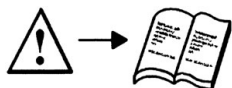
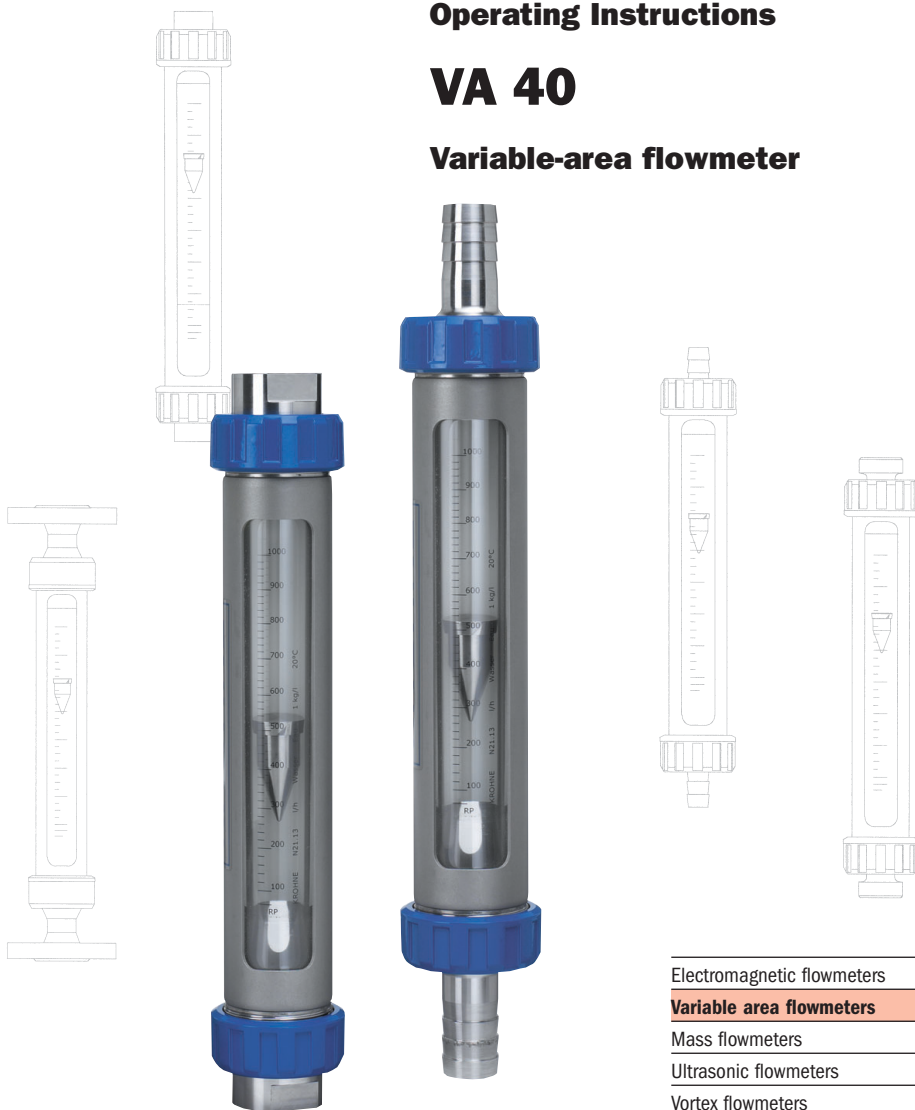


Installation and Operating Instructions

VA 40

Variable-area flowmeter



Electromagnetic flowmeters

Variable area flowmeters

Mass flowmeters

Ultrasonic flowmeters

Vortex flowmeters

Flow controllers

Level measuring instruments

Pressure and temperature

Heat metering

Communications technology

Switches, counters, displays and recorders

Engineering systems & solutions

**For explosion protected devices please refer to
Supplementary Installation and Operating Instructions:**

VA40/... Cat. I12GD

Cat. I13GD

without electr. built-in parts

Id. No. 702271##00

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Product liability and warranty

VA 40 variable-area flowmeters are suitable for measuring the volumetric or mass flow rate of liquids and gases.

Special regulations are applicable to their use in hazardous areas.

Responsibility as to suitability and intended use of these flowmeters rests solely with the operator.

Improper installation or improper operation of the flowmeters may lead to the loss of warranty. In addition, the "General conditions of sale" which form the basis of the purchase contract are applicable.

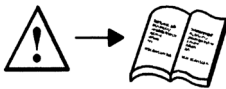
The calculation of the pressurized parts is effected with allowance for corrosion, erosion through abrasion or cavitation.

If the flowmeter needs to be returned to KROHNE Messtechnik, please note the information given at the end of these Instructions.

Scope of delivery

The scope of delivery of the variable area flowmeter in the version respectively ordered includes:

- Installation and operating instructions Ident. No. 702266##00



For explosion protected devices please refer to Supplem. Installation an Operating Instructions:

- VA 40/... Cat. II2GD II3GD without electr. built-in parts Id. No. 702271##00
- Supply without installation accessories

Special certificates (supplied to order only)

- Test certificate to EN 10204
- Hydrostatic test, leak-tightness test
- Cleaning to factory specification
- Calibration report

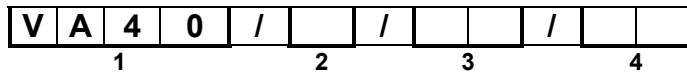
Note!

Connections which can be removed easily, such as threaded connections, screw-on reducers, clamp connections, are not permitted in case of flammable or readily flammable media.

1 General

1.1 Description code

The description code consists of the following elements: ¹⁾



1 : Device series

VA 40 : Flowmeter with tapered glass tube

2 : Type of connection

V : Screw connection

S : Tube socket

F : Flange connection

A : Aseptic connection, conforming to food standards

3 : Material of the connection

R : Stainless steel 1.4404 (316 L)

ST : Steel, electroplated and chromized

PV : Platics PVDF

4 : Limit switches

K1 : One limit switch

K2 : Two limit switches


¹⁾ Places for items not needed may be omitted from the description code

1.2 Marking

The type designation of the complete device is shown on the nameplate reproduced below.

Example:

PS : Max. operating pressure
PTmax. : Pressure tested (optional)
TS : Max. operating temperature
MD : Year of manufacture
Tag.-No. : Measurement point
PED.. : Key see above

VA40/R/K1	KROHNE Duisburg Germany
PS: 10 bar TS: 100°C PTmax: 12 bar	
Tag-No:	PED/G1/3.3/SEP 

SN: 4/123456.001	MD: 2004	AC: P02020598493
SO: 753166 / 020	VG614B1R0101A00000000	
KO No: 101753166		

SN : Serial number
AC : Article code
SO : Sales order / item
V060... : Product configurator code
KO No. : KROHNE order No.

1.3 Key for Pressure Equipment Directive

PED	/		/		/	
1		2	3	4		5

1 Pressure Equipment Directive

2 Fluid

G Gases, liquefied gases, gases dissolved under pressure, vapor and those liquids whose vapor pressure at the maximum permissible temperature is **more than 0.5 bar** above normal atmospheric pressure (1013 mbar).

L Liquids whose vapor pressure at the maximum permissible temperature is **not more than 0.5 bar** above the atmospheric pressure.

3 **Fluid group 1:** Explosive, extremely flammable, highly flammable, flammable (where the maximum allowable temperature is above flashpoint), very toxic, toxic, oxidizing.

Fluid group 2: All the fluids not specified in Group 1

4 Category

3.3 In accordance with Article 3.3 of Directive 97/23/EC

I Category I to 97/23/EG

II Category II to 97/23/EG

III Category III to 97/23/EG

5 Conformity assessment

SEP Solid engineering practice

A Module A Internal production control

A1 Module A1 Internal production control with monitoring of final assessment

H Module H Full quality assurance

The PED code marking is given on the device nameplate.

1.4 Functional principle

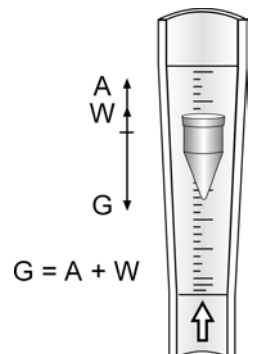
The flowmeter operates in accordance with the float measuring principle.

A glass cone is installed in the measuring unit of VA 40, in which a suitably formed float can move freely up and down.

The flowmeter is inserted into a vertical pipeline and the medium flows through it from bottom to top.

The guided float adjusts itself so that the buoyancy force A acting on it, the wave resistance W and its weight G are in equilibrium ($G = A + W$).

An annular gap which depends on the flow rate results. The height of the float in the measuring unit, which depends on the flow, is displayed on a scale.



2 Installation

2.1 Transport locks

Plastic rods are fitted as transport locks to protect the float during transportation. These need to be removed before start-up:

VA40 Flange version: DN15 / DN25* Remove yellow plastic cap from upper flange and remove fixing rod from the glass.
 DN40 / DN50* Cut through the cable tie and remove cap; remove fixing rod from the glass.

* for sizes in inches, see Point 5 Dimensions and weights

(V) Screw connection: Unscrew union nut and remove yellow plastic cap from the screw connection; remove fixing rod. When assembling the meter, tighten union nuts with strap wrench. Make sure the O-ring is positioned correctly!

(S) Tube socket: same as for screw connection

Aseptic: same as for screw connection

2.2 Preparation of the pipeline

- The variable-area flowmeter must be installed vertically (float measuring principle), direction of flow: upwards.
- Before installing, clean the pipe by blowing or flushing out.
- Connection is made using connectors appropriate to the device version. The pipes should be in axial alignment with the connections on the flowmeter and free of stresses. If necessary, suitably support the pipeline to prevent vibration from being transferred to the flowmeter.



Note:

Devices with flange connection tighten the union nut first before installation.

- Pipes for gas flow need to be dried before the device is installed.
- Recommended: a straight unimpeded inlet run of $\geq 5 \times \text{DN}$ upstream of the device and a straight outlet run of $\geq 3 \times \text{DN}$ downstream of the device.
- Arrange shutoff and control valves downstream of the flowmeter Installation recommendations: see also VDE/VDI Code 3513 Sheet 3.

2.3 Start-up

- Compare the actual operating pressure and the process temperature of the system with the figures given on the nameplate (PS and TS); these should not be exceeded.
- Make sure of materials compatibility.
- **Caution!** : **Open shutoff valve downstream of flowmeter slowly.**
On liquid service: carefully vent the pipeline.
On gas service: increase pressure slowly up to operating pressure.

Caution! : **avoid float impact** (e.g. caused by solenoid valves), as this is likely to damage measuring glass and float.

2.4 Measurement of liquids

Vent the pipeline during start-up.
Open valves slowly to avoid water hammer!

2.5 Measurement of gases

Should the float tend to oscillate, this condition can possibly be rectified by installing a throttle valve or appropriate orifice plate downstream of the flowmeter (Please consult KROHNE)

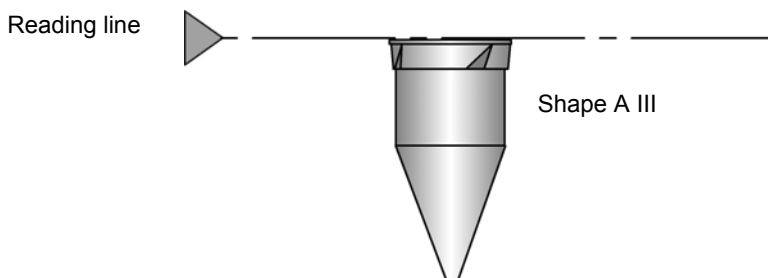
The device should not be subjected to pulsating flows.

Increase pressure slowly up to operating pressure.

Basically, vary the flow rate with the aid of adjusting valves downstream of the device to prevent the float from accelerating up to the upper stop (e.g. when solenoid valves are used) and possibly damaging the measuring section.

2.6 Measured value

The flow value is read off from the top edge of the float.



3 Flow table

Float materials, float shape A III

- 1 Stainless steel 1.4571 (316 Ti), Hastelloy B2 or C4
- 2 PTFE / inlay
- 3 TFM
- 4 Aluminium
- 5 Hard rubber

