

## BW25 Handbook

Level meter

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## 1.1 Intended use

The BW25 level meter from KROHNE Messtechnik GmbH & Co. KG is suitable for the measurement of liquids and interfaces in liquids.

The devices are particularly suitable for the measurement of:

- Liquids
- Water
- Chemicals with low corrosiveness



**WARNING!**

*The operator himself bears the sole responsibility for the intended use of the level meter regarding the suitability and the corrosion resistance of the used materials against the measured fluid.*

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

## 1.2 Certifications



The device fulfils 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 2004/108/EC for instruments with electrical options

As well as

- NAMUR Recommendations NE 21 and NE 43

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

## 1.3 Safety instructions from the manufacturer

### 1.3.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to German copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

### 1.3.2 Disclaimer

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

### 1.3.3 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 and 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.

### 1.3.4 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 underneath icons.

### 1.3.5 Display conventions

The following symbols are used to help you navigate this documentation more easily:



**DANGER!**

*This symbol designates safety advice on handling electricity.*



**WARNING!**

*These warning signs must be observed without fail. Even only partial disregarding such warnings can result in serious health damage, damage to the device itself or to parts of the operator's plant.*



**CAUTION!**

*These warnings must be observed without fail. Even only partial disregarding such warnings can lead to improper functioning of the device.*



**LEGAL NOTICE!**

*This symbol designates information on statutory directives and standards.*



**NOTE!**

*This symbol designates important information for the handling of the device.*



• **HANDLING**

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



**CONSEQUENCE**

This symbol designates all important consequences of the previous actions.

## 1.4 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!**

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



- ① Device in ordered version
- 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



- ① BW25 with indicator M9
- ② BW25 with indicator M10

### ① BW25/M9

- Local indication without auxiliary power supply
- Max. 2 limit switches, type NAMUR, NAMUR safety-oriented or 3-wire open collector
- 2-wire current output 4...20 mA, HART™ communication

### ② BW25/M10

- Pressure-resistant enclosure Ex d
- 2 digital adjustable limit switches, 2-wire open collector or type NAMUR
- 2-wire current output 4...20 mA, HART™ communication

## 2.3 Nameplate

**INFORMATION!**

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

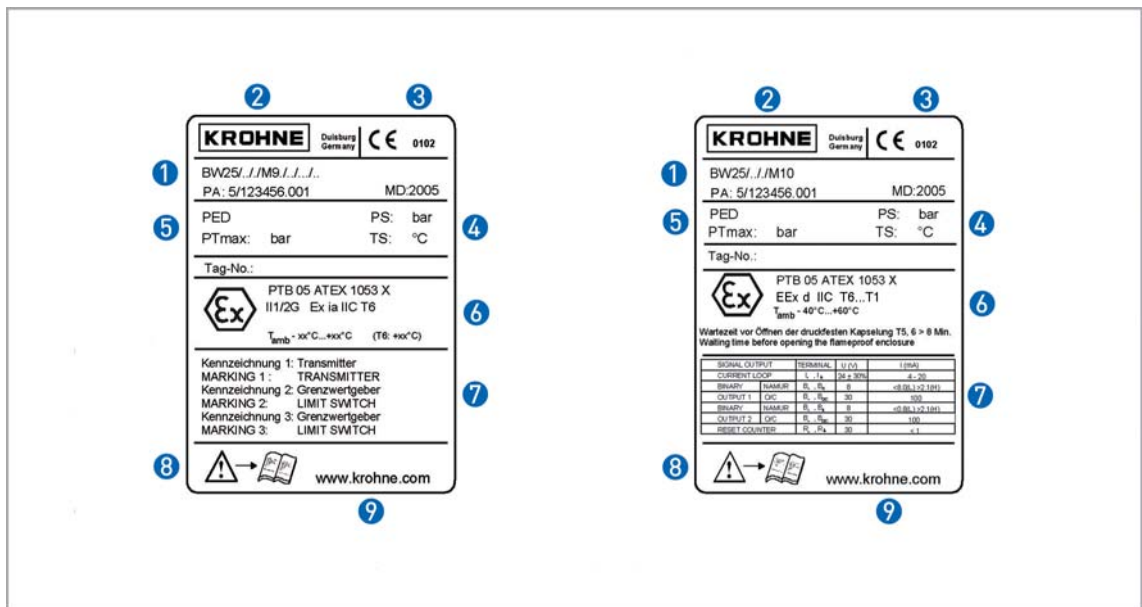


Figure 2-1: Nameplates on the indicator

- ① Device type
- ② Manufacturer
- ③ Named ATEX office
- ④ Design data: temperature & pressure rating
- ⑤ DGRL data
- ⑥ Ex data
- ⑦ Electrical connection data
- ⑧ Refer the manual
- ⑨ KROHNE website

#### Additional markings on the indicator

- SN - serial no.
- SO - sales order / item
- PA - 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
  - Ti - rust-proof steel (device flange), titanium (displacement rod)
- ② Version with bypass chamber
  - B - with bypass chamber
- ③ Indicator part series
  - M9 - Indicator M9 standard indicator
  - M9S - Indicator with knock-resistant sight glass
  - M9R - Indicator in stainless steel housing
  - M9T - Stainless steel indicator with knock-resistant sight glass
  - M10 - Indicator or signal converter M10
- ④ High-temperature version
  - HT version with HT extension
- ⑤ Electrical signal output
  - ESK - Electronic transmitter
- ⑥ Limit switch
  - K1 - One limit switch
  - K2 - Two limit switches

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

### 3.1 Notes on installation

**NOTE!**

*Inspect the cartons carefully for damage or signs of rough handling. Report damage to the carrier and to your local office.*

**NOTE!**

*Check the packing list to make sure that you have received your complete order.*

**NOTE!**

*Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.*

### 3.2 Storage

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

### 3.3 Installation conditions

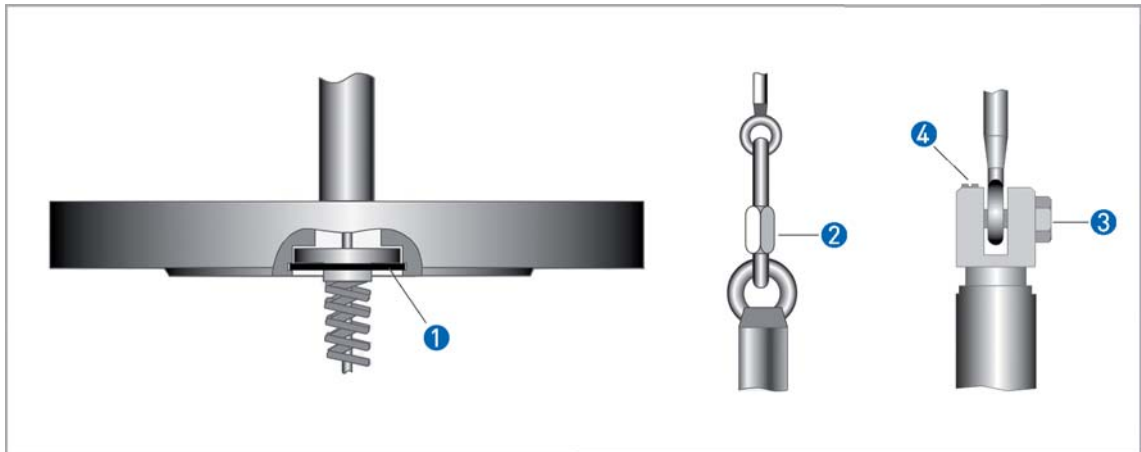
**CAUTION!**

*When installing the device, the following points must be observed:*

- *Before installation, compare the serial number of the indicator (nameplate) with the serial number on the displacement rod, the flange and the magnet.*
- *In the case of level meters with a bypass chamber, the BW25 serial number on the bypass chamber should be compared with the serial number on the indicator.*
- *Avoid combining parts with differing serial numbers.*
- *Ensure the material compatibility of the parts in contact with the product.*
- *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.*
- *Align the gaskets. Tighten the nuts with the tightening torques of the appropriate pressure rating.*
- *Do not lay signal cables directly next to cables for the power supply.*

### 3.4 Installation

The sealing surface of the tank flange must be horizontal to ensure the perfect function of the level measurement unit.



- ① Locking ring
- ② Quick-action lock
- ③ Retaining screw
- ④ Cover stop



- Insert the spring suspension pin in the flange system and secure it with a retaining ring ①.
- Install the retaining ring ① properly and check for a correct seat all round.
- Place the seal on the tank flange.
- Suspend the displacer body on the spring suspension pin.
- Tighten the locking elements of the quick-action lock ② (standard) or, with the variant, ③ and ④ and check for a tight fit.
- Insert the displacer element and the spring suspension pin into the tank through the tank flange or into the preinstalled bypass chamber.
- Tighten the flange connection.

### 3.5 Start-up



#### **CAUTION!**

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

- *The display was set in such a way at the factory that the pointer shows "0" under operating conditions and when the tank is empty.*
- *If the displacer rod is connected to the spring system under atmospheric conditions, then a different height may cause the pointer to show something different.*
- *Do not change the factory setting of the pointer. This particularly applies at high pressures and high temperatures.*

### 3.6 Protection category

The device meets all requirements of protection category IP 67, NEMA 4x.



**DANGER!**

*After all servicing and maintenance work on the device, 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 **3** upstream of the flowmeter to prevent water from getting into the housing.
- The cable glands **2** must be tightened.
- Close the unused cable glands using blanking plugs **1**.



### 3.7 Grounding



- ① Grounding on the flange
- ② Grounding indicator M9
- ③ Grounding indicator M10



**DANGER!**

*The grounding wire may not transfer any interference voltage.*

*Do not use this grounding wire to ground any other items of electrical equipment.*

## 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 national installation regulations!*



**WARNING!**

*Observe the regional occupational health and safety regulations without fail. Only work on the device electrics if you are appropriately trained.*



**NOTE!**

*Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.*



## 4.2 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.

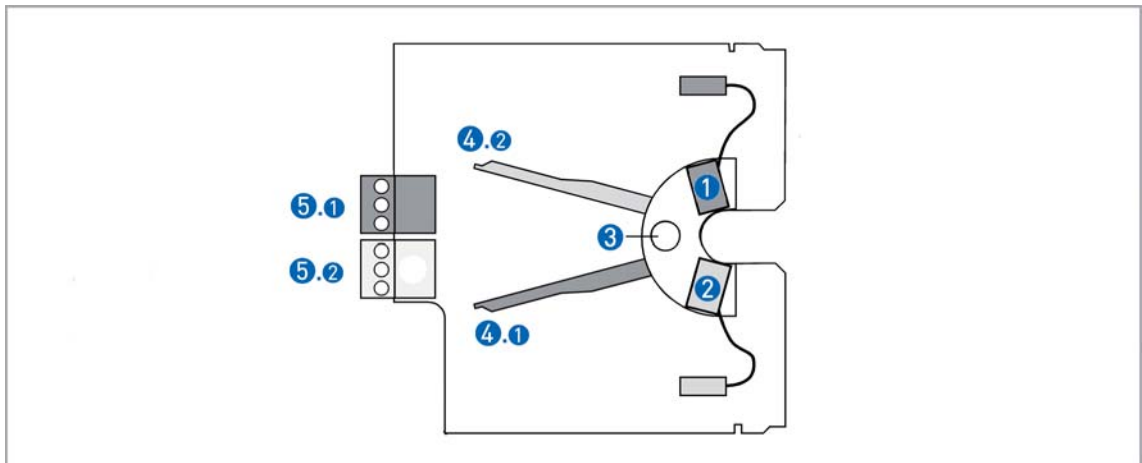


Figure 4-1: Limit switch module

- ① Min. contact
- ② Max. contact
- ③ Locking screw
- ④ Contact 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	-	-

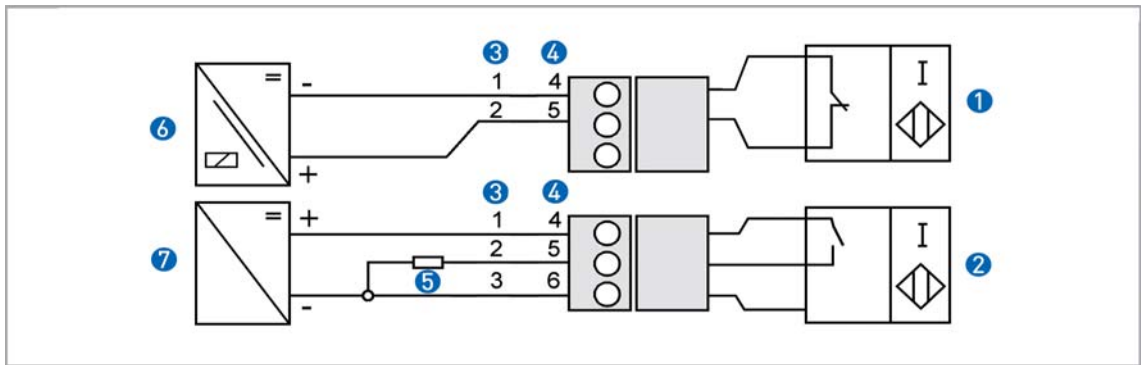
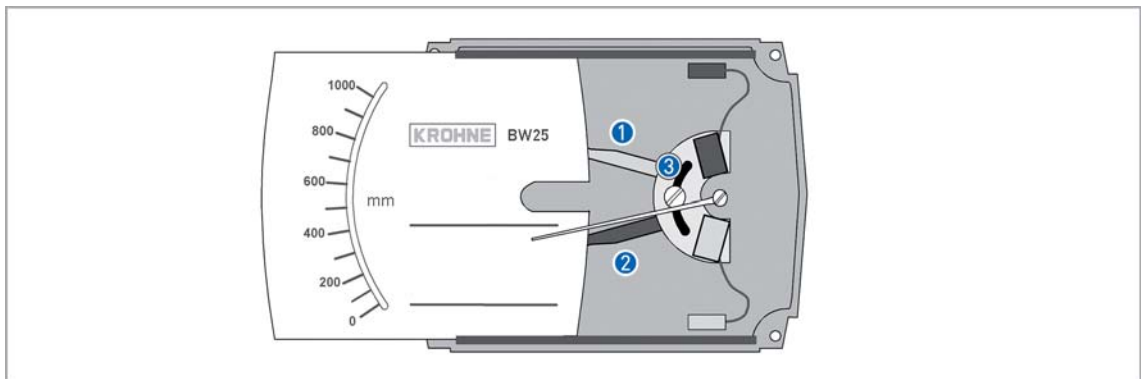


Figure 4-2: Limit switch connection terminals

- 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



- 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.

