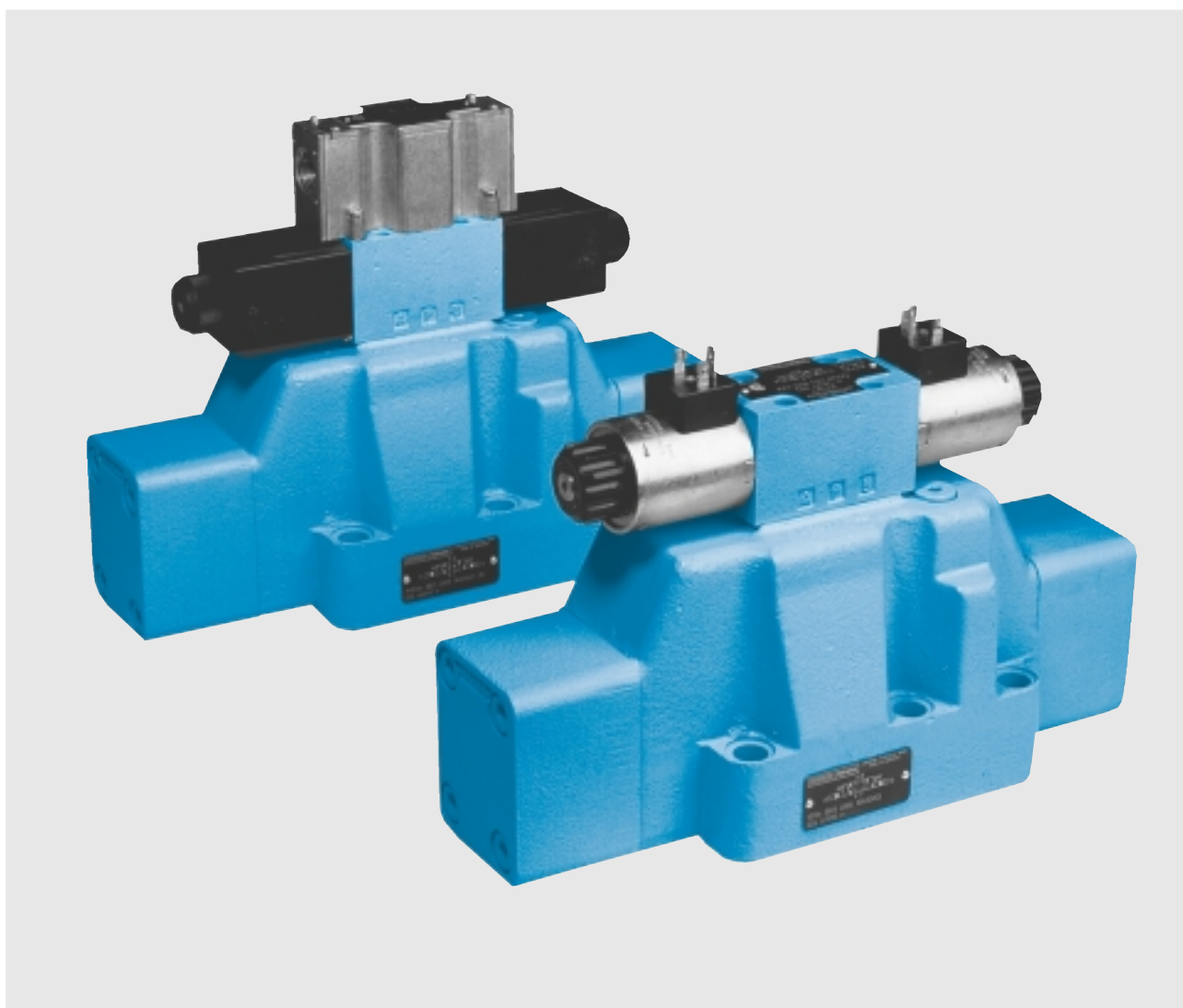


# DENISON HYDRAULICS

## Directional Control Valves

Series A4D06 – NFPA D08, Cetop 8



Publ. 4-AM 3710-B, replaces 4-AM 3710-A

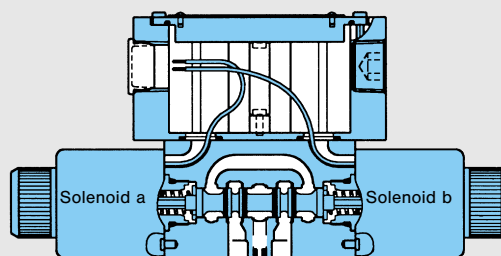
**DENISON** Hydraulics

## FEATURES, SYMBOL, GENERAL

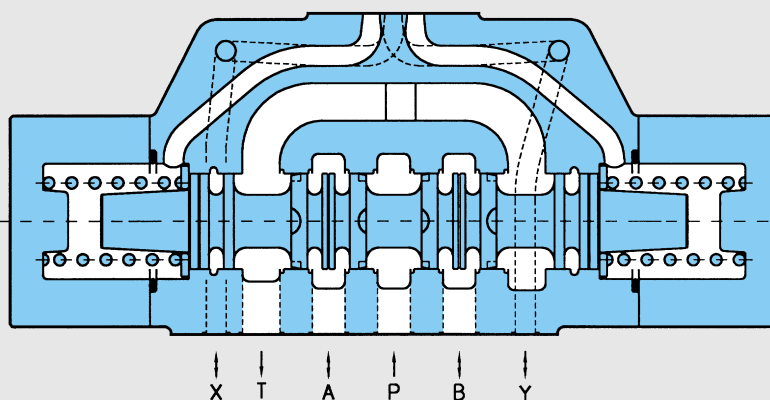
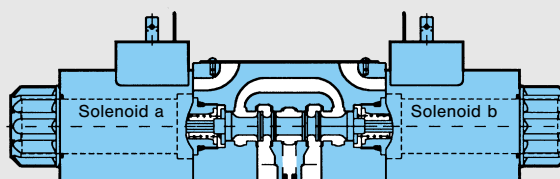
### FEATURES

- High functional limit up to 700 l/min (185 gpm) at nominal pressure.
- Nominal operating pressure 350 bar (5000 psi).
- Permissible pressure in the tank port up to 350 bar (5000 psi) with external drain, up to 210 bar (3000 psi) with internal drain (see characteristics).
- Extremely low pressure drop – energy saving.
- Wide variety 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.

AC Pilot Valve with Wiring Box

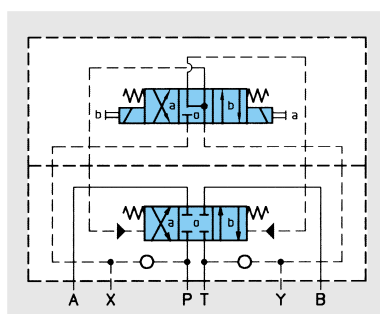


DC Pilot Valve with 3 Pin Socket



Example: solenoid operation

### SYMBOL



### GENERAL

The DENISON A4D06 is a pilot operated directional control valve controlled by solenoids, hydraulic pressure or mechanically. The A4D06 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

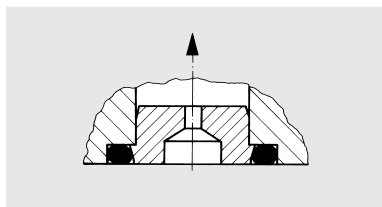
The electrically operated 4-way valve A4D06 consists of a main body and a solenoid operated pilot valve. The energized solenoid shifts the pilot control spool, thus directing fluid to one end of the main spool, and moving it to the desired position. Fluid can then flow e.g. from port P to either port 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 conform to NFPA D08, CETOP 8, ISO 4401
• Mounting position	Optional
• Ambient temperature range	-20 ... +50 °C (0 ... 120 ° F)
• Operating pressure (A, B, P, X)	up to 350 bar (5000 psi)
• Operating pressure (T, Y)	see pages 10 and 16
• External pilot pressure at 700 l/min (185 gpm)	
– min	9 bar (130 psi) for spools with open center position 10 bar (145 psi) for spools with closed center position
– max	350 bar (5000 psi) > 250 bar ... 350 bar (>3625 psi ... 5000 psi) a pilot orifice dia. 1.0 mm in P-port is recommended (code 10 or P3)
• Max. flow	700 l/min (185 gpm) (see diagrams)
• Max. leakage	350 ... 900 ml/min (21 ... 55 in <sup>3</sup> /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 (0 ... 176 ° F)
• 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.:	A4D06	- 3	.	..	-	..	.	.	A	.	...	-10	..	..
	1	2	3	4	5	6	7	8	9	10	11	12	13	
<b>1 Series</b>														
06 = Cetop 8														
<b>2 Control</b>														
A = Pilot operated, 1 solenoid (A4D01)														
B = Pilot operated, 2 solenoids (A4D01)														
C = Pilot operated, 2 solenoids (A4D01)														
pilot valve: 2 pos. detents														
0 = Hydraulic operation														
<b>3 Spool Type</b>														
refer to pages 6...8														
<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 centered pos. "o"														
04 = 2 (a, b), Spool is not centered, energized to "a" or "b"														
(pilot valve with detents)														
05 = 2 (o, b), Spring centered pos. "o", energized to "b"														
06 = 2 (o, a), Spring centered 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: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle;">}</div> <div style="display: inline-block; vertical-align: middle;">AC</div> </div>														
<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle;">}</div> <div style="display: inline-block; vertical-align: middle;">DC</div> </div>														
<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle;">}</div> <div style="display: inline-block; vertical-align: middle;">for DIN connector only</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														
1028 = 1.0 mm orifice in P-port; wiring box with 6" flying leads														
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														
102852 = 1.0 mm orifice in P-port; wiring box with 6" flying leads & rubber cover														
1081 = 1.0 mm orifice in P-port; wiring box with 6" flying leads & terminal strips														
108152 = 1.0 mm orifice in P-port; wiring box with 6" flying leads & terminal strips & 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.:

**A4D06 - 3 .**

**..**

**-**

**..**

**-**

**.**

**0**

**A**

**.**

**-**

**..**

**..**

**..**

**..**

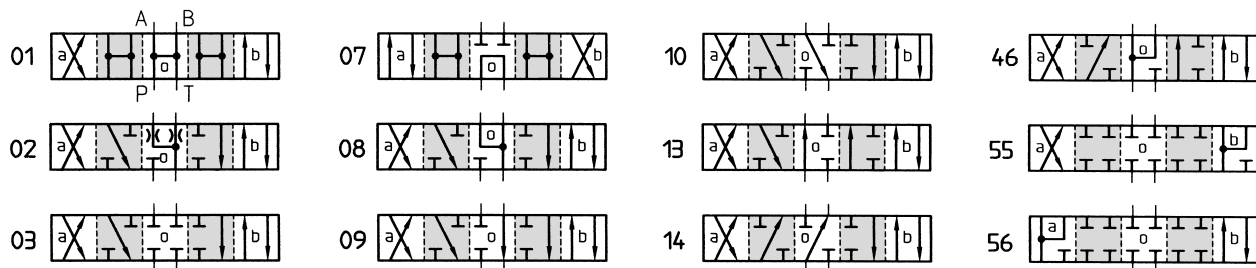
**..**

**..**

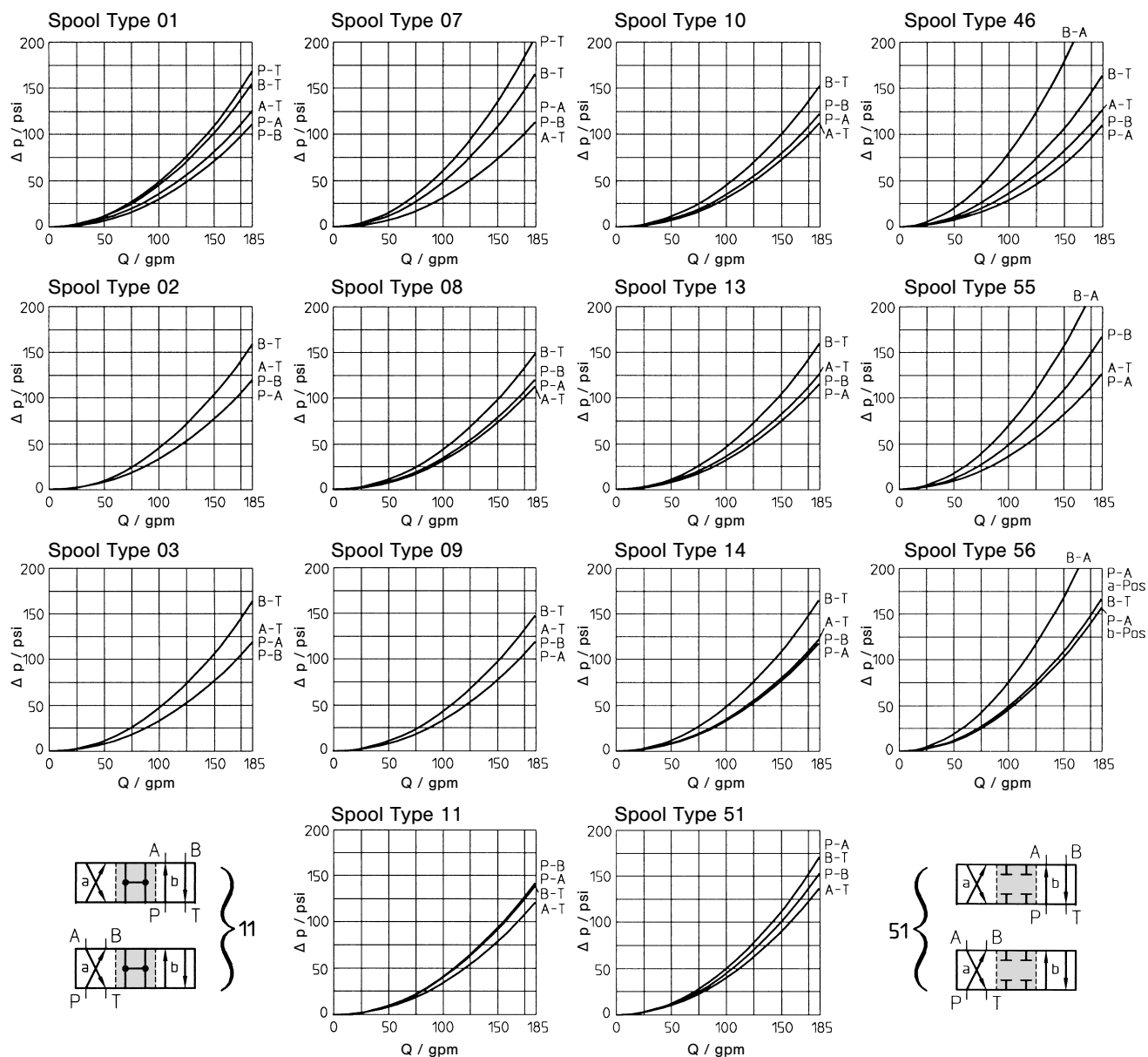
		1	2	3	4	5	6	7	8	9	10	11
1	<b>Series</b> _____ 06 = Cetop 8											
2	<b>Control</b> _____ 3 = Stem operation 4 = Lever operation											
3	<b>Spool Type</b> _____ refer to pages 6...8											
4	<b>Spool Position</b> _____ 01 = 2 (a, b), Spring offset to pos. "b", activated to pos. "a" 02 = 2 (a, b), Spring offset to pos. "a", activated to pos. "b" 03 = 3 (a, o, b), Spring centered pos. "o" 07 = 3 pos. detent											
5	<b>End Cap</b> _____ 04 = for spool position 01, 02 and 03 05 = for spool position 07											
6	<b>Pilot Connection</b> _____ 5 = Internal PD (max. 10 bar / 145 psi) 6 = External PD											
7	<b>Design Letter</b> _____											
8	<b>Seal Class</b> _____ 1 = NBR-seals (Standard) 4 = EPDM-seals 5 = FPM-seals (Viton®)											
9*	<b>Accessories / Modifications</b> _____											

## SPOOL TYPES, PRESSURE DROP (PSI), FUNCTIONAL LIMITS (GPM)

### Spool Types



### Pressure Drop



### Functional Limits

Spool Type	max. Flow (gpm) versus Pressure (psi)				
	1000	2000	3000	4000	5000
02, 03, 08, 09, 10, 13, 14, 46, 55, 56	185	185	185	185	185
01	185	185	185	180	158
07	185	177	156	135	114
11	185	185	185/166*	185/136*	185/106*
51	185	185/164*	185/127*	185/90*	185/53*

\* 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

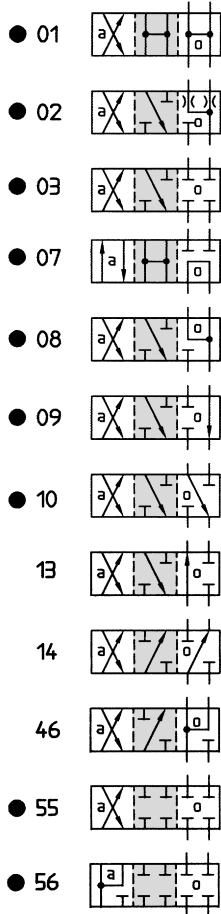
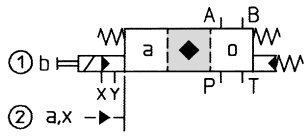
- ① 1-Solenoid operation (sol. B-side)
- ② hydraulic operation
- ③ Stem operation
- ④ Lever operation

- 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

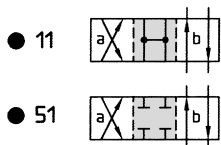
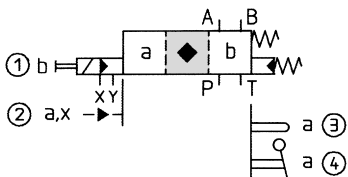
### Spool Position 06

Spring Centering



### Spool Position 01

Spring Offset

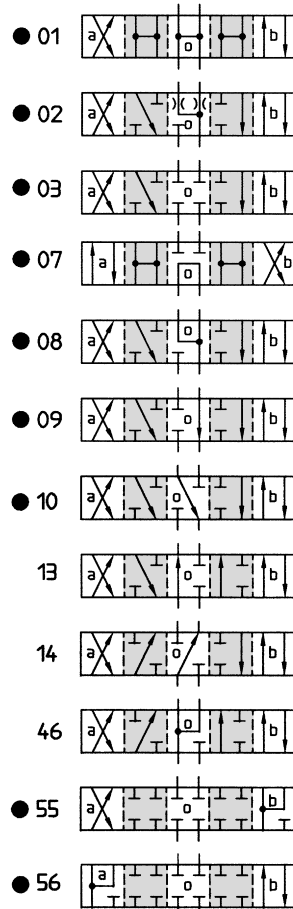
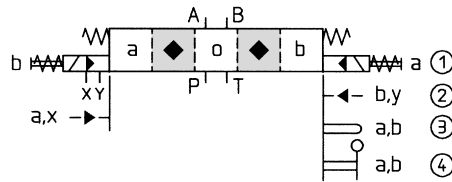


● Standard Spool

■ Transfer configuration only (not switched position)

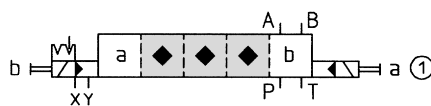
### Spool Position 03

Spring Centering



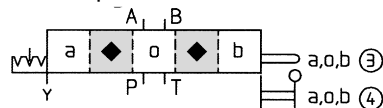
### Spool Position 04

Pilot Valve with Detents



### Spool Position 07

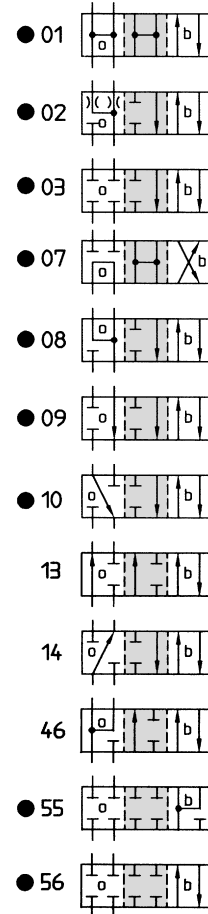
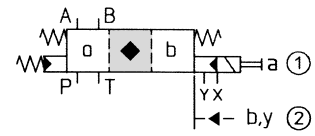
3 pos. detents



All spool types as shown above!

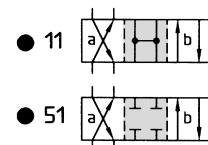
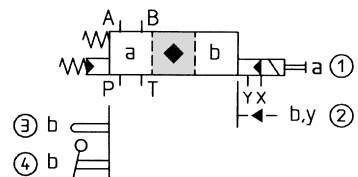
### Spool Position 05

Spring Centering



### Spool Position 02

Spring Offset



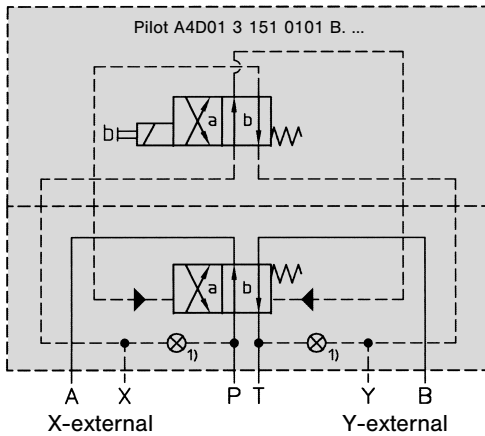


## DETAILED SYMBOLS – SOLENOID OPERATION

**A4D06 3 A51 0103 40A. ...**

### Spool Position 01

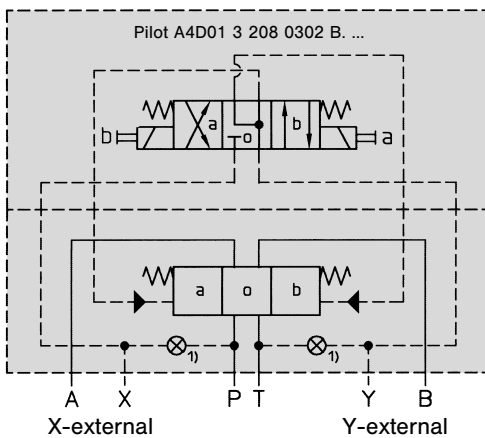
2 (a, b), Spring Offset



**A4D06 3 B.. 0303 40A. ...**

### Spool Position 03

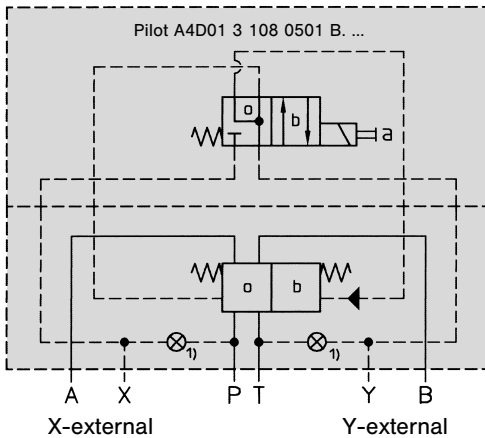
3 (a, o, b), Spring Centering



**A4D06 3 A.. 0503 40A. ...**

### Spool Position 05

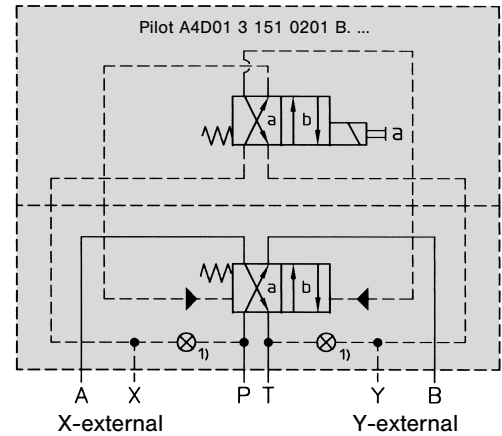
2 (o, b), Spring Centering



**A4D06 3 A51 0203 40A. ...**

### Spool Position 02

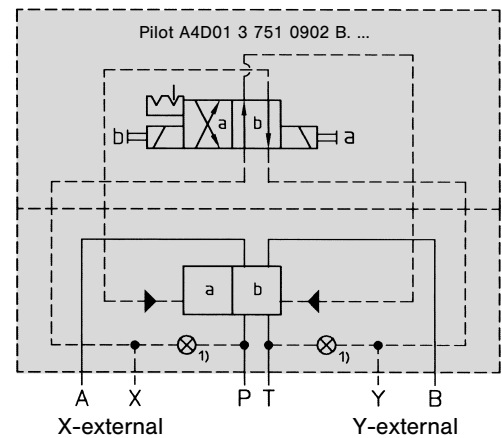
2 (a, b), Spring Offset



**A4D06 3 C.. 0403 40A. ...**

### Spool Position 04

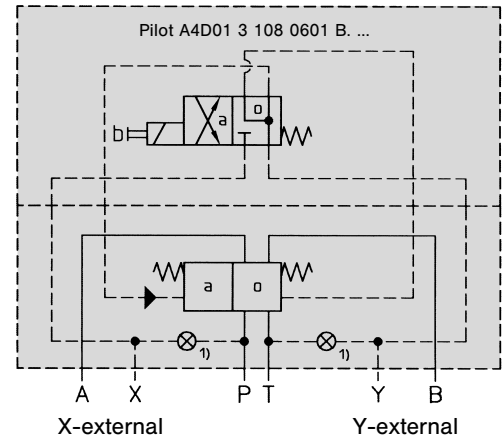
2 (a, b), Pilot Valve with detents



**A4D06 3 A.. 0603 40A. ...**

### Spool Position 06

2 (o, a), Spring Centering

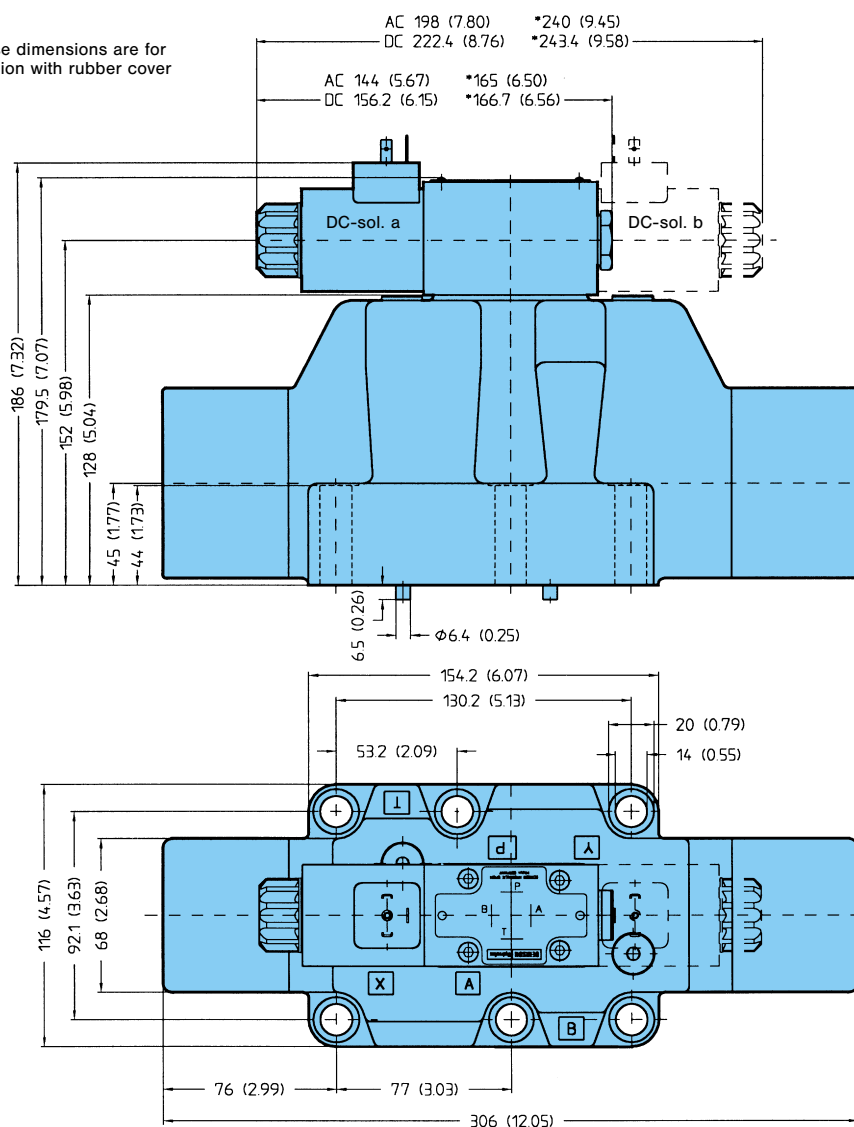


<sup>1)</sup> Plug mounted according to desired internal or external PP or PD.

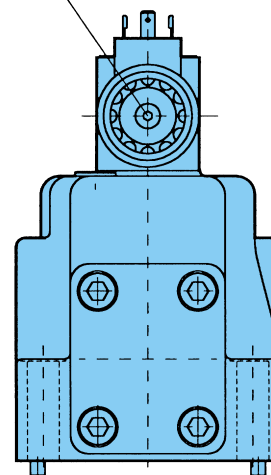
## 1 AND 2 SOLENOID OPERATED VERSIONS, 3 PIN SOCKET

	DC	AC
• Nominal voltage	See ordering code on page 4	
• Power input	31 W	31 W
• Permissible tank pressure (T)		
– with internal drain	... 210 bar (3000 psi)	... 140 bar (2000 psi)
– with external drain	... 350 bar (5000 psi)	... 350 bar (5000 psi)
• Permissible drain pressure (Y)	... 210 bar (3000 psi)	... 140 bar (2000 psi)
• Holding	–	78 VA
• Inrush	–	264 VA
• Permissible voltage difference	+ 5 % ... – 10 %	+ 5 % ... – 10 %
• Response times (at 400 l/min & without pilot orifice)		
– energized at 50 bar ( 725 psi)	50 ... 55 ms	35 ... 40 ms
at 150 bar (2175 psi)	50 ... 55 ms	30 ... 35 ms
at 250 bar (3625 psi)	55 ... 65 ms	28 ... 30 ms
– de-energized at 50 bar ( 725 psi)	40 ... 60 ms	40 ... 55 ms
at 150 bar (2175 psi)	32 ... 55 ms	30 ... 50 ms
at 250 bar (3625 psi)	27 ... 55 ms	28 ... 50 ms
• Max. coil temperature	+ 180 °C (350 ° F)	+ 180 °C (350 ° F)
• Temperature class	H	H
• Relative operating period	100 %	100 %
• Type of protection	IP 65	IP 65
• Weight 1 solenoid version	17.2 kg (37.9 lbs)	16.9 kg (37.3 lbs)
2 solenoid version	17.6 kg (38.8 lbs)	17.3 kg (38.1 lbs)

\* these dimensions are for version with rubber cover



Manual override



**Note:**  
For replacement of port seals (NBR) see page 19

## 1 AND 2 SOLENOID OPERATED VERSIONS, WIRING BOX

- Nominal voltage
- Power input
- Permissible tank pressure (T)
  - with internal drain
  - with external drain
- Permissible drain pressure (Y)
- Holding
- Inrush
- Permissible voltage difference
- Response times

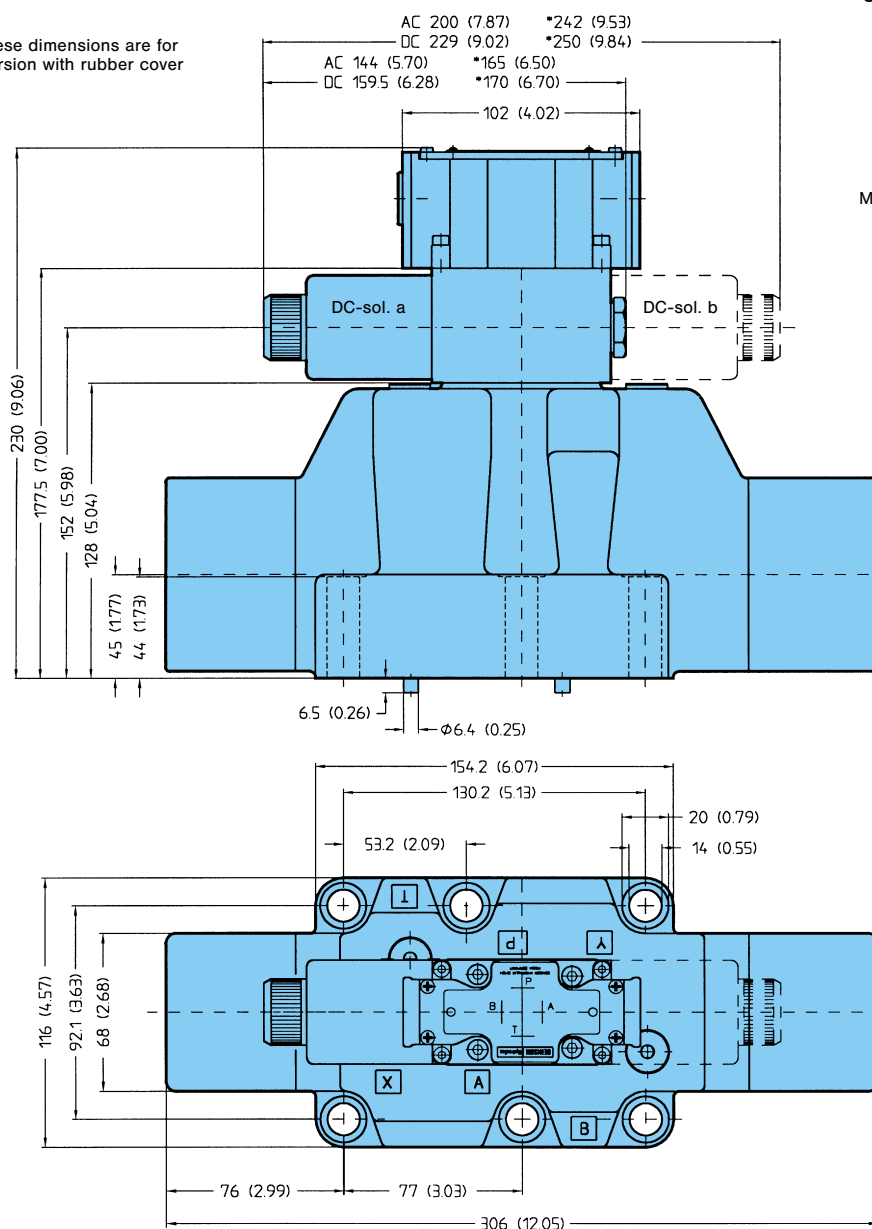
(at 400 l/min & without pilot orifice)

- energized
  - at 50 bar ( 725 psi)
  - at 150 bar (2175 psi)
  - at 250 bar (3625 psi)
- de-energized
  - at 50 bar ( 725 psi)
  - at 150 bar (2175 psi)
  - at 250 bar (3625 psi)

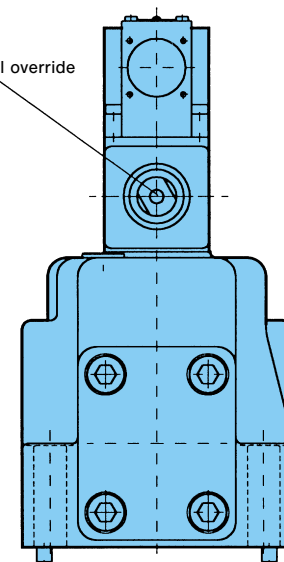
- Max. coil temperature
- Temperature class
- Relative operating period
- Type of protection
- Weight 1 solenoid version
- 2 solenoid version

DC	AC
See ordering code on page 4	See ordering code on page 4
31 W	31 W
... 210 bar (3000 psi)	... 140 bar (2000 psi)
... 350 bar (5000 psi)	... 350 bar (5000 psi)
... 210 bar (3000 psi)	... 140 bar (2000 psi)
–	78 VA
–	264 VA
+ 5 % ... – 10 %	+ 5 % ... – 10 %
50 ... 55 ms	35 ... 40 ms
50 ... 55 ms	30 ... 35 ms
55 ... 65 ms	28 ... 30 ms
40 ... 60 ms	40 ... 55 ms
32 ... 55 ms	30 ... 50 ms
27 ... 55 ms	28 ... 50 ms
+ 180 °C (350 ° F)	+ 180 °C (350 ° F)
H	H
100 %	100 %
IP 65	IP 65
17.4 kg (38.4 lbs)	17.1 kg (37.7 lbs)
17.8 kg (39.2 lbs)	17.5 kg (38.6 lbs)

\* these dimensions are for version with rubber cover



Manual override



**Note:** For replacement of port seals (NBR) see page 19

## 1 SOLENOID VERSION WITH POSITION CONTROL

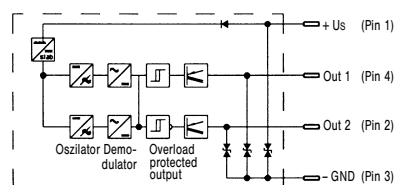
### CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

• Function	P-channel FET, contact positive
• Supply voltage $U_S$ (full wave bridge with capacitor)	$24\text{ V} \pm 20\%$ (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	$0^\circ\text{C} \dots +85^\circ\text{C}$ (32...185°F)
• Wire cross-sectional area	$4 \times 0.5\text{ mm}^2$ (0.0008 in <sup>2</sup> )
• Tensile strength of transmitting conduit	p dyn. 315 bar (4500 psi)
• Declaration of conformity no.	00 02 002 9 93

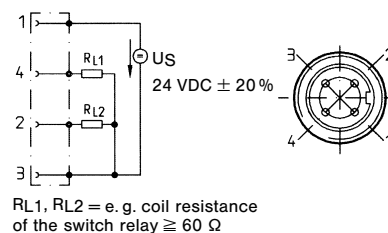
#### Attention:

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

Block diagram and connection of the inductive detector

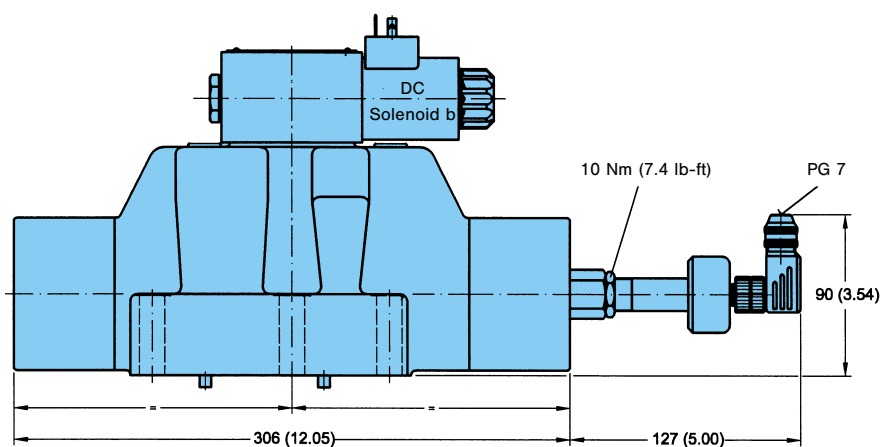


Socket connector



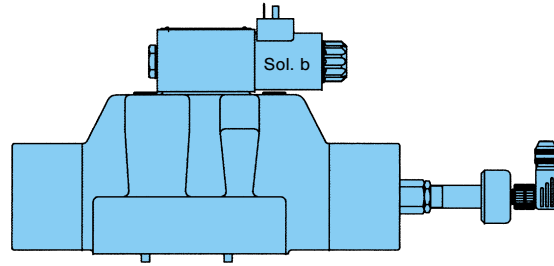
### DIMENSIONS

Example: A4D06-3A\*\*-01SA/SB  
-06SA/SB

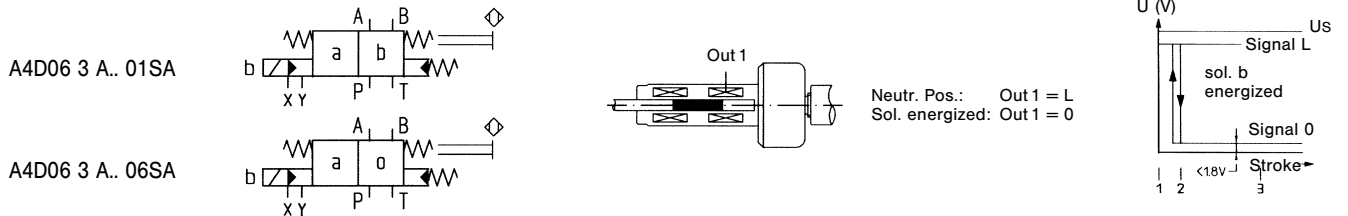


# 1 SOLENOID VERSION WITH POSITION CONTROL

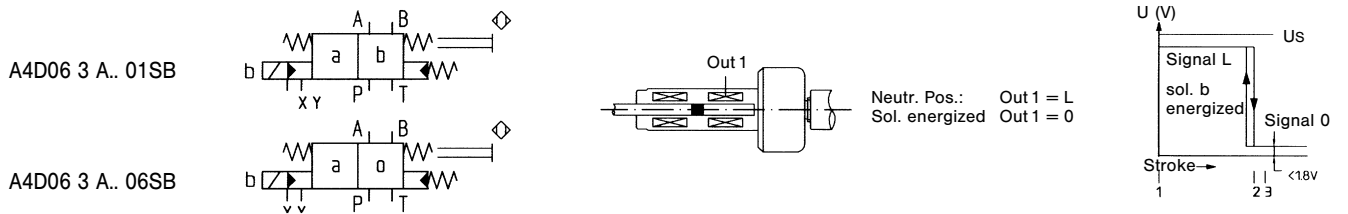
## Spool Positions 01/06



Neutral position controlled +

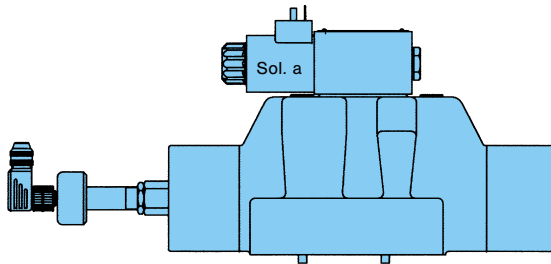


End position controlled +

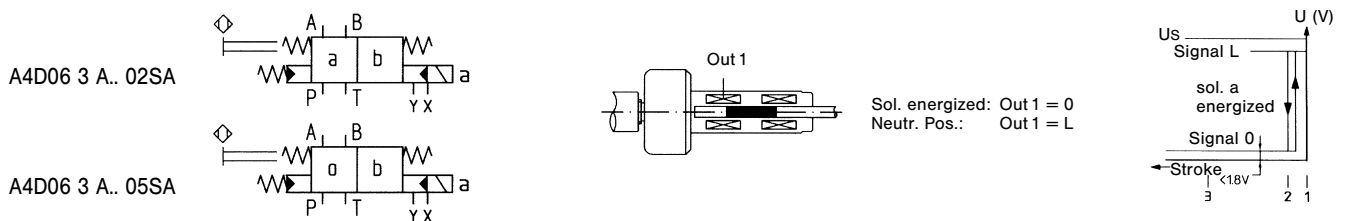


Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position

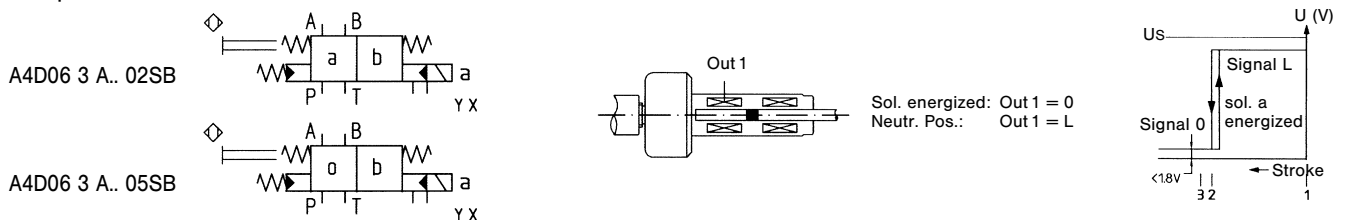
## Spool Positions 02/05



Neutral position controlled +



End position controlled +



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

## 2 SOLENOID VERSION WITH POSITION CONTROL

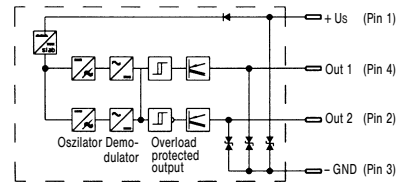
### CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

• 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	$0^\circ\text{C} \dots +85^\circ\text{C}$ (32...185°F)
• Wire cross-sectional area	$4 \times 0.5\text{ mm}^2$ (0.0008 in <sup>2</sup> )
• Tensile strength of transmitting conduit	p dyn. 315 bar (4500 psi)
• Declaration of conformity no.	00 02 002 9 93

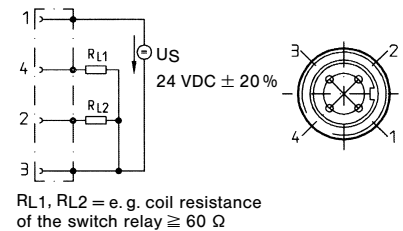
#### Attention:

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

Block diagram and connection of the inductive detector

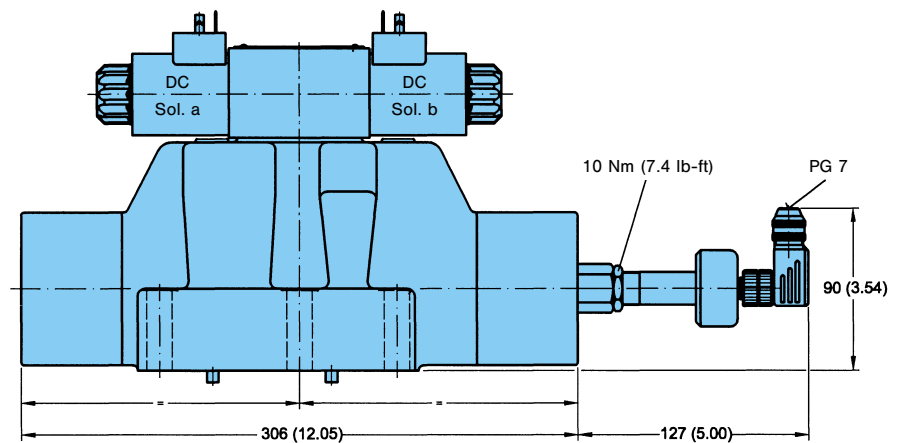


Socket connector



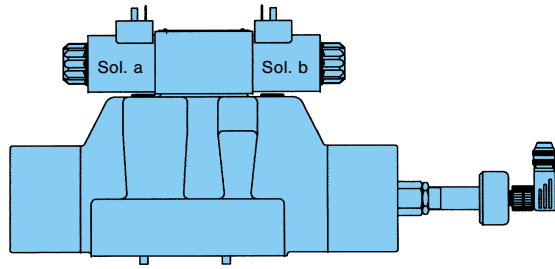
### DIMENSIONS

Example: A4D06-3B\*\*-03SA/SC

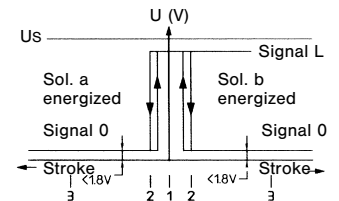
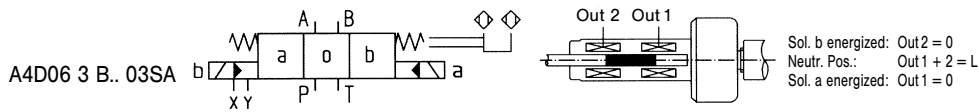


## 2 SOLENOID VERSION WITH POSITION CONTROL

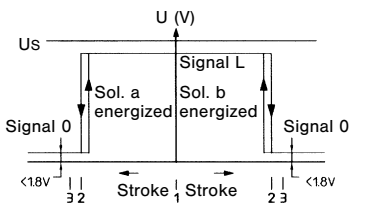
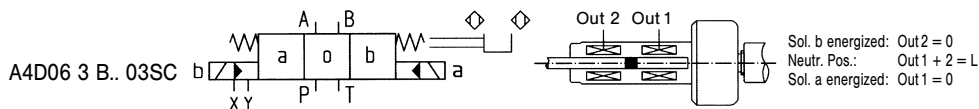
### Spool Position 03



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

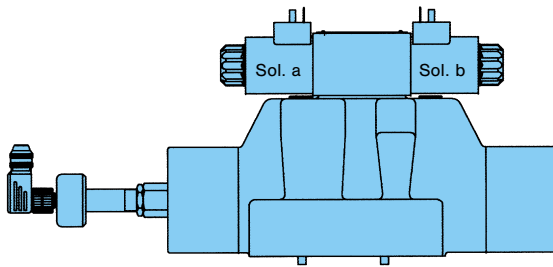


End position controlled  $\pm$  \_\_\_\_\_

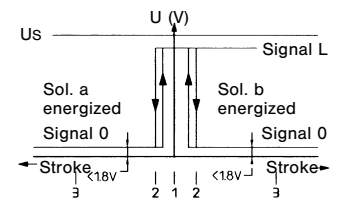
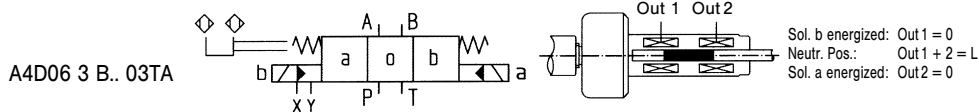


Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position

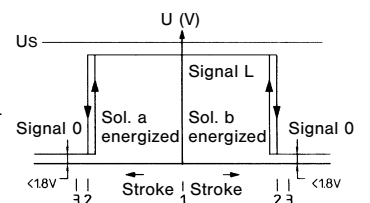
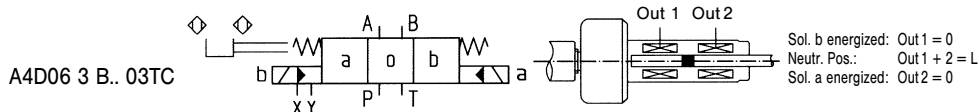
### Spool Position 03



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



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

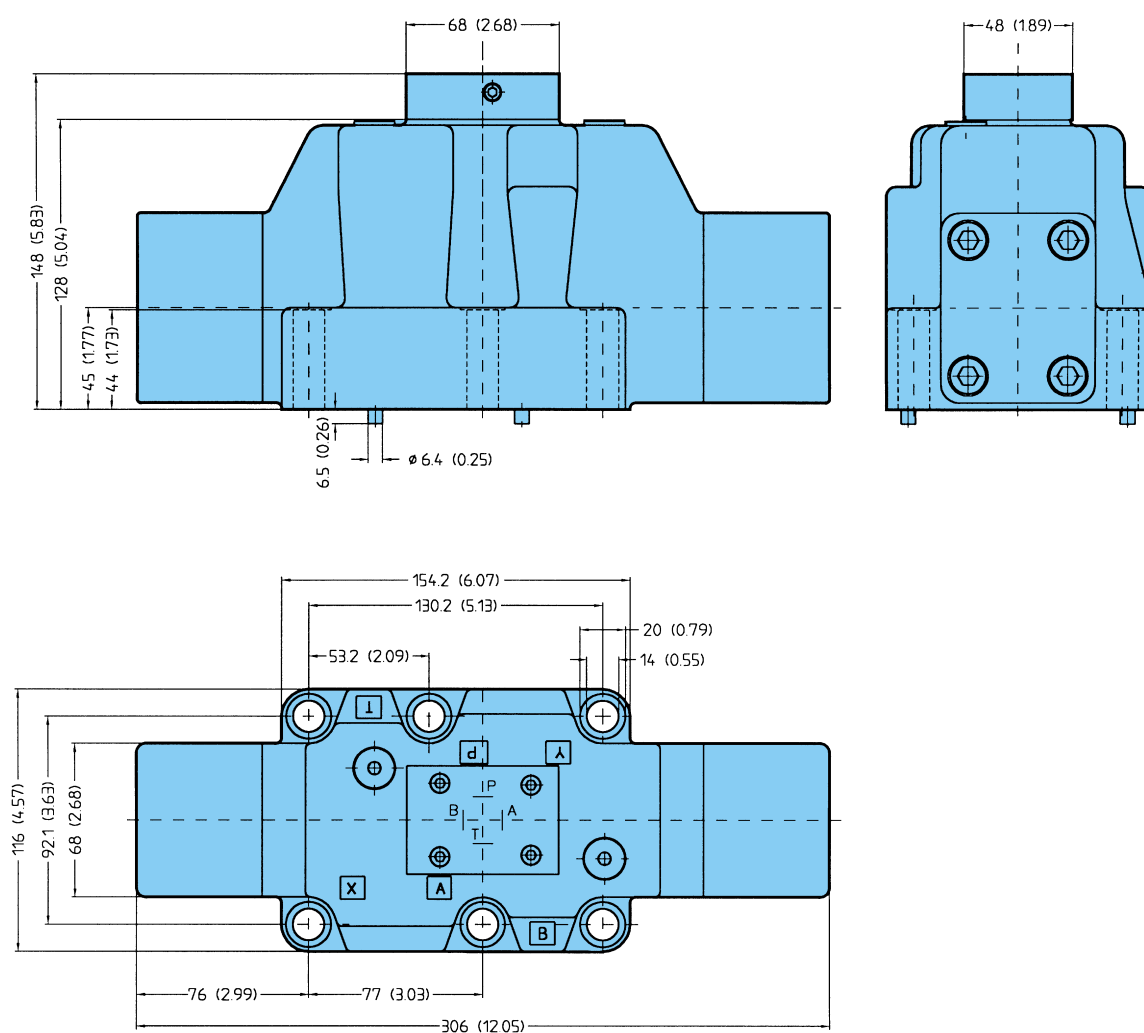


Pos. 1 = Neutral position  
Pos. 2 = Switch point  
Pos. 3 = End position



## HYDRAULIC OPERATION

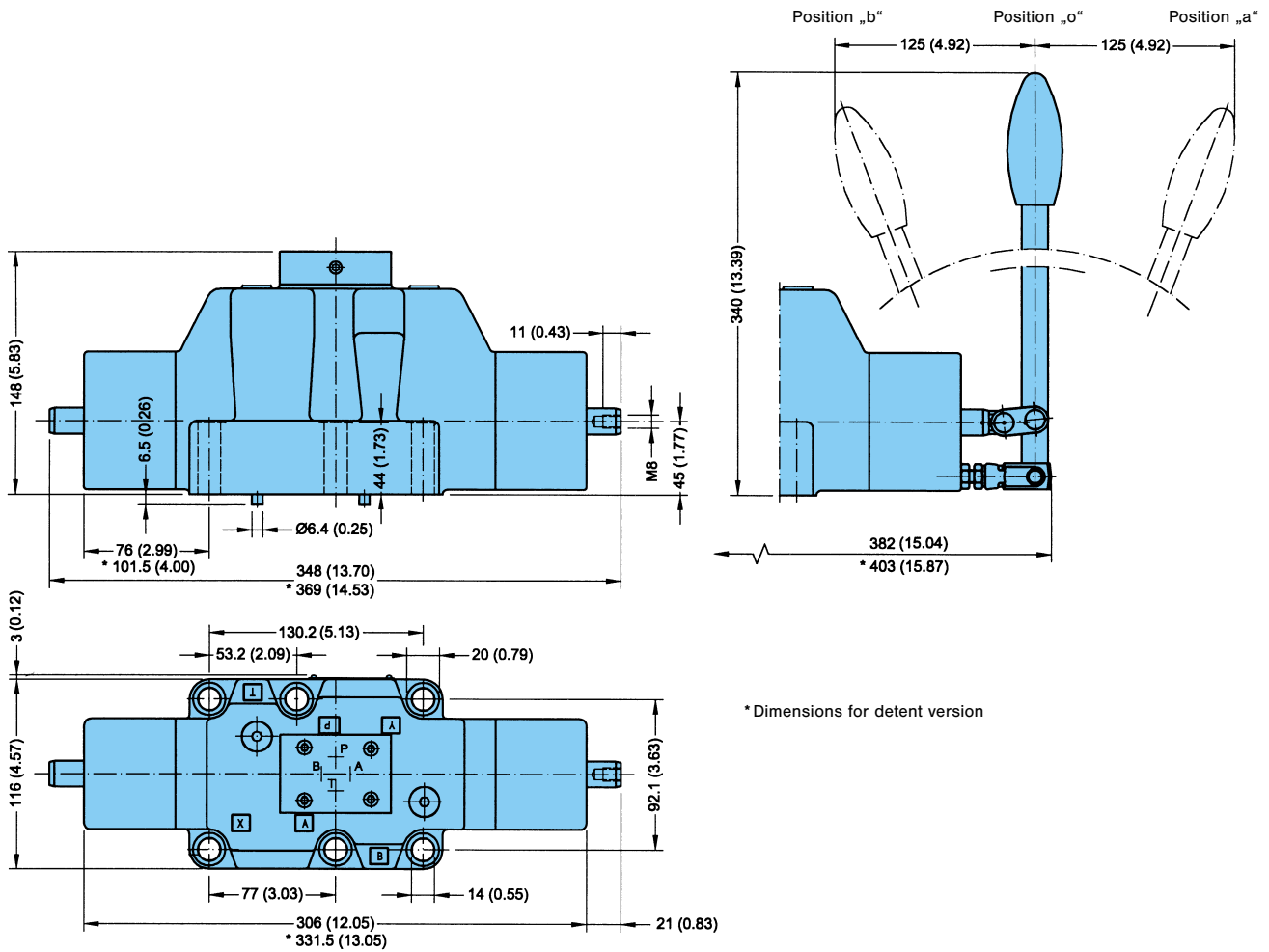
- Response time
  - pressurized e.g. 100 ms with pilot flow 6.5 l/min (1.72 gpm)
  - unpressurized e.g. 80 ms with pressureless return line
- Permissible pressure (ports T, X, Y) ... 350 bar (5000 psi)
- Weight 16.3 kg (36 lbs)



**Note:** For replacement of port seals (NBR) see page 19

## STEM AND LEVER OPERATION

• Tank pressure	max. 10 bar (143 psi)
• Operating force	
– Stem operation	600 N (135 lbs)
– Lever operation	75 N (16.9 lbs)
• Weight	
– Stem operation	16.2 kg (35.7 lbs)
– Lever operation	16.5 kg (36.4 lbs)

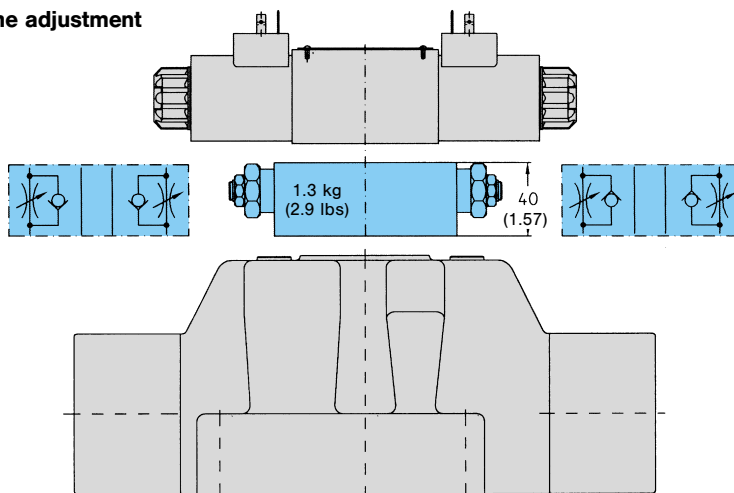


**Note:** Actuators are on principle  
at B-side for spool position 03 and 07!  
For replacement of port seals (NBR) see page 19.

## OPTIONS

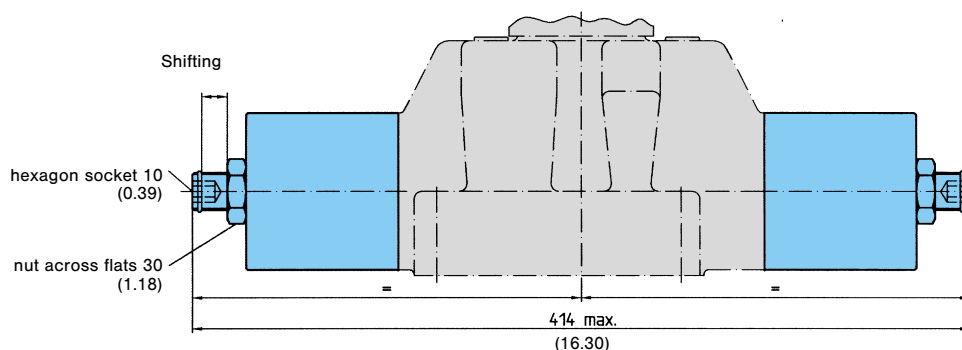
### Version with shifting time adjustment

Meter-in control in A and B  
ZRD-ABZ01-S0-D1  
098-91058-0



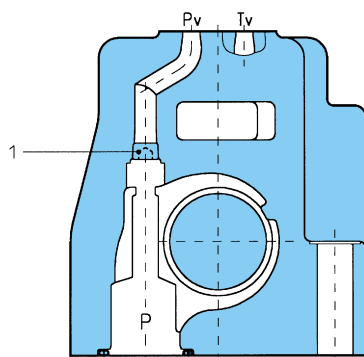
Meter-out control in A and B  
ZRD-ABA01-S0-D1  
098-91014-0

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

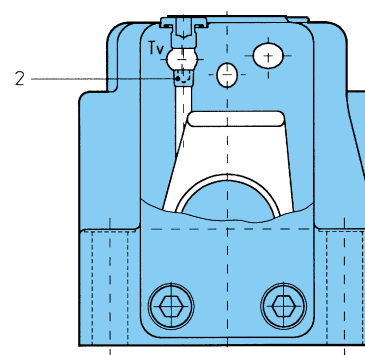


### Pilot connections

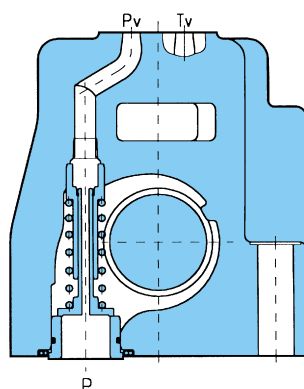
**Pilot Pressure PP**  
external: 1 closed  
internal: 1 open



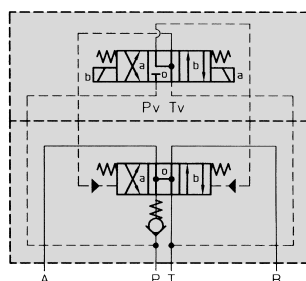
**Pilot Drain PD**  
external: 2 closed  
internal: 2 open



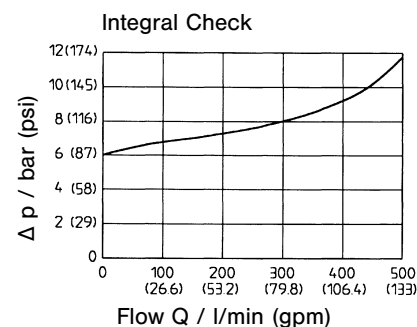
### Version with integral check



Symbol with Integral Check  
(Example)



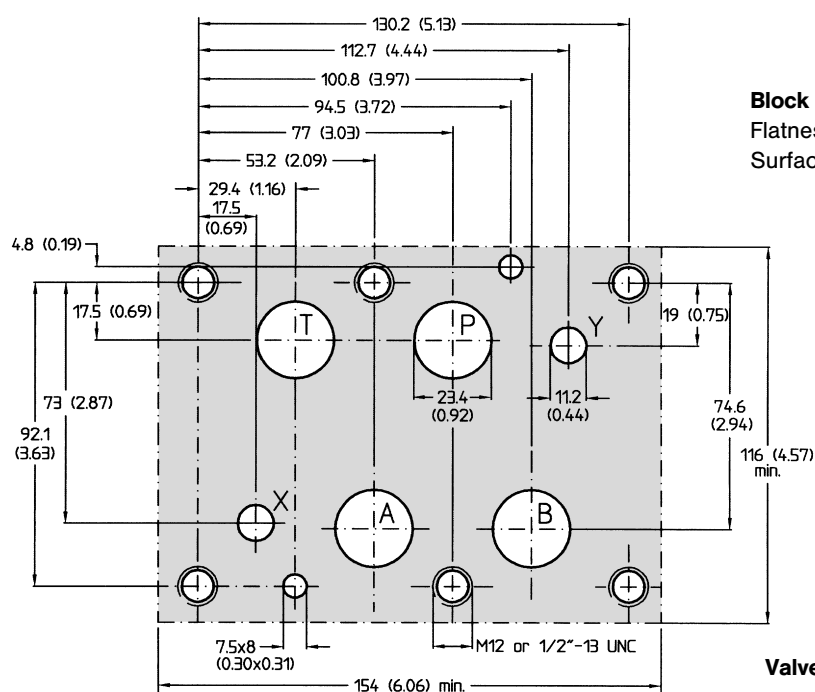
For flow lower than 450 l/min  
(119 gpm) an Integral Check  
should be applied (see Note).



**Note:** 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.

## MOUNTING CONFIGURATION, PLUG-IN CONNECTORS

Mounting configuration conform to ISO 4401



### Block mounting face

Flatness 0.01 mm/100 mm (.003/3.93 inches) length

Surface finish  $\sqrt{0.8}$

### Valve Mounting Screws

Qty.	Dimension	Order-No.
6	M 12 x 65, DIN 912; 10.9	361-12293-8
6	$\frac{1}{2}$ \"-13 UNC x 2 $\frac{1}{2}$ \" (SAE)	358-20280

Torque 103 Nm

### 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

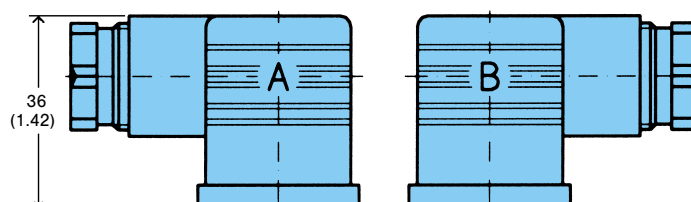
Y = Drain port for external PD: pilot operated valves

= Pilot port for hydr. operated valves

### NBR-Seals

A, B, T	28.17 x 3.53 mm	691-00216-0
P	31.34 x 3.53 mm	691-00218-0
X, Y	20.29 x 2.62 mm	691-00117-0

## PLUG-IN CONNECTORS CONFORM 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.

The product described is subject to continual development and the manufacturer reserves the right to change the specifications without notice.