# User manual

## Flow meter MDW / MDH 500


version 2.2.1

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## Content





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# 1. General

## 1.1 Description measuring principle

The MDW/MDH 500 meter is based on measurement principle by a well-known Faraday's electromagnetic induction law according to which an electric voltage is induced during the flow of a conductive liquid through the flow meter magnetic field. This is picked up by two electrodes in direct contact with the measured medium and evaluated in the electronic unit.

The MDW/MDH 500 type of induction meters are suitable exclusively for measurement of volumetric flow of electrically conductive liquid substances with a minimum conductivity of 20 µS/cm (at a lower conductivity, upon agreement with the manufacturer).

Meters are designed for flow measurement where the velocity of liquid is in the range of 0.01 - 12 m/s. The best measurement accuracy can be obtained in the range of 1 - 10 m/s.

## 1.2 Drawings, shortcut


**Warning!**
A non-observance can cause injuries to persons and/or the demolition of the device. There can be a dangerous to life.

**Attention!**
A non-observance can cause a faulty operation of the device or lead to property damage.

**Information!**
Information!
A non-observance can have influence on the operation of the device or cause unintentional reactions of the device.


**Danger!**
When not observing the safety instructions, there is a risk of serious or fatal injuries caused by electrical power.


**Warning!**
Possibly a dangerous situation can occur, which results in burns because of hot surfaces or liquids, if not avoided.



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## 2. Transport, Packaging, Storage

### 2.1 Transport

Check the instrument for any damage that may have been caused during transportation. If, report them immediately. The temperature during transportation and storage of the meter must be within the range of -10 °C to 50 °C.

### 2.2 Packaging

Do not remove packaging until just before mounting. Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending back).

### 2.3 Storage

For longer term storage avoid the following influences:

1. Direct sunlight or proximity to hot objects
2. Mechanical vibration, mechanical shock (putting it hard down)
3. Soot, vapour, dust and corrosive gases

If possible store the device in its original package or an equivalent one

## 3. Safety instructions

More important safety instructions can be found in the individual chapters.

### 3.1 Intended use of the product

The sensor has been designed and built solely for the intended use described here and may only be used accordingly. The technical specifications contained in these operating instructions must be observed. Improper handling or operation of the instrument outside of its technical specifications requires the instrument to be taken out of service immediately and an inspection by the manufacturer. When the instrument is transported from a cold into a warm environment, the formation of condensation may result in the instrument malfunctioning. Before putting it back into operation, wait for the instrument temperature and the room temperature to equalise. The manufacturer shall not be liable for claims of any type based on operation contrary to the intended use.



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## 3.2 Stuff qualification


Improper handling can result in considerable injury and damage to equipment. The activities described in these operating instructions may only be carried out by skilled stuff who have the qualifications described below. Keep unqualified stuff away from hazardous areas.

For installation and starting of the flow-meter the stuff has to be familiar with the relevant regulations and directives of the country and must have the qualification required. They must have knowledge on measurement and control technology, have to be acquainted with electric circuits, are capable of carrying out the work described and can independently recognize potential hazards. Depending on the operation conditions of the application they have to have the corresponding knowledge, e.g. of aggressive media.

## 3.3 Special hazards


For hazardous media such as oxygen, acetylene, flammable or toxic gases or liquids, refrigeration plants, compressors, etc., in addition to all standard regulations, the appropriate existing codes or regulations must also be followed. **If you do not observe the appropriate regulation, serious injuries and/or damage can occur!**


A protection from electrostatic discharge (ESD) is required. The proper use of grounded work surfaces and personal wrist straps is required when working with exposed circuitry (PCB, printed circuit boards), in order to prevent static discharge from damaging sensitive electronic components.


There is a danger of death caused by electric current. Upon contact with life parts, there is a direct danger of death. Electrical instruments may only be installed and connected by skilled electrical personnel. Operation using a defective power supply unit (e.g. short circuit from the mains voltage to the voltage output) can result in life-threatening voltages at the instrument.


Residual media in dismounted instruments can result in a risk to personnel, the environment and equipment. Take sufficient precautionary measures. Do not use this instrument in safety or Emergency Stop devices. Incorrect use of the instrument can result in injury. Should a failure occur, aggressive media with extremely high temperature and under high pressure or vacuum may be present at the instrument.



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# 4. Starting, operation

## 4.1 feature

## 4.2 Installation in pipeline

In case of detached design, the cable must not be extended or cut short.

## 4.3 Outdoor conditions

It is necessary to ensure that the flow sensor is not exposed to weather effects and that the measured medium cannot freeze in the flow sensor as it would damage the measuring tube.
In case of outdoor location of the electronic evaluation unit, the manufacturer recommends using a protective box or a roof to avoid direct solar exposure so that the evaluation electronics cannot get overheated.

## 4.4 Disturbance sources

These are the sources disturbing the steady flow of a liquid:

- The pumps or pipe bends if they are close together or on different levels. These elements must be located outside the respective inlet and outlet sections (see Chapter 4 Installation Examples)
- Sudden variations in the pipe section unless constructed as a cone with angle $\alpha \leq 16°$ (where $\alpha$ is the angle between the bevelled walls of the pipe adapter).
- Incorrectly centred seal, the seal with a mall internal diameter, or the seal made of soft elastic materials which penetrate into internal section of the pipe after the flanges have been tightened.
- Anything that interferes with the flow of liquid, e.g. the thermometer well.
- Branches, T-pieces, bends, elbows, slide valves, taps, and throttles. Shut-off valves, control valves, butterfly valves, and check valves. Pipe outlets from tanks, heat exchangers, and filters.

No strong electromagnetic field must take effect close to the inductive flow sensor (pick-up).



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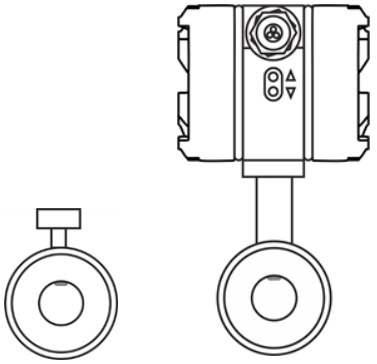
### 4.4.1 Vibrations

We recommend you to support the connecting pipes at both sides of the meter to partially eliminate vibrations. The level and range of vibrations must be below 2.2g within frequency range of 20 - 50 Hz according to IEC 068-2-34 standard.

### 4.4.2 Proper location

The flow sensor must not be at the top of the pipeline where air intake occurs or in the declining and also in horizontal pipeline with open end where air may penetrate. Sedimentation of impurities may occur during a long-run measurement of very low flow rates Q < 0.1 m/s. The site where the flow sensor is installed there must be a sufficient pressure so that vapour or gas bubbles cannot be discharged from the liquid. The tiny bubbles occurring in liquids all the time can accumulate at any of the electrodes and they can cause incorrect function of the meter. The gas bubbles are discharged from liquids also during a sudden drop of pressure. Therefore, the control butterfly valves and similar components should be inserted behind the flow sensor. For the same reason, the flow sensor should not be installed at the suction side of the pump. To prevent the bubbles from accumulating in the flow sensor while the flow is slow, it is useful for the pipeline either to be slightly ascending or the sensor is put into the vertical part of the pipeline.

If the meter is populated with measuring electrodes only (2 or 3 electrodes located beyond the upper profile of the tube), it is necessary for proper function of the meter, to fill up the flow sensor with the fluid to be measured so that erroneous measurement of quantity of liquid passing through the meter can be avoided when the pipe is empty. It is necessary to select the location of the meter in such a way that the flow sensor aeration is avoided. In the case of an open system, the flow sensor is placed in the bottom position of the U-profile, ensuring that the fluid will not flow out of the sensor. In the case that the sensor is equipped with an empty pipe test electrode (3rd or 4th electrode in the upper part of the measuring tube profile), there is no risk of erroneous measurement of quantity of liquid passing through the meter due to aeration of measuring electrodes. This function must be activated in PARAMETERS (EMPTY TUBE TEST) menu. If it be to the contrary, the same conditions stand good as if the testing electrode is not populated.





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### 4.4.3 Installation examples

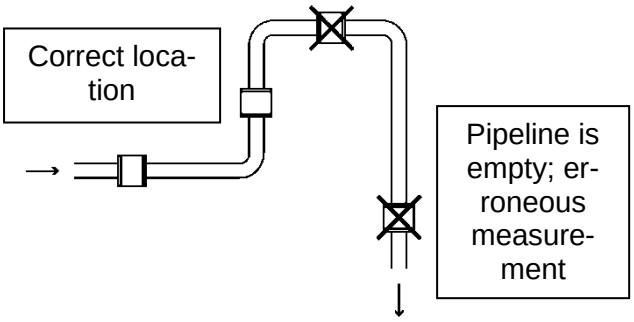
Trouble-free and exact operation of the meter is dependent on its correct location in the system. The most frequent methods of the placement are shown in the following figures:

**Recommended installation locations**

Bubbles are accumulated in the pipeline; erroneous measurement

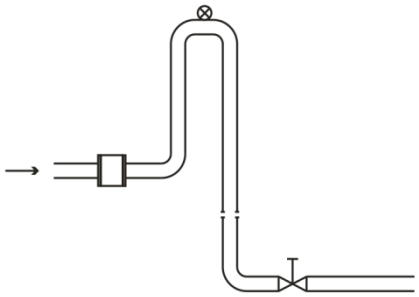
Correct location

Pipeline is empty; erroneous measurement



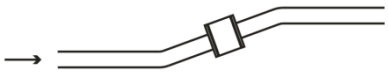
**Downtake pipe**

Install an air bleed valve after the sensor ⊗



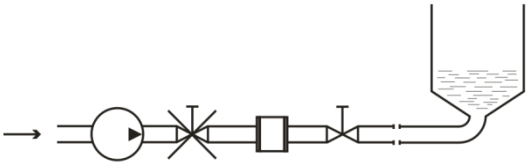
**Horizontally laid pipeline**

Place the sensor in a slightly ascending pipeline



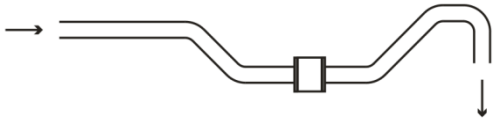
**Long pipeline**

Install controls and shut-off valves always after the sensor



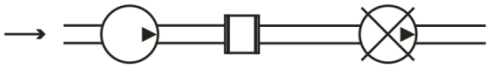
**Free inlet or outlet**

Built in the U-shaped pipeline



**Pumps**

The flow meter must not be installed in the suction side of the pump





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The flow of liquid flow in the flow sensor should be steady and free of whirling. For this reason, straight sections of pipeline with the same ID as that of the flow meter before and after the flow sensor (with permissible deviation of +5%). Recommended minimum length of straight sections is 5xd before the flow sensor and 3xd after the flow sensor where d is the inside diameter of the meter in millimetres. The same principles apply before and after the flow sensor in case of bi-directional flow measurement.

### 4.4.4 Recommendation

When the flow is whirled up, increase the stabilizing sections of the pipe or install the flow conditioner. When mixing facilities are blended, it is necessary to install the flow meter either before the blending spot or at a sufficient distance behind it (30xd min.) otherwise it may result in unstable readouts. The grounding rings are necessary when plastic or metal pipes with the internal non-conductive layer are used.

### 4.4.5 Compact construction of the meter

For the compact design, the following points should be particularly noted:

- The maximum temperature of the medium (max. +90° C, attention see here-for data sheet Lining). If the temperature is exceeded, this can lead to a faulty measurement or even to the destruction of the device. With the PTFE-lining CIP-cleaning processes are possible.
- When installing the device, do not pick up or hang up the flow meter on the evaluation unit (connection head).
- If the flowmeter is exposed to high vibrations, do not use a compact version.

The user is responsible for the proper use of the meter.



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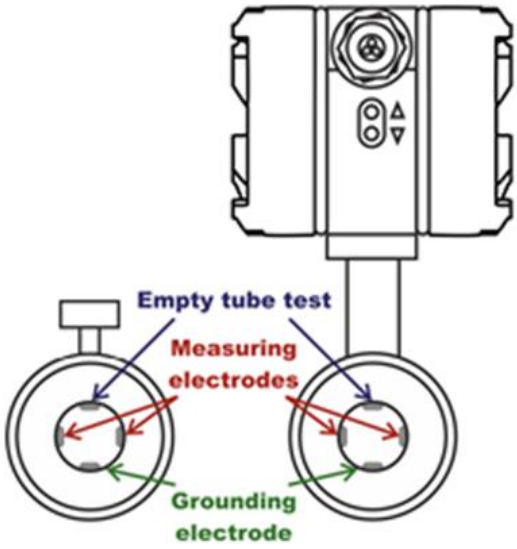
### 4.4.6 Installation in pipeline

The inductive flow sensor is installed in arbitrary position in vertical piping. In case of horizontal piping, it is necessary to make sure that the sensor is installed with its measuring electrodes in horizontal position. In case of the earthing electrode design, possibly with testing for empty pipeline, then the installation is always performed with the earthing reference electrode facing down (with the sensor terminal box, eventually with the evaluation unit facing upwards). Then the earthing reference electrode is in the bottom position and the empty tube sensing electrode is in the top position of the flow sensor.




Installation in piping and placement of measuring electrodes in flow sensor.



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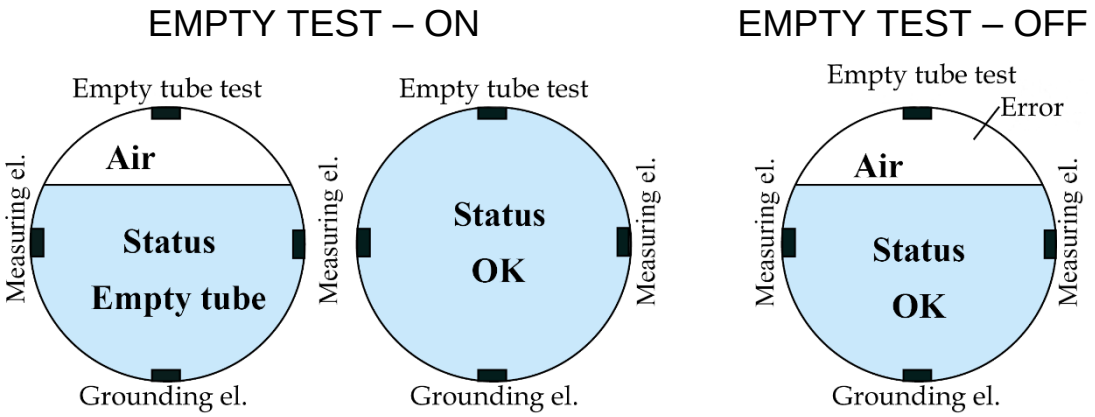
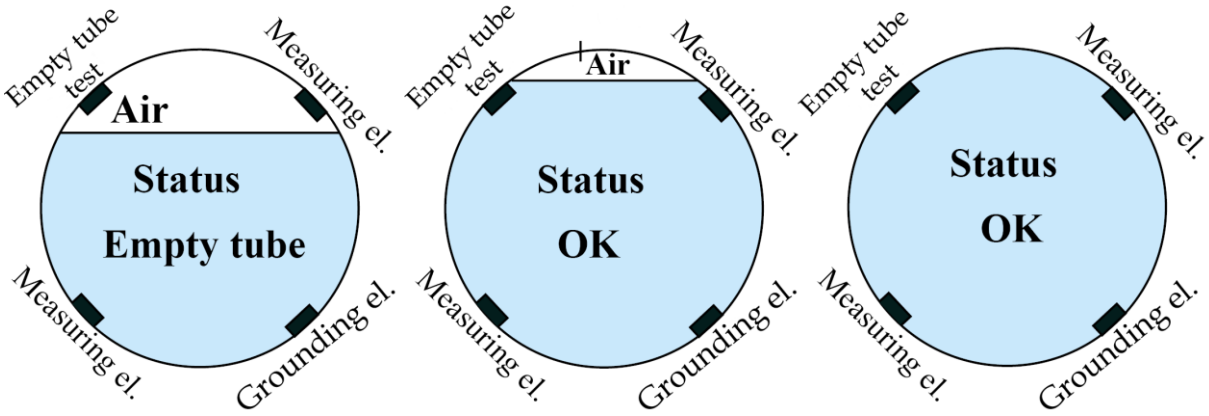
The measurement accuracy is maintained in this way. Once the electrode is covered with the liquid again, the error message disappears and the flow meter starts taking measurement again.

*Measurement error caused by incorrect mounting installation*

1) *correct installation (flow sensor should be install in arbitrary position in vertical piping)*




2) *incorrect installation (placing the unit diagonally, Empty test – ON)*



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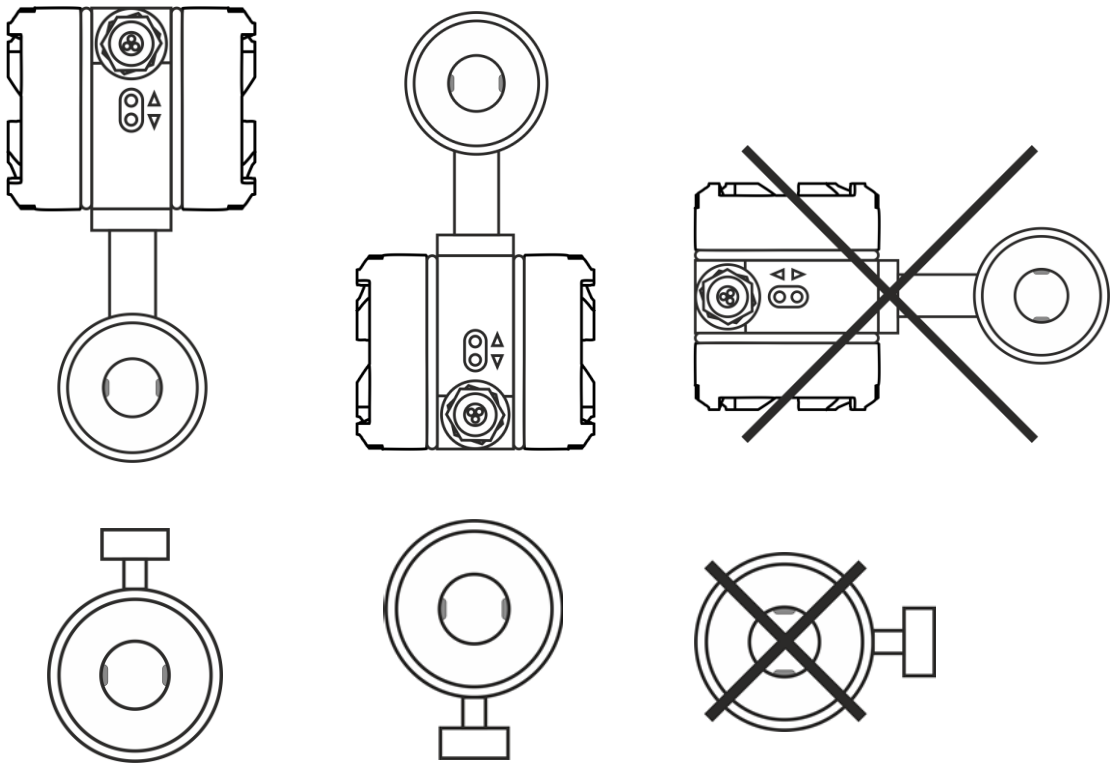
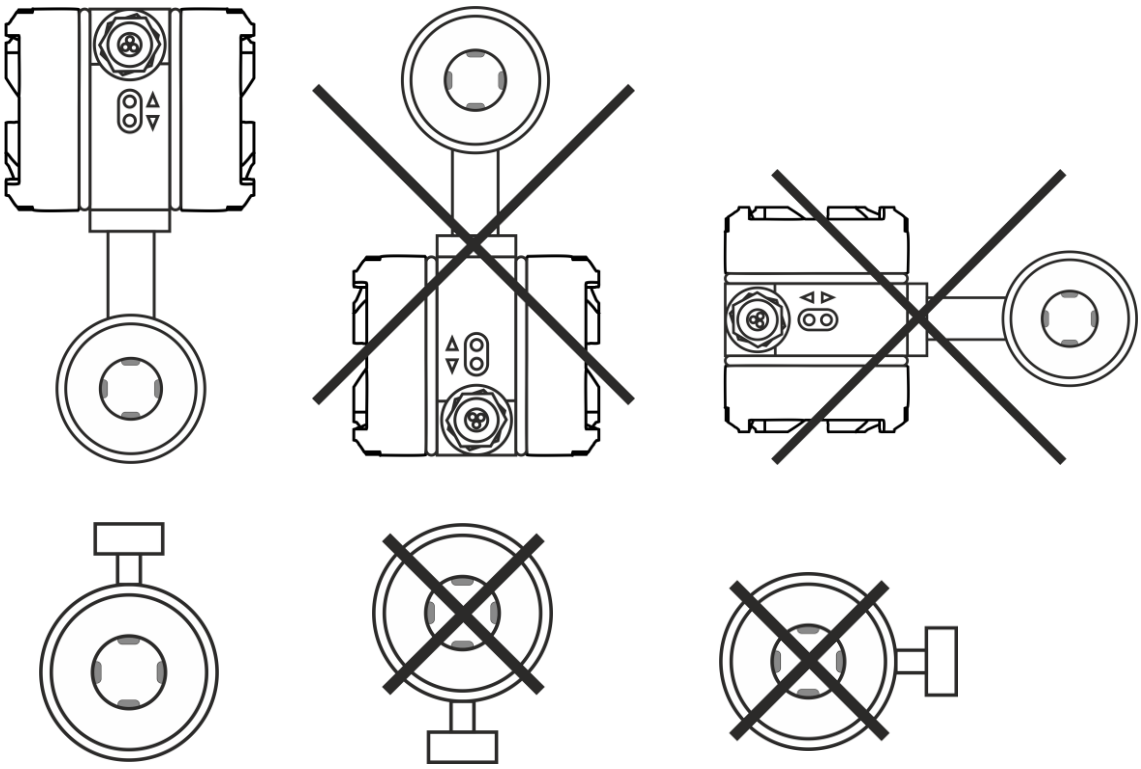
- *in the version without the earthed reference electrode and/or empty piping test (2 electrodes)*



