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**FO N4** Orifice flowmeter

# Operating Instructions

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# 1 Safety Instructions

## 1.1 Intended use

The *FO N4* orifice flowmeter is used to measure the flow of transparent liquids and gases in closed pipes. The flowmeter is suitable for any mounting location, position and flow direction.

The flowmeter can also be used for flow monitoring if equipped with limit contacts.



### **Warning!**

*The operator of these measuring devices is solely responsible for the suitability, intended use and corrosion resistance of the selected materials. It must be particularly ensured that the materials selected for the wetted parts of the flowmeter are suitable for the process media to be measured.*

*The manufacturer is not liable for any damage resulting from improper or unintended use of these devices.*

The *FO N4* may only be operated within the pressure and voltage limits specified on the name plate.

No external loads may act upon the meter. The flowmeters are primarily designed for static applications.

## 1.2 Certifications

Classification by

- Pressure equipment directive 97/23/EC

The meter meets the requirements of Article 3, paragraph 3 (sound engineering practice SEP).

**The most hazardous permissible media are**

- **for liquids and gases: fluids of group 2**

## 1.3 Safety instructions from the manufacturer

### Disclaimer

The manufacturer will not be liable for any damage resulting from the use of its product, including, but not limited to direct, indirect, incidental, punitive and consequential damages.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to revise the content of its documents, including this disclaimer, without prior notification, and will not be liable in any way for possible consequences of such changes.

### Product liability and warranty

Mecon GmbH assumes no guarantee for repair work carried out by the customer without prior notification and consultation. Any instruments or parts rejected by a customer must be returned to us, if no other arrangement has been made.

### General information

This manual is intended for the correct installation as well as operation and maintenance of the devices. Read this instructions carefully before installing the device and placing into operation.

Specially designed or customised models and specialised applications are not included in this manual.

## 2 Start-up

### **When starting up the unit, the following points must be observed:**

- Make sure that the actual operating conditions (pressure and temperature) do not exceed the limits specified on the nameplate.
- The calibration is carried out for defined conditions. It is essential to ensure compliance with the calibration conditions. Deviations of the density, pressure or temperature of gases, as well as density and viscosity of liquids, result in errors.
- Bends, valves and the like must be installed in such a distance of the orifice unit that disturbances have subsided. Orifice units with large diameters are highly sensitive to disturbance.
- When floats with magnets and contact switches are used, it is recommended during commissioning to ensure the correct position of the bistable contact by moving the float along the contact in flow direction.

### **Exceptions for the measurements of gases:**

- Provide valves downstream the flowmeter if  $p_{abs} > 1,013$  bar and usually upstream the flowmeter if  $p_{abs} = 1,013$  bar (no overpressure).
- Install a flow control valve close to the flowmeter (downstream), to prevent oscillations during the measurement.
- Adjust the operating pressure exactly to the reference pressure (during calibration) to prevent measurement errors.

## 3 Installation

### 3.1 Installation instructions

**Information !**

*All instruments are carefully checked for proper function before shipment. Immediately on receipt, the outer packing carefully for damage or signs of im handling.*

*Report damage to the carrier and your competent sales staff. In such cases, a desc of the defect, the type and the serial number of the device is indicated.*

**Information !**

*Unpack the unit carefully to avoid damage.*

**Information !**

*Check the completeness of the delivery by using the packing list. Check the name p the delivered flow meter is according to your order. Especially check units with el components for the correct supply voltage.*

### 3.2 Installation

The measuring regulations for the flow DIN EN ISO 5167 not only include the version of orifice units but also require an installation conforming to standards so that the indicated uncertainty in measurement can be kept.

The standard installation must already be considered during the projecting of the pipeline. The orifice unit must be installed in a straight pipeline which is long enough.

- Align orifice with the sharp edge (+ marking) to the entry side
- Insert differential pressure sensor with gaskets concentrically between the flanges of the pipeline and tighten uniformly
- Loosen the union nut, align the indicating part vertically downwards and then tighten union nut (Fig.4, ①)
- In general, an inlet pipe of 10 x D and an outlet section of 5 x D is sufficient.

