



VA40 Supplementary Instructions

Variable area flowmeter

Equipment protection level Gb
in protection type intrinsic safety "i"



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1.1 General notes

This additional instruction applies to explosion-protected versions of variable area flowmeter with electrical built-ins with protection type intrinsic safety "i", equipment protection level (EPL) Gb.

It completes the standard 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 EU conformity

The manufacturer declares with the EU declaration of conformity on his own responsibility conformity with the protection goals of directive 2014/34/EU for use in hazardous areas with gas. The EU type examination certificate of the Physikalisch Technische Bundesanstalt (PTB) forms the basis of the EU declaration of conformity. Conformity with harmonised standards was checked in accordance with EN IEC 60079-0:2018 and EN 60079-11:2012.

PTB 05 ATEX 2026 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 necessary, the EU type examination 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.



CAUTION!

When an equipment fault is detected the device shall be de-energised and send back to the manufacturer for repair.

2.1 Description of device

Variable area flowmeters measure and display the flow of flammable and non-flammable gases and liquids. Up to two separately adjustable electrical limit switches can be mounted to the local indication.

2.2 Description code

The safety description code consists of the following elements*:

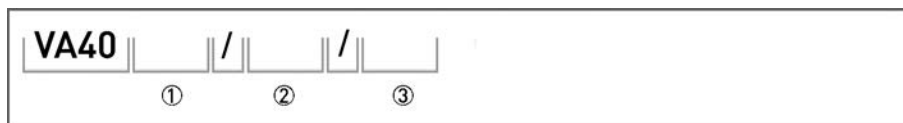


Figure 2-1: Safety description code VA40

- ① **Connection type**
 - V - screw connection
 - S - tube socket
 - F - flange connection
 - A - aseptic connection, conforming to food standards
- ② **Material of connection**
 - R - stainless steel 1.4404 (316 L)
 - ST - steel, electroplated and chromised
 - PV - plastic PVDF
- ③ **Limit switches / signal output**
 - K1 - one limit switch
 - K2 - two limit switches



Figure 2-2: Safety description code TG21

- ① TG - immersion limit switch
- ② 21 - version 21



Figure 2-3: Safety description code MS14

- ① **MS - Magnetic switch**
- ② **14 - Reed cartridge 14**
- ③ **Limit switch**
 - without - limit switch with cable tail
 - A - limit switch with connection box (standard)

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

2.3 Marking

The marking of the complete device is shown in the following nameplate.
The variable area flowmeter is marked on the round housing.

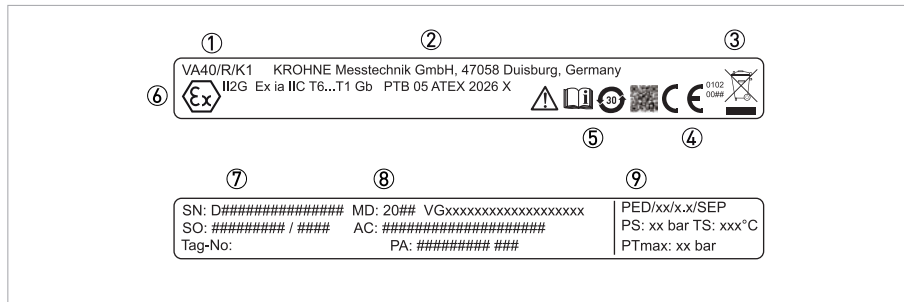


Figure 2-4: Example of a nameplate

- ① Device type
- ② Manufacturer
- ③ Disposal symbol
- ④ Identification number of the notified body ATEX & PED
- ⑤ Note to observe the documentation, China RoHs and data matrix code
- ⑥ Marking according to the notified body
- ⑦ Serial number
- ⑧ Year of manufacture
- ⑨ PED data

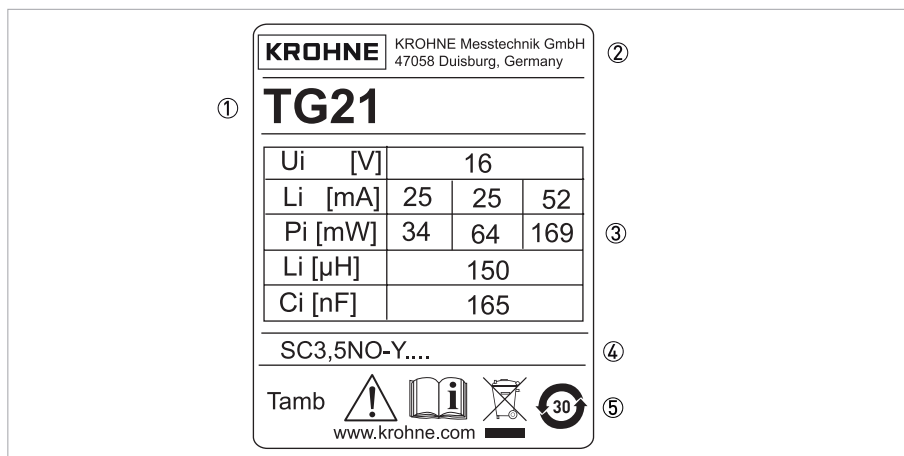


Figure 2-5: Example of marking of limit switch TG21

- ① Device type
- ② Manufacturer
- ③ Electrical connection data
- ④ Built-in equipment
- ⑤ Note to observe the documentation, disposal and China RoHs



Figure 2-6: Marking of limit switches MS14

- ① Device type
- ② Manufacturer
- ③ Ambient temperature
- ④ Internet site
- ⑤ Electrical connection data
- ⑥ Note to observe the documentation



Figure 2-7: Marking of limit switches MS14A

- ① Type
- ② Manufacturer
- ③ Ambient temperature
- ④ Internet site
- ⑤ Electrical connection data
- ⑥ Note to observe the documentation

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:

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 permissible if no explosive fuel/air mixture is formed in the piping when 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.

For additional information regarding electrostatics to be observed refer to Electrostatic charge on page 14.

2.5 Equipment category

Variable area flowmeters are designed according to EN 60079-0 and EN 60079-11 in equipment protection level (EPL) Gb for use in zone 1 and zone 2.

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.

2.6 Types of protection

The variable area flowmeter is designed in type of protection "intrinsic safety", protection level "ia" according to EN 60079-11.

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

The marking contains the following information:

II	Explosion protection, group II
2	Equipment category 2
G	Gas explosion protection
ia	Intrinsically safe, level of protection "ia"
IIC	Suitable for gas groups IIC, IIB and IIA
T6...T1	Temperature class range, suitable for temperature classes T6...T1
Gb	EPL, suitable for zone 1 or zone 2

Table 2-1: Description of the marking



INFORMATION!

The temperature class of the device depends on the product temperature.



INFORMATION!

For the equipment category II 2 G or EPL Gb, connection to an intrinsically safe circuit with protection level "ib" is required.

When connecting the variable area flowmeter to an intrinsically safe circuit with protection level "ia", a higher protection level is given.

2.7 Ambient temperature / temperature classes

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. 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:

- Maximum values P_i
- Ambient temperature T_{amb}
- Product temperature T_m
- Limit switch TG21 or MS14



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 standard manual.*
- *It must be ensured that the flowmeter is not heated by the effects of additional heat radiation (sunshine, neighboring 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.*

Maximum permissible product and ambient temperatures for TG21

Supply	Type 1 [$\leq 34\text{mW}$]			Type 2 [$\leq 64\text{mW}$]			Type 3 [$\leq 169\text{mW}$]		
Temperature class	T6	T5	T4...T1	T6	T5	T4...T1	T6	T5	T4...T1
Max. product temperature [°C]	70	85	95	60	75	95	35	50	70
Max. product temperature [°F]	158	185	203	140	167	203	95	122	158

Table 2-2: Max. permissible product and ambient temperatures TG21

Maximum permissible product and ambient temperatures for MS14/.

The maximum product and ambient temperature is $+85^\circ\text{C}$ / $+185^\circ\text{F}$.

These values may be limited by the information contained in the standard manual. The maximum values listed in the manual must be taken into consideration.

Minimum product temperature for all versions

The minimum product temperature is -20°C / -4°F .

2.8 Electrical data

Limit switch TG21

The built-in intrinsically safe NAMUR limit switch TG21 may only be connected to isolation switching amplifiers with separated intrinsically safe circuits to EN 60947-5-6 with the following max. values:

Supply	P_i [mW]	U_i [V]	I_i [mA]
Type 1	34	16	25
Type 2	64	16	25
Type 3	169	16	52

Table 2-3: Maximum values of the power supply units

When connecting to intrinsically safe circuits, take into consideration the following maximum values per circuit for the energy stores.

C_i [nF]	L_i [μ H]
165	150

Table 2-4: Maximum values per circuit

Limit switch MS14

Built-in limit switch MS14 may only be connected to separate intrinsically safe circuits with the following maximum values:

P_i [W]	U_i [V]	I_i [mA]
1	30	100

Table 2-5: Maximum values of the power supply units

When connecting to intrinsically safe circuits, take into consideration the following maximum values per circuit for the energy stores.

C_i [nF]	L_i [μ H]
0	0

Table 2-6: Maximum values per circuit



WARNING!

Also, when operating the variable area flowmeter outside of the hazardous area, the connection must be made to intrinsically safe circuits.

When connecting to non-intrinsically safe circuits, there is a risk of damage to the safety-defining components.

3.1 Mounting

Mounting and setup must be carried out according to the applicable installation standards (e.g. IEC 60079-14) 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)!*



WARNING!

Mounting of limit switches

Mounting the limit switches ensures the electrostatic connection to the indicator. Make sure that they are properly mounted and that the mounting elements fit properly.

3.2 Special conditions

Equipotential bonding

The variable area flowmeters type VA40/. / .. /K/ must be connected to the equipotential bonding system of the hazardous area.

For further information refer to *Grounding and equipotential bonding* on page 13.

Flammable products

In case of operation with flammable products the measuring units must be included in the periodic tests of the pipelines and fittings.



DANGER!

Operation with flammable products outside of atmospheric conditions ($-20^{\circ}\text{C} \leq T \leq +60^{\circ}\text{C}$ and $0.8 \text{ bar} \leq P \leq 1.1 \text{ bar}$) is only permissible if no explosive product/air mixture is formed inside of the flowmeter.

The operator is responsible to ensure that the measuring system is operated safely in terms of the temperature and pressure of the media used.

Electrostatics

Observe additional information regarding electrostatics.

For further information refer to *Electrostatic charge* on page 14.

Thermal data

Observe the maximum ambient and product temperatures.

For further information refer to *Ambient temperature / temperature classes* on page 9.

4.1 General notes

The separate intrinsically safe signal circuits of protection level "ia" or "ib" are electrically connected in the terminal compartment of the plug housing for the limit switch type TG21 and MS14. The limit switch MS14 is connected to the stranded wires. The terminal housing must have a protection class of min. IP20. Take note of the polarities given for the limit switch TG21.

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 so they are sufficiently protected against damage.

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

4.2 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. The location of the ground connection ① on the back rail is shown below. This connection only ensures electrostatic grounding of the device and does not meet the requirements for equipotential bonding.



Figure 4-1: Grounding and equipotential bonding

① Grounding connection

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 product.
- Correct connection of the built-in electrical equipment.
- Correct setting of the limit switches.
- Electrostatic grounding of the device.

5.2 Operation

Setting of the limit switches may be carried out during operation. For this unscrew the mounting equipment. After setting the limit switch unit to the switching point, fix it with the fastening screw.

Additionally the switching behaviour of the limit switch TG21 is to adjust in its terminal box. The switching function of the MS14 is determined by the fitting position of the Reed contact. A changing of the position during operation is permitted. Close the unit immediately.



CAUTION!

Ignition risks caused by pressure surges, impact or friction must be avoided for floats.

5.3 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.

To minimise danger due to electrostatic discharge, the variable area flowmeters type VA40/. / .. /K/ may not be used in areas in which there are processes that generate strong charges.

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 via the process connections in order to allow discharge of electrostatic charge.

The operator is also responsible for continuing the complete grounding of the process line.

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 "Grounding and equipotential bonding". This connection only ensures electrostatic grounding of the device and does not meet the requirements for equipotential bonding.

When dust-free gases or liquids are measured, the flow rate should not exceed 5 times the nominal flow rate. The max. allowable operating pressure PS printed on the nameplate is to be considered. The conductivity of liquids must be at least 1000 pS/m. Gases containing solid particles or liquid droplets are not permitted.



WARNING!

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

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 checks are required in order to maintain the proper condition.

The following checks are recommended:

- Check the housing, the cable entries and the feed lines for corrosion and/or damage.
- Check the measuring unit and the piping connections for leakage of the glass cone.
- Check the measuring unit and the indicator for dust deposits.
- Include the flowmeter in the periodic pressure test of the process line.

6.2 Dismantling

Exchanging the limit switches

The limit switch is to replace with an identical spare part in accordance with safety guidelines.

Exchanging the entire device

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

Exchanging and dismantling should take place in a de-energised state, if at all possible. If that is not possible, the basic conditions for intrinsic safety (e.g. no grounding or connection of different intrinsically safe circuits to one another) must be observed during dismantling.



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 piping.*







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