H250 M40 Handbook

Variable area flowmeter
with 3W2 angular position transmitter

KROHNE

IMPRINT

1.1 Intended use

CAUTION!
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

INFORMATION!
This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

INFORMATION!
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

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

Intended use:

- The product may not contain any ferromagnetic particles or solids. It may be necessary to install magnetic filters or mechanical filters.
- The product must be sufficiently liquid and free of deposits.
- Avoid pressure surges and pulsing flows.
- Open valves slowly. Do not use solenoid valves.

Use suitable measures to eliminate compression vibrations during gas measurements:

- Short pipeline lengths to next restriction
- Nominal pipe size not greater than nominal device size
- Use of floats with damping
- Increase in operating pressure (while taking into account the resulting change in density and thus change in scale)

Observe installation conditions according to VDI/VDE 3513-3.

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

CAUTION!
Do not use any abrasive media containing solid particles or highly viscous media.

1.2 Certifications

CE marking

The device fulfils all applicable statutory requirements of the EU directives:

- Pressure equipment directive
- For devices with electrical installations: EMC directive

The manufacturer certifies successful testing of the product by applying the CE mark.
An EU declaration of conformity regarding the directives in question and the associated harmonised standards can be downloaded from our internet site.

1.3 Pressure equipment directive

A conformity assessment in accordance with pressure equipment directive has been carried out for the devices described. Conformity is certified by applying the CE mark. The number of the notified body is also stated.

The PED key describes the rating of the devices:

Example: PED/G1/III/H	
G	Gases and vapours
1	Fluid group 1
III	Category III
H	Conformity assessment method according to Module H

The PED key identification can be found on the nameplate of the device (for details refer to *Nameplate* on page 14).

INFORMATION!
The stated pressures (PS) and temperatures (TS) only apply as refers to the pressure resistance of the sensor body. As regards the functionality of the entire device, further restrictions of the maximum temperature may need to be observed. Devices rated below category I due to their size, do not receive the CE mark in the scope of the PED. These devices are subject to applicable sound engineering practice (SEP).

Residual risk

A risk analysis in accordance with the pressure equipment directive has been carried out for the devices. The residual risk is described as follows:

- The devices are designed according to the valid and applicable rules and standards for static operation and their pressure resistance is calculated for the declared maximum pressure and temperature (no calculation for cyclical change).
- Responsibility for the use of the measuring devices with regard to corrosion resistance of the used materials against the measured fluid lies solely with the operator.
- Avoid abrasion.
- Avoid pulsation and cavitation.
- Protect devices from vibration and high-frequency oscillation.
- Draining (backflow) may be delayed due to the float in the measuring tube.
- Implement appropriate measures to counteract external fire hazards

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

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1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

DANGER!
This warning refers to the immediate danger when working with electricity.

DANGER!
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

DANGER!
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

DANGER!
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.

WARNING!
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.

CAUTION!
Disregarding these instructions can result in damage to the device or to parts of the operator's plant.

INFORMATION!
These instructions contain important information for the handling of the device.

LEGAL NOTICE!
This note contains information on statutory directives and standards.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➲ RESULT
This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
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.

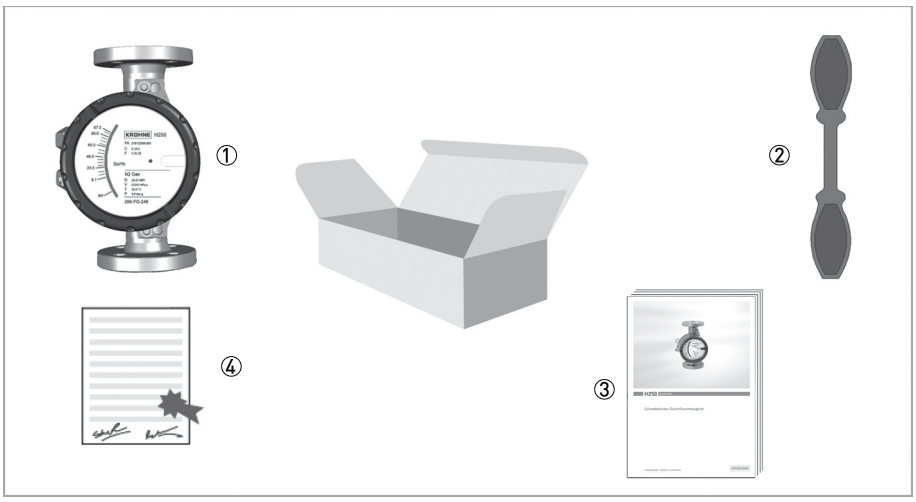


Figure 2-1: Scope of delivery

① Measuring device in ordered version
② Wrench
③ Documentation
④ Certificates, calibration report (supplied to order only)

2.2 Device version

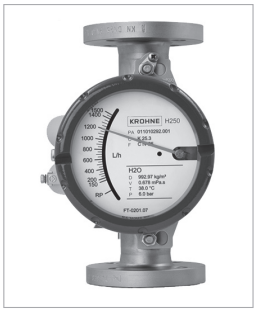


Figure 2-2: Device version - H250 with M40 indicator

Description of the device version

- Local indicator without auxiliary power
- 2 limit switches, type NAMUR
- Electrical signal output 4...20 mA, type KINAX 3W2

2.2.1 Indicator versions

The M40 indicator can be fitted with various modules.

- Version K1/K2
- Version KINAX 3W2

Both versions can be combined with one another.

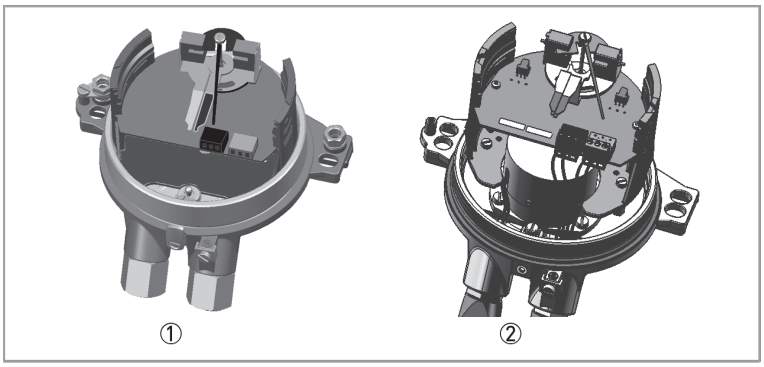


Figure 2-3: Indicator versions

① Indicator with K2 contact module
② Indicator with 3W2 angular position transmitter combined with contact module (special housing M40-L)

2.2.2 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 (refer to "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]
DN50	1/2"	≤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

2.3 Nameplate

INFORMATION!
Check on the device nameplates, that the device is supplied according to your order.