## 4 Service

### 4.1 Storage

Keep the device in a dry and dust-free place.

Keep away from direct sun and heat.

Avoid external load to the device

The storage temperature range for standard devices with electrical components is about -40 ... +70 °C (- 40 °F ... 158 °F)

### 4.2 Maintenance and cleaning

The devices were built within scope of low maintenance but periodically the flowmeters should be inspected for signs of corrosion, mechanical wear as well as damage to the fitting and the display unit.

We advice to carry out inspections at least once a year.

F3, or a detailed inspection and cleaning the device must be removed from the piping.

Contamination, especially around the bypass orifice, may lead to faults in the measurement. The bypass orifice plate can be dismounted and cleaned without interrupting the main flow if the ball valves are closed first.



**Caution!**

*Appropriate safety precautions have to be taken when removing the device. Always use new gaskets when reinstalling the device in the piping.*

### 4.3 Returning the device to the manufacturer

This device has been carefully manufactured and tested. Should you nevertheless need to return a device to MECON GmbH please observe the following points:



**Caution!**

According to the actual waste disposal directives, the owner/customer is responsible for the waste management of hazardous and toxic waste. For reasons of environmental protection and safeguarding the health and safety of our personnel **all devices sent to MECON GmbH to be repaired must be free of toxic and hazardous substances. This also applies to cavities of the devices before returning them to MECON.**

*The customer has to confirm this by filling in an appropriate form which is available for download on the MECON website:*

*[www.mecon.de/en/declaration/contamination.pdf](http://www.mecon.de/en/declaration/contamination.pdf)*



**Caution!**

In case of returning devices which contain hazardous and toxic substances, Mecon GmbH is entitled to dispose of these substances at cost to the customer without any further notice.



## 5 Device Description

### 5.1 Scope of delivery



- 1 Orifice flowmeter FO N4
- 2 Operating instructions
- 3 Certificates (optional)

**Fig. 1** Scope of delivery



**Information !**

**Please check the delivery for completeness using the packing list.**

### 5.2 Versions



**Fig. 2** Standard device with bypass  
and orifice made of PVC

The FO N4 orifice flowmeter primarily consists of an orifice plate as the sensor and a float as the display element. A differential pressure is produced across the orifice plate which is fitted in the main stream between two flanges in the piping. In a bypass, this differential pressure produces a volume flow in a variable area meter. The height of the float indicates the flow rate.

The flow is read at the position of the float's widest diameter.

**Special features:**

- Complies with requirements for treatment and disinfection of swimming / bathing pools (DIN 19 643)
- Simple installation
- Direct visualization of flow rate in bypass
- Suitable for any mounting positions without reduction in accuracy

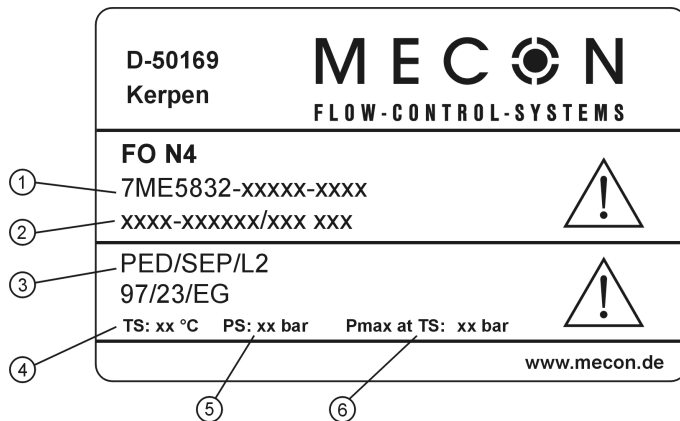
**5.3 Nameplate**



**Important!**

**Please refer to the device nameplate to ensure that the device is built according to your order.**

**Check particularly for the correct supply voltage**



**Fig. 3** Nameplate of the FO N4

- |   |                      |   |
|---|----------------------|---|
| ① | Code number          | Device specific code number                             |
| ② | Year / Serial number | Device specific serial number and the year it was built |
| ③ | Category             | Category acc. To Pressure Equipment directive (PED)     |
| ④ | TS Medium            | Maximum temperature of the medium                       |
| ⑤ | PS                   | Maximum pressure of the medium                          |
| ⑥ | Pmax bei TS          | Maximum pressure of the medium at temperature TS        |

## 7 Description Code

The description code consists of the following elements:

7ME5832--/

①
②
③
④
⑤
⑥
⑦
⑧
⑨

### ① Flow tube

- 0** Trogamid
- 1** Polysulfone

### ② Nominal diameter

- P** DN 25 (1")
- Q** DN 32 (1 ¼")
- A** DN 40 (1 ½")
- B** DN 50 (2")
- C** DN 65 (2 ½")
- D** DN 80 (3")
- E** DN 100 (4")
- F** DN 125 (5")
- G** DN 150 (6")
- H** DN 200 (8")
- J** DN 250 (10")
- K** DN 300 (12")
- L** DN 350 (14")
- M** DN 400 (16")

### ③ Measuring ranges (for water in [m³/h] (refer to the following table))

- A** Standard range A
- B** Standard range B
- C** Standard range C
- D** Standard range D
- E** Standard range E
- Z** Special range (with additional Y01)

Nominal size		A	B	C	D	E
DN	Inch					
25	1"	0.6 – 3.0	0.9 – 4.5	1.2 – 6.0	--	--
32	1 ¼"	0.8 – 4.0	1.5 – 7.5	2.0 – 10.0	--	--
40	1 ½"	1.2 – 6.0	2.0 – 10.0	3.2 – 16.0	--	--
50	2"	2.0 – 10.0	3.0 – 15.0	5.0 – 25.0	--	--
65	2 ½"	3.2 – 16.0	6.0 – 30.0	8.0 – 40.0	9.0 – 45.0	16.0 – 80.0
80	3"	5.0 – 25.0	10.0 – 50.0	13.0 – 65.0	15.0 – 75.0	20.0 – 100
100	4"	10.0 – 50.0	16.0 – 80.0	20.0 – 100	24.0 – 120	40.0 – 200
125	5"	13.0 – 65.0	24.0 – 120	32.0 – 160	39.0 – 195	40.0 – 200
150	6"	20.0 – 100	32.0 – 160	50.0 – 250	54.0 – 270	70.0 – 350
200	8"	34.0 – 170	60.0 – 300	80.0 – 400	99.0 – 495	130 – 640
250	10"	50.0 – 250	80.0 – 400	130.0 – 650	150 – 750	160 – 800
300	12"	80.0 – 400	120 – 600	200 – 1,000	--	180 – 900
350	14"	100 – 500	200 – 1,000	270 – 1,300	--	--
400	16"	140 – 700	240 – 1,200	320 – 1,600	--	--

**④ Float material**

- 0** Mat.No.. 1.4305
- 1** Mat.No. 1.4571
- 2** Mat. No..1.4571 with Magnet
- 3** PVC weighted
- 4** PVC weighted with Magnet

**⑤ Connection standard**

- 0** DIN 2501
- 1** ASME B16.5 150 RF

**⑥ Contacts (only with magnetic float)**

- 0** without
- 1** Contact K18/A (closes when limit is fallen below)
- 2** Contact K18/B (closes when limits exceeded)
- 3** 2 Contacts K18/A
- 4** 2 Contactc K18/B
- 5** 1 each Contact 18/A und K18/B

**⑦ Bypass pipe / Orifice**

- AW** PVC / PVC
- PW** PP / PP
- Bx** PVC / stainless steel mat. No.1.4571
- Qx** PP / stainless steel mat. No. 1.4571
- xP** DN 25 (1")
- xQ** DN 32 (1 ¼")
- xA** DN 40 (1 ½")
- xB** DN 50 (2")
- xC** DN 65 (2 ½")
- xD** DN 80 (3")
- xE** DN 100 (4")
- xF** DN 125 (5")
- xG** DN 150 (6")
- xH** DN 200 (8")
- xJ** DN 250 (10")
- xK** DN 300 (12")
- xL** DN 350 (14")
- xM** DN 400 (16")

**⑧ Calibration certificate**

- 0** Without calibration certificate
- 1** With calibration certificate

**⑨ Further designs**

- Y01** Measured medium: specify in plain text: medium always required measuring range with dimension, sensity with viscosity with dimension, operating temperature, operating
- Y04** Silicone-free-version
- Y99** Special version in plain text

## 7 Measuring ranges for liquids

Standard measuring ranges for liquids ( $\rho = 1 \text{ kg/l}$  (62,43 lb/cu.ft), viscosity 1mPa.s (1cP))

Nominal diameter		overpressure $\geq 0,5\text{bar}$							
		Minimum measuring range				Maximum measuring range			
		DN	Inch	[m <sup>3</sup> /h]	[Usgpm]	$\Delta p^*$		[m <sup>3</sup> /h]	[Usgpm]
[mbar]	[psi]					[mbar]	[psi]		
25	1	0,6 ... 3,0	2,64 ... 13,2	335	4,86	1,2 ... 6,0	5,28 ... 26,4	205	2,97
32	1 ¼	0,8 ... 4,0	3,52 ... 17,6	335	4,86	2,0 ... 10,0	8,8 ... 44,0	205	2,97
40	1 ½	1,2 ... 6,0	5,28 ... 26,4	335	4,86	3,2 ... 16,0	14,1 ... 70,0	200	2,90
50	2	2,0 ... 10,0	8,8 ... 44,0	330	4,79	5,0 ... 25,0	22,0 ... 110	200	2,90
65	2 ½	3,2 ... 16,0	14,1 ... 70,0	330	4,79	16,0 ... 80,0	39,6 ... 198	200	2,90
80	3	5,0 ... 25,0	22,0 ... 110	330	4,79	20,0 ... 100	66,0 ... 330	190	2,76
100	4	10,0 ... 50,0	44,0 ... 220	300	4,79	40,0 ... 200	106 ... 528	190	2,76
125	5	13,0 ... 65,0	57,0 ... 286	325	4,71	40,0 ... 200	172 ... 858	190	2,76
150	6	20,0 ... 100	88,0 ... 440	315	4,57	70,0 ... 350	238 ... 1188	175	2,54
200	8	34,0 ... 170	150 ... 749	320	4,64	130 ... 640	436 ... 2179	185	2,68
250	10	50,0 ... 250	220 ... 1100	250	3,63	160 ... 800	661 ... 3301	190	2,76
300	12	80,0 ... 400	352 ... 1761	315	4,57	200 ... 1000	881 ... 4403	180	2,61
350	14	100 ... 500	440 ... 2202	325	4,71	270 ... 1300	1189 ... 5724	190	2,76
400	16	140 ... 700	616 ... 3082	320	4,64	320 ... 1600	1409 ... 7045	200	2,90

\* Pressure drop

## 8 Measuring ranges for gases

Standard measuring ranges for gases ( $P_e=0$  bar,  $T=0$  °C,  $\rho=1,293$  kg/m<sup>3</sup>,  $v=0,0181$  mPa·s)

Nominal diameter		0,1 bar ≤ overpressure ≤ 0,5 bar				overpressure > 0,5 bar	
		Minimum measuring range		Maximum measuring range		Maximum measuring range	
DN	Inch	[m <sup>3</sup> /h]	Δp* [mbar]	[m <sup>3</sup> /h]	Δp* [mbar]	[m <sup>3</sup> /h]	Δp* [mbar]
25	1	--	--	--	--	--	--
32	1 ¼	--	--	--	--	--	--
40	1 ½	12.0 ... 60.0	40	36.0 ... 180	24	100 ... 500	125
50	2	20.0 ... 100	36	50.0 ... 250	22	160 ... 800	130
65	2 ½	20.0 ... 100	42	130 ... 650	22	280 ... 1,400	138
80	3	50.0 ... 250	38	130 ... 650	23	400 ... 2,000	125
100	4	100 ... 500	38	200 ... 1,000	22	600 ... 3,000	115
125	5	130 ... 650	35	360 ... 1,800	22	1,000 ... 5,000	130
150	6	200 ... 1,000	34	500 ... 2,500	22	1,500 ... 7,500	140
200	8	250 ... 1,250	38	500 ... 2,500	20	2,600 ... 13,000	135
250	10	500 ... 2,500	36	1,300 ... 6,500	18	4,000 ... 20,000	130
300	12	600 ... 3,000	37	2,000 ... 10,000	20	6,000 ... 30,000	140
350	14	1,000 ... 5,000	40	2,800 ... 14,000	23	8,000 ... 40,000	135
400	16	1,400 ... 7,000	35	3,600 ... 18,000	23	10,000 ... 50,000	125

\* Pressure drop

## 9 Technical Data

### General Data

Application	Flow measurement of transparent liquids and gases
Measuring principle	Orifice plate as differential pressure sensor with variable areas meter in bypass
Accuracy	± 2 % of full scale value
Dynamic range	1:5
Flow direction	Any

### Rated operating conditions

Temperature and pressure limits	[°C] (°F)	[bar] (psi)
Water and non-corrosive liquids	≤ 40 (104)	10 (145)
	50 (122)	6.25 (91)
	60 (140)	2.5 (36)
Corrosive liquids	≤ 20 (68)	10 (145)
	40 (104)	4 (58)
	60 (140)	1 (15)
Measuring range	0.6 to 1,600 m <sup>3</sup> /h (2.64 to 7,045 Usqpm). Special scale for liquids with a density other than 1 kg/l	

### Medium conditions

Measuring unit	m <sup>3</sup> /h
Viscosity limits for all measuring ranges	1.0 – 1.3 mPa.s

### Construction design

Process connection	Ring between flanges EN 1092-1 (PN 10) DN 25 (1") to 400 (16")
--------------------	---

### Material of wetted parts

Ring	PVC / PP
Orifice plate ⑨ (s. Fig. 4)	PVC / PP (optional stainless steel mat.-No. 1.4571)
Flow tube ⑤ (s.fig 4)	Trogamid (up to 50 °C (122 °F)), Polysulfone (up to 60 °C (140 °F))
Ball valve	PVC / PP
Connecting tube	PVC / PP
Float ⑦ (s.Fig. 4)	Stainless steel mat.-No. 1.4571, PVC
Limits ④ (s. Fig. 4)	Polysulfone
Gasket ② (s.Fig. 4)	Perbunan (NBR)
Bypass orifice plate ③ (s.Fig. 4)	Stainless steel mat.-No. 1.4571 (optional PVC)

## 9.1 Dimensions and weights

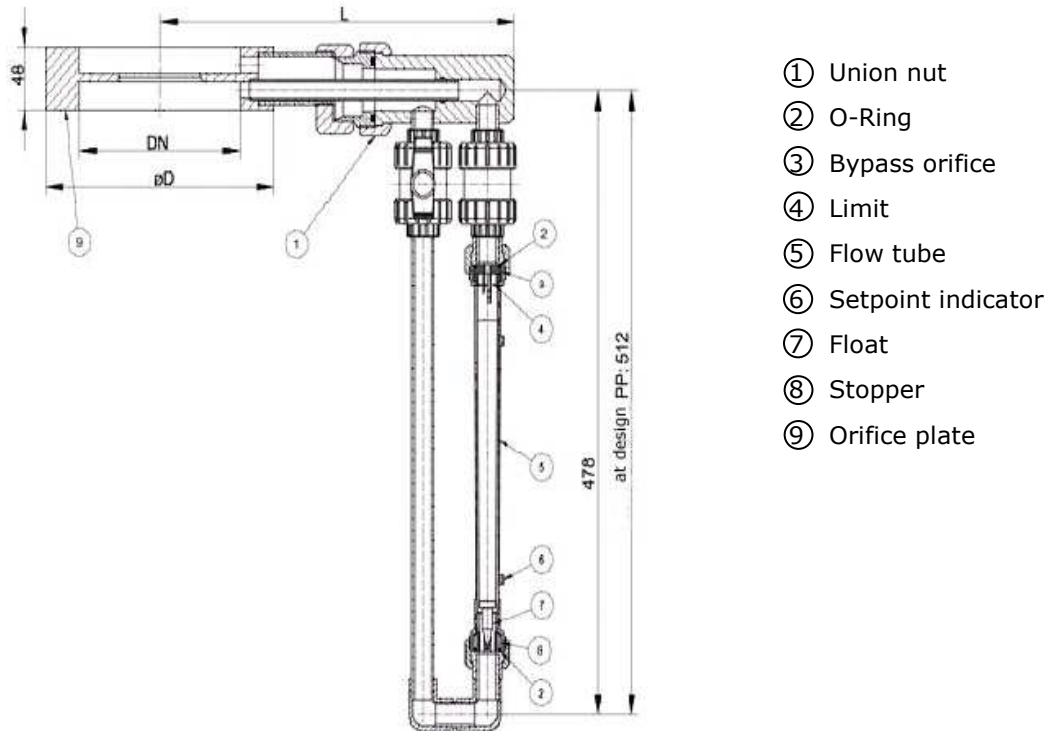


Fig. 4 FO N4, Dimensions in mm

Nominal diameter		L [mm] (inch)	Ø D [mm] (inch)	Weight [kg]
DN	Inch			
25	1"	259 (10.2)	68 (2.68)	1,4
32	1 ¼"	264 (10.39)	78 (3.07)	1,4
40	1 ½"	269 (10.59)	88 (3.46)	1,5
50	2"	276 (10.87)	102 (4.02)	1,6
65	2½"	286 (11.26)	122 (4.80)	1,8
80	3"	294 (11.57)	138 (5.43)	1,9
100	4"	304 (11.97)	158 (6.22)	2,0
125	5"	319 (12.56)	188 (7.40)	2,3
150	6"	331 (13.03)	212 (8.35)	2,5
200	8"	359 (14.13)	268 (10.55)	3,1
250	10"	385 (15.16)	320 (12.60)	3,5
300	12"	410 (16.14)	370 (14.57)	4,1
350	14"	444 (17.48)	430 (16.93)	5,1
400	16"	466 (18.35)	482 (18.98)	5,8



# 10 Contacts

The bistable contact K18 is intended for signaling of limit values and for controlling purposes.

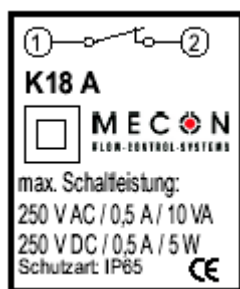
## Special features

- bistable function
- high vibration resistance
- no interaction between contacts
- low cost plastic version
- easy to use electrical connection

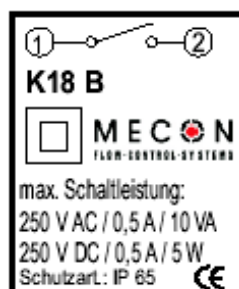
## Mode of operation

A bistable reed contact consists of a spring contact which is covered by a glass tube filled with inert gas. It is operated by a magnetic field. This magnetic field is generated by a permanent magnet inside the float of a MECON flowmeter.

There are two versions available:



**Fig. 5** Contact K 18 A



**Fig. 6** Contact K 18 B

**K 18 A:** contact closes on falling below the limit

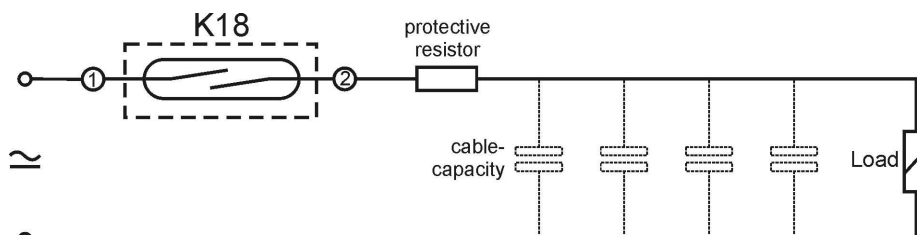
**K 18 B:** contact closes on exceeding the limit

## Electrical loadability

The spring contacts of the K18 are sensitive to current overload (max. 500 mA). A high current could lead to a welding effect and this will damage the contact blades – this specifically applies to inductive loads e.g. relays (high self-induction).

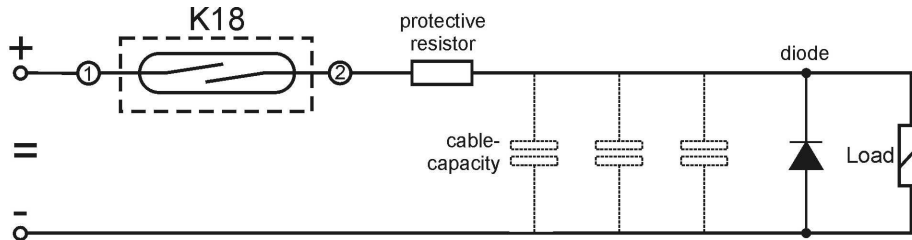
## Protective circuits

At great cable lengths (cable capacity) it is recommended to connect a protective resistor in series to contact K18 A(B) for current limitation.



**Fig. 7** Protective circuit for current limitation

When using a DC power supply in combination with an inductive load it is recommended to connect a diode in parallel to the load.



**Fig. 8** Protective circuit for inductive loads and DC power supply

**Technical data**

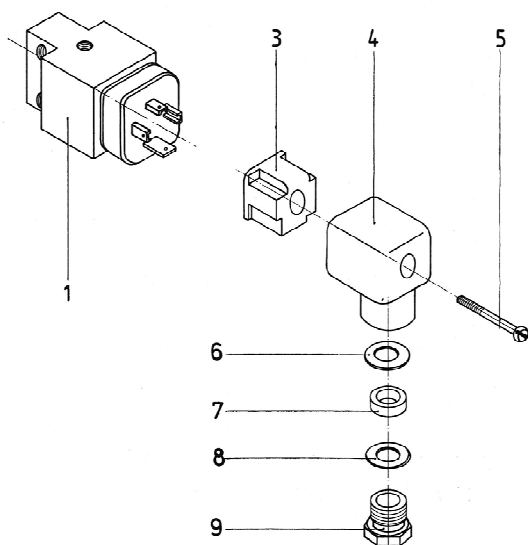
Contact material	Rhodium (with inert gas)
max. switching capacity	5 W / 10 VA
Max. switching voltage	250 V DC/AC
Contact resistance	0,1 Ω
Isolation resistance	10 <sup>11</sup> Ω
Contact closing time	2 ms
Contact opening time	0,07 ms
Frequency of operation	2000 Hz
Duration of bounce	0,5 ms
Temperature range	-40 °C to +80 °C
Material of housing	Plastics
Electrical connection	Rectangular connector acc. to DIN EN 175301-803 (previously DIN 43 650)
Protection class	IP 65
Max. starting current (peek)	0,5 A
Max. switching current	230 V DC : 21 mA 115 V DC : 43 mA 24 V DC : 0,2 A 10 V DC : 0,5 A



**Warning !**

Observe in any case the max. switching capacity and the max. starting current – other welding effect will damage the contact blades.

### Installation of the connection cable to the connector:



1. Remove the cable gland (9) and take out the gasket kit (8, 7, 6).
2. Remove the locking screw (5) and pull of the housing (4) from the insert connector (3).
3. Insert the connection cable through the cable gland (9), the gasket kit (6, 7, 8) and the housing.
4. Connect the wires to terminal 1 and 2 of the insert connector.
5. Assemble the rectangular connector in reverse order as described above. Please note, that the cable outlet can be varied by rotating the insert connector (4) through 90°.

**Fig. 9** Explosion drawing contact K 18

### Commissioning:

When commissioning the contact K18 we recommend to ensure the correct position of the bistable contact by moving the float along the K18 in flow direction.

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