SENSORS FOR FOOD AND LIFE SCIENCES.

SANITARY BY DESIGN
ANDERSON-NEGELE

INSTRUCTION MANUAL

Electromagnetic Flow Meter FMQ

30008 / 1.3 / 2021-05-17 / BK / NA

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1. General description

1.1. Preface

This documentation includes some information protected by copyright. Without prior authorization by **Anderson-Negele** this instruction manual is not allowed to be photocopied, copied, duplicated, translated, or recorded on data carriers (neither completely nor in extracts).

This instruction manual should be carefully read before the installation and operation of the device is started. It has to be deposited in the direct vicinity of the device described, easily accessible to all persons concerned.
The safety instructions have to be strictly observed.
Anderson-Negele cannot assume any liability or legal responsibility for operating errors caused by the non-observance of these directions.

1.2. Function

The electromagnetic flow meter, type FMQ, measures both the flow rate and the volume of liquid flows at a high precision.

The measuring device is suitable for measuring conductive liquids.

The FMQ converter is microprocessor controlled. It supplies the transmitter with a switched and regulated coil current.
The signal generated at the electrodes is amplified in the converter, conditioned and shown in the internal measuring registers both as flow rate and volume information.
Volume pulses (pulses per volume unit) are output for controlling and regulating purposes.
The instantaneous flow rate is output as an analog signal of 4...20 mA according to the desired range of 0...100 %.

When leaving the factory, each device is adjusted in such a way that only the power supply and any peripherals will have to be connected.

1.3. Technical data

1.3.1. Converter

Supply voltage: FMQ DC: 24V ±10% DC

Power consumption: 4 watts max.

Electrical fuse connection: DC power supply: T 1A

Digital pulse output/IO-Link: 1 x optocoupler output
Maximum load: 32 V / 20 mA / pulse sequence: 1 kHz max.

Analog output: 4 - 20 mA ±0.1 mA (active), maximum load 500 Ω

Ambient temperature: -20°C ... +60°C

1.3.2. Transmitter

Transmitter		Compact version
Process connections:		Aseptic flange
Optional adapters:		ASME Clamp,DIN Clamp,butt-weld
Nominal widths:		DN 10, 15, 25, 32, 40, 50, 65, 80, 100
Materials:		Meter tube:
Materials:	Liner:	PFA
	Electrodes:	Material no.: 1.4404 / AISI 316 L
	Housing:	Material no.: 1.4301 / AISI 304
Protection class:		IP67
Electrical connection:		M12 electrical connection
Product temperature:		100°C max.
Cleaning temperature:		130°C for a maximum period of 30 minutes
Product conductivity:		5 µS/cm at a minimum, see item conductivity conditions
Admissible pressure:		Minimum: 0.5 bar abs. at 20°C; Maximum: 16 bar (DN10 – DN100)
Flow velocities:		0.1 - 10 m/s

* The pressure rating depends on the process connection and the seals and gaskets used.

1.3.3. Measuring ranges

DN	Total flow range [L/h]			Flow rate at a Flow velocity of 1 m/s [L]	Unit
10	30	-	3,000	300	L/h
15	70	-	7,000	700	L/h
25	180	-	18,000	1,800	L/h
32	300	-	30,000	3,000	L/h
40	450	-	45,000	4,500	L/h
50	700	-	70,000	7,000	L/h
65	1,200	-	120,000	12,000	L/h
80	1,800	-	180,000	18,000	L/h
100	2,800	-	280,000	28,000	L/h

2. Safety instructions

Due to the great variety of possible conditions of use this instruction manual is done to address the general kind of application only.

Special cases such as extraordinary ambient conditions or special safety instructions require coordination with the manufacturer.

2.1. General remarks

2.1.1. Special attention to the user

This flow meter has been designed and built in consideration of industry standards and future technical specifications that may be implemented. It corresponds to the state of the art and offers an optimum of safety.

The user of the flow meter is responsible for any inputs of specific operational parameters.

In practical use, safety can only be obtained when all measures required will be used. It is the responsibility of the user of the flow meter to plan such measures and to verify that they are used.

In particular, the user has to ensure that:

- The flow meter is only used for the intended application as directed (also see the following chapter “Intended use”).
- The flow meter is operated in a perfect and functioning condition and especially that the safety devices used are regularly checked for their proper operation.
- The personal protective equipment required for the safe operating, maintenance, and repair personnel is kept available and really used.
- The complete instruction manual in a legible condition is permanently available at the location of the measuring device.
- The device is operated, serviced, and repaired by qualified and authorized personnel only.
- The personnel concerned is regularly trained in the protection of persons and environment and familiarized with the instruction manual and especially the safety precautions included therein.
- All the safety and warning instructions attached to the flow meter are not removed and kept in a legible condition.

In case of problems that cannot be solved, the user of the system should contact the service department of **Anderson-Negele**.

2.1.2. General safety instructions

These safety instructions have to be strictly observed in order:

- To not endanger the safety of persons and environment
- To avoid any damages to the flow meter
- To prevent any faulty batches upon the production

The electric connection may only be carried out by persons who have the necessary expertise (e.g. trained electrical fitters or persons instructed in electrical engineering) and the necessary authorization from the user.

Beware of dangerous voltage!

Unauthorized persons are not allowed to open a housing that shows this symbol!

Hinweis

Important information

The wiring of the voltage supply and the inputs and outputs of the control circuits has to be carried out professionally in consideration of the current standards and electrical codes. Also refer to **chapter 5** “Installation”/”Electrical Connection”.

In particular, the following references have to be observed:

- Safety instructions
- Electrical connection instructions

1. All persons who are involved in the installation, commissioning, operation, service, and maintenance of the flow meter have to be qualified as required.
2. This instruction manual has to be strictly observed. The user of the flow meter has to guarantee that the personnel involved has read and fully understands the instruction manual.
3. All kinds of work have to be done with utmost care and should be carried out by authorized and trained personnel only.
4. The instruction manual has to be available close to the flow meter, easily accessible to the operating staff.
5. Before starting any cleaning, conversion, service or maintenance work, the measuring device has to be switched off and separated from the mains supply. This requires a device for separating all live wires, e.g. a 2-pole main switch in the control cabinet. The associated device has to be protected against unauthorized switching-on.
6. Before starting any service and maintenance work, the system has to be flushed with water and emptied. If the flow meter has to be removed from the pipe system, all pipelines will have to be previously emptied and protected by means of some appropriate emptying and shut-off measures.
7. The flow meter fulfils the general safety requirements according to EN 61010.
8. Never remove or disable any safety devices by creating modifications to the flow meter!

9. Do not touch any parts of the meter while the flow meter is cleaned. Otherwise, you run the risk of getting burned!
10. To minimize the danger of injury, the working area of the operator has to allow sufficiently free space.
11. The technical data according to the instruction manual, nameplate and, if available, the performance specification has to be considered.

If damage is caused due to poor worksmanship during installation or servicing any warranty claims will be impacted.

Dangers not resulting from the functionality of the device, but from the ambient and operating conditions existing at the place of use have to be referred to in appropriate instructions to the operators and by the attachment of warning signs!

The user of the device is exclusively responsible for the compliance with these instructions!

2.2. Intended use

The flow meter is only allowed to be used for the application that it has been designed, dimensioned and built for:

- the connection to a direct current network (see the nameplate)
- in industrial areas according to EN 61000-6-2/4 for reasons of EMC

The intended purpose of the electromagnetic flow meter is the measurement of conductive liquids in the food processing industry and in the cosmetic, pharmaceutical and chemical industries.

This flow meter is *not* suitable for the measurement of hazardous, explosive, and combustible liquids according to the Pressure Equipment Directive 97/23/EC, category 1.

The nominal widths up to DN 50 are manufactured in consideration of our “many years of engineering experience”. The nominal widths larger than DN 65 are subject to category I of the Pressure Equipment Directive 97/23/EC and the Conformity Assessment Procedure, Module A. The intended use of the device has to be strictly observed by the user.

Any modifications to the measuring device that might have an influence on the function and the safety devices of the flow meter are only allowed to be carried out by the engineering specialists or authorized persons of Anderson-Negele.

Possible misuse

Any use being in contradiction to the above-mentioned application indicates a misuse of the flow meter! In such a case Anderson-Negele does not assume any responsibility for the safety.

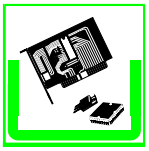
2.3. Special safety instructions and devices

The following dangers could be directly or indirectly caused by the flow meter, type FMQ, during operation or commissioning:

- Electric shock if the electronic housing is opened improperly
- Burns by touching hot pipe sections
- Scalds and/or chemical burns by hot liquids or gas coming out through leaking flange connections or because of an inexpert opening of the pipe system

2.4. Explanation of the safety symbols used

The FMQ flow meters are reliable in operation and meet the highest technical specifications. They leave our factory in a safe usable condition. The devices correspond to the relevant standards and directives according to EN 61010 “Electrical safety testing for measurement and laboratory devices”. However, a hazard can originate from the devices, if they are used improperly and not for their intended purpose. Therefore, strictly observe the safety instructions of this instruction manual which are marked by the following symbols:

 **Important Information**	 **Hot caustic solution can cause serious chemical burns**	 **Caution**
 **Beware of hazardous electric tension**	 **Beware of hand injuries!**	 **Beware of hot surfaces!**
 **Beware of hot liquids and steams**	 **Beware of media detrimental to health or irritating substances!**	 **Beware of an increased risk of skidding in wet areas!**
 **Electrostatically endangered system component**	 **Electronic scrap**	

3. Transport

3.1. General information

The following points have to be followed in order to avoid damages to the flow meter or injuries during the transport of the device:

Transport work is only allowed to be carried out:

- By accordingly qualified and authorized persons
- By the aid of appropriate lifting and mounting devices
- On the condition that any risk can be fully excluded while the device is lifted or conveyed

The packing of the flow meters is subject to the following labelling:

Fragile goods

Keep dry!

Check the added packing list before you will start opening the packing!
Compare by means of the packing list if all parts are really available or not!
Treat sensitive parts with special care!

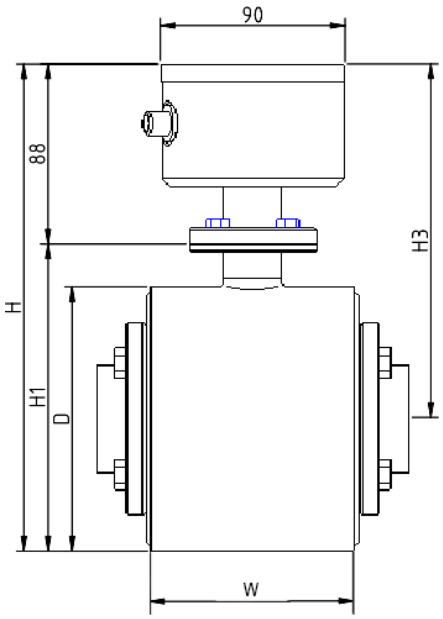
Please do not fail to dispose of the packing material according to the appropriate regulations.

3.2. Special notes

When removing the packaging film, see to it that no components of the device (such as display) are damaged or destroyed.

