

## DK32 DK34 Supplementary instructions

Variable area flowmeter  
with electrical built-ins

Equipment category II 3 G



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## 1.1 General notes

These additional instructions apply to explosion-protected versions of variable area flowmeters with electrical built-ins and the marking II 3 G. They complete the installation and operation instructions for the non-explosion protected versions.

The information given in these instructions contains only the data relevant to category 3 explosion protection. The technical details given in the installation and operation instructions for the non-explosion protected versions apply unchanged unless excluded or superseded by these instructions.

## 1.2 EC conformity

The manufacturer declares with the EC Declaration of Conformity on his own responsibility conformity with the protection goals of Directive 94/9/EC for use in hazardous areas with gas.

The assessment was made according to Directive 94/9/EC, Annex VIII (module "Internal control of production"), and is registered company-internal under KMT-TDZ-A0121X. This registration number is also provided on the nameplate.

## 1.3 Security information

Assembly, installation, start-up and maintenance may only be performed by personnel trained in explosion protection!



### **CAUTION!**

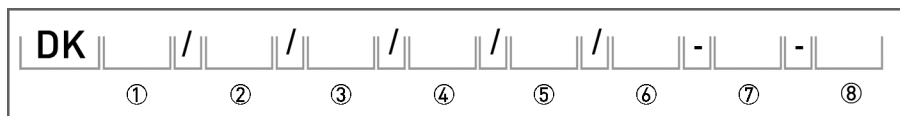
*The operator respectively his agent is responsible to follow further standards, directives or laws if required due to operating conditions or place of installation. This applies particularly for the use of easy detachable process connections such as SMS or Clamp when measuring flammable mediums.*

## 2.1 Device description

Variable area flowmeters measure and display the volume flow of flammable and non-flammable gases and liquids. The display houses one or two separately adjustable electrical limit switches.

## 2.2 Description code

The safety description code \* consists of the following elements:

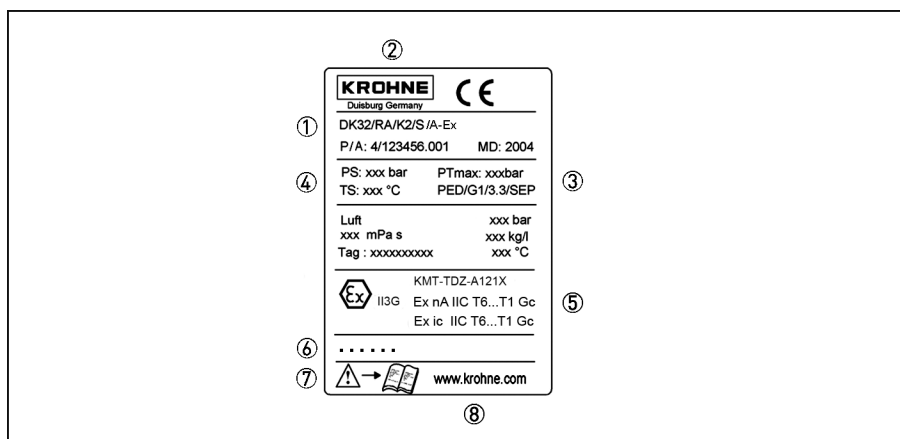


- ① 32 - with valve and horizontal connection / 34 without valve and vertical connection
- ② RE - inlet pressure regulator / RA - outlet pressure regulator
- ③ K1 - one limit switch / K2 - two limit switches
- ④ S - plug connector / L - cable gland incl. cable
- ⑤ HT - high-temperature version
- ⑥ A - Limit switch tested for EC type approval or IECEx tested
- ⑦ Ex - Explosion-protected equipment

\* positions which are not needed are omitted (no blank positions)

## 2.3 Marking

The marking of the entire device is on the display, where the following identification plate can be found. An additional marking is located on the inside of the display with the serial number (SN or P/A number).



- ① Device type
- ② Manufacturer
- ③ PED data
- ④ Sizing data: temperature & pressure rating
- ⑤ Ex data
- ⑥ Built-in equipment
- ⑦ Note manual
- ⑧ KROHNE website

## 2.4 Flammable products

### Atmospheric conditions

An explosive atmosphere is a mixture of air and flammable gases, vapours, mists or dusts under atmospheric conditions. The following values define it  $T_{\text{atm}} = -20^{\circ}\text{C} \dots +60^{\circ}\text{C}$  /  $-4^{\circ}\text{F} \dots 140^{\circ}\text{F}$  and  $P_{\text{atm}} = 0.8 \dots 1.1 \text{ bar}$ . Outside of this range, no key data are available as to ignition behaviour for most mixtures.

### Operating conditions

Variable area flowmeters operate outside of atmospheric conditions, which means that explosion protection according to Directive 94/9/EC (ATEX) – regardless of the zone assignment – is fundamentally not applicable due to the lack of key safety data for the interior of the measuring section.



#### CAUTION!

*Operation with flammable products is only permissible if no explosive fuel/air mixture is formed on the interior of the flowmeter under operating conditions. The user is responsible for the safe operation of the flowmeter with regard to the temperatures and pressures of the products used. In case of operation with flammable products the measuring units must be included in the periodic pressure tests of the system.*

## 2.5 Equipment category

The flowmeters are designed in category II 3G according to EN 60079-0, EN 60079-11 and EN 60079-15 for use in zone 2.



#### INFORMATION!

*Definition of Zone 2 according to EN 1127-1, Appendix B:*

*An area in which an explosive atmosphere as a result of the mixture of flammable substances in the form of gas, steam or mist with air is not expected to occur under normal operation. If, however, such an atmosphere does occur it only lasts for a brief period of time.*

For more information see the chapter entitled "Flammable products".

## 2.6 Protection types

Variable area flowmeters can be operated as protection type "non-sparking" or "intrinsic safety protection level ic". Explanations of the individual protection types appear below.

The variable area flowmeter is designed with protection type "non-sparking" in accordance with EN 60079-15. Protection against explosion is ensured in that no sparking contacts or hot surfaces lead to ignition under normal operating conditions.

The marking is: **II 3G Ex nA IIC T6...T1 Gc**

| The marking contains the following information: |                                   |
|---|-----------------------------------|
| <b>II</b>                                       | Group II explosion protection     |
| <b>3</b>  | Equipment category 3              |
| <b>G</b>  | Gas explosion protection          |
| <b>nA</b>                                       | Non-sparking equipment            |
| <b>IIC</b>                                      | Gas groups IIA, IIB, IIC          |
| <b>T6...T1</b>                                  | Temperature classes T6 ... T1     |
| <b>Gc</b>                                       | Equipment protection levels (EPL) |

The variable area flowmeter is designed with protection type "intrinsic safety, protection level ic" in accordance with EN 60079-11. The explosion protection is ensured by way of limiting the current and voltage so that no energy capable of ignition can occur.

The marking is: **II 3G Ex ic IIC T6...T1 Gc**

| The marking contains the following information: |   |
|---|---|
| <b>II</b>                                       | Group II explosion protection                     |
| <b>3</b>  | Equipment category 3                              |
| <b>G</b>  | Gas explosion protection                          |
| <b>ic</b>                                       | Intrinsically safe equipment, protection level ic |
| <b>IIC</b>                                      | Gas groups IIA, IIB, IIC                          |
| <b>T6...T1</b>                                  | Temperature classes T6 ... T1                     |
| <b>Gc</b>                                       | Equipment protection levels (EPL)                 |

## 2.7 Ambient temperature / temperature classes

Because of the influence of the temperature of the product, no fixed temperature class is assigned to variable area flowmeters. In fact, the temperature class of a device is a function of the temperature of both the product and the environment. There is no distinction between devices with one or two contacts. The classification is outlined in the following tables.

The tables take into account the following parameters:

- Ambient temperature  $T_{amb}$ .
- Product temperature  $T_m$



### INFORMATION!

*The maximum permissible product temperatures listed in the tables are valid under the following conditions:*

- *The measuring device is installed and operated in accordance with the installation instructions in the installation and operating manual.*
- *It must be ensured that the flowmeter is not heated by the effects of additional heat radiation (sunshine, neighbouring system components) and thus operated above the permissible ambient temperature range.*
- *Insulation must be limited to the piping.  
Unobstructed ventilation of the indicator part must be ensured.*

### DK3./.././../A–Ex permissible medium and ambient temperatures

| Temperature class | Ambient temperature |            | Maximum permitted product temperature with plug (P) or cable entry (C) |      |           |      |
|-------------------|---------------------|------------|--|------|-----------|------|
|                   |                     |            | Type DK32  |      | Type DK34 |      |
|                   | [°C]                | [°F]       | [°C]   | [°F] | [°C]      | [°F] |
| T6                | -25...+40           | -13...+104 | 75   | 167  | 80        | 176  |
|                   | -25...+50           | -13...+122 | 70   | 158  | 70        | 158  |
|                   | -25...+60           | -13...+140 | 60   | 140  | 60        | 140  |
| T5                | -25...+40           | -13...+104 | 100  | 212  | 100       | 212  |
|                   | -25...+50           | -13...+122 | 95   | 203  | 100       | 212  |
|                   | -25...+60           | -13...+140 | 85   | 185  | 90        | 194  |
| T4                | -25...+40           | -13...+104 | 135  | 275  | 135       | 275  |
|                   | -25...+50           | -13...+122 | 130  | 266  | 135       | 275  |
|                   | -25...+60           | -13...+140 | 120  | 248  | 130       | 266  |
|                   | -25...+90           | -13...+194 | 90   | 194  | 90        | 194  |
| T3...T1           | -25...+40           | -13...+104 | 135  | 275  | 150       | 302  |
|                   | -25...+50           | -13...+122 | 130  | 266  | 140       | 284  |
|                   | -25...+60           | -13...+140 | 120  | 248  | 130       | 266  |
|                   | -25...+90           | -13...+194 | 90   | 194  | 90        | 194  |

## 2.8 Electrical data

The electrical signal circuits are connected depending on the selected protection type:

### Design DK3./../../A–Ex

|   |             |
|---|-------------|
| When supplying as intrinsically safe equipment "ic" only to separate intrinsically safe circuits with the following maximum values. |             |
| $U_i$   | 16 VDC      |
| $C_i$   | 150 nF      |
| $L_i$   | 150 $\mu$ H |
| Observe the Special Conditions chapter when connecting ( refer to <i>Special conditions</i> on page 9).                             |             |

|  |          |
|--|----------|
| When supplying as non-sparking equipment "nA" only for connection to switch amplifiers in accordance with NAMUR (IEC 60947-5-6). |          |
| Nominal voltage $U_N$  | 8 VDC    |
| Nominal current $I_N$  | 1...3 mA |
| Consult the Special Conditions chapter when connecting ( refer to <i>Special conditions</i> on page 9).                          |          |



#### **WARNING!**

*As soon as the maximum value  $U_m = 16$  V is exceeded, the use in intrinsically safe circuits is no longer permitted!*

### 3.1 Special conditions

The protective glass on the display of the variable area flowmeter may not be exposed to any mechanical load.

During operation as non-sparking equipment "nA" only suitable for connection to switch amplifiers in accordance with NAMUR (IEC 60947-5-6).

During operation as intrinsically safe equipment "ic" only for connection to separated intrinsically safe circuit. In addition, for the variant with the cable assembly, a light blue hose must be shrink fitted onto the connecting cable on the connector plug and on the cable end (the hose is included in delivery) or other appropriate measures must be taken.



**INFORMATION!**

**Marking connecting points in accordance with EN 60079-11:** Connecting points, terminal boxes and connectors of intrinsically safe equipment and accompanying equipment must be uniquely marked and clearly identifiable. If a colour is used for this, it must be light blue.

### 3.2 Installation

Installation and setup must be carried out according to the applicable installation standards (e.g. EN 60079-14) by qualified personnel trained in explosion protection. The information given in the Installation and Operation Instructions and the Supplementary Installation and Operation Instructions must always be observed.

**Variable area flowmeters must be installed in such a way that**

- There is no danger from mechanical impact effects.
- There are no external forces affecting the indicator part.
- The device is accessible for any visual inspections that are necessary, and can be viewed from all sides.
- The nameplate is clearly visible.
- It can be operated from a location with secure footing.



**CAUTION!**

*The manufacturer is not liable for any damage resulting from improper use or use other than the intended purpose. This applies in particular to hazards due to insufficient corrosion resistance and suitability of the materials in contact with product.*

## 4.1 General notes

For version DK3../../S../.-Ex (plug), the separate intrinsically safe signal circuits of protection level "ic" are electrically connected in the terminal compartment of the plug housing and for version DK3../../L../.-Ex (connecting cable) it is the connecting cable as illustrated in the connection diagram. Permissible maximum values (electrical data) must be observed.

### Connecting cable

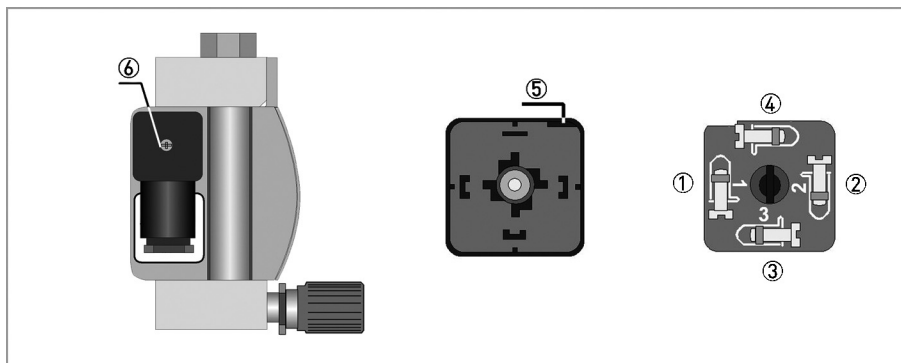
The connecting cables must be selected according to prevailing installation standards (e.g. EN 60079-14).. The outer diameter of the connecting cable must be within the sealing range of the cable entry. The connecting cables must be fixed and laid in such a way as to be sufficiently protected against damage.

All cores that are not used must be securely connected to the earth potential of the hazardous area or carefully insulated against each other and against ground (test voltage  $\geq 500 V_{eff}$ ).

### Cable entries / Blanking plugs

The DK3../../S../.-Ex variable area flowmeter is equipped with a connector. The connector guarantees protection from foreign bodies and water (protection category) IP65 acc. to EN 60529. The cable entry is closed with a plug. The plug is to be replaced with a suitable connecting cable (nominal diameter range 6...9mm).

### Connection diagrams

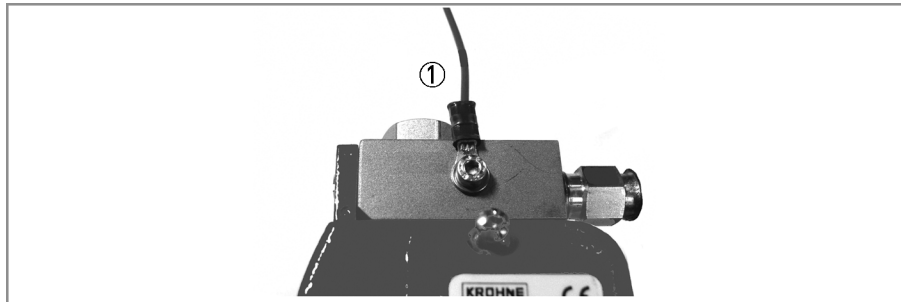


|   | Contact connection                | Cable colors of assembled cable |
|---|-----------------------------------|---------------------------------|
| ① | Min minus                         | white                           |
| ② | Min plus                          | yellow                          |
| ③ | Max minusMax minus                | green                           |
| ④ | Max plus                          | brown                           |
| ⑤ | Lift slot                         |                                 |
| ⑥ | Fastening screw of connection box |                                 |

## 4.2 Earthing and equipotential bonding

If the device is not sufficiently electrostatically grounded via the process cables, an additional earth connection must be established using the earth screw ①. The position of the ground terminal is illustrated below. The connection guarantees only an electrostatic connection of the device and does not comply with the requirements of an equipotential bonding connection.

### DK32 - DK34



## 5.1 Start-up

**Start-up is only permitted when the variable area flowmeter:**

- is correctly installed in the system and connected.
- has been checked for the proper state with regard to its installation and connection requirements.

The user of the system must have it checked before start-up in compliance with the national regulations for checks before startup.

## 5.2 Operation

Variable area flowmeters must be operated in such a way that they remain within the maximum and minimum permissible temperatures and pressures and the electrical limit values.

Variable area flowmeters may only be operated if the equipment parts necessary for safety are effective in the long run, and are not rendered inoperable during operation.

### 5.2.1 Operation as intrinsically safe equipment "ic"

Adjusting the limit switch during operation is permitted. To do so, remove the housing cover. Replace the housing cover immediately after adjusting the limit switch.

### 5.2.2 Operation as non-sparking equipment "nA"



***DANGER!***

*During operation it is only permitted to open the indicator if no explosive atmosphere is present.*

## 6.1 Maintenance

Maintenance work of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorised representative or under the supervision of authorised inspectors.

For systems in hazardous areas, regular tests are required in order to maintain the proper condition.

**The following checks are recommended:**

- Checking the housing, the cable entries and the feed lines for corrosion and/or damage.
- Checking the measuring unit and the piping connections for leakage.

The cover is to be closed following maintenance work on the display unit.

## 6.2 Dismantling

**Replacing the display part**

Due to the modular design of the variable area flowmeter, it is possible to replace a complete display with an identical spare part in accordance with safety guidelines.



**CAUTION!**

*There may be a loss of measuring accuracy!*

**Exchanging the entire device**

Removal and installation are the responsibility of the operator.

Before disconnecting the electric connecting cable of the device, make sure that all cables leading to the indication unit are isolated from the ground of the hazardous area. This also applies to functional earthing conductors (FE) and equipotential bonding conductors (PA).



**CAUTION!**

- *Pressurized pipes have to be depressurized before removing the measuring unit.*
- *In the case of environmentally critical or hazardous products, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.*
- *New gaskets have to be used when re-installing the device in the piping.*







### KROHNE product overview

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

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