OPTIMASS / 300 / 010

Guidelines for the use of Coriolis meters in hazardous areas

- 1000 Series Twin Straight Tube Coriolis Mass Flowmeter
- 2000 Series Twin Straight Tube Coriolis Mass Flowmeter
- 3000 Series Single Z Tube Coriolis Mass Flowmeter
- 4000 Series Twin U Tube Coriolis Mass Flowmeter
- 7000 Series Single Straight Tube Coriolis Mass Flowmeter
- 8000k Series Twin U Tube Coriolis Mass Flowmeter
- 8000/9000 Series Twin U Tube Coriolis Mass Flowmeter
- OPTIGAS 4000
- OPTIGAS 5000
- MFC 300 Mass Flow Converter
1. Introduction
   1.1 General ................................................................. 5
   1.2 MFC 300F & MFC 300F T6 ............................................ 6
   1.3 OPTIMASS 1000 / 1010C / 1300C ................................. 7
   1.4 OPTIMASS 1000 T6 / 1010C T6 / 1300C T6 ..................... 8
   1.5 OPTIMASS 2000 / 2010C / 2300C .................................. 9
   1.6 OPTIMASS 3000 / 3010C / 3300C ................................. 10
   1.7 OPTIMASS / OPTIGAS 4000 / 4010C .............................. 11
   1.8 OPTIGAS 5000 / 5010C / 5300C .................................... 12
   1.9 OPTIMASS 7000 / 7010C / 7300C .................................. 13
   1.10 OPTIMASS 8000k / 8010kC / 8300kC ......................... 14
   1.11 OPTIMASS 9000 / 9010C ........................................... 15
   1.12 Data Plates ......................................................... 16

2. Temperature limits
   2.1 General ................................................................. 17
   2.2 MFC 300F & MFC 300F T6 ............................................ 17
   2.3 OPTIMASS 1000 / 1010C / 1300C ................................. 18
   2.4 OPTIMASS 1000 T6 / 1010C T6 / 1300C T6 ..................... 19
   2.5 OPTIMASS 2000 / 2010C ............................................. 21
   2.6 OPTIMASS 3000 / 3010C / 3300C 7000 / 7010C / 7300C .... 22
   2.7 OPTIMASS 4000 / 4010C / OPTIGAS 4000 / 4010C .......... 24
   2.8 OPTIMASS 8000k / 8010kC / 8300kC ............................... 24
   2.9 OPTIMASS 8000 / 8010C / 8300C .................................. 26
   2.10 OPTIMASS 9000 / 9010C ........................................... 27
   2.11 OPTIGAS 5000 / 5010C / 5300C .................................. 27
   2.12 Painted options ..................................................... 28

3. Connection of separated systems
   3.1 General ................................................................. 29
   3.2 Cable parameters .................................................... 29
   3.3 Equipotential bonding ............................................... 29
   3.4 Terminal diagrams ................................................... 30

4. Electrical connections
   4.1 General ................................................................. 31
   4.2 Non-Ex I signal I/O connections .................................. 32
   4.3 Ex I signal I/O connections ......................................... 34

5. Service and maintenance
   5.1 Maintenance ............................................................ 36
   5.2 Replacement of mains fuse ......................................... 36
   5.3 Returning the device for service or repair ..................... 36
Appendix 1 ............................................................... 37
Explanation of Symbols Used

The following is a guide to the meaning of the symbols used in this handbook. The symbols fall into two types. The rectangular symbols with blue background draw the reader’s attention to general points of information. The triangular symbols with yellow background draw the reader’s attention to hazards or hazardous situations.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>General Information</td>
</tr>
<tr>
<td>🔄</td>
<td>General Warning</td>
</tr>
<tr>
<td>🔄</td>
<td>EX - Hazardous Area Warning</td>
</tr>
<tr>
<td>🔄</td>
<td>High Voltage</td>
</tr>
<tr>
<td>🔄</td>
<td>General Hazard</td>
</tr>
<tr>
<td>🔄</td>
<td>Hot Surface or High Temperature</td>
</tr>
<tr>
<td>🔄</td>
<td>Heavy Item</td>
</tr>
</tbody>
</table>

- Do not install, operate or maintain this device without reading, understanding and following the factory supplied handbook. Failure to do so, may result in injury or damage.
- Read these instructions carefully before starting installation and save them for future reference.
- Observe all warnings and instructions marked on the device.
- You MUST only use a power supply that has a protective earth.
- Do not use the device with the covers removed!
- You MUST follow the installation instructions in the handbook, paying particular attention to:
  - Handling
  - Lifting
  - Supporting and fixing the meter
  - Cabling and connections.
- If the product does not operate normally, refer to the handbook or consult a qualified KROHNE service engineer. There are no operator-serviceable parts inside the product.
These terms may appear in this manual or on the device:

**Warning statement:** Identify conditions or practice that could result in injury or loss of life.

or

**Caution statement:** Identify conditions or practice that could result in damage to the instrument or other property.

**Disclaimer:**
- This document contains important information on the device. 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 prior notice.
- KROHNE will not be liable for any damage of any kind by using this device, including, but not limited to: direct; indirect; incidental; punitive and consequential damages.
- Any device 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.

**Product liability and Warranty**
- Responsibility for suitability and intended use of this device rests solely with the user. Improper installation and operation of the device may lead to loss of warranty.
- In addition, the Terms and Conditions of Sale are applicable and are the basis for the purchase contract.
- If a device needs to be returned to KROHNE, please note the information given at the back of the Handbook. KROHNE regrets that they cannot repair or service a device unless accompanied by the completed form.

This instrument has been developed and manufactured by:
KROHNE Ltd
Rutherford Drive
Park Farm Industrial Estate
Wellingborough
Northants
NN8 6AE
United Kingdom

For information, maintenance or service, please contact your nearest local KROHNE representative.

See www.krohne.com

**WARNING**
No changes may be made to the devices. Unauthorized changes might affect the explosion safety of the devices. Be sure to follow these instructions!

**IMPORTANT**
- The prescriptions, regulations and electrical data described in the EC type examination certificate MUST be obeyed.
- In addition to the general regulations for low-voltage installations (e.g. HD384) the regulations laid down in the standard for electrical installations in gas hazardous areas (e.g. IEC/EN 60079-14) or dust hazardous areas (e.g. IEC/EN 61241-14) MUST be complied with.
- Installation, commissioning, utilization and maintenance must be carried out only by personnel trained in explosion safety.
- This manual must be read in conjunction with the OPTIMASS / OPTIGAS Handbooks.
1 INTRODUCTION

1.1 General

The OPTIMASS / OPTIGAS flowmeter systems consist of a mass flow sensor and a mass flow converter or a mass flow sensor and associated apparatus.

