



VA40 - VA45 Handbook

Variable area flowmeter

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1	Safety instructions	5
1.1	Intended use	5
1.2	Conformity	6
1.3	Pressure equipment directive	6
1.4	Safety instructions from the manufacturer	8
1.4.1	Copyright and data protection	8
1.4.2	Disclaimer	8
1.4.3	Product liability and warranty	9
1.4.4	Information concerning the documentation	9
1.4.5	Warnings and symbols used	10
1.5	Safety instructions for the operator	10
2	Device description	11
2.1	Scope of delivery	11
2.2	Device versions	12
2.2.1	Device versions VA40	12
2.2.2	Device versions VA45	12
2.3	Nameplate	13
2.4	Description code	14
3	Installation	15
3.1	General notes on installation	15
3.2	Storage	15
3.3	Installation conditions	16
3.4	Transport locks	16
4	Electrical connections	17
4.1	Safety instructions	17
4.2	Limit switch VA40	17
4.2.1	Connection of ring-type limit switch	18
4.2.2	Connection of limit switch MS14	18
4.2.3	Connection of limit switch TG21	19
4.3	Limit switch settings	19
4.3.1	Setting of ring-type limit switch	19
4.3.2	Setting of limit switch MS14	20
4.3.3	Setting of limit switch TG21	20
4.4	Minimum distance between two ring-type limit switches	21
4.5	Power-up performance of ring-type limit switch	21
4.6	Limit switch function reversal	22
4.6.1	Reversed function of the ring-type limit switches	22
4.6.2	Reversed function of the limit switches MS14	22
4.6.3	Reversed function of limit switch TG21	23
4.6.4	4...20 mA linear position sensor WIM 200 / WIM 160	24

5 Start-up	25
<hr/>	
5.1 Start-up.....	25
6 Service	26
<hr/>	
6.1 Maintenance	26
6.2 Spare parts availability.....	27
6.3 Availability of services	27
6.4 Returning the device to the manufacturer.....	27
6.4.1 General information.....	27
6.4.2 Form (for copying) to accompany a returned device.....	28
6.5 Disposal	28
7 Technical data	29
<hr/>	
7.1 Functional principle.....	29
7.2 Technical data.....	30
7.2.1 Limit switches (only VA40)	32
7.2.2 Linear position sensor WIM 200 / WIM 160 (only VA40)	34
7.3 Dimensions and weights	35
7.4 Measuring ranges.....	37
7.4.1 Measuring ranges VA40	37
7.4.2 Measuring ranges VA45	40
8 Notes	41
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1.1 Intended use

**CAUTION!**

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

**INFORMATION!**

This device is a Group 1, Class A device as specified within CISPR11. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

**INFORMATION!**

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The variable area flowmeter VA40 is suitable for measuring liquids and gases.

The variable area flowmeter VA45 is suitable for measuring gases at low operating pressures.

Intended use:

- The product may not contain any ferromagnetic particles or solids. It may be necessary to install magnetic filters or mechanical filters.
- The product must be sufficiently liquid and free of deposits.
- Avoid pressure surges and pulsing flows.
- Open valves slowly. Do not use solenoid valves.
- For accurate flow measurement, the application data should be consistent with the sizing data and calibration of the variable area flowmeter.

Use suitable measures to eliminate compression vibrations during gas measurements:

- Short pipeline lengths to next restriction
- Nominal pipe size not greater than nominal device size
- Increase in operating pressure (while taking into account the resulting change in density and thus change in scale)

**DANGER!**

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

**CAUTION!**

Do not use any abrasive or highly viscous media.

1.2 Conformity

The manufacturer certifies successful testing of the product by applying the conformity mark on the device.

This device fulfils the statutory requirements of the relevant directives and regulations.

For further information on directives, regulations, standards and certifications, please refer to the declaration of conformity which you can download from the manufacturer's website.



DANGER!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.



CAUTION!

For devices used in SIL applications, additional safety notes apply. For detailed information refer to the "Safety manual".

1.3 Pressure equipment directive

A conformity assessment in accordance with pressure equipment directive has been carried out for the devices described. Conformity is certified by applying the conformity mark. The number of the notified body is also stated.

The PED key describes the rating of the devices:

Example: PED/G1/4.3/SEP	
G	Gases and vapours
1	Fluid group 1
4.3	Article 4.3 of the directive 2014/68/EU
SEP	Sound engineering practice

Table 1-1: Example of PED key



INFORMATION!

The stated pressures (PS) and temperatures (TS) only apply as refers to the pressure resistance of the sensor body. As regards the functionality of the entire device, further restrictions of the maximum temperature may need to be observed (e.g. ATEX approval). Devices rated below category I due to their size, do not receive the conformity mark in the scope of the PED. These devices are subject to applicable sound engineering practice (SEP).

Residual risk

A risk analysis in accordance with the pressure equipment directive has been carried out for the devices. The residual risk is described as follows:

- The devices are designed according to the valid and applicable rules and standards for static operation and their pressure resistance is calculated for the declared maximum pressure and temperature (no calculation for cyclical change).
- Responsibility for the use of the measuring devices with regard to corrosion resistance of the used materials against the measured fluid lies solely with the operator.
- Avoid abrasion.
- Avoid pulsation and cavitation.
- Protect devices from vibration and high-frequency oscillation.
- Draining (backflow) may be delayed due to the float in the measuring tube.
- Implement appropriate measures to counteract external fire hazards

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer cannot accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



DANGER!

This warning refers to the immediate danger when working with electricity.



DANGER!

This warning refers to the immediate danger of burns caused by heat or hot surfaces.



DANGER!

This warning refers to the immediate danger when using this device in a hazardous atmosphere.



DANGER!

These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.



WARNING!

Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.



CAUTION!

Disregarding these instructions can result in damage to the device or to parts of the operator's plant.



INFORMATION!

These instructions contain important information for the handling of the device.



LEGAL NOTICE!

This note contains information on statutory directives and standards.



• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➔ **RESULT**

This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator



WARNING!

In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

**INFORMATION!**

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**

Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

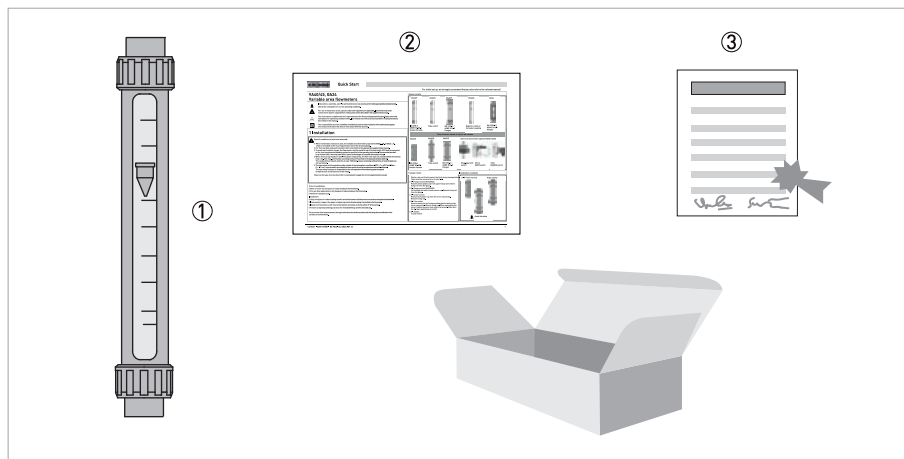


Figure 2-1: Scope of delivery

- ① Measuring device in ordered version
- ② Product documentation
- ③ Certificates, calibration report (supplied to order only)

2.2 Device versions

2.2.1 Device versions VA40

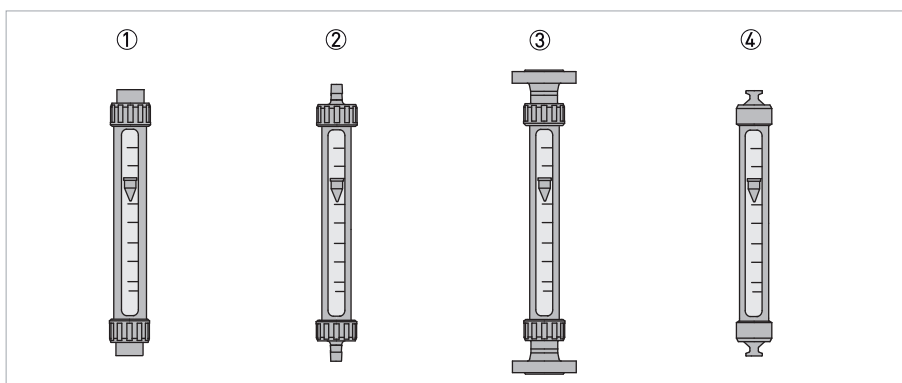


Figure 2-2: Device versions VA40

- ① VA40/V - ISO 228 or ASME B1.20.1 female thread
- ② VA40/S - Tube socket
- ③ VA40/F - EN 1092-1 / ASME B16.5 flanges
- ④ VA40/A - Hygienic clamp or threaded coupling

Optional versions:

- VA40 with max. two limit switches (NAMUR)
- VA40 with potential-free Reed contact

2.2.2 Device versions VA45

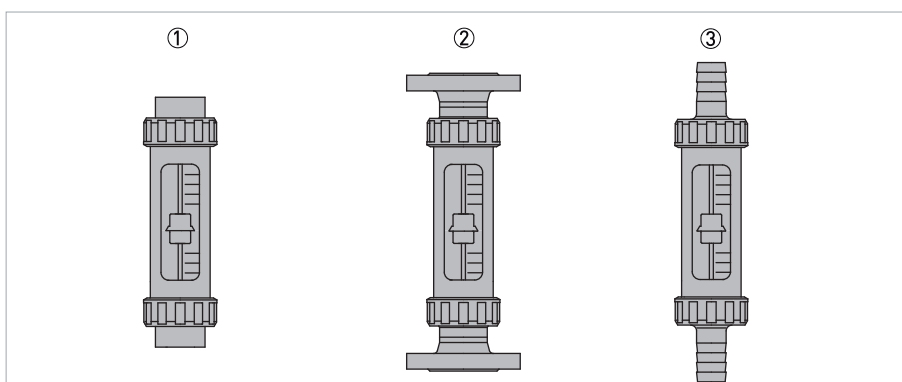


Figure 2-3: Device versions VA45

- ① VA45/V - ISO 228 or ASME B1.20.1 female thread
- ② VA45/S - Tube socket
- ③ VA45/F - EN 1092-1 / ASME B16.5 flanges

2.3 Nameplate



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

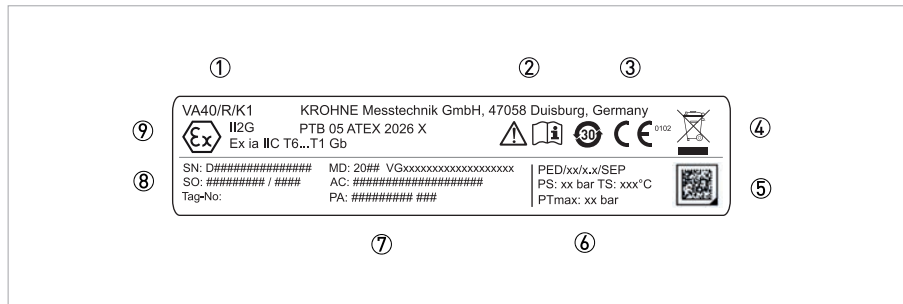


Figure 2-4: Example of a nameplate

- ① Device type
- ② Note to observe the documentation and China RoHS
- ③ Identification number of the notified body
- ④ Disposal symbol
- ⑤ Data Matrix code
- ⑥ Data according to the pressure equipment directive
- ⑦ Manufacturing date (MD), product configurator code (Vx), article code (AC) and production order number (PA)
- ⑧ Serial number (SN), sales order / item (SO) and measuring point identifier (Tag-No.)
- ⑨ Marking according to the notified body

2.4 Description code

Description code VA40

The description code consists of the following elements*:

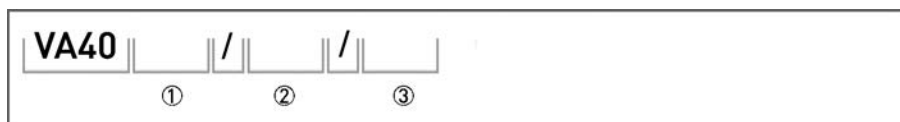


Figure 2-5: Safety description code VA40

- 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
 - WIM - linear position sensor

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

Description code VA45

The description code consists of the following elements*:



Figure 2-6: Safety description code VA45

- ① **Connection type**
 - V - screw connection
 - S - tube socket
 - F - flange connection
- ② **Material of connection**
 - R - stainless steel 1.4404 / 316 L
 - ST - steel electroplated
 - PV - plastic PVDF

3.1 General notes on installation

**INFORMATION!**

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**

Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Storage

- Store the device in a dry, dust-free location.
- Avoid lasting direct exposure to the sun.
- Store the measuring device in the original packaging.
- The permissible storage temperatures for standard devices are: -40...+80°C / -40...+176°F

3.3 Installation conditions

**CAUTION!**

When installing the device in the piping, the following points must be observed:

- *The variable area flowmeter must be installed vertically (within 5° of the vertical).*
- *Flow direction from bottom to top.*
- *Before connecting, blow or flush out the pipes leading to the device.*
- *Piping for gas flow need to be dried before the device is installed.*
- *Use connectors suitable for the particular device version.*
- *Align the piping centrally with the connection bores on the measuring device so they are free of stresses.*
- *If necessary, the piping has to be supported to avoid the vibrations transmitted to the measuring device.*
- *Do not lay signal cables directly next to cables for the power supply.*

3.4 Transport locks

Plastic rods are fitted to secure the float during transportation. These must be removed prior to start-up.

- **F** - Flange version DN15/DN25
Remove yellow plastic cap from upper flange and remove fixing rod from the glass.
- **F** - Flange version DN40/DN50
Cut through the cable tie and remove cap. Remove fixing rod from the glass.
- **V** - Screw version
Remove blue plastic cap from the screw connection. Remove fixing rod.
- **S** - Tube socket
Unscrew union nut and remove yellow plastic cap from the screw connection. Remove fixing rod. When assembling the meter, tighten the union nuts with strap wrench. Make sure the O-ring is positioned correctly!
- **A** - Aseptic
as tube socket

4.1 Safety instructions



DANGER!

All work on the electrical connections may only be carried out with the power disconnected.
Take note of the voltage data on the nameplate!



DANGER!

Observe the national regulations for electrical installations!



DANGER!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.



WARNING!

Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order.
Check for the correct supply voltage printed on the nameplate.

4.2 Limit switch VA40

The flowmeters VA40 can be equipped with a maximum of two limit switches.

Bistable function: Stable switching when passing through the switching point

Monostable function: Switching pulse at operating point

For use, selection and function refer to chapter "Technical data".

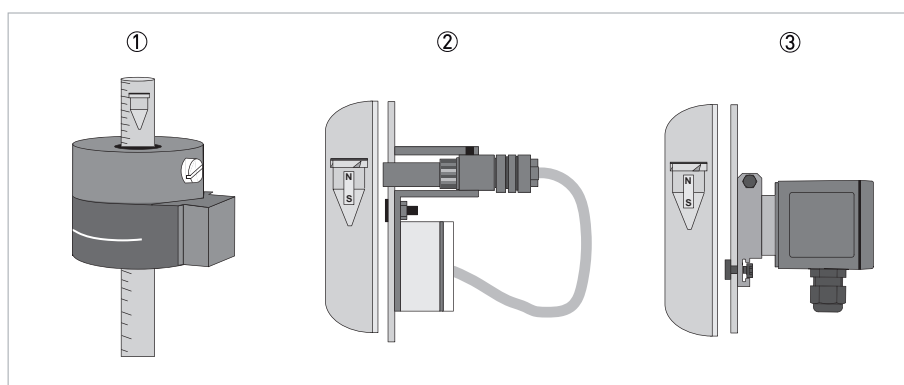


Figure 4-1: Types of the limit switches

- ① Ring-type limit switch
- ② MS 14/I - potential-free Reed contact
- ③ TG21 - with integrated switching vane and proximity switch

4.2.1 Connection of ring-type limit switch

The two connecting cables of the limit switch are guided through the long slot on the back.