3.3. Dimensions and weight

3.3.1. Compact version

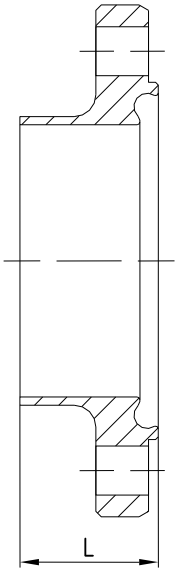


DN	W [mm]	D [mm]	H [mm]	H1 [mm]	H3 [mm]	Weight [kg]
10	104	90	225	110	180	6.0
15	104	90	225	110	180	5.8
25	104	90	225	110	180	5.6
32	104	105	240	125	188	6.4
40	104	105	240	125	188	6.4
50	104	130	265	150	200	7.9
65	160	130	265	150	200	8.8
80	160	155	290	175	213	11.2
100	200	170	305	190	223	13.2

3.3.2. Dimensions of the process connections

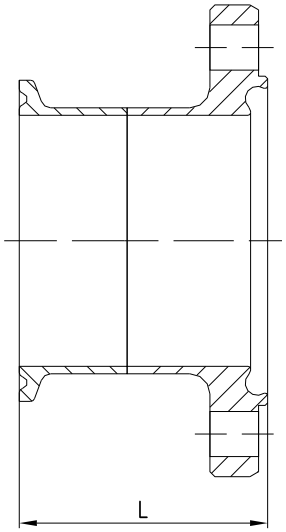
The welding socket belongs to the standard delivery.
If a flow meter of the previous series IZM-S™ or IZM-L™ is replaced by a FMQ, adapters up to DN 100 are required.

Welding socket (standard)



Dimension	L
DN 10	25.5
DN 15	25.5
DN 25	25.5
DN 32	25.5
DN 40	25.5
DN 50	25.5
DN 65	25.5
DN 80	27.5
DN 100	27.7

TriClamp ASME and DIN 32676



Dimension	L	
	DIN	ASMI
DN 10	25.5	33.8
DN 15	25.5	49.6
DN 25	25.5	49.6
DN 32	25.5	49.6
DN 40	25.5	49.6
DN 50	25.5	49.6
DN 65	25.5	34.3
DN 80	27.5	45.5
DN 100	27.7	51.1

4. Mounting

4.1. Conditions required for the transmitter

In any case the transmitter has to be installed in the product line and the converter has to be supplied with voltage.

When selecting the place for the installation of the flow meter you should in any rate ensure that the housing can be opened for service work whenever desired and that the flow meter can be simply removed, if necessary.

Equalising currents between the transmitter and the converter have to be absolutely avoided, as they will cause measuring errors.

Caution

To protect the transmitter against damage, select the place of installation so that:

- the process pressure is always kept below the admissible operating pressure
- the product temperature is always kept below the admissible temperature
- the transmitter is mechanically mounted (e.g. to avoid vibration)
- the meter tube can be emptied to protect from freezing
- the converter housing is not permanently exposed to water

4.1.1. Air and gas

The electromagnetic flow meter can supply good measuring results in the measurement of **gas-free liquids** only. Air locks or deaeration in a liquid will lead to incorrect measurements.
Thus, make sure that air locks or other possible parts of gas are safely separated before the measuring device e.g. by air eliminators or that outgassing can be avoided by a sufficient working pressure.

The measuring device is not damaged by air locks.

4.1.2. Particulates/Solids

Normally, particulates parts do not have any negative influence on the volume measurement.
The pipe diameter should always be chosen large enough to prevent the meter tube from being clogged by the solids.

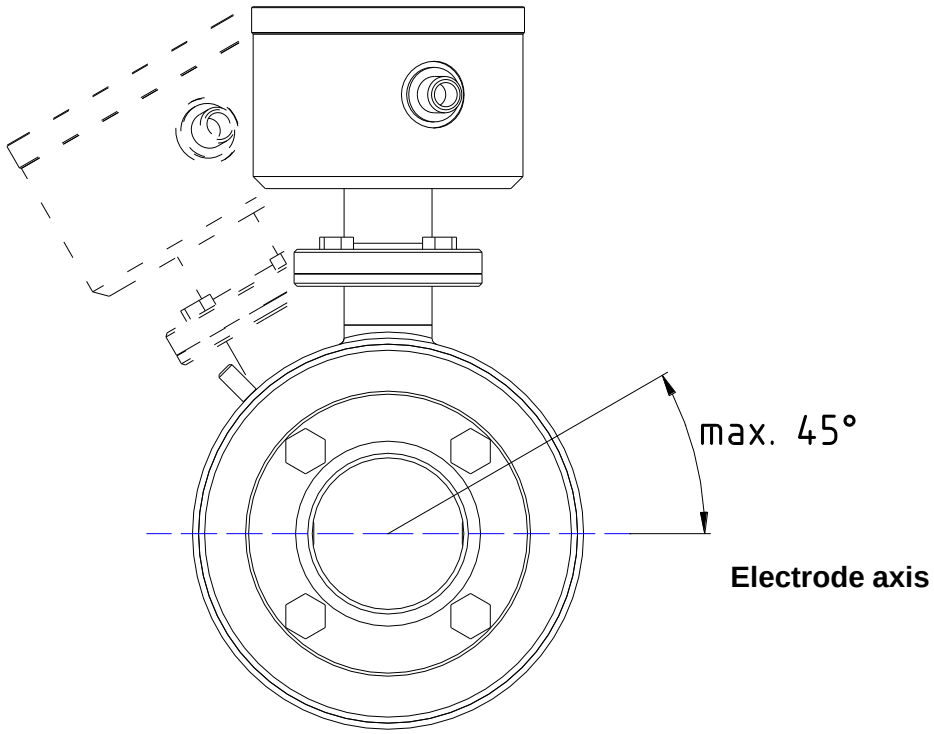
Due to the fact that the flow velocity of solids is relatively lower than that of the liquid part of the product, a higher flow fluctuation could be caused while the flow rate is measured.
The measurement of abrasive materials can cause a drifting of the measuring accuracies over time and, in the end permanante damage to the flow tube.

4.1.3. Fitting position – electrode axis

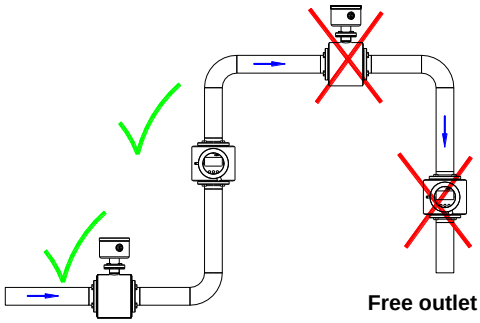
Due to the principle described, the fitting position – to a certain extent – can be selected any way desired. The basic condition for accurate measuring results is, however, a full and gas-free meter tube.
If possible, the electrode axis should be horizontally arranged, in order to avoid a deposition of gas bubbles or solid particles on the surface of the electrodes. Therefore, a slightly ascending pipeline is advisable, preferably with a deaerating possibility at its highest position.

The fitting position should be chosen in such a way that good readability and use of the display (if equipped) is possible.

The pipelines within the inlet and outlet pipe sections must not show any unevenness, e.g. welding beads to assure uniform flow.



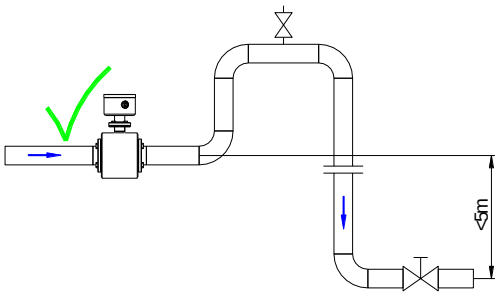
Suggestions for installation



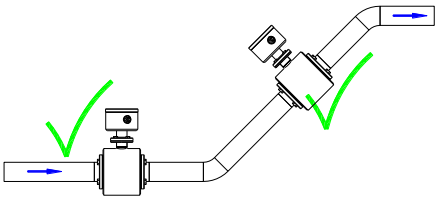
Wrong
At the highest point of the pipeline. Gas bubbles accumulate in the transmitter. → Faulty measurement!

Wrong
Descending pipe:
At the end of the conveyance of the metered product the pipe runs empty. → Measuring errors!

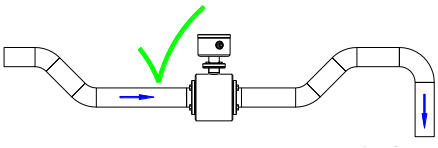
Correct
Preferred mounting position:
Rising pipeline and horizontal pipe section before an ascending pipeline



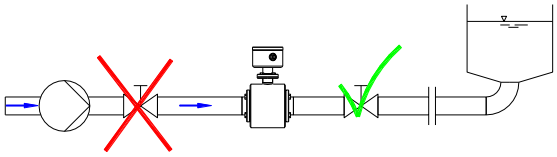
Descending pipelines of a length of more than 5 m have to be equipped with a deaeration valve after the flow meter.



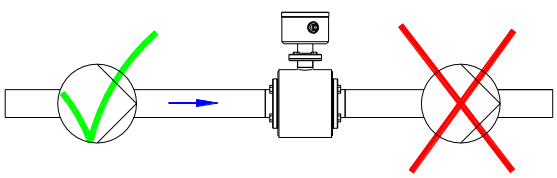
Correct
In case of a horizontal pipe conduct the mounting position is placed in slowly increasing sections of the pipe.



Correct
Provide a culvert for free inlet or outlet. The transmitter is permanently filled with liquid as demanded.

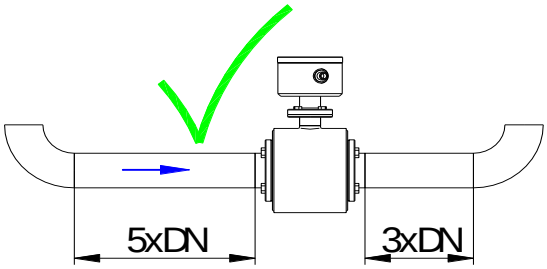


Long lines **after** the flow meter always have to be equipped with a shut-off device. If it is placed before the flow meter, a vacuum will be caused in the metering pipe by the big kinetic energy in the liquid column when shutting off. This can damage the lining of the tube!

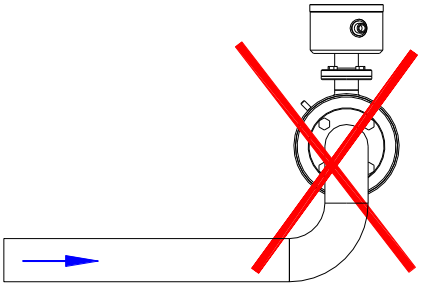


Do not place the flow meter on the suction side of the pump! → **Danger of negative pressure!**

Arrangement

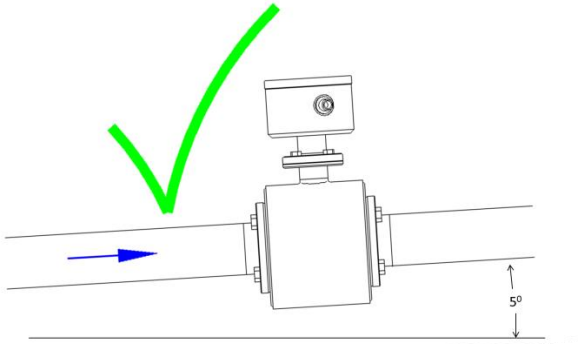


Keep the recommended inlet and outlet sections!



Avoid curvatures of space before the flow meter!

