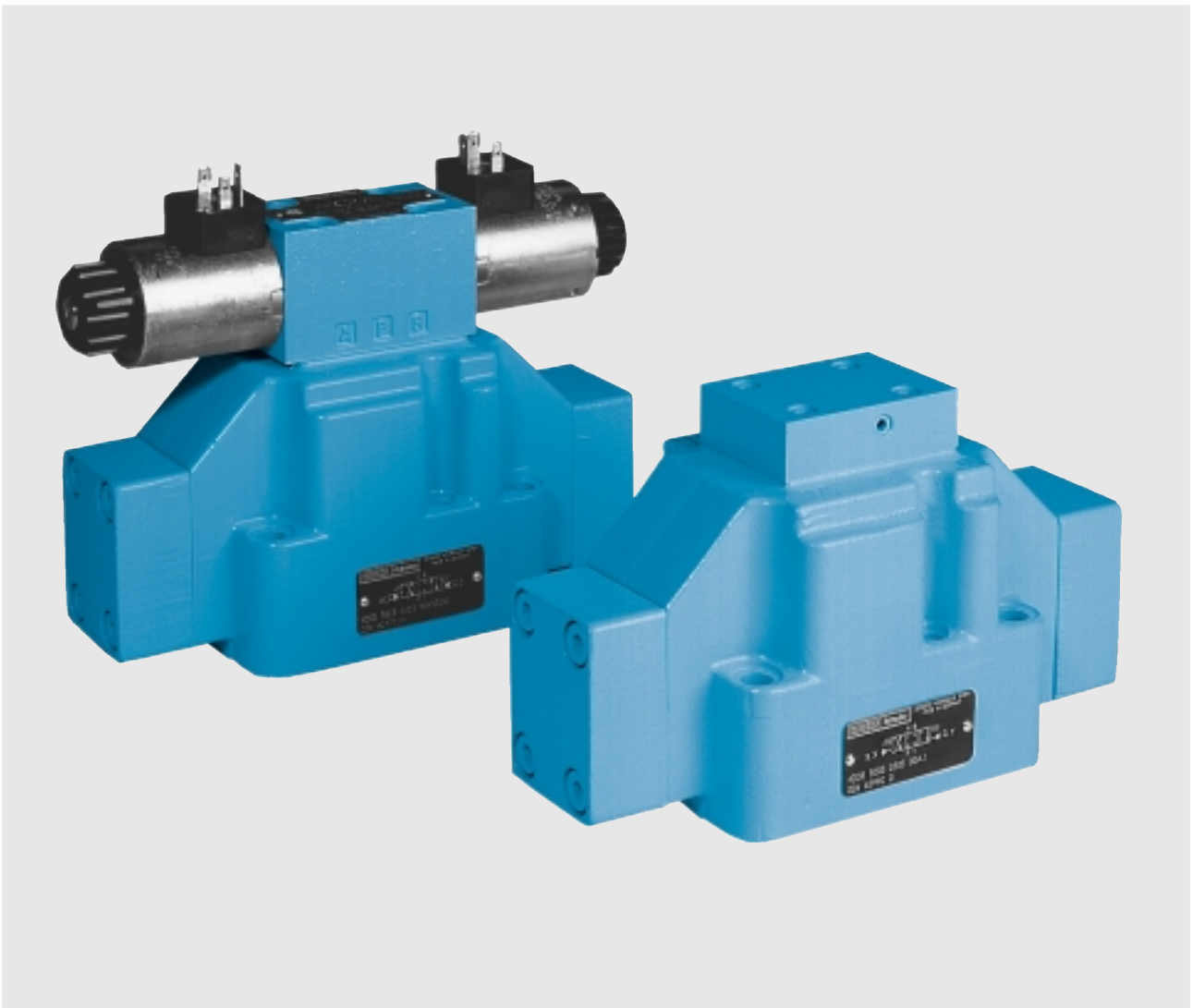


# DENISON HYDRAULICS

## Directional Control Valves

Series 4D03 – Cetop 07



Publ. 4-EN 3510-B, replaces 4-EN 3510-A & 4-EN 350-B

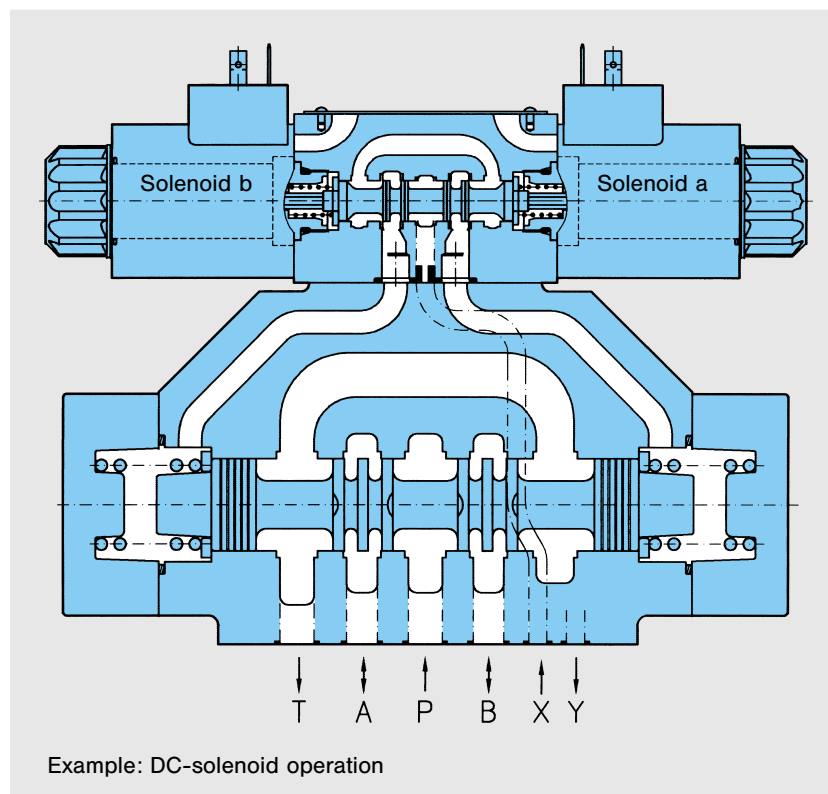
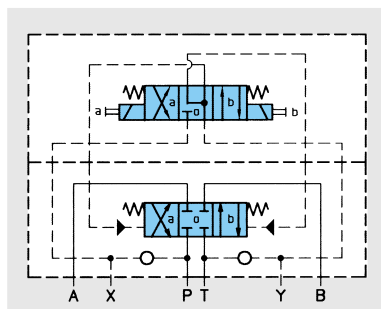
**DENISON** Hydraulics

## FEATURES, SYMBOL, GENERAL

### FEATURES

- High functional limit up to 300 l/min at nominal pressure.
- Nominal operating pressure 350 bar.
- Permissible pressure in the tank port up to 350 bar with external drain, up to 210 bar with internal drain (see characteristics).
- Extremely low pressure drop – energy saving.
- Wide range of spool types available.
- Versions with shifting time adjustment, main valve with adjustable spool stop and position control by inductive detector available.
- Coils are easily replaced without any oil leakage.
- Interchangeability of spools and bodies due to high precision manufacturing processes.
- Mounting configuration conform to ISO 4401.
- Every valve is factory tested prior to delivery.
- Worldwide DENISON Service.

### SYMBOL



### GENERAL

The DENISON 4D03 is a pilot operated directional control valve controlled by solenoids, hydraulic pressure or mechanically. The 4D03 valve controls the flow direction in a hydraulic circuit. It delivers the performance demanded of modern hydraulic systems. Streamlined internal channels ensure minimum pressure drop at maximum flow. Subplate or manifold mount as standard.

## OPERATION, PILOT VALVE ORIFICE, CHARACTERISTICS

### OPERATION

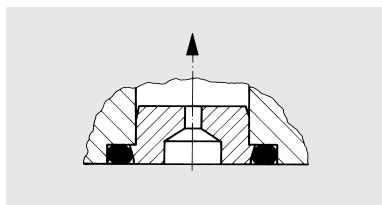
The electrically operated 4-way valve 4D03 consists of a main body and a solenoid operated pilot valve. The energized solenoid shifts the pilot control spool, thus directing fluid to one end of the main spool, and moving it to the desired position. Fluid can then flow e.g. from port P to either port A or B whilst the alternate port (B or A) is connected to the tank line. The necessary pilot pressure can be obtained internally from the system port P or from an external pressure supply connected to port X.

De-energizing the solenoid allows both the pilot control and the main spool to return to their neutral positions.

The hydraulically operated version may be remotely controlled by an external pilot valve.

The main spool of the direct operated valves can be moved mechanically by means of a lever or stem.

### PILOT VALVE ORIFICE



In certain operating conditions, a flow greater than the functional limit of the pilot valve may be generated. In this case, it is recommended that one orifice be fitted in the P port of the pilot valve (code 10 for solenoid operation) or two orifices in the A&B ports of the pilot cap (code P3 for hydraulic operation).