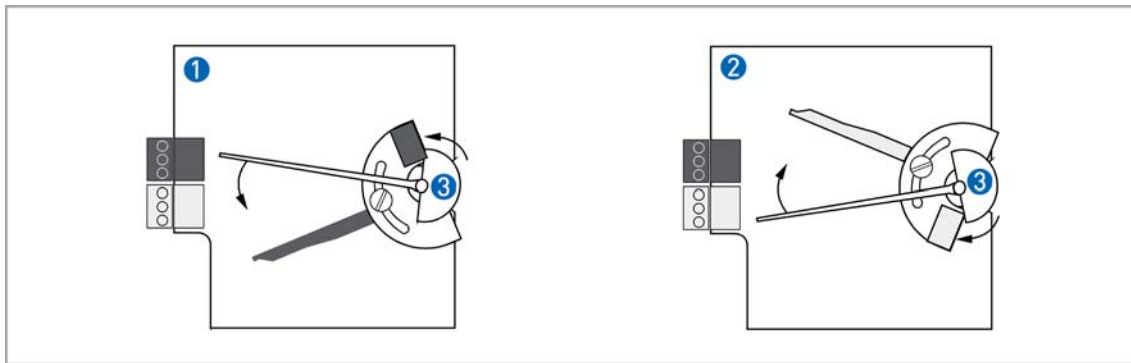


Figure 4-3: Switch contact definition

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

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

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

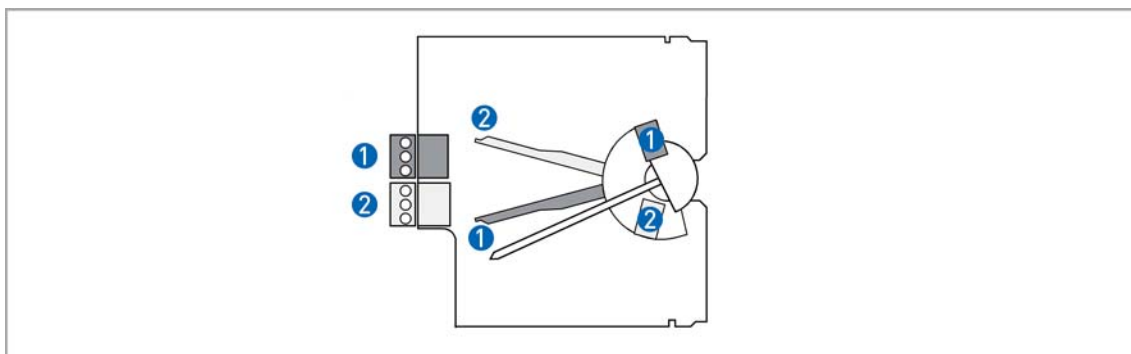


Figure 4-4: Definition MinMin - MaxMax

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

Contact	Type	Current
MIN 1	SJ3,5-S1N	≤ 1 mA
MIN 2	SC3.5-N0	≤ 1 mA
MAX 1	SJ3,5-S1N	≥ 3 mA
MAX 2	SC3,5-N0	≥ 3 mA

### 4.3 Electrical signal output ESK

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

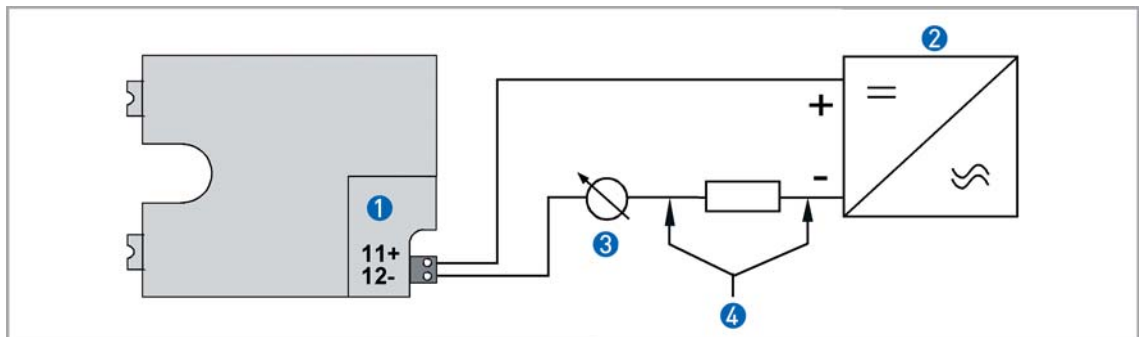


Figure 4-5: ESK2A connection

- 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.

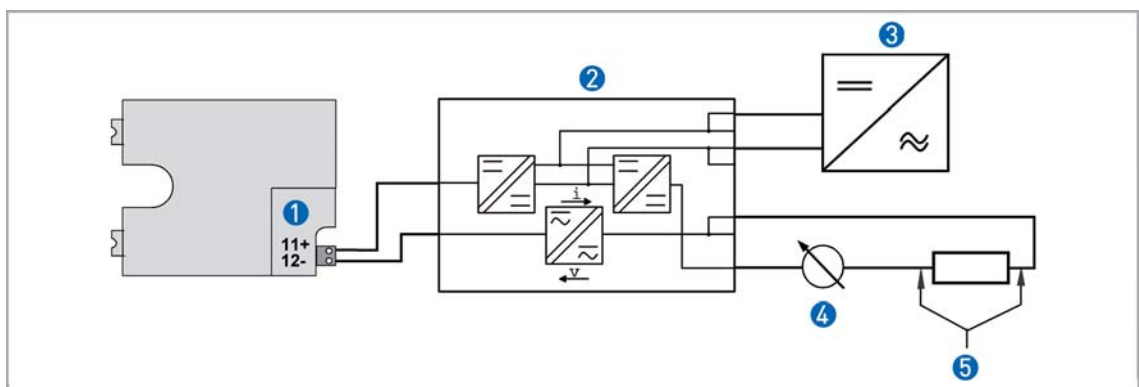


Figure 4-6: ESK2A connection with electrical isolation

- 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™ communication

When HART™ 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™ 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:

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

where

$U_B$  = the minimum supply voltage and

$R_{\text{tot}}$  = 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 resistance is calculated as follows:

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



#### **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).

### Configuration

The ESK can be configured via HART™ communication. DD (Device Descriptions) for AMS 6.x and PDM 5.2 and a DTM (Device Type Manager) are available for configuration (download centre at [www.krohne.com](http://www.krohne.com)).

