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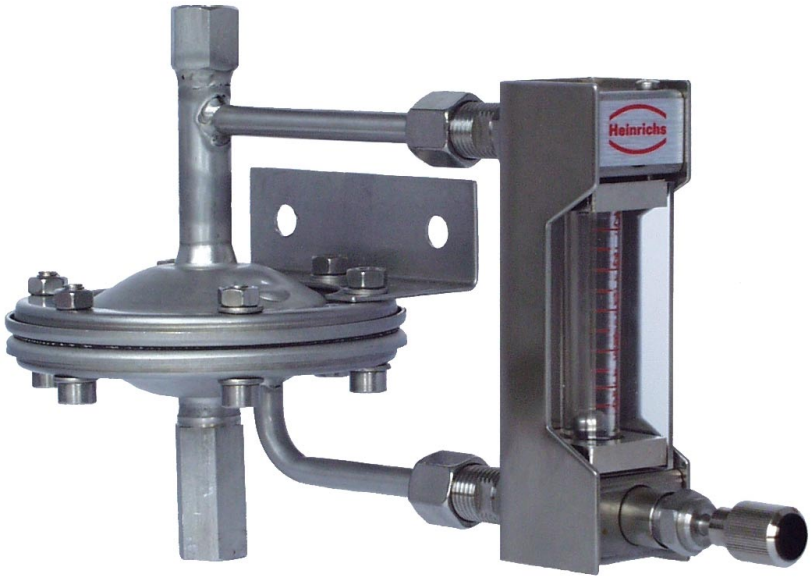
Heinrichs
Ein Unternehmen der IWKA Gruppe

Variable-Area Flowmeter KD1

Device description

KD1-K/C -M/D -L/E

KD1-R



Contents

1 Identification

1.1 Supplier/manufacturer

Heinrichs Messtechnik GmbH
Robert-Perthel-Str. 9 · D-50739 Köln
Phone +49 (221) 49708 - 0
Fax +49 (221) 49708 - 92
Internet: http://www.heinrichs-mt.nl
E-Mail: mailto:info@heinrichs-mt.nl

1.2 Product type

Miniature flowmeter based on the float principle

KD1-K 90 mm mounting length

KD1-C 90 mm mounting length with bolt for wall mounting

KD1-M 170 mm mounting length

KD1-D 170 mm mounting length with bolt for wall mounting

KD1-L 320 mm mounting length

KD1-E 320 mm mounting length with bolt for wall mounting

KD1-R 145 mm mounting length
with flow controller

1.3 Issue date

2003-11-11

1.4 Version no. / File

3.0 / KD1_GB_03_eng.doc

2 Applications

2.1 KD1-K/C, KD1-M/D and KD1-L/E

The flowmeter can be used for measuring the flow of liquid and gaseous products in pipes.
It shows the current flow quantity in volume or mass per unit in time.

Applications:
Measuring the flow of liquid and gaseous products in pipes as well as dosing, bubbling through, superimposing, monitoring, regulating and controlling them.

2.2 KD1-R

The flowmeter can be used for stabilizing set flow quantities of liquid and gaseous products in pipes. The set quantity is kept constant regardless of pressure changes during product inflow for type KD1-R.....N or of a pressure change during product outflow for type KD1-R .....V.
Applications: Constant dosing, level measurement in open and closed containers, N_2 superposition of combustible media

Caution: The devices should be used with the greatest possible caution to measure potentially hazardous liquids and (especially) gases. Precautionary measures must be taken to protect personnel and equipment from any potential danger or damage due to glass-tube breakage. The plant operator is fully responsible for using the devices. Where possible, we recommend the use of metal devices such as type KDS.

3 Operational mode and system design

3.1 Measuring principle for KD1-K/C, KD1-M/D and KD1–L/E flowmeters

Float principle:
The product flows through the meter vertically from the bottom to the top. The height of the float in the measuring tube is a measure of the flow quantity. The float is in equilibrium between the buoyant force of the flowing liquid and the counteracting force of gravity on the float. The measured value is displayed on the measuring-tube scale with the upper edge or the indicator edge of the float (ball).