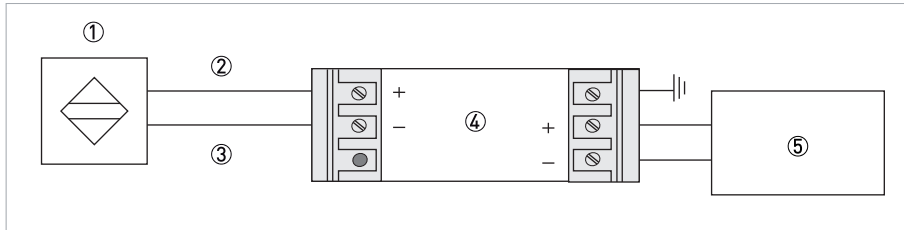


Figure 4-2: Electrical connection of NAMUR ring-type limit switch

- ① Limit switch, 2-wire NAMUR
- ② Connecting cable brown +
- ③ Connecting cable blue -
- ④ EMC filter
- ⑤ Receiver device

The bistable limit switches must be operated with an EMC filter.
The monostable limit switches do not require an EMC filter.

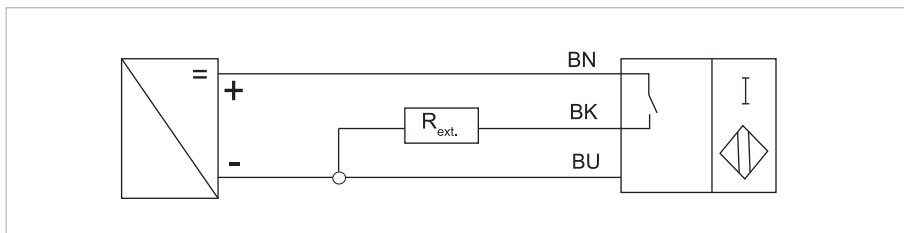


Figure 4-3: Electrical connection of transistor ring-type limit switch

- BN – brown +
- BK – black switch
- BU – blue -

4.2.2 Connection of limit switch MS14

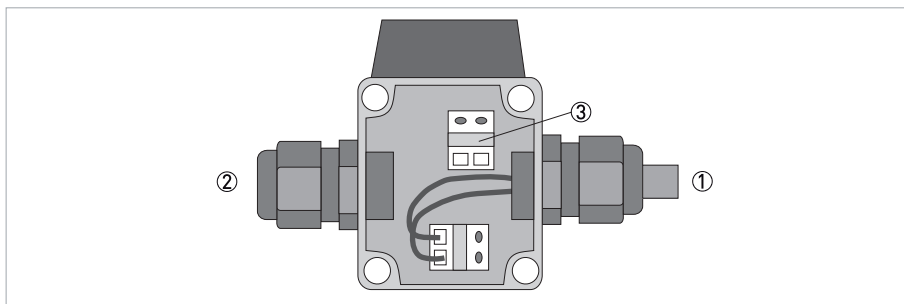


Figure 4-4: Electrical connection of REED limit switch MS14

- ① Connection to REED contact
- ② Connection from receiver device
- ③ Terminal connection (potential-free)

The switching function requires a float with integrated magnet.

4.2.3 Connection of limit switch TG21

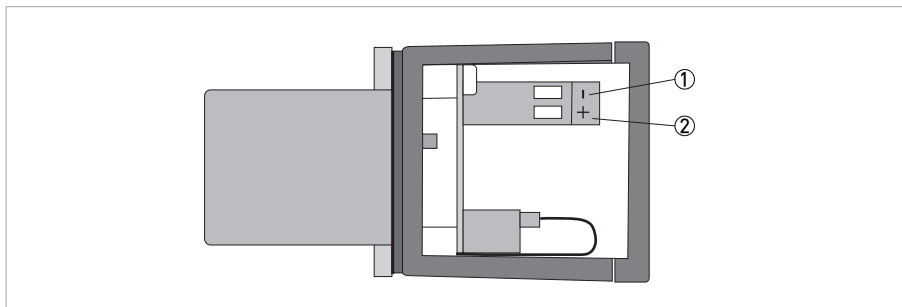


Figure 4-5: Electrical connection of NAMUR limit switch TG21

- ① Terminal -
- ② Terminal +

The TG21 is adapted for isolated switching amplifiers with an intrinsically safe circuit according to EN 60947-5-6 NAMUR.

The TG21 includes an inductive proximity switch with bistable switching characteristics. The proximity switch is activated by the immersion of an aluminium vane. The magnet of the switching vane is moved by the magnet in the float. The switching function requires a float with integrated magnet.

4.3 Limit switch settings

4.3.1 Setting of ring-type limit switch

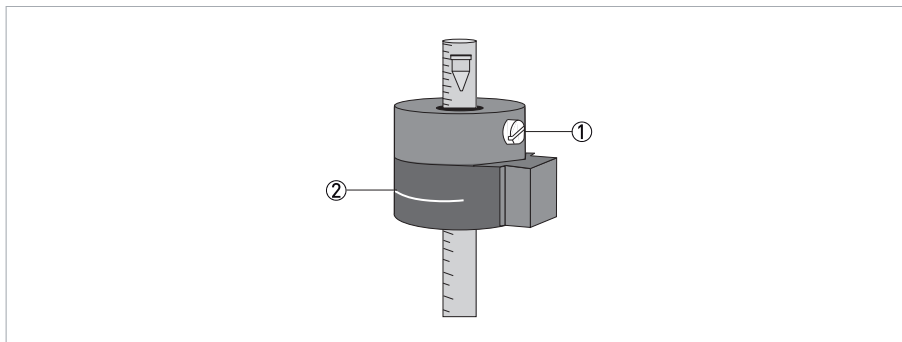


Figure 4-6: Ring-type limit switch



- Loosen plastic screw ① and move limit switch to desired switching point ② .
- Only slightly tighten screw ① (Risk of breaking the glass)!

The switching point is, as shown, at approx. half height of the ring ② .
The exact switching point is also dependent on the size of the used float!

4.3.2 Setting of limit switch MS14

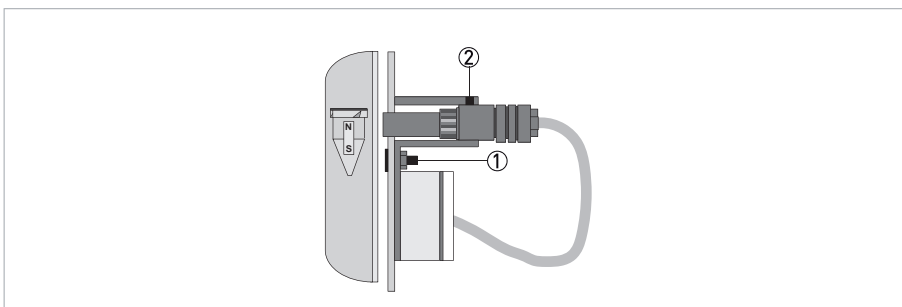


Figure 4-7: Limit switch MS14



- Untighten bracket screw ① and set switching position.
- Secure bracket screw ① .

The distance between the limit switch and the casing is factory set the with clamp screw ② in that way that the limit switch touches the glass cone at the maximum switching point.

The limit switch must be rotated 180° to reach the lower range of the scale.

4.3.3 Setting of limit switch TG21

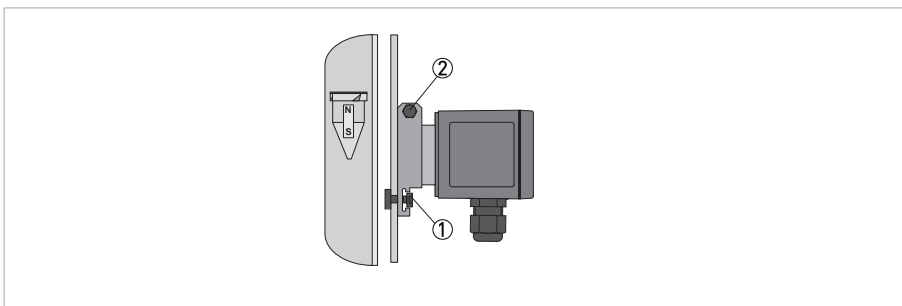


Figure 4-8: Limit switch TG21



- Untighten bracket screw ① and set switching position.
- Secure bracket screw ① .

The distance between the limit switch and the casing is factory set at approx. 1 mm / 0.039" with the clamp screw ② .

4.4 Minimum distance between two ring-type limit switches

Where two limit switches are used in one device are in close proximity of each other, minimum distances must be maintained in order to avoid mutual influence of the switches.

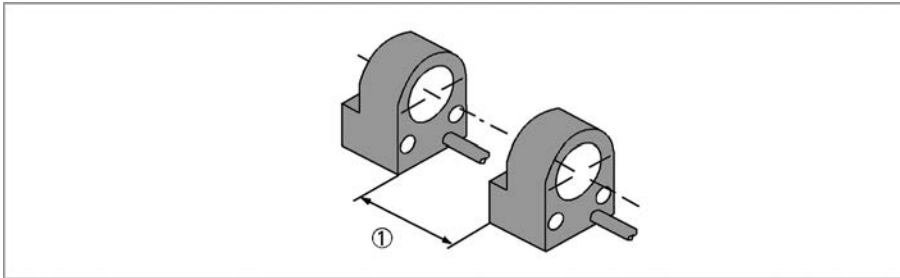


Figure 4-9: Minimum distance

- ① 2-wire: 16 mm / 0.63"
3-wire: 45 mm / 1.77"

4.5 Power-up performance of ring-type limit switch

2-wire limit switch NAMUR, monostable

Float outside of the limit switch: signal ≥ 3 mA

Float inside of the limit switch (centre): signal ≤ 1 mA

2-wire limit switch NAMUR, bistable

Independent of the float position and passage ① : signal ≥ 3 mA

Prerequisite: the float is outside of the limit switch.



INFORMATION!

For the proper initialisation after power up, the bistable NAMUR limit switch should pass through each of ① and ② once.

3-wire limit switch, transistor bistable

Independent of the float position and passage ② : output $U_a \leq 1$ V

Prerequisite: the float is outside of the limit switch.

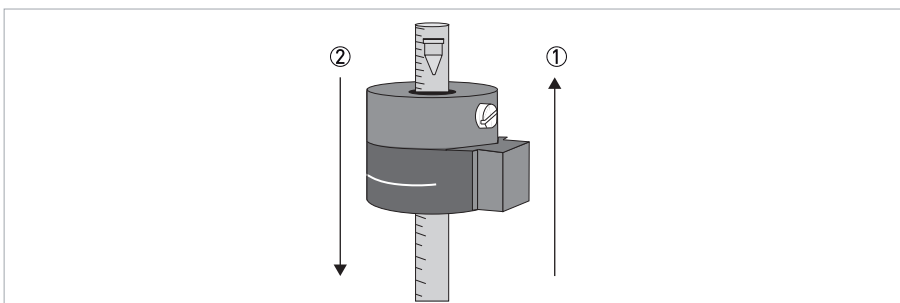


Figure 4-10: Power-up performance of ring-type limit switch

4.6 Limit switch function reversal

4.6.1 Reversed function of the ring-type limit switches

The bistable ring-type limit switches can be changed from normally open switch to normally closed switch.



- Remove the upper device connection.
- Unscrew the upper union nut.
- Lift-up and remove the connection very carefully.
On depending adhesion of the upper sealing ring, the connection may take the measuring glass with it!
- Loosen plastic screw ① of the ring-type limit switch.
- Carefully take the measuring glass out of the housing and the limit switch.
The ring-type limit switch remains in the housing. Avoid CANTING (glass breakage!).
- Rotate the limit switch by 180°.
- Assemble in reverse order. Ensure that the sealing ring is seated correctly!

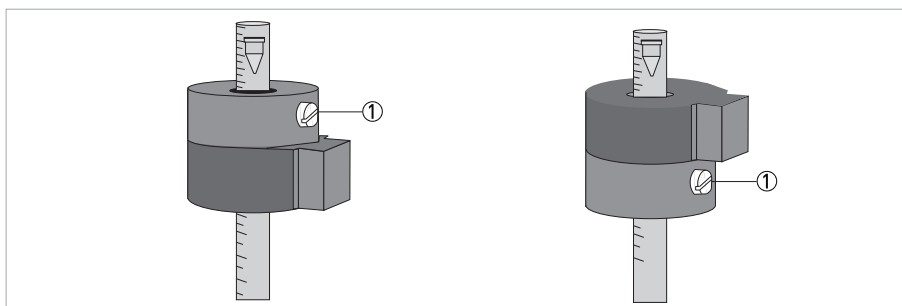


Figure 4-11: Reversed function of the ring-type limit switches

① Plastic screw

4.6.2 Reversed function of the limit switches MS14

The contact function can be changed by reconnecting the REED cartridge that is screwed into the cartridge housing:

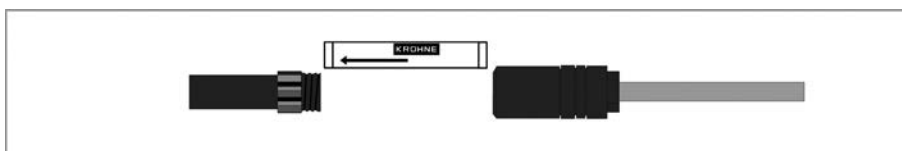


Figure 4-12: Reversed function of the limit switches MS14

- Closing at increasing flow: arrow on REED cartridge points towards measuring glass.
- Closing at decreasing flow: arrow on REED cartridge points away from measuring glass.

4.6.3 Reversed function of limit switch TG21

The contact function can be changed from normally open to normally closed by moving the position of the proximity switch ③ .

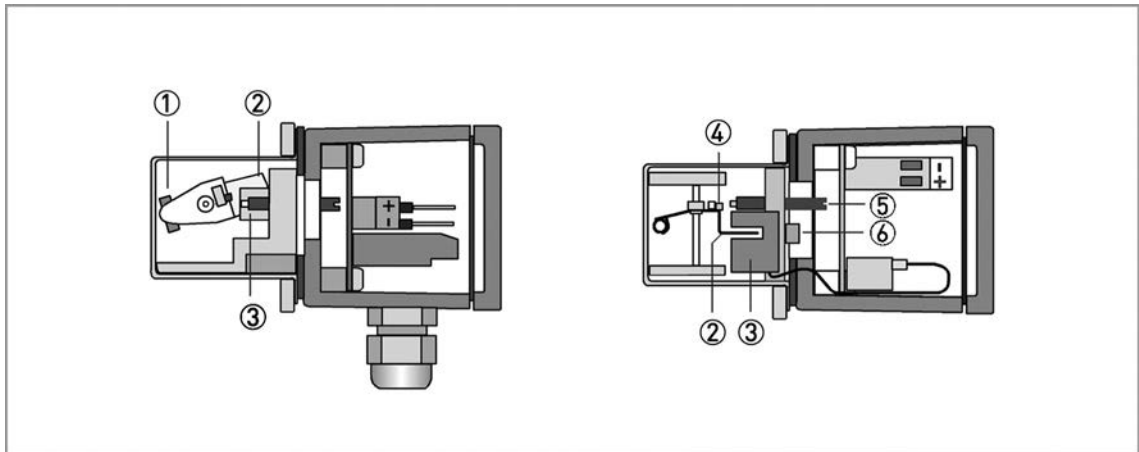


Figure 4-13: Reversed function of limit switch TG21

- ① Follower magnet
- ② Switching vane
- ③ Proximity switch
- ④ Hysteresis magnet
- ⑤ Adjusting screw sensitivity
- ⑥ Fixing screw of proximity switch

After loosening the screw ⑥ , the proximity switch ③ can be shifted to the other end position.

If vibrations could cause an unintentional switching function, use the grub screw ⑤ to adjust the force of the frictional connection between adjusting magnet and counter magnet ④ on the switching vane ② .

The switching repeatability is < 3% of the full-scale range and is influenced by the force of the frictional connection!

4.6.4 4...20 mA linear position sensor WIM 200 / WIM 160

The flowmeter VA40 with nominal diameter DN25, DN40 and DN50 can be equipped with a linear position sensor, which outputs a 4...20 mA current output signal linearly to the position of the float. The flow values corresponding to the current values can be assigned using the calibration curve supplied.

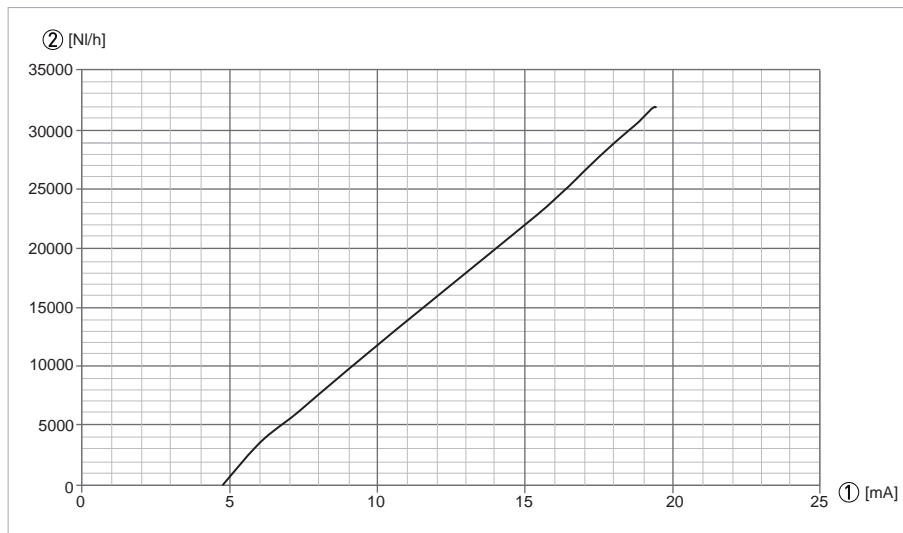


Figure 4-14: Calibration curve

- ① Current output [mA]
- ② Flow rate [NI/h]

Connecting the linear position sensors WIM 200 / WIM 160

The linear position sensors WIM 200 / WIM 160 are designed in 2-wire technology. That means the power supply as well as the 4...20 mA measuring signal are on the two identical connecting cables.

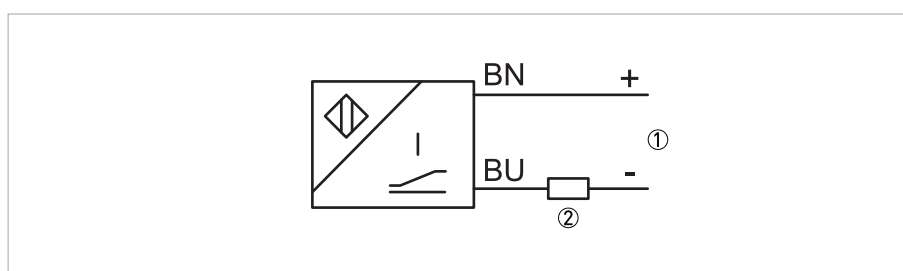


Figure 4-15: Electrical connection of linear 2-wire position sensor WIM 200 / WIM 160

- ① Power supply 14...30 VDC; BN – brown +, BU – blue -
- ② External load $< [(U-14V)/20mA] k\Omega$



INFORMATION!

For further information, especially when used in hazardous areas and connected to certified Ex i circuits, refer to the relevant supplementary instructions.

5.1 Start-up



CAUTION!

When starting up the device, the following points must be observed:

- *Compare the actual operating pressure and the product temperature of the system with the specifications on the nameplate (PS and TS). These specifications may not be exceeded.*
- *Make sure materials are compatible.*
- *Slowly open the shut-off valve.*
- *When measuring liquids ensure that the pipelines are carefully evacuated.*
- *When measuring gases, increase pressure slowly.*
- *Avoid float impact (e.g. caused by solenoid valves), as this is likely to damage the measuring unit or float.*

6.1 Maintenance

The flowmeter should be checked for signs of dirt, corrosion, mechanical wear and damage to the measuring glass during routine maintenance of the system and pipelines. We advise that inspections are carried out at least once per year.

For VA40/A (aseptic) a strap wrench is recommended to open the flowmeter.

For devices with a flanged connection, the union nut on the measuring glass must be securely tightened! Then tighten the flange connection.



CAUTION!

- *Pressurised pipes have to be depressurised before removing the device.*
- *Empty the pipelines as completely as possible.*
- *In the case of devices used for measuring aggressive or hazardous media, appropriate safety precautions must be taken with regard to residual liquids in the measuring unit.*
- *Loosen only the process connection to the pipeline (exception: devices with female thread).*
- *Always use new gaskets when re-installing the measuring device in the pipeline.*
- *For screw connections, make sure the O-Ring ① is positioned correctly!*
- *Avoid electrostatic charges when cleaning the surfaces (e.g. sight window).*
- *When replacing gaskets, for the aseptic version, use materials conforming to FDA standards e.g. EPDM.*
- *Test the leak tightness by suitable measures prior to start-up the measuring device again.*

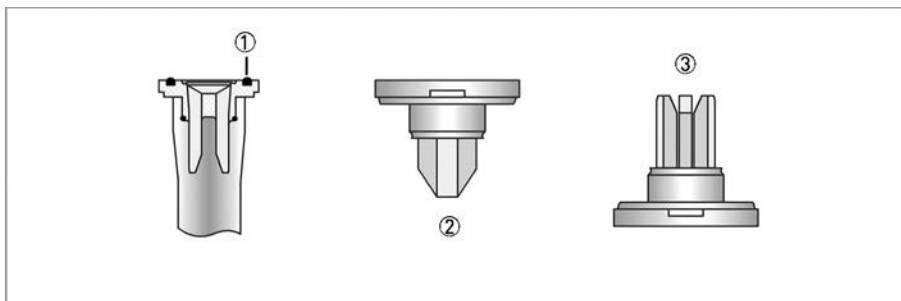


Figure 6-1: Position of sealing ring and float stop

- ① Sealing ring
- ② DN15 - upper float stop
- ③ DN15 - lower float stop

6.2 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.3 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.



INFORMATION!

For more precise information, please contact your local sales office.

6.4 Returning the device to the manufacturer

6.4.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



WARNING!

Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



WARNING!

If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*

6.4.2 Form (for copying) to accompany a returned device



CAUTION!

To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:	
Department:		Name:	
Telephone number:		Email address:	
Fax number:			
Manufacturer order number or serial number:			
The device has been operated with the following medium:			
This medium is:	<input type="checkbox"/>	radioactive	
	<input type="checkbox"/>	water-hazardous	
	<input type="checkbox"/>	toxic	
	<input type="checkbox"/>	caustic	
	<input type="checkbox"/>	flammable	
	<input type="checkbox"/>	We checked that all cavities in the device are free from such substances.	
	<input type="checkbox"/>	We have flushed out and neutralized all cavities in the device.	
We hereby confirm that there is no risk to persons or the environment caused by any residual media contained in this device when it is returned.			
Date:		Signature:	
Stamp:			

6.5 Disposal



LEGAL NOTICE!

Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment):



According to the directive 2012/19/EU or UK Regulation 2013 No. 3113, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste.**

The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

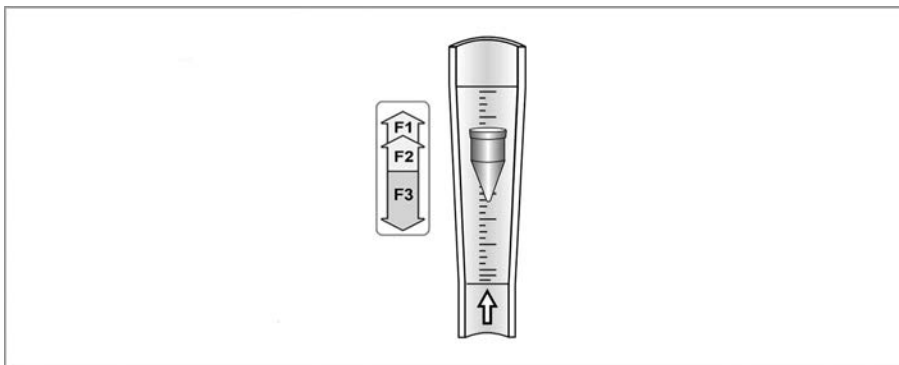
7.1 Functional principle

The flowmeter operates in accordance with the float measuring principle.

The measuring unit consists of a glass cone in which a float can move freely up and down.

The medium flows through the flowmeter from bottom to top.

The float adjusts itself so that the buoyancy force F_1 acting on it, the form resistance F_2 and its weight F_3 are in equilibrium: $F_3 = F_1 + F_2$



The height of the float is read on the scale of the measuring glass and indicates the flow rate.

The top edge of the float of the VA40 marks the reading line for flow values.

For the top edge of the float of the VA45 refer to "Measuring ranges VA45".

7.2 Technical data



INFORMATION!

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

Measuring system

Application range of VA40	Flow measurement of liquids and gases
Application range of VA45	Flow measurement of gases
Function / Measuring principle	Float measuring principle
Measured value	
Primary measured value	Float position
Secondary measured value	Operating volume flow, nominal volume flow or mass flow

Measurement accuracy

Max. permissible error VA40	1.0% of full scale range
	1.0% of measured value according to VDI/VDE 3513-2 ($q_G = 50\%$)
Max. permissible error VA45	2.0% of full scale range
	2.5% of measured value according to VDI/VDE 3513-2 ($q_G = 50\%$)
Measurement repeatability	
VA40	0.25%
VA45	0.5%

Operating conditions

Temperature	
Max. operating temperature TS	-20...+100°C / -4...+212°F; Higher temperatures on request
Ambient temperature	-20...+100°C / -4...+212°F
	For devices to be used in hazardous areas, special temperature ranges apply. These can be found in the supplementary instructions.
Pressure	
Device version	Max. permitted operating gauge pressure PS at TS = +100°C / +212°F
VA40 - DN15, DN25	10 barg / 145 psig; Other pressures on request
VA40 - DN40	9 barg / 131 psig; Other pressures on request
VA40 - DN50	7 barg / 102 psig; Other pressures on request
VA45	1 barg / 14.5 psig; Other pressures on request
Max. test pressure PT	Pressure equipment directive (refer to nameplate)

Installation conditions

Inlet section	$\geq 5 \times \text{DN}$
Outlet section	$\geq 3 \times \text{DN}$
	Note: Straight inlet and outlet sections are not required for accuracy reasons, but may reduce instable flow indication caused by fluctuating flow profiles and may increase lifetime because of reduced mechanical wear. It is recommended to consider the inlet/outlet sections especially for devices with DN50 / 2".

Materials

Screw connection VA.../R	Stainless steel 1.4404 / 316 L
Screw connection VA.../ST	Steel, electroplated and chromised
Tube socket	Stainless steel 1.4404 / 316 L
Flange connection VA.../R	Stainless steel 1.4404 / 316 L
Screw connection / tube socket VA.../PV	PVDF
Housing	Stainless steel 1.4301 / 304 electro-polished
Union nut	Standard: aluminium / powder coated Option: stainless steel
Measuring cone	Borosilicate glass
Float VA40	Stainless steel 1.4571 / 316 Ti, Hastelloy®, TFM (PTFE), aluminium, Polypropylene (PP)
Float VA45	Aluminium
Float stop and insert	PVDF (FDA conform)
Gaskets	NBR, EPDM (FDA conform), FFKM, FPM

Table 7-1: Technical data

7.2.1 Limit switches (only VA40)

Type	Switching function	Connection type	Shape	Note
I7R2010-N RC10-14-N0	monostable	2-wire NAMUR	Ring-type limit switch	non-Ex
I7R2010-NL RC10-14-N3	bistable	2-wire NAMUR	Ring-type limit switch	non-Ex
I7R2015-N RC15-14-N0	monostable	2-wire NAMUR	Ring-type limit switch	non-Ex
I7R2015-NL RC15-14-N3	bistable	2-wire NAMUR	Ring-type limit switch	non-Ex
RB15-14-E2	bistable	3-wire transistor	Ring-type limit switch	non-Ex
MS 14/A	bistable	2-wire, potential-free	Reed contact	Float with magnet required
TG 21	bistable	2-wire NAMUR	Proximity switch	Float with magnet required

Table 7-2: Types of limit switches

Nominal size	Cone no.	Limit switches	Nominal size	Cone no.	Limit switches	
DN15	G 13.11	-	DN25	N 21.09	MS14/A	TG21
	G 14.06	-		N 21.13	MS14/A	TG21
	G 14.08	-		N 21.18	MS14/A	TG21
	G 15.07	Ring Ø 10 mm		N 21.25	MS14/A	TG21
	G 15.09	Ring Ø 10 mm	DN40	N 41.09	MS14/A	TG21
	G 15.12	Ring Ø 10 mm		N 41.13	MS14/A	TG21
	G 16.08	Ring Ø 10 mm		N 41.19	MS14/A	TG21
	G 16.12	Ring Ø 10 mm	DN50	N 51.10	MS14/A	TG21
	G 17.08	Ring Ø 10 mm		N 51.15	MS14/A	TG21
	G 17.12	Ring Ø 15 mm		N 51.21	MS14/A	TG21
	N 18.07	MS14/A				
	N 18.09	MS14/A				
	N 18.13	MS14/A				
	N 19.09	MS14/A				
	N 19.13	MS14/A				
	N 19.19	MS14/A				
N 19.26	MS14/A					

Table 7-3: Use of the limit switches

Limit switches	I7R2010-NL	I7R2015-NL	I7R2010-N	I7R2015-N	RB15-14-E2
	RC10-14-N3	RC15-14-N3	RC10-14-N0	RC15-14-N0	
Ring diameter	10 mm / 0.4"	15 mm / 0.6"	10 mm / 0.4"	15 mm / 0.6"	15 mm / 0.6"
Switching function	bistable	bistable	monostable	monostable	bistable
NAMUR (IEC 60947-5-6)	yes	yes	yes	yes	no
SIL2-compliant according to IEC 61508	yes	yes	no	no	no
Connection technology	2-wire	2-wire	2-wire	2-wire	3-wire
Nominal voltage U_0	8 VDC	8 VDC	8 VDC	8 VDC	-
Current consumption	≤ 1 mA passage \downarrow		≥ 3 mA - ball outside of the limit switch		-
Current consumption	≥ 3 mA passage \uparrow		≤ 1 mA - ball in the limit switch		-
Operating voltage $U_{ext.}$					10...30 VDC
Operating current					0...100 mA
No-load current					20 mA
Output U_a - passage \downarrow					≤ 1 V
Output U_a - passage \uparrow					$\geq U_b$ - 3 VDC

Table 7-4: Technical data of the ring-type limit switches

Limit switches	MS14
Contact type	Normally open or normally closed, can be reconnected
Switching repeatability	< 2% of full scale range
Switching capacity	12 VA
Max. turn-on voltage	30 VDC
Max. switching current	0.5 A
Ambient temperature	-40...+85°C / -40...+185°F
Ingress protection according to IEC 60529	IP65
SIL2-compliant according to IEC 61508	yes

Table 7-5: Technical data of the Reed contact MS14

Limit switches	TG21
Nominal voltage	8 VDC
Current consumption, active surface open	3 mA
Current consumption, active surface covered	1 mA
Ambient temperature	-25...+100°C / -13...+212°F
Ingress protection according to IEC 60529	IP67 / NEMA 6
SIL2-compliant according to IEC 61508	yes

Table 7-6: Technical data of the proximity switch TG21

7.2.2 Linear position sensor WIM 200 / WIM 160 (only VA40)

Device size	Sensor type
VA40 DN15	Not applicable
VA40 DN25	WIM 200
VA40 DN40	WIM 200
VA40 DN50	WIM 160
Electrical data	
Operating voltage U	14...30 VDC
Connection	brown (+), blue (-)
Output function	2-wire, current output
Current output WIM 160	4...20 mA = 0...160 mm / 0...6.3"
Current output WIM 200	4...20 mA = 0...200 mm / 0...7.9"
Load impedance	$\leq [(U-14V)/20mA]$ k Ω
Cable length of connection	2 m / 6.6 ft
Cable quality	4 mm / 0.16", blue, PVC
Cable cross-section	2 x 0.25 mm ² (blue/brown)
Accuracy	
Max. permissible error	Current output related to flow rate
	2.0% of full scale range
	2.5% according to VDI/VDE 3513-2 (q _Q = 50%)
Temperature influence	$\leq \pm 0.06\%/K$
Operating conditions	
Ambient temperature	-25...+65°C / -13...+149°F
Housing material	Aluminium, coated
Housing protection class	IP67

Table 7-7: Technical data

7.3 Dimensions and weights

VA40

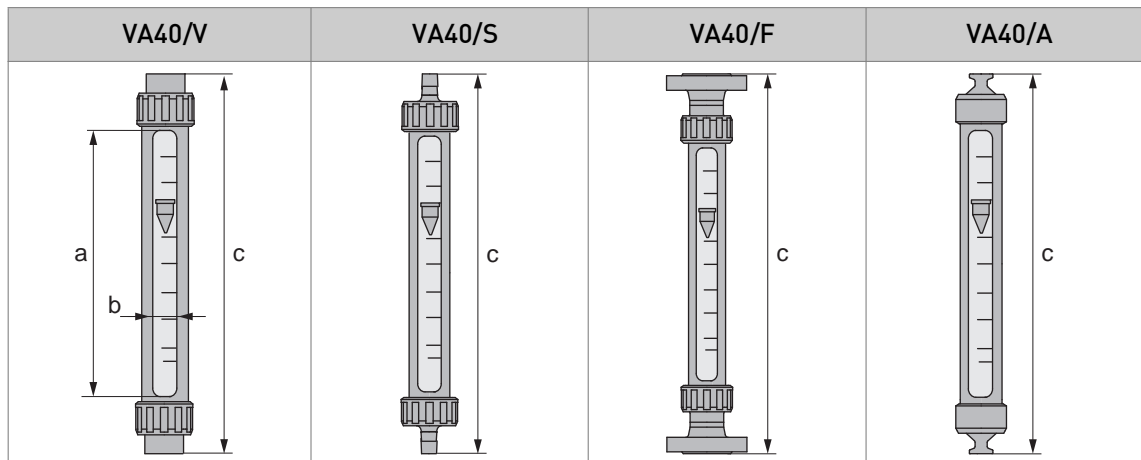


Table 7-8: Device versions

EN DN	ASME NPS	Type V		Type S		Type F		Type A					
		a	b	c	c	c	c						
		[mm]	["]	[mm]	["]	[mm]	["]	[mm]	["]				
15	1/2"	239	9.41	26	1.02	375	14.8	400	15.8	425 ^①	16.7 ^②	375	14.8
25	1"	239	9.41	36	1.42	375	14.8	450	17.7	425 ^①	16.7 ^②	375	14.8
40	1 1/2"	235	9.26	46	1.81	375	14.8	450	17.7	425 ^①	16.7 ^②	375	14.8
50	2"	227	8.94	62	2.44	375	14.8	450	17.7	425 ^①	16.7 ^②	375	14.8

Table 7-9: Dimensions in mm and inch

① Option 500 mm

② Option 19.7"

Nominal size	VA40 type V, S, A		VA40 type F	
	[kg]	[lb]	[kg]	[lb]
DN15	0.5	1.1	1.8	4.0
DN25	1.3	2.9	3.8	8.4
DN40	2.3	5.1	6.8	15.0
DN50	3.6	7.9	9.2	20.3

Table 7-10: Weights in kg and lb

VA45

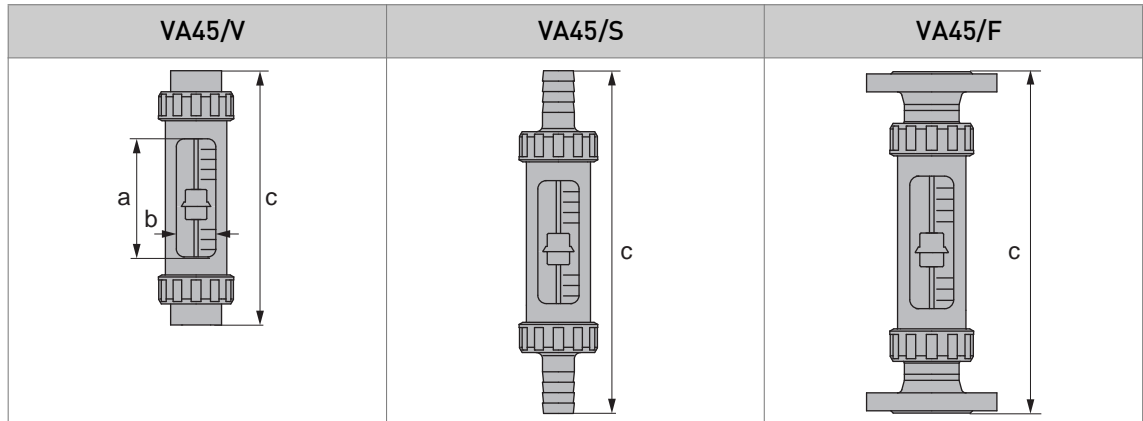


Table 7-11: Device versions

		a		b		c (Type V)		c (Type S)		c (Type F)	
EN DN	ASME NPS	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]	[mm]	[""]
15	1/2"	118	4.65	26	1.02	254	10.0	279	11.0	304	12.0
25	1"	118	4.65	36	1.42	254	10.0	329	13.0	304	12.0
40	1 1/2"	114	4.49	46	1.81	254	10.0	329	13.0	304	12.0

Table 7-12: Dimensions in mm and inch

Nominal size	VA45 type V, S		VA45 type F	
	[kg]	[lb]	[kg]	[lb]
DN15	0.4	0.88	1.7	3.7
DN25	1.2	2.6	3.7	8.2
DN40	2.2	4.9	6.7	14.8
DN50	-	-	-	-

Table 7-13: Weights in kg and lb

Process connections

		Type V		Type S	Type F		Type A	
		Female thread according to			Flanges according to		Pipe	Clamp
EN DN	ASME NPS	ISO 228	ASME B1.20	Ø [mm]	EN 1092-1	ASME B16.5	DIN 11851	ISO 2852
15	1/2"	G3/8...1/2	1/2 NPT	15	DN15	1/2"	SC15 ①	17.2 ①
25	1"	G3/4...G1	1 NPT	28	DN25	1"	SC25 ①	25 ①
40	1 1/2"	G1 1/2	1 1/2 NPT	42	DN40	1 1/2"	SC40 ①	40 ①
50 ①	2" ①	G2 ①	2 NPT ①	52 ①	DN50 ①	2" ①	SC50 ①	51 ①

Table 7-14: Dimensions of the process connections

① only VA40

7.4 Measuring ranges

7.4.1 Measuring ranges VA40

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia
Float:	1 Stainless steel or Hastelloy® - 2 PTFE/TFM with insert - 3 PTFE/TFM - 4 Aluminium - 5 Polypropylene (PP)		

Materials →		1	2	3	1	3	4	5	1	2	3	4	5
Cone ↓		Water [l/h]			Air [Nm ³ /h]				Max. pressure loss [mbar]				
G 13.11 ①	DN15	0.4	-	-	0.016	-	0.007	-	2	-	-	1	-
G 14.06		0.63	-	-	0.025	-	0.012	-	3	-	-	2	-
G 14.08		1	-	-	0.04	-	0.02	-	4	-	-	3	-
G 15.07		1.6	-	-	0.06	-	0.03	-	4	-	-	3	-
G 15.09		2.5	-	-	0.09	-	0.04	-	5	-	-	4	-
G 15.12		4	-	-	0.14	-	0.06	-	6	-	-	5	-
G 16.08		6.3	-	-	0.2	-	0.1	-	6	-	-	5	-
G 16.12		10	-	-	0.3	-	0.16	-	7	-	-	6	-
G 17.08		16	-	-	0.5	-	0.25	-	7	-	-	6	-
G 17.12		25	-	-	0.8	-	0.4	-	8	-	-	7	-
N 18.07		40	25	13	1.5	0.6	0.8	0.5	9	6	2	3	1
N 18.09		63	40	22	2.2	0.95	1.2	0.7	9	7	3	3	2
N 18.13		100	63	35	3.5	1.5	2.0	1.2	9	8	3	4	2
N 19.09		160	100	55	5.2	2.2	2.8	1.8	13	9	4	5	2
N 19.13		250	160	85	8	3.3	4.5	2.8	16	11	4	5	2
N 19.19		400	250	140	-	-	-	-	21	14	5	-	-
N 19.26		630	400	230	-	-	-	-	27	17	6	-	-
N 21.09	DN25	630	400	230	18 ②	9	11	7	22	14	6	8	3
N 21.13		1000	630	350	28 ②	14	18	12	23	17	6	8	4

Materials →		1	2	3	1	3	4	5	1	2	3	4	5
Cone ↓		Water [l/h]			Air [Nm ³ /h]				Max. pressure loss [mbar]				
N 21.18		1600	1000	600	49 ②	-	28 ②	17 ②	26	25	7	10	6
N 21.25		2500	1600	950	70 ②	-	42 ②	26 ②	33	40	8	12	9
N 41.09	DN40	1600	1000	600	45 ②	22	28	18	32	18	9	11	5
N 41.13		2500	1600	900	70 ②	36	45 ②	28 ②	34	20	10	12	5
N 41.19		4000	2500	1500	128 ②	-	76 ②	46 ②	38	24	11	15	8
N 51.10	DN50	4000	2500	1500	120 ②	56	70	45	43	25	12	15	7
N 51.15		6300	4000	2400	190 ②	90	110 ②	70 ②	47	30	13	16	7
N 51.21		10000	6300	3500	310 ②	-	170 ②	118 ②	55	42	14	20	10

Table 7-15: Measuring range, metric

① Accuracy 2.5%

② only possible with guided float

The operating pressure should be at least double the pressure loss for liquids and five times for gases. The indicated pressure losses are valid for water and air at maximum flow rate.

Other flow ranges on request. Conversion of other media or operating data is performed using the calculation method in accordance with VDI/VDE directive 3513.

Measuring span:	10 : 1		
Flow values:	Values = 100%	Water: +20°C / +68°F	Air: +20°C / +68°F, 1.013 bara / 14.7 psia
Float:	1 Stainless steel or Hastelloy® - 2 PTFE/TFM with insert - 3 PTFE/TFM - 4 Aluminium - 5 Polypropylene (PP)		

Materials →		1	2	3	1	3	4	5	1	2	3	4	5
Cone ↓		Water [GPH]			Air [SCFM]				Max. pressure loss [psi]				
G 13.11 ①	DN15	0.11	-	-	0.01	-	0.004	-	0.03	-	-	0.02	-
G 14.06		0.17	-	-	0.015	-	0.007	-	0.04	-	-	0.03	-
G 14.08		0.26	-	-	0.025	-	0.012	-	0.06	-	-	0.04	-
G 15.07		0.42	-	-	0.037	-	0.018	-	0.06	-	-	0.04	-
G 15.09		0.66	-	-	0.056	-	0.025	-	0.07	-	-	0.06	-
G 15.12		1.06	-	-	0.087	-	0.037	-	0.09	-	-	0.07	-
G 16.08		1.66	-	-	0.12	-	0.062	-	0.09	-	-	0.07	-
G 16.12		2.64	-	-	0.19	-	0.09	-	0.1	-	-	0.09	-
G 17.08		4.23	-	-	0.31	-	0.16	-	0.1	-	-	0.09	-
G 17.12		6.60	-	-	0.5	-	0.25	-	0.1	-	-	0.1	-
N 18.07		10.6	6.6	3.43	0.93	0.37	0.5	0.31	0.1	0.1	0.03	0.04	0.02
N 18.09		16.6	10.6	5.81	1.36	0.59	0.74	0.43	0.1	0.1	0.04	0.04	0.03
N 18.13		26.4	16.6	9.25	2.17	0.93	1.24	0.74	0.1	0.1	0.04	0.06	0.03
N 19.09		42.3	26.4	14.5	3.2	1.36	1.7	1.1	0.19	0.13	0.06	0.07	0.03
N 19.13		66.0	42.3	22.5	4.96	2.05	2.8	1.7	0.2	0.16	0.06	0.07	0.03
N 19.19		105	66.0	37	-	-	-	-	0.3	0.2	0.07	-	-
N 19.26		166	106	60.8	-	-	-	-	0.4	0.25	0.09	-	-
N 21.09	DN25	166	106	60.8	11.2 ②	5.58	6.8	4.3	0.3	0.2	0.09	0.1	0.06
N 21.13		264	166	92.5	17.4 ②	8.68	11	7.4	0.3	0.25	0.09	0.1	0.06
N 21.18		423	264	158	30.4 ②	-	17 ②	10.5 ②	0.3	0.3	0.1	0.15	0.9
N 21.25		660	423	251	43.4 ②	-	26 ②	16 ②	0.48	0.58	0.1	0.17	0.13
N 41.09	DN40	423	264	158	27.9 ②	13.6	17	11	0.48	0.26	0.1	0.16	0.07
N 41.13		660	423	238	43.4 ②	22.3	28 ②	17.4 ②	0.49	0.29	0.15	0.17	0.07
N 41.19		1057	660	396	79.4 ②	-	47 ②	28.5 ②	0.55	0.35	0.16	0.22	0.1
N 51.10	DN50	1057	660	396	74.4 ②	34.7	43.4	27.9	0.62	0.36	0.17	0.22	0.1
N 51.15		1664	1057	634	118 ②	55.8	68 ②	43.4 ②	0.68	0.44	0.19	0.23	0.1
N 51.21		2642	1664	925	192 ②	-	105 ②	73 ②	0.8	0.61	0.2	0.29	0.15

Table 7-16: Measuring range, imperial

① Accuracy 2.5%

② only possible with guided float

The operating pressure should be at least double the pressure loss for liquids and five times for gases. The indicated pressure losses are valid for water and air at maximum flow rate. Other flow ranges on request. Conversion of other media or operating data is performed using the calculation method in accordance with VDI/VDE directive 3513.

7.4.2 Measuring ranges VA45

Measuring span:	10 : 1	
Flow values:	Values = 100%	Air: +20°C / +68°F, 1.013 bara / 14.7 psia

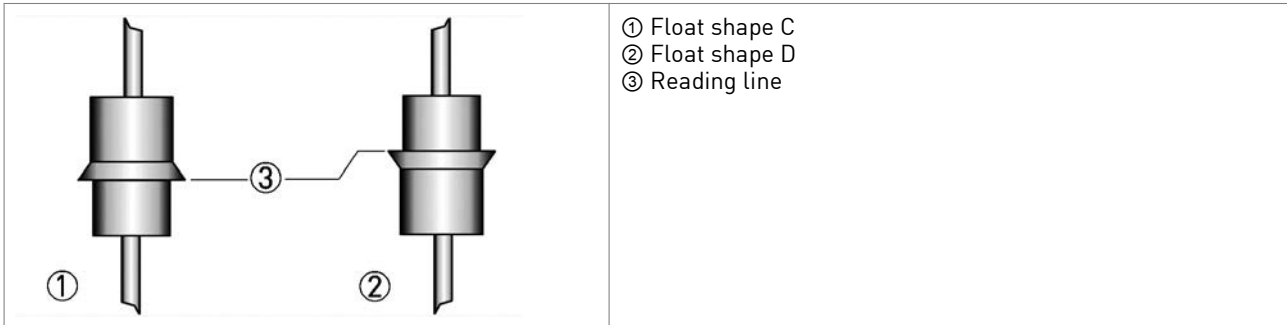


Table 7-17: Float shape and reading line

	Cone no.	Shape	Flow, air		Pressure loss	
			[NI/h]	[SCFH]	[mbar]	[psi]
DN15	N 15.01	C	1500...2300	55.8...85.6	3	0.044
		D	2300...4800	85.6...179	3	0.044
	N 15.02	C	5500...9000	205...335	3	0.044
		D	9000...16000	335...595	3	0.044
DN25	N 25.01	C	3000...5000	112...186	3	0.044
		D	5000...7500	186...279	3	0.044
	N 25.02	C	7500...16500	279...614	3	0.044
		D	16500...25000	614...930	4	0.058
DN40	N 40.01	C	17000...26000	632...967	4	0.058
		D	26000...34000	967...1265	4	0.058
	N 40.02	C	34000...60000	1265...2232	4	0.058
		D	60000...75000	2232...2790	4	0.058

Table 7-18: Measuring ranges



INFORMATION!

The operating pressure should be at least five times the pressure loss for gases. The indicated pressure losses are valid for air at maximum flow rate. Other flow ranges on request. Conversion of other media or operating data (pressure, temperature, density, viscosity) is performed using the calculation method in accordance with VDI/VDE directive 3513.

Reference condition for gas measurements:

Flow measurements for gases are attributed to

NI/h or Nm³/h: Volume flow at standard (norm.) conditions 0°C / +32°F, 1.013 bara / 14.7 psia (DIN 1343)

SCFM or SCFH: Volume flow at standard (std.) conditions +15°C / +59°F, 1.013 bara / 14.7 psia (ISO 13443)







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