LUDV control block in mono block/sandwich plate design M7-20

RE 64293
Edition: 06.2013
Replaces: –.–

HAD 6557

- Size 20
- Series 3X
- Maximum operating pressure
  - On the pump side 380 bar
  - On the actuator side 420 bar
- Maximum flow
  - On the pump side 350 l/min
  - On the actuator side 250 l/min

Features

- Load pressure-independent flow distribution LUDV
- Closed center for variable displacement pump
- Integrated load holding valves
- Integrated tank/cooler preloading possible
- Unloading function for
  - Improved response behavior
  - Reduction of switch-off peaks
- Cracking pressure of the unloading valve depending on Δp (standard: 23 bar)

Design

- Mono block with 5 actuator axes
- Can be extended by directional valves of different sizes (max. 8)
- Pure sandwich plate design possible
- Type of actuation
  - Hydraulic

Fields of application

- Excavators
- Stripping shovels/caterpillar cranes
- Handling equipment
- Cranes
- Drilling machinery

Contents

Functional description

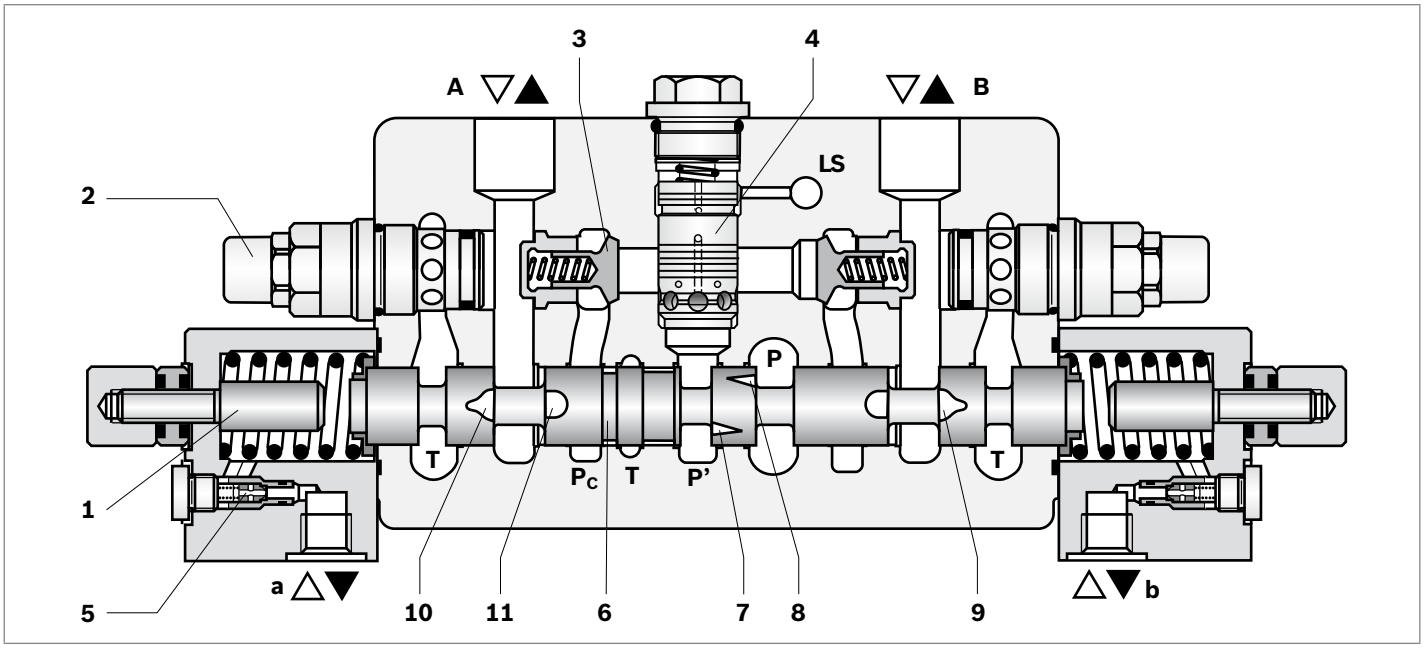
Control block M7-20
Proportional directional valve according to the LUDV principle (load pressure independent flow distribution).

Load pressure compensation, LUDV
The control block M7-20 works according to the LUDV principle. The pressure compensator (**4**) of this load-sensing version is mounted between the main spool (**6**) and the actuator ports (**A, B**).
The highest load pressure of all actuators involved is notified to all pressure compensators and simultaneously to the pump.
As opposed to standard LS versions, there is no unwanted standstill of individual actuators with LUDV if the pump flow is not sufficient for supplying all functions with the desired rated volume. The speed of all working movements will then be reduced in the same ratio.

Actuator control
In the neutral position of the main spool (no control pressure at the ports **a** or **b**, the connection from the pump to the **P'** channel is blocked by the main spool. The load holding valves and the pressure compensator are closed. The actuator ports are blocked by the main spool overlap in the housing.

The LUDV pressure compensator consists of a main spool and a compression spring defining a stable initial position. The main spool (**6**) is proportionally moved to the right against the spring force by the applied control pressure of the pilot control unit in the control cover **a**. The supply metering orifice (**7**) of the main spool opens the connection from the pump port **P** to the channel **P'**. The pressure in this chamber opens the pressure compensator (**4**) and is applied to the load holding valves (**3**).
The actuator pressure p_C of port **A** keeps the left load holding valve (**3**) closed via the passages in the main spool (**11**). When the value of **P'** exceeds that of p_C, the check valve is opened. The connection from the pump to the actuator is established and initiates the movement. The oil displaced in the actuator flows from **B** via the outlet orifice (**9**) back to the tank. The secondary pressure relief valves (**2**) remain closed as long as the pressure in the actuator port remains below their pressure setting. The main poppet of the combined pressure relief/feed valve (**2**) in the supply (side **A**) opens in the event of cavitation in the actuator port and enables feed-in from the tank channel. In this connection, an optional tank pre-loading increases the feed-in volume.

▼ **Section M7-20**



1 Stroke limitation
2 Secondary pressure relief valve/feed valve
3 Load holding valve
4 LUDV pressure compensator
5 Pilot pressure shuttle
6 Main spool
7 Supply metering orifice P → P´ → A
8 Supply metering orifice P → P´ → B
9 Outlet orifice B → T
10 Outlet orifice A → T
11 Directional grooves P → A (P → B accordingly)

Technical data

general				
Weight	5-fold mono block		kg	Approx. 90
	Directional valve M7-20		kg	Approx. 12
	Inlet plate		kg	15
	End plate		kg	Approx. 3
Installation position				Any
Type of actuator connection				Flange connection according to DIN EN ISO 6262
Ambient temperature range		θ	°C	–20 to +80
Priming				Single-layer coating RAL 5010

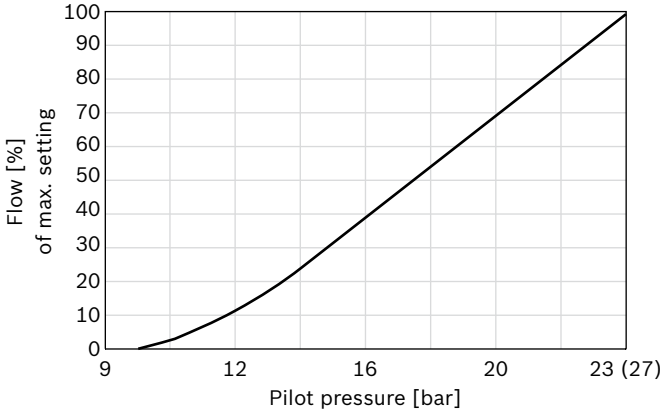
hydraulic				
Maximum operating pressure at port	P	p	bar	380
	A, B	p	bar	420
	LS	p	bar	360
	T	p	bar	30
	L	p	bar	Must be led to the tank in a depressurized form
Maximum pilot pressure at port	a, b	p	bar	40
Pilot pressure range	Hydraulic	p	bar	0 to 23 (27)
Maximum flow at port	P	q_{Vmax}	l/min	350
	A, B	q_{Vmax}	l/min	250 (at Δp block input P – LS = 19 bar)
Hydraulic fluid				Mineral oil (HL, HLP) according to DIN 51524, other hydraulic fluids, such as HEES (synthetic esters) according to VDMA 24568, as well as hydraulic fluids as specified in data sheet 90221, upon request
Hydraulic fluid temperature range		θ	°C	–20 to +80
Viscosity range		ν	mm²/s	10 to 380
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness class according to ISO 4406 (c)				Class 20/18/15, for this, it is recommended to use a filter with a minimum retention rate of $\beta_{10} \geq 75$
Recommended hydraulic pilot control units			Type	4 TH6...; characteristic curve 70, see data sheet 64555 2 TH6 R...; characteristic curve 70, see data sheet 64552

Notice

- For applications outside these parameters, please consult us!
- The technical data were determined at a viscosity of ν = 32 mm²/s (HLP46: 50 °C).

Characteristic curve

▼ **Typical spool characteristic curve**



Ordering code

Explanations

The ordering code documents the default functional features of the valve series which is set-up as a modular system. This series conists of a 5-fold mono block with LUDV function at which up to two LUDV directional valves with a respective end plate can be installed on one front side. On the opposite front side, LS directional valves and additional type SX14 directional valves with end plates can be flanged. The number of spool axes in the mono block and the number of individual LUDV and LS directional valve plates together define the total number of spool axes in the control block.

It is also possible to set up the block in pure sandwich plate design consisting of type M7-20/LS and type SX14 directional valves.

The first part of the ordering code (set-up of the overall control block) specifies the block configuration without definition of the individual spool axes.

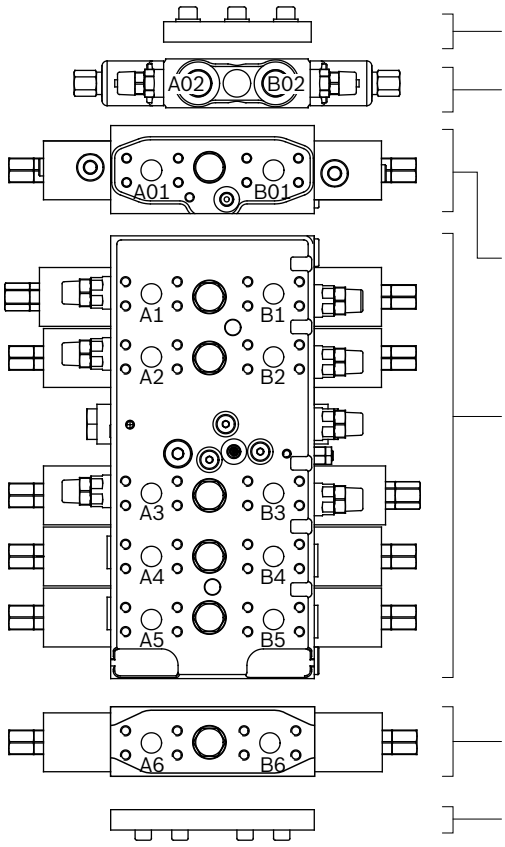
The second part of the ordering code (features of the overall control block) defines the available detail features and settings of the block.

Finally, the corresponding features for every spool axis of the block must be selected.

In order to ensure fast and clear processing of your order, please specify all features. In case of questions, please contact the relevant application specialist in sales-related product management.

Combination possibilities

▼ **Mono block/sandwich plate design**



End plate 2

Directional valves, group 3
SX14 LUDV (can only be flanged to M7 20/LS)

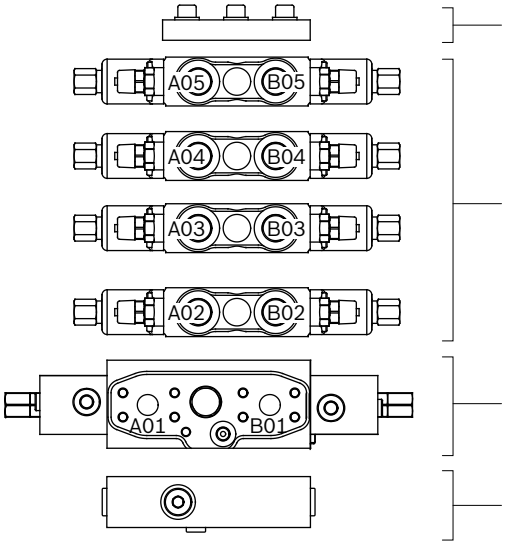
Directional valves, group 2
M7-20/LS

5-fold mono block

Directional valves, group 1
M7-20 LUDV

End plate 1

▼ **Sandwich plate design**



End plate 2

Directional valves, group 3
SX14 LUDV (can only be flanged to M7-20 LS)

Directional valves, group 2
M7-20/LS

Inlet plate
with P and T connections

Information on the name plate

The ordering code serves to specify the technical features and requirements.

The Rexroth distribution organization derives a short designation as well as a material number from the ordering code.

01	02		03		04					05		06		07	08	09
M7	**–**	**. . . .**	**–**	**3X**	**/**		**M7**	**–**	**20**	**/**		**–**	**H**	**/**	**V**	**11**	*****

Series

01	LUDV control block M7	**M7**

02	4-digit control block number	**. . . .**

Series

03	30 to 39 (unchanged installation and connection dimensions)	**3X**

04	Total number of spool axes	**1 to 13**

Design

05	5-fold mono block	**5**
	Sandwich plate design	**S**

Type of actuation

06	Hydraulic	**H**

Seal material

07	FKM seals	**V**

Actuator ports

08	Flange connection according to DIN EN ISO 6162	**11**

09	Further details in the plain text	*****

Overall control block set-up

01			02	03	04	05	06	07	08	09	10
	M7-20	**/**		**K**			**K**		**S**		

01	Total number of spool axes	**1 to 13**

Design

02	5-fold mono block	**5**
	Sandwich plate design	**S**

Directional valves group 1 [1)]

03	M7-20 LUDV	**K**
04	Number of directional valves	**0 to 2**

End plate 1

05	LUDV without function	**L**
	LUDV with P port	**C**
	Without end plate in sandwich plate design	**Z**

Directional valves group 2

06	M7-20/LS	**K**
07	Number of directional valves [2)]	**0 to 3**

Directional valves group 3

08	SX14	**S**
09	Number of directional valves [2)]	**0 to 4**

End plate 2

10	Without function	**Z**
	With P port	**C**

1) For a pure sandwich plate design, "K 0" is to be specified
2) The groups may add up to a maximum of 6

Overall control block features

		01	02		03	04	05		06	07	08	09	10
M7-20	**/**			**–**				**–**					

Primary pressure limitation

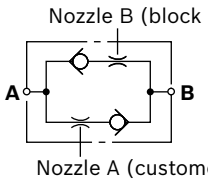
		01	02	03
01	Without	**Q**	**000**	**000**
	Pressure relief valve, pilot operated (MHDBV, see data sheet 64642)	**V**	**...**	**000**
	Pressure/feed valve with pressure sequencing stage (MHDBB, see data sheet 64642)	**B**	**...**	**...**
02	Specified pressure of the pressure relief valve (in bar, 3-digit)		**...**	
03	Specified pressure of the pressure sequencing stage (in bar, 3-digit)			**...**

LS pressure limitation

		04	05	06
04	Without	**Q**	**000**	**000**
	Pressure relief valve, direct operated (MHDBD 04, see data sheet 64642)	**S**	**...**	**000**
	Pressure relief valve, direct operated with pressure sequencing stage (MHDBZ)	**A**	**...**	**...**
05	Specified pressure of the pressure relief valve (in bar, 3-digit)		**...**	
06	Specified pressure of the pressure sequencing stage (in bar, 3-digit)			**...**

LS shuttle (nozzle diameter)

07	Without LS shuttle	**L0**
	A 0.6 – B 1.2	**L1**
	A 1.0 – B 0.4	**L2**
	A 1.2 – B 0.4	**L3**
	A 1.2 – B 0.6	**L4**
	A 2.0 – B 0.4	**L5**



Unloading function (q_{Vmin} circuit)

08	Without unloading function	**Z**
	With unloading function	**U**

Tank preloading [3)]

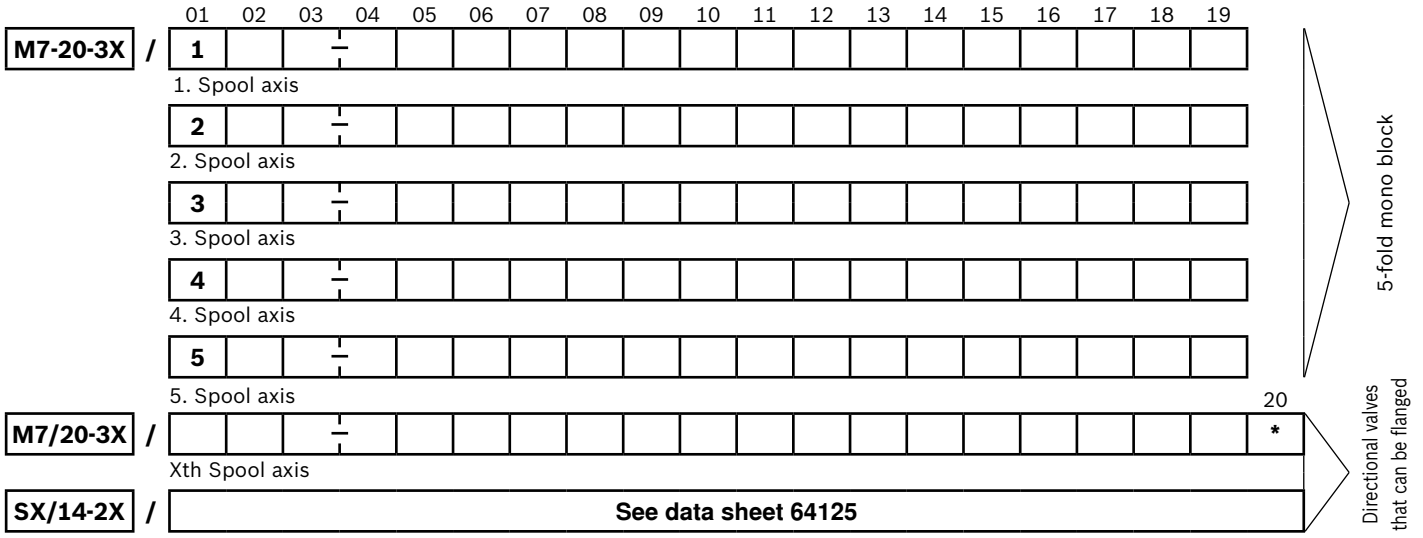
09	Without tank preloading	**TZ**
	0.5 bar	**T1**
	2.0 bar	**T2**
	3.5 bar	**T3**
	5.5 bar	**T5**
	7.0 bar	**T7**

Cooler preloading [3)]

10	Without cooler preloading	**KZ**
	0.5 bar	**K1**
	2.0 bar	**K2**
	3.5 bar	**K3**
	5.5 bar	**K5**
	7.0 bar	**K7**

3) When designing the preload values, the cooling power necessary for the machine is to be considered.

Spool axis design



01	Number of the spool axis	**1 to X**

Spool type [4]

02	Main spool A/B/T blocked in neutral position	**E**
	Main spool A/B → T blocked in neutral position	**J**
	Main spool A/B → T throttled to the tank in neutral position	**Q**
	Main spool P/B → A in spool position b	**R**
	Extra spool [5]	**S**

Flow

03	Actuator port A (in l/min, 3-digit)	**...**
04	Actuator port B (in l/min, 3-digit)	**...**

Load holding

05	With (both sides)	**L**
	Without	**Z**

Pressure compensator [6]

06	Direct operated	**D**
	Pilot operated	**V**

4) For symbols, see "Main spool" on page 11.
The gear ratio of hydraulic cylinders must be specified in plain text as E and Q spools have supply and outlet characteristic curves. Further spool types on demand.
5) Functional description in plain text
6) For symbols, see "Pressure compensator" on page 11

			A side			B side		
Type of actuation			07	08	09	10	11	12
07, 10	**Hydraulic** [7]		**H**			**H**		
08 11	Shuttle	Without shuttle		**00**			**00**	
		With shuttle 0.3 mm		**03**			**03**	
		With shuttle 0.5 mm		**05**			**05**	
		With shuttle 0.6 mm		**06**			**06**	
		With shuttle 0.8 mm		**08**			**08**	
09 12	Pilot oil port position	Axial			**A**			**A**
		Radial			**R**			**R**

Pilot oil port [8]

13	Poppet seal	**G**
	O-ring seal	**O**
	G 1/4 without adapter (only with H00)	**Z**

		A side			B side		
Secondary valves		14	15	16	17	18	19
14 17	Without	**Z**	**000**	**000**	**Z**	**000**	**000**
	Feed valve (MHSV 22, see data sheet 64642)	**E**	**000**	**000**	**E**	**000**	**000**
	Pressure/feed valve (MHDBN 22, see data sheet 64602)	**H**	**...**	**000**	**H**	**...**	**000**
	Pressure/feed valve with pressure sequencing stage (MHDBB 22, see data sheet 64642)	**B**	**...**	**...**	**N**	**...**	**...**
15, 18	Specified pressure of the pressure/feed valve (in bar, 3-digit)		**...**			**...**	
16, 19	Specified pressure of the pressure sequencing function (in bar, 3-digit)			**...**			**...**

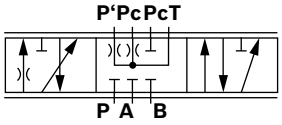
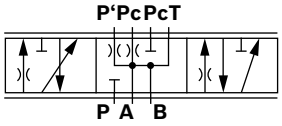
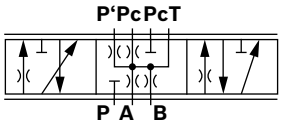
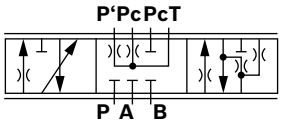
20	Specification of the type M7-20/LS directional valve plate in plain text	*

7) With measuring port

8) See "Line connections" on page 14

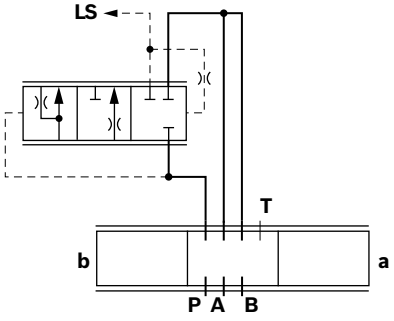
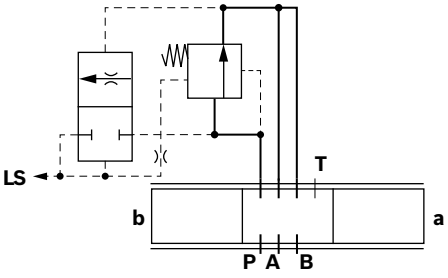
Symbols

Main spool

Ordering code	Main use	Symbol
E	▶ Hydraulic cylinder as actuator ▶ Spool with blocked ports A/B in neutral position	
J	▶ Hydraulic motors as actuator ▶ Actuator ports A/B → T open in neutral position	
Q	▶ Hydraulic cylinders and motors as actuator in connection with hose burst check valve, check-Q-meter and lowering brake valve ▶ Spool valve with defined remaining opening (A/B → T) in neutral position	
R	▶ E spool with regeneration function ▶ Main spool P/B → A	

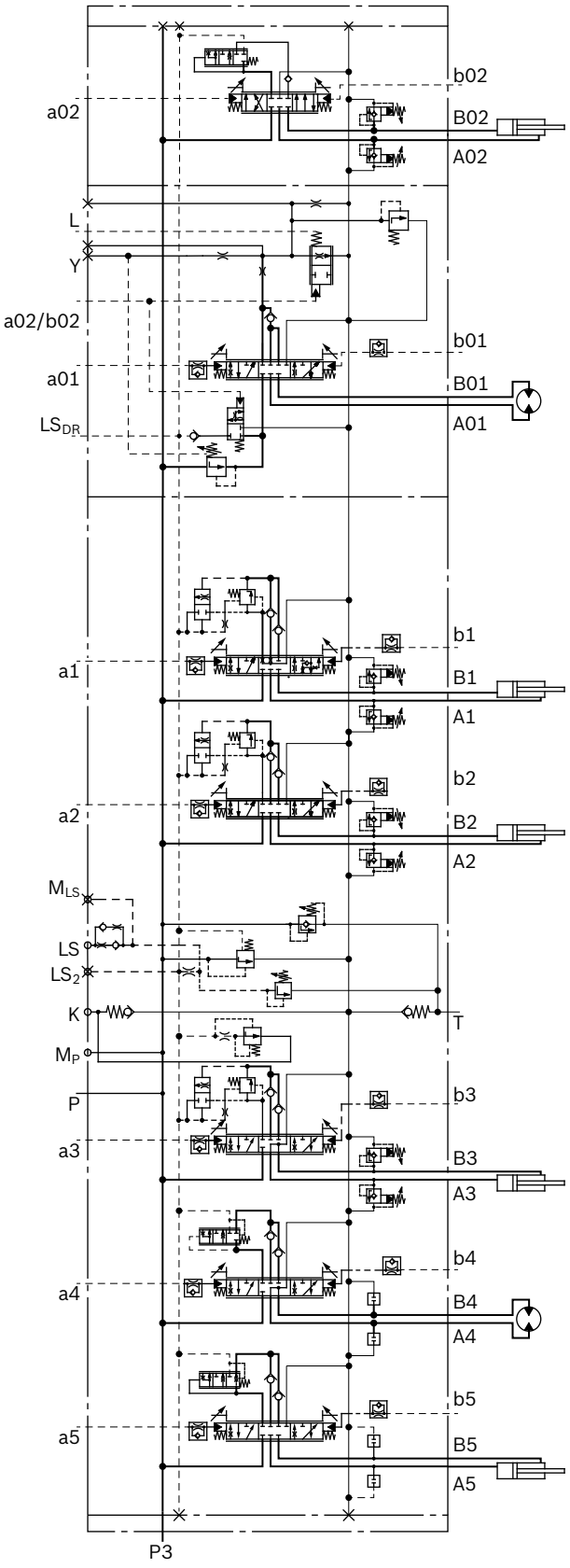
Notice
Further main spools on demand.

Pressure compensator

Ordering code	Main use	Symbol
D	Direct operated (standard)	
V	Pilot operated ▶ Use in case of superimposed motion if the actuator with the highest load changes frequently	

Control block

Example: 5-fold mono block with one M7 20/LS and one SX14 directional valve



◄ **Adjustment cylinder (SX14)**

◄ **Rotating mechanism (M7-20/LS DTS)**

◄ **Arm**

◄ **Bucket**

◄ **Boom**

◄ **Drive**

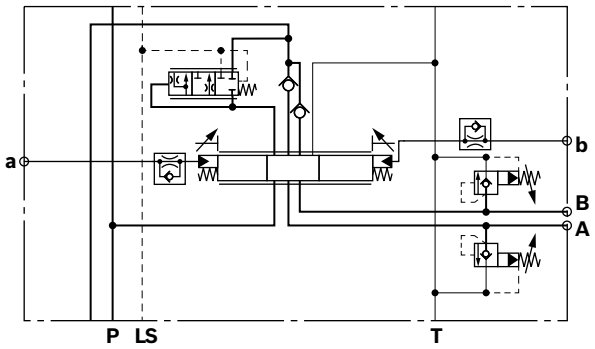
◄ **Support**

Directional valves

1-fold M7-20 LUDV

Short description

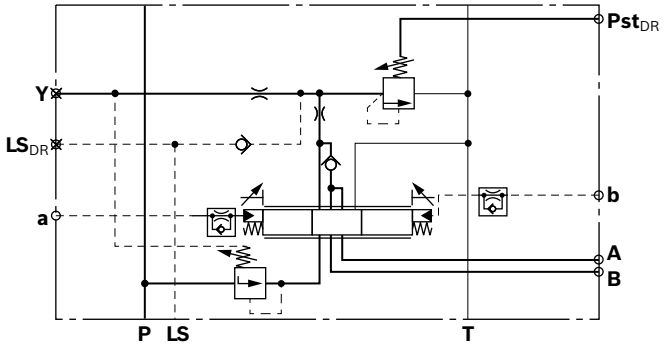
- LUDV directional valve plate
- Hydraulically controlled
- Switching speed of the main spool can be influenced
- Stroke stops available for exact flow setting
- Pressure/feed valves (optional)
- Load holding valves
- Maximum flow 250 l/min



1-fold M7-20/LS (standard)

Short description

- LS directional valve plate (e.g. for grabber)
- LS section pressure limitation
- Hydraulically controlled
- Switching speed of the main spool can be influenced
- Stroke stops available for exact flow setting
- Load holding valve
- No secondary limitation possible
- Maximum flow 200 l/min



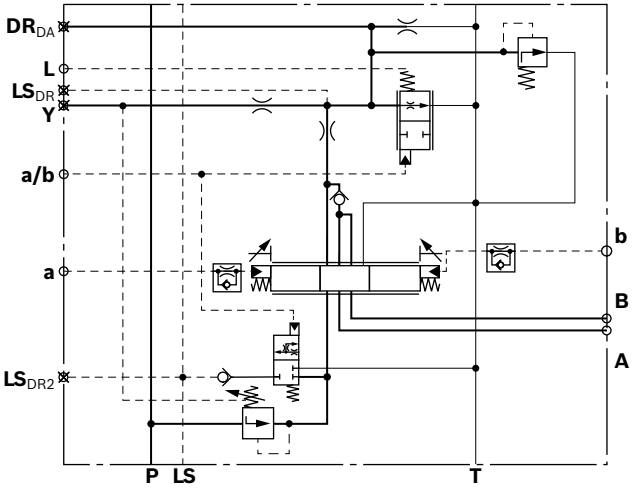
1-fold M7-20/LS DTS

Short description

- LS directional valve plate for rotating mechanism
- DTS pressure distributor circuit for oscillation-free actuation of the rotating mechanism
- Hydraulically controlled
- Maximum flow 180 l/m; in case of larger flows, a combination with the standard LS directional valve plate is possible

Notice

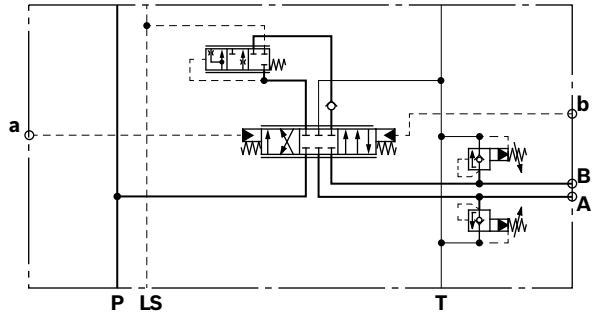
If more than one LS directional valve plate is used, the LS connection must be established externally.



1-fold SX14

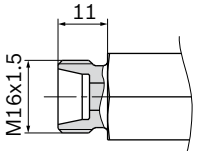
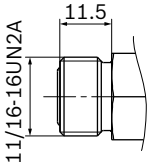
Short description

- LUDV directional valve plate
- Hydraulically controlled (optional electro-hydraulically)
- Stroke stops available for exact flow setting
- Pressure/feed valves
- Load holding valves
- Maximum flow 160 l/min



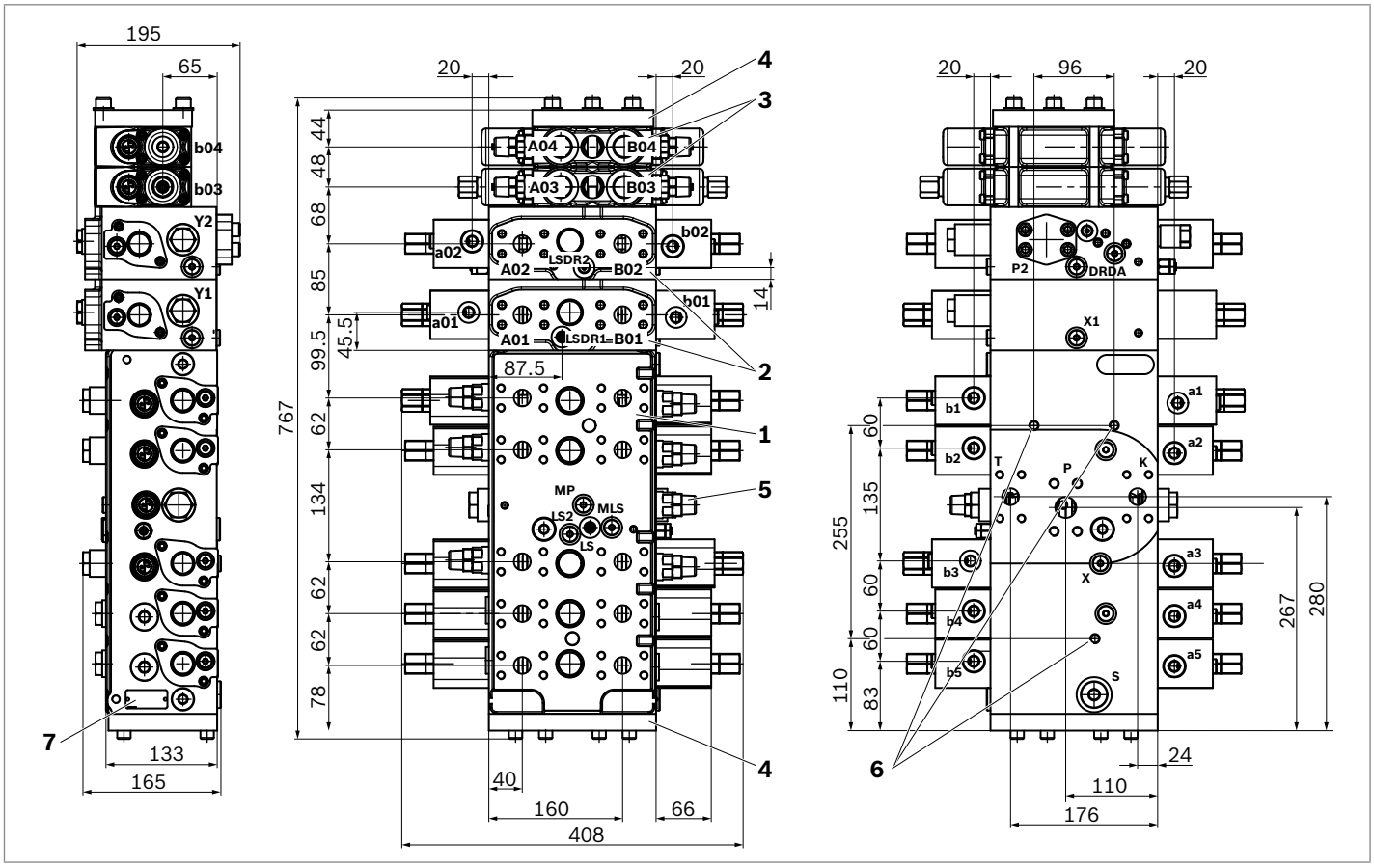
Dimensions

Line connections

Port	Dimension		Similar standard
P1	DN 25 (SAE 1"	6000 PSI)	DIN ISO 6162-2
P2, P3	DN 19 (SAE ³/₄"	6000 PSI)	DIN ISO 6162-2
T	DN 25 (SAE 1"	3000 PSI)	DIN ISO 6162-1
K			
A1 – B5	DN 19 (SAE ³/₄"	6000 PSI)	DIN ISO 6162-2
A0.. – B0..	DN 19 (SAE ³/₄"	6000 PSI)	DIN ISO 6162-2
	SX14: DN 19 (G ³/₄)		DIN EN ISO 1179-1
LS, LS_{DR}	DN 10 (G ¹/₄)		DIN EN ISO 1179-1
L			
Y			
M_{LS}, M_P			
a, b	G ¹/₄ (version **Z**)		DIN EN ISO 1179
			Poppet seal (version **G**): L10 according to DIN EN ISO 8434
			O-ring seal (version **O**): SAE J 1453-3

Ports	
P	Pump
T	Tank
K	Cooler
A, B	Actuator
LS	Load sensing
L	Leakage oil connection (depressurized to the tank)
Y	Load pressure LS valve plate
M	Measuring port
a, b	Pilot oil port

▼ **Example 9M7-20**



1 5-fold mono block
2 M7-20/LS directional valves
3 SX14 directional valves
4 End plate
5 Primary pressure relief valve
6 Three M12 mounting threads
7 Name plate

Project planning information

The LUDV control block M7-20 is the core component of the hydraulic control system of a mobile working machine. It is therefore recommended to only specify it in connection with an overall hydraulic circuit diagram.
For the design of a hydraulic LUDV control block of type M7-20, the following boundary conditions are relevant for project planning and should be enclosed to the enquiry:

- Machine type
- Pump flow at rated speed
- Type of pump control
- Description of the actuator on the sections (e.g. boom, winch)
- Cylinder ratios/displacement of the motor
- Information on whether a system element is installed downstream of the valve (e.g. hose burst check valve, lowering brake valve)
- Information on the loads (pressures) to be throttled per axis if there is no braking valve or similar.

Related documents

The control blocks M7-20 are system components.
Also observe the instructions for the other system components. Do not commission the product until you are provided with the following documentation and have understood and observed it.

Title	Document number	Document type
Control blocks for mobile applications	64025-B	Operating instructions
System documentation from the machine manufacturer		Operating instructions

Bosch Rexroth AG
Mobile Applications
Zum Eisengießer
97816 Lohr am Main, Germany
Phone +49 9352 18-0
info.ma@boschrexroth.de
www.boschrexroth.com