3.2 KD1-K/C, KD1-M/D and KD1-L/E system design

The meter consists of a conical measuring tube made of glass containing a float that can move vertically. The height of the float in the measuring tube reproduces the calibrated flow quantities on the measuring tube.

3.3 Measuring principle for KD1-R

Differential pressure:
The diaphragm of the controller is in a state of equilibrium when the pressure conditions are the same on both sides. The pressure on the input side is determined by the pressure of the product; the pressure on the output side is determined by the pressure drop of the setting valve of the flowmeter.
If either the inlet or outlet pressure changes, the change in pressure is compensated by the built-in diaphragm valve - thus maintaining a constant set flow rate.
Important: The controller can only regulate inlet or outlet pressure fluctuations. Steady pressure conditions must prevail on the other side.

3.4 KD1-R system design

The unit consists of a KD1 variable-area flowmeter, equipped with a diaphragm differential pressure flow controller. The variable-area flowmeter consists of a device fitting with an integrated measuring tube made of glass that contains a vertically movable float and the valve for setting the flow rate.

The differential pressure flow controller is made of stainless steel and consists of a diaphragm made of Perbunan or PTFE and a compensating valve made of stainless steel.

For gaseous products, two versions are available:

KD1-R...-V for a constant inlet pressure and a variable outlet pressure

KD1-R...-N for a constant outlet pressure and a variable inlet pressure

For liquids, both versions can be used; however, the **KD1-R...-V** version should be preferred.

4 Input

4.1 Measured variable

Volume flow

4.2 Measuring range (lower-range and upper-range values)

Measuring range span for type KD1-K/C/M/D:
10-100%
Smallest measuring range: 0.02-0.25 l/h water
Largest measuring range: 10-100 l/h water

Measuring range span for type KD1-L/E:
10-100%

Smallest measuring range: 0.025-0.27 l/h water
Largest measuring range: 5-65 l/h water

Measuring/controlling range for KD1-R
Span: 10-100%

Smallest measuring/controlling range
0.1-1.0 l/h water
Largest measuring/controlling range
10-100 l/h water

4.2.1 Measuring ranges for type KD1-K/C/M/D

Measuring range	Measuring range				Pressure loss	
	H_2O [l/h]	Air [Nl/h]	H_2O [l/h]	Air [Nl/h]	[mbar *]	
	FNU stainless steel		FNU glass		FNU stainl. st.	FNU glass
A	0.1-1.0	5.0-50	0.02-0.25	2.0-20	2	1
B	0.25-2.5	10-100	0.08-0.7	4.0-40	3	2
C	0.5-6.5	25-250	0.25-2.5	12-120	3	2
D	1.0-10	30-350	0.4-4.0	20-200	3	2
E	1.5-16	50-450	0.5-5.0	25-250	5	2.5
F	2.5-25	60-800	0.8-8.0	40-400	5	2.5
G	4.0-40	120-1200	1.5-15	60-600	5	2.5
H	5.0-65	200-2000	2.5-25	100-1000	5	2.5
I	10-100	300-3000	4.0-40	150-1600	6	3

* valve completely open

4.2.2 Measuring ranges for type KD1-L/E with float MNU

Measuring range	Measuring range				Pressure loss	
	H_2O [l/h]	Air [Nl/h]	H_2O [l/h]	Air [Nl/h]	[mbar *]	
	MNU stainless steel		MNU aluminum		H_2O	Air
A	0.1-1.0	5.0-50	0.025-0.27	2.0-20	2	2
B	0.25-2.5	15-90	0.08-0.8	5.0-40	3	2
C	0.4-4.0	20-140	0.13-1.3	7.0-70	3	2
D	2.5-25	70-700	1.0-11	40-400	3	2
E	4.0-40	110-1100	2.0-20	70-700	5	2.5
F	5.0-65	180-1800	2.0-30	100-1000	5	2.5

* valve completely open

4.2.3 Measuring ranges for type KD1-L/E with float FNU

Measuring range	Measuring range				Pressure loss	
	H_2O [l/h]	Luft [Nl/h]	H_2O [l/h]	Air [Nl/h]	[mbar *]	
	FNU stainless steel		FNU glass		H_2O	Air
A	0.6-7.0	30-250	0.25-2.5	10-130	3	1
B	1.4-11	80-380	0.4-4.0	2-200	3	1
C	1.6-16	50-500	0.5-6.5	2-260	3	1
D	2.5-25	120-850	0.5-9.0	30-410	5	2
E	4.0-40	180-1200	10-16	60-600	5	2
F	5.0-65	180-1800	10-26	60-1000	5	2

