



OPTISONIC 7300 / 8300 Supplementary instructions

Ultrasonic gas flow meter

Addendum for hazardous areas. These additional instructions are an extension to the OPTISONIC 7300 and OPTISONIC 8300 quick start and handbook



1 Introduction	4
<hr/>	
1.1 Safety instructions from the manufacturer	4
1.1.1 Copyright and data protection	4
1.1.2 Disclaimer	4
1.1.3 Information concerning the documentation	5
1.1.4 Warnings and symbols used	6
1.2 Safety instructions for the operator	7
1.3 Approval	8
1.4 OPTISONIC 7300 C/...-Ex	8
1.5 OPTISONIC 7000...-Ex	8
1.6 OPTISONIC 8000...-Ex	9
1.7 GFC 300 F/...-Ex	9
1.8 Ultrasonic gas transducers	9
1.9 Technical data	10
1.10 Marking codes	10
1.11 Marking labels	12
2 Temperature limits	16
<hr/>	
2.1 General	16
2.2 GFC 300 F/...-Ex	16
2.3 OPTISONIC 7300 C/...-Ex	16
2.4 OPTISONIC 7000...-Ex	17
2.5 OPTISONIC 8000...-Ex	17
3 Connection of separate systems	18
<hr/>	
3.1 General	18
3.2 Cable marking	18
3.2.1 Sensor	18
3.2.2 Converter	20
3.3 Equipotential bonding	21
4 Electrical connections	22
<hr/>	
4.1 General	22
4.2 Non-"Ex i" I/O connections	25
4.3 "Ex i" I/O connections	27
5 Maintenance	29
<hr/>	
5.1 Maintenance	29
5.2 Before and after opening	29
5.3 Replacement of mains fuse	30
5.4 Exchange of electronics unit	31
5.4.1 Field version	32
5.5 Service / repair information	34

5.6 Form (for copying) to accompany a returned device	35
5.7 Disposal	35

1.1 Safety instructions from the manufacturer

1.1.1 Copyright and data protection

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1.1.2 Disclaimer

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This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

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

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.1.3 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

1.1.4 Warnings and symbols used

Safety warnings are indicated by the following symbols.

**DANGER!**

This information refers to the immediate danger when working with electricity.

**DANGER!**

This warning refers to the immediate danger of burns caused by heat or hot surfaces.

**DANGER!**

This warning refers to the immediate danger when using this device in a hazardous atmosphere.

**DANGER!**

These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.

**WARNING!**

Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.

**CAUTION!**

Disregarding these instructions can result in damage to the device or to parts of the operator's plant.

**INFORMATION!**

These instructions contain important information for the handling of the device.

**LEGAL NOTICE!**

This note contains information on statutory directives and standards.

• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➔ **RESULT**

This symbol refers to all important consequences of the previous actions.

1.2 Safety instructions for the operator

**WARNING!**

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

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

1.3 Approval

The ultrasonic flowmeters are manufactured according to the European Directive 94/9/EC (ATEX 100a). These flowmeters are approved for installation and use in hazardous classified locations of Zone 1 and 2 and are in accordance with the European Standards of the EN 60079 series. They have approval number:

OPTISONIC 7300: **PTB 10 ATEX 1052 X** and **DEKRA 12 ATEX 0063 X**
 OPTISONIC 8300: **DEKRA 12 ATEX 0063 X**

1.4 OPTISONIC 7300 C/...-Ex

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

The marking code can be:

"Ex d" terminal compartment	"Ex e" terminal compartment
II 2 G Ex d IIC T6...T3	II 2 G Ex de IIC T6...T3
II 2 G Ex d [ia] IIC T6...T3 (PTB) II 2 (1) G Ex d [ia] IIC T6...T3 (DEKRA)	II 2 G Ex de [ia] IIC T6...T3 (PTB) II 2 (1) G Ex de [ia] IIC T6...T3 (DEKRA)
II 2 G Ex d [ib] IIC T6...T3	II 2 G Ex de [ib] IIC T6...T3
II 2 G Ex d ma IIC T6, T5	II 2 G Ex de ma IIC T6, T5
II 2 G Ex d ma [ia] T6, T5 (PTB) II 2 (1) G Ex d ma [ia] T6, T5 (DEKRA)	II 2 G Ex de ma [ia] T6, T5 (PTB) II 2 (1) G Ex de ma [ia] T6, T5 (DEKRA)
II 2 G Ex d ma [ib] T6, T5	II 2 G Ex de ma [ib] T6, T5

1.5 OPTISONIC 7000...-Ex

The OPTISONIC 7000...-Ex is the separate version of the ultrasonic flow sensor and has flameproof (Ex d) gas transducers. It is available in two versions, the normal version up to a process temperature of 180°C and the extended temperature (XT) version up to a 220°C process temperature.

The marking code can be:

OPTISONIC 7000-Ex	OPTISONIC 7000 XT-Ex
II 2 G Ex d IIC T6...T3	II 2 G Ex d IIC T6...T2
II 2 G Ex d ma IIC T6, T5	

1.6 OPTISONIC 8000...-Ex

The OPTISONIC 8000...-Ex high temperature (steam) flow sensor is for measuring (low and) high temperature gases including steam. The thermal sensitive parts of the transducer are located at a larger distance from the process medium inside the measuring tube. This meter is suitable for process temperatures from -200°C up to +440°C.

The marking code is:

OPTISONIC 8000-Ex
II 2 G Ex d IIC T6...T1

1.7 GFC 300 F/...-Ex

The GFC 300 F/...-Ex is the separate version of the ultrasonic flow converter and has flameproof protected connections to the flameproof gas transducers of the ultrasonic flow sensor. The ultrasonic gas flow converter is either provided with non-explosion protected or intrinsically safe in-/outputs ("Ex ia" or "Ex ib"). The connection terminals of these in-/outputs are located in the terminal compartment, which is either configured as "Ex d" or "Ex e".

The marking code can be:

"Ex d" terminal compartment	"Ex e" terminal compartment
II 2 G Ex d IIC T6	II 2 G Ex de IIC T6
II 2 G Ex d [ia] IIC T6 (PTB) II 2 (1) G Ex d [ia] IIC T6 (DEKRA)	II 2 G Ex de [ia] IIC T6 (PTB) II 2 (1) G Ex de [ia] IIC T6 (DEKRA)
II 2 G Ex d [ib] IIC T6	II 2 G Ex de [ib] IIC T6

1.8 Ultrasonic gas transducers

The OPTISONIC 7000...-Ex gas flow sensor, can be equipped with the ultrasonic gas transducers made of titanium (type G7.01 and G7.04) or with the gas transducers of type G5.nn and G6.nn (body: stainless steel, front part: epoxy compound).

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

Optionally the under KEMA 07 ATEX 0181 X approved gas transducers of type G5.nn and G6.nn can be used. These gas transducers have types of protection "flameproof enclosure" (Ex d) in accordance with EN 60079-1 and "encapsulation" (Ex ma) conform to EN 60079-18. These transducers have marking code: II 1/2 G Ex d ma IIC T4...T6.

The high temperature transducers (OPTISONIC 8000-Ex) are always flanged and have type of protection flameproof enclosure (Ex d).

See Chapter 2 for details on the temperature classification table(s).

1.9 Technical data

Process medium	Flammable and non-flammable gases
Protection category acc. to IEC 529 / EN 60529	IP 65 or better
Ambient temperature range	
Titanium transducers	OPTISONIC 7300 C/...-Ex: -40...+65°C ^①
	GFC 300 F/...-Ex: -40...+65°C ^①
	OPTISONIC 7000...-Ex (incl. XT-version) : -40...+70°C
Stainless steel HT / steam transducer	OPTISONIC 8000-Ex: -40...+60°C
Synthetic transducers ^② (only available in OPTISONIC 7000-Ex)	Type G5.nn: -50...+70°C
	Type G6.nn, Temp class T6: -50...+70°C
	Type G6.nn, Temp class T5: -50...+85°C
	Type G6.nn, Temp class T4: -50...+100°C
Process medium temperature range	
Titanium transducers	OPTISONIC 7300 C/...-Ex: -50...+180°C
	OPTISONIC 7000-Ex: -50...+180°C
	OPTISONIC 7000 XT-Ex: -50...+220°C
Stainless steel HT / steam transducer	OPTISONIC 8000-Ex: -200...+440°C
Synthetic transducers ^② (only available in OPTISONIC 7000-Ex)	Type G5.nn, Temp. class T6: -50...+70°C
	Type G6.nn, Temp class T6: -50...+70°C
	Type G6.nn, Temp class T5: -50...+85°C
	Type G6.nn, Temp class T4: -50...+100°C



INFORMATION!

^① Maximum ambient temperature applies to aluminum converter housing. Stainless steel version is limited to +55°C.

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

1.10 Marking codes

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

Marking code	Converter housing	Transducer	I/O
--------------	-------------------	------------	-----

OPTISONIC 7300 C-Ex

II 2 G Ex d IIC T6...T3	Ex d	Titanium	Non-Ex
II 2 G Ex de IIC T6...T3	Ex de	Titanium	Non-Ex
II 2 G Ex d ma IIC T6, T5	Ex d	Synthetic	Non-Ex
II 2 G Ex de ma IIC T6, T5	Ex de	Synthetic	Non-Ex

OPTISONIC 7300 C/i-Ex

II 2 G Ex d [ia] IIC T6...T3 (PTB) II 2 (1) G Ex d [ia] IIC T6...T3 (DEKRA)	Ex d	Titanium	Ex ia
II 2 G Ex de [ia] IIC T6...T3 (PTB) II 2 (1) G Ex de [ia] IIC T6...T3 (DEKRA)	Ex de	Titanium	Ex ia
II 2 G Ex d [ib] IIC T6...T3	Ex d	Titanium	Ex ib
II 2 G Ex de [ib] IIC T6...T3	Ex de	Titanium	Ex ib
II 2 G Ex d ma [ia] IIC T6, T5 (PTB) II 2 (1) G Ex d ma [ia] IIC T6, T5 (DEKRA)	Ex d	Synthetic	Ex ia
II 2 G Ex de ma [ia] IIC T6, T5 (PTB) II 2 (1) G Ex de ma [ia] IIC T6, T5 (DEKRA)	Ex de	Synthetic	Ex ia
II 2 G Ex d ma [ib] IIC T6, T5	Ex d	Synthetic	Ex ib
II 2 G Ex de ma [ib] IIC T6, T5	Ex de	Synthetic	Ex ib

OPTISONIC 7000-Ex

II 2 G Ex d IIC T6...T3	n.a.	Titanium	n.a.
II 2 G Ex d ma IIC T6, T5	n.a.	Synthetic	n.a.

OPTISONIC 7000 XT-Ex

II 2 G Ex d IIC T6...T2	n.a.	Titanium ①	n.a.
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OPTISONIC 8000-Ex

II 2 G Ex d IIC T6...T1	n.a.	HT / steam	n.a.
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GFC 300 F-Ex

II 2 G Ex d IIC T6	Ex d	n.a.	Non-Ex
II 2 G Ex de IIC T6	Ex de	n.a.	Non-Ex

GFC 300 F/i-Ex

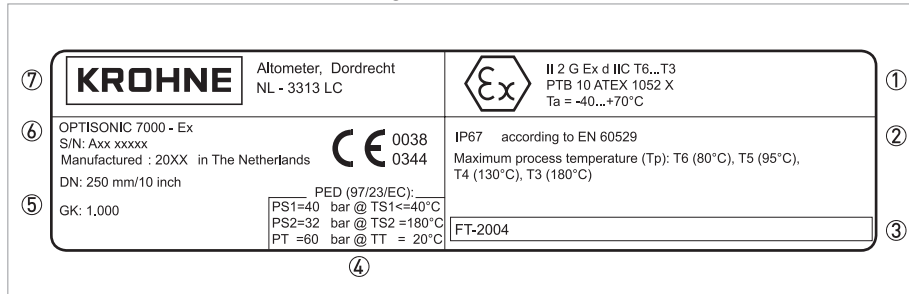
II 2 G Ex d [ia] IIC T6 (PTB) II 2 (1) G Ex d [ia] IIC T6 (DEKRA)	Ex d	n.a.	Ex ia
II 2 G Ex de [ia] IIC T6 (PTB) II 2 (1) G Ex de [ia] IIC T6 (DEKRA)	Ex de	n.a.	Ex ia
II 2 G Ex d [ib] IIC T6	Ex d	n.a.	Ex ib
II 2 G Ex de [ib] IIC T6	Ex de	n.a.	Ex ib

① Only available in separate version.

1.11 Marking labels

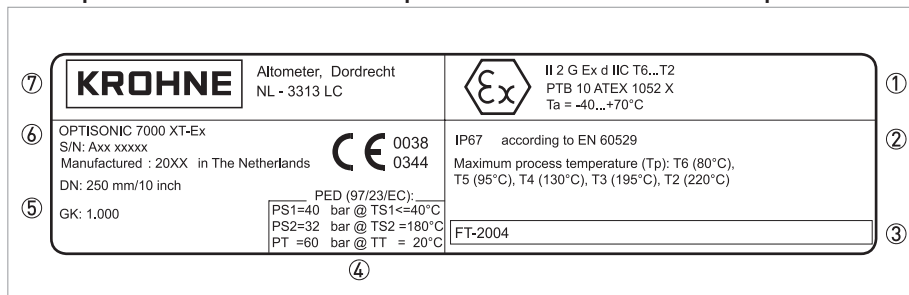
The marking labels shown here are configuration examples. Other marking codes are possible, see previous section.

Example for the Ex measuring sensor nameplate




- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Tag number.
- ④ PED data.
- ⑤ Calibration data.
- ⑥ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑦ Name and address of the manufacturer.

Example for the extended temperature (XT) version nameplate






- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Tag number.
- ④ PED data.
- ⑤ Calibration data.
- ⑥ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑦ Name and address of the manufacturer.

Example for the OPTISONIC 8000-Ex flow sensor nameplate

⑦	KROHNE	Alliometer, Dordrecht NL - 3313 LC	 II 2 G Ex d IIC T6...T1 DEKRA 12 ATEX 0063 X Ta = -40...+60°C	①
	⑥	OPTISONIC 8000 - Ex S/N: Axx xxxxx Manufactured : 20XX in The Netherlands		
⑤	DN: 250 mm/10 inch GK: 1,000	PED (97/23/EC): PS1=40 bar @ TS1<=40°C PS2=32 bar @ TS2 =180°C PT =60 bar @ TT = 20°C	IP67 according to EN 60529 Maximum process temperature: T6 (80°C), T5 (95°C), T4 (130°C), T3 (195°C), T2 (290°C), T1 (440°C)	③
	④		FT-2004	

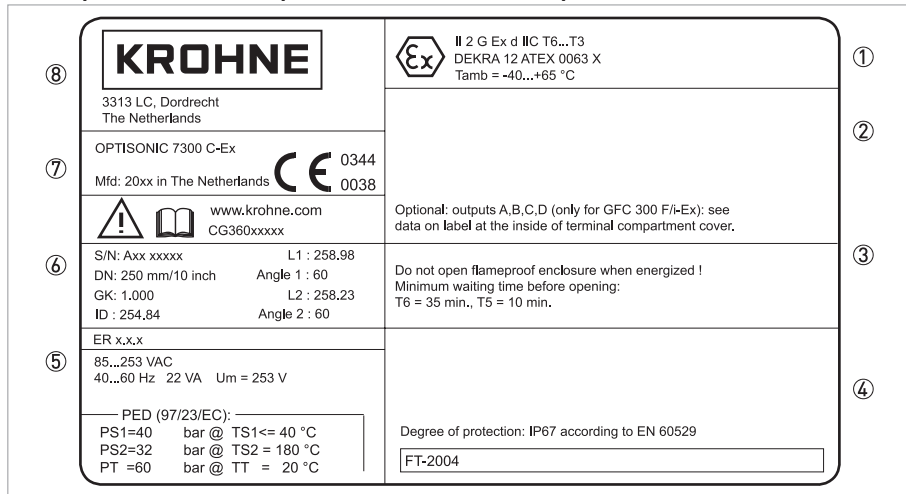
- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Tag number.
- ④ PED data.
- ⑤ Calibration data.
- ⑥ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑦ Name and address of the manufacturer.

Example for the compact Ex version nameplate (PTB)

⑧	KROHNE	3313 LC, Dordrecht The Netherlands	 II 2 G Ex d IIC T6...T3 PTB 10 ATEX 1052 X Tamb = -40...+65 °C	①
	⑦	OPTISONIC 7300 C-Ex Mfd: 20xx in The Netherlands		
⑥	  www.krohne.com CG360xxxxx	S/N: Axx xxxxx L1 : 258.98 DN: 250 mm/10 inch Angle 1 : 60 GK: 1,000 L2 : 258.23 ID : 254.84 Angle 2 : 60	Optional: outputs A,B,C,D (only for GFC 300 F/Ex): see data on label at the inside of terminal compartment cover.	③
	⑤	ER x.x.x 85...253 VAC 40...60 Hz 22 VA Um = 253 V	Do not open flameproof enclosure when energized ! Minimum waiting time before opening: T6 = 35 min., T5 = 10 min.	
	PED (97/23/EC): PS1=40 bar @ TS1<= 40 °C PS2=32 bar @ TS2 = 180 °C PT =60 bar @ TT = 20 °C	Degree of protection: IP67 according to EN 60529	FT-2004	

- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Intrinsic safe in-/output circuits information.
- ④ Warning messages.
- ⑤ Main supply data.
- ⑥ Calibration data.
- ⑦ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑧ Name and address of the manufacturer.

Example for the compact Ex version nameplate (DEKRA)



- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Intrinsic safe in-/output circuits information.
- ④ Warning messages.
- ⑤ Main supply data.
- ⑥ Calibration data.
- ⑦ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑧ Name and address of the manufacturer.

Example for separate Ex signal converter nameplate

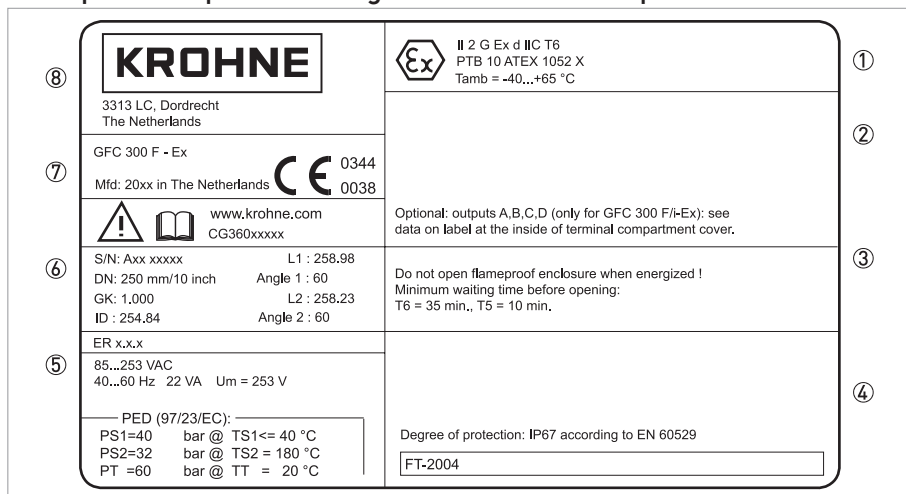


Figure 1-1: OPTISONIC 7300

- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Intrinsic safe in-/output circuits information.
- ④ Warning messages.
- ⑤ Main supply data.
- ⑥ Calibration data.
- ⑦ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑧ Name and address of the manufacturer.

Example for separate Ex signal converter nameplate





⑧	KROHNE	 II 2 G Ex d IIC T6 DEKRA 12 ATEX 0063 X Tamb = -40...+65 °C	①
	3313 LC, Dordrecht The Netherlands		②
⑦	GFC 300 F - Ex Mfd: 20xx in The Netherlands	 0344 0038	
	  www.krohne.com CG360xxxx	Optional: outputs A,B,C,D (only for GFC 300 F/i-Ex): see data on label at the inside of terminal compartment cover.	③
⑥	S/N: Axx xxxxx DN: 250 mm/10 inch GK: 1.000 ID : 254,84	L1 : 258,98 Angle 1 : 60 L2 : 258,23 Angle 2 : 60	④
	ER x.x.x	Do not open flameproof enclosure when energized ! Minimum waiting time before opening: T6 = 35 min., T5 = 10 min.	
⑤	85...253 VAC 50...60 Hz 22 VA Um = 253 V		⑤
	PED (97/23/EC): PS1=40 bar @ TS1<= 40 °C PS2=32 bar @ TS2 = 180 °C PT =60 bar @ TT = 20 °C	Degree of protection: IP67 according to EN 60529	
		FT-2004	

Figure 1-2: OPTISONIC 8300

- ① Specific sign for explosion protection, Ex codes and number of EC type examination certificate.
- ② Explosion safety notes.
- ③ Intrinsic safe in-/output circuits information.
- ④ Warning messages.
- ⑤ Main supply data.
- ⑥ Calibration data.
- ⑦ Type designation of the flowmeter and CE sign with number(s) of notified body / bodies.
- ⑧ Name and address of the manufacturer.

2.1 General

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

The temperature limits apply under the following conditions:

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



CAUTION!

The temperature data below only applies to the meters with ultrasonic gas transducers made of titanium (types G7.01 and G7.04). For the partly encapsulated transducer types G5.nn and G6.nn, refer to Technical data on page 10.

2.2 GFC 300 F/...-Ex

The GFC 300 F/...-Ex signal converter has a temperature classification of T6 (85°C). The permissible ambient temperature is dependent on the material that the electronics housing is made of, namely:

- die-casted aluminum: -40...+65°C
- die-casted stainless steel: -40...+55°C

2.3 OPTISONIC 7300 C/...-Ex

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



CAUTION!

The temperature data below only applies to the meters with ultrasonic gas transducers made of titanium (types G7.01 and G7.04). For the partly encapsulated transducer types G5.nn and G6.nn, refer to Technical data on page 10.

Temperature class	Maximum process temperature [°C] at		
	T _a = 40°C	T _a = 50°C	T _a = 65°C (55°C)
T6	80	80	80
T5	95	95	95
T4	130	130	125
T3	180	165	125

2.4 OPTISONIC 7000...-Ex

The OPTISONIC 7000-Ex and OPTISONIC 7000 XT-Ex have an ambient temperature in the range of -40...+70°C. The maximum process medium temperature is listed in the table below.



CAUTION!

The temperature data below only applies to the meters with ultrasonic gas transducers made of titanium (types G7.01 and G7.04). For the partly encapsulated transducer types G5.nn and G6.nn, refer to Technical data on page 10.

Temperature class	Maximum process temperature [°C] at $T_a = 70^\circ\text{C}$	
	Standard design	XT design
T6	80	80
T5	95	95
T4	130	130
T3	180	195
T2	n.a.	220

2.5 OPTISONIC 8000...-Ex

The OPTISONIC 8000...-Ex high temperature (steam) flow sensor has an ambient temperature in the range of -40...+60°C. The maximum process medium temperature is listed in the table below.

Temperature class	Maximum process temperature [°C] at $T_a = 60^\circ\text{C}$
T6	80
T5	95
T4	130
T3	195
T2	290
T1	440

3.1 General

The electrical connection between the ultrasonic flow sensor and the signal converter is established with one (single beam versions) or two (dual beam versions) MR 02 signal cable(s). The ends of the coaxial cables are provided with SMB plugs. The signal cable is provided with the system.

3.2 Cable marking

The coaxial transducer cables are marked at each end by yellow tubing with a black number of subsequently 1.1 and 1.2 for a single-beam design and numbers 1.1, 1.2, 2.1 and 2.2 for a double-beam design. The first number represents path, 1 (single-beam) or 2 (double-beam) and the second the position of the transducer of that path (1 or 2). The marking of the SMB receptacles in the connection box is identical to that of the transducers cables (1.1, 1.2, ...).

3.2.1 Sensor

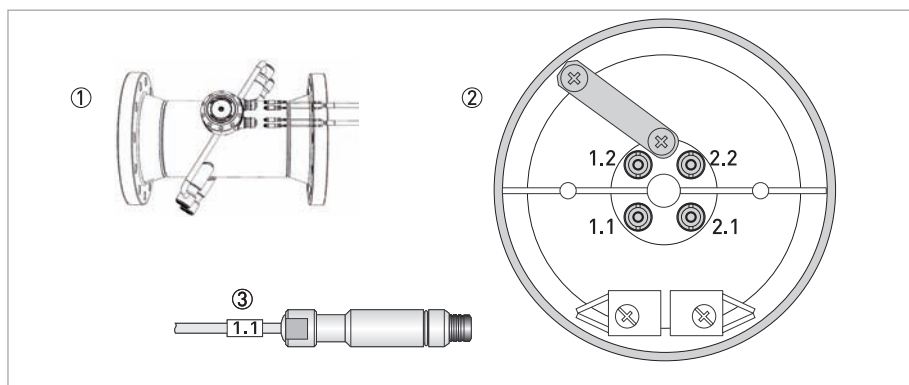


Figure 3-1: Connect the cables on the sensor.

- ① Sensor.
- ② Open connection box.
- ③ Marking on cable.

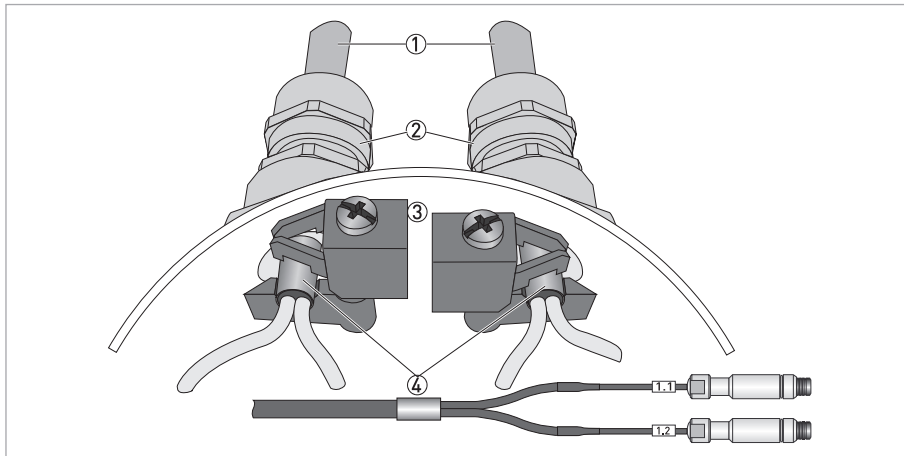


Figure 3-2: Clamp the cables on the shielding bush.

- ① Cables.
- ② Cable glands.
- ③ Grounding clamps.
- ④ Cable with metal shielding bush.

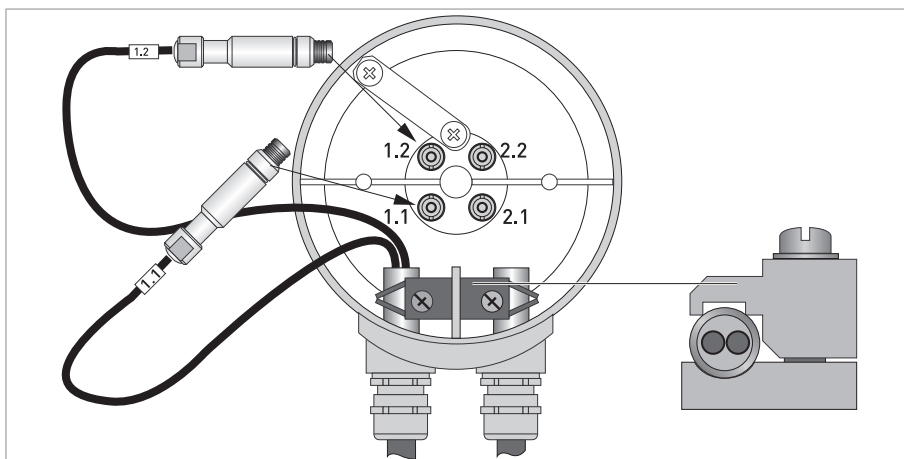
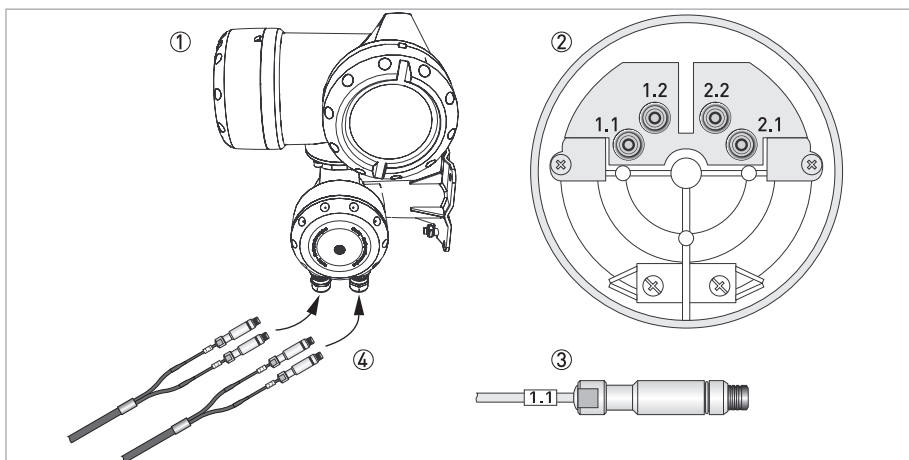


Figure 3-3: Connect the cables on the signal converter.

3.2.2 Converter



- ① Converter housing.
- ② Open connection box.
- ③ Marking on cable.
- ④ Insert cables through cable glands.

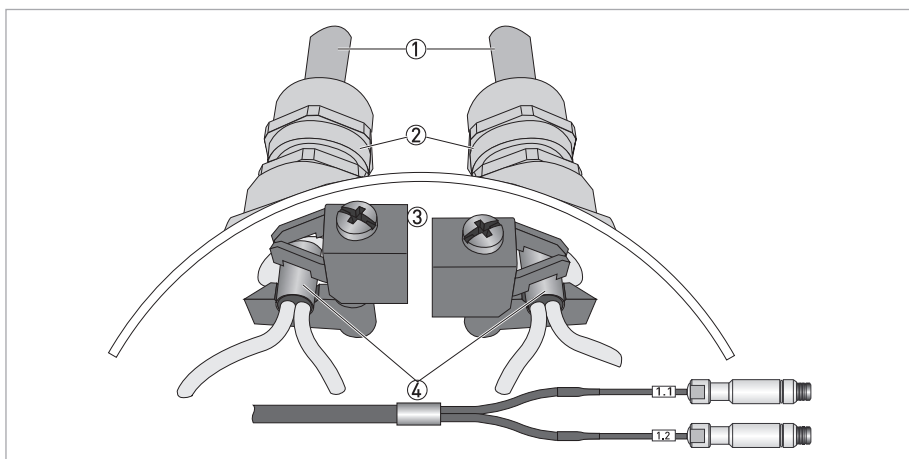


Figure 3-4: Clamp the cables on the shielding bush.

- ① Cables.
- ② Cable glands.
- ③ Grounding clamps.
- ④ Cable with metal shielding bush.

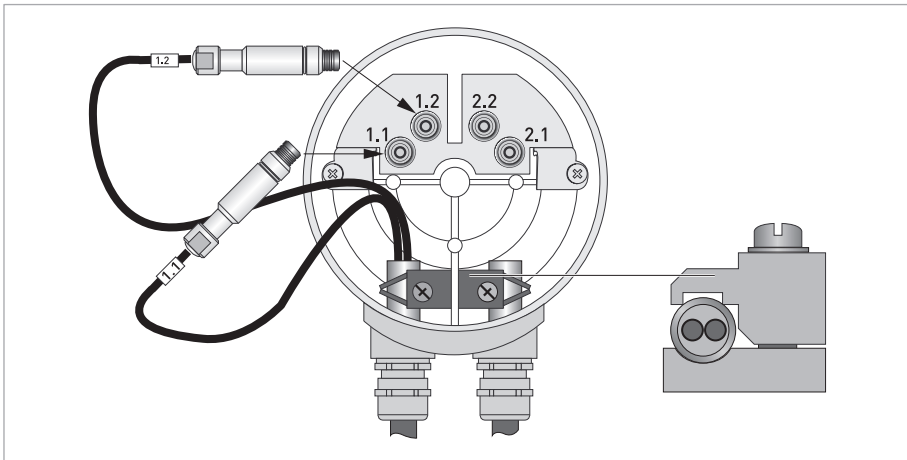


Figure 3-5: Connect the cables on the signal converter.

3.3 Equipotential bonding

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

The separate bonding conductor must be at least 4 mm^2 (11 AWG) or 2.5 mm^2 (14 AWG) in case it is mechanically protected, see Clause 413 of HD 384.4.41 or IEC 364-4-41. Make sure that the core of the bonding wire is properly mounted under the U-clamp of the external M5 terminal and that the screw is tightly fixed.

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

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

4.1 General

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

Keep the screw-threads free of dirt and well-greased (e.g. with PTFE grease). The grease will help to prevent the threads from locking due to corrosion.

To unscrew the covers, first release the interlocking devices (one at each cover). Therefore unscrew the M4 head screw with internal hexagon socket set using a No. 3 Allen key until the interlocking device can be turned. After the covers are screwed back onto the housing, make sure that the interlocking devices are properly refitted.



WARNING!

Allow the electronics to de-energize before opening the electronics compartment of the flow converter housing. Wait at least 35 minutes for T6 and 10 minutes for T5 before opening.

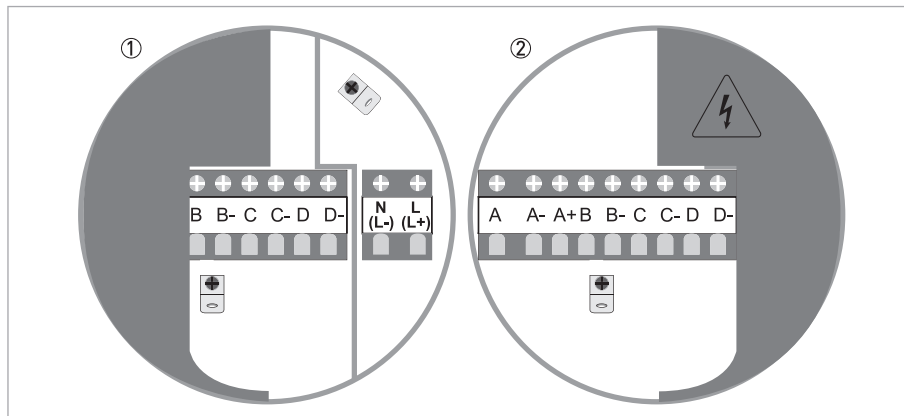


Figure 4-1: Electrical connections of converter

- ① Mains supply connections
 ② I/O connections

Terminals	Function, electrical data
L, N	100...230 VAC, +10% / -15%, 22 VA, 50/60 Hz Internal fuse protection $I_N \leq 0.8 \text{ A}$ $U_m = 253 \text{ V}$
	Connections for mains supply, always non-Ex i
L+, L-	12...24 VDC, +30% / -10% (short periods -25%), 12W Internal fuse protection $I_N \leq 2.0 \text{ A}$ $U_m = 253 \text{ V}$
	24 VACDC, 22 VA / 12W 24 VAC, +10% / -15%, 50/60 Hz 24 VDC, +30% / -25% Internal fuse protection $I_N \leq 2.0 \text{ A}$ $U_m = 253 \text{ V}$
	Connections for mains supply, always non-Ex i
	Connection to protective extra low voltage (PELV)
A, A-, A+ B, B- C, C- D, D-	Connections for signal I/Os (PELV circuits), non-“Ex i” or “Ex i”, are dependent on the specific version of the GFC 300 converter ordered. Consult the tables with CG36 numbers for details.

The exact I/O-configuration for circuits A, B, C and D is order-specific and can be determined by the CG36 number shown on the I/O sticker inside the terminal compartment. Therefore check the data on the back of the GFC 300 electronics unit. The CG36 number contains 10 characters of which the last three characters (XYZ) determine the configuration of the I/O circuits:

CG36	*	*	*	X	Y	Z
Pos 1...4	5	6	7	8	9	10
				determine I/O circuits		

For schematic overviews of the CG36 numbers, refer to *Non-"Ex i" I/O connections* on page 25 and refer to *"Ex i" I/O connections* on page 27. These overviews do not show all details. The exact connection diagram of a specific GFC 300 signal converter can be found on the sticker inside the terminal compartment.

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

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



WARNING!

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

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

4.2 Non-"Ex i" I/O connections

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

I/O PCB	Input/output functions, $U_n < 32 \text{ V DC}$, $I_n < 100 \text{ mA}$, $U_m = 253 \text{ V}$
Basic I/O	Current Output, active or passive, with HART Status Output / Control Input Status Output Pulse / Status Output
Modular I/O	Current Output, active or passive, with HART Pulse / Status Output, active or passive, highC or Namur
Modular carrier with 1 or 2 I/O modules	Each module: 1 out of following 3 in-/output functions: Current Output, active or passive Pulse / Status Output, active or passive, highC or Namur Control Input, active or passive, highC or Namur
Profibus DP I/O	Profibus-DP, active
Fieldbus I/O	Profibus-PA or Foundation Fieldbus
RS 485 Modbus	Modbus with or without termination
The options separated by "/" are software selectable (can be changed by the user) The options separated by "or" are hardware versions (must be ordered as such) All outputs are passive unless otherwise indicated HighC means High Current input/output, Namur means that the in-/outputs are according to the NAMUR NE43 standard	

Overview of the possible combinations, defined by characters XYZ of the CG36 number					
Characters XYZ	Name of I/O circuits	Terminals A, A-, A+	Terminals B, B-	Terminals C, C-	Terminals D, D-
100	Basic I/O	CO CO(a) over A+	SO/CI	SO	PO/SO
488 to 4LL 588 to 5LL 688 to 6LL 788 to 7LL 888 to 8LL A88 to ALL B88 to BLL C88 to CLL	Modular I/O or Modular Carrier with 1 or 2 I/O modules	Many combinations possible			
D88	Fieldbus I/O Profibus PA	n.c.	n.c.	PA	PA
D8A to DLL	Fieldbus I/O Profibus PA with Module Carrier with 1 or 2 I/O modules	Many combinations possible		PA	PA
E88	Fieldbus I/O Foundation Fieldbus	n.c.	n.c.	FF	FF
E8A to ELL	Fieldbus I/O Profibus PA with Module Carrier with 1 or 2 I/O modules	Many combinations possible		FF	FF

Overview of the possible combinations, defined by characters XYZ of the CG36 number					
Characters XYZ	Name of I/O circuits	Terminals A, A-, A+	Terminals B, B-	Terminals C, C-	Terminals D, D-
F00 to FL0	Profibus DP I/O	n.c.	DP(a)	DP(a)	DP(a)
F80 to FL0	Profibus DP I/O with 0 or 1 I/O module	Many combinations possible	DP(a)	DP(a)	DP(a)
G00 to GLL	RS 485 Modbus	Many combinations possible		RS485	RS485
H00 to HLL	Modbus with 1 or 2 I/O modules				
<p>Used abbreviations for in-/output functions: CO = Current Output, PO = Pulse Output, SO = Status Output, CI = Control Input, PA = Profibus PA, FF = Foundation Fieldbus, DP = Profibus DP, RS485 = RS 485 Modbus, n.c. = not connected. All in-/outputs are passive unless otherwise noted as active with extension (a).</p>					

4.3 "Ex i" I/O connections

The following intrinsically safe I/O connections are available:

I/O PCB	I/O functions	
Ex i IO	Current Output, passive + HART communication Pulse / Status Output, passive	Ex ia IIC or Ex ib IIC $U_i = 30 \text{ V}$, $I_i = 100 \text{ mA}$, $P_i = 1.0 \text{ W}$ $C_i = 10 \text{ nF}$, $L_i = \text{negligibly low}$
	Current Output, active + HART communication	Ex ia IIC or Ex ib IIC $U_o = 21 \text{ V}$, $I_o = 90 \text{ mA}$, $P_o = 0.5 \text{ W}$ Linear characteristics $C_o = 90 \text{ nF}$, $L_o = 2.0 \text{ mH}$ $C_o = 110 \text{ nF}$, $L_o = 0.5 \text{ mH}$
Ex i Option	Current Output, passive Pulse / Status Output / Control Input, passive	Ex ia IIC or Ex ib IIC $U_i = 30 \text{ V}$, $I_i = 100 \text{ mA}$, $P_i = 1.0 \text{ W}$ $C_i = 10 \text{ nF}$, $L_i = \text{negligibly low}$
	Current Output, active	Ex ia IIC or Ex ib IIC $U_o = 21 \text{ V}$, $I_o = 90 \text{ mA}$, $P_o = 0.5 \text{ W}$ Linear characteristics $C_o = 90 \text{ nF}$, $L_o = 2.0 \text{ mH}$ $C_o = 110 \text{ nF}$, $L_o = 0.5 \text{ mH}$
Ex i Option 2	Current Input, passive Pulse / Status Output / Control Input, passive	Ex ia IIC or Ex ib IIC $U_i = 30 \text{ V}$, $I_i = 100 \text{ mA}$, $P_i = 1.0 \text{ W}$ $C_i = 10 \text{ nF}$, $L_i = \text{negligibly low}$
	Current Input, active	Ex ia IIC or Ex ib IIC $U_o = 24.1 \text{ V}$, $I_o = 99 \text{ mA}$, $P_o = 0.6 \text{ W}$ Linear characteristics $C_o = 75 \text{ nF}$, $L_o = 0.5 \text{ mH}$
Fieldbus I/O	Profibus-PA Foundation Fieldbus, passive	Ex ia IIC or Ex ib IIC / IIB $U_i = 24 \text{ V}$, $I_i = 380 \text{ mA}$, $P_i = 5.32 \text{ W}$ $C_i = 5 \text{ nF}$, $L_i = 10 \text{ }\mu\text{H}$ Suitable for connection to an intrinsically safe fieldbus in accordance with the FISCO-model

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

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

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

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

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

**INFORMATION!**

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

Overview of possible "Ex ia" in-/outputs, defined by characters XYZ of the CG 36 numbers					
Characters XYZ	Name of I/O circuits	Terminals A, A-, A+	Terminals B, B-	Terminals C, C-	Terminals D, D-
200	Exi-IO	n.c.	n.c.	CO(a)	PO/SO
300		n.c.	n.c.	CO	PO/SO
210	Exi-IO with Exi-Option	CO(a)	PO/SO/CI	CO(a)	PO/SO
220		CO	PO/SO/CI	CO(a)	PO/SO
310		CO(a)	PO/SO/CI	CO	PO/SO
320		CO	PO/SO/CI	CO	PO/SO
230	Exi-IO with Exi-Option 2	lin _a active	PO/SO/CI	CO(a)	PO/SO
330		lin _a active	PO/SO/CI	CO	PO/SO
240		lin _p passive	PO/SO/CI	CO(a)	PO/SO
340		lin _p passive	PO/SO/CI	CO	PO/SO
D00	Fieldbus I/O Profibus PA	n.c.	n.c.	PA	PA
D10	Fieldbus I/O Profibus PA with Ex i Option	CO(a)	PO/SO/CI	PA	PA
D20		CO	PO/SO/CI	PA	PA
E00	Fieldbus I/O Foundation Fieldbus	n.c.	n.c.	FF	FF
E10	Fieldbus I/O Foundation Fieldbus with Ex i Option	CO(a)	PO/SO/CI	FF	FF
E20		CO	PO/SO/CI	FF	FF

Used abbreviations for in-/output functions: CO = Current Output, PO = Pulse Output, SO = Status Output, CI = Control Input, n.c. = not connected
All in-outputs are passive unless otherwise noted as active with extension (a).

5.1 Maintenance

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

5.2 Before and after opening



WARNING!

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

Before opening:

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

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

After opening:

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

5.3 Replacement of mains fuse



WARNING!

Before commencing the work, refer to *Before and after opening* on page 29, then continue as follows:



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

Fuse type: 5 x 20 mm (H) according to IEC 60127-2/V	
Power supply	Electrical data
12...24 V DC	250 V / 2 A
24 V AC/DC	250 V / 2 A
100...230 V AC	250 V / 0,8 A



WARNING!

Before reassembling the unit, refer to *Before and after opening* on page 29, then:



- Reassemble the unit in reverse order.

5.4 Exchange of electronics unit

Before opening the converter housing:



DANGER!

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



WARNING!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.



INFORMATION!

Make notes of important specific data, before exchanging the electronics.

Menu settings are stored on the circuit board (or backplane), that is fixed to the housing. After exchange of electronics unit and power-up, the following start up screen appears:

Load all data?



- Select yes



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

5.4.1 Field version

**DANGER!**

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

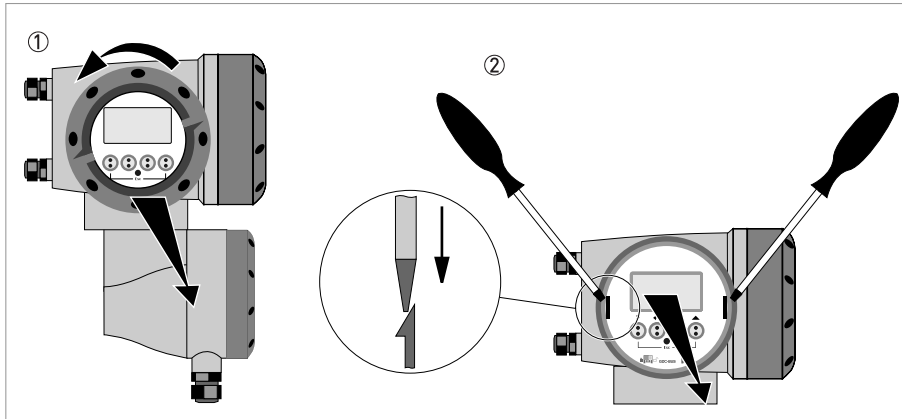


Figure 5-1: Unscrew the cover and remove the display

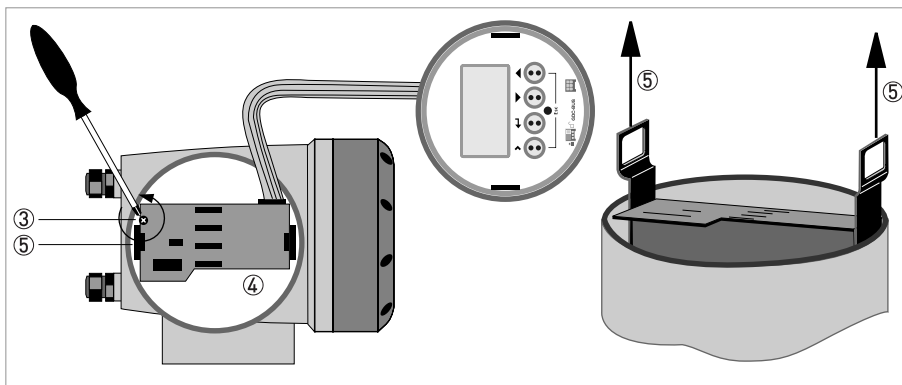


Figure 5-2: Pull off printed circuit board

**Perform the following procedures:**

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

**CAUTION!**

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

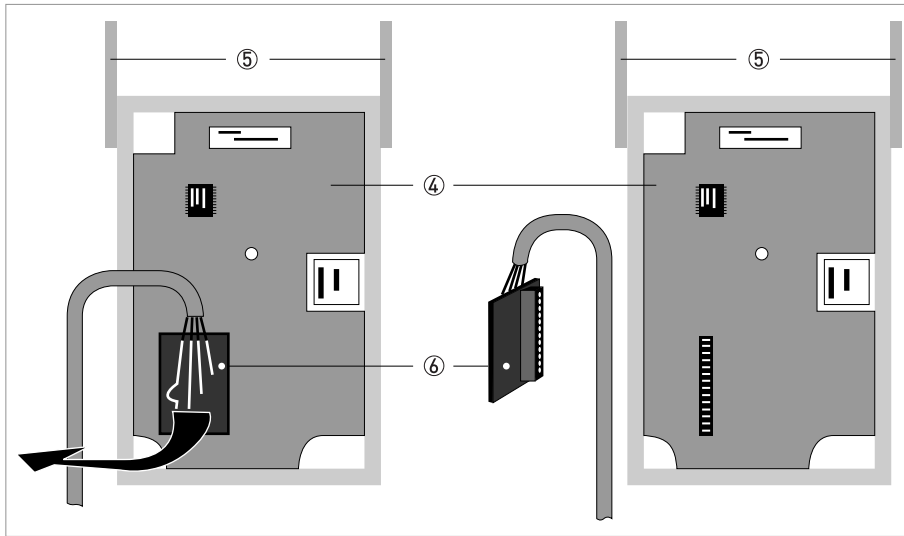


Figure 5-3: Small printed circuit board and electronics unit



DANGER!

Electrostatic discharge (ESD) can damage electronic parts. Make sure to discharge yourself by wearing a wrist strap. If no wrist strap is available, ground yourself by touching a metal surface that is grounded.



- Remove the printed circuit board ⑥ from the electronics unit ④.
- Check compatibility between the removed and new electronics unit ④, by checking the power voltage.
- Slide the new electronics unit ④ partially back into the housing.
- Mount the small printed circuit board back onto the electronics unit ④.
- Push the metal pullers ⑤ back to their original position.
Don't use excessive force, otherwise the connector at the backside can be damaged!
- Screw the electronics unit back to the housing.
- Re-install the display and make sure not to kink the display's flat ribbon cable.
- Replace cover and tighten by hand.
- Connect power.

5.5 Service / repair information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



CAUTION!

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



CAUTION!

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

5.6 Form (for copying) to accompany a returned device

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no.:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	water-hazardous		
	toxic		
	caustic		
	flammable		
	We checked that all cavities in the device are free from such substances.		
	We have flushed out and neutralized all cavities in the device.		
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

5.7 Disposal



CAUTION!

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



KROHNE product overview

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

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