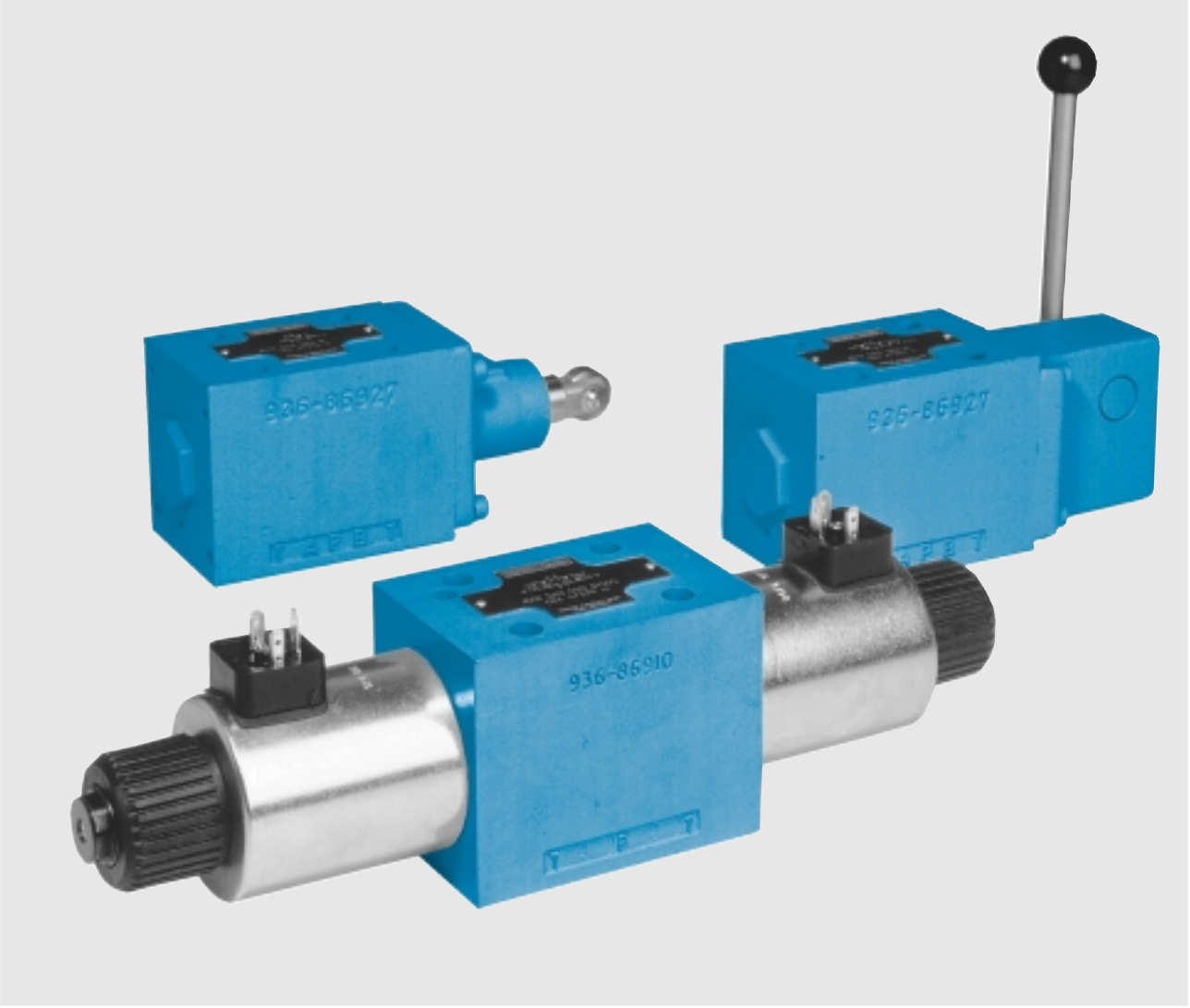
DENISON HYDRAULICS
Directional Control Valve Cetop 05

Series 4D02 – Design B

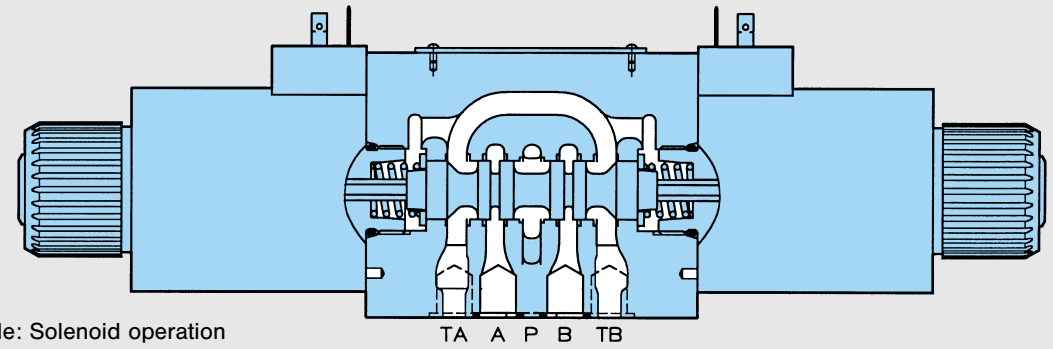


Publ. 4-EN 3300-B, replaces 4-EN 3300-A

DENISON Hydraulics

FEATURES

- Low pressure drop at high flow rates, due to optimized flow paths in body and spool design. 5-chamber technology.
- 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.
- Soft Shift version (Code G3).
- Change of solenoid coil is fast and simple without any risk of oil leakage.
- Solenoid coil can be turned to any position.
- Pressure up to 210 bar allowable on tank port as standard.
- Electrical connection by standard 3 pin plug confirming 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.



Example: Solenoid operation

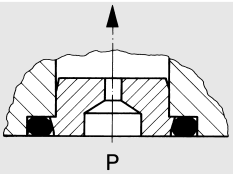
DESCRIPTION

DENISON's direct operated Directional Control Valve 4D02 conforms to Cetop 5 standard interface.
It is designed to be subplate or manifold mounted and to be used in conjunction with the stack valve system (see also publication 8-EN 5750).
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 the spool throughout it's stroke.
For any application not covered by the ordering code details, please contact your local DENISON office.

OPERATION

The Directional Control 4D02 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 or pneumatic actuator, allowing oil under pressure to flow from Port P to either port A or Port B and subsequently connecting the alternate port to tank.
De-energizing the actuator allows the spring to return the spool to the centre or offset position. The manual override pin(s) at the end of the solenoid tubes allows manual operation of the spool.

ORIFICE



In certain operating conditions a higher flow can take place than the functional limit of the valve permits.
In order to limit the flow through the valve 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.: 4D02 – . . .. – .. .. – B 1 ... – .. ..