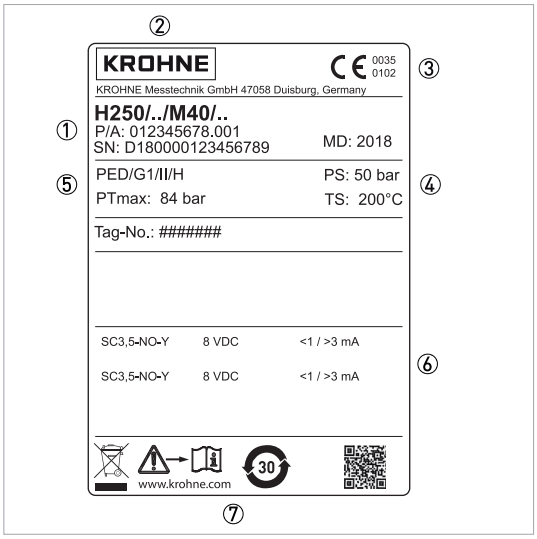


Figure 2-4: Example of a nameplate

① Device type
② Manufacturer and manufacturer address
③ Notified body
④ Rating data: temperature & pressure rating
⑤ PED data
⑥ Electrical connection data
⑦ Note to observe the documentation and for disposal

Additional markings on the indicator

- SN - serial number
- SO - sales order / item
- PA - production order
- Vx - product configurator code
- AC - article code

2.4 Description code

The description code consists of the following elements *:

Figure 2-5: Description code

① **Device type**
H250 - standard version
H250H - horizontal flow direction
H250U - flow direction from top to bottom
② **Materials / versions**
RR - stainless steel
C - PTFE or PTFE/ceramics
HC - Hastelloy®
Ti - Titanium
Mo - Monel
In - Inconel
F - aseptic version (food)
③ **Heating jacket version**
B - with heating jacket
④ **Type series of indicators**
M40 - Indicator M40
M40S - indicator with increased corrosion protection
M40R - indicator in stainless steel housing
M40-L - indicator with extended version
⑤ **High-temperature version**
HT - version with HT extension
⑥ **Electrical signal output**
ES - electrical signal output 4...20 mA KINAX 3W2
⑦ **Shielding**
W - Tungsten
⑧ **Limit switches**
K1 - one limit switch
K2 - two limit switches

* positions which are not needed are omitted (no blank positions)

3.1 General installation notes

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
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.

3.2 Storage

- Store the device in a dry, dust-free location.
- Avoid direct exposure to the sun.
- Store the measuring device in the original packaging.
- The permissible storage temperatures for standard devices are: -40...+80°C / -40...+176°F

3.3 Installation conditions

CAUTION!
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 directive 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 ≥ 5 DN upstream of the device and a straight outlet run of ≥ 3 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 inner diameter of the flange deviates from the standard dimensions. Flange seal standard DIN 2690 or ASME B16.21 can be applied.*
- *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, refer to 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.*
- *Piping for gas flow need to be dried before the device is installed.*
- *Use connectors suitable for the particular device version.*
- *Align the piping 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.*

Minimum distance between devices

When several devices are installed next to each other, a minimum distance of > 300 mm / 11.8" between the devices is necessary.

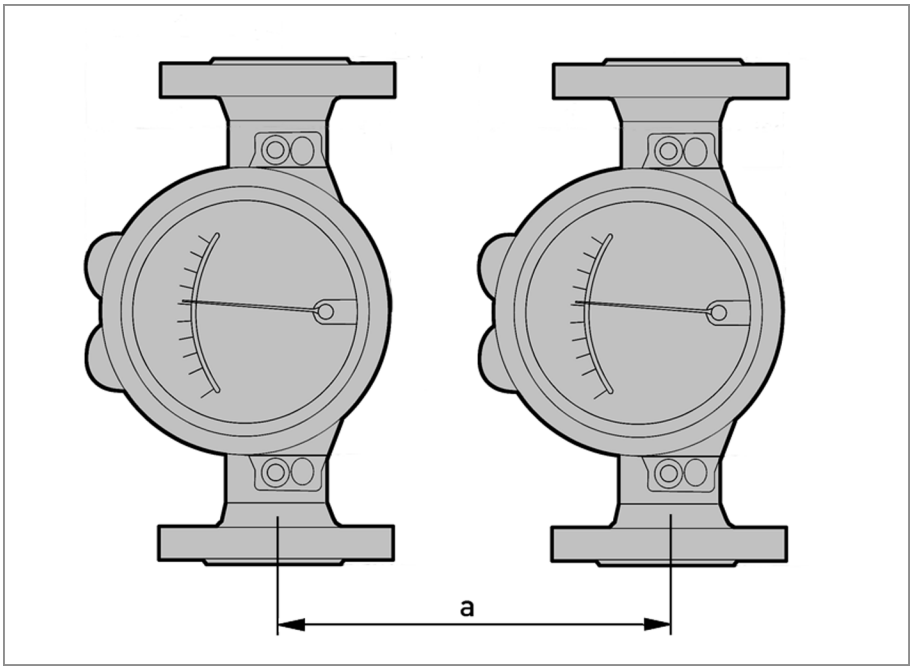


Figure 3-1: Minimum distance between devices

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

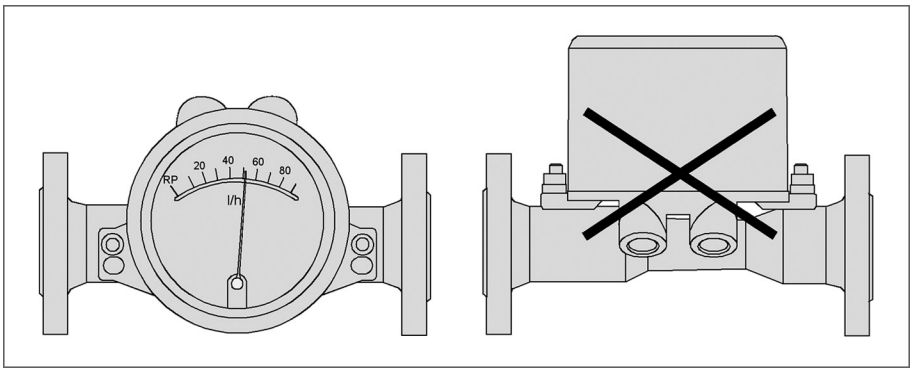


Figure 3-2: Installation position for H250H

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 product and ambient temperatures indicated as well as the measuring accuracy are based on lateral installation of the indicator.

3.3.1 Tightening torques

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

Nominal size according to				Stud bolts			Max. torque			
EN 1092-1		ASME B16.5		EN	ASME		EN 1092-1		ASME 150 lb	
DN	PN	Inch	lb		150 lb	300 lb	Nm	ft*lbf	Nm	ft*lbf
15	40	1/2"	150/300	4x M12	4x 1/2"	4x 1/2"	9.8	7.1	5.2	3.8
25	40	1"	150/300	4x M12	4x 1/2"	4x 5/8"	21	15	10	7.2
50	40	2"	150/300	4x M16	4x 5/8"	8x 5/8"	57	41	41	30
80	16	3"	150/300	8x M16	4x 5/8"	8x 3/4"	47	34	70	51
100	16	4"	150/300	8x M16	8x 5/8"	8x 3/4"	67	48	50	36

Table 3-1: Tightening torques

3.3.2 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: 1.4404 / 316L

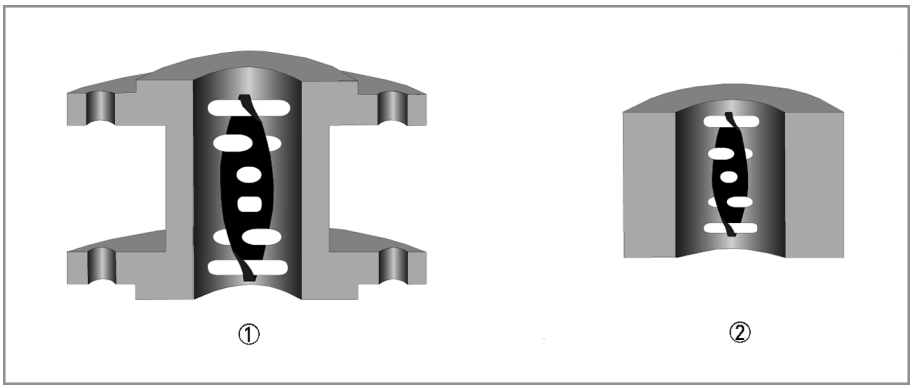


Figure 3-3: Types of magnetic filters

① Type F - fitting part with flange - overall length 100 mm / 4"
② Type FS - fitting part without flange - overall length 50 mm / 2"