The current level can be transmitted using the integral HART™ communications. Two limit values can be monitored.

## 5.1 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 national installation regulations!*



**WARNING!**

*Observe the regional occupational health and safety regulations without fail. Only work on the device electrics if you are appropriately trained.*



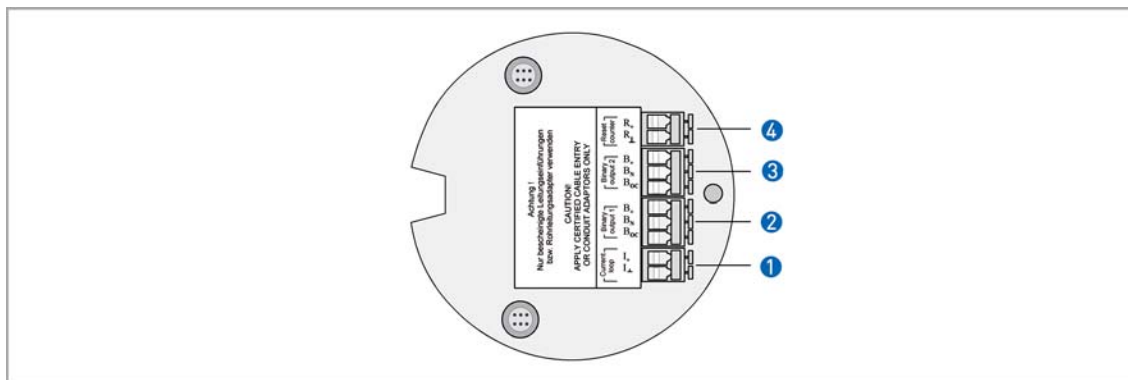
**NOTE!**

*Please check on the device nameplates, that the device is supplied according to your order. Check for the correct mains voltage printed on the nameplate. If not, contact your local representative for advice.*

## 5.2 M10 Electrical connection and functions

The display can be removed after the housing lid has been unscrewed. The connection terminals have a spring locking system.

### Terminal connection



- ① Power supply - analog output
- ② Switching output B1
- ③ Switching output B2
- ④ Not used for BW25

## 5.3 M10 Power supply - analog output

The electrical connection is polarized.

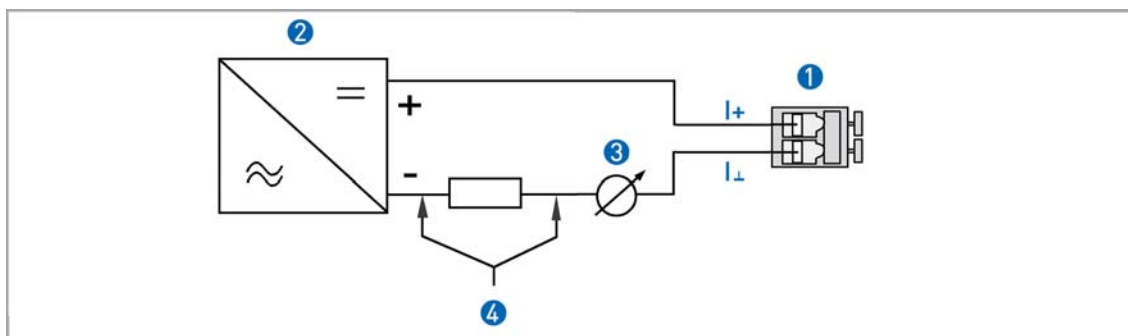


Figure 5-1: Indicator M10 - terminal connection I

- 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.

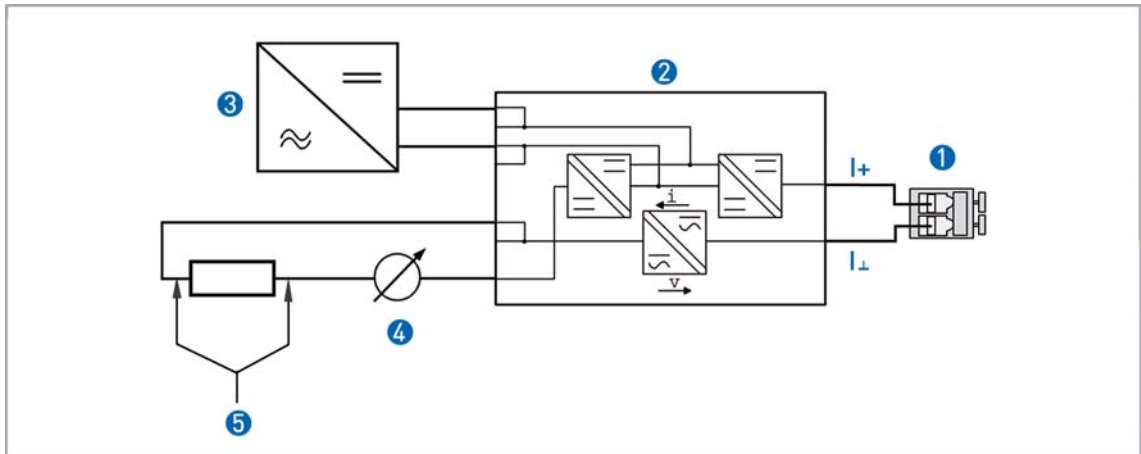


Figure 5-2: Power supply M10 with electrical isolation

- 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™ 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 for multidrop operation. In multidrop operation, a maximum of 15 devices with HART™ function can be operated in parallel, for which the current outputs are switched to inactive (I approx. 4 mA per device).

## 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:

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

where

$U_B$  = the minimum supply voltage and

$R_{\text{tot}}$  = 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 resistance is calculated as follows:

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

**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](http://www.krohne.com)).

The current level can be transmitted using the integral HART™ communications. Two limit values can be monitored.

### 5.4 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

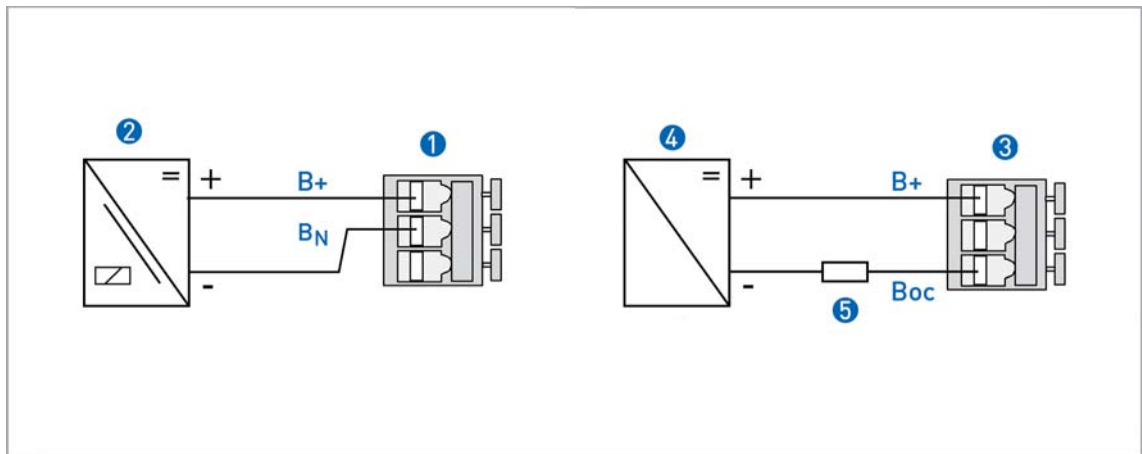


Figure 5-3: Indicator M10 - switching outputs

- 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

### Switching capacity of B1 and B2 with PNP technology

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

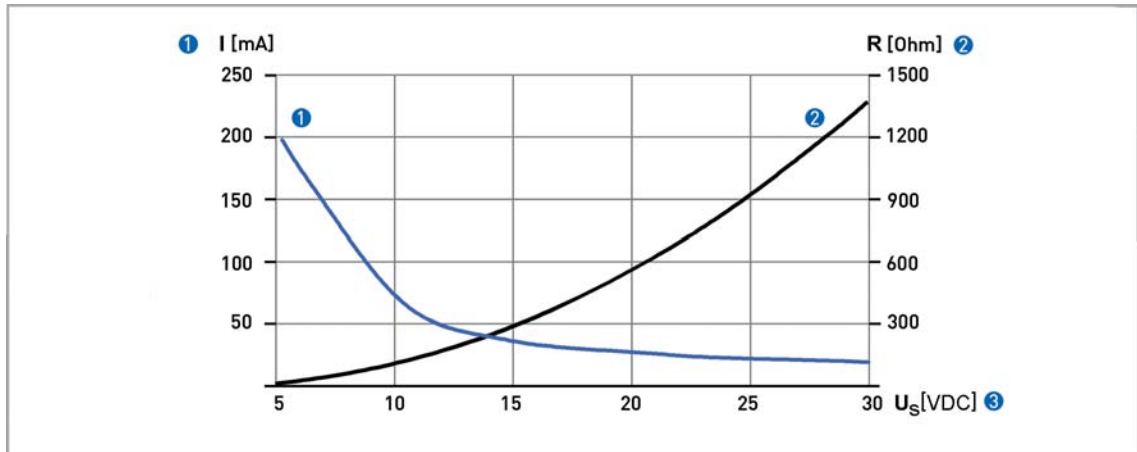


Figure 5-4: Indicator M10 - Breaking capacity of B1 and B2

- ① Max. switching current  $I_1$  [mA]
- ② Minimum load impedance  $Y_2$  [ohm]
- ③ Power supply

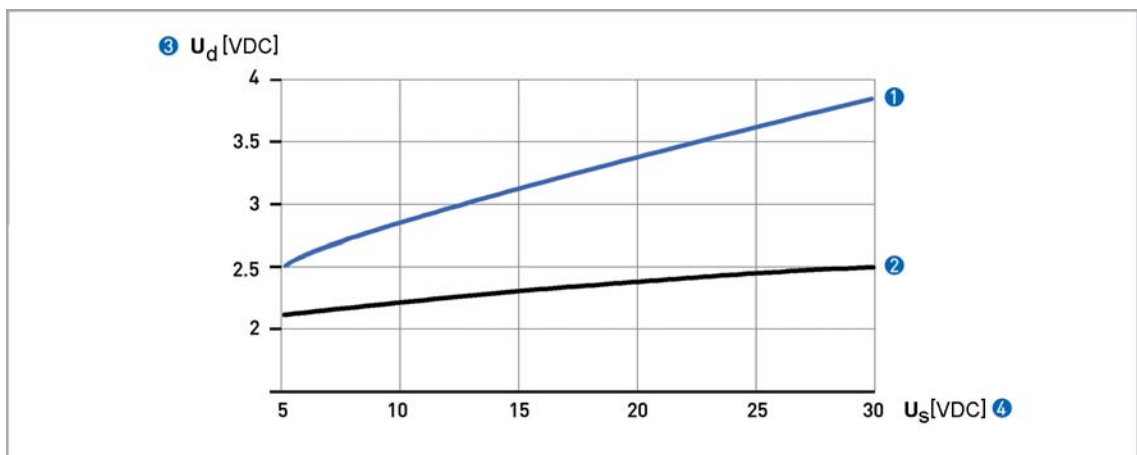


Figure 5-5: Indicator M10 - power loss of B1 and B2

- ① Load impedance 100 Ohm
- ② Load impedance 1000 Ohm
- ③ Power loss
- ④ Power supply

## 6.1 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.

Afterwards 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 device is low-maintenance*

*Comply with the application limits with regard to temperature of the medium and ambient temperature.*

## 6.2 Operating elements

Operation of the device is performed with the cover on the front open, using the mechanical **keys**, or with the cover closed using a **bar magnet**.



### CAUTION!

The switching point of the magnetic sensors is directly under the glass disc over the appropriate circle. Only touch the circle vertically and from the front using the bar magnet. Touching it from the side may cause a malfunction.

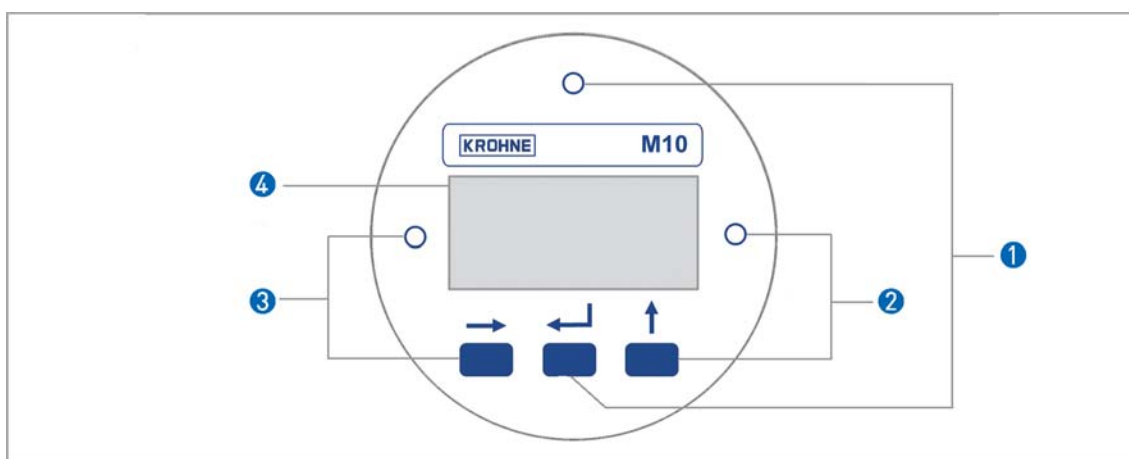


Figure 6-1: Display and operating elements

- 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 keys and keys for the bar magnet are identical in their function. In this documentation the keys are represented as symbols to describe the operating functions:

### M10 operation keys

Key	Symbol
right	→
up	↑
Enter	↵

## 6.3 Basic principles of operation

### 6.3.1 Functional description of the keys

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

### 6.3.2 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 to 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 ← key to exit the menu mode and return to the measuring mode.

Measuring operation	→	Main menu	→	Sub-menu	→	Function	→	Edit
	←	↑	←	↑	←	↑	←	→↑←

### 6.3.3 Changing the settings in the menu

#### Starting operation

Operation is started using the key

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

If an operation inhibit has been set, the code  $\leftarrow \leftarrow \leftarrow \uparrow \uparrow \uparrow$  has to be entered. If no key is pressed within 5 seconds, code input is exited.

#### Exiting operator input

Operation is exited by pressing the  $\leftarrow$  key 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	$\leftarrow$ 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 to cm

	Indicator		Indicator
Example:	5.0 m	1x	Fct. 3.13.1 LEVEL
1x	Fct.1.0 OPERATION	1x	5.0000 m
2x $\uparrow$	Fct. 3.0 INSTALLATION	6x $\uparrow$	500 cm
1x	Fct 3.1 LANGUAGE	1x $\leftarrow$	Quit Yes
12x $\uparrow$	Fct 3.13 END&UNIT	3x $\leftarrow$	500 cm

### 6.3.4 Measures in the event of faulty indications

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



## 6.4 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 current output
2.2 - 2.4	OUTPUT B	Testing the switching output
3.1	LANGUAGE	Select the menu language
3.13. 1	LEVEL	Maximum level of the liquid The value set is represented by a 20 mA current at the analog output.. If the current value exceeds the preset value, an alarm is indicated.

### **M10 level units**

The following units are supported: m - cm - mm - inch - feet

## 6.5 Error messages

Error Message	Description	Category	Remedy
NOT LINEARIZED	Linearization faulty or not activated = measuring error	Errors	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 non-existent data in the linearisation 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 of the linearisation value is not correct for the select level meter.	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 linearisation table does not have enough support 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 linearisation values does not rise monotonously.	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 level value of the linearisation 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 level value of the linearisation 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 4.00 mA is not calibrated. = Possible measurement error in the process control system	Warning	Perform calibration using ammeter and menu item 3.10 or using standard HART™ tools/process control equipment and poss. external ammeter. Caution: during the calibration, switch the measuring point to manual control

Error Message	Description	Category	Remedy
NO F.S.C. CAL OF AO	The analog output 100% = 20.00 mA is not calibrated. = Possible measurement error in the process control system	Warning	Perform calibration using ammeter and menu item 3.11 or using standard HART™ tools/process control equipment and poss. external ammeter. Caution: during the calibration, switch the measuring point to manual control
NO TEMP. COMPENSATION	The sensor temperature compensation of the device is faulty or was not carried out. = Possible measuring error	Error	The device, together with an indication of the error, must be sent back to KROHNE for checking.
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.
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. The polling address 0 reactivates the analog output.
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.

Error Message	Description	Category	Remedy
A0 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™
A0 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.

## 7.1 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
1.5.2	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
3.9	Multidrop polling address	0
3.12	Alarm current	OFF
3.13.1	Level meter	see nameplate
3.15	Input code	NO

Menu update in preparation



### **INFORMATION!**

*The device 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 device is changed.*

## 7.2 Menu structure

Menu	Sub-menu 1	Sub-menu 2	Sub-menu 3
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	Inactive
1.5.2		Reset error	
2	Test & Info		
	2.1	4...20 mA output	
	2.2	Output B1	
	2.3	Output B2	
	2.4	Inactive	
	2.5	Serial no.	
	2.6	Software version	
	2.7	Tag No.	

Menu	Sub-menu 1	Sub-menu 2	Sub-menu 3
3	Installation		
	3.1	Language	
	3.2	Function B1	
	3.3	Contact B1	
	3.4	Function B2	
	3.5	Contact B2	
	3.6	Inactive	
	3.7	Inactive	
	3.8	Inactive	
	3.9	Multidrop	
	3.10	4mA Calibration	
	3.11	20mA Calibration	
	3.12	Alarm current	
	3.13	Upper range value and unit	
		3.13.1	Level
		3.13.2	Inactive
	3.14	Inactive	
		3.14.1	Inactive
		3.14.2	Inactive
		3.14.3	Inactive
3.15	Input code		
3.16	Basic setting		

## 7.3 Menu explanations

Level	Designation	Selection/input options	Explanation
1.1.1	OUTPUT B1	INACTIVE	
		LEV.VALUE B1	Level value switching point. A numeric value between 0.0 ... 100% of the level value can be set. If the current level value exceeds this set switching point, then output B1 is activated. <b>Note</b> The function NC or NO can be selected using menu 3.3.
1.1.2	OUTPUT B1	HYST.B1	Hysteresis setting for the level value switching point. Value range 0...switching point. Example, if a switching value of 200 is set under 1.1.1, then a hysteresis value of 0...200 can be set here. If the value 0 is entered here, then this output does not have hysteresis. If the value 20 is input, then the output works as follows: it switches when the current value exceeds a value of 200. ③ If the current level value is below the hysteresis value of 180, then the switching output returns to the normal state. ④ <b>Note</b> To invert the operating method, use menu 3.3 to set the output from NO ① to NC ② or vice versa. This function is not activated on the counter switching point.
1.2.1	OUTPUT B2	INACTIVE	
		LEV.VALUE B2	See LEV.VALUE B1
1.2.2	OUTPUT B2	HYST.B2	See HYST. B1
1.3	DISPLAY	LEVEL	
		%	
		LEVEL & %	
1.4	TIME CONST.		Setting : 1 ... 20 seconds <b>Note</b> The settable time constant affects the current output and the displayed current level. It thus allows attenuated depiction when the display is not calm. If the current level is polled via HART communication, then the transferred measured value is dependent on the time constant.



Level	Designation	Selection/input options	Explanation
1.5.1	Inactive		
1.5.2	RESET	ERROR	YES - NO
2.1	4-20mA OUT		The analog current output can be set to fixed values in 10 % steps between 4.00...20.00 mA. This function has no influence on binary switching outputs. <b>Note</b> This test function is switched off in multidrop mode. Display: "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	Inactive		
3.1	LANGUAGE	ENGLISH	
		DEUTSCH	
		FRANCAIS	
		ITALIANO	
		ESPANOL	
		CESKY	
		POLSKI	
		NEDERLANDS	
3.2	FUNCTION B1	INACTIVE	Output B1 is switched off.
		SWITCHING POINT	The output B1 switches at a set value depending on the current level value.
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
3.5	CONTACT B2	NC CONTACT	See CONTACT B1
		NO CONTACT	See CONTACT B1
3.6	Inactive		
3.7	Inactive		
3.8	Inactive		

Level	Designation	Selection/input options	Explanation
3.9	MULTIDROP	0...15	Multidrop mode means that the device works continuously in bus mode via HART communication (max. 15 devices in parallel). The analog output is then set to a fixed value of 4.1 mA. Measured values are transferred via HART communication. However, the display allows local read-off of the measured values. The polling address can be set to between 1 and 15. Larger integers are not permitted. If the polling address is set to 0, then HART bus operation is switched off. The device works in analog mode. The analog output for 4-20 mA is active. Standard HART communication is guaranteed.
3.10	4mA CALIBR.		This menu option allows the precise calibration of the current output. The device generates a fixed analog output of 4.00 mA. If the measured value deviates from the displayed one, then the measured value must be input. When the menu is exited, the corrected value is saved.
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 displayed one, then the measured value must be input. When the menu is exited, the corrected value is saved.
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 level meter and end value can be changed.
3.13.1	LEVEL		For a units list, see Section 6.4 of the manual
3.13.2	Inactive		
3.14	Inactive		
3.15	INP. CODE	YES	The input code is used to prevent authorised adjustment of the measurement parameters. The input code is not active by default. If YES is selected, the last code entered must be typed in. The default code is:                      If, after confirmation with YES, the                      key is pressed, then a new individual, nine-digit code can be typed in. The display shows the required key combination.
		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	

## 8.1 Maintenance

During routine operational maintenance of the system, the level meter should also be checked for soiling, corrosion and mechanical wear or damage to the displacer rod, pressure sleeve and the display.

We advise that inspections be carried out at least once per year. The device must be removed before cleaning.



**CAUTION!**

*Before dismantling, ensure that the tank is depressurised and vented.*

*In the case of devices used for measuring aggressive media, appropriate safety precautions must be taken with regard to residual liquids on the measuring section.*

*Avoid electrostatic charges when cleaning the surfaces (e.g. viewing window)!*

## 8.2 Spare parts availability

The manufacturer adheres to the basic principle that operational spare parts for each device or each important accessory part will be kept available for a period of 10 (ten) years after delivery of the last production run for that device.

Operational spare parts are defined as parts that are subject to faults in normal operation.

## 8.3 Availability of services

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



**NOTE!**

*For more precise information, please contact your local representative.*

## 8.4 Returning the device to the manufacturer

### 8.4.1 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.



**CAUTION!**

*Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:*

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, 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.*



**CAUTION!**

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

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

8.4.2 Form (for copying) to accompany a returned instrument

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:			

## 9.1 Operating principle

The device works according to the displacement principle.

The length of the displacer rod ④ corresponds to the measuring range ②.

The displacer rod ④ suspended from a measuring spring ① is immersed in the liquid and detects a lifting force, which is proportional to the mass of the displaced liquid.

Each change to the rod weight corresponds to the change in the length of the spring and is thus a measure of the filling height.

The expansion of the spring and thus the measuring stroke is transmitted to a display using a solenoid coupling from the measuring chamber.

If the device cannot be installed from above, e.g. because there is an agitator in the tank, then there is a special bypass chamber available for side mounting.

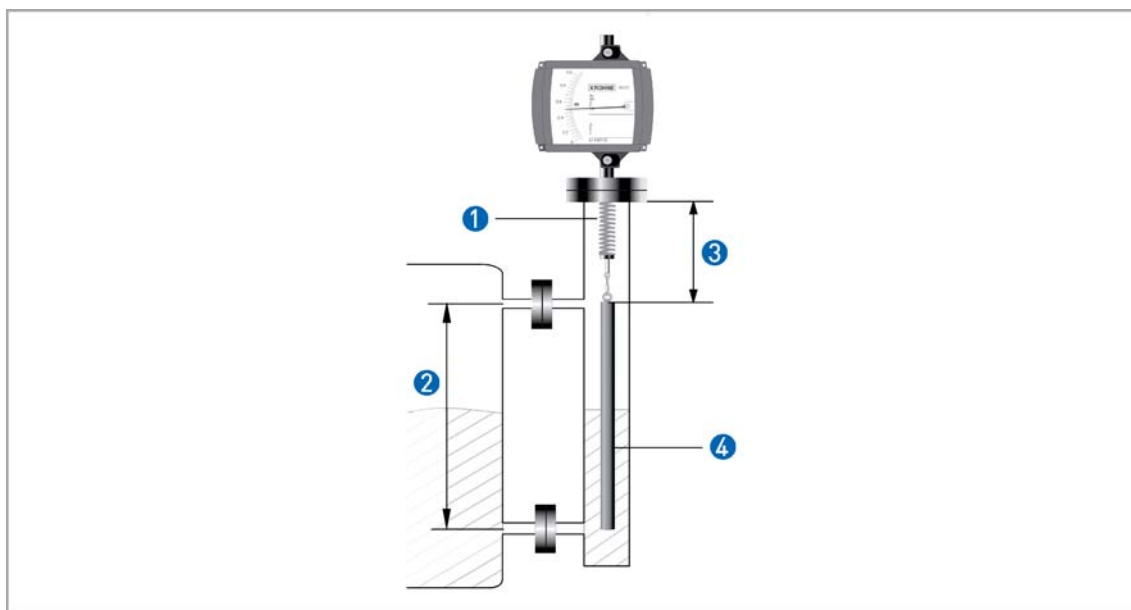
The lift of the proportional rod is dependent on the density of the product.

The level indication must be displayed for the liquid to be measured.

The difference in density between the tank atmosphere and liquid must be at least 100 g/l.

The atmospheric pressure and temperature must be known.

Due to the length of the spring suspension pin ③, the unmeasurable area is  $L = 340 \text{ mm}$ .



- ① Measuring spring
- ② Measuring range
- ③  $L \geq 340 \text{ mm}$
- ④ Displacer rod

## 9.2 Technical data

### General

Function	Displacement principle
Parameter	Level, separating layer
Min. measuring range	0.3 m / 12"
Max. measuring range	6 m / 20 ft
Medium	Liquids
Density	≥ 0.45 kg/l

### Accuracy

Accuracy	±1.5% of the end value
----------	------------------------

### Material

Housing	Die-cast aluminium, coated
Housing option	Stainless steel (indicator M9)
Displacer rod	Stainless steel 1.4404
Displacer rod option	Titanium
Spring	Stainless steel 1.4571 (T <sub>meas.</sub> < 100°C)
Spring option	ATS 340 (T <sub>meas.</sub> > 100°C)
Flange	Stainless steel 1.4404
Pressure sleeve	Stainless steel 1.4404

### Process connections

Max. operating pressure	40 bar - optional to 400 bar
Standard flange	DN50 - PN40 / 2" ASME 300 lb
Optional flange	...DN100 - ...PN400 / ...4" ASME ...2.500 lb

### Approvals

ATEX, indicator M9 with electrical installations	Cat. II 1/2G, EEx ia IIC T6
ATEX, indicator M10	Cat. II 1/2G, EEx d IIC T6
ATEX, indicator M9 without electrical installations	
for Zone 0 tanks	Cat. II 1/2 Gc
for Zone 1.21	Cat. II 2 GD
for Zone 2.22	Cat. II 3 GD

## Temperatures

Indicator M9 without electrical installations	
Product or flange temperature	-40...+400°C
Ambient temperature	-40...+60°C
Storage temperature	-40...+60°C
Indicator M9 with electrical installations	
Product or flange temperature	-20...+295°C
Product or flange temperature, HT version	-40...+400°C
Ambient temperature	-40...+60°C
Storage temperature	-40...+60°C
Indicator M10	
Product or flange temperature	-40...+200°C
Ambient temperature	-40...+60°C
Storage temperature	-40...+60°C



## Technical data, 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 <sup>2</sup>			
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 U <sub>0</sub>	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	U <sub>b</sub> -3 VDC
Continuous current	-	-	-	max. 100 mA
No-load current I <sub>0</sub>	-	-	-	≤15 mA

### M9 analog output ESK2A

Terminal connection	2.5 mm <sup>2</sup>	
Power supply	12...30 VDC	
Min. power supply for HART TM	18 VDC	
Measuring signal	4.00...20.00 mA for 0...100 % level	2-wire technology
Power supply influence	< 0.1%	
External resistance dependency	< 0.1%	
Temperature influence	< 5 uA / K	
Max. external resistance / load	800 Ohm (30 VDC)	
Min. load for HART TM	250 Ohm	
Software firmware version	02.14	
Ident No:	3210680500	

**M9 ESK2A HART**

ESK2A HART TM configuration		
Manufacturer name (code)	KROHNE Messtechnik (69 = 45h)	
Model name	ESK2A (226 = E2h)	
HART TM protocol revision	5.9	
Device revision	1	
Physical layer	FSK	
Device category	Transmitter non dc isolated device	

**M9 ESK2A process variable**

ESK2A process variable, level	Values [%]	Signal output [mA]
over range	+102.5 (± 1%)	20.24...20.56
Device error identification	> 106.25	> 21.00
Maximum	131.25	25
Multidrop operation	-	4.5
Lift-off voltage	12 VDC	

**Technical data, indicator M10**

Cable gland	without	[Standard]
Terminal connection	2.5mm <sup>2</sup>	
Power supply	24 VDC +/- 30%	
Min. power supply for HART TM	18 VDC	
Measuring signal	4.00...20.00 mA for 0...100 % level	
Power supply influence	< 0.1 %	
External resistance dependency	< 0.1 %	
Temperature influence	< 5 uA/K	
Max. external resistance / load	≤ 630 Ohm	
Min. load for HART	≥ 250 Ohm	
Software firmware version	02.14	
Ident No:	3209470500	

**M10 HART**

Manufacturer name (code)	KROHNE Messtechnik (69 = 45h)	
Model name	M10 (234 = EA)	
HART TM protocol revision	5.9	
Device revision	1	
Physical layer	FSK	
Device category	Transmitter	

### M10 process variable

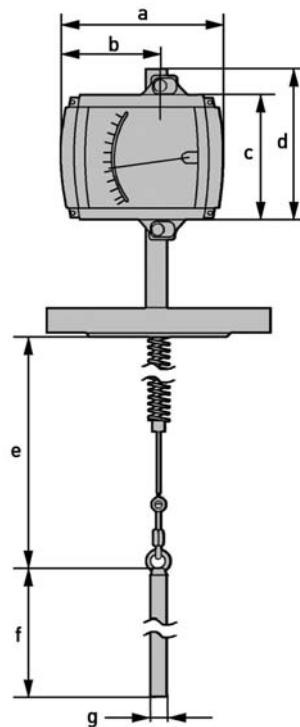
	Values [%]	Signal output [mA]
Over range	+105 ( $\pm 1\%$ )	20,64...20,96
Device error identification	> 110	> 21.60
Maximal	112.5	22
Multidrop operation	-	4.5
Lift-off voltage	12 VDC	

### M10 binary output

Two binary outputs	Electrically separated	
Operating mode	Switching output	NAMUR or Open collector
Configurable as	switching contact or pulse output	Open / closed or max. 10 P/s
NAMUR switching output		
Power supply	8 V	
Signal current	> 3 mA switching value not reached;	< 1 mA switching value reached
Switching output, Open Collector		
Power supply	8...30 VDC	
Pmax	500 mW	
I <sub>max</sub>	100 mA	

### 9.3 Dimensions

#### Dimensions with M9 indicator

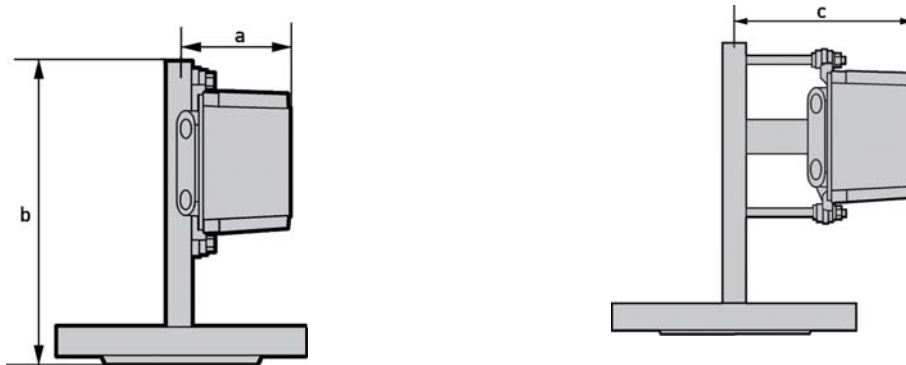


#### Dimensions with M9 indicator (I)

	a	b	c	d	e	f	g
Dimensions [mm]	181	110	138	168	min. 340	①	≥ 20 ②

- ① Length of the displacer rod (measuring area)
- ② According to the operating conditions

Dimensions with M9 indicator (II)



Dimensions with M9 indicator (II)

	a	b	c
Dimensions [mm]	106	303	185

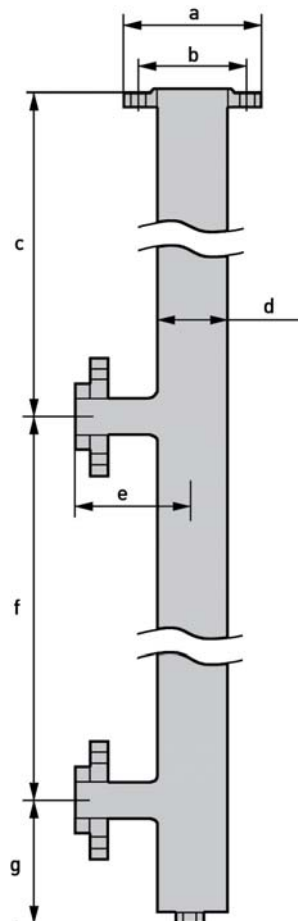
Dimensions with M10 indicator



Dimensions with M10 indicator

	a	b	c	d	e	f
Dimensions [mm]	71	64	37	124	302	114

### Dimensions of bypass chamber



### Dimensions of bypass chamber

	a	b	c	d	e	f	g
Dimensions [mm]	①	①	340	72	115	②	120

① Connection according to DIN EN 1092-1 or ASME B16.5

② Length of the displacer rod (measuring area)



## 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
- Oil and gas industry

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