* valve completely open

4.2.4 Measuring ranges for type KD1-R

Measuring range	Measuring range				Pressure loss	
	H_2O [l/h]	Air [Nl/h]	H_2O [l/h]	Air [Nl/h]	[mbar *]	
	FNU stainless steel		FNU glass		FNU stainl. st.	FNU glass
A	0.1-1.0	5.0-50	0.02-0.25	2.0-20	350	
B	0.25-2.5	10-100	0.08-0.7	4.0-40	350	
C	0.5-6.5	25-250	0.25-2.5	12-120	350	350
D	1.0-10	30-350	0.4-4.0	20-200	350	350
E	1.5-16	50-450	0.5-5.0	25-250	350	350
F	2.5-25	60-800	0.8-8.0	40-400	350	350
G	4.0-40	120-1200	1.5-15	60-600	350	350
H	5.0-65	200-2000	2.5-25	100-1000	350	350
I	10-100	300-3000	4,0-40	150-1600	350	350

* plus differential pressure

5 Electrical output (option)

1 or 2 inductive limit transducers
Astable or bistable
Astable RC 10/15-14-N0
Bistable RC 10/15-14-N3
Make Pepperl+Fuchs
Safety class PTB 99 ATEX 2128 X
II 2G EEx ia/ib IIC/IIB

When installing electrical equipment in hazardous areas please pay attention to the conditions specified in the approval certificate.

6 Measuring accuracy

6.1 Reference conditions

Water 20°C (air 20°C)

6.2 Measured error

KD1-K/C ± 3%
of URV within the range
of 10-100% (90 mm)

KD1-M/D ± 2%
of URV within the range
of 10-100% (170 mm)

KD1-L/E ± 1%
of URV within the range
of 10-100% (320 mm)

KD1-R
Measured error/system deviation ± 3% / ± 5%
of URV within the range
of 10-100%

6.3 Repeatabilty

KD1-K/C ± 1.0 % of URV

KD1-M/D ± 0.6 % or URV

KD1-L/E ± 0.3 % of URV

KD1-R ± 1.0 % / 1.7 % measured error/system deviation of URV

6.4 Influence of ambient temperature

none

6.5 Influence of fluid temperature

Deviations in fluid temperature from the temperature observed during calibration can result in a proportional display fault because of

the corresponding change in density. Temperature-related changes in viscosity will cause a non-linear display fault.

7 Conditions of use

The VDI/VDE guidelines must be observed.
The devices can be used for:

- liquid products that are sufficiently free-flowing, are free of solids, do not bond and do not tend to settle.
- gases with linear flow behavior and an adequate inlet pressure.

KD1-R: The minimum differential inlet and outlet pressures must be 350 mbar.

Please refer to the instructions for potentially hazardous products in Section 2.2.

7.1 Installation conditions

The variable-area flowmeter must be installed perpendicularly (direction of flow from the bottom to the top).

Take special care to install glass-tube devices free from strain. The size of the product line to be connected must be identical to the size of the device connection. In general, the valve must be installed in the output if gases are involved (for liquids, in the input).

KD1-R
When using gases, the version for a constant inlet pressure with "valve at the top" and for a constant counter pressure with "valve at the bottom" should be used.

If liquids are involved, the position of the valve does not have any impact on the function of the meter.

7.2 Ambient conditions

7.2.1 Ambient temperature ranges

0°C to + 80°C (with electrical contact + 70°C)
(risk of breakage due to frost)

7.2.2 Storage temperature

0°C to + 80°C

7.2.3 Climatic category

Weather-protected and/or unheated locations, class C according to IEC 654 Part 1

7.2.4 Degree of protection

IP 65

7.2.5 Shock resistance/vibration resistance

The meter should be protected from shocks and vibrations, which could cause damage.

7.2.6 Electromagnetic compatibility

Built-in limit transducer:

- In acc. with NE 21 NAMUR recommendation
- EN 50 081 Part 1 / EN 50 082 Part 2
- Product standard: EN 60947-5-2

7.3 Fluid conditions

7.3.1 Fluid temperature ranges

without limit transducer 0°C to + 100°C
with limit transduces 0°C to + 70°C
(risk of breakage due to frost)

7.3.2 Fluid pressure limit

16 bar
Important:
All pressure values are for non-hazardous liquids and for devices installed free from strain.
For **KD1-R,** the maximum unilateral pressure resistance of the diaphragm is **7 bar**.

7.3.3 Inlet and outlet sections

Inlet and outlet sections are not required for a linear flow profile of the fluid.

7.3.4 Physical state

Liquid or gaseous

7.3.5 Pressure for gas measurement

The measured values only apply to the calibrated fluid data stated on the scale. Any change or deviation in pressure will cause a display fault.

7.3.6 Pressure loss

Depends on the measuring range
(see measuring range tables in Section 4.4)

8 Construction details

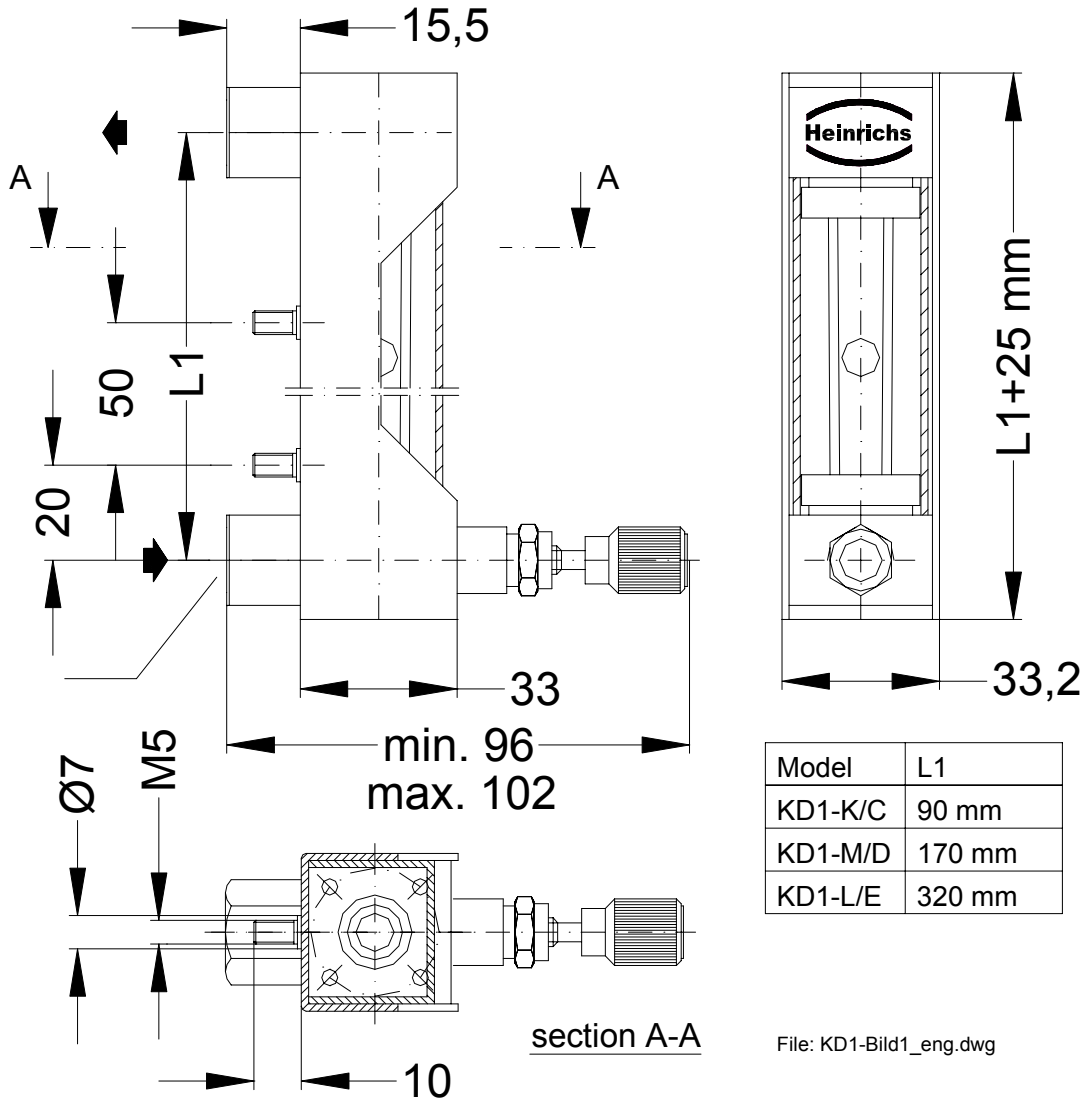
8.1 Construction/dimensions KD1-K/C, KD1-M/D and KD1-L/E

The meter consists of a conical measuring tube made of borosilicate glass with a vertically movable float made of stainless steel or glass (for types KD1-L/E, the float may be made of aluminum as an option). The measuring tube is installed in the device fitting and has a horizontal connection on both sides. The standard version of the device is equipped with a setting valve.

KD1-K/C mounting dimension 90 mm,
length of measuring tube 70 mm

KD1-M/D mounting dimension 170 mm,
length of measuring tube 150 mm

KD1-L/E mounting dimension 320 mm,
length of measuring tube 300 mm



Model	L1
KD1-K/C	90 mm
KD1-M/D	170 mm
KD1-L/E	320 mm

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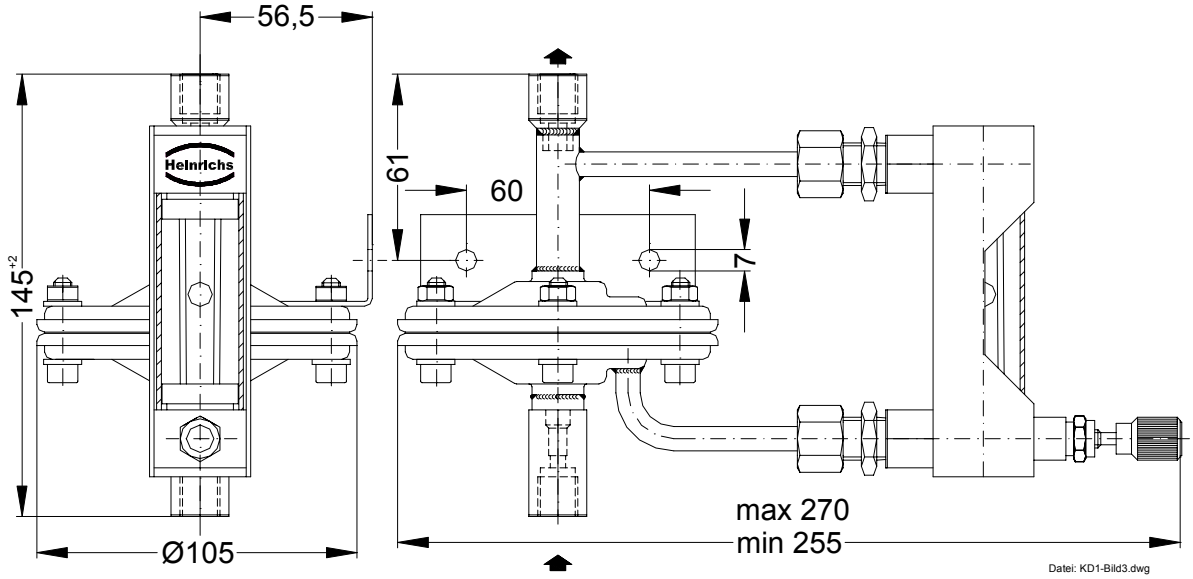
8.2 Construction/dimensions KD1-R

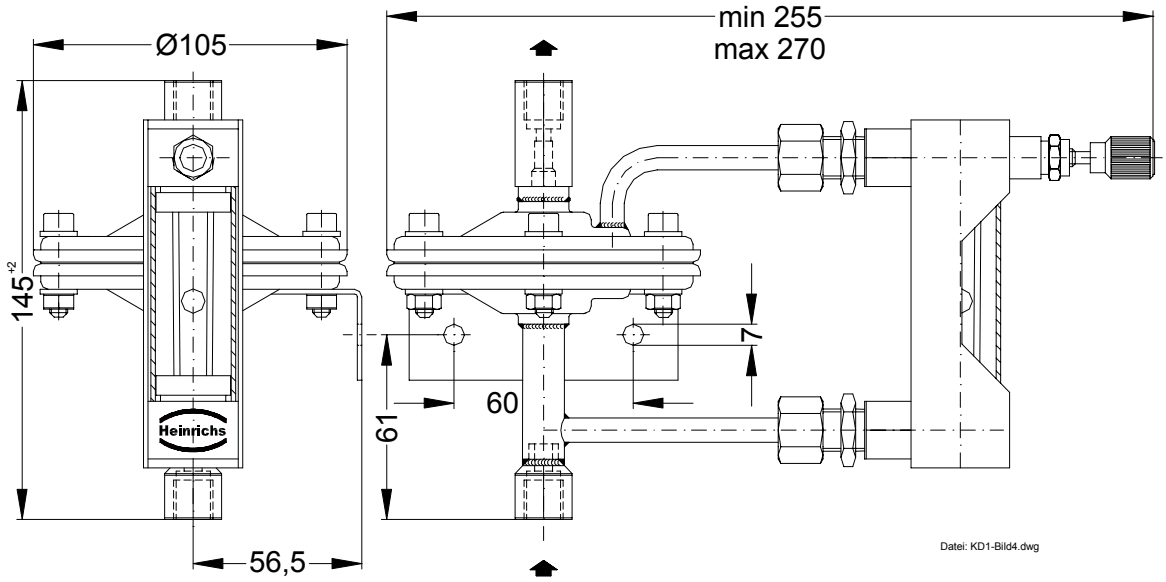
The unit consists of a variable-area flowmeter with a setting valve and a differential pressure flow controller mounted on the meter. The measured value is indicated via the indicator edge of the float (upper edge of the ball) on the scale of the measuring tube. The desired flow rate can be set using the built-in valve.

Mounting dimension 145 mm, length of measuring tube 70 mm

8.2.1 Dimension drawing KD1-R...-N with ¼“ NPT (F) connection as outlet pressure controller version



8.2.2 Dimension drawing KD1-R...-V with ¼“ NPT (F) connection as inlet pressure controller version



8.3 Weights

KD1-K/C 0.46 kg
KD1-M/D 0.56 kg
KD1-L/E 0.66 kg
KD1-R 0.80 kg

8.4 Materials

Fitting, device heads, connections, setting valve: 1.4404
KD1-R:
Controller/control pipes: stainless steel
Diaphragm: Perbunan or PTFE

8.5 Process connection

NPT ¼“ (F)
Special connections:
Ermeto
Swagelok
G ¼“, ½"
Hose connector 6 mm
DILO

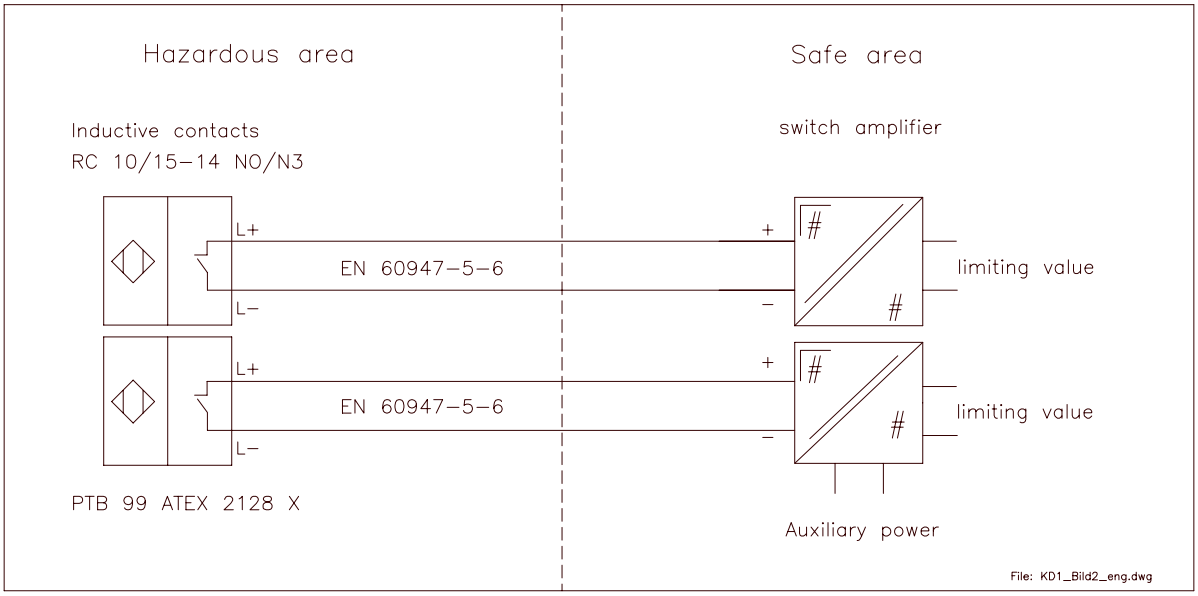
Important: The mounting lengths may be different.

Other connections are available as special versions.

9 Electrical connection for limit transducer option

with cable end length of 2 m

Wiring diagram for 2 limit transducers



10 Indicator unit

Direct indication via the position of the float in the measuring tube

11 Auxiliary energy (for option)

- via switch amplifier
- available for 24 / 115 /230 VAC and 24 VDC (accessories)

12 Use in hazardous areas

12.1 Without electrical equipment

The basic version of the flowmeter is a non-electrical device without its own ignition source and meets DIN EN 13463-1 requirements. It can be used in hazardous areas that require Category 2 equipment.

Marking:  II 2G c IIB

Tech. File Ref. 03-01 X

Since the device does not have its own power sources that would result in a temperature increase, the fluid temperature is decisive for the maximum surface temperature.

12.2 With limit transducer

When the limit transducer is installed, the device becomes an electrical assembly and receives a marking in accordance with DIN EN 50014 from the entire.
The electrical and thermal data and the special conditions of the PTB 00 ATEX 2128 X EC Type Examination Certificate must be observed.

Marking:  II 2G EEx ia IIB T6-T4

The influence of the fluid temperature on the built-in limit transducer must be observed.

13 Certificates and approvals

EC Type Examination Certificate for the inductive limit transducer

14 CE mark

The measuring system meets the statutory requirements of the following EU directives: *Directive 94/9/EC* (Equipment and Protective Systems for Use in Potentially Explosive Atmospheres) and Electromagnetic Compatibility (EMC) *Directive 89/336/EEC*. With respect to the Pressure Equipment *Directive 97/23/EC*, the devices fall within the scope of application of Article 3, Section 3, and need no CE mark in accordance with this directive. Heinrichs Messtechnik confirms compliance with the directives by attaching the CE mark.

15 Available accessories

- 1 or 2 inductive limit transducers inductively astable or bistable version
- Special connections
- Switch amplifier

16 Order information

Please include the following information in your order: Product data, specific weight, temperature, pressure, viscosity, material design, connection size, measuring range, desired accessories, required approvals and material certificates

17 EC Type Examination Certificate of the limit transducer

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

(1) **EC-TYPE-EXAMINATION CERTIFICATE**
(Translation)

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:
PTB 99 ATEX 2128 X

(4) Equipment: Ring initiator types RJ..., RC... and TG...

(5) Manufacturer: Pepperl + Fuchs GmbH

(6) Address: D-68307 Mannheim

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 99-29058.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 50014:1997 **EN 50020:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:
Ex II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order:
In the absence of Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, August 10, 1999

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2128 X**

(15) Description of equipment

The ring initiators of types RJ..., RC... and TG... are used to convert displacements into electrical signals.

The ring initiators may be operated with intrinsically safe circuits certified for categories and explosion groups [EEx ia] IIC or IIB resp. [EEx ib] IIC or IIB. The category as well as the explosion group of the intrinsically safe ring initiators depends on the connected supplying intrinsically safe circuit.

Electrical data

Evaluation and supply circuit..... type of protection Intrinsic Safety EEx ia IIC/IIB resp. EEx ib IIC/IIB
only for connection to certified intrinsically safe circuits
Maximum values:

type 1	type 2	type 3
U_i = 16 V	U_i = 16 V	U_i = 16 V
I_i = 25 mA	I_i = 25 mA	I_i = 52 mA
P_i = 34 mW	P_i = 64 mW	P_i = 169 mW

The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of ring intiators are shown in the table:

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2128 X

types	L_i	C_i	type 1			type 2			type 3		
			maximum permissible ambient temperature in °C for application in temperature class								
	[µH]	[nF]	T6	T5	T4-T1	T6	T5	T4-T1	T6	T5	T4-T1
RJ10-N...	20	30	75	90	100	70	85	100	55	70	90
RJ10-...-N...	20	30	75	90	100	70	85	100	55	70	90
RJ10-Bi...	20	90	75	90	100	70	85	100	55	70	90
RJ10-...-Bi...	20	90	75	90	100	70	85	100	55	70	90
RC10-...-N0...	100	150	75	90	100	70	85	100	55	70	90
RC10-...-N3...	120	90	75	90	100	70	85	100	55	70	90
TG10	20	30	75	90	100	70	85	100	55	70	90
TG10-1	100	150	75	90	100	70	85	100	55	70	90
TG10-bi	20	90	75	90	100	70	85	100	55	70	90
TG10-1bi	120	90	75	90	100	70	85	100	55	70	90
RJ15-N...	20	130	75	90	100	70	85	100	55	70	90
RJ15-...-N...	20	130	75	90	100	70	85	100	55	70	90
RJ15-Bi...	50	90	75	90	100	70	85	100	55	70	90
RJ15-...-Bi...	50	90	75	90	100	70	85	100	55	70	90
RC15-...-N0...	100	150	75	90	100	70	85	100	55	70	90
RC15-...-N3...	70	90	75	90	100	70	85	100	55	70	90
TG15	20	130	75	90	100	70	85	100	55	70	90
TG15-1	100	150	75	90	100	70	85	100	55	70	90
TG15-bi	50	90	75	90	100	70	85	100	55	70	90
TG15-1bi	70	90	75	90	100	70	85	100	55	70	90
RJ21-N...	25	30	75	90	100	70	85	100	55	70	90
RJ21-Bi...	50	70	75	90	100	70	85	100	55	70	90
RJ43-N...	50	40	75	90	100	70	85	100	55	70	90

(16) Test report PTB Ex 99-29058

(17) Special conditions for safe use

1. For the application within a temperature range of -60°C to -20 °C the ring initiators of types RJ..., RC... and TG... must be protected against damage due to impact by mounting into an additional housing.
2. The connection facilities of the ring initiators of types RJ..., RC... and TG... shall be installed as such that at least a degree of protection of IP20 according to IEC-publication 60529:1989 is met.

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 2128 X

3. The assignment of the type of the connected circuit to the maximum permissible ambient temperature and the temperature class as well as the effective internal reactances for the individual types of ring initiators is shown in the table given under item (15) of this EC-type-examination certificate..
4. Inadmissible electrostatic charge of the plastic housing of the ring initiators of types RJ43-...-N..., RJ21-...-N... and RJ21-...-Bi... has to be avoided. A warning label on the device shall point to this danger.

(18) Essential health and safety requirements

Met by the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:
In the absence of Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Braunschweig, August 10, 1999

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18 Sales representatives

www.heinrichs-mt.nl
Tel. +31 (0) 345 596 000
Fax +31 (0) 345 596 001
info@adinco.nl

19 Notes

ADINCO

ADVANCED INSTRUMENTS & COMPONENTS

Since 1970
Representative for

Heinrichs

Ein Unternehmen der IWKA Gruppe

www.heinrichs-mt.nl

Adinco bv

P.O.Box 90
4190 CB Geldermalsen
Netherlands

Tel. +31 (0) 345 59 60 00
Fax +31 (0) 345 59 60 01

E-mail: info@adinco.nl
Internet: www.adinco.nl