Installation requirements for 3-A sanitary applications



Correct
In horizontal applications a slope of greater than 5 degrees is required to ensure that proper drainage occurs in the pipeline.

Inlet and outlet pipe sections

For the installation of electromagnetic transmitters DIN 1944 recommends an inlet pipe section of 5 x DN and, accordingly, an outlet pipe section of 3 x DN in case of an undisturbed flow. For an irregular flow (e.g. distorted rotational flow profile) the inlet and outlet pipe sections have to be extended accordingly or a rectifying device for the flow has to be installed in order to guarantee the specified measuring accuracy.

4.1.4. Conductivity conditions

The liquid to be measured has to show a minimum conductivity of ≥ 5 µS/cm.
Demineralised water requires a conductivity of ≥ 20 µS/cm.

A count suppressor for empty meter tubes is part of the standard equipment of the converter. That fparameter for this function will need to be switched off at conductivities below 50 µS/cm (‘Pipe Detect’ off).

In case of very low conductivities it is recommended to carry out a specific calibration to minimize the impact under these operating conditions.

4.1.5. Interference fields

In the immediate vacinity of the transmitter ther should be no masses of iron or strong permanent or electromagnetic fields, as they could influence the defined exciting magnetic field, thus falsifying the signal.

4.1.6. Earthing/grounding conditions

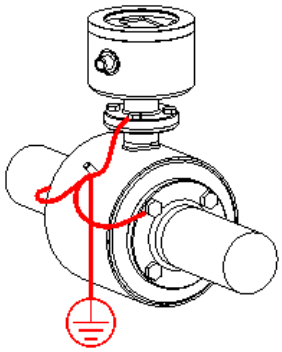
An earthing/grounding of the transmitter is an essential requirement for a reliable and accurate measurement.

“Inductive measuring method” means that the metered liquid itself acts as an electric conductor, i.e. a correct and careful earthing/grounding ensures that no additional potentials will falsify the extremely low metering signal that is generated.

For that reason, the earthing/grounding resistance has to be definitely smaller than 10 Ω. The earth/ground wire used must not transfer any interference voltages, i.e. no other electric devices must be connected to that line.

If in case of a plastic pipe system no equipotential bonding is available between the inlet and outlet sides, it will be necessary to take some appropriate measures for a potential equalisation.

The transmitter has to be earthed/grounded as shown in this picture:



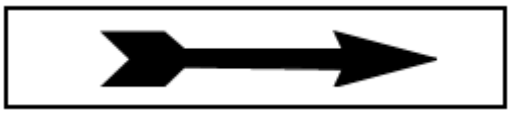
4.1.7. Meter tube lining

A damaged PFA lining can cause faulty measurements or even a failure of the flow meter.

Choose the place of installation in such a way that no negative pressure can be caused, even not when the pump is switched off. An installation at the highest point of the pipeline has to be avoided!

4.2. Flow direction

The FMQ measures the flows in both flow directions in principle. The main flow direction is marked on the transmitter by means of an arrow:



In the standard setting the digital outputs emit the volume pulses independently of the flow direction.
Negative flow rates and quantities are displayed with a MINUS sign.
On the condition that the inlet and outlet conditions are kept, the accuracy of the measurement in both directions will be only slightly different.

4.3. Conditions required for the converter

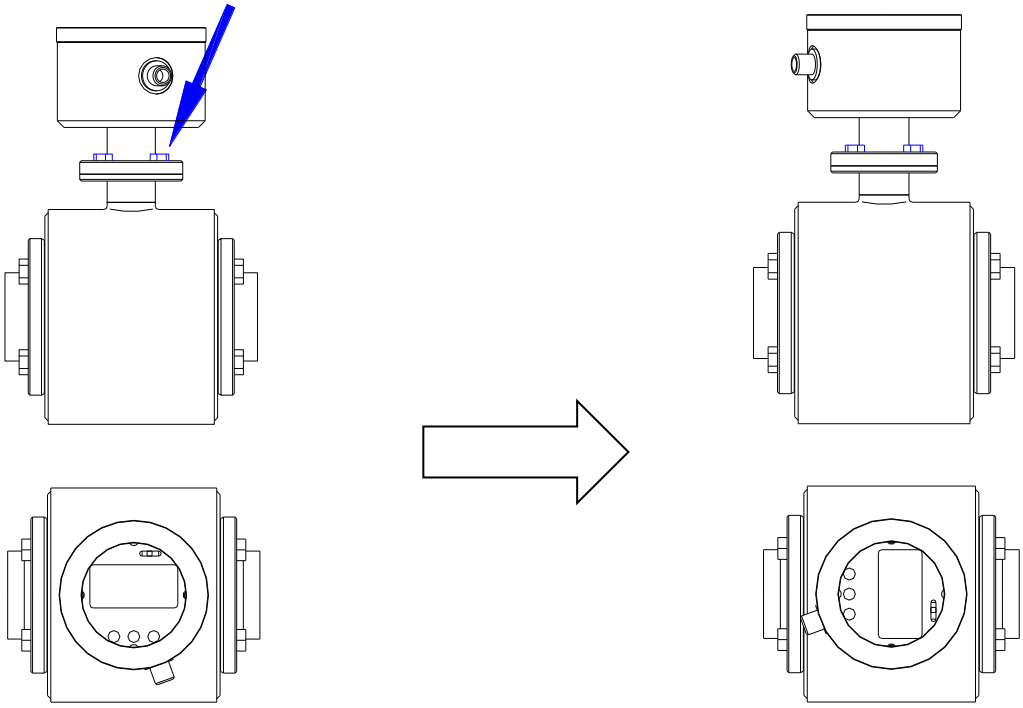
Caution

Please observe the following points for the locating place to protect the converter against damage:

- The limit values for the ambient temperature have to be kept.
- Fasten the field housing to eliminate mechanical strain!
- No moisture may enter the field housing through the cable gland.
- The converter has to be installed at a place which is free from vibration to a large extent.
- The covers have to be closed.
- The housing may not be permanently subject to dripping water.

Apart from that, please ensure that the housing can be easily opened for service purposes.
The converter has to be installed in such a way that perfect reading and operation of the operating unit is guaranteed!

4.4. Alignment of the converter



1. Loosen the 4 screws crosswise (**Do not remove them!**)!
2. Turn the converter into the desired direction (180° max. to the left or right)!
3. Tighten the 4 screws crosswise!

4.5. Welding work

Caution

Welding work involves the risk of destruction for this electronic measuring equipment!

Pay attention to the fact that the earthing/grounding of the welder is not to be carried through the transmitter!
The welded seams at pipelines have to be executed by means of suitable work equipment and filler materials and after a careful preparation of the pipe ends in such a way that a weld is guaranteed and that internal stresses (e.g. welding distortion) is kept limited to the absolute minimum. Before welding work is started, the FMQ will have to be removed from the pipeline:

1. Fasten the FMQ transmitter by some welding point inside the pipeline!
2. Unscrew the screws at the process connection flange! Remove the transmitter including the seal from the pipeline!
3. Weld the process connection into the pipeline!
4. Reinstall the transmitter into the pipeline! Pay attention to cleanliness and the correct position of the seal!

4.6. Cover

Unless the cover is closed,

the flow meter will *not* be protected from moisture!

If the cover is closed (finger-tight),

the flow meter will be protected from moisture!

The FMQ is only protected from moisture, if the covers are correctly screwed down.
A properly screwed down cover is recognized by the fact that the metallic stop is reached.

5. Installation

Only qualified persons with authorization of the user are allowed to carry out the installation work. The qualified personnel have to have read and fully understood this instruction manual and follow all instructions given therein.
The current standards will establish the requirements for the execution of the installation.

The following points should be taken into account after completion of the installation work:

- It has to be checked whether all external supply connections really meet the requirements specified in the technical data of the flow meter (e.g. pressure, temperature, etc.).
- The pipelines have to be cleaned and flushed before the production is started.
- All external supply joints have to be checked for safety, liquid tight, and stress-free connection to the transmitter.
- The media supplied has to be slowly raised to their required working pressure.
- Occurring leaks have to be removed immediately.
- All electrical lines have to be separated from the flow meter before welding work is started at the pipeline.

The electric wiring of the voltage supply and the inputs and outputs of the control circuits has to be carried out according to the wiring diagram.

In this respect current standards are to be followed.

5.1. Installation instructions for the transmitter

Caution

Pay attention to the fact that the threaded fittings, clamps, or flanges are perfectly tightened! Otherwise, hot or caustic solutions or gasses could escape through gaps and clearances.

- Escaping liquids can cause slip hazard.
- Escaping liquids have to be mopped up immediately and disposed of safely.
- If combustible liquids come out, they could cause an explosion hazardous area around that place which has to be marked accordingly.

If the transmitter is connected to existing process lines, those lines have to be unpressurized and free from product.

Do not omit to insert the seals into any fittings!
In case of leaking pipe connections you should check the seals.

5.2. Installation instructions for the converter

As the FMQ is a compact design, the converter is arranged on the transmitter, i.e. it is located straight on the pipeline.

When installing the flow meter, pay special attention to the fact that no moisture by drip or splash water can get onto the electronic board.

Metal particles, such as scobs or residues of the shielding braid, have to be removed from the boards before the electric power supply is switched on.

See to it that the pipelines are supported in such a way that no forces and moments are exerted on the measuring device.

Caution

The display must not be exposed to direct sunlight!

5.2.1. Installation of the electrical power supply

Caution

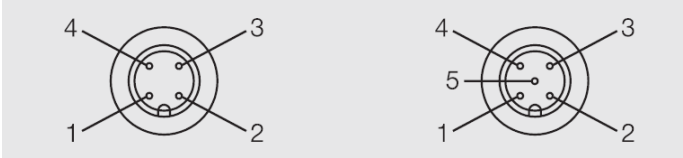
The following safety precautions have to be followed for the execution of the electrical installation work:

- The supplying system has to guarantee an overvoltage protection for the device according to category II.
- For reason of EMC (according to definition EN 50 081-2) the FMQ may be used in industrial areas only.

DC Input

M12-plug connection:

4-pin version **5-pin version**



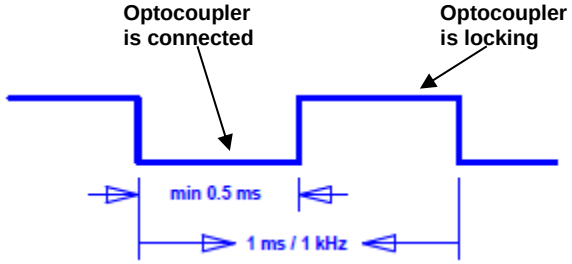
M12-plug, 4-pins	
1	DC Supply + (24V)
2	4…20 mA Output
3	DC Supply - (0V / GND)
4	Pulse Output / IO-Link (optional)

M12-plug, 5-pins	
1	DC Supply + (24V)
2	4…20 mA Output
3	DC Supply - (0V / GND)
4	Pulse Output / IO-Link (optional)
5	DC Input + (9…24V)

5.2.2. Digital output

Digital output	
Output current	20 mA max.
Voltage drop at the optocoupler at 20 mA	0.5 ... 1 V
Output frequency	1kHz max.

The following figure shows the basic wiring diagram of the pulse output.
The output switch off in case of overload. By removal of the overload the outputs will be reactivated after a few seconds.



Output signal at 1 kHz

The pulse duty cycle depends on the load, too. An electronic counter has to have an input frequency of at least 5 kHz.

