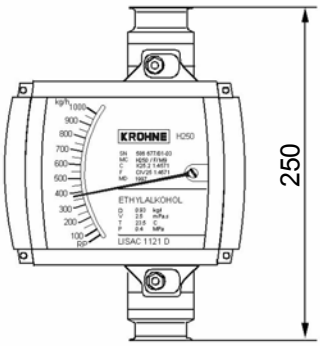
* The high-temperature version (HT version) is to be preferred at measuring tube insulation measures.

7.2 H250 with screw connection, H250 /F

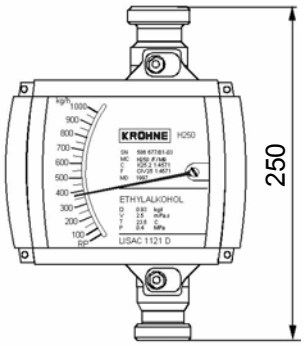
H250 with Female thread Iso 228
screwed welded



H 250 / F
Food with
clamp connection



H 250 / F
screw connection
DIN 11864-1



Stainless steel 1.4435
EHEDG approved
Surfaces coming into contact
with medium Ra = 0.8 µm

Weights H 250 with screw connection to DIN 11864-1

Flow nominal size		**Operating pressure**		**Approx. weight in**	
DN mm	Inch	Bar	psig	kg	lbs
15	½”	40	580	2.0	4.4
25	**1”**	40	580	3.5	7.7
50	2”	25	363	5.0	11.0
80	3”	25	363	7.6	16.8
100	4”	25	363	10.3	22.7

7.3 Weights H250/C (ceramics / PFTE)

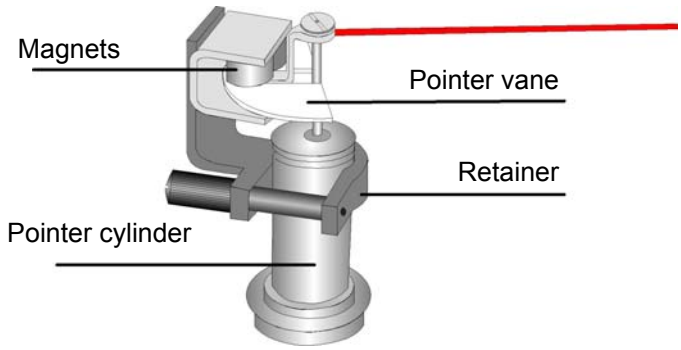
Nominal size to				**Approx. weights**					
EN 1092 - 1		ASME B 16.5		EN 1092 - 1		ASME B 16.5			
						150 lbs		300 lbs	
DN	PN	Inch	lbs	kg	lbs	kg	lbs	kg	lbs
15	40	½”	150/300	3.5	7.7	3.2	7.0	3.5	7.7
25	40	1”	150/300	5	11.0	5.2	11.5	6.8	15.0
50	40	2”	150/300	10	22.1	10	22.1	11	24.3
80	16	3”	150/300	13	28.7	13	28.7	15	33.0
100 *	16	4”	150/300	15	33.1	16	35.3	17	37.5

* only PTFE

Overall height from 3" / 300 lbs : 300 mm
Dimensions refer to standard design

8 Display M9

8.1 Eddy-current brake



In principle the pointer system with its four-pole magnetic system contains a pointer damping. In case of fluctuating or pulsating flows an additional eddy-current brake is advantageous.

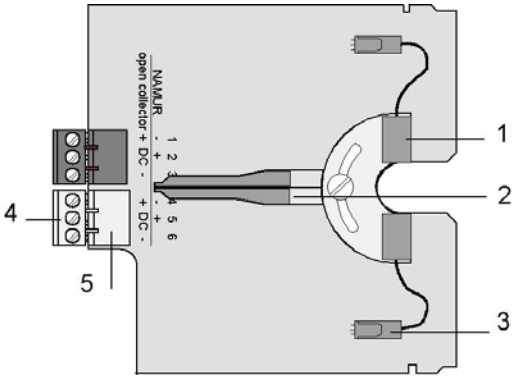
The magnets of the eddy-current brake enclose the pointer vane non-contacting and dampen its movement.

This leads to a clearly steadier pointer position without distorting the measured value.
A clamping bolt ensures a secure fit.
This eddy-current brake can be installed subsequently without recalibration during operation (refer to the Service section).

8.2 Contact inserts

The variable area flowmeter H250 /M9 can be equipped with a maximum of two electronic limit switches.

The limit switch functions with a slot-type initiator which is operated inductively through the semicircular metal vane belonging to the measuring pointer. The switching points are set through the contact pointer. The setting of the contact pointer serves at the same time for the optical display of the set limit.



Contact types:

SC3,5-N0-Y	2-wire technology (NAMUR)
SJ3,5-SN	2-wire technology safety-oriented
SJ3,5-S1N	2-wire technology safety-oriented (inverted)
SB 3.5-E2	3-wire technology

1 Limit switch
2 Contact pointer
3 Connecting plug
4 Connecting terminal
5 Terminal socket

8.2.1 Electrical connection

The housing cover of the M9 display has to be removed in order to connect the contact insert. The connecting terminals (4) have a pluggable design and can be removed in order to connect the lines. The built-in contact types are listed in the rating plate of the display.

Electrical connection of the limit switches in 2-wire technology

Connection assignment for
SC3,5-N0-Y
SJ3,5-SN
SJ3,5-S1N

Contact	MIN			MAX		
Connector color	black			gray		
Labeling	1	2	3	4	5	6
2-wire technology	-	+		-	+	

