

## Contamination Indicators

### 1. Features

Filter elements are economically used only if their dirt holding capacity is fully exploited. This is achieved by using filter housings with a contamination indicator.

MAHLE manufactures contamination indicators of the following designs:

- Differential pressure indicators
- Pressure indicators/Pressure switches
- Vacuum switches/manometers

With any filter element the collection of dirt particles continuously reduces the number of open pores or, in other words. The open cross section for allowing the liquid to flow is continuously reduced. Thus the pressure on the upstream side of the element. (dirt side) increases continuously.

With pressure filters, the pressure is measured upstream and downstream of the filter element (differential pressure). With return line filters the pressure is measured only on the upstream side because, depending on the tank design, atmospheric pressure exits on the downstream side of the filter element is measured analog.

A piston with attached magnet is moved against the force of a spring, with which the indicating point is determined by the piston surface.

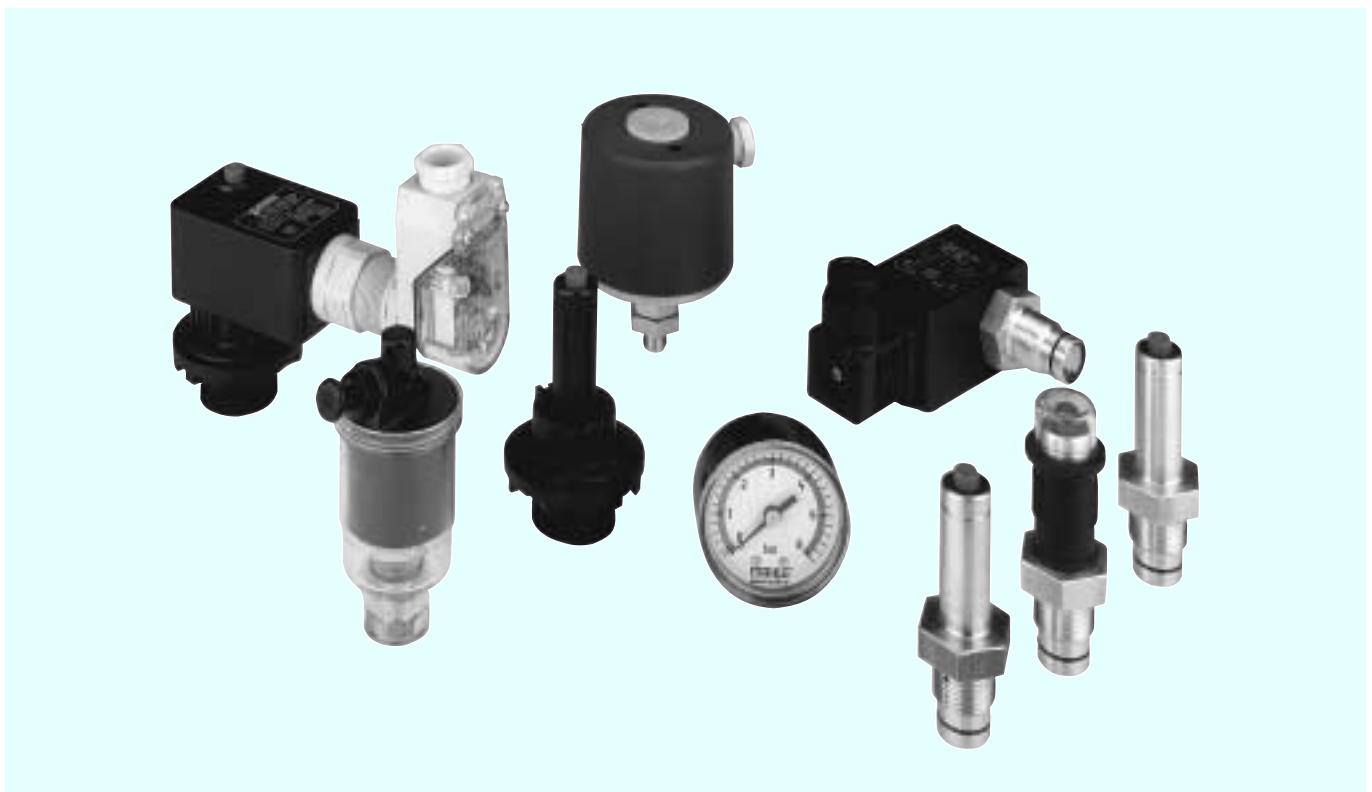
A homopolar poled magnet is fitted in the outer part in the indicating button.