The separate mass flow sensor with a mass flow converter is identified as:

- OPTIMASS 1000 flow sensor with MFC 300 F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS 1000 T6 flow sensor with MFC 300F T6 flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS 2000 flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS 3000 flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS / OPTIGAS 4000 flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS 7000 flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS 8000k flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIMASS 8000/9000 flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X
- OPTIGAS 5000 flow sensor with MFC 300F flow converter; see PTB 06 ATEX 2036 X with PTB 06 ATEX 2038 X

The separate flowmeter with associated apparatus is identified as:

- OPTIMASS 1010C; see PTB 06 ATEX 2036 X
- OPTIMASS 1010C T6; see PTB 06 ATEX 2036 X
- OPTIMASS 2010C; see PTB 06 ATEX 2036 X
- OPTIMASS 3010C; see PTB 06 ATEX 2036 X
- OPTIMASS / OPTIGAS 4010C; see PTB 06 ATEX 2036 X
- OPTIMASS 7010C; see PTB 06 ATEX 2036 X
- OPTIMASS 8010kC; see PTB 06 ATEX 2036 X
- OPTIMASS 8010C/9010C; see PTB 06 ATEX 2036 X
- OPTIGAS 5010C; see PTB 06 ATEX 2036 X

The flowmeter in a compact configuration is identified as:

- OPTIMASS 1300C (OPTIMASS 1000 + MFC300 ); see PTB 06 ATEX 2037 X
- OPTIMASS 1300C T6 (OPTIMASS 1000 T6 + MFC300 T6); see PTB 06 ATEX 2037 X
- OPTIMASS 2300C (OPTIMASS 2000 + MFC300 ); see PTB 06 ATEX 2037 X
- OPTIMASS 3300C (OPTIMASS 3000 + MFC300 ); see PTB 06 ATEX 2037 X
- OPTIMASS 7300C (OPTIMASS 7000 + MFC300 ); see PTB 06 ATEX 2037 X
- OPTIMASS 8300kC (OPTIMASS 8000k + MFC300 ); see PTB 06 ATEX 2037 X
- OPTIMASS 8300C (OPTIMASS 8000 + MFC300 ); see PTB 06 ATEX 2037 X
- OPTIGAS 5300 C (OPTIGAS 5000 + MFC300 ); see PTB 06 ATEX 2037 X

Note that the OPTIMASS 9000 is not available in a compact configuration. All OPTIMASS sensors (separate and compact) and converters are available with a painted finish for aggressive environments. For these meters, the model name has the suffix "-Painted".

Example: OPTIMASS 1000-Painted

The output configuration of the MFC300 is described by the CG32…….XYZ number listed on the data label. See section 4 for a detailed description.

All types are intended for use in Zone 1 Category 2. All types (except OPTIMASS 3000/3010C/3300C and OPTIGAS 5000/5010C/5300C) are also intended for Zone 0 Category 1 areas. Refer to the Ex markings table for each meter. In addition, certain versions of MFC300 have intrinsically safe signal outputs suitable for use in Category 1 areas.
1.2 MFC 300F & MFC 300F T6

The MFC 300F & MFC 300F T6 have intrinsically safe connections to the mass flow sensor with either increased safety or intrinsically safe signal outputs. The signal output connection compartment can be configured with protection type Ex d or Ex e. The marking is as follows:

<table>
<thead>
<tr>
<th>For Ex d outputs</th>
<th>For Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 2(1) G Ex d [ia/ib] IIC T6 Gb</td>
<td>II 2(1) G Ex de [ia/ib] IIC T6 Gb</td>
</tr>
<tr>
<td>II 2(1) D Ex ib t [ia Da] IIIC T80°C Db</td>
<td>II 2(1) D Ex ib t [ia Da] IIIC T80°C Db</td>
</tr>
</tbody>
</table>

For non-Ex i outputs:

<table>
<thead>
<tr>
<th>II 2 G Ex d [ib] IIC T6 Gb</th>
<th>II 2 G Ex de [ib] IIC T6 Gb</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 2 D Ex ib t IIIC T80°C Db</td>
<td>II 2 D Ex ib t IIIC T80°C Db</td>
</tr>
</tbody>
</table>

The output connections to the mass flow sensor have the following values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFC 300F</td>
<td>MFC 300F T6</td>
</tr>
<tr>
<td>Uo = 16.5 V</td>
<td>Uo = 16.5 V</td>
</tr>
<tr>
<td>Io = 305 mA</td>
<td>Io = 262 mA</td>
</tr>
<tr>
<td>Po = 1.25 W</td>
<td>Po = 1.07 W</td>
</tr>
<tr>
<td>Characteristic curve: linear</td>
<td></td>
</tr>
<tr>
<td>Co = 230 nF</td>
<td>Co = 240 nF</td>
</tr>
<tr>
<td>Lo = 320 μH</td>
<td>Lo = 450 μH</td>
</tr>
</tbody>
</table>

For details of the signal output values, compare the table in section 4 with the CG32.....XYZ number listed on the data label.
1.3 OPTIMASS 1000 / 1010C / 1300C

The OPTIMASS 1000 / 1010C mass flow sensor / mass flow meter is designed with intrinsically safe protection type. The marking for the OPTIMASS 1000 / 1010C for versions with or without heating jacket / insulation is as follows:

II 1/2 G Ex ib IIC T4....T1 Ga/Gb
II 2 D Ex ib IIIIC T175°C Db

The input connections to the OPTIMASS 1010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
</tr>
<tr>
<td>Ii = 340mA</td>
<td>Ii = 40mA</td>
</tr>
<tr>
<td>Pi = 1.3W</td>
<td>Pi = 120mW</td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
</tr>
<tr>
<td>Li = 10µH</td>
<td>Li = 10µH</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 1300C is as follows:

For non-Ex i signal outputs without heating jacket / insulation

Ex d connection compartment  Ex e connection compartment
II 1/2 G Ex d [ib] IIC T4....T1 Ga/Gb  II 1/2 G Ex de [ib] IIC T4....T1 Ga/Gb
II 2 D Ex t IIIIC T185°C Db  II 2 D Ex t IIIIC T185°C Db

For non-Ex i signal outputs with heating jacket / insulation

Ex d connection compartment  Ex e connection compartment
II 1/2 G Ex d [ib] IIC T4....T1 Ga/Gb  II 1/2 G Ex de [ib] IIC T4....T1 Ga/Gb
II 2 D Ex t IIIIC T195°C Db  II 2 D Ex t IIIIC T195°C Db

For Ex i signal outputs without heating jacket / insulation

Ex d connection compartment  Ex e connection compartment
II 2(1) D Ex t [ia Da] IIIIC T185°C Db  II 2(1) D Ex t [ia Da] IIIIC T185°C Db

For Ex i signal outputs with heating jacket / insulation

Ex d connection compartment  Ex e connection compartment
II 2(1) D Ex t [ia Da] IIIIC T195°C Db  II 2(1) D Ex t [ia Da] IIIIC T195°C Db
1.4 OPTIMASS 1000 T6 / 1010C T6 / 1300C T6

The OPTIMASS 1000 T6 / 1010C T6 mass flow sensor / mass flow meter is designed with intrinsically safe protection type. The marking for the OPTIMASS 1000 / 1010C T6 for versions with or without heating jacket / insulation is as follows:

II 1/2 G Ex ib IIC T6...T1 Ga/Gb
II 2 D Ex ib IIC T165°C Db

The input connections to the OPTIMASS 1010C T6 for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
</tr>
<tr>
<td>II = 265mA</td>
<td>II = 40mA</td>
</tr>
<tr>
<td>Pi = 1.1W</td>
<td>Pi = 120mW</td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
</tr>
<tr>
<td>Li = 10uH</td>
<td>Li = 10uH</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 1300C T6 is as follows:

For non-Ex i signal outputs without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2 G Ex d [ib] IIC T6...T1 Ga/Gb</td>
<td>II 1/2 G Ex d [ib] IIC T6...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIIIC T160°C Db</td>
<td>II 2 D Ex t IIIIC T160°C Db</td>
</tr>
</tbody>
</table>

For non-Ex i signal outputs with heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2 G Ex d [ib] IIC T6...T1 Ga/Gb</td>
<td>II 1/2 G Ex d [ib] IIC T6...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIIIC T160°C Db</td>
<td>II 2 D Ex t IIIIC T160°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2(1) G Ex d [ia/ib] IIIIC T6...T1 Ga/Gb</td>
<td>II 1/2(1) G Ex d [ia/ib] IIIIC T6...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2(1) D Ex t [ia Da] IIIIC T160°C Db</td>
<td>II 2(1) D Ex t [ia Da] IIIIC T160°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs with heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2(1) G Ex d [ia/ib] IIIIC T6...T1 Ga/Gb</td>
<td>II 1/2(1) G Ex d [ia/ib] IIIIC T6...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2(1) D Ex t [ia Da] IIIIC T160°C Db</td>
<td>II 2(1) D Ex t [ia Da] IIIIC T160°C Db</td>
</tr>
</tbody>
</table>
1.5 OPTIMASS 2000 / 2010C / 2300C

The OPTIMASS 2000 / 2010C mass flow sensors / mass flow meters are designed with intrinsically safe protection type. The marking for the OPTIMASS 2000 / 2010C is as follows:

II 1/2 G Ex ib IIC T6...T1 Ga/Gb
II 2 D Ex ib IIC T150°C Db

The input connections to the OPTIMASS 2010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
</tr>
<tr>
<td>II = 340mA</td>
<td>II = 40mA</td>
</tr>
<tr>
<td>Pi = 1.3W</td>
<td>Pi = 120mW</td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
</tr>
<tr>
<td>Li = 10uH</td>
<td>Li = 10uH</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 2300C is as follows:

For non-Ex i signal outputs

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2 G Ex d [ib] IIC T6...T1 Ga/Gb</td>
<td>II 1/2 G Ex de [ib] IIC T6...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIC T160°C Db</td>
<td>II 2 D Ex t IIC T160°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2(1) G Ex d [ia/ib] IIC T6...T1 Ga/Gb</td>
<td>II 1/2(1) G Ex de [ia/ib] IIC T6...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2(1) D Ex t [ia Da] IIC T160°C Db</td>
<td>II 2(1) D Ex t [ia Da] IIC T160°C Db</td>
</tr>
</tbody>
</table>
1.6 OPTIMASS 3000 / 3010C / 3300C

The OPTIMASS 3000 / 3010C mass flow sensors / mass flow meters are designed with intrinsically safe protection type. The marking for the OPTIMASS 3000 / 3010C is as follows:

<table>
<thead>
<tr>
<th>No heating jacket / insulation</th>
<th>Heating jacket / insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 2 G Ex ib IIIC T6....T1 Gb</td>
<td>II 2 G Ex ib IIIC T6....T1 Gb</td>
</tr>
<tr>
<td>II 2 D Ex ib IIIC T150°C Db</td>
<td>II 2 D Ex ib IIIC T165°C Db</td>
</tr>
</tbody>
</table>

The input connections to the OPTIMASS 3010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
</tr>
<tr>
<td>Ii = 340mA</td>
<td>Ii = 40mA</td>
</tr>
<tr>
<td>Pi = 1.3W</td>
<td>Pi = 120mW</td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
</tr>
<tr>
<td>Li = 10uH</td>
<td>Li = 10uH</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 3300C is as follows:

For non-Ex i signal outputs without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 2 G Ex d [ib] IIIC T6....T1 Gb</td>
<td>II 2 G Ex de [ib] IIIC T6....T1 Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIIC T160°C Db</td>
<td>II 2 D Ex t IIIC T160°C Db</td>
</tr>
</tbody>
</table>

For non-Ex i signal outputs with heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 2 G Ex d [ib] IIIC T6....T1 Gb</td>
<td>II 2 G Ex de [ib] IIIC T6....T1 Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIIC T170°C Db</td>
<td>II 2 D Ex t IIIC T170°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II (1) G Ex d [ia/ib] IIIC T6....T1 Gb</td>
<td>II (1) G Ex de [ia/ib] IIIC T6....T1 Gb</td>
</tr>
<tr>
<td>II (1) D Ex t [ia Da] IIIC T160°C Db</td>
<td>II (1) D Ex t [ia Da] IIIC T160°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs with heating jacket / insulation

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II (1) G Ex d [ia/ib] IIIC T6....T1 Gb</td>
<td>II (1) G Ex de [ia/ib] IIIC T6....T1 Gb</td>
</tr>
<tr>
<td>II (1) D Ex t [ia Da] IIIC T170°C Db</td>
<td>II (1) D Ex t [ia Da] IIIC T170°C Db</td>
</tr>
</tbody>
</table>
1.7 OPTIMASS 4000 / 4010C / OPTIGAS 4000 / 4010C

The OPTIMASS 4000 / 4010C / OPTIGAS 4000 / 4010C mass flow sensors / mass flow meters are designed with intrinsically safe protection type. The marking for the OPTIMASS 4000 / 4010C / OPTIGAS 4000 / 4010C is as follows:

II 1/2 G Ex ib IIC T4...T1 Ga/Gb
II 2 D Ex ib IIC T210°C Db

The input connections to the OPTIMASS 4010C / OPTIGAS 4010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_i = 16.5\text{V}$</td>
<td>$U_i = 11.8\text{V}$</td>
</tr>
<tr>
<td>$I_i = 340\text{mA}$</td>
<td>$I_i = 40\text{mA}$</td>
</tr>
<tr>
<td>$P_i = 1.3\text{W}$</td>
<td>$P_i = 120\text{mW}$</td>
</tr>
<tr>
<td>$C_i = 35\text{nF}$</td>
<td>$C_i = 35\text{nF}$</td>
</tr>
<tr>
<td>$L_i = 10\mu\text{H}$</td>
<td>$L_i = 10\mu\text{H}$</td>
</tr>
</tbody>
</table>
1.8 OPTIGAS 5000 / 5010C / 5300C

The OPTIGAS 5000 / 5010C mass flow sensor / mass flow meter is designed with intrinsically safe protection type. The marking for the OPTIGAS 5000 / 5010C for versions with or without heating jacket / insulation is as follows:

II 2 G Ex ib IIC T4....T1 Gb

The input connections to the OPTIGAS 5010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
</tr>
<tr>
<td>Ii = 340mA</td>
<td>Ii = 40mA</td>
</tr>
<tr>
<td>Pi = 1.3W</td>
<td>Pi = 120mW</td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
</tr>
<tr>
<td>Li = 10uH</td>
<td>Li = 10uH</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIGAS 5300C is as follows:

<table>
<thead>
<tr>
<th>For non-Ex i signal outputs</th>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex d connection compartment</td>
<td>II 2 G Ex d [ib] IIC T4....T1 Gb</td>
<td>II 2 G Ex de [ia] IIC T4....T1 Gb</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>For Ex i signal outputs</th>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex d connection compartment</td>
<td>II 2(1) G Ex d [ia/ib] IIC T4....T1 Gb</td>
<td>II 2(1) G Ex de [ia/ib] IIC T4....T1 Gb</td>
</tr>
</tbody>
</table>
1.9 OPTIMASS 7000 / 7010C / 7300C

The OPTIMASS 7000 / 7010C mass flow sensors / mass flow meters are designed with intrinsically safe protection type. The marking for the OPTIMASS 7000 / 7010C is as follows:

<table>
<thead>
<tr>
<th></th>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
<td></td>
</tr>
<tr>
<td>Ii = 340mA</td>
<td>Ii = 40mA</td>
<td></td>
</tr>
<tr>
<td>Pi = 13W</td>
<td>Pi = 120mW</td>
<td></td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
<td></td>
</tr>
<tr>
<td>Li = 10uH</td>
<td>Li = 10uH</td>
<td></td>
</tr>
</tbody>
</table>

The input connections to the OPTIMASS 7010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th></th>
<th>No heating jacket / insulation</th>
<th>Heating jacket / insulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1/2 G Ex ib</td>
<td>I1/2 G Ex ib IIC T6....T1 Ga/Gb</td>
<td></td>
</tr>
<tr>
<td>I2 D Ex ib</td>
<td>II 2 D Ex ib IIC T150°C Db</td>
<td></td>
</tr>
<tr>
<td>I1/2 G Ex ib IIC T6....T1 Ga/Gb</td>
<td>II 2 D Ex ib IIC T150°C Db</td>
<td></td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 7300C is as follows:

For non-Ex i signal outputs without heating jacket / insulation

<table>
<thead>
<tr>
<th></th>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1/2 G Ex d [ib] IIC T6....T1 Ga/Gb</td>
<td>I1/2 G Ex d [ib] IIC T6....T1 Ga/Gb</td>
<td></td>
</tr>
<tr>
<td>I2 D Ex t IIC T160°C Db</td>
<td>I2 D Ex t IIC T160°C Db</td>
<td></td>
</tr>
</tbody>
</table>

For non-Ex i signal outputs with heating jacket / insulation

<table>
<thead>
<tr>
<th></th>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I1/2 G Ex d [ib] IIC T6....T1 Ga/Gb</td>
<td>I1/2 G Ex d [ib] IIC T6....T1 Ga/Gb</td>
<td></td>
</tr>
<tr>
<td>I2 D Ex t IIC T170°C Db</td>
<td>I2 D Ex t IIC T170°C Db</td>
<td></td>
</tr>
</tbody>
</table>

For Ex i signal outputs without heating jacket / insulation

<table>
<thead>
<tr>
<th></th>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
</table>

For Ex i signal outputs with heating jacket / insulation

<table>
<thead>
<tr>
<th></th>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
</table>
1.10 OPTIMASS 8000k / 8010kC / 8300kC

The OPTIMASS 8000k / 8010kC mass flow sensors / mass flow meters are designed with intrinsically safe protection type. The marking for the OPTIMASS 8000k / 8010kC is as follows:

II 1/2 G Ex ib IIC T4...T1 Ga/Gb
II 2 D Ex ib IIC T210°C Db

The input connections to the OPTIMASS 8010kC / 8010kC for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_i = 16.5V$</td>
<td>$U_i = 11.8V$</td>
</tr>
<tr>
<td>$I_i = 340mA$</td>
<td>$I_i = 40mA$</td>
</tr>
<tr>
<td>$P_i = 1.3W$</td>
<td>$P_i = 120mW$</td>
</tr>
<tr>
<td>$C_i = 35nF$</td>
<td>$C_i = 35nF$</td>
</tr>
<tr>
<td>$L_i = 10uH$</td>
<td>$L_i = 10uH$</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 8300kC is as follows:

For non-Ex i signal outputs

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2 G Ex d [ib] IIC T4...T1 Ga/Gb</td>
<td>II 1/2 G Ex de [ib] IIC T4...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIC T265°C Db</td>
<td>II 2 D Ex t IIC T265°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2(1) G Ex d [ia/ib] IIC T4...T1 Ga/Gb</td>
<td>II 1/2(1) G Ex de [ia/ib] IIC T4...T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2(1) D Ex t [ia Da] IIC T265°C Db</td>
<td>II 2(1) D Ex t [ia Da] IIC T265°C Db</td>
</tr>
</tbody>
</table>
1.11 OPTIMASS 8000 / 8010C / 8300C / 9000 / 9010C

The OPTIMASS 8000 / 8010C and OPTIMASS 9000 / 9010C mass flow sensors / mass flow meters are designed with intrinsically safe protection type. The marking for the OPTIMASS 8000 / 8010C is as follows:

II 1/2 G Ex ib IIC T4...T1 Ga/Gb
II 2 D Ex ib IIC T280°C Db

The marking for the OPTIMASS 9000 / 9010C is as follows:

II 1/2 G Ex ib IIC T4...T1 Ga/Gb
II 2 D Ex ib IIC T385°C Db

The input connections to the OPTIMASS 8010 / 9010C for use with associated apparatus have the following maximum values:

<table>
<thead>
<tr>
<th>Power Supply Circuit</th>
<th>Data Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ui = 16.5V</td>
<td>Ui = 11.8V</td>
</tr>
<tr>
<td>Ii = 340mA</td>
<td>Ii = 40mA</td>
</tr>
<tr>
<td>Pi = 1.3W</td>
<td>Pi = 120mW</td>
</tr>
<tr>
<td>Ci = 35nF</td>
<td>Ci = 35nF</td>
</tr>
<tr>
<td>Li = 10uH</td>
<td>Li = 10uH</td>
</tr>
</tbody>
</table>

The marking for the compact OPTIMASS 8300C is as follows:

<table>
<thead>
<tr>
<th>For non-Ex i signal outputs</th>
<th>For Ex i signal outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex d connection compartment</td>
<td>Ex e connection compartment</td>
</tr>
<tr>
<td>II 1/2 G Ex d [ib] IIC T4....T1 Ga/Gb</td>
<td>II 1/2(1) G Ex de [ib] IIC T4....T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2 D Ex t IIC T275°C Db</td>
<td>II 2(1) D Ex t IIC T275°C Db</td>
</tr>
</tbody>
</table>

For Ex i signal outputs

<table>
<thead>
<tr>
<th>Ex d connection compartment</th>
<th>Ex e connection compartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>II 1/2(1) G Ex d [iab] IIC T4....T1 Ga/Gb</td>
<td>II 1/2(1) G Ex de [iab] IIC T4....T1 Ga/Gb</td>
</tr>
<tr>
<td>II 2(1) D Ex t [iab Da] IIC T275°C Db</td>
<td>II 2(1) D Ex t [iab Da] IIC T275°C Db</td>
</tr>
</tbody>
</table>
1.12 Data Plates

The data plate on the connection box of separate mass flow sensors typically contains the following information:

1. Company logo and address
2. Model/size
3. Year of Manufacture
4. Serial Number
5. Handbook Publication Number
6. Identification Number of the notified body, as required by Directive 94/95 EC, Annex IV
7. Ex Specific Requirements (example shown)
8. Certificate Number
9. Ex Marking (Example Shown)
2 TEMPERATURE LIMITS

2.1 General

Due to the influence of the media temperature, mass flow sensors and compact mass flow meters are not allocated to any fixed temperature class. For allocation regarding the non-insulated and heated/insulated versions, please refer to the tables below.

The temperature limits below apply under the following conditions:

- The flowmeter is installed and operated in accordance with the installation directions given in the Installation and Operating Instructions.
- The flowmeter 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 mass flow converter housing.

2.2 MFC 300F & MFC 300F T6

The MFC 300F mass flow converter is suitable for temperature classes T6...T1 with a Max Surface Temperature T80 °C, with the following restrictions on ambient temperature:

1 Aluminium converter housing:
   - I/O options listed in the table below: Tamb: - 40 °C...+65°C
   - I/O options not listed in the table below: Tamb - 40 °C...+60°C

2 Stainless steel converter housing:
   - Tamb: - 40 °C...+55 °C

<table>
<thead>
<tr>
<th>IO Configuration (last three characters)</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Basic IO</td>
</tr>
<tr>
<td>688, 4C8 to 4K8</td>
<td>Modular IO and Module Carrier with 1 module pulse / status or control in</td>
</tr>
<tr>
<td>688, 6C8 to 6K8</td>
<td></td>
</tr>
<tr>
<td>788, 7C8 to 7K8</td>
<td></td>
</tr>
<tr>
<td>888, 8C8 to 8K8</td>
<td>Modular IO and Module Carrier with 1 module pulse / status</td>
</tr>
<tr>
<td>B88, BC8 to BK8</td>
<td></td>
</tr>
<tr>
<td>C88, CC8 to CK8</td>
<td></td>
</tr>
<tr>
<td>D88 to DP8</td>
<td>Profibus PA or Foundation Fieldbus and Module Carrier with 1 module Pulse / Status or Control In</td>
</tr>
<tr>
<td>E88 to EP8</td>
<td></td>
</tr>
<tr>
<td>F80,</td>
<td>Profibus DP and Module Carrier with 1 module Pulse / Status or Control In</td>
</tr>
<tr>
<td>FC0 to FK0</td>
<td></td>
</tr>
<tr>
<td>G88 to GP8</td>
<td>MODBUS IO and Module Carrier with 1 module Pulse / Status or Control In</td>
</tr>
<tr>
<td>GCC to GKC, GCE to GKC</td>
<td></td>
</tr>
<tr>
<td>GCF to GKF</td>
<td></td>
</tr>
<tr>
<td>HCC to HKC, HCE to HKC</td>
<td></td>
</tr>
<tr>
<td>HCF to HKF</td>
<td></td>
</tr>
<tr>
<td>200 300</td>
<td>Exi IO</td>
</tr>
</tbody>
</table>
### 2.3 OPTIMASS 1000 / 1010C / 1300C

The OPTIMASS 1000 / 1010C / 1300C is suitable for temperature classes T4...T1 according to the following tables:

#### OPTIMASS 1000 / 1010C with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_{m}$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>89</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>T175</td>
</tr>
</tbody>
</table>

#### OPTIMASS 1300C with aluminium converter housing and without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_{m}$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>70</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>T185</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 – T1</td>
<td>T125</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 – T1</td>
<td>T130</td>
</tr>
</tbody>
</table>

#### OPTIMASS 1300C with aluminium converter housing and heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_{m}$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>65</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>T195</td>
</tr>
<tr>
<td>50</td>
<td>65</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T3 – T1</td>
<td>T165</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 – T1</td>
<td>T125</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 – T1</td>
<td>T130</td>
</tr>
</tbody>
</table>

#### OPTIMASS 1300C with stainless steel converter housing and without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_{m}$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>70</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>T185</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>T4 – T1</td>
<td>T120</td>
</tr>
</tbody>
</table>

#### OPTIMASS 1300C with stainless steel converter housing and heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_{m}$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>65</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>T3 – T1</td>
<td>T185</td>
</tr>
<tr>
<td>50</td>
<td>65</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>T3 – T1</td>
<td>T140</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>T4 – T1</td>
<td>T120</td>
</tr>
</tbody>
</table>

* Only for equipment configurations according to the table in section 2.2

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a continuous minimum working temperature of 80°C.
### 2.4 OPTIMASS 1000 T6 / 1010C T6 / 1300C T6

The OPTIMASS 1000 T6 / 1010C T6 / 1300C T6 is suitable for temperature classes T6...T1 according to the following table:

#### OPTIMASS 1000 T6 / 1010C T6 with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>45</td>
<td>T6</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>T5</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>165</td>
</tr>
<tr>
<td>50</td>
<td>60</td>
<td>T5</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>165</td>
</tr>
<tr>
<td>65</td>
<td>95</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>165</td>
</tr>
</tbody>
</table>

#### OPTIMASS 1300C T6 with aluminium converter housing & without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>45</td>
<td>T6</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>T5</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>165</td>
</tr>
<tr>
<td>50</td>
<td>60</td>
<td>T5</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>160</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 – T1</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>T4 – T1</td>
<td>100</td>
</tr>
</tbody>
</table>

#### OPTIMASS 1300C T6 with aluminium converter housing & heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>45</td>
<td>T6</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>T5</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 – T1</td>
<td>165</td>
</tr>
<tr>
<td>50</td>
<td>60</td>
<td>T5</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T3 – T1</td>
<td>135</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 – T1</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>T4 – T1</td>
<td>100</td>
</tr>
</tbody>
</table>

2.4 OPTIMASS 1000 T6 / 1010C T6 / 1300C T6

The OPTIMASS 1000 T6 / 1010C T6 / 1300C T6 is suitable for temperature classes T6...T1 according to the following table:
### OPTIMASS 1300C T6 with stainless steel converter housing & without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>45</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 - T1</td>
<td>T155</td>
</tr>
<tr>
<td>50</td>
<td>60</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 - T1</td>
<td>T160</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>T4 - T1</td>
<td>T95</td>
</tr>
</tbody>
</table>

*Only for equipment configurations according to the table in section 2.2*

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a minimum continuous working temperature of 80°C.
2.5 OPTIMASS 2000 / 2010C / 2300C

The OPTIMASS 2000 / 2010C / 2300C are suitable for temperature classes T6….T1 according to the following tables:

**OPTIMASS 2000 / 2010C with or without heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>65</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T1-3</td>
<td>T150</td>
</tr>
<tr>
<td>65</td>
<td>75</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T1-3</td>
<td>T150</td>
</tr>
</tbody>
</table>

**OPTIMASS 2300C with aluminium converter housing, with or without heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>50</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T3 - T1</td>
<td>T160</td>
</tr>
<tr>
<td>50</td>
<td>65</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4 - T1</td>
<td>T130</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 - T1</td>
<td>T90</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 - T1</td>
<td>T95</td>
</tr>
</tbody>
</table>

**OPTIMASS 2300C with stainless steel converter housing, with or without heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>50</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>65</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>T3 - T1</td>
<td>T150</td>
</tr>
<tr>
<td>50</td>
<td>65</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>T4 - T1</td>
<td>T105</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>T5 - T1</td>
<td>T85</td>
</tr>
</tbody>
</table>

* Only for equipment configurations according to the table in section 2.2

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a continuous working temperature of 80°C.
2.6 OPTIMASS 3000 / 3010C / 3300C / 7000 / 7010C / 7300C

The OPTIMASS 3000 / 3010C / 3300C and OPTIMASS 7000 / 7010C / 7300C are suitable for temperature classes T6...T1 according to the following tables:

**OPTIMASS 3000 / 3010C and 7000 / 7010 C without heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{\text{amb}}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>70</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T150</td>
</tr>
<tr>
<td>50</td>
<td>70</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>85</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>130</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T150</td>
</tr>
<tr>
<td>65</td>
<td>85</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T150</td>
</tr>
</tbody>
</table>

**OPTIMASS 3000 / 3010C and 7000 / 7010 C with heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{\text{amb}}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>65</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T165</td>
</tr>
<tr>
<td>65</td>
<td>80</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T165</td>
</tr>
</tbody>
</table>

**OPTIMASS 3300C / 7300C with aluminium converter housing and without heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{\text{amb}}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>55</td>
<td>T6</td>
<td>T80</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T140</td>
</tr>
<tr>
<td>50</td>
<td>75</td>
<td>T5</td>
<td>T95</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 – T1</td>
<td>T160</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 – T1</td>
<td>T85</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 – T1</td>
<td>T90</td>
</tr>
</tbody>
</table>
OPTIMASS 3300C / 7300C with stainless steel converter housing and without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. Tm °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>55</td>
<td>T6</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>T5</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>145</td>
<td>T3 - T1</td>
<td>170</td>
</tr>
<tr>
<td>50</td>
<td>70</td>
<td>T5</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>T4 - T1</td>
<td>125</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T4 - T1</td>
<td>85</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 - T1</td>
<td>90</td>
</tr>
</tbody>
</table>

OPTIMASS 3300C / 7300C with aluminium converter housing and with heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. Tm °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>55</td>
<td>T6</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>T5</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>T4</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>T3 - T1</td>
<td>170</td>
</tr>
<tr>
<td>50</td>
<td>70</td>
<td>T5</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>115</td>
<td>T4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>135</td>
<td>T3 - T1</td>
<td>145</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>T4 - T1</td>
<td>80</td>
</tr>
</tbody>
</table>

*Only for equipment configurations according to the table in section 2.2

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a minimum continuous working temperature of 80°C.
### 2.7 OPTIMASS 4000 / 4010C / OPTIGAS 4000 / 4010C

The OPTIMASS 4000 / 4010C / OPTIGAS 4000C / 4010C are suitable for temperature classes T₄...T₁ according to the following tables:

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40...65</td>
<td>60</td>
<td>T₄</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>T₃</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>140</td>
<td>T₂ - T₁</td>
<td>T210</td>
</tr>
</tbody>
</table>

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a continuous working temperature of 80°C.

### 2.8 OPTIMASS 8000k / 8010kC / 8300kC

The OPTIMASS 8000k / 8010kC / 8300kC is suitable for temperature classes T₄...T₁ according to the following tables:

#### OPTIMASS 8000k / 8010kC with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40...65</td>
<td>80</td>
<td>T₄</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>140</td>
<td>T₃</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>230</td>
<td>T₂ - T₁</td>
<td>T280</td>
</tr>
</tbody>
</table>

#### OPTIMASS 8000k / 8010kC with or without heating jacket / insulation. Cryogenic applications

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-20...65</td>
<td>-195...80</td>
<td>T₄ - T₁</td>
<td>T130</td>
</tr>
</tbody>
</table>

#### OPTIMASS 8300kC with aluminium converter housing and with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. $T_{amb}$ °C</th>
<th>Max. medium temp. $T_m$ °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40...40</td>
<td>60</td>
<td>T₄</td>
<td>T125</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>T₃</td>
<td>T190</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T₂ - T₁</td>
<td>T265</td>
</tr>
<tr>
<td>-40...50</td>
<td>120</td>
<td>T₃</td>
<td>T190</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T₂-T₁</td>
<td>T260</td>
</tr>
<tr>
<td>-40...55</td>
<td>55</td>
<td>T₄-T₁</td>
<td>T125</td>
</tr>
<tr>
<td>-40...60*</td>
<td>60</td>
<td>T₄-T₁</td>
<td>T130</td>
</tr>
</tbody>
</table>
OPTIMASS 8300kC with stainless steel converter housing and with or without heating jacket / insulation. (min. process temp. -40°C)

<table>
<thead>
<tr>
<th>Ambient Temp. T_{\text{Amb}} °C</th>
<th>Max. medium temp. T_{\text{m}} °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40...40</td>
<td>60</td>
<td>T4</td>
<td>T125</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T2 - T1</td>
<td>T265</td>
</tr>
<tr>
<td>-40...45</td>
<td>55</td>
<td>T4</td>
<td>T125</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T2-T1</td>
<td>T260</td>
</tr>
<tr>
<td>-40...50*</td>
<td>50</td>
<td>T4-T1</td>
<td>T120</td>
</tr>
</tbody>
</table>

* Only for equipment configurations according to the table in section 2.2

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a continuous minimum working temperature of 80°C.
2.9 OPTIMASS 8000 / 8010C / 8300C

The OPTIMASS 8000 / 8010C / 8300C is suitable for temperature classes T4...T1 according to the following tables:

### OPTIMASS 8000 / 8010C with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. Tm °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>80</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>145</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>230</td>
<td>T2 – T1</td>
<td>T280</td>
</tr>
</tbody>
</table>

### OPTIMASS 8300C with aluminium converter housing and with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. Tm °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>45</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T2 – T1</td>
<td>T275</td>
</tr>
<tr>
<td>50</td>
<td>110</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T2 – T1</td>
<td>T275</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T3 – T1</td>
<td>T145</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 – T1</td>
<td>T150</td>
</tr>
</tbody>
</table>

### OPTIMASS 8300C with stainless steel converter housing and with or without heating jacket / insulation

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. Tm °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>45</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>110</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T2 – T1</td>
<td>T275</td>
</tr>
<tr>
<td>50</td>
<td>110</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>190</td>
<td>T2 – T1</td>
<td>T275</td>
</tr>
<tr>
<td>55</td>
<td>55</td>
<td>T3 – T1</td>
<td>T140</td>
</tr>
</tbody>
</table>

* Only for equipment configurations according to the table in section 2.2

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a continuous working temperature of 80°C.
2.10 OPTIMASS 9000 / 9010C

The OPTIMASS 9000 / 9010C is suitable for temperature classes T4...T1 according to the following tables:

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. TM °C</th>
<th>Temperature Class</th>
<th>Max. Surface Temp. °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>95</td>
<td>T4</td>
<td>T130</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>T3</td>
<td>T195</td>
</tr>
<tr>
<td></td>
<td>255</td>
<td>T2</td>
<td>T290</td>
</tr>
<tr>
<td></td>
<td>350</td>
<td>T1</td>
<td>T385</td>
</tr>
</tbody>
</table>

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a continuous working temperature of 80°C.

2.11 OPTIGAS 5000 / 5010C / 5300C

The OPTIGAS 5000 / 5010C / 5300C is suitable for temperature classes T4...T1 according to the following tables:

**OPTIGAS 5300C with stainless steel converter housing and without heating jacket / insulation**

<table>
<thead>
<tr>
<th>Ambient Temp. Tamb °C</th>
<th>Max. medium temp. TM °C</th>
<th>Temperature Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>40</td>
<td>T4</td>
</tr>
<tr>
<td>50</td>
<td>93</td>
<td>T3 - T1</td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td>T3 - T1</td>
</tr>
<tr>
<td>65*</td>
<td>65</td>
<td>T4 - T1</td>
</tr>
</tbody>
</table>

*Only for equipment configurations according to the table in section 2.2

The cable supplied by KROHNE is designed for a continuous working temperature of up to 105°C. Alternative cabling must be a heat-resistant type with a minimum continuous working temperature of 80°C.
2.12 Painted options

OPTIMASS 1000, 1010C, 1000 T6, 1010C T6, 1300C, 1300C T6, 2000, 2010C, 2300C, 3300C, 4000, 4010C, 7000, 7010C, 7300C, 8000K, 8010K C, 8300KC and OPTIGAS 4000, 4010C are available with a paint finish to prevent corrosion. Where the meter is remote, the MFC 300F / T6 is also available with a painted finish. The painted option is not available where the meter has a heated jacket or insulation.

For painted meters, the maximum permissible ambient temperature $T_{amb}$ is 40°C and the maximum permissible medium temperature $T_{m}$ is 110°C (or lower as required by the temperature class).
3 CONNECTION OF SEPARATED SYSTEMS

3.1 General

In the case of separate systems, the sensor and converter are connected using 4 core 2 pair cable with an overall shield. Each cable pair carries an intrinsically safe circuit (Power Supply Circuit and Data Circuit). The maximum length of the connecting cable for functional reasons is 300m, provided that the capacitance and inductance of the cable does not exceed the limits specified in section 3.2 below.

The requirements of IEC/EN 60079-14 should be adhered to when installing the flowmeter.

3.2 Cable Parameters

The following points need be to be followed when selecting the connecting cable for separated systems:

- The maximum permitted total capacitance and inductance for the connecting cable is:
  - \( C_L = 195 \ \text{nF} \)
  - \( L_L = 310 \ \text{μH} \)
- Cable supplied by Krohne has the following parameters:
  - \( C_L' < 200 \text{pF/m} \)
  - \( L_L' < 0.7 \text{μH/m} \)
- The cable selected must have a temperature rating equal to or better than the maximum range of temperatures present in the installation taking into account temperature gradients on the flow sensors (see the notes in section 2).
- The cable must be capable of withstanding a test voltage of 1000V AC and have a minimum insulation thickness of 0.2mm, as per IEC/EN60079-14 clause 12.2.2.7.

3.3 Equipotential bonding

The MFC 300F mass flow converter or OPTIMASS / OPTIGAS x300C mass flow meter must be included in the equipotential bonding system of the installation using the equipotential bonding terminal on the mass flow converter housing wall bracket or mass flow meter housing mounting stem respectively.

In separated systems the intrinsically safe power supply and data circuits are galvanically isolated from earth, therefore, an equilisation cable between the mass flow sensor and mass flow converter should not be used.

