

Flow Monitors and Sensors

for intermittent and circulating centralized lubrication systems

Flow monitor



Flow sensor



Oil-streak sensor



Flow monitors/sensors have the task of monitoring the flow of lubricant from the pump or a piston distributor element to the lube point. Flow monitors with various designs are used for this job. A further task involves monitoring a continuous flow of oil from a pump through a lubrication system. These flow monitors are designed for a throughput ranging from 0,5 cm³ to 14 000 cm³.

Flow sensors keep an eye on the flow of lubricant from a metering point to the lube point, the metering point metering out a small amount of oil for only a short period of time.

Depending on the type, flow sensors can monitor lubricant quantities ranging from 10 mm³ all the way to 600 mm³ per lubricant pulse.

The oil-streak sensors monitor the continuity of the oil flow in oil+air systems.

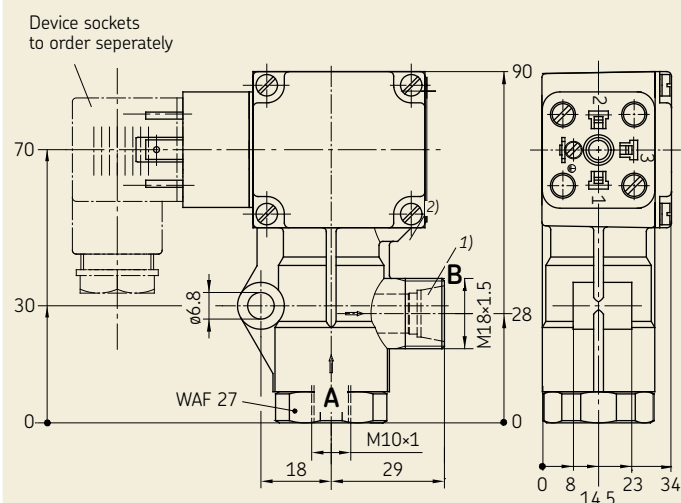
So the following points have to be observed when selecting an appropriate monitoring device:

- intermittent or continuous operation
- kind of lubrication system
- lubricant quantity to be monitored
- eff. viscosity of the lubricant
- system pressure.

Flow monitors for the monitoring of a continuous flow of oil

circulating lubrication systems with 50 bis 1800 cm³/min or 1,6 bis 14 l/min

Fig. 2



Note: See application II + III on page 4 + 5.

Technical data

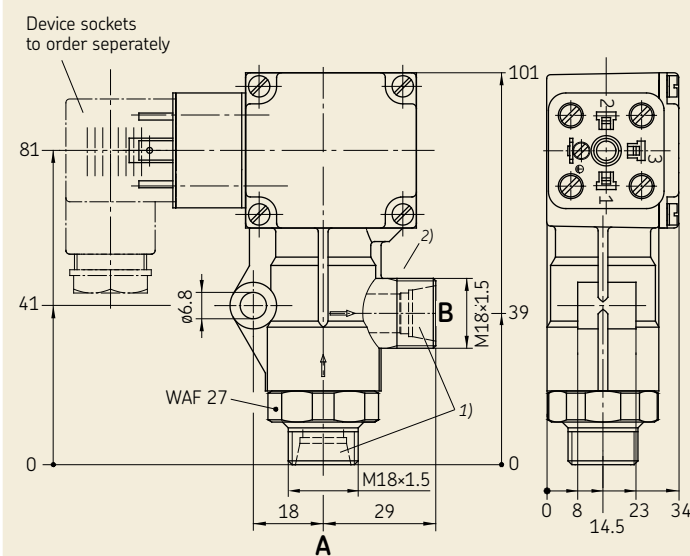
Operating viscosity 20 – 1000 mm²/s
Actuating pressure min. 4 bars ³⁾, max. 25 bars
Electr. switching changeover 250 V AC, 0,5 A
Perm. operating temperature + 5 bis +80 °C
Type of enclosure IP 65
Mounting position any

Materials:
Housing die-cast zinc, polyamide
Seals NBR (FKM version on request)

³⁾ If the flow monitors are equipped with metering restrictors, at least 6 bars are required in the feed line

Order No. (Fig. 2)	Flow rate
171-210-051	50 – 100
171-210-052	100 – 200
171-210-053	200 – 500
171-210-054	500 – 800
171-210-055	800 – 1800

Fig. 3



Note: See application IV, page 5.

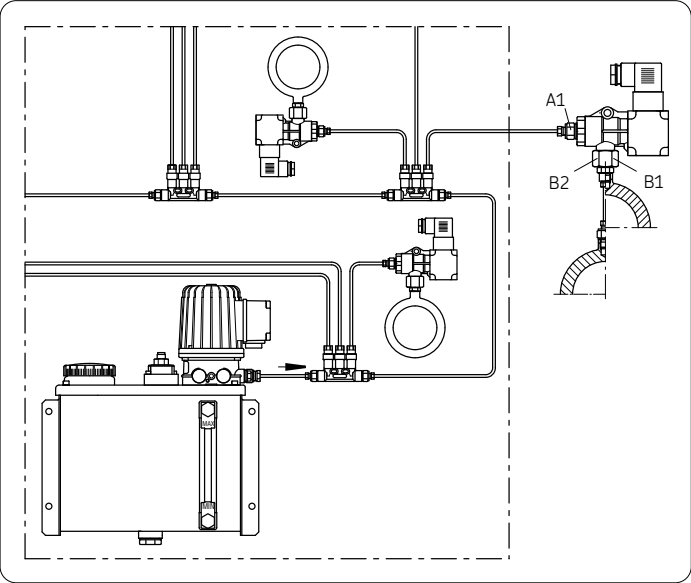
Order No. (Fig. 3)	Flow rate
171-210-061	1,6 – 2,5
171-210-062	2,3 – 4,0
171-210-063	3,6 – 6,0 l/min
171-210-064	5,5 – 10,0
171-210-065	8,0 – 14,0

¹⁾ Port tapped for cutting-sleeve screw union E0-2 DIN 2353 / ISO 8434-1

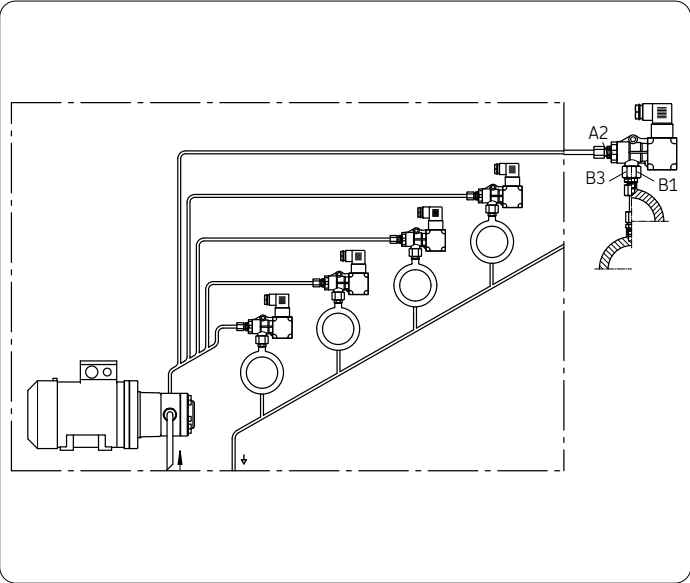
2) DIN 2353/ISO 8434-1. Only permissible for the use of preassembled fittings.
We recommend use of a preassembled EO-2 screw union.
(Example: GA21...23/GA30)

System examples and connection fittings

I. Singleline, totalloss lubrication system with piston distributors

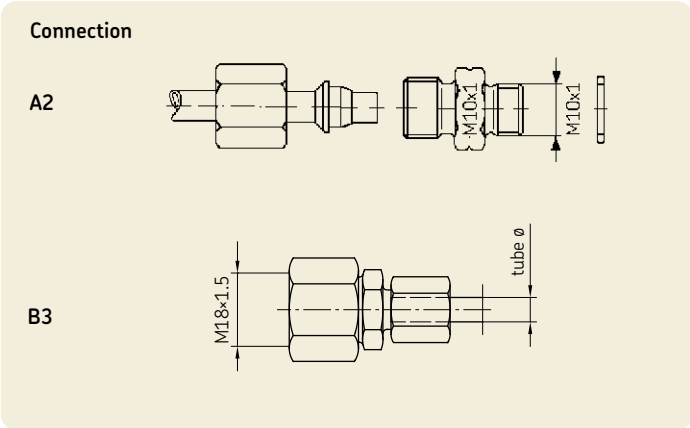
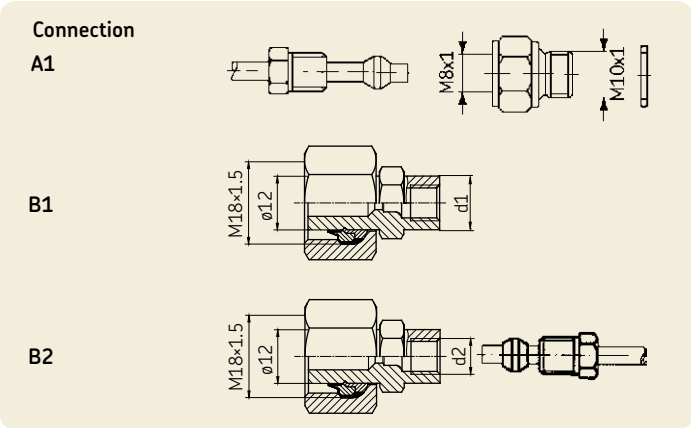


II. Circulating lubrication system with multicircuit pump unit



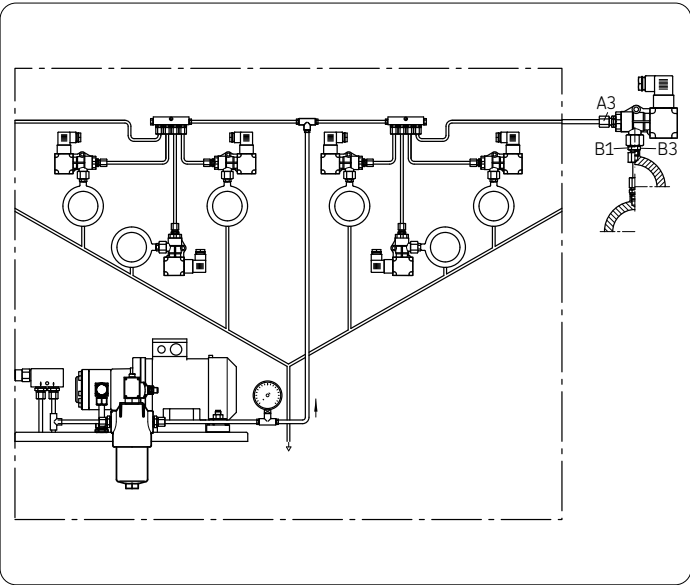
Connection fittings I					
Straight screwin connector ¹⁾					
Connection	for tubing diam.	Socket union order No.	Double tapered ring order No.	Adapter order No.	Washer order No.
A1	4	404-002	404-001	404-006	504-019
Connection fittings with screwed stud end for direct attachment of flow monitor to the lube point					
Connection	Adapter Order No.		d1		
B1	GA21		M10×1		
	GA22		M10×1 tap.		
	GA23		R1/8 tap.		
	GA24		R1/4 tap.		
Connection fitting for tubing ¹⁾					
Connection	for tubing diam.	Adapter order No.	d2	Socket union order No.	Double tap. ring order No.
B2	4	GA30	M8×1	404-002	404-001

Connection fittings II					
Connection piece without restrictor ²⁾					
Straight screw-in connector					
Connection	for tubing diam.	Union nut order No.	Cutting sleeve order No.	Adapter order No.	Washer order No.
A2	6	406-302	406-301	GD60.02	504-019
	8	408-302	408-301	GD80.02	
	10	410-302	410-301	GD100.02	
Connection fitting for tubing ²⁾					
Connection	for tubing diam.	Adapter order No.			
B3	6	473-806-391			
	8	473-808-392			
	10	473-810-391			

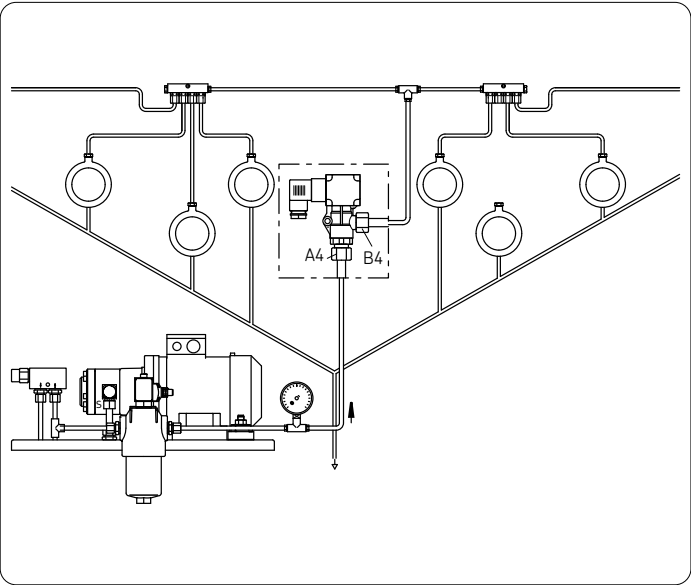


System examples and connection fittings

III. Circulating lubrication system with restrictors



IV. Circulating lubrication system with restrictor tubes



Connection fittings III

Connection piece with restrictor ²⁾
Straight screw-in connector

Connection	for tubing diam.	Union nut order No.	Cutting sleeve order No.	Adapter with restrictor (compl. with washer) order No. code No.	
A3	6	406-302	406-301	GD60	60
				GD61	61
				GD62	62
				GD63	63
				GD64	64
	8	408-302	408-301	GD65	65
				GD80	80
				GD81	81
				GD82	82
				GD83	83
				GD84	84
				GD85	85
				GD86	86
				GD87	87
				GD88	88
				GD89	89

Connection fittings IV

Only for a range of 1.6 to 14 l/min
(flow monitor as per Fig. 2, page 3)

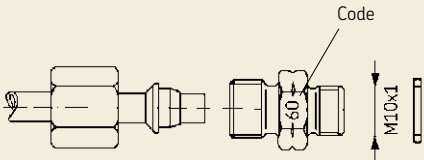
Tube union ²⁾
for direct connection to the flow monitor

Connection	for tubing diam.	Function nut order No.
A4	12	460-212-001

¹⁾ Port tapped for solderless tube connection
²⁾ Port tapped for solderless cutting-sleeve screw union to DIN 2353

Connection

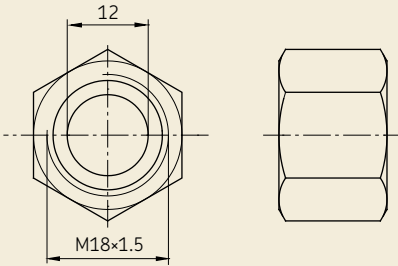
A3



The required restrictor sizes are determined
with the nomograph on page 6

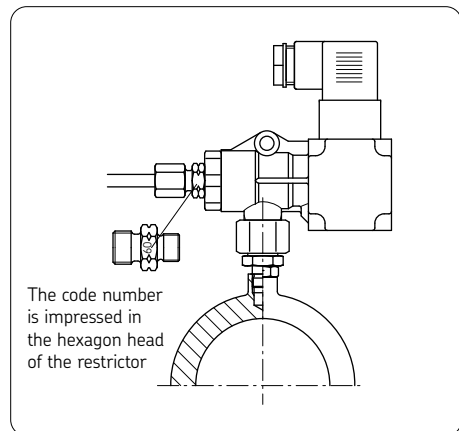
Connection

A4



Nomograph for determination of restrictor sizes

(connection A3, system example III)



Determining the restrictor size

1. Draw a straight line along the index lines through point **Q** v effective.
2. Determine the point at which **p** intersects with this line, resulting in **D**.
3. Select the restrictor **closest** to point **D**.

D must be inside the white field, that means small amounts cannot be "apportioned and monitored" with the unit.

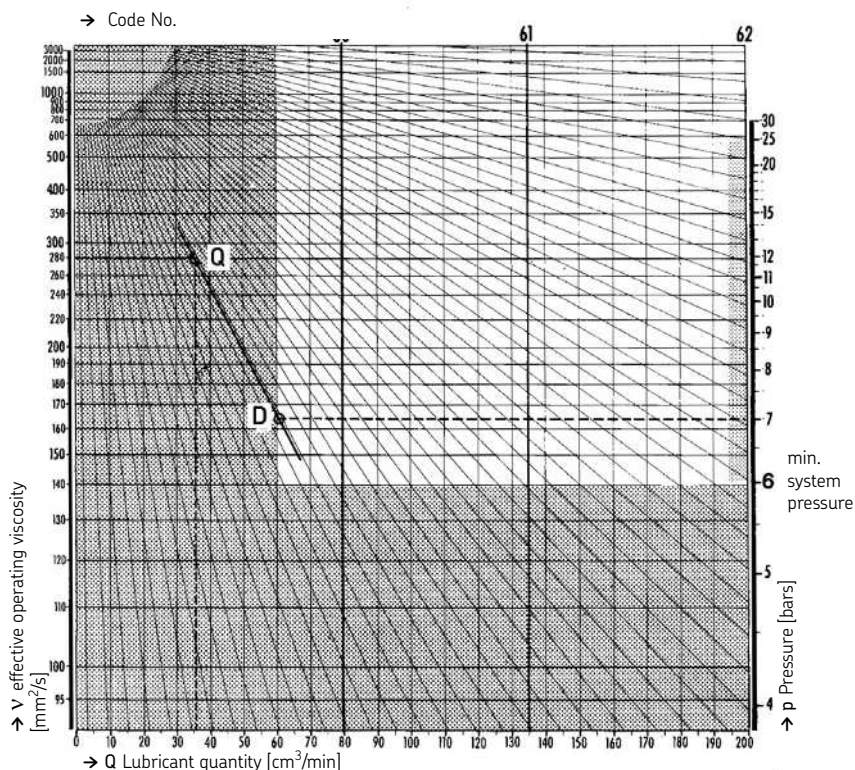
Example 1:

required: $Q = 36 \text{ cm}^3/\text{min}$,
 given: $v_{\text{eff}} = 280 \text{ mm}^2/\text{s}$
 $p = 7 \text{ bars}$
 Result: restrictor size No. 60
 (borderline case)

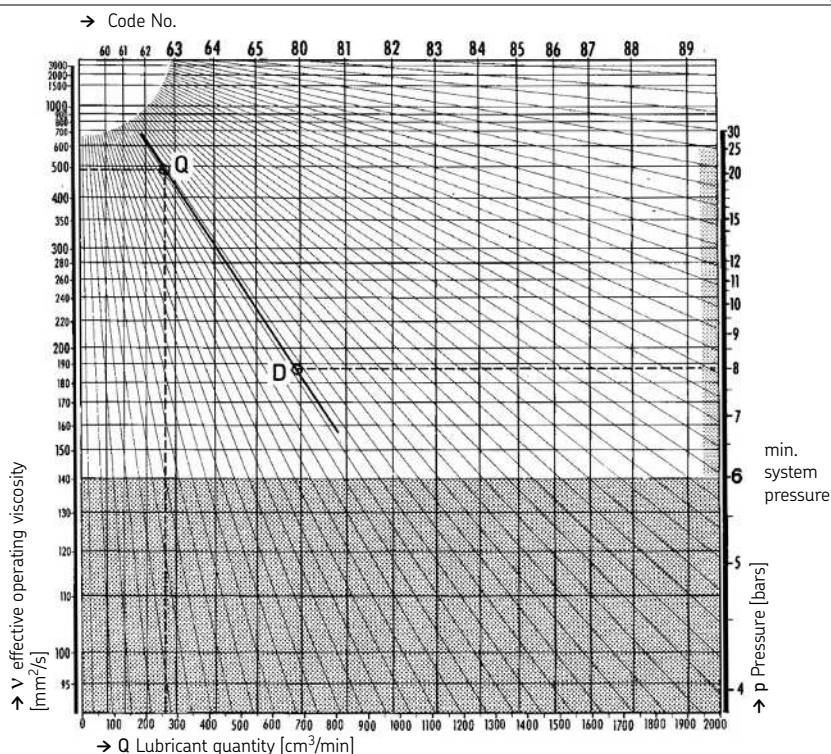
Example 2:

required: $Q = 260 \text{ cm}^3/\text{min}$,
 given: $v_{\text{eff}} = 480 \text{ mm}^2/\text{s}$
 $p = 8 \text{ bars}$
 Result: restrictor size No. 80

Example 1

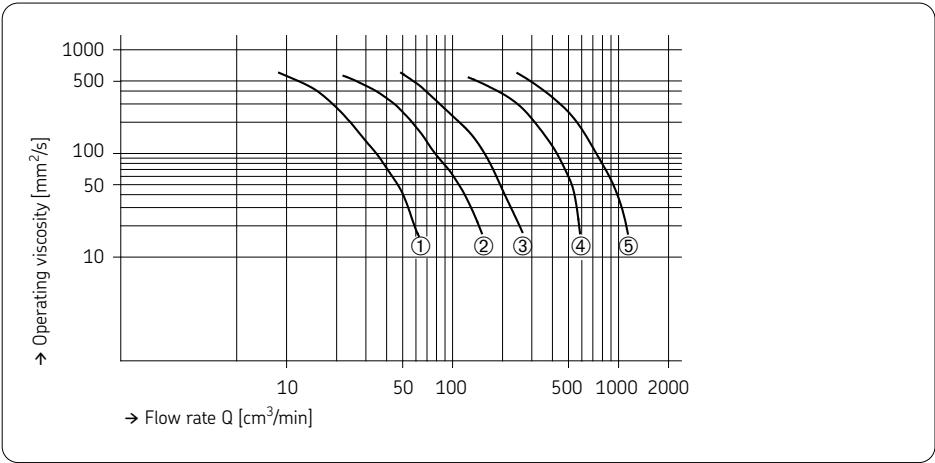


Example 2

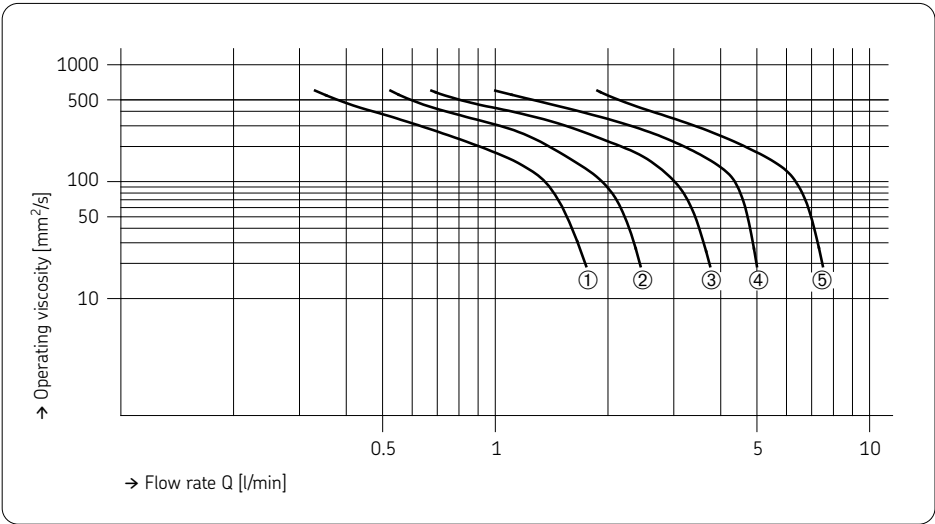


Flow rate at activation point as a factor of the viscosity

Flow monitors to monitor a flow of oil (circulating lubrication system)



Order No.	Flow rate activation point [cm³/min]	Actuation curve as per diagram
171-210-051	35	①
171-210-052	75	②
171-210-053	150	③
171-210-054	400	④
171-210-055	700	⑤

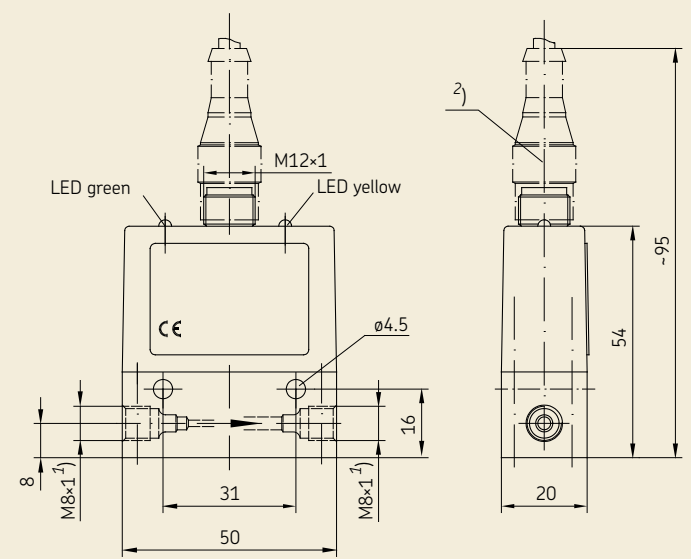


Order No.	Flow rate activation point [l/min]	Actuation curve as per diagram
171-210-061	1.3	①
171-210-062	1.9	②
171-210-063	3.0	③
171-210-064	4.5	④
171-210-065	6.5	⑤

GS300, GS304N, GS304P

Flow sensors for monitoring of lubricant feedright at the lube point

Fig. 4



1) Port tapped for solderless 4 mm diam. tube connection

2) Accessories
GS300: 5 m connection cable, order No. GS200.U4
GS304P / GS304N: 5 m connection cable with straight line socket, 4-pole type, order No. 179-990-600

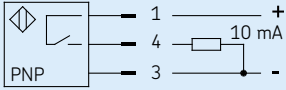
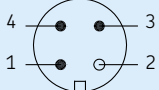
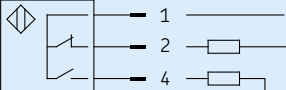
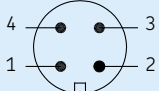
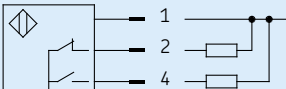
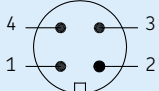
Technical data

Measuring principle. calorimetric
Suitable metered quantities from 0.01 to 0.6 cm³/pulse
Clock frequency³⁾ max. 4 pulse/min
Lubricant⁴⁾. oil and grease, NLGI grades 000, 00
Max. operating pressure 40 bars
Operating temperature +10 °C to +50 °C
Installation directly upstream of lube point
Vibration resistance 20 g (DIN/IEC 68-2-27, 10-2000 Hz)
Impact resistance 50 g (DIN/IEC 68-2-27, 11 ms)

3) Sensor needs 30 sec. of warmup time.
4) The use of lubricants containing corrosive and/or abrasive additives may impair sensor function and possibly damage the sensor.

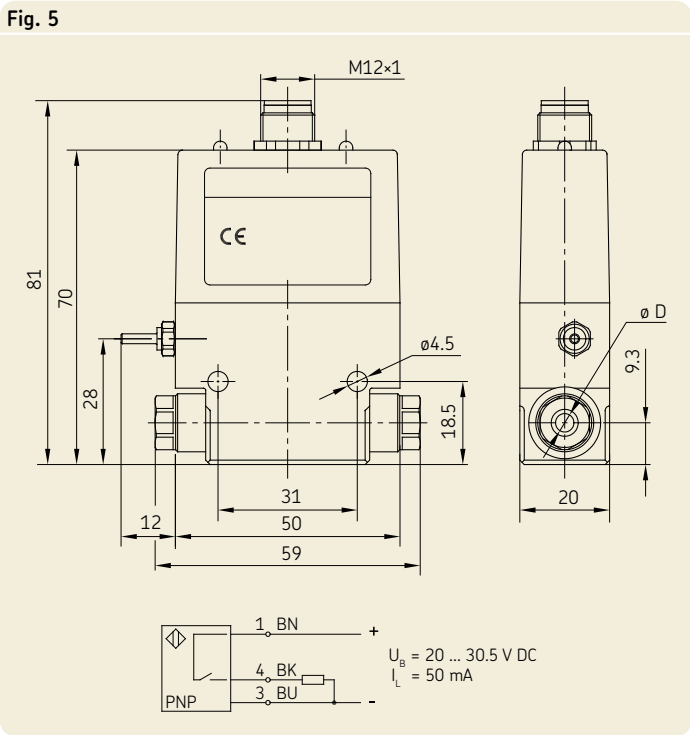
Electrical data

Rated voltage U_N 24 V DC
Residual ripple 10 %
Working range U_A 18 to 30 V DC
Max. power consumption I_E 25 mA
Pulse output 3 s
Load current I_A for GS300 max. 10 mA
for GS304 max. 500 mA per output
Output protection short-circuit protection
Built-in plug circular connector with M12x1 screw plug

Order No.	Switching function	Electrical connection
GS300	 Pin 1 (BN - brown): + 24 V Pin 3 (BU - blue): 0 V Pin 4 (BK - black): PNP/NO – closes in event of flow	
GS304P	 Pin 1 (BN - brown): + 24 V Pin 2 (WH - white): - white: Pin 3 (BU - blue): 0 V Pin 4 (BK - black): PNP/NO – closes in event of flow	PNP/NC – opens in event of flow 
GS304N	 Pin 1 (BN - brown): + 24 V Pin 2 (WH - white): - white: Pin 3 (BU - blue): 0 V Pin 4 (BK - black): NPN/NO – closes in event of flow	NPN/NC – opens in event of flow 

GS4011-S., GS6011-S..

The oil-streak sensors monitor the continuity of the oil flow in oil+air lubrication systems



So-called oil+air centralized lubrication systems are used to supply high-speed rolling bearings in tool spindles. The bearings are supposed to be supplied with extremely small quantities of lubricant (minimal-quantity lubrication) in the case of these applications. To achieve such small quantities of oil per unit of time, what was originally a relatively large drop of oil is torn apart by a current of air on its way from the metering point to the bearing. The oil to be delivered is fed in the line to the bearing as a thin flow of lubricant along the wall.

Monitoring:

So far, only the metered quantity of oil from the metering element has been checked upstream of the oil and air mixing point. The oil-streak sensor makes it possible to monitor the transport of a fine current of oil along the secondary line's wall downstream of the oil and air mixing point. The closer the sensor is located to the lube point, the more reliable the system monitoring.

Technical data	
Measuring principle.....	optical
Fluid	oil + air
Max. operating pressure	10 bars
Operating temperature	0 to +60 °C
Mounting position	horizontal, no swivel drive (GS4011-S300 and GS6011-S300 also vertical)

Electrical data	
Rated voltage U_N	24 V DC ¹⁾
Operating range U_B	20 to 30.5 V DC
Max. power consumption I_E	40 mA
Type of enclosure	IP54
Outputs	pnp type closes when oil streaks detected, opens when there are none
Color coding with standard sensor cables:	
brown (BN)	+ 24 V
blue (BU)	GND
black (BK)	make contact
white (WH)	break contact

¹⁾ Protective measure to be taken for operation in conformity with "Functional Extra-Low Voltage with Safety Separation" (PELV = Protective Extra-Low Voltage)

Accessories:
Connection cable with straight cable socket, 4-pole type, length 5 m, order No. 179-990-600
Socket, 90° angled, order No. 179-990-372

Order No.	Plastic tubing $\varnothing D$	Flow rate
GS4011-S20	4	120 – 600 mm ³ /h
GS4011-S50	4	60 – 120 mm ³ /h
GS6011-S20	6	120 – 600 mm ³ /h
GS6011-S50	6	60 – 120 mm ³ /h
GS4011-S300	4	from 2 mm ³ /pulse
GS6011-S300	6	from 2 mm ³ /pulse