The closer the pole-springs move towards each other, the stronger is the force with the magnets mutually repel, until finally the red button on the indicator pops out.

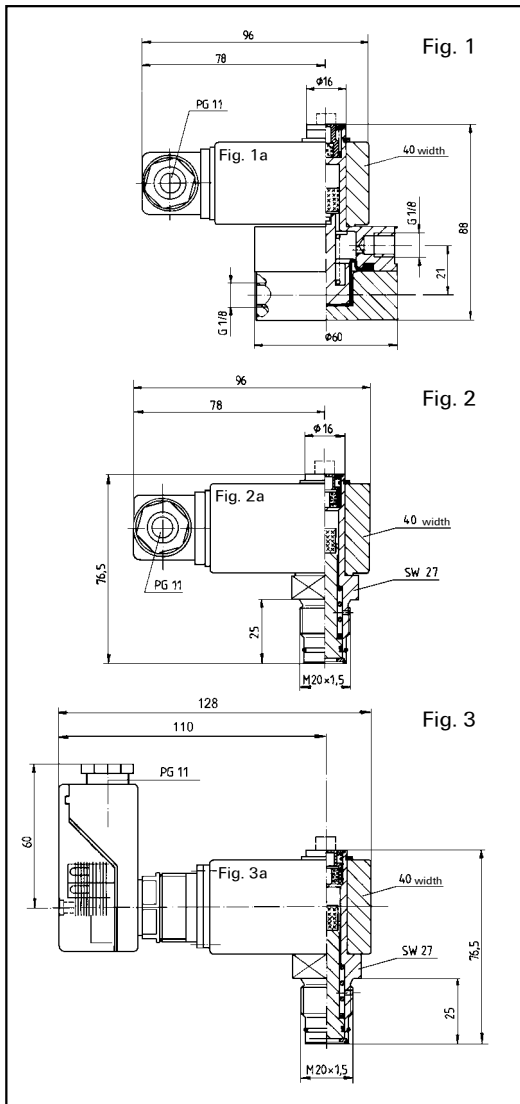
This red button remains visible until it is pushed in during the daily check which is to be performed while the plant is at operating temperature. If the button pops out immediately after being pushed in, the filter element must be replaced latest at the end of the shift.

This mechanical/visual function indication may also be used for generating contactless electrical signals. For this purpose an electrical upper part is pushed over the hydraulic/mechanical part. This upper part incorporates all electrical switching elements. Cable connection is via a DIN cube plug.

- Visual and electrical indicator with standard check function
- Normally open/normally closed combination - standard feature
- Electrical funktion, easy to install at a later time
- Two-step indication, at 75% and 100% optional
- Signal lock out up to approx. 30 °C optional
- Pressure resistance
  - up to 10 bar (pressure/differential pressure)
  - up to 160 bar (differential pressure)
  - up to 450 bar (differential pressure)
- Rugged, non-bypass design
- Optimal element exploitation
- Worldwide distribution

