OPTIFLUX Supplementary instructions

ATEX & IECEx supplement

OPTIFLUX 2100 C / 4100 C - OPTIFLUX 2000 F / 4000 F - IFC100 W

IECEx

KROHNE

1.1 Scope of the document

These instructions are applicable only to the explosion-protection version of the:

- OPTIFLUX 2100 C
- OPTIFLUX 4100 C
- OPTIFLUX 2000 F
- OPTIFLUX 4000 F
- IFC100 W

INFORMATION!
For all other data, use the Quick Start and Handbook. If you do not have these documents, please download them from the manufacturer's website.

1.2 Safety instructions for the operator

WARNING!

- *Do not change the device. Unauthorised changes 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 60364, e.g. VDE 0100), especially the regulations in EN/IEC 60079-14 "Electrical installations in hazardous locations", equivalent national standard (e.g. DIN VDE 0165 Part 1).*
- *Installation, establishment, utilisation and maintenance are only allowed to be executed by personnel with an education in explosion safety!*

These additional instructions are an extension to the handbook. All technical information as described in the handbook is applicable, when not specifically excluded, completed or replaced by the instructions in these additional instructions.

1.3 Approvals

The flowmeters consists of a flow sensor and a signal converter.
The approval numbers are:

Compact versions:

OPTIFLUX 2100 C = OPTIFLUX 2000 + IFC 100
OPTIFLUX 4100 C = OPTIFLUX 4000 + IFC 100

KEMA 08 ATEX 0157 X and IECEx KEM 09.0073 X

The flowmeters are approved to following standards:

- EN IEC 60079-0 : 2006 / 2004
- EN IEC 60079-1 : 2007 / 2007-04
- EN IEC 60079-7 : 2007 / 2006-07
- EN IEC 60079-11 : 2007 / 2006
- EN IEC 60079-18 : 2004 / 2004
- EN IEC 61241-0 : 2006 / 2004
- EN IEC 61241-1 : 2004 / 2004

and for ATEX (only)

- EN 50 014 :1997 + A1,A2
- EN 50 017 :1998

INFORMATION!
EN and IEC issue dates are seperated by a backslash, EN issue date precedes the IEC issue date.

Field versions:

IFC 100 W

KEMA 07 ATEX 0199 X and IECEx KEM 09.0042 X

Approved to following standards:

- EN IEC 60079-0 : 2006 / 2004
- EN IEC 60079-7 : 2007 / 2006-07
- EN IEC 60079-11 : 2007 / 2006
- EN IEC 60079-18 : 2004 / 2004
- EN IEC 61241-0 : 2006 / 2004
- EN IEC 61241-1 : 2004 / 2004

OPTIFLUX 2000 F and OPTIFLUX 4000 F

FTZU 13 ATEX 0175 X and IECEx FTZU 14.0001 X

Approved to following standards:

- EN IEC 60079-0 : 2012 / 2011
- EN IEC 60079-1 : 2007 / 2007-04
- EN IEC 60079-5 : 2007 / 2007-03
- EN IEC 60079-7 : 2007 / 2006-07
- EN IEC 60079-11 : 2012 / 2011
- EN IEC 60079-18 : 2009 / 2009
- EN IEC 60079-31 : 2009 / 2008

INFORMATION!
EN and IEC issue dates are seperated by a backslash, EN issue date precedes the IEC issue date.

INFORMATION!
All ATEX EC-type examination certificates and IECEx certificates of conformity can be downloaded from the KROHNE website.

1.4 OPTIFLUX 2000 / 4000

1.4.1 Field versions

OPTIFLUX 2000 F / 4000 F is suitable for installation in gas hazardous areas zone 1 or zone 2, gas group IIC, temperature class T6...T3 or T5...T3. The stainless steel version is also suitable for installation in dust hazardous areas zone 21 or 22, surface temperature 180 °C.

Field current circuit, in type of protection "Increased safety" (Ex e), terminals 7, 8 and 9:

U < 40 V (switched DC voltage, alternately +40 and -40 V)

I = 125 mA (injected square wave current)

Electrode circuits, in type of protection "Intrinsic safety" (Ex ia), terminals 1, 2, 3 and 4:

Ui = 20 V, Ii = 175 mA, Ci = 0 nF, Li 0 mH.

The before mentioned intrinsically safe circuits shall, from safety point of view, be considered to be connected to ground.
The cable gland for the electrode circuit is - as an intrinsically safe circuit - marked with a blue o-ring.

EX Marking OPTIFLUX 2000 F / 4000 F

Nominal diameter	Ex marking	
DN2,5...15 ("mb")	II 2G	Ex e ia mb IIC T6...T3 Gb
DN10...20 ("mb")	II 2G	Ex e ia mb IIC T6...T3 Gb
DN25...150 ("d")	II 2G	Ex d e ia IIC T6...T3 Gb
DN200...300 ("q")	II 2G	Ex e ia q IIC T6...T3 Gb
DN350...3000 ("e")	II 2G	Ex e ia IIC T6...T3 Gb
Optional:		
DN25...150 ("q")	II 2G	Ex e ia q IIC T5...T3
DN200...300 ("e")	II 2G	Ex e ia IIC T6...T3 Gb
Additionally:		
All diameters, stainless steel	II 2D	Ex tb IIIC T180°C Db

INFORMATION!
Equipment group (II) and equipment category (2G or 2D) only included in marking for ATEX

1.4.2 Compact versions

OPTIFLUX 2100 C / 4100 C is suitable for installation in gas hazardous areas zone 1 or zone 2, gas group IIC, temperature class T4 and dust hazardous areas zone 21 or 22, surface temperature 120 °C.

The connection compartment contains terminals for Power, Status / Pulse / Current, Sensor coils (all in type of protection Ex e) and Sensor signal (in type of protection Ex ia). For electrical data of these terminals, refer to section 3.2.

EX Marking OPTIFLUX 2100 C / 4100 C

Nominal diameter	Ex marking	
10...20 ("mb")	II 2G	Ex e ia mb IIC T4
25...150 ("d")	II 2G	Ex d e ia mb IIC T4
200...300 ("q") ATEX only	II 2G	Ex e ia mb q IIC T4
350...3000 ("e")	II 2G	Ex e ia mb IIC T4
Optional:		
25...150 ("q") ATEX only	II 2G	Ex e ia mb q IIC T4/T3
200...300 ("e")	II 2G	Ex e ia mb IIC T4
Additionally:		
All diameters	II 2D	Ex tD A21 IP64 T120°C

INFORMATION!
Equipment group (II) and equipment category (2G or 2D) only included in marking for ATEX

1.4.3 Signal converter IFC 100 W

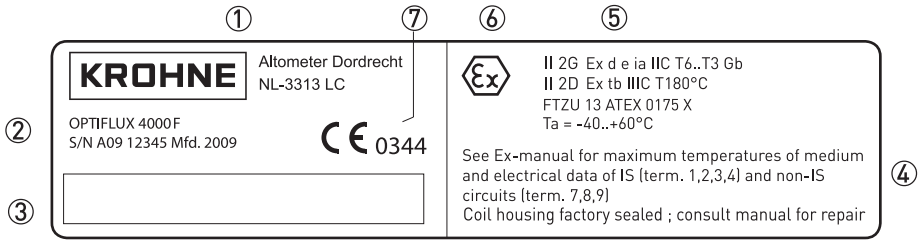
The IFC 100 W is certified as a group II, category 2G and 2D equipment, for gas hazardous areas zone 1 or 2, gas group IIC, temperature class T4 and dust hazardous areas zone 21 or 22, surface temperature T135°C.

Ex marking	
II 2G	Ex e [ia] mb IIC T4
II 2D	Ex tD A21 IP64 T135°C

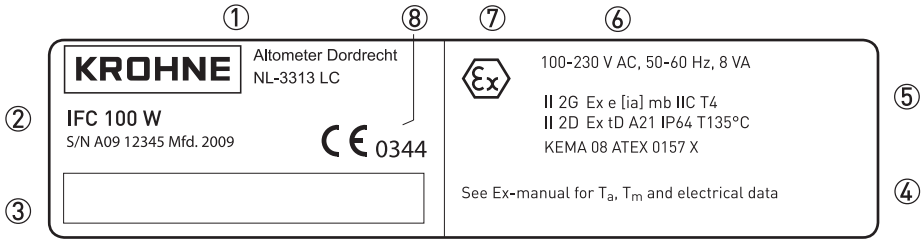
INFORMATION!
Equipment group (II) and equipment category (2G or 2D) only included in marking for ATEX

1.5 Marking labels (examples)

The ATEX/IECEx data stickers on the flowmeter and / or converter typically contains the following information



① Name and address of the manufacturer
② Type designation of flow meter
③ non-Ex specific data
④ Explosion safety notes and warnings
⑤ Symbols and code letters for explosion safety
⑥ Ex marking for explosion safety (ATEX only)
⑦ CE mark with number of notified body (ATEX only)



① Name and address of the manufacturer
② Type designation of flow meter
③ non-Ex specific data
④ Explosion safety notes and warnings
⑤ Symbols and code letters for explosion safety
⑥ Electrical data mains circuit
⑦ Ex marking for explosion safety (ATEX only)
⑧ CE mark with number of notified body (ATEX only)

The temperature limits apply under the following conditions:

- The instrument is installed and operated in accordance with the installation directions given in the installation and operating instructions.
- 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 signal converter housing.

2.1 OPTIFLUX 2000 / 4000

2.1.1 Field versions

- The OPTIFLUX 2000 F / 4000 F flow sensors are suitable for an ambient temperature of -40...+60°C.
- For dust hazardous areas, the maximum surface temperature is e180°C.
- The minimum process temperature for all DN sizes is -40°C.
- The maximum process temperature T_p is dependent on the required temperature class T6...T3 (or T5...T3), the diameter and the maximum ambient temperature T_a
- The process temperature range is often limited further by the liner type used (refer to the Quick Start).

DN2,5...15 ("mb")

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T6	70	70	70
T5	85	85	85
T4	120	120	120
T3	180	180	165
Use heat resistant cables for; T_p above ①	N.A.	N.A.	N.A.

Note; ① the continuous operating temperature of heat resistant cables must be at least 85°C

DN10...20("mb")

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T6	75	70	70
T5	95	90	75
T4	130	115	75
T3	150	130	75
Use heat resistant cables for; T_p above ①	N.A.	N.A.	N.A.

DN25...150("d")

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T6	70	70	70
T5	85	85	85
T4	120	120	120
T3	180	180	180
Use heat resistant cables for; T_p above ①	N.A.	155	105

DN25...150("q" - optional)

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T5	60	55	---
T4	110	105	100
T3	180	180	180
Use heat resistant cables for; T_p above ①	N.A.	155	105

Note; ① the continuous operating temperature of heat resistant cables must be at least 85°C

DN200...300("q")

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T6	75	70	70
T5	95	90	75
T4	130	115	75
T3	160	130	75
Use heat resistant cables for; T_p above ①	N.A.	145	110

DN200...300("e"- optional)

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T6	80	75	70
T5	95	95	95
T4	130	130	130
T3	160	160	160
Use heat resistant cables for; T_p above ①	N.A.	N.A.	145

DN350...3000("e")

Temperature class	Max. process temperature Tp [°C]		
	$T_a \leq 40°C$	$40 < T_a \leq 50°C$	$50 < T_a \leq 60°C$
T6	80	75	70
T5	95	95	95
T4	130	130	130
T3	160	160	160
Use heat resistant cables for; T_p above ①	N.A.	N.A.	145

Note; ① the continuous operating temperature of heat resistant cables must be at least 85°C

2.1.2 Compact versions

- The OPTIFLUX 2100 C / 4100 C is suitable for an ambient temperature of -20...+40°C or -20...+55°C.
- For dust hazardous areas, the maximum surface temperature is 120°C.
- The minimum process temperature for all DN sizes is -20°C.
- For Ta ≤ 40°C the maximum process temperature is determined by the temperature class T4 of the gas hazardous area of concern
- The process temperature range is often limited further by the liner type used (refer to the Quick Start).

DN10...20 ("mb"), DN25...150 ("d"), DN200...300 ("q", ATEX only), DN200...300 ("e") and DN350...3000 ("e")

Temperature class	Max. process temperature Tp [°C]	
	$T_a \leq 40°C$	$40 < T_a \leq 55°C$
T4	120	55

DN25...150 ("q", optional, ATEX only)

Temperature class	Max. process temperature Tp [°C]	
	$T_a \leq 40°C$	$40 < T_a \leq 55°C$
T4	100	55
T3	120	55

In the case of field versions, the electrical connection between the sensor and the signal converter is established via a signal cable and a field current cable.
The **field current cable** is no part of the supply and must be supplied by the user. It must be according EN IEC 60079-14 clause 9.3 and 11.2 (Increased safety).
The **signal cable** is part of the supply.

3.1 Signal cable A

The signal cable A is a double screen shielding cable, according to EN/IEC 60079-14 clause 12.2.2 (Intrinsic safety).

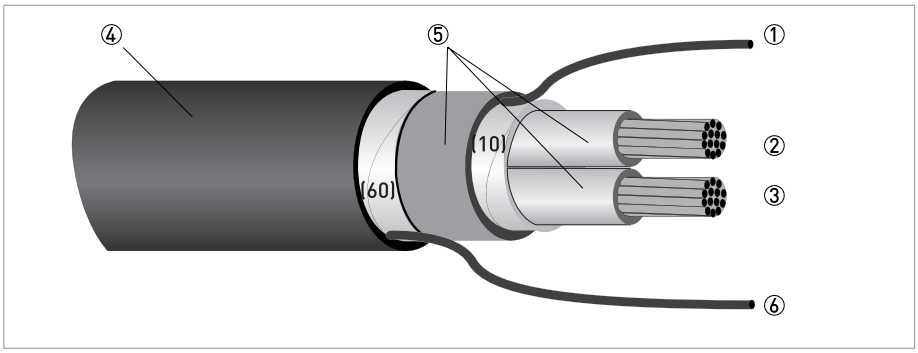


Figure 3-1: Construction of signal cable A

① Stranded drain wire (1) for the inner shield (10), 1.0 mm^2 Cu / AWG 17 (not insulated, bare)
② Insulated wire (2), 0.5 mm^2 Cu / AWG 20
③ Insulated wire (3), 0.5 mm^2 Cu / AWG 20
④ Outer sheath
⑤ Insulation layers
⑥ Stranded drain wire (6) for the outer shield (60)

3.2 Equipotential bonding

- As the Ex ia electrode circuits of the flow sensors are effectively grounded through the conductive liquid in the measuring tube, an equipotential bonding system must exist over the whole area in which the electrode circuits, including their wiring, are installed, conform EN/IEC 60 079-14 clause 12.2.4.
- The flowmeters OPTIFLUX 2000 F, 4000 F, the electrode cable and the IFC 100 W signal converter must all be included in the equipotential bonding system of the hazardous area. If a single separate conductor is used for equipotential bonding, than this conductor must have a cross section of at least 4 mm^2 copper.
- The separate equipotential bonding conductor between flowmeter and converter can be left out, if by other means (e.g. over bonding conductors over the metal piping system) a high level of assurance that potential equalization exists between flowmeter and converter is reached.

3.3 Signal cable connections

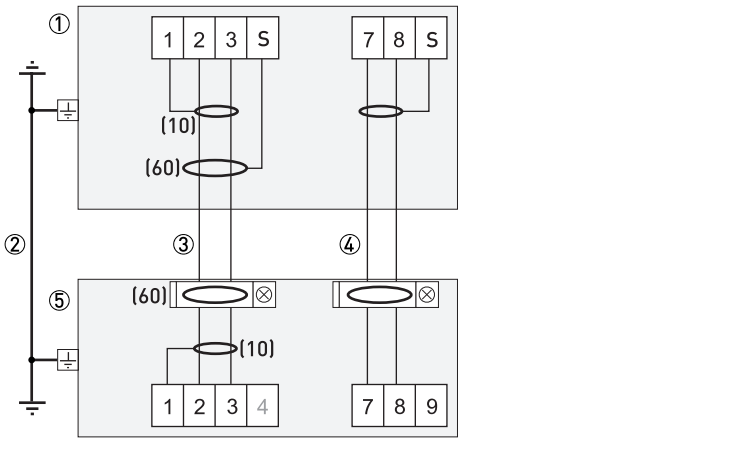


Figure 3-2: Connecting cables Field version

① Electrical terminal compartment in housing of the signal converter for signal and field current cable
② Equipotential bonding, conductor ≥ 4 mm^2
③ Signal cable acc. EN/IEC 60079-14 clause 12.2 (intrinsic safety)
④ Field current cable acc. EN/IEC 60079-14 clause 9.3 and 11.2 (increased safety)
⑤ Flow sensor outlet box

3.4 Installation instructions

For OPTIFLUX 2100 C / 4100 C, and IFC 100 W
The cable glands and blanking elements must be in type of protection increased safety "e", suitable for the conditions of use and correctly installed. The devices must provide a degree of protection of at least IP64 according to IEC 60 529.

Additionally for OPTIFLUX 2000 F / 4000 F C:
The field coils in type of explosion protection "q" and "m" must be protected by a 160 mA fuse. The breaking capacity of the fuse must be in accordance with the prospective short circuit current of the supply. This concerns:

OPTIFLUX 2000 F / 4000 F	DN10...20 ("mb")
	DN200...300 ("q")
	DN25...150 ("q") (optional)

INFORMATION!
General notes for all flowmeters:

- *The internal field coil fuses of an IFC 100 W signal converter fulfill the above mentioned requirements with respect to rated current and breaking capacity.*
- *The IFC 100 W signal converter is normally delivered with four Ex e certified M20x1.5 cable glands, clamping range Ø 6...12 mm.*
- *The OPTIFLUX 2000 F / 4000 F flow sensors and the OPTIFLUX 2100 C / 4100 C compact flowmeters are normally delivered with two Ex e certified M20x1.5 cable glands, clamping range Ø 6...12 mm.*

3.5 Connection of IFC 100 W and OPTIFLUX 2100 C / 4100 C

Terminals	Circuit	Type of protection Ex
L, N, PE	Power 100...230 V AC, +10%/-15%, 8 VA, U_m = 253 V 24 V AC/DC, for connection to a PELV circuit, U_m = 253 V, AC: +10%/-15%, 8 VA DC: +30%/-25%, 4 W	Ex e
C, C- D, D- A, A-, A+ S	Status, Pulse, Current, Screen (frame) All circuits $U_n \leq$ 32 V, $I_n \leq$ 50 mA, U_m = 253 V for connection to a PELV circuit	Ex e
IFC 100 W version only:		
7, 8, S	Sensor coils Screen (frame) switched DC current, $U_n \leq$ 20 V, $I_n \leq$ 160 mA, prospective short circuit current < 35 A, for connection to a PELV circuit	Ex e
1, 2, 3, S	Sensor signal (electrodes) Screen (frame) U_o = 19.7 V, I_o = 8 mA, P_o = 40 mW, C_o = 180 nF, L_o = 20 mH Lineair characteristic	Ex ia IIC

For IFC 100 W versions:
The intrinsically safe sensor signal (electrodes) circuit and the non-intrinsically safe sensor coils circuit are galvanically connected with each other. Both circuits are securely galvanically isolated from all other non-intrinsically safe circuits up to a peak voltage of 375 V. The sensor coils circuit shall be connected to a passive load only. For further details about the electrical connection, see the handbook.

For OPTIFLUX 2100 C / 4100 C only:
The housing must be connected to the equipotential bonding system of the hazardous area. See EN/IEC 60 079-14 clause 6.3. For this purpose the internal or external connection facility (PE clamp) can be used.

4.1 Maintenance and service

The OPTIFLUX flowmeters are maintenance free with respect to the flow metering properties. Within the scope of periodic inspections required for electrical equipment installed in hazardous areas it is recommended to check the flow meter and converter housing for signs of the corrosion. This is especially important for the flameproof Ex d flowmeter or coil housing of sizes DN25...150.

Specific notes for Ex d flowmeters, sizes DN25...150:

- In case of replacement of one (or more) of the four M6 hexagon socket head cap screws which connect the IFC 100 converter housing with the OPTIFLUX 2000 / 4000 flowmeter, equivalent types must be used, that are M6x16 hexagon socket head cap screws to ISO 4762, steel quality A2-70 or A4-70.

Specific notes for Ex q flowmeters, sizes DN25...150 and DN200...300:

- The coil housing is factory sealed. After opening of the seal the flowmeter must be returned to the manufacturer to re-fill the flowmeter with the Ex q approved powder filling material.

If needed, contact the manufacturer for information on the dimensions of the flameproof joints.

KROHNE product overview

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

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.:+49 203 301 0
Fax:+49 203 301 103 89
info@krohne.com

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

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