Electrical connection of the limit switches in 3-wire technology

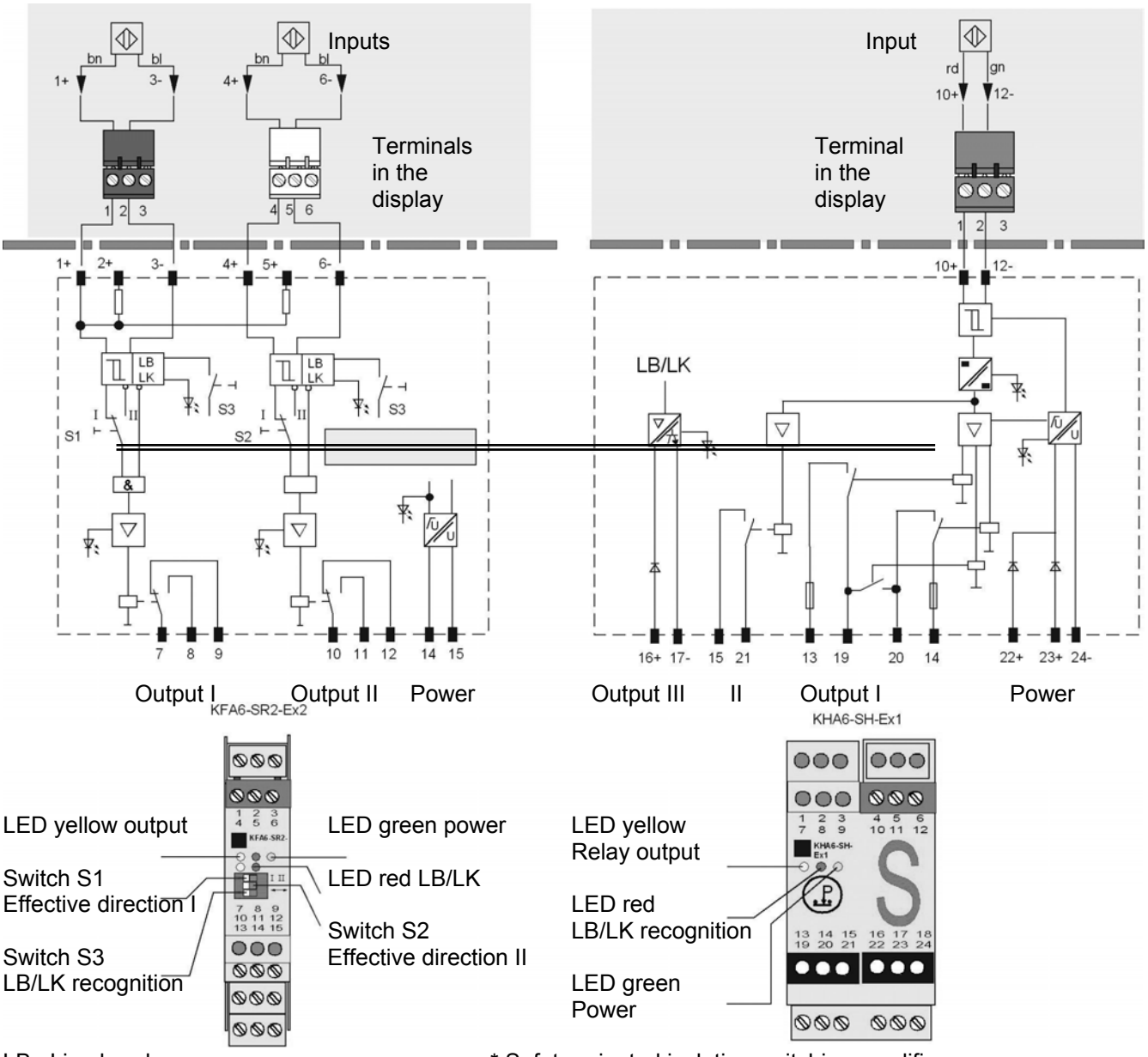
Connection assignment for
SB3,5-E2

Contact	MIN			MAX		
Connector color	black			gray		
Labeling	1	2	3	4	5	6
3-wire technology	+	DC	-	+	DC	-

Connection diagram 2-wire technology

NAMUR
SC3,5-N0-Y

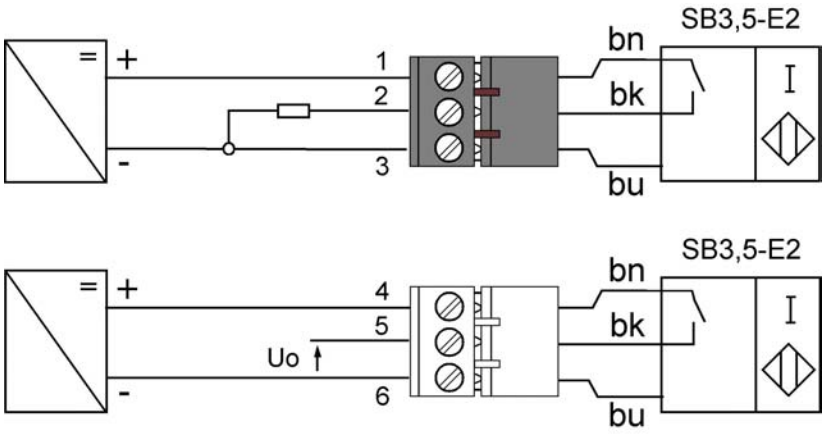
Safety-oriented *
SJ3,5-SN and SJ3,5-S1N



LB : Line break
LK : Line short-circuit

* Safety-oriented isolating switching amplifiers are only single-channel!

Connection diagram 3-wire technology

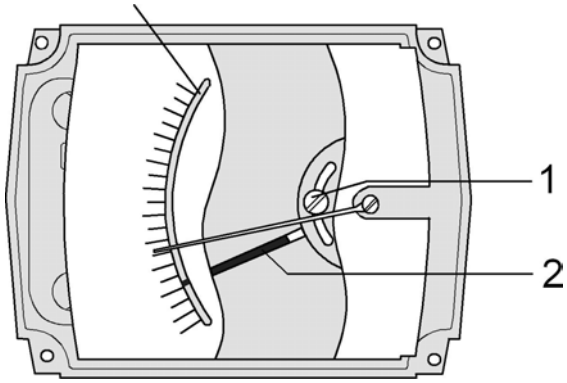


8.2.2 Limit setting

The setting is carried out directly via the contact pointer (2):

- Slide the scale away
- Loosen the locking screw (1) slightly
- Slide the scale back to the latching point
- Set the contact pointer (2) to the desired switching point
- After setting, the contact pointer (2) is to be fastened hand-screwed again with the locking screw (1) (max. 40 Ncm).
- Screw on the housing cover.

Scale opening



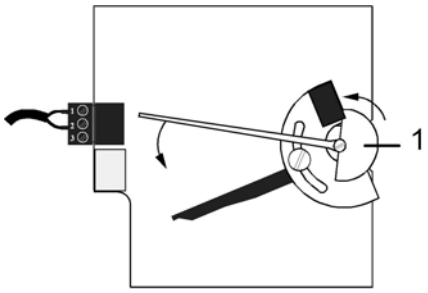
8.2.3 Switch contact definition

MIN contact

If the pointer vane (1) enters the slot, an alarm is triggered. If the pointer vane lies outside the slot initiator, a wire break also causes the alarm to be triggered.

No wire break recognition at SB3,5-E2

Option: Implementation as a maximum contact
In the alarm status the vane lies outside the slot.
Wire break recognition is not available here.

