Operating manual (Translation)

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Magnetic inductive flow sensor induQ®

Series VMI





_VMI • 10/2014

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0 About this operating manual

- The operating manual is aimed at specialists and semi-skilled personnel.
- Before each step, read through the relevant advice carefully and keep to the specified order.
- Thoroughly read and understand the information in the section "Safety instructions".

If you have any problems or questions, please contact your supplier or contact us directly at:

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Hazard signs and other symbols used:



WARNING! / CAUTION! Risk of injury!
This sign indicates dangers that cause personal injuries that can lead to health defects or cause considerable damage to property.



CAUTION! Electric current!
This sign indicates dangers which could arise from handling of electric current.



CAUTION! Material damage!
This sign indicates actions which could lead to possible damage to material or environmental damage.



ADHERE TO OPERATING MANUAL!



NOTICE!
This symbol indicates important notices, tips or information.



NO DOMESTIC WASTE!
The device must not be disposed of together with domestic waste.

⚠ Pay attention to and comply with information that is marked with this symbol.

↳ Follow the specified instructions and steps. Adhere to the given order.

❑ Check the specified points or notices.

→ Reference to another section, document or source.

• Item.

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1 Device description

The induQ® of the VMI series from SIKA, is a non-contact flow sensor. The measurement is performed using magnetic induction and works without any moving parts.

The VMI is used for measuring or metering water and aqueous solutions. The compact design and independence from the intake and discharge sections allows the VMI to be used under a variety of conditions.

Components:

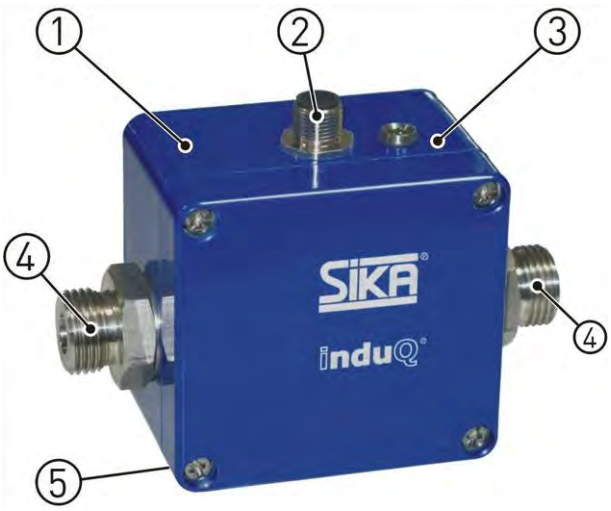
① Housing:
The housing consists of aluminium die casting and has the IP65 degree of protection.

② Electrical connection:
The electrical connection is made via 4(5)-pin plug M12x1.

③ Operation / flow indicator LED.

④ Process connection:
The process connections are available in different sizes.

⑤ Type plate (sticker).



Versions*:

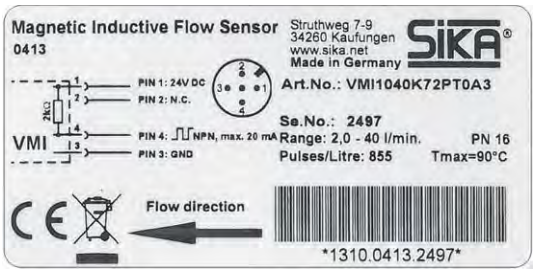
The VMI is available in nominal sizes DN 7, DN 10 and DN 20.

The versions can be configured differently. Further information can be found in our catalogues at catalogues.sika.net.

Type plate:

The type plate sticker is located at the bottom side of the VMI.

It contains the most important data, the connection diagram and the arrow for the flow direction (→ Example).



Example type plate

Scope of delivery and accessories:

Before installing the device, check the delivered items and ordered accessories:

Scope of delivery:

❒ 1x VMI as ordered.

❒ 1x Operating manual.