5.2.3. Analog output - current output

Analog output	
Hardware mode	Active
Operating mode	4...20 mA
Load	500 Ω max.
Error	< 0.2 %

The analog output works in both flow directions!

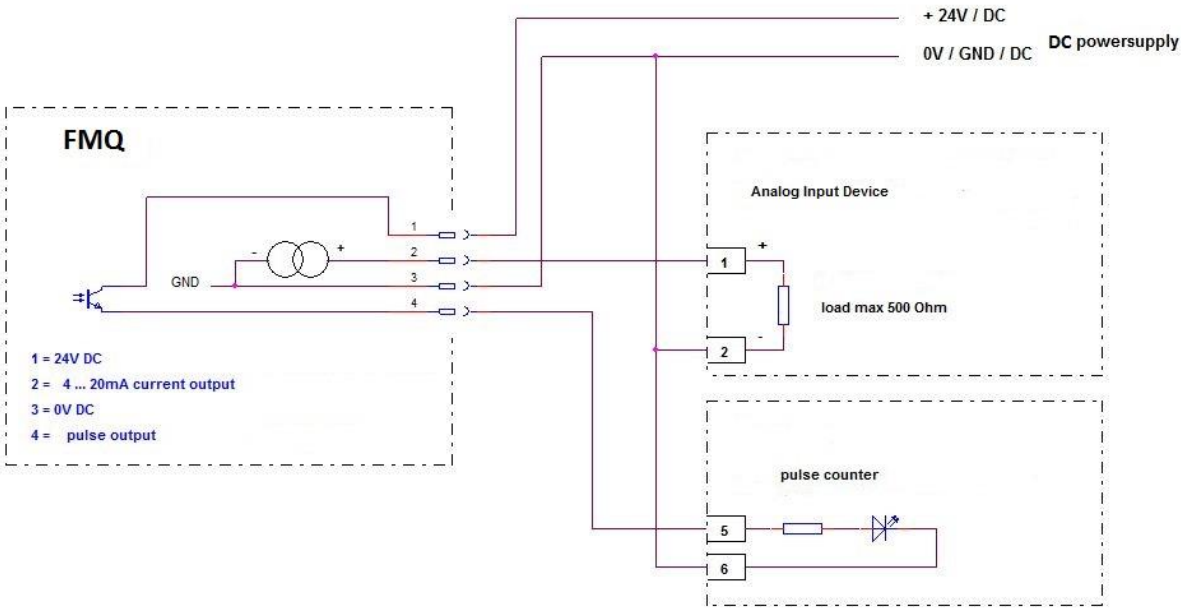


Figure 1: Wiring diagram – digital output and active current output

5.2.4 Optional Digital Input

Digital input	
Hardware	Optocoupler, passive
Auxiliary voltage	9…32 V
Input resistance	< 3.2 kΩ
Input frequency	1kHz max.
Function	Voltage ON → reset counter

5.3. Display

The standard version (converter without display) can be retrofitted with a display, if desired. The following parts are required for such a retrofit:

Item	Part number	Description
1	57001A0001	Display Kit

2	57002A0001	Display Cap

Conversion instructions:

1. Unscrew the cover!
2. Connect the display and the converter (plug XD1) by the cable!

3. Fix the display by the M3x10 screws

4. Close the housing by the cover (with the transparent pane)!

6. Commissioning

6.1. General information

The measuring device may only be operated by trained persons who have the necessary authorization from the user of the device. The operators have to be familiar with the process sequence, able to recognize possible dangers, and in a position to take the necessary steps for the removal of accident risks.

Safety measures for the commissioning work

Caution

Both a properly performed installation and a correct electrical connection are prerequisites for the commissioning work!

Pay attention to the following points upon the initial start-up of the flow meter:

- Close the housings of transmitter and converter!
  - Personal injury by electric shock can be caused, if the electric lines are touched.
  - Instrument damage can be caused by moisture or metal parts on the electronic unit.
- Ensure that all connections at the flow meter and in the direct vicinity are tight!

6.2. Advice for starting-up the FMQ

1. First of all the meter has to be installed into the pipeline!

- The power supply has to be switched off.
- The power supply has to match the specification on the nameplate.
- The pin assignment has to correspond to the wiring diagram.
- The temperature limits have to be kept.
- The meter has to be correctly earthed/grounded.
- The meter has to be installed at a place which is free from excessive vibration.
- The housing cover has to be closed before the auxiliary energy is switched on.
- The flow range adjusts itself automatically.
- After the electrical start-up a "**ZERO adjust**" should be carried out by means of the typical liquid to be measured (full meter tube and **no** flow!).

2. How to put into operation the analog output?

- Dependent on the flow rate, the analog output produces a current of 0/4...20 mA.

With display only (option):

- The allocation of the flow range "20mA = Q_{max}" for the analog output of the FMQ is set by the respective parameters.
- The flow simulation can be used for a functional check.

3. Which other conditions should be taken into consideration?

- Too low product conductivity?
  If it is below 50 µS/cm, the internal empty-pipe detection has to be switched off by the respective parameter setting.
- Is the analog output unsteady?
  A time constant TP3 can be set to average more signal to smooth the output.

6.3. Basic settings upon delivery

At the factory the electromagnetic flow meter is adjusted and delivered with a standard parameter setting.

6.3.1. System structure and operating elements

The electronic part is permanently installed in the FMQ converter. The electrical connection (M12 plug) is on the side of the device. For units not equipped with the optional display a satin-glass pane with a 3-coloured background LED-lighting is provided for meter status. The color shows the current status of the device. In case of the display version, the display with three optical buttons is arranged on the front side. The display can be used to read device information and to change settings.

6.4. Zero point adjustment (“ZERO adjust”)

Upon the first start-up of the flow meter it is recommendable to carry out a **zero point adjustment** (“**ZERO adjust**”) to adapt the flow meter to the environmental conditions.

ATTENTION! The following conditions have to be observed and kept for a **ZERO adjust**:

(1) The device has to have reached its working temperature, this will typically take at least 5 minutes after switching on.

(2) The transmitter has to be completely filled with the typical liquid which needs to be free of gas.

(3) **No flow** is allowed during this procedure and the liquid should be given time to settle.

(4) **No flow** is allowed to occur during the whole “**ZERO adjust**” measurement.

6.5. Metering with an empty meter tube

Metrologically correct flow measurements are only possible if the flow meter is filled with liquid. In order to avoid erroneous flow measurement due to an empty meter tube, the FMQ offers automatic detection and shut down for this condition.n:

6.5.1. "EMPTY pipe detection"

The FMQ is equipped with a special “EMPTY pipe detection” (**"pipe detect**"). The setting is made via the parameters accessible via the optional display. Usually, the EMPTY pipe detection is switched on such that an undefined count will be suppressed in case of an empty meter tube.

At the following situations, the internal EMPTY pipe detection has to be switched off by the parameter setting:

- At a product conductivity of less than 50µS/cm.
- At a heavily pulsating flow (piston, membrane or hose pumps).

6.6. Status indication

In the standard version the status of the device is displayed by a 3-colored LED through the satin-glass pane in the cover.

LED colour	Blinking code	Meaning
Blue	Increasing and decreasing	The device is ready for operation and no flow rate is available.
Blue	1:1	Zero-Adjust measurement is carried out
Blue	1:10	Empty pipe is detected
Green	--	Flow rate is measured
Green	1:1	Q_{max} exceeded (Q>120%)
Red	1:1	Malfunction

6.7. Optical operating elements (optional display version)

The display unit is provided with optical keys for the operation which enable the FMQ to be operated through the closed cover.

Important information

The converter calibrates the optical keys in regular intervals. Such a calibration can only function perfectly, if the optical keys are not covered. After removal or reassembly of the cover the optical keys should not be touched for approx. 20 seconds. After that time the optical keys will be functioning again.

During the operation or during an input the calibration will be ineffective.

Caution

The operation should only be done while the front cover is closed. Otherwise, the operating unit, the display, and the optical keys could be damaged.
Dirty fingers (e.g. by oils or fats) can cause faulty functions of the optical keys.

7. Operation

Only trained persons with the authorization of the user are allowed to operate the FMQ.

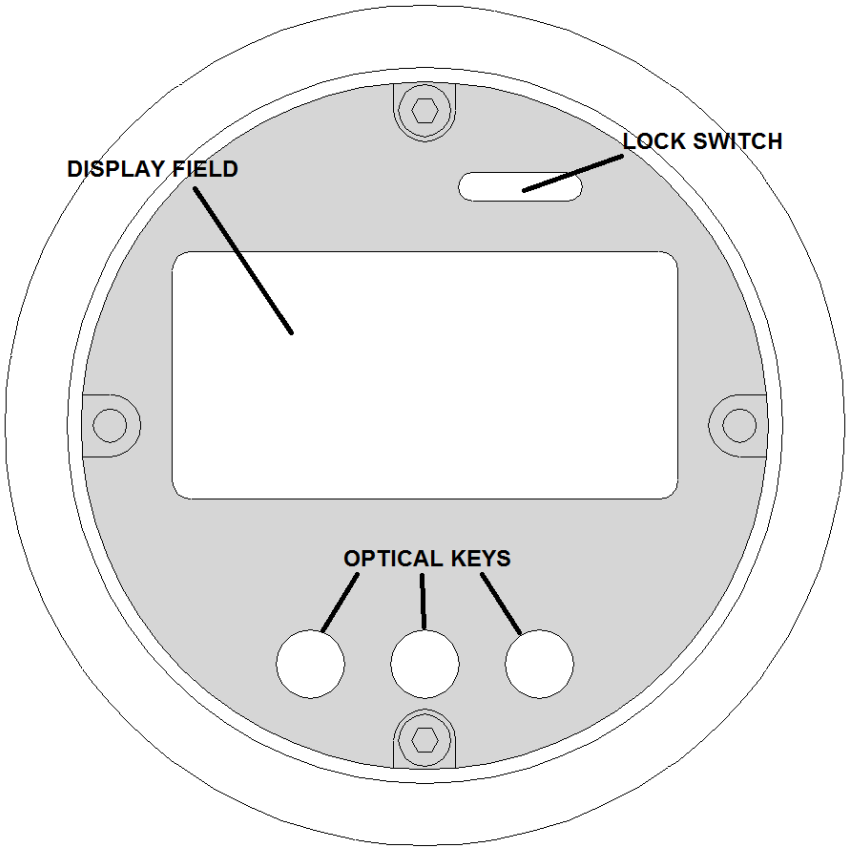
During normal measurements the display operation is restricted to the zero reset of the volume registers. The keypad is dynamically controlled by the image navigator.

The display unit can be adapted to the fitting position of the flow meter in steps of 90°, thus enabling optimal reading and handling of the display unit.

The display is illuminated by background lighting which permits reading and which is switched off after 5 minutes. It is only restarted after one of the three optical keys had been actuated.

The optical keys can be deactivated by means of the LOCK switch.
See the chapter “LOCK switch”.