1 2 3 4 5 6 7 8 9 10 11 12 13 14

1 Series
02 = Cetop 05

2 Body
3 = Standard Body
M = for Spool types 07, 12, 64, 65, 72
with AC & DC-solenoid operation
D = for Soft Shift option G3
with DC-solenoid operation

3 Control
1 = 1 solenoid
2 = 2 solenoid
7 = 2 solenoid, 2 pos. detents
(only for spool types 11 and 51)

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 option 1
02 = for control options 2 and 7

Versions with inductive detector:

SA = for control 1: neutral position controlled	For AC & DC solenoids
SB = for control 1: "a" or "b" position controlled	
TC = for control 2: "a" or "b" position controlled	For DC solenoids only
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	AC	G0R = 12 V	DC
W02 = 230 V / 60 Hz		G0Q = 24 V	
W06 = 115 V / 50 Hz		G0D = 27 V	
W07 = 230 V / 50 Hz			

1* Valve Accessories / Modifications
16 = 1.6 mm orifice in P-port
20 = 2.0 mm orifice in P-port
25 = 2.5 mm orifice in P-port
32 = Tube cartridge without manual override
52 = Tube cartridge with manual override and rubber cover
G3 = Soft Shift version with 0.8 mm orifice in channel-Z (only body type D with DC).

ORDERING CODE – LEVER, CAM, PNEUMATIC OPERATION

Model no.: **4D02 – . . .. – .. .. – B 1 – .. ..**

1 2 3 4 5 6 7 8 9 10 11 12

1 **Series**
02 = Cetop 05

2 **Body**
3 = Standard
M = only for spools types 07, 64, 65

3 **Control**
4 = Lever operated
5 = Cam operated
D = Pneumatic operation, one-side
E = Pneumatic operation, both-sides
F = Pneumatic operation, both-sides (2 pos. det.)

4 **Spool Type**
refer to pages 5 and 6

5 **Spool Position**
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)

6 **End Cap**
01 = for controls D
02 = for controls E, F
04 = for controls 4 and 5
05 = for control 4 and spool pos. 07 and 09

7 **Design Letter**

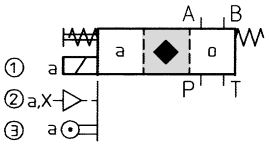
8 **Seal Class**
1 = NBR-seals (Standard)
4 = EPDM-seals
5 = FPM-seals (Viton®)

9.. **Valve Accessories / Modifications**
20 = 2.0 mm orifice in P-port
25 = 2.5 mm orifice in P-port

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

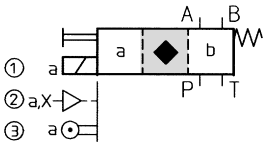
① 1-Solenoid operation
② pneumatic operation
③ Cam operation
} B-Side

Spool position 06
Spring centering



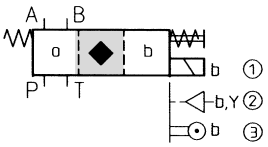
● 01
02
● 03
● 07
● 08
09
10
● 46
55
56
OM
OT
AR

Spool position 01
Spring offset



● 11
● 12
● 51
72

Spool position 05
Spring centering



● 01
02
● 03
● 07
● 08
09
10
● 46
55
56
OM
OT
AR

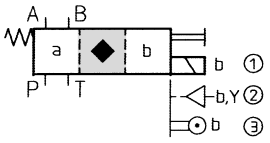
● standard spools
◆ transfer configuration only (not switched position)

Ordering Code | Back to Content

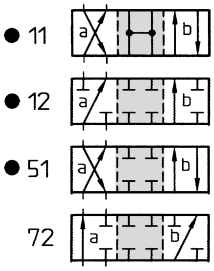
① 1-Solenoid operation
② pneumatic operation
③ Cam operation
} B-Side

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

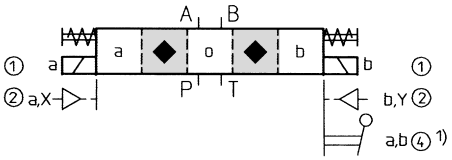
Spool position 02
Spring offset



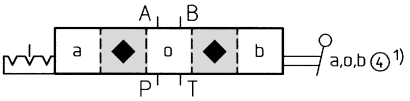
● 11
● 12
● 51
72



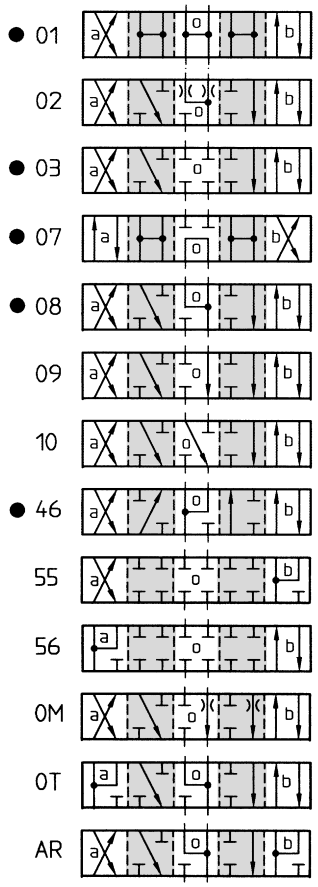
Spool position 03
Spring centering



Spool position 07
3 pos. detents

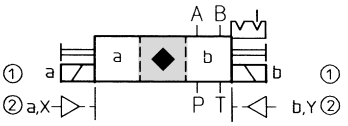


● 01
02
● 03
● 07
● 08
09
10
● 46
55
56
0M
0T
AR

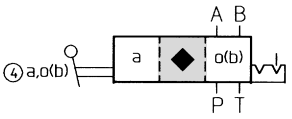


1) Lever operation only with spools 01, 03, 07, 08

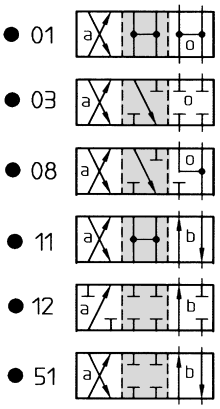
Spool position 09
2 pos. detents



● 11
● 51



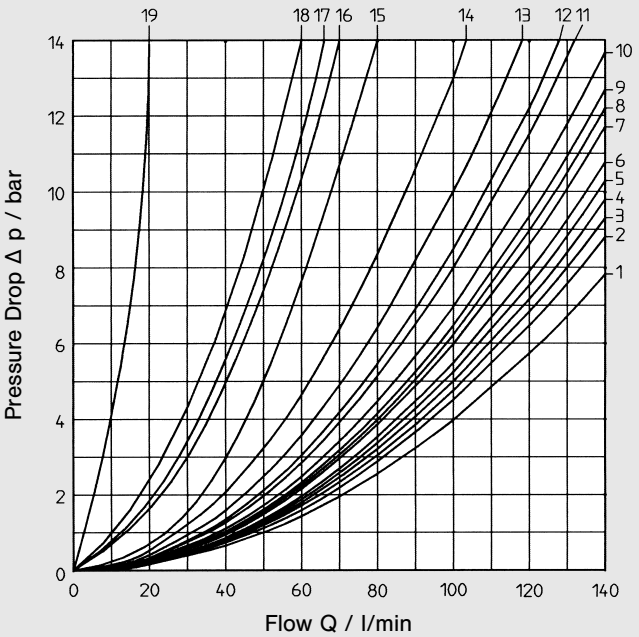
● 01
● 03
● 08
● 11
● 12
● 51



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

Ordering Code | Back to Content

PRESSURE DROP



All performance data is recorded with port TA connected to tank. Additionally connecting also TB to tank, pressure drop can be reduced by 1.5 . . . 3 bar.
Oil temperature 50 °C (122 °F); oil viscosity 40 cSt.

Spool Type	Flow Direction				o-Position					b-Pos.	a-Pos.
	P–A	P–B	A–T	B–T	P–T	P–A	P–B	A–T	B–T	P–A	P–B
01	1	1	4	10	14						
02	3	3	4	7				19	19		
03	3	3	5	8							
07	12	12	7	13	13						
08	3	3	3	6				17	18		
09	3	3	4	6					17		
10	3	3	3	9				16			
11	5	5	9	11							
12	4	4									
46	1	1	5	9							
51	5	5	10	11							
55	9	6	6							12	
56	7	7		12							13
72	4	6									
0M	3	3	4	7							
0T	6	11	9			15		13	13		
AR	12	5	10				15	11	11		

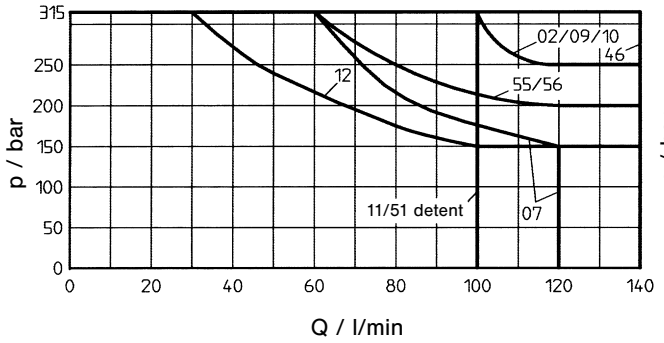
CHARACTERISTICS

• 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 315 bar (350 bar on request)
• Permissible tank pressure (T)	up to 210 bar (DC solenoids)
	up to 140 bar (AC solenoids)
• Max. flow	140 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 confirming to NAS 1638 Class 8 (Class 9 for 15 Micron and smaller) or ISO 17/14

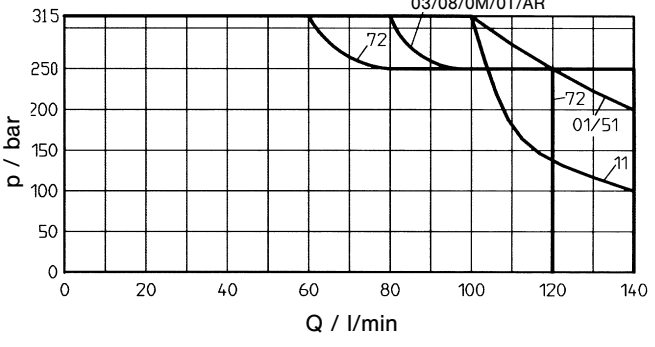
FUNCTIONAL LIMITS

The functional limits have been obtained with warm solenoid condition and at 10 % undervoltage from the selected nominal value.
All flow data given is considered for 2 flow directions (e. g. P→B and simultaneously from A→T).
For single flow direction (4-Way-Valve used as 3-Way-Valve) the permissible flow rates will be reduced by as much as 25 . . . 30 % in comparison to the data below.

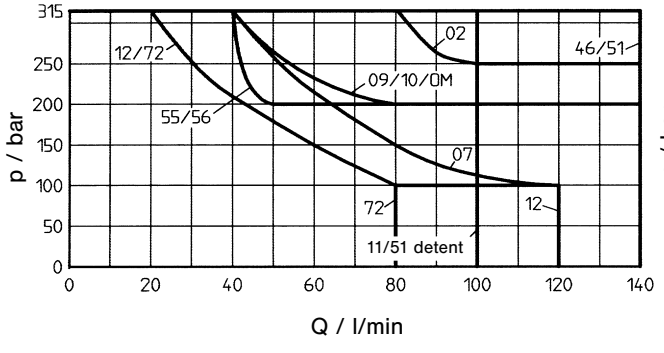
Valve with DC Solenoid(s)



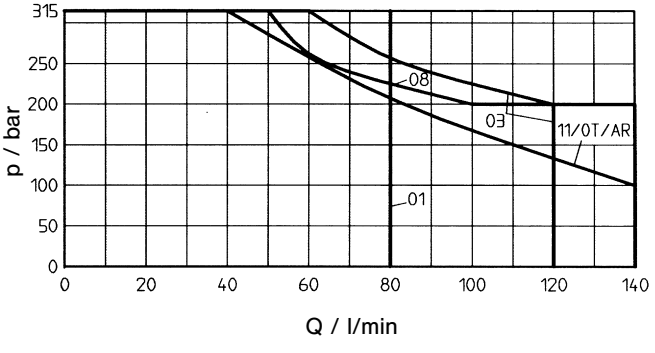
Valve with DC Solenoid(s)



Valve with AC Solenoid(s)



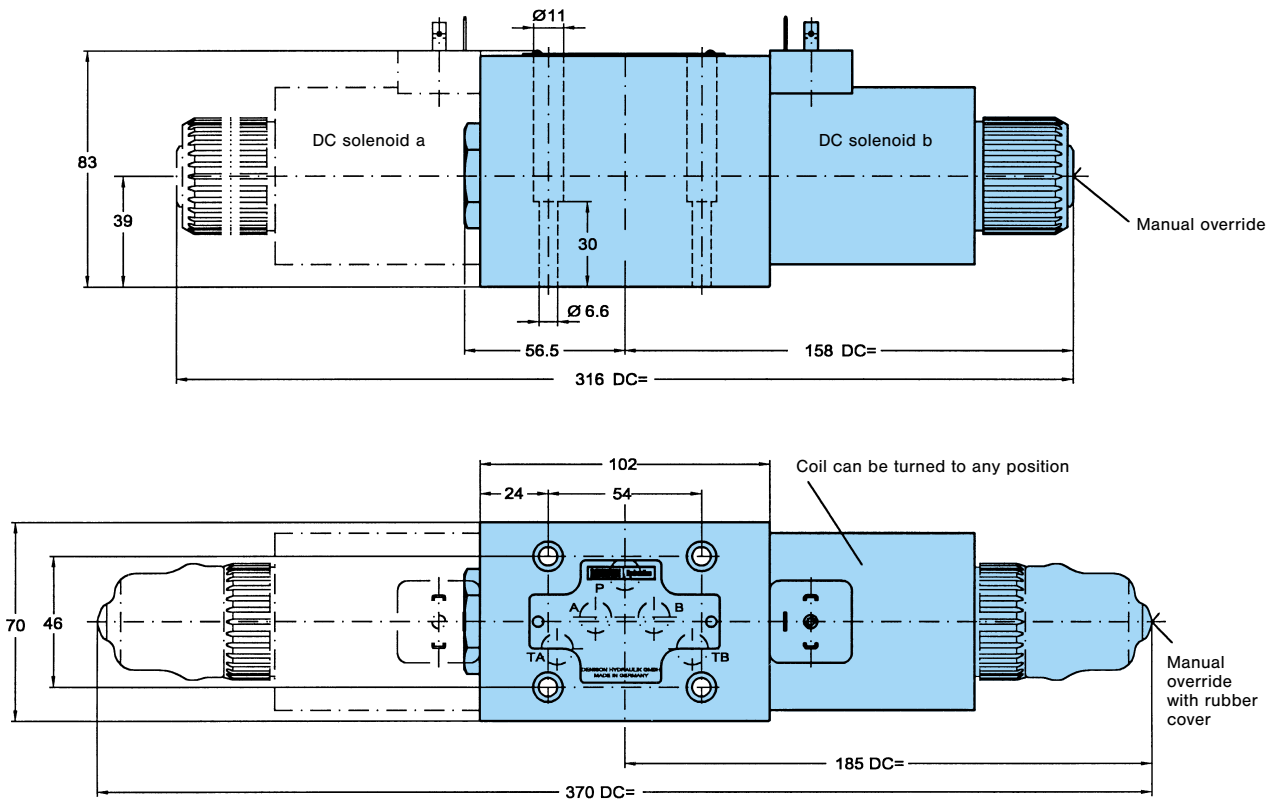
Valve with AC Solenoid(s)



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

Ordering Code | Back to Content

• Nominal voltage	See ordering code on page 3
• Power input	48 W
• Solenoid response time	
– sol. energized	...58 ms
– sol. de-energized	...39 ms
• 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)	...13.000
• Weight (1 solenoid version)	5.2 kg
(2 solenoid version)	6.6 kg



Port function

P = Pressure

T = Tank

A & B = User

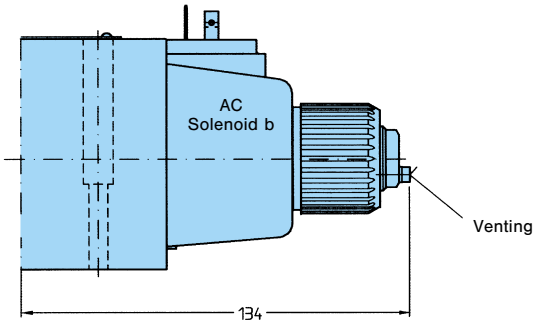
Seals for ports P, T, A, B

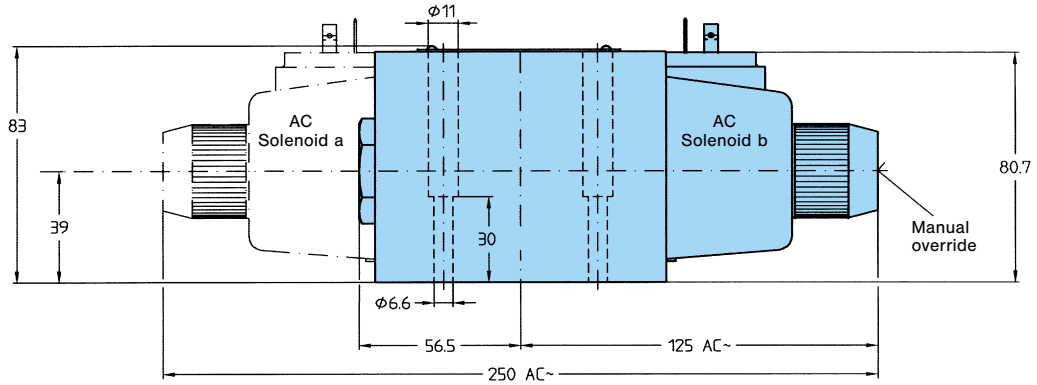
12.42 x 1.78	691-00014-0

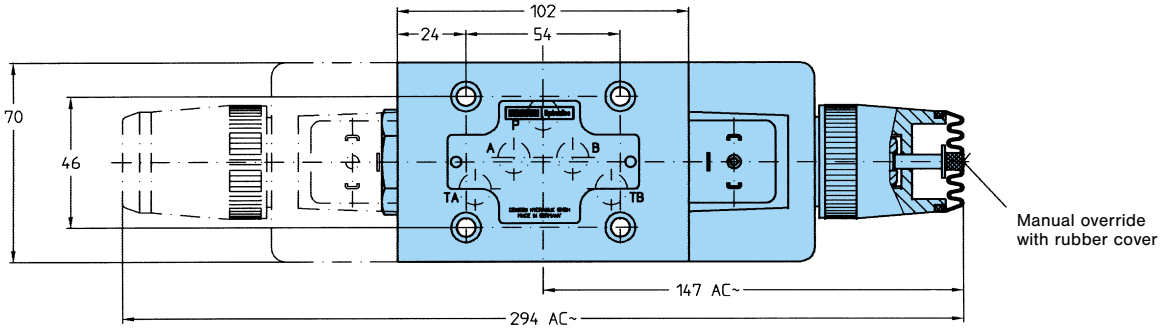
Ordering Code | Back to Content

• Nominal voltage	See ordering code on page 3
• Power input	43 W
• Holding (115 V / 60 Hz)	102 VA
• Inrush (115 V / 60 Hz)	518 VA
• Solenoid response time	
– sol. energized	...25 ms
– sol. de-energized	...18 ms
• 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)	...6.500
• Weight (1 solenoid version)	4.4 kg
(2 solenoid version)	5.2 kg

Version with Venting
(for spool types 07, 12, 64, 65, 72)
See page 11 for venting description







Port function

P = Pressure

T = Tank

A & B = User

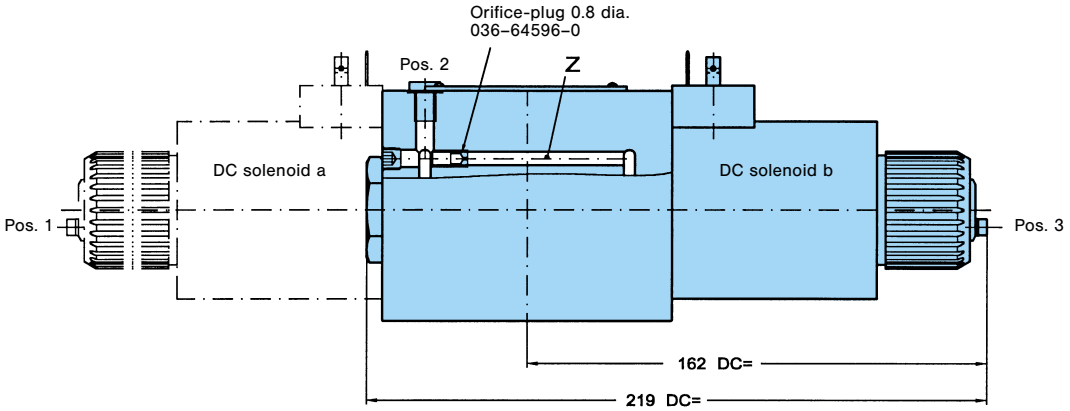
Seals for ports P, T, A, B

12.42 x 1.78	691-00014-0

GENERAL

DENISON offers this Directional Control Valve in CETOP 05 size with a "Soft Shift" option (G3). An orifice fitted in channel Z permits an increase in the standard spool response time (for body type D with DC only).

The Option G3 delivers:
– Reduced pressure shocks in venting operations.
– Reduced system noise during spool transition.
– Increased lifetime of the valve and system.



FUNCTIONAL LIMIT

With body option "D" and "Soft Shift", the flow rating of the valve is reduced by approximately 25 % of the nominal value.

VENTING

Ensure that channel Z is filled with oil at all times (as delivered, the channel is prefilled with oil).
Trouble-free operation of the valve can only be ensured when it is properly vented during the initial installation, and in case of service.

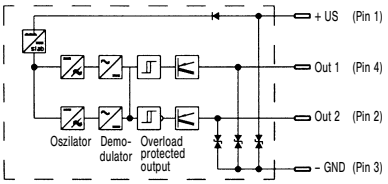
To vent this valve, please use the following procedure:
1. Remove the vent port screws pos. 1 . . . 3.
2. Fill one of the vent ports with hydraulic fluid until this runs bubble free from the other vent ports.
3. Replace the vent port screws.

CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

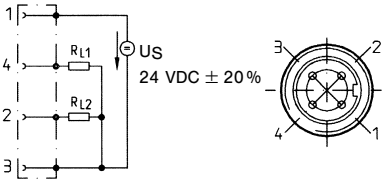
• Function	P-channel FET, contact positive
• Supply voltage U_S (full wave bridge with capacitor)	24 V ± 20 % (19.2 V...28.8 V)
• Reverse polarity protection	max. 300 V installed
• Ripple voltage	10 %
• Current consumption	approx. 40 mA
• Outputs	NC contact positive (no short circuit protection)
• Output 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 mm²
• 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



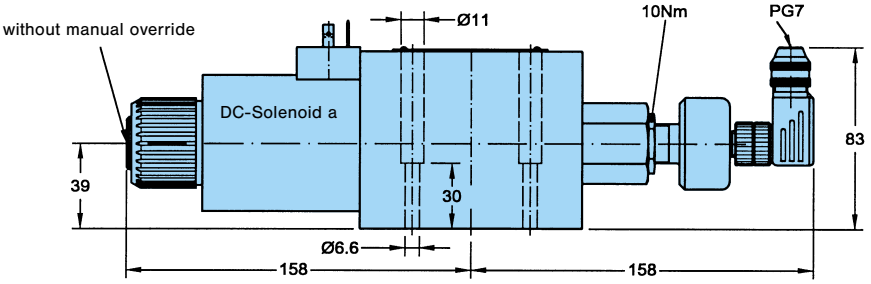
Socket connector



RL1, RL2 = e.g. coil resistance of the switch relay ≧ 60 Ω

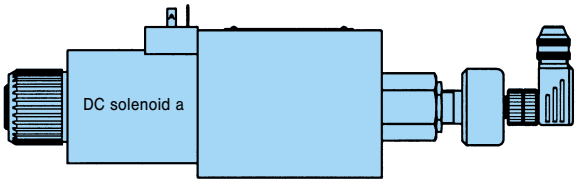
DIMENSIONS

Example: 4D02–*1**–01SA/SB
–06SA/SB



Ordering Code | Back to Content

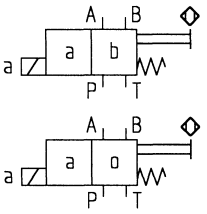
Spool Positions 01/06

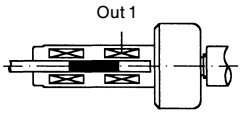


Neutral position controlled +

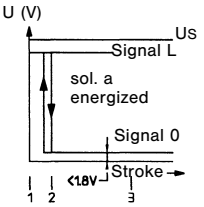
4D02–*1**–01SA

4D02–*1**–06SA





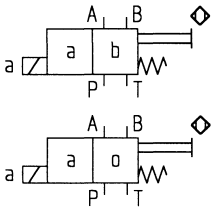
Neutr. Pos.: Out 1 = L
Sol. energized: Out 1 = 0

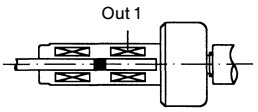


End position controlled +

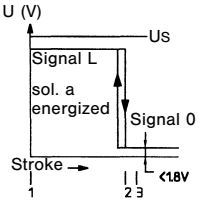
4D02–*1**–01SB

4D02–*1**–06SB



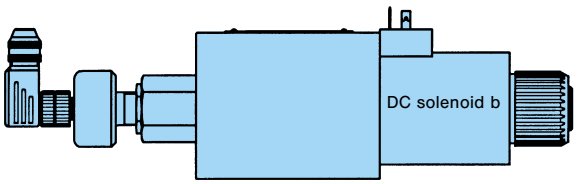


Neutr. Pos.: Out 1 = L
Sol. energized: Out 1 = 0



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

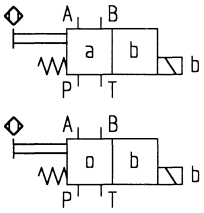
Spool Positions 02/05

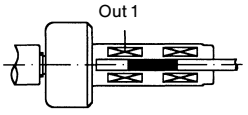


Neutral position controlled +

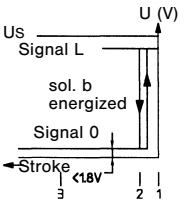
4D02–*1**–02SA

4D02–*1**–05SA





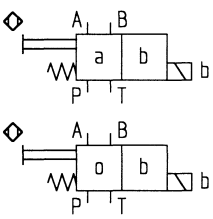
Sol. energized: Out 1 = 0
Neutr. Pos.: Out 1 = L

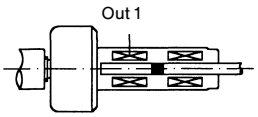


End position controlled +

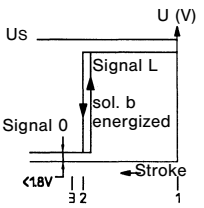
4D02–*1**–02SB

4D02–*1**–05SB





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



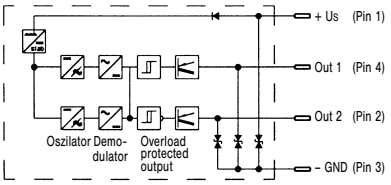
Pos. 1 = Neutral position
Pos. 2 = Switch point
Pos. 3 = End position

CHARACTERISTICS FOR THE INDUCTIVE DETECTOR

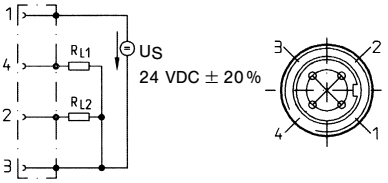
• Function	P-channel FET, contact positive
• Supply voltage U_S (full wave bridge with capacitor)	24 V ± 20 % (19.2 V...28.8 V)
• Reverse polarity protection	max. 300 V installed
• Ripple voltage	10 %
• Current consumption	approx. 40 mA
• Outputs	NC contact positive (no short circuit protection)
• Output 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 mm²
• Tensile strength of transmitting conduit	p dyn. 140 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



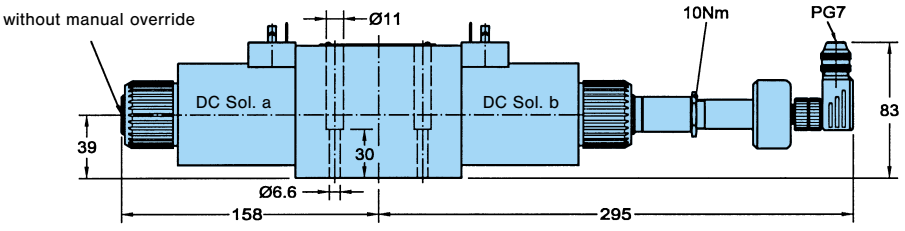
Socket connector



RL1, RL2 = e. g. coil resistance of the switch relay ≧ 60 Ω

DIMENSIONS

Example: 4D02–32**–03SA/SC



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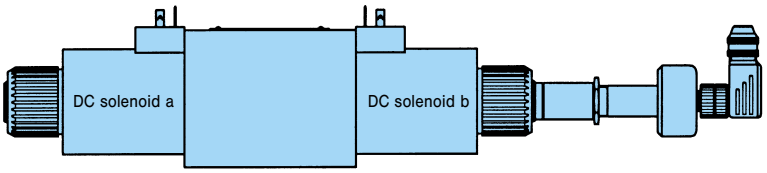
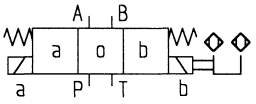
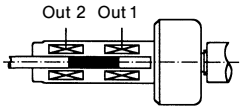
Spool Position 03



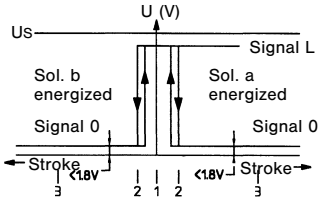
Neutral position controlled ±

4D02–32**–03SA



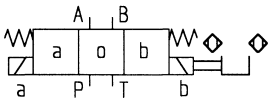


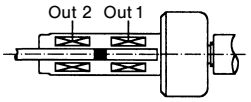
Sol. b energized: Out 2 = 0
Neutr. Pos.: Out 1 + 2 = L
Sol. a energized: Out 1 = 0



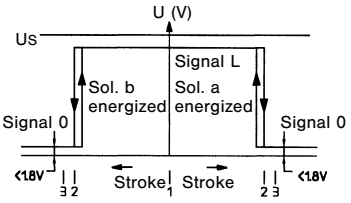
End position controlled ±

4D02–32**–03SC



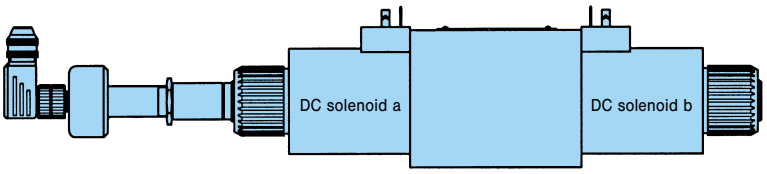


Sol. b energized: Out 2 = 0
Neutr. Pos.: Out 1 + 2 = L
Sol. a energized: Out 1 = 0



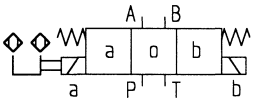
Pos. 1 = Neutral position
Pos. 2 = Switch point
Pos. 3 = End position

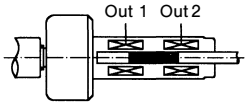
Spool Position 03



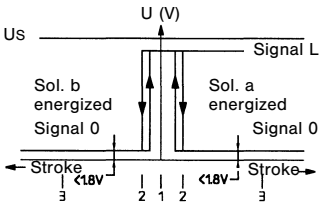
Neutral position controlled ±

4D02–32**–03TA



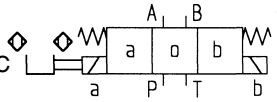


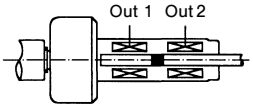
Sol. b energized: Out 1 = 0
Neutr. Pos.: Out 1 + 2 = L
Sol. a energized: Out 2 = 0



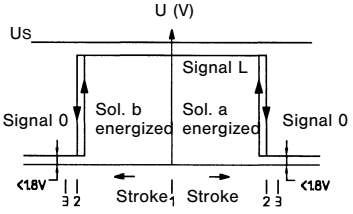
End position controlled ±

4D02–32**–03TC



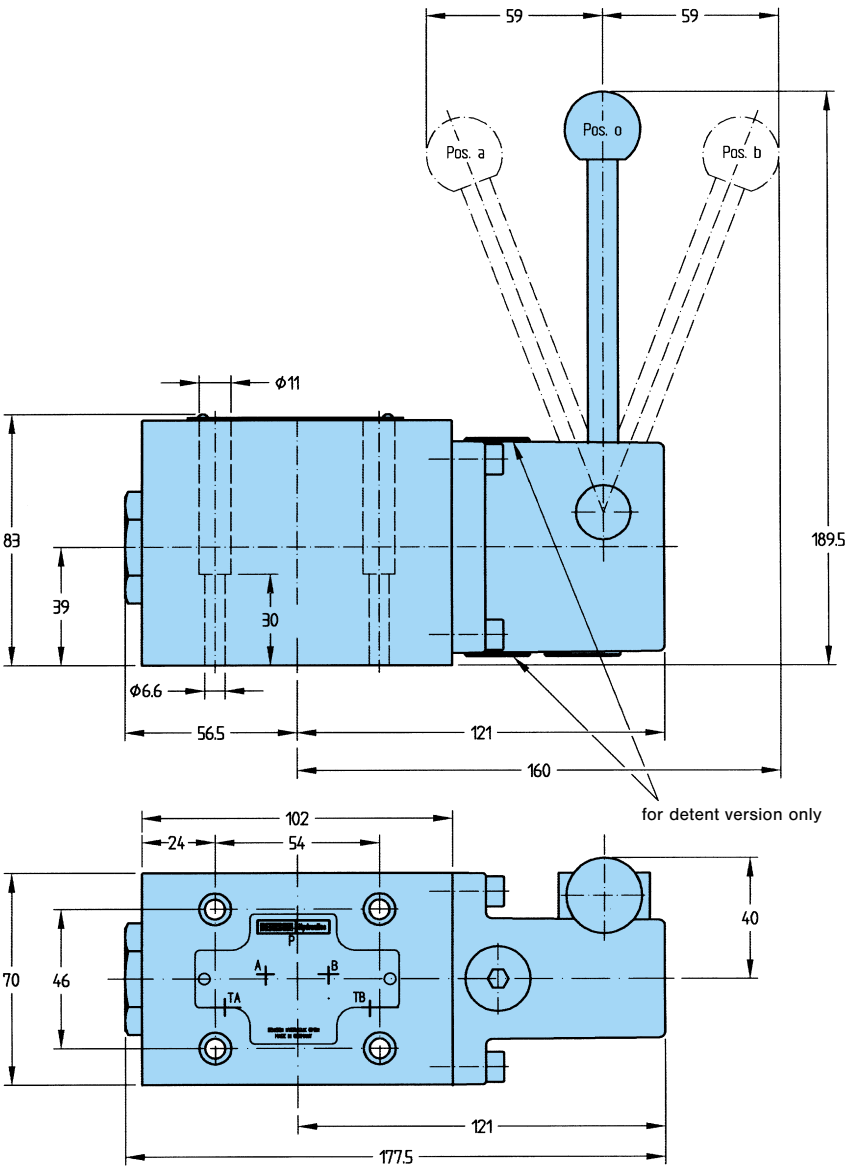


Sol. b energized: Out 1 = 0
Neutr. Pos.: Out 1 + 2 = L
Sol. a energized: Out 2 = 0



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

• Functional limits (at 315 bar)	120 l/min for spools 01, 03, 08 100 l/min for spools 07, 11, 51 60 l/min for spool 12
• Max. tank pressure	160 bar
• Operating force	30 N
• Weight	5.2 kg



Port function

P = Pressure

T = Tank

A & B = User

Seals for ports P, T, A, B

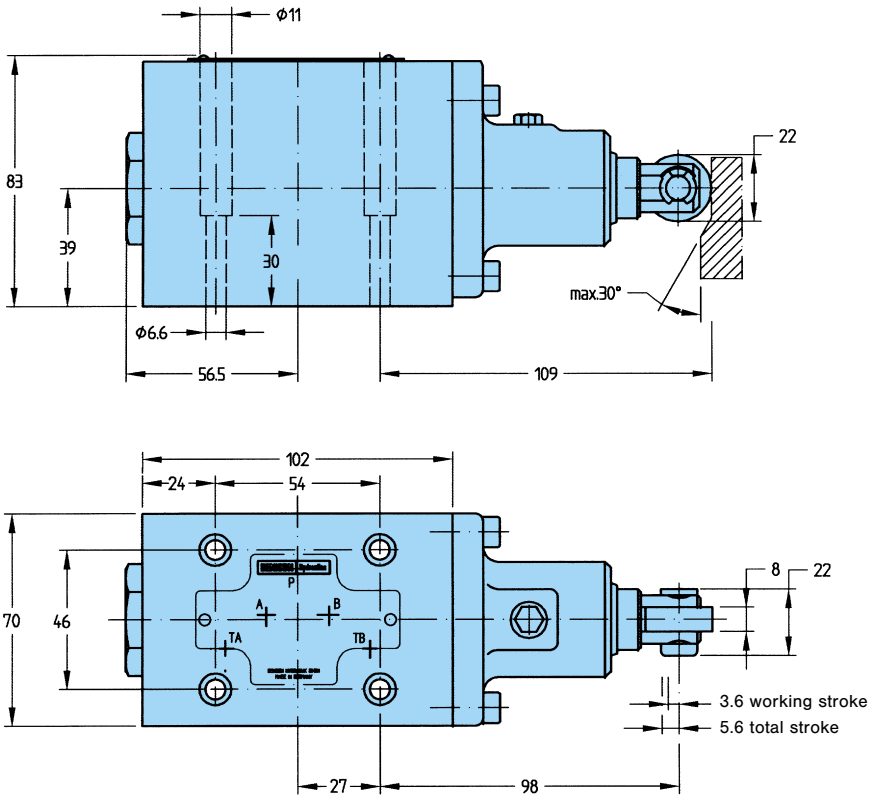
12.42 x 1.78	691-00014-0

- Functional limit (at 315 bar)
  120 l/min for spools 01, 03, 08
  100 l/min for spools 07, 11, 12, 51
- Operating force F(N) [1]

		at tank pressure 0 bar			at tank pressure 60 bar		
		neutral	working stroke	total stroke	neutral	working stroke	total stroke
at operating pressure	100 bar	80 N	215 N	360 N	155 N	290 N	435 N
	200 bar	80 N	255 N	360 N	155 N	330 N	435 N
	315 bar	80 N	295 N	360 N	155 N	370 N	435 N

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

- Max. tank pressure 160 bar
- Weight 4.4 kg



Port function

P = Pressure

T = Tank

A & B = User

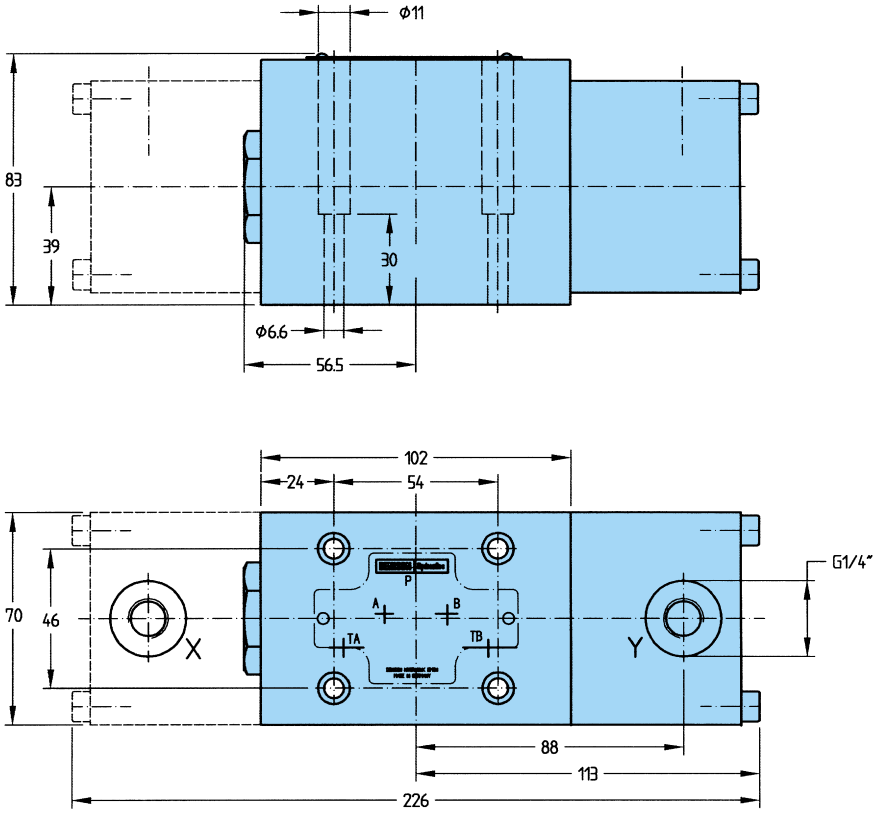
Seals for ports P, T, A, B

12.42 x 1.78	691-00014-0

• Functional limit (at 315 bar)	140 l/min for spool 46
	100 l/min for spools 01, 02, 09, 10, 11, 51
	80 l/min for spools 03, 08, 0M, 0T, AR
	60 l/min for spools 07, 55, 56, 72
	30 l/min for spool 12
	Note: See curves on page 8 for functional limits below 315 bar
• 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	8.1 cm^3
• Response time [1])	
– on	80 . . . 200 ms
– off	120 . . . 200 ms

[1]) depending on pilot pressure and pipe length

• Weight	
– operated one side	5.3 kg
– operated both sides	7.0 kg



Port function

P = Pressure

T = Tank

A & B = User

X & Y = Pilot ports

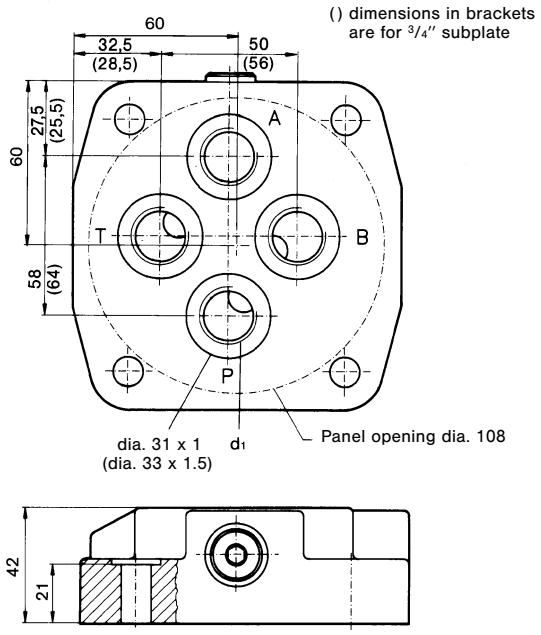
Seals for ports P, T, A, B

12.42 x 1.78	691-00014-0

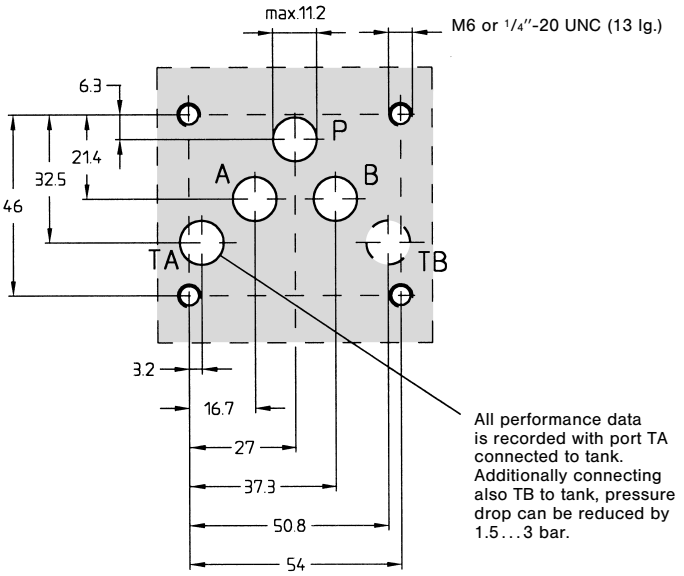
Ordering Code | Back to Content

Mounting configuration conform to ISO 4401

Subplate



Mounting Configuration



Block mounting face

Flatness 0.001 mm / 100 mm length

Surface finish 0.8

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

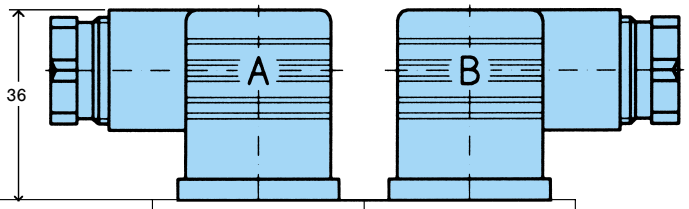
4 mounting screws	Order-No.
M 6 x 40, DIN 912; 12.9	361-08244-8
or	
1/4"-20 UNC x 1 1/2" (SAE)	358-12200-0

Torque 15 Nm

Model-No.	Order-No.	d_1 (A, B, P, T)	Weight
SS-B-08-G 138	S26-34192-0	G 1/2"	3 kg
SS-B-12-G 138	S26-34193-0	G 3/4"	3 kg

Please note:
Mounting screws are included in subplate order.

PLUG-IN CONNECTORS CONFIRMING TO ISO 4400



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