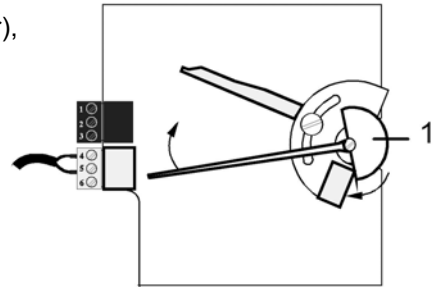


MAX contact

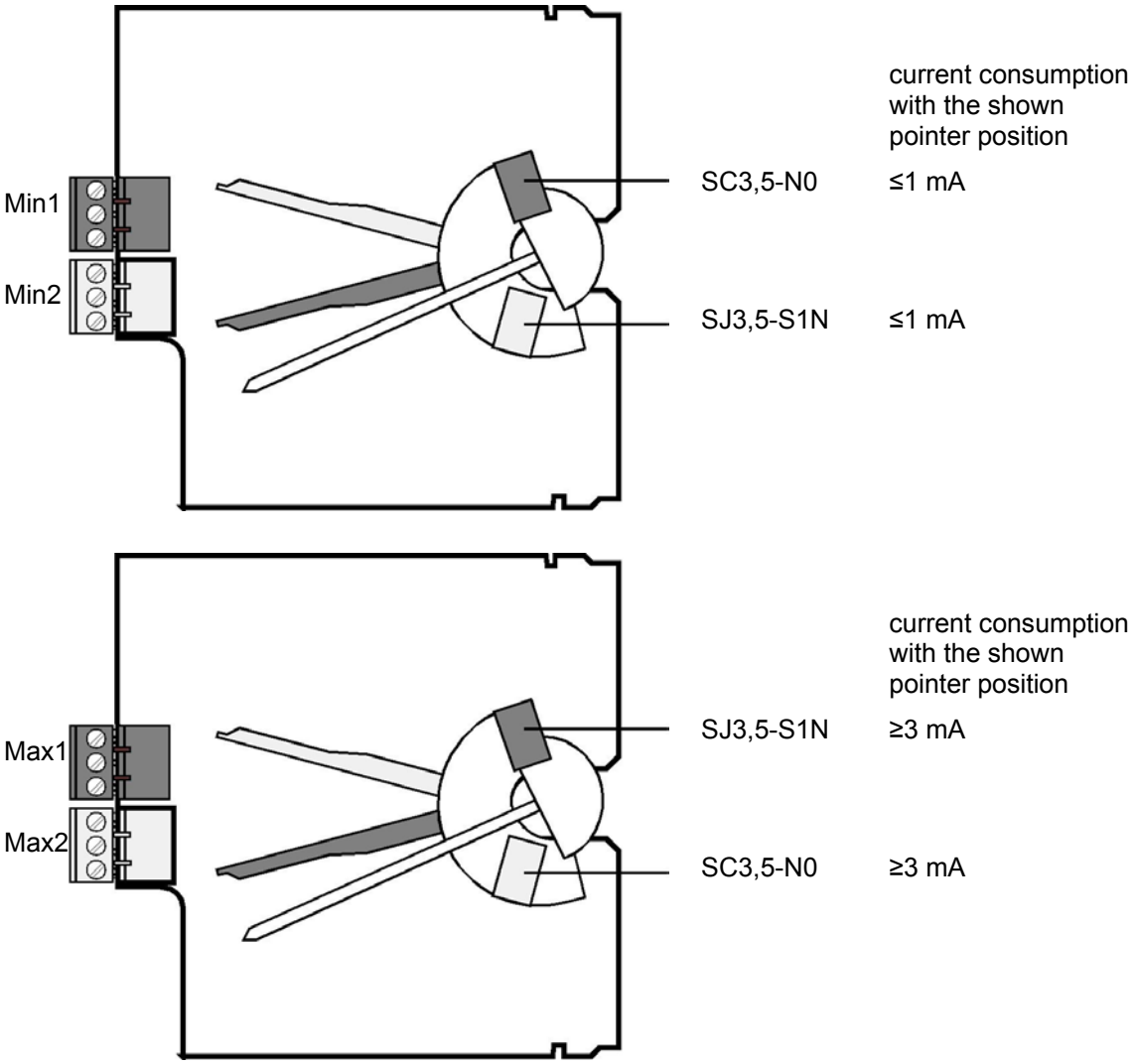
If the pointer vane (1) enters the slot (and thus dampens this initiator), an alarm is triggered. If the pointer vane lies outside the slot initiator, a wire break also causes the alarm to be triggered.

No wire break recognition at SB3,5-E2

Option: Implementation as a minimum contact
In the alarm status the vane lies outside the slot.
Wire break recognition is not available here.



Definition of Min1 and Min2 / Max1 and Max2



8.2.4 Technical data of limit switches

	SC3,5-N0-Y	SJ3,5-SN	SJ3,5-S1N	SB3,5-E2
	2-wire	2-wire	2-wire	3-wire
	NAMUR	NAMUR	NAMUR	
Switching element function	NC contact	NC contact	NO contact	NO contact PNP
Nominal voltage U0	8 V	8V	8V	10 to 30 V
Power consumption:				
Pointer vane not detected	≥ 3 mA	≥ 3 mA	≤ 1 mA	≤ 0.3 V
Pointer vane detected	≤ 1 mA	≤ 1 mA	≥ 3 mA	Ub - 3 V
Continuous current	-	-	-	max. 100 mA
No-load current I0	-	-	-	≤ 15 mA

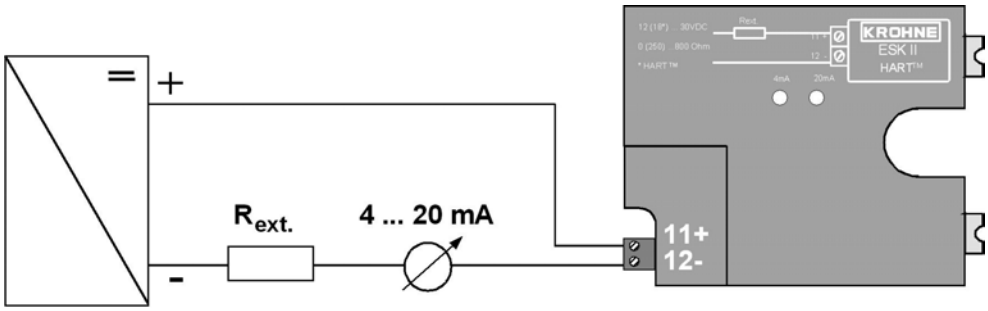
An isolating switching amplifier, e.g. Pepperl + Fuchs Series KF .. -SR2 ..., is required in order to operate the **SC3,5-N0-Y** limit switch (refer to the chapter on the spare part list).

SJ3,5-SN and **SJ3,5-S1N** limit switches safety-oriented are connected to a safety-oriented isolating switching amplifier, e.g. Pepperl + Fuchs K… –SH- ... (large S on the front)

8.3 Electrical signal output ESK II

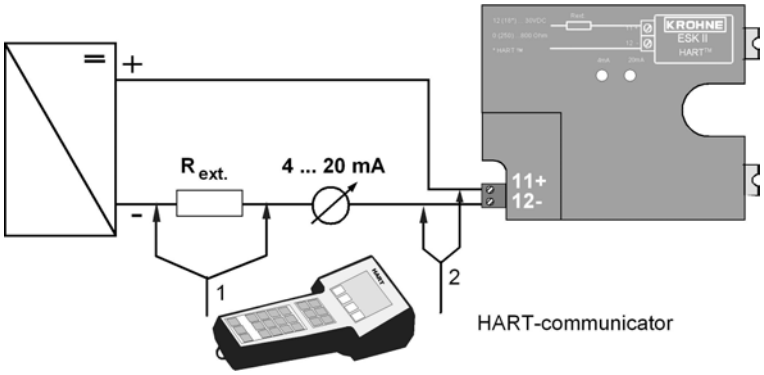
8.3.1 Electrical connection

The connecting terminals of the M9 display have a pluggable design and can be removed in order to connect the lines.