Elements of the operating unit:



7.1. Basic keypad functions

The keypad consists of 3 optical keys. The functions of the keys are indicated by symbols and texts. The function of the keypad is dynamically controlled by the display navigator:

^^^^^^	Changing the main display level
HOME	Returning to the main program level or to the measurent display
>>>>	Changing to the next sub-level
ZERO	Resetting the volume to zero
++	Changing an incrementing value, such as the pulse mode
change	Changing the numerical parameters, such as the low flow quantity

Key functions for the value input (numerical parameter):

<<	Next input position
++	Changes the input position
←	ENTER, enters the numeric input

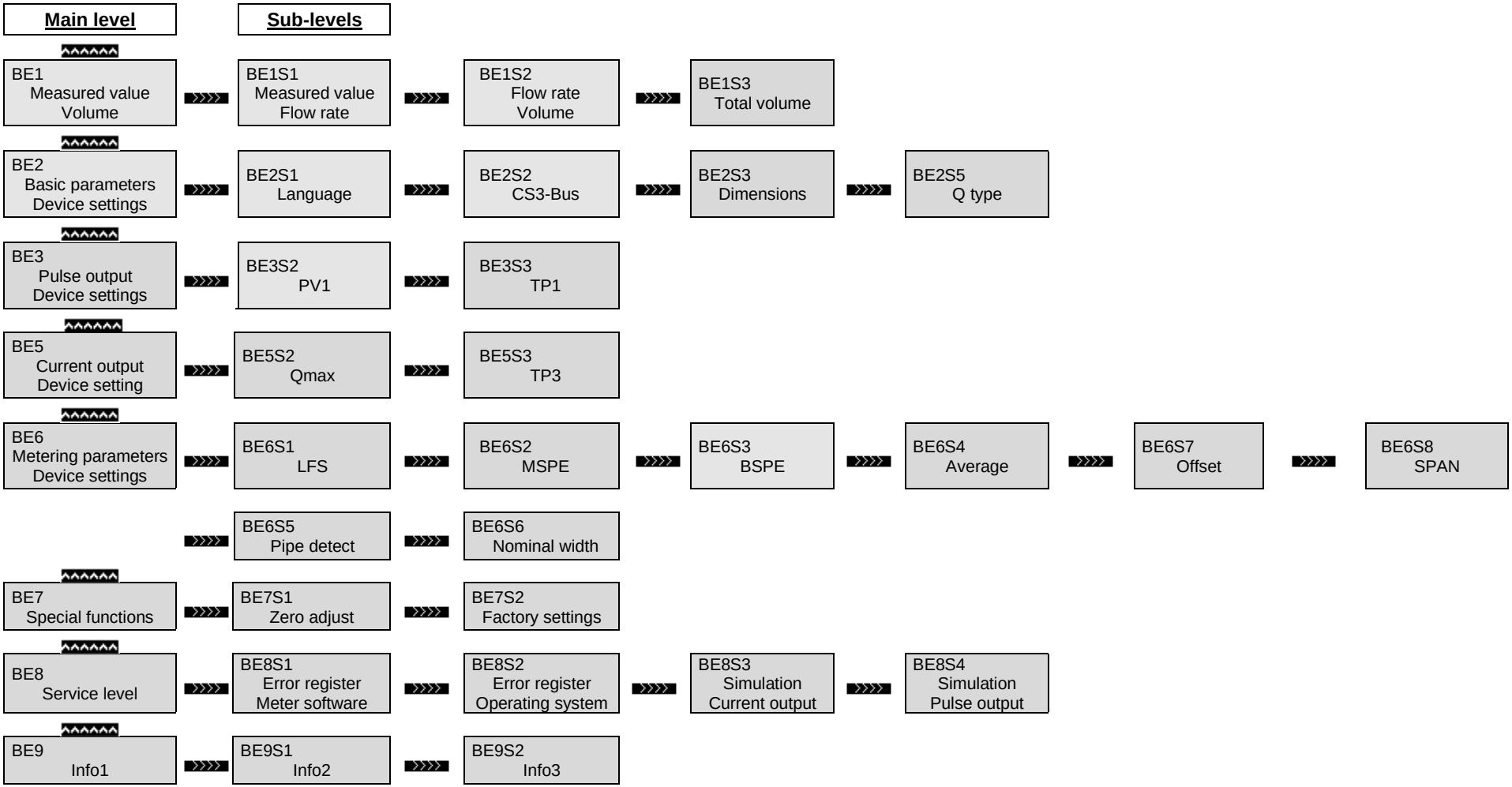
7.2. Display navigator

The display is divided into main parameter levels that contain sub-levels. Several sub-levels are allocated to each main level.
To permit a quick overview of the parameterization the main level shows the most important parameters and settings for the adjustment of the device.
The basic setting of the display navigator is the measurment display where the volume and the flow rate are displayed. A timeout function makes sure that the FMQ always returns to that display level.
The display navigator is controlled by the keys ^^^^^^, >>>> and HOME.

Basic functions of the display navigator:

- Reading the measured values
- Selecting the different functions
- Parameterization
- Service

Display navigator



7.2.1. Zero reset of the volume counter

The main display shows the volume. This image is permanently shown while the flow meter is switched on. “Zero reset” is a function which can be carried out without any additional activation. For a zero reset, please keep the ZERO key depressed for about 5 seconds.

7.2.2. How to delete malfunction messages

Possible error messages are deleted by resetting the volume counters. If they reoccur some troubleshooting may be necessary to solve the issue.

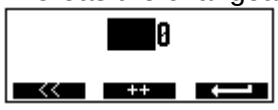
7.2.3. Parameter change

There are two kinds of parameters, in principle:
- **Setting parameters**, such as pulse mode
- **Numerical parameters**, such as the pulse duration TP1

A setting parameter is changed by the ++ key. The change key opens an input field for the entry of the numerical parameter selected.
Parameter change is only possible, if it has been unlocked during this visit to the parameter section or the unlock code will be requested automatically.

How to change a numerical parameter:

Press the change key and an input field will appear. The instantaneous value is shown inversely, whereas the changeable position is normally shown.



The ++ key changes the digit in the input position. The next left-hand input position is selected by the << key. If the numerical parameter is set to the desired value, the input is terminated and accepted by the ↵ key.

How to change a setting parameter:

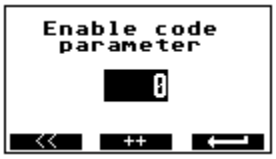
The procedure is described in example by describing a change to the “ Dimension”.

The current “Dimension” is set to “Litres”. The next “Dimension” is selected and/or adjusted by means of the ++ key.

The next “Dimension” appears on the display.

7.2.4. How to release a parameter change:

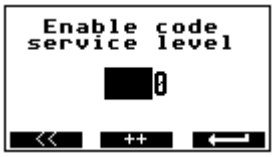
If a parameter has to be changed and the parameter change is not unlocked, the display will request the input of the code number.



Input the code number as described in item 7.2.3. If the correct code number has been input, the display will show the message “Parameter input unlocked”. In case of a wrong code number the display will show “parameter input blocked”.
Code number for the parameter change: **222.**

7.2.5. How to release the service functions:

Some service functions have to be unlocked by a code number. Unless they are unlocked, the display will show a request to input the code number.



Input the code number as described in item 7.2.3. If the correct code number has been input, the display will show the message "Service level unlocked". In case of a wrong code number the display will show "Service level blocked".
Code number for the service level: **333.**

7.3. Display level: Measured values

This level consists of the pictures BE1, BE1S1, BE1S2, and BE1S3.

7.3.1. Measured value: Volume

A 4-seconds long activation of the ZERO key will reset the volume to “0”.
The size of the digits is controlled by the size of the measured value.
The volume indication is the central image that is always shown after a reset.
The volume will be reset automatically, if the value exceeds 1.000.000.000 or falls below -100.000.000.

7.3.2. Measured value: Flow rate

The size of the digits depends on the size of the measured value.

7.3.3. Measured value: Flow rate and volume

Joint indication of volume and flow rate
The volume will be reset automatically, if the value exceeds 1.000.000.000 or falls below -100.000.000.

7.3.4. Measured value: Total quantity

The totalizer indicates the total sum of the quantities passed through the flow meter.

The totalizer cannot be reset to zero.

7.3.5. Error message: Transmitter not connected

This error message will be displayed, if the transmitter is not connected. The cause of the error is the missing coil connection.

7.4. Display level: Base parameters

This level consists of the following pictures: BE2, BE2S1, BE2S2, BE2S3, BE2S4 and BE2S5.

This level offers the possibility to make some basic settings. The main display shows the current device setting.

7.4.1. Language

Use the key ++ to change the language.
Lock code if required “222”.

7.4.2. CS3Bus address

The CS3-Bus address can be changed by means of the key ++.
Lock code if required “222”.

7.4.3. Dimension

The ++ key can be used for changing the dimension (unit) of the measured value.
You could be asked in advance to enter the unlock code.
When changing the dimension of the meter the single and total amounts will be set back on zero.

Abbreviation	Unit	m dim
l	Litres	1
m³	Cubic metres	0.001
hl	Hectolitres	0.01
ml	Millilitres	1000
gal	U.S. gallons	0.2642
gal	Gallons (CDN)	0.21997
gal	Imp. Gallons	0.21997
lb	lb raw milk	2.27189
bbl	beer barrels	0.00611
dm³	Cubic decimetres	1

7.4.4. Q type

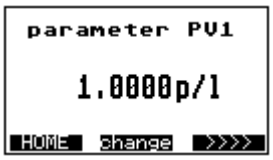
The key ++ can be used for setting the time unit of measure for the flow rate indication. Possibly the input of the unlock code is requested before.
Two different settings are possible: unit /hr or unit /min.

7.5. Display level: Pulse output

This level consists of the pictures: BE3, BE3S1, BE3S2, and BE3S3.

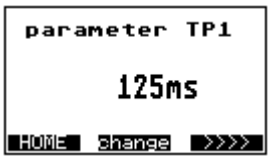
This level serves for the setting of the pulse output. The main level shows the current device setting.

7.5.1. PV1



The pulse value PV1 can be changed by the change key.
Lock code if required “222”.

7.5.2. TP1



Use the key change to change the pulse length of TP1 to ms.
TP1 is valid for Mode1 only. The value of 0 ms sets the pulse-to-pause ratio to 1:1.
Lock code if required “222”.

7.5.3. IT1

Use the key ändern to change IT1 into ms. IT1 determines how long the signal for the input will have to be available to activate the selected function.
Lock code if required “222”.

7.6. Display level: Current output

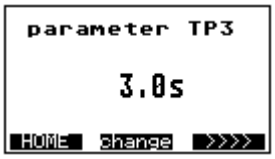
This level consists of the pictures BE5, BE5S2, and BE5S3.

On this level the settings for the current output are made.
The main level shows the current setting of the device.

7.6.1. Qmax

The key change can be activated for changing the Qmax value for the current output.
Qmax is the value for 20 mA.
Lock code if required “222”.

7.6.2. TP3



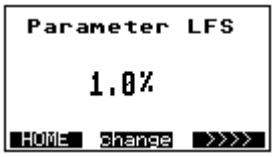
By means of the key change you can change the time delay TP3.
The current output is attenuated by this time.
Lock code if required “222”.

7.7. Display level: Metering parameters

This level consists of the following pictures: BE6, BE6S1, BE6S2, BE6S3, BE6S4, and BE6S5.

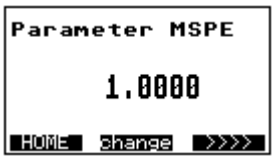
The settings for the measurement are made on this level.
The main level partially shows the current device settings.

7.7.1. LFS



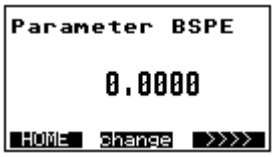
The key Change can be used to change the low-flow suppression LFS in %. The low-flow volume is calculated from the Qmax value.
Lock code if required “222”.

