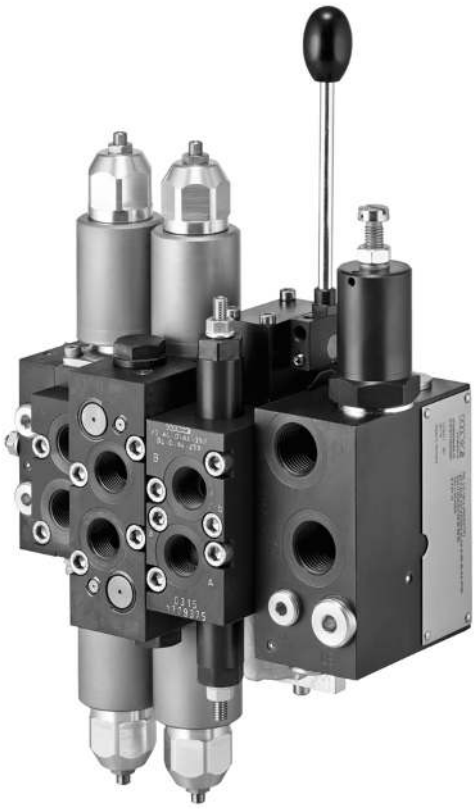
Proportional directional spool valve type PSL, PSV size 2 and EDL

Product documentation

Series connection

Operating pressure p_{max} PSL/PSV:	420 bar
Operating pressure (Valve section) p_{max} EDL:	320 bar
Flow rate (Pump) Q_{max}:	100 l/min
Flow rate (Consumer) Q_{max} PSL/PSV:	60 l/min
Flow rate (Consumer) Q_{max} EDL:	48 l/min



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HAWE HYDRAULIK

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Table of Contents

1 Introductory description of proportional directional spool valves type PSL, PSV size 2 and EDL

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 independent of the load and continuous.

The proportional directional spool valve type PSL is suitable for constant pump systems and type PSV is for variable pump systems. The flow rates and load pressures for the individual consumers can be individually adjusted. The proportional directional spool valve type PSL and PSV can be adapted to various control tasks, e.g. for safety functions. All sizes can be combined with each other.

The proportional directional spool valve type PSL, PSV and PSV is used in mobile hydraulics, can be combined for a wide range of tasks and enables sensitive movements.

The proportional directional spool valve type EDL is actuated directly. It can be flexibly combined with PSL 2.

Features and advantages

- Universally usable product for various flow rates and functions
- Extensive modular system with many variants and combination options
- Compact and lightweight design
- Precise and sensitive control
- Robust and long-lived design for pressures up to 420 bar
- Highest energy efficiency thanks to low Δp and low-energy solutions
- Suitable for use in potentially explosive areas

Intended applications

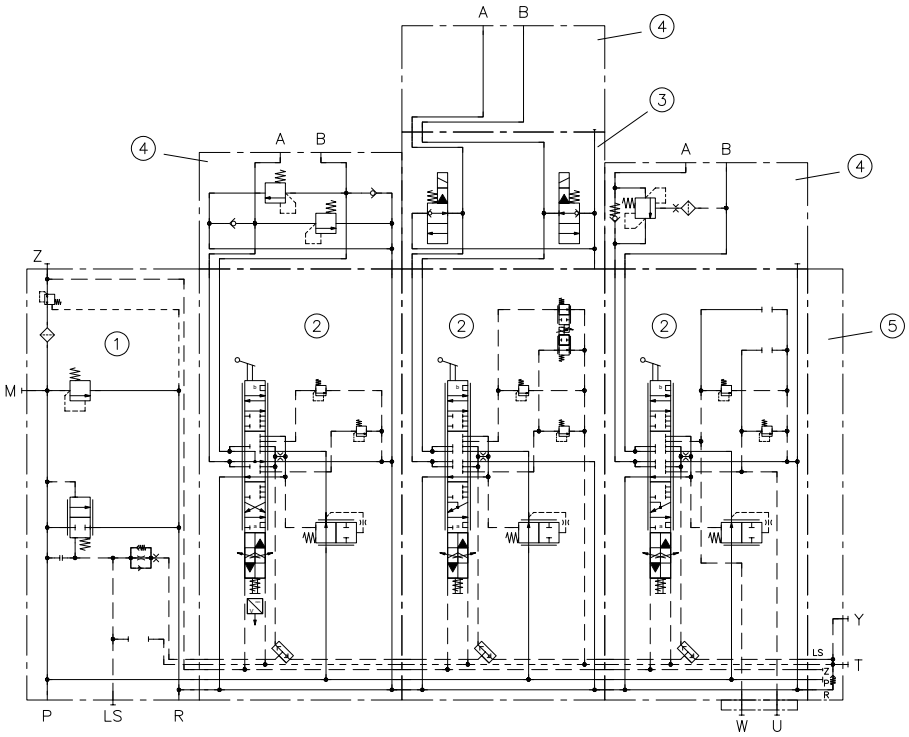
- Loading cranes
- Lifting platforms
- Municipal trucks
- Construction machines
- Drilling equipment
- Machines for forestry and agricultural purposes

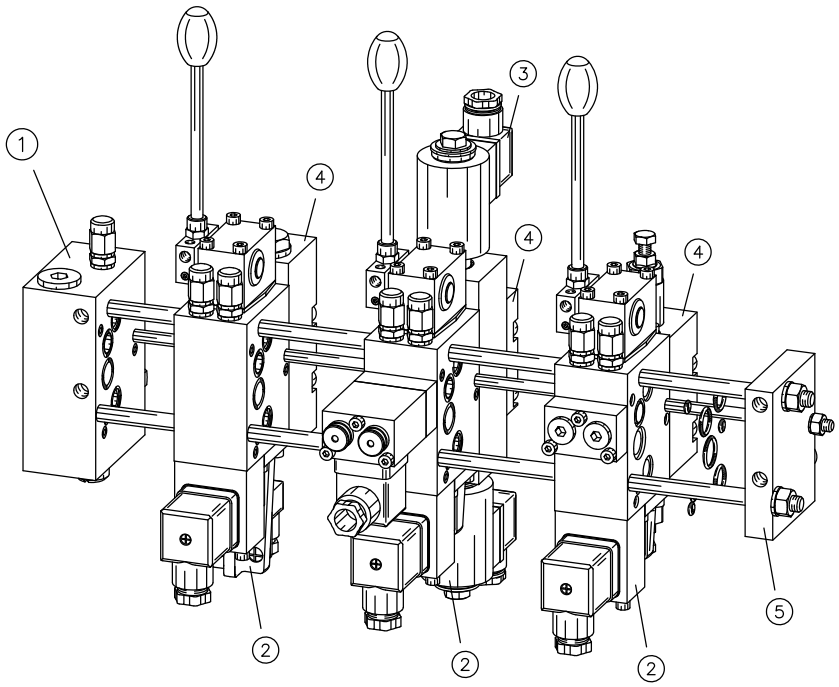
Proportional directional spool valve Type PSL 2

Proportional directional spool valve Type EDL

1.1 Configuration example PSL 2

PSL 31/420-2
- A2 H 25/40 A250 B300 /EA/WA/2 AN275 BN 320
- A2 L 10/16 A150 B150 FP22 /EA/ZVV/2
- A2 L 6/6 A200 B120 S1 /EA/2 AL-0-D 8-250
- E4 - G 24

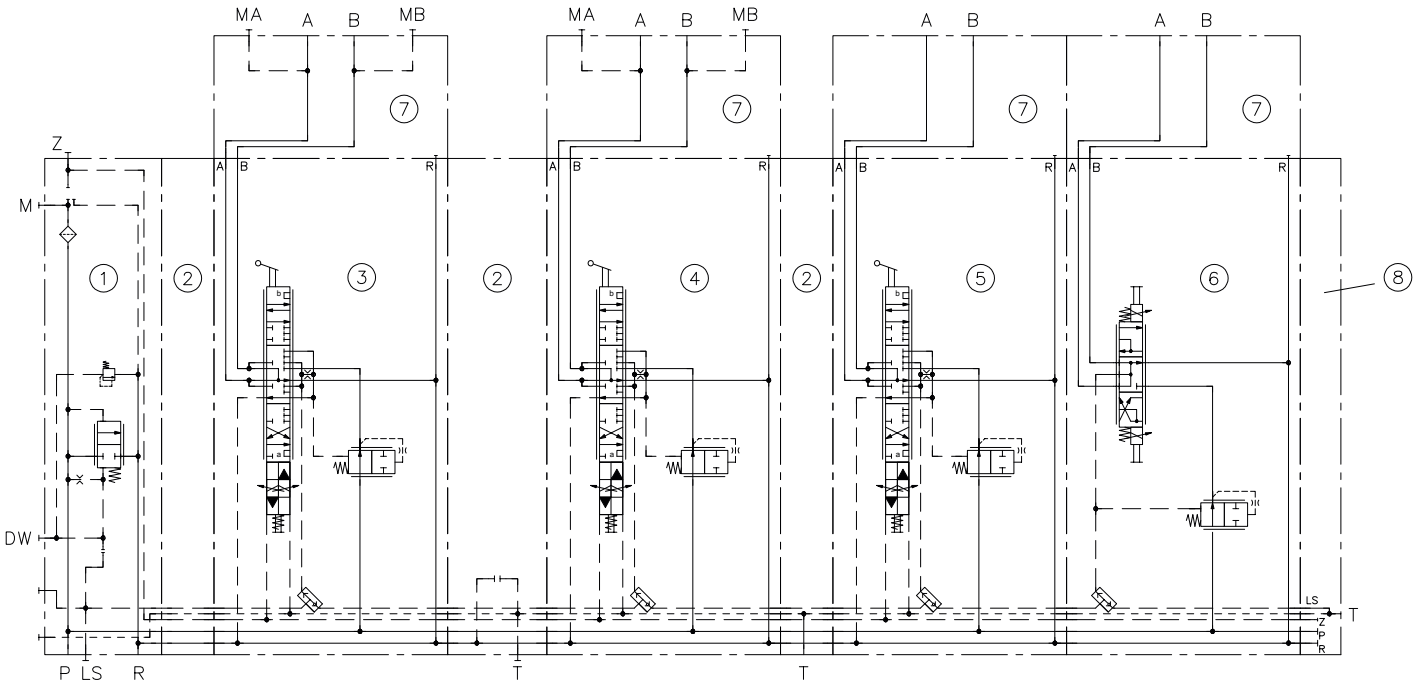


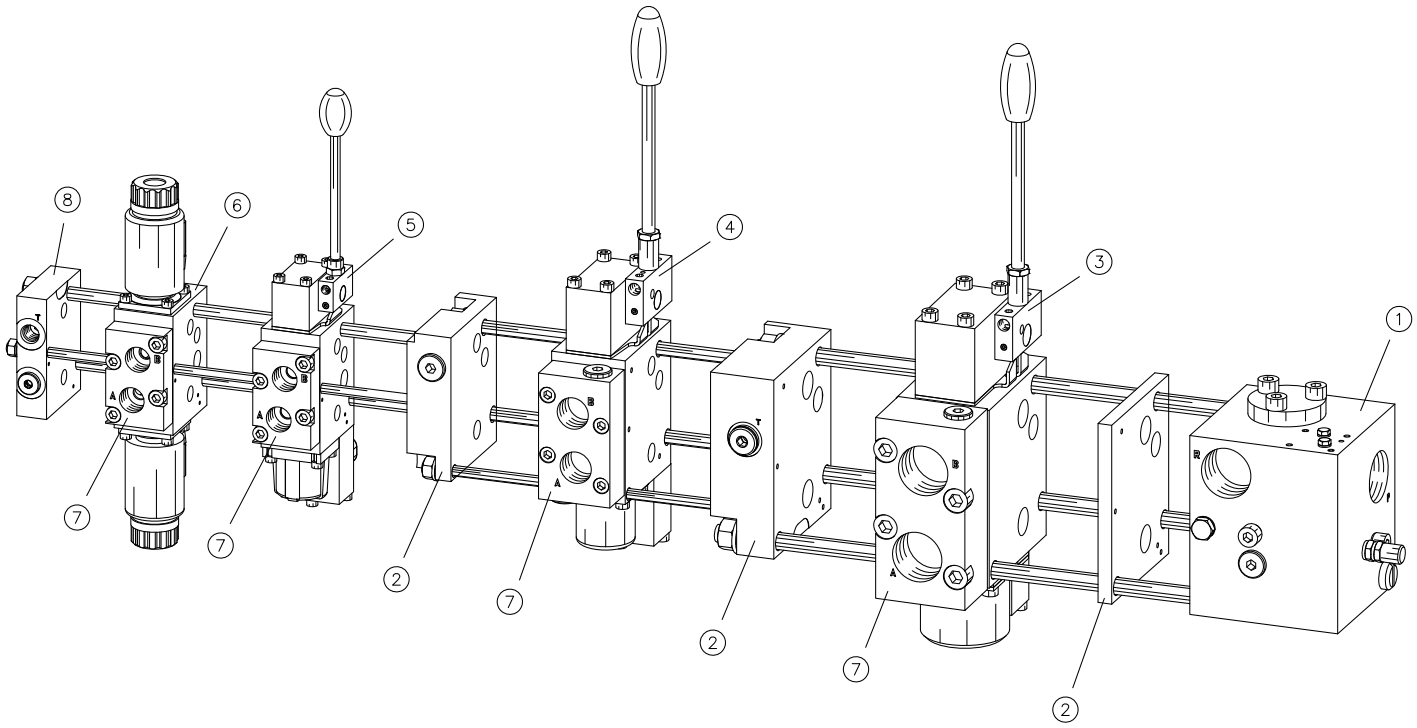


1 Connection block
2 Valve section or Series intermediate plate
3 Intermediate plate
4 Ancillary block
5 End plate

1.2 Configuration example PSL 2 in conjunction with PSL 5, PSL 3 and EDL 2

PSV 51/300-5
- ZPL 55/9
- A2 H 160/160/EA/5
- ZPL 531
- A2 H 80/80/EA/3
- ZPL 32
- A2 H 40/40/EA/2
- DA2 H 40/40/EI/2
- E 1-DT 24



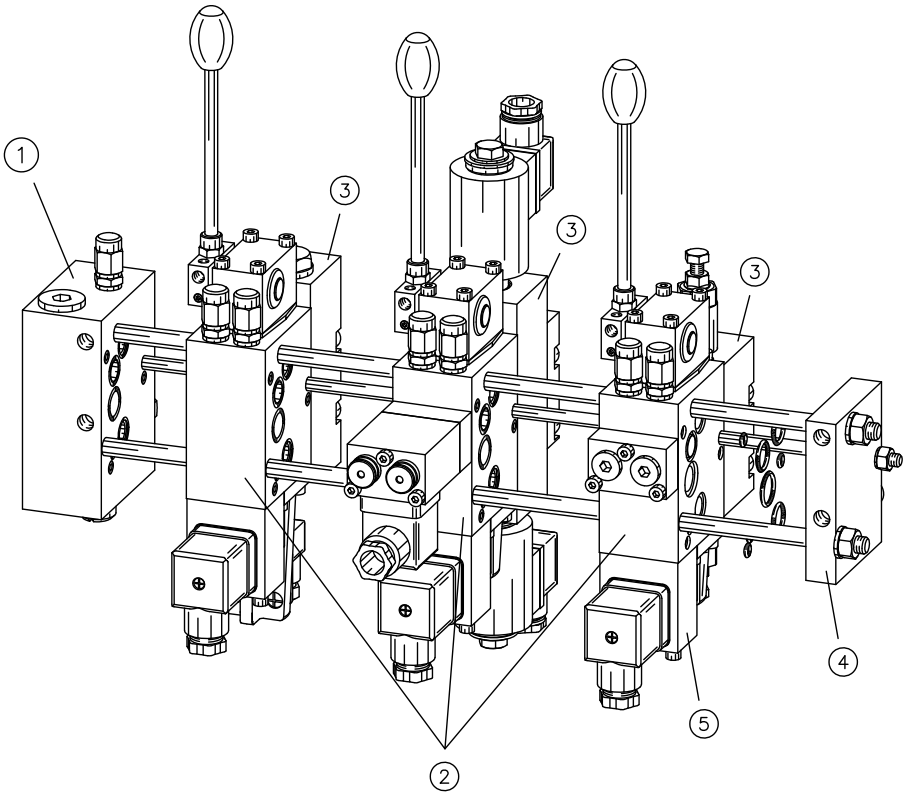


1 PSL 5 connection block
2 Series intermediate plate
3 PSL 5 valve section
4 PSL 3 valve section
5 PSL 2 valve section
6 EDL 2 valve section
7 Ancillary block
8 PSL 2 end plate

2 Available versions

Ordering example

PSL 31/420-2	Connection block (see Chapter 2.1)
-A2 H 25/40 A250 B300 /EA/WA/2 AN 275 BN 320	Valve section (see Chapter 2.2)
-A2 L 10/16 A150 B150 FP3 /EA/ZVV/2	Valve section with intermediate plate (see Chapter 2.2.4) and Ancillary block
-A2 L 6/6 A200 B120 S1 /EA/2 AL 180	Valve section with ancillary block (see Chapter 2.2.3)
-ZPL 22/15/R1	Series intermediate plate (see Chapter 2.3)
-E4 G 24	End plate with solenoid version and solenoid voltage (see Chapter 2.4, "End plate" and Chapter 2.5, "Solenoid voltage and solenoid version")



1 Connection block
2 Valve section or series intermediate plate
3 Ancillary block
4 End plate
5 Solenoid voltage and solenoid version

A single manifold can merge up to 14 valve sections of size .

This number can be increased by combining with PSL 5 or PSL 3 . In this case, transition plates are used and each size has its own tension rod.

Limits to the maximum possible number of valve sections result from:

a) tension rod strength
b) internal control oil supply for the electro-hydraulic actuation
c) the available control pressure difference for supply to the rear valve sections

2.1 Connection block

Connection blocks come in two basic variants:

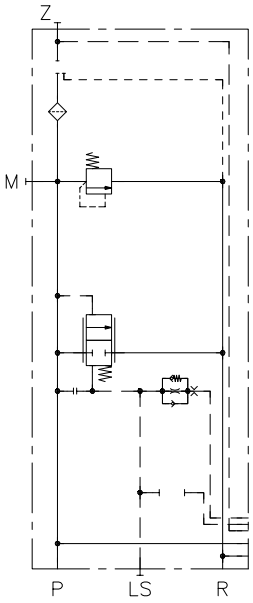
- **PSL:** Connection block with integrated 3-way controller for use in Open Center systems with constant pumps
- **PSV:** Connection block without 3-way controller for use in Closed Center systems with variable pumps or for simultaneous supply of two or more manifolds from a shared constant pump

Ordering example

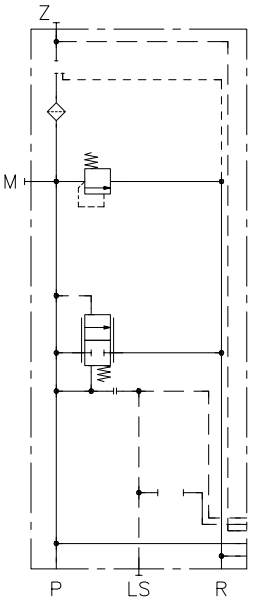
PSL 3	H	G	1	F	/420	-2

- -2: 2.1.9 "Size"
- /420: 2.1.8 "System pressure limitation"
- F: 2.1.7 "LS relief or LS pressure limitation"
- 1: 2.1.6 "Internal control oil supply"
- G: 2.1.5 "LS damping elements"
- H: 2.1.4 "Additional elements for 3-way controller"
- PSL 3: **Basic type**
  - 2.1.1 "Basic version"
  - 2.1.2 "Ports for P and R"
  - 2.1.3 "Connection block basic types"

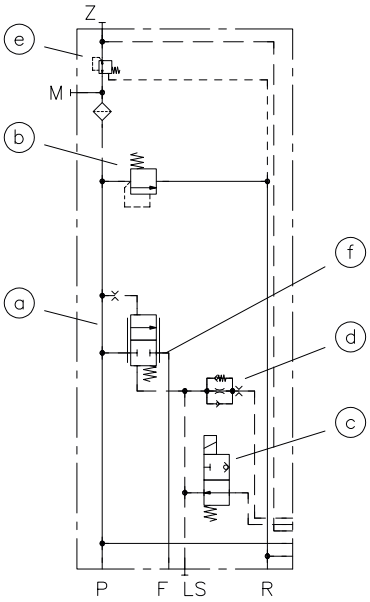
PSL

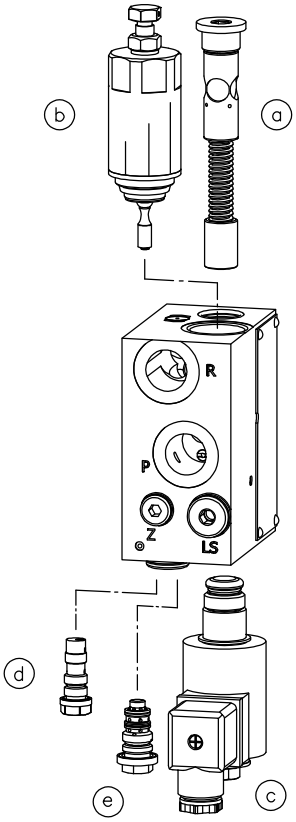


PSV



Depending on the configuration, the connection blocks incorporate:





a. A 3-way controller for Open Center systems with constant pump
b. A pressure-limiting valve to ensure maximum system pressure
c. A valve for LS relief or LS pressure limitation
d. A damping element to attenuate LS signal oscillation
e. A pressure reducing valve for internal control oil supply to the downstream valve sections
f. Various additional elements (e.g. idle circulation valve, power-beyond function, P-line shut-off, mechanical locking of the 3-way controller)

2.1.1 Basic version

Type	Description
PSL	Connection block with integrated 3-way controller for use in Open Center systems with constant pumps
PSV	Connection block without 3-way controller for use in Closed Center systems with variable pumps or for simultaneous supply of two or more manifolds from a shared constant pump

NOTICE
For instructions on how to convert the connection block from PSL to PSV, see Chapter 5.2.3

2.1.2 Ports for P and R

Coding	Description of P and R port
3	G 1/2 (ISO 228-1)
4	G 3/4 (ISO 228-1)
UNF 2	SAE-8 or 3/4-16 UNF-2B (SAE J 514)
UNF 4	SAE-12 or 1 1/16-12 UN-2B (SAE J 514)

2.1.3 Connection block basic types

PSL connection blocks

Type	Description
PSL 3.../D...-3 **PSL UNF 2.../D...-2**	Standard connection block with integrated 3-way controller. Pressure-limiting valve: direct actuation
PSL 3U.../...-2 **PSL UNF 2U.../...-2**	Additional idle circulation valve for automatic reduction of circulation pressure. In order to reliably close the idle circulation valve, the LS pressure must be at least 20 bar. If the LS pressure then falls below 25% of the pump pressure, the valve returns to idle circulation and the P gallery is relieved to the reflux. Electro-hydraulic actuation with internal control oil supply requires a pump flow rate of at least 60 l/min; otherwise, there will not be enough pilot pressure available to actuate the spools. Pressure-limiting valve: pilot-controlled
PSL 3 Z.../D...-2 **PSL UNF 2 Z.../D...-2**	Additional release valve for quick release of pressure in neutral position. Once all valve sections signal an LS pressure below around 1/3 of the 3-way controller's spring cavity pressure, the release valve opens to the reflux. The LS pressure in the 3-way controller's spring cavity is released to R. Common applications include systems that are susceptible to vibration and combinations with load-holding valves. Pressure-limiting valve: direct actuation **NOTICE** A spacer plate ZPL 22/7 is included below; this is not included in the order coding.
PSL 3 Y.../D...-2	Special version with an additional connection suitable for pressure loads for the 3-way controller's outflow (power beyond function). You can connect a second manifold to the F port. The first manifold's valve sections are prioritised. The second manifold's valve sections are supplied with the remaining flow rate. Pressure-limiting valve: direct actuation

Type	Description
PSL 3 C...D/...-2 **PSL 3 CR...D/...-2**	Additional integrated copier valve (LS booster valve) Via the optional blocking of the 3-way controller (Chapter 2.1.4), this connection block can also be operated with a variable pump as a closed-centre load-sensing valve (like PSV). In this case, the copier valve amplifies the externally reported LS signal and can thus compensate for losses in the LS line or at the pump controller. There are two versions: ▪ **C:** fixed ► selectable LS pressure increases - 2 bar - 10 bar - 15 bar - 20 bar ▪ **CR:** manually adjustable ► selectable LS pressure settings - 5 to 15 bar **Ordering example:** PSL 3 **CR** **10** T B 1/D...-2 Version LS pressure increase Pressure limitation: directly actuated **NOTICE** Depending on the LS damping element (Chapter 2.1.5), the copied pressure may increase further. The stronger the damping, the higher the increase.

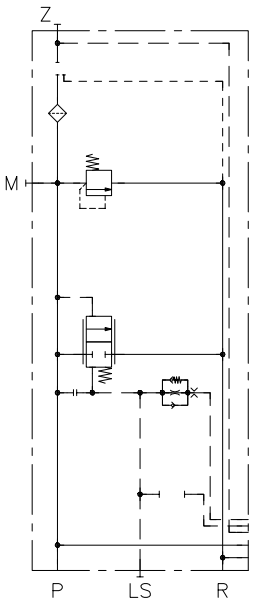
PSV connection blocks

Type	Description
PSV 3...-2 **PSV UNF 2...-2**	Standard connection block without 3-way controller. Pressure-limiting valve: without
PSV 3.../D...-2 **PSV UNF 2.../D...-2**	Standard connection block without 3-way controller. Pressure-limiting valve: direct actuation
PSV 4 N.../.../...-2 **PSV UNF 4 N.../.../...-2**	Special version with additional P channel shut-off to safely shut off pump and consumer from one another and prevent undesired movements. The P channel incorporates a piston controlled by a 2/2-way directional valve. In the de-energised state, the piston safely shuts off the P channel. The P channel is opened by actuating the 2/2-way directional valve. ▪ PSV (UNF) **N.. :** 2/2-way directional valve type EM 11 S as per D 7490/1 ▪ PSV (UNF) **NM.. :** with wing bolt for mechanical locking (EM 11 S-...M) ▪ PSV (UNF) **NP.. :** with button for manual override (EM 11 ST) Also available with external hydraulic actuation. The P-channel lock is open unless min. pump pressure is present. ▪ PSV 4 N 7490 105 E...: without EM, with external hydraulic connection Optionally, an additional LS release valve is available to depressurise the LS signal and switch the pump to standby pressure. ▪ PSV (UNF) 4 N **V:** LS relief, closed when unpowered (EM 11 V as per D 7490/1) ▪ PSV (UNF) 4 N **Z:** LS relief, open when unpowered (EM 11 S as per D 7490/1) ▪ PSV (UNF) 4 N **ZM:** LS relief, open when unpowered, with wing bolt for mechanical locking (EM 11 S-...-M) ▪ PSV (UNF) 4 N **ZP:** LS relief, open when unpowered, with button for manual override (EM 11 ST) The LS pressure-limiting valve can optionally be deselected. ▪ PSV (UNF) 4 N../ **X**-3 Only possible in conjunction with LS damping (see Chapter 2.1.5) **Ordering example:** PSV 4 N B 61ZM/220/200-2 – Setting for main pressure-limiting valve: 220 bar – Setting for LS pressure-limiting valve: 200 bar **NOTICE** If a P channel shut-off is being used, there will be an additional pressure drop in the P channel. This may mean that the nominal value is no longer reached in the downstream sections. **The undershooting of the nominal value depends on the** ▪ control pressure difference in the variable pump's pump controller, ▪ position of the valve section in the manifold and ▪ flow rate through the P channel shut-off. The nominal value may fall short of $Q_{nominal}$ by up to 30%, see Chapter 2.2.1.6.

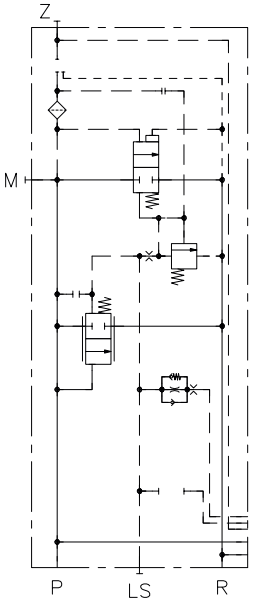
Type	Description
PSV 3X...-2	**Special version** ▪ without 3-way controller ▪ without pressure-limiting valve ▪ Without pressure reducing valve for internal control oil supply (only possible for E0A, E0H, E0Z, E0AR, E0K) ▪ without interface for LS pressure-limiting valve or LS release valve Only for EDL valve sections or PSL/PSV with actuations A, H and P. Damping in LS: Standard - none B4, B5, ...: with orifice ∅ 0.4, 0.5, ...; e.g. PSV 3X B5-2 **NOTICE** No retrofitting on electro-hydraulic actuation E.. possible.
PSV E0-2	Initial plate without its own functions and connections. – For the combination with EDL and middle input block ZPL 22 P6R6, see Chapter 2.3, "Series intermediate plate" or an end plate (see Chapter 2.4, "End plate") with P and R connection. Operating pressure max. 250 bar!

Circuit symbols

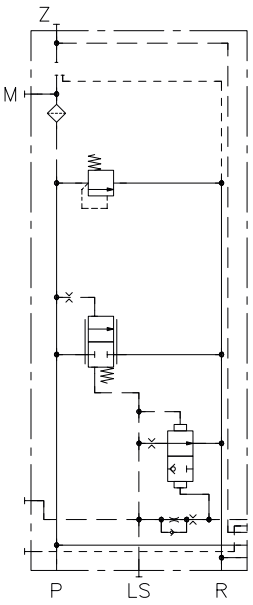
PSL 3.../D...-2
PSL UNF 2.../D...-2



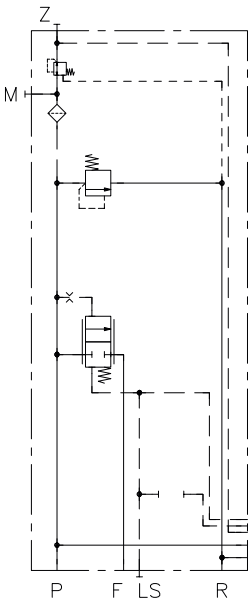
PSL 3U.../...-2
PSL UNF 2U.../...-2



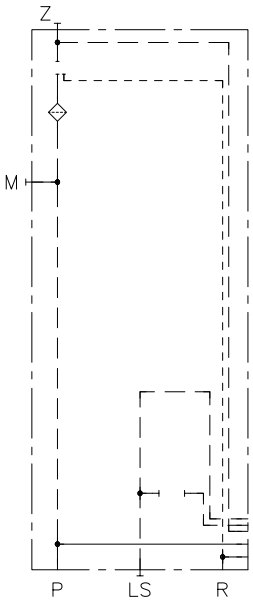
PSL 3 Z.../D...-2



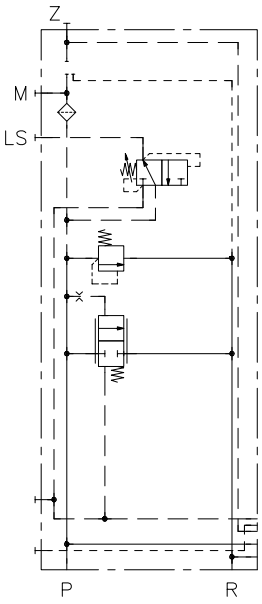
PSL 3 Y.../D...-2



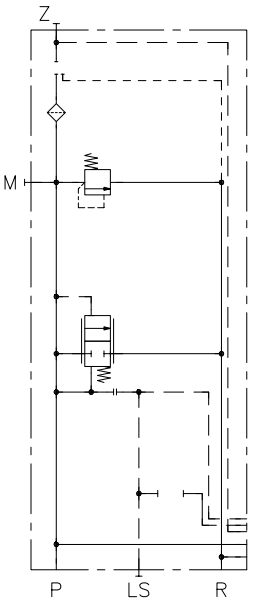
PSV 3...-2
PSV UNF 2...-2



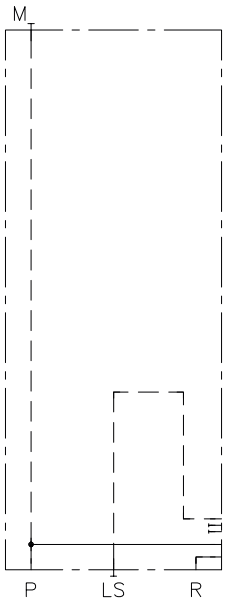
PSL 3 C... D/...-2
PSL 3 CR... D/...-2



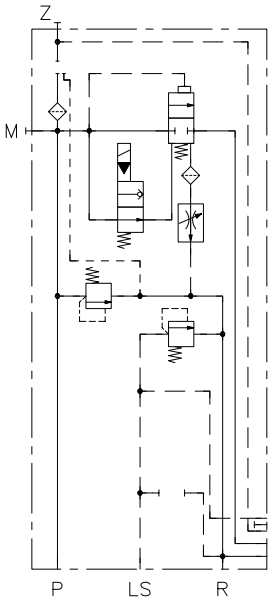
PSV 3.../D...-2
PSV UNF 2.../D...-2



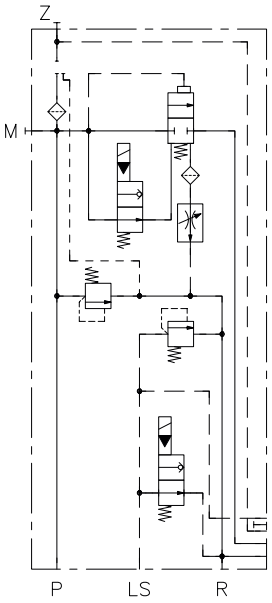
PSV 3X...-2



PSV 4 N.../.../...-2
PSV UNF 4 N.../.../...-2



PSV 4 N...Z/.../...-2
PSV UNF 4 N...Z/.../...-2



PSV E0-2

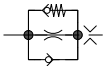
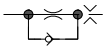
2.1.4 Additional elements for 3-way controller

Coding	Description
without coding	Standard version 3-way controller with 9 bar circulation pressure
H	Special version 3-way controller with higher circulation pressure (9 bar)
T, TR	Special version for mechanical locking of the 3-way controller ▪ T: tool adjustable ▪ TR: manually adjustable using turning knob
HT, HTR	Special version 3-way controller with higher circulation pressure (14 bar) and mechanical locking ▪ HT: tool adjustable ▪ HTR: manually adjustable using turning knob

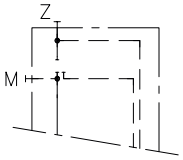
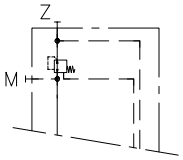
NOTICE

Only available for connection block **PSL 3 Z.../D...-2**.

2.1.5 LS damping elements

Coding	Description	Circuit symbol
without coding	▪ For PSL and PSM: as for coding S ▪ For PSV: without LS damping	-
B	∅ 0.8 mm orifice	
B 4 **B 5** **B 6** **B 7**	∅ 0.4 / 0.5 / 0.6 / 0.7 mm orifice	
B 55	Two ∅ 0.5 mm orifices in series	
S	Pre-load and damper valve (pre-load pressure: 25 bar)	
W	Pre-load and damper valve with increased throttle effect (pre-load pressure: 25 bar)	
E	Damper valve without pre-load valve Because there is no pre-load valve, LS relief with all directional spool valves in neutral position occurs with a slight delay, system pressure drops only slowly. Common applications include consumers with a tendency to oscillate at low frequencies.	
G	Damper valve with increased throttle effect without pre-load valve (Throttle cross-section smaller than for coding E) Because there is no pre-load valve, LS relief with all directional spool valves in neutral position occurs with a slight delay, system pressure drops only slowly. Common applications include consumers with a tendency to oscillate at low frequencies.	

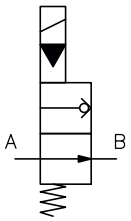
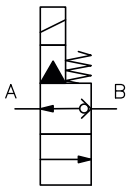
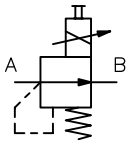
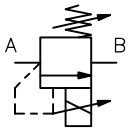
2.1.6 Internal control oil supply

Coding	Description	Circuit symbol
without coding	Without internal control oil supply For valve sections with manual, hydraulic or pneumatic actuation. Or for external control oil supply (required pilot pressure: 20 to 40 bar).	
1, 2	With internal control oil supply For valve sections with electro-hydraulic actuation. Optionally, a small quantity of control oil can be siphoned from the Z port to supply externally connected additional valves. In this case, the maximum permissible flow rate is 2 l/min. ▪ 1: 20 bar pilot pressure ▪ 2: 40 bar pilot pressure	

2.1.7 LS relief or LS pressure limitation

For the connection blocks with EM 2... interface:

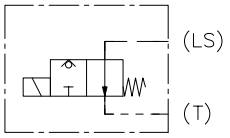
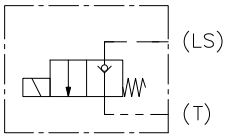
- PSL 3.../D...-2, PSL UNF 2.../D...-2
- PSL 3 U.../...-2, PSL UNF 2U.../...-2
- PSL 3 Y.../...-2 PSV 3...-2, PSV UNF 2...-2
- PSV 3.../D...-2
- PSV UNF 2.../D...-2

Coding	Description	Circuit symbol
without coding	Without LS relief or LS pressure limitation	
ZA **ZAM** **ZAP**	LS relief, open when unpowered ▪ **ZA**: EM 11 S as per D 7490/1 ▪ **ZAM**: with wing bolt for mechanical locking (EM 11 S-...-M) ▪ **ZAP**: with button for manual override (EM 11 ST) Contains adapter for EM 2.. hole to EM ..	
VA	LS relief, closed when unpowered (EM 11 V as per D 7490/1) Contains adapter for EM 2.. hole to EM ..	
Z **ZM** **ZP**	Proportional LS pressure limitation with ascending characteristic line ▪ **Z:** EM 21 DSE as per D 7490/1 E ▪ **ZM:** with wing bolt for mechanical locking (EM 21 DSE-...-M) ▪ **ZP:** with button for manual override (EM 21 DSET)	
V	Proportional LS pressure limitation with descending characteristic line (EM 21 DE as per D 7490/1)	

NOTICE
LS relief valves and LS pressure-limiting valves of types ZA, ZAM, ZAP, VA, F..., D... Z, ZM, ZP and V require the intake to be limited by means of LS damping, in order to ensure reliable release/pressure limitation, see Chapter 2.1.5, "LS damping elements"

For the connection blocks with WN hole pattern interface:

- PSL 3 Z.../D...-2

Coding	Description	Circuit symbol
without coding	Without LS relief or LS pressure limitation	(LS) (T)
F	LS relief, open when unpowered (WN 1 F as per D 7470 A/1)	
D	LS relief, closed when unpowered (WN 1 D as per D 7470 A/1)	

2.1.8 System pressure limitation

Coding	Description
without coding	Without pressure-limiting valve
/D...	With pressure-limiting valve Pressure setting in bar (adjustment range 50 to 420 bar). Directly actuated.
/...	With pressure-limiting valve (Adjustment range 50 to 420 bar) Pilot control of the 3-way controller via a pilot valve.
/.../...	With pressure-limiting valve and LS pressure-limiting valve (only for PSV 4 N and PSV UNF 4 N) The first value is the setting for the main pressure-limiting valve, the second value is the setting for the LS pressure-limiting valve.

2.1.9 Size

Coding	Description
-2	Size 2

For size 3, see D 7700-3, and for size 5, see D 7700-5

2.1.10 Variants and potential combinations

PSL connection blocks

Type	P and R port as per ISO 228-1 or SAE J 514	Max. recommended flow rate (l/min)	Pressure-limiting valve	
			direct actuation	pilot-controlled
PSL 3.../D...-2	G 1/2	80	●	
PSL 3 U.../...-2	G 1/2	100		●
PSL 3 Z.../D...-2	G 1/2	80	●	
PSL 3 Y.../D...-2	G 1/2	80	●	
PSL UNF 2.../D...-2	SAE-8 (3/4-16 UNF 2B)	80	●	
PSL UNF 2U .../...-2	SAE-8 (3/4-16 UNF 2B)	100		●

PSV connection blocks

Type	P and R port as per ISO 228-1 or SAE J 514	Max. recommended flow rate (l/min)	Pressure-limiting valve	
			without	direct actuation
PSV 3...-2	G 1/2	80	●	
PSV 3.../D...-2	G 1/2	80		●
PSV 4N.../.../...-2	G 3/4	100		●
PSV 3 X...-2	G 1/2	80	●	
PSV UNF 2...-2	SAE-8 (3/4-16 UNF 2B)	80	●	
PSV UNF 2.../D...-2	SAE-8 (3/4-16 UNF 2B)	80		●
PSV UNF 4 N.../.../...-2	SAE-12 (1 1/16-12 UN-2B)	100		●

2.2 Valve section PSL and EDL

A directional valve section is always provided with a flange surface for configuring an ancillary block or an intermediate plate and ancillary block.

PSL

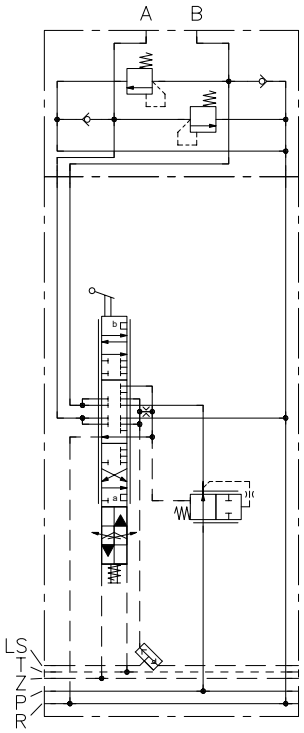
- Chapter 2.2.1, "PSL Directional valve section "
- Chapter 2.2.3, "Ancillary block"
- Chapter 2.2.4, "Intermediate plate (on the consumer side)"

EDL

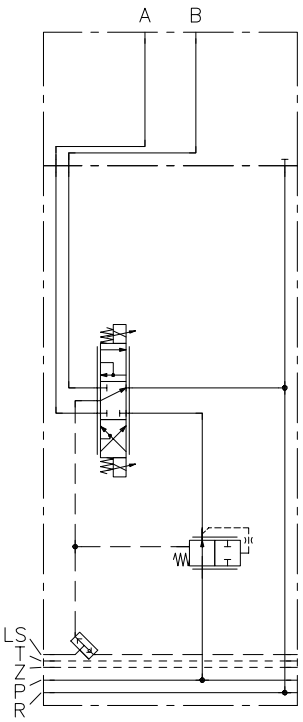
- Chapter 2.2.2, "EDL directional valve section"
- Chapter 2.2.3, "Ancillary block"
- Chapter 2.2.4, "Intermediate plate (on the consumer side)"

Valve section with ancillary block

PSL

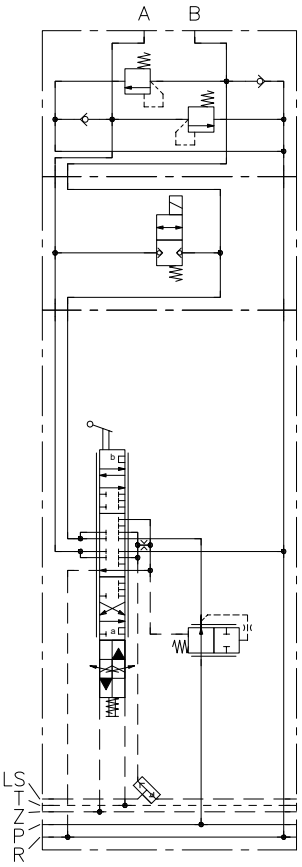


EDL

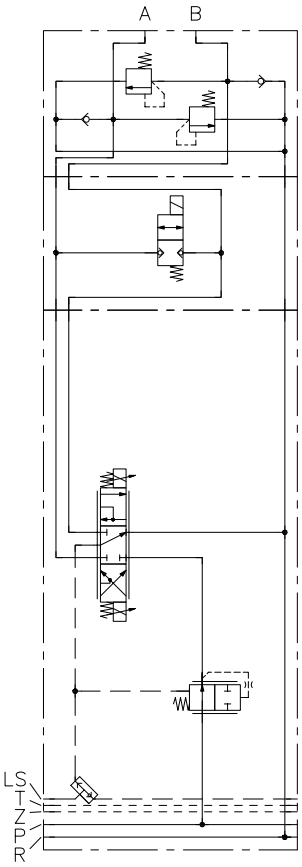


Valve section with intermediate plate and ancillary block

PSL

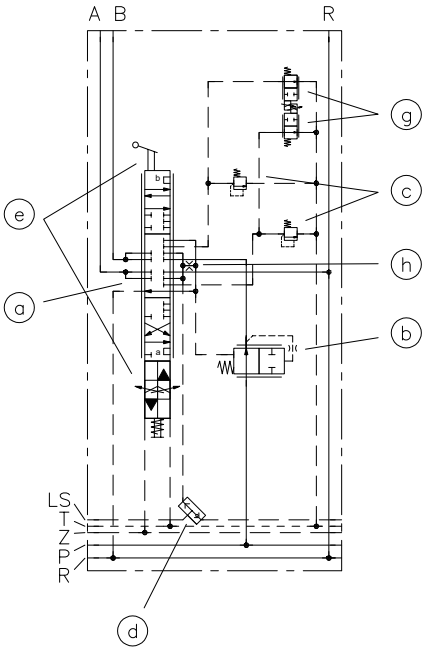


EDL

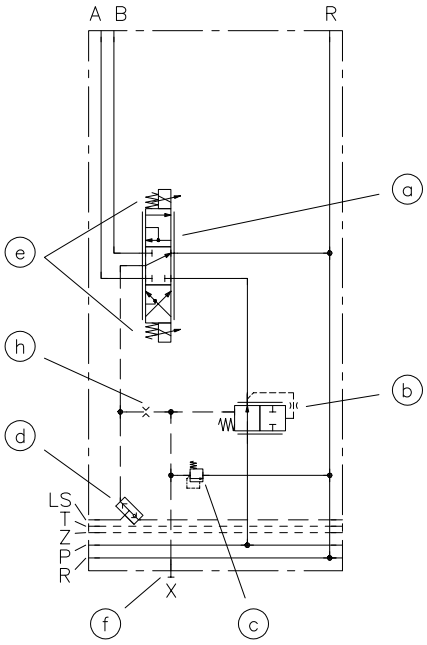


Depending on the configuration, the directional valve sections incorporate

PSL

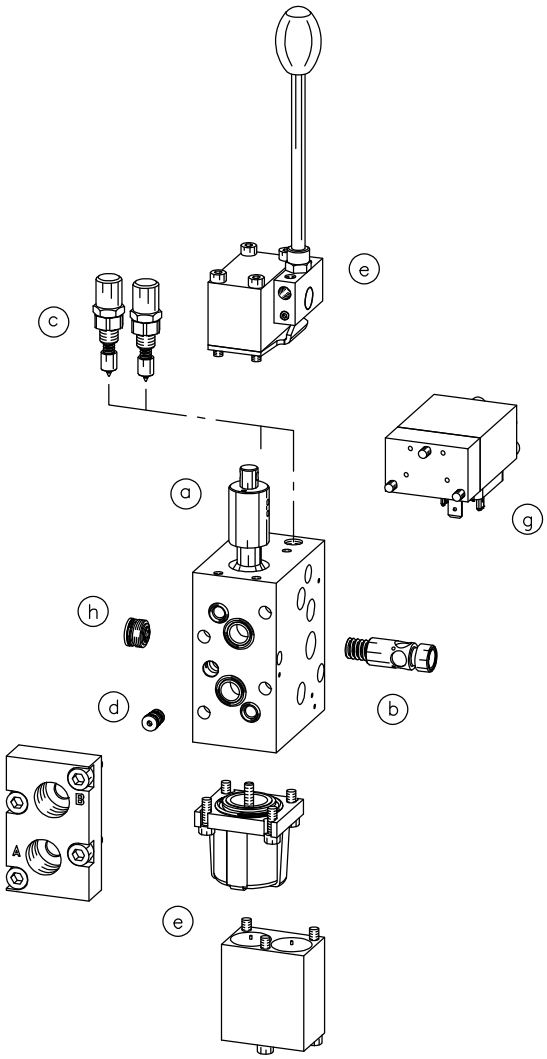


EDL

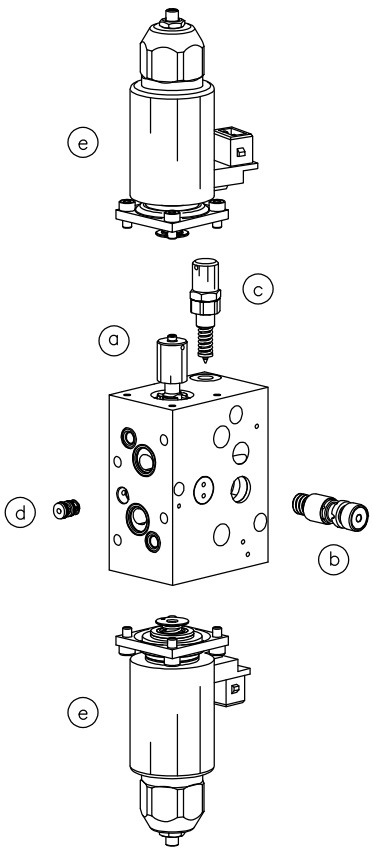


a. Valve spool for controlling proportional flow rate
b. 2-way controller (pressure compensator) for controlling a constant pressure difference using the valve spool, irrespective of the load pressure and pump pressure
c. Fixed LS pressure-limiting valves
d. Shuttle valve for linking the LS line to additional valve sections
e. Actuation for the control piston
f. Additional connections for external LS pressure limitation
g. Electric LS pressure-limiting valves for relief or electro-proportional limitation of the LS pressure
h. LS orifice for damping the LS signal

PSL



EDL



2.2.1 PSL Directional valve section

Ordering example

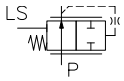
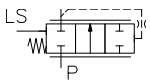
SL 2	-A	R2	H 40/40	A200 B300 F3	9	W1	L	/EA1	WA	/ZDRH	/2

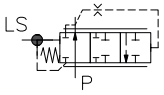
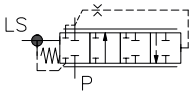
- /2: 2.2.3 "Ancillary block"
- /ZDRH: 2.2.4 "Intermediate plate (on the consumer side)"
- WA: 2.2.1.15 "Switching position monitoring, displacement transducer"
- /EA1: **Actuation**
  - 2.2.1.13 "Actuation"
  - 2.2.1.14 "Additional elements for actuation"
- L: 2.2.1.12 "Additional functions"
- W1: 2.2.1.11 "Shuttle valve"
- 9: 2.2.1.10 "LS orifice"
- A200 B300 F3: **LS pressure limitation**
  - 2.2.1.7 "LS pressure limitation"
  - 2.2.1.8 "Electric LS relief or LS pressure limitation"
  - 2.2.1.9 "LS port for external limitation"
- H 40/40: **Valve spool**
  - 2.2.1.5 "Circuit symbol"
  - 2.2.1.6 "Flow rate"
- R2: **Valve section, 2-way controller**
  - 2.2.1.2 "2-way controller"
  - 2.2.1.3 "2-way controller spring"
  - 2.2.1.4 "2-way controller damping"
- -A: 2.2.1.1 "Consumer ports"

2.2.1.1 Consumer ports

Coding	Description
A	Spool block without integrated thread for combining with an ancillary block (Chapter 2.2.3) or an intermediate plate (Chapter 2.2.4)

2.2.1.2 2-way controller

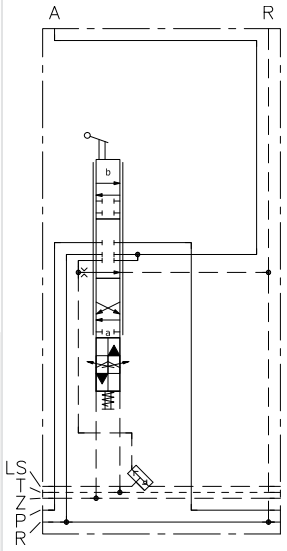
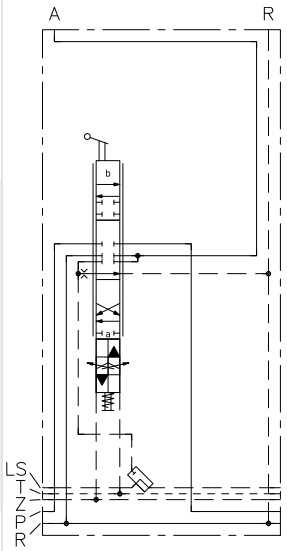
Coding	Description	Circuit symbol
without coding	Standard 2-way controller	
1	Without 2-way controller	-
R	2-way controller with check valve function In the event of a shortage in supply, the controller prevents return flow from the load line (A or B-line) to the P-line. Only in conjunction with 2-way controller spring coding 2 and 5, Chapter 2.2.1.3	

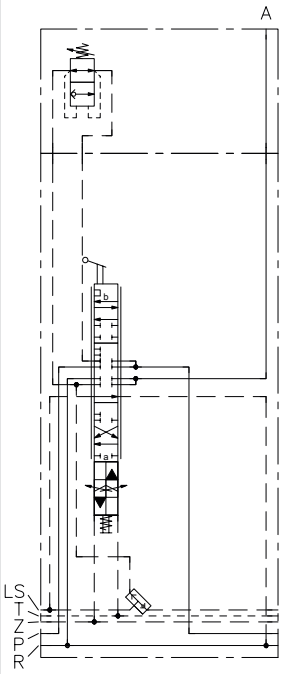
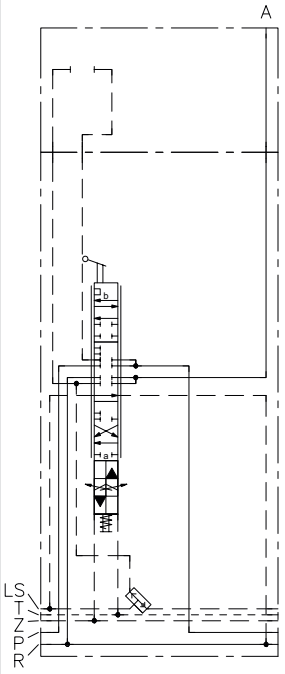
Coding	Description	Circuit symbol
D	2-way controller with release of pressure The controller prevents pressure creep in the P-line between the 2-way controller and valve spool. **Typical applications** ▪ Consumers with very low load pressures and without additional check valves. ▪ When using standard 2-way controllers, phantom movements may occur here. The D-controller can prevent this because the pressure is relieved towards T. ▪ In applications with check valves, the D-controller prevents undesired check valve intervention.	
B	2-way controller with release of pressure and check valve function **Check valve function:** In the event of a shortage in supply, the controller prevents return flow from the load line (A or B-line) to the P channel. **Release of pressure:** The controller prevents pressure creep in the P channel between the 2-way controller and valve spool. **Typical applications** ▪ Consumers with very low load pressures and without additional check valves. ▪ When using standard 2-way controllers, phantom movements may occur here. The D-controller can prevent this because the pressure is relieved towards T. ▪ In applications with check valves, the D-controller prevents undesired check valve intervention. Only in conjunction with 2-way controller spring coding 2 and 5, Chapter 2.2.1.3	

NOTICE

2-way controller depicted with applicable LS pressure.

For B and R: LS > P

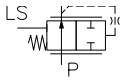
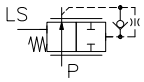
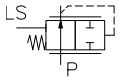
Coding	Description	Circuit symbol
8 **81**	Pre-selector valve section without 2-way controller The pre-selector valve section shuts off the P-line in neutral position. Once the pre-selector valve is activated, it supplies either the downstream valve sections (switching position b) or a second manifold connected to port A (switching position a). ▪ **8:** LS signal is signalled from port A (switching position a) and the following valve section (switching position b). Standard configuration if an open-centre valve (PSL) is used on port A. ▪ **81:** LS signal is only signalled by the downstream valve sections (switching position b). Is used if a Closed Center LS valve (PSV) is connected to port A; the LS signal is then usually signalled externally to the variable pump. **Typical applications** ▪ Loading cranes, concrete line pumps, lifting platforms, etc. ▪ Here, the pre-selector valve is used to switch between crane or mast operation and outrigger operation. ▪ The pre-selector valve can further also be used as a P-line shut-off in safety functions.	• 8 
	Only in conjunction with ▪ PSL connection block with 3-way controller spring coding H (Chapter 2.1.4) or PSV connection block ▪ Circuit symbol L or H (Chapter 2.2.1.5) ▪ Actuation coding E... (Chapter 2.2.1.13) **NOTICE** When using a pre-selector valve, there is an additional pressure drop in the P-line that can lead to the downstream sections no longer reaching the nominal value. **The undershooting of the nominal value depends on the** a) control pressure difference of the 3-way controller (PSL) or variable pump's pump controller (PSV), b) position of the valve section in the manifold and c) flow rate through the pre-selector valve or P-line shut-off. The nominal value may fall short of $Q_{nominal}$ by up to 30%, Chapter 2.2.1.6.	• 81 

Coding	Description	Circuit symbol
A8...L1	Pre-selector valve with additional LS pressure increase for the downstream valve sections. The pre-selector valve shuts off the P channel in neutral position. Once activated, it supplies either the downstream valve sections (switching position b) or a second manifold connected to port A (switching position a). In the switching position b, P is switched to LS. The LS pressure can be set via a CDSV 1 A (as per D 7876) that is installed in the ancillary block. In P, the LS pressure set on the CDSV plus the standby pressure of the pump is already present when the pre-selector valve is switched and no LS is reported by the downstream valve sections. In the case of fast switching operations, a negative impact on the load can therefore be prevented before the pump responds to the LS signal. The ancillary block in which the CDSV is installed is available in two versions: ▪ /2 CDSV 1 A-...: adjustment range of 100 - 420 bar ▪ /2 XCDSV 1: prepared for use with CDSV **Ordering example:** -A8 L 40/40 L1/EA/2 CDSV 1 A-200 **Typical applications** ▪ Loading cranes, concrete line pumps, lifting platforms, etc. ▪ Here, the pre-selector valve is used to switch between crane or mast operation and outrigger operation. ▪ The pre-selector valve can further also be used as a P-line shut-off in safety functions. Not in conjunction with ▪ Shuttle valve W3 (In the case of a sub-optimal shuttle valve position relating to the downstream valve sections, the LS could be relieved via the end plate in R)	• A8..L1/../2 CDSV 1 A-..  • A8..L1/../2 XCDSV 1 

2.2.1.3 2-way controller spring

Coding	Description
without coding	Without coding for configurations without 2-way controller (coding 1 or 8 Chapter 2.2.1.2)
2	Standard version (6 bar spring)
5	Heavy-duty version (9 bar spring) Only possible in conjunction with PSL connection block with 3-way controller spring coding H (Chapter 2.1.4) or with PSV connection block
7	Heavy-duty version (13 bar spring) Only possible in conjunction with PSV connection block

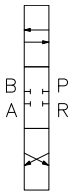
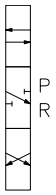
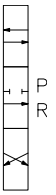
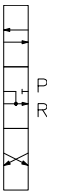
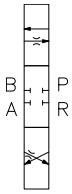
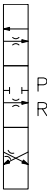
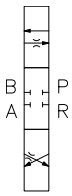
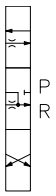
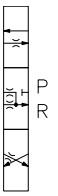
2.2.1.4 2-way controller damping

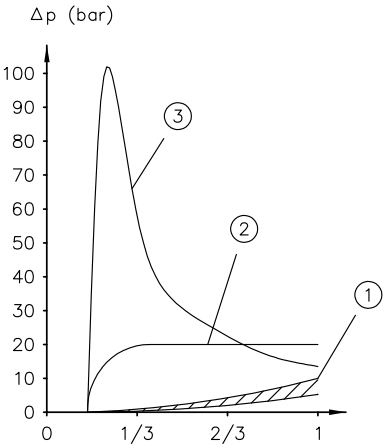
Coding	Description	Circuit symbol
without coding	Standard version (damping with ∅ 0.4 mm orifice)	
S	Special version with closing damping Only in conjunction with standard 2-way controller (without coding) Chapter 2.2.1.2 Sample application: Hydraulic motors with a small number of pistons or low rotation speed, leading to oscillating changes in the requested flow rate.	
X	Special version without damping Only in conjunction with standard 2-way controller (without coding) or 2-way controller with check valve function (coding R) Chapter 2.2.1.2	

NOTICE

2-way controller depicted with applicable LS pressure.

2.2.1.5 Circuit symbol

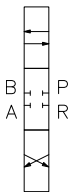
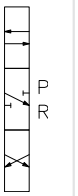
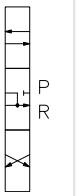
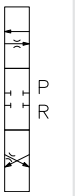
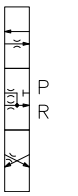
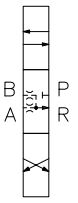
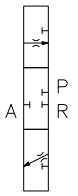
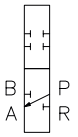
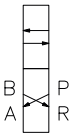
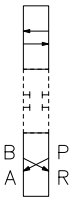
Coding	Description	Circuit symbol			
L, M, F, H	Standard spool valve with low return pressure	L 	M 	F 	H 
J, B, R, O	Standard spool valve with constant return pressure of 20 bar Common applications: Stabilising cylinders with dragging loads, especially when used with load-holding valves or when used without additional check valves.	J 	B 	R 	O 
I, Y, V	Standard spool valve with high reflux at < 1/3 spool stroke and rapid subsequent return pressure drop. Common applications: Controlled deceleration of winches, slewing gear or other rotating consumers.	I 	Y 		V 

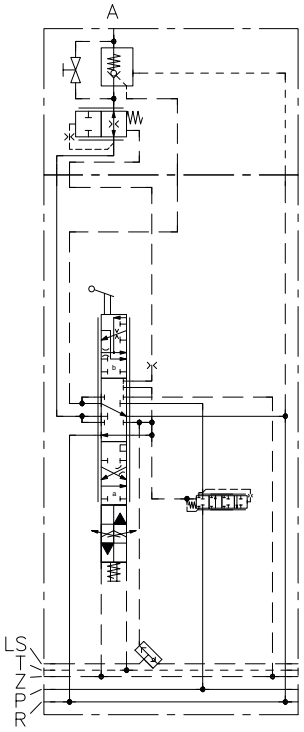


Δ$p_{A/B}$ return pressure (bar)

1 Circuit symbols L, M, F, H
2 Circuit symbols J, B, R, O
3 Circuit symbols I, Y, Z, V

NOTICE
The return pressure is in relation to the nominal flow rate. It may be higher or lower than shown in the diagram depending on the cylinder ratio or 2-way controller spring.

Coding	Description	Circuit symbol
LW, MW, HW, JW, OW	Special version with broad fitting tolerance. ▪ Advantage: reduces risk of jamming spool valve in systems prone to soiling. ▪ Drawback: higher spool valve leak rate	LW  MW  HW  JW  OW 
LB	Special version with minimal release of pressure from A and B-line when spool valve in idle position. Sample application: Combined with load-holding valves that require closed spool valve in neutral position due to safety requirements, e.g. lifting platform. In this case, the LB spool valve prevents pressure from being trapped between the load-holding valve and spool valve.	LB 
G	3/3-way directional spool valve for single-acting cylinders The G spool valve can be combined with any valve section, port B is sealed with a tapped plug when doing so. No LS signal is produced when load drops. If used in conjunction with electro-hydraulic actuation and a PSL connection block with standard 3-way controller spring, this can result in the internally generated pilot pressure not being sufficient for the full spool valve stroke, Chapter 2.1.4. Load reduction is throttled using the spool valve's meter-out edge. If desired, the maximum reduction rate can be capped using a separate flow control valve (e.g. type SB as per D 6920). To obtain pressure-compensated load reduction, you can alternatively also use an NX spool valve.	G 
X **W**	Special spool valve in conjunction with P → A in neutral position Common applications: Fan drives, generator drives or other consumers requiring a specific flow rate when unpowered for safety reasons. ▪ **X:** 2/2-way directional spool valve Maximum flow rate in neutral position. By shifting the spool valve to switching position b, the flow rate can be reduced to zero proportionally. ▪ **W:** 4/2-way directional spool valve In neutral position, the maximum flow rate is towards A-side. By shifting the spool valve to switching position b, the direction is reversed and the flow rate is towards B-side. Decelerating consumer to zero as well as proportional flow rate control are only possible to a limited degree. This makes the W spool valve suitable primarily for applications with constant speed. LS is signalled in both switching positions. **Combination options:** Only with actuation concepts Chapter 2.2.1.13 that have stroke limitation. Available versions: ▪ X 40 ▪ W 30/30	X  W  W Intermediate position 

Coding	Description	Circuit symbol
NX	3/3-way directional spool valve for single-acting cylinders with outflow pressure compensator and releasable check valve for pressure-compensated load reduction and load holding without leaking seating. The NX spool valve is combined with a valve section designed specifically for this purpose and cannot be used with any other valve sections. When the load drops, the pilot pressure (Z) is used to open the releasable check valve. At the same time, Z is switched to LS to increase the pressure level of the pilot control as required. **Ordering example:** SL 2-A2 **NX 25/25** /EA **22 HRPH 3 V** **Ancillary block** **Spool valve** Only in conjunction with ▪ Ancillary block coding, /2.. HRP 3 V, (Chapter 2.2.3) ▪ Internal control oil supply coding 2 (Chapter 2.1.6)	

NOTICE

- For instructions on how to replace the valve spool, Chapter 5.2.4.

2.2.1.6 Flow rate

Coding 2-way controller spring, see Chapter 2.2.1.3	Coding Flow rate ($Q_{nominal}$ in l/min) With maximum spool valve actuation					
	3	6	10	16	25	40
2	3	6	10	16	25	40
5	4	9	14	22	34	54
7	5	10	15	24	37	59

Flow rate for coding 1 and 8

On valve sections without a 2-way controller (coding 1 or 8, see Chapter 2.2.1.2, "2-way controller"), it is possible to calculate the flow rate using the following formula:

$$Q_{A/B} = Q_{nominal} \cdot \sqrt{0{,}2 \cdot \Delta p_{controller}}$$

$Q_{A/B}$ = flow rate to port A or B

$Q_{nominal}$ = Nominal flow rate of valve spool at pressure difference of 6 bar

$\Delta p_{controller}$ = control pressure difference of the 3-way controller (PSL) or variable pump's pump controller (PSV)

Example:

- PSL connection block, standard 3-way controller spring (9 bar)
  $Q_{A/B} = 40\ l/min \cdot \sqrt{0.2 \cdot 9} = 54\ l/min$
- PSL connection block, 3-way controller with heavy-duty spring (14 bar)
  $Q_{A/B} = 40\ l/min \cdot \sqrt{0.2 \cdot 14} = 67\ l/min$

NOTICE
The calculated values are rough reference values!
They apply only to the highest-load consumer. If multiple consumers are being actuated in parallel, the pressure difference may be considerably greater at the lower-load consumers.

Flow rate for all codings

NOTICE
When using a pre-selector valve (coding 8 as per Chapter 2.2.1.2) or a P channel shut-off (coding PSV 4 N or PSV UNF 4 N as per Chapter 2.1.1 there is an additional pressure drop in the P channel that can result in the downstream valve sections no longer reaching the nominal value.

The undershooting of the nominal value depends on

- the control pressure difference of the 3-way controller (PSL, Open Center) or variable pump's pump controller (PSV, Closed Center)
- the position of the valve section in the valve bank
- the flow rate through the pre-selector valve or P channel shut-off

The nominal value may fall short of $Q_{nominal}$ by up to 30%, Chapter 2.2.1.6.

Flow rate coding

Spool valves are defined using two flow rate codings in the order coding. The first number defines the nominal flow rate on the A-side (Q_A) and the second number defines the nominal flow rate on the B-side (Q_B). The shape of the spool valve's two meter-out edges is defined by the circuit symbol, see Chapter 2.2.1.5, "Circuit symbol".

► **Ordering example:** L 40/25, J 40/16, H 40/40, O 25/10

Flow rate setting value

The valve spools' sizes are designed to make actual flow rate slightly higher than $Q_{nominal}$ in practice. If the actuation includes a mechanical spool stroke limitation, this is set to the nominal flow rate as standard
(see Chapter 2.2.1.13, "Actuation")

If the spool stroke should not be limited or should be set to a lower value, this can be specified in the type designation using two separate bracket values.

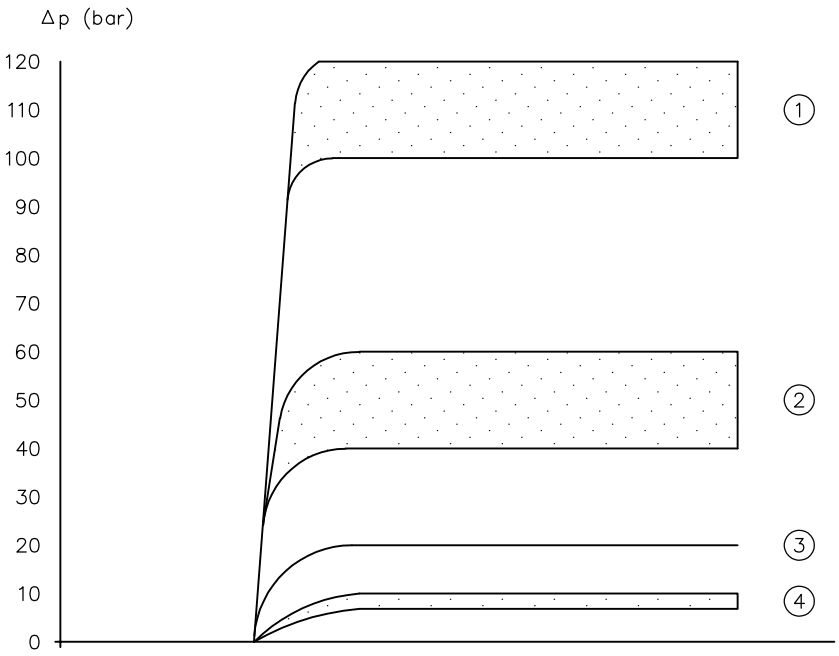
Not possible in conjunction with CAN actuation, see Chapter 2.2.1.13, "Actuation".

► **Ordering example:** SL 2-A2 L 25/40/EA (22/35)
Setting values: A – 22 l/min, B – 35 l/min
► **Ordering example:** SL 3-A2 L 25/400/EA (20/-)
Setting values: A – 20 l/min, B – no stroke limitation

Flow rate coding with larger or smaller meter-out edges

For J and O spool valves, the meter-out edge can also be customised. In such a case, the order coding has 4 digits and looks like this: $Q_{A \rightarrow R}$ – $Q_{P \rightarrow A}$ / $Q_{P \rightarrow B}$ – $Q_{B \rightarrow R}$. Choosing a smaller key figure increases return pressure. A larger key figure reduces return pressure.

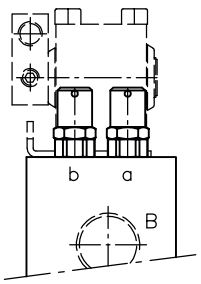
► **Ordering example:** J 25/40-16, O 25-16/40-25



1 Outflow edge two numbers smaller
2 Outflow edge one number smaller
3 Standard version
4 Outflow edge one number larger

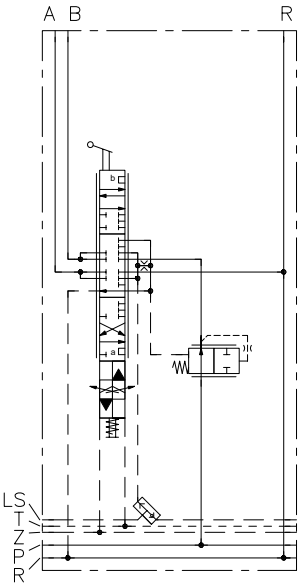
NOTICE
The return pressure is in relation to the nominal flow rate. It may be higher or lower than shown in the diagram depending on the cylinder ratio or 2-way controller spring.

2.2.1.7 LS pressure limitation

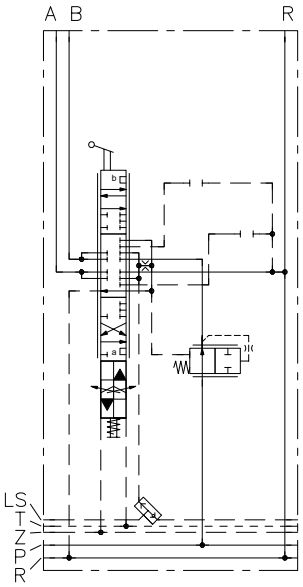
Coding	Description	View
without coding	Without LS pressure limitation	-
AB	Without LS pressure limitation, but prepared for later conversion to coding A.., B.. or A.. B..	
A..	LS pressure limitation for A-side (Adjustment range: 50 to 400 bar)	
B..	LS pressure limitation for B-side (Adjustment range: 50 to 400 bar)	
A.. B..	LS pressure limitation for A and B-side with two separate pressure settings (Adjustment range: 50 to 400 bar)	

Circuit symbols

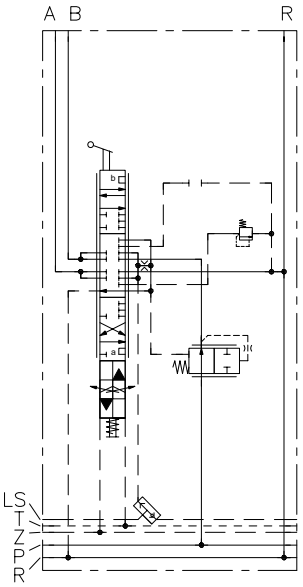
without coding



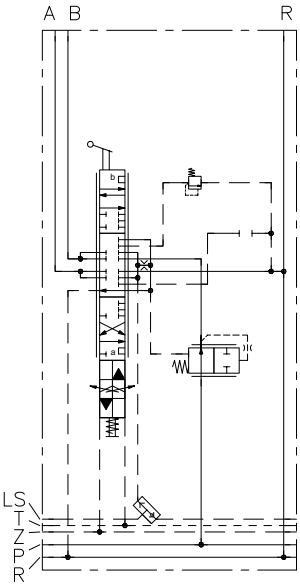
AB



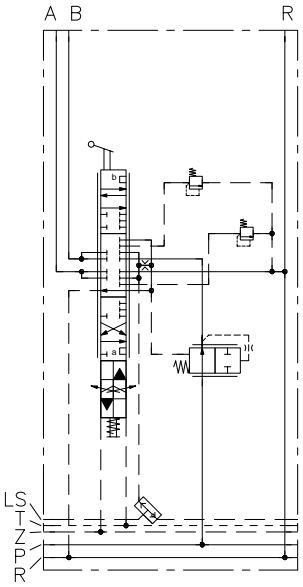
A..



B..



A.. B..



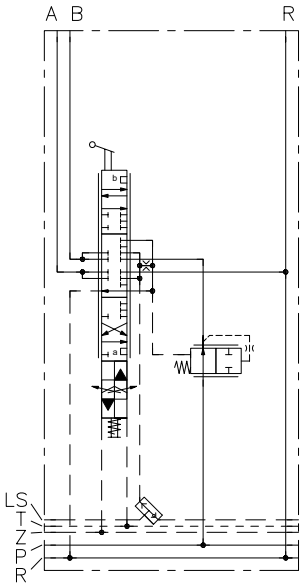
NOTICE
LS pressure limitation is only available in conjunction with a 2-way controller (Chapter 2.2.1.2).

2.2.1.8 Electric LS relief or LS pressure limitation

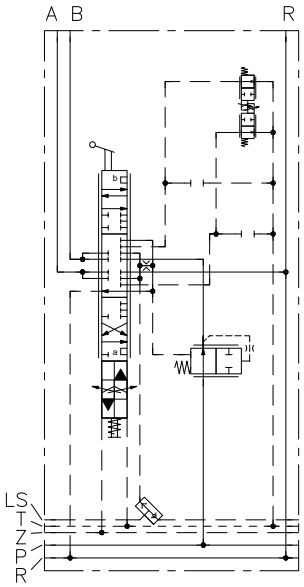
Coding	Description
without coding	Without electric LS relief or LS pressure limitation
FP.. **FPH..**	Electro-proportional LS pressure limitation with ascending characteristic line **Pressure ranges for A and for B-side** ▪ 1 = 10 to 100 bar ▪ 2 = 15 to 150 bar ▪ 4 = 30 to 250 bar ▪ 6 = 40 to 350 bar **INFORMATION** The first number applies to A-side. The second number applies to B-side. **Ordering example:** FP12 ▪ **FPH..:** additionally with button for manual override Only in conjunction with actuation coding LS DBV... (Chapter 2.2.1.13)
FPC-S.. **FPC-R../..**	Electro-proportional LS pressure limitation Limits the pressure for A and B-side. Different pressure values in A and B are controlled electrically. ▪ **FPC-S..:** – ascending characteristic line / normally open (PMVE 1 S... according to D 8143) ▪ **FPC-R../..:** – falling characteristic line / normally closed (PMVE 1 R according to D 8143) – with additional mechanical p_{max} setting (75 – 100 % from pressure range) **Pressure stage** ▪ A = up to 50 bar ▪ B = up to 100 bar ▪ C = up to 150 bar ▪ D = up to 200 bar ▪ E = up to 250 bar ▪ F = up to 300 bar ▪ G = up to 350 bar ▪ H = up to 420 bar Only in conjunction with: Consumer ports (Chapter 2.2.1.1): SL 2-**A..** LS pressure limitation (Chapter 2.2.1.7): AB, A..B.., A.., B.. Actuation (Chapter 2.2.1.13): with E
FPCX	Prepared for electro-proportional LS pressure release FPC-S.. and FPC-R../.. Only in conjunction with: Consumer ports (Chapter 2.2.1.1): SL 2-**A..** LS pressure limitation (Chapter 2.2.1.7): AB, A..B.., A.., B.. Actuation (Chapter 2.2.1.13): with E

Circuit symbols

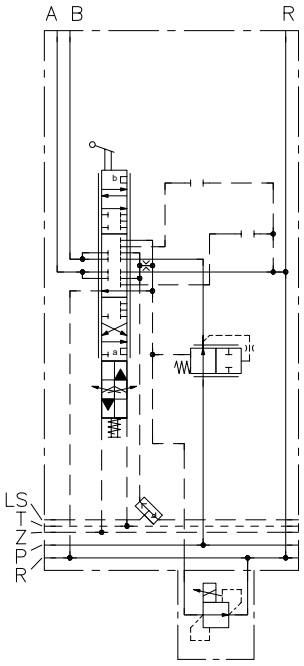
without coding



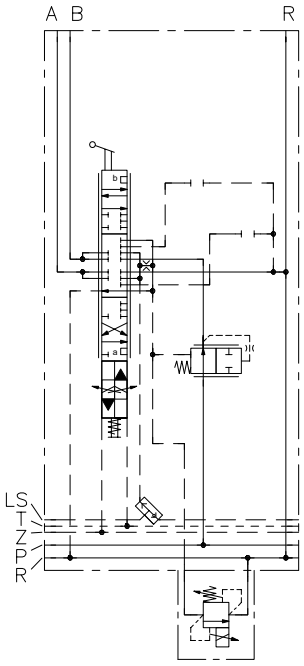
FP.., FPH..



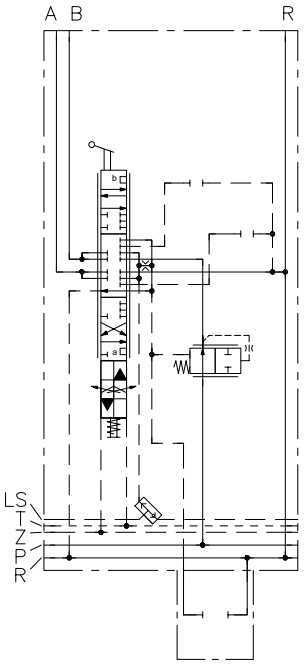
FPC-S..



FPC-R../..



FPCX



NOTICE
Electric LS relief or LS pressure limitation is only available in conjunction with a 2-way controller, Chapter 2.2.1.2

NOTICE
Even with LS relief, pressure in consumer line A or B cannot be reduced completely to 0 bar. The remaining minimum pressure in A or B ($p_{min, A/B}$) is the sum of:

a) control pressure in the 2-way controller ($\Delta p_{2\text{-way controller}}$)
b) internal dynamic pressure in block (Δp_{Block})
c) Tank or return pressure (depending on the end plate used)

Resulting minimum pressures, without tank or return pressure

FP...: approx. 40 bar

FPC...: approx. 13 bar

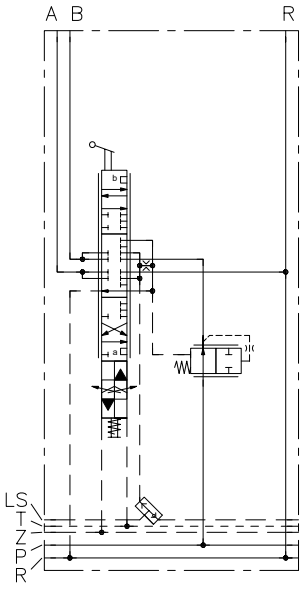
NOTICE
The electrical LS relief or LS pressure limitation cannot be combined with circuit symbols with a wide fitting tolerance, Chapter 2.2.1.5

2.2.1.9 LS port for external limitation

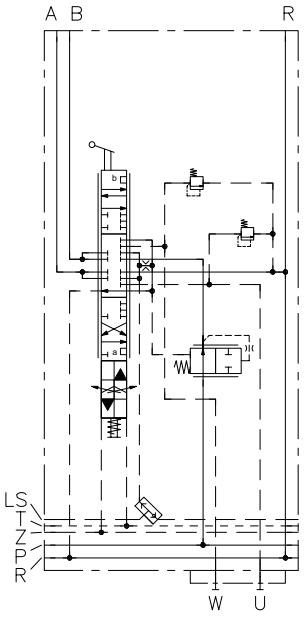
Coding	Description
without coding	Without LS port for external limitation
S1 **S1 UNF**	U and W port for connecting external pilot valve ▪ U port = LS_A ▪ W port = LS_B ▪ **S1:** G 1/8 (ISO 228-1) ▪ **S1 UNF:** SAE-2 or 5/16-24 UNF-2B (SAE J 514) **Only in conjunction with** ▪ LS pressure limitation coding AB, A..B.., A.., B.. (Chapter 2.2.1.7)

Circuit symbols

without coding



S1, S1 UNF



NOTICE
An LS port for external limitation is only possible in conjunction with a 2-way controller (Chapter 2.2.1.2).

NOTICE
Even with LS relief, pressure in consumer line A or B cannot be reduced completely to 0 bar. The remaining minimum pressure in A or B ($p_{min, A/B}$) is the sum of:

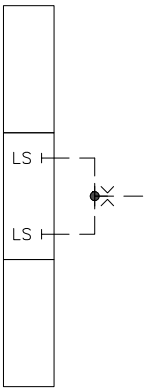
a) control pressure in the 2-way controller ($\Delta p_{2\text{-way controller}}$)
b) internal dynamic pressure in block (Δp_{Block})
c) Return pressure (p_{reflux}).

$p_{min,A/B} = \Delta p_{2\text{-way controller}} + \Delta p_{Block} + p_{reflux}$

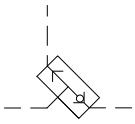
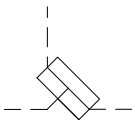
$\Delta p_{\text{ 2-way controller}}$: see Chapter 2.2.1.3

Δp_{Block} for coding S1 = 5 bar

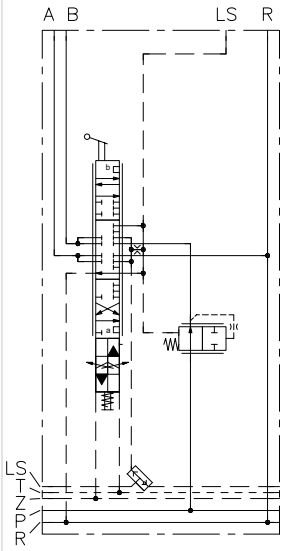
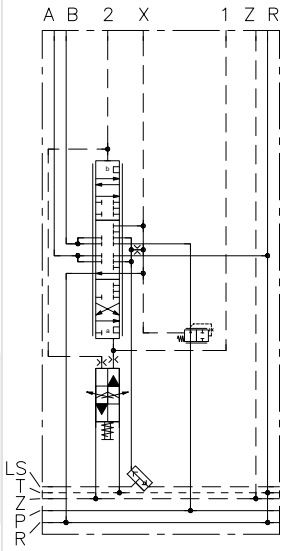
2.2.1.10 LS orifice

Coding	Description	Circuit symbol
without coding	Standard version with ∅ 0.6 mm orifice	

2.2.1.11 Shuttle valve

Coding	Description	Circuit symbol
without coding	Standard version	
W3	Special version without ball Only useful in manifold's final valve section in case the downstream LS-line is not relieved by the end plate.	

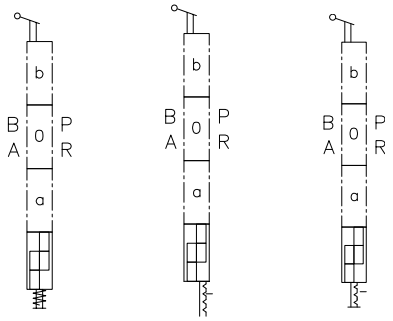
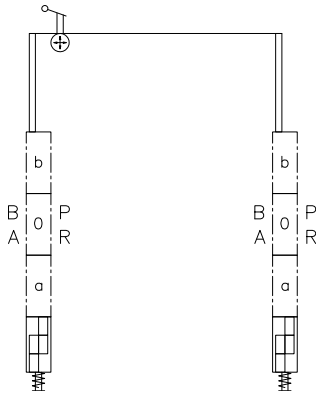
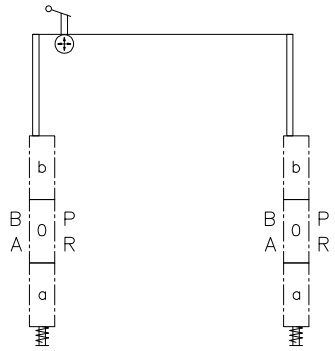
2.2.1.12 Additional functions

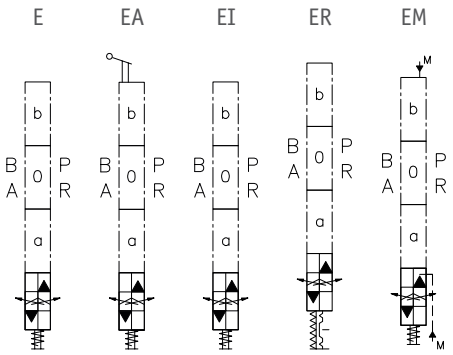
Coding	Description	Circuit symbol
L	Valve section with additional LS port facing ancillary block. The LS signal is picked up downstream of the LS orifice. **Combination options** ▪ The additional LS port is required for the intermediate plate (on the consumer side) ZN.../ ZNX.... ▪ In conjunction with other ancillary blocks or intermediate plates, the LS port is closed.	
FL	Valve section with additional 1-, 2-, X- and Z-port facing ancillary block The Z port can be used to realise additional functions for an ancillary block or intermediate plate. The LS signal is picked up downstream of the LS orifice. **Only in conjunction with** ▪ Ancillary blocks /2 FL and /UNF 2 FL (Chapter 2.2.3) ▪ Intermediate plate /ZFL A-B-6 B-B-6 (Chapter 2.2.4) Alternatively only available as a single valve section without ancillary block. **NOTICE** ▪ Only with return pressure < 10 bar (similar to end plate E 4) ▪ For Z, approximately 2 l/min are available. It must be ensured that sufficient hydraulic fluid is available for the actuations.	

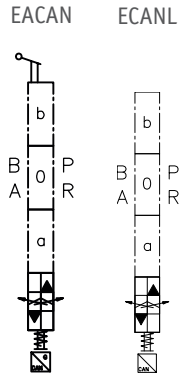
2.2.1.13 Actuation

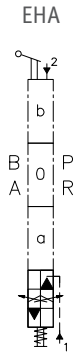
Actuation types

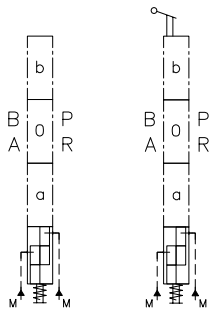
The different actuation types can be combined with one another.

Coding	Description	Circuit symbol
Electro-hydraulic actuation prepared		
EO	Prepared for electro-hydraulic actuation	-
Manual actuation		
A	Manual actuation with spring return Only in conjunction with actuation variants: ▪ EA, EACAN(L), EMA, EMACAN(L) ▪ E0A, E0ZA, EAR, E0AR ▪ EHA, E0HA EHACAN, E0ZA, E0ZMA	E0A E0C E0AR 
C	Manual actuation, infinitely variable Only in conjunction with actuation variants: ▪ C, E0C	
R	Actuation supplement for a 3-stage detent for switching position 0, a or b. Without stroke limitation. With spring return. No flow rate setting possible. Only in conjunction with actuation variants: ▪ AR, E0AR ▪ EAR, ER	E0K 
K	Joystick actuation Combined manual actuation for two adjacent valve sections with shared 2-axis actuation. Only in conjunction with actuation variants: ▪ E0K **NOTICE** If the subsequent valve section is also to be equipped with a manual actuation, a ZPL 22 must be installed directly after the E0K actuation to avoid a collision between the hand levers.	K 

Coding	Description	Circuit symbol
Electro-hydraulic actuation		
E **EI** **EM** **EM UNF**	Electro-hydraulic actuation. ▪ **E:** with stroke limitation ▪ **EI:** no stroke limitation ▪ **EM:** with measurement fitting, with stroke limitation on spring housing and lever housing ▪ EM: G 1/8 (ISO 228-1) ▪ EM UNF: SAE-4 or 7/16-20UNF-2B (SAE J 514) Only in conjunction with actuation variants: ▪ E, EA, EMA ▪ ECAN(L), EICAN(L), EACAN(L), EMACAN(L), EHACAN(L) ▪ EHA ▪ ER, EAR ▪ EI	

Coding	Description	Circuit symbol
CAN actuation		
CAN **CANL**	Directly mounted CAN controls as per D 7700 CAN ▪ **CAN:** CAN actuation with integrated displacement transducer for spool valve position control. The spool valve characteristic line is linearised and hysteresis is minimised. ▪ **CANL:** CAN Lite actuation without integrated displacement transducer. Spool valve position is controlled; start and end point are calibrated. Only in conjunction with actuation variants: ▪ EACAN(L) ▪ EMACAN(L) ▪ EICAN(L) ▪ EHACAN **NOTICE** When using CAN actuation, the nominal flow rate may be undershot under certain circumstances. To enable optimum control, an additional tolerance for the mechanical travel stop has been programmed.	

Coding	Description	Circuit symbol
Hydraulic actuation		
HA **HA UNF**	Combination of hydraulic and manual actuation with control pressure connections on the spring housing and lever housing. With stroke limitation. Ports 1 and 2 in spool valve axis. ▪ HA: G 1/8 (ISO 228-1) ▪ HA UNF: SAE-4 or 5/16-24 UNF-2B (SAE J 514) Only in conjunction with actuation variants: ▪ EOHA ▪ EHA ▪ EHACAN	

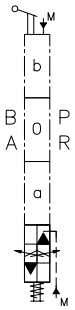
Coding	Description	Circuit symbol
Z **Z UNF**	Hydraulic actuation with pilot pressure ports in the spool block beneath spring housing. ▪ Z: G 1/8 (ISO 228-1) ▪ Z UNF: SAE-2 or 5/16-24 UNF-2B (SAE J 514) Only in conjunction with actuation variants: ▪ E0Z ▪ E0ZI ▪ E0ZA, E0ZA UNF ▪ E0ZMA UNF	E0ZM E0ZMA 

Coding	Description	Circuit symbol
Pneumatic actuation		
P	Pneumatic actuation with pilot pressure ports on lever housing. Suitable for switching the valve spool on/off. Ports 1 and 2: M10x1 with 24° sealing bevel Pilot pressure required: approx. 6–13 bar P_{max}: 15 bar Only in conjunction with actuation variants: ▪ E0P	P 

Actuation combinations

Actuation	combined with		= coding
manual	+ electro-hydraulic	--	= EA, EMA(UNF)
manual	+ hydraulic	--	= E0HA(UNF), E0ZA, E0ZMA
electro-hydraulic	+ 3-stage detent	--	= ER
electro-hydraulic	+ manual	+ 3-stage detent	= EAR
electro-hydraulic	+ hydraulic	--	= EHA(UNF)

EMA



EAR

EHA (UNF)

E0A
E0A8

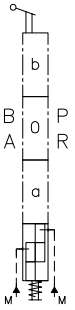
E0HA (UNF)

E0P

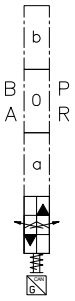
E0Z (UNF)

E0ZA (UNF)

E0MZA (UNF)

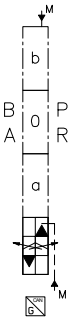


EICAN



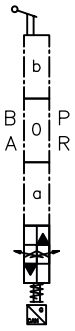
EICANL

EIMCAN

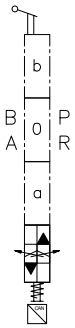


EIMCANL

EACAN

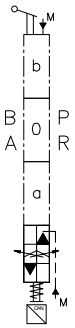


EACANL

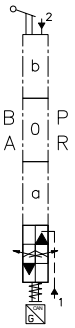


EMACAN

EMACANL



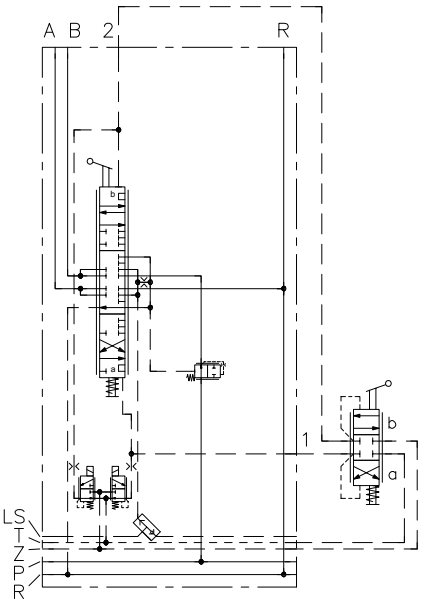
EHACAN



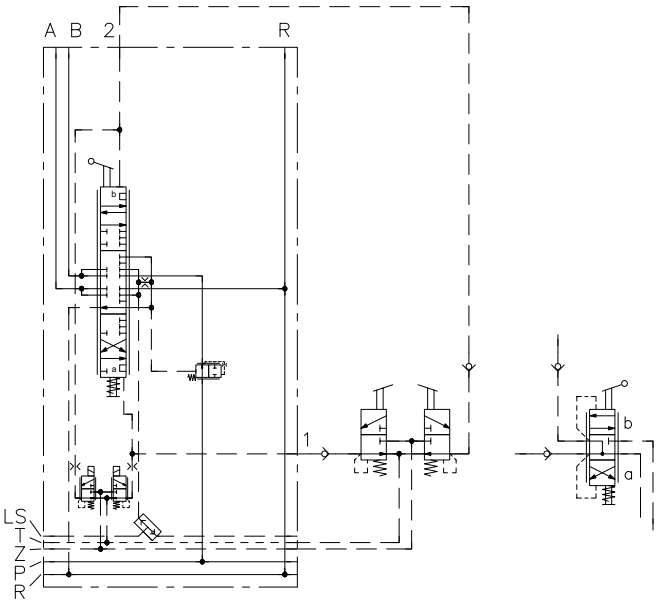
EHACANL

Combination with hydraulic joysticks

with closed centre position



with open centre position

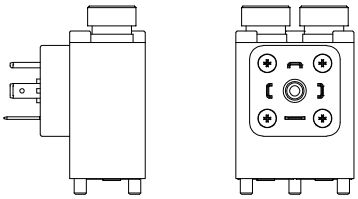


There are two ∅ 0.8 mm orifices between the electro-hydraulic actuation's pilot valves and the pilot pressure ports 1 and 2. The control oil flow for the hydraulic joystick needs to be sufficiently large to compensate for bypass leakage through the orifice.

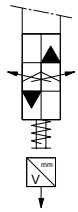
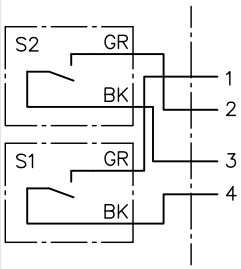
For joysticks with open centre position, pilot pressure ports 1 and 2 are connected to the tank when the joystick is in neutral position. Electro-hydraulic actuation would then result in the entire control oil flow escaping that way, and no pressure would be built up to shift the valve spool. For this reason, additional check valves need to be added to the control lines in this case.

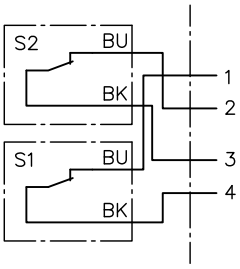
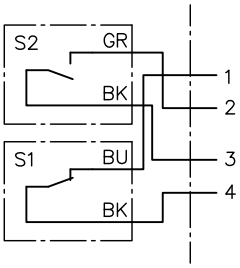
2.2.1.14 Additional elements for actuation

Coding	Description
without coding	Standard version Hand lever straight approx. 122 mm
1 **2** **3** **4** **005** **015** **025** **030**	Add-on for manual actuation ▪ **1:** Without hand lever ▪ **2:** Hand lever straight approx. 78 mm ▪ **3:** Hand lever straight approx. 174 mm ▪ **4:** Hand lever straight approx. 92 mm ▪ **005:** Hand lever 5° curved approx. 122 mm ▪ **015:** Hand lever 15° curved approx. 120 mm ▪ **025:** Hand lever 25° curved approx. 115 mm ▪ **030:** Hand lever 30° curved approx. 114 mm Ordering example: SL 2-A2 H 40/25 A150 B200/EA025/2
S	Reinforced version of spring housing made from steel (seaworthy version). Not in conjunction with the actuations as per coding ▪ C ▪ R ▪ CAN ▪ CANL
8 **9**	Additional description for stronger or weaker spring package ▪ **8:** Actuation torques as for E actuation ▪ **9:** Actuation torques as for H actuation Ordering example: SL 2-A2 H 40/25 A150 B200/EA9/2
BE...	Add-on for actuation E0Z, E0ZA. With restrictor check valve type BE 0-... as per D 7555 B in the ports. Ordering example: SL 2-A2 H16/16/E0Z BE0606
00 **04** **05** **06** **07**	Add-on for actuation with E Additional damping in the electro-hydraulic pilot control. ▪ **04:** 0.4 mm orifice ▪ **05:** 0.5 mm orifice ▪ **06:** 0.6 mm orifice ▪ **07:** 0.7 mm orifice Ordering example: SL 2-A2 H16/16/E0Z 07 (if A and B are the same, 0.7 mm orifice here) SL 2-A2 H16/16/E0Z 0705 (if A and B are different, 0.7 mm orifice here in A and 0.5 mm orifice in B)

Coding	Description
H	Push buttons for the solenoid versions with manual override H, see Chapter 2.5.1, "PSV/PSL standard solenoid versions " Colours: ▪ Side A: white ▪ Side B: black 

2.2.1.15 Switching position monitoring, displacement transducer

Coding	Description	Circuit symbol
U	Comparator for monitoring spool valve position. ▪ In neutral position: A and B on ▪ P → A: A on, B off ▪ P → B: A off, B on ▪ Voltage U: 10 - 32 V DC Connector types: DT, M12, X Ordering example: SL 2 A2 H16/16/EAU **Only in conjunction with** ▪ Actuation coding E, EI, EA, E0Z, E0ZI, E0ZA, E0A, E0C and E0K Chapter 2.2.1.13	
WA	Integrated displacement transducer (Hall sensor) for spool valve position monitoring with analogue output signal. Connector types: DT, X, G, C Ordering example: SL 2 A2 H16/16/EAWA **NOTICE** Not possible in the first valve section if an LS pressure limitation or LS release valve with coding V, Z or ZM is selected in the connection block. The electric field of the solenoid influences the displacement transducer. **Only in conjunction with** ▪ Actuation coding E is the stroke limitation only possible for consumer A. Chapter 2.2.1.13 Only in conjunction with the ancillary blocks **- /2 AL-0-..-BL-0-.. - /UNF 2 AL-0-..-BL-0-..**, because this results in a collision.	
VCHO **VCHO2K**	Contact switch for monitoring spool valve position. Direction detection direction A (S2) and B (S1) as normally open contact (NO)  ▪ **VCHO:** With connector, without cable ▪ **VCHO2K:** With connector and 2 m cable Ordering example: SL 2-A2 H16/16/EAVCHO **Only in conjunction with** ▪ Actuation coding EA, EAR, ER, E0ZA, E0A, E0C and E0AR (Chapter 2.2.1.13)	

Coding	Description	Circuit symbol
VCHC **VCHC2K**	Contact switch for monitoring spool valve position. Direction detection direction A (S2) and B (S1) as normally closed contact (NC)  ▪ **VCHC:** With connector, without cable ▪ **VCHC2K:** With connector and 2 m cable Contact switch type V 4 N 4 Sk 2 ® with lever AR 1 and Hirschmann connector by BURGESS. Ordering example: SL 2-A2 H16/16/EAVCHC **Only in conjunction with** ▪ Actuation coding EA, EAR, ER, E0ZA, E0A, E0C and E0AR (Chapter 2.2.1.13)	
VCHOC **VCHOC2K**	Contact switch for monitoring spool valve position. Direction detection direction A (S2) as normally open contact (NO) and B (S1) as normally closed contact (NC)  ▪ **VCHOC:** With connector, without cable ▪ **VCHOC2K:** With connector and 2 m cable Contact switch type V 4 N 4 Sk 2 ® with lever AR 1 and Hirschmann connector by BURGESS. Ordering example: SL 2-A2 H16/16/EAVCHOC **Only in conjunction with** ▪ Actuation coding EA, EAR, ER, E0ZA, E0A, E0C and E0AR (Chapter 2.2.1.13)	

A detailed description of the electric parameters is available in Chapter 3.5.4, "Switching position monitoring, displacement transducer".

2.2.2 EDL directional valve section

Ordering example

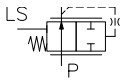
EDL 2	-DA	2	H25/25	C 150 X	W3	/E	/ZDRH	/2

- /2 → 2.2.3 "Ancillary block"
- /ZDRH → 2.2.4 "Intermediate plate (on the consumer side)"
- /E → 2.2.2.10 "Actuation"
- W3 → 2.2.2.9 "Shuttle valve"
- C 150 X
  - 2.2.2.6 "LS pressure limitation"
  - 2.2.2.7 "LS port for external limitation"
- H25/25
  - 2.2.2.4 "Circuit symbol"
  - 2.2.2.5 "Flow rate"
- 2
  - 2.2.2.2 "2-way controller"
  - 2.2.2.3 "-way controller spring"
- -DA → 2.2.2.1 "Consumer ports"

2.2.2.1 Consumer ports

Coding	Description
DA	Spool block without integrated threads for combining with a Ancillary block or a Intermediate plate (on the consumer side)

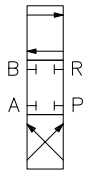
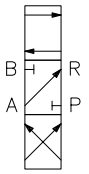
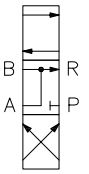
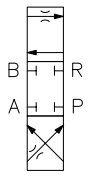
2.2.2.2 2-way controller

Coding	Description	Circuit symbol
2	Standard 2-way controller	

2.2.2.3 -way controller spring

Coding	Description
2	Standard version (approx. 6 bar spring)
7	Heavy-duty version (approx. 13 bar spring) – Only possible in conjunction with PSV connection block

2.2.2.4 Circuit symbol

Coding	Description	Circuit symbol		
L, F, H	Standard spool valve with low return pressure	L 	F 	H 
J	Standard spool valve with constant return pressure of approx. 20 bar – Max. flow rate: 25 l/min Common applications: Stabilising cylinders with dragging loads, especially when used without additional check valves.	J 		

2.2.2.5 Flow rate

Coding 2-way controller spring, as per Chapter 2.2.2.3	Coding for flow rate ($Q_{nominal}$ in l/min) With maximum spool valve actuation					
	3	**6**	**10**	**16**	**25**	**40**
2	3	6	10	16	25	40
7	4	7	12	19	29	48

NOTICE

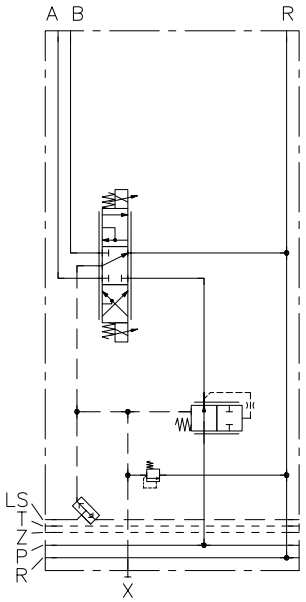
- The specified nominal flow rates correspond to the setting values during actuation **E**. During actuation **EI**, the max. flow rates can be higher.
- The maximum reflux flow rate must not exceed 80 l/min.
- The flow rates for the consumer ports A and B can be selected in accordance with the table, e.g. 40/25, 16/16. This enables optimal adaptation to the respective consumer while exploiting the full functional lift.
  In addition, there is the option of stroke limitation.

2.2.2.6 LS pressure limitation

<table>
<tr><th>Coding</th><th>Description</th><th>Circuit symbol</th></tr>
<tr><td>without coding</td><td>Without LS pressure limitation</td><td>-</td></tr>
<tr><td>C...</td><td>LS pressure limitation for A and B-side with a single shared pressure setting for both sides (adjustment range: 50 to 320 bar)

Only in conjunction with:

<table>
<tr><th>Consumer ports (Chapter 2.2.2.1)</th><th>LS pressure limitation</th><th>LS port for external limitation (Chapter 2.2.2.7)</th></tr>
<tr><td>EDL 2-DA...</td><td>C...</td><td>X</td></tr>
</table>

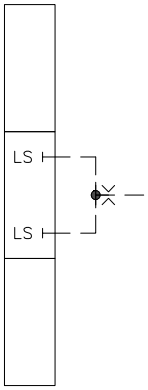
NOTICE
When using the LS pressure limitation, the solenoid versions G..., X... , L... can only be used to a limited extent. To avoid a collision, the solenoids must be rotated 180° so that the connector points towards the ancillary block. Depending on the ancillary block, a collision can also occur there. In this case, only the solenoid versions DT... and AMP... can be used.</td><td> 
</td></tr>
</table>

2.2.2.7 LS port for external limitation

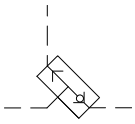
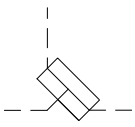
Coding	Description
without coding	Without LS port for external limitation
X	Port for an external pilot valve ▪ X port = LS $_{A/B}$ ▪ G 1/8 (ISO 228-1) Only in conjunction with:

Consumer ports (Chapter 2.2.2.1)	LS pressure limitation (Chapter 2.2.2.6)	LS port for external limitation
EDL 2-DA...	C...	X

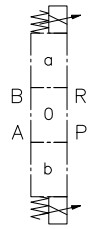
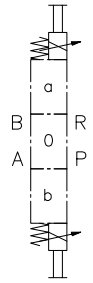
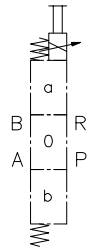
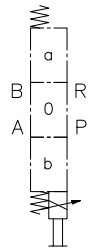
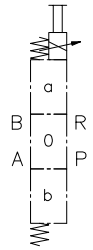
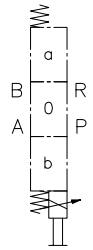
2.2.2.8 LS orifice

Coding	Description	Circuit symbol
without coding	Standard version with ∅ 0.6 mm orifice	

2.2.2.9 Shuttle valve

Coding	Description	Circuit symbol
without coding	Standard version	
W3	Special version without ball – Required in the last valve section if an E 0 end plate is used. This relieves the load on the downstream LS gallery through the spool.	

2.2.2.10 Actuation

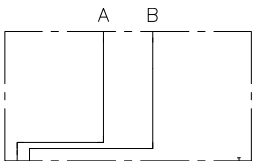
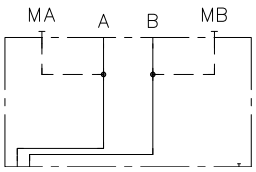
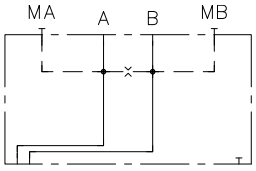
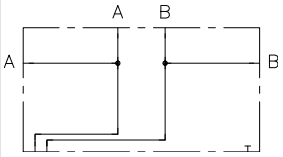
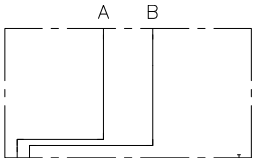
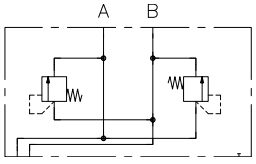
Coding	Description	Circuit symbol
E	Electrical actuation ▪ A-side and B-side ▪ with stroke limitation	
EI	Electrical actuation ▪ A-side and B-side ▪ with emergency override ▪ Without stroke limitation	
AEI	Electrical actuation ▪ A-side only ▪ with emergency override ▪ Without stroke limitation	
BEI	Electrical actuation ▪ B-side only ▪ with emergency override ▪ Without stroke limitation	
AEEI	Electrical actuation ▪ A-side only ▪ with emergency override ▪ with stroke limitation	
BEEI	Electrical actuation ▪ B-side only ▪ with emergency override ▪ with stroke limitation	

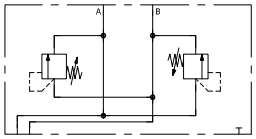
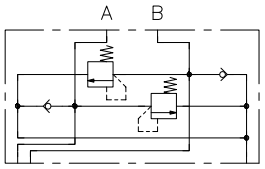
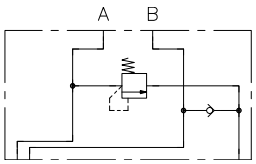
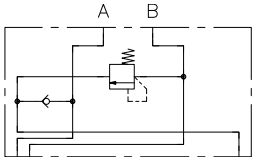
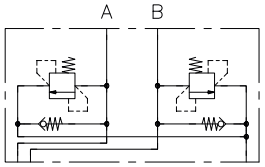
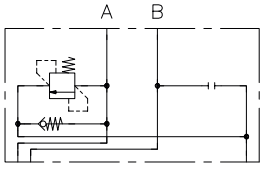
2.2.3 Ancillary block

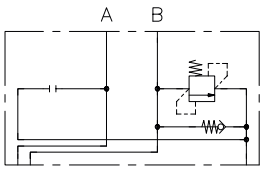
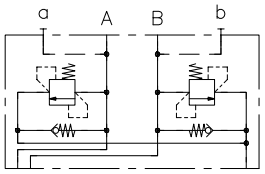
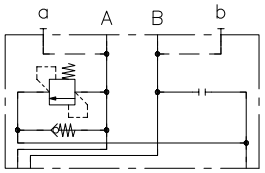
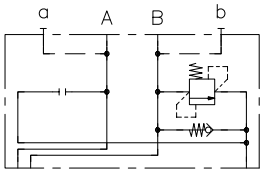
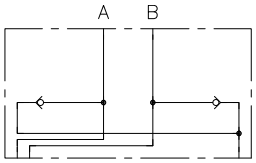
Depending on their version, the ancillary blocks comprise different kinds of additional valves (e.g. shock valves, releasable check valves, load-holding valves or electrically actuated 2/2-way directional seated valves). They can be flange-mounted either on a valve section with flange surface (coding A as per Chapter 2.2.1.1) or on an intermediate plate (Chapter 2.2.4).

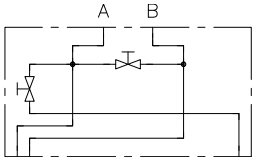
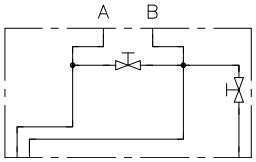
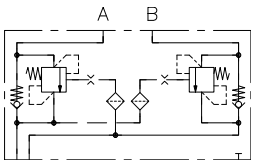
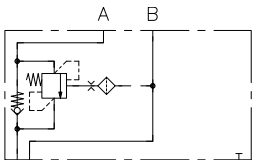
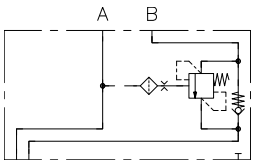
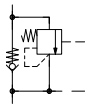
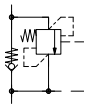
Ports A and B as per ISO 228-1 or SAE J 514 or JIS B 2351:

- **/2:** G 3/8
- **/22:** G 3/8 (more distance between consumer ports A and B)
- **/3:** G 1/2
- **/4:** G 3/4
- **/UNF 1:** 7/16-20 UNF-2B (SAE-4)
- **/UNF 12:** 9/16-18 UNF-2B (SAE-6)
- **/UNF 2:** 3/4-16 UNF-2B (SAE-8)
- **/JIS 2:** JIS G 3/8
- **/M 222:** M22x1.5 and G 3/8

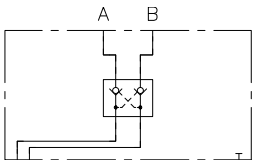
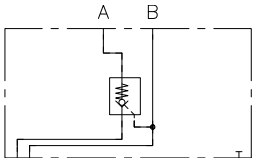
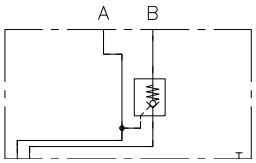
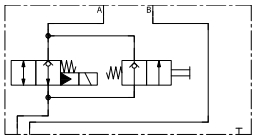
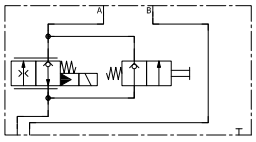
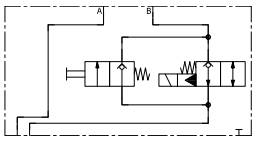
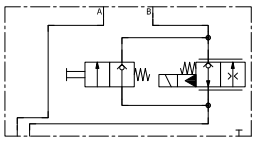
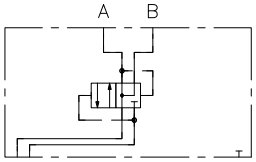
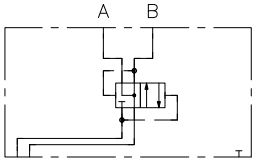
Coding	Description	Circuit symbol
/2 **/22** **/3** **/UNF 1** **/UNF 12** **/UNF 2** **/JIS 2**	No additional function	
/2 M **/UNF 2 M**	Additional measurement fittings a and b G 1/4.	
/2 M-.. **/UNF 2 M-..**	Connection A - B via orifice. Additional measurement fittings a and b G 1/4. **Ordering example:** SL 2-/ M-06	
/M 222	Consumer ports A and B in M22x1.5. Additional A and B ports laterally G 3/8.	
/2 FL **/UNF 2 FL**	No additional function. For the valve section with additional function FL, see Chapter 2.2.1.12, "Additional functions"	
/2 AS.. BS.. **/22 AS.. BS..** **/UNF 2 AS.. BS..**	Fixed shock valve in A and B. (Adjustment range: 40 to 420 bar) The shock valves are each connected to their opposite side.	

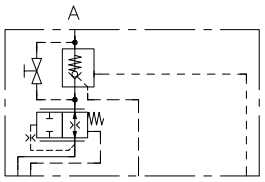
Coding	Description	Circuit symbol
/2 AS..R BS..R	Adjustable shock valve in A and B. (Adjustment range: 40 to 420 bar) The shock valves are each connected to their opposite side. If the pressure setting is changed, the spring must be adjusted according to the pressure range. ▪ Pressure ranges in which the different springs can be used: – 20 - 59 bar – 60 - 149 bar – 150 - 209 bar – 210 - 279 bar – 280 - 420 bar	
/2 AN.. BN.. **/22 AN.. BN..** **/UNF 2 AN.. BN..**	Fixed shock and anti-cavitation valves in A and B. (Adjustment range: 40 to 420 bar) The shock and anti-cavitation valves are each connected to the reflux. Common applications: Pressure safeguard in hydraulic cylinders. ▪ **/22 AN.. BN..:** Greater distance between consumer ports A and B than for coding /2	
/22 AN.. **/UNF 2 AN..**	Fixed shock valve in A and anti-cavitation valves B. ▪ **/22 AN..:** Greater distance between consumer ports A and B	
/22 BN.. **/UNF 2 BN..**	Fixed shock valve in B and anti-cavitation valves A. ▪ **/22 AN..:** Greater distance between consumer ports A and B	
2 ANV..BNV..	Shock and anti-cavitation valve in A and B ▪ Permanently set pressure ▪ Available pressure settings for A or B: – 80 bar – 100 bar – 120 bar – 150 bar – 180 bar – 200 bar – 220 bar – 250 bar – 280 bar – 300 bar – 325 bar – 350 bar – 380 bar	
2 ANV..	Shock and anti-cavitation valve in A ▪ Permanently set pressure ▪ Available pressure settings: – 80 bar – 100 bar – 120 bar – 150 bar – 180 bar – 200 bar – 220 bar – 250 bar – 280 bar – 300 bar – 325 bar – 350 bar – 380 bar	

Coding	Description	Circuit symbol
2 BNV..	Shock and anti-cavitation valve in B ▪ Permanently set pressure ▪ Available pressure settings: – 80 bar – 100 bar – 120 bar – 150 bar – 180 bar – 200 bar – 220 bar – 250 bar – 280 bar – 300 bar – 325 bar – 350 bar – 380 bar	
2 M ANV..BNV.. /UNF 2 M ANV..BNV..	Shock and anti-cavitation valve in A and B ▪ Permanently set pressure ▪ Available pressure settings for A or B: – 80 bar – 100 bar – 120 bar – 150 bar – 180 bar – 200 bar – 220 bar – 250 bar – 280 bar – 300 bar – 325 bar – 350 bar – 380 bar Measurement fittings in A and B: G 1/4	
2 M ANV.. /UNF 2 M ANV..	Shock and anti-cavitation valve in A ▪ Permanently set pressure ▪ Available pressure settings: – 80 bar – 100 bar – 120 bar – 150 bar – 180 bar – 200 bar – 220 bar – 250 bar – 280 bar – 300 bar – 325 bar – 350 bar – 380 bar Measurement fittings in A and B: G 1/4	
2 M BNV.. /UNF 2 M BNV..	Shock and anti-cavitation valve in B ▪ Permanently set pressure ▪ Available pressure settings: – 80 bar – 100 bar – 120 bar – 150 bar – 180 bar – 200 bar – 220 bar – 250 bar – 280 bar – 300 bar – 325 bar – 350 bar – 380 bar Measurement fittings in A and B: G 1/4	
2 ANV BNV /UNF 2 ANV BNV	Anti-cavitation valve at A and B	

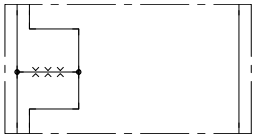
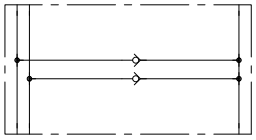
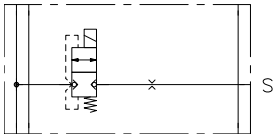
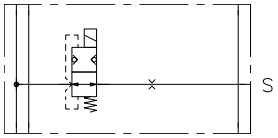
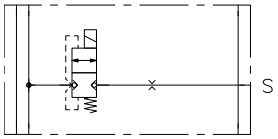
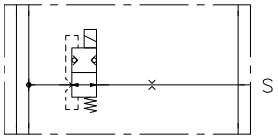
Coding	Description	Circuit symbol
/2 A HN	Manual short-circuit valve for connection A to B. Manual drain valve A to R.	
/2 B HN	Manual short-circuit valve for connection A to B. Manual drain valve B to R.	
/2 AL-0-..-BL-0-.. **/2 ALX-0-..-BLX-0-..** **/UNF 2 AL-0-..-BL-0-..** **/UNF 2 ALX-0-..-BLX-0-..** **/2 AL-0-..** **/2 ALX-0-..** **/UNF 2 AL-0-..** **/UNF 2 ALX-0-..** **/2 BL-0-..** **/2 BLX-0-..** **/UNF 2 BL-0-..** **/UNF 2 BLX-0-..**	Load-holding valves (type LHT 20 as per D 7918). ▪ **/2 AL-0-..-BL-0-..:** Load-holding valves at A and B ▪ **/2 AL-0-..:** Load-holding valve in A ▪ **/3 BL-0-..:** Load-holding valve in B ▪ **AL or BL:** Pressure setting adjustable from the outside using a tool ▪ **ALX or BLX:** fixed /(UNF) 2 AL-0..BL-0-.. /(UNF) 2 ALX-0-..-BLX-0-..  /(UNF) 2 AL-0-.. /(UNF) 2 ALX-0-..  /(UNF) 2 BL-0-.. /(UNF) 2 BLX-0-..  **Ordering example:** /2 AL - 0 **- A** **8** **- 400** Pressure setting in bar Geometric pilot ratio Flow rate ▪ **Geometric pilot ratio:** - 1:∞ (coding 0) - 1:4 (coding 4) - 1:8 (coding 8) Coding **0**  Coding **4, 8**  For coding 0, the load pressure has no effect, and the load-holding valve is opened by the pilot pressure alone. In this case, the load-holding valve does not have an overpressure function. The pressure setting corresponds to the pilot pressure and is limited to max. 100 bar. ▪ **Flow rate:**

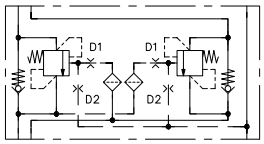
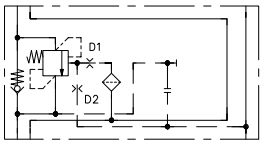
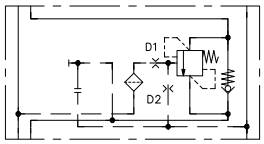
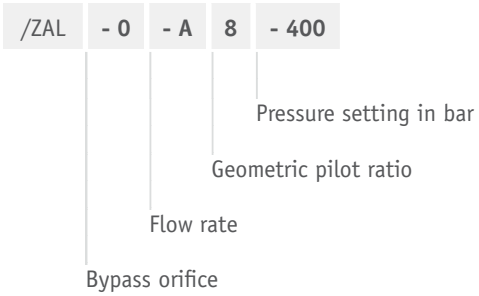
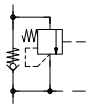
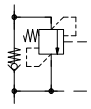
Coding	A	AB	B	C	D	E
Q_{max} (l/min)	28	20	14	10	6	3

Coding	Description	Circuit symbol
/2 DRH **/UNF 2 DRH**	Releasable check valves (type DRH 2 as per D 6110) ▪ **/2 DRH:** releasable check valves in A and B ▪ **/2 DRH A:** releasable check valve in A ▪ **/2 DRH B:** releasable check valve in B **Pressure required for releasing:** ▪ 0.4-fold of shut-off pressure + 3 bar	
/2 DRH A **/UNF 2 DRH A**		
/2 DRH B **/UNF 2 DRH B**		
/3 AVT **/3 AVPT**	Electrically actuated 2/2-way directional seated valve closed in neutral position. (Type according to D 7490/1) With manual override function. **On/off actuated (with type EM 22 V)** ▪ **/3 AVT:** Check valve at A ▪ **/3 BVT:** Check valve at B **Proportional (with type EMP 21 V)** ▪ **/3 AVPT:** Check valve at A ▪ **/3 BVPT:** Check valve at B **NOTICE** The actuation of the override function is only possible up to approx. 100 bar.	/3 AVT  /3 AVPT 
/3 BVT **/3 BVPT**		/3 BVT  /3 BVPT 
/32 DFA	Differential function (regeneration function) – The differential circuit makes it possible to reach considerably greater cylinder extension speeds at the same pump flow rate. – The force available becomes lower because the pressure applied on the cylinder's piston and rod side is the same; only the effective areas differ. Therefore, the differential function is suitable for loads that pull on the cylinder. ▪ **/32 DFA:**Cylinder's piston side on A-side, rod side on B-side ▪ **/32 DFB:** Cylinder's piston side on B-side, rod side on A-side Formula for calculating the required pump flow rate (Q_{pump}) as a function of desired flow rate for cylinder extension (Q_{piston}) and cylinder ratio (φ). $Q_{pump} = Q_{piston} \cdot \left(1 - \frac{1}{\varphi}\right)$	
/32 DFB		

Coding	Description	Circuit symbol
/2.. HRPH 3 V	Output controller for proportional lowering speed independent of load pressure in single-acting cylinders combined with a releasable check valve for seat-tight load holding. With the 2-way regulator spring, the Δp and therefore the flow rate can be increased. **Only in conjunction with** ▪ Circuit symbol NX **Ordering example:** /22 **HRPH** 3 V ▪ 2-way controller without coding ▪ 2-way controller spring	

2.2.4 Intermediate plate (on the consumer side)

Coding	Description	Circuit symbol
/Z 20	Connection to A and B via 3 orifices, height: 20 mm **Ordering example**: SL 2-/Z 20-12-20-12 (orifices 1.2 mm, 2.0 mm, 1.2 mm)	
/Z 40	Spacer plate, height 40 mm, for compensating height differences relative to adjacent valve sections.	
/Z AN BN	Anti-cavitation valves in A and B.	
/Z2A BVE 1 R B..	Additional port S in A or B. ▪ **/Z2A BVE 1 R B.. and /Z2B BVE 1 R B..:** closed when unpowered ▪ **/Z2A BVE 1 S B.. and /Z2B BVE 1 S B..:** open when unpowered **Selectable orifices for volume limitation:**	
/Z2A BVE 1 S B..	- ∅d: 0.4 / 0.5 / 0.6 / 0.7 / 0.8 / 0.9 / 1.0 / 1.2 / 1.5 mm - Q_{max} = 15 l/min $d = \sqrt{\frac{2{,}24 \times Q}{\sqrt{\Delta p}}}$	
/Z2B BVE 1 R B..	**Ordering example:** /Z2A BVE 1 R B 0.8	
/Z2B BVE 1 S B..		

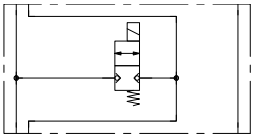
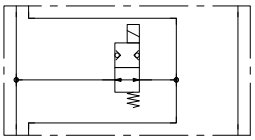
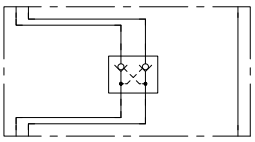
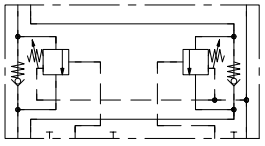
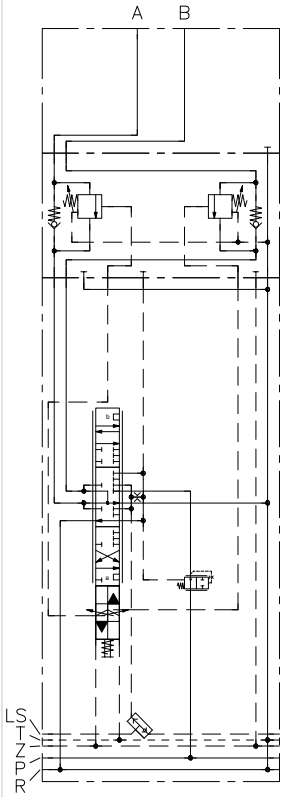
Coding	Description
/Z AL.. BL.. **/Z ALX.. BLX..** **/Z AL-..** **/Z ALX-..** **/Z BL-...** **/Z BLX-..**	Load-holding valves (type LHT 20 as per D 7918). ▪ **/Z AL.. BL..:** Load-holding valves at A and B ▪ **/Z AL-..:** Load-holding valve in A ▪ **/Z BL-..:** Load-holding valve in B ▪ **/Z AL or /Z BL:** Pressure setting adjustable from the outside using a tool ▪ **/Z ALX or /Z BLX:** fixed /Z AL.. BL..  /Z AL..  /Z BL..  **Ordering example:**  ▪ Inflow orifice D1: - ∅ 0.4 mm ▪ Bypass orifice D2: - 0 = sealed - ∅ 0.3 / 0.4 / 0.5 / 0.6 / 0.7 mm ▪ Geometric pilot ratio: - 1:∞ (coding 0) - 1:4 (coding 4) - 1:8 (coding 8) Coding **0**  Coding **4, 8**  For coding 0, the load pressure has no effect, and the load-holding valve is opened by the pilot pressure alone. In this case, the load-holding valve does not have an overpressure function. The pressure setting corresponds to the pilot pressure and is limited to max. 100 bar. **Actual pilot ratio depends on bypass orifice:**

Coding		**0**	**3**	**4**	**5**	**6**	**7**
Bypass orifice ∅ (mm)		sealed	0.3	0.4	0.5	0.6	0.7
Actual pilot ratio	at 1:4	1:4	1:3.04	1:2.0	1:1.16	1:0.66	1:0.39
	at 1:8	1:8	1:6.08	1:4.0	1:2.32	1:0.77	1:0.47

Flow rate:

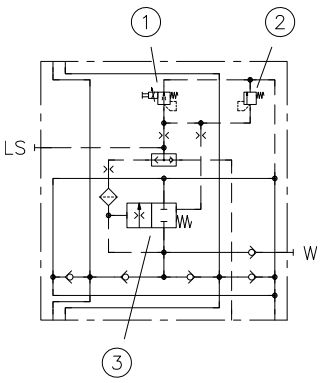
Coding	**A**	**AB**	**B**	**C**	**D**	**E**
Q_{max} (l/min)	28	20	14	10	6	3

Anti-cavitation valve in A and B.

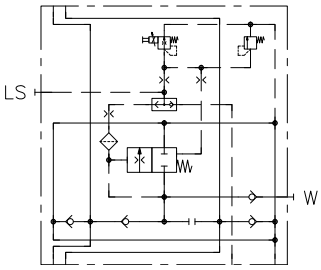
Coding	Description	Circuit symbol
/ZDR	Electrically actuated 2/2-way directional seated valve as short-circuit valve. Q_{max} = 20 l/min ▪ **/ZDR:** closed in neutral position (type BV 1 R) ▪ **/ZDS:** open in neutral position (type BV 1 S)	
/ZDS	The maximum switchable pressure depends on the actuating solenoid: ▪ G, L, L5K, L10K: 400 bar ▪ DT, AMP, M, F, S: 250 bar Not in conjunction with ancillary block types **/(UNF)(2)2 AS...BS..., /2 AS...R BS...R, /(UNF)(2)2 AN...BN..., /(UNF 2) 22 AN..., /(UNF 2) 22 BN..., /(UNF) 2 AL-0-...-BL-0-..., /(UNF) 2 ALX-0-...-BLX-0-..., /(UNF) 2 AL-0-..., /(UNF) 2 ALX-0-..., /(UNF) 2 BL-0-..., /(UNF) 2 BLX-0-...**	
/ZDRH	Releasable check valves in A and B. (Type DRH 2 as per D 6110) **Pressure required for releasing:** ▪ 0.4-fold of shut-off pressure + 3 bar	
/ZFL A-B-6 B-B-6	Intermediate plate for floating position option. In combination with a H-spool valve (Chapter 2.2.1.5), a float position can be realised with this intermediate plate. To open the float position, both solenoid coils of the actuation must be controlled simultaneously with the same mA value. Additional channels from the actuation then open the load-holding valves in A and B. Through the spool valve (A and B open to R), both sides of the consumer are connected to each other via the reflux. Because both solenoid coils of the actuation (Chapter 2.2.1.13) are controlled simultaneously, the permissible ambient temperature at 100% duty cycle is reduced depending on the current value: ▪ With electro-hydraulic actuation (Chapter 2.2.1.13): – 50 °C Ambient temperature: I_{max} 1000 mA – 60 °C Ambient temperature: I_{max} 900 mA – 70 °C Ambient temperature: I_{max} 850 mA ▪ With CAN actuation (Chapter 2.2.1.13): – 50 °C Ambient temperature: I_{max} 730 mA – 60 °C Ambient temperature: I_{max} 670 mA – 70 °C Ambient temperature: I_{max} 630 mA Only in conjunction with: ▪ Additional function (Chapter 2.2.1.12), Coding FL ▪ Circuit symbol (Chapter 2.2.1.5), Coding H ▪ Electro-hydraulic actuation (Chapter 2.2.1.13), Coding EI, EICAN, EICANL ▪ Internal control oil supply (Chapter 2.1.6), Coding 2 ▪ Additional elements for actuation (Chapter 2.2.1.14), Coding 9 Max. Operating pressure 350 bar	 Ordering example: SL 2-A2 H 40/40 FL/ EI9/ZFL A-B-6 B-B-6/2 

Coding	Description	Circuit symbol
/ZN.. **/ZNX..**	Shock and anti-cavitation valves with electrically adjustable pressure limitation. The opening pressure of the shock valve can be configured using the electric LS pressure limitation. It opens upon the selected shock valve minimum pressure and configured LS pressure limitation (EM 21 D...).	

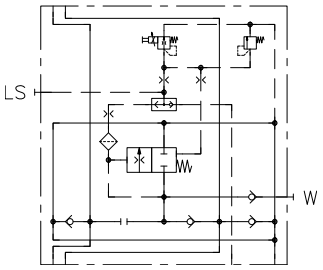
/ZN



/ZNA



/ZNB



1 LS pressure limitation
2 Pressure limitation
3 Shock valve

Ordering example:

/ZN	A	250	PV	15

Shock valve minimum pressure
LS pressure limitation
Pressure limitation
Protected against shock
LS signal hole

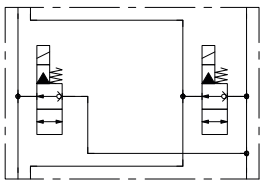
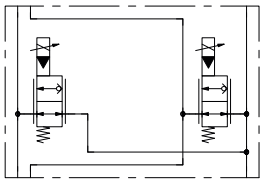
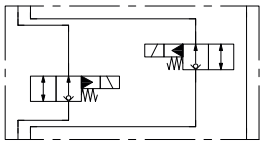
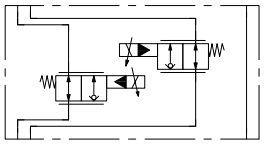
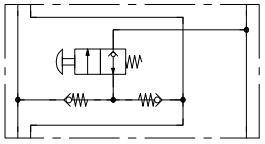
- LS signal hole to the valve
  - : open
  X: sealed
- Protection against shock
  - : Shock protection in A and B
  A: Shock protection in A
  B: Shock protection in B
- LS pressure limitation
  max. 400 bar
  fixed
- LS pressure limitation
  PV: closed when unpowered (EM 21 DE)
  PZ: open when unpowered (EM 21 DSE)

PV

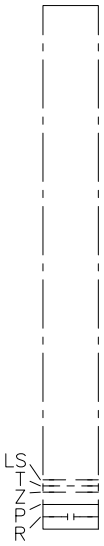
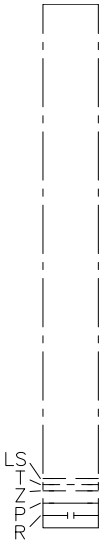
PZ

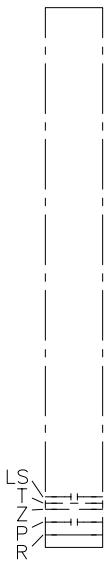
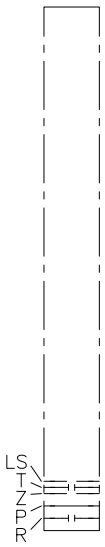
- Shock valve minimum pressure
  10, 15, 20, 25 or 30 bar: fixed

Only in conjunction with valve sections that contain the additional function **L**.
Cannot be combined with LS pressure limitation in the valve section.

Coding	Description	Circuit symbol
/ZVV **/ZVX** **/ZXV** **/ZSS** **/ZSX** **/ZXS** **/ZPVPV** **/ZPVX** **/ZXPV** **/ZPSPS** **/ZPSX** **/ZXPS**	Electrically actuated 2/2-way directional seated valve from A to R or B to R **Ordering example:** /Z **PV** **PV** B-side A-side - **V:** Check valve, closed in neutral position (EM 22 V as per D 7490/1) - **S:** Check valve, open in neutral position (EM 22 S as per D 7490/1) - **PV:** Proportional check valve, closed in neutral position (EMP 22 V as per D 7490/1) - **PS:** Proportional check valve, closed in neutral position (EMP 22 S as per D 7490/1) - **X:** Without check valve, connection sealed	ZVV  ZPSPS 
/Z1VV **/Z1VX (previously ZVX)** **/Z1XV (previously ZXV)** **/Z1SS** **/Z1SX** **/Z1XS** **/Z1PVPV** **/Z1PVX (previously ZVPX)** **/Z1XPV (previously ZXVP)** **/Z1PSPS** **/Z1PSX** **/Z1XPS**	Electrically actuated 2/2-way directional seated valve in A or B **Ordering example:** /Z1 **PV** **PV** B-side A-side - **V:** Check valve, closed in neutral position (EM 22 V as per D 7490/1) - **S:** Check valve, open in neutral position (EM 22 S as per D 7490/1) - **PV:** Proportional check valve, closed in neutral position (EMP 22 V as per D 7490/1) - **PS:** Proportional check valve, closed in neutral position (EMP 22 S as per D 7490/1) - **X:** Without check valve, connection open	Z1VV  Z1PSPS 
/ZRT	Intermediate plate with shared manual drain valve at A and B - **/ZRT:** Actuation of drain valve on the lever housing side. - **/ZRT-180:** Actuation of drain valve on the spring hood side Check valves RK 0 as per D 7445	

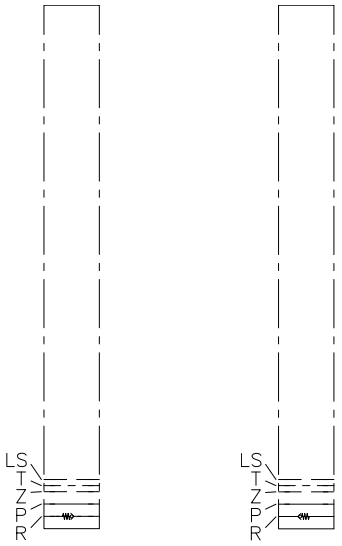
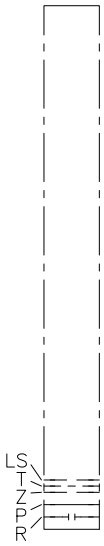
2.3 Series intermediate plate

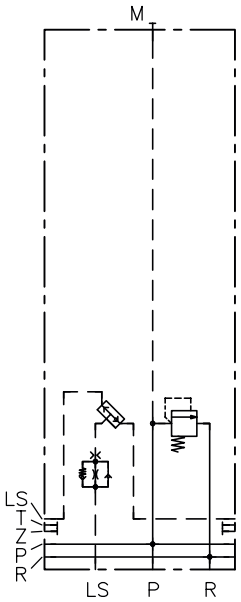
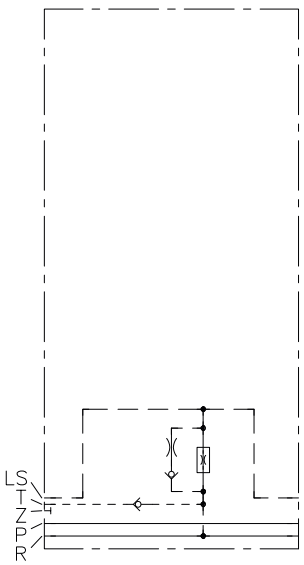
Coding	Description
ZPL 22/7 **ZPL 22/15** **ZPL 22**	Spacer plate. ▪ **ZPL 22/7:** 7 mm ▪ **ZPL 22/15:** 15 mm ▪ **ZPL 22:** 39.3 mm 
ZPL 22/7 EX	Spacer plate, 7 mm. If used with solenoid see Chapter 2.5.2, " PSV/PSL Solenoid versions for potentially explosive atmospheres" ▪ G.. M2FP.. ▪ G.. TEX455FM this intermediate plate has to be applied upstream and downstream of the valve section for mechanical protection purposes. 

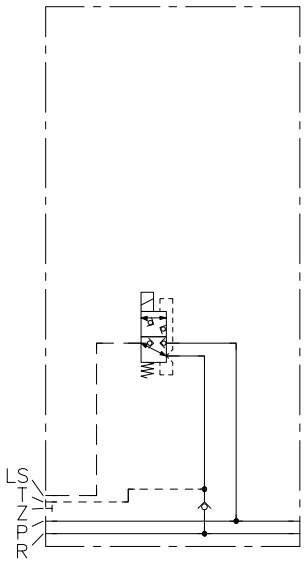
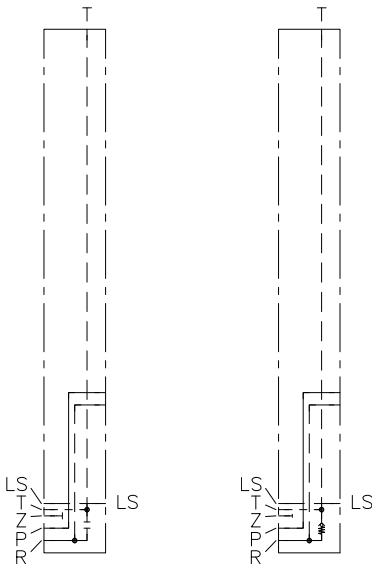
Coding	Description
ZPL 22/7/XPLS	Locks the P channel and the LS gallery. 
ZPL 22/7/XRT	Locks the R channel and the T channel. 

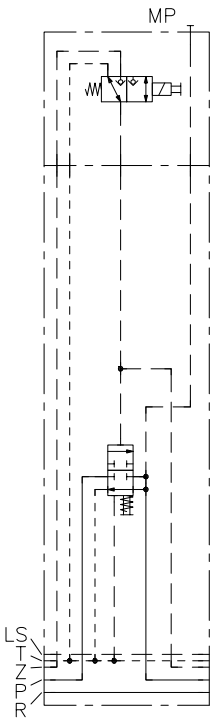
NOTICE

If the ZPL 22/7/XRT is used together with an LS relief or LS pressure limitation as per Chapter 2.1.7 or 2.2.1.8 an additional T port for the relief must be provided.

Coding	Description
ZPL 22/15/R1 **ZPL 22/15/R2**	Check valve in R channel. Q_{max} in R: 20 l/min ▪ **ZPL 22/15/R1:** Locking direction from connection block toward end plate ▪ **ZPL 22/15/R2:** Locking direction from end plate toward connection block ZPL 22/15/R1 ZPL 22/15/R2 
ZPL 22/15/XR	Locks the R channel 

Coding	Description
ZPL 22 P6R6	Middle input block for installation of EDL 2 valve sections on both sides. Connection block without 3-way controller for use in closed-centre systems with variable pumps or for simultaneous supply of two or more manifolds with a shared constant pump. Only possible in conjunction with connection plate PSV E0-2 connection plate. see Chapter 2.1, "Connection block" 
ZPL 2-CWL	Transition plate to CWL as per D 7953 CWL. P_{max}: 315 bar The control oil in the T channel of the PSL/PSV valve sections is returned to the R channel internally. The LS gallery is connected to the R channel by means of a flow control valve (setting value: 0.6 l/min). As a result, the LS of the CWL valve sections is relieved when in neutral position.  Width: 49.5 mm **NOTICE** Internal control oil recirculation through R line is permissible only for return pressures < 10 bar.

Coding	Description
ZPL 2-CWS BV 1 Z	Transition plate to CWS as per D 7951 CWS. P_{max}: 315 bar The control oil in the T channel of the PSL/PSV valve sections is returned to the R channel internally. Since CWS does not signal LS, it is generated through actuation of BV 1 Z from the P channel. When in neutral position, it connects LS to the T channel.  Width: 49.5 mm **NOTICE** Internal control oil recirculation through R line is permissible only for return pressures < 10 bar.
ZPL 2-SWS2 **ZPL 2-SWS2/RB**	Transition plate to SWS as per D 7951. ZPL 2-SWS2 ZPL 2-SWS2/RB 

Coding	Description
ZPL 2 P3R3	Additional P and R ports. Ports P and R: G 1/2 (ISO 228-1) 
ZPL 2 VZ/BVE1 ZT	Intermediate plate to shut off the P channel and the control pressure Z. In neutral position, the control pressure is blocked by the BVE 1 and the P channel is closed. The following valve sections are non-functional. If BVE 1 is actuated, the P channel and the control pressure Z are released to the subsequent valve sections. ▪ Additional measuring connection MP (from P after the lock) **Ordering example:** **ZPL 2 VZ** **BVE1 Z** **T1** **A** Coil alignment Manual override Seated valve as per D 7921 Intermediate plate with ancillary block ▪ Manual override ▪ **T:** With detent ▪ **T1:** without detent ▪ Coil alignment ▪ **- :** Connection socket faces away from the valve ▪ **A:** Connection socket in the direction of the valve see Chapter 4, "Dimensions" 

NOTICE

The following valve section can only be selected with the hand lever **030**, see Chapter 2.2.1.14, "Additional elements for actuation". This means there is no collision with the contained BVE 1. If a straight hand lever is to be used, at least one ZPL 22/7 spacer plate, see Chapter 2.3, "Series intermediate plate" must be inserted.

Coding	Description
ZPL 2-Z2	P channel interruption and P port for additional pump circuit. G 3/8 (ISO 228-1) 
ZPL LS/...	LS limitation for downstream spool valve sections. Additional LS port: G 1/4 (ISO 228-1) Pressure ranges: – B: from 315 bar – C: up to 315 bar **Ordering example:** -ZPL LS/C 250 

Coding	Description
A1 RR.../.../...	Intermediate plate with 2/2-way directional seated valves (type EM 31... / EMP 31... as per D 7490/1) for lifting and lowering of single-acting cylinders.

Ordering example:

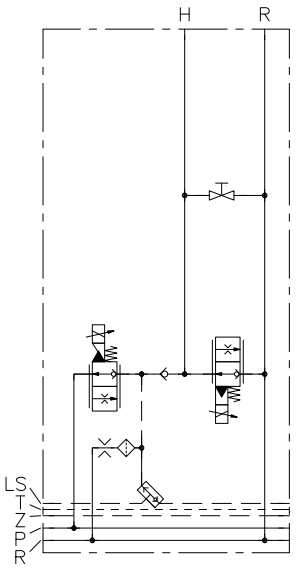
A1	RR	PV/PV	/3

/3: Connecting thread of ancillary block
- **/3:** G 1/2
- **/4:** G 3/4

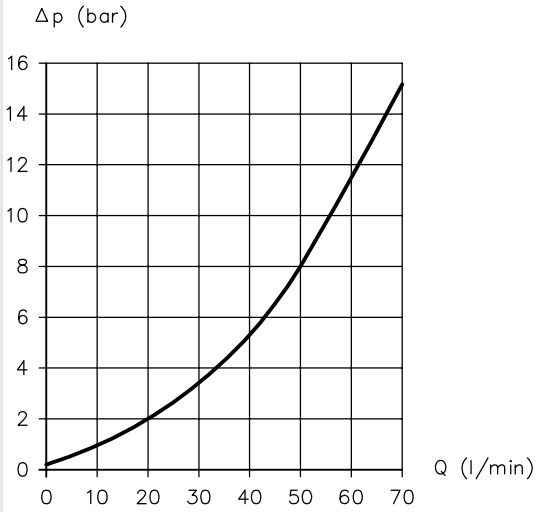
PV/PV: Directional seated valve (lifting/lowering)
- **/V:** EM 31 V
- **/S:** EM 31 S
- **/PV:** EMP 31 V
- **/PV70:** EMP 31 V70
- **/PV80:** EMP 31 V80

RR: Designation
- **A:** Interface for ancillary block
- **1:** Without 2-way controller

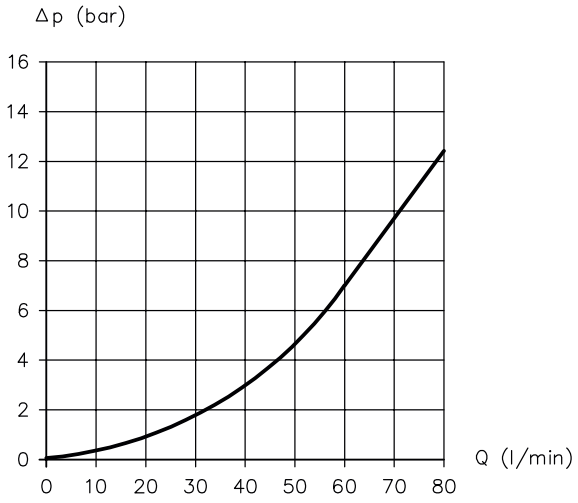
A1 RR PVPV/3



Δp P → H (lifting)



Δp H → P (lowering)



Cannot be combined with ancillary blocks see Chapter 2.2.3, "Ancillary block".

NOTICE
If a valve section with manual operation A is to be installed downstream of this ZPL, a SL 2-ZPL 22/7 spacer plate, see Chapter 2.3, "Series intermediate plate" must be installed so that there are no collisions.

2.4 End plate

End plates are the final element in a manifold and close off the valve bank.

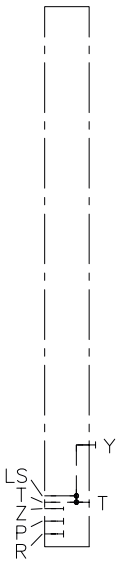
Depending on the version, the end plates feature ports themselves (e.g. P, R or LS port) or additional valves (e.g. flow control valve or pressure reducing valves) for supplying downstream valves.

Coding	Description
E 1, E 1 UNF **E 17, E 17 UNF**	T port for external recirculation of control oil to tank. ▪ **E 17, E 17 UNF:** with additional P and R port
E 4, E 4 UNF **E 19, E 19 UNF**	T-line internally linked with R-line for internal recirculation of control oil through R line. ▪ **E 19, E 19 UNF:** with additional P and R port
E 2, E 2 UNF **E 18, E 18 UNF**	With additional Y port for connecting a downstream manifold's LS signal. T port for external recirculation of control oil to tank. ▪ **E 18, E 18 UNF:** with additional P and R port
E 5, E 5 UNF **E 20, E 20 UNF**	With additional Y port for connecting a downstream manifold's LS signal. T-line internally linked with R-line for internal recirculation of control oil through R line. ▪ **E 20, E 20 UNF:** with additional P and R port
E 3 **E 6**	With integrated 3/2-way directional valve (WN 1 H as per D 7470 A/1) to switch P to LS when required and shut off the PSL connection block's unpressurised circulation. ▪ **E 3:** T port for external recirculation of control oil to tank ▪ **E 6:** T-line internally linked with R-line for internal recirculation of control oil through R-line
E 0	End plate for EDL valve sections, without additional function. Not suitable in conjunction with PSL/PSV size 2. ▪ Only in conjunction with the shuttle valve **W3** in the last valve section. ▪ Can only be used with max. 3 valve sections, as there are no mounting holes. **NOTICE** Operating pressure max. 250 bar!

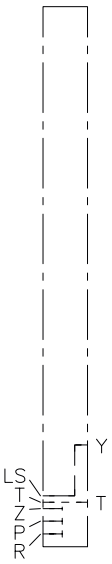
NOTICE
Internal control oil recirculation through R line is permissible only for return pressures < 10 bar.

Circuit symbols

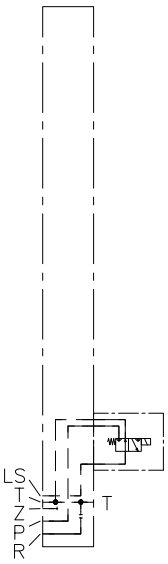
E 1, E 1 UNF



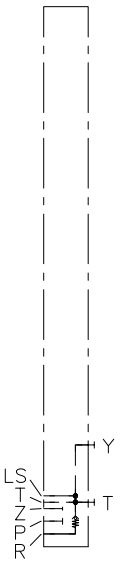
E 2, E 2 UNF



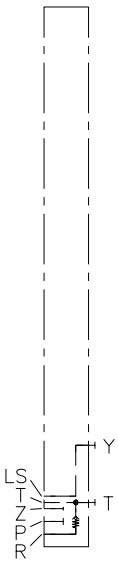
E 3



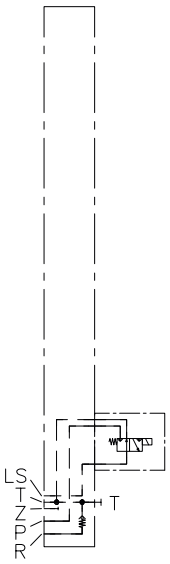
E 4, E 4 UNF



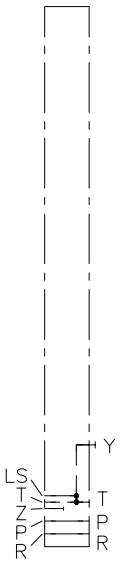
E 5, E 5 UNF



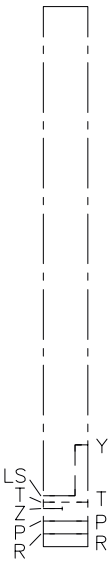
E 6



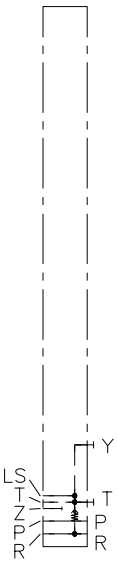
E 17, E 17 UNF



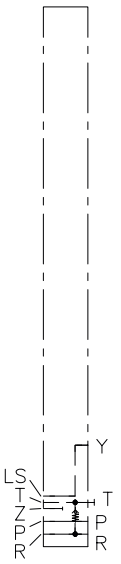
E 18, E 18 UNF



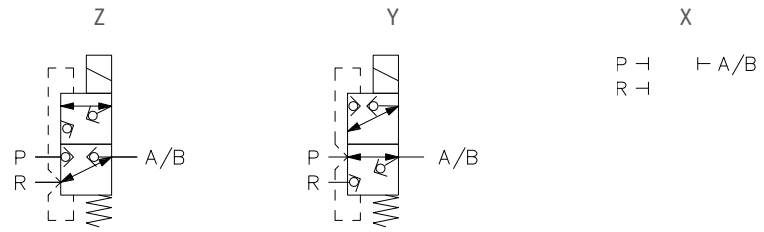
E 19, E 19 UNF



E 20, E 20 UNF

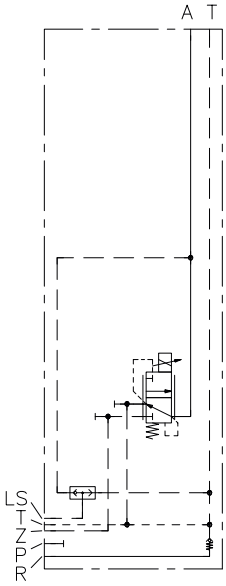


E 0

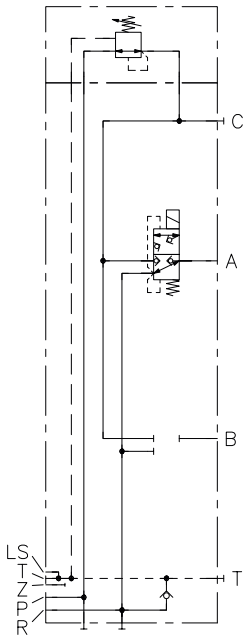
Coding	Description
E 4 PMZ1-...-...	Like E 4 but with a mounted proportional pressure reducing valve of type PMZ 1 as per D 7625 up to approx. 30 bar. Typical application is for supply to a brake. **Ordering example:** **E 4 PMZ1** **-30** **-AMP 24 K 4** -AMP 24 K 4: Solenoid version and solenoid voltage -30: Coding PM - round insert assembly E 4 PMZ1: Designation
E 19 UNF-...-ADM 22 P...-...	T-line internally linked with R-line for internal recirculation of control oil through R line. With additional P and R port. The mounted pressure reducing valve ADM 22 P as per D 7120 is upstream of two optional valves type NBVP 16 as per D 7765 N. This means the pressure is set for consumers A and B. - p_{max} A, B: 250 bar - Q_{max} A, B: 20 l/min Combination:  **Ordering example:** **E 19 UNF** **-Z** **X** **-ADM 22 P** **150** **-DT 12** **-AMP 24 K** -AMP 24 K: Solenoid version, if different from actuation -DT 12: Solenoid version actuations at PSL 150: Pressure setting ADM 22 P -ADM 22 P: Pressure reducing valve X: Seated valve NBVP 16 - consumer B -Z: Seated valve NBVP 16 - consumer A E 19 UNF: Designation / basic version

Circuit symbols

E 4 PMZ1-...-...



E 19 UNF-...-



2.5 Solenoid voltage and solenoid version

2.5.1 PSV/PSL standard solenoid versions

Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)	Valve section with electro-hydraulic actuation (EI, EA, EH, EHA etc.)	Can be combined with certain additional valves			
					WN	BVE	EM, EMP	FP, FPH
AMP 12 K 4 **AMP 24 K 4**	AMP Junior Timer	12 V DC 24 V DC	IP 67	4-pin, connector position front		●	●	
AMP 12 H 4 **AMP 24 H 4**		12 V DC 24 V DC		4-pin, connector position side (bottom)		●	●	
AMP 12 H 4 T **AMP 24 H 4 T**		12 V DC 24 V DC		4-pin, connector position side (bottom), with override		●	●	
AMP 12 K **AMP 24 K**		12 V DC 24 V DC		3-pin, connector position front		●	●	
DT 12 **DT 24**	Deutsch (DT 04-4P)	12 V DC 24 V DC	IP 69k	4-pin, connector position side (bottom)		●	●	
DT 12 T **DT 24 T**		12 V DC 24 V DC		4-pin, connector position side (bottom), with override		●	●	
DT 12 TH **DT 24 TH**		12 V DC 24 V DC		4-pin, connector position side (bottom), with override button		●	●	
DT 12 K **DT 24 K**		12 V DC 24 V DC		4-pin, connector position front		●	●	
S 12 **S 24**	Bayonet coupling PA6 Schlemmer	12 V DC 24 V DC	IP 67	3-pin, connector position front	●	●	●	●
S 12 T **S 24 T**		12 V DC 24 V DC		3-pin, connector position front, with override	●	●	●	●
G 12 **G 24**	EN 175 301-803 A ▪ **G:** with male connector (MSD 3-309 as per D 7163) ▪ **X:** without male connector ▪ **L:** with male connector with LED (SVS 296365 as per D 7163) ▪ **L5K:** with male connector with LED and 5 m cable (L5K-VZP as per D 7163 Erg. 78/1) ▪ **L10K:** with male connector with LED and 10 m cable (L10K-VZP as per D 7163 Erg. 78/1)	12 V DC 24 V DC	IP 65	3-pin, connector position side (bottom)	●	●	●	●
X 12 **X 24**		12 V DC 24 V DC			●	●	●	●
L 12 **L 24**		12 V DC 24 V DC			●	●	●	●
L5K 12 **L5K 24**		12 V DC 24 V DC			●	●	●	●
L10K 12 **L10K 24**		12 V DC 24 V DC			●	●	●	●
G 12 T **G 24 T**		12 V DC 24 V DC		3-pin, connector position side (bottom), with override	●	●	●	●
X 12 T **X 24 T**		12 V DC 24 V DC			●	●	●	●
L 12 T **L 24 T**		12 V DC 24 V DC			●	●	●	●
L5K 12 T **L5K 24 T**		12 V DC 24 V DC			●	●	●	●
L10K 12 T **L10K 24 T**		12 V DC 24 V DC			●	●	●	●

Coding	Electrical connection	Nominal voltage	Protection class (IEC 60529)	Valve section with electro-hydraulic actuation (EI, EA, EH, EHA etc.)	Can be combined with certain additional valves			
					WN	BVE	EM, EMP	FP, FPH
G 12 TH **G 24 TH**	EN 175 301-803 A ▪ **G:** with male connector (MSD 3-309 as per D 7163) ▪ **X:** without male connector ▪ **L:** with male connector with LED (SVS 296365 as per D 7163) ▪ **L5K:** with male connector with LED and 5 m cable (L5K-VZP as per D 7163 Erg. 78/1) ▪ **L10K:** with male connector with LED and 10 m cable (L10K-VZP as per D 7163 Erg. 78/1)	12 V DC 24 V DC	IP 65	3-pin, connector position side (bottom), with override button	●	●	●	●
X 12 TH **X 24 TH**		12 V DC 24 V DC			●	●	●	●
L 12 TH **L 24 TH**		12 V DC 24 V DC			●	●	●	●
L5K 12 TH **L5K 24 TH**		12 V DC 24 V DC			●	●	●	●
L10K 12 TH **L10K 24 TH**		12 V DC 24 V DC			●	●	●	●
G 12 DS * **G 24 DS** *		12 V DC 24 V DC		3-pin, connector position side (bottom), deep-sea version (coil and connector socket not potted)				
X 12 DS * **X 24 DS** *		12 V DC 24 V DC						
G 12 H 4 **G 24 H 4**		12 V DC 24 V DC		4-pin, connector position side (bottom)	●	●	●	●
X 12 H 4 **X 24 H 4**		12 V DC 24 V DC			●	●	●	●
L 12 H 4 **L 24 H 4**		12 V DC 24 V DC			●	●	●	●
X 12 C 4 **X 24 C 4**	EN 175 301-803 C	12 V DC 24 V DC	IP 65	3-pin, connector position front				
DTL 12 **DTL 24**	MIL-DTL-38999 series III	12 V DC 24 V DC	IP 67	4-pin, connector position side (bottom)			●	
DTL 12 **DTL 24**	MIL-DTL-38999 series III	12 V DC 24 V DC	IP 67	4-pin, connector position side (bottom), with manual override				
ITT 12 **ITT 24**	VG 95234 MIL	12 V DC 24 V DC	IP 67	4-pin, connector position side (bottom)			●	

* (available upon request only)

Electrical connection for additional valves:

- **WN:** see D 7470 A/1
- **BVE:** see D 7921
- **EM 21:** see D 7490/1 E
- **EM 31, EMP 31:** see D 7490/1
- **SWS:** see D 7951
- **PM 1, PMZ 1:** see D 7625

Different types of plug (e.g. EA actuation with AMP 24 K 4 and WN valve with G 24) are available upon request.

