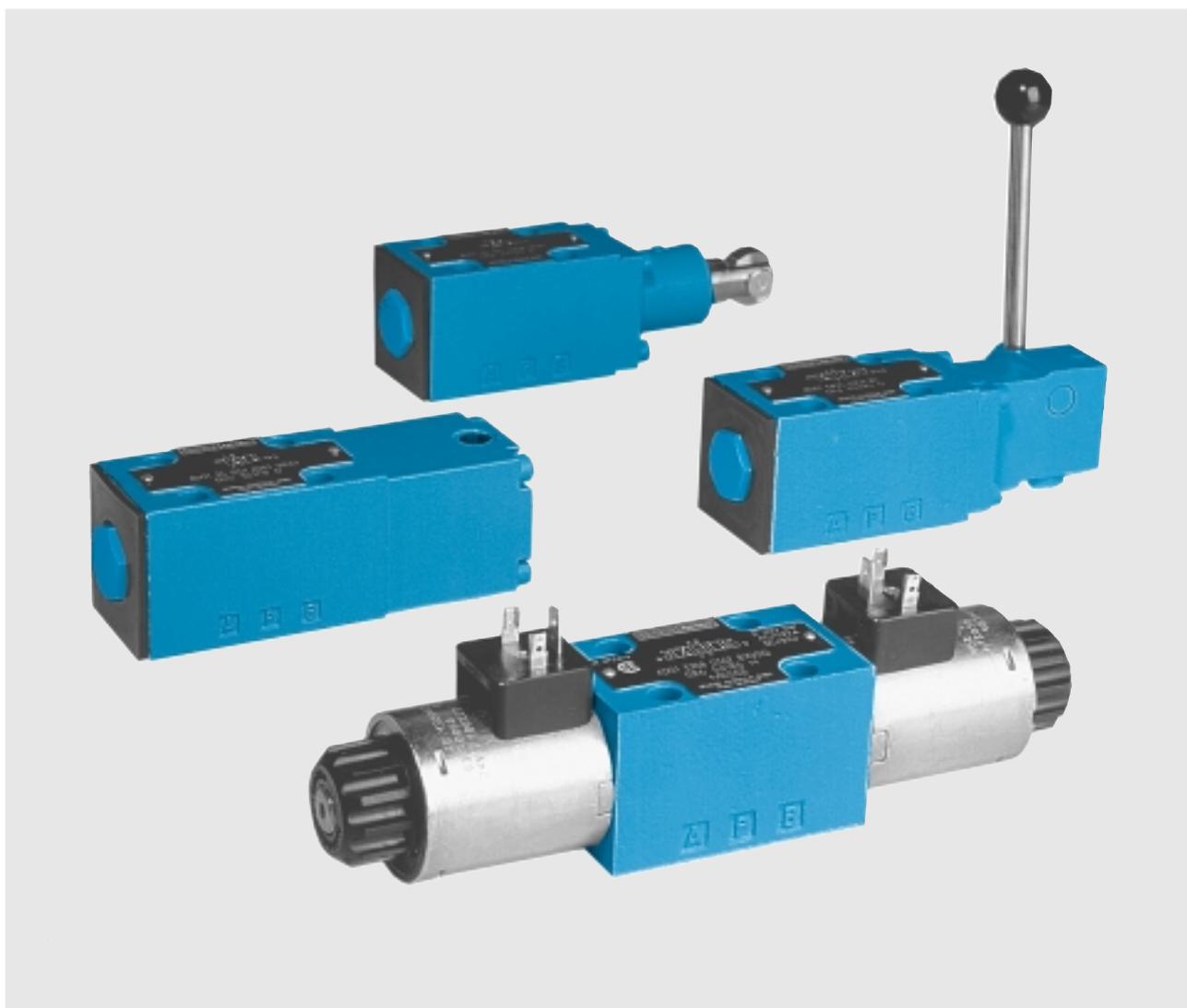


DENISON HYDRAULICS

Directional Control Valve Cetop 03

Series 4D01 – Design B



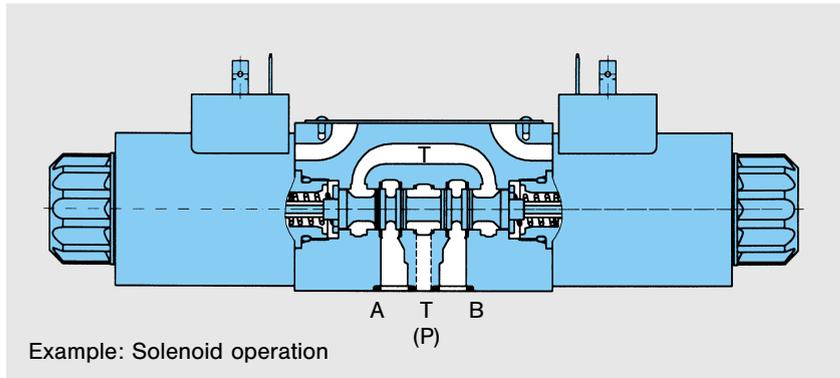
Publ. 4-EN 3060-B, replaces 4-EN 3060-A

DENISON Hydraulics

FEATURES, DESCRIPTION

FEATURES

- Low pressure drop at high flow rates, due to optimized flow paths in body and spool design.
- Mounting configuration conform to ISO 4401.
- Wide variety of spool types available, including detent.
- Interchangeability of spools and bodies due to high precision manufacturing processes.
- Position control by inductive detector (see pages 12... 15).
- Soft shift version available.
- Low electrical power consumption (31 W / 24 VDC).
- Change of solenoid coil is fast and simple without risk of oil leakage.
- Pressure up to 210 bar (DC) / 140 bar (AC) allowable in the tank port.
- Electrical connection by standard 3 pin connector according to ISO 4400 or DIN 43650.
- All components designed and tested for a minimum life of 10 million cycles.
- Every valve is factory tested prior to delivery.
- Worldwide DENISON Service.



DESCRIPTION

DENISON's direct operated Directional Control Valve 4D01 conforms to Cetop O3 standard interface.

They are designed to be subplate or manifold mounted or used in conjunction with the stack valves system (see also Bulletin 8-EN 5650).

Both the valve mounting interface and electrical connection methods available conform to the accepted International Standards Cetop, ISO and DIN.

The five annuli body design gives a precise guide for many types of spools.

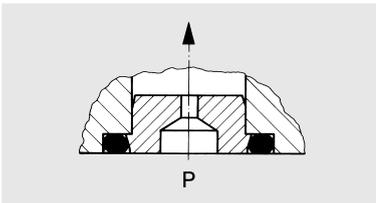
High precision economical manufacturing processes allow interchangeability of spools without the need for selective assembly.

For any applications which are not covered by the ordering code details, please contact your local DENISON office.

OPERATION

The Directional Control 4D01 consists principally of a spool, body and either one or two actuators, depending on the application. The spool is shifted either by use of solenoids, mechanical actuator, hydraulic or pneumatic actuator, allowing oil under pressure from port P to flow to either port A or B, and subsequently connecting the alternate port to the tank. De-energizing the actuator allows the spring to return the spool to the centre or offset position. The manual override option allows for manual operation of the spool.

ORIFICE



In certain operating conditions a higher flow-volume can take place than the functional limit of the valve permits.

In this case it is recommended to fit an orifice-plug in the P-port. For order details refer to page 3 or 4.

ORDERING CODE – SOLENOID OPERATION

Model No.: 4D01 - . 3 - . 4 - . 5 - . 6 - B 1 . . . -

1	Series 01 = Cetop 03	1	2	3	4	5	6	7	8	9	10	11	12	13	14
2	Body 3 = Standard F = only for spools 55, 56														
3	Control 1 = 1 solenoid 2 = 2 solenoids 7 = 2 solenoids, 2 pos. detents (only for spools 11, 12, 51, 52 & 91)														
4	Spool Type refer to pages 5 and 6														
5	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 centered pos. "o" 05 = 2 (o, b), Spring centered pos. "o", energized to "b" 06 = 2 (o, a), Spring centered pos. "o", energized to "a" 09 = 2 pos. detents (for control option 7)														
6	End Cap 01 = for control 1 02 = for controls 2, 7 Versions with inductive detector: SA = for control 1: neutral position controlled SB = for control 1: "a" or "b" position controlled TC = for control 2: "a" or "b" position controlled SC = for control 2: "b" or "a" position controlled TA = for control 2: "o" position controlled SA = for control 2: "o" position controlled														
7	Design Letter														
8	Seal Class 1 = NBR-seals (Standard) 4 = EPDM-seals 5 = FPM-seals (Viton®)														
9	Solenoid Voltage W01 = 115 V / 60 Hz W02 = 230 V / 60 Hz W06 = 115 V / 50 Hz W07 = 230 V / 50 Hz														
		} AC		} DC											
		} G0R = 12 V		} G0Q = 24 V											
		} G0D = 27 V													
Order information for plug-in connectors see pages 9 or 10															
1*	Valve Accessories / Modifications 08 = Orifice 0.8 mm dia. in P-port 10 = Orifice 1.0 mm dia. in P-port 12 = Orifice 1.2 mm dia. in P-port 32 = Tube cartridge without manual override 52 = Tube cartridge with manual override and rubber cover G3 = Tube cartridge with manual override and soft shift orifice (only for DC version) – see page 11														

ORDERING CODE – LEVER, CAM, PNEUMATIC & HYDRAULIC OPERATION

Model no.:

4D01 - . . . - . . . - B 1 -

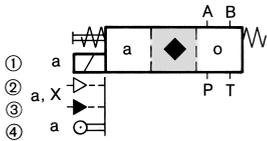
		1	2	3	4	5	6	7	8	9	10	11	12
<p>1 Series _____</p> <p>01 = Cetop 03</p> <p>2 Body _____</p> <p>3 = Standard F = only for spools 55, 56</p> <p>3 Control _____</p> <p>4 = Lever operated 5 = Cam operated D = Pneumatic operation, one-side E = Pneumatic operation, both-sides F = Pneumatic operation, both-sides (2 pos. det.) Q = Hydraulic operation, one-side R = Hydraulic operation, both-sides S = Hydraulic operation, both sides (2 pos. det.)</p> <p>4 Spool Type _____</p> <p>refer to pages 5 and 6</p> <p>5 Spool Position _____</p> <p>01 = 2 (a, b), Spring offset to pos. "b", activated to "a" 02 = 2 (a, b), Spring offset to pos. "a", activated to "b" 03 = 3 (a, o, b), Spring centering pos. "o" 05 = 2 (o, b), Spring centering pos. "o", activated to "b" 06 = 2 (o, a), Spring centering pos. "o", activated to "a" 07 = 3 pos. detents (for control 4) 09 = 2 pos. detents (for control 4)</p> <p>6 End Cap _____</p> <p>01 = for controls D and Q 02 = for controls E, F, R and S 04 = for controls 4 and 5 05 = for control 4 and spool pos. 07 and 09</p> <p>7 Design Letter _____</p> <p>8 Seal Class _____</p> <p>1 = NBR-seals (Standard) 4 = EPDM-seals 5 = FPM-seals (Viton®)</p> <p>9.. Valve Accessories / Modifications _____</p> <p>10 = orifice 1.0 mm in P 12 = orifice 1.2 mm in P</p>													

SYMBOLS

- ① 1-Solenoid operation
 - ② pneumatic operation
 - ③ hydraulic operation
 - ④ Cam operation
- } A-Side

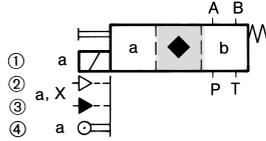
- ① 1-Solenoid operation
 - ② pneumatic operation
 - ③ hydraulic operation
 - ④ Cam operation
- } B-Side

Spool position 06
Spring centering



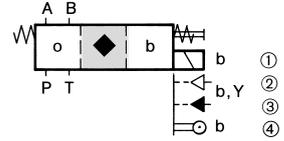
- 01
- 02
- 03
- 07
- 08
- 09
- 10
- 46
- 55
- 56
- 64
- 65
- 0X

Spool position 01
spring offset



- 11
- 12
- 51
- 52
- 81
- 91
- 0C
- 0Y

Spool position 05
Spring centering



- 01
- 02
- 03
- 07
- 08
- 09
- 10
- 46
- 55
- 56
- 64
- 65
- 0X

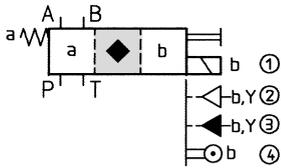
- standard spools
- ◆ transfer configuration only (not switched position)

SYMBOLS

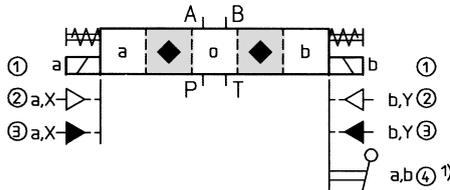
- ① 1-Solenoid operation
 - ② pneumatic operation
 - ③ hydraulic operation
 - ④ Cam operation
- } B-Side

- ① 2-Solenoid operation
- ② pneumatic operation, both sides
- ③ hydraulic operation, both sides
- ④ Lever operation

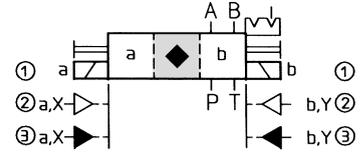
Spool position 02
Spring offset



Spool position 03
Spring centering

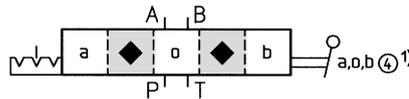


Spool position 09
2 pos. detents



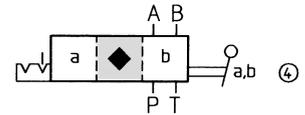
- 11
- 12
- 51
- 52
- 81
- 91
- 0C
- 0Y

Spool position 07
3 pos. detents



- 01
- 02
- 03
- 07
- 08
- 09
- 10
- 46
- 55
- 56
- 64
- 65
- 0X

- 11
- 12
- 51
- 52
- 91



- 11
- 51

1) Lever operation not with spools 02, 55, 56

- standard spools
- ◆ transfer configuration only (not switched position)

FUNCTIONAL LIMITS – SOLENOID OPERATION

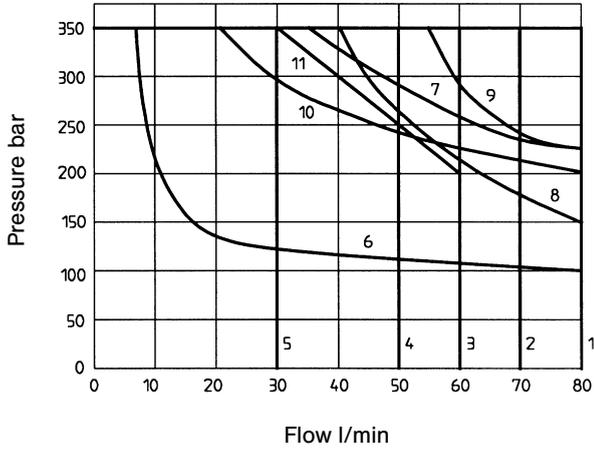
FUNCTIONAL LIMITS

The functional limits have been obtained with warm solenoid condition and at 10% undervoltage.

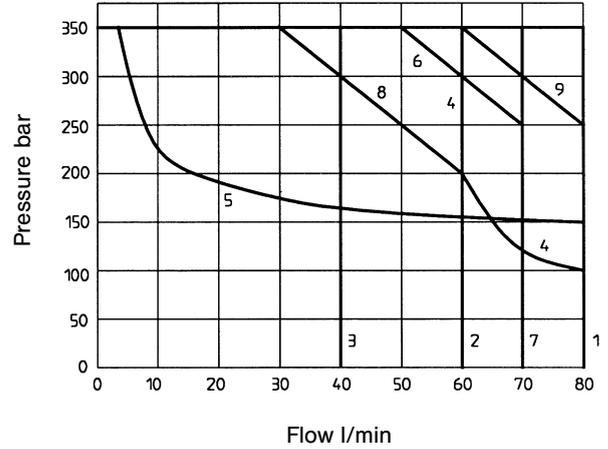
All flow data given is considered as 2 flow directions (e. g. P→B and simultaneously from A→T).

For only one flow direction (4-Way-Valve used as 3-Way-Valve) the permissible flow rates will be lower.

Valve with Standard DC-Solenoid



Valve with Standard AC-Solenoid



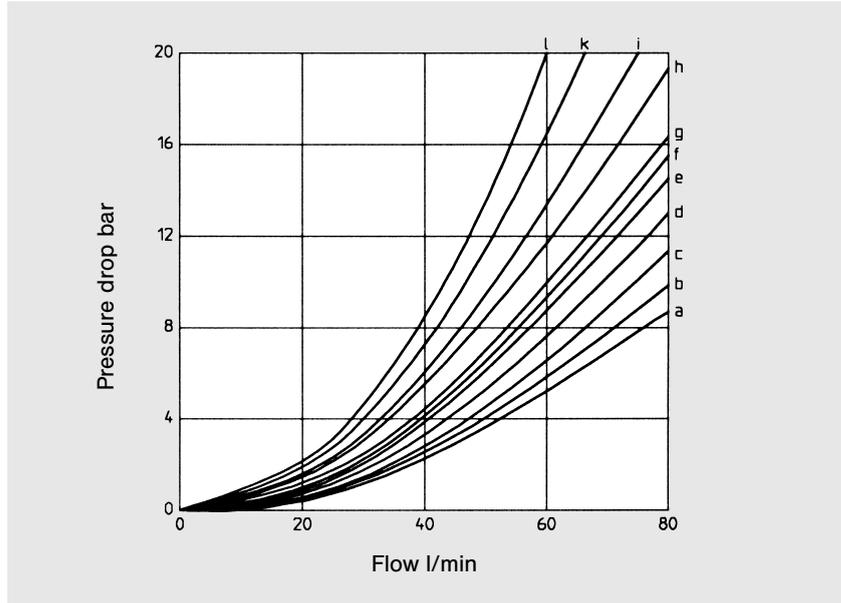
Spool type	DC Curve no.	AC Curve no.
01	4	2
02	9	6
03	1	2
07	5	3
08	7	2
09	10	7
10	10	7
11	2 (1)	1 (1)
12 1)	6 (8)	5 (9)
46	3	4
51	2 (1)	2 (1)
52	6 (8)	5 (9)
55	9	9
56	9	9
64	5	3
65	5	3
81	3	1
91	(1)	(1)
0C	1	1
0Y	11	8
0X	11	8

() Curves for spool with detents

1) Only if port A or B is closed

PRESSURE DROP, CHARACTERISTICS

PRESSURE DROP



Oil temperature 50 °C; oil viscosity 40 cSt.

	Spool type																				
	01	02	03	07	08	09	10	11	12	46	51	52	55	56	64	65	81	91	0C	0Y	0X
P→A	a	e	d	l	d	c	c	c	h	a	e	f	g	g	h	l	b	i	k	a	b
P→B	a	e	d	l	d	c	c	c	h	a	e	f	g	g	l	h	b	i	k	a	b
P→T	b	-	-	i	-	-	-	-	-	-	-	-	-	-	k	k	-	-	k	-	-
A→T	c	c	d	l	a	e	a	d	-	g	g	-	f	-	k	l	e	d	-	e	c
B→T	c	c	d	l	b	a	e	d	-	g	g	-	-	f	l	k	e	d	-	e	c

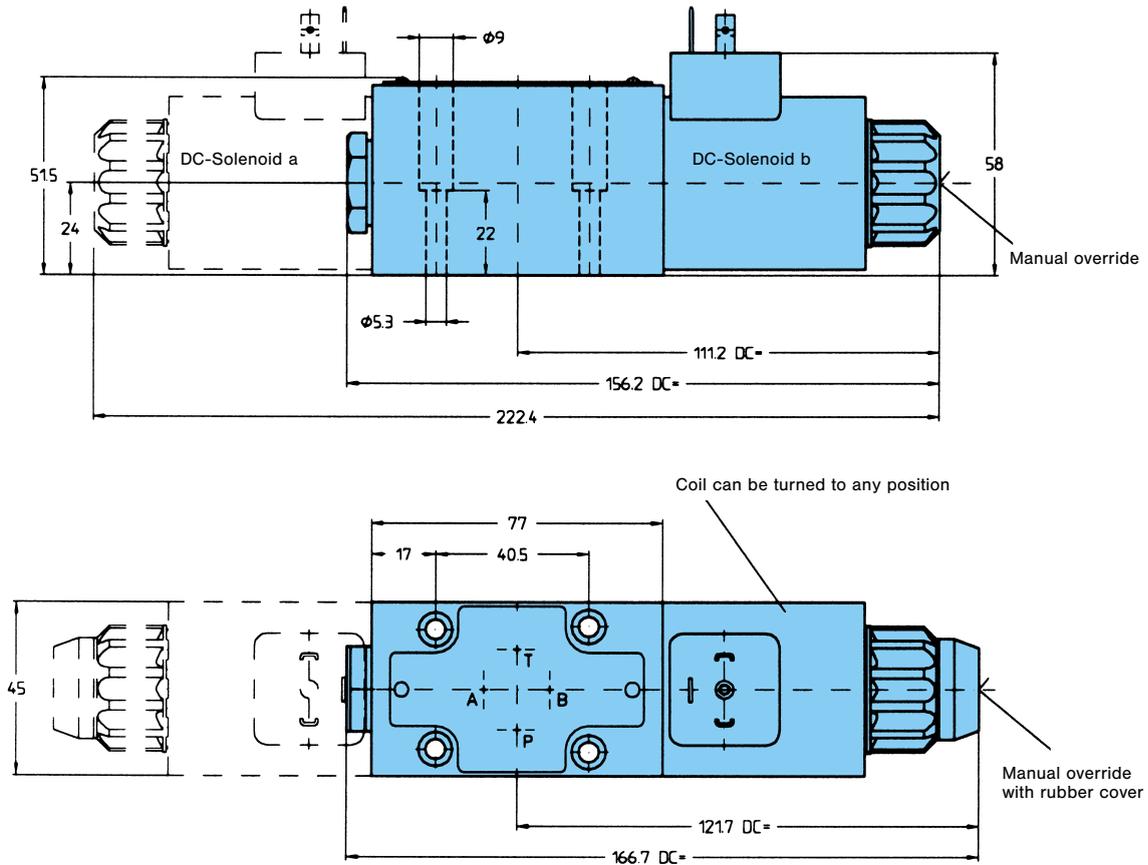
CHARACTERISTICS

• Design	Sliding spool valve
• Type of mounting	Subplate
• Mounting position	Optional but horizontal optimal
• Ambient temperature range	-20...+50 °C
• Operating pressure (P, A, B)	up to 350 bar
• Max. flow	80 l/min (see diagrams)
• Fluid	Mineral oil according to DIN 51524 and 51525 (For other fluids please consult DENISON)
• Viscosity range	10...650 cSt, optimal 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

If the performance characteristics outlined above do not meet your own particular requirements, please consult your local DENISON Office.

1- AND 2-SOLENOID OPERATED VERSIONS, DC-VOLTAGE

• Nominal voltage	See ordering code page 3
• Power input	31 W
• Permissible pressure T210 bar
• Solenoid response time	
– sol. energized	... 46 ms
– sol. de-energized	... 27 ms
– quick energizing ¹⁾	... 30 ms 1) double voltage
• Permissible voltage difference	+ 5... – 10 %
• max. coil temperature	+ 180 °C
• Temperature class	H
• Relative operating period	100 %
• Type of protection	IP 65
• Cycle (1/H)	... 16.000
• Weight 1 sol.	1.4 kg
2 sol.	1.7 kg



Port function

P = Pressure

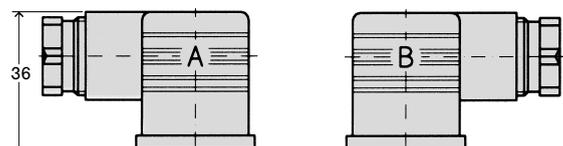
T = Tank

A + B = User

NBR-Seals for ports P, A, B, T

9.25 x 1.78	691-00012-0
-------------	-------------

Plug-in connectors according to ISO 4400



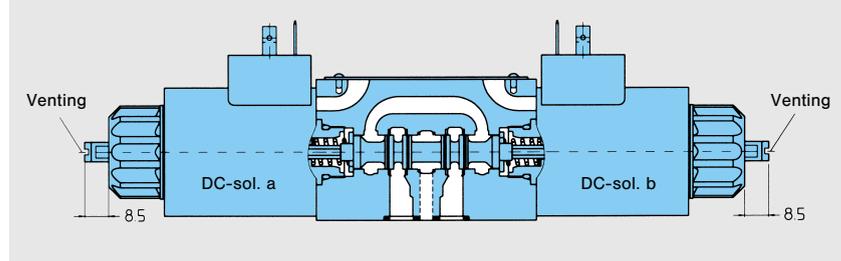
Versions	A-Side (grey)	B-Side (black)
Standard < 250 V PG 11	167-01007-8	167-01008-8
with LED (red) 15...30 V	167-01100-8	167-01101-8
with bridge rectifier 12...250 V	167-01076-8	167-01014-8

SOFT SHIFT VERSION, OPTION G3

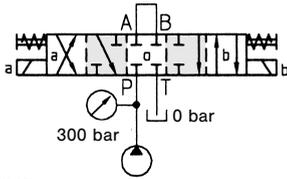
DENISON offers the Directional Control Valve in Cetop 03 size with a "soft shift" option (G3). A special solenoid type permits a multiple increase in the standard solenoid response time.

The Option G3 delivers:

- Reduced pressure shocks in venting operations.
- Reduced system noise during spool transition.
- Increased lifetime of the valve and system.



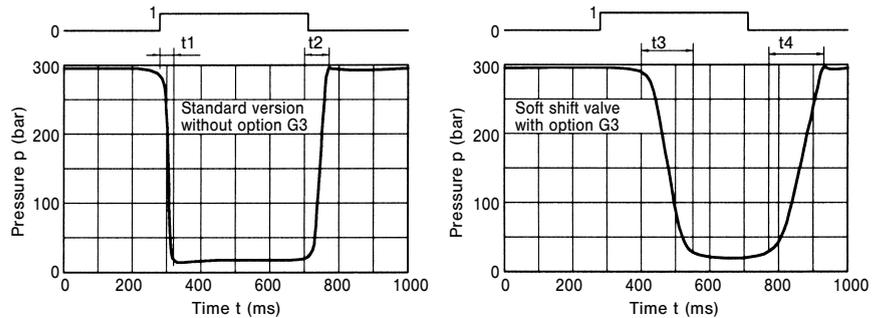
Circuit design



Example sol. "a" energized decompression P→A (t₃):

300 bar;
60 l/min;
36 cSt; 50 °C;
4D01-3203-0302-B1 G0Q-G3

Pressure shift sequence of spool stroke o→a or o→b



Response times (ms) for 24 V DC Solenoid

	t ₁	t ₂	t ₃	t ₄
Spool stroke	35...40	55...60	300...500	400...800
Pressure change	20...25	35...40	80...200	80...400

Note:
Response time will be influenced by changes in viscosity, pressure or flow.

Ordering code: 4D01-....-....-B1... - G3

Solenoid voltage and current

G0R = 12 VDC

G0Q = 24 VDC

G0H = 48 VDC

With rectifier ¹⁾

DC-Output

AC-Input

GAN = 102 VDC

115 V / 50 (60) Hz

GAG = 205 VDC

230 V / 50 (60) Hz

GAR = 98 VDC

110 V / 50 (60) Hz

Modification

G3 = soft shift

¹⁾ For applications with AC input voltage a DC solenoid with rectifier connector must be used!

Depending on spool type, the functional limits of the soft shift valve will be reduced with as much as 25% in comparison to the data in this bulletin.

Note: Ensure that the solenoid tube cartridges are filled with oil at all times. For that the tube cartridges have venting screws (see above). In applications above the oil level, the use of a check valve 1...2 bar in the tank line is recommended.

1 SOLENOID VERSION WITH POSITION CONTROL

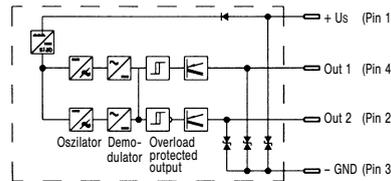
CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

- | | |
|--|--|
| <ul style="list-style-type: none"> • Function • Supply voltage U_S
(full wave bridge with capacitor) • Reverse polarity protection • Ripple voltage • Current consumption • Outputs
 • Output voltage <ul style="list-style-type: none"> - Signal L - Signal 0 • Output current • Environmental protection • Operating temperature range • Wire cross-sectional area • Tensile strength of transmitting conduit • CE Declaration of conformity no. | <p>P-channel FET, contact positive
24 V \pm 20 % (19.2 V ... 28.8 V)</p> <p>max. 300 V installed
10 %
approx. 40 mA
NC contact positive
(no short circuit protection)</p> <p>$U_S - 2.5$ V
< 1.8 V
< 400 mA at $U_S + 20$ %
IP 65
0 °C ... + 85 °C
4 x 0.5 mm²
p dyn. 315 bar
00 02 002 9 93</p> |
|--|--|

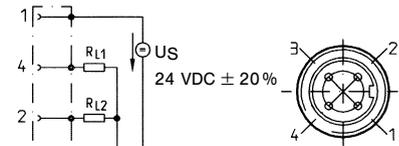
Attention:

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

Block diagram and connection of the inductive detector



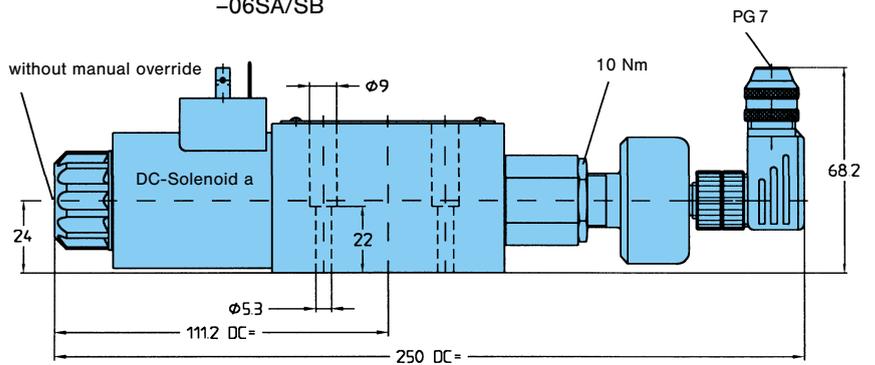
Socket connector



RL1, RL2 = e.g. coil resistance of the switch relay $\geq 60 \Omega$

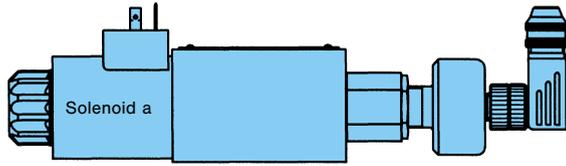
DIMENSIONS

Example: 4D01-*1**-01SA/SB
-06SA/SB

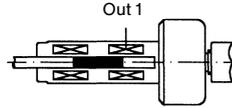
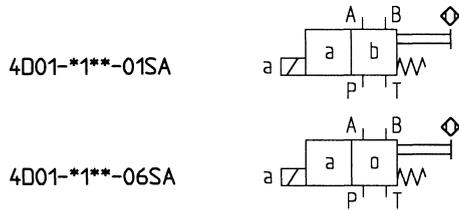


1 SOLENOID VERSION WITH POSITION CONTROL

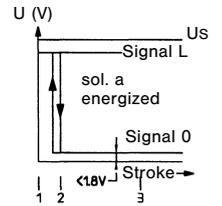
Spool Positions 01/06



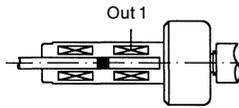
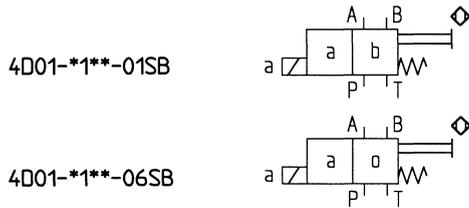
Neutral position controlled +



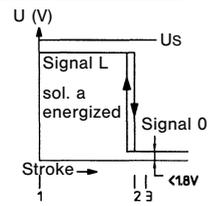
Neutr. Pos.: Out 1 = L
Sol. energized: Out 1 = 0



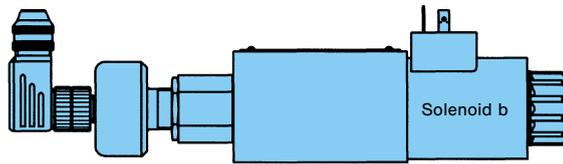
End position controlled +



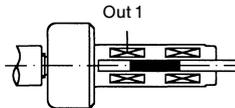
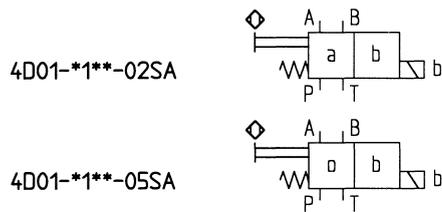
Neutr. Pos.: Out 1 = L
Sol. energized: Out 1 = 0



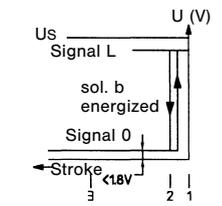
Spool Positions 02/05



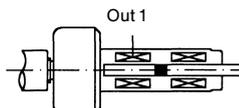
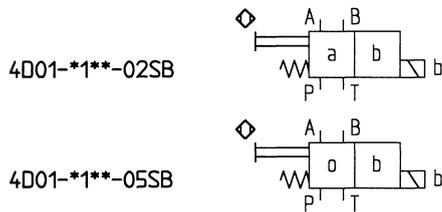
Neutral position controlled +



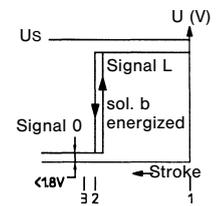
Sol. energized: Out 1 = 0
Neutr. Pos.: Out 1 = L



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

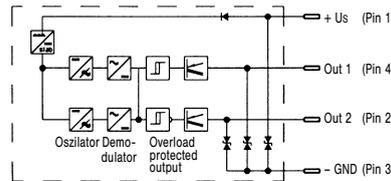
CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

- | | |
|--|--|
| <ul style="list-style-type: none"> • Function • Supply voltage U_S
(full wave bridge with capacitor) • Reverse polarity protection • Ripple voltage • Current consumption • Outputs
 • Output voltage <ul style="list-style-type: none"> - Signal L - Signal 0 • Output current • Environmental protection • Operating temperature range • Wire cross-sectional area • Tensile strength of transmitting conduit • CE Declaration of conformity no. | <p>P-channel FET, contact positive
24 V \pm 20 % (19.2 V ... 28.8 V)</p> <p>max. 300 V installed
10 %
approx. 40 mA
NC contact positive
(no short circuit protection)</p> <p>$U_S - 2.5$ V
< 1.8 V
< 400 mA at $U_S + 20$ %
IP 65
0 °C ... + 85 °C
4 x 0.5 mm²
p dyn. 315 bar
00 02 002 9 93</p> |
|--|--|

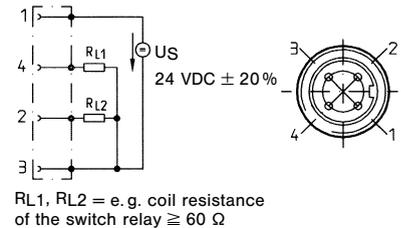
Attention:

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

Block diagram and connection of the inductive detector

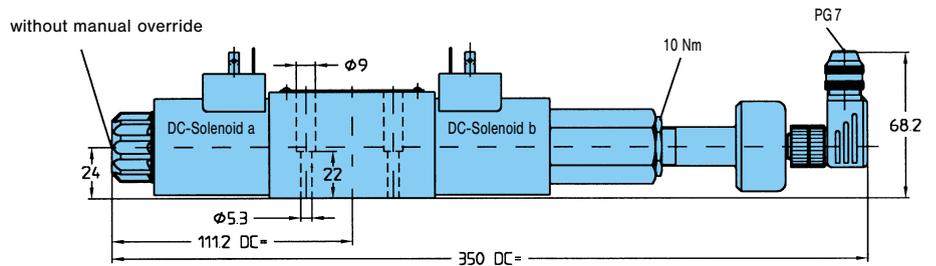


Socket connector



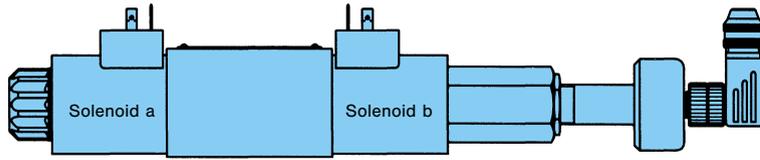
DIMENSIONS

Example: 4D01-32**-03SA/SC



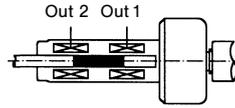
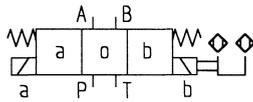
2 SOLENOID VERSION WITH POSITION CONTROL

Spool Position 03

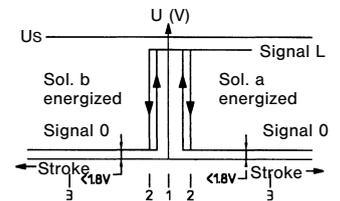


Neutral position controlled \pm _____

4D01-32**-03SA

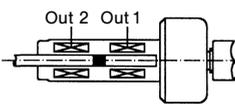
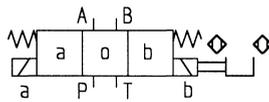


Sol. b energized: Out2 = 0
 Neutr. Pos.: Out 1 + 2 = L
 Sol. a energized: Out 1 = 0

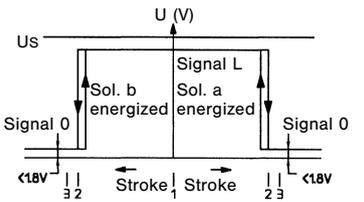


End position controlled \pm _____

4D01-32**-03SC

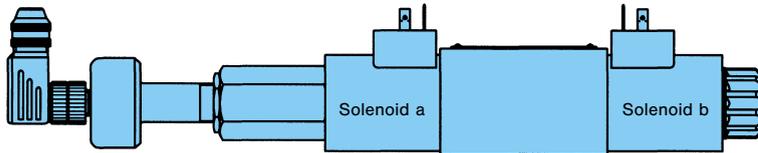


Sol. b energized: Out2 = 0
 Neutr. Pos.: Out 1 + 2 = L
 Sol. a energized: Out 1 = 0



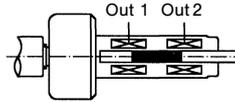
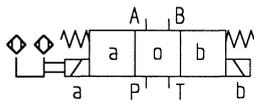
Pos. 1 = Neutral position
 Pos. 2 = Switch point
 Pos. 3 = End position

Spool Position 03

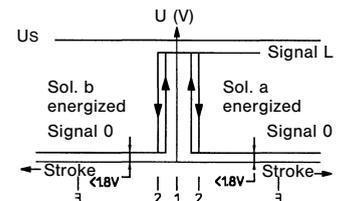


Neutral position controlled \pm _____

4D01-32**-03TA

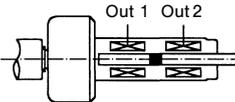
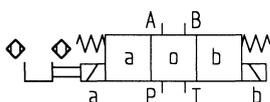


Sol. b energized: Out 1 = 0
 Neutr. Pos.: Out 1 + 2 = L
 Sol. a energized: Out 2 = 0

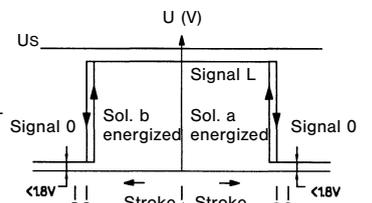


End position controlled \pm _____

4D01-32**-03TC



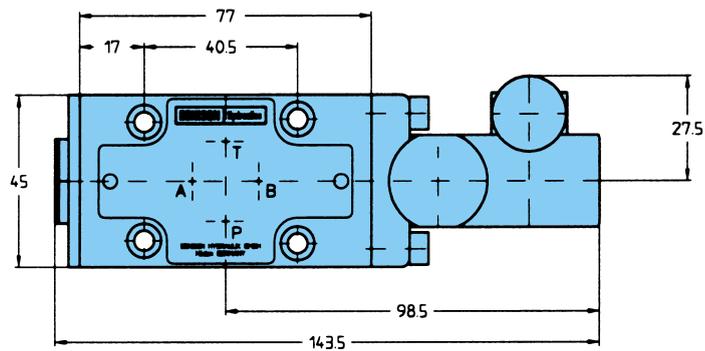
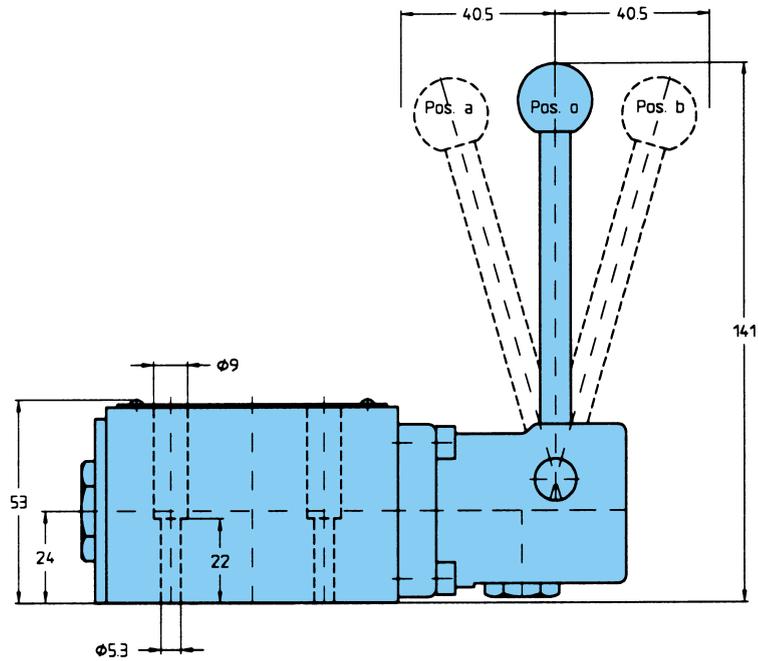
Sol. b energized: Out 1 = 0
 Neutr. Pos.: Out 1 + 2 = L
 Sol. a energized: Out 2 = 0



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

LEVER OPERATED VERSION

- Functional Limits (at 350 bar) 60 l/min for spools 01, 02, 03, 08, 09, 10, 46, 55, 56, 0X
40 l/min for spools 07, 64, 65
- Operating force 30 N
- Angle of operation $\pm 17^\circ$
- Max. tank pressure 160 bar
- Weight 1.7 kg



Port function

P = Pressure

T = Tank

A + B = User

NBR-Seals for ports P, A, B, T

9.25 x 1.78	691-00012-0
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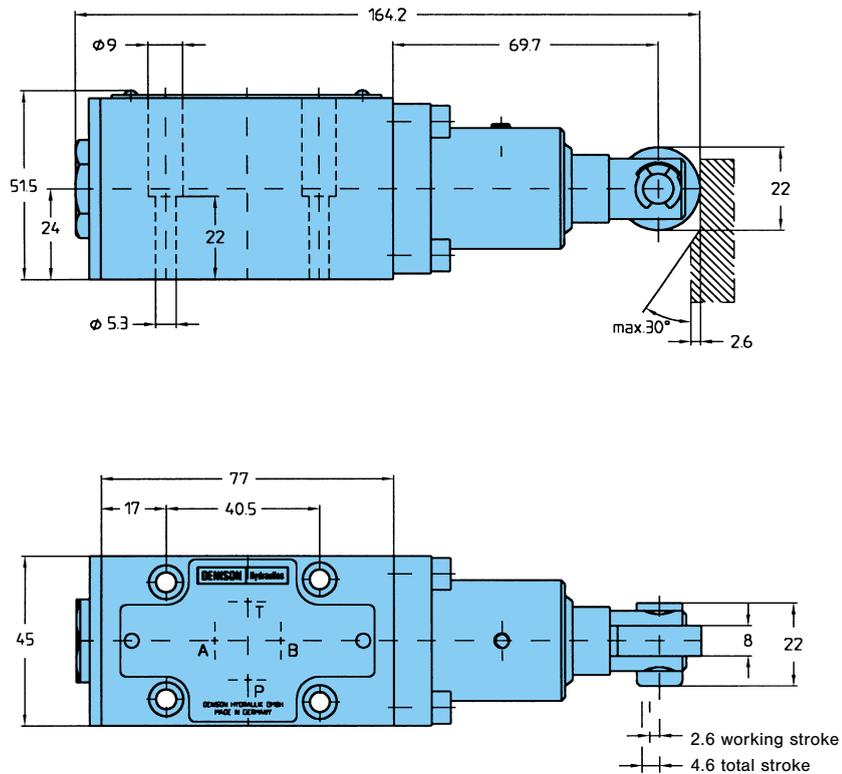
CAM OPERATED VERSION

- Functional Limits (at 350 bar)
 - 60 l/min for spools 01, 02, 03, 08, 09, 10, 11, 46, 51, 55, 56, 81, 91, 0C
 - 10 l/min for spools 12, 52
 - 35 l/min for spools 07, 64, 65, 0Y, 0X
- Operating force F(N) ¹⁾

		at tank pressure 0 bar			at tank pressure 20 bar		
		neutral	working stroke	total stroke	neutral	working stroke	total stroke
at operating pressure	100 bar	35 N	135 N	195 N	60 N	160 N	220 N
	200 bar	35 N	155 N	195 N	60 N	180 N	220 N
	350 bar	35 N	175 N	195 N	60 N	200 N	220 N

¹⁾ depending on operating and tank pressure at max. flow

 - Max. tank pressure 20 bar
 - Weight 1.4 kg



Port function

P = Pressure

T = Tank

A + B = User

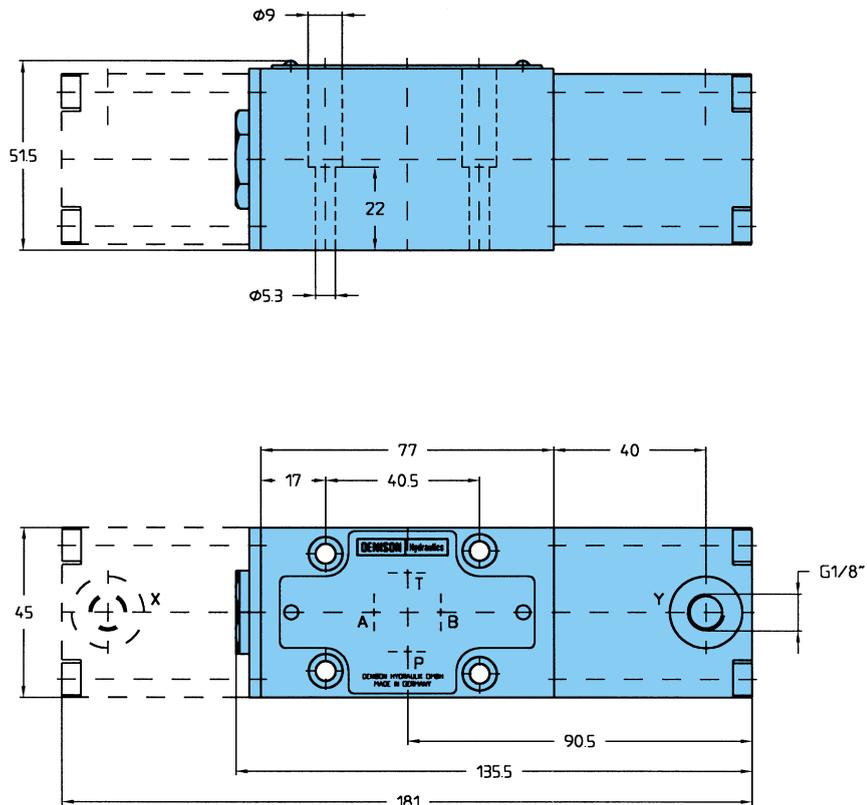
NBR-Seals for ports P, A, B, T

9.25 x 1.78	691-00012-0
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PNEUMATICALLY OPERATED VERSIONS

- Functional Limits (at 350 bar)
 - 60 l/min for spools 01, 02, 03, 08, 09, 10, 11, 46, 51, 55, 56, 81, 91, 0C
 - 10 l/min for spools 12, 52
 - 35 l/min for spools 07, 64, 65, 0Y, 0X
- Pilot pressure
 - 4 ... 12 bar
 - tank pressure 0 bar min. 4 bar
 - tank pressure 160 bar min. 6 bar
 - max. allowed 12 bar
- Tank pressure max. 160 bar
- Pilot volume 3.2 cm³
- Response time ¹⁾
 - on 50 ... 200 ms
 - off 100 ... 200 ms

¹⁾ depending on pilot pressure and pipe length
- Weight
 - operated one side 1.7 kg
 - operated both sides 2.3 kg



Port function

P = Pressure

T = Tank

A + B = User

X + Y = Pilot ports

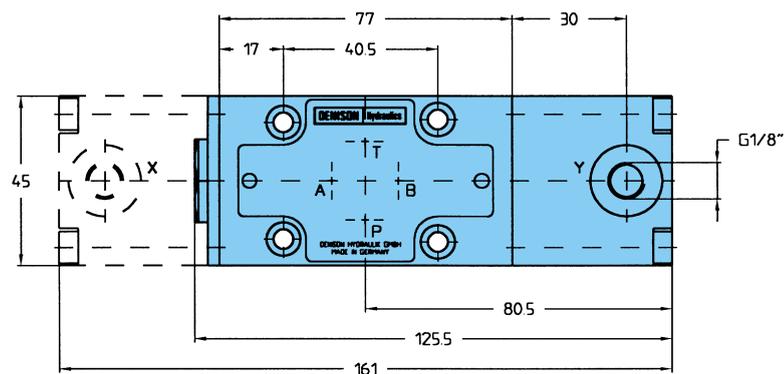
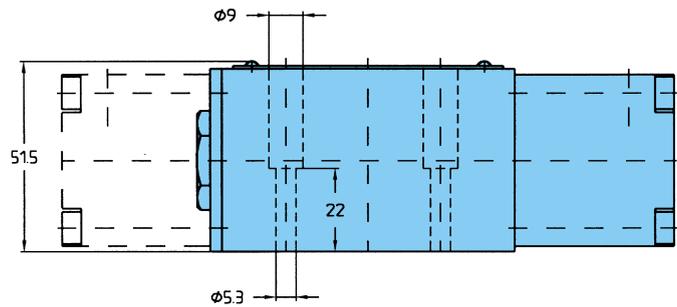
NBR-Seals for ports P, A, B, T

9.25 x 1.78	691-00012-0
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HYDRAULICALLY OPERATED VERSION

- Functional Limits (at 350 bar)
 - 60 l/min for spools 01, 02, 03, 08, 09, 10, 11, 46, 51, 55, 56, 81, 91, 0C
 - 10 l/min for spools 12, 52
 - 35 l/min for spools 07, 64, 65, 0Y, 0X
- Max. tank pressure 160 bar
- Pilot pressure min. 10 bar > tank pressure
max. 210 bar
- Pilot volume (each side) 1 cm³
- Response time ¹⁾

	pp 50 bar	pp 200 bar
– on	50... 100 ms	15... 40 ms
– off	60... 160 ms	60... 160 ms
- ¹⁾ depending on pilot pressure and pipe length
- Weight
 - operated one side 1.6 kg
 - operated both sides 2.2 kg



Port function

P = Pressure

T = Tank

A + B = User

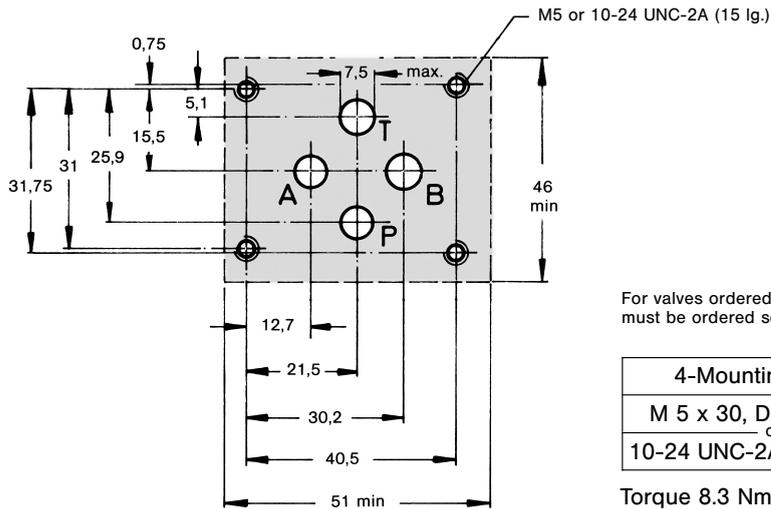
X + Y = Pilot ports

NBR-Seals for ports P, A, B, T

9.25 x 1.78	691-00012-0
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MOUNTING CONFIGURATION, SUBPLATES

MOUNTING CONFIGURATION (conform to ISO 4401)



Block mounting
 Flatness 0.01 mm
 Surface finish 0,8

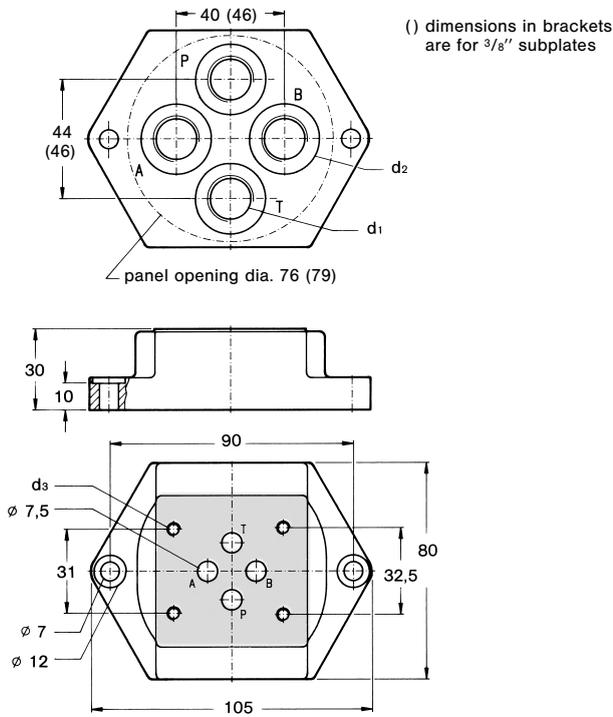
For valves ordered without subplate, mounting screws must be ordered separately.

4-Mounting screws	Order-No.
M 5 x 30, DIN 912; 10.9	700-70834-8
or 10-24 UNC-2A x 1 1/4" (SAE)	358-10183-8

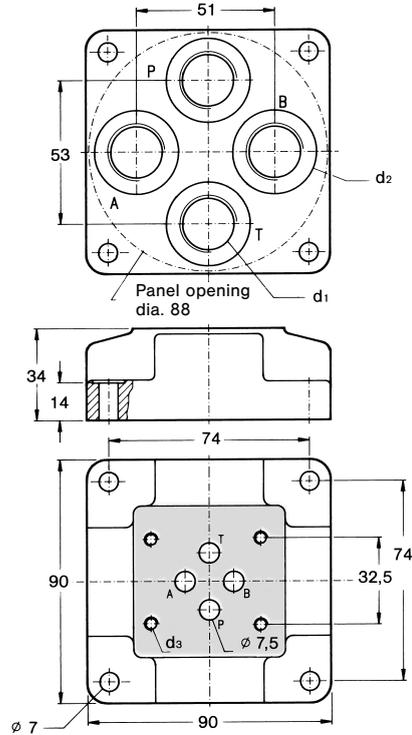
Torque 8.3 Nm

SUBPLATES

1/4" & 3/8" Subplates



1/2" Subplate



Model no.	Order no.	Weight	d ₁ (A, B, P, T)	d ₂	Thread for mount. screws d ₃
SS-B-04-G 136	S26-32959-0	1.4 kg	G 1/4"	∅ 23 x 1	M 5
SS-B-06-G 136	S26-32960-0	1.4 kg	G 3/8"	∅ 26 x 1	M 5
SS-B-08-G 136	S26-32961-0	1.7 kg	G 1/2"	∅ 31 x 1	M 5

Mounting screws are included in subplate order.