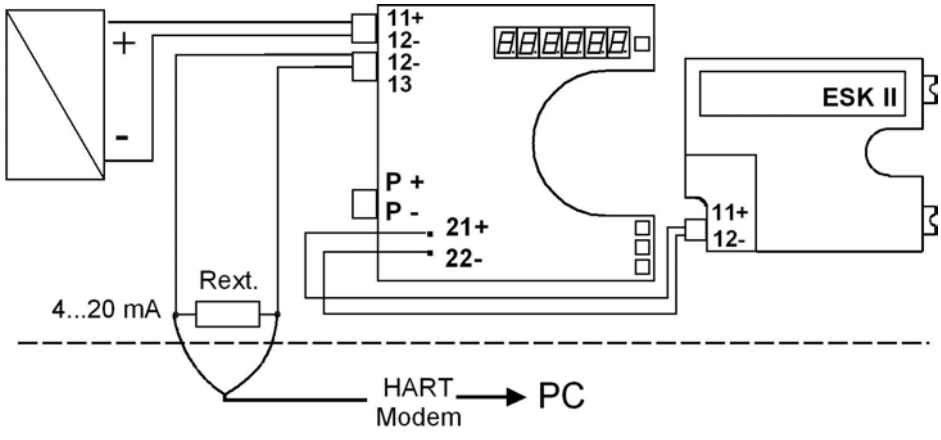
8.3..2 HART™ communication with the ESK II

HART™ communication is not compellingly required in order to operate the ESK II.
When HART™ communication is carried out with the ESK II, this does not by any means impair analog measured value transfer (4...20mA)
Exception at Multidrop operation. In Multidrop operation a maximum of 15 instruments with HART™ function can be operated in parallel, whereby their current outputs are switched inactive (approx. 4 mA).



If a HART™ communicator (type Fisher Rosemount, Model 275) or a PC with HART™ modem PC is used, the resistor which is connected in series ($R_{ext.}$) has to exceed 250 Ohms.
In this type of operation the auxiliary power must amount to at least 18 V. The communicator or the PC is connected as shown in the drawing above.
It can be operated optionally via the connecting terminals of the ESK II (2) or via an external resistance (1) connected in series. The counter cannot be read out or operated by means of HART™ communication!

If the ESK II is operated in combination with the counter, a HART™ communication is possible in accordance with the following connection diagram:



8.3.3 Technical data of ESK II

Auxiliary power	12 (18 *) to 30 V DC
Measurement signal	4.00 to 20.00 mA for 0 to 100 % flow value > 20.8 mA for alarm status
Auxiliary power influence	< 0.1%
Dependency on external resistance	< 0.1%
Temperature influence	< 5 μA / K
Max. external resistance / load	0 (250 *) to 800 Ohms

* These values are to be observed as minimum values during HART™ communication.

8.4 Electrical signal output ESK3-PA PROFIBUS

8.4.1 Bus cable

The statements of the FISCO model only apply if the bus cable used fulfills the following specifications:

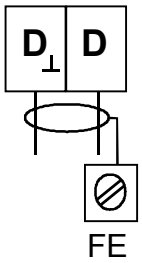
R´ = 15...150 Ohm/km
L´ = 0.4...1 mH/km
C´ = 80...200 nF/km.

8.4.2 Shielding and grounding

In order to ensure optimum electromagnetic compatibility of systems it is very important that the system components, and in particular the bus cables which connect the components, are shielded and that these shields form an electrically unbroken envelope as far as possible.

8.4.3 PROFIBUS-PA connection

For the connection of the bus cable refer to the adjacent figure. Connect the cable conductors to D and D- (polarity reversal does not have any influence). The cable shield should be connected with minimum length to the functional grounding FE.



8.4.4 Technical data of the ESK3-PA

Hardware to IEC 1158-2 and the FISCO model
Supply voltage via 2-wire bus connection: .....9 to 32 V DC
Basic current .....12 mA
Starting current .....< Basic current
FDE (fault drop electronics) .....< 18 mA
Accuracy to VDI/ VDE 3513.....1.6
Measured value resolution.....< 0.1% of upper range value
Temperature influence .....< 0.05% / K of upper range value

Software
GSD .....(device master file) is supplied on a diskette
or via Internet www.krohne.com

Device profile .....Complete implementation of Profile B, V3.0

Function blocks
Flow rate (AI0) .....Optionally for volume or mass rate of flow
Default units: Qv [m3/h]; Qm [kg/h]

Counter (TOT0).....Volume counter Default unit: [m3]
Counter (TOT1).....Mass counter Default unit: [kg]
Address range.....0-126, default 126 ("Set slave address" is supported)
SAPs .....Service_Access_Points 1

DD .....Device Description DD for PDM

Operation .....Via PROFIBUS PA (no local operation at the instrument)

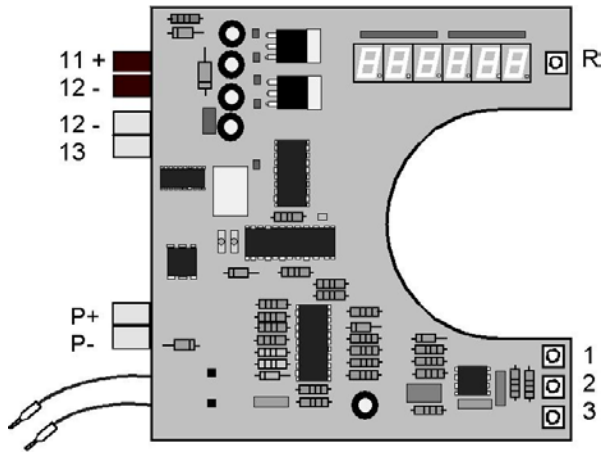
8.5 Flow counter ESK-Z

The flow counter ESK-Z in 3-wire technology can be installed in the display M9 in combination with the electrical current output ESK II.

A 6-digit display shows the counted flow value, which can be changed over to the current flow value in 0 to 100%.

Supply 11/12 and current loop 12/13 are not electrically isolated! If the current loop is not required, a short-circuit jumper has to be connected to the terminals 12/13.

An electrically isolated pulse output P+ and P- supplies a pulse at every displayed counter progress. If the pulse output is not required, its terminals can remain unused.



4...20mA from ESK II

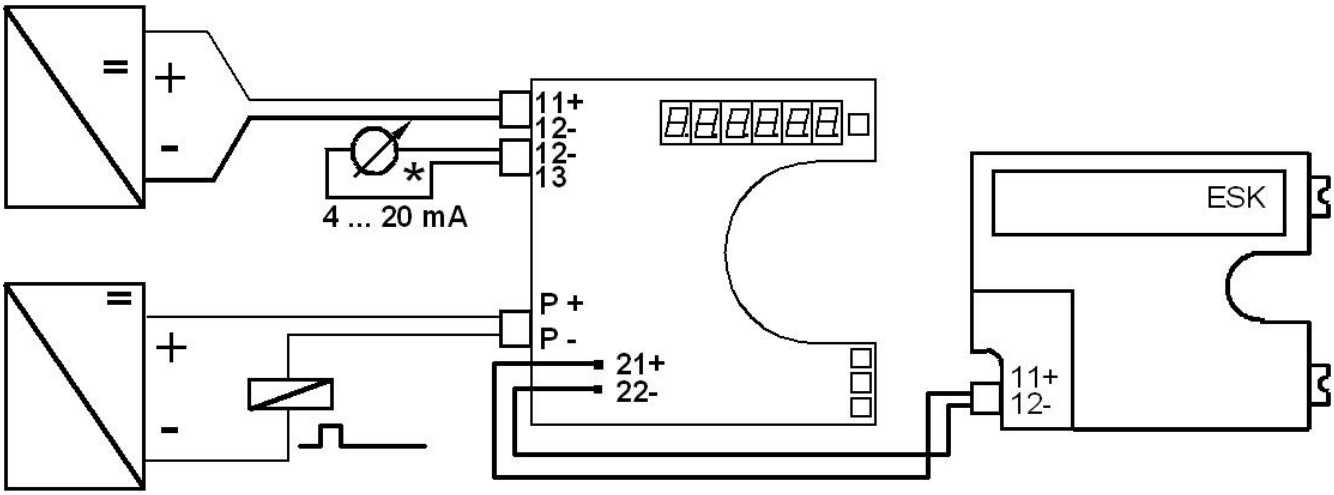
A data backup is carried out automatically at a voltage drop.

