H250 Handbook

Variable area flowmeter

KROHNE

1.1 Intended use

The variable area flowmeters manufactured by KROHNE Messtechnik GmbH & Co. KG are suitable for measuring gases, vapours and liquids.
These devices are particularly suitable for measuring:

- Liquids
- Hydrocarbons
- Water
- Chemicals with low corrosiveness
- Saturated steam
- Superheated steam
- Food industry
- Industrial gases

DANGER!
In case of instruments which are used in explosive endangered areas please consider the supplementary installation and operating instructions mentioned in the Ex-manual.

WARNING!
The operator shall bear sole responsibility for the use of the flowmeters with regard to suitability, intended use and corrosion resistance of the materials used to the medium.
The manufacturer shall not be liable for any damage resulting from improper use or use for other than the intended purpose.
Do not use any abrasive or highly viscous media.

1.2 Safety instructions for the operator

CAUTION!
Flowmeters from KROHNE Messtechnik GmbH & Co. KG may only be installed, commissioned operated and maintained by properly trained and authorized personnel.

This document must be read by all users prior to installation, commissioning, operation and maintenance of the flowmeter.

1.3 Certifications

The flowmeter meets the statutory requirements of the following EC directives:

- Pressure Equipment Directive 97/23/EC
- ATEX Directive 94/9/EC for instruments in Ex-areas
- EMC Directive 89/336/EC for instruments with electrical options

And also

- NAMUR recommendations NE 21 and NE 43

KROHNE Messtechnik GmbH & Co. KG certifies successful testing of the product by applying the CE mark.

1.4 Manufacturer's safety instructions

The flowmeter has been built and tested in accordance with the current state of the art, and complies with the relevant safety standards.
However, dangers may arise from improper use or use for other than the intended purpose. For this reason, observe all of the safety instructions in this document carefully.

1.4.1 Notes about the documentation

In addition to the safety rules and industrial safety regulations in this documentation, national and regional safety rules and industrial safety regulations must also be observed.

1.4.2 Symbol conventions

For greater clarity, the following symbols are used in this documentation:

DANGER!
These warnings must always be observed. Even partial failure on your part to observe them can lead to serious damage to health, damage to the device, to the user's system components, or to the environment.

DANGER!
This symbol is used to identify dangers when working with electric current.

INFORMATION!
This symbol identifies important notes and information for working with the flowmeter.

LEGAL NOTICE!
This symbol identifies important notes and information for working with the flowmeter.

- **Action**
  This symbol identifies all instructions for actions to be carried out by the operator in the specified sequence.

➲ **Consequence**
This symbol indicates all important consequences of the previous actions.

2.1 Scope of delivery

INFORMATION!
Please check the contents of the consignment for completeness and intactness.

Figure 2-1: **Scope of delivery**

1. Flowmeter in the version ordered
2. For indicator M10 - bar magnet
3. For indicator M10 - key
4. Manual
5. Certificates, calibration report (supplied to order only)

2.2 Device version

- H250 with indicator M9
- H250 with indicator M10
- H250 with indicator M8

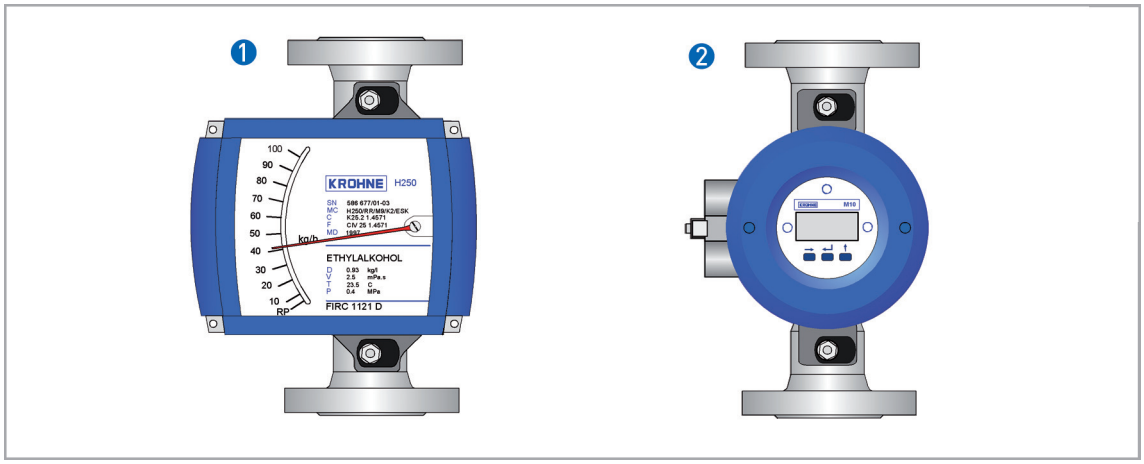


Figure 2-2: **Device versions 1**

1. H250/RR/M9

- Local indication without auxiliary power supply
- Max. 2 limit switches, type NAMUR, NAMUR safety-oriented or 3-wire open collector
- 2-wire analog output 4...20 mA, HART^{TM}- or Profibus communication
- 6-digit flow counter (non Ex)

2. H250/RR/M10

- Pressure-resistant enclosure Ex d
- 2 digital adjustable limit switches, 2-wire open collector or type NAMUR
- 2-wire analog output 4...20 mA, HART^{TM} communication
- Pulse output up to 10Hz (also for electromechanical counters)
- 12-digit flow counter with external resetting (batch operation)

The following designs are available as options:

- H250 with indicator M9 as high-temperature version HT
- H250 with indicator M9 with added corrosion protection (special paint finish)
- H250 with indicator M9 in stainless steel housing

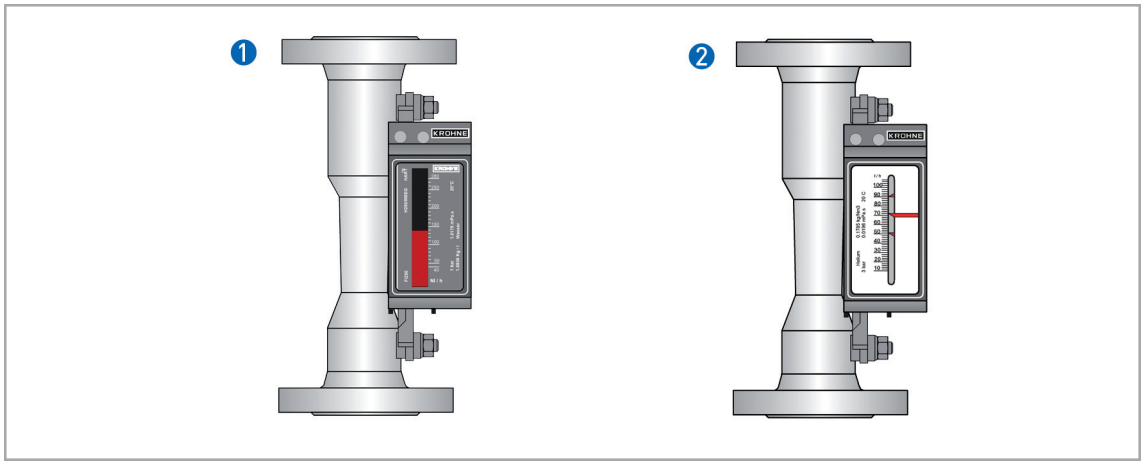


Figure 2-3: **Device versions 2**

1. H250/RR/M8EG
   - Electronical bargraph display
   - 2-wire analog output 4...20 mA, HART^{TM} communication

2. H250/RR/M8MG
   - Local indication without auxiliary power supply
   - 2 limit switches, 2 wire type NAMUR or NAMUR safety-oriented

2.3 Nameplate

INFORMATION!
Before installing the device, make sure that the information on the nameplate corresponds to the ordering data.

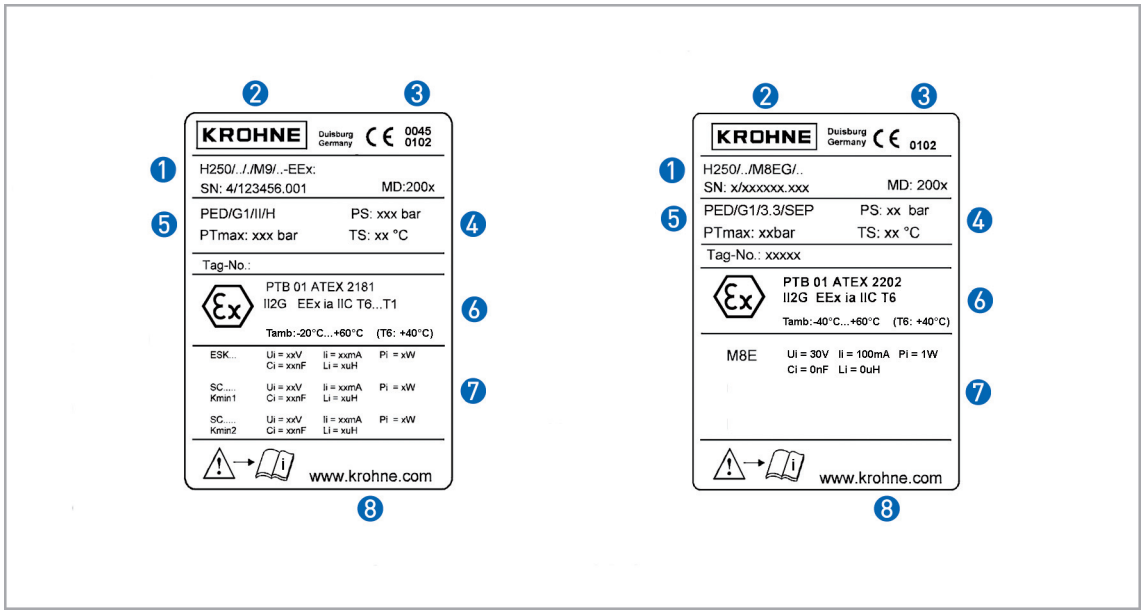


Figure 2-4: **Nameplates on the indicator**

1. Type of meter
2. Manufacturer
3. Appointed ATEX & DGRL body
4. Design data: temperature & pressure rating
5. DGRL data
6. Ex data
7. Electrical connection data
8. KROHNE website

Additional markings on the indicator

- SO - sales order / item
- KO - KROHNE order
- Vx - product configurator code
- AC - article code

2.4 Description code

The description code* consists of the following elements:

1 Materials / versions
- RR - Stainless steel
- C - PTFE or PTFE/ceramics
- HC - Hastelloy
- Ti - Titanium
- F - Sterile version (food)

2 Heating jacket version
- B - with heating jacket

3 Indicator part series
- M8 - Indicator M8
- M9 - Indicator M9 standard indicator
- M9S - Indicator with added corrosion protection
- M9R - Indicator in stainless steel housing
- M10 - Indicator or signal converter M10

4 Design of indicator M8
- MG - Mechanical indicator
- EG - Electronic indicator with signal output 4...20mA

5 High-temperature version
- HT version with HT extension

6 Electrical signal output
- ESK - Electronic transmitter - Analog output 4...20mA or Profibus PA
- ESK-Z - Analog output and totalizer

7 Limit switch
- K1 - One limit switch
- K2 - Two limit switches

8 Explosion protection
- EEx - Explosion-protected equipment to European Standard

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

3.1 General installation instructions

CAUTION!
Installation, assembly, start-up and maintenance may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.

The following procedures have to be carried out before installing the device!

- Check the packaging and the device itself for any damage.
- Check the contents of the consignment for completeness.
- Compare your order specification with the scope of delivery.

INFORMATION!
Comply with the application limits of the device with regard to pressure and temperature in accordance with EN 1092-1 and/or ASME B 16.5. Further information is contained in Section 9 "Technical data".

3.2 Storage

- Store the flowmeter in a dry and dust-free location.
- Avoid lasting direct exposure to the sun.
- Store the flowmeter in its original packaging.
- The permissible storage temperature is from -40 to +80°C for standard meters.

3.3 Functional principle

The flowmeter operates on the float measurement principle

The measuring section 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:

$$W = B + D$$

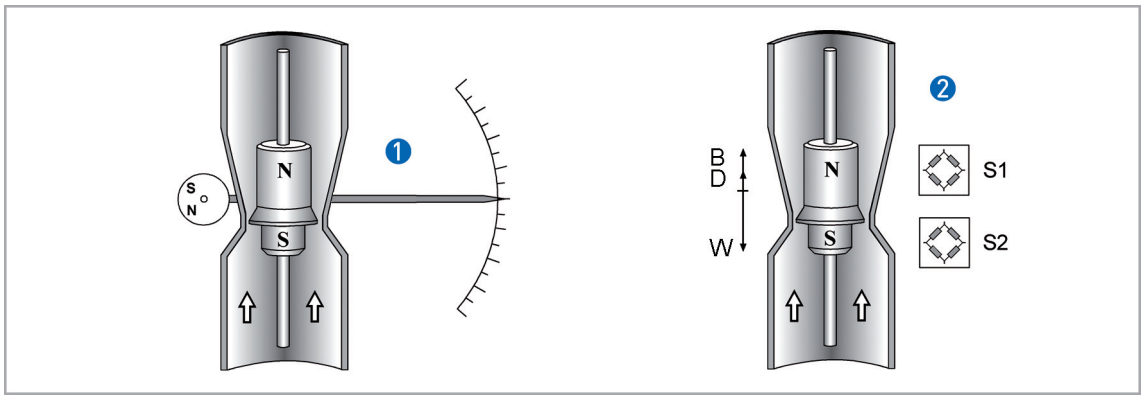


Figure 3-1: **Operating principle**

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 section 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 section is transmitted to the electronic display by means of a magnetic coupling on sensors S1 and S2.

Functional principle of devices H250H and H250U

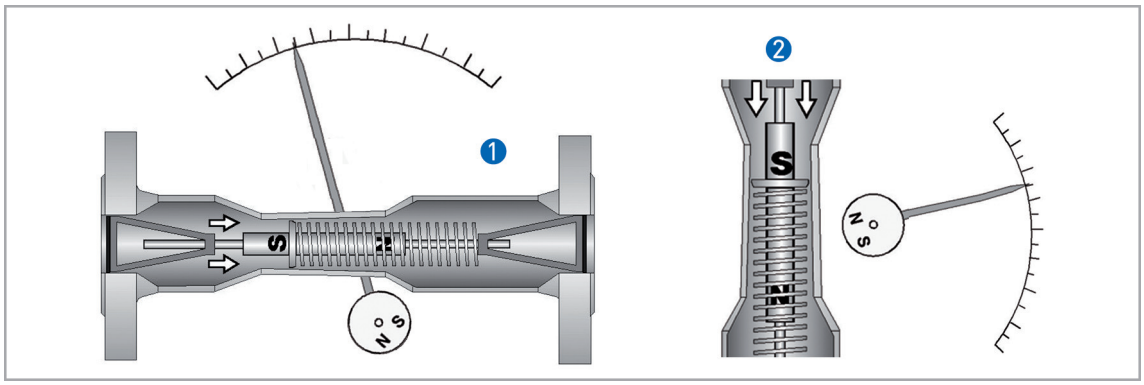


Figure 3-2: **Operating principle H250H and H250U**

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

The flowmeters operate according to a modified float measurement 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 section is displayed on a scale by means of a magnetic coupling.

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

3.4 Installation requirements

CAUTION!

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

- *The variable area flowmeters must be installed vertically (measurement principle). The flow direction must be from bottom to top. For installation recommendations please refer also to VDE/VDI Directive 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 mounting flange 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 sealing faces, see Section 3.3.1 "Tightening torques".
- *Control devices are to be positioned downstream of the flowmeter.*
- *Shutoff devices are preferably to be positioned upstream of the flowmeter.*
- *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 axially with the connections on the flowmeter so they are free of stresses.*
- *If necessary, the piping has to be supported to prevent vibrations being transmitted to the flowmeter.*
- *Do not lay signal cables directly next to cables for the power supply.*

3.4.1 Tightening torques

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

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

3.4.2 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.

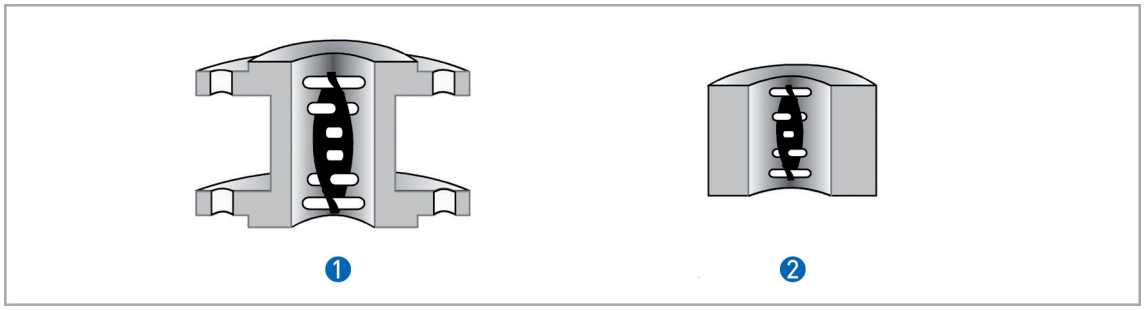


Figure 3-3: **Magnetic filters**

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

Material: 1.4571

3.4.3 Heat insulation

CAUTION!
The signal converter housing may not be heat-insulated.
The heat insulation ❸ may only reach as far as the housing fastening ❹.

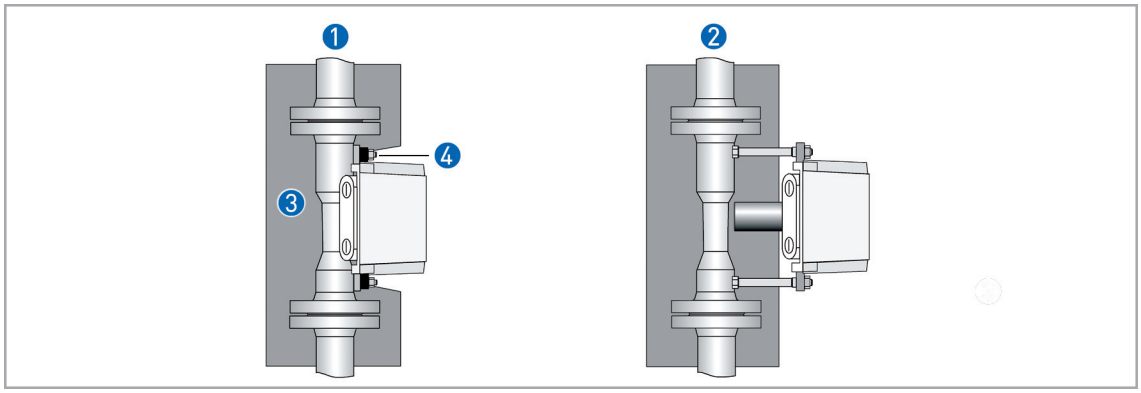


Figure 3-4: **H250 heat insulation**

❶ Standard indicator M9
❷ Indicator with HT extension

This applies in the same manner to indicators M8 and M10.

CAUTION!
The heat insulation ❶ may only reach to the rear of the housing ❷. The area of the cable entries ❸ must be freely accessible.

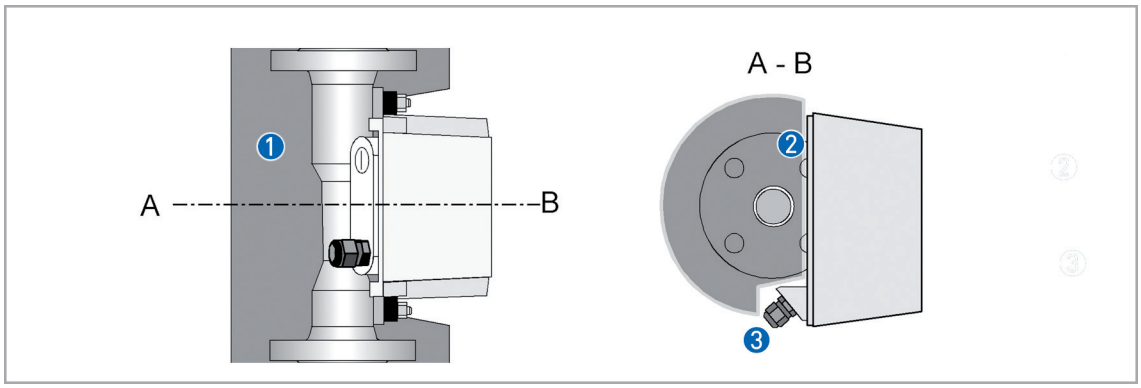


Figure 3-5: **Insulation - cross section**

3.5 Start-up

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

- *Compare the actual operating pressure and the process temperature of the system with the specifications on the nameplate (PS and TS). The PS and TS must not be exceeded.*
- *Make sure materials are compatible.*
- *Slowly open the shutoff valve.*
- *When measuring liquids, vent the pipes carefully.*
- *When measuring gases, increase pressure slowly.*
- *Avoid float impact (e.g. caused by solenoid valves), as this is likely to damage the measuring section or float.*

INFORMATION!
Damping can be fitted to avoid possible compression-induced oscillation of the float. If the float should nevertheless tend to oscillate, this can be eliminated by installing a throttle valve or a suitable orifice plate (on request) downstream of the device.

3.6 Protection category

The flowmeter meets all requirements of protection category IP 67.

DANGER!
After all servicing and maintenance work on the flowmeter, the specified protection category has to 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 have to be replaced.
- The electrical cables used must be undamaged and must comply with regulations.
- The cables must be laid with a loop ❸ upstream of the flowmeter to prevent water from getting into the housing.
- The cable glands ❷ have to be firmly tightened.
- Close the unused cable glands using blanking plugs ❶.

Figure 3-6: **Cable gland**

❶ Use blanking plugs if no cable is routed through
❷ Tighten the protective cover
❸ Lay the cable in a loop

3.7 Ground connections

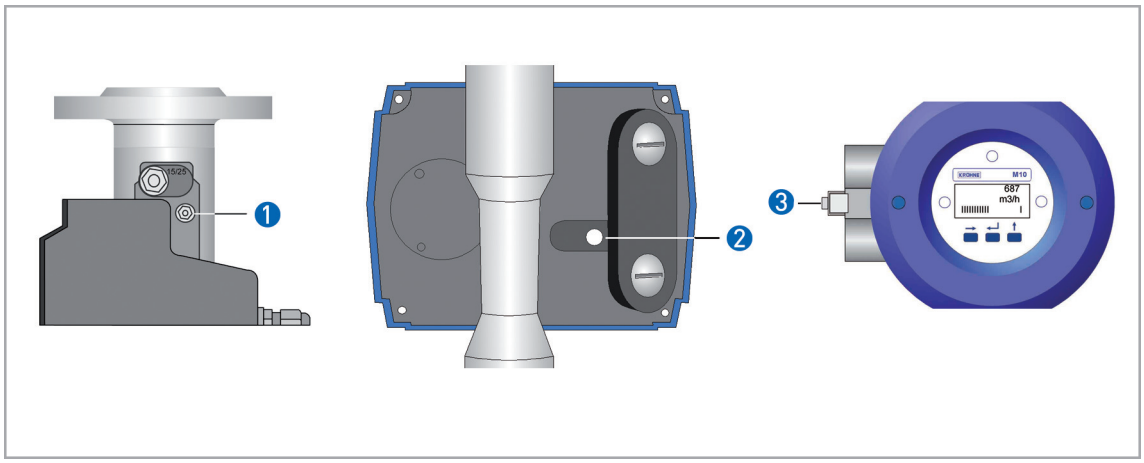


Figure 3-7: **Ground connections**

1. Indicator M8
2. Indicator M9
3. Indicator M10

DANGER!
The earth conductor must not transfer any interference voltage.
Do not use this earth conductor to ground any other electrical devices.

3.8 Safety instructions

For indicators with electrical internals, the following safety instructions apply:

CAUTION!
All work on the electrical equipment of the device may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.

DANGER!
Only perform work on the electrical connections in the de-energized state.

DANGER!
Observe the applicable national and international regulations for electrical installations!

4.1 Indicator M8M - limit switches

The limit switches can be set over the entire measuring range using the maximum pointer. The set limit values are displayed on the scale. The pointers are set to the desired limit values using a slip coupling along the scale.

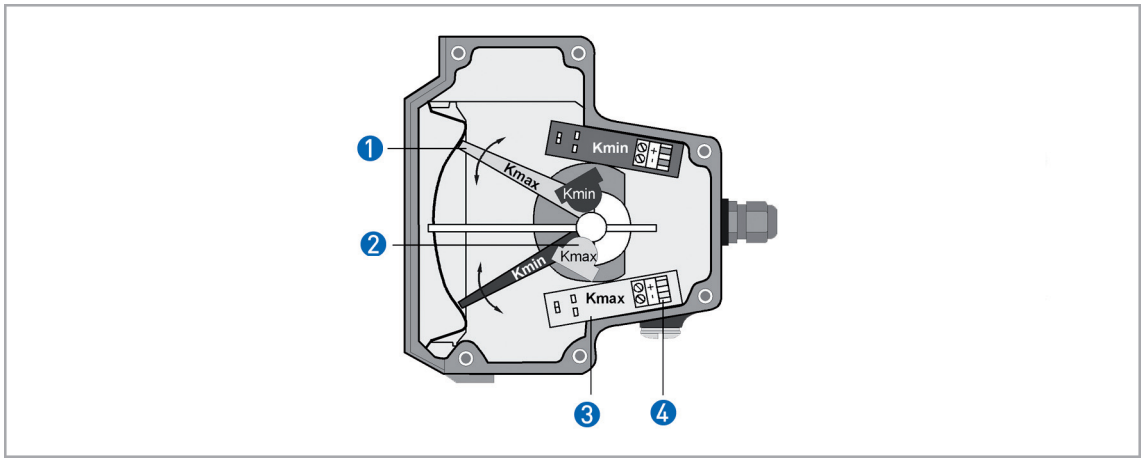


Figure 4-1: **Limit switch settings M8MG**

1. Maximum pointer, switching point indicator
2. Limit switch
3. Connection board
4. Connection terminal

4.2 Indicator M8E - analog output

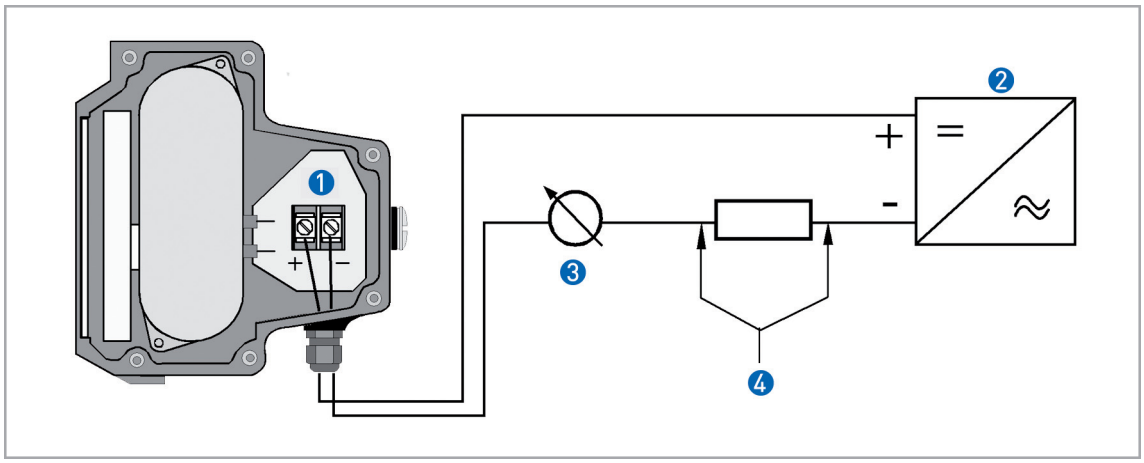


Figure 4-2: **Electrical connection M8EG**

1. Terminal connection
2. Power supply 14.8...30 VDC
3. Measurement signal 4...20 mA
4. External load, HART™ communication

The circuitry for connection to other devices such as digital evaluator units or process control equipment must be designed with especial 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.

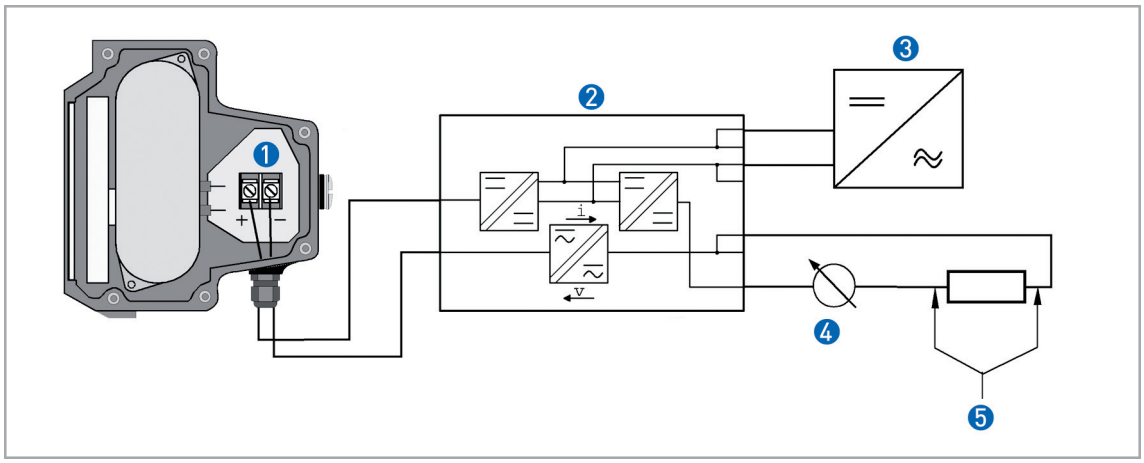


Figure 4-3: **Electrical connection M8EG with electrical isolation**

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

Power supply

INFORMATION!
The supply voltage has to be between 14.8 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 flowmeter).

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

$U_B = R_{tot} \cdot 22\ mA + 14.8\ V$

where
U_B = the minimum supply voltage and
R_{tot} = the total measuring loop resistance

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

Load for HART™ communication

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

The maximum load impedance is calculated as follows:

$$R_{max} = \frac{U_B - 14{,}8V}{22\ mA}$$

DANGER!
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).

Parametrization

The M8E electronic indicator can be parametrized via HART™ communications. DD (Device Descriptions) for AMS 6.x and PDM 5.2 and a DTM (Device Type Manager) are available for parametrization (download center at **www.krohne.com**).

The current flow rate can be transmitted using the integral HART™ communications. A flow counter can be parametrized. Two limit values can be set and monitored. The limit values are assigned either to flow values or to the counter overflow. The limit values are not depicted on the display.

5.1 Indicator M9 - Limit switch

Indicator M9 can be equipped with a maximum of two electronic limit switches. The limit switch functions with a slot sensor which is operated inductively through the semicircular metal vane belonging to the measuring pointer. The switching points are set through the contact pointers. The position of the contact pointer is indicated on the scale.

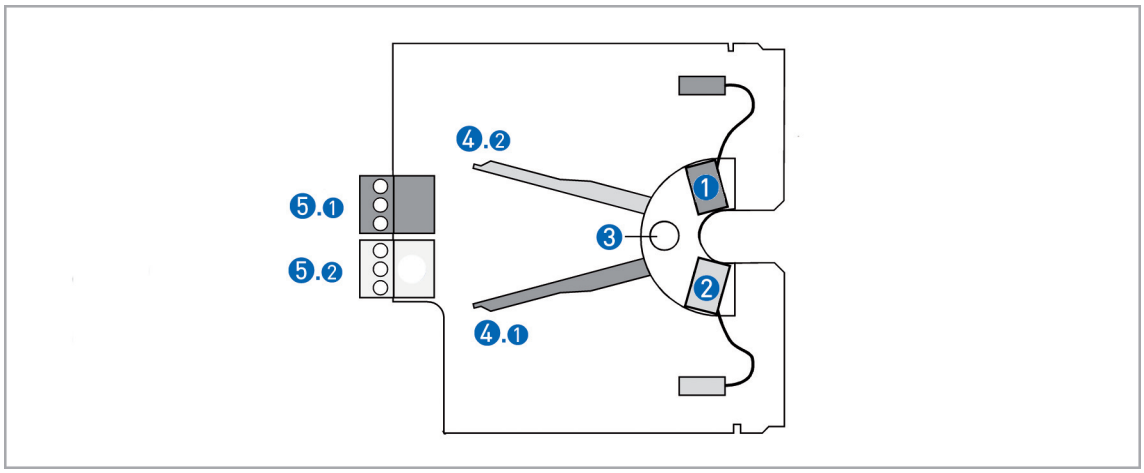


Figure 5-1: **Limit switch module**

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 lines. The built-in contact types are shown on the indicator.

Electrical connection of the limit switches

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

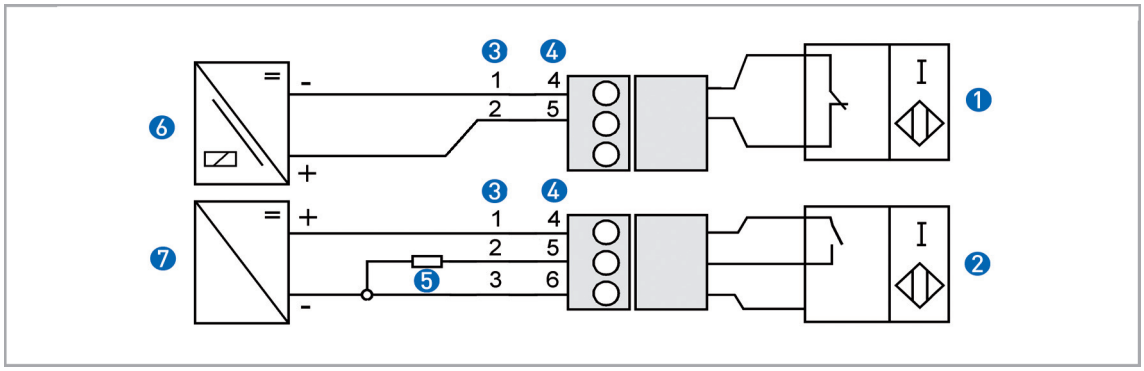


Figure 5-2: **Limit switch connection terminals**

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 isolation switching amplifier
7. 3-wire power supply

Limit setting

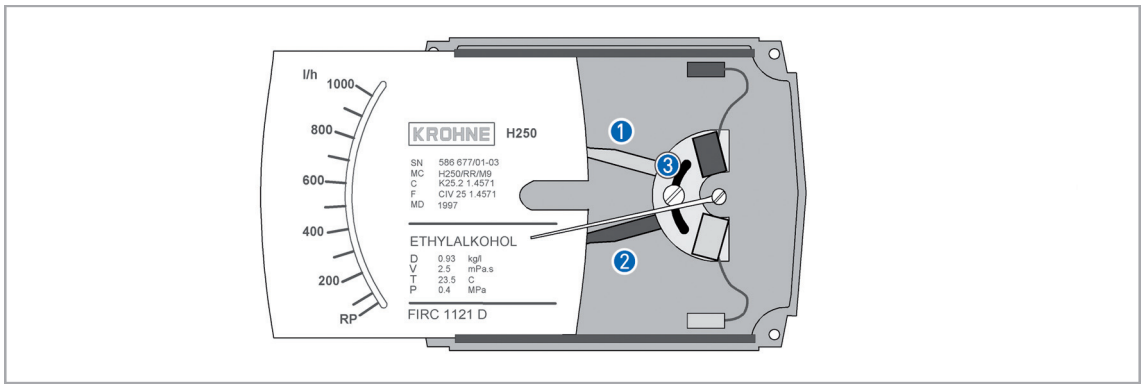


Figure 5-3: **Limit switch settings**

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

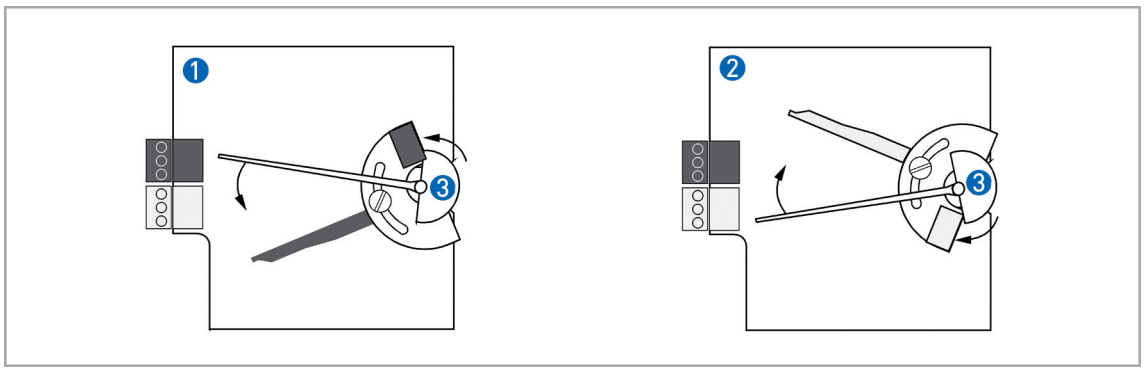


Figure 5-4: **Switch contact definition**

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 of MIN/MIN - MAX/MAX contact

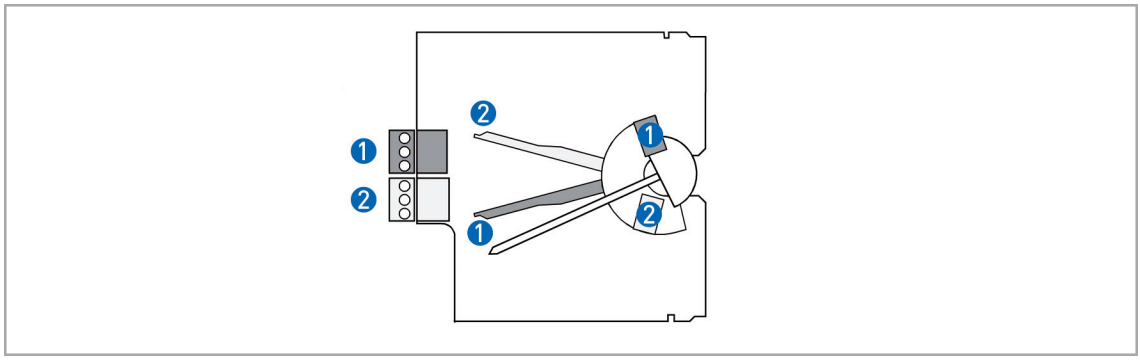


Figure 5-5: **Definition MinMin - MaxMax**

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	SJ3,5-S1N	≤ 1 mA
MIN 2	SC3.5-NO	≤ 1 mA
MAX 1	SJ3,5-S1N	≥ 3 mA
MAX 2	SC3,5-NO	≥ 3 mA

5.2 Indicator M9 - Electrical signal output ESK2A

The connecting terminals of the ESK2A have a pluggable design and can be removed in order to connect the lines.

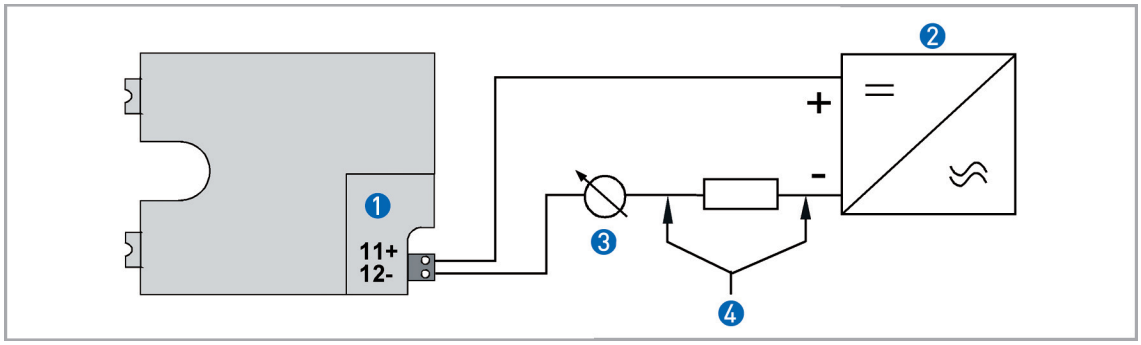


Figure 5-6: **ESK2A connection**

1. ESK2A current transmitter
2. Power supply 12...30VDC
3. Measurement signal 4...20 mA
4. External load, HART™ communication

The circuitry for connection to other devices such as digital evaluator units or process control equipment must be designed with especial 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.

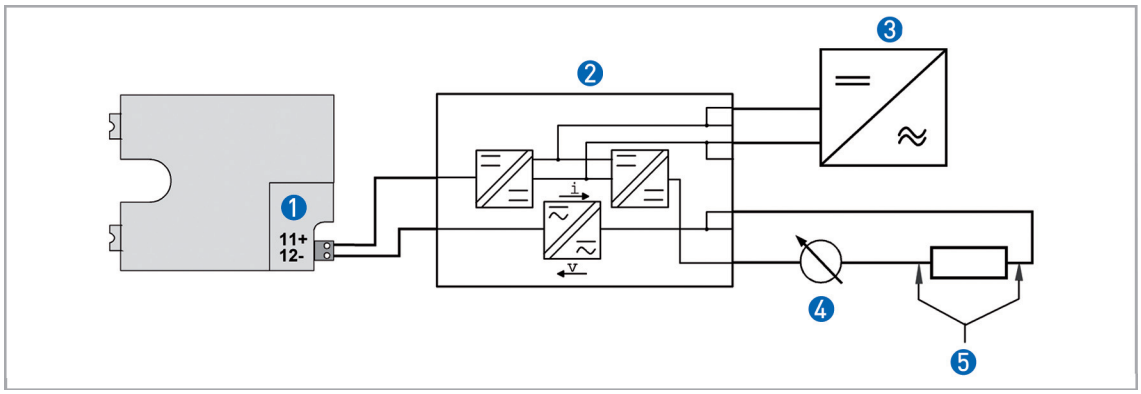


Figure 5-7: **ESK2A connection with electrical isolation**

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

HART^{TM} communication

When HART^{TM} communication is carried out with the ESK, this will not in any way impair analog measured-data transmission (4...20 mA).

Exception: multidrop operation. In multidrop operation a maximum of 15 devices with HART^{TM} function can be operated in parallel, whereby their analog outputs are switched inactive.
(I approx. 4 mA per device).

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 determine this, add up the resistances of each component in the measuring loop (not including the flowmeter).

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

$U_B = R_{tot} \cdot 22\ mA + 12\ V$

where
U_B = the minimum supply voltage and
R_{tot} = the total measuring loop resistance

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

Load for HART™ communication

INFORMATION!

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

The maximum load impedance is calculated as follows:

$$R_{max} = \frac{U_B - 12\,V}{22\,mA}$$

DANGER!

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).

Parametrization

The ESK can be parametrized via HART™ communications. DD (Device Descriptions) for AMS 6.x and PDM 5.2 and a DTM (Device Type Manager) are available for parametrization (download center at **www.krohne.com**).

The current flow rate can be transmitted using the integral HART™ communications. A flow counter can be parametrized. Two limit values can be monitored. The limit values are assigned either to flow values or to the counter overflow.

5.3 Indicator M9 - Electrical signal output ESK3-PA Profibus

Bus cable - shielding and grounding

The statements of the FISCO model only apply if the bus cable used meets the required specifications. For specifications, see the section "Technical data" ESK3-PA

In order to ensure optimum electromagnetic compatibility of systems it is important that the system components, and in particular the bus cables, are shielded. These shields must have as few gaps as possible.

Connection

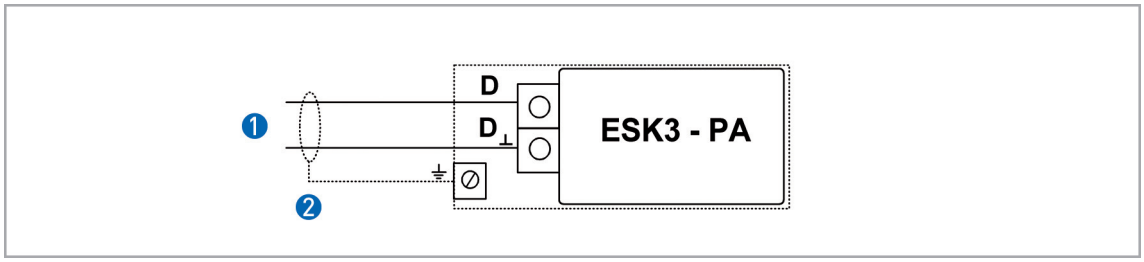


Figure 5-8: **ESK3-PA connection**

1. Signal connection
2. Shielding and grounding

Polarity reversal has no effect on the function. The cable shield should be connected with minimum length to the functional ground FE.

5.4 Indicator M9 - Flow totalizer ESK-Z

The flow totalizer only works in conjunction with the ESK current transmitter. A 6-digit display shows the totalised flow value. It can be changed over to the instantaneous flow value in 0 to 100%.

A data backup is carried out automatically in the event of a power failure.

The counter is factory-set to the measuring range of the indicator. The total value can be read directly.

Supply 11/12 and measured signals S+ and S- are not electrically isolated. If the measured signal is not needed externally, a short-circuit jumper has to be connected to terminals S+ and S-.

Pulse outputs P+ and P- are electrically isolated. A pulse is generated for each counter advance. If the pulse output is not required, its terminals can remain unused.

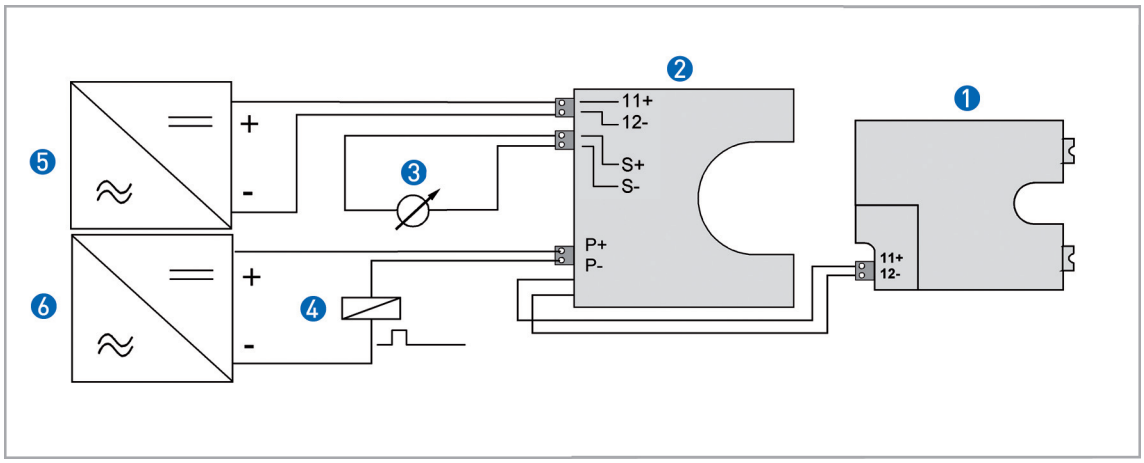


Figure 5-9: **Counter connection**

1. ESK - measurement signal 4...20 mA
2. Counter module
3. Transfer of the measurement signal or short-circuit jumper
4. Pulse output load
5. Counter power supply
6. Pulse output power supply

A functional extra-low voltage with protective electrical isolation (PELV) in accordance with VDE 0100 Part 410 is required as auxiliary power. All the instruments (recorder, display, etc.) connected to measuring circuits S+ and S- are connected in series. If this measuring circuit is not needed, then a short-circuit jumper is required.

Settings - display modes

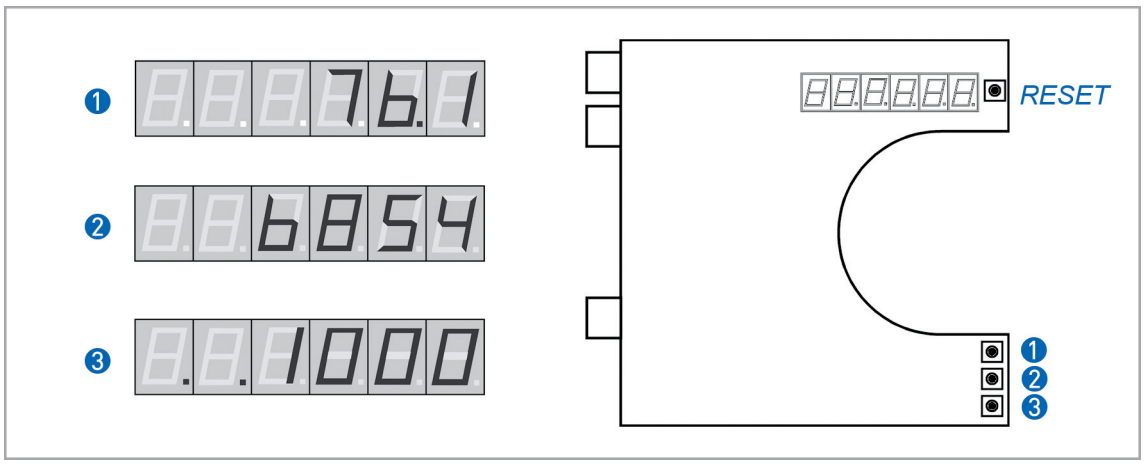


Figure 5-10: **Counter display modes**

1. Flow rate as % display
2. Flow totalizer display
3. Conversion factor display

The RESET button deletes only the current total value.

Settings by pressing a button at the moment of switch-on

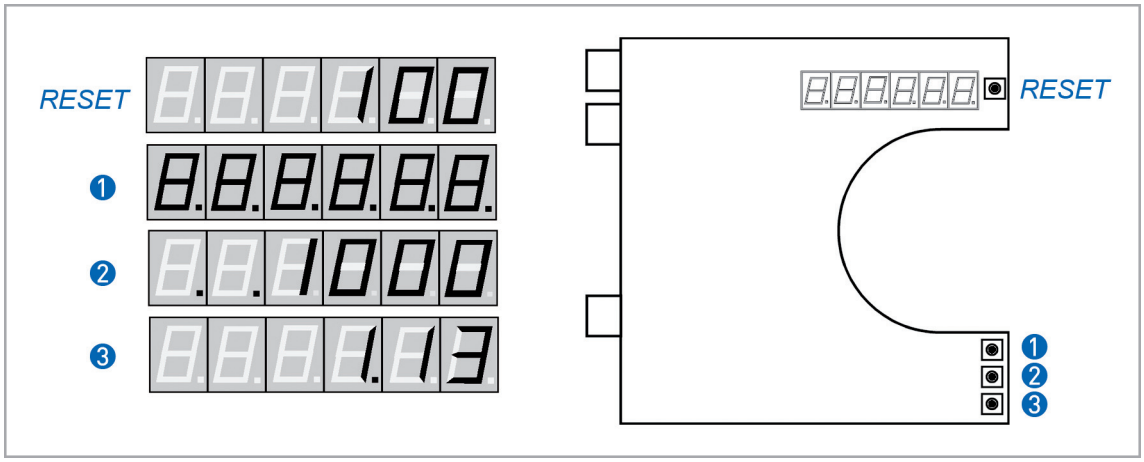


Figure 5-11: **Settings of the counter at the moment of switch-on**

- RESET button - mA calibration
- Button 1 - Display test
- Button 2 - Changing the conversion factor
- Button 3 - Software hardware version (information)

Conversion factor

The conversion factor is always 10% of the full-scale range.
If the measuring range is not know, the conversion factor is factory-set to 1000.

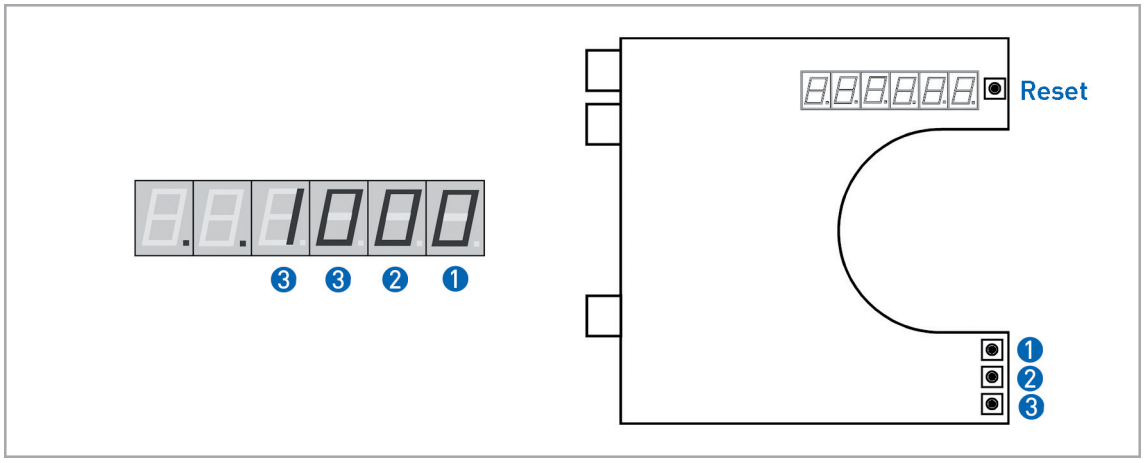


Figure 5-12: **Changing the conversion factor**

1. Units position
2. Tens position
3. Hundreds and 1000s position

Exit the setting by pressing the RESET button
The largest factor that can be set is 1099.
Factors with decimal values are not possible.

Counter overflow

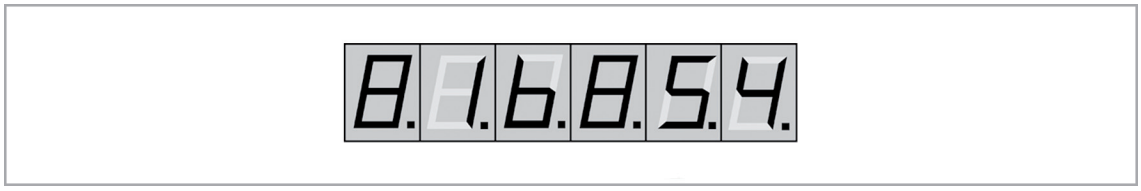


Figure 5-13: **Depiction of counter overflow**

A counter overflow is signaled by all the decimal points lighting up.
Reset by pressing the RESET button.

Analog input calibration

During the switching-on process keep the RESET button pressed until three decimal points light up.

- Set 4.00 mA
- Keep button 1 pressed until the number 0 is displayed
- Set 20.00 mA
- Keep button 3 pressed until the number 100 is displayed
- Exit calibration by pressing button 2

6.1 Indicator M10 - Electrical connection and functions

After the housing cover is unscrewed, the display can be pulled off. The connection terminals have a spring clamp system.

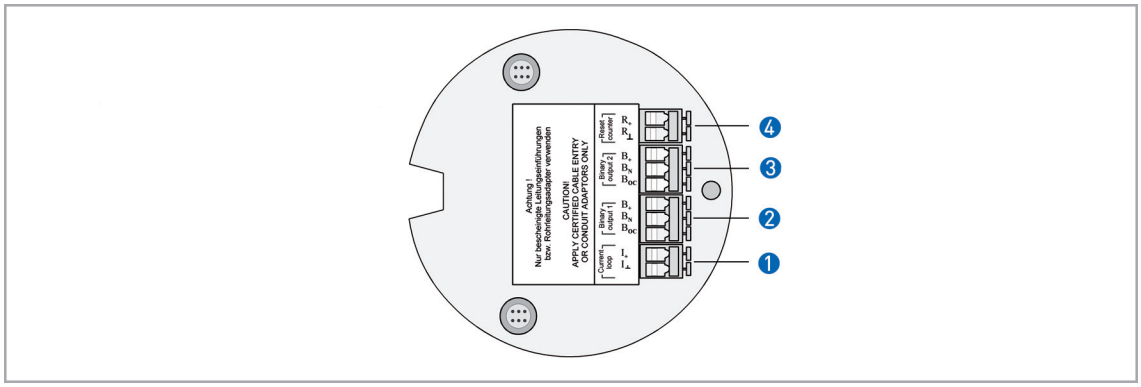


Figure 6-1: **Indicator M10 terminal connection**

1. Power supply - analog output
2. Switching output B1
3. Switching output B2 or pulse output
4. Reset input R

6.2 Indicator M10 - Power supply - analog output

The electrical connection is polarized.

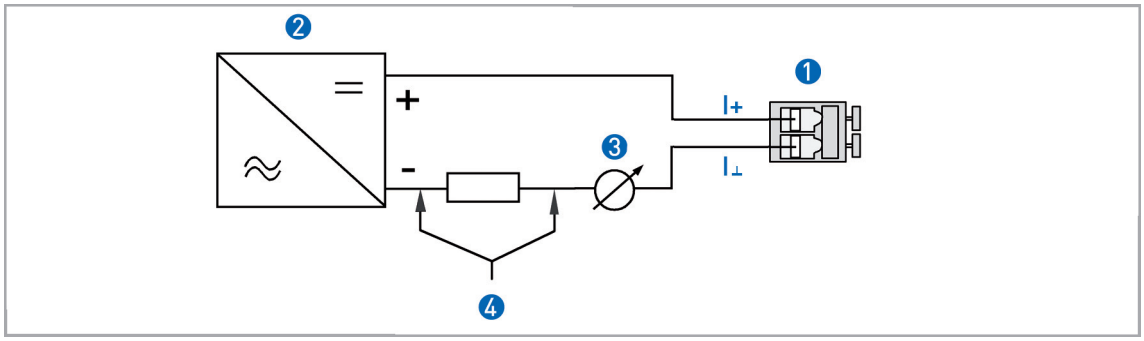


Figure 6-2: **Indicator M10 - terminal connection I**

1. Terminal connection
2. Power supply 16...32VDC
3. Measurement signal 4...20 mA
4. External load, HART™ communication

The circuitry to other devices must be designed with especial 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.

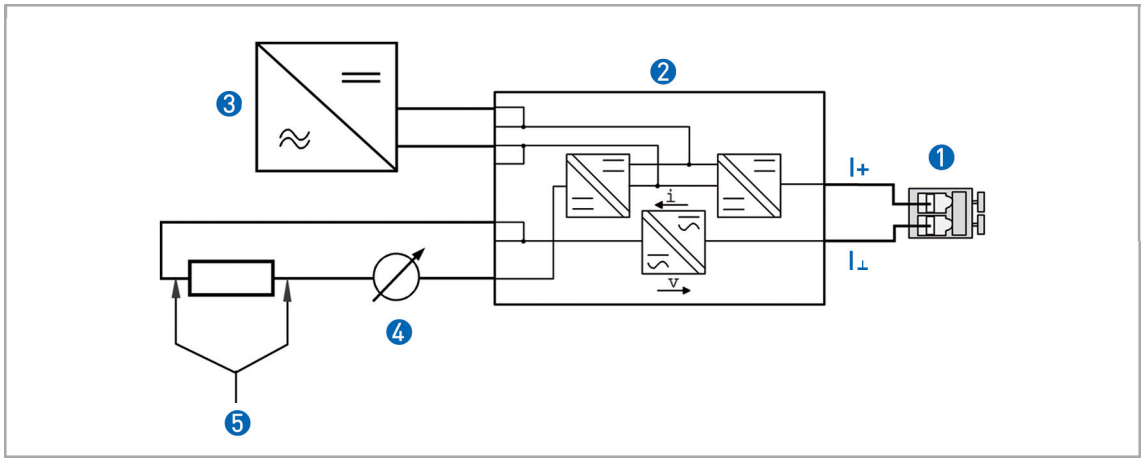


Figure 6-3: **Power supply M10 with electrical isolation**

1. Terminal connection
2. Converter supply isolator with electrical isolation
3. Measurement signal 4...20mA
4. External load, HART™ communication

HART™ communication

When HART™ communication is carried out with the M10, this will not in any way impair analog measured data transmission (4...20 mA).

Exception: multidrop operation. In multidrop operation a maximum of 15 devices with HART™ function can be operated in parallel, whereby their analog outputs are switched inactive.

Power supply

INFORMATION!

The supply voltage has to be between 16 VDC and 32 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 flowmeter).

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

$U_B = R_{tot} \cdot 22\ mA + 16\ V$

where
U_B = the minimum supply voltage and
R_{tot} = the total measuring loop resistance

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

Load for HART™ communication

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

The maximum load impedance is calculated as follows:

$$R_{max} = \frac{U_B - 16\,V}{22\,mA}$$

DANGER!
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).

Parametrization

The M10 electronic indicator can be parametrized via HART™ communications. DD (Device Descriptions) for AMS 6.x and PDM 5.2 and a DTM (Device Type Manager) are available for parametrization (download center at **www.krohne.com**).

The current flow rate can be transmitted using the integral HART™ communications. The flow counter can be parametrized. Two limit values can be monitored. The limit values are assigned either to flow values or to the counter.

6.3 Indicator M10 - Switching outputs B1 and B2

The switching outputs are electrically isolated from each other and from the analog output.

CAUTION!
The switching outputs can only be operating if the power supply is applied to terminals I+ and I-.

Switching outputs B1 and B2 can be implemented electrically with two attachment types:

- NAMUR switching output - Ri approx. 1kOhm
- Low-resistance switching output with PNP technology

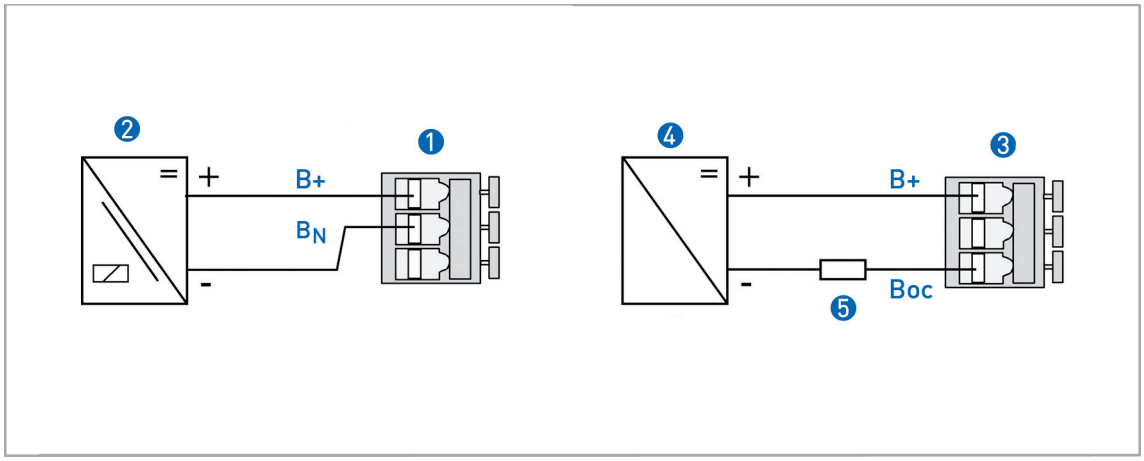


Figure 6-4: **Indicator M10 - switching outputs**

1. NAMUR terminal connection
2. Isolation switching amplifier
3. PNP technology terminal connection
4. Power supply
5. Load

Switching values

	NO contact		NC contact	
	NAMUR	OC	NAMUR	OC
	I [mA]			
Switching value reached	< 1	< 1	> 3	max 100
Switching value not reached	> 3	max. 100	< 1	< 1

Breaking capacity of B1 and B2 with PNP technology

Due to the PNP technology and the associated protective elements, there is a voltage drop Uv for the load to be operated.

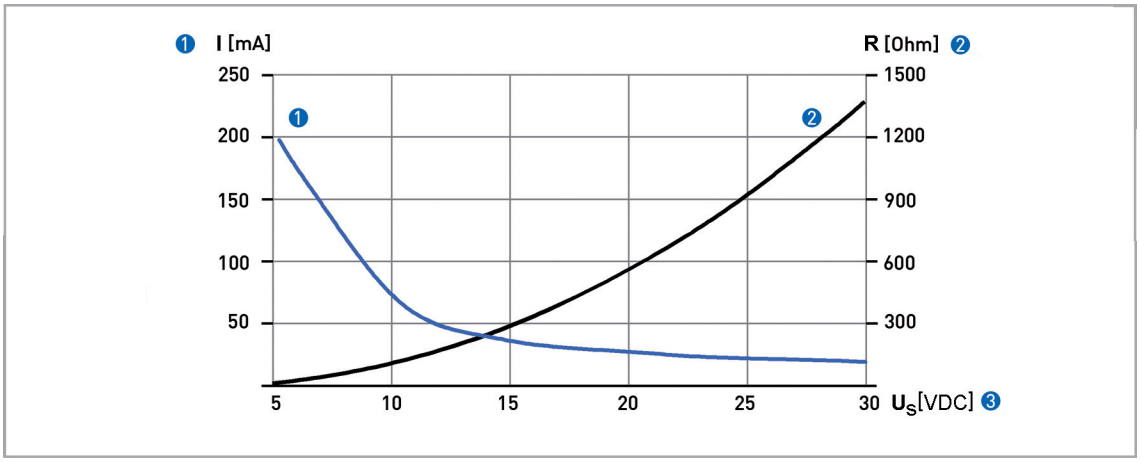


Figure 6-5: **Indicator M10 - Breaking capacity of B1 and B2**

❶ Max. switching current Y1 [mA]
❷ Minimum load impedance Y2 [ohm]
❸ Power supply

Voltage drop of B1 and B2 with PNP technology

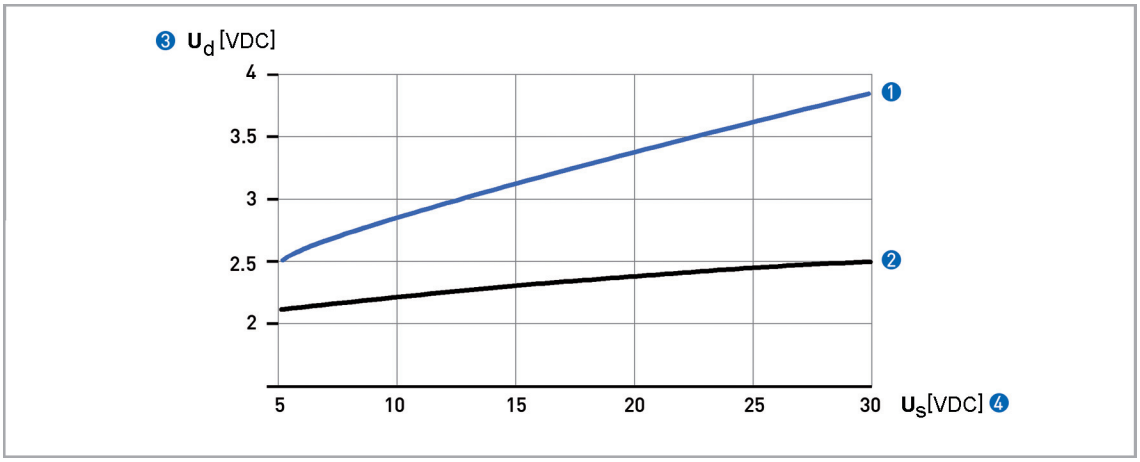


Figure 6-6: **Indicator M10 - power loss of B1 and B2**

❶ Load impedance 100 Ohm
❷ Load impedance 1000 Ohm
❸ Power loss
❹ Power supply

6.4 Indicator M10 - Switching output B2 as a pulse output

INFORMATION!
When switching output B2 is used as a pulse output, two separate signal circuits are required. Each signal circuit requires its own supply voltage.
The total resistance must be adapted so that the total current I_{tot} does not exceed 100 mA.

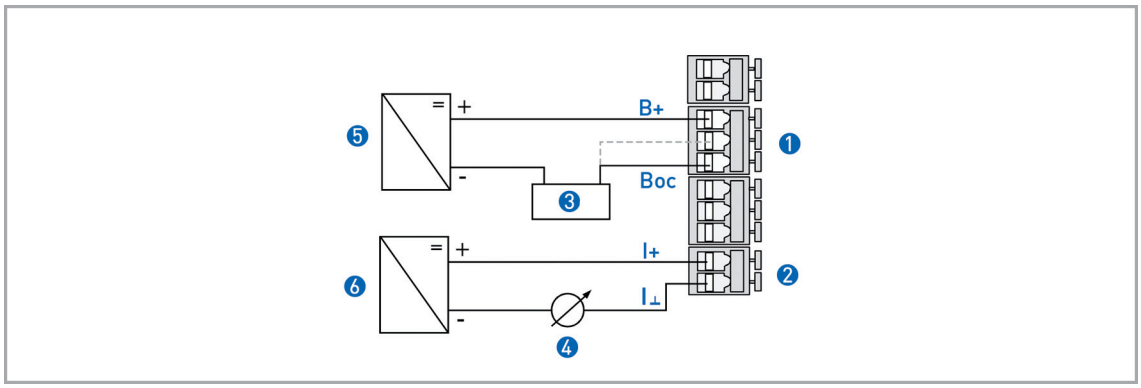


Figure 6-7: **Electrical pulse output**

1. Terminal B2
2. Terminal I
3. e.g. counter
4. Flow rate measurement 4...20 mA
5. Pulse output power supply
6. M10 power supply

Pulse output B2 is a passive "open collector" output which is electrically isolated from the analog output and output B1. It can be operated as a low-resistance output or as a NAMUR output.

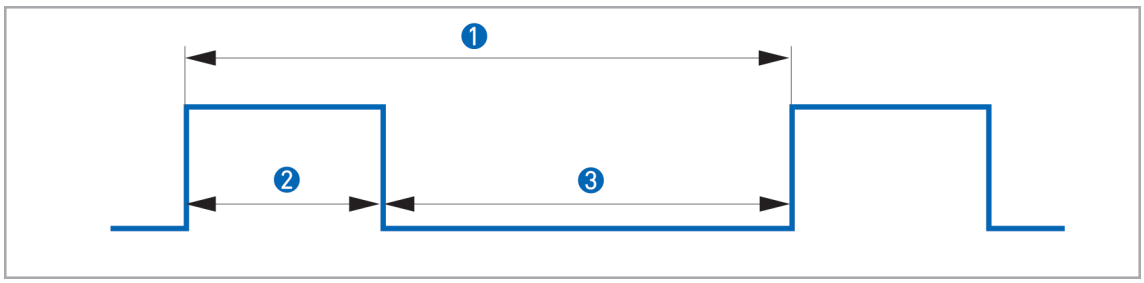


Figure 6-8: **Data pulse output**

1. f_{max} = 10 Hz
2. t_{on}
3. t_{off}

The pulse duration t_{on} can be configured from 30...500 ms in the menu of the indicator.

6.5 Indicator M10 - Connection reset input R

Input R can be used as a reset input for the internal counter.

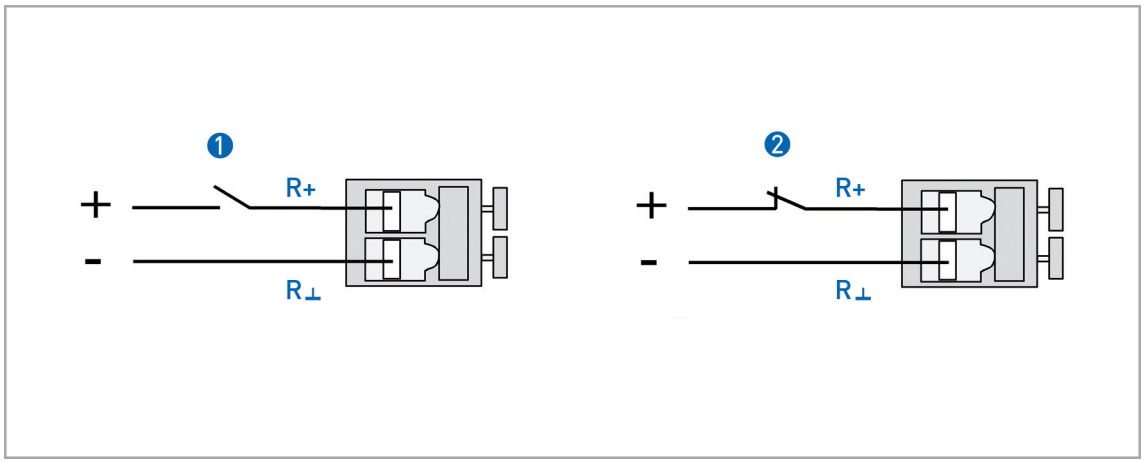


Figure 6-9: **Indicator M10 - reset input**

1 Function active HI
2 Function active LO

This reset input can be activated in the menu of indicator M10, and can be configured to ACTIVE HI or ACTIVE LO. See also Section 8.4 - "Indicator M10 menu explanations"

If the input is set as ACTIVE LO, an interruption causes the counter to be reset.

7.1 Indicator M10 - Start-up

INFORMATION!
The device is always preset for the user and his application.

Start

After the device is switched on, the display shows the following in sequence

- “Test”,
- the type of meter, and
- the version number.

After that the device performs a self-test and switches to measurement mode. Here all of the parameters preset for the customer are analysed and checked for plausibility, and the current measured value is displayed.

Operation

INFORMATION!
The flowmeter is low-maintenance
Comply with the application limits with regard to temperature of the medium and ambient temperature.

7.2 Indicator M10 - Operating elements

Operator input for the flowmeter is performed with the cover on the front open, using the mechanical **buttons**, or with the cover closed using a **bar magnet**.

CAUTION!
The switching point of the magnetic sensors is directly under the glass pane over the corresponding circle. Only touch the circle with the bar magnet perpendicularly from the front. Actuation from the side may lead to faulty input.

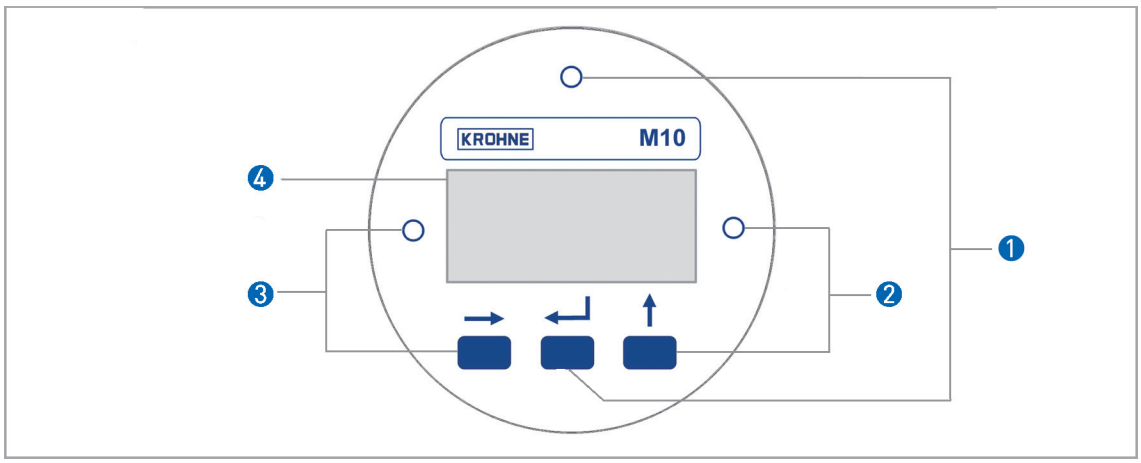


Figure 7-1: **Display and operating elements**

1. Enter button (circuit for bar magnet)
2. Up button (circuit for bar magnet)
3. Right button (circuit for bar magnet)
4. Display

The mechanical operator input buttons and the operator input buttons for the bar magnet have the same functions. In this documentation, the operator input functions are depicted as symbols:

Button	Symbol
right	→
up	↑
Enter	↵

Table 7-1: **M10 operator input buttons**

7.3 Indicator M10 - Basic principles of operator input

7.3.1 Functional description of the buttons

→	Switch from measurement mode to menu mode
	Switch to one menu level lower
	Open menu item and activate change mode
	In change mode: Move the input cursor one position to the right; after the last digit the input cursor jumps back to the beginning.
↑	**In measurement mode:** Switch between measured values and error messages
	Switch between the menu items within a menu level
	In change mode: Changing parameters and settings; running through the available characters; shifting the decimal point to the right.
↵	Switch to one menu level higher
	Return to measurement mode with a query whether the data should be accepted

Table 7-2: **Functional description of the operator input buttons**

7.3.2 Navigation within the menu structure

Navigation within the menu is by means of the and ↵ buttons. Pressing button takes you one menu level lower, ↵ takes you one menu level higher.

If you are already located at the lowest level (function level), you can use the button to go the the change mode, which can be used to set data and values.

If you are located at the first level (main menu), you can use the ↵ button to exit the menu mode and return to the measurement mode.

Measuring operation	→ / ↵	Main menu ↑	→ / ↵	Submenu ↑	→ / ↵	Function ↑	→ / ↵	Edit → ↑ ↵

Table 7-3: **Navigation menu structure**

7.3.3 Changing the settings in the menu

Starting operator input

Operator input is started using the button

If a different button is pressed, it is necessary to wait 5 seconds before activating the button.

If an operator input inhibit has been set, the code ↵ ↵ ↵ ↑ ↑ ↑ has to be entered. If no button is pressed within 5 seconds, code input is exited.

Exiting operator input

Operator input is exited by pressing the ↵ button several times.

If data have been changed:

Save Yes	Changes are accepted. An update is carried out and the indicator jumps back to measuring operation.
Save No	↵ Changes are discarded and the indicator jumps back to measuring operation.

CAUTION!
Each time parameters or settings are changed, the flowmeter carries out an internal plausibility check.
If implausible inputs have been made, the indicator remains in the current menu, and the changes are not accepted.

Example: Changing the default parameter from m^3/h to l/h

	Indicator			Indicator
Example:	7.2 m^3/h		1x	Fct. 3.13.**1** FLOW RATE
1x	Fct. **1**.0 OPERATION		1x	10.0000 m^3/h
2x ↑	Fct. **3**.0 INSTALLATION		6x ↑	10000 l/h
1x	Fct 3.**1** LANGUAGE		1x ↵	Quit Yes
12x ↑	Fct 3.**13** END&UNIT		3x ↵	7200 L/h

7.3.4 Measures in the event of faulty indications

If the indications on the display or responses to keypad commands are faulty, you will have to carry out a hardware reset. Switch the power supply OFF and ON again.

7.4 Overview of the most important functions and indicators

INFORMATION!
A complete list of all functions and short descriptions is provided in the appendix. All default parameters and settings are adapted for the specific customer.

Level	Designation	Explanation
1.4	TIME CONST.	Time constant, damping value [s]
1.5.2	ERROR	Error indicator Yes: Error messages are deleted No: Error messages are suppressed.
2.1	4-20mA OUT	Check analog output
2.2 -2.4	OUTPUT B	Check switching outputs and RESET input
3.1	LANGUAGE	Select the menu language
3.13.1	FLOW RATE	Maximum flow rate The value set is represented by 20 mA at the analog current input. If the current value exceeds the preset value, an alarm is indicated.

Table 7-4: **The most important functions**

M10 flow units

Measured variables	Units				Media
Volume	m^3/s	m^3/min	m^3/h	m^3/d	Liquids, vapours, gases
	L/s	L/min	L/h	-	
	ft^3/s	ft^3/min	ft^3/h	ft^3/d	
	gal/s	gal/min	gal/h	gal/d	
	bb/s	bb/min	bb/h	bb/d	
	ImpGal/s	ImpGal/min	ImpGal/h	ImpGal/d	
Mass	g/s	g/min	g/h	-	Liquids, vapours, gases
	kg/s	kg/min	kg/h	kg/d	
		t/min	t/h	t/d	
	lb/s	lb/min	lb/h	-	
	-	short t/min	short t/h	short t/d	
	-	-	long t/h	long t/d	

7.5 Error messages

Error message	Description	Category	Remedy
NOT LINEARIZED	Linearization faulty or not activated = measuring error	Error	Activate linearization or carry it out again (HART™ communication and linearization software are required; the original calibration values must be known), or send the device back to KROHNE for linearization.
NEW LINEARI. TABLE BAD	Faulty or missing data in the linearization table = measuring error	Error	Check linearization or carry it out again (HART™ communication and linearization software are required; the original calibration values must be known), or send the device back to KROHNE for a check of the linearization.
LINEARIZATIO UNDER CONFIG	The device is in linearization mode = measuring error	Error	Complete the linearization and activate it (HART™ communication and linearization software are required), or send the device back to KROHNE for linearization.
UNIT SYSTEM CONFLICT	The unit for the linearization flow is incompatible with the selected flow type (mass/volume)	Error	Correct error, carry out linearization again if necessary (HART™ communication and linearization software are required), or send the device back to KROHNE for linearization.
TOO FEW ENTRIES	The linearization table has too few data points	Error	Carry out linearization at at least 5 points (HART™ communication and linearization software are required), or send the device back to KROHNE for linearization.
NOT MONOTONIC	The sequence of the linearization values is not strictly monotonic increasing	Error	Check linearization and/or carry it out again (HART™ communication and linearization software are required), or send the device back to KROHNE for linearization.
FIRST NOT 0 %	The first flow value if the linearization table is not 0%	Error	Check linearization and/or carry it out again (HART™ communication and linearization software are required), or send the device back to KROHNE for linearization.
LAST NOT 100 %	The last flow value if the linearization table is not 100%	Error	Check linearization and/or carry it out again (HART™ communication and linearization software are required), or send the device back to KROHNE for linearization.
NO ZERO CAL OF AO	The analog output zero point 4.00mA is not calibrated. = poss. measuring error in the process control equipment	Warning	Perform calibration using ammeter and menu item 3.10 or using standard HART™ tools/process control equipment and poss. external ammeter. Important: during calibration, switch measuring point to manual control.
NO F.SC. CAL OF AO	The analog output 100% = 20.00mA is not calibrated. = poss. measuring error in the process control equipment	Warning	Perform calibration using ammeter and menu item 3.11 or using standard HART™ tools/process control equipment and poss. external ammeter. Important: during calibration, switch measuring point to manual control.
NO TEMP. COMPENSATION	The sensor temperature compensation of the device is faulty or has not been performed. = poss. measuring error	Error	The device, together with an indication of the error, must be sent back to KROHNE for checking.

Error message	Description	Category	Remedy
OUTPUT NOT LINEARIZED	Linearization is not activated = measuring error	Error	Activate linearization or carry it out again (HART™ communication and linearization software are required, the original calibration values must be known), or send the device back to KROHNE for linearization.
COUNTER LOST	Totalizer value was reset by error/overflow	Warning	Because the reset time is not known: Controlled reset of the counter using menu item 1.5.1 or using HART™ tools/process control equipment.
FRAM WRITE FAULT	Internal communication error	Error	Check whether the display is plugged in correctly and restart the device. If the error occurs again: send the device back to KROHNE with an indication of the error
ROM/FLASH ERROR	Memory error detected during self-test.	Error	Restart the device. If the error occurs again: send the device back to KROHNE with an indication of the error
RESTART OF DEVICE	A device restart has taken place	Information	The device has been restarted using menu item 1.5.2 since the last time the error messages were reset.
MULTIDROP MODE	The HART™ multidrop mode is activated. The analog output is set to a fixed value of 4.5 mA.	Information	The HART™ multidrop mode is activated with selection of a polling address not equal to 0 using menu item 3.9. Polling address 0 activates the analog output again.
CRYSTAL OSC FAULT	Internal error in device	Error	The device must be sent back to KROHNE with an indication of the error.
REF VOLTAGE FAULT	Internal error in device	Error	The device must be sent back to KROHNE with an indication of the error.
SENSOR A FAULT	Internal error in device	Error	The device must be sent back to KROHNE with an indication of the error.
SENSOR B FAULT	Internal error in device	Error	The device must be sent back to KROHNE with an indication of the error.
MEMORY CORRUPTION	Internal memory error, caused by a hardware or software problem	Error	Restart the device; if the error occurs again the device must be sent back to KROHNE with an indication of the error.
AO FIXED	The analog output is set to a fixed value.	Information	The analog output is fixed and does not reflect the measured value. This is the case in Multidrop mode, with analog output test/calibration using the menu or HART™
AO SATURATED	Analog output saturated	Information	The analog output is saturated at 20.4 or 22.0 mA (depending on whether the alarm current is activated or deactivated in menu item 3.12), and is no longer coupled with the measured value.

Device drivers for HART™ tools, process control equipment (e.g. Siemens PDM or AMS) PACTware™ and HART™ DTMs are available at the KROHNE Download Center.

8.1 Factory settings

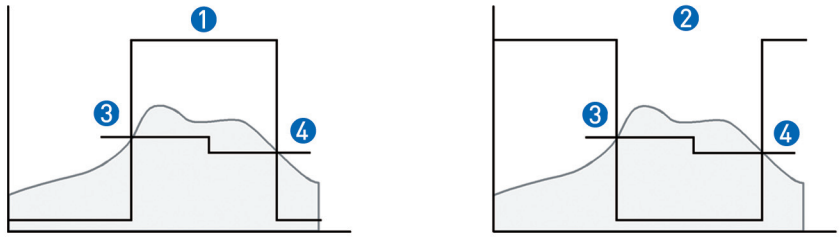
Menu	Function	Setting
1.1.1	Switching value B1	0.0
1.1.2	Hysteresis B1	0.0
1.2.1	Switching value B2	0.0
1.2.2	Hysteresis B2	0.0
1.3	Display	Flow rate
1.4	Time constant	3 s
1.5.1	Reset counter	NO
1.5.2	Reset error	NO
3.1	Language	DEUTSCH
3.2	Function B1	INACTIVE
3.3	Contact B1	NC contact
3.4	Function B2	INACTIVE
3.5	Contact B2	NC contact
3.6	Pulse duration	100ms
3.7	Pulse / unit	001 / liter
3.8	Function B3	INACTIVE
3.9	Multidrop polling address	0
3.12	Alarm current	OFF
3.13.1	Flow unit	see rating plate
3.13.2	Counter unit	Derived from the flow unit
3.14	LFC	6% ON 4% OFF
3.15	Input code	NO

INFORMATION!
The flowmeter has been set at the factory in accordance with the customer order. Therefore subsequent configuration via the menu is only necessary if the intended use of the flowmeter is changed.

8.2 Menu structure

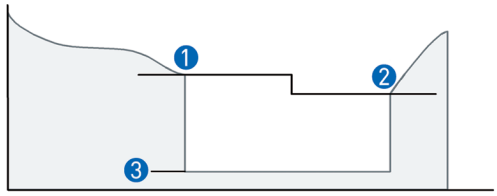
Menu	Submenu 1	Submenu 2
1 Operation	1.1 Output B1	1.1.1 Switching value B1
		1.1.2 Hysteresis B1
	1.2 Output B2	1.2.1 Switching value B2
		1.2.2 Hysteresis B2
	1.3 Display	
	1.4 Time constant	
	1.5 Reset	1.5.1 Reset counter
		1.5.2 Reset error
2 Test & Info	2.1 Output 4...20mA	
	2.2 Output B1	
	2.3 Output B2	
	2.4 Input B3	
	2.5 Serial no.	
	2.6 Software version	
	2.7 Tag no.	
3 Installation	3.1 Language	
	3.2 Function B1	
	3.3 Contact B1	
	3.4 Function B2	
	3.5 Contact B2	
	3.6 Pulse duration	
	3.7 Pulse/unit	
	3.8 Function B3	
	3.9 Multidrop	
	3.10 Calibration 4mA	
	3.11 Calibration 20mA	
	3.12 Alarm current	
	3.13 Upper range value and unit	3.13.1 Flow rate
		3.13.2 Counter
	3.14 Low Flow Cutoff LFC	3.14.1 Control
		3.14.2 Switch-on value
		3.14.3 Switch-off value
	3.15 Input code	
	3.16 Basic setting	

8.3 Menu explanations

Level	Designation	Selection/ input options	Explanation
1.1.1	OUTPUT B1	INACTIVE	
		FLOW_VAL B1	Flow value switching point. set in engineering units If the current flow value exceeds this set switching point, then output B1 is activated. Note: The function NC or NO can be selected using menu 3.3.
		COUNTER_VAL B1	Counter value switching point. Each positive number can be set here. If the counter exceeds this value, then output B1 is activated. Note: The function NC or NO can be selected using menu 3.3.
1.1.2	OUTPUT B1	HYST.B1	Hysteresis setting for the flow value switching point. Value range from 0 to switching point. Example: If a switching value of 200 is set under 1.1.1 then a hysteresis value from 0 to 200 can be set here. If the value 0 is entered here, then this output has no hysteresis. If the value 20 is entered here, then the output functions as follows: If the current flow value exceeds the value 200, then the output switches ❸. If the current flow value drops below the hysteresis value of 180, then the switching output returns to its normal state ❹. Note: To invert the operating method, use menu 3.3 to set the output from NO ❶ to NC ❷ or vice versa. This function is not activated for counter switching points.
			
1.2.1	OUTPUT B2	INACTIVE	
		FLOW_VAL B2	see FLOW_VAL B1
		COUNTER_VAL B2	see COUNTER_VAL B1
		PUL. VAL B2	B2 = pulse output Note: Settings under menu 3.6 pulse duration and 3.7 Pulse/unit
1.2.2	OUTPUT B2	HYST.B2	see HYST. B1

Level	Designation	Selection/ input options	Explanation
1.3	DISPLAY	FLOW RATE	
		COUNTER	
		FLOW&COUNT	
1.4	TIME CONST.		Setting: 1...20 seconds Note: The settable time constant affects the analog output and the displayed current flow rate. It thus enables damped depiction if there is a highly variable flow rate. If the current flow rate is polled via HART communication, then the transferred measured value is dependent on the time constant here, too.
1.5.1	RESET	COUNTER	YES - NO
1.5.2	RESET	ERROR	YES - NO
2.1	4-20mA OUT		The analog current output can be set from 4.00 to 20.00mA in steps of 10%. This function has no effect on the binary switching outputs. Note: This test function is switched off in Multidrop mode. Indicator: "NOT AVAIL." (not available).
2.2	OUTPUT B1	OPEN	The function assignment in menu 3.2 is not taken into consideration here.
		CLOSED	
2.3	OUTPUT B2	OPEN	The function assignment in menu 3.3 is not taken into consideration here.
		CLOSED	
2.4	INPUT B3		Here there is a visual depiction of whether or not input B3 has a voltage of from 5 to 30 V. If input B3 is set to ACTIVE HI in menu 3.8, then the display shows "ON" when the switching voltage is applied. Note: NO test function possible when the output is set to INACTIVE in menu 3.8.
3.1	LANGUAGE	ENGLISH	
		DEUTSCH	
		FRANCAIS	
		ITALIANO	
		ESPANOL	
		CESKY	
		POLSKI	
		NEDERLANDS	
3.2	FUNCTION B1	INACTIVE	Output B1 is switched off.
		SWITCHING POINT	Output B1 switches at a set value depending on the current flow value.
		COUNTER_LIM	Output B1 switches when the counter exceeds the counter limit value.

Level	Designation	Selection/ input options	Explanation
3.3	CONTACT B1	NC contact	Output B1 is normally closed. If an alarm situation occurs, the contact opens.
		NO CONTACT	Output B1 is normally open. If an alarm situation occurs, the contact closes.
3.4	FUNCTION B2	INACTIVE	See FUNCTION B1
		SWITCHING POINT	See FUNCTION B1
		COUNTER_LIM	See FUNCTION B1
		PULSE OUTPUT	Output B2 generates pulses up to 10 Hz depending on the current flow value.
3.5	CONTACT B2	NC contact	See CONTACT B1
		NO CONTACT	See CONTACT B1
3.6	PULSE DURATION	30 ms	
		50 ms	
		100 ms	
		200 ms	
		500 ms	
3.7	PULSE/UNIT	0.000001	Smallest scaling factor Note: In the basic setting, the unit of the pulse output corresponds to the flow unit. Example: Volume flow unit is m3/h, so the pulse output is set to pulses / m3 or Mass flow unit is kg/h, so the pulse output is set to pulses / kg
		999999.0	Largest scaling factor
3.8	FUNCTION B3	INACTIVE	
		ACTIVE HI	The internal counter is reset to zero when a positive voltage of from 5 - 30 Vdc is applied to terminals R+ and R for at least 100ms.
		ACTIVE LO	The internal counter is reset to zero when a positive voltage of from 5 - 30 Vdc applied to terminals R+ and R is interrupted for at least 100ms.
3.9	MULTIDROP	0...15	Multidrop mode means that the device is operating continuously via HART communication in bus operation (max. 15 devices in parallel). The analog current output is then set to a fixed value of 4.1 mA. Measured value transfer takes place via HART communication. The measured values can be read locally using the display, however. The polling address can be set to from 1 to 15. Larger integer values are not permitted. If the polling address is set to 0, then HART bus operation is switched off. The device is working in analog mode. The 4-20mA analog output is active. The standard HART communication is still ensured.

Level	Designation	Selection/ input options	Explanation
3.10	4mA CALIBR.		This menu item allows precise calibration of the analog output. The device generates a fixed analog output of 4.00 mA. If the measured value deviates from the indicated value, the measured value has to be entered. The corrected value is saved when the menu is exited.
3.11	20mA CALIBR.		This menu item allows precise calibration of the analog output. The device generates a fixed analog output of 20.00 mA. If the measured value deviates from the indicated value, the measured value has to be entered. The corrected value is saved when the menu is exited.
3.12	ALARM CURRENT	OFF	Measured values > 100% are indicated as a current signal up to a maximum of 22 mA.
		ON	In the event of an error the analog output is set to the fixed value of 22mA.
3.13	END&UNIT		The flow unit and the upper range value can be changed. Note: Changing from volume flow measurement to mass flow measurement is only possible with a new calibration.
3.13.1	FLOW RATE		For a units list, see Section 6.3 of the manual
3.13.2	COUNTER		As standard, the unit for the counter is derived from the unit for the flow measurement. It can also be changed individually.
3.14	LFC		LFC stands for Low Flow Cutoff. With variable area flowmeters, the flow range from 0 to 10% is not defined. In order to ensure a stable zero point of the analog output, the analog output can be set to a stable value of 4.00mA in a selectable range from 0 to 20%.
3.14.1	CONTROL	INACTIVE	LFC is switched off
		ACTIVE	LFC is switched on
3.14.2	LFC ON_VALUE	1…19 %	Switch-on value ❶: The flow is greater than 20%. The analog output corresponds to this. If the flow rate falls, then the analog output follows it until the ON value. If the flow value continues to fall, the analog output is switched to 4.00mA ❸.
3.14.3	LFC OFF_VALUE	2…20 %	Switch-off value ❷: The flow rate is 0. The analog output is 4.00mA ❸. If the flow rate rises, the analog output remains at 4.00mA ❸ until the OFF value, and is switched to the corresponding flow value if the flow value rises further.
			

Level	Designation	Selection/ input options	Explanation
3.15	INPUT CODE	YES	The input code can be used to prevent unauthorized alteration of the measurement parameters. In the factory setting, the input code is not active. If YES is selected, the last code that was entered has to be typed in. Factory code: ↵ ↵ ↵ ↑ ↑ ↑ If, after confirmation with YES, the button is also pressed, then a new, individual, nine-element code can be typed in. The desired button combination is visualized on the display.
		NO	
3.16	BASIC SETTING	YES	This menu item can be used to select the calibrated basic setting. This can be helpful if operating data have been changed a number of times. This menu item cannot be used to reset the calibration.
		NO	

9.1 Technical data

Application range	Flow measurement of liquids, gases and vapors
Function / measuring principle	Suspended solid particle measuring principle
Measuring accuracy H250 /RR /HC /F	1.6 acc. to directive VDI / VDE 3513, sheet 2
Measuring accuracy H250/C (ceramic/PTFE)	2.5 acc. to directive VDI / VDE 3513, sheet 2
Inlet run	≥ 5 x DN
Outlet run	≥ 3 x DN
Max. Operating pressure PS	per pressure equipment directive 97/23/EC
Max. Test pressure PT	per pressure equipment directive 97/23/EC or AD 2000-HP30
Max. Process temperature TS	300 °C
Min. required operating pressure	Twice as great as pressure loss (see measuring ranges)
Suspended solid particle decrease during gas measurement recommended:	
DN15 ... DN25 / ½" ... 1"	Operating pressure less than 0.3 bar
DN50 ... DN100 / 2" ... 4"	Operating pressure less than 0.2 bar

Materials

RR - stainless steel, HC - Hastelloy, C - ceramic/PTFE, F - food					
Device	Measuring tube	Flanges / raised face	Float	Float stop / guide	Circular orifice
H250 /RR	CrNi-steel 1.4404 ❶	CrNi-steel 1.4404 massive ❶	CrNi-steel 1.4404 ❶	CrNi-steel 1.4404 ❶	-
H250/HC	Hastelloy C4 (2.4610)	CrNi-steel 2.4610 mit Hastelloy C4 (2.4610) plated ❶	Hastelloy C4 (2.4610)	Hastelloy C4 (2.4610)	-
H250/C ❷	CrNi steel 1.4571 with TFM/PTFE liner ❸	CrNi-steel 1.4571 with TFM/PTFE liner ❸	PTFE or Al2O3 with FFKM seal	Al2O3 and PTFE	Al2O3
H250/F ❹	CrNi steel 1.4435	CrNi steel 1.4435	CrNi steel 1.4435	CrNi steel 1.4435	-

❶ CrNi-steel 1.4571 on request, clamp connections CrNi-steel 1.4435
❷ DN100 / 4" only PTFE
❸ TFM/PTFE (electrically nonconductive)
❹ wetted surfaces Ra ≤ 0.8 µm

Other options:

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

Temperatures

H250/M9 - mechanical indicator without power supply

	Float	Liner	Measuring temp. [°C]	Ambient temp. [°C]
H250/RR	Stainless steel	Stainless steel	-196 ... +300	-40...+120
H250/RR Screw fitting				-20...+120
H250/HC	Hastelloy C4	Hastelloy C4	-196 ... +300	-40...+120
H250/C	PTFE	PTFE	-196 ... +70	-40 ... +70
H250/C	Ceramic	PTFE	-196 ... +150	-40 ... +70
H250/C	Ceramic	TFM	-196 ... +250	-40 ... +120
H250H - H250U	stainless steel	stainless steel	-40 ... +100	-20...+90

H250/M9 with electrical components

			TS °C (Tamb. <40 °C)		TS °C (Tamb. <60 °C) *	
DIN	ASME	Version with	Standard	HT	Standard	HT
DN15, DN25	1/2", 1"	ESK2A, ESK3-PA	+200	+300	+180	+300
		ESK2A with counter	+200	+200	+80	+130
		Limit switches SC.. SJ..	+200	+300	+200	+300
		Limit switches SB..	+200	+300	+130	+295
DN 50	2“	ESK2A, ESK3-PA	+200	+300	+165	+300
		ESK2A with counter	+180	+300	+75	+100
		Limit switches SC.. SJ..	+200	+300	+200	+300
		Limit switches SB..	+200	+300	+120	+195
DN 80, DN100	3“, 4"	ESK2A, ESK3-PA	+200	+300	+150	+250
		ESK2A with counter	+150	+270	+70	+85
		Limit switches SC.. SJ..	+200	+300	+200	+300
		Limit switches SB..	+190	+300	+110	+160

* without heat insulation measures, a heat-resistant cable is necessary (continuous operating temperature of the cable to be used: 100°C)

Abbreviations

HT	High temperature version
ESK2A	Transmitter, two-wire technology 4 ... 20 mA
ESK3-PA	PROFIBUS PA transmitter
SC	Limit switch type NAMUR
SJ	Limit switch type NAMUR safety oriented
SB	Limit switch type 3-Leiter, PNP normally open

Min. ambient temperatures Tamb with ESK and limit switches

Limit switches	-25 °C
ESK2A - ESK3-PA	-40 °C

M8M

Max. Tmeas. at Tamb. +60 °C	+200°C
Min. measurement temperature TS without limit switches	-80°C
Min. measurement temperature TS with limit switches	-25°C
Max. ambient temperature Tamb.	+70°C
Min. ambient temperature Tamb.	-25°C

M8E

Max. Tmeas at Tamb. +40°C	+200°C
Max. Tmeas at Tamb. +50°C	+185°C
Max. Tmeas at Tamb. +60°C	+145°C
Min. Tmeas	-25°C
Max. ambient temperature Tamb.	+70°C
Min. ambient temperature Tamb.	-25°C

M10

Max. Tmeas at Tamb. +60 °C	+200°C
Min. meas temperature TS	-80°C
Max. ambient temperature Tamb.	+75°C
Min. ambient temperature Tamb.	-40°C

Indicator M8

M8M limit switch

Clamp connection	2.5mm^2		
Limit switches	SC3,5-N0-Y	SJ3,5-SN	SJ3,5-S1N
Type	2-wire NAMUR	2-wire NAMUR	2-wire NAMUR
Switch configuration	Normally closed	Normally closed	Normally open
Nominal voltage U0	8 VDC	8 VDC	8 VDC
Pointer shaft not read	≥3 mA	≥3 mA	≤1 mA
Pointer shaft read	≤1 mA	≤1 mA	≥3 mA

M8E current output

Cable gland	M16 x 1.5	
Pipe diameter	8...10 mm	
Clamp-type terminal	4 mm^2	
Measuring signal	4...20 mA 0...100% flow value	Two-wire technology
Power supply	14.8...30 VDC	
Min. power supply at HART^{TM}	20.5 VDC	
Power supply effect	< 0.1%	
Input impedance dependence	< 0.1%	
Temperature effect	< 10uA / K	
Max. input impedance / load	640 Ohm (30 VDC)	
Min. load at HART^{TM}	250 Ohm	

M8E HART

M8E HART^{TM} Parameterization		
Manufacturer's name (code)	KROHNE Messtechnik (69)	
Model name	M8E (230)	
HART^{TM} Protocol revision	5.1	
Device revision	1	
Physical layer	FSK	
Device category	Transmitter	

M8E process variable

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

Indicator M9

M9 Cable fitting

Cable fitting	Material	Cable diameter
M 16x1,5 Standard	PA	5...10 mm
M 20x1,5	PA	8...13 mm
M 16x1,5	Nickel-plated brass	5...9 mm
M 20x1,5	Nickel-plated brass	10...14 mm

M9 limit switches

Clamp connection	$2,5mm^2$			
Limit switches	SC3,5-N0-Y	SJ3,5-SN	SJ3,5-S1N	SB3,5-E2
Type	2-wire NAMUR	2-wire NAMUR	2-wire NAMUR	3-wire
Switch configuration	Normally closed	Normally closed	Normally open	PNP Normally open
Nominal voltage U0	8 VDC	8 VDC	8 VDC	10...30 VDC
Pointer shaft not read	≥3 mA	≥3 mA	≤1 mA	≤ 0.3 VDC
Pointer shaft read	≤1 mA	≤1 mA	≥3 mA	Ub - 3 VDC
Continuous current	-	-	-	max. 100 mA
No-load current I0	-	-	-	≤15 mA

M9 current output ESK2A

Clamp connection	$2.5\ mm^2$	
Power supply	12...30 VDC	
Measurement signal	4.00...20.00 mA 0...100% flow value	Two-wire technology
Power supply	12...30 VDC	
Min. power supply for HART™	18 VDC	
Effect of supply power	< 0.1%	
External resistance dependence	< 0.1%	
Temperature influence	< 5 µA / K	
Max. external resistance / load impedance	800 ohms (30 VDC)	
Min. load with HART™	250 ohms	

M9 ESK2A HART

ESK2A HART™ parameter configuration		
Name of manufacturer (code)	KROHNE Messtechnik (69 = 45h)	
Name of model	ESK2A (226 = E2h)	
HART™ protocol revision	5.9	
Device revision	1	
Physical layer	FSK	
Device category	Transmitter non dc isolated device	

M9 ESK2A process variable

ESK2A process variable flow rate	Values [%]	Signal output [mA]
Over range	+102.5 (± 1%)	20.24...20.56
Device error detection	> 106.25	> 21.00
Maximum	131.25	25
Multi-drop operation	-	4.5
Lift-off voltage	12 VDC	

M9 ESK totalizer

Clamp connection	2,5mm2	
Power supply	10...30 VDC	
$R_{ext.}$ Current loop	0...600 Ohm	
Power consumption	max. 2,5 watts	
Indicating error	< 1%	maximum one scalar unit
Max. reset voltage	30 VDC	
Min. reset pulse	300ms	
Software firmware version	1.19	
Power supply	10...30 VDC	
Max. current	50mA	
Max. dissipation	250mW	
T on	80ms	fixed pulse width
T off	depends on flow rate	
V on	Ub – 3 VDC	
V off	0 Volt	
Pulse value	1 pulse = 1 display totalizer advance	= 1 flow unit (1 liter , 1 m^3 ....)

Indicator M9 ESK3PA- Profibus PA

Clamp connection	2,5mm^2	
Bus cable R´	15...150 Ohm/km	
Bus cable L´	0,4...1 mH/km	
Bus cable C´	80...200 nF/km.	

M9 ESK3PA Hardware

Hardware	according to IEC 1158-2 and FISCO model	
Power supply	9...32 VDC	
Base current	12 mA	
Starting current	< Base current	
FDE	< 18 mA	
Accuracy as per VDI/ VDE 3513	1,6	
Measurement resolution	< 0.1 % of full-scale value	
Temperature influence	< 0.05 % / K of full-scale value	
Software- firmware version	1.01/000418	
Ident No.	3184980200	

M9 ESK3PA Software

Software		
GSD	Device master file	
Device profile	Profiles B, V3.0	
Function blocks		
Flow rate (AI0)	Volume or mass	
Totalizer (TOT0)	Volume totalizer	Default units: [m3]
Totalizer (TOT1)	Mass totalizer	Default units: [kg]
Address range	0...126, default 126	
SAP`s	Service_Access_Points	
DD	Device-Description	

Indicator M10

M10 indicator

Cable fitting	none	(standard)
M 20x1,5	on request	
M 20x1,5 Ex d	on request	

M10 current output

current putput	Two-wire-technology	
Power supply	24 VDC +/- 30%	
Signal output current	4...20 mA	
Effect of supply power	< 0,1 %	
External resistance dependence	< 0,1 %	
Temperature influence	< 5 µA/K	
External resistance / load impedance	≤ 630 ohms	
External resistance with HART	≥ 250 ohms	

M10 HART

Name of manufacturer (code)	KROHNE Messtechnik (69 = 45h)	
Name of model	M10 (234 = EA)	
Software- Firmware version	02.14	
Ident No.	3209470500	
HART TM protokol revision	5.9	
device revision	1	
Physical layer	FSK	
Device category	Transmitter	

M10 process variable

	Values [%]	Signal output [mA]
Over range	+105 (± 1%)	20,64...20,96
Device error detection	> 110	> 21,60
Maximum	112,5	22
Multi-drop operation	-	4,5
Lift-off voltage	12 VDC	

M10 digital output

Binary outputs	galvanically isolated	
Operating mode	Binary output	NAMUR or open collector
configurable as	switching contact	normally open / normally closed or
	pulse output	max. 10 pulses per second

NAMUR binary output

Power supply	8 VDC	
Signal current	> 3 mA if switching value not reached	< l mA if switching value reached

Open collector binary output

Power supply	8...30 VDC	
Pmax	500 mW	
Imax	100 mA	

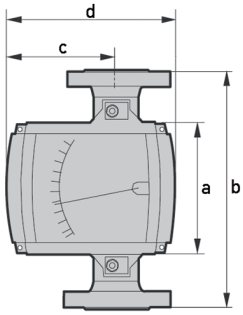
M10 reset input

Binary input	galvanically isolated	
Operating mode	Counter reset	
configurable as	active HI / active LO	
Voltage level	5...30 VDC	
Current drawn	≤ 1 mA	
Pulse length (active)	≥ 500 ms	

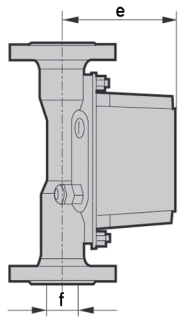
9.2 Dimensions and weights

Dimensions, H250/M9

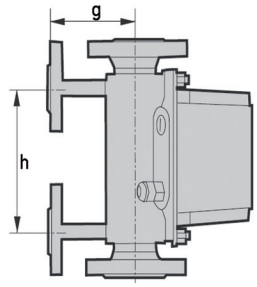
M9
Front view



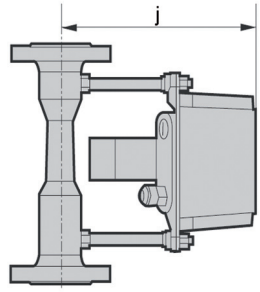
M9
Side view



M9
with heating

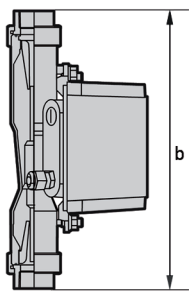


M9
high temperature

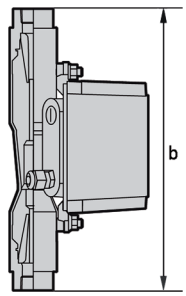


	Dimensions [mm]								
	a	b	c	d	e	Ø f	g	h	j
DN15 PN40	138	250	110,5	181	107	20	100	150	187
DN25 PN40	138	250	110,5	181	119	32	106	150	199
DN50 PN40	138	250	123,5	181	132	65	120	150	212
DN80 PN40	138	250	123,5	181	148	89	160	150	228
DN100 PN40	138	250	123,5	181	158	114	150	150	232
Overall height b of H250/C (ceramic/PTFE) from 3" / 300 lbs: 300 mm									
ISO 228		300							
H250/F		250							

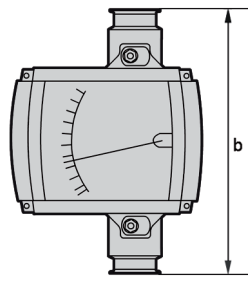
ISO 228
female thread
screwed



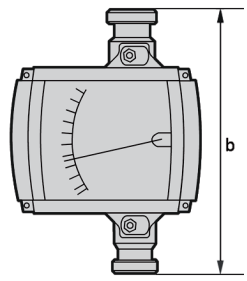
ISO228
female thread
welded



H250/F
Clamp connection



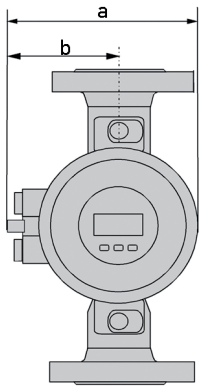
H250/F
Screw connection
DIN 11851



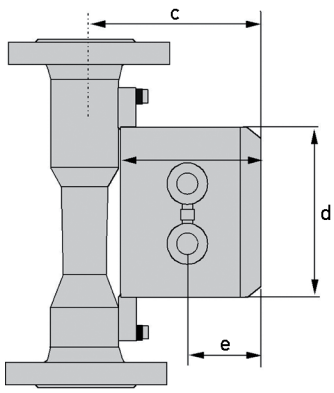
❶ stainless steel 1.4435 - EGEDG approved. Surfaces with contact to medium Ra = 0.8 µm

Dimensions, H250/M10 /M8

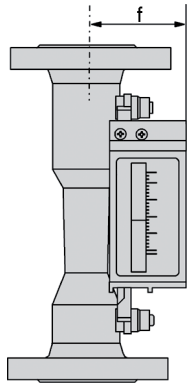
M10
Front view



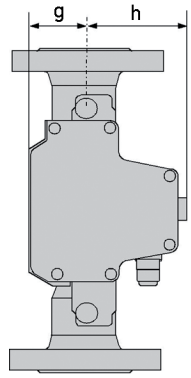
M10
Side view



M8
Front view



M8
Side view



	M10 dimensions [mm]					M8M dimensions [mm]			M8E dimensions [mm]		
	a	b	c	d	e	f	g	h	f	g	h
DN15 PN40	147	83	118	Ø 132	55	63	60	58,5	53,5	66	52,5
DN25 PN40	147	83	130	Ø 132	55	75	60	58,5	65,5	66	52,5
DN50 PN40	147	83	143	Ø 132	55	89	73	45,5	79,5	79	39,5
DN80 PN40	147	83	160	Ø 132	55	105	73	45,5	95,5	79	39,5
DN100 PN40	147	83	169	Ø 132	55	114	73	45,5	104,5	79	39,5

Overall height see devices with indicator M9

Weights

Nominal diameter	H250	with heating		H250/C (Ceramic / PTFE)			Screw connection
	EN 1092-1	Flange connection	Ermeto 12 connection	EN 1092-1	ASME B 16.5 150 lbs	ASME B 16.5 300 lbs	DIN 11864-1
	[kg]						
DN15 / ½“	3,5	5,6	5,7	3,5	3,2	3,5	2
DN25 / 1“	5	7,5	7,6	5	5,2	6,8	3,5
DN50 / 2“	8,2	11,2	11,3	10	10	11	5
DN80 / 3“	12,2	14,8	14,9	13	13	15	7,6
DN100 / 4“	14	17,4	17,5	15	16	17	10,3

Process connections

	Standards	Connection dimensions	Pressure rating
Flange (H250/RR /HC /C)	EN-1092-1	DN15...DN100	PN16...PN100
	ASME B16.5	1/2"...4"	150 lbs...600 lbs
	JIS B 2238	LR15...LR100	10K...20K
Clamp connections (H250/RR /F)	DIN 32676	DN15...DN100	10 bar...16 bar
	ISO 2852	Größe 25...139,7	10 bar...16 bar
Threaded connections (H250/RR /HC /F)	DIN 11851	DN15...DN100	25 bar...40 bar
	SMS 1146	1"...4"	6 bar
Inside thread welded (H250/RR /HC)	ISO 228	G1/2"...G2"	≥ PN50
	ASME B1.20.1	1/2"...2" NPT	
Inside thread, screwed (H250/RR /HC)	ISO 228	G1/2"...2"	PN40...PN50
with insert and union nut	ASME B1.20.1	1/2"...2" NPT	
Aseptic threaded connection (H250/F)	DIN 11864 - 1	DN15...DN50	PN40
	-	DN80...DN100	PN16
Aseptic flange (H250/F)	DIN 11864 - 2	DN15...DN50	PN40
	-	DN80...DN100	PN16
Meters (H250/RR /HC) with heating:			
Heating with flange connection	EN 1092-1	DN15	PN40
	ASME B16.5	1/2"	150 lbs / RF
Heating with pipe connection for Ermeto	-	E12	PN40

Higher pressure ratings and other connection on request

Bolts and tightening torques

Nominal sizes, EN

	Bolts	Tightening torques	
Nominal sizes as per EN 1092-1	Quantity x size	SI [Nm]	Imp [lb-ft]
DN15 PN40	4 x M12	9,8	7.1
DN25 PN40	4 x M12	21	15
DN50 PN40	4 x M16	57	41
DN80 PN16	8 x M16	47	34
DN100 PN16	8 x M16	67	48

Nominal sizes, ASME

	Bolts		Tightening torques	
Normal sizes as per ASME B 16.5	Quantity x size		SI [Nm]	Imp [lb-ft]
	150 lbs	300 lbs		
½“ 150 lbs / 300 lbs	4 x ½“	4 x ½“	5,2	3.8
1“ 150 lbs / 300 lbs	4 x ½“	4 x 5/8“	10	7.2
2“ 150 lbs / 300 lbs	4 x 5/8“	8 x 5/8“	41	30
3“ 150 lbs / 300 lbs	4 x 5/8“	8 x ¾“	70	51
4“ 150 lbs / 300 lbs	8 x 5/8“	8 x ¾“	50	36

9.3 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 diameter	Cone	[l/h]			[m3/h]			[mbar]			
DN15 1/2"	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 - 1.013bar abs.

Comments:

- Air measurement - TIV float: heating not possible
- The specified pressure drops are valid for water and air at maximum flow rate
- Other flow ranges on request
- Conversion of other media or operating data (pressure, temperature, density, viscosity) is performed at KROHNE using the calculation method in accordance with VDI /VDE Directive 3513

H250/C - ceramic/PTFE

Measuring span 10 : 1
Flow values 100%

		Flow			Max. pressure loss		
		Water		Air	Water		Air
Liner float ▸		PTFE	Ceramic	CeramiC	PTFE	Ceramic	Ceramic
Nominal size	Cone	[l/h]		[m3/h]	[mbar]		
DN15, 1/2"	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 (2)	-	-	284	-	-
DN80, 3"	E 87.1	16000	16000	-	81	70	-
	E 87.2	25000	25000	-	95	85	-
	E 87.3	40000 (2)	-	-	243	-	-
DN100, 4"	E 107.1	40000	-	-	100	-	-
	E 107.2	60000 (2)	-	-	225	-	-

(1) special föoat
(2) special float

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

Comments:

- The specified pressure drops are valid for water and air at maximum flow rate
- Other flow ranges on request
- Conversion of other media or operating data (pressure, temperature, density, viscosity) is performed at KROHNE using the calculation method in accordance with VDI /VDE Directive 3513

H250H - horizontal installation position

Measuring span 10 : 1
Flow values 100%

	Float Type	Cone No.	Flow Water [l/h]		Max. pressure loss [mbar]	
			spring A	spring B	spring A	spring B
DN15	DIV TB	K 15.1	70		195	
		K 15.2	120		204	
		K 15.3	180		195	
		K 15.4	280		225	
		K 15.5	450		250	
		K 15.6	700		325	
		K 15.7	1200		590	
		K 15.8	1600	2400	950	1600
DN25	DIV T	K 25.1	1300		122	
		K 25.2	2000		105	
		K 25.3	3000		116	
		K 25.4	5000		145	
		K 25.5	8500	10000	217	336
DN50	DIV T	K 55.1	10000		240	
		K 55.2	16000		230	
		K 55.3	22000	34000	220	420
DN80	DIV T	K 85.1	25000		130	
		K 85.2	35000	60000	130	290
DN100	DIV L	K 105.1	80000	120000	250	340

Reference condition:
Water 20°C

Comments:

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

H250U - vertical installation position

Flow direction from top to bottom

Measuring span 10 : 1
Flow values 100%

	Float	Cone no.	Flow, water [l/h]	Max. pressure loss [mbar]
DN15	DIV TB	K 15.1	65	175
		K 15.2	110	178
		K 15.3	170	180
		K 15.4	260	200
		K 15.5	420	220
		K 15.6	650	290
		K 15.7	1100	520
		K 15.8	1500	840
DN25	DIV T	K 25.1	1150	97
		K 25.2	1800	85
		K 25.3	2700	92
		K 25.4	4500	115
		K 25.5	7600	172
DN50	DIV T	K 55.1	9000	220
		K 55.2	15000	230
		K 55.3	21000	240

Reference condition:
Water 20°C

Comments:

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

10.1 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 indicator.
We advise that inspections be carried out at least once per year.
The device must be removed from the piping before cleaning.

CAUTION!
Pressurized pipes must be depressurized before removing the device.
Empty pipes 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 section.
Always use new gaskets when reinstalling the device in the pipeline.
Avoid electrostatic charges when cleaning the surfaces (e.g. viewing window)!

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10.2 Returning the device to the manufacturer

CAUTION!

When returning the device, it is essential to observe the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, KROHNE Messtechnik GmbH & Co. KG may only handle, test or repair returned devices that have been in contact with liquid products if this can be done without risk to personnel and the environment.*
- *This means that KROHNE Messtechnik GmbH & Co. KG can only service your returned item if it is accompanied by a certificate (see Section 10.3 "Form to accompany a returned device").*

CAUTION!

If the device has been operated with media which are toxic, caustic, flammable or hazardous to waters, you must perform the following procedures:

- *Check that all cavities are free of these hazardous substances.*
- *If necessary, flush or neutralize these cavities.*
- *Enclose a certificate with the device confirming that it is safe to handle and stating the medium used.*

10.3 Form [for copying] to accompany a returned device

Company:		Address:
Department:		Name:
Tel. no.:		Fax no.:
Manufacturer's order no. or serial no.:		
The device has been operated with the following medium:		
This medium is:		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:		

KROHNE measuring technology - Product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Mass flowmeters
- Ultrasonic flowmeters
- Vortex flowmeters
- Flow controllers
- Level measuring instruments
- Temperature measuring instruments
- Pressure measuring instruments
- Analysis
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Addresses:

Germany

Northern sales office

KROHNE Messtechnik GmbH & Co. KG
Bremer Str. 133
D-21073 Hamburg
Phone:+49 (0)40 767 3340
Fax:+49 (0)40 767 33412
nord@krohne.com
ZIP code: 10000 - 29999, 49000 - 49999

Western and middle sales office

KROHNE Messtechnik GmbH & Co. KG
Ludwig-Krohne-Straße
D-47058 Duisburg
Phone:+49 (0)203 301 4416
Fax:+49 (0)203 301 10416
west@krohne.com
ZIP code: 30000 - 34999, 37000 - 48000, 50000 - 53999, 57000 - 59999, 98000 - 99999

Southern sales office

KROHNE Messtechnik GmbH & Co. KG
Landsberger Str. 392
D-81241 Munich
Phone:+49 (0)89 121 5620
Fax:+49 (0)89 129 6190
sued@krohne.com
ZIP code: 0 - 9999, 80000 - 89999, 90000 - 97999

Southwestern sales office

KROHNE Messtechnik GmbH & Co. KG
Rüdesheimer Str. 40
D-65239 Hochheim/Main
Phone: +49(0)6146) 827 30
Fax:+49 (0)6146 827 312
rhein-main@krohne.com
ZIP code: 35000 - 36999, 54000 - 56999, 60000 - 79999

Instrumentation and control equipment catalog

TABLAR Messtechnik GmbH
Ludwig-Krohne-Str. 5
D-47058 Duisburg
Phone:+49 (0)2 03 305 880
Fax:+49 (0)2 03 305 8888
kontakt@tablar.de; www.tablar.de

KROHNE sales companies

International

Australia
KROHNE Australia Pty Ltd
Quantum Business Park 10/287
Victoria Rd Rydalmere NSW 2116
Phone: +61 2 8846 1700
Fax: +61 2 8846 1755
krohne@krohne.com.au

Austria
KROHNE Gesellschaft m.b.H.
Modecenterstraße 14
A-1030 Vienna
Phone:+43 (0)1/203 45 32
Fax:+43 (0)1/203 45 32 99
info@krohne.at

Belgium
KROHNE Belgium N.V.
Brusselstraat 320
B-1702 Groot Bijgaarden
Phone:+32 (0)2 4 66 00 10
Fax:+32 (0)2 4 66 08 00
krohne@krohne.be

Brazil
KROHNE Conaut Controles Automaticos Ltda.
Estrada Das Águas Espraiadas, 230
C.P. 56 06835 - 080 EMBU - SP
Phone:+55 (0)11-4785-2700
Fax:+55 (0)11 4785-2768
conaut@conaut.com.br

China
KROHNE Measurement Instruments (Shanghai) Co. Ltd., (KMIC)
9th Floor, Xujiahui International Building
1033 Zhaojiabang Road
Shanghai 200030
Phone: +86 21 6487 9611
Fax:+86 21 6438 7110
info@krohne-asia.com

Czech Republic
Krohne CZ, spol. s r.o.
Sobìsická 156
63800 Brno
Phone: +420 (0)545.242 627
Fax: +420 (0)545 220 093
brno@krohne.cz

France
KROHNE S.A.S.
Les Ors BP 98
F-26103 ROMANS Cedex
Phone:+33 (0)4 75 05 44 00
Fax:+33 (0)4 75 05 00 48
info@krohne.fr

Great Britain
KROHNE Ltd.
Rutherford Drive
Park Farm Industrial Estate
Wellingborough
Northants NN8 6AE
Phone:+44 (0)19 33 408 500
Fax:+44 (0)19 33 408 501
info@krohne.co.uk

CIS
Kanex KROHNE Engineering AG
Business-Centre Planeta
Office 404 ul.
Marxistskaja 3
109147 Moscow/Russia
Phone:+7 (0)095 911 7165
Fax:+7 (0)095 742 8873
krohne@dol.ru

India
Krohne Marshall Ltd.
A-34/35, M.I.D.C. Industrial Area,
H-Block
Pimpri Poona 411018
Phone:+91 (0)202 744 2020
Fax:+91 (0)202 744 2020
pcu@vsnl.net

Iran
KROHNE Liaison Office
North Sohrevardi Ave. 26,
Sarmad St., Apt. #9
Tehran 15539
Phone: +9821 8874 5973
Fax: +9821 8850 1268
krohne@krohneiran.com

Italy
KROHNE Italia Srl.
Via V. Monti 75
I-20145 Milan
Phone:+39 02 4300 661
Fax:+39 02 4300 6666
info@krohne.it

Korea
KROHNE Korea
Room 508 Miwon Bldg 43
Yoido-Dong Youngdeungpo-Ku
Seoul, Korea
Phone: 00-82-2-782-1900
Fax: 00-82-2-780-1749
mail@krohne.co.kr

Netherlands
KROHNE Nederland B.V.
Kerkeplaat 14
NL-3313 LC Dordrecht
Phone:+31 (0)78 630 6200
Fax:+31 (0)78 630 6405
Service Direct: +31 (0)78 630 6222
info@krohne.nl

Norway
KROHNE Norway A.S.
Ekholtveien 114
NO-1521 Moss
Phone:+47 (0)69 264 860
Fax:+47 (0)69 267 333
postmaster@krohne.no

Poland
KROHNE Polska Sp.z.o.o.
ul. Stary Rynek Oliwski 8a
80-324 Gdansk
Phone: +48 (0)58 520 9211
Fax.:+48 (0)58 520 9212
info@krohne.pl

Switzerland
KROHNE AG
Uferstr. 90
CH-4019 Basel
Phone:+41 (0)61 638 30 30
Fax:+41 (0)61 638 30 40
info@krohne.ch

Singapore
Tokyo Keiso - KROHNE (Singapore) Pte. Ltd.
14, International Business Park,
Jurong East
Chiyoda Building, #01-01/02
Singapore 609922
Phone: (65) 6567 4548
Fax : (65) 6567 9874
tks@tokyokeiso-krohne.com.sg

Republic of South Africa
KROHNE Pty. Ltd.
Bushbock Close
Corporate Park South
Midrand, Gauteng
P.O. Box 2069
Midrand, 1685
Tel.: +27 (0)11 314 1391
Fax: +27 (0)11 314 1681
midrand@krohne.co.za

Spain
I.I. KROHNE IBERIA, S.r.l.
Polígono Industrial Nilo
Calle Brasil, nº. 5
28806 Alcalá de Henares Madrid
Phone: +34 (0)91 883 2152
Fax: +34 (0)91 883 4854
krohne@krohne.es

USA
KROHNE, Inc.
7 Dearborn Road
Peabody, MA 01960
Phone: +1 (800) FLOWING
Phone: +1 (978) 535 6060 (in MA)
info@krohne.com

Representatives

Algeria
Argentina
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Other countries

KROHNE Messtechnik GmbH & Co. KG
Ludwig-Krohne-Str. 5
D-47058 Duisburg
Phone:+49 (0)203 301 0
Fax:+49 (0)203 301 389
export@krohne.com

KROHNE

www.krohne.com