

Magnetic-Inductive Flow Meter FMQ

Application/Specified usage

- Magnetic-inductive flowmeter for the measurement of flow rate and volume in food and pharmaceutical applications
- Suitable for liquids, mash and pastes with a minimum conductivity of $5 \mu\text{S}/\text{cm}$
- Precise measurement of media containing solids (< 5 % solid particle content)
- Measurement range from 30 l/h to 640 000 l/h
- Suitable for dosing and filling applications

Hygienic design/Process connection

- Sensor made entirely of stainless steel
- Hygienic design
- All parts in contact with the product are FDA-compliant
- Transmitter made of PFA; vacuum-tight and piggable
- Process connection optional available; material 1.4404 or 1.4435 with 3.1 certificate
- Process connection optionally with $R_a \leq 0.4 \mu\text{m}$, electropolished
- Electrodes made of stainless steel 1.4404
- CIP-/SIP-cleaning up to max. 130 °C (max. 30 minutes)

Special features/Advantages

- High measurement accuracy even at low flow rates
- Simple and user-friendly parameterization
- Automatic empty pipe detection avoids undefined readings for empty pipes
- PFA lining for maximum resistance to aggressive substances such as acids and bases
- Vacuum-tight, rigid meter tube lining, even at high temperatures
- Swiveling housing head with illuminated graphic display
- Operation of device via optical keys without opening the housing
- Minimal maintenance and care requirements
- Pharmaceutical version available with all necessary certificates

Functional principle

The principle behind this measurement method is Faraday's law of induction. This law states that a voltage is induced in a conductor that moves in a magnetic field. In the magnetic-inductive measurement method, the flowing, conductive medium acts as the conductor. Two vertically positioned field coils generate a constant magnetic field. The voltage induced in the flowing medium is measured by two stainless steel electrodes that are arranged horizontally. The voltage is directly proportional to the flow rate and can be expressed as the flow volume using the nominal tube width. The determined measurement values are made available as a counting pulse and 4...20 mA standard signal.

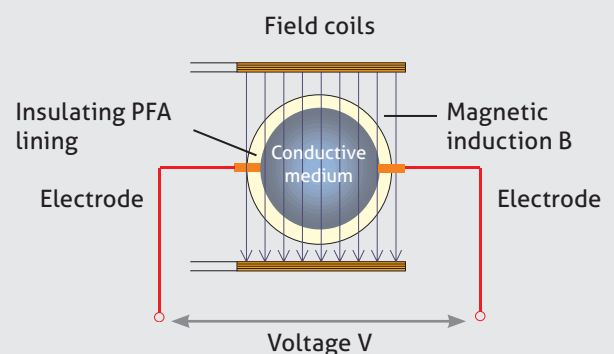
Certification



FMQ flowmeter



Magnetic-inductive measurement



Display (optional)

- Integrated graphic display, illuminated
- Display surface swivels 4 x 90°
- Operation via optical keys (housing does not need to be opened)
- User guidance in English/German (switchable)

Bus system (optional)

- CS3/RS485 Bus System

Outputs

- 1 digital output
- 1 analog output

Supply voltage

Supply voltage
24 V DC

Meter tube

Universal DIN 11864
aseptic flange

Tube standards
· DIN 11850 Series 2

Measurement transmitter

- DN 10 ... DN 150
- PFA liner, vacuum-tight, piggable, FDA-approved
- Measurement electrodes, 1.4404


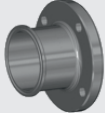
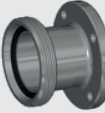




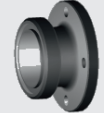
Electrical connection

M12 plug

**Note**

The display comes with a power saving mode. The background lighting automatically switches off after 30 minutes, while the measured values continue to be displayed. For better readability, however, the lighting can be switched on again at any time by pressing the optical keys.

Process adapters (optional available)

| | | | | | | | |
|---|---|---|---|---|--|---|---|
|  |  |  |  |  |  |  |  |
| Weld flange | Tri-Clamp | Milk pipe fitting | Aseptic fitting | Varivent | FG hygienic flange | DIN flange | SMS threaded connector |

| Technical data | | |
|--------------------------------------|--|--|
| Transmitter | Measuring principle Measurement ranges Nominal width | Magnetic-inductive 0.15...10 m/s DN10...DN150 |
| Process connection (optional) | Transmitter Tube standards | Aseptic flange DIN 11864-2, Form A Inside diameter as per DIN 11850 Series 2 Food: DIN 11850 Series 2, OD Tube (ASME BPE) Pharma: DIN 11866 Series A, B, C |
| Process adapters | | optional available |
| Materials | Pipe connection Seal Transmitter housing Transmitter lining Electrodes Converter housing Sight glass M12 plug | Food: 1.4404 Pharma: 1.4435 with 3.1 certificate Food: EPDM (FDA CFR 21.177) Pharma: EPDM with USP Class VI 1.4301 (blasted) PFA (FDA CFR 21.177) 1.4404 1.4404 PMMA (acrylic glass) 1.4305 |
| Temperature ranges | Ambient Process CIP / SIP cleaning | -25...+60 °C 0...+100 °C up to 130 °C max. 30 min |
| Operating pressure | DN125...150 DN10...100 | 0.1...10 bar (PN10) 0.1...17 bar (PN16) |
| Protection class | | IP 67 |
| Transmitter | LCD display Electrical connection Supply voltage Power consumption | Graphic LCD, 46 mm x 23 mm, back-lit M12 plug (DC power supply only) DC: 24 V +/- 10 % Max. 2.5 W (without display) Max. 3.0 W (with display) |
| Measurement accuracy | | ±0.5 % ±2 mm/s, under reference conditions as per DIN EN 29104 and VDI/VDE 2641 |
| Product conductivity | | > 5 µS/cm, for demineralized water > 20 µS/cm |
| Pulse output (volume counter) | 1x optocoupler, passive | 24 V / 20 mA, pulse sequence max. 1 kHz |
| Analog output (flow rate) | active Load resistance | 4...20 mA Max. 500 Ω |

Pharmaceutical version

For optional process connections DIN 11866 Series A, B, C

- Material 1.4435 with inspection certificate 3.1
- USP Class VI for PFA lining and seal

Optional:

- Surface finish on metal process connection $R_a \leq 0.4 \mu\text{m}$
- Measurement report for surface roughness and delta ferrite content

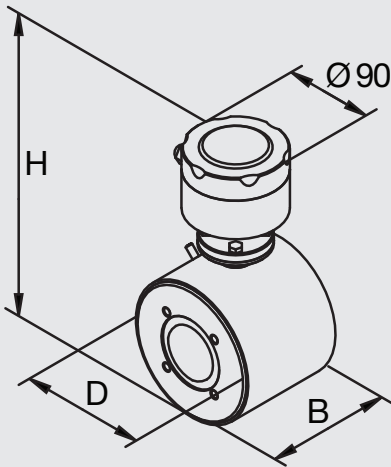
Note

This product information is not an operating manual. Please note the information on device safety, installation and operation in the product operating manual.



FMQ Dimensions

FMQ dimensional drawing

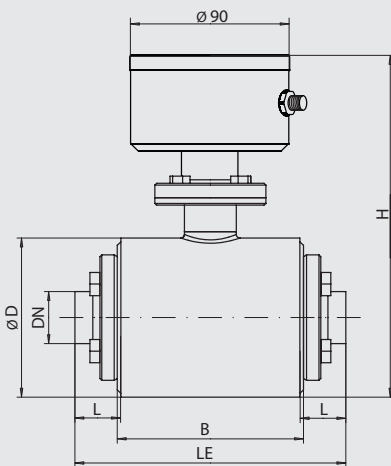


FMQ dimensions, incl. measurement range and weight

| Nominal width DN | B [mm] | D [mm] | H [mm] | Measurement range [l/h] | Weight [kg] |
|------------------|--------|--------|--------|-------------------------|--|
| | | | | | Transmitter and converter (display unit) |
| 10 | 104 | 90 | 201 | 30...3.000 | 4 |
| 15 | 104 | 90 | 201 | 70...7.000 | 4 |
| 25 | 104 | 90 | 201 | 180...18.000 | 4 |
| 32 | 104 | 105 | 216 | 300...30.000 | 5 |
| 40 | 104 | 105 | 216 | 450...45.000 | 5 |
| 50 | 104 | 130 | 241 | 700...70.000 | 6 |
| 65 | 160 | 130 | 241 | 1.200...120.000 | 6 |
| 80 | 160 | 155 | 266 | 1.800...180.000 | 10 |
| 100 | 200 | 170 | 281 | 2.800...280.000 | 15 |
| 125 | 110 | 220 | 331 | 4.400...440.000 | 20 |
| 150 | 140 | 220 | 331 | 6.400...640.000 | 23 |

FMQ dimension equipped with Anderson-Negele process connection

FMQ dimensional drawing



Main application area: Food | Material: 1.4404

| Transmitter Ø | OD-Tube (ASME-BPE) | | | | |
|---------------|------------------------|------------------------|----------------------|---------------------------------------|------------------------|
| | installation length LE | | | | |
| | Pipe DN | Pipe size OD x WT [mm] | Weld flange ASME BPE | Tri-Clamp ASME BPE (* Tri-Clamp size) | SMS threaded connector |
| 10 | 1/2" | 12.7 x 1.65 | 152 | 209 (TC25)* | - |
| 15 | 3/4" | 19.05 x 1.65 | 152 | 209 (TC25)* | - |
| 25 | 1" | 25.4 x 1.65 | 152 | 224 (TC50)* | 182 |
| 32 | - | - | - | - | - |
| 40 | 1½" | 38.1 x 1.65 | 152 | 224 (TC50)* | 192 |
| 50 | 2" | 50.8 x 1.65 | 152 | 224 (TC64)* | 192 |
| 65 | 2½" | 63.5 x 1.65 | 208 | 280 (TC77)* | 256 |
| 80 | 3" | 76.2 x 1.65 | 212 | 308 (TC91)* | 260 |
| 100 | 4" | 101.6 x 2.11 | 252 | 348 (TC119)* | 312 |

Main application area: Food | FMQ-FC/DIN2 - Material 1.4404

| DIN11850 Series 2 | | | | | | | | | |
|--|---------|------------------------|-------------|--|--|---|--|------------------------|--------------------|
| installation length LE (with Anderson-Negele process connection) | | | | | | | | | |
| Transmitter Ø | Pipe DN | Pipe size OD x WT [mm] | Weld flange | Tri-Clamp DIN 32676 (* Tri-Clamp size) | Threaded connector DIN 11851 (milk pipe) | Aseptic fitting DIN 11864-1 (threaded side) | DIN flange DIN EN 1092-1 (type 11, Form B) | VARIVENT smooth flange | FG hygienic flange |
| 10 | 10 | 13 x 15 | 152 | 200 (TC34)* | 200 | 190 | 200 | - | - |
| 15 | 15 | 19 x 1.5 | 152 | 200 (TC34)* | 200 | 190 | 200 | - | - |
| 25 | 25 | 29 x 1.5 | 152 | 200 (TC50)* | 200 | 204 | 225 | - | 200 |
| 32 | 32 | 35 x 1.5 | 152 | 200 (TC50)* | 200 | 212 | - | 200 | - |
| 40 | 40 | 41 x 1.5 | 152 | 200 (TC50)* | 200 | 214 | 225 | - | 200 |
| 50 | 50 | 53 x 1.5 | 152 | 200 (TC64)* | 200 | 214 | 225 | 200 | 200 |
| 65 | 65 | 70 x 2.0 | 208 | 256 (TC91)* | 256 | 280 | 306 | 256 | 256 |
| 80 | 80 | 85 x 2.0 | 212 | 256 (TC106)* | 256 | 296 | 305 | 256 | 255 |
| 100 | 100 | 104 x 2.0 | 252 | 340 (TC119)* | - | 352 | 340 | - | 340 |
| 125 | 125 | 129.0 x 2.0 | 166 | - | - | - | - | - | 220 |
| 150 | 150 | 154.0 x 2.0 | 196 | - | - | - | - | - | 250 |

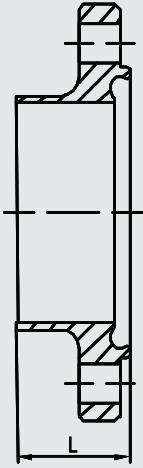
Main application area: Pharma | FMQ-PC/DIN A/B/C: 1.4435 with 3.1 certificate

| DIN 11866 Series A | | | | | DIN 11866 Series B | | | |
|--------------------|---------|------------------------|--|--|--------------------|--------------------------|--|--|
| Transmitter Ø | Pipe DN | Pipe size OD x WT [mm] | installation length LE (with Anderson-Negele process connection) | | Pipe DN | Pipe size OD x WT [mm] | installation length LE (with Anderson-Negele process connection) | |
| | | | Weld flange | Tri-Clamp DIN 32676 (* Tri-Clamp size) | | | Weld flange | Tri-Clamp DIN 32676 (* Tri-Clamp size) |
| 10 | 10 | 13 x 1.5 | 152 | 209 (TC34)* | 8 | 13.5 x 1.6 | 152 | 209 (TC25)* |
| 15 | 15 | 19 x 1.5 | 152 | 209 (TC34)* | 10 | 17.2 x 1.6 | 152 | 224 (TC25)* |
| 25 | 25 | 29 x 1.5 | 152 | 224 (TC50)* | 20 | 26.9 x 1.6 | 152 | 224 (TC50)* |
| 32 | 32 | 35 x 1.5 | 152 | 224 (TC50)* | 25 | 33.7 x 2.0 | 152 | 224 (TC50)* |
| 40 | 40 | 41 x 1.5 | 152 | 224 (TC50)* | 32 | 42.4 x 2.0 | 152 | 224 (TC64)* |
| 50 | 50 | 53 x 1.5 | 152 | 224 (TC64)* | 40 50 | 48.3 x 2.0 60.3 x 2.0 | 152 | 224 (TC64)* 224 (TC77)* |
| 65 | 65 | 70 x 2.0 | 208 | 304 (TC91)* | 65 | 76.1x2.0 | 208 | 280 (TC91)* |
| 80 | 80 | 85 x 2.0 | 212 | 308 (TC106)* | 80 | 88.9 x 2.3 | 212 | 304 (TC106)* |
| 100 | 100 | 104 x 2.0 | 252 | 348 (TC119)* | - | - | - | - |

Main application area: Pharmaceutical | Material: 1.4435 with 3.1 certificate

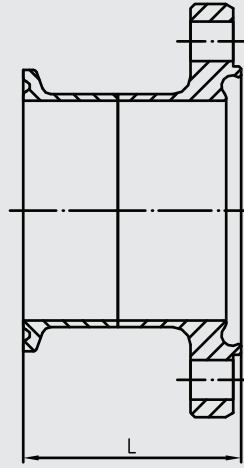
| DIN 11866 Series C | | | | |
|--------------------|---------|------------------------|--|---------------------------------------|
| Transmitter Ø | Pipe DN | Pipe size OD x WT [mm] | installation length LE (with Anderson-Negele process connection) | |
| | | | Weld flange | Tri-Clamp ASME BPE (* Tri-Clamp size) |
| 10 | 1/2" | 12.7 x 1.65 | 152 | 209 (TC25)* |
| 15 | 3/4" | 19.05 x 1.65 | 152 | 209 (TC25)* |
| 25 | 1" | 25.4 x 1.65 | 152 | 224 (TC50)* |
| 32 | - | - | - | - |
| 40 | 1½" | 38.1 x 1.65 | 152 | 224 (TC50)* |
| 50 | 2" | 50.8 x 1.65 | 152 | 224 (TC64)* |
| 65 | 2½" | 63.5 x 1.65 | 208 | 280 (TC77)* |
| 80 | 3" | 76.2 x 1.65 | 212 | 308 (TC91)* |
| 100 | 4" | 101.6 x 2.11 | 252 | 348 (TC119)* |

Weld flange



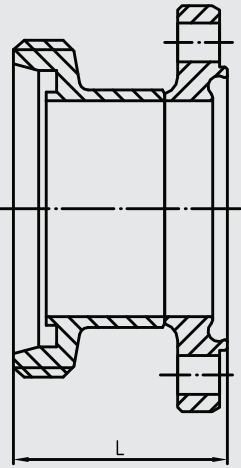
| DN | L [mm] |
|-----|--------|
| 10 | 25.5 |
| 15 | 25.5 |
| 25 | 25.5 |
| 32 | 25.5 |
| 40 | 25.5 |
| 50 | 25.5 |
| 65 | 25.5 |
| 80 | 27.5 |
| 100 | 27.5 |
| 125 | 29.5 |
| 150 | 29.5 |

Tri-Clamp



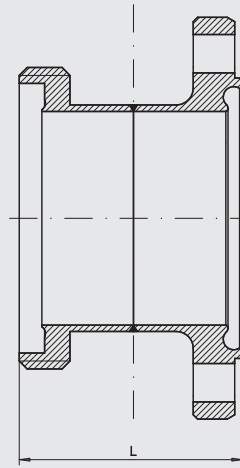
| DN | L [mm] (DINA, DINB) | L [mm] (ASME, DINC) |
|-----|---------------------------|---------------------------|
| 10 | 49.5 | 54.1 |
| 15 | 49.5 | 54.1 |
| 25 | 49.5 | 61.5 |
| 32 | 49.5 | - |
| 40 | 49.5 | 61.5 |
| 50 | 49.5 | 61.5 |
| 65 | 49.5 | 61.5 |
| 80 | 49.5 | 75.5 |
| 100 | 71.5 | 75.5 |
| 125 | - | - |
| 150 | - | - |

Milk pipe fitting DIN 11851



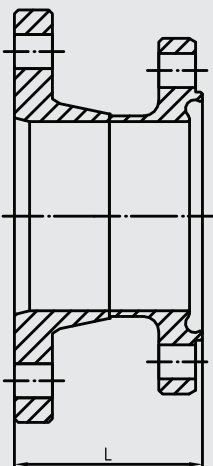
| DN | L [mm] |
|-----|--------|
| 10 | 49.5 |
| 15 | 49.5 |
| 25 | 49.5 |
| 32 | 49.5 |
| 40 | 49.5 |
| 50 | 49.5 |
| 65 | 49.5 |
| 80 | 49.5 |
| 100 | - |

Aseptic fitting 11864



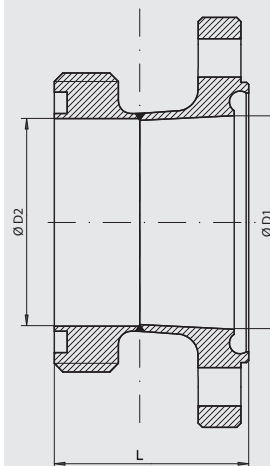
| DN | L [mm] |
|-----|--------|
| 10 | 44.5 |
| 15 | 44.5 |
| 25 | 51.5 |
| 32 | 55.5 |
| 40 | 56.5 |
| 50 | 56.5 |
| 65 | 61.5 |
| 80 | 69.5 |
| 100 | 77.5 |

VARIVENT



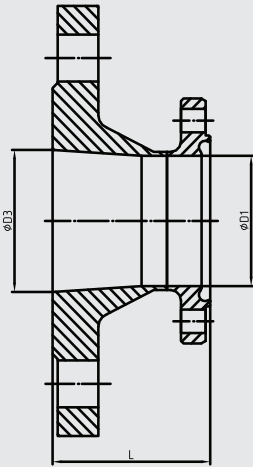
| DN | L [mm] |
|-----|--------|
| 10 | - |
| 15 | - |
| 25 | - |
| 32 | 49.5 |
| 40 | - |
| 50 | 49.5 |
| 65 | 49.5 |
| 80 | 49.5 |
| 100 | - |

SMS threaded connector



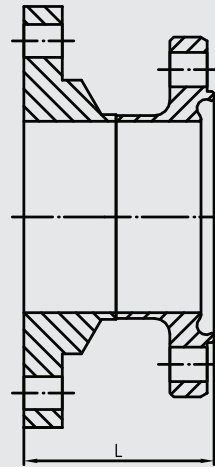
| DN | D1 [mm] | D2 [mm] | L [mm] |
|-----|---------|---------|--------|
| 10 | - | - | - |
| 15 | - | - | - |
| 25 | 26 | 22.5 | 40.5 |
| 32 | - | - | - |
| 40 | 38 | 35.5 | 45.5 |
| 50 | 50 | 48.5 | 45.5 |
| 65 | 66 | 60.5 | 49.5 |
| 80 | 81 | 73.1 | 51.5 |
| 100 | 100 | 97.6 | 57.5 |

DIN flange



| DN | L [mm] | D1 [mm] | D3 [mm] |
|-----|--------|---------|---------|
| 10 | 49.5 | 10 | 13.6 |
| 15 | 49.5 | 16 | 17.3 |
| 25 | 62 | 26 | 28.5 |
| 32 | - | - | - |
| 40 | 62 | 38 | 43.1 |
| 50 | 62 | 50 | 54.5 |
| 65 | 74.5 | 66 | 70.3 |
| 80 | 74 | 81 | 82.3 |
| 100 | 71.5 | 100 | 107.1 |
| 125 | - | - | - |
| 150 | - | - | - |

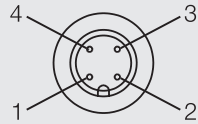
FG hygienic flange



| DN | L [mm] |
|-----|--------|
| 10 | - |
| 15 | - |
| 25 | 49.5 |
| 32 | - |
| 40 | 49.5 |
| 50 | 49.5 |
| 65 | 49.5 |
| 80 | 49 |
| 100 | 71.5 |
| 125 | 56.5 |
| 150 | 56.5 |

Electrical connection (M12-plug, 4-pins)

- 1: +24 V DC
- 2: 4...20mA
- 3: 0V DC
- 4: Pulse output

**Mechanical Connection / Installation**

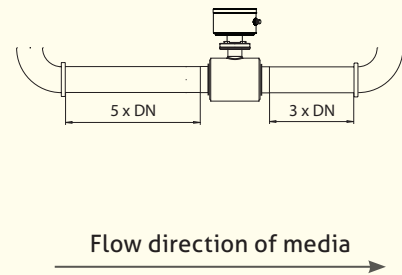
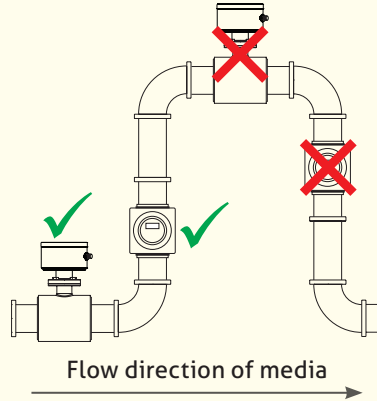
· For installation please check also the installation remarks mentioned in the product manual.

· **Correct installation:**

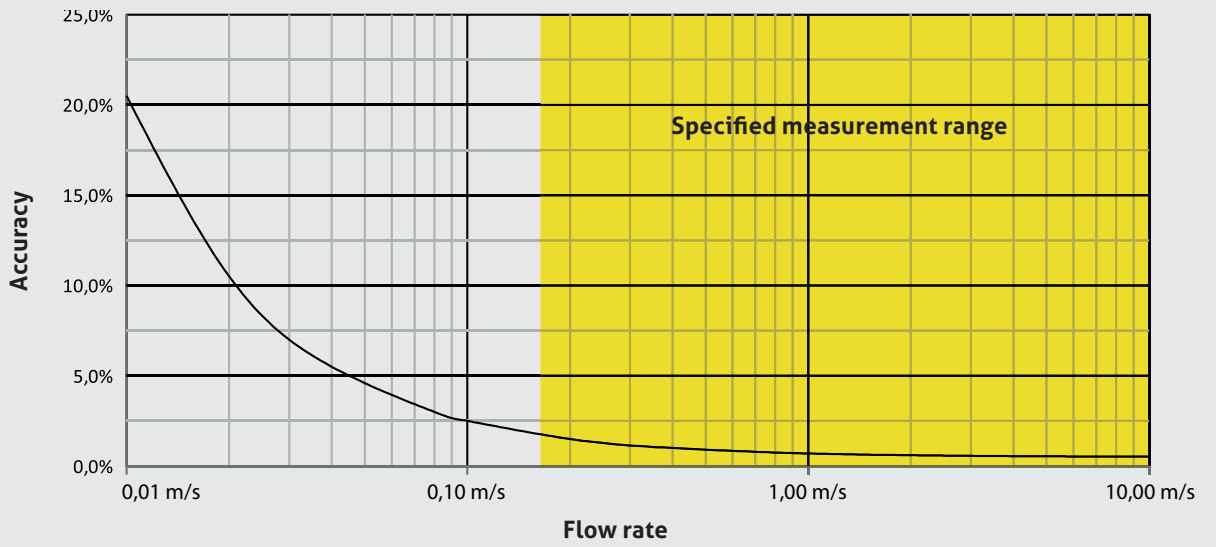
- Before or into an ascending pipe.

· **Wrong installation:**

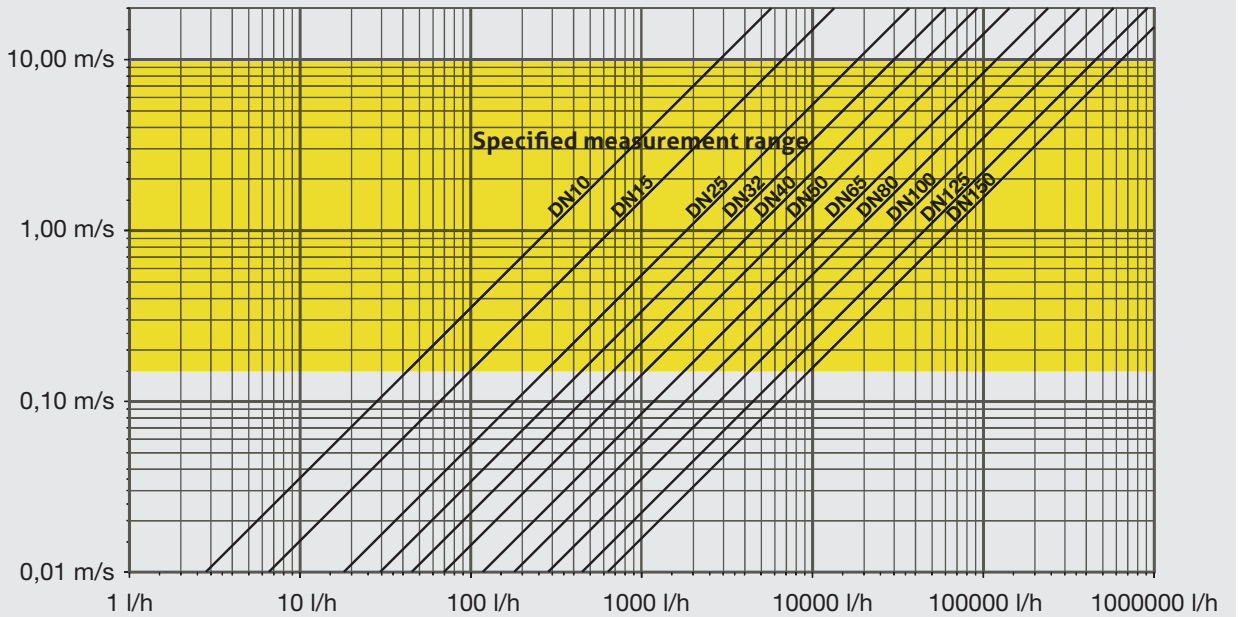
- Before or into a descending pipe.
- Into the highest point of a pipe, air bubbles will concentrate there.

**Notes**

Measurement accuracy by flow rate



Flow rate nomogram



Process connection kit suitable for magnetic inductive flow sensor FMI and FMQ

FMQ-FC Process connection FMI/FMQ for Food application; material 1.4404 (including screws and gaskets)

Tube standard

DIN2 DIN11850 Series 2
ASME OD-Tube OD Tube (ASME-BPE)

Nominal diameter

| | DIN2 | ASME |
|------------|------|------|
| 010 | 10 | 1/2" |
| 015 | 15 | 3/4" |
| 025 | 25 | 1" |
| 032 | 32 | - |
| 040 | 40 | 1½" |
| 050 | 50 | 2" |
| 065 | 65 | 2½" |
| 080 | 80 | 3" |
| 100 | 100 | 4" |
| 125 | 125 | - |
| 150 | 150 | 6" |

Process connection type

SS (weld flange)
TC (Tri-Clamp)
GG (milk pipe fitting DIN 11851)
HH (aseptic fitting DIN 11864-1 threaded side)
VN (VARIVENT smooth flange)
FG (FG hygienic flange, smooth flange)
DF (DIN flange EN 1092-1 Type 11 Form B, similar to DIN 2623/2633)
SM (SMS threaded connector)

DIN 11850 Series 2

| DIN2 | SS | TC | GG | HH | VN | FG | DF |
|------------|----|----|----|----|----|----|----|
| 10 | x | x | x | x | | | x |
| 15 | x | x | x | x | | | x |
| 25 | x | x | x | x | | x | x |
| 32 | x | x | x | x | x | | |
| 40 | x | x | x | x | | x | x |
| 50 | x | x | x | x | x | x | x |
| 65 | x | x | x | x | x | x | x |
| 80 | x | x | x | x | x | x | x |
| 100 | x | x | | x | | x | x |
| 125 | x | | | | | x | x |
| 150 | x | | | | | x | x |

OD-Tube (ASME BPE)

| ODT | SS | TC | SM |
|-------------|----|----|----|
| 1/2" | x | x | |
| 3/4" | x | x | |
| 1" | x | x | x |
| - | | | |
| 1½" | x | x | x |
| 2" | x | x | x |
| 2½" | x | x | x |
| 3" | x | x | x |
| 4" | x | x | x |
| - | | | |
| 6" | | | |

x = process connection available for nominal width

Surface quality

XX (Standard 0,8 µm / 0,8 micron)

FMQ-FC / DIN2 / 015 / SS / XX

Process connection kit suitable for magnetic inductive flow sensor FMI and FMQ

FMQ-PC Process connection FMI/FMQ for Pharma application; material 1.4435 (316L) with material certificates (including screws and gaskets)

Tube standard

DINA DIN 11866 Series A (pipe size as per DIN 11850 Series 2)
DINB DIN 11866 Series B (pipe size as per DIN EN ISO 1127)
DINC DIN 11866 Series C (pipe size as per ASME-BPE)

Nominal diameter

| | DINA | DINB | DINC |
|------------|------|------|------|
| 010 | 10 | 08 | 1/2" |
| 015 | 15 | 10 | 3/4" |
| 025 | 25 | 15 | 1" |
| 032 | 32 | 25 | |
| 040 | 40 | 32 | 1½" |
| 050 | 50 | 40 | 2" |
| 065 | 65 | 50 | 2½" |
| 080 | 80 | 65 | 3" |
| 100 | 100 | 80 | 4" |
| 125 | 125 | | |
| 150 | 150 | | 6" |

Process connection type

SS (weld flange)
TC (Tri-Clamp)

DIN 11866 Series A

| | SS | TC |
|------------|----|----|
| 10 | x | x |
| 15 | x | x |
| 25 | x | x |
| 32 | x | x |
| 40 | x | x |
| 50 | x | x |
| 65 | x | x |
| 80 | x | x |
| 100 | x | x |

DIN 11866 Series B

| | SS | TC |
|-----------|----|----|
| 08 | x | x |
| 10 | x | x |
| 15 | x | x |
| 25 | x | x |
| 32 | x | x |
| 40 | x | x |
| 50 | x | x |
| 65 | x | x |
| 80 | x | x |

DIN 11866 Series C

| | SS | TC |
|-------------|----|----|
| 1/2" | x | x |
| 3/4" | x | x |
| 1" | x | x |
| 1½" | x | x |
| 2" | x | x |
| 2½" | x | x |
| 3" | x | x |
| 4" | x | x |

x = process connection available for nominal width

Surface quality

XX (Standard 0,8 µm / 0,8 micron)
04 (0,4 µm / 0,4 micron)

FMQ-PC / DINA / 015 / SS / XX

Certificates



2.2
EN 10204



3.1
EN 10204



Calibration
certificate



USP
Class VI



Surface

Main application area: Food | Material: 1.4404

FMQ Magnetic-Inductive Flow Meter

Nominal diameter/Size

| | |
|------------|----------|
| 010 | (10 mm) |
| 015 | (15 mm) |
| 025 | (25 mm) |
| 032 | (32 mm) |
| 040 | (40 mm) |
| 050 | (50 mm) |
| 065 | (65 mm) |
| 080 | (80 mm) |
| 100 | (100 mm) |
| 125 | (125 mm) |
| 150 | (150 mm) |

Certifications

| | |
|----------|------------------------|
| S | (none) |
| P | (with 3.1 certificate) |

Display

| | |
|----------|----------------------------|
| L | (Optical LED status light) |
| D | (Graphical Display) |

Electrical connection

| | |
|----------|--------------------|
| X | (M12-plug, 4 pins) |
|----------|--------------------|

FMQ / 010 / P / L / X

Accessories

PVC-cable with M12-connection made of 1.4305, IP 69 K, unshielded

| | |
|-------------------------|------------------------------|
| M12-PVC / 4-5 m | PVC-cable 4-pin, length 5 m |
| M12-PVC / 4-10 m | PVC-cable 4-pin, length 10 m |
| M12-PVC / 4-25 m | PVC-cable 4-pin, length 25 m |
| M12-PVC / 5-5 m | PVC-cable 5-pin, length 5 m |
| M12-PVC / 5-10 m | PVC-cable 5-pin, length 10 m |
| M12-PVC / 5-25 m | PVC-cable 5-pin, length 25 m |

PVC-cable with M12-connection, brass nickel-plated, IP 67, shielded

| | |
|--------------------------|------------------------------|
| M12-PVC / 4G-5 m | PVC-cable 4-pin, length 5 m |
| M12-PVC / 4G-10 m | PVC-cable 4-pin, length 10 m |
| M12-PVC / 4G-25 m | PVC-cable 4-pin, length 25 m |
| M12-PVC / 5G-5 m | PVC-cable 5-pin, length 5 m |
| M12-PVC / 5G-10 m | PVC-cable 5-pin, length 10 m |
| M12-PVC / 5G-25 m | PVC-cable 5-pin, length 25 m |

| | |
|------------------|--|
| M12-K / 4 | M12-connection 4-pin, IDC technique, with plastic knurled screw |
| M12-K / 5 | M12-connection 5-pin, screw connection, with plastic knurled screw |

PVC-cable with M12-connection



Graphical Display



Options

CERT / 2.2 / FMQ
CAL / FMI/FMQ
CAL / FMI/FMQ / MP

factory certificate 2.2 as per DIN EN 10240 for FMQ
standard factory calibration certificate (2 calibration points)
multipoint factory calibration certificate (4 calibration points)