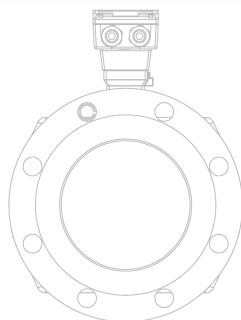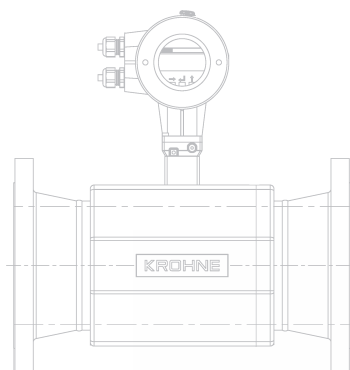# KROHNE

CMD

**Installation and
operating instructions**

# ALTOSONIC III

**3-beam ultrasonic flowmeters
for custody transfer
of liquid hydrocarbons
UFC III F/...EEx ultrasonic flow converter
UFS III F/...EEx ultrasonic flow sensor**

- Long term stability; high reliability
- Eliminates maintenance
- Non-intrusive
- No wear
- No pressure loss
- Bi-directional
- Compliant with OIML R-117, API

Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

**Ultrasonic flowmeters**

Mass flowmeters

Level measuring instruments

Communications technology

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

| General advice on safety | • Do not install, operate or maintain this flowmeter without reading, understanding and following the factory-supplied instructions, otherwise injury or damage may result. |
| | • Read these instructions carefully before starting installation and save them for future reference. |
| | • Observe all warnings and instructions marked on the product. |
| | • Use only mains supply with protective earthing connected. |
| | • Do not use the product with removed covers under wet conditions. |
| | • Consider handling and lifting instructions to avoid damage. |
| | • Install the product securely and stable. |
| | • Install and connect cabling proper to exclude damage or harmful situations. |
| | • If the product does not operate normally, refer to the service instructions or refer to qualified KROHNE service engineers. There are no operator-serviceable parts inside the product. |

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

**Attention:** Refer to operating and installation instructions!

**Danger:** Risk of electric shock!

**Protective Earth (PE)** conductor terminal!

These terms may appear in this manual or on the instrument:

**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 instrument. 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 its instrument, including, but not limited to direct, indirect, incidental, punitive and consequential damages. |
| | • This disclaimer does not apply in case KROHNE has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations. |
| | • Any instrument 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 ultrasonic flowmeter rests solely with the user. Improper installation and operation of the flowmeter (system) 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 flowmeters need to be returned to KROHNE, please note the information given on the last pages of the installation and operating instructions. KROHNE regrets that they cannot repair or check flowmeter(s) unless accompanied by the completed form (see last pages of the installation and operating instructions). |

| Items included with order | • ALTOSONIC III ultrasonic flowmeter, consisting of a flow sensor (UFS III) and a flow converter (UFC III) either built together as a compact system or supplied as two separate pieces, in the size as indicated on the packaging box. |
| | • Signal cable (only in case of a separate system). |
| | • Special tool for opening the converter housing. |

**Documentation supplied**
- Handbook; manual and installation and operation instructions
- Approval documents and certificates
- Report of factory settings of the flow converter
- Certificate of flowmeter calibration data

This instrument is developed and manufactured by:
KROHNE Altometer
Kerkeplaat 12
3313 LC Dordrecht
The Netherlands

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 and regulations as well as the electrical data described in the EC type examination certificate must be obeyed.
- Beside the instructions for electrical installations in non-hazardous locations according to the applicable national standard (equivalent of HD 384 or IEC 364, e.g. VDE 0100), especially the regulations in EN 60079-14 "Electrical installations in hazardous locations" or equivalent national standard (e.g. DIN VDE 0165 Part 1) must be strictly followed.
- Installation, establishment, utilization and maintenance are only allowed to be executed by personnel with an education in explosion safety!

**WARNING!**
When removing the front or rear cover of the converter any sealing will be broken.

## Table of contents

# 1. Introduction

## 1.1 Cautions

**For flowmeters supplied with a voltage over 50 V AC:**
- Refer all maintenance or service to trained KROHNE service engineers.
- Mains power shall be disconnected from the product before performing any maintenance.
- This product is prepared for and can only function with the rated AC mains or DC supply voltage as indicated on the type plate.

**For 100 – 240 V AC supplied flowmeters:**
- This product is a Class 1 device (earthed) and requires a correct connection to protective earth. The protective earth conductor of the main power shall be properly connected to the marked protective earth terminal to ensure safety from electric shock for the operator and its environment.

## 1.2 Unpacking and inspection

- The product has been thoroughly inspected and tested before shipment and is ready for operation.
- After carefully unpacking, inspect for shipping damage before attempting to operate. If any indication of mechanical damage is found, immediately contact the responsible transport service and your local KROHNE representative.
- A simple operating check of the electronics after unpacking and before permanent installation is advisable to ascertain whether it has suffered damage during shipment.
- Confirm for the correct mains voltage printed on the type plate. If it differs from the ordered product please contact your local KROHNE representative.
- After connecting to the mains, check if there is any indication on the display and if the backlight of the display is lighted. If not, contact your local KROHNE representative.

## 1.3 System description

The ALTOSONIC III ultrasonic flowmeter is a precision instrument designed for linear, bi-directional flow measurement of liquids. Flow measurement values can be outputted via the standard analog and-or pulse/frequency outputs. Via a user friendly operator interface (HMI) the flow can be read. Next to actual volumetric flow measurement the converter can be configured to perform measurement and output of the liquid sonic velocity and acoustic signal attenuation.

## 1.4 Approvals

**CE Approvals**
EMC, Electromagnetic Compatibility Directive
EMC directive 89/336/EEC.

**Low Voltage Directive**
73/23/EEC and is designed in accordance with EN IEC 61010-1 first and second edition.

**Pressure Equipment Directive 97/23/EC / Module H**
The KROHNE organization complies with the requirements of Module H of the Pressure Equipment Directive 97/23/EC (full quality assurance).

**ATEX directive ATEX Directive 94/9/EC**
Both the flow sensor and the flow converter are in compliance with the European Directive 94/9 EG (i.e. ATEX 100A).

# 2. Mechanical Installation

## 2.1 Handling the flowmeter

Important: Do not lift the flowmeter by the signal converter housing or the terminal box. Check the weight of the flowmeter as indicated on the type plate before handling the unit. When handling the flowmeter avoid hard blows, jolts or impacts.
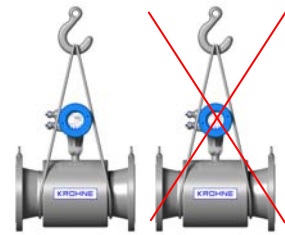
Do not place the flowmeter on the signal converter housing.

## 2.2 Installation location and position

As the ALTOSONIC III is used in hydrocarbon pipelines, be aware of potentially explosive atmospheres. Local standards and regulations must be respected.

The flow sensor must be completely filled at all times for proper flow measurement. Non-wetted sensors show loss of signal. There is no damage when this occurs.
The sensor must be installed in a horizontal or vertical position. A correct position of the unit guarantees a completely filled flow sensor and accurate flow measurement.
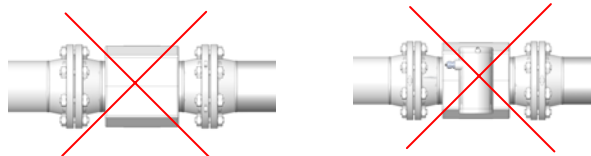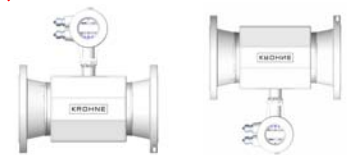
### Inlet and outlet sections
For functioning within stated accuracy the flow sensor has to be installed with specified inlet flow conditioner and outlet sections. The flow conditioner is delivered as a part of the flowmeter as the flow sensor and flow conditioner are calibrated together for optimal performance.

Inlet configurations (upstream): Straight inlet section, length 10 D with ISO tube bundle flow conditioner.
Outlet configuration (downstream): Straight outlet section, length 5 D.

D = nominal diameter of the flow sensor.

It is advised to keep length of 5 D straight pipe section upstream between flow conditioner and upstream disturbances.
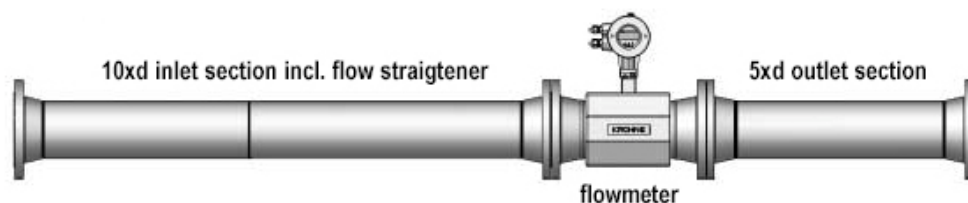


### Bush guides
Every ALTOSONIC III is calibrated in combination with a dedicated inlet flow conditioner. To minimize the installation effects on the performance of the ALTOSONIC III a provision is made to assure that the flow conditioner versus the ALTOSONIC III have the same position at operation as during the initial calibration.

During the mechanical installation of the ALTOSONIC III and the flow conditioner it is absolutely required that both parts are aligned with high accuracy.

"Bush Guides" are permanently welded in one of the top bolt holes of the inlet flange of the ALTOSONIC III and the outlet flange of the flow conditioner. The position of these "Bush Guides" is marked on the flange with "BG". This provision is integrated to assure the position and to align the ALTOSONIC III in combination with the flow conditioner as accurate as possible. If the ALTOSONIC III is used bi-directionally the outlet flange is provided with a "Bush Guide" as well.
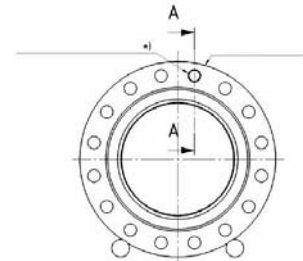
Seen upstream, only the right top hole is fitted with a bush guide. When the flowmeter is bidirectional, both flanges of the flowmeter are fitted with a bush guide, which are placed collinear.

Mark the location of the bush guide in both flanges
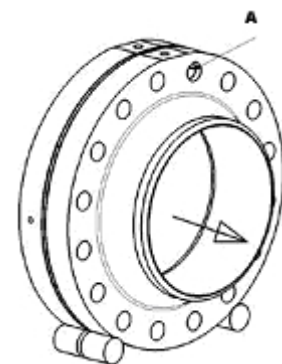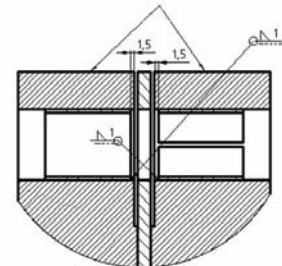
### Flow direction
Please note to the forward direction of the flow sensor indicated by the direction arrow on the body. If the flow has this direction the output indication will be positive.

### Bolts and nuts
Use the specified bolts and nuts and gaskets, according to the ordered flange type and pressure rating and mount according the general or local requirement.

### Vibration
Do not expose the sensor unit to intensive vibrations. Support of the flow sensor is only allowed at the in- and outlet sections near the flowmeter.

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### Gas inclusion

To avoid measuring errors due to gas inclusion, adequate measures have to be taken. Gas inclusion should be limited to the lowest possible value and shall be < 1 vol. % according to OIML R117 for accurate measuring.

### Particle inclusion

To avoid measuring errors due to particle inclusion, adequate measures have to be taken. Particle inclusion should be limited to the lowest possible value and shall be < 5 % for accurate measurement.

### Cavitation

In order to prevent cavitation in the following formula should be applied to calculate the minimum required back pressure:

$$Pb \geq 2.65 \; 10E\text{-}5 \; \rho L^* \; vL^2 + 1.25 \; Pv$$

| Pb | Back pressure | [bar] |
|----|---------------|-------|
| ρL | Liquid density | [kg/m3] |
| vL | Liquid velocity | [m/s] |
| Pv | Vapour pressure | [bar] (at operational temperature) |

**2.3 Accessibility and environmental precautions**

If required the position of the signal converter can be modified by turning the display through 90° or 180°.

In case of direct sunlight, we recommend installation of a sunshield to prolong the life of the meter. No direct damage will occur without a sunshield. Do not expose the signal converter to excessive vibration. For this, support the pipeline on either side of the flowmeter.

Ambient temperature: -40°C to +70°C/ -40°F to +158°F
Product temperature:  -25°C to +180°C/ -13°F to +356°F
Storage temperature: -40°C to +80°C/ -40°F to +176°F

Keep a minimum distance between pipe centerline and adjacent wall of at least 0.5 m (1.6 ft).

**2.4 Special installation requirements**

To avoid measuring errors and malfunctioning of the flowmeter due to gas or air inclusions or an empty pipe, please observe the following precautions: Since gas will collect at the highest point of a pipe, installation of the flowmeter at that location should be avoided at all times. Also installation in a down going pipe should be avoided since a completely filled pipe may not be guaranteed due to cascading affects. Additionally flow profile distortion is possible.

### Long horizontal pipes

Install in slightly ascending pipe section. If not possible, ensure adequate velocity to prevent air, gas or vapor from collecting in upper part of flow tube As a partially filled meter will report higher than actual flow rates, or not measure (as transducer pairs become non-wetted).



### Mixing different fluid products

Install the flowmeter upstream of mixing point or at minimum distance of 30 D (D = flowmeter diameter) downstream of the mixing point, otherwise the flow measurement may be unstable.

## 2.5 Pipe flanges

Refer to dimensional drawings for flange spacing and in addition allow for thickness of gaskets. Install flowmeter in line with pipe axis. Pipe flange faces must be parallel to each other, max.
Permissible deviation: Lmax - Lmin ≤ 0.5 mm (0.02").
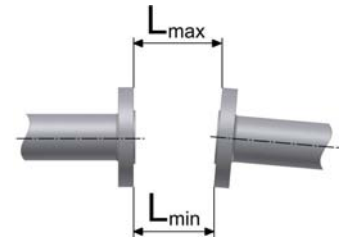
## 2.6 Pipes with cathodic protection

Pipes with electric corrosion protection are generally insulated inside and outside so that the fluid has no conductive connection to ground. The flowmeter must be insulated from the pipe. Note the following when installing the flowmeter:

The pipe flanges must be connected to each other using a copper cable (L), but must not be connected to the flowmeter. The bolts for the flange connections and the gaskets must be insulated. Use sleeves and washers that are made of insulating material (these must be provided by customer).

Follow grounding instructions.
Use ≥ 4 mm² (≥ AWG 11 cable).
Note: No earthing cables are supplied by KROHNE.

1. Flange of flow sensor
2. Pipe flange
3. Gasket
4. Bolt
5. Nut
6. Washer
7. Insulating sleeve
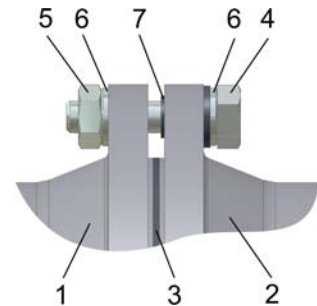
# 3. Connecting the signal converter

## 3.1 Safety instructions

This product is designed for use in accordance with EN IEC 61010-1 for Installation Category 2 and Pollution Degree 2. Hazardous voltages are present within this product during normal operation.

The product is designed for Protection Class I and should never be operated without protective earthing.

The product shall also never be operated with covers removed unless equivalent protection of the operator and its environment from accidental contact with hazardous internal voltages is provided. Always follow basic and local safety precautions when using this product to reduce risk of injury from electrical shock, spread of fire or other dangerous situations.

## 3.2 Installation in hazardous areas

All ultrasonic flowmeters of the ALTOSONIC III series must always be incorporated within the equipotential bonding system of the hazardous area. For this purpose it is provided with an external PE-terminal. The external PE-terminal is located on the connecting flange at the bottom of the flow converter housing and on top of the support of the flow sensor, just below the junction box.

A separate bonding conductor must be at least 4 mm$^2$ (11 AWG) or 2,5 mm$^2$ (14 AWG) in case it is mechanical protected, see Clause 413 of HD 384.4.41 or IEC 364-4-41. Make sure that the core of the bonding wire is properly mounted under the U-clamp of the PE-terminal and that the screw is tightly fixed.

## 3.3 Converter terminal box

- The converter terminal box is accessible after removing the rear (blind) cover of the electronics section using the special wrench supplied with the flowmeter.
- Do not damage the screw thread and the gasket, never allow dirt to accumulate, and make sure that the screw thread is well greased, using Teflon grease at all times. A damaged gasket must be replaced immediately!
- Do not cross or loop the cables in the terminal box of the signal converter. Use separate cable entries for power supply and signal cables.
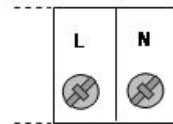
## 3.4 Power supply connection

### Environmental conditions

The ALTOSONIC III is designed to operate safely under the following conditions:

- Suitable for indoor and outdoor use, the instrument is usable up to protection category IP 67 (IEC 60529).
- Use up to an altitude of 2000 m above sees.
- Suitable for an operation ambient temperature range: - 40°C to +70°C / - 40°F to +158°F.
- Suitable for an storage temperature range: -40°C to + 80°C / -40°F to + 176°F.
- Suitable for use in atmospheres with a relative humidity up to 80%.
- Mains supply voltage fluctuations up to -15 and +10% of the specified voltage range.
- Over voltages up to category II on the main supply voltage (IEC 60364-4-443).
- Connected to protective earth conductor (Protection Class I).
- Rated pollution degree 2.
- This instrument is intended for permanent connection to the mains. It is required (for example for service) to mount an external switch or circuit breaker near the product for disconnection from the mains. It must be easily reachable by the operator and marked as the disconnecting device for this product. The switch or circuit breaker has to be suitable for the application and shall also be in accordance with to local (safety) requirements and of the building installation (IEC 60947-1/-3).
- The protective conductor clamp terminal size M5, press-fitted in the terminal compartment (near the main connection terminals), shall always to be connected to the protective earth conductor of the mains supply. Conductors up to 4 mm² (11 AWG) be connected to this terminal. The diameter of the conductors of the mains supply, including the protective earth conductor shall be in accordance with the general and local requirements.
- It is not allowed to use the protective conductor terminal for any other connection than the protective earth conductor.
- IP 67 is only warranted when using suitable cabling with the cable glands and covers mounted as specified.

100-240 V AC supply:
The mains voltage
power supply terminal
has two connections

| L | N |

L           Live power supply                    Mains voltage AC supply: 100…240 V AC +10%/-15%,
                                                  48 - 63 Hz, 11 W

N           Neutral power supply

            PE: Protective ground connection      Protective conductor clamp terminal. Conductors up to 4
            FE: Functional ground connection      mm² (11 AWG) need to be connected to this terminal.

24 V AC/DC supply:
The low voltage
AC/DC power supply
terminal has two
connections

| L⁓ | L⁓ |
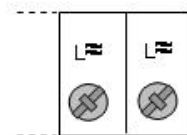
L           Live power supply                    SELV AC/DC supply:
                                                  24 V AC +10%/-15%, 48 - 63 Hz, 8 W of
                                                  24 V DC +33%/-25%, 8 W

L           Neutral power supply

            FE: Functional ground connection

**3.5  Connection of sensor cables**

The sensors of the separate flowmeter must be connected using the factory supplied MR06 cable between the flow sensor terminal box and the converter housing terminal box. For compact flowmeters these are connected at the factory.
Both the flow sensor terminals and the converter sensor terminals should be connected between the appropriate numbers indicated on the sensor cable and in the terminal boxes

Cable diameter: 11 mm (0,433 inch), minimum bending radius: 8 x cable diameter.

| 3.2 | 3.1 |
| 2.2 | 2.1 |
| 1.2 | 1.1 |
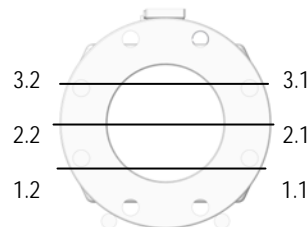
## 3.6 Electrical connection of the signal inputs and outputs

The terminal to connect the electrical signal inputs and outputs consist of 6 connections. For wiring of the signal inputs and outputs it is advised to use unshielded twisted pairs.
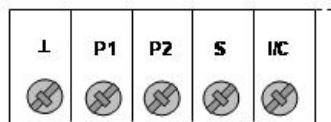


| Terminal | Function | Specification |
|---|---|---|
| $\perp$ | Common ground | - |
| P1 | Pulse output 1, passive open collector output. Pulse output to flow computer for volume counting. Function can be set via menu option. | $I_{max}$: 150 mA $U_{max}$: 32V DC, 24V AC Max frequency: 1,5 kHz |
| P2 | Pulse output 2, passive open collector output. 90° or 180° phase shifted from P1. For pulse fidelity checking P1 and P2 should be connected to 2 separate inputs of a flow computer. Function can be set via menu option. | $I_{max}$: 150 mA $U_{max}$: 32V DC, 24V AC Max frequency: 1,5 kHz |
| S | Status output. Function can be set via menu option 3.5.0. | $I_{max}$: 150 mA $U_{max}$: 32V DC, 24V AC |
| I/C | Current output (I), 0(4) to 20 mA Passive open collector current sink output. Digital input (C) Function can be set via menu option 3.4.0. and 3.6.0. | Current output (I): $I \leq 22$ mA, $R_{load} \leq 680$ Ohm. $U_{max} = 15$V DC. Digital input (C): low = 0-5 V DC, high = 15-32 V DC. Will be switched off when current output activated. |

The electrical input and output signals can be connected in passive mode. Please observe instrument polarity: current (I) is always flowing towards P1, P2, S, I/C, terminals (current sink).

## 3.7 Connection diagram examples

**Pulse output, P1, P2**
For supply:
U ≤ 32V DC, ≤ 24V AC
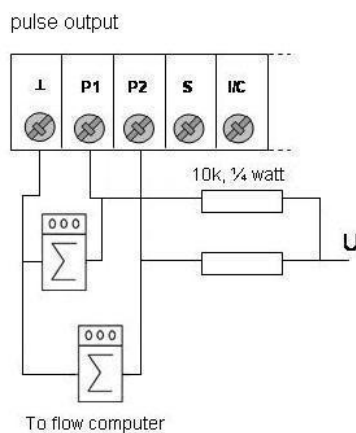


**Status output, S**
For supply:
U ≤ 32V DC, ≤ 24V AC
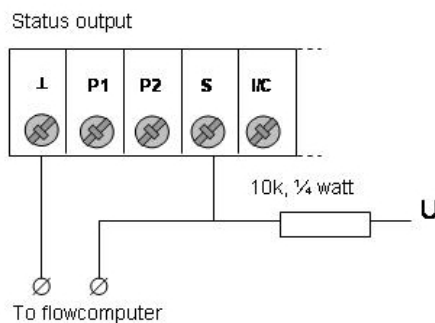
**Current output / control input, I/C**

For supply:
U = 15…24V
DC, ≥ 22mA

Current output
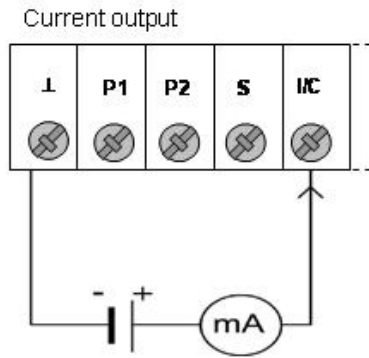


For supply:
15 – 30V DC, I ≥
1,5 mA

Control input
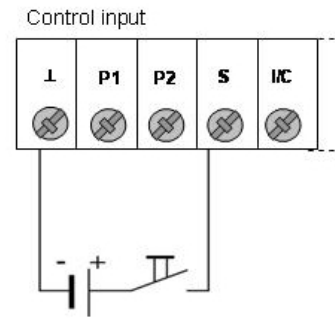


**Connection to Omni 3000/6000 flow computer**

Single flow pulse connection
Omni 6000,
Omni 3000
A/B type combo module
Channel 3 or 4 on A type
Channel 3 only on B type
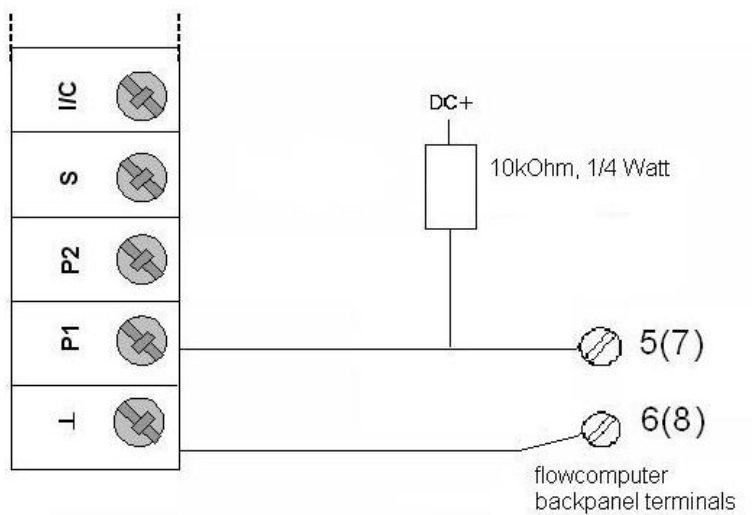


Dual pulse connection
for pulse fidelity checking
Omni 6000,
Omni 3000
E type combo module



　　　　　　ALTOSONIC III　　　　　　**KROHNE**
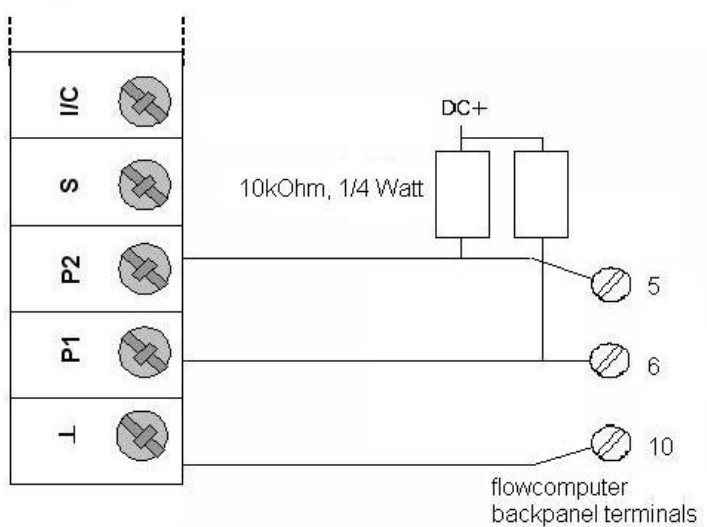
Flowmeter status
connection
Omni 6000,
Omni 3000
Digital I/O
module
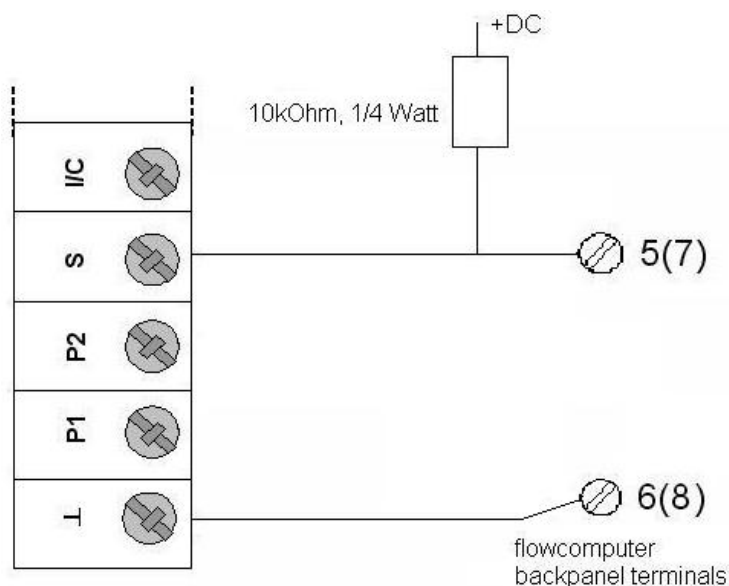


## 3.8 Start-up

- Check that the flowmeter has been correctly installed. With separate systems, check before initial start-up that the correct converter (UFC III F) is used with the correct flow sensor (UFS III F).
- Order No., see instrument type plates
- Meter size, Function 3.1.5
- Primary constant GK, Function 3.1.6
- Flow direction, Function 3.1.7
- When powered, the signal converter operates in the measuring mode. TEST, NO ERROR and IDENT NO. _ _ _ _ _ _ _ of the signal converter appear in succession on the display. This is followed by display of the actual flow rate and/or the internal count on a continuous or alternating basis (depending on setting, see Function 3.03 Display or Function 1.02 Display).