- *in the version with earthed electrode and/or empty piping test electrode (3/4 of the electrode)*





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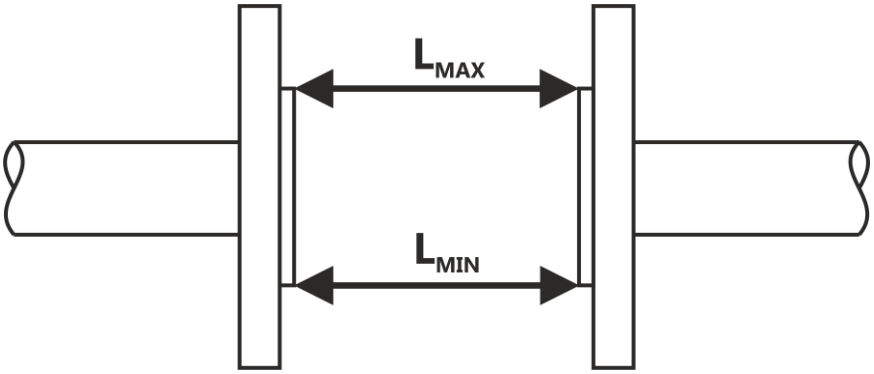
The installation is carried out by fixing it between the counter flanges (sandwich) welded on the calming pipe (5D before, 3D behind and downstream) whereas the liquid must flow through the flow sensor in the direction indicated on it with an arrow.

When counter flanges are being welded on the pipe, it is essential to maintain their alignment so as to ensure uniformity of seating faces of the flanges on the face areas of the sensor (however, this must not be reached by uneven tightening of the connecting bolts because there is a risk of leakage resulting from temperature strain in the future and, in some case, the measuring tube might crack when being tightened unevenly). The difference in LMAX and LMIN distances of the both sealing faces on the flanges before the flow sensor is installed, must not be longer than 0.5 mm.




In the same way, the mating positions of holes for connecting bolts in counter-flanges should be ensured as well as ample room behind the flanges for the connecting bolts and nuts in order to ensure proper installation of the sensor in the pipe and the attachment by connecting bolts.

The manufacturer recommends using a fitting adapter for welding. It is absolutely inadmissible to use the flow meter as a fitting adapter due to possible thermal destruction. The welding current must not flow through the flow sensor during electric welding. The installation of the flow sensor itself is carried out after all welding, painting, building, and similar jobs are finished.

If the flow sensor has a fibre-rubber sealing, it is inevitable to lubricate it using graphite grease or oil with graphite.



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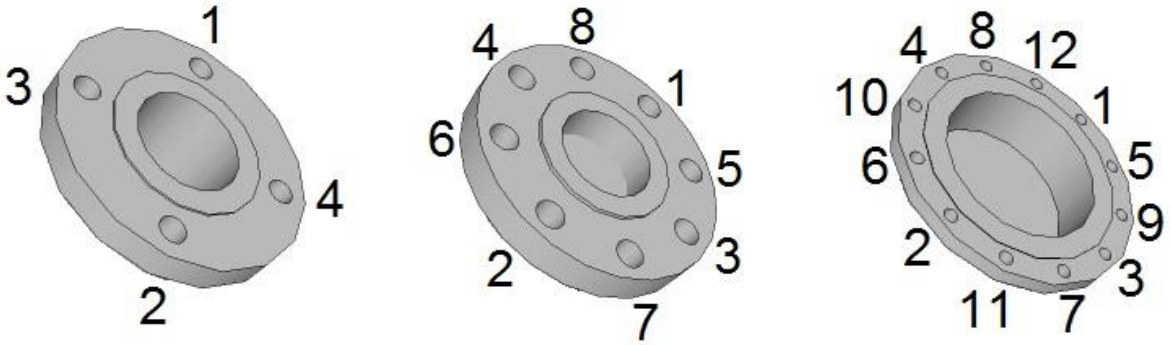
When a threaded connection is used, it is essential to check the thread on the sensor, while it is being tightened, to prevent it from moving round a slight amount.

During installation, beware of:

- dropping the meter onto the ground and damaging the measuring tube or electronics
- contamination of the electrodes (do not touch the electrodes, otherwise they get contaminated)
- when additional sealing is used, avoid its interference in the flow profile of the detector between the flanges and the pipeline, otherwise the flow measurement error may be increased

*Tightening torques*

It is absolutely necessary to tighten the bolts and nuts equally by alternating sides and in the order shown in figure applying the maximum torque according to the table:




| **Diameter nominal** DN | **PN 10** Screws | Tightening torque [Nm] Rubber | PTFE | **PN 16** Screws | Tightening torque [Nm] Rubber | PTFE |
|---|---|---|---|---|---|---|
| *10* | 4 x M12 | 10 | 15 | 4 x M12 | 10 | 15 |
| 15 | | 15 | 20 | | 15 | 20 |
| 20 | | 20 | 25 | | 20 | 25 |
| 25 | | 20 | 25 | | 20 | 25 |
| 32 | 4 x M16 | 20 | 25 | 4 x M16 | 20 | 35 |
| 40 | | 20 | 25 | | 20 | 35 |
| 50 | | 20 | 45 | | 20 | 45 |
| 65 | | 20 | 46 | | 20 | 46 |
| 80 | 8 x M16 | 20 | 48 | 8 x M16 | 20 | 48 |
| 100 | | 20 | 50 | | 20 | 50 |
| 125 | | 20 | 80 | | 20 | 65 |
| 150 | 8 x M20 | 24 | 90 | 8 x M20 | 27 | 90 |
| 200 | | 27 | 115 | 12 x M20 | 35 | 80 |
| 250 | 12 x M20 | 35 | 95 | 12 x M24 | 55 | 100 |
| 300 | | 50 | 100 | | 80 | 110 |
| 350 | 16 x M20 | 60 | 70 | 16 x M24 | 95 | 105 |
| 400 | 16 x M24 | 75 | 120 | 16 x M27 | 140 | 150 |



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| Diameter nominal | PN 25 | | | PN 40 | | |
|---|---|---|---|---|---|---|
| DN | Screws | Tightening torque [Nm] | | Screws | Tightening torque [Nm] | |
| | | Rubber | PTFE | | Rubber | PTFE |
| 10 | 4 x M12 | 15 | 15 | 4 x M12 | 15 | 15 |
| 15 | | 20 | 20 | | 25 | 25 |
| 20 | | 25 | 25 | | 25 | 25 |
| 25 | | 25 | 25 | | 25 | 25 |
| 32 | 4 x M16 | 25 | 35 | 4 x M16 | 25 | 40 |
| 40 | | 25 | 35 | | 35 | 50 |
| 50 | | 35 | 45 | | 35 | 60 |
| 65 | 8 x M16 | 35 | 46 | 8 x M16 | 45 | 55 |
| 80 | | 40 | 48 | | 45 | 60 |
| 100 | 8 x M20 | 40 | 55 | 8 x M20 | 50 | 75 |
| 125 | 8 x M24 | 50 | 110 | 8 x M24 | 70 | 120 |
| 150 | | 57 | 115 | | 75 | 136 |
| 200 | 12 x M24 | 68 | 100 | 12 x M27 | 85 | 145 |
| 250 | 12 x M27 | 88 | 120 | 12 x M30 | 105 | 220 |
| 300 | 16 x M27 | 95 | 125 | 16 x M30 | 115 | 250 |
| 350 | 16 x M30 | 115 | 200 | 16 x M33 | 140 | - |
| 400 | 16 x M33 | 135 | 255 | 16 x M36 | 165 | - |

In case of using a corundum or thermoplastic tube, the same torques apply as in case of using the PTFE tube according to the given pressure series.

*Threaded connection (EN 10226-1):*

| Diameter nominal DN | Process connection [inch] | Tightening torque [Nm] |
|---|---|---|
| 10 | 3/8” | 8 |
| 15 | ½“ | 10 |
| 20 | ¾“ | 21 |
| 25 | 1“ | 31 |
| 32 | 1 ¼“ | 60 |
| 40 | 1 ½“ | 80 |
| 50 | 2“ | 5 |
| 65 | 2 ½“ | 6 |
| 80 | 3“ | 15 |
| 100 | 4“ | 14 |

The screws are tightened in three steps: first the screws are tightened to 50% of the recommended torque, then to 80% and later to 100% of the maximum torque.

It is recommended to check the tightened screws within the next 24 hours.



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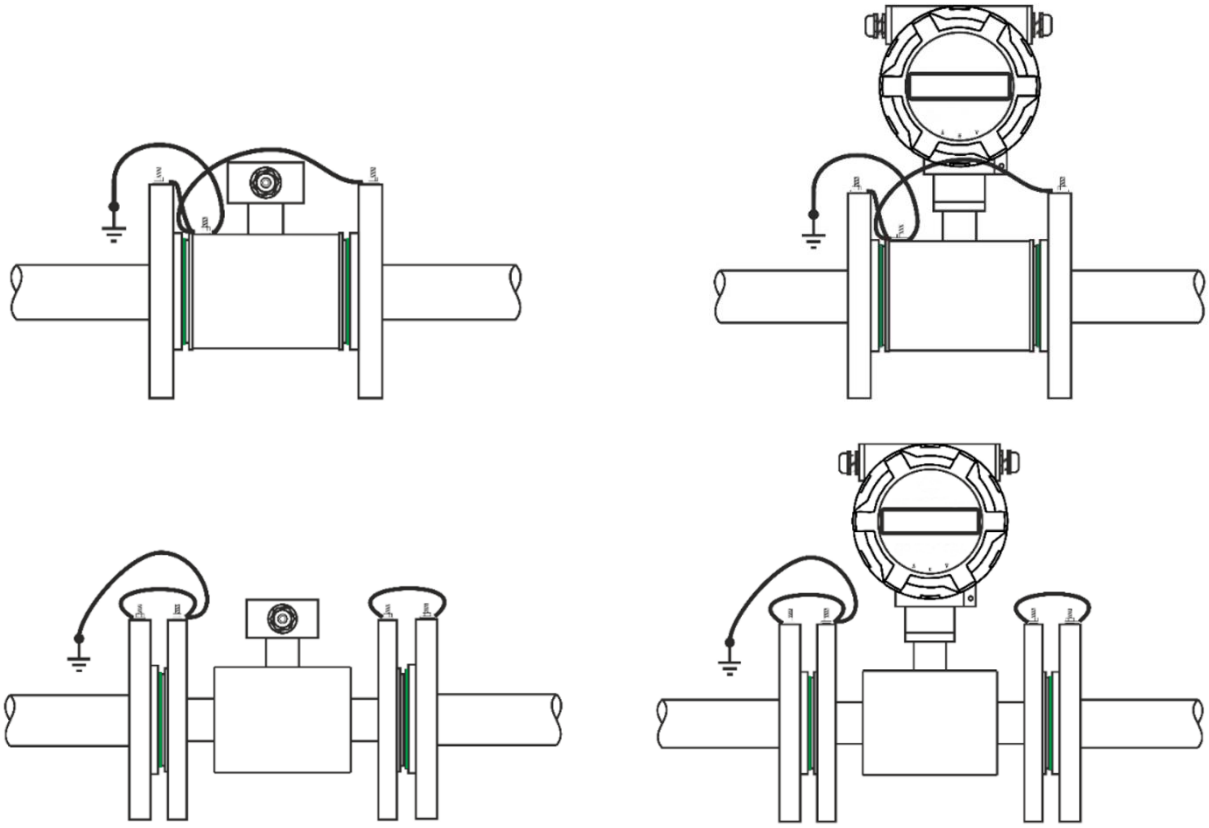
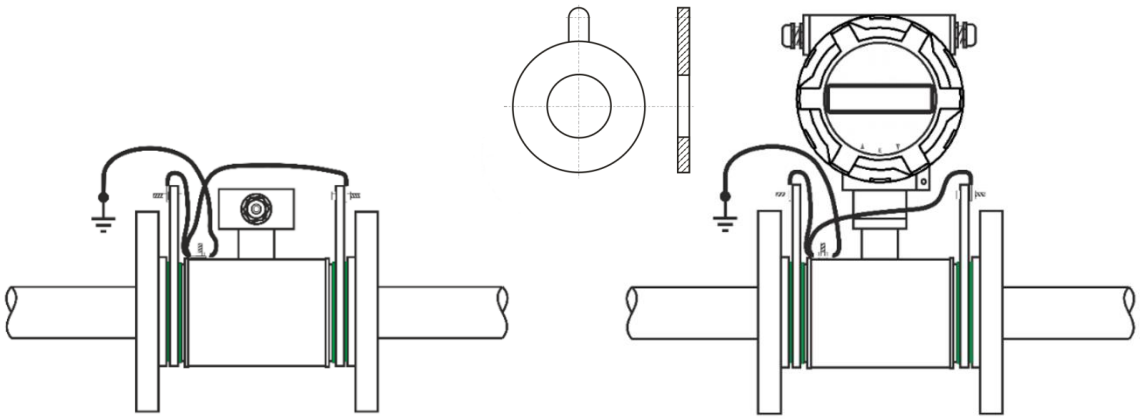
Grounding
Each flow sensor must be earthed. The earthing cable must not transmit the interference voltage, i.e. this cable must not be used for earthing other sensors at the same time.
The sensor is equipped with a grounding screw, washer and nut made of stainless steel M5. These must be connected to the earth cable. If it is not ensured that the counter flanges are in direct contact with the measured liquid and are conductive, it is recommended to use earthing rings.



Grounding rings - only if ordered.
The earthing rings are used when plastic pipes or metal pipes with internal plastic coating are used. The conductive stainless steel rings provide a conductive connection with the measuring liquid. The sensor is equipped with an earthing screw and earthing cable. This cable must be connected to the grounding rings for grounding.





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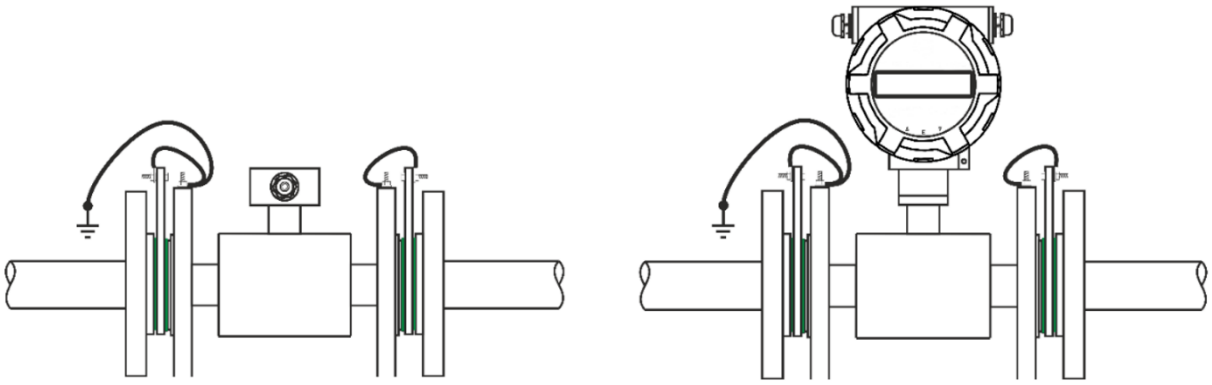

*High temperature pipeline*
If the temperature of the measuring liquid is higher than 100°C, it is necessary to compensate for the forces caused by linear expansion. If a short tube is used, a flexible seal should be used. If a long pipe section is used, flexible components such as bends should be used.

*Electrodes*
The electrode material must be selected according to chemical resistance to the liquid to be measured. The purity of the electrodes may have an influence on measurement accuracy, their heavy foulness may cause even the interruption of the measuring function (isolation from the liquid). It is not necessary to clean the electrodes right after delivery before their installation in the pipeline. If the electrodes indicate signs of foulness, clean them with a soft cloth or use a chemical cleaning agent. Mind damaging to the lining! During routine operation, in case of a great majority of liquids, it is not necessary to clean the flow meter for the entire operation period of the flow sensor; self-cleaning by flow of the liquid is sufficient (recommended velocity is over 2 m/sec).

*PTFE, PFA, EFTE lining*
The installation is carried out at the lowest point of the pipes to avoid negative pressure. The PTFE coating must not be damaged under any circumstances. The protective caps must not be removed until just before installation between the flanges.

***Installation check***
After installation of the flow sensor in the pipeline, the following must be checked:

- According to the name plate, if there is a relevant meter in the given measuring point (pressure, temperature, dimension, etc.).
- If the direction of the arrow on the device is in agreement with the direction of the flow in the pipeline.
- Correct position of the measuring electrodes (horizontally).
- Correct position of the electrode for empty pipeline detection (up).
- If all bolts (screws) are tightened properly.
- If earthing rings are used, then their correct installation and connection with the sensor.
- Accuracy of flow sensor earthing.
- Accuracy of execution of the pipeline calming section lengths
- If the sensor is protected against vibrations and mechanical damage.



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- If the name plate (serial number) on the sensor corresponds to the one on the electronics.

