Variable-area flowmeter
Device category II2G with electrical internals
1 Safety instructions

1.1 General notes ................................................................. 3
1.2 EC conformity .............................................................. 3
1.3 Security information .................................................... 3

2 Device description

2.1 Device description .......................................................... 4
2.2 Safety description code .................................................. 4
2.3 Marking ........................................................................ 5
2.4 Flammable products ...................................................... 7
2.5 Equipment category ..................................................... 7
2.6 Types of protection ....................................................... 7
2.7 Ambient temperature / temperature classes ................... 8
2.8 Electrical data ............................................................. 8

3 Installation

3.1 Installation ................................................................. 9

4 Electrical connections

4.1 General notes ............................................................. 10
4.2 Grounding and equipotential bonding ......................... 10

5 Operation

5.1 Start-up ................................................................. 11
5.2 Operation ............................................................... 11
5.3 Electrostatic charge .................................................. 11

6 Service

6.1 Maintenance ............................................................ 12
6.2 Dismantling ............................................................ 12

7 Notes

7.1 Maintenance ............................................................ 13
1.1 General notes

These additional instructions apply to explosion-protected versions of variable area flowmeters with electrical built-ins and the marking II 2 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 2 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the installation and operation instructions for the non-explosion protected versions apply unchanged unless excluded or superseded by these instructions.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 EC Type Test Certificate of the Physikalisch Technische Bundesanstalt (PTB) forms the basis of the EC Declaration of Conformity: Conformity with the harmonised standards was verified according to EN 60079-0 and EN 60079-11.

PTB 05 ATEX 2025 X

If required the EC Type Test Certificate can be downloaded under www.krohne.com.

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 the volume flow of flammable and non-flammable gases and liquids. Up to two separately adjustable electrical limit switches can be mounted to the on-site display.

2.2 Safety description code

The safety description code * consists of the following elements:

```
<table>
<thead>
<tr>
<th>GA24</th>
<th>/</th>
<th>/</th>
</tr>
</thead>
</table>
① R - Stainless steel
PTFE - Stainless steel with PTFE liner
② K1 - one limit switch
K2 - two limit switches
```

```
<table>
<thead>
<tr>
<th>TG</th>
<th>21</th>
</tr>
</thead>
</table>
① TG - Slot sensor limit switch
② 21 - Version 21
```

```
<table>
<thead>
<tr>
<th>MS</th>
<th>14</th>
<th>/</th>
</tr>
</thead>
</table>
① MS - Magnetic switch
② 14 - Reed cartridge 14
③ A - Limit switch with terminal box (standard)
   Empty space - Limit switch with cable assembly
```

* positions which are not needed are omitted [no blank positions]
2.3 Marking

Type designation of the complete unit is shown on the indicator with the nameplates reproduced below.

**Nameplate GA24**

1. Device type
2. Manufacturer
3. Manufacturer’s website
4. Note manual
5. Ex data
7. Year of manufacture
8. Year of manufacture
9. PED-data
10. Design data: Temperature & pressure rating

**Nameplate limit switch TG21**

1. Manufacturer
2. Type
3. Serial number
4. Year of manufacture
5. Electrical data of built-in components
6. Observe Operation and Installation manual
7. Built-in components
8. Internet site
Marking Limit switches MS14

1. Type
2. Manufacturer
3. Year made
4. Observe Operation and Installation manual
5. Ambient temperature
6. KROHNE website
7. Electrical connection data

Marking Limit switches MS14A

1. Type
2. Manufacturer
3. Observe Operation and Installation manual
4. Year made
5. Electrical connection data
6. KROHNE website

No Ex marking for MS14 and MS14/A, because the reed limit switch operates as a simple device and complies to intrinsic safety EN 60079-11 paragraph 5.7.
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 $T_{\text{atm}} = -20^\circ\mathrm{C}...+60^\circ\mathrm{C} / -4^\circ\mathrm{F}...140^\circ\mathrm{F}$ and $P_{\text{atm}} = 0.8...1.1\text{bar}$. 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.

