Instruction Manual

DK04

Flap flowmeter and switch for low viscosity media

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Safety Information

General Instructions

To ensure safe operation, the device should only be operated according to the specifications in the instruction manual. The requisite Health & Safety regulations for a given application must also be observed. This statement also applies to the use of accessories.
Every person who is commissioned with the initiation or operation of this device must have read and understood the operating instructions and in particular the safety instructions!
The work safety instructions in this manual as well as the safety, accident prevention and environmental protection regulations generally valid for the work area must be observed.

The liability of the manufacturer expires in the event of damage due to improper use, non-observance of this operating manual, use of insufficiently qualified personnel and unauthorized modification of the device.

Proper Usage

The flap-type flow meters of the DK04 series are used to measure and monitor the flow of low-viscosity, liquid media that do not attack the materials used. All other usage is regarded as being improper and outside the scope of the device.

In particular, applications in which shock loads occur (for example, pulsed operation) should be discussed and checked in advance with our technical staff.

The series DK04 flow meter devices should not be deployed as the sole agents to prevent dangerous conditions occurring in plant or machinery. Machinery and plant need to be designed in such a manner that faulty conditions and malfunctions do not arise that could pose a safety risk for operators.

Dangerous substances

For dangerous media such as e.g. Oxygen, Acetylene, flammable or toxic substances as well as refrigeration systems, compressors, etc. must comply with the relevant regulations beyond the general rules.

Qualified Personnel

The DK04 devices may only be installed by trained, qualified personnel who are able to mount the devices correctly. Qualified personnel are persons, who are familiar with assembling, installation, placing in service and operating these devices and who are suitably trained and qualified.

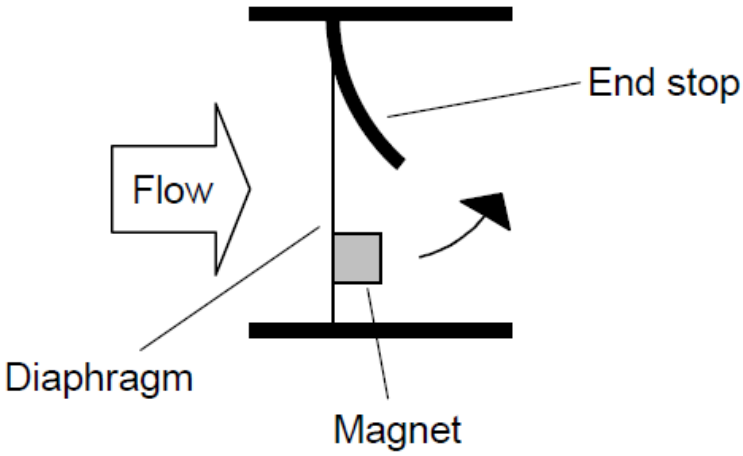
Inward Monitoring

Please check directly after delivery the device for any transport damages and deficiencies. Additional with reference to the accompanying delivery note the number of parts must be checked.
Claims for replacement or goods which relate to transport damage can only be considered valid if the delivery company is notified without delay.

How it works

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.

There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.



Flexible diaphragm made of stainless steel, with plastic-coated magnet.

Because the diaphragm only bends, and functions without a bearing, there is almost no frictional effect. The movement therefore occurs practically free of hysteresis, and the measurements have very good reproducibility.

The diaphragm's low bulk results in a short response time. The almost complete covering of the flow cross-section in the neutral position produces very high start-up sensitivity. As soon as the slightest flow exists, the diaphragm is of necessity deflected. The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary.

The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage.

The low number of media contact parts guarantees reliable operation and a low tendency to contamination.

There are flanged connection pieces on the inlet and outlet; these are available in various nominal widths and materials.

By removing the four bolts of the flange connection, it is simple to remove the measurement unit for servicing, while the connections remain in the pipework.

Design variants

Full metal construction

The standard version has a plastic body with a pressure resistance of 16 bar. A metalled body (nickelled brass or stainless steel) with a pressure resistance of 100 bar is optionally available.
The higher operating pressure requires a combination with metal connection pieces.
Measurements in the range of 1..100 l/min are possible.

High temperature

If the full metal model with high temperature sensors is fitted, operation at media temperatures up to 110 °C is possible. Here, the primary sensor element is located in the housing of the measurement unit, while the converter / counter is located away from housing via a 40 cm long heat-resistant cable.

Resistance to backflows

With forward flows, the diaphragm pushes against an arched end stop, and is undamaged by flow rates which are significantly higher than the intended metering range, or by water hammer.
For flows or pressure surges in the reverse direction, in the standard version the diaphragm pushes against a circumferential support ring made of plastic, and almost completely closes the flow cross-section. This causes pressure to build up which can damage the diaphragm.
In applications where such conditions can arise (e.g. from elastic hoses to the rear of the measuring equipment) the use of the "resistance to backflows" option is recommended. Here, the support ring is replaced by another arched end stop made of stainless steel, so that the diaphragm is provided with the same overload and pressure surge resistance in the reverse direction as in the forward direction. However, a measurement in the reverse direction is not possible.

Low value measurement

For metering ranges up to 6 l/min, the sensitivity of the measuring system can be increased, and so measurements even less than 1 l/min, i.e. from 0.4 l/min become possible. For this, the sensor is installed on the opposite side of the housing. This option is not available for metal housings and models with resistance to backflows.

Installation

Inlet and outlet sections are not to be taken into account when mounting the measuring instrument. However, care must be taken to ensure that the free cross-section of the inflow is not reduced by the assembled pipeline in a way that a nozzle effect leads to unequal distribution of the flow in the inside of the measuring instrument. This could cause measurement errors.

The device is supplied with connection pieces mounted. These may be removed for the installation in the pipework.
For this purpose, the four screws in the front side of one of the connections are loosened and completely removed.
The fittings are then mounted in the pipeline. The connections of the inlet and outlet side may be swapped with each other if necessary, e.g. to change the mounting direction of the four threaded screws.

Subsequently, the body of the instrument is pushed between the connectors and fastened with the help of the four threaded screws. It must be ensured that the O-rings are in the intended position.

This fastening method allows easy disassembly for cleaning and maintenance or replacement of the instrument while retaining the existing connectors.

The diaphragm is very robust despite its low mass. Nevertheless, it should not be forcibly bent or compressed during assembly.

The measuring instrument is intended for operation with water or non-aggressive media of the same viscosity.
Operation with air or other gases can lead to a flutter of the diaphragm, which can destroy the diaphragm within a short time.

It is therefore particularly important during commissioning that the system is slowly filled with the liquid medium and only then operating states with a higher flow rate are started.
It should be ensured by suitable piping that the measuring instrument cannot run empty during breaks in operation.

The sensor can be operated in any direction. However, the lowest tendency to contamination occurs when the diaphragm swings from bottom to top. If possible. installation should therefore be made either with flow from bottom to top, or horizontal. (see principle sketch p. 1 Characteristics). For this purpose, the installation must be carried out in a horizontally guided pipeline.

When installed horizontally, the electronics should point downwards in the low value range model (max. 6 l/min, see options), for other versions upwards.

The adjustment in the factory takes place with flow in a horizontal direction.

Important:
Regardless of the mounting direction, the prerequisite for trouble-free operation is that the medium does not contain any ferritic particles that can attach to the magnet on the orifice. These can lead to measurement errors. In addition, it must be ensured that no particles with grain sizes > 100 µm are present in the medium. These can get stuck in the gap of the aperture and possibly inhibit the orifice plate from returning to zero, so that a flow rate is displayed even without a flowing medium.

If necessary, a filter with mesh size is located in front of the measuring system < 100 µm.

The flow direction must be observed. This is marked on the housing with an arrow. If there is a risk of rear flows (e.g. due to elastic hoses present in the pipeline), a version with the option "backflow resistance" should be selected.

The electronic housing is connected to the primary sensor and cannot be disassembled by the user.

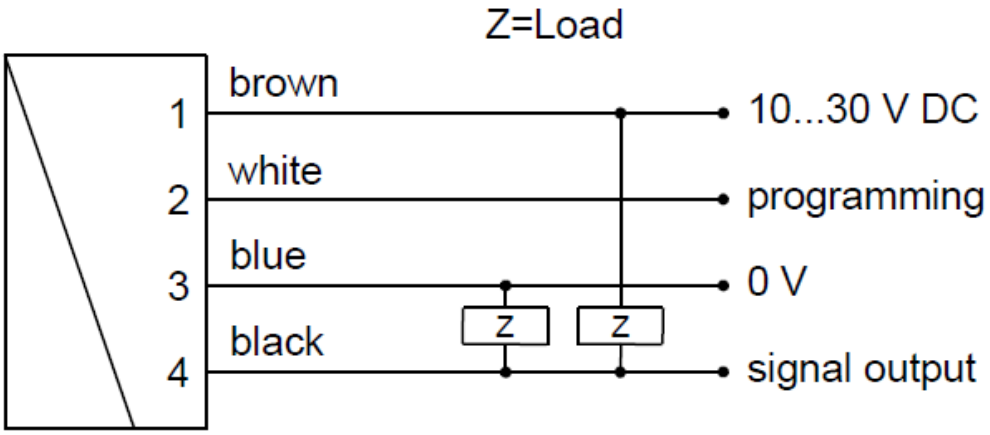
Electrical characteristics

Output data	all outputs are resistant to short circuits and reversal polarity protected
Current output:	4...20 mA (0...20 mA on request)
Voltage output:	0...10 V (2...10 V on request) output current max. 20 mA
Frequency output:	transistor output "Push-Pull" I_{out} = 100 mA max. output frequency depends on measuring range, standard 500 Imp/l (corresponds to 833,3 Hz at 100 l/min) minimum value range: 5000 Imp/l (corresponds to 500 Hz at 6 l/min) (other frequencies on request)
Pulse output:	transistor output "Push-Pull" I_{out} = 100 mA max. puls width 50 ms pulse per volume is to be stated
Switching output	transistor output "Push-Pull" (resistant to short circuits and polarity reversal) I_{out} = 100 mA max.
Indication:	yellow LED shows: operating voltage (analogue output) or output status (frequency and pulse output) or on= normal, off = alarm (switching output) rapid flashing = programming
Electrical connection:	For round plug connector M12x1, 4-pole
Supply voltage:	10...30 V_{DC} or. 15...30 V_{DC} (for voltage output 10 V)
Protection class:	IP 67

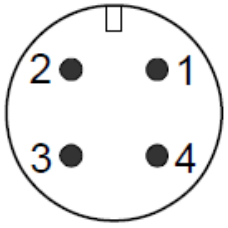
Electrical connections

Before the electrical installation, it must be ensured that the supply voltage corresponds to the data sheet.
It is recommended to use shielded wiring.
The push-pull output of the frequency and switching output version can as desired be connected as a PNP or an NPN output.

Wiring:



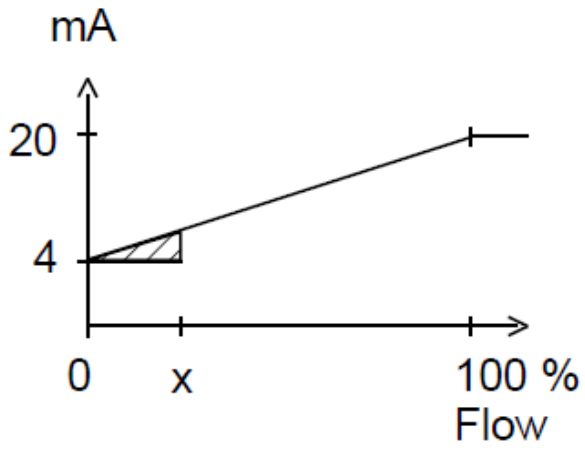
Connection example: PNP NPN



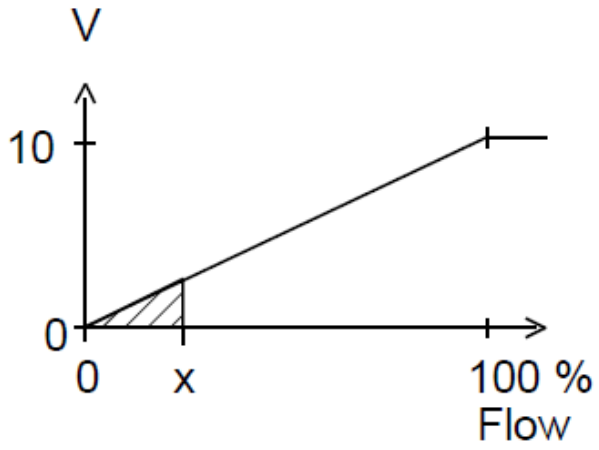
Signal output curves

Value x = Begin of the specified range
= not specified range

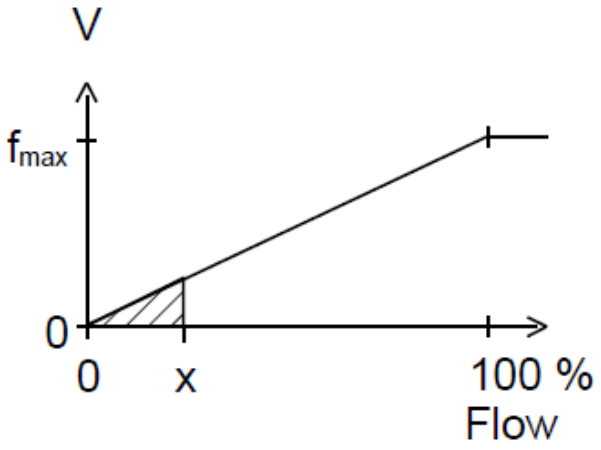
Current output



Voltage output



Frequency output

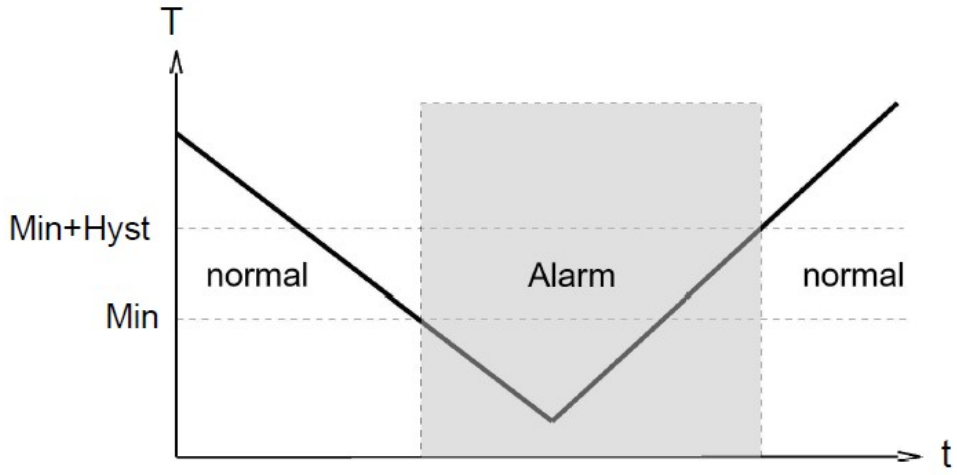


f_{max} selectable in the range of up to 2000 Hz

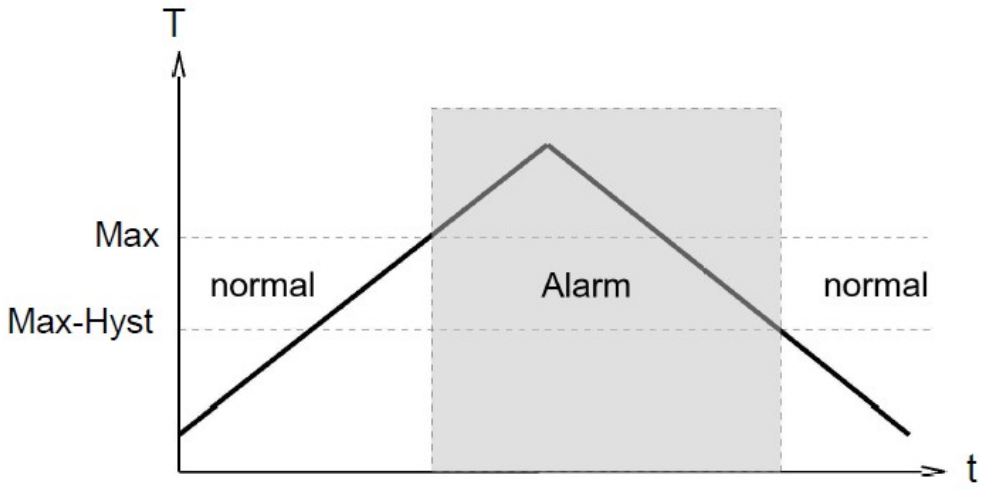
Version with switching output:

The limit switch can be used to monitor minimal or maximal.

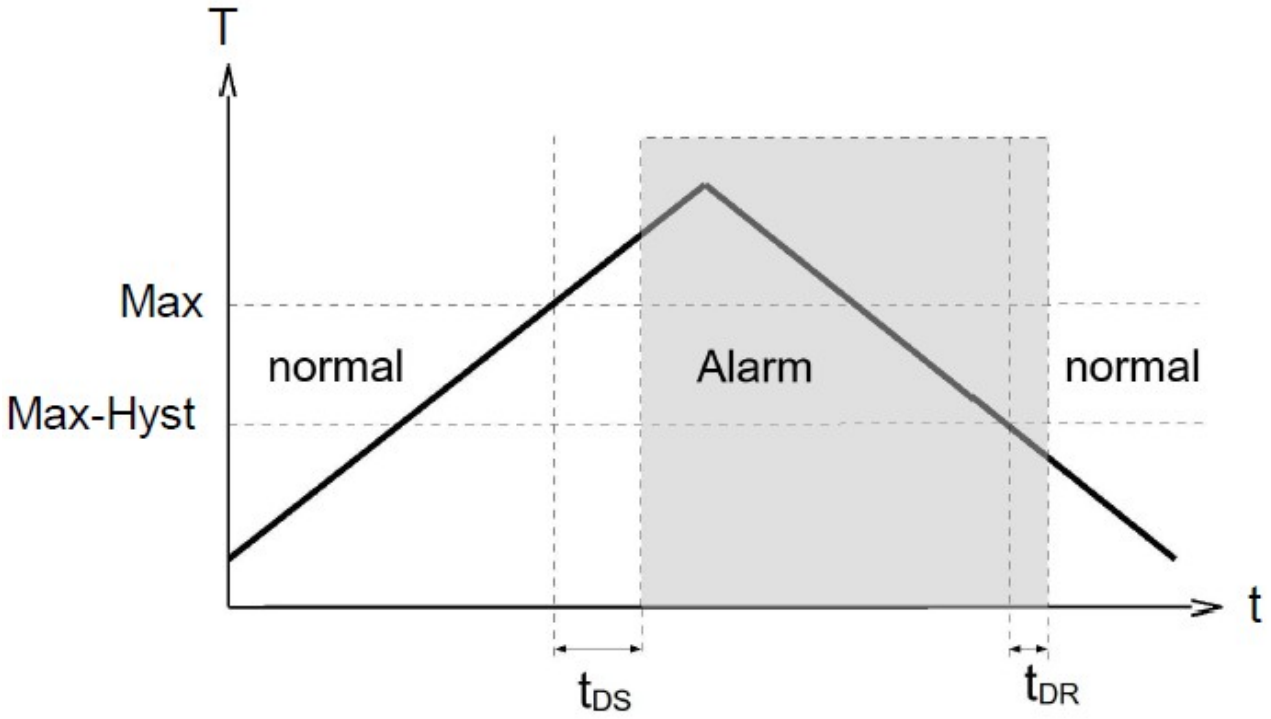
With a **minimum-switch**, falling below the limit value causes a switchover to the alarm state. Return to the normal state occurs when the limit value plus the set hysteresis is once more exceeded.



With a **maximum-switch**, exceeding the limit value causes a switchover to the alarm state. Return to the normal state occurs when the measured value once more falls below the limit value minus the set hysteresis.



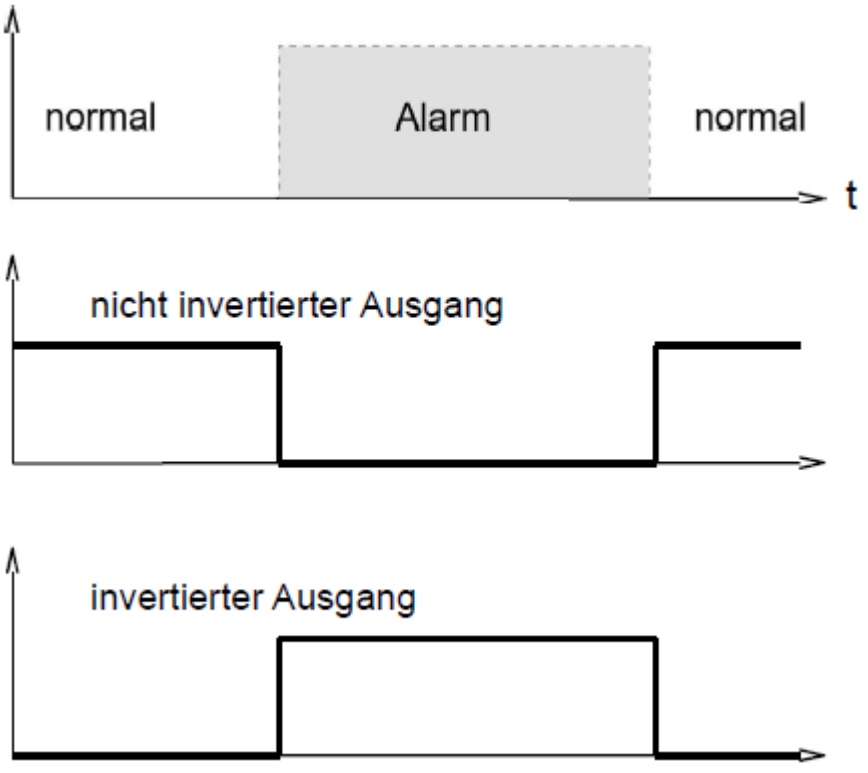
A switchover delay time (t_{DS}) can be applied to the switchover to the alarm state. Equally, one switch-back delay time (t_{DR}) of several can be applied to switching back to the normal state.



In the normal state the integrated LED is on, in the alarm state it is off, and this corresponds to its status when there is no supply voltage.

In the **non-inverted** (standard) model, while in the normal state the switching output is at the level of the supply voltage; in the alarm state it is at 0 V, so that a wire break would also display as an alarm state at the signal receiver. Optionally, an **inverted** switching output can also be provided, i.e. in the normal state the output is at 0 V, and in the alarm state it is at the level of the supply voltage.

A Power-On-Delay function (ordered as a separate option) makes it possible to maintain the switching output in the normal state for a defined period after application of the supply voltage.



DK04

Flap Flowmeter and Switch for Low Viscosity Media

- **robust design**
- **measuring ranges 0,4...6 l/min up to 1...100 l/min**
- **output 4-20 mA, 0-10 V, frequency, pulse or switching output**
- **highly resistant to overload**
- **low pressure loss**
- **all metal version of brass or stainless steel optional (max. pressure 100 bar)**
- **high temperature version up to 110 °C optional**

Description:

The DK04 flap type flowmeter consists of a thin flexible flap which covers the complete cross section of the flow. This flap is moved by the liquid changing the position of a magnet. The magnet's position is detected by a Hall-sensor and the attached electronic unit generates a linearised electrical signal proportional to the flow. Due to the flexible flap and a special designed thrust bearing even heavy hydraulic shocks will not damage the device. Because of the small number of wetted parts the DK04 flowmeter assures high reliable operation and it is very insensitive to particles in the flow.

Typical application:

The flowmeters type DK04 are applied to monitor and supervise water or liquids similar to water up to a viscosity of 20 cSt. All applications where a high repeatability is required the DK04 flowmeters can be applied with success.

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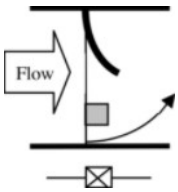
Subject to technical changes

Models:

DK04.x.x.1:	voltage output 0–10 V
DK04.x.x.2:	current output 0(4)–20 mA
DK04.x.x.3:	frequency output 10…2000 Hz
DK04.x.x.4/4M:	programmable switch PNP and NPN
DK04.x.x.5:	counting pulse

Operating Principle:



Technical Data:

Sensor:	dynamic diaphragm
Nominal size:	DN 8...25
Connection:	female thread G 1/4...G 1
Measurement accuracy:	standard ranges: ±3 % of measured value, minimum 0,25 l/min minimum value range (0,4–6,0 l/min): ±3 % of measured value, minimum 0,1 l/min
Pressure loss:	max. 0,5 bar
Pressure resistance:	plastic version: PN 16 full metal version: PN 100
Media temperature:	0...+70 °C high temperat. version.: 0...+110 °C
Ambient temperature:	0...+70 °C
Storage temperature:	-20...+80 °C

Materials with Medium-Contact:

Body:	PPS, CW614N (brass) nickelled stainless Steel 1.4404
Connections:	POM CW614N (Messing) nickelled stainless Steel 1.4404
Seals:	FKM
Diaphragm:	stainless steel 1.4031k
Magnet holder:	PPS
Back-up ring:	PVDF
Adhesive:	epoxy resin

Materials Non-Medium-Contact:

Sensor tube:	CW614N (brass) nickelled
Adhesive:	epoxy resin
Flange bolts:	stainless steel full metal construction: steel

Electrical Data:

Supply voltage:	10…30 V_{DC} 15...30 V_{DC} (for voltage output 10 V)
Power consumption:	< 1 W (for no-load outputs)
Connection:	Round plug connector M12 x 1, 4-pole
Protection class:	IP67
Indication/Display:	yellow LED
Analogue outputs:	operating voltage
frequency, pulse output.:	output status
Switching outputs:	on= normal / off = Alarm rapid flashing = programming

Output Data:

Safety:	all outputs are resistant to short circuits and reversal polarity protected
Current output:	4...20 mA (0...20 mA on request)
Voltage output:	0...10 V (2...10 V on request) output current max. 20 mA
Frequency output:	transistor output "Push-Pull" I_{out} = 100 mA max. output frequency depends on metering range, standard is 500 Imp/l (corresponds to 833,3 Hz at 100 l/min) minimum value range: 5000 Imp/l (corresponds to 500 Hz at 6 l/min) (other frequencies available on request)
Pulse output:	transistor output "Push-Pull" I_{out} = 100 mA max. pulse width 50 ms pulse per volume is to be stated
Switching output:	transistor output "Push-Pull" (resistant to short circuits and polarity reversal) I_{out} = 100 mA max. hysteresis: 2 % of meas. span

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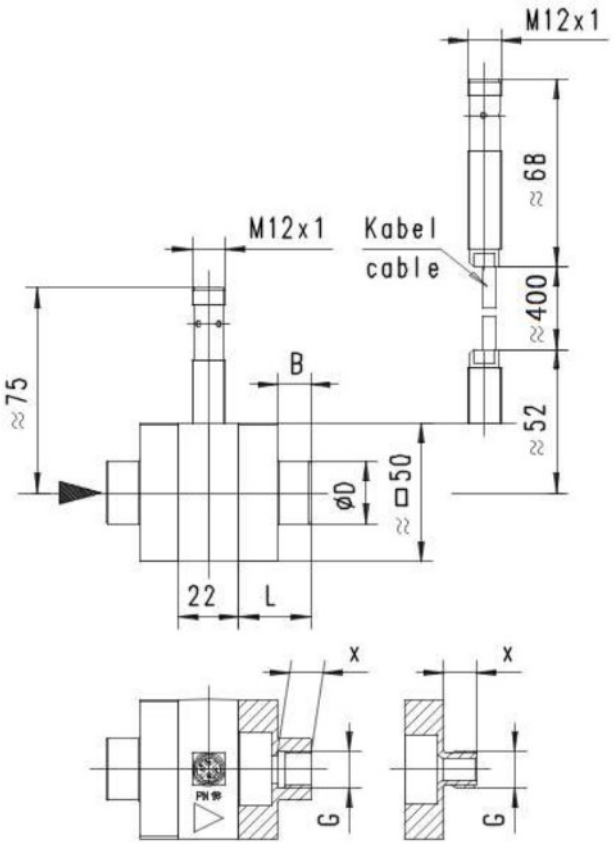
Order Code Connection Size / Measuring Range:

	Connection size				
Measuring range	DN 8	DN 10	DN 15	DN 20	DN 25
A: 0,4...6,0 l/min	**08A**	**10A**	**15A**	**20A**	**25A**
B: 1,0...15 l/min	**08B**	**10B**	**15B**	**20B**	**25B**
C: 1,0...25 l/min	**/**	**10C**	**15C**	**20C**	**25C**
D: 1,0...50 l/min	**/**	**/**	**15D**	**20D**	**25D**
E: 1,0...80 l/min	**/**	**/**	**/**	**20E**	**25E**
F: 1,0...100 l/min	**/**	**/**	**/**	**/**	**25F**

Dimensions and Q_{max} Values:



G	DN	L [mm]	B [mm]	X [mm]	ØD Metal	ØD Plastic
G 1/4	DN 08	26	12	12	22,5	33
G 3/8	DN 10	26	12	12	22,5	33
G 1/2	DN 15	28	14	14	28,0	37
G 3/4	DN 20	30	15	16	35,0	42
G 1	DN 25	30	-	18	-	-

Connection pieces:

G	Q_{max} [l/ min]	Weight [kg] Metal	Weight [kg] Plastic
G 1/4	20	0,245	0,055
G 3/8	40	0,240	0,050
G 1/2	80	0,250	0,055
G 3/4	100	0,270	0,060
G 1	100	0,400	0,085

Body, sensor, internal parts:	0,400	0,100

Order Code:

Order number:	**DK04.**	**10.**	**A.**	**1.**	**0.**	**0.**	**0**

Flap flowmeter and switch for low viscosity media

Process connection*:
08 = DN 8, G 1/4
10 = DN 10, G 3/8
15 = DN 15, G 1/2
20 = DN 20, G 3/4
25 = DN 25, G 1 *****see table on the left

Measuring ranges*:
A = 0,4–6,0 l/min (with PPS-housing only)
B = 1–15 l/min
C = 1–25 l/min (not for process connection 08)
D = 1–50 l/min (not for process connection 08, 10)
E = 1–80 l/min (only for process connection. 20, 25)
F = 1-100 l/min (only for process connection. 25)
Measuring ranges can be changed downwards at the factory

Output:
1 = analogue output 0…10 V
2 = analogue output 4….20 mA
3 = frequency output **(please indicate f_{max})**
4 = programmable switching output, maximum switch (Push Pull, PNP and NPN) **(please indicate switch point)**
4M= programmable switching output, minimum switch (Push Pull, PNP and NPN) **(please indicate switch point)**
5 = counting pulse

Electrical connection:
0 = plug (M12x1) 4- wire. without mating connector

Housing version:
0 = housing PPS, connection brass, standard
1 = housing PPS, connection POM
2 = housing PPS, connection stainless steel
3 = housing + connection brass (P_{max} = 100 bar)
4 = housing + connection st. steel (P_{max} = 100 bar)
5 = housing + connection brass (P_{max} = 100 bar, high temperature version up to 110 °C)
6 = housing + connection st. steel (P_{max} = 100 bar, high temperature version up to 110 °C)

Options:
0 = without
1 = please specify in plain text

For devices with switching output:
S = Switching delay period, 0,0...99,9 s (from normal to alarm)
R = Switch-back delay period, 0,0...99,9 s (from alarm to normal)
P = Power-on-delay period, 0...99 s (after connecting the supply, time during which the switching output is not activated)
Hxx = Switching hysteresis [% of metering range] (standard: 2 %)

Accessory:

M12 plug connector with PVC-cable
SM12.4 (4-wire)

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