KROHNE

04/02

Magnetic-inductive flowmeters

Addition to the installation and operating instructions

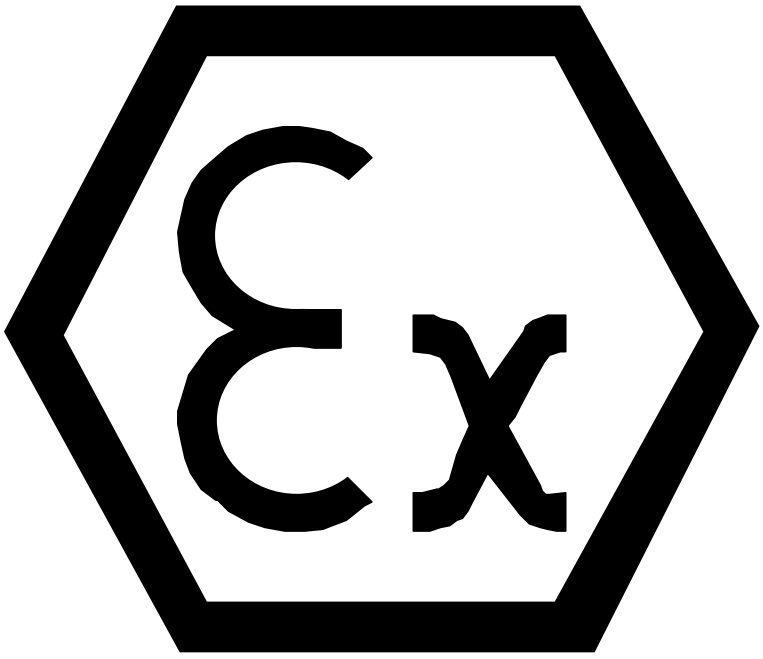
CE

ALTOFLUX

IFM 4080 K-EEx

IFM 4080 K/i-EEx

Compact flowmeter



7.30917.31.00

WARNING !

No changes may be made to the devices. Unauthorized changes might affect the explosion safety of the devices.

These additional instructions are an extension to the Installation and Operating Instructions and only applies for the EEx version of the IFM 4080 K or IFM 4080 K / i - EEx magnetic-inductive compact flowmeter. All technical information described in the Installation and Operating Instructions are applicable, when not specifically excluded or replaced by the instructions in these additional instructions.

CONTENTS

Be sure to follow these instructions !

IMPORTANT !

- The **prescriptions and regulations** as well as the **electrical data** described in the **EC-type examination certificate must be obeyed**.
- Beside the instructions for electrical installations in non-hazardous locations according to the applicable national standard (equivalent of 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) **must** be followed.
- **Installation, establishment, utilization and maintenance** are **only allowed** to be executed by **personnel with an education in explosion safety** !

1 SYSTEM COMPONENTS

1.1 General information

The Altoflux IFM 4080 K/…-EEx magnetic-inductive compact flowmeter is in accordance with the European Directive 94/9 EC (ATEX 100a) and approved for hazardous classified locations of Zone 1 and 2 by the KEMA conform to the European Standards of the EN 500xx series. The IFM 4080 K/…-EEx has the following approval number.

KEMA 01 ATEX 2200 X

The compact flowmeter is available in two types, namely:

- IFM 4080 K-EEx regular explosion protected version;
- IFM 4080 K/i-EEx, MODIS version. This type has intrinsically safe signal output circuits, which are provided by two on the IFC 090i-EEx electronics unit installed MODIS modules.

The regular IFM 4080 K-EEx compact flowmeter is designed for ambient temperatures in the range of -20°C (special -40°C) up to +60°C, the MODIS version type IFM 4080 K/i-EEx is rated for ambient temperatures from -20°C up to +60°C.

The allowed process liquid temperature is a.o. limited by the combustible atmosphere that (possibly) surrounds the apparatus, which again is determined by the temperature class of the atmosphere (first column of the tables). See table 1 and 2 below for details.

For dusts the second column of the two below listed tables is applicable.

Temperature class (for gases)	**Max. surface temperature** (for dusts)	**Maximum process liquid temperature**		
		$T_a \leq 40°C$	$T_a \leq 50°C$	$T_a \leq 60°C$
T6	T85°C	75°C	70°C	70°C
T5	T100°C	95°C	90°C	75°C
T4	T135°C	130°C	115°C	75°C
T3	T180°C	150°C	115°C	75°C

Table 1: Temperature classification DN200 and larger.

Temperature class (for gases)	**Max. surface temperature** (for dusts)	**Maximum process liquid temperature**		
		$T_a \leq 40°C$	$T_a \leq 50°C$	$T_a \leq 60°C$
T6	T85°C	70°C	70°C	70°C
T5	T100°C	85°C	85°C	85°C
T4	T135°C	120°C	120°C	115°C
T3	T180°C	180°C	180°C	115°C
Use heat-resistant cables above		-	-	50°C

Table 2: Temperature classification DN25…150 with PFA liner.

The IFM 4080 K/…-EEx flowmeter consists of the IFC 090/…-EEx signal converter unit, which is screwed on top of the primary head (i.e. measuring unit). The compact flowmeter is marked with one of the codes below, depending on the meter size:

- DN25-150: II 2GD EEx d [ib] IIC T6…T3 (EEx d terminal compartment) or
  II 2GD EEx de [ib] IIC T6…T3 (EEx e terminal compartment).
- DN200 and up: II 2GD EEx de [ib] IIC T6…T3 (both EEx d and EEx e terminal compartment).

In case of the MODIS version IFM 4080 K/i-EEx , the electronics unit of type IFC 090i-EEx is provided with protective modules, which provide intrinsically safe output signals of category "ia". The flowmeter is then marked with one of the following codes:

- DN25-150: II 2GD EEx d [ia] [ib] IIC T6…T3 (EEx d terminal compartment) or
  II 2GD EEx de [ia] [ib] IIC T6…T3 (EEx e terminal compartment).
- DN200 and up: II 2GD EEx de [ia] [ib] IIC T6…T3. (both EEx d and EEx e terminal compartment)

For details see the EC-type examination certificate in Section 11 of these instructions.

1.2 Primary head

The primary head is the measuring unit of the IFM 4080 K/…-EEx compact flowmeter and contains two field coils (see table 3 for type of protection) and two electrodes in type of protection intrinsic safety category "ib" according to EN 50020.

Meter size	Type of protection	
DN25 up to DN150	Housing: Electrodes:	Flameproof enclosure "d" according to EN 50018 Intrinsic safety "ib" according to EN 50020
DN200 and larger	Field coils: Electrodes:	Increased safety "e" according to EN 50019 Intrinsic safety "ib" according to EN 50020

Table 3: Types of protection of primary head.

NOTE:
The intrinsically safe electrode circuits of the IFM 4080K/…-EEx compact flowmeter are **only internal circuits** and not accessible for the customer.

1.3 IFC 090/…-EEx signal converter

The IFC 090/…-EEx signal converter consists of a cylindrical housing of die-casted aluminum, which has two separate compartments, divided from each other by an integrated wall with casted flameproof terminal feed-through. The neck at the bottom of the housing contains a flameproof cable feed-through. The signal converter housing is on both ends closed by a cylindrical threaded cover with O-ring sealing. The housing has an ingress protection degree of at least IP67 conform to EN 60529.

1.3.1 Electronics compartment

The electronics compartment accommodates the pre-certified IFC 090…-EEx electronics unit with approval number PTB 98 ATEX 2012 U. The compartment is designed with type of protection **flameproof enclosure "d"** according to EN 50018. It is closed by a flameproof display cover with glass window.

1.3.2 Terminal compartment

The terminal compartment has seven terminals for connection of the power supply and signal output circuits. Chapter 2 and 7 show the terminal arrangement for the regular and MODIS version of the IFC 090/…-EEx signal converter. The terminal arrangement of the MODIS version (i.e. IFC 090i-EEx) is shown in figure 4 on page 6. Two of the terminals are used for connection of the **non-intrinsically safe** power supply and four terminals (marked with "*") for the **intrinsically safe, category "ia"** signal outputs of the MODIS modules. The non-intrinsically and intrinsically safe terminals are separated from each other by a metal dividing plate, which is screwed to the remaining (not connected) M4 terminal. The two **non-intrinsically safe** power supply terminals are covered by an insulating plate.

The terminal compartment (with standard type of protection increased safety "e") is standard equipped with two ATEX approved "EEx e" cable glands. The terminal compartment can also be provided as a flameproof enclosure "d", in which case ATEX approved "EEx d" cable glands of size Pg13.5, Pg16 or M20x1.5 are either factory installed or must be installed by the customer. For flameproof conduit systems, the terminal compartment must have type of protection flameproof enclosure "d" according to EN 50018. The conduits must be sealed by "EEx d" approved (within the ATEX 100a directive) sealing devices (i.e. stopping box) directly at the conduit entrances of the as flameproof enclosure performed terminal compartment.

1.4 Electronics unit

The IFM 4080 K/…-EEx magnetic-inductive compact flowmeter can be equipped with the regular IFC 090-EEx or with the IFC 090i-EEx electronics unit with intrinsically safe signal outputs (i.e. MODIS version). The next subsections give a detailed description of these units.

1.4.1 Regular IFC090-EEx electronics unit

The IFC 090-EEx is used in the regular IFM 4080 K-EEx and can be equipped with one of the following power supplies (depends on the area of application).

Power supply	Terminal	Function	Electrical data
AC-versions	L N PE	Live Neutral Protective Earth	U_n = 100/115/200/230 V_{ac} -15/+10% P_n = approx. 10 VA, U_m = 253 V
AC/DC-version	1L≂ 0L≂ FE	Live Neutral Functional Earth	U_n = 24 V ac/dc AC: -15/+10%, P_n=10 VA DC: -25/+30%, P_n=8 W U_m = 253 V

Table 4: Electrical data of power supply.

The IFC 090-EEx electronics unit is equipped with the following in-/output circuits. Terminals B1, B⊥ and B2 can be configured as status or pulse outputs or as control inputs via the software. See the table below for the electrical data of these in-/output circuits.

Terminals	Description	Nominal voltage	Maximum current
I+, I	Current output	15 V	22 mA
B1, B⊥, B2	Pulse, status, control in-/outputs	32 V	150 mA

Table 5: Electrical data of in-/output circuits.

1.4.2 IFC 090i-EEx unit with MODIS modules

The IFC 090i-EEx electronics unit is equipped with a pair of MODIS-modules (see page 8). It is equipped with one of the following power supplies.

Power supply	Terminals	Function	Electrical data
AC-version	L N PE	Live Neutral Protective Earth	U_n = 100…230 Vac –15%/+10% P_n = 15 VA, U_m = 253 V
AC/DC-version	1L≂ 0L≂ FE	Live Neutral Functional Earth	U_n = 24 Vac/dc AC: -15%/+10% or 20.4…26.4 Vac DC: -25%/+30% or 18…32 Vdc P_n = 10 W, U_m = 253 V

Table 6: Electrical data of IFC 090i-EEx electronics unit.

NOTE: The mains fuses for both electronics units are listed in Section 8 of this manual.

2 ELECTRICAL CONNECTION

2.1 Equipotential bonding system

The IFM 4080 K-EEx and IFM 4080 K / i-EEx flowmeters must always be incorporated into the equipotential bonding system of the hazardous area. This connection can be achieved through the PE/FE conductor connected to the PE terminal in the terminal compartment (see figure 1) or through a separate PE conductor, cross sectional area at least 4 mm^2, connected to the external PE clamp, placed below the converter housing.

2.2 Regular IFC 090-EEx electronics unit

The field cables that enter the terminal compartment of the IFC 090-EEx signal converter unit (i.e. power supply, current and binary outputs) are non-intrinsically safe. To connect external devices to the signal output terminals, the wiring requirements for the type of protection of the compartment (standard: increased safety "e", optional: flameproof "d") must be conform to the international or national standard involved (e.g. EN 60079-14).
The terminal arrangement is shown by figure 1 below.

