Ultrasonic gas flow meter

Addendum for hazardous areas. These additional instructions are an extension to the OPTISONIC 7300 quick start and handbook.
1 Introduction

1.1 Safety instructions from the manufacturer
1.1.1 Copyright and data protection
1.1.2 Disclaimer
1.1.3 Information concerning the documentation
1.1.4 Warnings and symbols used
1.2 Safety instructions for the operator
1.3 Approval
1.4 OPTISONIC 7300 C/...-Ex
1.5 Ultrasonic gas transducers
1.6 Technical data
1.7 Marking codes
1.8 Marking labels

2 Temperature limits

2.1 General
2.2 OPTISONIC 7300 C/...-Ex

3 Electrical connections

3.1 General
3.2 Non-"Ex i" I/O connections
3.3 "Ex i" I/O connections

4 Maintenance

4.1 Maintenance
4.2 Before and after opening
4.3 Replacement of mains fuse
4.4 Exchange of electronics unit
4.5 Service / repair information
4.6 Form (for copying) to accompany a returned device
4.7 Disposal

5 Notes
1.1 Safety instructions from the manufacturer

1.1.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer’s documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet [e.g. when communicating by e-mail] may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.1.2 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.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

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.
1.1.3 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 can not 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.
1.1.4 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.
1.2 Safety instructions for the operator

**WARNING!**
- Do not change the device. Unauthorized changes may affect the explosion safety of the devices.
- The prescriptions and regulations as well as the electrical data described in the EC type examination certificate must be obeyed.
- Beside the instructions for electrical installations in non-hazardous locations according to the applicable national standard (equivalent to HD 384 or IEC 364, e.g. VDE 0100), especially the regulations in EN 60079-14 "Electrical installations in hazardous locations" or equivalent national standard (e.g. DIN VDE 0165 Part 1) must be strictly followed.
- Installation, establishment, utilization and maintenance are only allowed to be executed by personnel with an education in explosion safety!

These additional instructions are an extension to the standard documentation and only apply to the explosion protected versions of the devices. All technical information as described in the standard documentation is applicable, when not specifically excluded, completed or replaced by the instructions in these additional instructions. These notes and instructions shall accompany each device in an adequate form.

- The relation between ambient temperature, process temperature and temperature class is described in this manual.
- For details of the flameproof joints, contact KROHNE Altometer.
- Repairs on flameproof joints may only be performed in accordance with KROHNE Altometer’s design specifications. Repair on basis of the values in tables 1 respectively 2 of IEC 60079-1 is not permissible.

**Connection conditions**

1. When the terminal compartment of the OPTISONIC 7300 C/…-Ex ultrasonic gas flowmeter is designed to Ex-“d” type of protection, the following must be complied with:
- The device shall be connected with suitable cable glands or conduit systems that meet the requirements stipulated in IEC 60079-1, sections 13.1 and 13.2, and for which a separate test certificate has been issued. If the device is connected to conduit systems, the required sealing device shall be provided immediately at the enclosure.
- Cable glands (Pg type glands) and blanking plugs of simple design must not be used.
- Openings that are not used shall be sealed in compliance with the specifications in IEC 60079-1, section 11.9.
- If connection is made in a potentially explosive area, the connecting cable (unconnected cable end) of the OPTISONIC 7300 C/…-Ex ultrasonic gas flowmeter, shall be connected in an enclosure that meets the requirements of an approved type of protection in accordance with EN 60079-0, section 1.

2. The connecting cable of the OPTISONIC 7300 C/…-Ex ultrasonic gas flowmeter shall be fixed and routed so that it will be adequately protected against damage.
3. If the temperature at the input parts exceed 70°C, temperature-resistant connecting cables shall be used.
4. The OPTISONIC 7300 C/…-Ex ultrasonic gas flowmeter shall be included in the local equipotential bonding system of the potentially explosive area.
Components attached or installed [terminal compartments, bushings, Ex-type cable glands, connectors] shall be of a technical standard that complies as a minimum with the specifications on the cover sheet, and shall have a separate examination certificate. The operating conditions specified in the component certificates must be complied with.

**Warning sign**

In potentially explosive atmospheres, the enclosure may only be opened after it has been de-energized, and after the following waiting times have been allowed for (warning sign!).

The waiting time is 35 minutes for temperature class T6, and 10 minutes for temperature class T5. No waiting times have to be considered with temperature classes T4...T1.

The warning reads as follows:

*Do not open flameproof enclosure when energized!*  
Minimum waiting time before opening: T6 = 35 min., T5 = 10 min.

### 1.3 Approval

The ultrasonic gas flowmeters are manufactured according to the IECEx standards. These flowmeters are approved for installation and use in hazardous classified locations of Zone 1 and 2 and are in accordance with the IECEx Standards of the IEC 60079 series. They have approval number:

**IECEX FTZU 14.0007 X**

### 1.4 OPTISONIC 7300 C/...-Ex

The OPTISONIC 7300 C/...-Ex is the compact configuration of the GFC 300 ultrasonic flow converter and the OPTISONIC 7000 ultrasonic gas flow sensor. The gas flow sensor contains flameproof (Ex d) gas transducers made of titanium or flameproof (Ex d) transducers with a partly encapsulated (Ex ma) synthetic front. The gas flow converter is provided with non-Ex or intrinsically safe (Ex ia or Ex ib) signal outputs that are located in the terminal compartment, which can either be configured as “Ex d” (flameproof enclosure) or “Ex e” (increased safety).

The marking code can be:

<table>
<thead>
<tr>
<th>&quot;Ex d&quot; terminal compartment</th>
<th>&quot;Ex e&quot; terminal compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEx d [ia] IIC T6...T3 Gb</td>
<td>Ex de [ia] IIC T6...T3 Gb</td>
</tr>
<tr>
<td>Ex d IIC T6...T3 Gb</td>
<td>Ex de IIC T6...T3 Gb</td>
</tr>
<tr>
<td>Ex d [ib] IIC T6...T3 Gb</td>
<td>Ex de [ib] IIC T6...T3 Gb</td>
</tr>
<tr>
<td>Ex d ma IIC T6, T5 Gb</td>
<td>Ex de ma IIC T6, T5 Gb</td>
</tr>
<tr>
<td>Ex d ma [ia] T6, T5 Gb</td>
<td>Ex de ma [ia] T6, T5 Gb</td>
</tr>
<tr>
<td>Ex d ma [ib] T6, T5 Gb</td>
<td>Ex de ma [ib] T6, T5 Gb</td>
</tr>
</tbody>
</table>
1.5 Ultrasonic gas transducers

The OPTISONIC 7000...-Ex gas flow sensor, can be equipped with various types of ultrasonic gas transducers:

- titanium (type G7.01 and G7.04)
- synthetic material (type G5.nn and G6.nn)
  (body: stainless steel, front part: epoxy compound)

The gas transducers of type G7.01, G7.04 have type of protection “flameproof enclosure” (Ex d) in accordance with EN 60079-1. The electrical connections are established in specially designed flameproof enclosures with a free volume well below 100 cm³.

Optionally the under KEMA 07 ATEX 0181 X approved gas transducers of type G5.nn and G6.nn can be used. These gas transducers have types of protection “flameproof enclosure” (Ex d) in accordance with EN 60079-1 and “encapsulation” (Ex ma) conform to EN 60079-18. These transducers have marking code: II 1/2 G Ex d ma IIC T5.

1.6 Technical data

<table>
<thead>
<tr>
<th>Process medium</th>
<th>Flammable and non-flammable gases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection category acc. to EN 60529</td>
<td>IP 65 or better</td>
</tr>
<tr>
<td><strong>Ambient temperature range</strong></td>
<td></td>
</tr>
<tr>
<td>Titanium transducers</td>
<td>-40° to +65°C ¹</td>
</tr>
</tbody>
</table>
| Synthetic transducers ² (only available in OPTISONIC 7000-Ex) | Type G5.nn: -50° to +70°C  
Type G6.nn, Temp class T6: -50° to +70°C  
Type G6.nn, Temp class T5: -50° to +85°C  
Type G6.nn, Temp class T4: -50° to +100°C |
| **Process medium temperature range** | |
| Titanium steel transducers | OPTISONIC 7300 C/...-Ex: -50° to +180°C |
| Synthetic transducers ² (only available in OPTISONIC 7000-Ex) | Type G5.nn, Temp. class T6: -50° to +70°C  
Type G6.nn, Temp class T6: -50° to +70°C  
Type G6.nn, Temp class T5: -50° to +85°C  
Type G6.nn, Temp class T4: -50° to +100°C |

**INFORMATION!**

¹ The maximum ambient temperature applies to the aluminum converter housing. The stainless steel version is limited to an ambient temperature of +55°C.

² The ATEX-certificate KEMA 07 ATEX 0181 X (Issue no. 3) describes the maximum ambient temperatures of transducers type G5.nn and G6.nn, which should be read as process temperature (this is the temperature of the medium that surrounds the transducers). The ambient temperature is the (air) temperature at the location where the meter is installed.
1.7 Marking codes

Due to the various configuration options, the OPTISONIC 7300 gas flowmeter series can have several (different) explosion safety measures implemented.

<table>
<thead>
<tr>
<th>Marking code</th>
<th>Converter housing</th>
<th>Transducer</th>
<th>I/O</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OPTISONIC 7300 C-Ex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex d IIC T6...T3 Gb</td>
<td>Ex d</td>
<td>Titanium</td>
<td>Non-Ex</td>
</tr>
<tr>
<td>Ex d e IIC T6...T3 Gb</td>
<td>Ex d e</td>
<td>Titanium</td>
<td>Non-Ex</td>
</tr>
<tr>
<td>Ex d ma IIC T6, T5 Gb</td>
<td>Ex d</td>
<td>Synthetic</td>
<td>Non-Ex</td>
</tr>
<tr>
<td>Ex d e ma IIC T6, T5 Gb</td>
<td>Ex d e</td>
<td>Synthetic</td>
<td>Non-Ex</td>
</tr>
<tr>
<td><strong>OPTISONIC 7300 C/i-Ex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex d [ia] IIC T6...T3 Gb</td>
<td>Ex d</td>
<td>Titanium</td>
<td>Ex ia</td>
</tr>
<tr>
<td>Ex d e [ia] IIC T6...T3 Gb</td>
<td>Ex d e</td>
<td>Titanium</td>
<td>Ex ia</td>
</tr>
<tr>
<td>Ex d [ib] IIC T6...T3 Gb</td>
<td>Ex d</td>
<td>Titanium</td>
<td>Ex ib</td>
</tr>
<tr>
<td>Ex d e [ib] IIC T6...T3 Gb</td>
<td>Ex d e</td>
<td>Titanium</td>
<td>Ex ib</td>
</tr>
<tr>
<td>Ex d ma [ia] IIC T6, T5 Gb</td>
<td>Ex d</td>
<td>Synthetic</td>
<td>Ex ia</td>
</tr>
<tr>
<td>Ex d e ma [ia] IIC T6, T5 Gb</td>
<td>Ex d e</td>
<td>Synthetic</td>
<td>Ex ia</td>
</tr>
<tr>
<td>Ex d ma [ib] IIC T6, T5 Gb</td>
<td>Ex d</td>
<td>Synthetic</td>
<td>Ex ib</td>
</tr>
<tr>
<td>Ex d e ma [ib] IIC T6, T5 Gb</td>
<td>Ex d e</td>
<td>Synthetic</td>
<td>Ex ib</td>
</tr>
</tbody>
</table>
1.8 Marking labels

The marking label shown here is a configuration example. Other marking codes are possible, see previous section.

Example for the nameplate

1. Ex codes and number of EC type examination certificate.
2. Explosion safety notes.
3. Intrinsical safe in-/output circuits information.
4. Warning messages.
5. Main supply data.
6. Calibration data.
7. Type designation of the flowmeter
8. Name and address of the manufacturer.
2.1 General

Due to the influence of the process medium (gas) temperature, ultrasonic flow sensors in separate version with type designation OPTISONIC 7000...-Ex and ultrasonic compact gas flow meters with type designation OPTISONIC 7300 C/...-Ex are not allocated to any fixed temperature class.

The temperature limits apply under the following conditions:

- The instrument is installed and operated in accordance with the installation directions given in the quickstart and / or handbook.
- The instrument is not heated up by any additional heat radiation (direct solar radiation, heat from adjacent plant parts) so causing it to operate above the permissible ambient temperature range.
- Insulation is not hindering free ventilation of the ultrasonic signal converter housing.

**CAUTION!**
The temperature data below only applies to the meters with ultrasonic gas transducers made of titanium (types G7.01 and G7.04). For the partly encapsulated transducer types G5.nn and G6.nn, refer to Technical data on page 8.

### 2.2 OPTISONIC 7300 C/...-Ex

The OPTISONIC 7300 C/...-Ex ultrasonic compact gas flow meter is provided with the same electronics housing as the GFC 300 F/...-Ex and therefore has the same ambient temperature range of -40...+65°C (aluminum housing) and -40...55°C (stainless steel). The temperature classification table shows the relationship between the maximum process medium temperatures at a certain maximum ambient temperature.

**CAUTION!**
The temperature data below only applies to the meters with ultrasonic gas transducers made of titanium (types G7.01 and G7.04). For the partly encapsulated transducer types G5.nn and G6.nn, refer to Technical data on page 8.

<table>
<thead>
<tr>
<th>Temperature class</th>
<th>Maximum process temperature [°C] at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$T_a = 40°C$</td>
</tr>
<tr>
<td>T6</td>
<td>80</td>
</tr>
<tr>
<td>T5</td>
<td>95</td>
</tr>
<tr>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td>T3</td>
<td>180</td>
</tr>
</tbody>
</table>
3.1 General

The GFC 300 F/...-Ex ultrasonic signal converter must always be incorporated within the equipotential bonding system of the installation in the hazardous classified location. For this purpose it must be connected to the external U-clamp screw terminal (size M5) on the wall-mounting device.

The separate bonding conductor must be at least 4 mm² (11 AWG) or 2.5 mm² (14 AWG) in case it is mechanically protected, see Clause 413 of HD 384.4.41 or IEC 364-4-41. Make sure that the core of the bonding wire is properly mounted under the U-clamp of the external M5 terminal and that the screw is tightly fixed.

The transducer circuits are galvanically isolated from earth and therefore an equipotential bonding conductor between the ultrasonic flow sensor and the ultrasonic flow converter does not have to be connected, but can be used if desirable.

Where screened signal cable is used, the screen should only be earthed at the flow sensor end. In the special case of a screen being earthed at both ends of the system, a potential difference between the sensor and converter is not permitted. Refer to EN 60079-14, Clause 12.2.2.3, for further requirements of cable screens.

The display cover seals the electronics compartment of the converter housing and provides type of protection “flameproof enclosure” (Ex d) according to EN 60079-1. The terminal compartment is either in type of protection “increased safety” (Ex e) or performed as “flameproof enclosure” (Ex d). The threaded joints formed by the covers and housing are a tight fit due to the requirements for type of protection “flameproof enclosure”. Screw the covers on and off with care and never use excessive force!

Keep the screw-threads free of dirt and well-greased (e.g. with PTFE grease). The grease will help to prevent the threads from locking due to corrosion. To unscrew the covers, first release the interlocking devices (one at each cover). Therefore unscrew the M4 head screw with internal hexagon socket set using a No. 3 Allen key until the interlocking device can be turned. After the covers are screwed back onto the housing, make sure that the interlocking devices are properly refitted.

WARNING!
Allow the electronics to de-energize before opening the electronics compartment of the flow converter housing. Wait at least 35 minutes for T6 and 10 minutes for T5 before opening.
Figure 3-1: Electrical connections of converter

1. Mains supply connections
2. I/O connections

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Function, electrical data</th>
</tr>
</thead>
</table>
| L, N      | 100...230 VAC, +10% / -15%, 22 VA, 50/60 Hz  
Internal fuse protection $I_F \leq 0.8 \, $A  
$U_{in} = 253 \, $V  
Connections for mains supply, always non-Ex i |
| L+, L-    | 12...24 VDC, +30% / -10% (short periods -25%), 12W  
Internal fuse protection $I_F \leq 2.0 \, $A  
$U_{in} = 253 \, $V  
24 VAC, +10% / -15%, 50/60 Hz  
24 VDC, +30% / -25%  
Internal fuse protection $I_F \leq 2.0 \, $A  
$U_{in} = 253 \, $V  
Connections for mains supply, always non-Ex i  
Connection to protective extra low voltage [PELV] |
| A, A-, A+ | Connections for signal I/Os [PELV circuits], non-“Ex i” or “Ex i”, are dependent on the specific version of the GFC 300 converter ordered. Consult the tables with CG36 numbers for details. |
| B, B-     |  |
| C, C-     |  |
| D, D-     |  |
The exact I/O-configuration for circuits A, B, C and D is order-specific and can be determined by the CG36 number shown on the I/O sticker inside the terminal compartment. Therefore check the data on the back of the GFC 300 electronics unit. The CG36 number contains 10 characters of which the last three characters (XYZ) determine the configuration of the I/O circuits:

<table>
<thead>
<tr>
<th>CG36</th>
<th>*</th>
<th>*</th>
<th>*</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos 1...4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

The exact connection diagram of a specific GFC 300 signal converter can be found on the sticker inside the terminal compartment.

**For use in gaseous hazardous areas:** The chosen cable glands must have the appropriate type of protection for the terminal compartment that is increased safety [Ex e] or flameproof enclosure [Ex d]. They MUST be suitable for the conditions of use and correctly installed.

The flowmeter with the terminal compartment in type of protection increased safety “Ex e” is factory supplied with two or three “Ex e” approved cable glands and one or no “Ex e” approved blanking element (i.e. stopping plug).

**WARNING!**
The flowmeter with the terminal compartment performed as flameproof enclosure “Ex d” is supplied with one “Ex d” approved stopping plug and two temporary plugs. The temporary plugs are only intended for sealing the housing against entry of dust, moisture or else during transport, handling and storage. These temporary plugs must be replaced by suitable “Ex d” approved cable glands, stopping plugs or conduit adapters with sealing devices before the flowmeter is put into operation. Unused openings must be sealed by suitable certified plugs.

The wiring of instruments has to be in accordance with the requirements as specified in the relevant national or international standard for electrical installations in hazardous areas, e.g. EN 60079-14. Section 9 (wiring systems) of this standard applies to all types of protection. Section 10 (additional requirements for type of protection “d” - flameproof enclosures), section 11 (additional requirements for type of protection “e” - increased safety) and section 12 (additional requirements for type of protection “i” - intrinsic safety) apply to respectively “Ex d”, “Ex e” and “Ex i” performed connection [terminal] compartments.
3.2 Non-"Ex i" I/O connections

The following non-intrinsically safe I/O (inputs/outputs) are available:

<table>
<thead>
<tr>
<th>I/O PCB</th>
<th>Input/output functions, $U_n &lt; 32 \text{ V DC}$, $I_n &lt; 100 \text{ mA}$, $U_m = 253 \text{ V}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic I/O</td>
<td>Current Output, active or passive, with HART</td>
</tr>
<tr>
<td></td>
<td>Status Output / Control Input</td>
</tr>
<tr>
<td></td>
<td>Status Output</td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output</td>
</tr>
<tr>
<td>Modular I/O</td>
<td>Current Output, active or passive, with HART</td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output, active or passive, highC or Namur</td>
</tr>
<tr>
<td>Modular carrier with 1 or 2 I/O modules</td>
<td>Each module: 1 out of following 3 in-/output functions:</td>
</tr>
<tr>
<td></td>
<td>Current Output, active or passive, highC or Namur</td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output, active or passive, highC or Namur</td>
</tr>
<tr>
<td></td>
<td>Control Input, active or passive, highC or Namur</td>
</tr>
<tr>
<td>Profibus DP I/O</td>
<td>Profibus-DP, active</td>
</tr>
<tr>
<td>Fieldbus I/O</td>
<td>Profibus-PA or Foundation Fieldbus</td>
</tr>
<tr>
<td>RS 485 Modbus</td>
<td>Modbus with or without termination</td>
</tr>
</tbody>
</table>

The options separated by "/" are software selectable (can be changed by the user)
The options separated by "or" are hardware versions (must be ordered as such)
All outputs are passive unless otherwise indicated
HighC means High Current input/output, Namur means that the in-/outputs are according to the NAMUR NE43 standard

Overview of the possible combinations, defined by characters XYZ of the CG36 number

<table>
<thead>
<tr>
<th>Characters XYZ</th>
<th>Name of I/O circuits</th>
<th>Terminals A, A-, A+</th>
<th>Terminals B, B-</th>
<th>Terminals C, C-</th>
<th>Terminals D, D-</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Basic I/O</td>
<td>CO</td>
<td>SO</td>
<td>S0</td>
<td>PO/SO</td>
</tr>
<tr>
<td>488 to 4LL</td>
<td>Modular I/O</td>
<td>CO</td>
<td>CO(a) over A+</td>
<td>S0/C0</td>
<td>S0</td>
</tr>
<tr>
<td>588 to 5LL</td>
<td>Modular Carrier with 1 or 2 I/O modules</td>
<td>Many combinations possible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>688 to 6LL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>788 to 7LL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>888 to 8LL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>FF</td>
<td>FF</td>
</tr>
<tr>
<td>A88 to ALL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>B88 to BLL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>C88 to CLL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>D88</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>D8A to DLL</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>E88</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>FF</td>
<td>FF</td>
</tr>
</tbody>
</table>
## Overview of the possible combinations, defined by characters XYZ of the CG36 number

<table>
<thead>
<tr>
<th>Characters XYZ</th>
<th>Name of I/O circuits</th>
<th>Terminals A, A-, A+</th>
<th>Terminals B, B-</th>
<th>Terminals C, C-</th>
<th>Terminals D, D-</th>
</tr>
</thead>
<tbody>
<tr>
<td>E8A to ELL</td>
<td>Fieldbus I/O Foundation Fieldbus with Module Carrier with 1 or 2 I/O modules</td>
<td>Many combinations possible</td>
<td>FF</td>
<td>FF</td>
<td></td>
</tr>
<tr>
<td>F00 to FL0</td>
<td>Profibus DP I/O</td>
<td>n.c.</td>
<td>DP[a]</td>
<td>DP[a]</td>
<td>DP[a]</td>
</tr>
<tr>
<td>F80 to FL0</td>
<td>Profibus DP I/O with 0 or 1 I/O module</td>
<td>Many combinations possible</td>
<td>DP[a]</td>
<td>DP[a]</td>
<td>DP[a]</td>
</tr>
<tr>
<td>G00 to GLL</td>
<td>RS 485 Modbus</td>
<td>Many combinations possible</td>
<td>RS485</td>
<td>RS485</td>
<td></td>
</tr>
<tr>
<td>H00 to HLL</td>
<td>Modbus with 1 or 2 I/O modules</td>
<td>Many combinations possible</td>
<td>RS485</td>
<td>RS485</td>
<td></td>
</tr>
</tbody>
</table>

Used abbreviations for in-/output functions: CO = Current Output, PO = Pulse Output, SO = Status Output, CI = Control Input, PA = Profibus PA, FF = Foundation Fieldbus, DP = Profibus DP, RS485 = RS 485 Modbus, n.c. = not connected.

All in-/outputs are passive unless otherwise noted as active with extension [a].
3.3 "Ex i" I/O connections

The following intrinsically safe I/O connections are available:

<table>
<thead>
<tr>
<th>I/O PCB</th>
<th>I/O functions</th>
<th>Ex ia IIC or Ex ib IIC</th>
<th>U_i = 30 V, I_i = 100 mA, P_i = 1.0 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex i IO</td>
<td>Current Output, passive + HART communication</td>
<td>50 nF, L_i = negligibly low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output, passive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ex i Option</td>
<td>Current Output, passive</td>
<td>Ex ia IIC or Ex ib IIC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output / Control Input, passive</td>
<td>U_i = 30 V, I_i = 100 mA, P_i = 1.0 W</td>
<td></td>
</tr>
<tr>
<td>Ex i Option 2</td>
<td>Current Input, passive</td>
<td>Ex ia IIC or Ex ib IIC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output / Control Input, passive</td>
<td>U_i = 30 V, I_i = 100 mA, P_i = 1.0 W</td>
<td></td>
</tr>
<tr>
<td>Fieldbus I/O</td>
<td>Profibus-PA, Foundation Fieldbus, passive</td>
<td>Ex ia IIC or Ex ib IIC / IIB</td>
<td></td>
</tr>
</tbody>
</table>

The I/O circuits titled “Ex i IO”, “Ex i Option” and “Ex i Option 2” are always provided with type of protection Intrinsic Safety (Ex ia). The I/O-circuits “Fieldbus I/O Profibus-PA” as well as “Fieldbus I/O Foundation Fieldbus” can be provided with type of protection Intrinsic Safety.

Up to a maximum of 4 intrinsically safe (Ex ia) in-/outputs are possible. All intrinsically safe circuits are galvanically isolated from earth and each other. To avoid summation of voltages and current, the wiring of these "Ex ia"-circuits must be sufficiently separated, e.g. in accordance with the requirements of standard EN 60079-14, clause 12.2.

The “Ex ia” in-/outputs may only be connected to other “Ex ia” or “Ex ib” approved devices (e.g. intrinsically safe isolation amplifiers), even if such devices are installed in a non-hazardous location!

Connection to non-“Ex i” devices cancels the “Ex ia” properties of the flowmeter.

Terminals L and N (or L+ and L-) for connection of the mains supply are not available with type of protection “intrinsic safety”. To achieve the necessary separation distances according to EN 60079-11 between the non-“Ex ia” and “Ex ia” circuits, the mains terminals are provided with a semi-circular protection cover with a “snap-in” lock. This cover MUST be closed before establishing the power supply to the converter.
**INFORMATION!**

For converters with an “Ex e” terminal compartment, the compartment can be opened in an energized state for short periods of time, to access the intrinsically safe terminals for possible checks. However, the semi-circular insulation cover over the non-intrinsically safe mains supply terminals L and N (or L+ and L-) MUST be kept closed.

<table>
<thead>
<tr>
<th>Characters XYZ</th>
<th>Name of I/O circuits</th>
<th>Terminals A, A-, A+</th>
<th>Terminals B, B-</th>
<th>Terminals C, C-</th>
<th>Terminals D, D-</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>Exi-IO</td>
<td>n.c.</td>
<td>n.c.</td>
<td>CO(a)</td>
<td>PO/SO</td>
</tr>
<tr>
<td>300</td>
<td></td>
<td>n.c.</td>
<td>n.c.</td>
<td>CO</td>
<td>PO/SO</td>
</tr>
<tr>
<td>210</td>
<td>Exi-IO with Exi-Option</td>
<td>CO(a)</td>
<td>PO/SO/Cl</td>
<td>CO(a)</td>
<td>PO/SO</td>
</tr>
<tr>
<td>220</td>
<td></td>
<td>CO</td>
<td>PO/SO/Cl</td>
<td>CO(a)</td>
<td>PO/SO</td>
</tr>
<tr>
<td>310</td>
<td></td>
<td>CO(a)</td>
<td>PO/SO/Cl</td>
<td>CO</td>
<td>PO/SO</td>
</tr>
<tr>
<td>320</td>
<td></td>
<td>CO</td>
<td>PO/SO/Cl</td>
<td>CO</td>
<td>PO/SO</td>
</tr>
<tr>
<td>D00</td>
<td>Fieldbus I/O Profibus PA</td>
<td>n.c.</td>
<td>n.c.</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>D10</td>
<td>Fieldbus I/O Profibus PA with Ex i Option</td>
<td>CO(a)</td>
<td>PO/SO/Cl</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>D20</td>
<td></td>
<td>CO</td>
<td>PO/SO/Cl</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>E00</td>
<td>Fieldbus I/O Foundation Fieldbus</td>
<td>n.c.</td>
<td>n.c.</td>
<td>FF</td>
<td>FF</td>
</tr>
<tr>
<td>E10</td>
<td>Fieldbus I/O Foundation Fieldbus with Ex i Option</td>
<td>CO(a)</td>
<td>PO/SO/Cl</td>
<td>FF</td>
<td>FF</td>
</tr>
<tr>
<td>E20</td>
<td></td>
<td>CO</td>
<td>PO/SO/Cl</td>
<td>FF</td>
<td>FF</td>
</tr>
</tbody>
</table>

**Used abbreviations for in-/output functions:**
- CO = Current Output
- PO = Pulse Output
- SO = Status Output
- CI = Control Input
- n.c. = not connected

**All in-outputs are passive unless otherwise noted as active with extension (a).**
4.1 Maintenance

The flowmeters are maintenance free with respect to the flowmetering properties. Within the scope of periodic inspections required for electrical equipment installed in hazardous areas it is recommended to check the flameproof converter housing and covers for signs of damage or corrosion.

For information about the joints please contact your KROHNE representative.

The four M6 bolts to screw the MH300-Ex housing have a strength of 700N/mm²

4.2 Before and after opening

**WARNING!**

the following instructions must always be carefully followed, if the housing of the signal converter has to be opened respectively closed again.

Before opening:

- Make absolutely sure that there is no explosion hazard!
- Make sure that all connecting cables are safely isolated from all external sources!
- Allow the electronics to de-energize before opening the electronics compartment of the converter housing. Wait at least 35 minutes for T6 and 10 minutes for T5 before opening.

When the instructions above are strictly followed, the display cover (includes glass window) of the electronics compartment may be removed. First unscrew the head screw with internal hexagon socket set [size M4] of the interlocking device by a No. 3 Allen key, until the cover can rotate freely.

After opening:

- Before the cover is screwed back onto the housing, the screw-thread must be clean and well-greased with an acid and resin-free grease, e.g. PTFE grease.
- Screw the cover as tight as possible onto the housing by hand, until it cannot be opened by hand anymore. Fixate the screw of the interlocking device tight with the No. 3 Allen key.
4.3 Replacement of mains fuse

**WARNING!**
*Before commencing the work, refer to Before and after opening on page 19, then continue as follows:*

- Pull the display unit of the mounting frame and turn display unit carefully aside.
- Unscrew the two screws size M4 that hold the mounting frame with the electronics unit.
- Carefully pull the mounting frame with electronics unit out of the housing, until the small printed circuit board with the six soldered coaxial cables can be pulled out from the sensor driver PC-board. Now carefully remove the unit from the housing, while keeping the small printed circuit board with coaxial cables down, and close to the housing wall.
- The mains fuse is located in a fuse holder at the back-end of the electronics unit on the top printed circuit board (power supply PCB). The specifications must be as follows:

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Electrical data</th>
<th>KROHNE part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>12...24 V DC</td>
<td>250 V / 2 A</td>
<td>5060200000</td>
</tr>
<tr>
<td>24 V AC/DC</td>
<td>250 V / 2 A</td>
<td>5060200000</td>
</tr>
<tr>
<td>100...230 V AC</td>
<td>250 V / 0,8 A</td>
<td>5080850000</td>
</tr>
</tbody>
</table>

**WARNING!**
*Before reassembling the unit, refer to Before and after opening on page 19, then:*

- Reassemble the unit in reverse order.
4.4 Exchange of electronics unit

Before opening the converter housing:

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!

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!
Make notes of important specific data, before exchanging the electronics. Menu settings are stored on the circuit board (or backplane), that is fixed to the housing. After exchange of electronics unit and power-up, the following start up screen appears: Load all data?

- Select yes
  - if in the screen appears “load sensor data”, the electronics units were not fully compatible. You can proceed by selecting yes. Note that all settings need to be checked and changed. Only the sensor calibration data are loaded.
  - if in the screen appears “load no data”, all data have been lost. Contact your local representative.

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!

Figure 4-1: Unscrew the cover and remove the display
Perform the following procedures:
- Unscrew the display cover of the electronics compartment by hand, by turning it counter clockwise (1).
- Remove the display by using two screwdrivers (2).
- Unscrew the two M4 screws (3) at the electronics unit (4).
- Pull the two metal pullers (5) at the left and right of the display, using a screwdriver or similar tool and partially pull out the electronics unit.

⚠️ **CAUTION!**
Please pay attention that the same amount of force is applied on both pullers, otherwise the connector at the backside can be damaged.

⚠️ **DANGER!**
Electrostatic discharge (ESD) can damage electronic parts. Make sure to discharge yourself by wearing a wrist strap. If no wrist strap is available, ground yourself by touching a metal surface that is grounded.
• Remove the printed circuit board \(4\) from the electronics unit \(4\).
• Check compatibility between the removed and new electronics unit \(4\), by checking the power voltage.
• Slide the new electronics unit \(4\) partially back into the housing.
• Mount the small printed circuit board back onto the electronics unit \(4\).
• Push the metal pullers \(5\) back to their original position.
  Don’t use excessive force, otherwise the connector at the backside can be damaged!
• Screw the electronics unit back to the housing.
• Re-install the display and make sure not to kink the display’s flat ribbon cable.
• Replace cover and tighten by hand.
• Connect power.

### 4.5 Service / repair 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 personnel, the manufacturer may handle, test and repair returned devices (that have been in contact with dangerous media) only, without bringing any risk to personnel or 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 neutralizing, 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.*
### 4.6 Form (for copying) to accompany a returned device

<table>
<thead>
<tr>
<th>Company:</th>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department:</td>
<td>Name:</td>
</tr>
<tr>
<td>Tel. no.:</td>
<td>Fax no.:</td>
</tr>
<tr>
<td>Manufacturer’s order no. or serial no.:</td>
<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.

Date: | Signature: |
---|---|
Stamp: |

### 4.7 Disposal

**CAUTION!**

Disposal must be carried out in accordance with legislation applicable in your country.
KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry