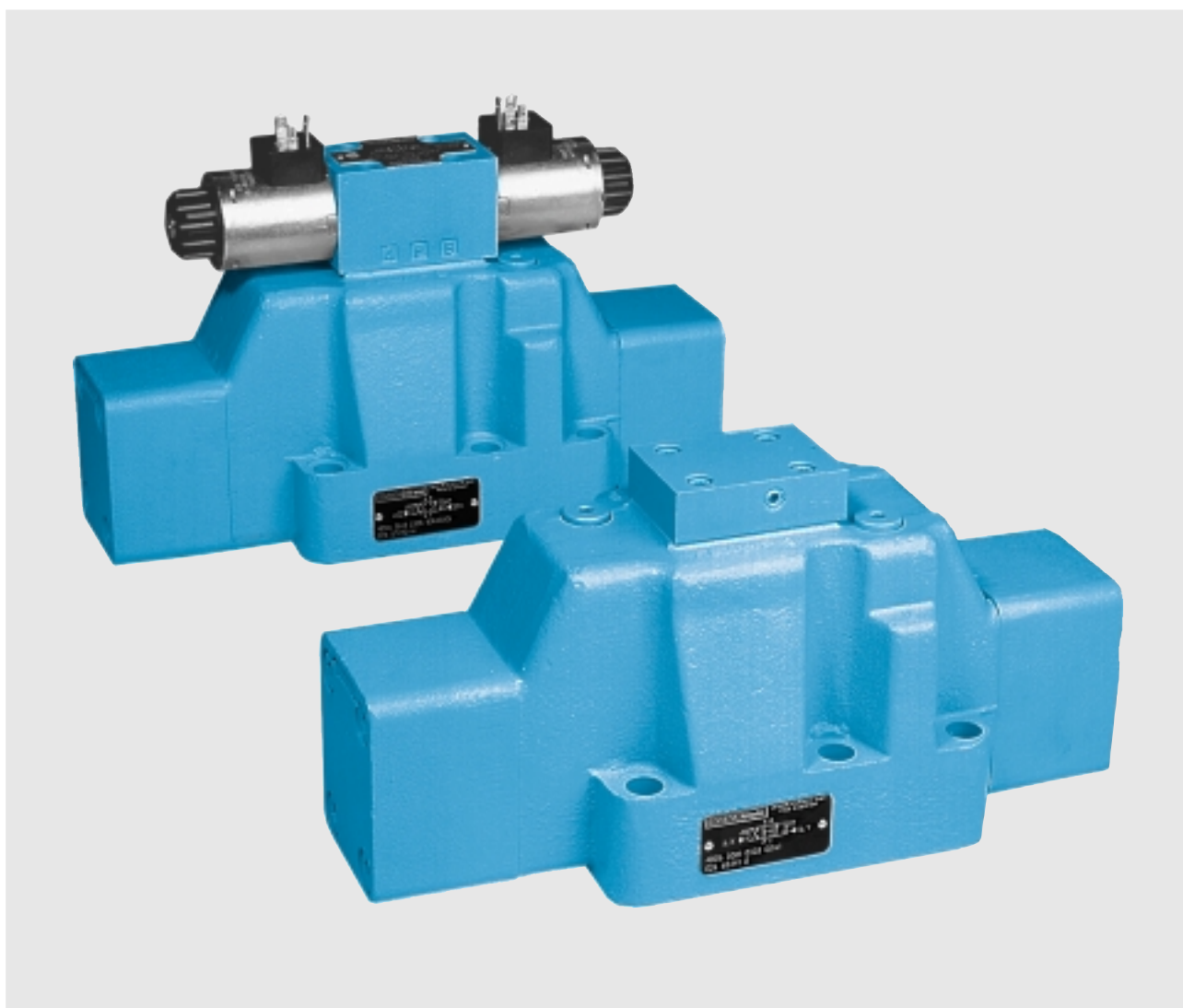


DENISON HYDRAULICS

Directional Control Valves

Series 4D06 – Cetop 08



Publ. 4-EN 3710-B, replaces 4-EN 370-B and 4-EN 371-A

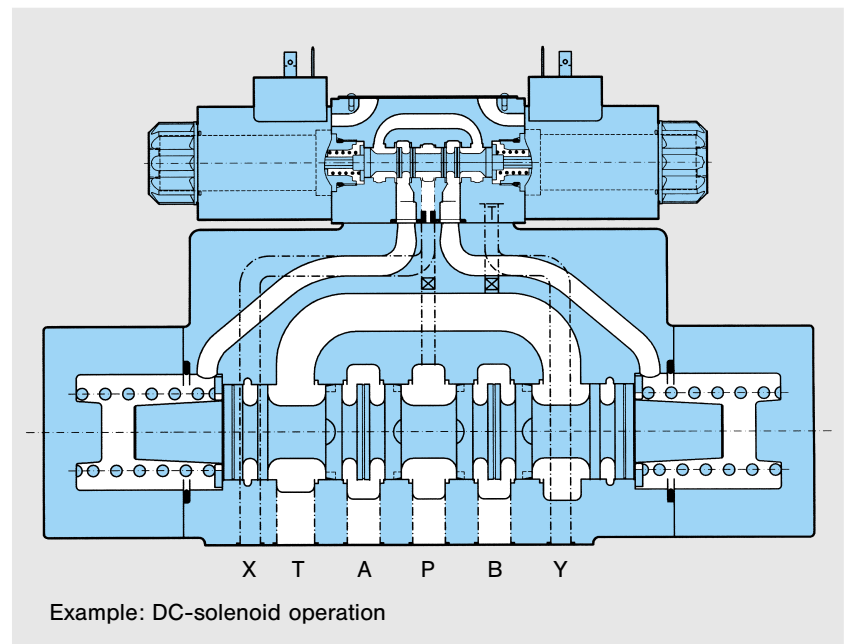
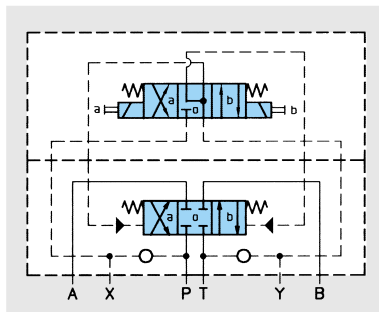
DENISON Hydraulics

FEATURES, SYMBOL, GENERAL

FEATURES

- High functional limit up to 700 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 4D06 is a pilot operated directional control valve controlled by solenoids, hydraulic pressure or mechanically. The 4D06 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

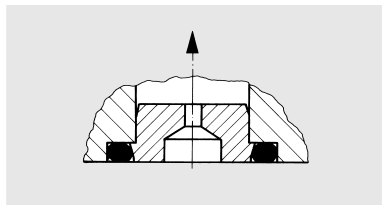
The electrically operated 4-way valve 4D06 consists of a main body and a solenoid operated pilot valve. The energized solenoid shifts the pilot control spool, thus directing fluid to one end of the main spool, and moving it to the desired position. Fluid can then flow e.g. from port P to either port 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 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 700 l/min)	
– min	9 bar for spools with open centre position 10 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	700 l/min (see diagrams)
• Max. leakage	350...900 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.:	4D06	- 3	.	..	-	..	-	.	.	A	-10
	1	2	3	4	5	6	7	8	9	10	11	12	13		
1 Series _____															
06 = Cetop 08															
2 Control _____															
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															
3 Spool Type _____															
refer to pages 6 and 7															
4 Spool Position _____															
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"															
5 End Cap _____															
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															
6 Pilot Connection _____															
0 = External PP, external PD (for hydraulic operation)															
1 = Internal PP, internal PD ¹⁾															
2 = Internal PP, external PD ¹⁾															
3 = External PP, internal PD															
4 = External PP, external PD															
7 Main Valve Accessories _____															
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" ¹⁾															
8 = Shifting time adjustment (meter-out control) & integral check in "P" ¹⁾															
4 = Integral check in "P" ¹⁾															
8 Design Letter _____															
9 Seal Class _____															
1 = NBR-seals (Standard)															
4 = EPDM-seals															
5 = FPM-seals (Viton®)															
10 Solenoid Voltage _____															
W01 = 115 V / 60 Hz G0R = 12 V															
W02 = 230 V / 60 Hz G0Q = 24 V															
W06 = 115 V / 50 Hz G0D = 27 V															
W07 = 230 V / 50 Hz															
Order informationen for plug-in connectors see page 19															
1* Pilot Accessories / Modifications _____															
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:

¹⁾ 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.

²⁾ For standard applications orifice in P-port always recommended.

ORDERING CODE – LEVER AND STEM OPERATION

Model No.:

4D06 - 3

.

..

-

..

-

.

0 A

.

-

..

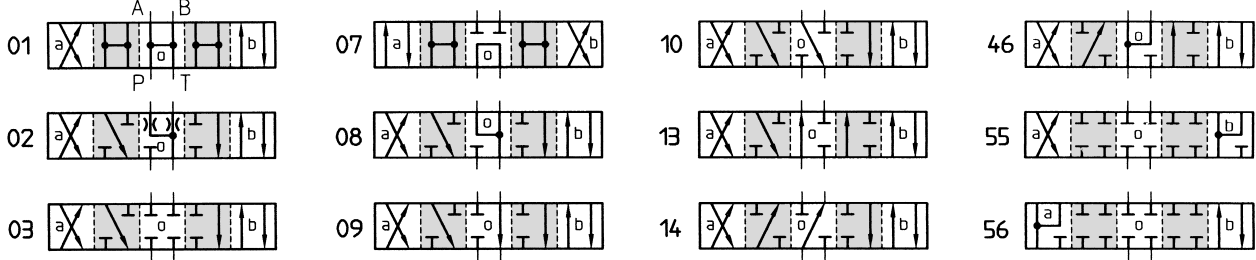
..

..

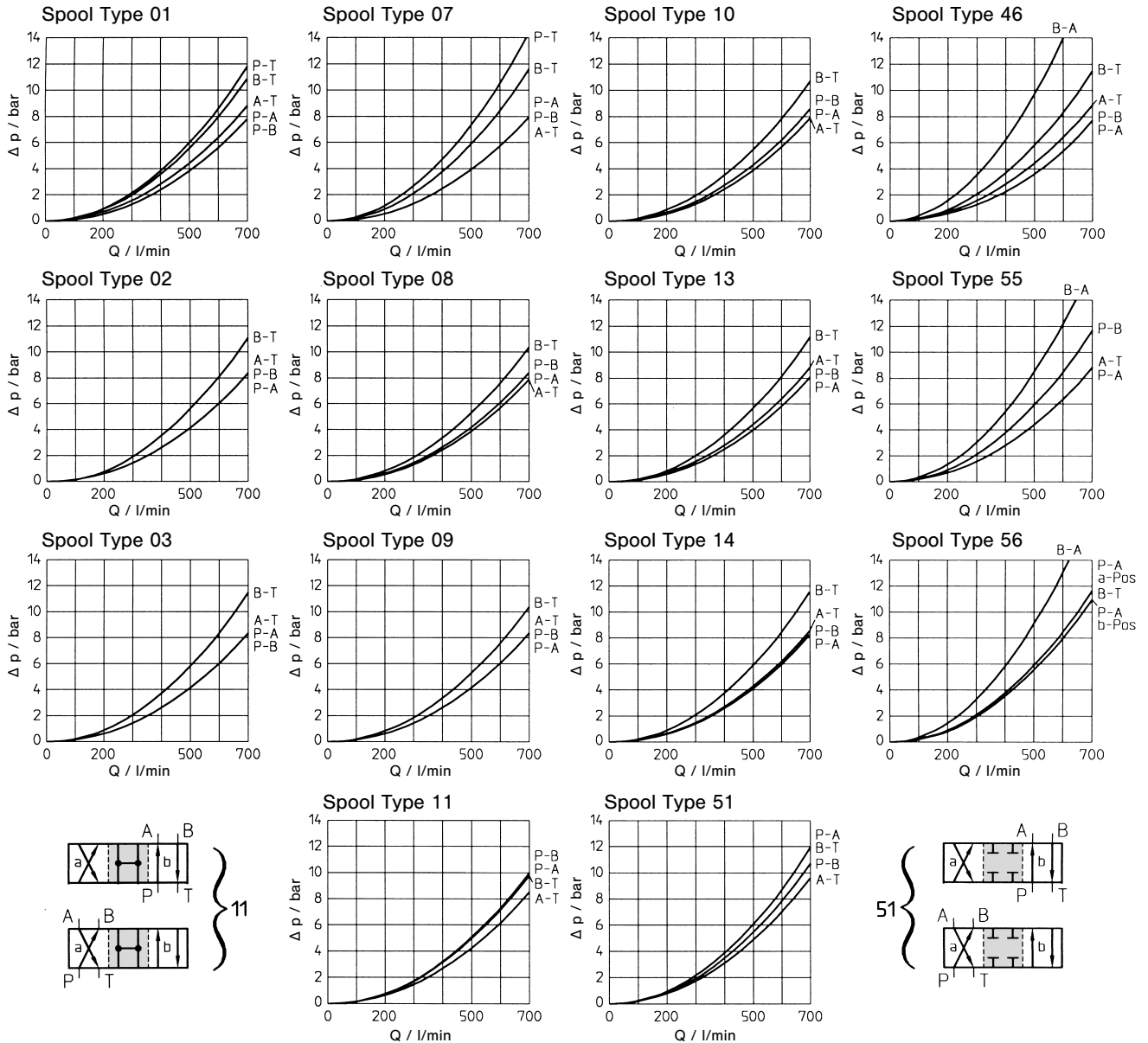
		1	2	3	4	5	6	7	8	9	10	11
1	Series _____ 06 = Cetop 08											
2	Control _____ 3 = Stem operation 4 = Lever operation											
3	Spool Type _____ refer to pages 6 and 7											
4	Spool Position _____ 01 = 2 (a, b), Spring offset to pos. "b", activated to pos. "a" 02 = 2 (a, b), Spring offset to 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
02, 03, 08, 09, 10 13, 14, 46, 55, 56	700	700	700	700	700
01	700	700	700	680	600
07	700	670	590	510	430
11	700	700	700/630*	700/515*	700/400*
51	700	700/620*	700/480*	700/340*	700/200*

* 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

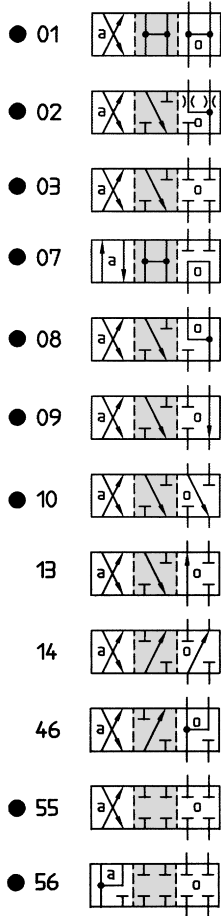
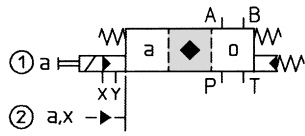
- ① 1-Solenoid operation (sol. B-side)
- ② hydraulic operation
- ③ Stem operation
- ④ Lever operation

- 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

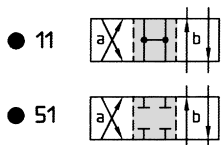
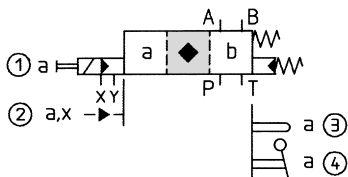
Spool Position 06

Spring Centring



Spool Position 01

Spring Offset

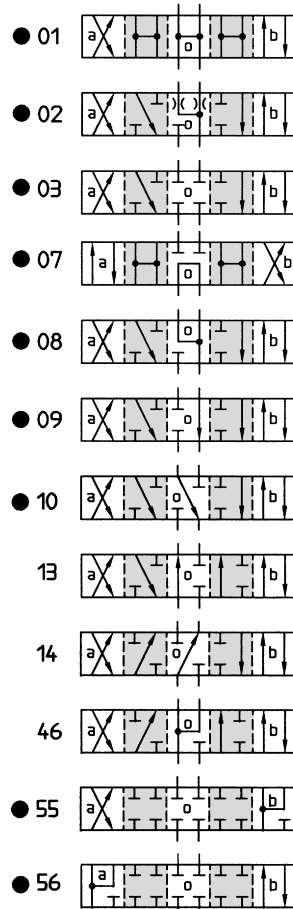
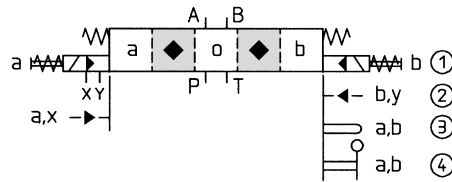


● Standard Spool

Transfer configuration only (not switched position)

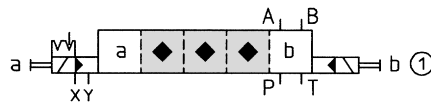
Spool Position 03

Spring Centring



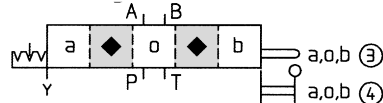
Spool Position 04

Pilot Valve with Detents



Spool Position 07

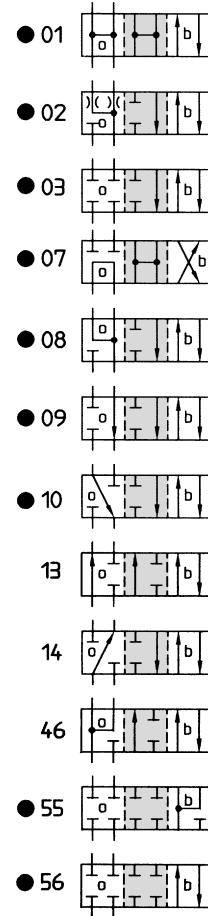
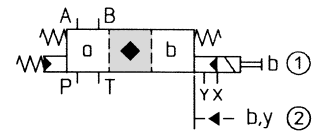
3 pos. detents



All spool types
as shown above!

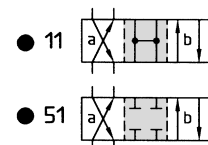
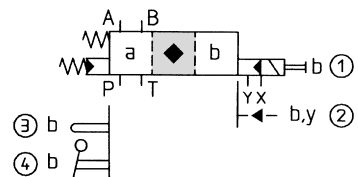
Spool Position 05

Spring Centring



Spool Position 02

Spring Offset

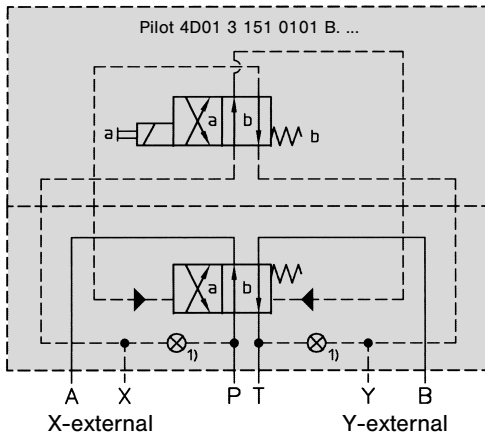


DETAILED SYMBOLS – SOLENOID OPERATION

4D06 3 A51 0103 40A. ...

Spool Position 01

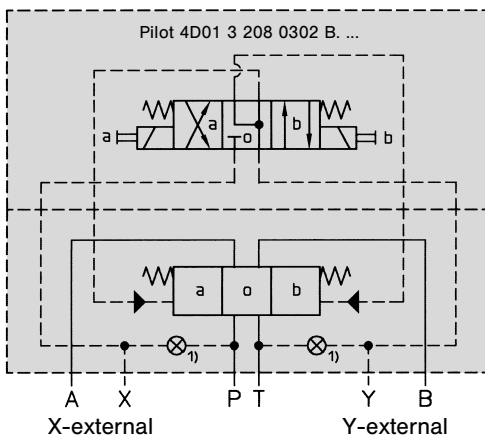
2 (a, b), Spring Offset



4D06 3 B.. 0303 40A. ...

Spool Position 03

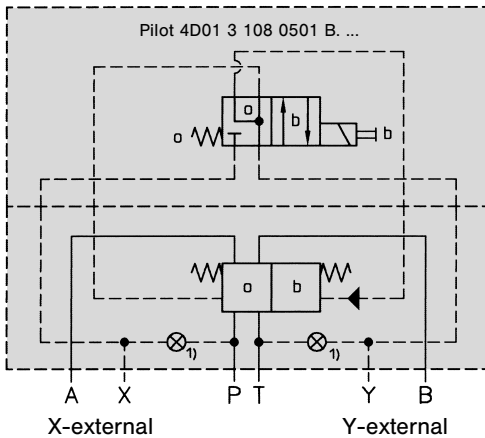
3 (a, o, b), Spring Centring



4D06 3 A.. 0503 40A. ...

Spool Position 05

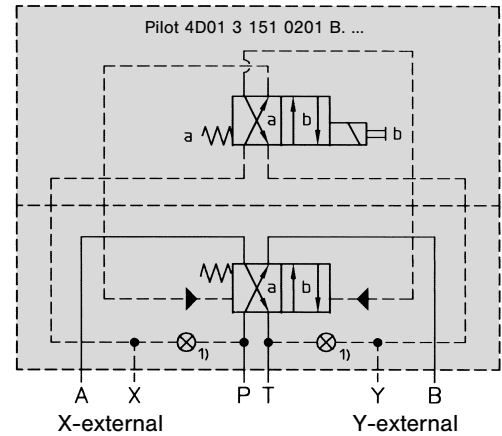
2 (o, b), Spring Centring



4D06 3 A51 0203 40A. ...

Spool Position 02

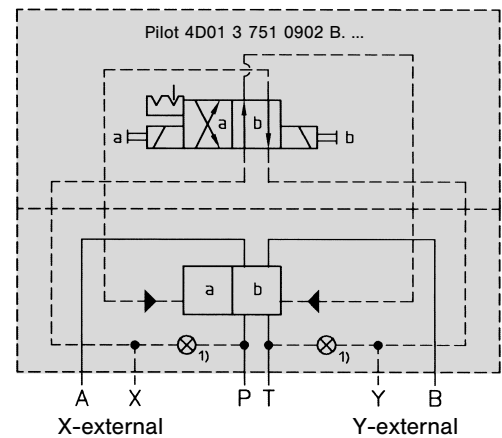
2 (a, b), Spring Offset



4D06 3 C.. 0403 40A. ...

Spool Position 04

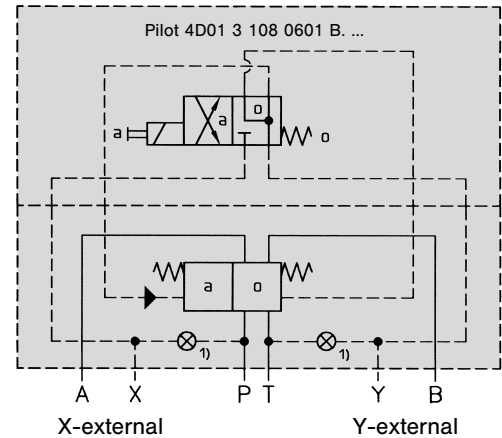
2 (a, b), Pilot Valve with detents



4D06 3 A.. 0603 40A. ...

Spool Position 06

2 (o, a), Spring Centring



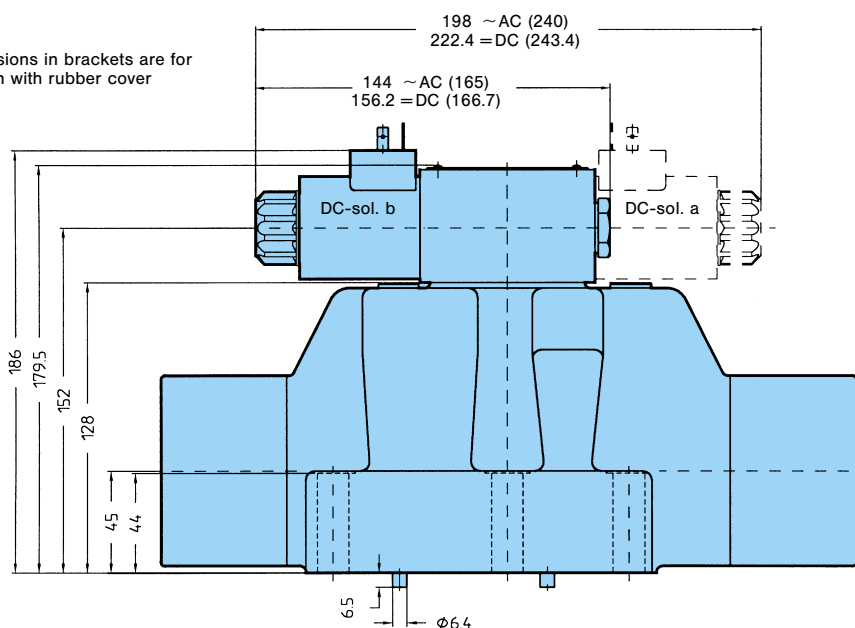
¹⁾ Plug mounted according to desired internal or external PP or PD.

1 AND 2 SOLENOID OPERATED VERSIONS

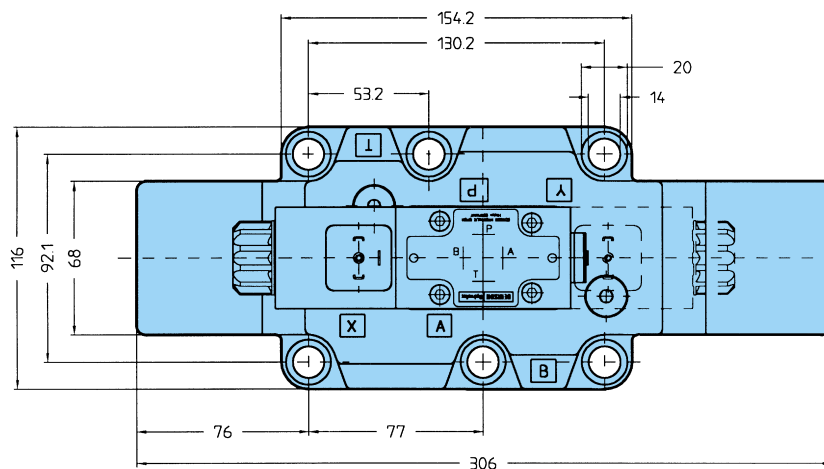
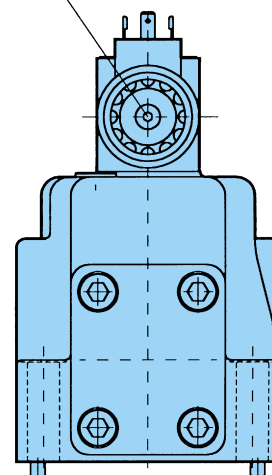
- Nominal voltage
- Power input
- Permissible tank pressure (T)
 - with internal drain
 - with external drain
- Permissible drain pressure (Y)
- Holding
- Inrush
- Permissible voltage difference
- Response times
 - (at 400 l/min & without pilot orifice)
 - energized
 - at 50 bar
 - at 150 bar
 - at 250 bar
 - de-energized
 - at 50 bar
 - at 150 bar
 - at 250 bar
- 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	
31 W	31 W
...210 bar	...140 bar
...350 bar	...350 bar
...210 bar	...140 bar
–	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	+ 180 °C
H	H
100 %	100 %
IP 65	IP 65
17.2 kg	16.9 kg
17.6 kg	17.3 kg

() dimensions in brackets are for version with rubber cover



Manual override



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

1 SOLENOID VERSION WITH POSITION CONTROL

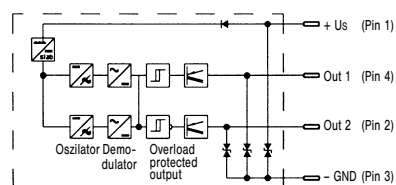
CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

• Function	P-channel FET, contact positive
• Supply voltage U_S (full wave bridge with capacitor)	$24\text{ V} \pm 20\%$ (19.2 V...28.8 V)
• Reverse polarity protection	max. 300 V installed
• Ripple voltage	10 %
• Current consumption	approx. 40 mA
• Outputs	NC contact positive (no short circuit protection)
• Output voltage	$U_S - 2.5\text{ V}$
– Signal L	$< 1.8\text{ V}$
– Signal 0	$< 400\text{ mA}$ at $U_S + 20\%$
• Output current	IP 65
• Environmental protection	$0^\circ\text{C} \dots + 85^\circ\text{C}$
• Operating temperature range	$4 \times 0.5\text{ mm}^2$
• Wire cross-sectional area	p dyn. 315 bar
• Tensile strength of transmitting conduit	00 02 002 9 93
• CE Declaration of conformity no.	

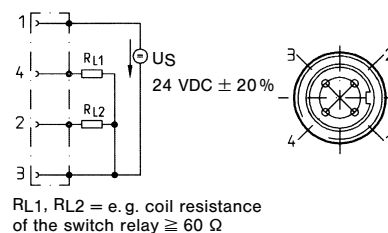
Attention:

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

Block diagram and connection of the inductive detector

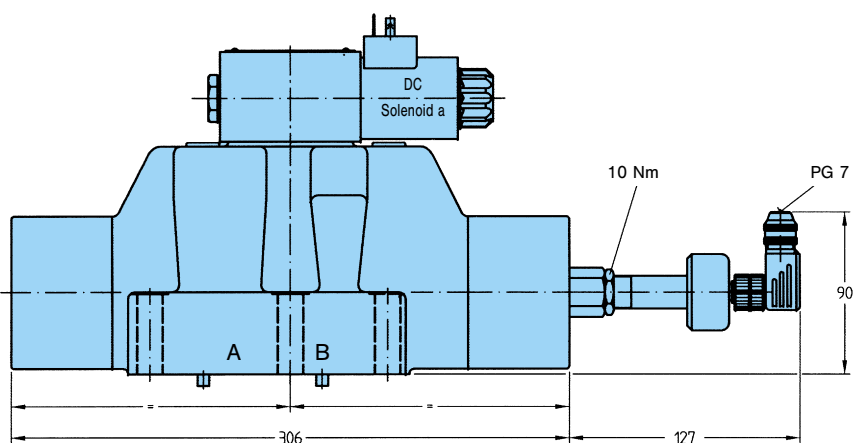


Socket connector



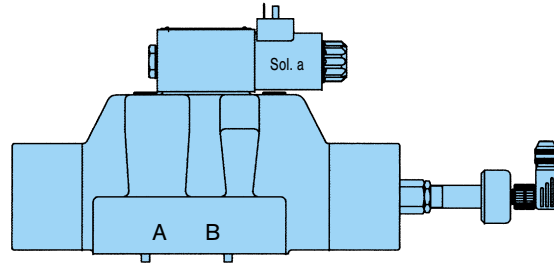
DIMENSIONS

Example: 4D06-3A**-01SA/SB
-06SA/SB

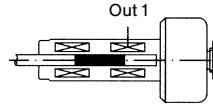
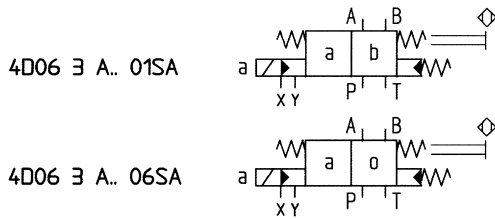


1 SOLENOID VERSION WITH POSITION CONTROL

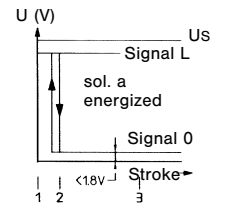
Spool Positions 01/06



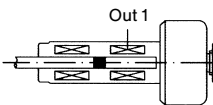
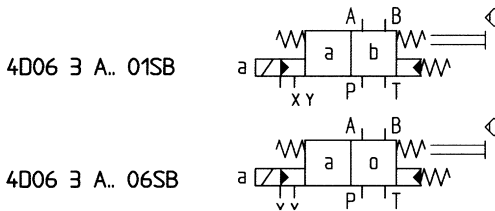
Neutral position controlled +



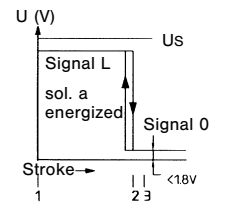
Neutr. Pos.: Out 1 = L
Sol. energized: Out 1 = 0



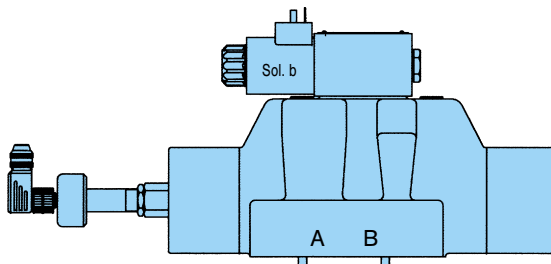
End position controlled +



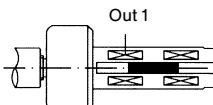
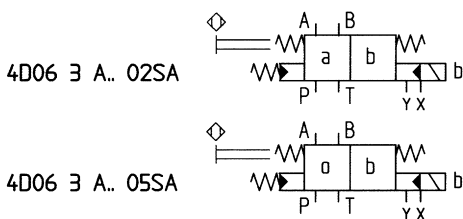
Neutr. Pos.: Out 1 = L
Sol. energized: Out 1 = 0



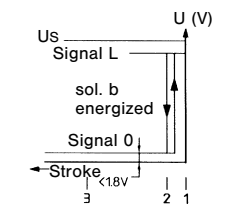
Spool Positions 02/05



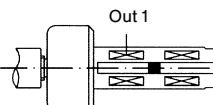
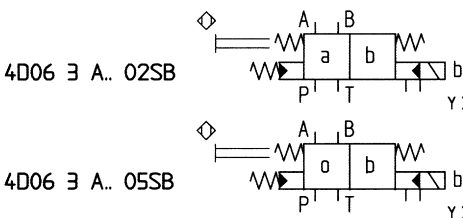
Neutral position controlled +



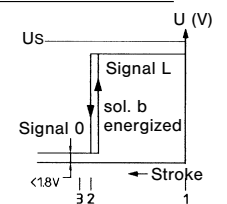
Sol. energized: Out 1 = 0
Neutr. Pos.: Out 1 = L



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

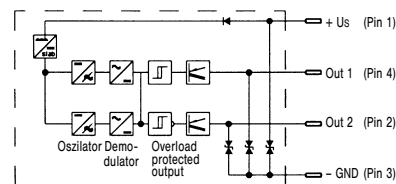
CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

• Function	P-channel FET, contact positive
• Supply voltage U_S (full wave bridge with capacitor)	24 V \pm 20 % (19.2 V ... 28.8 V)
• Reverse polarity protection	max. 300 V installed
• Ripple voltage	10 %
• Current consumption	approx. 40 mA
• Outputs	NC contact positive (no short circuit protection)
• 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 ²
• Tensile strength of transmitting conduit	p dyn. 315 bar
• CE Declaration of conformity no.	00 02 002 9 93

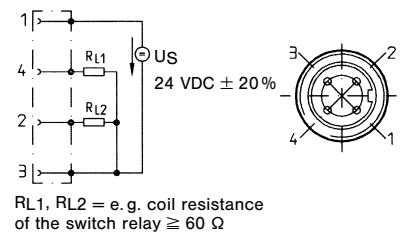
Attention:

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

Block diagram and connection of the inductive detector

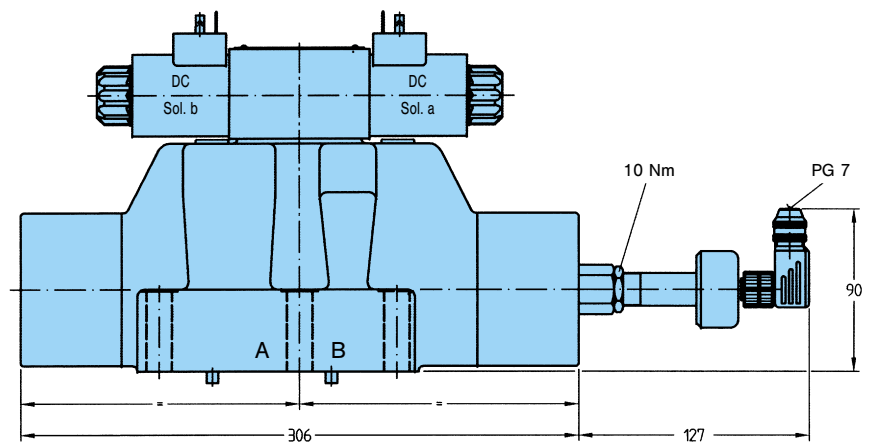


Socket connector



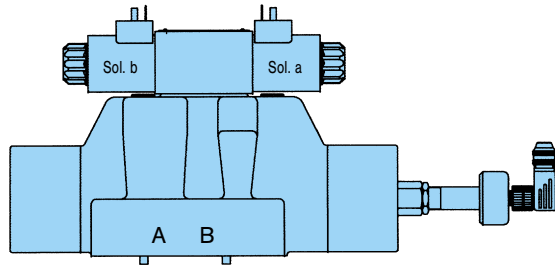
DIMENSIONS

Example: 4D06-3B**-03SA/SC

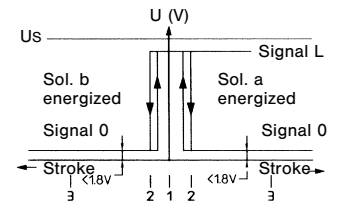
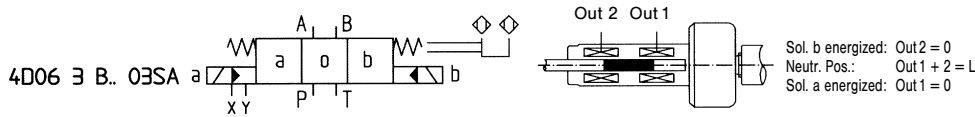


2 SOLENOID VERSION WITH POSITION CONTROL

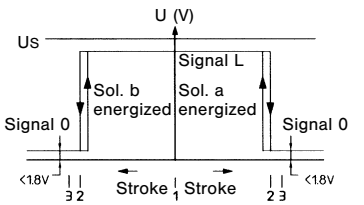
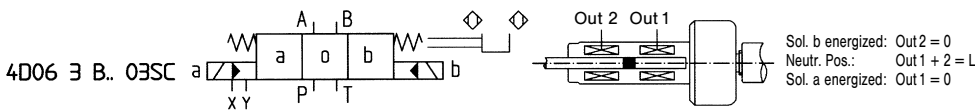
Spool Position 03



Neutral position controlled \pm _____

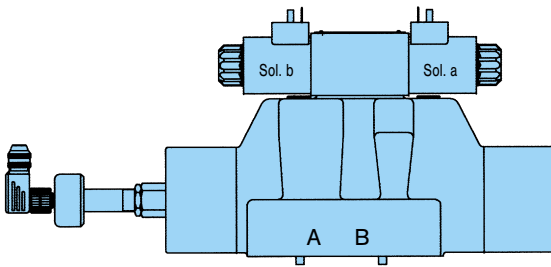


End position controlled \pm _____

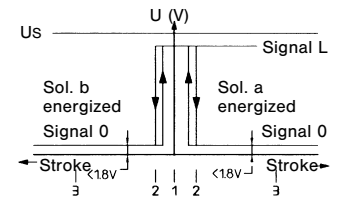
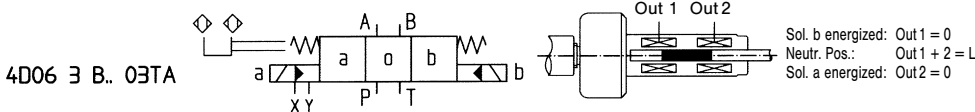


Pos. 1 = Neutral position
Pos. 2 = Switch point
Pos. 3 = End position

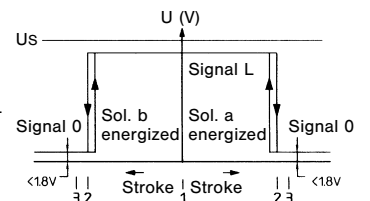
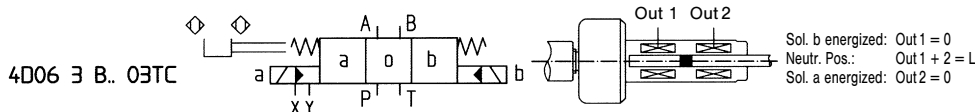
Spool Position 03



Neutral position controlled \pm _____



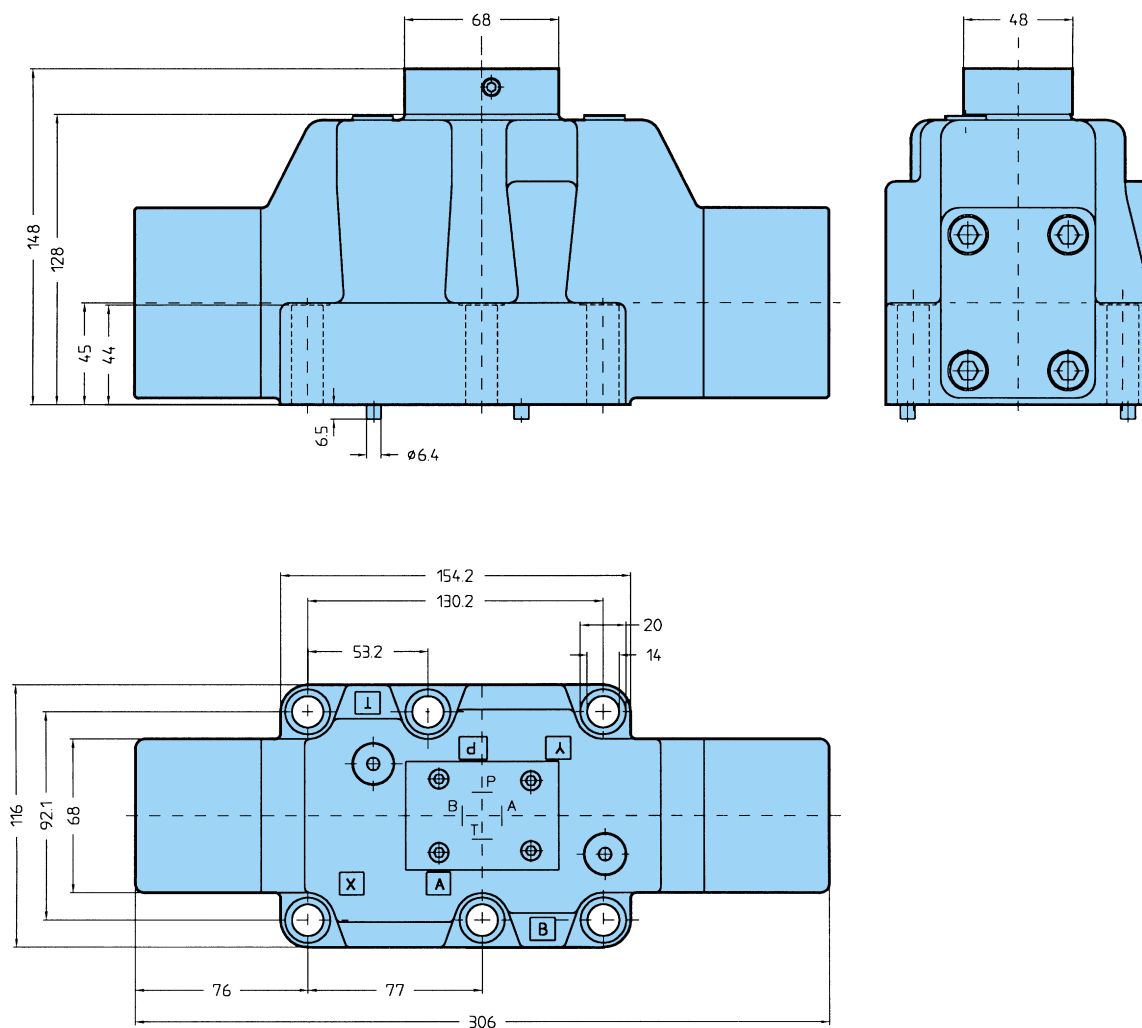
End position controlled \pm _____



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

HYDRAULIC OPERATION

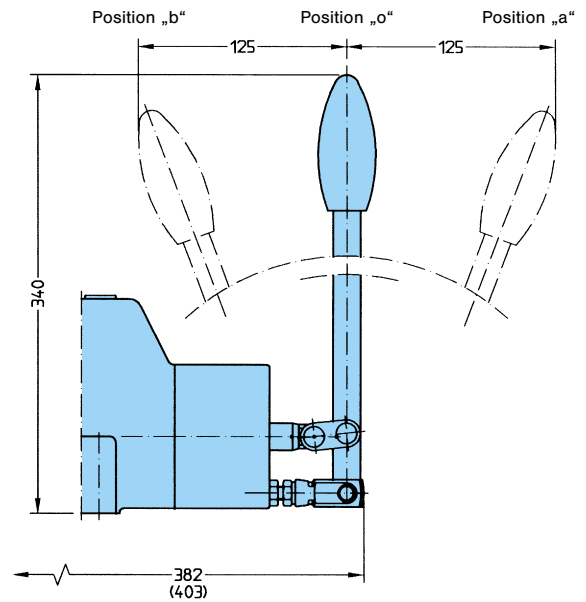
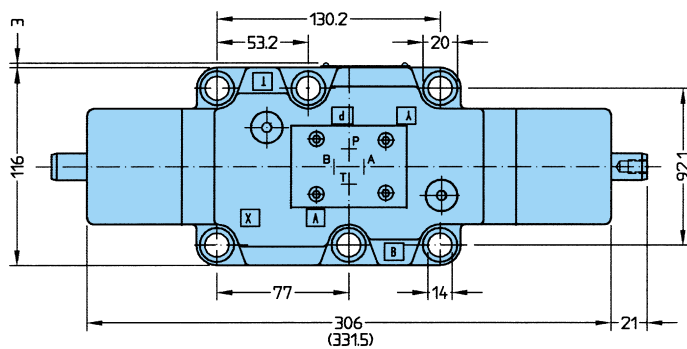
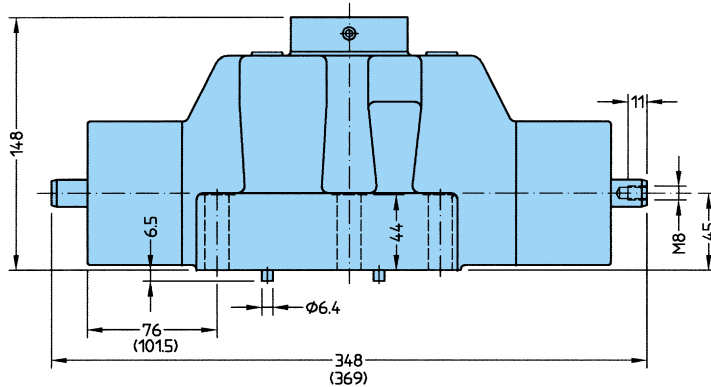
- Response time
 - pressurized e.g. 100 ms with pilot flow 6.5 l/min
 - unpressurized e.g. 80 ms with pressureless return line
- Permissible pressure (ports T, X, Y) ... 350 bar
- Weight 16.3 kg



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

STEM AND LEVER OPERATION

- | | |
|-------------------|-------------|
| • Tank pressure | max. 10 bar |
| • Operating force | |
| – Stem operation | 600 N |
| – Lever operation | 75 N |
| • Weight | |
| – Stem operation | 16.2 kg |
| – Lever operation | 16.5 kg |



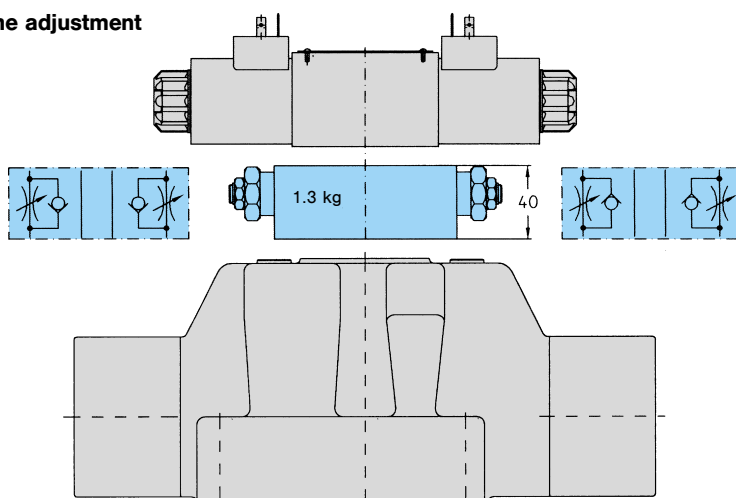
() Dimensions for detent version

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

OPTIONS

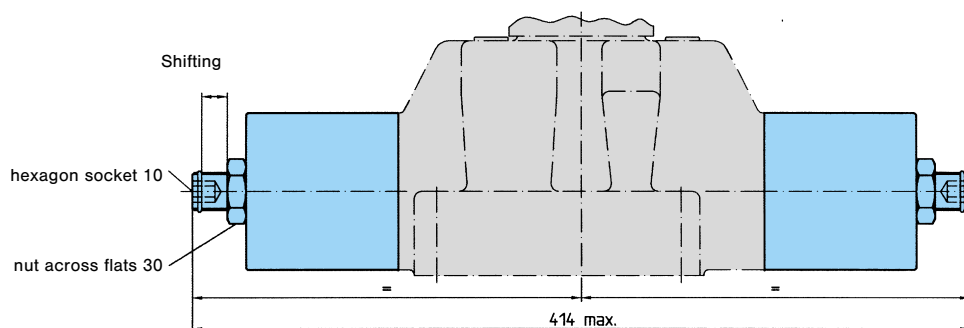
Version with shifting time adjustment

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



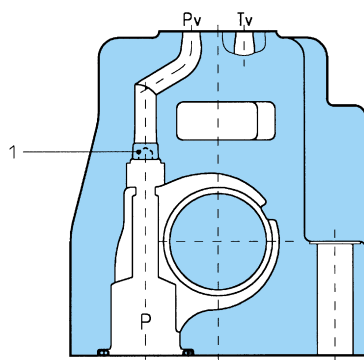
Meter-out control in A and B
ZRD-ABA01-S0-D1
098-91014-0

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

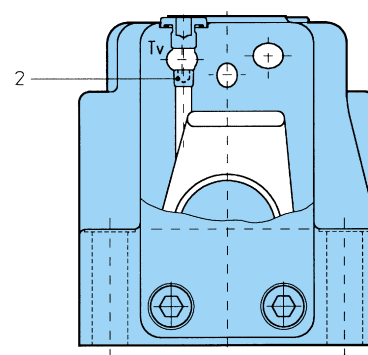


Pilot connections

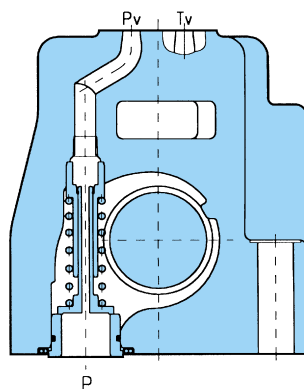
Pilot Pressure PP
external: 1 closed
internal: 1 open



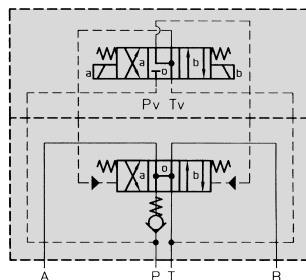
Pilot Drain PD
external: 2 closed
internal: 2 open



Version with integral check

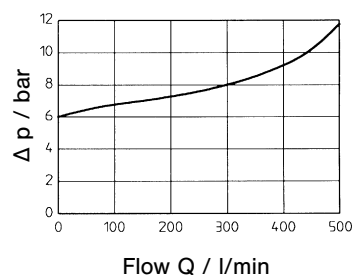


Symbol with Integral Check
(Example)



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

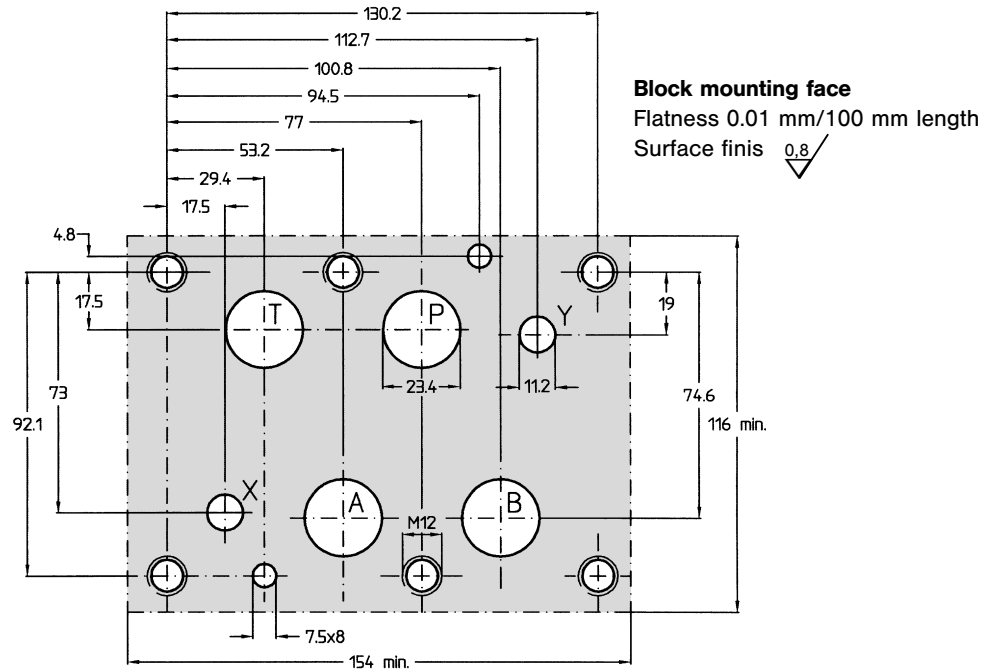
Integral Check



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

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
and mechanical operation
= Pilot port for hydr. operated valves

NBR-Seals

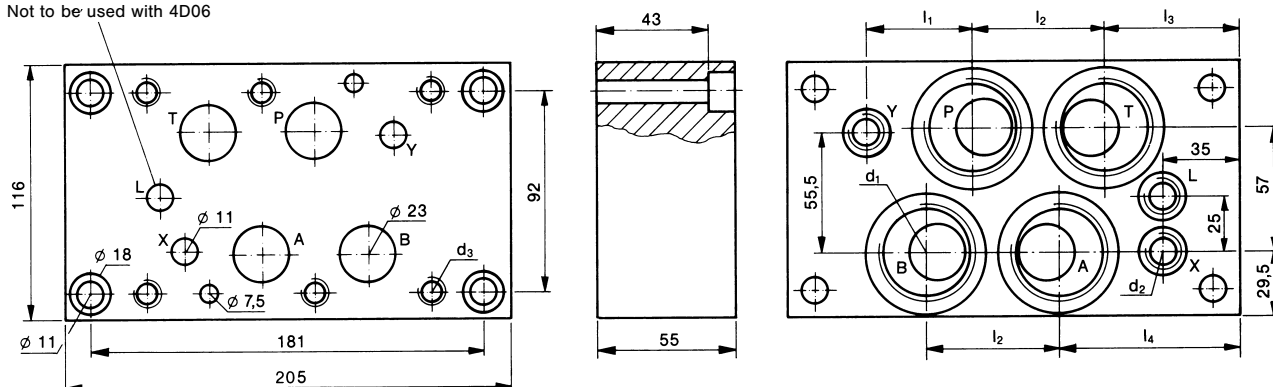
A, B, T	28.17 x 3.53	691-00216-0
P	31.34 x 3.53	691-00218-0
X, Y	20.29 x 2.62	691-00117-0

SUBPLATES, PANEL OPENING

Subplate (mounting configuration conform to ISO 4401)

Weight: ≈ 8 kg

Not to be used with 4D06



Please note:

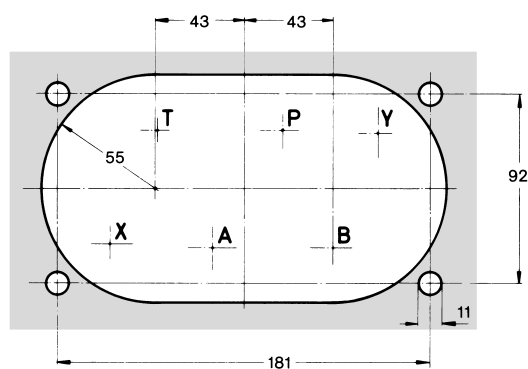
Mounting screws are included in subplate order.
For valves ordered without subplate, mounting screws must be ordered separately.

Qty.	Mounting screws	Order-No.
6	M 12 x 65, DIN 912; 10.9	361-12293-8

Torque 103 Nm

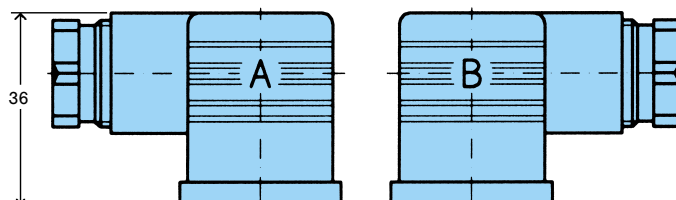
Model-No.	Order-No.	d ₁ (A, B, P, T)	d ₂ (X, Y, L)	d ₃	l ₁	l ₂	l ₃	l ₄
SS-B-12-G 130-L	S26-34487-0	G 3/4"	G 1/4"	M 12	55	49	66	90
SS-B-16-G-130-L	S26-34488-0	G 1"	G 1/4"	M 12	48.5	59.5	62	82

Panel opening



ACCESSORIES

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.