### CHARACTERISTICS

• Design	Sliding spool valve
• Type of mounting	Subplate according to CETOP 07, ISO 4401
• Mounting position	Optional
• Ambient temperature range	– 20 ... + 50 °C
• Operating pressure (A, B, P, X)	up to 350 bar
• Operating pressure (T, Y)	see pages 9 and 14
• External pilot pressure (at 300 l/min)	
– min	8.5 bar for spools with open centre position 9.5 bar for spools with closed centre position
– max	350 bar > 250 bar ... 350 bar a pilot orifice dia. 1.0 mm in P-port is recommended (code 10 or P3)
• Max. flow	300 l/min (see diagrams)
• Max. leakage	300 ... 650 ml/min (depends on spool type)
• Fluid	Petroleum base anti-wear fluids (covered by DENISON HF-0 and HF-2 specification). Such as mineral oil according to DIN 51524/25. Maximum catalogue ratings and performance data are based on operation with these fluids.
• Viscosity range	10 ... 650 cSt, optimum 30 cSt
• Fluid temperature range	– 18 ... + 80 °C
• Contamination level	Max. permissible contamination level according to NAS 1638 Class 8 (Class 9 for 15 Micron and smaller) or ISO 17/14

## ORDERING CODE – SOLENOID & HYDRAULIC OPERATION

Model No.:	4D03	- 3	.	..	-	..	-	.	.	A	.	...	-10	..	..
	1	2	3	4	5	6	7	8	9	10	11	12	13		
<b>1 Series</b> _____															
03 = Cetop 07															
<b>2 Control</b> _____															
A = Pilot operated, 1 solenoid (4D01)															
B = Pilot operated, 2 solenoids (4D01)															
C = Pilot operated, 2 solenoids (4D01)															
pilot valve: 2 pos. detents															
0 = Hydraulic operation															
<b>3 Spool Type</b> _____															
refer to pages 6 and 7															
<b>4 Spool Position</b> _____															
01 = 2 (a, b ), Spring offset to pos. "b", energized to "a"															
02 = 2 (a, b ), Spring offset to pos. "a", energized to "b"															
03 = 3 (a, o, b), Spring centred pos. "o"															
04 = 2 (a, b), Spool is not centred, energized to "a" or "b"															
(pilot valve with detents)															
05 = 2 (o, b), Spring centred pos. "o", energized to "b"															
06 = 2 (o, a), Spring centred pos. "o", energized to "a"															
<b>5 End Cap</b> _____															
03 = for controls A, B, C, 0															
09 = for controls A, B, C, 0 with adjust. spool stop on both sides															
Versions with inductive detector:															
SA = for spool position 01, 02, 03, 05, 06: Neutral position controlled															
SB = for spool position 01, 02, 05, 06: a- or b-position controlled															
TA = for spool position 03: Neutral position controlled															
SC = for spool position 03: Both end pos. controlled															
TC = for spool position 03: Both end pos. controlled															
<b>6 Pilot Connection</b> _____															
0 = External PP, external PD (for hydraulic operation)															
1 = Internal PP, internal PD <sup>1)</sup>															
2 = Internal PP, external PD <sup>1)</sup>															
3 = External PP, internal PD															
4 = External PP, external PD															
<b>7 Main Valve Accessories</b> _____															
0 = without															
1 = Shifting time adjustment (meter-in control)															
2 = Shifting time adjustment (meter-out control)															
6 = Shifting time adjustment (meter-in control) & integral check in "P" <sup>1)</sup>															
8 = Shifting time adjustment (meter-out control) & integral check in "P" <sup>1)</sup>															
4 = Integral check in "P" <sup>1)</sup>															
<b>8 Design Letter</b> _____															
<b>9 Seal Class</b> _____															
1 = NBR-seals (Standard)															
4 = EPDM-seals															
5 = FPM-seals (Viton®)															
<b>10 Solenoid Voltage</b> _____															
W01 = 115 V / 60 Hz															
W02 = 230 V / 60 Hz															
W06 = 115 V / 50 Hz															
W07 = 230 V / 50 Hz															
<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <math>\left. \begin{array}{l} \text{G0R} = 12 \text{ V} \\ \text{G0Q} = 24 \text{ V} \\ \text{G0D} = 27 \text{ V} \end{array} \right\} \text{DC}</math> </div> <div> <math>\left. \begin{array}{l} \text{W01} = 115 \text{ V / 60 Hz} \\ \text{W02} = 230 \text{ V / 60 Hz} \\ \text{W06} = 115 \text{ V / 50 Hz} \\ \text{W07} = 230 \text{ V / 50 Hz} \end{array} \right\} \text{AC}</math> </div> </div>															
Order informationen for plug-in connectors see page 19															
<b>1* Pilot Accessories / Modifications</b> _____															
10 = 1.0 mm orifice in P-port; for solenoid with manual override															
1032 = 1.0 mm orifice in P-port; for solenoid without manual override															
1052 = 1.0 mm orifice in P-port; for solenoid with manual override; with rubber cover															
P3 = 1.0 mm orifices in A & B-ports of the cap; for hydraulic operation only (control code 0)															

### Notes:

<sup>1)</sup> For valves with spools 01, 07, 11 and internal PP an integral check is recommended in P-port of the main body to obtain the minimum pilot pressure. The integral check is not provided for load pressure holding back to P-port.

<sup>2)</sup> For standard applications orifice in P-port always recommended.

### ORDERING CODE – LEVER AND STEM OPERATION

**Model No.:**

**4D03 – 3**

**- 3**

■

■

---

■

—

**O**

**A**

□ □

□ □

1

## Series

03 = Cetop 07

2

### Control

3 = Stem operation  
4 = Lever operation

3

**Spool Type**

refer to pages 6 and 7

4

### **Spool Position**

01 = 2 (a, b ), Spring offset to pos. "b", activated to pos. "a"  
02 = 2 (a, b ), Spring offset to pos. "a", activated to pos. "b"  
03 = 3 (a, o, b), Spring centred pos. "o"  
07 = 3 pos. detent

5

## End Cap

04 = for spool position 01, 02 and 03  
05 = for spool position 07

6

## **\_Pilot Connection**

5 = Internal PD (max. 10 bar)  
6 = External PD

7

## Design Letter

8

## Seal Class

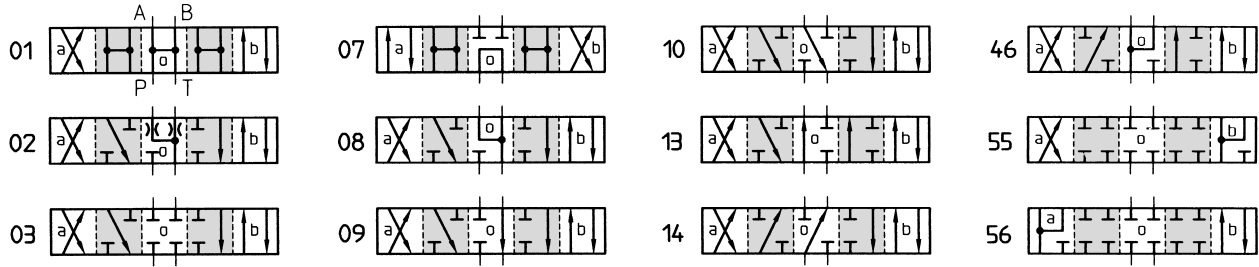
1 = NBR-seals (Standard)  
4 = EPDM-seals  
5 = FPM-seals (Viton®)

9\*

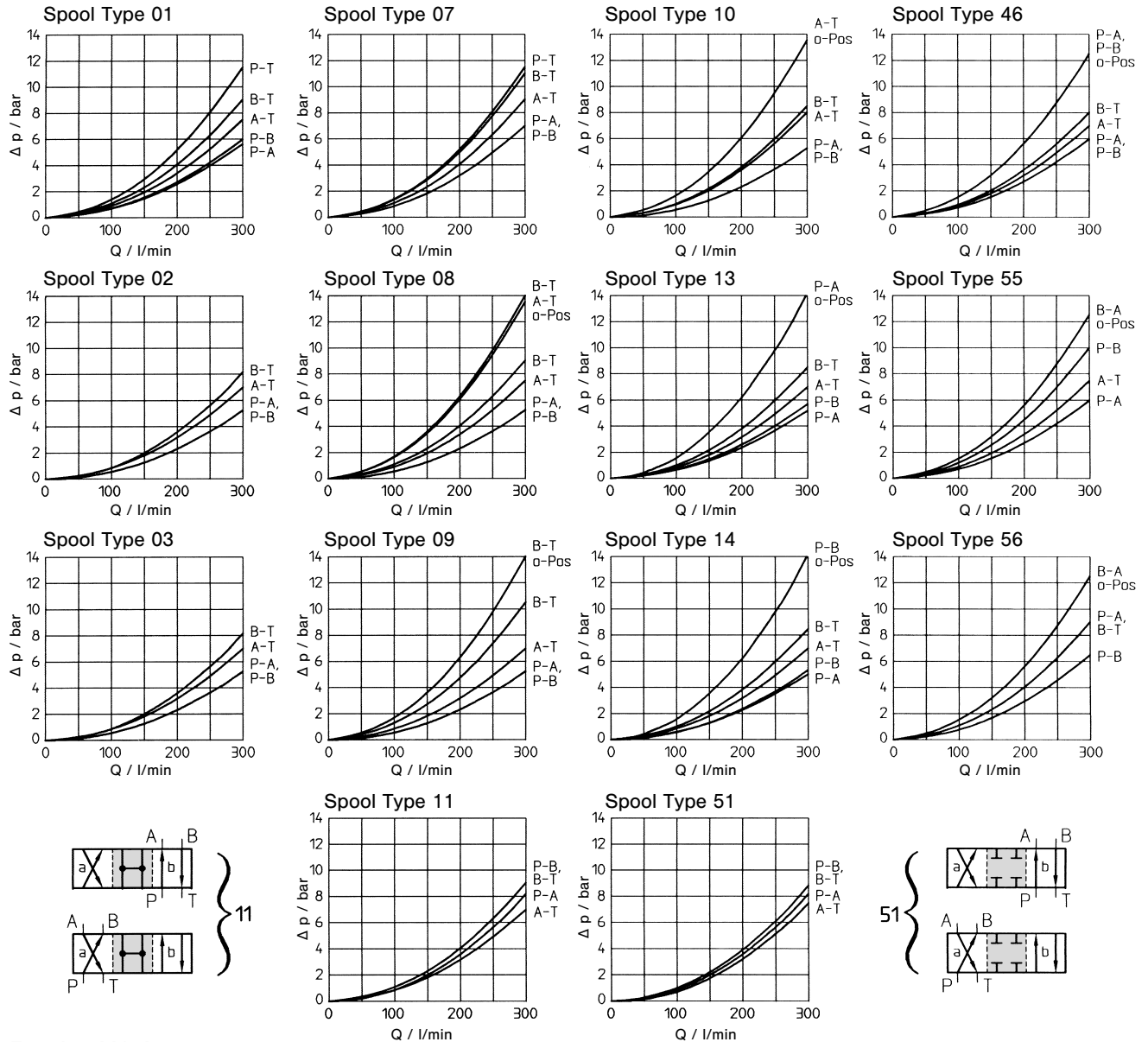
### Accessories / Modifications

## SPOOL TYPES, PRESSURE DROP, FUNCTIONAL LIMITS

### Spool Types



### Pressure Drop



### Functional Limits

Spool Type	max. Flow (l/min) versus Pressure (bar)				
	70	140	210	280	350
01, 02, 03, 08, 09, 10, 13, 14, 46, 55, 56	300	300	300	300	300
07	300	300	280	230	180
11	300	300	300	300/200*	300/190*
51	300	300/200*	300/170*	300/160*	300/100*

\* The "fail safe" flow limits of the spool types 11 & 51 must be reduced at higher operating pressure to comply with "safety regulations" where applicable.

**Means:** The main spool returns to "spring offset" position only by spring force (**without** pilot pressure).

## SIMPLIFIED SYMBOLS & SPOOL TYPES AVAILABLE

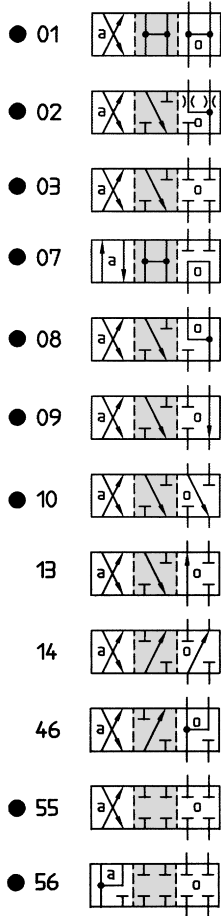
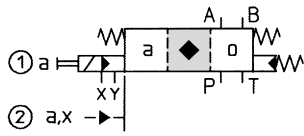
- ① 1-Solenoid operation (sol. B-side)
- ② hydraulic operation
- ③ Stem operation
- ④ Lever operation

- ① 2-Solenoid operation
- ② hydraulic operation
- ③ Stem operation
- ④ Lever operation

- ① 1-Solenoid operation (sol. A-side)
- ② hydraulic operation
- ③ Stem operation
- ④ Lever operation

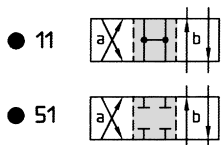
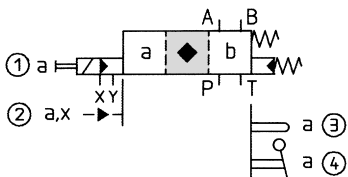
### Spool Position 06

Spring Centring



### Spool Position 01

Spring Offset

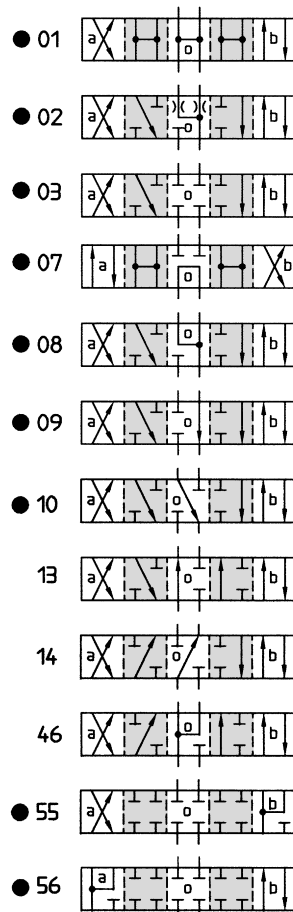
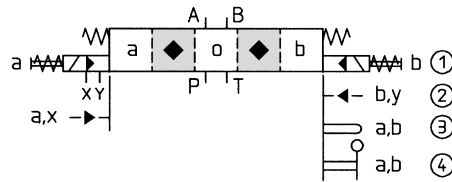


● Standard Spool

Transfer configuration only (not switched position)

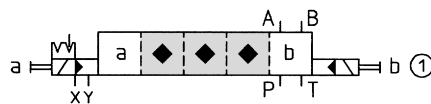
### Spool Position 03

Spring Centring



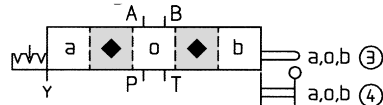
### Spool Position 04

Pilot Valve with Detents



### Spool Position 07

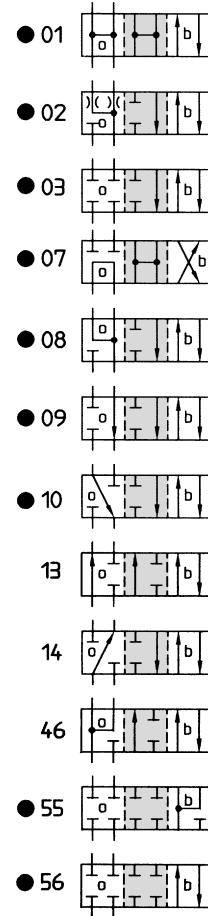
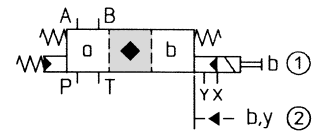
3 pos. detents



All spool types  
as shown above!

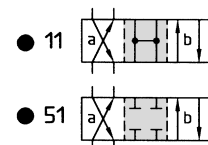
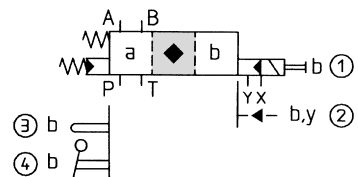
### Spool Position 05

Spring Centring



### Spool Position 02

Spring Offset

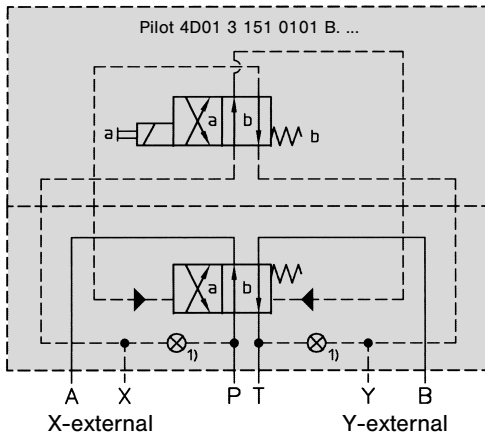


## DETAILED SYMBOLS – SOLENOID OPERATION

**4D03 3 A51 0103 40A. ...**

**Spool Position 01**

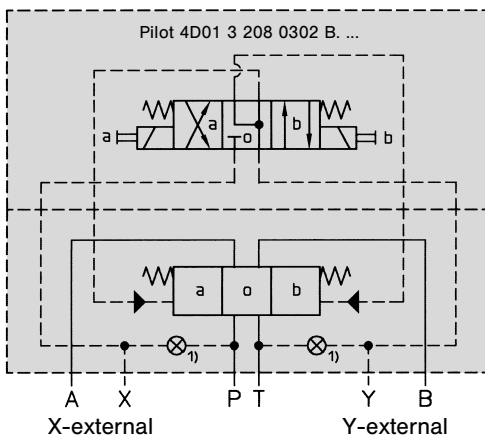
2 (a, b), Spring Offset



**4D03 3 B.. 0303 40A. ...**

**Spool Position 03**

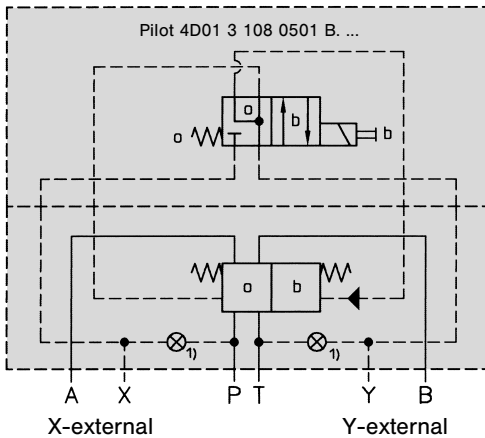
3 (a, o, b), Spring Centring



**4D03 3 A.. 0503 40A. ...**

**Spool Position 05**

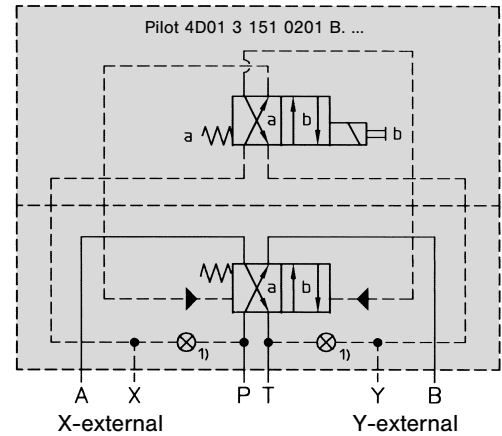
2 (o, b), Spring Centring



**4D03 3 A51 0203 40A. ...**

**Spool Position 02**

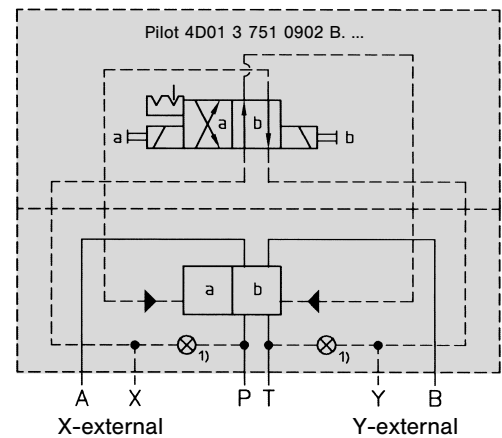
2 (a, b), Spring Offset



**4D03 3 C.. 0403 40A. ...**

**Spool Position 04**

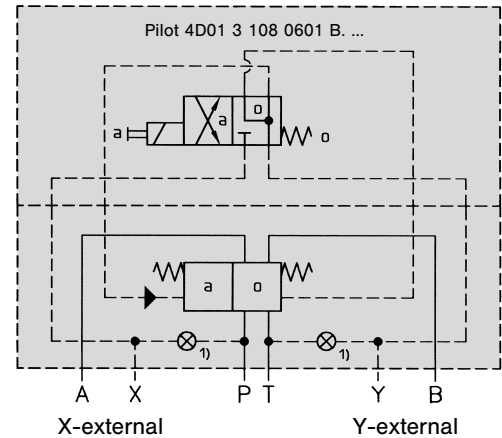
2 (a, b), Pilot Valve with detents



**4D03 3 A.. 0603 40A. ...**

**Spool Position 06**

2 (o, a), Spring Centring

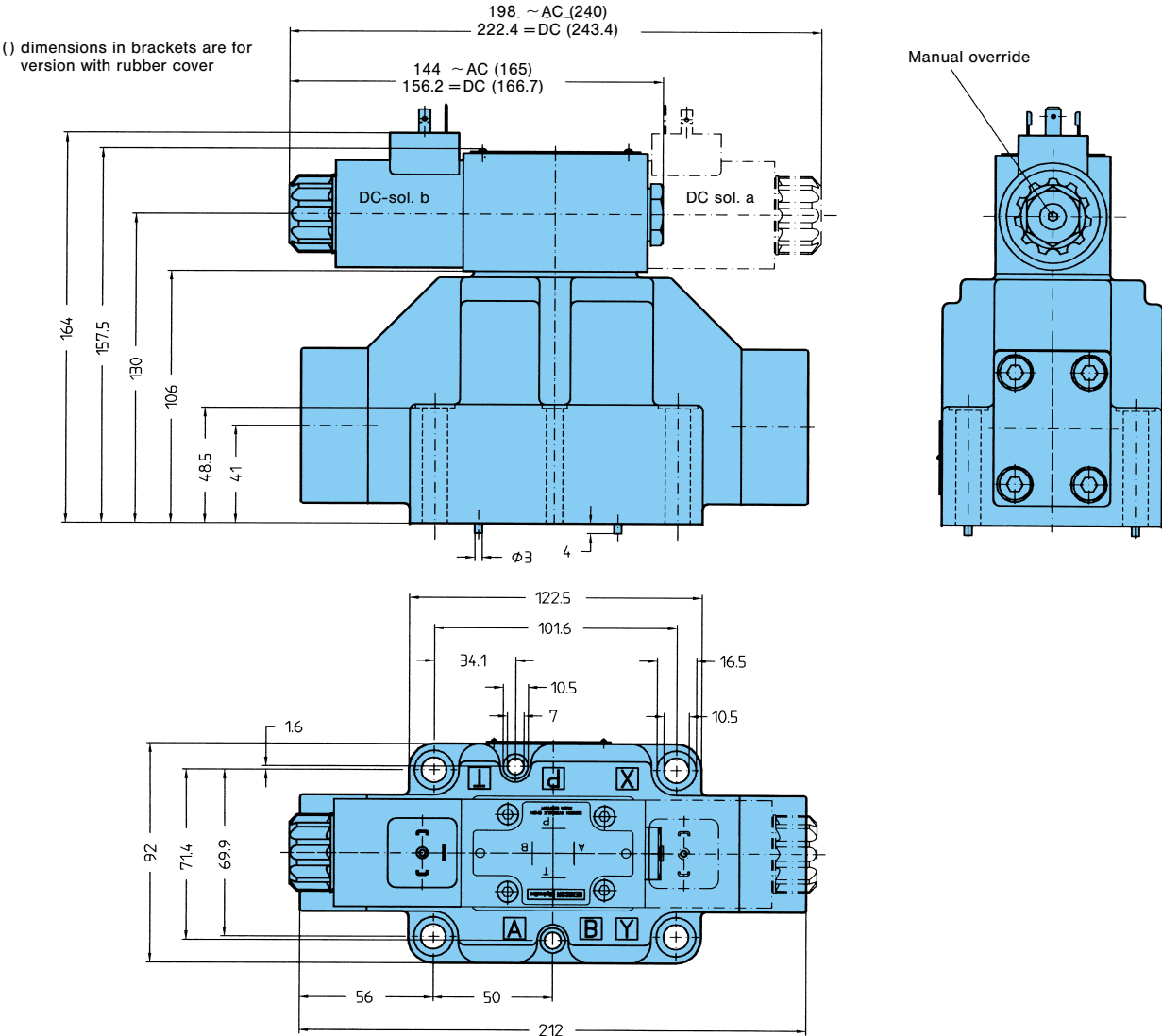


<sup>1)</sup> Plug mounted according to desired internal or external PP or PD.



## 1 AND 2 SOLENOID OPERATED VERSIONS

DC	AC
See ordering code on page 4	
31 W	31 W
up to 210 bar	up to 140 bar
up to 350 bar	up to 350 bar
up to 210 bar	up to 140 bar
–	78 VA
–	264 VA
+ 5 %...– 10 %	+ 5 %...– 10 %
40...45 ms	27...30 ms
40...50 ms	22...26 ms
45...50 ms	20...24 ms
45 ms	32...38 ms
40...45 ms	30...35 ms
40...45 ms	30...35 ms
+ 180 °C	+ 180 °C
H	H
100 %	100 %
IP 65	IP 65
9.5 kg	9.3 kg
10.0 kg	9.7 kg



**Note:** For replacement of port seals (NBR) see page 17

## 1 SOLENOID VERSION WITH POSITION CONTROL

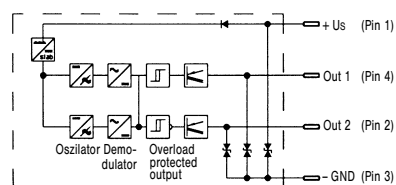
### CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

• Function	P-channel FET, contact positive
• Supply voltage $U_S$ (full wave bridge with capacitor)	24 V $\pm$ 20 % (19.2 V ... 28.8 V)
• Reverse polarity protection	max. 300 V installed
• Ripple voltage	10 %
• Current consumption	approx. 20 mA each circuit
• Outputs	Out 1: NC contact positive (not short circuit protection)
	Out 2: NO contact positive
• Output voltage	
– Signal L	$U_S - 2.5$ V
– Signal 0	$< 1.8$ V
• Output current	$< 400$ mA at $U_S + 20$ %
• Environmental protection	IP 65
• Operating temperature range	0°C ... + 85°C
• Wire cross-sectional area	4 x 0.5 mm <sup>2</sup>
• Tensile strength of transmitting conduit	p dyn. 315 bar
• Declaration of conformity no.	00 02 002 9 93

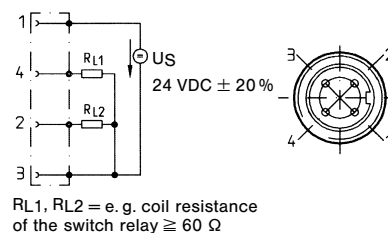
#### Attention:

EMC only ensured when using screened cables and screened plug casing!

Block diagram and connection of the inductive detector

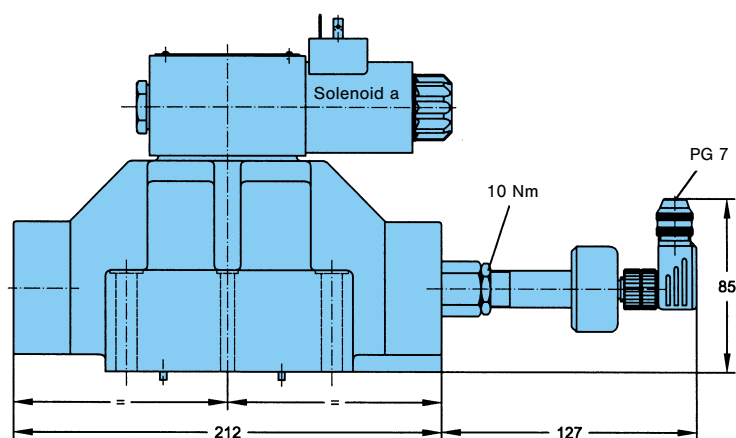


Socket connector



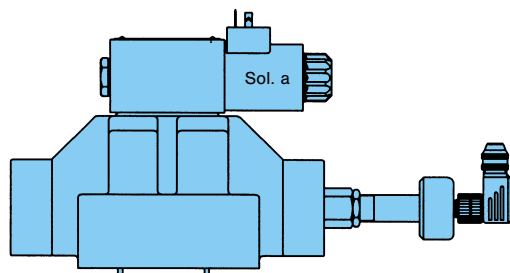
### DIMENSIONS

Example: 4D03-3A\*\*-01SA/SB  
-06SA/SB

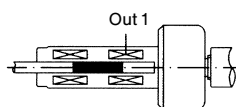
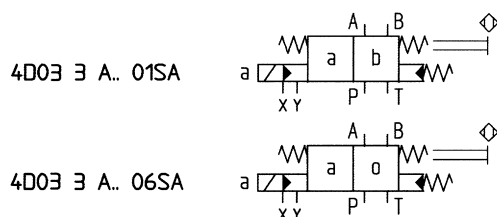


# 1 SOLENOID VERSION WITH POSITION CONTROL

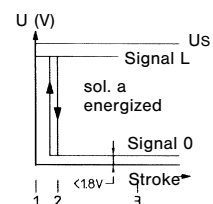
## Spool Positions 01/06



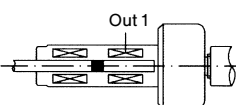
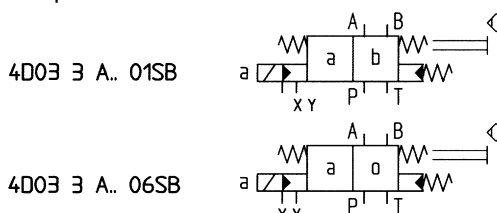
Neutral position controlled +



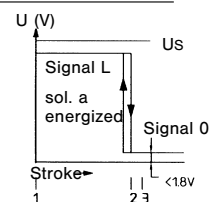
Neutr. Pos.: Out 1 = L  
Sol. energized: Out 1 = 0



End position controlled +

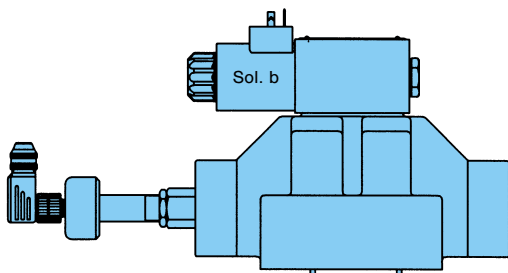


Neutr. Pos.: Out 1 = L  
Sol. energized: Out 1 = 0

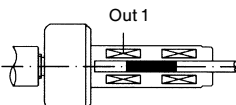
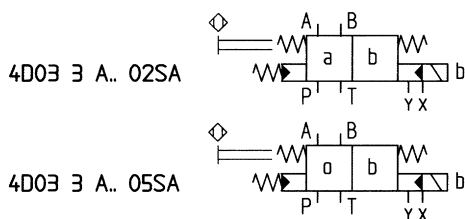


## Spool Positions 02/05

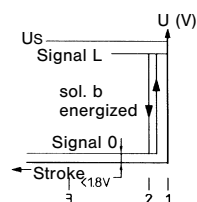
Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position



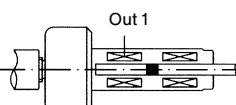
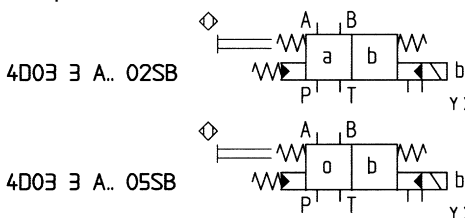
Neutral position controlled +



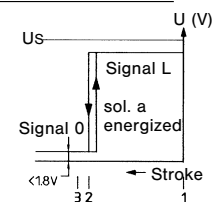
Sol. energized: Out 1 = 0  
Neutr. Pos.: Out 1 = L



End position controlled +



Sol. energized: Out 1 = 0  
Neutr. Pos.: Out 1 = L



Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position

## 2 SOLENOID VERSION WITH POSITION CONTROL

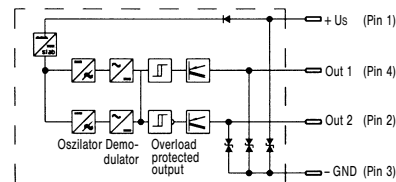
### CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

• Function	P-channel FET, contact positive
• Supply voltage $U_S$ (full wave bridge with capacitor)	$24\text{ V} \pm 20\%$ (19.2 V...28.8 V)
• Reverse polarity protection	max. 300 V installed
• Ripple voltage	10 %
• Current consumption	approx. 20 mA each circuit
• Outputs	Out 1: NC contact positive (not short circuit protection)
	Out 2: NO contact positive
• Output voltage	$U_S - 2.5\text{ V}$
– Signal L	$< 1.8\text{ V}$
– Signal 0	
• Output current	$< 400\text{ mA}$ at $U_S + 20\%$
• Environmental protection	IP 65
• Operating temperature range	$0^\circ\text{C} \dots +85^\circ\text{C}$
• Wire cross-sectional area	$4 \times 0.5\text{ mm}^2$
• Tensile strength of transmitting conduit	p dyn. 315 bar
• Declaration of conformity no.	00 02 002 9 93

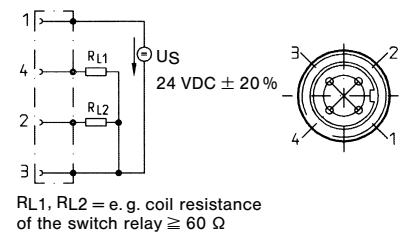
#### Attention:

EMC only ensured when using screened cables and screened plug casing!

Block diagram and connection of the inductive detector

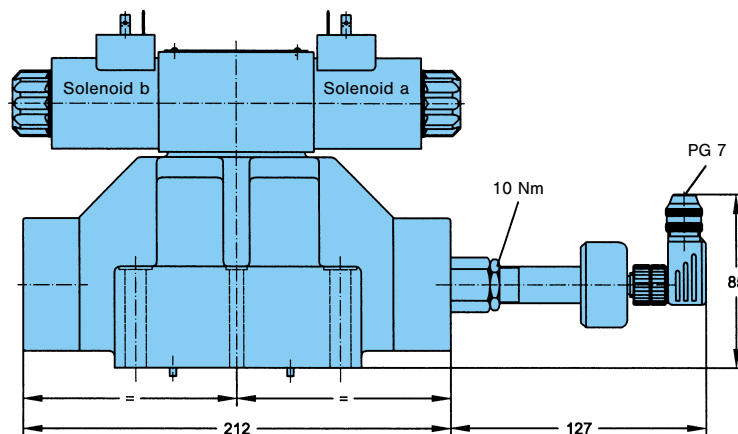


Socket connector



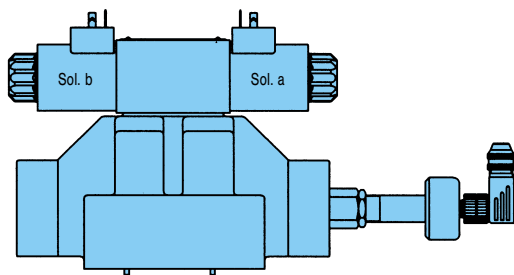
### DIMENSIONS

Example: 4D03-3B\*\*-03SA/SC

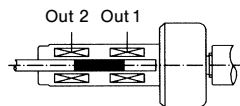
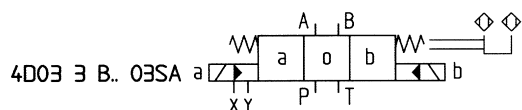


## 2 SOLENOID VERSION WITH POSITION CONTROL

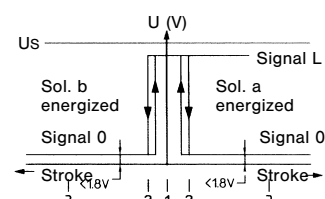
### Spool Position 03



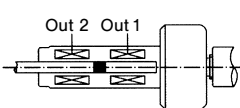
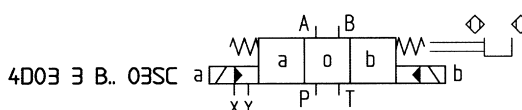
Neutral position controlled  $\pm$  \_\_\_\_\_



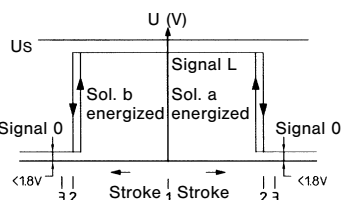
Sol. b energized: Out2 = 0  
Neutr. Pos.: Out1 + 2 = L  
Sol. a energized: Out1 = 0



End position controlled  $\pm$  \_\_\_\_\_

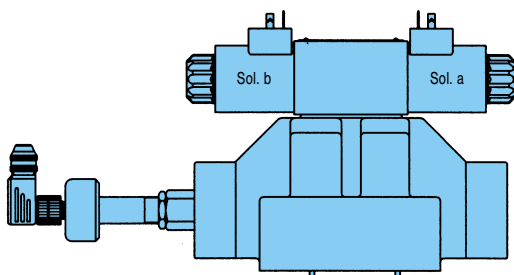


Sol. b energized: Out2 = 0  
Neutr. Pos.: Out1 + 2 = L  
Sol. a energized: Out1 = 0

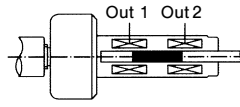
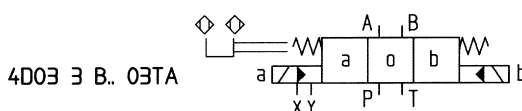


Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position

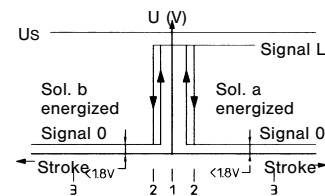
### Spool Position 03



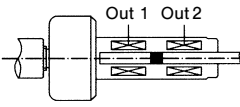
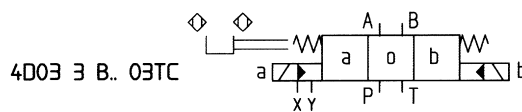
Neutral position controlled  $\pm$  \_\_\_\_\_



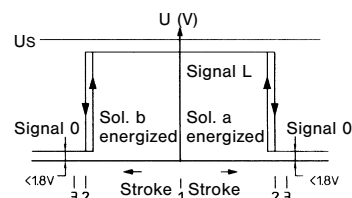
Sol. b energized: Out1 = 0  
Neutr. Pos.: Out1 + 2 = L  
Sol. a energized: Out2 = 0



End position controlled  $\pm$  \_\_\_\_\_



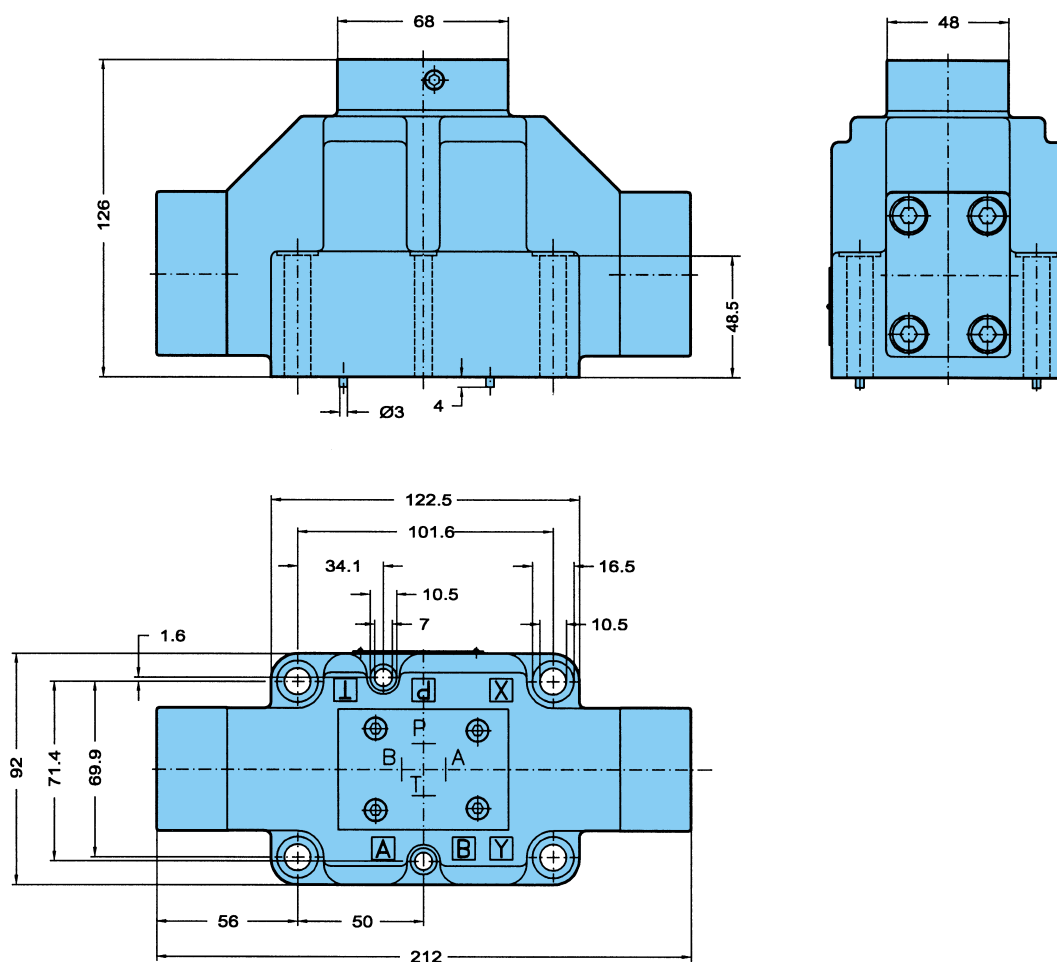
Sol. b energized: Out1 = 0  
Neutr. Pos.: Out1 + 2 = L  
Sol. a energized: Out2 = 0



Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position

## HYDRAULIC OPERATION

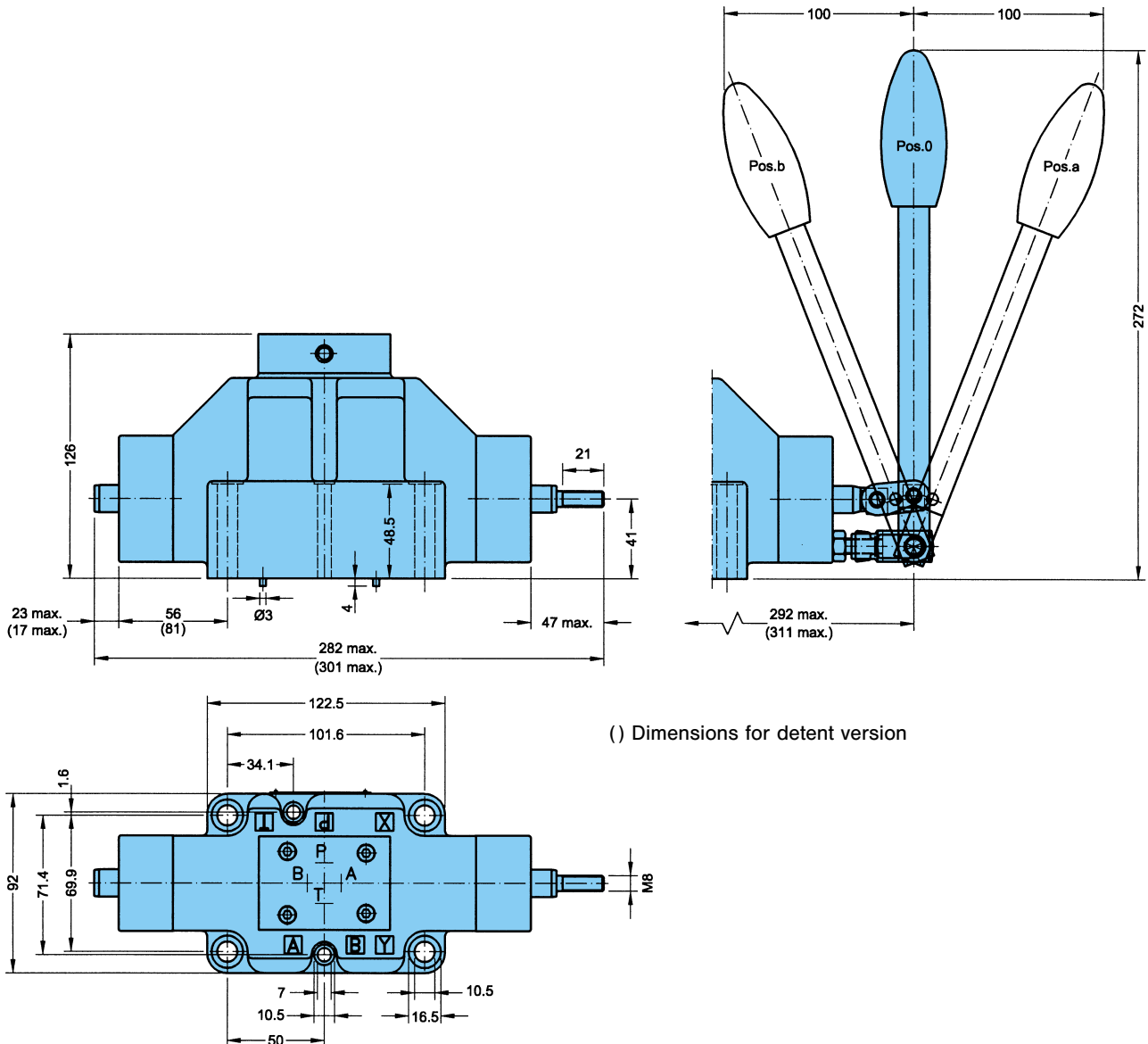
- Response time
  - pressurized e.g. 50 ms with pilot flow 6.5 l/min
  - unpressurized e.g. 40 ms pressureless return line
- Permissible pressure (ports T, X, Y) ...350 bar
- Weight 8.2 kg



**Note:** For replacement of port seals (NBR) see page 17

## STEM & LEVER OPERATION

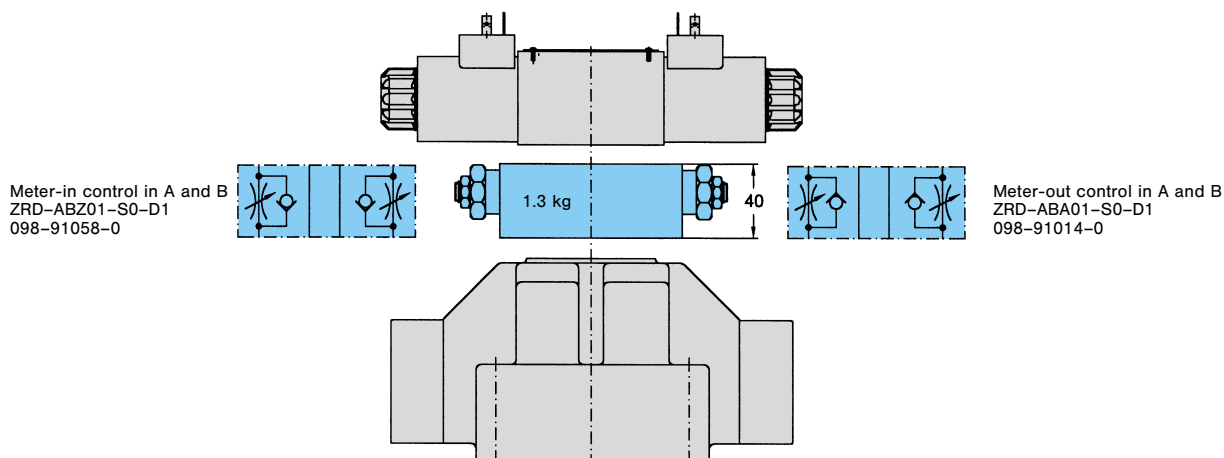
- |                   |             |
|-------------------|-------------|
| • Tank pressure   | max. 10 bar |
| • Operating force |             |
| – Stem operation  | 300 N       |
| – Lever operation | 30 N        |
| • Weight          |             |
| – Stem operation  | 8.3 kg      |
| – Lever operation | 8.7 kg      |



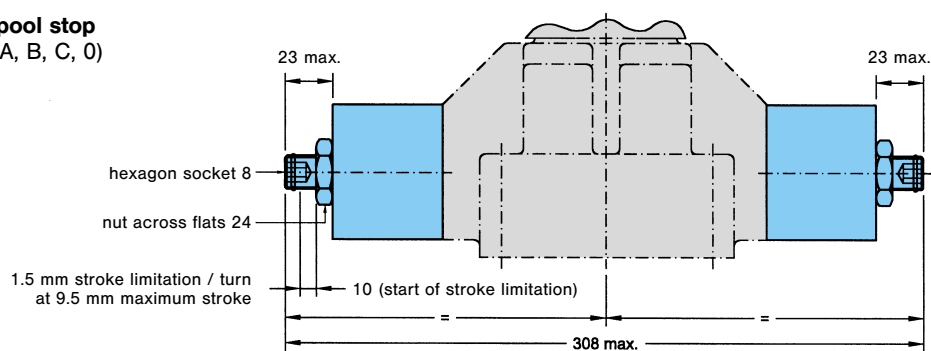
**Note:** Actuators are on principle  
at B-side for spool position 03 and 07!  
For replacement of port seals (NBR) see page 17.

## OPTIONS

### Version with shifting time adjustment



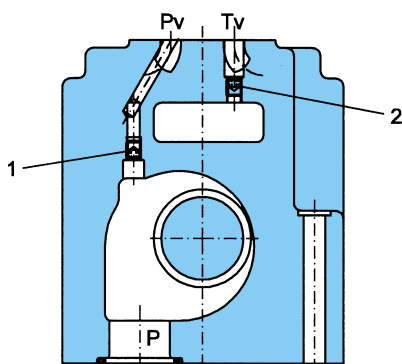
### Adjustable spool stop (for controls A, B, C, 0)



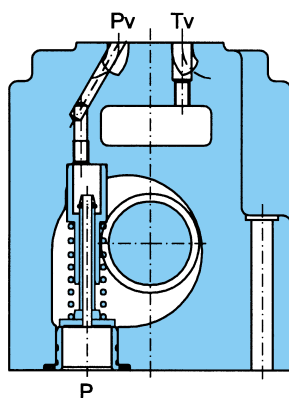
### Pilot connections

**Pilot Pressure PP**  
external: 1 closed  
internal: 1 open

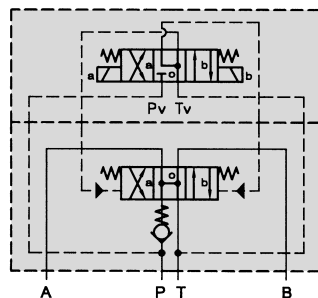
**Pilot Drain PD**  
external: 2 closed  
internal: 2 open



### Version with integral check

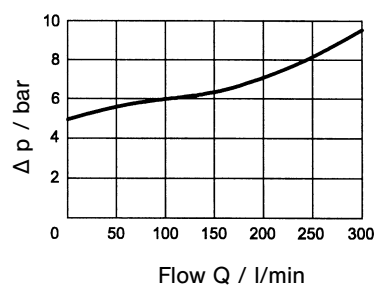


Symbol with Integral Check  
(Example)



For flow lower than 200 l/min an  
Integral Check should be applied  
(see Note)

Integral Check

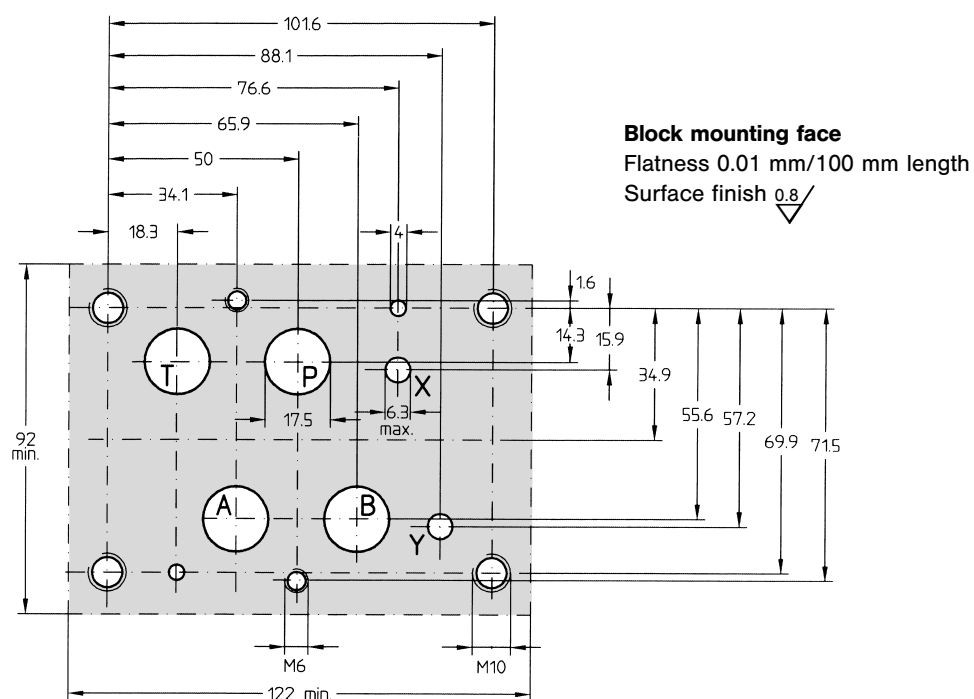


**Note:** For valves with no-load flow (spools 01, 07, 11) and internal PP an integral check is recommended in P-port of the main body to obtain the minimum pilot pressure. The integral check is not provided for load pressure holding back to P-port.



## MOUNTING CONFIGURATION, PANEL OPENING

Mounting configuration conform to ISO 4401



### Portings

P = Pressure port

T = Tank port

A & B = Actuator ports

X = Pilot port for external PP: pilot operated valves

= Pilot port for hydr. operated valves

Y = Drain port for external PD: pilot operated valves

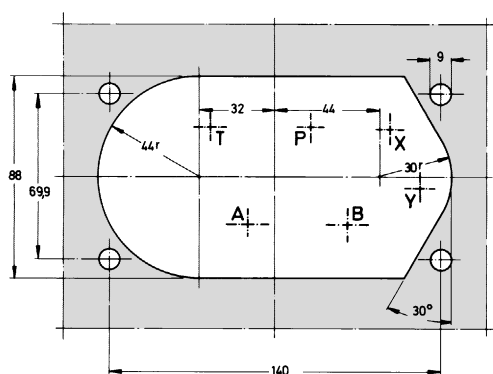
= Pilot port for hydr. operated valves

### NBR-Seals

A, B, P, T	23.47 x 2.62	691-00119-0
X, Y	9.25 x 1.78	691-00012-0

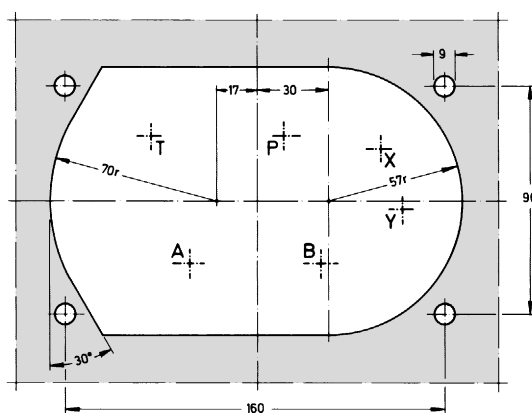
### Panel opening

for subplate G 3/4"



### Panel opening

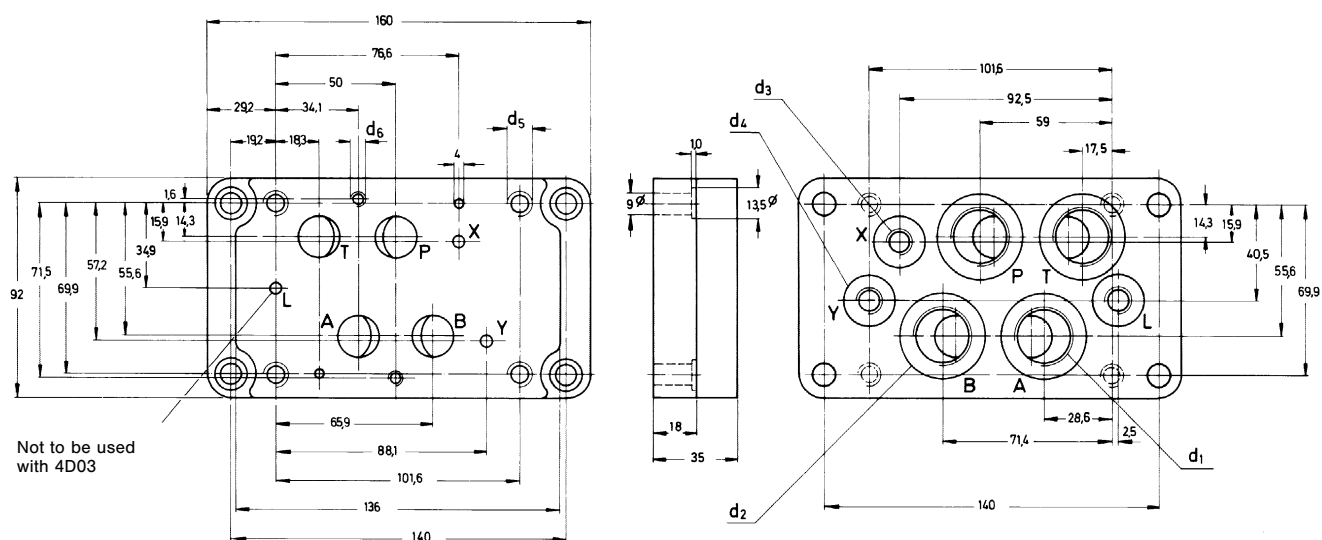
for subplate G 1"



## SUBPLATES

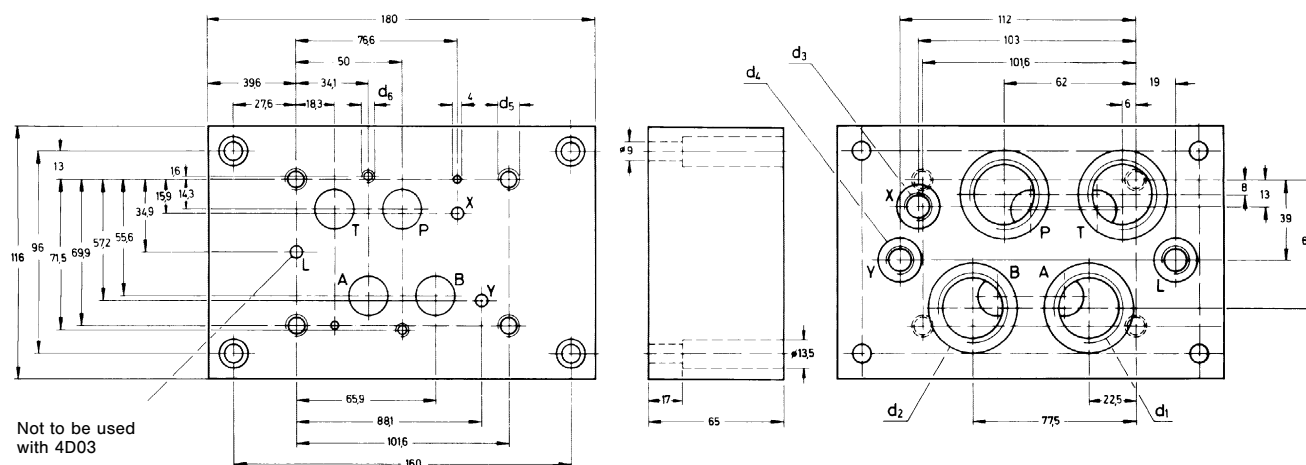
**Subplate G 3/4"** (mount. configuration conform to ISO 4401)

Weight:  $\approx 3.5$  kg



**Subplate G 1"** (mount. configuration accord. to CETOP, ISO and DIN)

Weight:  $\approx 8.3$  kg



### Please note:

Mounting screws are included in subplate order.  
For valves ordered without subplate, mounting screws must be ordered separately.

Mounting screws	Order-No.
(4) M 10 x 65 DIN 912; 10.9	700-71449-8
(2) M 6 x 60 DIN 912; 10.9	700-70806-8

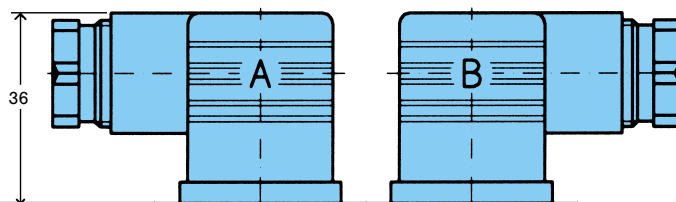
Torque 50 Nm for M10

13 Nm for M6

Model-No.	Order-No.	d <sub>1</sub> (A, B, P, T)	d <sub>2</sub>	d <sub>3</sub> (X, Y)	d <sub>4</sub>	d <sub>5</sub>	d <sub>6</sub>
SS-B-12-G 121-L	S26-58610-0	G 3/4"	41; 0.8 dp.	G 1/4"	23; 0.8 dp.	M 10	M 6
SS-B-16-G 123-L	S26-58611-0	G 1"	47; 0.8 dp.	G 1/4"	23; 0.8 dp.	M 10	M 6

## ACCESSORIES

### PLUG-IN CONNECTORS CONFIRMING TO ISO 4400



Versions	A-Side (grey)	B-Side (black)
Standard <250 V PG 11	167-01007-8	167-01008-8
with LED (red) 15...30 V	167-01100-8	167-01101-8
with bridge rectifier 12...250 V	167-01076-8	167-01014-8

**Note:** Plug-in connectors to be ordered as separate items.