

Variable-Area Flowmeters

**KDS
BGK**

Device Description



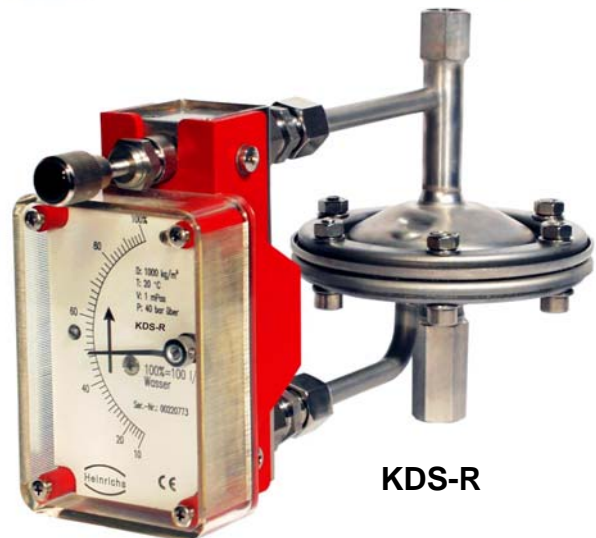
KDS-S



KDS-K/C



BGK



KDS-R

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1 Identification

1.1 Supplier/manufacturer

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Internet: <http://www.heinrichs-mt.nl>
E-Mail: <mailto:info@heinrichs-mt.nl>

1.2 Product type

KDS-K/C/S and BGK:

Miniature flowmeter in all-metal design based on the float principle

KDS-R:

Miniature flowmeter in all-metal design based on the float principle with differential pressure regulator

1.3 Product name

KDS-K/C (horizontal connection)
KDS-S (vertical connection)
KDS-R (vertical connection)
BGK (vertical flange connection)

1.4 Issue date

31/03/2004

1.5 Version no.

3.0

2 Applications

2.1 KDS und BGK

The KDS and BGK flowmeters are used for measuring the flow of liquid and gaseous products in pipes as well as dosing, monitoring, adjusting and controlling them. They show the current flow quantity in volume or mass per unit in time.

2.2 KDS-R

The KDS-R flowmeter can be used for stabilizing set flow quantities of liquid and gaseous products in pipes. The set quantity is kept constant independent of pressure changes during product inflow for type KDS-R.....N or a pressure change during product outflow for type KDS-RV.

3 Operational mode and system design

3.1 Measuring principle for BGK and KDS-K/C/S flowmeters

Float principle: The product flows through the meter vertically from the bottom to the top, lifting the float until the buoyancy force and the weight of the float establish equilibrium. The height of the float is a measure of the flow quantity.

3.2 BGK and KDS-K/C/S system design

The meter consists of a conical fitting pipe with a float that can move vertically. The position of the float resulting from the flow rate is converted to a rotary motion on the pointer axis of the analog indicator unit by the built-in permanent magnet through the magnetic tracking system.

3.3 Measuring principle of the KDS-R

Differential pressure: The diaphragm of the regulator is in a state of equilibrium when the pressure conditions are the same on both sides. The pressure on the input side depends on the pressure of the product and the pressure on the output side on the pressure drop of the setting valve of the flowmeter.

If the pressure changes either on the input side or the output side, the built-in diaphragm valve causes a pressure compensation that keeps the set flow rate constant.

Important: The regulator can only adjust pressure fluctuations on the input or the output side. The pressure conditions on the respective other side must be stable.

3.4 KDS-R system design

The unit consists of a type KDS variable-area flowmeter equipped with a differential pressure regulator.

The variable-area flowmeter consists of the device fitting made of stainless steel with an integrated conical metal tube and a vertically movable float. The valve for setting the flow rate is built-in.

The height of the float resulting from the flow rate is transmitted by the permanent magnet in the float through the magnetic tracking system in a rotation to the pointer axis of the analog indicator unit.

The differential pressure regulator 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:
 1) KDS-R...-V- for a constant inlet pressure and a variable outlet pressure
 2) KDS-R...-N- for a constant outlet pressure and a variable inlet pressure
 For liquids, both versions can be used; however, the KDS-R...-V version is preferred.

4 Input

4.1 Measured variable

Volume flow

4.2 Measuring range

The lower range value is considered 10% of the upper range value.

Measuring range span: 10-100%

Smallest measuring range: 0.1-1.0 l/h water

Largest measuring range:
 10-100 l/h water (KDS-K/C)
 20-200 l/h water (KDS-S and BGK)

4.3 Regulator range

Largest regulator range:
 10-100 l/h water (KDS-R)

4.4 Measuring range table

Type	Measuring range	Measuring range for water at 1000 kg/m ³	Measuring range for air at 1.013 bars absolute pressure	Pressure loss H ₂ O [mbar *] KDS-R	Pressure loss H ₂ O [mbar*] KDS-K/C	Pressure loss H ₂ O [mbar] KDS-S, BGK
KDS-K/C/R	A	0.1-1.0 l/h	3.0 - 30 l/h	350	6	6
	B	0.25-2.5 l/h	7.5 - 75 l/h	350	7	7.5
	C	0.6-6.0 l/h	18 - 180 l/h	350	7	7.5
KDS-S	D	1.0-10 l/h	30 - 300 l/h	350	10	8
	E	1.6-16 l/h	48 - 480 l/h	350	12	9
BGK	F	2.5-25 l/h	75 - 750 l/h	350	17	10
	G	4.0-40 l/h	120 - 1200 l/h	350	25	11
	H	6.0-60 l/h	180 - 1800 l/h	350	45	12
	I	10-100 l/h	300 - 3000 l/h	350	95	15
only KDS-S, BGK	J	16-160 l/h	480 - 4800 l/h		-	20
	K	20-200 l/h	600 - 6000 l/h		-	28

*with valve completely open

5 Electrical output

1 or 2 limit transducers,
 type SJ 3,5N, make Pepperl+Fuchs
 (NJ 2-11 SN special switch)
 Safety class: PTB 00 ATEX 2048 X

6 Measuring accuracy

6.1 Reference conditions

Water 20°C (air 20°C)

6.2 Measured error

± 3% of URV within the range of 10-100%

6.3 System deviation for KDS-R

± 5% of URV

6.4 Repeatability

± 1.0% of URV

6.4.1 KDS-R regulator

± 1.7% of URV

6.5 Influence of ambient temperature

none

6.6 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. Changes in viscosity cause a non-linear display fault.

7 Conditions of use

The VDI/VDE guidelines must be observed. The meter is suitable for 1) liquid products with sufficient flowability, that are free of solids, do not bond and do not tend to settle, and 2) gases with linear flow behavior and an adequate inlet pressure.

KDS-R: The minimum differential pressure between input and output side must be 350 mbar.

7.1 Mounting/start-up

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

The size of the product line to be connected must be identical to the size of the device connection. Please make sure that there is adequate clearance from parts that might cause magnetic interferences, such as solenoid valves and ferromagnetic components like steel brackets/supports. We recommend that the minimum lateral distance between two adjacently mounted devices be **300 mm**. The devices can be mounted close together if vertically offset by one device length. The minimum lateral clearance for interfering steel parts should be **200 mm**. In case of doubt, check the interference by moving the device back and forth in the selected distance by about 200 mm and testing whether the pointer position changes.

Select the mounting location so as to enable a reliable reading of the scale values. Please take note as well of the space requirement for any possible disassembly of the device.

To achieve stress-free mounting, the flanges of the pipe must be aligned parallel to each other. Please check whether the pipe is adequately stable to rule out the possibility of vibration or swinging. (Do not use steel mounting parts on the device.)

If there is risk of dirt or solid matter penetrating the process pipes, flush them beforehand so that these materials do not get caught in the device. Ferromagnetic solid matter such as spatter can lead to the breakdown of the device. If these materials are still present during normal operating conditions, mount a magnetic filter (accessory) in front of the device.

When using gases, slowly let the inlet pressure rise to avoid pressure surges. Basically, avoid activation using solenoid valves to prevent the float from shooting upwards.

KDS-S, BGK: Avoid installing a valve directly in front of the device.

KDS-K/C: As a rule, the valve must be installed in the output if gases are involved.

KDS-R: For gases, the version for a constant input pressure with a valve must be installed at the top. As an option, the version for a constant output pressure with a valve can be installed at the bottom. If liquids are involved, the position of the valve does not have any impact on the function.

7.1.1 Device setting

The measuring equipment is delivered ready for operation according to your order specifications. **The limit transducers** are set to the desired values. If you have not submitted any requirements, the basic settings are the following:

1 contact device: - Minimum contact switching point at 10% of descending flow (damped/closed-circuit principle)

2 contact devices: Minimum contact switching point at 10% of descending flow and maximum contact switching point at 90% of ascending flow

7.2 Ambient conditions

7.2.1 Ambient temperature ranges

without limit transducer: - 25°C to + 65°C
with limit transducer: - 25°C to + 65°C

7.2.2 Storage temperature

- 25°C to + 65°C

7.2.3 Climatic category

Weather-protected and/or unheated locations, class C

7.2.4 Degree of protection

IP 65

7.2.5 Shock resistance/vibration resistance

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

7.2.6 Electromagnetic compatibility

Built-in limit transducer:

In accordance with NAMUR
recommendation NE 21
EN 50 081 Part 1 / EN 50 082 Part 2

7.3 Fluid conditions

7.3.1 Fluid temperature ranges KDS-S/C/K and BGK

with limit transducer: - 40°C to + 130°C
without limit transducer : - 25°C to + 100°C

7.3.2 Fluid temperature range KDS-R

- 10°C to + 100°C

7.3.3 Fluid pressure limit

KDS-K/C PN 40, special version up to PN 160
KDS-S PN 63, special version up to PN 320
BGK PN 40
KDS-R 16 bar, special version up to PN 40
The maximum unilateral pressure resistance of the diaphragm is 7 bar.

7.3.4 Inlet and outlet sections

Inlet and outlet sections are not required for a linear flow profile of the fluid. For a non-linear flow profile, we recommend an inlet section of 150 mm (see also guidelines in accordance with VDI/VDE 3513).

7.3.5 Physical state

Liquid, gaseous

7.3.6 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.

7.3.7 Pressure loss

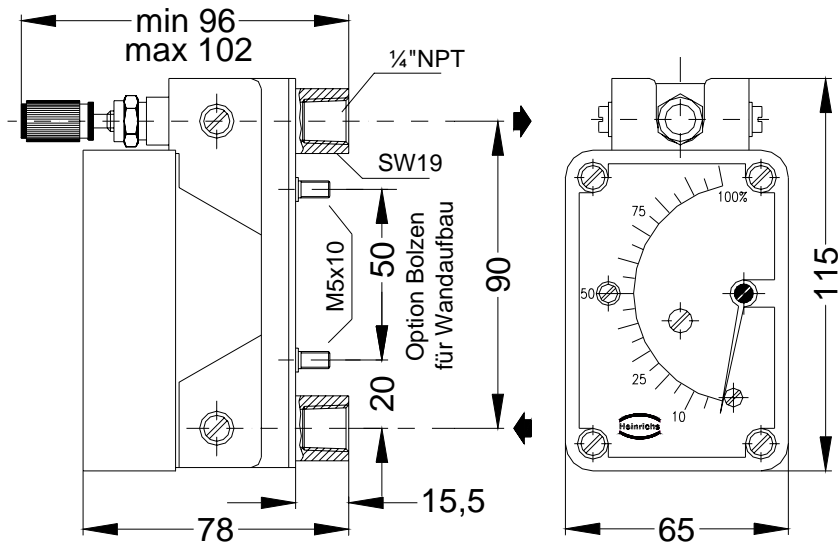
Depends on the meter size and the measuring range (see 4.4 *Measuring range table*).

8 Construction details, type of construction/dimensions

8.1 KDS-K/C

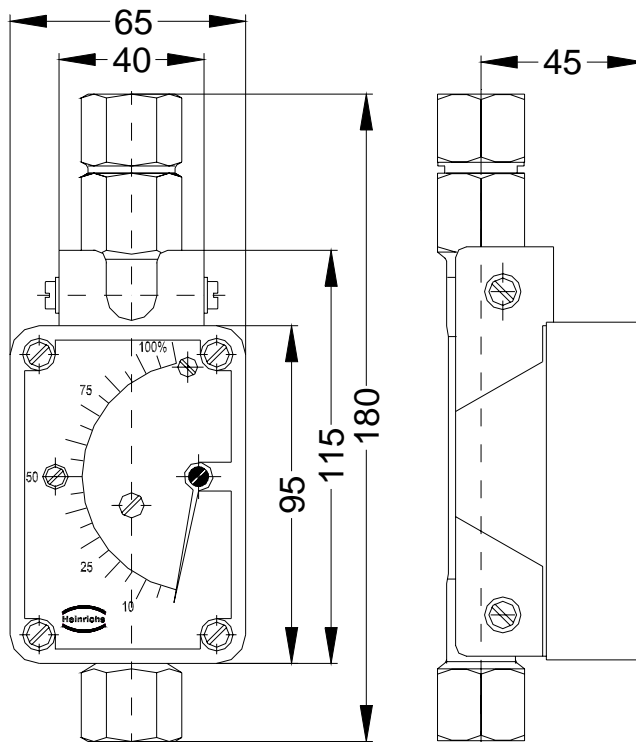
The meter consists of a conical measuring tube with a vertically movable float.
 All metallic wetted parts are made of 1.4404 (316L) stainless steel.
 The measured values are transmitted magnetically to the analog indicator unit mounted on the device.

KDS-K – process connections horizontally towards the back, mounting dimension: 90 mm (NPT ¼ " F connection)
 KDS-C – similar to KDS-K, but with bolt for panel mounting



8.2 KDS-S

Process connections vertically at the top/at the bottom, mounting dimension: 180 mm (NPT ¼ " F connection)



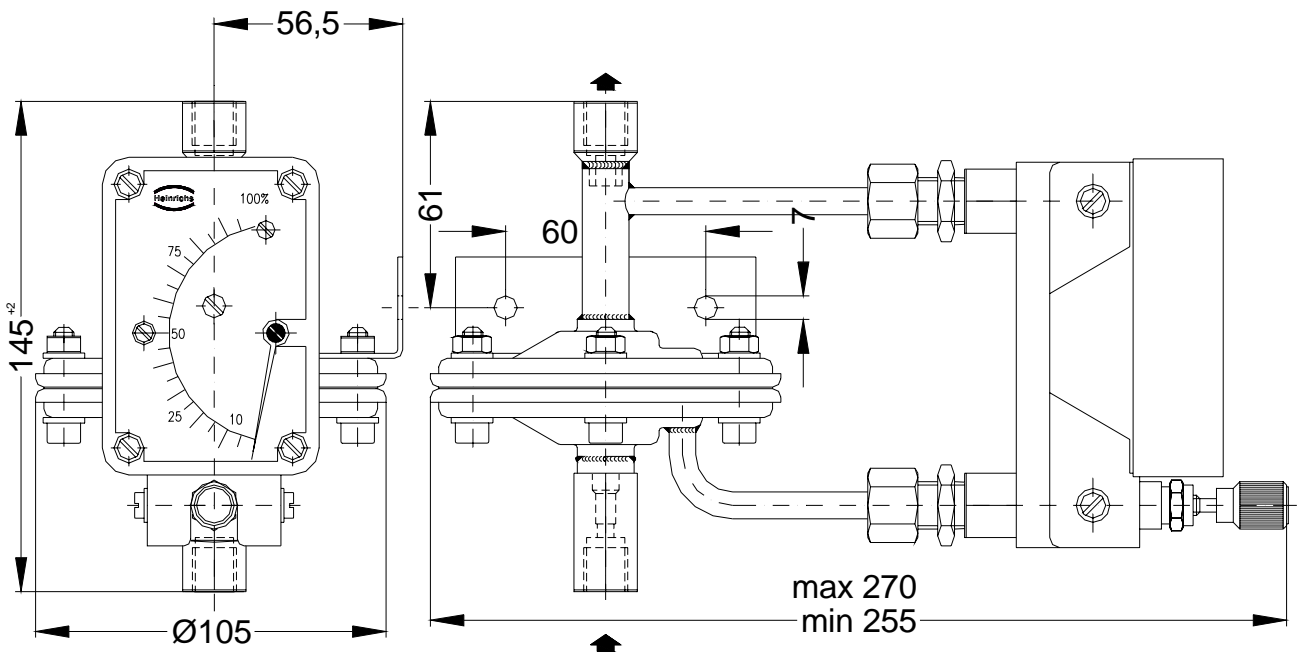
8.3 KDS-R with 1/4" NPT (F) connection as outlet pressure regulator version

The unit consists of a variable-area flowmeter with a setting valve and a differential pressure regulator mounted on the meter.

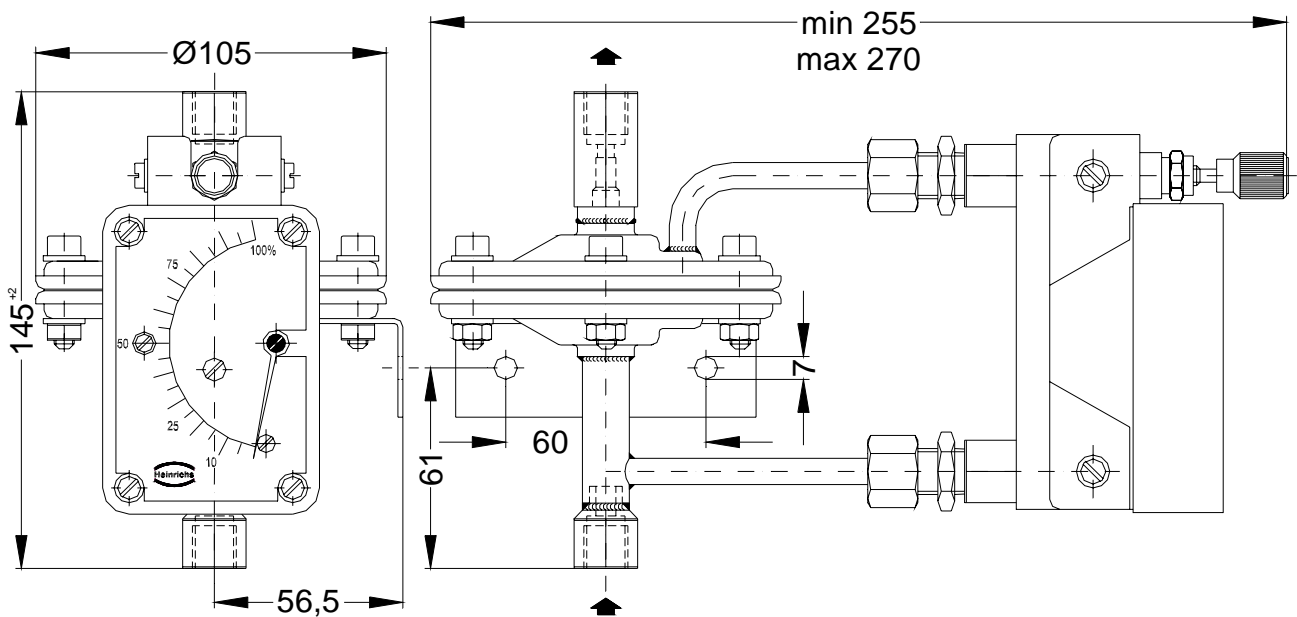
The measured value is displayed on the scale of the analog indicator unit.

The desired flow rate can be set using the built-in valve.

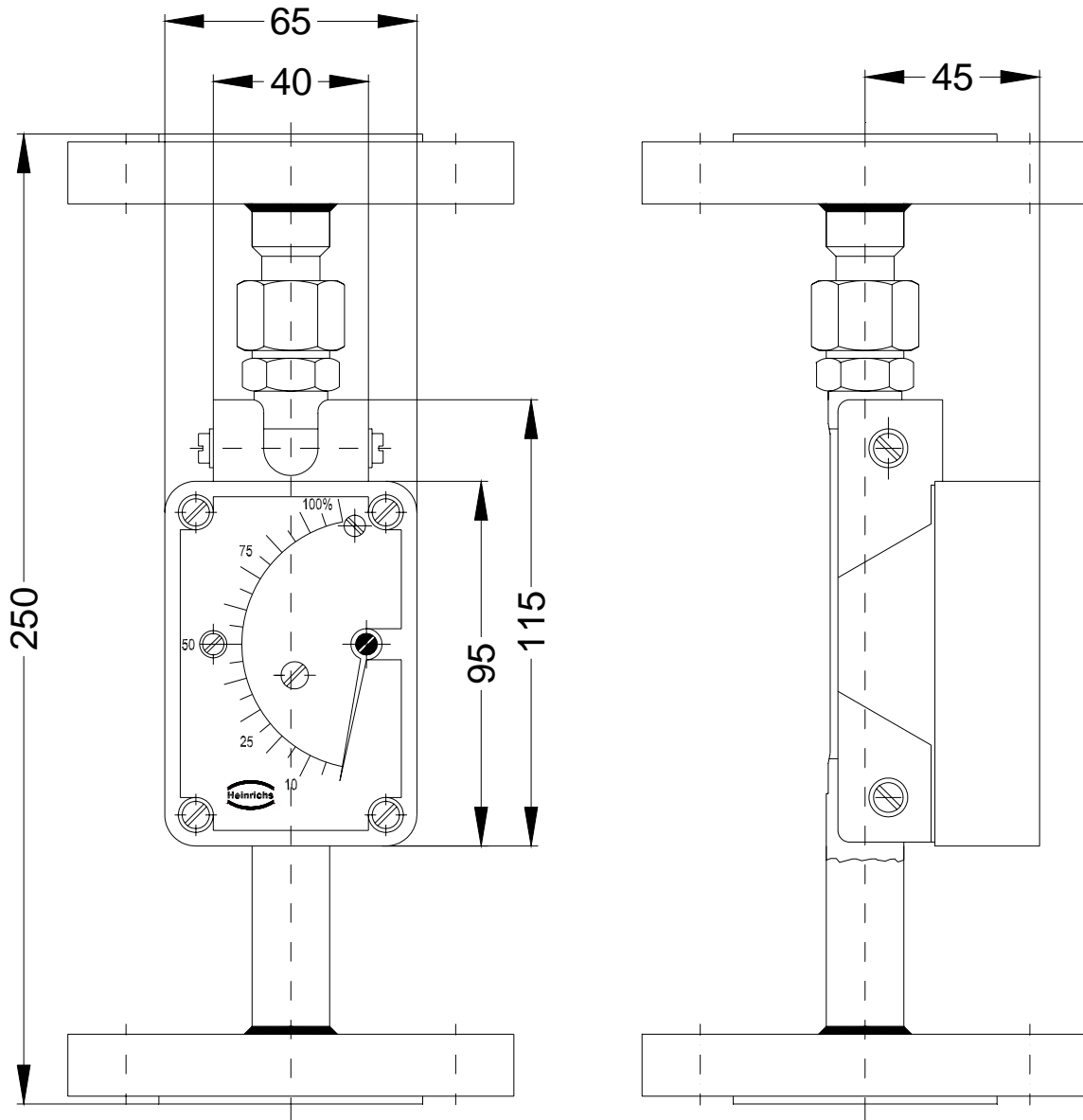
All metallic wetted parts are made of 1.4404 (316L) stainless steel.



8.4 KDS-R with 1/4" NPT (F) connection as inlet pressure regulator version



8.5 BGK with flange connection



8.6 Weights

KDS-K/C 650 g
 KDS-R 1400 g
 KDS-S 620 g

BGK 2400 g

8.7 Materials

- Measuring tube, float, connections: 1.4404 (316L) stainless steel
- Indicator unit: Polyamide
- Indicator cover: Ultramide
- Setting valve: 1.4404 (316L) stainless steel
- Valve sealing: PTFE (KDS-K/C/R)
- Tube sealing: Viton/PTFE (KDS-K/C/R/S)
- Regulator diaphragm: Perbunan/PTFE (KDS-R)

8.8 Process connection

KDS-* ¼" NPT (F)

Special connections:
 Ermeto 6/8/10/12/15 mm,
 Swagelok 6/8/10/12 mm,
 G ¼"(M), G ½" (M),
 Hose connector ¼" (6.35 mm), available as an adaptor.

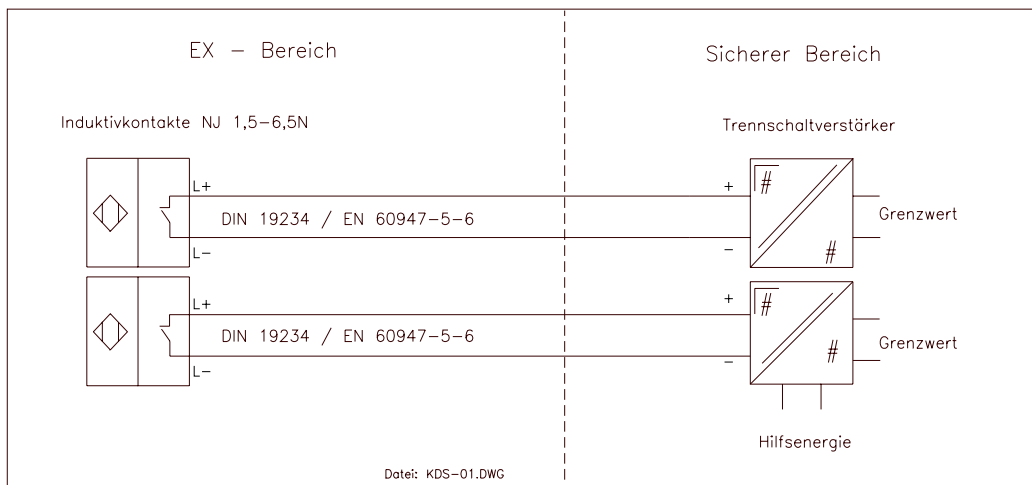
Important: The mounting lengths may be different.

Other connections are available a special versions.

BGK: Flanges: DN15/25, ANSI ¾", 1"
 Other flanges are available as special versions.

9 Electrical connection

9.1 Wiring diagram for limit transducer



10 Indicator unit

- Analog indicator approx. 160° with pointer
- Customized product scale

11 Auxiliary power for limit switch

Through switch amplifier
 Switch amplifier is available as an accessory for 24/115/230 VAC and 24 VDC.

12 Available accessories

1 or 2 inductive limit transducers

13 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

14 Use in hazardous areas

14.1 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 2GD 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.

When used in potentially explosive dust atmospheres, the device must be cleaned regularly in order to avoid deposits exceeding 5 mm.

14.2 With limit transducer

When the limit transducer is installed, the device becomes an electrical assembly. The installed limit transducer of the company Pepperl & Fuchs is certified for the use in a explosive gas environment by **PTB 00 ATEX 2048 X** EC Type Examination Certificate and for the use in a explosive dust environment by **ZELM 03 ATEX 0128 X** EC Type Examination Certificate. The electrical and thermal data and the special conditions of these EC Type Examination Certificates must be observed.

Marking on the cable of the limit transducer:



PTB 00 ATEX 2048 X
II 2G EEx ia IIB T6-T4
ZELM 03 ATEX 0128 X
II 2D Ex iaD 20 T...°C



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

The overtemperature of the maximum fluid temperature based on the maximum ambient temperature must be considered with a factor of **0.4**.



Example:

Max. ambient temperature: $T_{amb} = 40^{\circ}\text{C}$
Max. fluid temperature: $T_m = 90^{\circ}\text{C}$
Temperature class: T4

$T_{\ddot{u}}$ = Overtemperature

T_a = Ambient temperature of limit transducer

$$T_{\ddot{u}} = T_m - T_{amb} = 90^{\circ}\text{C} - 40^{\circ}\text{C} = 50^{\circ}\text{C}$$

$$T_a = T_{\ddot{u}} \cdot 0,4 + T_{amb} = 50^{\circ}\text{C} \cdot 0,4 + 40^{\circ}\text{C} = 60^{\circ}\text{C}$$

In accordance with the tables in the PTB 00 ATEX 2048 X EC Type Examination Certificate, the NJ 1,5-6,5 N... inductive sensor must be operated in the T4 temperature class with an intrinsically safe circuit that does not exceed the maximum values of the Type 3 circuit.

15 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.

16 Standards and directives

- Certified to DIN-EN 9001
- Production in accordance with AD guidelines and HPO approval (TRB200/TRD201)
- TÜV approval for welding requirements in accordance with DIN-EN 729-2
- Measuring range rated and converted to other products according to VDE/VDI guidelines 3513
- Directive 94/9/EC (Equipment and Protective Systems for Use in Potentially Explosive Atmospheres)
- EN 50014:1997+A1-A2 - General requirements
- EN 50020:1994 - Intrinsic safety "i"
- Directive 89/336/EEC (EMC Directive)
- EN 61000-6-2:1999 – Immunity industrial environment
- EN 50 081-1 – Emitted interference residential environment
- EN 55011:1998+A1:1999 – Group 1, Class B
- NAMUR recommendation NE 21
- EN 60529 – Degrees of protection through housing (IP code)
- EN 61010 – Safety requirements for electrical measuring, control and laboratory devices
- EN 60947-5-6:2000 – Switchgear and controlgear
- Directive 97/23/EC (Pressure Equipment Directive)

EC Type Examination Certificate of the inductive sensor



Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

(13) **SCHEDULE**
(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X**

(15) Description of equipment
The cylindrical inductive sensors, types NC... and NJ... are used to convert displacements into electrical signals.
The cylindrical inductive sensors 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 cylindrical inductive sensors 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	type 4
U _i = 16 V	U _i = 16 V	U _i = 16 V	U _i = 16 V
I _i = 25 mA	I _i = 25 mA	I _i = 52 mA	I _i = 76 mA
P _i = 34 mW	P _i = 64 mW	P _i = 169 mW	P _i = 242 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 cylindrical inductive sensors is shown in the following table:

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EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig



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 00 ATEX 2048 X

(4) Equipment: Cylindrical inductive sensors, types NC... and NJ...
(5) Manufacturer: Peppert + 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.

(9) The examination and test results are recorded in the confidential report PTB Ex 00-29206.
EN 50014:1997
EN 50020:1994
Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

(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:

Braunschweig, September 26, 2000



Zertifizierungsstelle Explosionsschutz
By order:
Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

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Physikalisch-Technische Bundesanstalt



Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 00 ATEX 2048 X

NCB10-30GM...-N0...	NJ 2-11-N-G...	NJ 8-18GM-N...
NCN15-30GM...-N0...	NJ 2-12GM-N...	NJ 10-22-N-G...
NJ 0,2-10GM-N...	NJ 2-14GM-N...	NJ 10-30GM-N...
NJ 0,8-4,5-N...	NJ 2,5-14GM-N...	
NJ 0,8-5GM-N...	NJ 4-12GM-N...	

(18) Essential health and safety requirements

Met by the standards mentioned above

Zertifizierungsstelle Explosionschutz
By order:

Braunschweig, September 26, 2000

Johannsmeyer
Dr.-Ing. U. Johannsmeyer
Regierungsdirektor



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