## 3.9 Operating the signal converter

**Front panel and operating keys**
The front panel and its operating keys are accessible after removing the front (glass) cover of the electronics section using the special wrench supplied with the flowmeter.



When removing the cover, do not damage the screw thread and the gasket, never allow dirt to accumulate, and make sure that they are well greased using Teflon grease at all times. A damaged gasket must be replaced immediately!



1. Display 1st (top) line, measured value
2. Display 2nd (middle) line, units of measured value
3. Display 3rd (bottom) line with markers ▼
   to identify actual displayed value, from left to right:
   Flow rate
   Velocity Of Sound VOS
4. Compass field for error indication
5. Operating keys for programming the signal converter
6. Magnetic sensors to program the signal converter by means of a hand-held bar magnet (optional) without having to open the housing. To prevent change of settings with the cover in place sensors are only fitted for the 2 right most keys.
The function of the sensors is as follows: the right most sensor is equivalent to the right key and the top sensor is equivalent to the center key.

The converter can display several types of measured values (depending on the programming), indicated by the markers at the display bottom line. They can be selected manually at any time by pressing the ↑ key or they are automatically cycled at 5 second intervals.
Errors are indicated by flashing display lines and/or by the compass field. For a description of the errors and what to do, see main "error" menu.

**3.10 Menu structure and function of operating keys**

The menu structure consists of shows the available functions for system check and configuration. Function block 0 can be accessed with the display cover in place. For access to function block 1 to 4 the display cover has to be removed as it requires the leftmost key for operation.

- **Function block 0 Function** is accessible without removing display cover. System info and error reset, can be accessed from the measuring mode and provides detailed information on errors occurred during operation. It allows for fast and easy resetting of the errors. System information like software version numbers can be displayed using this function. Also a display test can be performed using this function.
- **Function block 1 Operation** contains a subset of options from function block 3, Installation. The options in function block 1 are selected so that the most commonly used functions can be selected quickly from this menu. In most cases only function block 1 needs to be accessed in order to perform the required setting or programming task.
- **Function block 2 Test** contains all available test functions. This block can be accessed to check proper functioning off all converter hard- and software.
- **Function block 3 Installation** contains all other set-up parameters for the converter. In general the converter is factory-preset. See Service Handbook for modification instructions.
- **Function block 4 Parameter Error** becomes active automatically when non-plausible values have been programmed, e.g. a too high a flow rate in too small a diameter. If this is the case menu 4 will indicate that either FULL SCALE or METER SIZE needs to be changed.

The figure below shows the main operation structure of the converter. The cursor or flashing part of the display is shown as underlined text.
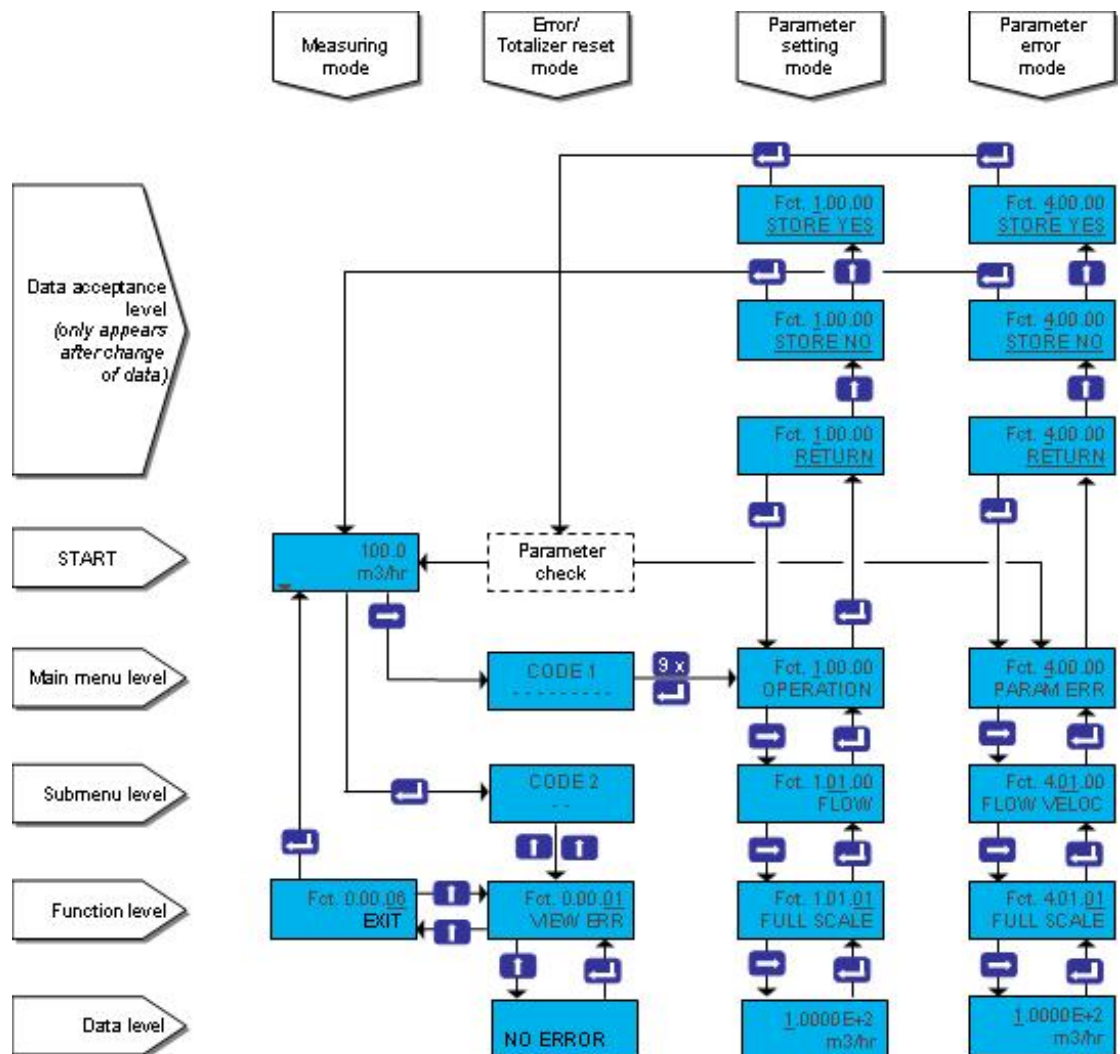
| Key | Measuring mode | Menu mode | Data level |
|---|---|---|---|
| → | Go to the parameter setting mode, function 1.00.00 OPERATION. If access CODE 1 is activated, CODE 1 must be entered first. Using function 3.07.02 access CODE 1 can be activated or deactivated. | Go to the next, lower menu level. | Go to the next character or change line (only when 2 lines are displayed) |
| ↵ | Go to the error/Totalizer reset mode (via "CODE 2") | Return to the previous (higher) menu level or leave the menu mode. | Accept entered value |
| ↑ | Cycle through measured values, see Function 3.03.07 CYCL DISP | Cycle through menu options within actual menu level. | Cycle active digit up to new values |

| Function | Text | Description and settings |
|---|---|---|
| **0.00.00** | **ERROR/TOT** | **Main menu 0.00.00** |
| 0.00.01 | VIEW ERR | View error messages list |
| 0.00.02 | RST ERR | Reset error messages |
| 0.00.03 | UP2 SW NO | Software version micro processor 2 |
| 0.00.04 | DSP SW NO | Software version digital signal processor |
| 0.00.05 | DISPLAY | Display test, all display items on |
| 0.00.06 | EXIT | Leave menu 0.00 |
| **1.00.00** | **OPERATION** | **Main menu 1.00.00 Operation** |
| 1.01.00 | FLOW | Submenu 1.01.00 Flow |
| 1.01.01 | FULL SCALE | Full-scale value for 100% volume flow rate, see Function 3.01.01 |
| 1.01.02 | ZERO VALUE | Zero value, see Function 3.01.02 |
| 1.01.03 | ZERO CAL | Zero calibration, see Function 3.01.03 |
| 1.01.04 | MASTER TC | Master time constant, see Function 3.01.04 |
| 1.01.05 | LF CUTOFF | Low-flow cut-off, see Function 3.01.05 |
| 1.01.06 | CUTOFF ON | Cut-off active, see Function 3.01.06 |
| 1.01.07 | CUTOFF OFF | Cut-off de-active, see Function 3.01.07 |
| 1.02.00 | DISPLAY | Submenu 1.02.00 Display |
| 1.02.01 | DISP FLOW | Display of flow, see Function 3.03.01 |
| 1.03.00 | PULSE OUTP | Submenu 1.03.00 Pulse output |
| 1.03.01 | PULSE RATE | Pulse frequency value for 100% scale, see Function 3.05.08 |
| 1.03.02 | PULSE/UNIT | Pulse value per volume flow unit, see Function 3.05.09 |
| **2.00.00** | **TEST** | **Main menu 2.00.00 Test functions** |
| 2.01.00 | DISPLAY | Submenu 2.01.00 Display |
| 2.01.01 | DISPLAY | Test display, lights all pixels. End with ↵ key |
| 2.02.00 | OUTPUTS | Submenu 2.02.00 Outputs |
| 2.02.01 | CURRENT | Test current output<br>0 mA     4 mA<br>12 mA    20 mA<br>22 mA<br>Use up arrow to advance. Displayed value directly present at current output. Actual value present at output after pressing ↵ key. |
| 2.02.02 | PULSE | Test pulse/frequency output<br>1 Hz    10 Hz<br>100 Hz    1000 Hz<br>2000 Hz<br>Use the up arrow to advance. Displayed value directly present at Pulse output. Actual value present at output after pressing ↵ key |
| 2.03.00 | INPUTS | Submenu 2.03.00 Inputs |
| 2.03.03 | DIG INPUT | Test digital input<br>Measure level at digital input. End with ↵ key. |
| 2.04.00 | DEV INFO | Submenu 2.04.00 Device information |
| 2.04.01 | MANUFACT | Display manufacturer |
| 2.04.02 | MODEL NO | Display model number |
| 2.04.03 | SERIAL NO | Display serial number |
| 2.04.04 | UP2 HW NO | Display µP2 hardware number |
| 2.04.05 | UP2 SW NO | Display µP2 software number |
| 2.04.06 | FRNT HW NO | Display front end hardware number |
| 2.04.07 | DSP HW NO | Display D.S.P. hardware number |
| 2.04.08 | DSP SW NO | Display D.S.P. software number |
| 2.04.09 | TIME COUNT | Display time counter |
| **3.00.00** | **INSTALL** | **Main menu 3.00.00 Installation** |
| 3.01.00 | FLOW | Submenu 3.01.00 Volume flow parameters |

| 3.01.01 | FULL SCALE | Full-scale value for 100% volume and flow rate units (see Function 1.01.01). The selection of units may be limited to SI units only. m³/s, m³/min, m³/hr, L/s, L/min, L/hr, US Gal/s, US Gal/min, US Gal/hr, bbls/hr, bbls/day, ********** (free user configurable unit). |
|---|---|---|
| 3.01.02 | ZERO VALUE | Zero value (see Function 1.01.02) FIXED (factory zero setting) MEASURED (zero calibration possible, see Function 3.01.03) |
| 3.01.03 | ZERO CAL | Zero calibration (see Function 1.01.03) Carry out only at "zero" flow and with completely filled measuring tube. Duration approximately 15s with display indicating "BUSY". STORE NO (preserve old zero value) STORE YES (store new zero value) |
| 3.01.04 | MASTER TC | Master time constant of display and current output (see Function 1.01.04) Range: 0.02 through 99.99 s |
| 3.01.05 | LF CUTOFF | Low-flow cut-off for display and outputs (see 1.01.05) NO (fixed tripping points: ON = 0.1%, OFF = 0.2%) YES (see Function 3.01.06 and 3.01.07) |
| 3.01.06 | CUTOFF ON | Cut off "active" value Range: 1 through 19% of Q100% |
| 3.01.07 | CUTOFF OFF | Cut off "de-active" value Range: 2 through 20% of Q100% Value "off" must be greater than value "on" |
| 3.01.08 | METER SIZE | Meter size Selection of size from meter size table: 25-3000 mm equivalent to 1-120 inch |
| 3.01.09 | GK VALUE | Flow sensor constant (GK) Must equal flow sensor type plate value Range: 0.02 through 20 |
| 3.01.10 | FLOW DIR | Definition of forward flow direction POSITIVE NEGATIVE Setting in accordance with direction of arrow on flow sensor |
| 3.01.11 | MIN VOS | Minimum velocity of sound (VOS) Value used for I0% or P0% when function "VOS" selected in Function 3.04.01 or 3.05.01 Unit: m/s or feet/s Range: 0 through 4999 m/s (0 through 15000 feet/s) |
| 3.01.12 | MAX VOS | Maximum velocity of sound Value used for I100% or P100% when function "VOS" selected in Function 3.04.01 or 3.05.01 Unit: m/s  or feet/s Range:1 through 4999 m/s (0 through 15000 feet/s) Maximum value must be greater than minimum value |
| 3.02.00 | VERSION | Submenu 3.02.00 Version |
| 3.02.01 | FUNCTION | Function of converter CUSTODY. This is factory set and can not be changed. |
| 3.03.00 | DISPLAY | Submenu 3.03.00 Display (see Function 1.02.01) |
| 3.03.01 | DISP FLOW | Display of flow RATE (full-scale units) Percent (percentage of full-scale, 0% - 100%) NO DISPLAY (no flow display) |
| 3.03.06 | VOS | Unit for Velocity Of Sound NO DISPLAY, m/s, feet/s |
| 3.03.07 | CYCL DISP | Cyclic display of measured values NO, YES |
| 3.03.08 | ERROR MSG | Display error messages NO, YES |
| 3.03.11 | SIGN LEVEL | Display signal level NO, YES |
| 3.04.00 | CURR OUTP | Submenu 3.04.00 Current output |
| 3.04.01 | FUNCTION | Function of current output OFF (switched off) ACT FLOW (actual flow) F/R IND (forward/reverse indication of actual flow) VOS (velocity of sound, range is defined in Function 3.01.11 and 3.01.12) GAIN (sensor signal gain, range is 0 dBV through 100 dBV) |
| 3.04.02 | DIRECTION | Direction of current output FORWARD (forward flow measurement) |

| | | |
|---|---|---|
| | | BOTH (forward and reverse flow measurement indicating both in the same range) |
| | | F/R SPEC (forward and reverse flow measurement indicated in different range see Function 3.04.04) |
| 3.04.03 | RANGE | Range of current output<br>OTHER (user defined, see Function 3.04.04 through 3.04.06)<br>0-20/22 mA (0 pct - 100 pct / limit)<br>4-20/22 mA(0 pct - 100 pct / limit) |
| 3.04.04 | 0 pct | Current value for 0% scale<br>Range: 0 through 16 mA |
| 3.04.05 | 100 pct | Current value for 100% scale<br>Range: 4 through 20 mA<br>Value must be at least 4 mA greater than current value for 0% scale |
| 3.04.06 | LIMIT | Limitation of current value<br>Range: 20 through 22 mA |
| 3.05.00 | PULSE OUTP | Submenu 3.05.00 Pulse output |
| 3.05.01 | FUNCTION | Function of pulse output<br>OFF (switched off)<br>ACT FLOW (actual flow)<br>VOS (velocity of sound, range defined in Function 3.01.11 and 3.01.12)<br>GAIN (sensor signal gain, range is 0 dBV through 100 dBV) |
| 3.05.02 | DIRECTION | Direction of pulse output<br>FORWARD (forward flow measurement)<br>BOTH (forward and reverse flow measurement indicating both in the same range) |
| 3.05.06 | TIME CONST | Time constant of pulse output<br>25 ms<br>MASTER TC (see Function 3.01.04) |
| 3.05.07 | OUTPUT | Unit of pulse output (see Function 1.03.00)<br>PULSE FREQUENCY, pulses per unit time, see Function 3.05.08)<br>PULSE/UNIT, Totalizer pulse output, pulses per unit volume, see Function 3.05.09 |
| 3.05.08 | PULSE RATE | Pulse rate (frequency) value for 100 % scale<br>pulse/s, pulse/hr, pulse/min<br>Range: 1 pulse/hr through 2000 pulse/s |
| 3.05.09 | PULSE/UNIT | Pulse value per volume unit for totalization<br>pulse/m³, pulse/l, pulse/US Gal, pulse/bbl,<br>free user definable unit |
| 3.06.00 | DIG INPUT | Submenu 3.06.00 Digital input |
| 3.06.01 | FUNCTION | Function of digital input<br>OFF (switched off)<br>RST ERROR (reset error messages) |
| 3.07.00 | USER DATA | Submenu 3.07.00 User data |
| 3.07.01 | LANGUAGE | Language for display texts<br>GB/USA (English)<br>D (German)<br>F (French) |
| 3.07.02 | ENTRY CODE | Entry code for setting mode<br>NO (entry with  key only)<br>YES (entry with key and code 1, factory set on 9 x key,  see Function 3.07.03) |
| 3.07.03 | CODE 1 | Code 1<br>Press any 9-keystroke combination and then press the same combination again. Each keystroke is acknowledged by "Ж" in the display. If both combinations are equal, "CODE OK" appears and the new code can be stored, else "WRONG CODE" appears and the desired code has to be entered again. |
| 3.07.04 | LOCATION | Tag name setting<br>Free settable tag for identification, maximum 10 characters.<br>Characters assignable to each place: A..Z / blank character / 0..9<br>Factory setting: KROHNE |
| 3.07.05 | UNIT TEXT | Text for user-defined unit<br>Definition: volume/time<br>Characters assignable to each place: A..Z / blank character / 0..9<br>Fraction bar "/" in 5th place is unalterable<br>Factory setting: XXXX/YYY |
| 3.07.06 | UNIT VOL | User-defined unit volume<br>Quantity of user-defined volume per m³.<br>Range: 10-5 through 107<br>Factory setting: 1 |
| 3.07.07 | UNIT TIME | User-defined unit time<br>Amount of user-defined time in seconds<br>Range: 10-5 through 107<br>Factory setting: 1 |

| 3.10.01 | DIG OUTPUT | Function of digital status output<br>CUST ERR (Only errors related to custody transfer operation, also see error list)<br>ALL ERR (indication of all errors)<br>F/R IND (forward/reverse flow indication)<br>OVERRANGE (overrange indication)<br>TRIP POINT (trips when actual flow (Q) goes over a set limit, see 3.10.02 and 3.10.03 for settings) |
|---------|------------|------------|
| 3.10.02 | TRIP PNT 1 | First trip point<br>Range: 0 through 120% of Q100% |
| 3.10.03 | TRIP PNT 2 | Second trip point<br>Range: 0 through 120 % of Q100% |
| **4.00.00** | **PARAM ERR** | **Main menu 4.00.00 Parameter error** |
| 4.01.00 | FLOW VELOC | Volume flow velocity (v) value incorrect. The flow speed is calculated from the full scale volume flow and the meter size.<br>Ensure condition 0.5 m/s $\leq$ v $\leq$ 20 m/s (1,5 to 66 feet/s) is met! |
| 4.01.01 | FULL SCALE | Full-scale value for 100% volume flow rate, see Function 3.01.01 |
| 4.01.02 | METER SIZE | Meter size, see Function 3.01.08 |
| 4.02.00 | CURR OUTP | Current output range incorrect. Setting for 100% is compared with setting for 0%. Ensure condition 100 pct-0 pct $\geq$ 4 mA is met! |
| 4.02.01 | RANGE | Range of current output, see Function 3.04.03 |
| 4.02.02 | 0 pct | Current value for 0% scale, see Function 3.04.04 |
| 4.02.03 | 100 pct | Current value for 100% scale, see Function 3.04.05 |
| 4.03.00 | LF CUTOFF | Low-flow cut-off range incorrect: If low flow cut-off is set to on, the value for CUTOFF-OFF is compared with the value of CUTOFF-ON on.<br>Ensure condition CUTOFF-OFF – CUTOFF-ON $\geq$ 1% is met! |
| 4.03.01 | LF CUTOFF | Low-flow cut-off, see Function 3.01.05 |
| 4.03.02 | CUTOFF ON | Cut off "on" value, see Function 3.01.06 |
| 4.03.03 | CUTOFF OFF | Cut off "off" value, see Function 3.01.07 |
| 4.05.00 | PULSE/VOS | Unit of pulse output for velocity of sound function incorrect<br>Ensure "PULSE RATE" is selected for "VOS"! |
| 4.05.01 | PULS FUNCT | Function of pulse output, see Function 3.05.01 |
| 4.05.02 | PULSE OUTP | Unit of pulse output, see Function 3.05.07 |
| 4.06.00 | VOS | Velocity of sound range incorrect:<br>Ensure condition MAX VOS - MIN VOS $\geq$ 1 m/s (3.3 ft/sec) is met |
| 4.06.01 | MIN VOS | Minimum velocity of sound, see Function 3.01.11 |
| 4.06.02 | MAX VOS | Maximum velocity of sound, see Function 3.01.12 |
| 4.07.00 | PULSE OUTP | Pulse output frequency value (f) incorrect. The max frequency is calculated from the pulse/unit setting and the max value of the measured value.<br>Ensure condition 1 pulse/hr $\leq$ f $\leq$ 2000 pulse/s is met. |
| 4.07.01 | PULSE/UNIT | Pulse value for volume flow rate unit, see Function 3.05.09 |
| 4.08.00 | PULS WIDTH | Pulse output pulse width incorrect<br>Ensure condition pulse width $\leq$ 0.5 x pulse period time is met. |
| 4.08.01 | PULS WIDTH | Pulse width for frequencies $\leq$ 10 Hz, see Function 3.05.11 |
| 4.09.01 | CURR RANGE | Range of current output, see Function 3.04.03 |
| 4.09.02 | CURR 0 pct | Current value for 0% scale, see Function 3.04.04 |
| 4.10.00 | INP/OUTP | The digital input (C) and current output (I) are not allowed to be switched on simultaneously. The current output is deactivated by setting the function of current output to off en setting the range of current output to 0-20mA. |
| 4.10.01 | INP FUNCT | Function of digital input, see Function 3.06.01 |
| 4.10.02 | CURR FUNCT | Function of current output, see Function 3.04.01 |
| 4.10.03 | CURR RANGE | Range of current output, see Function 3.04.03 |
| 4.10.04 | PULS FUNCT | Range of pulse output, see Function 3.05.01 |
| 4.13.00 | EPROM | EPROM checksum error, reset device. |

## 3.11 Description of functions

### 3.11.1 Main menu 0.00.00 Error

This menu is accessible from the measuring mode by pressing the ← key and entering "CODE 2" (↑→).
Depending on the programming of Function 3.03.08 ERROR MSG, errors occurring during process flow measurement are represented with flashing display lines and/or a compass field. Depending on the programming of Function 3.03.07 CYCL DISP, the error messages alternate with the display of the measured value(s) every 5 seconds, or they can be manually selected by pressing the ↑ key.



1. Flashing line with number of errors that have occurred.
2. Flashing line with description of error message(s).
3. Flashing bar, indicating "new" errors, not yet acknowledged.
4. Compass field, indicating measuring path error(s):

**Indication of measuring path errors:**

1, 2, 3: for measuring path 1,2 and 3, open or shorted sensor no measured value from path.
4. Noise error, to much noise on measuring path(s). Flowmeter functions outside specification.



The following list gives an alphabetical overview of error messages that can occur during process flow measurement and what to do. The error messages only appear when Function 3.03.08 ERROR MSG is YES. Errors indicated with "YES" in the column "via status output" the status output is activated when the error occurs
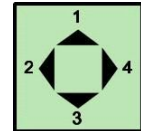
**Function 0.00.01 through 0.00.06 View error messages list / Reset error messages**

All occurred error messages are stored in an error messages list and can be viewed using Function 0.00.01 VIEW ERR. The messages are kept in this list until the cause of the errors has been removed and the error messages have been reset using Function 0.00.02 RST ERR. Errors that have been reset, but whose cause has not been removed, are kept in the list but are displayed without bar. This allows identification of previously acknowledged and unacknowledged errors. See table below.

| Error message | Description of error message | OIML error (set function 3.10.1 to CUST. ERR) | What to do? |
|---|---|---|---|
| CURR > MAX | Current output overflow (> 22 mA) | No | Check flow velocity |
| DSP | Digital signal processor (DSP) internal error | Yes | Only checked at power-up. Switch off and on the flowmeter. If the error still exists, contact KROHNE representative |
| EE MENU | Menu parameters corrupted | Yes | Contact KROHNE representative |
| EE SERVICE | Service parameters internal error | Yes | Contact KROHNE representative |
| EMPTY PIPE | Measuring tube not completely filled, flow reading to 0, error on all 3 paths. | Yes | Fill measuring tube completely |
| FLOW > MAX | Measuring range overflow (flow > 2 x $Q_{max}$) | No | Check flow velocity |
| FRONT END | Front end internal error | Yes | Only checked at power-up. Switch off and on the flowmeter. If the error still exists, contact KROHNE representative |
| RESTART | Flowmeter restarted | No | Reset errors |
| UNRELIABLE | Flow data disturbed, same as right compass field (4) | Yes | Check flow conditions |
| PATH 1 | Measuring path 1 error | Yes | Check flow conditions |
| PATH 2 | Measuring path 2 error | Yes | Check flow conditions |
| PATH 3 | Measuring path 3 error | Yes | Check flow conditions |
| PULS > MAX | Pulse output overflow (> 120 %) | No | Check flow velocity |
| UP2 | µP2 internal error | Yes | Contact KROHNE service |
| VOS path 1 | Deviation > 5% from average VOS of 3 measuring paths | Yes | Check VOS of each path |
| VOS path 2 | Deviation > 5% from average VOS of 3 measuring paths | Yes | Check VOS of each path |
| VOS path 3 | Deviation > 5% from average VOS of 3 measuring paths | Yes | Check VOS of each path |
| Flow calc. | Algorithm check error | Yes | Reset error |
| Cal data | | Yes | Contact KROHNE representative |
| System stp | System error | Yes | Power on/off. Contact KROHNE representative when message remains |

**Function 0.00.03 Reset Totalizer**
Reset display totalizer(s). Only available when Function 3.07.08 RST ENABLE is YES. Note that all totalizer values are reset.

**3.11.2 Main menu 1.00.00 Operation**

The functions in this menu are a subset of Main menu 3.00.00 Installation, and are selected in this menu as most commonly used functions for a quick installation. Note that parameters set in these functions are automatically set in both menus.

**3.11.3 Main menu 2.00.00 Test functions**

This menu is for testing the display, the in- and outputs and for information on hard- and software numbers. See chapter on functional checks and service.

| 3.11.4 Main menu 3.00.00 | Submenu 3.01.00 Volume flow parameters |
| Installation | |

**3.11.4 Main menu 3.00.00 Installation**

**Submenu 3.01.00 Volume flow parameters**

**Function 3.01.01 Full-scale value for 100% volume flow rate**

The following units can be applied:

m³/s - cubic meter per second – US Gal/s - US gallons per second

m³/min- cubic meter per minute – US Gal/min - US gallons per minute

m³/hr- cubic meter per hour – US Gal/hr - US gallons per hour

L/s - liter per second - bbls/hr - barrels per hour

L/min -liter per minute - bbls/day - barrels per day

L/hr -liter per hour - free unit, a user-definable unit, which can be defined using Function 3.07.05 to 3.07.07.

Range depends on diameter (D) and volume flow velocity (v):

$Q_{min}$ [m³/h] = 0,9 x $D^2$  ($v_{min}$ = 0.5 m/s)

$Q_{max}$ [m³/h] = 31,25 x $D^2$  ($v_{max}$ = 20 m/s)

$Q_{min}$ [US GPM]= 3,9 x $D^2$ ($v_{min}$ = 1.5 feet/s)

$Q_{max}$ [US GPM] = 138 x $D^2$ ($v_{max}$ = 20 m/s)

**Function 3.01.02 through 3.01.03 Zero value / Zero calibration**

Although zero calibrated at the factory the flow sensor might still give an offset flow reading, at "zero" flow in the pipeline (measuring tube completely filled with medium. Function 3.01.02 ZERO VALUE can be used for zero calibration. It can be set to either FIXED, which will give a factory zero setting, or MEASURED, which will allow to compensate for the small signal using Function 3.01.03 ZERO CAL.

**Function 3.01.04 Master time constant of display and outputs**

This is the time that it takes for the display and the current and pulse outputs to reach 66% of the end value, after a change in the flow rate. The time constant does not apply for totalization. The time constant does not apply for the current output in F/R setting. If required, a different time constant value can be set for the pulse/frequency output under Function 3.05.06 TIME CONST.

**Function 3.01.05 through 3.01.07 Low-flow cut off for display and outputs / Cut off "on" value/ Cut off "off" value**

Due to the extreme low flow sensitivity of the ALTOSONIC III, it will detect the slightest movement of fluid, even at zero flow.  To avoid these measurements causing outputs and totalizer changes, the low flow cut-off can be used to force reading to zero.  These are set as a percentage of Full Scale, as configured in Fct.1.01.01 or 3.01.01.

When the flow rate decreases below the "on" value, the display and outputs are set to their "zero" values. When the flow increases above he "off" value, measurements are resumed. The "off" value must be larger than the "on" value by at least 1%. With Function 3.01.05 LF CUTOFF set to NO, factory settings are used for the "on" and "off" values.

**Function 3.01.08 Meter size**

The nominal diameter of the measuring tube. See the flow sensor nameplate. This value can be entered In mm or in inches.

**Function 3.01.09 Flow sensor constant GK**

At the factory, each flow sensor is calibrated and supplied with a calibration constant. This constant can be found on the flow sensor nameplate.

**Function 3.01.10 Definition of forward flow direction**

The forward flow direction is indicated with an arrow on the flow sensor. If the actual flow is in the direction of the arrow then the flow is in the positive direction and the converter will have a positive flow reading. By setting this function to NEGATIVE, the converter's reading can be reversed. This can be useful when the process flow direction is changed so the flow sensor will not need to be reversed.

**Function 3.01.11 through 3.01.12 Minimum/Maximum velocity of sound**

In media of varying composition, the ultrasonic wave speed will vary, like in oil-water mixtures. This is identifiable by means of measuring the velocity of sound. The current output and the pulse output can be programmed to indicate the velocity of sound, see Function 3.04.01 and 3.05.01. Their "zero" values (0% scale) will then correspond with the velocity of sound set in Function 3.01.11 MIN VOS, where their "full-scale" values (100% scale) will correspond with the velocity of sound set in Function 3.01.12 MAX VOS. See also Function 3.03.06 VOS for the display of the velocity of sound. NOTE: Only necessary for setting span for outputting VOS, is not needed to measure flow!

**Submenu 3.02.00 Version**

**Function 3.02.01 Function of converter**

The function of the converter is factory preset to CUSTODY and can not be altered.

### Submenu 3.03.00 Display
### Function 3.03.01 Display of flow
To display the flow, three options are available
Rate; flow is shown with the unit as set in function 3.01.01
Percentage; flow is shown as a percentage of the full scale as set in 3.01.01
No display; no flow is shown.

### Function 3.03.06 Unit for velocity of sound
The display of the velocity of sound, as described in Function 3.01.11 through 3.02.12.
The following units can be applied:
NO DISPLAY no display of velocity of sound
m/s meter per second
feet/s feet per second

### Function 3.03.07 Cyclic display of measured values
Whenever more than one measured value is to be displayed (e.g. flow rate and totalizer), each value can be selected manually by pressing the ↑ key, or the values can be alternately displayed each 5 seconds by turning the cyclic display function on. This also includes the display of various readings as described in Function 3.03.08 through 3.03.11.

### Function 3.03.08 Display error messages
Enable/disable the display of error messages as described in section 5.1. When enabled, the converter display will FLASH when an error occurs, and the error code will be displayed. It will continue to flash until the alarm is acknowledged or cleared. An unacknowledged alarm will be displayed with 3 horizontal lines in front of the error message. Acknowledging the alarm will remove the lines. If the alarm is acknowledged but the cause is not removed the error will stay in the error list. To remove the error from the list the cause must be removed and the error must be reset. When it is turned off, the compass display indicates errors are present, but the display will not flash.

### Function 3.03.11 Display gain
Enable/disable the display of the signal level from the sensors. For each measuring path this level is displayed as a gain value 0 dBV through 80 dBV at the input amplifier.

### Submenu 3.04.00 Current output
### Function 3.04.01 Function of current output
The current output can be programmed for the following functions:
- OFF switched off, current output steady at current value for 0 % scale, see Function 3.04.03 ACT FLOW proportional with the actual volume flow, see Function 3.01.0.1 FULL SCALE.
- F/R IND forward/reverse flow indication, see Function 3.01.10, 100 pct mA value for forward flow, 0 pct mA value for reverse flow, see Function 3.04.03 through 3.04.05.
- VOS proportional with the velocity of sound, see Function 3.01.11 through 3.01.12.
- SIGN LEVEL proportional with the signal level, see Function 3.03.11.

### Function 3.04.02 Direction of current output
Only available when ACT FLOW is selected in Function 3.04.01. When FORWARD is selected, the current output will only be active when the flow is in the forward flow direction as defined in Function 3.01.10 FLOW DIR, while when BOTH is selected, the current output will be active forward and reverse flow direction. Use F/R SPEC to indicate the reverse flow in the range from 0 mA through 0 pct mA (see Function 3.04.04 0 pct). I.e. when the flow goes from the forward direction to the negative direction, the current output will pass the "0 pct" mA value down to 0 mA, where it stops.
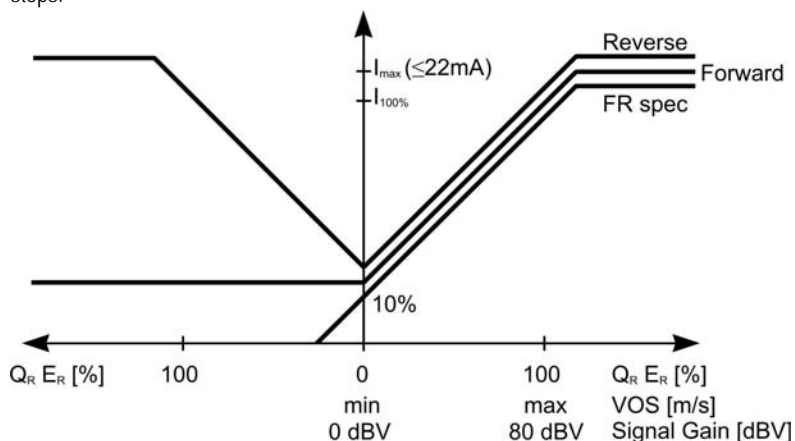
### Abbreviations used:
I Current output
QF  Forward volume flow rate
$I_{0\%}$ Current output at 0 % scale
$I_{100\%}$ Current output at 100 % scale
QR Reverse volume flow rate
$I_{max}$ Current output maximum
When VOS or signal gain is set, only the forward characteristic applies.

### Function 3.04.03 Range of current output
The range of the current output can be set to standard 0-20mA or 4-20 mA or to "other" for other user specified spans. Max reading is 22 mA. The range for "other" is set using functions 3.04.04 to 3.04.06.

### Function 3.04.04 0 pct
mA setting for 0 percent of the range. It can be set between 0 and 16 mA. Default is 4 mA.

### Function 3.04.05 100 pct
mA setting for 100 percent of the range. It can be set between 4 and 20 mA. Default is 20 mA.

### Function 3.04.06 Limit
Limit of current output. Max setting and default setting: 22 mA. Limit it to 20mA when safety systems reserve higher currents as Fault Codes.

### Submenu 3.05.00 Pulse / frequency output
### Function 3.05.01 Function of pulse output
The pulse output can be programmed for the following functions:
- OFF switched off, contact closed.
- ACT FLOW proportional with the actual volume flow, see Function 3.01.01 FULL SCALE.
- CORR FLOW proportional with the corrected volume flow, availability depending on version, see Function 3.02.01.
- F/R IND forward/reverse flow indication, see Function 3.01.10, contact closed for forward flow, contact open for reverse flow.
- VOS proportional with the velocity of sound, see Function 3.01.11 through 3.01.12.
- DIG OUTPUT digital output, see Function3.05.03.
- SIGN GAIN, gain of sensor amplifier, proportional with the signal level, see Function 3.03.11.

### Function 3.05.02 Direction of pulse output
Only available when ACT FLOW is selected in Function 3.05.01. When FORWARD is selected, the pulse output will only be active when the flow is in the forward flow direction as defined in Function 3.01.10 FLOW DIR, while when BOTH is selected, the pulse output will be active in both flow directions.

### Function 3.05.06 Time constant of pulse output
The time constant of the pulse output can be set to 25 ms, which is the lowest value, or MASTER TC, which will result in the value, set in Function 3.01.04 MASTER TC. The time constant setting only applies to actual flow and corrected flow.

### Function 3.05.07 pulse output function
The function of the pulse output can be set to either PULSE RATE (frequency) or PULSE/UNIT (Totalizer pulse).
PULSE RATE: Is set by entering a frequency at 100 % volume flow rate.
PULSE/UNIT: Is set by entering a value for the number of pulses for each volume (or energy) unit. Each pulse having a fixed volume, i.e. 1 pulse / 0.1 liter. This is the best method of remote totalizing, as pulses simply need to be counted, i.e. 10 pulses = 1 liter. See Function 3.05.08 through 3.05.10.

### Function 3.05.08 Pulse rate
If the function of 3.05.07 is set to pulse rate, the frequency of the pulse can be set that will be available at 100% flow. The frequency can be set to: pulse/s, pulse/min, pulse/hr. The default setting is 1000 pulses/second (Hz), the max setting is 1500.

### Function 3.05.09 Pulse/unit
If the function of 3.05.07 is set to pulse/unit, the unit and number of pulses per unit can be set for the flow measurement using this function. Options are; pulse/m³, pulse/l, pulse/US Gal., pulse/bbl. Also a user definable unit can be set. The max number of pulses per unit is 7870000, the default setting is 1. NOTE: Check that the max. flow span will not cause the number of pulses generated per second to exceed the maximum of 2 000 Hz.

Submenu 3.06.00 Digital input
Function 3.06.01 Function of digital input
The digital input terminal is the same as the current output terminal. Therefore, when the digital input function is selected, the function of the current output (see Function 3.04.01) needs to be set to OFF and the current output range has to be set to 0-20mA (see Function 3.04.03).
The digital input can programmed for the following functions:

- OFF switched off, no function
- RST ERROR reset error messages, see also Function 0.00.02 RST ERR

Submenu 3.07.00 User data
Function 3.07.01 Through 3.07.04  Language for display texts / Entry code for setting mode / Code 1 / Tag name setting

Function 3.07.05 through 3.07.07 User-defined unit for volume flow rate
Instead of choosing from pre-defined units for the volume flow as in Function 3.01.01 FULL SCALE, a user-defined unit can be programmed. This unit is to be defined as a volume unit per time unit. In Function 3.07.05 UNIT TEXT the text can be defined, in Function 3.07.06 UNIT VOL the amount of volume units that will fit in one m³ must be programmed, and in Function 3.07.07 UNIT TIME the amount of seconds that will fit in a time unit must be programmed.

Example: to program barrels per day, program in Function 3.07.06 6,289 (= 1/0,159) and in 3.07.07 8,640E4 (=24*60*60).

**3.11.5 Main menu 4.00.00 Parameter error**

For description see under main menu 0.00.00.

# 4. Functional checks and service

**4.1 Functional checks**

The signal converter has several different test functions (Function 2.01.01 to 2.01.05).

**4.1.1 Display test**

Function 2.01.01 Display test
Select function 2.01.01 as described above.
Press right arrow to start.
All segments in the 3 lines of the display are activated sequentially. The test can be terminated by pressing ← key.

**4.1.2 Current output test**

Function 2.02.01 Test, current output I
WARNING – This will affect the current output, and will no longer be process output!

A milliamp-meter must be connected between terminals V+ and I for this test, see the connection diagrams.
Select current value with ↑ key:
0 mA - 4 mA
12 mA - 20 mA
22 mA
The milliamp-meter indicates the current value selected. Press the ← key to terminate the test and display the actual value again

**4.1.3 Frequency output test**

Function 2.02.02 Test, frequency output F
WARNING – this will affect the pulse/frequency output, and will no longer be process output!
An electronic totalizer (EC) must be connected to terminal P. for this test.
Select function 2.02.02. Select frequency value with ← key:
1 Hz - 10 Hz
100 Hz - 1000 Hz
1500 Hz
The totalizer indicates the frequency value selected. Press the ← key to terminate the test and display the actual value again.

**4.1.4 Status output test**

2.03.03 Test of the status inputs (if applicable)
Connect a voltage source to terminal I/GND.
Select Function 2.03.03.
Apply a voltage < 5 V and check if the display indicates a '0' level as value.
Apply a voltage >15 V and check if the display indicates a '1' level as value.
Press '<-' to terminate.

**4.2 Device information**

2.04.00 Device info
Select the 2.04 menu. The various sub-menus (2.04.01 to 2.04.09) will show:
- manufacturer
- model no.
- serial no.
- uP2 hardware no.
- uP2 Software no.
- Front Hardware no.
- DSP Hardware no.
- DSP software no.
- Time count

**4.3 Measuring zero flow value**

Set zero flow in the pipeline. Make sure the flow sensor is completely filled with liquid.
Select function 1.01.02 or 3.01.02, ZERO VALUE and set this to MEASUREMENT
Select 1.01.03 or 3.01.03, ZERO CAL, zero calibration will start upon entry of this function.
the zero measurement will take approximately 15 seconds, display indicating BUSY. At the end the display shows "STORE NO". Use the '^' to select "STORE YES" if desired use the "<-" to store and exit the zero calibration routine.
Remark: if fixed zero value is selected (1.01.02 or 3.01.02) a zero calibration routine is not possible.

# 5. Installation in hazardous areas, zone 1 and zone 2

## 5.1 Approvals

The ALTOSONIC III ultrasonic flowmeters in compact and separate design are in accordance with the European Directive 94/9 EC (ATEX 100a) and approved for hazardous classified locations of Zone 1 and 2 by the PTB conform to the European Standards of the EN 500xx series, approval number: PTB 03 ATEX 2021 X.

## 5.2 Compact flowmeter

The standard ALTOSONIC III C-EEx compact flowmeter is designed for ambient temperatures (i.e. Ta) in the range of -40°C / 104°F up to +70°C/158°F. The maximum allowed process liquid (medium) temperature is restricted by the combustible atmosphere that (possibly) surrounds the apparatus, determined by the temperature class of the atmosphere, see table below.

| Temperature class | Maximum process liquid temperature at | | |
|---|---|---|---|
| | Ta ≤ 40°C / 104°F | Ta ≤ 50°C / 122°F | Ta ≤ 60°C / 140°F |
| T6 | 80°C / 176°F | 80°C / 176°F | 80°C / 176°F |
| T5 | 95°C / 203°F | 95°C / 203°F | 95°C / 203°F |
| T4 | 130°C / 266°F | 130°C / 266°F | 125°C / 257°F |
| T3 | 180°C / 356°F | 165°C / 329°F | 125°C / 257°F |

The ALTOSONIC III K/…-EEx compact flowmeter consists of the UFC III…-EEx flow converter that is screwed on top of the UFS III-EEx flow sensor by four hexagonal socket head cap screws of size M6. The standard compact flowmeter is marked with one of the codes below:

**Standard:** II 2G EEx de [ib] IIC T6…T3 for the terminal compartment of the flow converter housing in type of protection increased safety "e" according to EN 50019.

**Optional:** II 2G EEx d [ib] IIC T6…T3 for the terminal compartment of the flow converter housing designed as flameproof enclosure "d" according to EN 50018.

## 5.3 Flow sensor

The UFS III…-EEx flow sensor is the measuring unit of the ALTOSONIC III (3-beam) ultrasonic flowmeters. It contains the ultrasonic sensor (three pairs of opposite transducers) in type of protection intrinsic safety category "ib" according to EN 50020. All sensor circuits are wired by separate coaxial cables and connected through SMB connectors, which are marked by the respective numbers 1.1, 1.2, 2.1, 2.2, 3.1 and 3.2. The flow sensors are available in size DN25 (1") up to DN1000 (40") in diameter.

The UFS III…-EEx flow sensor is used in combination with the flow converter unit type UFC III…-EEx, which is either directly mounted on top of the flow sensor (compact meter) or installed on a distance and connected via a cable (separate version). In the last case the flow sensor as well as the flow converter unit are both provided with a junction box, in which the SMB connectors are mounted.

The UFS III F/…-EEx flow sensor in separate design is the measuring unit of the separate flowmeter system. The sensor is suitable for process liquid temperatures from -25°C/-13°F up to +180°C/356°F and designed for an ambient temperature in the range of -40°C/-40°F up to +70°C/158°F.

The UFS III F/…-EEx flow sensors in separate design are classified according to the temperature classification table below.

| Temperature class | Maximum process liquid temperature at Ta = 60°C / 140°F |
|---|---|
| T6 | 80°C / 176°F |
| T5 | 95°C / 203°F |
| T4 | 130°C / 266°F |
| T3 | 180°C / 356°F |

The UFS III F/…-EEx flow sensors are marked with the explosion safety codes: UFS III F-EEx: II 2G EEx ib IIC T6…T3.

The intrinsically safe "ib" ultrasonic sensor circuits inside the UFS III…-EEx flow sensor have the following maximum values (i.e. entity parameters):
Maximum input voltage : $V_{max} = 13.1$ V

Maximum input current : Imax = 600 mA
Maximum internal capacitance : $C_i$ = 13.1 nF (maximum, 3 sensor circuits)
Maximum internal inductance : $L_i$ = 134 µH (maximum, 3 sensor circuits)

The intrinsically safe sensor circuits of the ALTOSONIC III C/…-EEx compact flowmeter are only internal circuits and not accessible for the user.

## 5.4 Flow converter

The UFC III…-EEx flow converter consists of an approved cylindrical housing, made of a stainless steel (type VX-EEx with PTB No. Ex-96.D.1068 U). It contains two separate compartments, divided from each other by wall with an integrated encapsulated flameproof terminal feed-through. The housing of the compact version is screwed on top of the flow sensor, the housing of the separate version is screwed on an aluminium or stainless steel wall-mounting bracket. A junction box made of stainless steel is screwed to the side of the bracket by four M6 recessed head screws with internal hexagonal socket set (only applicable for the flow converter in separate design).

The flow converter housing is on both ends closed by a threaded cylindrical cover with O-ring sealing. Coaxial cables of type RG179 or RG316 with SMB plugs at their ends connect the intrinsically safe sensor output circuits of the flow converter to the corresponding SMB male-to-male bulkheads in the junction box.

The equipotential bonding conductor is screwed under the external M5 U-clamp terminal, which is located on the mounting flange at the bottom of the neck of the flow converter housing. The flow converter housing has an ingress protection degree of at least IP67 in accordance with EN 60529.

### Electronics compartment

The electronics compartment accommodates the UFC III…-EEx electronics unit. The compartment is designed with type of protection flameproof enclosure "d" in accordance with EN 50018. It is closed by a flameproof display cover with glass window, which is glued and additionally mechanical supported by a screwed in back-up ring made of aluminum or stainless steel (depends on the material of the housing). The interconnecting part (i.e. neck) at the bottom of the housing contains a flameproof cable feed-through, through which the coaxial cables run. The feed-through provides a flameproof sealing at the bottom of the electronics compartment.

The UFC III…-EEx electronics unit is inserted into the electronics compartment with the help of two sliding rubbers that position and fixate the unit at the front of the inside of the housing. Two M4 screws mount the unit and a third M4 screw fixates the brass earth strip at the back-end of the front-end printed circuit board, which contains the integrated voltage/current limiting circuit. The three screws are screwed to the integrated wall inside the electronics compartment. The on the front-end PCB integrated voltage/current limiting circuit provides the ultrasonic sensors inside the flow sensor with type of protection intrinsic safety category "ib" according to EN 50020.

The voltage/current limiting circuit has the following maximum output values:
Maximum output voltage : $V_O$ = 8.15 V
Maximum output current : $I_O$ = 220 mA
Maximum allowed external capacitance : $C_O$ = 1.3 µF
Maximum allowed external inductance : $L_O$ = 0.5 mH

### Terminal compartment

The terminal compartment accommodates seven M4 clamp terminals for connection of the power supply and the signal in-/output circuits. The terminals are separated from each other by insulation plates (eight in total, from which one at each end of the row).

The terminal compartment (default in type of protection increased safety "e") is standard equipped with two metal cable glands of size M20x1.5 or Pg13.5. The terminal compartment can optionally be provided as a flameproof enclosure "EEx d", in which case the customer must use pre-certified
"EEx d" cable glands or conduits.

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

 "EEx d" approved cable glands are no part of the standard delivery package, but must be provided by the customer himself or ordered explicitly at KROHNE.
1) Semi-circular insulating cover plate
2) U-clamp terminal size M4 (7 in total)
3) Dividing plate of insulating material (8 in total)
4) Flameproof terminal feed-through

5) Sticker with handling instructions for insulating cover plate
6) Metal dividing plate intrinsically safe and non-intrinsically safe terminals
7) Cable gland (size M20x1.5 or Pg13.5) or cable adapter (e.g. M20x1.5 to ½ inch NPT)
8) PE/FE U-clamp terminal size M5
9) External U-clamp terminal size M5 for equipotential bonding cable.

## 5.5 Technical data

### Electrical power supply unit

The UFC III…-EEx electronics unit is equipped with a switching-mode power supply, which is available in two supply voltage ranges, namely:

- 100…240 V AC power supply;
- 24 V AC/DC power supply.

The power supply's mains transformer provides the galvanic separation between the primary circuit (i.e. mains supply) and the secondary circuits. The secondary windings of the mains transformer deliver the following output voltages:

The table below lists the electrical input voltages of the power supply units, at the primary side of mains transformer.

| Power supply | Nominal voltage | Tolerances | Mains supply voltage | Power supply | Nominal voltage |
|---|---|---|---|---|---|
| | | | Minimum | Maximum | Limit |
| 24 V AC/DC | 24 V AC | -15/+10% | 20.4 V AC | 24 V AC/DC | 24 V AC |
| | 24 V DC | -25/+33% | 18 V DC | 32 V | 24 V DC |
| 100…240 V AC | 100…240 V AC | -15/+10% | 85 V AC | 100…240 V AC | 100…240 V AC |

The table below lists the electrical data of the power supply outputs.

| Power supply output | Parameter | Minimum | Nominal | Maximum | Limit |
|---|---|---|---|---|---|
| Electronics pos. supply | Voltage | +5.4 V | +6 V | +6.54 V (1) | 40 V |
| | Current | 225 mA | 400 mA | 571 mA | - |
| Electronics neg. supply | Voltage | -5.2 V | -6 V | -9 V | 40 V |
| | Current | 20 mA | 50 mA | 88 mA | - |
| Analogue input driver | Voltage | 21.6 V | 24 V | 26.4 V | 40 V |

(1) Depends on the load.

### Intrinsically safe sensor circuits

The on the front-end printed circuit board integrated voltage/current limiting circuits are connected via SMB receptacles of type Radiall R114 665 (for coaxial cables). They are soldered into the PCB at the front side of the board (close to the local display unit). The connections are established during the installation of the UFC III…-EEx electronics unit inside the flameproof electronics compartment of the flow converter housing by KROHNE personnel.

### Signal in-/outputs

Standard versions: Connector X1, pins 1, 2, 3, 4 and 5 on power supply PCB
24 V DC ±10% (40 V DC max) , 0-22 mA (100 mA max),  Vm = 264 V

Ultrasonic sensor circuits: 6 separate SMB connectors X1, X2, X6, X7, X10 and X11 on front-end PCB in type of protection Intrinsic Safety EEx ib IIC. Maximum values (i.e. entity parameters):
Vo = 8.15 V, Io = 220 mA
Lo = 0.5 mH, Co = 1.3 µF

Environment temperatures: Ambient temperature Ta -40°C...+70°C / Ta -40°F...+158°F
Component ambient temperature Tac (inside closed converter housing): during unfavorable operation 85°C / 185°F under fault conditions 100°C / 212°F.

### Power dissipation

At nominal supply voltage and full load at the outputs, the nominal power dissipation of the UFC III…-EEx with the 100…240 V AC power supply is limited at a maximum of 11 W and with 24 V AC/DC supply, limited to 8 W.

# 6. Electrical installation

### 6.1 General

The field cables enter the terminal compartment of the UFC III…-EEx flow converter unit (i.e. power supply, current and signal in-/outputs) and are non-intrinsically safe.

To connect external devices to the in-/output terminals, the wiring requirements for the type of protection of the compartment (standard: increased safety "e", optional: flameproof "d") must be conform to the international or national standard involved (e.g. DIN VDE 0165, paragraph 5.6).

To connect external devices to the in-/output terminals, the wiring requirements for the specific type of protection of the terminal compartment (standard: increased safety "e", optional: flameproof enclosure "d") must be respected, see standard EN 60079-14 or the corresponding national standard.

The non-intrinsically safe terminals for connection of the power supply (L, 1L≈ and N, 0L≈) must be connected in accordance with the relevant standard code of practice for electrical apparatus intended for use in potentially hazardous locations, type of protection increased safety "e" or type of protection flameproof enclosure "d", depending on the type of protection of the terminal compartment of the flow converter housing.
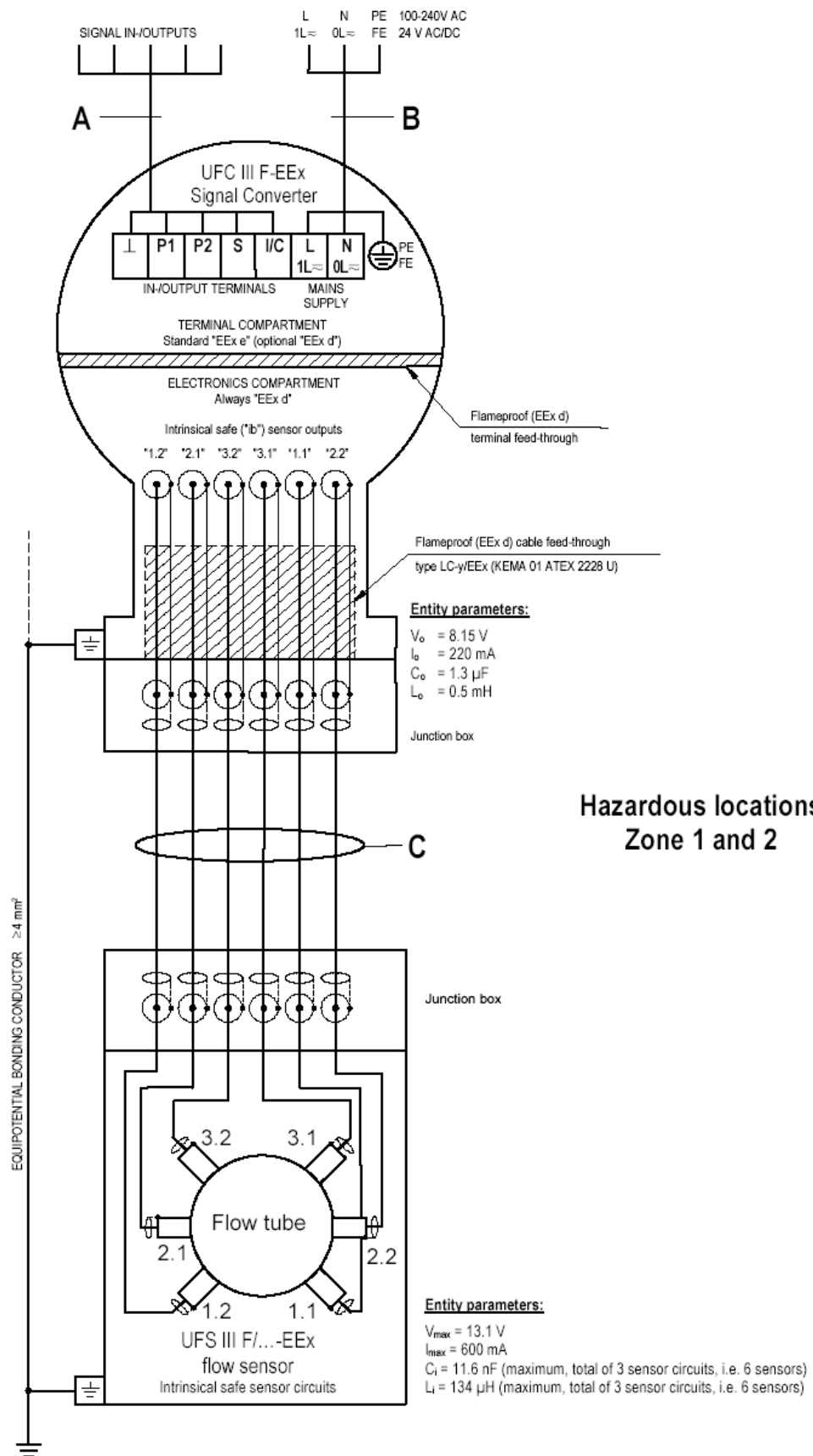
### 6.2 Connecting cables

**Cable A**
Signal cable for current output and binary in-/outputs (pulse and status output). This cable type must be in accordance with clause 9 of the EN 60079-14 "Electrical installations in hazardous locations" or an equivalent national standard (e.g. DIN VDE 0165 Part 1).

**Cable B**
Mains power supply cable. This cable type must also be in accordance with clause 9 of the EN 60079-14 "Electrical installations in hazardous locations" or an equivalent national standard (e.g. DIN VDE 0165).
Rated voltage: 500 V
Examples: H07..-., H05..-. to HD 21.S2 or HD22.S2

**Cable C**
MR06 coaxial cable (only for remote default version), to be supplied by KROHNE.
Technical data:
Test voltage: 500 V
Diameter of strand (core and screen): 0.1 mm
Distributed capacitance (core/screen): 67 pF/m
Distributed inductance (core/screen): 0.4 µH/m

**Equipotential bonding conductor**
Minimum cross-sectional area;
unprotected: 4 mm$^2$ (11 AWG)
protected by metal conduit: 2.5 mm$^2$ (14 AWG).

### 6.3 Connection diagrams

The following diagrams show the connection diagrams of respectively the compact ultrasonic flowmeter system and remote ultrasonic flowmeter system (default).

SIGNAL IN-/OUTPUTS

L   N   PE  100-240V AC
1L≈  0L≈  FE  24V AC/DC

**A**

**B**

UFC III-EEx
Signal Converter

| ⊥ | P1 | P2 | S | I/C | L | N | ⏚ | PE |
|---|---|---|---|---|---|---|---|---|
| | | | | | 1L≈ | 0L≈ | | FE |

IN-/OUTPUT TERMINALS

MAINS
SUPPLY

TERMINAL COMPARTMENT
Standard "EEx e" (optional "EEx d")

ELECTRONICS COMPARTMENT
Always "EEx d"

Intrinsical safe ("ib") sensor outputs

"1.2"  "2.1"  "3.2"  "3.1"  "1.1"  "2.2"

Flameproof (EEx d)
terminal feed-through

Flameproof (EEx d) cable feed-through
type LC-y/EEx (KEMA 01 ATEX 2228 U)

**Hazardous locations
Zone 1 and 2**

EQUIPOTENTIAL BONDING CONDUCTOR  ≥ 4 mm²

3.2      3.1

Flow tube

2.1      2.2

1.2      1.1

UFS III…-EEx
flow sensor
Intrinsical safe sensor circuits

SIGNAL IN-/OUTPUTS

L  N  PE  100-240V AC
1L≈  0L≈  FE  24 V AC/DC

**A**

**B**

UFC III F-EEx
Signal Converter

| ⊥ | P1 | P2 | S | I/C | L | N | PE FE |
| | | | | | 1L≈ | 0L≈ | ⏚ |

IN-/OUTPUT TERMINALS        MAINS
                           SUPPLY

TERMINAL COMPARTMENT
Standard "EEx e" (optional "EEx d")

ELECTRONICS COMPARTMENT
Always "EEx d"

Intrinsical safe ("ib") sensor outputs

"1.2"  "2.1"  "3.2"  "3.1"  "1.1"  "2.2"

Flameproof (EEx d)
terminal feed-through

Flameproof (EEx d) cable feed-through
type LC-y/EEx (KEMA 01 ATEX 2228 U)

**Entity parameters:**

$V_o$   = 8.15 V
$I_o$   = 220 mA
$C_o$   = 1.3 μF
$L_o$   = 0.5 mH

Junction box

**Hazardous locations
Zone 1 and 2**

**C**

Junction box

EQUIPOTENTIAL BONDING CONDUCTOR  ≥4 mm²

3.2        3.1

Flow tube

2.1        2.2

1.2        1.1

UFS III F/...-EEx
flow sensor
Intrinsical safe sensor circuits

**Entity parameters:**

$V_{max}$ = 13.1 V
$I_{max}$ = 600 mA
$C_i$ = 11.6 nF (maximum, total of 3 sensor circuits, i.e. 6 sensors)
$L_i$ = 134 μH (maximum, total of 3 sensor circuits, i.e. 6 sensors)

KROHNE

# 7. Service and maintenance

## 7.1 Introduction

Contact your nearest local KROHNE representative for ordering information of the UFC III…-EEx electronics units and/or fuses.
The ALTOSONIC III ultrasonic flowmeters are maintenance free with regard to the flow metering properties. Within the scope of the periodical inspections, which are required for electrical apparatus that is installed and used in a hazardous classified location, it is recommended to check the flameproof converter housing on signs of corrosion and damages

## 7.2 Replacement of electronics unit or power fuse(s)

The following instructions must always be carefully followed, if the flow converter housing in which the UFC III…-EEx is installed has to be opened respectively closed again!

**Before opening:**

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

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

**After opening:**

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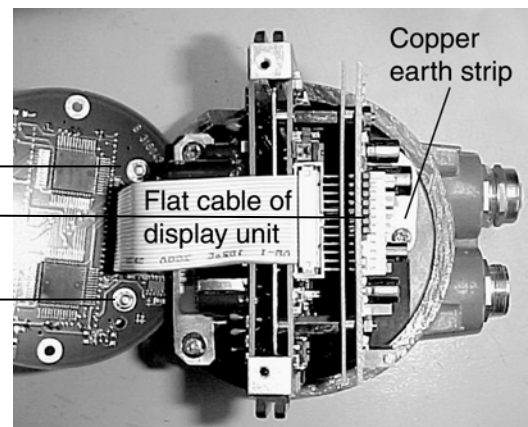


Display unit                                                    Electronics unit after removal of display unit

### 7.3 Replacement of electronics unit

Refer to the instructions for information about resetting and reprogramming the new electronics unit after replacement. Important application specific should be noted before replacing the UFC III...-EEx electronics unit!

**Before commencing work, note the "Before opening" instructions, then continue as follows:**

- Remove the cover of the electronics compartment.
- Unscrew the two screws A of the display unit and turn display unit carefully aside or remove the unit completely by taking out the flat cable connector.
- Unscrew the two mounting screws B of the electronics unit as well as screw C, which fixes the copper earth strip at the back of the housing. A screwdriver with a long shaft (200 mm) can best be used to unscrew C (e.g. screwdriver type Philips No. 2).
- Carefully pull the electronics unit slightly out of the converter housing, until the SMB connectors of the coaxial cables can easily be unplugged. Then remove the complete electronics unit from the housing.
- Carefully insert the new electronics unit until the numbered SMB connectors can be connected to the corresponding numbered SMB receptacles on the electronics unit. Then mount the unit completely into the housing and fix the screws. First C, then B and finally screw the display unit on the electronics via screws A, after the flat cable connector is connected.
- Screw the cover of the electronics compartment back into the housing.

**Note the "After opening" instructions during reassembling.**

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

### 7.4 Replacement of mains fuse

**Before commencing work, note the "Before opening" instructions, then continue as follows:**

- Remove the cover of the electronics compartment.
- Unscrew the two screws A of the display unit and turn the display unit carefully aside.
- The fuse-holder, in which the mains fuse in accordance with IEC 127-2 size Ø5 x 20 mm is mounted, is now accessible to replace the defect power fuse by a new fuse with the same rating. The 100...240 V AC power supply (see figure below) is provided with a fuse rated at T 0.8 A / 250 V, the 24 V AC/DC power supply has a fuse of T 1.25 A / 250 V (see figure below).
- Reassemble the unit in reverse order.

**Note the "After opening" instructions during reassembling.**
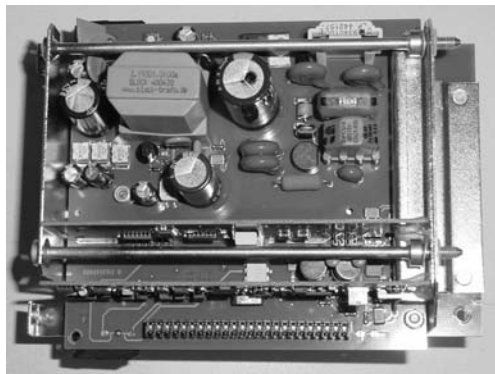


Power supply PCB - 100...240 V AC
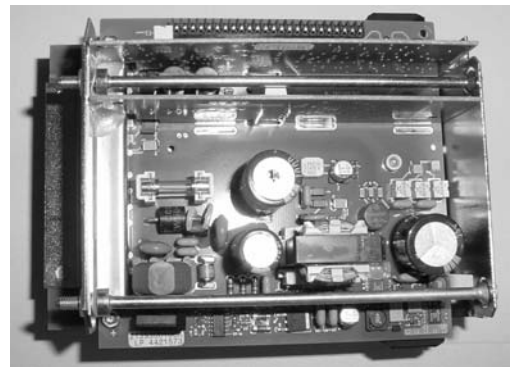


Power supply PCB - 24 V AC/DC

**7.5 Returning the flowmeter to KROHNE for service or repair**

KROHNE will only service your flowmeter if it is accompanied by a statement in line with the following model confirming that the flowmeter is safe to handle.

If the flowmeter 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 flowmeter are free from dangerous substances.
To enclose a statement with the flowmeter confirming that the flowmeter is safe to handle and stating the liquid used. KROHNE regrets that they can not service your flowmeter unless accompanied with such a statement.

The following specimen statement is 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 meter.

**Specimen statement:**

Company:
Department:
Address:
Name:
Tel. No.

Details enclosed flowmeter:

Type:
KROHNE Order No.

Has been operated with the following liquid:

Because the liquid is:
☐ water-pollutant   ☐ toxic   ☐ caustic   ☐ flammable (tick where applicable)

We have checked that the flowmeter and all cavities in the flowmeter are
☐ free from such substances   ☐ flushed* out and   ☐ neutralized.
* delete where not applicable

We hereby confirm that there is no risk to man or environment through any residual liquid in or on the flowmeter or in any of its cavities.

Date:                                             Place:
Signature:              Company Stamp:

.

# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

PTB

(1) **EG-Baumusterprüfbescheinigung**

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - **Richtlinie 94/9/EG**

⟨Ex⟩

(3) EG-Baumusterprüfbescheinigungsnummer

**PTB 03 ATEX 2223 X**

(4) Gerät: Ultraschall Durchflussmesssystem, bestehend aus
Signalumformer Typ UFC-III/F-EEx bzw. UFC-III/F/i-EEx,
Sensorkopf Typ UFS-III/F-EEx bzw. UFS-III/F/XT-EEx und
Kompakt-Durchflussmesser Typ Altosonic III/K-EEx bzw. Altosonic III/K/i-EEx

(5) Hersteller: Krohne Altometer

(6) Anschrift: Kerkeplaat 12, 3313 LC Dordrecht, Niederlande

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage und den darin aufgeführten Unterlagen zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die Physikalisch-Technische Bundesanstalt bescheinigt als benannte Stelle Nr. 0102 nach Artikel 9 der Richtlinie des Rates der Europäischen Gemeinschaften vom 23. März 1994 (94/9/EG) die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie.

Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht PTB Ex 03-23337 festgehalten.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

**EN 50014:1997 + A1 + A2      EN 50018:2000      EN 50019:2000      EN 50020:2002**

(10) Falls das Zeichen „X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese EG-Baumusterprüfbescheinigung bezieht sich nur auf Konzeption und Prüfung des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Weitere Anforderungen dieser Richtlinie gelten für die Herstellung und das Inverkehrbringen dieses Gerätes. Diese Anforderungen werden nicht durch diese Bescheinigung abgedeckt.

(12) Die Kennzeichnung des Gerätes muß die folgenden Angaben enthalten:

⟨Ex⟩ II 2 G  EEx d [ib] IIC T6 bzw. EEx de [ib] IIC T6 bzw. EEx d [ia/ib] IIC T6 bzw. EEx de [ia/ib] IIC T6 bzw.
EEx ib IIC T6...T3  bzw. EEx ib IIC T6...T2  bzw.
EEx d [ib] IIC T6...T3 bzw. EEx de [ib] IIC T6...T3 bzw. EEx d [ia/ib] IIC T6...T3 bzw. EEx de [ia/ib] IIC T6...T3

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Braunschweig, 05. November 2003

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

PTB

(13)                          A n l a g e

(14)         EG-Baumusterprüfbescheinigung PTB 03 ATEX 2223 X

(15)  Beschreibung des Gerätes

Das Ultraschall Durchflussmesssystem dient zur Messung, Zählung und Anzeige des Durch-flusses flüssiger brennbarer und nicht brennbarer Medien. Das System wird als abgesetzte Version mit getrenntem Signalumformer Typ UFC-III/F-EEx bzw. UFC-III/F/i-EEx und zugehörigem Sensorkopf Typ UFS-III/F-EEx bzw. UFS-III/F/XT-EEx gefertigt, sowie als Kompakt-Durchflussmesser Typ Altosonic III/K-EEx bzw. Altosonic III/K/i-EEx, bei dem beide Einheiten miteinander montiert sind. Für beide Versionen wird der gleiche Elektronikeinsatz verwendet. In die Elektronik der Typen UFC-III/F/i-EEx und Altosonic III/K/i-EEx sind „MODIS"-Module zur Erzeugung eigensicherer Stromkreise mit galvanischer Trennung eingebaut.

Der zulässige Bereich der Umgebungstemperatur für die verschiedenen Ausführungen beträgt:

| | |
|---|---|
| Typ UFC-III/F-EEx und Typ Altosonic III/K-EEx: | -40 °C bis +60 °C |
| Typ UFC-III/F/i-EEx und Typ Altosonic III/K/i-EEx | -20 °C bis +60 °C |

Die Zuordnung der Temperaturklasse zur höchstzulässigen Mediumtemperatur für die abgesetzte Version ist der Tabelle 1 zu entnehmen.

*Tabelle 1* **UFS-III/F-EEx bzw. UFS-III/F-EEx UFS-III/F/XT-EEx**

| Temperaturklasse | Höchstzulässige Mediumtemperatur | |
|---|---|---|
| | Sensorkopf Typ **UFS-III/F-EEx** | Sensorkopf Typ **UFS-III/F/XT-EEx** |
| T6 | 80 °C | 80 °C |
| T5 | 95 °C | 95 °C |
| T4 | 130 °C | 130 °C |
| T3 | 180 °C | 195 °C |
| T2 | - | 220 °C |

Die Zuordnung der Temperaturklasse zur höchstzulässigen Mediumtemperatur in Abhängigkeit von der Umgebungstemperatur für die Kompaktversion ist der Tabelle 2 zu entnehmen.

*Tabelle 2* **Altosonic III/K-EEx und Altosonic III/K/i-EEx**

| Temperaturklasse | Höchstzulässige Mediumtemperatur | | |
|---|---|---|---|
| | $T_{amb}$ = 40 °C | $T_{amb}$ = 50 °C | $T_{amb}$ = 60 °C |
| T6 | 80 °C | 80 °C | 80 °C |
| T5 | 95 °C | 95 °C | 95 °C |
| T4 | 130 °C | 130 °C | 125 °C |
| T3 | 180 °C | 165 °C | 125 °C |

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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**Anlage zur EG-Baumusterprüfbescheinigung PTB 03 ATEX 2223 X**

Elektrische Daten:

| | |
|---|---|
| **Signalumformer** **Kompakt-Durchflussmesser** | **UFC-III/F-EEx, UFC-III/F/i-EEx** **Altosonic III/K-EEx, Altosonic III/K/i-EEx** |

Versorgungsstromkreis
(Klemmen L, N, PE)

$100 ... 240$ V AC $+10$ % / $-15$ %, 11 VA , $U_m = 265$ V
bzw.
24 V AC $+10$ % / $-15$ %, 8 VA , $U_m = 265$ V
bzw.
24 V DC $+33$ % / $-25$ %, 8 W , $U_m = 265$ V

**Signalumformer**  **UFC-III/F-EEx,  UFC-III/F/i-EEx**

Ultraschall Sensorstromkreise
(6 separate SMB-Verbinder
3.1, 2.1, 1.1, 1.2, 3.2, 2.2)

in Zündschutzart Eigensicherheit EEx ib IIC
Höchstwerte je Stromkreis:

$U_o$ = 8,15 V
$I_o$ = 220 mA
$P_o$ = 448 mW
lineare Kennlinie
$L_o$ = 0,5 mH
$C_o$ = 1,3 µF

**Kompakt-Durchflussmesser**  **Altosonic III/K-EEx, Altosonic III/K/i-EEx**

Ultraschall Sensorstromkreise
(6 separate SMB-Verbinder)

geräteintern in Zündschutzart Eigensicherheit EEx ib IIC

**Signalumformer**  **UFC-III/F-EEx**
**Kompakt-Durchflussmesser**  **Altosonic III/K-EEx**

Signal Ein/Ausgänge
(Klemmen ⊥, A1, A2, P, I/C)

24 V DC $\pm10$ % (max. 40 V DC), 0-22 mA (max. 100 mA)
$U_m = 265$ V

Alle Stromkreise sind als miteinander verbunden zu betrachten.

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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**Anlage zur EG-Baumusterprüfbescheinigung PTB 03 ATEX 2223 X**

Signalumformer      UFC-III/F/i-EEx      (MODIS-Version)
Kompakt-Durchflussmesser      Altosonic III/K/i-EEx (MODIS-Version)

Signal Ein/Ausgänge

Module:

**P-SA**
(Anschlüsse: I⊥, I)      in Zündschutzart Eigensicherheit EEx ia IIC
nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis
Höchstwerte:

$U_i$ = 30   V
$I_i$ = 250   mA
$P_i$ = 1   W
$L_i$ = vernachlässigbar klein
$C_i$ = 0,5   nF

**FA-ST**
(Anschlüsse: B1⊥, B1 oder B2⊥, B2)      in Zündschutzart Eigensicherheit EEx ia IIC
nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis
Höchstwerte:

$U_i$ = 30   V
$I_i$ = 250   mA
$P_i$ = 1   W
$L_i$ = vernachlässigbar klein
$C_i$ = 0,5   nF

**F-PA**
(Anschlüsse: D⊥, D)      in Zündschutzart Eigensicherheit EEx ia IIC
nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis
Höchstwerte:

$U_i$ = 30   V
$I_i$ = 380   mA
$P_i$ = 5,32   W
$L_i$ = vernachlässigbar klein
$C_i$ = 0,5   nF

Die eigensicheren Modulstromkreise sind von den nichteigensicheren Stromkreisen bis zu einem Scheitelwert der Nennspannung von 375 V sicher galvanisch getrennt.

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# Physikalisch-Technische Bundesanstalt

**Braunschweig und Berlin**

**Anlage zur EG-Baumusterprüfbescheinigung PTB 03 ATEX 2223 X**

| | |
|---|---|
| **Sensorkopf** | **Typ UFS-III/F-EEx und UFS-III/F/XT-EEx** |
| Ultraschall Sensorstromkreise (6 separate SMB-Verbinder 3.1, 2.1, 1.1, 1.2, 3.2, 2.2) | in Zündschutzart Eigensicherheit EEx ib IIC nur zum Anschluss an bescheinigte eigensichere Stromkreise |

Höchstwerte:

$U_i$ = 13,1 V
$I_i$ = 600 mA
$L_i$ = 134 µH
$C_i$ = 11,6 nF

(16) <u>Prüfbericht</u>  PTB Ex 03-23337

(17) <u>Besondere Bedingungen</u>

  1. Es ist sicherzustellen, dass der Anschluss für den Potentialausgleichsleiter mit dem Potentialausgleich des explosionsgefährdeten Bereiches sicher verbunden ist.

  2. Bei den Typen UFC-III/F-EEx und Altosonic III/K-EEx ist zum Öffnen der druckfesten Kapselung nach dem Abschalten des Durchflussmessers eine Wartezeit einzuhalten (Warnschild). Diese ist wie folgt abhängig von der Temperaturklasse:

     T6...20 min;  T5...11 min.

(18) <u>Grundlegende Sicherheits- und Gesundheitsanforderungen</u>

  erfüllt durch Übereinstimmung mit den vorgenannten Normen

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Braunschweig, 05. November 2003

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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**Appendix 2 Declaration of conformity**

# EC-DECLARATION OF CONFORMITY KROHNE

The Level and Flow Company

KROHNE Altometer
Kerkeplaat 12
3313 LC  DORDRECHT
The Netherlands

We declare herewith under sole responsibility that the product(s):

**Signal converter UFC-III/F-EEx**
**Flow sensor UFS-III/F-EEX,**
**Compact Ultrasonic Flowmeter ALTOSONIC III/C-EEx**

Ultrasonic Flowmeter (Type in accordance with quotation, order acknowledgement, tagging; details in Installation and Operation Manual) are in conformity with the protection requirements of Council Directives (as far as applicable):

Low Voltage Directive 73/23/EC
EMC Directive 89/336/EC
Pressure Equipment Directive 97/23/EC (if applicable)
ATEX Directive 94/9/EC
Pressure Equipment Directive 97/23/EC

The stipulated safety and public health safety requirements are fulfilled in accordance with the harmonized standards or mentioned technical specifications (as far as applicable):

| 89/336/EEC | 94/9/EC |
|---|---|
| EN 50 081-1<br>EN 50 082-2<br>EN 61 010-1 | EN 50014 :1997 + A1 + A2<br>EN 50018 : 2000<br>EN 50019 : 2000<br>EN 50020 : 1994 |

The equipment type plates and order acknowledgement show the detailed tagging due to these directives. These are described in the Installation and Operation Manual.

| Directive | Assessment | Certificate | Notified Body | Ident. No. |
|---|---|---|---|---|
| 94/9/EC | | PTB 03 ATEX 2223 X | PTB | 0102 |
| 97/23/EC | Module H | STW 304050726 | Stoomwezen | 0343 |

Dordrecht, July 28th, 2004

General Management

## Appendix 3 Type plates

Notes

ALTOSONIC III KROHNE