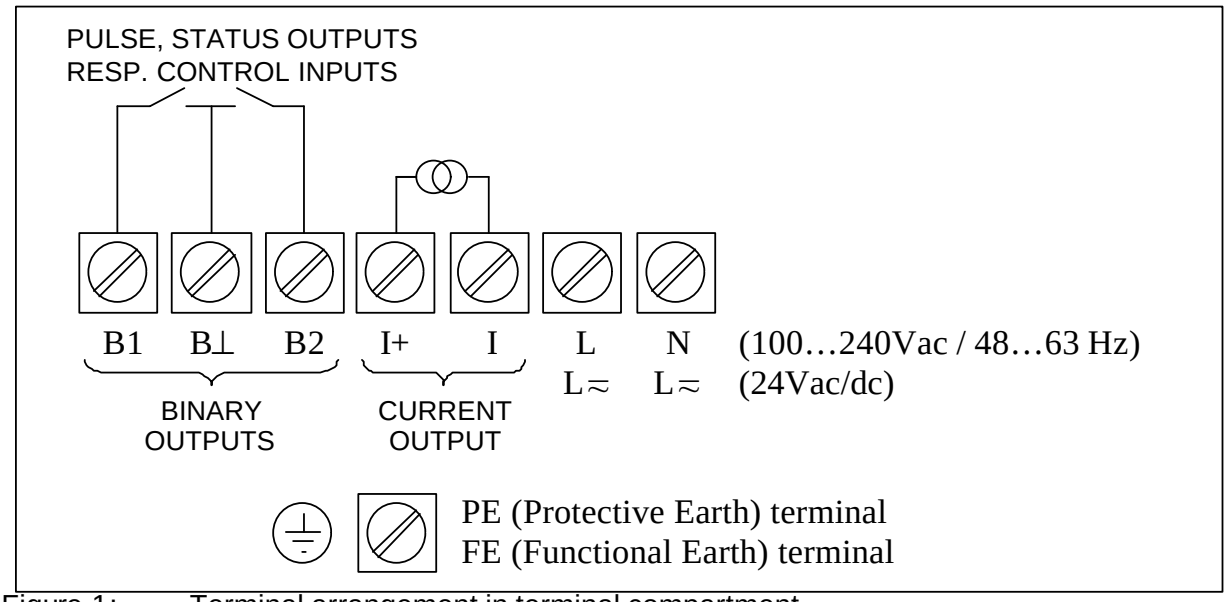


Figure 1: Terminal arrangement in terminal compartment.

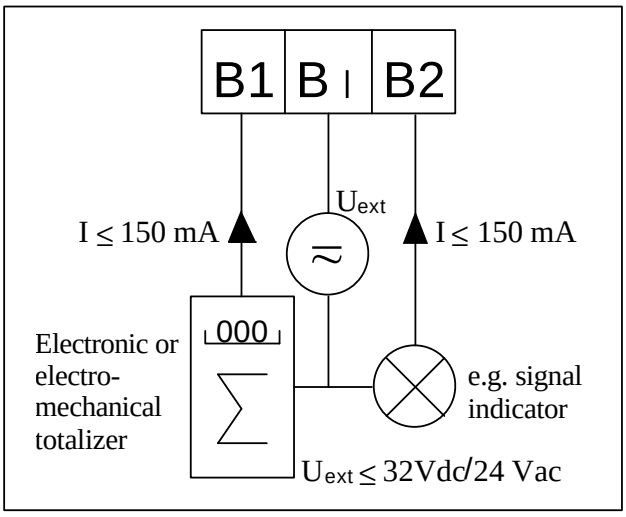


Figure 2 Passive pulse/status output

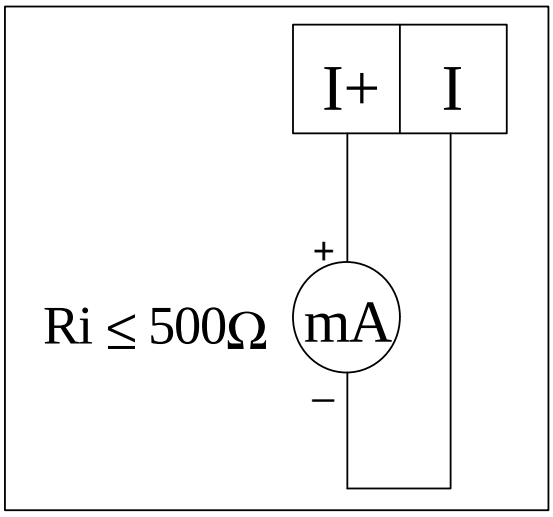


Figure 3 Active current output

Note:
The binary outputs (terminals B1, B⊥ and B2) can only be configured as passive outputs, the current output (terminals I+ and I) can only be configured as active output.

2.3 MODIS version IFC 090i-EEx electronics unit

The field cables of the **non-intrinsically safe** power supply and the **intrinsically safe, category "ia"** signal outputs enter the terminal compartment of the IFC 090i-EEx signal converter unit via two separate entrances. To connect external devices to the intrinsically safe signal output terminals, the wiring requirements for their type of protection as well as of the compartment (standard: increased safety "e", optional: flameproof enclosure "d") must be conform to the international or national standard involved (e.g. EN 60079-14). Figure 4 below shows the terminal arrangement inside the terminal compartment.

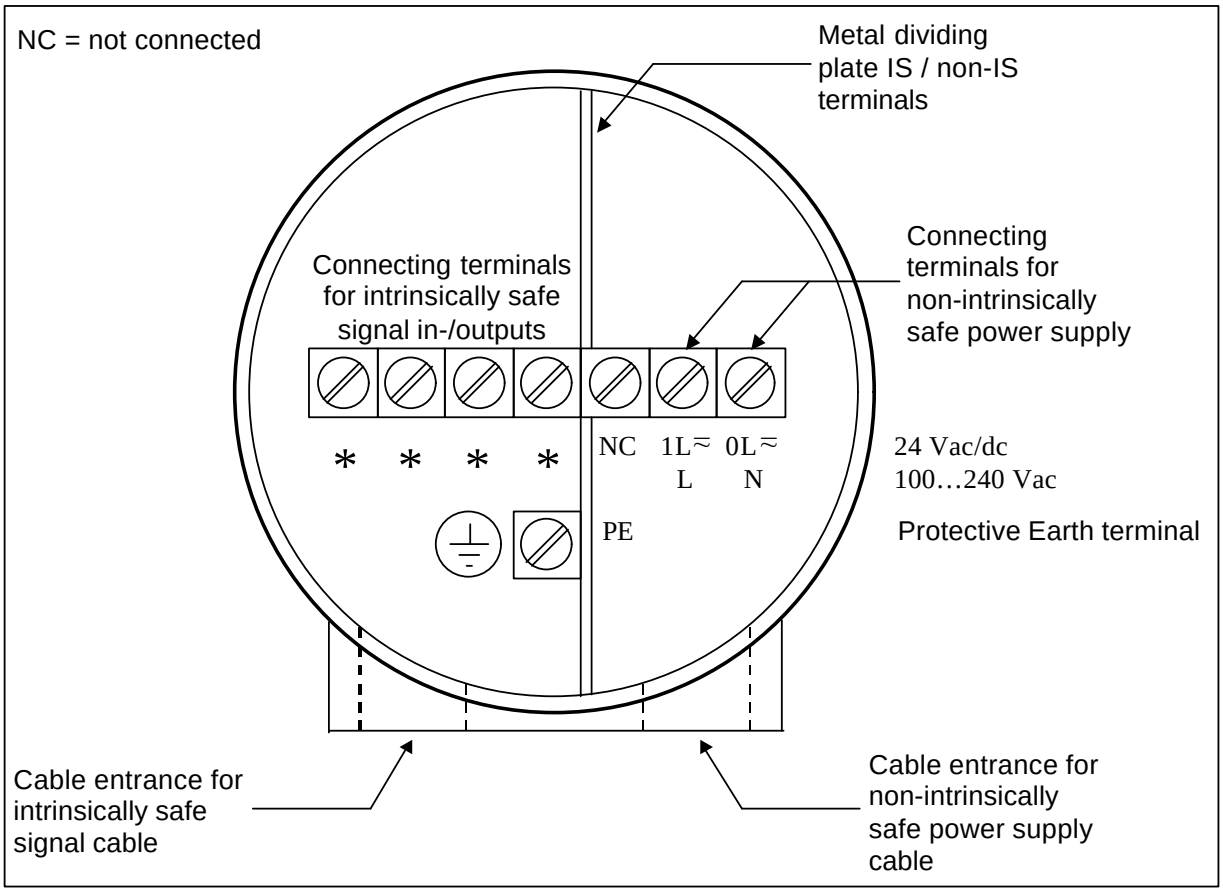


Figure 4: Terminal arrangement in terminal compartment.

The non-intrinsically safe terminals for connection of the power supply (1L≂ and 0L≂) must be connected according to the relevant standard code of practice for electrical apparatus intended for use in potentially hazardous locations, type of protection Increased Safety "e" or type of protection Flameproof Enclosure "d", depending on the type of protection of the terminal compartment of the signal converter housing.

To gain access to the connection terminals of the power supply, the half-circular cover plate of insulating material must be slightly lifted at one end and then rotated downwards, see the instruction on the cover plate. After connection of the power supply cable, the half-circular cover plate must be restored into its original position, so that the minimum clearances and creepage distances towards the **intrinsically safe** signal in-/output terminals are maintained.

See for details figure 5 .

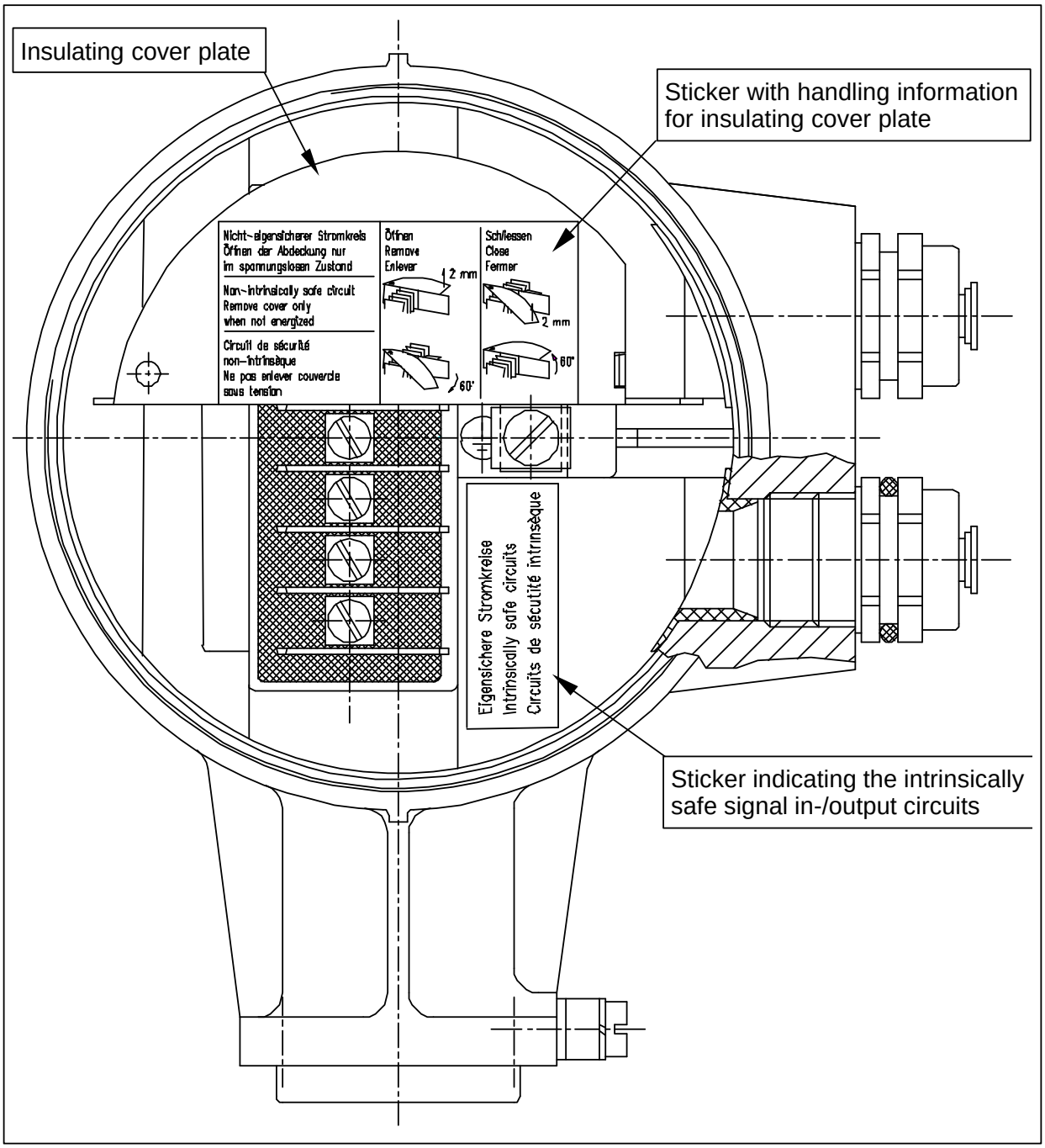


Figure 5: Terminal compartment MODIS version IFC 090i-EEx.

The PE (or FE) conductor must be connected to the press-fitted M5 clamp terminal marked inside the terminal compartment. This conductor must be guided through the rectangular opening in the metal dividing plate that separates the non-intrinsically safe power supply terminals from the intrinsically safe signal in-/output terminals.

2.3.1 Connection diagrams MODIS

Section 7 shows the block diagram of the IFM 4080 K/ i…-EEx magnetic-inductive compact flowmeter. The power supply (terminals 1L≂, 0L≂) is connected via cable B. The PE terminal must be connected to the protective earth conductor of the mains supply.

The IFC 090i-EEx electronics unit is provided with **intrinsically safe signal in-/output circuits** due to the installed pair of MODIS modules in accordance with the table below.

Module	Terminal designation	Function / Intrisically safe maximum data
P-SA	I⊥, I	Current output (0/4-20 mA), passive U_i = 30 V, I_i = 250 mA, P_i = 1.0 W C_i = 5 nF, $L_i \approx 0$
FA-ST	B1, B1⊥ or B2, B2⊥	Pulse (frequency) output or status in-/output, all passive The function can be set by software U_i = 30 V, I_i = 250 mA, P_i = 1.0 W C_i = 5 nF, $L_i \approx 0$
F-PA	D, D⊥	Fieldbus module, type Profibus system, passive U_i = 30 V, I_i = 300 mA, P_i = 4.2 W C_i = 5 nF, $L_i \approx 0$
F-FF	D, D⊥	Fieldbus module, type Fieldbus Foundation, passive U_i = 30 V, I_i = 300 mA, P_i = 4.2 W C_i = 5 nF, $L_i \approx 0$
DC-I (see note)	I+, B1+	Intrinsically safe voltage source for the passive module P-SA or FA-ST, so that active operation is possible. U_o = 23.5 V, I_o = 98 mA, P_o = 0.6 W C_o = 132 nF [1], L_o = 4 mH

Table 7: Overview of MODIS modules.

NOTES:

- Besides the shown intrinsically safe maximum values for voltages and current -which are based on certain fault conditions as prescribed by the standard EN 50 020 - the nominal values for current and voltage must also be respected otherwise a proper funtioning of the modules is not guaranteed! See table 8 for the nominal values.
- The active module DC-I is needed in the 24 Vac/dc power supply version to form an active current or pulse output in combination with one of the passive modules P-SA or FA-ST. Due to limited space it is **not** available for 100...230 Vac supply versions.

Table 9 shows the possible combinations of the installed MODIS modules for the 24 Vac/dc power supply version of the IFC 090i-EEx and table 10 for the 100-230 Vac version.

[1] *When modules P-SA (or FA-ST) and DC-I are connected in series, the internal capacitance C_i of 5 nF must be subtracted from the C_o of 132 nF. So the data plate will list a C_o of 127 nF.*

MODIS modul	Nominal values for voltage and current	
P-SA (passive current output)	Current: Working voltage: Voltage drop :	4 .. 20 mA 8 .. 30V 8V at 4mA
FA-ST (frequency/pulse/status output or control input)	Working voltage: Working current: Voltage drop: in ON-state: Leakage current in OFF-state: Control input: Input voltage LOW level: Input voltage HIGH level: Frequency range :	6 .. 30V < 110 mA < 2V at 110 mA < 900 µA at 30V < 3V > 7V 0 .. 12 KHz
DC-I (active voltage source)	Voltage: Current Internal resistance:	20V 30 mA 260

Table 8: Nominal voltage and current values for the MODIS modules

IFC 090i-EEx version	Part No.	MODIS modules		Terminal designation			
Ex-i1	2.11582.01.00	P-SA	FA-ST	I⊥	I	B1	B1⊥
Ex-i2	2.11582.03.00	P-SA	F-PA	I⊥	I	D	D⊥
Ex-i3	2.11582.02.00	P-SA	DC-I	I+			I
Ex-i4	2.11582.05.00	FA-ST	F-PA	B1	B1⊥	D	D⊥
Ex-i5	2.11582.06.00	FA-ST	DC-I	B1+			B1
Ex-i6	2.11582.07.00	FA-ST	FA-ST	B2	B2⊥	B1	B1⊥
Ex-i7	2.11582.08.00	P-SA	F-FF	I⊥	I	D	D⊥
Ex-i8	2.11582.09.00	FA-ST	F-FF	B1	B1⊥	D	D⊥

Table 9 : IFC 090i-EEx 24 Vac/dc versions.

IFC 090i-EEx version	Part No.	MODIS modules		Terminal designation			
Ex-i1	2.12253.01.00	P-SA	FA-ST	I⊥	I	B1	B1⊥
Ex-i2	2.12253.02.00	P-SA	F-PA	I⊥	I	D	D⊥
Ex-i4	2.12253.03.00	FA-ST	F-PA	B1	B1⊥	D	D⊥
Ex-i6	2.12253.04.00	FA-ST	FA-ST	B2	B2⊥	B1	B1⊥
Ex-i7	2.12253.05.00	P-SA	F-FF	I⊥	I	D	D⊥
Ex-i8	2.12253.06.00	FA-ST	F-FF	B1	B1⊥	D	D⊥

Table 10: IFC 090i-EEx 100-230 Vac versions.

Due to mechanical and electrical limitations, only the in table 9 and 10 listed pairs of MODIS modules are possible. The two modules each use two terminals of the bottom four terminals of the flameproof terminal feed-through in the dividing wall between the electronics and terminal compartment of the signal converter housing, except for the combination with module DC-I (only applicable for 24 Vac/dc versions), where only two of the four terminals are used. Interconnection of the two modules, P-SA and DC-I resp. FA-ST and DC-I is made internally.

The flameproof terminal feed-through has seven terminals in total, the top two terminals are used for connection of the power supply, the third one is only used for mounting of a metal dividing plate with insulating cover plate. The remaining four are used for the intrinsically safe signal in-/output circuits of the installed MODIS modules.

The metal dividing plate and the insulating cover plate warrant the required separation distances (i.e. clearances, creepage distances and distances through insulation) between the non-intrinsically safe power supply terminals and the intrinsically safe signal in-/output circuits. The insulating cover plate is provided with a sticker that contains important instructions how to remove and re-install the cover plate and the conditions under which it should be established (**circuits not live !**).

IMPORTANT !

Carefully follow the instructions on the sticker that is glued on top of the insulating cover plate, that covers the non-intrinsically safe power supply terminals !

For the connection diagrams of the intrinsically safe signal in-/outputs of the installed MODIS modules in the IFC 090i-EEx electronics unit (see figure 6, 7 and 8 on the following pages). It has to be noted that the intrinsically safe signal in-/outputs may only be connected to the following listed apparatus' (registering devices like amp-meters, pulse counters, etc.):

- EEx-approved intrinsically safe apparatus;
- EEx-approved associated apparatus;
- Passive apparatus as defined in your national standard for installation of electrical apparatus in hazardous locations (equivalent of EN 60079-14, e.g. DIN VDE 0165).

Other types of apparatus may only be connected to the intrinsically safe signal in-/outputs through EEx-approved safety barriers, isolating interface units and the like. These barriers or units are not depicted in the connection diagrams of figure 6, 7 and 8 for reasons of readability. It is assumed that they are an integrated part of the registering devices or as separate devices connected in series with them. The registering devices may only be installed in the hazardous location if they also have a type of protection for explosion safety according to the European Standards of the EN 500xx series, or if they are constructed as prescribed in your standard national code of practice.

When the intrinsically safe signal in-/outputs are connected to other intrinsically safe or associated apparatus, the maximum safety values (i.e. entity parameters) of all intrinsically safe circuits have to be considered.

IMPORTANT !

The 100…230 Vac power supply versions of the IFC 090i-EEx signal converter electronics unit with MODIS modules can only be equipped with passive outputs. The connection diagrams in the following figures 6 through 8 with the numbers 1, 3, 6 ,8 and 10 are therefore not applicable for the 100…230 Vac power supply versions.

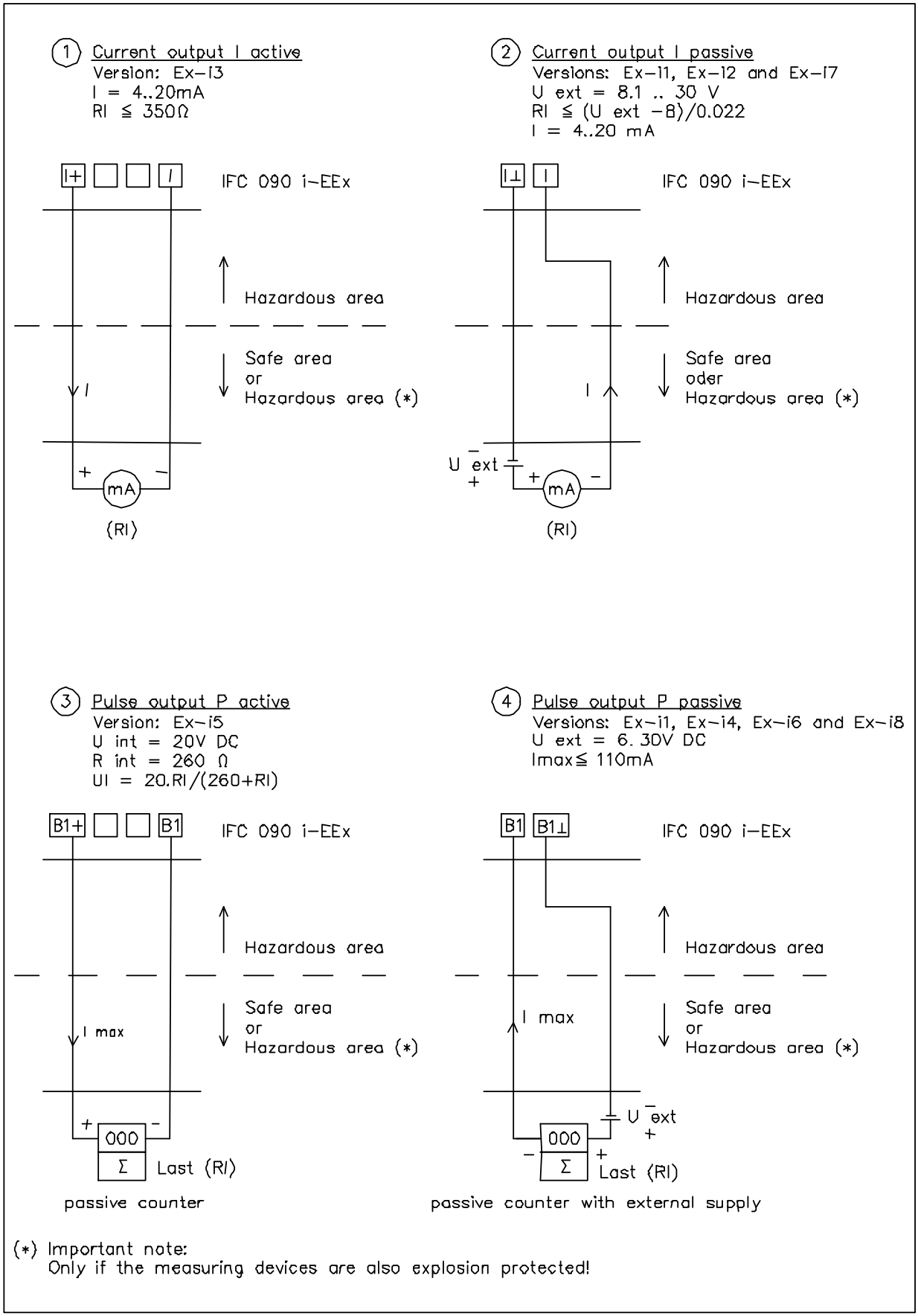


Figure 6: Connection diagrams 1 through 4 of the intrinsically safe signal in-/outputs.

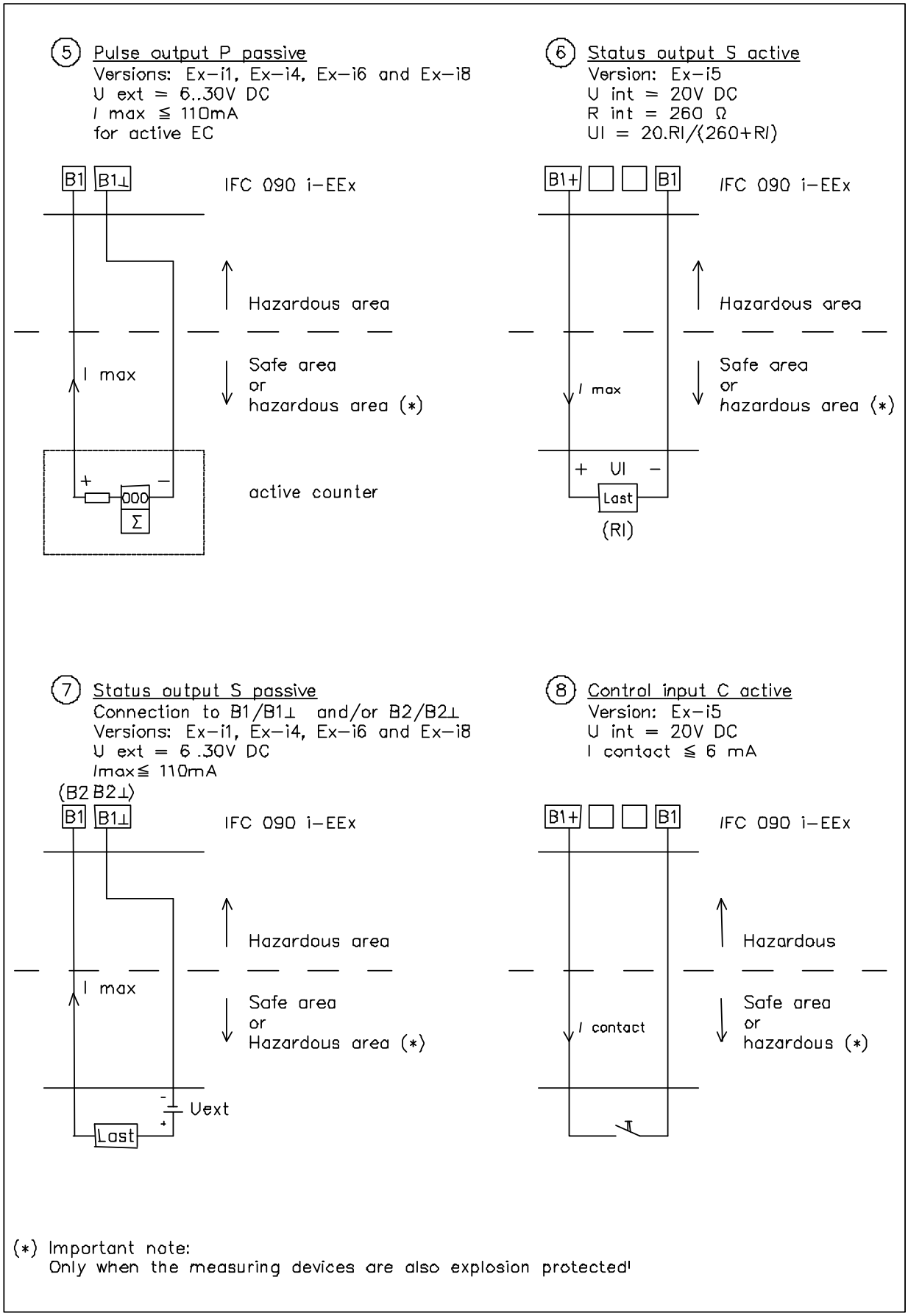


Figure 7: Connection diagrams 5 through 8 of the intrinsically safe signal in-/outputs.

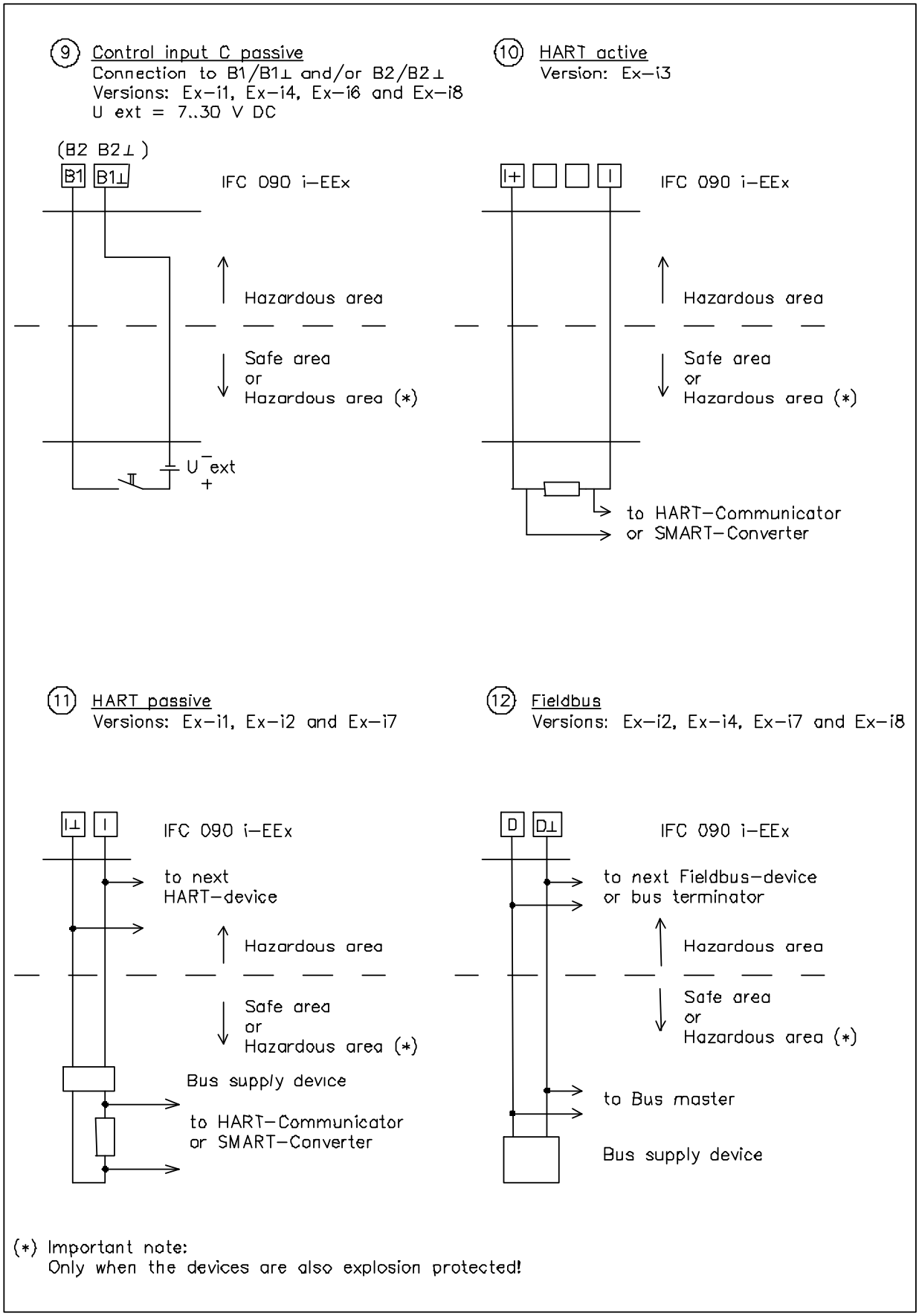


Figure 8: Connection diagrams 9 through 12 of the intrinsically safe signal in-/outputs.

3 OPERATION OF THE SIGNAL CONVERTER

The IFM 4080 K / i-EEx compact flowmeters are always equipped with magnet sensors. In that way is possible to change the settings of the converter with aid of the magnet-bar without the necessity to open the flameproof converter housing in the hazardous area.

For the program functions and settings of the converter the standard Installation and operating instructions have to be consulted. It must be noted that - depending on the IFC090 i-EEx version installed - not all output/input functions are available.

Following menus do not apply for the IFC090 i-EEx versions Ex-i2 and Ex-i3:
(see also section 4.4. "Table of settable Functions" in the of the standard "Installation and operating instructions" of the IFC090 K/F signal converter)

- 1.01 → VALUE P
- 1.06 Output/input B1
- 1.07 Output/input B2
- 1.06 PULS B1
- 1.06 STATUS B1
- 1.07 STATUS B2
- 1.06 CONTROL B1
- 1.07 CONTROL B2
- 3.02 → VALUE P
- 3.07 HARDWARE

Fct.	Text	Description and settings
1.00	OPERATION	Operations menu
1.01	FULL SCALE	...
	~~→ VALUE P~~	
~~1.06~~	~~Output/Input B1~~	
~~1.07~~	~~Output/Input B2~~	
~~1.06~~	~~PULS B1~~	
~~1.06~~	~~STATUS B1~~	
~~1.07~~	~~STATUS B2~~	
~~1.06~~	~~CONTROL B1~~	
~~1.07~~	~~CONTROL B2~~	
3.00	INSTALL.	Installation menu
3.02	FLOWMETER	...
	~~→ VALUE P~~	
~~3.07~~	~~HARDWARE~~	

As a consequence, the chapters included in the standard Installations and operating instructions, giving detailed descriptions of these menus, must be skipped.

4 SERVICE

See section 8 or contact your (local) Krohne sales representative for the ordering information of spare parts or replacements of IFC 090…-EEx electronics units and/or power fuses.

4.1 Replacement of electronics unit or power fuse(s)

IMPORTANT !

The following instructions **must be followed carefully**, if the IFC 090/…-EEx signal converter housing 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 the power supply !**
- Allow the prescribed waiting time to elapse before opening the housing:
  20 minutes for temperature class T6
  11 minutes for temperature class T5

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

After opening:

- The copper earth strip at the back of the electronics unit **must** be securely screwed to the housing (back-end of electronics compartment) by screw **SE** (see figure 9 below). The electronics unit is screwed into the electronics compartment by two screws **D**. Before screws **SE** and **D** can be accessed, the display unit must be removed via screws **A**.
- Before the cover is screwed back into the housing, the screw-thread must be **clean and well-greased with an acid and resin-free grease**, e.g. silicone grease.
- Screw the cover as tight as possible into the housing by hand, until it cannot be opened by hand anymore. Screw the recessed head screw of the interlocking device tight.

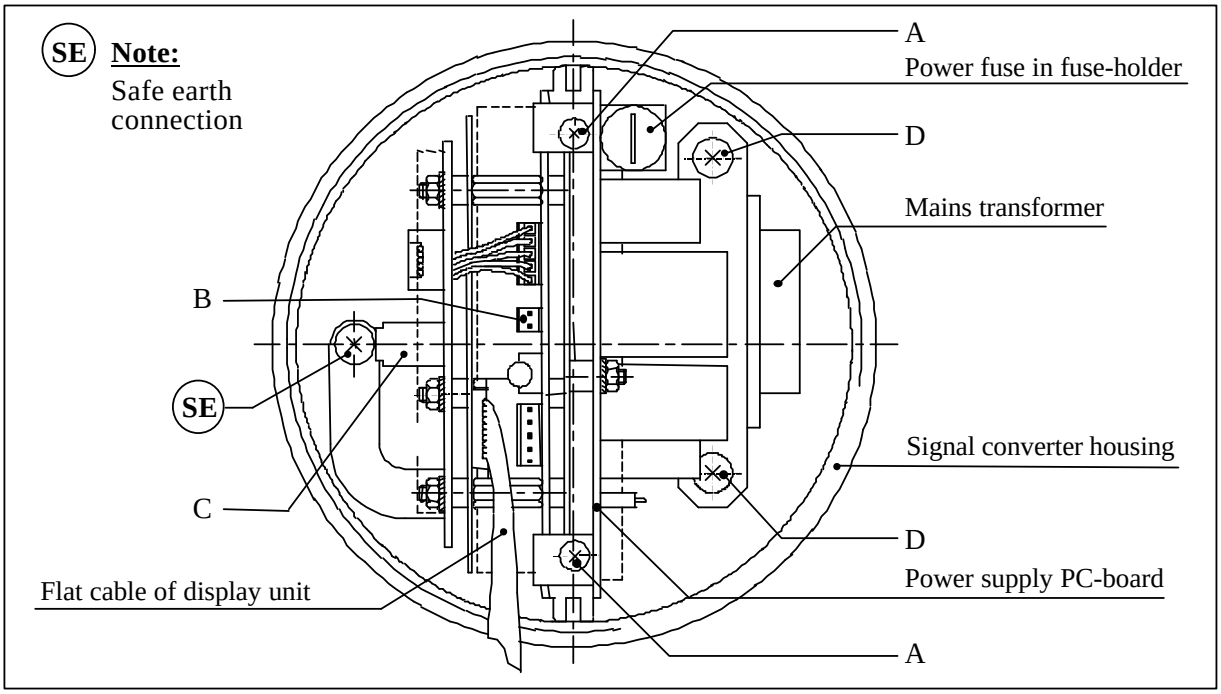


Figure 9: IFC 090-EEx electronics unit after removal of display unit.

4.1.1 Replacement of electronics unit

Refer to the standard Installation and Operating Instructions for detailed information about resetting and reprogramming the new electronics unit after replacement. The customer specific data (like the value of the internal totalizer) are stored in DATAPROM **IC-18**, which must be transferred from the "old" to the "new" electronics unit. See Section 8.7 of the standard Installation and Operating Instructions for detailed information.

Figure 10: Display unit of IFC 090…-EEx.

Before commencing work, **note the instructions in Section 3.1 ("Before opening")**. Then continue as follows:

1. Remove the display cover of the electronics compartment.
2. Unscrew the two screws **A** of the display unit (see figure 10) and turn it carefully aside.
3. Disconnect the 2-pole field circuit connector (item **B** in figure 9) and the 3-pole electrode circuit connector (item **C**). Also see figure 11 on the next page.
4. Unscrew the two mounting screws **D** of the electronics unit and screw **SE**, which fixes the copper earth strip to the back of the housing. A screwdriver with a long shaft (≥ 200 mm) is most suitable for unscrewing screw **SE** (e.g. screwdriver type **Philips No. 2**).
5. Carefully remove the electronics unit of the converter housing (see the **remark** below).
6. Check if the voltage setting (only applicable for AC power supplies) and power fuse rating are correct on the new electronics unit. If necessary, change the voltage setting or replace the power fuse (see section 3.1.3 resp. 3.1.2 of this manual).
7. Carefully insert the electronics unit (keep cables aside, see **remark** below). Then mount the unit completely into the housing and fix the screws. First the two screws **D**, then screw **SE** and reconnect the 2-pole field circuit connector **B** and the 3-pole electrode circuit connector **C** to the right counter-plugs on the electronics unit (see also figure 9).
8. Finally screw the display unit back on the frame of the electronics via the two screws **A**.
9. Screw the cover of the electronics compartment back into the housing.

Note the instructions of section 3.1 ("After opening") during reassembling.

IMPORTANT !

Carefully keep the connecting cables of the field coil and electrode circuits to the side of the housing, while removing respectively inserting the electronics unit into the signal converter housing. This is to prevent damaging of the connecting cables !

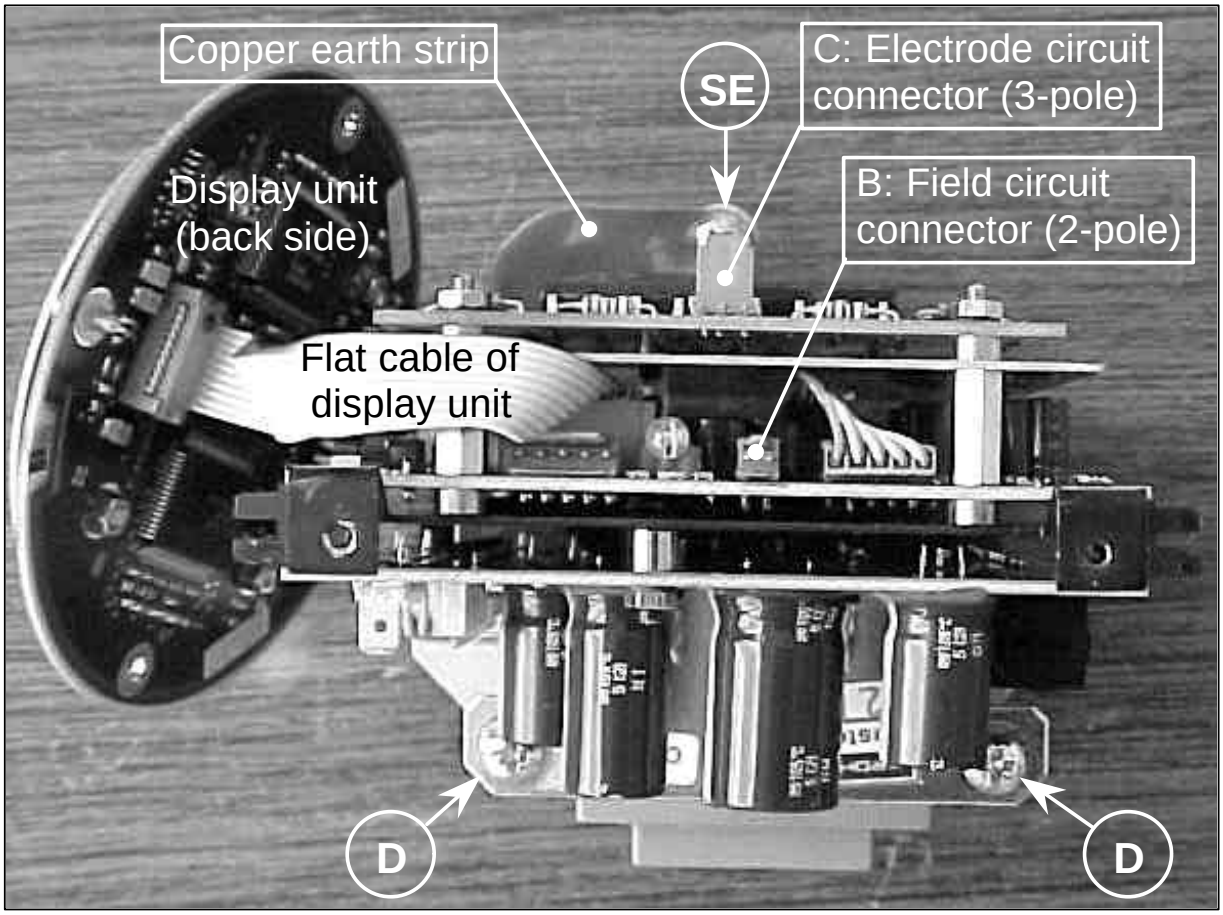


Figure 11: IFC 090-EEx electronics unit (115/230 Vac version).

4.1.2 Replacement of power fuse(s)

The power fuse(s) of the different IFC 090…-EEx electronics units (regular or MODIS) have a different rating and are located on slightly different locations on the power supply printed circuit board. Only the power fuse on the 100…230 Vac power supply version of the regular IFC 090-EEx electronics unit can be reached without removing the complete unit out of the housing (only the display unit has to be unscrewed).

Regular IFC 090-EEx with 24 Vac/dc power supply

Before commencing work, **note the instructions in Section 3.1 ("Before opening")**. Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws marked with **A** of the display unit and turn it carefully aside.
3. Disconnect the 2-pole field circuit connector (item **B**) as well as the 3-pole electrode circuit connector (item **C**). See figure 11 above.
4. Unscrew the two mounting screws **D** of the electronics unit and screw **SE**, which fixes the copper earth strip to the integrated aluminum dividing wall at the back of the electronics compartment. Use a screwdriver with a long shaft (≥ 200 mm) like type **Philips No. 2** for screw **SE**. Then take out the electronics unit, but be careful with the connecting cables, so that they do not get damaged.
5. The defective power fuse(s) F1 and/or F2 (see figure 12 on the next page) can be replaced now. The 24 Vac/dc power supply uses two sub-miniature fuses type TR 5 that are rated **T1.25A** in accordance with IEC 127-3 publication (part No. **5.09080.00.00**).
6. Reassemble in reverse order (points 3 through 1).

Note the instructions of section 3.1 ("After opening") during reassembling.

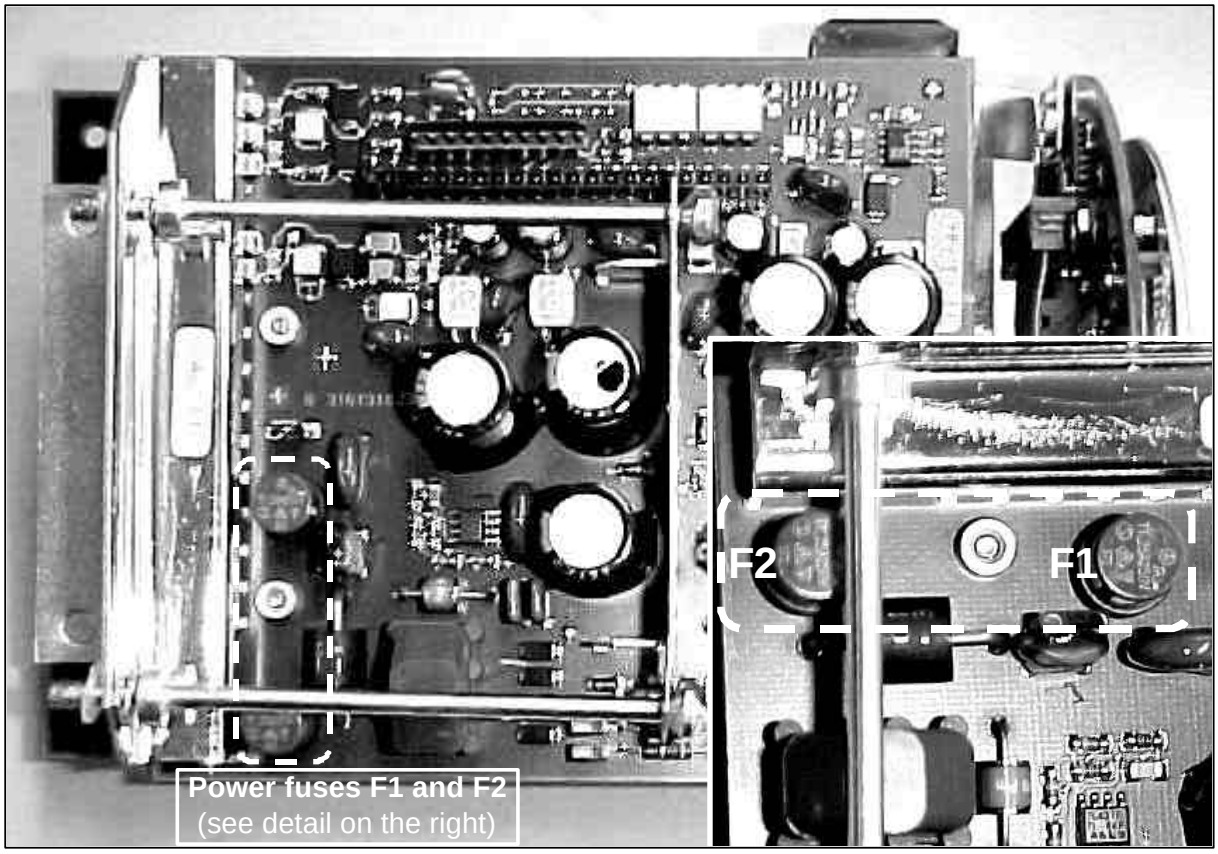


Figure 12: IFC 090-EEx electronics unit with 24 Vac/dc power supply.

Regular IFC 090-EEx with 100…230 Vac power supply

Before commencing work, **note the instructions in Section 3.1 ("Before opening")**. Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws **A** of the display unit and turn the display unit carefully aside.
3. The fuse-holder, in which the power fuse in accordance with IEC 127-2 size Ø5 x 20 mm is mounted, is now accessible to replace the defect power fuse **F1** by a new fuse with the **same rating**. The rating depends on the voltage setting of the power supply unit. The power supply of 100/115 Vac requires a fuse of **T200mA** (part No. **5.05678.00.00**) and the 200/230 Vac requires a fuse of **T125mA** (part No. **5.06627.00.00**).

   The fuse rating is also shown by the yellow sticker that is glued on the mains transformer, which can only be seen after the regular IFC 090-EEx electronics unit is completely removed from the flameproof signal converter housing. See figure 13 on the next page.

   NOTE:
   In case of any doubt about the fuse rating or the voltage setting of the unit, remove the complete unit from the housing as described in section 3.1.1 on page 16 and check the in figure 13 (on the next page) depicted items. Change when needed !

4. Reassemble the unit in reverse order (points 2 and 1).

Note the instructions of section 3.1 ("After opening") during reassembling.

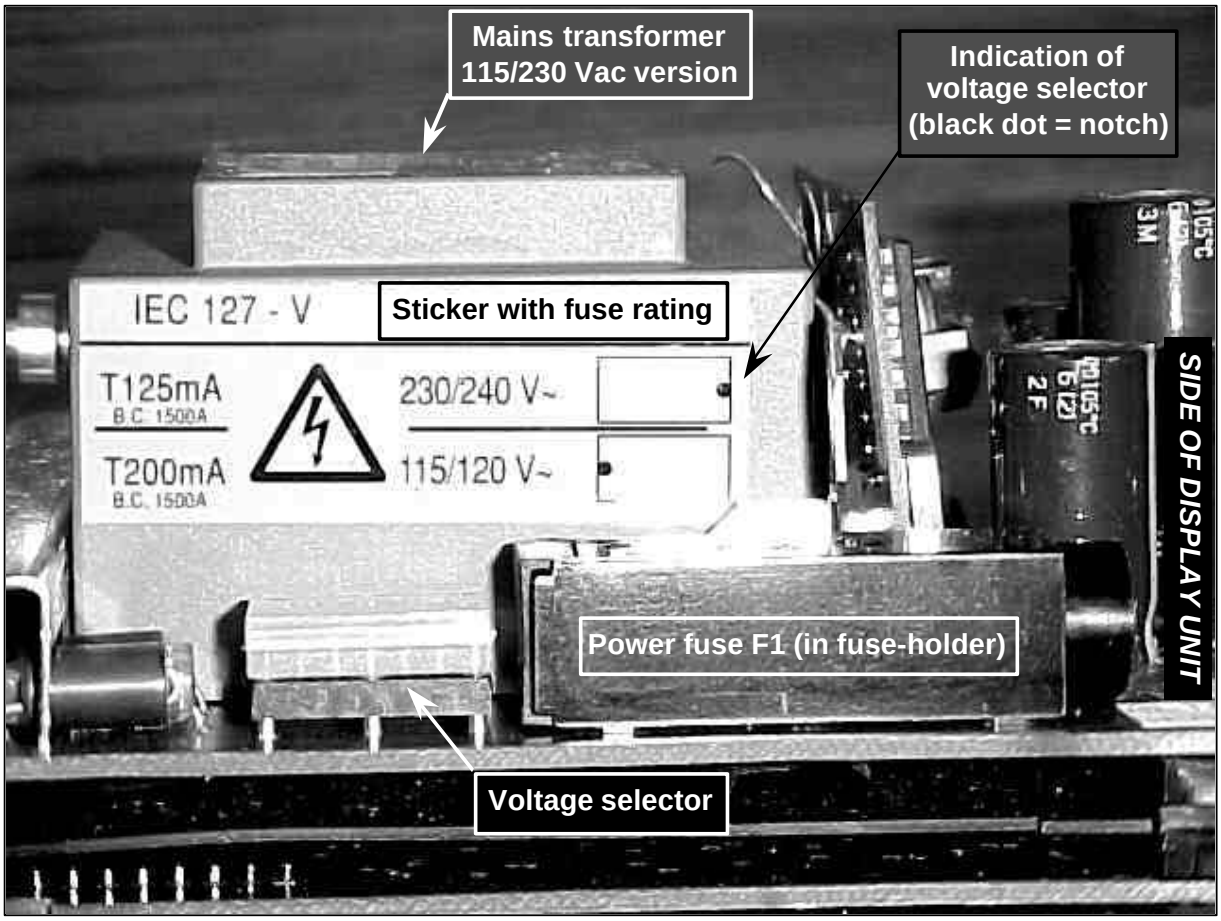


Figure 13: Power supply version 115/230 Vac.

MODIS version IFC 090i-EEx

Before commencing work, **note the instructions in Section 3.1 ("Before opening")**. Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws **A** of the display unit and turn it carefully aside.
3. Disconnect the 2-pole field circuit connector (item **B**) and the 3-pole electrode circuit connector (item **C**). See figure 11 on page 15 for details.
4. Unscrew the two screws **D** and screw **SE** by a screwdriver with a long shaft (200 mm). Take out the electronics unit, but do not damage the connecting cables. See the note marked with **IMPORTANT** (gray-shaded box) below.
5. The defective power fuse (see figure 14 on the next page) can be replaced now. Use a fuse rated at **T1.25H250V** (part No. **5.06232.00.00**) for the 24 Vac/dc power supply and a fuse of **T1.6H250V** (part No. **5.07823.00.00**) for the 100…230 Vac power supply. Notice that the locations are slightly different (the 24 Vac/dc supply version is shown).
6. Reassemble in reverse order (points 4 through 1).

Note the instructions of section 3.1 ("After opening") during reassembling.

IMPORTANT !

Carefully keep the connecting cables of the field coil and electrode circuits to the side of the housing, while removing respectively inserting the electronics unit into the signal converter housing. This is to prevent damaging of the connecting cables !

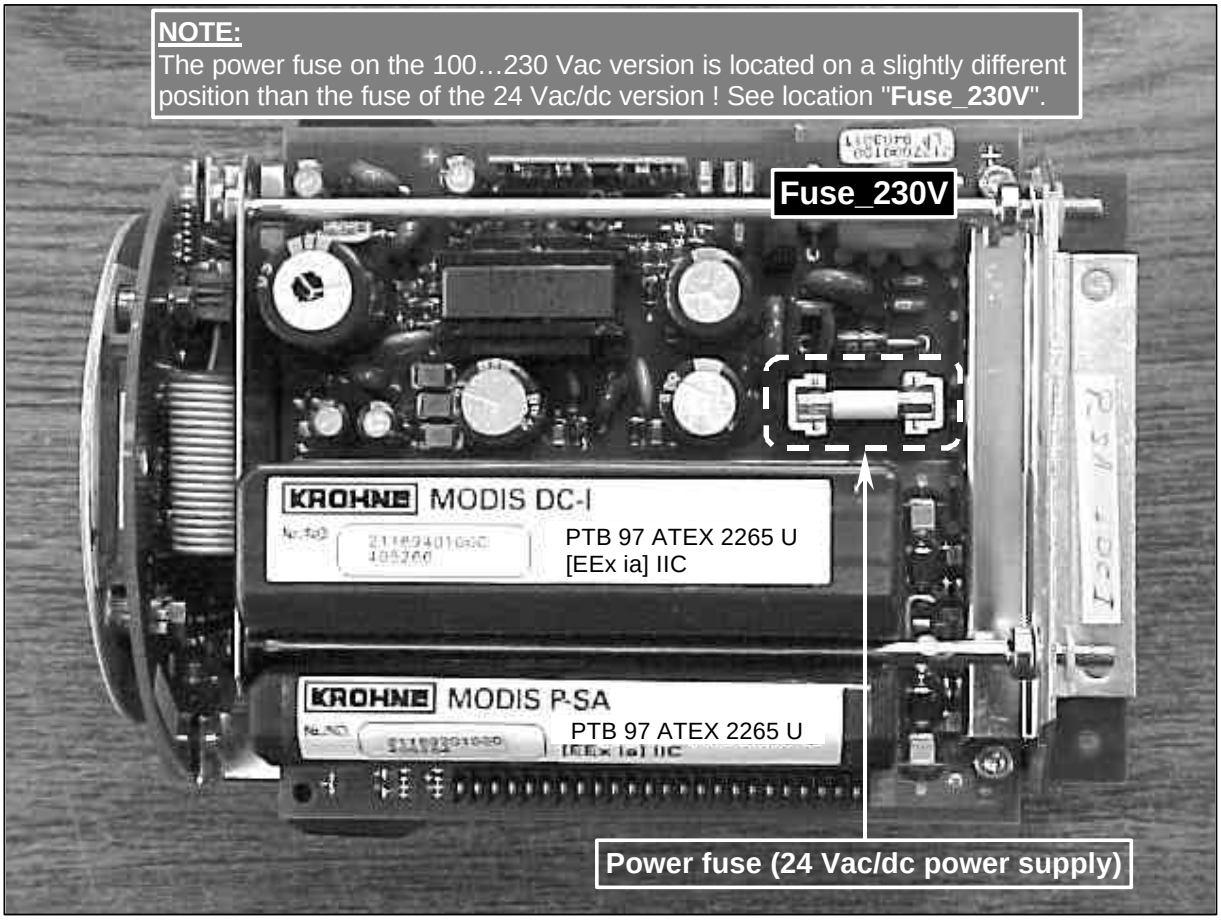


Figure 14: IFC 090i-EEx electronics unit (24 Vac/dc version is shown).

4.1.3 Changing power supply voltage

This only applies to the regular IFC 090-EEx electronics unit with 100-230 Vac power supply. Before commencing work, **note the instructions in Section 3.1 ("Before opening")**. Then continue as follows:

1. Remove the cover of the electronics compartment.
2. Unscrew the two screws **A** of the display unit and turn the display unit carefully aside.
3. Unscrew the two mounting screws **D** of the electronics unit and screw **SE**, which fixes the copper earth strip at the back of the housing. A screwdriver with a long shaft (200 mm) can best be used to unscrew **SE** (e.g. screwdriver type **Philips No. 2**).
4. Disconnect the 2-pole and 3-pole connectors and carefully remove the electronics unit.
5. The voltage setting of the power supply can be changed by turning the dummy dual-in-line block (i.e. **voltage selector**, see figure 13 on the previous page) over 180° in its socket. The position of the notch on the dummy dual-in-line block indicates the voltage setting. Also see the sticker that is glued on the mains transformer.
6. Reassemble in reverse order (points 4 through 1).
7. Screw the cover of the electronics compartment back into the housing.

Note the instructions of section 3.1 ("After opening") during reassembling.

IMPORTANT !

Carefully keep the connecting cables of the field coil and electrode circuits to the side of the housing, while inserting the electronics unit into respectively removing it from the signal converter housing. This is to prevent damaging of the connecting cables !

5 CONNECTING CABLES

NOTE:
The below described cables are shown in the connection diagram on the following page.

Cable A:
Signal cable for current output and binary outputs (pulse and status output). The cable parameters must be in accordance with the regulations in the EN 60079-14 "Electrical installations in hazardous locations" or an equivalent national standard (e.g. DIN VDE 0165). For the MODIS version with IFC 090i-EEx electronics unit (right detail in connection diagram) the signal cable for the intrinsically safe signal in-/outputs must also conform the requirements as specified in the relevant standard national code of practice for the installation of electrical apparatus with type of protection Intrinsic Safety "i".

Cable B:
Power supply cable. The cable parameters must be in accordance with the regulations of the EN 60079-14 "Electrical installations in hazardous locations" or an equivalent national standard (e.g. DIN VDE 0165).

Rated voltage:	≥ 500 V
Examples:	H07..-., H05..-.

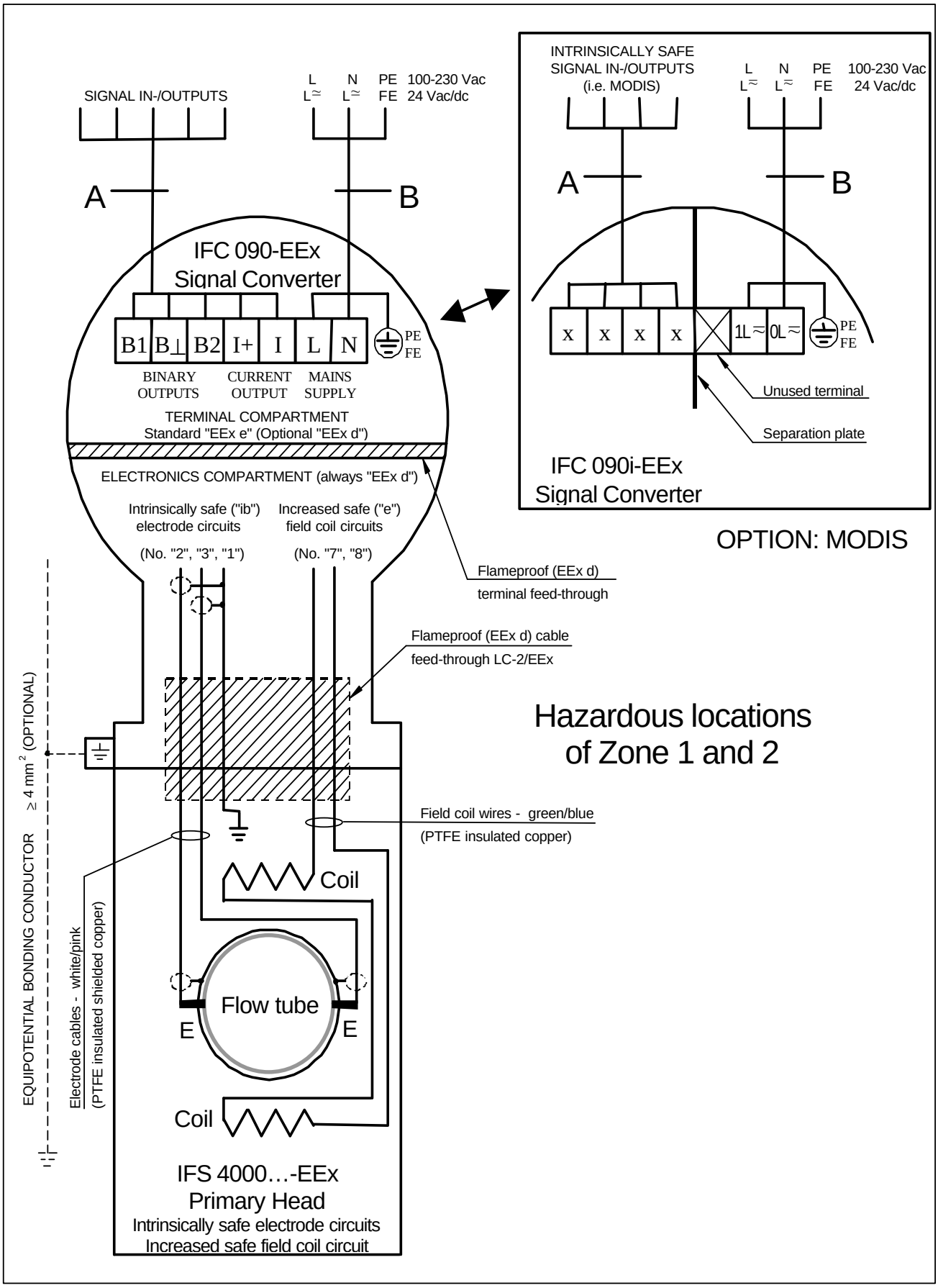
Equipotential bonding conductor

Cross-sectional area:	4 mm^2 (equivalent to AWG 10)

6 MAINTENANCE

The IFM 4080 K/…-EEx magnetic-inductive compact flowmeters are maintenance free with regard to the flowmetering properties. Within the scope of the periodical inspections, which are required for electrical apparatus that are installed and used in hazardous classified locations, it is recommended to check the flameproof enclosure(s).

7 CONNECTION DIAGRAM



8 ORDERING INFORMATION

In case of questions about spare or replacing parts contact your local Krohne representative. The part numbers of the several parts are listed in the sections below.

8.1 Regular IFC 090-EEx electronics unit

The below listed table shows the available regular (non-MODIS) IFC 090-EEx versions with the possible power supply units and the accompanying power fuse(s).

IFC 090-EEx electronics unit		Power fuse(s)			
Power supply	Part No.	Symbol	Type	Rating	Part No.
230/240 Vac	2.10664.10.00	F1	G-fuse Ø5x20 1500A @ 250V	125 mA T	5.06627.00.00
115/120 Vac		F1		200 mA T	5.05678.00.00
200 Vac	2.10664.13.00	F1		125 mA T	5.06627.00.00
100 Vac		F1		200 mA T	5.05678.00.00
24 Vac/dc	2.10665.10.00	F1 + F2	TR5, 35A @ 250V	1.25 A T	5.09080.00.00

Table 10: IFC 090-EEx electronics units and power fuses.

8.2 MODIS version IFC 090i-EEx electronics unit

Table 11 below summarizes the available IFC 090i-EEx electronics units (MODIS version) and the matching part number. The accompanying power fuses are listed in table 12.

Version	MODIS modules		Part number	
	Position A	Position B	24 Vac/dc power supply	100…230 Vac power supply
Ex-i1	P-SA	FA-ST	2.11582.01.00	2.12253.01.00
Ex-i2	P-SA	F-PA	2.11582.03.00	2.12253.02.00
Ex-i3	P-SA	DC-I	2.11582.02.00	*not available*
Ex-i4	FA-ST	F-PA	2.11582.05.00	2.12253.03.00
Ex-i5	FA-ST	DC-I	2.11582.06.00	*not available*
Ex-i6	FA-ST	FA-ST	2.11582.07.00	2.12253.04.00
Ex-i7	P-SA	F-FF	2.11582.08.00	2.12253.05.00
Ex-i8	FA-ST	F-FF	2.11582.09.00	2.12253.06.00

Table 11: IFC 090i-EEx electronics units.

The above listed IFC 090i-EEx electronics units are either provided with a 24 Vac/dc power supply or a 100…230 Vac power supply. The table below lists the accompanying power fuse.

Power supply version	Power fuse		
	Type	Rating	Part number
24 Vac/dc	G-fuse Ø5x20 1500A @ 250V	1.25 A T (T1.25H250V)	5.06232.00.00
100…230 Vac	G-fuse Ø5x20 1500A @ 250V	1.6 A T (T1.6H250V)	5.07823.00.00

Table 12: Power fuses of IFC 090i-EEx electronics units.

NOTES:

The in table 10 and 12 above listed G-fuses of size Ø5 x 20 mm and with 1500 A breaking capacity at 250 V are in accordance with IEC publication 127-2.

Fuse type TR5 is of size sub-miniature and has a breaking capacity of 35 A at 250 V. It is in accordance with IEC 127-3. The regular IFC 090-EEx electronics unit with 24 Vac/dc power supply contains two of these fuses in the primary circuits, labeled as F1 and F2.

9 DATA PLATES

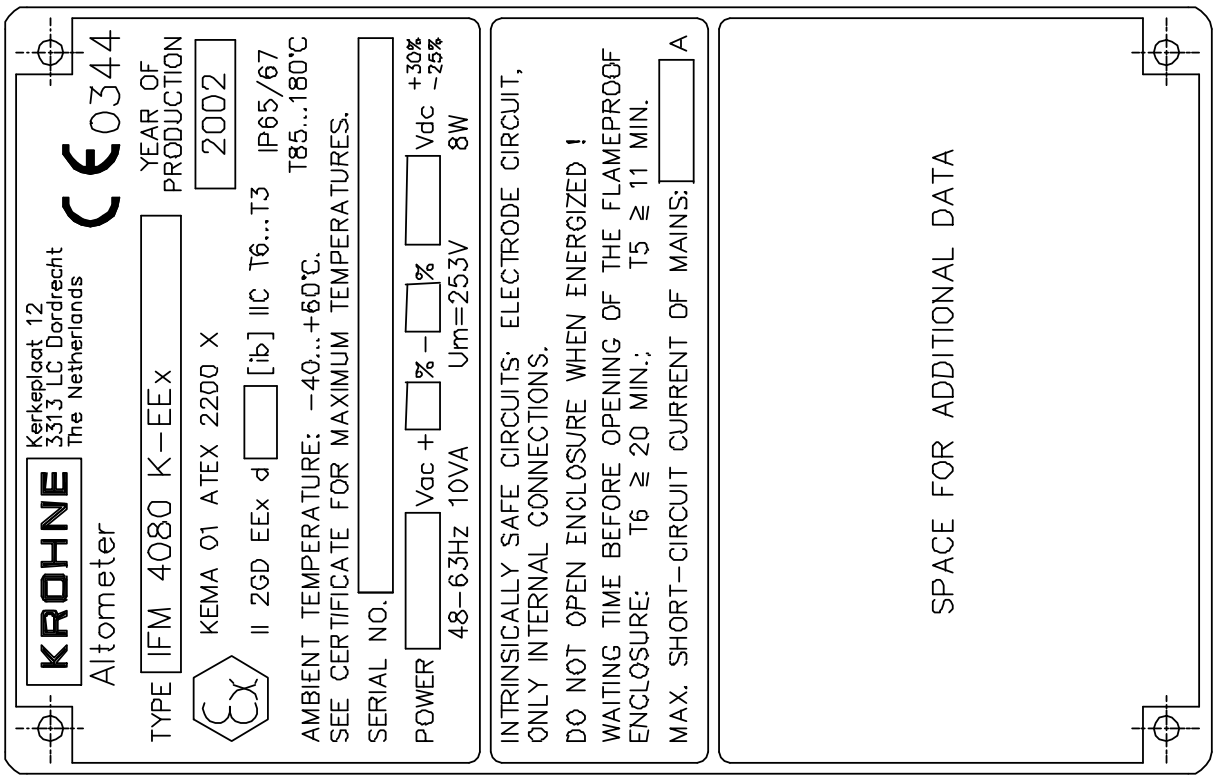


Figure 15: Data plate of IFM 4080 K-EEx.

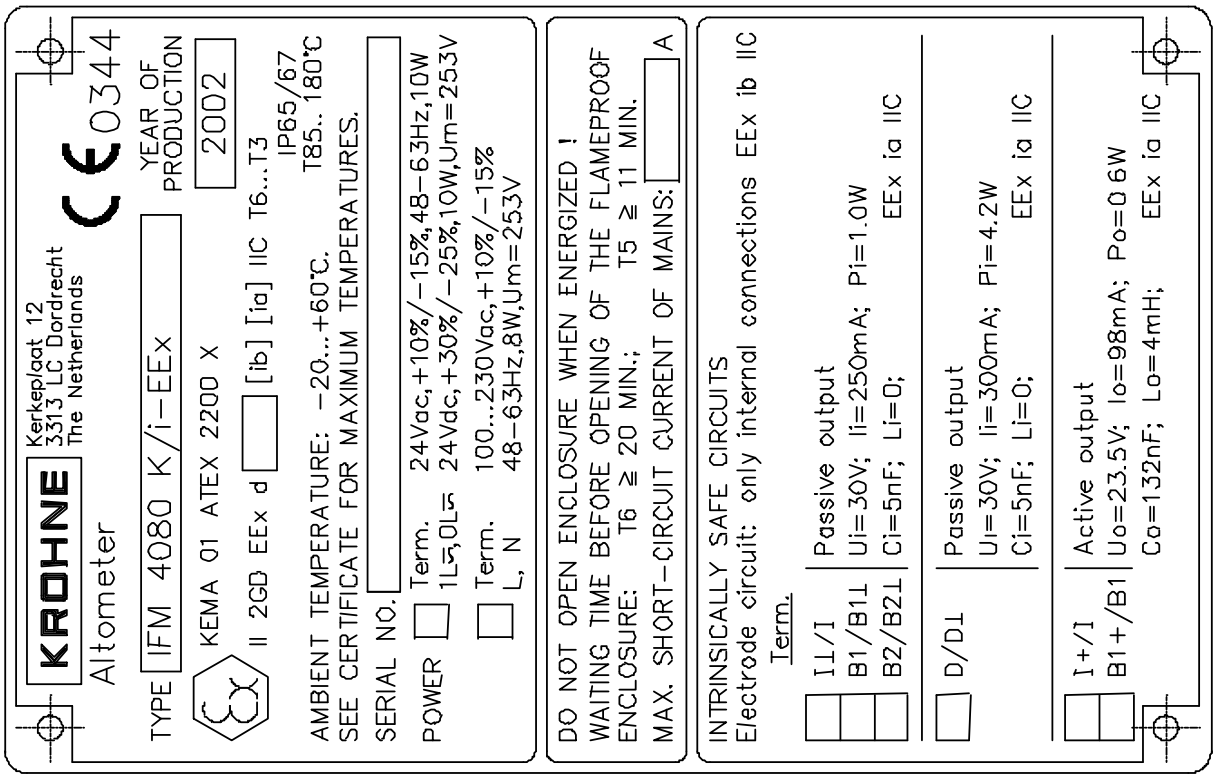


Figure 16: Data plate of IFM 4080 K/i-EEx.

10 DECLARATION OF CONFORMITY

KROHNE
Altometer

EC - Declaration of Conformity

We

Krohne Altometer
Kerkeplaat 12
3313 LC Dordrecht
The Netherlands

declare under our sole responsibility that the products

compact magnetic inductive flowmeter types

IFM 4080 K - EEx and
IFM 4080 K / i- EEx
IFM 4042 K- EEx

fulfill the requirements of following EC directives:

- ATEX Directive 94/9/EC
- EMC Directive 89/336/EC

The IFM 4080 K-EEx, IFM 4080 K / i-EEx and IFM 4042 K-EEx flowmeters are designed and manufactured conform following harmonized standards:

- EN 50 014 : 1997
- EN 50 018 : 2000
- EN 50 019 : 2000
- EN 50 020 : 1994
- EN 50 281-1-1 : 1998

- EN 50 081-1
- EN 50 082-2
- EN 61 010-1

The IFM 4080 K-EEx, IFM 4080 K / i-EEx and IFM 4042 K-EEx flowmeters are examined and type-approved under EC-type examination certificate KEMA 01 ATEX 2200 X. Our quality system is assessed by KEMA registered Quality b.v.

Dordrecht, 26-03-2002

L. IJmker
(General manager)

IFM4080K-EEx CE-declaration.doc

KEMA

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment or protective system intended for use in potentially explosive atmospheres – Directive 94/9/EC

(3) EC-Type Examination Certificate Number: **KEMA 01ATEX2200 X**

(4) Equipment or protective system: **Compact Magnetic Inductive Flowmeter, types IFM 4080 K/...-EEx, IFM 4042 K-EEx, MGM 4090 K/...-EEx and MGM 4042 K-EEx**

(5) Manufacturer: **Krohne Altometer**

(6) Address: **Kerkeplaat 12, 3313 LC Dordrecht, The Netherlands**

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report no. 2011064.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014 : 1997 **EN 50018 : 2000** **EN 50019 : 2000**
EN 50020 : 1994 **EN 50281-1-1 : 1998**

(10) If the sign 'X' is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment or protective system in accordance with the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

(12) The marking of the equipment or protective system shall include the following:

Ex **II 2 GD** **EEx d [ia] IIC T6...T3 or EEx de [ib] IIC T6...T3 or EEx d [ia] [ib] IIC T6...T3 or EEx de [ia] [ib] IIC T6...T3 T 85...180 °C**

Arnhem, 28 March 2002
KEMA Quality B.V.

T. Pijpker
Certification Manager

* This Certificate may only be reproduced in its entirety and without any change.

KEMA Quality B.V.
Utrechtseweg 310, 6812 AR Arnhem, The Netherlands
P.O. Box 5185, 6802 ED Arnhem, The Netherlands
Telephone +31 26 3 56 35 65, Telefax +31 26 3 52 58 00

ACCREDITED BY THE DUTCH COUNCIL FOR ACCREDITATION

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 01ATEX2200 X**

(15) **Description**

The Compact Magnetic Inductive Flowmeter, types IFM 4080 K/...-EEx, IFM 4042 K-EEx, MGM 4090 K/...-EEx and MGM 4042 K-EEx is used for measuring, counting and displaying the linear flow of an electrical conductive liquid.

The flowmeter consists of a signal converter housing in type of explosion protection flameproof enclosure "d" with a terminal compartment in type of explosion protection flameproof enclosure "d" or increased safety "e". The integral primary heads are in type of explosion protection flameproof enclosure "d" (sizes DN25 - DN150) or increased safety "e" (DN200 - DN3000) and are provided with measuring electrodes in type of explosion protection intrinsic safety EEx ia IIC.

Ambient temperature range -20 °C ... +60 °C (for flowmeter with electronics unit type IFC 090).
Ambient temperature range -40 °C ... +60 °C (for flowmeter with electronics unit types IFC 040 and IFC 090).

The maximum surface temperature T 85...180 °C is based on a maximum ambient temperature of 60 °C.

Electrical data

IFM4080 K/...-EEx / MGM 4090 K/...-EEx with IFC 090-EEx electronics

Power supply ..... 100/200 Vac, 115/230 Vac -15/+10 %, 10 VA
24 Vdc -25/+30 %, 24 Vac -15/+10 %, 8 W
U_m = 253 V

Signal I/O's ..... ≤ 36 Vdc

IFM4080 K/...-EEx / MGM 4090 K/...-EEx with IFC 090i-EEx electronics

Power supply ..... 100...230 Vac -15/+10 %, 15 VA
24 Vdc -25/+30 %, 24 Vac -15/+10 %, 10 W
U_m = 253 V

Signal circuit
Modules P-SA and FA-ST ..... in type of explosion protection intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit in type of explosion protection intrinsic safety
EEx ia IIC or EEx ia IIB or
EEx ib IIC or EEx ib IIB,
with the following maximum values:

U_i	=	30	V
I_i	=	250	mA
P_i	=	1,0	W

The effective internal capacitance C_i = 5 nF,
the effective internal inductance L_i is negligibly small.

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 01ATEX2200 X**

Electrical data (continued)

Signal circuit
Modules F-PA and F-FF ..... in type of explosion protection intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit (for instance a Supply of the FISCO Model in accordance with document CLC/SC31-3(SEC)155 of Dec. 2000) in type of explosion protection intrinsic safety
EEx ia IIC or EEx ia IIB or
EEx ib IIC or EEx ia IIB,
with the following maximum values:

U_i	=	30	V
I_i	=	300	mA
P_i	=	4,2	W

The effective internal capacitance C_i = 5 nF,
the effective internal inductance L_i is negligibly small.

Signal/supply circuit
Module DC-I .....
(24 Vdc/dc version only) in type of explosion protection intrinsic safety EEx ia IIC, with the following maximum values:

U_o	=	23,5	V
I_o	=	98	mA
P_o	=	0,6	W

Maximum allowed external capacitance C_o = 127 nF,
maximum allowed external inductance L_o = 4 mH.

Only for connection to certified intrinsically safe circuits in type of explosion protection EEx ia IIC or EEx ia IIB or EEx ib IIC or EEx ib IIB without supply (passive).

The applicable type of explosion protection of the aforementioned intrinsically safe circuits EEx ia IIC is determined by the type of protection of the intrinsically safe circuit which is connected to it, respectively EEx ia IIB or EEx ib IIC or EEx ib IIB.

The aforementioned intrinsically safe circuits shall, from the safety point of view, be considered to be connected to ground.

IFM 4042 K-EEx / MGM 4042 K-EEx with IFC 040-EEx electronics

The signal/supply circuits may all be connected either intrinsically safe or non-intrinsically safe. A combination of intrinsic and non-intrinsic safe connections however is not allowed.

a) Connection to a non-intrinsically safe circuit

Signal/supply circuit 1 ..... 14 - 36 Vdc, 4 - 20 mA

Signal/supply circuit 2 ..... 14 - 36 Vdc, 22 mA

Signal/supply circuit 3 ..... max. 36 Vdc, 100 mA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 01ATEX2200 X**

Electrical data (continued)

b) Connection to an intrinsically safe circuit

Signal/supply circuits 1 and 2 ..... in type of explosion protection intrinsic safety EEx ib IIC with the following maximum values (each circuit):

U_i	=	30	V
I_i	=	100	mA
P_i	=	1,0	W

The effective internal capacitance C_i = 20 nF,
the effective internal inductance L_i is negligibly small.

Signal/supply circuit 3 ..... in type of explosion protection intrinsic safety EEx ib IIC with the following maximum values:

U_i	=	30	V
I_i	=	100	mA
P_i	=	1,0	W

The effective internal capacitance C_i is negligibly small,
the effective internal inductance L_i is negligibly small.

The applicable type of explosion protection of the aforementioned intrinsically safe circuits EEx ib IIC is determined by the type of protection of the intrinsically safe circuit which is connected to it, respectively EEx ib IIB.

The aforementioned intrinsically safe circuits are safely galvanically separated from the non-intrinsically safe circuits up to a peak value U_m = 60 V.

Installation instructions

For use in potentially explosive atmospheres of flammable gases, fluids or vapours:
The cable entry device shall be in type of protection flameproof enclosure "d" for the terminal compartment in type of protection flameproof enclosure "d" or increased safety "e" for the terminal compartment in type of protection increased safety "e", suitable for the conditions of use and correctly installed.

For use in the presence of combustible dust:
The cable entry device shall be in type of equipment Category II 2 D, suitable for the conditions of use and correctly installed.

Unused openings shall be closed with suitable certified closing elements.

With the use of conduit, a suitable certified sealing device such as a stopping box with setting compound shall be provided immediately at the entrance to the flameproof enclosure.

Routine tests

- Each welded primary head of size DN25 - DN150 must be submitted to the routine overpressure test according to EN 50018, Clause 16 at a test pressure of 14 bar during one minute.

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 01ATEX2200 X**

Routine tests (continued)

- Routine tests according to EN 50018, Clause 16 are not required for the electronics enclosure since the type test has been made at a static pressure of four times the reference pressure.

Each primary head of size DN200 - DN3000 shall withstand a test voltage according to EN 50019, Clause 6.1, of 500 V during one minute without breakdown between the field coils circuit and the enclosure and a test voltage of 1500 Vrms during one minute without breakdown between the field coils circuit and the intrinsically safe sensor circuit.

(16) **Report**

KEMA No. 2011054.

(17) **Special conditions for safe use**

The relation between temperature class, maximum surface temperature, maximum process temperature and ambient temperature is shown in the following tables:

a) Meter size DN25 - DN150

Temperature class	Max. surface temperature	Max. process temperature		
		Ta ≤ 40 °C	Ta ≤ 50 °C	Ta ≤ 60 °C
T6	T 85 °C	70 °C	70 °C	70 °C
T5	T 100 °C	85 °C	85 °C	85 °C
T4	T 135 °C	120 °C	120 °C	115 °C
T3	T 180 °C	180 °C	180 °C	115 °C

For Ta > 50 °C and a process temperature ≤ 115 °C, heat resistant cables with a continuous operating temperature of at least 120 °C must be used.

b) Meter size DN200 - DN3000

Temperature class	Max. surface temperature	Max. process temperature		
		Ta ≤ 40 °C	Ta ≤ 50 °C	Ta ≤ 60 °C
T6	T 85 °C	75 °C	70 °C	70 °C
T5	T 100 °C	95 °C	90 °C	75 °C
T4	T 135 °C	130 °C	115 °C	75 °C
T3	T 180 °C	150 °C	115 °C	75 °C

(18) **Essential Health and Safety Requirements**

Covered by the standards listed at (9).

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 01ATEX2200 X**

(19) **Test documentation**

1. Component Certificate: KEMA No. Ex-99.E.8128 U
   KEMA No. Ex-01.E.2036 U
   Certificate of Conformity: KEMA No. Ex-97.D.2886 X
   PTB No. Ex-90.C.2003 X
   PTB No. Ex-95.D.2209
   EC-Type Examination Certificate: KEMA 01ATEX2263 X
   PTB 98 ATEX 2012 U
   PTB 00 ATEX 2213 U

	dated
2. Description (22 pages)	04.03.2002
3. Drawings index sheet	04.03.2002

Krohne Altometer
Kerkeplaat 12
3313 LC Dordrecht
The Netherlands
Tel.: ++ 31 (0)78 - 630 63 00
Fax.: ++ 31 (0)78 - 630 63 90