The flow counter is set in the works to the order data and does not have to be calibrated! The conversion factor of the counter is set with reference to the measuring range, if not ordered differently, so that the total value (in liters, m3, etc.) can be read directly.

	Display	Remark
Button 1	Flow rate as %	Counter continues to run in the background.
Button 2	Total value	E.g. liters or m3
Button 3	Conversion factor	Standard: 10% of Q100
Reset R	Deleting of the stored total value	

8.5.1 Electrical connection

A functional extra-low voltage with protective electrical isolation in accordance with VDE 0100 Part 410 is required as auxiliary power. All the instruments (display, recorder, etc.) connected to the measuring circuit are connected in series and may in total not exceed the maximum external resistance of 720 Ohms. The supply voltage U_S of max. 30 VDC is connected to Terminals 11+ and 12- at the counter module.



* If electrically isolated current evaluated modules (PLC) are used at Terminals 12/13, the auxiliary power (11/12) may not be grounded.
If the ESK signal is only used for the counter, a short-circuit jumper is required at Terminal 12/13.

8.5.2 Settings, display mode

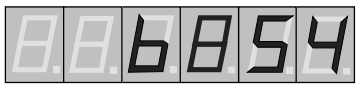
Reset Deleting of the stored total value

Button 1
Example

Flow rate as [%]

With decimal point and one decimal value

Button 2
Example



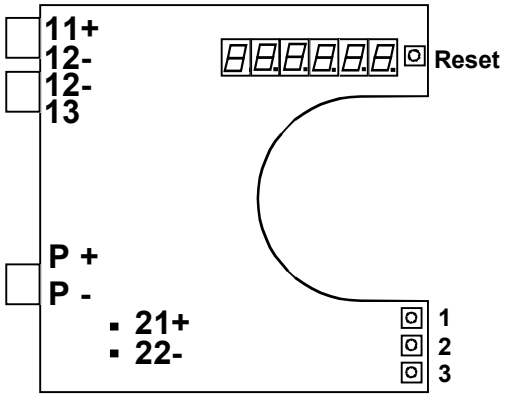
Counter

Without decimal points

Button 3
Example

Conversion factor

Lighting up of the first two decimal points



Conversion factor

The conversion factor is always set in the factory with reference to the measuring range.
Conversion factor = 10% of upper limit of effective range.
If the measuring range is not known, e.g. when a spare part is supplied, a conversion factor of 1000 is set in the works.

Changing of the conversion factor

Press **Button 2 at the moment when the supply voltage is switched on**.
Buttons 1 to 3 can be used to set a factor of 1 to 1099. Factor 0 is not defined.
Button 1: Unit
Button 2: Tens value
Button 3: Hundreds and thousands value

The input is confirmed or terminated by using the **Reset** button.

Counter contents

The counter contents are stored in case of a power failure.
An counter overflow is signaled by all the decimal points lighting up. Resetting to zero is carried out by pressing the RESET button.

Calibration

- During the switching-on process keep the RESET button pressed until three decimal points light up.
- Set 4.00 mA and then keep **Button 1** pressed until the number 0 is displayed
- Set 20.00 mA and then keep **Button 3** pressed until the number 100 is displayed

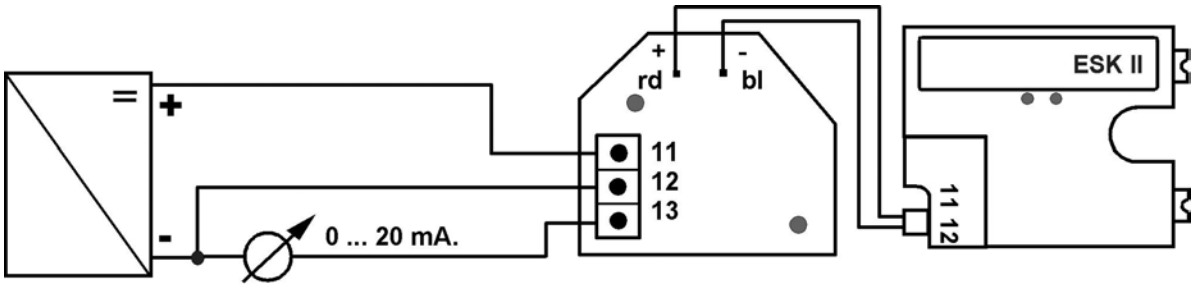
Exit the calibration by pressing **Button 2**

8.5.3 Technical data of counter ESK-Z

Auxiliary power	16 to 30 V DC
$R_{ext.}$ current loop	0 ... 600 Ohms
Power consumption	Max. 2 Watt
Max. external resistance / load	0 to 720 Ohm depending on the supply voltage
Pulse output	Terminal P+, P-
Auxiliary power	10 to 30 VDC
Max. current	50 mA
Max. power loss	250 mW
T in	Fixed pulse width 80 ms
T out	Depending on flow rate
U in	Ub – 3 Volt
U out	0 Volt
Pulse value	1 Pulse = 1 Display counter progress = 1 flow unit (1 liter, 1 m3, etc.)
Display error	< 1% of the displayed value, maximum of one display unit

8.6 Converter ESK-S

The converter ESK-S in 3-wire technology converts the power output signal of the ESK II into a power signal of 0 ... 20 mA.
The converter is mounted on the contact insert board without impairing its function. If contacts are not required, the converter is supplied on an unequipped board.



8.6.1 Technical data of the ESK-S

Auxiliary power	18 ... 30 VDC
Power consumption	Max. 70 mA
Input signal	4 ... 20 mA
Output signal	0 ... 20 mA / 0 ... 100% flow rate
$R_{ext.}$ Load	0 ... 600 Ohms
Conversion error	< 0.35% of input signal
Load influence	< 0,1%
Temperature influence	< 0,2%

9 Service

Some components of the volume area flowmeters with the display M9 can be retrofitted:
- Float damping
- Eddy-current brake
- Contact inserts
- ESK II, if the display was ordered with ESK II preparation
- Counter ESK-Z
- ESK-S (0...20 mA converter)

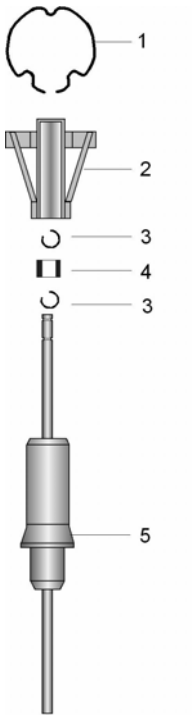
Retrofitting of the ESK3-PA can only be carried out by means of recalibration.

9.1 Replacing the float

Remove the instrument from the pipeline.
Remove the upper snap ring from the measuring unit.
Remove the upper float stop and float out of the measuring unit.
Introduce the new float into the central bore of the lower float stop and insert it together with the upper float stop into the measuring unit. Ensure that the upper float guide rod is guided through the center bore of the upper float stop.
Insert the snap ring into the measuring unit.
Next install the instrument into the pipeline again.
Note! An additional measuring error is to be expected unless recalibration is carried out.

9.2 Retrofitting of float damping

A complete retrofit kit consists of:
2 snap rings (3)
1 sleeve (4)
1 damping cylinder with float stop (2)



Installation:
Remove the instrument from the pipeline.
Remove the upper snap ring (1) from the measuring unit.
Remove the upper float stop (5) and float out of the measuring unit.
Fasten the snap ring (3) in the lower groove of the float guide rod.
Slide the ceramics sleeve (4) onto the float guide rod and fasten it in the upper groove using the snap ring (3).
Insert the float into the lower float guide in the measuring unit.
Install the included damping cylinder with the integrated float stop (2) into the measuring unit.
Insert the upper snap ring (1).
Install the instrument into the pipeline again.

9.3 Installation of the eddy-current brake

Brake

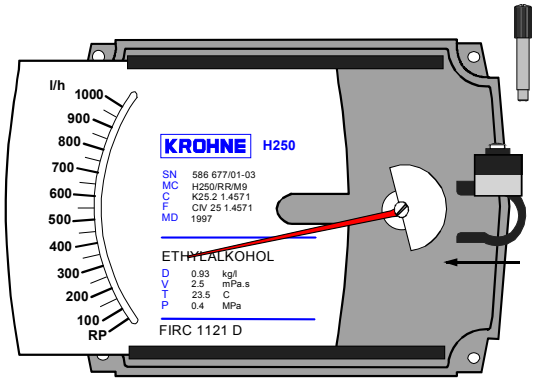
Clamping bolt

At an M9 display with ESK / current output and contact sensors take into account that pointer movements may occur briefly when the eddy-current brake is installed. These can possibly trigger a faulty alarm or can change the current output with peaks.
The eddy-current brake consists of two parts:

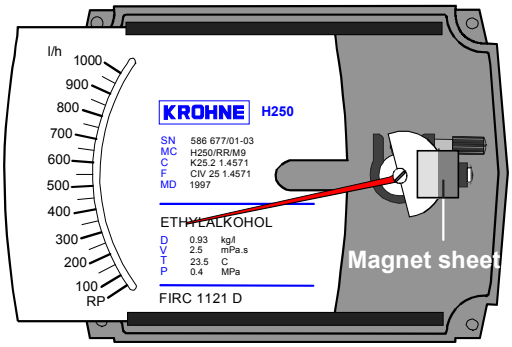
The brake with the retaining ring can be clipped onto the pointer cylinder irrespective of the built-in components such as the ESK II, contacts or counters.

When installing the brake take into account that the slot between brake magnets only amounts to approx. 3 mm and that the aluminium pointer vane is only 1 mm thick.

Check whether the pointer vane can be moved between the magnets without coming into contact.



Turn the eddy-current brake slightly clockwise and screw in the clamping bolt.
The brake is set as shown in the adjacent figure and the clamping bolt is tightened.



9.4 Contact insert

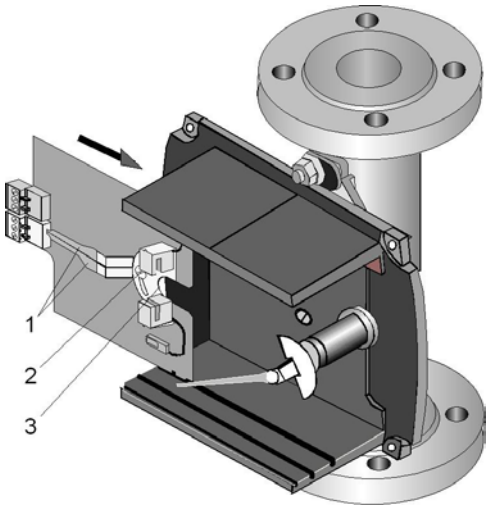
Remove the flow counter ESK-Z, if appropriate.

Bring the contact pointers (1) together in the center

Loosen the locking screw (2) of the contact pointers

Slide the contact insert into the third rail until the semicircle (3) encloses the pointer support.

The connecting terminals of the contact insert have a pluggable design and can be removed in order to connect the lines.



9.5 Electrical signal output ESK II

ESK II as a retrofit kit:

The ESK II is supplied non-linearized as a retrofit kit. It contains an EEPROM with basic data which allows an individual linearization.

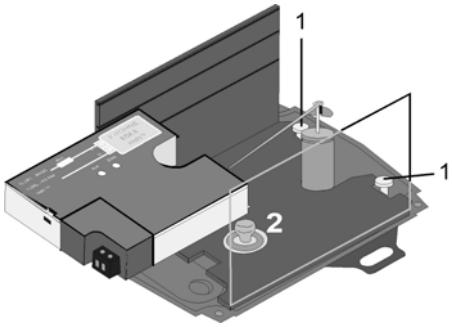
ESK II as a replacement

The ESK II is normalized in the works so that, for example, it can be replaced without having to carry out recalibration. To this purpose the EEPROM of the old ESK has to be inserted into the new one. If necessary, the zero point and 100% value can be re-adjusted.

9.5.1 Installing an ESK II

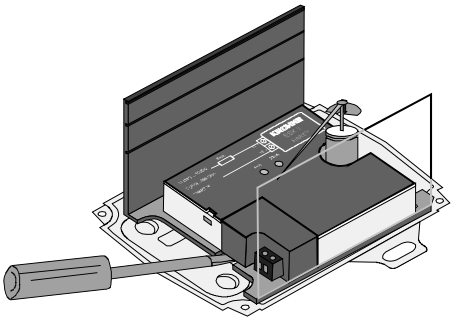
Installation is carried out with plug-in technology.

The plug-in clips of the ESK are inserted under the two bolts of the baseplate (1).
The ESK is pressed with a slight pressure on the spring bolts (2) until it latches in and the ESK II is fastened securely.

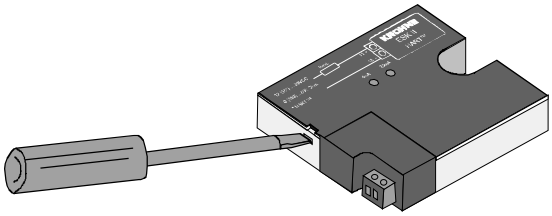


9.5.2 Replacing an ESK II

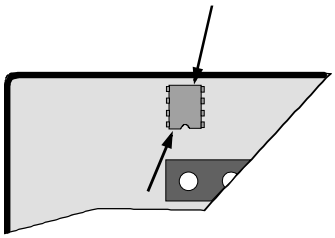
When the ESK II is replaced, a recalibration is necessary if an accuracy class is to be observed. Class 2.5 can be attained without recalibration.
The calibration data are stored in the EEPROM used.
If the measuring or material data do not change, this EEPROM can continue to be used. De-energize the ESK II.
Use a screwdriver to lever the ESK II up slightly and pull it out.



