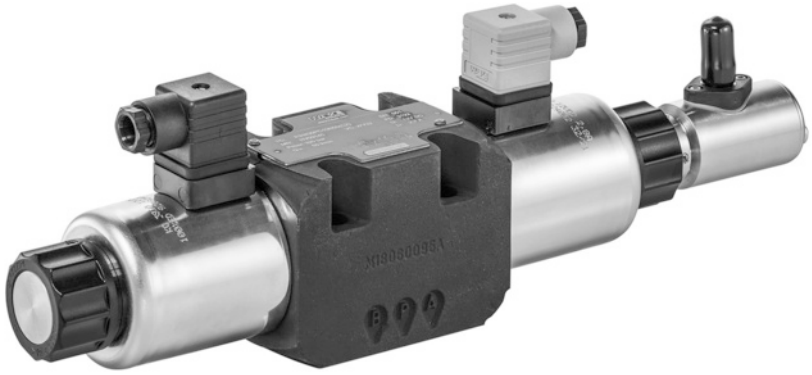
Proportional 4/2- and 4/3-way directional spool valve type POL, PRL, PIL

Product documentation

Operating pressure p_{max}:	350 bar
Flow rate Q_{max}:	100 l/min



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06-2024-1.1 en

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Table of Contents

1 Overview of proportional 4/2- and 4/3-way directional spool valve type POL, PRL, PIL....4

2 Available versions....5
2.1 Basic type....5
2.2 Circuit symbol....7
2.3 Size....9
2.4 Solenoid voltage and connector....9
2.5 Flow rate....10

3 Parameters....11
3.1 General data....11
3.2 Pressure and volumetric flow....12
3.3 Weight....12
3.4 Characteristic lines....13
3.5 Electrical data....15

4 Dimensions....19
4.1 Single valve without displacement transducer type POL....19
4.2 Single valve with displacement transducer type PRL and centre-position signal type PIL....27
4.3 Hole pattern of the base plate....36

5 Installation, operation and maintenance information....38
5.1 Intended use....38
5.2 Assembly information....38
5.3 Operating instructions....38
5.4 Maintenance information....39

6 Other information....40
6.1 Accessories, spare and individual parts....40

1 Overview of proportional 4/2- and 4/3-way directional spool valve type POL, PRL, PIL

Proportional directional spool valves are a type of directional valve. They control the direction of movement and the velocity of individual or multiple hydraulic consumers actuated simultaneously. Control is infinitely adjustable.

The directional spool valve type POL, PRL and PIL is a 4/2- or 4/3-way directional spool valve with standard connection pattern NG 6 (CETOP 3) and NG 10 (CETOP 5). It is directly actuated and proportionally activated.

The directional spool valve is available for manifold mounting. Intended applications include industrial hydraulics, in particular machine tools.



Proportional 4/2-way and 4/3-way directional spool valve type POL, PRL, PIL

Features and advantages

- High flexibility by means of a variety of circuit symbols
- Directly and proportionally controlled
- Good resolution
- Low hysteresis through integrated displacement transducer

Applications

- Hydraulic power packs
- Industrial hydraulics

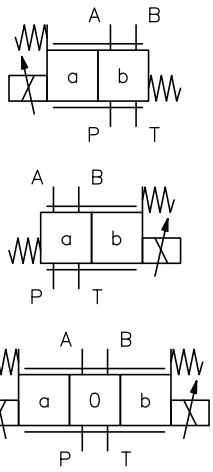
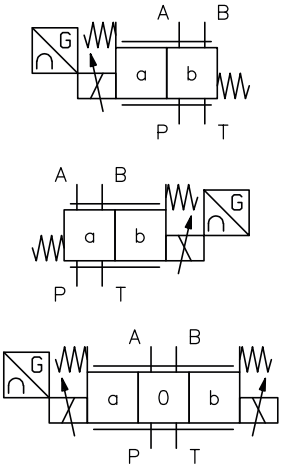
2 Available versions

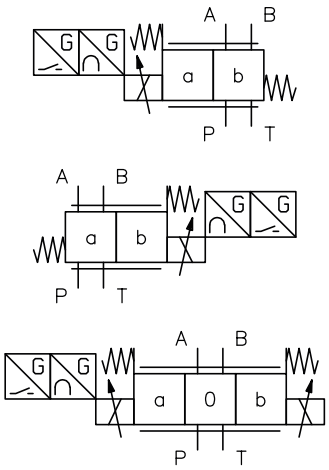
Ordering example

PRL | 600 | PC06 | P | 18

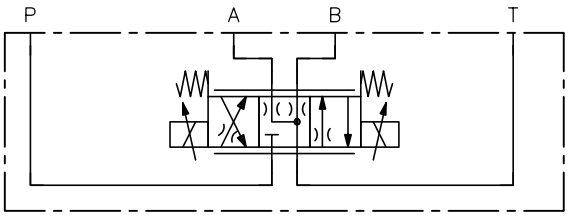
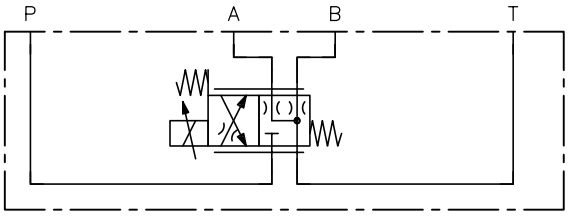
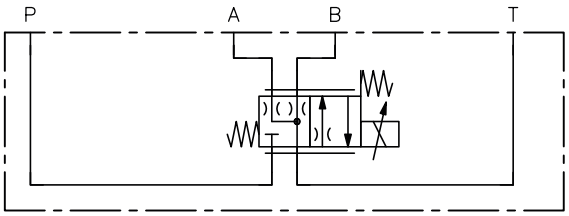
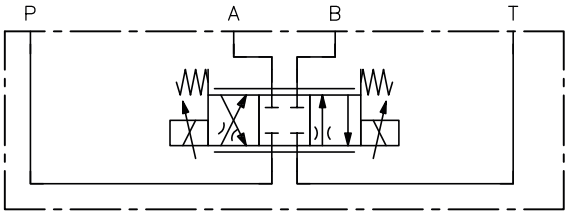
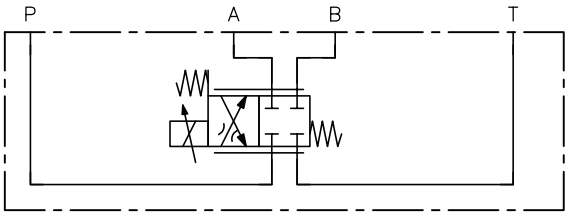
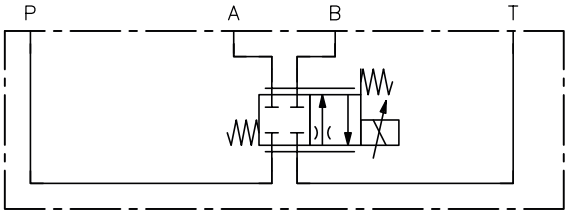
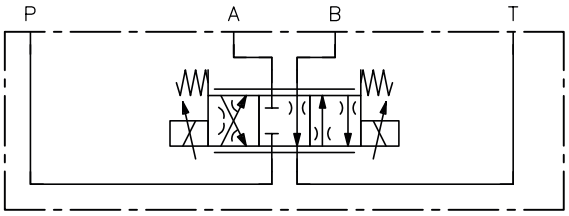
- 18 → 2.5 "Flow rate"
- P → 2.4 "Solenoid voltage and connector"
- PC06 → 2.3 "Size"
- 600 → 2.2 "Circuit symbol"
- PRL → 2.1 "Basic type"

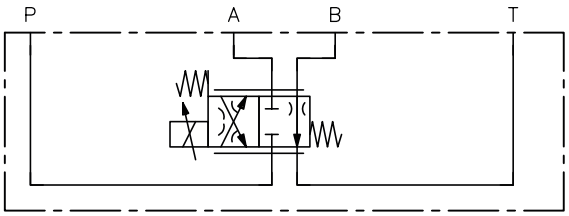
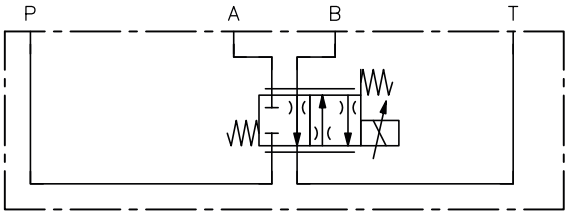
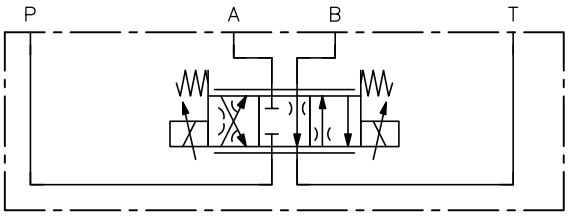
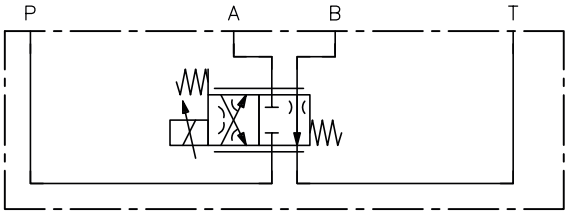
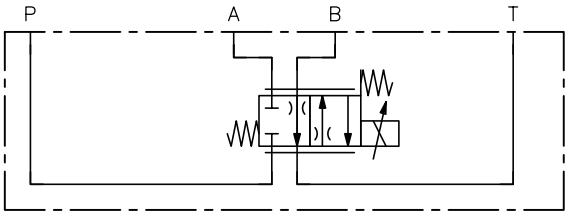
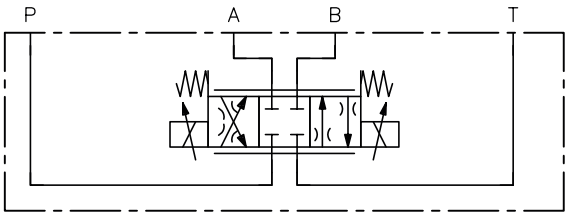
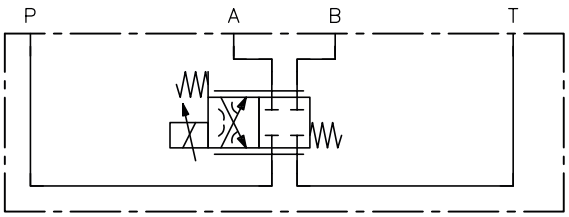
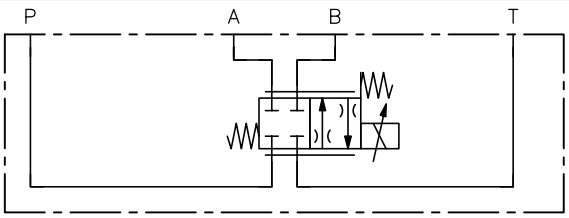
2.1 Basic type

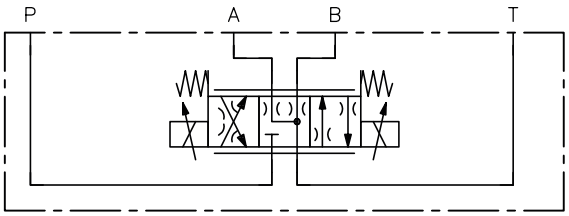
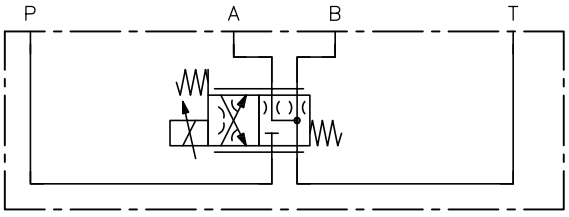
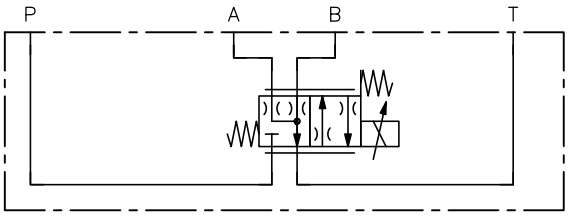
Type	Designation	Circuit symbol
POL	Proportional directional spool valve without displacement transducer	
PRL	Proportional directional spool valve with displacement transducer	

Type	Designation	Circuit symbol
PIL	Proportional directional spool valve with displacement transducer and centre-position signal	

2.2 Circuit symbol

Coding	Description	Circuit symbol
100	4/3 directional spool valve ▪ Neutral position: A, B → T throttled ▪ a-position: P → B throttled ▪ b-position: P → A throttled	
110	4/2 directional spool valve ▪ a-position: P → B throttled ▪ Neutral position: A, B → T throttled	
120	4/2 directional spool valve ▪ Neutral position: A, B → T throttled ▪ b-position: P → B throttled	
200 *	4/3 directional spool valve ▪ Neutral position: All ports throttled ▪ a-position: P → B throttled ▪ b-position: P → A throttled	
210 *	4/2 directional spool valve ▪ a-position: P → B throttled ▪ Neutral position: P → All ports throttled	
220 *	4/2 directional spool valve ▪ Neutral position: All ports throttled ▪ b-position: P → A throttled	
400	4/3 directional spool valve ▪ Neutral position: B → T throttled ▪ a-position: P → B and A → T throttled ▪ b-position: P → A and B → T throttled	

Coding	Description	Circuit symbol
410	4/2 directional spool valve ▪ a-position: P → B and A → T throttled ▪ Neutral position: B → T throttled	
420	4/2 directional spool valve ▪ Neutral position: B → T throttled ▪ b-position: P → A and B → T throttled	
500	4/3 directional spool valve ▪ Neutral position: B → T throttled ▪ a-position: P → B and A → T throttled ▪ b-position: P → A throttled	
510	4/2 directional spool valve ▪ a-position: P → B and A → T throttled ▪ Neutral position: B → T throttled	
520	4/2 directional spool valve ▪ Neutral position: B → T throttled ▪ b-position: P → A throttled	
600	4/3 directional spool valve ▪ Neutral position: All ports throttled ▪ a-position: P → B and A → T throttled ▪ b-position: P → A and B → T throttled	
610	4/2 directional spool valve ▪ a-position: P → B and A → T throttled ▪ Neutral position: All ports throttled	
620	4/2 directional spool valve ▪ Neutral position: All ports throttled ▪ b-position: P → A and B → T throttled	

Coding	Description	Circuit symbol
700 *	4/3 directional spool valve ▪ Neutral position: A, B → T throttled ▪ a-position: P → B and A → T throttled ▪ b-position: P → A and B → T throttled	
710 *	4/3 directional spool valve ▪ a-position: P → B and A → T throttled ▪ Neutral position: A, B → T throttled	
720 *	4/2 directional spool valve ▪ Neutral position: A, B → T throttled ▪ b-position: P → A and B → T throttled	

* Only available in conjunction with sizes **PC06, PC10**, see Chapter 2.3, "Size"

2.3 Size

Coding	Flow rate Q_{max} (l/min)	Pressure p_{max} (bar)	
		P, A, B	T
PC06	36	350	180
P08	40	350	180
PC10	100	320	180

NOTICE
Maximum pressure difference between two ports is 100 bar. For higher pressure differences, a 2- or 3-way pressure compensator must be installed in the supply line. The pressure compensator is available upon request.

2.4 Solenoid voltage and connector

Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)
P	EN 175 301-803 A ▪ with male connector (MSD 3-309 as per D 7163)	24 V DC	IP 65
N	EN 175 301-803 A ▪ with male connector (MSD 3-309 as per D 7163) Only for size **PC06**	12 V DC	IP 65

2.5 Flow rate

Coding	Flow rate Q_{max} (l/min)
Size PC06	
06	6
09	9
12	12
18	18
24	24
30	30
36	36
Size P08	
08	8 *
12	12
18	18 *
25	25
30	30 *
40	40
Size PC10	
40	40
60	60
80	80
100	100

* Only in conjunction with circuit symbol coding 500 see Chapter 2.2, "Circuit symbol"

3 Parameters

3.1 General data

Designation	4/3- or 4/2-way directional spool valve
Design	Piston spool valves, operated directly
Model	Single valve for manifold mounting
Material	▪ Housing: PC06 and PC10: cast P08: Steel ▪ Solenoid: Steel
Installation position	any; horizontally if possible
Line connection	Through holes, see Chapter 4, "Dimensions"
Ports/connections	▪ **P** = Pump ▪ **A, B** = Consumers ▪ **T** = tank
Flow direction	As per circuit symbol **NOTICE** Observe permissible pressure at T!
Hydraulic fluid	Hydraulic fluid, according to DIN 51 524 Parts 1 to 3; ISO VG 10 to 68 according to DIN ISO 3448 Viscosity range: 10 - 600 mm²/s Also suitable for biologically degradable hydraulic fluids type HEES (synthetic ester) at operating temperatures up to approx. +70°C.
Cleanliness level	**ISO 4406** 19/17/14
Temperatures	Environment: approx. -20 to +50°C, hydraulic fluid: -20 to +70°C, ensure the correct viscosity range. Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C.

3.2 Pressure and volumetric flow

Operating pressure	▪ PC06 and P08: p_{max} = 350 bar (ports P, A and B) ▪ PC10: p_{max} = 320 bar (ports P, A and B) ▪ Return pressure port T: p_{max} = 180 bar **NOTICE** Maximum pressure difference between two ports is 100 bar. For higher pressure differences, a 2- or 3-way pressure compensator must be installed in the supply line. The pressure compensator is available upon request.
Flow rate	▪ PC06: Q_{max} = 36 l/min ▪ P08: Q_{max} = 40 l/min ▪ PC10: Q_{max} = 100 l/min

3.3 Weight

POL	**4/2 directional spool valve**	
	Size	
	PC06	= 1.7 kg
	P08	= 3.0 kg
	PC10	= 4.6 kg
	4/3 directional spool valve	
	Size	
	PC06	= 2.1 kg
	P08	= 3.4 kg
	PC10	= 6.1 kg
PRL, PIL	**4/3 directional spool valve**	
	Size	
	PC06	= 2.5 kg
	P08	= 3.8 kg
	PC10	= 6.6 kg

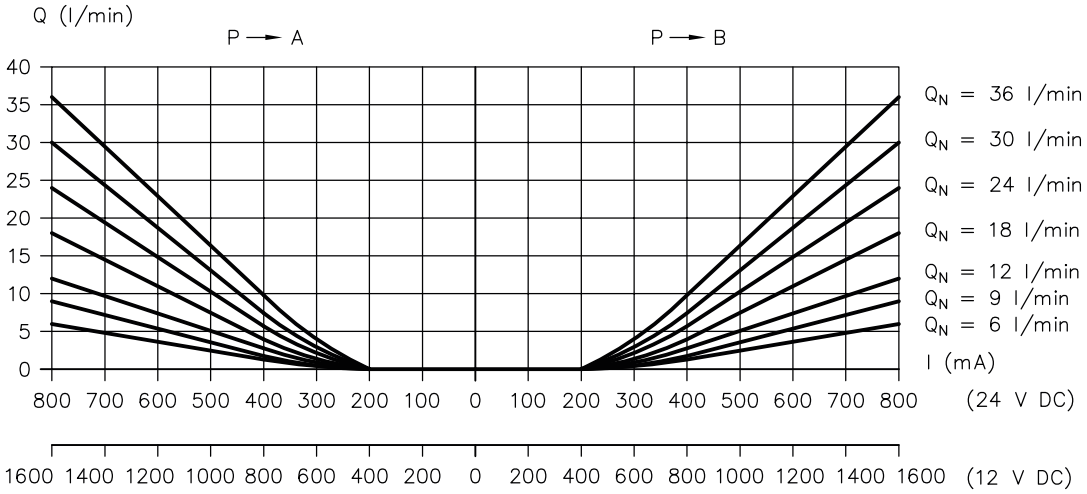
3.4 Characteristic lines

Viscosity of the hydraulic fluid approx. 35 mm²/s

Control characteristic lines for consumer flow rate

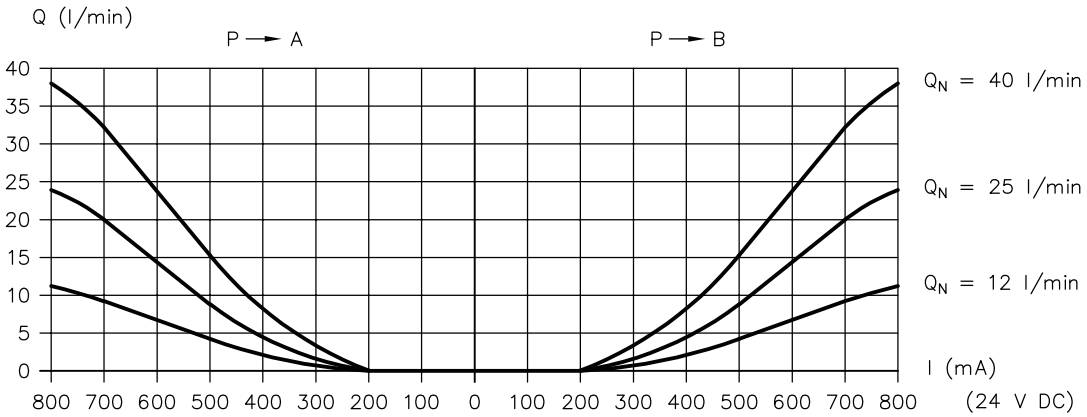
INFORMATION
Pressure difference is 5 bar per control edge.

POL..PC06, PRL..PC06, PIL..PC06



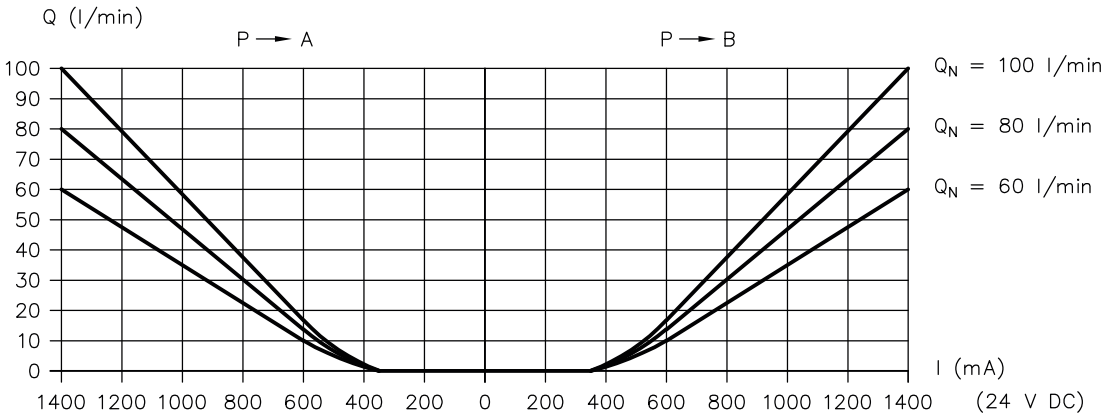
I control current (mA); Q flow rate (l/min)

POL..P08, PRL..P08, PIL..P08



I control current (mA); Q flow rate (l/min)

POL..PC10, PRL..PC10, PIL..PC10



I control current (mA); Q flow rate (l/min)

3.5 Electrical data

Proportional solenoid for electric actuation

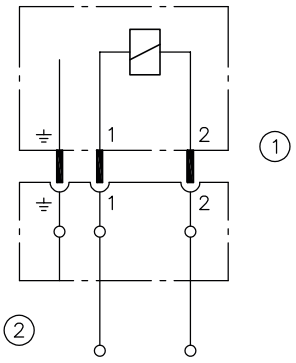
Coding		**N** PC06	**P** PC06, P08	**P** PC10
Nominal voltage		12 V DC	24 V DC	24 V DC
Permissible voltage deviation		± 20%	± 20%	± 20%
Control	**POL..PC06** **POL..P08**	▪ Classic actuation P → A: I = 0 - I_{max}, where P → B: I = 0 mA and vice versa in open loop I_{max} = 1600 mA for coding N (12 V DC) I_{max} = 800 mA for coding N (24 V DC) see Chapter 3.4, "Characteristic lines"		
	PRL..PC06 **PIL..PC06** **PRL..P08** **PIL..P08**	▪ Digital amplifier type EV2D according to D 7821 without dither ▪ Classic actuation P → A: I = 0 - I_{max}, where P → B: I = 0 mA and vice versa in closed loop I_{max} = 1600 mA for coding N (12 V DC) I_{max} = 800 mA for coding N (24 V DC) see Chapter 3.4, "Characteristic lines"		
	POL..PC10	▪ Classic actuation P → A: I = 0 - I_{max}, where P → B: I = 0 mA and vice versa in open loop I_{max} = 1400 mA for coding N (24 V DC) see Chapter 3.4, "Characteristic lines"		
	PRL..PC10 **PIL..PC10**	▪ Digital amplifier type EV2D according to D 7821 without dither ▪ Classic actuation P → A: I = 0 - I_{max}, where P → B: I = 0 mA and vice versa in closed loop I_{max} = 1400 mA for coding N (24 V DC) see Chapter 3.4, "Characteristic lines"		
Coil resistance at 20°C		5.8 Ω	21.6 Ω	13.4 Ω
Nominal power		14 W	14 W	26 W
Relative duty cycle		100%	100%	100%
Switching times	**PC06** **P08**	on = approx. 80 ms, off = approx. 25 ms		
	PC10	on = approx. 160 ms, off = approx. 100 ms		
Protection class		IP 65 (plugs mounted correctly)		

Electrical connection

- EN 175 301-803 A
- IP 65 (IEC 60529)

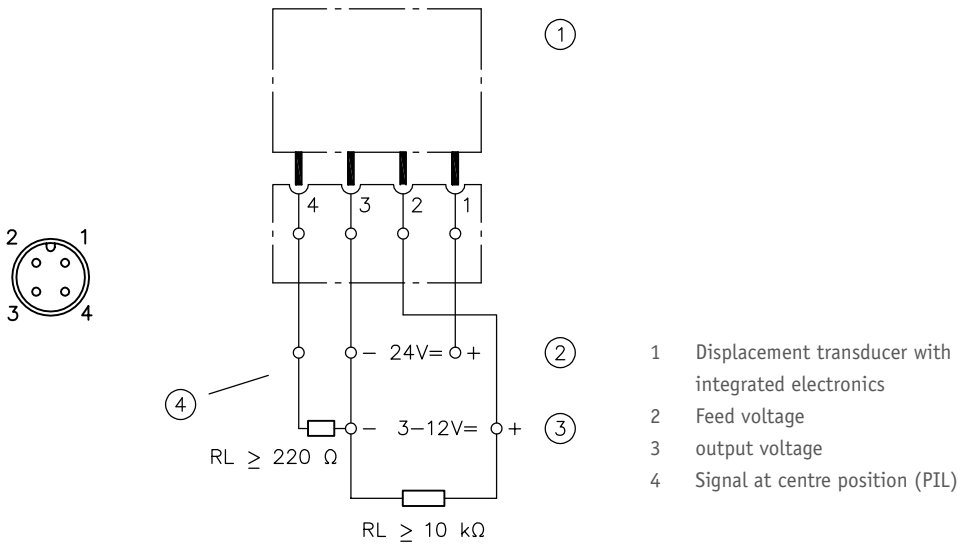


Terminal assignment for proportional solenoid



1 Proportional solenoid
2 Power supply

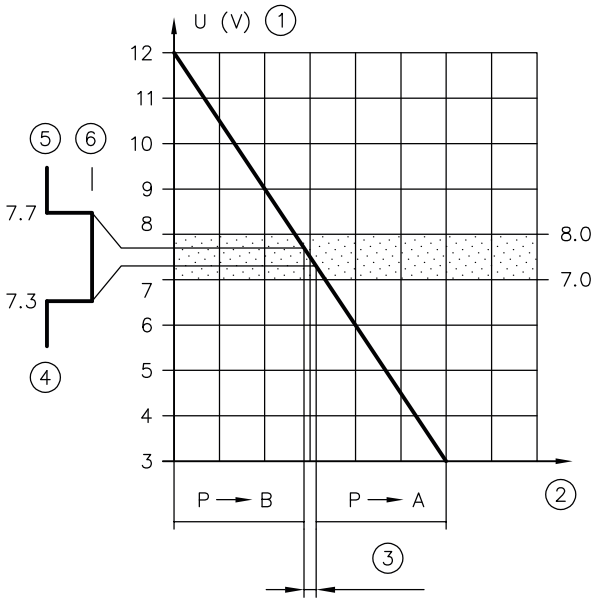
Inductive displacement transducer

Nominal voltage		24 V DC
Residual ripple of the nominal voltage		< 5%
Output voltage (linear range)		▪ P → A: 7.5 to 3 V ▪ P → B: 7.5 to 12 V
Residual ripple of the output voltage		≤ 20 mV
Output voltage load		≥ 10 kΩ
Current consumption		< 40 mA
Linearity		± 1.5%
Sensitivity	**PC06, P08**	1.5 V/mm (± 3%)
	PC10	1.25 V/mm (± 3%)
Temperature drift		≤ approx. ± 0.03%/°C
Protection class		IP 65 with mounted female connector
Connection type		M12x1
Digital centre position signal (PIN 4)		▪ Low signal: U_A = 0 V ▪ High signal: $U_A \leq U_B$ - 2 V
Load resistance		≥ 220 Ω
Switching window		▪ Upper threshold: 7.7 V ± 20 mV ▪ Lower threshold: 7.3 V ± 20 mV
Electrical connection		

1 Displacement transducer with integrated electronics
2 Feed voltage
3 output voltage
4 Signal at centre position (PIL)

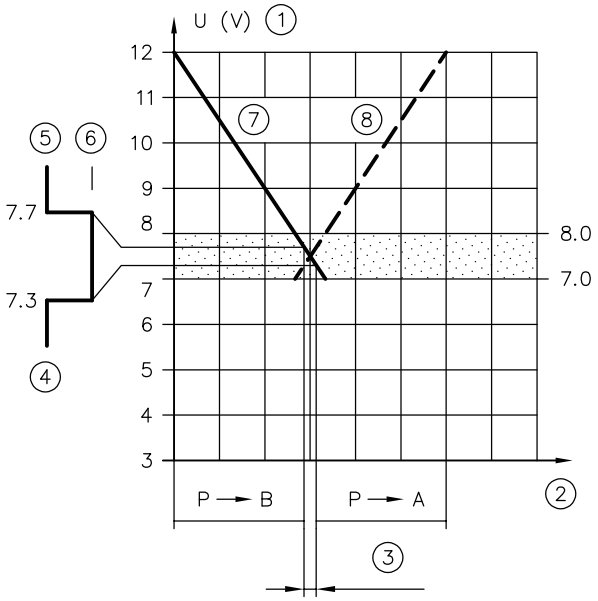
Output value

4/3-way directional spool valve



1 Displacement transducer voltage output
2 Valve stroke
3 For overlap
4 Digital signal at centre position
5 low
6 high

4/2-way directional spool valve



1 Displacement transducer voltage output
2 Valve stroke
3 For overlap
4 Digital signal at centre position
5 low
6 high
7 Circuit symbols 120, 220, 420, 520, 620, 720
8 Circuit symbols 110, 210, 410, 510, 610, 710

4 Dimensions

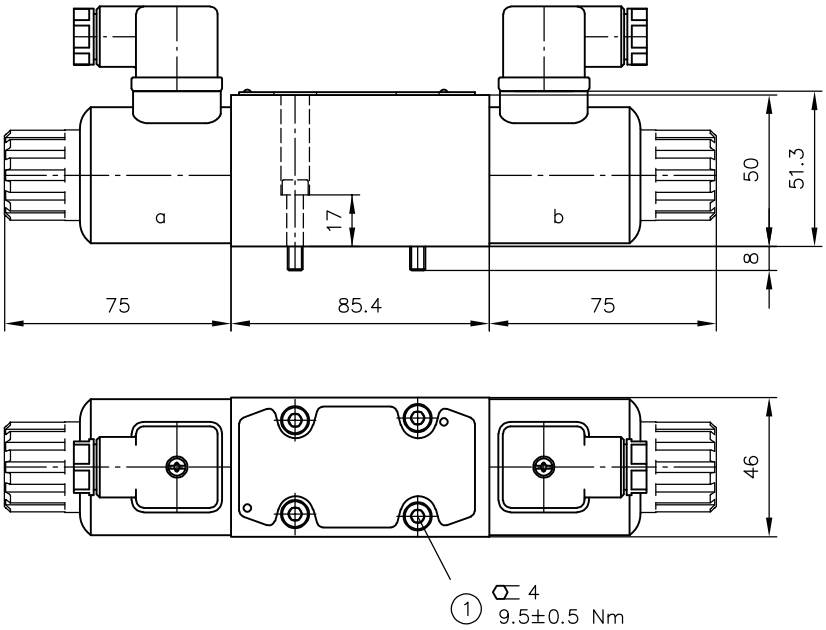
All dimensions in mm, subject to change.

4.1 Single valve without displacement transducer type POL

POL..PC06

4/3-way directional spool valve

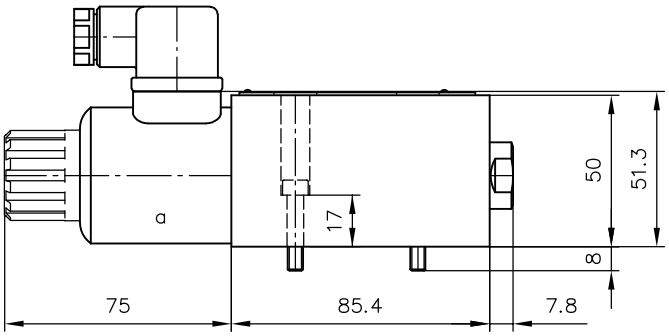
Circuit symbols **100, 200, 400, 500, 600, 700**



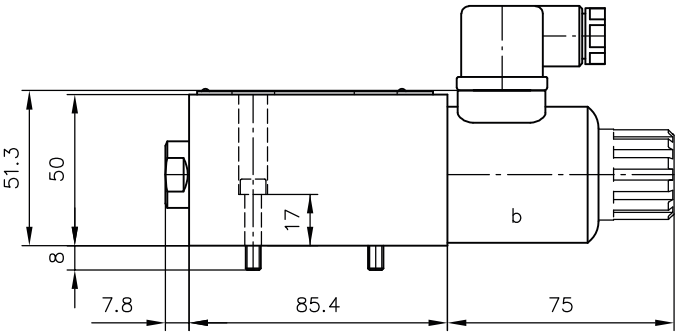
1 Cylinder screw M5x25-12.9 ISO 4762 mechanically galvanised

4/2-way directional spool valve

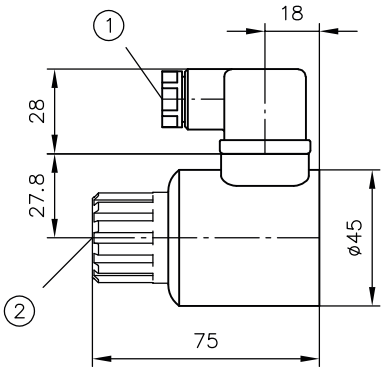
Circuit symbols **110, 210, 410, 510, 610, 710**



Circuit symbols **120, 220, 420, 520, 620, 720**

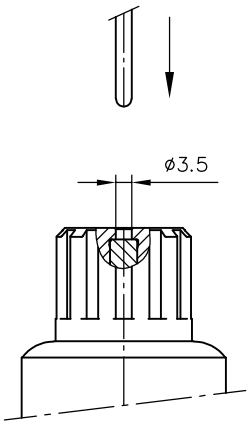


Actuation



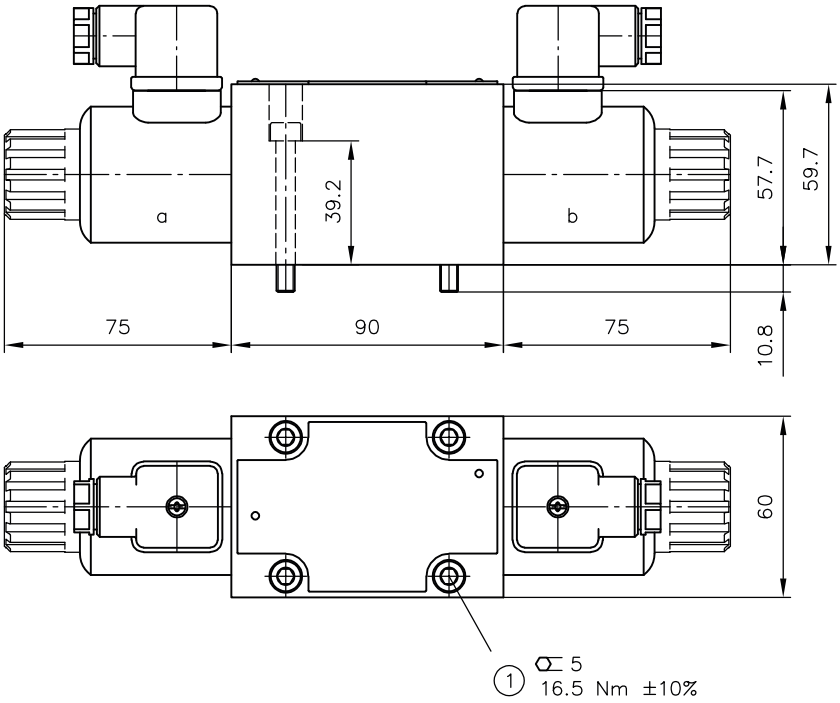
1 Cable fitting
2 Manual override

Manual override



4/3-way directional spool valve

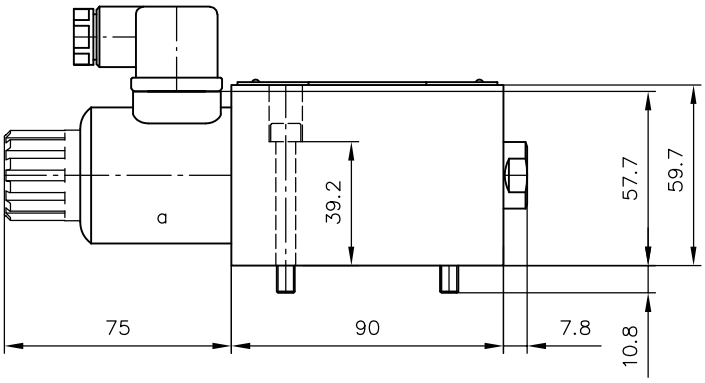
Circuit symbols **100, 400, 500, 600**



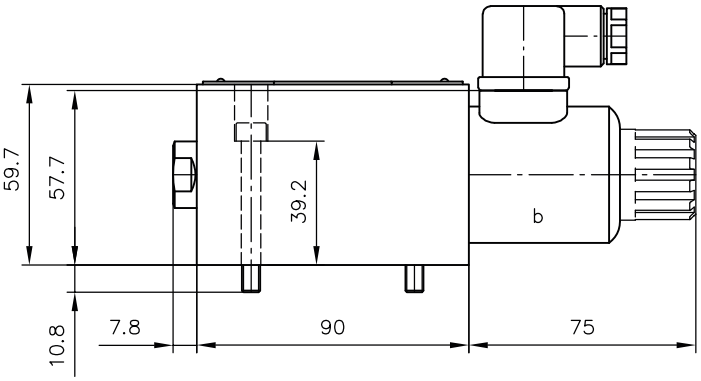
1 Cylinder screw M6x50-12.9 ISO 4762 Mechanically galvanised (not included in scope of delivery)

4/2-way directional spool valve

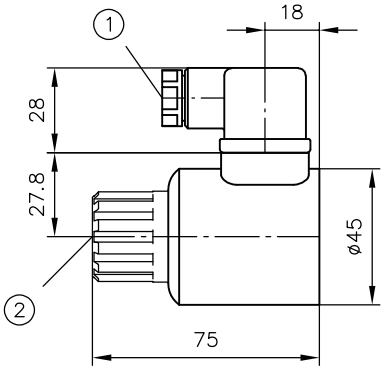
Circuit symbols **110, 410, 510, 610**



Circuit symbols **120, 420, 520, 620**

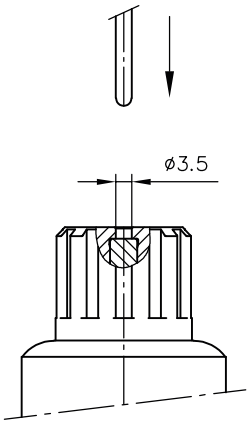


Actuation



1 Cable fitting
2 Manual override

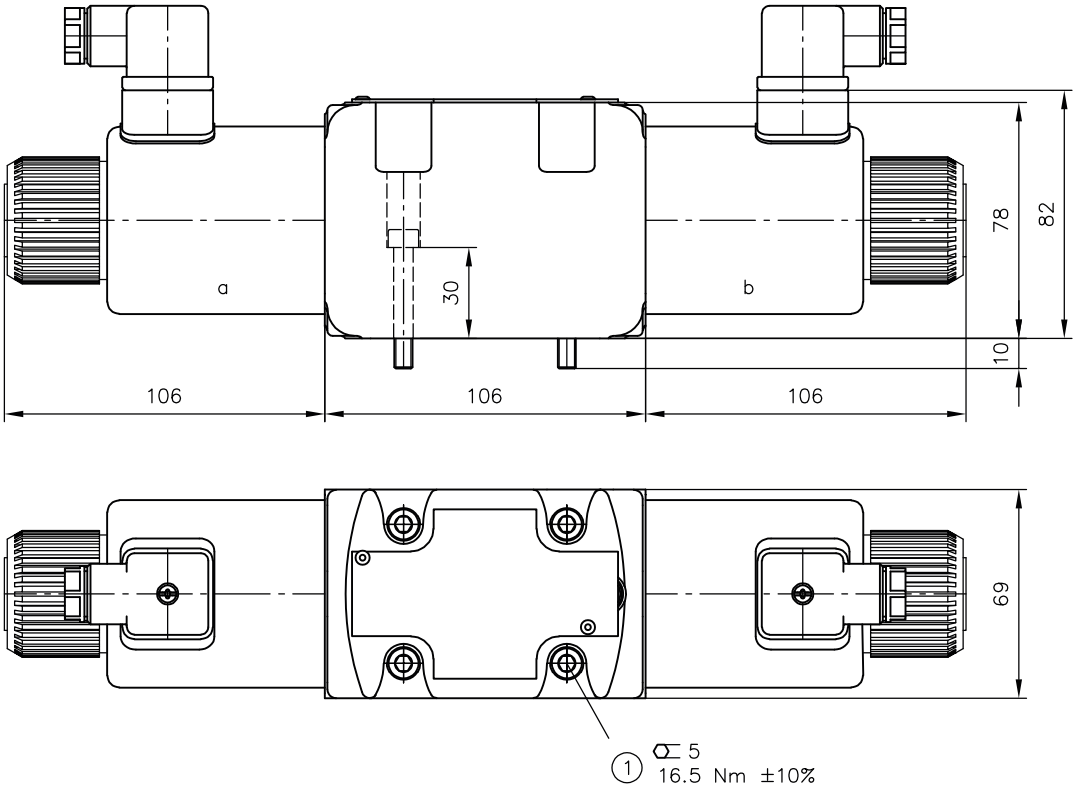
Manual override



POL..PC10

4/3-way directional spool valve

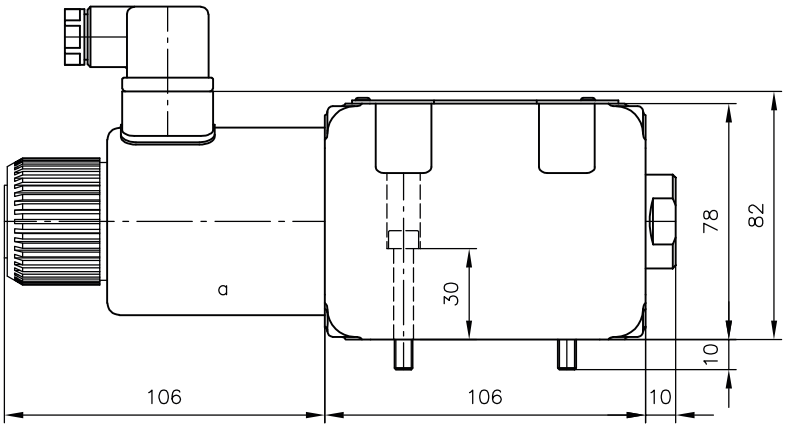
Circuit symbols **100, 200, 400, 500, 600, 700**



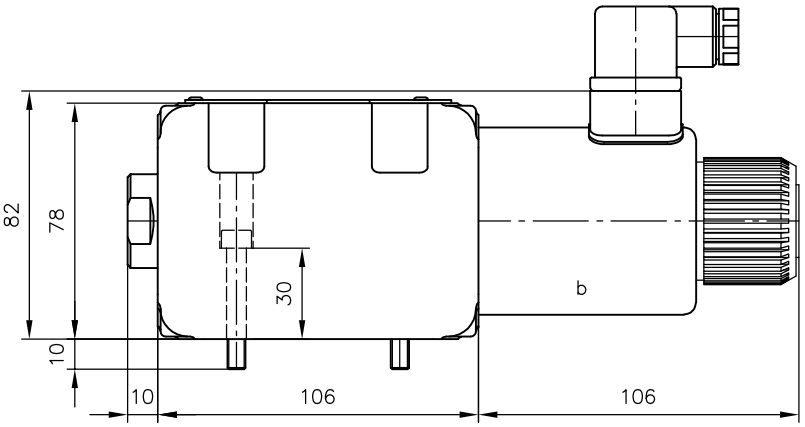
1 Cylinder screw M6x40-12.9 ISO 4762 Mechanically galvanised (not included in scope of delivery)

4/2-way directional spool valve

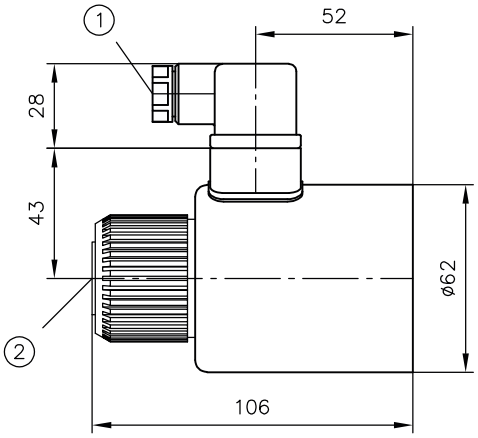
Circuit symbols **110, 210, 410, 510, 610, 710**



Circuit symbols **120, 220, 420, 520, 620, 720**

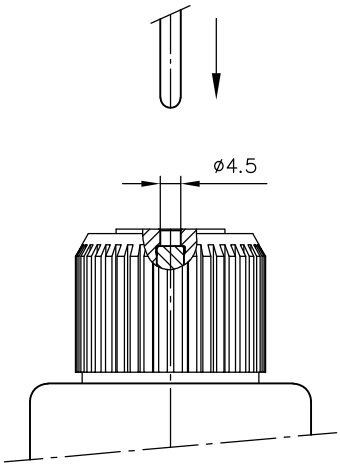


Actuation



1 Cable fitting
2 Manual override

Manual override

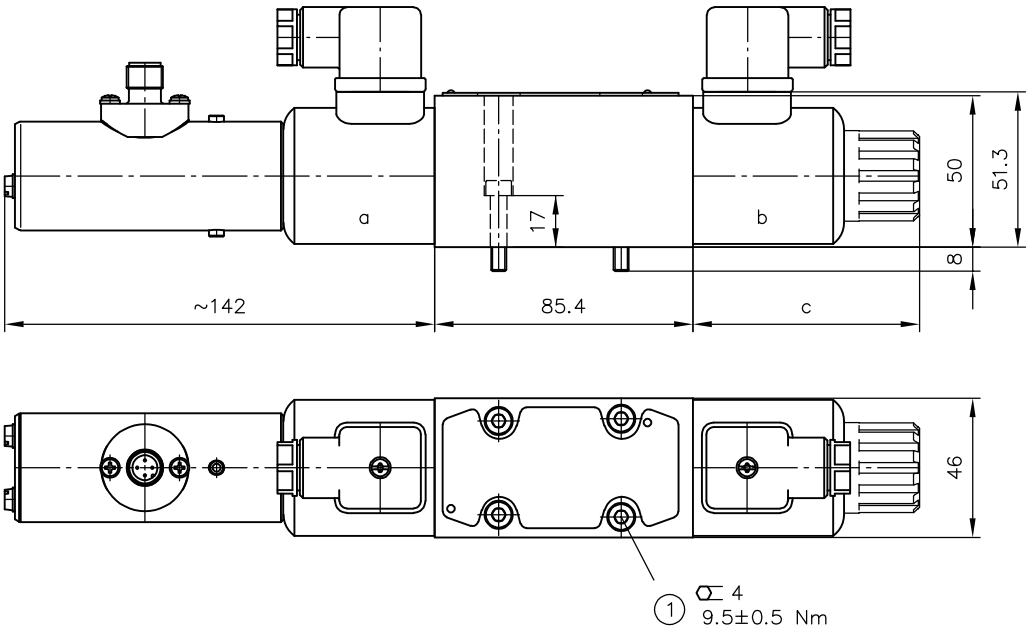


4.2 Single valve with displacement transducer type PRL and centre-position signal type PIL

PRL..PC06, PIL..PC06

4/3-way directional spool valve

Circuit symbols **100, 200, 400, 500, 600, 700**

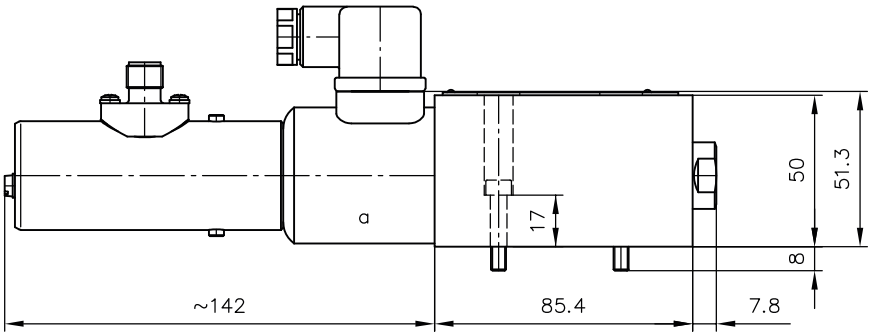


1 Cylinder screw M5x25-12.9 ISO 4762 mechanically galvanised

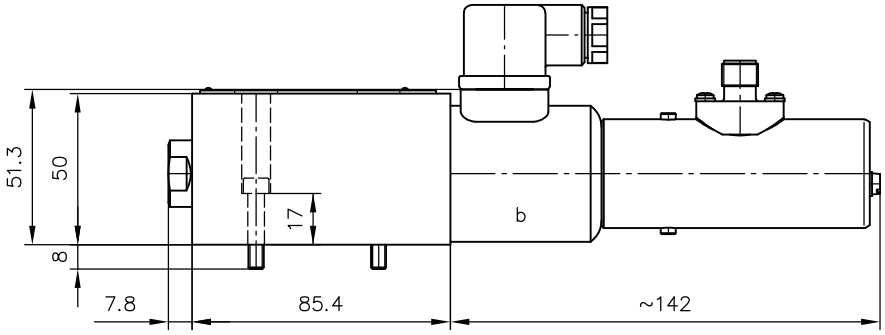
Type	c
PRL	75
PIL	78

4/2-way directional spool valve

Circuit symbols **110, 210, 410, 510, 610, 710**

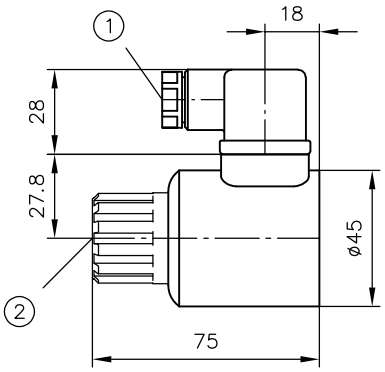


Circuit symbols **120, 220, 420, 520, 620, 720**



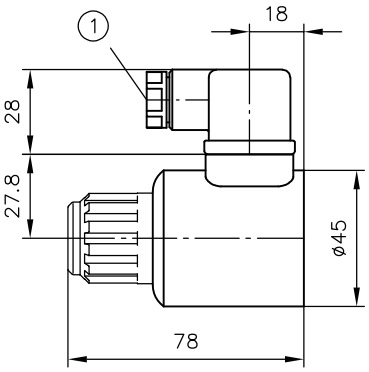
Actuation

PRL..PC06



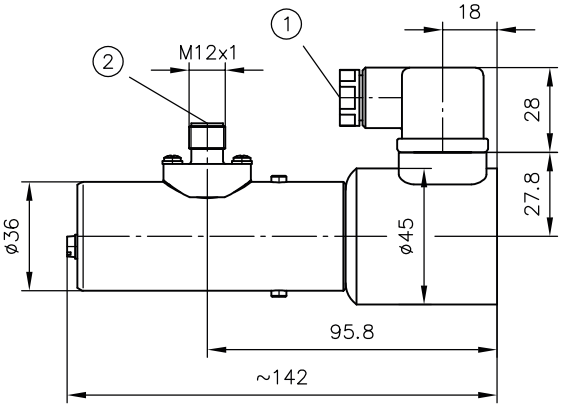
1 Cable fitting
2 Manual override

PIL..PC06



1 Cable fitting

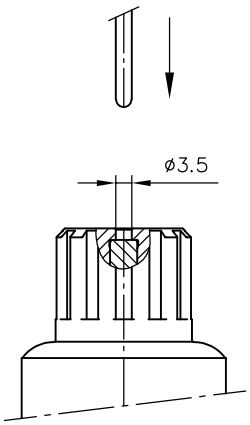
PRL..PC06, PIL..PC06



1 Cable fitting
2 Angled connector, plastic version, KC3409
Not included in scope of delivery, order separately

Manual override

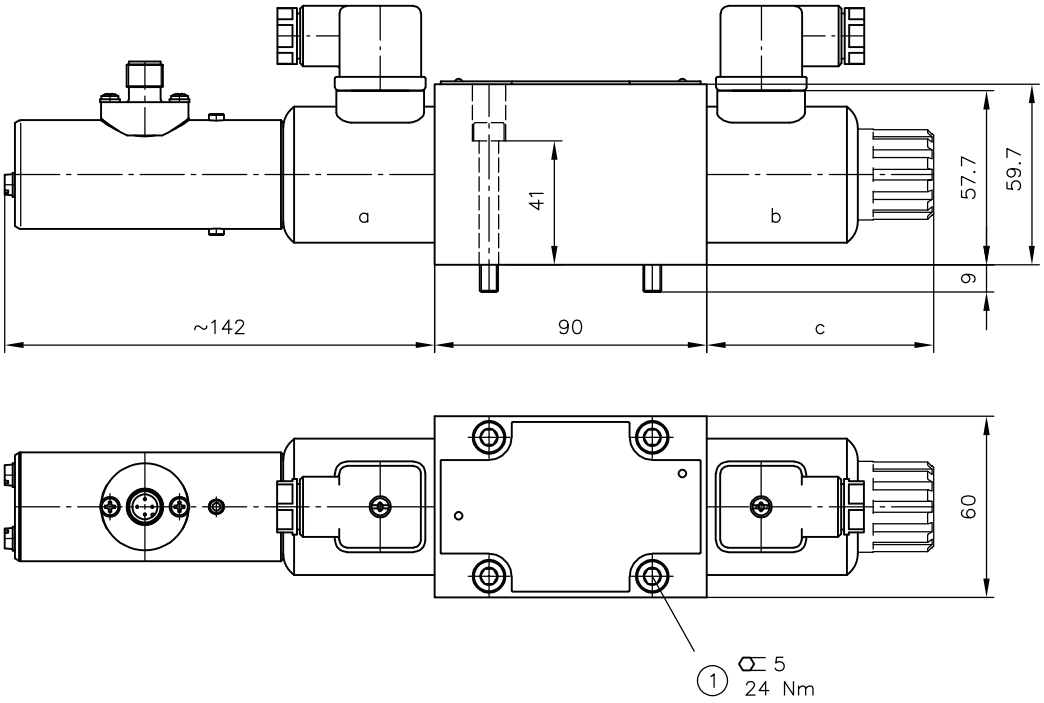
PRL..PC06



PRL..P08, PIL..P08

4/3-way directional spool valve

Circuit symbols **100, 400, 500, 600**

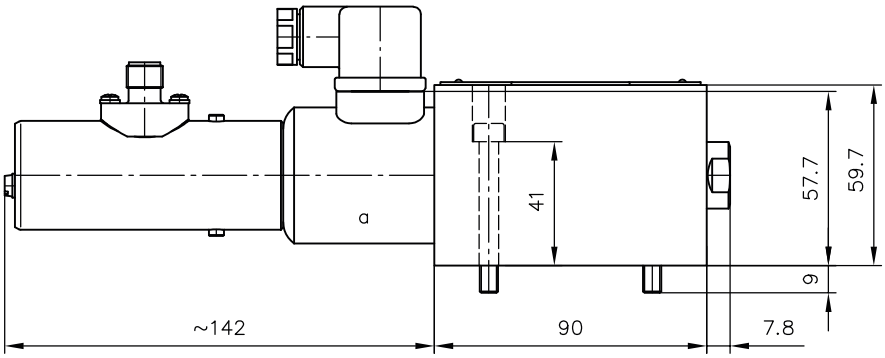


1 Cylinder screw M6x50-12.9 ISO 4762 Mechanically galvanised (not included in scope of delivery)

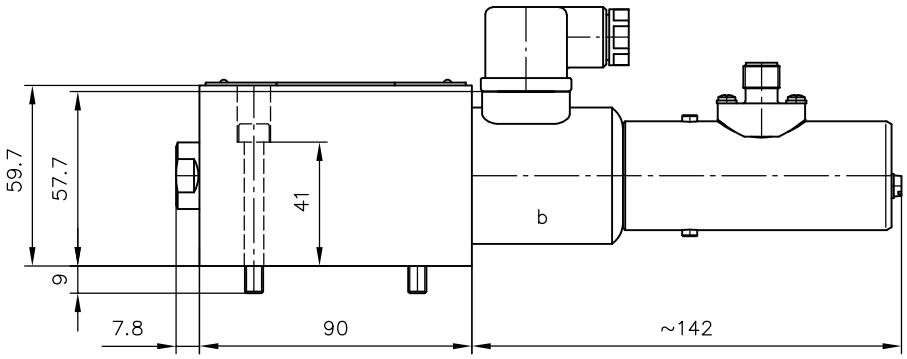
Type	c
PRL	75
PIL	78

4/2-way directional spool valve

Circuit symbols **110, 410, 510, 610**

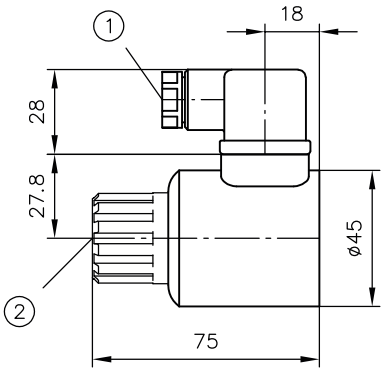


Circuit symbols **120, 420, 520, 620**



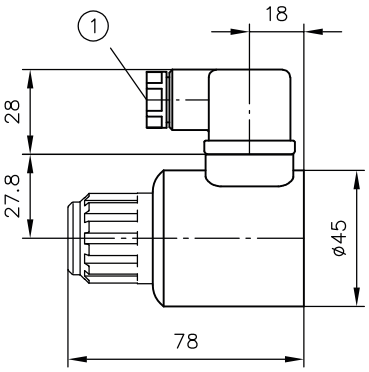
Actuation

PRL..P08



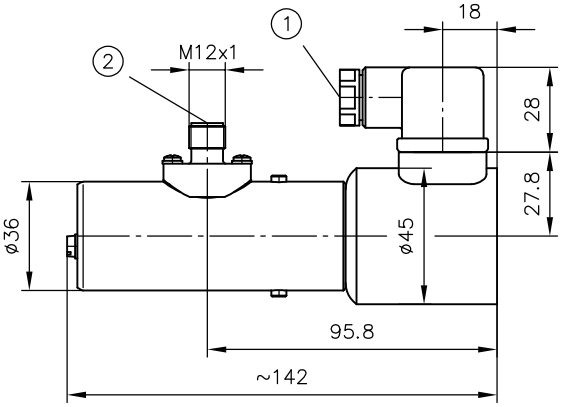
1 Cable fitting
2 Manual override

PIL..P08



1 Cable fitting

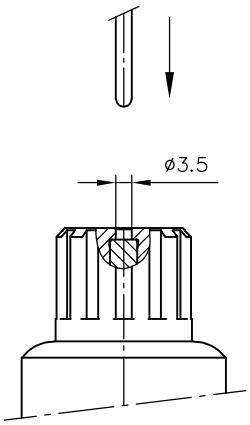
PRL..P08, PIL..P08



1 Cable fitting
2 Angled connector, plastic version, KC3409
Not included in scope of delivery, order separately

Manual override

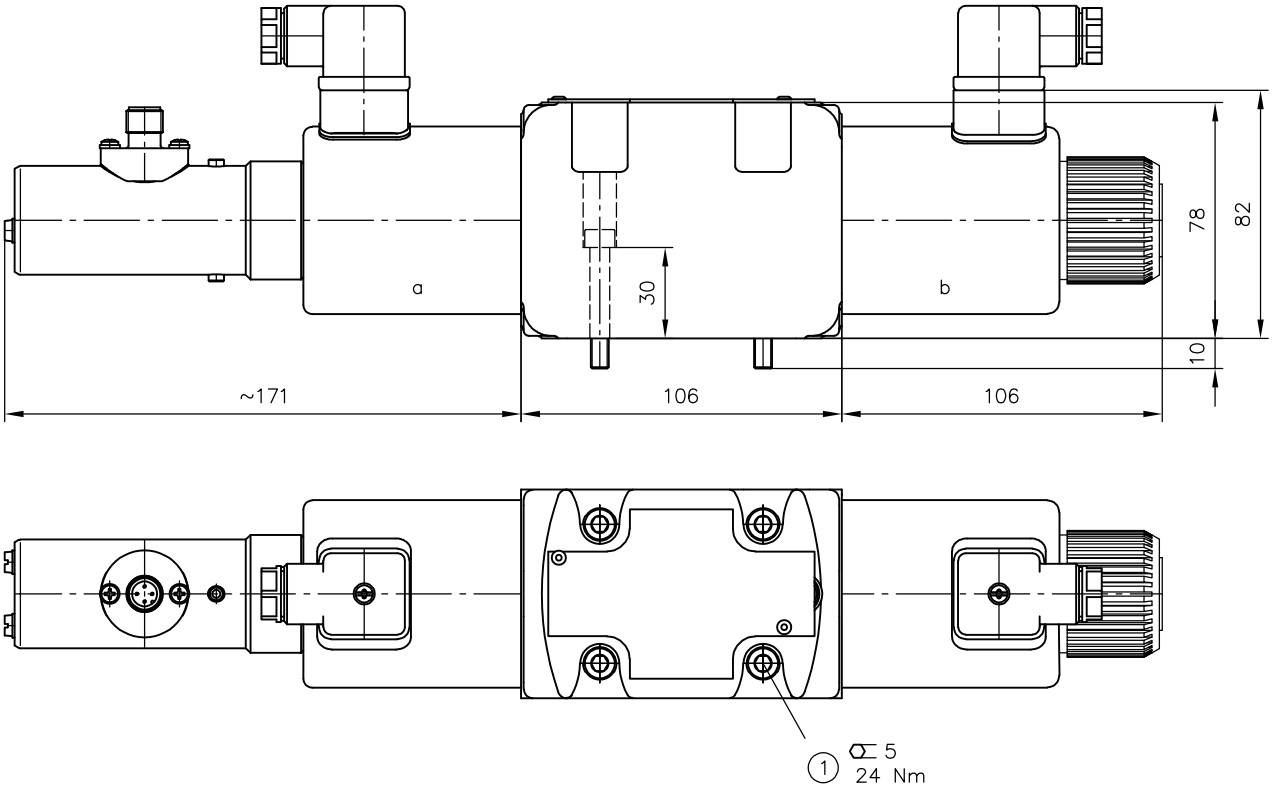
PRL..P08



PRL..PC10, PIL..PC10

4/3-way directional spool valve

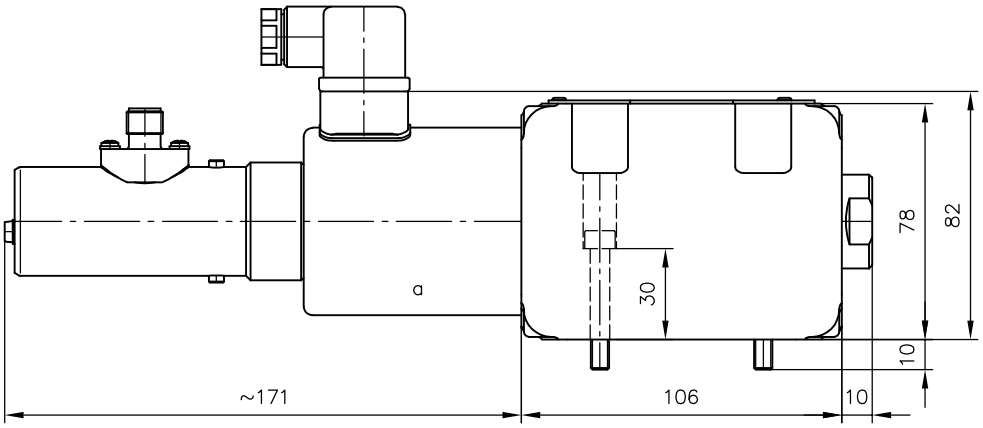
Circuit symbols **100, 200, 400, 500, 600, 700**



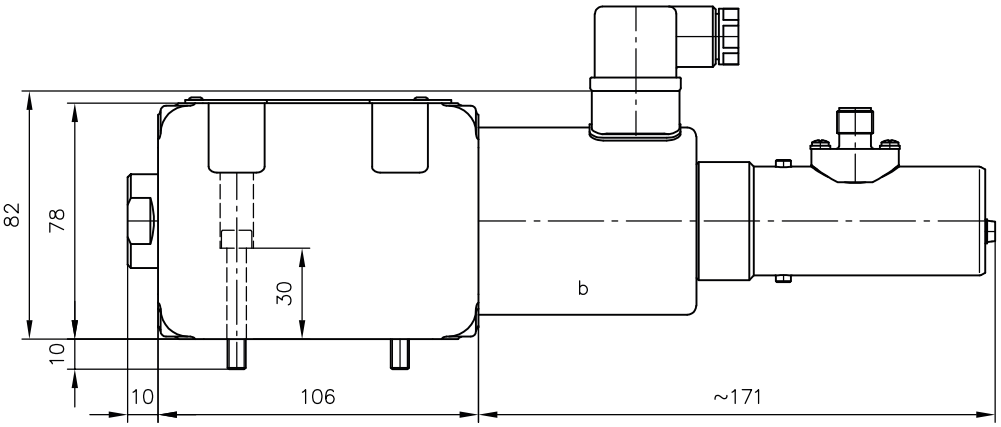
1 Cylinder screw M6x40-12.9 ISO 4762 Mechanically galvanised (not included in scope of delivery)

4/2-way directional spool valve

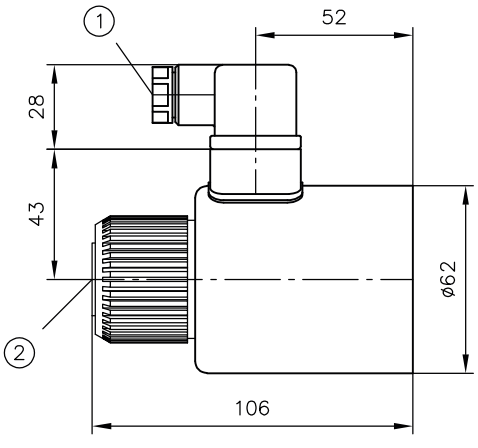
Circuit symbols **110, 210, 410, 510, 610, 710**



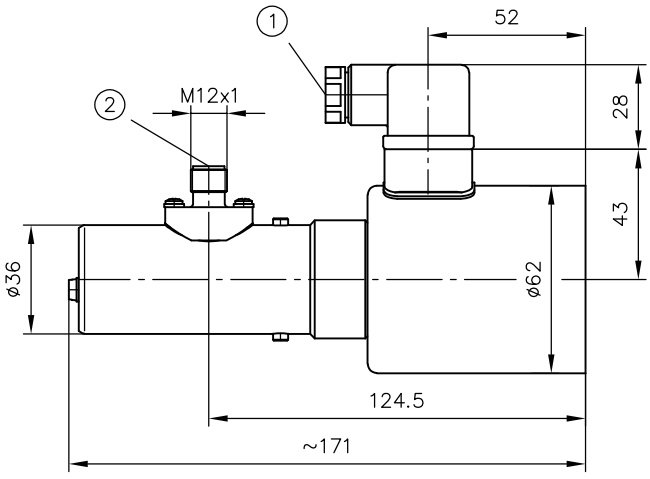
Circuit symbols **120, 220, 420, 520, 620, 720**



Actuation

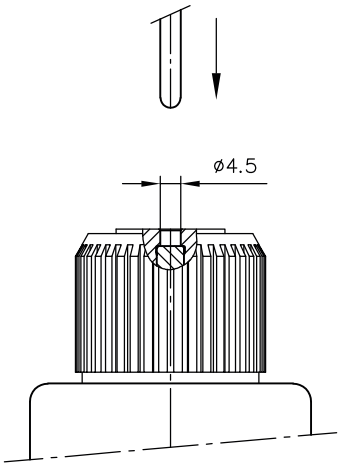


1 Cable fitting
2 Manual override



1 Cable fitting
2 Angled connector, plastic version, KC3409
Not included in scope of delivery, order separately

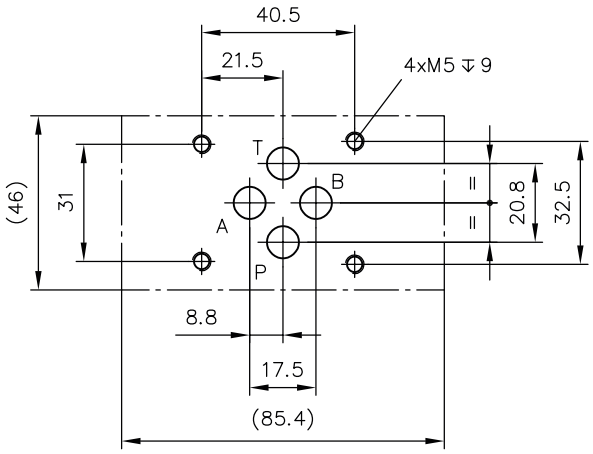
Manual override

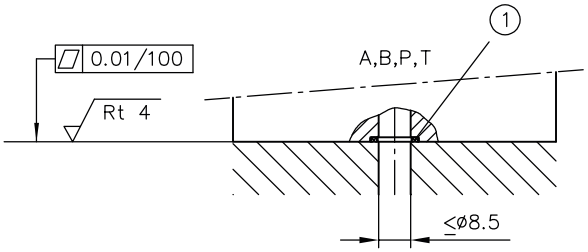


4.3 Hole pattern of the base plate

POL..PC06, PRL..PC06, PIL..PC06

Base plate as per ISO 4401-03 or DIN 24 340-A6

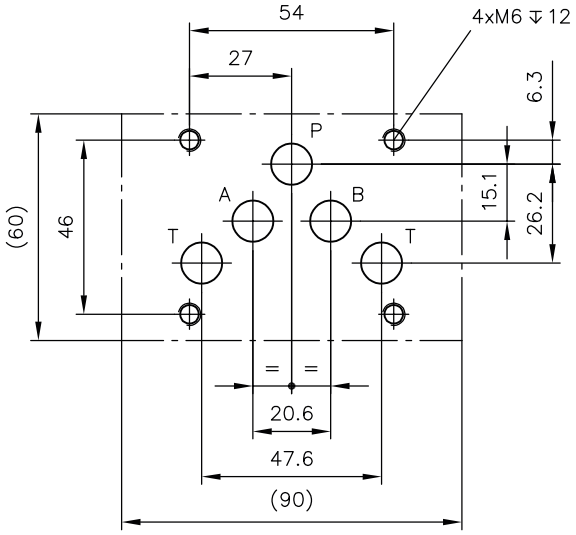


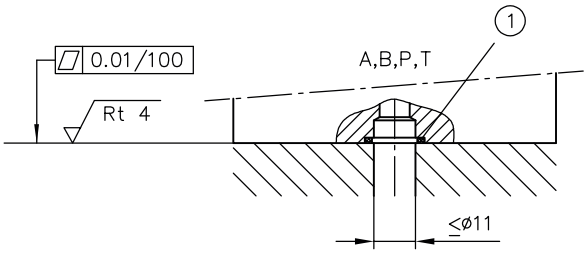


1 Sealing of ports A, B, P and T via O-rings 10x1.5 NBR 80 Sh

POL..P08, PRL..P08, PIL..P08

Base plate as per ISO 4401-05 or DIN 24 340-A6

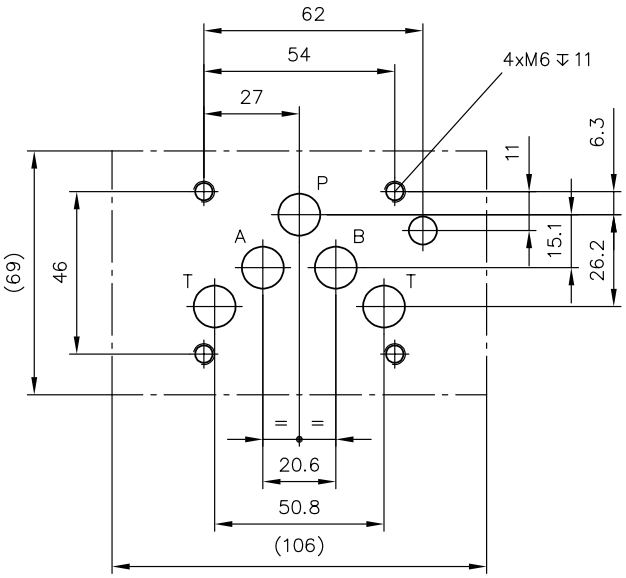


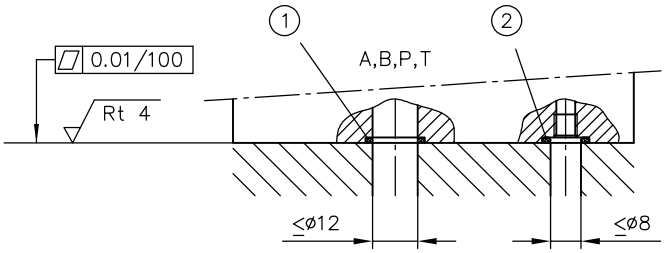


1 Sealing of ports A, B, P and T via O-rings 12.42x1.78 NBR 90 Sh

POL..C10, PRL..PC10, PIL..PC10

Base plate as per ISO 4401-05 or Hydraulic valves – hole patterns and connection plates





1 Sealing of ports A, B, P and T via O-rings 12x42x1.78 NBR 90 Sh
2 O-ring 9.25x1.78 NBR 80 Sh

5 Installation, operation and maintenance information

Observe the document B 5488 “General operating instructions for assembly, commissioning, and maintenance.”

5.1 Intended use

This product is intended exclusively for hydraulic applications (fluid technology).

The user must observe the safety measures and warnings in this document.

Essential requirements for the product to function correctly and safely:

- ► All information in this documentation must be observed. This applies in particular to all safety measures and warnings.
- ► The product must only be assembled and put into operation by specialist personnel.
- ► The product must only be operated within the specified technical parameters described in detail in this document.
- ► All components must be suitable for the operating conditions when using an assembly.
- ► The operating instructions for the components, assemblies and the specific complete system must also always be observed.

If the product can no longer be operated safely:

1. Remove the product from operation and mark it accordingly.
   ✓ It is then not permitted to continue using or operating the product.

5.2 Assembly information

The product must only be installed in the complete system with standard and compliant connection components (screw fittings, hoses, pipes, fixtures etc.).

The product must be shut down correctly prior to disassembly (in particular in combination with hydraulic accumulators).

⚠ **DANGER**

Sudden movement of the hydraulic drives when disassembled incorrectly

Risk of serious injury or death

- ► Depressurise the hydraulic system.
- ► Perform safety measures in preparation for maintenance.

5.3 Operating instructions

Observe product configuration and pressure/flow rate.

The statements and technical parameters in this document must be strictly observed.
The instructions for the complete technical system must also always be followed.

NOTICE

- ► Read the documentation carefully before usage.
- ► The documentation must be accessible to the operating and maintenance staff at all times.
- ► Keep documentation up to date after every addition or update.

⚠ **CAUTION**

Overloading components due to incorrect pressure settings.

Risk of minor injury. Parts may burst or fly off, and uncontrolled leakage of hydraulic fluid.

- ▪ Pay attention to the maximum operating pressure of the pump, valves and fittings.
- ▪ Always monitor the pressure gauge when setting and changing the pressure.

Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of the product. Contamination can cause irreparable damage.

Examples of fine contamination include:

- Swarf
- Rubber particles from hoses and seals
- Dirt due to assembly and maintenance
- Mechanical debris
- Chemical ageing of the hydraulic fluid

NOTICE

New hydraulic fluid from the manufacturer may not have the required purity.

Damage to the product is possible.

- ► Filter new hydraulic fluid to a high quality when filling.
- ► Do not mix hydraulic fluids. Always use hydraulic fluid that is from the same manufacturer, of the same type, and with the same viscosity properties.

For smooth operation, pay attention to the cleanliness level of the hydraulic fluid (cleanliness level see Chapter 3, "Parameters").

Additionally applicable document: D 5488/1 oil recommendations

5.4 Maintenance information

Check regularly (at least once a year) by visual inspection whether the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the surface of the device regularly (at least once a year) (dust deposits and dirt).

6 Other information

6.1 Accessories, spare and individual parts

To purchase spare parts, please see HAWE Hydraulik interactive contact map.

Line connectors

Version	Order coding	
Line connector (black)	MSD 3-309	6217 0002-00
Line connector (grey)	MSD 3-309 gr	6217 0003-00

Cylinder screws

Type	Order coding	
POL..PC06 PRL..PC06 PIL..PC06	M5x25-12.9-ISO 4762	ZV5078
POL..P08 PRL..P08 PIL..P08	M6x50-12.9-ISO 4762	ZY5007
POL..PC10 PRL..PC10 PIL..PC10	M6x40-12.9-ISO 4762	ZP2862

Sealing

Type	Order coding	
POL..PC06 PRL..PC06 PIL..PC06	SEAL KIT\P.L/P.H..PC06	HEX0599B
POL..P08 PRL..P08 PIL..P08	SEAL KIT\ P.L..P08	HEX0521C
POL..PC10 PRL..PC10 PIL..PC10	SEAL KIT\P.L/H..PC10	HEX0665A

References

Additional versions

- 4/3-way directional spool valve type PIH: D 6418
- Proportional directional spool valve type PSLF, PSVF and SLF: D 7700-F
- Proportional directional spool valve banks type PSLF and PSVF size 7: D 7700-7F
- Proportional directional spool valves types PSL, PSV size 2: D 7700-2
- Proportional directional spool valves types PSL/PSV/PSM, size 3: D 7700-3
- Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5
- 4/2- and 4/3-way directional spool valves type SWPM (SAM, SBM, SCM): D 6420/1
- Directional spool valve type CWPN: D 7451 CWPN
- Directional spool valve type NSWP 2: D 7451 N
- Proportional amplifier type EV2D: D 7821

Application

- Valve bank (nominal size 6) type BA: D 7788
- Valve bank type BNG: D 7788 BNG
- Control for CNC press brakes type SAKB: D 6335
- Control for CNC press brakes type SAMB, SAPB: D 6336
- Control for CNC press brakes type SAMB, SPLM: D 6337
- Control for CNC press brakes type SPVM: D 6338

D 6394 06-2024-1.1

HAWE Hydraulik SE
Einsteinring 17 | 85609 Aschheim/Munich | P.O. Box 11 55 | 85605 Aschheim | Germany
Phone +49 89 379100-1000 | info@hawe.de | www.hawe.com

hawe.com/contact