Electrical connection for electro-proportional LS pressure limitation coding FP.., FPH..:

Only twin solenoids with manual override (coding -...T or -...TH) are possible.
If a twin solenoid without manual override was chosen for the valve section's electro-hydraulic actuation, the same twin solenoid type is automatically used for the LS pressure limitation's electro-proportional actuation, but with additional manual override. If the twin solenoid type is not possible with manual override, coding -G...T is used by default.

2.5.2 PSV/PSL Solenoid versions for potentially explosive atmospheres

Coding	Description
G 24 TEX 4 55 FM **G 24 TEX 4 55 FM-10 m**	Explosion-proof solenoid with cable ▪ **No additional specification:** with 3 m cable ▪ **10 m:** with 10 m cable In the case of PSL valve banks, ZPL 22/7 EX are also required as mechanical protection plates. They are inserted downstream of the connection block and upstream of the end plate. A ZPL 52 (D 7700-5) or ZPL 32 (D 7700-3) replaces the protection plate on size combinations. Information on the solenoid is provided in the operating instructions B ATEX

2.5.3 EDL solenoid versions

Coding	Electrical connection	Nominal voltage	Protection class
G 12 **G 24**	EN 175 301-803 A ▪ **G:** with male connector (MSD 3-309 as per D 7163) ▪ **X:** without male connector ▪ **L:** with male connector with LED (SVS 296365 as per D 7163)	12 V DC 24 V DC	IP 65
X 12 **X 24**			
L 12 **L 24**			
AMP 12 **AMP 24**	AMP Junior Timer	12 V DC 24 V DC	IP 65
DT 12 **DT 24**	Deutsch (DT 04-2P)	12 V DC 24 V DC	IP 69 K

2.6 Additional versions

2.6.1 Sealing

Coding	Description
Sealed-p_{max}	Pressure-limiting valve on connection block is provided with a wire seal as per the pressure setting
Sealed	All pressure-limiting valves are provided with a wire seal as per the pressure setting

2.6.2 Paint finish

Coding	Description
-painted RAL 9005	Colour
GLOSS 20-40	Gloss level

3 Parameters

3.1 General data

Designation	Proportional directional spool valves PSL, PSV, EDL
Design	Manifold with up to 14 valve sections
Material	Steel; Nitrocarburised surfaces (anti-corrosion), Hardened and ground functional inner parts, Surfaces of the solenoids electro-galvanised If the valve is exposed to corrosive factors, we recommend an additional coating or housing.
Attachment	Mounting thread M8, see Chapter 4, "Dimensions"
Installation position	As desired
Ports/connections	▪ **P** = Pump ▪ **R** = Reflux ▪ **A, B** = Consumers ▪ **LS, DW, U, W, X, XH, Y** = load pressure signals ▪ **M** = Pressure gauge connection for pump pressure ▪ **a, b** = Pressure gauge connection for consumer pressure ▪ **Z** = Pilot pressure ▪ **T** = Tank line for control oil **Connecting thread:** ▪ **P, R, A, B** = as per type designation ▪ **M, LS, DW, Z** = G 1/8, G 1/4 (ISO 228-1) or SAE-4, or 7/16-20 UNF-2B (SAE J 514) ▪ **Y, T** = G 1/8, (ISO 228-1) ▪ **U, W, X, XH** = G 1/8 (ISO 228-1) ▪ **a, b** = G 1/4 or G 1/8 (ISO 228-1)
Hydraulic fluid	Hydraulic fluid, according to DIN 51524 Parts 1 to 3; ISO VG 10 to 68 according to DIN ISO 3448 Viscosity range: 4 - 1500 mm²/s Optimal operating range: approx. 10 - 500 mm²/s Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C. Not suitable for HETG such as rapeseed oil and water-glycol solutions, e.g. HFA and HFC.
Cleanliness level	**ISO 4406** 20/17/14
Temperatures	Environment: approx. -40 to +80 °C, hydraulic fluid: -25 to +80 °C, pay attention to the viscosity range. Start temperature: down to -40 °C is permissible (take account of the start viscosities!), as long as the steady-state temperature is at least 20 K higher during subsequent operation. Biologically degradable hydraulic fluids: note manufacturer specifications. With consideration for the seal compatibility, not above +70°C. **NOTICE** Observe restrictions on electronic components and explosion-proof solenoids.

3.2 Pressure and volumetric flow

Operating pressure PSL/PSV	▪ p_{max} = 420 bar (ports P, P1, P2, A, B, LS, M, Y) ▪ Pilot pressure ≤ 40 bar (port Z) ▪ Return pressure ≤ 50 bar (ports R, R1, T) for high return pressures, T port should be routed to the tank separately (end plate E 1, E 2, E 3, etc. see Chapter 2.4, "End plate")
Operating pressure EDL (valve section)	▪ p_{max} = 320 bar; ports P, A, B, LS, M, Y ▪ The pressure achievable at the consumer side of the directional spool valves is lower by the amount of the internal control pressure drop at the 3-way controller PSL (see Chapter 3.4, "Characteristic lines") or at the pump controller (PSV). ▪ Return connection R(R1) ≤ 50 bar
Flow rate PSL/PSV	▪ Q_{max} connection block: see Chapter 3.4, "Characteristic lines" ▪ Q_{max} consumer: see Chapter 2.2.1.6, "Flow rate"
Flow rate EDL	▪ Max. consumer flow rates see Chapter 2.2.2.5, "Flow rate"

3.3 Weight

Connection block	**Type**	
	PSL 3	= 1.7 kg
	PSL 3 Z	= 2.0 kg
	PSV 3	= 1.7 kg
	PSV 4	= 2.0 kg
	PSV 3X-2	= 1.7 kg
	PSV E0-2	= 0.3 kg
	Supplement	
	F, D, PA, PB, PC, PD	+ 0.6 kg
Directional valve section	**Valve section with actuation**	
	Coding	
	SL 2... A, E, E0A	= 1.6 kg
	SL 2... EA	= 1.9 kg
	SL 2... EHA	= 1.8 kg
	SL 2... HA	= 2.2 kg
	DA... E, EI	= 2.5 kg
	DA... AE, AEI, BE, BEI	= 1.9 kg
	Supplement:	
	SL 2... A...B...FP(H) 1(2, 3), S1	+ 0.4 kg

Ancillary block	**Coding**	
	/(UNF) 2, /(UNF) 3	= 0.25 kg
	/(UNF) 2 AS.. BS.., /3	= 0.3 kg
	/(UNF) 2 AN.. BN..	= 0.4 kg
	/(UNF) 2 AL-0-.. BL-0-..	= 0.6 kg
	/(UNF) 2 ALX-0-.. BLX-0-..	= 0.6 kg
	/(UNF) 2 DRH, /ZDRH	= 0.3 kg
	/ZSS, /ZVV, /3 AVT, /3 BVT	= 1.0 kg
	/ZDR, /ZDS, /Z 2 A(B)..	= 1.0 kg
	/32 DFA, /32 DFB	= 0.6 kg
	/Z 40	= 0.5 kg
	/Z AL.. BL..	= 0.6 kg
End plate	**Coding**	
	E 1(UNF), E 2(UNF), E 4(UNF), E 5(UNF)	= 0.5 kg
	E 3, E 6	= 1.1 kg
	E 17(UNF), E 18(UNF), E 19(UNF), E 20(UNF)	= 1.0 kg
	E 0	= 0.3 kg

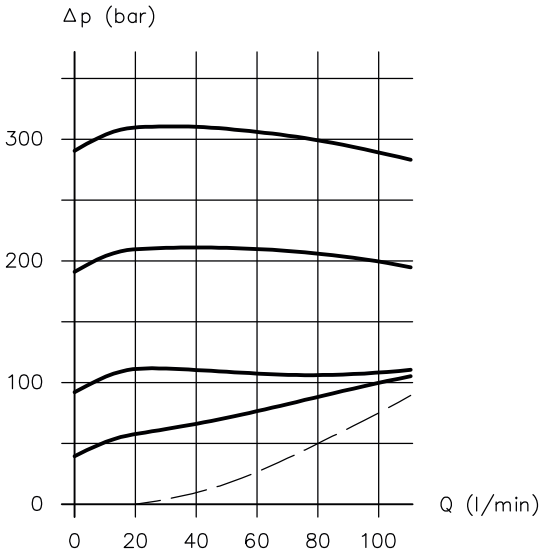
3.4 Characteristic lines

Viscosity of the hydraulic fluid approx. 60 mm²/s

3.4.1 Connection block

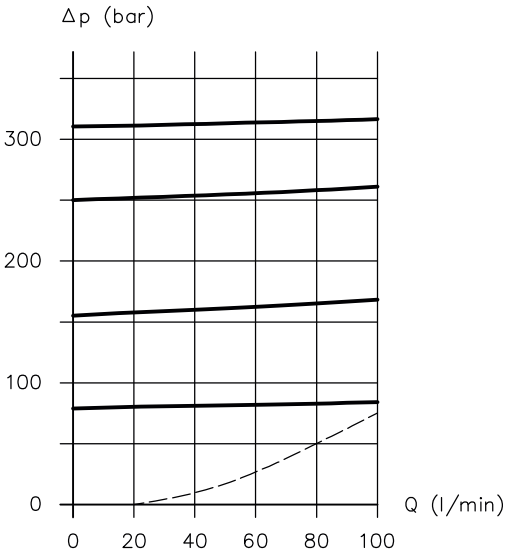
Pressure-limiting valve (P → R)

PSL 3../D..-2
PSL UNF 2../D..-2
PSV 3../D..-2
PSV UNF 2../D..-2
PSV 4 N...



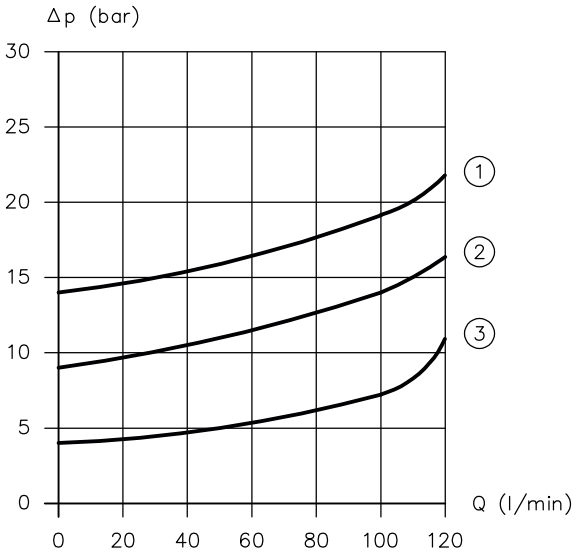
Q flow rate (l/min); Δp pressure difference (bar)

PSL 3 U.../...-2
PSL UNF 2 U.../...-2



Q flow rate (l/min); Δp pressure difference (bar)

Circulation pressure (P → R) in PSL connection blocks



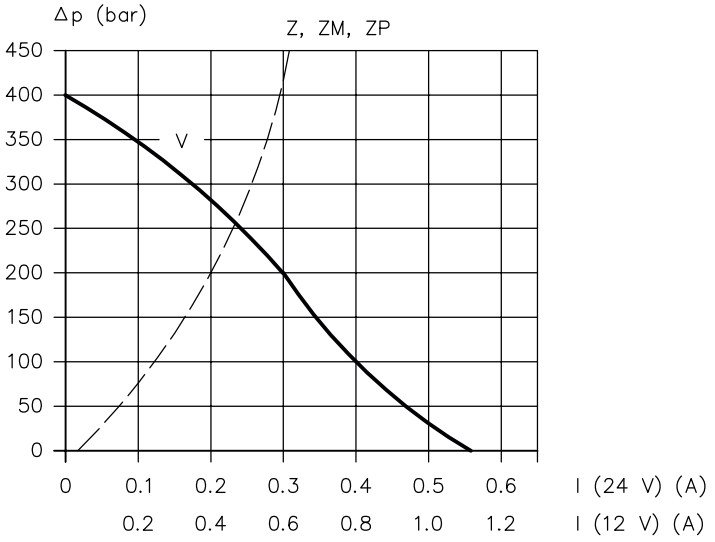
Q flow rate (l/min); Δp pressure difference (bar)

1 PSL 3H/..., PSL UNF 2H...
2 PSL 3..., PSL UNF 2...
3 PSL 3U/..., PSL UNF 2U...

Electro-proportional LS pressure limitation

see Chapter 2.1.7, "LS relief or LS pressure limitation"

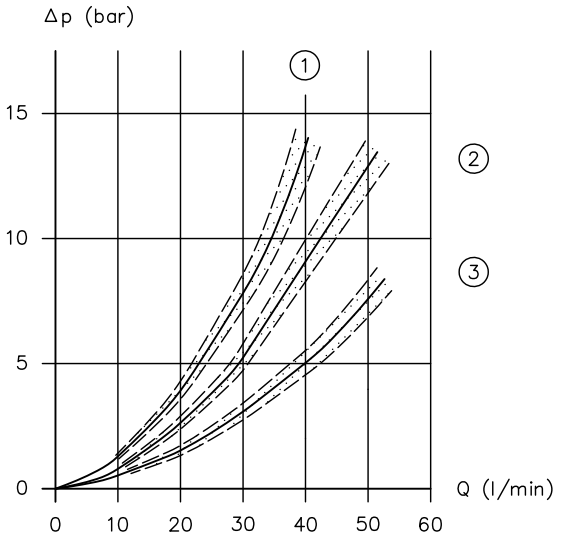
Coding **V, Z, ZM, ZP**



I control current (A) at 24 V DC or 12 V DC; Δp pressure difference LS - R (bar)

3.4.2 Directional valve section PSL/PSV

Pressure difference P → A/B and A/B → R



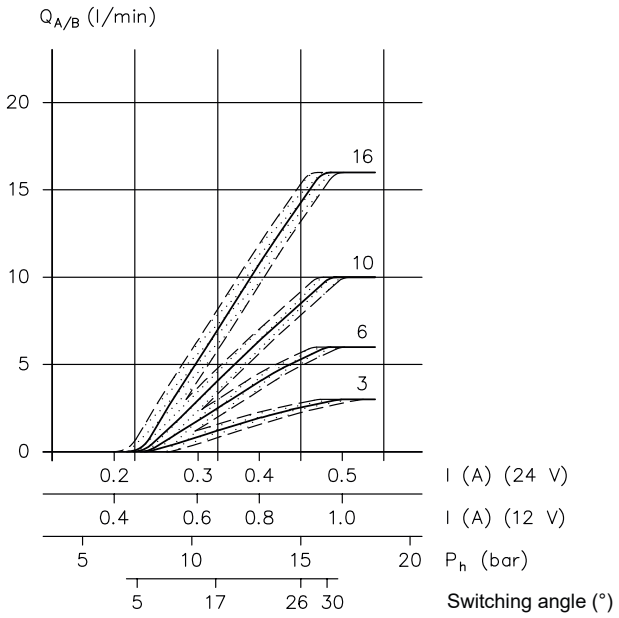
Q flow rate (l/min); Δp pressure difference (bar)

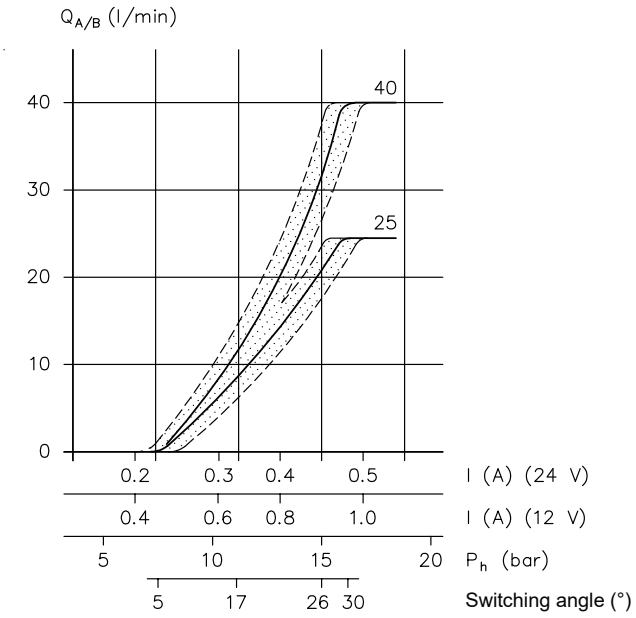
1 1 P → A/B in valve section with 2-way controller, see Chapter 2.2.1.2, "2-way controller", without coding)
2 2 P → A/B in valve section without 2-way controller, see Chapter 2.2.1.2, "2-way controller", coding 1)
3 3 A/B → R in spool valve coding L, M, F, H, see Chapter 2.2.1.5, "Circuit symbol")

Control characteristic line for consumer flow rate

see Chapter 2.2.1.6, "Flow rate"

(reference values measured with 2-way controller and standard 2-way controller spring)

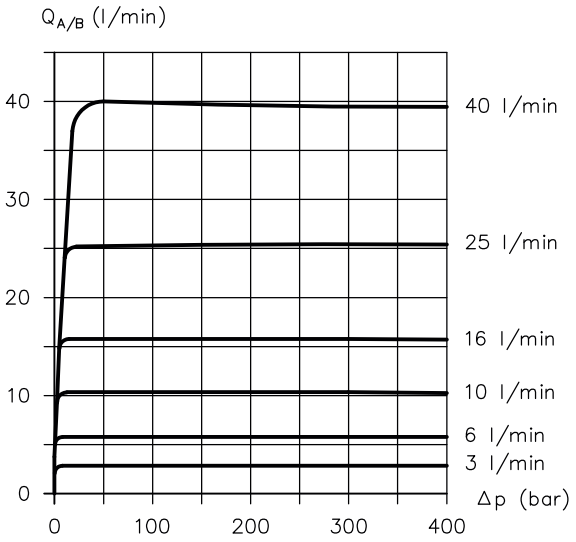




$p_{hydr.}$ Pilot pressure (bar) for hydraulic actuation
Switching angle (°) for manual actuation with hand lever
$Q_{A/B}$ flow rate (l/min)

2-way controller

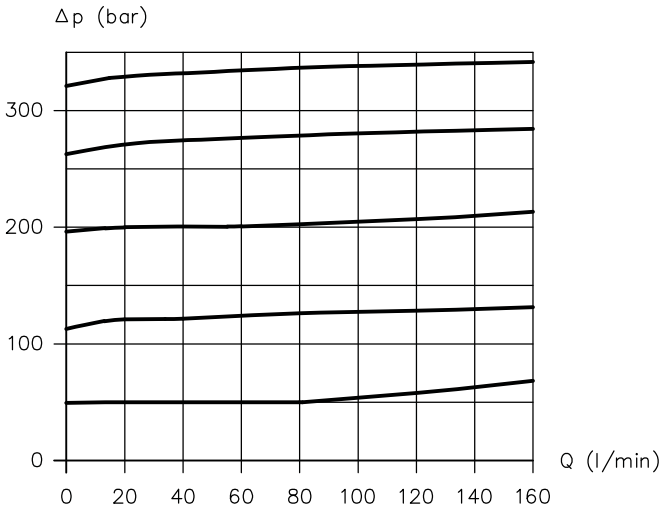
see Chapter 2.2.1.2, "2-way controller"



Δp load pressure (bar); $Q_{A/B}$ flow rate (l/min)

LS pressure-limiting valves

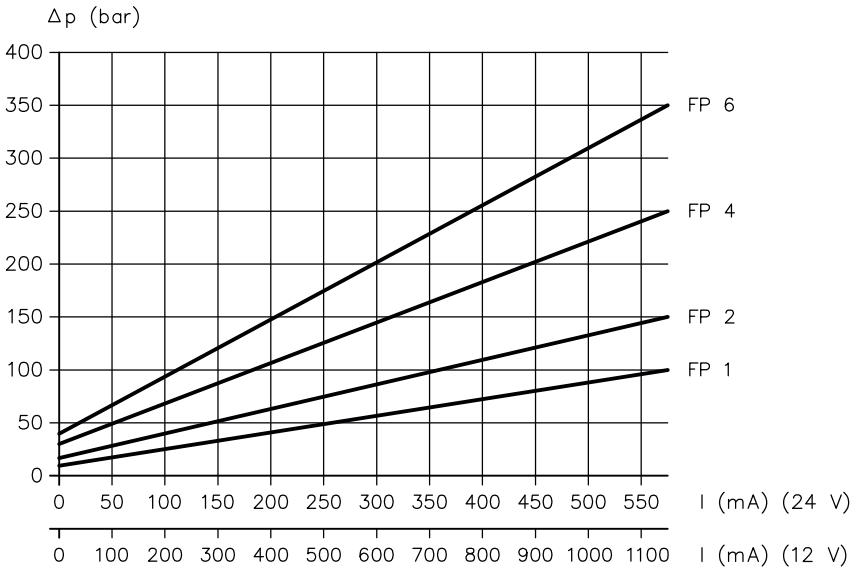
see Chapter 2.2.1.7, "LS pressure limitation"



Q flow rate (l/min); Δp pressure difference LS - R (bar)

Electro-proportional LS pressure limitation

see Chapter 2.2.1.8, "Electric LS relief or LS pressure limitation"

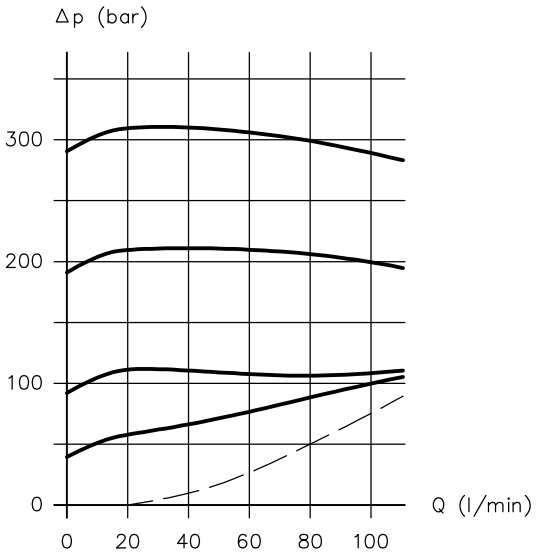


I control current (A) at 24 V DC or 12 V DC; Δp pressure difference LS - T (bar)

3.4.3 EDL directional valve section

Viscosity of the hydraulic fluid approx. 60 mm²/s

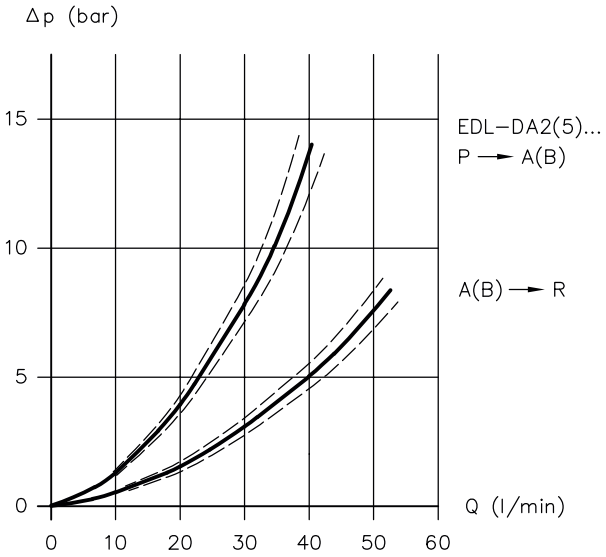
Pressure-limiting valve in the middle input block type ZPL 22 P6R6



Q flow rate (l/min); Δp pressure setting (bar)

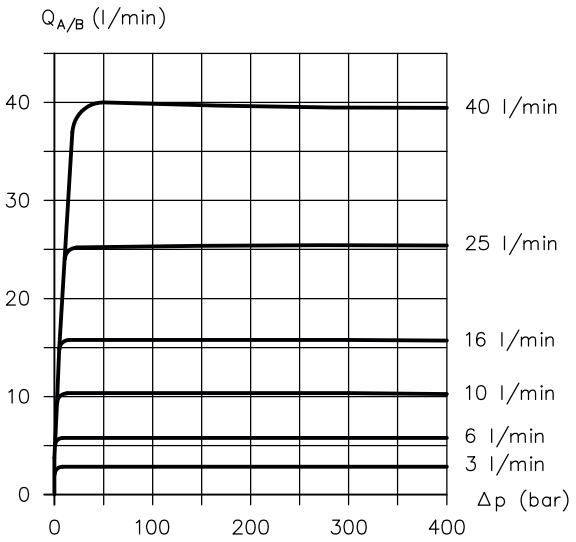
Directional spool valve

P→ A(B), A(B) → R



Q flow rate (l/min); Δp pressure setting (bar)

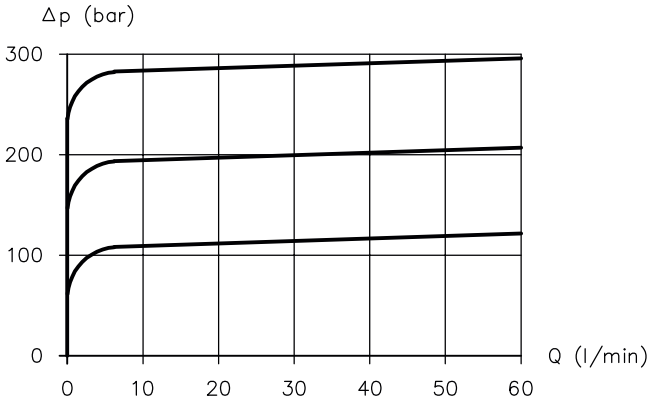
2-way inflow controller



Δp load pressure (bar); $Q_{A/B}$ flow rate (l/min)

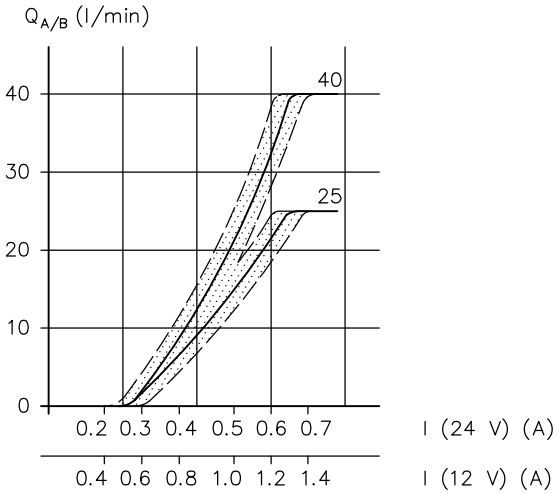
LS pressure limitation

Coding **C ...**

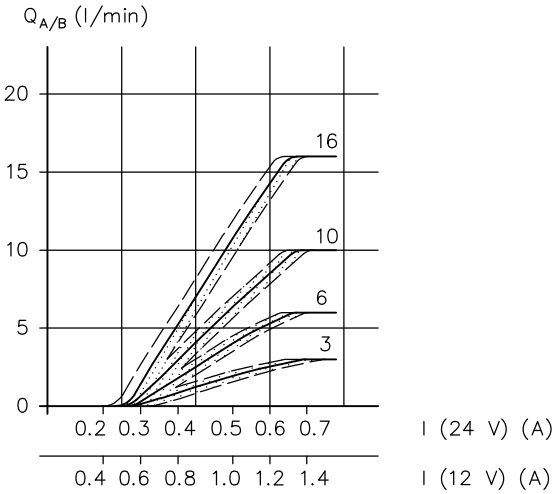


Control characteristic line for consumer flow rate

(reference values, example for directional spool valve variant with inflow controller type EDL 2 - D. 2...)



I control current (A); $Q_{A/B}$ consumer flow rate (l/min)



I control current (A); $Q_{A/B}$ consumer flow rate (l/min)

3.5 Electrical data

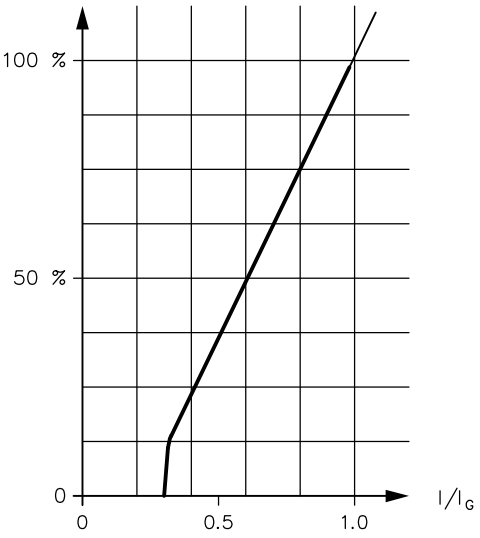
3.5.1 PSL/PSV Electro-hydraulic actuation with standard solenoid

Proportional solenoid, produced and tested in accordance with DIN VDE 0580

Twin solenoid with anchor chambers sealed on the outside and connected to the tank channel. The anchors in the anchor chambers are thereby lubricated by the hydraulic fluid and protected against corrosion without the need for maintenance.

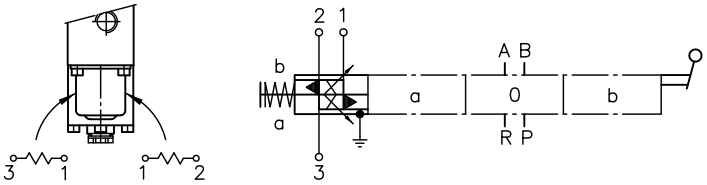
Nominal voltage U_N	12 V DC	24 V DC
Resistance R_{20}	6.3 Ω	27.0 Ω
Current, cold I_{20}	1.9 A	0.9 A
Limit current I_G	1.26 A	0.63 A
Limit power P_G	15.1 W	15.1 W
Duty cycle	S1 (100%)	
Dither frequency	40 - 70 Hz (recommended value 55 Hz)	
Dither amplitude $A_D(\%) = \frac{I_{Peak-Peak}}{IG} \cdot 100$	20% ≤ A_D ≤ 50%	

I stroke characteristic curve

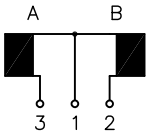
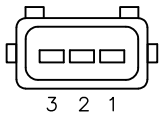
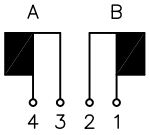
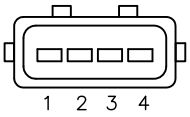
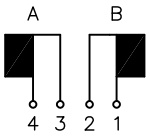
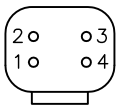
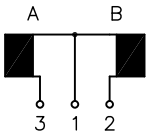
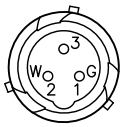
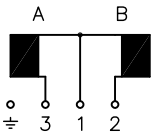
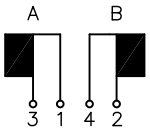
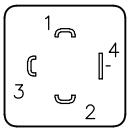
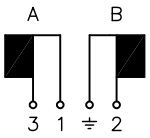
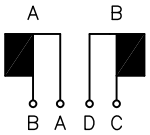
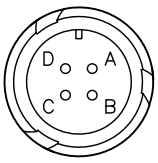
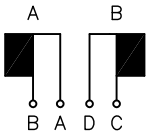
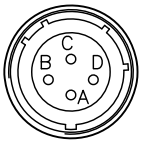


I/I_G control current; spool stroke (%)

Ports



Electrical connection

Coding	Specification	Connection	Plug
AMP 12 (24) K	AMP Junior Timer 3-pin IP 67 (IEC 60529)		
AMP 12 (24) K 4 **AMP 12 (24) H 4** **AMP 12 (24) H 4 T**	AMP Junior Timer 4-pin IP 67 (IEC 60529)		
DT 12 (24) **DT 12 (24) T** **DT 12(24) K**	German (DT04 – 4p) 4-pin IP 69k (IEC 60529)		
S 12 (24) **S 12 (24) T**	Bayonet coupling PA6 Schlemmer 3-pin IP 67 (IEC 60529)		
X 12 (24) **G 12 (24)** **L 12 (24)** **X 12 (24) T** **G 12 (24) T** **L 12 (24) T** **X 12 (24) TH** **G 12 (24) TH** **L 12 (24) TH** **X 12 (24) DS** **G 12 (24) DS**	EN 175 301-803 A 3-pin IP 65 (IEC 60529)		
X 12 (24) H 4 **G 12 (24) H 4** **L 12 (24) H 4**	EN 175 301-803 A 4-pin IP 65 (IEC 60529)		
X 12 (24) C4 **G 12 (24) C4**	EN 175 301-803 C 3-pin IP 65 (IEC 60529)		
ITT 12 (24)	VG 95234 MIL 4-pin IP 67 (IEC 60529)		
DTL 12 (24) **DTL 12 (24) T**	MIL-DTL 38999 series III 4-pin IP 67 (IEC 60529)		

3.5.2 PSL/PSV Electro-hydraulic actuation with solenoid for potentially explosive atmospheres

NOTICE

When using solenoids for potentially explosive atmospheres: observe operating instructions B ATEX and the separate operating instructions for the respective solenoid.

Refer to the applicable operating instructions for operating thresholds, classifications, electrical parameters and electrical connections.

Coding	Operating instructions with declaration of conformity
G 24 TEX 4 55 FM G 24 TEX 4 55 FM-10 m	▪ B ATEX ▪ B 28/2012 (EX04)

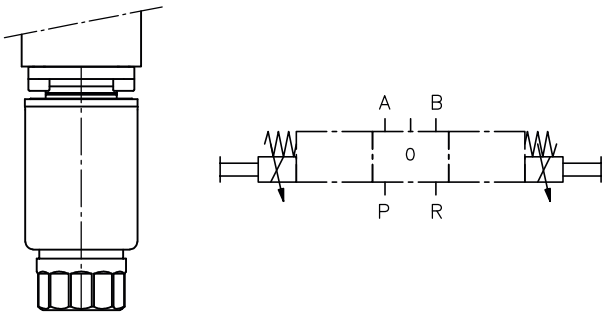
3.5.3 EDL actuation with standard solenoid

Actuation E, EI

Solenoid, produced and tested in accordance with DIN VDE 0580

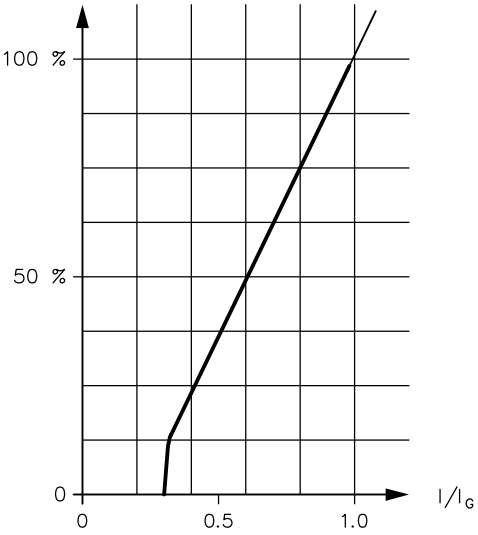
Single-action solenoid with anchor chambers sealed on the outside and connected to the return duct. The anchors in the anchor chambers are thereby lubricated by the hydraulic fluid and protected against corrosion without the need for maintenance.

Nominal voltage U_N	12 V DC	24 V DC
Coil resistance R_{20}	5.5 Ω	22 Ω
Current, cold I_{20}	2.18 A	1.10 A
Limit current I_G (I_{lim})	1.56 A	0.78 A
Power, cold $P_{20} = U_N \times I_{20}$	26 W	26 W
Limit power $P_G = U_N \times I_G$	19 W	19 W
Cut-off energy W_A	≤ 0.3 Ws	≤ 0.3 Ws
Relative duty cycle (reference temperature ϑ_{11} = 50°C)	S1	S1
Required dither frequency	40 ... 70 Hz (recommended value: 55 Hz)	
Dither amplitude $A_D(\%) = \frac{I_{Peak-Peak}}{I_G} \cdot 100$	$20\% \le A_D \le 50\%$	



I stroke characteristic curve

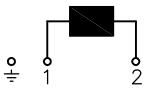
Viscosity of the hydraulic fluid approx. 60 mm²/s

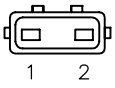


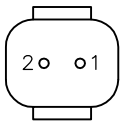
I/I_G control current; spool stroke (%)

Electrical connection

	X 12, X 24	**AMP 12, AMP 24**	**DT 12, DT 24**
	EN 175 301-803 A	AMP Junior Timer	
Coil a (1) coil b (2)	IP 65 (IEC 60529)	IP 65 (IEC 60127)	IP 69K (IEC 60529)







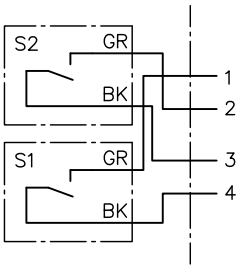
The specifications regarding the IP protection class apply for versions featuring a properly assembled male connector.

3.5.4 Switching position monitoring, displacement transducer

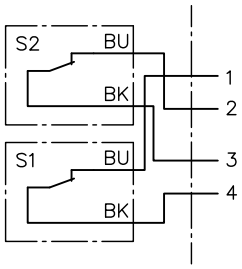
Coding VCHO, VCHC, VCHOC

Connection socket	G 4 A 5 M ® Hirschmann
compatible connector	G 4 W 1 F ® Hirschmann
Resistance load up to 30 V DC	5 A
Inductive load	3 A
Protection class	IP 65 (IEC 60529)
Labelling	▪ **VCHO:** NO ▪ **VCHC:** NC ▪ **VCHOC:** NOC

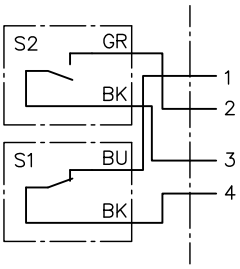
VCHO



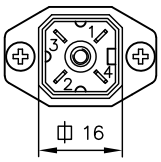
VCHC



VCHOC



Contact switch S2 = towards A
Contact switch S1 = towards B



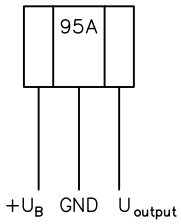
Coding WA

Coding	Electrical connection	Protection class (IEC 60529)
WA	EN 175 301-803 A	IP 65
WA-AMP	AMP Junior Timer	IP 67
WA-DT	German (DT 04-4P)	IP 69k
WA-C	EN 175 301-803 C	IP 65

Pin assignment:

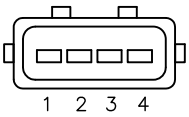
1 = U_{output}
2 = $+U_B$ (5 to 10 V)
3 = GND
Earth = not assigned

Sensor assignment:

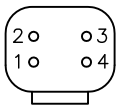


WA

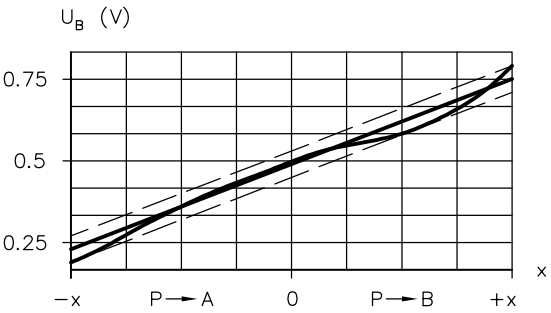
WA-AMP



WA-DT



WA-C



x spool stroke; U_B signal voltage (V)

U_B = supply voltage
$U_{B\ max}$ = 76%
$U_{B\ min}$ = 24%
Accuracy +/- 9% (of U_B)

Use stabilised, smoothed DC voltage only.

NOTICE
The displacement transducer will be destroyed by strong magnetic fields.

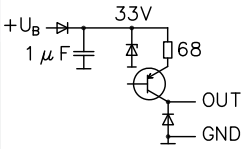
Coding U

Protection class

Coding	Electrical connection	Protection class (IEC 60529)
U	EN 175 301-803 A	IP 65 (plugged in)
U-DT	Deutsch (DT 04-4P)	IP 67 (plugged in) IP 66 (plugged in)
U-M	M12x1.5	IP 67 (plugged in) IP 66 (plugged in)

Pin assignment

Signal	Description	Pin assignment		
		U	U-DT	U-M
GND	0 V DC	PE (⏚)	2	3
A_Out	PNP positive-switching	1	3	2
B_Out	PNP positive-switching	2	4	4
$+U_B$	10 ... 32 V DC	3	1	1



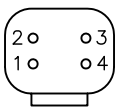
Open-Collector:
I_{max} = 10 mA
short-circuit-proof

Status table

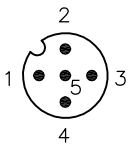
Running no.	Spool valve action	Signal outputs PNP transistor with open collector:	
		OUTA	OUTB
1	Neutral position in centre	ON	ON
2	P → B	OFF	ON
3	P → A	ON	OFF

U

U-DT



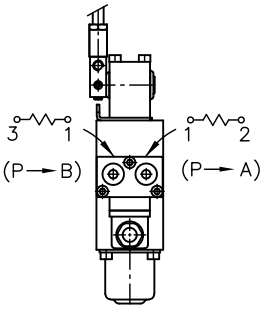
U-M



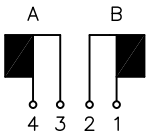
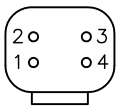
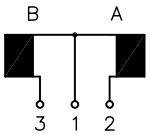
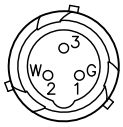
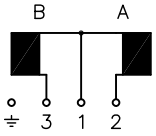
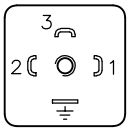
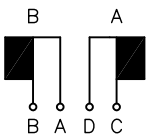
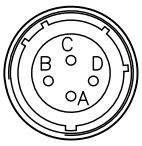
3.5.5 Electric LS relief or LS pressure limitation

Electro-proportional LS pressure limitation coding FP.., FPH..

Nominal voltage U_N	12 V DC	24 V DC
Resistance R_{20}	6.3 Ω	27.0 Ω
Current, cold I_{20}	1.9 A	0.9 A
Limit current I_G	1.26 A	0.63 A
Limit power P_G	15.1 W	15.1 W
Duty cycle	S1 (100%)	
Dither frequency	40 - 70 Hz (recommended value 55 Hz)	
Dither amplitude $A_D(\%) = \frac{I_{Peak-Peak}}{IG} \cdot 100$	$20\% \leq A_D \leq 50\%$	



Electrical connection

Coding	Specification	Connection	Plug
DT 12 (24) T	German (DT04 – 4p) 4-pin IP 69k (IEC 60529)		
S 12 (24) T	Bayonet coupling PA6 Schlemmer 3-pin IP 67 (IEC 60529)		
X 12 (24) T **G 12 (24) T** **L 12 (24) T** **X 12 (24) TH** **G 12 (24) TH** **L 12 (24) TH**	EN 175 301-803 A 3-pin IP 65 (IEC 60529)		
DTL 12 (24) T	MIL-DTL 38999 series III 4-pin IP 65 (IEC 60529)		

NOTICE
Duty cycle applies separately for a single twin solenoid coil. If both coils are powered simultaneously, only 50% is permitted as duty cycle.

NOTICE

- Only twin solenoids with manual override (coding T or -TH) are possible.
- If a twin solenoid without manual override was chosen for the valve section's electro-hydraulic actuation, the same twin solenoid type is automatically used for the LS pressure limitation's electro-proportional actuation, but with additional manual override.
- If the twin solenoid type is not possible with manual override, coding -G..T is used by default.

3.5.6 Electric LS relief or LS pressure limitation for potentially explosive atmospheres

NOTICE

When using solenoids for potentially explosive atmospheres: observe operating instructions B ATEX and the separate operating instructions for the respective solenoid.

Refer to the applicable operating instructions for operating thresholds, classifications, electrical parameters and electrical connections.

Coding	Operating instructions with declaration of conformity
G 24 TEX 4 55 FM **G 24 TEX 4 55 FM-10 m**	▪ B ATEX ▪ B 22/2011 (EX11)
G 24 M2FP **G 24 M2FP-10 m**	▪ B ATEX ▪ B 04/2005 (EX05)

3.5.7 Additional valves

The types of plugs available are described in Chapter 2.5, "Solenoid voltage and solenoid version". Refer to the respective additional valve's data sheet for electrical parameters.

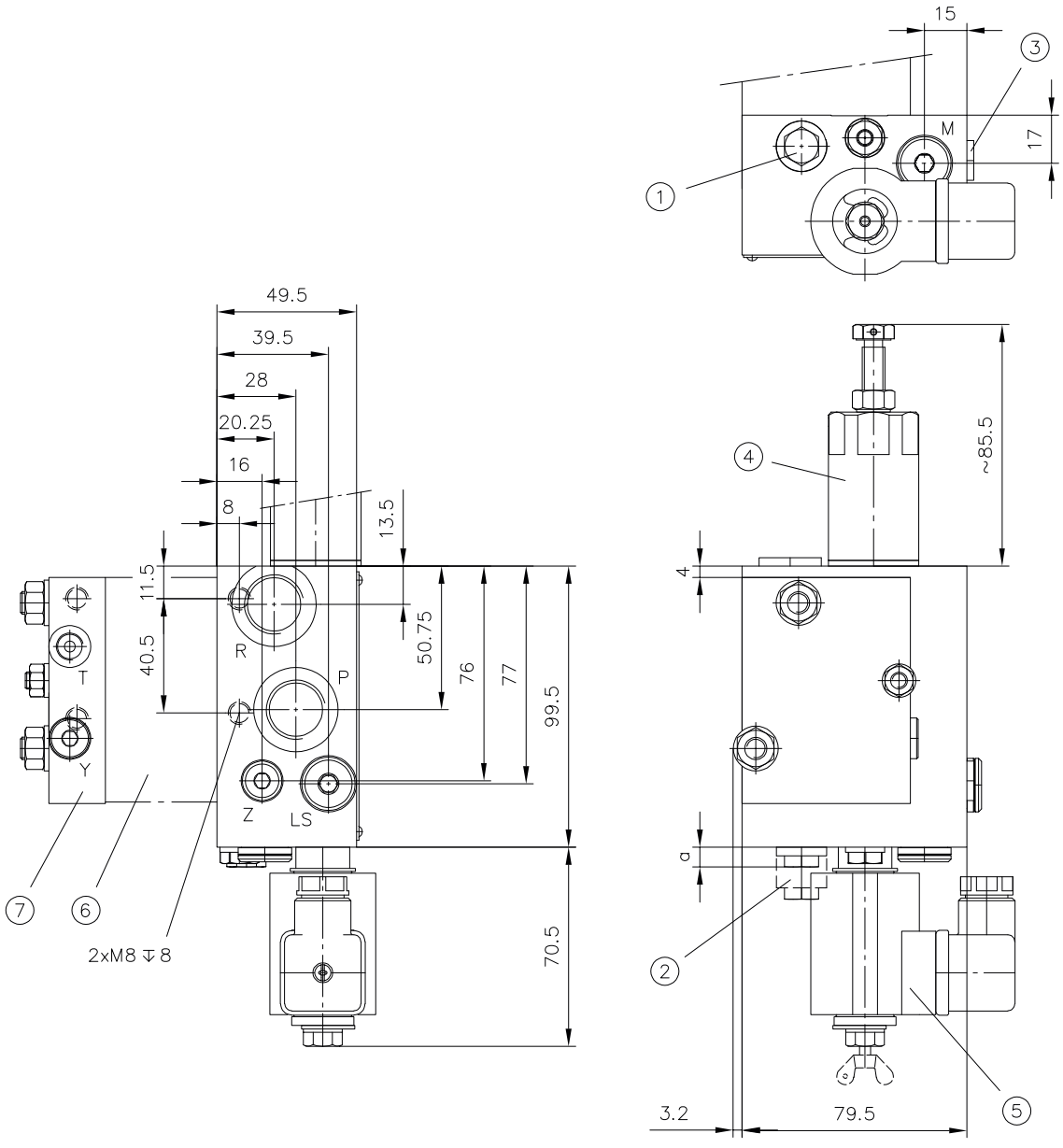
4 Dimensions

All dimensions in mm, subject to change.

4.1 Connection block

see Chapter 2.1.3, "Connection block basic types"

PSL 3.../D...-2, PSV 3.../D...-2, PSL UNF 2.../D...-2, PSV UNF 2.../D...-2

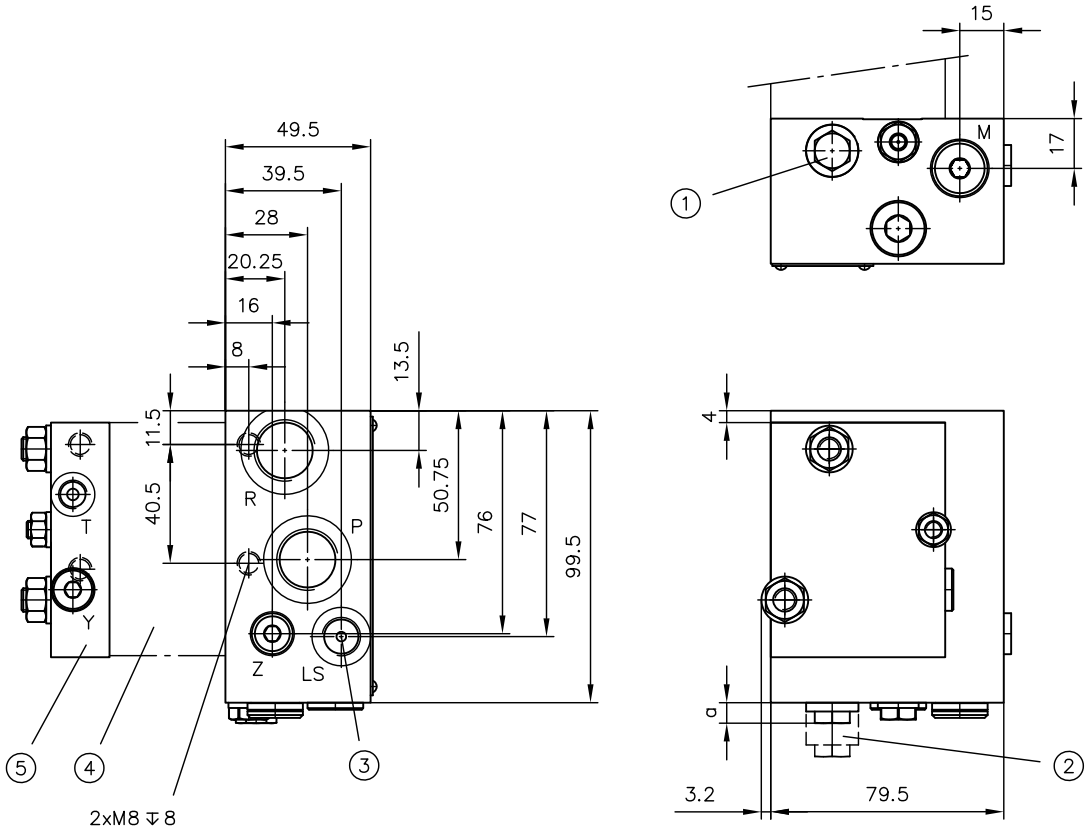


1 Internal control oil supply coding 1 or without coding
2 1 Internal control oil supply coding 2
3 LS damping
4 Pressure-limiting valve
5 optional ZM
6 Valve section
7 End plate

Coding	a
without coding	6.5
1	6.5
2	18.4

Type	Ports (ISO 228-1 or SAE J 514)		
	P, R	LS, M	Z
PSL 3../D..-2 PSV 3../D..-2	G 1/2	G 1/4	G 1/8
PSL UNF 2../D..-2 PSV UNF 2../D..-2	3/4-16 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B

PSV 3...-2
PSV UNF 2...-2

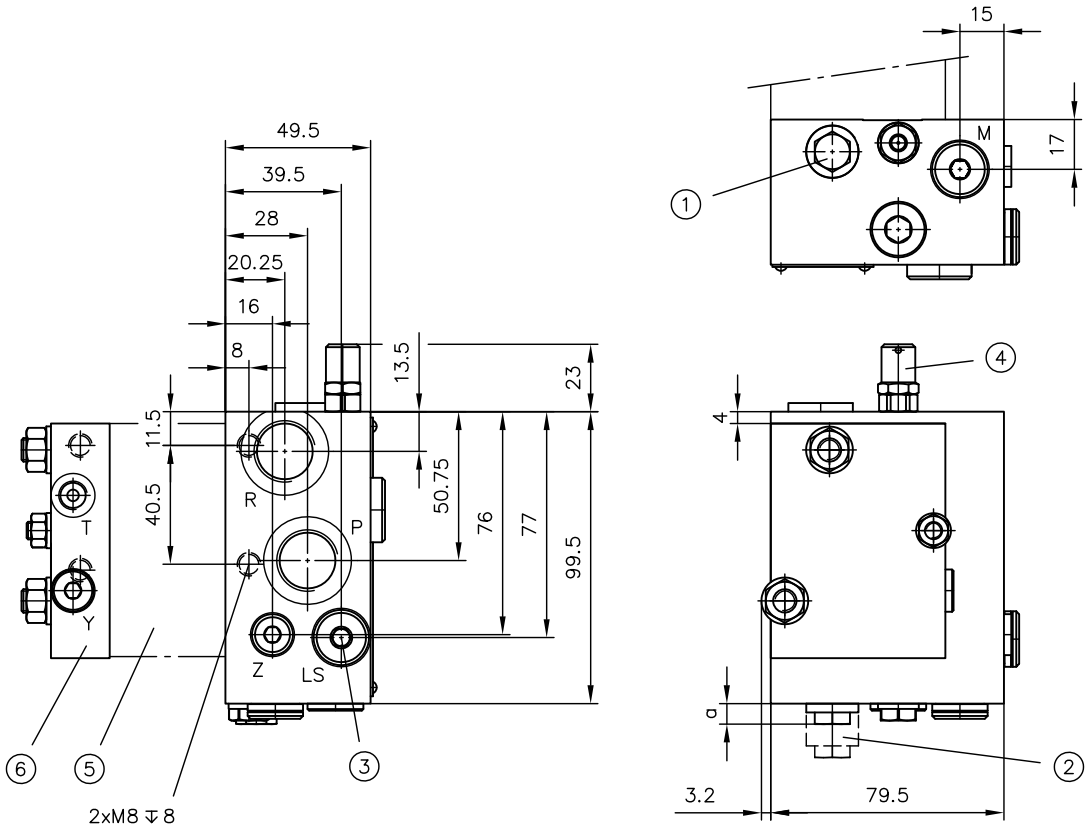


1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 LS damping
4 Valve section
5 End plate

Coding	a
without coding	6.5
1	6.5
2	18.4

Type	Ports (ISO 228-1 or SAE J 514)		
	P, R	LS, M	Z
PSV 3...-2	G 1/2	G 1/4	G 1/8
PSV UNF 2...-2	3/4-16 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B

PSL 3U.../...-2
PSL UNF 2U.../...-2

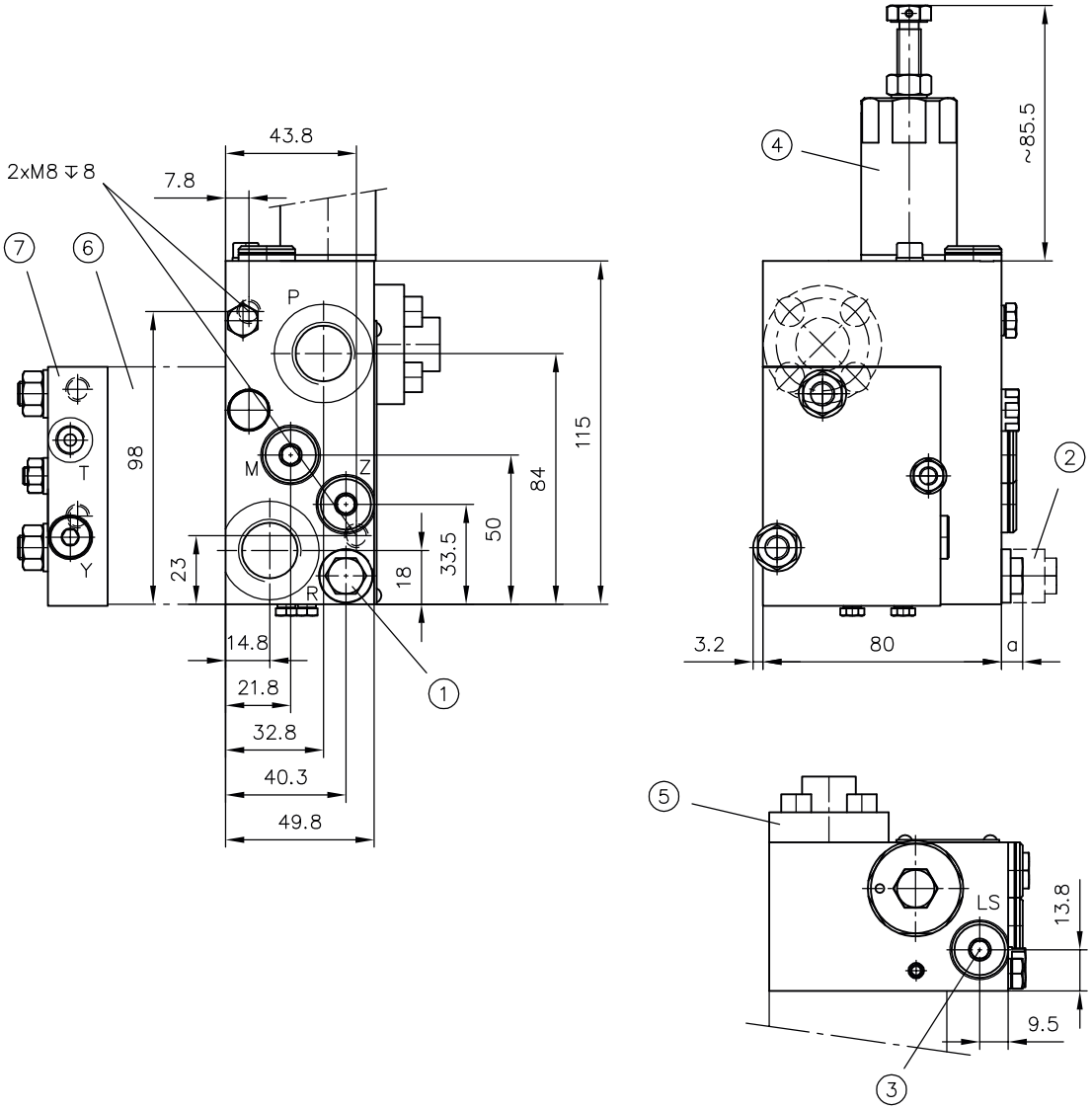


1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 LS damping
4 Pressure-limiting valve
5 Valve section
6 End plate

Coding	a
without coding	6.5
1	6.5
2	18.4

Type	Ports (ISO 228-1 or SAE J 514)		
	P, R	LS, M	Z
PSL 3U.../...-2	G 1/2	G 1/4	G 1/8
PSL UNF 2U.../...-2	3/4-16 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B

PSL 3 Z.../D...-2



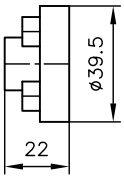
1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 LS damping
4 Pressure-limiting valve
5 3-way controller's spring housing
6 Valve section
7 End plate

Coding	a
without coding	6.5
1	6.5
2	18.4

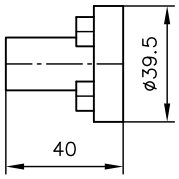
Type	Ports (ISO 228-1)	
	P, R	LS, M, Z
PSL 3 Z.../D...-2	G 1/2	G 1/4

3-way controller's spring housing

without coding

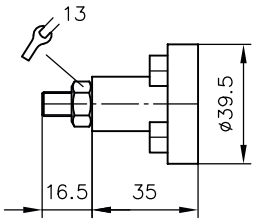


Coding **H**

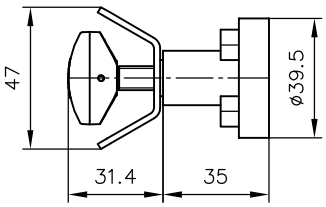


3-way controller's spring housing with locking tapped plug

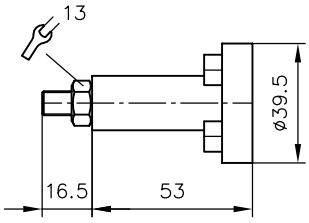
Coding **T**



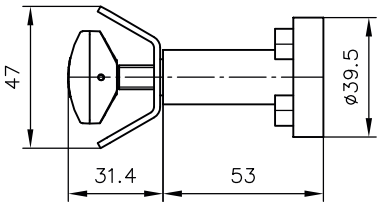
Coding **TR**



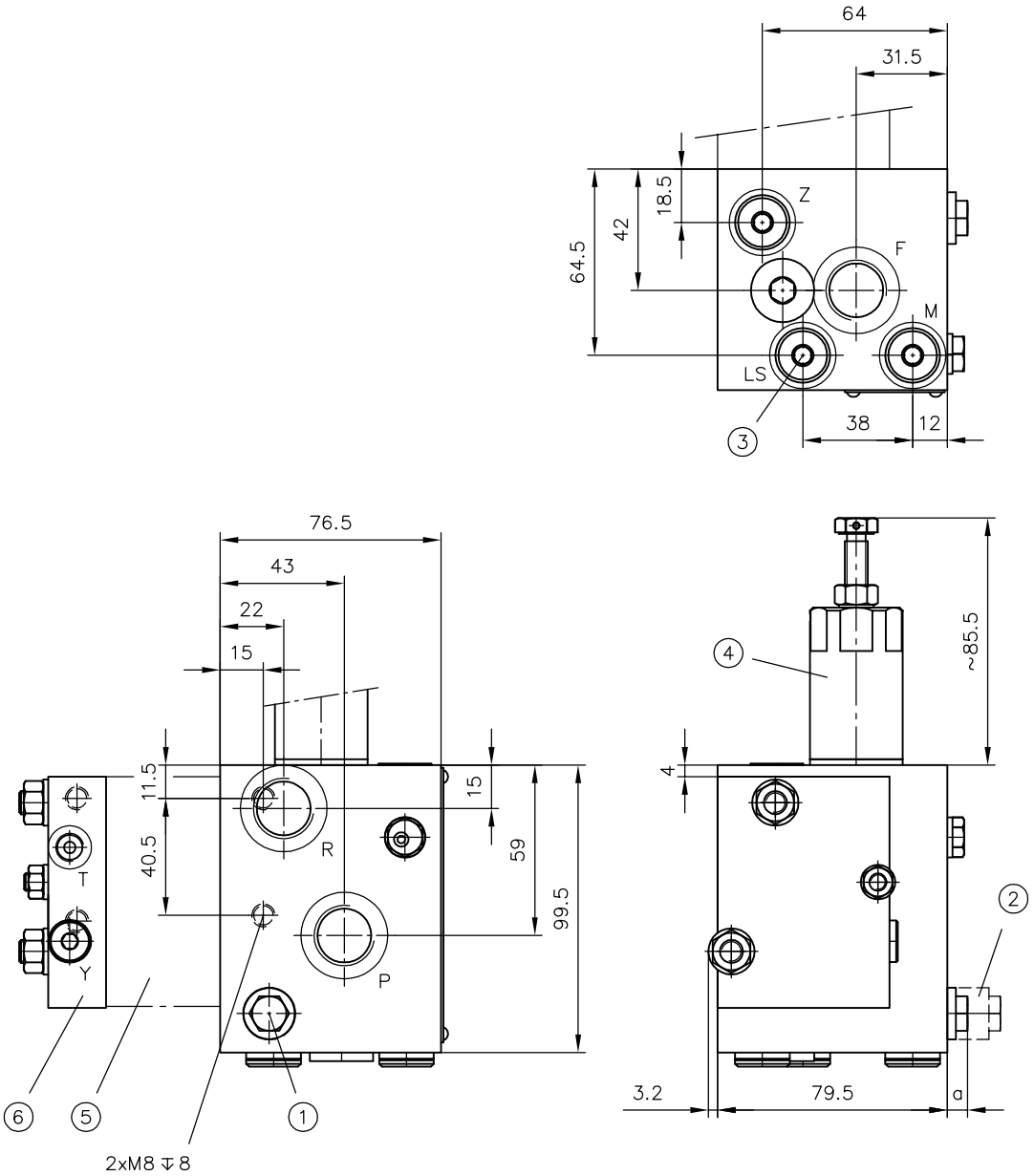
Coding **HT**



Coding **HTR**



PSL 3Y.../D...-2

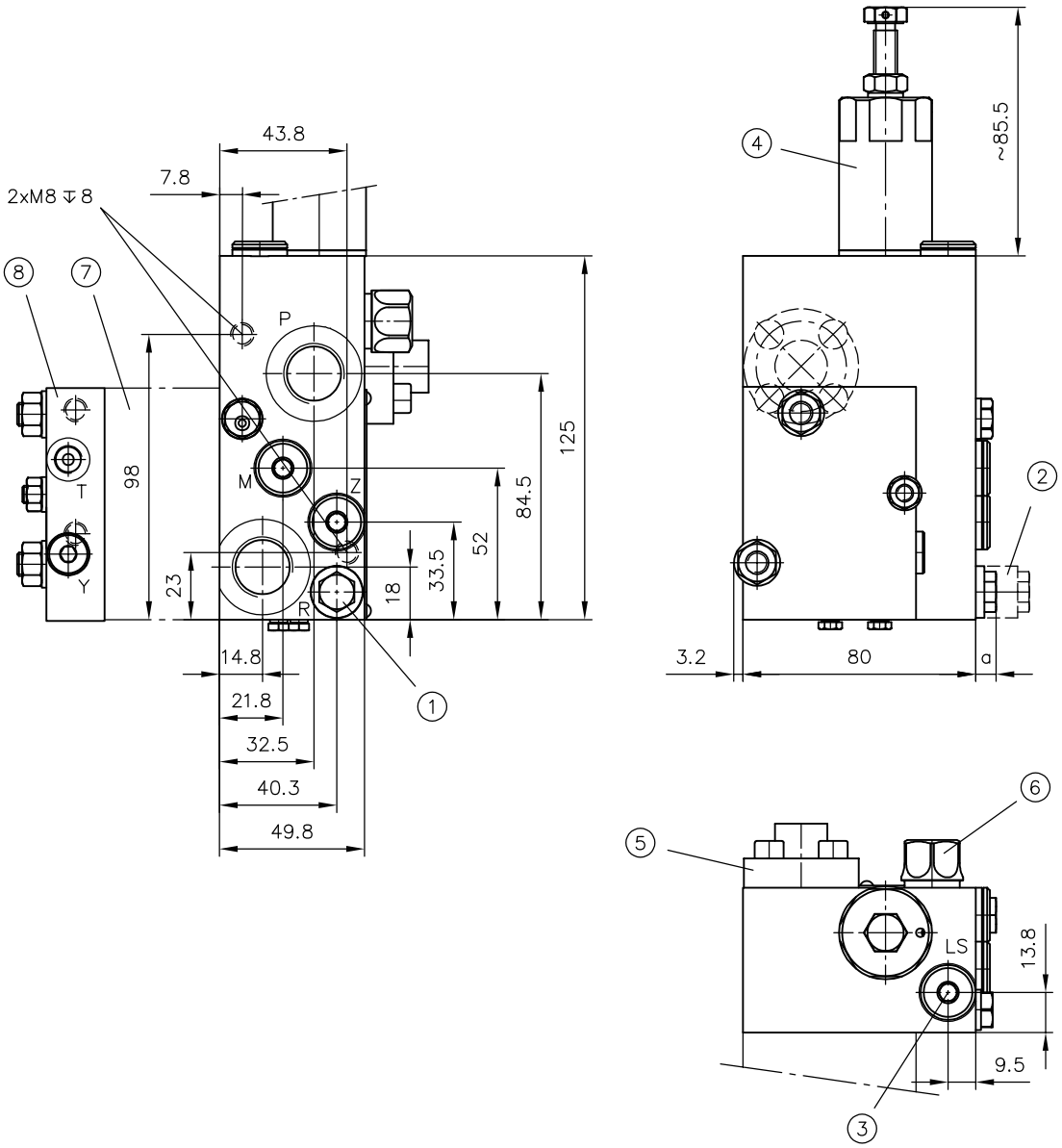


1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 LS damping
4 Pressure-limiting valve
5 Valve section
6 End plate

Coding	a
without coding	6.5
1	6.5
2	18.4

Type	Ports (ISO 228-1)	
	P, R, F	LS, M
PSL 3Y.../...-2	G 1/2	G 1/4

PSL 3 C... D/...-2
PSL 3 CR... D/...-2

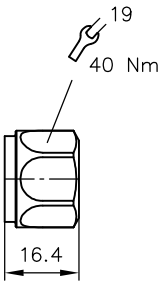


1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 LS damping
4 Pressure-limiting valve
5 3-way controller's spring housing
6 Version
7 Valve section
8 End plate

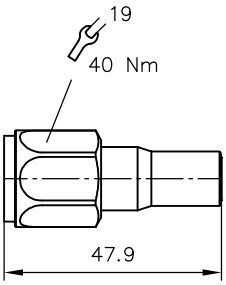
Coding	a
without coding	6.5
1	6.5
2	18.4

Adjustment

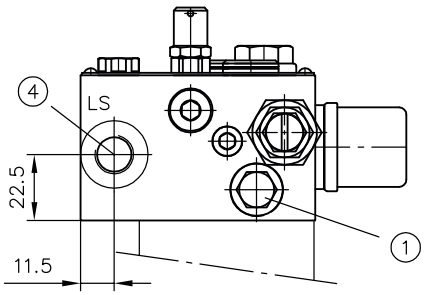
fixed

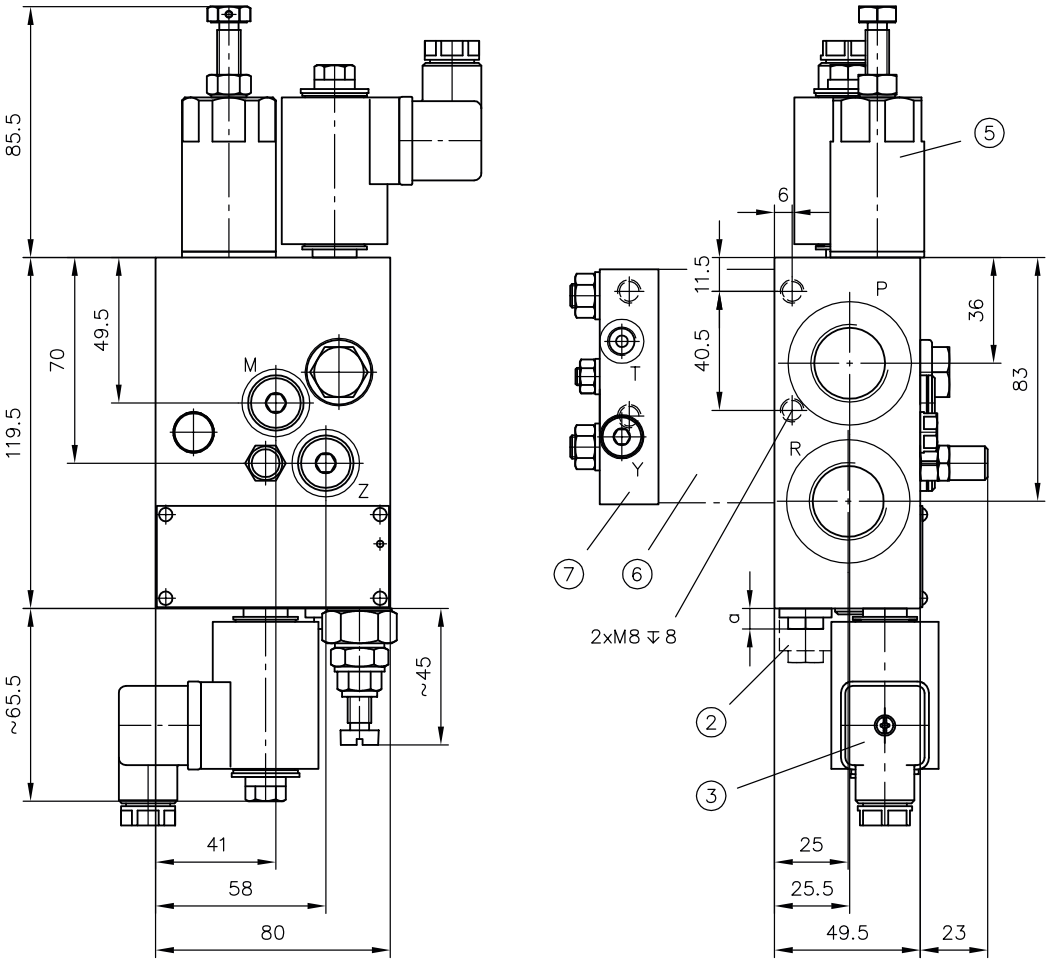


Manually adjustable



PSV 4N.../.../...-2
PSV UNF 4N.../.../...-2



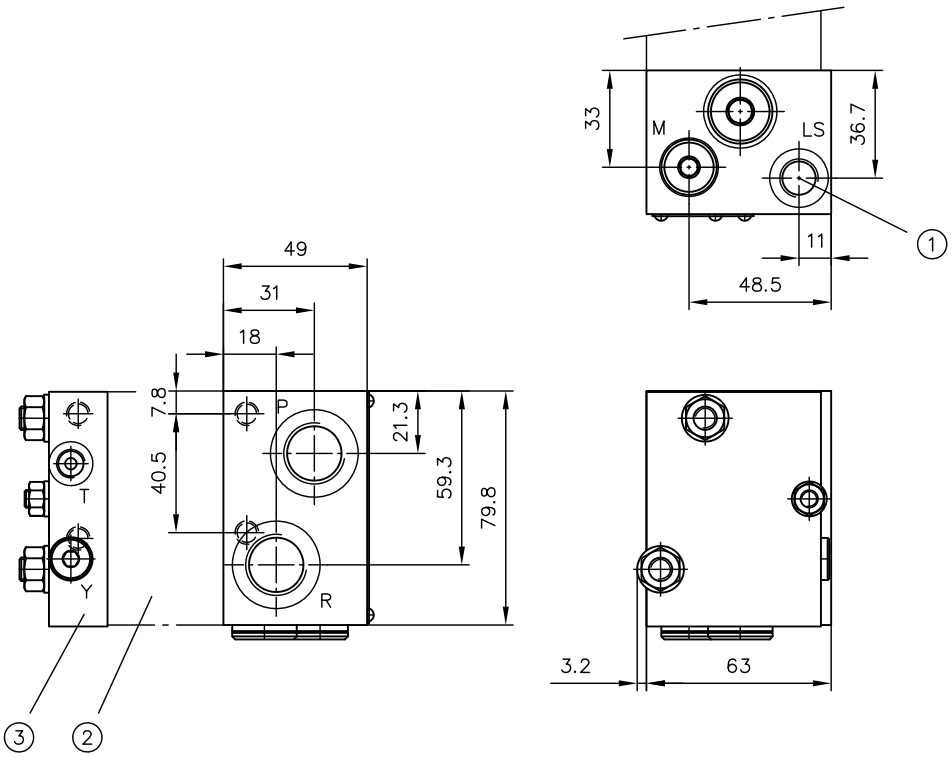


1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 Only included with optional variant V or Z
4 LS damping
5 Pressure-limiting valve
6 Valve section
7 End plate

Coding	a
without coding	6.5
1	6.5
2	18.4

Type	Ports (ISO 228-1 or SAE J 514)		
	P, R	LS, M	Z
PSV 4N.../.../...-2	G 3/4	G 1/4	G 1/8
PSV UNF 4N.../.../...-2	11/16-12 UNF-2B	7/16-20 UNF-2B	7/16-20 UNF-2B

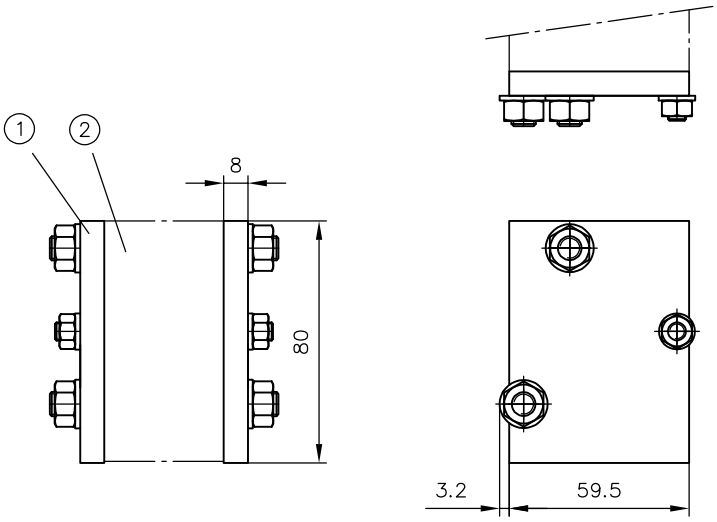
PSV 3X...-2



1 LS damping
2 Valve section
3 End plate

Type	Ports (ISO 228-1)	
	P, R	LS, M
PSV 3X...-2	G 1/2	G 1/4

PSV E0-2



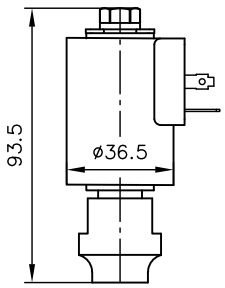
1 End plate
2 Directional spool valve

Additional valves for LS relief or LS pressure limitation on connection block

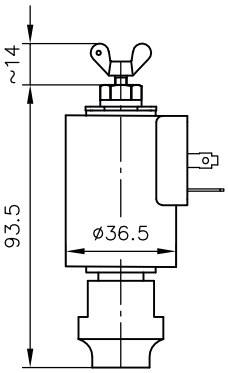
see Chapter 2.1.7, "LS relief or LS pressure limitation"

without coding

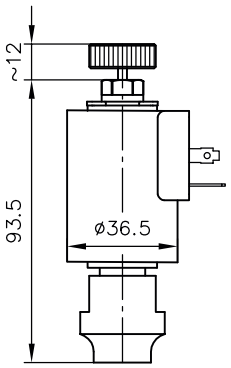
Coding **VA, ZA**



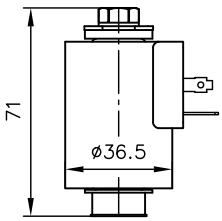
Coding **ZAM**



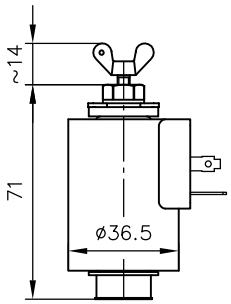
Coding **ZAP**



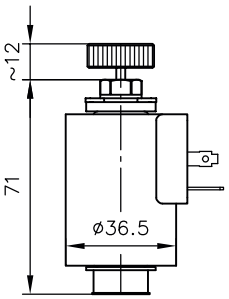
Coding **V, Z**



Coding **ZM**



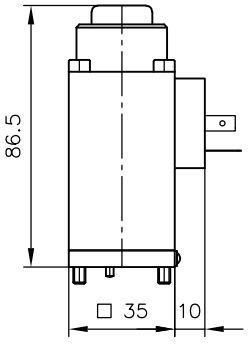
Coding **ZP**



Only for PSL 3 Z.../D...-2:

without coding

Coding **F, D**

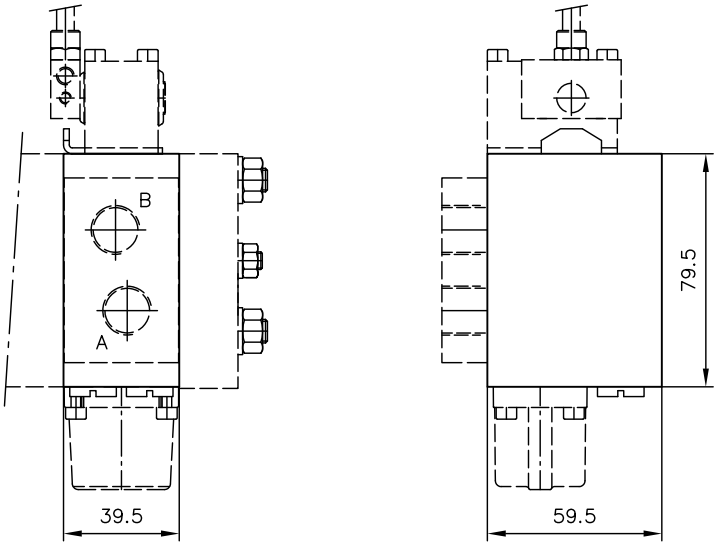


4.2 Valve section

4.2.1 PSL/PSV directional valve section

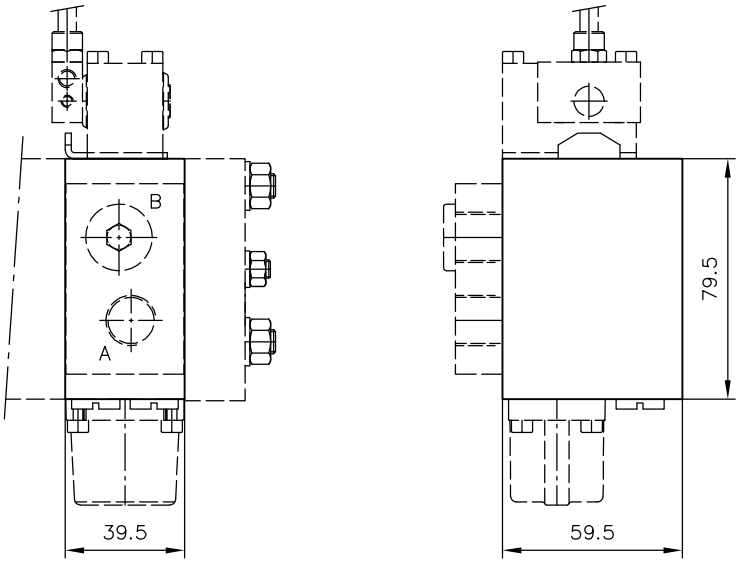
Directional valve section without integrated threads for combining with an ancillary block

Coding **A...** see Chapter 2.2.1.1, "Consumer ports"



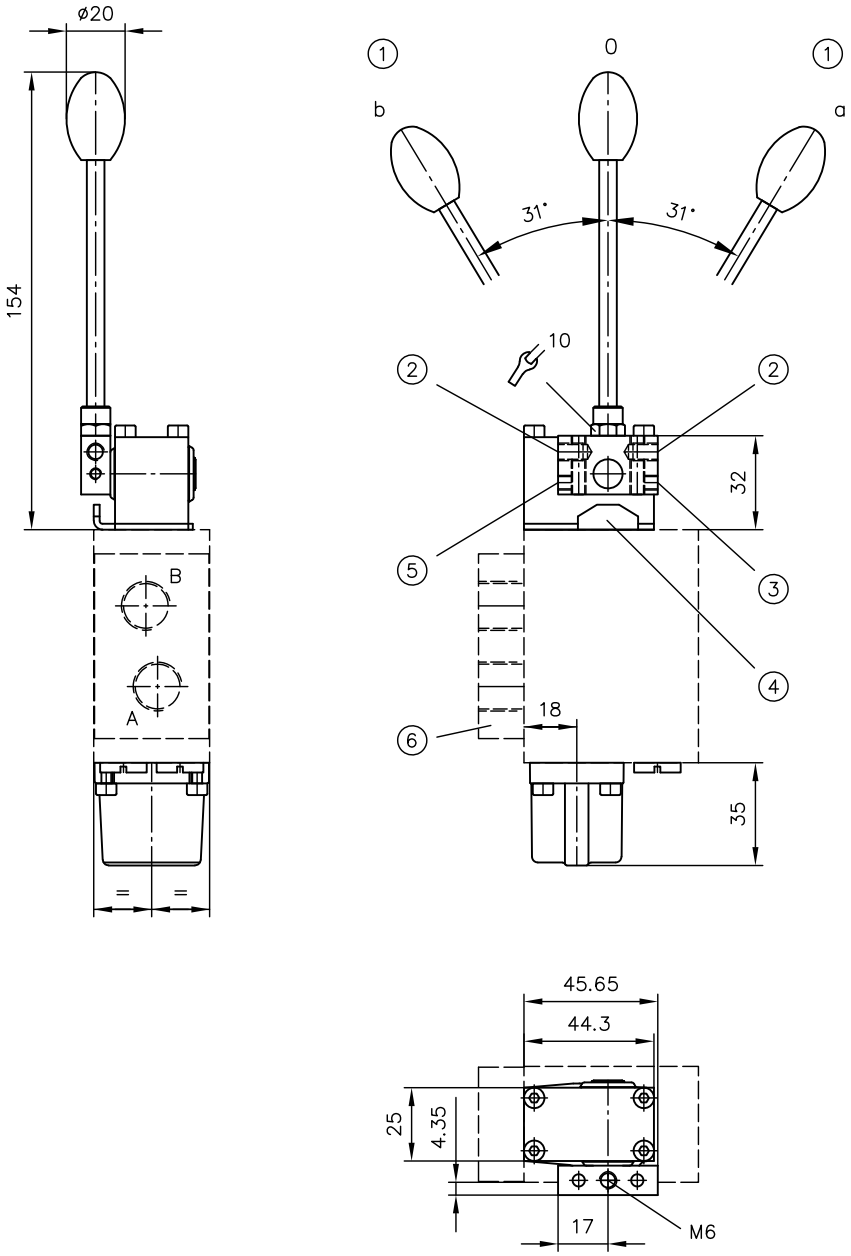
Pre-selector directional valve section with integrated ports

Coding **8...** see Chapter 2.2.1.2, "2-way controller")



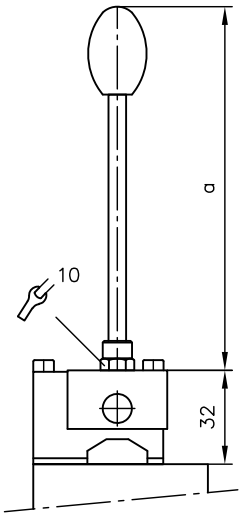
Directional valve section with manual actuation

Actuation **EOA, EOC**



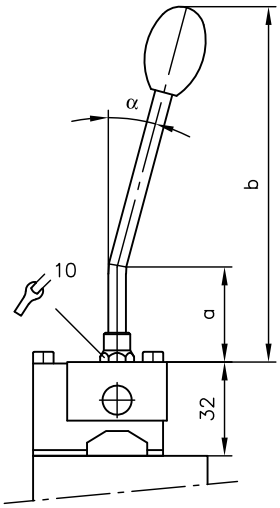
1 Switching position 0, a and b
2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
3 Travel stop for flow limitation at A (adjustable via grub screw M5)
4 Intermediate sheet to act as stop for stroke limitation
5 Travel stop for flow limitation at B (adjustable via grub screw M5)
6 Ancillary blocks

Lever straight



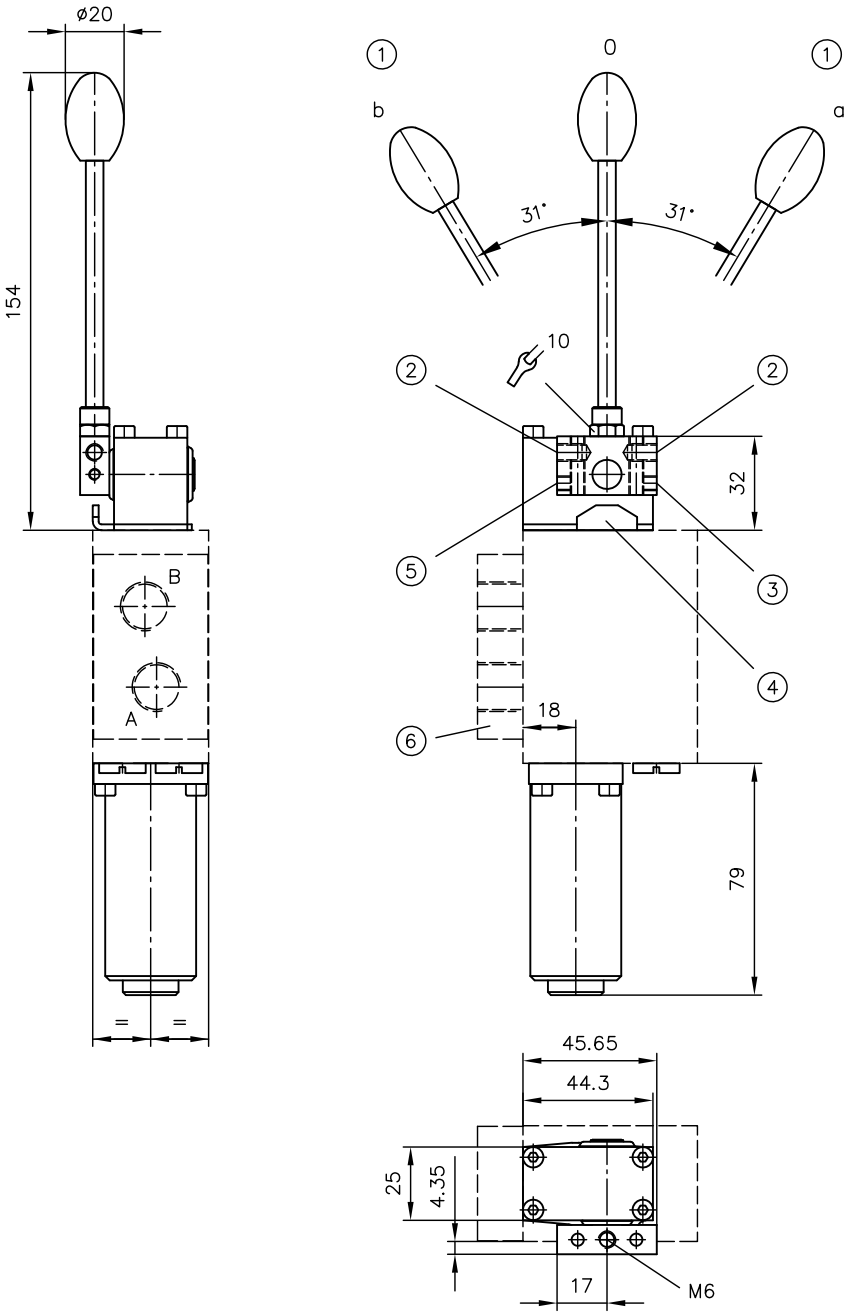
Coding	a
without coding	122
1	--
2	78
3	174
4	92

Lever for angle

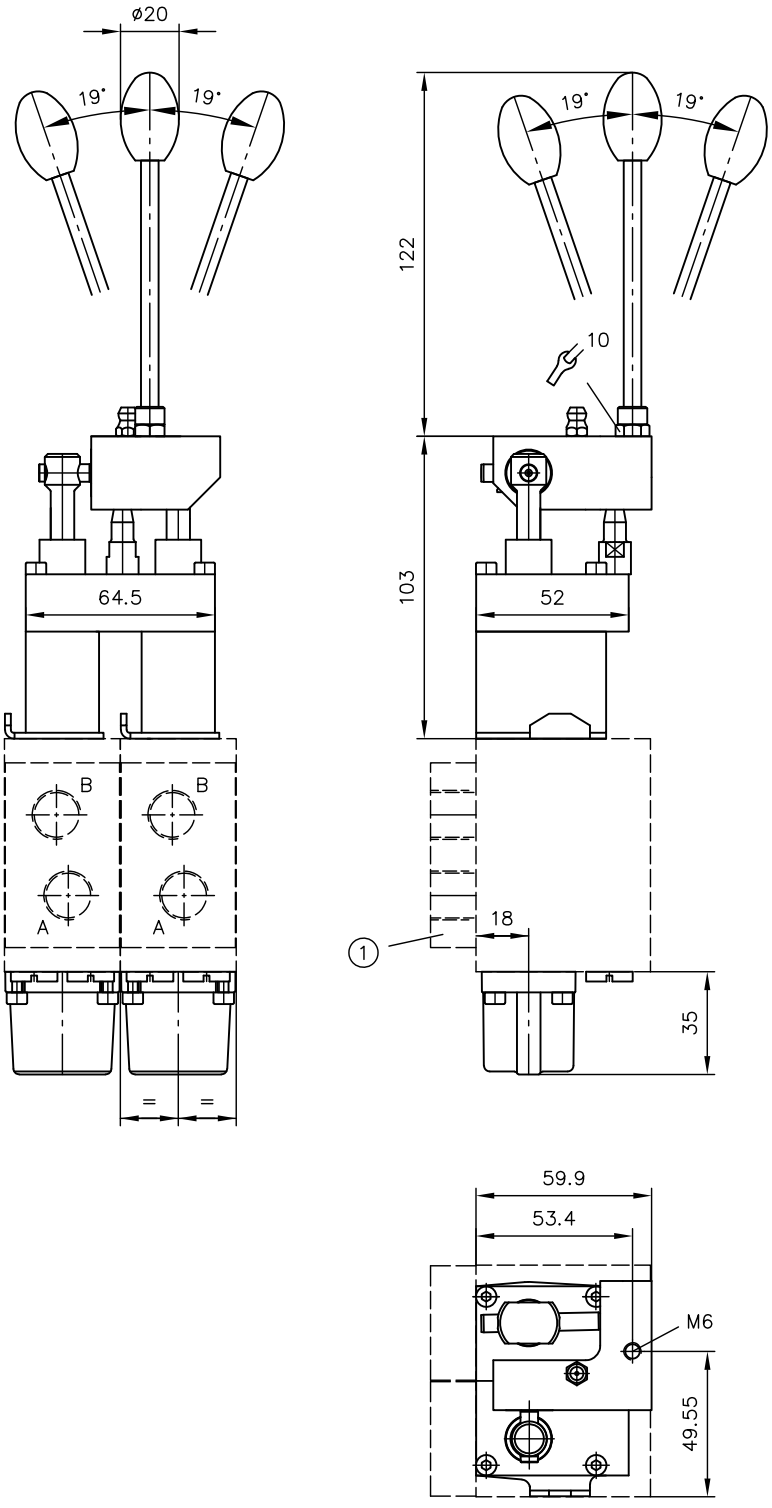


Coding	a	b	α
005	31	122	5°
015	31	120	15°
025	31	115	25°
030	49	114	30°

Actuation **EOAR**



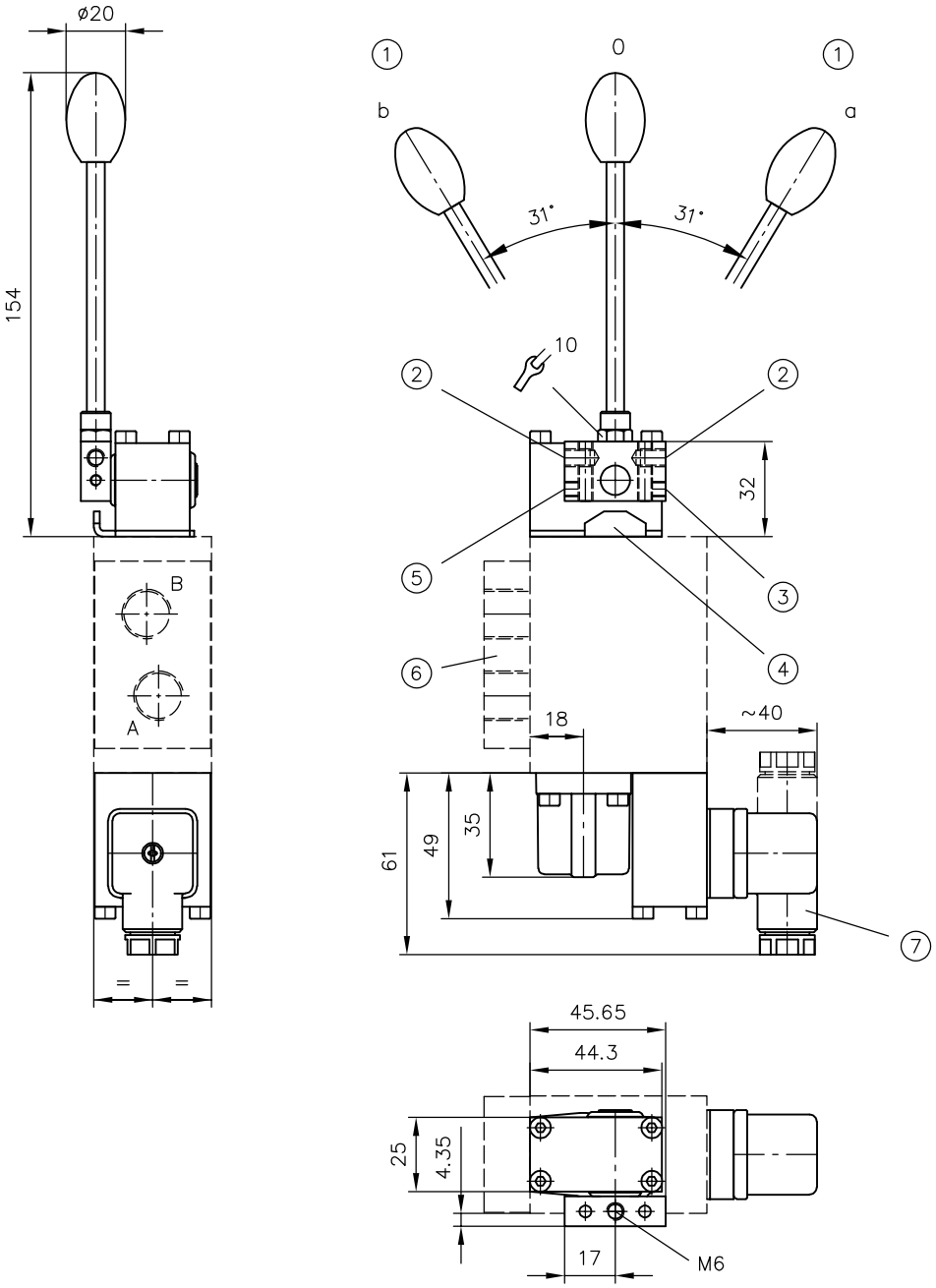
1 Switching position 0, a and b
2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
3 Travel stop for flow limitation at A (adjustable via grub screw M5)
4 Intermediate sheet to act as stop for stroke limitation
5 Travel stop for flow limitation at B (adjustable via grub screw M5)
6 Ancillary blocks



1 Ancillary blocks

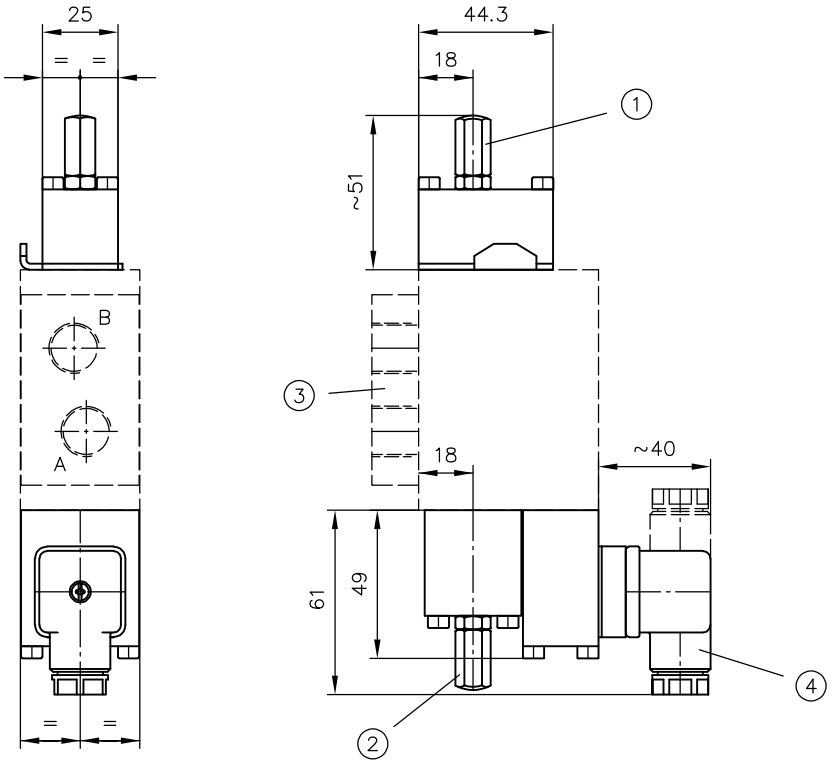
Directional valve section with electro-hydraulic actuation

Actuation **EA**



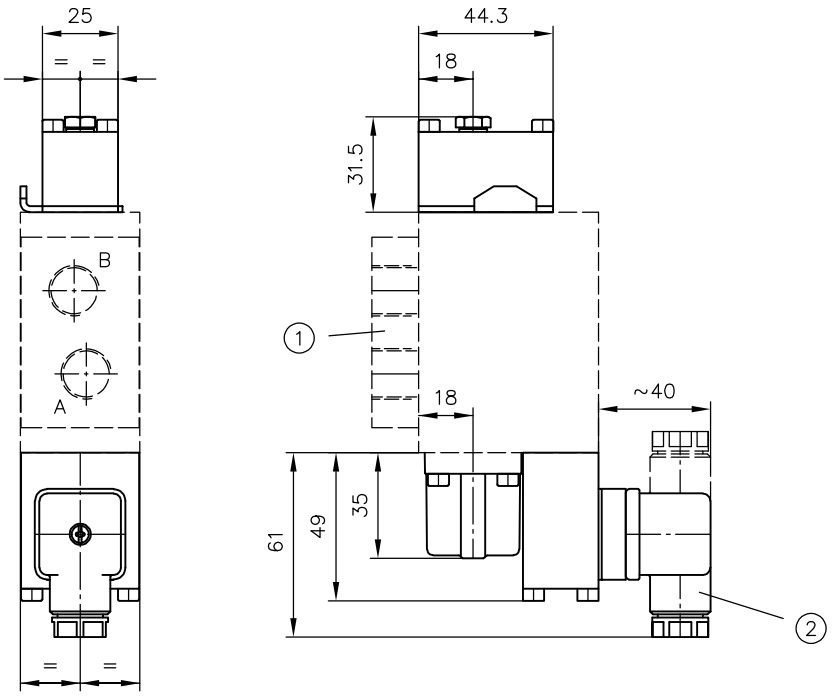
1 Switching position 0, a and b
2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
3 Travel stop for flow limitation at A (adjustable via grub screw M5)
4 Intermediate sheet to act as stop for stroke limitation
5 Travel stop for flow limitation at B (adjustable via grub screw M5)
6 Ancillary blocks
7 Male connector can be mounted offset by 180°

Actuation **E**



1 Travel stop for flow limitation at A
2 Travel stop for flow limitation at B
3 Ancillary blocks
4 Male connector can be mounted offset by 180°

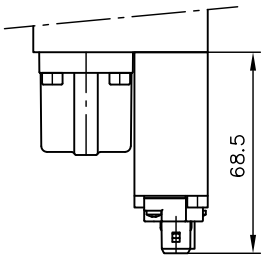
Actuation **EI**



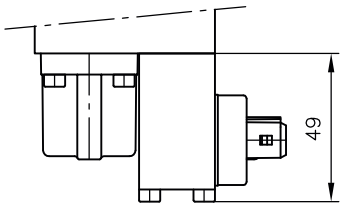
1 Ancillary blocks
2 Male connector can be mounted offset by 180°

Solenoid versions

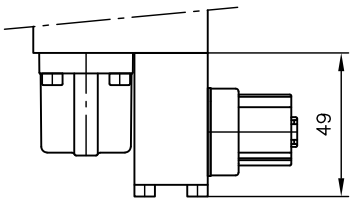
Coding
AMP 12(24) K4



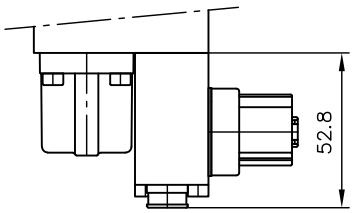
Coding
AMP 12 H 4



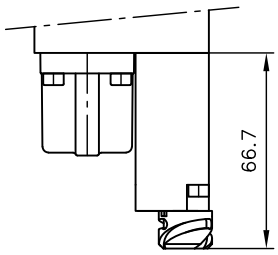
Coding
DT 12(24)



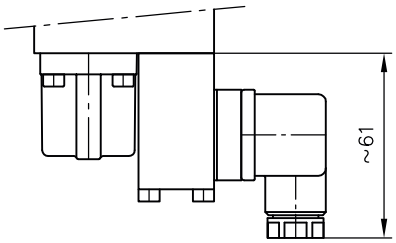
Coding
DT 12(24) T



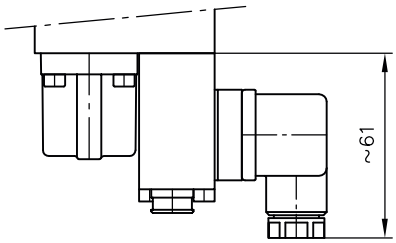
Coding
S 12(24)



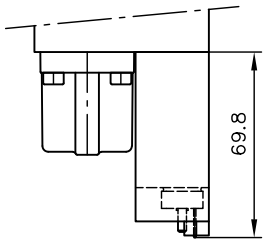
Coding
G(X) 12(24)



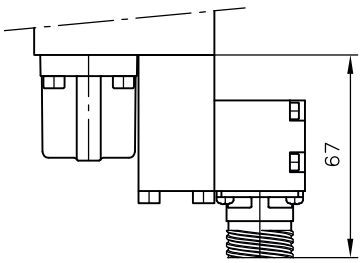
Coding
G(X) 12(24) T



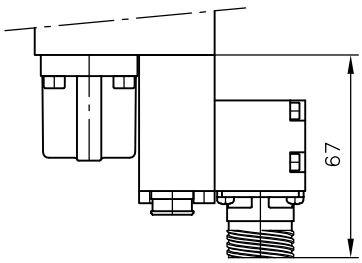
Coding
G(X) 24 C4



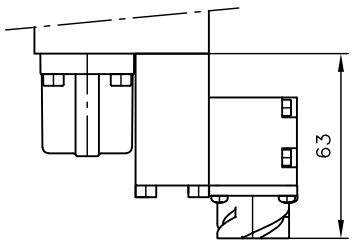
Coding
DTL 12(24)



Coding
DTL 12(24) T

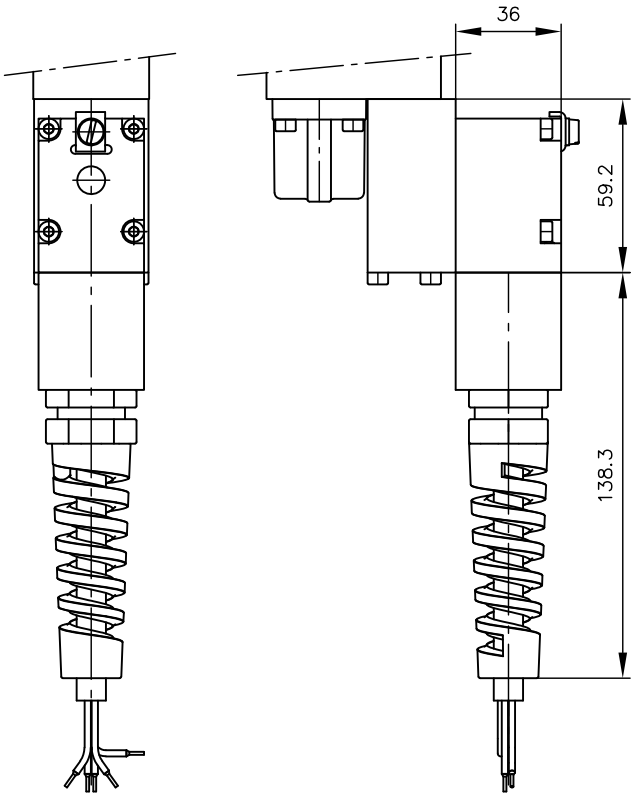


Coding
ITT 12(24)



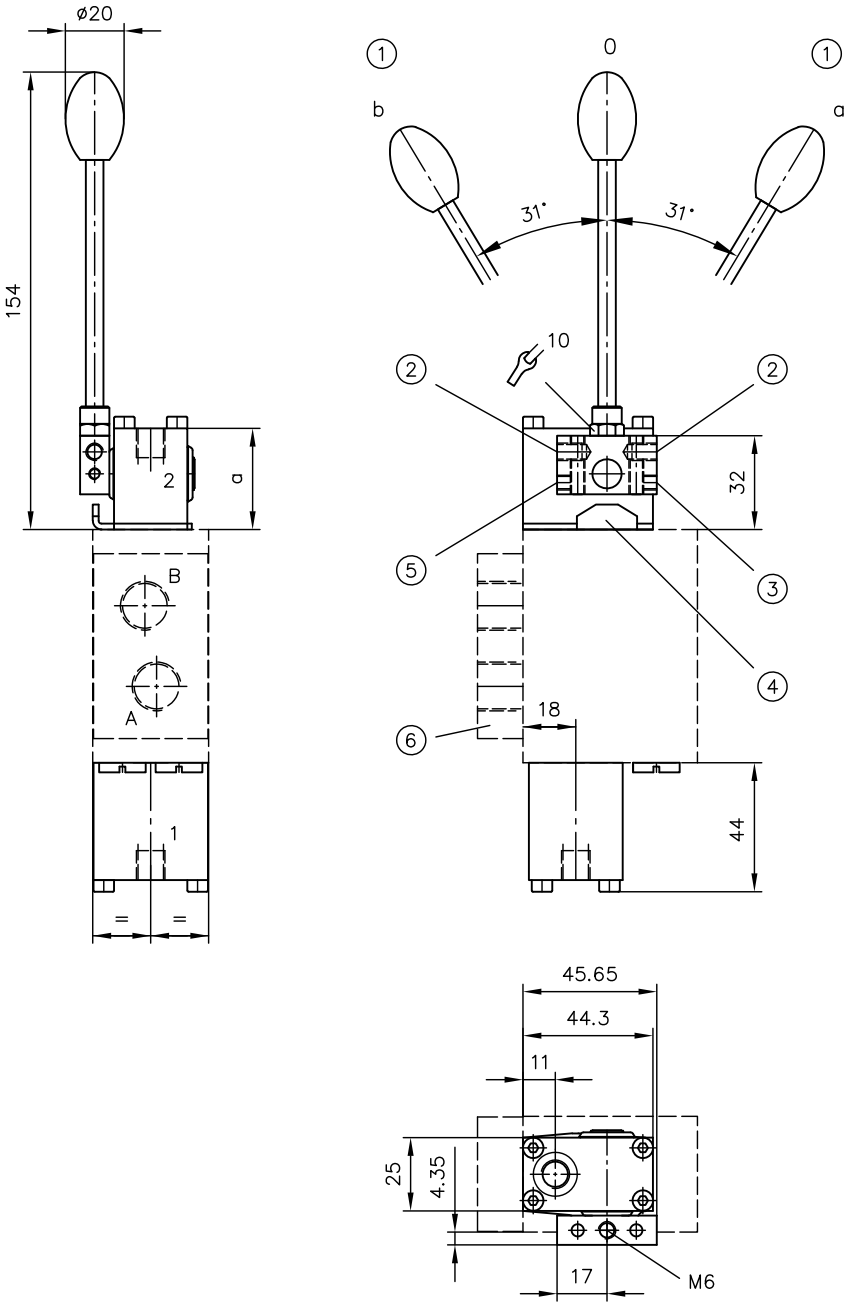
Coding

G 24 TEX 4 55FM



Directional valve section with hydraulic actuation

Actuation **E0HA (UNF)**

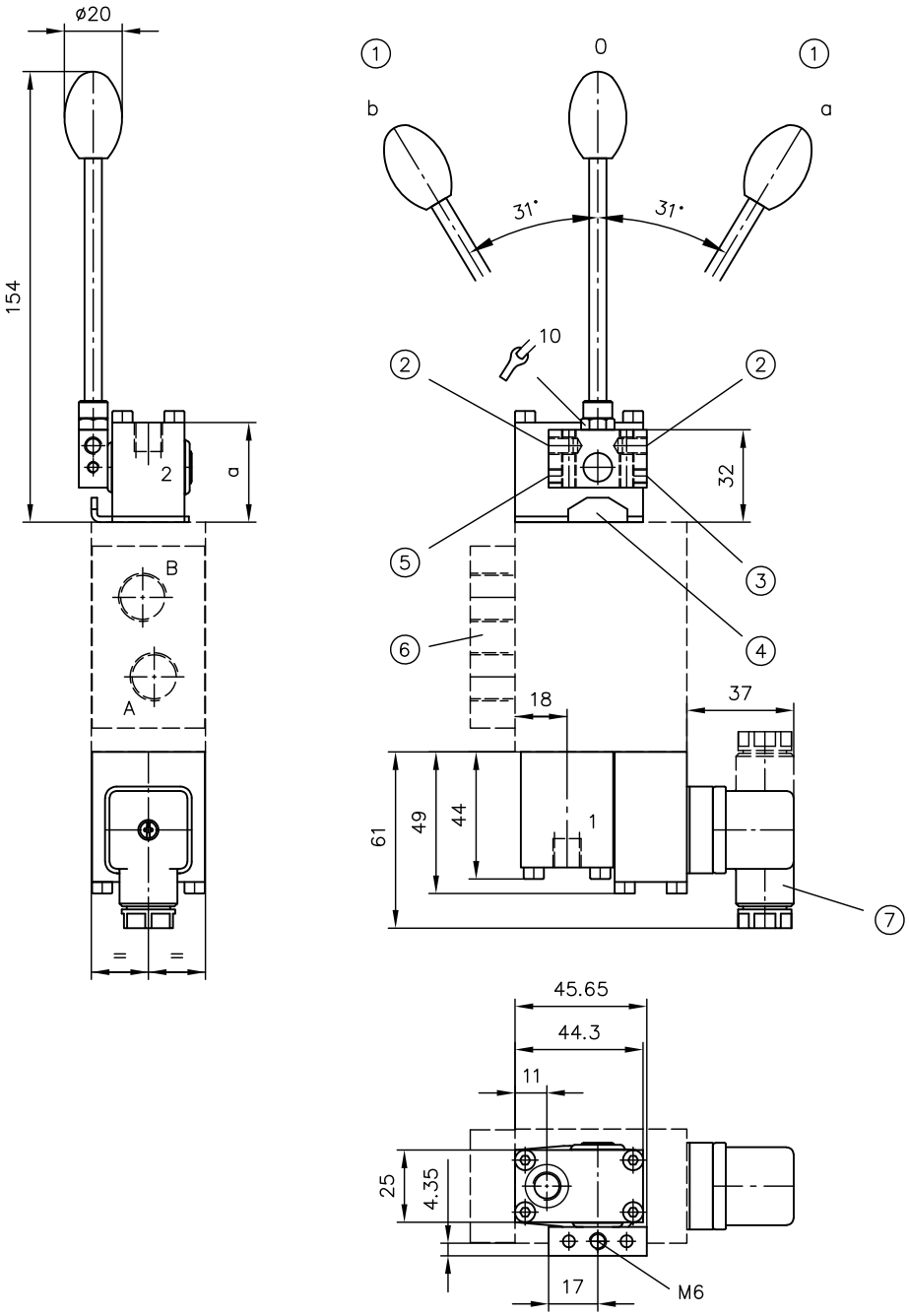


1 Switching position 0, a and b
2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
3 Travel stop for flow limitation at A (adjustable via grub screw M5)
4 Intermediate sheet to act as stop for stroke limitation
5 Travel stop for flow limitation at B (adjustable via grub screw M5)
6 Ancillary blocks

Coding	a
E0HA	34.5
E0HA UNF	39.5

Coding	Ports (ISO 228-1 or SAE J 514)
	1, 2
E0HA	G 1/8
E0HA UNF	SAE-2 (5/16-24 UNF-2B)

Actuation **EHA (UNF)**

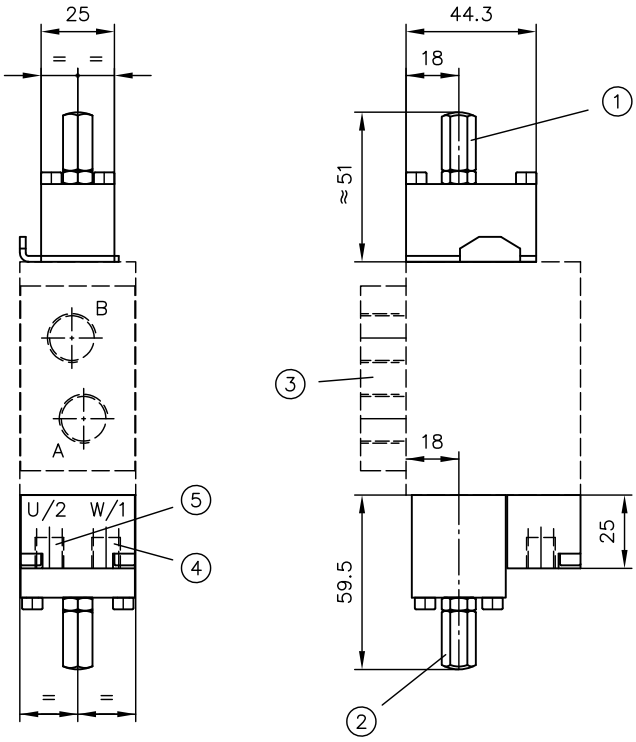


1 Switching position 0, a and b
2 Alternative mounting position for hand lever (thread M6, 8.5 mm deep)
3 Travel stop for flow limitation at A (adjustable via grub screw M5)
4 Intermediate sheet to act as stop for stroke limitation
5 Travel stop for flow limitation at B (adjustable via grub screw M5)
6 Ancillary blocks

Coding	a
EHA	34.5
EHA UNF	39.5

Coding	Ports (ISO 228-1 or SAE J 514)
	1, 2
EHA	G 1/8
EHA UNF	SAE-2 (5/16-24 UNF-2B)

Actuation **E0Z (UNF)**

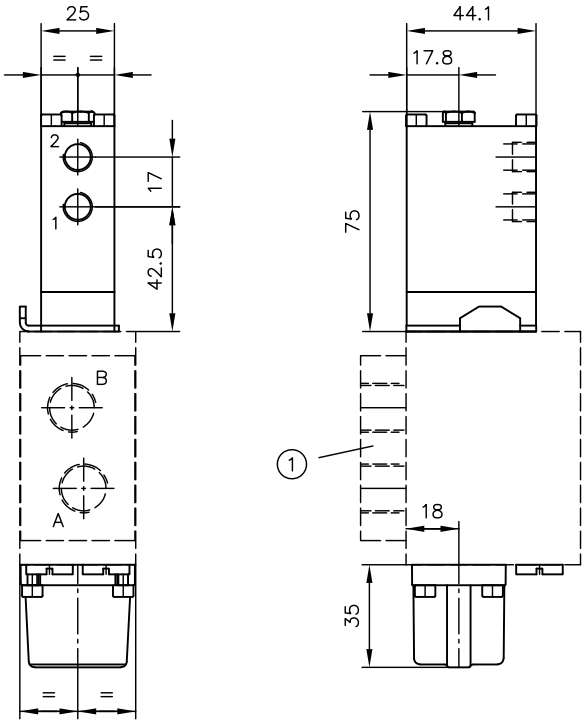


1 Travel stop for flow limitation at A
2 Travel stop for flow limitation at B
3 Ancillary blocks
4 Port W/1
5 Port U/2

Coding	Ports (ISO 228-1 or SAE J 514)
	W/1, U/2
E0Z	G 1/8
E0Z UNF	SAE-2 (5/16-24 UNF-2B)

Directional valve section with pneumatic actuation

Actuation **P**

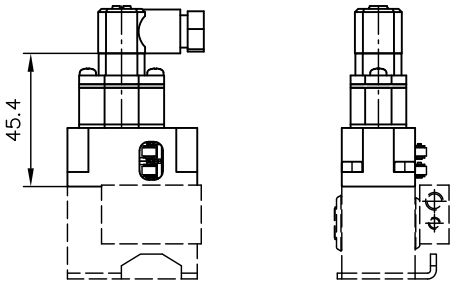


1 Ancillary blocks

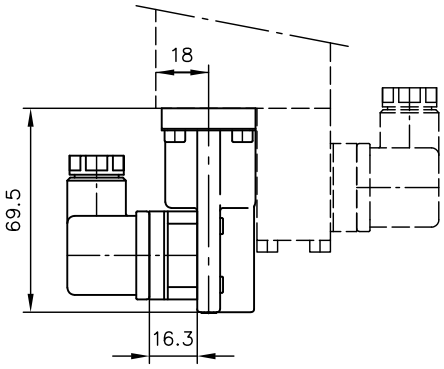
Coding	Ports (ISO 228-1)
	1, 2
P	G 1/8

Switching position monitoring, displacement transducer

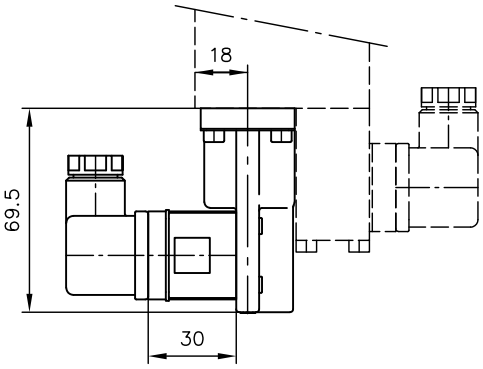
Coding **VC**



Coding **WA**

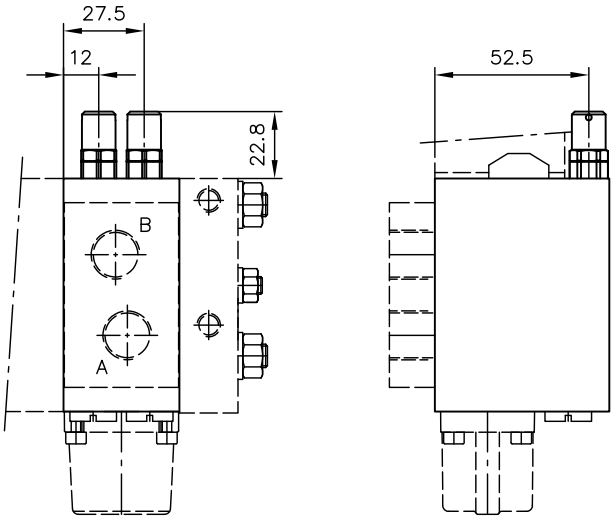


Coding **U**



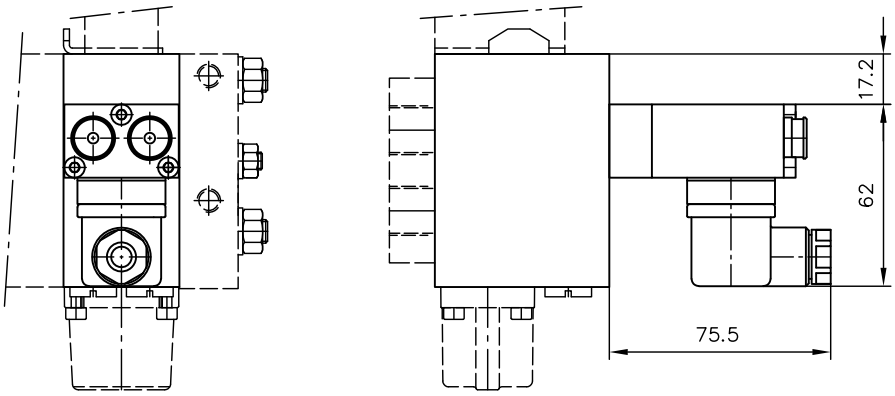
Directional valve section with LS pressure limitation

Coding **A.., B.., A.. B..**

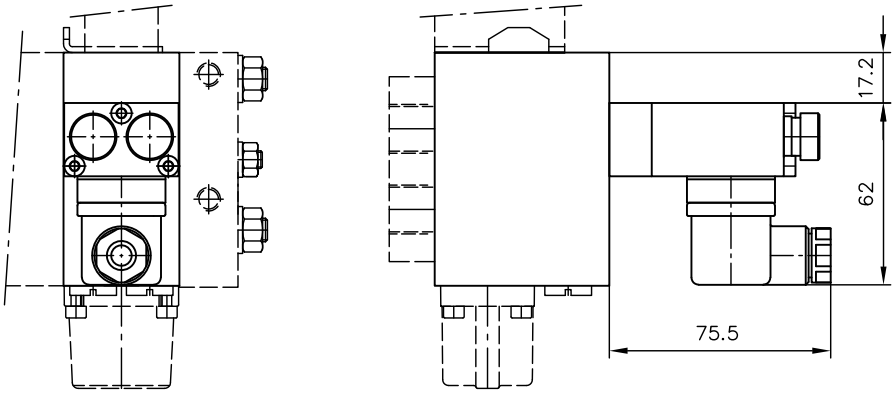


Directional valve section with electric LS relief or LS pressure limitation

Coding **FP**

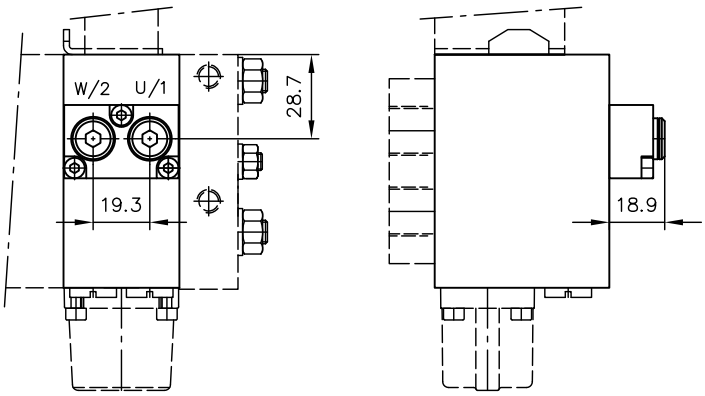


Coding **FPH**



Directional valve section with LS port for external limitation

Coding **S1**

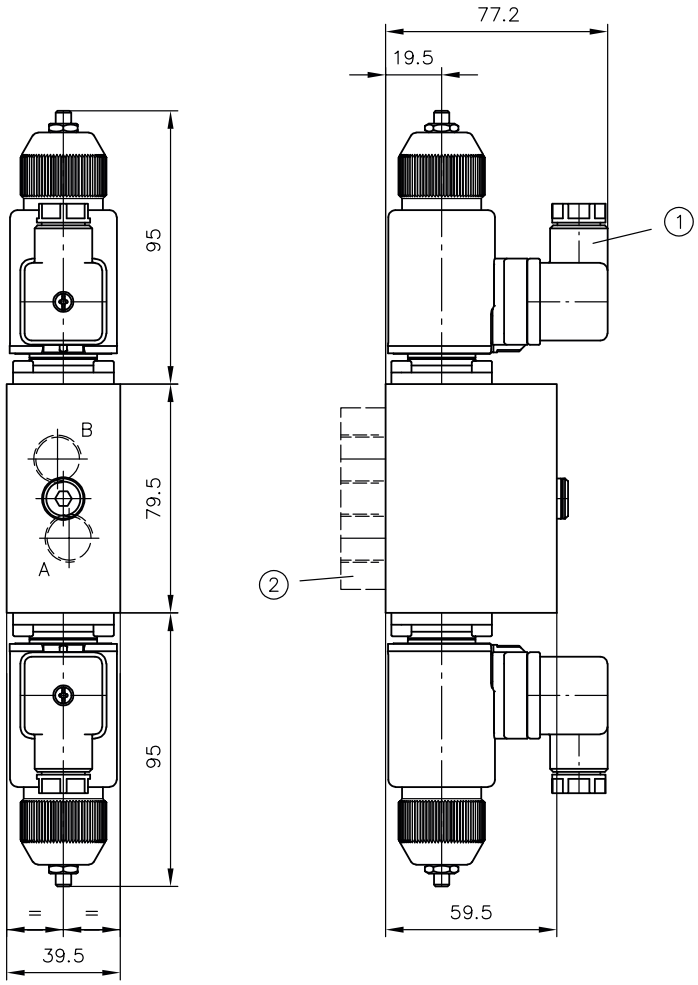


Coding	Ports (ISO 228-1)
	U/1, W/2
S1	G 1/8

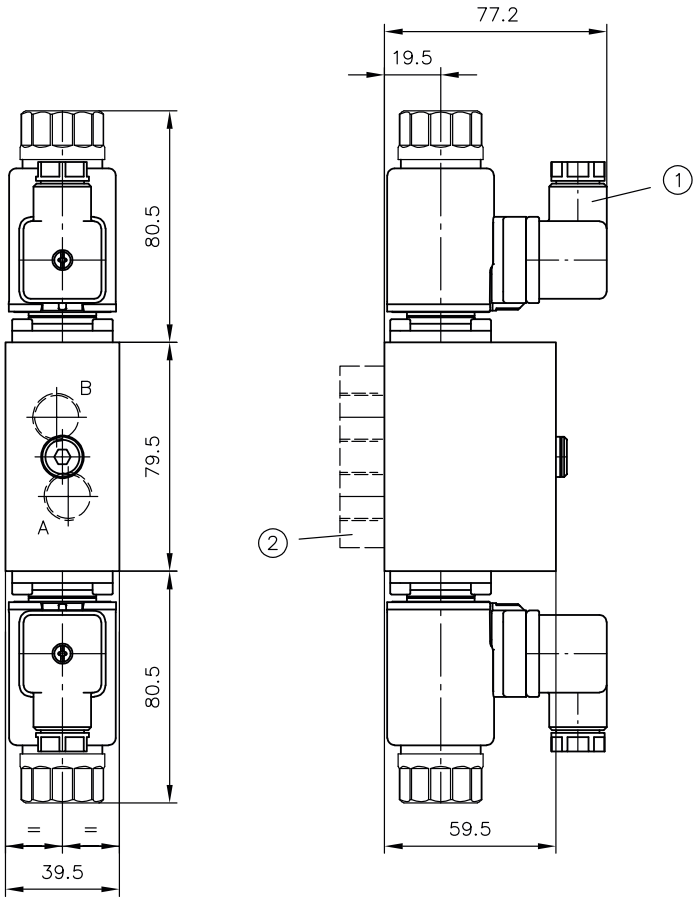
4.2.2 EDL directional valve section

Actuations

Coding **E**



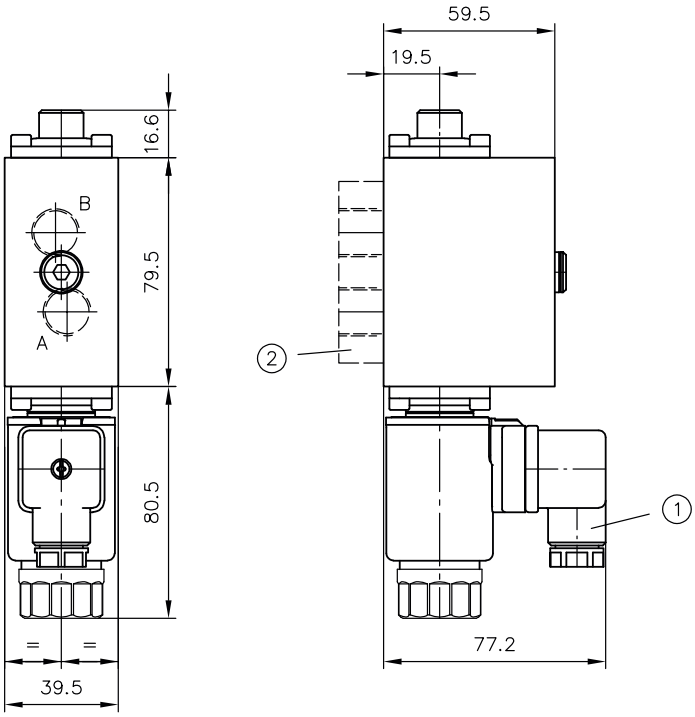
Coding **EI**



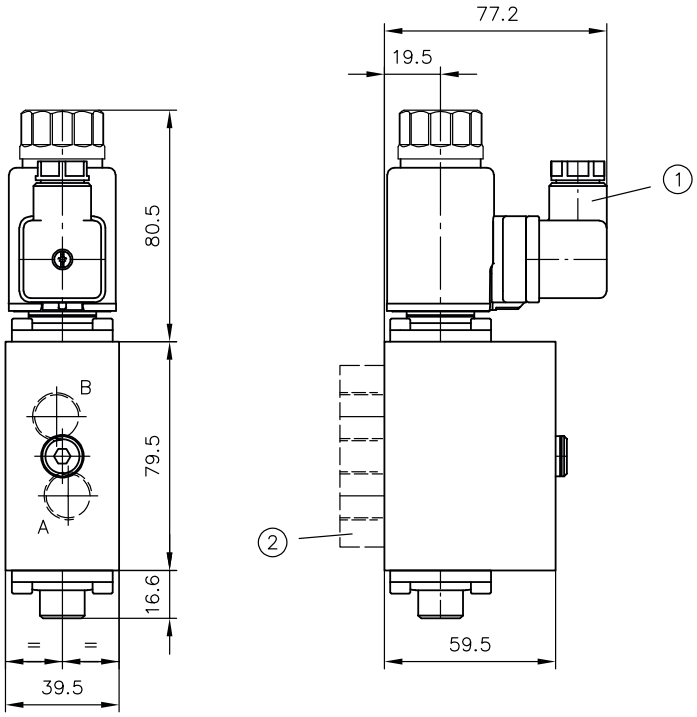
1 Male connector can be mounted offset by 180°

2 Ancillary blocks

Coding **AEI**

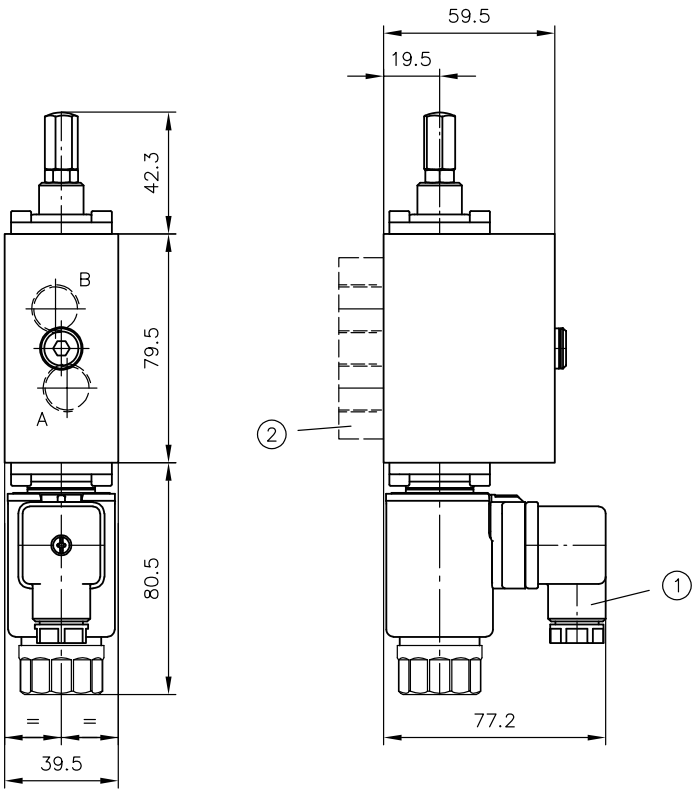


Coding **BEI**

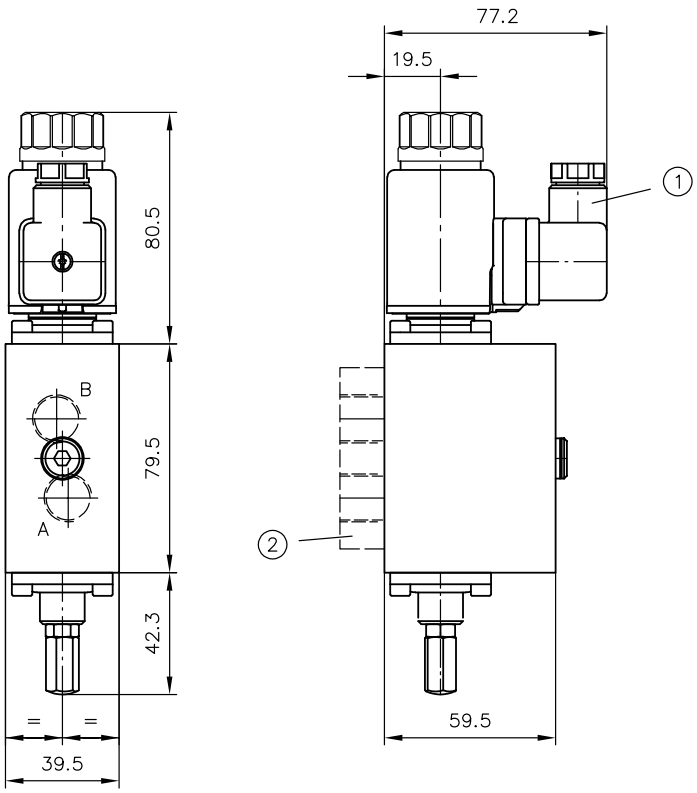


1 Male connector can be mounted offset by 180°
2 Ancillary blocks

Coding **AEEI**



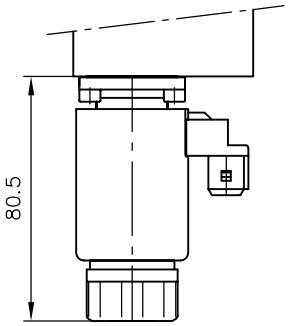
Coding **BEEI**



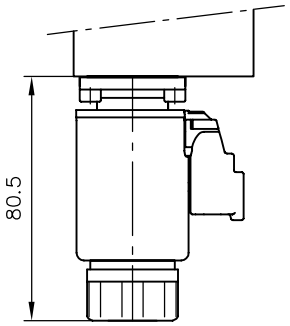
1 Male connector can be mounted offset by 180°
2 Ancillary blocks

Additional solenoid versions

Coding **AMP 12, AMP 24**

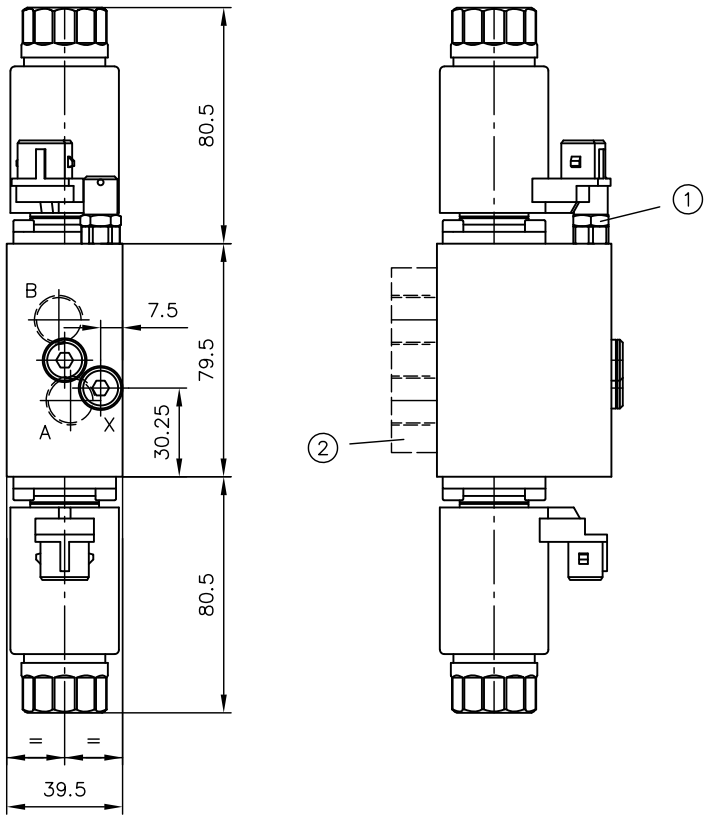


Coding **DT 12, DT 24**



LS pressure limitation and load-signal outlet X

Coding **C ... X**



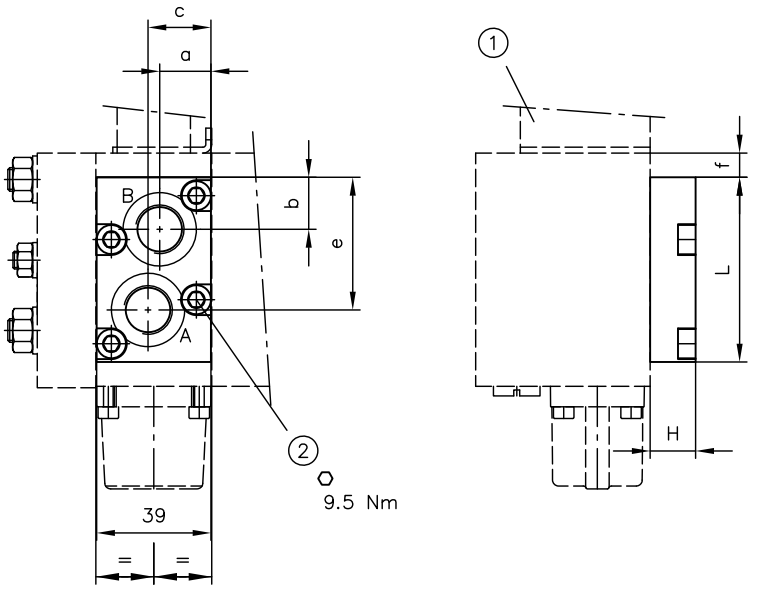
1 LS pressure limitation
2 Ancillary blocks

	Port (ISO 228-1)
X	G 1/8

4.2.3 Ancillary block

see Chapter 2.2.3, "Ancillary block"

/2, /22, /3
/UNF 1, /UNF 12, /UNF 2
/JIS 2

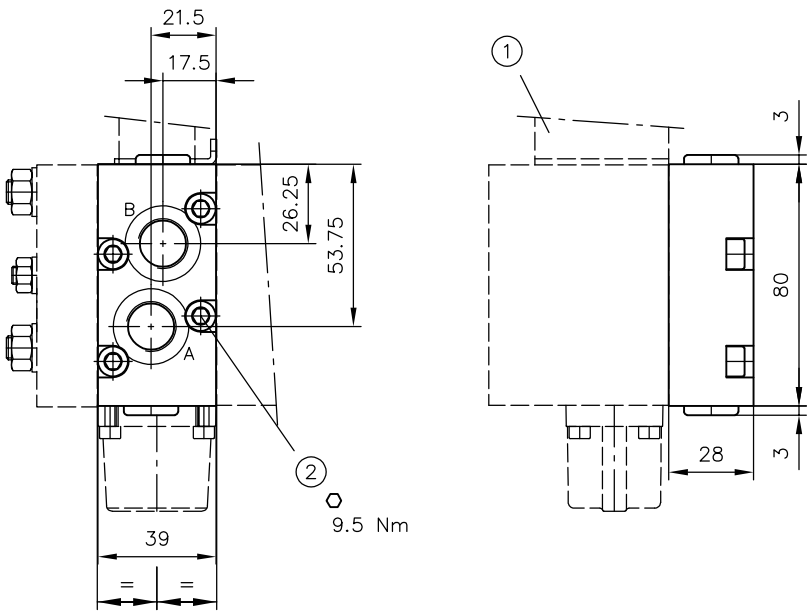


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	L	a	b	c	e	f	g
/2	16	63	17.5	17.75	21.5	45.25	8.25	16
/22	24.5	68	21	13	18	55	5.25	25
/3	28	80	17.5	28.5	17.5	56	--	28
/UNF 1 /UNF 12 /UNF 2	16	63	17.5	17.75	21.5	45.25	8.25	16
/JIS 2	25	80	17.5	26.25	21.5	53.75	--	25

Coding	Connections (ISO 228-1 or SAE J 514 or JIS B 2351)
	A, B
/2, /22	G 3/8
/3	G 1/2
/UNF 1	7/16-20 UNF-2B (SAE-4)
/UNF 12	9/16-18 UNF-2B (SAE-6)
/UNF 2	3/4-16 UNF-2B (SAE-8)
/2 FL	G 3/8
/UNF 2 FL	3/4-16 UNF-2B (SAE-8)
/JIS 2	JIS G 3/8

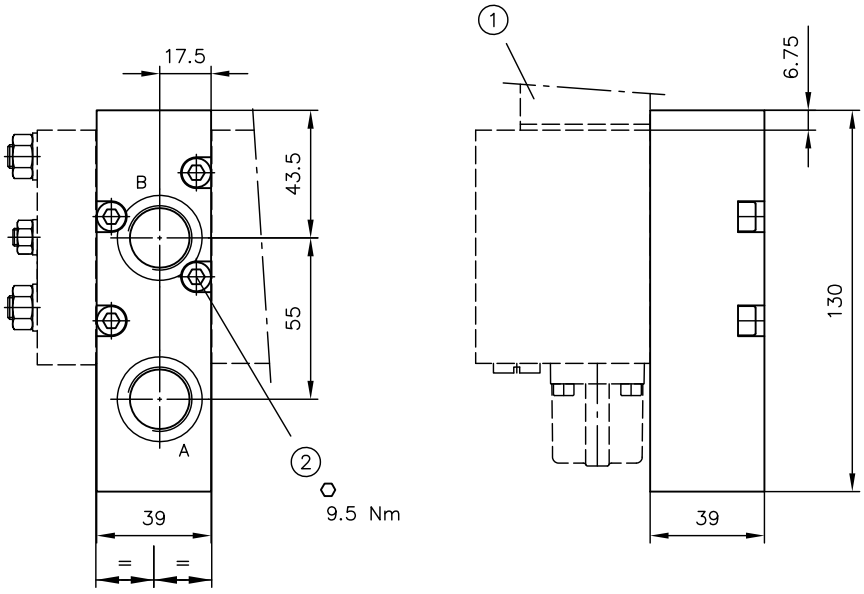
/2 M
/UNF 2 M



1 Directional valve section
2 Cylinder screws ISO 4762-M6x **24** -A2-70

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 M	G 3/8
/UNF 2 M	3/4-16 UNF-2B (SAE-8)

/M 222

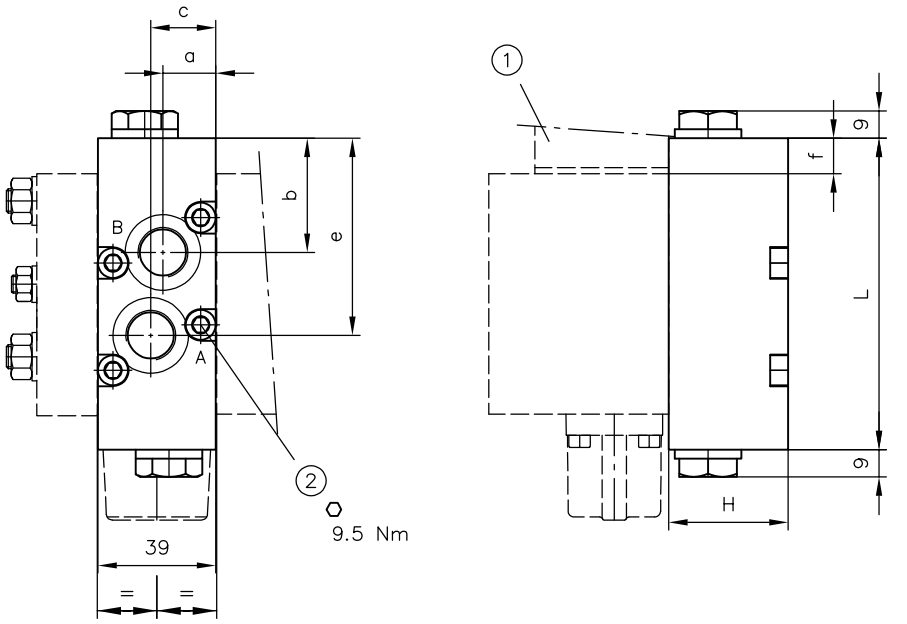


1 Directional valve section

2 Cylinder screws ISO 4762-M6x **35** -A2-70

Coding	Ports
	A, B
/M 222	M22x1.5

/2(22) AS..BS.., /UNF 2 AS..BS..
/2(22) AN..BN.., /UNF 2 AN..BN..



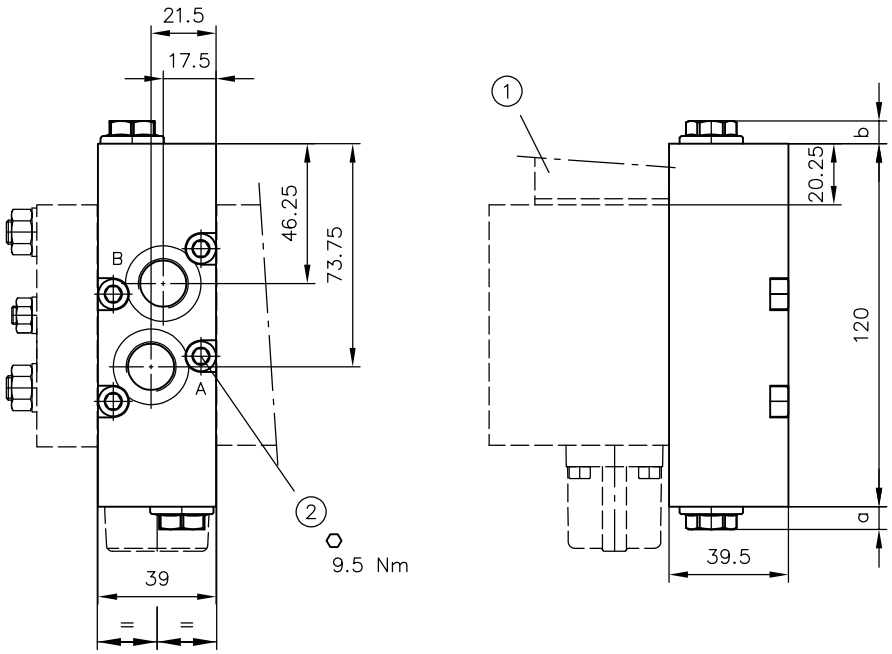
1 Directional valve section

2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	L	a	b	c	e	f	g
/2 AS.. BS.. /UNF 2 AS..BS..	39.5	83	17.5	27.5	21.5	55.25	1.75	40
/22 AS..BS..	39	105	20.2	22.5	19.5	83.5	1.75	39
/2 AN..BN.. /UNF 2 AN..BN..	29.5	103	17.5	37.75	21.5	65.25	11.75	40

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 AS..BS.. /22 AS..BS.. /2 AN..BN..	G 3/8
/UNF 2 AS..BS.. /UNF 2 AN..BN..	3/4-16 UNF-2B (SAE-8)

/2 ANV...BNV..., /2 ANV BNV
/2 ANV..., /2 BNV...
/2 ANV, /2 BNV

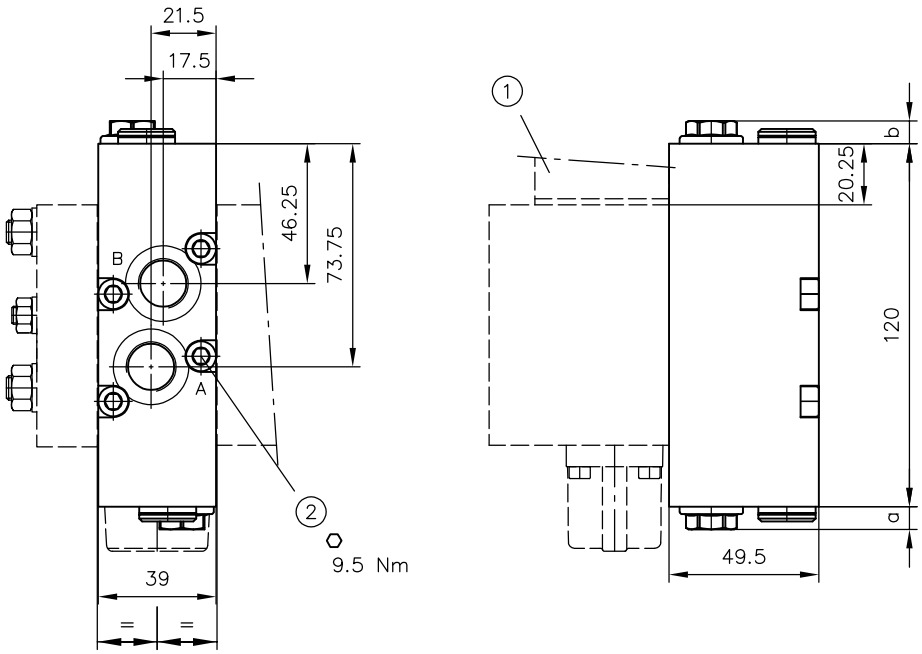


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **40** -A2-70

Coding	a	b
/2 ANV... BNV...	7.5	7.5
/2 ANV BNV	8	8
/2 ANV... BNV	7.5	8
/2 ANV BNV...	8	7.5
/2 ANV...	7.5	7.5
/2 ANV	8	7.5
/2 BNV...	7.5	7.5
/2 BNV	7.5	8

Coding	Connections (ISO 228-1)
	A, B
/2 ANV... BNV... /2 ANV BNV /2 ANV... /2 ANV /2 BNV... /2 BNV	G 3/8

/2 M ANV... BNV... , /2 M ANV BNV
/2 M ANV..., /2 BNV...
/2 M ANV, /2 BNV

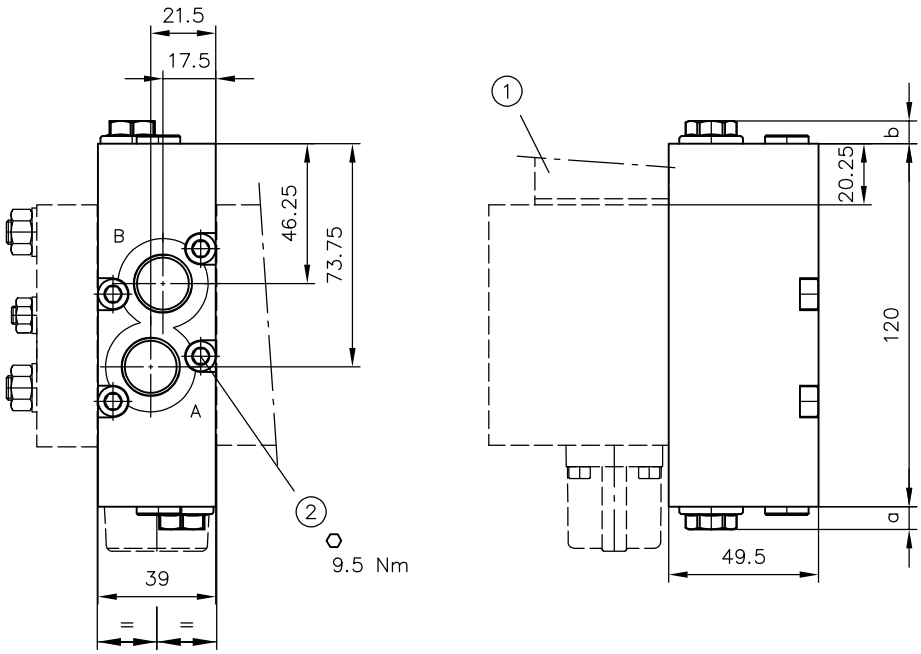


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **50** -A2-70

Coding	a	b
/2 M ANV... BNV...	7.5	7.5
/2 M ANV BNV	8	8
/2 M ANV... BNV	7.5	8
/2 M ANV BNV...	8	7.5
/2 M ANV...	7.5	7.5
/2 M ANV	8	7.5
/2 M BNV...	7.5	7.5
/2 M BNV	7.5	8

Coding	Connections (ISO 228-1)
	A, B
/2 M ANV... BNV... /2 M ANV BNV /2 M ANV... /2 M ANV /2 M BNV... /2 M BNV	G 3/8

/UNF 2 M ANV... BNV... , /UNF 2 M ANV BNV
/UNF 2 M ANV..., /UNF 2 BNV...
/UNF 2 M ANV, /UNF 2 BNV

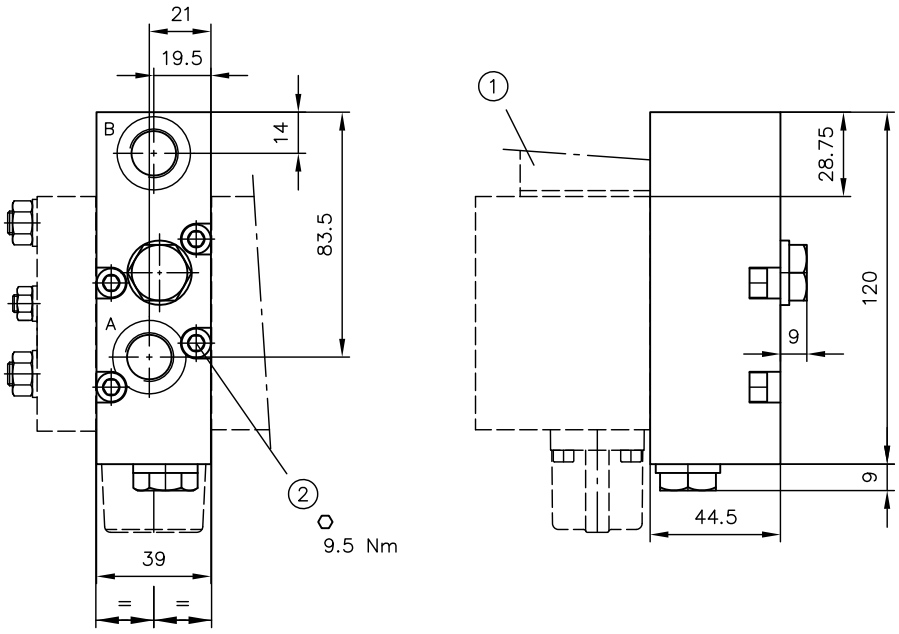


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **50** -A2-70

Coding	a	b
/UNF 2 M ANV... BNV...	7.5	7.5
/UNF 2 M ANV BNV	8	8
/UNF 2 M ANV... BNV	7.5	8
/UNF 2 M ANV BNV...	8	7.5
/UNF 2 M ANV...	7.5	7.5
/UNF 2 M ANV	8	7.5
/UNF 2 M BNV...	7.5	7.5
/UNF 2 M BNV	7.5	8

Coding	Connections (SAE J 514)
	A, B
/UNF 2 M ANV... BNV... /UNF 2 M ANV BNV /UNF 2 M ANV... /UNF 2 M ANV /UNF 2 M BNV... /UNF 2 M BNV	3/4-16 UNF-2B (SAE-8)

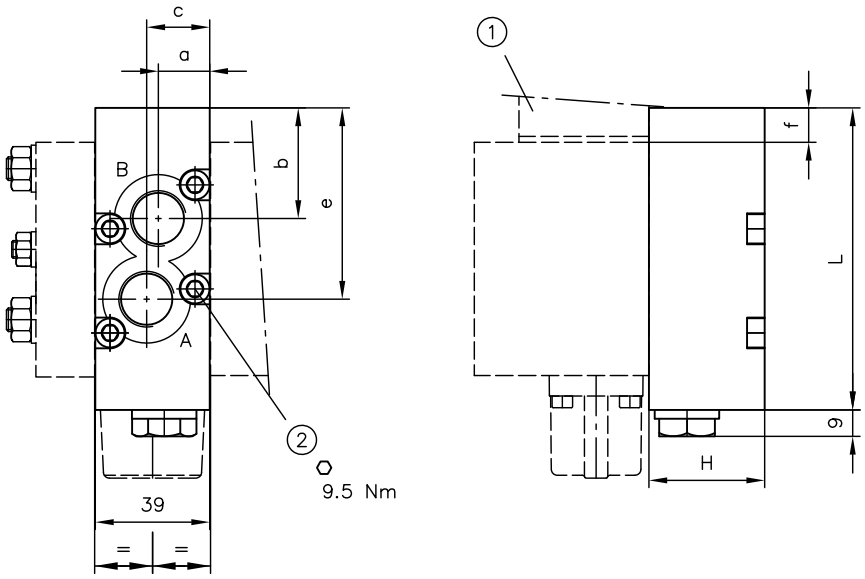
/22 AN..BN..



1 Directional valve section
2 Cylinder screws ISO 4762-M6x **45** -A2-70

Coding	Ports (ISO 228-1)
	A, B
/22 AN..BN..	G 3/8

/22 AN..
/UNF 2 AN..

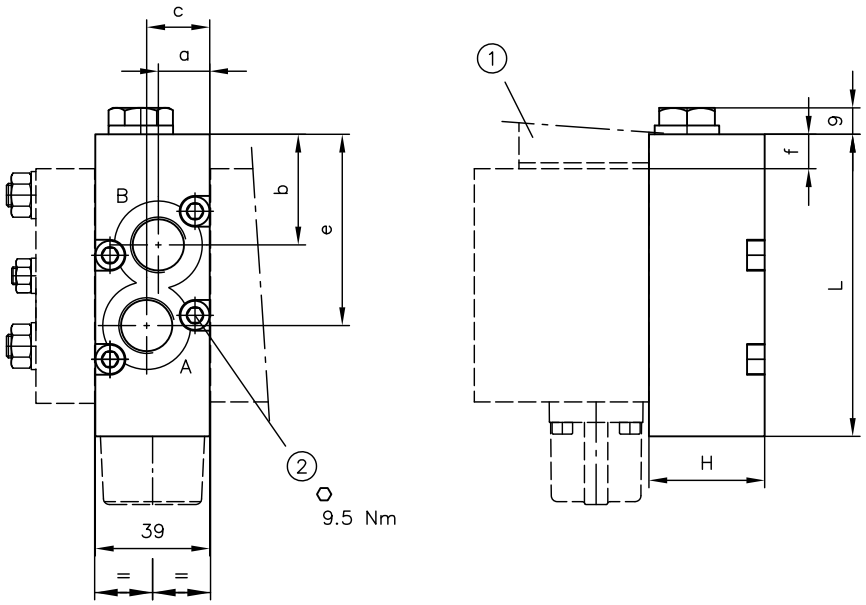


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	L	a	b	c	e	f	g
/22 AN..	39	110	19.5	13.75	21	74.25	19.5	39
/UNF 2 AN..	39.5	103	17.5	37.75	21.5	65.25	11.75	40

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/22 AN..	G 3/8
/UNF 2 AN..	3/4-16 UNF-2B (SAE-8)

/22 BN..
/UNF 2 BN..

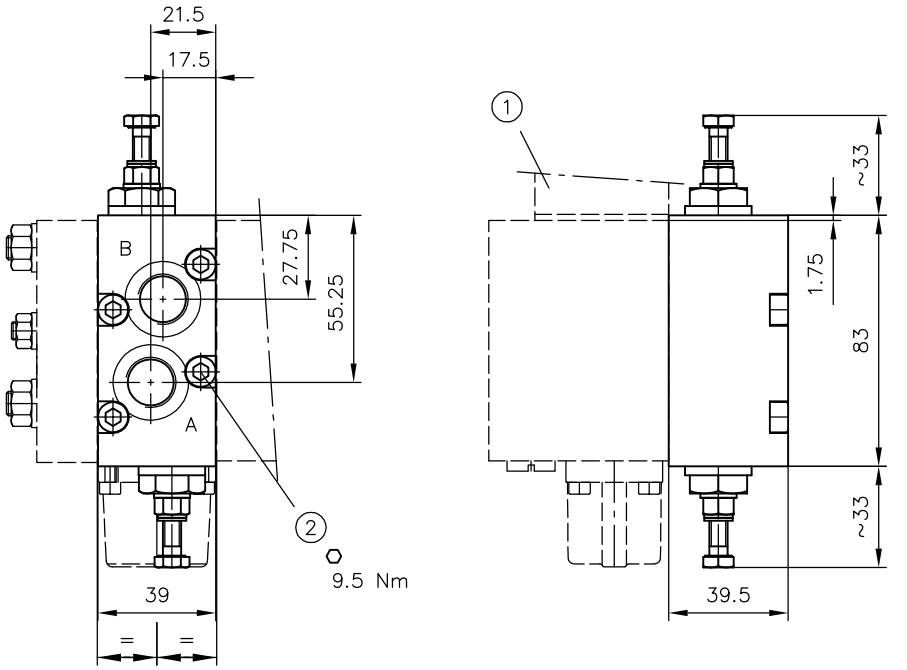


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	L	a	b	c	e	f	g
/22 BN..	39	110	18	35.75	19.5	96.25	11	39
/UNF 2 BN..	39.5	103	17.5	37.75	21.5	65.25	11.75	40

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/22 BN..	G 3/8
/UNF 2 BN..	3/4-16 UNF-2B (SAE-8)

/2 AS..R BS..R

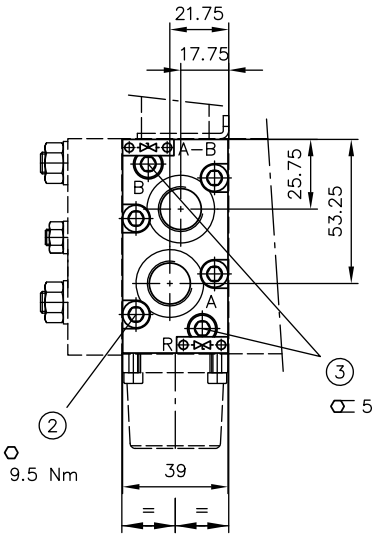


1 Directional valve section

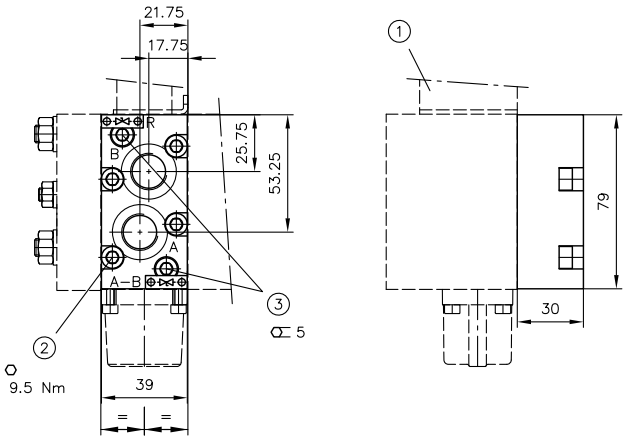
2 Cylinder screws ISO 4762-M6x **40** -A2-70

Coding	**Ports (ISO 228-1)**
	A, B
/2 AS..R BS..R	G 3/8

/2 A HN



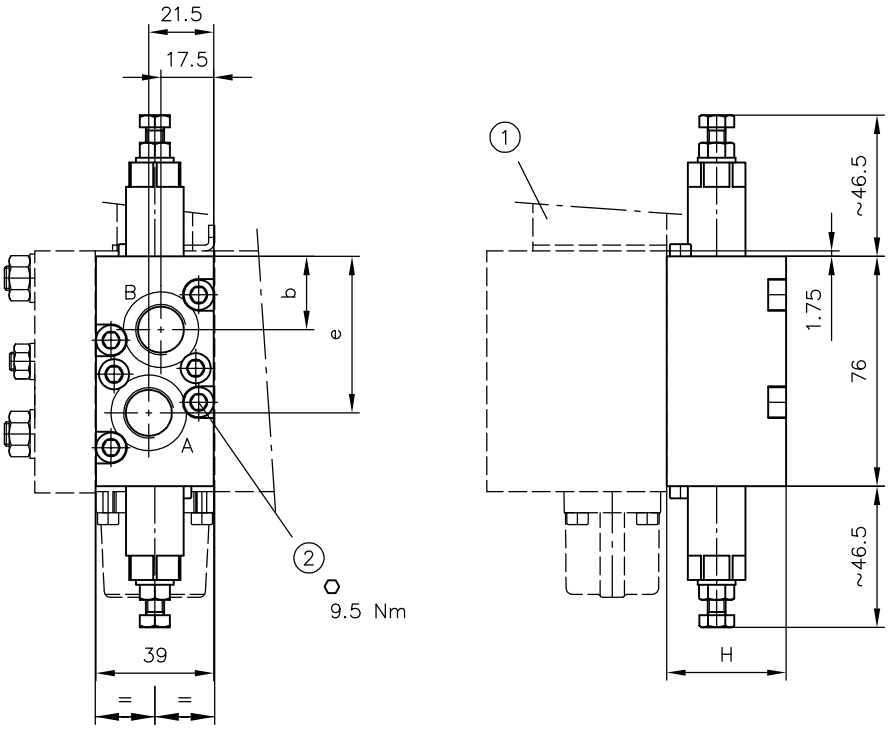
/2 B HN



1 Directional valve section
2 Cylinder screws ISO 4762-M6x **25** -A2-70
3 Drain screw

Coding	Ports (ISO 228-1)
	A, B
/2 A HN /2 B HN	G 3/8

/2 AL-0.. - BL-0..
/UNF 2 AL-0.. - BL-0..

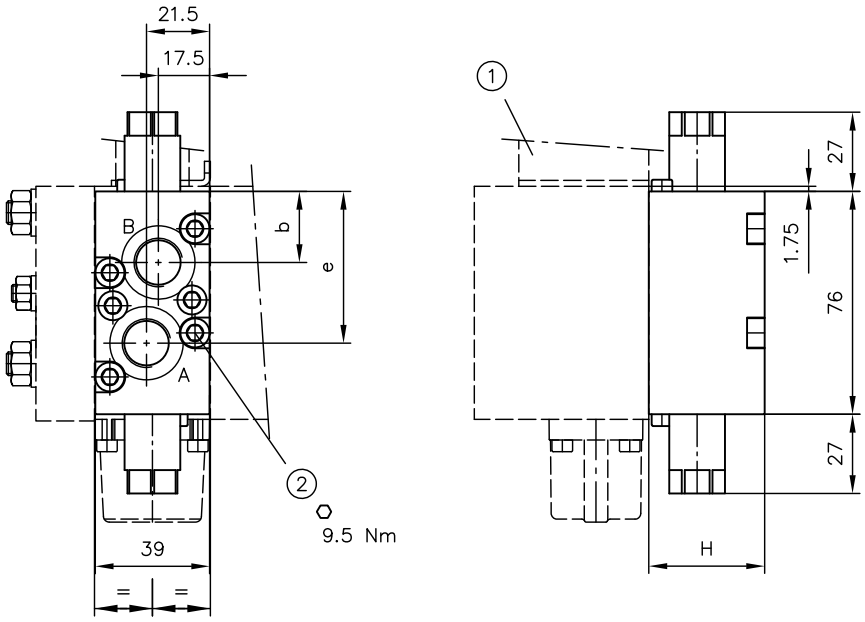


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	b	e	g
/2 AL-0.. - BL-0..	39.5	25.25	51.75	40
/UNF 2 AL-0.. - BL-0..	44.5	23.5	52.5	45

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 AL-0.. - BL-0..	G 3/8
/UNF 2 AL-0.. - BL-0..	3/4-16 UNF-2B (SAE-8)

/2 ALX-0.. - BLX-0..
/UNF 2 ALX-0.. - BLX-0..

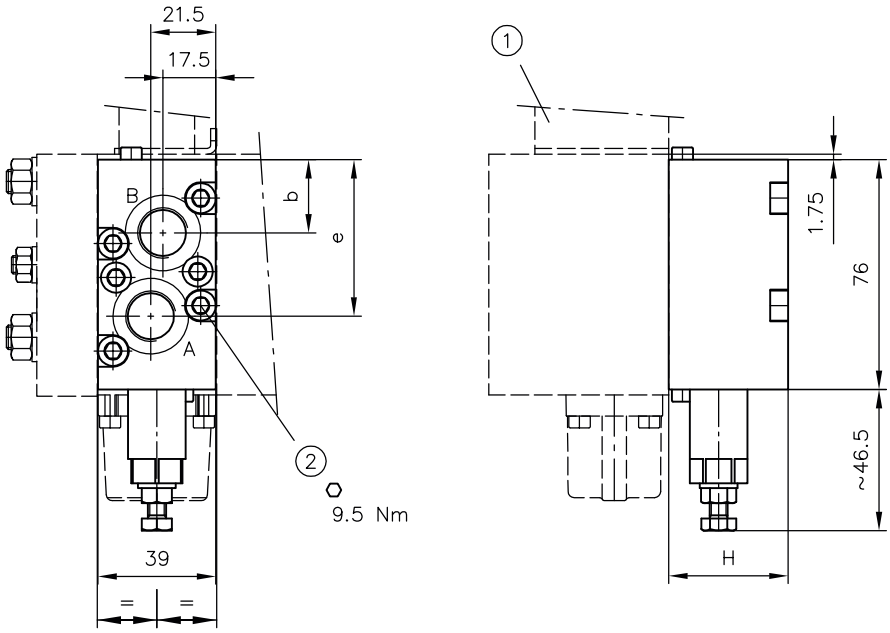


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	b	e	g
/2 ALX-0.. - BLX-0..	39.5	25.25	51.75	40
/UNF 2 ALX-0.. - BLX-0..	44.5	23.5	52.5	45

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 ALX-0.. - BLX-0..	G 3/8
/UNF 2 ALX-0.. - BLX-0..	3/4-16 UNF-2B (SAE-8)

/2 AL-0..
/UNF 2 AL-0..

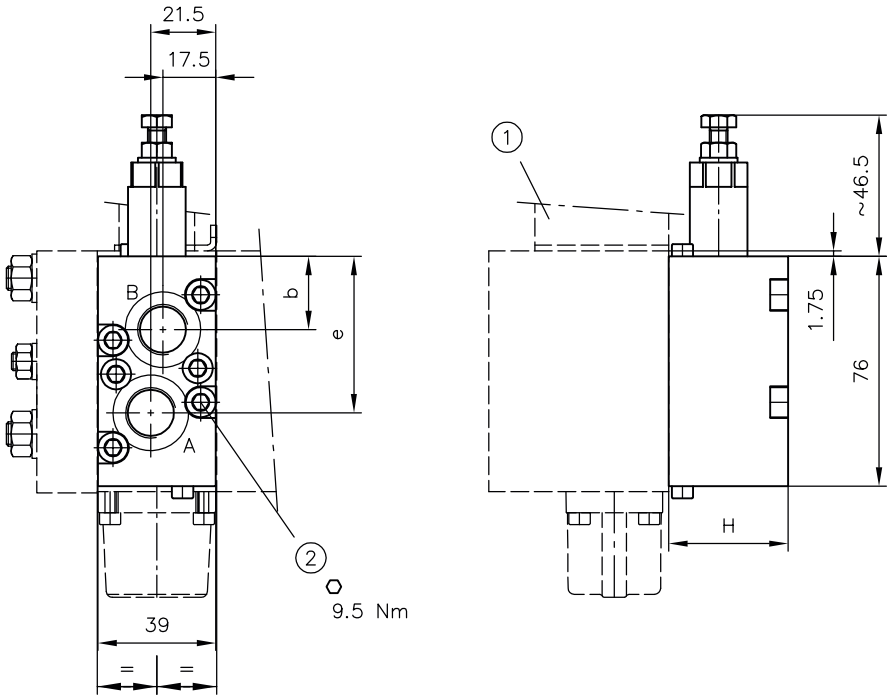


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	b	e	g
/2 AL-0..	39.5	25.25	51.75	40
/UNF 2 AL-0..	44.5	23.5	52.5	45

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 AL-0..	G 3/8
/UNF 2 AL-0..	3/4-16 UNF-2B (SAE-8)

/2 BL-0..
/UNF 2 BL-0..

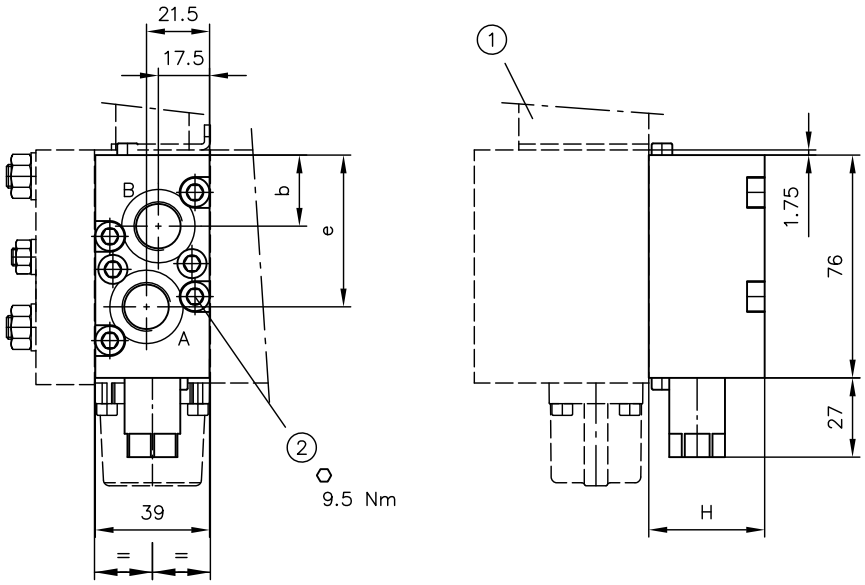


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	b	e	g
/2 BL-0..	39.5	25.25	51.75	40
/UNF 2 BL-0..	44.5	23.5	52.5	45

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 BL-0..	G 3/8
/UNF 2 BL-0..	3/4-16 UNF-2B (SAE-8)

/2 ALX-0..
/UNF 2 ALX-0..

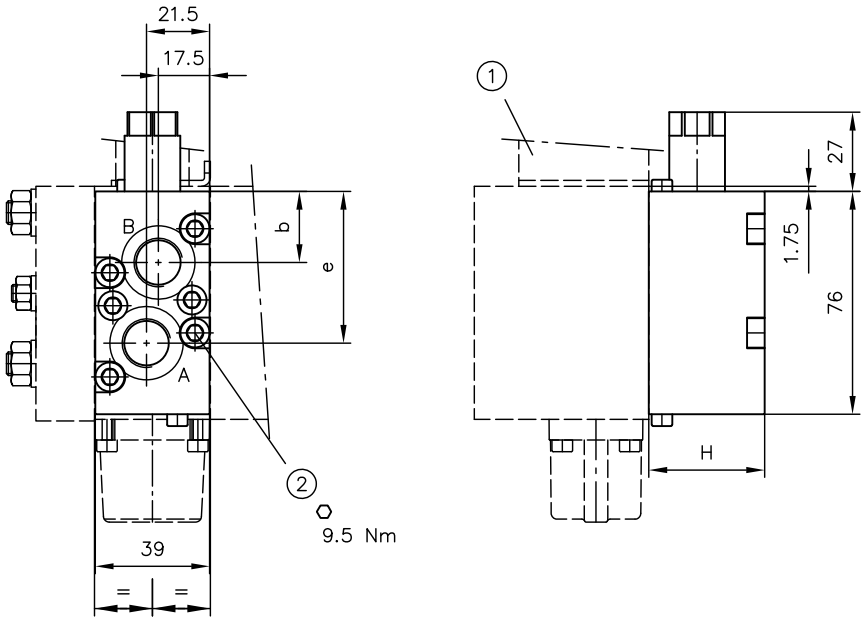


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	b	e	g
/2 ALX-0..	39.5	25.25	51.75	40
/UNF 2 ALX-0..	44.5	23.5	52.5	45

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 ALX-0..	G 3/8
/UNF 2 ALX-0..	3/4-16 UNF-2B (SAE-8)

/2 BLX-0..
/UNF 2 BLX-0..

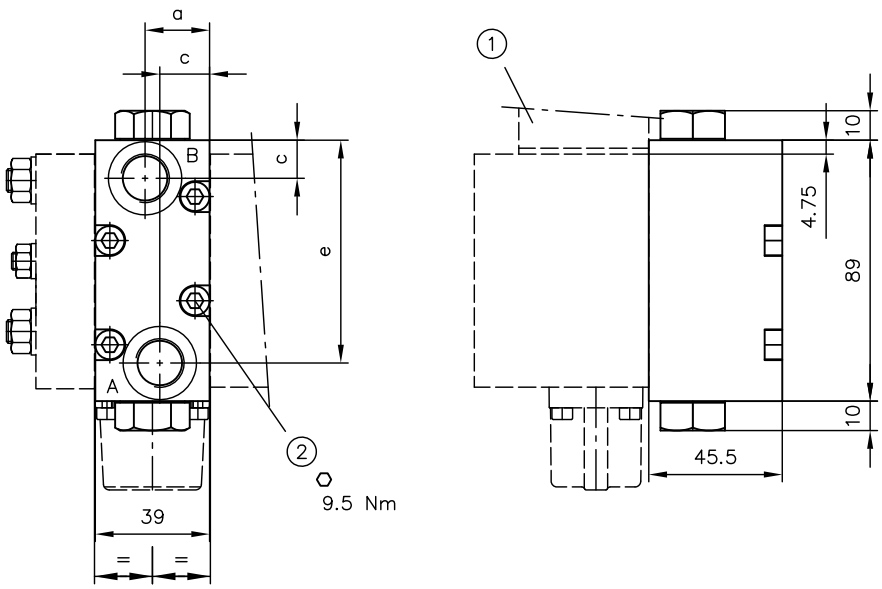


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **g** -A2-70

Coding	H	b	e	g
/2 BLX-0..	39.5	25.25	51.75	40
/UNF 2 BLX-0..	44.5	23.5	52.5	45

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 BLX-0..	G 3/8
/UNF 2 BLX-0..	3/4-16 UNF-2B (SAE-8)

/2 DRH, /2 DRH A, /2 DRH B
/UNF 2 DRH, /UNF 2 DRH A, /UNF 2 DRH B

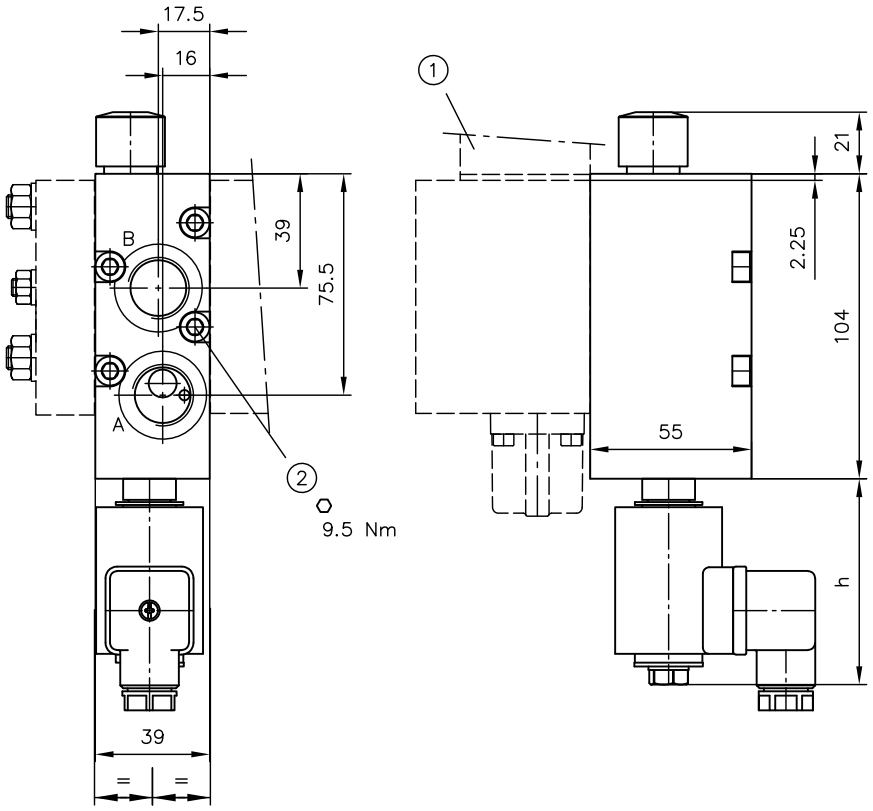


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **46** -A2-70

Coding	a	c	e
/2 DRH A /2 DRH B	22	17	76
/UNF 2 DRH A /UNF 2 DRH B	21.5	17.5	73.5

Coding	Ports (ISO 228-1 or SAE J 514)
	A, B
/2 DRH /2 DRH A /2 DRH B	G 3/8
/UNF 2 DRH /UNF 2 DRH A /UNF 2 DRH B	3/4-16 UNF-2B (SAE-8)

/3 AVT/3 AVPT



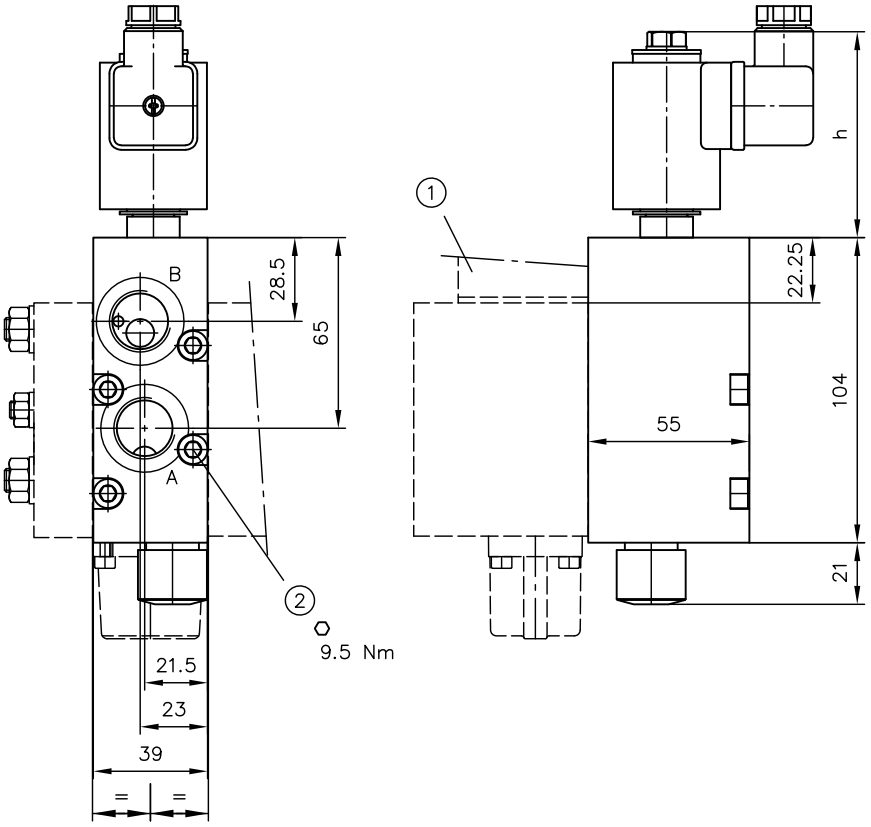
1 Directional valve section

2 Cylinder screws ISO 4762-M6x **55** -A2-70

Coding	h
/3 AVT	70.5
/3 AVPT	74

Coding	Ports (ISO 228-1)
	A, B
/3 AVT /3 AVPT	G 1/2

/3 BVT
/3 BVPT

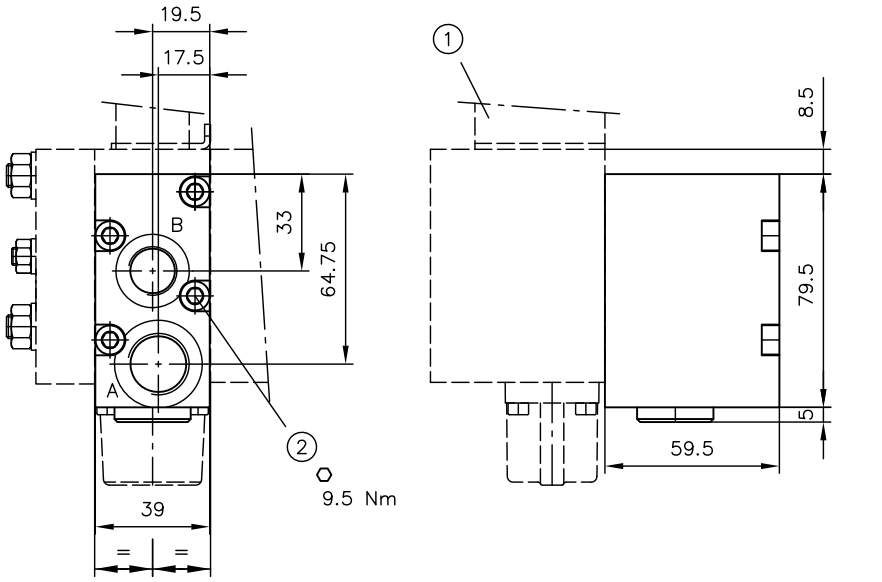


1 Directional valve section
2 Cylinder screws ISO 4762-M6x **55** -A2-70

Coding	h
/3 BVT	70.5
/3 BVPT	74

Coding	Ports (ISO 228-1)
	A, B
/3 BVT /3 BVPT	G 1/2

/32 DFA

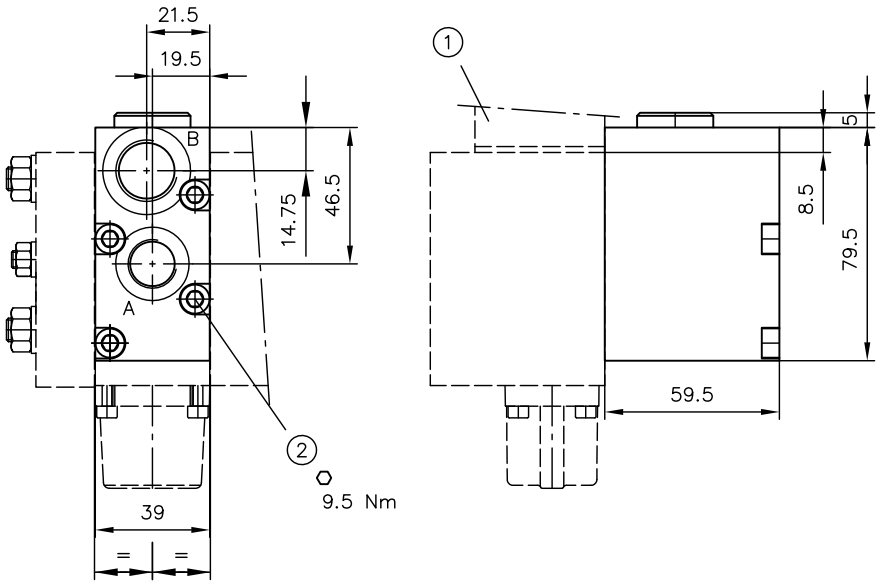


1 Directional valve section

2 Cylinder screw ISO 4762-M6x **60** -A2-70

Coding	Ports (ISO 228-1)	
	A	B
/32 DFA	G 1/2	G 3/8

/32 DFB



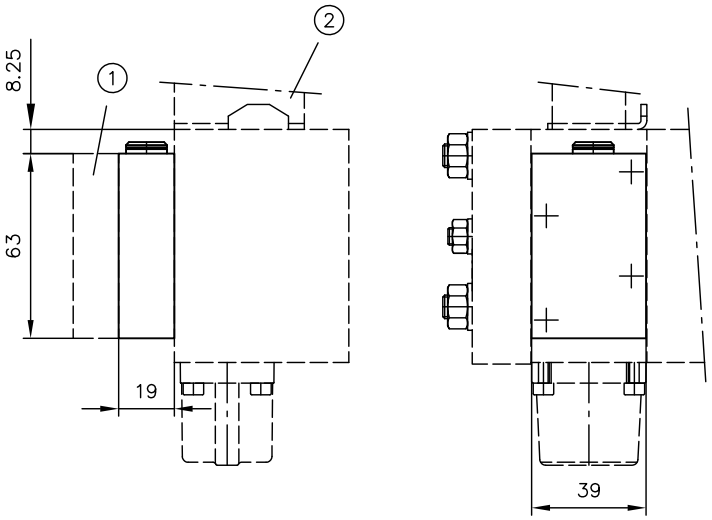
1 Directional valve section

2 Cylinder screws ISO 4762-M6x **60** -A2-70

Coding	Ports (ISO 228-1)	
	A	B
/32 DFB	G 3/8	G 1/2

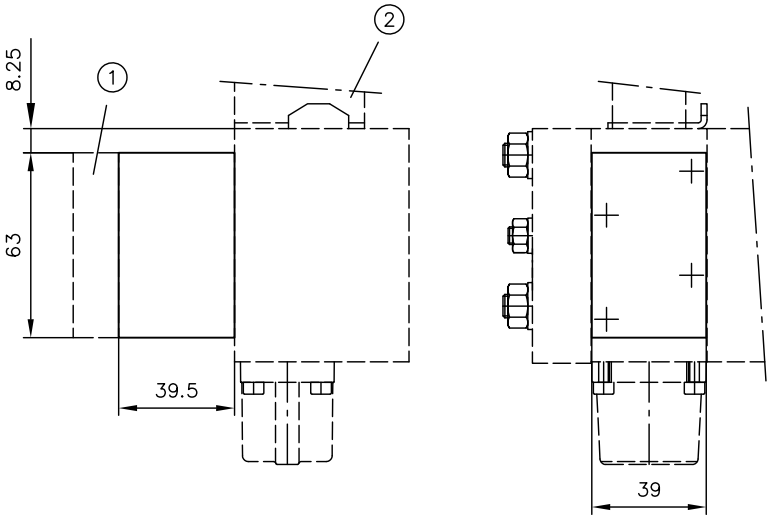
4.2.4 Intermediate plate

/Z20



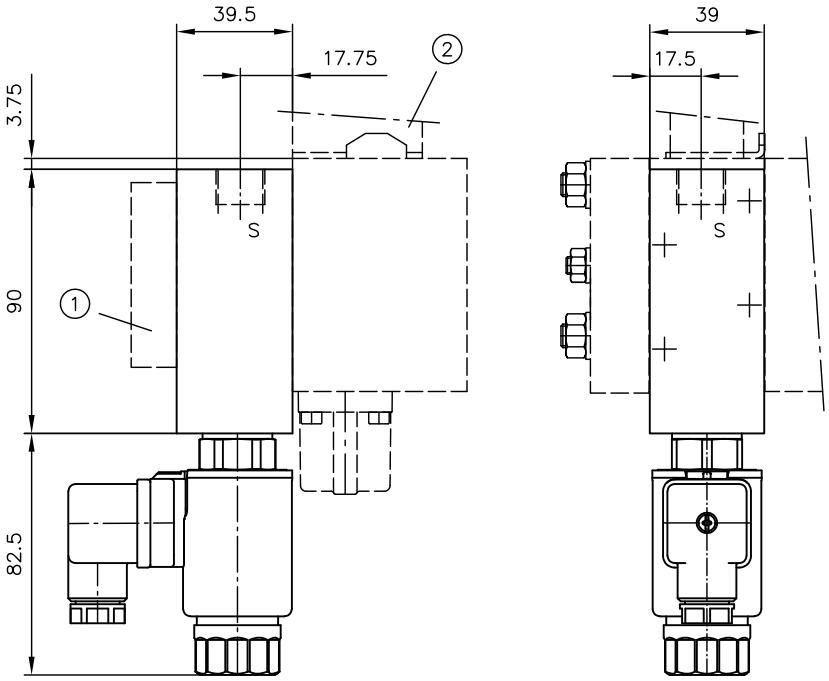
1 Ancillary block
2 Directional valve section

/Z40



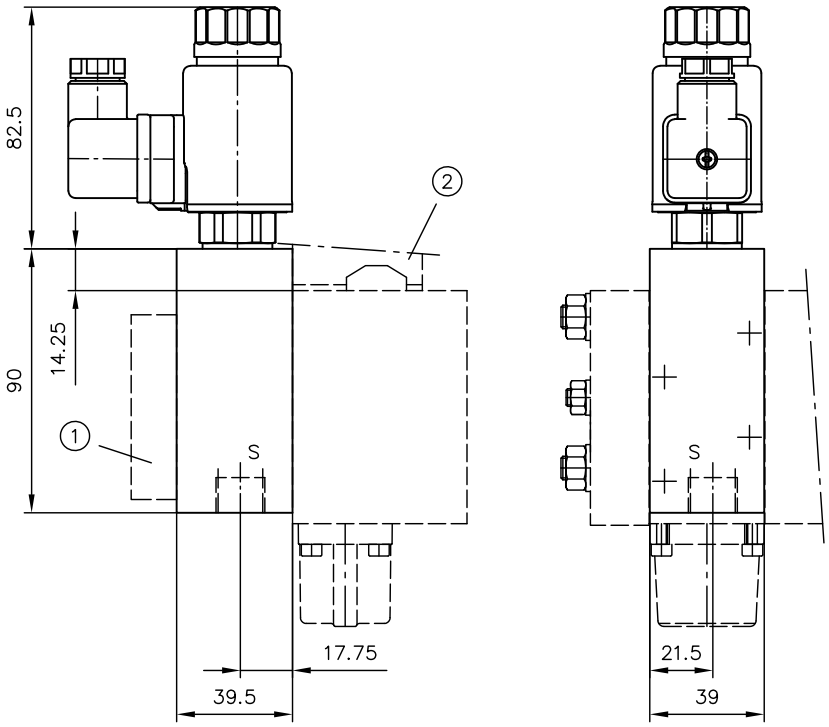
1 Ancillary block
2 Directional valve section

/Z2A BVE 1 R(S) B



1 Ancillary block
2 Directional valve section

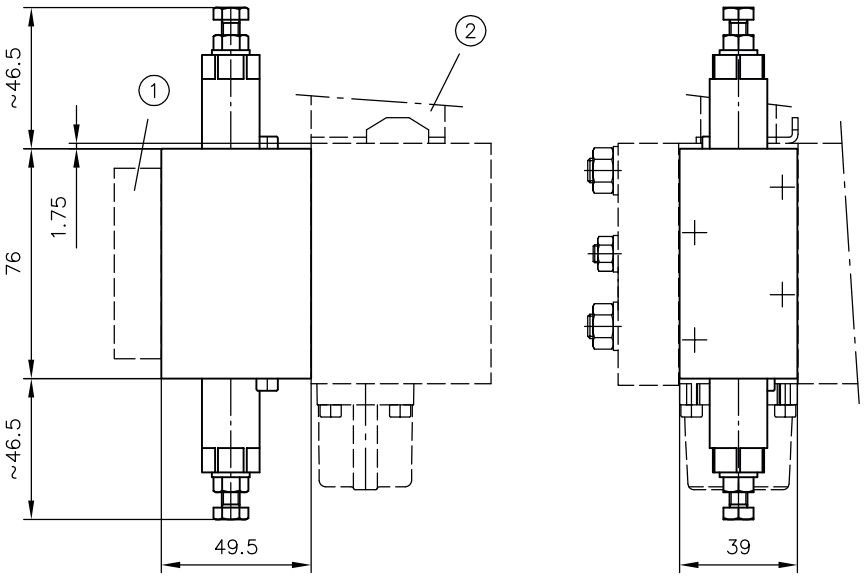
/Z2B BVE 1 R(S) B



1 Ancillary block
2 Directional valve section

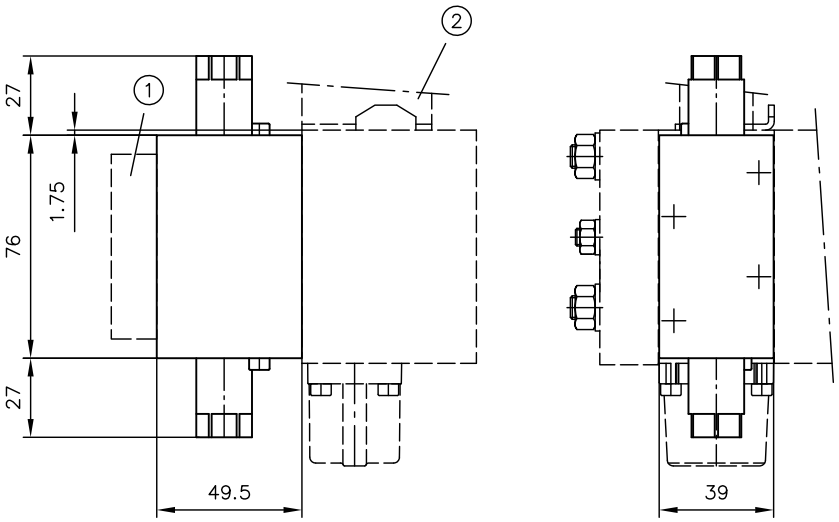
Coding	Connections (ISO 228-1)
	S
/Z2A BVE 1 R(S) B /Z2B BVE 1 R(S) B	G 3/8

/Z AL...BL...



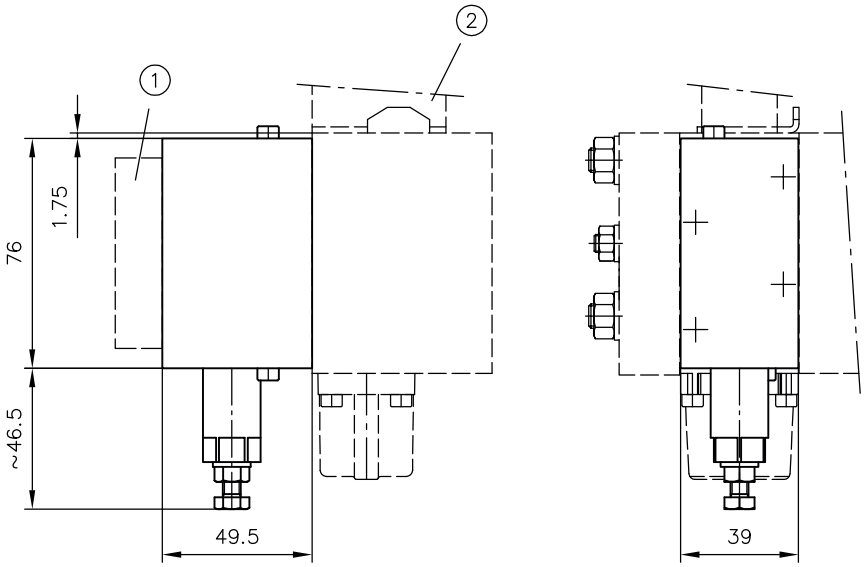
1 Ancillary block
2 Directional valve section

/Z ALX...BLX...



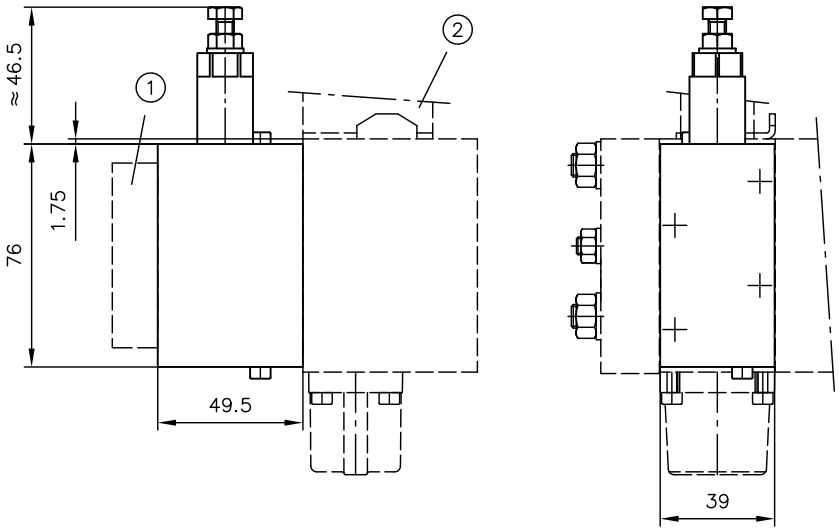
1 Ancillary block
2 Directional valve section

/Z AL-...



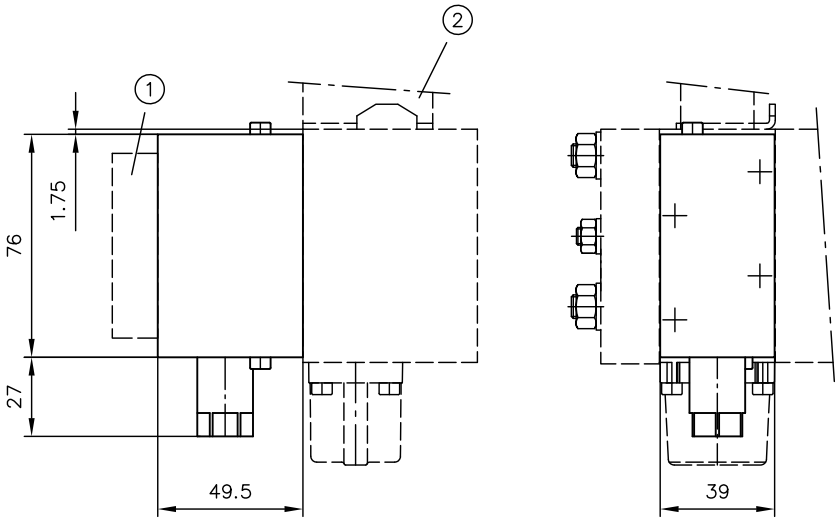
1 Ancillary block
2 Directional valve section

/Z BL-...



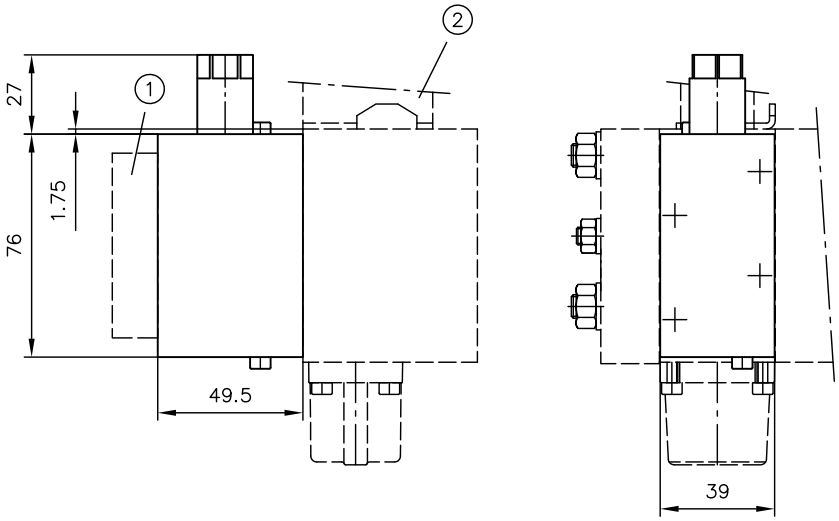
1 Ancillary block
2 Directional valve section

/Z ALX-...



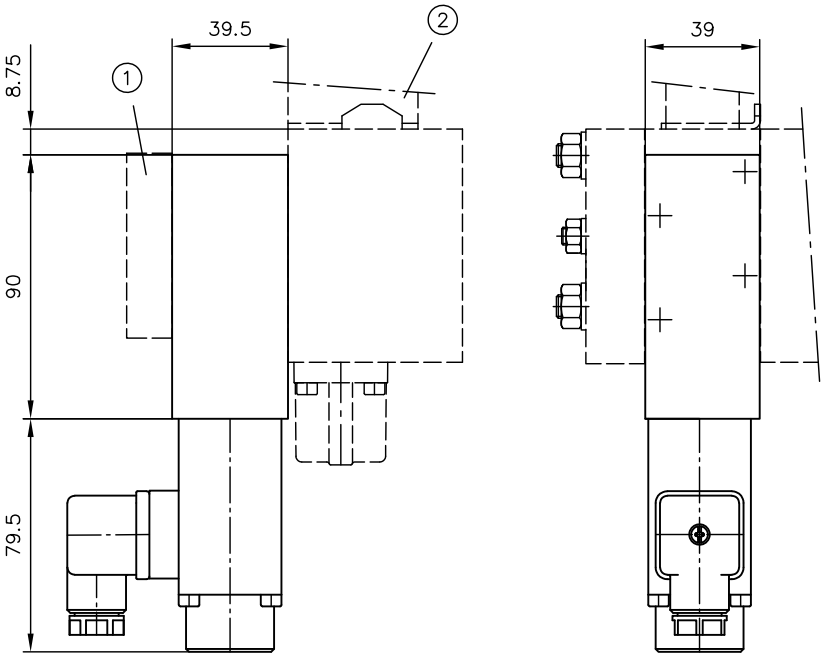
1 Ancillary block
2 Directional valve section

/Z BLX-...



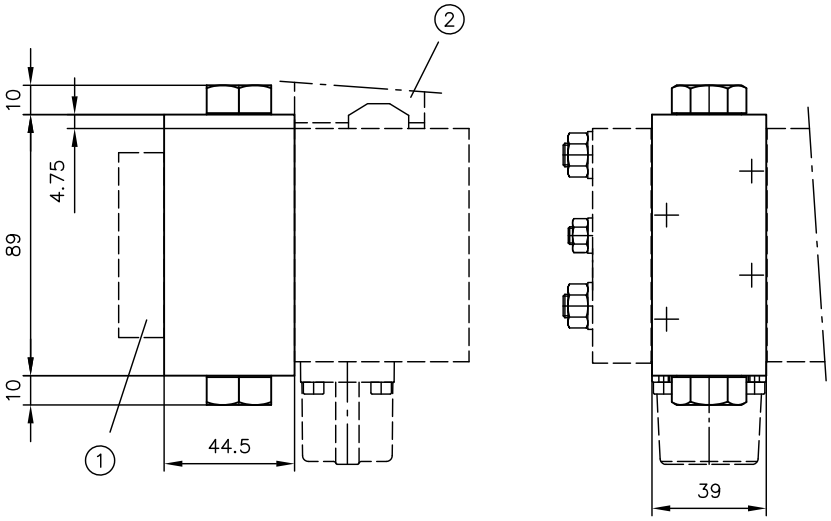
1 Ancillary block
2 Directional valve section

/ZDR
/ZDS



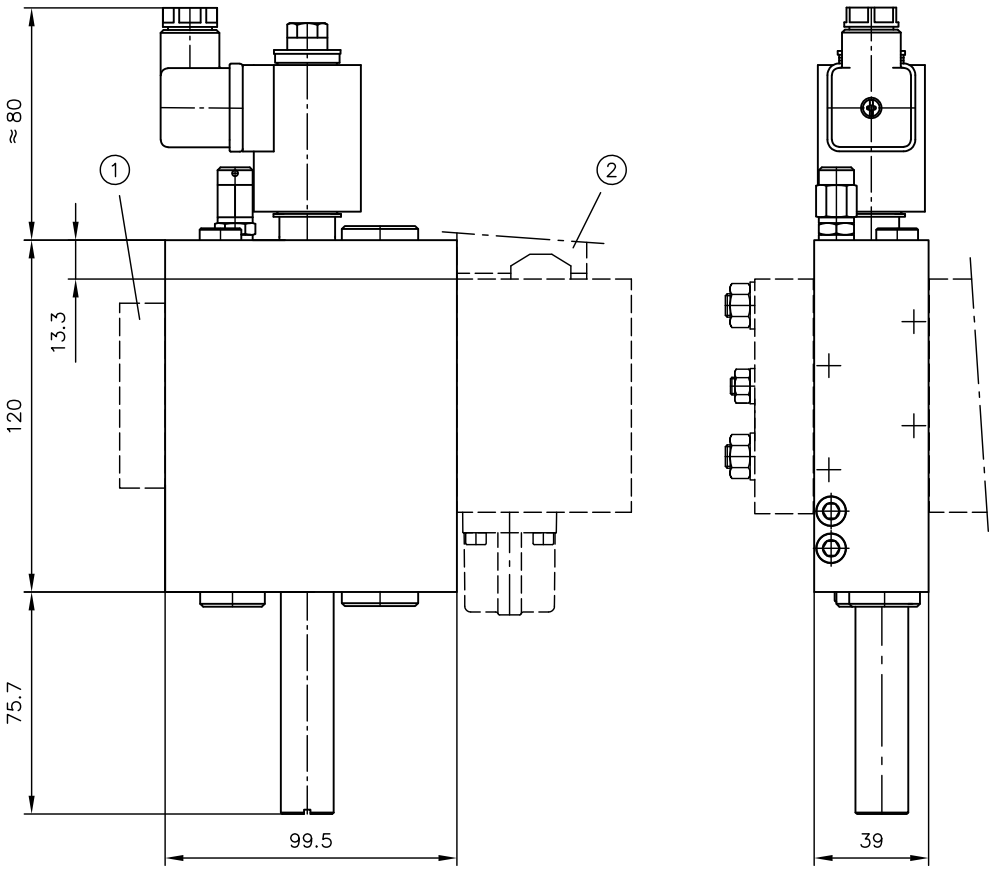
1 Ancillary block
2 Directional valve section

/ZDRH



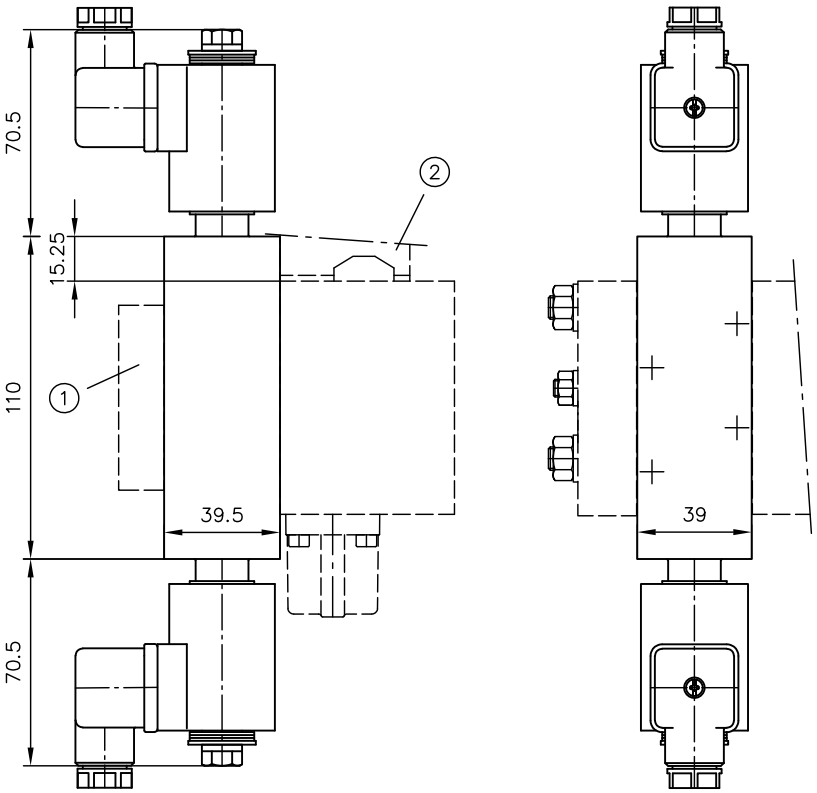
1 Ancillary block
2 Directional valve section

/ZN...
/ZNX...



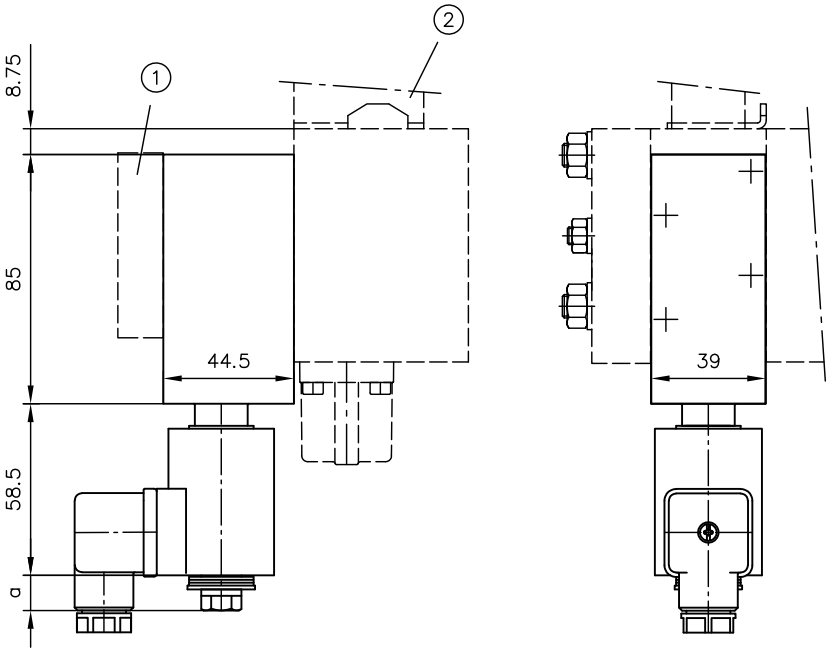
1 Ancillary block
2 Directional valve section

/ZSS, /ZVV



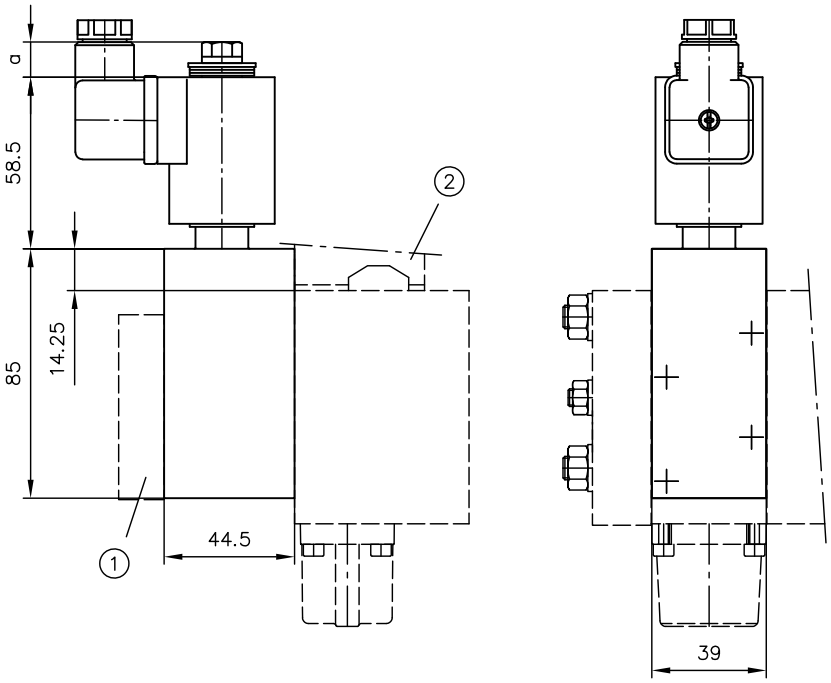
1 Ancillary block
2 Directional valve section

/ZVX, /ZPVX
/Z1SX, /Z1PSX, /Z1VX, /Z1PVX



1 Ancillary block
2 Directional valve section

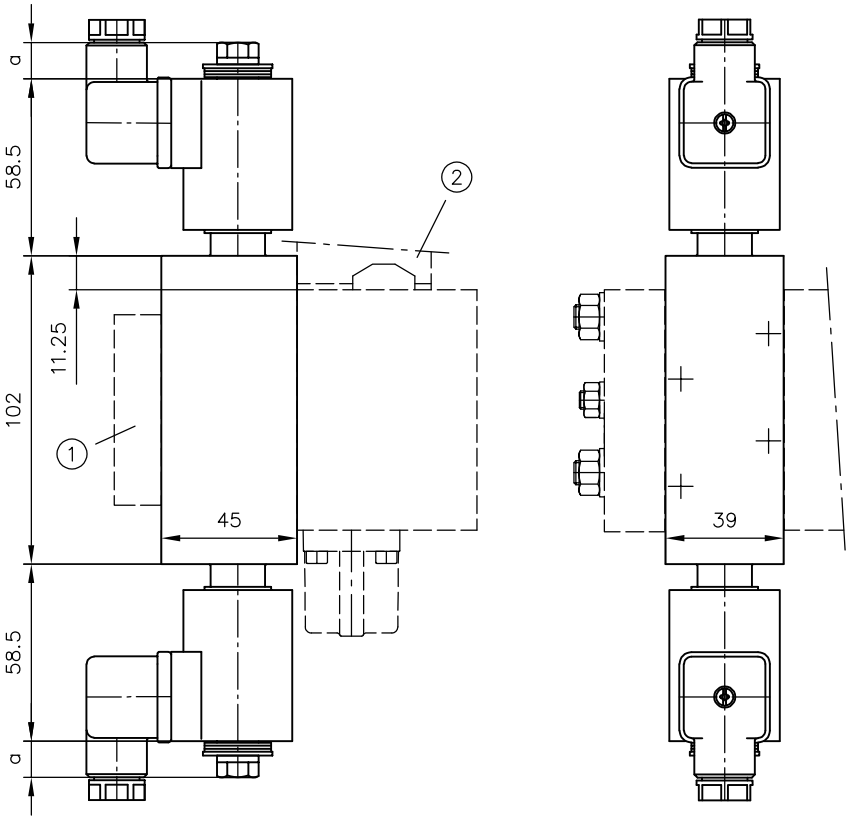
/ZXV, /ZXPV
/Z1XS, /Z1XPS, /Z1XV, /Z1XPV



1 Ancillary block
2 Directional valve section

Coding	a
EM 22	12
EMP 22	15

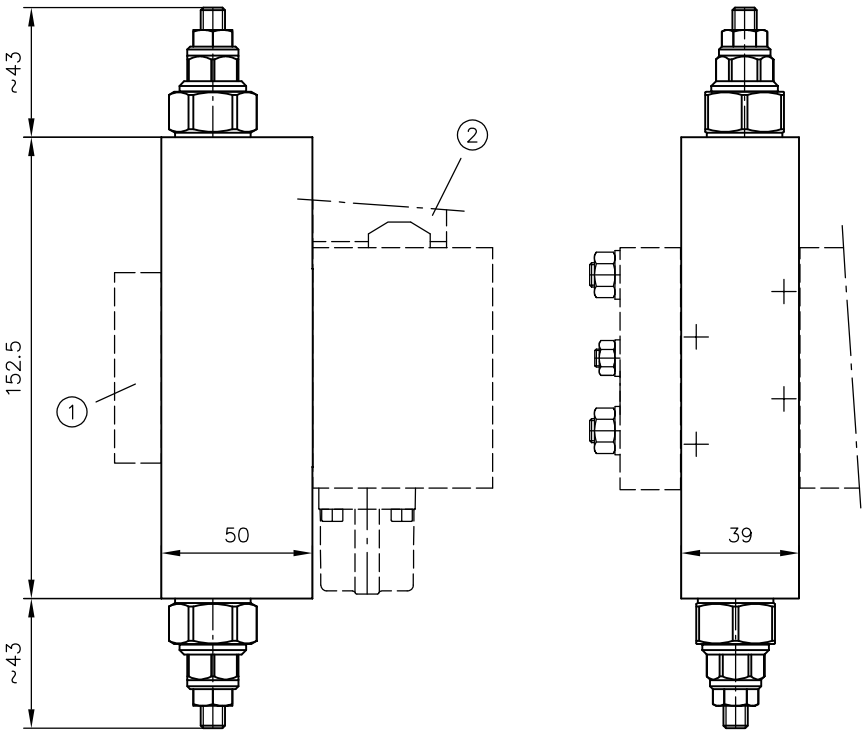
/Z1SS, /Z1PSPS, /Z1VV, /Z1PVPV



1 Ancillary block
2 Directional valve section

Coding	a
EM 22	12
EMP 22	15

/ZFL A-B-6 B-B-6

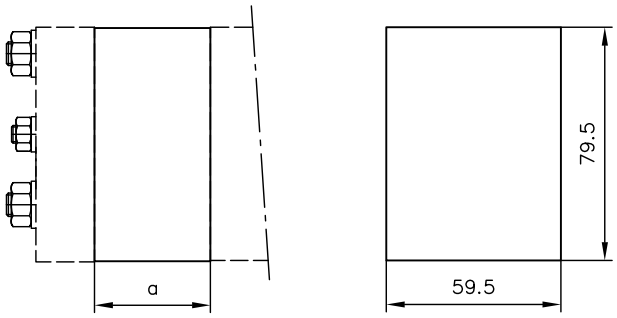


1 Ancillary block
2 Directional valve section

4.3 Series intermediate plate

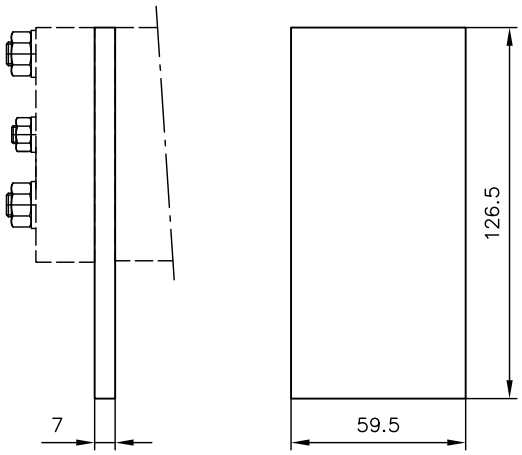
see Chapter 2.3, "Series intermediate plate"

ZPL 22
ZPL 22/7
ZPL 22/15

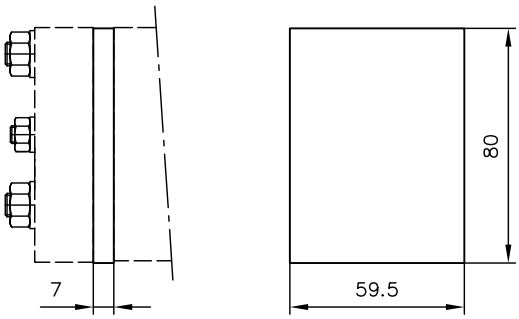


Coding	a
ZPL 22	39.5
ZPL 22/7	7
ZPL 22/15	14.5

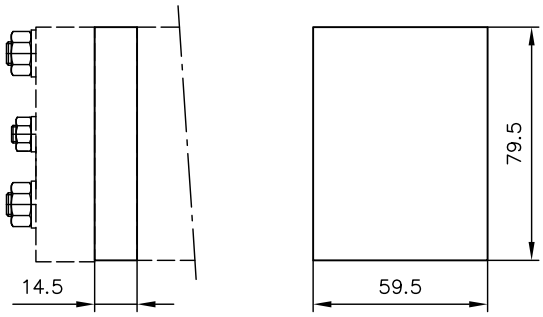
ZPL 22/7 EX



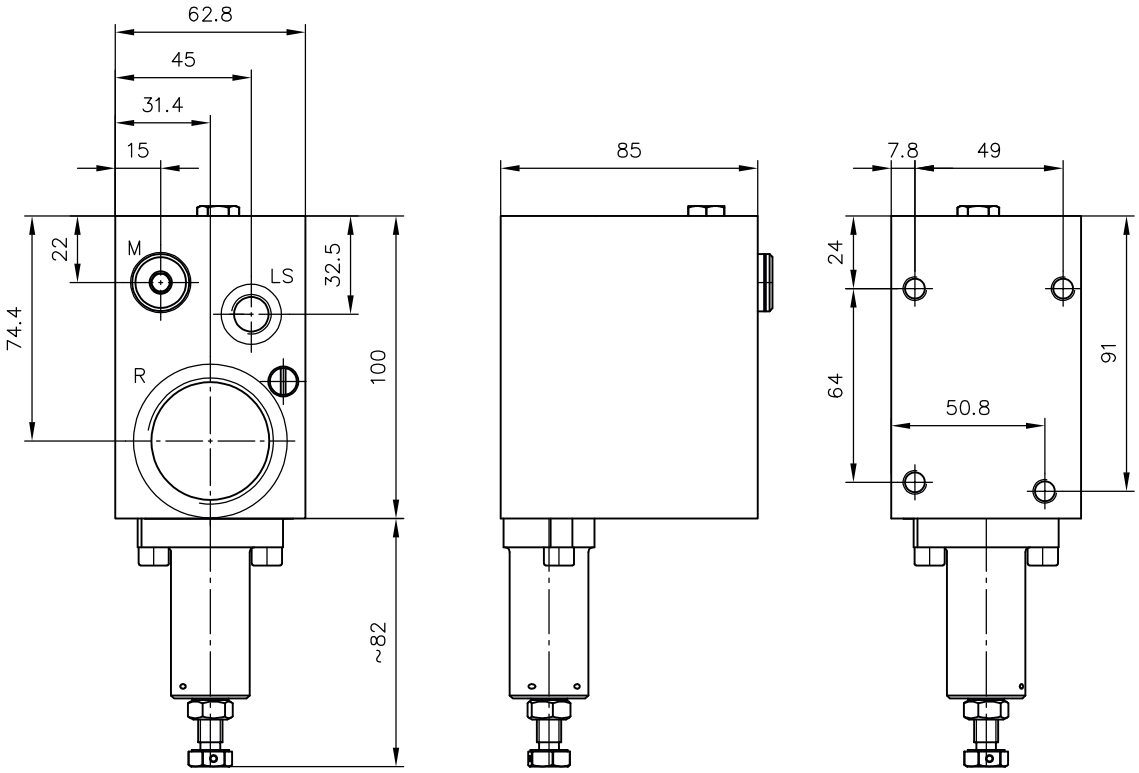
ZPL 22/7/XRT

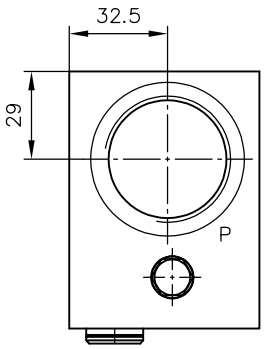


ZPL 22/15/R1
ZPL 22/15/R2
ZPL 22/15/XR



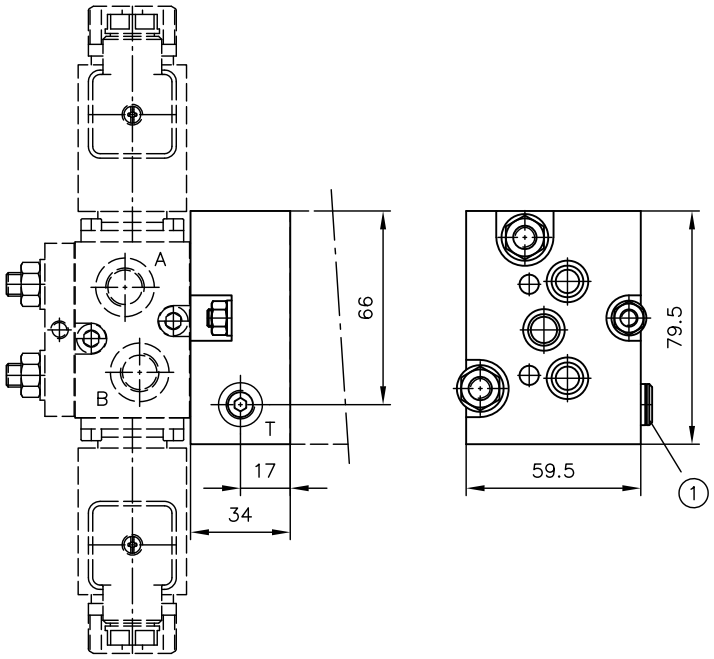
ZPL 22 P6R6





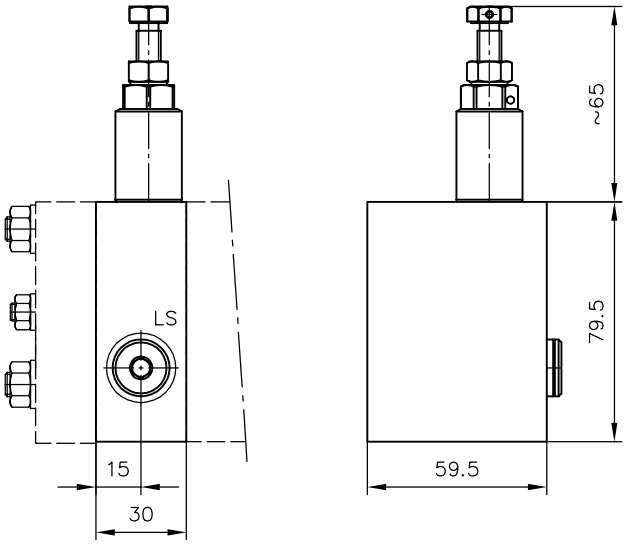
	Connections (ISO 228-1)
M, LS	G 1/4
R, P	G 1 1/4

ZPL 2-SWS 2
ZPL 2-SWS 2/RB

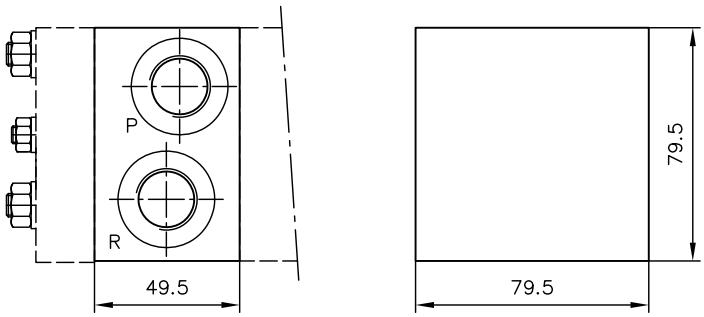


1 Tapped plug for ZPL 2-SWS 2/RB

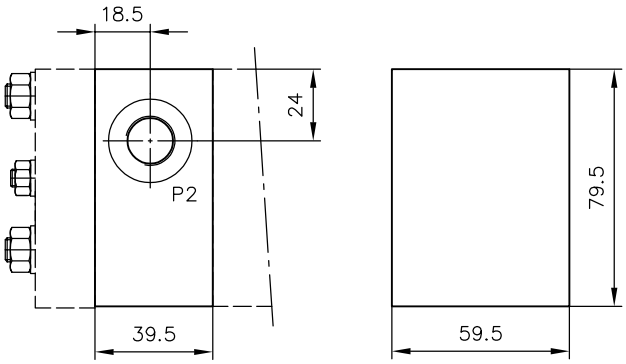
ZPL LS/...



ZPL 2 P3R3

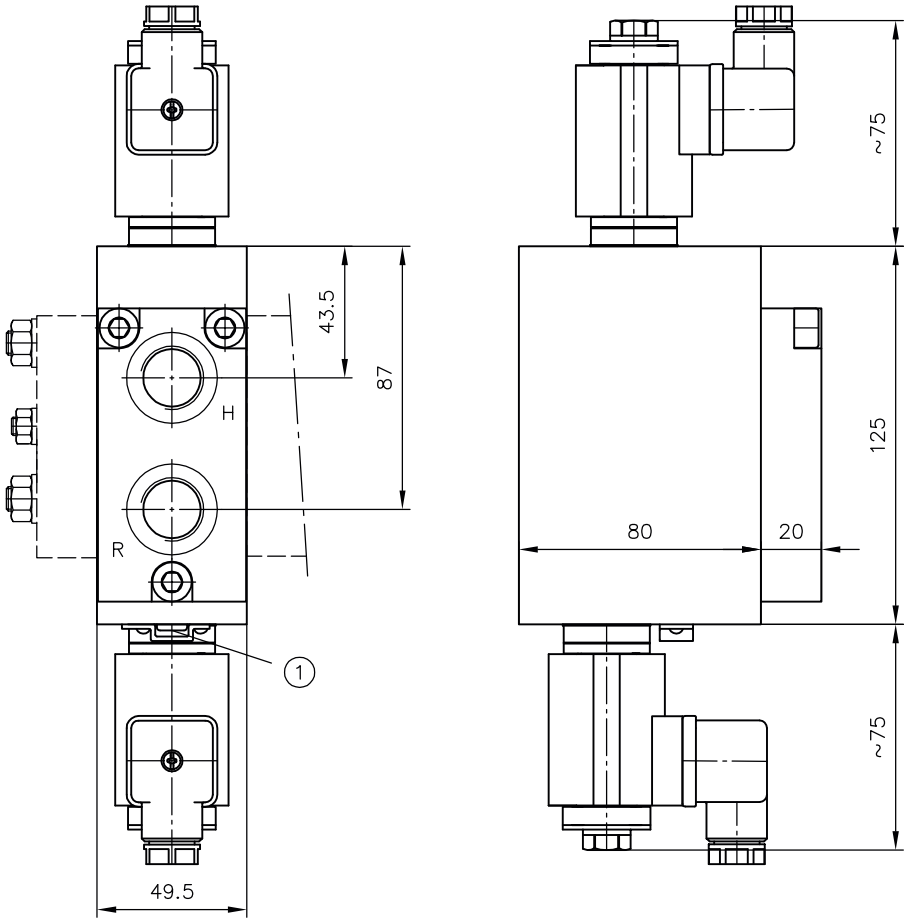


ZPL 2-Z2



Coding	Connections (ISO 228-1)			
	T	LS	R, P	P2
ZPL 2-SWS 2 ZPL 2-SWS 2/RB	G 1/8	--	--	--
ZPL LS/...	--	G 1/4	--	--
ZPL 2 P3R3	--	--	G 1/2	--
ZPL 2-Z2	--	--	--	G 3/8

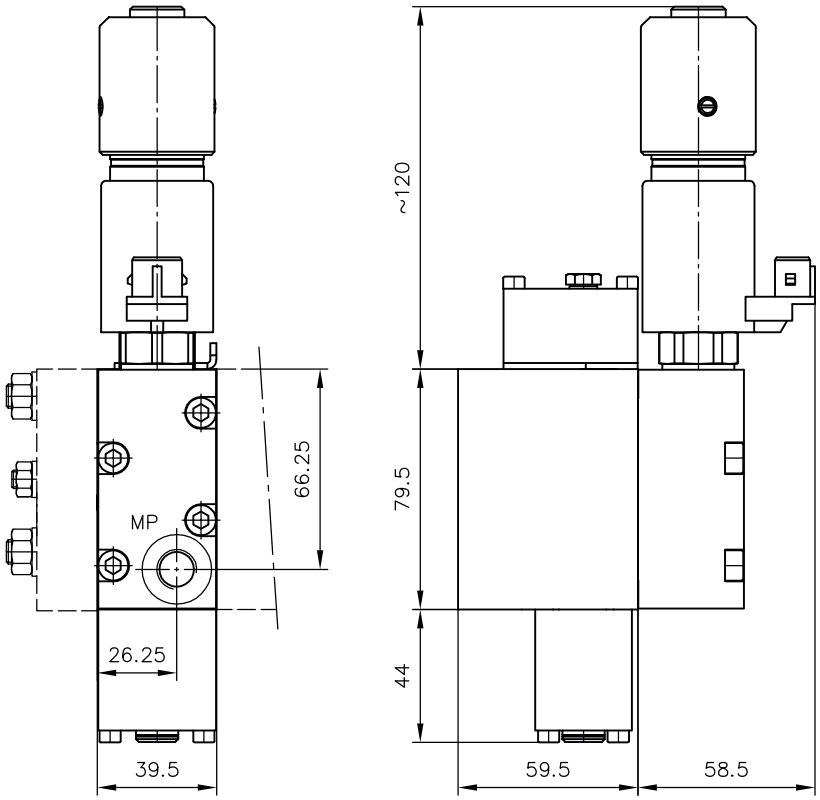
A1 RR ../../3
A1 RR ../../4



1 Drain screw

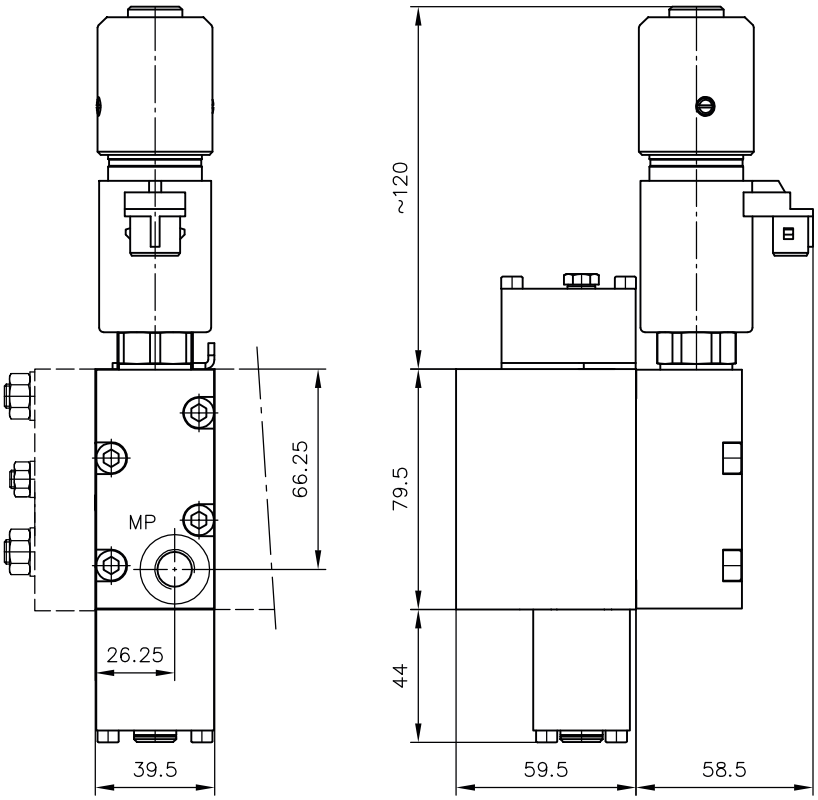
Coding	Connections (ISO 228-1)
	H, R
A1 RR ../../3	G 1/2
A1 RR ../../4	G 3/4

ZPL 2 VZ/BVE 1 ZT



	Connections (ISO 228-1)
MP	G 1/4

ZPL 2 VZ/BVE 1 ZT.A

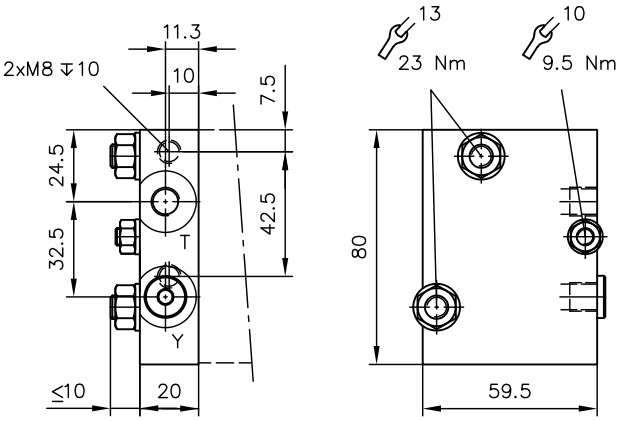


	Connections (ISO 228-1)
MP	G 1/4

4.4 End plate

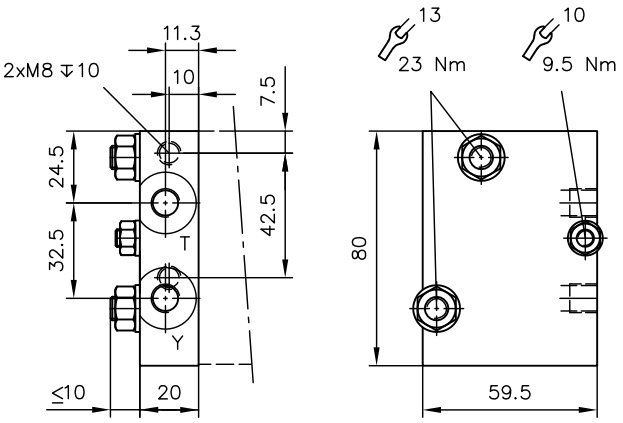
see Chapter 2.4, "End plate"

E 1, E 1 UNF



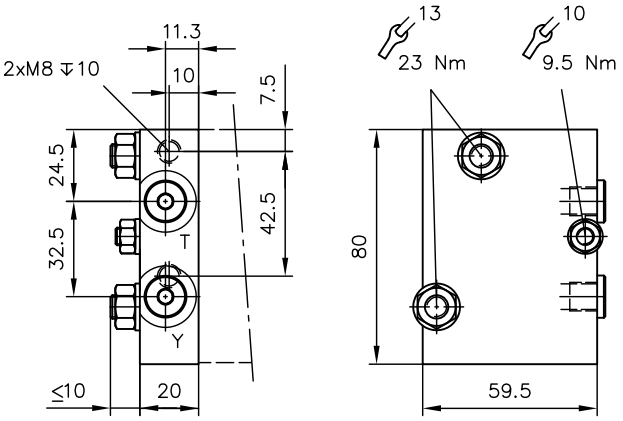
- T - open, Y - sealed

E 2, E 2 UNF



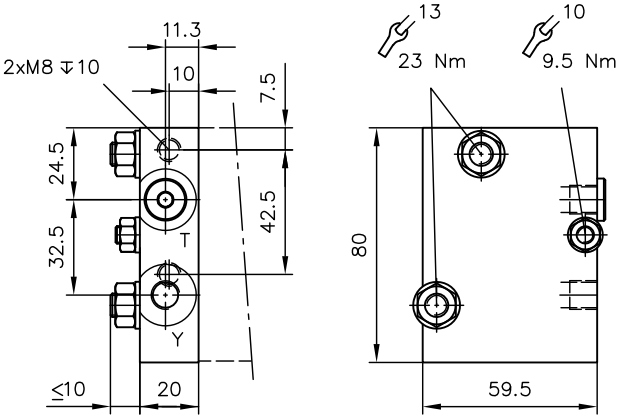
- T - open, Y - open

E 4, E 4 UNF



- T - sealed, Y - sealed

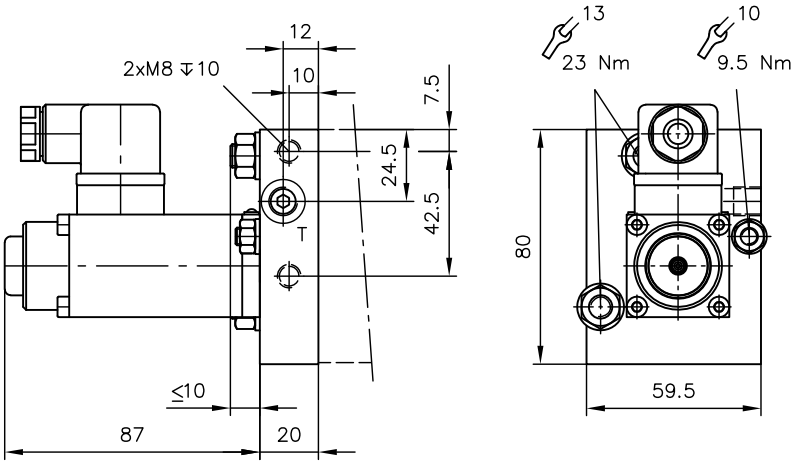
E 5, E 5 UNF



- T - sealed, Y - open

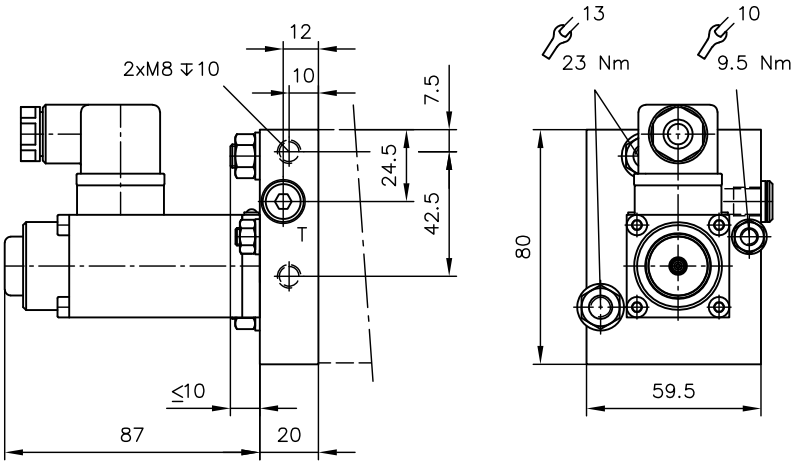
Coding	Connections (ISO 228-1 or SAE J 514)
	T, Y
E 1, E 2, E 4, E 5	G 1/8
E 1 UNF, E 2 UNF, E 4 UNF, E 5 UNF	SAE-4 (7/16-UNF-2B)

E 3



- T - open

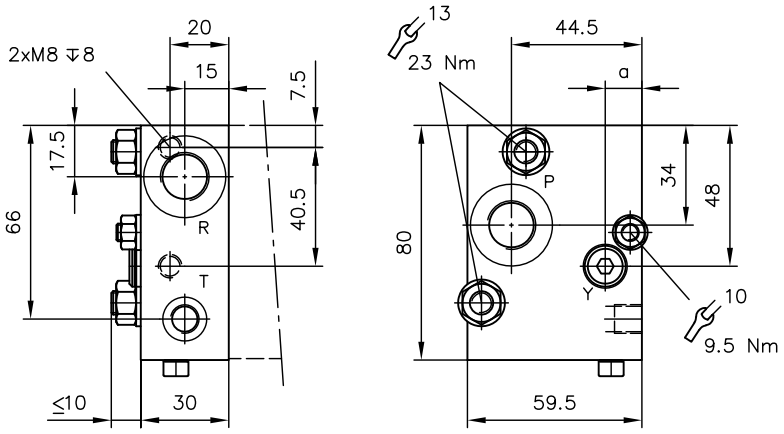
E 6



- T - sealed

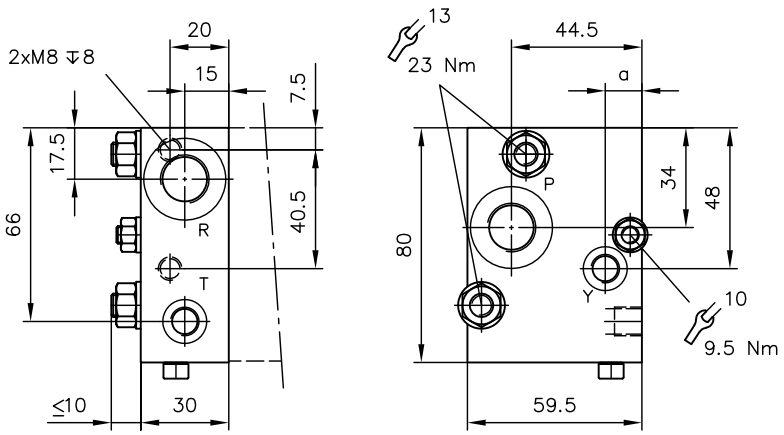
Coding	Connections (ISO 228-1)
	T
E 3, E 6	G 1/8

E 17, E 17 UNF



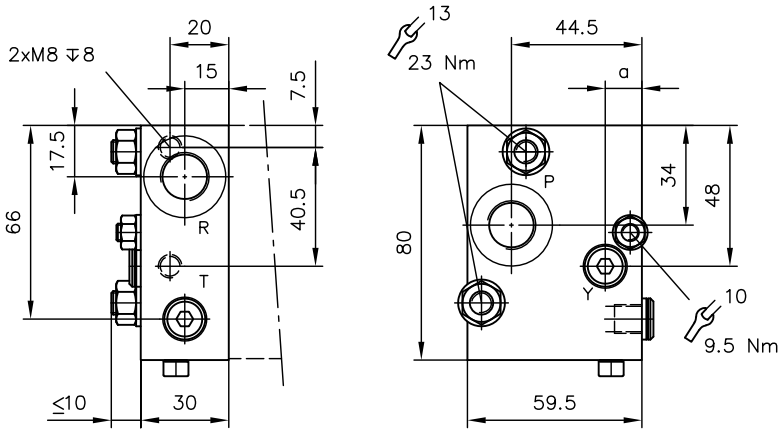
- T - open, Y - sealed, P - open, R - open

E 18, E 18 UNF



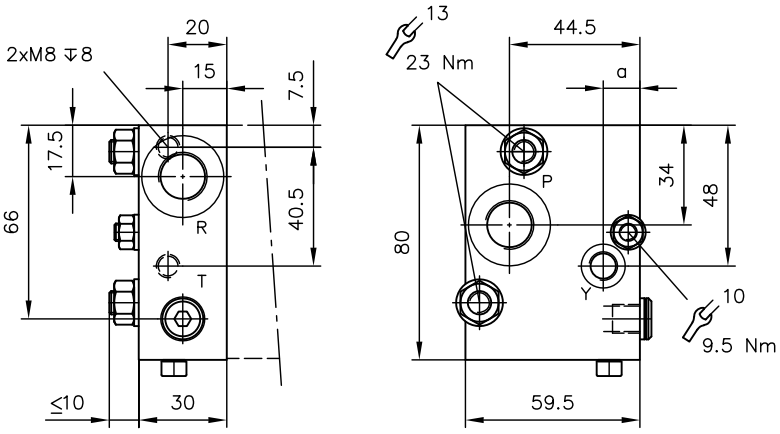
- T - open, Y - open, P - open, R - open

E 19, E 19 UNF



- T - sealed, Y - sealed, P - open, R - open

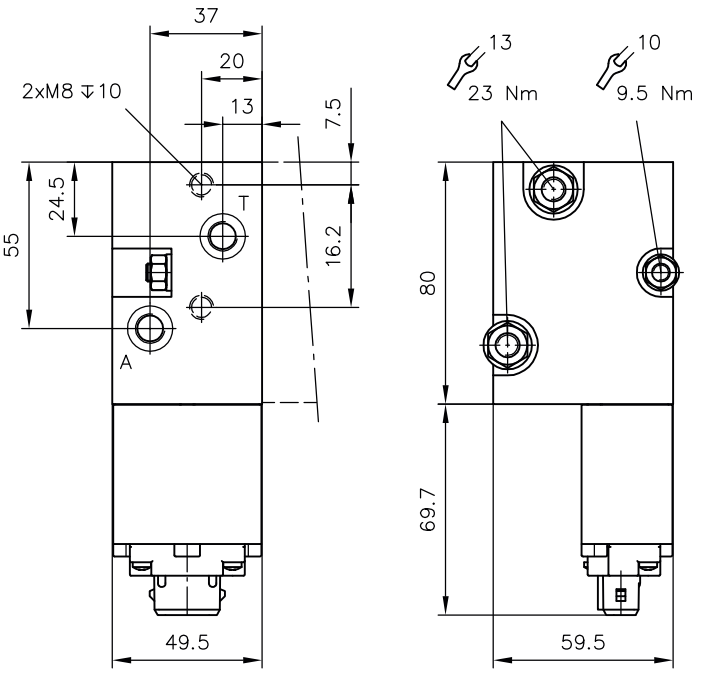
E 20, E 20 UNF



- T - sealed, Y - open, P - open, R - open

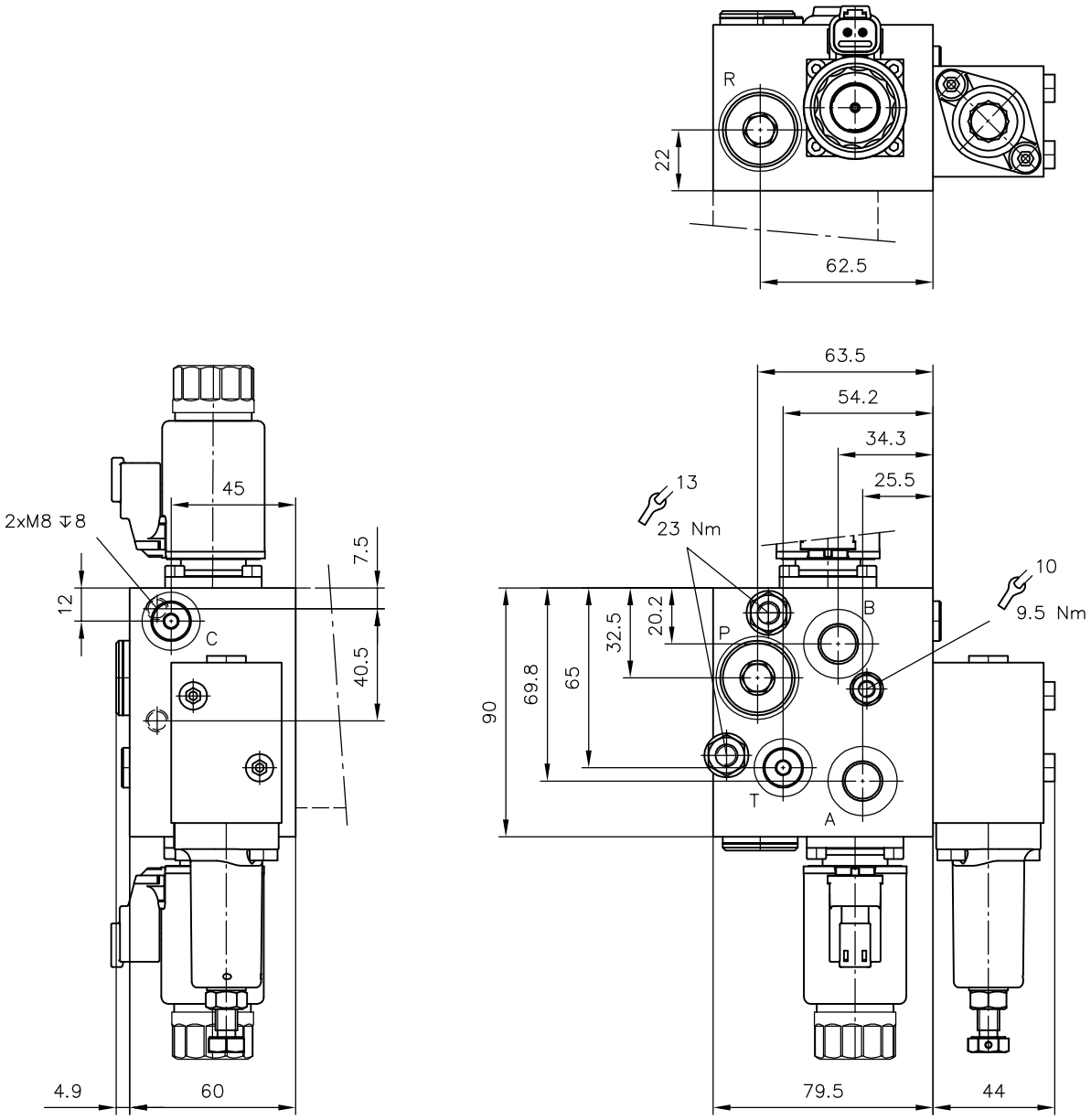
Coding	a	Connections (ISO 228-1 or SAE J 514)	
		T, Y	P, R
E 17, E 18, E 19, E 20	12.5	G 1/8	G 3/8
E 17 UNF, E 18 UNF, E 19 UNF, E 20 UNF	16	SAE-4 (7/16 UNF-2B)	SAE-8 (3/4-16 UNF-2B)

E 4 PMZ1-...



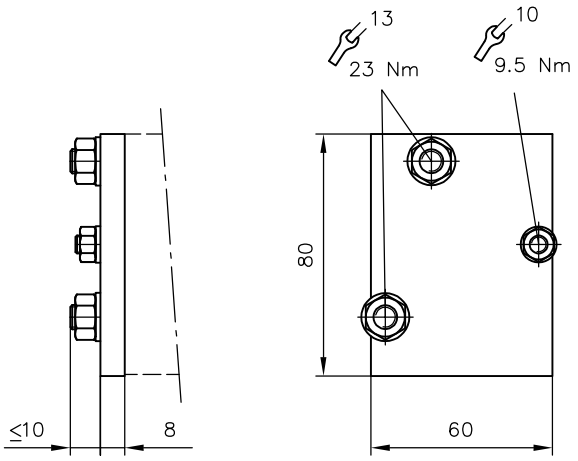
	Connections (ISO 228-1)
A, T	G 1/8

E 19 UNF - ADM 22 P



	Connections (SAE J 514)
C, T	SAE-4 (7/16-20 UNF-2B)
A, B	SAE-6 (9/16-18 UNF-2B)
P, R	SAE-8 (3/4-16 UNF-2B)

E 0



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.

5.2.1 Attachment

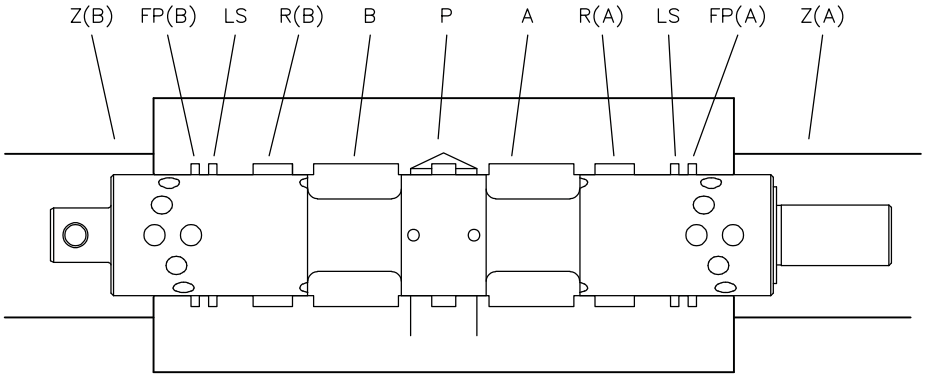
The valve bank must be mounted to the frame or base of the machine in such a way that no stress is induced. Three screws and elastic washers between the bank and the frame are recommended for attachment.

5.2.2 Piping

All fittings used must utilise deformable seals. The recommended tightening torque values must not be exceeded.

5.2.2.1 Reflux piping routed externally to the tank

If the reflux line from the consumer is routed externally back to the tank, this may impair the film of lubrication between the spool block and spool valve between R(B) and Z(B).



This could lead to a higher level of wear if the following conditions are also fulfilled:

- A consumer is actuated on a sustained basis for longer than 10 minutes.
- These three configurations apply
  - ► without LS pressure limitation (Chapter 2.2.1.7)
  - ► without LS relief or LS pressure limitation coding (Chapter 2.2.1.8)
  - ► without LS port for external limitation (Chapter 2.2.1.9)

Recommendation for improving the lubrication in this case:

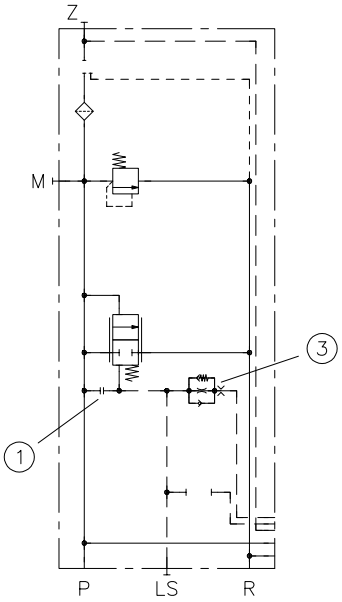
- Pre-load the reflux in PSL/PSV(max. 5 bar)
- Valve section with one of these three functions
  - ► LS pressure limitation
    - AB
    - A..B..
    - B..
  - ► LS relief or LS pressure limitation
    - F0
    - F..
  - ► LS port for external limitation
    - S
    - S1
    - X
- On valve sections (Chapter 2.2.1.3) with code 8 and code 81, do not use dither.

5.2.3 Converting the connection block from PSL to PSV

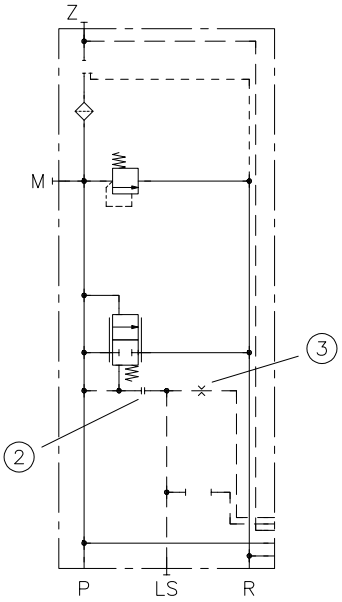
The connection blocks of type PSL 3.../D...-2 or PSL UNF 3.../D...-2 can be converted into a connection block for a control pump system (Closed Center). For this purpose, the components listed below must be installed as shown.

The connection blocks of type PSV 3.../D...-2 or PSV UNF 3.../...-2 can be converted into a connection block for a constant pump system (Open Center). For this purpose, the components listed below must be installed as shown.

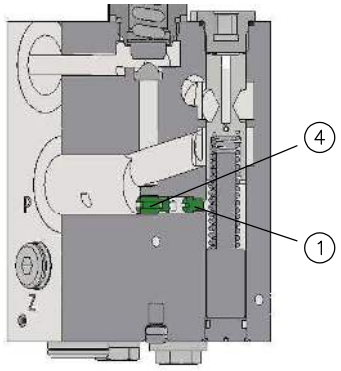
PSL 3.../D...-2
PSL UNF 3.../D...-2

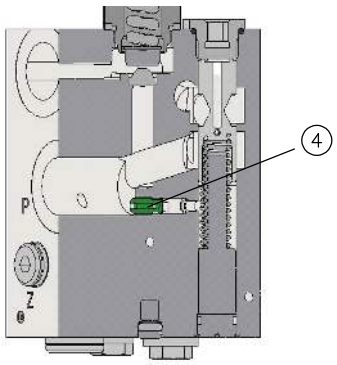


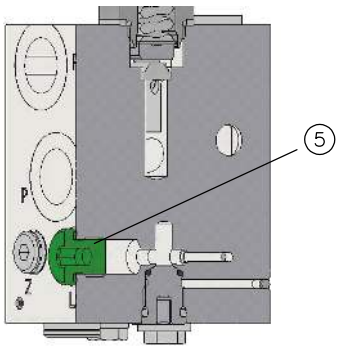
PSV 3.../D...-2
PSV UNF 3.../...-2

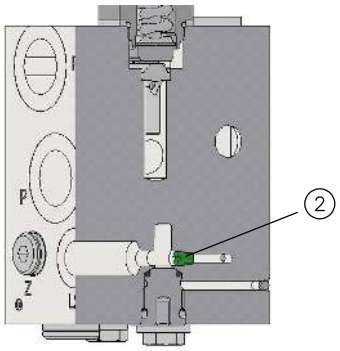


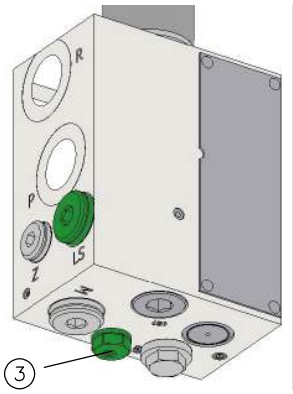
Position	PSL 3.../D...-2	PSV 3.../D...-2
1	Screw 7997 019	--
2	--	Screw 7997 019
3	Dampening screw S	Dampening screw B
4	Filter screw 7700 794	Filter screw 7700 794
5	Tapped plug	--

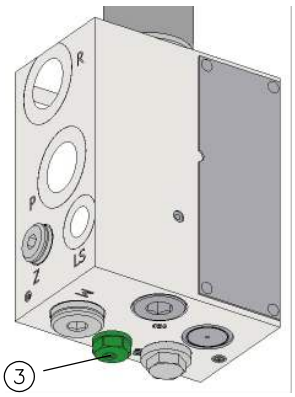








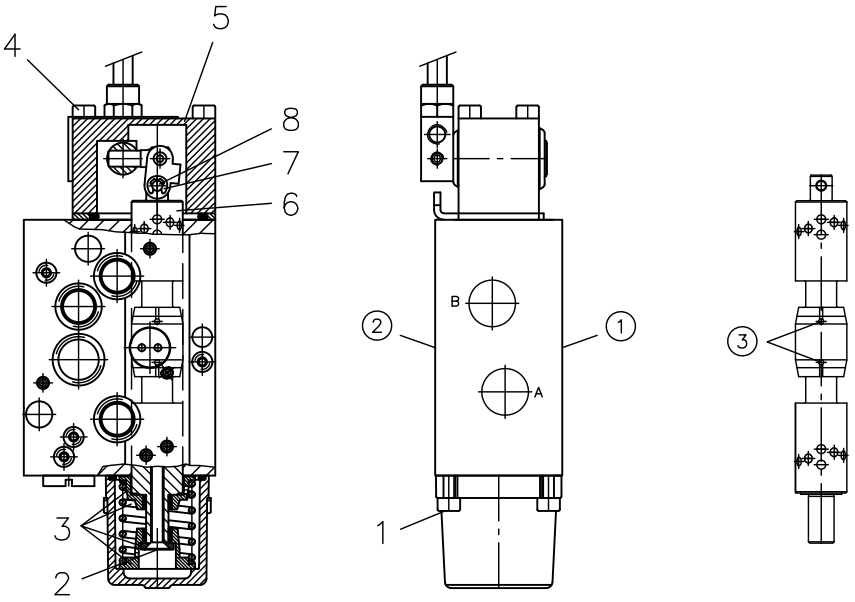




5.2.4 Changing the valve spool

The valve spools are not specially adapted to a spool block. This means that spool valves can be exchanged at any time to bring them in line with any changes in consumer requirements.

In doing so, the following must be observed:



1 End plate side
2 Connection block side
3 Metering ports

Changing the valve spool

1. Unscrew screws **1** (ISO 4762--M4x12-8.8-A2-70)), remove spring housing
2. Unscrew screw **2** M4x30
3. Take off spring package with spring plates **3**
4. Screws **4** (ISO 4762-M4x35-8.8-A2-70) are to be unscrewed
5. Pull the lever housing out of the spool block together with the valve spool **5 6**
6. Remove lock washer DIN 6799-3.2 and bolt **7 8**
7. Proceed in reverse order to reassemble with (new) valve spool

INFORMATION
When assembled, the valve spool's metering ports must always face towards the end plate!
Exception: Valve spools with coding 40 do not have metering ports and can be installed any way around.

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 or the surfaces of the valve blocks are damaged. If damage or 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

Seal kits

Connection block	DS 7700-21
Valve section	DS 7700-22

References

Additional versions

- 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
- 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
- Actuation for proportional directional spool valves type PSL/PSV: D 7700 CAN
- Valve bank (directional spool valve) type CWS: D 7951 CWS

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