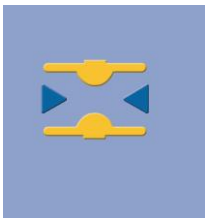
UMF3

Transmitter for magnetic-inductive flowmeters

EPX

Additional Operating Manual

for explosion-proof flow meters



Please read the instructions carefully and store them in a safe place

Contents

Introduction

I. Shipping and storage; product inspection

Shipping and storage
The device is to be safeguarded against dampness, dirt, impact and damage.

Product inspection
Upon receipt of the product, check the contents of the box and the product particulars against the information on the delivery slip and order form so as to ensure that all ordered components have been supplied. Notify us of any shipping damage immediately upon receipt of the product. Any damage claim received at a later time will not be honored.

II. Warranty

Your flowmeter was manufactured in accordance with the highest quality standards and was thoroughly tested prior to shipment. However, in the event any problem arises with your device, we will be happy to resolve the problem for you as quickly as possible under the terms of the warranty which can be found in the terms and conditions of delivery. Your warranty will only be honored if the device was installed and operated in accordance with the instructions for your device. Any mounting, commissioning and/or maintenance work is to be carried out by qualified and authorized technicians only.

III. Validity of this operating manual

The present instructions apply to explosion-proof magnetic-inductive flow meters EPX (IS X.1XX EX) und PIT* series which are operated in conjunction with the UMF3 transmitter **as of year of construction January 2016 or later.**
These instructions are supplementary operating manual for non-explosion proof magnetic inductive flow meters.

If you do not have a copy of the latter instructions, please request one from Heinrichs Messtechnik GmbH or download the instructions from our website. The instructions herein pertain primarily to explosion proof Coriolis flow meters. The technical data in the mounting and operating instructions for non-explosion proof Coriolis flow meters still apply insofar as the present instructions do not replace them or exclude their application.

IV. Repairs and hazardous materials

It is important that you do the following before shipping your flow meter to Heinrichs Messtechnik GmbH for repair:

- Enclose a description of the problem with your device. Describe in as much detail as possible the application and the physical and chemical properties of the fluid.
- Remove any residues from the device and be sure to clean the seal grooves and recesses thoroughly. This is particularly important if the fluid is corrosive, toxic, carcinogenic, radioactive or otherwise hazardous.
- The operator is liable for any substance removal or personal damage costs arising from inadequate cleaning of a device that is sent for repair.

1. Steps prior to operation

It is essential that you read these operating instructions before installing and operating the device. Prior to installation and commissioning, the operating instructions for the standard flow meter and this additional ex operating instructions must be read completely and fully understood. If you do not have a copy of the latter instructions or any part is missing, please request one from Heinrichs Messtechnik GmbH or download the instructions from our website.

The transmitter UMF3 described in this manual may only be used for the measurement of liquids in conjunction with a sensor EPX series or PIT* of the company Heinrichs Messtechnik GmbH!

1.1 Hazard warnings

The purpose of the hazard warnings listed below is to ensure that device operators and maintenance personnel are not injured and that the flowmeter and any devices connected to it are not damaged.

The safety advisories and hazard warnings in the present document that aim to avoid placing operators and maintenance personnel at risk and to avoid material damage are prioritized using the terms listed below, which are defined as follows in regard to these instructions herein and the advisories pertaining to the device itself.

1.1.1 Danger

means that failure to take the prescribed precautions **will result** in death, severe bodily injury, or substantial material damage.

1.1.2 Warning

means that failure to take the prescribed precautions **could result** in death, severe bodily injury, or substantial material damage.

1.1.3 Caution

means that the accompanying text contains important information about the product, handling the product or about a section of the documentation that is of particular importance.

1.1.4 Note

means that the accompanying text contains important information about the product, handling the product or about a section of the documentation that is of particular importance.

1.2 Installation, commissioning and servicing

The devices described in this manual are to be installed and serviced only by qualified technical personnel especially for hazardous areas, such as a qualified Heinrichs Messtechnik electronics engineer or service technician.

Warning
A repair that is relevant to safety in the sense of explosion protection, may only be performed by the manufacturer, his agents or under the supervision of an expert.

Warning
To avoid potential electric shock, follow the relevant national standards and safety regulations or the rules of the local supplier when wiring this unit to a power source and to peripheral devices.

Failure to comply may result in injury or death. All wiring work must be performed with the power off!

Details about the installation and operation in hazardous areas can be found in section **Fehler! Verweisquelle konnte nicht gefunden werden.** „**Fehler! Verweisquelle konnte nicht gefunden werden.**“ starting at page **Fehler! Textmarke nicht definiert.** and section **Fehler! Verweisquelle konnte nicht gefunden werden.** „**Fehler! Verweisquelle konnte nicht gefunden werden.**“ from page **Fehler! Textmarke nicht definiert.** of this manual. Details of the transmitter's electrical connection and the Ex-technical characteristics can be found in Section **Fehler! Verweisquelle konnte nicht gefunden werden.** „**Fehler! Verweisquelle konnte nicht gefunden werden.**“ page **Fehler! Textmarke nicht definiert.** and in Section 5.3.6 „Characteristics of transmitter UMF3“ starting at page 15.

Warning
Before servicing the device, it must be completely switched off, and disconnected from all peripheral devices. The technician must also check to ensure that the device is completely off-circuit. Only original replacement parts are to be used

Heinrichs Messtechnik GmbH accepts no liability for any loss or damage of any kind arising from improper operation of any product, improper handling or use of any replacement part, or from external electrical or mechanical effects, overvoltage or lightning. Any such improper operation, use or handling shall automatically invalidate the warranty for the product concerned.

In the event a problem arises with your device, please contact us at one of the following numbers to arrange to have your device repaired:

Phone: +49 221 49708-0
Fax: +49 221 49708-178

Contact our customer service department if your device needs repair or if you need assistance in diagnosing a problem with your device

1.3 Proper use of the device

Warning
The operator is responsible for ensuring that the material used in the sensor and housing is suitable and that such material meets the requirements for the fluid being used and the ambient site conditions. The manufacturer accepts no responsibility in regard to such material and housing!

Warning
In order for the device to perform correctly and safely, it must be shipped, stored, set up, mounted operated and maintained properly.

Only devices with Ex marking may be operated in hazardous areas.

2. Identification

Manufacturer Heinrichs Messtechnik GmbH
Robert-Perthel-Straße 9
D - 50739 Köln

Phone: +49 (221) 4 97 08 – 0
Fax: +49 (221) 4 97 08 – 178

Internet: http://www.heinrichs.eu
e-mail: info@heinrichs.eu

Product group magnetic-inductive flowmeter

Type Sensor Type EPX or PIT
Transmitter Type UMF3

2.1 Version / Date

Version: UMF3-EX_BA_00_ENG.DOC
Date: 18.02.2016

3. Relevant standards

- **IEC 60079-0**:2011 Ed. 6, modified Cor. 2012 + Cor. 2013 / EN 60079-0:2012 + A11:2013 Explosive atmospheres – Part 0: General Requirements
- **IEC 60079-1**:2014 Ed. 7 / EN 60079-1:2014 Explosive atmospheres – Part 1: Equipment protection by type of protection “d”
- **IEC 60079-7**:2006 Ed.4 / EN 60079-7:2007 Explosive atmospheres – Part 7: Equipment protection by increased safety “e”
- **IEC 60079-11**:2011 Ed. 6 + Cor. 2012 / EN 60079-11:2012 Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”
- **IEC 60079-31**:2013 Ed. 2 / EN 60079-31:2014 Explosive atmospheres – Part 31: Equipment dust ignition protection by enclosure “t”

4. General information about explosion protection

In accordance to guideline 94/9/EG (ATEX)

Example designation CE 0158 Ex | II | 2G | Ex | ia | IIB | T4 | Gb

Equipment groups

I	Equipment group I applies to equipment intended for use in underground parts of mines as well as those parts of surface installations of such mines endangered by firedamp and/or combustible dust.
II	Equipment group II applies to equipment intended for use in other places liable to be endangered by explosive atmospheres. This group is subdivided into three categories.

Equipment category

Designation for gases	Designation for dust	Definition
1G (0)	1 D (20)	Equipment in this category is intended for use in areas in which explosive atmospheres caused by mixtures of air and gases, vapours or mists or by air/dust mixtures are present continuously, for long periods or frequently.
2 G (1)	2 D (21)	Equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists or air/dust mixtures are likely to occur.
3G (2)	3D (22)	Equipment in this category is intended for use in areas in which explosive atmospheres caused by gases, vapours, mists, or air/dust mixtures are unlikely to occur or, if they do occur, are likely to do so only infrequently and for a short period only.

(The numbers in round brackets correspond to the IEC Zones.)

In accordance to EN 60079-0 ff / IEC 60079-0 ff

Ex = Explosion-proof electrical equipment

Types of protection

	General requirements	EN 60079-0
„d“	Flameproof enclosure	EN 60079-1
„q”	Sand filling	EN 60079-5
„e“	Increased safety	EN 60079-7
„i“	Intrinsic safety (ia, ib)	EN 60079-11
„n“	Non-incentive electrical equipment	EN 60079-15
„m“	Encapsulation	EN 60079-18
„t"	Dust explosion protection through enclosure (ta, tb or tc)	EN 60079-31

Explosion group

Gas group	
IIA	Acetone, benzene, fuel oil, ethanoic acid
IIB	City gas, ethylene, isoprene
IIC	Acetylene, hydrogen, carbon toulphide
Dust group	
IIIA	Inflammable fluff or fibers
IIIB	Non conductive dust
IIIC	Conductive dust

Temperature classes

Maximum surface temperature		Temperature class
450 °C	842 °F	T1
300 °C	572 °F	T2
200 °C	392 °F	T3
135 °C	275 °F	T4
100 °C	212 °F	T5
85 °C	185 °F	T6

Equipment Protection Level (EPL)	
Gas: Ga, Gb or Gc	Dust: Da, Db or Dc

(Explosion protection designations [square brackets] refer to “Related electrical equipment or circuits.”)

5. Use of transmitter UMF3

The magnetic-inductive transmitter type UMF3 is used in conjunction with a flow sensor for detecting the volume flow of conductive liquids in pipes. It can be mounted directly or separately to the sensor. It can be programmed via a built-in control unit and is therefore very flexible to the user's needs. While the basic configuration, e.g. the calibration of the device is made in the factory, the operator can make further settings related to the measurement and the display of measured data.

Following flow sensors can be used
When **separately** installed (connection of sensor via Ex e / tb – enclosure

a) Flow Sensor PIT * according to IECEx BVS 12.0034X or BVS 03 ATEX E 150 X,
b) Flow sensor type IS X.1XXEx according to FTZU 14 ATEX 0160 X (ATEX only)

As **compact** version:

c) Flow Sensor PIT * according to IECEx BVS 12.0034X or BVS 03 ATEX E 150 X
d) Induction sensor type IS X.1XXEx according to FTZU 12 ATEX 0139U (ATEX only)

The UMF3 supplies, from a secondary power circuit with main safe isolation, the field coil of the sensor and measures the volume flow proportional electrode voltage (E1 and E2). The intrinsically safe electrodes circuit is in contact with the liquid to be measured.

Available output circuits

1. Standard version:
   - 1 output 4-20 mA with HART® interface
   - 2 binary outputs
     - 1 pulse output useable as pulse or frequency output
     - 1 status output

2. extended version
   - 1 output 4-20 mA with HART® interface
   - 3 binary outputs (pulse output 1 and 2 and status output)
   - 1 binary input

All output circuits are passive, potential free to each other and to ground.

The wiring can be made as intrinsic safe or non-intrinsic safe. The terminals numbers depend on the type of protection used.

5.1 Mounting

The mounting instructions for the standard sensor also apply to the explosion-proof sensor.

5.2 Area Classification

In Zone 1:	Gas-Ex,	Explosion protection level Gb in gas group IIA and IIB
In Zone 21:	Dust Ex,	Explosion protection level Db in dust group IIIA, IIIB und IIIC.

The area of classification of the complete device can be reduced depending on the approval of the sensor.

Warning
The device may only be used as intended. Any breach of this rule leads to a loss of warranty and liability of the manufacturer!

5.2.1 Transmitter's type of protection

Transmitter and terminals are assembled in a housing with a class of protection „EX-d" – flame-proof enclosure.
The signal outputs can be used as intrinsic safe "Ex-i" or "not intrinsically safe". Either all signal outputs are designed in protection class „i" or "non-intrinsically safe". A mixture is not permitted! The transmitter complies with category 2G usable in zone 1 or 2D usable in zone 21.

Danger:
The devices may only be used in dust-Ex-environments where no high level of electrostatic charging is to be expected, which could lead to propagating brush discharge.

5.2.2 Device identification

The rating plates on Heinrichs Messtechnik flow meters that are suitable for use in potentially explosive atmospheres are labeled accordingly. Since the sensor and transmitter have different ratings, each device has its own rating plate.

The rating plate of the transmitter UMF3 is carried out according to the following examples:

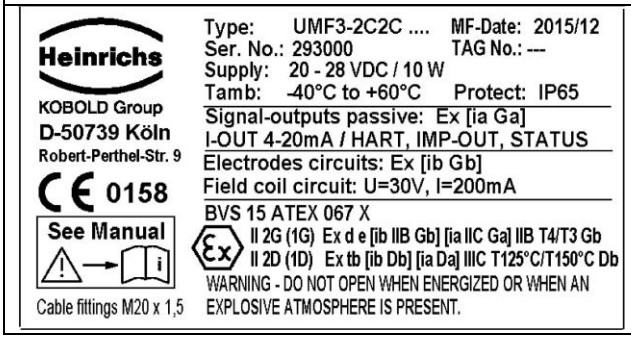
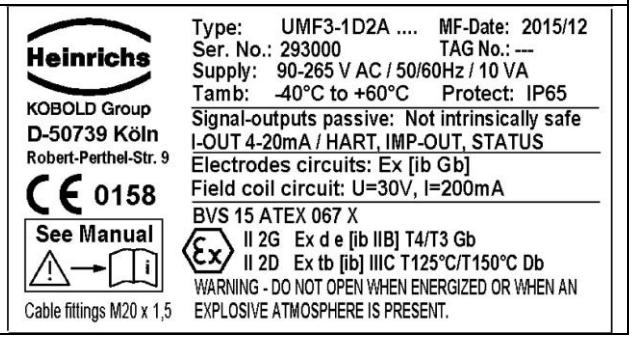
5.2.2.1 Compact version, ATEX, gas and dust

Signal outputs intrinsically safe	Signal outputs standard
Heinrichs KOBOLD Group D-50739 Köln Robert-Perthel-Str. 9 CE 0158 See Manual Cable fittings M20 x 1,5	Heinrichs KOBOLD Group D-50739 Köln Robert-Perthel-Str. 9 CE 0158 See Manual Cable fittings M20 x 1,5
Type: UMF3-2A2C .... MF-Date: 2015/12 Ser. No.: 293000 TAG No.: --- Supply: 20 - 28 VDC / 10 W Tamb: -40°C to +60°C Protect: IP65 Signal-outputs passive: Ex [ia Ga] I-OUT 4-20mA / HART, IMP-OUT, STATUS Electrodes circuits: Ex [ib Gb] Field coil circuit: U=30V, I=200mA BVS 15 ATEX 067 X II 2G (1G) Ex d e ib [ia IIC Ga] IIB T4/T3 Gb II 2D (1D) Ex tb ib [ia Da] IIIC T125°C/T150°C Db WARNING - DO NOT OPEN WHEN ENERGIZED OR WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.	Type: UMF3-1B2A .... MF-Date: 2015/12 Ser. No.: 293000 TAG No.: --- Supply: 90-265 V AC / 50/60Hz / 10 VA Tamb: -40°C to +60°C Protect: IP65 Signal-outputs passive: Not intrinsically safe I-OUT 4-20mA / HART, IMP-OUT, STATUS Electrodes circuits: Ex [ib Gb] Field coil circuit: U=30V, I=200mA BVS 15 ATEX 067 X II 2G Ex d e ib IIB T4/T3 Gb II 2D Ex tb ib IIIC T125°C/T150°C Db WARNING - DO NOT OPEN WHEN ENERGIZED OR WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

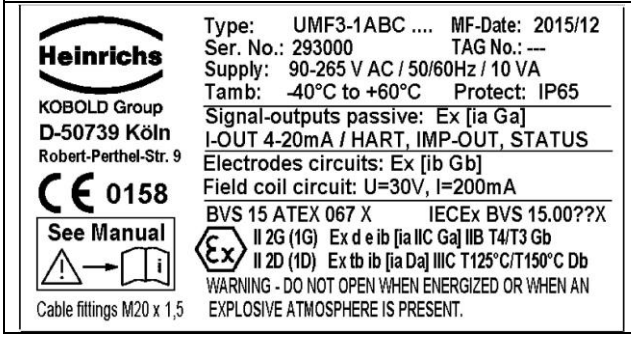
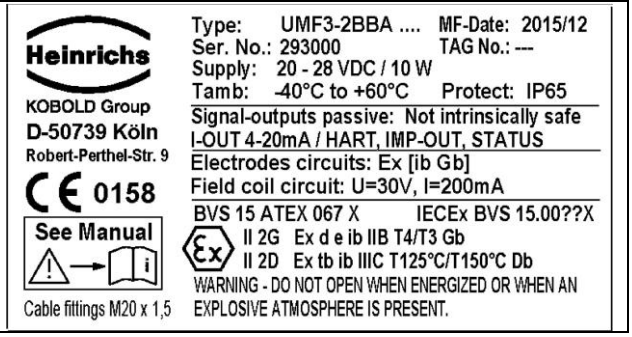
5.2.2.1 Separate version with fixed sensor cable, ATEX, gas and dust

Signal outputs intrinsically safe	Signal outputs standard
Heinrichs KOBOLD Group D-50739 Köln Robert-Perthel-Str. 9 CE 0158 See Manual Cable fittings M20 x 1,5	Heinrichs KOBOLD Group D-50739 Köln Robert-Perthel-Str. 9 CE 0158 See Manual Cable fittings M20 x 1,5
Type: UMF3-1E2C .... MF-Date: 2015/12 Ser. No.: 293000 TAG No.: --- Supply: 90-265 V AC / 50/60Hz / 10 VA Tamb: -40°C to +60°C Protect: IP65 Signal-outputs passive: Ex [ia Ga] I-OUT 4-20mA / HART, IMP-OUT, STATUS Electrodes circuits: Ex [ib Gb] Field coil circuit: U=30V, I=200mA BVS 15 ATEX 067 X II 2G (1G) Ex d ib [ia IIC Ga] IIB T4/T3 Gb II 2D (1D) Ex tb ib [ia Da] IIIC T125°C/T150°C Db WARNING - DO NOT OPEN WHEN ENERGIZED OR WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.	Type: UMF3-2F2A .... MF-Date: 2015/12 Ser. No.: 293000 TAG No.: --- Supply: 20 - 28 VDC / 10 W Tamb: -40°C to +60°C Protect: IP65 Signal-outputs passive: Not intrinsically safe I-OUT 4-20mA / HART, IMP-OUT, STATUS Electrodes circuits: Ex [ib Gb] Field coil circuit: U=30V, I=200mA BVS 15 ATEX 067 X II 2G Ex d ib IIB T4/T3 Gb II 2D Ex tb ib IIIC T125°C/T150°C Db WARNING - DO NOT OPEN WHEN ENERGIZED OR WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

5.2.2.2 Separate version with terminal box, ATEX, gas and dust

Signal outputs intrinsically safe	Signal outputs standard
	

5.2.2.1 Compact version, ATEX and IEC-Ex, gas and dust

Signal outputs intrinsically safe	Signal outputs standard
	

5.2.3 Warning label

Following warnings are mounted on the enclosure or are printed on the rating plate:

“WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT"
"WARNUNG - NICHT ÖFFNEN BEI VORHANDENER EXPLOSIONSFÄHIGER ATMOSPHÄRE"

“WARNING - DO NOT OPEN WHEN ENERGIZED"
"WARNUNG - NICHT UNTER SPANNUNG ÖFFNEN"

The cable fitting thread size is printed on the rating plate.

5.3 Connecting cables

The operator is to comply in all cases with the applicable installation regulations such as EN 60079-14 “Electrical apparatus for explosive gas atmospheres- Part 14: Electrical installations in hazardous areas”.

Note

- The connecting cables are to be installed in such a way that they are protected against mechanical damage and unduly high temperatures.
- The external diameters of the connecting cables must be compatible with the thickness range of the cable glands and rubber seals used.
- The cables and cable glands used must be compatible with the type of protection of the junction box being used.
- The dummy plugs used for unused cable glands must be compliant with the type of protection of the housing being used.
- It must be ensured that the cable gland gaskets are correctly seated.

The installation of the cable in the terminal compartment Ex d can be done in two ways:

- Direct connection of the cable through a certified flameproof cable gland
- Direct connection of cable and wires through specially certified conduits. The associated stopping boxes must be installed close to the housing.

5.3.1.1 Cable and conduit entries

Cable and conduit entries are not part of the instrument and have to be supplied by the operator according to the chosen kind of installation. They have to be certified for the same type of protection as the transmitter and be suitable for the used cables.
The transmitter series UMF3 for temperature class T4 does not have any of its own ignition sources as long the transmitter runs in smooth operation. Therefore flame-proof certified cable and conduit entries with sealing ring can be used. See also EN 60079-14/10.3.

If the sensor is used at an ambient temperature of less than -20 °C or greater 60°C, suitable cables, cable entries and conduit entries are to be used.

5.3.2 Equipotential bonding

When the sensor is mounted externally (remote mount configuration), equipotential bonding between the sensor and transmitter must be realized. For this purpose, terminals are provided on the outside of both the sensor and transmitter.

There is also a PE terminal for equipotential bonding near the cable entries of the terminal compartment on the inside of the transmitter enclosure.

5.3.3 Sensor circuits

5.3.3.1 Compact version UMF3

As a compact version, the sensor circuits (field coil circuit and electrode circuit) are wired as an "internal wiring" and connected by the manufacturer.

5.3.3.2 Separate version UMF3

As remote versions 2 variants are available:

- with external **terminal box**,
- with a **cable tail** – a fixed cable fitted to the transmitter with a maximum length of 10m.

In the separate version, the transmitter is mounted on a bracket on the wall or on a pipe. The sensor cable must be routed by the operator so that it is protected against tensile stress.

5.3.4 Version with cable tail

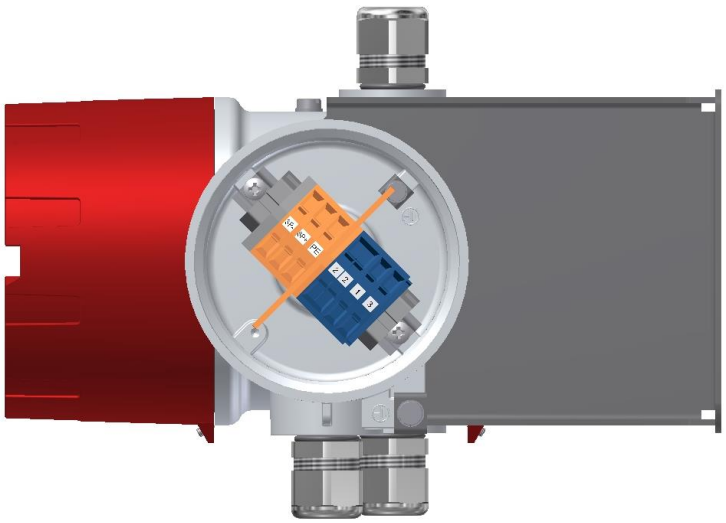
The version with **cable tail** is pre-assembled by the manufacturer and the loose end has to be connected in the terminal box of the sensor. The cable is connected directly to the transmitter and is considered to be an internal wiring of the transmitter. The cable length must be specified when ordering.

Note

- It is forbidden to replace the cable tail!
- It is forbidden for the customer to repair a damaged cable tail!
- The connection cable is to be laid and routed so that it is protected against mechanical damage and high temperatures.
- It is forbidden to extend the cable tail.
- It is forbidden to loosen the bushing of the transmitter enclosure.
- Repair or replacement work may only be performed by the manufacturer.

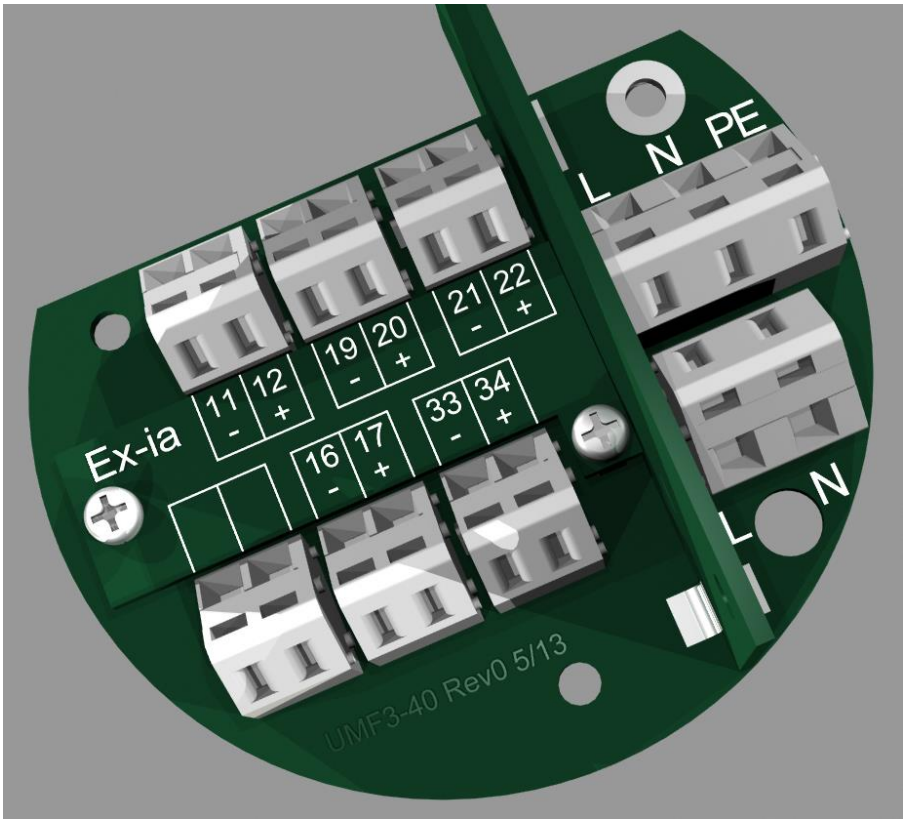
Assignment of wire colors:

Terminal	Function	**Wire color**	Circuit
3	E2 Electrode	White	Intrinsically safe
1	E1 Electrode	Brown	Intrinsically safe
2	FE Functional earth / electrodes	Screen	
SP-	Field coil	Yellow	Ex – e
SP+	Field coil	Green	Ex – e



5.3.5 Electrical connection of power and signal circuits

The electrical connection of power and signal circuits are realized in the terminal compartment of the transmitter. In it are intrinsically safe and non-intrinsically safe circuits, depending on the type of protection of the signal output circuits. The type of protection of the terminal compartment is Ex d.



The transmitter's mains is connected to the 3-fold terminal with the terminal markings L, N and PE. The connection of a protective conductor is required, even with a 24V DC supply voltage

5.3.5.1 Mains terminals

Terminal	230 / 115 V AC	24V DC	Function
L	Phase	+24V DC	Power supply
N	Neutral	0 V	Power supply
PE	Protective conductor	PE / Gnd	Equipment grounding

5.3.6 Characteristics of transmitter UMF3

5.3.6.1 Power circuit (terminals L, N and PE)

115V / 230V AC version:

Nominal voltage		AC	90 - 253	V
max. voltage	Um	AC	253	V

24V DC version:

Nominal voltage		DC	24 V ± 20 %	
max. voltage	Um	DC	60	V

5.3.6.2 Sensor circuits (electrodes- and field coil circuit)

5.3.6.2.1 **Electrodes circuits in type of protection** Ex ia IIB

Circuit	U_0	I_0	P_0	C_i	L_i
	(V)	(mA)	(mW)	(nF)	(mH)
Electrodes E1, E2	29,7	6,6	49	negligible	negligible
Equipment grounding FE	-	-	-	-	-

(Linear characteristic)

When mounted separately, the maximum values must be observed for the external inductance and capacitance of the intrinsically safe electrode circuit!

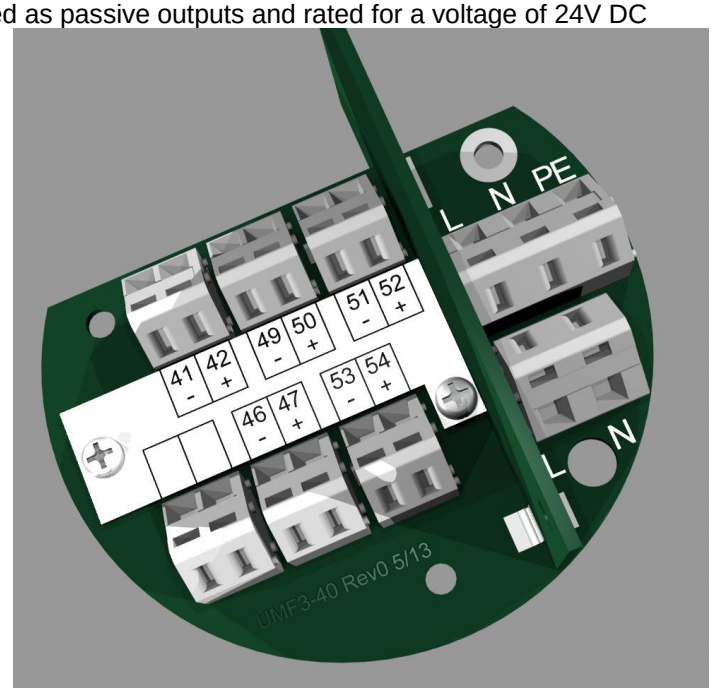
The intrinsically safe electrode circuit is grounded operationally via the measuring liquid. For separate mounting of the transmitter, a potential equalization between the transmitter and the sensor must be guaranteed.

5.3.6.2.2 **Field coil circuit** (terminals SP+ and SP-)

Nominal current	I_n		200	mA
Maximum current	I_{max}	(PIT*)	250	mA
Maximum current	I_{max}	(EPX / IS X.1XXEx)	200	mA
Maximum voltage	U_{max}		30	V

5.3.6.3 Non intrinsically safe passive signal output

All circuits are designed as passive outputs and rated for a voltage of 24V DC



5.3.6.3.1 Current output 4-20 mA, passive

Terminal	Polarity	Limits
42	+	30 V DC
41	-	3,2 mA – 21,6 mA

5.3.6.3.2 Binary output 1: pulse- or frequency

Terminal	Polarity	Limits
47	+	30 V DC
46	-	< 100 mA

5.3.6.3.3 Binary output 2: status output

Terminal	Polarity	Limits
47	+	30 V DC
46	-	< 100 mA

5.3.6.3.4 Binary output 3:

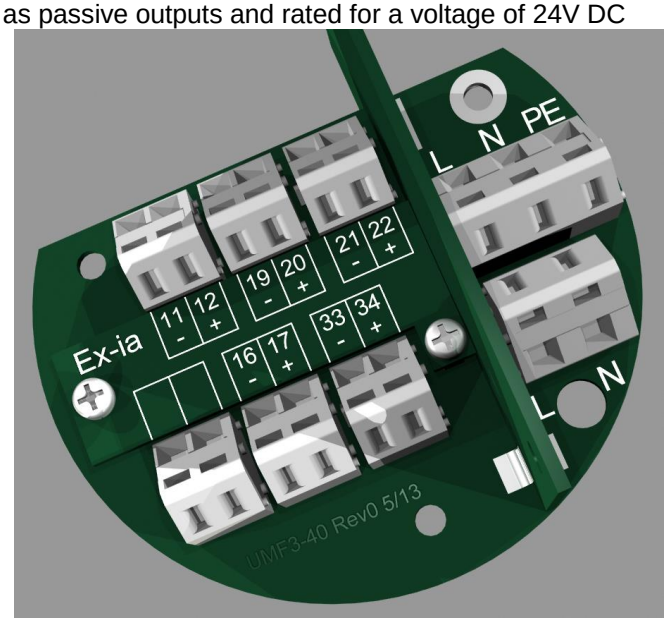
Terminal	Polarity	Limits
54	+	30 V DC
53	-	< 100 mA

5.3.6.3.5 Binary input:

Terminal	Polarity	Limits
52	+	30 V DC
51	-	< 3 mA

5.3.6.4 Signalausgangs-Stromkreise in der Zündschutzart Ex ia IIC

All circuits are designed as passive outputs and rated for a voltage of 24V DC



5.3.6.4.1 Passive current output in type of protection Ex ia IIC

Terminal	Polarity	Limits
12	+	Ui = 30 V Ii = 150 mA Pi = 1,3 W
11	-	Ci = 20 nF Li = 0,1 mH

5.3.6.4.2 Binary output 1: pulse- or frequency

Potential free optocoupler output circuit in type of protection Ex ia IIC

Terminal	Polarity	Limits
17	+	Ui = 30 V Ii = 200 mA Pi = 3 W
16	-	Ci = negligible Li = negligible

5.3.6.4.3 Binary output 2: status output

Potential free optocoupler output circuit in type of protection Ex ia IIC

Terminal	Polarity	Limits
20	+	Ui = 30 V Ii = 200 mA Pi = 3 W
19	-	Ci = negligible Li = negligible

5.3.6.4.4 Binary output 3:

Potential free optocoupler output circuit in type of protection Ex ia IIC

Terminal	Polarity	Limits
34	+	Ui = 30 V Ii = 200 mA Pi = 3 W
33	-	Ci = negligible Li = negligible

5.3.6.4.5 Passive Binary input:

Potential free optocoupler input circuit in type of protection Ex ia IIC

Terminal	Polarity	Limits
22	+	Ui = 30 V Ii = 200 mA Pi = 3 W
21	-	Ci = negligible Li = negligible

5.3.6.5 Ambient temperature range Ta

As a function of process temperature, way of installation and temperature class according to the following tables.
The influence of external temperature sources must be taken into consideration; the flange connecting to the process must be kept at a temperature lower than 100 °C. Further information can be found in the following table:

Compact version:

Process temperature - 20 °C to	Adapter temperature up to	Ambient temperature - 40 °C to	Temperature class
60 °C	60 °C	60 °C	T4
100 °C	100 °C	60 °C	T4
130 °C	100 °C	60 °C	T4
150 °C	100 °C	60 °C	T3

When the sensor is thermally insulated, it may only be insulated to the half of the adapter's length. It must always be ensured that the maximum temperature is lower than the allowed maximum.
Note: In special cases, e.g. with a sensor type EPX / IS X *** in accordance to FTZU 14 ATEX 0160, the min. ambient temperature is reduced to -35 °C. The rating plate has to be observed!

Compact Version with sensor EPX and IS X.1XXEx

Ambient temperature range	Temperature class
- 35 °C to 60 °C	T4 and T3

Remote version:

Ambient temperature range	Temperature class
- 40 °C to 60 °C	T4and T3

5.3.6.1 Surface temperature for dust application

T125 °C / T150 °C

6. Conditions for installation and safe use

6.1 Installation of electrical wires

6.1.1 Compact version

Sensor and transmitter are forming a unit and are electrically connected internally.
The electrical connection of the sensor circuits was carried out by the manufacturer. Furthermore, the proof of intrinsic safety for the electrode circuit (in accordance with EN 60079-14) was carried out by the manufacturer and is ensured. For the operator, no action is necessary for this circuit.

6.1.2 Remote version

In the separate version the sensor and transmitter are installed separately. Here, the complete measuring system can be mounted in zone 1 and 21 respectively

The electrical connection between the sensor and converters is similar to the standard version. However, the installation regulations of EN IEC 60079-14 "Electrical installations in hazardous areas" must be observed.

The field coil circuit is a non-intrinsically safe circuit and the electrode circuit must meet the requirements of intrinsic safety..

6.1.3 Conduit-system

When connecting the transmitter by an approved conduit system, the associated sealing devices must be installed close to the transmitter’s housing.

6.1.4 Cable glands

According to the type of protection and ambient temperature, approved cable glands and dummy plugs must be used. Furthermore, the cable used must be suitable for the prevailing ambient temperature range.

6.2 General requirement

a) If the conditions described here are not adhered to or if there is any inappropriate interference with the equipment, the manufacturer's warranties become void.

b) The conditions described in this instruction manual, and the conditions of use and permissible data which are stated on the prints/type labels of the respective equipment must be observed.

c) When selecting and operating equipment always pay attention to the general engineering rules.

d) Appropriate measures must be met to prevent unintentional activation, or inadmissible damage.

e) The equipment has only been approved for its appropriate and intended use in standard industrial atmospheres. Any breach of this rule leads to loss of warranty and manufacturer's responsibility!

f) It must be ensured that the equipment installed complies with the types of protection applicable to the relevant zones!

g) All electrical connected equipment must be suitable for the respective intended use.

h) The plant operator must ensure protection against lightning according to the local applicable regulations.

i) The device must be protected against the danger of falling objects.

j) For process connection, pressure resistant cable glands / plugs with a thread of M20 x 1.5 mm are used. By replacement, only equivalent and certified versions relevant to the on-site zones are to be used. Furthermore, the thread size is indicated on the rating plate.

6.3 Safety during commissioning and installation

a) The transmitter can be mounted in zone 1 and 2 as well as 21 and 22. The measurement circuits may be conducted into zone 0. The intrinsically safe circuits must be installed (from specialists) according to applicable regulations (verification of the specialists expert knowledge, protected installation of the intrinsically safe circuits, etc.).

b) It is to be ensured that intrinsically safe and non-intrinsically safe circuits are separately laid.

c) The devices complies with the requirements of the degree of protection IP66 to IP68 (depending of the used cable glands) and, where appropriate, must be protected against adverse environmental conditions.

d) The devices may only be used in dust-Ex-environments where no high level of electrostatic charging is to be expected, which could lead to propagating brush discharge. Under normal conditions such charging is not initiated by humans.

e) The installation of the intrinsically safe circuit requires a control drawing (system description), to be issued by the erector/operator.

f) The equipment is only to be connected when de-energised.

g) The equipotential bonding terminal of the device must be connected with a low inductive connection to the equipotential bonding of the system.

h) The device is electrically connected with a permanently connected cable. Care must be taken to assure a proper installation as well as to guarantee the IP protection class.

i) The equipment shall only be used as intended.

j) The inter-connection of the related and/or intrinsically safe equipment must be verified separately.

k) Any removable parts of the equipment which is got stuck (e. g. by frost or corrosion) may not be removed by force if potentially explosive atmosphere is present.

l) This instrument must be operated only in a fully mounted and intact enclosure; if the enclosure is damaged, the operation is not permitted.

m) Certified connection adapters may be used to convert the threads to an inch based thread. The references to the KLE (cable glands) apply analogous.

n) The sensors are to be electrostatically earthed. Electrostatic charging must be avoided.

o) Do not put stress on the system by vibration, bending or torsion.

6.4 Instructions for installation in hazardous areas

Inside potentially explosive atmosphere's assembly shall only be performed taking the local applicable rules of erection into account. The following conditions have to be observed (incomplete):

a) Assembly and maintenance is only to be carried out if the atmosphere is Ex-free and while observing the instructions valid in the operator's country.

b) Additional precautions have to be taken if the presence of hydro-sulphide, ethylene oxide and/or carbon monoxide is to be expected: those substances possess a very low ignition energy!

c) Where these substances and any substance of explosion group IIC are present, and where a potentially explosive atmosphere is expected to be present, only non-sparking tools may be used!

d) The electrical connections from the transmitter to the sensor is made by means of a connection flange. Care must be taken to assure a proper installation as well as to guarantee the IP protection class.

6.5 Important tightening torque

a) KLE (cable glands) to the enclosure	12 Nm
b) Cap nut to the KLE (cable glands)	8 Nm
c) Thread adapter to the enclosure	12 Nm
d) Thread adapter to the mounting flange	30 Nm
e) Enclosure lid	8 Nm
f) Flange screw M6	6 Nm
g) Flange screw M5	5 Nm

7. Maintenance and repair

7.1 Definition of terms according to IEC 60079-17:

Maintenance: defines a combination of any actions carried out to retain an item in, or restore it to, conditions in which it is able to meet the requirements of the relevant specification and perform its required functions.

Inspection: defines any action comprising careful scrutiny of an item carried out either without dismantling, or with the addition of partial dismantling as required, supplemented by means such as measurement, in order to arrive at reliable conclusion as to the condition of an item.

Visual inspection: defines an inspection which identifies, without the use of access equipment and tools, those defects, such as missing bolts, which will be apparent to the eye.

Close inspection: defines an inspection which encompasses those aspects covered by a visual inspection and, in addition, identifies those defects, such as loose bolts, which will be apparent only be the use of access equipment, for example steps, where necessary, and tools.

Detailed inspection: defines an inspection which encompasses those aspects covered by a close inspection and, in addition, identifies those defects, such as loose terminations, which will only be apparent by opening the enclosure, and/or using, where necessary, tools and test equipment.

7.2 Maintenance plan

Activity	Visual inspection	Close inspection	Detailed inspection
	every 3 months	every 6 months	every 12 months
Visual inspection of equipment for intactness	X		
removal of dust settlements	X if required in shorter intervals		
Check of electrical system for intactness and functionality			X
Check of entire system	User's responsibility		

7.3 Assembly and dismantling

When assembling and disassembling the general rules of engineering must be observed. Especially when working on electrical systems special safety conditions must be adhered to.

Warning
It must be stressed that inspection, maintenance and repair work may only be performed by experienced personnel, who have been mediated with the necessary knowledge of the various types of protection and installation methods, as well as relevant rules and principles of zoning!

a) Maintenance or replacement work may be carried out by qualified personnel only, i.e. personnel qualified according to TRBS 1203 or similar.

b) Only such auxiliary components may be used in potentially explosive atmospheres which meet all requirements of European and national directives and legislation.

c) By use inside potentially Ex-atmospheres or dust the equipment must be cleaned regularly. The intervals are to be defined by the operator in compliance with the environmental rules valid at the place of operation.

d) After maintenance and repair works have been performed, all barriers and notes removed for that purpose have to be put back in their original place.

e) If a fault in the equipment occurs, remove the equipment. The inner parts cannot be maintained by the customer. Send the equipment to the manufacturer for inspection.

f) Fuses, with the exception of the replaceable mains fuse, may not be replaced by the operator, since the effected Zener diodes must also be simultaneously replaced. This work requires a follow-up adjustment, which can only be carried out at the manufacturer's factory.

7.4 Fault elimination

Repair or modification of the approved Ex marked device may only be performed by specially trained, and authorized personnel. Except for the mains fuse no components of the measuring device may be replaced or repaired by the operator. A defective device may only be repaired by the manufacturer.

7.5 Disposal

Packaging material and worn components shall be disposed of according to the regulations applicable in the country of installation

8. Model code UMF3 (ex-relevant excerpt)

Modelcode description			
UMF3 - A B C D			
A		**Power supply**	
	1	90-253 V AC, 50/60 Hz	
	2	24 V DC ± 15%	
B		**Approval marking**	
	0	without EX aproval	
	A	Ex d e ib [ia IIC Ga] IIB T4/T3 Gb Ex tb ib [ia Da] IIIC T125 °C / T150 °C Db	UMF3 compact Version intrinsically safe outputs
	B	Ex d e ib IIB T4/T3 Gb Ex tb ib IIIC T125 °C / T150 °C Db	UMF3 compact Version standard outputs
	C	Ex d e [ib IIB Gb] [ia IIC Ga] IIB T4/T3 Gb Ex tb [ib Db] [ia Da] IIIC T125 °C / T150 °C Db	UMF3 remote Version intrisically safe outputs
	D	Ex d e [ib IIB] T4/T3 Gb Ex tb [ib] IIIC T125 °C / T150 °C Db	UMF3 remote Version standard outputs
	E	Ex d ib [ia IIC Ga] IIB T4/T3 Gb Ex tb ib [ia Da] IIIC T125 °C / T150 °C Db	UMF3 remote version with fixed sensor cable intrinsically safe outputs
	F	Ex d ib IIB T4/T3 Gb Ex tb ib IIIC T125 °C / T150 °C Db	UMF3 remote version with fixed sensor cable standard outputs
C		**Aproval type**	
	0	without Ex aproval	
	1	ATEX - only Ex atmosphere	
	2	ATEX - Ex atmosphere and dust	
	A	IEC Ex - only Ex atmosphere	
	B	IEC Ex - Ex atmosphere and dust	
D		**Outputs**	
	A	Standard: 1 current output 4 - 20mA (passive), HART 1 pulse output 1kHz, passive, 24V DC (Um = 30V DC) 1 status output, passive, 24V DC (Um = 30V DC)	not intrinsically safe outputs
	B	Extended: 1 current output 4 - 20mA (passive), HART 2 pulse outputs 1kHz, passive, 24V DC (Um = 30V DC) 1 status output, passive, 24V DC (Um = 30V DC) 1 binary input 24V DC	not intrinsically safe outputs
	C	Standard: 1 current output 4 - 20mA (passive), HART 1 pulse output 1kHz, passive, 24V DC (Um = 30V DC) 1 status output, passive, 24V DC (Um = 30V DC)	intrinsically safe outputs Ex-ia IIC / Ex-ia Da
	D	Extended: 1 current output 4 - 20mA (passive), HART 2 pulse outputs 1kHz, passive, 24V DC (Um = 30V DC) 1 status output, passive, 24V DC (Um = 30V DC) 1 binary input 24V DC	intrinsically safe outputs Ex-ia IIC / Ex-ia Da

9. Declaration of conformity

CE

K o n f o r m i t ä t s e r k l ä r u n g
Declaration of conformity

Heinrichs Messtechnik GmbH, Robert-Perthel-Straße 9, 50739 Köln

Gerät:	**magnetisch-induktives Durchfluss-Messsystem**
Device:	**magnetic inductive flowmeter**
Sensor/ sensor:	EPX / IS X.1XX EX
Umformer / transmitter:	UMF3

Hiermit erklären wir, dass soweit zutreffend, oben genanntes Messsystem den Anforderungen der EG-Richtlinien 2014/30/EU und 94/9/EG einschließlich allen bis heute veröffentlichten Änderungen bzw. Nachträgen entspricht und mit den folgenden Normen oder normativen Dokumenten übereinstimmt.

EMV- Richtlinie 2014/30/EU

EN 61000-6-2:2011	Störfestigkeit Industriebereich / immunity for industrial environments
EN 61000-6-3:2011	Störaussendung Wohnbereich / emissions residential environments
EN 55011:2009 +A1:2011	Störaussendung: Grenzwerte und Messverfahren / group 1 class B
EN 61326-1:2013	Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen

Ex-Richtlinie 94/9/EG

EN 60079-0:2011, Ed.6	Allgemeine Bestimmungen
EN 60079-1:2007, Ed. 6	Druckfeste Kapselung "d"
EN 60079-7:2006, Ed. 4	Erhöhte Sicherheit „e“
EN 60079-11:2011, Ed. 6	Eigensicherheit "i"
EN 60079-31:2013, Ed. 2	Staubexplosionsschutz durch Gehäuse „t“

Name und Anschrift der benannten Stellen der QS-Überwachung

DEKRA EXAM GmbH
Dinnendahlstraße 9
D-44809 Bochum
Identifikationsnummer RL 94/9/EG: 0158

TÜV SÜD Industrie Service GmbH
Westendstraße 199
D-80686 München
Identifikationsnummer RL 97/23/EG: 0036

Köln, den 18.02.2016

Winfried Meissner
(Explosionsschutzbeauftragter)

10. Magnetic-inductive flowmeter

The transmitter UMF3 may be used in conjunction with magnetic flowmeter sensors series EPX (inliner) and PIT (insertion probe). The assembly instructions and ex-relevant technical data are each documented in the instructions / supplementary operation manual of the sensor.

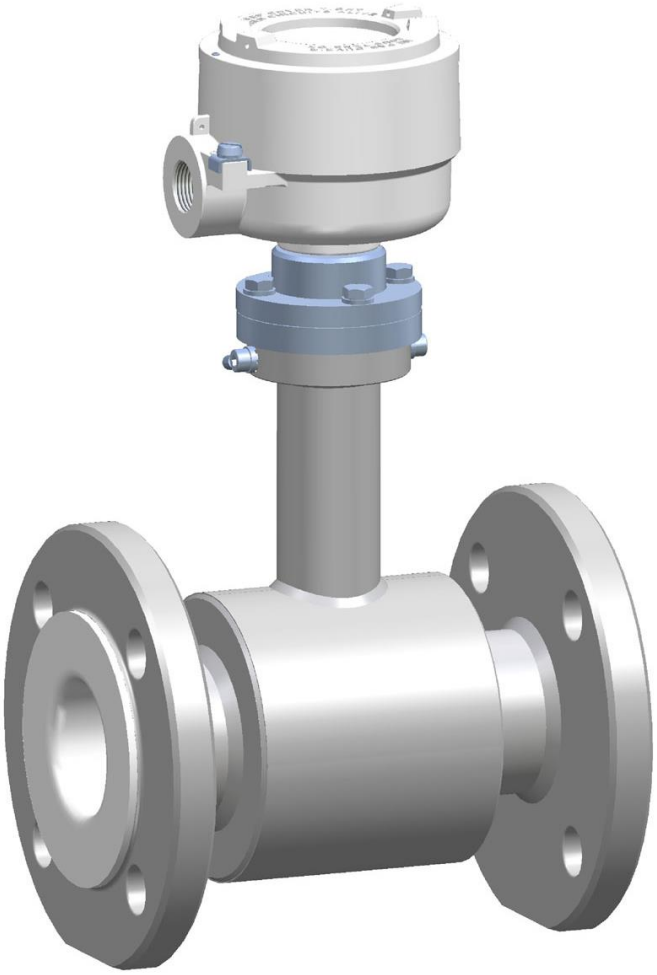
Sensor für
magnetic induktive flowmeter

EPX

UMF3

Ex supplement operation manual

EPX
IS X.1XXEx



11.1 Application

The induction sensor EPX / IS X.1XXEx is designed to measure volume flow rates of electrically conductive liquids in closed piping systems. Measurements can be performed over a wide range of flow rates (0.1 to 10 m/s), with high measurement accuracy in both flow directions. For a reliable measurement the minimum required conductivity of the measured medium is 20 µS/cm. Besides standard applications, the sensor is primarily intended for use in explosive atmospheres (see the specifications below).Sensor can be assembled in combination with transmitter UMF3 (compact version) or separately (remote version).

11.2 Measurement principle

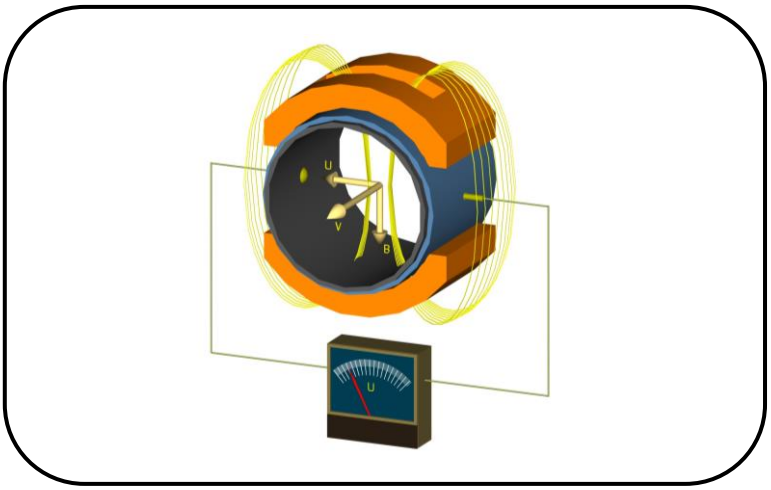
The function of an induction flow meter is based on Faraday's induction law. The meter sensor consists of a non-magnetic and non-conductive tube with two embedded measuring electrodes to pick up the induced voltage. To create an alternating magnetic field, two coils are fitted onto the tube in parallel with the plane defined by the active parts of the measuring electrodes. If a conductive liquid flows through the magnetic field **B**, the voltage **U,** proportional to the flow velocity **v** and the conductor length **l,** will appear on the measuring electrodes.

The following applies:

$$\mathbf{U = B \times l \times v}$$

(Vector)

With U Induced voltage
B magnetic flux density
l distance between the measuring electrodes
v liquid flow velocity



Since the magnetic flux density and distance between the electrodes are constant, the induced voltage is proportional to the liquid flow velocity in the tube. The value of the volume flow rate can then be readily determined as a product of the flow velocity and cross section of the tube, **Q = v x S**

11.3 Technical description

Different sensor design versions are intended for different types of measured liquids/fluids and their operational parameters. The way the sensor is installed in the fluid piping is given by the flanges used.

The selection of the sensor construction material should ensure the sensor resistance to the measured liquid that may have pH in the range 0 to 14 (acidic - alkaline fluids), contain abrasive particles or it may be an organic substance with detrimental effect on the sensor lining.

The type of measured fluid is of key importance in selection of the materials for the sensor lining, measuring electrodes, earthing electrode and earthing rings. Equally important is the temperature of the measured fluid. The excitation coils and electrodes are protected against the environmental effects by encapsulation in a hermetic cover made of painted steel or stainless steel. The same applies to the sensor flanges.

The electric connections to the measuring and earthing electrodes and to the excitation coils are led to the sensor through the adapter neck; a steel tube provided with a flange serving the purpose of mechanical connection to the electronic unit of the induction flow meter.

Induction sensor of the type EPX / IS X.1XXEx consists of the measuring pipe section of rated dimension DN15 to DN300, measuring electrodes, electromagnetic excitation coils and an adapter, i.e. a steel tube provided with a flange and serving the purpose of mechanical connection to the transmitter (compact version) of the induction sensor or to a terminal box (remote version). The measuring pipe section is lined on the inside with a material of suitable thermal resistance (see section 11.8 “Selecting the sensor tube lining” on page 32). The measuring electrodes shall be connected to form a non-sparking circuit of intrinsic safety (protection class "ia“). The electromagnetic coils are attached to the sheathed pipe section; the coils are designed to meet the requirements of protection class "e" increased safety.

In the remote version the head section consists of an approved junction box in protection class "e" or "tb IIC". It contains approved terminals. For cable entries an approved cable gland with M 20x1.5 mm thread is used assuring the type of protection class "e”.

11.4 Technical parameters

The assembly or maintenance work on the sensor and transmitter shall be performed in a non-explosive environment. Before disassembling, the flowmeter must be de-energized.
No strong electromagnetic fields are permitted in the sensor vicinity. Regarding classification of explosion risks, the flow-through sensor section is considered a non-defined zone. In operation, the internal sensor space shall always be fully flooded. Upon each dismantling of the electronic unit, replace the sealing O-ring on the sensor adapter neck.

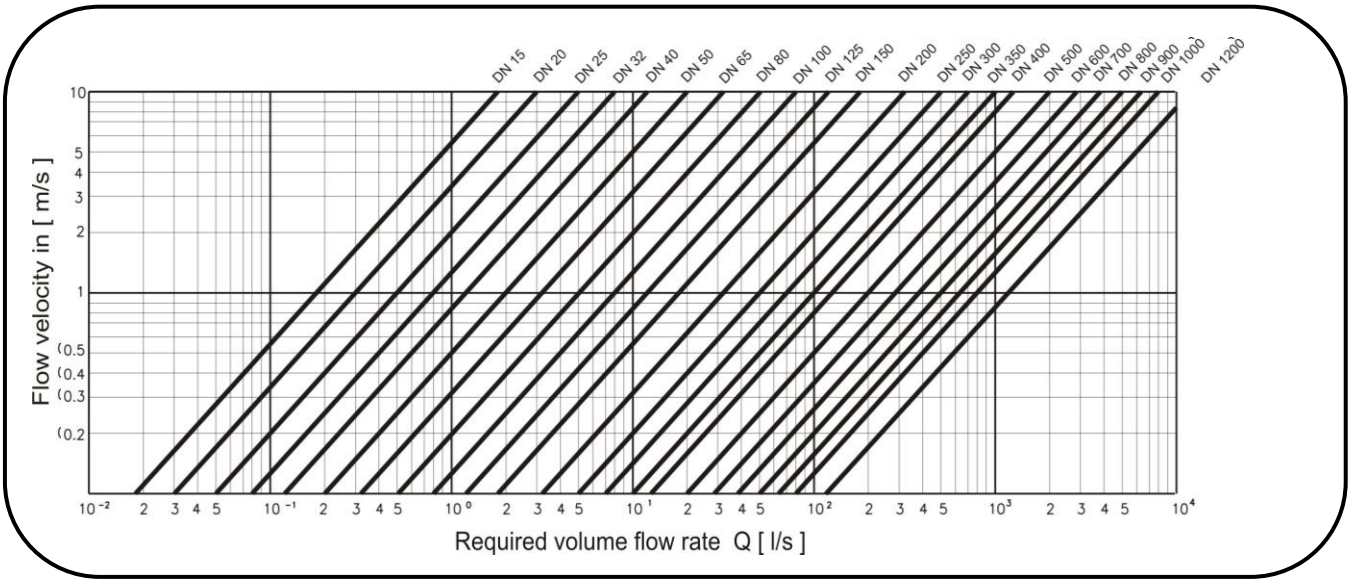
11.5 Selection of correct sensor size

The following table shows minimum and maximum flow rates for various sensor sizes and flow velocities ranging from 0.1 to 10 m/s. The best operational properties will be achieved at the flow-velocity range of 0.5 to 5 m/s. For lower flow velocities, the measurement accuracy is poorer while at higher flow velocities the turbulences at contact edges may cause undesirable interference.

Minimum and maximum flow rates for various sensor sizes
Qmin corresponds to flow velocity 0.1 m/s
Qmax corresponds to flow velocity 10.0 m/s

DN	l / s		m3 / h	
	Qmin	Qmax	Qmin	Qmax
15	0,018	1,8	0,065	6,5
20	0,0333	3,33	0,12	12
25	0,05	5	0,18	18
32	0,0833	8,33	0,30	30
40	0,125	12,5	0,45	45
50	0,2	20	0,72	72
65	0,3333	33,33	1,2	120
80	0,5	50	1,8	180
100	0,7777	77,77	2,8	280
125	1,1944	119,44	4,3	430
150	1,8055	180,55	6,5	650
200	3,194	319,4	11,5	1150
250	5	500	18	1800
300	7	700	25,2	2520

Operational flow rates and flow velocities for various sensor sizes:



11.6 Operational pressure of measured liquid

The sensor has to be dimensioned depending on maximum occurring pressure. The standard flow-sensor versions have the following pressure ratings:

With flanges EN1092-1

Sensor size	Pressure rating
DN 15 – DN 50	PN 40
DN 65 – DN 200	PN 16
DN 250 – DN 300	PN 10

With flanges ASME B16.5

Sensor size	Pressure rating
NPT ½“ ÷ 12“	Class 150

The permissible operating pressure may be limited by the prevailing temperatures and the type of flanges used.

11.7 Selecting electrode material

In most cases, electrodes made of stainless steel, quality grade 1.4571 (316Ti) are satisfactory. However, in special applications it may be necessary to select a higher-quality material. On request, the sensor manufacturer may supply electrodes made of Hastelloy C276, titanium, tantalum, platinum-rhodium or other materials.

11.8 Selecting the sensor tube lining

The selection of the sensor lining material depends on the operational parameters of the measured liquid.

11.8.1 Technical rubber (MG)

Soft rubber with high abrasion resistance. It is suitable for low chemical aggressive environments (non-oxidizing environment), the medium may contain abrasive particles and it is very resistant against dilatation and abrupt changes in temperatures -35°C to 80°C.

11.8.2 Hard rubber for potable water (NG)

Hard rubber is suitable for most applications concerning water management and water supply. Hard rubber is certified for contact with potable water. It is also suitable for acids and alkali of mean concentration at an operating temperature of 5°C to 80°C.

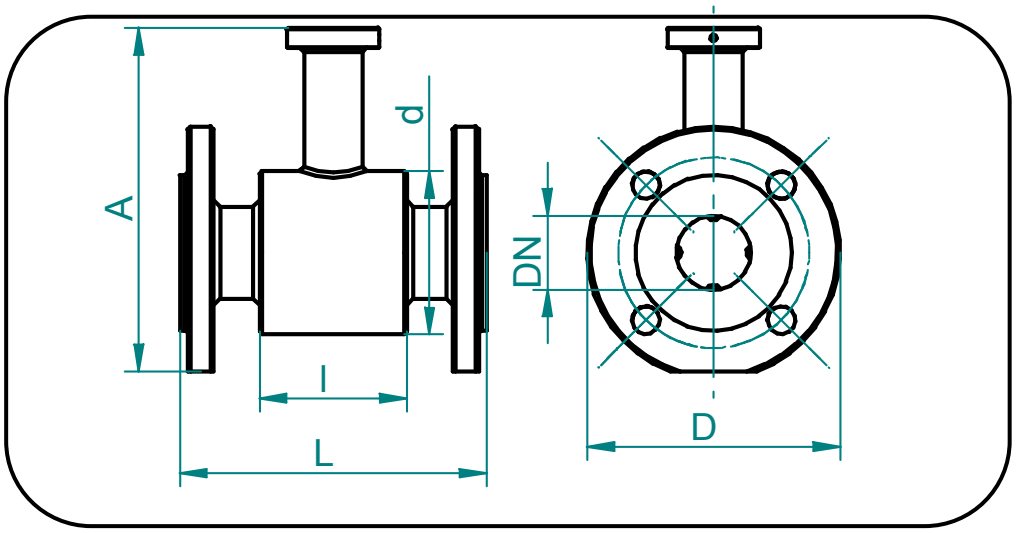
11.8.3 PTFE

PTFE lining is a universal solution for highly corrosive liquids and temperatures ranging from –35°C to +123°C for sensor size DN15 to DN25 and to +139 for sensor size DN32 to DN300. Typical applications are found in the chemical and food processing industries.

11.8.4 E-CTFE

E-CTFE lining is a universal solution for sensors from DN 250 and larger for corrosive liquids and temperatures ranging from –35°C to +114°C. Typical applications are in the chemical processing industries.

11.9 Sensor dimensions



11.9.1 Flanges according to standard EN 1092-1.

	DN	D	d	A	L	l	Weight* [kg]
PN40	15	95	62	164	200	66	3
	20	105	62	170	200	66	3
	25	115	72	180	200	96	3
	32	140	82	199	200	96	4
	40	150	92	209	200	96	4
	50	165	107	223	200	96	6
PN16	65	185	127	244	200	96	9
	80	200	142	260	200	96	14
	100	220	162	280	250	96	16
	125	250	192	310	250	126	19
	150	285	218	340	300	126	25
	200	340	274	398	350	211	41
PN10	250	395	370	480	450	211	54
	300	445	420	535	500	320	77

* The sensor weight data are only approximates.

11.9.2 Flanges according to standard ASME B16.5

	NPT	D	d	A	L	l	Weight* [kg]
Class 150	1/2"	88.9	62	172	200	66	3
	3/4"	98.6	62	177	200	66	3
	1"	108	72	187	200	96	3
	1 1/4"	117.3	82	197	200	96	4
	1 1/2"	127	92	207	200	96	4
	2"	152.4	107	227	200	96	6
	2 1/2"	177.8	127	249	200	96	9
	3"	190.5	142	263	200	96	14
	4"	228.6	162	292	250	96	16
	5"	254	192	320	250	126	19
	6"	279.4	218	346	300	126	25
	8"	342.9	274	405	350	211	41
	10"	406.4	370	485	450	211	54
	12"	482.6	420	548	500	320	77

* The sensor weight data are only approximates

11.10 Flow sensor specifications

Sensor type	EPX / IS X.1XXEx
Sensor size	Flanged sensors DN 15 ÷ 300 , NPT ½“ ÷ 12“
Operational pressure	*With flange EN 1092-1* 40 bar at RT* (DN 15 ÷ 50/ PN40) 16 bar at RT* (DN 65 ÷ 200/ PN16) 10 bar at RT* (DN 250 ÷ 300/ PN10) *With flange ASME B16.5* 15,9 bar at -29° to +38 °C (NPT ½“ to 10“ Class 150) 10,3 bar at -29° to +38 °C (NPT 12“ Class 150)
Mechanical connection	Flanges according to EN 1092-1, ASME B16.5, Others
On flanges	On flanges
Coils excitation	Umax = 30 V, Imax = 200 mA
Coils excitation	Pulse, 0,5 Hz – 30 Hz
Flow velocity of measured liquid	0,1 m/s to 10 m/s
Temperature of medium	-35°C to +139 ºC (according to used lining and sensor size)
Ambient temperature	-35°C to +60 °C
Minimum conductivity of measured liquid	20 µS/cm, 5 µS/cm in special applications
Lining	Soft rubber (TG) Technical rubber (MG) Ebonite for potable water (EB) Hard rubber for potable water (NG) PTFE E - CTFE
Measuring electrodes	Stainless steel, grade 1.4571 (316Ti) – standard Hastelloy C276 Titanium Tantalum Platinum-Rhodium Others
Protection class	IP 67
Storage temperature	-10 ºC to +70 ºC at max. relative air humidity 70 % (for PTFE, E-CTFE, MG) +5 ºC to +70 ºC at max. relative air humidity 70 % (for NG)

* RT – reference temperature is accordance to EN1092-1 in the range of temperature -10°C ÷ +50°C

11.11 Assignment of temperature classes

determination of the maximum surface temperature with respect to the fluid temperature and type of lining material used:

DN 15 – DN 25

Lining	*Max. Temperature of measured medium*	*Temperature class 2G*	*Surface temperature 2D*
MG	-35°C to +48°C	T6	+80°C
NG	+5°C to +48°C	T6	+80°C
PTFE	-35°C to +48°C	T6	+80°C
PTFE	-35°C to +63°C	T5	+95°C
PTFE	-35°C to +98°C	T4	+130°C
PTFE	-35°C to +123°C	T3	+155°C

DN 32 - DN300

Lining	*Max. Temperature of measured medium*	*Temperature class 2G*	*Surface temperature 2D*
MG	-35°C to +64°C	T6	+80°C
NG	+5°C to +64°C	T6	+80°C
E-CTFE and PTFE	-35°C to +64°C	T6	+80°C
E-CTFE and PTFE	-35°C to +79°C	T5	+95°C
E-CTFE and PTFE	-35°C to +114°C	T4	+130°C
PTFE	-35°C to +139°C	T3	+155°C

11.12 Terminal box – technical specification

The terminal box is designed for operation in explosive atmospheres where it meets the specifications of protection class "e". It contains certified WAGO terminals and other components of the WAGO type series 264. Connected to the terminals are signals from the meter sensor and conductors providing connections to the electronic unit of the meter. The related technical specifications and information concerning the limitations on the terminal box use are contained in the PTB 98 ATEX 3129 U and IECEx PTB 04.0003U certificates.

11.13 Cable bushing - technical specification

The connection conductors from the terminal box are led through a screw-on cable bushing designed for operation in explosive atmospheres and meeting the specifications of protection class "e" or "tb IIIC“. THE CABLE BUSHING IS NOT PART OF THE INDUCTION SENSOR, EPX / IS X.1XXEx or the terminal box. The cable bushing used to accommodate the connection conductors to the terminal box shall meet at least the requirements of standards EN 60079-0:2012, EN 60079-7:2007 and EN 60079-31:2009. The bushing connection screw size is M20x1.5 where the bushing position shall be secured by at least 5 complete screw turns.

11.14 Ex component marking

Devices that can be used for use in hazardous areas is marked accordingly on the nameplate. Since the sensor and the converters are certified separately, the sensor and the converter are marked individually with their own rating plates

Ex II 2G Ex e ia IIC T6-T3 Gb

Ex II 2D Ex tb IIIC T** Db

All the important characteristics of the sensor are located on the rating plate. To ensure that all electrical parameters are adhered to, the sensor may only be operated on the supplied UMF3 transmitter from the company Heinrichs Messtechnik

Only devices with Ex markings may be operated in hazardous areas.

11.15 Electrical characteristics of the Sensors

Ui ≤ 30V
Ii ≤ 100mA
Ci and Li negligible

The sensor possesses none of its own energy sources.

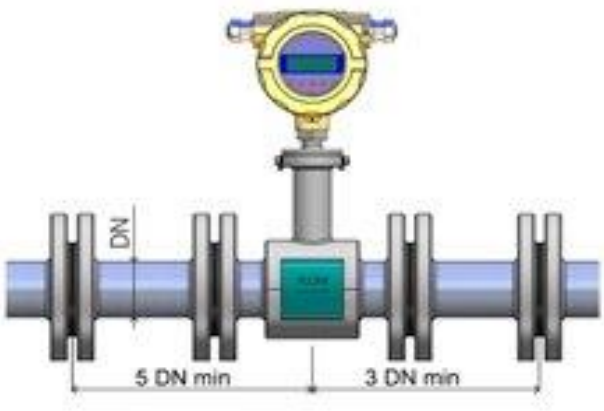
11.16 Meter application rules

11.16.1 Placing the sensor in the piping system

When medium flows through the sensor in the direction indicated by an arrow on the, then a positive flow will be displayed on the transformer. In the opposite direction (back-flow), a negative flow is indicated by means of a minus sign.

11.16.1.1 Standard

The meter performs at its best if the liquid flow through the piping is well stabilised; it is therefore necessary to observe specific rules for the sensor placement in the piping. In the contact planes between the sensor and the adjoining piping sections there should be no edges as these cause flow turbulence. Make sure that straight piping sections are provided before and after the sensor; their required length is proportional to the inner diameter of the piping concerned.



Required straight piping sections

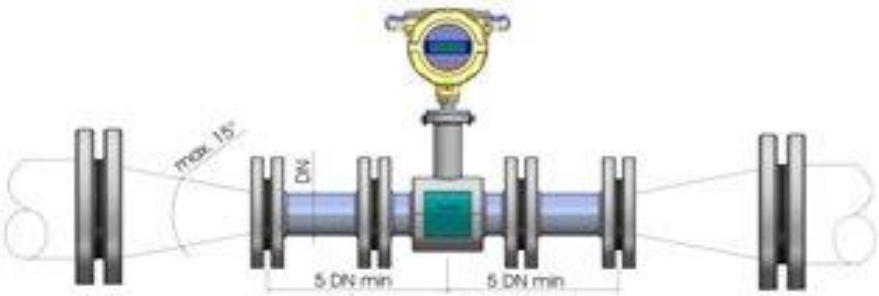
If more than one flow-disturbing element such as pipe bends or fittings are located near the sensor, it is advised to multiply the minimum length of straight piping section, on the sensor side concerned, with the number of such elements.

As required by clause 4.2.1 of standard EN 29104, the inner diameter of the connected pipe should not differ by more than 3% from that of the sensor.

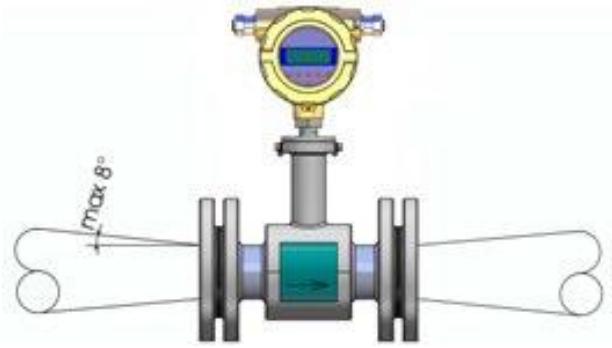
In the cases of bi-directional flow-rate measurement, the same conditions concerning flow stability shall be met at the input and output sides of the sensor.

Chemical injection or batching units (such as chlorine compound injector) should not be located on the input side of the sensor. The insufficient homogeneity of the flowing liquid affects the flow-rate values indicated by the meter in the form of signal noise.

11.16.1.2 Pipe narrowing



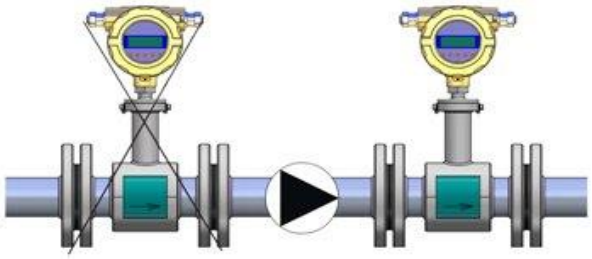
In cases where the inner pipe diameter is larger than that of the meter sensor, it is necessary to use conical reduction pieces, whereby the angle of taper shall not exceeding 15° (see the picture). In cases of bi-directional flow measurement, the minimum length of straight piping sections on both sides of the sensor is 5 DN. In horizontal sensor installations, to prevent bubbling, use eccentrically-fitted reduction pieces (see standard EN ISO 6817).



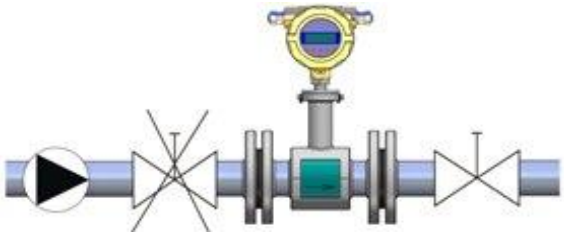
Pipe narrowing sections with angles not exceeding 8° can be taken for straight sections.

11.16.1.3 Pumps & valves

In cases where liquid is pumped, the flow sensor should always be placed on the output side of the pump to prevent negative pressure in the piping which may damage the sensor. The minimum length of the straight piping section between pump and sensor should be at least 25 DN.

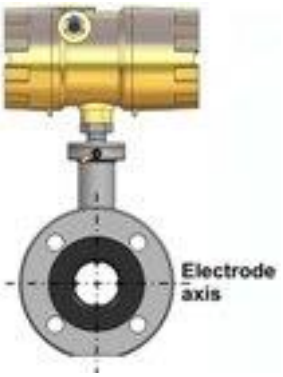


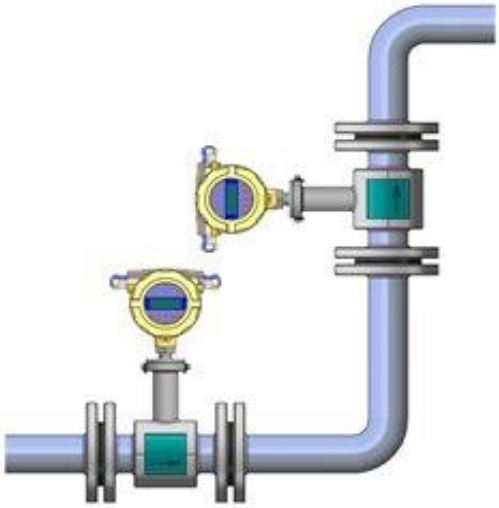
For the same reason, the sensor should always be placed before the closing valve in the piping.



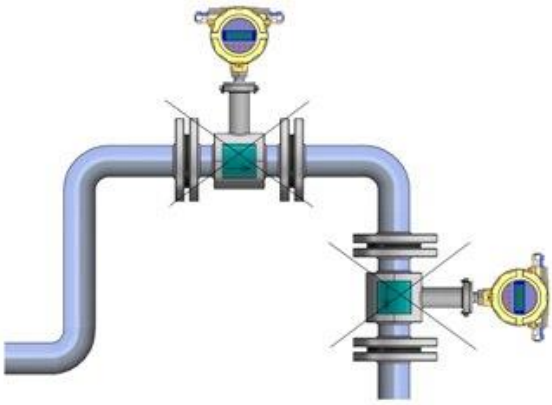
11.16.1.4 Vertical and horizontal mounting

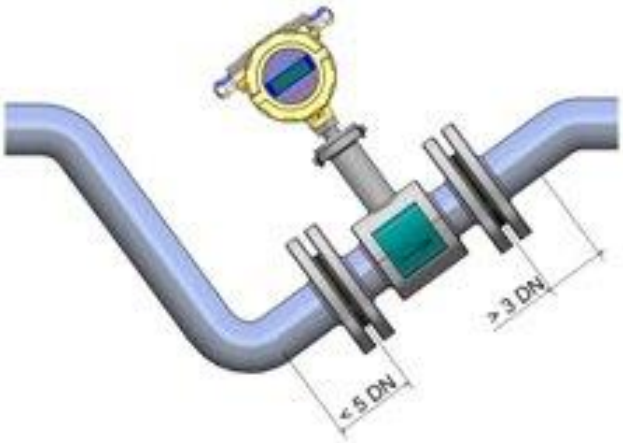
The sensor can be fitted into the piping either in a horizontal or vertical position. It should however always be ensured that the electrode axis is always mounted in the horizontal position and, when the sensor is mounted in a horizontal position, that the flange section for the attachment of the transmitter is facing upwards.





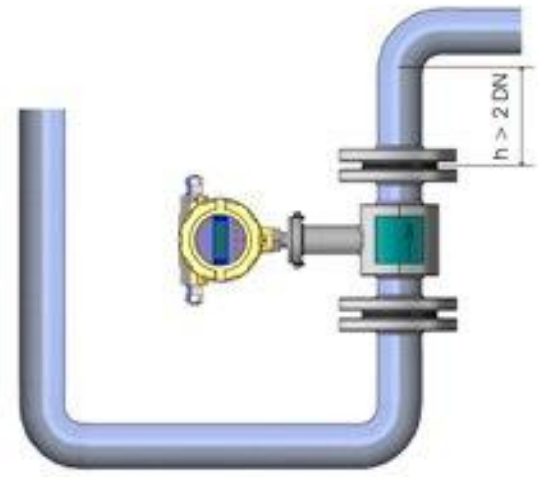
In cases where the sensor is mounted in a vertical position, the flow direction shall always be upwards





To ensure the meter functions correctly at all times, the sensor tube must be completely filled with the liquid to be measured. Also no air bubbles may be permitted to accumulate or develop within the sensor tube. For these reasons the sensor shall never be placed in an upper pocket of the piping or in a vertical piping section where the flow direction is downwards.
In piping systems where complete flooding of the piping cannot always be guaranteed, consider placing the sensor in a bottom pocket where a complete flooding is ensured.

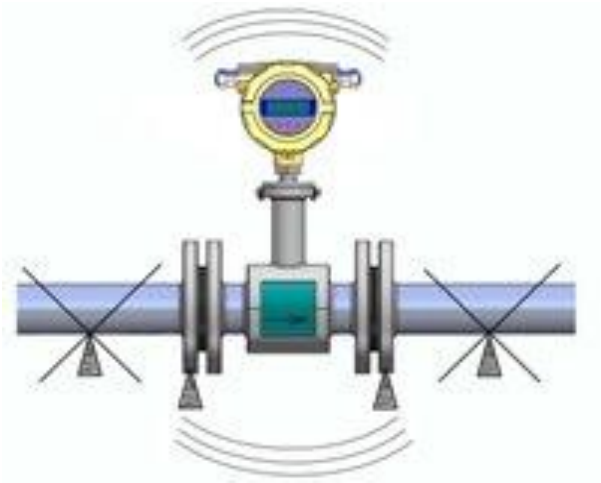
If the sensor is located near an open discharge point, the discharge point must be by at least 2 DN higher than the highest part of the sensor.



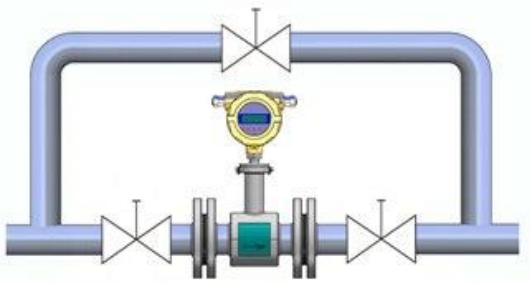
Sensor placement near open discharge point

11.16.1.1 Avoiding vibrations

To prevent vibrations and damage to the sensor, make sure that the adjoining piping is clamped / supported as close to the sensor as possible,



11.16.1.2 Bypassing the sensor

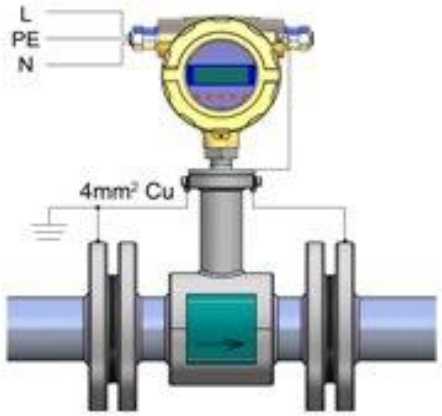


In applications where continuous liquid flow is essential, it is advisable to provide a bypass to allow for sensor servicing. A sensor bypass may also be a reasonable solution in cases where long piping sections would have to be emptied in order to dismantle the flow sensor

11.16.2 Grounding the Sensor, Potential equalization

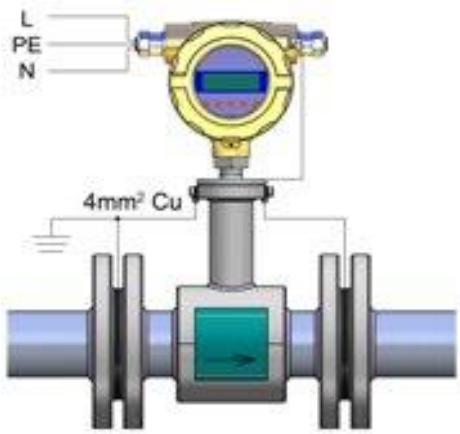
For the meter to function correctly, the sensor and adjoining piping sections must be grounded with a low-impedance conductor to the equipotential bonding point (PE) and the protection conductor of the power source. The overall arrangement shall be such that the potential of the measured liquid at the sensor input and output sides are as close as possible to that of the earth (PE).

11.16.2.1 Potential equalization in metal piping



11.16.2.1 Potential equalization in plastic piping

Should the adjoining piping sections be non-conductive, earthing rings or similar arrangements must be used to ensure that the electrical potential of the measured liquid is put to earth.



11.16.2.1 Getrennter Aufbau von Umformer und Sensor

To ensure potential equalization by the remote meter version, it is recommended to connect the flow sensor body to the transmitter using a copper conductor with a cross-section of 4mm².

11.16.2.2 Thermal isolation of the sensor

The sensor can also be provided with a thermal insulation for hazardous areas. However, the insulation should only cover half of the connecting tube, to which the terminal box or the transmitter is mounted.

The maximum surface temperature of insulated and non-insulated sensors is specified in section 11.11 Assignment of temperature classes on page 36. The maximum temperature of the insulated sensor was determined by thermal test series in accordance with the EN 60079-0. For this purpose the sensor was

wrapped in 40 mm thick, laminated strips of mineral wool with vertically oriented fibers, wrapped on aluminum foil and reinforced with a glass mesh.

Declared values of thermal conductivity coefficients λ_D according to EN ISO 13787			
°C	50	100	150
$Wm^{-1}K^{-1}$	0,046	0,056	0,070

11.16.2.3 Heating the Sensor

To avoid crystallization in the measuring tube, the sensor can also be heated by the operator from the outside. When using an electric heater, it must be suitable for use in hazardous areas.

The operator must ensure that the temperature of the external heating does not exceed the maximum permitted device design process temperature as well as the maximum temperature according to the temperature class of the hazardous area in question.

The maximum medium temperature is indicated on the rating plate of the sensor.