Reference conditions

Air at 20°C, 1.013 bar abs.
Water at 20°C

100% flow values, turndown ratio 10:1

Product ▶		Water			Air				Max. pressure loss				
Material ▶	Cone Nr.	1 l/h	2 l/h	3 l/h	1 m³/h	3 m³/h	4 m³/h	5 m³/h	1 mbar	2 mbar	3 mbar	4 mbar	5 mbar
Meter size DN inch													
15 ½"	G13.11	0.4	–	–	0.016	–	0.007	–	2	–	–	1	–
	G14.06	0.63	–	–	0.025	–	0.012	–	3	–	–	2	–
	G14.08	1	–	–	0.04	–	0.02	–	4	–	–	3	–
	G15.07	1.6	–	–	0.06	–	0.03	–	4	–	–	3	–
	G15.09	2.5	–	–	0.09	–	0.04	–	5	–	–	4	–
	G15.12	4	–	–	0.14	–	0.06	–	6	–	–	5	–
	G16.08	6.3	–	–	0.2	–	0.1	–	6	–	–	5	–
	G16.12	10	–	–	0.3	–	0.16	–	7	–	–	6	–
	G17.08	16	–	–	0.5	–	0.25	–	7	–	–	6	–
G17.12	25	–	–	0.8	–	0.4	–	8	–	–	7	–	
15 ½"	N18.07	40	25	13	1.5	0.6	0.8	0.5	9	6	2	3	1
	N18.09	63	40	22	2.2	0.95	1.2	0.7	9	7	3	3	2
	N18.13	100	63	35	3.0	1.5	1.8	1.2	9	8	3	4	2
	N19.09	160	100	55	5	2.2	2.8	1.8	13	9	4	5	2
	N19.13	250	160	85	8	3.3	4.5	2.8	16	11	4	5	2
	N19.19	400	250	140	–	–	–	–	21	14	5	7	3
	N19.26	630	400	230	–	–	–	–	27	17	6	10	4
25 1"	N21.09	630	400	230	18	9	11	7	22	14	6	8	3
	N21.13	1000	630	350	28	14	18	12	23	17	6	8	4
	N21.18	1600	1000	600	49*	–	28*	17*	26	25	7	10	6
	N21.25	2500	1600	950	70*	–	42*	26*	33	40	8	12	9
40 1½"	N41.09	1600	1000	600	45	22	28	18	32	18	9	11	5
	N41.13	2500	1600	900	70*	36	45*	28*	34	20	10	12	5
	N41.19	4000	2500	1500	128*	–	76*	46*	38	24	11	15	8
50 2"	N51.10	4000	2500	1500	120	56	70	45	43	25	12	15	7
	N51.15	6300	4000	2400	190*	90	110*	70*	47	30	13	16	7
	N51.21	10000	6300	3500	310*	–	170*	118*	55	42	14	20	10

* only possible with guided float

The operating pressure should be at least twice the pressure loss for liquids, and at least 5 times the pressure loss for gases!

4 Materials

Device connections	
Screw connection / tube socket / Flange connection VA 40... / R	Stainless steel 1.4404 (316 L)
Screw connection VA 40... / N	Steel, electroplated and chromized
Screw connection / tube socket VA 40 ... / K	PVDF
Housing	Stainless steel 1.4404 (316 L) sandblasted, Option: electropolished
Union nut	Aluminium / powder-coated, Option: stainless steel
Measuring cone	Borosilicate glass
Float (also for food use)	Stainless steel 1.4571 (316 Ti), Hastelloy B2 or C4, PTFE/inlay,
(not for food use)	TFM (PTFE), Aluminium, Hard rubber
Float and insert	PVDF (conforming to FDA standards)
Gaskets	NBR (Perbunan), EPDM (FDA approved), FPM (Viton)

5 Technical data

Scale division	flow units or millimetre graduation
Accuracy class to VDI/VDE Code 3513, Sheet 2	1.0
Connections	
Screw connection, inside thread	G $\frac{3}{8}$ " to G 2" ($\frac{1}{2}$ " NPT to 2" NPT)
Tube socket	Dia. 15 mm to 52 mm ($\frac{1}{2}$ " to 2")
Flange connections	DN 15 to DN 50 according to EN 1092 / PN 40 $\frac{1}{2}$ " to 2" acc. ASME 16.5 Class 150 lbs / RF or 300 lbs / RF
Dairy pipe screw connection to DIN 11851 (Tri)-Clamp connection to ISO 2852	SC 15 to SC 50 17.2 to 51 NS (Nominal Size) Other versions on request
Glass measuring cone	Length 300 mm
Overall height	
Type V Screw connection	375 mm
Type S Tube socket	DN 15:400 mm, \geq DN 25:450 mm
Type F Flange connection	425 mm; 500mm available on request
Type A Aseptic	375 mm [ISO 2852: 17.2 DN15 400 mm]
Max. allowable operating pressure PS at TS = 100 °C	DN 15, DN 25 / 10 bar DN 40 / 9 bar DN 50 / 7 bar

Directive 97/23/EC of the Council dated 29 April 1999 concerning transportable pressure equipment (pressure equipment directive) applies. The max. allowable operating pressure PS is calculated for the max. allowable operating temperature TS. Both limit values (PS and TS) are given on the nameplate. As a rule, PS is equivalent to the nominal pressure of the connection.

