OPERATING MANUAL

Electromagnetic Flow Meter FMQ

In allegato
ISTRUZIONI PER LA MESSA IN SERVIZIO
(in italiano)

Table of contents

1. General description

1.1. Preface

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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.
Negele Messtechnik GmbH 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 in principle.

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: 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

For further technical data please refer to item 5.3.

1.3.2. Transmitter in compact design

Transmitter		Compact version
Process connection:		Aseptic flange
Nominal widths:		DN 10, 15, 25, 32, 40, 50, 65, 80, 100, 125, 150
Optional product connections:		Clamp, dairy pipe, small flange, etc.
Materials:	Meter tube:	Material no.: 1.4301 / AISI 304
	Liner:	PFA
	Electrodes:	Material no.: 1.4404 / AISI 316 L
	Housing:	Material no.: 1.4301 / AISI 304 (blasted)
Protection class:		IP67
Electrical connection:		Internal cable connection Calibration data included in the associated converter
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) Maximum: 10 bar (DN125 – DN150) *
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
125	4,400	-	440,000	44,000	L/h
150	6,400	-	640,000	64,000	L/h

* See 8.2 “Measuring accuracy”.

2. Safety instructions

Due to the great variety of possible conditions of use, this instruction manual can consider 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 diligence of the user

This measuring instrument has been designed and built in consideration of a risk analysis and after a careful choice of the harmonized standards and further technical specifications to be kept. It corresponds to the state of the art and offers an optimum safety.

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

In practical use, however, that degree of safety can only be obtained when all measures required in this respect will be really taken. It belongs to the diligence of the user of the flow meter to plan such measures and to check and survey if they are really fulfilled.

In particular, the user has to ensure that:

- The measuring instrument is only used for the intended application as directed (also see the following chapter “Intended use”).

- The measuring instrument is operated in a perfect and functioning condition and that especially the safety devices are regularly checked for their proper operation.

- The personal protective equipment required for the operating, maintenance, and repair staff 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 sufficiently qualified and authorized personnel only.

- The personnel concerned is regularly trained for all applicable questions of the protection of labour and environment and familiarized with the instruction manual and especially the safety precautions included therein.

- All the safety and warning instructions attached to the measuring instrument are not removed and kept in a legible condition.

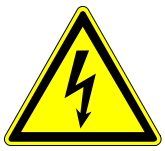
In case of problems that he cannot remove on his own, the user of the system should contact the service department of **Negele Messtechnik GmbH**.

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 measuring instrument
- To prevent any faulty batches upon the production

The electric connection may only be carried out by persons who have got the necessary expert knowledge (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!

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 up-to-date state of the art. Also refer to **chapter 5** “Installation”/”Electrical Connection”.

In particular, the following references have to be observed:

- Safety instructions
- Electrical connection data

1. All persons who are involved in the installation, commissioning, operation, service, and maintenance of the flow meter have to be qualified accordingly.
2. This instruction manual has to be strictly observed. The user of the flow meter has to guarantee that the personnel concerned has read and fully understood the instruction manual.
3. All kinds of work have to be done with utmost care and may be carried out by accordingly authorized and trained personnel only. At any rate the directives of the respective country for opening and repairing the devices have to be considered.
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 put out of action any safety devices by modifications to the flow meter!
9. Do not touch any parts flown through by the medium while the measuring instrument is cleaned. Otherwise, you run the risk of getting burnt!

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 an inexpert performance of work any warranty claims will definitely extinguish.

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

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

2.2. Intended use

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

- the connection to an earthed monophase network or 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 Negele Messtechnik GmbH.

Possible misuse

Any utilisation being in contradiction to the above-mentioned application means an inadmissible misuse of the measuring instrument! In such a case Negele Messtechnik GmbH does not assume any responsibility for the safety.

Negele Messtechnik GmbH has to be contacted before the flow meter will be used for any different application, and after a careful investigation of all facts Negele Messtechnik GmbH could possibly release the flow meter for the intended new application.

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 at a safety-related flawless 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 inexpertly 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 respected in order to avoid damages to the measuring instrument or injuries during the transport of the device:

Caution

Transport work is only allowed to be carried out:

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

The packing of the measuring instruments 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!

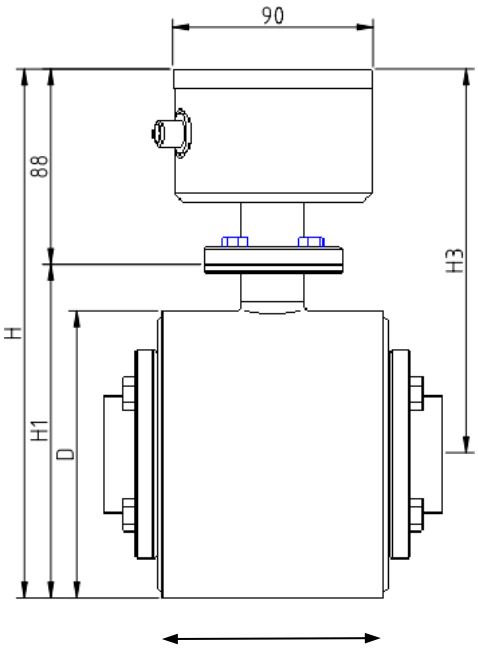
Please do not fail to dispose of the packing material according to the appropriate regulations.

3.2. Special notes

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

3.3. Dimensions and weight

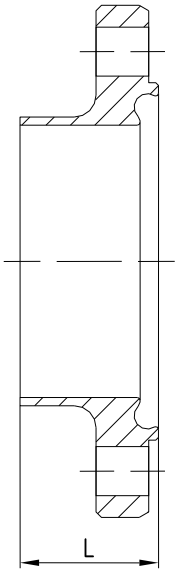
3.3.1. Compact version



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
125	250	220	355	240	245	27.0
150	300	220	355	240	245	30.0

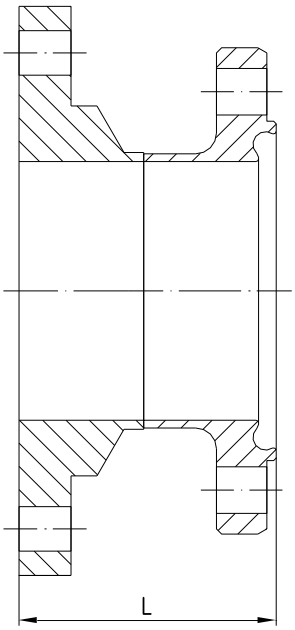
3.3.2. Dimensions of the process connections

Welding socket (standard)



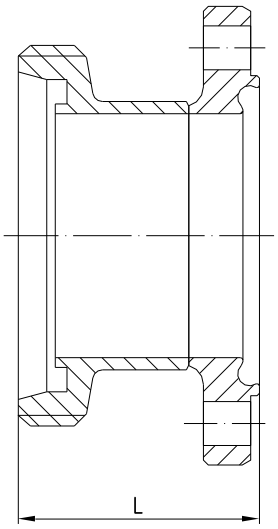
Nennweite	L
DN 10	25,5
DN 15	25,5
DN 25	25,5
DN 32	25,5
DN 40	25,5
DN 50	25,5
DN 65	25,5
DN 80	27,5
DN 100	27,5
DN 125	29,5
DN 150	29,5

FG hygienic flange



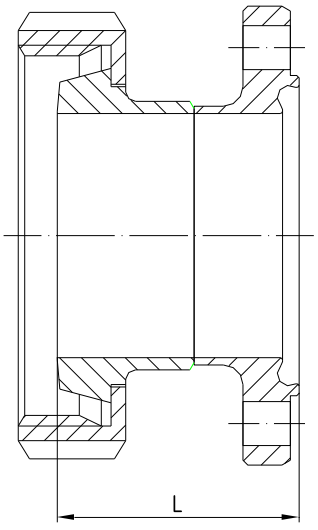
Nennweite	L
DN 10	49,5
DN 15	49,5
DN 25	49,5
DN 32	49,5
DN 40	49,5
DN 50	49,5
DN 65	49,5
DN 80	49
DN 100	71,5
DN 125	56,5
DN 150	56,5

Threaded socket DIN 11851



Nennweite	L
DN 10	49,5
DN 15	49,5
DN 25	49,5
DN 32	49,5
DN 40	49,5
DN 50	49,5
DN 65	49,5
DN 80	49
DN 100	71,5
DN 125	56,5
DN 150	56,5

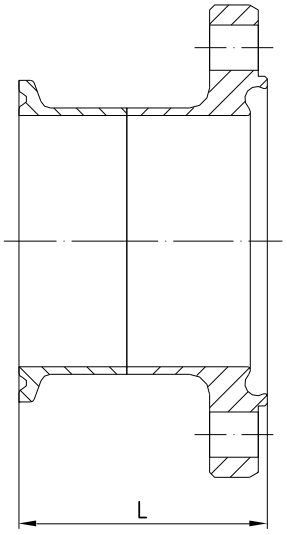
Conical socket / grooved nut DIN 11851



Nennweite	L
DN 10	49,5
DN 15	49,5
DN 25	49,5
DN 32	49,5
DN 40	49,5
DN 50	49,5
DN 65	49,5
DN 80	49
DN 100	71,5
DN 125	56,5
DN 150	56,5

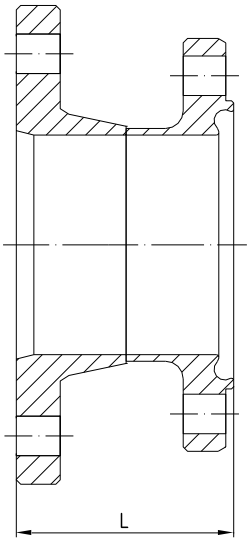
Transport

TriClamp DIN 32676



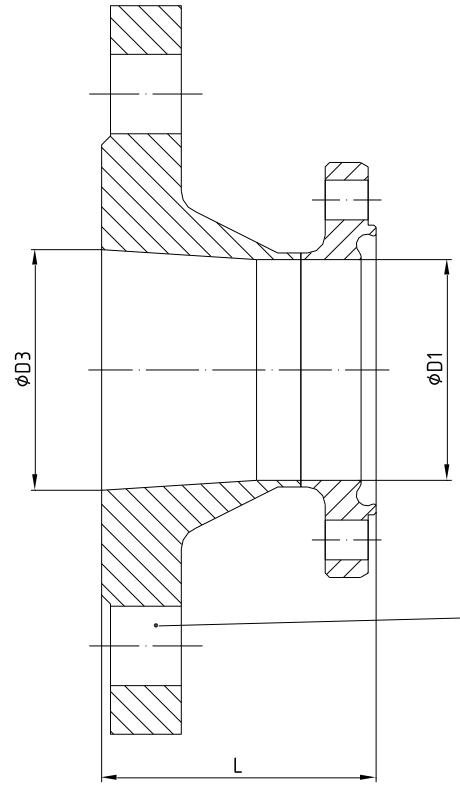
Nennweite	L
DN 10	49,5
DN 15	49,5
DN 25	49,5
DN 32	49,5
DN 40	49,5
DN 50	49,5
DN 65	49,5
DN 80	49
DN 100	71,5
DN 125	56,5
DN 150	56,5

Varivent flange



Nennweite	L
DN 10	49,5
DN 15	49,5
DN 25	49,5
DN 32	49,5
DN 40	49,5
DN 50	49,5
DN 65	49,5
DN 80	49
DN 100	71,5
DN 125	56,5
DN 150	56,5

DIN flange EN ISO 1092-1



Nennweite	PN	ØD1	ØD2	ØD3	L
DN 10	16	10	13	13,6	49,5
DN 15	16	16	19	17,3	49,5
DN 25	16	26	29	28,5	62
DN 32	16	32	35	37,2	62
DN 40	16	38	41	43,1	62
DN 50	16	50	53	54,5	62
DN 65	16	66	70	70,3	74,5
DN 80	16	81	85	82,5	74
DN 100	16	100	104	107,1	71,5
DN 125	10	125	129	131,7	84,5
DN 150	10	150	154	159,3	84,5

All undimensioned parts are according to DIN EN 1092-1
PN16, type 11, shape B (DN 10…100)
PN10, type 11, shape B (DN 125…150)

4. Arrangement

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 measuring instrument 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
Achtung

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 levelled out (e.g. to avoid vibration)
- the meter tube can be emptied in case of the danger of frost
- the measuring instrument is not arranged straight above a gully or sink hole
- the connection housing is not permanently exposed to drip water

4.1.1. Parts of air and gas

The electromagnetic measuring instrument can supply perfect measuring results in case of **gas-free liquids** only. Air locks or deaeration in a liquid will lead to faulty measurements.
Thus, make sure that air locks or other possible parts of gas are safely separated before the measuring device e.g. by gas separators or that deaeration can be excluded by a sufficient working pressure.

The measuring device is not damaged e.g. by air locks.

4.1.2. Solid parts

Normally, solid parts do not have any negative influence on the volume measurement.
The pipe diameter should always be chosen sufficiently large in order to prevent the meter tube from being clogged in case of products including solid particles.

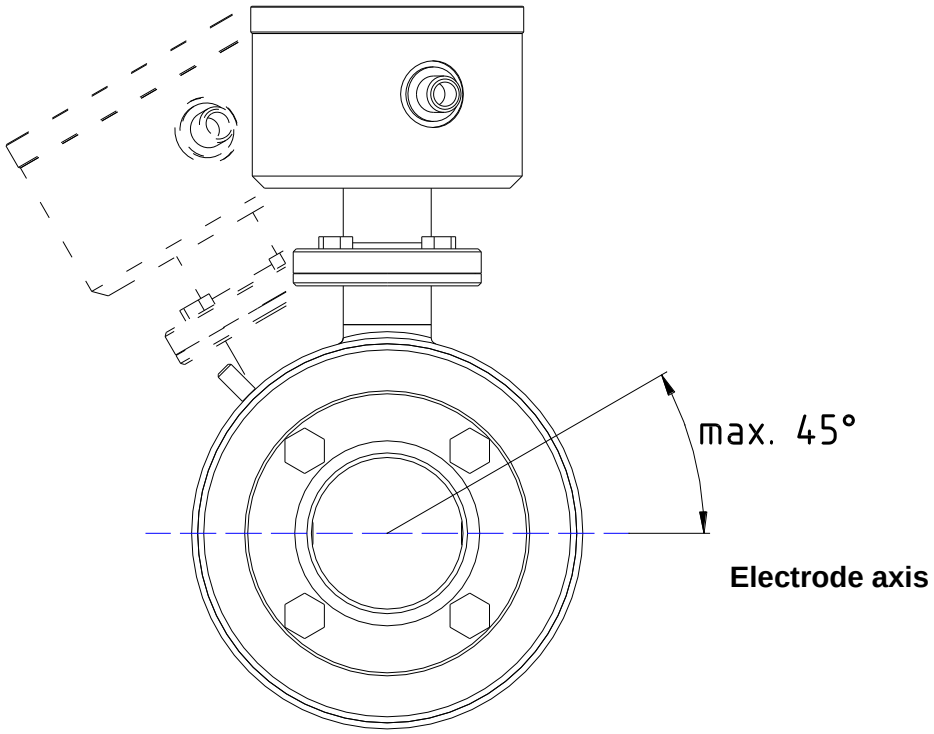
Due to the fact that the flow velocity of solid matters is relatively lower than that of the liquid part of the product, a higher flow fluctuation could be caused while the flow rate is determined.
The measurement of abrasive materials can cause a drifting of the measuring accuracies and, in the end, a deterioration of the transmitter.

4.1.3. Fitting position – electrode axis

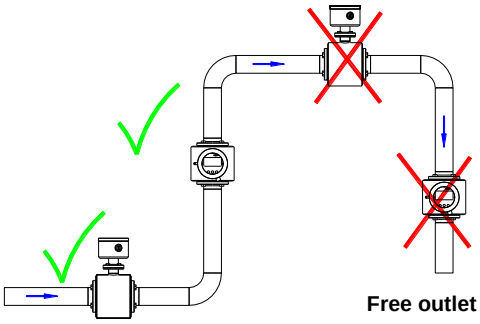
Due to the principle described, the fitting position – to a certain extent – can be selected any way desired. The basic condition for accurate measuring results is, however, a full and gas-free meter tube.
If possible, the electrode axis should be horizontally arranged, in order to avoid a deposition 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 a good readability and handling of the operating unit is guaranteed.

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



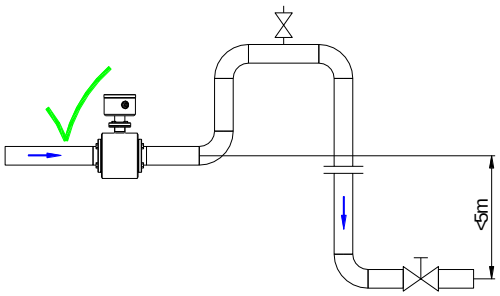
Suggestions for installation



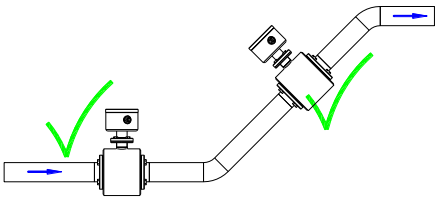
Wrong
At the highest point of the pipeline. Gas bubbles accumulate in the transmitter. → Faulty measurement!

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

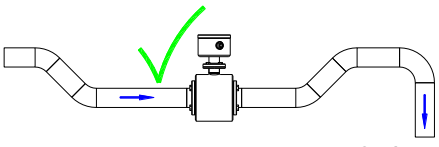
Correct
Preferred mounting position:
Rising pipeline and horizontal pipe section before an ascending pipeline



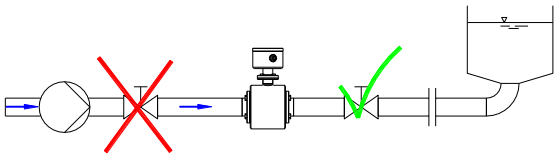
Descending pipelines of a length of more than 5 m have to be equipped with a deaeration valve after the flow meter.



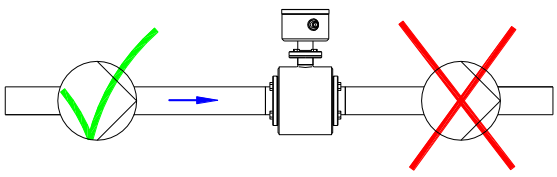
Correct
In case of a horizontal pipe conduct the mounting position is placed in slowly increasing sections of the pipe.



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

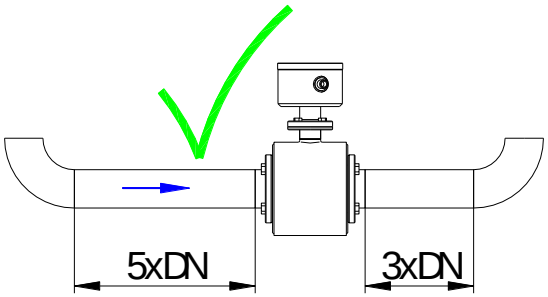


Long lines **after** the flow meter always have to be equipped with a shut-off device. If it is placed before the flow meter, a vacuum will be caused in the metering pipe by the big kinetic energy in the liquid column when shutting off. This can damage the lining of the tube!

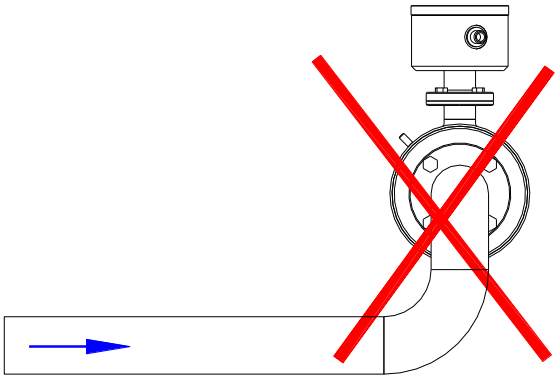


Do not place the flow meter on the suction side of the pump! → **Danger of negative pressure!**

Arrangement



Keep the recommended inlet and outlet sections!



Avoid curvatures of space before the flow meter!

4.1.4. 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.

4.1.5. 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 belongs to the standard equipment of the converter. That function will have to be switched off at conductivities below 50 µS/cm (‘Pipe Detect’ off).

In case of low conductivities it is recommended to carry out a calibration under operating conditions.

4.1.6. Interference fields

Straight at the transmitter masses of iron or strong permanent or electromagnetic fields must absolutely not exist, as they could influence the defined exciting magnetic field, thus falsifying the signal.

4.1.7. Earthing/grounding conditions

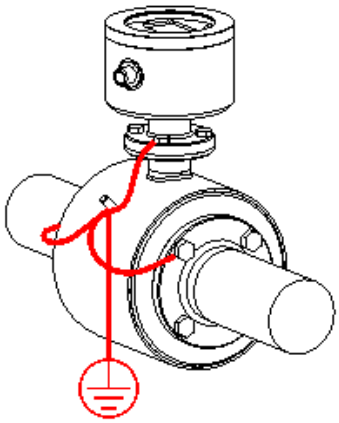
A perfect earthing/grounding of the transmitter is an essential requirement for a reliable and accurate measurement.

“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.

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:



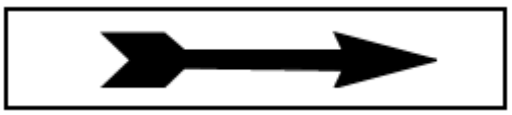
4.1.8. Meter tube lining

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 converter 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 is only slightly different.

4.3. Conditions required for the converter

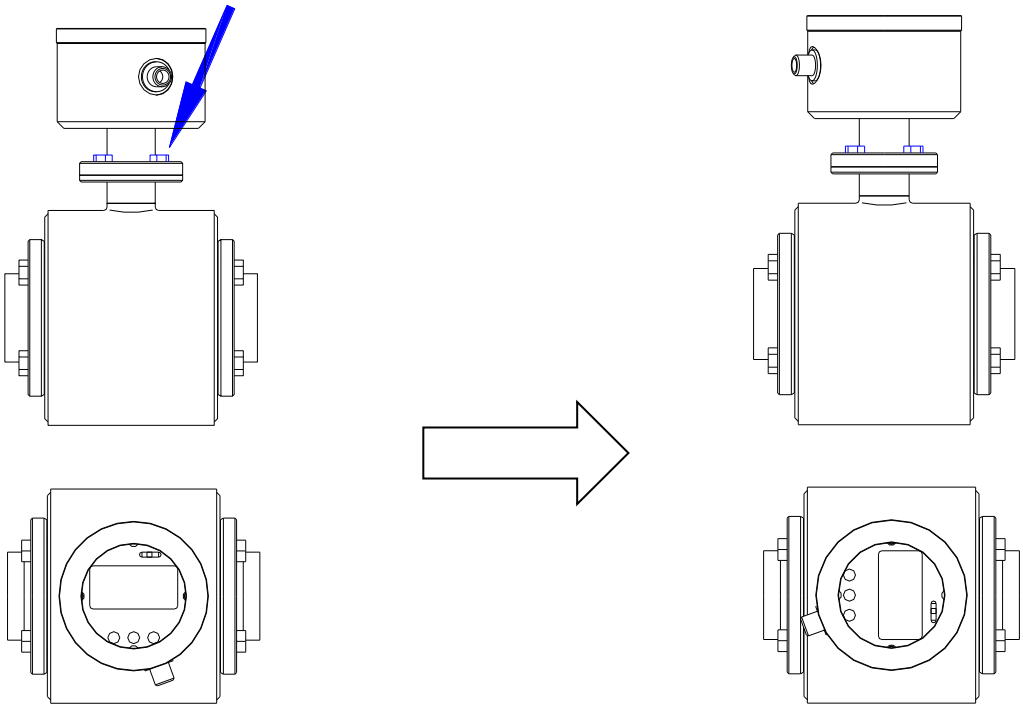
Caution

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 from 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 the electronic measuring equipment!

Pay attention to the fact that the earthing/grounding of the welding set is not carried out through the transmitter or the converter!
The welding 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 perfect welding effect 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 persons disposing of the necessary expert knowledge and 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 state of the art is always a decisive criterion 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 flushed before the production is started.
- All external supply joints have to be checked for their safe, leak-proof, and nearly stress-free connection to the transmitter.
- The media supplied have to be cautiously adjusted 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 the state of the art is relevant, too.

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 the screwed counterfittings!
In case of leaking pipe connections you should in any rate check the seals. Never squeeze the seal when tightening the threaded pipe connections!

5.2. Installation instructions for the converter

In case of the compact design, the converter is arranged on the transmitter, i.e. it is located straight inside the pipeline.
For the separated design the field housing is typically delivered for wall mounting.
Cable glands always have to point downwards.

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 insolation!

5.2.1. Installation of the electrical power supply

Caution

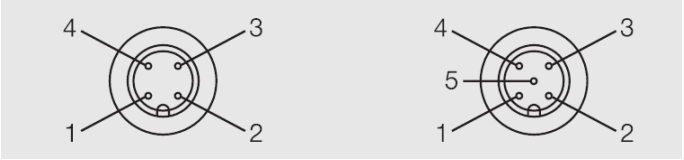
The following safety precautions have to be followed for the execution of the electrical installation work:

- 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.

5.2.3 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

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

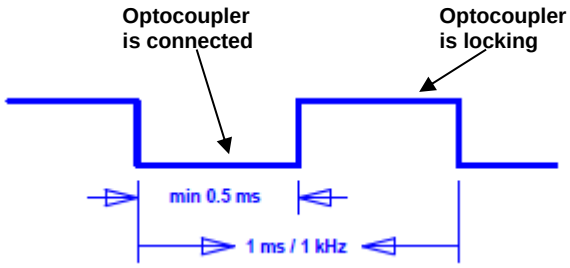
5.2.4 Digital Input

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

5.2.5 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 outputs.
The outputs 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.

5.2.6 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!

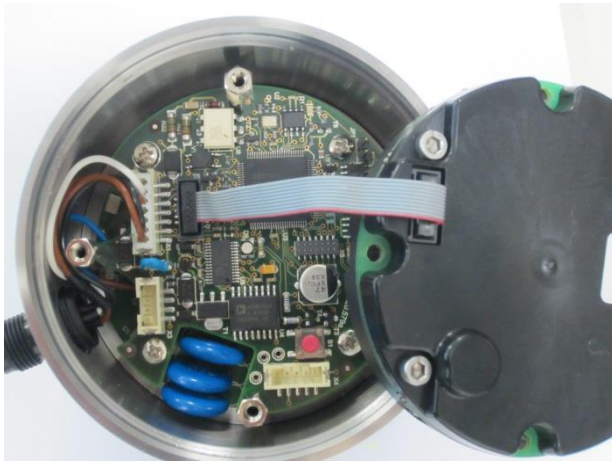
5.3 Display

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

Item	Description
1	Display
2	Display cable
3	Cover with transparent pane
4	4x M3x10

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 got 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 an orderly performed installation and a correct electrical connection are absolute 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 threaded joints at the measuring instrument and in the direct vicinity are really tight!
- Any possibly existing dehydrating agents have to be removed from the housings before the commissioning is started!

6.2 Advice for starting-up the FMQ

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

- The auxiliary energy has to be switched off.
- The auxiliary energy has to correspond to the specification on the nameplate.
- The pin assignment has to correspond to the wiring diagram.
- The temperature limits have to be kept.
- Both the transmitter and the converter have to be correctly earthed/grounded.
- The converter has to be installed at a place which is free from vibration to a large extent.
- 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?
  Below 50 µS/cm, the internal empty-pipe detection has to be switched off by the respective parameter setting.
- Is the analog output too unsteady?
  A time constant TP3 can be set by the relevant parameters.

6.3 Basic settings upon delivery

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

6.3 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. The front is equipped with a satin-glass pane with a 3-coloured background LED-lighting. The colour 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 device 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**") for an adaptation of the flow meter to the conditions prevailing in situ.

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

(1) The device has to have reached its working temperature, i.e. it should have been switched on at least 5 minutes before.

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

(3) **No flow** is allowed to be available. The liquid has to be resting.

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

6.5 Metering with an empty meter tube

Metrologically perfect flow measurements are only possible, if the meter tube is evidently filled with liquid.
In order to avoid an undefined counting in case of an empty meter tube, the FMQ offers an internal possibility for suppression:

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. Usually, the EMPTY pipe detection is switched on, i.e. 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 External reset of counter (use of digital input)

For the external reset of the conter can be done by using the digital input IN1. Activation can be done by having a 9V … 24V DC signal on PIN 5 of the 5-PIN M12 plug. This function has to be switched on by the parameter settings.

6.7 Status indication

In the standard version the status of the device is displayed by a 3-coloured 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

6.8 Optical operating elements (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 are not allowed to 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 is only permitted to be carried out 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 persons disposing of the necessary expert knowledge and authorization of the user are allowed to operate the FMQ.

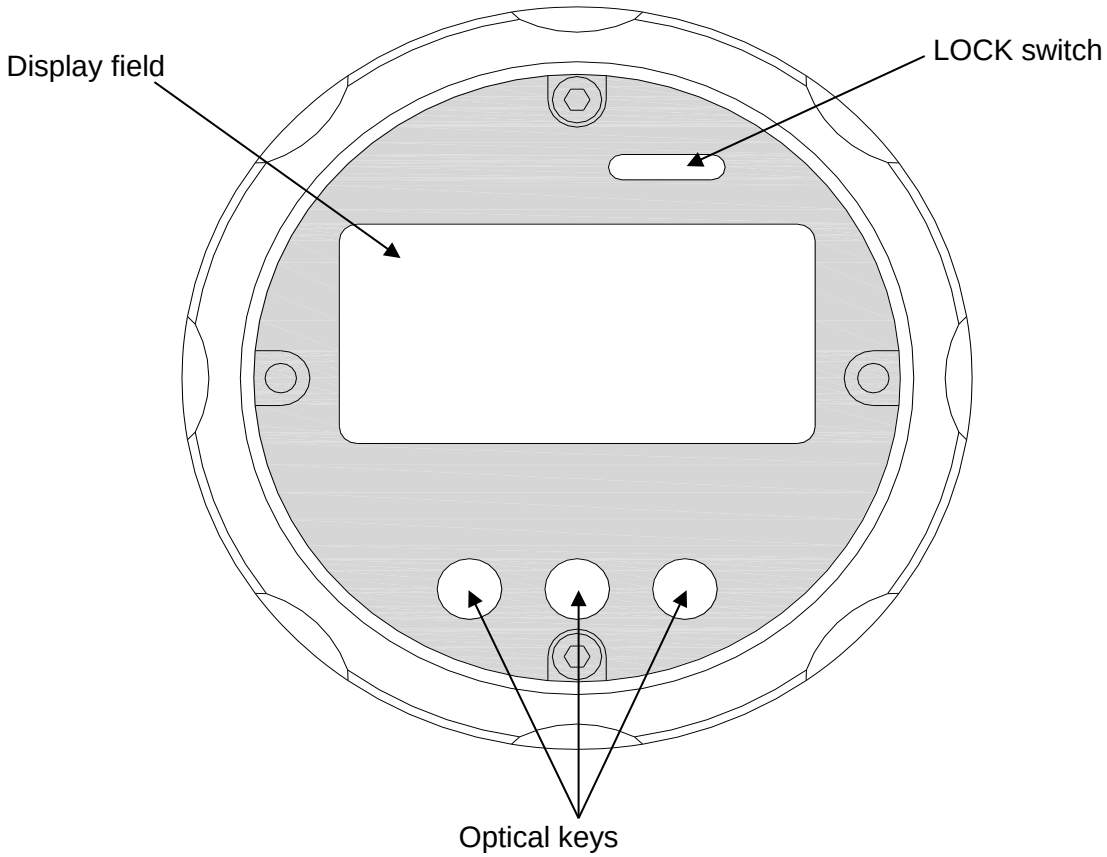
During normal measurements the operation is restricted to the zero reset of the volume registers. The keypad is dynamically controlled by the image navigator.

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

The display is illuminated by a permanently switched on background lighting which permits a stressfree 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 image navigator:

^^^^^^	Changing the main image level
HOME	Returning to the main image level or to the measuring image
>>>>	Changing to the next sub-image
ZERO	Resetting the volume to zero
++	Changing the setting parameters, e.g. to change the pulse mode
change	Changing the numerical parameters, e.g. low flow quantity

Key functions for the value input (numerical parameter):

<<	Next input position
++	Changes the input position
↵	ENTER, terminates the numeric input

7.2 Image navigator

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

Basic functions of the image navigator:

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

HYGIENIC BY DESIGN
ANDERSON-NEGELE

Menu principali	**Sottomenu**			
BE1 Valore misurato Volume	BE1S1 Valore misurato Portata	BE1S2 Portata Volume	BE1S3 Volume totale	
BE2 Parametri base Impostaz. disp.	BE2S1 Lingua	BE2S2 CS3-Bus	BE2S3 Dimensioni	BE2S5 Tipo Q
BE3 Uscita impulsi Impostaz. disp.	BE3S2 PV1	BE3S3 TP1		
BE 4 Ingresso digitale Impostaz. disp	BE4S1 Funzione	BE4S2 IT1		
BE5 Uscita corrente Impostaz. disp	BE5S2 Qmax	BE5S3 TP3		
BE6 Parametri misura Impostaz. disp	BE6S1 LFS	BE6S2 MSPE	BE6S3 BSPE	BE6S4 Media / BE6S7 Offset / BE6S8 SPAN
	BE6S5 Tubo vuoto	BE6S6 Diam. nomin.		
BE7 Funzioni speciali	BE7S1 Regolaz. zero	BE7S2 Impostaz. fabbrica		
BE8 Service	BE8S1 Registro errori SW misuratore	BE8S2 Registro errori Sistema operativo	BE8S3 Simulazione Uscita corrente	BE8S4 Simulazione Uscita impulsi
BE9 Info1	BE9S1 Info2	BE9S2 Info3		

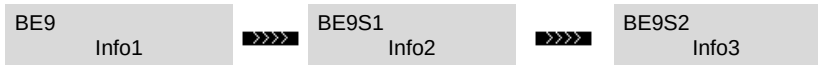


Image navigator

7.3.1 Zero reset of the volume counter

The main image 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.

7.3.2 How to delete malfunction messages

Possible malfunction messages are deleted by resetting the volume counters.

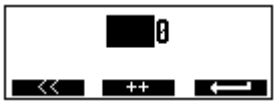
7.3.3 Parameter change

There are two kinds of parameters, in principle:
- **Setting parameters**, e.g. pulse mode
- **Numerical parameters**, e.g. 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 before. Unless it is unlocked, the input of the unlock code is 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:

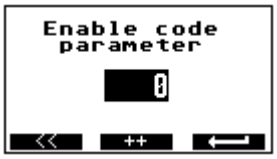
The procedure is described by means of the example of the Dimension”.

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.

7.3.4 How to release a parameter change:

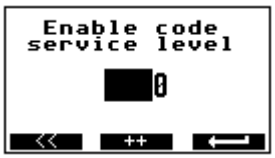
If a parameter has to be changed and the parameter change is not released, the display will request the input of the code number.



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.**

7.3.5 How to release the service functions:

Some service functions have to be released by a code number. Unless they are released, 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.**

7.4 Image level: Measured values

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

7.4.1 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, falls below -100.000.000 or the digital input for external resetting the conter is active.

7.4.2 Measured value: Flow rate

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

7.4.3 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, falls below -100.000.000 or the digital input for external resetting the conter is.

7.4.4 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.

7.4.5 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.

7.5 Image level: Base parameters

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

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

7.5.1 Language

Use the key ++ to change the language.
You could be asked in advance to enter the unlock code.

7.5.2 CS3Bus address

The CS3-Bus address can be changed by means of the key ++.
You could be asked in advance to enter the unlock code.

7.5.3 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.
In case of changing the dimension 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

7.5.4 QTYP

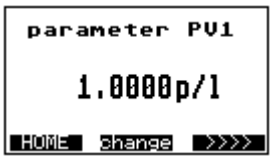
The key ++ can be used for setting the unit of measure for the flow rate indication. Possibly the input of the unlock code is requested before.
Two different settings are possible: l/h or l/min.

7.6 Image level: Pulse output

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

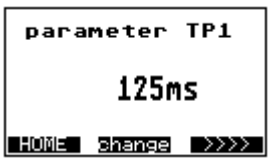
This image level serves for the setting of the pulse output. The main image shows the current device setting.

7.6.1 PV1



The pulse value PV1 can be changed by the change key.
You could be asked in advance to enter the unlock code.

7.6.2 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.
You could be asked in advance to enter the unlock code.

7.6.3 IT1

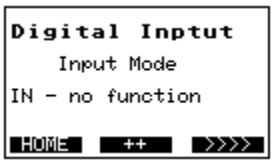
Use the key ändern to change IT1 into ms. IT1 determines how long the signal for the input will have to be available to activate the selected function.
You could be asked in advance to enter the unlock code.

7.7 Image level: Digital input

This image level consists of the pictures BE4, BE4S1, BE4S2.

The settings for the digital input are made on this image level. The main image shows the current device setting.

7.7.1 Function: Digital input



The function of the digital input can be selected by means of key ++.
The input can be set to:

- No function
- Count interruption
- Zero setting

The key ++ only appears if the unlock code has been activated before.
You might be prompted to first input an unlock code.

7.7.2 IT1

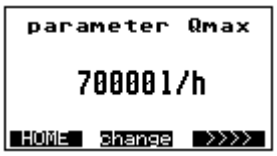
The change key can be used to change IT1 to ms. IT1 determines how long the signal will have to be available for the input to permit the selected function to become active.
You might be prompted to first input an unlock code.

7.8 Image level: Current output

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

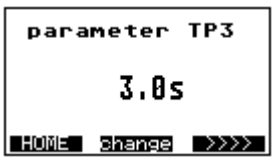
On this image level the settings for the current output are made.
The main image shows the current setting of the device.

7.8.1 Qmax



The key change can be activated for changing the Qmax value for the current output.
Qmax is the value for 20 mA.
You could be asked in advance to enter the unlock code.

7.8.2 TP3



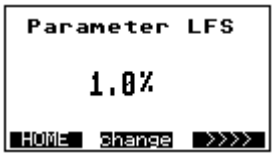
By means of the key change you can change the time delay TP3.
The current output is attenuated by this time.
You could be asked in advance to enter the unlock code.

7.9 Image level: Metering parameters

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

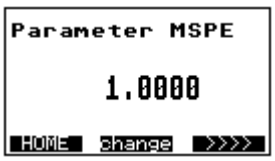
The settings for the measurement are made on this image level.
The main image partially shows the current device settings.

7.9.1 LFS



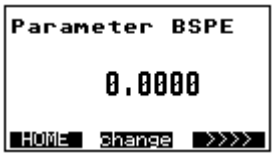
The key Change can be used to change the low-flow suppression LFS in %. The low-flow volume is calculated from the Qmax value.
You could be asked in advance to enter the unlock code.

7.9.2 MSPE



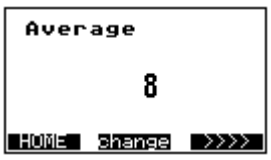
By means of the key Change you can change the dimensionless factor MSPE.
You could be asked in advance to enter the unlock code.

7.9.3 BSPE



Use the key Change for changing the dimensionless offset BSPE.
You could be asked in advance to enter the unlock code.

7.9.4 Average

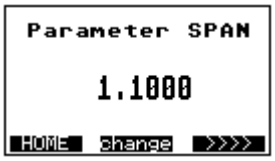


The average value can be changed by means of the key Change.
You could be asked in advance to enter the unlock code.

7.9.5 Offset

Press the key change for changing the Offset value.
The Offset is a calibration value of the sensor which is normally not changed!
Code number for the offset level: **145**.

7.9.6 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 not changed!
Code number for the SPAN level: **145**.

7.9.7 Pipe Detect (recognition of an empty meter tube)

The empty pipe detection can be switched on and off by means of the ++ key.
You could be asked in advance to enter the unlock code.

7.9.8 Nominal width

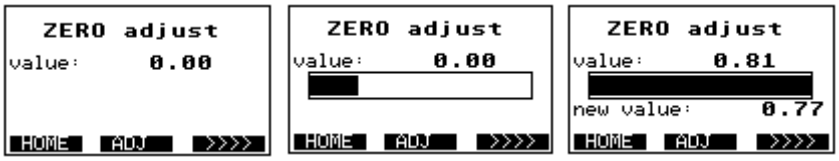
The display shows the nominal width of the transmitter.
Code number for the Nominal width: **222**

7.10 Image level: Special functions

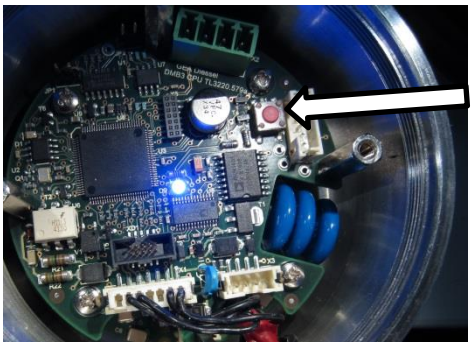
This image level consists of the pictures BE7, BE7S1, BE7S2.

Special functions can be carried out on this image level.

7.10.1 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.

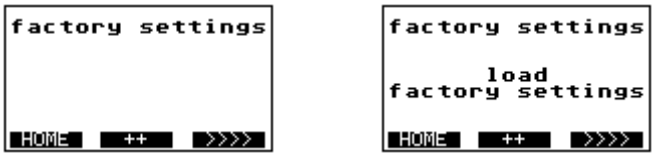


The ZERO adjust measurement can be alternatively started by means of the red ZERO adjust key (see the picture). The LED is blinking in blue colour as long as the function is active.

Important information

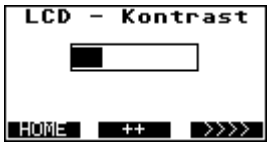
Prerequisite:
The meter tube has to be filled up with the liquid to be measured.
No flow rate is allowed to be available, the liquid rests.
Unless the prerequisites are observed, a faulty ZERO value will be determined and the FMQ will not be able work correctly.

7.10.2 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.
You could be asked in advance to enter the unlock code.

7.10.3 LCD contrast



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

7.11 Image level: Service level

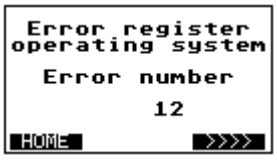
The image level consists of the pictures BE8, BE8S1, BE8S2, BE8S3, and BE8S4, BE8S5.

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

7.11.1 Error register: Metering

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

7.11.2 Error register: Operating system

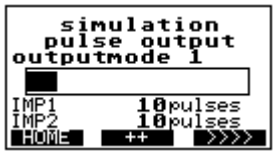


This image shows the error numbers of the operating system.

7.11.3 Simulation of the current output

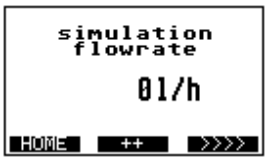
The simulation can be used to check the cable connection or to adjust an analog instrument.
The first value 20 mA is set to 100 % by means of the key ++. Another activation of the key ++ will set 12 mA, 50 %. After that the key ++ is used for the setting of the value of 4 mA to 0 %. The simulated current 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.
You could be asked in advance to enter the unlock code.

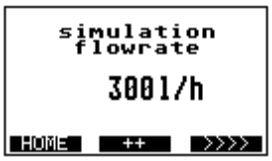
7.11.4 Simulation of the pulse outputs



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.
You could be asked in advance to enter the unlock code.

7.11.5 Simulation of the flow rate





This function can simulate the complete metrological functionality of the FMQ converter, i.e. 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.
You could be asked in advance to enter the unlock code.

7.12 Image level: Info

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

7.12.1 Info1

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

7.12.2 Info2

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

7.12.3 Info3

The image Info3 shows whether the device is equipped with a parameter box. 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 (standard scope of supply), the text “no parameter box” will be displayed.
If the text “SENSORBOX” is displayed, the new box is available particularly for the FMQ.

7.13 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 image level (BE1, BE1S1, BE1S2 or BE1S3) is shown in the LOCK position, depending on the image which was displayed upon the actuation of the LOCK switch. If the display is on another image level while the LOCK switch is actuated, 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 parameters (factory settings).

Important information

Only trained persons authorized by the user of the flow meter are allowed to set and/or change parameters. The persons concerned have to be familiar with the process sequence. They have to be able to recognize possible risks and to take the necessary steps to eliminate dangers of accident.
Take into account that interventions into the parameters of the flow meter carried out while the production is running could lead to undefined reactions!

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
125	440000.0	1.0
150	640000.0	1.0

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	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 adjustment.

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

If, however, some deviations have to be compensated which were determined e.g. upon a comparison with a calibration vessel or a balance it is possible to make an adjustment via the factor "**m spe**".

However, before you will start carrying out an adjustment you should have clarified the following questions in any rate:

- Are you sure that the reference standard (reference meter, balance, or calibrated vessel) does really deliver an exactly comparative value?
- Is the limitation of quantities always equal from measurement to measurement?

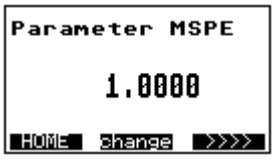
  Take into account that differently emptying pipelines, a missing break-off edge for the liquid or temporary air occlusions will lead to faulty results during the measurement!

- Have the production paths been unlocked? Or are there any manual valves or sampling valves or any cross links possibly open?
- Is the liquid really conveyed during the measurement without any air or gas?
- Are the flow limits kept?
- Is the conductivity of the product within the required tolerance?

An adjustment is only reasonable if similar (reproducible) deviations have been ascertained during the comparative measurements.

8.1.1 Adjustment by calibration factor "m spe"

The adjustment by the calibration factor "**m spe**" can be set via the operating unit.



The standard value is set to 1.

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**

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

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

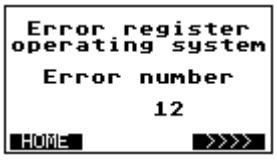
9.1 Error diagnosis

The FMQ is equipped with an integrated self-monitoring function.
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! - Use the compact device version for critical installations!
963	Pulse output of the output channel **IMP1** is exceeded.	- Adapt 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 (e.g. SPAN)!
3083	The "ZERO adjust" measurement has not been accepted.	During the adjustment the flow rate was not "zero".

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) Has the internal **EMPTY pipe detection** 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 electronic part is working correctly, use the existing simulating function (hardware or software) for your 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 your 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 completely disconnected from the FMQ. The analog output signal has to be checked by the simulating function by the aid of an ammeter:

   - If the analog output is ZERO at a 50% simulation, the electronic part is defective, i.e. it will be necessary to replace the complete converter.
   - If the analog output remains constant at 20 mA, the internal “current mode” parameter could be wrong. Verification is possible by means of the operating unit.

b. If the differences only occur after the disconnection of the external evaluating device, it 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 erroneously designed as an “**active**” analog output?
     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 scatter into the positive or negative direction?

c) Has something been repaired or replaced?

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 process steps?

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. The wiring between transmitter and converter has to be shielded through the metal cable gland.

f) The same verification has to be carried out with a full meter tube while the transmitter is removed as a whole. Any interfering influences by electrical disturbances or a leaking pipe system can be excluded in that status.

g) In case of moisture or other faults in the transmitter or converter it will be necessary to replace the measuring instrument by a new one.

h) Check the pipe path for by-pass lines or air occlusions (faulty seals).

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

- Take into account the temperature compensation of the volume.
- If different products are compared with the value of the balance, the conversion will have to be carried out by means of the density.

Or the same volume differences always occur e.g. at different quantities!
If so, possible reasons could be:

- A start and stop of the measurement while the meter tube is empty.
- An undefined limitation of quantity due to the absence of a break-off edge.
- An undefined dropping-off behaviour due to the absence of an appropriate draining sieve.

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

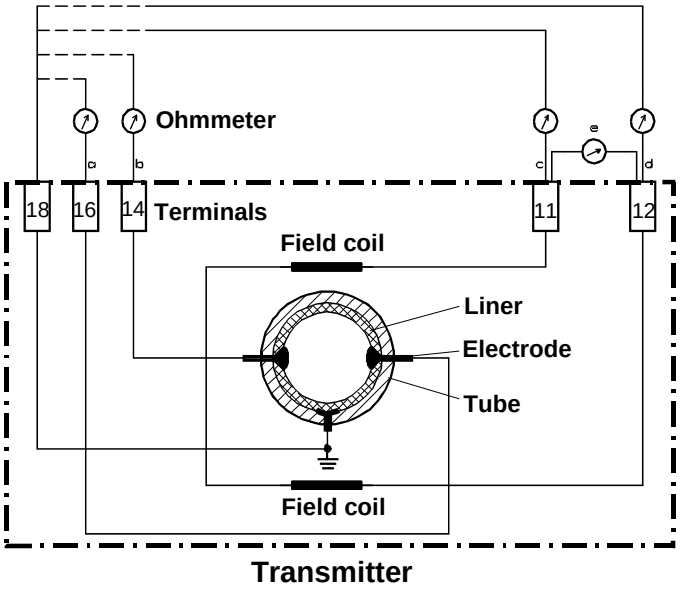
9.3 Error reset

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 Insulation test

The test is carried out by means of an ohmmeter. The meter tube of the transmitter has to be completely emptied before. The inner tube has to be absolutely dry, especially for measurements a) and b).



	Ohmmeter to terminal	Required resistance
a	14 / 18	> 20 megohms
b	16 / 18	> 20 megohms
c	11 / 18	> 20 megohms
d	12 / 18	> 20 megohms
e	11 / 12	70 … 140 ohms

Figure: **Insulation test**

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 and accordingly trained personnel entrusted with the required authorization from the user.

The persons concerned have 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 taken to guarantee a safe stability (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 by suitable safety precautions (e.g. 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 fittings.
- Rinse the pipe system with clear water before the disassembly of fittings or instruments in order to remove possible residuals of 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.

Thus, ensure a regular and careful cleaning of both the pipelines and the flow meter!

See to it during the external cleaning that e.g. no high-pressure steam-jets are directed to the housing parts!

In case of flow meters with 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 CIP in principle.

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 seal has to be replaced from time to time.

Accuracy test

Accuracy tests of the flow meter should be carried out in the frame of your in-house quality assurance.

A regular calibration by the Service Engineers of Negele Messtechnik increases the reliability of the measuring instrument.

10.2.1 Preventive maintenance steps

A regular and careful maintenance of the measuring spot (flow meter in its fitting situation) is indispensable in order:

- To avert any danger for persons and the environment
- Not to endanger the product quality
- Not to reduce 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**.

The recommended maintenance intervals result from 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

Negele Messtechnik recommends checking the measuring spot continuously, i.e.:

The **operators** of the system should **currently** pay attention to:
- occurring leaks
- unusual measuring results

Regular maintenance:

Following different strategies suggest themselves:

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 measuring instruments of the system in regular intervals in the frame of the in-house quality assurance. Moreover, the measuring instruments should be regularly calibrated at the manufacturer's workshop.

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 enable a quick and cost-effective settlement.

- The components/devices have to be packed in such a way that damage in transit is excluded.
- The forms "**Fault Location Report**" and "**Declaration of Product Safety**" which you will find in the appendix of this instruction manual have to be completed and added to the delivery of the components/devices to be repaired.
- Without those form the handling of the repairs could be delayed by superfluous queries.

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!

- Negele Messtechnik, as the manufacturers of the device, reserve themselves the right not to treat in their workshop such devices which are not accompanied by a completed "Declaration of product safety" duly signed by the user.

- 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 and accordingly trained personnel only. Interventions in the electronic 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 part 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 operating unit

The sealing cover will have to be replaced if the front pane is destroyed or scratched and if the operating 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 electronic part has to be switched off.

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 of the FMQ offers some functions that could support a troubleshooting process.

Moreover, it is 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 to be kept available on your stock

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

The following details are absolutely necessary and should never be missing in a spare parts order:

- Quantity and unit
- Designation

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 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.

Negele Messtechnik GmbH | Raiffeisenweg 7 | 87743 Egg Guenz | Germany | Phone: +49 83 33. 92 04 – 0 | Fax: +49 83 33. 92 04 - 49
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Misuratore di portata elettromagnetico

FMQ

Manuale operativo
MESSA IN SERVIZIO

SMERI

INDICE

Questa documentazione fornisce informazioni sulla messa in servizio, operatività e configurazione del sistema di misura.
E' allegata alle istruzioni di funzionamento di ANDERSON-NEGELE, "Operating manual FMQ" (30007/3.1/2018-09-21; edizione inglese).
Riporta il testo tradotto in italiano per la messa in servizio, l'operatività e la configurazione del dispositivo.

SCAN ME

6. MESSA IN SERVIZIO

6.1 Informazioni generali

Questo misuratore può essere impiegato solo da personale tecnico qualificato e autorizzato dal responsabile dell'impianto. Gli operatori devono conoscere la sequenza del processo, essere in grado di riconoscere eventuali rischi ed eseguire le procedure necessarie per eliminare qualsiasi pericolo.

Misure di sicurezza per la messa in servizio

Prerequisiti indispensabili per la messa in servizio sono la corretta esecuzione dell'installazione e dei collegamenti elettrici!
Considerare con attenzione quanto segue prima di eseguire la messa in servizio iniziale del dispositivo:

- Chiudere le custodie di trasmettitore e convertitore
  Rischio di scosse elettriche, se si toccano le linee sotto tensione.
  Danni al misuratore dovuti a penetrazione di umidità o parti metalliche sull'unità elettronica
- Garantire che gli attacchi filettati del misuratore siano chiusi saldamente
- Eliminare qualsiasi agente disidratane dalle custodie prima di mettere in funzione il sistema

SMERI srl non è responsabile di eventuali danni dovuti a un uso improprio, non conforme allo scopo d'uso.

Per qualsiasi non conformità, dubbio o modifica:
contattare l'ufficio tecnico **SMERI** (tel. +39 02 539 8941; e-mail: smeri@smeri.com).

6.2 Indicazioni per la messa in funzione del misuratore FMQ

Installazione del misuratore nella tubazione

- L'energia ausiliaria deve essere disattivata e deve corrispondere alle specifiche sulla targhetta.
- L'assegnazione dei pin deve corrispondere allo schema dei collegamenti.
- Le soglie di temperatura devono essere rispettate.
- Trasmettitore e convertitore devono essere installati in posizioni esenti da vibrazioni o soggette a ridotte vibrazioni.
- Il coperchio della custodia deve essere chiuso prima di attivare l'energia ausiliaria.
- Il campo di portata è regolato automaticamente.
- Dopo l'attivazione elettrica, si consiglia una taratura di zero ("Zero adjust") con il liquido da misurare (tubo di misura pieno e assenza di portata).

Esecuzione della messa in servizio dell'uscita analogica

- In base alla portata, l'uscita analogica genera una corrente 0/4-20 mA.

Solo con display (opzionale):

- L'assegnazione della portata "20 mA = Qmax" per l'uscita analogica del misuratore può essere impostata nel menu mediante gli specifici parametri.
- La simulazione della portata può servire da controllo funzionale.

Altre condizioni da considerare

- Conducibilità del prodotto troppo bassa? Sotto 50 µS/cm, il controllo interno di tubo vuoto deve essere disattivato nel relativo parametro.
- Uscita analogica non stabile? Si deve impostare la costante di tempo **TP3** nei relativi parametri.

Impostazioni di fabbrica

Il misuratore di portata elettromagnetico è impostato in fabbrica e consegnato con una configurazione standard.

6.3 Struttura del sistema ed elementi operativi

L'elettronica è installata in modo permanente nel convertitore FMQ.
Il collegamento elettrico (connettore M12) è su un lato del dispositivo.
Il lato anteriore è dotato di un vetro per la visualizzazione di stato mediante LED (3 colori). La versione con display grafico e tre pulsanti ottici consente di richiamare i dati e di modificare la configurazione del dispositivo.

6.4 Regolazione del punto zero ("ZERO adjust")

Alla prima messa in servizio si consiglia di eseguire una regolazione del punto zero ("**ZERO adjust**") per adattare il dispositivo alle condizioni ambiente e operative.

ATTENZIONE!
Devono essere presenti le seguenti condizioni:

1. Il dispositivo ha raggiunto la sua temperatura operativa, ossia deve essere stato attivato almeno 5 minuti prima.
2. Il trasmettitore è pieno di liquido da misurare e senza bolle di gas.
3. Non si ha deflusso. Il liquido deve essere fermo.
4. Non si ha portata durante l'esecuzione della funzione "ZERO adjust".

6.5 Misure con tubo di misura vuoto

Misure di portata metrologicamente corrette sono possibili solo se il tubo del misuratore è pieno di liquido. Per evitare un conteggio indefinito nel caso di tubo di misura vuoto, il misuratore FMQ offre una funzione di soppressione interna.

6.5.1 Controllo di tubo vuoto ("EMPTY pipe detection")

FMQ è dotato di una funzione speciale per il riconoscimento di tubo vuoto ("**pipe detect**"). L'impostazione è eseguita mediante menu. In genere, questa funzione è attiva, ossia il conteggio indefinito è soppresso nel caso il tubo sia vuoto.

Nei seguenti casi, il controllo di tubo vuoto deve essere disattivato nel relativo parametro:

- con conducibilità del prodotto inferiore a 50 µS/cm
- con una portata fortemente pulsante (pompa a pistone, a membrana o peristaltica).

6.6 Reset esterno del contatore (uso dell'ingresso digitale)

Per un reset esterno del contatore si può utilizzare l'ingresso digitale **IN1**.
L'attivazione è eseguita avendo un segnale 9...14 V CC al pin 5 del connettore a 5 pin M12.
Questa funzione deve essere attivata mediante il menu.

6.7 Indicazione di stato

Nella versione standard, lo stato del dispositivo è visualizzato mediante LED e 3 colori attraverso il vetro satinato del coperchio.

Colore del LED	Codice lampeggiante	Significato
Blu	In aumento e diminuzione	Il dispositivo è pronto al funzionamento e non è disponibile portata
Blu	1:1	Regolazione di zero in corso
Blu	1:10	Rilevato tubo vuoto
Verde	-	La portata è misurata
Verde	1:1	Qmax. superata (Q>120%)
Rosso	1:1	Malfunzionamento

6.8 Tasti operativi ottici (versione con display)

Il display è dotato di tasti ottici per l'operatività, che consentono di controllare il misuratore di portata FMQ attraverso il coperchio.

Il convertitore tara i tasti ottici a intervalli regolari. Questa taratura può funzionare perfettamente solo se i tasti ottici non sono coperti.
Dopo aver tolto e rimesso il coperchio, i tasti ottici non devono essere toccati per ca. 20 secondi.
Al termine di questo intervallo, i tasti ottici riprendono il funzionamento.

Durante il funzionamento o durante un inserimento nel menu, la taratura non avrà effetto.

Il funzionamento è consentito solo se il coperchio anteriore è chiuso.
In caso contrario, l'unità di controllo, il display e i tasti ottici possono danneggiarsi.
Dita sporche (ad es. di oli o grassi) possono causare il malfunzionamento dei tasti ottici.

7. OPERATIVITÀ

Il controllo del misuratore di portata FMQ può essere eseguito solo da personale tecnico esperto, con specifiche conoscenze e autorizzato dal responsabile dell'impianto.

Durante l'esecuzione delle misure, gli interventi si riducono al reset del punto zero dei registri volumetrici.
L'unità operativa può essere adattata alla posizione di montaggio del misuratore ruotandola a passi di 90° per consentire una migliore visibilità e semplificare gli interventi operativi.

Il display è retroilluminato e consente una facile lettura. Si disattiva dopo 5 minuti di inattività dell'operatore. Si riattiva toccando uno dei tre tasti ottici.
I tasti ottici possono essere disattivati mediante l'interruttore di blocco.
Consultare anche il cap. "Interruttore di blocco".

7.1 Funzioni base della tastiera

La tastiera comprende 3 tasti ottici e le relative funzioni sono indicate mediante simboli e testi.
La funzione della testiera è controllata dinamicamente in base a quanto selezionato e visualizzato:

^^^^^^ Cambio del livello del menu

HOME Ritorno alla finestra principale, alla visualizzazione della misura

>>>>> Modifica del sottomenu

ZERO Azzeramento del volume

++ Modifica delle impostazioni dei parametri, ad es. per passare alla modalità a impulsi

change Modifica dei valori numerici, ad es. quantità bassa portata

Funzioni dei tasti per l'inserimento dei valori (parametri numerici):

<< Posizione di inserimento successiva

++ Modifica della posizione di inserimento

← Enter, per terminare l'inserimento numerico

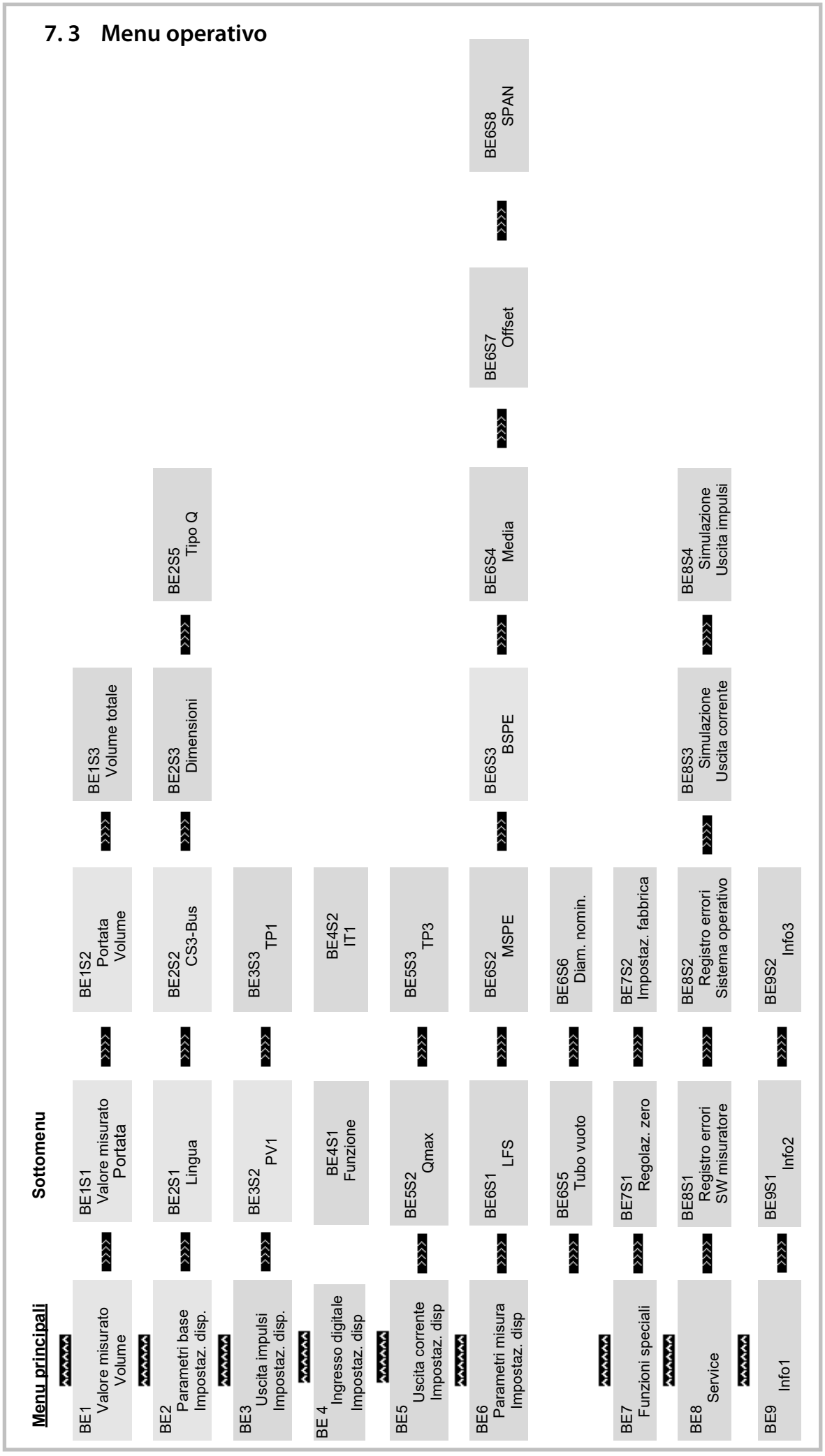
7.2 Navigatore

Il menu è suddiviso in parametri e relative visualizzazioni. Per una rapida panoramica della configurazione, la finestra principale indica i parametri e le impostazioni base del dispositivo. L'impostazione base del navigatore è la finestra del valore misurato, che indica volume e portata. Una funzione di timeout riporta il misuratore sempre a questa finestra. La navigazione è controllata dai tasti ^^^^^^, >>>>> e HOME

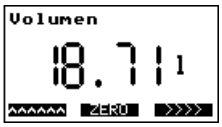
Funzioni base del navigatore di finestre:

- Lettura dei valori misurati
- Selezione delle diverse funzioni
- Configurazione
- Display di service

7. 3 Menu operativo



7.3.1 Azzeramento del contatore volumetrico



La finestra principale indica il volume ed è visualizzata permanentemente mentre il misuratore è attivo.
"**Zero reset**" è la funzione che può essere eseguita senza attivazioni addizionali.
Per l'azzeramento, infatti, basta premere il **tasto ZERO** per ca. 5 secondi.

7.3.2 Annullamento dei messaggi di errore

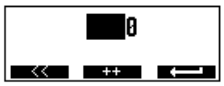
Gli eventuali messaggi di guasto sono annullati eseguendo l'azzeramento dei contatori volumetrici.

7.3.3 Modifica dei parametri

Di base sono disponibili due tipi di parametri:
- Parametri per le opzioni operative, ad es. modalità a impulsi
- Parametri numerici, ad es. **TP1** (lunghezza impulso)

I parametri delle opzioni operative si possono modificare con il **tasto** ++.
Il **tasto change** apre il campo di inserimento per il parametro numerico selezionato.
La modifica dei parametri è consentita solo, se è stata sbloccata e abilitata in precedenza.
Se è disabilitata, appare automaticamente la richiesta di inserimento del codice di sblocco.

<u>Modifica dei parametri numerici:</u>



Premere il **tasto change** e si apre un campo per l'inserimento. Il valore istantaneo è indicato in negativo mentre la posizione modificabile è visualizzata normalmente.
Il **tasto** ++ modifica la cifra nella posizione di inserimento.
Con il **tasto** << si seleziona la posizione di inserimento successiva, subito a sinistra.
Quando il parametro è impostato sul valore richiesto, confermare con il **tasto Enter**.

<u>Modifica dei parametri operativi:</u>

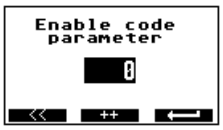
La procedura descritta in questo esempio, riguarda il parametro "**Dimension**".

La dimensione attuale è impostata su litri.
La dimensione successiva può essere selezionata e/o regolata mediante il **tasto** ++.

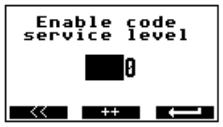
L'opzione successiva appare sul display.

7.3.4 Abilitazione della modifica del parametro

Se un parametro deve essere modificato e la relativa modifica non è abilitata, il display visualizza un messaggio con la richiesta di inserimento del codice. Inserire il codice come descritto nel **paragrafo 7.2.3**.
Se si inserisce il codice corretto, il display visualizza il messaggio "**Parameter input unlocked**".
Codice per la **modifica dei parametri**: **222**



7.3.5 Abilitazione della funzione service



Alcune funzioni service devono essere abilitate con un codice numerico.
Finché non sono sbloccate, il display visualizza la richiesta di inserimento del codice.
Inserire il codice come descritto nel **paragrafo 7.2.3**.
Se si inserisce il codice errato, il display visualizza "**Service level blocked**".
Codice per il livello di **service: 333**

7.4 Menu Valori misurati

Questo livello del menu comprende le finestre **BE1, BE1S1, BE1S2 e BE1S3**.

7.4.1 Valore misurato: Volume

Se si interviene per 4 secondi sul **tasto ZERO**, il volume si azzera. La dimensione delle cifre dipende dalla dimensione del valore misurato. Dopo l'azzeramento, è visualizzata l'indicazione del volume. Il volume si azzera automaticamente, se il valore supera 1.000.000.000, scende sotto -1.000.000.000 o se è attivo l'ingresso digitale per l'azzeramento del contatore dall'esterno.

7.4.2 Valore misurato: Portata

La dimensione delle cifre dipende dalla dimensione del valore misurato.

7.4.3 Valore misurato: Portata e volume

Visualizzazione congiunta di volume e portata. Il volume si azzera automaticamente se il valore supera 1.000.000.000, scende sotto -1.000.000.000 o se è attivo l'ingresso digitale per l'azzeramento del contatore dall'esterno.

7.4.4 Valore misurato: Quantità totale

Il totalizzatore indica la somma totale delle quantità che hanno attraversato il misuratore di portata. Il totalizzatore non può essere azzerato.

7.4.5 Messaggio di errore: Trasmettitore non collegato

Questo messaggio di errore è visualizzato se il trasmettitore non è collegato.
La causa è la mancanza di corrente alla bobina.

7.5 Menu Parametri base

Questo livello del menu comprende le finestre **BE2, BE2S1, BE2S2, BE2S3, BE2S4 e BE2S5**.
Consente di eseguire delle impostazioni di base. La finestra principale visualizza l'impostazione attuale del dispositivo.

7.5.1 Lingua

Utilizzare il **tasto** ++ per modificare la lingua.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.5.2 Indirizzo CS3Bus

L'indirizzo CS3 bus può essere modificato con il **tasto** ++.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.5.3 Dimensione

Il **tasto** ++ può essere usato per modificare le unità del valore misurato.
Potrebbe essere richiesto l'inserimento del codice di sblocco. Se si modifica la dimensione, le singole quantità e quelle totali si azzerano.

Abbreviazione	Unità	m dim
l	Litri	1
m³	Metri cubi	0.001
hl	Ettolitri	0.01
ml	Millilitri	1000
gal	Galloni U.S.	0.2642
gal	Galloni (CDN)	0.21997
gal	Galloni imp.	0.21997
lb	lb latte grezzo	2.27189
bbl	Barili birra	0.00611

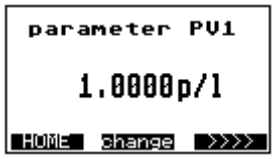
7.5.4 QTYP

Questo parametro serve per impostare l'unità di misura della portata.
Potrebbe essere richiesto l'inserimento del codice di sblocco.
Si può selezionare una delle seguenti opzioni: **l/h** o l/**min**.

7.6 Menu Uscita impulsi

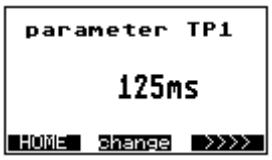
Questo livello del menu comprende le finestre **BE3, BE3S1, BE3S2 e BE3S3**.
Consente di impostare l'uscita a impulsi.
La finestra principale visualizza l'impostazione corrente del dispositivo.

7.6.1 PV1



Il valore di impulso PV1 può essere modificato con il **tasto change**.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.6.2 TP1



Con il **tasto change** modificare la lunghezza d'impulso di TP1 su **ms**.
TP1 è valido solo per la modalità 1 (**Mode1**).
Il valore 0 ms imposta il rapporto impulso-pausa 1:1.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

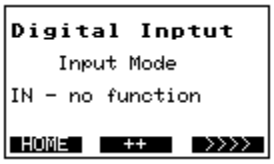
7.6.3 IT1

Con il **tasto change** impostare IT1 su **ms**.
IT1 definisce il tempo, che il segnale deve essere disponibile per l'ingresso così da attivare la funzione selezionata.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.7 Menu Ingresso digitale

Questo livello del menu comprende le finestre **BE4, BE4S1 e BE4S2**.
Consente di impostare l'ingresso digitale.
La finestra principale visualizza l'attuale impostazione del dispositivo.

7.7.1 Funzione Ingresso digitale



La funzione dell'ingresso digitale può essere selezionata mediante il tasto ++.
L'ingresso può essere impostato su:
No function (nessuna funzione)
Count interruption (interruzione conteggio)
Zero setting (impostazione di zero)
Il **tasto** ++ è abilitato solo se è stato inserito il codice di sblocco: potrebbe essere richiesto il suo inserimento.

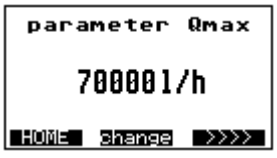
7.7.2 IT1

Con il **tasto change** configurare IT1 su **ms**.
IT1 definisce il tempo, che il segnale deve essere disponibile per l'ingresso, così da attivare la funzione selezionata.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.8 Menu Uscita in corrente

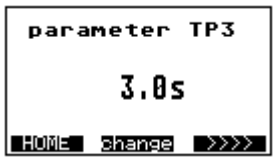
Questo livello del menu comprende le finestre **BE5, BE5S2 e BE5S3**.
Consente di impostare l'uscita in corrente.
La finestra principale visualizza l'attuale impostazione del dispositivo.

7.8.1 Qmax



Con il **tasto change** i può modificare il valore di Qmax per l'uscita in corrente.
Qmax è il valore per **20 mA**.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.8.2 TP3

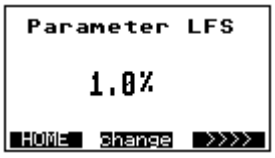


Con il tasto change si può modificare il ritardo di tempo TP3.
L'uscita in corrente è attenuata in base a questo tempo.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.9 Menu Parametri di misura

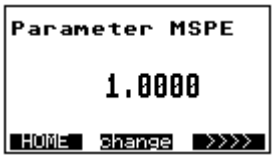
Questo livello del menu comprende le finestre **BE6, BE6S1, BE6S2, BE6S3, BE6S4 e BE6S5**.
Consente di eseguire le impostazioni per la misura.
La finestra principale visualizza le impostazioni attuali del dispositivo.

7.9.1 LFS



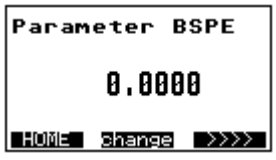
Con il **tasto change** modificare il taglio di bassa portata **LFS** in %.
Il volume di bassa portata è calcolato dal valore Qmax.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.9.2 MSPE



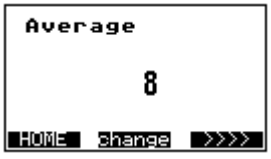
Con il **tasto change** modificare la dimensione del fattore di taratura MSPE.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.9.3 BSPE



Con il **tasto change** si può modificare la dimensione dell'offset BSPE.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.9.4 Media

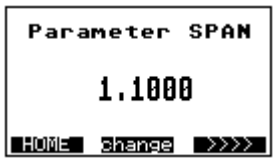


Con il **tasto change** i può modificare il valore medio.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.9.5 Offset

Premere il **tasto change** per modificare il valore di offset.
L'offset è un valore della taratura del sensore che in genere non deve essere modificato!
Codice per la **funzione offset: 145**

7.9.6 SPAN



Il valore SPAN può essere modificato con il **tasto change**.
Lo span è un valore della taratura del sensore che in genere non deve essere modificato!
Codice per la **funzione SPAN: 145**

7.9.7 Pipe detect (controllo di tubo di misura vuoto)

Il controllo di tubo vuoto può essere attivato e disattivato mediane il **tasto ++**.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

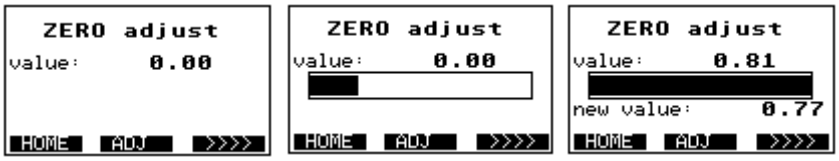
7.9.8 Diametro nominale

Il display visualizza le dimensioni nominali del trasmettitore.
Codice per il **diametro nominale: 222**

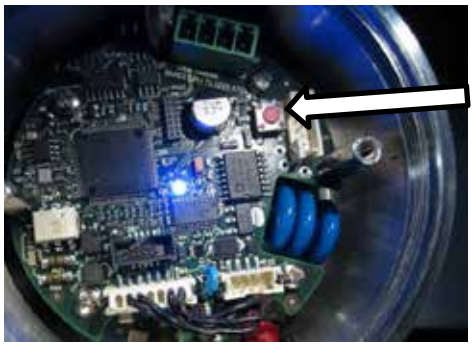
7.10 Menu Funzioni speciali

Questo livello del menu comprende le finestre **BE7, BE7S1 e BE7S2**.
Consente di eseguire delle funzioni speciali.

7.10.1 Regolazione di zero



La funzione "**ZERO adjust**" si attiva premendo il **tasto ADJ** per ca. 1,5 secondi. La riga superiore visualizza il valore zero attuale. Il bargraph indica l'avanzamento della regolazione, che termina quando il bargraph è completamente pieno. Il nuovo valore zero ("**new value**") è visualizzato sotto il bargraph e adottato.



La regolazione di zero può essere avviata anche mediante il tasto rosso (v. figura). Il LED è blu e lampeggia finché è attiva la funzione.

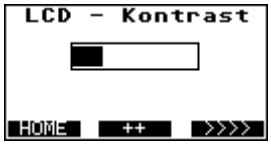
INFORMAZIONI IMPORTANTI

Prerequisito:
Il tubo di misura deve essere pieno di liquido da misurare. Non deve essere presente portata, il liquido è fermo. Se non sono rispettati questi requisiti, è determinato un valore zero errato e il misuratore non lavora correttamente.

7.10.2 Impostazioni di fabbrica

Tutti i parametri sono ripristinati alle impostazioni di fabbrica. Eseguita la funzione, la visualizzazione ritorna alla finestra 7.9 (Parametri di misura). Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.10.3 Contrasto LCD



La funzione **LCD contrast** consente il perfetto adattamento del contrasto del display.

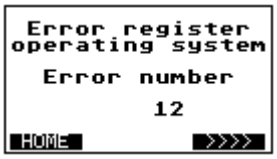
7.11 Menu Service

Questo livello del menu comprende le finestre **BE8, BE8S1, BE8S2, BE8S3, BE8S4 e BE8S5**.
Sono visualizzati solo valori di service. Consente di eseguire le funzioni di assistenza.

7.11.1 Registro degli errori: Misura

Questa finestra visualizza i codici numerici degli errori di misura.
Codice ed errore sono annullati quando si azzera il misuratore.

7.11.2 Registro degli errori: Sistema operativo



Questa funzione visualizza i codici numerici degli errori del sistema operativo.

7.11.3 Simulazione dell'uscita in corrente

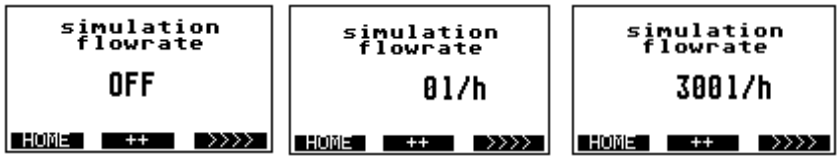
La simulazione serve per controllare il collegamento del cavo o per regolare un dispositivo analogico.

Il primo valore 20 mA è impostato sul 100% mediante il **tasto** ++. Premendo di nuovo il **tasto** ++ si può impostare il valore 12 mA sul 50%. Al termine, il **tasto** ++ è utilizzato per impostare il valore 4 mA su 0%.
Il valore di corrente simulato è determinato dalla modalità di corrente, v. **paragrafo 7.7.1** (Funzione Ingresso Digitale). Se l'impostazione è 0...20 mA, i valori simulati sono 20 mA, 10 mA e 0 mA.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.11.4 Simulazione delle uscite a impulsi

La simulazione può servire per verificare la connessione del cavo, un contatore o, anche, un controller collegato.
In base alla modalità di uscita, il numero di impulsi simulato è indicato sul display (**riga 6 e 7**).
La simulazione si avvia premendo il **tasto** ++ ed è visualizzato un bargraph. La simulazione termina quando il bargraph è completamente pieno e scompare.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.11.5 Simulazione della portata



Questa funzione consente di simulare la completa funzionalità metrologica del convertitore FMQ; le uscite a impulsi e l'uscita in corrente si comportano come durante il normale funzionamento. Questa funzione e adatta per la messa in servizio "**a secco**" di un sistema o sezioni di sistema.
La funzione si avvia con il **tasto** ++. La lettura di portata è 0 l/h. Qualsiasi successivo intervento sul tasto ++ incrementa la portata a passi del 10% di Qmax. La funzione si arresta non appena è raggiunto il valore massimo.
Potrebbe essere richiesto l'inserimento del codice di sblocco.

7.12 Menu Info

Questo livello del menu comprende le finestre **BE9, BE9S1e BE9S2**.
Visualizza alcune informazioni generali, che servono ad es. per identificare il dispositivo.

7.12.1 Info1

La finestra Info1 visualizza le versioni software e la data dell'ultimo download del software.

7.12.2 Info2

La finestra Info2 visualizza la versione hardware e il numero della scheda principale.

7.12.3 Info3

La finestra Info3 indica se il dispositivo è dotato di una casella dei parametri. Questa casella comprende i parametri del trasmettitore salvati e le impostazioni specifiche del cliente.
Nel caso di sostituzione del convertitore, i parametri possono essere trasmessi mediante questa casella al nuovo convertitore.
Se il dispositivo non è dotato di questa casella (fornitura standard), il display visualizza il testo "**no parameter box**".
Se è visualizzato il testo "**SENSORBOX**", la nuova casella è disponibile, in particolare per il misuratore FMQ.

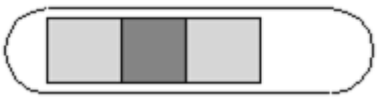
7.12.1 Interruttore LOCK

A partire dalla versione software V2.02, i tasti ottici possono essere disattivati mediante l'interruttore LOCK (posizione interruttore **a sinistra**) per evitare interventi non voluti.
Una delle funzioni BE1, BE1S1, BE1S2 o BE1S3 è visualizzata dopo l'attuazione dell'interruttore LOCK.
Se il display visualizza un'altra finestra e si interviene sull'interruttore LOCK, si apre automaticamente la finestra **BE1**.

Lo stato di blocco è indicato sopra i tasti ottici.

Significa che è attivo l'interruttore di blocco.

Per disattivare la modalità di blocco, si deve spingere l'interruttore nella posizione a destra.



I tasti ottici sono bloccati

I tasti ottici sono sbloccati

8 Configurazione dei parametri

In fabbrica il misuratore FMQ viene impostato con parametri standard (impostazioni di fabbrica).

Solo personale tecnico qualificato e autorizzato dal responsabile dell'impianto può impostare e/o modificare i parametri. Il personale addetto deve conoscere la sequenza del processo. Deve essere in grado di riconoscere possibili rischi e di intraprendere le misure necessarie a eliminare qualsiasi pericolo di incidente.
Considerare che gli interventi sui parametri del misuratore, eseguiti durante il funzionamento e la produzione, possono causare reazioni impreviste!

La seguente tabella riporta le impostazioni di fabbrica e i valori soglia:

Parametri	Impostazioni di fabbrica	Valore minimo	Valore massimo
Indirizzo CS3	32	32	64
PV1	1.0	0.0	In base a modalità uscita, dimensioni e Qmax
TP1	125 ms	0 ms	16000 ms
IT1	125 ms	0 ms	32000 ms
Qmax 100% per 20mA	In base al diametro nominale	1.0	999999.0
Tipo Q	l/h	l/min	l/h
TP3	0.2 s	0.0 s	30.0 s
LFS = Taglio bassa portata	1.0 %	0.0 %	10.0 %
MSPE	1.0	-1000.0	+1000.0
BSPE	0.0	-1.0	+1.0
Media	16	1	128
Offset	v. targhetta	-1.0	+1.0
SPAN	v. targhetta	0.000001	1000.0
Controllo tubo	Controllo tubo	Senza controllo tubo	Controllo tubo

DN	Q max [l/h]	PV1 [impulsi/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
125	440000.0	1.0
150	640000.0	1.0

8 Configurazione dei parametri (continua)

Abbreviazione	Funzione
PV1	Valore impulso per IMP1
TP1	Lunghezza impulso per IMP1
IT1	Lunghezza impulso per IN1
Q max.	100% del valore di portata per l'uscita in corrente
Q type	Impostazione dell'unità ingegneristica di portata
TP3	Costante di tempo per l'uscita in corrente
Dimension	Unità ingegneristiche di volume
LFS	Taglio bassa portata
MSPE	Fattore di taratura
BSPE	Offset di taratura
Average	Filtro del segnale di portata (media)
Offset	Valore di taratura del trasmettitore (non modificare!)
SPAN	Valore di taratura del trasmettitore (non modificare!)
Pipe-Detect	Controllo di tubo vuoto interno

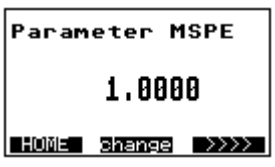
8.1 Regolazioni

Il misuratore FMQ non richiede regolazioni.
In genere, la regolazione del punto zero ("**ZERO adjust**") è eseguita solo durante la prima messa in servizio.
In ogni caso, se si devono compensare delle deviazioni, ad es. dopo un confronto con un recipiente di taratura, si possono eseguire delle regolazione mediante il fattore "**MSPE**".
Tuttavia, prima di eseguire qualsiasi regolazione, si devono chiarire i seguenti punti:

- Lo standard di riferimento (misuratore, bilancia o recipiente tarato) fornisce realmente un valore di confronto?
- Le quantità sono sempre uguali da una misura all'altra? Considerare che tubazioni riempite diversamente, inclusioni di aria e interruzioni di liquido causano risultati di misura sfalsati.
- I passaggi produttivi sono stati sbloccati? Oppure sono aperte valvole manuali o di campionamento e altri collegamenti incrociati?
- Il liquido scorre durante la misura in assenza di bolle di aria o gas?
- Sono rispettate le soglie di portata?
- La conducibilità del prodotto rispetta i valori di tolleranza richiesti?

Una regolazione è ragionevole se deviazioni simili (riproducibili) sono state accertate durante le misure di confronto.

8.1.1 Regolazione mediante il fattore di taratura "MSPE"



La regolazione mediane il fattore di taratura "**MSPE**" può essere eseguita mediante display ed elementi operativi. **Il valore standard è impostato su 1**.
Il fattore di taratura è calcolato in base al rapporto Vref/ Vdis

Vref -> volume previsto
Vdis -> visualizzazione FMQ
Esempio:
deviazione ΔF del +0.54% determinata durante una misura di confronto

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

Recipiente di taratura Vref = 5000 l
Display Vdis = 5027 l

8.2 Accuratezza di misura

Linearità: ± 0,5% ± 2 mm/s alle condizioni di riferimento

Riproducibilità: ± 0,1%

Condizioni di riferimento per determinare l'accuratezza di misura

Secondo DIN EN 29104 e VDI/VDE 2641:

- Temperatura del prodotto misurato +20°C ± 10 K
- Temperatura ambiente +20°C ± 5 K
- Portata 0.5 – 12 m/s
- Prodotto acqua (tipicamente 500 µS/cm)

Installazione:

- Sezione del tratto in entrata > 10 x DN
- Sezione del tratto in uscita > 5 x DN
- Trasmettitore e convertitore sono collegati alla messa a terra
- Il trasmettitore è posizionato al centro del tubo