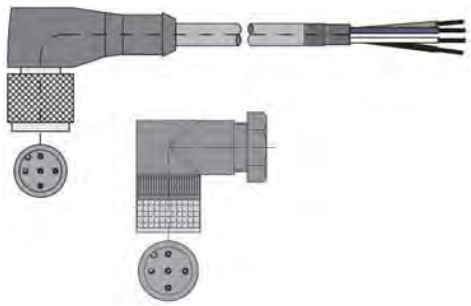
❒ 1x Packing.



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Accessories:

- ❒ Connection cable with moulded M12x1 coupling socket.
- ❒ M12x1 coupling socket as component.



1.1 Intended use

The magnetic inductive flow sensor VMI must only be used for measuring and metering liquids with a minimum conductivity of 50 µS/cm.

WARNING! No safety component!

The magnetic inductive flow sensor of the series VMI is not safety components in accordance with Directive 2006-42-EC (Machine Directive).

↳ Never use the VMI as a safety component.

The operational safety of the device supplied is only guaranteed by intended use. The specified limits (→ § 9 "Technical data") may under no circumstances be exceeded.

Before installing the device, check that the wetted materials of the device are compatible with the media being used (→ § 9.2 "Materials table").

Measuring tube empty (or partially filled). / Conductivity too low.

The green LED may blink irregularly if the measuring tube of the VMI is empty or partially filled or if the conductivity of the fluid being used is too low. Random pulses will be present at the output, but they do not represent an actual flow.

↳ Ensure that the measuring tube of the VMI is always completely filled (→ § 4.1 "Installation instructions").

↳ Ensure that the conductivity of the fluid is at least 50 µS/cm.

1.2 Exclusion of liability

We accept no liability for any damage or malfunctions resulting from incorrect installation, in-appropriate use of the device or failure to follow the instructions in this operating manual.

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2 Safety instructions



Before you install the VMI, read through this operating manual carefully. If the instructions contained within it are not followed, in particular the safety guidelines, this could result in danger for people, the environment, and the device and the system it is connected to.

The VMI correspond to the state-of-the-art technology. This concerns the accuracy, the operating mode and the safe operation of the device.

In order to guarantee that the device operates safely, the operator must act competently and be conscious of safety issues.

SIKA provides support for the use of its products either personally or via relevant literature. The customer verifies that our product is fit for purpose based on our technical information. The customer performs customer- and application-specific tests to ensure that the product is suitable for the intended use. With this verification all hazards and risks are transferred to our customers; our warranty is not valid.

Qualified personnel:

⚠ The personnel who are charged for the installation, operation and maintenance of the VMI must hold a relevant qualification. This can be based on training or relevant tuition.
The personnel must be aware of this operating manual and have access to it at all times.

⚠ The electrical connection should only be carried out by a fully qualified electrician.

General safety instructions:

⚠ In all work, the existing national regulations for accident prevention and safety in the workplace must be complied with. Any internal regulations of the operator must also be complied with, even if these are not mentioned in this manual.

⚠ Degree of protection according to EN 60529:
Please ensure that the ambient conditions at the site of use does not exceed the requirements for the stated protection rating (→ § 9 "Technical data").

⚠ Prevent freezing of the medium in the device with appropriate measures.

⚠ Only use the VMI if it is in perfect condition. Damaged or faulty devices must be checked without delay and, if necessary, replaced.

⚠ When fitting, connecting and removing the VMI use only suitable appropriate tools.

⚠ Do not remove or obliterate type plates or other markings on the device, as otherwise the warranty is rendered null and void.

Special safety instructions:

Warnings that are specifically relevant to individual operating procedures or activities can be found at the beginning of the relevant sections of this operating manual.

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3 Construction and function

Construction:

The measuring tube with its earthing sleeves and electrodes passes through the housing and forms the external process connection of the VMI.



A magnetic field for the measurement process is generated inside the sensor housing, which also contains the sensor and signal conditioning circuitry.