Test pressure PT

The test pressure is calculated in accordance with the pressure equipment directive (97/23/EC) and AD 2000-HP30 in conformity with the maximum allowable operating pressure and the maximum operating temperature.

6 Medium Temperatures

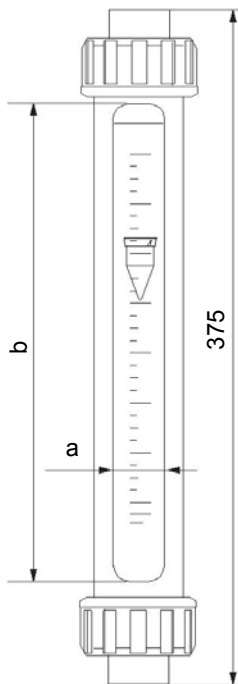
Max. Medium temperatures TS	-20°C to + 100 °C (Standard; other on request) -10°C to + 60 °C [with float made of hard rubber]
------------------------------------	---

Ambient temperatures T_{amb.}	-20°C to + 100°C (Standard; other on request)
--	---

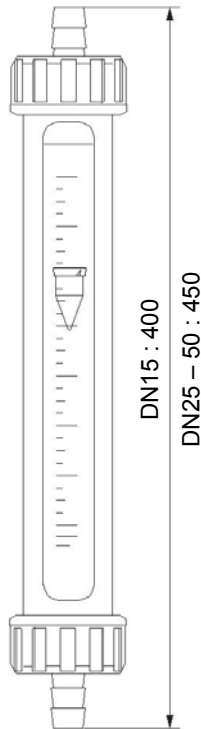
7 Dimensions and weights

Meter size		Connection							Dimensions Window size a x b	Weight	
		Type V Inside thread to		Type S Ø	Type F Flange size to		Type A			Type V, S, A	Type F
DN mm	inch	ISO	ASME 1.20.1	mm	EN	ASME	Screw connect.	Clamp connect.	mm	app. kg	app. kg
15	½"	G ¾" G ½"	½" NPT	15	15	½"	SC 15	17.2	27 x 239	0.5	1.8
25	1"	G ¾" G 1"	1" NPT	28	25	1"	SC 25	25	37 x 239	1.3	3.8
40	1½"	G 1½"	1½" NPT	42	40	1½"	SC 40	40	50 x 235	2.3	6.8
50	2"	G 2"	2" NPT	52	50	2"	SC 50	51	65 x 227	3.6	9.2

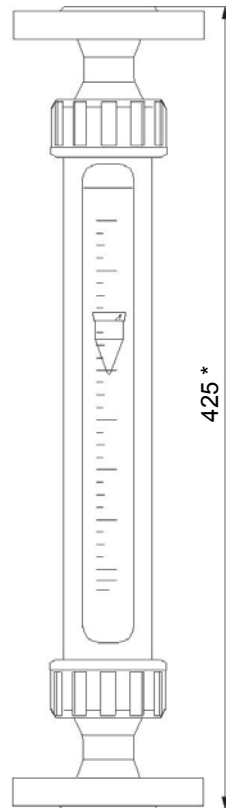
Type V
Screw connection



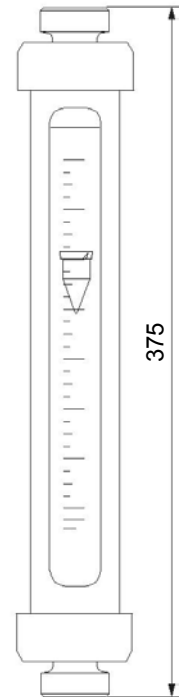
Type S
Tube socket



Type F
Flange



Type A
Aseptic



* Overall length 500 mm in flange version available on request

8 Limit switches

8.1 Limit switches RC10 , RC15, RB15

The flowmeter can be equipped with a maximum of two limit switches

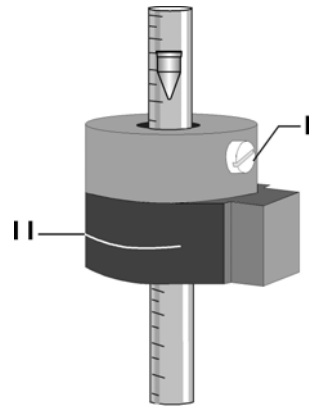
Type	Switching function
RC10-14-N3	bistable, NAMUR
RC15-14-N3	bistable, NAMUR
RC10-14-N0	monostable, NAMUR
RC15-14-N0	monostable, NAMUR
RB15-14-E2	bistable, 3-wire

Function monostable:	Switching pulse at operating point
Function bistable:	Stable changeover from NC to NO contact (and vice versa)

8.1.1 Setting

Slacken plastic screw (I) and move sensor to desired operating point (II). Only slightly tighten screw (I)! (Risk of breaking the glass)

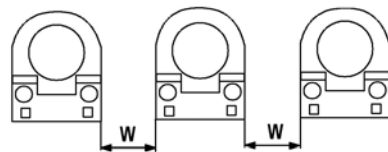
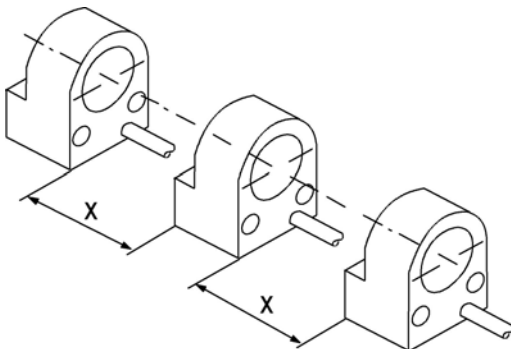
The operating point is, as shown, at approx. half height of the ring. The exact operating point is also dependent on the size of the used float!



8.1.2 Minimum clearance two ring initiators

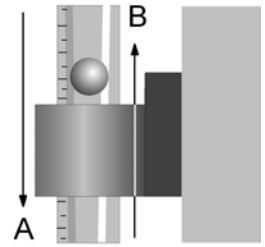
Where two sensors are in one device, and also where devices with ring sensor are arranged close together, minimum clearances must be maintained in order to avoid mutual influence of the switches.

Min. clearance	RC... (2 wire, NAMUR)	RB... (3 wire)
X	16 mm	45 mm
W	6 mm	30 mm



8.1.3 Switching performance

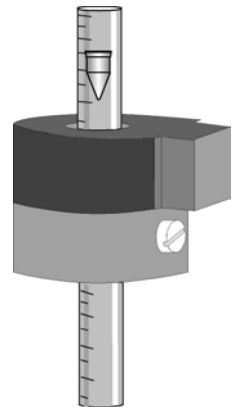
- a) RC 10-14-N0, RC15-14-N0
Ball outside sensor: Signal ≥ 3 mA
Ball inside sensor: Signal ≥ 1 mA
- b) RC 10-14-N3, RC 15-14-N3 (independent of ball position)
 ≥ 3 mA (as transit B)
pre condition: The ball is located outside the sensor.
- c) RB 15-14-E2-Bi (independent of ball position)
 ≤ 1 V (as transit A)
pre condition: The ball is located outside the sensor.



8.1.4 Function

Bistable ring sensors RC 10-14-N3 and RC 15-14-N3 can be changed over from NO to NC:

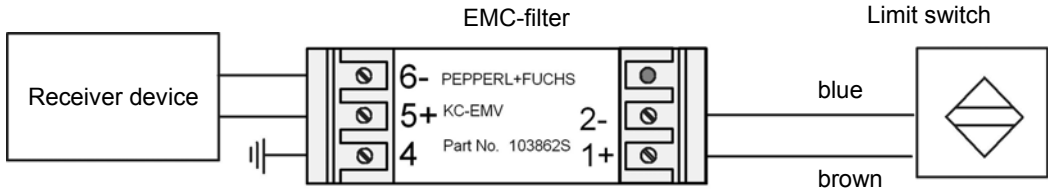
- Remove upper device connection.
- Slacken plastic screw (I) on ring sensor.
- Unscrew upper union nut.
- Lift up and remove connection very carefully.
Depending on an adhesion of the upper sealing ring, the connection may take the measuring glass with it!
- Carefully take the measuring glass out of the housing and the sensor. The ring sensor remains in the housing.
Avoid CANTING (glass breakage!)
- Turn limit switch through 180°.



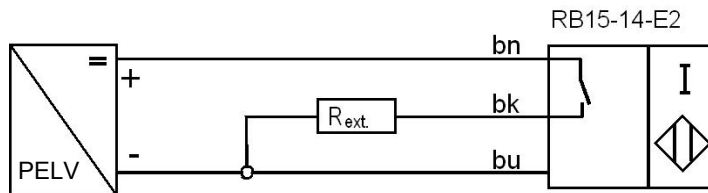
Assemble in reverse order. Make sure sealing ring is seated correctly!

Note: Devices with flange connection tighten the union nut first before installation.

8.1.5 Electrical connection with EMC-filter



Connection wiring 3-wire technology

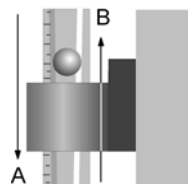


Colour of wire: bn - brown +
bk - black / switch
bu - blue -

8.1.6 Technical data RC10, RC15, RB15

2-wire limit switch

Technology	2-wire technology, DIN EN 50227 (NAMUR)	
Nominal voltage	8 V DC	
Current consumption	RC ... N0	3 mA (ball outside the sensor) 1 mA (ball inside the sensor)
	RC ... N3	1 mA transit A ↓ 3 mA transit B ↑
Connection Protection category to DIN 60529/IEC 529	terminal box M16 x 1,5: line diameter 6 ... 12 mm IP 55	



3-wire limit switch

RB15-14-E2-Bi - bistable, Ø inner diameter 15 mm	
Technology	3-wire technology
Operating voltage U_b	10 V to 30 V
Operating current I_b	0 to 100 mA
Output voltage U_a	1 V transit A ↓ $U_b - 3 V$ transit B ↑ Power up behavior 1 V as transit A ↓
No load current	20 mA

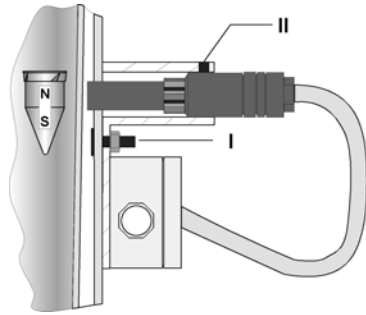
8.2 Limit switch MS14/I

The MS 14/I is fastened to the housing with a support and is adjustable over the full measuring range. Limit switch MS 14/I is a floating, bistable reed contact. It can be operated optionally as an NO or NC contact. Unless specified otherwise, it is supplied by the factory as an NO contact. It can be used for DN 15 to DN 50 meter sizes with cone N 18.07 and higher. The limit switch can also be retrofitted, provided a magnet float is used.

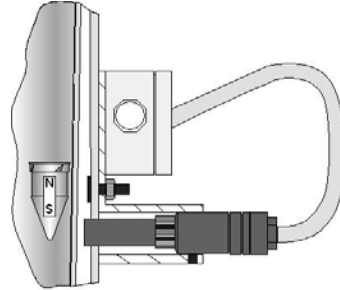
8.2.1 Setting

- Detach support screw (I).
- Set operating point.
- Tighten support screw (I).

The distance between limit switch and housing is factory set with clamping screw (II) so that the limit switch comes into contact with the glass cone at the highest possible operating point.



To be able to reach the lower range of the scale, turn the sensor with support through 180°



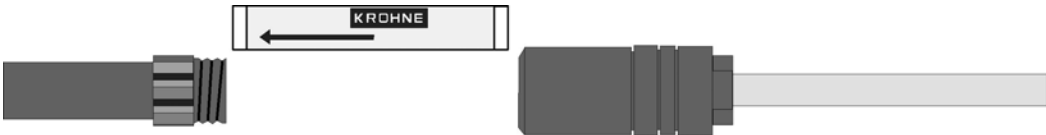
8.2.2 Contact function

Two contact functions are available for remote transmission.

Closing, at decreasing flow. Arrow on reed cartridge points away from measuring glass.

Closing, at increasing flow. Arrow on reed cartridge points towards measuring glass.

The contact function can be changed by changing over the reed cartridge screwed into the cartridge case:



8.2.3 Electrical connection

For the electrical connection, first unscrew the housing cover. Because the reed contact is of the floating type, the terminals are not labeled. As power source, a functional extra-low voltage with safety separation in conformity with (PELV) VDE 0100 Part 410 or an isolation switching amplifier is needed.

8.2.4 Technical data MS 14/I

Contact type	bistable reed contact, rearrangeable as NO or NC contact
Switching reproducibility	< 2% of full-scale range
Contact rating	12 V A
max. switching voltage	30 Vdc
max. switching current	0.5 A
Type of protection	to EN 60529 / IEC 529 IP 44

8.3 Limit switch TG 21

The TG 21 includes an inductive slot sensor SC3,5-N0 with bistable switching performance.

