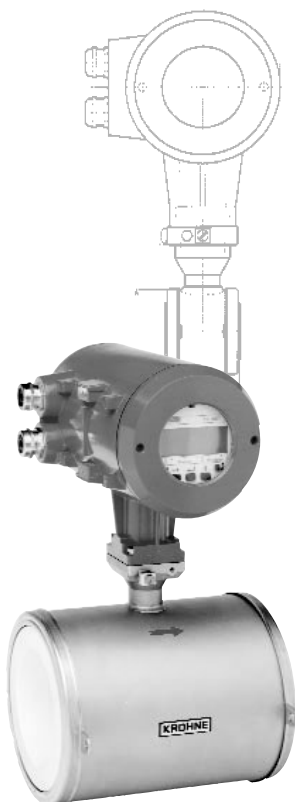


Addition to the installation and operating instructions

CAPAFLUX IFM 5080 K / CAP-EEEx CAPAFLUX IFM 5080 K / CAP i-EEEx

Compact electromagnetic flowmeters

...with non-contact and capacitive electrodes



Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications technology

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

WARNING!

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

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 (e.g. IEC 364), especially the regulations in EN 60079-14 "Electrical installations in hazardous locations" or equivalent national standard must be 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 Installation and Operating Instructions and only apply to the EEx version of the CAPAFLUX IFM 5080 K / CAP-EEx or IFM 5080 K / CAP i-EEx electromagnetic compact flowmeter. All technical information described in the "Installation and Operating Instructions" are applicable, when not specifically excluded, completed or replaced by the instructions in these additional instructions.

Contents

| | | |
|----------|--|--------------|
| 1 | System components | 3-6 |
| 1.1 | General information | 3-4 |
| 1.2 | IFC 090 / CAP ... -EEx signal converter | 5 |
| 1.2.1 | Electronics compartment | 5 |
| 1.2.2 | Terminal compartment | 5 |
| 1.3 | Electronics unit | 6 |
| 2 | Electrical connection | 7-17 |
| 2.1 | Equipotential bonding system | 7 |
| 2.2 | Connecting cables | 7 |
| 2.3 | Connection diagram | 8 |
| 2.4 | Regular IFC 090 / CAP - EEx electronics unit | 9 |
| 2.5 | Modis version IFC 090 / CAP i-EEx electronics unit | 10 |
| 2.6 | Connection diagrams MODIS | 11-17 |
| 3 | Operation of the signal converter | 18 |
| 4 | Maintenance | 18 |
| 5 | Service | 19-24 |
| 5.1 | General information for replacements | 19 |
| 5.2 | Replacement of electronics unit | 20 |
| 5.3 | Replacement of power fuse(s) | 21-23 |
| 5.4 | Changing power supply voltage | 24 |
| 6 | Declarations of conformity | 25 |
| 7 | EC-type examination Certificates | 26-30 |

1 System components

1.1 General information

This compact flowmeter complies with the European Directive 94/9/EC (ATEX 100a) and has been approved for hazardous classified locations of Zone 1 and 2 under EC-type Examination Certificate number:

KEMA 01 ATEX 2232 X

The compact flowmeter is available in two types, namely:

- IFM 5080 K/CAP-EEEx regular explosion protected version;
- IFM 5080 K/CAP i-EEEx, MODIS version. This type has intrinsic safe signal output circuits, which are provided by two MODIS modules that are installed on the IFC090 K/CAP/i-EEEx electronics unit.

Temperature classification

The regular IFM 5080 K/CAP-EEEx compact flowmeter is designed for ambient temperatures (T_a) of -20°C (special -40°C) up to +60°C.

The allowed process liquid temperature is a.o. limited by the maximum occurring surface temperature of systems components in the combustible atmosphere that (possibly) surrounds the apparatus (first column of the table). For dusts the second column of the table applies. Details see following table.

| Temperature class (for gases) | Max. surface temperature (for dusts) | Maximum process liquid temperature | | |
|-------------------------------|--------------------------------------|------------------------------------|-----------------------------|-----------------------------|
| | | $T_a \leq 40^\circ\text{C}$ | $T_a \leq 50^\circ\text{C}$ | $T_a \leq 60^\circ\text{C}$ |
| T6 | T 85°C | 60°C | 55°C | not allowed |
| T5 | T 100°C | 75°C | 75°C | 75°C |
| T4 | T 115°C | 115°C | 115°C | 75°C |

The IFM 5080 K/CAP...-EEEx compact flowmeter consists of the IFC 090 / CAP/...-EEEx signal converter unit, which is screwed on top of the IFS 5000 CAP-EEEx primary head (i.e. measuring unit). The regular compact flowmeter is marked with one of the following codes below, depending on the type of protection of the terminal compartment:

- II 2 GD EEx d IIC T6...T4 (EEx d terminal compartment) or
- II 2 GD EEx de IIC T6...T4 (EEx e terminal compartment)

In case of the MODIS version IFM 5080 K/CAP i-EEEx, the electronics unit of type IFC 090 / CAPi-EEEx is provided with protective modules, which provide intrinsic safe output signals of category "ia". The flowmeter is then marked with the codes:

- II 2 GD EEx d [ia] IIC T6...T4 (EEx d terminal compartment) or
- II 2 GD EEx de [ia] IIC T6...T4 (EEx e terminal compartment)

For details see the EC-type Examination Certificate in Sect. 7 at the end of these additional instructions.

Primary head

The primary head contains two field coils and the capacitive signal pick-up.

The primary head is constructed in type of protection flameproof enclosure (EEx d).

Data plates of CAPAFLUX IFM 5080 K/CAP/...-EEx flowmeters

IFM 5080 K/CAP-EEx

KROHNE Kettelerstr. 12
49103 Lütjeharpen
Deutschland

Atometer

TYPE | IFM 5080 K/CAP-EEx

CE 0344

YEAR OF PRODUCTION: 2000

IFMA 01 ATEX 2232 X

IP 65/67

1 Ex d IIC T4

SEL. CERTIFICATE FOR MAXIMUM TEMPERATURES

AMBIENT TEMPERATURE: -40...+60°C

SERIAL NO.:

POWER [] Term: 24Vdc, 100% / 150V, 10W
[] Term: 24Vdc, 300% / 270V, 10W, Um=253V

DO NOT OPEN ENCLOSURE WHEN ENERGIZED!
WAITING TIME BEFORE OPENING OF THE FLAMEPROOF ENCLOSURE: T8 > 20 MIN.; T5 > 11 MIN.

SPACE FOR ADDITIONAL DATA

IFM 5080 K/CAP/i-EEx

KROHNE Kettelerstr. 12
49103 Lütjeharpen
Deutschland

Atometer

TYPE | IFM 5080 K/CAP/i-EEx

CE 0344

YEAR OF PRODUCTION: 2000

IFMA 01 ATEX 2232 X

IP 65/67

1 Ex d IIC T4

SEL. CERTIFICATE FOR MAXIMUM TEMPERATURES

AMBIENT TEMPERATURE: -40...+60°C

SERIAL NO.:

POWER [] Term: 24Vdc, 100% / 150V, 10W
[] Term: 24Vdc, 300% / 270V, 10W, Um=253V
[] Term: 180...240Vdc, 100% / 150V
[] Term: 48...63V, 10V, Um=253V

DO NOT OPEN ENCLOSURE WHEN ENERGIZED!
WAITING TIME BEFORE OPENING OF THE FLAMEPROOF ENCLOSURE: T8 > 20 MIN.; T5 > 11 MIN.

