



Kirchner und Tochter
Durchflussmesstechnik seit 1951



Assembly and operating Instructions

Variable Area Flow Meters

SGM

SGM-PVC

SGM-PP

SGM-PVDF



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1 Foreword

These Installation and Operating Instructions are applicable to devices of Series SGM. Please follow all instructions and information given for installation, operation, inspection and maintenance. The Instructions form a component part of the device, and should be kept in an appropriate place accessible to the personnel in the vicinity of the location. Where various plant components are operated together, the operating instructions pertaining to the other devices should also be observed.

2 Safety

2.1 Symbol and meaning



Safety notice

This symbol is placed against all directions/information relating to occupational health and safety in these Installation and Operating Instructions and draws attention to danger to life and limb. Such notices should be strictly observed.

2.2 General safety directions and exemption from liability

This document contains basic instructions for the installation, operation, inspection and maintenance of the variable area flow meter. Non-observance of these directions can lead to hazardous situations for man and beast and also to damage to property, for which Kirchner und Tochter disclaims all liability.

The operator is required to rule out potentially hazardous situations through voltage and released media energy.

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Variable area flow meters

2.3 Intended use

The SGM devices are designed and intended for measuring the flow of compressible and incompressible fluids. Installation in the pipeline may only be carried out according to these instructions. Select the SGM device model on the basis of the nominal diameter and nominal pressure at the site and also the kind of fluid product concerned; limit values are specified in the Section "Technical data" and should not be exceeded. A version for horizontal installation is available optionally. Only devices that bear the "Ex" marking may be operated in hazardous areas.

2.4 Information for Operator and operating personnel

Authorized installation, operating, inspection and maintenance personnel should be suitably qualified for the jobs assigned to them and should receive appropriate training and instruction. All persons charged with assembly, mounting, operation, inspection and maintenance duties must have read and understood the operating instructions. Gaskets in contact with the fluid product must be replaced after all maintenance and repair work.

2.5 Regulations and guidelines

In addition to the directions given in these Installation and Operating Instructions, observe the regulations, guidelines and standards, such as DIN EN and for specific applications, the codes of practice issued by DVGW (gas and water) and VdS (underwriters) or the equivalent national codes and applicable national accident prevention regulations.

2.6 Notice as required by the hazardous materials directive

In accordance with the law concerning handling of waste (critical waste) and the hazardous materials directive (general duty to protect), we would point out that all flow meters returned to Kirchner und Tochter for repair are required to be free from any and all hazardous substances (alkaline solutions, acids, solvents etc.).



Make sure that devices are thoroughly rinsed out to neutralize hazardous substances.



3 Transport and storage

Always use the original packing for transport, handling and storage. Protect the device against rough handling, coarse impact, jolts etc.

4 General

4.1 Declarations of conformity with EU Directives

The variable area flow meter SGM meets all requirements of the EU Directives applicable to the product:

- EMC-Directive (2014/30/EU)
 - EN 61326-2-3:2013
 - EN 61326-2-5:2013
- ATEX (2014/34/EU)
 - EN 60079-0:2012
 - EN 60079-1:2007
 - EN 60079-11:2012
 - EN 60079-15:2010
 - EN 60079-31:2014
 - EN 13463-1:2009
 - EN 13463-5:2011
- PED (2014/68/EU)
 - EN 13445-2
 - EN 3834-2
 - AD2000 instruction sheet series B



The device types SGM-PVC, SGM-PP and SGM-PVDF may not be used in hazardous areas!

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Variable area flow meters

4.2 Type series

Version	Description
SGM	all-metal device
SGM-PVC	polypropylene device body
SGM-PP	polyvinyl chloride device body
SGM-PVDF	polyvinylidene fluoride device body
SGM-...-EM	with electrical signal output
SGM-...-EMZ	with electrical signal output and totalizer
SGM-...-IK1	with one inductive switch (SC3,5-N0-Y)
SGM-...-IK2	with two inductive switches (SC3,5-N0-Y)
SGM-...-IKS1	with one electronic switch (SB3,5-E2)
SGM-...-IKS2	with two electronic switches (SB3,5-E2)
SGM-...-IK1-EM	with one inductive switch and with electrical signal output
SGM-...-IK2-EM	with two inductive switches and with electrical signal output
SGM-...-IKS1-EM	with one electronic switch and with electrical signal output
SGM-...-IKS2-EM	with two electronic switches and with electrical signal output
SGM Ex	all-metal device, explosion-proof design
SGM-EM Ex	with electrical signal output, explosion-proof design
SGM-IK1 Ex	with one inductive switch, explosion-proof design
SGM-IK2 Ex	with two inductive switches, explosion-proof design
SGM-EMZ Ex	with electrical signal output and totalizer, explosion-proof design
SGM-IK1-EM Ex	with one inductive switch and with electrical signal output, explosion-proof design
SGM-IK2-EM Ex	with two inductive switches and with electrical signal output, explosion-proof design



4.3 Description

Indicator of modular design

A module rack in the indicator accommodates all electrical options and the scale plate. The modules pertaining to the electrical options (see Figure) and the scale plate are inserted in the rack using the plug-in technique.

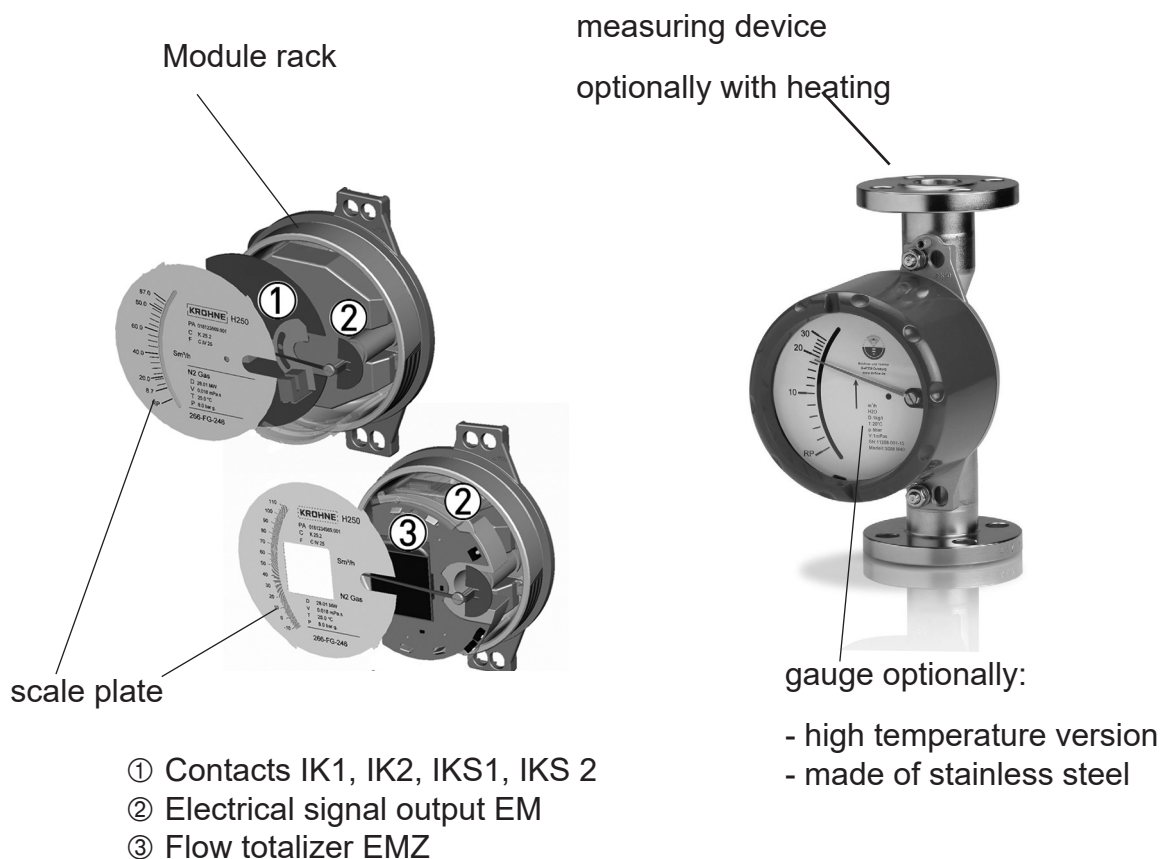
The modules can be replaced or retrofitted without interrupting the process and without having to remove the pointer.

If actual temperatures are higher than the max. allowable process temperatures for the standard version, the indicator can be (subsequently) adapted to suit the new operating conditions by using an adapter (HT version).

Measuring parts made of various materials and fitted with different liners are available for the process media.

The flow meter can be ordered with magnetic filter and/or float damper, and these can also be retrofitted. In the case of variable or pulsating flows, an eddy-current brake can additionally be installed to dampen the pointer.

An indicator part of stainless steel is available on request.





