

Installation and Operating Instructions

H 250 U

Variable-area Flowmeter
flow direction up/down

H 250 H

Variable-area Flowmeter
for horizontal mounting



Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications technology

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

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Product liability and warranty

The variable area flowmeter for horizontal mounting and flow direction up/down are 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.: 702608##00
- Supply without installation accessories (screw bolts, flange seal and cabling)

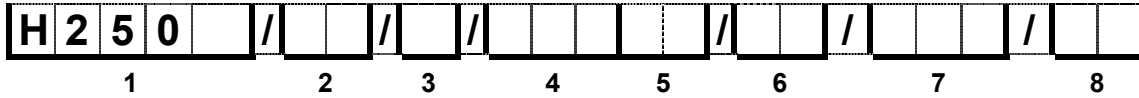
Special certificates (supplied to order only)

- 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

1 General

1.1 Description code

The description code consists of the following elements: 1)



- 1 Series measuring unit
H250 H for horizontal mounting process flow from right to left (or contrariwise)
H250 U with flow direction up/down
- 2 Material of the parts coming into contact with the medium
RR : Stainless steel
- 3 Heating jacket design
B : With heating jacket
- 4 : Display part series
M9 : Standard indicator
M9S : with added corrosion prevention
M9R : Stainless steel housing
- 6 **High-temperature design**
HT : Design with HT extension
- 7 Electrical signal output
ESK : electronical signal output or counter
- 8 Limit switch
K1 : one limit switch
K2 : two limit switches

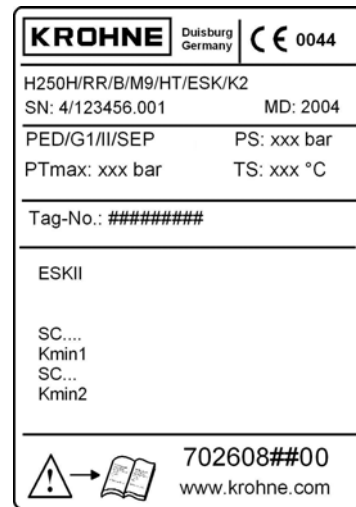
1) Positions which are not used in the description code are not required.

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).

Example:

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



1.3 Key for Pressure Equipment Directive

PED	/			/		/	
1		2	3		4		5

1 Pressure Equipment Directive

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

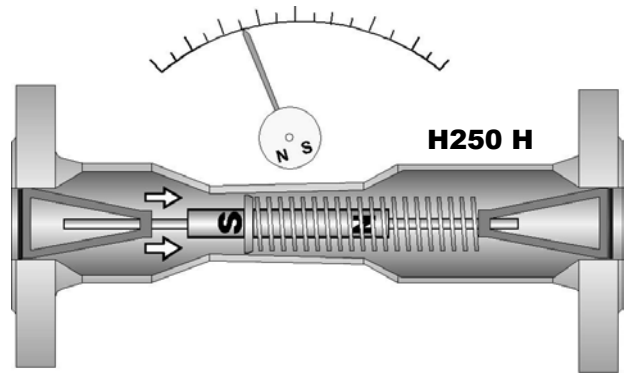
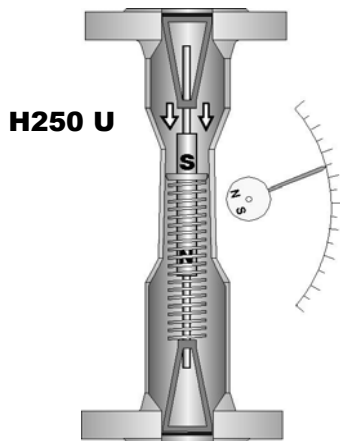
The PED key marking is contained on the rating plate of the instrument.

1.4 Functional principle

The H250 H flowmeter for horizontal mounting and the H250 U for flow direction up/down operate in accordance with the modified float measuring principle.

A metal cone is installed in the measuring unit, in which a suitably formed float can move freely.

The guided float adjusts itself so that the flow force and the opposing spring force are in equilibrium.



An annular gap which depends on the flow rate results.

The position of the float in the measuring section depends on the flow and is transmitted by a magnetic coupling to the 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 H250 H flowmeter has to be installed horizontally.

The H250 U flowmeter has to be installed vertically.

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 $\geq 5 \times \text{DN}$ before the instrument and a straight outflow section of $\geq 3 \times \text{DN}$ 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.

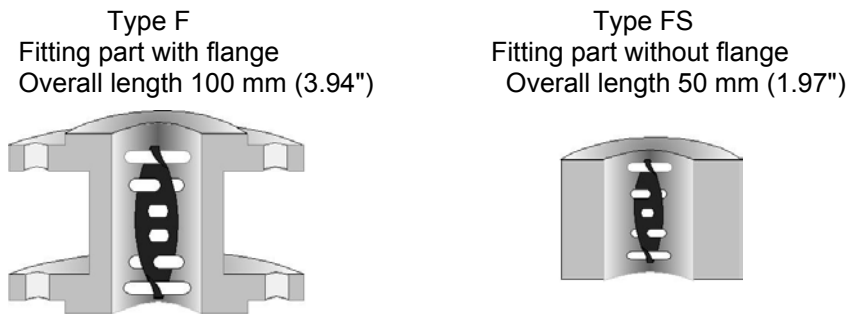
The inside diameter of the flange deviates from the standard dimensions.

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:



Materials 1.4571 (316 Ti)

2.5 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
		mm	inch		
M 16x1.5	PA	5 - 10	0.2 - 0.4	IP 68 - 5 bars	Standard
M 20x1.5	PA	8 - 13	0.3 - 0.5	IP 68 - 5 bars	
M 16x1.5	Nickel-plated brass	5 - 9	0.2 - 0.4	IP 68 - 5 bars	
M 20x1,5	Nickel-plated brass	10 - 14	0.4 - 0.6	IP 68 - 10 bar	

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

2.6 Start-up

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

Medium	Pressure loss : Operating pressure
Liquids	1 : 2

For the pressure losses please refer to the flow tables

2.7 Measurement of liquids

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

Open valves slowly!

3 Flow table H250 . /RR

General

Reference conditions: Water at 20°C

The turn-down range amounts to 10 : 1

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

Float material: stainless steel

Float form: DN15 DIV TB
 DN25 ... DN80 DIV T
 DN100 DIV L

3.1 Durchflusstabelle H250 H

Nominal size		Cone No.	flow [l/h]				pressure loss [mbar]			
EN	ASME		spring no. 02		spring no. 03		spring no. 02		spring no. 03	
			l/h	US GPM	l/h	US GPM	mbar	psig	mbar	psig
DN15	1/2"									
		K 15.1	70	0.31			195	2.83		
		K 15.2	120	0.53			204	2.96		
		K 15.3	180	0.79			195	2.83		
		K 15.4	280	1.23			225	3.27		
		K 15.5	450	1.98			250	3.63		
		K 15.6	700	3.08			325	4.72		
		K 15.7	1200	5.28			590	8.56		
		K 15.8	1600	7.05	2400	10.6	950	13.8	1600	23.2
DN25	1"		spring no. 04		spring no. 05		spring no. 04		spring no. 05	
		K 25.1	1300	5.72			122	1.77		
		K 25.2	2000	8.81			105	1.52		
		K 25.3	3000	13.2			116	1.68		
		K 25.4	5000	22.0			145	2.11		
		K 25.5	8500	37.4	10000	44.0	217	3.15	336	4.88
DN50	2"		spring no. 06		spring no. 08		spring no. 06		spring no. 08	
		K 55.1	10000	44.0			240	3.48		
		K 55.2	16000	70.4			230	3.34		
		K 55.3	22000		34000	150	220	3.19	420	6.10
DN80	3"		spring no. 09		spring no. 11		spring no. 09		spring no. 11	
		K 85.1	25000	96.9			130	1.89		
		K 85.2	35000	154	60000	264	130	1.89	290	4.21
DN100	4"		spring no. 09		spring no. 11		spring no. 09		spring no. 11	
	K 105.1	80000	352	120000	528	250	3.63	340	4.94	

3.2 Flow table H250 U

float form water: DN15 DIV TB
 DN25 ... DN50: DIV T

Nominal size		Cone No.	flow		pressure loss	
EN	ASME					
DN15	1/2"		l/h	US GPM	mbar	psig
		K 15.1	65	0.29	175	2.54
		K 15.2	110	0.48	178	2.58
		K 15.3	170	0.75	180	2.61
		K 15.4	260	1.15	200	2.90
		K 15.5	420	1.85	220	3.19
		K 15.6	650	2.86	290	4.21
		K 15.7	1100	4.84	520	7.55
		K 15.8	1500	6.60	840	12.2
DN25	1"	K 25.1	1150	5.06	97	1.41
		K 25.2	1800	7.93	85	1.23
		K 25.3	2700	11.9	92	1.34
		K 25.4	4500	19.8	115	1.67
		K 25.5	7600	33.5	172	2.50
DN50	2"	K 55.1	9000	39.6	220	3.19
		K 55.2	15000	66.0	230	3.34
		K 55.3	21000	92.5	240	3.48

4 Materials

Design H 250	Materials				
	Measuring tube	Flange / sealing strip	Float	Stop / Guide	Spring
H 250. / RR	CrNi-Stahl 1.4404	CrNi-Stahl 1.4404 solid	CrNi-Stahl 1.4404	CrNi-Stahl 1.4404	1.4310

5 Technical data

Accuracy class to VDI/VDE Directive 3513, Sheet 2
H250. / RR

2.5

Connections H 250

Flange (H250. / RR)	Connection dimensions to	EN-1092-1 ASME B 16.5 JIS B 2238	DN15-100, 1/2" - 4", LR 15-100,	PN16-100 150 - 600 lbs 10K-20K
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Connection for heating (H250. /RR)

Flange connection	EN1092-1 ASME B 16.5	DN 15 1/2"	PN 40 150 lbs / RF
Pipe connection for Ermeto		E12,	PN 40

Higher pressure stages and other connection designs on request

Measuring tube	H250. / RR	Metal tube with conic measuring section
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Float form	H250. /RR	liquids TIV
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Overall height

With flange connection (without seals)	250 mm (9.85")
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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 Process temperatures

6.1 Max. Process temperatures TS

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

Design	Material	max. Process temperature TS	at Ambient temperature T _{amb.}
H250. / RR	stainless steel	100 °C / 212 °F	≤ 90 °C / 194°F

Min. Process temperatures TS - 40°C / -40°F

Ambient temperature T_{amb.} - 20°C ... + 90°C (Standard) (-4 ... 194°F)

6.2 M9 with electrical built-in components

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

Without heating jacket		With heating jacket		Design	$T_{amb.} < 40^{\circ}\text{C} (104^{\circ}\text{F})$		$T_{amb.} < 60^{\circ}\text{C} (140^{\circ}\text{F})$	
EN	ASME	EN	ASME		$^{\circ}\text{C}$	$^{\circ}\text{F}$	$^{\circ}\text{C}$	$^{\circ}\text{F}$
DN15	1/2"	DN15	1/2"		ESK II, ESK-S, ESK3-PA	100	212	100
DN25	1"			ESK II with counter	100	212	80	176
				Limit switch SC.. SJ..	100	212	100	212
				Limit switch SB..	100	212	100	212
DN 50	2"	DN 25	1"	ESK II, ESK-S, ESK3-PA	100	212	100	212
				ESK II with counter	100	212	75	167
				Limit switch SC.. SJ..	100	212	100	212
				Limit switch SB..	100	212	100	212
DN 80	3"	DN 50	2"	ESK II, ESK-S, ESK3-PA	100	212	100	212
DN 100	4"	DN 80	3"	ESK II with counter	100	212	70	158
				Limit switch SC.. SJ..	100	212	100	212
				Limit switch SB..	100	212	100	212

Short term:

- 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

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

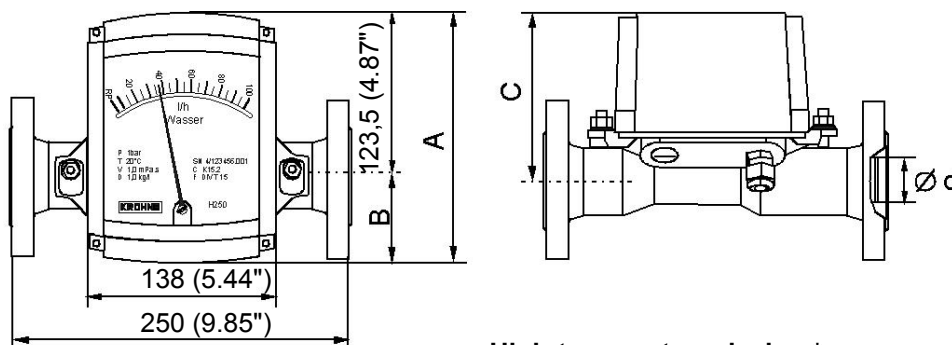
Flange to ASME B 16.5 1/2", 1" 50lbs/RF

Pipe for Ermeto 12

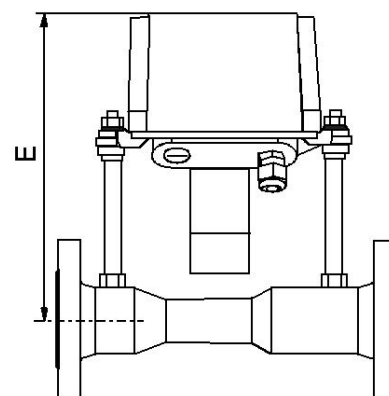
Nominal widths		Dimensions in mm												Approx. weight * [kg]			
DN	PN	A		B		C		D		E		Ø d		EN flanges		with heating	
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	kg	lbs	kg	lbs
15	40	70,5	2.77	194	7.64	107	4.22	100	3.94	187	7.37	20	0.79	3.5	7.7	4.8	11
25	40	70,5	2.77	194	7.64	119	4.69	106	4.18	199	7.84	32	1.26	5.0	11	6.7	15
50	40	57,5	2.27	181	7.13	132	5.20	120	4.73	212	8.35	65	2.56	8.2	18	10.4	23
80	16	57,5	2.27	181	7.13	148	5.83	160	6.30	228	8.98	89	3.51	12.2	27	14.0	31
100	16	57,5	2.27	181	7.13	158	6.22	150	5.91	232	9.14	114	4.49	14.0	31	16.6	37

* At heating with flange connection DN 25 plus 0.75 kg (1.65 lbs)
 At heating with Ermeto 12 connection minus 0.9 kg (1.98 lbs)

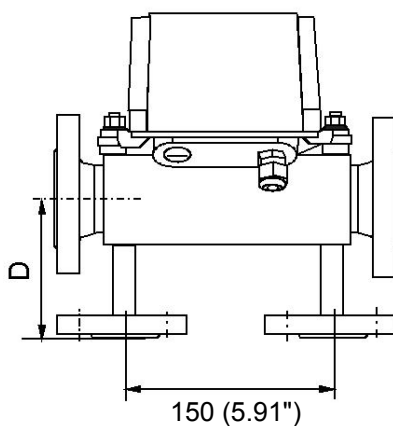
H 250 with flange connection



High-temperature design *



Measuring unit with heating

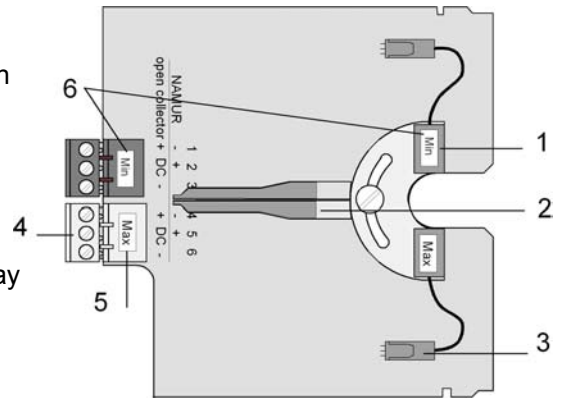


* The high-temperature version (HT version) is to be preferred at measuring tube insulation measures.

8.1 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.



- 1 Limit switch
- 2 Contact pointer
- 3 Connecting plug
- 4 Connecting terminal
- 5 Terminal socket
- 6 Information sign

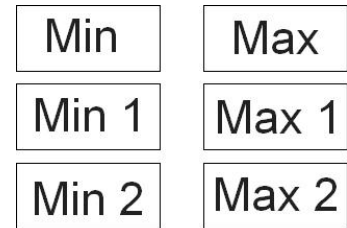
Contact types:

- 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

8.1.1 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 information signs (6) show the function of the built-in limit switches.

The built-in contact types are listed in the rating plate of the display. Example: Built-in device: Kmin SJ3,5-SN



- SC3,5-N0-Y** limit switches 2-wire technology
- SJ3,5-SN** and **SJ3,5-S1N** limit switches 2-wire technology safety-oriented
- SB3.5-E2** limit switches 3-wire technology

Electrical connection of the limit switches in 2-wire technology

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

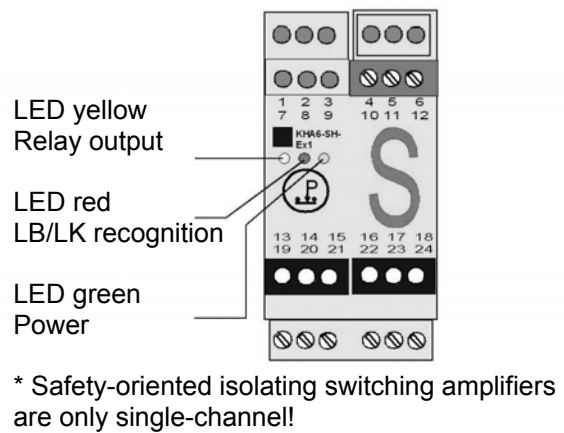
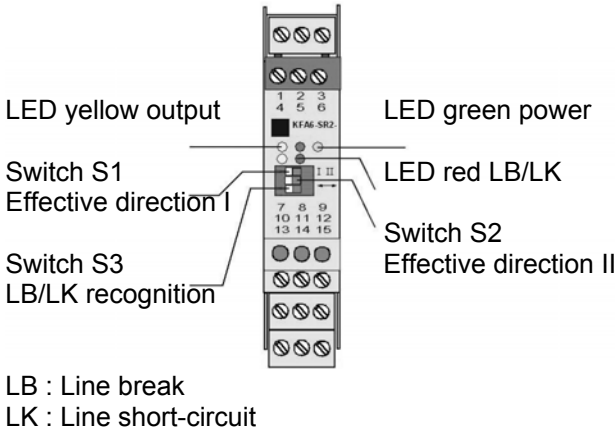
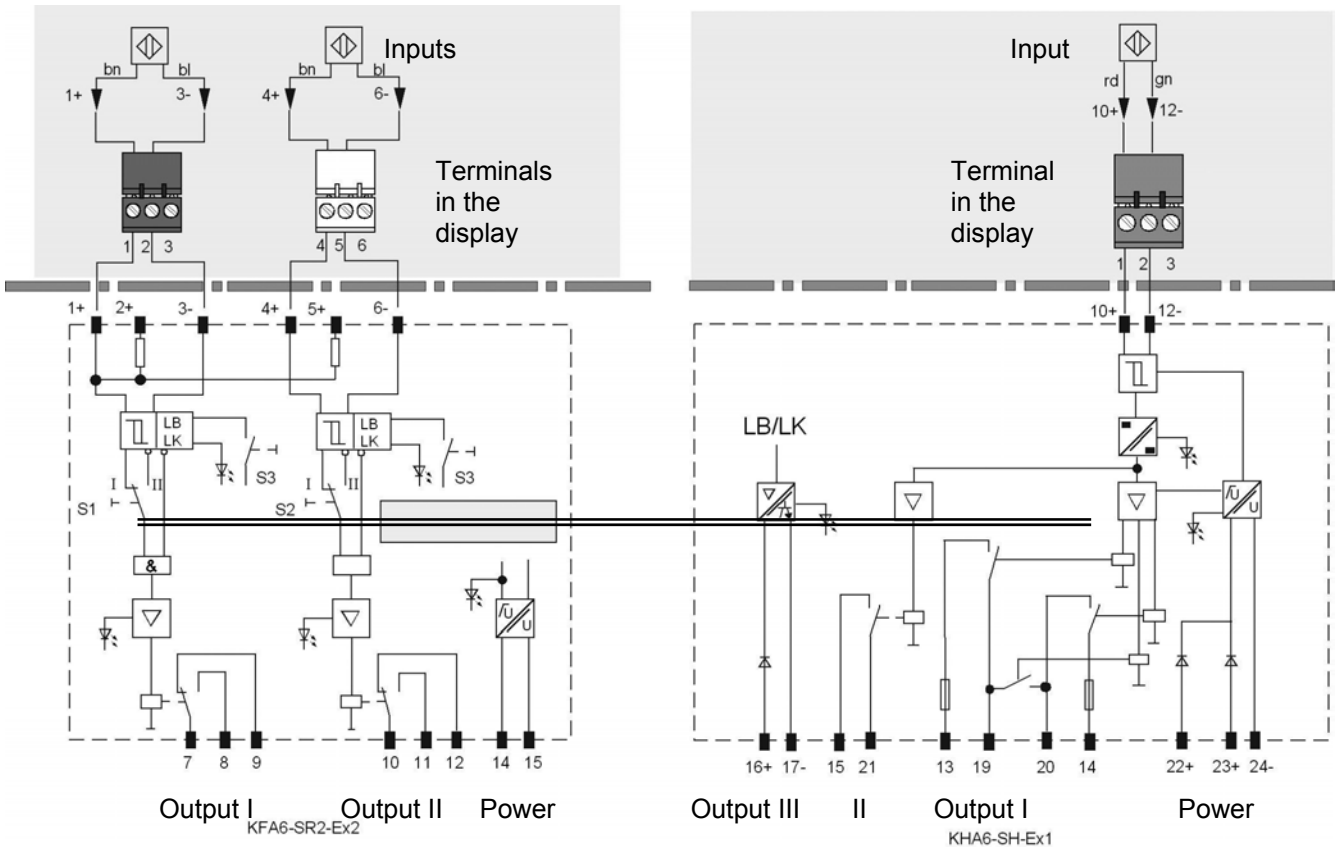
Electrical connection of the limit switches in 3-wire technology

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

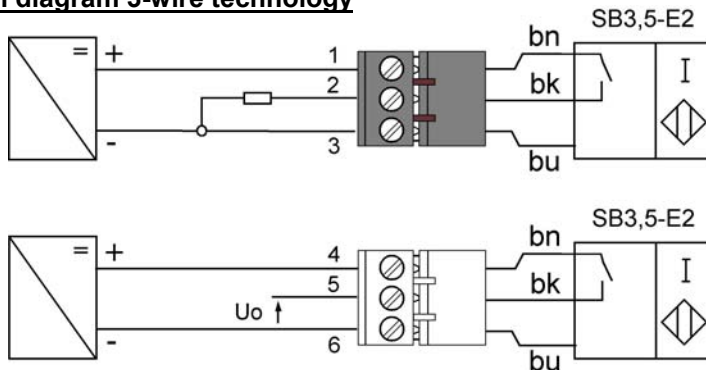
Connection diagram 2-wire technology

NAMUR
SC3,5-N0-Y

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



Connection diagram 3-wire technology

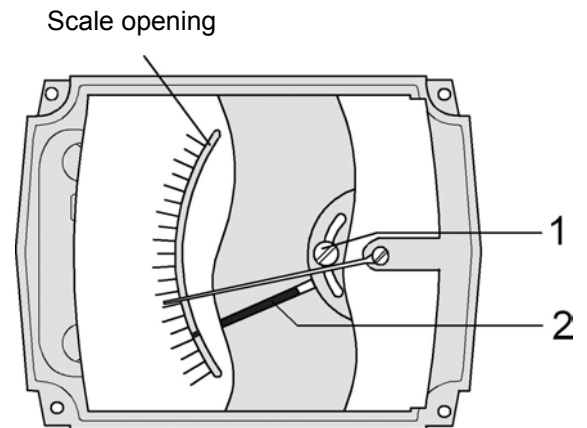


8.1.2 Limit setting

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 has been carried out, the contact pointer (2) should be fastened again by using the locking screw (1).



8.1.3 Switch contact definition

MIN contact

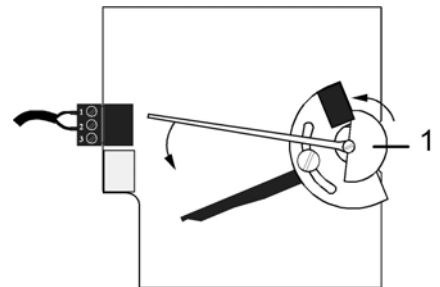
If the pointer vane (1) enters the slot, an alarm is triggered. If the pointer vane lies outside the slot initiator, a wire break also causes the alarm to be triggered.

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

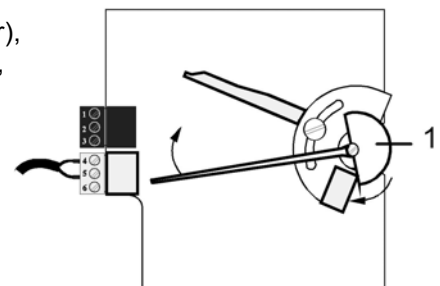
If the pointer vane (1) enters the slot (and thus dampens this initiator), an alarm is triggered. If the pointer vane lies outside the slot initiator, a wire break also causes the alarm to be triggered.

No wire break recognition at SB3,5-E2

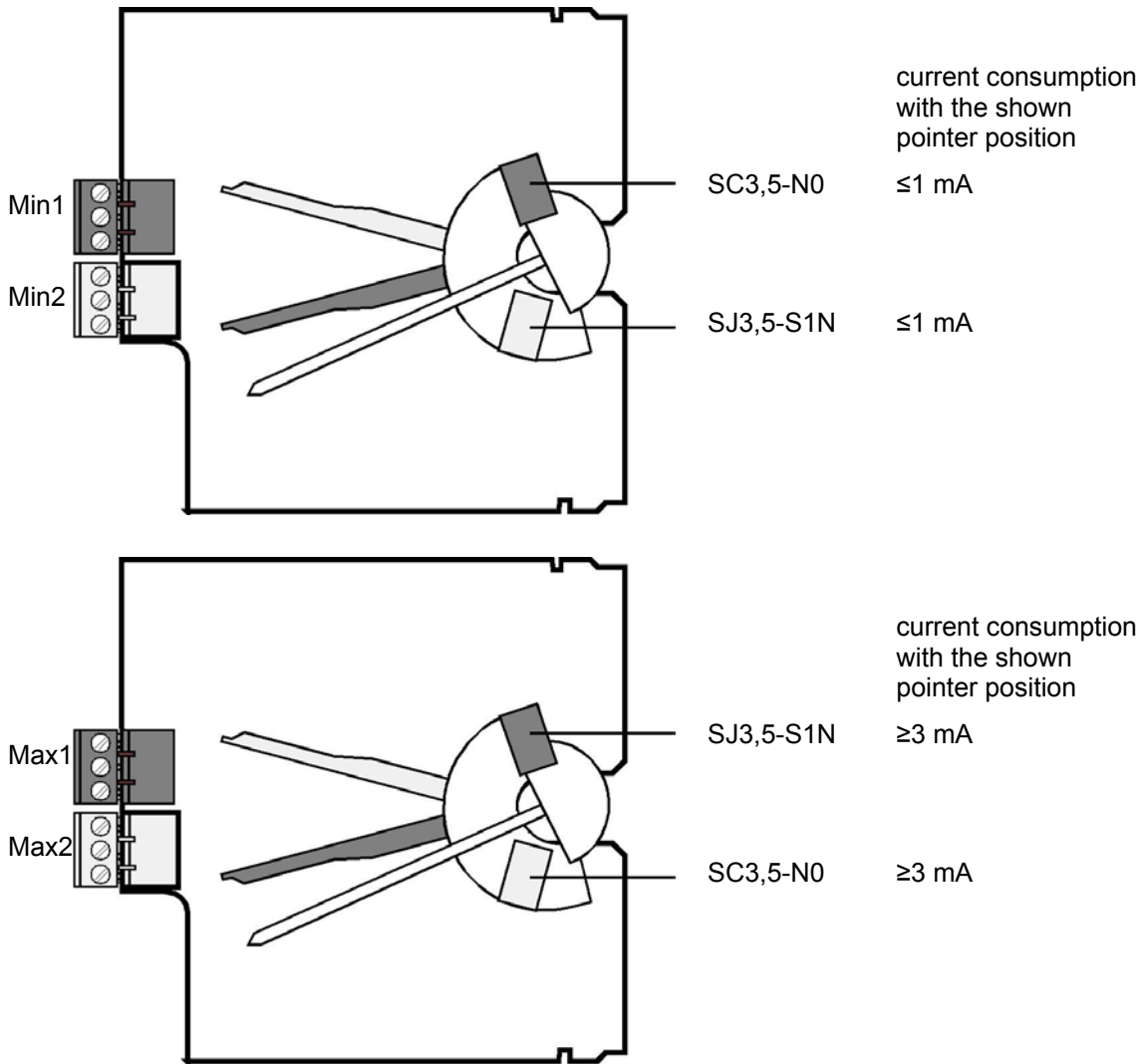
Option: Implementation as a minimum contact

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



8.1.4 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 U ₀	8 V	8V	8V	10 to 30 V
Power consumption:				
Pointer vane not detected	$\geq 3 \text{ mA}$	$\geq 3 \text{ mA}$	$\leq 1 \text{ mA}$	$\leq 0.3 \text{ V}$
Pointer vane detected	$\leq 1 \text{ mA}$	$\leq 1 \text{ mA}$	$\geq 3 \text{ mA}$	U _b - 3 V
Continuous current	-	-	-	max. 100 mA
No-load current I ₀	-	-	-	$\leq 15 \text{ mA}$

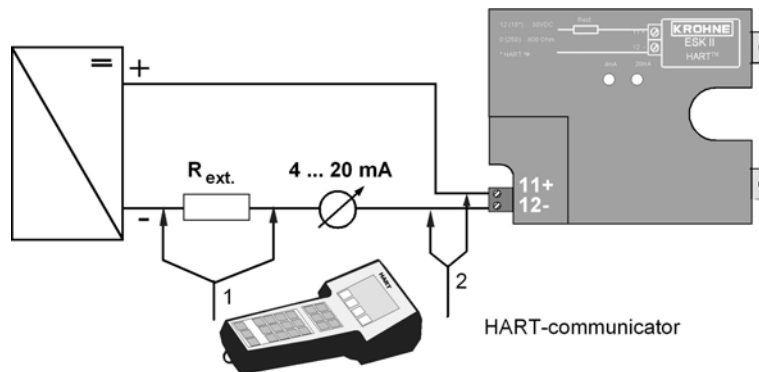
An isolating switching amplifier, e.g. Pepperl + Fuchs Series KF .. -SR2 ..., is required in order to operate the **SC3,5-N0-Y** limit switch (refer to the chapter on the spare part list).

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)

8.2 Electrical signal output ESK II

8.2.1 Electrical connection

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



8.2.2 HART™ communication with the ESK II

HART™ communication is not compellingly required in order to operate the ESK II.

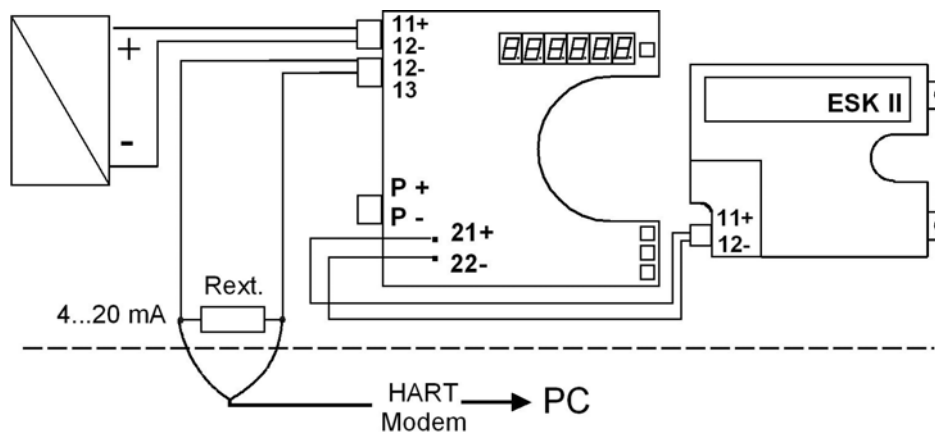
When HART™ communication is carried out with the ESK II, this does not by any means impair analog measured value transfer (4...20mA)

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 C 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:



8.2.3 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 μ A / K
Max. external resistance / load	0 (250 *) to 800 Ohms

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

8.3 Electrical signal output ESK3-PA (PROFIBUS-PA)

8.3.1 Bus cable

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

$R' = 15...150 \text{ Ohm/km}$

$L' = 0.4...1 \text{ mH/km}$

$C' = 80...200 \text{ nF/km}$.

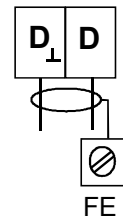
8.3.2 Shielding and grounding

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.

8.3.3 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.



8.3.4 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)

8.4 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.

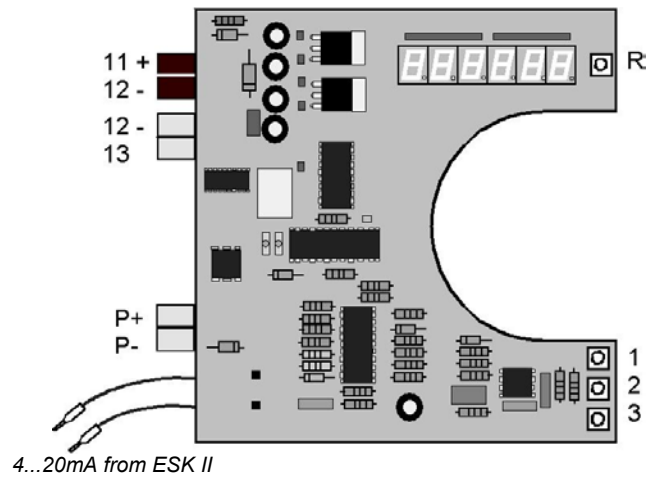
A 6-digit display shows the counted flow value, which can be changed over to the current flow value in 0 to 100%.

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.

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

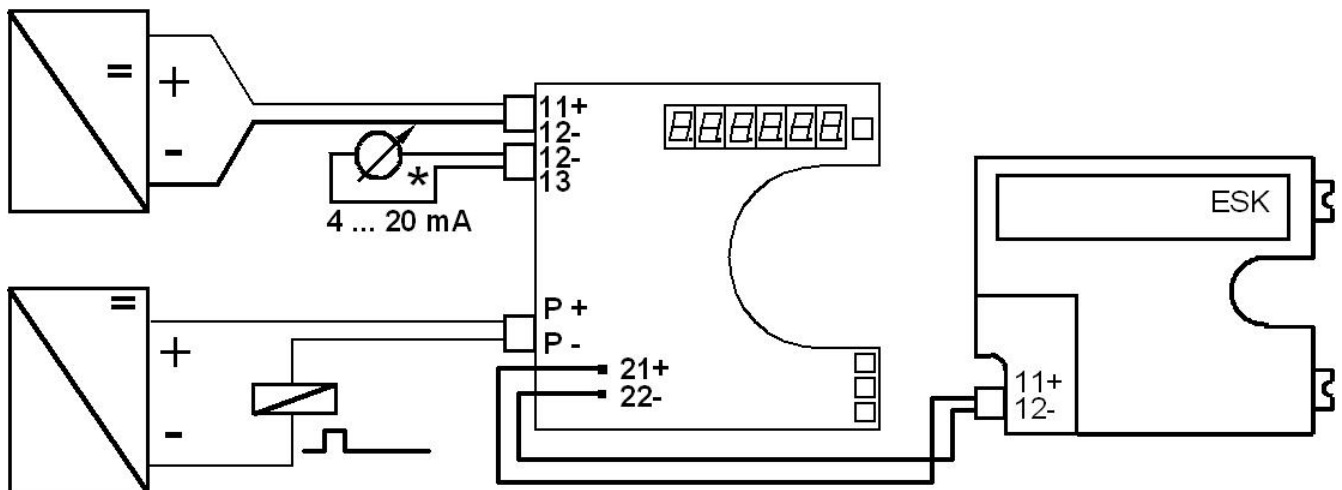
The flow counter is set in the works to the order data and does not have to be calibrated! The conversion factor of the counter is set with reference to the measuring range, if not ordered differently, so that the total value (in liters, m³, etc.) can be read directly.



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

8.4.1 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.

8.4.2 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

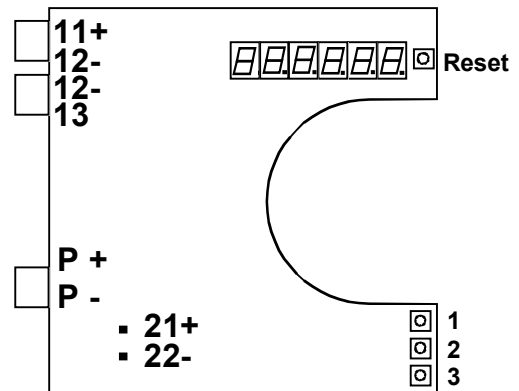
Without decimal points

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**

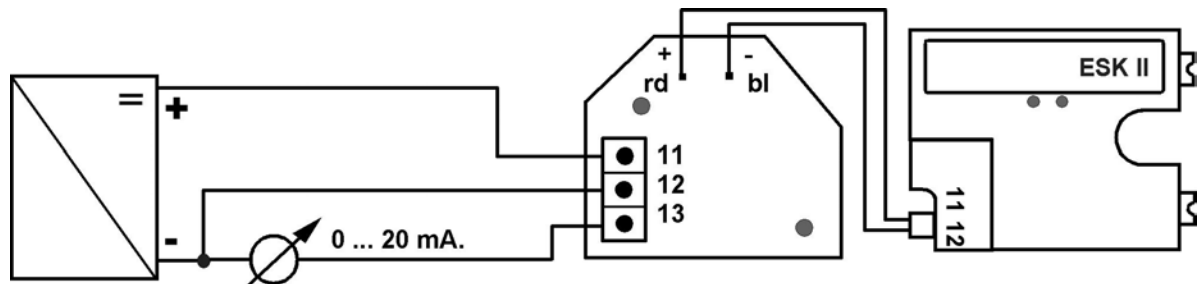
8.4.3 Technical data of counter ESK-Z

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	U _b – 3 Volt
U out	0 Volt
Pulse value	1 Pulse = 1 Display counter progress = 1 flow unit (1 liter, 1 m ³ , etc.)
Display error	< 1% of the displayed value, maximum of one display unit

8.5 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.



8.5.1 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%

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 upper snap ring (4) from the measuring unit.

Remove the upper float stop (3) and float (1) out of the measuring unit.

Note: Spring (2) tension !

Introduce the new float (1) into the central bore of the lower float stop.

Insert the spring (2).

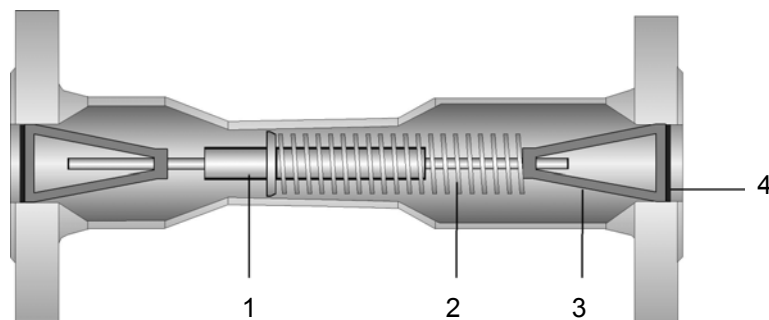
Insert the upper float stop (3) into the measuring unit.

Ensure that the upper float guide rod is guided through the center bore of the upper float stop (3).

Insert the snap ring (4) 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 Contact insert

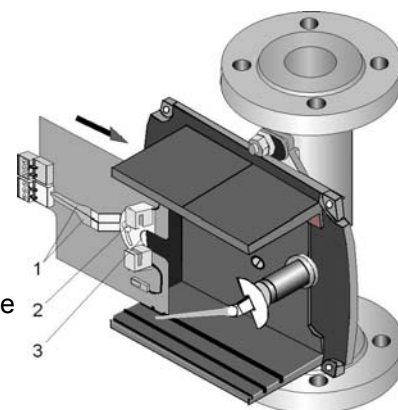
Remove the flow counter ESK-Z, if appropriate.

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.



9.3 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 with the program KROVACAL (see spare parts).

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. An reducing of the accuracy class is possible (class 1.6 → class 2.5).

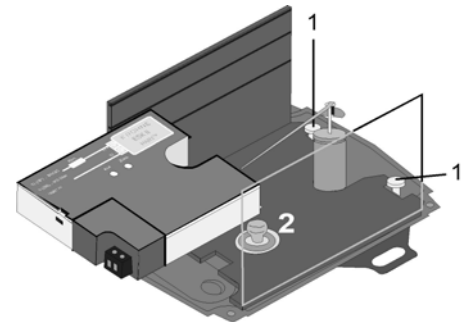
9.3.1 Installing an ESK II

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.

When the ESK II is retrofitted, the fastening bridge (3) is pushed away automatically and can be removed.



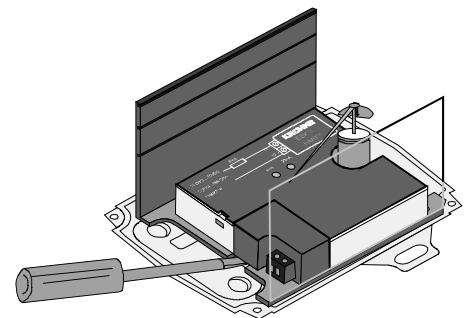
9.3.2 Replacing an ESK II

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.

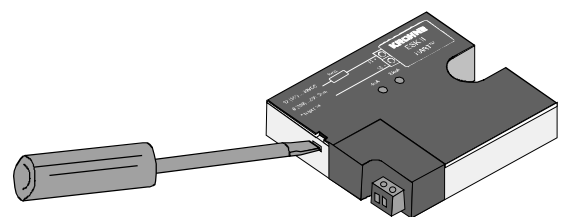
The calibration data are stored in the EEPROM used.

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.



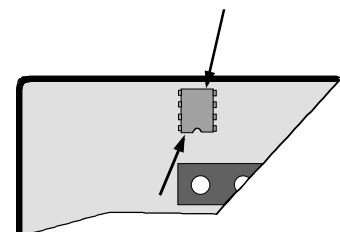
Deformation of the connecting pins can be avoided by lifting the unit at both sides which do not have connections.

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.



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

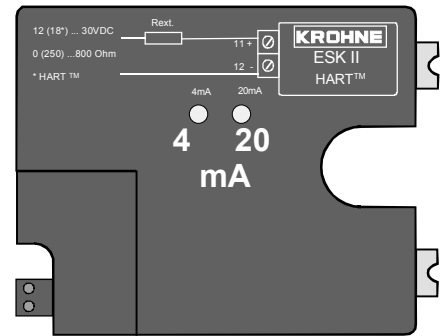
The zero point and the 100% value can be set at the ESK II by means of built-in pushbuttons.

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.



9.3.4 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.

9.3.5 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.

9.4 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 frames the counter display.

SN	586 677/01-03
MC	H250/RR/M9/K2/ESK
C	K25.2 1.4571
F	CIV 25 1.4571
MD	1997

ETHYLALKOHOL

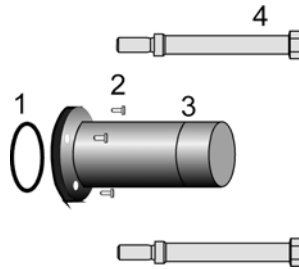
D	0.93	kg/l
V	2.5	mPa.s
T	23.5	C
P	0.4	MPa

FIRC 1121 D

9.5 High-temperature design M9 display

The scope of delivery includes:

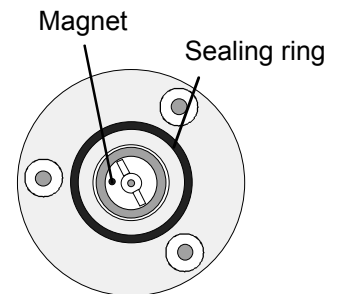
- 1 pc(s). Sealing ring (1)
- 3 pc(s). Fastening bolts (2)
- 1 pc(s). HT extension (3)
- 2 pc(s). Distance bolts (4)



Installation

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

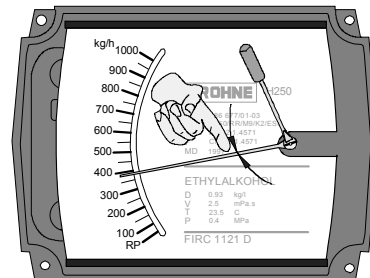
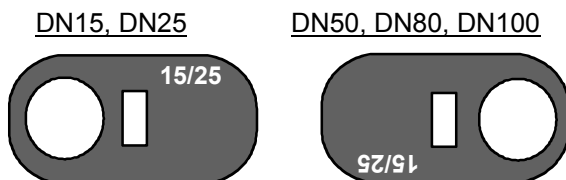
- Record the pointer position before removing the display!
- Loosen both nuts which are used to fasten the display.
- Remove the display with fastening clips from the measuring unit.
- Remove the plastic protective cover of the HT extension.
- Insert the sealing ring (1) exactly into the groove of the 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:



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 TIV 15 1.4404.....	X251043000
Set float stop, standard (1 stop, 1 snap ring).....	X251050100
Spring 02.....	3204830200
Spring 03.....	3204830300
DN 25	
Float TIV 25 1.4404.....	X252043000
Set float stop, standard (1 stop, 1 snap ring).....	X252050100
Spring 04.....	3204830400
Spring 05.....	3204830500
DN 50	
Float TIV 55 1.4404.....	X253043000
Set float stop, standard (1 stop, 1 snap ring).....	X253050100
Spring 06.....	3204830600
Spring 07.....	3204830700
Spring 08.....	3204830800
DN 80	
Float TIV 85 1.4404.....	X254043000
Set float stop, standard (1 stop, 1 snap ring).....	X254050100
Spring 09.....	3204830900
Spring 10.....	3204831000
Spring 11.....	3204831100
DN 100	
Float DIVT 1051.4404.....	X255044000
Set float stop, standard (1 stop, 1 snap ring) only for below!.....	X255050100
Spring 09.....	3204830900
Spring 10.....	3204831000
Spring 11.....	3204831100
M9 display	
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™ 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!

Return a device for testing or repair to KROHNE

This device has been manufactured carefully 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 the 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 device 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:

