



H250 M9 Supplementary instructions

Variable area flowmeter

Equipment category II 3 G and II 3 D with electrical components
in protection type non-sparking 'nA' and
in protection type equipment - dust ignition protection 't'



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1.1 General notes

These additional Instructions apply to the explosion-protected versions of the variable area flowmeters with electrical components and the marking II 3 G and II 3 D. 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the installation and operation instructions for the non-explosion protected versions apply unchanged unless excluded or superseded by these instructions.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 and dust.

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-A041X. 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 are used to measure and display volume flows of flammable and non-flammable gases and liquids. Depending on the device version, electrical limit switches and a 4-20 mA signal output or a Profibus PA interface can be built into the indicator part.

2.2 Description code

The safety description code * consists of the following elements:



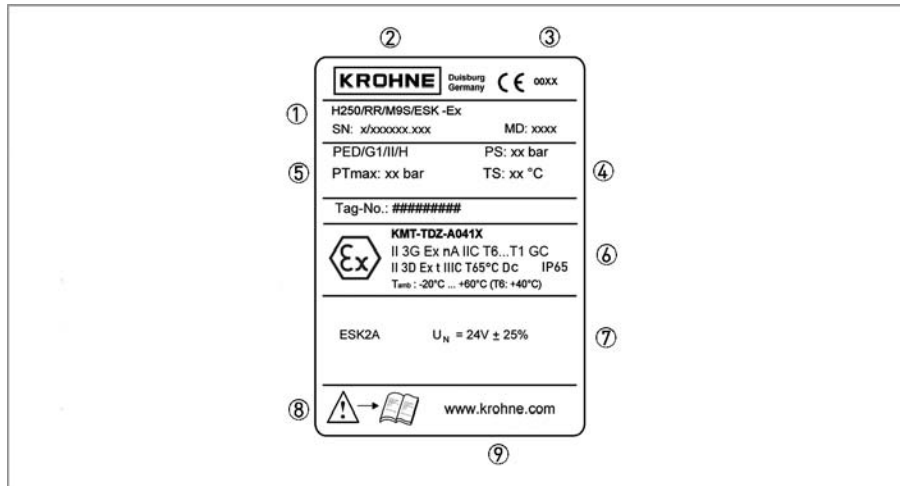
- ① Direction of flow
H - horizontal orientation
U - vertical downwards
no identifier - standard upwards
- ② Materials / versions
RR - Stainless steel
C - PTFE or PTFE/ceramics
HC - Hastelloy
Ti - Titanium
F - Sterile version (food)
- ③ Heating jacket version
B - with heating jacket
- ④ Indicator part series
M9 - Indicator M9 standard indicator
M9S - Indicator with increased protection
M9R - Indicator in stainless steel housing
M9T - Indicator in stainless steel housing with increased protection
- ⑤ High-temperature version
HT version with HT extension
- ⑥ Electrical signal output
ESK - Electronic transmitter
- ⑦ Limit switch
K1 - One limit switch
K2 - Two limit switches
- ⑧ Explosion protection
Ex - Explosion-protected equipment

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

The indicator M9 standard version and M9R stainless steel version is not available for equipment categories II 3 G and II 3 D.

2.3 Marking

The marking of the entire device is on the display, where the following identification plate can be found.



- ① Device type according to description code
- ② Manufacturer
- ③ Identification number of the notified body, Pressure Equipment Directive (PED)
- ④ Design data: temperature & pressure rating
- ⑤ DGRL data
- ⑥ Ex data
- ⑦ Electrical connection data
- ⑧ Note manual
- ⑨ KROHNE website

Additional markings on the device:

- SN - serial number
- SO - sales order / item
- KO - KROHNE order
- Vxxx - product configurator code
- AC - article code

Additional plate

The association of the housing cover to the device is confirmed by an additional plate with the serial number on the interior of the indicator part.

2.4 Flammable products

Atmospheric conditions:

An explosive atmosphere is a mixture of air and flammable gases, vapours, mists or dusts under atmospheric conditions. It is defined by the following values $T_{\text{atm}} = -20\dots+60^{\circ}\text{C}$ / $-4\dots+140^{\circ}\text{F}$ and $P_{\text{atm}} = 0.8\dots1.1$ bar. Outside of this range, for most mixtures no key figures are available for the ignition behaviour.

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.



WARNING!

Operation with flammable products is only permitted as long as no explosive fuel/air mixture builds up on the inside of the flowmeter under operating conditions. 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 system. When using the device version H250/C... (PTFE-liner, nonconductive) the min. conductivity of the medium must be 10^{-8} S/m, in order to avoid the electrostatic charge.

2.5 Equipment category

The flowmeters are designed in category II 3G according to EN 60079-0 and EN 60079-15 and category II 3D according to EN 60079-31 for use in hazardous areas, zone 2 and zone 22.

2.6 Types of protection

2.6.1 Type of protection for gas hazard areas

The variable area flowmeter is designed with protection type "non-sparking" 'nA' 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:	
II	Group II explosion protection
3	Equipment category 3
G	Gas explosion protection
Ex nA	Protection type non-sparking
IIC	Gas group, suitable for gas groups IIA, IIB, IIC
T6...T1	Temperature class, suitable for T6 ... T1
Gc	EPL, suitable for zone 2

2.6.2 Type of protection for dust hazard areas

The variable area flowmeter is designed with protection type "protection by enclosure in accordance with EN 60079-31. Dust protection is guaranteed by the use of a housing which provides appropriate protection against penetration by dust.

The marking is:

II 3D Ex t IIIC T65°C Dc

IP65

The marking contains the following information:	
II	Group II explosion protection
3	Equipment category 3
D	Dust explosion protection
Ex t	Protection type equipment 'dust ignition protection through housing'
IIIC	Dust group, suitable for dust groups IIIA, IIIB and IIIC
T65°C	Maximum surface temperature without dust coating at ambient temperature 60°C / 140°F and product temperature 60°C / 140°F
Dc	EPL, suitable for zone 22
IP65	Foreign bodies and water pollution control

2.7 Ambient temperature / temperature classes

Due to the influence of the product temperature, variable area flowmeters with built-in electrical equipment (electric variants) are not assigned to any fixed temperature class. The temperature class of these devices is rather a function of the product temperature and ambient temperature that is present and the specific device version. The classification is outlined in the following tables.

The tables take into account the following parameters:

- Installed equipment
- Ambient temperature T_{amb}
- Product temperature T_m
- Nominal DN
- Standard or high temperature version (HT)
- Standard or heating jacket version
- Heat resistance of the connecting cable

When there is more than type of built-in equipment, the data of the most unfavourable equipment should be used.



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. To do this, the variant with a projecting indicator (HT version) is preferable.*
- *For device versions with a heating jacket, that the temperature of the heating medium does not exceed the maximum permissible product temperature.*

For certain device version, lower values apply due to differing boundary conditions (e.g. lining materials).

Here the user should consult the technical data sheet.

Using a heat resistant connecting cable

Temperature table in °C				
Heating jacket			T _m ①	
none	with	HT-version	T _{amb} ≤ 40	T _{amb} ≤ 60
DN15, DN25	DN15		-	150
		x	-	236
DN50	DN25		-	127
		x	-	171
DN80, DN100	DN50, DN80		-	109
		x	-	145

Temperature table in °F				
Heating jacket			T _m ①	
none	with	HT-version	T _{amb} ≤ 104	T _{amb} ≤ 140
DN15, DN25	DN15		-	302
		x	-	456
DN50	DN25		-	260
		x	-	340
DN80, DN100	DN50, DN80		-	228
		x	-	293

① Maximum value of the product temperature for the use of a standard connecting cable. For higher product temperatures a connecting cable with a temperature resistance of 100°C / 212°F is required.

HT version - high-temperature version with projecting indicator

The permitted ambient temperature range is indicated on the nameplate; depending on the device version it is T_{amb} = -40...+60°C / -40...+140°F or T_{amb} = -25...+60°C / -13...+140°F.

Maximum permitted product temperature in °C

				Maximum permitted product temperature T_m						
Heating jacket			TK ▶	T6	T5	T4	T3		T2, T1	
none	with	HT Version	T_{amb} ▶	≤ 40	≤ 60	≤ 60	≤ 40	≤ 60	≤ 40	≤ 60
ESK II / ESK2A and ESK3-PA										
DN15, DN25	DN15			85	100	135	200	183	200	183
		x		85	100	135	200	200	300	300
DN50	DN25			85	100	135	200	165	200	165
		x		85	100	135	200	200	300	300
DN80, DN100	DN50, DN80			85	100	135	200	150	200	150
		x		85	100	135	200	200	300	252
K1 / K2										
DN15, DN25	DN15			85	100	135	200	200	200	200
		x		85	100	135	200	200	300	300
DN50	DN25			85	100	135	200	200	200	200
		x		85	100	135	200	200	300	300
DN80, DN100	DN50, DN80			85	100	135	200	200	200	200
		x		85	100	135	200	200	300	300

Maximum permitted product temperature in °F

				Maximum permitted product temperature T_m						
Heating jacket			TK ▶	T6	T5	T4	T3		T2, T1	
none	with	HT Version	T_{amb} ▶	≤ 104	≤ 140	≤ 140	≤ 104	≤ 140	≤ 104	≤ 140
ESK II / ESK2A and ESK3-PA										
DN15, DN25	DN15			185	212	275	392	361	392	361
		x		185	212	275	392	392	572	572
DN50	DN25			185	212	275	392	329	392	329
		x		185	212	275	392	392	572	572
DN80, DN100	DN50, DN80			185	212	275	392	302	392	302
		x		185	212	275	392	392	572	485
K1 / K2										
DN15, DN25	DN15			185	212	275	392	392	392	392
		x		185	212	275	392	392	572	572
DN50	DN25			185	212	275	392	392	392	392
		x		185	212	275	392	392	572	572
DN80, DN100	DN50, DN80			185	212	275	392	392	392	392
		x		185	212	275	392	392	572	572

2.8 Surface temperature equipment category II 3 D

For use in areas with flammable dust it should be noted that the indicated maximum surface temperature of T65°C at an ambient temperature of 60°C / 140°F and a product temperature of 65°C / 149°F is valid without a dust coating. For higher product temperatures the maximum surface temperature is determined by the product.

2.9

Electrical data

Electrical equipment	Nominal voltage	Nominal current
Limit switch K1 / K2	8 VDC	1...3 mA
Signal output ESK II and ESK2A	24 VDC \pm 25%	4...20 mA with HART communication
ESK3-PA Profibus transmitter ①	9...32 VDC	12 mA

① Further information and instructions for operation of the ESK3-PA Profibus transmitter are provided in separate supplementary instructions.

3.1 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.

The variable area flowmeter can withstand the low risk of mechanical damage according to EN 60079-0 (impact energy 4/2 joules).



CAUTION!

The manufacturer is not liable for any damage resulting from improper use or use for 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

Electrical connection of the signal circuits is carried out in the integrated terminal compartment of the indicator part. Separate conduit entries are provided for the signal output and limit switches.

Unused conduit entries should be closed using approved blind plugs and seals. Ensure that the seals are tight.

The connecting cables should be selected according to the applicable installation standards (e.g. EN 60079-14) and the maximum operating temperature. The outer diameter of the connecting wires must be adapted to the sealing range of the cable entries (6...10 mm / 0.24...0.39"). The connecting cables must be fixed and laid in such a way as to be sufficiently protected against damage.

Before connecting or disconnecting the electric connecting cable of the device, ensure that all of the cables leading to the signal converter are de-energised relative to each other and to the reference potential of the hazardous area. This also applies to earthing conductors (FE) and equipotential bonding conductors (PA).

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 $\geq 500 V_{\text{eff}}$).

Cable entries / Blanking plugs

The variable area flowmeter is optionally equipped with one conduit entry and one blind plug or two conduit entries. These elements guarantee protection against foreign bodies and water (protection category) IP65 or greater according to EN 60529. The cable entries are sealed with a plug. The plugs should be replaced with suitable connecting cables.

4.2 Power supply

The variable area flowmeter does not require any separate power supply. The necessary power for the built-in electrical equipment is supplied via the signal circuits.

4.3 Inputs/outputs

The signal circuits of the variable area flowmeter may only be connected to downstream devices or circuits that satisfy the requirements of protective extra-low voltage (PELV). The terminal assignment of the built-in electrical equipment is described in the Standard Installation and Operation Instructions.

Only circuits that are suitable for operation in Zone 2 / Zone 22 hazardous areas may be connected. Outside of the flowmeter, measures must be taken to prevent the rated voltage from being exceeded by more than 40% due to temporary faults.

Use a 50 mA microfuse when connecting the signal output (ESK II / ESK2A) to voltage sources with a possible short-circuit current of more than 100 mA.

4.4 Earthing and equipotential bonding

The variable area flowmeter must be included in the equipotential bonding of the hazardous area. This is done using the earth connection on the rear of the indicator part.

Shields should be securely connected to the earth potential of the hazardous area, and connected to the terminal located in the indicator part via the shortest route. In the case of shield earthing at both ends (e.g. for reasons of electromagnetic compatibility), adequate equipotential bonding that reliably prevents potential differences is necessary between the two earthed ends of the shield in order to avoid excessive equalising current.

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.

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

5.3 Electrostatic charge

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

- processes that generate large charges,
- machines with friction and cutting processes,
- spraying of electrons (e.g. in the vicinity of electrostatic painting systems),
- dust carried by compressed air.

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.
- Checking the measuring unit and the indicator for dust deposits.



CAUTION!

Avoid electrostatic charges when cleaning the sight window!

6.2 Dismantling

Exchanging the built-in equipment

Due to the modular structure of the variable area flowmeters, from a safety point of view it is possible to exchange the electrical equipment built into the indicator for identical spare parts.

To do this, remove the housing cover. The housing cover must be closed immediately after the spare parts are exchanged. Make sure that the cover seal is properly seated. The fastening screws of the housing cover should be tightened with a torque of 1.2 Nm.



CAUTION!

There may be a loss of measuring accuracy!

Exchanging the entire device

Removal and installation is the user's responsibility.

Before disconnecting the electric connecting cable of the device, it must be ensured that all of the cables leading to the indicator part are de-energised relative to each other and to the reference potential of the hazardous area. This also applies to functional earthing conductors (FE) and equipotential bonding conductors (PA).



CAUTION!

- *Pressurized pipes must be depressurized before removing the measuring section.*
- *In the case of environmentally critical or hazardous products, appropriate safety precautions must be taken with regard to residual liquids in the measuring section.*
- *New seals must 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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