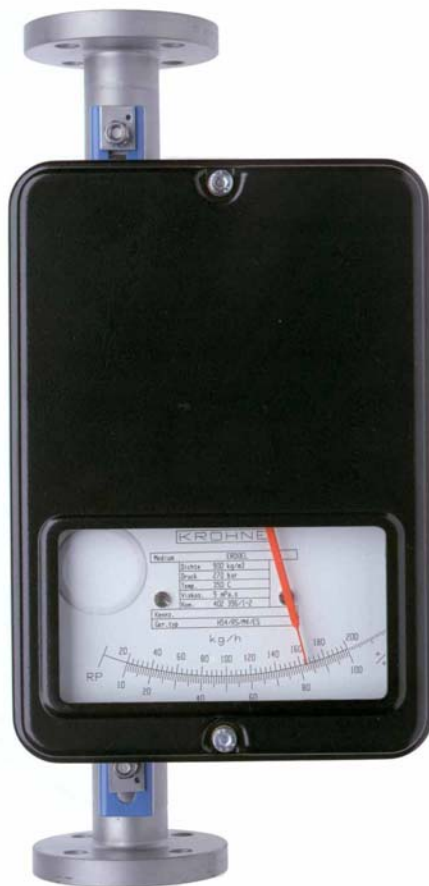


Installation and Operating Instructions H54 / M4 Variable Area Flowmeter



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

GA24/... Cat. II2GD

Cat. II3GD without electr. built-in parts Id. No. 702271##00

Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications technology

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

Product liability and warranty

The variable area flowmeter is suitable for measuring the volume flow of liquids, gases and vapor.

Special regulations apply for use in explosion-hazardous areas. Responsibility for the suitability and usage to the intended purpose 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 forms 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 at the end of these installation and operating 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. 702281##00

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

- H54/... Cat. II2GD Cat. II3GD without electr. built-in parts Id. No. 702271##00
- Supply without installation accessories (screw bolts, flange seal and cabling)

Special certificates (supplied to order only)

- Record on setting in works
- Test certificate to EN 10204:
- Pressure test, paint penetration test, irradiation test, leak test, ultrasonic test, helium leakage test,
- Cleaning to works regulations.

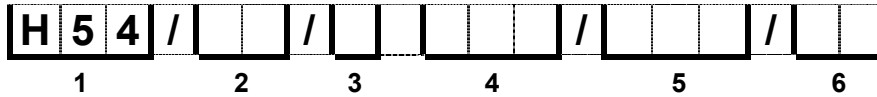
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1 General

1.1 Type code

The type code consists of the following elements: 1)



- 1 Series measuring unit H54
- 2 Materials
 - RR** : stainless Steel
 - C** : stainless steel with PTFE liner
- 3 Heating jacket design
 - B** : with heating jacket
- 4 Display part series
 - M4** : mechanical indicator
 - M10** : electronic transmitter with LC display M10
- 5 Signal output (M4 display)
 - ESK** : electronic transmitter
- 6 Limit switch
 - K1** : one limit switch
 - K2** : two limit switches

1) Positions which are not used in the type code are not required.

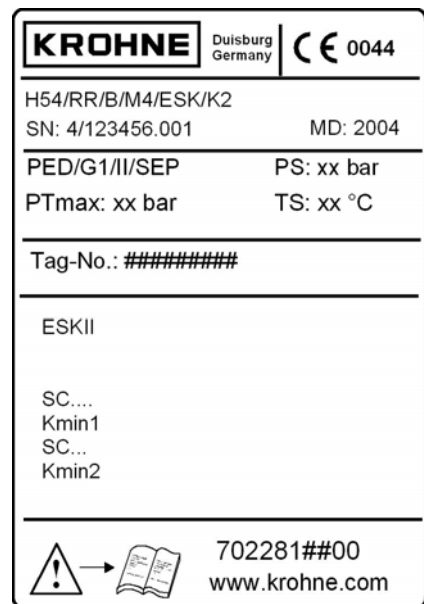
1.2 Marking

The type marking of the complete instrument is carried out at the display part by means of the rating plates shown here (also refer to the type code).

