



H250 Technical Datasheet

Variable area flowmeter

- Sturdy construction for high pressure, temperature and media resistance
- Simple to install - Measure and display without auxiliary power supply
- Modular and adaptable to meet customer-specific applications



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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 4...20 mA output / Profibus PA
- ② Limit switch
- ③ Flow counter

Highlights

- Simple, low-cost installation: Measure and display without auxiliary power supply
- Rugged stainless steel construction for high operating pressure up to 3000 bar / 44100 psi and extreme process temperatures of -200...+400°C / -328...+752°F
- Optionally available with PTFE/ceramic liner for acids and alkalis
- High application safety, even with extremely low flows
- Excellent long-term stability
- Modular and flexible to adapt to customer-specific applications
- SIL 2 certified
- International approvals for use in hazardous areas and nuclear power plants

Industries

Can be used in all industrial sectors, for example:

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

Applications

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

1.2 Options and variants

Stainless steel indicator housing (H250/M9R)



For particularly rough environmental conditions, the M9 indicator housing is optionally available in stainless steel.

This guarantees its reliable use in corrosive atmospheres caused by operational emissions.

When installed outdoors, external influences such as salt fog or contaminated precipitation no longer lead to corrosion.

The stainless steel housing is equally well-suited for use in splash water zones such as in the food and luxury food industry.

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 $\leq 0.8 \mu\text{m}$ or $0.6 \mu\text{m}$ of the wetted parts make deposition difficult 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.

Indicator variants

Indication M9 (modular)



- Local indication without auxiliary power supply
- 2 limit switches (NAMUR or 3-wire transistor)
- 2-wire current output 4...20 mA with HART®
- Profibus PA interface
- 6-digit flow counter with pulse output (non Ex)
- Intrinsically safe Ex i (ATEX, FM, NEPSI)

Indicator M10 (integrated)



- Graphic display for measured value and counter display
- 2 limit switches (NAMUR or open collector transistor)
- 2-wire current output 4...20 mA with HART®
- 12-digit flow counter with pulse output and reset input
- Explosion proof enclosure Ex d (ATEX, FM, CSA, NEPSI)

Indicator M8 (compact)



- Compact, space saving design
- Intrinsically safe Ex i (ATEX)

M8M

- Mechanical indicator without auxiliary power
- 2 limit switches (NAMUR)

M8E

- Electronic bargraph indicator
- 2-wire current output 4...20 mA with HART®

1.3 Operating principle

The flowmeter H250 operates on the float 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 **B**, acting on it, the form drag **D** and its weight **W** are in equilibrium: $W = B + D$.

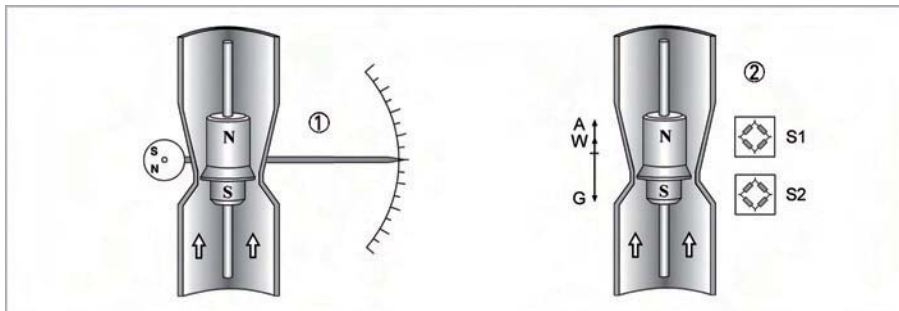


Figure 1-1: Operating principle

- ① Indication principle M9 and M8MG
- ② Indication principle M10 and M8EG

For indicators M9 and M8MG ① the flow-dependent height of the float in the measuring unit is transmitted by means of a magnetic coupling and displayed on a scale. For indicators M10 and M8EG ② the flow-dependent height of the float in the measuring unit is transmitted to the electronic display by means of a magnetic coupling on sensors S1 and S2.

Operating principle of H250H and H250U

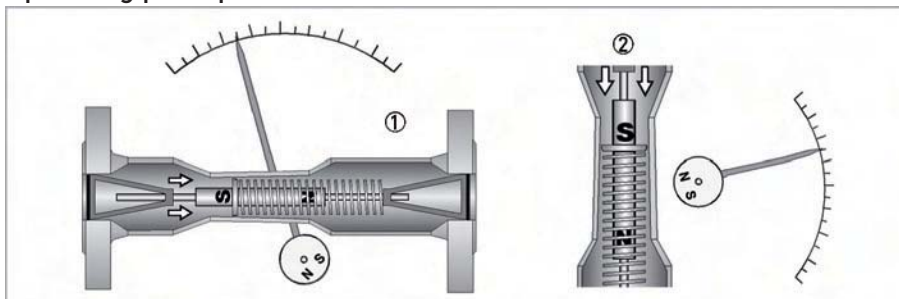


Figure 1-2: Operating principle H250H and H250U

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

The flowmeters operate according to 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.

Flowmeters H250H and H250U only work in conjunction with indicator M9.

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 (Downloadcenter).*

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
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)
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

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

Materials

Device	Flanges / 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 ₂ O ₃ with FFKM gasket	Al ₂ O ₃ and PTFE		Al ₂ O ₃
H250/F 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/M9 - mechanical indicator without power supply

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

Temperatures H250/M9 - with electrical components [°C]

Maximum product temperatures T_m			$T_{amb.} < +40^\circ\text{C}$		$T_{amb.} < +60^\circ\text{C}$ ①	
EN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	½", 1"	ESK2A, ESK3-PA	+200	+300	+180	+300
		ESK2A with counter	+200	+300	+80	+130
		Limit switch NAMUR	+200	+300	+200	+300
		3-wire limit switch	+200	+300	+130	+295
DN50	2"	ESK2A, ESK3-PA	+200	+300	+165	+300
		ESK2A with counter	+180	+300	+75	+100
		Limit switch NAMUR	+200	+300	+200	+300
		3-wire limit switch	+200	+300	+120	+195
DN80, DN100	3", 4"	ESK2A, ESK3-PA	+200	+300	+150	+250
		ESK2A with counter	+150	+270	+70	+85
		Limit switch NAMUR	+200	+300	+200	+300
		3-wire limit switch	+190	+300	+110	+160

Temperatures H250/M9 - with electrical components [°F]

Maximum product temperatures T_m			$T_{amb.} < +104^\circ\text{F}$		$T_{amb.} < +104^\circ\text{F}$ ①	
EN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	½", 1"	ESK2A, ESK3-PA	392	572	356	572
		ESK2A with counter	392	572	176	266
		Limit switch NAMUR	392	572	392	572
		3-wire limit switch	392	572	266	563
DN50	2"	ESK2A, ESK3-PA	392	572	165	572
		ESK2A with counter	356	572	167	212
		Limit switch NAMUR	392	572	392	572
		3-wire limit switch	392	572	248	383
DN80, DN100	3", 4"	ESK2A, ESK3-PA	392	572	302	482
		ESK2A with counter	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
ESK2A	Current output 2-wire 4...20 mA
ESK3-PA	PROFIBUS PA interface

Minimum ambient temperatures $T_{amb.}$ with ESK and limit switches

Device	[°C]	[°F]
Limit switch	-25 / -40	-13 / -40
ESK2A - ESK3-PA	-40	-40

Temperatures H250 /M8 /M10

	[°C]	[°F]
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M8M

Min. product temperature T_m without limit switches	-80...+200	-112...+392
Min. product temperature T_m with limit switches	-25...+200	-13...+392
Ambient temperature $T_{amb.}$	-25...+70	-13...+158

M8E

Max. product temperature T_m at $T_{amb.}$ +40°C / +104°F	-25...+200	-13...+392
Max. product temperature T_m at $T_{amb.}$ +50°C / +122°F	-25...+185	-13...+365
Max. product temperature T_m at $T_{amb.}$ +60°C / +140°F	-25...+145	-13...+293
Ambient temperature $T_{amb.}$	-25...+70	-13...+158

M10

Max. product temperature T_m at $T_{amb.}$ +60°C / +140°F	-80...+200	-112...+392
Ambient temperature $T_{amb.}$	-40...+75	-40...+167

Indicator M8

M8M limit switches

Terminal connection	2.5 mm ²		
Limit switch	I7S2002-N SC2-N0	SJ2-SN	SJ2-S1N
Type	2-wire NAMUR	2-wire NAMUR ①	2-wire NAMUR ①
Switch configuration	NC contact	NC contact	NO contact
Nominal voltage U ₀	8 VDC	8 VDC	8 VDC
Pointer vane not read	≥ 3 mA	≥ 3 mA	≤ 1 mA
Pointer vane read	≤ 1 mA	≤ 1 mA	≥ 3 mA

① safety oriented

M8E current output

Cable gland	M16 x 1.5
Cable diameter	8...10 mm
Terminal connection	4 mm ²
Measuring signal	4...20 mA = 0...100 % flow value in 2-wire technology
Power supply	14.8...30 VDC
Min. power supply for HART®	20.5 VDC
Power supply influence	< 0.1%
Dependence on external resistance	< 0.1%
Temperature influence	< 10 µA / K
Max. external resistance / load	640 Ohm (30 VDC)
Min. load for HART®	250 Ohm

M8E HART® configuration

Manufacturer name (code)	KROHNE Messtechnik (69)
Model name	M8E (230)
HART® protocol revision	5.1
Device revision	1
Physical layer	FSK
Device category	Transmitter

M8E process variable

M8E process variable flow rate	Values [%]	Signal output [mA]
Over range	+105 (±1%)	20.64...20.96
Device error identification	>110	>21.60
Maximum	112.5	22
Multidrop operation	-	4.5

Indicator M9

M9 cable glands

Cable gland	Material	Cable diameter	
M 16x1.5 Standard	PA	5...10 mm	0.197...0.394"
M20 x 1.5	PA	8...13 mm	0.315...0.512"
M 16x1.5	Nickel-plated brass	5...9 mm	0.197...0.355"
M20 x 1.5	Nickel-plated brass	10...14 mm	0.394...0.552"

M9 limit switches

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
Type	2-wire NAMUR	2-wire NAMUR	2-wire NAMUR	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

M9 current output ESK2A

Terminal connection	2.5 mm ²
Power supply	12...30 VDC
Min. power supply for HART®	18 VDC
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	800 Ohm (30 VDC)
Min. load for HART®	250 Ohm
Software firmware version	02.15
Ident No.	4000054602
ESK2A HART® configuration	
Manufacturer name (code)	KROHNE Messtechnik (69 = 45h)
Model name	ESK2A (226 = E2h)
HART® protocol revision	5.9
Device revision	1
Physical layer	FSK
Device category	Transmitter without galvanic isolation

M9 ESK2A process variable

ESK2A process variable flow rate	Values [%]	Signal output [mA]
Over range	+102.5 ($\pm 1\%$)	20.24...20.56
Device error identification	> 106.25	>21.00
Maximum	131.25	25
Multidrop operation	-	4.5
Min. $U_{ext.}$	12 VDC	

M9 ESK-Z totalizer

Terminal connection	2.5 mm ²
Power supply	10...30 VDC
$R_{ext.}$ current loop	0...600 Ohm
Power consumption	max. 2.5 Watt
Indication error	< 1% in relation to the value displayed
Max. reset voltage	30 VDC
Min. reset pulse	300 ms
Software firmware version	1.19
Power supply	10...30 VDC
Max. current	50 mA
Max. dissipation	250 mW
T on	80 ms fixed pulse width
T off	depending on flow rate
U on	$U_b - 3$ VDC
U off	0 VDC
Pulse value	1 pulse = 1 display counter advance (1 litre, 1 m ³ ...)