5 Installation

5.1 Preparation of the pipeline

- Check the direction of flow in the pipe at the installation point of the flow meter. VA flow meters are as a rule only suitable for vertical installation, with the direction of flow being from bottom to top. For all other installation situations appropriate pipe bends need to be fitted in the existing pipeline to ensure vertical flow through the device from below. Straight unimpeded pipe runs should have a length equal to 5x DN upstream and 3x DN downstream of the installation location. Any control equipment, particularly in the case of gaseous media, should always be installed downstream of the flow meter. Refer also to Guideline VDE/VDI 3513 Sheet 3.
- The SGM type series can as a special version optionally be constructed for horizontal installation (except for SGM-PVC/PP/PVDF).
- If necessary, support the ends of the pipeline to prevent vibration from being transmitted to the flow meter.
- Clean by blowing or flushing out the pipes leading to the device before connecting up.
- Prepare the installation point before starting to mount the flow meter. Make sure the sealing faces are correctly spaced apart and in true alignment.
- On no account should the VA flow meter be used to pull the ends of the pipeline together (stress-free installation!).



5.2 Installation in the pipeline

1. Check that the device is free from solid foreign bodies.
2. Use bolts and gaskets (to be provided by customer) in keeping with the pressure rating of the connection flanges and the operating pressure.
3. The inside diameter of the flanges differs from standard dimensions.
Flange gaskets standard DIN EN 1514-1 can be applied without restriction.
4. Align gaskets, tighten nuts with the torques relevant to the appropriate pressure rating.

For measuring parts with PTFE liner and for measuring parts with ceramic liner and PTFE sealing face, tighten the flange bolts with the following max. torques:

Nominal size to ...				stud bolts			Max. torque			
EN 1092-1		ANSI B 16.5		EN	ANSI		EN		ANSI 150 lbs	
DN	PN	Zoll	lbs		150 lbs	300 lbs	Nm	ft lbf	Nm	ft. lbf
15	40	½"	150/300	4 x M 12	4 x ½"	4 x ½"	9.8	7.1	5.2	3.8
25	40	1"	150/300	4 x M 12	4 x ½"	4 x 5/8"	21	15	10	7.2
50	40	2"	150/300	4 x M 16	4 x 5/8"	8 x 5/8"	57	41	41	30
80	16	3"	150/300	8 x M 16	4 x 5/8"	8 x ¾"	47	34	70	51
100	16	4"	150/300	8 x M 16	8 x 5/8"	8 x ¾"	67	36	50	36

The tightening torque does not apply to devices made of PVC / PP / PVDF.



SGM

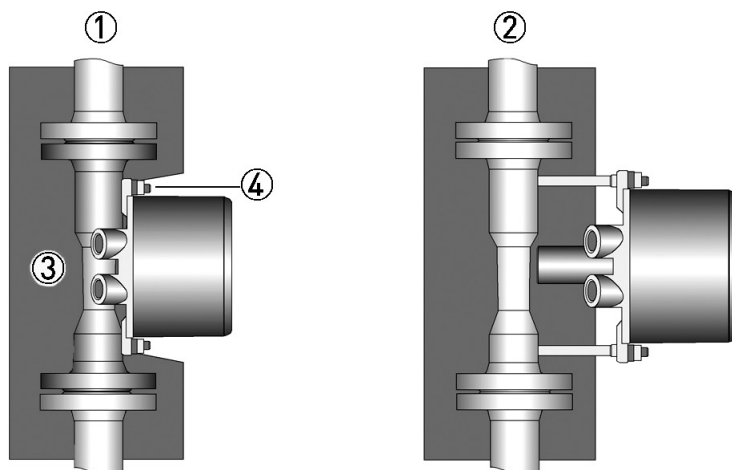
Variable area flow meters

5.3 Heat insulation

CAUTION!

The indicator housing may not be heat-insulated.

The heat insulation ③ may only reach to the housing mounting ④.

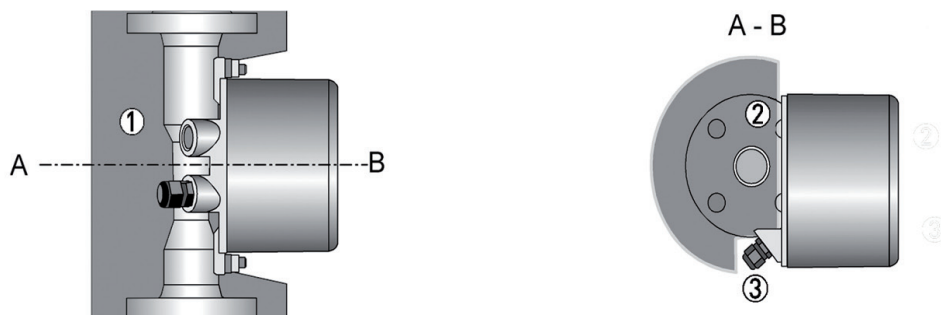


- ① Standard indicator M40
- ② M40 indicator with HT extension
- ③ Insulation
- ④ Fastening screw

CAUTION!

The heat insulation ① may only reach to the rear of the housing ②.

The area around the cable entries ③ must be freely accessible.





6 Start-up

A minimum operating pressure (inlet pressure) is necessary for operation of the device.

Process medium	Ratio	
	pressure drop	operating pressure
Liquids	1	2
Gases (without damper)	1	5
Gases (with damper)	1	2

The device must be properly installed before it is started up:

1. Test the device connections.
2. To set the flow: pressurize the pipes by slowly opening the shutoff valves. On liquid service, carefully evacuate the pipeline.
3. Check that all components are leak-tight and, if necessary, retighten threaded joints or screw connections.

Applies to gases in particular:

Avoid pulsation of the medium.

- Basically, vary the flow with the aid of adjusting valves so that the float is not subjected to pressure surges (e.g. from solenoid valves), otherwise the measuring part could sustain damage.
- Devices for flowmetering of gases can be equipped with a gas damping system to avoid possible float oscillation due to compression.
- Should the float nevertheless tend to oscillate, this can be remedied by installing a throttle valve or suitable aperture plate downstream of the device, see Guideline VDE/VDI 3513 Sheet 3.
- A float damping system is recommended for gas measurements.



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Variable area flow meters

6.1 Measuring ranges

6.1.1 Version: stainless steel

Size	Stainless steel float							
	Water			Pressure drop [mbar]	Air STP ¹⁾			Pressure drop [mbar]
15 (½")	2,5	- 25	l/h	26	65	- 650	l/h	21
	4	- 40	l/h	26	100	- 100	l/h	21
	6,3	- 63	l/h	26	150	- 1500	l/h	21
	10	- 100	l/h	26	220	- 2200	l/h	21
	16	- 160	l/h	26	360	- 3600	l/h	21
	25	- 250	l/h	26	550	- 5500	l/h	21
	40	- 400	l/h	28	1	- 10	m³/h	21
	63	- 630	l/h	32	1,4	- 14	m³/h	22
	70	- 700	l/h	38	1,8	- 18	m³/h	38
	100	-1000	l/h	50	2,8	- 28	m³/h	50
	160	-1600	l/h	85	5	- 50	m³/h	85
25 (1")	63	- 630	l/h	32	1,4	- 14	m³/h	24
	100	-1000	l/h	33	2,3	- 23	m³/h	24
	160	-1600	l/h	34	3,5	- 35	m³/h	25
	250	-2500	l/h	38	5	- 50	m³/h	26
	400	-4000	l/h	45	9,5	- 95	m³/h	30
	630	-6300	l/h	103 ²⁾	11	- 110	m³/h	78
					18	- 180	m³/h	103 ²⁾
50 (2")	630	-6300	l/h	74	8	- 80	m³/h	13
	1	- 10	m³/h	77	11	- 110	m³/h	13
	1,6	- 16	m³/h	84	15	- 150	m³/h	13
	2,5	- 25	m³/h	104	23	- 230	m³/h	60
					35	- 350	m³/h	69
					70	- 700	m³/h	104
80 (3")	2,5	- 25	m³/h	68	35	- 350	m³/h	16
	4	- 40	m³/h	89	40	- 400	m³/h	16
	6,4	- 64	m³/h	125	100	- 1000	m³/h	95
					180	- 1800	m³/h	125
100 (4")	6,3	- 63	m³/h	120				
	10	- 100	m³/h	220				

Devices used for gas measurement: float damping system recommended!

¹⁾ at STP (0°C and 1.013 bar abs.)

²⁾ 300mbar with damping system



6.1.2 Version PTFE

Size	Water				Pressure drop [mbar]	Air STP ¹⁾				Pressure drop [mbar]
15 / ½"	2,5	-	25	l/h	65	70	-	700	l/h	65
	4	-	40	l/h	66	110	-	1100	l/h	66
	6,3	-	63	l/h	66	180	-	1800	l/h	66
	10	-	100	l/h	68	280	-	2800	l/h	68
	16	-	160	l/h	72	480	-	4800	l/h	72
	25	-	250	l/h	86	700	-	7000	l/h	86
	40	-	400	l/h	111	1000	-	10000	l/h	111
25 / 1"	63	-	630	l/h	70	1,6	-	16 m³/h		70
	100	-	1000	l/h	80	3	-	30 m³/h		80
	160	-	1600	l/h	108	4,5	-	45 m³/h		108
	250	-	2500	l/h	158	7	-	70 m³/h		158
	400	-	4000	l/h	290	12	-	120 m³/h		194
50 / 2"	400	-	4000	l/h	81	11	-	110 m³/h		81
	630	-	6300	l/h	110	18	-	180 m³/h		110
	1	-	10	m³/h	170	25	-	250 m³/h		170
80 / 3"	1,6	-	16	m³/h	81					
	2,5	-	25	m³/h	95					
100 / 4"	4	-	40	m³/h	100					

Devices used for gas measurement: float damping system recommended!

¹⁾ at STP (0°C and 1.013 bar abs.)

6.1.3 Version ceramics

Size	Water				Pressure drop [mbar]	Air STP ¹⁾				Pressure drop [mbar]
15 / ½"	3	-	30	l/h	62					
	5	-	50	l/h	64	180	-	1800	l/h	64
	7	-	70	l/h	66	240	-	2400	l/h	66
	13	-	130	l/h	68	400	-	4000	l/h	68
	20	-	200	l/h	70	650	-	6500	l/h	70
	25	-	250	l/h	72	900	-	9000	l/h	72
	25	-	250	l/h	72	900	-	9000	l/h	72
25 / 1"	50	-	500	l/h	55	1,8	-	18 m³/h		55
	70	-	700	l/h	60	2,2	-	22 m³/h		60
	110	-	1100	l/h	70	3	-	30 m³/h		70
	160	-	1600	l/h	82	5	-	50 m³/h		82
	250	-	2500	l/h	100	7,5	-	75 m³/h		100
50 / 2"	450	-	4500	l/h	70	14	-	140 m³/h		70
	630	-	6300	l/h	80	20	-	200 m³/h		80
	1,1	-	11	m³/h	110	35	-	350 m³/h		110
80 / 3"	1,6	-	16	m³/h	70					
	2,5	-	25	m³/h	85					

Devices used for gas measurement: float damping system recommended!

¹⁾ at STP (0°C and 1.013 bar abs.)

**6.1.4 Version PVC, PP resp. PVDF**

Size	Water			
25 (1")	0,25	-	2,5	m³/h
50 (2")	1	-	10	m³/h
65 (2 ½")	1,6	-	16	m³/h
80 (3")	3	-	30	m³/h
100 (4")	4,5	-	45	m³/h

Specifications serve as an overview. Exact measuring ranges and measuring ranges for air or gas are available on request.



6.2 Materials

Version	Measuring tube/float	Temperature	Ambient temperature
SGM / VA	Stainless steel 1.4404	-70 ... +300 °C	-40 ... +120 °C
SGM / C4	Hastelloy C4 2.4610	-70 ... +300 °C	-40 ... +120 °C
SGM-PVC	Polyvinyl chloride	0 ... + 40 °C	0 ... + 40 °C
SGM-PP	Polypropylene	0 ... + 80 °C	0 ... + 70 °C
SGM-PVDF	Polyvinylidene fluoride	0 ... +100 °C	0 ... + 70 °C
SGM / PTFE	PTFE ¹⁾ /PTFE	-70 ... + 70 °C	-40 ... + 70 °C
SGM / PTFE / K	PTFE ¹⁾ / ceramics	-70 ... +150 °C	-40 ... + 70 °C
SGM / TFM / K	TFM ¹⁾ / ceramics	-70 ... +250 °C	-40 ... +120 °C
Indicator part	Pointer	Scale	Pane
aluminium, painted	aluminium, painted	aluminium, coated	float glass

¹⁾ Measuring tube of stainless steel (1.4404) with liner

6.3 Technical data SGM

Accuracy class	
Standard (VA/C4)	1,6 acc. to VDI/VDE 3513 Side. 2
alternative (PTFE/ceramics)	2,5 acc. to VDI/VDE 3513 Side. 2
SGM-PVC / PP / PVDF	2,5 acc. to VDI/VDE 3513 Side. 2 (1,6 on request)
Indicator part	
Scale	in physical units e.g.: l/h, m³/h
Scale length	90 mm
Turndown ratio	1:10
Type of protection, indicator part	IP 67, NEMA 4X
Allowable working pressure	
DN 15, DN 25, DN 50	PN 40
DN 80, DN 100	PN 16
SGM-PVC / PP / PVDF	PN 16
Connections	
Flanges	Flanges to DIN EN 1092-1, optional: ANSI B 16.5, JIS (other on request)
screw connection	optional: to ISO 228, DIN 11851

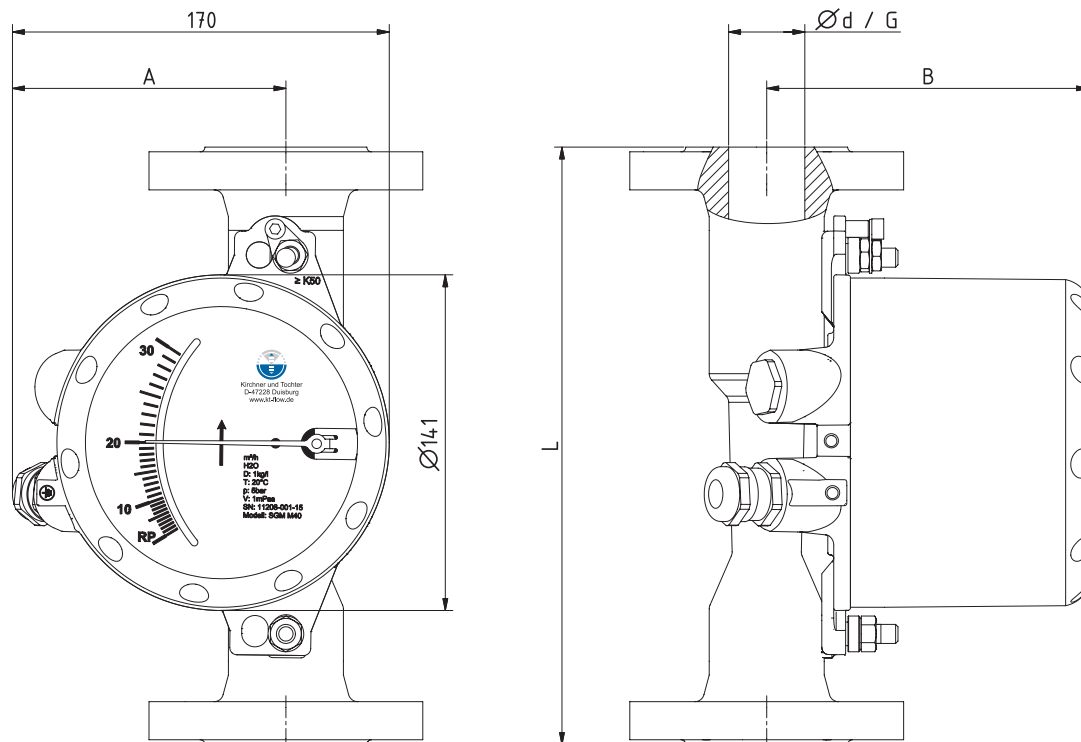
Electrical data and limit values are specified in the **chapter. 7**



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Variable area flow meters

6.4 Dimensions and weights



6.4.1 Version: stainless steel with flanged connection

DN	PN	Dim. [mm]				Weight [kg]	
		L	A	B	d	stainless steel	ceramics / PTFE
15	40	250	104	114	20	3,5	3,5
25	40	250	104	127	32	5	5
50	40	250	117	139	65	8,2	10
80	16	250	117	155	89	12,2	13
100 ¹⁾	16	250	117	164	114	14	15

¹⁾ PTFE only

Overall length for devices with female thread acc. to ISO 228: 300 mm;
acc. to ANSI B 16.5 (from 3" / 300lbs): 300 mm

Other connections on request

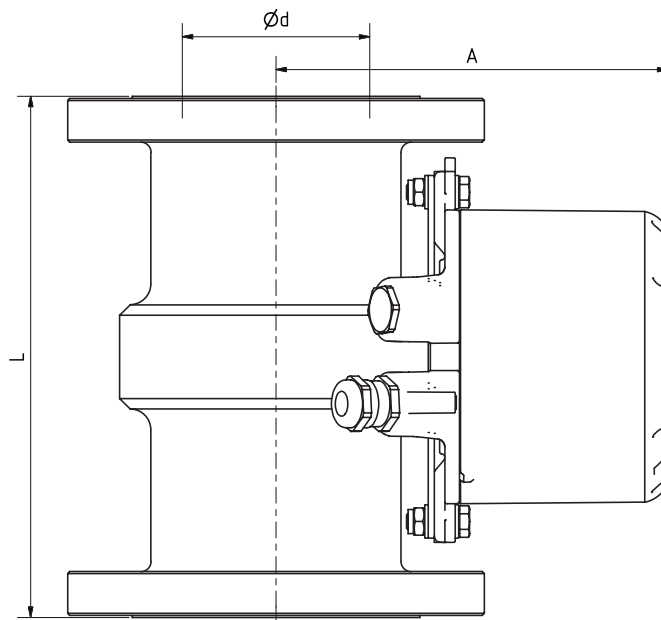
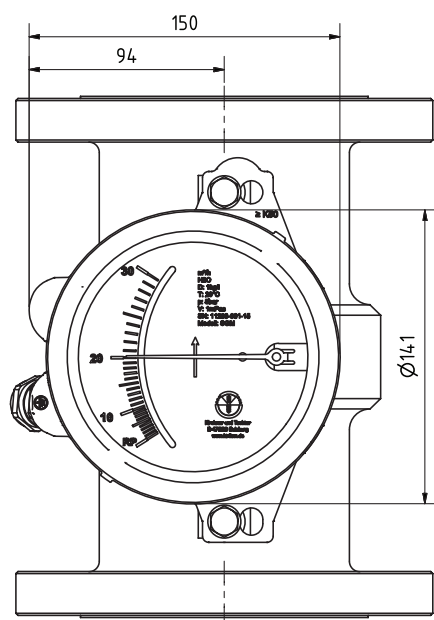


6.4.2 Version PTFE / ceramics with flanged connection

DN	G	Dimensions [mm]				Weight [kg]
		L	A	B	d	
15	G ½	300	104	114	20	3,5
15	½" NPT	300	104	114	20	3,5
15	¾" NPT	300	104	114	20	3,5
15	G 1	300	104	114	20	3,5
25	1" NPT	300	104	127	32	5
25	G 1	300	104	127	32	5

Other connections on request

6.4.3 Versions SGM-PVC, SGM-PP, SGM-PVDF with flanged connection



DN	PN	Dimensions [mm]			Weight [kg]		
		L	A	d	PVC	PP	PVDF
25	16	250	158	40	2	1,8	2,4
50	16	250	171	60	3,2	2,8	4,1
65	10	250	185	75	4	3,6	5,2
80	10	250	188	90	4,9	4,2	6,4
100	10	250	200	114	5,6	4,8	7,7

**SGM**

Variable area flow meters

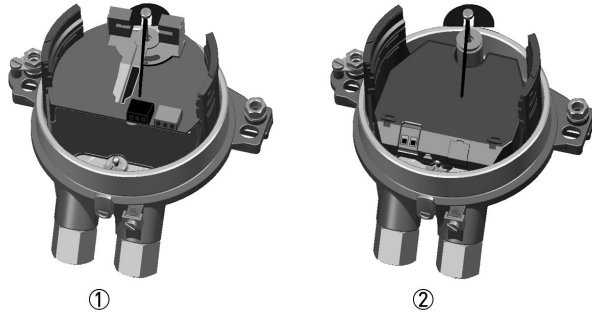
7 Plug-in contact unit IK1, IK2, IKS1, IKS2

INFO:

KFS-M40-IK/IKS and
KFS-EM may be combined!

Indicator M40:

- ① contact unit IK/IKS
- ② EM current output
4 ... 20 mA



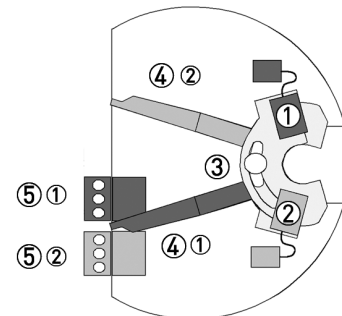
The VA flow meter SGM can be equipped with a maximum of two electronic contacts. The contact operates with a slot type initiator which is actuated inductively by the half-round metal vane on the measuring pointer. The switching points are set by means of a contact pointer, the position of the contact pointer at the same time serving to visually indicate the set limit value.

Contact types:

SC3,5-N0-Y 2-wire technology (NAMUR)

SB3.5-E2 3-wire technology

- ① MIN limit contact
- ② MAX limit contact
- ③ Arretierungsschraube
- ④ contact pointer
- ⑤ terminal socket



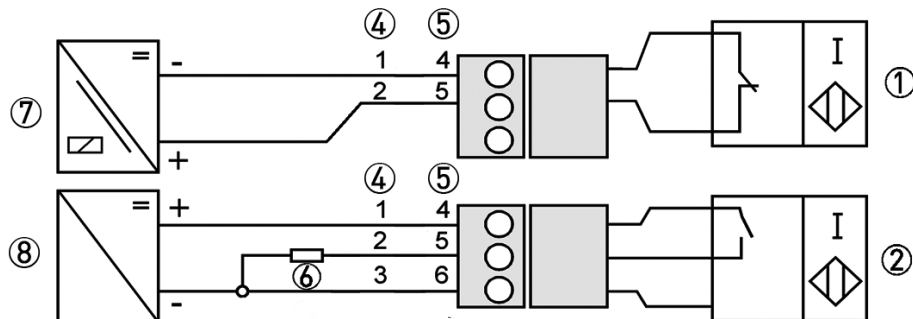
7.1 Electrical connection

Remove the housing cover of the indicator part to connect the plug-in contact unit. The terminals ⑤ are of the plug-in type and can be detached for connecting the cables.

The built-in contact types are specified on the indicator nameplate.

SC3,5-N0-Y limit contacts in 2-wire technology are connected in conformity with DIN EN 50227 (NAMUR).

SB3.5-E2 limit contacts in 3-wire technology require a supply power of 10 to 30 V. They may be connectet directly to a SPS-Control.



- ① 2-wire limit switch SC3,5-NO-Y NAMUR
- ② 3-wire limit switch SB3,5-E2
- ④ Terminal connection MIN contact
- ⑤ Terminal connection MAX contact
- ⑥ 3-wire load
- ⑦ NAMUR isolated switching amplifier
- ⑧ 3-wire power supply

Electrical connection of limit contact in 2-wire technology Terminal assignment for SC3,5-NO-Y

Contact	MIN			MAX		
Plug colour	black			grey		
Labelling	1	2	3	4	5	6
2-wire technology	-	+	×	-	+	×

Electrical connection of limit contact in 3-wire technology Terminal assignment for SB3,5-E2

Contact	MIN			MAX		
Plug colour	black			grey		
Labelling	1	2	3	4	5	6
3-wire technology	+	↗	-	+	↗	×



SGM

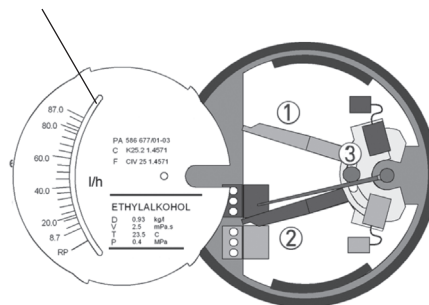
Variable area flow meters

7.2 Setting the limit Value

Setting is made directly via the contact pointer ① and ②:

1. Unscrew housing cover
2. Move scale to the side
3. Slightly loosen locking screw ③
4. Slide scale back up to point where it snaps into place
5. Set contact pointer ① & ② to the desired switching point.
6. After setting, the pointer should be tightened down again with locking screw ③.
7. Screw the housing cover back on

Scale opening



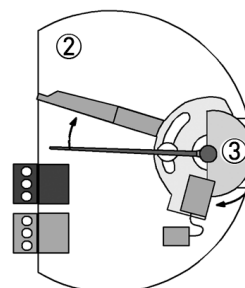
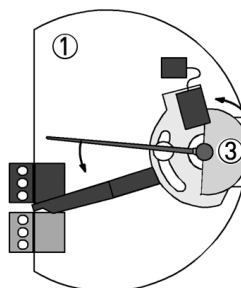
7.3 Switching contact definition

An alarm is generated when the pointer vane ① dips into the slot. When the pointer vane is outside the slot type initiator, a wire break will also cause an alarm to be initiated.

- ① MIN – Contact
- ② MAX – Contact (optional)
- ③ pointer and pointer vane

NOTE:

No wire break identification by 3-wire limit switch SB3,5-E2!

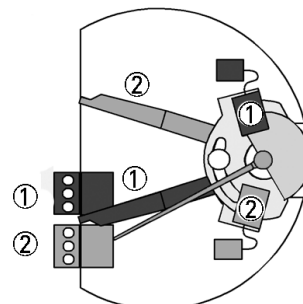


7.4 Definition MINMIN - MAXMAX

- ① MIN 2 Contact or MAX 1 Contact
- ② MIN 1 Contact or MAX 2 Contact

Current consumption in the shown position

Contact	Type	Current
MIN 1	NAMUR	≤ 1 mA
MIN 2	NAMUR	≤ 1 mA
MAX 1	NAMUR	≥ 3 mA
MAX 2	NAMUR	≥ 3 mA





7.5 Technical data

2-wire SC3,5-N0-Y	
Switching element function	NAMUR NC (normally closed)
Nominal voltage U_o	8 V
Current consumption:	
Pointer vane not sensed	≥ 3 mA
Pointer vane sensed	≤ 1 mA
Ambient temperature	-25 ... +100 °C
EMV according to	NE 21
SIL according to	IEC 61508
Approval certificate	PTB 99 ATEX 2219X only with isolation switching amplifier
3-wire SB3,5-E2	
Switching element function	PNP NO (normally open)
Nominal voltage U_o	10 ... 30 V DC
Pointer vane not sensed	$\leq 0,3$ V DC
Pointer vane sensed	$U_B = -3$ V DC
Ambient temperature	-25 ... +70 °C
Continuous current	max. 100 mA
No load current I_o	≤ 15 mA
EMV according to	EN 60947-5-2

degree of protection (EN 60529/IEC 529) IP 67

7.6 Electrical data

Built-in equipment	Identification data				
	U_i [V]	I_i [mA]	P_i [mW]*	C_i [nF]	L_i [uH]
SC3,5-N0-Y	≤ 16	≤ 25	≤ 64	≤ 150	≤ 150
	≤ 16	≤ 52	≤ 169	≤ 150	≤ 150
SJ3,5-SN	≤ 16	≤ 25	≤ 64	≤ 30	≤ 100

* dependent on the isolation switching amplifier used

Operation of the SC3,5-N0-Y contact requires the use of an isolation switching amplifier, e.g. Pepperl + Fuchs Series KF .. -SR2 ...



8 Electrical signal output SGM-EM

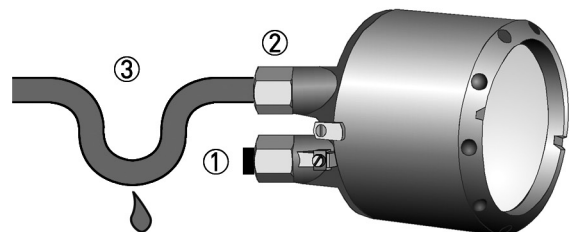
The indicator part of the SGM-EM with the ESK4 module supplies a current of 4 to 20 mA in two-wire connection that is proportional to the instantaneous flow rate. Transmission is force-free and hysteresis-free. The ESK4 has been factory-calibrated on the basis of the flow measuring range. The calibration values, used for linearization of the indicator, are stored in a memory module (EEPROM). The required power supply is a functional extra-low voltage with protective separation (galvanic) in accordance with VDE 0100 Part 410. All instruments (indicators, recorders) connected to the measuring circuit are connected in series and together may not exceed the maximum external resistance (see 8.3). The ESK4 features polarity reversal protection.

8.1 Compliance with IP degree of protection

The following notes must be observed for compliance with the IP protection class for electrical installations:

- Use only original gaskets. They must be clean and free of any damage. Defective gaskets must be replaced.
- The electrical cables must be undamaged and must comply with regulations.
- The cables must be laid with a loop ③ upstream of the measuring device to prevent water from getting into the housing.
- The cable feedthroughs ② must be tightened.
- Close the unused cable feedthroughs using blanking plugs ①.
- Do not kink lines at the cable gland.
- The supplied cables may not be mechanically stressed.

- ① Use blanking plugs if no cable is routed through
- ② Tighten cable feedthrough firmly
- ③ Lay the cable in a loop





Cable glands / screwed cable glands:

Thread	Material	Diameter	Protection*	Note
M20x1.5	PA	8 - 13 mm	IP 68 - 5 bar	Standard
M20x1.5	Nickel-plated brass	10 - 14 mm	IP 68 - 5 bar	
M20x1.5	Stainless steel	10 - 14 mm	IP 68 - 5 bar	

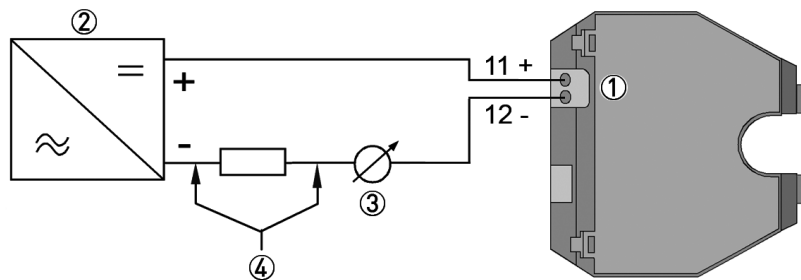
* Degree of protection restricted to screwed cable gland only

8.2 Electrical connection SGM-EM

The plug-in type connection terminals of the ESK4 module in the M40 indicator part can be removed to connect the cables.

Terminal connection pluggable; $< 2,5 \text{ mm}^2$

Type of connection 2 wire current sink - polarity reversal protection only
for connection to extra-low voltage according to SELV or PELV



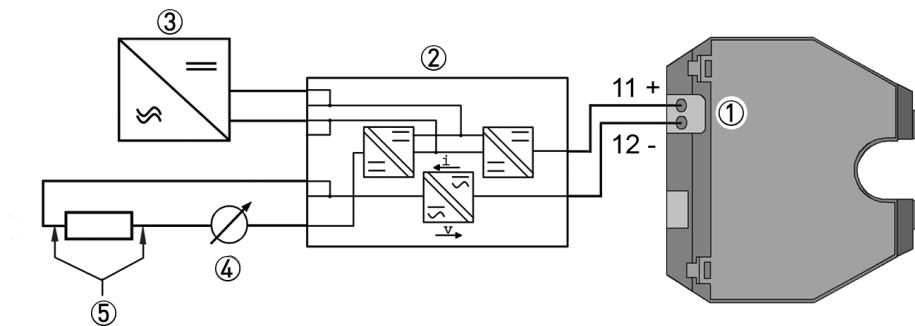
- ① Current output ESK4 /ESK4A
- ② Power supply 14...30 VDC
- ③ Measuring signal 4...20 mA
- ④ External load, HART® communication

Power supply M40 with galvanic isolation

Wiring must be planned with great care when it comes to connecting other devices such as evaluation units or process control. Internal connections in these devices (e.g. GND with PE, mass loops) may lead to non-permitted voltage potentials which could negatively affect the function of the converter itself or that of a device connected to it. In such cases a protected extra-low voltage (PELV) is recommended.

**SGM**

Variable area flow meters



- ① Terminal connection
- ② Converter supply isolator with electrical isolation
- ③ Power supply (see supply isolator information)
- ④ Measuring signal 4...20 mA
- ⑤ External load, HART® communication

Connections at hazardous locations

Before installation in hazardous location read the Supplementary Installation and Operating Instructions - Flap-type flow meter KFS ... Ex.

Power supply

The supply voltage has to be between 14 VDC and 30 VDC. This is based on the total resistance of the measuring loop. To calculate this, the resistance of each component in the measuring loop (not including the device) must be added up.

The required supply voltage can be calculated using the formula below:

$$U_{\text{ext.}} = R_L \times 24 \text{ mA} + 14 \text{ V}$$

where

$U_{\text{ext.}}$ = the minimum supply voltage and
 R_L = the total measuring loop resistance.

The power supply has to be able to supply a minimum of 30 mA!

HART Communication

When HART® communication is carried out with the ESK4, the analogue measured data transmission (4...20 mA) is not impaired in any way. Exception for multidrop operation. In multidrop operation a maximum of 15 devices with HART® function can be operated in parallel, whereby their current outputs are switched to inactive (I approx. 4 mA per device)



8.3 HART® communication with ESK4

HART® communication is not obligatory in order to operate the ESK4. When HART® communication is carried out with the ESK4, the analogue measured data transmission (4...20 mA) is not impaired in any way. Exception for multidrop operation. In multidrop mode, a maximum of 15 devices with HART® function can be operated in parallel, whereby their current outputs are switched inactive (I approx. 4.5 mA per device).

A load of at least 230 Ohm is required for HART® communication.

The maximum load resistance is calculated as follows:

$$R_L = (U_{\text{ext.}} - 14V) / 24 \text{ mA}$$

Use a twisted two-core cable to prevent electrical interference from impeding the DC output signal.

In some cases a shielded cable may be necessary, if noise levels higher than the NE21 specification are anticipated.

8.3.1 Configuration

The ESK can be configured via HART® communication. DD (Device Description) for AMS and PDM as well as a DTM (Device Type Manager) for PACTware™ are available for configuration. They are available on request.

The current flow rate can be transmitted using the integrated HART® communication. A flow counter can be configured. Two limit values can be monitored. The limit values are assigned either to flow values or to the counter overflow.



8.3.2 Self monitoring - Diagnostics

During both start-up and operation, a wide variety of diagnostic functions are performed cyclically in the ESK4 / ESK4A in order to guarantee function reliability. When an error is detected, a failure signal (high) is activated (current > 21 mA, typically 22 mA) via the analogue output. In addition more detailed information can be requested via HART® (CMD#48). The failure signal is not activated for information and warnings.

Diagnostic functions (Monitoring):

- Plausibility of FRAM data
- Plausibility of ROM data
- Working range of internal reference voltages
- Signal detection of the measuring range of the internal sensors
- Temperature compensation of the internal sensors
- Calibration based on the application
- Plausibility of counting value
- Plausibility of physical unit, system and selected unit

For ESK4A (HART® 7) the diagnosis is reported in compliance with NE 107.

8.4 Technical data EM

Power supply	12 ... 30 V DC (HART® min. 20 V DC)
Current consumption	4 ... 20 mA for 0 ... 100 % of measured value
NAMUR failure signal	> 21 mA
Reproducibility	< 0,1 % of FS
Linearity error	< 0,1 %
Influence of supply power	< 0,1 %
Ext. resistance dependence	< 0,1 %
Temperature effect	< 10 µA/K
Max. load impedance	0/250 ¹⁾ ... 800 Ω
Individual certificate	PTB 00 ATEX 2063

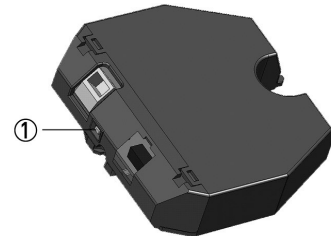
¹⁾ With HART®-communication, this value is the minimum value
For use in potentially explosive areas: built-in equipment may only be connected to separate intrinsically safe circuits.



8.5 Operation: ESK4 – Loop Check Mode

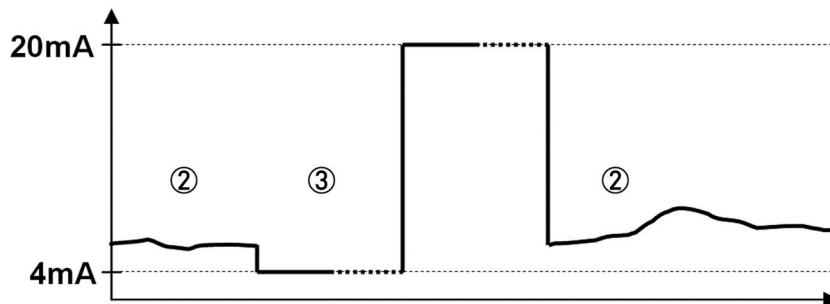
The ESK4 is equipped with a loop check function, enabling a simple test of the entire 4...20 mA current loop.

It is activated and operated using a microswitch ①.



CAUTION!

When activating the loop check mode, ensure that no alarms are unintentionally triggered in the downstream system components.



- Press and hold the microswitch ① for more than 6 seconds to activate the loop check mode ③. The current output jumps to constant 4 mA.
- Change the current output from constant 4 mA to constant 20 mA as often as you like by briefly pressing it (less than 6 seconds) to check the function of the measuring circuit.
- Exit loop check mode by holding down the microswitch (longer than 6 seconds). The current output jumps back to measuring mode ②.

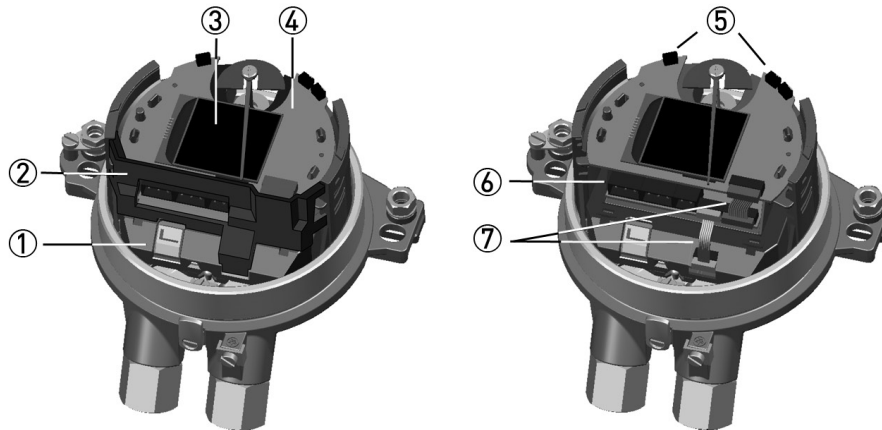
INFORMATION!

If the microswitch has not been pressed for longer than 60 seconds, the ESK4 automatically returns to measuring mode ②.

**SGM**

Variable area flow meters

9 Durchfluss-Summenzähler SGM-EMZ



- | | |
|---------------------------|---|
| ① ESK4 / ESK4A connection | ⑤ Operating keys ↵ ↑ |
| ② Module cover | ⑥ Connection binary outputs and reset input |
| ③ Display | ⑦ Module connection cable |
| ④ Display module ESK4-IO | |

The flow totalizer ESK4-T (EMZ) is a combination of the electrical current output ESK4 (EM) and the display module ESK4-IO. Both parts (ESK4 and ESK4-IO). Both modules are installed together in the display, whereas the ESK4-IO can only be used together with the ESK4.

A passive graphic LC display shows the measured value with units and / or counter reading with units. The max. 11-digit counter reading is secured with a non-volatile memory. Binary flags indicate the limit state and a 0 ... 100% bar graph display the measured value. Furthermore, NE107 diagnostic test symbols are displayed and the configuration menu is executed in plain text. There are two configurable binary outputs for limit or pulse output and a binary input for start / stop or reset of the counter. The power supply and data connection between ESK4 and ESK4-IO are via a flat ribbon cable provided.

The flow totalizer has been factory-set according to data specified in the order and requires no adjustment! The conversion factor for the totalizer, unless otherwise ordered, is set relative to the measuring range so that the summated value (in Liter, m³ etc.) can be read directly.

For further information on commissioning and operation, please refer to the supplementary installation and operating instructions SGM-EMZ. It is included in the scope of delivery.



10 Maintenance and cleaning of the flow meter

Within the scope of routine operational maintenance of the plant and the pipelines, the flow meter should also be inspected for dirt accumulation, signs of corrosive wear, mechanical wear and damage to the measuring tube and the indicator. We recommend that inspections be carried out at least once a year. To clean the device it must be removed from the pipeline.

Some components of the variable area flowmeter can be replaced or retrofitted:

Attention!



Pressurized pipes to be depressurized before removing the measuring part. In connection with devices used for flow measurement of aggressive media, appropriate safety precautions should be taken in regard to residual liquids in the measuring part.

New gaskets should always be used when the measuring part is reinstalled in the pipeline.

Electrostatic charges should be avoided when surfaces (e.g. viewing window) are cleaned!

11 Service, retrofits and conversions

The variable area flow meter with indicator part can be retrofitted with a number of components:

- float damping system
- contact module K1 / K2
- analogue output EM (ESK4, 4 ... 20 mA)
- totalizer EMZ (ESK4-T) with LCD (ESK I/O)

An assembly kit is also available to enable the SGM device to be converted to a high-temperature version.

All devices with defects or deficiencies should be sent directly to our repair department. In the service area of the Kirchner und Tochter homepage (www.kt-flow.de) you will find the declaration of decontamination as download and more information about returns.

To avoid risks to our employees and the environment, we can only process devices, for which we get a declaration of decontamination certifying that they are safe due to legal regulations. For questions, please contact our sales department, Tel. +49 2065-96090.

**SGM**

Variable area flow meters

11.1 Replacement of the float

1. Remove the device from the pipeline.
2. Remove the upper circlip from the measuring part.
3. Remove upper float stop and float from the measuring part.
4. Insert new float into the centre hole in the lower float stop and place it together with the upper float stop in the measuring part. Note that the upper float guide rod must be guided through the centre hole of the float stop.
5. Insert the circlip in the measuring part.
6. Re-install the device in the pipeline.

**Caution!**

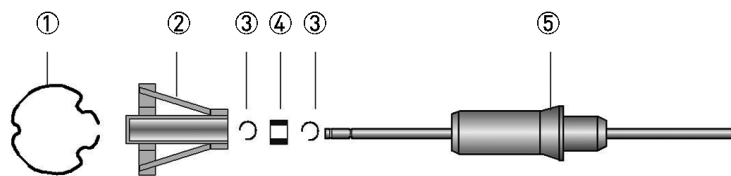
An additional measuring error is to be expected unless recalibration is carried out.

11.2 Retrofitting a float damping system

The complete retrofit kit consists of:

- 2 circlips ③
- 1 ceramics collet ④
- 1 damping cylinder with float stop ②

- ① circlip
- ② float stop
- ③ locking ring
- ④ ceramics collet
- ⑤ float





Installation:

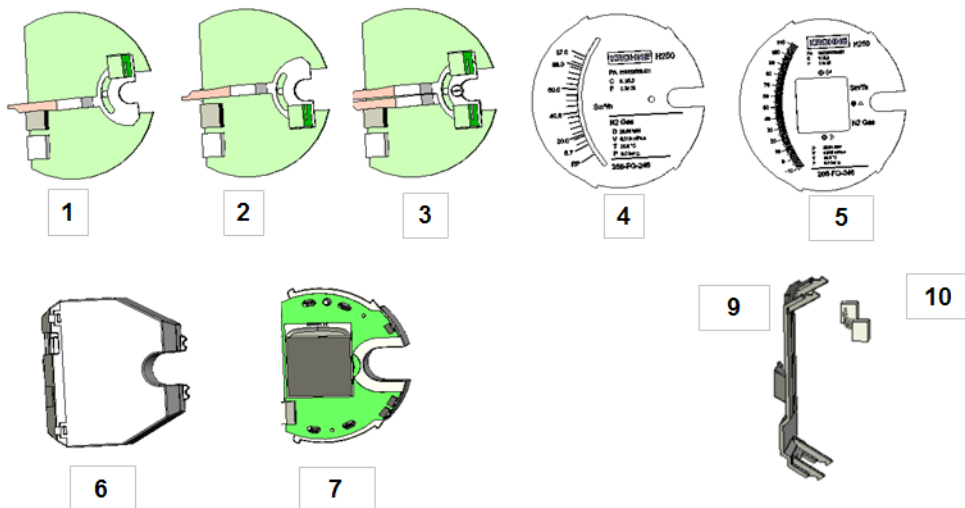
1. Remove device from the pipeline.
2. Remove upper circlip ① from measuring part.
3. Take upper float stop ② and float ⑤ out of the measuring part.
4. Fasten circlip ③ in the lower groove on the float guide rod.
5. Slide ceramic collet ④ on to the float guide rod and fasten with the circlip ③ in the upper groove.
6. Insert float in the lower float guide in the measuring part.
7. Install the supplied damping cylinder with integrated float stop ② in the measuring part.
8. Insert upper circlip ①.
9. Re-install device in the pipeline.



SGM

Variable area flow meters

11.3 Component overview for electrical retrofits



ESK	11; 12	
ESK I/O	1,2,3; 4,5,6; 7,8	

12

13

Part	Type
1	Contact module IK1 / IKS1min
2	Contact module IK1 / IKS1max
3	Contact module IK2 / IKS2minmax
4	Standard scale
5	Scale with cut-out for display ESK4-T
6	Sensor module ESK4 with 4 ... 20mA
7	ESK4 I / O LCD module
9	Cover for ESK4-T
10	Flat ribbon cable for module connection for ESK4-T
12	Connector for ESK4: 11/12 for 4 ... 20mA / HART
13	Connector for I / O-LCD module: 1/2/3 for binary output B1, 4/5/6 for binary output B2, 7/8 for binary input B3

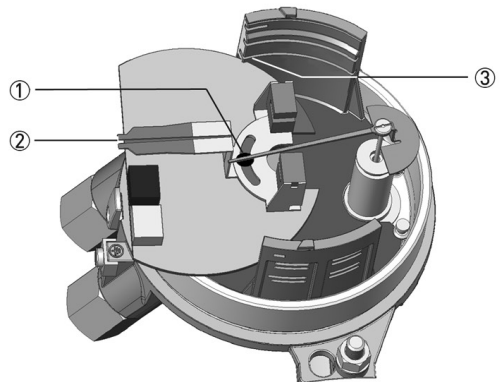


11.4 Retrofitting contact module IK1, IK2, IKS1, IKS2

Required components (see section 11.3):

- Contact module IK1 / IKS1 or IK2 / IKS2
- Connectors 1/2/3 or 4/5/6

1. Unscrew housing cover
(if necessary, remove totalizer EMZ)
2. Merge contact pointer ②
3. Unscrew the locking screw ① of the contact pointer
4. Insert the contact module into the lowest guide groove ③ of the holder until the semicircle ① surrounds the pointer cylinder
5. Make sure that no connecting cables are pinched or damaged.
6. Depending on version, insert connectors 1/2/3 for MIN and 4/5/6 for MAX



The connection terminals of the plug-in connector are pluggable and can be removed for connecting the cables.

Observe the instructions in **section 8.1** for compliance with the IP protection class.



11.5 Retrofitting a second contact

The retrofit kit consists of the required contact pointer and integrated contact. The connecting cable is fitted with the integrally moulded plug.

To install, it may be necessary to unplug the flow totalizer first.

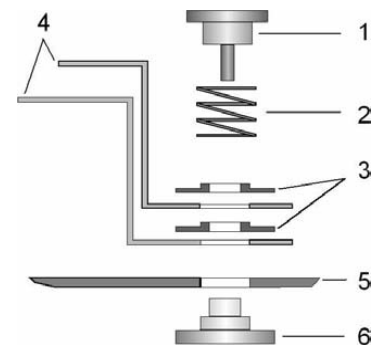
1. Unplug the contact unit from the module rack.
2. Remove locking screw ①.



Caution:

Spring ② is under pressure

3. Assemble contact pointers ④, slide rings ③, spring ② and locking screw as shown in the drawing.
4. The second ring ③ is already provided in the version with one contact.
5. Insert plug connector of the contact (blue) into the socket on the circuit board.
6. Plug in and connect up the contact unit.





11.6 Replacement - Retrofitting an ESK4 and its calibration

Retrofitting is only possible if the display has been delivered "with EM preparation".

When replacing or retrofitting an ESK4, it is mandatory to indicate the serial number (SN) when ordering. This information can be found on the indicator nameplate.

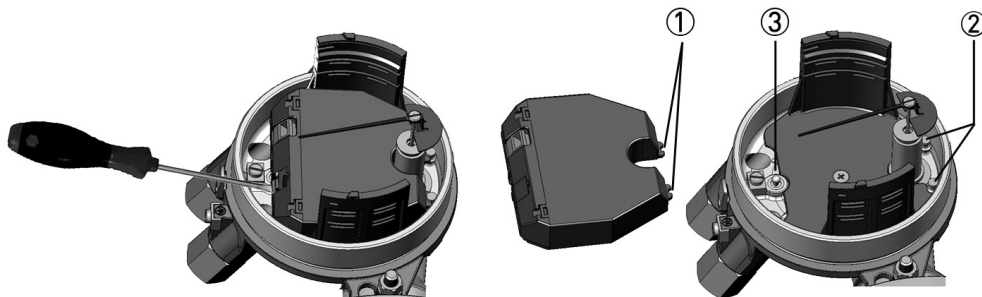
The ESK4 is factory calibrated, making it possible to replace it or retrofit it without recalibrating.

Required components (see section 11.3):

- ESK4 sensor module
- Connector 11/12

Removing ESK4:

1. De-energise the ESK4.
2. Lift and remove the ESK4 with a screwdriver.



Installation ESK4:

1. The ESK4 plug-in tongues ① are plugged in under the two bolts ② on the base plate.
2. Slight pressure is used to press the ESK4 onto the spring pins ③ until it stops, firmly attaching the ESK4.
3. Finally the 11/12 connector is attached.

If a change in measuring range, product temperature, product, density, viscosity or pressure is desired, this can be done by Kirchner und Tochter.



Linearization

Linearization of the ESK4 is performed in 3 steps:

- Recording of measuring points
- Linearization of the characteristic curve using a PC
- Storing the linearization data in the EEPROM via a serial interface

Recording of measuring points:

The recording of the measuring points should be carried out at the main scale marks in order to achieve the best possible linearization result. Approaching these points is possible in two different ways:

dynamic setting:

setting the flow value (original medium or a reference medium established by conversion)

static setting:

lifting up the float (not the pointer!) until the pointer indicates the main scale value.

For all approached measuring points, both the respective flow value and also the associated current value of the ESK4 should be noted.

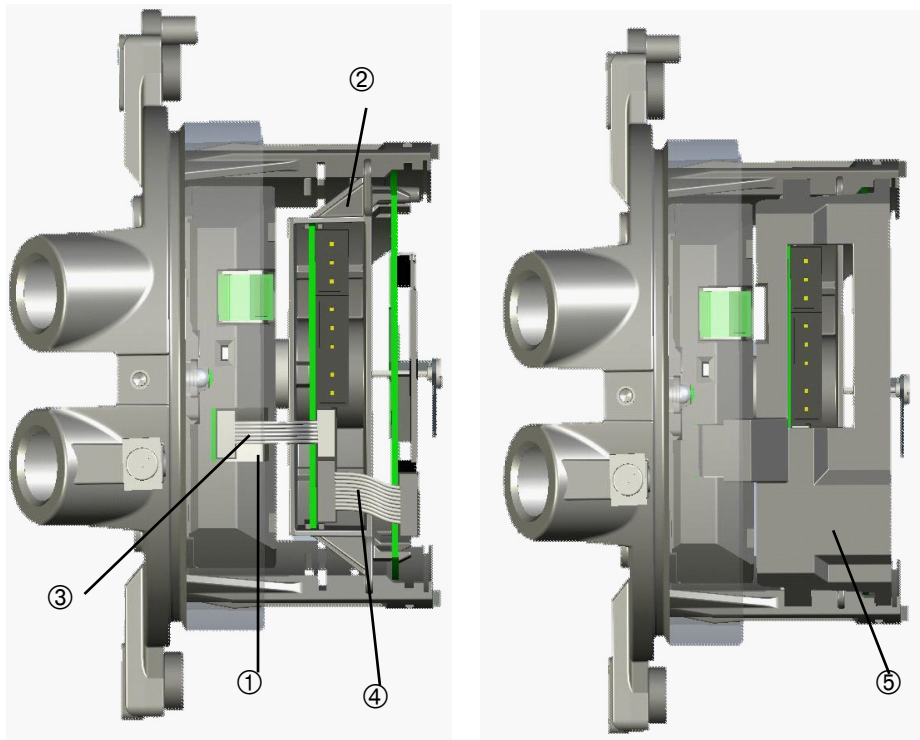
11.7 Retrofitting flow totalizer EMZ (ESK4-T)

The flow totalizer can also be subsequently installed in the display part in conjunction with the electrical current output EM.

When ordering the totalizer as a retrofit kit, please specify the device data (serial number), as well as the measuring range. With the aid of these data, the supplied new scale with the counter display break-out can already be prepared for installation! The flow meter is then preset with the conversion factor referring to the measuring range.

Required components:

- Installed ESK4 sensor module
- I/O-LCD module
- Module cover
- Ribbon cable
- Terminal connectors 1/2/3, 4/5/6, 7/8
- Scale with LCD cutout



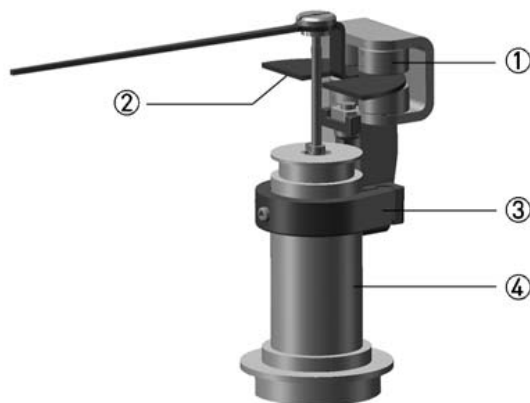
Assembly:

1. Remove terminal connector 11/12 from installed ESK4
2. Break out the perforated opening for the ribbon cable from the ESK4 ①
3. Insert the I/O-LCD module ② in the 2nd guiding slot of the module rack until it snaps in
4. Connect I/O-LCD module and ESK4 with the ribbon cable ③
5. Check ribbon cable ③ and ④ whether properly fixed
6. Insert the module cover ⑤ in the 1st and 3rd guiding slot of the rack
7. Plug in terminal connectors 11/12, 1/2/3, 4/5/6, 7/8
8. Exchange the standard scale by the scale with cutout for LCD



11.8 Retrofitting pointer damping

In principle, the indicating element with its magnetic system contains indicator damping. An additional eddy current brake is advantageous in the event of fluctuating or pulsing flows. The magnets on the eddy current brake surround the pointer vane without touching it, damping its movement. The result is a much steadier pointer position, without distorting the measured value. A turnbuckle ensures a proper fit. The eddy current brake can be retrofitted during operation without recalibrating.



- ① Eddy current brake
- ② Pointer vane
- ③ Bracket
- ④ Pointer cylinder

In connection with the indicator part with EM / current output and contactors, be aware of the fact that short-time movements of the pointer may occur when the eddy-current brake is being installed. These may possibly generate a false alarm or cause peaking of the current output.

The brake with retaining ring can be clipped on to the pointer cylinder independent of built-in components such as EM, contacts or totalizers.

When mounting the brake, bear in mind that the slot between the brake magnets measures only approx. 3 mm and the aluminium pointer vane has a material thickness of 1 mm. Check that the pointer vane can be moved between the magnets without coming into contact with them.

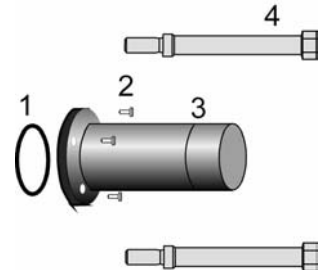
Slightly turn the eddy-current brake clockwise and screw in the clamping screw. Adjust the brake as shown on the right and tighten down the clamping screw.



11.9 High-temperature version, indicator part

Items supplied:

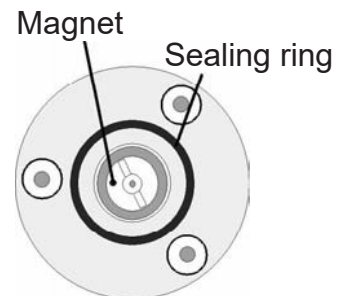
- 1 pcs. sealing ring (1)
- 3 pcs. fastening screws (2)
- 1 pcs. HT extension (3)
- 2 pcs. distance bolts (4)



Installation:

When retrofitted to HT version, the device can remain in the pipeline

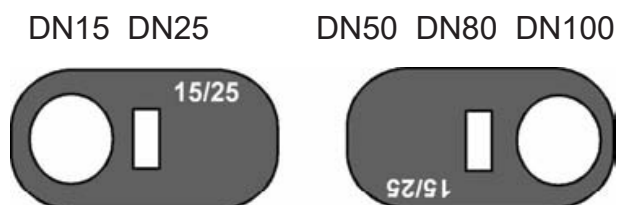
1. Note pointer position before removing indicator!
2. Detach both nuts fastening the indicator.
3. Remove indicator with its fastening clips from the measuring part.
4. Remove plastic cap from HT extension.
5. Position ring ① exactly in the groove on the HT extension.
6. Fasten HT extension with the three screws ② to reverse side of indicator.
7. Screw distance bolts ④ to the threaded pin on measuring part and tighten down (width A/F: 14 mm).



11.10 Mounting the indicator

Position the indicator with fastening clips on the distance bolts ④, fit washers and tighten down with nut (max. 8 Nm).

Caution: be aware of mounting position of the fastening clips:

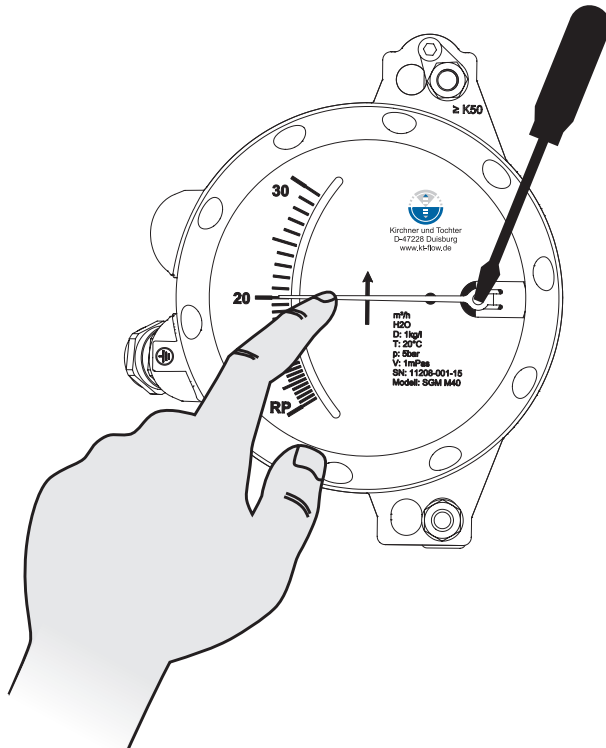


**SGM**

Variable area flow meters

Compare the pointer position with the previously noted display value.

In case of a deviation of the display value:



1. Hold the pointer axle with a screwdriver (see illustration).
2. Set the pointer against the friction forces of the measuring pointer attachment to the previously noted value.

12 Disposal

Please help to protect our environment and dispose workpieces in conformity with current regulations resp. continue using them.

[illegible]

[illegible]



The devices from **Kirchner und Tochter** have been tested in compliance with applicable EC/EU CE-regulations of the European Community.

The respective declaration of conformity is available on request. Subject to change without notice. The current valid version of our documents can be found at www.kt-flow.de.

The **Kirchner und Tochter** QM-System is certified in accordance with DIN EN ISO 9001:2015. The quality is systematically adapted to the continuously increasing demands.