Electromagnetic flow sensor for partially filled pipes

- Measurement in partially filled pipes up to DN1600 / 64”
- Patented, non-contact level measurement
- Measurement possible down to 10% filling of pipe

The documentation is only complete when used in combination with the relevant documentation for the signal converter.
# TIDALFLUX 2300 F

## CONTENTS

1. **Product features**
   - 1.1 Solution for partially filled pipes ................................................................. 3
   - 1.2 Options .............................................................................................................. 5
   - 1.3 Measuring principle .......................................................................................... 6

2. **Technical data**
   - 2.1 Technical data ................................................................................................... 7
   - 2.2 Dimensions and weights .................................................................................. 11
   - 2.3 Measuring accuracy .......................................................................................... 13

3. **Installation**
   - 3.1 Intended use ....................................................................................................... 14
   - 3.2 General notes on installation ............................................................................ 14
     - 3.2.1 Vibration ...................................................................................................... 14
     - 3.2.2 Magnetic field ............................................................................................ 14
   - 3.3 Installation conditions ....................................................................................... 15
     - 3.3.1 Inlet and outlet ............................................................................................ 15
     - 3.3.2 Control valve .............................................................................................. 15
     - 3.3.3 Slope ............................................................................................................ 15
     - 3.3.4 Mounting advice for difficult situations ...................................................... 16
     - 3.3.5 Open discharge ........................................................................................... 16
     - 3.3.6 Cleaning of flow sensor .............................................................................. 17
     - 3.3.7 Flange deviation .......................................................................................... 17
     - 3.3.8 Mounting position ..................................................................................... 17
   - 3.4 Mounting ............................................................................................................ 18
     - 3.4.1 Torques and pressures ................................................................................. 18
     - 3.4.2 Temperatures .............................................................................................. 19

4. **Electrical connections**
   - 4.1 Safety instructions .......................................................................................... 20
   - 4.2 Important notes on electrical connection ....................................................... 20
   - 4.3 Cable lengths .................................................................................................... 21
   - 4.4 Grounding ......................................................................................................... 22
     - 4.4.1 Mounting grounding rings ......................................................................... 22
   - 4.5 Connection diagrams ....................................................................................... 22

5. **Notes**
   - 5.1 Notes ................................................................................................................. 23
1.1 Solution for partially filled pipes

The TIDALFLUX 2000 flow sensor with integrated and non-contact capacitive level measuring system provides accurate flow measurement in partially filled pipes. TIDALFLUX is designed to measure reliably between 10% and 100% of the pipe cross section. The integrated level sensors in the liner are in no contact with the liquid and are therefore insensitive against fat and oil floating on the surface.

① Various flange standards
② Patented, capacitive and non-contact flow level measuring system integrated in the liner
③ Remote converter IFC 300 (PF)
Highlights

- For partially filled pipes in the water and wastewater industry
- Broad diameter range up to DN1600 / 64”
- High abrasion resistance and chemical resistance
- Measurement possible between 10% and 100% filling
- Electrodes for flow measurement are below 10% filling level, therefore no blind folding by fat and oil floating on the water surface
- Complete factory calibration - no on-site calibration necessary

Industries

- Water
- Wastewater

Applications

- For partially filled pipes instead of expensive siphon tube constructions
- Water and wastewater
- Surface water
- Biological and chemical wastewater
1.2 Options

The solution for the water and wastewater industry

Flanged flowsensor
- Robust construction, completely welded
- Various flange standards like DIN, ANSI and JIS
- IP 68
- ATEX / IECex Zone 1
- 220 / 110 V or 24 VDC power supply
- Polyurethane liner

Remote converter
- IFC 300 F (PF)
- Stainless steel
- ATEX / IECex Zone 1
- Extra connector space (for use with NPT)
- Mounting to wall or 2” pipe with clamps
- mA, HART or Modbus
1.3 Measuring principle

The TIDALFLUX 2000 is an electromagnetic flow sensor with an integrated capacitive level measurement system, designed for electrically conductive process liquids. The flow rate \( Q(t) \) through the tube is: 

\[
Q(t) = v(t) \times A(t)
\]

in which 

\( v(t) \) = flow velocity of liquid product 
\( A(t) \) = wetted area of tube section.

The flow velocity is determined on basis of the known electromagnetic measurement principle. The two measuring electrodes are located in the lower part of the measuring tube, on a level of approx. 10% of the inner diameter of the pipe in order to get a reliable measurement up from a level of 10%.

An electrically conductive fluid flows inside an electrically insulating pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils. Inside of the fluid, a voltage \( U \) is generated:

\[
U = v \times k \times B \times D
\]

in which:

\( v \) = mean flow velocity 
\( k \) = factor correcting for geometry 
\( B \) = magnetic field strength 
\( D \) = distance between electrodes

The signal voltage \( U \) is picked off by electrodes and is proportional to the mean flow velocity \( v \) and thus the flow rate \( q \). The signal voltage is quite small (typically 1 mV at \( v = 3 \text{ m/s} / 10 \text{ ft/s} \) and field coil power of 1 W). Finally, a signal converter is used to amplify the signal voltage, filter it (separate from noise) and convert it into signals for totalising, recording and output processing.

![Diagram of TIDALFLUX measuring principle](image)

**Figure 1-1: Measuring principle TIDALFLUX**

1. Electrodes  
2. Induced voltage (proportional to flow velocity)  
3. Capacitive plates in liner for height measurement  
4. Magnetic field  
5. Field coils

The wetted area \( A \) is computed from the known inside diameter of the pipe by the patented capacitive level measurement system that is built into the measuring tube liner. The required electronics unit is accommodated in a compact housing that is mounted on top of the measuring sensor. This electronics is connected to the remote IFC 300 F converter by means of a digital communication line.
2.1 Technical data

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

#### Measuring system

<table>
<thead>
<tr>
<th>Measuring principle</th>
<th>Faraday's law</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Electrically conductive fluids</td>
</tr>
</tbody>
</table>

#### Measured value

<table>
<thead>
<tr>
<th>Primary measured value</th>
<th>Flow velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary measured value</th>
<th>Volume flow</th>
</tr>
</thead>
</table>

#### Design

<table>
<thead>
<tr>
<th>Features</th>
<th>Flange version with full bore flow tube</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard as well as higher pressure ratings</td>
</tr>
<tr>
<td></td>
<td>Broad range of nominal sizes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Modular construction</th>
<th>The measurement system consists of a flow sensor and a signal converter. It is available as remote version. More information about the signal converter can be found in the documentation of the signal converter.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Remote version</th>
<th>In field [F] version with IFC 300 converter: TIDALFLUX 2300 F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note</td>
<td>Compact versions are not available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nominal diameter</th>
<th>DN200...1600 / 8...64&quot;</th>
</tr>
</thead>
</table>
### Measuring accuracy

<table>
<thead>
<tr>
<th>Reference conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope: 0%</td>
<td></td>
</tr>
<tr>
<td>Medium: water</td>
<td></td>
</tr>
<tr>
<td>Electrical conductivity: 50...5000 μS/cm</td>
<td></td>
</tr>
<tr>
<td>Temperature: +10...+30°C / +50...+86°F</td>
<td></td>
</tr>
<tr>
<td>Inlet section: ≥ 10 DN</td>
<td></td>
</tr>
<tr>
<td>Outlet section: ≥ 5 DN</td>
<td></td>
</tr>
<tr>
<td>Flow velocity at full scale: &gt; 1 m/s / 3 ft/s</td>
<td></td>
</tr>
<tr>
<td>Operating pressure: 1 bar / 14.5 psi</td>
<td></td>
</tr>
<tr>
<td>Wet calibrated on EN 17025 accredited calibration rig by direct volume comparison or by master meter.</td>
<td></td>
</tr>
</tbody>
</table>

Maximum measuring error

For detailed information on the measuring accuracy, see chapter “Measuring accuracy”.

- Related to volume flow (MV = Measured Value, FS = Full Scale)
- These values are related to the pulse / frequency output
- The additional typical measuring deviation for the current output is ±10 μA

**Partly filled:**

\[
\text{v} \geq 1 \text{ m/s} / 3.3 \text{ ft/s} : \leq 1\% \text{ of FS}
\]

**Fully filled:**

\[
\begin{align*}
\text{v} & \geq 1 \text{ m/s} / 3.3 \text{ ft/s} : \leq 1\% \text{ of MV} \\
\text{v} < 1 \text{ m/s} / 3.3 \text{ ft/s} & : \leq 0.5\% \text{ of MV} + 5 \text{ mm/s} / 0.2 \text{ inch/s}
\end{align*}
\]

- Minimum level: 10% of inner diameter

### Operating conditions

#### Temperature

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Process temperature</td>
<td>0...+60°C / +32...+140°F</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>Non ATEX: -40...+65°C / -40...+149°F</td>
</tr>
<tr>
<td></td>
<td>ATEX zone 1: -20...+65°C / -4...+149°F</td>
</tr>
<tr>
<td></td>
<td>Protect electronics against self-heating with ambient temperatures above 55°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-50...+70°C / -58...+158°F</td>
</tr>
<tr>
<td>Measurement range</td>
<td>-12...+12 m/s / -40...+40 ft/s</td>
</tr>
<tr>
<td>Vacuum load (DN200...DN1600 / 8...64&quot;)</td>
<td>500 mbar abs. at $T_{\text{process}} = 40°C / 600$ mbar abs. at $T_{\text{process}} = 60°C$ / 7.3 psia at $T_{\text{process}} = 104 °F / 8.7$ psia at $T_{\text{process}} = 140 °F</td>
</tr>
</tbody>
</table>

#### Chemical properties

<table>
<thead>
<tr>
<th>Physical condition</th>
<th>Conductive liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical conductivity</td>
<td>≥ 50 μS/cm</td>
</tr>
<tr>
<td>Permissible solid content (volume)</td>
<td>≤ 20%</td>
</tr>
<tr>
<td>If process liquid is slurry: density &lt; 1.15 kg/dm³.</td>
<td></td>
</tr>
</tbody>
</table>
Installation conditions

| Installation | For detailed information see chapter “Installation”. |
| Flow direction | Forward and reverse. Arrow on flow sensor indicates positive flow direction. |
| Inlet run | ≥ 5 DN (without disturbing flow, after a single 90° bend)  
≥ 10 DN (after a double bend 2x 90°)  
≥ 10 DN (behind a control valve) |
| Outlet run | ≥ 3 DN |
| Dimensions and weights | For detailed information see chapter “Dimensions and weights”. |

Materials

| Sensor housing | Standard: sheet steel  
Other materials on request |
| Measuring tube | Austenitic stainless steel |
| Flange | Standard: carbon steel, polyurethane coated  
Other materials on request. |
| Liner | Polyurethane |
| Connection box | IP 67: polyurethane coated die-cast aluminium  
IP 68: Stainless steel |
| Measuring electrodes | Hastelloy® C |
| Grounding rings | Stainless steel  
Tailor made to innerdiameter of connecting pipeline.  
Necessary if innerside of connecting pipeline isn’t electrically conductive. |

Process connections

| Flange | DN200...1600 in PN 6...40 (others on request)  
8...64” in 150...300 lb RF (others on request) |
| JIS | DN200...1600 in JIS 10...20 K (others on request) |
| Design of gasket surface | RF (others on request) |
## Electrical connections

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Electrical connection is carried out in conformity with the VDE 0100 directive &quot;Regulations for electrical power installations with line voltages up to 1000 V&quot; or equivalent national specifications.</td>
</tr>
</tbody>
</table>
| **Power supply**     | Standard: 100...230 VAC (-15% / +10%), 50/60 Hz  
                           Option 1: 24 VAC/DC (AC: -15% / +10%, 50/60 Hz; DC: -25% / +30%) |
| **Power consumption**| AC: 22 VA                                                                   |
| **Field current cable** | Shielded cable must be used, no part of delivery.                        |
| **Signal cable**     | **DS 300 (type A)**Max. length: 600 m / 1950 ft (dependent on electrical conductivity). |
|                      | **BTS 300 (type B)**Max. length: 600 m / 1950 ft                           |
| **Data interface cable** | For transmission of measured level to IFC 300 F.  |
|                      | Shielded Liycy cable, 3 x 0.75 mm²                                           |
| **Cable entries**    | Standard: 2x M20 x 1.5 + 2x M16 x 1.5 EMC type  
                           Option: ½” NPT                                                        |

## Approvals and certificates

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CE</strong></td>
<td>This device fulfills the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE mark.</td>
</tr>
</tbody>
</table>
| **Electromagnetic compatibility** | Directive: 2004/108/EC, NAMUR NE21/04  
                           Harmonized standard: EN 61326-1 : 2006 |
| **Low voltage directive** | Directive: 2006/95/EC  
                           Harmonized standard: EN 61010 : 2001 |
| **Pressure equipment directive** | Directive: 97/23/EC  
                           Category I, II or SEP  
                           Fluid group 1  
                           Production module H |
| **Hazardous areas**   | Option: Ex zone 1, IECex                                                      |
| **Other approvals and standards** | Protection category acc. to IEC 529 / EN 60529  
                           Standard: IP 66/67 (NEMA 4/4X/6)  
                           Option: IP 68 (NEMA 6P)  
                           Vibration resistance: IEC 68-2-6  
                           Random vibration test: IEC 68-2-34  
                           Shock test: IEC 68-2-27 |
2.2 Dimensions and weights

The inner pipe diameter should match the inner diameter of the flowmeter. Since the inner diameter is not a standard DN size, choose the inner pipe diameter to be just a little bit bigger than the flowmeter diameter. If a lot of sediment or fat is expected the optimal solution is to produce a diameter compensation ring on both sides to have smooth transits.

**EN 1092-1**

<table>
<thead>
<tr>
<th>Nominal size</th>
<th>Dimensions [mm]</th>
<th>Approx. weight [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN</td>
<td>PN</td>
<td>a</td>
</tr>
<tr>
<td>200</td>
<td>10</td>
<td>350</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>400</td>
</tr>
<tr>
<td>300</td>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>350</td>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>400</td>
<td>10</td>
<td>600</td>
</tr>
<tr>
<td>500</td>
<td>10</td>
<td>600</td>
</tr>
<tr>
<td>600</td>
<td>10</td>
<td>600</td>
</tr>
<tr>
<td>700</td>
<td>10</td>
<td>700</td>
</tr>
<tr>
<td>800</td>
<td>10</td>
<td>800</td>
</tr>
<tr>
<td>900</td>
<td>10</td>
<td>900</td>
</tr>
<tr>
<td>1000</td>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>1200</td>
<td>6</td>
<td>1200</td>
</tr>
<tr>
<td>1400</td>
<td>6</td>
<td>1400</td>
</tr>
<tr>
<td>1600</td>
<td>6</td>
<td>1600</td>
</tr>
</tbody>
</table>
### 150 lb flanges

<table>
<thead>
<tr>
<th>ASME [1]</th>
<th>PN [psi]</th>
<th>a</th>
<th>b</th>
<th>Øc</th>
<th>d</th>
<th>ØD</th>
<th>ØDi</th>
<th>Approx. weight [lb]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>284</td>
<td>13.78</td>
<td>22.93</td>
<td>11.46</td>
<td>5.75</td>
<td>13.5</td>
<td>7.44</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>284</td>
<td>15.75</td>
<td>24.80</td>
<td>13.03</td>
<td>6.54</td>
<td>16.0</td>
<td>9.09</td>
<td>120</td>
</tr>
<tr>
<td>12</td>
<td>284</td>
<td>19.69</td>
<td>26.76</td>
<td>15</td>
<td>7.52</td>
<td>19.0</td>
<td>11.06</td>
<td>145</td>
</tr>
<tr>
<td>14</td>
<td>284</td>
<td>27.56</td>
<td>30.22</td>
<td>16.85</td>
<td>9.8</td>
<td>21.0</td>
<td>12.44</td>
<td>210</td>
</tr>
<tr>
<td>16</td>
<td>284</td>
<td>31.5</td>
<td>31.13</td>
<td>19.02</td>
<td>9.53</td>
<td>23.5</td>
<td>14.37</td>
<td>255</td>
</tr>
<tr>
<td>20</td>
<td>284</td>
<td>31.5</td>
<td>35.21</td>
<td>23.03</td>
<td>11.54</td>
<td>27.5</td>
<td>18.39</td>
<td>320</td>
</tr>
<tr>
<td>24</td>
<td>284</td>
<td>31.5</td>
<td>39.50</td>
<td>27.32</td>
<td>13.66</td>
<td>32.0</td>
<td>22.32</td>
<td>400</td>
</tr>
<tr>
<td>28</td>
<td>Class D</td>
<td>35.43</td>
<td>44.71</td>
<td>31.97</td>
<td>15.98</td>
<td>36.5</td>
<td>26.22</td>
<td>692</td>
</tr>
<tr>
<td>32</td>
<td>Class D</td>
<td>39.37</td>
<td>49.51</td>
<td>36.3</td>
<td>18.15</td>
<td>41.8</td>
<td>30.24</td>
<td>1031</td>
</tr>
<tr>
<td>36</td>
<td>Class D</td>
<td>43.31</td>
<td>54.42</td>
<td>41.89</td>
<td>20.94</td>
<td>46.0</td>
<td>33.98</td>
<td>1267</td>
</tr>
<tr>
<td>40</td>
<td>Class D</td>
<td>47.24</td>
<td>58.14</td>
<td>44.57</td>
<td>22.28</td>
<td>50.8</td>
<td>37.99</td>
<td>1554</td>
</tr>
<tr>
<td>48</td>
<td>Class D</td>
<td>55.12</td>
<td>66.61</td>
<td>52.76</td>
<td>26.38</td>
<td>59.5</td>
<td>46.02</td>
<td>2242</td>
</tr>
</tbody>
</table>

[1] Nominal size ≤ 24": ASME; > 24": AWWA
2.3 Measuring accuracy

The measuring accuracy for partly filled pipes and completely filled pipes are different. In these graphs it is assumed that the velocity at full scale value is at least 1 m/s [is also the standard value for calibration, since it will result in the most accurate measurements].

Partly filled:
• \( v \geq 1 \, \text{m/s} / 3.3 \, \text{ft/s}: \leq 1\% \, \text{of Full Scale} \)

Fully filled:
• \( v \geq 1 \, \text{m/s} / 3.3 \, \text{ft/s}: \leq 1\% \, \text{of MV} \)
• \( v < 1 \, \text{m/s} / 3.3 \, \text{ft/s}: \leq 0.5\% \, \text{of MV} + 5 \, \text{mm/s} / 0.2 \, \text{inch/s} \) (see following graph)

Fully filled pipes

![Graph showing maximum measuring error of measured value](image)

Figure 2-1: Maximum measuring error of measured value
3.1 Intended use

The TIDALFLUX 2300 F is especially designed for measuring the flow of conductive fluids, in partially filled pipes. It can only be combined with the IFC 300 PF electromagnetic flow converter.

3.2 General notes on installation

Inspect the cartons carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

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

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

3.2.1 Vibration

Vibration

Figure 3-1: Avoid vibrations

3.2.2 Magnetic field

Magnetic field

Figure 3-2: Avoid magnetic fields
3.3 Installation conditions

3.3.1 Inlet and outlet

![Diagram showing recommended inlet and outlet sections, top view](image)

Figure 3-3: Recommended inlet and outlet sections, top view

1. $\geq 5$ DN
2. $\geq 3$ DN

3.3.2 Control valve

![Diagram showing installation before control valve](image)

Figure 3-4: Installation before control valve

3.3.3 Slope

The accuracy is influenced by the slope. Stay within $\pm 1\%$ to get the most accurate measurements!

![Diagram showing recommended slope](image)

Figure 3-5: Recommended slope
### 3.3.4 Mounting advice for difficult situations

If you cannot meet the installation conditions install the flowmeter between two containers. The inlet to the flowmeter must be higher than the outlet of the fluid. In this way you will have a calm flow into the flowmeter, resulting in a highly accurate measurement. The sizes of the containers must be proportional to the size of the flowmeter.

*Always use a free exit pipe to prevent backflow in the flow sensor and to keep the velocity at the maximum flow at least at 1 m/s.*

### 3.3.5 Open discharge

*Figure 3-7: Open discharge*

1. ≥ 5 DN
2. Make sure that the water level stays below the pipe outlet.
3.3.6 Cleaning of flow sensor

The flow sensor is highly resistant against dirt and the measurement will rarely be influenced by anything. However, it is advisable to create a possibility for cleaning just in front or behind the sensor.

![Figure 3-8: Option for cleaning of flow sensor](image)

- **Opening for cleaning**

3.3.7 Flange deviation

*Max. permissible deviation of pipe flange faces: $L_{\text{max}} - L_{\text{min}} \leq 0.5 \, \text{mm} / 0.02\"*

![Figure 3-9: Flange deviation](image)

- **$L_{\text{max}}$**
- **$L_{\text{min}}$**

3.3.8 Mounting position

*Only install the flow sensor in the shown position to keep the electrodes under water. Limit the rotation to $\pm 2^\circ$ to maintain the accuracy.*

![Figure 3-10: Mounting position](image)
3.4 Mounting

3.4.1 Torques and pressures

Tightening of bolts

- Always tighten the bolts uniformly and in diagonally opposite sequence.
- Do not exceed the maximum torque value.
- Step 1: Apply approx. 50% of max. torque given in table.
- Step 2: Apply approx. 80% of max. torque given in table.
- Step 3: Apply 100% of max. torque given in table.
3.4.2 Temperatures

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>min.</td>
<td>max.</td>
<td>min.</td>
<td>max.</td>
</tr>
<tr>
<td>All versions</td>
<td>0</td>
<td>60</td>
<td>-40</td>
<td>65</td>
</tr>
</tbody>
</table>
4.1 Safety instructions

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

Observe the national regulations for electrical installations!

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

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.

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

4.2 Important notes on electrical connection

Electrical connection is carried out in conformity with the VDE 0100 directive “Regulations for electrical power installations with line voltages up to 1000 V” or equivalent national regulations.

- Use suitable cable entries for the various electrical cables.
- The sensor and converter are configured together in the factory. For this reason, please connect the devices in pairs. Ensure that the sensor constant GK (see nameplates) are identically set.

For more information about the grounding of the flowmeter, refer to Grounding on page 22.
4.3 Cable lengths

*The maximum allowed distance between the flow sensor and the converter is determined by the shortest cable length.*

**Interface cable**: maximum length is 600 m / 1968 ft.

**Type B (BTS) signal cable**: maximum length is 600 m / 1968 ft.

**Type A (DS) signal cable**: maximum length depends on the conductivity of the fluid:

<table>
<thead>
<tr>
<th>Electrical conductivity [µS/cm]</th>
<th>Maximum length [m]</th>
<th>[ft]</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>120</td>
<td>394</td>
</tr>
<tr>
<td>100</td>
<td>200</td>
<td>656</td>
</tr>
<tr>
<td>200</td>
<td>400</td>
<td>1312</td>
</tr>
<tr>
<td>≥400</td>
<td>600</td>
<td>1968</td>
</tr>
</tbody>
</table>

**Field current cable**: The cross section of the cable determines the maximum length:

<table>
<thead>
<tr>
<th>Cross section [mm²]</th>
<th>Maximum length [AWG] [m] [ft]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x 0.75</td>
<td>2 x 18 150 492</td>
</tr>
<tr>
<td>2 x 1.5</td>
<td>2 x 16 300 984</td>
</tr>
<tr>
<td>2 x 2.5</td>
<td>2 x 14 600 1968</td>
</tr>
</tbody>
</table>
4.4 Grounding

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

4.4.1 Mounting grounding rings

In order to get a reliable height measurement it is absolutely necessary that the inner side of the connecting pipeline is electrically conductive and connected to ground. If not, tailor-made grounding rings with a cylindrical part can be delivered. Please contact your local agency in case of doubt.

Figure 4-1: Grounding with grounding rings

1. Existing pipeline
2. Grounding rings, custom made to inner diameter of pipeline
3. TIDALFLUX
4. Insert the cylindrical part of the grounding ring into the pipeline. Use an appropriate gasket between the grounding ring and the flange.

Sizes of the grounding rings are diameter dependent and available on request.

4.5 Connection diagrams

For the connection diagrams please refer to the documentation of the applicable signal converter.
KROHNE product overview

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

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.:+49 (0)203 301 0
Fax:+49 (0)203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com