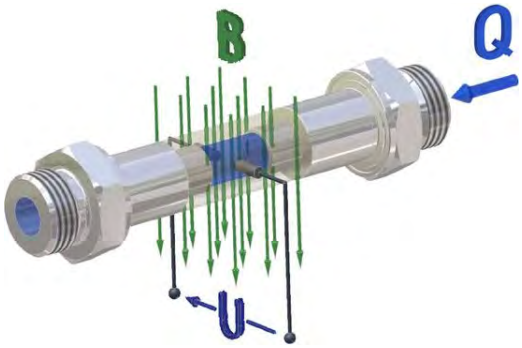
The two stainless steel electrodes are located in the middle of the measuring tube between the earthing sleeves.

The VMI does not need any moving parts to make measurements. The inside of the measuring tube is completely open, allowing the fluid to flow unhindered through the measuring tube.

Function:

The magnetic inductive flow sensor operates in accordance with the principle of induction, i.e. a DC voltage is generated by the movement of a conductor in a magnetic field:

The measuring tube of the VMI is located in a magnetic field (B).
An electrically conductive liquid (Q) flows through the measuring tube. The positive and negative charge carriers are deflected in opposite directions.



A voltage perpendicular to the magnet field is generated and picked up by the two electrodes.
The resulting induced voltage is proportional to the mean flow velocity of the liquid.

The electronics of the VMI converts the induced voltage to a flow-proportional frequency signal.

4 Installation of VMI

Before installing, check that

- ❒ the wetted materials of the device are suitable for the liquid being used (→ § 9.2 "Materials table").
- ❒ the equipment is switched off and is in a safe and de-energised state.
- ❒ the equipment is depressurised and has cooled down.

SUITABLE TOOLS:

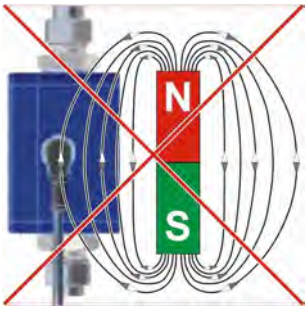
↳ Use only suitable tools of the correct size.

4.1 Installation instructions

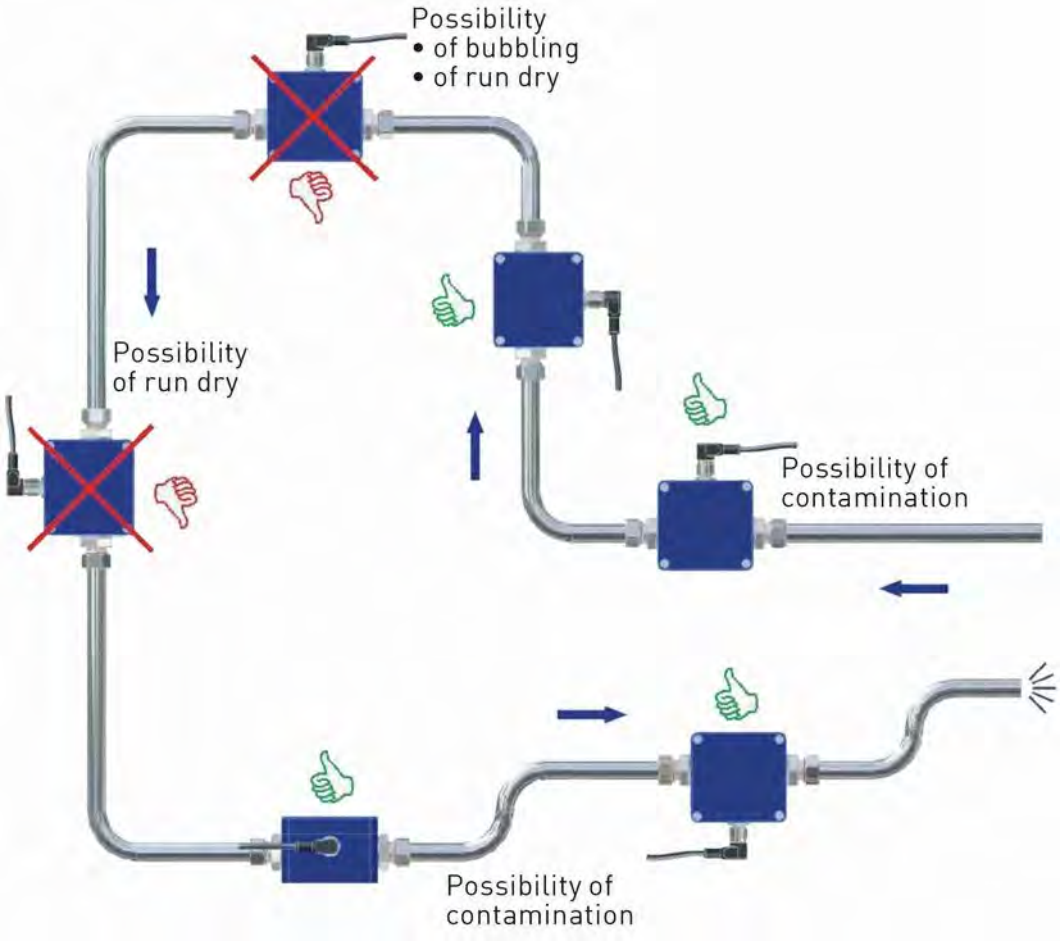
CAUTION! Risk of malfunction due to external magnetic fields!

Magnetic fields close to the device can cause malfunctions and should be avoided.

↳ Ensure that no external magnetic fields are present at the installation site of the VMI.



- The VMI can always be installed anywhere along the pipeline. Straight sections of piping are preferable, however.



- Installation can occur in horizontal and vertical pipes. The flow sensor is only suitable for application in completely filled pipe systems.
- As a matter of principle magnetic inductive flow sensors are widely independent from the flow profile. An inlet section is not absolutely necessary.
  To reach a most highly accuracy of the measurement, you should use straight inlet and outlet sections according to the nominal width (DN). The inlet section has to be at least 10 x DN; the outlet section 5 x DN in order to achieve the specified accuracy.
- The inlet and outlet sections and the gaskets must have the same or a slightly larger inside diameter than the measuring tube in order to achieve the specified accuracy.

4.2 Mounting

The VMI is installed directly into the pipeline. The compact design and light weight of the unit make wall-mounting unnecessary.

IMPORTANT NOTICES:
- Only use suitable gaskets for installation.
- Observe the flow direction indicated on the type plate.
- Observe the mounting dimensions (→ § 9.4 "Dimensions").



↳ Select an appropriate location for installation (→ § 4.1 "Installation instructions").
To ensure the best possible measuring accuracy, a vertical installation position with increasing flow is preferable (no collecting of dirt deposits).

↳ Install the appropriate screwed connections at the installation location.

↳ Insert the VMI together with the gaskets.

↳ Screw the union nuts of the screwed connection onto the process connections of the VMI.

CAUTION! Material damage!
While tightening, counter the union nut on the hexagon of the process connection!
If you do not counter it, the VMI can be damaged!



↳ Tighten both union nuts.
When tightening, use a spanner (af27 or af34) to counter the process connection on the hexagon in place.

5 Electrical connection

The electrical connection of the VMI is via the 4(5)-pin plug M12x1 at the top of the housing.

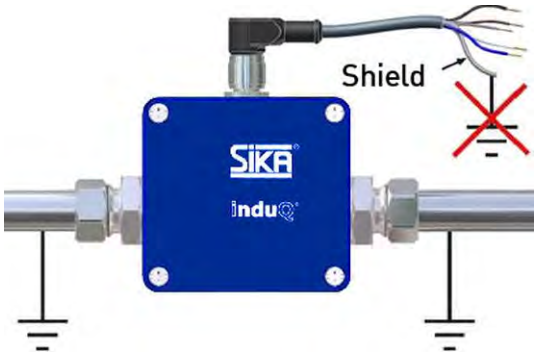
CAUTION! Electric current!
The electrical connection should only be carried out by a fully qualified electrician.

↳ De-energize the electrical system before connecting the VMI.

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IMPORTANT! Shielding required!

- Use only shielded connection cables.
- The shield of the connection cable should not be connected to earth.

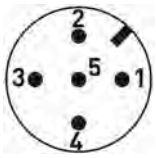


We recommend to earth the pipes directly before and behind the VMI (→ Figure).

Connection 4(5)-pin plug M12x1:

- Screw the coupling socket of the connection cable to the plug of the VMI.
- Tighten the knurled nut of the coupling socket with a maximum torque of 1 Nm.

Pin assignment and colour code:



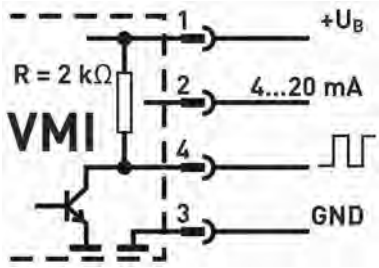
Pin 1 (brown*): $+U_B$ = 24 V_{DC}
Pin 2 (white*): Analogue output 4...20 mA (optional)
Pin 3 (blue*): GND
Pin 4 (black*): Frequency output NPN

⚠ IMPORTANT! Do not connect pin 5 (centre)!

* Colour code is only applicable with SIKA accessories.

Wiring for frequency and analogue output:

- Connect the connection cables in accordance with the wiring diagram on your VMI.
- Observe that the maximum load of 250 Ω to GND is not exceeded at the analogue output (optional).



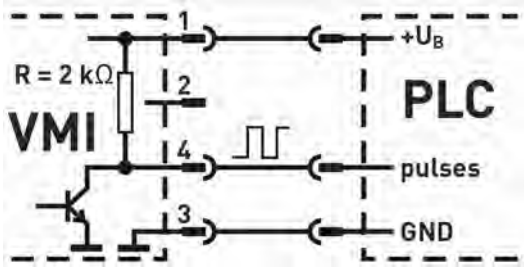
IMPORTANT! No galvanic isolation!
There is no galvanic isolation between supply voltage and output signal.

Wiring for an programmable logic controller (PLC):

The most PLC inputs are designed for connection to PNP signals. However, the NPN frequency signal of the VMI with a signal current of ~12 mA is detected as a signal by the standard PLC.

Thus, operating a VMI with an PLC should not present any problems.

- Connect the connection cables of the VMI with a digital input of the PLC in accordance with the connection diagram.



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IMPORTANT! Check the frequency input of the PLC!

Please ensure that your PLC is able to process the high frequencies of the VMI output signal.

If lower frequencies are necessary, the VMI can optionally be delivered with a custom-specific pulse rate (→ § 9 "Technical data").

6 Commissioning and measuring mode

Before switching on the VMI for the first time, please follow the instructions in the following section.

6.1 Commissioning

Check that

- ❒ the VMI has been installed correctly and that all screw connections are sealed.
- ❒ the electrical wiring has been connected properly.
- ❒ the measuring system is vented by flushing.

6.2 Switching on and off

The VMI has no switch and can therefore not be switched on and off independently. Switching on and off takes place via the connected supply voltage.

↳ Switch on the supply voltage.

The green LED blinks 4 times. The VMI is ready for use and goes into measuring operation.



6.3 Measuring mode

In measuring mode, the green LED flashes corresponding to the frequency of the output signal.

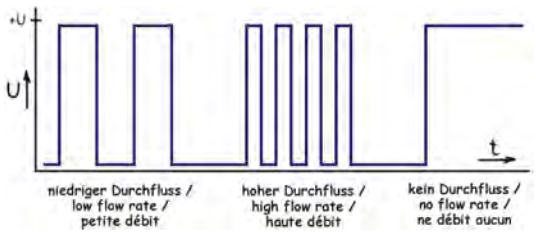
The human eye cannot detect the flashing any longer from a frequency of ~30 ... 40 Hz.
In that case the green LED seems to be lit permanently.



Frequency output:

The frequency output provides a flow proportional NPN square wave signal.

The amplitude corresponds approximately to the supply voltage.



Analogue output (optional):

The analogue output provides a flow proportional signal current of 4...20 mA.

7 Maintenance and cleaning

Maintenance:
The VMI is maintenance-free and cannot be repaired by the user. In case of a defect, the device must be replaced or sent back the manufacturer for repair.

CAUTION! Material damage!
When opening the device, critical parts or components can be damage.
↳ Never open the device and perform any repair yourself.

Cleaning:
Clean the VMI with a dry or slightly damp lint-free cloth. Do not use sharp objects or aggressive agents for cleaning.

8 Disassembly and disposal

CAUTION! Risk of injury!
Never remove the device from a plant in operation.
↳ Make sure that the plant is shut down professionally.

Before disassembly:
Prior to disassembly, ensure that
❒ the equipment is switched off and is in a safe and de-energised state.
❒ the equipment is depressurised and has cooled down.

Disassembly:
↳ Remove the electrical connectors.
↳ Remove the VMI using suitable tools.

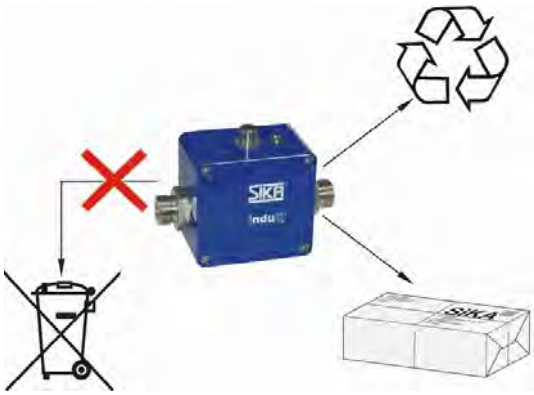
Disposal:

NO HOUSEHOLD WASTE!
The VMI consists of various different materials. He must not be disposed of with household waste.

↳ Take the VMI to your local recycling plant

or

↳ send the VMI back to your supplier or to SIKA.



9 Technical data

The technical data of customised versions may differ from the data in these instructions. Please observe the informations specified on the type plate.

9.1 Characteristics VMI

Type	VMI 07	VMI 10	VMI20
Measurement device characteristics			
Flow range	1...20 l/min	2...40 l/min	10...200 l/min
Accuracy *1 pulse output - with analogue output	±1,5% of reading ±0,3% of full scale value also typically ±1,25% of reading ±0,3% of full scale value		
Repeatability *1 - with analogue output	1% also typically ±0,1% of reading		
Output signal starting from	~0,5 l/min	~1 l/min	~5 l/min
Response time	< 500 ms		
Flow indication	LED green, flow proportional blinking		
Output signal characteristics			
Frequency output:			
Pulse rate - optional*2	855 pulses/l 1...2000 pulses/l	855 pulses/l 1...1000 pulses/l	200 pulses/l 1...200 pulses/l
Resolution - optional*2	1,2 ml/pulse 1000...0,5 ml/pulse	1,2 ml/pulse 1000...1 ml/pulse	5 ml/pulse 1000...5 ml/pulse
Signal shape	Square wave signal • duty cycle 50:50 NPN, 2 kΩ pull-up resistor (built-in)		
Signal current	⩽ 20 mA, current limited		
Analogue output (optional):			
Signal current - corresponding flow of *3	4...20 mA 0...20 l/min	4...20 mA 0...40 l/min	4...20 mA 0...200 l/min
maximum signal current	~ 26 mA		
maximum load	250 Ω to GND		
Electrical characteristics			
Supply voltage	24 V_{DC} ±10%		
Current consumption - with analogue output	~ 80 mA ~ 95 mA		
Protection measures	short-circuit proof (up to 30 V) protected against polarity reversal (up to -30 V)		
Electrical connection	4(5)-pin plug M12x1		
Degree of protection (EN 60529)	IP 65 (with attached coupling socket)		

*1 Test conditions: Water 23 °C at 300 µS; Standard pulse rate.

*2 factory setting. For analogue output only with standard pulse rate.

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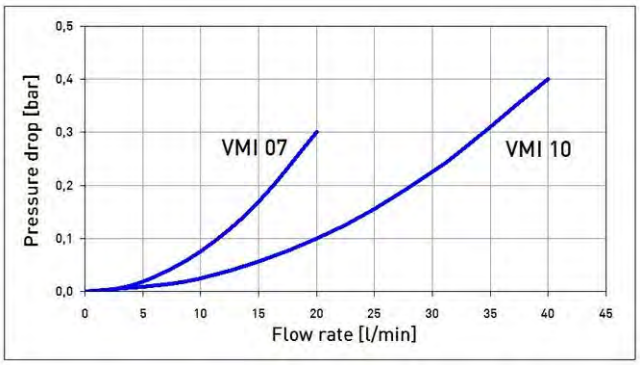
Type	VMI 07	VMI 10	VMI20
Process variables			
Medium to measure:	Water and other conductive liquids		
- Conductivity	> 50 µS/cm		
- Temperature	5...90 °C		
Ambient temperature	5...70 °C		
Nominal diameter	DN 7	DN 10	DN 20
Nominal pressure	PN 16		
Process connection	½'' BSP male thread	½'' BSP male thread	1'' BSP male thread

9.2 Materials table

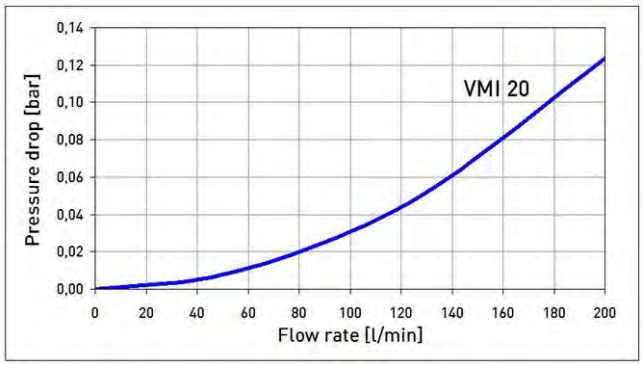
Component	Material	Wetted component
Housing	Aluminium die casting	
Measuring tube	PEEK-GF30	X
Electrodes	Stainless steel 1.4571	X
Gaskets	EPDM	X
Process connections	Stainless steel 1.4571	X

9.3 Pressure drop

VMI 07 and VMI 10:



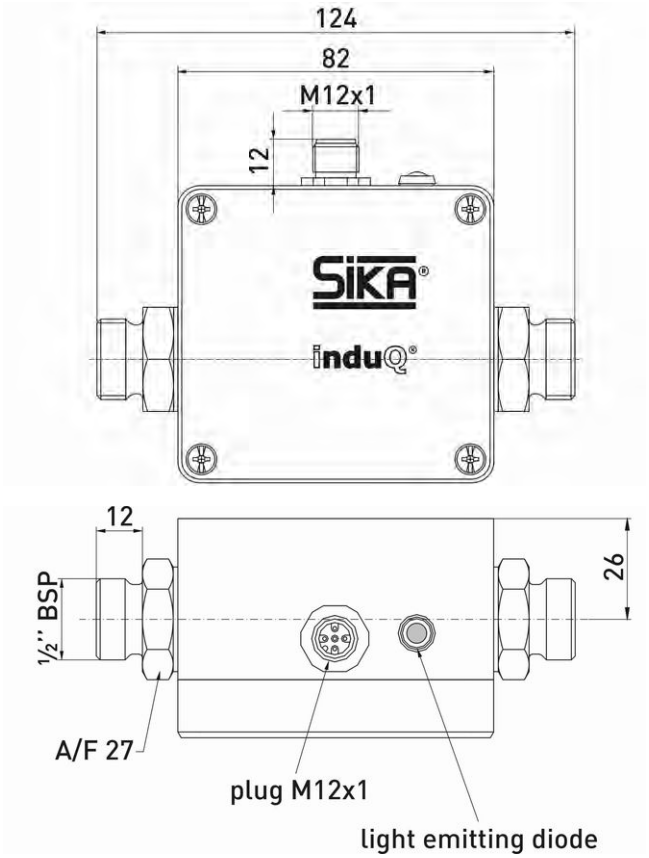
VMI 20:

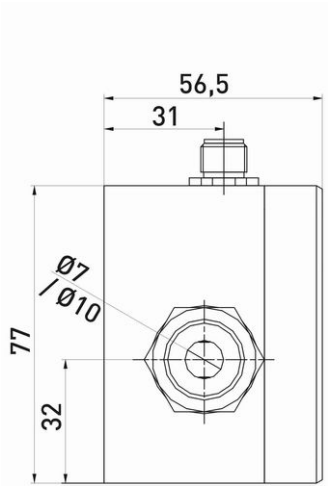


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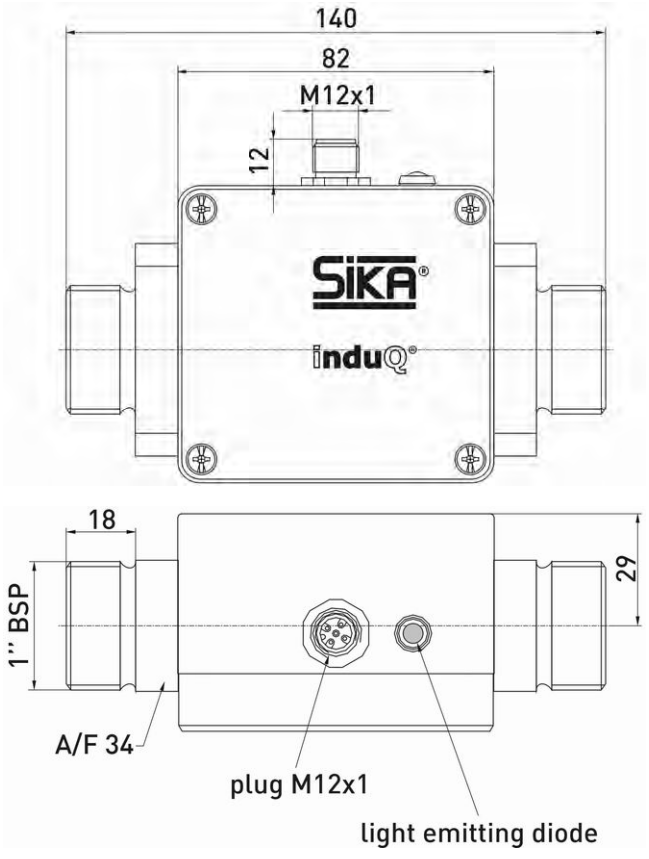
9.4 Dimensions

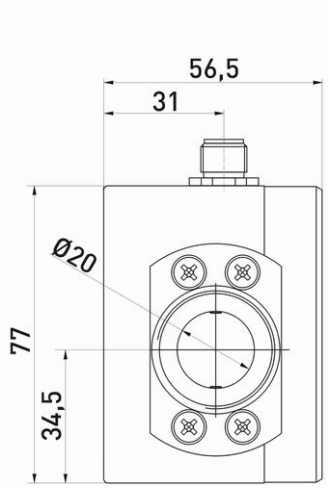
VMI 07 and VMI 10:





VMI 20:







Mechanical measuring instruments



Flow measuring instruments



Electronic measuring- & calibration instruments

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