## 4.5 Wiring

**!** When the operations described below are performed unprofessionally, the claim on warranty becomes extinct!!! Prior to any opening of the evaluation unit, switch off the power!!! It is necessary to bear in mind that in case of detached design, the electronic evaluation unit and the flow sensor form an integral unit which is calibrated and matched uniquely. In consequence, make sure that the serial numbers of both parts are always identical!!!

### 4.5.1 Meter wiring

In case of a separate version, the connecting cable must not be shortened or extended.

The signal cable of the separate sensor must not be laid next to voltage distributors, motor electromagnets, frequency converters or similar sources with electromagnetic fields.

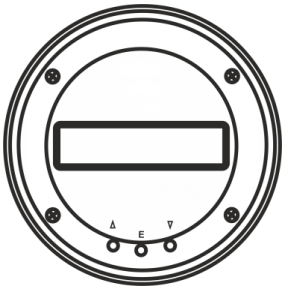
To ensure the tightness of the cover of the evaluation unit, the seal must be kept intact and clean.

*Evaluation unit*
Standard power supply: 230V / 50 ÷ 60Hz
Other power supply possible: DC 24VAC / DC / 250mA

The signal inputs and outputs of the flow meter must only be connected with the units where protection against personal injuries is ensured by safe voltage and where generated voltages do not exceed limits specified for safe voltage.

The evaluation unit consists of two independent subunits:

- measuring element (front panel with display unit)





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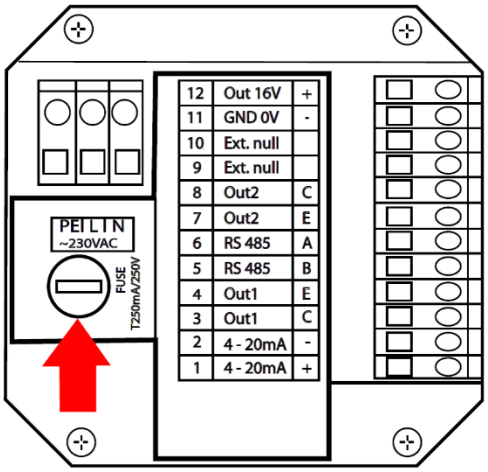
- input/output and power supply board




*Note: Connecting the terminal board is always described on the inner label placed on the meter rear lid or the cover metal sheet of the power source.*

Evaluation unit terminal board wiring:

| | |
|---|---|
| Terminals No. 1, 2 | current output 4÷20 mA |
| Terminals No. 3, 4 | impulse output OUT IMP |
| Terminals No. 5, 6 | RS485 communication |
| Terminals No. 7, 8 | output 2 |
| Terminals No. 9, 10 | reset Total V register (resettable counter) by external button |
| Terminals No.11, 12 | output voltage 16 V/100 mA (power supply for changing to active current and impulse outputs) |
| Terminals L, N, PE | mains voltage 230 VAC (standard), available also in 24 VAC/VDC version |

Under no circumstances should the cabling form loops or similar.
A separate cable should always be used for the power supply.
Unused plugs should be secured with insulation or plastic cover.



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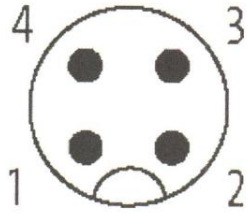
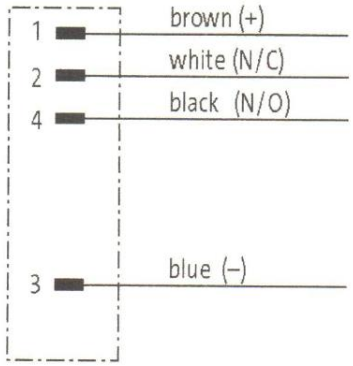
### 4.5.2 Assignment M12 plug

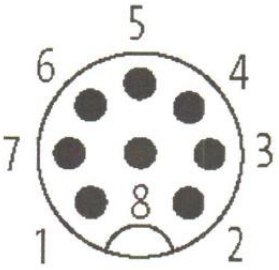
Male

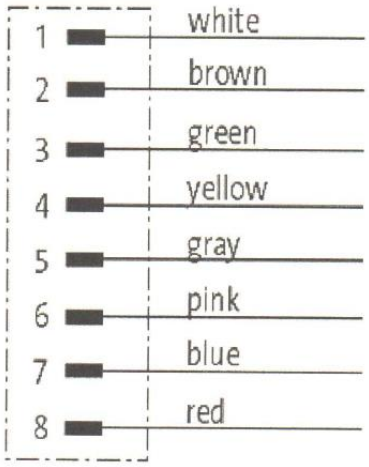



UB+
EXT. null
EXT. null
UB-

Male




4…20mA +
4…20mA –
OUT 1 C
OUT 1 E
OUT 2 C
OUT 2 E
OUT 16V +
OUT 0V -



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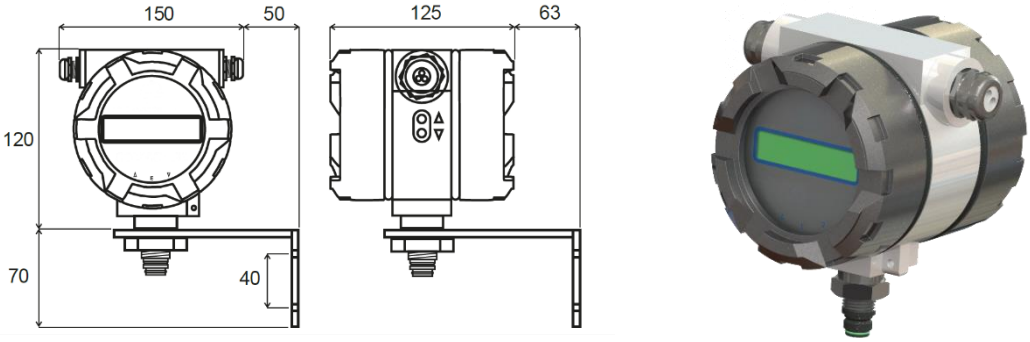
**Installation of the separate evaluation unit of the flow meter**
*The version HEAD (85mm) - it is a remote evaluation electronics (according to order).*

Firstly decide if you want to install the fixing bracket behind, or under the electronics (the bracket with holes upward or downward). Install the fixing bracket on the meter's aluminium housing; place the unit as required on the wall or on a structure and mark the holes in this position for the attachment of the bracket. Unscrew the bracket and attach it to the marked location, e.g. using wall plugs and screws. Screw down the electronics on to the fixing bracket and connect the sensor cable using the connector. Attach the cable to the wall or to the structure so that it does not "dangle" from the connector. Make a "drip loop" downwards so that water cannot trickle onto the connector. Fix the conductors for power and the outputs in a similar way. After installation of all cables, turn the electronics to the required position and fix the unit to the bracket by tightening the fastening nut.




## 4.6 Power supply cover sheet

There is a cover sheet installed on power supply board with the access to jumper J1. This jumper switches invoicing mode to operational. Basic difference between the states with and without the jumper is in the level of control. The version with installed jumper allows the user to adjust almost all parameters. On the contrary, the version without jumper only controls parameters that do not have influence on meteorological settings. If the sensor must comply with meteorological approval, there will be metrological seal over the jumper.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## 4.7 Impulse output / Flow Switch contact OUT1 / OUT2

The outputs OUT1 and OUT2 are freely configurable and are realized by the optocoupler with an NPN switching transistor. The limit values of this optocoupler are 80V/50mA/100mW max. The output can be connected as passive or active output when using terminals 11 and 12. In active mode the instrument uses its internal, galvanically isolated 16V power supply. In this case, the switching voltage for **logically high 16V** at the recommended current consumption of approx. 2mA for the transmission of optocouplers. The output in off-state is in high impedance state, so it is necessary to use a pull-down or pull-up resistor to define the stational level.

Configuration:

1) The impulse output is used for remote transmission of volumetric pulses. The conversion constant is arbitrarily variable via keys or user software. It must be set so that the frequency is <400Hz at maximum flow rate.
2) The flow switch is used to monitor the flow value. If the set limit flow is exceeded, the contact is switched (contact closing/opening). The degree of contact making and contact opening is different - the contact has a hysteresis. The hysteresis is adjustable in %.
3) The status output is used to evaluate the counter status - error, warning, fault, error + warning.



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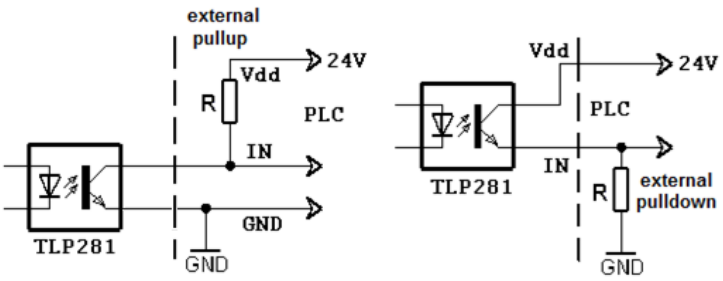
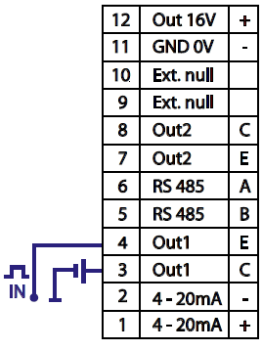
*Wiring connection examples – **passive** impulse output:*

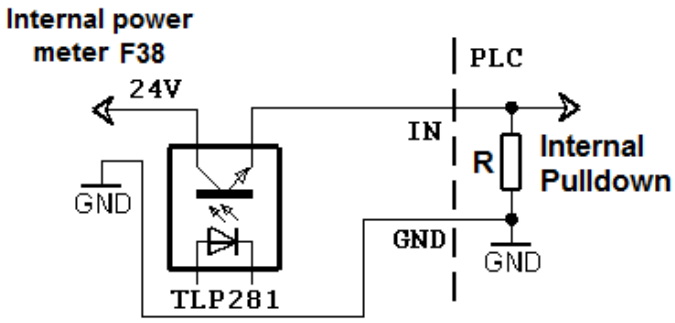



*Terminal board wiring connection:*

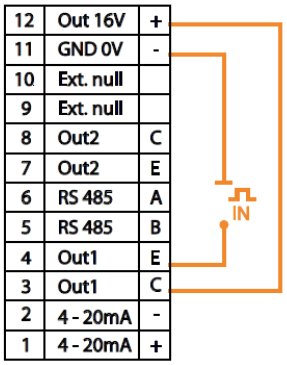



| | | |
|---|---|---|
| 12 | Out 16V | + |
| 11 | GND 0V | - |
| 10 | Ext. null | |
| 9 | Ext. null | |
| 8 | Out2 | C |
| 7 | Out2 | E |
| 6 | RS 485 | A |
| 5 | RS 485 | B |
| 4 | Out1 | E |
| 3 | Out1 | C |
| 2 | 4 - 20mA | - |
| 1 | 4 - 20mA | + |

*Examples of connection – **active** impulse output*




*Terminal board wiring connection:*




| | | |
|---|---|---|
| 12 | Out 16V | + |
| 11 | GND 0V | - |
| 10 | Ext. null | |
| 9 | Ext. null | |
| 8 | Out2 | C |
| 7 | Out2 | E |
| 6 | RS 485 | A |
| 5 | RS 485 | B |
| 4 | Out1 | E |
| 3 | Out1 | C |
| 2 | 4 - 20mA | - |
| 1 | 4 - 20mA | + |

Due to CTR≈100% and If=2.5mA, it is suitable to select collector current up to 2.5mA.



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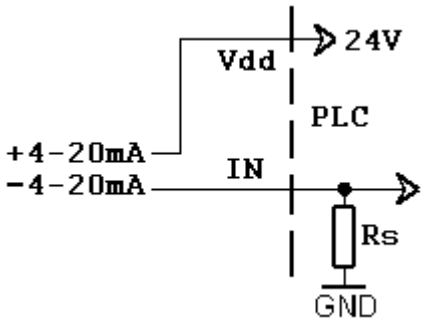
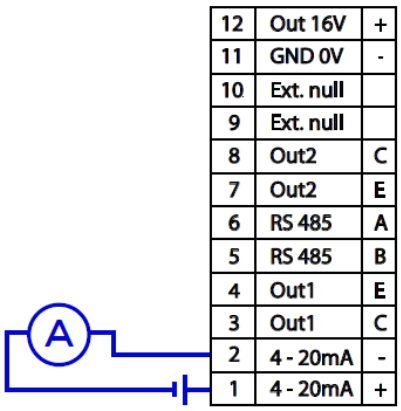
## 4.8 Current output

D/A - converter of the MDW / MDH 500 evaluation unit is 16-bit with data recovery per second. The converter is isolated from the meter by optocouplers. If the current output is passive, it is necessary to feed the current output from an external power supply. External power supply Ue can be 12 - 24 V. The loop resistance must not be higher than R = Ue / 0,02 (Ω;V).
As standard, it is set in such a way that with the maximum flow Qmax the loop current is 20mA and with the zero or negative flow, the loop current is 4mA. The borders can be set by buttons or user software for all flow directions. In case of loss of power for the meter, it is indicated by 0mA current loop output.
When the empty pipe monitoring is activated, the analog output goes to approx. 2...2.5mA when the "empty pipe status" is reached.

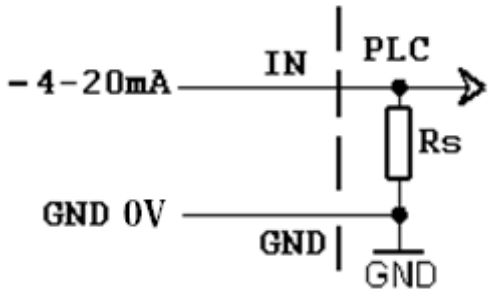
*Current loop wiring connection example:*
*Passive current loop*



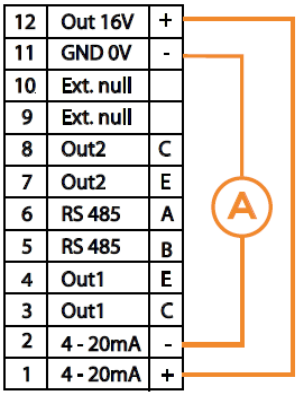

*Terminal board wiring connection:*




*Active current loop*




*Terminal board wiring connection:*



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## 4.9 Control input

*External zeroing (Reset)*
Zeroing the user volumetric counter is led out to the external input PIN9 and PIN10 provided that jumpers on the power supply part are switched to the position as shown in the figure below. The input is isolated by an optocoupler. It can be managed by an external zeroing button is connected to terminals 9 and 10.

| | | |
|---|---|---|
| 12 | Out 16V | + |
| 11 | GND 0V | - |
| 10 | Ext. null | |
| 9 | Ext. null | |
| 8 | Out2 | |
| 7 | Out2 | |
| 6 | RS 485 | A |
| 5 | RS 485 | B |
| 4 | Out1 | E |
| 3 | Out1 | C |
| 2 | 4 - 20mA | - |
| 1 | 4 - 20mA | + |


## 4.10 Data output

The meter can also be provided with RS485 communication with M-Bus protocol as per EN 1434-3 or ModBus RTU.

## 4.11 Protection degree

The meters meet all the requirements for IP 65 (connection head IP67) protection degree. In order to ensure IP 65 protection after installation in the plant or after a service intervention, the following must be met:

- The "O" rings inserted in sealing grooves must be clean and intact.
- If necessary, the "O" rings should be dried, cleaned or replaced with new ones.
- Screw caps must be tightened properly.
- Cables used for connection must have their outside diameters according to cable entries used.
- Tighten the cable entries properly.
- Cables before entering the cable entries should form a loop pointing downwards ("drip loop"). This will eliminate the penetration of moisture into the cable entry. Install the measuring instrument always with cable entries not facing upwards if it is possible.
- Provide all unused cable entries with dummy plugs.
- Do not remove sealing rings from the cable entries.



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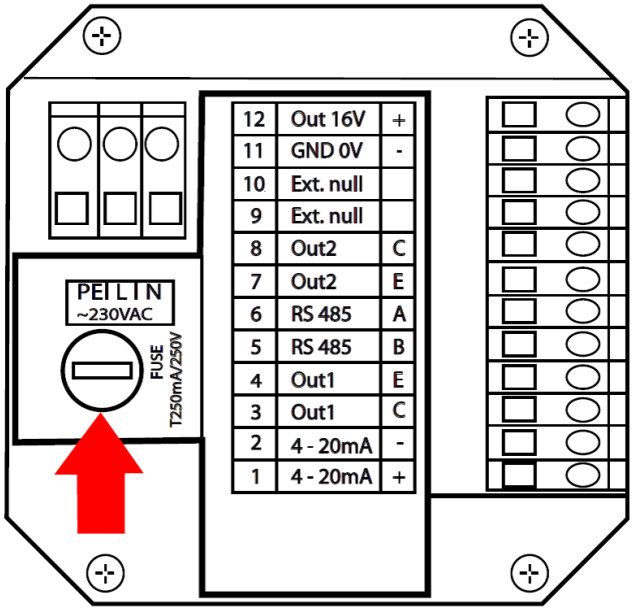
## 4.12 Replacement of tube fuse in the meter


Risk of electric shock! Uncovered components generate dangerous voltages. Before removing the cover from the electronics area, make sure that the meter is not under voltage!!!

The instrument fuse is on the power supply PCB and it is replaced as follows:

1. Switch off power.
2. Unscrew the rear cover of the meter housing
3. Remove the protective cover and replace the instrument fuse (use solelyT250mA/250V tube fuses)




## 4.13 Wiring check

After completion of wiring, it is necessary to check:

- Connecting cables for damage.
- If the cables used are suitable for given cable entries.
- Cables for pull relief.
- Correct tightening of cable entries.
- Correct connection of cables to terminals.
- Whether the supply voltage corresponds with the nameplate data.
- After the meter is closed, tighten the covers properly to the O-rings.



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## 5. Putting into operation

Prior to connection to power supply, check the device installation accuracy in accordance with “Installation in pipeline“ and “Wiring” chapters.

***If an exact measurement (reference measurement) is to be carried out directly after installation, it is recommended to cover the measuring electrodes with water 1 or 2 days before installation. Immediately before installation the water should be drained off and the flow sensor should be installed immediately to prevent the electrodes from drying out.***
If the meter has no electrode for empty tube detection, do not connect the meter to power before filling the system with the fluid to be measured and power off the meter before system discharge.
Immediately after power on, the green LED on the front display of the MDW / MDH 500 will light up, indicating that voltage is applied to the device and the flow meter is loading its data. As soon as the data are stabilized, the measurement starts.

### 5.1 Meter status

The status of the measuring device is continuously shown on the display. In case of a malfunction or failure, the operator is informed by a flashing display. The status displays of the meter are divided into 4 main groups:

| | |
|---|---|
| 1) OK | everything is all right |
| 2) Warning | the meter takes measurement but some of the parameters are out of range |
| 3) Error | critical error – the meter does not take measurement |
| 4) Empty tube | if the EMPTY TUBE TEST function is activated |

***Flow direction:***
***The arrow on the stainless steel shield indicates the direction in which the liquid flows inside the sensor. This helps to correctly mount the meter in the pipe. The flow direction can be changed using the control buttons and the menu. This avoids error measurements.***

*Basic parameter settings*
The meter or flow meter parameters are set by the manufacturer in accordance with the purchase order. If these values are not indicated in your purchase order, the meter will be set up using the default parameters in accordance with the meter's range. The operator can make modifications by means of three buttons on the meter's panel.