Where screened cable is used, the screen should only be earthed at the mass 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 IEC/EN 60079-14 clause 12.2.2.3 for further requirements for cable screens.
3.4 Terminal Connections

1. MFC 300F Mass flow converter junction box
2. OPTIMASS / OPTIGAS Mass flow sensor junction box

MFC 300F Mass flow converter junction box
The Power Supply Circuit is connected to terminals + and − and the Data Circuit is connected to terminals A and B. The other terminals should not be used.

OPTIMASS / OPTIGAS Mass flow sensor junction box
The Power Supply Circuit is connected to terminals + and − and the Data Circuit is connected to terminals A and B. The other terminals should not be used. The jumper connection determines the termination resistor for the Data Circuit.

Screening:
Please see the illustrations above and refer to section 3.3.
4 ELECTRICAL CONNECTIONS

4.1 General

- The MFC 300F mass flow converter or OPTIMASS / OPTIGAS x300C mass flow meter must be included in the equipotential bonding system of the installation using the equipotential bonding terminal on the mass flow converter housing wall bracket or mass flow meter housing mounting stem respectively.

- The covers of the housing electronics compartment and the housing itself are provided with a “flameproof” thread. The “flameproof” thread is a tight fit due to explosion proof requirements. Screw the cover on or off with care and never use excessive force!

- Keep the threads free of dirt and apply Teflon grease (e.g. NONTRIBOS® type Li EP2). The grease will help to prevent the threads from locking due to corrosion.

- To open the covers, remove the hexagonal “retention” lock using a No. 3 Allen key. After closing the covers, refit the “retention lock”.

Electronics compartment:

- Allow the electronics to de-energize before opening the electronics compartment: T6: at least 35 min., T5: at least 10 min.

Terminal compartment:

- The terminal compartment can be opened in hazardous areas, for a short period of time (e.g. to check wiring configuration) with the power supply connected, where:
  a) the terminal compartment has an ignition protection type “increased safety” (standard) and
  b) the I/O circuits have an ignition protection type “intrinsic safety” and
  c) the cover for the power supply terminals (L, N) is closed (see illustration)

Work on I/O terminals A-D can be carried out with the power supply connected, provided that the regulations on intrinsically safe circuits are followed.

As soon as the work has been completed, the cover must be replaced and the retention lock re-fitted.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function, electrical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>L, N</td>
<td>Connection for mains, always non-Ex i</td>
</tr>
<tr>
<td>L+, L-</td>
<td>100-230 VAC, +10%/-15%, 22 VA</td>
</tr>
<tr>
<td></td>
<td>12-24 V DC, +30%/-25%, 12 W</td>
</tr>
<tr>
<td></td>
<td>24 VAC, +10%/-15%, 22VA</td>
</tr>
<tr>
<td></td>
<td>24 VDC, +30%/-25%, 12W</td>
</tr>
<tr>
<td></td>
<td>Um = 253 V</td>
</tr>
<tr>
<td>A, A+, A-</td>
<td>Connection for signal I/Os (PELV circuits), non-Ex i or Ex i, are dependent on specific version of the MFC300 converter ordered. Consult the table with CG32 numbers below for details</td>
</tr>
</tbody>
</table>

1 Electrical Connections
2 I/O Connections
The exact I/O-configuration for circuits A, B, C and D is order-specific and can be determined by the CG32 number shown on the converter - check the data on the back of the MFC300 electronic unit. The CG32 number contains 10 characters of which the last three (XYZ) determine the I/O configuration (I/O circuits):

<table>
<thead>
<tr>
<th>CG32</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>
</tr>
</tbody>
</table>

The exact I/O-configuration for circuits A, B, C and D is order-specific and can be determined by the CG32 number shown on the converter - check the data on the back of the MFC300 electronic unit. The CG32 number contains 10 characters of which the last three (XYZ) determine the I/O configuration (I/O circuits):

• Schematic overviews of the CG32 numbers can be found in paragraph 4.2 (non-Ex i signal I/O connections) and 4.3 (Ex i signal I/O connections). The overviews do not show all details. The exact connection diagram for a specific MFC 300 converter can be found on the sticker inside the cover of the connection compartment.

• For use in Gas 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 an Ex e terminal compartment is supplied ex-factory with two Ex e certified cable glands and one Ex e stopping plug.

• The flowmeter with an Ex d terminal compartment is supplied ex-factory one Ex d stopping plug and two temporarily plugs. The two temporarily plugs – only for transport and storage – must be replaced by suitable Ex d certified glands, plugs or conduit accessories before the flowmeter is taken into service.

• Unused openings must be closed by suitable certified plugs.

• The wiring of the compact flowmeter has to conform to the requirements specified in the relevant national or regional standard for electrical installations in hazardous areas, e.g. IEC/EN 60079-14. From this standard section 9 (Wiring systems) is valid for 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) are valid for Ex e, Ex d or Ex i connection compartments respectively.

• Tighten terminals to a torque setting of 0.7 Nm.

• The compact flowmeter must always be included in the equipotential bonding system of the hazardous area. This can be achieved internally – by means of the PE conductor of the mains system connected to the internal PE clamp – or externally – by means of a separate equipotential bonding conductor connected to the external PE clamp under the converter housing. A separate bonding conductor must have a cross sectional area of at least 4 mm².

4.2 Non-Ex i signal I/O connections

The following non-intrinsically safe signal inputs/outputs are available:

<table>
<thead>
<tr>
<th>I/O PCB</th>
<th>Input/output functions, Um = 253 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic I/O</td>
<td>Current Output active and passive, with HART Status Output / Control Input Status Output Pulse / Status Output</td>
</tr>
<tr>
<td>Modular I/O</td>
<td>Current Output, active or passive, with HART 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: Current Output, active or passive Status / Pulse Output, active or passive, highC or Namur 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>RS485 Modbus</td>
<td>Modbus with or without termination</td>
</tr>
</tbody>
</table>
- The options separated with "/" are software selectable (can be changed by 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 input/output to Namur recommendations

**Overview of possible combinations, defined by the CG32 number**

<table>
<thead>
<tr>
<th>Characters XYZ</th>
<th>Name I/O circuits</th>
<th>Terminals A, A-</th>
<th>Terminals B, B-</th>
<th>Terminals C, C-</th>
<th>Terminals D, D-</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Basic I/O</td>
<td>C0 CO (a) over A-</td>
<td>SO/CI</td>
<td>SO</td>
<td>PO/SO</td>
<td></td>
</tr>
<tr>
<td>488 to 4RR</td>
<td>Modular I/O or Modular Carrier with 1 or 2 I/O Modules</td>
<td>Many combinations possible</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>588 to 5RR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>688 to 6RR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>788 to 6RR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>888 to 6RR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A88 to ARR</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 BRR</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>FF</td>
<td>FF</td>
</tr>
<tr>
<td>C88 to CRR</td>
<td>Fieldbus I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>FF</td>
<td>FF</td>
</tr>
<tr>
<td>D88 Fieldbus I/O</td>
<td>Fieldbus I/O with 1 or 2 I/O Modules</td>
<td>PA</td>
<td>PA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D8A to DRR</td>
<td>Fieldbus I/O</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E88 Fieldbus I/O</td>
<td>Foundation Fieldbus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E8A to ERR</td>
<td>Fieldbus I/O</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F00 Profibus DP I/O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F80 to FRO</td>
<td>Profibus DP I/O</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G00 to GRR</td>
<td>RS485 Modbus</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H00 to HRR</td>
<td>Modbus with 1 or 2 I/O modules</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- all in/outputs are passive unless otherwise noted as active (a)
- n.c. = not connected.
4.3 Ex i signal I/O connections

Following intrinsically safe I/Os are available:

<table>
<thead>
<tr>
<th>I/O PCB</th>
<th>I/O functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex i I/O</td>
<td>Current Output + HART communication</td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td></td>
<td>Ui = 30V, Ii = 100 mA, Pi = 1.0 W</td>
</tr>
<tr>
<td></td>
<td>Ci = 10 nF, Li = negligibly low</td>
</tr>
<tr>
<td></td>
<td>Current Output, active</td>
</tr>
<tr>
<td></td>
<td>+ HART communication</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td></td>
<td>Uo = 21 V, Io = 90 mA, Po = 0.5 W</td>
</tr>
<tr>
<td></td>
<td>linear characteristic</td>
</tr>
<tr>
<td></td>
<td>Co = 90 nF, Lo = 2.0 mH</td>
</tr>
<tr>
<td></td>
<td>Co = 110 nF, Lo = 0.5 mH</td>
</tr>
<tr>
<td>Ex i Option</td>
<td>Current input passive</td>
</tr>
<tr>
<td>or Ex i Option2</td>
<td>Current Output</td>
</tr>
<tr>
<td></td>
<td>Pulse / Status Output / Control Input</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td></td>
<td>Ui = 30 V, Ii = 100 mA, Pi = 1.0 W</td>
</tr>
<tr>
<td></td>
<td>Ci = 10 nF, Li = negligibly low</td>
</tr>
<tr>
<td>Fieldbus I/O</td>
<td>Current Output, active</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td></td>
<td>Uo = 21 V, Io = 90 mA, Po = 0.5 W</td>
</tr>
<tr>
<td></td>
<td>linear characteristic</td>
</tr>
<tr>
<td></td>
<td>Co = 90 nF, Lo = 2.0 mH</td>
</tr>
<tr>
<td></td>
<td>Co = 110 nF, Lo = 0.5 mH</td>
</tr>
<tr>
<td></td>
<td>Current input active</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td></td>
<td>Uo = 24.1 V, Io = 99 mA, Po = 0.6 W</td>
</tr>
<tr>
<td></td>
<td>linear characteristic</td>
</tr>
<tr>
<td></td>
<td>Co = 75 nF, Lo = 0.5 mH</td>
</tr>
<tr>
<td></td>
<td>Profibus-PA</td>
</tr>
<tr>
<td></td>
<td>Foundation Fieldbus</td>
</tr>
<tr>
<td></td>
<td>Ex ia IIC</td>
</tr>
<tr>
<td></td>
<td>Ui = 24 V, Ii = 380 mA, Pi = 5.32 W</td>
</tr>
<tr>
<td></td>
<td>Ci = 5 nF, Li = 10 μH</td>
</tr>
</tbody>
</table>

- The I/O circuits named Ex i I/O, Ex i Option are always in the Intrinsically safe (Ex ia) type of protection. The I/O circuits Fieldbus I/O Profibus PA and Fieldbus I/O Foundation Fieldbus can be in the Intrinsically safety type of protection.
- A maximum of 4 intrinsically safe (Ex ia) in/outputs are possible. All intrinsically safe circuits are galvanically insulated with respect to earth and each other. To avoid summation of voltages and currents, the wiring of these Ex ia circuits must be sufficiently separated, e.g. in line with the requirements of standard IEC/EN 60079-14, clause 12.2.
- The Ex ia signal in/outputs may only be connected to other Ex ia or ib certified device (e.g. intrinsically safe isolation amplifiers), even if such devices are installed in the non-hazardous area!
- Connection to a non-Ex i apparatus cancels the Ex ia properties of the flowmeter.
- Terminals L, N (or L+, L-) for mains connection are always non-intrinsically safe. To achieve the necessary spatial separation to IEC/EN 60079-11 between the non-Ex i and Ex i circuits, the mains terminals are provided with a semi-circular insulation cover with a "snap-in" lock. This cover MUST be closed before establishing the power supply to the converter.
### Overview possible C032 numbers with Ex ia in/outputs

<table>
<thead>
<tr>
<th>Characters XYZ</th>
<th>Name I/O circuits</th>
<th>Terminals 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>Ex i I/O</td>
<td>n.c.</td>
<td>n.c.</td>
<td>CO [a]</td>
<td>PO/SO</td>
</tr>
<tr>
<td>300</td>
<td>n.c.</td>
<td>n.c.</td>
<td>CO</td>
<td>PO/SO</td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>Ex i I/O with Ex i Option</td>
<td>CO [a]</td>
<td>PO/SO/CI</td>
<td>CO [a]</td>
<td>PO/SO</td>
</tr>
<tr>
<td>220</td>
<td>CO</td>
<td>PO/SO/CI</td>
<td>CO [a]</td>
<td>PO/SO</td>
<td></td>
</tr>
<tr>
<td>310</td>
<td>CO [a]</td>
<td>PO/SO/CI</td>
<td>CO</td>
<td>PO/SO</td>
<td></td>
</tr>
<tr>
<td>320</td>
<td>CO</td>
<td>PO/SO/CI</td>
<td>CO</td>
<td>PO/SO</td>
<td></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/CI</td>
<td>PA</td>
<td>PA</td>
</tr>
<tr>
<td>D20</td>
<td>CO</td>
<td>PO/SO/CI</td>
<td>PA</td>
<td>PA</td>
<td></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/CI</td>
<td>FF</td>
<td>FF</td>
</tr>
</tbody>
</table>

- 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
- All in/outputs are passive unless otherwise noted as active (a)
- n.c. = not connected
5 SERVICE AND MAINTENANCE

5.1 Maintenance
The OPTIMASS / OPTIGAS 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.

5.2 Replacement of mains fuse
Open the window cover. Press the two metal clips on each side of the display and pull the display unit forward. Move the display-unit sideward, out of the way. Loosen the two crosshead screws holding the electronic unit in place. Slide the electronic unit forward, with care. When the unit is almost completely removed from the housing, disconnect the long rectangular (10-pole) blue connector at the back-end of the unit. This connector is for the flow sensor circuits. Remove the unit from the housing.

The mains fuse is situated in a fuse holder at the back-end of the electronic unit. The specification must be as follows:

<table>
<thead>
<tr>
<th>Power Supply</th>
<th>Time Lag</th>
<th>KROHNE Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-24 VDC</td>
<td>250V / 2A</td>
<td>5060200000</td>
</tr>
<tr>
<td>24 VAC/DC</td>
<td>250V / 2A</td>
<td>5060200000</td>
</tr>
<tr>
<td>100-230 VAC</td>
<td>250V / 0.8A</td>
<td>5080850000</td>
</tr>
</tbody>
</table>

5.3 Returning the device for service or repair
This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems. Should you 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 our personnel, KROHNE may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.

This means that KROHNE can only service this device if it is accompanied by the following certificate confirming that the device is safe to handle.

If the device has been operated with toxic, caustic, flammable or water polluting liquids, you are kindly requested:

To check and ensure, if necessary by rinsing or neutralizing, that all cavities in the device are free from dangerous substances.

To enclose a certificate with the device confirming that it is safe to handle and stating the product used.

We cannot service your device unless accompanied by a certificate.

The specimen shown in appendix 1 can be photocopied and used and it is also available on the KROHNE website as a word file. Simply download and use the tabulator key to go from one fill-out field to the next. Please attach the form to the returned device.
Appendix 1 Declaration of Cleanliness Certificate

Company: ........................................ Address: ........................................

Department: ................................. Name ........................................

Tel. No. ........................................ Fax No.: ........................................

The enclosed device

Type: ........................................

KROHNE Order No. or Series No.: ........................................

has been operated with the following liquid: ........................................

Because this liquid is □ water-hazardous □ toxic □ caustic □ flammable

we have □ checked that all cavities in the instrument are free from such substances /

□ rinsed out and neutralized all cavities in the device

We confirm that there is no risk to humans or environment through any residual liquid contained in this device.

Date: ........................................ Signature: ........................................

Company stamp: