Installation and operating instructions

GFM 700 K
GFM 700 F
GFM 700 F-EEEx ATEX
GFM 700 F/HT-EEEx ATEX

Ultrasonic gas flowmeter
General advice on safety

Safety instructions
This product is designed for use in accordance with EN IEC 61010-1 for Installation Category 2 and Pollution Degree 2. Hazardous voltages are present within this product during normal operation. The product is designed for Protection Class I and should never be operated without protective earthing. The product shall also never be operated with covers removed unless equivalent protection of the operator and its environment from accidental contact with hazardous internal voltages is provided. Always follow basic and local safety precautions when using this product to reduce risk of injury from electrical shock, spread of fire or other dangerous situations.

1. Do not install, maintain or operate this flow meter without reading, understanding and following the factory-supplied instructions and manuals, otherwise injury or damage may result.
2. Read these instructions carefully before starting installation. Save these instructions for future reference.
3. Observe all warnings and instructions marked on the product.
4. Use only mains supply with protective earthing connected.
5. Do not use the product with removed covers under wet conditions.
6. Consider handling and lifting instructions to avoid damage.
7. Install the product securely and stable.
8. Install and connect cabling proper to exclude damage or harmful situations.
9. If the product does not operate normally refer to qualified KROHNE service technicians.
10. There are no operator serviceable components inside the product.

The following symbols may appear in this manual or on the product:

- **Attention** : refer to the manual
- **DANGER** : risk of electrical shock
- **PROTECTIVE conductor terminal**
- **WARNING**
  Warning statements identify conditions or practice that could result in injury loss of live.
- **CAUTION**
  Caution statements identify conditions or practice that could result in damage to the product or other property.

**Declarations of Conformity / Statement of Compliance**
Low Voltage directive
The product complies with the requirements of the Low Voltage Directive 73/23/EEC and is designed in accordance with EN IEC 61010-1 first and second edition. (safety requirements for electrical equipment for measurement, control and laboratory use part 1) Local safety regulations shall be observed in combination with the measures special to this product to avoid dangerous situations.
**Unpacking and inspection**

This product has been thoroughly inspected and tested before shipment and is ready for operation. After carefully unpacking, inspect for shipping damage before attempting to operate. If any indication of mechanical damage is found contact immediately the responsible transport service and your local KROHNE representative.

A simple operating check of the electronics after unpacking and before permanent installation, is advisable to ascertain whether it has suffered damage during shipment. Confirm for the correct mains voltage printed on the nameplate. If it differs from the ordered product, please contact your local KROHNE representative.

After connecting to the mains, check if there is any indication on the display and if the backlight of the display is lighted. If not contact your local KROHNE representative for advise.

**Disclaimer**

This document contains important information of the product. KROHNE attempts to be as accurate and up-to-date as possible but assumes no responsibility for errors or omissions. Nor does KROHNE make any commitment to update the information contained herein. This manual and all other documents are subject to change without notice. KROHNE will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect, incidental, punitive and consequential damages. This disclaimer does not apply in case KROHNE has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations. Any product purchased from KROHNE is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale. KROHNE reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

**CAUTION**

- There are no operator serviceable parts or adjustments within the product enclosure. Refer all servicing to trained service technicians.

- Source power shall be removed from the product to perform any servicing.

- This product is prepared for the nominal AC mains voltage indicated on its tagplate. To reconfigure the product power input for other mains voltages as listed in the chapter Technical data, the product must be modified including the fuses by a trained service technician. After a power input reconfiguration the tagplate needs to be adapted.

- This product is a Class 1 device, (earthed which utilizes a proper connection to the protective earthing for protection from electrical shock to ensure operator and its environmental safety.

- The protective conductor terminal of the product shall be properly connected to the protective earth wiring of the source power to ensure safety from electrically shock. See instruction manual.

- Protective earthing conductor terminal. This symbol indicates the point on the product to which the protective earthing conductor shall be connected. It is positioned near the terminal block, inside the terminal compartment. The diameter of the protective earthing conductor shall be in accordance with the Low Voltage Directive.

**Manufacturer**

The GFM 700 is developed and manufactured by
KROHNE Altometer
Kerkeplaat 12
3313 LC Dordrecht, The Netherlands
Content

1 GFM 700 Ultrasonic gas flowmeter 5
2 Size, flow velocity, flowrate 5
3 Measuring principle 6
4 Technical data 7 – 10
  4.1 Versions, full-scale ranges, accuracies 7
  4.2 GFS 700 Primary head 7
  4.3 GFC 700 Signal converter 8 – 9
  4.4 Environmental conditions 9
  4.5 Dimensions and weights 10
5 Installation notes 11
6 Electrical 11
  6.1 Electrical connections 11
  6.2 Electrical installation to the main supply voltage 11
7 Operation of the signal converter 12 – 20
  7.1 Table of settable functions 12 – 18
  7.2 Error messages 19 – 20
8 Addition for the GFM 700 F-Ex ATEX and
  GFM 700 HT Ex-Ex ATEX 20 – 30
  8.1 General 21
  8.2 System components 21 – 22
  8.3 Electrical connection 23 – 28
  8.4 Connecting cables 29
  8.5 Connection diagram 30
9 ATEX approvals 31 – 36
  9.1 GFC 700 F - Ex Signal converter 31 – 33
  9.2 GFS 700 F - Ex Primary head (flowmeter) 34 – 36
1 GFM 700 Ultrasonic gas flowmeter

First ultrasonic gas flowmeter with two beams

Non-contact ultrasonic gas flow measurement and volume counting, suitable for all gases available meter sizes DN 50-600 and 2”-24”.

Wide range of application
The large range of products that can be measured accurately and easily make this a truly universal device. Just a few examples:
- Natural gas
- Air
- Methane
- Nitrogen
- Determination of the molecular weight of gases
- Measurement in hazardous locations, Zones 1 and 2

Calibrated on EN 17025 accredited calibration rigs, calibration accuracy better than 99.97% of the measured value.

2 Size, flow velocity, flowrate

Selection of meter size / nominal pipe size
Flow velocities in m/s or ft/s and the flowrate in m³/h or US Gal / min can be determined for each meter size (DN) using the Tables below.

Example: \( v \) in m/s
Nominal pipe size DN 150
Required measuring range 1000 m³/h

For a flow velocity of 1 m/s at DN 150, the table gives a flowrate of 63.617 m³/h.

For 1000 m³/hr, the flow velocity \( v \) is thus

\[
1000 \text{ m}^3/\text{hr} \times 1 \text{ m/s} = 15.72 \text{ m/s}
\]

\[
v = \frac{1000 \text{ m}^3/\text{hr} \times 1 \text{ m/s}}{63.617 \text{ m}^3/\text{h}} = 15.72 \text{ m/s}
\]

Flowtable for \( v = 1 \text{ m/s} \)

<table>
<thead>
<tr>
<th>Meter size (in mm)</th>
<th>Flow (in m³/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN 50</td>
<td>7.0686</td>
</tr>
<tr>
<td>DN 65</td>
<td>11.946</td>
</tr>
<tr>
<td>DN 80</td>
<td>18.096</td>
</tr>
<tr>
<td>DN 100</td>
<td>28.274</td>
</tr>
<tr>
<td>DN 125</td>
<td>44.179</td>
</tr>
<tr>
<td>DN 150</td>
<td>63.617</td>
</tr>
<tr>
<td>DN 200</td>
<td>113.10</td>
</tr>
<tr>
<td>DN 250</td>
<td>176.71</td>
</tr>
<tr>
<td>DN 300</td>
<td>254.47</td>
</tr>
<tr>
<td>DN 350</td>
<td>346.36</td>
</tr>
<tr>
<td>DN 400</td>
<td>452.39</td>
</tr>
<tr>
<td>DN 500</td>
<td>706.86</td>
</tr>
<tr>
<td>DN 600</td>
<td>1017.9</td>
</tr>
</tbody>
</table>

Precise determination of flow velocities
For range setting, use the flow table below to determine the precise flow velocity for each nominal pipe size.

Example: \( v \) in ft/s
Nominal pipe size 6”
Required measuring range 5000 US Gal / min

For a flow velocity of 3.3 ft/s at 6”, the table gives a flowrate of 280.11 gal/min.

For 5000 Gal / min, the flow velocity \( v \) is thus

\[
5000 \text{ US Gal / min} \times 3.3 \text{ ft/s} = 58.91 \text{ ft/s}
\]

\[
v = \frac{5000 \text{ US Gal / min} \times 3.3 \text{ ft/s}}{280.11 \text{ US Gal / min}} = 58.91 \text{ ft/s}
\]

Flowtable for \( v = 10 \text{ ft/s} \)

<table>
<thead>
<tr>
<th>Meter size (in inches)</th>
<th>Flow (in US Gal/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN 50</td>
<td>31.13</td>
</tr>
<tr>
<td>DN 80</td>
<td>79.68</td>
</tr>
<tr>
<td>DN 100</td>
<td>124.49</td>
</tr>
<tr>
<td>DN 125</td>
<td>194.52</td>
</tr>
<tr>
<td>DN 150</td>
<td>280.11</td>
</tr>
<tr>
<td>DN 200</td>
<td>497.98</td>
</tr>
<tr>
<td>DN 250</td>
<td>778.05</td>
</tr>
<tr>
<td>DN 300</td>
<td>1525.0</td>
</tr>
<tr>
<td>DN 400</td>
<td>3112.8</td>
</tr>
<tr>
<td>DN 500</td>
<td>4418.8</td>
</tr>
</tbody>
</table>

Flowtable for \( v = 10 \text{ ft/s} \)
### Measuring principle

All KROHNE ultrasonic flowmeters operate using the transit-time differential method. Transit-time differential measurement is based on a simple physical fact. Imagine two canoes crossing a river on the same diagonal line, one with the flow and the other against the flow. The canoe moving with the flow needs much less time to reach the opposite bank.

Ultrasonic waves behave exactly the same way. A sound wave travelling in the direction of flow of the product is propagated at a faster rate than one travelling against the flow ($v_{AB} > v_{BA}$).

Transit times $t_{AB}$ and $t_{BA}$ are measured continuously. The difference ($t_{BA} - t_{AB}$) in time travelled by the two ultrasonic waves is directly proportional to the mean flow velocity ($v_{m}$) of the product.

The volumetric flowrate per unit time is the product of the mean flow velocity ($v_{m}$) multiplied by the pipe cross-section.

A liquid product is identified by direct measurement of the transit time of ultrasonic waves. Assuming the same path length (L), the transit time in water is shorter than in crude oil, for example.

#### Propagation rate of ultrasonic waves

<table>
<thead>
<tr>
<th>Direction of Flow</th>
<th>Propagation Rate $v_{AB}$</th>
<th>Transit Time $t_{AB}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>... in direction of flow of product from sensor A to B</td>
<td>$v_{AB} = c_{0} + v_{m} \times \cos \phi$</td>
<td>$t_{AB} = \frac{L}{c_{0} + v_{m} \times \cos \phi}$</td>
</tr>
<tr>
<td>... counter to direction of flow of product from sensor A to B</td>
<td>$v_{BA} = c_{0} - v_{m} \times \cos \phi$</td>
<td>$t_{BA} = \frac{L}{c_{0} - v_{m} \times \cos \phi}$</td>
</tr>
</tbody>
</table>

#### Mean flow velocity

| Mean Flow Velocity $v_{m}$ | $v_{m} = \frac{GK \times (t_{BA} - t_{AB})}{(t_{AB} \times t_{BA})}$ |

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A (A')$</td>
<td>Sensor A, transmitter and receiver</td>
</tr>
<tr>
<td>$B (B')$</td>
<td>Sensor B, transmitter and receiver</td>
</tr>
<tr>
<td>$c_{0}$</td>
<td>Sound velocity in the product</td>
</tr>
<tr>
<td>$GK$</td>
<td>A calibration constant</td>
</tr>
<tr>
<td>$L$</td>
<td>Length of measuring beam, distance between sensors A and B</td>
</tr>
<tr>
<td>$\phi$</td>
<td>Angle between pipe axis and measuring beam</td>
</tr>
</tbody>
</table>

$\text{Transit time } t_{AB}$ and $t_{BA}$ are measured continuously. The difference ($t_{BA} - t_{AB}$) in time travelled by the two ultrasonic waves is directly proportional to the mean flow velocity ($v_{m}$) of the product.
Technical data

4.1 Versions, full-scale ranges, accuracies

<table>
<thead>
<tr>
<th>Versions</th>
<th>Primary head (S)</th>
<th>Signal converter (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFM 700 K integral system</td>
<td>GFS 700 K</td>
<td>GFC 700 K</td>
</tr>
<tr>
<td>GFM 700 F remote system</td>
<td>GFS 700 F</td>
<td>GFC 700 F</td>
</tr>
<tr>
<td>GFM 700 F-EEEx</td>
<td>GFS 700 F-EEEx</td>
<td>GFC 700 F - EEx</td>
</tr>
<tr>
<td>(Ex versions (remote system))</td>
<td>Approval to ATEX (Ex II 2 G)</td>
<td>signal converter is installed</td>
</tr>
<tr>
<td></td>
<td>EEX de IIC T6 oder EEx d IIC T6</td>
<td>in non hazardous area</td>
</tr>
<tr>
<td></td>
<td>DEMKO Nr. 00ATEX2118 X</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Full-scale ranges (configurable)</th>
<th>Q_{100%} volume flow</th>
<th>V_{100%} flow velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>14 – 25000 m³/h</td>
<td>2 – 25 m/s</td>
</tr>
<tr>
<td>Option</td>
<td>14 – 30000 m³/h</td>
<td>2 – 30 m/s</td>
</tr>
<tr>
<td></td>
<td>60 – 88000 US Gal/min</td>
<td>6.6 – 80 ft/s</td>
</tr>
<tr>
<td></td>
<td>60 – 156000 US Gal/min</td>
<td>6.6 – 100 ft/s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Error limits</th>
<th>Accuracy</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DN ≤ 80 / ≥ 3”</td>
<td>V ≤ 2 m/s</td>
<td>± 0.04 m/s (± 0.13 ft/s)</td>
</tr>
<tr>
<td></td>
<td>V ≥ 2 m/s</td>
<td>± 2% of measured value</td>
</tr>
<tr>
<td>DN ≤ 65 / ≤ 1½”</td>
<td></td>
<td>± 2% of measured value + 0.04 m/s (± 2% of measured value + 0.13 ft/s)</td>
</tr>
<tr>
<td>Repeatability</td>
<td></td>
<td>± 0.5% of measured value</td>
</tr>
</tbody>
</table>

4.2 GFS 700 Primary head

<table>
<thead>
<tr>
<th>Diameter</th>
<th>DN 50 – 600 / 2” – 24” (option DN 700 – 1200 / 28” – 48”)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Flange connections</th>
<th>Pressure rating (standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td>to DIN 2501</td>
<td>PN 40 40 bar / 580 psig</td>
</tr>
<tr>
<td>DN 50, DN 80:</td>
<td>PN 16 16 bar / 230 psig</td>
</tr>
<tr>
<td>DN 65, DN 100 – 150:</td>
<td>PN 10 10 bar / 150 psig</td>
</tr>
<tr>
<td>DN 200 – 600:</td>
<td></td>
</tr>
<tr>
<td>to ANSI B 16.5</td>
<td>2” – 24”; Class 150 lb / RF</td>
</tr>
<tr>
<td>Special versions</td>
<td>max. 100 bar / 900 lb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Max. operating data</th>
<th>Gas-Temperature</th>
<th>Operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integral systems</td>
<td>140°C / 284°F</td>
<td>≤ 25 bar / 360 psig</td>
</tr>
<tr>
<td>Ambient temperature ≤ 40°C / ≤ 104°F</td>
<td>≤ 25 bar / 360 psig</td>
<td>≤ 40 bar / 580 psig</td>
</tr>
<tr>
<td>Ambient temperature ≤ 60°C / ≤ 140°F</td>
<td>≤ 25 bar / 360 psig</td>
<td>≤ 40 bar / 580 psig</td>
</tr>
<tr>
<td>Remote systems</td>
<td>180°C / 356°F</td>
<td>≤ 25 bar / 360 psig</td>
</tr>
<tr>
<td>Hazardous-duty versions</td>
<td>180°C / 356°F</td>
<td>≤ 20 bar / 300 psig</td>
</tr>
</tbody>
</table>

| Max. allowable flow velocity    | 25 m/s / ≤ 80 ft/s, optionally ≤ 30 m/s / ≤ 100 ft/s |

| Max. allowable meter size (DN)  | DN_{max} [mm] = 200 \times p_{gas} [kg/m³] or [inches] = 0.47 \times p_{gas} [lb/ft³] |
|---------------------------------| Density \rho_{gas} in kg/m³ or in lb/ft³ |

| Protection category (IEC 529 / EN 60529) | IP 65 equivalent to NEMA 4 and 4X |

<table>
<thead>
<tr>
<th>Materials</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring tube and flanges</td>
<td></td>
</tr>
<tr>
<td>Standard</td>
<td>DN 50-300 2”-12” SS 1.4301 (measuring tube) and steel (flanges)</td>
</tr>
<tr>
<td>DN 350-600 14”-24” steel</td>
<td></td>
</tr>
<tr>
<td>Option</td>
<td>DN 50-600 2”-24” SS 1.4404</td>
</tr>
<tr>
<td>DN 50-600 (only DIN)</td>
<td>SS 1.4571</td>
</tr>
<tr>
<td>Ultrasonic sensors</td>
<td>SS 1.4301</td>
</tr>
<tr>
<td>Gaskets</td>
<td>Viton</td>
</tr>
</tbody>
</table>
4.3 GFC 700 Signal converter

**Versions**
- Integral systems (K): GFC 700 K signal converter mounted on primary head
- Remote systems (F): GFC 700 F signal converter with wall mount (rotating design) and additional terminal box
- Option MP: signal converter equipped with magnet sensors, to set the signal converter by means of hand held bar magnet without opening the housing

**Power supply**

<table>
<thead>
<tr>
<th></th>
<th>1. AC Version</th>
<th>AC / DC Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Rated voltage</td>
<td>115 / 230 V</td>
<td>24 V AC</td>
</tr>
<tr>
<td>Tolerance band</td>
<td>+/- 13 %</td>
<td>20 – 27 V AC</td>
</tr>
<tr>
<td>Frequency</td>
<td>48 – 63 Hz</td>
<td>48 – 63 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>Max. 13 VA</td>
<td>approx. 10 VA</td>
</tr>
<tr>
<td>(incl. primary head)</td>
<td>approx. 8 W</td>
<td></td>
</tr>
</tbody>
</table>

When connected to functional extra-low voltage (24 V) safety separation (PELV) is essential to VDE 0100 / VDE 0106 and IEC 364 / IEC 536 or equivalent national standards.

**Analog Output**

- Function: continuous flowrate measurement or measurement of sound velocity to determine (composition of) liquid product
- all operating data configurable
- galvanically isolated
- for active and passive mode
- useable as internal power supply for the binary outputs

- Current
  - for Q = 0%: 0 – 16 mA settings in 1 mA increments
  - for Q = 100%: 4 – 20 mA (I_{max} = 22 mA)

- Active mode
  - load max. 680 Ohm

- Passive mode
  - external voltage \( \leq 18 \) V DC
  - load \( \leq 680 \) Ohm

- Low-flow cutoff
  - cutoff "on" value 1 – 19% of Q_{100%}
  - cutoff "off" value 2 – 20% setting in 1% increments

- Time constant
  - 0.04 – 3600 s, setting in increments of 1, 0.1 or 0.01 s

- Forward / reverse measurement
  - direction identified via status output (or pulse output)

- Internal power supply for binary outputs
  \( U_{int} = 19 – 32 \) V DC / I \( \leq 50 \) mA

**Pulse output**

- Function
  - continuous flow counting or measurement of sound velocity to determine (composition of) liquid product
  - all operating data configurable
  - galvanically isolated
  - active and passive mode

- Pulse rate for Q = 100%
  - 10 – 3600000 pulses/h
  - 0.167 – 60000 pulses/min
  - 0.0028 – 1000 pulses/s (= Hz)

- Pulse width
  - automatic: pulse duty cycle 1:1, max. 1000 Pulse/s = max. 1000 Hz variable: 30, 50, 100, 200, 500 ms, \( \leq 10 \) Pulse/s \( \leq 10 \) Hz

- Active mode
  - connection: electronic totalizer
  - internal voltage: 19 – 32 V DC, from current output
  - load current: \( I_{max} < 50 \) mA, operation with status output

- Passive mode
  - connection: electronic or electromechanical totalizer
  - external voltage: \( U_{ext} \leq 32 \) V DC / \( \leq 24 \) V AC
  - load current: \( I_{max} \leq 150 \) mA

- Low-flow cutoff
  - cutoff "on" value: 1 – 19%
  - cutoff "off" value: 2 – 20%

- Time constant
  - 0.04 – 3600 s, setting in increments of 1, 0.1 or 0.01 s

- Forward / reverse measurement
  - direction identified via status output or current output (status output only available in non-EEx version)
Local display

Display function
- 3-field LCD
- Actual flow rate, measurement of sound velocity to determine (composition of) liquid product, forward, reverse and sum totalizer (7-digit) and status messages; each can be set for continuous or sequential display

Units:
- Actual flow rate: m³, liter, US gallons per second, minute or hour, or in user-defined unit, e.g. liter/h or US gallon/day
- Totalizer: m³, liter, US gallons or in user-defined unit, e.g. hecto liter or US million gallon (min. 1 year overflow time)

Language of plain texts
- English, French, German, Dutch, other on request

Display
1st line (top): 8-character, 7-segment numeral and sign display, and symbols for key acknowledgement
2nd line (middle): 10-character, 14-segment text display
3rd line (bottom): 5 markers to identify display in measuring mode

Housing
- Material: die-cast aluminium with polyurethane finish
- Protection category: IP 67 (IEC 529 / EN 60529) equivalent to NEMA 4 and 4X

Signal cable
- Only for remote systems (F) length up to 10 m / 30 ft (max. 20 m / 60 ft, option)

4.4 Environmental conditions

In accordance with EN IEC 61010-1 the following environmental conditions have to be observed:

- The GFM 700 is designed to operate safe under the following conditions:
  - a) suitable for indoor and outdoor use, the housing of the signal converter is usable up to Protection Category IP67
  - b) IP 67 is only warranted when using suitable cabling in the cable glands
  - c) use up to an altitude of 2000 m above sea level
  - d) suitable for an operation ambient temperature range -40 … +60 °C
  - e) suitable for an storage temperature range -40 … + 80 °C
  - f) suitable for use in atmospheres with a relative humidity up to 80%
  - g) mains supply voltage fluctuations up to ± 13 % of the nominal voltage range
  - h) withstands over voltages up to category II on the main supply voltage (IEC 60364-4-443)
  - i) connected to protective earth conductor (Protection Class I)
  - j) rated pollution degree 2
### 4.5 Dimensions and weights

Flange connections to DIN 2501 / pressure PN, s. Tabelle: dimensions $b_{\text{DIN}}$ and $c_{\text{DIN}}$, maximum operation pressure, see Sect. 4.2
to ANSI / class 150 lb/RF: dimensions $b_{\text{ANSI}}$ and $c_{\text{ANSI}}$

<table>
<thead>
<tr>
<th>Meter size to ANSI</th>
<th>Dimensions in mm and (inches)</th>
<th>Weight ** approx. in kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$a$</td>
<td>$b_{\text{DIN}}$</td>
</tr>
<tr>
<td>**DIN mm</td>
<td>PN inches</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>65</td>
<td>16</td>
<td>2 1/4</td>
</tr>
<tr>
<td>80</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>100</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>125</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>150</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>200</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>300</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>350</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>400</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>450</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>500</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>550</td>
<td>10</td>
<td>22</td>
</tr>
<tr>
<td>600</td>
<td>10</td>
<td>24</td>
</tr>
</tbody>
</table>

Please note for compact flowmeter:

* dimension "b" see Table plus 210 mm

** weight see Table plus approx. 3.0 kg

GFM 700 K  Compact flowmeter
GFS 700 S  Primary head

GFC 700 F  Signal converter
wall mounting (rotatable)
weight approx. 4.2 kg

GFC 700 F – EEex  Signal converter
wall mounting (rotatable)
weight approx. 4.2 kg
5  Installation notes

Inlet run:
• downstream of a compressure or nozzle \( \geq 40 \times DN \)
• downstream of a fan \( \geq 30 \times DN \)
• downstream of fully open control valve \( \geq 20 \times DN \)
• downstream of a 90° bend (elbow) \( \geq 20 \times DN \)
• downstream of a reducer \( (\alpha/2 < 4°) \) no additional inlet run required

Outlet run:
\( \geq 10 \times DN \) (DN = meter size)

Installation conditions
Select position such that the measuring beam is approximately horizontal.
Fit the mating flanges precisely at right angles to the pipeline.

6.1 Electrical connection

• Power supply, power consumption and load rating of outputs, see "Technical data"

<table>
<thead>
<tr>
<th>Selection of connection diagrams</th>
<th>Standard operation</th>
<th>EEx operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current output</td>
<td>2) passive/active</td>
<td>1) active (also standard)</td>
</tr>
<tr>
<td>Pulse output</td>
<td>3) passive</td>
<td>4) passive (also standard)</td>
</tr>
<tr>
<td>Power supply and connection terminals</td>
<td>5)</td>
<td>6)</td>
</tr>
</tbody>
</table>

1) Current output active Standard and EEx

\[ R_l \leq 680 \, \Omega \]

\[ U_{ext} \leq 18 \, V \, DC \]
\[ R_i \leq 680 \, \Omega \]

2) Current output passive Standard

\[ U_{ext} = 19 \, V \, - \, 32 \, V \]
\[ R_1 \geq 650 \, \Omega \]
\[ I \leq 50 \, mA \]
EC electronic totalizer

3) Pulse output active Standard

\[ U_{output} = 19 \, V \, - \, 32 \, V \]
\[ R_1 \geq 650 \, \Omega \]
\[ I \leq 50 \, mA \]
EC electronic totalizer

4) Pulse output passive Standard and EEx

\[ U_{ext} \leq 32 \, V \, DC \leq 24 \, V \, AC \]
\[ I \leq 150 \, mA \]
EC electronic totalizer
EMC electromechanical totalizer

5) Power supply connection and all outputs standard

6) Power supply connection and all outputs EEx version

6.2 Electrical installation to the mains supply voltage

The GFM 700 is intended for permanent connection to the mains. It is required (for example for service) to mount an external switch or circuitbreaker near the product for disconnection from the mains. It must be reached easily by the operator and marked as the disconnecting device for this product. The switch or circuitbreaker has to be suitable for the application and shall also be in accordance with local (safety) requirements and requirements of the building installation.

The protective conductor clamp terminal size M5, press-fitted, in the terminal compartment (linear the power connection terminals) shall always be connected to the protective earth conductor of the main supply. Conductors up to 4mm² can be connected.

The diameter of the conductors of the main supply, including the protective earth conductor shall be in accordance with the general requirements.
## 7 Operation of the signal converter

### 7.1 Table of settable functions

<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>OPERATION</td>
<td>Main menu 1.0 Operation</td>
</tr>
<tr>
<td>1.1.0</td>
<td>BASIC. PARAM</td>
<td>Submenu 1.1.0 Basis parameters</td>
</tr>
<tr>
<td>1.1.1</td>
<td>FULL SCALE</td>
<td>Full-scale range for flowrate $Q_{100%}$, see Fct. 3.1.1</td>
</tr>
<tr>
<td>1.1.2</td>
<td>REV. SCALE</td>
<td>Different range for reverse flow required? See Fct. 3.1.2</td>
</tr>
<tr>
<td>1.1.3</td>
<td>REV. VALUE</td>
<td>Full-scale range for reverse flow $Q_{100%}$, see Fct. 3.1.3</td>
</tr>
<tr>
<td>1.1.4</td>
<td>ZERO SET.</td>
<td>Zero setting, see Fct. 3.1.4</td>
</tr>
<tr>
<td>1.2.0</td>
<td>DISPLAY</td>
<td>Submenu 1.2.0 Display</td>
</tr>
<tr>
<td>1.2.1</td>
<td>DISP. FLOW</td>
<td>Unit for flowrate display, see Fct. 3.2.1</td>
</tr>
<tr>
<td>1.2.2</td>
<td>DISP. TOTAL.</td>
<td>Function of totalizer display, see Fct. 3.2.2</td>
</tr>
<tr>
<td>1.2.3</td>
<td>UNIT TOTAL.</td>
<td>Unit for totalizer display required? See Fct. 3.2.3</td>
</tr>
<tr>
<td>1.2.4</td>
<td>DISP. SP. S.</td>
<td>Display of sound velocity required? See Fct. 3.2.4</td>
</tr>
<tr>
<td>1.2.5</td>
<td>CYCL. DISP.</td>
<td>Cyclic display required? See Fct. 3.2.5</td>
</tr>
<tr>
<td>1.3.0</td>
<td>CUR. OUTP. I</td>
<td>Submenu 1.3.0 Current output I</td>
</tr>
<tr>
<td>1.3.1</td>
<td>TIMECONST. I</td>
<td>Time constant of current output I, see Fct. 3.3.6</td>
</tr>
<tr>
<td>1.3.2</td>
<td>L.F.CUTOFF I</td>
<td>Low-flow cutoff (SMU) for current output required? See Fct. 3.3.7</td>
</tr>
<tr>
<td>1.3.3</td>
<td>CUTOFF ON</td>
<td>Cutoff &quot;on&quot; value SMU-I, see Fct. 3.3.8</td>
</tr>
<tr>
<td>1.3.4</td>
<td>CUTOFF OFF</td>
<td>Cutoff &quot;off&quot; value SMU-I, see Fct. 3.3.9</td>
</tr>
<tr>
<td>1.4.0</td>
<td>FREQ. OUTP. F</td>
<td>Submenu 1.4.0 Frequency output F</td>
</tr>
<tr>
<td>1.4.1</td>
<td>PULSRATE or PULSE/UNIT</td>
<td>Pulse rate for 100% flowrate or for sound velocity, see Fct. 3.4.3 or Pulse value for flowrate unit, see Fct. 3.4.3</td>
</tr>
<tr>
<td>1.4.2</td>
<td>L.F.CUTOFF F</td>
<td>Low-flow cutoff (SMU) for frequency output required? See Fct. 3.4.3</td>
</tr>
<tr>
<td>1.4.3</td>
<td>CUTOFF ON</td>
<td>Cutoff &quot;on&quot; value SMU-F, see Fct. 3.4.7</td>
</tr>
<tr>
<td>1.4.4</td>
<td>CUTOFF OFF</td>
<td>Cutoff &quot;off&quot; value SMU-F, see Fct. 3.4.8</td>
</tr>
<tr>
<td>2.0</td>
<td>TEST</td>
<td>Main menu 2.0 Test functions</td>
</tr>
<tr>
<td>2.1</td>
<td>TEST DISP.</td>
<td>Carry out display test (Sect. 7.1.1) Start with $\rightarrow$ key, duration approx. 30 Sec. Test interruption with $\downarrow$ key.</td>
</tr>
<tr>
<td>2.2</td>
<td>TEST I</td>
<td>Test current output I (Sect. 7.1.2)</td>
</tr>
<tr>
<td>2.3</td>
<td>TEST F</td>
<td>Test frequency output F (Sect. 7.1.3)</td>
</tr>
<tr>
<td>2.4</td>
<td>PROCESSOR</td>
<td>Test microprocessor (Sect. 7.1.4) Start with $\downarrow$ key, duration approx. 2 Sec. End of test: NO ERROR or ERROR displayed.</td>
</tr>
<tr>
<td>Fct.</td>
<td>Text</td>
<td>Description and settings</td>
</tr>
<tr>
<td>------</td>
<td>------</td>
<td>--------------------------</td>
</tr>
<tr>
<td><strong>3.0</strong> INSTALL</td>
<td><strong>Main menu 3.0 Installation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>3.1.0</strong> BASIS.PARAM.</td>
<td><strong>Submenu 3.1.0 Basisparameters</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 3.1.1 | FULL SCALE | Full-scale range for flowrate $Q_{100\%}$  
Unit: select from list under Fct. 3.2.1  
Value: $9.5 \times 10^{-7}$ - 150.8 m³/Sec or  
3.9 - 1,987,200 US Gal/min  
After selecting unit, call numerical value with ↓ key, 1st digit flashes. |
| 3.1.2 | REV. SCALE | Different range for reverse flow required? Setting NO or YES |
| 3.1.3 | REV. VALUE | Full-scale range for reverse flow (appears only if YES set under Fct. 3.2.1)  
Unit: select from list under Fct. 3.2.1  
Value: $9.5 \times 10^{-7}$ - 150.8 m³/Sec or  
3.9 - 1,987,200 US Gal/min  
Value must not be larger than that of Fct. 3.1.1!  
After selecting unit, call numerical value with ↓ key, 1st digit flashes. |
| 3.1.4 | ZERO SET | Zero setting  
• FIXED.VALUE  
• VALUE.MEASU.  
(Carry out only at “zero” flow and with completely filled measuring tube).  
1) Inquiry: CALIB. NO or YES  
2) if YES: calibration (duration approx 20 Sec) with zero display in PERCENT of $Q_{100\%}$  
3) Inquiry: STORE NO or YES. |
| 3.1.5 | METER SIZE | Meter size  
Unit: mm or inches  
Value: 25 - 1200 mm or 0.98 - 48 inches  
After selecting unit, call numerical value with ↓ key, 1st digit flashes. |
| 3.1.6 | GK VALUE | Primary head constant GK (see also primary head nameplate).  
Range: 0.5 - 14 |
| 3.1.7 | FLOW DIR | Define direction of forward flow, see Sect. 5.4.  
Setting: + or -, acc. to direction of arrow on primary head. |
| 3.1.8 | MIN SP. S. | Minimum sound velocity  
Minimum value used for $I_0\%$ or $F_0\%$ (when function SOUND.VELO. selected in 3.3.1 or 3.4.1)  
Value: 0 to 5000 m/s |
| 3.1.9 | MAX SP. S | Maximum sound velocity  
Maximum value used for $I_{100\%}$ or $F_{100\%}$ (when function SOUND.VELO. selected in 3.3.1 or 3.4.1)  
Value: 1 - 5000 m/s |
<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2.0</td>
<td>DISPLAY</td>
<td>Submenu 3.2.0 Display</td>
</tr>
</tbody>
</table>
| 3.2.1 | DISP. FLOW | Unit for flowrate  
• m³/sec • Liter/sec  
• US Gal/sec  
• m³/min • Liter/min  
• US Gal/min  
• m³/hr • Liter/hr • US Gal/hr  
• h Liter/hr or US.Mgal/DAY  
(factory set, can be changed as required, see Fct. 3.6.6, 3.6.7+3.6.8 and Sect. 5.14)  
• PERCENT  
• NO DISPLAY |
| 3.2.2 | DISP. TOTAL | Function of totalizer display  
• + TOTAL. (forward totalizer)  
• -- TOTAL. (reverse totalizer)  
• +/- TOTAL. (forward and reverse totalizers, alternating)  
• SUM TOTAL. (sum of + and -- totalizers)  
• ALL TOTAL. (alternating, sum, + and --totalizers)  
• TOTAL. OFF (totalizer switched off) |
| 3.2.3 | UNIT TOTAL | Unit for totalizer display  
• m³ • Liter • US Gal  
• h Liter or US.Mgal  
(see Fct. 3.2.1 “hLiter/hr” and “US.Mgal/DAY”) |
| 3.2.4 | DISP. SP. S | Display of sound velocity (in m/s) required?  
Setting: NO or YES |
| 3.2.5 | CYCL. DISP. | Cyclic display required?  
Setting: NO or YES |
| 3.2.6 | ERROR MSG. | Which error messages to be displayed?  
• NO MESSAGES  
(no error messages)  
• US ERROR  
(only ultrasonic errors)  
• TOTAL.ERROR  
(only errors of internal totalizer)  
• ALL ERRORS (all errors) |
### 3.3.0 CUR. OUTP. I

**Submenu 3.3.0 Current output I**

<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
</table>
| 3.3.1 | FUNCTION I | Function, current output I  
• OFF (switched off)  
• F/R IND.  
  (F/R indication, e.g. for F)  
• 1 DIR. (1 flow direction)  
• 1<lf 0 PCT  
  (Forward / Reverse flow,  
e.g. in 0 - 20 mA range:  
  F=10 - 20 mA and R=10 - 0 mA)  
• 2 DIR. (Forward/Reverse flow,  
  F/R-measurement)  
• SP. SOUND (sound velocity) |
| 3.3.2 | RANGE I | Range for current output I, see Sect. 5.7.2  
• 0 - 20 mA  
• 4 - 20 mA  
• OTHER RANGE  
  (see Fct. 3.3.3, 3.3.4 + 3.3.5) |
| 3.3.3 | 10 PCT. | Current for 0% flow (l0%)  
  (appears only if OTHER RANGE  
  set under Fct. 3.3.2).  
  Value: 00 to 16 mA |
| 3.3.4 | 100 PCT. | Current for 100% flow (l100%)  
  of full-scale range (Fct. 3.1.1)  
  (appears only if OTHER RANGE  
  set under Fct. 3.3.2).  
  Value: 04 - 20 mA  
  (value must be at least 4 mA  
  greater than that of Fct. 3.3.4). |
| 3.3.5 | MAX mA | Current limitation (lmax)  
  see Fct. 5.7.2  
  (appears only if OTHER RANGE is  
  set under Fct. 3.3.2)  
  Value: 04 - 20 mA  
  (value must be at least 4 mA  
  greater than that of Fct. 3.3.4). |
| 3.3.6 | TIMECONST. I | Time constant of current output I  
  Value: 0.04 - 3600 Sec |
| 3.3.7 | L.F.CUTOFF I | Low flow cutoff (SMU) for current output required?  
  Setting: NO or YES |
| 3.3.8 | L.F.CUTOFF ON | Cutoff "on" value for SMU-I  
  (appears only if YES set  
  under Fct. 3.3.7)  
  Value: 01 - 19 PERCENT of Q100%  
  (Fct. 3.1.1) |
| 3.3.9 | L.F.CUTOFF OFF | Cutoff "off" value for SMU-I  
  (appears only if YES set  
  under Fct. 3.3.7)  
  Value: 02 - 20 PERCENT of Q100%  
  (Fct. 3.1.1), value must be greater  
  than that of Fct. 3.3.8. |
<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.4.0</td>
<td>FREQ. OUTP_F</td>
<td>Submenu 3.4.0 Frequency output F</td>
</tr>
</tbody>
</table>
| 3.4.1 | FUNCTION F | Function, frequency output F  
• OFF (switched off)  
• F/R IND. (F/R indication, e.g. for I)  
• 1 DIR. (1 flow direction)  
• 2 DIR. (forward / reverse flow, F/R measurement)  
• SP. SOUND (sound velocity) |
| 3.4.2 | PULSOUTP | Unit of frequency output F  
• PULSRATE (setting in pulses per unit time)  
• PULSE/UNIT (setting in pulses per unit volume) |
| 3.4.3 | PULSRATE | Pulse rate for 100% flowrate or for sound velocity, see Fct. 3.1.1 or 3.1.8 + 3.1.9 (appears only if PULSRATE set under Fct. 3.4.2)  
Value: 2.775\times10^{-3} - 1000 \text{Pulse/Sec} (= \text{Hz}) or 0.1667 - 60,000 \text{Pulse/min} or 10 - 3,600,000 \text{Pulse/hr}  
After selecting unit, call numerical value with key. 1 digit flashes. |
| 3.4.3 | PULSE/UNIT | Pulse value for flowrate unit (appears only if PULSE/UNIT set under Fct. 3.4.2)  
Unit: \text{Pulse} \text{per m}^3, \text{Liter}, \text{US Gal} or unit of Fct. 3.6.6, 3.6.7+3.6.8  
Value: 0.0001 to 9.9999\times10^9 \text{Pulse}  
(no check, but Q_{100\%}\times pulse value ≤ 3,600,000 pulses/hr).  
After selecting unit, call numerical value with key. 1 digit flashes. |
| 3.4.4 | PULSWIDTH | Pulse width for frequency output F  
≤ 10 Hz  
• 30 mSec  
• 200 mSec  
• 50 mSec  
• 100 mSec |
| 3.4.5 | TIMECONST. F | Time constant of frequency output F  
• 40 mSec  
• SAME AS I (time constant for F same as for I, see Fct. 3.3.6) |
| 3.4.6 | L.F.CUTOFF F | Low-flow cutoff (SMU) for frequency output required?  
Setting: NO or YES |
| 3.4.7 | CUTOFF ON | Cutoff “on” value SMU-F (appears only if YES set under Fct. 3.4.6)  
Value: 01 - 19 \text{PERCENT} of Q_{100\%} (Fct. 3.1.1) |
| 3.4.8 | CUTOFF OFF | Cutoff “off” value SMU-F (appears only if YES set under Fct. 3.4.6)  
Value: 02 - 20 \text{PERCENT} of Q_{100\%} (Fct. 3.1.1), value must be greater than of Fct. 3.3.8 |
## 3.5.0 USER DATA

### Submenu 3.5.0 User data

<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
</table>
| 3.5.1 | LANGUAGE | Language for display texts, see Sect. 5.11  
- GB/USA (English)  
- D (German)  
- F (French)  
- N (Dutch) |
| 3.5.2 | ENTRY.CODE. 1 | Entry code 1 for setting level required?  
See Sect. 5.12  
- NO = Entry with → key only  
- YES = Entry with → key and 9-keystroke code  
Setting of the code under Fct. 3.5.3 |
| 3.5.3 | CODE 1 | Set Code 1, see Sect. 5.12  
(appears only if YES set under Fct. 3.6.2)  
- Factory setting: →, →, →, ↵, ↵. ▲, ▲, ↑, ↑  
- Different code required: Press any 9-keystroke combination and then press the same combination again.  
Each keystroke acknowledged by "*".  
WRONG CODE appears if 1st and 2nd entries are not equal.  
Press ▲ + → keys and repeat entries. |
| 3.5.4 | LOCATION | Tag name setting  
(measurement point no.)  
max. 10 digits. Required only for flowmeters of "HHC" design  
(operator control via Hand-Held Communicator MIC 500, connected to current output).  
Factory setting: ALTIMETER  
Characters assignable to each place: A..Z / a..z / 0..9 / + / -./ underscore character = blank character. |
| 3.5.5 | OUTP. HOLD | Hold values of outputs during settings?  
Setting: NO or YES |
| 3.5.6 | UNIT TEXT | Text for user-defined unit  
Factory setting: hLiter/hr or US.MGal/DAY  
Characters assignable to each place: A..Z / a..z / 0..9 / + / -./ underscore character = blank character.  
Fraction bar "/" in 7th place is unalterable. |
| 3.5.7 | FACT. QUANT | Conversion factor for quantity F_M  
F_M = quantity per 1 m³!  
Factory setting: 1.00000 E1 (for hecto Liter)  
or 2.64172 E-4 (for US M.gallons)  
Value setting: 0.00001*10⁻⁹ - 9.99999*10⁻⁹ |
| 3.5.8 | FACT. TIME | Conversion factor for time F_T  
F_T in seconds!  
Factory setting: 3.60000 E3 (for hour)  
or 8.64000 E4 (for day)  
Value setting: 0.00001*10⁻⁹ - 9.99999*10⁻⁹ |
<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5.9</td>
<td>TOTAL.</td>
<td>RESET</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5.10</td>
<td>ENABL.</td>
<td>RESET</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5.11</td>
<td>PLAUSIB</td>
<td>ERR.</td>
</tr>
<tr>
<td>3.5.12</td>
<td>WEIGHT</td>
<td>P. OK</td>
</tr>
<tr>
<td>3.5.13</td>
<td>N. ER.</td>
<td>PLASIB</td>
</tr>
</tbody>
</table>
### 7.2 Error messages

<table>
<thead>
<tr>
<th>Fct.</th>
<th>Text</th>
<th>Description and settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0</td>
<td><strong>PARAM. ERROR</strong></td>
<td>Main menu 4.0 Parameter error</td>
</tr>
<tr>
<td></td>
<td><strong>FLOW VELOC.</strong></td>
<td>FLOW VELOCITY “v” incorrect: Ensure condition 0.5 m/s ≤ v ≤ 60 m/s or 1.5 ft/s ≤ v ≤ 180 ft/s is met!</td>
</tr>
<tr>
<td>4.1.1</td>
<td><strong>FULL SCALE</strong></td>
<td>Full-scale range for flowrate Q_{100%}, see Fct. 3.1.1</td>
</tr>
<tr>
<td>4.1.2</td>
<td><strong>METER SIZE</strong></td>
<td>Meter size, see Fct. 3.1.5</td>
</tr>
<tr>
<td>4.2.0</td>
<td><strong>F/R FLOW</strong></td>
<td>FULL-SCALE RANGE(S) for forward/reverse flow incorrect: Ensure condition F ≥ R is met!</td>
</tr>
<tr>
<td>4.2.1</td>
<td><strong>FULL SCALE</strong></td>
<td>Full-scale range for forward flowrate Q_{100%}, see Fct. 3.1.1</td>
</tr>
<tr>
<td>4.2.2</td>
<td><strong>REV. SCALE</strong></td>
<td>Different range for reverse flow required? See Fct. 3.1.2</td>
</tr>
<tr>
<td>4.2.3</td>
<td><strong>REV. VALUE</strong></td>
<td>Full-scale range for reverse flow Q_{100%}, see Fct. 3.1.3</td>
</tr>
<tr>
<td>4.3.0</td>
<td><strong>I RANGE</strong></td>
<td>CURRENT OUTPUT I RANGE incorrect: Ensure condition l_{100%}−l_{0%} ≥ 4 mA is met!</td>
</tr>
<tr>
<td>4.3.1</td>
<td><strong>I 0 PCT</strong></td>
<td>Current for 0% flow (l_{0%}), see Fct. 3.3.3</td>
</tr>
<tr>
<td>4.3.2</td>
<td><strong>I 100 PCT</strong></td>
<td>Current for 100% flow (l_{100%}), see Fct. 3.3.4</td>
</tr>
<tr>
<td>4.4.0</td>
<td><strong>I MAXIMUM</strong></td>
<td>CURRENT LIMITATION incorrect: Ensure condition l_{max} ≥ l_{100%} is met!</td>
</tr>
<tr>
<td>4.4.1</td>
<td><strong>I 100 PCT</strong></td>
<td>Current for 100% flow (l_{100%}), see Fct. 3.3.4</td>
</tr>
<tr>
<td>4.4.2</td>
<td><strong>I MAX mA</strong></td>
<td>Setting of max. output current (l_{max}), see Fct. 3.3.5</td>
</tr>
<tr>
<td>4.5.0</td>
<td><strong>LFC. I RANG.</strong></td>
<td>LOW-FLOW CUTOFF RANGE I incorrect: Ensure condition cutoff “off”. Cutoff “on” &gt; 1% is met!</td>
</tr>
<tr>
<td>4.5.1</td>
<td><strong>L.F. CUTOFF I</strong></td>
<td>Low-flow cutoff (SMU) for current output required? See Fct. 3.3.7</td>
</tr>
<tr>
<td>4.5.2</td>
<td><strong>CUTOFF ON</strong></td>
<td>Cutoff “on” value SMU-I, see Fct. 3.3.8</td>
</tr>
<tr>
<td>4.5.3</td>
<td><strong>CUTOFF OFF</strong></td>
<td>Cutoff “off” value SMU-I, see Fct. 3.3.9</td>
</tr>
<tr>
<td>4.6.0</td>
<td><strong>LFC. F RANG.</strong></td>
<td>LOW-FLOW CUTOFF RANGE F incorrect: Ensure condition cutoff “off”. Cutoff “on” ≥ 1% is met!</td>
</tr>
<tr>
<td>4.6.1</td>
<td><strong>L.F. CUTOFF F</strong></td>
<td>Low-flow cutoff (SMU) for frequency output required? See Fct. 3.4.6</td>
</tr>
<tr>
<td>4.6.2</td>
<td><strong>CUTOFF ON</strong></td>
<td>Cutoff “on” value SMU-F, see Fct. 3.4.7</td>
</tr>
<tr>
<td>4.6.3</td>
<td><strong>CUTOFF OFF</strong></td>
<td>Cutoff “off” value SMU-F, see Fct. 3.4.8</td>
</tr>
<tr>
<td>Fct.</td>
<td>Text</td>
<td>Description and settings</td>
</tr>
<tr>
<td>-------</td>
<td>------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>4.7.0</td>
<td>F &gt; 1 kHz</td>
<td>OUTPUT FREQUENCY too high: must be less than 1 kHz!</td>
</tr>
<tr>
<td>4.7.1</td>
<td>FULL SCALE</td>
<td>Full-scale range for flowrate Q100%, see Fct. 3.1.1</td>
</tr>
<tr>
<td>4.7.2</td>
<td>PULSOUTP.</td>
<td>Unit of frequency output F, see Fct. 3.4.2</td>
</tr>
<tr>
<td>4.7.3</td>
<td>PULSRATE or PULSE/UNIT</td>
<td>Pulse rate for 100% flowrate or for sound velocity, see Fct. 3.4.3 or Pulse value for flowrate unit, see Fct. 3.4.3</td>
</tr>
<tr>
<td>4.8.0</td>
<td>F &lt;&gt; PULSW.</td>
<td>FREQUENCY/PULSE WIDTH ASSIGNMENT is incorrect</td>
</tr>
<tr>
<td>4.8.1</td>
<td>PULSOUTP.</td>
<td>Unit of frequency output F, see Fct. 3.4.2</td>
</tr>
<tr>
<td>4.8.2</td>
<td>PULSRATE or PULSE/UNIT</td>
<td>Pulse rate for 100% flowrate or for sound velocity, see Fct 3.4.3 or Pulse value for flowrate unit, see Fct. 3.4.3</td>
</tr>
<tr>
<td>4.8.3</td>
<td>PULSWIDTH</td>
<td>Pulse width for frequencies ≤ 10 Hz, see Fct. 3.4.4</td>
</tr>
<tr>
<td>4.9.0</td>
<td>PULS/T.TIME</td>
<td>Incorrect ASSIGNMENT of UNIT for F and SOUND VELOCITY</td>
</tr>
<tr>
<td>4.9.1</td>
<td>FUNCTION I</td>
<td>Function of frequency output F, see Fct. 3.4.1</td>
</tr>
<tr>
<td>4.9.2</td>
<td>PULSOUTP.</td>
<td>Unit of frequency output F, see Fct. 3.4.2</td>
</tr>
<tr>
<td>4.10.0</td>
<td>LFC. I/T.TIME</td>
<td>LOW-FLOW CUTOFF I incorrect: Ensure low-flow cutoff is “off” when function of current output is sound velocity.</td>
</tr>
<tr>
<td>4.10.1</td>
<td>FUNCTION I</td>
<td>Function of current output I, see Fct. 3.3.1</td>
</tr>
<tr>
<td>4.10.2</td>
<td>L.F.CUTOFF I</td>
<td>Low-flow cutoff (SMU) for current output required? See Fct. 3.3.7</td>
</tr>
<tr>
<td>4.11.0</td>
<td>LFC. F/T.TIME</td>
<td>LOW-FLOW CUTOFF F incorrect: Ensure low-flow cutoff is “off” when function of frequency output is sound velocity.</td>
</tr>
<tr>
<td>4.11.1</td>
<td>FUNCTION F</td>
<td>Function of frequency output F, see Fct. 3.4.1</td>
</tr>
<tr>
<td>4.11.2</td>
<td>L.F.CUTOFF F</td>
<td>Low-flow cutoff (SMU) for frequency output required? See Fct. 3.4.6</td>
</tr>
<tr>
<td>4.12.0</td>
<td>V.S. min&gt;max</td>
<td>MAX. SOUND VELOCITY MUST BE LARGER THAN MIN. SOUND VELOCITY.</td>
</tr>
<tr>
<td>4.12.1</td>
<td>MIN SP. S</td>
<td>Minimum sound velocity, sound velocity for I0% or F0%</td>
</tr>
<tr>
<td>4.12.2</td>
<td>MAX SP. S</td>
<td>Maximum sound velocity, sound velocity for I100% or F100%</td>
</tr>
</tbody>
</table>
8. Addition for the GFM 700 F-EEx ATEX and GFM 700 HT EEx-ATEX

8.1 Safety instructions
This product is designed for use in accordance with EN IEC 61010-1 for Installation Category 2 and Pollution Degree 2. Hazardous voltages are present within this product during normal operation. The product is designed for Protection Class I and should never be operated without protective earthing. The product shall also never be operated with covers removed unless equivalent protection of the operator and its environment from accidental contact with hazardous internal voltages is provided. Always follow basic and local safety precautions when using this product to reduce risk of injury from electrical shock, spread of fire or other dangerous situations.

WARNING!
No changes may be made to the devices. Unauthorized changes might affect the explosion safety of the devices.

These additional instructions are an extension to the standard Installation and Operating Instructions and only applies for the EEx version of the GFM 700 F gas flowmeter. All technical information described in the standard Installation and Operating Instructions are applicable, when not specifically excluded or replaced by the instructions in these additional instructions.

Be sure to follow these instructions!

8.2 SYSTEM COMPONENTS

8.2.1 General information
The Altosonic gas flowmeter system GFM 700 F-EEx consists of the ultrasonic gas flow sensor GFS 700 F-EEx or GFS 700 F/HT-EEx (high-temperature version) in combination with the ultrasonic gas flow converter GFC 700 F-EEx. Both the sensor and the converter can be installed in a hazardous location of Zone 1 or 2. The schematic block diagram of the gas flowmeter system is given in Figure 1 (see Section 4 Connection diagram for details).

Figure 1: Schematic block diagram of the GFM 700 F-EEx gas flowmeter.

Important
The prescriptions and regulations as well as the electrical data described in the EG certificate of conformity must be obeyed.

Beside the instructions for electrical installations in non-hazardous locations according to the applicable National standard (equivalent to IEC 364, i.e. VDE 0100) especially the regulations in EN 60079-14 “Electrical installations in hazardous locations” or equivalent national standard (e.g. DIN VDE 0165) must be followed.

Installation, establishment, utilization and maintenance are only allowed to be executed by personnel with an education in explosion safety.
8.2.2 Gas flow sensor

There are two types of gas flow sensors, namely the GFS 700 F-EEx (standard version) and the GFS 700 F/HT-EEx (high-temperature version). The GFS 700 F/…-EEx gas flow sensors are in conformance with the European Directive 94/9 EG (ATEX 100a) and approved by KEMA according to the European Standards EN 50xxx under the following number.

KEMA 00 ATEX 2119 X

The GFS 700 F/…-EEx gas flow sensors have type of protection flameproof enclosure "d" according to EN 50018 (measuring sensors) and increased safety "e" according to EN 50019 (junction box). Both types of gas flow sensors are designed for ambient temperatures (i.e. $T_a$) in the range of -40°C to +60°C. The maximum permissible temperature of the gas(es) to be measured is restricted by the temperature class of the explosive atmosphere that (possibly) surrounds the gas flow sensor, see therefore Table 1 and 2 below.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Maximum gas temperature at $T_a \leq 60^\circ$C</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>80°C</td>
</tr>
<tr>
<td>T5</td>
<td>95°C</td>
</tr>
<tr>
<td>T4</td>
<td>130°C</td>
</tr>
<tr>
<td>T3</td>
<td>180°C</td>
</tr>
</tbody>
</table>

Table 1: Temperature classification of GFS 700 F-EEx (standard).

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Maximum gas temperature at $T_a \leq 60^\circ$C</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>80°C</td>
</tr>
<tr>
<td>T5</td>
<td>95°C</td>
</tr>
<tr>
<td>T4</td>
<td>130°C</td>
</tr>
<tr>
<td>T3</td>
<td>195°C</td>
</tr>
<tr>
<td>T2</td>
<td>290°C</td>
</tr>
<tr>
<td>T1</td>
<td>440°C</td>
</tr>
</tbody>
</table>

Table 2: Temperature classification of GFS 700 F-EEx (standard).

The GFS 700 F-EEx gas flow sensor is marked with the code II 2G EEx de IIC T6...T3, the high-temperature version GFS 700 F/HT-EEx bears code II 2G EEx de IIC T6...T1. See also the respective Certificate of Conformity in section 5.1 of these additional instructions.

8.2.3 Gas flow converter

The GFC 700 F-EEx gas flow converter also conforms to the European Directive 94/9 EG (ATEX 100a) and is approved by KEMA in accordance with the European Standards of the EN 50xxx series. The GFC 700 F-EEx has the following approval number.

KEMA 00 ATEX 2118 X

The GFC 700 F-EEx ultrasonic gas flow converter has type of protection flameproof enclosure "d" to EN 50018 (electronics compartment and optional for terminal compartment) and/or increased safety "e" according to EN 50019 (standard for terminal compartment). The flow converter is suitable for ambient temperatures in the range of -40 to +60°C and is marked with temperature classification T6, because a maximum surface temperature of 80°C (85°C minus 5 K safety margin) is not exceeded.

The GFC 700 F-EEx is marked with code II 2G EEx d IIC T6 for the terminal compartment in type of protection "d" or with code II 2G EEx de IIC T6 (terminal compartment in "e"). The Certificate of Conformity is listed in section 5.2 of these additional instructions.
8.3 ELECTRICAL CONNECTION

8.3.1 General
The GFC 700 F-EEx gas flow converter is always connected to one of two in Section 1.2 (see previous page) described GFS 700 F/-EEx ultrasonic gas flow sensors via the factory installed MR04 type connecting cable. Both apparatus must also be incorporated into the equipotential bonding system via respectively the external M5 clamp terminal that is pressed into the connecting flange at the bottom of the signal converter housing (of GFC 700 F-EEx) and the M8 terminal on the warning plate of the GFS 700 F/-EEx gas flow sensor.

8.3.2 Gas flow converter
The MR04 connecting cable runs into the flameproof ("EEx d") electronics compartment through an "EEx d" approved cable gland. The cable is factory installed and tightly clamped by this gland. The gland may under no conditions be (re)assembled by the customer, because it could damage the flameproof properties of the electronics compartment.

The field cables that enter the terminal compartment of the GFC 700 F-EEx flow converter (power supply, current output and binary outputs) are non-intrinsically safe. For connection of measuring devices to the output terminals, the wiring requirements for type of protection of the compartment (standard: increased safety "e", option: flameproof enclosure "d") must be according to the international or national standard (e.g. DIN VDE 0165, section 5.6) involved.

For flameproof conduit systems, the terminal compartment must have type of protection flameproof enclosure "d" according to EN 50018. The conduits must be sealed by "EEx d" approved (within the ATEX 100a directive) sealing devices (i.e. stopping box) directly at the conduit entrances of the as flameproof enclosure performed terminal compartment.

The arrangement of the terminals in the terminal compartment is shown by Figure 2 below.

**Figure 2:** Arrangement of terminals.

<table>
<thead>
<tr>
<th>Pulse output</th>
<th>Status output</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 B- B2 I+ I</td>
<td>L N</td>
</tr>
</tbody>
</table>

**NOTE:** The status output is not supported by the current software yet, but will be supported by future software versions. The current and pulse output are galvanically insulated from each other as well as from all other input/output circuits.
8.3.3 Replacement of electronics unit or power fuse(s)

**IMPORTANT !**

The following instructions must be followed carefully if the GFC 700 F-EEx gas flow converter housing has to be opened respectively closed!

**Before opening:**
- Make absolutely sure that there is no explosion hazard!
- **Gas-free certificate**!
- Make sure that all connecting cables are safely isolated from the power supply!
- Allow the prescribed waiting time to elapse before opening the housing:
  - 20 minutes for temperature class T6
  - 11 minutes for temperature class T5

When the instructions above are strictly followed, the cover (includes a glass window) of the electronics compartment may be removed. First unscrew the recessed head screw of the interlocking device by a hollow-head screw wrench size 3, until the cover can rotate freely. Unscrew the cover with the special plastic wrench (black) that is supplied with the apparatus.

**After opening:**
- The copper grounding strip at the back of the electronics unit must be securely screwed to the housing (back-end of electronics compartment) by screw C (see Figure 5). The electronics unit is mounted to the back-end of electronics compartment by two screws B. Before screws B and C can be accessed, the display unit must be removed via screws A.
- Before the cover is screwed back into the housing, the screw-thread must be clean and well-greased with an acid and resin-free grease, e.g. silicone grease.
- Screw the cover as tight as possible into the housing by hand, until it cannot be opened by hand anymore. Screw the recessed head screw of the interlocking device tight.
8.3.4 Replacement of electronics unit

See the standard Installation and Operating Instructions for detailed information about resetting and reprogramming the new electronics unit after replacement. Important customer specific data (like the value of the internal totalizer) should be noted before replacing the electronics unit!

Before commencing work, note the instructions in Section 2.3 ("Before opening"). Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws A of the display unit and turn display unit carefully aside or remove the unit completely by taking out the flat cable connector.
3. Unscrew the two mounting screws B of the electronics unit as well as screw C, which fixes the copper earth strip at the back of the housing. A screwdriver with a long shaft (200 mm) can best be used to unscrew C (e.g. screwdriver type Philips No. 2).
4. Pull the electronics unit carefully out of the converter housing, till the SMB connectors of the coaxial cables can be unplugged easily. Then remove the complete electronics unit.
5. Check the new electronics unit if the voltage setting (only applicable for AC supplies) and power fuse rating are correct. Change the voltage setting (see section 2.3.3) or exchange the fuse if necessary.
6. Carefully insert the electronics unit till the numbered SMB connectors can be connected to the corresponding numbered SMB receptacles on the electronics unit. Then mount the unit completely into the housing and fix the screws. First C, then B and finally screw the display unit on the electronics via screws A, after the flat cable connector is connected.
7. Screw the cover of the electronics compartment back into the housing.

Note the instructions of section 2.3 ("After opening") during reassembling.

IMPORTANT!

Carefully keep the coaxial cables to the side of the housing, while inserting or removing the electronics unit into respectively from the converter housing. This is to prevent damaging of the coaxial cables!
8.3.5 Replacement of power fuse(s)

a) AC versions 115/230 VAC and 100/200 VAC

Before commencing work, note the instructions in Section 2.3 ("Before opening").

Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws A of the display unit and turn the display unit carefully aside.
3. The fuse-holder in which the power fuse is mounted is accessible now to exchange the defect power fuse F1 for one with the same rating. The rating depends on the voltage of the mains (T200mA for 100/115VAC and T125mA for 200/230 VAC setting). See also the yellow sticker on the mains transformer as shown in Figure 6 below.
4. Reassemble in reverse order (points 2 and 1).

Note the instructions of section 2.3 ("After opening") during reassembling.

---

b) 24 VAC/DC version

Before commencing work, note the instructions in Section 2.3 ("Before opening").

Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws A of the display unit and disconnect the display unit via the flat cable connector (see right picture of Figure 5 on the previous page).
3. Unscrew the copper earth strip (screw C) with the and the mounting screws B of the electronics unit. Pull the unit out until the SMB connectors of the coaxial cables can be disconnected from the electronics. Then take out the complete electronics unit. Be careful with the coaxial cables, so that they do not damage while removing the electronics unit from the flow converter housing. Continued on the next page!
4. The power fuses F1 and F2 (see Figure 7 below) can be replaced now. The 24 VAC/DC power supply uses two sub-miniature fuses of **T1.25A** in accordance with IEC 127-3.

5. Reassemble in reverse order (points 3 through 1).

*Note the instructions of section 2.3 ("After opening") during reassembling.*

---

**Figure 7:** GFC 700 electronics unit with 24 VAC/DC power supply.

**Figure 8:** Location of fuses F1, F2 on 24 VAC/DC unit.
8.3.6 Changing power supply voltage (not for 24 VAC/DC version)

Before commencing work, note the instructions in Section 2.3 (“Before opening”).
Then continue as follows:
1. Remove the cover of the electronics compartment.
2. Unscrew the two screws A of the display unit and turn display unit carefully aside or remove the unit completely by taking out the flat cable connector.
3. Unscrew the two mounting screws B of the electronics unit as well as screw C, which fixes the copper earth strip at the back of the housing. A screwdriver with a long shaft (200 mm) can best be used to unscrew C (e.g. screwdriver type Philips No. 2).
4. Pull the electronics unit carefully out of the converter housing, till the SMB connectors of the coaxial cables can be unplugged easily. Then remove the complete electronics unit.
5. The voltage setting of the power supply can be changed by turning the dummy dual-in-line block (i.e. voltage selector, see Figure 6 on page 6) over 180° in its socket. The position of the notch on the dummy dual-in-line block indicates the voltage setting. Also see the sticker that is mounted on the mains transformer (see Figure 6).
6. Carefully insert the electronics unit back into the housing until the numbered SMB connectors can be connected to the corresponding numbered SMB receptacles on the electronics unit. Then mount the unit completely into the housing and fix the screws. First C, then B and finally screw the display unit on the electronics via screws A, after the flat cable connector is connected.
7. Screw the cover of the electronics compartment back into the housing.

Note the instructions of section 2.3 (“After opening”) during reassembling.

IMPORTANT !
Carefully keep the coaxial cables to the side of the housing, while inserting or removing the electronics unit into respectively from the converter housing. This is to prevent damaging of the coaxial cables !

8.3.7 Gas flow sensor

The gas flow sensor is available in two designs, the GFS 700 F-EEx (standard) for gas temperatures up to a maximum of 180°C and the GFS 700 F/HT-EEx (high-temperature) for higher gas temperatures. Both types are connected to a GFC 700 F-EEx gas flow converter via a MR04 connecting cable (i.e. four RG 179 B/U coaxial cables with additional insulation). Each coaxial cable is marked by a number “1” to “4”. The core of each cable is connected to a “EEx e” approved terminal in the terminal box of the flow sensor. The core of the cable with number “1” is connected to the terminal marked with number “21”, the screen is connected to the adjoining terminal with number “1”. Core number “2” is connected to terminal number “22”, etcetera. An equipotential bonding conductor must interconnect the flow sensor to the gas flow converter (see section 2.5 below).

8.3.8 Equipotential bonding system

The equipotential bonding conductor consists of a insulated copper wire with a minimum cross-sectional area of 4 mm² (AWG 10). One side of the wire is connected to the external M5 clamp terminal on the connecting flange at the bottom of the converter housing, the other end is screwed to the M8 bolt/nut terminal on the warning plate of the gas flow sensor. This end of the cable is therefor provided with a eye cable tag.

8.3.9 Maximum length of connecting cable

The maximum length of the connecting MR04 cable between the GFC 700 F-EEx gas flow converter and the GFS 700 F/…-EEx gas flow sensor is standard limited at 10 m (30 ft) due to measurement technical reasons. Longer cables on request, but must be evaluated first.
8.4 CONNECTING CABLES

NOTE:
The below described cables are shown in the connection diagram on the following page.

**Cable A:**
Quad coaxial cable
Type MR04 (to be supplied by Krohne Altometer)

Technical data:
- Test voltage: \( \geq 500 \text{ V} \)
- Diameter of strand (core and screen): \( \geq 0.1 \text{ mm} \)
- Distributed capacitance (core/screen): 67 pF/m
- Distributed inductance (core/screen): 0.4 \( \mu \text{H/m} \)

**Cable B:**
Power supply cable
Cable parameters must be in accordance with the regulations in the EN 60079-14 *Electrical installations in hazardous locations* or an equivalent national standard (e.g. DIN VDE 0165).

- Rated voltage: \( \geq 500 \text{ V} \)
- Examples: H07.-., H05.-.

**Cable C:**
Signal cable for current output and binary outputs (pulse and status output).
Cable parameters must be in accordance with the regulations in the EN 60079-14 *Electrical installations in hazardous locations* or an equivalent national standard (e.g. DIN VDE 0165).

**Bonding conductor:**
- Minimum cross-sectional area: 4 mm\(^2\) (AWG 10)
8.5 CONNECTION DIAGRAM

S1 = gas sensor 1
S2 = gas sensor 2
S3 = gas sensor 3
S4 = gas sensor 4

Gas sensors have type of protection flameproof enclosure "EEx d"
9  ATEX approvals

9.1  GFC 700 F - EEx Signal converter
SCHEDULE
to EC-Type Examination Certificate KEMA 00ATEX2118 X

Description
The Ultrasonic Gas Flow Converter type GFC 700 F-EEx is the remote unit that is to be connected to the remote measuring unit Ultrasonic Gas Flowmeter type GFS 700 F-EEx. The enclosure is constructed in type of explosion protection flameproof enclosure “d”, with a terminal compartment either in type of explosion protection flameproof enclosure “d” or increased safety “e”.
The converter unit supplies power to the GFS 700-EEx unit and processes the electrical measurement signals thereof.
Ambient temperature range –40 °C ... +60 °C.

Electrical data
Power supply .................................. 100-240 Vac, 48 ... 63 Hz, 13 VA, or
24 Vdc, 8 W
Current output .................................. max. 22 mA, U ≤ 18 V
Pulse in-/outputs .................................. max. 150 mA, U ≤ 36 V

Installation instructions
The cable entry devices shall be of a certified (“ATEX” or “E-generation”) type EEx d for the terminal compartment in type of protection flameproof enclosure “d” or of a certified type EEx e for the terminal compartment in type of protection increased safety “e”, suitable for the conditions of use and correctly installed.
Unused apertures shall be closed with suitable blanking elements.

Routine tests
Routine tests according to Clause 16 of EN 50018 are not required since the type test has been made at a static pressure of four times the reference pressure.

Report
KEMA No. 2006240.

Special condition for safe use
The unterminated cable from the converter housing is to be connected and terminated in the terminal box of the GFS 700 F-EEx sensor assembly.
The cable between the GFC 700 F-EEX converter housing and the terminal box of the GFS 700 F-EEx sensor assembly, is to be fixed installed in such a way that it is protected against mechanical damage.
SCHEDULE

to EC-Type Examination Certificate KEMA 00ATEX2118 X

(18) Essential Health and Safety Requirements

<table>
<thead>
<tr>
<th>Clause</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.5</td>
<td>Marking</td>
</tr>
<tr>
<td>1.0.6 b) and d)</td>
<td>Instructions</td>
</tr>
</tbody>
</table>

These Essential Health and Safety Requirements are examined and positively judged. The results are laid down in the report listed at (16).

(19) Test documentation

1. Component Certificate PTB 98.E.1046 U

   Signed:

2. Description (6 pages)

3. Drawing No. 8.30872.10 rev. A
   8.30872.09
   33119301
   33119401

4. Samples
9.2 GFS 700 F - EEx Primary head (flowmeter)
SCHEDULE

to EC-Type Examination Certificate KEMA 00ATEX2119 X

Description

The Ultrasonic Gas Flow Meters type GFS 700 F-EEex and GFS 700 F/HT-EEex are the measuring units that are to be connected to the remote Ultrasonic Gas Flow Convertor type GFC 700 F-EEex. The Flow Meters consist of measuring sensors in type of explosion protection flameproof enclosure “d”, connected to a terminal box in type of explosion protection increased safety “e”.

Ambient temperature range –40 °C ... +60 °C.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Max. procès temperature (GFS 700 F-EEex)</th>
<th>Max. procès temperature (GFS 700 F/HT-EEex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6</td>
<td>80 °C</td>
<td>80 °C</td>
</tr>
<tr>
<td>T5</td>
<td>95 °C</td>
<td>95 °C</td>
</tr>
<tr>
<td>T4</td>
<td>130 °C</td>
<td>130 °C</td>
</tr>
<tr>
<td>T3</td>
<td>180 °C</td>
<td>180 °C</td>
</tr>
<tr>
<td>T2</td>
<td>-</td>
<td>290 °C</td>
</tr>
<tr>
<td>T1</td>
<td>-</td>
<td>440 °C</td>
</tr>
</tbody>
</table>

Electrical data

Current output ........................................... I ≤ 22 mA, U ≤ 18 V

Pulse status in-/outputs .............................. I ≤ 150 mA, U ≤ 36 V

Sensor outputs ........................................... U ≤ 400 Vpeak

Installation instructions

The cable entry device for the connecting cable to the Ultrasonic Gas Flow Convertor type GFC 700 F-EEex, shall be in type of explosion protection increased safety “e”, suitable for the conditions of use and correctly installed.

Unused apertures shall be closed with suitable certified blanking elements.

Routine tests

Routine tests according to Clause 16 of EN 50018 shall be carried out using an overpressure of at least 20 bar, during 1 minute.

Report

KEMA No. 2006242.
(13)

SCHEDULE

to EC-Type Examination Certificate KEMA 00ATEX2119 X

(17) Special conditions for safe use
The cable between the terminal box of the GFS 700 F-EEEx sensor assembly and the GFC 700 F-EEEx converter, is to be fixed installed in such a way that it is protected against mechanical damage.

(18) Essential Health and Safety Requirements
Covered by the standards listed at (9).

(19) Test documentation

1. EC-Type Examination Certificate PTB 00ATEX1063
   EC-Type Examination Certificate KEMA 98ATEX1651 U
   signed:
   25.10.2000 / 20.11.2001

2. Description (9 pages) 21.11.2001

3. Drawing No. 8.30872.01, rev. A
   8.30872.02, rev. A
   8.30872.03, rev. A
   8.30872.04, rev. B
   8.30872.05, rev. D
   8.30872.06, rev. A
   8.30872.07, rev. C
   8.30872.08, rev. B
   8.30872.11, rev. D
   8.30872.13, rev. A
   8.30872.12, rev. B
   8.30872.16, rev. A
   8.30872.17, rev. A
   12.04.2001

4. Samples

Page 3/3