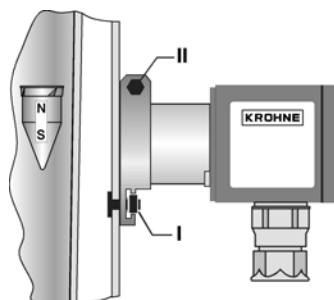
The slot sensor is actuated by the dipping action of an aluminium vane. The magnet on the dipping vane is moved by the magnet in the float and follows its movement.

A magnet float is required.

8.3.1 Setting

- Detach support screw (I).
- Set switching point.
- Refit screw (I).

The distance between limit switch and housing is factory set with the clamping screw (II) to approx. 1 mm.



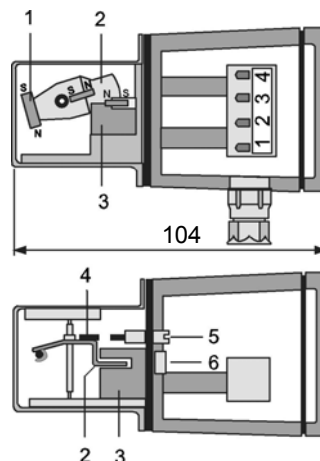
8.3.2 Contact function

The contact function can be changed over from NO to NC by shifting the position of the slot sensor (3):

After detaching screw (6), the slot sensor (3) can be shifted into the other end position.

If vibrations can initiate a switching operation not in keeping with the function, use the grub screw (5) to adjust the force of the frictional connection between adjusting magnet and counter-magnet (4) on the dipping vane (2).

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



8.3.3 Electrical connection

For the electrical connection, first unscrew the housing cover.

Terminal 1 + Terminal 2 -

8.3.4 Technical data

Nominal voltage	8V DC
Current consumption	
active area clear	3 mA
active area obscured	1 mA
Switching hysteresis	4 - 5 mm
max. perm. funct. impact energy	0,5 Joule

9 Maintenance

Within the scope of routine maintenance of the system and pipelines, the flowmeter should also be inspected for signs of soiling, corrosive attack and mechanical wear or damage to the measuring glass. We advise that inspections be carried out at least once a year.

For VA 40 (aseptic): a strap wrench is recommended to open the flowmeter.

Note: Devices with flange connection tighten the union nut first before installation.

Note:

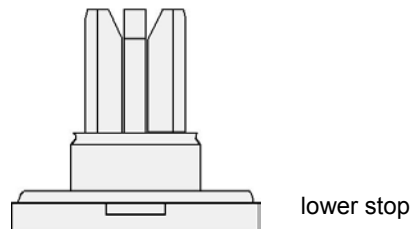
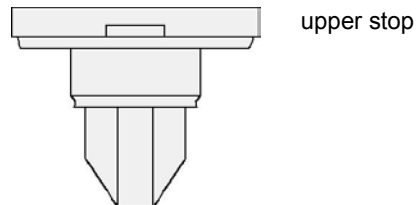
Pressurized pipes to be depressurized before removing the device.

Devices used for measurement of aggressive media: take appropriate safety precautions regarding residual liquid in the measuring section.

Always use new gaskets when reinstalling the flowmeter in the pipeline. Aseptic version: when replacing gaskets, use materials conforming to FDA standards e.g. EPDM.

Cleaning of surfaces (e.g. viewing window):
avoid electrostatic charges!

DN15 devices: due to their design, the upper and lower float stops cannot be reversed (see sketch)



Returning a device for testing or repair to KROHNE

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems. 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 our personnel, KROHNE may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.

This means that KROHNE can only service this device if it is accompanied by the following certificate confirming that the device is safe to handle.

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

- to check and ensure, if necessary by rinsing or neutralizing, 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.

We cannot service this device unless accompanied by such a certificate.

SPECIMEN certificate

Company: Address:

Department: Name:

Tel. No.: Fax No.:

The enclosed device

Type:

KROHNE Order No. or Series No.:

has been operated with the following liquid:

Because this liquid is water-hazardous toxic caustic flammable

we have checked that all cavities in the instrument are free from such substances /

flushed out and neutralized all cavities in the device

We confirm that there is no risk to humans or environment through any residual liquid contained in this device.

Date: Signature:

Company stamp: