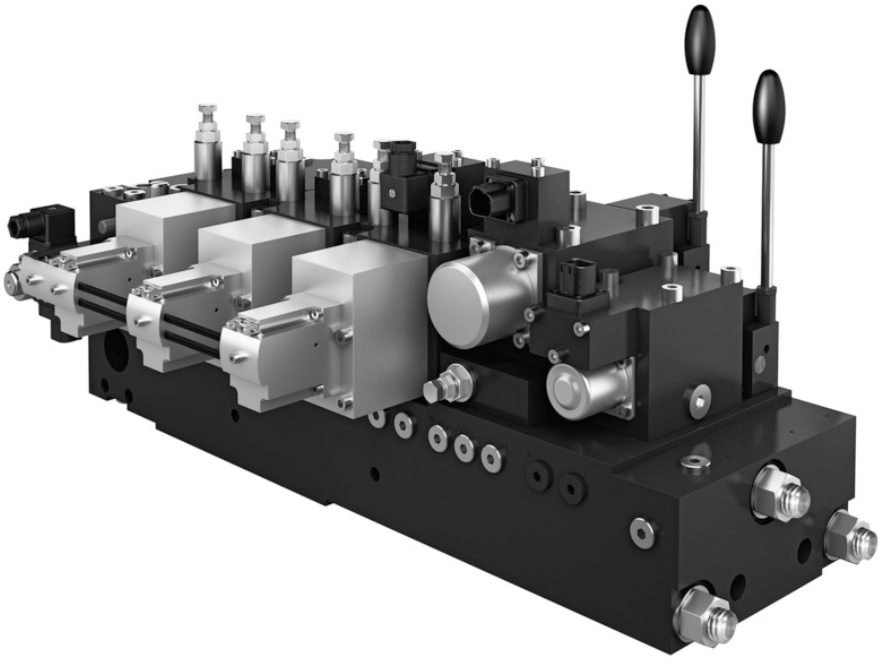
Proportional directional spool valve type PSLF, PSVF, SLF size 7

Product documentation

Operating pressure p_{max}:	400 bar
Flow rate Q_{max}:	400 l/min



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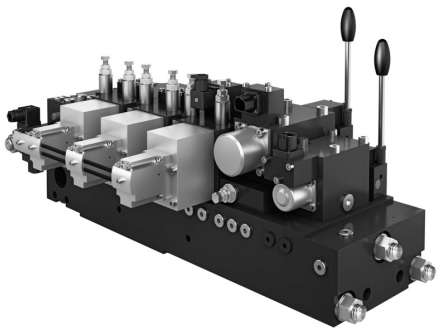
1 Overview of proportional directional spool valve type PSVF 7

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 PSVF 7 is suitable for variable pump systems. It is available as a single manifold mounting valve or in a valve bank.

The flow rates and load pressures for the individual consumers can be individually adjusted. PSVF 7 can be adapted to various control tasks, e.g. for safety functions. All PSVF sizes can be combined with each other.



Proportional directional spool valve type PSVF

Features and advantages

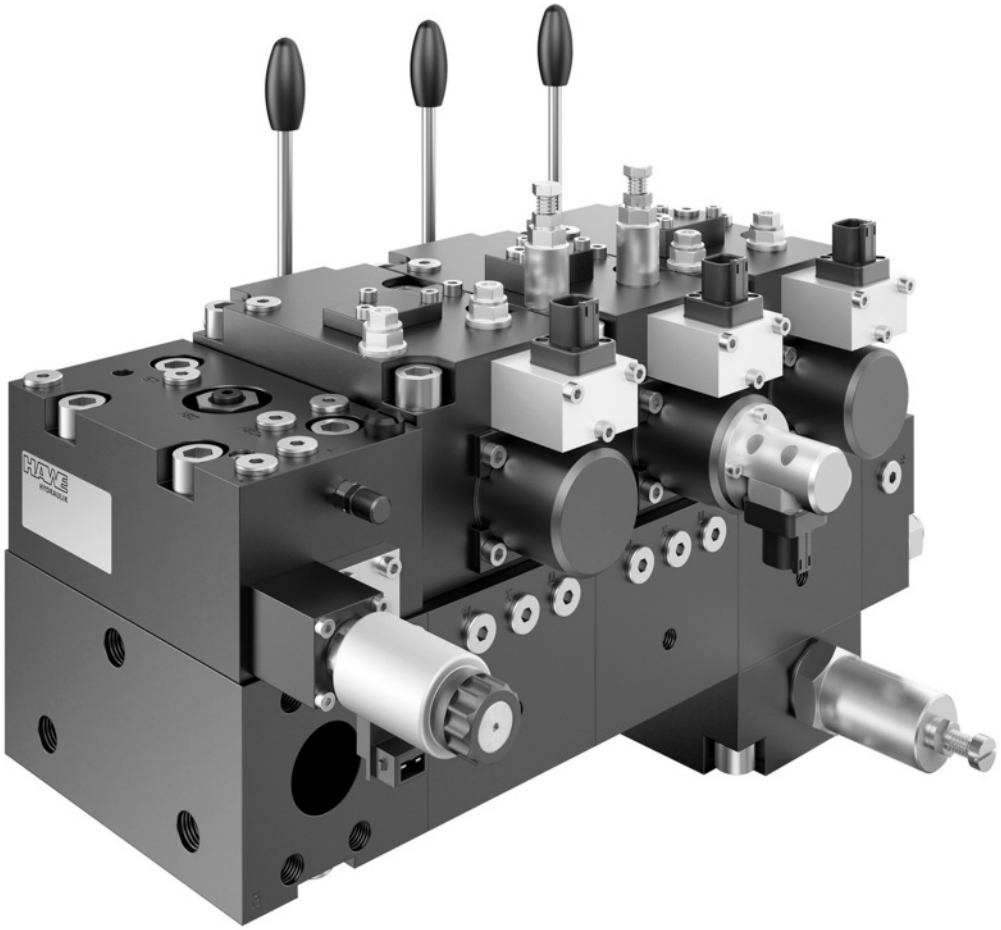
- Flow rates up to 1,000 l/min at 400 bar via input section
- Connections on the rear for easy access to the valve for servicing, even in tight installation spaces
- Flange design can be combined across all sizes with fast valve replacement
- Simultaneous operation of several functions at full speed

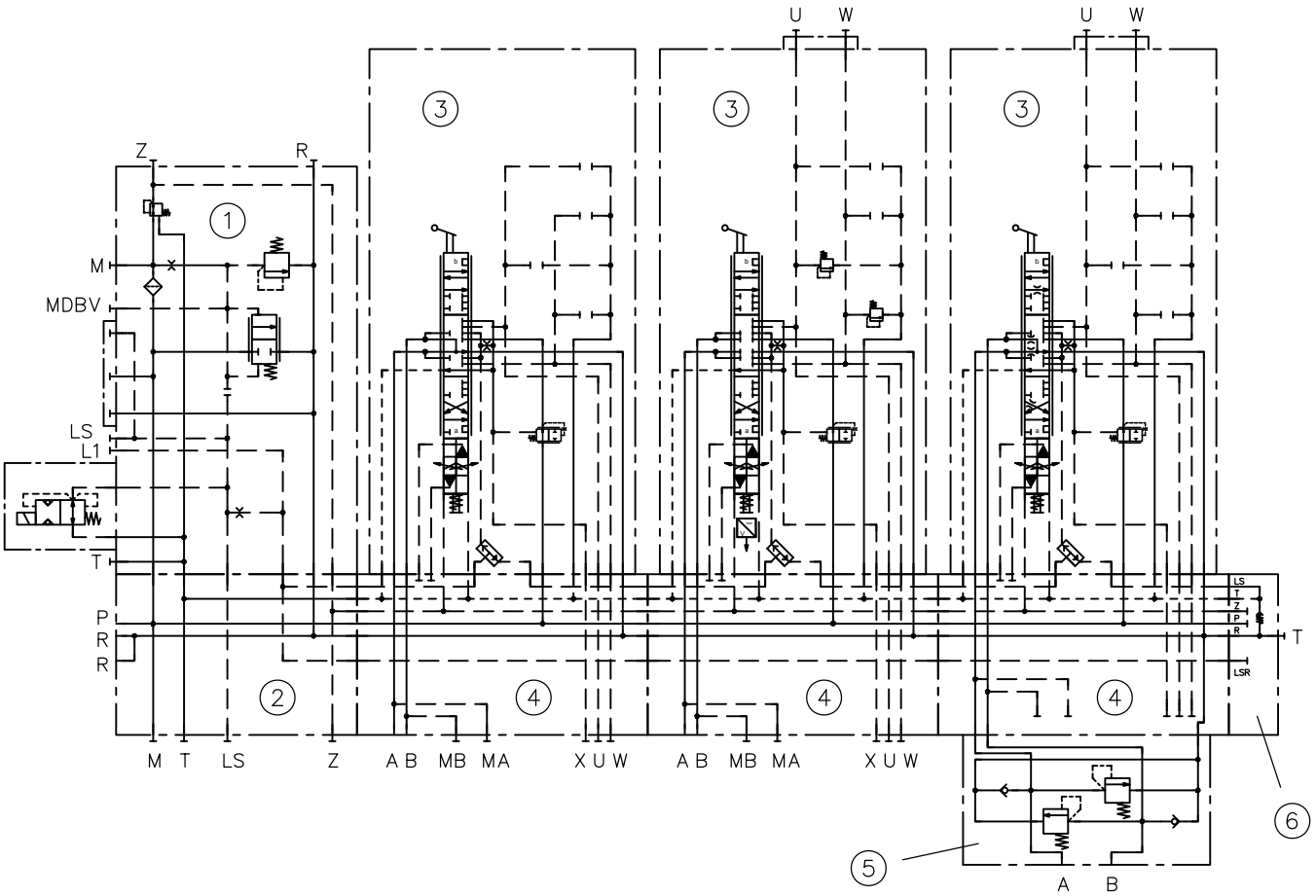
Intended applications

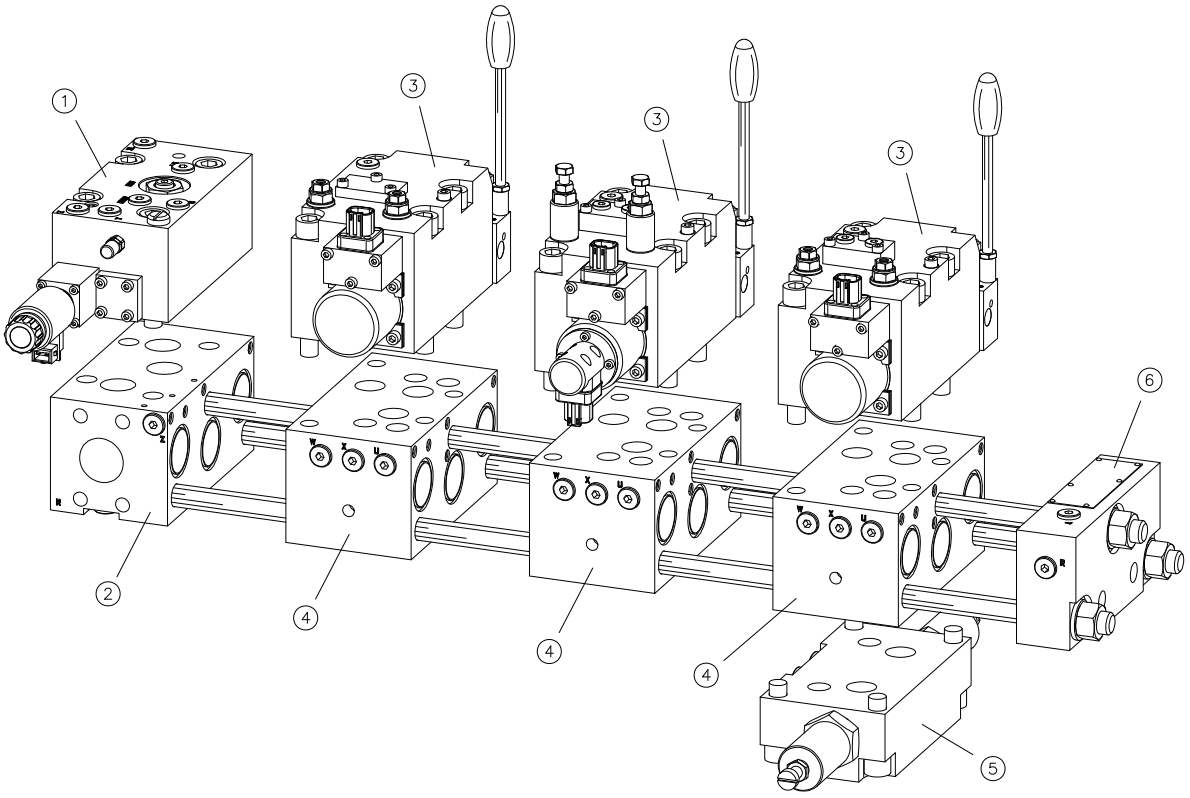
- Cranes and lifting equipment
- Construction machinery and machines for building materials
- Drilling equipment
- Offshore and marine technology

1.1 Configuration example PSVF 7

PSVF A B 1 FBVE/400/7 SAE-7
-A2 H 320/320 AB F0/EA/6 SAE
-A2 L 400/400 A250 B350 S1/EAWA-DT/6 SAE
-A2 O 400/250 AB S1/EA/U 7/6 SAE AN300 BN250
-E 4-DT 24



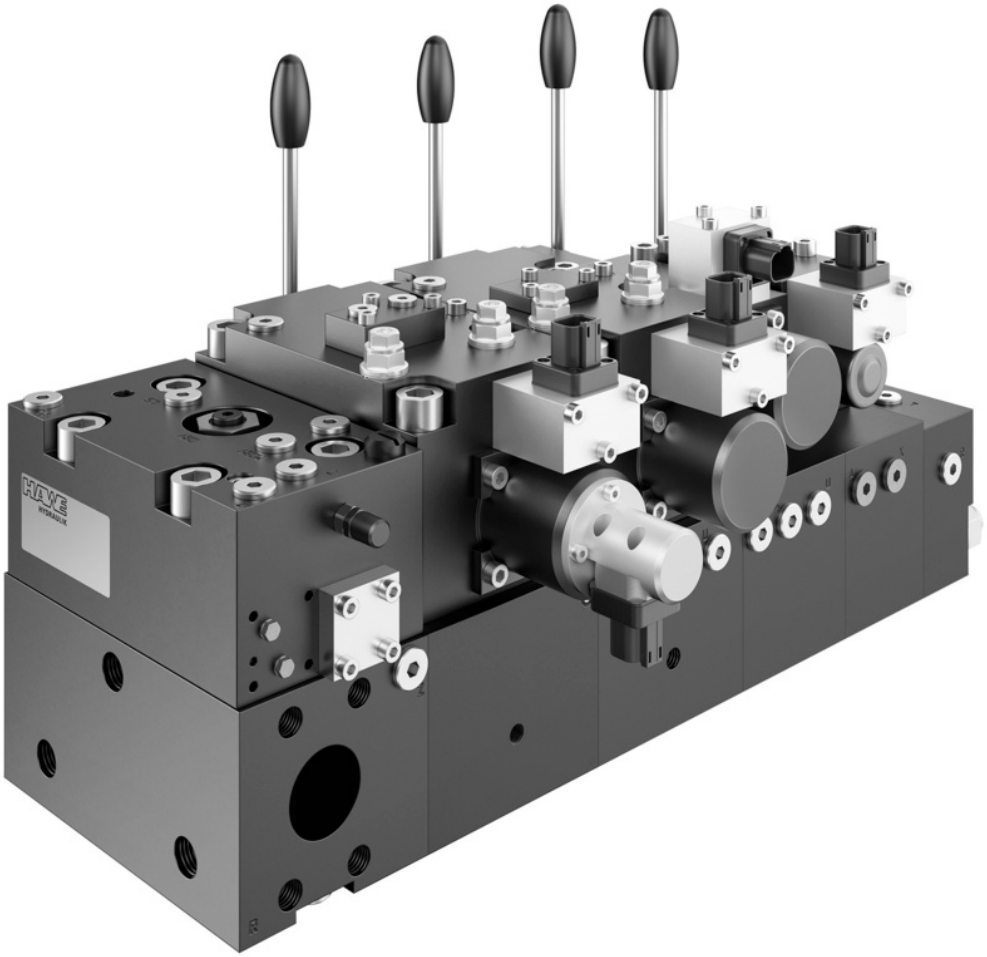


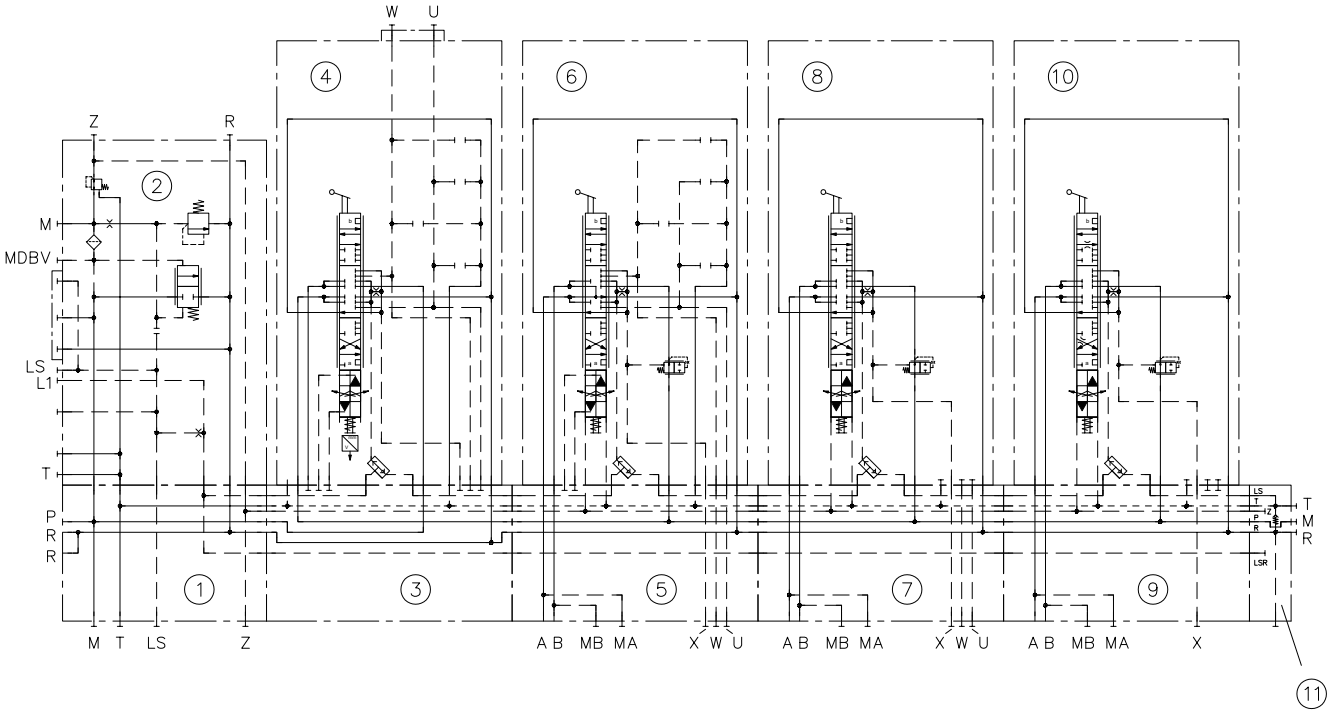


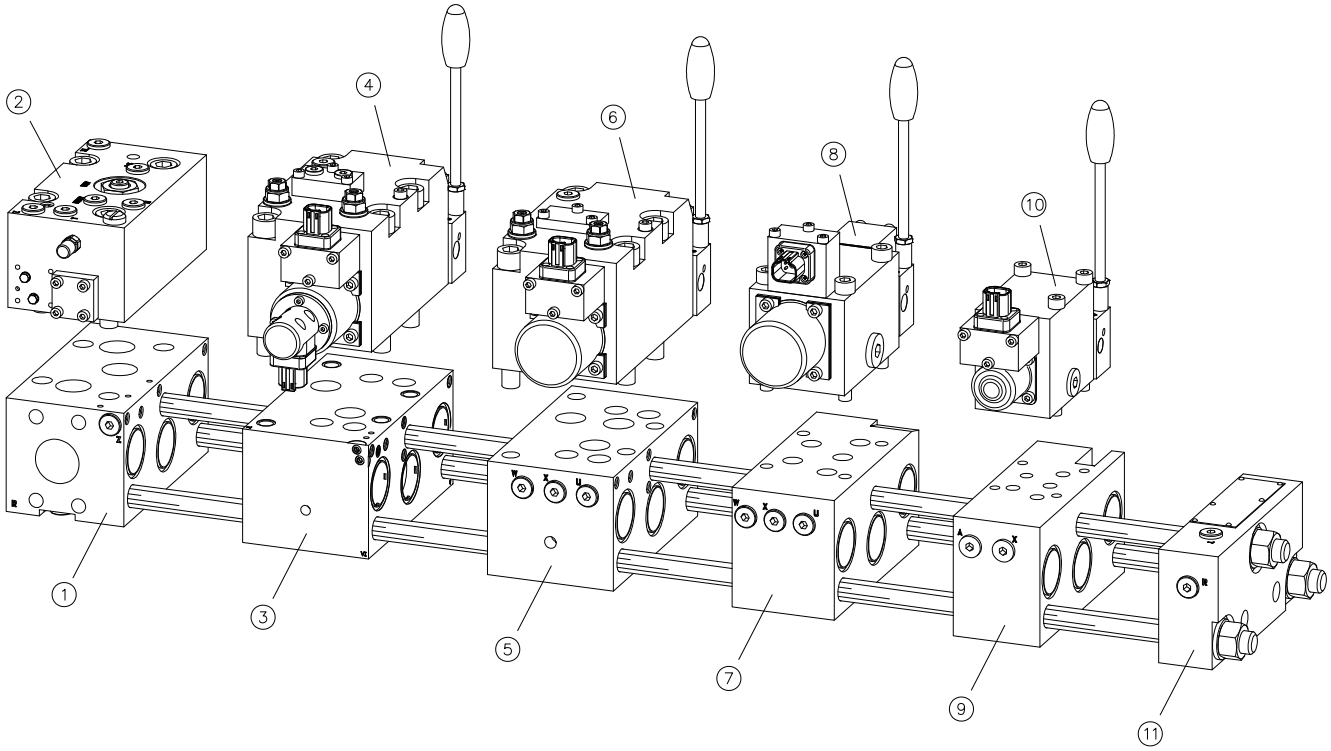
1 Controller block
2 Connection plate
3 Valve section
4 Sub-plate
5 Ancillary block
6 End plate

1.2 Configuration example PSVF 7 in combination with PSVF 5 and PSVF 3

PSVF A B 1/400/7 SAE-7
-A 1 L 400/400 AB S1/EAWA-DT/XP
-A2 H 400/320 AB F0/EA/6 SAE
-A2 L 160/120/EA/55 SAE
-A2 J 80/63/EA/33 SAE
-E 4-DT 24







1 Connection plate
2 Controller block
3 Sub-plate with P channel shut-off
4 SLF 7 valve section
5 Sub-plate with interface to SLF 7 valve section
6 SLF 7 valve section
7 Sub-plate with interface to SLF 5 valve section
8 SLF 5 valve section
9 Sub-plate with interface to SLF 3 valve section
10 SLF 3 valve section
11 End plate

1.3 Configuration examples, individual part ordering

Ordering example, controller block (Chapter 2.1):

PSVF A B 1/400-7

Ordering example, connection plate, controller block (Chapter 2.2):

PSVF7-/7SAE

Ordering example, valve section (Chapter 2.3):

- without sub-plate:

  SLF 7-A2 L 400/320 AB S1/EA-DT 24

- with sub-plate:

  SLF 7-A2 L 400/320 AB S1/EA/6 SAE-DT 24

- with sub-plate and ancillary block:

  SLF 7-A2 L 400/320 AB S1/EA/U 7/6 SAE AN250 BN250-DT 24

Ordering example, sub-plate (Chapter 2.4):

SLF 7-/6 SAE

Ordering example, ancillary block (Chapter 2.5):

SLF 7-/6 SAE AN250 BN250

Ordering example, end plate (Chapter 2.6):

SLF 7-E 4

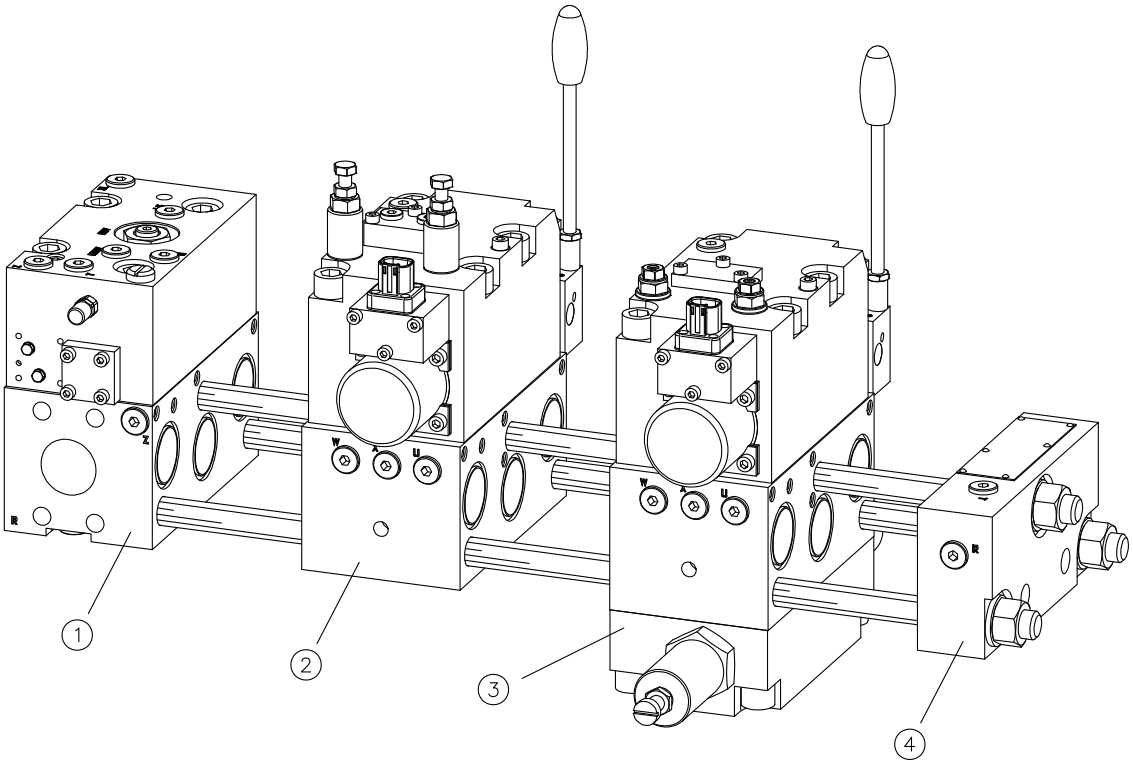
Ordering example, spool valve:

SL 7-H 250/320

2 Available versions

Ordering example

PSVF A B 1/400/7 SAE-7	Controller block (Chapter 2.1) and connection plate (Chapter 2.2)
-A2 H 400/320 A250 B320 S1/EA/6 SAE	Valve section (Chapter 2.3) and sub-plate (Chapter 2.4)
-A2 H 400/320 AB F0/EA/U 7/6 SAE AN250 BN320	Valve section (Chapter 2.3), sub-plate (Chapter 2.4) and ancillary block (Chapter 2.5)
-E 4-DT 24	End plate (Chapter 2.6) with solenoid version and solenoid voltage (Chapter 2.7)



1 Controller block with connection plate
2 Valve section with sub-plate
3 Valve section with sub-plate and ancillary block
4 End plate

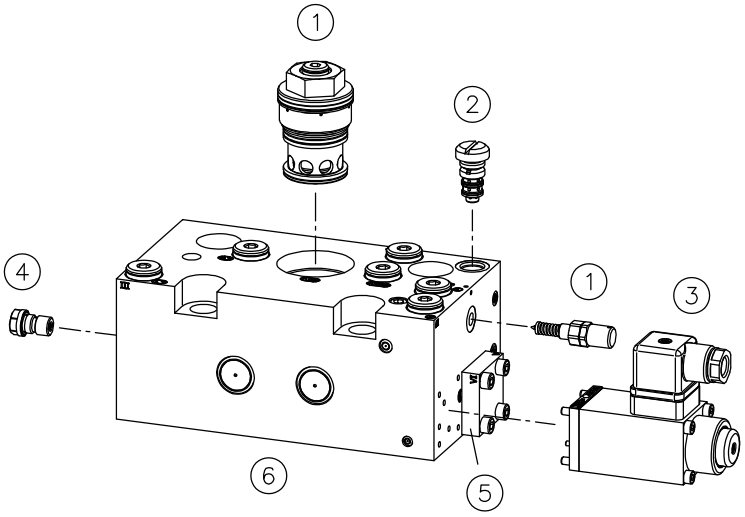
A single manifold can merge up to 10 valve sections of size 7.

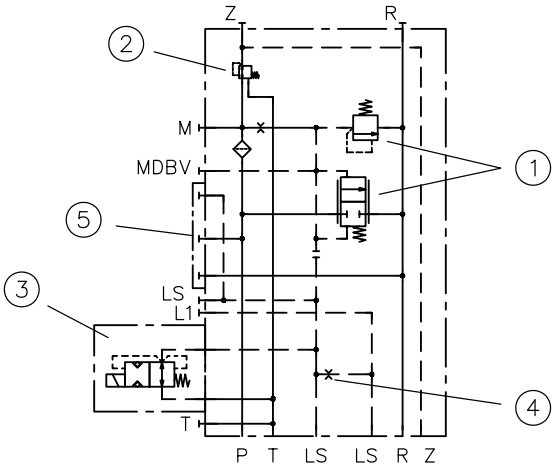
Limits to the maximum possible number of valve sections result from:

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 Controller block

Depending on the configuration, the following components are included in the controller block.





1 Pressure-limiting valve to ensure maximum system pressure
2 Pressure reducing valve for the control oil supply
3 LS pressure-limiting valve or LS release valve
4 Damping element for the LS signal
5 Additional elements such as idle circulation valve
6 Interface to connection plate

Ordering examples

Controller block without connection plate:	**PSVF A**	**A**	**B**	**1**	**F**	**/400**		**-7**
Controller block with connection plate:	**PSVF A**	**A**	**B**	**1**	**F**	**/400**	**/7 SAE**	**-7**

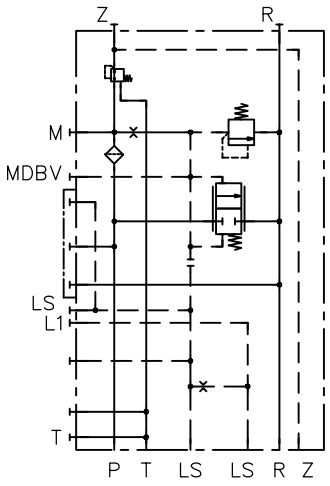
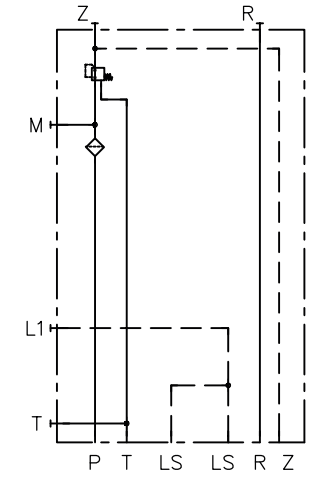
2.1.8 "Size"
2.2 "Connection plate, controller block"
2.1.7 "System pressure limitation"
2.1.6 "LS relief or LS pressure limitation"
2.1.5 "Internal control oil supply"
2.1.4 "LS damping elements"
2.1.3 "PSV idle circulation valve"

Basic type
- 2.1.1 "Ports"
- 2.1.2 "Controller block, basic types"

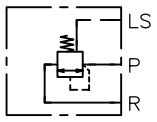
2.1.1 Ports

Coding	Description	Ports (ISO 228-1)
M	Measurement fitting from P	Provided with tapped plugs. G 1/4
Z	Pilot pressure, input/output	
LS	Load signal, tapping after damping	
T	Tank	
MDBV	Measurement fitting, pressure-limiting valve	
L1	Load signal, tapping before damping	
R	Reflux	

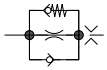
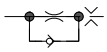
2.1.2 Controller block, basic types

Type	Description	Circuit symbol
PSVF A../..-7	Controller block with pressure-limiting valve (pilot-controlled) ▪ Interface to LS relief or LS pressure limitation, see Chapter 2.1.6 ▪ Interface to PSV idle circulation valve, see Chapter 2.1.3 ▪ LS damping ▪ internal control oil supply	
PSVF AX..-7	Controller block without pressure-limiting valve ▪ internal control oil supply ▪ LS damping possible	

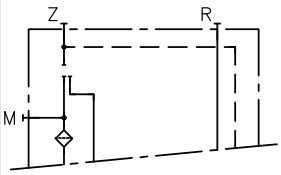
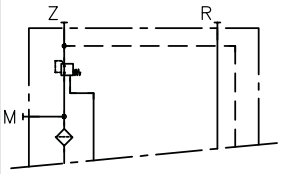
2.1.3 PSV idle circulation valve

Coding	Description	Circuit symbol
A	Special version Application: The idle circulation valve reduces the pressure in P to 30 bar if LS is relieved to the tank in spool valve idle position but the pump does not swing completely to the standby position, but continues to delivery 10 – 20 l/min. ADM 1 used. Q_{max} 10 l/min.	

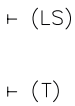
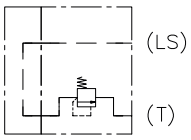
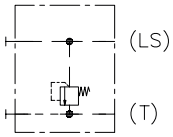
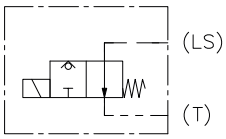
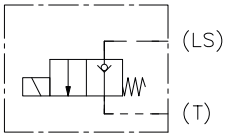
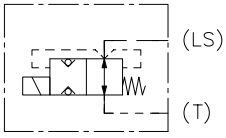
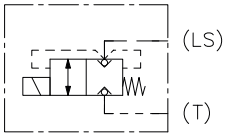
2.1.4 LS damping elements

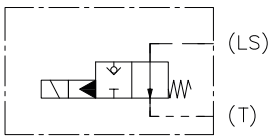
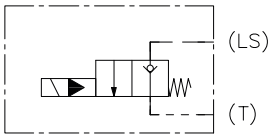
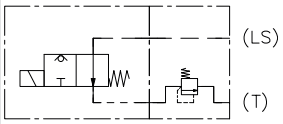
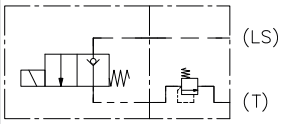
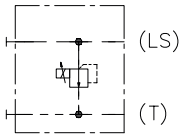
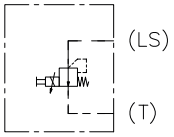
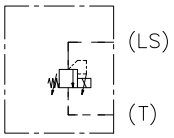
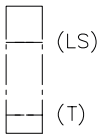
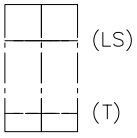
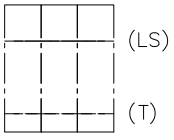
Coding	Description	Circuit symbol
without coding	▪ For PSL and PSM: as for coding S ▪ For PSV: without LS damping	-
B	∅ 0.8 mm orifice	
B 4 **B 5** **B 6** **B 7**	∅ 0.4 / 0.5 / 0.6 / 0.7 mm orifice	
B 55	Two ∅ 0.5 mm orifices in series	
S	Pre-load and damper valve (pre-load pressure: 25 bar)	
W	Pre-load 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.	

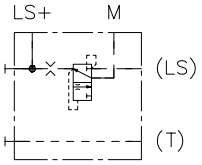
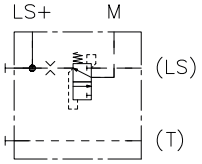
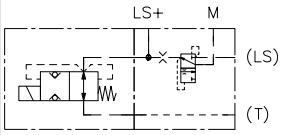
2.1.5 Internal control oil supply

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 **NOTICE** If multiple valve sections need to be actuated simultaneously, we recommend a pilot pressure of 40 bar.	

2.1.6 LS relief or LS pressure limitation

Coding	Description	Circuit symbol
without coding	Without LS relief or LS pressure limitation	
X...	LS pressure limitation (Adjustment range: 50 to 400 bar)	
VX...	LS pressure limitation (Adjustment range: 50 to 400 bar) Prepared for later conversion to coding ZD..., ZDM..., ZDP... or VD...	
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)	
F BVE	LS relief, open when unpowered (BVE 1 R as per D 7921) When combined with solenoid version G 24 EX 55 FM, only approved for up to 250 bar.	
D BVE	LS relief, closed when unpowered (BVE 1 S as per D 7921) When combined with solenoid version G 24 EX 55 FM, only approved for up to 250 bar.	

Coding	Description	Circuit symbol
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)	
VA	LS relief, closed when unpowered (EM 11 V as per D 7490/1)	
F...	Switchable LS pressure limitation, active when unpowered (WN 1 F as per D 7470 A/1) (Adjustment range: 50 to 400 bar)	
D...	Switchable LS pressure limitation, disabled when unpowered (WN 1 D as per D 7470 A/1) (Adjustment range: 50 to 400 bar)	
PA **PB** **PC** **PD**	Proportional LS pressure limitation with ascending characteristic line Pressure ranges: ▪ **PA:** 35 to 320 bar ▪ **PB:** 25 to 210 bar ▪ **PC:** 40 to 400 bar ▪ **PD:** 50 to 420 bar	
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)	
X9 **X18** **X27**	Intermediate plate for turning the downstream valve for LS relief or LS pressure limitation ▪ **X9:** Turns clockwise through 90° ▪ **X18:** Turns through 180° ▪ **X27:** Turns clockwise through 270°	X9  X18  X27 

Coding	Description	Circuit symbol
Z ADM 0 **Z ADM 3**	Intermediate plate with copier valve for amplifying LS signal ▪ **0:** without LS pressure amplification ▪ **3:** with 3 bar LS pressure amplification The M port of the copier valve is connected externally to the M port on the . Optionally, additional LS damping is possible. The copier valve is designed as an intermediate plate. Port T and LS+ are usually sealed. If required, you can connect a release valve type F, D, F BVE or D BVE there (e.g. Z ADM 0/F BVE).	Z ADM 0  Z ADM 3  Z ADM 0/F BVE 

NOTICE
LS relief valves and LS pressure-limiting valves of types X..., VX..., ZA, ZAM, ZAP, VA, F..., D..., ZD..., ZDM..., ZDP..., VD..., PA, PB, PC, PD, 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 2.1.4, "LS damping elements"

NOTICE
If LS pressure-limiting valves of types PA, PB, PC, PD, Z, ZM, ZP, V are used for emergency stop functions, it is important to note that a certain residual pressure will always remain while the directional spool valve is shifted and there is a load pressure.

LS damping	Residual pressure at load pressure of	
Coding	**250 bar**	**350 bar**
B, S, W, E, G	125	150
B 7	100	120
B 6	85	95
B 5	75	80
B 4	60	70

see Chapter 2.1.4, "LS damping elements"

2.1.7 System pressure limitation

Coding	Description
without coding	Without pressure-limiting valve
/...	With pressure-limiting valve (Adjustment range 50 to 400 bar)

2.1.8 Size

Coding	Description
-7	Size 7

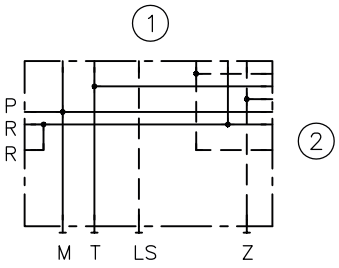
For size 3 and size 5 see D 7700-F

2.1.9 Variants and potential combinations

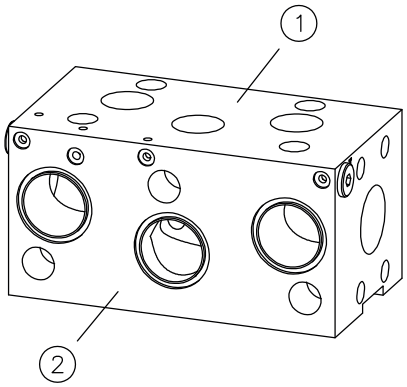
PSVF controller blocks

Type	P and R port (ISO 228-1 or SAE J 514)	Max. recommended flow rate (l/min)	Pressure-limiting valve	
			without	pilot-controlled
PSVF../..-7	G 1	1000		●
PSVF AX..-7	G 1 1/4	1000	●	

2.2 Connection plate, controller block



1 Interface, controller block
2 Interface, sub-plate

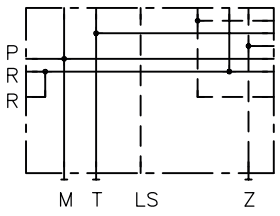


2.2.1 Connection plate connections

Coding	Description, P and R port
6 SAE	SAE 1 1/4
7 SAE	SAE 1 1/2

Coding	Description	Ports (ISO 228-1)
LS	Load signal	G 1/4 ▪ Open
M	Measurement fitting from P	G 1/4 ▪ Sealed
Z	Pilot pressure, input/output	
T	Tank	

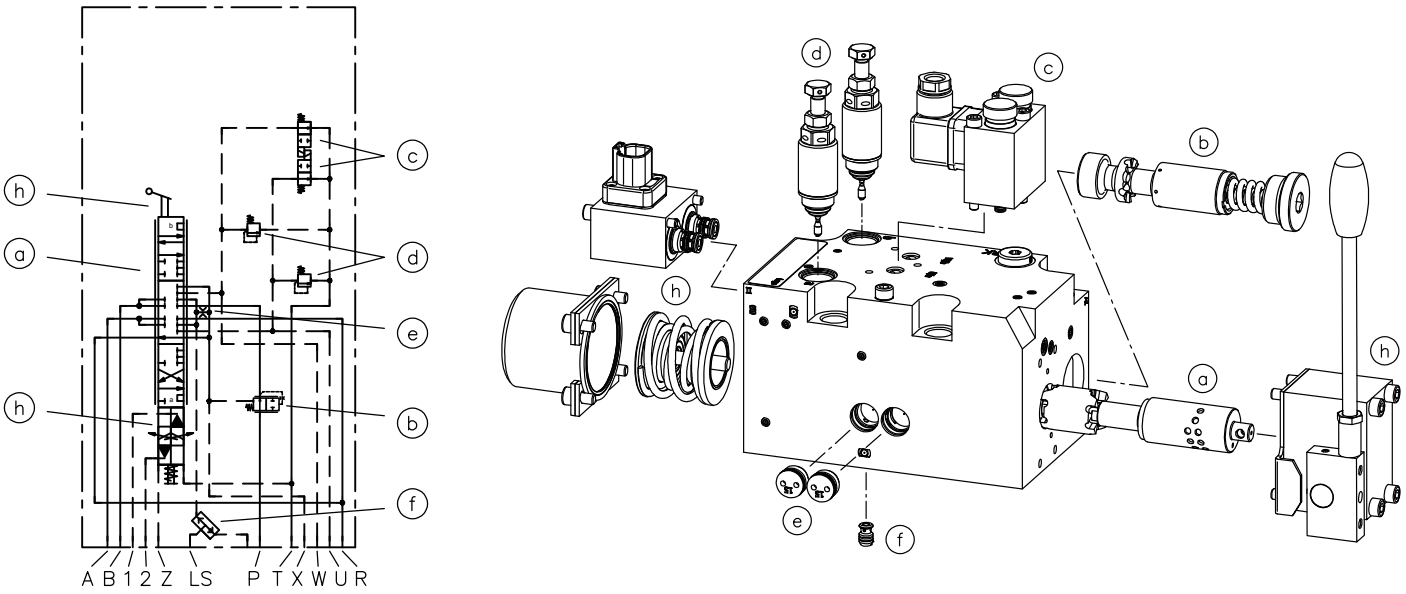
2.2.2 Connection plate, basic types

Coding	Description	Circuit symbol
6 SAE-7	Ports for P, R and LS	
7 SAE-7	Interface ▪ for controller block ▪ for sub-plate - valve section	

2.3 Valve section

The valve section is flanged to a sub-plate, on which the ports for A and B, as well as the interfaces for P and R, are located.

Depending on the configuration, the directional valve sections incorporate



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. Electric LS pressure-limiting valves for relief or electro-proportional limitation of the LS pressure
d. Fixed LS pressure-limiting valves
e. LS orifice for damping the LS signal
f. Shuttle valve for linking the LS line to additional valve sections
h. An actuation for shifting the valve spool

Ordering examples

without sub-plate:	SLF 7	-A	25	H 400/400	A200 B300 F3	/EA1		
with sub-plate and ancillary block:	SLF 7	-A	25	H 400/400	A200 B300 F3	/EA1	/U 7	/6 SAE AN250 BN350

2.5 "Ancillary block"

2.4 "Sub-plate - valve section"

Actuation
- 2.3.1.12 "Actuation"
- 2.3.1.13 "Additional elements for actuation"

LS pressure limitation
- 2.3.1.7 "LS pressure limitation"
- 2.3.1.8 "Electric LS relief or LS pressure limitation"
- 2.3.1.9 "LS port for external limitation"

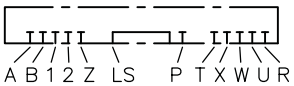
Spool valve
- 2.3.1.5 "Circuit symbol"
- 2.3.1.6 "Flow rate"

2-way controller
- "2-way controller"
- 2.3.1.3 "2-way controller spring"
- 2.3.1.4 "2-way controller damping"

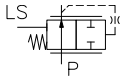
2.3.1.1 "Consumer ports"

2.3.1 Directional valve section

2.3.1.1 Consumer ports

Coding	Description	Circuit symbol
A	Spool block without integrated thread for combining with a sub-plate, see Chapter 2.4, "Sub-plate - valve section"	-
AX	Reactive plate	

2.3.1.2 2-way controller

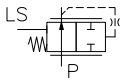
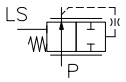
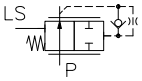
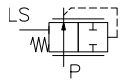
Coding	Description	Circuit symbol
without coding	Standard 2-way controller	
1	Without 2-way controller	-

2.3.1.3 2-way controller spring

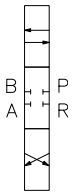
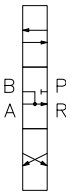
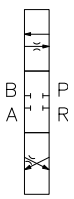
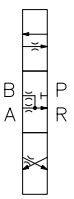
Coding	Description
without coding	(coding 1 Chapter 2.3.1.2)
2	Standard version (12 bar spring)

Coding	Description
5	Heavy-duty version (15 bar spring) Only in conjunction with: ▪ Circuit symbols L and H, Chapter 2.3.1.5 ▪ Circuit symbols O and J only in conjunction with 2-way controller damping coding 5

2.3.1.4 2-way controller damping

Coding	Description	Circuit symbol
without coding	Standard version for circuit symbol L and H. Damping with ∅ 0.7 mm orifice.	
4	Special version with stronger damping. Damping with ∅ 0.4 mm orifice.	
5	Standard version with circuit symbol J and O in combination with 2-way controller spring coding 5. Damping with ∅ 0.5 mm orifice.	
S	Special version with closing damping Only in conjunction with standard 2-way controller (without coding) Common applications include hydraulic motors with a small number of pistons or with a low rotation speed. Here, the volume requested by the motor can be subject to oscillating changes if differing numbers of pistons in the motor are connected to the consumer at the PSL.	
X	Special version without damping Only in combination with standard 2-way controller (without designation)	

2.3.1.5 Circuit symbol

Coding	Description	Circuit symbol	
L, H	Standard spool valve with low return pressure	L 	H 
J, 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 	O 

NOTICE

- If the nature of the application means the reflux is not directed through the valve section to the tank, please observe Chapter 5.2.2.1, "Reflux piping routed externally to the tank".

2.3.1.6 Flow rate

Coding 2-way controller spring, see Chapter 2.3.1.3	Coding Flow rate ($Q_{nominal}$ in l/min) With maximum spool valve actuation				
	120	180	250	320	400
2	120	180	250	320	400
5	150	225	315	415	520

Flow rate for coding 1

On valve sections without a 2-way controller (coding 1 , see Chapter 2.3.1.2, "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 pump controller of the variable pump (PSVF)

Example:

- PSV connection block, pump controller with 25 bar standby pressure
  $Q_{A/B} = 120l/min \cdot \sqrt{0.2 \cdot 25} = 268l/min$

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 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 2.3.1.5, "Circuit symbol".

► **Ordering example:** L 400/320, J 250/250, H 320/320, O 250/120

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 2.3.1.12, "Actuation")

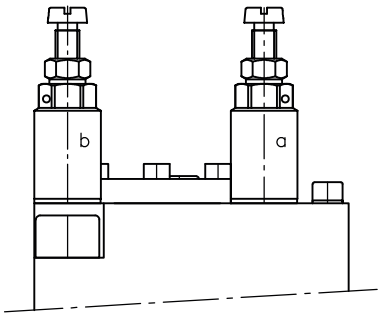
If the spool stroke should not be limited or should be set to a lower value, this can be specified in the type designation using two separate bracket values.

Not possible in conjunction with CAN actuation, see Chapter 2.3.1.12, "Actuation".

► **Ordering example 1:** SLF 7-A2 L 400/320/EA (360/300)
Setting values: A – 360 l/min
B – 300 l/min

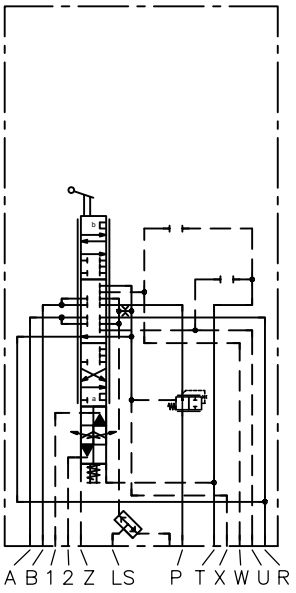
► **Ordering example 2:** SLF 7-A2 L 400/320/EA (360/-)
Setting values: A – 360 l/min
B – no stroke limitation

2.3.1.7 LS pressure limitation

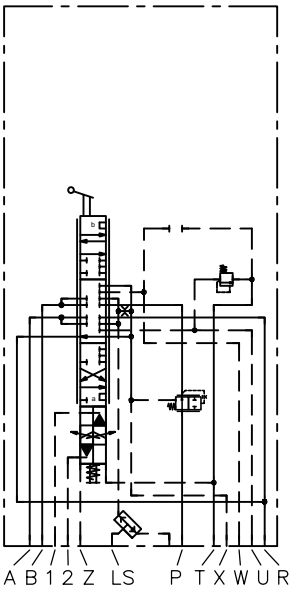
Coding	Description	View
AB	Without LS pressure limitation, but prepared for later conversion to coding A.., B.. or A.. B..	
A..	LS pressure limitation for A-side (Adjustment range: 50 to 400 bar)	
B..	LS pressure limitation for B-side (Adjustment range: 50 to 400 bar)	
A.. B..	LS pressure limitation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

Circuit symbols

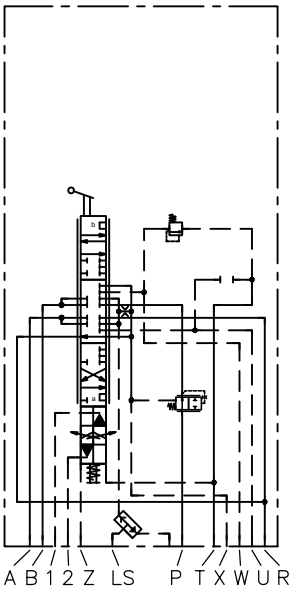
AB



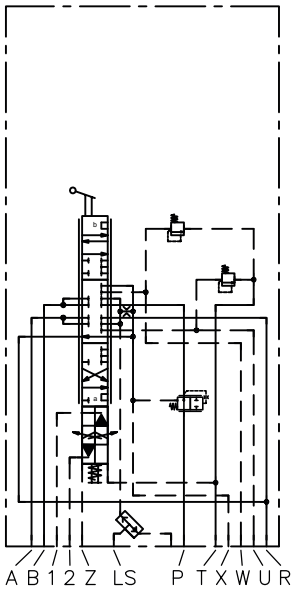
A..



B..



A.. B..

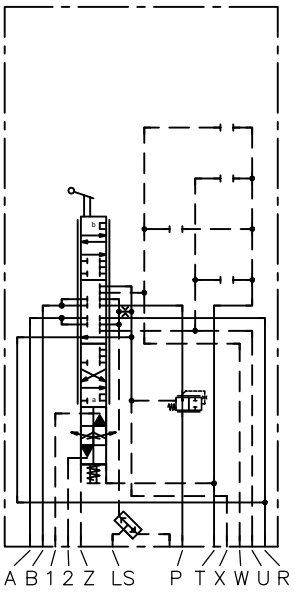


2.3.1.8 Electric LS relief or LS pressure limitation

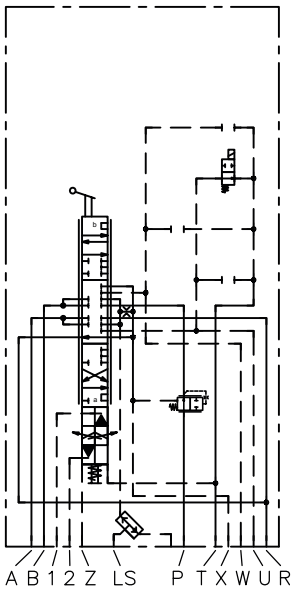
Coding	Description
F 0	Without electric LS relief or LS pressure limitation, but prepared for later conversion to coding F, FH.
F 1, F 2, F 3 **FH 1, FH 2, FH 3**	Electric LS relief (function deactivation) LS signal without load when unpowered. ▪ F1: A-side only ▪ F2: B-side only ▪ F3: A and B-side separate ▪ FH 1, FH 2, FH 3: additionally with button for manual override

Circuit symbols

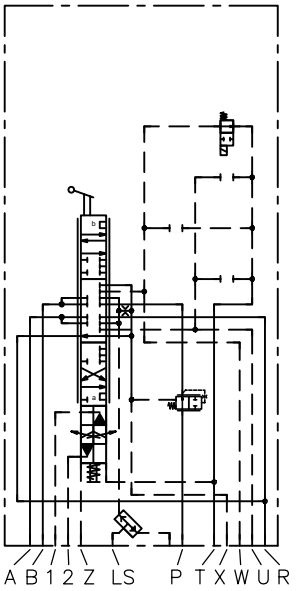
F 0



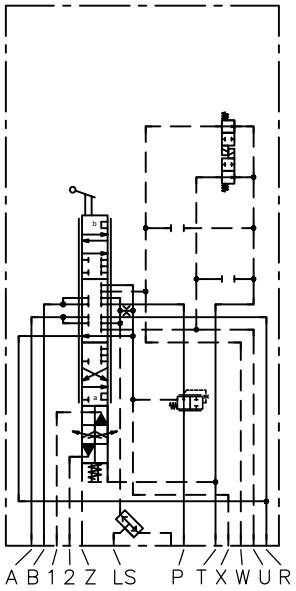
F 1, FH 1



F 2, FH 2



F 3, FH 3



NOTICE

Electric LS relief or LS pressure limitation is only available in conjunction with a 2-way controller, Chapter 2.3.1.2

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

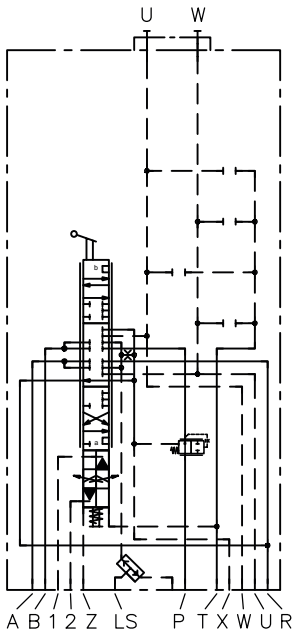
FPC...: approx. 13 bar

2.3.1.9 LS port for external limitation

Coding	Description
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-4 or 7/16-20 UNF-2B (SAE J 514)

Circuit symbols

S1, S1 UNF



NOTICE
An LS port for external limitation is only possible in conjunction with a 2-way controller (Chapter 2.3.1.2).

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:

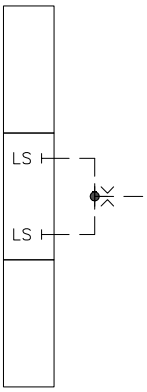
a) control pressure in the 2-way controller ($\Delta p_{2\text{-way controller}}$)
b) internal dynamic pressure in block (Δp_{Block})
c) Return pressure (p_{reflux}).

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

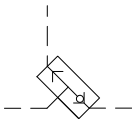
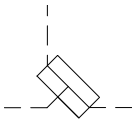
$\Delta p_{2\text{-way controller}}$: see Chapter 2.3.1.3

Δp_{Block} for coding S1 = 5 bar

2.3.1.10 LS orifice

Coding	Description	Circuit symbol
without coding	Standard version with ∅ 1.5 mm, subsequently ∅ 1.0 mm SK orifice	

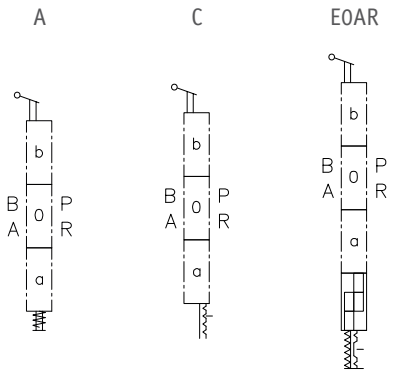
2.3.1.11 Shuttle valve

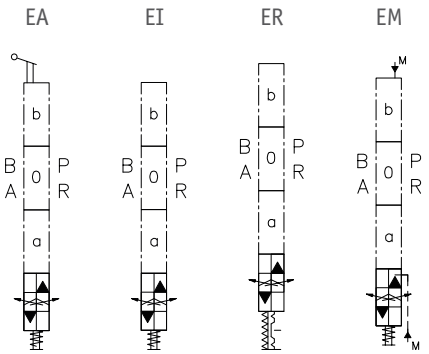
Coding	Description	Circuit symbol
without coding	Standard version	
W3	Special version without ball Only useful in manifold's final valve section in case the downstream LS-line is not relieved by the end plate.	

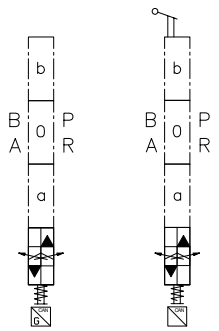
2.3.1.12 Actuation

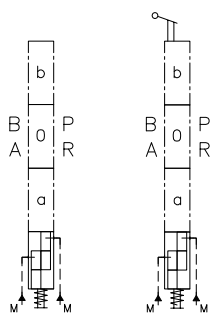
Actuation types

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: ▪ A, EOA, AR, EOAR, EAR ▪ EA, EMA(UNF) ▪ HA(UNF), FA(UNF), EHA(UNF), EFA(UNF), EOHA(UNF), EOFA(UNF), EOZA, EOZMA, TA, TOHA, TOFA ▪ PA, EOPA	
C	Manual actuation, infinitely variable Only in conjunction with actuation variants: ▪ C, EOC	
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, EOAR ▪ ER ▪ EAR	

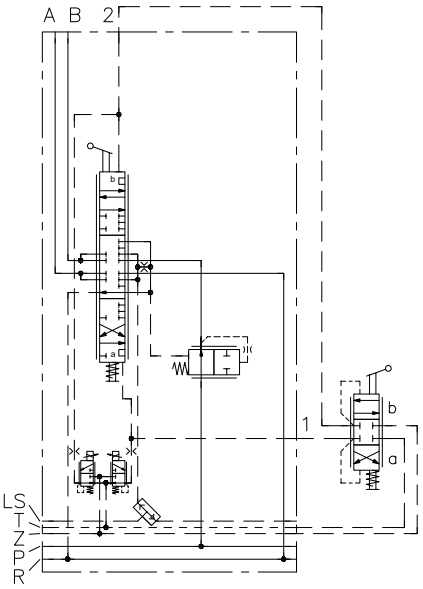
Coding	Description	Circuit symbol
Electro-hydraulic actuation		
EI **EM** **EM UNF**	Electro-hydraulic actuation. ▪ **EI:** no stroke limitation ▪ **EM:** with measurement fitting, with stroke limitation on spring housing and lever housing ▪ EM: G 1/4 (ISO 228-1) ▪ EM UNF: SAE-4 or 7/16-20UNF-2B (SAE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

Coding	Description	Circuit symbol
CAN actuation		
CAN	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. Only in conjunction with actuation variants: ▪ EACAN ▪ EMACAN ▪ EICAN ▪ EIMCAN ▪ EHACAN ▪ EFACAN **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.	EICAN EACANL 

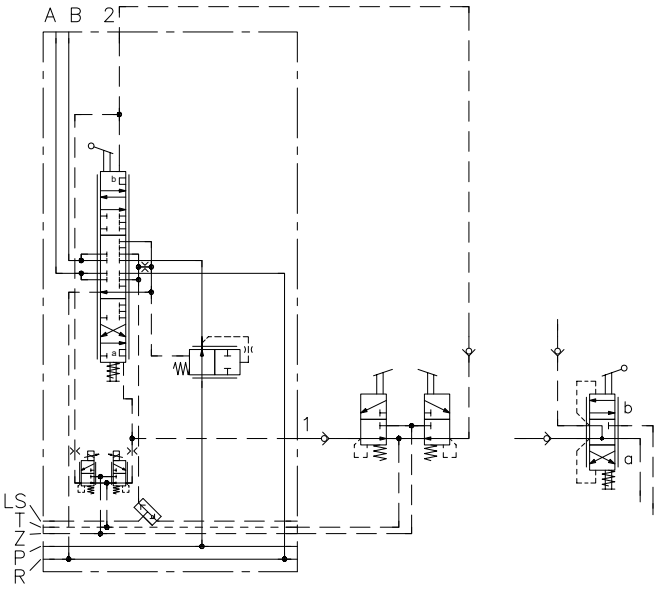
Coding	Description	Circuit symbol
Hydraulic actuation		
H **F** **H UNF** **F UNF**	Hydraulic actuation with pilot pressure ports on spring housing. ▪ **H**: Ports 1 and 2 perpendicular to spool valve axis. Not in conjunction with ancillary blocks or intermediate plates that have additional valves, as port 1 would otherwise be concealed by the additional valves. ▪ **F, FI:** Ports 1 and 2 parallel to spool valve axis. ▪ **H / F:** with stroke limitation ▪ **HI / FI:** without stroke limitation ▪ H / F: G 1/4 (ISO 228-1) ▪ H UNF / F UNF: SAE-4 or 7/16-20UNF-2B (SAE J 514) Pilot pressure: min.: approx. 5 bar max.: approx. 18 bar max. perm.: 50 bar Only in conjunction with actuation variants: ▪ H, F, E0H, E0F, HI, FI, E0HI, E0FI ▪ HA, FA, E0HA, E0FA ▪ EH, EF, EHI, EFI ▪ EHA, EFA (also as UNF variants)	EHA
E0Z **E0Z UNF**	Hydraulic actuation with pilot pressure ports in the spool block beneath spring housing. ▪ E0Z: G 1/8 (ISO 228-1) ▪ E0Z UNF: SAE-2 or 5/16-24 UNF-2B (SAE J 514) Only in conjunction with actuation variants: ▪ E0ZM ▪ E0ZI, E0ZIM ▪ E0ZA, E0ZMA (also as UNF variants)	E0ZM E0ZMA 

Combination with hydraulic joysticks

with closed centre position



with open centre position



There are two ∅ 0.7 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.

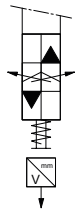
For joysticks with open centre position, pilot pressure ports 1 and 2 are connected to the tank when the joystick is in neutral position. Electro-hydraulic actuation would then result in the entire control oil flow escaping that way, and no pressure would be built up to shift the valve spool. For this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

2.3.1.13 Additional elements for actuation

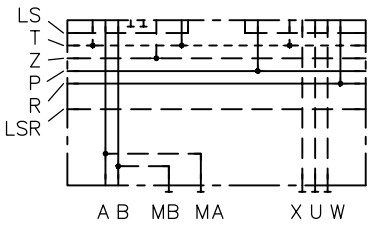
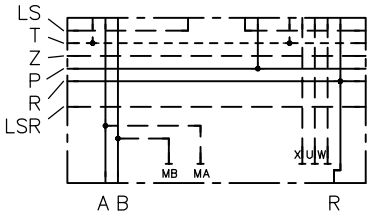
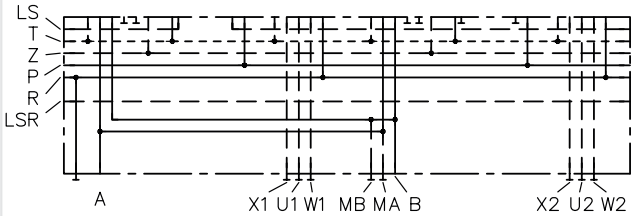
Coding	Description
without coding	Standard version Hand lever straight approx. 177 mm
1 **2** **045** **212**	Add-on for manual actuation A ▪ **1:** Without hand lever ▪ **2:** Hand lever straight approx. 106 mm ▪ **045:** Hand lever 45° curved approx. 152 mm ▪ **212:** Hand lever 12.5° curved approx. 104 mm Ordering example: SLF 7-A2 L 320/320 AB S1/EA212 -DT24
8 **9**	Additional description for stronger or weaker spring package ▪ **8:** Actuation torques as for E actuation (neutral position: 3.0 Nm; end position: 12.0 Nm) ▪ **9:** Actuation torques as for H actuation (neutral position: 5.0 Nm; end position: 16.5 Nm) Ordering example: SLF 7-A2 L 320/320 AB S1/EA9 -DT 24
BE...	Add-on for actuation E0Z actuation. With restrictor check valve type BE 0-... as per D 7555 B in the ports. Ordering example: SLF 7-A2 L 320/320 AB S1/E0Z0810

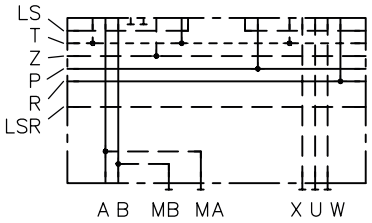
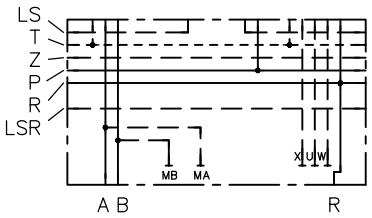
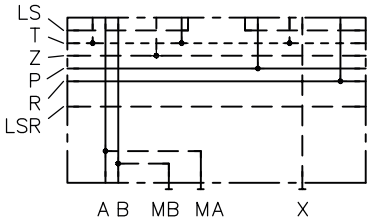
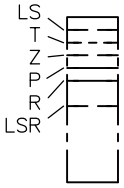
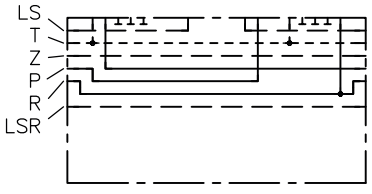
Coding	Description
04 **05** **06** **07** **08**	Add-on for actuation with E Additional damping in the electro-hydraulic pilot control. ▪ **04:** 0.4 mm orifice ▪ **05:** 0.5 mm orifice ▪ **06:** 0.6 mm orifice ▪ **07:** 0.7 mm orifice ▪ **08:** 0.8 mm orifice Ordering example: SLF 7-A2 L 320/320 AB S1/EA 07 (if A and B are the same, 0.7 mm orifice here) SLF 7-A2 L 320/320 AB S1/EA 0705 (if A and B are different, 0.7 mm orifice here in A and 0.5 mm orifice in B)

2.3.1.14 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: SLF 7-A2 L 320/320 AB S1/EAU	
WA **WA-EX** **WA-IS** **WA-MSHC**	Integrated displacement transducer (Hall sensor) for spool valve position monitoring with analogue output signal. Connector types: DT, X, G, C ▪ **WA-EX:** explosion-proof version ▪ **WA-IS:** intrinsically safe version ▪ **WA-MSHC:** explosion-proof version Ordering example: SLF 7-A2 L 320/320 AB S1/EAWA-AMP	

2.4 Sub-plate - valve section

Coding	Description	Circuit symbol
/6 SAE	Interface, valve section: SLF 7 Interface, on the consumer side: SAE 1 1/4" Ports for an external pilot valve. Thread size G 1/4 ▪ U port = LS_A ▪ W port = LS_B ▪ X port = $LS_{A/B}$ Measurement fittings. Thread size G 1/4 ▪ a ▪ b	
/U7	Interface, valve section: SLF 7 Interface, on the consumer side: Ancillary blocks as per Chapter 2.5, "Ancillary block" Ports for an external pilot valve. Thread size G 1/4 ▪ U port = LS_A ▪ W port = LS_B ▪ X port = $LS_{A/B}$ Measurement fittings. Thread size G 1/4 ▪ a ▪ b	
/7D SAE	Interface, valve section: 2x SLF 7 Interface, on the consumer side: SAE 1 1/2" Using this sub-plate, the flow rate from two valve sections can be combined to one consumer port in A and B. Ports for an external pilot valve. Thread size G 1/4 ▪ U1 port = LS_A (1st valve section) ▪ W1 port = LS_B (1st valve section) ▪ X1 port = $LS_{A/B}$ (1st valve section) ▪ U2 port = LS_A (2nd valve section) ▪ W2 port = LS_B (2nd valve section) ▪ X2 port = $LS_{A/B}$ (2nd valve section) Measurement fittings. Thread size G 1/4 ▪ a ▪ b	

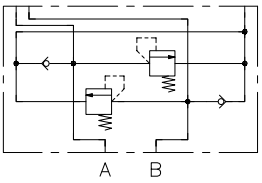
Coding	Description	Circuit symbol
/55 SAE	Interface, valve section: SLF 5 Interface, on the consumer side: SAE 1” Ports for an external pilot valve. Thread size G 1/4 ▪ U port = LS_A ▪ W port = LS_B ▪ X port = $LS_{A/B}$ Measurement fittings. Thread size G 1/4 ▪ a ▪ b	
/U55	Interface, valve section: SLF 5 Interface, on the consumer side: Ancillary blocks as per D 7700-5, Chapter 2.2.2 Ports for an external pilot valve. Thread size G 1/4 ▪ U port = LS_A ▪ W port = LS_B ▪ X port = $LS_{A/B}$ Measurement fittings. Thread size G 1/4 ▪ a ▪ b	
/33 SAE	Interface, valve section: SLF 3 Interface, on the consumer side: SAE 1/2” Ports for an external pilot valve. Thread size G 1/4 ▪ X port = $LS_{A/B}$ Measurement fittings. Thread size G 1/4 ▪ a ▪ b	
/ZPL 77/40	Spacer plate 40 mm	
/XP	Interface, valve section: SLF 7 Interface, on the consumer side: without P channel shut-off. The P channel is conducted through an SLF 7 valve section. The valve spool is thereby used as a block. To unblock it, the valve section must be deflected in the A direction. The B side has no function.	

2.5 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 onto a valve section with flange surface (coding A, Chapter 2.3.1.1) .

Ports A and B as per SAE J 514

- **/6:** SAE 1 1/4

Coding	Description	Circuit symbol
/6 SAE AN.. BN..	Shock and anti-cavitation valves in A and B. – Adjustment range: 40 to 400 bar – The shock and anti-cavitation valves are each connected to the reflux.	

2.6 End plate

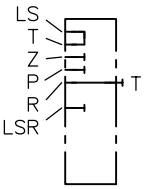
Coding	Description
E 1	T port for external recirculation of control oil to tank. T: G 1/4
E 4	T channel connected to the R channel internally in order to feed back the control oil.
E 1 PSVF../6 SAE..	End plate with interface for a controller block, see Chapter 2.1, "Controller block". This enables the end plate to be used as an additional port for the oil supply. The LS signal is conducted from the connection plate controller block to the end plate via the valve section as an LSR. T port for external recirculation of control oil to tank. Ordering example 1: **E 1** **PSVF AX** **B** **1/6 SAE** 2.1.5 "Internal control oil supply" 2.1.4 "LS damping elements" 2.1.2 "Controller block, basic types" 2.6 "End plate" Ordering example 2: **E 1** **PSVF A** **B** **2** **F** **/400/6 SAE** 2.1.7 "System pressure limitation" 2.1.6 "LS relief or LS pressure limitation" 2.1.5 "Internal control oil supply" 2.1.4 "LS damping elements" 2.1.2 "Controller block, basic types" 2.6 "End plate" P: SAE 1 1/4 R: SAE 1 1/4 2 ports are available for R. T: G 1/4

Coding	Description
E 4 PSVF../6 SAE	End plate with interface for a controller block, see Chapter 2.1, "Controller block". This enables the end plate to be used as an additional port for the oil supply. The LS signal is conducted from the connection plate controller block to the end plate via the valve section as an LSR. T channel connected to the R channel internally in order to feed back the control oil. Ordering example 1: **E 4** **PSVF AX** **B** **1/6 SAE** 2.1.5 "Internal control oil supply" 2.1.4 "LS damping elements" 2.1.2 "Controller block, basic types" 2.6 "End plate" Ordering example 2: **E 4** **PSVF A** **B** **2** **F** **/400/6 SAE** 2.1.7 "System pressure limitation" 2.1.6 "LS relief or LS pressure limitation" 2.1.5 "Internal control oil supply" 2.1.4 "LS damping elements" 2.1.2 "Controller block, basic types" 2.6 "End plate" P: SAE 1 1/4 R: SAE 1 1/4 2 ports are available for R.

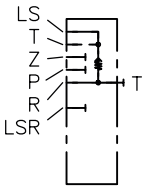
NOTICE
Internal control oil recirculation through R line is permissible only for return pressures < 10 bar.

Circuit symbols

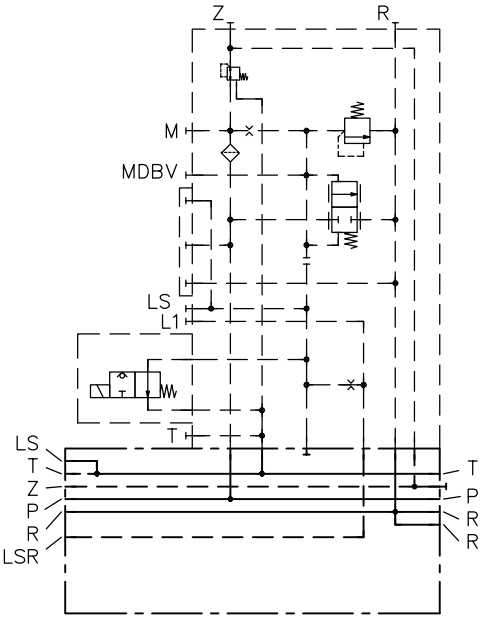
E 1



E 4

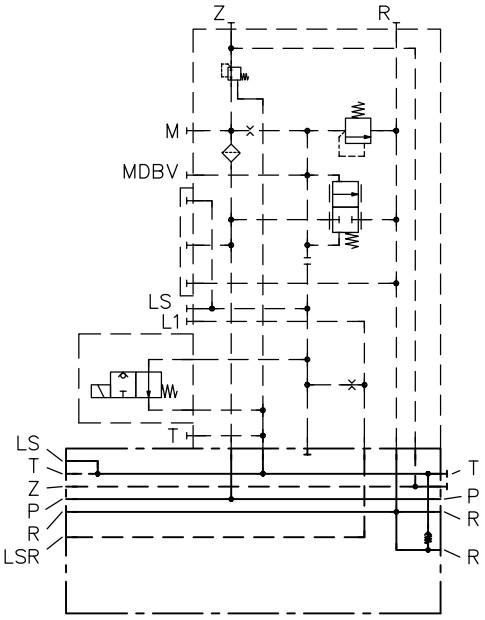


E 1 PSVF.../6 SAE



Here in the example: -E 1 PSVF A B 2 F/400/6 SAE

E 4 PSVF.../6 SAE



Here in the example: -E 4 PSVF A B 2 F/400/6 SAE

2.7 Solenoid voltage and solenoid version

2.7.1 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	F, FH	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	F, FH	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 **X 24 C**	EN 175 301-803 C	12 V DC 24 V DC	IP 65	3-pin, connector position front					
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)			●		
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
- **SWS:** see D 7951

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 LS relief coding F 1, F 2, F3, FH 1, FH 2, FH 3:

The electrical LS relief's on/off twin solenoids are only available with DIN connectors and manual override (coding -G...T(H), -X...T(H) or -L...T(H). Should you require another plug option, the electro-proportional LS pressure limitation coding FP.., FPH.. can be used instead.

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.

2.7.2 Solenoid versions for potentially explosive atmospheres

Coding	Description
X 24 TEX 4 70 FM	Explosion-proof solenoid in terminal box For information on the solenoid and matching cable kits, cables and cable fittings, see the operating instructions B ATEX
G 24 EX **G 24 EX-10 m**	Explosion-proof solenoid with cable ▪ **No additional specification:** with 3 m cable ▪ **10 m:** with 10 m cable Information on the solenoid is provided in the operating instructions B ATEX
G 12 IS **G 12 IS-10 m** **G 24 MSHA** **G 24 MSHA-10 m**	Explosion-proof solenoid with cable. ▪ **No additional specification:** with 3 m cable ▪ **10 m:** with 10 m cable Information on the solenoid is provided in the operating instructions B ATEX

3 Parameters

3.1 General data

Designation	Proportional directional spool valves PSLF, PSVF and SLF
Design	Manifold with up to 10 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 M10, see Chapter 4, "Dimensions"
Installation position	As desired
Ports/connections	▪ **P** = Pump ▪ **R** = Reflux ▪ **A, B** = Consumers ▪ **LS, DW, U, W, 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, Y, Z, T** = G 1/4 (ISO 228-1) or SAE-4, or 7/16-20 UNF-2B (SAE J 514) ▪ **U, W** = 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	▪ p_{max} = 400 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 2.6, "End plate")
Flow rate	▪ Q_{max} connection block: see Chapter 3.4, "Characteristic lines" ▪ Q_{max} consumer: see Chapter 2.3.1.6, "Flow rate"

3.3 Weight

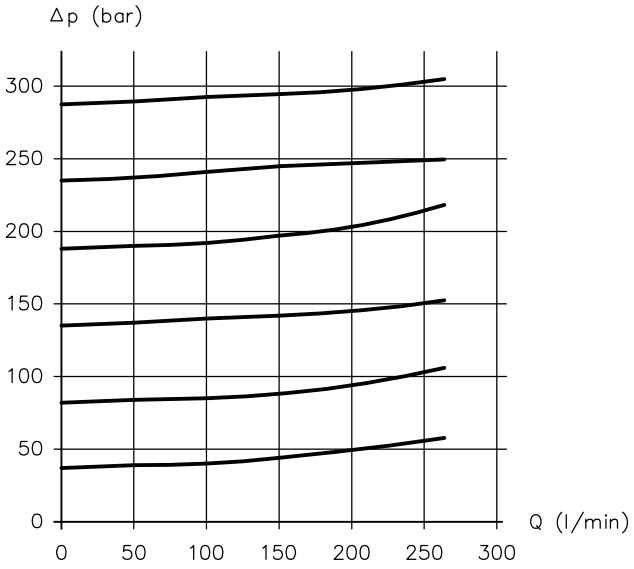
Controller block with connection plate	**Type**	
	PSVF A..	= 12.0 kg
	For additional functions, "LS relief or LS pressure limitation":	
	Coding	
	F, D	+ 0.6 kg
Valve section	**Valve section with actuation**	
	Coding	
	EOC, EOA, EOF, EOH	= 12.6 kg
	EA	= 13.0 kg
	EOFA, EOHA	= 12.6 kg
	EFA, EHA	= 13.0 kg
Sub-plate - valve section	**Coding**	
	/6 SAE	= 12.0 kg
	/55 SAE	= 12.0 kg
End plate	**Coding**	
	E1	= 3.0 kg
	E4	= 3.0 kg

3.4 Characteristic lines

Viscosity of the hydraulic fluid approx. 60 mm²/s

3.4.1 Connection block

Pressure-limiting valve (P → R)

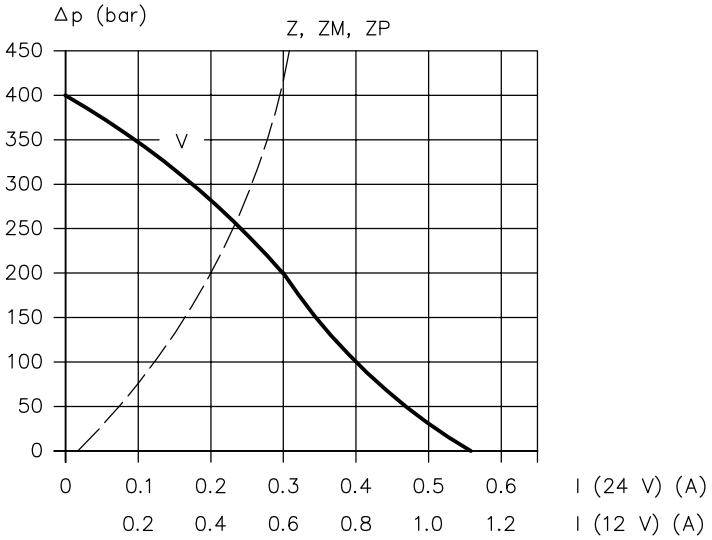


Q flow rate (l/min); Δp pressure difference (bar)

Electro-proportional LS pressure limitation

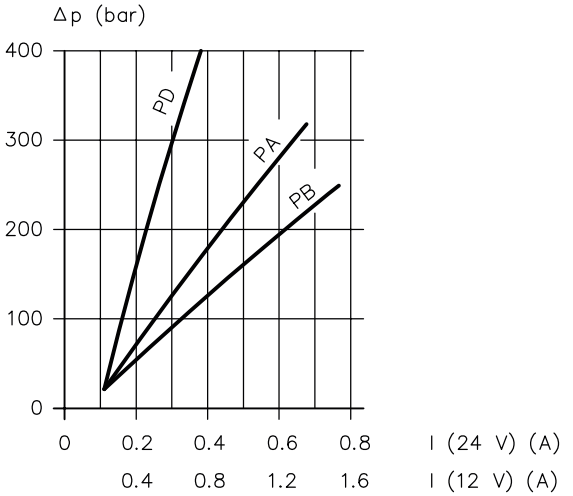
see Chapter 2.1.6, "LS relief or LS pressure limitation"

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



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

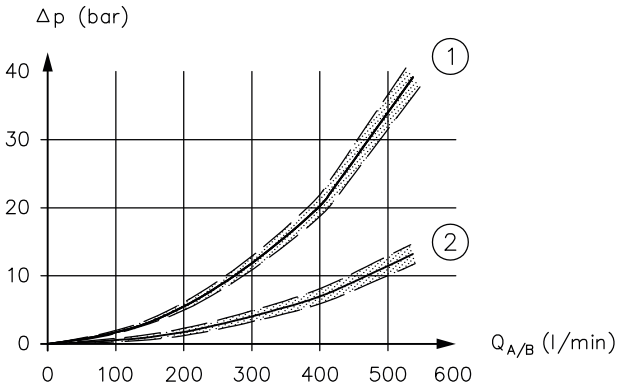
Coding **PA, PB, PD**



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

3.4.2 Directional valve section

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



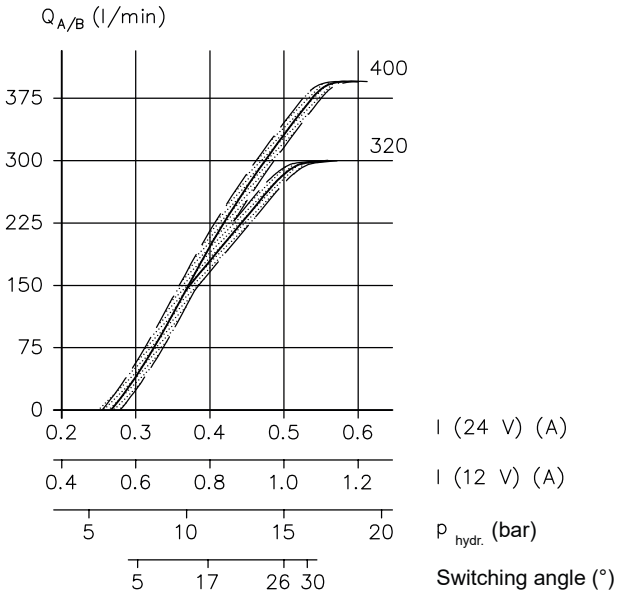
$Q_{A/B}$ flow rate (l/min); Δp pressure difference P - A/B (bar)

1 P → A/B in valve section with 2-way controller code 2, 5 or 7, see Chapter 2.3.1.2, "2-way controller"

2 A/B → R in spool valve coding L, M, F, H, see Chapter 2.3.1.5, "Circuit symbol"

Control characteristic line for consumer flow rate

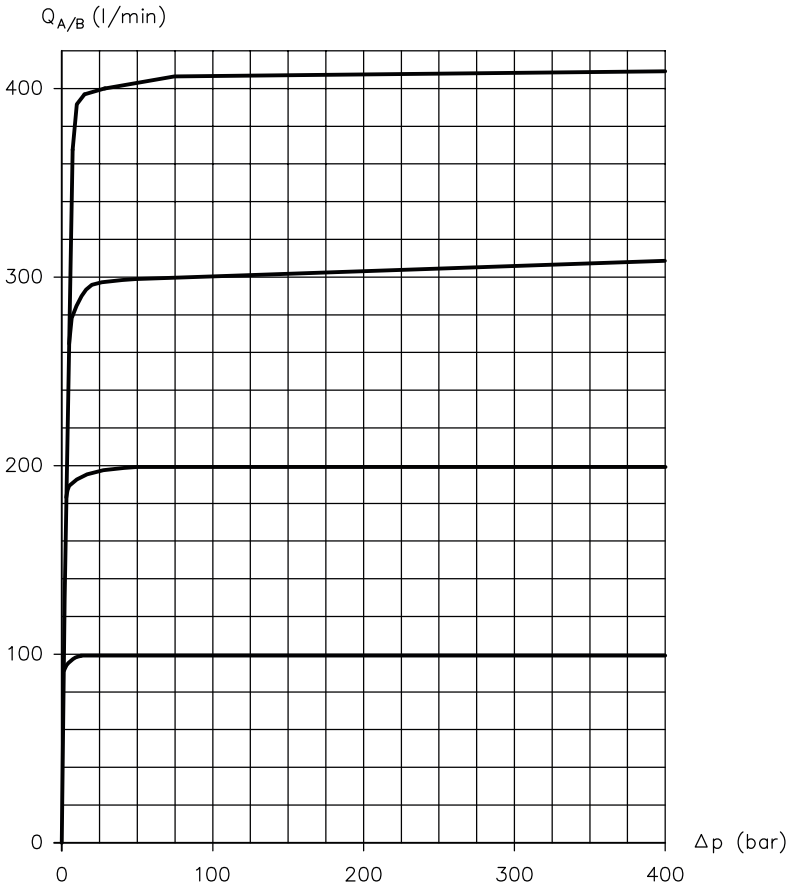
(reference values measured with 2-way controller and standard 2-way controller spring)



I control current (A) at 24 V DC or 12 V DC for electro-hydraulic actuation;
$p_{hydr.}$ 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 2.3.1.2, "2-way controller"



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

3.5 Electrical data

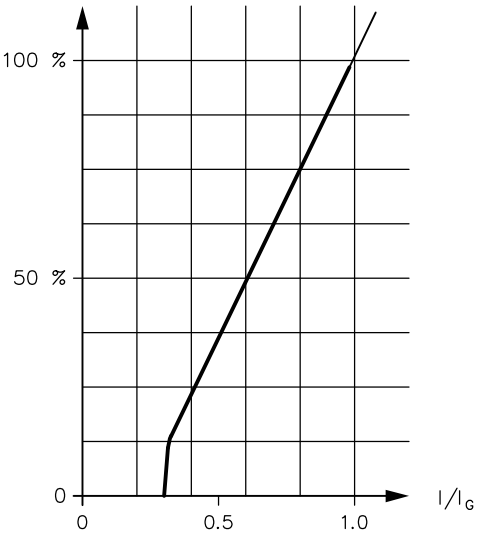
3.5.1 Electro-hydraulic actuation with standard solenoid

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.

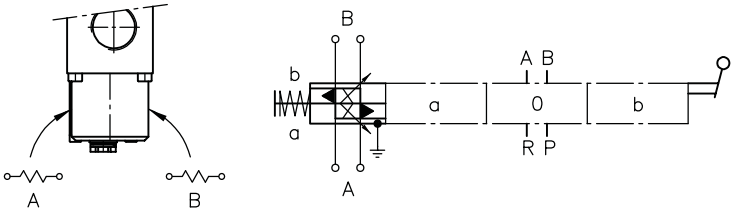
Nominal voltage U_N	12 V DC	24 V DC
Resistance R_{20}	6.3 Ω	27.0 Ω
Current, cold I_{20}	1.9 A	0.9 A
Limit current I_G	1.26 A	0.63 A
Limit power P_G	15.1 W	15.1 W
Duty cycle	S1 (100%)	
Dither frequency	40 - 70 Hz (recommended value 55 Hz)	
Dither amplitude $A_D(\%) = \frac{I_{Peak-Peak}}{IG} \cdot 100$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

I stroke characteristic curve



I/I_G control current; spool stroke (%)

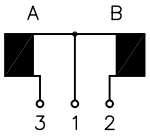
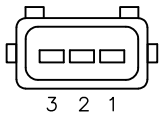
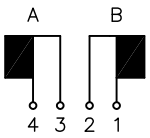
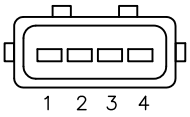
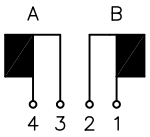
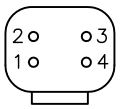
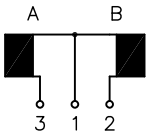
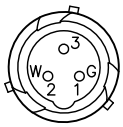
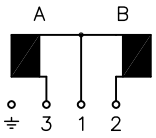
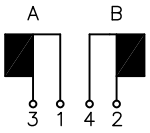
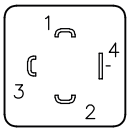
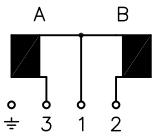
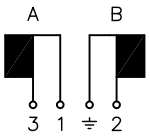
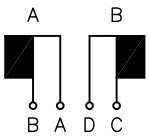
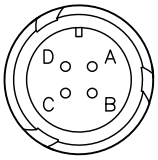
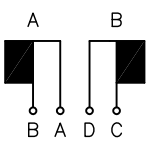
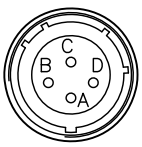
Ports



*Specifications for **A** and **B***

see Table “Electrical connection”, “Connection” column

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) C **G 12 (24) C**	EN 175 301-803 C 3-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 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
X 24 TEX 4 70 FM	▪ B ATEX ▪ B 41/2017 (EX23)
G 24 EX G 24 EX-10 m	▪ B ATEX ▪ B 01/2002 (EX01)
G 12 IS G 12 IS-10 m	▪ B ATEX ▪ B 17/2011 (EX05)
G 24 M2FP G 24 M2FP-10 m	▪ B ATEX ▪ B 04/2005 (EX05)
G 24 MSHA G 24 MSHA-10 m G 24 MSHA-20 m	▪ B ATEX ▪ B 04/2005 (EX05)

3.5.3 Switching position monitoring, displacement transducer

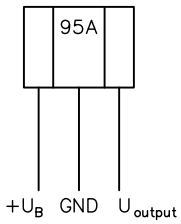
Coding WA

Coding	Electrical connection	Protection class (IEC 60529)
WA	EN 175 301-803 A	IP 65
WA-S	Bayonet coupling PA6 Schlemmer	IP 67
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

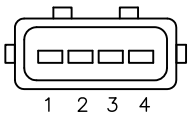
Sensor assignment:



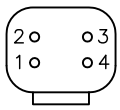
WA

WA-S

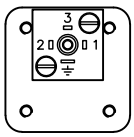
WA-AMP

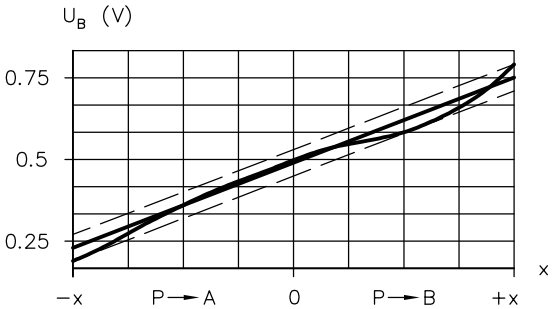


WA-DT



WA-C





x spool stroke; UB 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.

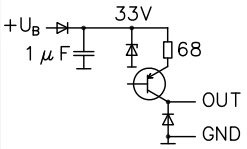
Coding U

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



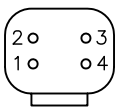
Open-Collector:
I_{max} = 10 mA
short-circuit-proof

Status table

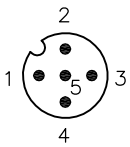
Running no.	Spool valve action	Signal outputs PNP transistor with open collector:	
		OUTA	OUTB
1	Neutral position in centre	ON	ON
2	P → B	OFF	ON
3	P → A	ON	OFF

U

U-DT



U-M



3.5.4 Switching position monitoring, displacement transducer for potentially explosive atmospheres

NOTICE

When using displacement transducers for potentially explosive atmospheres, it is essential to observe the operating instructions B ATEX and the separate operating instructions for the respective displacement transducer.

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

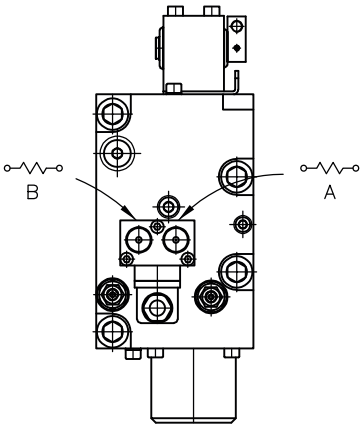
Coding	Operating instructions with declaration of conformity
WA-EX	▪ B ATEX ▪ B 10/2008 (EX09)
WA-M2FP	▪ B ATEX ▪ B 10/2008 (EX09)
WA-IS	▪ B ATEX ▪ B 31/2013 (EX16)

Coding	Operating instructions with declaration of conformity
WA-MSHC	▪ B ATEX ▪ B 10/2008 (EX09)

3.5.5 Electric LS relief or LS pressure limitation

Electric LS relief coding F 1, F 2, F 3, FH 1, FH 2, FH 3

Nominal voltage U_N	12 V DC	24 V DC
Resistance R_{20}	8.7 Ω	34.8 Ω
Current, cold I_{20}	1.38 A	0.69 A
Limit current I_G	0.97 A	0.48 A
Limit power P_G	11.6 W	11.6 W
Duty cycle	S1 (100%)	

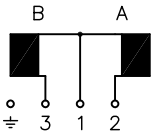
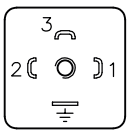


For specifications for **A** and **B** see Table “Electrical connection”, “Connection” column.

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
The electrical LS relief’s on/off twin solenoids are only available with DIN connectors and manual override (coding -G..T(H), -X..T(H) or -L..T(H).

Electrical connection

Coding	Specification	Connection	Plug
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)		

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
X 24 TEX 4 70 FM	▪ B ATEX ▪ B 41/2017 (EX23)

3.5.7 Additional valves

The types of plugs available are described in Chapter 2.7, "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.

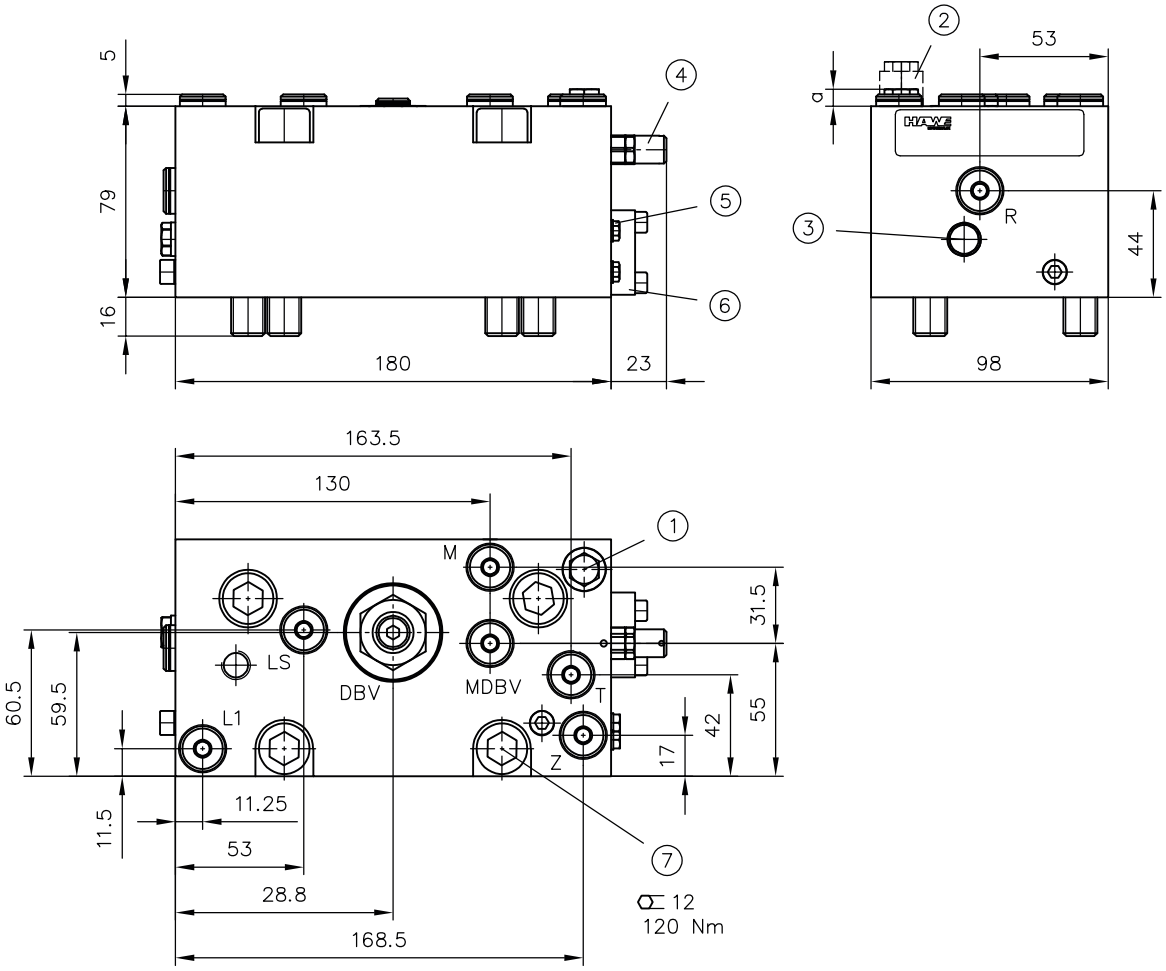
4.1 Controller block

see Chapter 2.1, "Controller block"

4.1.1 Controller block, basic types

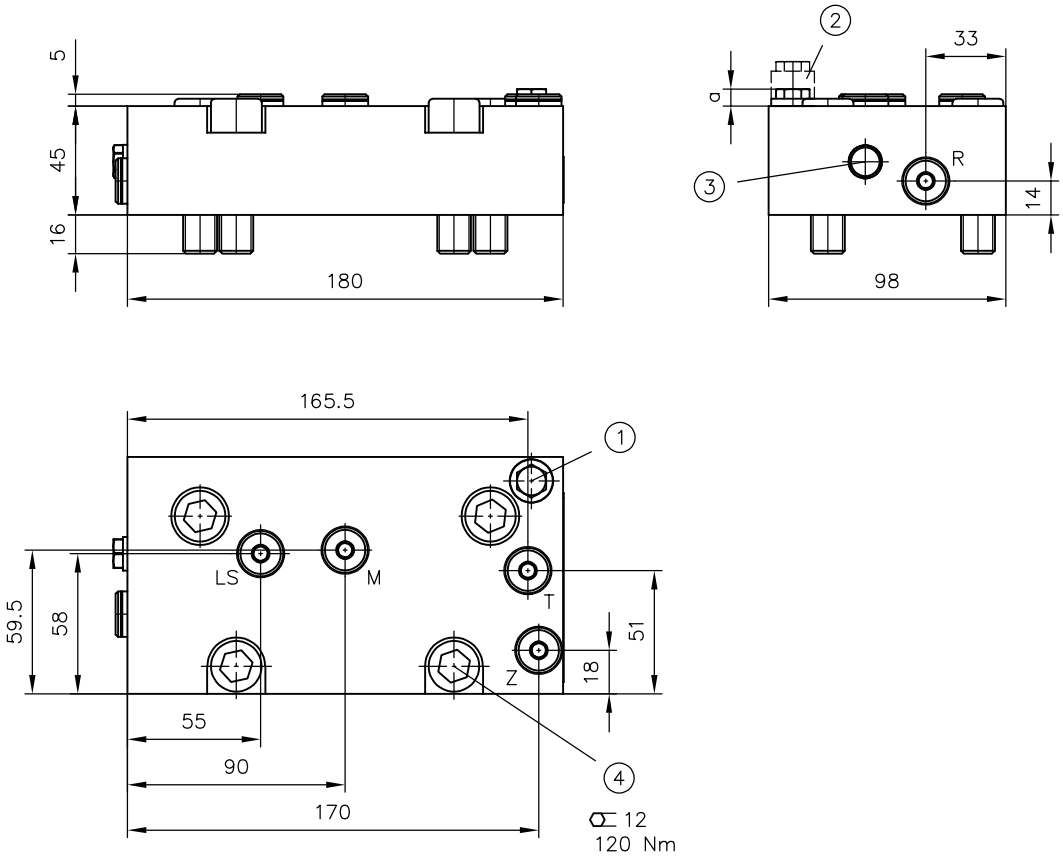
see Chapter 2.1.2, "Controller block, basic types"

PSVF../..-7



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 Mounting point for additional valve for LS relief or LS pressure limitation
6 PSV idle circulation valve, without designation
7 Cylinder screw ISO 4762-M14x80-A2-70

PSVF AX..-7



1 Internal control oil supply coding 1 or without coding
2 Internal control oil supply coding 2
3 LS damping
4 Cylinder screw ISO 4762-M14x50-A2-70

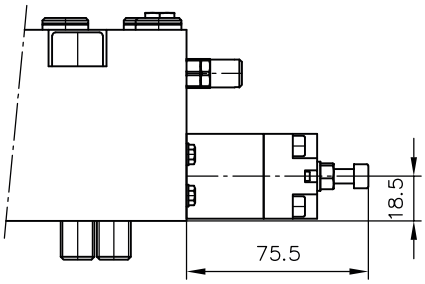
Coding	a
without coding	6.5
1	6.5
2	18.4

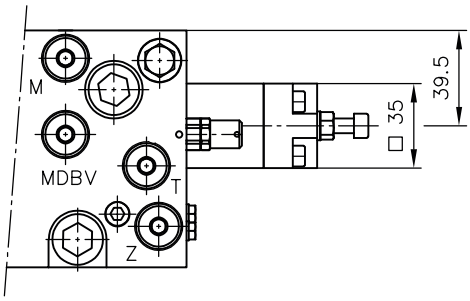
Type	Ports (ISO 228-1)
	M, Z, LS, T, MDBV, L1, R
PSVF../..-7 PSVF AX..-7	G 1/4

4.1.2 PSV idle circulation valve

see Chapter 2.1.3, "PSV idle circulation valve"

Coding **A**



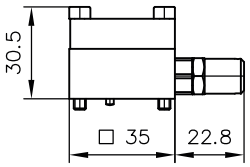


4.1.3 LS relief or LS pressure limitation

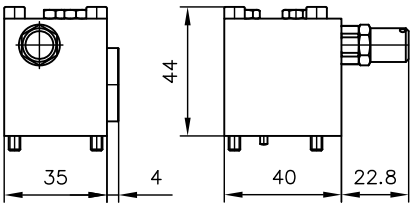
see Chapter 2.1.6, "LS relief or LS pressure limitation"

without coding

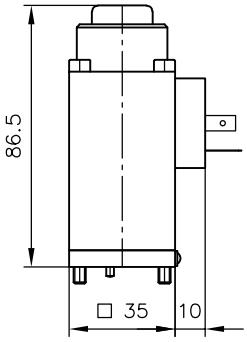
Coding **X**



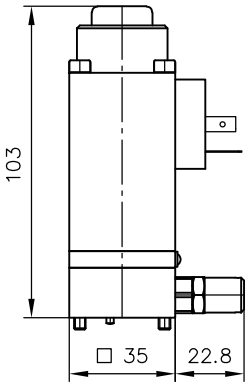
Coding **VX**



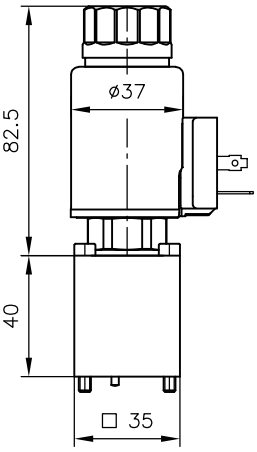
Coding **F, D**



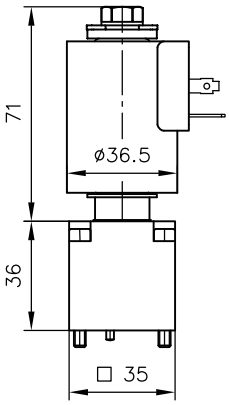
Coding **F.., D..**



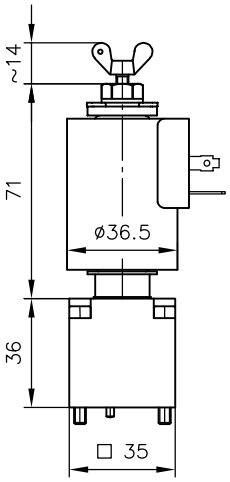
Coding **F BVE, D BVE**



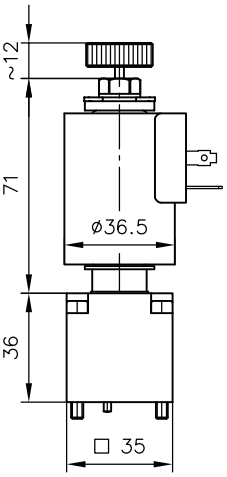
Coding **V, Z**



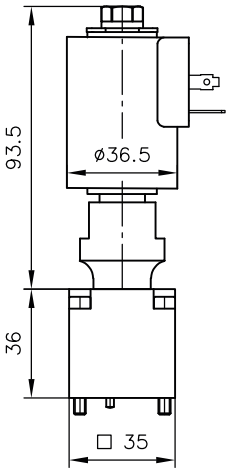
Coding **ZM**



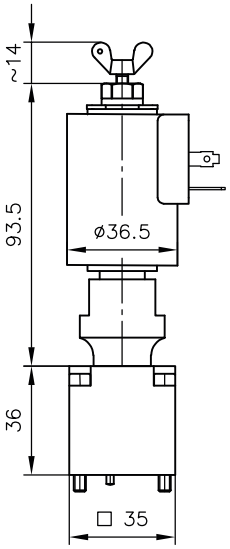
Coding **ZP**



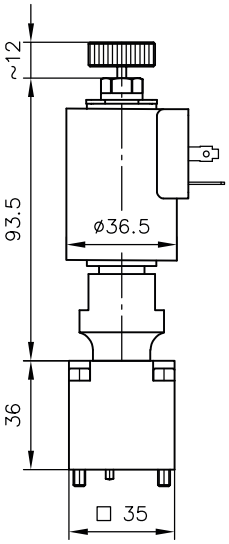
Coding **VA, ZA**



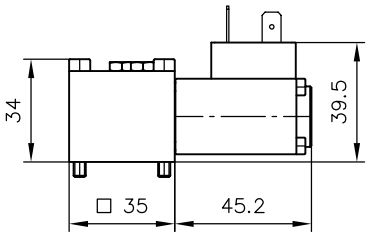
Coding **ZAM**



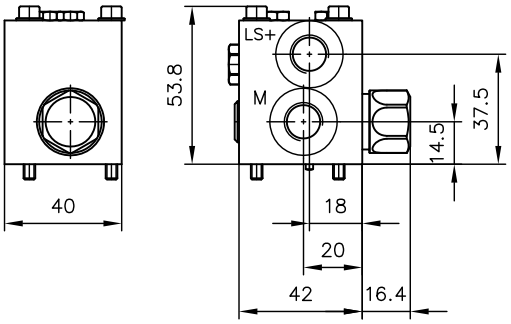
Coding **ZAP**



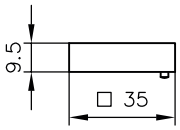
Coding **PA, PB, PC, PD**



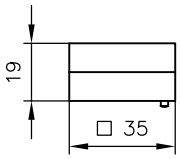
Coding **Z ADM..**



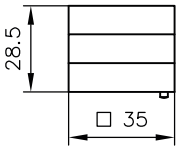
Coding **X9**



Coding **X18**



Coding **X27**

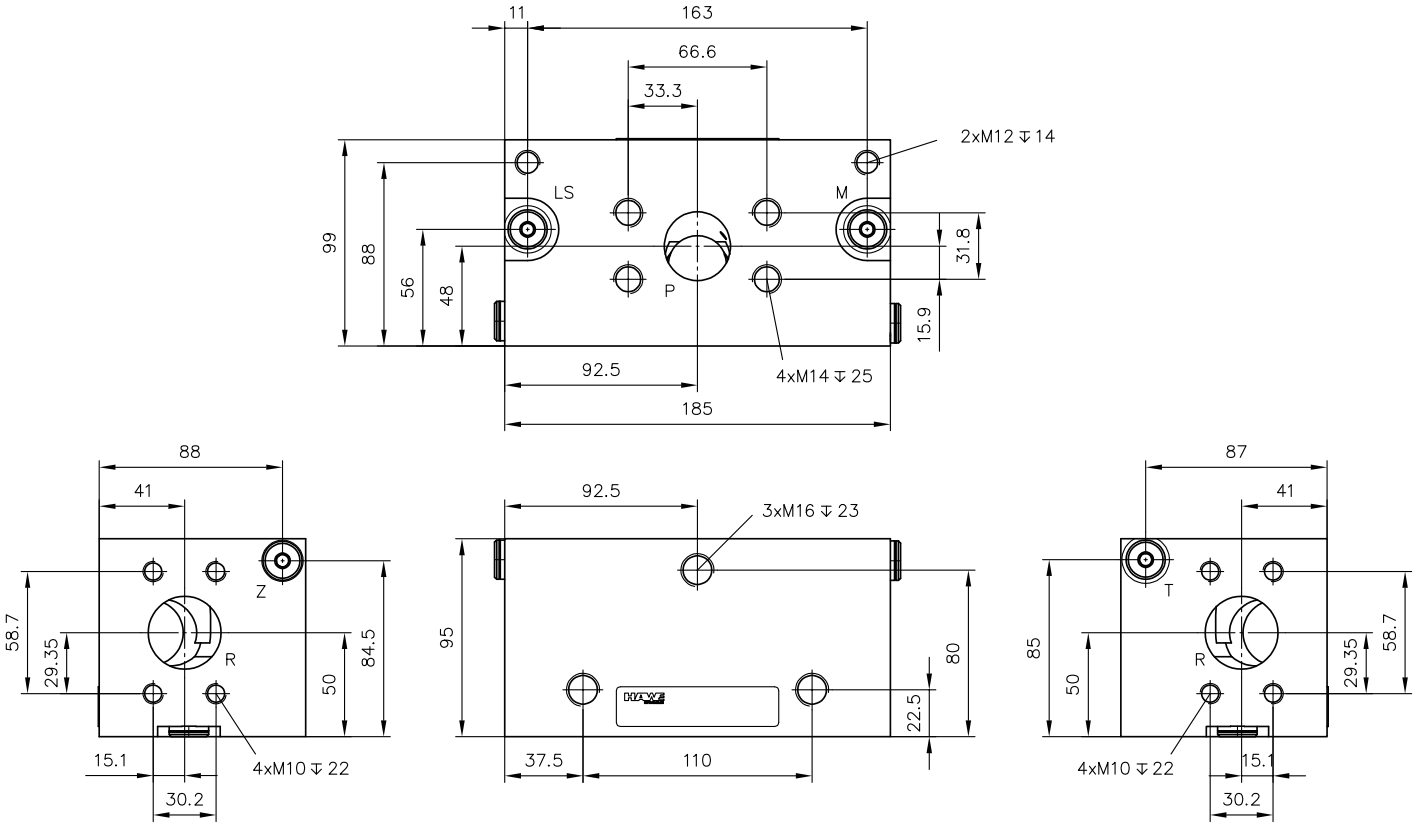


4.2 Connection plate, controller block

see Chapter 2.2, "Connection plate, controller block"

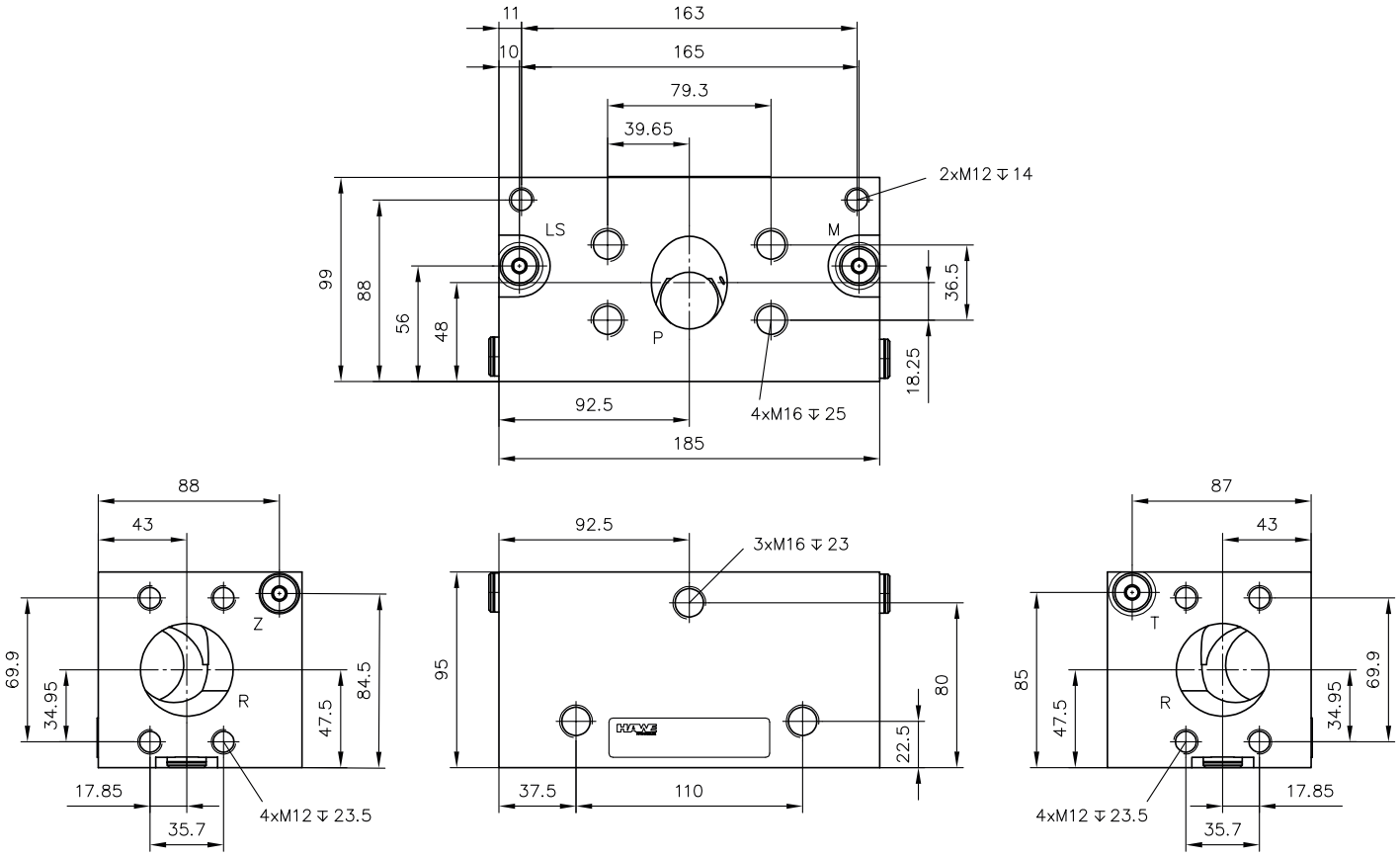
4.2.1 Connection plate, basic types

Coding **/6 SAE**



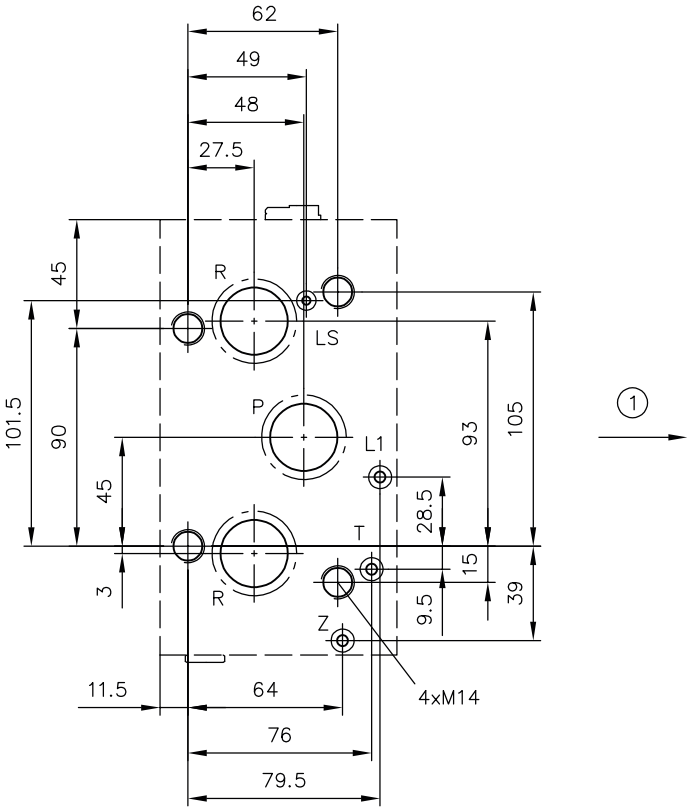
Coding	Ports (ISO 228-1 or SAE J 514)	
	Z, M, LS, T	P, R
/6 SAE	G 1/4	SAE 1 1/4

Coding **/7 SAE**



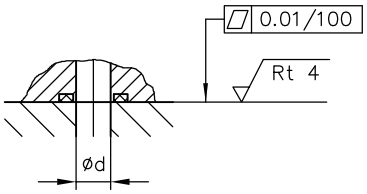
Coding	Ports (ISO 228-1 or SAE J 514)		
	P	**R**	**M, LS, Z, T**
/7 SAE	SAE 1 1/2" (6000 psi)	SAE 1 1/2" (3000 psi)	G 1/4

4.2.2 Hole pattern



1 Valve section

Base plate



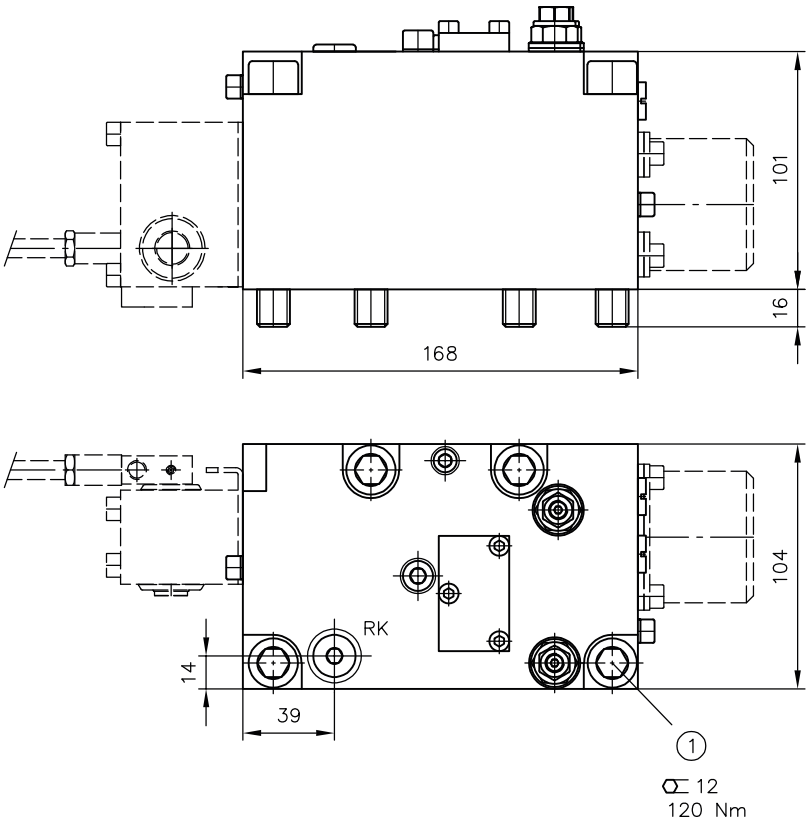
Controller block

Port	∅d	O-ring PUR 90 Sh
P	20	29.82x2.62
F (R)	20	29.82x2.62
M, LS, L1, Z	4,7	6.07x1.78

4.3 Valve section

4.3.1 Valve section

With interface to a sub-plate as per see Chapter 2.4, "Sub-plate - valve section".

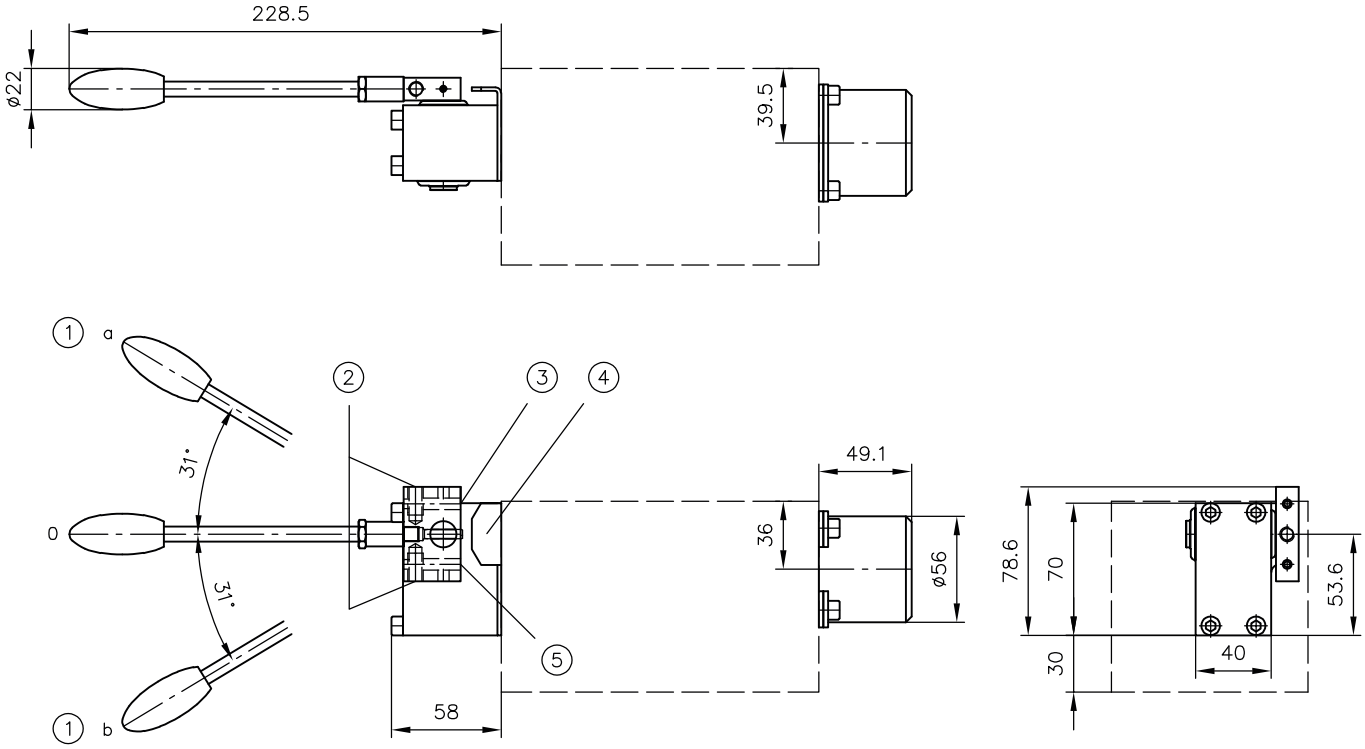


1 Cylinder screw ISO 4762-M14x100-A2-70

	Ports (ISO 228-1)
RK	G 1/4

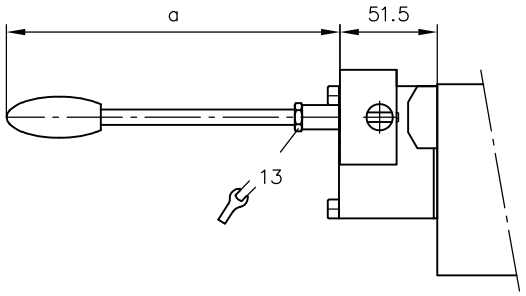
Directional valve section with manual actuation

Actuation **A, C**



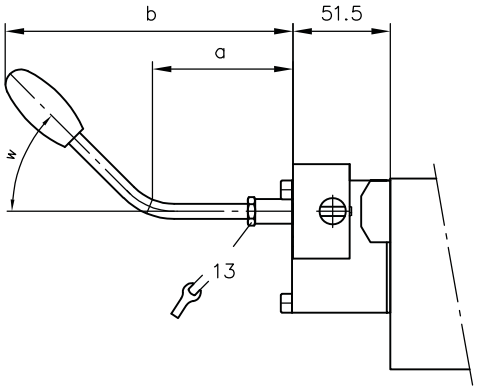
1 Switching position 0, a and b
2 Hand lever can also be mounted here, thread M8, 15 deep.
This lever position cannot be used in combination with ancillary blocks.
3 Travel stop for flow rate limitation in A
4 Travel stop / intermediate sheet
5 Travel stop for flow rate limitation in B

Lever straight



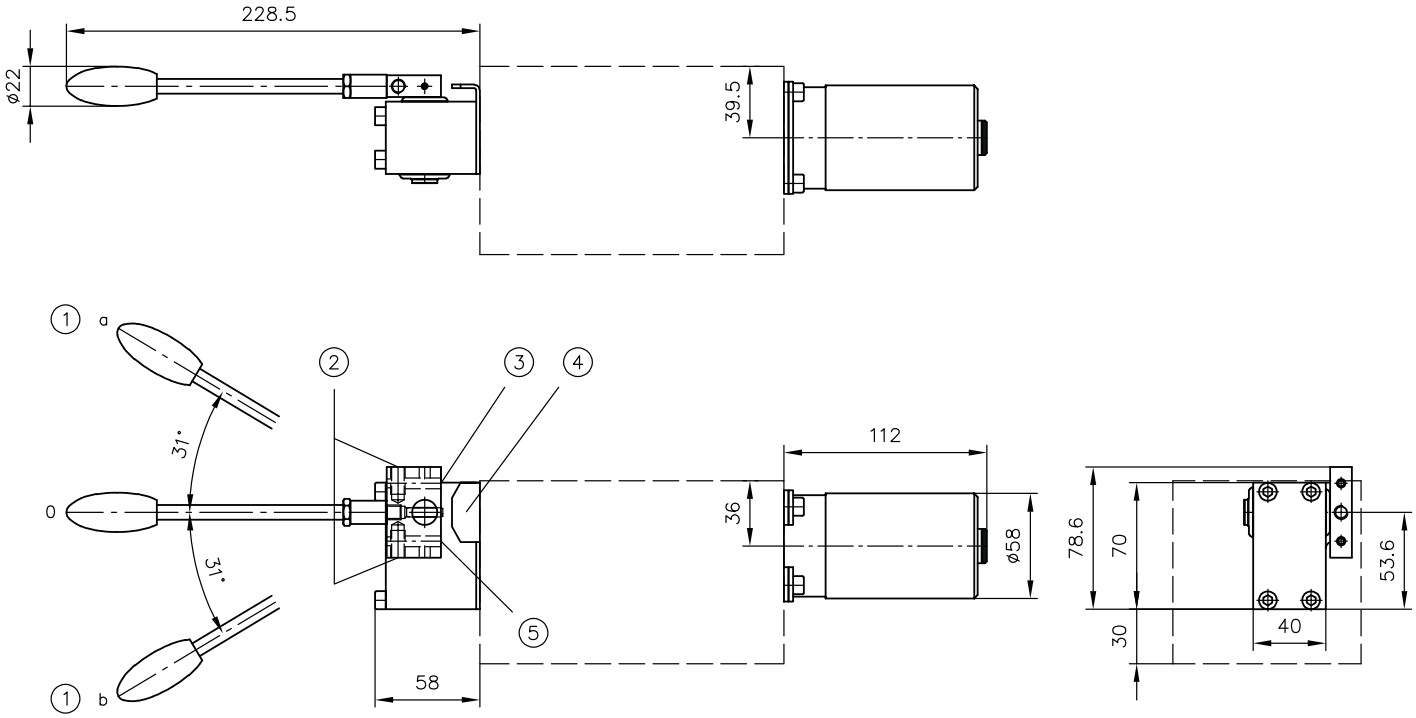
Coding	a
without coding	177
1	--
2	106

Lever for angle



Coding	a	b	w
045	74,5	152	45°
212	26,5	104	12.5°

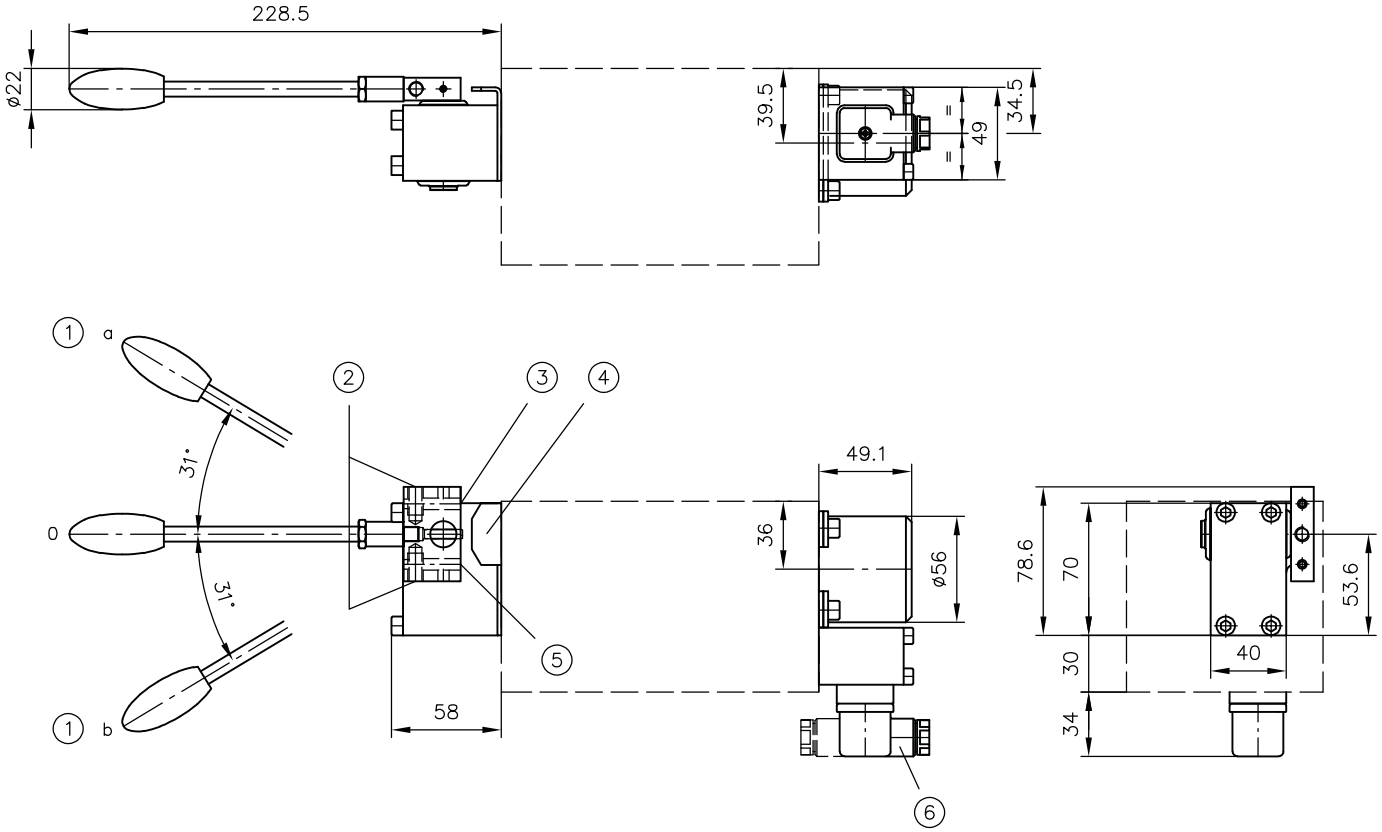
Actuation **AR**



1 Switching position 0, a and b
2 Hand lever can also be mounted here, thread M8, 15 deep.
This lever position cannot be used in combination with ancillary blocks.
3 Travel stop for flow rate limitation in A
4 Travel stop / intermediate sheet
5 Travel stop for flow rate limitation in B

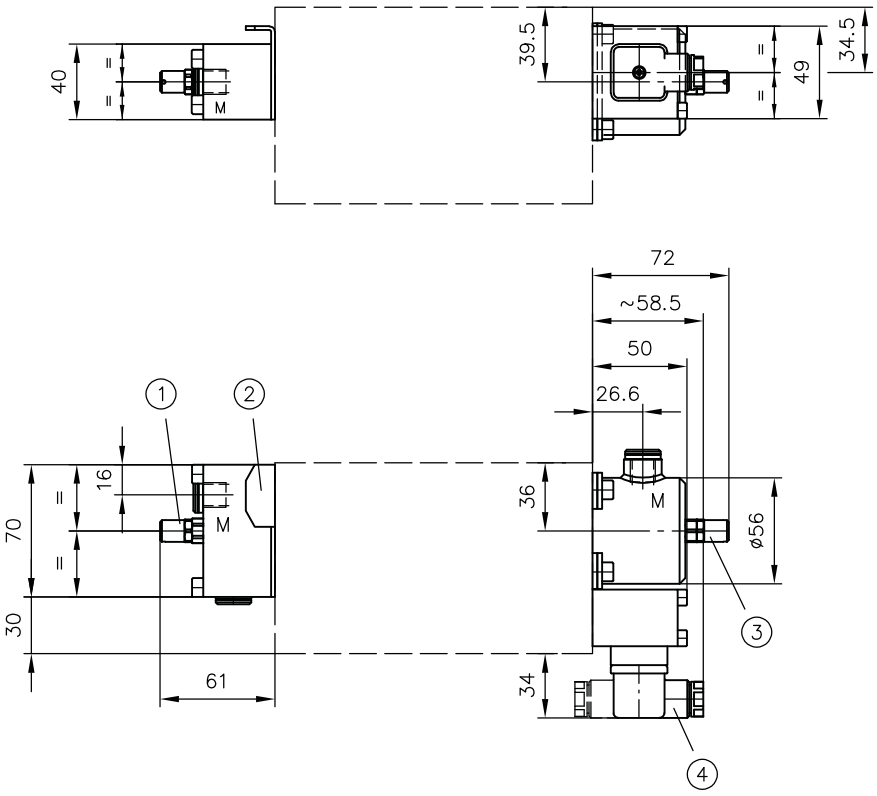
Directional valve section with electro-hydraulic actuation

Actuation **EA**



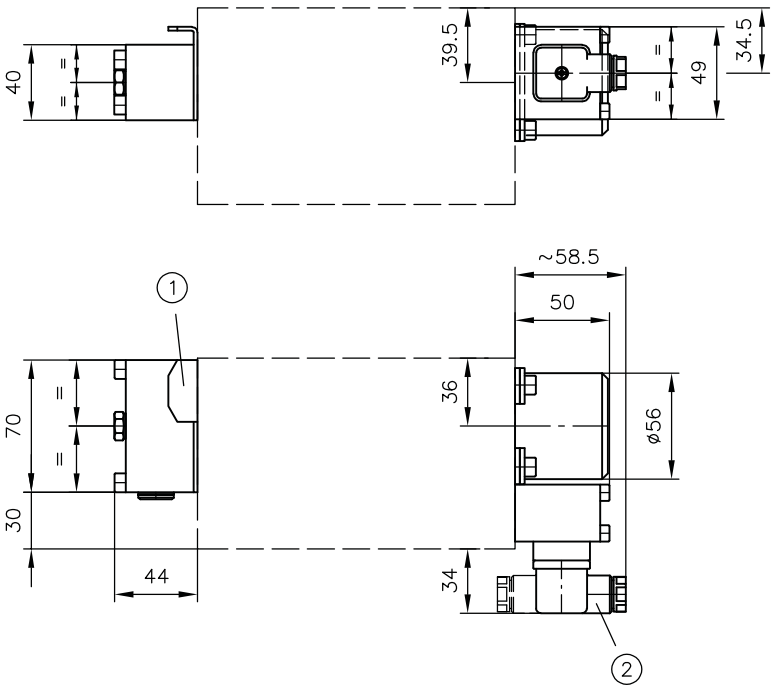
1 Switching position 0, a and b
2 Hand lever can also be mounted here, thread M8, 15 deep.
This lever position cannot be used in combination with ancillary blocks.
3 Travel stop for flow rate limitation in A
4 Travel stop / intermediate sheet
5 Travel stop for flow rate limitation in B
6 Male connector can be mounted offset by 180°

Actuation **EM**



1 Travel stop for flow rate limitation in A
2 Travel stop intermediate sheet
3 Travel stop for flow rate limitation in B
4 Male connector can be mounted offset by 180°

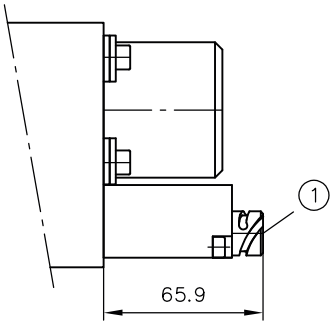
Actuation **EI**



1 Travel stop intermediate sheet
2 Male connector can be mounted offset by 180°

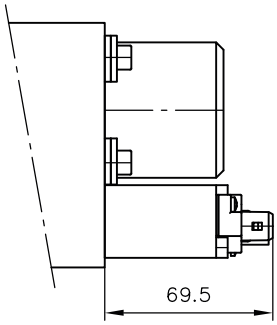
Solenoid version drawings

S 12 (T), S 24 (T)

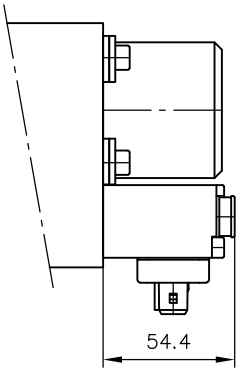


1 Bayonet plug connection PA 6

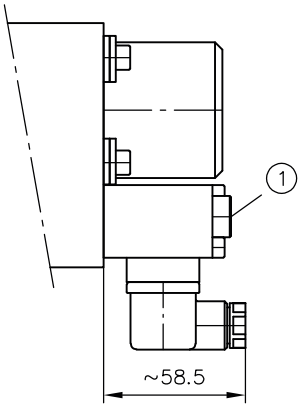
AMP 12 K 4, AMP 24 K 4



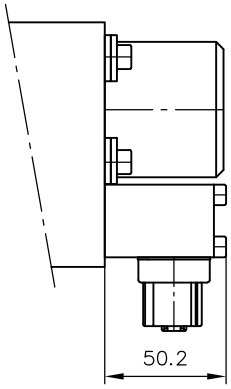
AMP 24 H 4 T



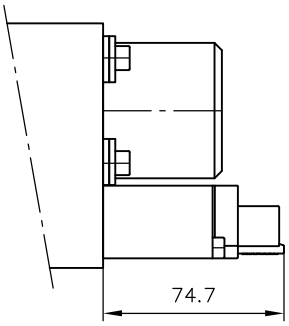
G 12 T, G 24 T
X 12 T, X 24 T



DT 12, DT 24

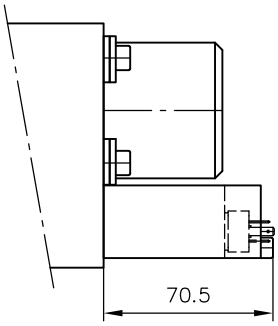


DT 12 K, DT 24 K

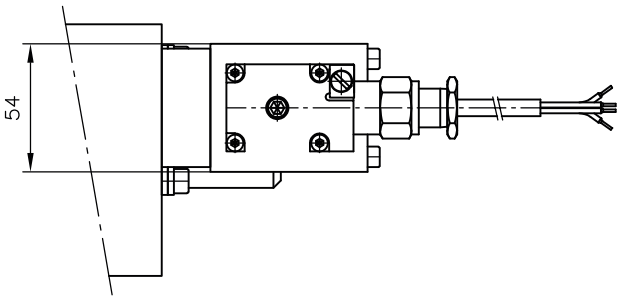


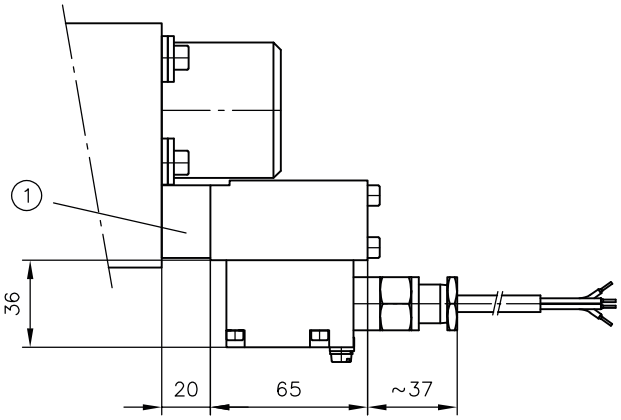
1 Manual override

G 24 C 4, X 24 C 4



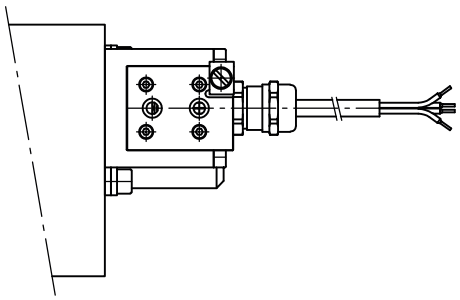
G 12 IS, G 12 MSHA, G 24 M2FP

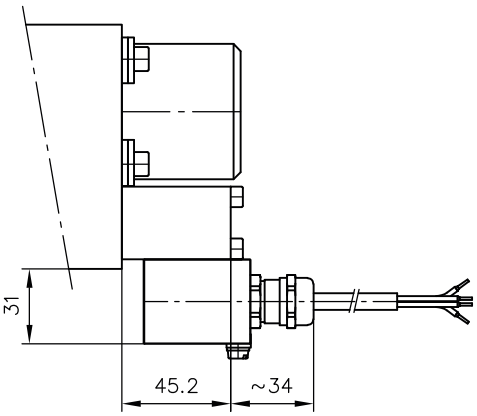




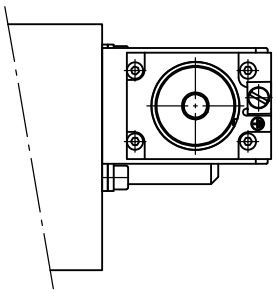
1 Intermediate plate only in combination with actuations ER and EAR

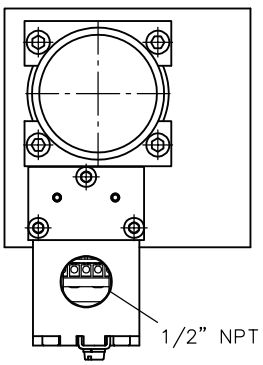
G 24 EX, G 24 EX 4

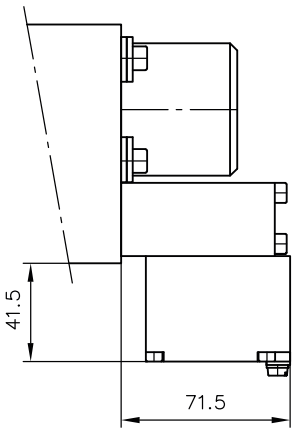




X 24 TEX 4 70 FM

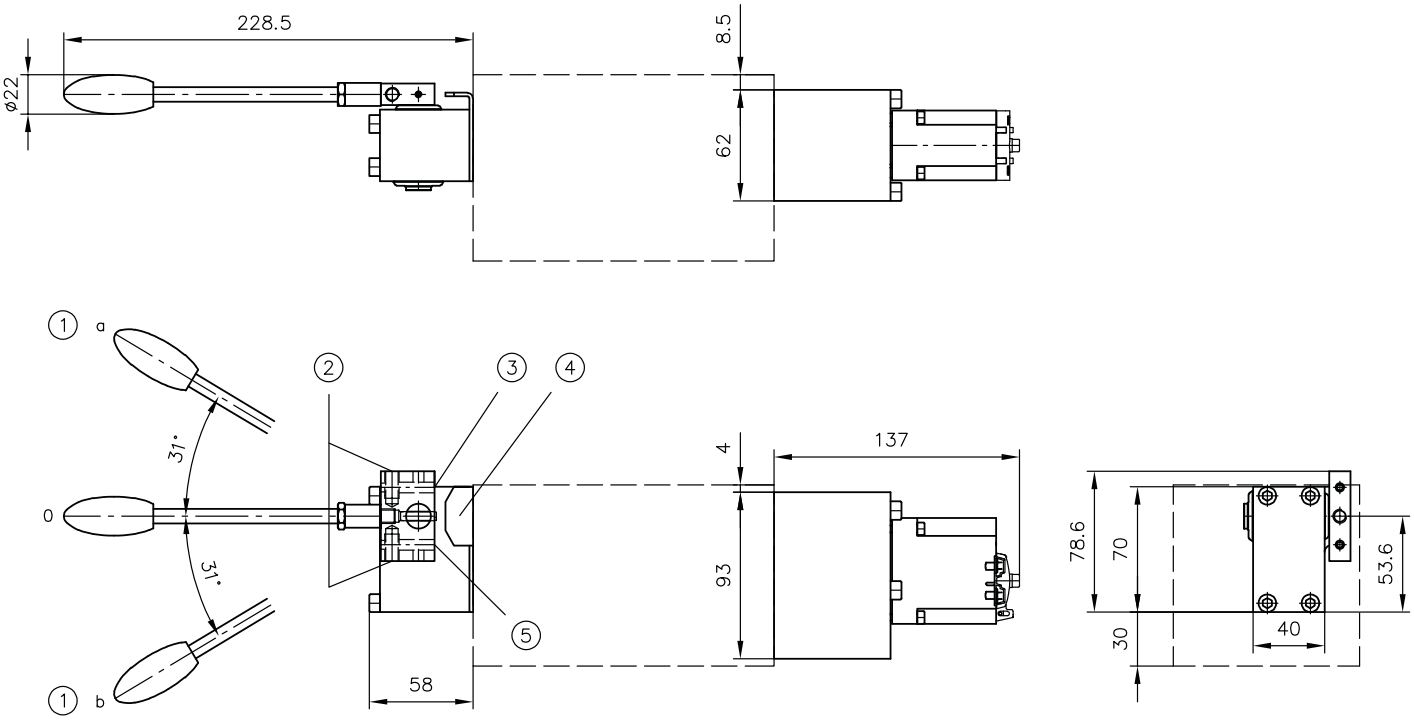






Directional valve section with CAN actuation

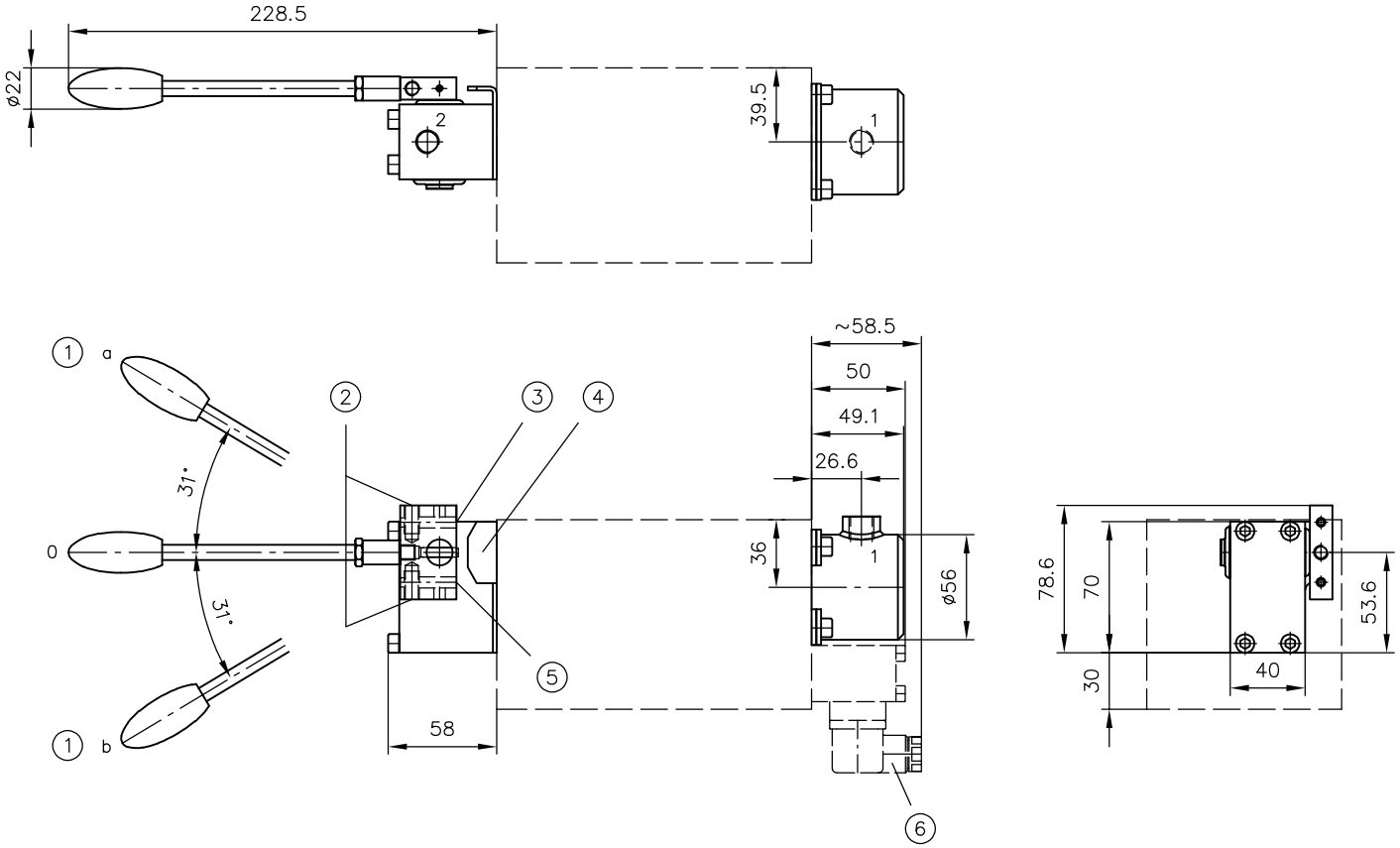
Actuation **EACAN**



1 Switching position 0, a and b
2 Hand lever can also be mounted here, thread M8, 15 deep.
This lever position cannot be used in combination with ancillary blocks.
3 Travel stop for flow rate limitation in A
4 Travel stop / intermediate sheet
5 Travel stop for flow rate limitation in B

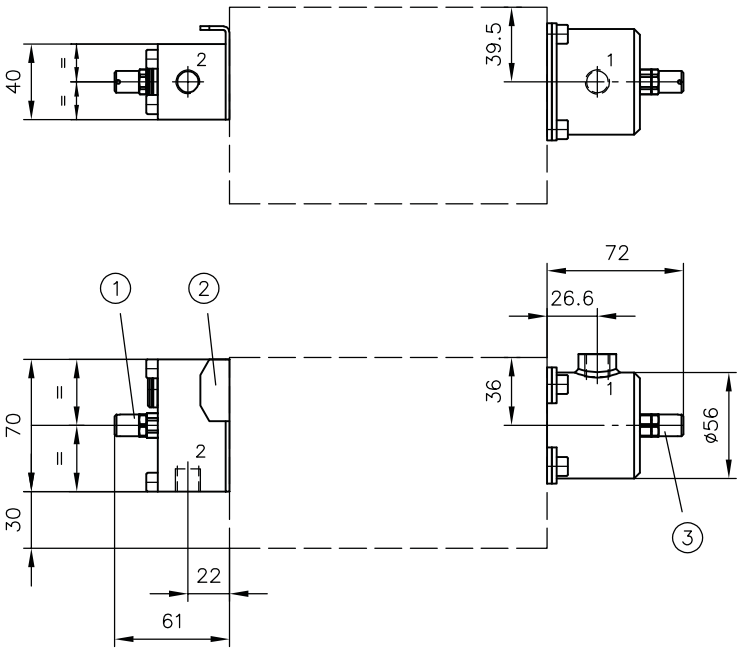
Directional valve section with hydraulic actuation

Actuation **EHA**



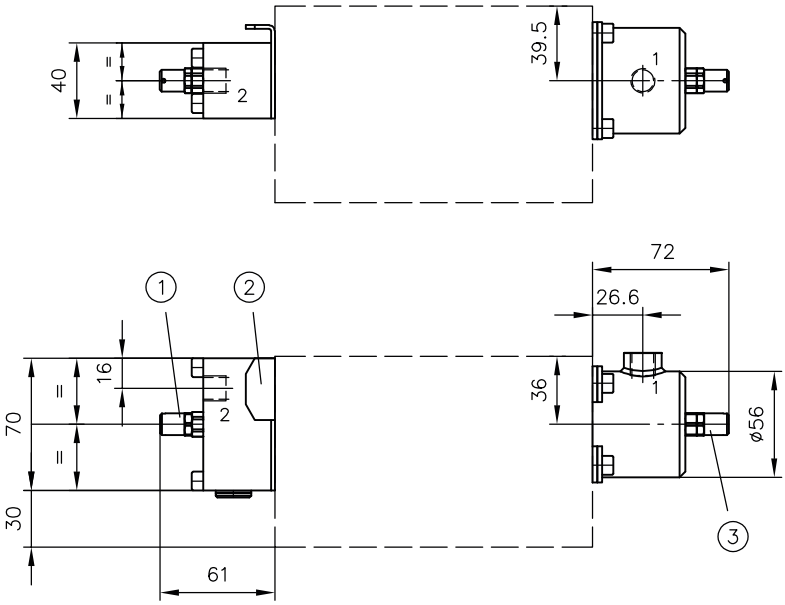
1 Switching position 0, a and b
2 Hand lever can also be mounted here, thread M8, 15 deep.
This lever position cannot be used in combination with ancillary blocks.
3 Travel stop for flow rate limitation in A
4 Travel stop / intermediate sheet
5 Travel stop for flow rate limitation in B
6 Male connector can be mounted offset by 180°

Actuation **H**



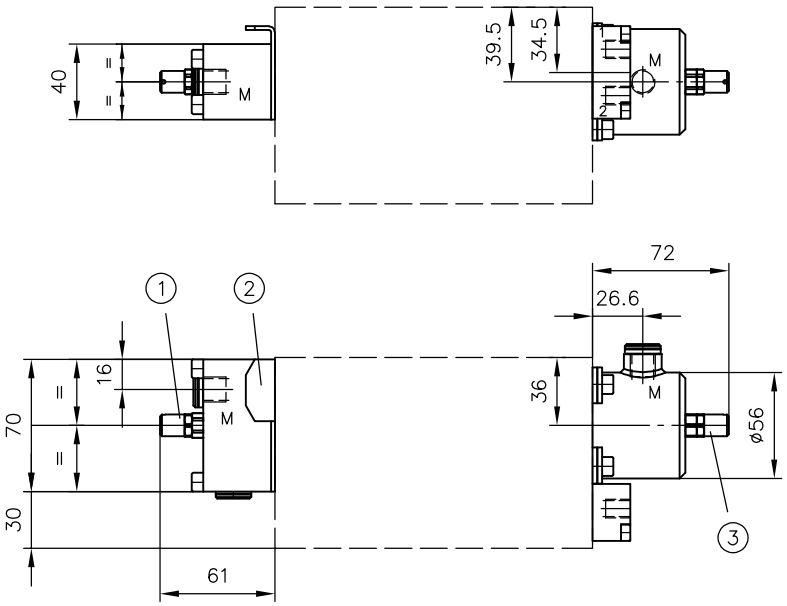
1 Travel stop for flow rate limitation in A
2 Travel stop / intermediate sheet
3 Travel stop for flow rate limitation in B

Actuation **F**



1 Travel stop for flow rate limitation in A
2 Travel stop / intermediate sheet
3 Travel stop for flow rate limitation in B

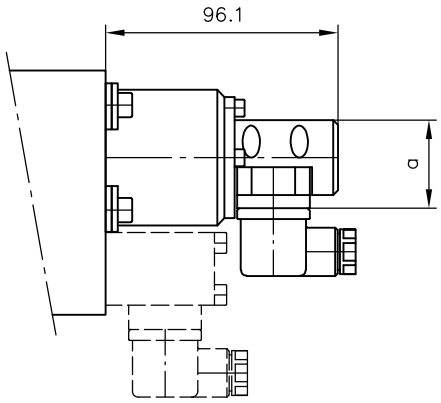
Actuation **EOZM**



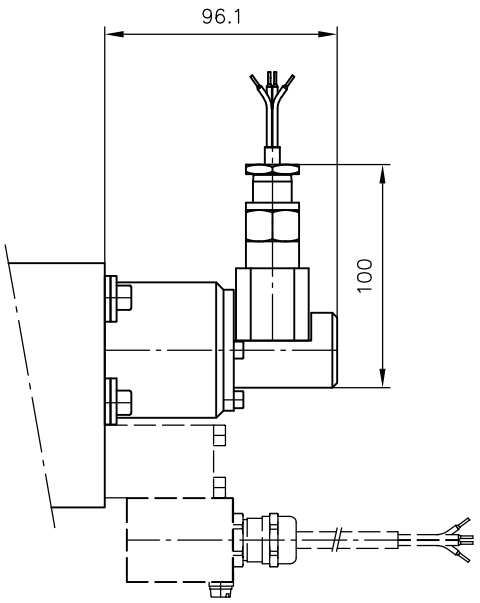
1 Travel stop for flow rate limitation in A
2 Travel stop / intermediate sheet
3 Travel stop for flow rate limitation in B

4.3.2 Switching position monitoring, displacement transducer

Coding **U, WA**



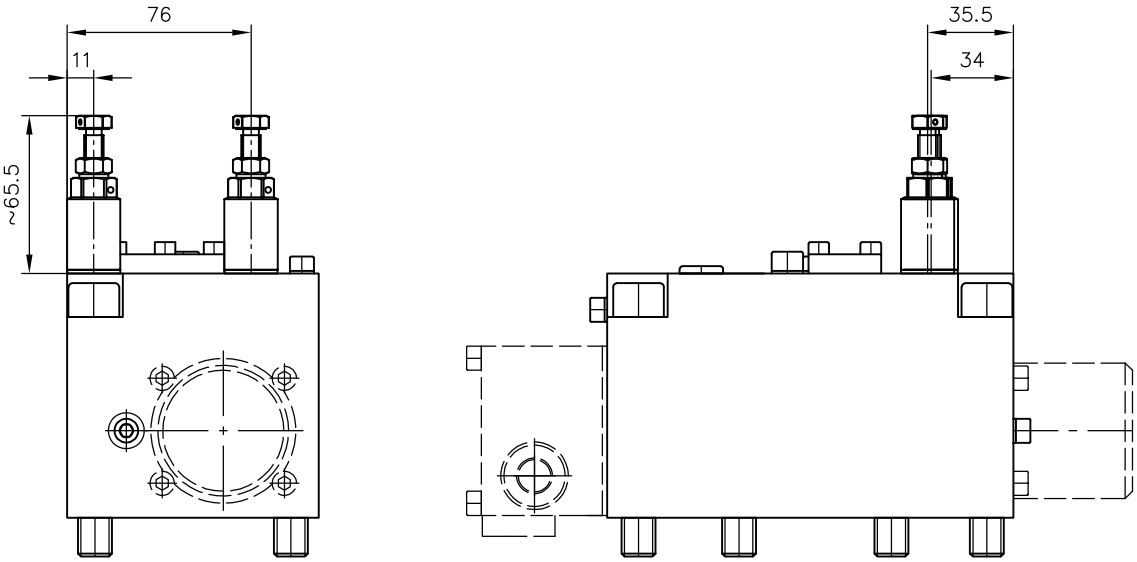
Coding **WA-EX, WA-IS**



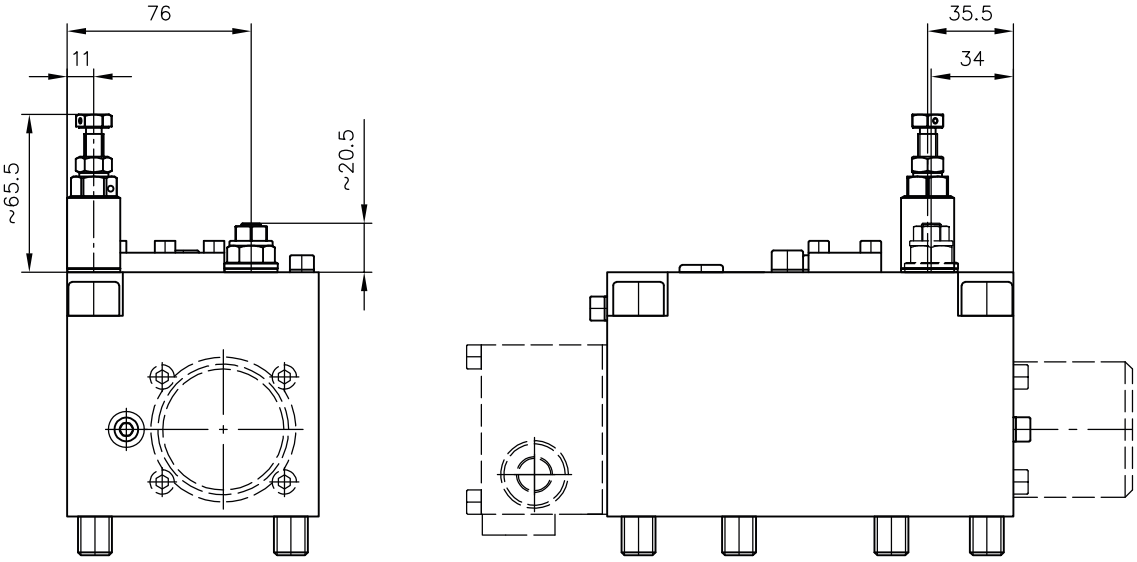
Coding	a
WA	36,4
U	49,5

4.3.3 LS pressure limitation

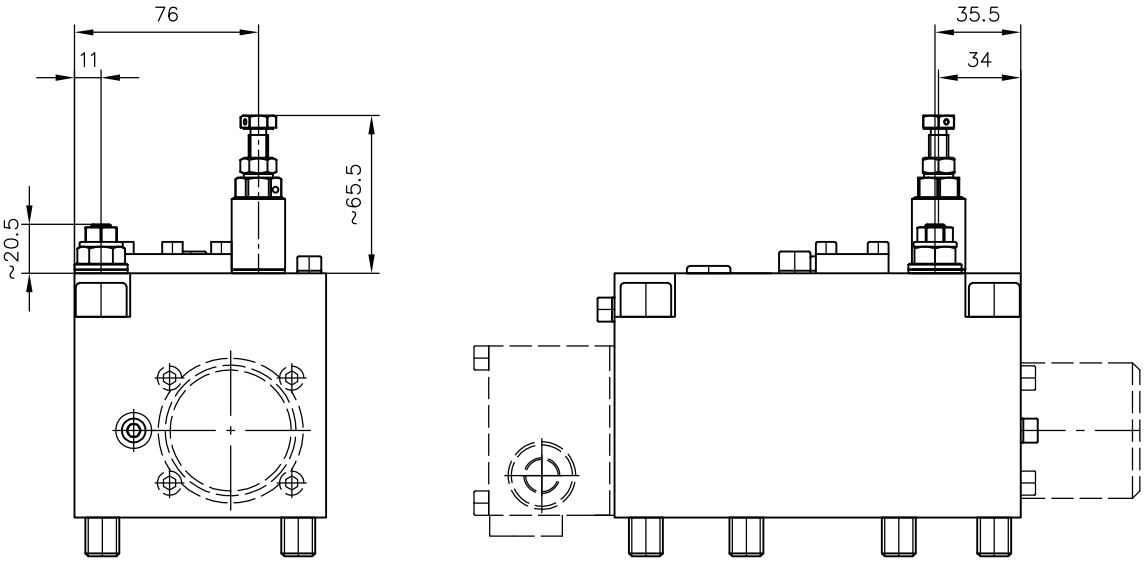
Coding **A.. B..**



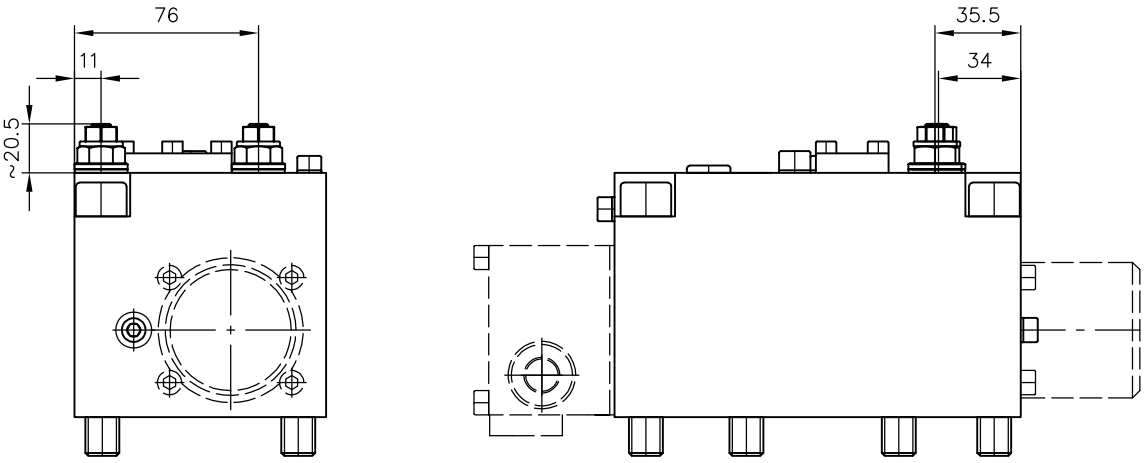
Coding **A..**



Coding **B..**

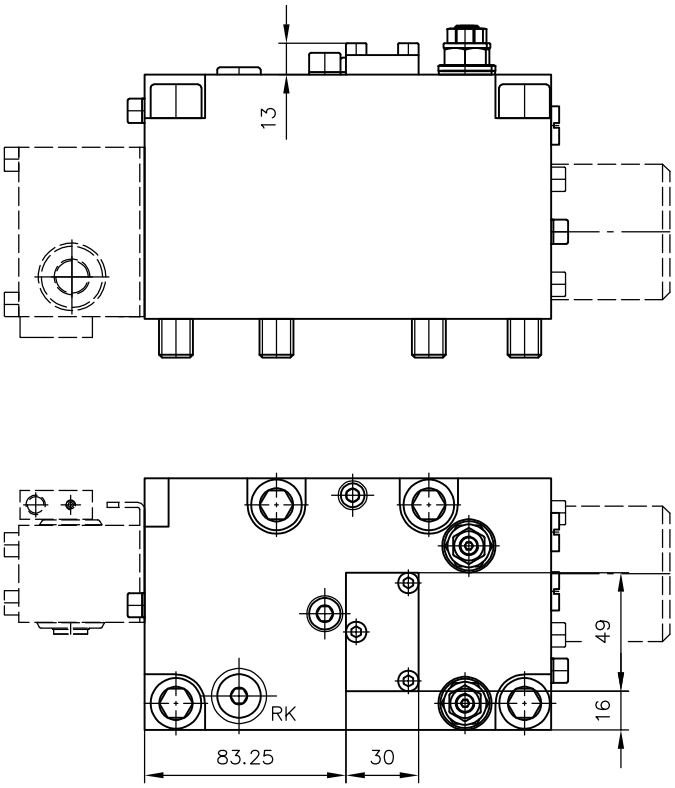


Coding **AB**

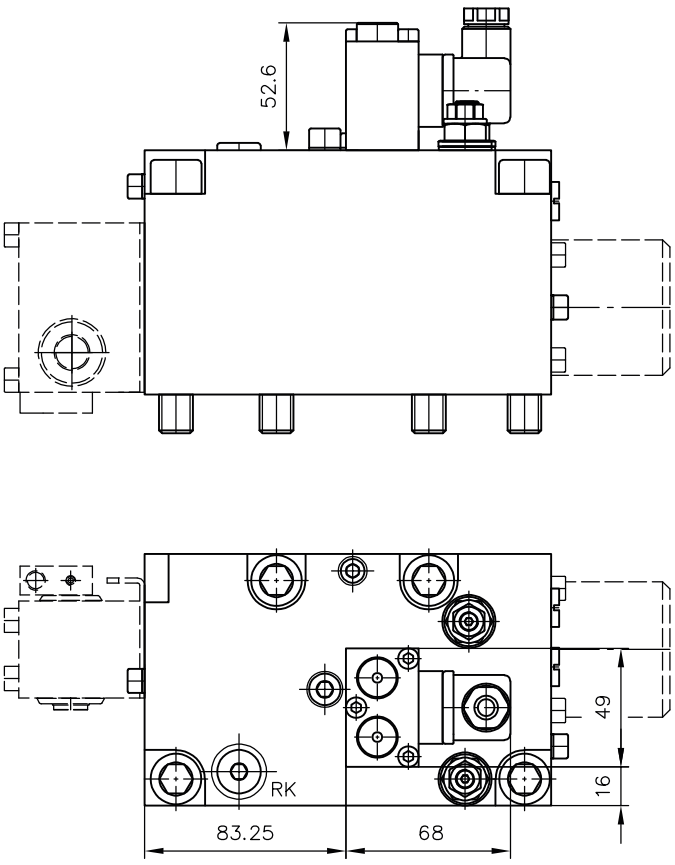


4.3.4 Electric LS relief or LS pressure limitation

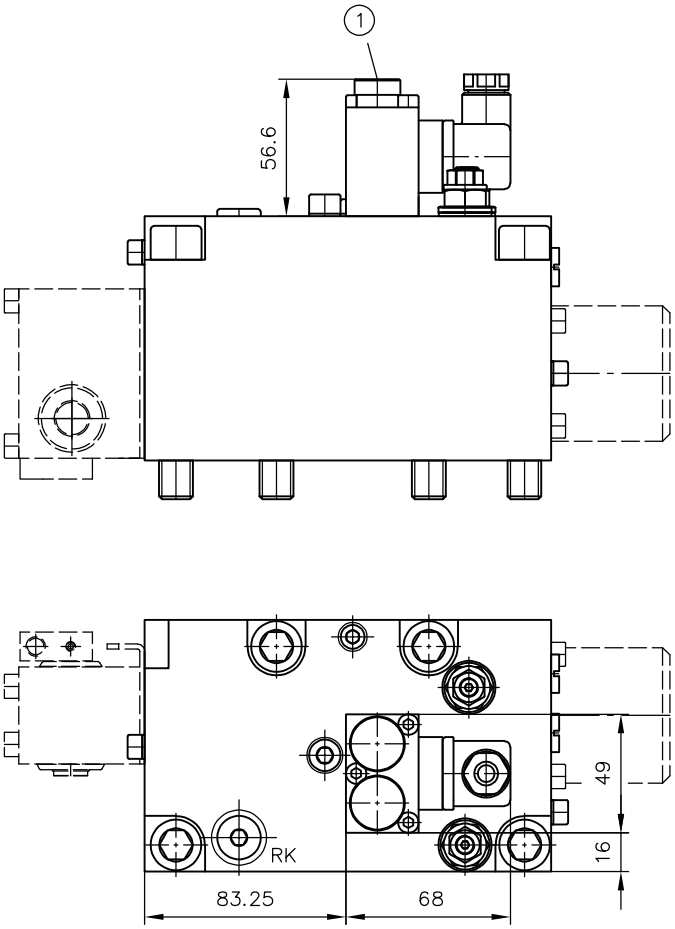
Coding **F 0**



Coding **F 1, F 2, F 3**



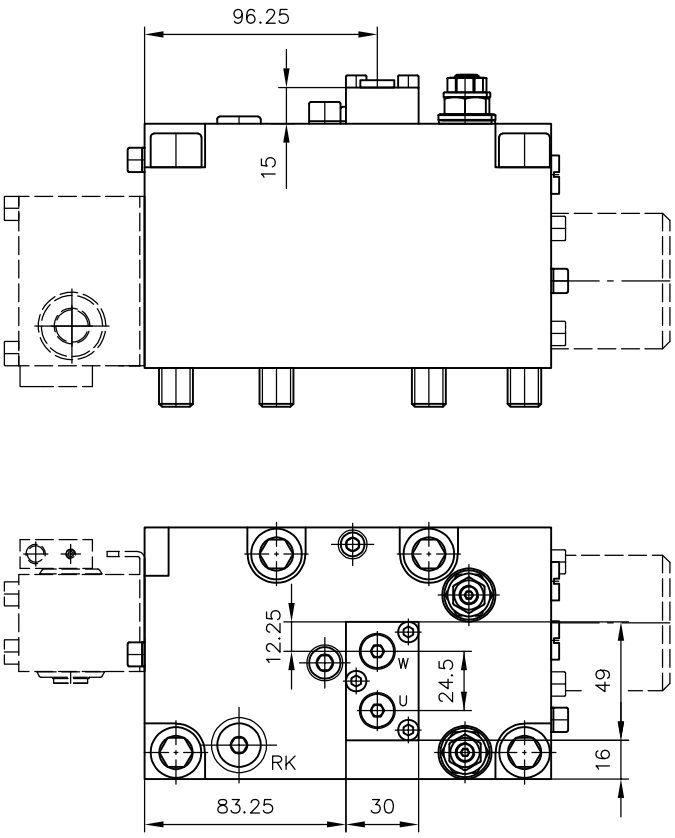
Coding **FH 1, FH 2, FH 3**



1 Button (manual override) for type FH..

4.3.5 LS port for external limitation

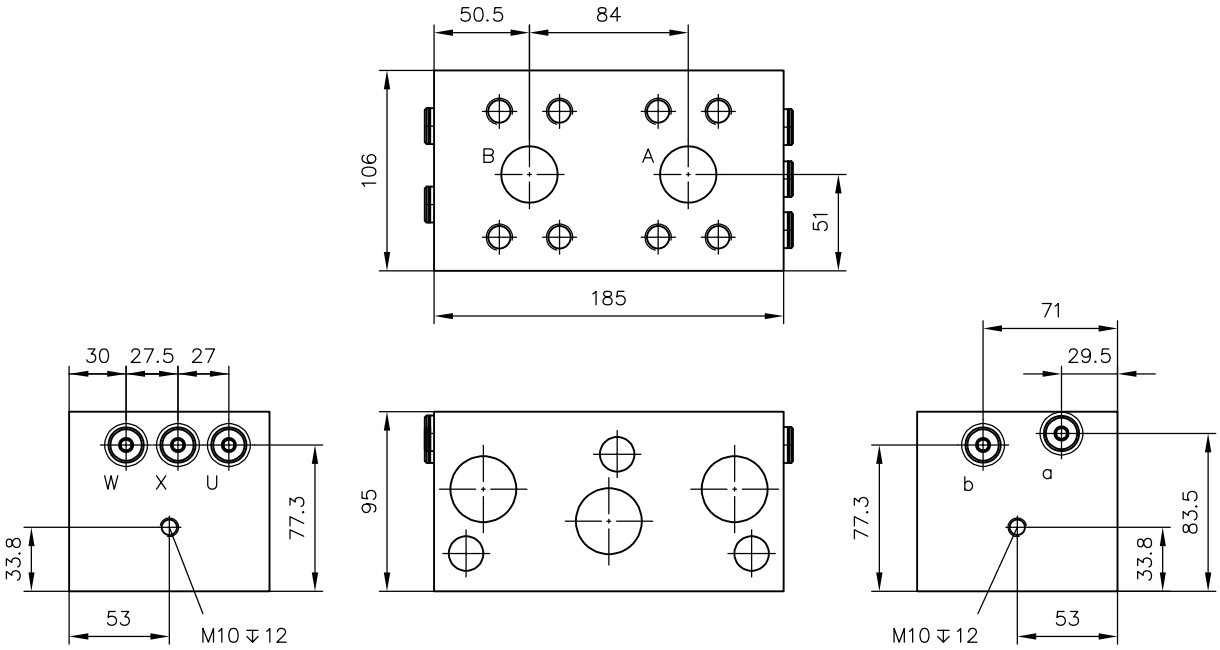
Coding **S 1**



4.4 Sub-plate - valve section

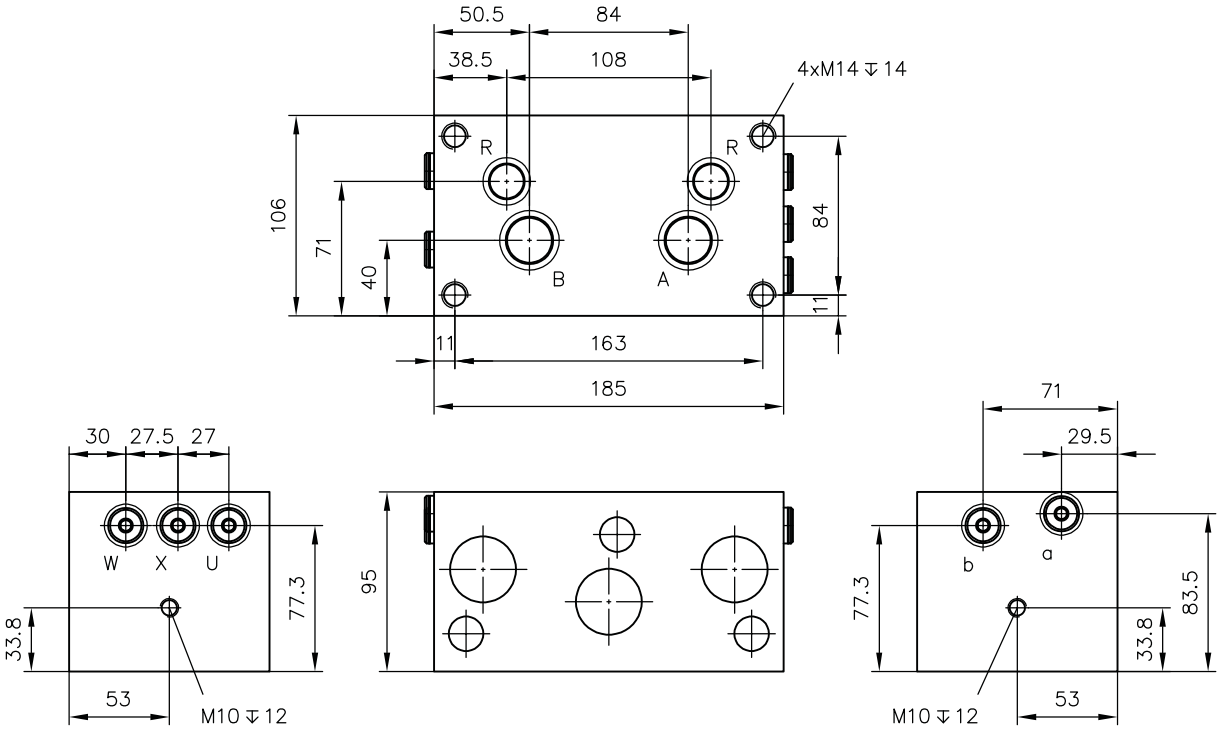
4.4.1 Basic types

Coding **/6 SAE**



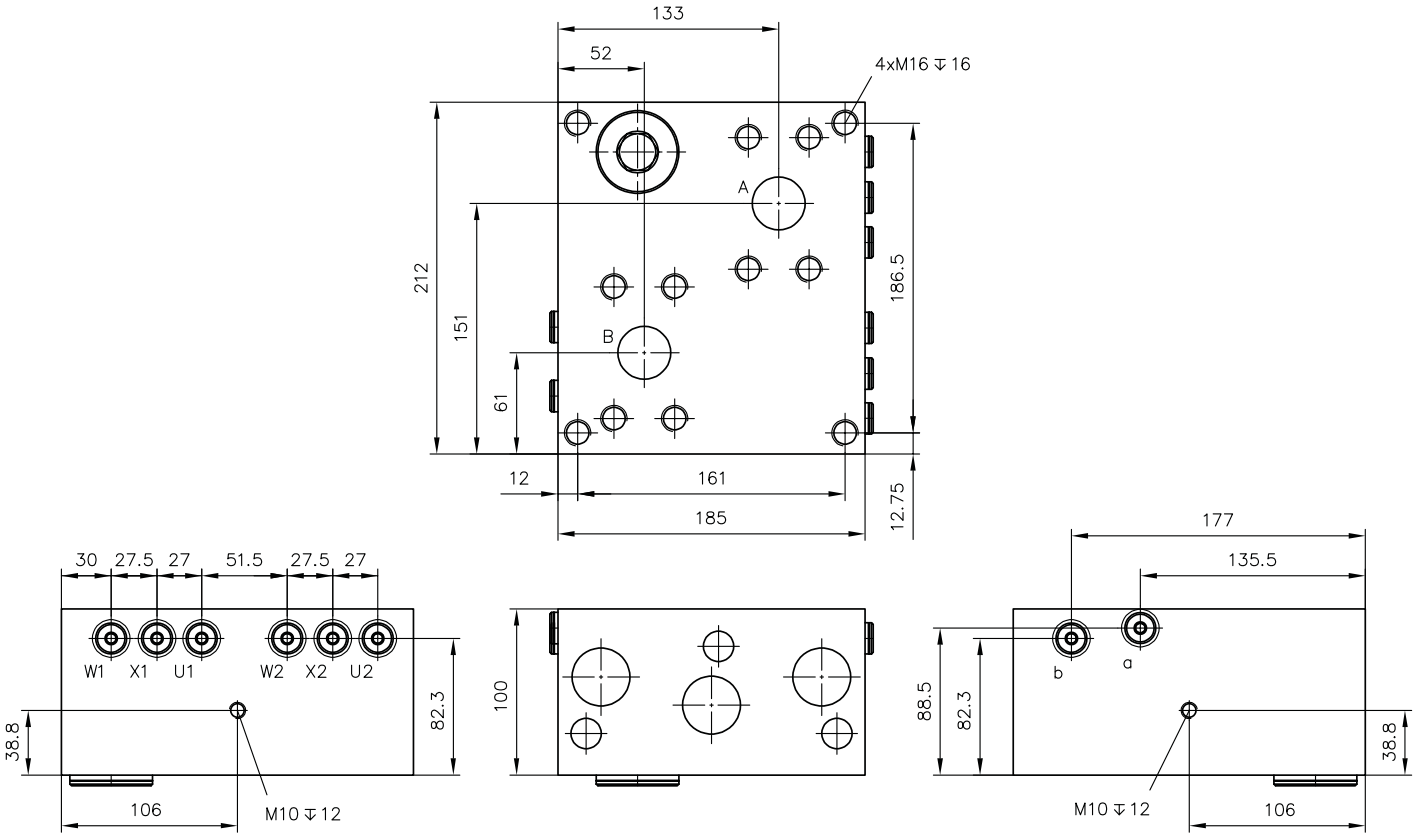
Coding	Ports (ISO 228-1 or SAE J 514)	
	a, b, W, X, U	A, B
/6 SAE	G 1/4	SAE 1 1/4

Coding **/U7**



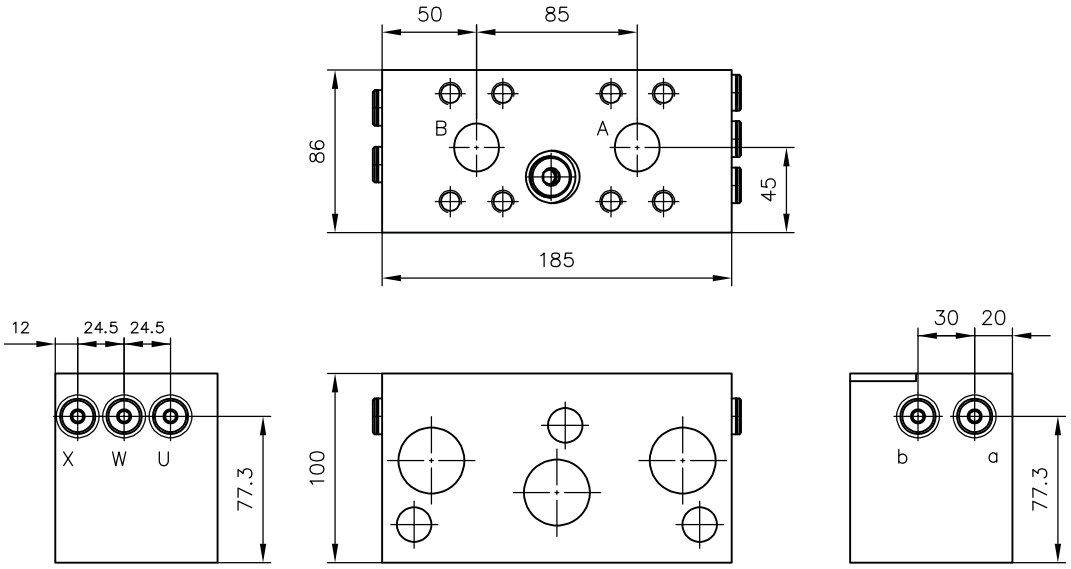
Coding	Ports (ISO 228-1 or SAE J 514)	
	a, b, W, X, U	A, B
/U7	G 1/4	SAE 1 1/4

Coding **/7D SAE**



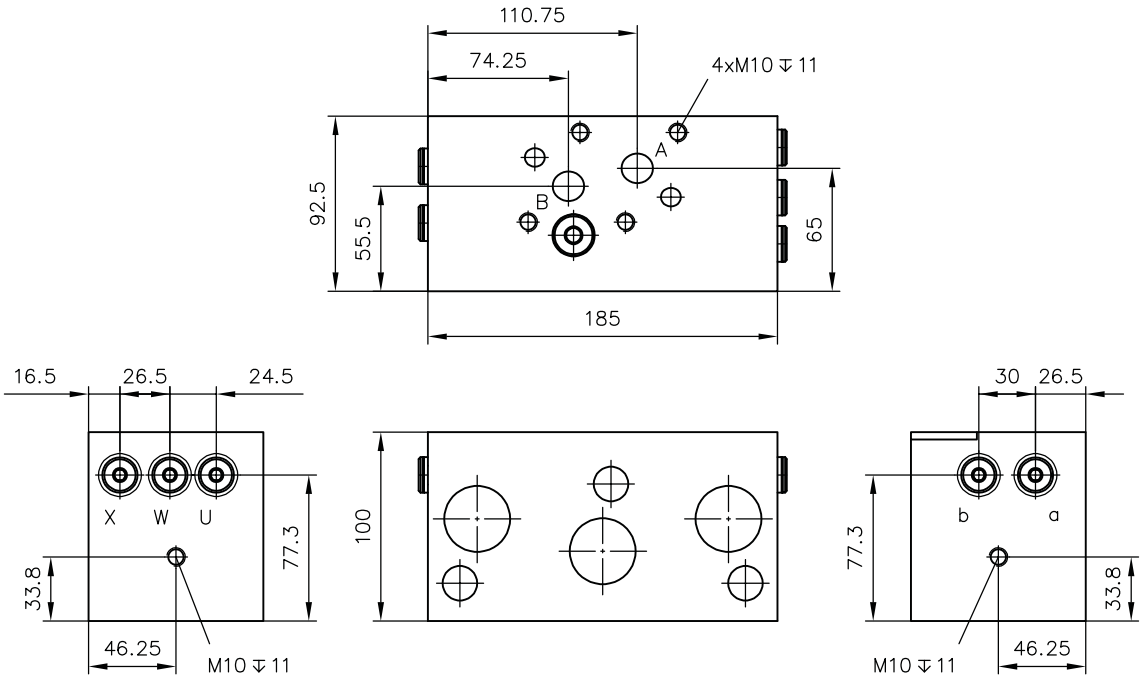
Coding	Ports (ISO 228-1 or SAE J 514)	
	a, b, W1, X1, U1, W2, X2, U2	A, B
/7D SAE	G 1/4	SAE 1 1/2

Coding **/55 SAE**



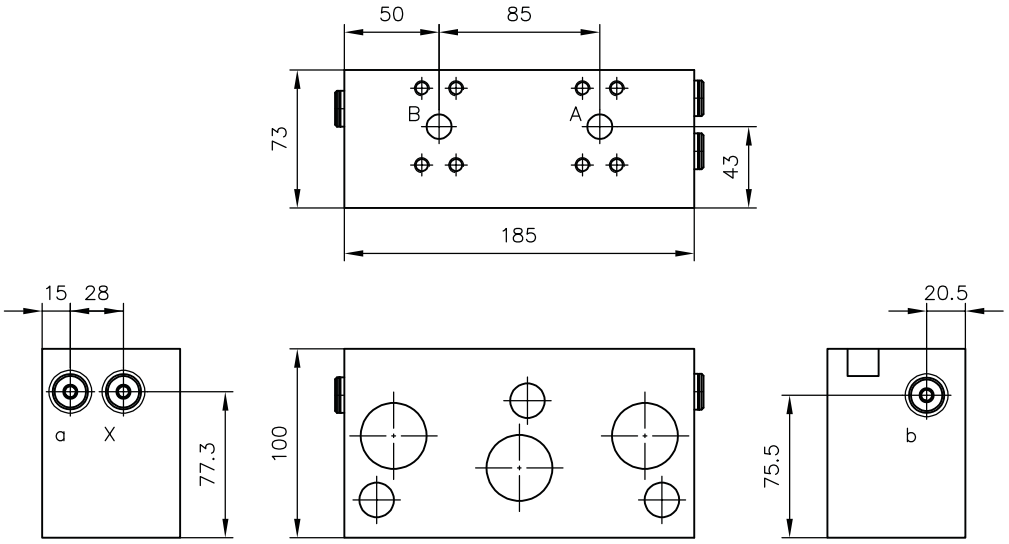
Coding	Ports (ISO 228-1 or SAE J 514)	
	a, b, W, X, U	A, B
/55 SAE	G 1/4	SAE 1

Coding **/U55**



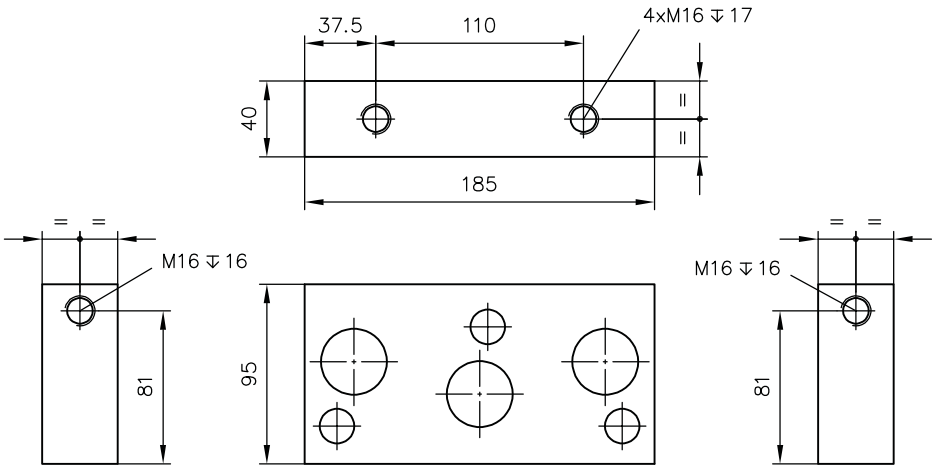
Coding	Ports (ISO 228-1)
	a, b, W, X, U
/U55	G 1/4

Coding **/33 SAE**

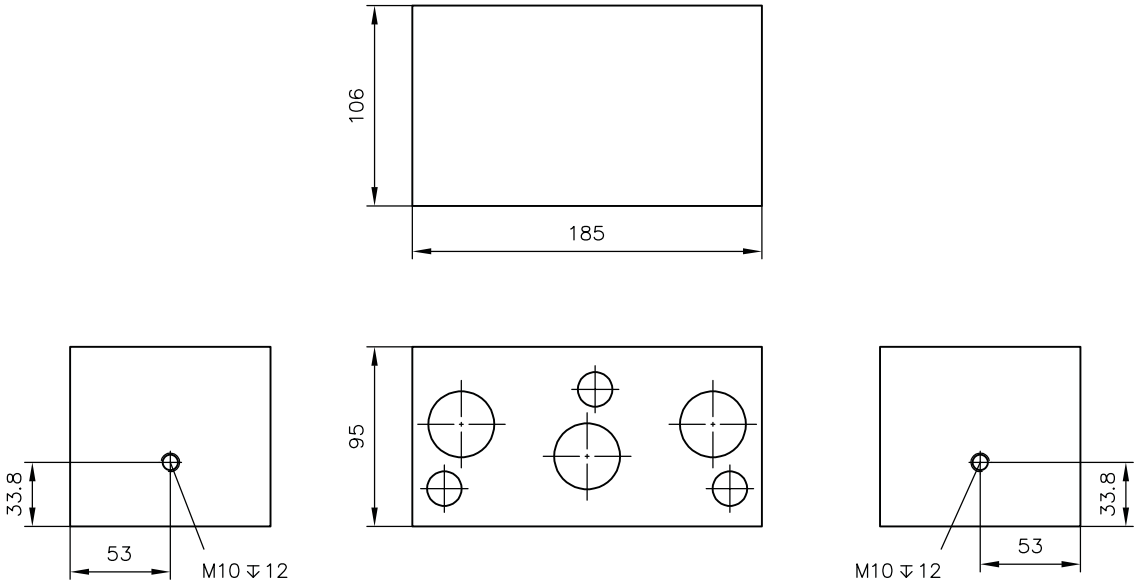


Coding	Ports (ISO 228-1 or SAE J 514)	
	a, b, X	A, B
/33 SAE	G 1/4	SAE 1/2

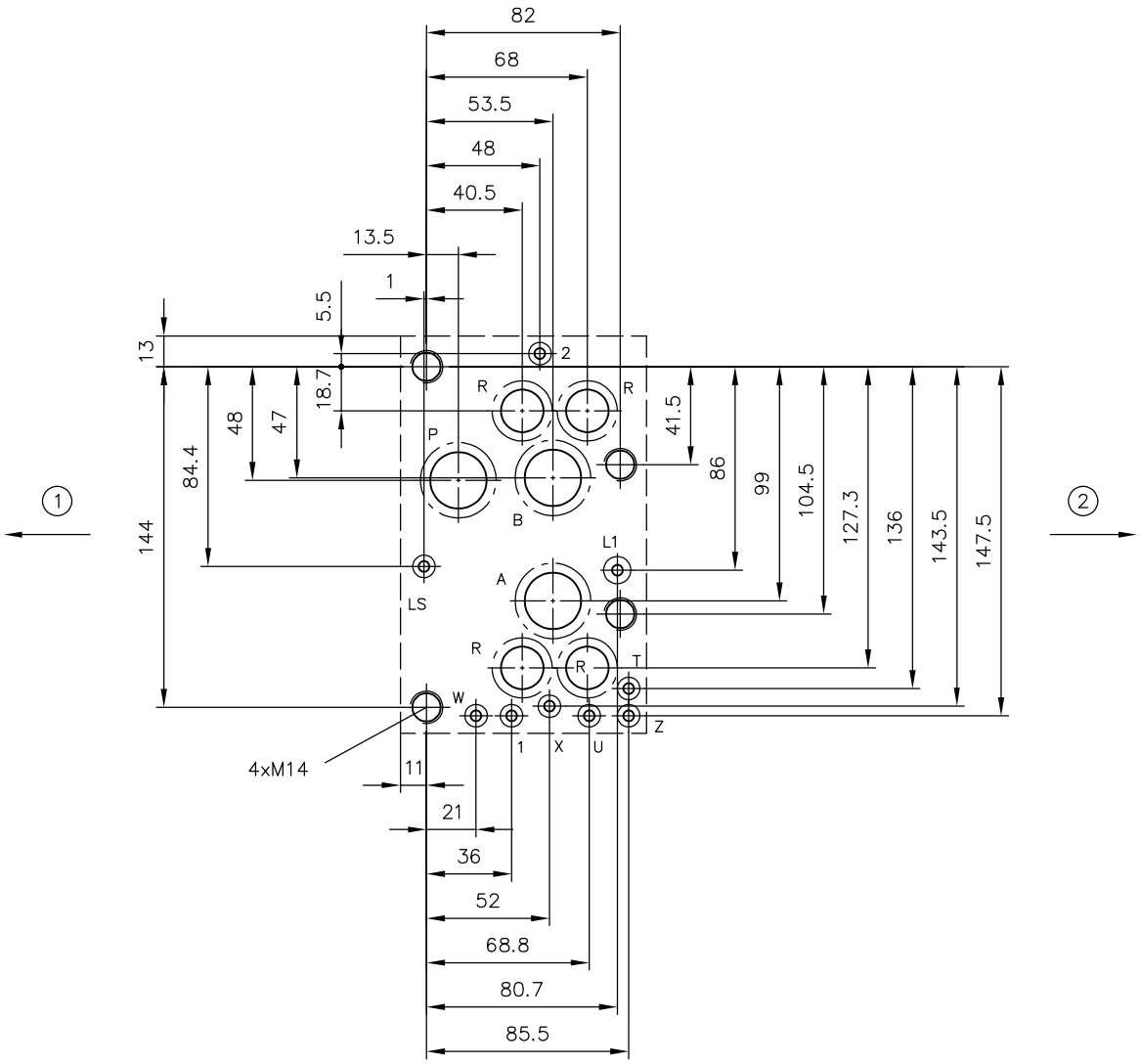
Coding **/ZPL 77/40**



Coding **/XP**

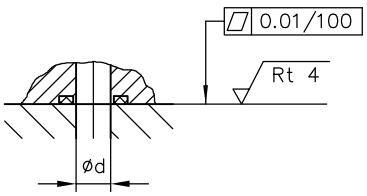


4.4.2 Hole pattern



1 Connection plate
2 End plate

Base plate



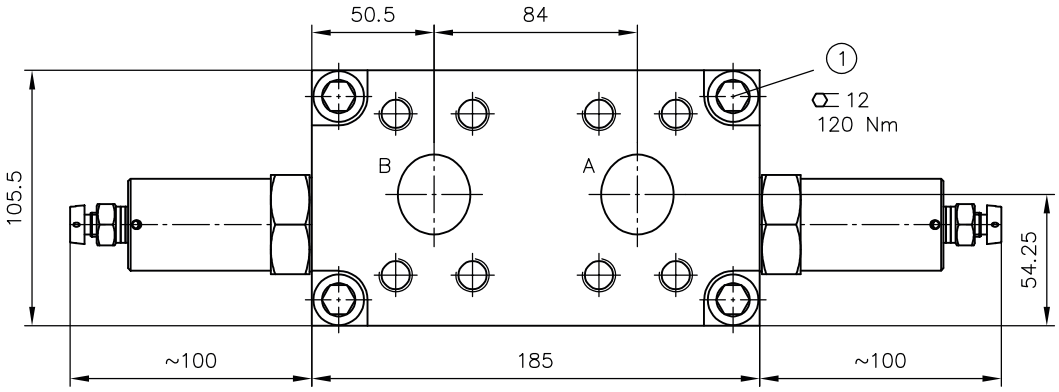
Valve section

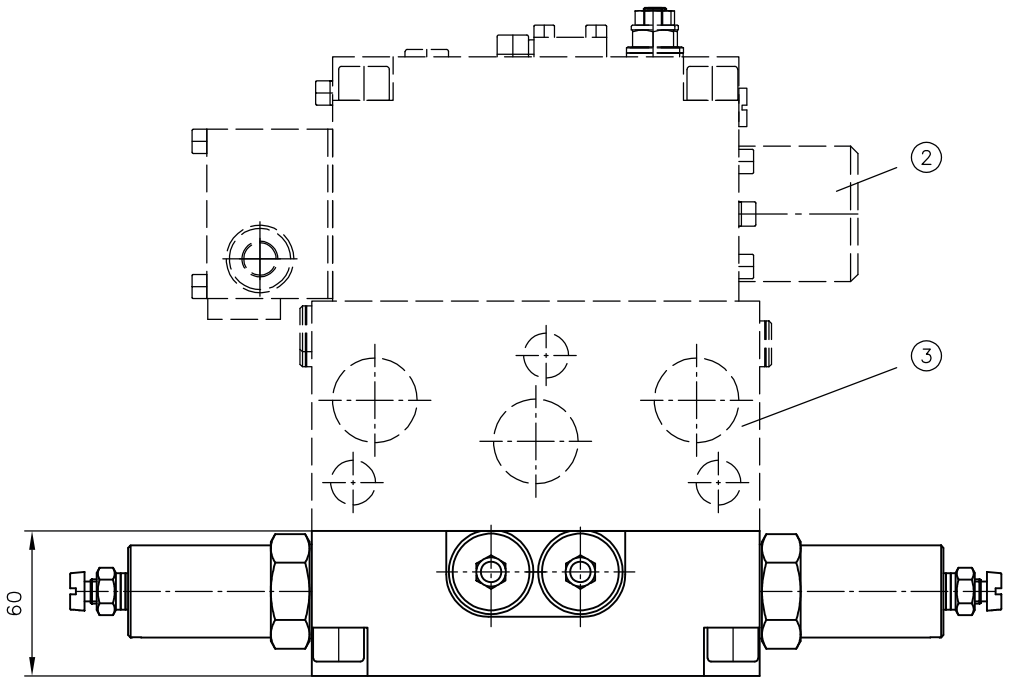
Port	∅d	O-ring PUR 90 Sh
P, A, B	24	26.64x2.62
R	18	20.29x2.62
LS, T, U, W, X, Z	4,7	6.07x1.78
L1	4,7	7.65x1.78

4.5 Ancillary block

see Chapter 2.5, "Ancillary block"

Coding **/6 SAE AN.. BN..**



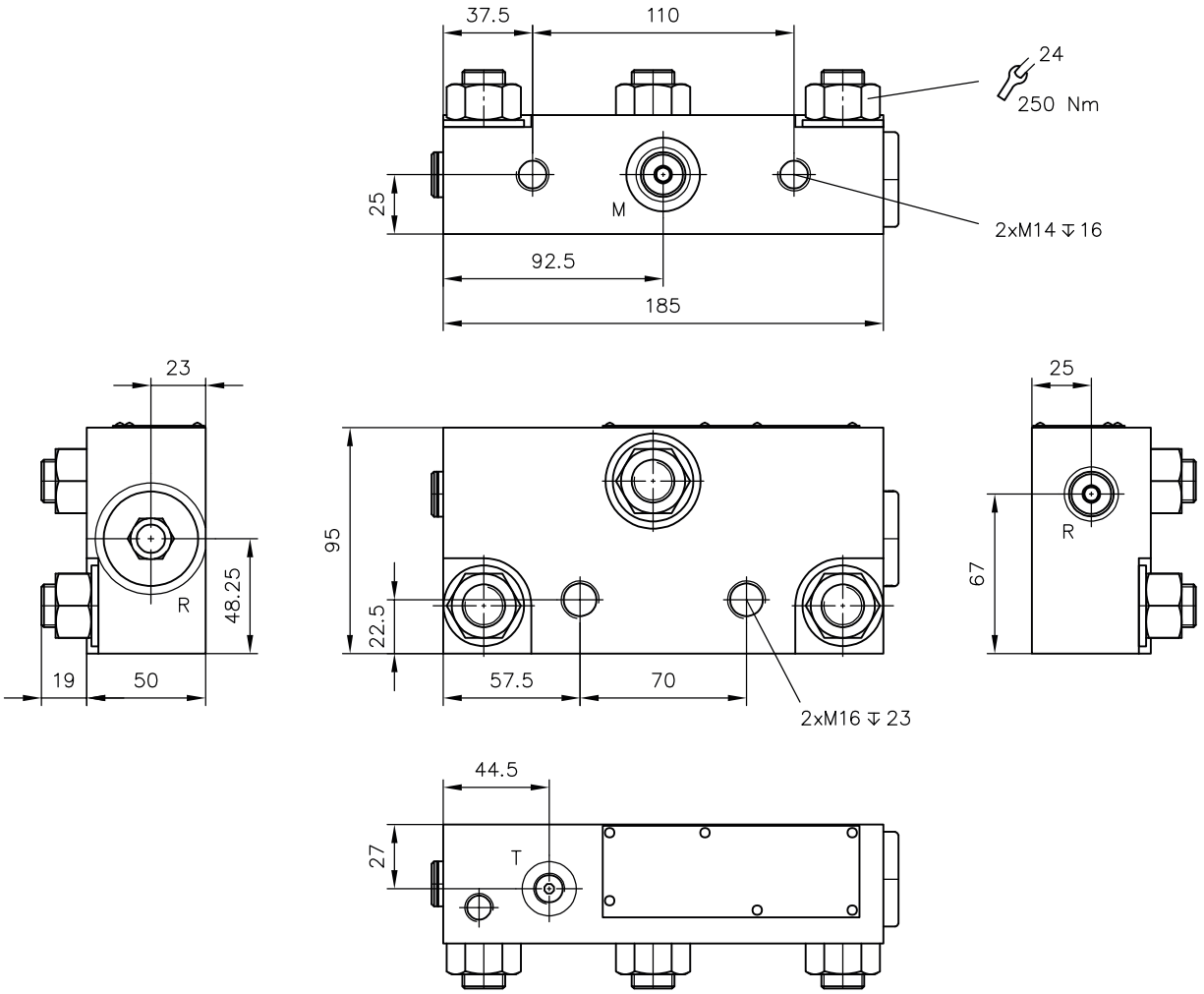


1 Cylinder screw ISO 4762-M14x50-A2-70
2 Valve section
3 Sub-plate /U7

4.6 End plate

see Chapter 2.6, "End plate"

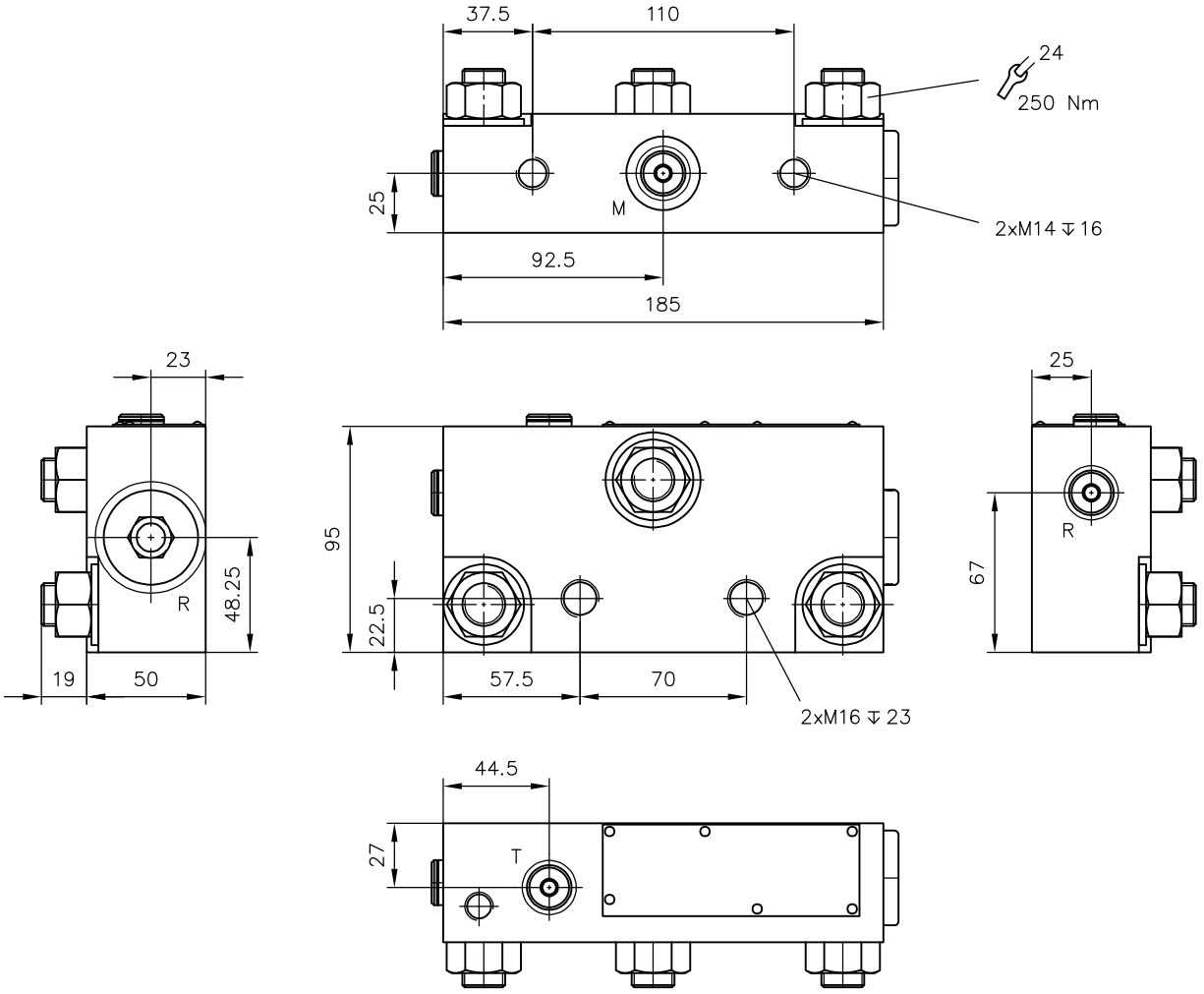
Coding **E 1**



- T - open
- Y - sealed

Coding	Ports (ISO 228-1)	
	T, M, R	R
E 1	G 1/4	G 1

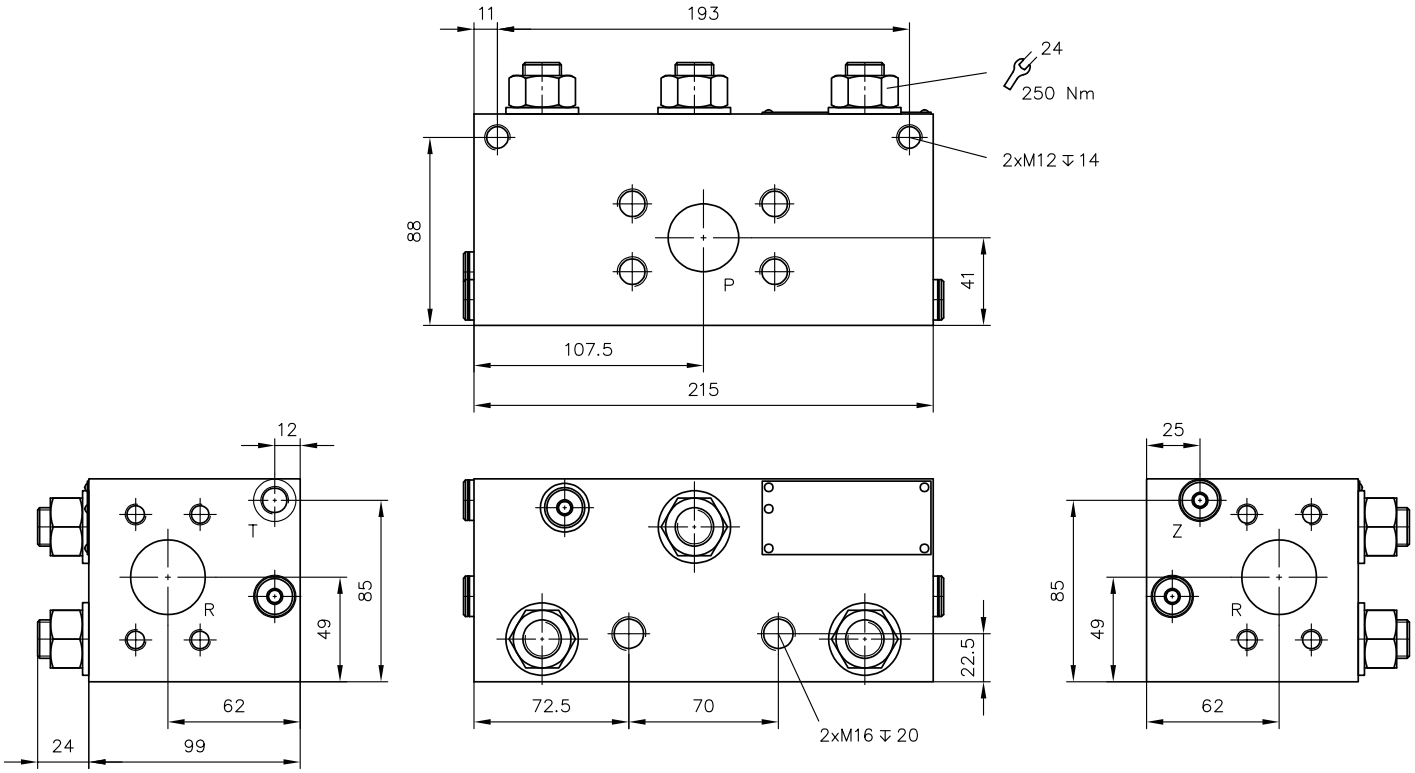
Coding **E 4**



- T - sealed
- Y - sealed

Coding	Ports (ISO 228-1)	
	T, M, R	R
E 4	G 1/4	G 1

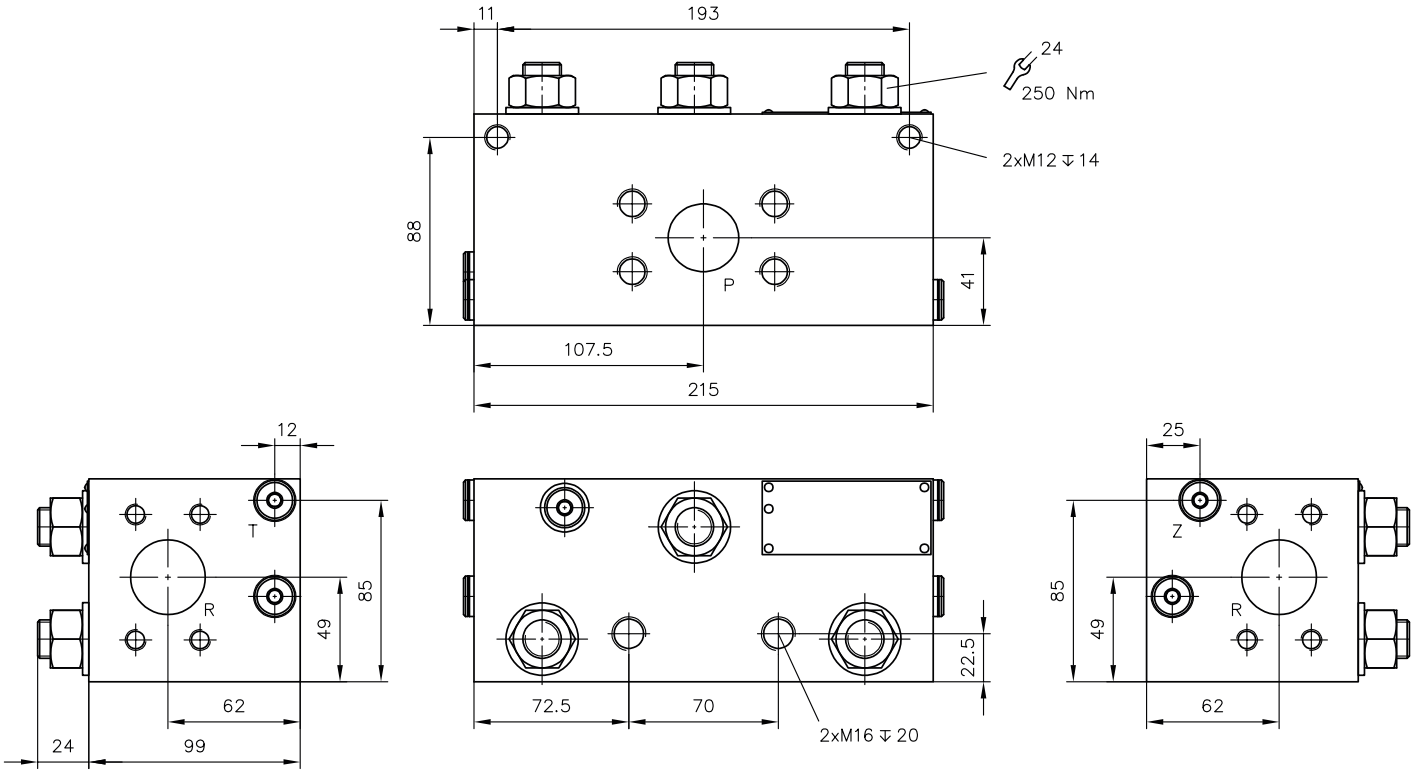
Coding **E 1 PSV../6 SAE**



- T - open
- Y - sealed

Coding	Ports (ISO 228-1 or SAE J 514)	
	T, Z	P, R
E 1 PSVF../6 SAE	G 1/4	SAE 1 1/4

Coding **E 4 PSVF../6 SAE**



- T - sealed
- Y - sealed

Coding	Ports (ISO 228-1 or SAE J 514)	
	T, Z	P, R
E 4 PSVF../6 SAE	G 1/4	SAE 1 1/4

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

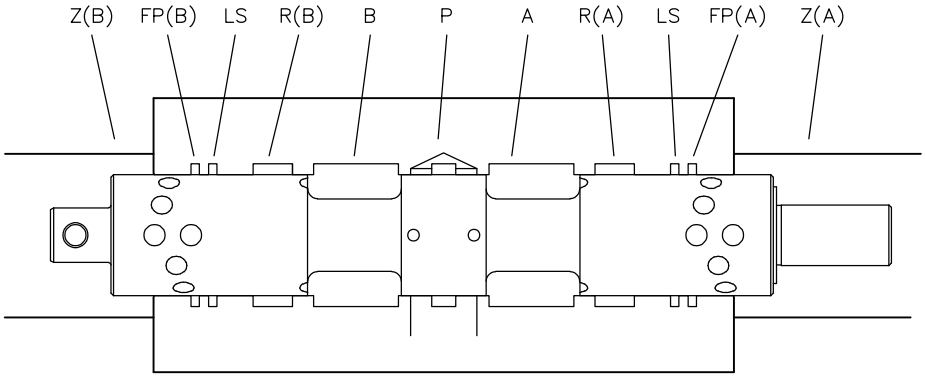
The valve bank must be mounted to the frame or base of the machine in such a way that no stress is induced. Three screws and elastic washers between the bank and the frame are recommended for attachment.

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 2.3.1.7)
  - ► without LS relief or LS pressure limitation coding (Chapter 2.3.1.8)
  - ► without LS port for external limitation (Chapter 2.3.1.9)

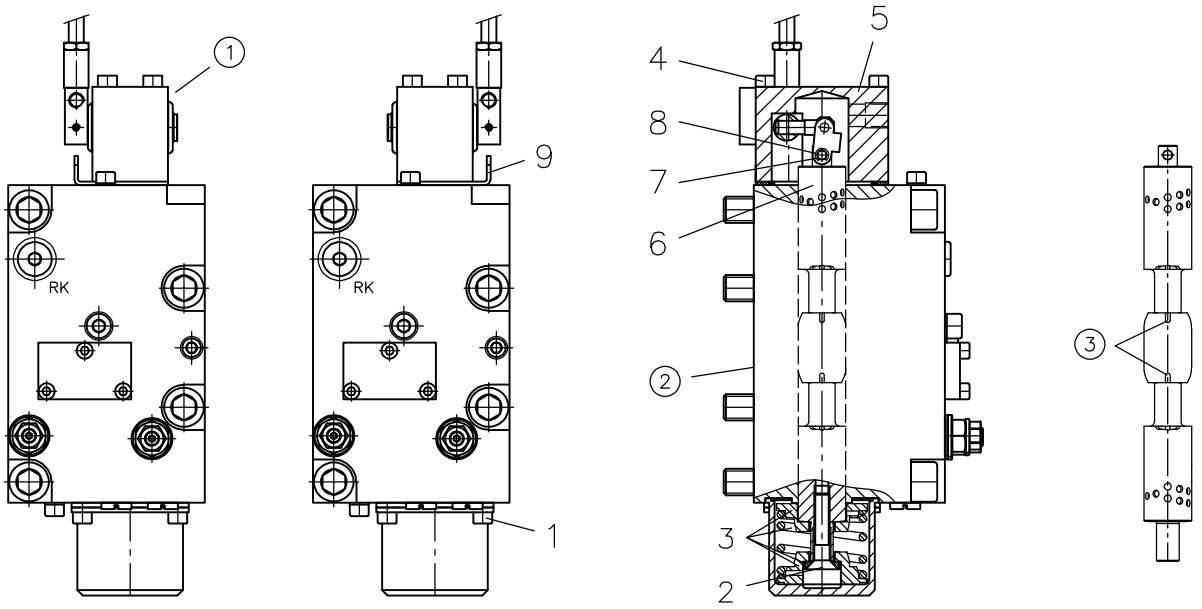
Recommendation for improving the lubrication in this case:

- 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..
    - C..
  - ► LS relief or LS pressure limitation
    - F0
    - F..
  - ► LS port for external limitation
    - S
    - S1
    - X
    - XXH
- On valve sections (Chapter 2.3.1.3) with code 8 and code 81, do not use dither.

5.2.3 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 Lever housing, turned through 180°
2 Side, sub-plate
3 Metering ports

Changing the valve spool

1. Unscrew screws **1** (ISO 4762-M5x8-8.8-A2K), remove spring housing
2. Unscrew screw **2** M8x40
3. Take off spring package with spring plates **3**
4. Screws **4** (ISO 4762-M6x60-8.8-A2K) 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 160 do not have metering ports and can be installed any way around.

Turning the lever housing through 180° (reversing the switching direction)

1. As instructed under 1. - 7., but instead of a new valve spool, detach the existing valve spool and re-install it rotated through 180° (see note above).
2. Turn the intermediate sheet **9** through 180° together with the lever housing.
3. All lever housings in the valve bank must be turned.

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

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

Seal kits	
Controller block to connection plate	DS 7700-F71
Valve section to sub-plate	DS 7700-F72
Sub-plate to sub-plate	DS 7700-F7

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
- Actuation for proportional directional spool valves type PSL/PSV: D 7700 CAN

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