H250 /M40 Technical Datasheet

Variable area flowmeter

- Sturdy construction for high pressure, temperature and media resistance
- Universal Ex concept: Ex i and Ex d
- Modular scalability – from mechanical to fieldbus

KROHNE

1 Product features 3

1.1 The standard solution for the process industry ... 3
1.2 Options and variants ... 5
1.3 Operating principle ... 7

2 Technical data 8

2.1 Technical data ... 8
2.2 Dimensions and weights ... 14
2.3 Measuring ranges ... 17

3 Installation 25

3.1 Intended use ... 25
3.2 Installation conditions ... 26
3.2.1 Tightening torques ... 27
3.2.2 Magnetic filters ... 28
3.2.3 Heat insulation ... 29
3.2.4 Float damping ... 30
3.2.5 Pointer damping ... 30

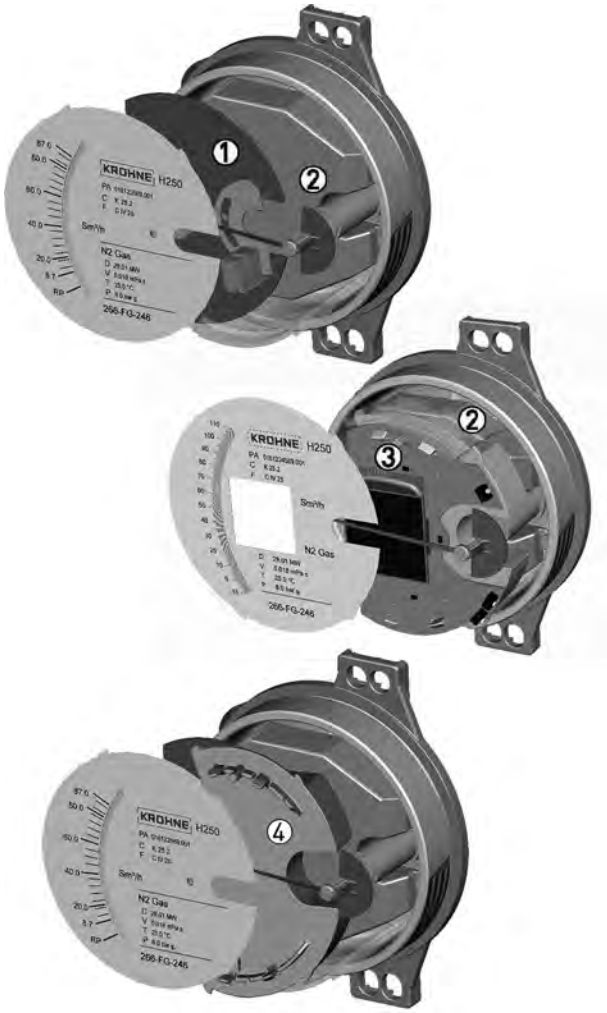
4 Electrical connections 31

4.1 Safety instructions ... 31
4.2 Electrical connection indicator M40 ... 32
4.2.1 Indicator M40 - limit switches ... 32
4.2.2 Current output ESK4A ... 35
4.3 Grounding connections ... 38
4.4 Protection category ... 38

5 Order form 39

1.1 The standard solution for the process industry

The all-metal variable area flowmeter H250 is used for flow measurement of conductive and non-conductive liquids, gases and vapours.



① Limit switch
② 4...20 mA output
③ With LCD, flow counter, electronic limit switches and pulse output
④ Fieldbus - Profibus PA or Foundation Fieldbus

Highlights

- Simple, low-cost installation: Measure and display without auxiliary power supply
- Universal Ex concept: Ex i and Ex d
- Modular scalability – from mechanical to fieldbus
- Any installation position: vertical upward, horizontal, vertical downward
- Robust measuring tube construction for high process temperatures and extreme operating pressures
- Choice of material: Stainless steel, hastelloy®, titanium, Monel, PTFE/TFM etc.
- Many connection variants: flanged, screwed, clamped, weld-on ends etc.
- Extended measuring range: up to100:1
- High application safety, even with extremely low flows

Industries

Can be used in all industrial sectors, for example:

- Chemicals
- Petrochemicals
- Pharmaceuticals
- Machinery
- Food & Beverage
- Oil & Gas
- Iron, Steel & Metals
- Power plants
- Paper & Pulp
- Water & Wastewater

Applications

- Continuous gas and liquid measurement
- Measurement of non-conductive media
- Industrial burner controlling
- Compressor monitoring
- Dry-run protection of pumps

1.2 Options and variants

FOOD & PHARMA (H250 F)

The only EHEDG-certified variable area flowmeter approved for used in the food and pharmaceuticals industry.
Smooth stainless steel surfaces with a surface roughness of ≤ 0.8 µm or 0,6 µm on parts exposed to the media make it difficult for deposits to take hold and are very easy to clean.
Combined with a design featuring no dead spaces or stagnation zones, micro-organisms have no chance to adhere and multiply.
The measuring devices can be cleaned (CIP) and sterilised (SIP) in place.
Suitable connections and FDA conforming materials for the food and pharmaceutical industry are available.

PTFE/ceramic liner for aggressive media

All wetted parts are made of PTFE or ceramic and can thus be used for almost all acids and alkalis.
Depending on the choice of material, the measuring device can be used up to a maximum temperature of 70°C / 158°F (PTFE) or 250°C / 482°F (ceramic).

Versions for special installation positions (H250H / H250U)

Variable area flowmeters typically feature a vertically positioned measuring cone through which the medium flows from bottom to top, lifting a float against the weight.

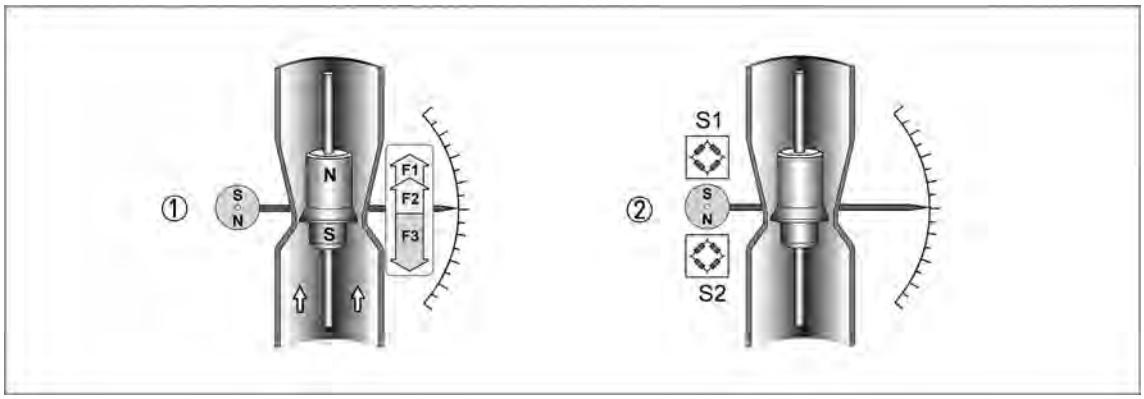
If the installation structure does not permit otherwise, versions for horizontal or inverted (from top to bottom) installation positions are used.
The missing reset force of the variable area float weight is replaced by a spring.

Version with extended measuring range 100:1

The normal measuring range of the H250 measuring device is 10:1.
A measuring range of 100:1 can be achieved by inserting a spring which, from a defined float travel, acts as a restoring force in addition to the weight.
This eliminates the need for an additional device for minimal volumes.

1.3 Operating principle

The H250 flowmeter operates on the variable area measuring principle. The measuring unit consists of a metal cone in which a float can move freely up and down. The medium flows through the flowmeter from bottom to top. The float adjusts itself so that the buoyancy force **F1** acting on it, the form drag **F2** and its weight **F3** are in equilibrium: **F3 = F1 + F2**



① Indication principle M40 magnetic coupling
② Magnetic coupling sensors

① For the indicator, the flow-dependent height of the float in the measuring unit is transmitted by means of a magnetic coupling and displayed on a scale.

② For a built-in signal converter (ESK4), the flow-dependent height of the float in the measuring unit is detected by the S1 and S2 magnetic field sensors and electronically processed.

Operating principle of H250H and H250U

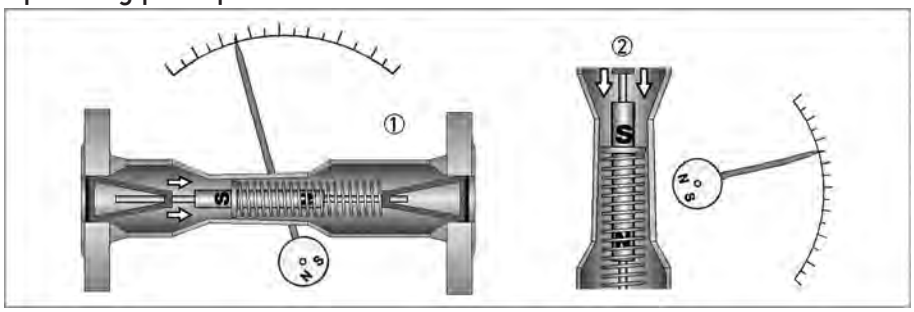


Figure 1-1: Operating principle H250H and H250U

① H250H - horizontal flow direction
② H250U - flow direction from top to bottom

The flowmeter operates based on a modified float measuring principle. The guided float adjusts itself so that the flow force acting on it is in equilibrium with the opposing spring force. The flow-dependent position of the float in the measuring unit is displayed on a scale by means of a magnetic coupling.

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

Measuring system

Application range	Flow measurement of liquids, gases and vapors
Operating method / measuring principle	Variable area measuring principle
Measured value	
Primary measured value	Float position
Secondary measured value	Operating and standard volumetric flow

Measuring accuracy

Directive	VDI / VDE 3513, sheet 2 (q_G = 50%)
H250 /RR /HC /F	1.6%
H250/C (Ceramic, PTFE) H250H, H250U, H250 (100 : 1)	2.5%

Operating conditions

Temperature	
Max. operating temperature TS	-196..+300°C / -321...+572°F
Pressure	
Max. operating pressure PS	Depending on the version, up to 400 bar / 5802 psig ①
Max. test pressure PT	Pressure equipment directive 97/23/EC or AD 2000-HP30
Min. required operating pressure	2 times greater than pressure loss (see measuring ranges)
Protection category	
According to EN 60529 and NEMA250	IP 66/67, NEMA 4/4X/6
Float damping during gas measurement recommended:	
DN15...25 / ½"...1"	Operating pressure <0.3 bar / 4.4 psig
DN50...100 / 2"...4"	Operating pressure <0.2 bar / 2.9 psig

Installation conditions as per VDI/VDE 3513 Sheet 3

Inlet run	≥ 5 x DN
Outlet run	≥ 3 x DN

① higher operating pressures on request

Materials

Device	Flange / raised face	Measuring tube	Float	Float stop / guide	Ring orifice
H250 /RR Stainless Steel	CrNi steel 1.4404 massive ①	CrNi steel 1.4404 ①			-
H250/HC Hastelloy®	CrNi steel 1.4571 with plated Hastelloy® C4 (2.4610) ①	Hastelloy® C4 (2.4610)			-
H250/C Ceramic/PTFE	CrNi steel 1.4571 with TFM/PTFE liner ②		PTFE or Al_2O_3 with FFKM gasket	Al_2O_3 and PTFE	Al_2O_3
H250/F - Food	CrNi steel 1.4435				-

① CrNi steel 1.4571 on request, for clamp connection CrNi steel 1.4435
② TFM/PTFE liner (electrically non-conductive)

H250/C - DN100 / 4" only PTFE
H250/F: wetted surfaces Ra ≤0.8 µm, optional ≤0.6 µm

Other options:

- Special materials on request: e.g. SMO 254, titanium, 1.4435
- Float damping: ceramic or PEEK
- Gasket for devices with female thread as insert: O-ring FPM / FKM

Temperatures

For devices to be used in hazardous areas, special temperature ranges apply. These can be found in the separate instructions.

Temperatures H250/M40 - mechanical indicator without power supply

	Float	liner	Product temperature		Ambient temperature	
			[°C]	[°F]	[°C]	[°F]
H250/RR	Stainless Steel		-196...+300	-321...+572	-40...+120	-40...+248
H250/RR screw fitting			-196...+300	-321...+572	-20...+120	-4...+248
H250/HC	Hastelloy® C4		-196...+300	-321...+572	-40...+120	-40...+248
H250/C	PTFE	PTFE	-196...+70	-321...+158	-40...+70	-40...+158
H250/C	Ceramic	PTFE	-196...+150	-321...+302	-40...+70	-40...+158
H250/C	Ceramic	TFM / Ceramic	-196...+250	-321...+482	-40...+120	-40...+248
H250 H/U	Stainless Steel		-40...+100	-40...+212	-20...+90	-4...+194

Minimum ambient temperatures $T_{amb.}$ with electrical components

Version	[°C]	[°F]
ESK4, ESK4-FF, ESK4-PA	-40	-40
ESK4-T ①	-40	-40
Limit switch NAMUR	-40	-40
3-wire limit switch	-25	-13

① Decreasing display contrast out of the temperature range 0...60 °C / 32..140°F.

Temperatures H250/M40 - with electrical components [°C]

			Tamb. < +40 °C		Tamb. < +60 °C	
EN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	½", 1"	ESK4, ESK4-FF, ESK4-PA	+200	+300	+180	+300
		ESK4-T	+200	+300	+80	+130
		Limit switch NAMUR	+200	+300	+200	+300
		3-wire limit switch	+200	+300	+130	+295
DN50	2“	ESK4, ESK4-FF, ESK4-PA	+200	+300	+165	+300
		ESK4-T	+180	+300	+75	+100
		Limit switch NAMUR	+200	+300	+200	+300
		3-wire limit switch	+200	+300	+120	+195
DN80, DN100	3“, 4"	ESK4, ESK4-FF, ESK4-PA	+200	+300	+150	+250
		ESK4-T	+150	+270	+70	+85
		Limit switch NAMUR	+200	+300	+200	+300
		3-wire limit switch	+190	+300	+110	+160

Temperatures H250/M40 - with electrical components [°F]

			$T_{amb.}$ < +104°F		$T_{amb.}$ < +104°F ①	
EN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	½", 1"	ESK4, ESK4-FF, ESK4-PA	392	572	356	572
		ESK4-T	392	572	176	266
		Limit switch NAMUR	392	572	392	572
		3-wire limit switch	392	572	266	563
DN50	2“	ESK4, ESK4-FF, ESK4-PA	392	572	165	572
		ESK4-T	356	572	167	212
		Limit switch NAMUR	392	572	392	572
		3-wire limit switch	392	572	248	383
DN80, DN100	3“, 4"	ESK4, ESK4-FF, ESK4-PA	392	572	302	482
		ESK4-T	302	518	158	185
		Limit switch NAMUR	392	572	392	572
		3-wire limit switch	374	572	230	320

① if there are no heat insulation measures, a heat-resistant cable is necessary (continuous operating temperature of the cable to be used: +100°C)

Abbreviation

HT	High-temperature version
ESK4	Current output 2-wire 4...20 mA
ESK4-T	ESK4 Basic with LCD, binary status outputs, digital counter and pulse output.
ESK4-FF	FOUNDATION FIELDBUS interface (pending)
ESK4-PA	PROFIBUS PA interface (pending)

Cable glands

Cable gland	Material	Cable diameter	
M 20x1.5 Standard	PA	8...13 mm	0.315...0.512"
M20 x 1.5	Nickel-plated brass	10...14 mm	0.394...0.552"

Limit switch

Terminal connection	2.5 mm^2			
Limit switch	I7S23,5-N SC3,5-N0	SJ3,5-SN ①	SJ3,5-S1N ①	SB3,5-E2
NAMUR	yes	yes	yes	no
Connection type	2-wire	2-wire	2-wire	3-wire
Switching element function	NC contact	NC contact	NO contact	PNP NO contact
Nominal voltage U_0	8 VDC	8 VDC	8 VDC	10...30 VDC
Pointer vane not detected	≥ 3 mA	≥ 3 mA	≤ 1 mA	≤ 0.3 VDC
Pointer vane detected	≤ 1 mA	≤ 1 mA	≥ 3 mA	U_B - 3 VDC
Continuous current	-	-	-	max. 100 mA
No load current I_0	-	-	-	≤ 15 mA

① safety oriented

Current output ESK4

Terminal connection	2.5 mm^2
Power supply	14...30 VDC
Min. power supply for HART®	20 V DC, load ≤ 250 Ohm
Measuring signal	4.00...20.00 mA = 0...100% flow value in 2-wire technology
Power supply influence	<0.1%
Dependence on external resistance	<0.1%
Temperature influence	<5 µA / K
Max. external resistance / load	650 Ohm (30 VDC)
Min. load for HART®	250 Ohm
ESK4 HART® configuration	
Manufacturer name (code)	KROHNE Messtechnik (69 = 45h)
Model name	ESK4 (214 = 0xD6)
HART® protocol revision	5.9
Device revision	1
Physical layer	FSK
Device category	Transmitter without galvanic isolation

ESK4 process variable

	Values [%] from full-scale range	Signal output [mA]
Over range	+102.5 (±1%)	20,24...20.56
Device error identification	> 106.25	>21.00
Max. current consumption	131.25	25
Multi-drop operation		4.5

ESK4-FF in preparation
ESK4-PA in preparation

ESK4-T with LCD, binary inputs and outputs and digital counter

Binary output

Two binary outputs	Galvanically isolated	
Mode	Switch output	NAMUR or open collector
Configurable as	Switch contact or Pulse output	Opener/NO contact or max. 10 pulses / s
NAMUR switch output		
Power supply	8 VDC	
Signal current	> 3 mA switching value not reached;	< 1 mA switching value reached
Switch output, open collector		
Power supply	5...30 VDC	
P_{max}	500 mW	
Continuous current	max. 100 mA	
No load current I_0	≤ 1 mA	

Pulse output

T_{on}	configurable from 50...500 ms
T_{off}	depending on flow rate
Pulse value	configurable in flow units e.g. 5 pulses / m^3

Reset input

Binary input	Galvanically isolated
Mode	Reset counter
Configurable as	active Hi / active Lo
Voltage level	5...30 VDC
Current consumption	≤ 1 mA
T_{on} (active)	≥500 ms

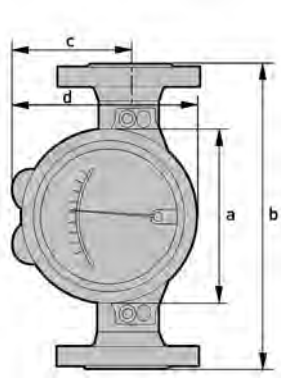
Approvals (pending)

Standard	Display	Marking
ATEX / IECEx	M40 mechanical	II2GD IIC II3GD IIC
	M40 electrical	II2G Ex ia IIC T6, II3G Ex nA IIC T6 II2D tD IIC T6, II3D IP66 T65°C
FM FM-C	M40	IS/I/1/ABCD;T6 NI/I/2/ABCD;T6 IS/I, II, III/1/A-G NI/II/2/ABCD XP/I/1/ABCD;T6 DIP/II,III/1/EFG/T6
Nepsi	M40	Ex ia IIC T1-T6 Ex nA II T1-T6 Ex d IIC T1...T6

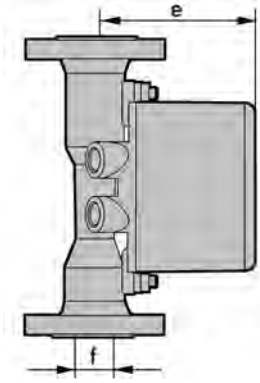
2.2 Dimensions and weights

Dimensions H250/M40

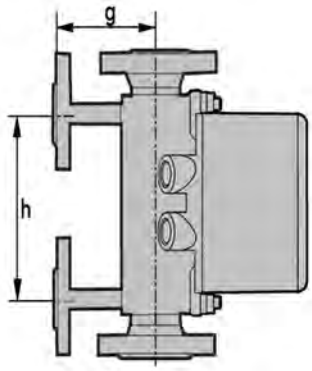
Front view



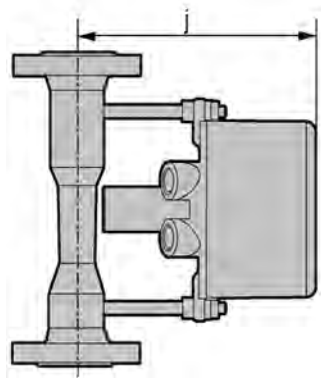
Side view



with heating



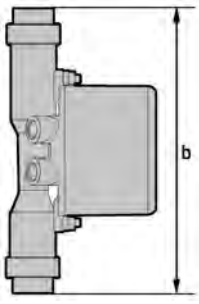
High-temperature



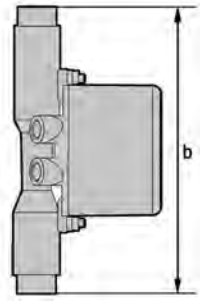
	a		b		d		h	
	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
All nominal sizes	138	5.44	250	9.85	160	6.30	150	5.91
ISO 228			300	11.82				
H250/C - 3"/300 lbs			300	11.82				

EN	ASME	c		e		Ø f		g		j	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
DN15	½"	94	3.70	114	4.49	20	0.79	100	3.94	197	7.76
DN25	1"	94	3.70	125	4.92	32	1.26	106	4.18	208	8.19
DN50	2"	107	4.22	139	5.48	65	2.56	120	4.73	222	8.75
DN80	3"	107	4.22	155	6.11	89	3.51	145	5.71	238	9.38
DN100	4"	107	4.22	164	6.46	114	4.49	150	5.91	247	9.73

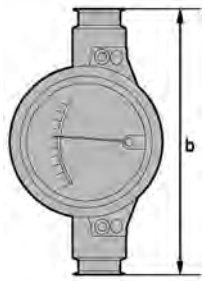
ISO 228
female thread
screwed



ISO 228
female thread
welded

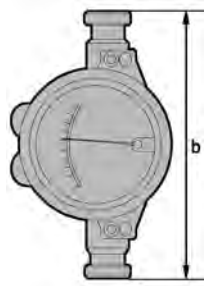


H250/F
Clamp connection



①

H250/F
Screw connection
DIN 11851



① Stainless steel 1.4435 - EHEDG tested - wetted surfaces Ra ≤ 0.8 / 0.6 µm

Weights

		H250		with heating			
Nominal size		EN 1092-1		Flange connection		Ermeto connection	
EN	ASME	[kg]	[lbs]	[kg]	[lbs]	[kg]	[lbs]
DN15	½"	3.5	7.7	5.6	12.6	3.9	8.6
DN25	1"	5	11	7.5	16.5	5.8	12.8
DN50	2"	8.2	18.1	11.2	24.7	9.5	21
DN80	3"	12.2	26.9	14.8	32.6	13.1	28.9
DN100	4"	14	30.9	17.4	38.4	15.7	34.6

		H250/C [Ceramic / PTFE]						Screw connect.	
Nominal size		EN 1092-1		ASME 150 lbs		ASME 300 lbs		DIN 11864-1	
EN	ASME	[kg]	[lbs]	[kg]	[lbs]	[kg]	[lbs]	[kg]	[lbs]
DN15	½"	3.5	7.7	3.2	7.1	3.5	7.7	2	4.4
DN25	1"	5	11	5.2	11.5	6.8	15	3.5	7.7
DN50	2"	10	22.1	10	22.1	11	24.3	5	11
DN80	3"	13	28.7	13	28.7	15	33.1	7.6	16.8
DN100	4"	15	33.1	16	35.3	17	37.5	10.3	22.7

Process connections

	Standards	Conn. dim.	Pressure rating
Flanges (H250/RR /HC /C)	EN 1092-1	DN15...150	PN16...250
	ASME B16.5	½...6"	150...2500 lbs
	JIS B 2220	15...100	10...20K
Clamp connections (H250/RR /F)	DIN 32676	DN15...100	10...16 bar
	ISO 2852	Size 25...139.7	10...16 bar
Screw connections (H250/RR /HC /F)	DIN 11851	DN15...100	25...40 bar
	SMS 1146	1...4"	6 bar / 88.2 psig
Female thread welded (H250/RR /HC)	ISO 228	G½...G2"	≥ 50 bar / 735 psig
	ASME B1.20.1	½...2" NPT	
Female thread (H250/RR /HC) with insert, FPM gasket and union nut	ISO 228	G½...2"	≤ 50 bar / 735 psig
	ASME B1.20.1	½...2" NPT	
Thread connection aseptic (H250/F)	DIN 11864 - 1	DN15...50	PN40
		DN80...100	PN 16
Flange aseptic (H250/F)	DIN 11864 - 2	DN15...50	PN40
		DN80...DN100	PN 16
Meters (H250/RR /HC) with heating:			
Heating with flange connection	EN 1092-1	DN15	PN40
	ASME B16.5	½"	150 lbs / RF
Heating pipe connection for Ermeto	-	E12	PN40

Higher pressure ratings and other connections on request

Bolts and tightening torques

For measuring devices with PTFE liner or ceramic liner and PTFE raised face, tighten the flange threads with the following torques:

Nominal sizes EN

Nominal size	Bolts	Tightening torques	
acc. to EN 1092-1	Quantity x size	[Nm]	[lb-ft]
DN15 PN40 ①	4 x M 12	9.8	7.1
DN25 PN40 ②	4 x M 12	21	15
DN50 PN40 ②	4x M16	57	41
DN80 PN16 ②	8x M16	47	34
DN100 PN16 ②	8x M16	67	48

① standard connections; other connection on request
② standard connections; other connections on request

Nominal size ASME

Nominal size	Bolts (Quantity x size)		Tightening torques	
acc. to ASME B 16.5	150 lbs	300 lbs	[Nm]	[lb-ft]
½" 150 lbs / 300 lbs ①	4x ½"	4x ½"	5.2	3.8
1" 150 lbs / 300 lbs ①	4x ½"	4x 5/8"	10	7.2
2" 150 lbs / 300 lbs ①	4x 5/8"	8x 5/8"	41	30
3" 150 lbs / 300 lbs ①	4x 5/8"	8x ¾"	70	51
4" 150 lbs / 300 lbs ①	8x 5/8"	8x ¾"	50	36

① standard connections; other connections on request

Low pressure resistance (vacuum) H250/C

Max. process temperature ▸			+70°C (+158°F)		+150°C (*302°F)		+250°C (+482°F)	
			Min. operating pressure					
Nominal size	float	lining	[mbar abs.]	[psia]	[mbar abs.]	[psia]	[mbar abs.]	[psia]
DN15...DN100	PTFE	PTFE	100	1,45	-	-	-	-
DN15...DN80	ceramic	PTFE	100	1,45	250	3,63	-	-
DN15...DN80	ceramic	TFM / ceramic	100	1,45	100	1,45	100	1,45

2.3 Measuring ranges

H250/RR - Stainless Steel, H250/HC - Hastelloy®
Measuring span 10 : 1; flow values 100%

		Water			Air			Max. pressure loss			
Float ▸		TIV	CIV	DIV	TIV Alu	TIV	DIV	TIV Alu	TIV	CIV	DIV
Nominal size	Cone	[l/h]			[m^3/h]			[mbar]			
DN15, ½"	K 15.1	18	25	-	0.42	0.7	-	12	21	26	-
	K 15.2	30	40	-	0.7	1	-	12	21	26	-
	K 15.3	55	63	-	1	1.5	-	12	21	26	-
	K 15.4	80	100	-	1.7	2.2	-	12	21	26	-
	K 15.5	120	160	-	2.5	3.6	-	12	21	26	-
	K 15.6	200	250	-	4.2	5.5	-	12	21	26	-
	K 15.7	350	400	700	6.7	10	18 ①	12	21	28	38
	K 15.8	500	630	1000	10	14	28 ①	13	22	32	50
	K 15.8	-	-	1600 ②	-	-	50 ②	-	-	-	85
DN25, 1"	K 25.1	480	630	1000	9.5	14	-	11	24	32	72
	K 25.2	820	1000	1600	15	23	-	11	24	33	74
	K 25.3	1200	1600	2500	22	35	-	11	25	34	75
	K 25.4	1700	2500	4000	37	50	110 ①	12	26	38	78
	K 25.5	3200	4000	6300	62	95	180 ①	13	30	45	103 ③
DN50, 2"	K 55.1	2700	6300	8400	58	80	230 ①	8	13	74	60
	K 55.2	3600	10000	14000	77	110	350 ①	8	13	77	69
	K 55.3	5100	16000	25000	110	150	700 ①	9	13	84	104
DN80, 3"	K 85.1	12000	25000	37000	245	350	1000 ①	8	16	68	95
	K 85.2	16000	40000	64000	280	400	1800 ①	9	16	89	125
DN100, 4"	K105.1	19000	63000	100 000	-	550	2800 ①	-	-	120	220

① P >0.5 bar
② with TR float
③ 300 mbar with damping (gas measurement)

Reference condition:
Water 20°C
Air 20°C - 1.013 bar abs.

Remarks:

- Air measurement - TIV float: heating not possible.
- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion of other media or operating data is performed using the calculation method in accordance with VDI /VDE Directive 3513.

H250/RR - Stainless Steel, H250/HC - Hastelloy®

Measuring span 10 : 1; flow values 100%

		Water			Air			Max. pressure loss			
Float ▸		TIV	CIV	DIV	TIV Alu	TIV	DIV	TIV Alu	TIV	CIV	DIV
Nominal size	Cone	[gph]			[scfm]			[psig]			
DN15, ½"	K 15.1	4.76	6.60	-	0.26	0.43	-	0.18	0.31	0.38	-
	K 15.2	7.93	10.6	-	0.43	0.62	-	0.18	0.31	0.38	-
	K 15.3	14.5	16.6	-	0.62	0.93	-	0.18	0.31	0.38	-
	K 15.4	21.1	26.4	-	1.05	1.36	-	0.18	0.31	0.38	-
	K 15.5	31.7	42.3	-	1.55	2.23	-	0.18	0.31	0.38	-
	K 15.6	52.8	66.0	-	2.60	3.41	-	0.18	0.31	0.38	-
	K 15.7	92.5	106	185	4.15	6.20	11.2 ①	0.18	0.31	0.41	0.56
	K 15.8	132	166	264	6.20	8.68	17.4 ①	0.19	0.32	0.47	0.74
	K 15.8	-	-	423 ②	-	-	31.0 ②	-	-	-	1.25
DN25, 1"	K 25.1	127	166	264	5.89	8.68	-	0.16	0.35	0.47	1.06
	K 25.2	217	264	423	9.30	14.3	-	0.16	0.35	0.49	1.09
	K 25.3	317	423	660	13.6	21.7	-	0.16	0.37	0.50	1.10
	K 25.4	449	660	1057	22.9	31.0	68.2 ①	0.18	0.38	0.56	1.15
	K 25.5	845	1057	1664	38.4	58.9	111 ①	0.19	0.44	0.66	1.51 ③
DN50, 2"	K 55.1	713	1664	2219	36.0	49.6	143 ①	0.12	0.19	1.09	0.88
	K 55.2	951	2642	3698	47.7	68.2	217 ①	0.12	0.19	1.13	1.01
	K 55.3	1347	4227	6604	68.2	93.0	434 ①	0.13	0.19	1.23	1.53
DN80, 3"	K 85.1	3170	6604	9774	152	217	620 ①	0.12	0.24	1.00	1.40
	K 85.2	4227	10567	16907	174	248	1116 ①	0.13	0.24	1.31	1.84
DN100, 4"	K105.1	5019	16643	26418	-	341	1736 ①	-		1.76	3.23

① P >7.4 psig
② with TR float
③ 4.4 psig with damping (gas measurement)

Reference condition:
Water 68°F
Air 68°F - 14.7 psi

Remarks:

- Air measurement - TIV float: heating not possible.
- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion of other media or operating data is performed using the calculation method in accordance with VDI /VDE Directive 3513.

H250/C - Ceramic/PTFE

Measuring span 10 : 1; flow values 100%

		Flow rate			Max. pressure loss		
		Water		Air	Water		Air
Liner / Float ▸		PTFE	Ceramic	Ceramic	PTFE	Ceramic	Ceramic
Nominal size	Cone	[l/h]		[m^3/h]	[mbar]		
DN15, ½"	E 17.2	25	30	-	65	62	62
	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	68	68	68
	E 17.6	160	200	6.5	72	70	70
	E 17.7	250	250	9	86	72	72
	E 17.8	400	-	-	111	-	-
DN25, 1"	E 27.1	630	500	18	70	55	55
	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	4000 ①	2500	75	290	100	100
DN50, 2"	E 57.1	4000	4500	140	81	70	70
	E 57.2	6300	6300	200	110	80	80
	E 57.3	10000	11000	350	170	110	110
	E 57.4	16000 ①	-	-	284	-	-
DN80, 3"	E 87.1	16000	16000	-	81	70	-
	E 87.2	25000	25000	-	95	85	-
	E 87.3	40000 ①	-	-	243	-	-
DN100, 4"	E 107.1	40000	-	-	100	-	-
	E 107.2	60000 ①	-	-	225	-	-

① special float

Reference condition:
Water 20°C
Air 20°C - 1.013 bar abs.

Remarks:

- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion of other media or operating data is performed using the calculation method in accordance with VDI /VDE Directive 3513.

H250/C - Ceramic/PTFE

Measuring span 10 : 1; flow values 100%

		Flow rate			Max. pressure loss		
		Water		Air	Water		Air
Liner / Float ▸		PTFE	Ceramic	Ceramic	PTFE	Ceramic	Ceramic
Nominal size	Cone	[gph]		[scfm]	[psig]		
DN15, ½"	E 17.2	6.60	7.93	-	0.96	0.91	0.91
	E 17.3	10.6	13.2	1.12	0.97	0.94	0.94
	E 17.4	16.6	18.5	1.49	0.97	0.97	0.97
	E 17.5	26.4	34.3	2.48	1.00	1.00	1.00
	E 17.6	42.3	52.8	4.03	1.06	1.03	1.03
	E 17.7	66.0	66.0	5.58	1.26	1.06	1.06
	E 17.8	106	-	-	1.63	-	-
DN25, 1"	E 27.1	166	132	11.2	1.03	0.81	0.81
	E 27.2	264	185	13.6	1.18	0.88	0.88
	E 27.3	423	291	18.6	1.59	1.03	1.03
	E 27.4	660	423	31.0	2.32	1.21	1.21
	E 27.5	1056 ①	660	46.5	4.26	1.47	1.47
DN50, 2"	E 57.1	1057	1189	86.8	1.19	1.03	1.03
	E 57.2	1664	1664	124	1.62	1.18	1.18
	E 57.3	2642	2906	217	2.50	1.62	1.62
	E 57.4	4226 ①	-	-	4.17	-	-
DN80, 3"	E 87.1	4227	4227	-	1.19	1.03	-
	E 87.2	6604	6604	-	1.40	1.25	-
	E 87.3	10567 ①	-	-	3.57	-	-
DN100, 4"	E 107.1	10567	-	-	1.47	-	-
	E 107.2	15850 ①	-	-	3.31	-	-

① special float

Reference condition:
Water 68°F
Air 68°F - 14.7 psi

Remarks:

- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion of other media or operating data is performed using the calculation method in accordance with VDI /VDE Directive 3513.

H250H - Horizontal installation position

Measuring span 10 : 1; flow values 100%

EN	ASME	Cone	Flow rate Water [l/h]	Flow rate Air [Nm^3/h]	Pressure loss [mbar]
DN15	½	K 15.1	70	1.8	195
		K 15.2	120	3	204
		K 15.3	180	4.5	195
		K 15.4	280	7.5	225
		K 15.5	450	12	250
		K 15.6	700	18	325
		K 15.7	1200	30	590
		K 15.8	1600	40	950
		K 15.8	2400	60	1600
DN25	1"	K 25.1	1300	35	122
		K 25.2	2000	50	105
		K 25.3	3000	80	116
		K 25.4	5000	130	145
		K 25.5	8500	220	217
		K 25.5	10000	260	336
DN50	2"	K 55.1	10000	260	240
		K 55.2	16000	420	230
		K 55.3	22000	580	220
		K 55.3	34000	900	420
DN80	3"	K 85.1	25000	650	130
		K 85.2	35000	950	130
		K 85.2	60000	1600	290
DN100	4"	K 105.1	80000	2200	250
		K 105.1	120000	3200	340

Reference condition:
Water 20°C
Air 20°C - 1.013 bar abs.

Remarks:

- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion to other media or operating data in accordance with VDE /VDI Directive 3513

H250H - Horizontal installation position

Measuring span 10 : 1; flow values 100%

EN	ASME	Cone	Flow rate Water [gph]	Flow rate Air [scfm]	Pressure loss [psig]
DN15	1/2"	K 15.1	18.5	1.12	2.87
		K 15.2	31.7	1.86	3.00
		K 15.3	47.6	2.79	2.87
		K 15.4	74.0	4.65	3.31
		K 15.5	119	7.44	3.68
		K 15.6	185	11.2	4.78
		K 15.7	317	18.6	8.68
		K 15.8	423	24.8	14.0
		K 15.8	634	37.2	23.5
DN25	1"	K 25.1	343	21.7	1.79
		K 25.2	528	31.0	1.54
		K 25.3	793	49.6	1.71
		K 25.4	1321	80.6	2.13
		K 25.5	2245	136	3.19
		K 25.5	2642	161	4.94
DN50	2"	K 55.1	2642	161	3.53
		K 55.2	4227	260	3.38
		K 55.3	5812	360	3.23
		K 55.3	8982	558	6.17
DN80	3"	K 85.1	6604	403	1.91
		K 85.2	9246	589	1.91
		K 85.2	15851	992	4.26
DN100	4"	K 105.1	21134	1364	3.68
		K 105.1	31701	1984	5.00

Reference condition:
Water 68°F
Air 68°F - 14.7 psi

Remarks:

- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion to other media or operating data in accordance with VDE /VDI Directive 3513

H250U - Vertical installation position

Flow direction from top to bottom

Measuring span 10 : 1; flow values 100%

EN	ASME	Cone	Flow rate Water [l/h]	Flow rate Air [Nm^3/h]	Pressure loss [mbar]
DN15	½"	K 15.1	65	1.6	175
		K 15.2	110	2.5	178
		K 15.3	170	4	180
		K 15.4	260	6	200
		K 15.5	420	10	220
		K 15.6	650	16	290
		K 15.7	1100	28	520
		K 15.8	1500	40	840
DN25	1"	K 25.1	1150	30	97
		K 25.2	1800	45	85
		K 25.3	2700	70	92
		K 25.4	4500	120	115
		K 25.5	7600	200	172
DN50	2"	K 55.1	9000	240	220
		K 55.2	15000	400	230
		K 55.3	21000	550	240

Reference condition:
Water 20°C
Air 20°C - 1.013 bar abs.

Remarks:

- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion to other media or operating data in accordance with VDE /VDI Directive 3513

H250U - Vertical installation position

Flow direction from top to bottom

Measuring span 10 : 1; flow values 100%

EN	ASME	Cone	Flow rate Water [gph]	Flow rate Air [scfm]	Pressure loss [psig]
DN15	½"	K 15.1	17.2	0.99	2.57
		K 15.2	29.1	1.55	2.62
		K 15.3	44.9	2.48	2.65
		K 15.4	68.7	3.72	2.94
		K 15.5	111	6.20	3.23
		K 15.6	172	9.92	4.26
		K 15.7	291	17.4	7.64
		K 15.8	396	24.8	12.3
DN25	1"	K 25.1	304	18.6	1.42
		K 25.2	476	27.9	1.25
		K 25.3	713	43.4	1.35
		K 25.4	1189	74.4	1.69
		K 25.5	2008	124	2.53
DN50	2"	K 55.1	2378	149	3.23
		K 55.2	3963	248	3.38
		K 55.3	5548	341	3.53

Reference condition:
Water 68°F
Air 68°F - 14.7 psi

Remarks:

- The indicated pressure losses are valid for water and air at maximum flow rate.
- Other flow ranges on request.
- Conversion to other media or operating data in accordance with VDE /VDI Directive 3513

3.1 Intended use

The variable area flowmeters are suitable for measuring gases, vapours and liquids.

The devices are particularly suitable for the measurement of:

- Water
- Hydrocarbons
- Corrosion protection agents and lubricants
- Chemicals and additives
- Solvents
- Superheated steam
- Food, beverages and tobacco
- Air
- Industrial gases

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

Responsibility for the use of the measurement devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.
Do not use any abrasive media containing solid particles or highly viscous media.

3.2 Installation conditions

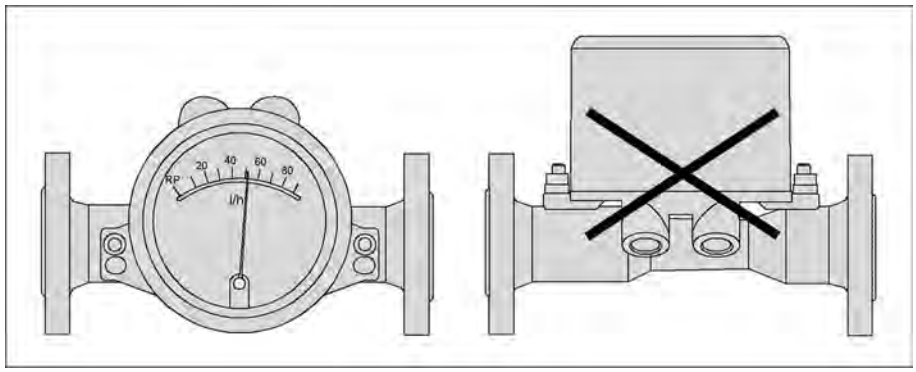
When installing the device in the piping, the following points must be observed:

- *The variable area flowmeter must be installed vertically (measuring principle). Flow direction from bottom to top. For installation recommendations please refer also to VDI/VDE 3513 Sheet 3.*

  H250Hs are installed horizontally and H250U devices are installed vertically with the flow direction from top to bottom.
- *A straight unimpeded inlet run of ≥ 5x DN upstream of the device and a straight outlet run of ≥ 3x DN downstream of the device are recommended.*
- *Screws, bolts and gaskets are to be provided by the customer and must be selected in accordance with the pressure rating of the connection or the operating pressure.*
- *The inside diameter of the flange deviates from the standard dimensions. Flange seal standard DIN 2690 can be applied without any limitation.*
- *Align the gaskets. Tighten the nuts with the tightening torques of the appropriate pressure rating.*

  For devices with PTFE liner or ceramic liner and PTFE raised faces, see chapter "Tightening torques".
- *Control devices are to be positioned downstream of the measuring device.*
- *Shutoff devices are preferably to be positioned upstream of the measuring device.*
- *Before connecting, blow or flush out the pipes leading to the device.*
- *Pipes for gas flow need to be dried before the device is installed.*
- *Use connectors suitable for the particular device version.*
- *Align the pipes centrically with the connection bores on the measuring device so they are free of stresses.*
- *If necessary, the piping has to be supported to reduce the vibrations transmitted to the measuring device.*
- *Do not lay signal cables directly next to cables for the power supply.*

Take special note of the installation position for the H250H with horizontal flow direction:



In order to comply with thermal parameters and measuring accuracy, H250H flowmeters for horizontal installation are to be installed in the pipeline so that the display is located on the side of the measuring tube. The maximum medium and ambient temperatures indicated as well as the measuring accuracy are based on lateral installation of the display.

3.2.1 Tightening torques

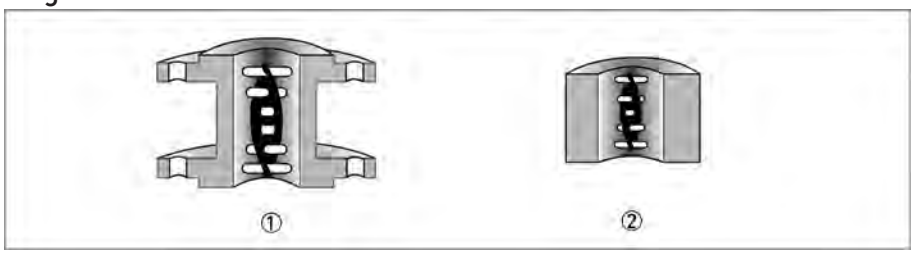
For measuring devices with PTFE liner or ceramic liner and PTFE raised face, tighten the flange threads with the following torques:

Nominal size acc. to				Bolts			Max. torque			
EN 1092-1		ASME B16.5		EN 1092-1	ASME		EN 1092-1		ASME 150 lbs	
DN	PN	Inches	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

3.2.2 Magnetic filters

The use of magnetic filters is recommended when the medium contains particles which can be influenced magnetically. The magnetic filter is to be installed in the flow direction upstream of the flowmeter. Bar magnets are positioned helically in the filter to provide optimal efficiency at low pressure loss. All of the magnets are coated individually with PTFE to protect against corrosion. Material: 1.4571

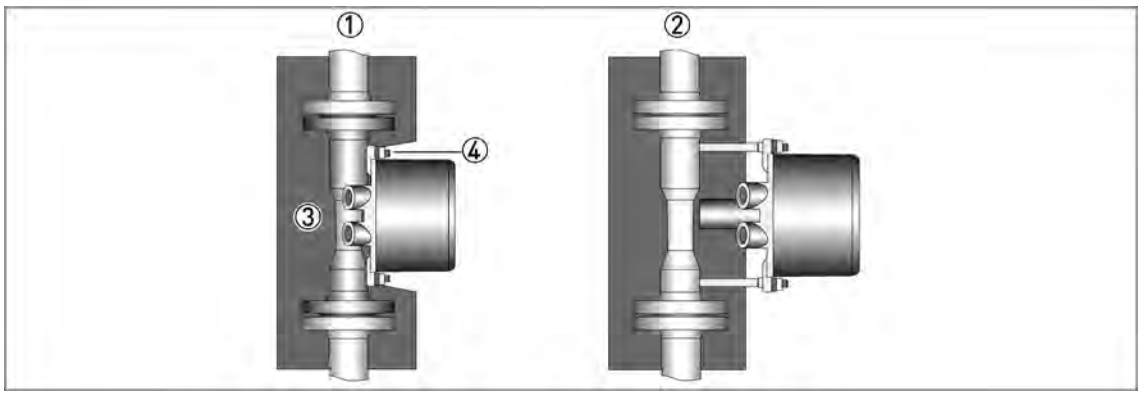
Magnetic filters



① Type F - fitting part with flange - overall length 100 mm
② Type FS - fitting part without flange - overall length 50 mm

3.2.3 Heat insulation

The indicator housing may not be heat-insulated.
The heat insulation ③ may only reach as far as the housing fastening ④.



① Standard indicator M40
② Indicator with HT extension

The heat insulation ① may only reach to the rear of the housing ②. The area of the cable entries ③ must be freely accessible.

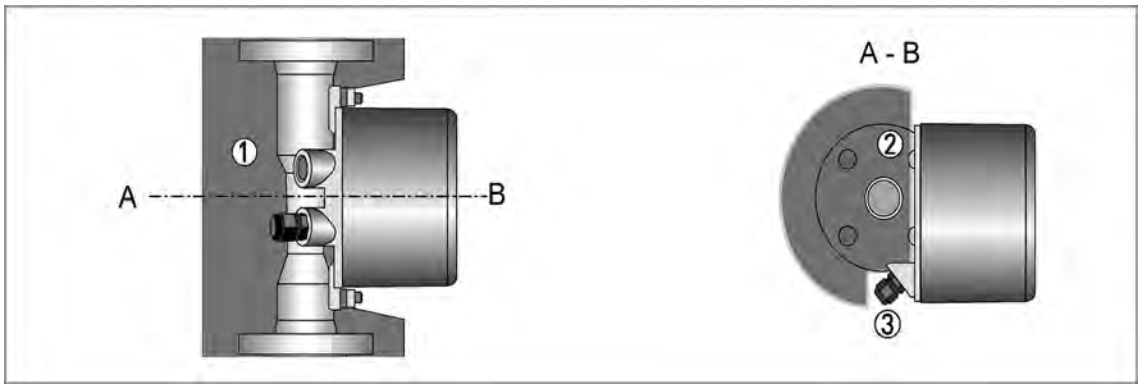


Figure 3-1: Insulation - cross section

3.2.4 Float damping

Float damping is characterised by high standstill times and self-centering. The damping sleeve is made of high performance ceramic or PEEK, depending on the medium and the application. Float damping can also be retrofitted for the user (see Service).

Use of damping

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

Nominal size according to		Operating primary pressure	
EN 1092-1	ASME B16.5	[bar]	[psig]
DN15	½"	≤0.3	≤4.4
DN25	1"	≤0.3	≤4.4
DN50	2"	≤0.2	≤2.9
DN80	3"	≤0.2	≤2.9
DN100	4"	≤0.2	≤2.9

3.2.5 Pointer damping

The pointer system with its magnetic system basically contains pointer damping. An additional eddy current brake is advantageous for fluctuating or pulsing flows. The eddy current brake magnets surround the pointer vane without touching it, damping its movement. The result is a pointer position that is considerably calmer, and there is no distortion of the measured value. A clamp screw holds it in place securely. The eddy current brake can be retrofitted without having to recalibrate and while in operation (see Service).

4.1 Safety instructions

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Observe the national regulations for electrical installations!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

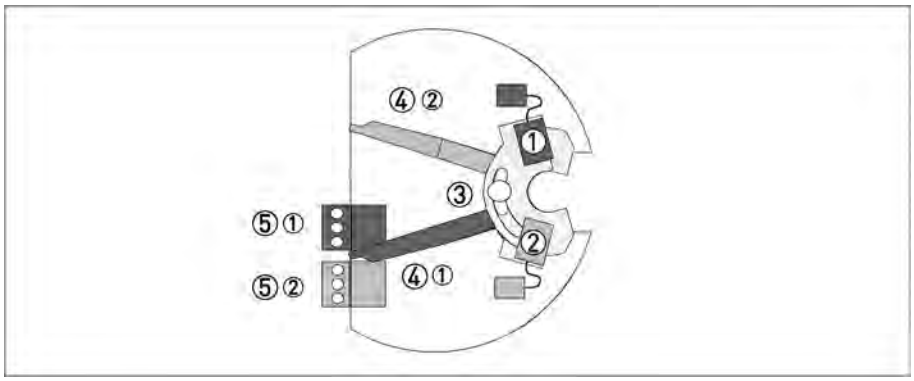
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Electrical connection indicator M40

4.2.1 Indicator M40 - limit switches

The M40 indicator can be equipped with a maximum of two electronic limit switches. The limit switch functions as a slot sensor which is operated inductively through the semicircular metal vane belonging to the measuring pointer. The switching points are set using the contact pointers. The position of the contact pointer is indicated on the scale.

Limit switch module



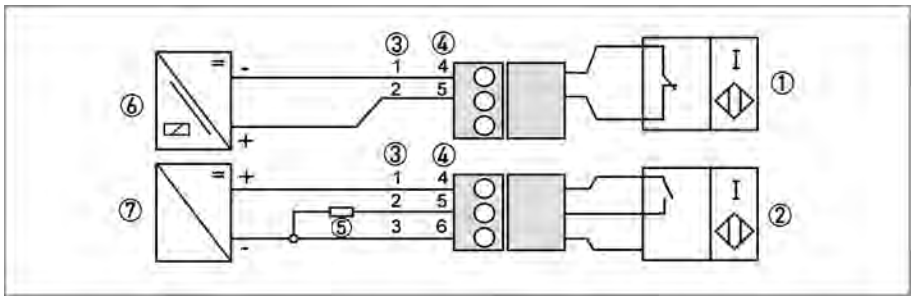
① Min. contact
② Max. contact
③ Locking screw
④ Maximum pointer
⑤ Connection terminal

The connecting terminals have a pluggable design and can be removed in order to connect the cables. The built-in limit switch types are shown on the indicator.

Electrical connection of the limit switches

Contact	MIN			MAX		
Terminal no.	1	2	3	4	5	6
Connection 2-wire NAMUR	-	+		-	+	
Connection 3-wire	+	DC	-	+	DC	-

Limit switch connection terminals



① 2-wire limit switch NAMUR
② 3-wire limit switch
③ Terminal connection min contact
④ Terminal connection max contact
⑤ 3-wire load
⑥ NAMUR isolated switching amplifier
⑦ 3-wire power supply

Limit setting

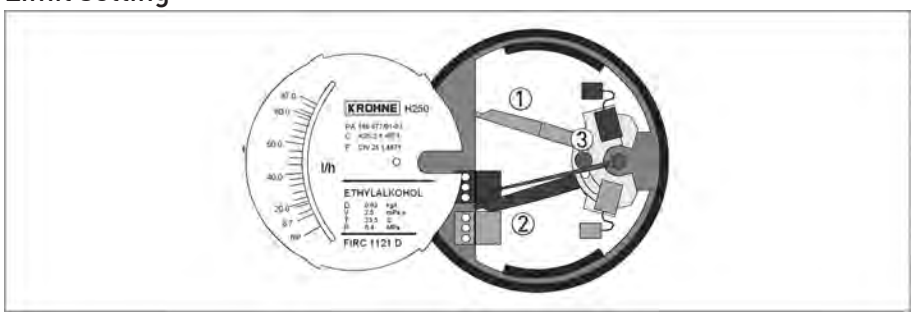


Figure 4-1: Limit switch settings

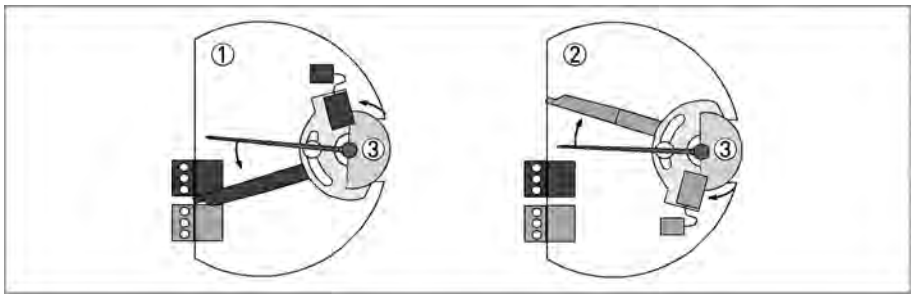
① Contact pointer MAX
② Contact pointer MIN
③ Locking screw

Setting is carried out directly via contact pointers ① and ②:

- Slide the scale away
- Loosen the locking screw ③ slightly
- Slide the scale back to the latching point
- Set contact pointers ① and ② to the desired switching point

After setting has been carried out: Fix the contact pointers with the locking screw ③.

Switch contact definition

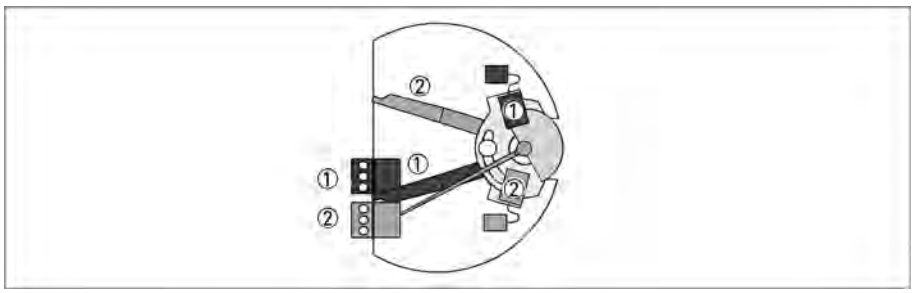


① MIN contact
② MAX contact
③ Pointer vane with switching vane

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

The 3-wire limit switch does not have any wire break detection.

Definition MinMin - MaxMax



① MIN 2 contact or MAX 1 contact
② MIN 1 contact or MAX 2 contact

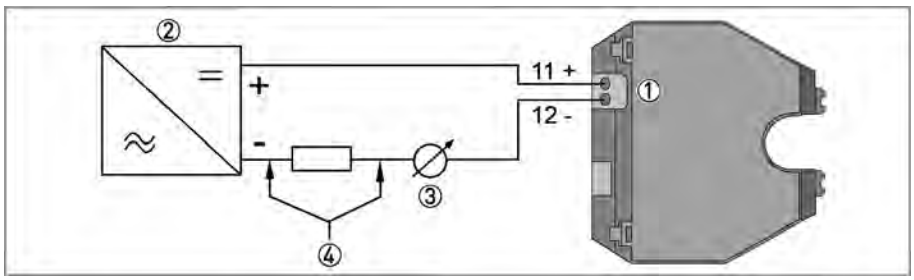
Current consumption in the position shown:

Contact	Type	Current
MIN 1	NAMUR	≤ 1 mA
MIN 2	NAMUR	≤ 1 mA
MAX 1	NAMUR	≥ 3 mA
MAX 2	NAMUR	≥ 3 mA

4.2.2 Current output ESK4A

The connecting terminals of the ESK4 have a pluggable design and can be removed in order to connect the cables.

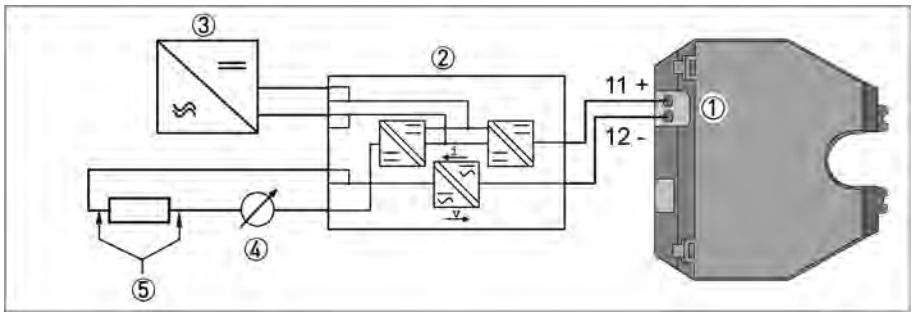
ESK4 connection



① ESK4A current output
② Power supply 14...30 VDC
③ Measuring signal 4...20 mA
④ External load, HART® communication

Power supply M40 with electrical isolation

The circuitry for connection to other devices such as digital evaluator units or process control equipment must be designed with special care. In some circumstances, internal connections in these devices (e.g. GND with PE, ground loops) may lead to impermissible voltage potentials, which can compromise the function of the device itself or a connected device. In such cases a protected extra-low voltage (PELV) is recommended.



① Terminal connection
② Converter supply isolator with electrical isolation
③ Power supply (see supply isolator information)
④ Measuring signal 4...20 mA
⑤ External load, HART® communication

Power supply

The supply voltage must be between 14 VDC and 30 VDC. This is based on the total resistance of the measuring loop. To determine this, add up the resistances of each component in the measuring loop (not including the device).

The required supply voltage can be calculated using the formula below:

$U_{ext.} = R_L \cdot 24\ mA + 14\ V$

where
$U_{ext.}$ = the minimum supply voltage and
R_L = the total measuring loop resistance.

The power supply has to be able to supply a minimum of 30 mA.

HART® communication

When HART® communication is carried out with the ESK4, the analogue measured data transmission (4...20 mA) is not impaired in any way.

Exception for multidrop mode. In multidrop mode, a maximum of 15 devices with HART® function can be operated in parallel, whereby their current outputs are switched inactive (I approx. 4.5 mA per device).

Load for HART® communication

For HART® communication a load of at least 230 ohm is required.

The maximum load resistance is calculated as follows:

$$R_L = \frac{U_{ext.} - 14V}{24\,mA}$$

Use a twisted two-core cable to prevent electrical interference from impeding the DC output signal.
In some cases a shielded cable may be necessary. The cable shield may only be earthed (grounded) at one place (on the power supply unit).

Configuration

The ESK can be configured via HART® communication. DD (Device Descriptions) for AMS 10.1 and PDM 5.4 - PACTware™ version 3.6.0.2 as well as a DTM (Device Type Manager) are available for configuration. They can be downloaded free of charge from our website.

The current flow rate can be transmitted using the integrated HART® communication. A flow counter can be configured. Two limit values can be monitored. The limit values are assigned either to flow values or to the counter overflow.

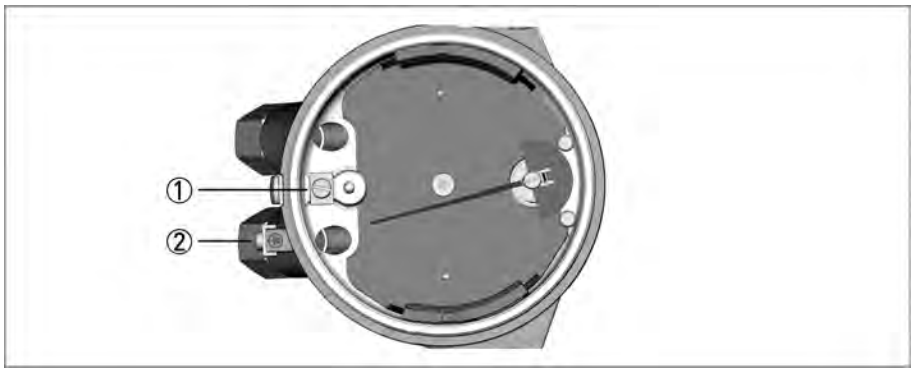
Self monitoring - Diagnostics

During both start-up and operation, a wide variety of diagnostic functions are performed cyclically in the ESK4, in order to guarantee function reliability. When an error is detected, a failure signal (high) is activated (current> 21 mA, typically 22 mA). In addition, more detailed information can be requested via HART® (CMD#48). The failure signal is not activated for information and warnings.

Diagnostic functions (Monitoring):

- Plausibility of FRAM data
- Plausibility of ROM data
- Working range of internal reference voltages
- Signal detection of the measuring range of the internal sensors
- Temperature compensation of the internal sensors
- Calibration based on the application
- Plausibility of counting value
- Plausibility of physical unit, system and selected unit

4.3 Grounding connections



① Grounding connection in the indicator
② External grounding connection

The grounding wire may not transfer any interference voltage.
Do not use this grounding wire to ground any other electrical devices.

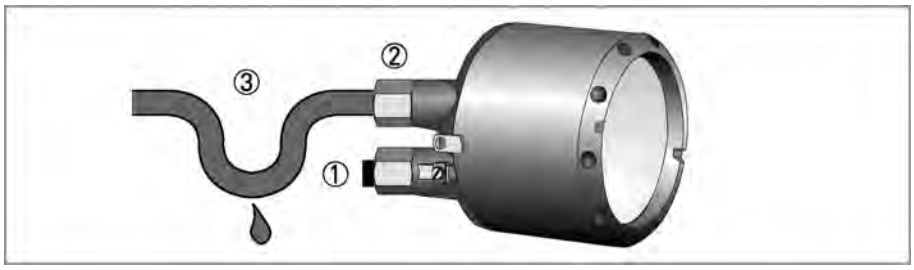
4.4 Protection category

The measuring device meets all requirements of protection category IP66/67.

After all servicing and maintenance work on the measuring device, the specified protection category must be ensured again.

Therefore it is essential to observe the following points:

- Use only original gaskets. They must be clean and free of any damage. Defective gaskets must be replaced.
- The electrical cables used must be undamaged and must comply with regulations.
- The cables must be laid with a loop ③ upstream of the measuring device to prevent water from getting into the housing.
- The cable feedthroughs ② must be tightened.
- Close the unused cable feedthroughs using blanking plugs ①.



① Use blanking plugs if no cable is routed through
② Tighten cable feedthrough firmly
③ Lay the cable in a loop

You can help us to assist you as quickly as possible by giving us a few items of information.

Then please fax this page to the appropriate sales associate. We will then contact you as soon as possible.

Device data

Connection type:				
Nominal connection size:				
Pressure rating:				
Raised face:				
Material of pipeline:				
Indicator options:	☐ K1 ① ☐ K2 ② ☐ ESK4 ☐ ESK4-T ☐ ESK4-FF* ☐ ESK4-PA*			
Approvals* :	☐ None	☐ ATEX / IEC-Ex	☐ FM / FMc	☐ NEPSI

① 1 limit switch
② 2 limit switches

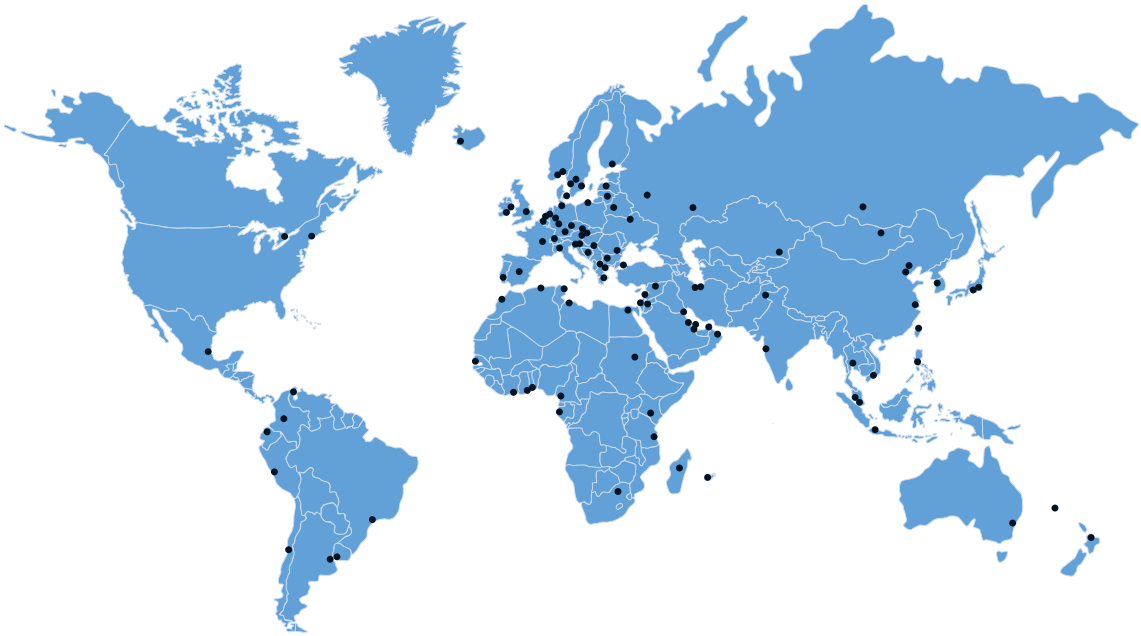
* in preparation

Rating data

Product:			
Operating pressure:		☐ Absolute pressure	☐ Overpressure
Rated pressure:			
Operating temperature:			
Rated temperature:			
Density:		☐ Standard density	☐ Operating density
Viscosity:			
Measuring range:			
Comments:			

Contact data

Company:	
Contact person:	
Telephone number:	
Fax number:	
E-mail:	



KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Measuring systems for the oil and gas industry
- Measuring systems for sea-going tankers

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
D-47058 Duisburg (Germany)
Tel.:+49 (0)203 301 0
Fax:+49 (0)203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com

KROHNE