INTRINSICALLY SAFE CIRCUIT IS

Electrode circuit, only internal connections EEx ia IIC Term.

[] 01/01 Positive output
B1-/B1 0...10V, I_a=250mA, P_a=10W
B2-/B2 0...5mA, U_a=0; EEx ia IIC

[] 01/01 Positive output
0...10V, I_a=300mA, P_a=4.0W
0...5mA, U_a=0; EEx ia IIC

[] 01/01 Active output
0...13.5V, I_a=98mA, P_a=0.6W
0...127V, I_a=4mA; EEx ia IIC

1.2 IFC 090 / CAP/...-EEx signal converter

The IFC 090 / CAP/...-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 IP 65 / IP 67 conform to EN 60529.

1.2.1 Electronics compartment

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

1.2.2 Terminal compartment

The terminal compartment has seven terminals for connection of the power supply and signal output circuits. Sect. 2 (Connection diagram) shows the terminal arrangement for the regular and MODIS version of the IFC 090 / CAP/...-EEx signal converter. The terminal arrangement of the MODIS version (i.e. IFC 090 / CAP i-EEx) is shown in Sect. 2 (Modis Converter). 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.

1.3 Electronics unit

This electromagnetic compact flowmeter can be equipped with the regular IFC 090 / CAP-EEEx or with the IFC 090 / CAP i-EEEx electronics unit with intrinsically safe signal outputs (i.e. MODIS version). This version is described in the following.

Regular IFC090-EEEx electronics unit

The IFC 090 / CAP-EEEx is used in the regular IFM 5080 K-EEEx and can be equipped with one of the following power supplies (depends on the area of application).

Electrical data for power supply

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

The IFC 090 / CAP-EEEx electronics unit is equipped with the following in-/output circuits. Terminals B1, B \perp 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.

Electrical data of in-/output circuits

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

IFC 090 / CAP i-EEEx unit with MODIS modules

The IFC 090 / CAP i-EEEx electronics unit is equipped with a pair of MODIS-modules. It is equipped with one of the following power supplies.

Electrical data of IFC 090 / CAP i-EEEx electronics unit

| Power supply | Terminals | Function | Electrical data |
|---------------|--------------|-------------------|--|
| AC-version | L | Live | $U_n = 100 \dots 230 \text{ Vac} -15\%/+10\%$ $P_n = 15 \text{ VA}, U_m = 253 \text{ V}$ |
| | N | Neutral | |
| | PE | Protective Ground | |
| AC/DC-version | 1L \approx | Live | $U_n = 24 \text{ Vac/dc}$ AC: $-15\%/+10\%$ or $20.4 \dots 26.4 \text{ Vac}$ DC: $-25\%/+30\%$ or $18 \dots 32 \text{ Vdc}$ $P_n = 10 \text{ W}, U_m = 253 \text{ V}$ |
| | 0L \approx | Neutral | |
| | FE | Functional Ground | |
| | FE | Functional Ground | |

Note The mains fuses for both electronics units are listed in Sect. 6 of this manual.

2 Electrical connection

2.1 Equipotential bonding system

All EEx and EEx/i 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 of terminal arrangement below) or through a separate PE conductor, cross sectional area at least 4 mm², connected to the external PE clamp, placed below the converter housing.

2.2 Connecting cables

Note The below described cables are shown in the following connection diagram.

Cable A:

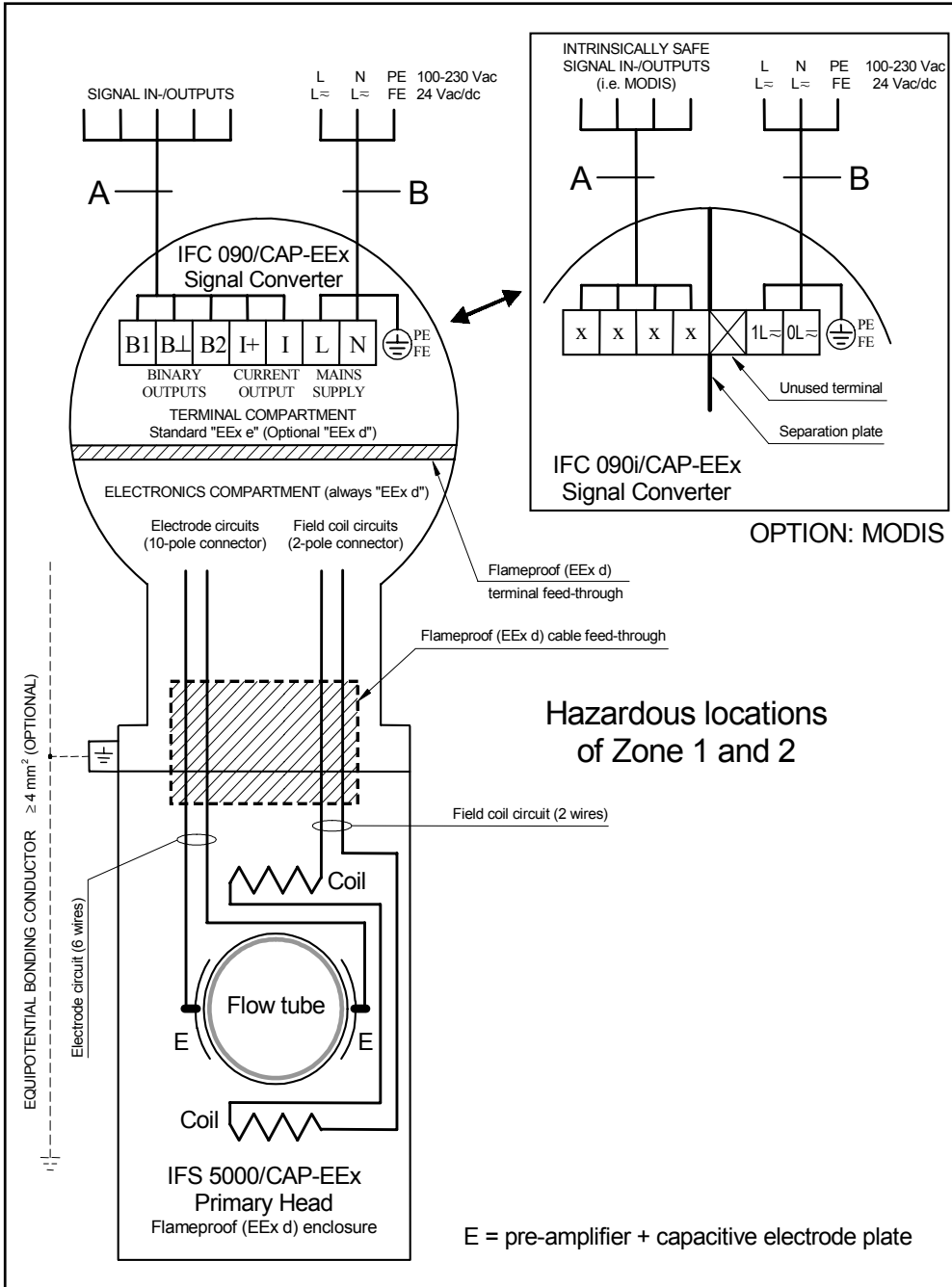
Signal cable for current output and binary outputs (pulse and status output): The cable parameters must be in accordance with the regulations in the EN 60079-14 "Electrical installations in hazardous locations" or an equivalent national standard. For the MODIS version with IFC 090 / CAP i-EEx electronics 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.

| | |
|--|--|
| Rated voltage: | ≥ 500 V |
| Examples: | H07...-, H05...- |
| Equipotential bonding conductor Cross-sectional area: | 4 mm ² (equivalent to AWG 10) |

2.3 Connection diagram



2.4 Regular IFC 090 / CAP-EEEx electronics unit

The field cables that enter the terminal compartment of the IFC 090 / CAP-EEEx 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).

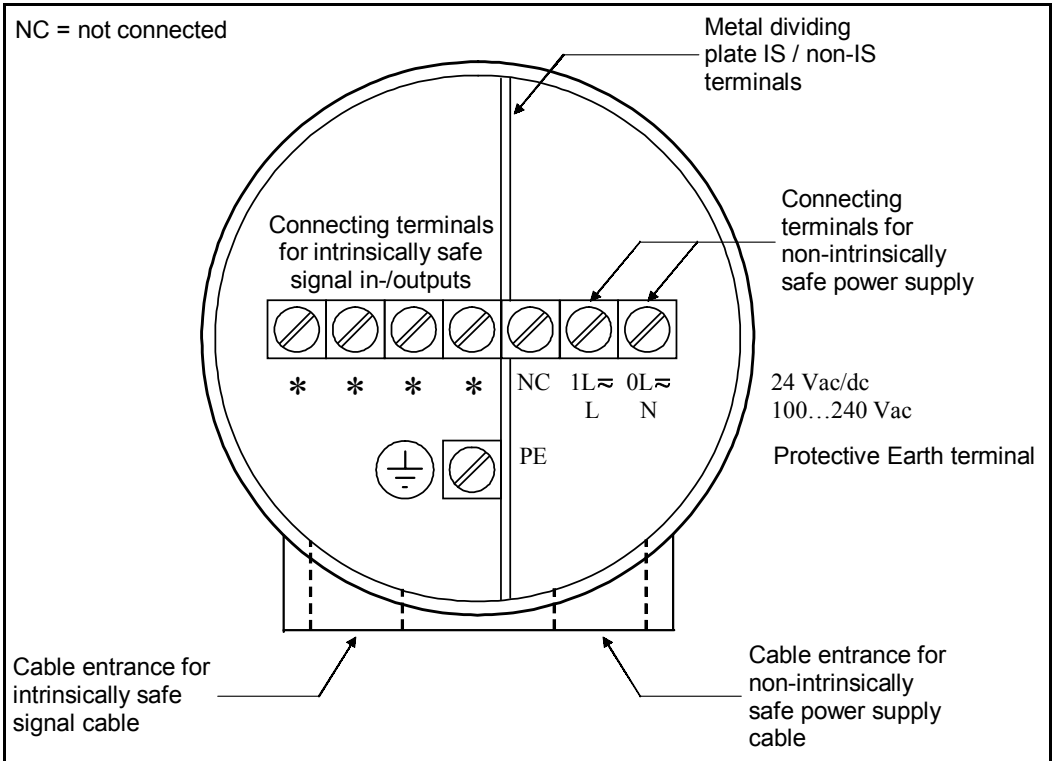
The terminal arrangement is shown below.

| Terminal arrangement in terminal compartment | |
|--|---|
| <p>pulse and status outputs or control inputs</p> <p>binary outputs current output L N 100 - 240 V AC / 48 - 63 Hz L~ L~ 24 V AC / DC</p> <p>PE Protective ground FE Functional ground</p> | |
| Passive pulse/status output | Active current output |
| <p>$I \leq 150 \text{ mA}$</p> <p>electronic or electro-mechanical totalizer</p> <p>$I \leq 150 \text{ mA}$</p> <p>$U_{\text{ext}} \leq 32 \text{ V DC}$ $\leq 24 \text{ V AC}$</p> <p>e.g. signal indicator</p> | <p>$R_i \leq 500 \Omega$</p> |
| <p>Note The binary outputs (terminals B1, B\perp and B2) can only be configured as passive outputs, the current output (terminals I+ and I) can only be configured as active output.</p> | |

2.5 MODIS version IFC 090 / CAP i-EEEx 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 090 / CAP i-EEEx 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).

Terminal arrangement in terminal compartment

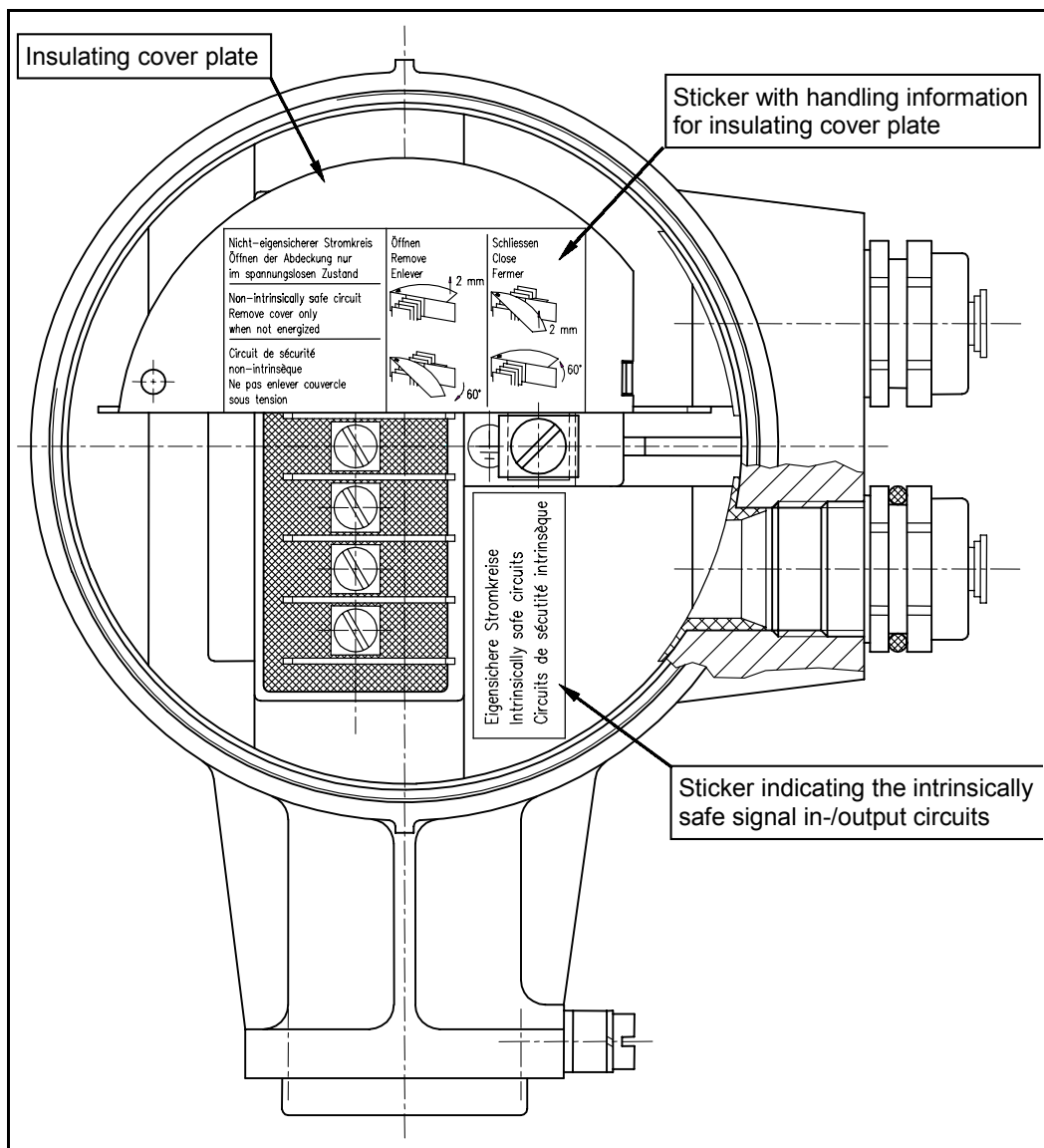


The non-intrinsically safe terminals for connection of the power supply (1L ≈ and 0L ≈) must be connected according to the relevant standard code of practice for electrical apparatus intended for use in potentially hazardous locations, type of protection Increased Safety "e" or type of protection Flameproof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

For details, see diagram on terminals compartment MODIS on next page.

Terminal compartment MODIS version IFC 090 / CAP i-EEEx



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.

2.6 Connection diagrams MODIS

Sect. 2.3 shows the block diagram of the EEx electromagnetic compact flowmeter. The power supply (terminals 1L \approx , 0L \approx) is connected via cable B. The PE terminal must be connected to the protective ground conductor of the mains supply.

The IFC 090 / CAP i-EEEx 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.

Overview of MODIS modules

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

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 functioning of the modules is not guaranteed!

Nominal voltage and current values for the MODIS modules

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

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.

Possible combinations of the installed MODIS modules for the 24 Vac/dc power supply version of the IFC 090 / CAP i-EEEx

| IFC 090 / CAP i-EEEx version | Part No. | MODIS modules | | Terminal designation | | | |
|------------------------------|---------------|---------------|-------|----------------------|------|----|------|
| | | | | | | | |
| Ex-i1 | X317.01.440.0 | P-SA | FA-ST | I ⊥ | I | B1 | B1 ⊥ |
| Ex-i2 | X317.01.450.0 | P-SA | F-PA | I ⊥ | I | D | D ⊥ |
| Ex-i3 | X317.01.460.0 | P-SA | DC-I | I+ | | | I |
| Ex-i4 | X317.01.470.0 | FA-ST | F-PA | B1 | B1 ⊥ | D | D ⊥ |
| Ex-i5 | X317.01.480.0 | FA-ST | DC-I | B1+ | | | B1 |
| Ex-i6 | X317.01.490.0 | FA-ST | FA-ST | B2 | B2 ⊥ | B1 | B1 ⊥ |
| Ex-i7 | X317.01.xxx.0 | P-SA | F-FF | I ⊥ | I | D | D ⊥ |
| Ex-i8 | X317.01.xxx.0 | FA-ST | F-FF | B1 | B1 ⊥ | D | D ⊥ |

Possible combinations of the installed MODIS modules for the 100-230 Vac power supply version of the IFC 090 / CAP i-EEEx

| IFC 090 / CAP i-EEEx version | Part No. | MODIS modules | | Terminal designation | | | |
|------------------------------|---------------|---------------|-------|----------------------|------|----|------|
| | | | | | | | |
| Ex-i1 | X317.01.560.0 | P-SA | FA-ST | I ⊥ | I | B1 | B1 ⊥ |
| Ex-i2 | X317.01.570.0 | P-SA | F-PA | I ⊥ | I | D | D ⊥ |
| Ex-i4 | X317.01.580.0 | FA-ST | F-PA | B1 | B1 ⊥ | D | D ⊥ |
| Ex-i6 | X317.01.590.0 | FA-ST | FA-ST | B2 | B2 ⊥ | B1 | B1 ⊥ |
| Ex-i7 | X317.01.600.0 | P-SA | F-FF | I ⊥ | I | D | D ⊥ |
| Ex-i8 | X317.01.610.0 | FA-ST | F-FF | B1 | B1 ⊥ | D | D ⊥ |

Due to mechanical and electrical limitations, only the 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 with DC-I or FA-ST with 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 to the 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 090 / CAP i-EEEx electronics unit (see figures 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.):

EEEx-approved intrinsically safe apparatus;

EEEx-approved associated apparatus;

Passive apparatus as defined in your national standard for installation of electrical apparatus in hazardous locations (e.g. EN 60079-14).

Other types of apparatus may only be connected to the intrinsically safe signal in-/outputs through EEEx-approved safety barriers, isolating interface units and the like. These barriers or units are not depicted in the connection diagrams 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 090 / CAP i-EEEx signal converter electronics unit with MODIS modules can only be equipped with passive outputs. Therefore the connection diagrams with the numbers 2, 4, 5, 7, 9, 11 and 12 are applicable for the 100...230 Vac power supply versions. |
|--------------------|---|

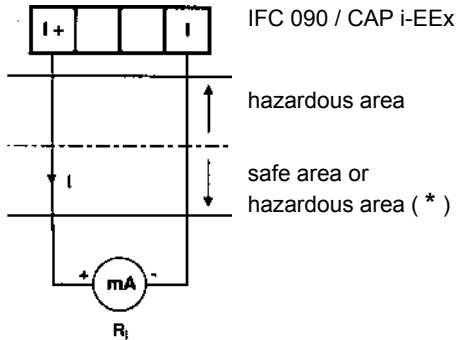
Connection diagrams 1 to 4 of the intrinsically safe signal in-/outputs

1 Current output I_{active}

Version: Ex-i3

$I = 4 - 20 \text{ mA}$

$R_i = 350 \Omega$



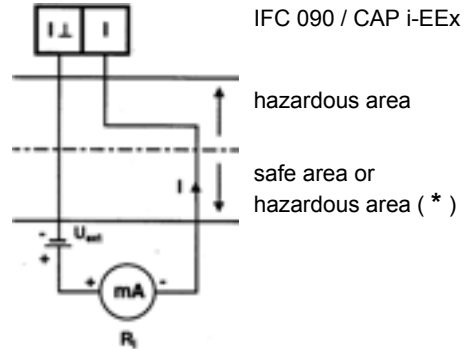
2 Current output $I_{passive}$

Versions: Ex-i1, Ex-i2, Ex-i7

$U_{ext} = 8.1 - 30 \text{ V}$

$I = 4 - 20 \text{ mA}$

$R_i \leq (U_{ext} - 8) / 0.022$



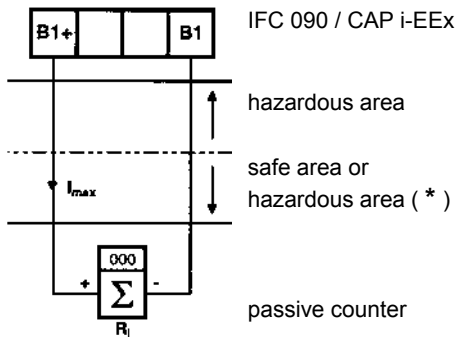
3 Pulse output P_{active}

Version: Ex-i5

$U_{int} = 20 \text{ V DC}$

$R_{int} = 260 \Omega$

$U_L = 20 \times R_L / (260 + R_L)$

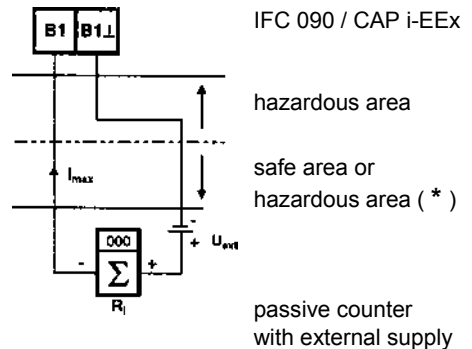


4 Pulse output $P_{passive}$

Versions: Ex-i1, Ex-i4, Ex-i6, Ex-i8

$U_{ext} = 6 - 30 \text{ V DC}$

$I_{max} \leq 110 \text{ mA}$

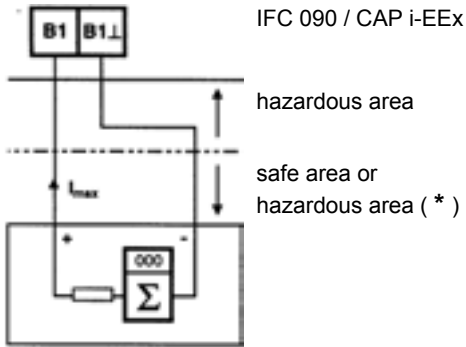


(*) **Important note:** Only if the measuring devices are also explosion protected !

Connection diagrams 5 to 8 of the intrinsically safe signal in-/outputs

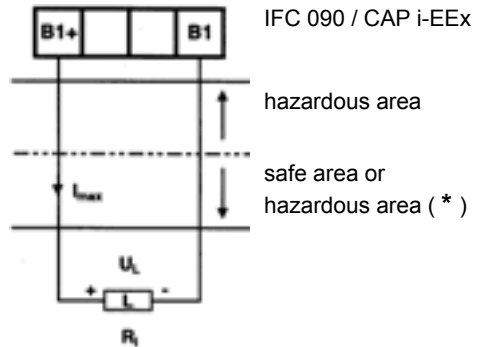
5 Pulse output P_{passive}

Versions: Ex-i1, Ex-i4, Ex-i6, Ex-i8
 $U_{\text{ext}} = 6 - 30 \text{ V}$
 $I_{\text{max}} \leq 110 \text{ mA}$
 for active EC



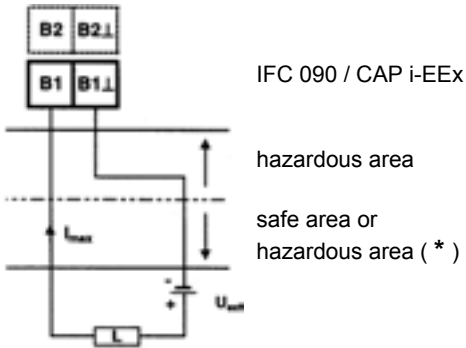
6 Status output S_{active}

Version: Ex-i5
 $U_{\text{int}} = 20 \text{ V DC}$
 $R_{\text{int}} = 260 \Omega$
 $U_L = 20 \times R_L / (260 + R_L)$



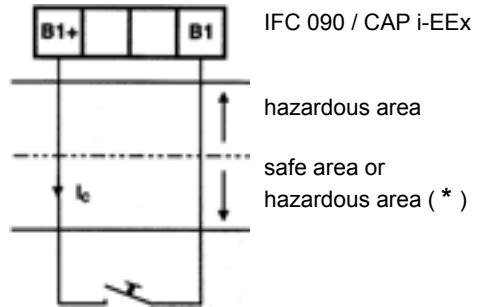
7 Status output S_{passive}

Versions: Ex-i1, Ex-i4, Ex-i6, Ex-i8
 $U_{\text{ext}} = 6 - 30 \text{ V}$
 $I_{\text{max}} \leq 110 \text{ mA}$
 Connection to terminals B1/B1L and/or B2/B2L



8 Control input C_{active}

Version: Ex-i5
 $U_{\text{int}} = 20 \text{ V DC}$
 $I_{\text{contact}} \leq 6 \text{ mA}$

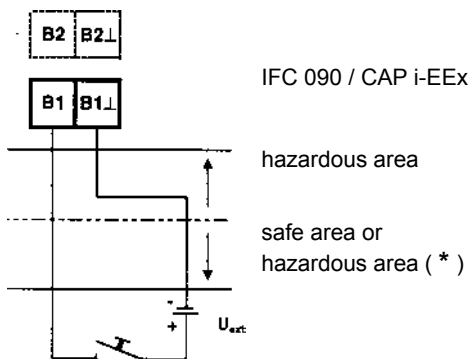


(*) Important note: Only if the measuring devices are also explosion protected !

Connection diagrams 9 to 12 of the intrinsically safe signal in-/outputs

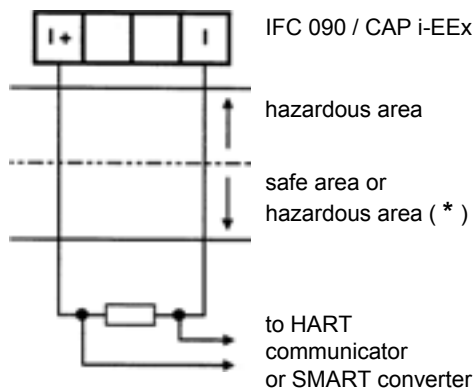
9 Control input $C_{passive}$

Versions: Ex-i1, Ex-i4, Ex-i6, Ex-i8
 $U_{ext} = 7 - 30 \text{ V DC}$
 Connection to terminals B1/B1 \perp and/or B2/B2 \perp



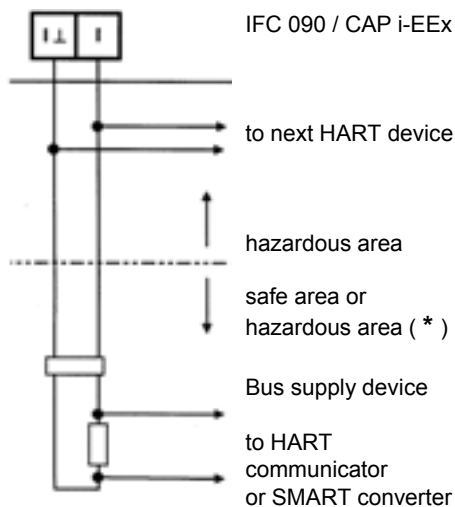
10 HART active

Version: Ex-i3



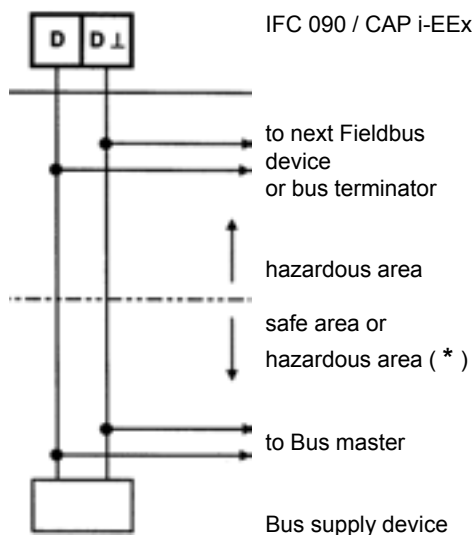
11 HART passive

Versions: Ex-i1, Ex-i2, Ex-i7



12 Fieldbus

Versions: Ex-i2, Ex-i4, Ex-i7, Ex-i8



(*) **Important note:** Only if the measuring devices are also explosion protected !

3 Operation of the signal converter

The compact flowmeters are always equipped with magnet sensors. In that way it 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.

It must be noted that the IFC 090 i/CAP-EEEx versions Ex-i2 and Ex-i3, following menus do not apply. (see also Sect. 4.4. "Table of settable functions" in the standard "Installation and operating instructions" of the IFC090 K/F signal converter)

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

| Fct. | | Text | Description and settings |
|-------------|-----------------|----------------------------|--------------------------|
| 1.00 | 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 | 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 Maintenance

The IFM 5080 K/CAP/...-EEEx electromagnetic 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 on signs of damage or corrosion. This concerns the converter housing and the primary head housings.

5 Service

Contact your (local) KROHNE sales representative for the ordering information of spare parts or replacements of IFC 090/CAP...-EEx electronics units and/or power fuses.

5.1 General information for replacements

| | |
|--------------------|--|
| IMPORTANT ! | The following instructions must be followed carefully, if the IFC 090 / CAP/...-EEx signal converter housing has to be opened respectively closed again! |
|--------------------|--|

Before opening

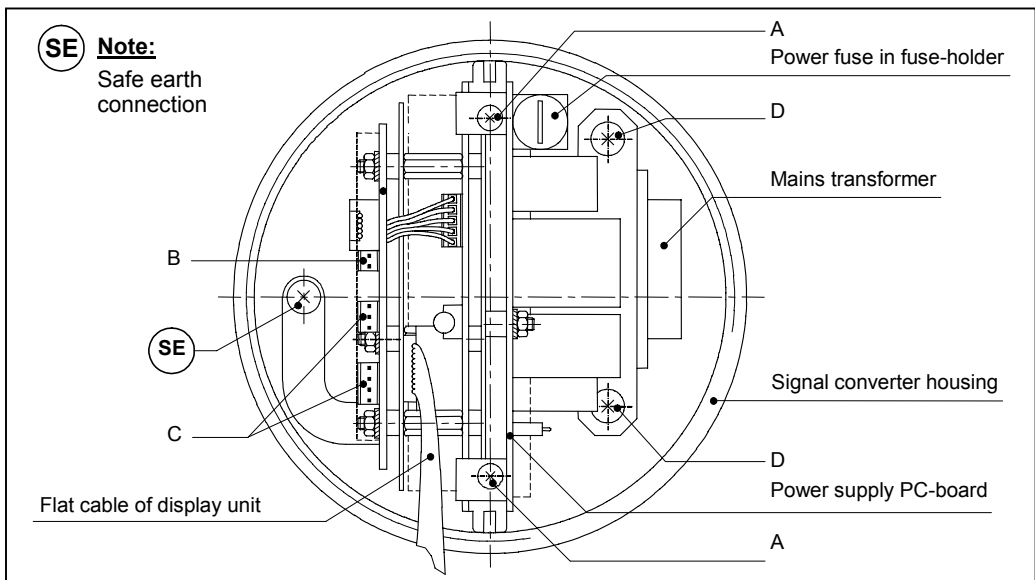
- Make absolutely sure there is no explosion hazard!
- If necessary provide a "Gas-free certificate" !
- Make sure that all connecting cables are safely isolated from the power supply !

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.

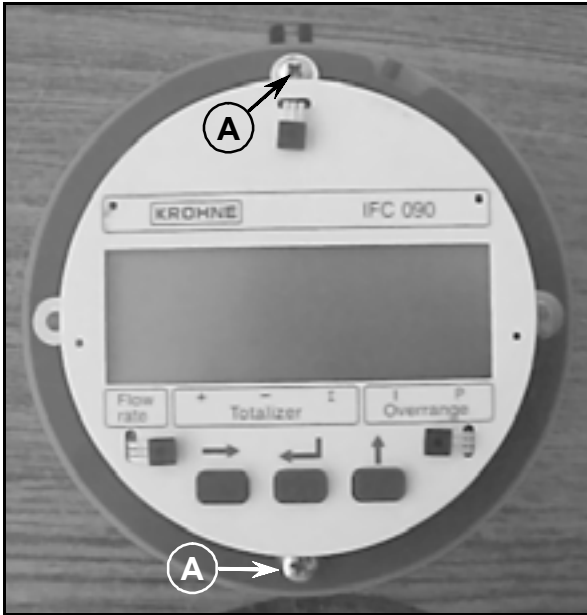
After opening

- The copper ground 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 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.

IFC 090 / CAP-EEx electronics unit after removal of display unit



5.2 Replacement of electronics unit



Display unit of IFC 090 / CAP...-EEx

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 Sect. 8.7 of the standard Installation and Operating Instructions for detailed information.

Before commencing work, note the instructions in Sect. 5.1, "Before opening".

Then continue as follows:

1. Remove the display cover of the electronics compartment.
2. Unscrew the two screws A (M3) of the display unit (see figure above) and turn it carefully aside.
3. Disconnect the 2-pole field circuit connector (item B in figure on last page) and the 10-pole electrode circuit connector (item C). See figures in Sect. 5.1 and the following.
4. Unscrew the two mounting screws D of the electronics unit and unscrew SE, which fixes the copper ground 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 Sect. 5.3 and 5.4 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 10-pole electrode circuit connector C to the right counter-plugs on the electronics unit (see figure in Sect. 5.1).
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 Sect. 5.1 ("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!

5.3 Replacement of power fuse(s)

The power fuse(s) of the different IFC 090 / CAP...-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 / CAP-EEx electronics unit can be reached without removing the complete unit out of the housing (only the display unit has to be unscrewed).

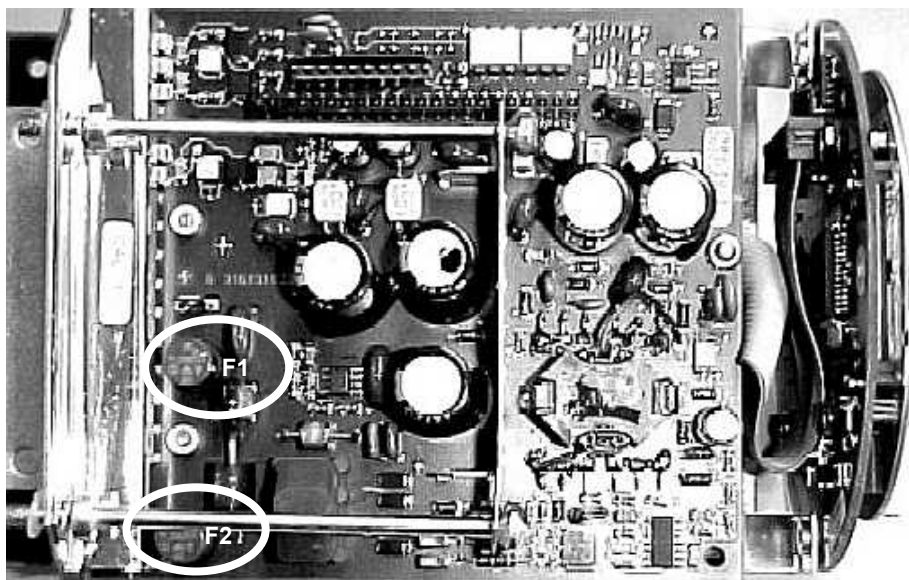
Regular IFC 090 / CAP-EEx with 24 Vac/dc power supply

| | |
|-------------|--|
| Note | Before commencing work, read the instructions in Sect. 5.1 ("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 10-pole electrode circuit connector (item C). See figures in Sect.5.1 and 5.2.
4. Unscrew the two mounting screws D of the electronics unit and screw SE, which fixes the copper ground 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 following figure) can be replaced now. The 24 Vac/dc power supply uses two sub-miniature fuses type TR 5 that are rated T1.25 A in accordance with IEC 127-3 publication (part No. 5.09080.00.00).
6. Reassemble in reverse order (points 3 through 1).

| | |
|-------------|---|
| Note | Read the instructions of Sect. 5.1 ("After opening") during reassembling. |
|-------------|---|

IFC 090 / CAP-EEx electronics unit with 24 Vac/dc power supply



F1 and F2 fuses of power supply

Regular IFC 090 / CAP-EEx with 100 ... 230 Vac power supply

Note Before commencing work, read the instructions in Sect. 5.1 ("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 $\varnothing 5 \times 20$ 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 T125 mA (part No. 5.06627.00.00).

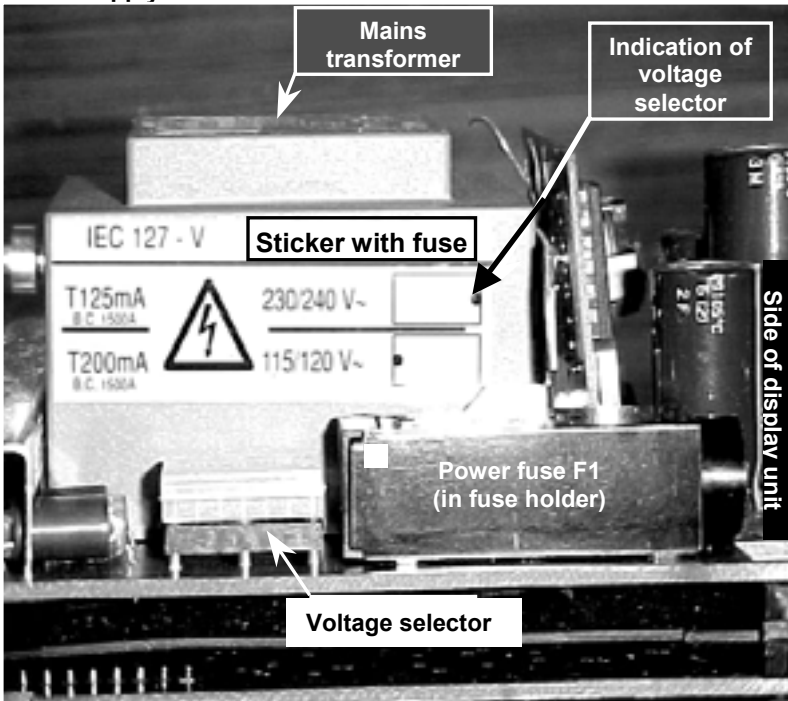
The fuse rating is also shown by the yellow sticker that is glued on the mains transformer, which can only be seen after the regular IFC 090 / CAP-EEx electronics unit is completely removed from the flameproof signal converter housing. See the next figure.

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 Sect. 5.2 and check in the following figure depicted items. Change when needed !

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

Note Read the instructions of Sect. 5.1 ("After opening") during reassembling.

Power supply version 115/230 Vac



MODIS version IFC 090 / CAP i-EEEx

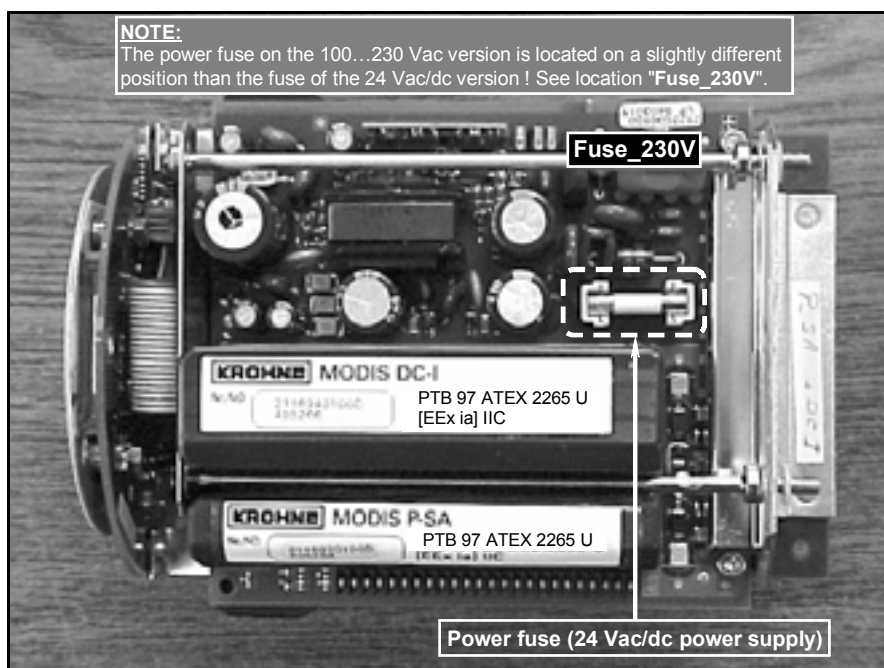
| | |
|-------------|--|
| Note | Before commencing work, read the instructions in Sect. 5.1 ("Before opening"). Then continue as follows: |
|-------------|--|

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 10-pole electrode circuit connector (item C). See figures in Sect. 5.1 and 5.2 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 IMPORTANT.
5. The defective power fuse (see following figure) 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 rated at T1.6H250V (Part No. 5.07823.00.00) for the 100...230 Vac power supply. Note that the locations are slightly different (the 24 Vac/dc supply version is shown).
6. Reassemble in reverse order (points 4 through 1).

| | |
|-------------|--|
| Note | Read the instructions of Sect. 5.1 ("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 or inserting the electronics unit into the signal converter housing. This is to prevent damaging of the connecting cables!

IFC 090 / CAP i-EEEx electronics unit (24 Vac/dc version is shown)



5.4 Changing power supply voltage

This only applies to the regular IFC 090 / CAP-EEEx electronics unit with 100-230 Vac power supply.

| | |
|-------------|---|
| Note | Before commencing work, read the instructions in Sect. 5.1 ("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 ground 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 10-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 last figure in Sect. 5.3) 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 | Note the instructions of Sect. 5.1 ("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! |
|-------------------|---|



EC Declaration of Conformity

We,

KROHNE Altometer
Kerkeplaat 12
3313 LC Dordrecht
The Netherlands

Declare under our sole responsibility that the products

Compact electromagnetic flowmeter types

**CAPAFLUX IFM 5080 K/CAP-EEEx and
CAPAFLUX IFM 5080 K/ CAP i -EEEx**

Fulfill the requirements of following EC directives:

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

The CAPAFLUX IFM 5080 K/CAP-EEEx and IFM 5080 K/CAP/ i -EEEx 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 CAPAFLUX IFM 5080 K/CAP-EEEx and IFM 5080 K/CAP/ i -EEEx flowmeters are examined and type-approved under EC-Examination certificate KEMA 01 ATEX 2232 X. The KROHNE Altometer quality assurance system is approved by KEMA Registered Quality b.v. (KEMA 01 ATEX Q3049).

Dordrecht, 20.07.2002

A.H. Boer
(Vice President Flow Division)

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 01ATEX2232 X**

(4) Equipment or protective system: **Compact Magnetic Inductive Flowmeter, types IFM 5080 K/CAP-EEx, IFM 5080 K/CAPi-EEx, MGM 5090 K/CAP-EEx and MGM 5090 K/CAPi-EEx**

(5) Manufacturer: **Krohne Altometer**

(6) Address: **Kerkpleat 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. 2011381.


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

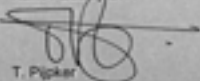
| | | |
|------------------------|----------------------------|------------------------|
| EN 50014 : 1997 | EN 50018 : 2000 | EN 50019 : 2000 |
| EN 50020 : 1994 | EN 50281-1-1 : 1998 | |

(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:

 **II 2 GD** **EEx d IIC T6...T4 or EEx de IIC T6...T4 or EEx d [Ia] IIC T6...T4 or EEx de [Ia] IIC T6...T4 T85 ... 115 °C**

Amhem, 17 January 2002,
KEMA Quality B.V.

T. Pijper
Certification Manager

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

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ACCREDITED BY THE
DUTCH COUNCIL FOR
ACCREDITATION 

Page 1/4

(13)

SCHEDULE

(14)

to EC-Type Examination Certificate KEMA 01ATEX2232 X

(15) **Description**

The Compact Magnetic Inductive Flowmeter, types IFM 5080 K/CAP-EEEx, IFM 5080 K/CAP/i-EEEx, MGM 5090 K/CAP-EEEx and MGM 5090 K/CAP/i-EEEx 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 (sizes DN 25 to DN100) are in type of explosion protection flameproof enclosure "d".

Within the flameproof signal converter housing various modules are fitted, some models contain intrinsically safe circuits for connection to external circuits as specified below

Ambient temperature range -20 °C ... +60 °C (for flowmeter with electronics unit type IFC090i).

Ambient temperature range -40 °C ... +60 °C (for flowmeter with electronics unit type IFC090)

The maximum surface temperature T85 ... 115 °C is based on an ambient temperature of 60 °C.

Electrical data

IFC 5080 K/CAP-EEEx / MGM 5090 K/CAP-EEEx with IFC090-EEEx electronics

Power supply 100/200 Vac, 115/230 Vac -15/+10 %, 13 VA
24 Vdc -25/+30 %, 24 Vac -15/+10 %, 8 W

Signal I/O's ≤ 36 Vdc

IFC 5080 K/CAP/i-EEEx / MGM 5090 K/CAP/i-EEEx with IFC090i-EEEx 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 01ATEX2232 X

Test documentation (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 ib IIB, with the following maximum values:

$$\begin{aligned} U_i &= 30 \text{ V} \\ I_i &= 300 \text{ mA} \\ P_i &= 4,2 \text{ W} \end{aligned}$$

The effective internal capacitance $C = 5 \text{ nF}$, the effective internal inductance L_i is negligibly small.

Signal/supply circuit

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

$$\begin{aligned} U_o &= 23,5 \text{ V} \\ I_o &= 98 \text{ mA} \\ P_o &= 0,6 \text{ W} \end{aligned}$$

Maximum allowed external capacitance $C_o = 127 \text{ nF}$, maximum allowed external inductance $L_o = 4 \text{ mH}$.

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.

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.

(13)

SCHEDULE

(14)

to EC-Type Examination Certificate KEMA 01ATEX2232 X

Installation instructions (continued)

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 and feedthrough must be submitted to the routine overpressure test according to EN 50018, Clause 16, at a test pressure of 22,5 bar during one minute.

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.

(16) **Report**

KEMA No. 2011381.

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

The relation between temperature class, max. surface temperature, max. process temperature and ambient temperature is shown in following table:

| Temperature class | Max. surface temperature | Max. process temperature | | |
|-------------------|--------------------------|--------------------------|------------|-------------|
| | | Ta ≤ 40 °C | Ta ≤ 50 °C | Ta ≤ 60 °C |
| T6 | T 85 °C | 60 °C | 55 °C | not allowed |
| T5 | T 100 °C | 75 °C | 75 °C | 75 °C |
| T4 | T 115 °C | 115 °C | 115 °C | 75 °C |

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

Covered by the standards listed at (9).

(19) **Test documentation**

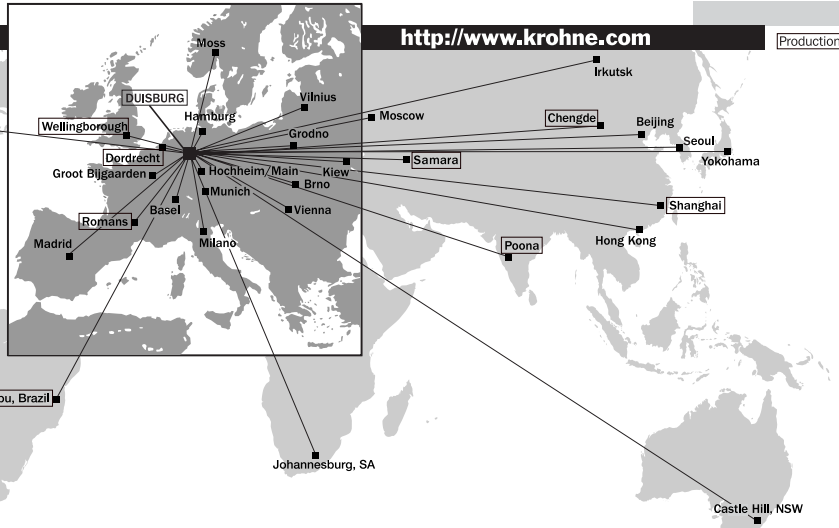
- Component Certificate KEMA No. Ex-99.E.8128 U
Certificate of Conformity KEMA No. Ex-96.D.2713 X
EC-Type Examination Certificate PTB 98 ATEX 2012 U

dated
- Description (15 pages) 05.04.2001, 05.12.2001,
13.12.2001 and 14.01.2002
- Drawings index sheet 14.01.2002

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