3.3.3 Heat insulation

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

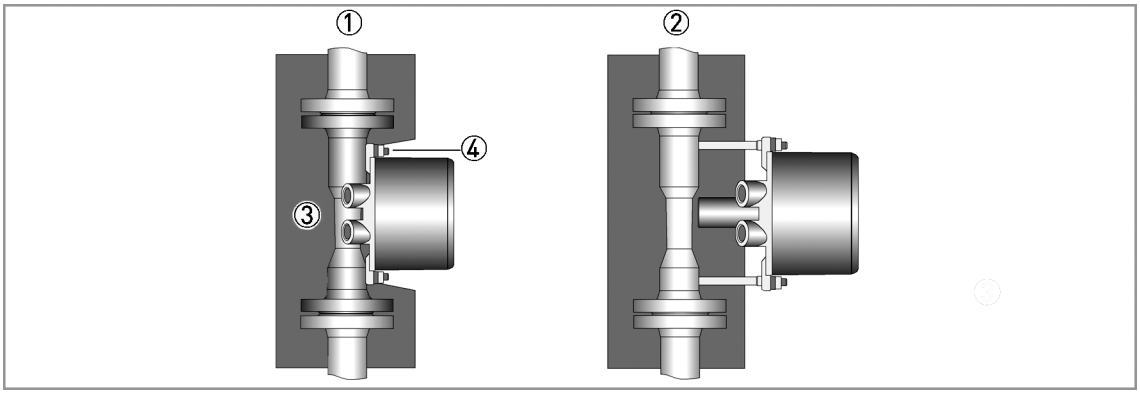


Figure 3-4: Heat insulation

① Standard indicator M40
② Indicator with HT extension

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

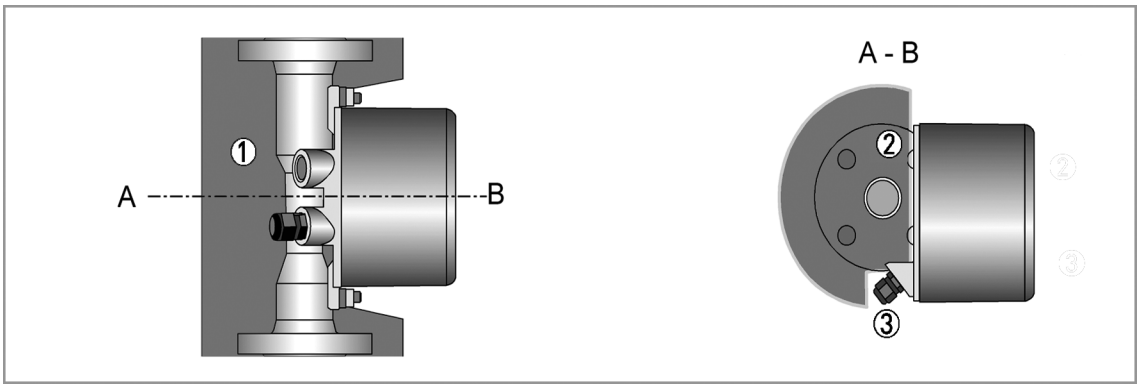


Figure 3-5: Heat insulation - cross-section

4.1 Safety instructions

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

DANGER!
Observe the national regulations for electrical installations!

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

WARNING!
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.

INFORMATION!
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 for indicator M40

4.2.1 Connection of the limit switches K1/K2

The M40 indicator can be fitted with a maximum of two limit switches.
The limit switch operates as a proximity switch which is activated inductively by the semicircular metal vane of the pointer. The switching points are set using the contact pointers.
The position of the contact pointers is indicated on the scale.

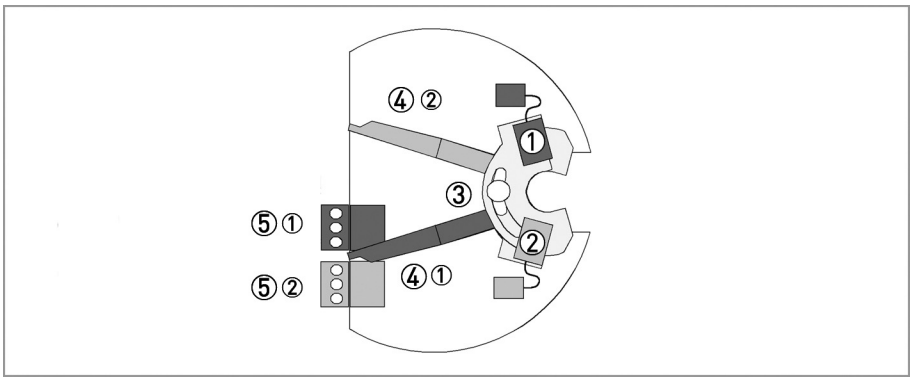


Figure 4-1: Design of limit switch module

① MIN contact
② MAX contact
③ Locking screw
④ Peak value
⑤ Connection terminal

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

Contact	MIN			MAX		
Terminal number	1	2	3	4	5	6
Connection 2-wire NAMUR	-	+		-	+	
Connection 3-wire	+		-	+		-
Connection Reed SPST	+		-	+		-

Table 4-1: Electrical connection of the limit switches

Connection diagram for the limit switches

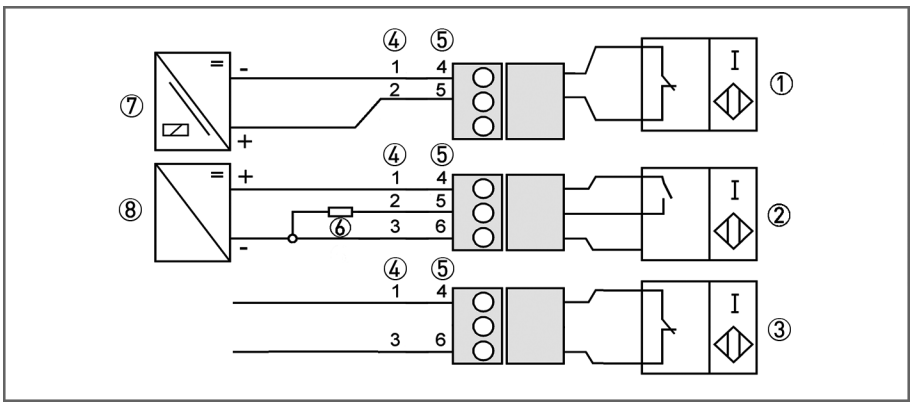


Figure 4-2: Connection terminals for limit switches

① Limit switch 2-wire NAMUR
② Limit switch 3-wire
③ Limit switch Reed SPST
④ Terminal connection of Min. contact
⑤ Terminal connection of Max. contact
⑥ 3-wire load
⑦ NAMUR isolated switching amplifier
⑧ 3-wire power supply