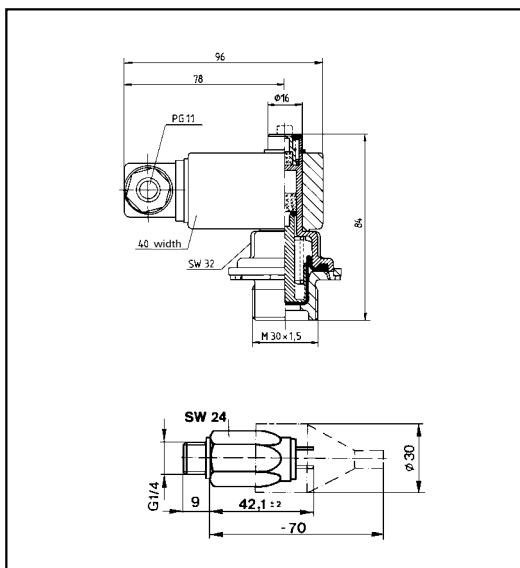


## 2. Differential pressure indicator



Operating pressure/temperature resistance	Indicator setting	Indication	Contact type*	Fig.	Type	Part number	Material	
							lower section	upper section
10 bar -10 to +120 °C	1,2 bar	visual		1	PIS 3087	773.899.0	Al	PA 6
		visual/electr.	1	1+1a	PIS 3086	773.751.3		
			4	1+3a	PIS 3104	823.699.4		
160 bar -10 to +120 °C	2,2 bar	visual		2	PIS 3098	766.997.1	AL	PA 6
		visual/electr.	1	2+2a	PIS 3097	766.994.8		
			3		PIS 3116	830.807.4		
	1,7 / 2,2 bar	visual/electr.	2	3+3a	PIS 3119	830.912.2		
			4		PIS 3012	830.845.4		
		5	PIS 3124		838.365.5			
	3,5 bar	visual		2	PIS 3098	793.858.2		
		vis./el.	1	2+2a	PIS 3097	823.664.8		
	5,0 bar	visual		2	PIS 3098	766.998.9		
		visual/electr.	1	2+2a	PIS 3097	766.995.5		
			3		PIS 3116	830.808.2		
		3,7 / 5,0 bar	visual/electr.	2	3+3a	PIS 3119		
4				PIS 3012		830.844.7		
5	PIS 3124	838.366.3						
400 bar -10 to +120 °C	2,2 bar	visual		2	PIS 3093	766.989.8	Ms	PA 6
		visual/electr.	1	2+2a	PIS 3092	766.985.6		
			3		PIS 3115	830.804.1		
	1,7 / 2,2 bar	visual/electr.	2	3+3a	PIS 3105	797.038.7		
			4		PIS 3102	794.213.9		
		5	PIS 3122		838.363.0			
	5,0 bar	visual		2	PIS 3093	766.991.4		
		visual/electr.	1	2+2a	PIS 3092	766.986.4		
			3		PIS 3115	830.805.8		
	3,7 / 5,0 bar	visual/electr.	2	3+3a	PIS 3105	797.039.5		
			4		PIS 3102	794.214.7		
		5	PIS 3122		838.364.8			
8,0 bar	visual		2	PIS 3093	766.988.0			
	visual/electr.	1	2+2a	PIS 3092	766.987.2			
3	PIS 3115	830.806.6						
450 bar -10 to +120 °C	2,2 bar	visual		2	PIS 3193	784.406.1	1.4301	PA 6
		vis./el.	1	2+2a	PIS 3192	830.848.8		
	5,0 bar	visual		2	PIS 3193	830.853.8		
		vis./el.	1	2+2a	PIS 3192	830.854.6		

## 3. Pressure indicator/pressure switch



Operating pressure/temperature resistance	Indicator setting	Indication	Contact type*	Fig.	Type	Part number		
10 bar -10 to +80 °C	1,2 bar	visual		4	PIS 3084	766.978.1	PA 66	PA 6
		visual/electr.	1	4+4a	PIS 3085	766.980.7		
			3		PIS 3125	830.803.3		
	0,9 / 1,2 bar	visual/electr.	2	4+3a	PIS 3106	830.915.5		
			4		PIS 3103	794.217.0		
		5	PIS 3123		838.367.1			
	2,2 bar	visual		4	PIS 3084	773.780.2		
		visual/electr.	1	4+4a	PIS 3085	773.803.2		
			3		PIS 3125	830.810.8		
	1,7 / 2,2 bar	visual/electr.	2	4+3a	PIS 3106	830.885.0		
			4		PIS 3103	797.042.9		
		5	PIS 3123		838.368.9			
10 bar -25 to +85 °C	1,2 bar	electr.	norm. open	5	DSS/1,2	786.381.4		
		norm. closed	DSO/1,2		787.058.7			
	2,2 bar	electr.	norm. open		DSS/2,2	784.584.5		
		norm. closed	DSO/2,2		787.059.5			
	5,0 bar	electr.	norm. open		DSS/5	786.382.2		
			norm. closed		DSO/5	787.060.3		

\*Contact type:

- 1) Normally open/normally closed, wiring box DIN 43650, max. 230 V, max. 2,5 A
- 2) Normally closed, 2 setting points (75% / 100%); wiring box DIN 43650, max. 150 V, max. 1 A
- 3) Change over contact; wiring box DIN 43650, max. 150 V, max. 1 A
- 4) Change over contact; 2 setting points (75% / 100%); 3 LED; wiring box DIN 43651, 10-30 V, max. 1 A
- 5) Normally closed; 2 setting points (75% / 100%), signal suppression; wiring box DIN 43651, 10-30 V, max. 1 A



## 7. Accessories

### 7.1 Seal kits

Types	Part number		
	NBR	FPM	EPDM
PIS 3092, 3093, 3102, 3105, 3115, 3122, 3192, 3193	776.027.5	776.028.3	776.029.1
PIS 3012, 3019, 3024, 3097, 3098, 3116	776.030.9	776.031.7	776.032.5
PIS 3084, 3085, 3103, 3106, 3123, 3125	838.338.2	838.339.0	838.340.8
PIS 3086, 3087, 3104	776.024.2	776.025.9	

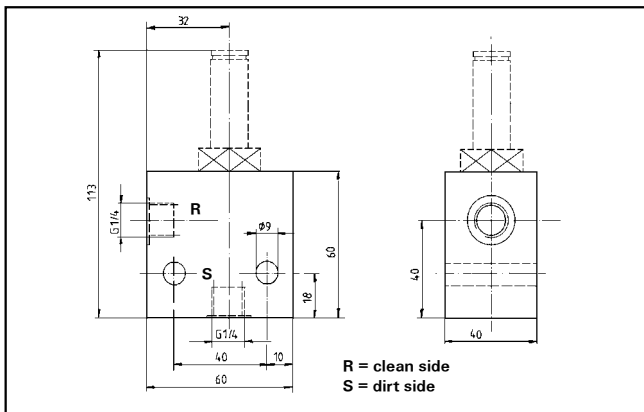
### 7.2 Electrical upper sections

Specification	Part number
Electrical upper section Normally open / Normally closed for PIS 3084, 3093, 3098, 3193 (Contact type 1)	753.655.0
Wiring box with lamp insert 12–230 V for electrical upper section Normally open (acc. to DIN 43650)	830.754.8
Electrical upper section Change over contact for PIS 3084, 3087, 3093, 3098, 3193 (Contact type 3)	830.801.7
Wiring box with 2 LED's 10–30 V for electrical upper section change over contact (acc. to DIN 43650)	830.802.5
Electrical upper section Normally closed with signal suppression (PIS 3003)	776.535.7

### 7.3 Mounting block

Mounting block for differential pressure indicators, exceptional types PIS 3086, 3087, 3104

Specification	Part number
Mounting block (Material St)	780.909.8
Mounting block (Material 1.4301)	769.851.7



### 7.4 Protection cap

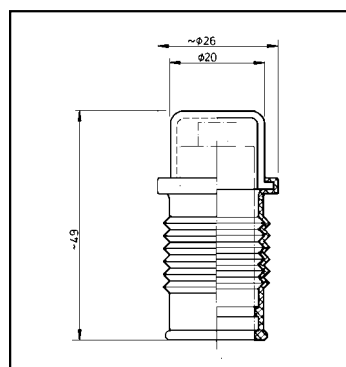
Protection cap for all visual differential pressure and pressure indicators

Part number:  
828.533.0

resistant to:

- gasoil
- purifying agent
- insulation
- dust
- salt
- water
- concret

Temperature resistance:  
-20 °C to +80 °C

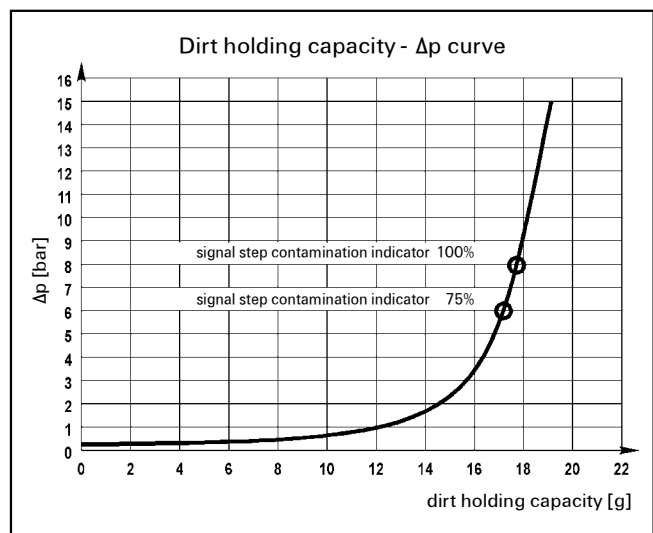
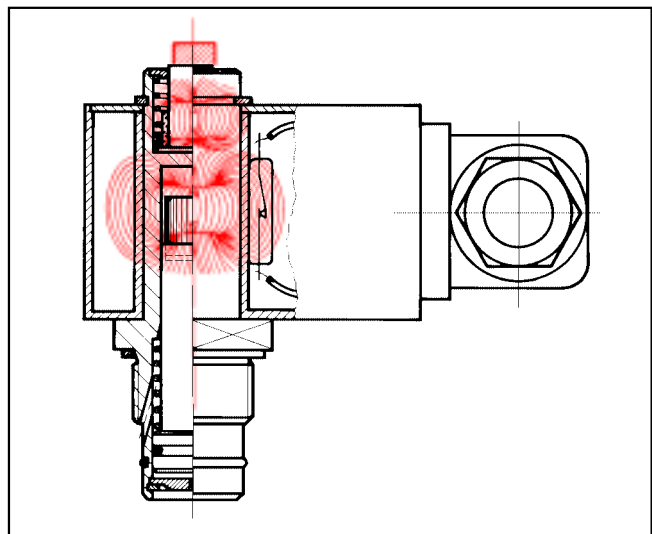


## 8. Function

The magnetic field as previously described, contactless operates Reed contacts in the electrical upper part. The desired contact type is selected by inverting upper part. Another option keeping the electrical signal electronically suppressed up to 30 °C operating temperature is also available. This eliminates false electrical signal during the cold start phase.

For efficient servicing it is desirable to have a pre-warning device (so that the filter element can be replaced, e.g. with the next tool change). For this purpose electrical upper parts with two indicating points, i.e. at 75% and at 100% of the indicator setting are available. Pressure/vacuum manometers give an analog reading of the existing state of contamination of the filter elements. They require continuous control to ensure that the service time and reserve capacity are not unduly exceeded. If the contamination signal is disregarded, the filter element may collapse or, if a bypass valve is installed, part of the contaminated fluid may reach the hydraulic components via the bypass valve and cause failure of the hydraulics.

Pressure/vacuum switches are provided with snapaction switches, which ascertains that signal are issued only when the limit values have been fully reached.



## 9. Technical Data

### 9.1 Contact type normally open/normally closed


Typen PIS 3085, 3086, 3092, 3097, 3192

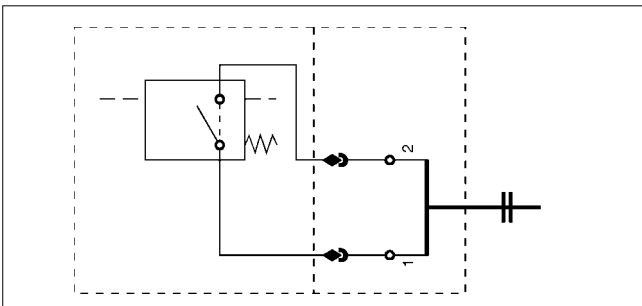
Maximum voltage: 230 V ~/=  
 Maximum current on contact: 2,5 A  
 Maximum contact load: 60 VA / 40 W  
 Inrush current: 70 VA  
 Type of protection: IP 65 when inserted and secured  
 Contact: normally open / normally closed  
 Cable connection: PG 11 Ø 6-10

The electrical indicator function can be changed from the Normally Open position to the Normally Closed position or visa versa by inverting the electrical section.