*Safety rules for operator*

Any interventions in the inductive flow sensor and evaluation unit itself are illegal on the part of operator and they may lead to direct scalding by medium. Perform electrical connection always after powering off.



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## 6. Technical specifications

*Evaluation system*

| | |
|---|---|
| Supply voltage: | 230V AC (+10; -20%) 50 ÷ 60Hz (standard)<br>24V AC/DC with reverse polarity protection (per order) |
| Input power: | 4.6VA |
| Display: | LCD 2 x 16 characters, backlite |
| Size: | DN 10÷400 |
| Lining material: | rubber (hard, soft, certif. for potable water): DN25÷400 (up to 80°C)<br>PTFE: DN 15÷DN 250 (up to 150°C)<br>E-CTFE, FEP, PFA: DN 300÷DN 400 (do 130°C)<br>ceramics: DN 15÷DN80 (up to 170 °C) |
| Electrode material:<br>All-welded frame | CrNi steel DIN 1.4571, Hastelloy C4, Titanium, Tantalum |
| Sensor material: | flanged – stainless steel and structural steel with polyurethane coating<br>sandwich, threaded, food processing – stainless steel |
| Process connection: | sandwich<br>flanged DIN (EN1092)<br>threaded (EN10226-1)<br>food processing (fittings DIN 11851, clamp) |
| Measuring range (Qmin/Qmax): | 0.2÷12 m/s (1/60); 0.12÷12 m/s (1/100); 0.06÷12 m/s (1/200) |
| Sample: | 12.5 samples per second (default) |
| Display response: | 1.28 s |
| Current loop response: | 1.28 s |
| Flow range: | 1:60; 1:100 (0.1÷10m/s); 1:200 |
| Accuracy: | 0.5% for 0.1 ÷ 10 m/s |
| Min. medium conductivity: | 20uS/cm |
| Flow meter accuracy: | up to 0.5% (for 0.1 ÷ 10 m/s) |
| Repeatability: | up to 0.2 % (for 0.1 ÷ 10 m/s) |
| Additional electrodes: | reference, earthing and detection for empty pipeline (DN 15÷DN 400) |
| Empty pipeline detection: | DN 15÷DN 400 |
| Min. conductivity of Medium: | 20 µS/cm (at a lower conductivity upon agreement with manufacturer) |
| Displayed values: | flow – m3/h; L/h; L/min; L/s; positive, negative<br>volume – m3; L; positive, negative, sum in both directions |
| Controls: | 2 x buttons outside (display)<br>3 x buttons inside (display + parameter change) |
| Output: | pulses up to 400 Hz; selectable constant current loop 4 to 20 mA; selection area |
| Input: | reset of zero counters (only when ordered) |



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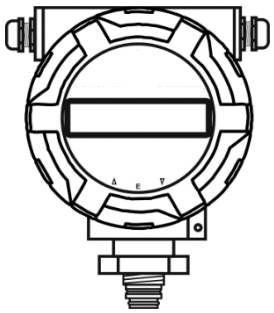
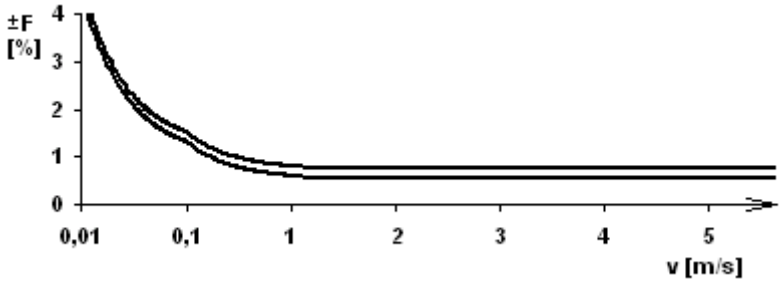
| | |
|---|---|
| Communication: | Interface RS485; Protocol MODBUS, M-Bus |
| Control: | external buttons ▲ and ▼ internal keys ▲, E , ▼ |
| Degree of protection: | at least IP 65 |
| Cable bushings: | left (network) 1x cable max. Ø 13 mm<br>right (outputs) 1 x cable max. Ø 13 mm (standard) |
| Ambient temperature: | 5…55 °C |
| Humidity: | max. 90% |
| Weight: | 1340g |
| Dimensions: | 144 x 151 x 125 mm (H x W x D), Ø head 104 mm |
| Material: | cast aluminium, powder coati |



*Error limits at reference conditions (range 1:1000)*




| Diameter nominal | Measured value maximum error | | | Curve |
|---|---|---|---|---|
| DN [mm] | v >= 1 m/s | 1 m/s > v >= 0.1 m/s | v < 0.1 m/s | |
| <= DN 10 | 0.8 % z M* | 0.72 % + 0.8 mm/s | 1.52 % + 0.35 mm/s | 1 |
| >= DN 15 | 0.5 % of M* | 0.52 % + 0.8 mm/s | 1.22 % + 0.35 mm/s | 2 |

* Of M – of the measured value



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## 6.1 Factory settings

The current loop is set in such a manner that 4 mA corresponds to zero flow and 20 mA corresponds to its maximum value.

The address of the meter is set to 1 by default and communication parameters to 2400Bd, 8db, 1sb, parity EVEN (Mbus) or 9600Bd, 8db, 1sb, no parity (Modbus).

Access password (PIN) for parameter changing is always set to 0000 and this value will be reset in case of restoring to factory default settings.

***Impulse constants and current loop – factory settings***

| ***Diameter nominal*** *DN* | **Impulse output** | | **4 – 20mA (in Qmin/Qmax 1/100 range)** | |
|---|---|---|---|---|
| | Vout[imp/l] | Vout - pulse width [ms] | Q[l/h] for 4mA | Q[l/h] for 20mA |
| *6* | on request | | | |
| *8* | on request | | | |
| *10* | 10 | 4 | 0 | 3,400 |
| *15* | 10 | 4 | 0 | 7,600 |
| *20* | 10 | 4 | 0 | 14,200 |
| *25* | 10 | 4 | 0 | 21,000 |
| *32* | 1 | 4 | 0 | 34,000 |
| *40* | 1 | 4 | 0 | 54,000 |
| *50* | 1 | 4 | 0 | 84,000 |
| *65* | 1 | 4 | 0 | 144,000 |
| *80* | 1 | 4 | 0 | 220,000 |
| *100* | 0.1 | 4 | 0 | 340,000 |
| *125* | 0.1 | 4 | 0 | 534,000 |
| *150* | 0.1 | 4 | 0 | 760,000 |
| *200* | 0.1 | 4 | 0 | 1,350,000 |
| *300* | 0.1 | 4 | 0 | 3,052,000 |
| *400* | 0.1 | 2.5 | 0 | 5,400,000 |

| **Diameter nominal** | **Resolution V** | **Resolution Q** |
|---|---|---|
| DN≤15 | V [0.001 m3] | Q [0.001 m3/h] |
| 50≥DN>15 | V [0.01 m3] | Q [0.01 m3/h] |
| DN>50 | V [0.1 m3] | Q [0.1 m3/h] |



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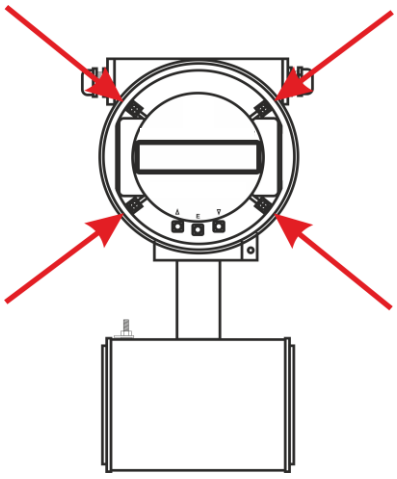
Table with flow ranges for individual DN sizes:

| Diameter nominal [mm] | Qmin [m3/h] as per Qmin /Qmax | | | Qmax [m3/h] |
|---|---|---|---|---|
| | 1/60 (0.2 m/s) | 1/100 (0.12 m/s) | 1/200 (0.06 m/s) | (12 m/s) |
| DN 6 | on request | | | |
| DN 8 | on request | | | |
| DN 10 | 0.06 | 0.034 | — | 3.4 |
| DN 15 | 0.13 | 0.076 | 0.038 | 7.6 |
| DN 20 | 0.24 | 0.142 | 0.071 | 14.2 |
| DN 25 | 0.35 | 0.21 | 0.105 | 21 |
| DN 32 | 0.6 | 0.34 | 0.17 | 34 |
| DN 40 | 0.9 | 0.54 | 0.27 | 54 |
| DN 50 | 1.4 | 0.84 | 0.42 | 84 |
| DN 65 | 2.4 | 1.44 | 0.72 | 144 |
| DN 80 | 3.6 | 2.2 | 1.1 | 220 |
| DN 100 | 5.6 | 3.4 | 1.7 | 340 |
| DN 125 | 8.9 | 5.34 | 2.67 | 534 |
| DN 150 | 13 | 7.6 | 3.8 | 760 |
| DN 200 | 23 | 13.5 | 6.75 | 1350 |
| DN 250 | 35 | 21.1 | — | 2115 |
| DN 300 | 51 | 30 | — | 3050 |
| DN 350 | 70 | 41 | — | 4150 |
| DN 400 | 90 | 54 | — | 5426 |

## 6.2 Adjusting and control of the meter MDW/ MDH 500

*1) User modification*

Measuring mechanism enables user to turn the display according to meter installation. To change the display position, it is necessary to unscrew the top lid with meter glass window. To change the position, work loose four attachment bolts, remove protective metal frame together with printed circuit plate and turn it by 90° or 180°. While turning it, give a particular attention to the connection cables with the source component attached to the rear of meter head.





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The instructions for adjusting the position of the display board:

1. Unscrew the front cover with glass viewing window.
2. Unscrew four attachment bolts.
3. Remove metal frame.
4. Turn the printed circuit plate with display to the required position (by ± 90° or 180).
5. Fix the metal frame in the appropriate position.
6. Screw on four attachment bolts. Ensure sufficient tightening of screws!
7. Screw on the front cover with the viewing window.

### 6.3 Instruction manual MDW / MDH 500

The meter is provided with two external buttons on the side of the electronics housing and with three internal buttons on the bottom of the measuring electronics PCB which is accessible after unscrewing the front glazed cover:

*Functions of external buttons:*

| | | |
|---|---|---|
| ▲ | short press | movement in current menu up or modification of the value at the cursor up |
| ▼ | short press | movement in current menu down or modification of the value at the cursor down |
| ▲ | long press (>3s) | entry to PARAMETERS menu |
| ▼ | long press (>3s) | exit from PARAMETERS menu |
| ▲ ▼ | simultaneously ▲ and ▼ | resetting user rV (ca. 0,5s) |
| ▲ ▼ | simultaneously ▲ and ▼ | total restart of the meter (>8s) |



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*Functions of internal buttons:*

Before pressing **E** and entering the password:

| | | |
|---|---|---|
| ▲ | short press | movement in current menu up or modification of the value at the cursor up |
| ▼ | short press | movement in current menu down or modification of the value at the cursor down |
| ▲/ **E** | long press (>3s) | entry to PARAMETERS menu |
| ▼ | long press (>3s) | exit from PARAMETERS menu |
| ▲<br>▼ | simultaneously<br>▲ and ▼ | resetting user rV counter (ca. 0,5s) |
| ▲<br>▼ | simultaneously<br>▲ and ▼ | in PARAMETERS menu, end of modification of values without writing (> 3s) |
| ▲<br>▼ | simultaneously<br>▲ and ▼ | total restart of the meter (>8s) |
| **E** | short press | confirmation (Enter) or modification of a value (setting) |

*Basic display menu contains the following items:*

| | |
|---|---|
| Date and Time | |
| Current flow | Q |
| Flow bar graph | \|>>>> \| |
| Volume in positive direction against the arrow on the meter's name plate | + V |
| Volume in negative direction against the arrow on the meter's name plate | - V |
| Total volume (summary in both directions) | ΣV |
| User volume (resettable) in positive direction only | r V |
| Status | OK |

The order may vary as per meter's settings. The customers may select the data to be displayed on the first two lines (or change the order) in such a manner that corresponds to their requirements.

If the meter status changes or is in an incorrect state, it is indicated by a flashing display.



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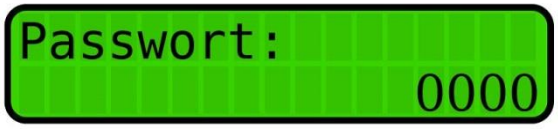
Special button functions

A long press on the two external buttons activates a REBOOT (reinitialization of the flow meter).
A long triple press on the internal buttons activates the service communication interface. After initialization you are asked to enter a password. If the password is not entered, the service interface is only available for reading.
You can exit the setup menu by pressing and holding the lower button on the side of the display unit or by pressing and holding the right button under the front glass pane. You can also wait for TimeOut to return the flow meter to its basic menu.

Password setting

MDW / MDH 500 have two password levels, a user password and a production password.

The USER PASSWORD allows you to change user parameters that have no effect on the calibration of the meter. It is a customized password, the default value for the password being 0000. The password is only required the first time it is entered and is invalid after returning to the basic display or within two minutes of inactivity when the meter automatically returns to the basic display.




The PRODUCTION PASSWORD is a generated, unique password that is linked to the meter in use and not publicly accessible. The data can only be changed under the production password of a person authorized by **promesstec GmbH**.

These are the following data:
Serial number
K1 - constant
n1 - constant
Sensor – DN



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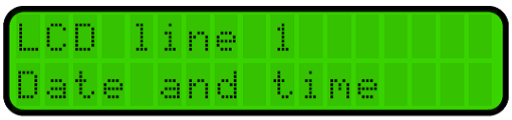
Basic menu

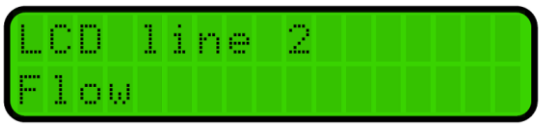
The basic menu contains the following items:

| NAME | INDEX |
|---|---|
| Date and time | - |
| Flow rate | **Q** |
| Flow bar graph | **»** |
| Volume (+) | **+V** |
| Volume (-) | **-V** |
| Total volume | **ΣV** |
| User volume | **rV** |
| Status | - |

The order may have different settings of the meter. Customers can change the data to be displayed on the first two lines (or change the order) to suit their requirements.

e.g.




In case that the meter's status is found in a different than normal and correct (OK) status, measurement failure indication alternates with the normal display indication. As a consequence, it is not necessary to check the status all the time; in case of trouble, it is indicated on the display unit automatically.



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Using the external and internal menu buttons ▲ and ▼ you can scroll through the basic menu, reset user volumes, change parameters or exit the menu.

*PARAMETERS menu contains the following menu items:*

1. DATE AND TIME
2. OPERATION TIME COUNTER
3. POWER LOSS COUNTER
4. IMPULSE OUTPUT or FLOW SWITCH
5. CURRENT OUTPUT
6. COMMUNICATION
7. BASIC INDOICATIONS ON DISPLAY
8. DISPLAY DIMMING
9. DISPLAY BACKLIGHT
10. SERIAL NUMBER
11. CALIBRATION CONSTANTS
12. EMPTY TUBE TEST
13. FIRMWARE VERSION
14. DEAD BAND – MEASUREMENT START SUPPRESSION*
15. ZERO CALIBRATION*
16. FLOW SIMULATION
17. LANGUAGE
18. COUNTER RESETTING*
19. NOMINAL DIAMETER (DN)
20. FLOW DIRECTION*
21. FLOW UNITS DISPLAYED [Q]
22. Q DISPLAYED IN PER CENTS (BAR GRAPH)
23. VOLUME UNITS DISPLAYED [V]*
24. USER (RESETTABLE) COUNTER
25. PASSWORD CHANGE
26. DEFAULT SETTINGS (ORIGINAL FACTORY SETTINGS)

***** *If the meter is delivered for billing purposes, then these parameters marked with an asterisk cannot be changed (in case of restoration of factory settings, the volumetric counter is not reset).*



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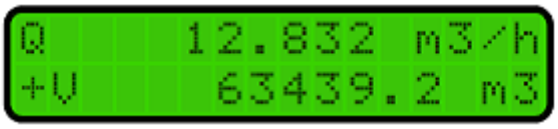
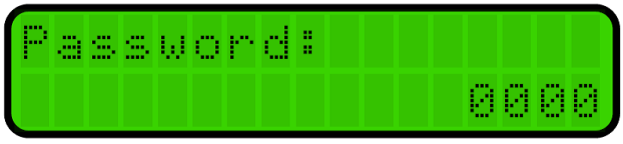
For editing items in PARAMETERS menu, the central **E** button is used, once it is pressed down, the operator is asked for authorization of access by password (by default, it is **0000**). Consequently, it is possible to use the ▲ and ▼ buttons to change the value upwards or downwards and confirm the modification by the central **E** button. In case that the parameter to be changed is not a numerical one, the entire parameter is changed by means of a "scroll bar". The password is required only at the first entry and it will become invalid after returning to basic display or within two and a half minutes of inactivity when the meter returns again to its basic display automatically. Examples of representation in normal status according to user settings:




*Note: The order of representation of menu items can be modified by user according to the customer's needs.*

Within framework of setting, it is necessary to unscrew the front cover with glass window to get access to internal buttons. After initial entry to Parameters menu (long press of and an attempt to edit an item (by **E** button), the operator is asked for entering an authorization access code (by default 0000). This is entered successively for each of four digits separately from left to right using the ▲ or ▼ buttons whereas the transfer of cursor to another digit, including the final confirmation of the entire code is implemented by the **E** button. By applying a double press ▲▼ (simultaneosusly ▲ and ▼ short press approx. 0.5sec) you can return by one position and correct it. In case of entering an invalid password, modification of parameters is not enabled and the password entry must be repeated.




*Note: The password will become invalid after returning to basic display or within two and a half minutes of inactivity when the meter returns again to its basic display automatically.*

Entering numerical values for individual menu items takes place in a similar manner.



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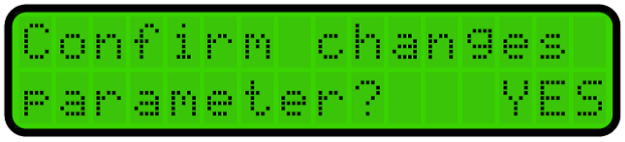
If it is not a freely adjustable numerical item but a list of possible values, the selection is implemented by successive scrolling using the▲ and ▼ buttons and once the desired value is displayed, you simply confirm the selection by pressing the E button.
After successful entry, the confirmation of the request for modification is required by the ▲or ▼ buttons, followed by\ selecting YES/NO and confirming by the **E** button. By doing this, the modification is saved in the internal memory of the meter.


### *1) DATE AND TIME*

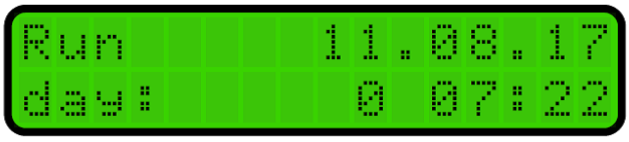
This menu item is in DD/MM/RRRR HH/MM formats
Use the ▲and▼ buttons to set the menu item on the display and press the **E** to edit. Implement settings in a standard way, using the setting buttons and confirm by pressing the **E** button.


It is necessary again to confirm the change.




### *2) OPERATION TIME COUNTER*

The counter registers the operation time of the meter (switching on). The first line indicates the date when the last counter reset was performed and the second line indicates the length of operation in days, hours and minutes.




This counter can be reset by pressing the **E** button when necessary.



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### *3) POWER LOSS COUNTER*

The counter registers the time of loss of power time for the meter. The first line indicates the date when the last reset of power loss counter was performed and the second line indicates the length of time when the meter was out of operation in days, hours and minutes. The counter can be reset again by pressing the **E** button.

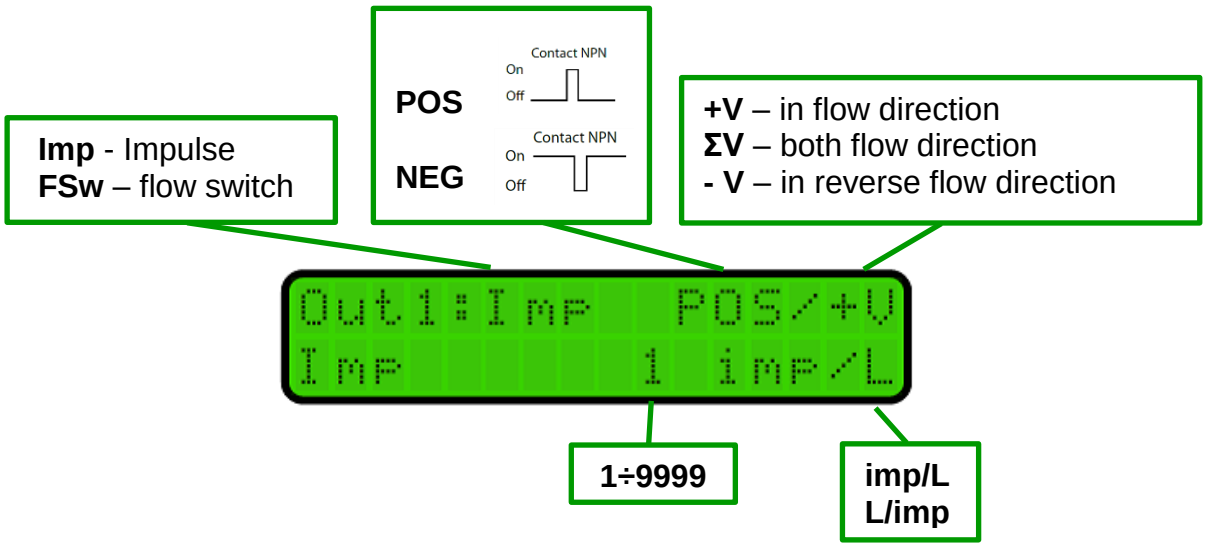

OUT1 and OUT2 Output / flow switch

OUT1 can be configured as impulse output or flow switch contact.
OUT2 can be configured as impulse output, flow switch or status contact.

1) OUT1 Setting

**Impulse output**

When setting the parameters for impulse output, it is possible to change the logic (polarity) of the electrical signal (on/off state), to set the impulse output, to which direction the volume meter should respond (flow rate runs in positive direction, in opposite direction and in both directions) and your own impulse constant, including its display (impulse / L or L / impulse) and impulse width.
This output can be configured as the impulse output or the Flow Switch contact.




The impulse width cannot be set freely using an arbitrary value. The impulse lengths can be selected with the buttons ▲ and ▼.



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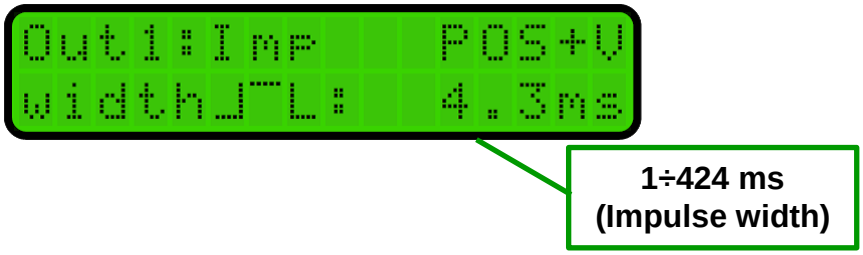
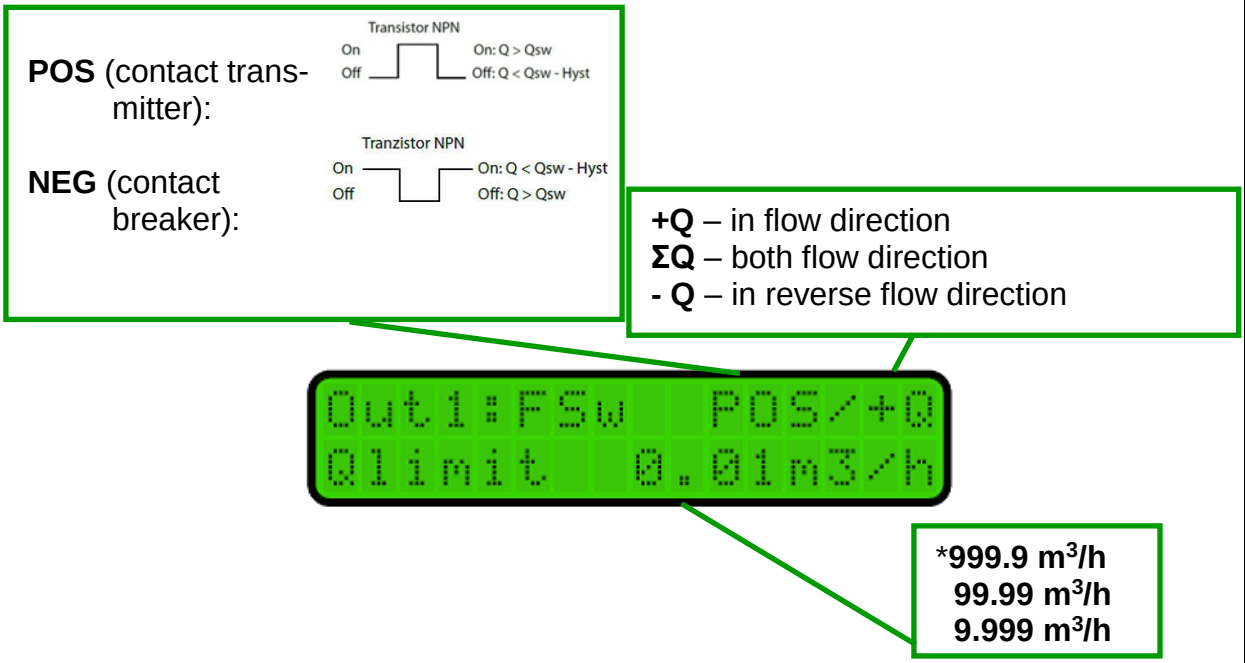



*Note
Period [ms] = impulse width [ms] + impulse distance [ms] where gap ≥ Width
The impulse width is selected in steps by scrolling through predefined values with the ▲ or ▼ buttons.

**Flow switch**
For complete setting the parameters of status output, it is possible to change the logics (polarity) of the electrical signal (positive/negative) and then set to which volume the output will respond (flow in positive direction, in opposite direction and in both directions) as well as your own switching point value.
The status contact makes it possible to set the amount of hysteresis between Qon and Qoff states




*Qlimit - the number of decimal places is given by DN of the specified meter and can not be changed.

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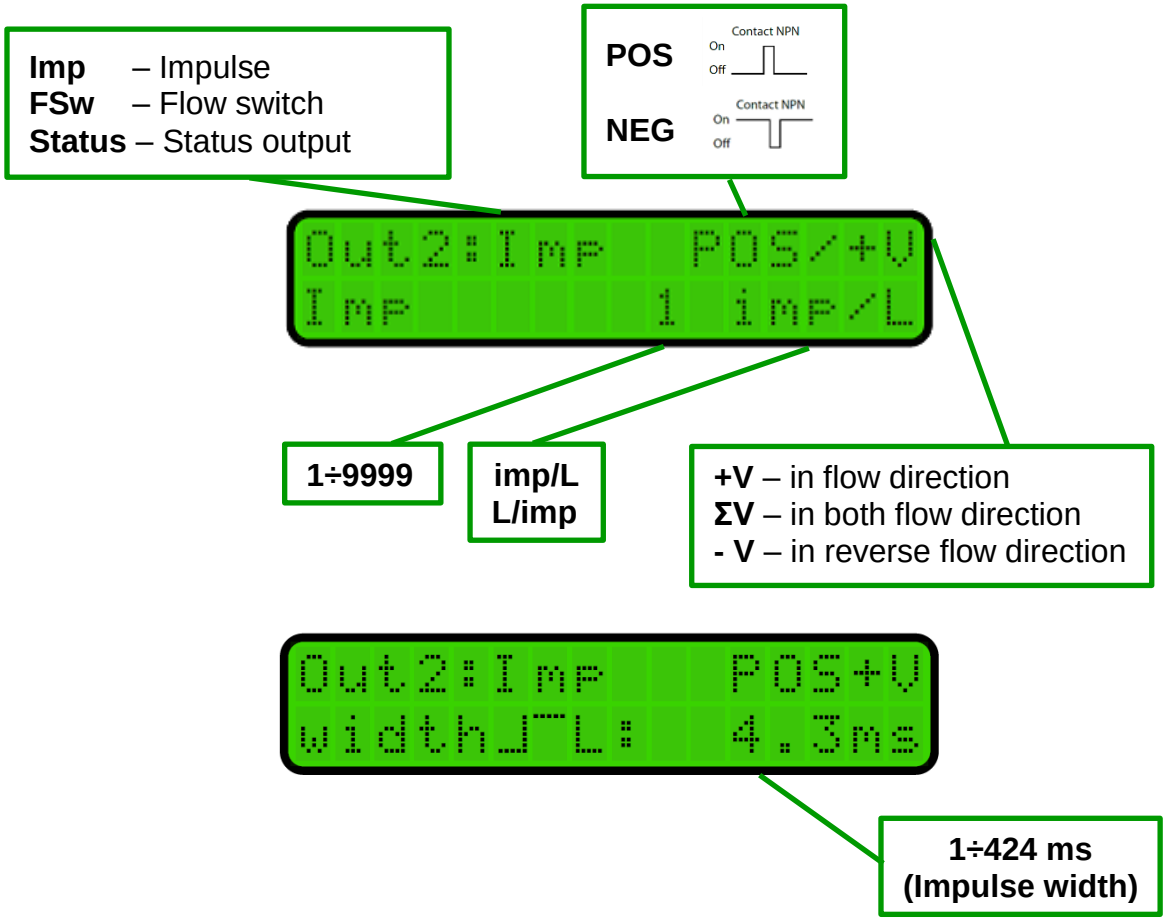
2) OUT2 settings

Impulse output

To fully adjust the parameters of the impulse output, it is possible to change the logic (polarity) of the electrical signal (positive/negative), to set the impulse output to which the volumetric counter should respond (volume runs in positive direction, in opposite direction and in both directions) and to set your own impulse constant including its indication (imp/L or L/imp)




*Note
Period [ms] = impulse width [ms] + interpulse distance [ms] where gap ≥ Width

The pulse width is selected in steps by scrolling through predefined values with the ▲ or ▼ buttons.

Operation of the flow switch

In the "Flow Switch" status output parameter setting, it is possible to change the logic (polarity) of the electrical signal (on state/off state), to set the output, to which direction the output should respond (flow in positive direction, in opposite direction and in both directions) and your own set point value.



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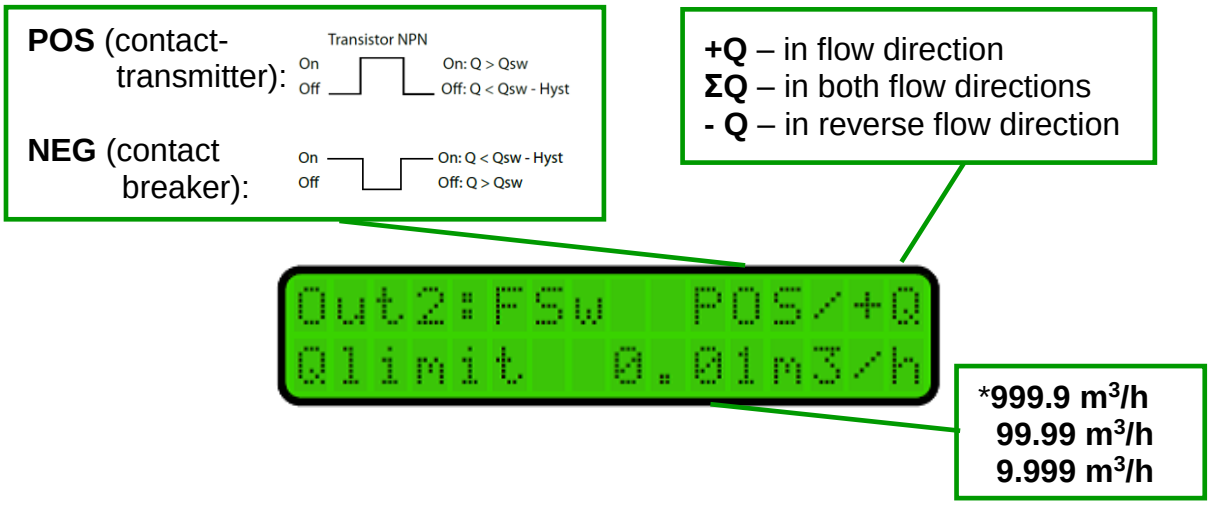
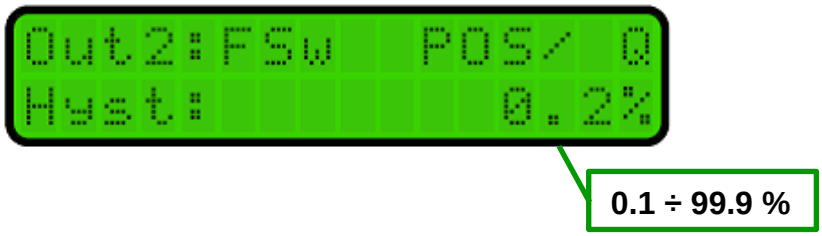
The status contact makes it possible to set the hysteresis between Qon and Qoff state.

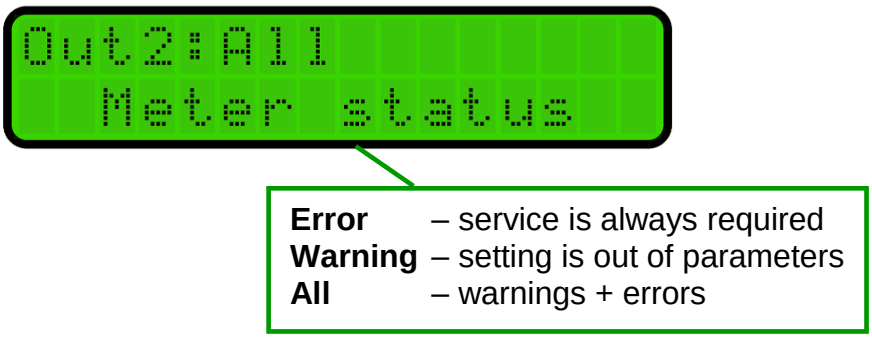



*Qlimit - the number of decimal places is given by DN of the specified meter and can not be changed.




Counter reading - Error output

Output 2 opposite to output 1 can additionally be set as error status output of the counter. If no error status occurs in the counter, the status output is switched on.



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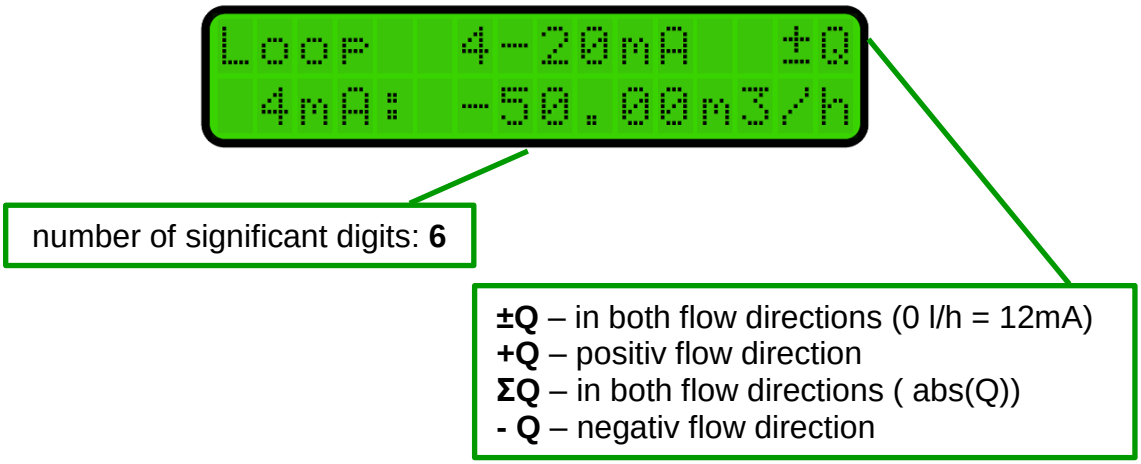
### *4) CURRENT OUTPUT*

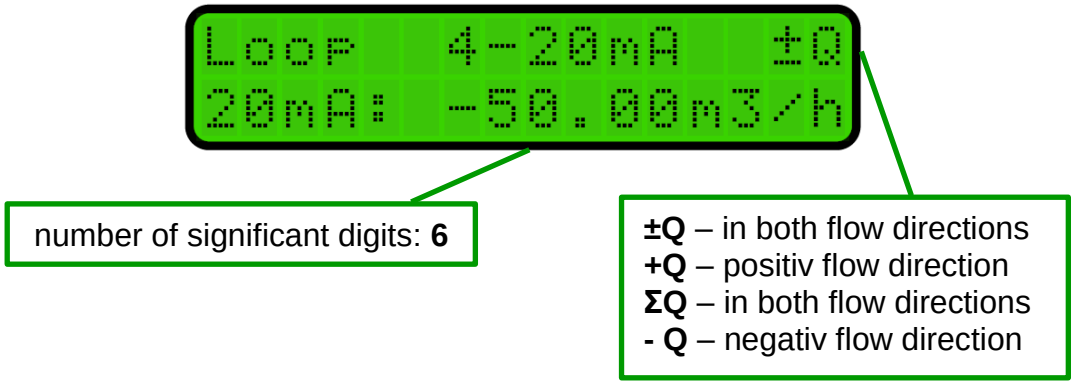
For setting the current output, there are two parameters by which means the current loop boundary is set to the required flow and method of linkage to flow direction.

If +Q is set, then the current loop output corresponds linearly to the set boundaries of the current output, however, in the positive flow direction only. In case of -Q, the current loop output is then similarly dependent on the flow in the negative direction only.

If ∑Q is set, the value of the output current loop will not be dependent on the flow direction but only on its absolute value, i.e. without dependency on the direction the medium flowing through the meter.

Setting takes place in a similar manner by changing the flow quantity value (without a sign) in $m^3/h$ for 4mA and consequently 20mA.



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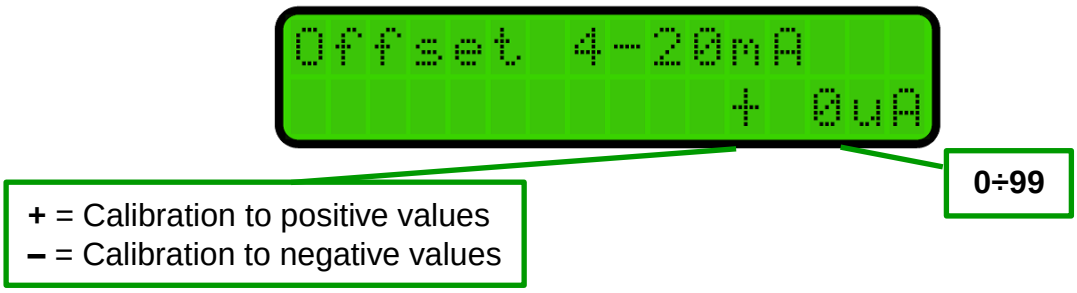
### 5) *Offset*

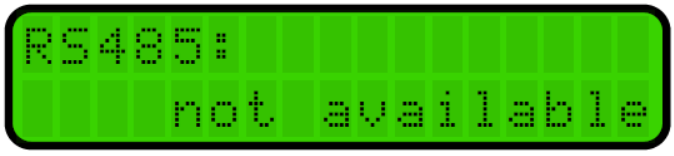
The 4-20mA value can be trimmed by selection of an offset.



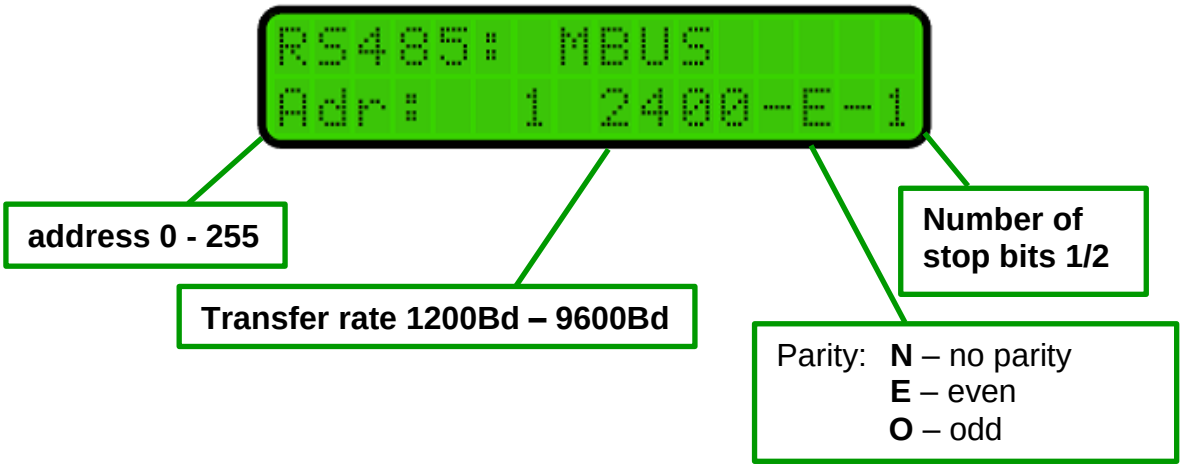

### 6) *COMMUNICATION*

If the meter is ordered with communication, it is possible to set all of its parameters. For selection of an address, any number 0 – 255 can be set and the velocity should be selected according to custom practice. If you wish to change the type of communication, press the **E** button. Then press ▲▼ (simultaneously ▲ and ▼ approx. >0.5sec). Select the desired communication type by ▲ or ▼ and confirm the selection by the **E** button.

Once the MBus/MODBUS type of protocol is to be changed, the recommended velocity for these communication types is completed automatically displayed.




*If the communication interface has not been ordered, the parameters are not available.*



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## 7.1 Communication protocol MODBUS RTU

### Transmission service

The master station is the primary station that initiates all information transfers. The satellite stations are secondary stations that only transmit information when requested.

### Transmission speed

The transmission speed can be 1200, 2400, 4800 or 9600 Baud. The transmission is asynchronous RS485 with one start bit, 8 data bits and one stop bit. Standard transmission speed is 9600 baud.

After changing the transmission rate, the MDW/MDH must be restarted to accept the change. You can do this in two ways:

1. Disconnect the MDW / MDH from the power supply (pull the fuse briefly)
2. Via button combination, press and hold the buttons ▲ and ▼ together for approx. 8 sec.

### Address

The addresses 1 to 255 are reserved for the 255 secondary stations.

### Request/ Answer

Public function code 03h - read holding registers

The master sends the public function code 03h (read holding register), start address, number of the register and the address of the secondary station.

Address range:

| | |
|---|---|
| 0x00 | unsigned long manufacturer number |
| 0x02 | unsigned long volume ∑ |
| 0x04 | unsigned long volume + |
| 0x06 | unsigned long volume – |
| 0x08 | unsigned long user volume |
| 0x0A | signed long flow |
| 0x0C | Error Code* |



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*Error Code: Hi Byte = 0
Lo Byte = Error Code:

| | |
|---|---|
| bit 0 | add volume overflow (undue increase) |
| bit 1 | Frame Error |
| bit 2 | empty pipe |
| bit 3 | Input/ Output Overflow |
| bit 4 | reserved |
| bit 5 | reserved |
| bit 6 | reserved |
| bit 7 | reserved |

request:

| | |
|---|---|
| address | 1 Byte |
| function code (03h) | 1 Byte |
| start address | 2 Byte |
| register number | 2 Byte |
| CRC32 | 2 Byte |

reply:

| | |
|---|---|
| address | 1 Byte |
| function code (03h) | 1 Byte |
| number of bytes | 1 Byte 2xN* |
| register value | N* x 2 Bytes |
| CRC32 | 2 Byte |

*N= Number of registers

Error:

| | |
|---|---|
| address | 1 Byte |
| Error Code (83h) | 1 Byte |
| Exception code | 1 Byte |
| CRC32 | 2 Byte |

**Example**

Read volume Register 02h-09h:

request:

| | |
|---|---|
| address | 01h |
| function code | 03h |
| start address Hi | 00h |
| start address Lo | 02h (Volumen ∑) |
| register number Hi | 00h |



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| | | |
|---|---|---|
| register number Lo | 08h | |
| CRC32 Hi | E5h | |
| CRC32 Lo | CCh | |

reply:

| | | |
|---|---|---|
| address | 01h | |
| function code | 03h | |
| number of bytes | 10h | |
| register number Hi | xxh | (volume ∑) |
| | xxh | |
| | xxh | |
| register number Lo | xxh | |
| register number Hi | xxh | (volume +) |
| | xxh | |
| | xxh | |
| register number Lo | xxh | |
| register number Hi | xxh | (volume -) |
| | xxh | |
| | xxh | |
| register number Lo | xxh | |
| register number Hi | xxh | (volume user) |
| | xxh | |
| | xxh | |
| Registeranzahl Lo | xxh | |
| CRC32 Hi | xxh | |
| CRC32 Lo | xxh | |

Resolution units of the registers are provided by the resolution of the LCD display.

Example:

| LCD | register |
|---|---|
| 53,4 m³ | 534 |
| 689,89 L | 68989 |
| 5,6 m³/h | 56 |



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### Illegal data address

The data addresses 1, 3, 5, 7, 9, 11 are not permitted addresses for the server or the slave. The addresses generate exception 0x02. Memory address spaces 0xFE00 through 0xFF are system registers that are locked to users.

### Modbus register

| *register* | Content | | Format | Note |
|---|---|---|---|---|
| *40001* | serial number | upper register | INT | *1 |
| *40002* | serial number | lower register | INT | |
| *40003* | Total flow rate | upper register | UINT | *2 |
| *40004* | Total flow rate | lower register | UINT | |
| *40005* | Total + flow rate | upper register | UINT | |
| *40006* | Total + flow rate | lower register | UINT | |
| *40007* | Total – flow rate | upper register | UINT | |
| *40008* | Total – flow rate | lower register | UINT | |
| *40009* | Total users Flow rate | upper register | UINT | |
| *40010* | Total users Flow rate | lower register | UINT | |
| *40011* | Actual flow rate | upper register | INT | |
| *40012* | Actual flow rate | lower register | UINT | |
| *40013* | Error status | | INT | *3 |

***1 Calculation of the serial number using the following formula:**

Serial number = (upper register * 65536) + lower register

***2 Calculation of the sums according to the following formula:**

SumX = ((upper register *65536) + lower register) /100



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***3 Content of the status register:**

| | |
|---|---|
| bit 0 | error in summation (fehlerhaftes Increment) |
| bit 1 | FRAME Error |
| bit 2 | empty pipe |
| bit 3 | overflow Impulse output |
| bit 4 | reserve |
| bit 5 | reserve |
| bit 6 | reserve |
| bit 7 | reserve |

## 7.2 *Communication protocol M-Bus*

### Transmission service

The master station is the primary station that initiates all information transfers. The satellite stations are secondary stations that only transmit information when requested.

### Initialization of slave (SND_NKE)

EN 1434-3 compatibility (redundant) Command. The secondary station responds ACK (E5h) if the reception is correct.

| | | |
|---|---|---|
| request: | 10h | |
| | 40h | Initialization Slave |
| | A | address |
| | CS | checksumme |
| | 16h | stop |

Reply: E5h

### Request/ Reply (REQ_UD2)

The master sends a short frame with the data request code 5Bh or 7Bh and the address of the secondary station.

| | | |
|---|---|---|
| request: | 10h | |
| | 5Bh/7Bh | data request Command code |
| | A | address |
| | CS | checksumme |
| | 16h | stop |



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reply:

The meter replies with a frame consisting of the following parameters:

**Identification number**
**volume Σ**
**volume users**
**volume +**
**volume –**
**flow rate**
**software version**
**error code**

**volume Σ, volume users, volume +, volume –**

The volume is transmitted (32Bit integer coded) with the unit of the lowest position/digit on the display. The following possibilities of the VIF value exist:

| Transferred unit | VIF |
|---|---|
| **1m³** | 16h |
| **100L** | 15h |
| **10L** | 14h |
| **1L** | 13h |
| **0,1L** | 12h |
| **0,01L** | 11h |
| **0,001L** | 10h |



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**Flow rate**

The flow rate is transmitted by 4 binary bytes (32-bit integer coded). The following possibilities of the VIF value exist:

| Transferred unit | VIF |
|---|---|
| **1 m³/h** | 3Eh |
| **100 L/h** | 3Dh |
| **10 L/h** | 3Ch |
| **1 L/h** | 3Bh |
| **0,1 L/h** | 3Ah |
| **0,01 L/h** | 39h |
| **0,001 L/h** | 38h |
| **1 L/min** | 44h |
| **0,01 L/min** | 43h |
| **0,001 L/min** | 41h |
| **1 L/s** | 4Eh |
| **0,1 L/s** | 4Dh |
| **0,01 L/s** | 4Ch |
| **0,001 L/s** | 4Bh |

**software version**

format 8 bit integer

**alarms (8 bit integer)**

| | |
|---|---|
| Bit 0 | Add volume overflow (inappropriate increase) |
| Bit 1 | Frame error |
| Bit 2 | empty pipe |
| Bit 3 | input/ output overflow |
| Bit 4 | reserved |
| Bit 5 | reserved |
| Bit 6 | reserved |
| Bit 7 | reserved |

Total length of the frame: 70 bytes



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**meter reply frame**

| | | |
|---|---|---|
| 0 | 68h | start |
| | 40h | (total length of the frame) – 6 |
| | 40h | (total length of the frame) – 6 |
| | 68h | start |
| | 08h | |
| 5 | xxh | address |
| | 72h | CI (Modus 1) |
| | xxh | identification number (LSB) |
| | xxh | " |
| | xxh | " |
| 10 | xxh | " (MSB) |
| | 43h | manufacturer identification |
| | 4Dh | " |
| | xxh | dimension code |
| | 07h | water meter |
| 15 | xxh | access number |
| | xxh | error code |
| | 00h | signature |
| | 00h | " |
| | 0Ch | DIF: 8digit BCD |
| 20 | 78h | VIF: manufacturer identification |
| | xxh | SN (LSB) |
| | xxh | " |
| | xxh | " |
| | xxh | " (MSB) |
| 25 | 04h | DIF: 4 Bytes binär codiert |
| | 10h-16h | VIF: volume Σ, depending on the decimal place |
| | xxh | volume Σ (LSB) |
| | xxh | " |
| | xxh | " |
| 30 | xxh | " (MSB) |
| | 84h | DIF: 4 Bytes binär codiert |
| | 40h | DIFE/ UNIT 1 |
| | 10h-16h | VIF: volume user, depending on the decimal place |
| | xxh | volume user (LSB) |
| 35 | xxh | " |
| | xxh | " |
| | xxh | " (MSB) |
| | 84h | DIF: 4 Bytes binär codiert |
| | 80h | DIFE |



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| | | |
|---|---|---|
| 40 | 40h | DIFE/ UNIT 2 |
| | 10h-16h | VIF: volume +, depending on the decimal place |
| | xxh | volume + (LSB) |
| | xxh | " |
| | xxh | " |
| 45 | xxh | " (MSB) |
| | 84h | DIF: 4 Bytes binär codiert |
| | C0h | DIFE |
| | 40h | DIFE/ UNIT3 |
| | 10h-16h | VIF: volume -, depending on the decimal place |
| 50 | xxh | volume – (LSB) |
| | xxh | " |
| | xxh | " |
| | xxh | " (MSB) |
| | 04h | DIF: 4 Bytes binär codiert |
| 55 | 38h-4Eh | VIF: flow rate, depending on the decimal place |
| | xxh | flow rate - (LBS) |
| | xxh | " |
| | xxh | " |
| | xxh | " (MSB) |
| 60 | 01h | DIF: 1 Byte binär codiert |
| | FDh | VIF: extension of the VIF codes |
| | 0Fh | VIFE: software version |
| | xxh | software version value |
| | 01h | DIF: 1 Byte binär codiert |
| 65 | FDh | VIF: extension of the VIF codes |
| | 17h | VIFE: alarm |
| | xxh | error code |
| | CS | checksumme |
| | 16h | stop |



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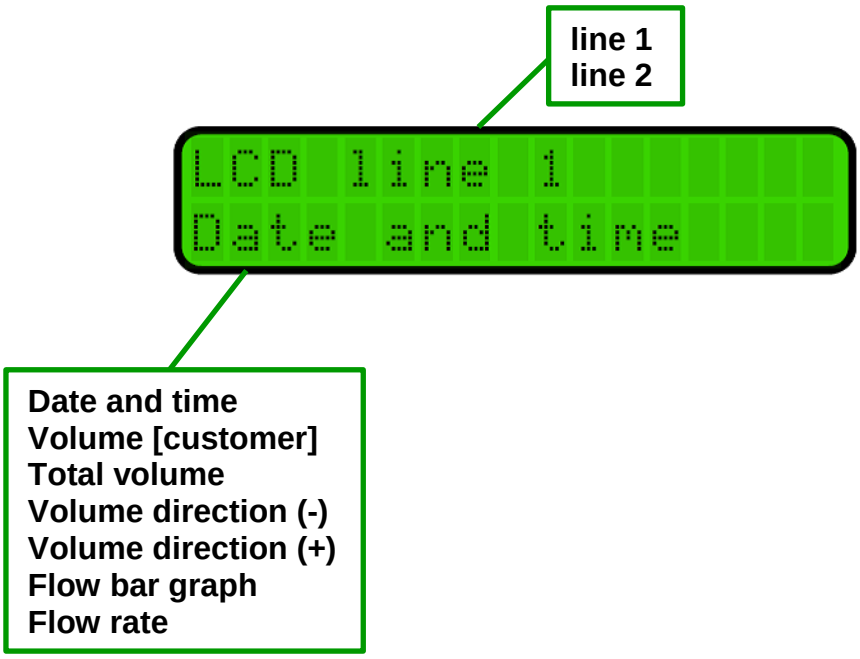
## *7) IDLE STATE BASIC INDICATIONS ON DISPLAY*

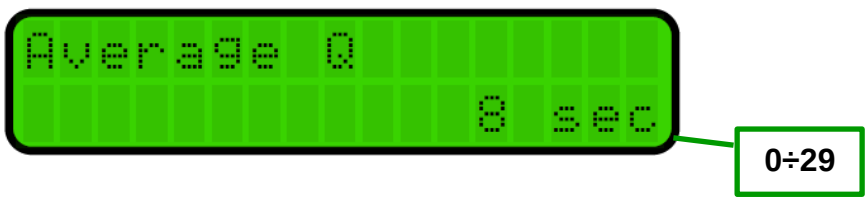
Basic indications in idle state can be influenced and modified in such a manner that the data needed by the user can be found on the first two lines on the display. Whereas the order of the other items is retained. If you want to change a setting, press the **E** and ▲ or ▼ buttons and select the data on the line which is then confirmed by the **E** button. The customer can select from these indications, namely both on the first and the second lines:

- Date and Time
- Customer volume — user defined volume rV
- Total volume ∑V — sum of volumes in both directions ∑V
- Volume (-) direction reverse — flow volume -V
- Volume (+) direction — volume in positive flow direction +V
- Flow bar graph
- Flow — current flow Q




## *8) DISPLAY DIMMING*

The period of averaging flow values within the range is set here. Maximum value is 29sec. Averaging is then used for the other outputs as well.



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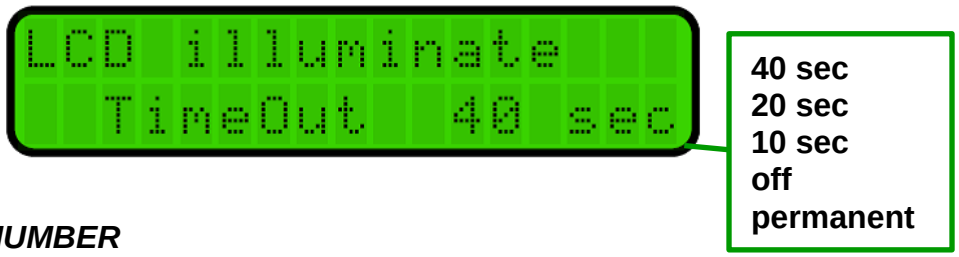
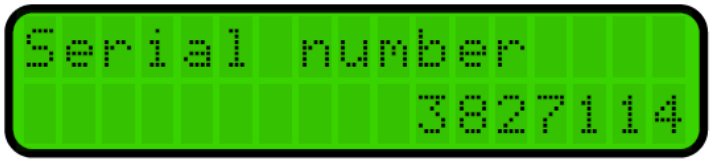
### *9) DISPLAY BACKLIGHT*

Here, you can set the period during which the display backlight is turned off after the last activation of a button. Use the ▲ and ▼ buttons to select the desired settings from menu (permanent, 40sec, 20sec, 10sec, switched off).



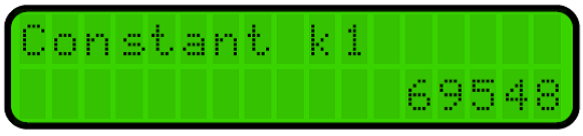

### *10) SERIAL NUMBER*

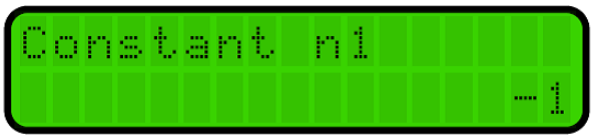
The serial number is registered in the factory and cannot be changed by user.




### *11) CALIBRATION CONSTANTS*

Calibration constants are set by promesstec and can not be changed by the user. Changes can only be made by an authorized person with a production password.



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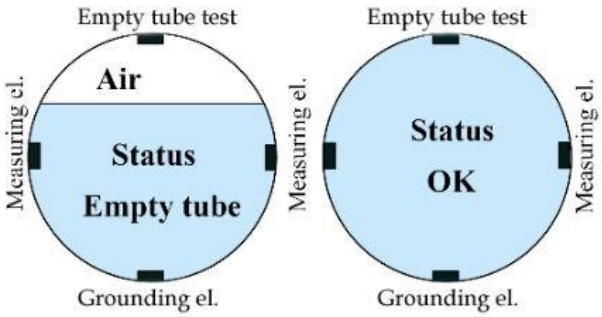
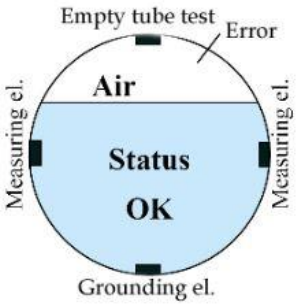
### *12) EMPTY TUBE TEST*

Activates and deactivates monitoring of measuring tube filling. If the meter was ordered without the empty tube test electrode, the flooding test cannot be activated.





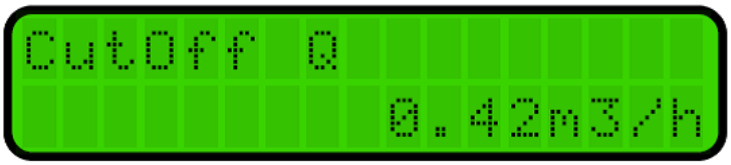




### *13) FIRMWARE VERSION*

The firmware version is registered in the factory and cannot be changed by user.


### *14) DEAD BAND – MEASUREMENT START SUPPRESSION*

Star of measurement is registered in the factory and can not be changed by user. Modifications can only be carried out by an authorized person under production password.



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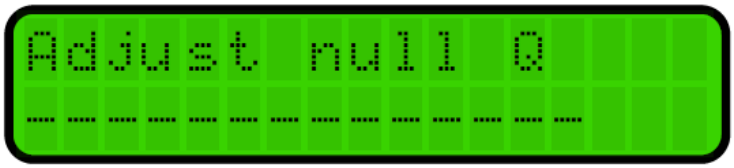
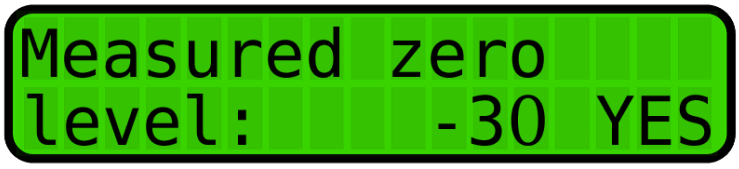
### *15) ZERO CALIBRATION*

The date under "Zero calibration" heading indicates the date when zero flow calibration was performed.




If you want to recalibrate the zero flow, press the **E** button. The flow meter evaluates the measured data automatically and if YES is set, upon confirmation of the selection by the E button, a new value for zero flow will be set and the date of the last recalibration is updated (when NO is selected, the value for recalibration is not registered and everything remains in original setting.

*Note: Before recalibration is performed, do not forget to close the valves first and secure a real zero flow (stationary medium) in the system.*



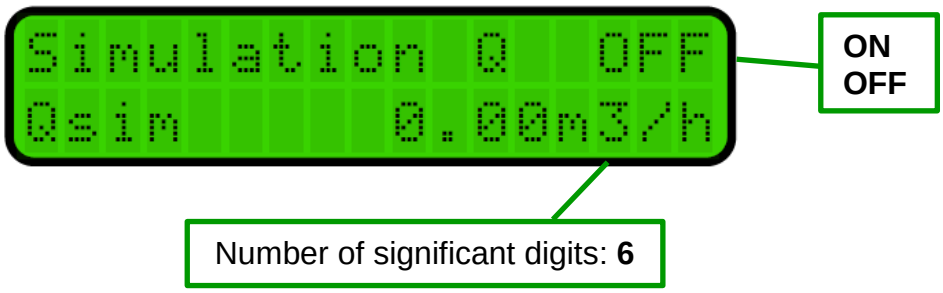

### *16) FLOW SIMULATION*

Flow simulation serves for comfortable setting and checking the systems in which the flow meter is used without necessity to use realistic flow of medium through the meter and without necessary installation of the meter in the pipeline. The display shows the simulated flow and current and impulse outputs of the meter correspond to this data. Such a simulated flow is not registered in the volume registry, of course.

*WARNING! If the meter runs in simulation flow mode, it does not return automatically after two and a half minutes as it is typical for all other modes and representations. After termination of flow simulation mode, it is necessary to exit Parameters menu by the (▼ long press >3sec) button!!!*

The customer can set the value of the simulated flow. If you want to activate or deactivate the simulation, press the **E** button.

.



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### *17) LANGUAGE*

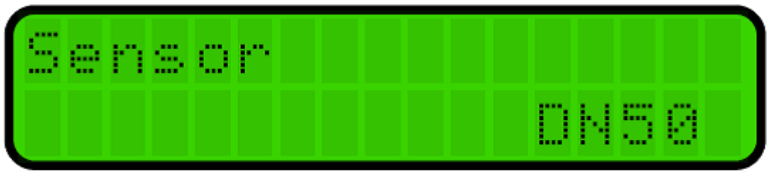
If you want to change the meter's language, press **E** and then select a desired language from menu.


### *18) COUNTER RESETTING*

Here, it is possible to reset all or only certain volumetric counters. If you want to perform resetting, press E and select which counter you wish to reset (∑V,-V, +V or all). After resetting, the date when the last reset was performed is displayed and which counter was reset (again, ∑V,-V, +V or all).


### *19) NOMINAL DIAMETER (DN)*

This parameter is configured by promesstec and cannot be changed.
The DN change can only be performed by an authorized person with a production password.



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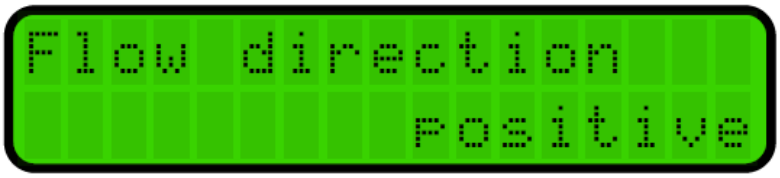
### *20) FLOW DIRECTION*

Specifies the direction of flow in the flow sensor with respect to the data in electronics. Positive direction is the flow in the sensor identical to the arrow indicated on the meter' name plate. If the medium flows through the sensor against the arrow on the sensor, select the NEGATIVE direction.

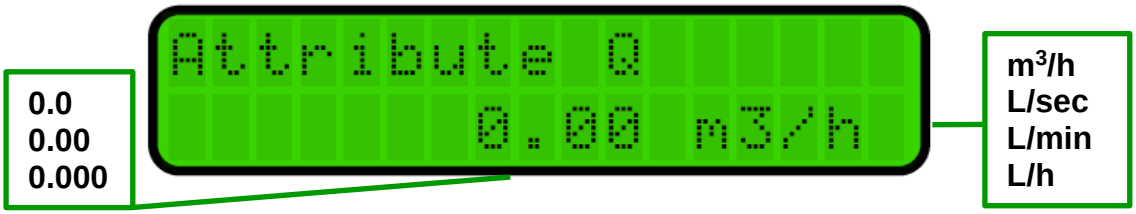
If you wish to make the change, press **E**.




### *21) FLOW UNITS DISPLAYED [Q]*

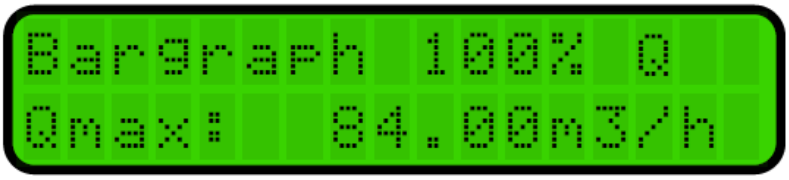
If you wish to change the way of flow indication, press **E**.

Use the ▲ and ▼ buttons to set the required number of decimal places and by confirming with **E**, go to setting the flow unit representation.

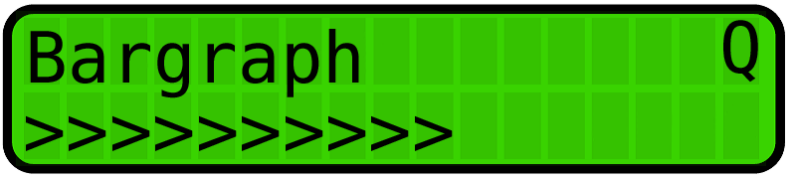



### *22) Q DISPLAYED IN PER CENTS (BAR GRAPH)*

If you wish to set a bar graph range, press **E**. It is set here to which flow the bar graph l respond (+ Q, - Q, ∑Q) and the maximum flow at full indication of the horizontal linear graph of the Q range. This is formed by 16-character segments >> or << according to direction in which the medium flows (in case of selection of - Q or ∑Q only). This is illustrated also by the beginning of the graph either from left side (positive direction of flow) or from the right side (negative direction of flow).




Example of bar graph indication (the medium is flowing in the positive direction)



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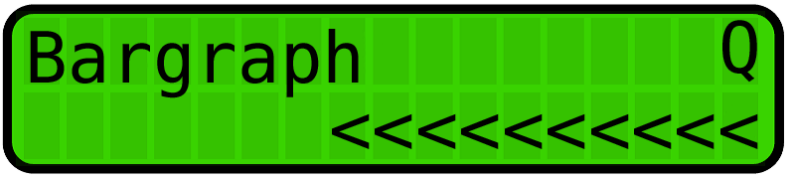
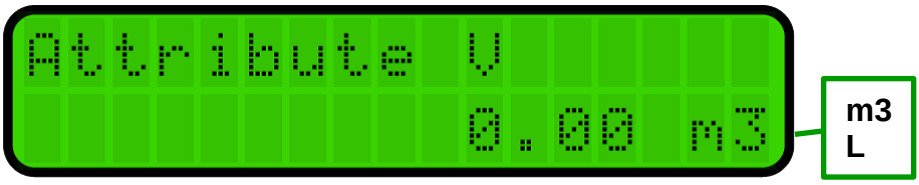
Example of bar graph indication (the medium is flowing in the negative direction)



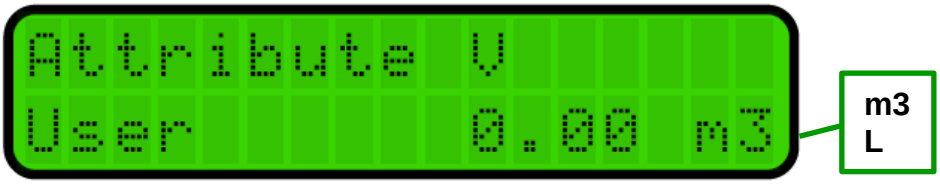

### *23) VOLUME UNITS DISPLAYED [V]*

To change the way of volumetric indication (+V, -V and ∑V), press **E**. The number of decimal places for the volumetric counters can be selected from 3 to none. Furthermore, the selection of units is here (L, $m^3$). If these parameters are changed, the respective measured value will be changed as well. In consequence, we recommend resetting of the counters changed in this way after reconfiguration.



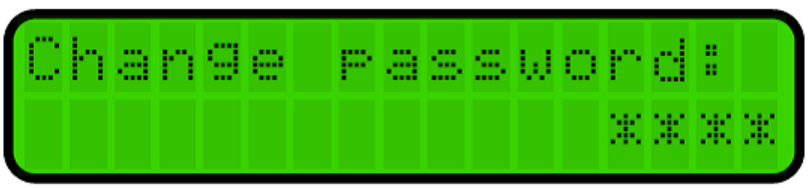

### *24) USER COUNTER WITH RESET OPTION*

It is the volumetric counter (rV) available to user who can reset it using external control buttons (simultaneously ▲ and ▼). The number of decimal places can be selected from 3 to none. Furthermore, the selection of units is here (L, $m^3$). If these parameters are changed, the respective measured value will be changed as well. In consequence, we recommend resetting of the counters changed in this way after reconfiguration.




### *25) PASSWORD CHANGE*

The password for modification of the customer parameters is set by default to **0000**. However, the user can change it in this window by pressing **E**. The access code must have 4 digits.



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### *26) DEFAULT SETTINGS (ORIGINAL FACTORY SETTINGS)*

During activation of this function, the configuration of the meter will be restored to the factory default state in which it was shipped. All user settings will be deleted and if the metrology jumper J1 on the power supply board is connected (non-certified meter used for **non-billing** purposes), all volumetric counters will be reset as well.

The user password is cancelled and the access code is reset to original (**0000**).

This applies to calibration of the meter as well. Before activating this function, it is useful to record or make a back up of the data of all counters.


***This function can be activated without the access code!***

If you wish to apply the original factory settings, press **E** and use the ▲ or ▼ button to select YES from menu and then confirm by **E**.


After confirmation of the change, the meter will have the settings it had when it was delivered by the manufacturer.



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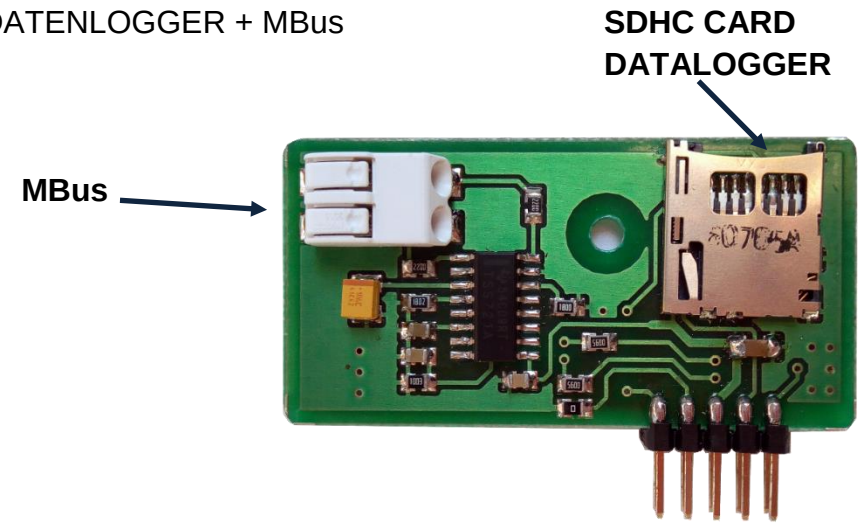
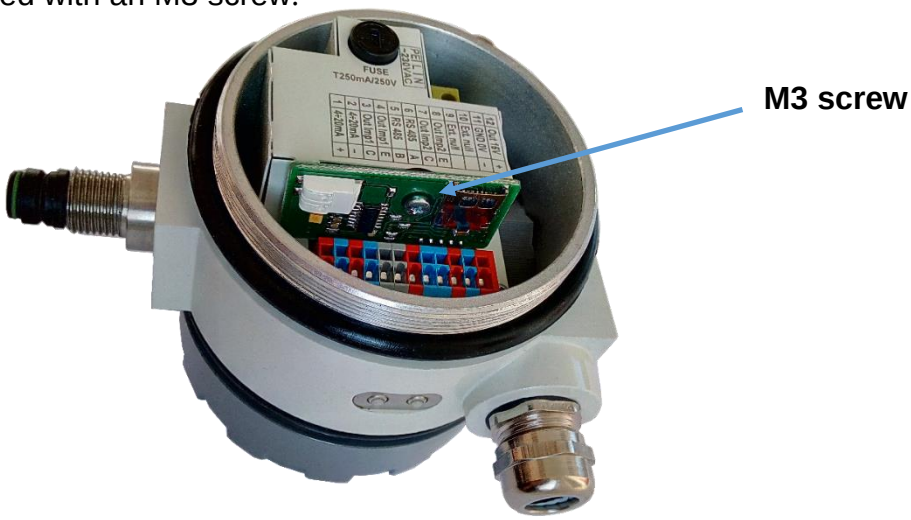
Expansion module

The MDW / MDH can be equipped with an expansion module for expansion with the following function:

1) DATALOGGER
2) MBus
3) DATENLOGGER + MBus




The expansion module is inserted in the slot found in power supply part of the meter and it is attached with an M3 screw.



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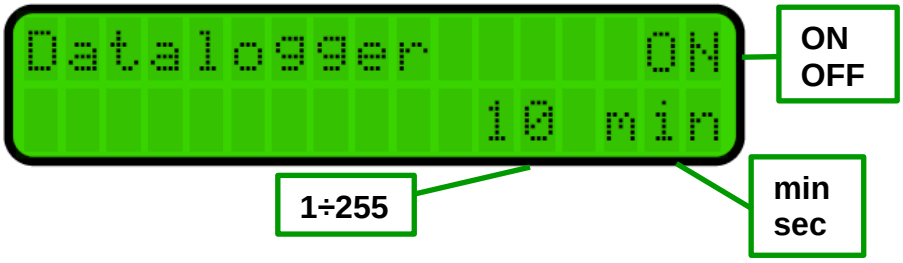
## 1) Datalogger

Power off, insert the expansion card into the available slot and fix it with an M3 screw.

Insert the prepared microSDHC card in the module after power on. After insertion, DATALOGGER is created in SET menu of the meter automatically.




If the meter does not enter the DATALOGGER menu after it is inserted, you can find this item in the SET menu. Now you can set the activation / deactivation of logging and the logging interval. Available units for the logging interval are minutes or seconds.
If the card is accepted and a log file exists at the same time, the end of the file is searched and the data is added to the end of this file. While the end of the file is searched, the number of clusters searched and occupied is displayed in the lower left corner. The number of clusters in a file for searching is limited to 4096 (2MB). If the log file is longer, a new one is created, increased by 1.

The log file name is LOG00.TXT-LOG99.TXT.

If the data is written correctly, WRITE is displayed for a moment in the lower left corner.

If the microSDHC card is not accepted after logging is activated, an error message is displayed:

E:1 - GO_IDLE_STATE
E:2 - SEND_IF_COND
E:3 - ACMD41
E:4 - READ OCR
E:5 - no SDHC card

Requirements for microSDHC card:

1) The card must be SDHC type (cards with 4GB capacity and more)
2) File format must be FAT32
3) Cluster size must be 512B*



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*Note
Cards larger than 2GB cannot be normally formatted to 512B clusters, so the card must be split into two partitions where an active partition must always be lower than 2GB, formatted to FAT32 with 512B clusters.

The formatted card can be bought as accessory to the expansion module.

**1) MBus**

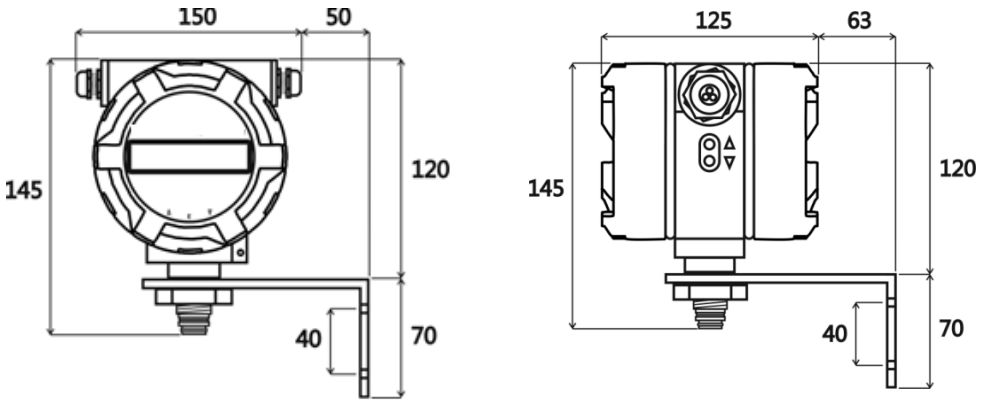
Power off, insert the expansion card into the available slot and fix it with an M3 screw. After power off, connect the MBus communication line to the terminals of the expansion module.

communication parameters:
2400Bd
paEven
8 data bits
1 stop bit
Address: last two digits of the serial number

Diagnostics:
Reception and transmission can be diagnosed in the SET menu, communication Line 1 - RS485 settings.
Rx – reception on line 1 (RS4858, MBus/Modbus)
Tx – transmission on line 1 (RS485, MBus/Modbus)
R1 – reception on line 2 (MBus Erweiterungsmodul)
T1 – transmission on line 2 (MBus Erweiterungsmodul)

## 7. Application information

Installation of the sensor with a separate evaluation unit:
First of all, it should be determined which type of installation is to be used, whether the mounting is to be behind the electronics or under the electronics. The mounting corner is fixed to the wall with screws. The evaluation unit is mounted to the fastening and wired. The cables should form a suspension so that no condensation water runs into the housing.



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## 7.1 Disassembly and assembly of PCB

*Power supply and terminal board PCB*


**Risk of electric shock!!!**
Before removing the rear cover (cap) for the electronics, make sure that the power is off.

1. Unscrew the rear cover of the meter's housing.
2. Disconnect the connected cables and if necessary, take them out of the cable entries.
3. Unscrew the four screws holding the power supply cover sheet along with the PCB.
4. Pull the power supply PCB, including the cover sheet a little out and disconnect the flat cable connector carefully.
5. Pull the power supply PCB out of the electronics cover and replace it with a good one, possibly use the PCB with another version of the power supply.
6. Connect the flat cable connector and insert the PCB in the electronics cover in proper orientation.
7. Using four screws, fix the PCB with cover sheet to the evaluation unit box.
8. Reconnect the cables and screw in the instrument housing cap.

*Display PCB – replacement*

1. Unscrew the front cover with the glass window.
2. Unscrew four fixing bolts.
3. Remove the original electronic board including the plastic cover and disconnect carefully the flat cable connector and the button connector.
4. Disconnect the sensor conductors from terminals.
5. Connect the sensor conductors to the terminals of the new board.
6. Reconnect the button connectors and flat cable connector.
7. Turn the electronic PCB with display to the required position (3x ± 90° maximum).
8. Screw in the four fixing screws.
   *Make sure that the screws are tightened properly!!!*
9. Screw in the front cover with the window.



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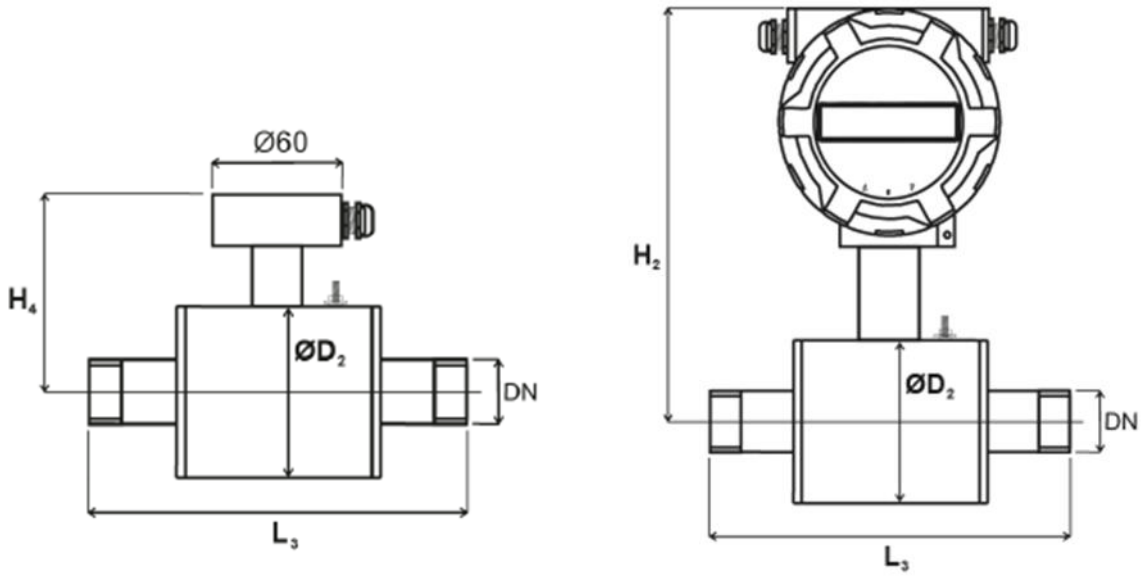
## 7.2 Basic sensor sizes

*Threaded design*




| Diameter nominal [mm] | Threaded connection | D2 External ∅ sensors | L3 Building length of sensor | H4 Building height of sensor | Weight of detached flow sensor (kg) | H2 Building height of comp. meter | Compact flow meter weight (kg) |
|---|---|---|---|---|---|---|---|
| 10 | 3/8“ | 70 | 193 | 90 | 4 | 177 | 5 |
| 15 | ½” | 70 | 196 | 90 | 4 | 177 | 5 |
| 20 | ¾“ | 80 | 206 | 95 | 4 | 182 | 5 |
| 25 | 1“ | 90 | 206 | 100 | 5 | 187 | 6 |
| 32 | 1 ¼“ | 100 | 233 | 105 | 5 | 192 | 6 |
| 40 | 1 ½“ | 116 | 256 | 113 | 6 | 200 | 7 |
| 50 | 2” | 136 | 261 | 123 | 6 | 210 | 7 |



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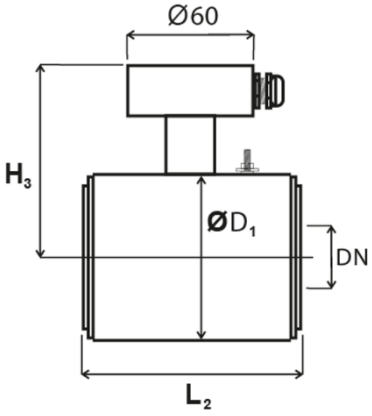
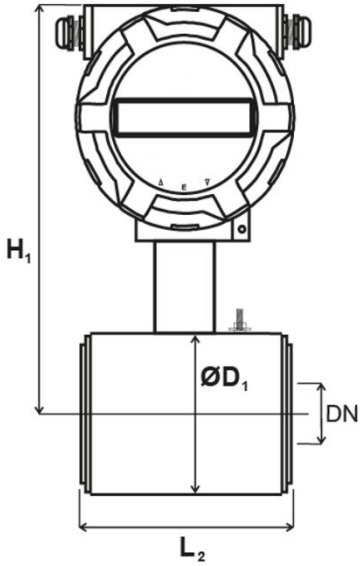
*Sandwich*




| Diameter nominal [mm] | D1 Outside diameter of sensor | L2 Building length of sensor | H3 Building height of sensor | Weight of detached flow sensor (kg) | H1 Building height of comp. meter | Compact flow meter weight (kg) |
|---|---|---|---|---|---|---|
| 10*,15 | 51 | 90 | 110 | 2 | 195 | 3 |
| 20 | 61 | 90 | 120 | 2 | 205 | 3 |
| 25 | 71 | 90 | 130 | 3 | 215 | 4 |
| 32 | 82 | 90 | 140 | 3 | 226 | 4 |
| 40 | 92 | 110 | 150 | 4 | 236 | 5 |
| 50 | 107 | 110 | 165 | 4 | 251 | 5 |
| 65 | 127 | 130 | 185 | 5 | 271 | 6 |
| 80 | 142 | 130 | 200 | 6 | 286 | 7 |
| 100 | 168 | 200 | 226 | 7 | 312 | 8 |
| 125 | 194 | 200 | 253 | 9 | 338 | 10 |
| 150 | 224 | 200 | 283 | 11 | 368 | 12 |
| 200 | 284 | 200 | 340 | 14 | 427 | 15 |



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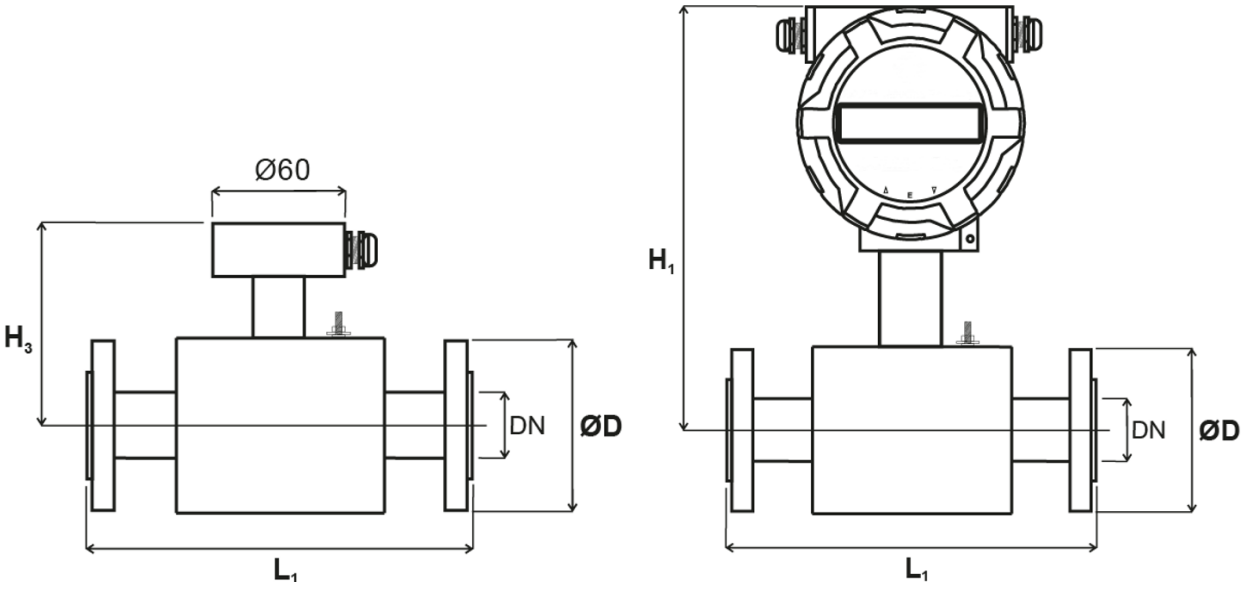
*Flansch*




| Diameter nominal [mm] | D Outside diameter of flanges | L1 Building length of sensor | H3 Building height of sensor | Weight of detached flow sensor (kg) | H1 Building height of comp. meter | Compact flow meter weight (kg) |
|---|---|---|---|---|---|---|
| 10*,15 | The outside diameter corresponds to the required pressure class and standards. | 200 | 140 | 4 | 230 | 5 |
| 20 | | 200 | 150 | 4 | 240 | 5 |
| 25 | | 200 | 160 | 5 | 250 | 6 |
| 32 | | 200 | 175 | 6 | 265 | 7 |
| 40 | | 200 | 185 | 7 | 275 | 8 |
| 50 | | 200 | 215 | 9 | 300 | 10 |
| 65 | | 200 | 235 | 11 | 320 | 12 |
| 80 | | 200 | 250 | 12 | 335 | 13 |
| 100 | | 250 | 275 | 19 | 360 | 20 |
| 125 | | 250 | 305 | 26 | 390 | 27 |
| 150 | | 300 | 335 | 37 | 420 | 38 |
| 200 | | 350 | 395 | 44 | 480 | 45 |
| 250 | | 450 | 475 | 65 | 560 | 66 |
| 300 | | 500 | 520 | 78 | 605 | 79 |
| 350 | | 550 | 580 | 88 | 660 | 89 |
| 400 | | 600 | 640 | 106 | 725 | 107 |



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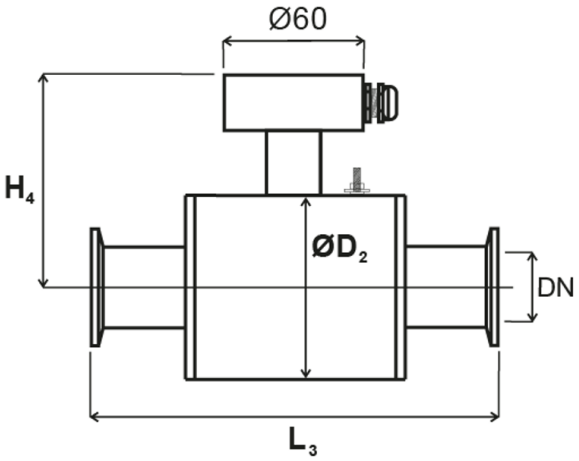
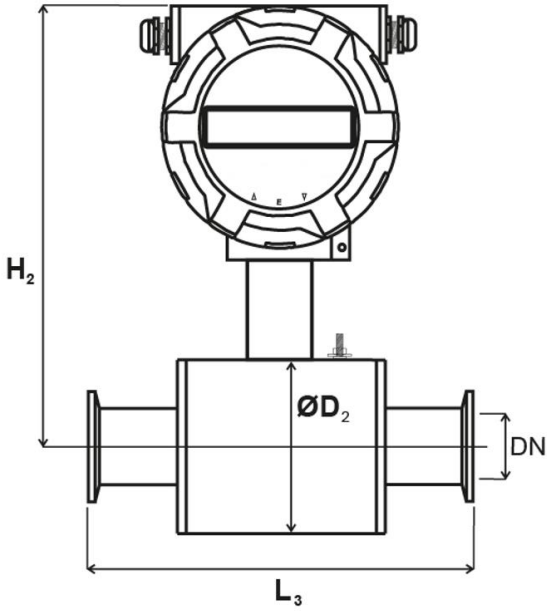
*Food industry design*




| Diameter nominal [mm] | Food grade connection CLAMP/ Screwed fitting | D2 Outside Ø | L3 Sensor length Clamp | L3 Sensor length Milk pipe screw connection | H4 Sensor height | Weight (kg) | H2 Compact sensor height | Compact sensor weight (kg) |
|---|---|---|---|---|---|---|---|---|
| 10 | DN 10 | 70 | 189 | 179 | 90 | 4 | 177 | 5 |
| 15 | DN 15 | 70 | 182 | 172 | 90 | 4 | 177 | 5 |
| 20 | DN 20 | 80 | 182 | 176 | 95 | 4 | 182 | 5 |
| 25 | DN 25 | 90 | 182 | 186 | 100 | 5 | 187 | 6 |
| 32 | DN 32 | 100 | 189 | 197 | 105 | 5 | 192 | 6 |
| 40 | DN 40 | 116 | 189 | 220 | 113 | 6 | 200 | 7 |
| 50 | DN 50 | 136 | 217 | 231 | 123 | 7 | 210 | 8 |
| 65 | DN 65 | 151 | on | on | 131 | 7 | 218 | 8 |
| 80 | DN 80 | 177 | request | request | 144 | 8 | 231 | 9 |



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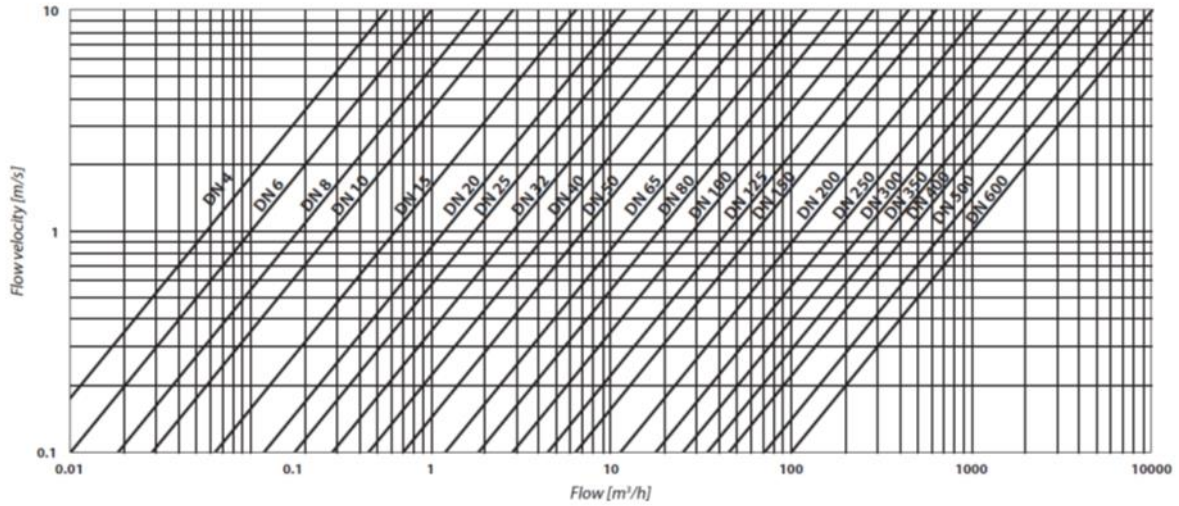
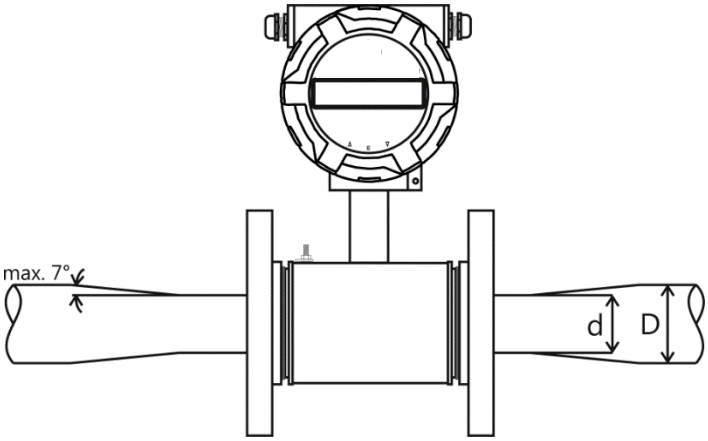
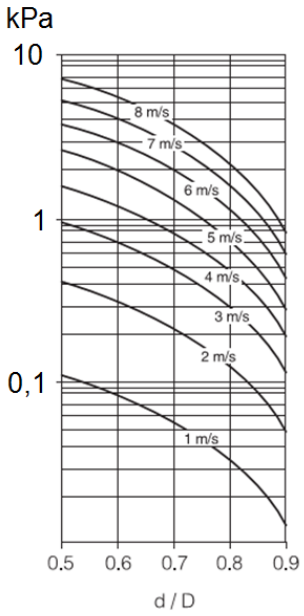
## 7.3 Nomogram for quick proposal of the measured place




## 7.4 Reduction in DN pipe

*If the pipe's DN is higher than that of the meter selected*




## 7.5 Faults and their symptoms during measurement

Unstable indications and readouts may appear due to:

- big portion of solids
- in homogeneities as a result of the state of matter
- turning point of immixture
- continuous chemical reactions in the measured fluid
- use of diaphragm pumps or plunger pumps
- poor grounding



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## 8. Dismounting, Return, Cleaning, Disposal

### 8.1 Dismounting


Residual media in dismounted instruments can result in a risk of personnel, the environment and equipment. Take sufficient precautionary measures.


There is a risk of burns. Let the instrument cool down sufficiently before dismounting. During dismounting there is a risk of dangerously hot pressure media escaping.
Only disconnect the resistance thermometer once the system has been depressurised.

### 8.2 Return


When returning the instrument, use the original packaging or a suitable package.
To avoid a damage, use for example antistatic plastic film, shock-absorbent material, a marking as highly sensitive measuring instrument.

### 8.3 Cleaning

Before cleaning the instrument disconnect the electrical connection. Clean the instrument with a moist cloth. Electrical connections must not come into contact with moisture. Wash or clean the dismounted instrument before returning it in order to protect personnel and the environment from exposure to residual media.
Residual media in dismounted instruments can result in a risk to persons, the environment and equipment. Take sufficient precautionary measures.

### 8.4 Disposal

Dispose instrument components and packaging materials in accordance with the respective waste treatment and disposal regulations of the region or country to which the sensor is supplied.



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