Example:

- MD: Manufacturing date
- PS: Max. permissible operating pressure at max. permissible operating temperature TS
- PT max: Maximum pressure tested
- TS: Max. operating temperature
- PED: Directive for Pressure Equipment
- Tag No : Measuring point tag
- 0044: Identification number of the supervising office for EC Directive for Pressure Equipment 97/23/EC

- SN: Serial number
- SO: Sales order / item
- KO: KROHNE order
- V251...: Product configurator code
- AC: Article code



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, vapors and those liquids whose vapor pressure lies **more than 0.5 bars** over the normal atmospheric pressure (1013 mbars) at the maximum permissible temperature
 - L Liquids whose vapor pressure lies a **maximum of 0.5 bars** above the atmospheric pressure at the maximum permissible temperature
- 3 Fluid group**
 - 1 Group 1: Explosion-hazardous, highly flammable, readily flammable, flammable (when the maximum permissible temperature lies above the flash point), highly toxic, toxic, fire stimulating
 - 2 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/EC
 - II Category II to 97/23/EC
 - III Category III to 97/23/EC
- 5 Conformity evaluation process**
 - SEP Solid engineering practice
 - A Module A internal process inspection
 - A1 Module A1 internal process inspection with supervision of the acceptance
 - H Module H Comprehensive quality assurance

The PED key marking is contained on the rating plate of the instrument.

1.4 Functional principle

The flowmeter operates in accordance with the float measuring principle.

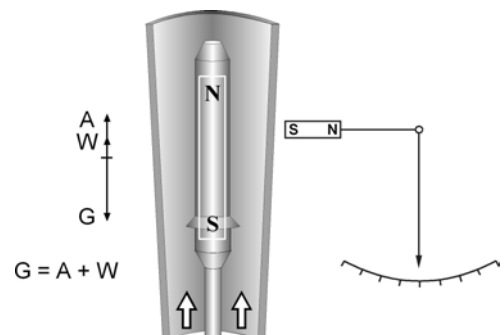
A metal cone is installed in the measuring unit H54, in which a suitably formed float can move freely up and down.

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 transmitted by a magnetic coupling and displayed on a scale. Strong magnetic fields can lead to deviations in the measured value.

The installation of several instruments in immediate vicinity to each other does not cause notable influences.



2 Installation and Start-up

2.1 Protection during shipment

The sensing arm and cam plate are secured by a rubber band.

2.2 Prerequisite for the installation

The operating pressure of the plant may not exceed the value indicated on the rating plate.

Ensure that the parts coming into contact with the medium are compatible with the material. (For the list of the materials please refer to the chapter on the materials of the instrument designs.)

The ambient and medium temperatures may not exceed certain maximum values.

The variable area flowmeter has to be installed vertically (float measuring principle - flow direction from bottom to top).

In order to prevent distortions the connecting flanges have to face each other axially and in parallel.

2.3 Preparation of the pipeline

The pipeline is to be supported by suitable installation measures, so that vibrations at the pipeline are prevented and axial stresses on the instrument are minimized.

A straight unimpeded inflow section of $\geq 5 \times \text{DN}$ before the instrument and a straight outflow section of $\geq 3 \times \text{DN}$ behind the instrument are recommended.

Shutoff and control devices are to be positioned in the flow direction behind the measuring unit.

For installation recommendations please also refer to the Directive VDE/VDI 3513, Sheet 3.

2.4 Installation in the pipeline

The instrument may not be subjected to tensile or compressive stresses through the pipelines.

Immediately before carrying out the installation check whether the instrument is free of foreign particles.

Screws, bolts and seals (provided by customer) are to be selected in accordance with the pressure stage of the connecting flange or the operating pressure.

The inside diameter of the flange deviates from the standard dimensions.

Flange seal standard DIN 2690 (ASME B16.21) can be applied without any limitation.

Align the seals. Tighten the nuts with the tightening torques of the corresponding pressure stage.

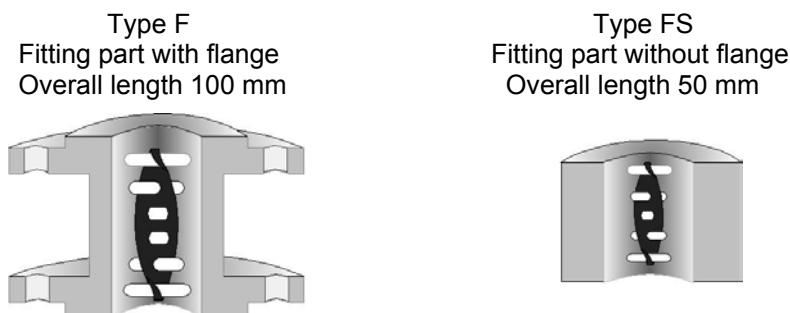
2.5 Fastening torque

The flange bolts are to be tightened with the following maximum torques in case of measuring units with PTFE liner or of measuring units with ceramic lining and PTFE sealing surface:

Nominal size to				Bolts			Max. tightening torque			
DIN 2501		ASME B 16.5		DIN	ASME		DIN		ASME 150 lbs	
DN	PN	Inch	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
125	16	5"	150/300	8 x M 16	8 x 5/8"	8 x ¾"	67	48	75	54
150	16	6"	150/300	8 x M 20	8 x ¾"	8 x ¾"	88	64	94	68

2.6 Magnetic filters

Magnetic filters are used when the medium contains particles which can be influenced magnetically. The magnetic filter is to be installed in the flow direction before the flowmeter. Magnetic bars are positioned helically in the filter so that an optimal efficiency at a low pressure loss is achieved. All the magnets are coated individually with PTFE to protect against corrosion. Two models are available:



Materials 1.4571 (316 Ti)

2.7 Observance of the IP degree (NEMA Type) of protection

The following instructions are to be observed in order to observe the IP degree (Nema Type) of electrical built-in parts.

- After the connecting cable has been introduced, tighten the outlet nut.
- All the cable glands which are not used remain closed with blanking plugs.
- Do not kink lines directly at the cable gland.
- Provide a drain bend
- The feed lines may not be subjected to mechanical strains. Refer to the description of the electrical supplementary components for this device.

Cable glands / screwed glands: PG11 - line diameter 8 to 10mm

2.8 Start-up

A minimum operating pressure (pre-pressure) is required to operate the instrument.

Medium	Pressure loss : Operating pressure
Liquids	1 : 2
Gases (without damping)	1 : 5
Gases (with damping)	1 : 2

For the pressure losses please refer to the flow tables

2.9 Measurement of liquids

Vent the pipeline during starting-up in order to avoid liquid beats.

Open valves slowly!

2.10 Measurement of gases

Pulsations of the medium are to be kept away from the instrument.

In case of gases increase the operating pressure slowly.

The flow is to be varied by means of adjusting valves, so that the float is not subjected to blows (e.g. through solenoid valves) thus ensuring that damage to the measuring unit cannot occur.

Instruments for measuring the flow rate of gases can be equipped with a gas damping, in order to avoid possible compression vibrations of the float.

If vibrations nevertheless occur at the float, these can be eliminated by installing a throttle valve or a suitable aperture hole (on request) behind the instrument.

A float damping is recommended for gas measurement.

3 Flow tables

General

Reference conditions: Water at 20°C
Air at 20°C, 1.013 bar abs.

The conversion to other media or operating data (pressure, temperature, density, viscosity) is carried out by means of the KROHNE calculation procedure KroVaCal on the basis of the VDE /VDI Guideline 3513. The specified flow values amount to 100% values of the measuring range.

The turn-down range amounts to 10 : 1

The specified pressure losses apply for water and air at the maximum flow rate.

3.1 Flow table H 54 / DN15

Float material CrNi steel
Float form Water: N
Air: NA

Nominal size		Cone	Float	Water		Air		Max. pressure loss	
DN	ASME			N		NA		N / NA	
mm	inches	No.	No.	l/h	US GPM	m ³ /h	SCFM	mbar	psig
15	1½"	R10.03	10	16	0.07	0.4	0.28	60	0.87
		R10.04	11	25	0.11	0.9	0.56	60	0.87
		R10.06	11	40	0.18	1.2	0.74	60	0.87
		R10.08	11	63	0.28	1.8	1.11	60	0.87
		R11.07	31	100	0.44	2.8	1.74	65	0.94
		R11.10	32	160	0.70	5	3.10	65	0.94
		R11.17	33	250	1.10	8.5	5.27	70	1.02
		R11.27	34	400	1.76	11.5	7.13	80	1.16
		R12.21	42	630	2.77	20	12.4	100	1.45
		R12.32	43	1000	4.40	26	16.1	140	2.03

3.2 Flow table H54 DN25 ... DN150

Float material CrNi steel
 Float form Water: CIVB, CIVTF
 Air: CIVT, DIVBLD

Nominal size		Cone	Float	Water				Air				Max. pressure loss							
DN	ASME			C IV B		C IV TF		C IV T		D IV BLD		C IV B		C IV TF		C IV T		C IV BLD	
mm	inches	No.	No.	l/h	US GPM	l/h	US GPM	m ³ /h	SCFM	m ³ /h	SCFM	mbar	psig	mbar	psig	mbar	psig	mbar	psig
25	1"	K20.12	21	800	3.52	500	2.20	12	7.44	20	12.4	46	0.67	19	0.28	13	0.19	21	0.30
		K20.16		1.000	4.40	600	2.64	15	9.31	25	15.5	48	0.70	19	0.28	14	0.20	24	0.35
		K20.23		1.600	7.04	1000	4.40	24	14.9	40	24.8	50	0.73	21	0.30	16	0.23	30	0.44
		K20.33		2.500	11.0	1600	7.04	35	21.7	60	37.2	60	0.87	26	0.38	19	0.28	38	0.55
		K20.49		4.000	17.6	2500	11.0	55	34.1	100	62.0	90	1.31	36	0.52	25	0.36	60	0.87
		K20.55		5.000	22.0	3000	13.2	70	43.4	130	80.6	110	1.60	48	0.70	32	0.46	80	1.16
40	1 1/2"	K40.37	41	6.300	27.7	4000	17.6	85	52.7	200	124	60	0.87	31	0.45	19	0.28	75	1.09
		K40.50		10.000	44.0	6000	26.4	125	77.5	280	174	90	1.31	41	0.59	25	0.36	100	1.45
		K40.54		12.500	55.0	7500	33.0	150	93.1	350	217	110	1.60	51	0.74	30	0.44	110	1.60
50	2"	K50.34	51	12.500	55.0	7000	30.8	160	99.3	450	279	65	0.94	30	0.44	11	0.16	90	1.31
		K50.57		16.000	70.5	9000	39.6	180	111	650	403	75	1.09	32	0.46	11	0.16	120	1.74
		K50.60		20.000	88.1	12000	52.8	200	124	750	465	100	1.45	44	0.64	12	0.17	140	2.03
80	3"	K80.23	81	20.000	88.1	12000	52.8	250	155	520	323	60	0.87	25	0.36	14	0.20	50	0.73
		K80.37		25.000	110	14000	61.6	300	186	620	385	70	1.02	26	0.38	14	0.20	52	0.75
		K80.40		30.000	132	16000	70.5	350	217	700	434	80	1.16	27	0.39	14	0.20	54	0.78
		K80.50		40.000	176	20000	88.1	400	248	900	558	90	1.31	29	0.42	15	0.22	56	0.81
100	4"	K102.35	CIV 102	50.000	220							120	1.74						
		K102.41	CIV 102	63.000	277								135	1.96					
125	5"	K122.39	TR 122	80.000	352							130	1.89						
		K122.42	TR 122	90.000	396								140	2.03					
150	6"	K152.45	TR 152	150.000	660							150	2.18						

4 Materials

Design H 54	Materials				
	Measuring tube	Flange	Cone	Internals, seal strip	Float
H 54 / RR	CrNi-steel 1.4571 (316Ti)	CrNi-steel 1.4571 (316Ti)	CrNi-steel 1.4571 (316Ti)	CrNi-steel 1.4571 (316Ti)	CrNi-steel 1.4571 (316Ti)
H 54 / R PTFE *	CrNi-steel 1.4571 (316Ti) with PTFE liner	CrNi-steel 1.4571 (316Ti)	PTFE **	PTFE	PTFE
H 54 / Hastelloy	Hastelloy B3 or C4	CrNi-Stahl HC cladded 1.4571 (316Ti)	Hastelloy B3 or C4	Hastelloy B3 or C4	Hastelloy B3 or C4

* With this liner, flanges are those of the next meter size up,
 e.g. cone 20.12 with flange DN40 instead of DN 25

** Alternatively: cone of glass, gasket of PTFE (Only for cone DN 15)

5 Technical Data

Accuracy class

to VDI/VDE Directive 3513, Sheet 2 1.0

Connections H 54

Flange dimensions to DIN EN 1092-1

DN 15 ... DN 80 / PN 40
DN 80 ... DN 150 / PN 16

Flange dimensions to ASME B 16.5

½" ... 6" class 150 lbs / RF or 300 lbs / RF

Pipe connection for Ermeto

Ermeto 12

Pipe connection for air cooling

Ermeto 6, 8, 10 or 12
other on request

Overall height

500 mm

With flange connection (without seals)

Operating pressure PS

Directive 97/23/ EC of the Council of April 29, 1999 on mobile pressurized equipment (Directive for Pressure Equipment) is applied. The maximum permissible operating pressure PS is calculated for the maximum operating temperature TS. Both limits (PS and TS) are listed on the rating plate. As a rule PS corresponds to the nominal pressure of the connection.

Pressure Tested PT

The pressure tested is calculated in accordance with the Directive for Pressure Equipment (97/23/EC) or AD 2000-HP30 under consideration of the maximum permissible operating pressure as well as the maximum operating temperature.

Degree of protection

IP 67, NEMA Type 4X / 6

in accordance with EN 60529 / IEC 60529

6 Medium Temperatures

Max. Medium Temperatures TS without electrical built-in components

-80 °C to +400 °C

Max. Medium Temperatures with ESK, K, KD

H 54 / M4 / ESK

160 °C (DN 15 : 80 °C)

H 54 / M4 / K (KD)

180 °C (DN 15 : 100 °C)

Ambient temperature $T_{amb.}$

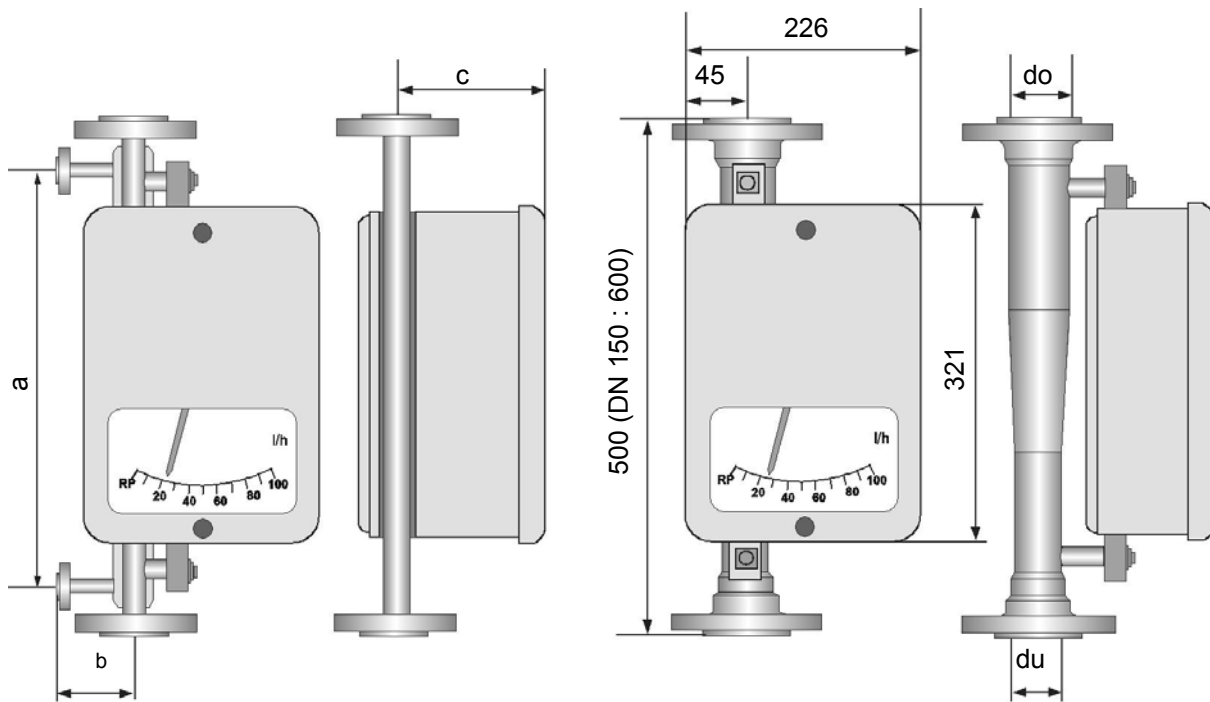
-40°C to + 90°C

Ambient temperature $T_{amb.}$ with ESK, K, KD

-25 °C to +60 °C

Other temperatures on request

7 Dimensions and weights



Nominal size				Dimensions [mm]					approx. weight *
DIN		ASME		a	b	c	du	do	kg
DN	PN	inches	mm						
15	40	½"	23	410	97	125	23	23	5
25	40	1"	34.5	380	109	165	34.5	34.5	7
40	40	1½"	50	380	120	175	45	50	9
50	40	2	67	380	128	185	57	67	12
80	40	3	89	380	147	190	89	89	25
80	16	3	89	380	147	190	89	89	27
100	16	4	106	380	164	205	93	106	29
125	16	5	148	380	175	225	115	148	35
150	16	6	175	380	190	240	127	175	42

* Weights with DIN-Flanges

8 Limit switches

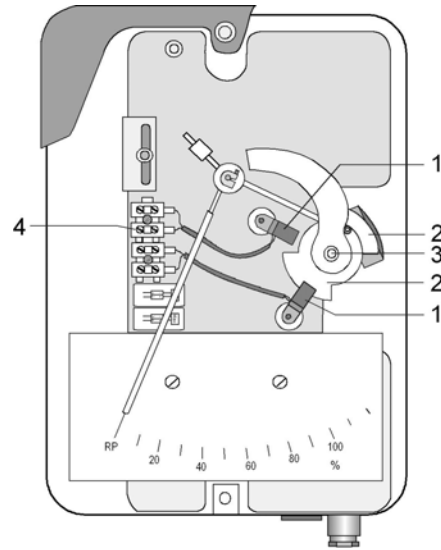
Description

The variable area flowmeter H54 can be equipped with a maximum of two electronic limit switches.

The limit switch functions with a slot-type initiator (1) which is operated inductively through a metal vane (2).

Contact types:

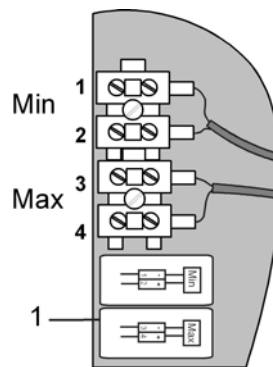
SC3,5-N0-Y	2-wire technology (NAMUR)
SJ3,5-SN	2-wire technology safety-oriented
SJ3,5-S1N	2-wire technology safety-oriented (inverted)



8.1 Electrical connection

SC3,5-N0-Y, SJ3,5-SN, SJ3,5-S1N:

Limit switch Min	Terminal 1	-
Limit switch Min	Terminal 2	+
Limit switch Max	Terminal 3	-
Limit switch Max	Terminal 4	+

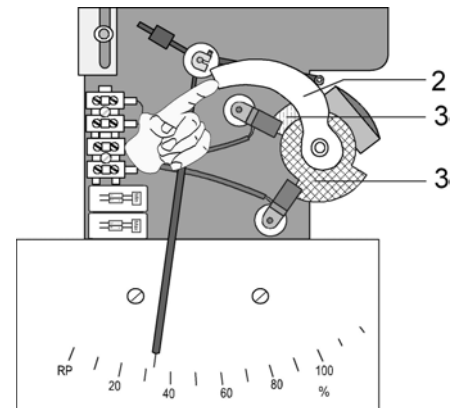


The label (1) shows the type of contact (1).

8.2 Setting

The limit switches K1 and K2 are set individually from each other as normally open or normally close!

Lift the cam disk (2) and set the pointer at the switch point. The metal vanes (3) are set via slipping clutch.



8.3 Technical data of limit switches

Technical data	2-wire SC3,5-N0-Y NAMUR	2-wire SJ3,5-SN NAMUR	2-wire SJ3,5-S1N NAMUR
Switching element function	NC contact	NC contact	NO contact
Nominal voltage U ₀	8 V	8V	8V
Power consumption:			
Pointer vane not detected	≥ 3 mA	≥ 3 mA	≤ 1 mA
Pointer vane detected	≤ 1 mA	≤ 1 mA	≥ 3 mA

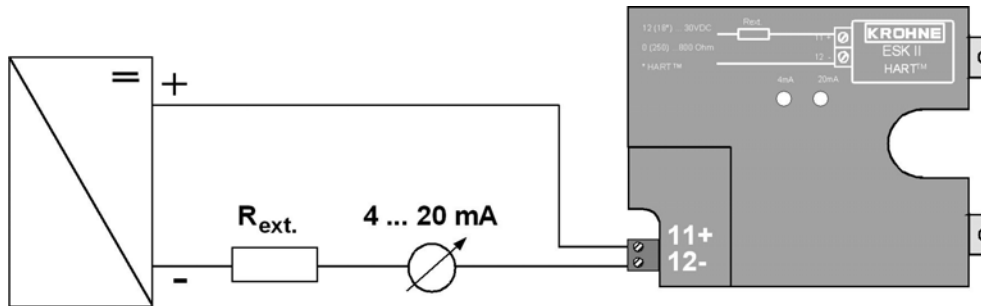
An isolating switching amplifier, e.g. Pepperl + Fuchs Series KF .. -SR2 ..., is required in order to operate the SC3,5-N0-Y limit switch (refer to the chapter on the spare part list).

SJ3,5-SN and SJ3,5-S1N limit switches in 2-wire technology safety-oriented are connected to a safety-oriented isolating switching amplifier, e.g. Pepperl & Fuchs K... -SH- ... (large S on the front)

9 Electrical signal output ESK II

9.1 Electrical connection

The connecting terminals of the M9 display have a pluggable design and can be removed in order to connect the lines.

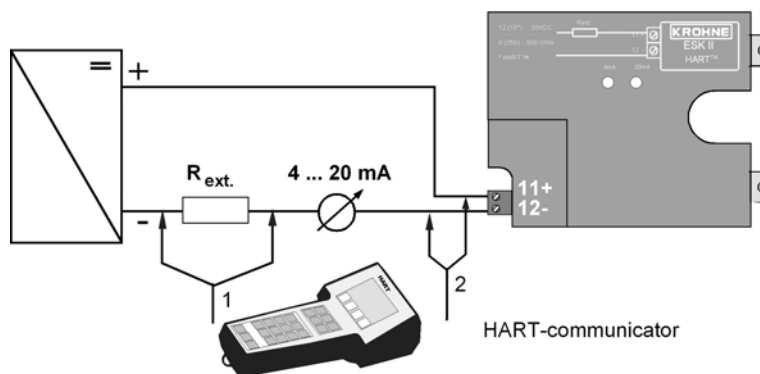


9.2 HART™ communication with the ESK II

HART™ communication is not compellingly required in order to operate the ESK II.

When HART™ communication is carried out with the ESK II, this does not by any means impair analog measured value transfer (4...20mA).

Exception at Multidrop operation: a maximum of 15 instruments with HART™ function can be operated in parallel, whereby their current outputs are switched inactive (approx. 4 mA).



If a HART™ communicator (type Fisher Rosemount, Model 275) or a PC with HART™ modem is used, the resistor which is connected in series ($R_{ext.}$) has to exceed 250 Ohms.

In this type of operation the auxiliary power must amount to at least 18 V. The communicator or the PC is connected as shown in the drawing above.

It can be operated optionally via the connecting terminals of the ESK II (2) or via an external resistance (1) connected in series. The counter cannot be read out or operated by means of HART™ communication!

9.3 Technical data of ESK II

Auxiliary power	12 (18 *) to 30 V DC
Measurement signal	4.00 to 20.00 mA for 0 to 100 % flow value > 20.8 mA for alarm status
Auxiliary power influence	< 0.1%
Dependency on external resistance	< 0.1%
Temperature influence	< 5 μ A / K
Max. external resistance / load	0 (250 *) to 800 Ohms

* These values are to be observed as minimum values during HART™ communication.

10 Electrical signal output ESK3-PA

10.1 Bus cable

The statements of the FISCO model only apply if the bus cable used fullfills the following specifications:

$R' = 15...150 \text{ Ohm/km}$

$L' = 0.4...1 \text{ mH/km}$

$C' = 80...200 \text{ nF/km}$.

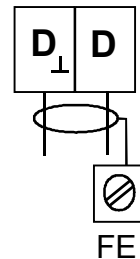
10.2 Shielding and grounding

In order to ensure optimum electromagnetic compatibility of systems it is very important that the system components, and in particular the bus cables which connect the components, are shielded and that these shields form an electrically unbroken envelope as far as possible.

10.3 PROFIBUS-PA connection

For the connection of the bus cable refer to the adjacent figure.

Connect the cable conductors to D and D- (polarity reversal does not have any influence). The cable shield should be connected with minimum length to the functional grounding FE.



10.4 Technical data of the ESK3-PA

Hardware to IEC 1158-2 and the FISCO model

Supply voltage via 2-wire bus connection:9 to 32 V DC

Basic current 12 mA

Starting current < Basic current

FDE (fault drop electronics) < 18 mA

Accuracy to VDI/ VDE 3513 1.6

Measured value resolution < 0.1% of upper range value

Temperature influence < 0.05% / K of upper range value

Software

GSD (device master file) is supplied on a diskette
or via Internet www.krohne.com

Device profile Complete implementation of Profile B, V3.0

Function blocks

Flow rate (AI0) Optionally for volume or mass rate of flow
Default units: Qv [m³/h]; Qm [kg/h]

Counter (TOT0) Volume counter Default unit: [m³]

Counter (TOT1) Mass counter Default unit: [kg]

Address range 0-126, default 126 ("Set slave address" is supported)

SAPs Service_Access_Points 1

DD Device Description DD for PDM

Operation Via PROFIBUS PA (no local operation at the instrument)

11 Maintenance

The flowmeter is also to be inspected for soiling, corrosive erosion and mechanical wear or damage to the measuring tube and the display in the context of the routine operational maintenance of the installation and the pipelines. We recommend at least annual inspections. In order to clean the instrument remove it from the pipeline.

Note

Pressurized lines have to be relieved before the measuring unit is removed.

Corresponding safety precautions with regard to residual liquids in the measuring unit in case of instruments which are used to measure aggressive media.

New seals must always be used when remounting the measuring unit in the pipeline.

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

Information on returning instruments

Your instrument has been manufactured carefully and tested several times. If installed and operated in accordance with these instructions your instrument will rarely present any problems. Should you nevertheless need to return an instrument for checking or repair, please pay strict attention to the following points:

Due to statutory regulations concerning protection of the environment and safeguarding the health and safety of our personnel, KROHNE may only handle, test and repair returned instruments that have been in contact with liquids if it is possible to do so without risk to personnel and environment. This means that KROHNE can only service your device if it is accompanied by a certificate in line with the following model confirming that the device is safe to handle.

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

- To check and ensure, if necessary by rinsing or neutralizing, that all the cavities in the instrument are free from such dangerous substances. (Directions on how you can find out whether the primary head has to be opened and flushed out and neutralized are obtainable from KROHNE on request.)
- To enclose a certificate with the device confirming that the device is safe to handle and stating the liquid used.

KROHNE regret that we cannot service your device unless it is accompanied by such a certificate and thank you for your understanding.

Form for returning the instrument

Company: Address:

Department: Name:

Tel. No.: Fax. No.:

The enclosed instrument

Type:

KROHNE Order No. or Series No.:

has been operated with the following process liquid:

Because this process liquid is water-endangering * / 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 instrument *

(* delete where not applicable)

We confirm that there is no risk to man or environment through any residual liquid contained in the instrument.

Date: Signature

Company stamp: