VA FLOWMETERS

Supplementary Instructions

Variable area flowmeters without electrical built-ins

Type series DK32, DK34, DK37 M8M, H250 M8M, H250 M40, H250 M40R

EPL Gb, EPL Db

IEC Ex KIWA 001

KROHNE

1.1 General notes

These additional instructions apply to explosion-protected versions of variable area flowmeters with protection type "design safety c", EPL Gb, EPL Db.
It completes the manual for the non explosion-protected versions.

The information given in this instruction contains only the data relevant to explosion protection. The technical details given in the manual for the non explosion-protected versions remain unchanged unless they will be excluded or replaced by this supplementary instruction.

1.2 Approval according to the IECEx scheme

Conformity for use in hazardous areas with gas and dust was tested in accordance with the "IECEx Certification Scheme for Explosive Atmospheres" according to
ISO 80079-36:2016 and ISO 80079-37:2016.

The number of the IEC certificate is:

IECEx KIWA 19.0016 X

The "X" after the certificate number refers to special conditions for safe use of the device, which have been listed in these instructions.
If needed, the IEC certificate can be downloaded from the manufacturer's website.

1.3 Safety instructions

If these instructions are not followed, there is a risk of explosion.

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

CAUTION!
The operator or his agent is responsible for observing any additional standards, directives or laws if required due to operating conditions or place of installation.
This applies in particular to the use of easily detachable process connections when measuring flammable media.

2.1 Device description

Variable area flowmeters measure and display the flow of flammable and non-flammable gases and liquids.

2.2 Description code

The safety description code consists of the following elements *:

Figure 2-1: Safety description code for the type series of DK32 / DK34

① **Type series of measuring unit DK**
32 - with valve and horizontal connection
34 - without valve and vertical connection
② **Optional flow regulator**
RE - for variable inlet pressure
RA - for variable outlet pressure
③ **High-temperature version**
HT - high-temperature version
④ **Version**
Ex - explosion-protected equipment

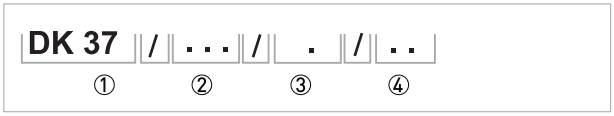

Figure 2-2: Safety description code for the type series of DK37/M8M

① **Type series of DK37, optional with needle valve**
② **Type series of M8M, mechanical indicator**
③ **Design of indicator housing**
without - indicator housing in PPS
R - indicator housing in stainless steel
④ **Optional flow regulator**
RE - for variable inlet pressure
RA - for variable outlet pressure

Figure 2-3: Safety description code for the type series of H250/M8MG

① **Type series of measuring unit H250**
② **Materials / versions**
RR - stainless steel
C - PTFE or PTFE with ceramic liner
HC - Hastelloy®
Ti - Titanium
MO - Monel
IN - Inconel
F - Food
③ **Type series of indicators - M8**
④ **Design of indicator M8**
MG - mechanical indicator
⑤ **Design of indicator housing**
without - indicator housing in PPS
R - indicator housing in stainless steel
⑥ **Version**
Ex - explosion-protected version

Figure 2-4: Safety description code for the type series of H250 M40

① **Type series of measuring unit H250**
H250 - standard version, vertical upwards
H250H - horizontal orientation
H250U - vertical downwards
② **Measuring unit materials / versions**
RR - stainless steel
C - PTFE or PTFE/ceramics
HC - Hastelloy® C
Ti - Titanium
MO - Monel
IN - Inconel
F - Food
③ **Heating jacket version**
blank - without heating jacket
B - with heating jacket
④ **Signal converter version**
M40 - aluminium housing, painted (standard)
M40R - stainless steel housing
⑤ **High-temperature version**
blank - without HT extension
HT - with HT extension
⑥ **Version**
Ex - explosion-protected version

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

2.3 Marking

The flowmeters are identified by the following nameplates (examples are not to scale):

Nameplate DK32, DK34

Figure 2-5: Example of a nameplate for DK3x

Nameplate H250/M40, DK37/M8M, DK37/M8M/R, H250/M8MG, H250/M8MG/R

Figure 2-6: Example of a nameplate for H250 M40

CAUTION!
The values stated on the nameplates (indicated with XXX) vary according to the individual device versions and can be found on the respective nameplate or standard manual for the device.

- 0035 - identification number of the PED supervisory body
- SN - serial number and/or PA - production order number
- MD - manufacturing date
- PS - max. operating pressure (Pressure Specified)
- PT max. - max. test pressure (Pressure Test max.)
- TS - max. operating temperature (Temperature Specified)
- PED - Pressure Equipment Directive key
- Tag-No. - tag identifier
- Reg.No. - registration number of notified body
- Tamb. - max. ambient temperature
- VG - V number, Germany
- SO - order number
- PA - production order number
- AC - article code

2.4 Flammable products

Atmospheric conditions:

The standard atmospheric conditions under which it may be assumed that Ex equipment can be operated are:

- Temperature: -20...+60°C / -4...+140°F
- Pressure: 80...110 kPa (0.8...1.1 bar) / 11.6...15.9 psi
- Air with normal oxygen content, typically 21%v/v

Ex equipment operating outside the standard temperature range must be tested and certified (e.g. for ambient temperature range -40...+65°C / -40...+149°F).
Ex equipment operating outside the standard atmospheric pressure range and standard oxygen content is not permitted.

Operating conditions:

The measuring unit of variable area flowmeters operate outside the standard atmospheric pressure range, which means that explosion protection, regardless of the zone assignment, is fundamentally not applicable for the measuring unit (piping).

WARNING!
Operation with flammable products is only permitted as long as no explosive fuel/air mixture builds up inside of the piping at the same time the atmospheric conditions are exceeded.

The operator is responsible to ensure that the flowmeter is operated safely in terms of the temperature and pressure of the products used. In case of operation with flammable products the measuring units must be included in the periodic pressure tests of the piping.

When using the device version H250/C... (PTFE version, non-conductive) the minimum conductivity of the media must be 10^{-8} S/m, in order to avoid danger from electrostatic charge.

2.5 EPL

Variable area flowmeters are designed in EPL Gb and EPL Db for use in zone 1 or zone 2 or zone 21 or zone 22. The inside of the measuring unit is also approved for zone 1.

INFORMATION!
Definition of zone 1:
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, under normal operation may occasionally occur.

Definition of zone 21:
An area in which an explosive atmosphere may occasionally occur in the form of a cloud of flammable dust in the air under normal operation.

2.6 Types of protection

Non-electrical variable area flowmeters are designed in the protection type "design safety c" in accordance with ISO 80079-37.

The marking of the non-electrical versions for the device type is:

Device type	Gas range	Dust range
DK32 / DK34 / DK37	Ex h IIC T6...T3 Gb	Ex h IIIC T150°C Db
DK32 HT / DK34 HT H250/M8MG	Ex h IIC T6...T3 Gb	Ex h IIIC T200°C Db
H250/M40	Ex h IIC T6...T2 Gb	Ex h IIIC T300°C Db

Table 2-1: Marking of the non-electrical versions for the device type

The marking contains the following information:

Ex h	Non-electrical device - Protection through design safety
IIC	Gas group, suitable for gas groups IIC, IIB and IIA
IIIC	Dust areas, suitable for groups IIIC, IIIB and IIIA
T6...T2	Temperature class range, suitable for temperature classes T6...T1
T300 °C	Maximum surface temperature of measuring unit
Gb	EPL, suitable for zone 1 and zone 2
Db	EPL, suitable for zone 21 and zone 22

Table 2-2: Description of the marking

2.7 Ambient temperature / Product temperature

Due to the influence of the product temperature, no fixed temperature class is assigned to variable area flowmeters. The temperature class of these devices is rather a function of the present product temperature and ambient temperature.

The correlation of the temperature class as a function of the ambient temperature and the process temperature is shown separately for each type series in the following table.

Device type	Temp. class	Surface temperature	Maximum permissible	
			Ambient temperature in °C	Product temperature in °C
DK32 / DK34	T6	T85°C	-40...+70	-40...+85
	T5	T100°C		-40...+100
	T4	T135°C		-40...+135
	T3	T150°C		-40...+150
DK32 HT / DK34 HT	T6	T85°C	-25...+85	-25...+85
	T5	T100°C	-25...+100	-25...+100
	T4	T135°C	-25...+135	-25...+135
	T3	T200°C	-25...+200	-25...+200
DK37 / M8M	T6	T85°C	-40...+70	-40...+85
	T5	T100°C		-40...+100
	T4	T135°C		-40...+135
	T3	T150°C		-40...+150
H250 / M8MG	T6	T85°C	-40...+70	-40...+85
	T5	T100°C		-40...+100
	T4	T135°C		-40...+135
	T3	T200°C		-40...+200
H250 / M40 H250 / M40 HT	T6	T85°C	-40...+85	-40...+85
	T5	T100°C	-40...+100	-40...+100
	T4	T135°C	-40...+120	-40...+135
	T3	T200°C		-40...+200
	T2	T300°C		-40...+300

Table 2-3: Temperature class and surface temperature in °C

Device type	Temp. class	Surface temperature	Maximum permissible	
			Ambient temperature in °F	Product temperature in °F
DK32 / DK34	T6	T185°F	-40...+158	-40...+185
	T5	T212°F		-40...+212
	T4	T275°F		-40...+275
	T3	T302°F		-40...+302
DK32 HT / DK34 HT	T6	T185°F	-13...+185	-13...+185
	T5	T212°F	-13...+212	-13...+212
	T4	T275°F	-13...+275	-13...+275
	T3	T392°F	-13...+392	-13...+392
DK37 / M8M	T6	T185°C	-40...+158	-40...+185
	T5	T212°F		-40...+212
	T4	T275°F		-40...+275
	T3	T302°F		-40...+302
H250 / M8MG	T6	T185°F	-40...+158	-40...+185
	T5	T212°F		-40...+212
	T4	T275°F		-40...+275
	T3	T392°F		-40...+392
H250 / M40 H250 / M40 HT	T6	T185°F	-40...+185	-40...+185
	T5	T212°F	-40...+212	-40...+212
	T4	T275°F	-40...+248	-40...+275
	T3	T392°F		-40...+392
	T2	T572°F		-40...+572

Table 2-4: Temperature class and surface temperature in °F

2.8 Surface temperature

It is to be assumed that a combustible fuel / air mixture can be in contact with the outer wall of the measuring tube and process connections. Any temperature gradient between the internal wall in contact with the product (product temperature) and the outer surface is not taken into consideration.

The actual maximum surface temperature does not depend on the device itself, but instead on the operating conditions. The device itself does not generate heat and, for this reason, the surface temperature is determined by the product temperature and, in versions with heating jackets, by the heating medium temperature as well.

The nameplate shows the maximum values of the temperature classes and the maximum surface temperature. Depending on the device version, these values may not be reached. The maximum permitted ambient and product temperatures can be found in the standard manual.

2.9 Ignition hazard assessment / protective measures

Non-electrical variable area flowmeters were subject to an ignition hazard assessment in accordance with ISO 80079-36. The following table lists the ignition hazards considered and the protective measures carried out or to be carried out by the operator.

Device type	Ignition hazard	Constructive protective measures	Construction site protective measures (note special conditions!)
All versions	Electrostatics	Electrostatic connection between conductive components, ground connection device	Include device in the equipotential bonding of the hazardous area.
			For installations in hazardous areas of group IIC, observe the notes for the elimination of electrostatic charge.
	Impact of sparking in measuring units	Float stop in measuring unit	Eliminate pressure surges in pipelines.
	Impact of sparking on surfaces	Materials (without titanium)	None
	Surface temperatures	None, as no self-warming occurs	Note max. permissible product and ambient temperatures.
	Oxygen in conjunction with titanium measuring units	None	Products with an oxygen content higher than that of the earth's atmosphere are not permitted.
H250 M40 / H250 M8MG	Impact of sparking on titanium surfaces	Marking in the type marking (Ti)	Equipment with titanium surfaces may only be used in shock-resistant areas.
DK32 / DK34 / DK37		Marking with material code (e. g. 3.7025, 3.7035 or 3.7055) on the measuring unit	
H250/C... (PTFE version)	Electrostatics	Minimum conductivity of the medium $\geq 10^{-8}$ S/m	Note the minimum conductivity of the medium.
DK3x HT (unpainted indicator)	Corrosion	None	Exclude corrosive environmental conditions.

Table 2-5: Ignition hazard assessment / protective measures

3.1 Mounting

Mounting and setup must be carried out according to the applicable installation standards by qualified personnel trained in explosion protection.
The information given in the manual and the supplementary 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 necessary visual inspections 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.

DANGER!
Components made of titanium in oxygen applications
*Variable area flowmeters with titanium components are **NOT** suitable for use in explosion-protected areas in conjunction with oxygen applications (products with an oxygen content which is significantly above the oxygen content in the earth's atmosphere)!*

3.2 Special conditions

Equipotential bonding

Variable area flowmeters must be included in the equipotential bonding of the hazardous area.
For further information refer to *Grounding and equipotential bonding* on page 14.

Electrostatics

If the installation takes place in hazardous areas of group IIC, the instructions for electrostatics must be observed.
For further information refer to *Electrostatic charge* on page 16.

Mechanical tests

Variable area flowmeters are tested for shock resistance with 4 Joules in accordance with ISO 80079-36 for device group II with a low degree of mechanical risk. Testing is not required for the sight glass for all-metal variable area flowmeters. With regard to explosion protection for these devices, the integrity of the sight glass is not important. If the degree of mechanical risk is greater, additional protective measures on-site must be taken.

Flammable products

Observe the safety instructions when operating with flammable products. For further information refer to *Flammable products* on page 8.

Measuring units with titanium components

Observe the information regarding installation and safe operation.
For further information refer to *Mounting* on page 13 and refer to *Operation* on page 16.

Unpainted indicators

The unpainted DK3x..HT indicator may not be used in corrosive environments.

3.3 Grounding and equipotential bonding

If the device is not sufficiently electrostatically grounded via the process pipes, an additional ground connection must be established using the ground terminal ① or ②. The position of the ground terminal is illustrated below. This connection only ensures electrostatic grounding of the device and does not meet the requirements for equipotential bonding.

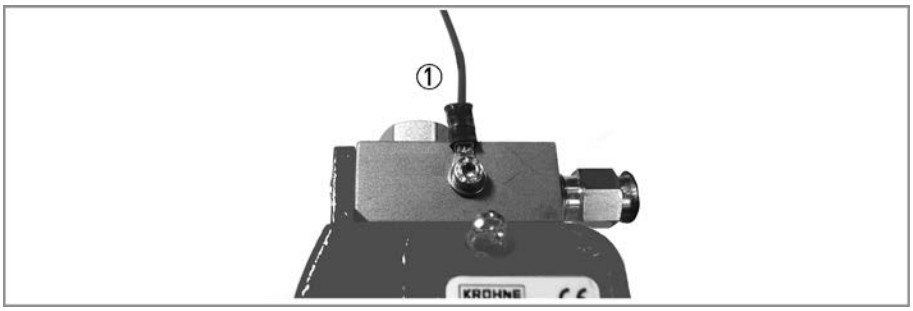

Figure 3-1: Ground terminal for DK32, DK34

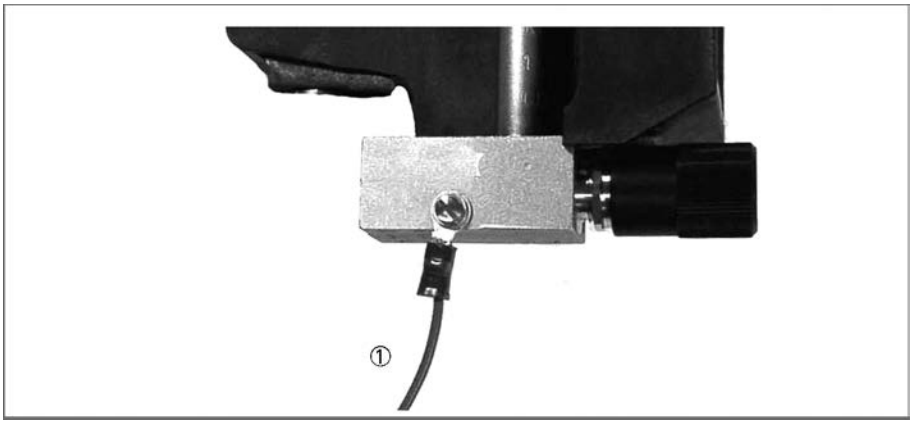

Figure 3-2: Ground terminal for DK37/M8M.

INFORMATION!
The indicator housing is made of conductive plastic. Friction cannot cause electrostatic charge.

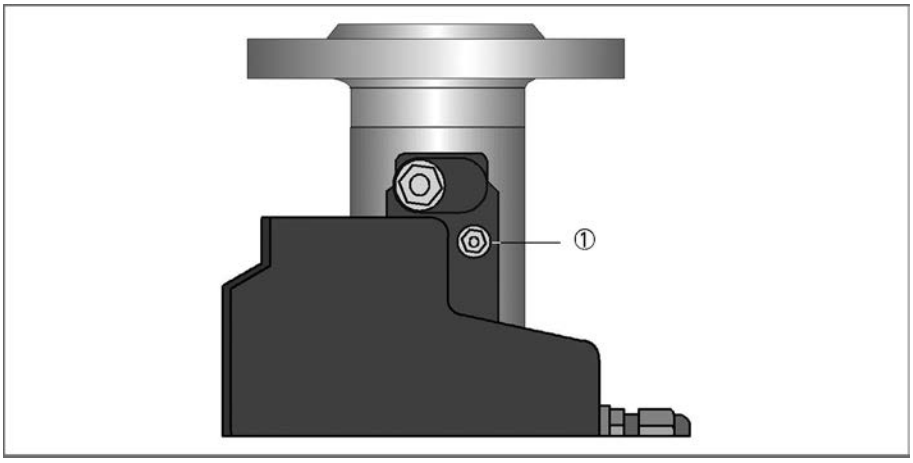

Figure 3-3: Ground terminal for H250/M8MG/.

INFORMATION!
The indicator housing is made of conductive plastic. Friction cannot cause electrostatic charge.

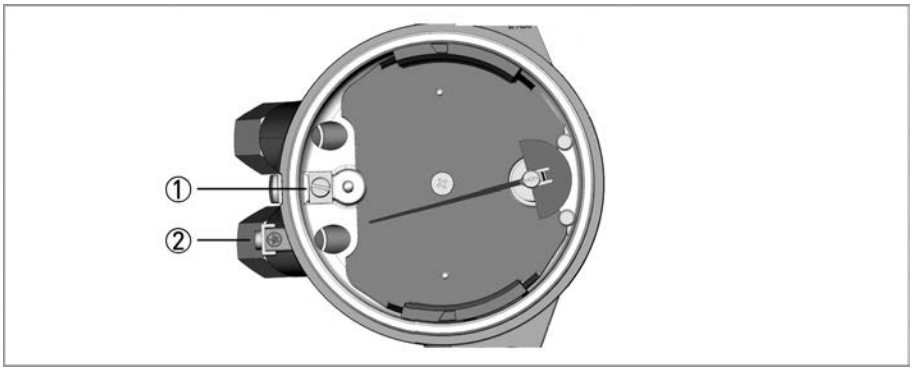

Figure 3-4: Ground terminal for H250/M40.

INFORMATION!
The grounding ① and ② are equivalent.

INFORMATION!
The temperature at the electrostatic equalisation connector on the DK32, DK34 and DK37 measuring units corresponds to the process temperature. It is thus the responsibility of the operator to select the connecting cable according to the process temperature.

4.1 Start-up

Make the following checks before starting up the device:

- Check that it has been correctly mounted and connected to the system.
- Check that it is in proper state with regard to the installation requirements.
- Suitability of the materials used for the measuring unit and for the gaskets for adequate resistance to corrosion from the product.

The operator of the system has to check prior to start-up, if the start-up was in compliance with the national regulations for checks.

4.2 Operation

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

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.

In case of flammable products the measuring units must be included in the periodic pressure tests of the system.

WARNING!
Avoid ignition risks caused by pressure surges, impact or friction, particularly when using titanium measuring units (material number 3.7025, 3.7035 or 3.7055 on pressurised parts).

4.3 Electrostatic charge

In order to avoid ignition hazards due to electrostatic charge, variable area flowmeters may not be used in areas with:

- processes that generate strong charges,
- mechanical friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems) or
- pneumatically conveyed dust is exposed.

WARNING!
Electrostatic charging of the housing surface by friction must be avoided. The devices must not be dry cleaned.

5.1 Dismounting

Replacing the display

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

CAUTION!
There may be a loss of measuring accuracy!

Exchanging the entire device

The dismantling and installation is within the responsibility of the operator.

CAUTION!

- *Pressurised pipes have to be depressurised 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 pipeline.*

5.2 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:

- Check the housing for corrosion or damage.
- Check the measuring unit and the piping connections for leakage.
- Check the measuring unit and the indicator for dust deposits.
- Include the flowmeter in the periodic pressure test of the process line.

During re-assembly after maintenance of the indicator/converter (or replacement) or the flowmeter, the operator must take appropriate measure to ensure that

- no charge is applied to the surface of the housing.
- no charge is applied to the inner surfaces of the housing.
- any damaged gaskets are replaced.

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

Cleaning the measuring unit

Depending on the application, worst-case operating conditions may lead to reduced measuring performance as a result of fouling of the measuring system. Clean the measuring unit in accordance with the standard manual for non explosion-protected versions.
The measuring unit must be dismantled for cleaning. This dismantling will need to be coordinated with operating conditions (e.g., check for existence of a flammable liquid or explosive atmosphere in or at the tank or pressurized tank) and is within the responsibility of the operator.
To do this, follow the instructions for exchanging the entire device (for details refer to *Dismounting* on page 17).

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