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**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

Variable area flowmeters are designed in accordance with EN 60079-0 and EN 60079-11 in category II 2 G for use in zone 1. The inside of the measuring unit is also approved for zone 1.

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**INFORMATION!**

Definition of zone 1 according to EN 1127-1, Appendix B:

An area in which an explosive atmosphere may occasionally occur as a result of the mixture of flammable substances in the form of gas, steam or mist with air under normal operation.

2.6 Types of protection

The variable area flowmeter is designed with protection type intrinsic safety, protection level "ia" as per EN 60079-11.

The marking is: **II 2G Ex ia IIC T6...T1 Gb**

<table>
<thead>
<tr>
<th>The marking contains the following information:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>II</strong></td>
</tr>
<tr>
<td><strong>2</strong></td>
</tr>
<tr>
<td><strong>G</strong></td>
</tr>
<tr>
<td><strong>ia</strong></td>
</tr>
<tr>
<td><strong>IIC</strong></td>
</tr>
<tr>
<td><strong>T6...T1</strong></td>
</tr>
<tr>
<td><strong>Gb</strong></td>
</tr>
</tbody>
</table>
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 with attached electrical equipment. 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 assignment is outlined in the following tables.

The tables take into account the following parameters to determine the permissible temperature class:

- Ambient temperature $T_{\text{amb}}$.
- Product temperature $T_{\text{m}}$
- attached equipment
- Supply type (maximum values for $P_i$)

**Maximum permitted product temperature $T_{\text{m}}$ for limit switch TG21**

<table>
<thead>
<tr>
<th>Supply</th>
<th>Type 1</th>
<th>Type 2</th>
<th>Type 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature class</td>
<td>T6</td>
<td>T5</td>
<td>T4...T1</td>
</tr>
<tr>
<td>$T_{\text{m}}$ in °C (1)</td>
<td>70</td>
<td>85</td>
<td>95</td>
</tr>
<tr>
<td>$T_{\text{m}}$ in °F (1)</td>
<td>158</td>
<td>185</td>
<td>203</td>
</tr>
</tbody>
</table>

(1) These values may be limited by the Installation and Operating instructions. Observe the maximum values listed in the Installation and Operating instructions.

The maximum permitted ambient and product temperature for the type MS14 limit switch is 85°C / 185°F for temperature classes T6 ... T1.

The minimum permitted ambient temperature $T_{\text{amb}}$ for all versions is -20°C / -4°F.

2.8 Electrical data

The connection of limit switches MS14/ or TG21 may only be connected to intrinsically safe circuits to DIN 19234 with the following max. values:

**MS14/.

<table>
<thead>
<tr>
<th>$P_i$</th>
<th>$U_i$</th>
<th>$I_i$</th>
<th>$C_i$</th>
<th>$L_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 W</td>
<td>30 VDC</td>
<td>100mA</td>
<td>$\approx$ 0 nF</td>
<td>$\approx$ 0 µH</td>
</tr>
</tbody>
</table>

**TG21**

<table>
<thead>
<tr>
<th>Supply</th>
<th>$P_i$</th>
<th>$U_i$</th>
<th>$I_i$</th>
<th>$C_i$</th>
<th>$L_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>34 mW</td>
<td>16 VDC</td>
<td>25mA</td>
<td>165 nF</td>
<td>150 µH</td>
</tr>
<tr>
<td>Type 2</td>
<td>64 mW</td>
<td>16 VDC</td>
<td>25mA</td>
<td>165 nF</td>
<td>150 µH</td>
</tr>
<tr>
<td>Type 3</td>
<td>169 mW</td>
<td>16 VDC</td>
<td>52mA</td>
<td>165 nF</td>
<td>150 µH</td>
</tr>
</tbody>
</table>
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.

**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

The electrical connection of the limit switch with protection level “ia” or “ib” is described in the manual. Permissible maximum values (electrical data) must be observed. Observe the specified polarities.

The TG21 limit switch is electrically connected to the connection terminals in the connection box.

The MS14 limit switch is electrically connected on the strands of the connecting cable. The terminal compartment used must satisfy a minimum IP protection category of IP20. The MS14/A variant is electrically connected to the connection terminals in the connection box. The MS14/limit switch is connected regardless of polarity.

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 ≥ 500 Veff).

4.2 Grounding and equipotential bonding

If the device is not sufficiently electrostatically grounded via the process cables, an additional earth connection must be established using the ground terminal. The location of the earth connection ① on the back of the housing. This connection merely ensures electrostatic connection of the device and does not meet the requirements for equipotential bonding.

The conductive parts of the limit switches are connected to the variable area flowmeter housing. Ensure proper installation and fit of the installation elements.
5.1 Start-up

Make the following checks before starting up the device:

- Suitability of the materials used for the measuring unit and for the gaskets for adequate resistance to corrosion from the process product.
- Correct connection of the built-on electrical components of the electrical option.
- Proper fastening of the mounting elements of the limit switches.
- Electrostatic earthing of the measuring device.

5.2 Operation

Adjusting the limit switch during operation is permitted.
To do this, loosen the fastening screws on the mounting device.
Tighten the fastening screws again immediately after the switching point on the limit switch has been set.

The switching behaviour for the TG21 limit switch can also be set in the terminal compartment. Close the terminal compartment immediately after adjustment.

The mounting position of the reed contact cartridge determines the switching function of the reed contact in the MS14/ limit switch. Changing the switching direction during operation is permitted. Close the limit switch housing immediately afterwards.

5.3 Electrostatic charge

In variable area flowmeters, it is possible under field conditions for charge separation to occur in the measuring tube due to the transport of non-conductive fluids and/or when the flow comes into contact with non-conductive built-ins.
In glass devices, it is basically possible for the electrostatic field generated inside the measuring tube to "punch through" to the outside of the device. For that reason, variable area flowmeters need to be permanently grounded by the operator by way of the process connections in order to allow discharge of electrostatic build-up.
The operator is also responsible for extending the ground continuity of the process pipeline.

If grounding cannot be made via the process connections, e.g. top and bottom connection blocks are made of plastic, the flowmeter should be connected to the local ground potential via the connection to ground described in the section entitled "Grounding and equipotential bonding". This connection only ensures electrostatic grounding of the device and does not meet the requirements for equipotential bonding.

When measuring dust-free gases or liquids, the flow rate should not exceed ten times the nominal flow rate. The max. allowable working pressure PS printed on the type nameplate is to be noted.
6.1 Maintenance

The measuring device requires no maintenance under normal operating conditions and when used as prescribed.

The following visual checks should be carried out at regular intervals in conjunction with the system inspections required in hazardous areas to keep equipment in good operating condition:

- Checking the housing, the cable entries and the feed lines for corrosion and/or damage.
- Inspection of the measuring unit for leaks and glass cones.
- Include the flowmeter in the periodic pressure testing of the process piping.

Depending on application, however, the measuring function may in unfavourable cases become impaired through soiling of the measuring cone and/or float.

Clean the meter in accordance with the installation and operating instructions for non-explosion proof versions of the product.

The measuring unit must be removed for cleaning. To do this, follow the instructions for removing the entire device.

6.2 Dismantling

**Electrical connection**

Dismantling should take place in a de-energised state if at all possible. If not possible, observe the boundary conditions for intrinsic safety (e.g. no grounding or connection of different intrinsically safe circuits) during dismantling.

**Process connections**

**CAUTION!**

- Pressurized pipes have to be depressurized before removing the measuring unit.
- Avoid uncontrolled discharge of residual liquids from the measuring unit.
- Avoid uncontrolled discharge of residual fluid from the measuring unit.
- Where environmentally critical products are concerned, carefully decontaminate the wetted parts of the measuring tube after dismantling.
- Removal and installation are the responsibility of the operator.
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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