With the inrush current of 70 VA the indicator can trigger small contactors or contactor relays.

Inductivity in the direct current may require the use of a signal eraser.

The electric sections are shockproof  (plastic housing)

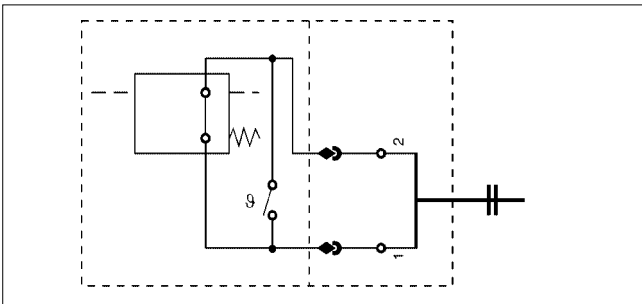


### 9.2 Contact type normally closed/signal lock-out

Type PIS 3003

Signal lock-out by thermorelay

Signal is released at 30 °C, reset at 20 °C  
 for further technical details see 9.1

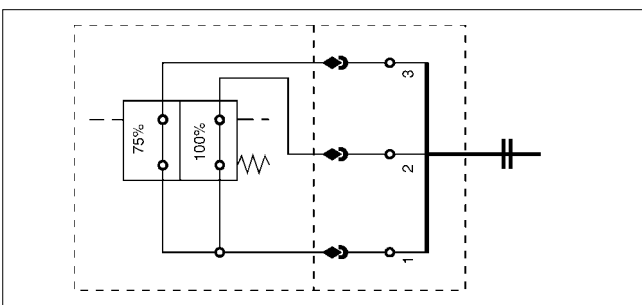


### 9.3 Contact type normally closed 2 step

Types PIS 3105, 3106, 3119

1. indicating at 75%
2. indicating at 100% of the indicating pressure

Maximum voltage: 150 V ~/=  
 Maximum current on contact: 1 A  
 Maximum contact load: 20 VA / 20 W  
 for further technical details see 9.1



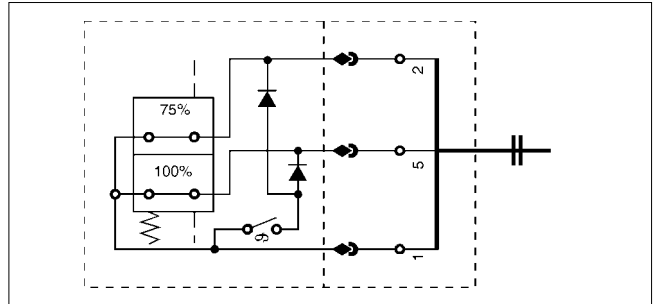
### 9.4 Contact type normally closed 2 step/signal lock-out

Types PIS 3122, 3123, 3124

Maximum voltage: 10-30 V =  
 Maximum current on contact: 1 A  
 Maximum contact load: 20 W

Signal lock-out by thermorelay  
 Signal is released at 30 °C  
 reset at 20 °C

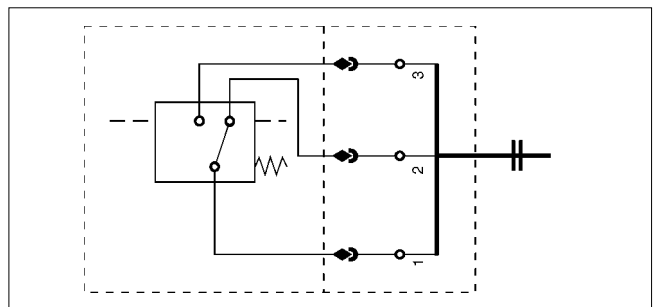
1. indicating at 75%
2. indicating at 100% of the indicating pressure  
 for further technical details see 9.1



### 9.5 Contact type change-over contact

Types PIS 3115, 3116, 3125

Maximum voltage: 150 V ~/=  
 Maximum current on contact: 1 A  
 Maximum contact load: 20 VA / 20 W  
 for further technical details see 9.1

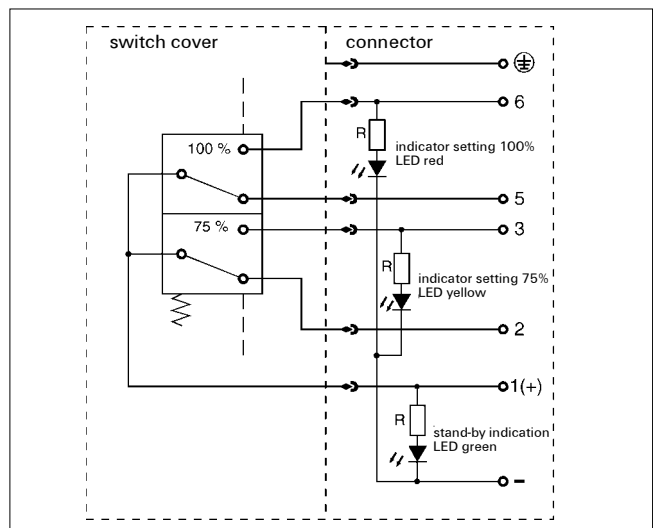


### 9.6 Contact type change-over contact/2 step LED

Types PIS 3012, 3102, 3103

Maximum voltage: 10-30 V =  
 Maximum current on contact: 1 A  
 Maximum contact load: 20 VA / 20 W

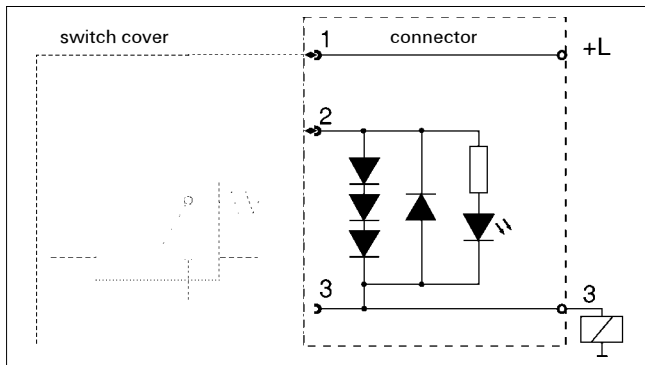
1. indicating at 75%
2. indicating at 100% of the indicating pressure  
 for further technical details see 9.1



## 9.7 Wiring box with lamp insert

will be supplied instead of standard connection

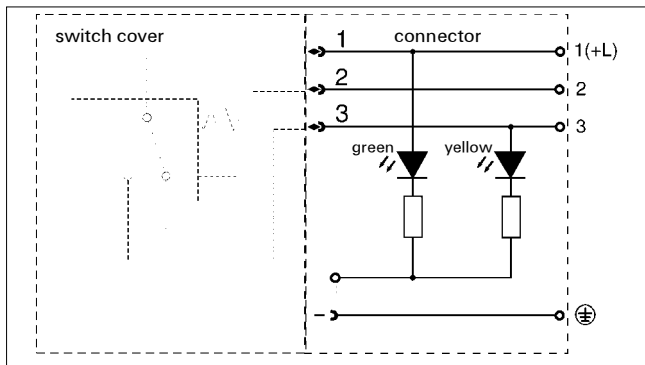
Voltage: 12-230 V ~/=  
not to combine with indicators with 2 setting points.



## 9.8 Wiring box with lamp insert

will be supplied instead of standard connection plug

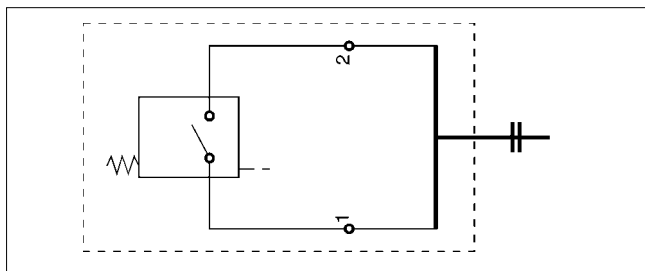
Voltage: 10-30 V =  
to combine with PIS 3115, 3116, 3125



## 9.9 Vacuum switch HES / LES

Contact: Normally open  
Contact load: HES: 42 V / 6 W  
LES: 24 V / 6 W

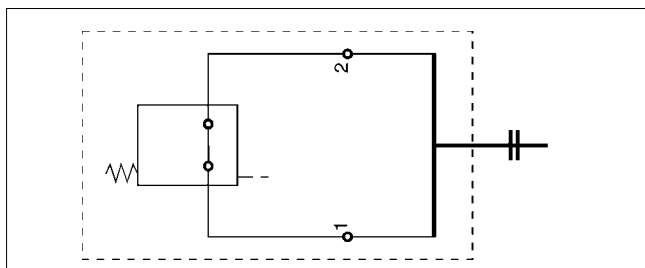
Type of protection: IP 54 - with protecting cap  
Electrical connections: AMP 6,3 DIN 46248  
DIN 46247



## 9.10 Vacuum switch HEO / LEO

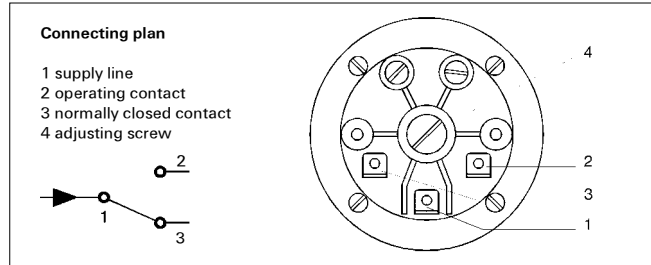
Contact: Normally closed  
Contact load: HEO: 42 V / 6 W at resistive load  
LEO: 24 V / 6 W at resistive load

for further technical details see 9.9



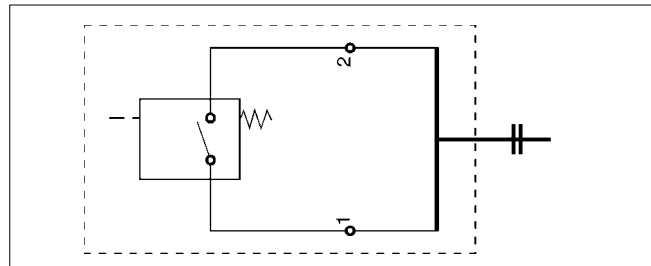
## 9.11 Vacuum switch PIS 3070

Maximum voltage: 230 V ~/=  
Maximum current on contact: 6 A  
Contact: Single pole changeover switch  
Electrical connections: AMP 6,3 DIN 46248  
DIN 46247  
Type of protection: IP 00 - without cover  
IP 54 - with cover



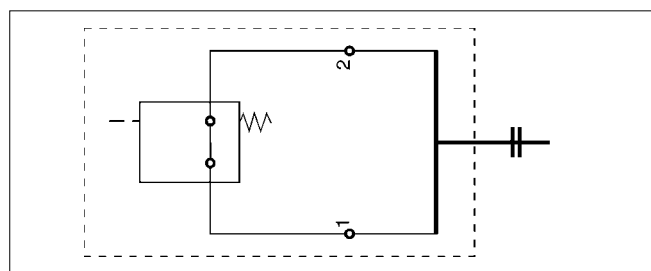
## 9.12 Pressure switch DSS

Contact: Normally open  
Maximum voltage: 42 V  
Maximum current on contact: 2 A  
Contact load: 100 VA  
Duty classification: 200/min  
Type of protection: IP 00 - without protecting cap  
IP 65 with protecting cap  
Electrical connections: AMP 6,3 DIN 46248  
DIN 46247



## 9.13 Pressure switch DSO

Contact: Normally closed  
for further technical details see 9.12



Subject to technical alteration without prior notice.

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