Sensor for gas dispenser applications

Software revision:
V2.3.xx

The documentation is only complete when used in combination with the relevant documentation for the signal converter.

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1 SAFETY INSTRUCTIONS

1.1 Intended use

This flowmeter has been specifically designed for measuring Compressed Natural Gas (CNG) in retail dispensers.

CAUTION!
Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

INFORMATION!
This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

INFORMATION!
The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

1.2 Associated documents

This handbook should be read in conjunction with relevant documents in relation to:

- hazardous areas
- communications
- concentration
- corrosion

1.3 Dirty gas

Dirty gas is gas that carries sand or other solid particles. Dirty gas causes excessive wear to the primary measuring tube that can eventually result in complete tube failure. In some situations tube failure where gas is being measured, can be very dangerous.

DANGER!
If the meter is being used to measure gas and there is a risk that the gas might be dirty, you must fit a filter upstream of the meter to catch solid particles.
1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

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1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer 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.

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The manufacturer 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.

1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective “Standard Terms and Conditions” which form the basis for the sales contract shall also apply.
1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer cannot accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.
1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

**DANGER!**
This warning refers to the immediate danger when working with electricity.

**DANGER!**
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

**DANGER!**
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

**DANGER!**
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator’s plant.

**WARNING!**
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator’s plant.

**CAUTION!**
Disregarding these instructions can result in damage to the device or to parts of the operator’s plant.

**INFORMATION!**
These instructions contain important information for the handling of the device.

**LEGAL NOTICE!**
This note contains information on statutory directives and standards.

**HANDLING**
This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

**RESULT**
This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator

**WARNING!**
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel. This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.
2 DEVICE DESCRIPTION

2.1 Scope of delivery

If any items are missing, please contact the manufacturer.

2.2 Device description

This device has been designed for the mass measurement of Compressed Natural Gas (CNG) in CNG dispensers.

With excellent repeatability and low flow stability, the device is supplied ready to install and operate. The operating data is factory set according to the order specification but can be changed with the use of Toolbox.
3.1 Storage

- Store the device in a dry and dust-free location.
- Avoid direct exposure to the sun.
- Store the device in its original packing.
- Do not allow the ambient temperature to fall below -50°C / -58°F or rise above +85°C / +185°F.

3.2 General notes on installation

**INFORMATION!** Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!** Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!** Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.3 Mounting restrictions

3.3.1 General installation principles

There are no special installation requirements but you should note the following points:

- Support the weight of the meter as close to the meter body as possible.
- Mount the meter in such a way to avoid the build up of liquid in the measuring tube.
- Straight runs either side of the meter are not required.
- The use of reducers and other fittings at flanges, including flexible hoses, is allowed but you should take care to avoid cavitation.
- Avoid extreme pipe size reductions.
- Meters are not affected by crosstalk and can be mounted in series or in parallel.
- Avoid mounting the meter at the lowest point in the pipeline where liquid can collect.
Mounting positions

1. Avoid mounting the meter with the flow running uphill because it can cause liquid to build up on the supply side of the meter.
2. Mount the meter with the flow running downhill. This will allow any build up of liquid to drain from the meter.
3. Avoid mounting the meter with the connection box above the meter. This can cause liquid to collect in the measuring tubes at their lowest point in the meter.
4. Mount the meter with the junction box underneath the meter. This will prevent liquid from collecting in the measuring tubes.
5. The meter can be mounted vertically but DO NOT mount it so that the flow is uphill. This can cause fluid to build up on the supply side of the meter.
6. If you are mounting the meter vertically, mount it so that the flow is downhill. This will allow any build up of fluid to drain from the meter.
3.3.2 Flow direction

With the orientation of the meter as shown in the illustration, the factory set flow direction is left to right.

If the meter has been installed with the process flow running from right to left, the flow direction can be changed through the supplied software Toolbox. Please see the START-UP section.
Electrical connections

4.1 Safety instructions

DANGER!
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

DANGER!
Observe the national regulations for electrical installations!

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

WARNING!
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Electrical and I/O connections

For information regarding electrical and I/O connections, please refer to the handbook for the relevant signal converter.
5.1 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

5.2 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

5.3 Fault finding

The status of the meter and possible problems, can be checked using the diagnostic functions available in the Toolbox software supplied with the meter, or Modbus RS485 communication. There are no serviceable components in the meter. If the Toolbox diagnostics show a fault, the meter should be replaced.

The following diagnostic functions are available [please refer to the relevant converter Handbook for register values]:

Temperature:
This displays the temperature in either °C or °F. The temperature shown should be stable and the same as the actual process temperature.

Frequency:
This displays the vibration frequency of the measuring tubes and should be stable to the first decimal point. For example, the display might show 230.1xxx Hz. Variations in the first digit after the decimal point indicates a fluctuation in gas density. This fluctuation can be caused by changes in pressure / temperature or moisture in the gas.

Drive energy:
The typical value of the drive energy for gas with no moisture content is: 1...5%.

Sensor A and B:
The display should show values for sensors A and B of 80% and should be within 2% of each other.
5.4 Returning the device to the manufacturer

5.4.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

**CAUTION!**

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.
- This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.

**CAUTION!**

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,
- to enclose a certificate with the device confirming that is safe to handle and stating the product used.
5.4.2 Form (for copying) to accompany a returned device

**CAUTION!**
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

<table>
<thead>
<tr>
<th>Company:</th>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Department:</th>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tel. no.:</th>
<th>Fax no. and/or Email address:</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manufacturer’s order no. or serial no.:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

The device has been operated with the following medium:

This medium is:
- radioactive
- water-hazardous
- toxic
- caustic
- flammable

We checked that all cavities in the device are free from such substances.
We have flushed out and neutralized all cavities in the device.

We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.

<table>
<thead>
<tr>
<th>Date:</th>
<th>Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stamp:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

5.5 Disposal

**CAUTION!**
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life must not be disposed of with other waste. The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.
6.1 Measuring principle

When the meter is energised, the drive coil vibrates the measuring tubes causing them to oscillate and produce a sine wave (3). The sine wave is monitored by the two sensors.

Temperature measurement is made using a Pt500 sensor.
6.2 Technical data

INFORMATION!
- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

Measuring system

<table>
<thead>
<tr>
<th>Measuring principle</th>
<th>Coriolis mass flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Measurement of Compressed Natural Gas (CNG)</td>
</tr>
<tr>
<td>Measured values</td>
<td>Mass, standard or normal volume, temperature (volume &amp; density for liquids only)</td>
</tr>
</tbody>
</table>

Design

| Basic                          | System consists of a measuring sensor with integral MFC010 converter to process the output signal. |
| Features                      | Fully welded maintenance-free sensor with twin U-shaped measuring tube |

Application conditions

| Fluid                          | Compressed Natural Gas (CNG) with operating pressure typically > 100 barg / 1450 psig |
| Flow range capacity           | 1...70 kg/min / 2.2...155 lbs/min |
| Accuracy                      | ±0.5% of total batch (where minimum actual flow rate is 1 kg/min / 2.2 lbs/min) |
| Repeatability                 | ±0.3% of actual flow rate + zero stability (for a batch size > 1 kg, 2.2 lbs) |
| Zero stability                | ±0.015% of flow range capacity |
| Pressure rating               | |
| Static                        | 350 barg / 5076 psig |
| Cycling                       | 380 barg / 4351 psig |
| Process fluid temperature     | -40...+93°C / -40...+200°F |
| Ambient temperature           | -40...+55°C / -40...+131°F |

Mechanical

| Process connections           | ¾” NPT female (adaptor options are available) |
| Materials                     | |
| Measuring tube                | Stainless Steel 316L (1.4404) |
| Outer casing                  | |
| Sensor electronics housing    | |
| Junction box                  | Die cast Aluminium (polyurethane coating) |

Electrical

| Power supply                  | 12 VDC via Ex approved barrier (11.4...12.6 VDC) |
| Programming                   | Via Modbus. |
| Outputs                       | Modbus RTU over RS485 |
| Diagnostics                   | |
OPTIGAS 4010C

**Interface cable**
2 x screened twisted pairs with a minimum 20 AWG conductors. Total C ≤ 50nF, total L ≤ 200µH

**Cable glands**
M20 X 1.5 Stainless Steel suitable for cable diameter 6.5...9.5 mm

**Approvals**
- Custody transfer: PTB type approval 5.411 / 04.15
- Vibration: IEC 60068-2-6

**ATEX (acc. 94/9/EC)**

| OPTIGAS 4010C without heating jacket / insulation | Ex ib IIC T4...T1 Ga/Gb |
| OPTIGAS 4010C | II 1/2 G Ex ib IIC T4...T1 Ga/Gb |
| | II 2 D Ex ib IIC T210°C Db |
| | Ex ib IIC T4...T1 Ga/Gb |
| | Ex ib IIC T210°C Db |

**NEPSI**

| OPTIGAS 4010C | Ex ib IIC T4...T1 Ga/Gb |

1. Toolbox software is available from the manufacturer but it requires a compatible Modbus to PC adapter with approved barrier. Please call for more information.

**ATEX (acc. 94/9/EC) temperature limits**

<table>
<thead>
<tr>
<th>OPTIGAS 4010C without heating jacket / insulation</th>
<th>Ambient temp. Tamb °C</th>
<th>Max. medium temp. Tm °C</th>
<th>Temp. class</th>
<th>Max. surface temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40...+65</td>
<td>40</td>
<td>T4</td>
<td>T130</td>
<td></td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>T3</td>
<td>T195</td>
<td></td>
</tr>
<tr>
<td></td>
<td>140</td>
<td>T2 - T21</td>
<td>T210</td>
<td></td>
</tr>
</tbody>
</table>
6.3 Dimensions and weights

```
<table>
<thead>
<tr>
<th></th>
<th>[mm]</th>
<th>[inches]</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>359 ±2</td>
<td>14.1 ±0.08</td>
</tr>
<tr>
<td>B</td>
<td>97</td>
<td>3.8</td>
</tr>
<tr>
<td>C</td>
<td>97</td>
<td>3.8</td>
</tr>
<tr>
<td>D</td>
<td>194</td>
<td>7.6</td>
</tr>
<tr>
<td>E</td>
<td>50</td>
<td>1.97</td>
</tr>
</tbody>
</table>
```

Meter weights

```
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<thead>
<tr>
<th></th>
<th>kg</th>
<th>lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>All versions</td>
<td>9</td>
<td>19.8</td>
</tr>
</tbody>
</table>
```