7.7.2. MSPE



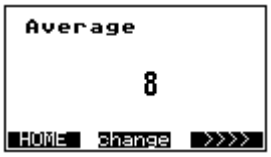
By means of the key Change you can change the multiplier MSPE.
Lock code if required “222”.

7.7.3. BSPE



Use the key Change for changing the dimensionless offset BSPE.
Lock code if required “222”.

7.7.4. Average

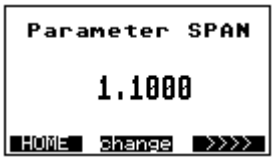


The average value can be changed by means of the key Change.
Lock code if required “222”.

7.7.5. Offset

Press the key change for changing the Offset value.
The Offset is a calibration value of the sensor which is normally <u>not changed</u>!
Lock code if required “145”.

7.7.6. SPAN



The SPAN value can be changed by the aid of the change key.
The SPAN value is a calibration value of the sensor which is normally <u>not changed</u>!
Lock code if required “145”.

7.7.7. Pipe Detect (recognition of an empty meter tube)

The empty pipe detection can be switched on and off by means of the ++ key.
Lock code if required “222”.

7.7.8. Nominal width

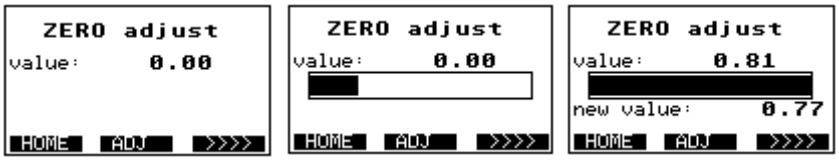
The display shows the nominal width of the transmitter.
Lock code if required “333”.

7.8. Display level: Special functions

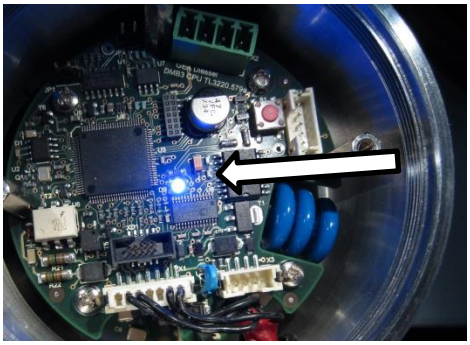
This level consists of the pictures BE7, BE7S1, BE7S2.

Special functions can be carried out on this level.

7.8.1. Zero adjust



The “ZERO adjust” measurement is activated if the ADJ key is depressed for a period of 1.5 seconds. The top line of the display shows the current ZERO value. The course of the bargraph shows the progress of the measurement. The measurement is finished when the bargraph is completely filled. The new ZERO value is displayed below the bargraph and taken over.

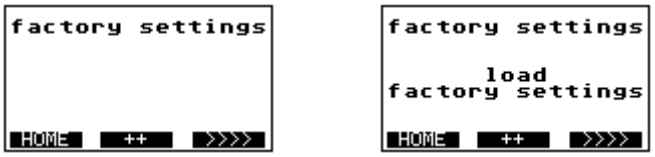


The ZERO adjust measurement can be alternatively started by means of the red ZERO adjust key (see the picture). The LED is blinking in blue colour as long as the function is active.

Important information

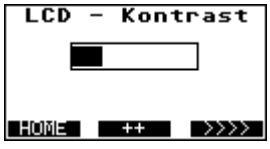
<u>Prerequisite:</u>
The meter tube has to be filled up with the liquid to be measured.
No flow rate is allowed to be available, the liquid rests.
Unless the prerequisites are observed, a faulty ZERO value will be determined and the FMQ will not be able work correctly.

7.8.2. Factory settings



All parameters are reset to the factory settings. After the execution of the function, the image navigator will change back to the image of item 7.9.
Lock code if required “333”.

7.8.3. LCD contrast



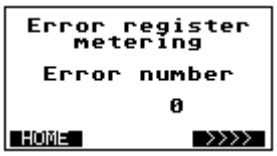
The LCD contrast level permits an optimum setting of the display contrast.

7.9. Display level: Service level

This level consists of the pictures BE8, BE8S1, BE8S2, BE8S3, and BE8S4, BE8S5.

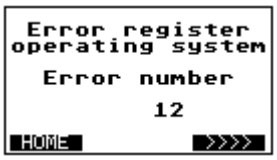
Only service values are displayed and service functions are performed on this service level.

7.9.1. Error register: Metering



This shows the error numbers of the measurement.
The error number is reset while the flow meter is set back to zero.

7.9.2. Error register: Operating system

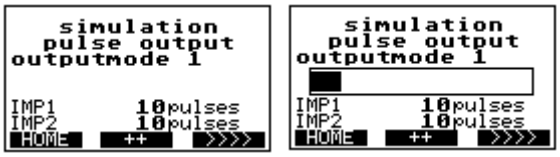


This image shows the error numbers of the operating system.

7.9.3. Simulation of the current output

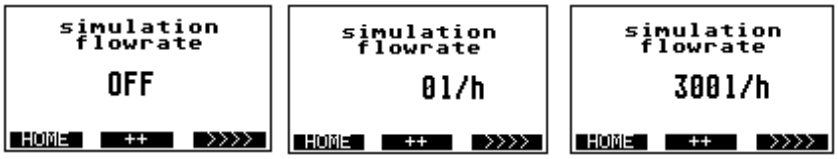
The simulation can be used to check the cable connection or to adjust an analog instrument. The first value 20 mA is set to 100 % by means of the key ++. Another activation of the key ++ will set 12 mA, 50 %. After that the key ++ is used for the setting of the value of 4 mA to 0 %. The simulated current value is determined by the current mode, see item 7.7.1. If the setting is 0...20 mA, the simulated values are 20 mA, 10 mA, and 0 mA.
Lock code if required “333”.

7.9.4. Simulation of the pulse outputs



This simulation can be used for checking a cable connection or a counting instrument or even a connected controller. According to the output mode, the number of pulses to be simulated is shown in display lines 6 and 7. The simulation is started by the key ++ and a bargraph is displayed. The simulation is finished when the bargraph is completely filled. Then the bargraph is erased.
Lock code if required “333”.

7.9.5. Simulation of the flow rate



This function can simulate the complete metrological functionality of the FMQ converter, such as the pulse outputs and the current output behave like in the normal operation. This function is suitable for the “dry” commissioning of a system or of system sections.
The ++ key starts the function. The flow reads 0 l/h. Each further activation of the ++ key increases the flow in steps of 10% of Qmax. The function stops running as soon as the maximum value is reached.
Lock code if required “333”.

7.10. Display level: Info

This level consists of the pictures BE9, BE9S1, BE9S2.
This level shows some general information which serves for the identification of the device.

7.10.1. Info1

The Info1 shows the software versions and the date of the most recent software download.

7.10.2. Info2

The Info2 image shows the hardware version and the board number of the main board.

7.10.3. Info3

The image Info3 shows whether the device is equipped with a SENSORBOX™ or a MEMBOX™. That box includes the stored parameters of the transmitter and customer-specific settings. In case of an exchange of the converter, the parameters will be transmitted with this box to the new converter.
Unless the device is equipped with a parameter box, the text “no parameter box” will be displayed.
If the text “SENSORBOX” is displayed, the memory box is specific for the FMQ. If the text “MEMBOX” is displayed, the box included in the converter has been taken from the previous device, type IZMS™.

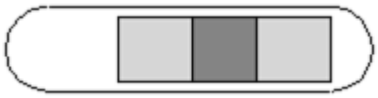
7.11. LOCK switch

From the software version V2.02 it is possible to deactivate the optical keys by means of the LOCK switch (left-hand switch position) in order to avoid operating errors. The display level (BE1, BE1S1, BE1S2 or BE1S3) that will be shown during the locked period will depend on what the display indicated at the time of locking. If the display is on another level at the time of locking, BE1 will be automatically displayed.
The LOCK status indication appears above the optical keys.

 means that the LOCK switch is active.

To terminate the LOCK mode, the switch has to be pushed into its right-hand position.

The optical keys are blocked.



The optical keys are released.

8. Parameterization

At the factory the FMQ is provided with standard calibration and configuration parameters (factory settings).

Important information

Only trained individuals authorized by the user of the flow meter should be allowed to set and/or change parameters. These individuals need to be familiar with the process and recognize the possible risks of such changes can have on the operation of the system. It is their reponsibility to take the necessary precautions to avoid creating any danger.

Take into account that changes into the parameters of the flow meter carried out while the production is running could lead to unknown consequences!

It is possible to modify the set parameters via the keypad and the display unit in principle.

The following table shows the factory settings and the limit values:

Parameters	Factory settings	Minimum value	Maximum value
CS3Bus address	32	32	64
PV1	1.0	0.0	Depending on output mode, dimension and Qmax
TP1	125 ms	0 ms	16000 ms
IT1	125 ms	0 ms	32000 ms
Qmax 100% for 20mA	Depending on the nominal width	1.0	999999.0
Q type	l/h	l/min	l/h
TP3	0.2 s	0.0 s	30.0 s
LFS = Low Flow Suppression	1.0 %	0.0 %	10.0 %
MSPE	1.0	-1000.0	+1000.0
BSPE	0.0	-1.0	+1.0
Average	16	1	128
Offset	See nameplate	-1.0	+1.0
SPAN	See nameplate	0.000001	1000.0
Pipe detect	Pipe detect	No pipe detect	Pipe detect

DN	Q max [l/h]	PV1 [pulse/l]
10	3000.0	1000.0
15	7000.0	100.0
25	18000.0	100.0
32	30000.0	100.0
40	45000.0	10.0
50	70000.0	10.0
65	120000.0	10.0
80	180000.0	10.0
100	280000.0	10.0

Table of the abbreviations used and their meaning:

Abbreviation	Function
PV1	Pulse value for IMP1
TP1	Pulse length for IMP1
IT1	Pulse length for IN1
Q max.	100% of the flow value for the current output
Q type	Setting of the flow unit
TP3	Time constant for the current output
Dimension	Unit of the volume
LFS	Low-flow suppression
MSPE	Field Calibration factor
BSPE	Calibration offset
Average	Filter of the flow signal (averaging)
Offset	Calibration value of the transmitter (Do not change!)
SPAN	Calibration value of the transmitter (Do not change!)
Pipe-Detect	Internal EMPTY pipe detection

8.1. Adjustments

The FMQ normally needs no calibration adjustment.

Usually, the zero point adjustment ("**ZERO adjust**") is carried out only during the first commissioning.

If, however, some deviations have to be compensated for which were determined when comparing with a calibration vessel or a balance it is possible to make an adjustment using the "**m spe**" value.

However, before you will start carrying out an adjustment on the meter it is best to answer the following questions first:

- Are you sure that the reference standard (reference meter, balance, or calibrated vessel) does really deliver an exactly comparative value?
- Is there repeatability in the data that is being created,is the difference the same from measurement to measurement?

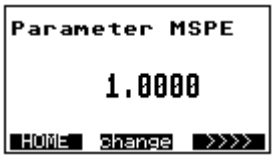
  Take into account that differently emptying pipelines, a missing break-off edge for the liquid or temporary air occlusions will lead to faulty results during the measurement!

- Is there a possibilty that any of the liquid being measured is not making it to the reference either through a leak or diversion point?
- Is the liquid clean and free of any air or gas?
- Are the flow rate used within the limits of the meter?
- Is the conductivity of the product within the required tolerance?

An adjustment is only reasonable if repeatable deviations have been measured during the comparative measurements.

8.1.1. Adjustment by calibration factor "m spe"

The adjustment by the calibration factor "**m spe**" can be set using the optional display.



The factory set value is 1.0000

The calibration factor is calculated by means of the following formula:

V_{ref} → Target volume (e.g. calibration vessel, balance, or the like)

V_{dis} → FMQ display

An example is shown overleaf:
Example:

Deviation **ΔF** of +0.54% determined during a comparative measurement

Calibration vessel: V_{ref} **= 5000 L**

Display: V_{dis} **= 5027 L**

$$m\ spe = \frac{5000}{5027} \bullet 1.0 = 0.9946$$

This would mean that we would set the m spe value to 0.9946

8.2. Measuring accuracy

Flow linearity: ± 0.5 % ± 2 mm/s under reference conditions
Reproducibility: ± 0.1 %

Reference conditions for the determination of the measuring accuracy.

According to DIN EN 29104 and VDI/VDE 2641:

- Temperature of the measured product: +20°C ± 10 K
- Ambient temperature: +20°C ± 5 K
- Flow velocity: 0.5 – 12 m/s
- Product: Water (typical 500µS/cm)
- Warm-up period: 30 minutes

Installation:

- Inlet pipe section > 10 x DN
- Outlet pipe section > 5 x DN
- Transmitter and converter are earthed/grounded.
- The transmitter is positioned in the centre of the pipeline.

9. Trouble-shooting

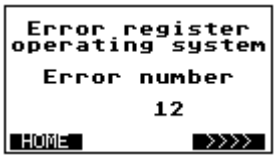
9.1. Error diagnosis

The FMQ is equipped with an integrated self-diagnostic system.
Malfunctions are recognized and automatically removed, if necessary.

9.1.1. Error diagnosis via the display

Displayed messages can support the troubleshooting in case of malfunction or faulty measurement. A distinction is made between error messages for the measurement or for the operating system. The messages are displayed on the service level:

Error message for the measurement



Error message for the operating system

Usually, all displayed messages are erased when the volume is reset to zero. In case of a permanent malfunction, however, the message will be reactivated over and over again.

9.1.2. Error list

Error No.:	Diagnosis	Remedial actions
905	Error found on the occasion of the internal examination of the quantity registers	a. The measuring result can be falsified due to the interference received. - Reset the message by resetting the individual quantity to zero! b. Check the whole installation for possible EMC interference sources; frequency converters have to be laid into separate cable channels! - Ensure good shielding and earthing/grounding for all devices!
963	Pulse output of the output channel **IMP1** is exceeded.	- Reduce the flow rate! - Reduce the pulse value "**pv1**"!
3031	Parameters of the transmitter cannot be saved.	Replace the converter!
3034	Calibration parameters of the electronics are faulty.	Replace the converter!
3035	Free parameters are faulty.	Replace the converter!
3036	Parameters of the transmitter are defective: Checksum error.	Replace the converter!
3037	Base parameters for the measurement are faulty: Checksum error.	Replace the converter!
3052	Meter parameters are faulty: Checksum error.	Replace the converter!
3063	Pulse value "**pv1**" set for the counting output **IMP1** is too high (>1000 Hz).	Reduce the pulse value "**pv1**"!
3070	One of the calibration factors is set to zero.	Input the respective factor (SPAN)!
3083	The "ZERO adjust" measurement has not been accepted.	During the adjustment the flow rate was not "zero".Establish zero flow and zero-adjust

9.2. Typical effects or error sources

Disturbances or malfunctions can normally be recognized by the aid of the display unit only.

9.2.1. **Flow without flow rate indication:**

(a) Is the conductivity higher than 5 µS/cm? Is the conductivity in case of demineralised water higher than 20 µS/cm?

(b) Does the internal **EMPTY pipe detection** need to be switched off?

Check whether the display shows “0 L/h” while the flow is running!

If “adsum 0” is displayed, the internal EMPTY pipe detection is active! This is the case, when:

- The conductivity of the liquid is below 50 µS/cm.
- The type of transmitter connected is smaller than DN 15.
- A heavily pulsating flow is available.

To make sure that the electronics are working correctly, use the existing simulating function (hardware or software) for further diagnosis of the digital or analog output!

9.2.2. **No pulse transmission despite displayed flow**

(a) Is the polarity of the pulse counter correctly connected?

(b) Check the parameters:
- Is the pulse value too low? (Parameter setting)

Use the simulating function for further diagnosis (hardware or software)!

9.2.3. **No analog signal available**

If no analog signal or a faulty analog signal is measured, the following checks are recommended to be carried out:

a. First the connected measuring system (digital display, PLC or the like) has to be disconnected from the FMQ. The analog output signal then should be checked by using the simulating function on the meter and an ammeter:

- If the analog output is ZERO at a 50% simulation, the FMQ electronics are defective making replacement of the converter required.
- If the analog output remains constant at 20 mA, the internal “current mode” parameter could be set wrong. Verification is possible by means of the display unit.

b. If the problem only occurs when the external device is connected then the following should be checked:

- If the burden of the whole current loop is higher than 500 Ω?
  (Observe the technical data sheets of the connected devices!)
- If the input of the external evaluating device is incorrectly configured for a passive input?
  Faults can especially occur upon a connection to a PLC due to the fact that it might both have an "**active**" and a "**passive**" configuration.

c. If nonlinearities occur over the whole range from 0 - 100%, it should be checked:

- Whether the burden of the whole current loop is higher than 500 Ω?

9.2.4. Deviations of measured values

a) Is there a time-related connection between the occurrence of the problem and some modifications to a system in the vicinity of the measuring device?

b) Does the deviation show more or less similar values or a constant shift or does it heavily deviate in both the positive or negative direction?

c) Has something been repaired or replaced on this device or something that may impact such as a pump?

d) Does the deviation always occur at a certain point of time (e.g. on Mondays at the start of production, on the early shift, or the like) or at certain steps in the process?

e) If a display unit is connected, the measuring signals can be checked by means of the service data while the flow is static.

- Change the display to the presentation of the measured values "adsum" which may be fluctuating between -300 ... +300 units at a maximum.
- If you carry out several zero point measurements ("ZERO adjust"):
  The displayed value is not allowed to change by more than 10 units among the repeated measurements.

Unless stability exists, the earthing/grounding of the transmitter will have to be checked.

f) The same above verification of adsum can be carried out with a full meter tube while the transmitter is removed as a whole from the pipeline. This allows for isolation from any interfering influences such as electrical disturbances or a leaking valve in the system piping.

g) In case of moisture or other faults in the transmitter or converter it will be necessary to replace the flow meter with a new one.

h) Check the pipe path for the possibility of places where liquid may be able to by-pass equipment or the possibility of air entrainment (faulty seals).

Check the reference measuring methods or the test procedure (reference meter such as a scale):

- Take into account the temperature compensation of the volume.
- If different products are compared with the value of the scale, a conversion will need to be made for the change in density.

Or pay special attention if the actual amount of deviation stays the same regardless of the total quantity that is delivered.
If so, possible reasons could be:

- A start and stop of the measurement while the meter tube is empty.
- A situation where the piping does not maintain a consistent amount of fill due to a poorly configured drop location or back flow from a leaking valve.

i) Low conductivities or pulsating flow upon the use of the internal **EMPTY pipe detection**.

9.3. Error reset

Error messages and error outputs can be reset:
(a) By a zero reset of the quantity counter
(b) Automatically after a maximum period of 30 seconds, unless any further fault did occur.

9.4. Transmitter tests

9.4.1. Visual check

The transmitter can be optically checked while being disassembled:

Reason	Action
Humidity in the connection housing	Dry the housing and perform an insulation test subsequently!
Damaged PFA liner	Replace the transmitter; check the seal!

Table: **Visual check**

10. Maintenance

10.1. Safety instructions for maintenance work

Maintenance and repair work must only be carried out by skilled personnel with the authorization from the user.

The persons involved need to be familiar with the process sequence and be able to recognize possible dangers and to take all necessary steps to remove imminent risks of accidents.

Caution

First ensure your personal safety before you will start carrying out any service and maintenance work!

- Appropriate measures have to be used to guarantee a safe condition (approved ladders, lifting platforms, safety harnesses, etc.).
- Applicable tools and personal protective measures are necessary.
- Before you start working at electrical or rotating equipment, make absolutely sure that the equipment concerned is disconnected from the power supply network! An unintended restart has to be avoided using suitable safety precautions (information signs or padlocks).
- Fittings and instruments and their contents can be hot! First permit them to cool down before you will start working at such parts!
- If fittings and instruments have to be removed from the pipe system, the whole pipe system has to be completely emptied, depressurized, and protected by some appropriate shut-off.
- Rinse the pipe system with clear water before the disassembly of fittings or instruments in order to remove possible residual chemicals!

10.2. Routine maintenance

On normal operating conditions the flow meter type FMQ does not require any special maintenance work.
Nevertheless, we wish to give you some recommendations for maintenance steps:

Cleaning

Deposits in the meter tube or at the electrodes will cause measuring errors or malfunctions.

This can be achieved with a regular cleaning of both the pipelines and the flow meter!

During the external cleaning there should be no use of high-pressure steam-jets directed to the housing parts!

In case of flow meters with the optional integrated display the external cleaning temperature must not exceed 50 °C.

The pane of the operating unit should only be cleaned by means of clear water and a soft cloth.

The FMQ transmitter is suitable for use in CIP environments.

Regarding the cleaning, disinfecting, and flushing agents and procedures we refer to the manufacturers and the relevant guidelines of the food processing industry.

Seals

The process seals require servicing that should align with plant process connection replacement.

Accuracy test

Accuracy tests of the flow meter should be carried out under the guidance of your in-house quality/metrological requirements.

A regular calibration by the Service Engineers of Anderson-Negele increases the confidence in the performance of the flow meter.

10.2.1. Preventive maintenance steps

A regular maintenance of the measuring installation is useful in order:

- To avert any danger for persons and the environment
- Maintain product quality
- To improve the service life of the system and its components

The preventive maintenance steps for the flow meter type FMQ refer to the **seals of the pipe connections**.

Recommended maintenance intervals are a result of the experience in other systems. However, the really required maintenance intervals can considerably differ from that experience for the following reasons:

- Daily running time and number of the annual production days
- Aggressiveness of the media
- Frequency of cleaning phases, especially with hot water and caustic solution as well as disinfectants
- Duration and temperature of the cleaning phases
- Possible drying on of product residuals

Anderson-Negele recommends comtinuous monitoring of the measuring installation:

The **operators** of the system should pay attention to:

- occurring leaks
- unusual measuring results

Regular maintenance:

The following different strategies are offered as suggestion:

1. A consequent replacement of **all** seals and wearing parts in regular intervals, e.g. every year. Exceptions have to be allowed as a matter of course.
2. Replacement of heavier stressed seals and wearing parts in short intervals (e.g. once a year) and of less stressed parts in larger intervals (e.g. every 2 years). It is important that the serviced components are marked accordingly.
3. Exchange of the seals and wearing parts when required (e.g. when leaks occur). On that occasion it is reasonable to replace the wearing parts in the whole adjoining area, especially of the strongly stressed parts. It is indispensable to mark the serviced components accordingly.
4. Accuracy tests of the flow meters of the system in regular intervals in the frame of the in-house quality/metrology standards. **Of course, the aforesaid regular maintenance work can be carried out by the specialists of the Anderson-Negele service department, if preferred.**

10.3. Repairs

10.3.1. Sending-in the flow meter to the manufacturer

If repairs have to be carried out at the factory, the following conditions will have to be fulfilled in order to ensure a quick and cost-effective settlement.

- The components/devices have to be packed in such a way that damage in transit is excluded.
- A RMA “returned materials authorization” needs to be completed online and referenced in the returned shipment.

Warning:

- Do not send back to the manufacturer any measuring devices, if you are not absolutely sure that you could completely remove before any harmful substances which are detrimental to health, e.g. such substances which penetrated through gaps or slots or which diffused through plastic material!
- The user of the flow meter will be charged for such costs arising for a potential disposal of the device or for personal injuries (e.g. chemical burns, etc.) caused by the device as a result from an insufficient or missing cleaning before sending in the flow meter to the manufacturer.

10.3.2. Repair work

Repairs are allowed to be carried out by skilled personnel only. Repairs to the circuit boards are impossible. Only complete converters can be exchanged.

For each repair it is indispensable to strictly observe the general maintenance safety instructions.

A replacement of components in the fitting position should be avoided for the following reasons:

- Lock washers could drop out and be left on the electronic part when the fastening screws are loosened.
- Metal particles could destroy the electronic part when the power supply is switched on.
- When the electronic housing is open there is the risk that moisture could drip down onto the electronic boards. Moisture immediately destroys the electronic components when the power supply is switched on.

For all kinds of repairs the flow meter has to be definitely separated from the power supply!

10.3.2.1. Replacement of the sealing cover of the display unit

The sealing cover will have to be replaced if the front pane is destroyed or scratched and if the display unit does not function.

10.3.2.2. Replacement of the transmitter

Before replacing the transmitter, ensure that the pipe system is empty and unpressurized!
Flush the pipe system before the removal of the transmitter with clear cold water in order to avoid any residues of chemicals or elevated temperatures.

The distribution voltage for the electronics has to be switched off.

Following replacement carry out a zero point measurement ("**ZERO adjust**") with the new transmitter in order to optimize the accuracy of the flow meter!

10.4. Special program functions

The program functionality of the FMQ offers some functions that can support troubleshooting the meter. It is also possible to use those functions for the adjustment and verification of connected devices.

10.4.1. Flow simulation

As an adjusting aid or for diagnosing purposes of connected devices the FMQ offers the possibility to simulate flow without any flowing product.

10.4.2. Simulation via the display unit

Select the "SIMULATION" function by means of the keypad.

During the simulation the analog output is set to 12.0 mA (4...20 mA setting) or 10.0 mA (0...20mA setting). The volume pulses are produced for the flow of 50 % according to the set pulse value.

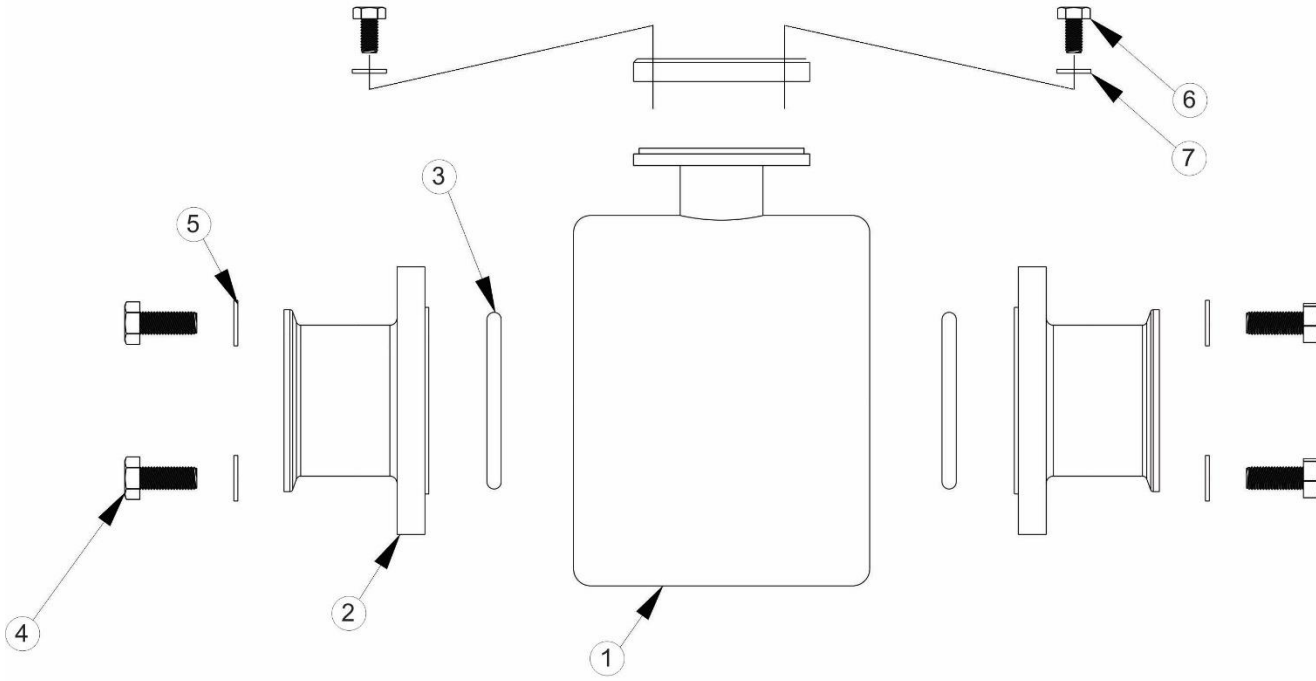
10.5. Spare parts

The spare parts list results from the experience in the different applications of the flow meter. However, the actually required spare parts may be deviating from it for the following reasons:

- Daily running time and number of the annual production days
- Aggressiveness of the media
- Frequency of the required cleaning phases, especially with hot water, caustic solution, and disinfectants
- Duration and temperature of the cleaning phases

ITEM	PART NUMBER	DESCRIPTION
1	SEE TABLE 2	FLOWTUBE
2	SEE TABLE 2	ADAPTORS
3	SEE TABLE 2	ADAPTOR O-RINGS
4	33720T200908	ADAPTOR BOLTS 3/4" THRU 2-1/2"
	33720T2009010	ADAPTOR BOLTS 3" & 4"
5	45678M0809	ADAPTOR WASHERS 3/4" THRU 2-1/2"
	45678M1009	ADAPTOR WASHERS 3" & 4"
6	33720T120906	HOUSING BOLTS
7	45678M0609	HOUSING WASHERS

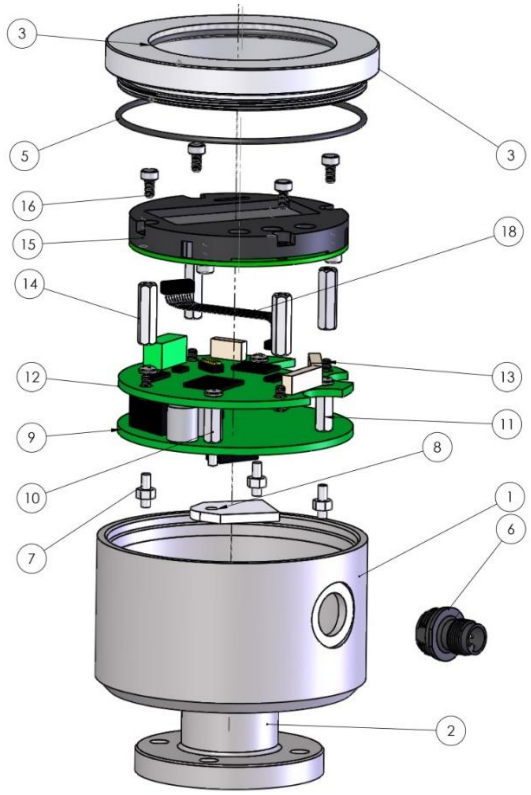
TABLE 1



Size	Flow tube	Adapters			Orings	
		DIN 11864-2 Butt Weld Flange	ASME Clamp Connection	DIN Clamp Connection	EPDM	Silicone
010	IZAG010XX0	45672A0010	56721A0010	56721G0010	45669A0010	45669B0010
015	IZAG015XX0	45672A0015	56721A0015	56721G0015	45669A0015	45669B0015
025	IZAG025XX0	45672A0025	56721A0025	56721G0025	45669A0025	45669B0025
032	IZAG032XX0	45672A0032	56721A0032	56721G0032	45669A0032	45669B0032
040	IZAG040XX0	45672A0040	56721A0040	56721G0040	45669A0040	45669B0040
050	IZAG050XX0	45672A0050	56721A0050	56721G0050	45669A0050	45669B0050
065	IZAG065XX0	45672A0065	56721A0065	56721G0065	45669A0065	45669B0065
080	IZAG080XX0	45672A0080	56721A0080	56721G0080	45669A0080	45669B0080
100	IZAG100XX0	45672A0100	56721A0100	56721G0100	45669A0100	45669B0100

TABLE 2

Maintenance



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	45673B0002	TERM HOUSING	1
2	45676A0001	FLANGE TERM ENCL	1
3	44886A0001 87004A0001	CAP ITM SS Blind Cap	1 1
4	44887A0001	WINDOW ITM	1
5	36241N0017807900	79MM O-RING	1
6	56623D0004 56623D0006 SP56623D0005	RCPT MACH EURO TO M16 ASY RCPT 4CNDT IOLINK FMQ	1 1 1
7	44401E3199	M3 x 3mm x 5mm MALE MALE STANDOFF	3
8	42068A0001	HEAT SINK FMQ	1
9	FMQ-EL-DC-BOC1	FMQ ELECTRONICS 1	1
10	44401E2108	M3 x 13mm MALE FEMALE STANDOFF	1
11	44401E1108	M3 x 13mm FEMALE STANDOFF	3
12	FMQ-EL-DC-BOC	FMQ ELECTORNICS 2	1
13	92492A116	M3 PAN HEAD PHILLIPS 6MM LONG	8
14	44401E1109	M3 x 20mm FEMALE STANDOFF	4
15	IZMAG-DB-BOC	IZMAG DISPLAY	1
16	91292A111	M3 SCREW	4
17	36241N0020006200	62MM O-RING	1
18	46029A0001	FMQ RIBBON	1
9 & 12	FMQ-EL-IOLINK	All electronic boards for IO-LinK	1
7,8,10,11,13	FMQ-EL-IOLINK-MT	Mounting kit for IO-Link boards	1

11. Decommissioning

11.1. Temporary decommissioning

If the device is to be put out of operation for a temporary period only, no special measures have to be observed for its later recommissioning.
If the transmitter is removed from the process line, the pipe system first has to be emptied and depressurized.

Before removing the transmitter, flush the pipe system with clear cold water in order to avoid any residues of chemicals or elevated temperatures.
Attach the covers for the protection of the liner.

11.2. Final decommissioning / disposal

If the whole device is defective and beyond repair, you should take into account for the final decommissioning that wastes, contrivances, and system components to be scraped will have to be disposed of according to the valid laws, decrees, and regulations for waste disposal.

Maintenance

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