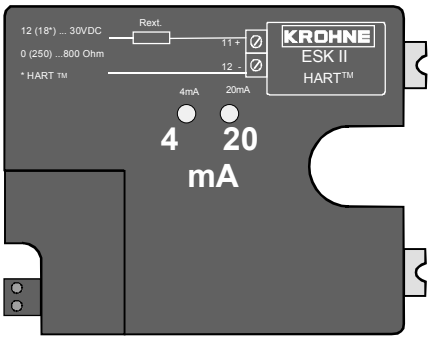
Loosen the locking device of the cover and remove it.
Lift the EEPROM from the base.



Deformation of the connecting pins can be avoided by lifting the unit at both sides which do not have connections.
The EEPROM is inserted into the replacement ESK II.
When plugging in the EEPROM ensure that it is positioned correctly (Pin 1 / notch)!
Press all eight connecting pins carefully and simultaneously into the base!
Close the cover and install the ESK II.



9.5.3 Setting the zero point and 100% value at the ESK II



The zero point and the 100% value can be set at the ESK II by means of built-in pushbuttons.

If the button behind the "4" is pressed for longer than 5 seconds, the measured value jumps to 4 mA. The ESK II is now in calibration mode for the zero point.

You can now press either the button 4 to correct downwards or the button 20 to correct upwards until the zero point amounts to exactly 4.00 mA.

The 100% value can be set by the same method if the pushbutton "20" is pressed for longer than 5 seconds.

If no button is pressed for 10 seconds, the ESK II changes over automatically to measuring operation and takes the corrections into consideration. These corrections are stored and remain valid even when the ESK II is switched off. These settings do not have any influence on the linearity of the measurement.

9.5.4 Retrofitting an ESK II and calibrating it

Retrofitting is only possible if the display was supplied "with ESK preparation".
The required calibration data are shown on the display cover.

The conversion program KroVaCal and a HART modem linearization connected to the serial interface of the PC are required to carry out the linearization.

Linearization of the ESK II is carried in 3 steps:

- Recording of the measuring points
- Linearization of the characteristic curve by means of PC
- Storing of the linearization data in the EEPROM by means of the serial interface

Recording of the measuring points should be carried out at the main scale marking in order to attain the best possible linearization result.

Approaching these points can be carried out by three different methods:

Dynamic setting:
Setting of the flow value (original medium or by conversion of the determined reference medium)

Static setting:
Lifting of the float (not the pointer!) until the pointer displays the main scale value.

Record the respective flow value as well as the corresponding current value of the ESK for all the approached measuring points.

The linearization is carried out by using the KroVaCal program. This program has to be installed on a common PC. The operating system should be Win95/98. An update for Win 2000 / ME / XP is being prepared. A HART modem which is connected to the serial interface of the PC allows communication with the ESK II.

9.5.5 Changing and converting ESK II

If a change in the measuring range, the medium temperature, the medium, the density, the viscosity, the pressure is desired, this can be carried out by using the KroVaCal program.

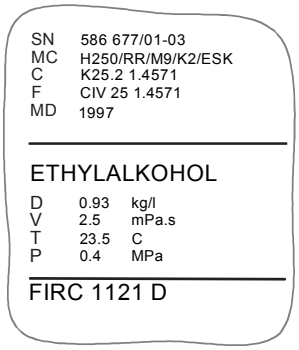
Properties and possibilities of the program:

- Calibration and conversion to every medium and every measuring range
- Instrument identification, instrument address, serial number, measuring point designation
- Digital measured value sampling in flow units, % and mA
- Test / setting functions
- Calibration 4.00 and 20.00 mA
- Setting the current output to any value
- Self-test of the integrated components and configurations
- Scale pressure

However, every measuring unit is subjected to its physical limits which the KroVaCal program calculates correctly and, if appropriate, refuse the desired change. If a change is carried out with the program, the new data are also transferred to the ESK II.

9.6 Flow counter ESK-Z

The flow counter ESK-Z can also be retrofitted in the M9 display in combination with the electrical current output ESK II. When ordering the counter as a retrofit kit, please specify the instrument data (as shown adjacently) as well as the measuring range. These data allow the included new scale with the counter display partial section to be prepared beforehand for the installation! The flow counter is then preset to the conversion factor with reference to the measuring range.



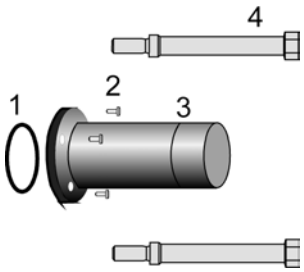
Installation:

Slide the existing scale out.
Slide the flow counter unit into the center rail of the module retainer.
Then slide the new scale into the module retainer.
When sliding over the counter display lift the scale slightly until the scale partial section frame the counter display.

9.7 High-temperature design M9 display

The scope of delivery includes:

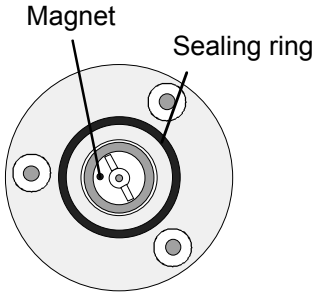
- 1 pc(s). Sealing ring (1)
- 3 pc(s). Fastening bolts (2)
- 1 pc(s). HT extension (3)
- 2 pc(s). Distance bolts (4)



Installation

The instrument can remain in the pipeline during the conversion to the HT version.

- Record the pointer position before removing the display!
- Loosen both nuts which are used to fasten the display.
- Remove the display with fastening clips from the measuring unit.
- Remove the plastic protective cover of the HT extension.
- Insert the sealing ring (1) exactly into the groove of the HT extension
- Screw the HT extension onto the rear of the display by means of the three fastening screws (2).
- Screw the distance bolts (4) onto the setscrew at the measuring unit and tighten them (width across flats 14).

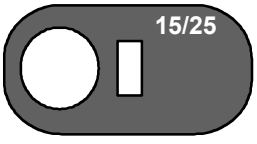


Mounting the display

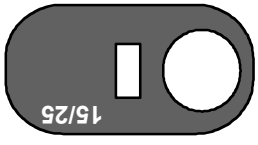
Place the display with the fastening clips on the distance bolts (4), slip on the shims and tighten with the nuts (max. of 8 Nm).

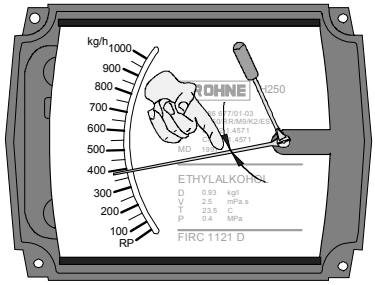
Note: Observe the installation position of the fastening clips:

DN15, DN25



DN50, DN80, DN100





Compare the pointer position with the display value recorded beforehand. If the display value deviates:

- Hold the pointer axis by means of a screwdriver (refer to figure).
- Set the pointer to the previously recorded value against the frictional forces of the measuring pointer fixture.

10 Spare part list

Spare part list measuring unit			Order No.
DN 15			
Float	CIV 15	1.4404	X251041000
Float	DIV 15	1.4404	X251042000
Float	TIV 15	1.4404	X251043000
Float	DVIT 15	1.4404	X251044000
Float	TIV 15	Aluminium	X251043100
Float	TIV 15	Titanium	X251043200
Set float stop, standard (1 stop, 1 snap ring)			X251050100
Set float stop, gas damping (AL2O3)			X251050200
Set float stop, gas damping (PEEK)			X251050300
Damping socket (7x8) AL2O3 incl. 2x snap rings			X251053100
Damping socket (7x8) PEEK incl. 2x snap rings			X251053200
DN 25			
Float	CIV 25	1.4404	X252041000
Float	DIV 25	1.4404	X252042000
Float	TIV 25	1.4404	X252043000
Float	DVIT 25	1.4404	X252044000
Set float stop, standard (1 stop, 1 snap ring)			X252050100
Set float stop, gas damping (AL2O3)			X252050200
Set float stop, gas damping (PEEK)			X252050300
Damping socket (12x8) AL2O3 incl. 2x snap rings			X252053100
Damping socket (12x8) PEEK incl. 2x snap rings			X252053200
DN 50			
Float	CIV 55	1.4404	X253041000
Float	DIV 55	1.4404	X253042000
Float	TIV 55	1.4404	X253043000
Float	DVIT 55	1.4404	X253044000
Set float stop, standard (1 stop, 1 snap ring)			X253050100
Set float stop, gas damping (AL2O3)			X253050200
Set float stop, gas damping (PEEK)			X253050300
Damping socket (14x10) AL2O3 incl. 2x snap rings			X253053100
Damping socket (14x10) PEEK incl. 2x snap rings			X253053200
DN 80			
Float	CIV 85	1.4404	X254041000
Float	DIV 85	1.4404	X254042000
Float	TIV 85	1.4404 (special material Titanium = 468)	X254043000
Float	DVIT 85	1.4404	X254044000
Set float stop, standard (1 stop, 1 snap ring)			X254050100
Set float stop, gas damping (AL2O3)			X254050200
Set float stop, gas damping (PEEK)			X254050300
Damping socket (18x14) AL2O3 incl. 2x snap rings			X254053100
Damping socket (18x14) PEEK incl. 2x snap rings			X254053200
DN 100			
Float	CIV 105	1.4404	X255041000
Float	DIV 105	1.4404	X255042000
Float	DIVT 105	1.4404	X255044000
Set float stop, standard (1 stop, 1 snap ring) only for below!			X255050100
Set float stop, gas damping (AL2O3)			X255050200
Set float stop, gas damping (PEEK)			X255050300
Damping socket (18x14) AL2O3 incl. 2x snap rings			X254053100
Damping socket (18x14) PEEK incl. 2x snap rings			X254053200

M9 display		**Order No.**
Display housing complete without scale		X251010000
Cover M9 complete, standard (blue; RAL 5015)		X251010100
Cover M9 complete, seawater-resistant (gray; RAL 7001)		X251010200
Cover M9 complete, free of silicone (blue; RAL 5015)		X251010300
Viewing window multilayer glass		X251011100
Viewing window plastic (Macrolon)		X251011200
Cover seal (silicone)		X251012100
Baseplate M9 standard		X251020100
Baseplate M9 seawater-resistant		X251020200
Retrofit kit HT extension		X251021000
Module retainer (profile rail)		X251021100
Set housing fastening parts (1 pair)		X251021300
Pointer system, complete		X251022100
Eddy-current brake		X251022200
Scale printed (serial number required)		X251023100
Scale blank		X251023200
Scale printed with counter cut-out (serial number required)		X251023300
Scale blank with counter cut-out		X251023400
Retrofit kit ESK II, linearized (serial number required)		X251030100
0...20 mA converter on slide-in board		X251031900
0...20 mA converter		X251032000
DC counter ESK-Z (with impedance output)		X251032100
Contact insert K1 Min	SC3,5 N0 standard	X251033100
Contact insert K1 Max	SC3,5 N0 standard	X251033200
Contact insert K2 Min / Max	SC3,5 N0 standard	X251033300
Contact insert K2 Min1 / Min2	SJ3,5 S1N / SJ 3,5 SN	X251033400
Contact insert K2 Max1 / Max2	SJ3,5 S1N / SJ 3,5 SN	X251033500
Contact insert K1 Min	SJ3,5 SN	X251033600
Contact insert K1 Max	SJ3,5 SN	X251033700
Contact insert K2 Min / Max	SJ3,5 SN	X251033800
Contact insert K1 Min	SB3,5 E2akt.Low	X251033900
Contact insert K1 Max	SB3,5 E2akt.Low	X251034000
Contact insert K2 Min / Max	SB3,5 E2akt.Low	X251034100
HART^{TM} modem (converter RS232 √ HART)		4.00313.00.00
Calculation software KroVaCal (CD)		317850xx
Isolating 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

11 Maintenance

The flowmeter is also to be inspected for soiling, corrosive erosion and mechanical wear or damage to the measuring tube and the display in the context of the routine operational maintenance of the installation and the pipelines. We recommend at least annual inspections. In order to clean the instrument remove it from the pipeline.

Note
Pressurized lines have to be relieved before the measuring unit is removed.

Corresponding safety precautions with regard to residual liquids in the measuring unit in case of instruments which are used to measure aggressive media.

New seals must always be used when remounting the measuring unit in the pipeline.

Electrostatic charges are to be avoided when the surfaces (e.g. viewing window) are cleaned!

Information on returning instruments

Your instrument has been manufactured carefully and tested several times. If installed and operated in accordance with these instructions your instrument will rarely present any problems. Should you nevertheless need to return an instrument for checking or repair, please pay strict attention to the following points:

Due to statutory regulations concerning protection of the environment and safeguarding the health and safety of our personnel, KROHNE may only handle, test and repair returned instruments that have been in contact with liquids if it is possible to do so without risk to personnel and environment.
This means that KROHNE can only service your device if it is accompanied by a certificate in line with the following model confirming that the device is safe to handle.

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

- To check and ensure, if necessary by rinsing or neutralizing, that all the cavities in the instrument are free from such dangerous substances. (Directions on how you can find out whether the primary head has to be opened and flushed out and neutralized are obtainable from KROHNE on request.)

- To enclose a certificate with the device confirming that the device is safe to handle and stating the liquid used.

KROHNE regret that we cannot service your device unless it is accompanied by such a certificate and thank you for your understanding.

Form for returning the instrument

Company: ..... Address: .....

Department: ..... Name: .....

Tel. No.: ..... Fax. No.: .....

The enclosed instrument
Type: .....

KROHNE Order No. or Series No.: .....

has been operated with the following process liquid: .....

Because this process liquid is water-endangering * / 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 instrument *

(* delete where not applicable)

We confirm that there is no risk to man or environment through any residual liquid contained in the instrument.

Date: ..... Signature .....

Company stamp: