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РАСХОДОМЕРЫ УЛЬТРАЗВУКОВЫЕ OPTISONIC 4000



OPTISONIC 4000 F/...-Ex

The OPTISONIC 4000 F/...-Ex is the remote (field) configuration of the ultrasonic flow sensor and has intrinsically safe transducer circuits. It is available in 2 versions as follows,

- High-pressure (HP) versions, suitable for process temperatures up to +180°C / +356°F
- High-temperature versions (HT), suitable for process temperatures up to +440°C / +824°F

The HP and HT versions are also available as flow sensors, equipped with a closed steel circuit for hot medium (e.g. steam or hot oil), which is called heating jacket (HJ). The maximum temperature of the heating medium never exceeds the maximum permissible process temperature. The flow sensor equipped with a heating jacket, ensures stable process temperatures.

Marking for the different flow sensor types, are listed below.

OPTISONIC 4000 F/HP-Ex OPTISONIC 4000 F/HP-/HJ-Ex	OPTISONIC 4000 F/HT-Ex & /HP/HT-Ex OPTISONIC 4000 F/HT/HJ-Ex & /HP/HT/HJ-Ex
II 2 G Ex ia IIC T6...T3 Gb	II 2 G Ex ia IIC T6...T1 Gb

The intrinsically safe (Ex ia) transducer circuits of the OPTISONIC 4000 F/...-Ex are connected to an associated device and have the following maximum values:

$U_i = 13,1 \text{ V}$	$I_i = 600 \text{ mA}$	$C_i = 11,6 \text{ nF}$	$L_i = 134 \text{ } \mu\text{H}$
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TEMPERATURE LIMITS

OPTISONIC 4000 F/...-Ex

The OPTISONIC 4000 F/...-Ex ultrasonic flow sensors in field version, are designed for an ambient temperature range of -40...+70°C. The following tables show the temperature limitation / classification.

OPTISONIC 4000 F/... (default & HJ).

Temperature class	Maximum process temperature [°C] at $T_a = 70^\circ\text{C}$	
	OPTISONIC 4000 F /HP-Ex	OPTISONIC 4000 F /HP/HJ-Ex
T6	80	80
T5	95	95
T4	130	130
T3	180	180

OPTISONIC 4000 /HT...-Ex with aluminum or stainless steel MH 300 housing with or without heat insulation

Temperature class	Maximum process temperature [°C] up to 70°C
T6	80
T5	95
T4	130
T3	195
T2	290

OPTISONIC 4000 /HT...-Ex: temperature class T1

Temperature class T1	Maximum process temperature [°C] up to 70°C ...			
	$T_a \leq 40^\circ\text{C}$	$T_a \leq 60^\circ\text{C}$	$T_a \leq 65^\circ\text{C}$	$T_a \leq 70^\circ\text{C}$
With aluminum connection box and no heat insulation	440	440	415	350
With aluminum connection box and heat insulation	440	440	440	425
With stainless steel connection box and no heat insulation	440	410	355	305
With stainless steel connection box and heat insulation	440	440	440	375

3.1 General

In the case of remote systems, the electrical connection between OPTISONIC 4000F/...-Ex ultrasonic flow sensor and UFC 400 F/...-Ex ultrasonic signal converter is established via a signal cable of type MR02, MR04-RG316. Depending on the version, this cable consists 2 or 4 coaxial cables surrounded by an additional screen and outer insulation layer. The ends of the coaxial cables are provided with SMB plugs. The signal cable is included with the field system by KROHNE.

3.2 Cable marking

The SMB plugs of the coaxial cables are marked by yellow tubing with a black number of subsequently 1.1, 1.2, 2.1, 2.2. The first number represents the path 1 or 2 and the second the transducer of that path (1 or 2). The marking of the SMB counter-plugs in the connection box of the signal converter is respectively 1.1, 1.2, 2.1, 2.2 for the connection of the several connection box types.

3.3 Cable parameters

The maximum permitted total capacitance and inductance for the connecting cable is:

$$C_L ; 1.29 \mu\text{F} \text{ or } 0.79 \mu\text{F}$$

$$L_L ; 0.37 \text{ mH} \text{ or } 1.07 \text{ mH}$$

The cable supplied by the manufacturer has the following parameters:

distributed capacitance C_C (core/screen) = 94 pF/m

distributed inductance L_C (core/screen) = 0.24 $\mu\text{H}/\text{m}$



INFORMATION!

The standard length of the signal cable is 5 m / 16.4 ft. In case a longer length is required, please contact your local representative for detailed information.



INFORMATION!

More than 30 m signal cable length is not recommendable, it will have a negative effect on the measuring accuracy.

3.5 Signal cable (remote versions only)

The flow sensor is connected to the signal converter via one signal cable, with 2 or 4 (labeled) inner coax cables for the connection of one or two acoustic paths.

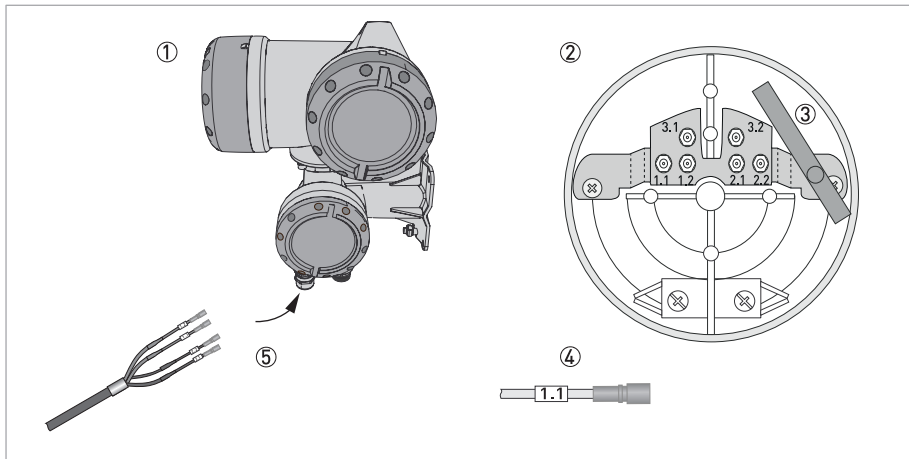


Figure 3-1: Construction of field version

- ① Signal converter
- ② Open connection box
- ③ Tool for releasing connectors
- ④ Marking on cable
- ⑤ Insert cable(s) into terminal compartment



CAUTION!

To ensure smooth functioning, always use the signal cable(s) included in the delivery.

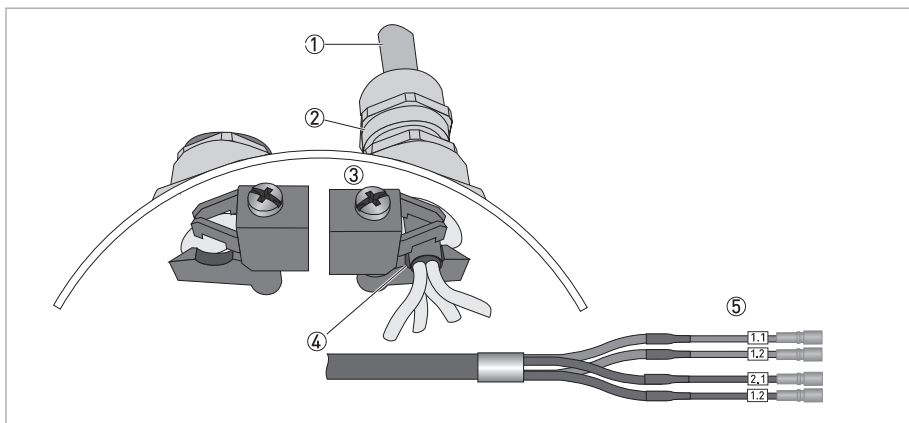


Figure 3-2: Clamp the cables on the shielding bush

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

4 ELECTRICAL CONNECTIONS

Non-"Ex i" I/O connections

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

I/O PCB without HART	Input/output functions: U_n active: 24V DC, U_n passive: < 32 V DC, I_n < 100 mA, U_m = 253 V
Basic I/O	Current Output, active or passive, with HART, I_n < 22 mA Status Output / Control Input Status Output Pulse / Status Output
Modular I/O	Current Output, active or passive, with HART, I_n < 22 mA 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
Fieldbus I/O I_n < 10.5 mA	Foundation Fieldbus
	Profibus-PA/ DP (max 12 Mbaud)
RS 485 Modbus	Modbus with or without termination

Notes:

- 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 CG35 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 688 to 6LL 788 to 7LL 888 to 8LL 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 Foundation Fieldbus with Module Carrier with 1 or 2 I/O modules	Many combinations possible		FF	FF
F00 to FL0	Profibus DP with 1 or 0 I/O module	Many combinations possible		DP(a)	DP(a)
G00 to GLL	RS485 Modbus	Many combinations possible		RS485	RS485
H00 to HLL	Modbus with 1 or 2 I/O modules				
Used abbreviations for in-/output functions: CO = Current Output, PO = Pulse Output, SO = Status Output, CI = Control Input, PA = Profibus PA, FF = Foundation Fieldbus, RS485 = RS485 Modbus, n.c. = not connected. All in-/outputs are passive unless otherwise noted as active with extension (a).					

4 ELECTRICAL CONNECTIONS

4.5 "Ex i" I/O connections

The following intrinsically safe I/O connections are available:

I/O PCB	I/O functions	
Ex i I/O	Current Output + HART communication Pulse / Status Output Current Output, active + HART communication	Ex ia IIC $U_i = 30 \text{ V}$, $I_i = 130 \text{ mA}$, $P_i = 1,0 \text{ W}$ $C_i = 10 \text{ nF}$, $L_i = 0$ Ex ia 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 Pulse / Status Output / Control Input Current Output, active	Ex ia IIC $U_i = 30 \text{ V}$, $I_i = 130 \text{ mA}$, $P_i = 1,0 \text{ W}$ $C_i = 10 \text{ nF}$, $L_i = 0$ Ex ia IIC $U_o = 21 \text{ V}$, $I_o = 90 \text{ mA}$, $P_o = 0,5 \text{ W}$ Linear characteristics $C_o = 90 \text{ nF}$, $L_o = 2,0 \text{ mH}$ $C_o = 110 \text{ nF}$, $L_o = 0,5 \text{ mH}$
Fieldbus I/O	Profibus-PA Foundation Fieldbus	Ex ia IIC $U_i = 24 \text{ V}$, $I_i = 380 \text{ mA}$, $P_i = 5,32 \text{ W}$ $C_i = 5 \text{ nF}$, $L_i = 0$ Suitable for connection to an intrinsically safe fieldbus in accordance with the FISCO model.

The I/O circuits titled "Ex i I/O" and "Ex i Option" 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 with respect to 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 IEC/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 between the non-I.S. and I.S. according to IEC/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 flow converters with an "Ex e" terminal compartment, terminal 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 35 numbers					
Characters XYZ	Name of I/O circuits	Terminals A, A-, A+	Terminals B, B-	Terminals C, C-	Terminals D, D-
200	Ex i I/O	n.c.	n.c.	CO(a)	PO/SO
300		n.c.	n.c.	CO	PO/SO
210	Ex i I/O with Ex i 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
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, PA = Profibus PA, FF = Foundation Fieldbus, n.c. = not connected
All in-outputs are passive unless otherwise noted as active with extension (a).

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