In addition, the operator must consider the exposure to hot surfaces in accordance with the requirements of EN 1127-1 (Explosion prevention and protection – basic concepts and methodology) section 5.2 and 6.4.2.

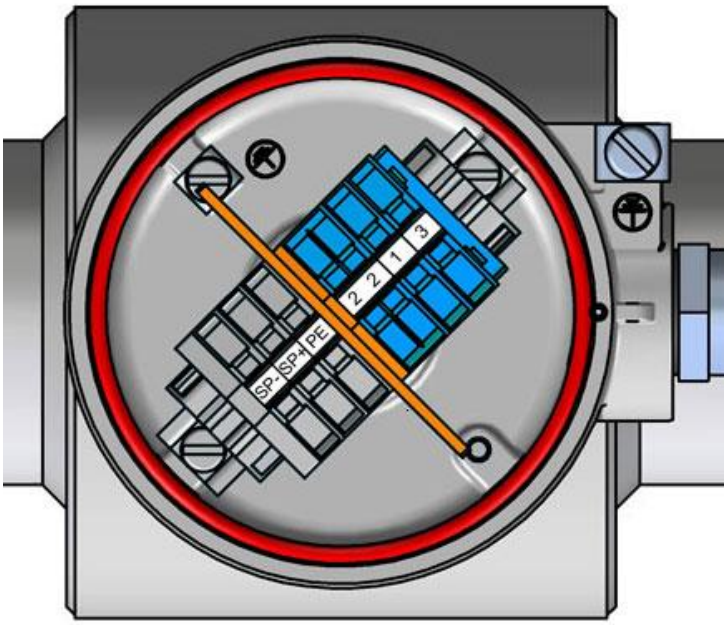
11.16.3 Sensor connection

The terminal box lid is secured in position by a setscrew located at the border of the lid. The box lid can only be removed in a non-explosive environment. Prior to replacing the lid make sure that the lid threads are free of any contaminants that might damage them. When handling the lid or its securing crew, never use excessive force. The operational temperature stress may result in additional tightening of the lid connection. In such cases, use a hammer with a rubber head and knock gently on the lid to release the tight screw fit.

The connecting wires between the sensor and terminals are part of the internal wiring and may only be handled by the manufacturer.

11.16.4 Terminal assignment:

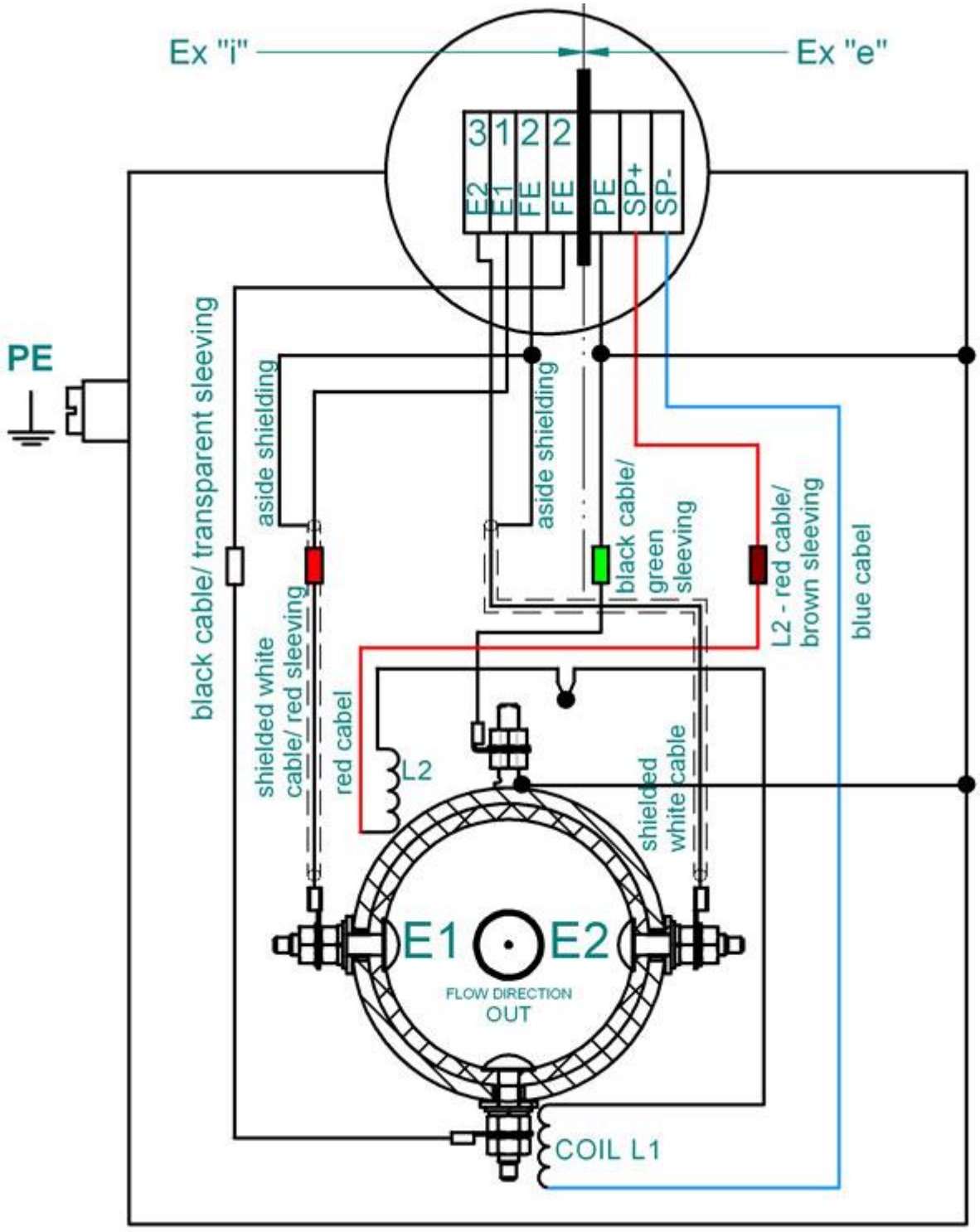
Terminal:	Function:
SP-, SP+	Field coil (Ex e)
PE	Screen, guard earthing conductor (outer screen)
2	FE (sensor earthing conductor) (inner screen)
1,3	Electrodes (Ex i)



Junction Box with terminals

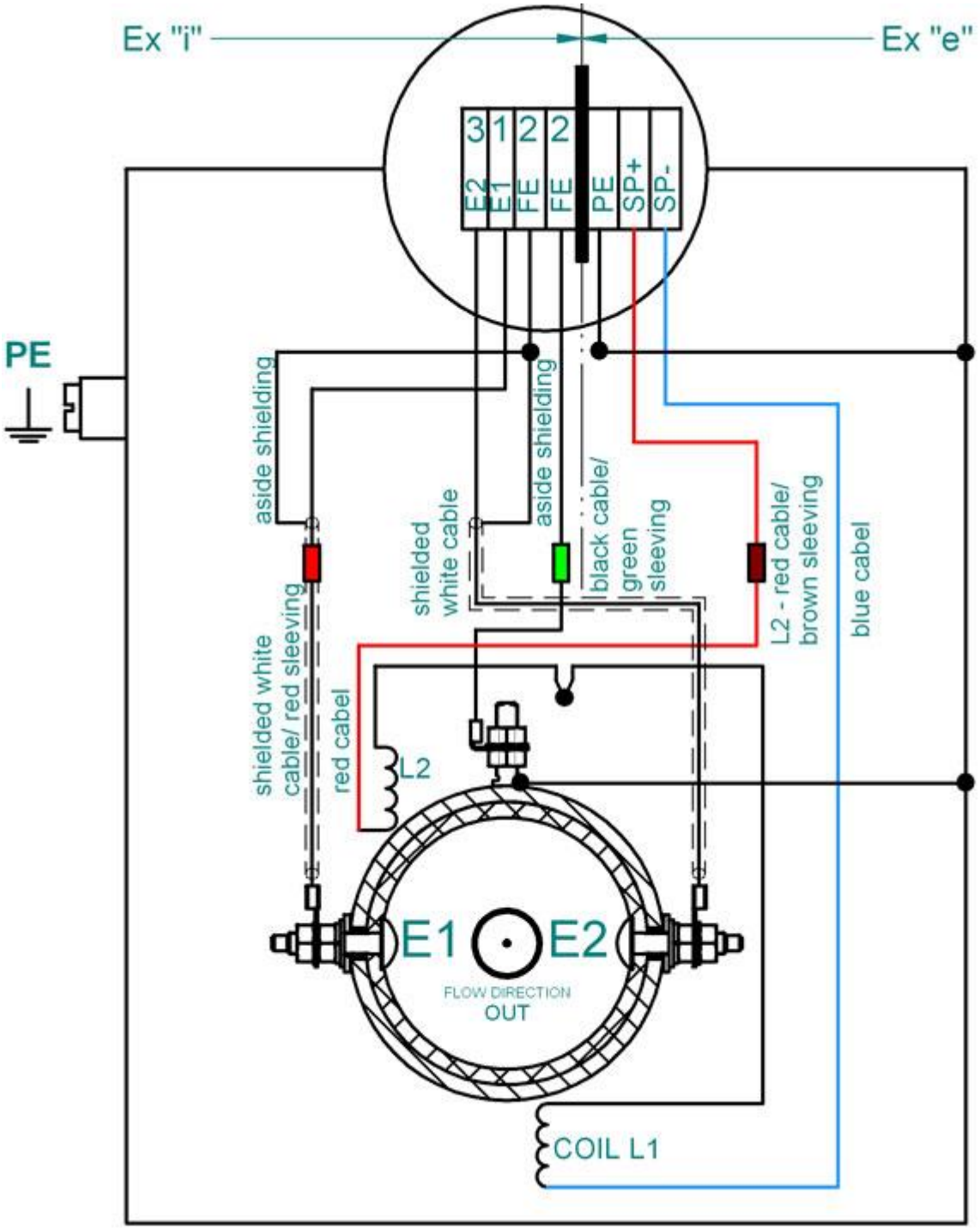
For the assignment of wire colors and circuits see Section 5.3.4 Version with cable tail.**Fehler! Verweisquelle konnte nicht gefunden werden.**

11.16.4.1 Internal wiring of sensor with ground electrode



Sensor schema internal wiring– variant with a ground electrode

11.16.4.1 Internal wiring of sensor without ground electrode



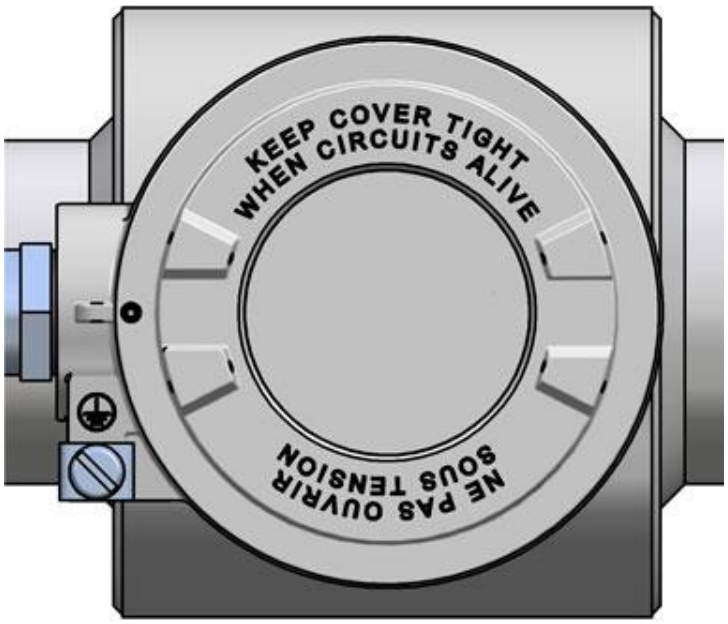
Sensor schema internal wiring– variant without ground electrode

11.17 Warning labels

11.17.1 Rating plate on the terminal box

DO NOT OPEN WHEN ENERGISED OR IN EXPLOSIVE ENVIRONMENTS

11.17.2 Warning notes on the terminal box:



The lid of the terminal box must not be opened if the transmitter is turned on and the operating voltage is present.