Limit setting

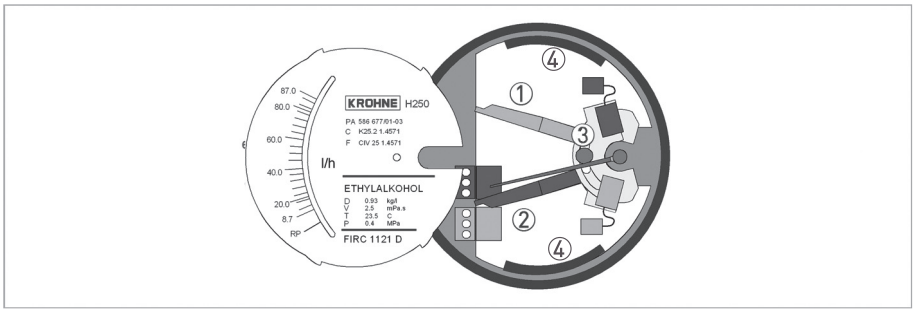


Figure 4-3: Limit setting

① Contact pointer MAX
② Contact pointer MIN
③ Locking screw (max. tightening torque is 0.2 Nm)
④ Scale support

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

- Pull the upper scale support 2 mm / 0.08" flexibly upwards and pull out the scale from its locking point to the side.
- Loosen the locking screw ③ slightly.
- Slide in the scale up to the locking point.
- Set contact pointers ① and ② to the desired switching point.

After the setting:

- Pull the upper scale support 2 mm / 0.08" flexibly upwards and pull out the scale again from its locking point to the side.
- Tighten the locking screw ③ with max. 0.2 Nm.
- Slide in the scale up to the locking point.

CAUTION!
If the maximum torque (0.2 Nm) is exceeded, the locking screw can be torn off during tightening!

Definition of switch contact

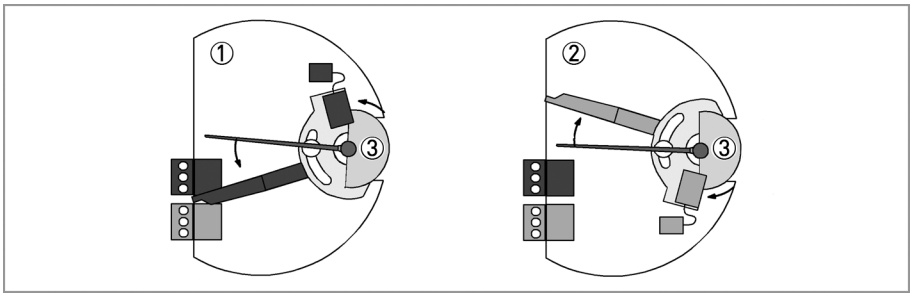


Figure 4-4: Definition of switch contact

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

If the pointer vane goes into the slot, an alarm is triggered.
If the pointer vane is outside of the proximity switch, a wire break in a NAMUR contact also triggers the alarm.

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

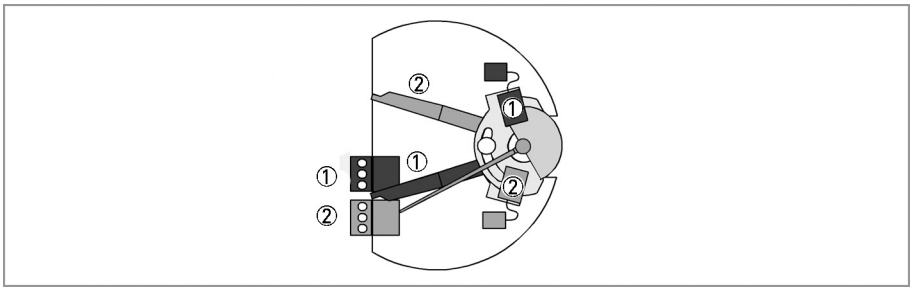


Figure 4-5: Definition MIN-MIN - MAX-MAX

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

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

Table 4-2: Current consumption in the position shown:

4.2.2 Connection of current output 3W2

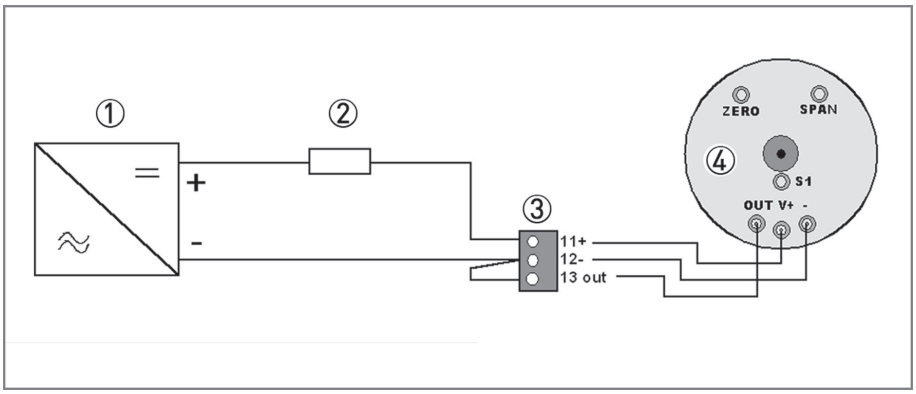


Figure 4-6: Current output terminal connection

① Power supply 12...30 VDC
② External load
③ Terminal connection
④ 3W2 angular position transmitter

INFORMATION!
In the case of a KINAX with tungsten coating, the terminal strip is omitted ③.
Instead, either a customer-specific plug is mounted on the device or a pre-assembled cable is routed to the outside. The corresponding cable configuration is described on a sticker at the outside of the cable.

Power supply 3W2 with galvanic isolation

Wiring must be planned with great care when it comes to connecting other devices such as evaluation units or process control. Internal connections in these devices (e.g. GND with PE, mass loops) may lead to non-permitted voltage potentials which could negatively affect the function of the converter itself or that of a device connected to it. In such cases a protected extra-low voltage (PELV) is recommended.

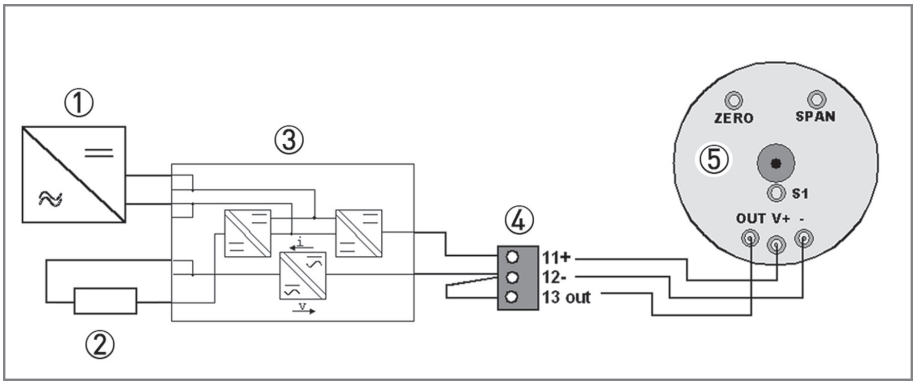


Figure 4-7: Current output terminal connection with galvanic isolation

① Power supply (refer to supply isolator information)
② External load
③ Converter supply isolator with galvanic isolation
④ Terminal connection
⑤ 3W2 angular position transmitter

INFORMATION!
In the case of a KINAX with tungsten coating, the terminal strip is omitted ④.
Instead, either a customer-specific plug is mounted on the device or a pre-assembled cable is routed to the outside. The corresponding cable configuration is described on a sticker at the outside of the cable.

Power supply

INFORMATION!
The supply voltage has to be between 12 VDC and 30 VDC. This is based on the total resistance of the measuring loop. To calculate this, the resistance of each component in the measuring loop (not including the device) must be added up.

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

$U_{ext.} = R_L * 22\ mA + 12\ V$

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

INFORMATION!
The power supply has to be able to supply a minimum of 22 mA.

Current output adjustment

- A fine adjustment of the current output can be performed using the ZERO and SPAN adjustment screws of the KINAX 3W2 angular position transmitter.
- For adjustment of 4.00 mA, the pointer must be set to RP on the scale.
  4.00 mA can be set using ZERO.
- For adjustment of 20.00 mA, the pointer must be set to 100% flow rate value of the scale.
  20.00 mA can be set using SPAN.
- Instead of manual adjustment of the pointer, the flow rate values ??0 and 100% can be set for the adjustment.

4.2.3 Connection of the Harting plug

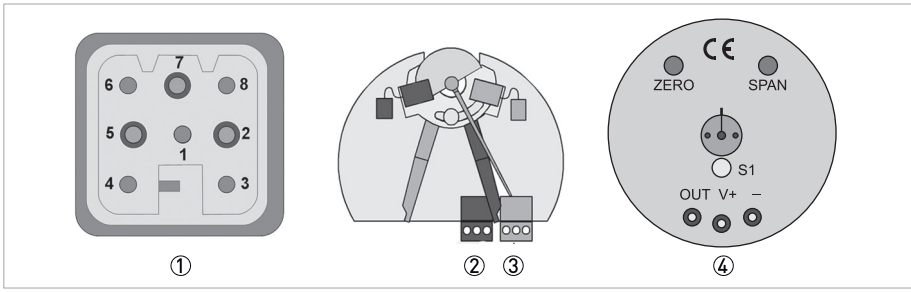


Figure 4-8: Terminal assignment

① Terminal assignment of HAN® 7D - View of plug connection

① Pin number HAN® 7D	K1/K2 NAMUR contacts	ES	Terminal number
1	② NAMUR MIN (-)	-	1
2	② NAMUR MIN (+)	-	2
3	③ NAMUR MAX (-)	-	4
4	③ NAMUR MAX (+)	-	5
5	-	④ 4...20 mA (+)	11
6	-	④ 4...20 mA (-)	12
7	-	④ 0...20 mA	13
8	-	-	-

Table 4-3: Terminal assignment - Harting plug to terminal number

INFORMATION!
In the case of a KINAX with tungsten coating ④, for the electrical connection the terminal strip is omitted.
Instead, either a customer-specific plug is mounted on the device or a pre-assembled cable is routed to the outside. The corresponding cable configuration is described on a sticker at the outside of the cable.

4.3 Grounding connections

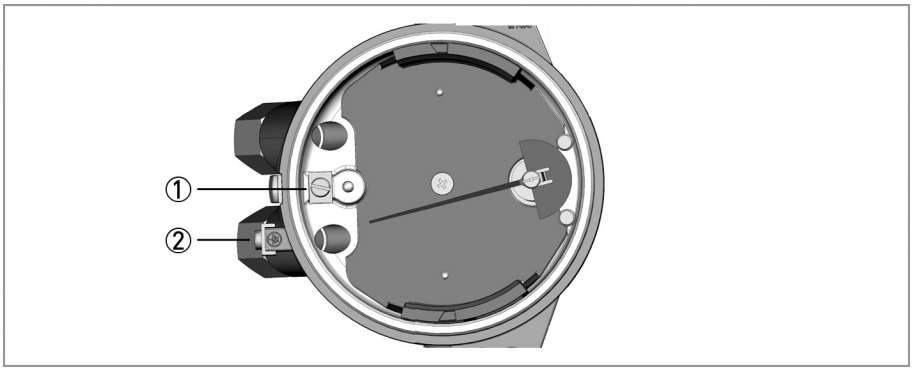


Figure 4-9: Grounding connections

① Grounding connection on the indicator
② Outer grounding connection

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

4.4 Ingress protection

The measuring device meets all requirements of ingress protection IP66/68.

DANGER!
After all servicing and maintenance work on the measuring device, the specified protection class 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 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.

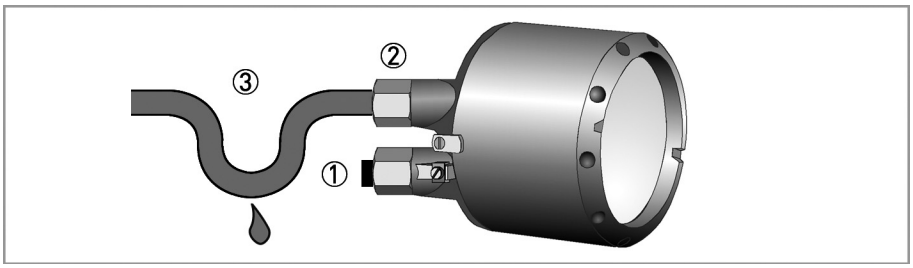


Figure 4-10: Laying the cable

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

5.1 Standard device

CAUTION!

When starting up the device, the following points must be observed:

- *Compare the actual operating pressure and the product temperature of the system with the specifications on the nameplate (PS and TS). These specifications may not be exceeded.*
- *Make sure materials are compatible.*
- *Slowly open the shut-off valve.*
- *When measuring liquids ensure that the pipelines are carefully evacuated.*
- *When measuring gases, increase pressure slowly.*
- *Avoid float impact (e.g. caused by solenoid valves), as this is likely to damage the measuring unit or float.*

A minimum operating pressure (primary pressure) is necessary to operate the device:

Medium	Pressure loss : operating pressure
Liquids	1 : 2
Gases without float damping	1 : 5
Gases with float damping	1 : 2

6.1 Maintenance

Within the scope of routine maintenance of the system and pipelines, the flowmeter should also be inspected for signs of fouling, corrosion, mechanical wear and leaks, as well as damage to the measuring tube and the indicator.
We advise that inspections are carried out at least once per year.
The device must be removed from the pipeline before cleaning.

CAUTION!
Pressurised pipes have to be depressurised before removing the device.
Empty the pipelines as completely as possible.
In the case of devices used for measuring aggressive or hazardous media, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.
New gaskets have to be used when re-installing the device in the pipeline.
Avoid electrostatic charges when cleaning the surfaces (e.g. sight window)!

6.2 Replacement and retrofitting

Some components of the variable area flowmeter can be exchanged or retrofitted:

- Float
- Float damping

6.2.1 Replacing floats

- Remove the device from the pipeline.
- Take the upper span ring out of the measuring unit.
- Take the upper float stop and float out of the measuring unit.
- Insert the new float into the centre hole of the lower float stop and push into the measuring unit along with the upper float stop. While doing this, the float's upper guide rod must be guided through the middle hole of the float stop.
- Insert the span ring into the measuring unit.
- Fit the device back into the pipeline.

CAUTION!
Without a recalibration an additional measuring error is to be expected.

6.2.2 Retrofitting of the float damping

- Take the upper span ring ① out of the measuring unit.
- Take the upper float stop ② and float ⑤ out of the measuring unit.
- Fasten the retaining ring ③ into the lower slot of the float's guide rod.
- Slide ceramic sleeve ④ on to the float's guide rod and attach it to the top slot using the retaining ring ③.
- Insert float into the lower float guide in the measuring unit.
- Retrofit the supplied damping cylinder with the integrated float stop ② into the measuring unit.
- Insert upper span ring ①.

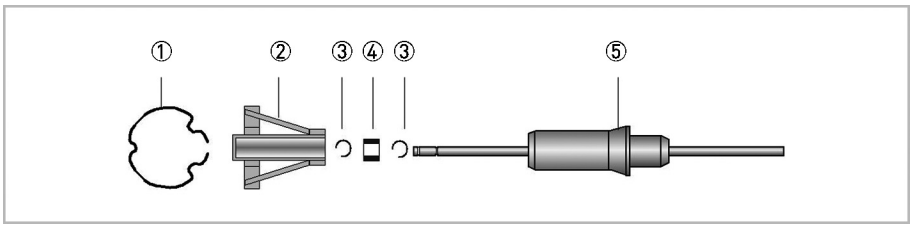


Figure 6-1: Design of the float damping

① Span ring
② Float stop
③ Retaining ring
④ Ceramic sleeve
⑤ Float

6.3 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.4 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

6.5 Returning the device to the manufacturer

6.5.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

WARNING!
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 the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

WARNING!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*

6.5.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:
Department:		Name:
Tel. no.:		Fax no. and/or Email address:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:		radioactive
		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.		
Date:		Signature:
Stamp:		

6.6 Disposal

LEGAL NOTICE!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

7.1 Measuring principle

The H250 flowmeter operates in accordance with the float measuring principle. The measuring unit consists of a metal cone in which a float can move freely up and down. The flow goes from bottom to top. The float adjusts itself so that the buoyancy force A acting on it, the form resistance W and its weight G are in equilibrium: G = A + W.

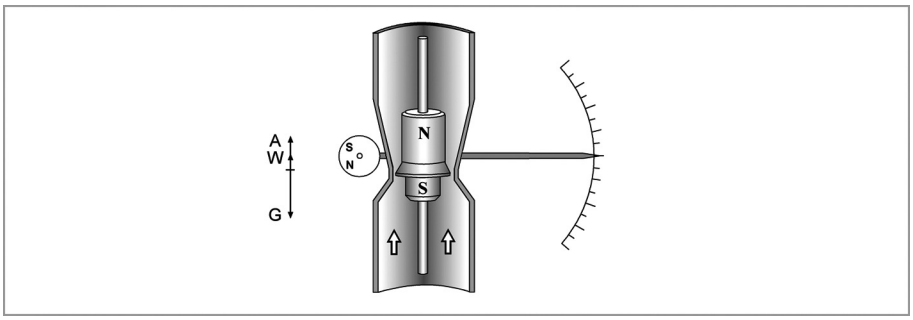


Figure 7-1: Measuring principle - general

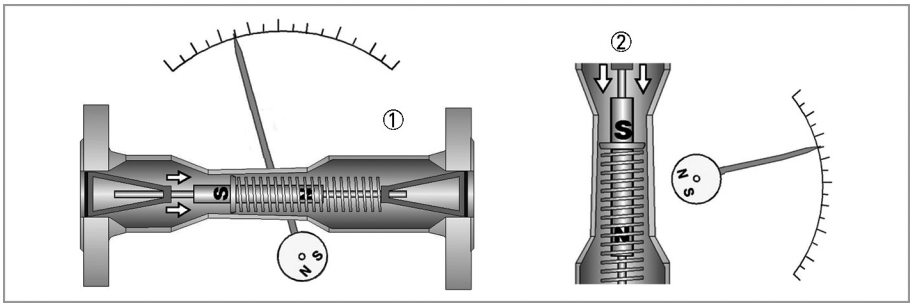


Figure 7-2: Measuring principle for H250H and H250U

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

The flowmeter operates in accordance with 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.

7.2 Technical data

INFORMATION!

- *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 sales office.*
- *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 vapours
Function / Measuring principle	Float measuring principle
Measured value	
Primary measured value	Float position
Secondary measured value	Operating volume flow, standard volume flow or mass flow

Measuring accuracy

Directive	VDI/VDE 3513, sheet 2 (q_G = 50%)
H250 /RR /HC /F	2.5%
H250/C (Ceramic, PTFE) H250H, H250U, H250 (100 : 1)	4%
Precision (repeatability)	
H250 /RR /HC /F	0.5%
H250H, H250U, H250 (100 : 1)	1%

Operating conditions

Temperature	
Max. operating temperature TS	-196...+300°C / -321...+572°F Depending on the version (refer to nameplate)
Pressure	
Max. operating pressure PS	Depending on the version (refer to nameplate)
Max. test pressure PT	Depending on the version (refer to nameplate)
Min. required operating pressure	2 times greater than pressure loss (refer to measuring ranges)
Ingress protection	
M40, M40R	IP66/68 according to EN 60529, NEMA 4/4X/6 according to NEMA 250
M40R	IP69K according to DIN 40050-9
Float damping during gas measurement recommended	
DN15...25 / 1/2...1"	Operating pressure <0.3 barg / 4.4 psig
DN50...100 / 2...4"	Operating pressure <0.2 barg / 2.9 psig

Installation conditions according to VDI/VDE 3513, sheet 3

Inlet section	≥ 5 x DN
Outlet section	≥ 3 x DN

Materials

Device	Flange	Measuring tube	Float	Float guide	Ring orifice
H250/RR	CrNi steel 1.4401 / 1.4404, 316 / 316L (dual certification)		1.4404, 316L		
H250/HC	Hastelloy® C4 (2.4610) solid or plated	Hastelloy® C4			
H250/F - Food	CrNi steel 1.4435		CrNi-steel 1.4435 / 1.4404		
H250/C - Ceramic/PTFE ①	CrNi steel 1.4571 with TFM/PTFE ②		PTFE or Al_2O_3 with FFKM gasket	Al_2O_3 and PTFE	Al_2O_3

① DN100/4" only PTFE
② TFM/PTFE liner (electrically non-conductive), conductive PTFE on request

Other options on request:

- Special materials: e.g. SMO 254/6Mo/1.4547, Titanium Grade 2, Hastelloy® C276/2.4819, Monel®/2.4360, Inconel®/2.4856 a.o.
- Float damping: PEEK (only for gas) or ceramic
- Standard gasket for devices with female thread as insert: O-ring FPM / FKM, others optional e.g. FFKM, EPDM

M40	Aluminium, two-layer powder coating (epoxy / polyester)
M40R	Stainless steel without coating 1.4408 / CF8M
Offshore	Wet coating on request

Temperatures

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

Temperatures H250/M40 - mechanical indicator without auxiliary power

	Material		Product temperature		Ambient temperature	
	Float	Liner	[°C]	[°F]	[°C]	[°F]
H250/RR	Stainless steel		-196...+300	-321...+572	-40...+120	-40…+248
H250/RR screw fitting FPM/FKM			-20...+200	-4...+392	-20…+120	-4…+248
H250/HC	Hastelloy®		-196...+300	-321...+572	-40...+120	-40…+248
H250/C	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	Spring material stainless steel 1.4301		-40...+100	-40…+212	-40…+120	-40…+248
	Spring material Hastelloy® 2.4610		-40...+200	-40...+392	-40…+120	-40…+248

Ambient temperatures T_{amb} with electrical components

Version	[°C]	[°F]
KINAX 3W2 angular position transmitter	-25...+70	-13...+158
Limit switches SJ3,5-SN / I7S23,5-N	-40...+70	-40...+158
Limit switches SC3,5-N0 / SJ3,5-S1N / SB3,5-E2	-25...+70	-13...+158

INFORMATION!
The device must not be heated by radiated heat (e.g. exposure to the sun) to an electronics housing surface temperature above the maximum permissible ambient temperature. A sunshade is available as option.

Maximum product temperatures H250/M40 - with electrical components [°C]

			T_{amb} < +40°C		T_{amb} < +60°C ①	
EN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	1/2", 1"	KINAX	+200	+300	+180	+300
		Limit switch NAMUR	+200	+300	+200	+300
		Limit switch 3-wire	+200	+300	+130	+295
DN50	2"	KINAX	+200	+300	+165	+300
		Limit switch NAMUR	+200	+300	+200	+300
		Limit switch 3-wire	+200	+300	+120	+195
DN80, DN100	3", 4"	KINAX	+200	+300	+150	+250
		Limit switch NAMUR	+200	+300	+200	+300
		Limit switch 3-wire	+190	+300	+110	+160

Maximum product temperatures H250/M40 - with electrical components [°F]

			T_{amb} < +104°F		T_{amb} < +140°F ①	
EN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	1/2", 1"	KINAX	392	572	356	572
		Limit switch NAMUR	392	572	392	572
		Limit switch 3-wire	392	572	266	563
DN50	2"	KINAX	392	572	165	572
		Limit switch NAMUR	392	572	392	572
		Limit switch 3-wire	392	572	248	383
DN80, DN100	3", 4"	KINAX	392	572	302	482
		Limit switch NAMUR	392	572	392	572
		Limit switch 3-wire	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 / +212°F)

Short name

HT	High-temperature version
KINAX	Current output 4…20 mA, KINAX 3W2

Cable glands

	Material	Cable diameter	
		[mm]	[Inch]
M20x1.5 Standard	PA	8...13	0.315...0.512
M20x1.5	Nickel-plated brass	10...14	0.394...0.552
M20x1.5	Stainless steel	10...14	0.394...0.552

Limit switches K1/K2

Terminal connection	2.5 mm^2			
Limit switches	I7S23,5-N SC3,5-N0	SJ3,5-SN ①	SJ3,5-S1N ①	SB3,5-E2
NAMUR (IEC 60947-5-6)	Yes	Yes	Yes	No
Connection type	2-wire	2-wire	2-wire	3-wire
Switching element function	N/C contact	N/C contact	N/O contact	PNP N/O contact
Nominal voltage U_0	8.2 VDC	8.2 VDC	8.2 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
Switching cycles	-	-	-	-

① safety oriented

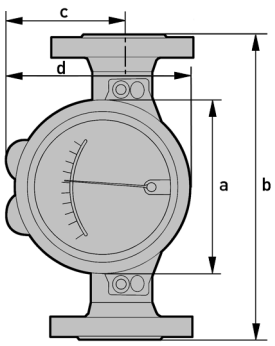
3W2 angular position transmitter

Type	708 - 211D 1/C
Power supply	12...30 VDC
Rotation angle	10°
Signal output	4...20 mA

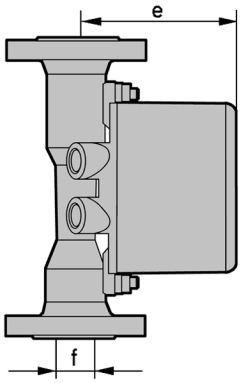
7.3 Dimensions and weight

Dimensions H250/M40

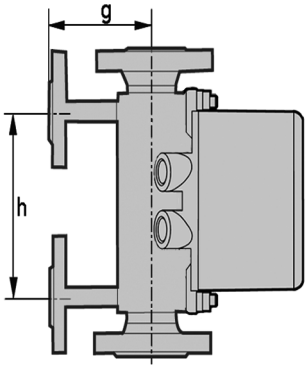
Front view



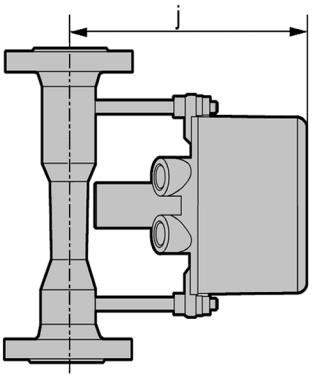
Side view



with heating



High-temperature

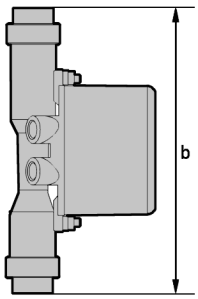


	a		b		d		h	
	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
H250/RR flange, H250/F Clamp connection	141	5.56	250	9.85	150	5.91	150	5.91
H250/RR from 2" 600 lb, ISO 228, ASME B1.20.1, SMS			300	11.82				

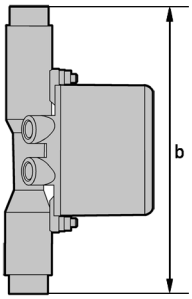
EN	ASME	c ①		e ②		Ø f		g		j	
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]
DN15	½"	94	3.70	114	4.49	20	0.80	97	3.82	197	7.76
DN25	1"	94	3.70	127	5.00	32	1.28	109	4.27	209	8.23
DN50	2"	107	4.22	141	5.55	65	2.57	125	4.90	222	8.74
DN80	3"	107	4.22	157	6.18	89	3.51	143	5.61	238	9.37
DN100	4"	107	4.22	167	6.57	114	4.50	150	5.91	248	9.76

① without cable gland; ② M40-L + 25 mm / 1"

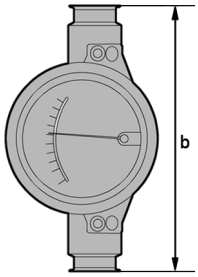
ISO 228 / ASME B1.20.1
Female thread screwed



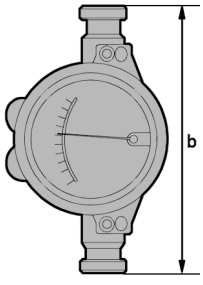
ISO 228 / ASME B1.20.1
Female thread welded



H250/F ① Clamp connection



H250/F screw connection
DIN 11851



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

Weight

		H250		Heating			
Nominal size		EN 1092-1		with flange connection		with Ermeto connection	
EN	ASME	[kg]	[lb]	[kg]	[lb]	[kg]	[lb]
DN15	1/2"	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 connection	
Nominal size		EN 1092-1		ASME 150 lb		ASME 300 lb		DIN 11864-1	
EN	ASME	[kg]	[lb]	[kg]	[lb]	[kg]	[lb]	[kg]	[lb]
DN15	1/2"	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

	Standard	Conn. dim.	Pressure rating
Flanges (H250/RR /HC /C)	EN 1092-1	DN15...150	PN16...250
	ASME B16.5	1/2...6"	150...2500 lb
	JIS B2220	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 barg / 88.2 psig
Female thread welded (H250/RR /HC)	ISO 228	G1/2...G2"	≥ 50 barg / 735 psig
	ASME B1.20.1	1/2…2" NPT	
Female thread (H250/RR /HC) with insert, FPM gasket and union nut	ISO 228	G1/2…2	≤ 50 barg / 735 psig
	ASME B1.20.1	1/2…2" NPT	
Thread connection aseptic (H250/F)	DIN 11864-1	DN15…50	PN40
		DN80…100	PN16
Flange aseptic (H250/F)	DIN 11864-2	DN15…50	PN40
		DN80…DN100	PN16
Measuring device (H250/RR /HC) with heating:			
Heating with flange connection	EN 1092-1	DN15	PN40
	ASME B16.5	1/2"	150 lb / 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

	Stud bolts	Tightening torques	
Nominal size according to EN 1092-1	Quantity x size	[Nm]	[lb-ft]
DN15 PN40 ①	4x M12	9.8	7.1
DN25 PN40 ①	4x M12	21	15
DN50 PN40 ①	4x M16	57	41
DN80 PN16 ①	8x M16	47	34
DN100 PN16 ①	8x M16	67	48

① Standard connections; other connections on request

Nominal size ASME

	Stud bolts		Tightening torques	
Nominal size acc. to ASME B16.5	Quantity x size		[Nm]	[lb-ft]
	150 lb	300 lb		
1/2" 150 lb / 300 lb ①	4x 1/2"	4x 1/2"	5.2	3.8
1" 150 lb / 300 lb ①	4x 1/2"	4x 5/8"	10	7.2
2" 150 lb / 300 lb ①	4x 5/8"	8x 5/8"	41	30
3" 150 lb / 300 lb ①	4x 5/8"	8x 3/4"	70	51
4" 150 lb / 300 lb ①	8x 5/8"	8x 3/4"	50	36

① Standard connections; other connections on request

Pressure tightness (vacuum) H250/C

Max. process temperature ▸			+70°C / +158°F		+150°C / +302°F		+250°C / +482°F	
			Min. operating pressure					
Nominal size	Float	Liner	[mbara]	[psia]	[mbara]	[psia]	[mbara]	[psia]
DN15...100	PTFE	PTFE	100	1.45	-	-	-	-
DN15...80	Ceramic	PTFE	100	1.45	250	3.63	-	-
DN15...80	Ceramic	TFM / Ceramic	100	1.45	100	1.45	100	1.45

7.4 Measuring ranges

H250/RR - stainless steel, H250/HC - Hastelloy®

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

		Water			Air			Max. pressure loss			
Float ▸		TIV	CIV	DIV	TIV Alu.	TIV	DIV	TIV Alu.	TIV	CIV	DIV
Nominal size	Cone	[l/h]			[Nm³/h]			[mbar]			
DN15, 1/2"	K 15.1	18	25	-	0.42	0.65	-	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)

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to:
Nl/h or Nm³/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

H250/RR - stainless steel, H250/HC - Hastelloy®

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

		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, 1/2"	K 15.1	4.76	6.60	-	0.26	0.40	-	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)

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to:
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)

H250/C - Ceramic/PTFE

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

		Flow rate				Max. pressure loss			
		Water		Air		Water		Air	
Liner / Float ▸		PTFE	Ceram.	PTFE	Ceram.	PTFE	Ceram.	PTFE	Ceram.
Nominal size	Cone	[l/h]		[Nm³/h]		[mbar]			
DN15, 1"	E 17.2	25	30	0.7	-	65	62	65	62
	E 17.3	40	50	1.1	1.8	66	64	66	64
	E 17.4	63	70	1.8	2.4	66	66	66	66
	E 17.5	100	130	2.8	4	68	68	68	68
	E 17.6	160	200	4.8	6.5	72	70	72	70
	E 17.7	250	250	7	9	86	72	86	72
	E 17.8	400	-	10	-	111	-	111	-
DN25, 1"	E 27.1	630	500	16	18	70	55	70	55
	E 27.2	1000	700	30	22	80	60	80	60
	E 27.3	1600	1100	45	30	108	70	108	70
	E 27.4	2500	1600	70	50	158	82	158	82
	E 27.5	4000 ①	2500	120	75	290	100	194	100
DN50, 2"	E 57.1	4000	4500	110	140	81	70	81	70
	E 57.2	6300	6300	180	200	110	80	110	80
	E 57.3	10000	11000	250	350	170	110	170	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

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to
Nl/h or Nm³/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

H250/C - Ceramic/PTFE

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

		Flow rate				Max. pressure loss			
		Water		Air		Water		Air	
Liner / Float ▸		PTFE	Ceram.	PTFE	Ceram.	PTFE	Ceram.	PTFE	Ceram.
Nominal size	Cone	[GPH]		[SCFM]		[psig]			
DN15, 1/2"	E 17.2	6.60	7.93	0.43	-	0.94	0.90	0.94	0.90
	E 17.3	10.6	13.2	0.68	1.12	0.96	0.93	0.96	0.93
	E 17.4	16.6	18.5	1.12	1.49	0.96	0.96	0.96	0.96
	E 17.5	26.4	34.3	1.74	2.48	0.99	0.99	0.99	0.99
	E 17.6	42.3	52.8	2.98	4.03	1.04	1.02	1.02	1.02
	E 17.7	66.0	66.0	4.34	5.58	1.25	1.04	1.25	1.04
	E 17.8	106	-	6.2	-	1.61	-	1.61	-
DN25, 1"	E 27.1	166	132	9.92	11.2	1.02	0.80	1.02	0.80
	E 27.2	264	185	18.6	13.6	1.16	0.87	1.16	0.87
	E 27.3	423	291	27.9	18.6	1.57	1.02	1.57	1.02
	E 27.4	660	423	43.4	31.0	2.29	1.19	2.29	1.19
	E 27.5	1056 ①	660	74.4	46.5	4.21	1.45	2.81	1.45
DN50, 2"	E 57.1	1057	1189	68.2	86.8	1.18	1.02	1.18	1.02
	E 57.2	1664	1664	111.6	124	1.60	1.16	1.60	1.16
	E 57.3	2642	2906	155	217	2.47	1.60	2.47	1.60
	E 57.4	4226 ①	-	-	-	4.12	-	-	-
DN80, 3"	E 87.1	4227	4227	-	-	1.18	1.02	-	-
	E 87.2	6604	6604	-	-	1.38	1.23		-
	E 87.3	10567 ①	-	-	-	3.55	-		-
DN100, 4"	E 107.1	10567	-	-	-	1.45	-		-
	E 107.2	15850 ①	-	-	-	3.29	-		-

① Special float

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to:
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)

H250H - Horizontal installation position

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

EN	ASME	Cone	Water [l/h]	Air [Nm^3/h]	Pressure loss [mbar]
DN15	1/2"	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

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to:
Nl/h or Nm^3/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

H250H - Horizontal installation position

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

EN	ASME	Cone	Water [GPH]	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

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)

H250U - Vertical installation position

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia
Flow direction:	Vertical downwards		

EN	ASME	Cone	Water [l/h]	Air [Nm^3/h]	Pressure loss [mbar]
DN15	1/2"	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

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to:

Nl/h or Nm^3/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

H250U - Vertical installation position

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia
Flow direction:	Vertical downwards		

EN	ASME	Cone	Water [GPH]	Air [SCFM]	Pressure loss [psig]
DN15	1/2"	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

INFORMATION!
The operating pressure should be at least double the pressure loss for liquids and five times for gases. 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.

Reference condition for gas measurements:
Flow measurements for gases are attributed to:
SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)

KROHNE – Process instrumentation and measurement solutions

- Flow
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- Temperature
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